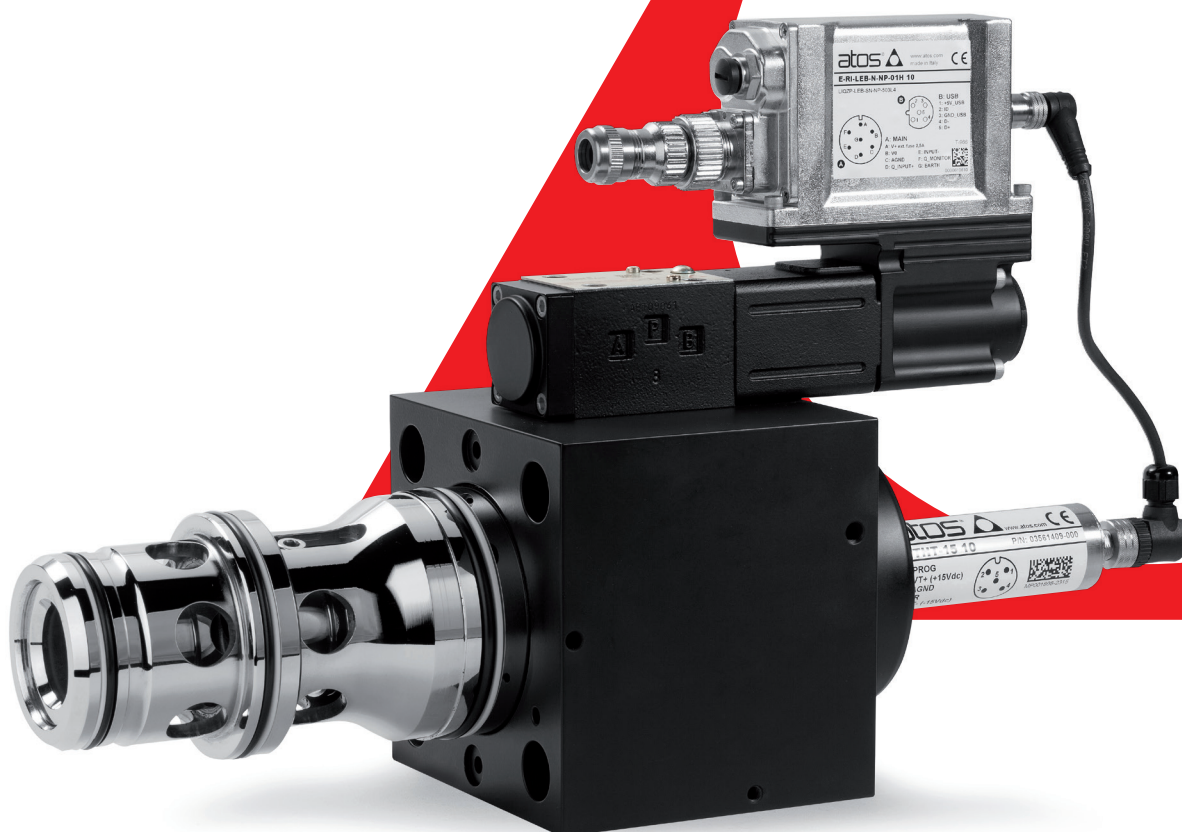


INDUSTRIAL ELECTROHYDRAULICS

MASTER CATALOG





● **First class facilities**

high level of automation
with in-line process control

● **Know-how**

from the design to the production
of the finished product

● **Full product range**

standard, customized, ex-proof,
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thanks to long lasting
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according to ISO 9001, including
automotive's sector methods

● **Sales & service**

worldwide network of experienced
engineers, oriented to customer care

● **Professional team**

to quickly meet every
customer need

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GENERAL INFORMATION

1

PROPORTIONAL VALVES



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PROPORTIONAL VALVES

Size Qmax [l/min] Table **Pag**

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SERVOPROPORTIONAL DIRECTIONALS

zero overlap with LVDT transducer

DLHZO-TEB/TES	direct, sleeve execution, on-board driver	06 ÷ 10	70 ÷ 160	FS180	9
DLKZOR-TEB/TES					
DLHZO-T, DLKZOR-T	direct, sleeve execution, off-board driver	06 ÷ 10	70 ÷ 160	F180	21
DHZO-TEB/TES	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS168	27
DKZOR-TEB/TES					
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F168	39
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS178	45
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F178	61
LIQZO-LEB/LES	3 way cartridge, piloted, on-board driver,	25 ÷ 80	500 ÷ 5000	FS340	69
LIQZP-LEB/LES	2 LVDT transducers				
LIQZO-L	3 way cartridge, piloted, off-board driver,	25 ÷ 80	500 ÷ 5000	F340	83
LIQZP-L	2 LVDT transducers				

HIGH PERFORMANCE DIRECTIONALS

positive overlap with LVDT transducer

DHZO-TEB/TES	direct, on-board driver	06 ÷ 10	80 ÷ 180	FS165	91
DKZOR-TEB/TES					
DHZO-T, DKZOR-T	direct, off-board driver	06 ÷ 10	80 ÷ 180	F165	103
DPZO-LEB/LES	piloted, on-board driver, 2 LVDT transducers	10 ÷ 35	180 ÷ 3500	FS175	109
DPZO-L	piloted, off-board driver, 2 LVDT transducers	10 ÷ 32	180 ÷ 1600	F175	125
DPZO-TEB/TES	piloted, on-board driver, 1 LVDT transducer	10 ÷ 32	180 ÷ 1600	FS172	135
DPZO-T	piloted, off-board driver, 1 LVDT transducer	10 ÷ 32	180 ÷ 1600	F172	149
LIQZO-LEB/LES	2 way ISO cartridge, piloted, on-board driver,	16 ÷ 100	600 ÷ 16000	FS330	157
LIQZP-LEB/LES	2 LVDT transducers				
LIQZO-L, LIQZP-L	2 way ISO cartridge, piloted, off-board driver,	16 ÷ 100	600 ÷ 16000	F330	171
	2 LVDT transducers				

DIRECTIONAL VALVES

positive overlap without transducer

DHZO-A/AEB/AES	direct, off-board or on-board driver	06 ÷ 10	70 ÷ 160	FS160	179
DKZOR-A/AEB/AES					
DHZE-A, DKZE-A	direct, off-board driver	06 ÷ 10	70 ÷ 160	F150	193
DPZO-A/AEB/AES	piloted, off-board or on-board driver	10 ÷ 32	180 ÷ 1500	FS170	199

SAFETY PROPORTIONALS

IEC 61508 & ISO 13849, on-board driver with double power supply /U

DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, LVDT transducer	06 ÷ 10	70 ÷ 160		
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, LVDT transducer	06 ÷ 10	80 ÷ 180	FY100	215
DPZO-TES, DPZO-LES	piloted, positive or zero overlap, 1 or 2 LVDT transducers	10 ÷ 35	180 ÷ 3500		

IEC 61508 & ISO 13849, on-board driver with on-off signals /K

DLHZO-TES, DLKZOR-TES	direct, zero overlap, sleeve execution, LVDT transducer	06 ÷ 10	70 ÷ 160		
DHZO-TES, DKZOR-TES	direct, positive or zero overlap, LVDT transducer	06 ÷ 10	80 ÷ 180	FY200	221
DPZO-TES, DPZO-LES	piloted, positive or zero overlap, 1 or 2 LVDT transducers	10 ÷ 35	180 ÷ 3500		

HIGH PERFORMANCE PRESSURE VALVES

with pressure transducer

RZMO-R/REB/RES-010	relief, direct, off-board or on-board driver	06	4	FS010	229
RZMO-R/REB/RES-030	relief, piloted, off-board or on-board driver	06	40	FS067	237
AGMZO-R/REB/RES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS040	245
RZGO-R/REB/RES-010	reducing, direct, off-board or on-board driver	06	12	FS020	255
RZGO-R/REB/RES-033	reducing, piloted, off-board or on-board driver	06	40	FS075	263
AGRCZO-R/REB/RES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS055	271

ISO cartridges, with pressure transducer

LIMZO-R/REB/RES	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500		
LIRZO-R/REB/RES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800	FS305	281
LICZO-R/REB/RES	compensator, piloted, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		

PRESSURE VALVES

without transducer

RZMO-A/AEB/AES-010	relief, direct, off-board or on-board driver	06	4	FS007	293
RZME-A	relief, direct, off-board driver, subplate	06	4	F005	301
CART RZME-A	relief, direct, off-board driver, screw-in cartridge	M20			
RZMO-A/AEB/AES-030	relief, piloted, off-board or on-board driver	06	40	FS065	307
HZMO-A	relief, piloted, off-board driver, modular				
AGMZO-A/AEB/AES	relief, piloted, off-board or on-board driver	10 ÷ 32	200 ÷ 600	FS035	315
AGMZE-A	relief, piloted, off-board driver	10 ÷ 32	200 ÷ 600	F030	325
RZGO-A/AEB/AES-010	reducing, direct, off-board or on-board driver	06	12	FS015	331
RZGE-A	reducing, direct, off-board driver, subplate	06	12		
CART RZGE-A	reducing, direct, off-board driver, screw-in cartridge	M20	12	F012	339
RZGO-A/AEB/AES-033	reducing, piloted, off-board or on-board driver	06 ÷ 10	40 ÷ 100	FS070	345
HZGO-A, KZGO-A	reducing, piloted, off-board driver, modular				
AGRCZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	10 ÷ 20	160 ÷ 300	FS050	355

ISO cartridges, without transducer

LIMZO-A/AEB/AES	relief, piloted, off-board or on-board driver	16 ÷ 80	200 ÷ 4500		
LIRZO-A/AEB/AES	reducing, piloted, off-board or on-board driver	16 ÷ 40	160 ÷ 800	FS300	365
LICZO-A/AEB/AES	compensator, piloted, off-board or on-board driver	16 ÷ 50	200 ÷ 2000		

for pilot lines, without transducer

DHRZO-A/AEB/AES	3 way reducing, direct, off-board or on-board driver	06	24	FS025	377
DHRZE-A	3 way reducing, direct, off-board driver	06	24	F022	385

		Size	Qmax [l/min]	Table	Pag
FLOW VALVES					
pressure compensated					
QVHZO-TEB/TES QVKZOR-TEB/TES	direct, on-board driver, LVDT transducer	06 ÷ 10	45 ÷ 90	FS412	389
QVHZO-T, QVKZOR-T	direct, off-board driver, LVDT transducer	06 ÷ 10	45 ÷ 90	F412	399
QVHZO-A/AEB/AES QVKZOR-A/AEB/AES	direct, off-board or on-board driver, without transducer	06 ÷ 10	45 ÷ 90	FS410	403

ELECTRONIC DRIVERS

off-board digital, DIN-rail EN 60715

E-BM-TES, E-BM-LES	for directional and flow valves with LVDT transducers, fieldbus, P/Q control			GS240	415
E-BM-TEB, E-BM-LEB	for directional and flow valves with LVDT transducers			GS230	423
E-BM-TID, E-BM-LID	for directional and flow valves with LVDT transducers			GS235	429
E-BM-RES	for pressure valves with transducer, fieldbus			GS203	435
E-BM-AES	for valves without transducer, fieldbus			GS050	441
E-BM-AS	for valves without transducer			G030	447

on-board, solenoid plug-in DIN 43650

E-MI-AS-IR	digital, for valves without transducer			G020	453
E-MI-AC	analog, for valves without transducer			G010	457

ACCESSORIES

E-ATR-8	pressure transducer with amplified analog output signal			GS465	813
BA	single station subplates, mounting surfaces ISO 4401, 6264 and 5781			K280	819
BA-214, BA-314, BA-244	multi-station subplates, mounting surface ISO 4401			K290	823
BA-214/AL	multi-station subplates, mounting surface ISO 4401, aluminium			K295	827
HAND LEVERS	for on-off and proportional valves			E138	829
HANDWHEELS & KNOBS	for on-off and proportional valves			K150	831
CONNECTORS	for transducers, on-off and proportional valves			K800	833

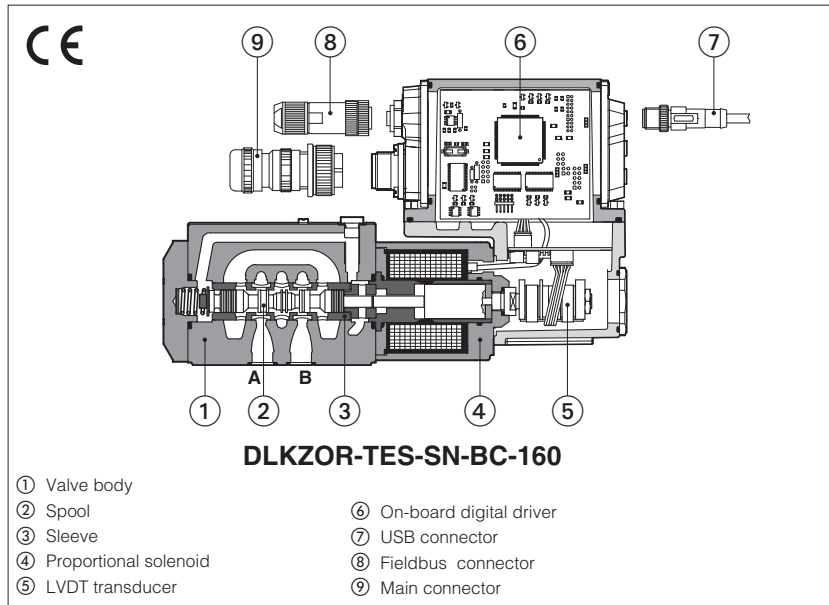
OPERATING INFORMATION

Operating and maintenance information for proportional valves				FS900	877
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Supplementary components range available on www.atos.com

Digital servoproportional directional valves sleeve execution

direct, with on-board driver, LVDT transducer and zero spool overlap with fail safe



DLHZO-TEB, DLHZO-TES DLKZOR-TEB, DLKZOR-TES

Digital servoproportional directional valves, direct, in sleeve execution with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital TEZ version (see tech. table FS610) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DLHZO:	DLKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 70 l/min	Max flow: 160 l/min
Max pressure: 350 bar	Max pressure: 315 bar

1 MODEL CODE

DLHZO	-	TES	-	SN	-	NP	-	0	40	-	L	7	3	/	*	/	*
--------------	---	------------	---	-----------	---	-----------	---	----------	-----------	---	----------	----------	----------	---	---	---	---

DLHZO = size 06
DLKZOR = size 10

TEB = basic on-board digital driver (1)
TES = full on-board digital driver

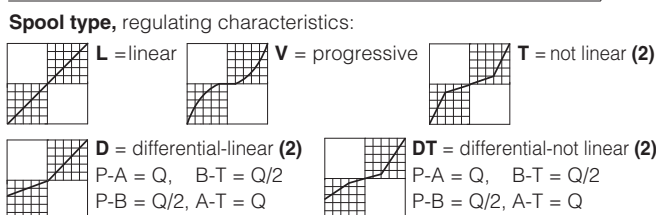
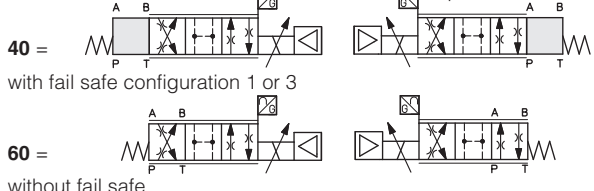
Alternated P/Q controls, see section 5:

SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interfaces, USB port always present:

NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: 0 = 06 1 = 10



(1) Only in version **SN-NP**
(2) Only for configuration **40**
(3) For possible combined options, see section 16
(4) Double power supply only for **TES**

Seals material, see section 11:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (3):
B = solenoid with on-board digital driver and LVDT transducer at side of port A
Y = external drain

Electronics options (3):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only **TES-SP, SF, SL**
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector (4)

Safety options TÜV certified - only TES (3):
U = safe double power supply
K = safe on/off signals
See section 7



Fail safe configuration, see section 13:



Note: select 1 for configuration 60 even without fail safe

Spool size: 0(L) 1(L) 1(V) 3(L) 3(T) 3(V) 5(L,T) 7(L,T,V,D,DT)

DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

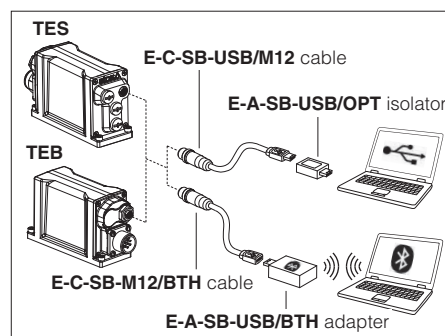
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



4 FIELDBUS - only for TES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for TES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table FS610

Digital servoproportional with on-board electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. **S*** option add alternated P/Q control to the basic position ones.

Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

**SAFETY
CERTIFIED**



8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DLHZO											DLKZOR							
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10											ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10							
Spool type	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	T3	L7	T7	V7	D7	DT7
Nominal flow Δp P-T [l/min]																			
(1)																			
$\Delta p = 30$ bar	2,5	4,5	8	9	13	18		26		26÷13		40	60		60÷33				
$\Delta p = 70$ bar	4	7	12	14	20	28		40		40÷20		60	100		100÷50				
Max permissible flow	8	14	16	30	40	50		70		70÷40		90	160		160÷80				
Leakage (2) [cm ³ /min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time (3) [ms]	≤ 10											≤ 15							
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatability	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$																		

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2

(2) Referred to spool in neutral position and 50°C oil temperature

(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	DLHZO = 2,6 A		DLKZOR = 3 A	
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω		DLKZOR = 2,2 ÷ 2,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
		see also filter section at www.atos.com or KTF catalog	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

12.1 Regulation diagrams

- 1** = Linear spools L
- 2** = Differential - linear spool D7
- 3** = Differential non linear spool DT7
- 4** = Non linear spool T5 (only for DLHZO)
- 5** = Non linear spool T3 (only for DLKZOR) and T7
- 6** = Progressive spool V

T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.

The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

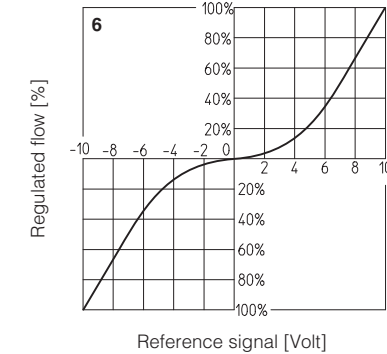
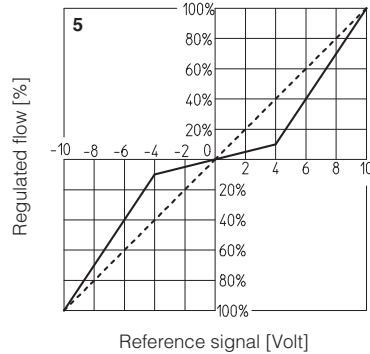
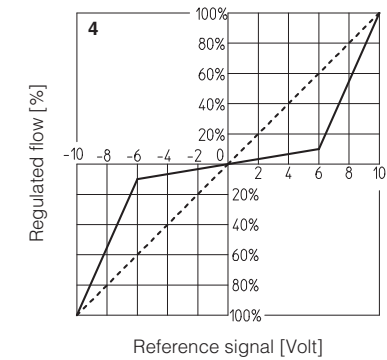
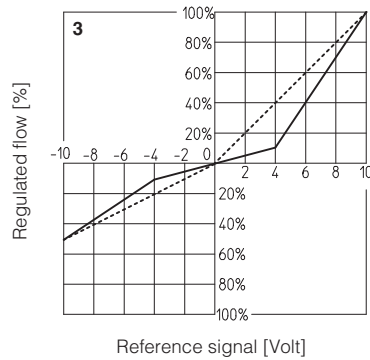
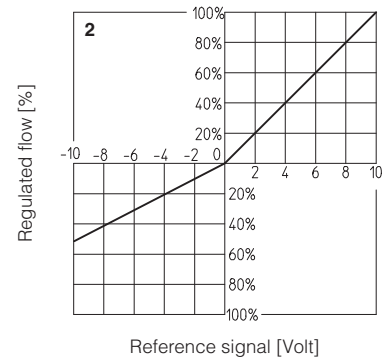
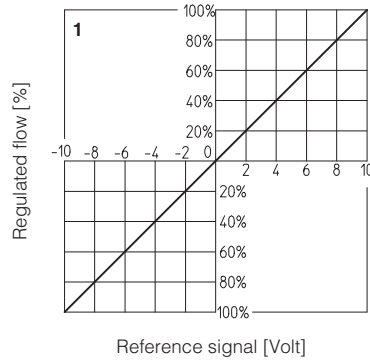
Note:
Hydraulic configuration vs. reference signal:

Standard:
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

option /B:
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

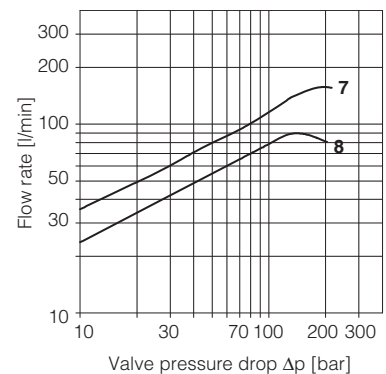
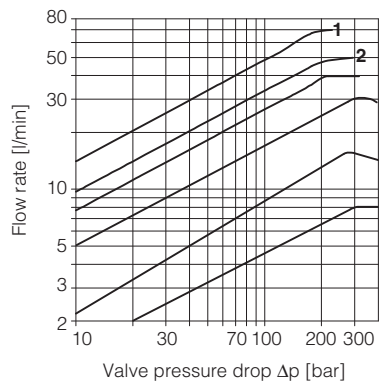


12.2 Flow /Δp diagrams

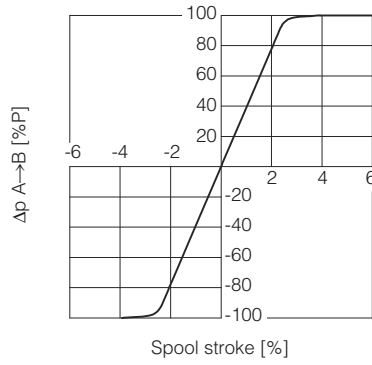
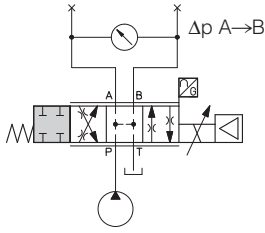
Stated at 100% of spool stroke

- DLHZO:
- 1** = spool L7, T7, V7, D7, DT7
 - 2** = spool L5, T5
 - 3** = spool V3
 - 4** = spool L3
 - 5** = spool L1, V1
 - 6** = spool L0

- DLKZOR:
- 7** = spool L7, T7, V7, D7, DT7
 - 8** = spool L3, T3

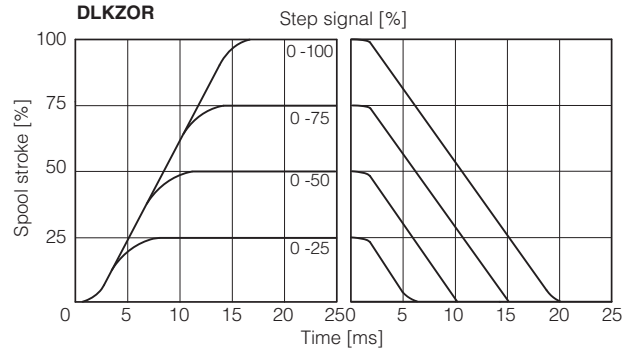
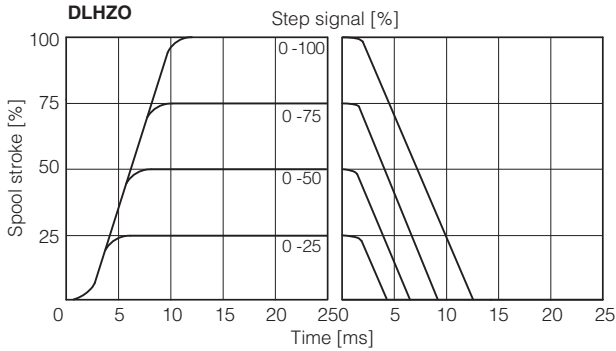


12.3 Pressure gain



12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



12.5 Bode diagrams

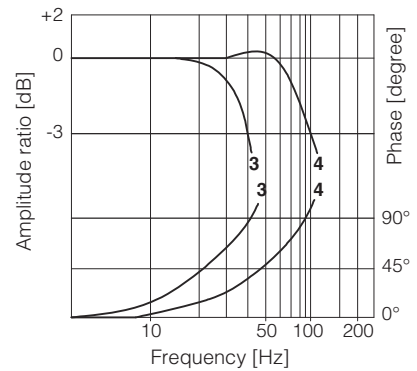
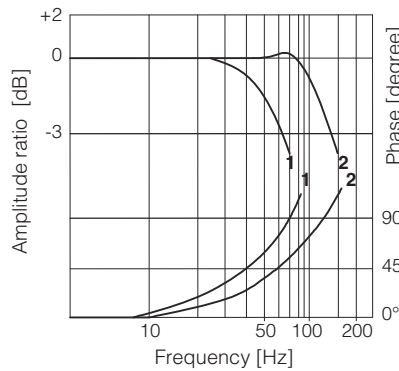
Stated at nominal hydraulic conditions

DLHZO:

- 1 = ± 100% nominal stroke
- 2 = ± 5% nominal stroke

DLKZOR:

- 3 = ± 100% nominal stroke
- 4 = ± 5% nominal stroke



13 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
<p>fail safe 1</p> <p>fail safe 3</p> <p>without fail safe</p>	<p>$t = 7-10$ ms (DLHZO) $t = 15-20$ ms (DLKZOR)</p>	<p>$t = 7-10$ ms (DLHZO) $t = 15-20$ ms (DLKZOR)</p>
<p>t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar</p>		

Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm ³ /min] at P = 100 bar (1)	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] (2)	DLHZO	-	-	15÷30	10÷20
	DLKZOR	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at $\Delta p = 35$ bar per edge

14 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.

I = This option provides $4 \div 20$ mA current reference and monitor signals, instead of the standard ± 10 Vdc.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.

The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle - see 17.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see above option /F

Enable input signal - see above option /Q

Repeat enable output signal - only for **TEB** (see 17.8)

Power supply for driver's logics and communication - only for **TES** (see 17.2)

C = This option is available to connect pressure (force) transducers with $4 \div 20$ mA current output signal, instead of the standard ± 10 Vdc.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

16 POSSIBLE COMBINED OPTIONS

Standard versions for TEB-SN and TES-SN:

/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY, /BY, /BYZ, /BZ,
/FI, /FIY, /FY,
/IQ, /IQY, /IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for TES-SP, SF, SL:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for TES-SN:

/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY,
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for TES-SP, SF, SL:

/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY,
/BCK, /BCKI, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY


17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table **FY100** and /K see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).

Analog input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus	NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VLO		VLO	V0	Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
	Q_INPUT+				Flow reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VLO		VLO	V0	Flow monitor output signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
	AGND				Analog ground	Gnd - analog signal
7	NC				Do not connect	
	F_INPUT+				Pressure/Force reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
8	R_ENABLE				Repeat enable, output repeater signal of enable input, referred to V0	Output - on/off signal
	NC				Do not connect	
9	NC				Do not connect	
	VL+				Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	NC				Do not connect	
	VLO				Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0 VLO		VLO	V0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
	D_IN0				Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	NC				Do not connect	
	VLO				Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	NC				Do not connect	
	VLO				Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	D_IN1				Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
	EARTH				Internally connected to the driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

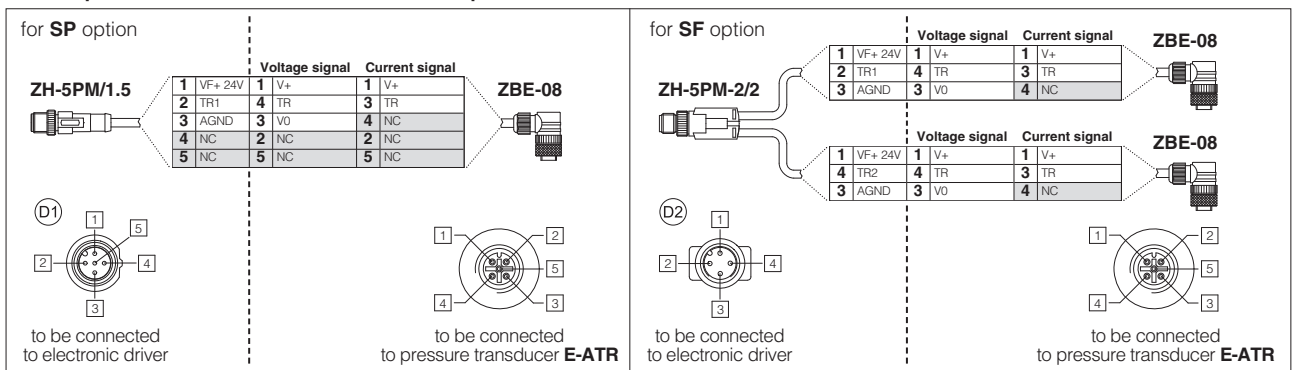
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 V _{dc} / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 V _{dc} / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

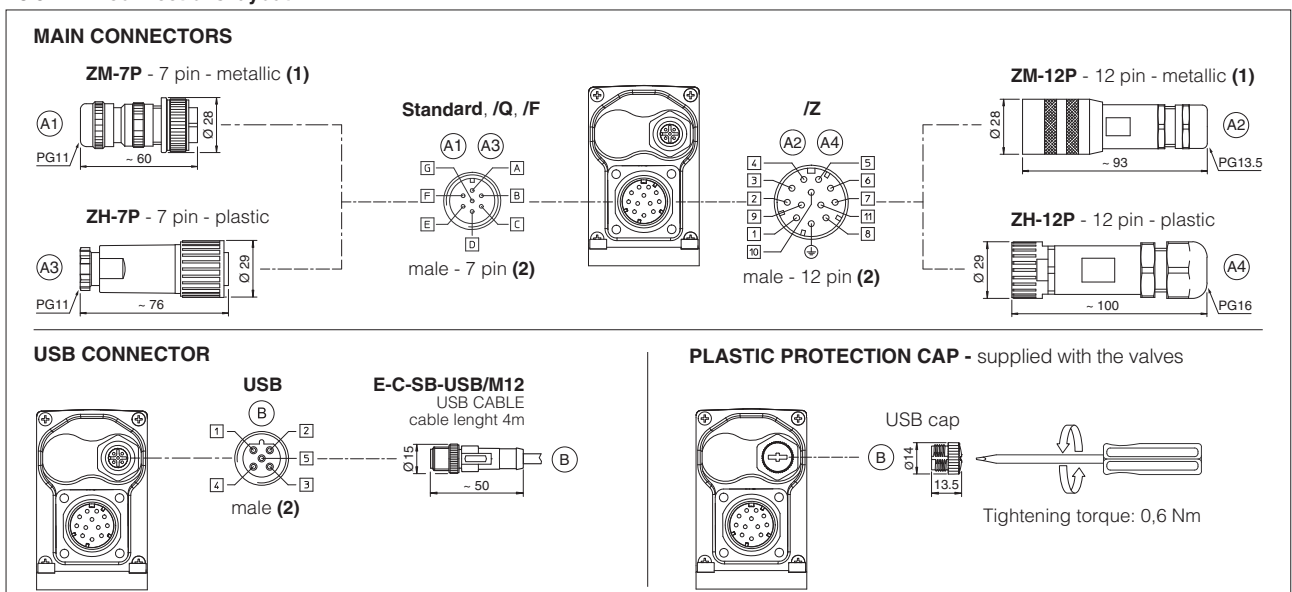
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

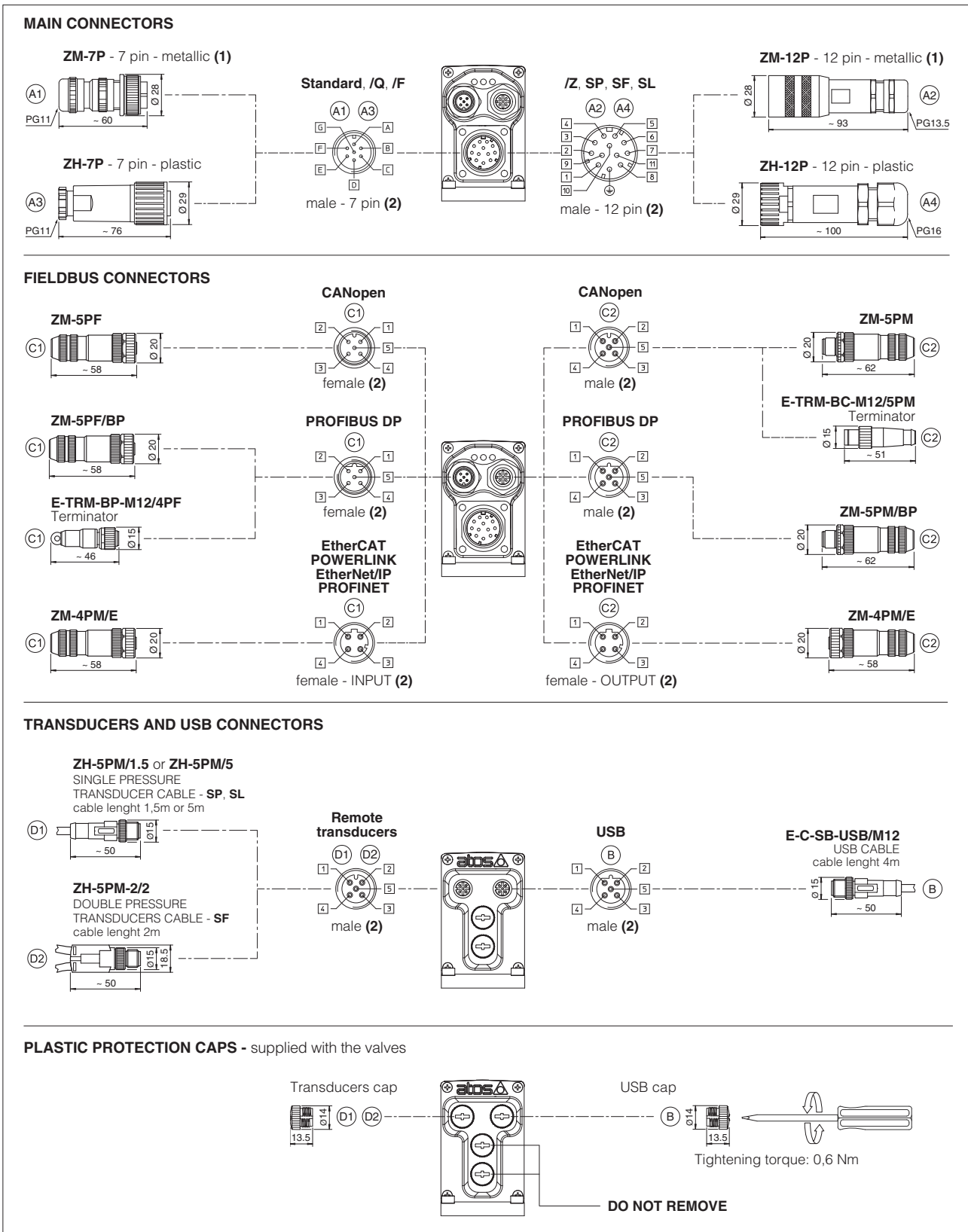
18.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

18.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDs	FIELDBUS							L1 L2 L3
	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	Ei EtherNet/IP	EP PROFINET	
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

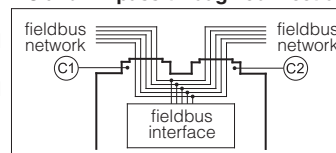
19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

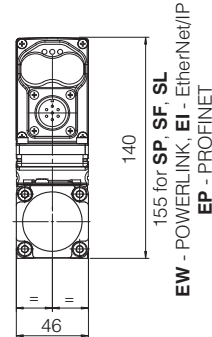
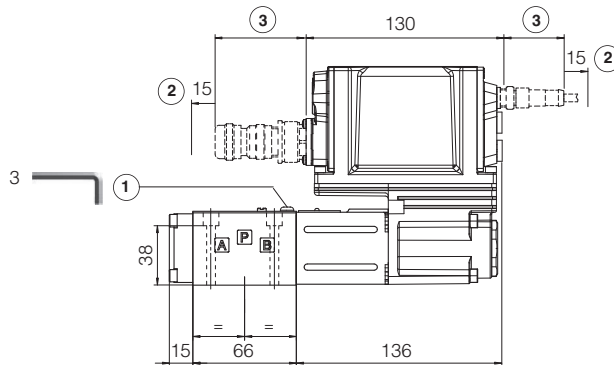
21 FASTENING BOLTS AND SEALS

	DLHZO	DLKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

DLHZO-TEB, DLHZO-TES

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see table P005)
 (for /Y surface 4401-03-03-0-05 without X port)

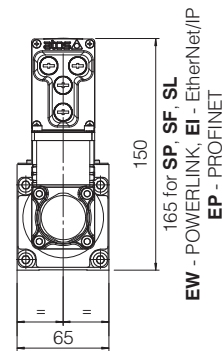
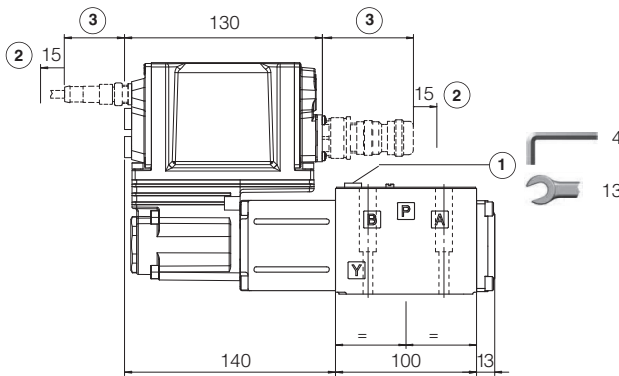
Mass [kg]	
DLHZO	2,3



DLKZOR-TEB, DLKZOR-TES

ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05 (see table P005)
 (for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3



- ① = Air bleeding
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

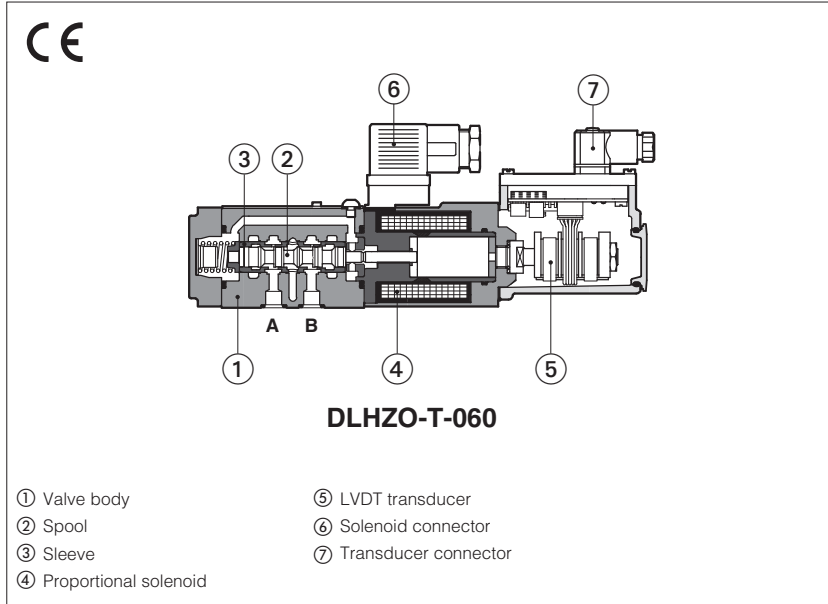
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS500	Digital proportional valves with P/Q control	K800	Electric and electronic connectors
FS610	Digital proportional valves with integral axis controller	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB300	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	QF300	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves sleeve execution

direct, with LVDT transducer and zero spool overlap with fail safe



DLHZO-T, DLKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section [2].

The LVDT transducer and the sleeve execution grant very high regulation accuracy and response sensitivity.

The fail safe position permits to intercept the actuator movement in case of power supply interruption.

Spools regulation characteristics:

L = linear

V = progressive

T = non linear for fine low flow control

D and DT = differential, for control of actuators with area ratio 1:2

DLHZO:

Size: **06** - ISO 4401

Max flow: **70 l/min**

Max pressure: **350 bar**

DLKZOR:

Size: **10** - ISO 4401

Max flow: **160 l/min**

Max pressure: **315 bar**

1 MODEL CODE

DLHZO - **T** - **0** **40** - **L** **7** **3** / ***** ***** / *****

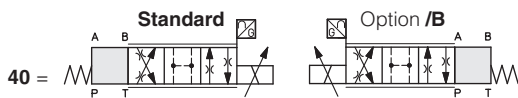
DLHZO = size 06
DLKZOR = size 10

T = with LVDT transducer

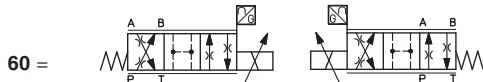
Valve size ISO 4401:

0 = 06 **1** = 10

Configuration:



with fail safe configuration 1 or 3



without fail safe

Spool type, regulating characteristics:

L = linear

V = progressive

T = not linear (1)



D = differential-linear (1)

DT = differential-not linear (1)



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material,
see section [6]:

- = NBR

PE = FKM

BT = HNBR

Series number

Hydraulic options (2):

B = solenoid and LVDT transducer at side of port A

Y = external drain

Fail safe configuration, see section [8]:



Note: select **1** for configuration **60** even without fail safe

Spool size: 0(L) 1(L) 1(V) 3(L) 3(T) 3(V) 5(L,T) 7(L,T,V,D,DT)

DLHZO = 4 7 8 14 - 20 28 40

DLKZOR = - - - 60 60 - - 100

Nominal flow (l/min) at Δp 70bar P-T

(1) Not available for configuration 60

(2) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TES	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DLHZO											DLKZOR							
	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10											ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10							
Pressure limits [bar]	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	T3	L7	T7	V7	D7	DT7
Spool type																			
Nominal flow Δp P-T [l/min] (1)																			
$\Delta p = 30$ bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
$\Delta p = 70$ bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage (2) [cm ³ /min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time (3) [ms]	≤ 10											≤ 15							
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatability	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$																		

(1) For different Δp , the max flow is in accordance to the diagrams in section 7.2

(2) Referred to spool in neutral position and 50°C oil temperature

(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	DLHZO = 2,6 A DLKZOR = 3 A
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω DLKZOR = 2,2 ÷ 2,4 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

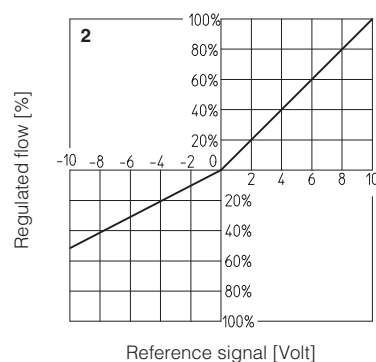
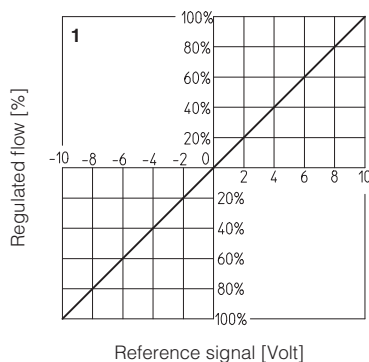
6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

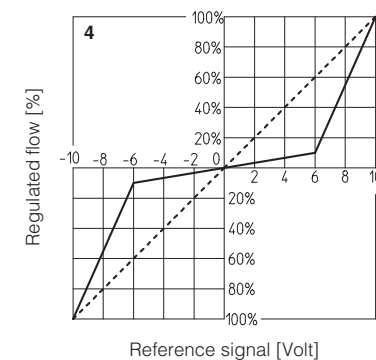
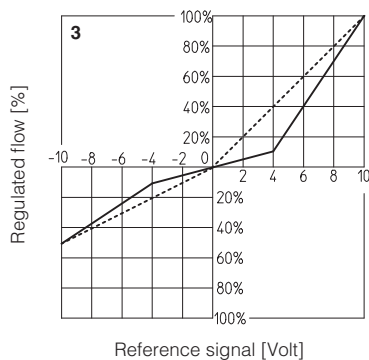
7.1 Regulation diagrams

- 1 = Linear spools L
- 2 = Differential - linear spool D7
- 3 = Differential non linear spool DT7
- 4 = Non linear spool T5 (only for DLHZO)
- 5 = Non linear spool T3 (only for DLKZOR) and T7
- 6 = Progressive spool V



T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3, T7) of max spool stroke. The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2



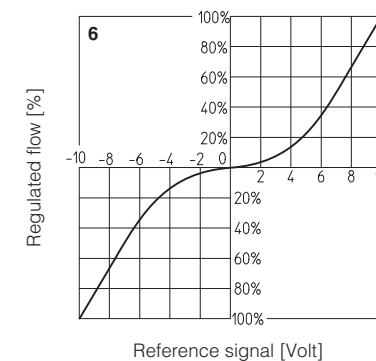
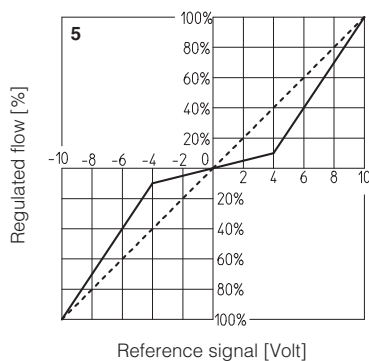
Note:
Hydraulic configuration vs. reference signal:

Standard:
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

option /B:
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$



7.2 Flow / Δp diagrams

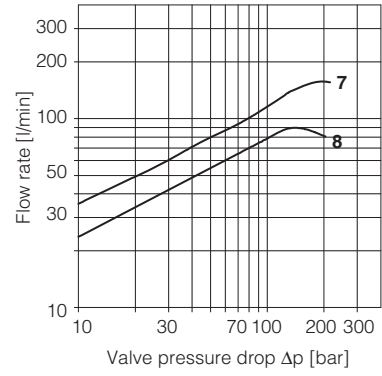
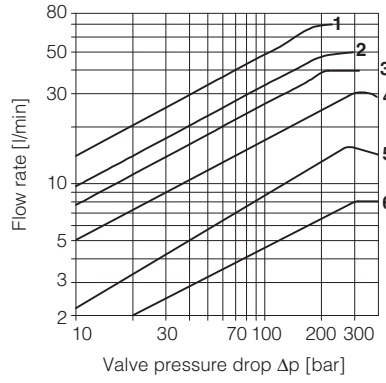
Stated at 100% of spool stroke

DLHZO:

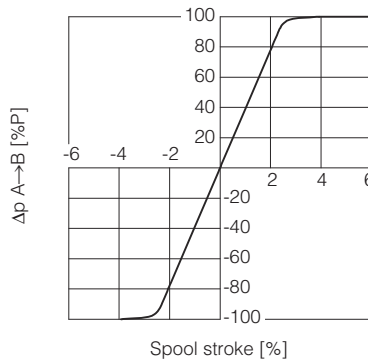
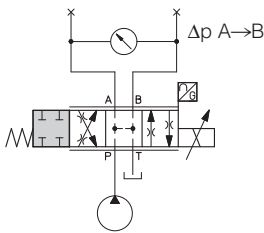
- 1 = spool L7, T7, V7, D7, DT7
- 2 = spool L5, T5
- 3 = spool V3
- 4 = spool L3
- 5 = spool L1, V1
- 6 = spool L0

DLKZOR:

- 7 = spool L7, T7, V7, D7, DT7
- 8 = spool L3

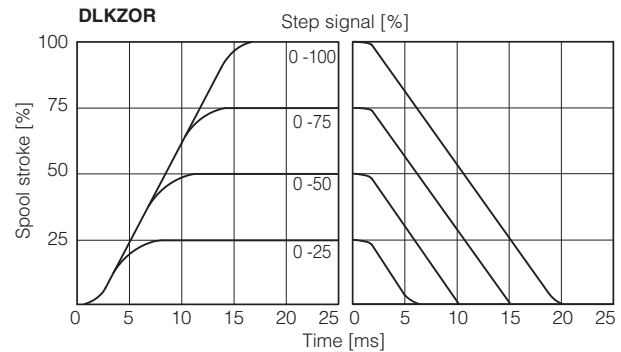
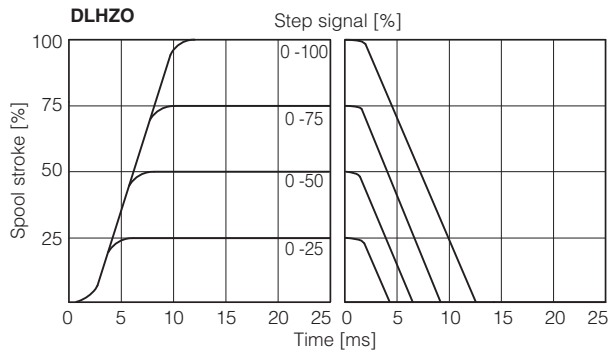


7.3 Pressure gain



7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



7.5 Bode diagrams

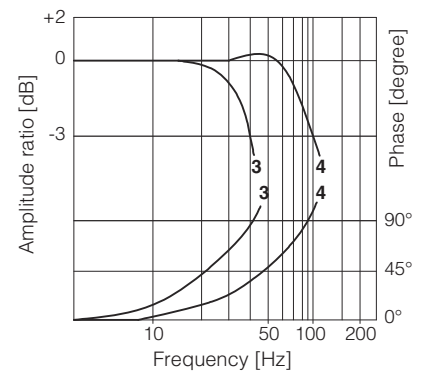
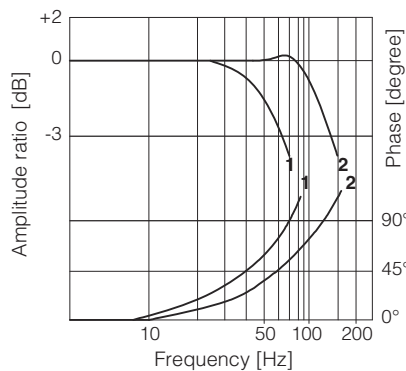
Stated at nominal hydraulic conditions

DLHZO:

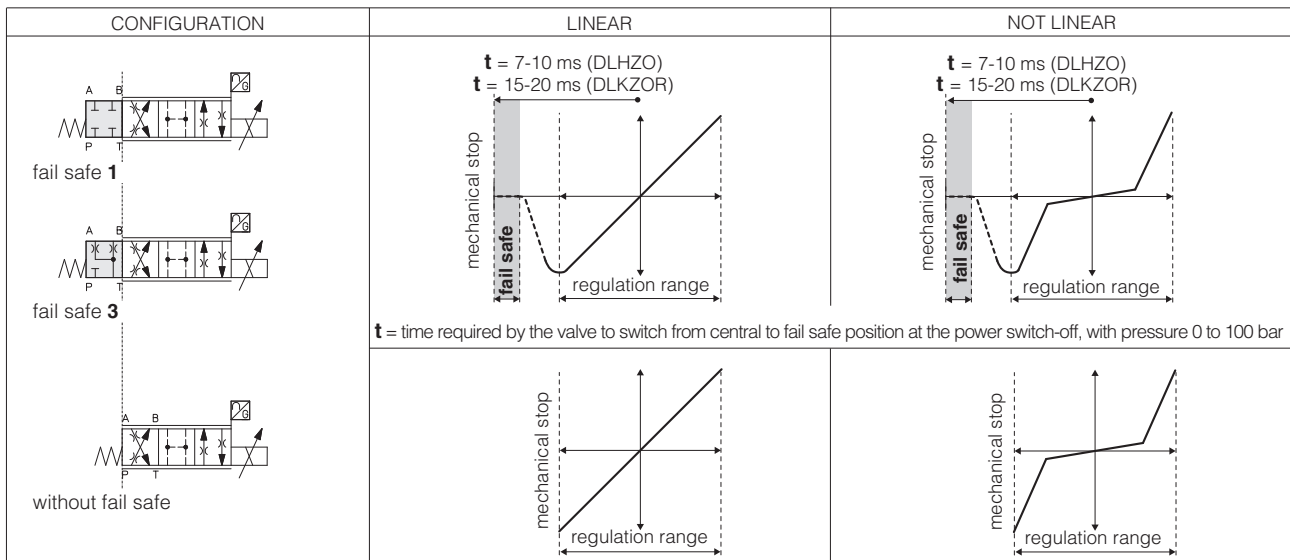
- 1 = $\pm 100\%$ nominal stroke
- 2 = $\pm 5\%$ nominal stroke

DLKZOR:

- 3 = $\pm 100\%$ nominal stroke
- 4 = $\pm 5\%$ nominal stroke



8 FAIL SAFE POSITION



Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm ³ /min] at P = 100 bar (1)	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] (2)	Fail safe 3	DLHZO	-	15÷30	10÷20
		DLKZOR	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature (2) Referred to spool in fail safe position at $\Delta p = 35$ bar per edge

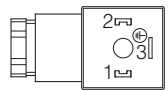
9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1

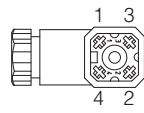
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION



10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

11 FASTENING BOLTS AND SEALS

	DLHZO	DLKZOR
	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>	<p>Fastening bolts:</p> <p>4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>
	<p>Seals:</p> <p>4 OR 108; Diameter of ports A, B, P, T: $\varnothing 7,5$ mm (max) 1 OR 2025 Diameter of port Y: $\varnothing = 3,2$ mm (only for /Y option)</p>	<p>Seals:</p> <p>5 OR 2050; Diameter of ports A, B, P, T: $\varnothing 11,2$ mm (max) 1 OR 108 Diameter of port Y: $\varnothing = 5$ mm (only for /Y option)</p>

12 INSTALLATION DIMENSIONS [mm]

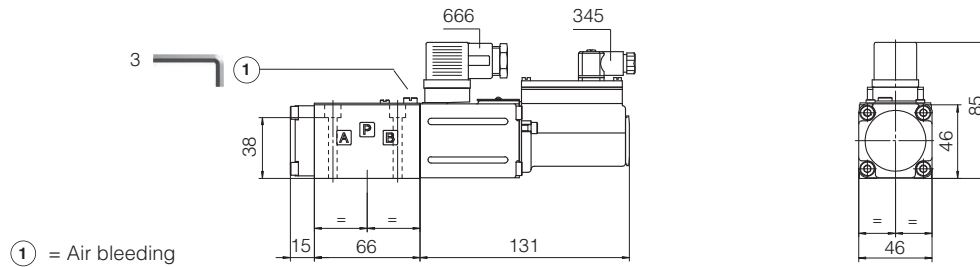
DLHZO-T

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)

(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DLHZO	2,3



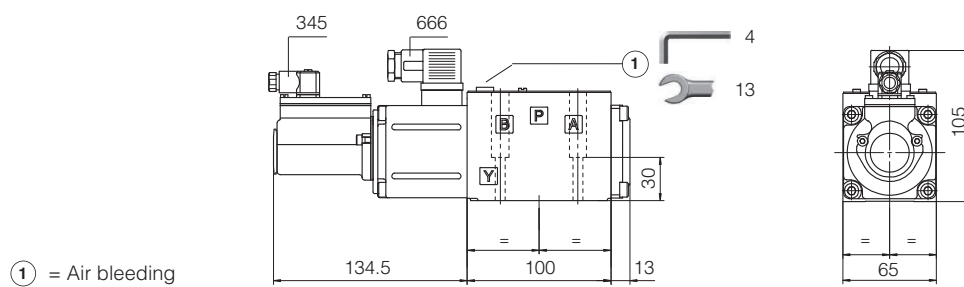
DLKZOR-T

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005)

(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3



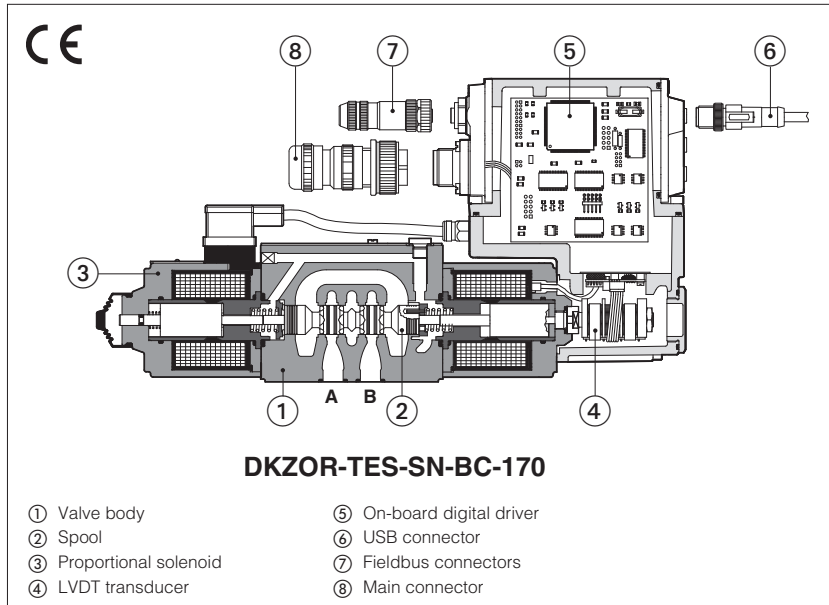
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS330	Z-BM-TEZ digital axis card
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
GS230	E-BM-TEB digital driver	GS510	Fieldbus
GS235	E-BM-TID digital driver	K800	Electric and electronic connectors
GS240	E-BM-TEZ digital driver	P005	Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

direct, with on-board driver, LVDT transducer and zero spool overlap



DHZO-TEB, DHZO-TEB
DKZOR-TEB, DKZOR-TEB

Digital servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for position closed loop controls. The double solenoid construction involves larger flows and central safety rest position.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

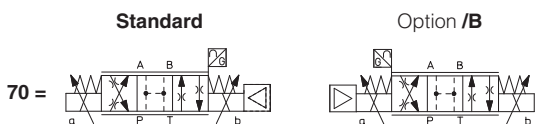
Digital TEZ version (see tech. table FS620) integrates on-board driver and axis card, while TEB and TES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

DHZO:	DKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 80 l/min	Max flow: 180 l/min
Max pressure: 350 bar	Max pressure: 315 bar

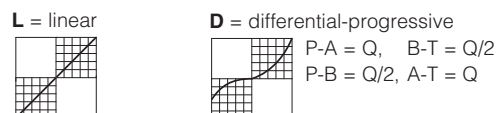
1 MODEL CODE

DHZO	-	TES	-	SN	-	NP	-	0	-	70	-	L	/	5	/	*	/	*
<p>Servoproportional directional valves, direct DHZO = size 06 DKZOR = size 10</p> <p>TEB = basic on-board digital driver (1) TES = full on-board digital driver</p> <p>Alternated P/Q controls, see section 5 :</p> <p>SN = none SP = pressure control (1 pressure transducer) SF = force control (2 pressure transducers) SL = force control (1 load cell)</p> <p>Fieldbus interfaces, USB port always present:</p> <p>NP = Not present BC = CANopen EW = POWERLINK BP = PROFIBUS DP EI = EtherNet/IP EH = EtherCAT EP = PROFINET RT/IRT</p> <p>Valve size ISO 4401: 0 = 06 1 = 10</p>																		
<p>Seals material, see section 11 :</p> <p>- = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Hydraulic options (2): B = solenoid with on-board digital driver and LVDT transducer at side of port A Y = external drain</p> <p>Electronics options (2): C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only TES-SP, SF, SL F = fault signal I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector (3)</p> <p>Safety options TÜV certified - only TES (2): U = safe double power supply K = safe on/off signals See section 7</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;">SAFETY CERTIFIED</div>																		
<p>Spool size: 3 (L) 5 (L,D)</p> <p>DHZO = 17 28</p> <p>DKZOR = 45 75</p> <p>Nominal flow (l/min) at Δp 10bar P-T</p>																		

Configuration:



Spool type, regulating characteristics:



(1) Only in version **SN-NP**

(2) For possible combined options, see section 15

(3) Double power supply only for **TES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

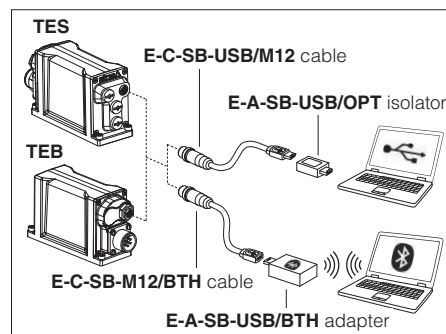


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



4 FIELDBUS - only for TES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for TES, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table **FS620**

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. **S*** option add alternated P/Q control to the basic position ones.

Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for TES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems. They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**



Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO			DKZOR		
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10			ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10		
Spool type	L3	L5	D5	L3	L5	D5
Nominal flow Δp P-T [l/min] (1)						
$\Delta p = 10$ bar	18	28	28	45	75	75
$\Delta p = 30$ bar	30	50	50	80	130	130
$\Delta p = 70$ bar	45	75	75	120	170	170
Max permissible flow (2)	50	80	80	130	180	180
Leakage [cm ³ /min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time (3) [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$					

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2

(2) See detailed diagrams in section 12.3

(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	DHZO = 2,6 A		DKZOR = 3 A	
Coil resistance R at 20°C	DHZO = 3 \div 3,3 Ω		DKZOR = 3,8 \div 4,1 Ω	
Analog input signals	Voltage: range ± 10 VDC (24 V _{MAX} tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ± 10 VDC @ max 5 mA current ± 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 5 VDC (OFF state), 9 \div 24 VDC (ON state), 5 \div 9 VDC (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

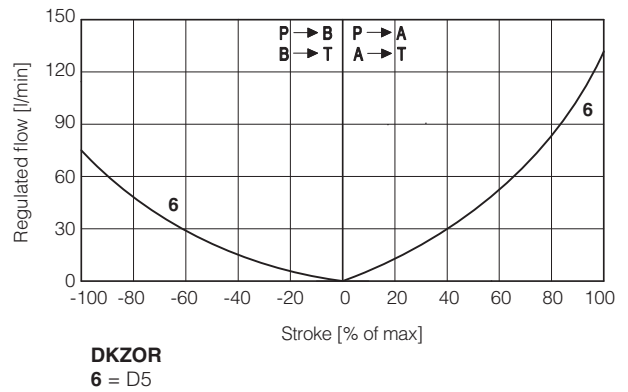
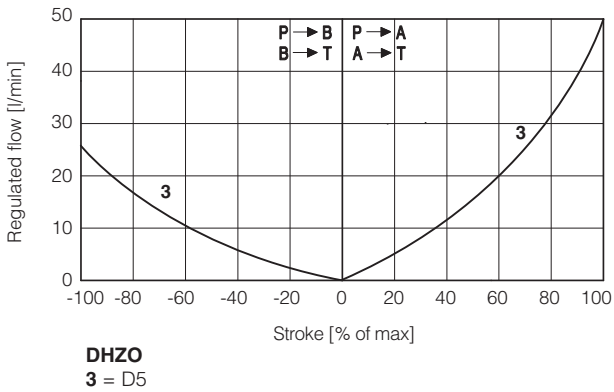
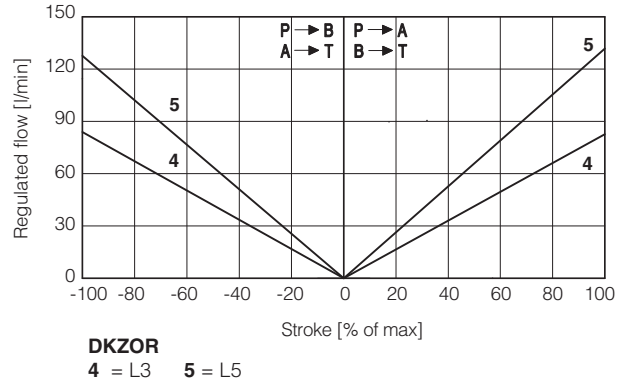
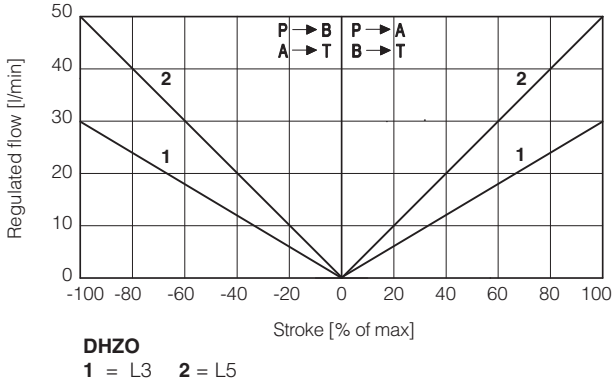
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{dc} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7
	longer life	ISO4406 class 16/14/11	NAS1638 class 5
		see also filter section at www.atos.com or KTF catalog	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

12.1 Regulation diagrams (values measure at Δp 30 bar P-T)



Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$ Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

12.2 Flow / Δp diagrams

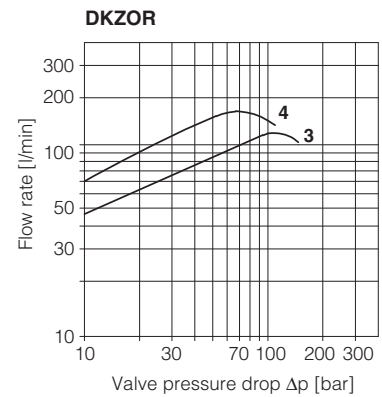
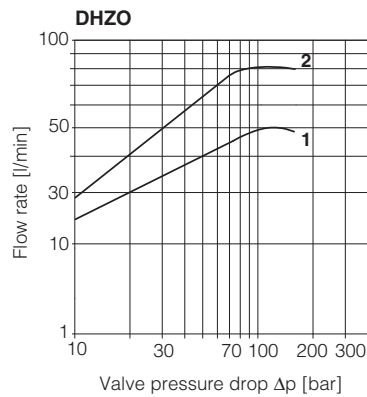
stated at 100% of valve stroke

DHZO

- 1 = spool L3,
- 2 = spool L5, D5

DKZOR

- 3 = spool L3
- 4 = spool L5, D5



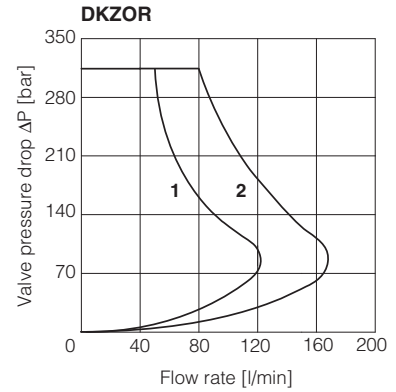
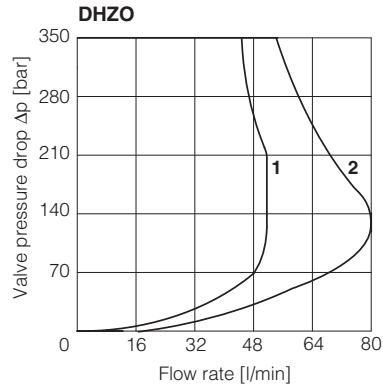
12.3 Operating limits

DHZO

- 1 = spool L3
- 2 = spool L5, D5

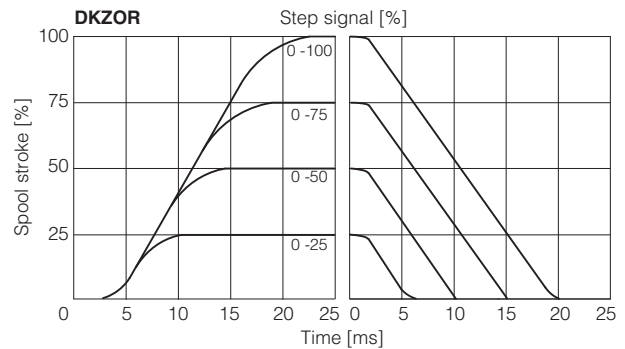
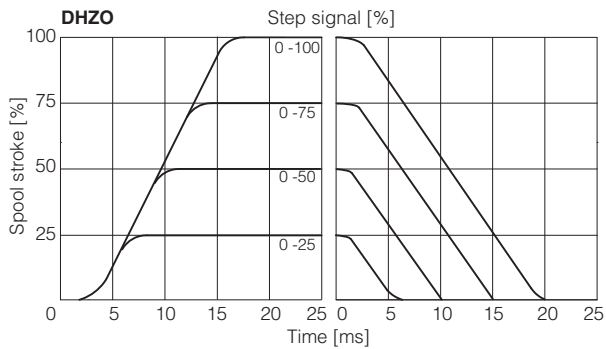
DKZOR

- 3 = spool L3
- 4 = spool L5, D5



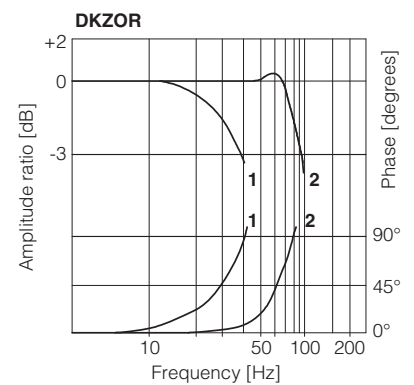
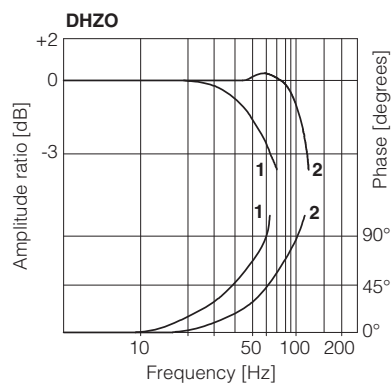
12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



12.5 Bode diagrams

- 1 = 10% \leftrightarrow 90% nominal stroke
- 2 = 50% \pm 5% nominal stroke



13 HYDRAULIC OPTIONS

- B** = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1
- Y** = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 Vdc.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **TEB** (see 17.8)
Power supply for driver's logics and communication - only for **TES** (see 17.2)
- C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 Vdc.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:

/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:

/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:

/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCKI, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CKI, /CKY, /IK, /IKY, /KY

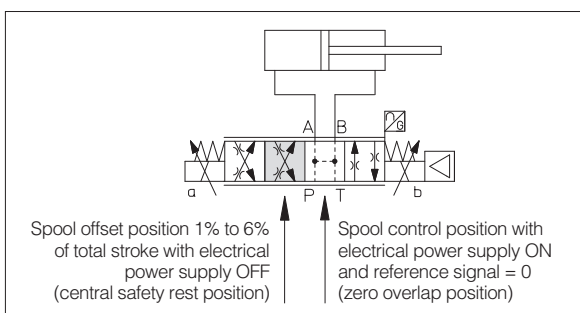
16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 Vdc), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.

The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 Vdc and reference input = 0V (or 12 mA for option /I) is applied to the driver.



17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table **FY100** and /K see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for $4 \div 20$ mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to:			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
	AGND	V0			
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus	NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0				Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+				Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND				Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	AGND				Analog ground	Gnd - analog signal
		NC			Do not connect	
8	R_ENABLE				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
9	VL+				Power supply 24 Vdc for driver's logic and communication	Input - power supply
				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
10	V0				Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
11	FAULT referred to: V0				Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

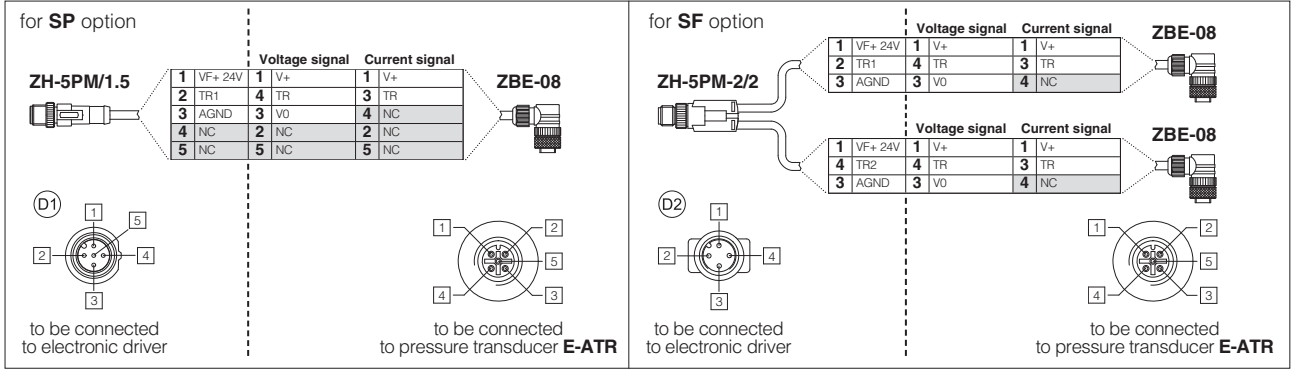
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

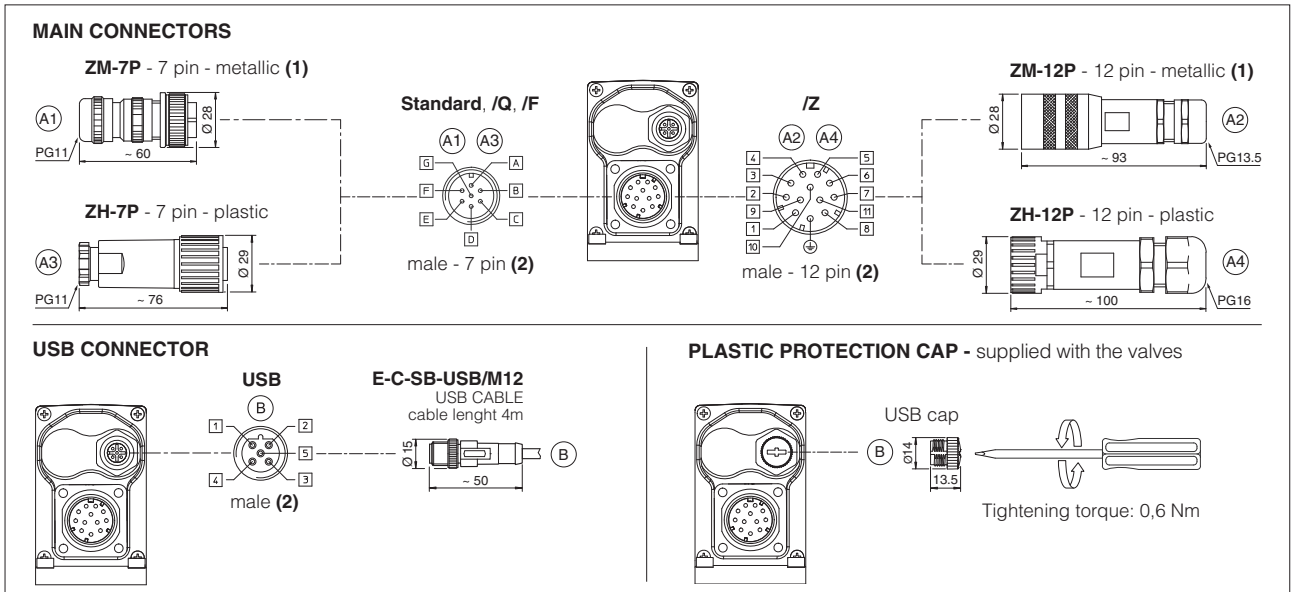
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

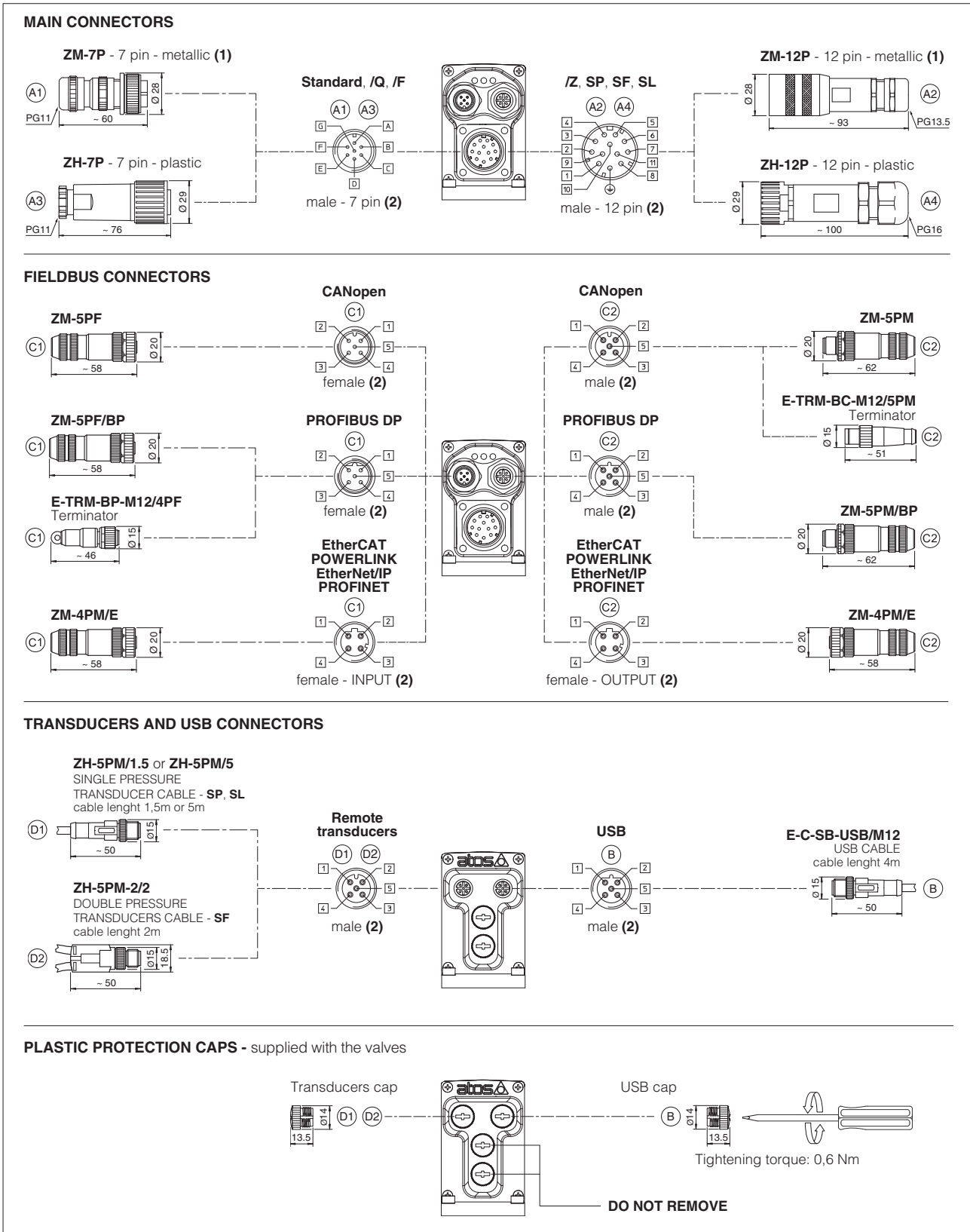
18.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

18.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1			VALVE STATUS			LINK/ACT			
L2			NETWORK STATUS			NETWORK STATUS			
L3			SOLENOID STATUS			LINK/ACT			

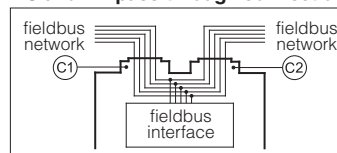
19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

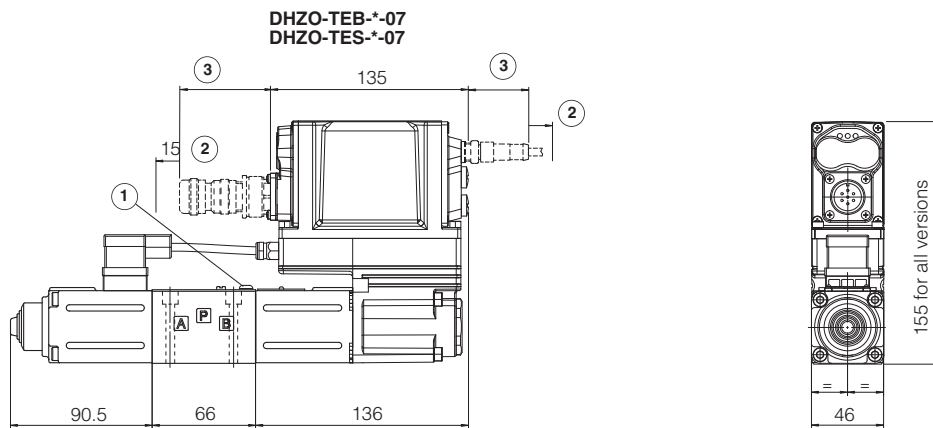
21 FASTENING BOLTS AND SEALS

	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

DHZO-TEB, DHZO-TES

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see table P005)
 (for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO	3,1

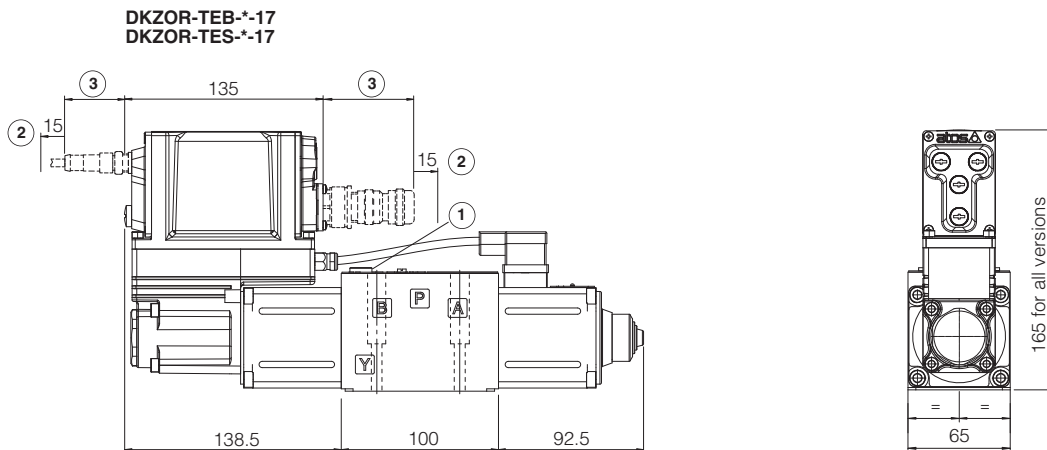


- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

DKZOR-TEB, DKZOR-TES

ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05 (see table P005)
 (for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR	5,0



- ① = Air bleeding 4 13
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

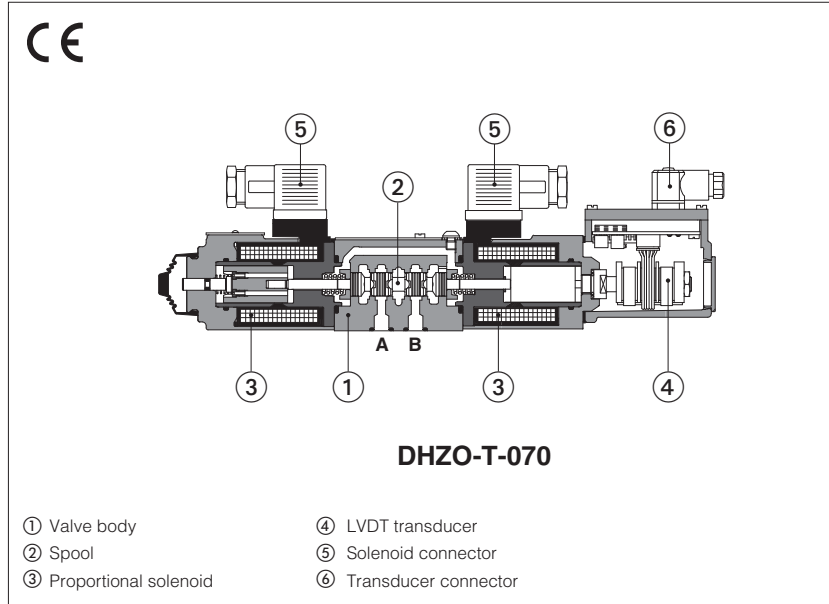
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS500	Digital proportional valves with P/Q control	K800	Electric and electronic connectors
FS620	Digital proportional valves with integral axis controller	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB300	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	QF300	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves

direct, with LVDT transducer and zero spool overlap



DHZO-T, DKZOR-T

Servoproportional directional valves, direct, with LVDT position transducer and zero spool overlap for best performances in any position closed loop.

The valves operate in association with digital off-board divers or axis card, see section [2]. The LVDT transducer grants very high regulation accuracy and response sensitivity. With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:

L = linear

D = differential-progressive, for control of actuators with area ratio 1:2

DHZO:

Size: **06** - ISO 4401

Max flow: **80 l/min**

Max pressure: **350 bar**

DKZOR:

Size: **10** - ISO 4401

Max flow: **180 l/min**

Max pressure: **315 bar**

1 MODEL CODE

DHZO	-	T	-	0	-	70	-	L	/	5	/	*	/	*	/	*								
<p>DHZO = size 06 DKZOR = size 10</p> <p>T = with LVDT transducer</p> <p>Valve size ISO 4401: 0 = 06 1 = 10</p> <p>Configuration:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Standard</p> </div> <div style="text-align: center;"> <p>Option /B</p> </div> </div> <p>Spool type, regulating characteristics:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>L = linear</p> </div> <div style="text-align: center;"> <p>D = differential-progressive</p> </div> </div> <p style="margin-left: 100px;">P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>																								
<p>Seals material, see section [6]:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR <p>Series number</p>																								
<p>Hydraulic options (1): B = solenoid and LVDT transducer at side of port A Y = external drain</p>																								
<p>Spool size:</p> <table style="margin-left: auto; margin-right: 0;"> <tr> <td></td> <td style="text-align: center;">3 (L)</td> <td style="text-align: center;">5 (L,D)</td> </tr> <tr> <td>DHZO</td> <td style="text-align: center;">= 17</td> <td style="text-align: center;">28</td> </tr> <tr> <td>DKZOR</td> <td style="text-align: center;">= 45</td> <td style="text-align: center;">75</td> </tr> </table> <p>Nominal flow (l/min) at Δp 10bar P-T</p>																	3 (L)	5 (L,D)	DHZO	= 17	28	DKZOR	= 45	75
	3 (L)	5 (L,D)																						
DHZO	= 17	28																						
DKZOR	= 45	75																						

(1) Possible combined options: /BY

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TEB	E-BM-TID	E-BM-TE5	Z-BM-TEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO			DKZOR		
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10			ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10		
Spool type	L3	L5	D5	L3	L5	D5
Nominal flow Δp P-T [l/min] (1)						
Δp= 10 bar	18	28	28	45	75	75
Δp= 30 bar	30	50	50	80	130	130
Δp= 70 bar	45	75	75	120	170	170
Max permissible flow (2)	50	80	80	130	180	180
Leakage [cm ³ /min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time (3) [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2

(2) See detailed diagrams in section 7.3

(3) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

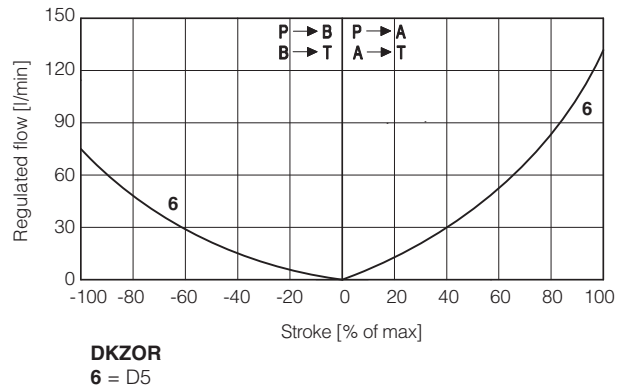
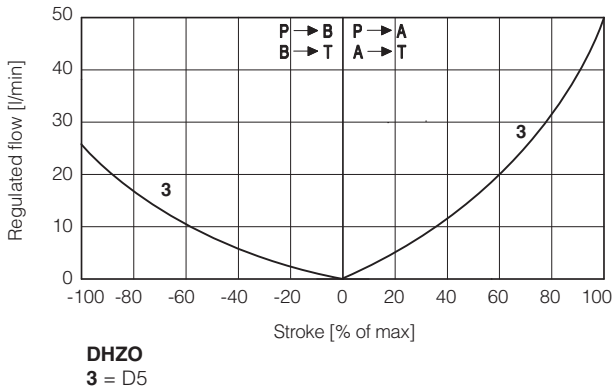
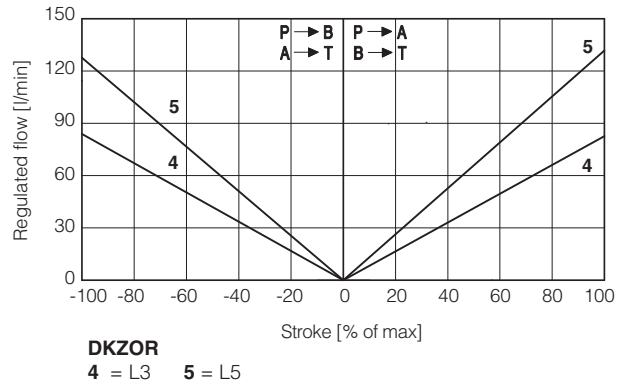
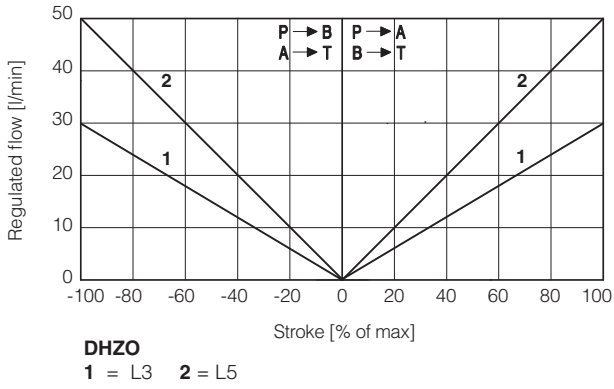
Max power consumption	30 W
Max. solenoid current	DLHZO = 2,6 A DLKZOR = 3 A
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω DLKZOR = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

7.1 Regulation diagrams (values measure at Δp 30 bar P-T)



Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$ Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

7.2 Flow / Δp diagrams

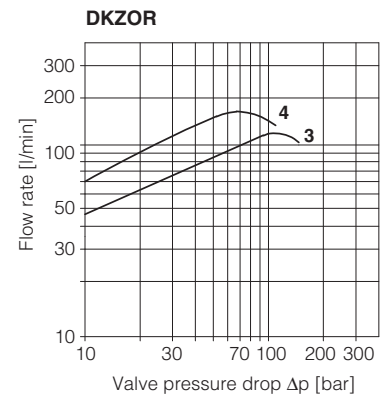
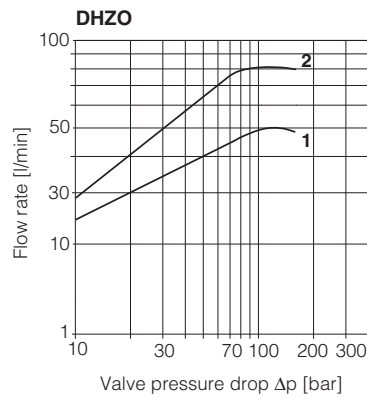
stated at 100% of valve stroke

DHZO

1 = spool L3,
2 = spool L5, D5

DKZOR

3 = spool L3
4 = spool L5, D5



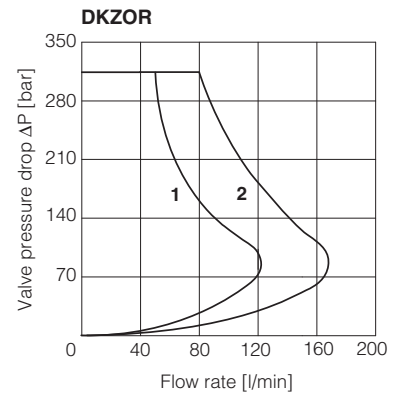
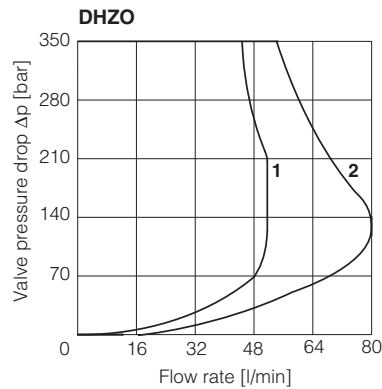
7.3 Operating limits

DHZO

1 = spool L3
2 = spool L5, D5

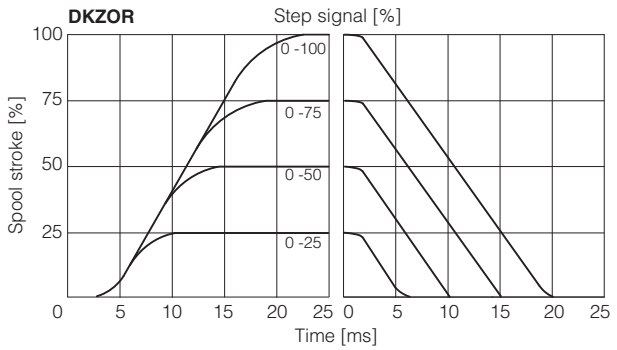
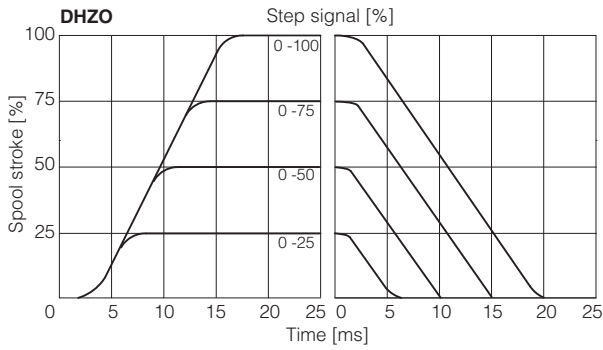
DKZOR

3 = spool L3
4 = spool L5, D5



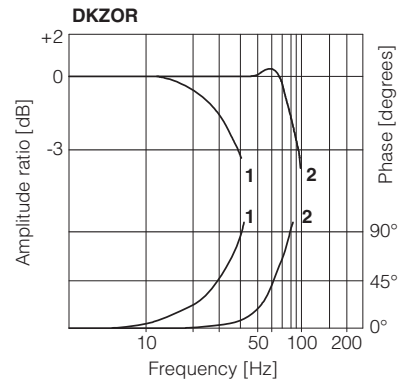
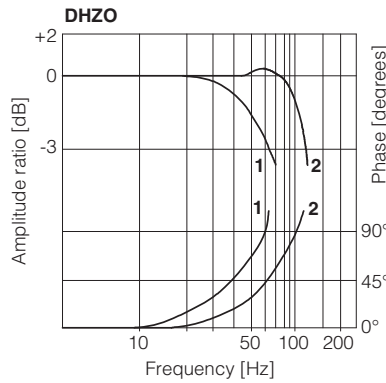
7.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



7.5 Bode diagrams

- 1 = 10% ↔ 90% nominal stroke
- 2 = 50% ± 5% nominal stroke



8 HYDRAULIC OPTIONS

- B** = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 7.1
- Y** = This option is mandatory if the pressure in port T exceeds 210 bar.

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

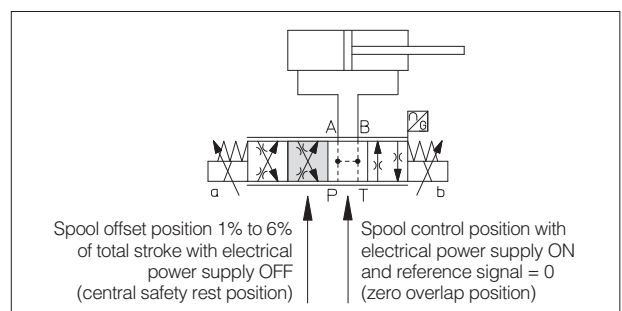
9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

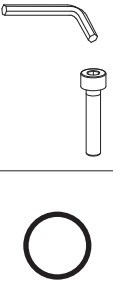
10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



11 FASTENING BOLTS AND SEALS

	<p>DHZO</p> <p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>	<p>DKZOR</p> <p>Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>
	<p>Seals: 4 OR 108; Diameter of ports A, B, P, T: \varnothing 7,5 mm (max) 1 OR 2025 Diameter of port Y: \varnothing = 3,2 mm (only for /Y option)</p>	<p>Seals: 5 OR 2050; Diameter of ports A, B, P, T: \varnothing 11,2 mm (max) 1 OR 108 Diameter of port Y: \varnothing = 5 mm (only for /Y option)</p>

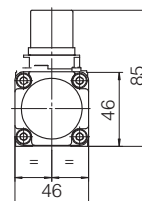
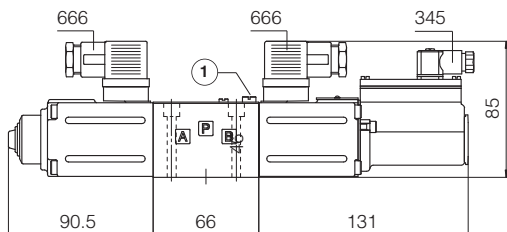
12 INSTALLATION DIMENSIONS [mm]

DHZO-T

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-T-07	2,6



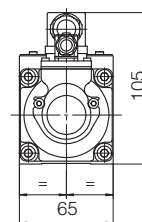
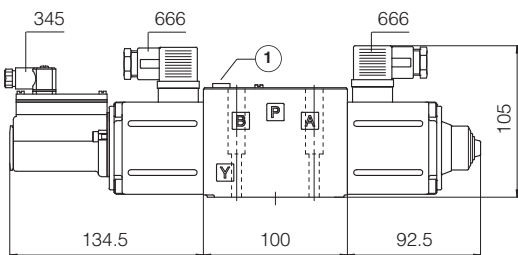
① = Air bleeding 

DKZOR-T

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-T-17	4,5



① = Air bleeding  

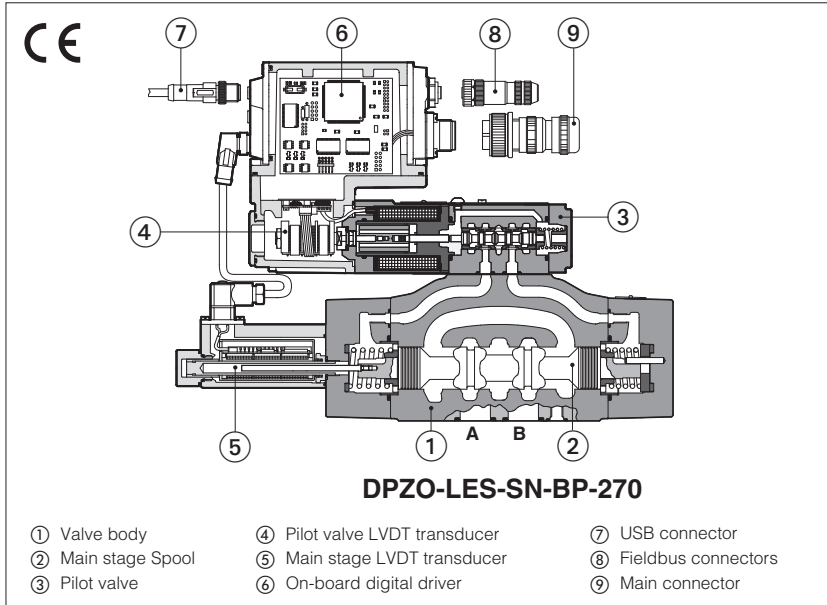
Note: for option /B the solenoid and the LVDT transducer are at side of port A

13 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics	GS330 Z-BM-TEZ digital axis card
FS900 Operating and maintenance information for proportional valves	GS500 Programming tools
GS230 E-BM-TEB digital driver	GS510 Fieldbus
GS235 E-BM-TID digital driver	K800 Electric and electronic connectors
GS240 E-BM-TES digital driver	P005 Mounting surfaces for electrohydraulic valves

Digital servoproportional directional valves

piloted, with on-board driver, two LVDT transducers and zero spool overlap



DPZO-LEB, DPZO-LES

Digital servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

LEB basic execution with analog reference signals and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

Digital LEZ version (see tech. table FS630) integrates on-board driver and axis card, while LEB and LES versions can be used in combination with Z-BM-KZ off-board axis card (see tech. table GS340).

Size: **10 ÷ 35** - ISO 4401
 Max flow: **180 ÷ 3500** l/min
 Max pressure: **350** bar

1 MODEL CODE

DPZO	-	LES	-	SN	-	NP	-	2		70	-	L		5	/	*		*	/	*
Servoproportional directional valve, piloted		LEB = basic on-board digital driver (1) LES = full on-board digital driver		SN = none SP = pressure control (1 pressure transducer) SF = force control (2 pressure transducers) SL = force control (1 load cell)		Fieldbus interfaces , USB port always present: NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK EI = EtherNet/IP EP = PROFINET RT/IRT		Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 4M = 27 6 = 32 8 = 35		Series number		Seals material , see section 11: - = NBR PE = FKM BT = HNBR								

Alternated P/Q controls, see section 5 :

SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

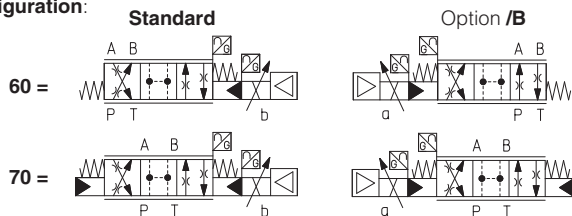
Fieldbus interfaces, USB port always present:

NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

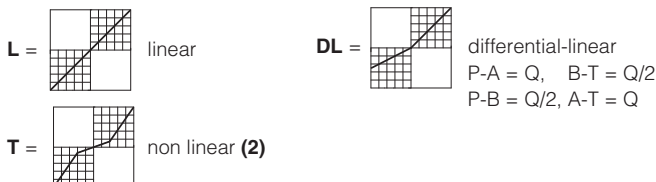
Valve size ISO 4401:

1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Configuration:



Spool type, regulating characteristics:



Hydraulic options (3):

B = solenoid with on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve)

D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (3):

C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only **LES-SP, SF, SL**

F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)

Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector (4)

Safety options TÜV certified - only LES (3):

U = safe double power supply
K = safe on/off signals

See section 7

**SAFETY
 CERTIFIED**

Spool size: 3 (L) 5 (L,DL) 5 (L) 5 (T)

DPZO-1	=	-	100	-	-
DPZO-2	=	160	250	-	190
DPZO-4	=	-	480	-	-
DPZO-4M	=	-	550	-	-
DPZO-6	=	-	-	640	-
DPZO-8	=	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

(1) Only in version **SN-NP**
 (2) Only for DPZO-*-270

(3) For possible combined options, see section 15
 (4) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

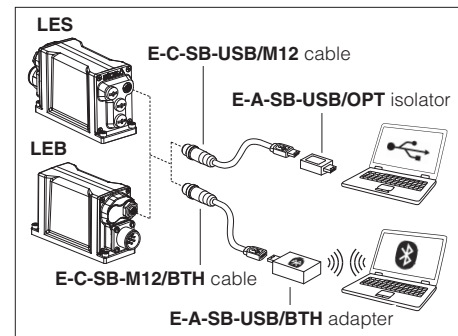


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



4 FIELDBUS - only for LES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for LES, see tech. table FS500

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 AXIS CONTROLLER - see tech. table FS630

Digital servoproportional with integral electronics **LEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. **S*** option add alternated P/Q control to the basic position ones.

Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

7 SAFETY OPTIONS - only for LES

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**



Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO*-1	DPZO*-2		DPZO*-4	DPZO*-4M	DPZO*-6	DPZO*-8
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;						
Spool type	L5, DL5	L3	L5, DL5	T5	L5, DL5		L5
Nominal flow Δp P-T [l/min] (1)							
$\Delta p = 10$ bar	100	160	250	190	480	550	640
$\Delta p = 30$ bar	160	270	430	330	830	950	1100
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)						
Piloting volume [cm ³ /min]	1,4	3,7		9	11,3	21,6	39,8
Piloting flow (2) [l/min]	3,5	9		18	20	19	24
Leakage (3) Pilot [cm ³ /min]	100 / 300	150 / 450		200 / 600	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5		1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time (4) [ms]	≤ 25	≤ 25		≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis	≤ 0,1 [%of max regulation]						
Repeatability	± 0,1 [%of max regulation]						
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$						

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2

(3) At $p = 100/350$ bar

(2) With step reference input signal 0 ÷ 100 %

(4) 0-100% step signal, see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

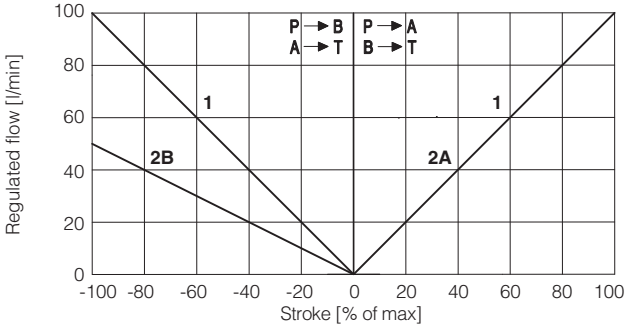
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

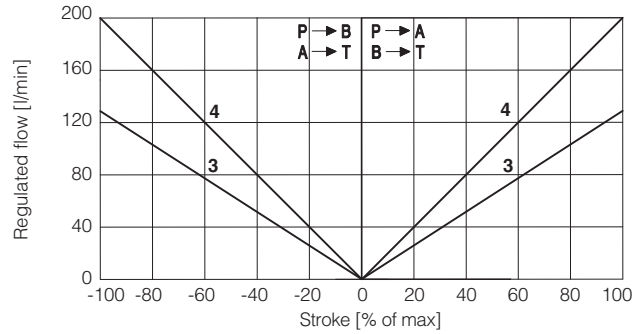
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7
	longer life	ISO4406 class 16/14/11	NAS1638 class 5
		see also filter section at www.atos.com or KTF catalog	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

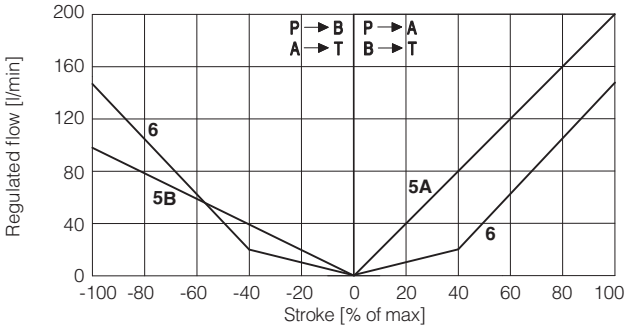
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



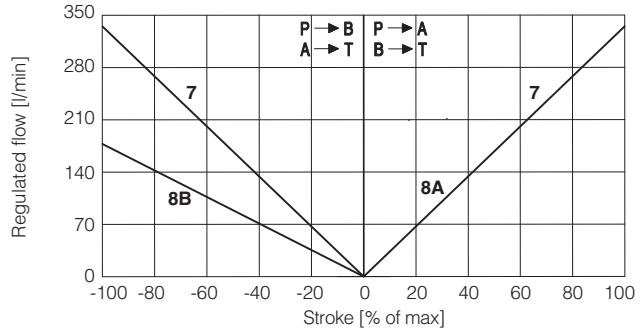
DPZO-1: 1 = L5 2A = DL5 (P → A, A → T)
2B = DL5 (P → B, B → T)



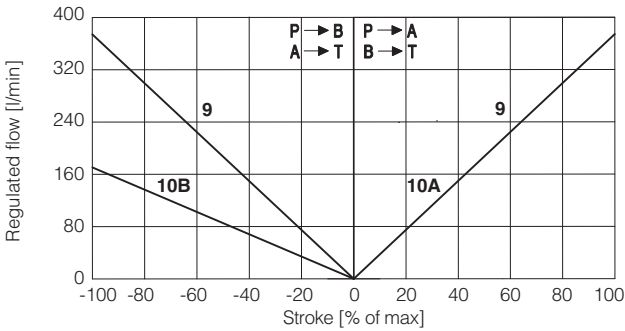
DPZO-2: 3 = L3 4 = L5



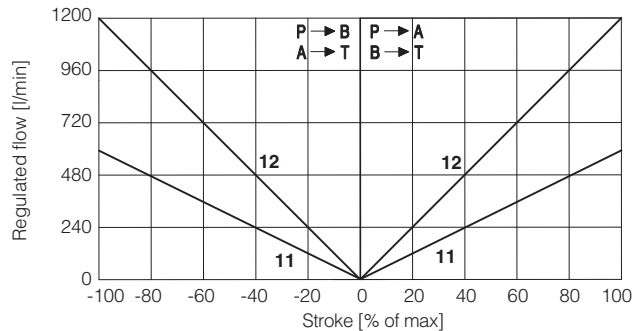
DPZO-2: 5A = DL5 (P → A, A → T) 6 = T5
5B = DL5 (P → B, B → T)



DPZO-4: 7 = L5 8A = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

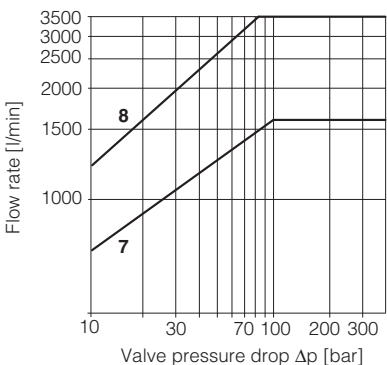
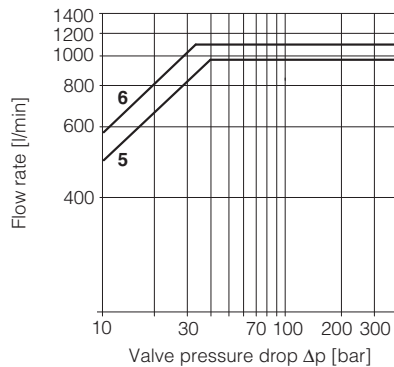
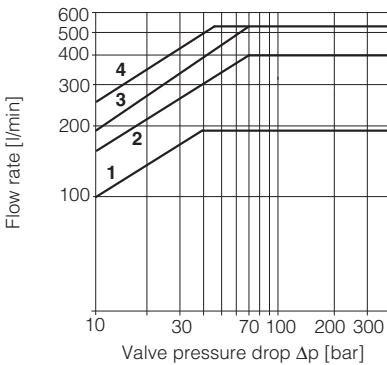


DPZO-4M: 9 = L5 10A = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)



DPZO-6: 11 = L5
DPZO-8: 12 = L5

12.2 Flow / Δp diagram - stated at 100% of spool stroke



DPZO-1: 1 = spools L5, DL5 **DPZO-4:** 5 = spools L5, DL5 **DPZO-6:** 7 = L5
DPZO-2: 2 = spools L3 **DPZO-4M:** 6 = spools L5, DL5 **DPZO-8:** 8 = L5
3 = spool T5
4 = spools L5, DL5

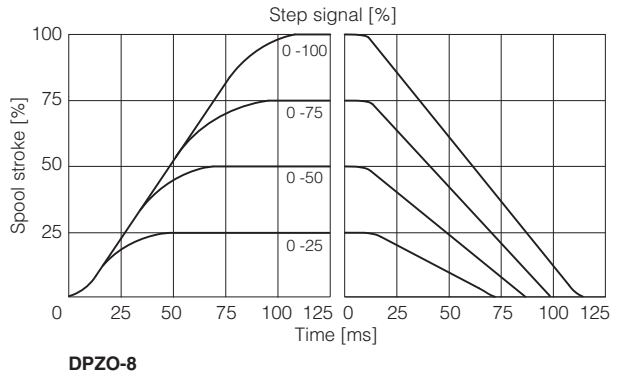
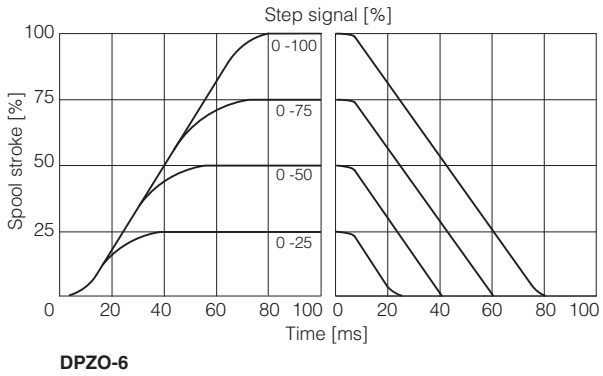
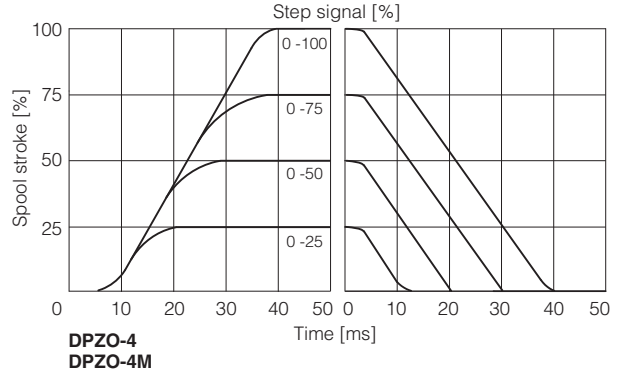
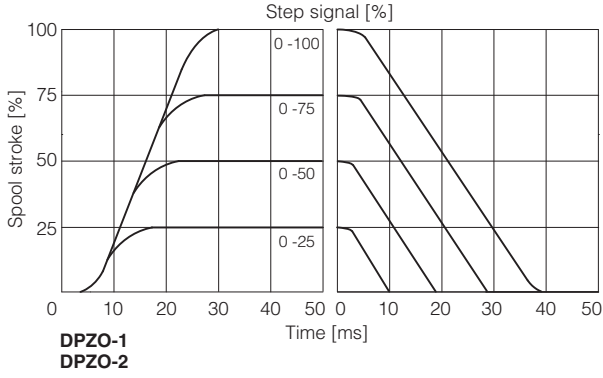
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 4 \div 12 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

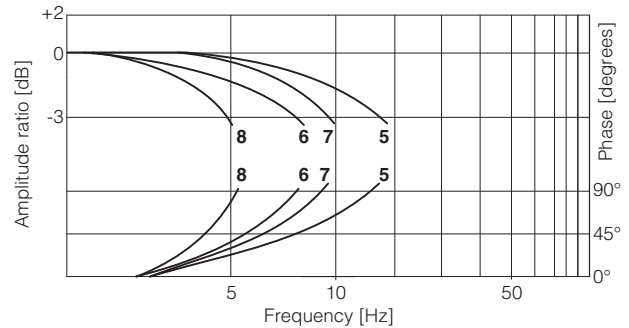
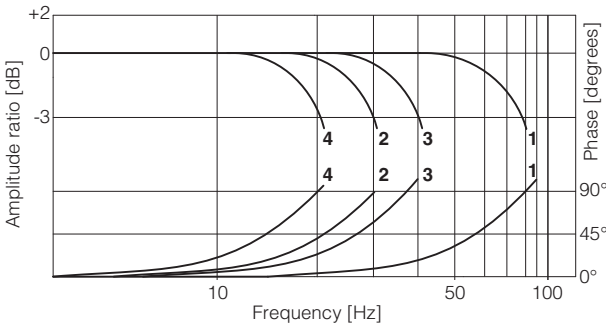
12.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



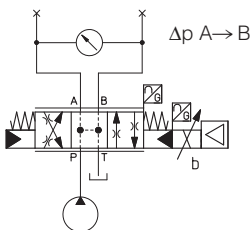
12.4 Bode diagrams

Stated at nominal hydraulic conditions.

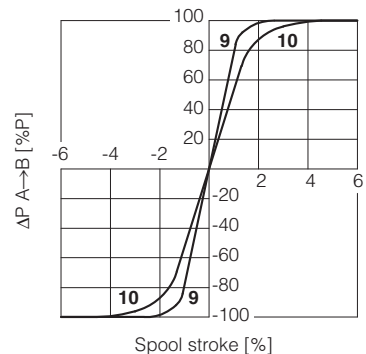


- | | |
|--------------------------|----------------------------|
| 1 = DPZO-1 } ± 5% | 2 = DPZO-1 } ± 100% |
| DPZO-2 } | DPZO-2 } |
| 3 = DPZO-4 } ± 5% | 4 = DPZO-4 } ± 100% |
| DPZO-4M } | DPZO-4M } |
| 5 = DPZO-6 ± 5% | 6 = DPZO-6 ± 100% |
| 7 = DPZO-8 ± 5% | 8 = DPZO-8 ± 100% |

12.5 Pressure gain



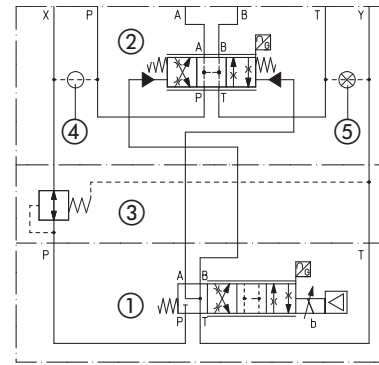
- | |
|--------------------|
| 9 = DPZO-1 |
| 10 = DPZO-2 |
| DPZO-4 |
| DPZO-4M |
| DPZO-6 |
| DPZO-8 |



13 HYDRAULIC OPTIONS

- B** = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1
- D** = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.
- E** = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 21
The valve's standard configuration provides internal pilot and external drain.
- G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:
DPZO-2 = **28 bar**
DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**
- It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



- ① Pilot valve
② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot through port X
⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 17.9 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.7 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **LEB** (see 17.8)
Power supply for driver's logics and communication - only for **LES** (see 17.2)
- C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:

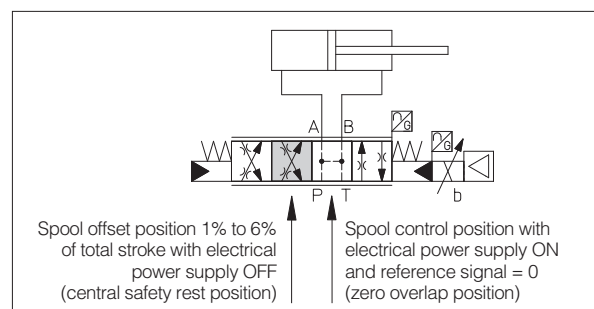
LEB-SN, LES-SN
/FI, /IQ, /IZ
LES-SP, SF, SL
/CI

Electronics options - Safety certified versions:

LES-SN
/IU, /IK
LES-SP, SF, SL
/CU, /IU, /CIU, /CK, /IK, /CIK

16 SAFETY REST POSITION - configuration 70

In absence of electric power supply (+24 VDC), the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.
This is specifically designed to avoid that in case of accidental interruption of the electrical power supply to the valve, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury.
Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.
The main spool moves to the closed loop control position (zero overlap) when the pilot pressure is activated, the valve is fed with power supply +24 VDC and reference input = 0V (or 12 mA for option /I) is applied to the driver.



17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and TES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

17.4 Pressure or force reference input signal (F_INPUT+) - only for TES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

17.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for TES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 17.7).

17.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for $4 \div 20$ mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

17.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 18.4).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

17.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL Fieldbus	NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VL0 VL0 V0				Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+				Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VL0 VL0 V0				Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	AGND				Analog ground	Gnd - analog signal
		NC			Do not connect	
8	R_ENABLE				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC			Do not connect	
9	NC				Do not connect	
		VL+			Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	NC				Do not connect	
		VL0			Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0 VL0 VL0 V0				Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

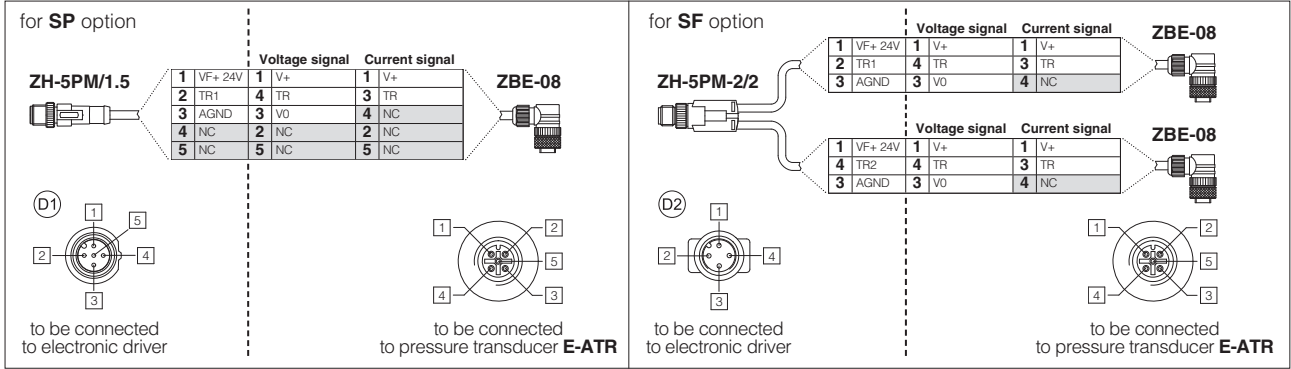
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

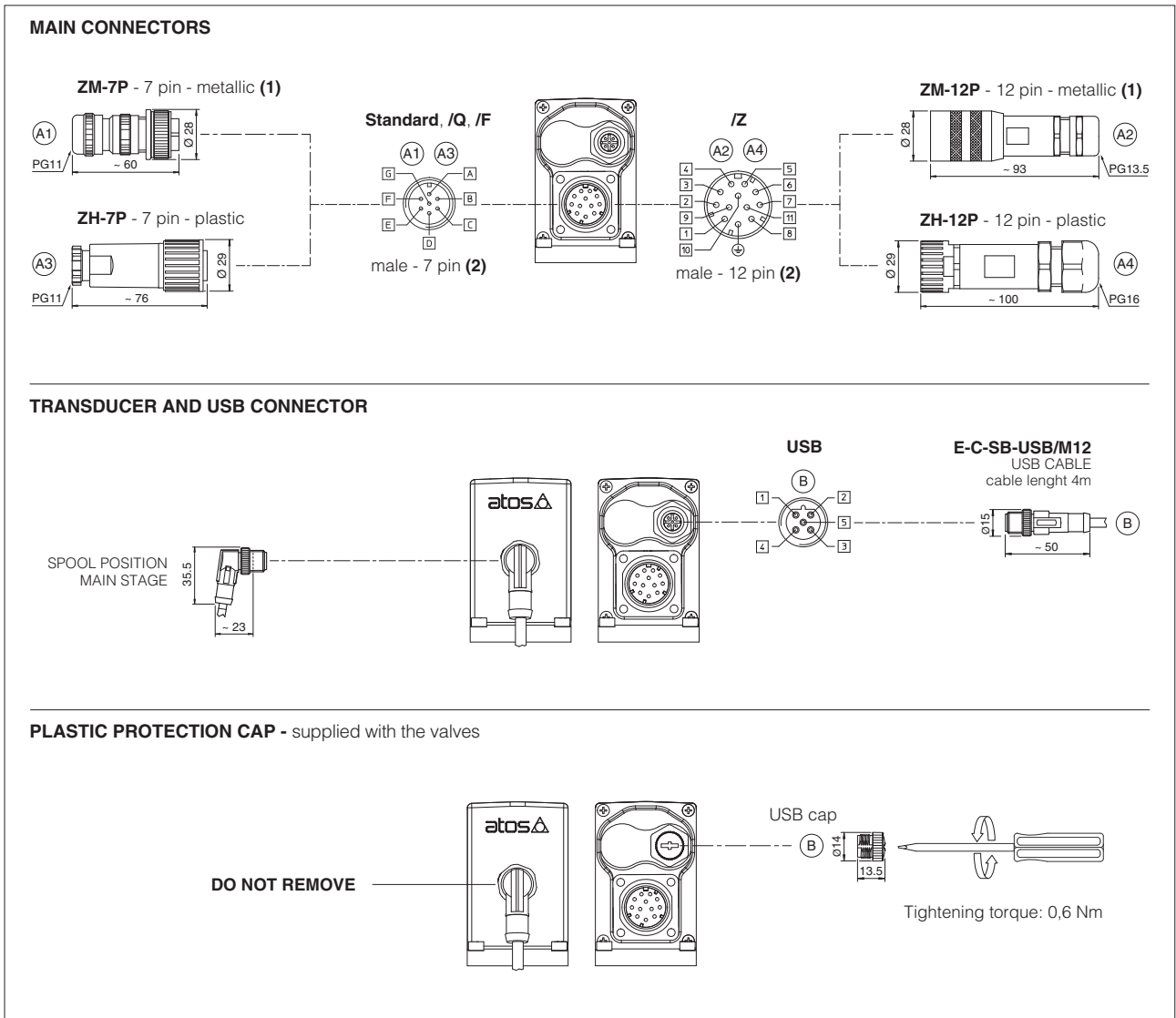
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

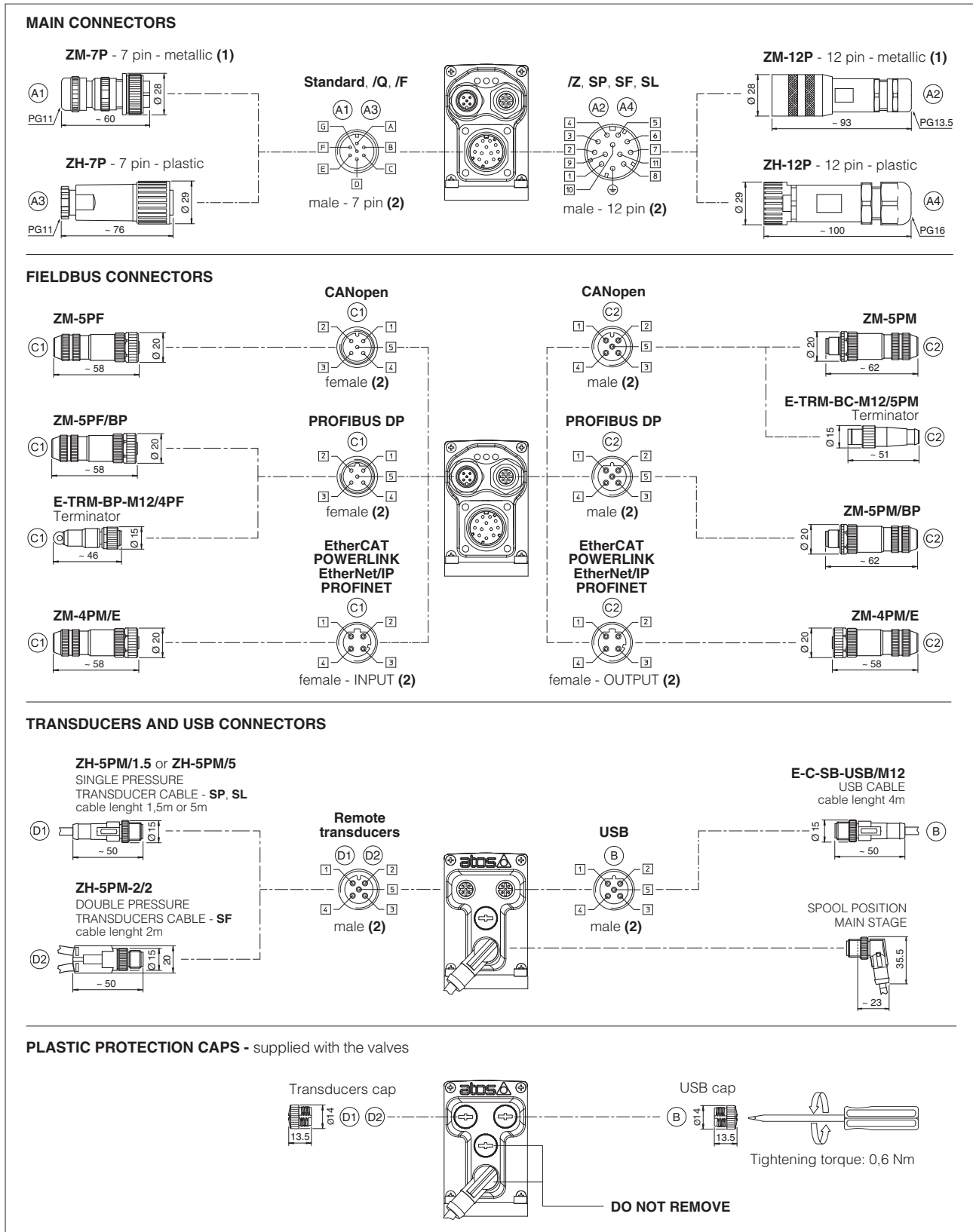
18.5 LEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

18.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1			VALVE STATUS			LINK/ACT			
L2			NETWORK STATUS			NETWORK STATUS			
L3			SOLENOID STATUS			LINK/ACT			

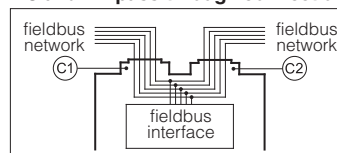
19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

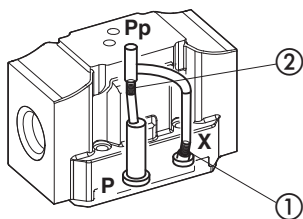
20.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

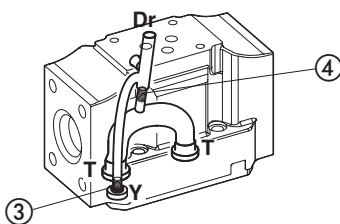
21 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.

DPZO-1 Pilot channels

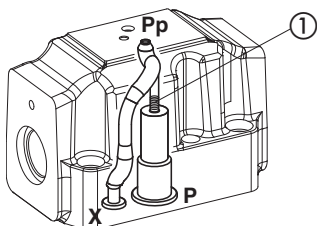


Drain channels

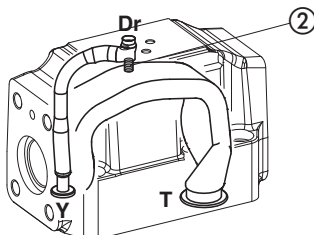


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

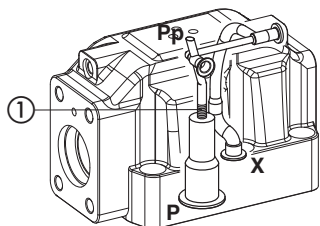


Drain channels

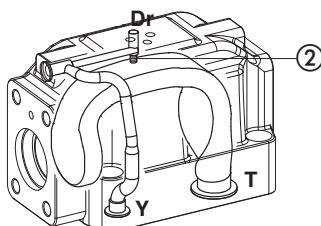


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

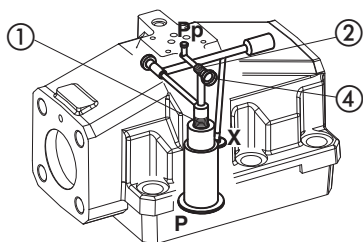


Drain channels

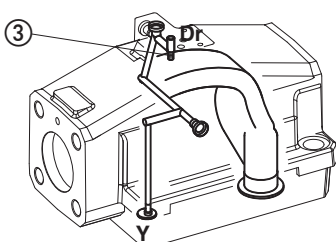


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels

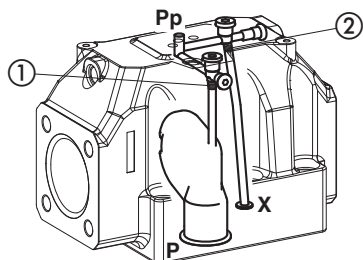


Drain channels

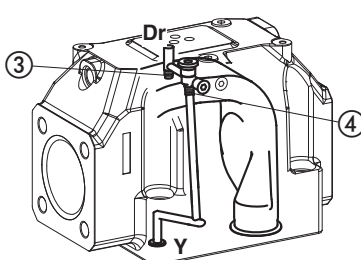


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
 plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
 Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

22 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

23 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-*-1	9,5

Technical drawing showing front and side views of the DPZO valve. The front view includes dimensions: 256 (total height), 30 (height of the lower section), 92.5 (width of the lower section), and 192 (total width). Callouts 1, 2, and 3 indicate specific features. The side view shows a height of 86 mm and a width of 70 mm.

① = Air bleeding 3

② = Space to remove the connectors

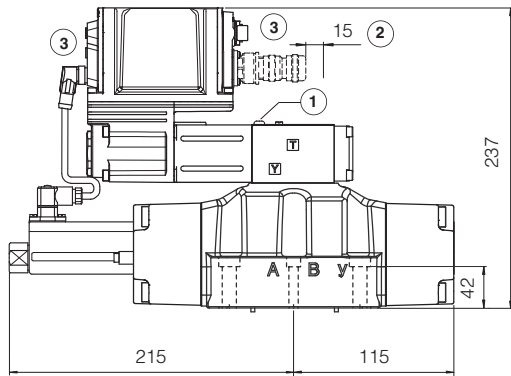
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

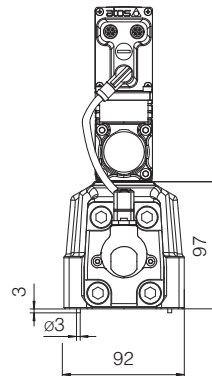
DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14



252 for SP, SF, SL
EW - POWERLINK
EI - EtherNet/IP, EP - PROFINET



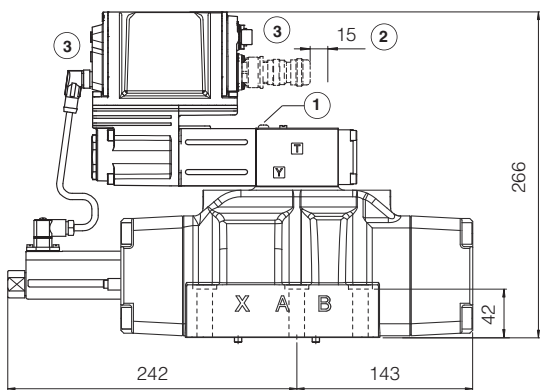
DPZO-LEB-*-4
DPZO-LES-*-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)

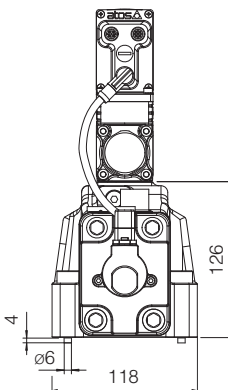
DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05(see table P005)
ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-*-4	19



281 for SP, SF, SL
EW - POWERLINK
EI - EtherNet/IP, EP - PROFINET



① = Air bleeding 

② = Space to remove the connectors

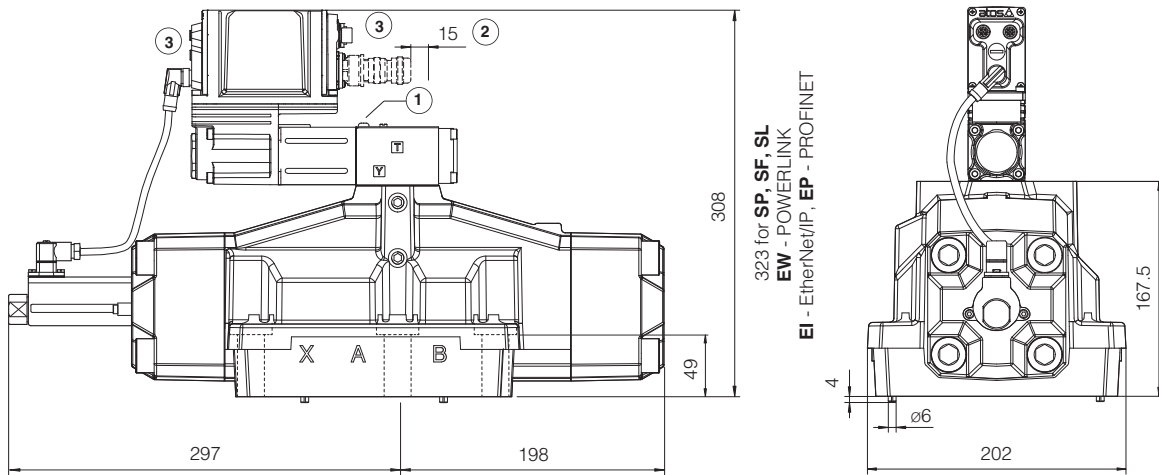
③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

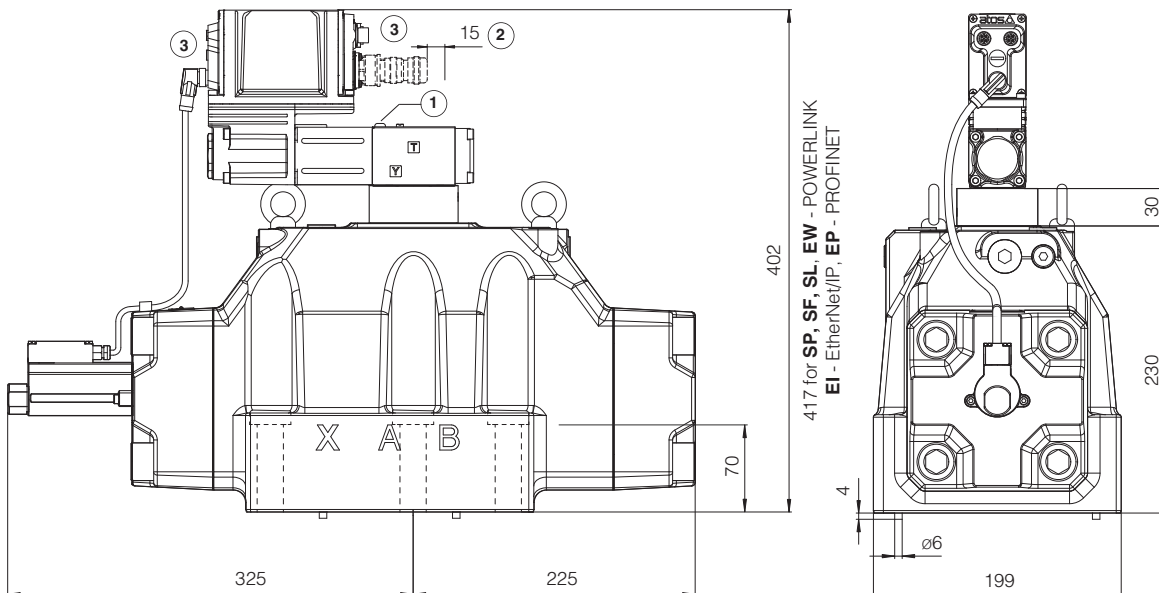
Mass [kg]	
DPZO-*-6	43



DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

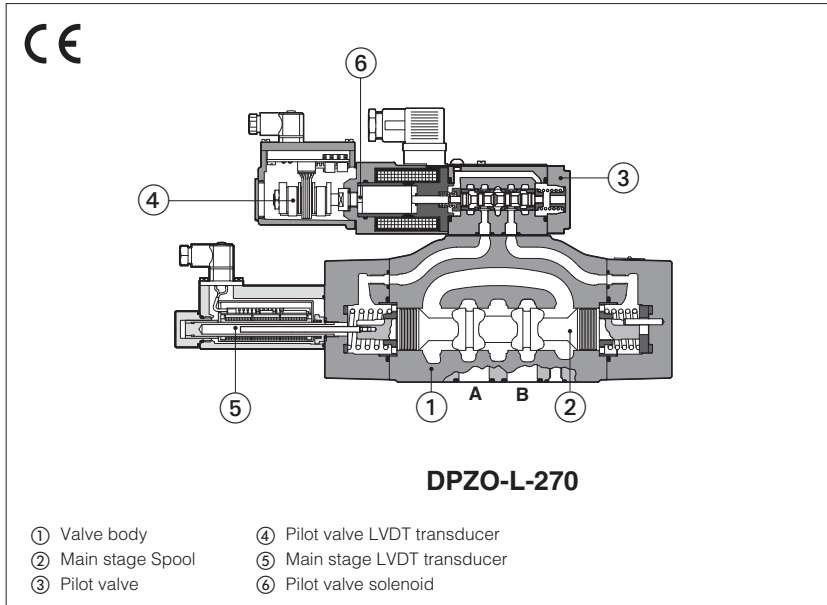
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
 for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS500	Digital proportional valves with P/Q control	K800	Electric and electronic connectors
FS630	Digital proportional valves with integral axis controller	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB320	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	QF320	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Servoproportional directional valves

piloted, with two LVDT transducers and zero spool overlap



DPZO-L

Servoproportional directional valves, piloted, with two LVDT position transducer and zero spool overlap for position closed loop controls.

The valves operate in association with digital off-board divers or axis card, see section [2]. The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, full open position of the main stage spool is performed by configuration 60 or central position is performed by configuration 70, see section [10].

Spools regulation characteristics:

L = linear

DL = differential-linear, for control of actuators with area ratio 1:2

T = non linear, for fine low flow control

Size: 10 ÷ 32 - ISO 4401

Max flow: 180 ÷ 1600 l/min

Max pressure: 350 bar

1 MODEL CODE

DPZO	-	L	-	2	-	70	-	L	/	5	/	*	/	*	/	*
<p>Servoproportional directional valve, piloted</p> <p>L = two LVDT transducers</p> <p>Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 4M = 27 6 = 32</p> <p>Configuration:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Standard</p> <p>60 = </p> <p>70 = </p> </div> <div style="text-align: center;"> <p>Option /B</p> <p></p> <p></p> </div> </div> <p>Spool type, regulating characteristics:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>L = linear</p> </div> <div style="text-align: center;"> <p>DL = differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p> </div> <div style="text-align: center;"> <p>T = non linear (2)</p> </div> </div>																
<p>Seals material, see section [6]:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR <p>Series number</p>																

Hydraulic options (1):

B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)

D = internal drain

E = external pilot pressure

G = pressure reducing valve for piloting

Spool size:	3 (L)	5 (L,DL)	5 (L)	5 (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-

Nominal flow (l/min) at Δp 10bar P-T

(1) All combination possible

(2) Only for DPZO-L-270

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LEB	E-BM-LID	E-BM-LES	Z-BM-LEZ
Type	Digital	Digital	Digital	Digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS230	GS235	GS240	GS330

3 GENERAL CHARACTERISTICS

Assembly position	Any position			
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100			
MTTFd valves according to EN ISO 13849	75 years, see technical table P007			
Ambient temperature range	Standard = -20°C ÷ +60°C		/PE option = -20°C ÷ +60°C	/BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C		/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation			
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-L-1	DPZO-L-2		DPZO-L-4	DPZO-L-4M	DPZO-L-6
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;					
Spool type	L5, DL5	L3	L5, DL5	T5	L5, DL5	
Nominal flow Δp P-T [l/min]						
(1)						
Δp= 10 bar	100	160	250	190	480	640
Δp= 30 bar	160	270	430	330	830	1100
Max permissible flow [l/min]	180	400	550	550	1000	1600
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume [cm ³ /min]	1,4	3,7		9	11,3	21,6
Piloting flow (2) [l/min]	3,5	9		18	20	19
Leakage (3) Pilot [cm ³ /min]	100 / 300	150 / 450		200 / 600	200 / 600	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5		1,0 / 4,0	1,0 / 4,0	3,0 / 9,0
Response time (4) [ms]	≤ 25	≤ 25		≤ 30	≤ 35	≤ 80
Hysteresis	≤ 0,1 [%of max regulation]					
Repeatability	± 0,1 [%of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 7.2

(3) At p = 100/350 bar

(2) With step reference input signal 0 ÷ 100 %

(4) 0-100% step signal, see detailed diagrams in section 7.3

5 ELECTRICAL CHARACTERISTICS

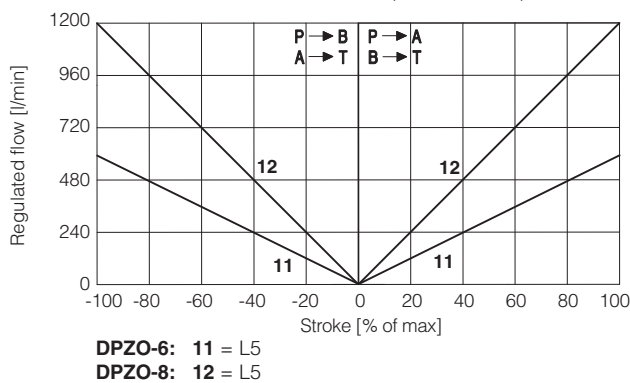
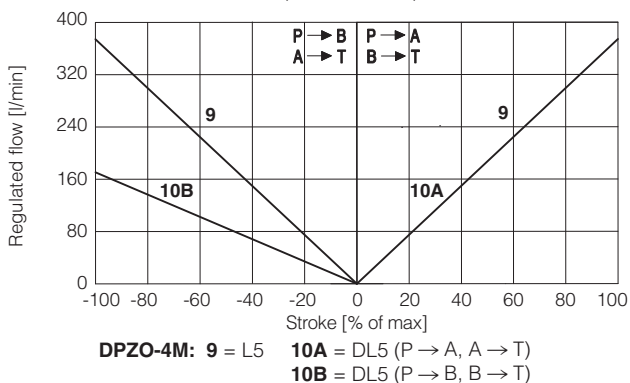
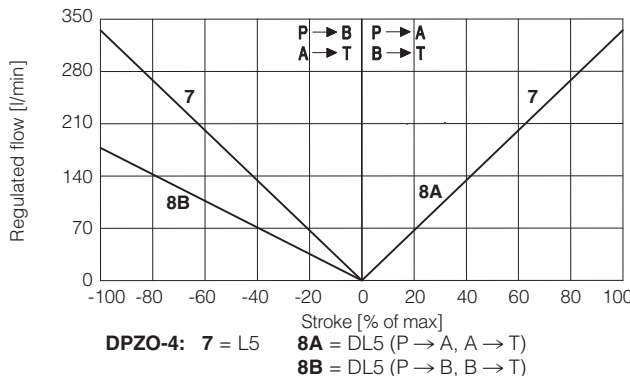
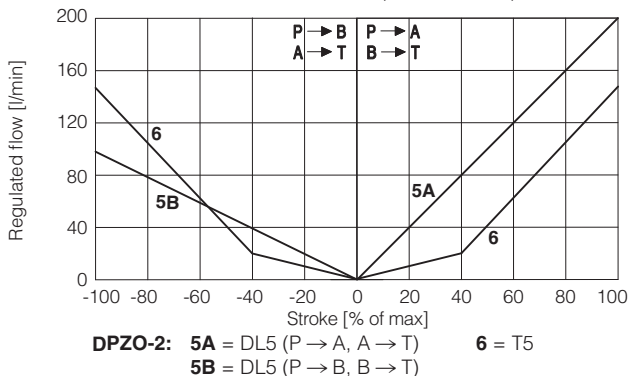
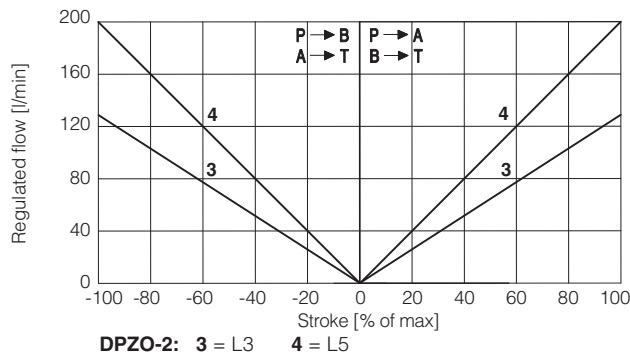
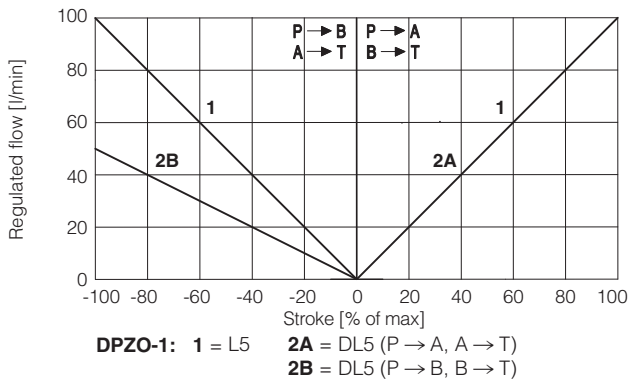
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

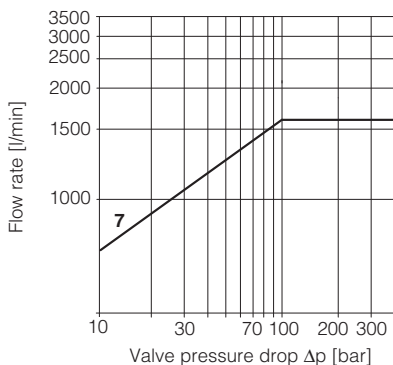
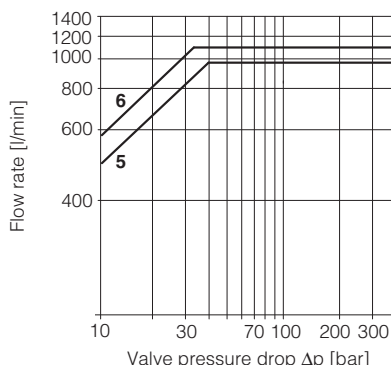
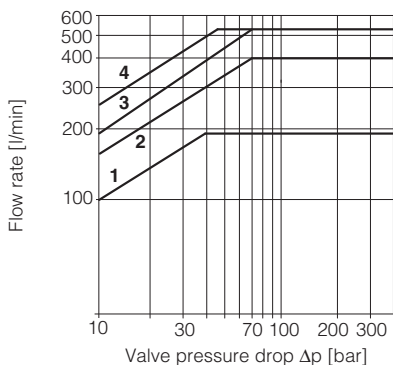
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

7.1 Regulation diagrams (values measure at Δp 10 bar P-T)



7.2 Flow / Δp diagram - stated at 100% of spool stroke



- DPZO-1: 1 = spools L5, DL5
- DPZO-2: 2 = spools L3
3 = spool T5
4 = spools L5, DL5
- DPZO-4: 5 = spools L5, DL5
- DPZO-4M: 6 = spools L5, DL5
- DPZO-6: 7 = L5

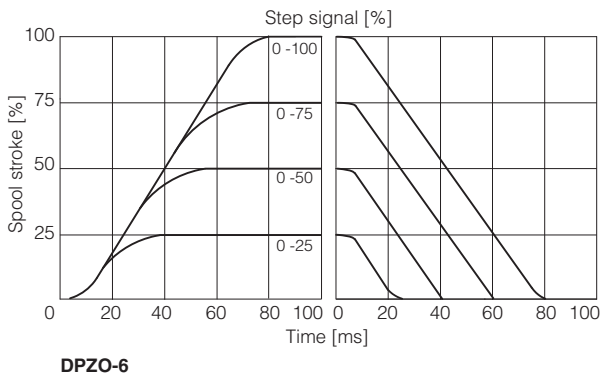
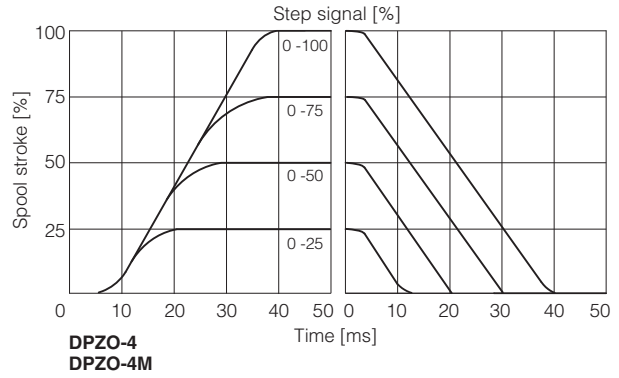
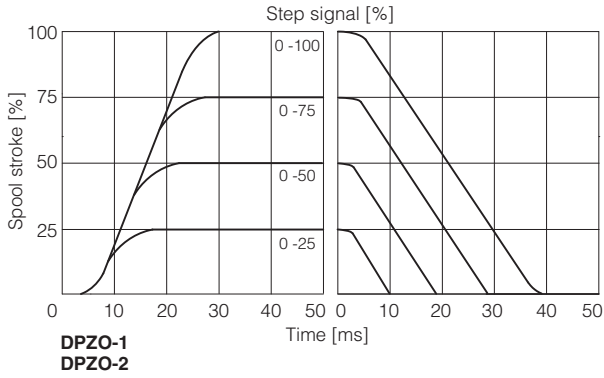
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 4 \div 12 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

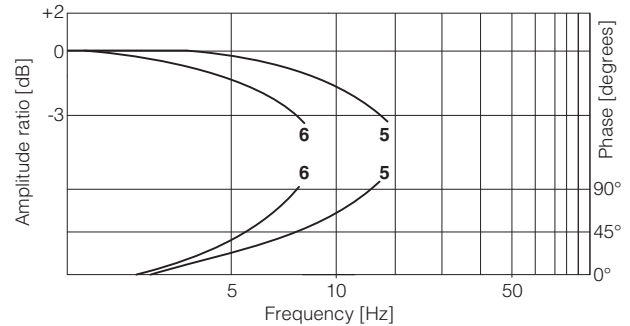
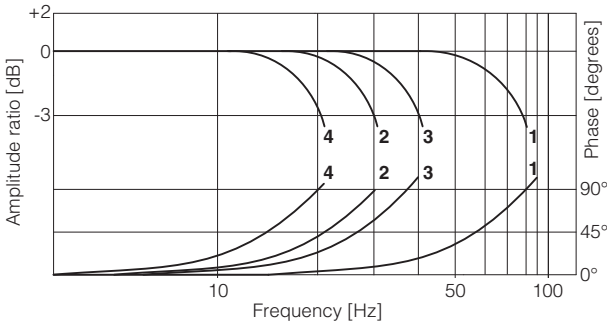
7.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



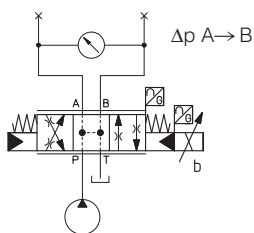
7.4 Bode diagrams

Stated at nominal hydraulic conditions.

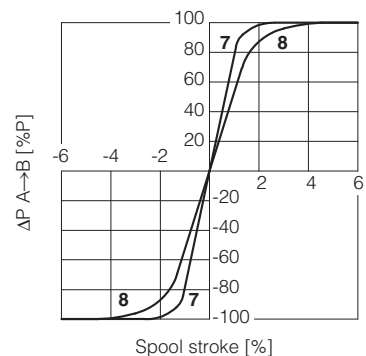


- | | |
|--------------------------|----------------------------|
| 1 = DPZO-1 } ± 5% | 2 = DPZO-1 } ± 100% |
| DPZO-2 } | DPZO-2 } |
| 3 = DPZO-4 } ± 5% | 4 = DPZO-4 } ± 100% |
| DPZO-4M } | DPZO-4M } |
| 5 = DPZO-6 ± 5% | 6 = DPZO-6 ± 100% |

7.5 Pressure gain



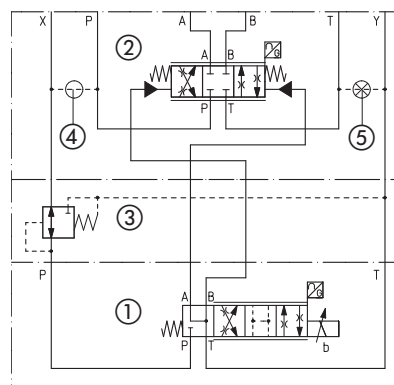
- 7** = DPZO-1
- 8** = DPZO-2
- DPZO-4
- DPZO-4M
- DPZO-6



8 HYDRAULIC OPTIONS

- B** = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 7.1
- D** = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.
- E** = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.
- G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:
DPZO-2 = **28 bar**
DPZO-1, DPZO-2, DPZO-4(M) and DPZO-6 = **40 bar**
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

9 ELECTRICAL CONNECTION

9.1 Solenoid connector - supplied with the valve

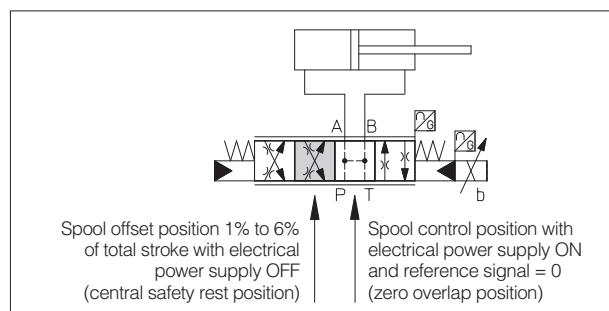
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

9.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

10 SAFETY REST POSITION - configuration 70

In absence of power supply to the solenoids, the valve main spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration. This is specifically designed to avoid that in case of accidental interruption of power supply to the valve solenoids, the actuator moves towards an undefined direction (due to the tolerances of the zero overlap spool), with potential risk of damages or personnel injury. Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



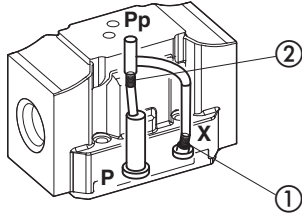
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

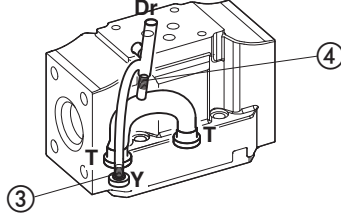
12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.

DPZO-1 Pilot channels

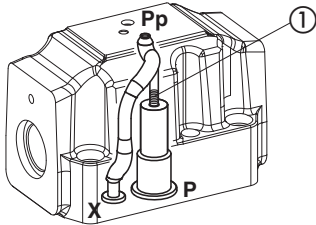


Drain channels

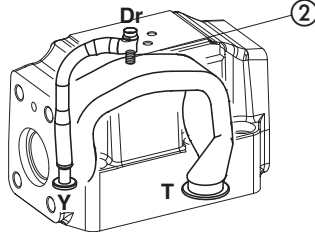


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

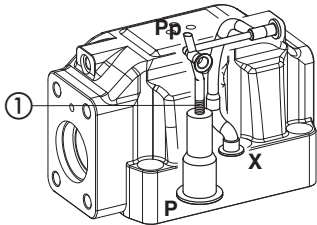


Drain channels

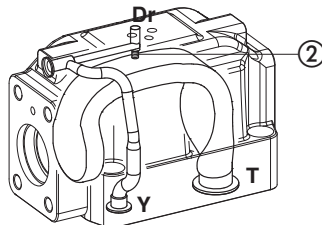


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

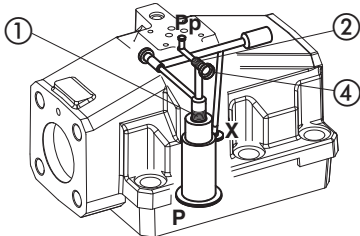


Drain channels

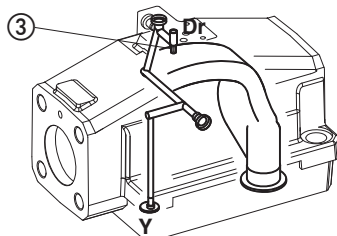


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



Drain channels



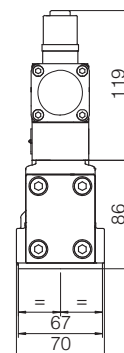
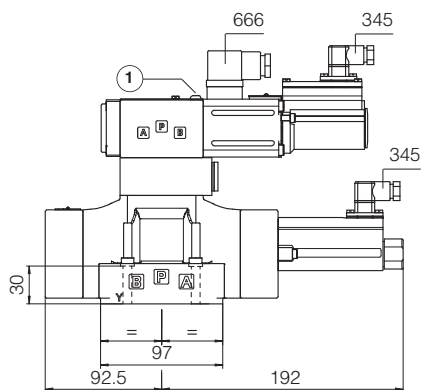
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-L-1

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



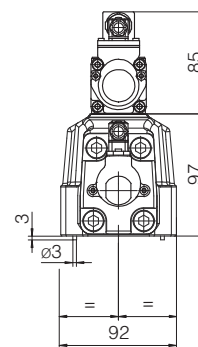
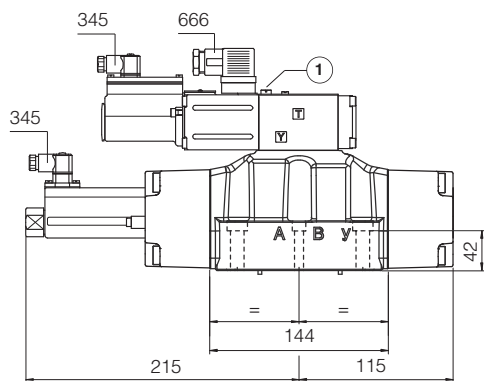
① = Air bleeding 

DPZO-L-2

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5



① = Air bleeding 

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

DPZO-L-4

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

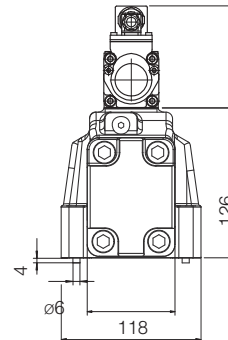
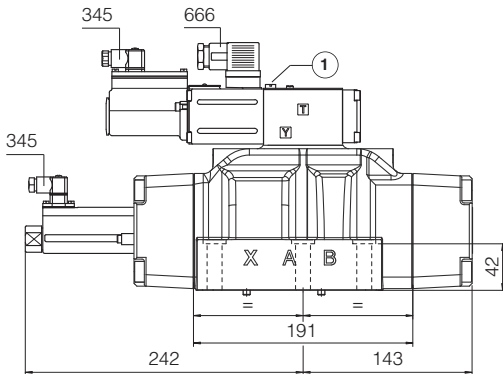
DPZO-L-4M

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

ports A, B, P, T Ø 32mm

Mass [kg]	
DPZO-L-4*	17,5



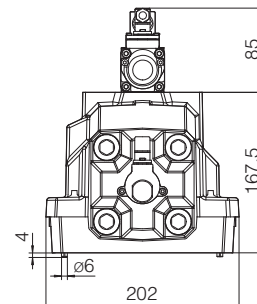
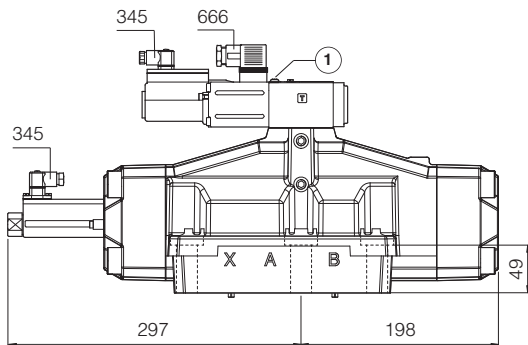
① = Air bleeding 

DPZO-L-6

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5



① = Air bleeding 

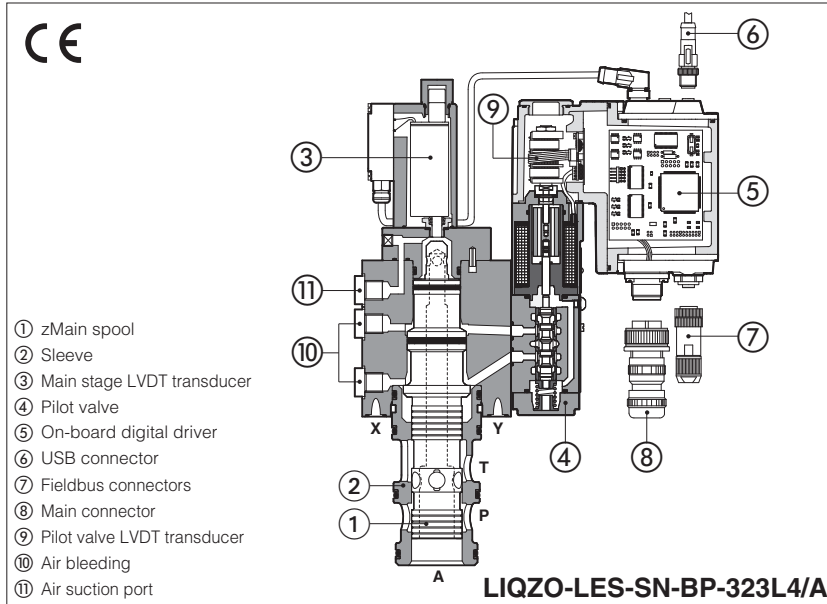
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS330	Z-BM-LEZ digital axis card
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
GS230	E-BM-LEB digital driver	GS510	Fieldbus
GS235	E-BM-LID digital driver	K800	Electric and electronic connectors
GS240	E-BM-LES digital driver	P005	Mounting surfaces for electrohydraulic valves

Digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers



- ① zMain spool
- ② Sleeve
- ③ Main stage LVDT transducer
- ④ Pilot valve
- ⑤ On-board digital driver
- ⑥ USB connector
- ⑦ Fieldbus connectors
- ⑧ Main connector
- ⑨ Pilot valve LVDT transducer
- ⑩ Air bleeding
- ⑪ Air suction port

LIQZO-LEB, LIQZP-LEB LIQZO-LES, LIQZP-LES

Digital servoproportional 3-way cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in directional controls and not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **25 ÷ 40**
Max flow: **500 ÷ 1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 80**
Max flow: **2000 ÷ 5000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	LES	-	SN	-	NP	-	25		3		L4	/	*		*	/	*
<p>Servoproportional 3-way cartridge, piloted</p> <p>LIQZO = size 25 to 40, Pmax 350 bar</p> <p>LIQZP = size 50 to 80, Pmax 420 bar</p>																		
<p>LEB = basic on-board digital driver (1)</p> <p>LES = full on-board digital driver</p>																		
<p>Seals material, see section 9:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR 																		

LEB = basic on-board digital driver (1)
LES = full on-board digital driver

Alternated P/Q controls:

- SN** = none
- SP** = pressure control (1 pressure transducer)
- SL** = force control (1 load cell)

Fieldbus interfaces, USB port always present:

- NP** = Not present
- BC** = CANopen
- BP** = PROFIBUS DP
- EH** = EtherCAT
- EW** = POWERLINK
- EI** = EtherNet/IP
- EP** = PROFINET RT/IRT

Valve size, see section 7:

LIQZO =	25	32	40
l/min	185	330	420
LIQZP =	50	63	80
l/min	780	1250	2100

Nominal flow (l/min) at Δp 5 bar

Hydraulic options (2):

A = reversal hydraulic configuration of main spool:
P-A in rest position

Electronic options (2):

- C** = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only **LES-SP, SL**
- F** = fault signal
- I** = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)
- Q** = enable signal
- Z** = double power supply, enable, fault and monitor signals - 12 pin connector (3)

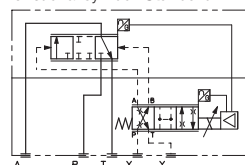
Spool type
regulating characteristics:

L4 = linear

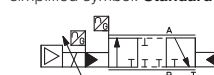


Configuration: 3 = 3 way

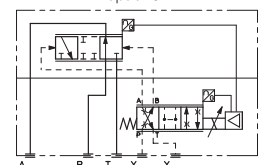
functional symbol: **Standard**



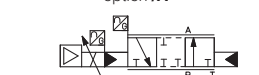
simplified symbol: **Standard**



option **/A**



option **/A**



(1) Only in version **SN-NP**

(2) For possible combined options, see section 13

(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections **15**.

WARNING

The loss of the pilot pressure causes the undefined position of the main spool. The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A). This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

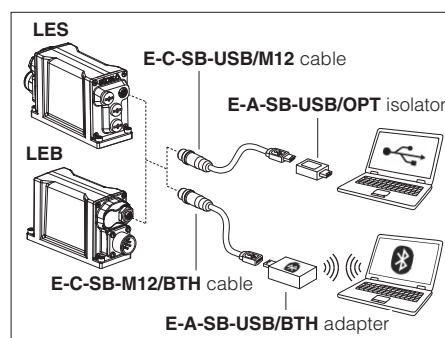
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

 **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

 **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



4 FIELDBUS - only for LES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 ALTERNATED P/Q CONTROLS - only for LES, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	25	32	40	50	63	80
Nominal flow Δp P-A or A-T [l/min]						
$\Delta p = 5$ bar	185	330	420	780	1250	2100
$\Delta p = 10$ bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	LIQZO		Ports P, A, T = 350		X = 350	Y \leq 10
	LIQZP		Ports P, A, T = 420		X = 350	Y \leq 10
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm ³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow (1) [l/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal (2) [ms]	21	22	22	25	30	34
Hysteresis [% of the max regulation]	$\leq 0,1$					
Repeatability [% of the max regulation]	$\pm 0,1$					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$					

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see detailed diagrams in section 10.2

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ± 10 VDC @ max 5 mA current ± 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 Vdc (OFF state), 9 ÷ 24 Vdc (ON state), 5 ÷ 9 Vdc (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

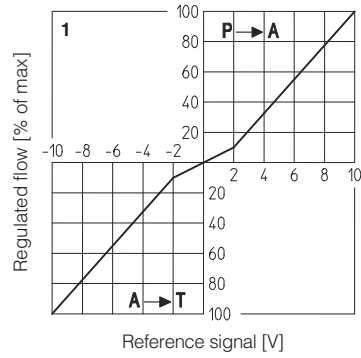
10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

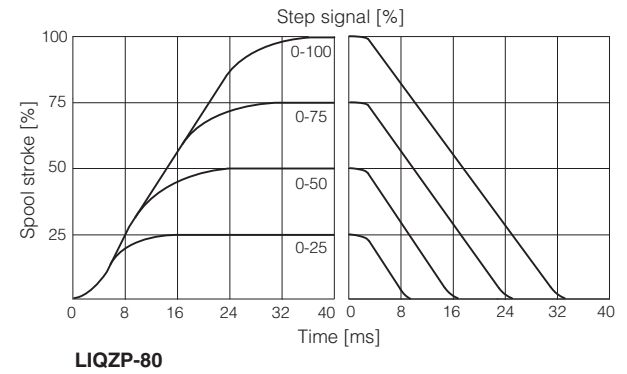
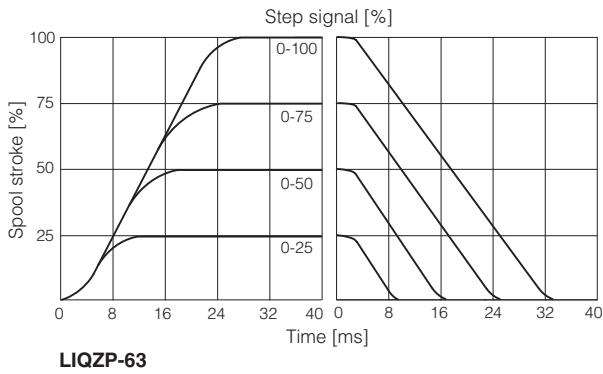
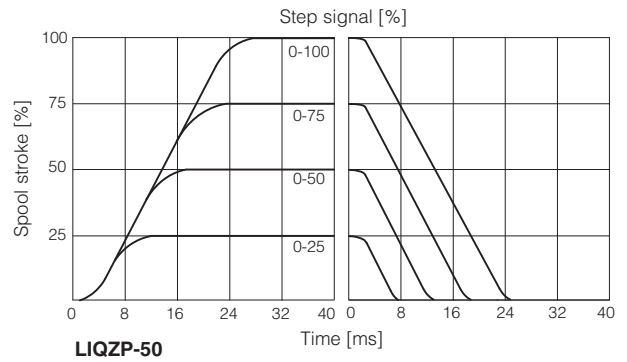
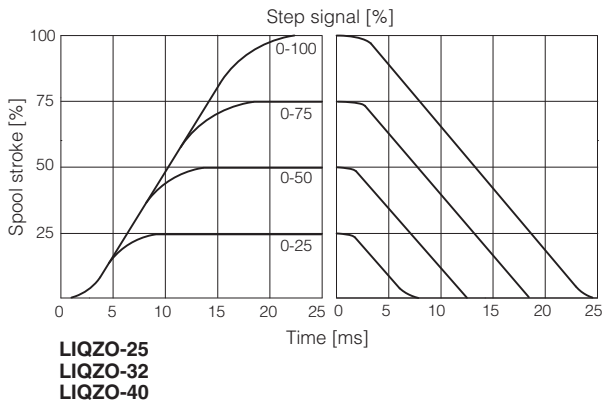
Hydraulic configuration vs. reference signal:

		standard	option /A
Reference signal	$0 \div +10 \text{ V}$ $12 \div 20 \text{ mA}$	} P → A	A → T
Reference signal	$0 \div -10 \text{ V}$ $4 \div 12 \text{ mA}$		A → T

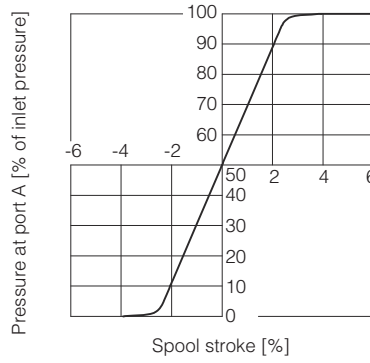
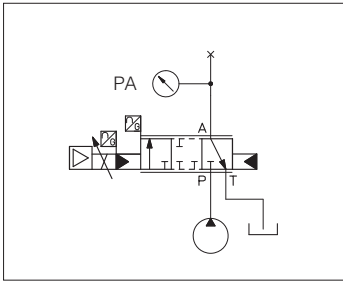


10.2 Response time

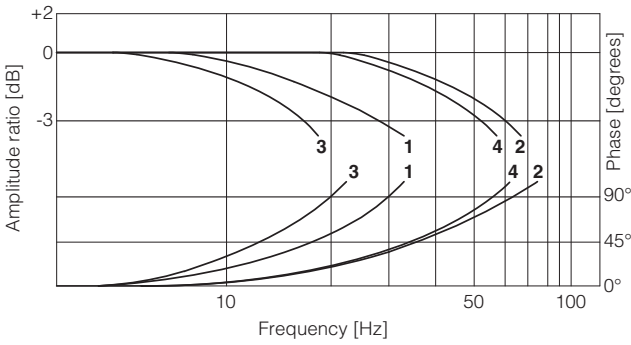
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



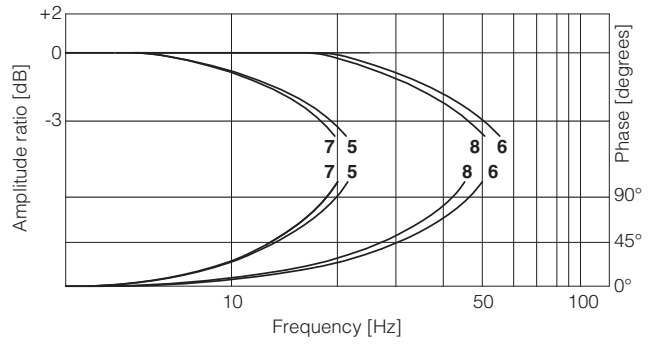
10.3 Pressure gain diagram



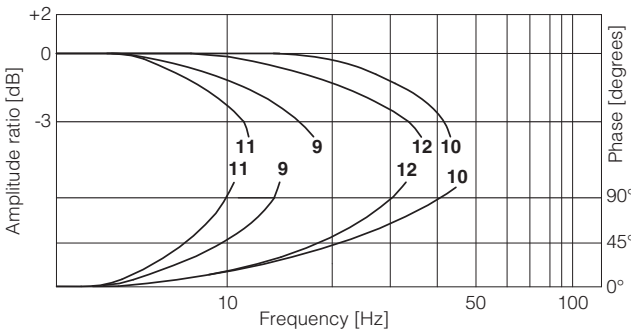
10.4 Bode diagrams



- 1 = LIQZO-L*-253L4: ± 90%
- 2 = LIQZO-L*-253L4: ± 5%
- 3 = LIQZO-L*-323L4: ± 90%
- 4 = LIQZO-L*-323L4: ± 5%



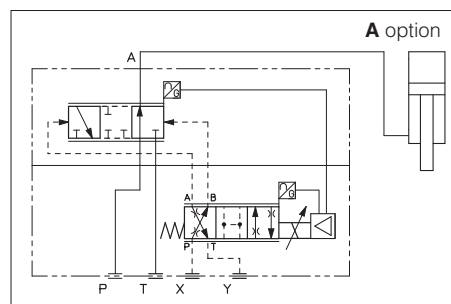
- 5 = LIQZO-L*-403L4: ± 90%
- 6 = LIQZO-L*-403L4: ± 5%
- 7 = LIQZP-L*-503L4: ± 90%
- 8 = LIQZP-L*-503L4: ± 5%



- 9 = LIQZP-L*-633L4: ± 90%
- 10 = LIQZP-L*-633L4: ± 5%
- 11 = LIQZP-L*-803L4: ± 90%
- 12 = LIQZP-L*-803L4: ± 5%

11 HYDRAULIC OPTIONS

- A** = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.
This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.



12 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **LEB** (see 13.6)
Power supply for driver's logics and communication - only for **LES** (see 13.2)
- C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

13 POSSIBLE COMBINED OPTIONS

LEB-SN, LES-SN

/AF, /AI, /AQ, /AZ, /FI, /IQ, /IZ, /AFI, /AIQ, /AIZ

LES-SP, SL

/AC, /CI, /ACI

14 AIR BLEEDING

Size 25 to 40

Size 50

Sizes 63 to 80

1 Plugged port - do not open

2 Air bleeding:
N° 2 plugs G1/4"

At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.
Operate the valve for few seconds at low pressure and then lock the plugs.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VLO) - only for /Z option and LES-SP, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 VDC for standard and 4 \div 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24Vdc.

15.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24Vdc.

15.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are \pm 10 Vdc for standard and 4 \div 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

15.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

15.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

15.8 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 15.7).

15.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 \div 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15.10 Remote pressure/force transducer input signal - only for LES-SP, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 16.4).

Analog input signal is factory preset according to selected valve code, defaults are \pm 10 Vdc for standard and 4 \div 20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

15.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin - standard, /F and /Q options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc Rectified and filtered: $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: $\pm 10 V_{dc} / \pm 20 mA$ maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND	V0		Flow monitor output signal: $\pm 10 V_{dc} / \pm 20 mA$ maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin - /Z option and SP, SL (A2)

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SL Fieldbus	SL NP	TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0	VLO	VLO	V0	Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+				Flow reference input signal: $\pm 10 V_{dc} / \pm 20 mA$ maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND	VLO	VLO	V0	Flow monitor output signal: $\pm 10 V_{dc} / \pm 20 mA$ maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	AGND				Analog ground	Gnd - analog signal
		NC			Do not connect	
8			F_INPUT+		Pressure/Force reference input signal: $\pm 10 V_{dc} / \pm 20 mA$ maximum range Defaults are $\pm 10 V_{dc}$ for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
	R_ENABLE				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
9		NC			Do not connect	
		VL+			Power supply 24 Vdc for driver's logic and communication	Input - power supply
10				D_IN0	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
	NC				Do not connect	
11		VLO			Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
				D_IN1	Multiple pressure/force PID selection, referred to V0	Input - on/off signal
11	FAULT referred to: V0	VLO	VLO	V0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

16.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

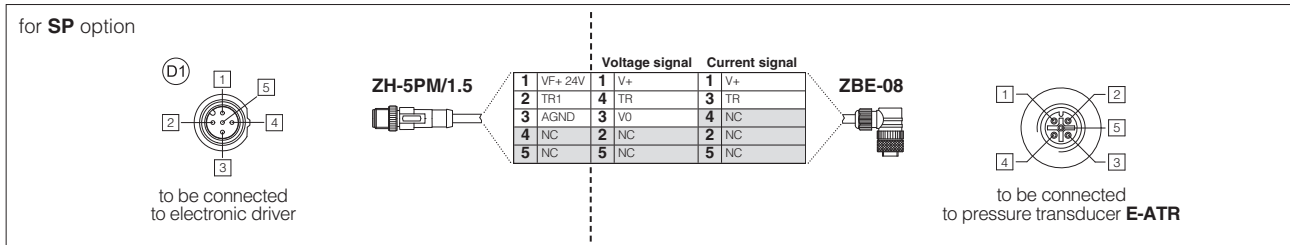
(2) Pin 2 can be fed with external +5V supply of CAN interface

16.4 Remote pressure transducer connector - M12 - 5 pin - only for SP, SL ^(D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR	Signal transducer ± 10 V _{dc} / ± 20 mA maximum range, software selectable Defaults are ± 10 V _{dc} for standard and $4 \div 20$ mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

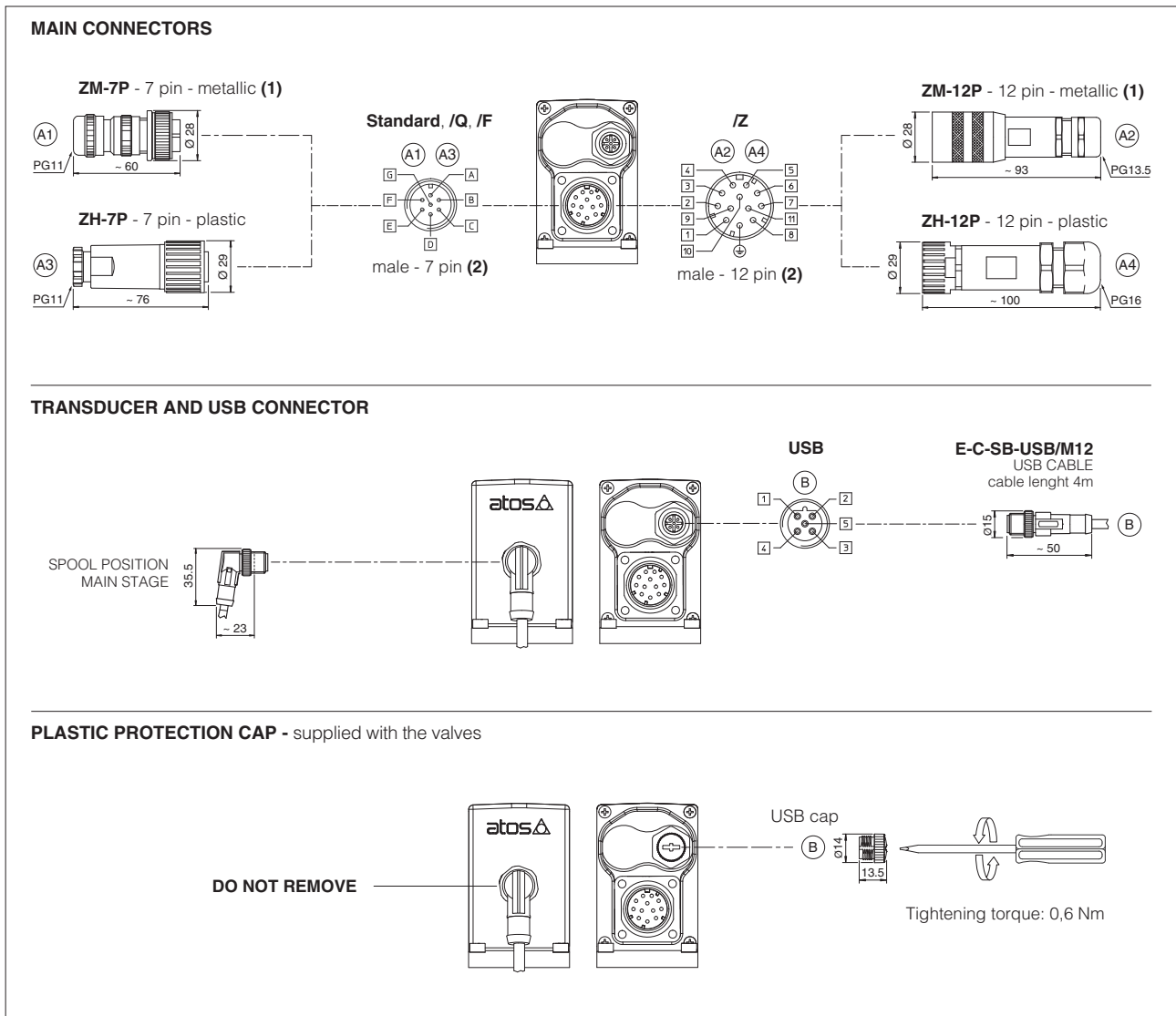
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

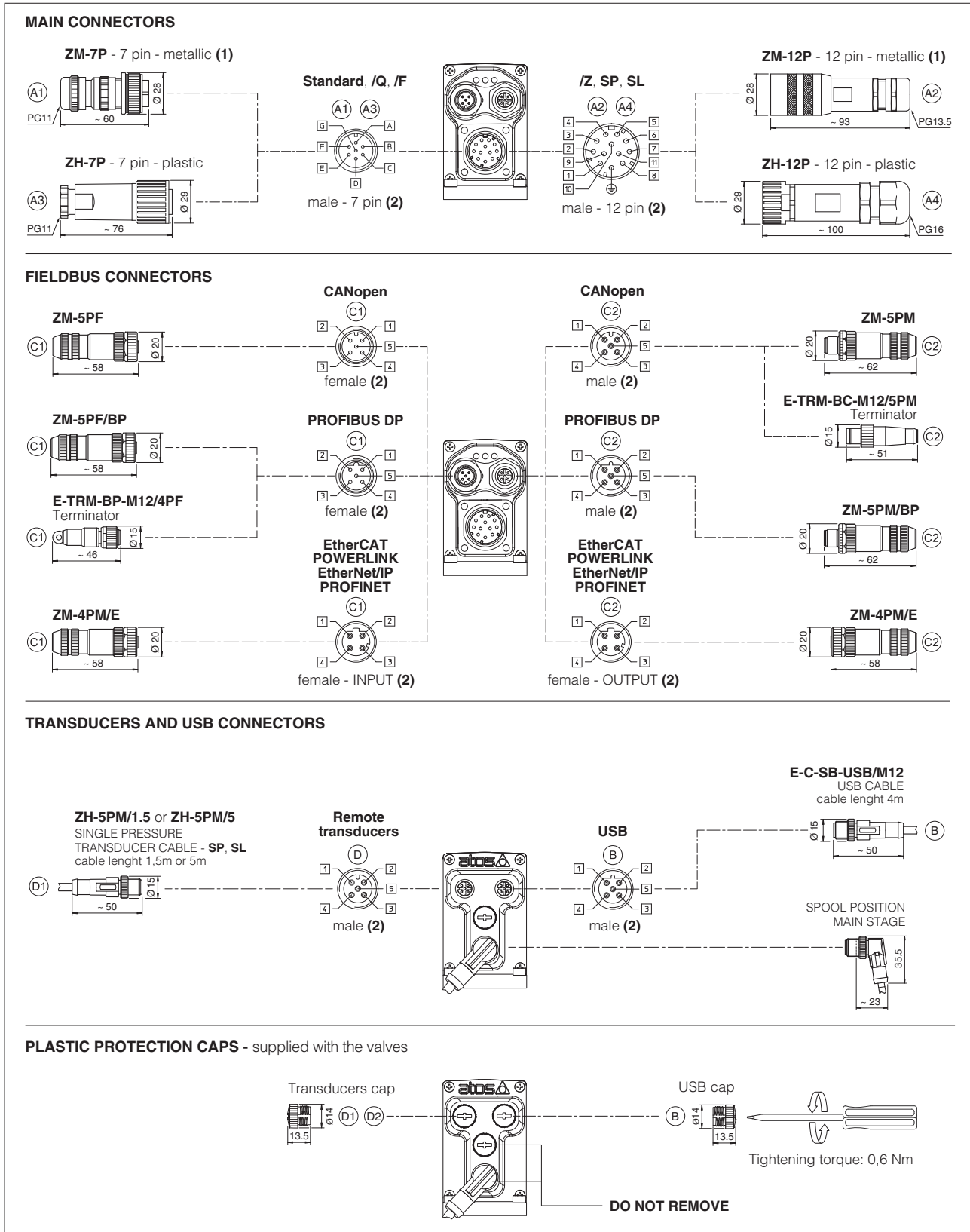
16.5 LEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

16.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

16.7 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

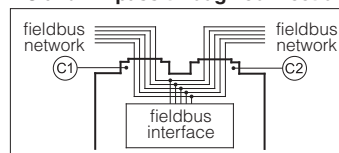
17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18.4 Pressure/Force transducer connectors - only for SP, SL

CONNECTOR TYPE	SP, SL - Single transducer	
CODE	(D) ZH-5PM/1.5	(D) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables	
	1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm ²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

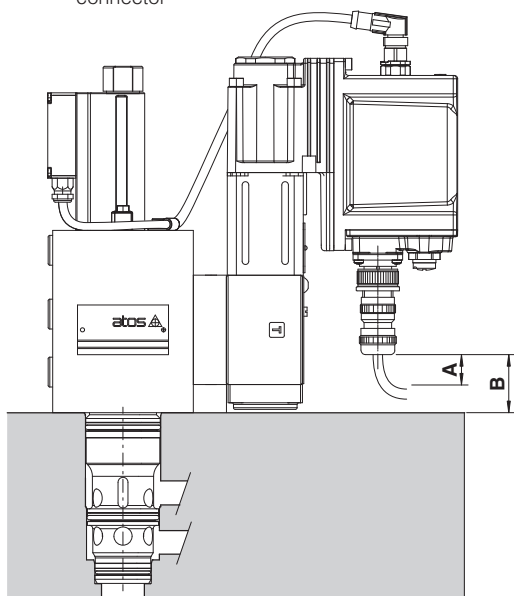
19 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

(1) Fastening bolts supplied with the valve

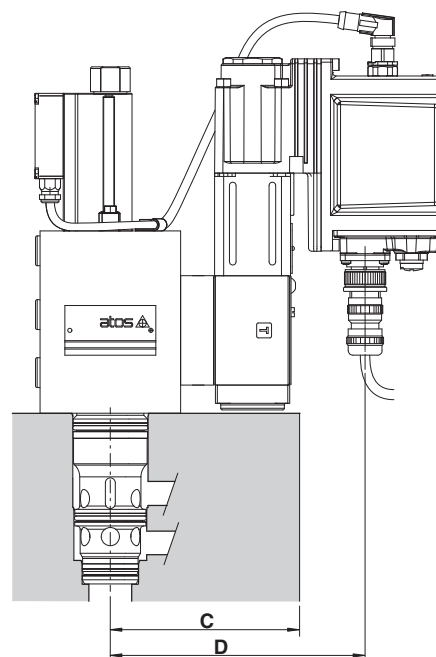
20 MAIN CONNECTORS INSTALLATION DIMENSIONS

Installation 1 - possible interference between manifold and main connector



A = 15 mm space to remove the 7 or 12 pin main connectors
B = Clearance between main connector to valve's mounting surface.
 See the below table to verify eventual interferences, depending to the valve size and connector type

Installation 2 - no interference



C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size					
		25	32	40	50	63	80
B	ZM-7P	32	32	32	45	68	68
	ZH-7P	(1)	(1)	(1)	29	52	52
	ZM-12P	(1)	(1)	(1)	(1)	35	35
	ZH-12P	(1)	(1)	(1)	(1)	(1)	(2)
C (max) for standard valve	-	134	141	154	161	192	222
C (max) for /A option	-	114	121	134	141	172	202
D for standard valve	-	154	161	174	181	212	242
D for /A option	-	134	141	154	161	192	222

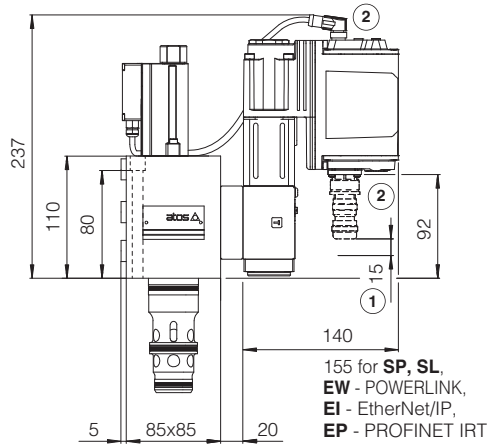
Above dimensions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered

(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as represented in above "Installation 2"

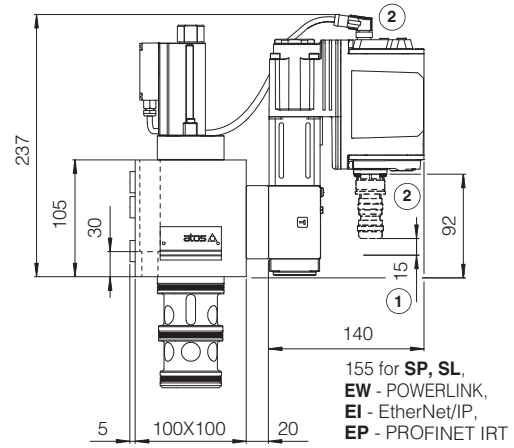
(2) The connector installation may be critical, depending to the cable size and bending radius

21 INSTALLATION DIMENSIONS [mm]

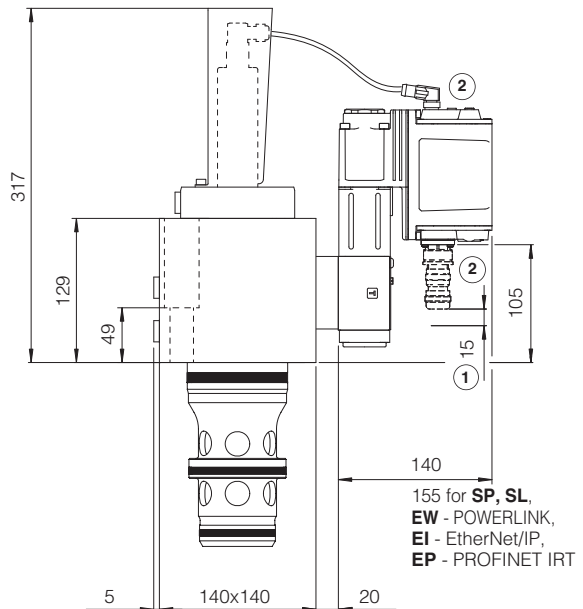
LIQZO-LEB-253
LIQZO-LES-253



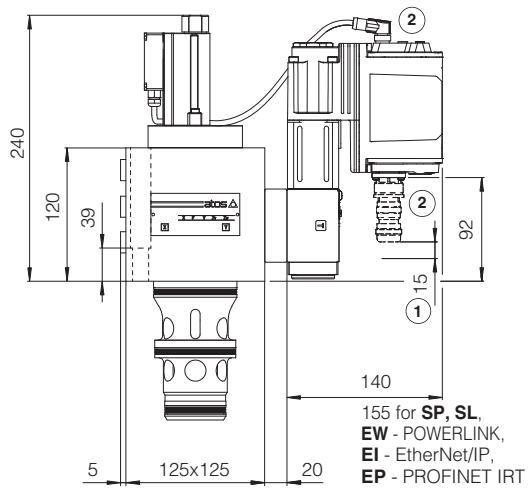
LIQZO-LEB-323
LIQZO-LES-323



LIQZP-LEB-503
LIQZP-LES-503



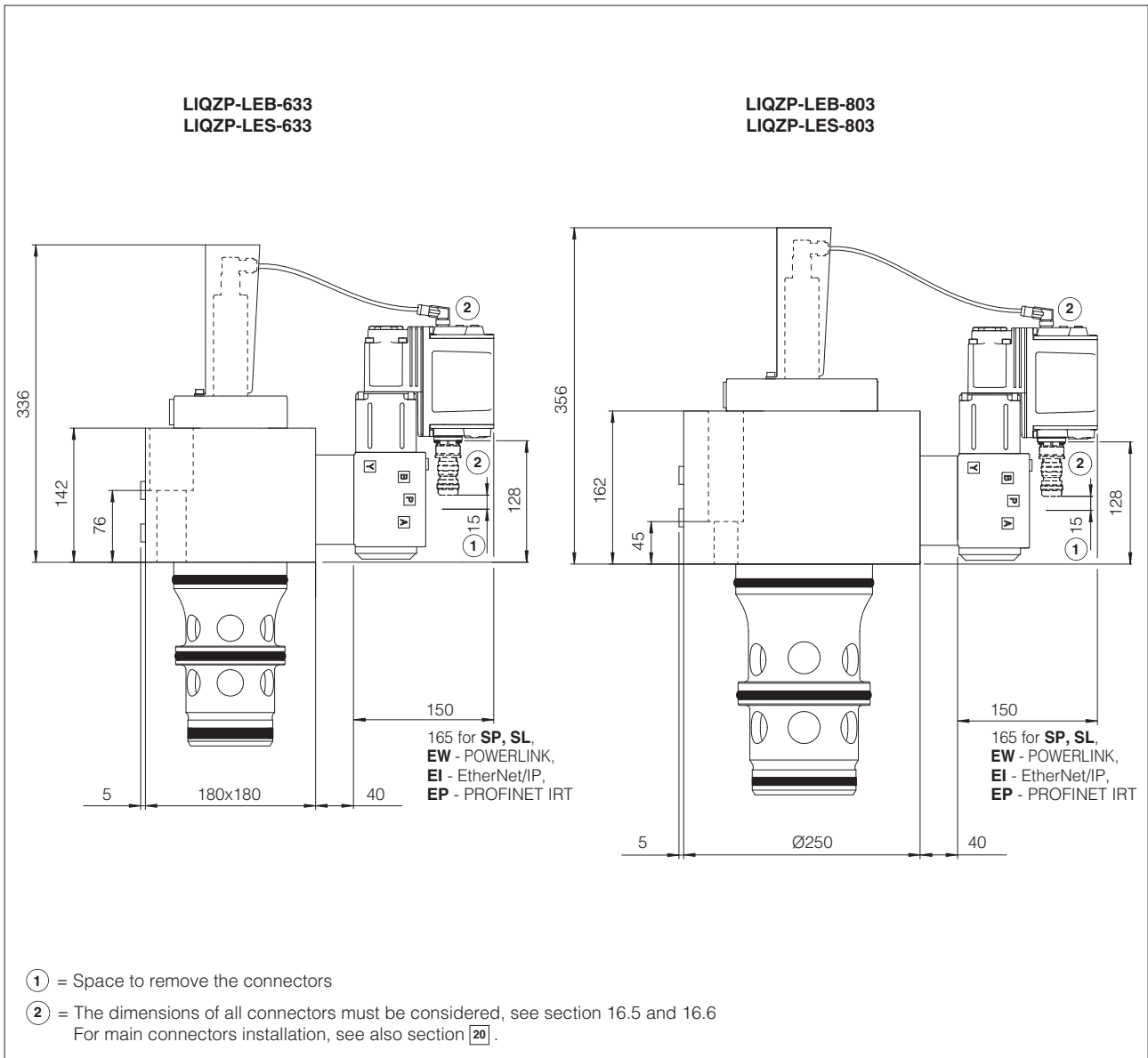
LIQZO-LEB-**-403
LIQZO-LES-**-403



① = Space to remove the connectors

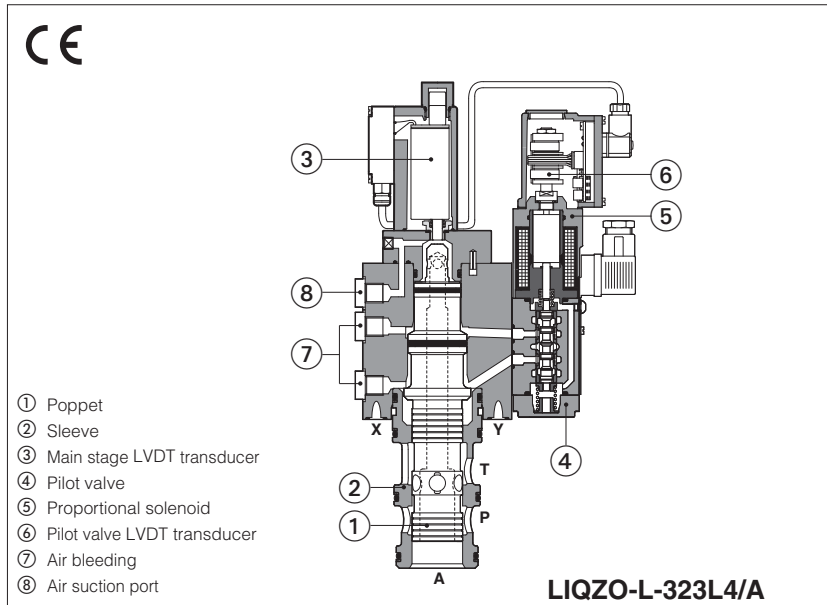
② = The dimensions of all connectors must be considered, see section 16.5 and 16.6
For main connectors installation, see also section 20.

Note: for mounting surface and cavity dimensions, see table P006



Servoproportional 3-way cartridges

piloted, with two LVDT transducers, sizes from 25 to 80



- ① Poppet
- ② Sleeve
- ③ Main stage LVDT transducer
- ④ Pilot valve
- ⑤ Proportional solenoid
- ⑥ Pilot valve LVDT transducer
- ⑦ Air bleeding
- ⑧ Air suction port

LIQZO-L, LIQZP-L

Servoproportional 3-way cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board drivers, see section 2.

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: 25 ÷ 40

Max flow: **500 ÷ 1050 l/min**
Max pressure: **350 bar**

LIQZP: Size: 50 ÷ 80

Max flow: **2000 ÷ 5000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	-	25	3	L4	/	*	/	*	/	*															
<p>Servoproportional cartridge, piloted</p> <p>LIQZO = size 25 to 40, Pmax 350 bar LIQZP = size 50 to 80, Pmax 420 bar</p> <p>L = two LVDT transducers</p> <p>Valve size, see section 4 :</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td>LIQZO =</td> <td style="text-align: center;">25</td> <td style="text-align: center;">32</td> <td style="text-align: center;">40</td> </tr> <tr> <td>l/min</td> <td style="text-align: center;">185</td> <td style="text-align: center;">330</td> <td style="text-align: center;">420</td> </tr> <tr> <td>LIQZP =</td> <td style="text-align: center;">50</td> <td style="text-align: center;">63</td> <td style="text-align: center;">80</td> </tr> <tr> <td>l/min</td> <td style="text-align: center;">780</td> <td style="text-align: center;">1250</td> <td style="text-align: center;">2100</td> </tr> </table> <p>Nominal flow (l/min) at Δp 5 bar</p> <p>Configuration: 3 = 3 way</p> <p>functional symbol: Standard</p> <div style="display: flex; justify-content: space-around;"> </div> <p>simplified symbol: Standard</p> <div style="display: flex; justify-content: space-around;"> </div>												LIQZO =	25	32	40	l/min	185	330	420	LIQZP =	50	63	80	l/min	780	1250	2100
LIQZO =	25	32	40																								
l/min	185	330	420																								
LIQZP =	50	63	80																								
l/min	780	1250	2100																								
<p>Seals material, see section 6 :</p> <p>- = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Hydraulic options: A = reversal hydraulic configuration of main spool: P-A in rest position</p> <p>Spool type, regulating characteristics:</p> <p>L4 = linear </p>																											

2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240



WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	25	32	40	50	63	80
Nominal flow Δp P-A or A-T [l/min]						
$\Delta p = 5$ bar	185	330	420	780	1250	2100
$\Delta p = 10$ bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	LIQZO Ports P, A, T = 350 X = 350 Y ≤ 10 LIQZP Ports P, A, T = 420 X = 350 Y ≤ 10					
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	28	40	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,5	0,7	0,7	0,7
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160					
Piloting volume [cm ³]	2,16	7,2	8,9	17,7	33,8	42,7
Piloting flow (1) [l/min]	6,5	20	25	43	68	76
Response time 0 ÷ 100% step signal (2) [ms]	21	22	22	25	30	34
Hysteresis [% of the max regulation]	≤ 0,1					
Repeatability [% of the max regulation]	± 0,1					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$					

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see detailed diagrams in section 7.2



WARNING

The loss of the pilot pressure causes the undefined position of the main spool.

The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A).

This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

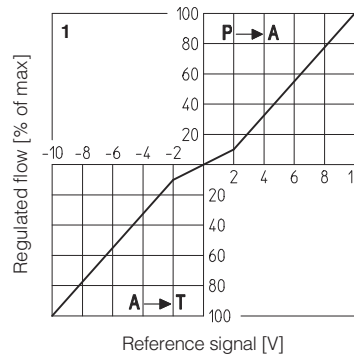
7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams, see note

1 = LIQZO, LIQZP (all sizes)

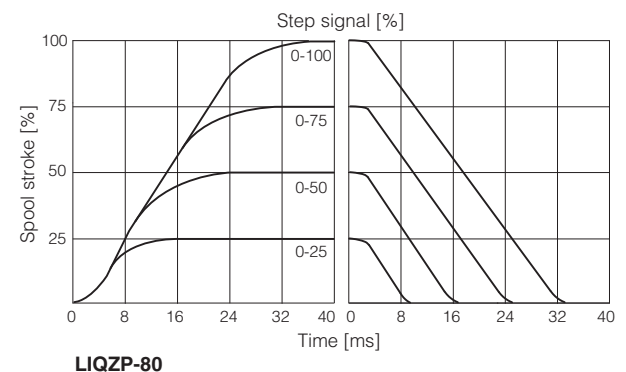
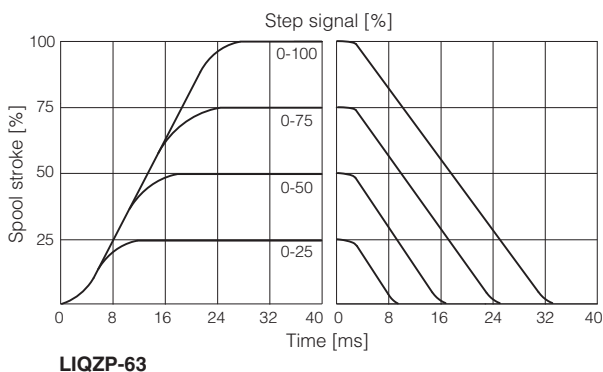
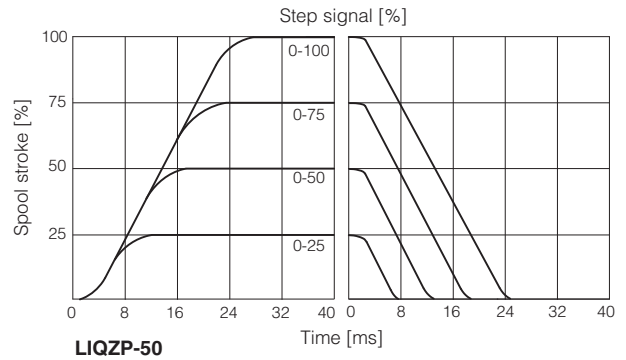
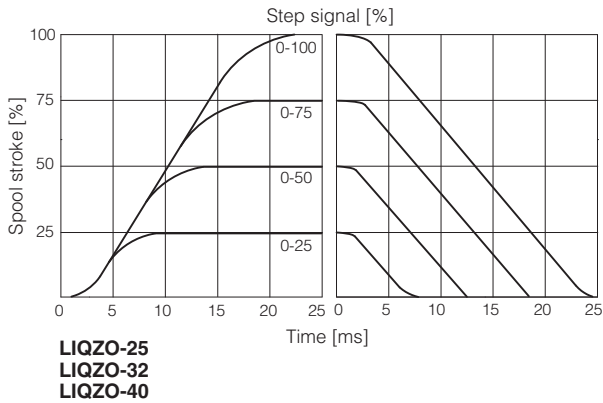
Hydraulic configuration vs. reference signal:

	standard	option /A
Reference signal	0 ÷ +10 V 12 ÷ 20 mA	P → A A → T
Reference signal	0 ÷ -10 V 4 ÷ 12 mA	A → T P → A

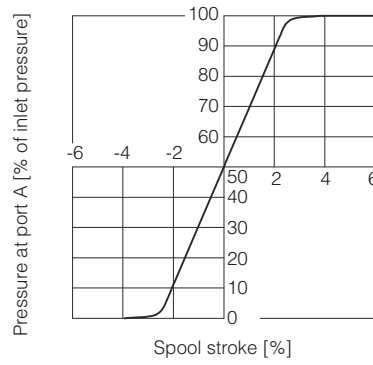
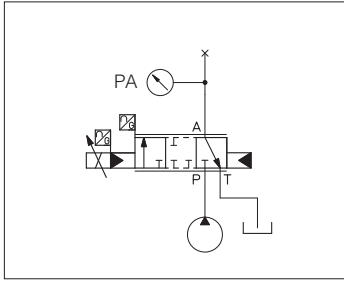


7.2 Response time

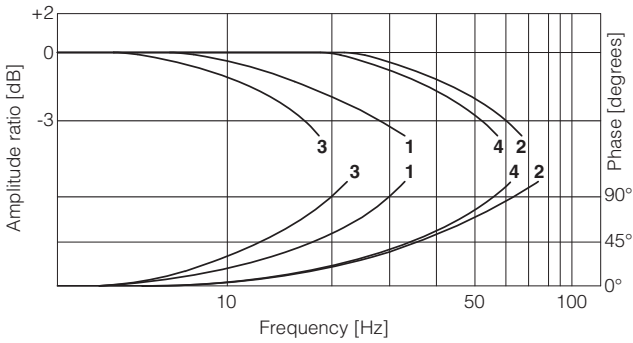
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



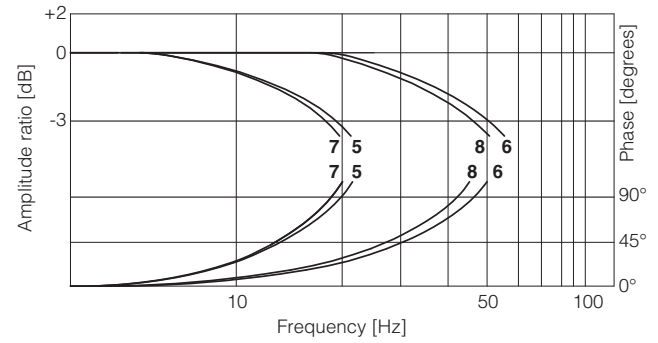
7.3 Pressure gain diagram



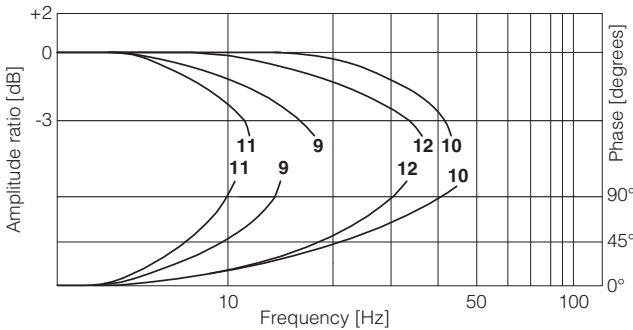
7.4 Bode diagrams



- 1 = LIQZO-L-253L4: $\pm 90\%$
- 2 = LIQZO-L-253L4: $\pm 5\%$
- 3 = LIQZO-L-323L4: $\pm 90\%$
- 4 = LIQZO-L-323L4: $\pm 5\%$



- 5 = LIQZO-L-403L4: $\pm 90\%$
- 6 = LIQZO-L-403L4: $\pm 5\%$
- 7 = LIQZP-L-503L4: $\pm 90\%$
- 8 = LIQZP-L-503L4: $\pm 5\%$



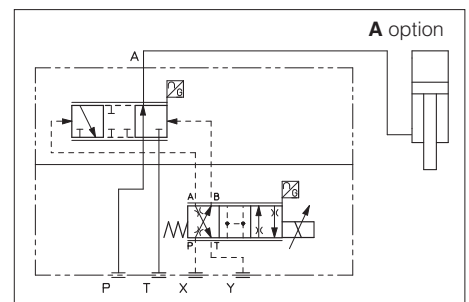
- 9 = LIQZP-L-633L4: $\pm 90\%$
- 10 = LIQZP-L-633L4: $\pm 5\%$
- 11 = LIQZP-L-803L4: $\pm 90\%$
- 12 = LIQZP-L-803L4: $\pm 5\%$

8 HYDRAULIC OPTIONS

A = The standard valve version provides the hydraulic configuration A-T of main spool in absence of electric power supply to the valve.

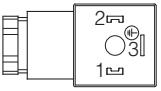
The option /A provides the reverse configuration P-A of main spool in absence of electric power supply to the valve.

This execution is particularly requested in vertical presses for safety reasons, because in case of electric power breakdown the P-A configuration of the main spool prevents the uncontrolled and dangerous downstroke of the press ram.

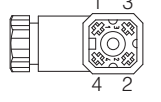


9 ELECTRICAL CONNECTION - connectors supplied with the valve

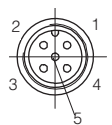
9.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

9.2 LVDT transducer connector - for LIQZO

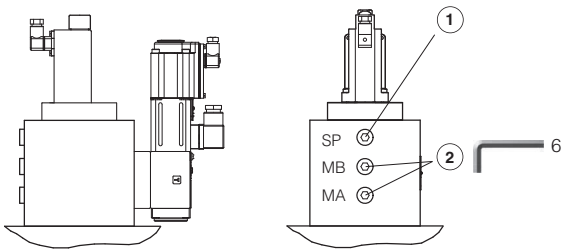
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345 
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

9.3 LVDT transducer connector - for LIQZP

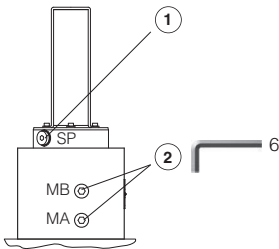
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08 
1	PROG	Do not connect	
2	VT+	Power supply +15Vdc	
3	AGND	Ground	
4	TR	Output signal	
5	VT-	Power supply -15Vdc	

10 AIR BLEEDING

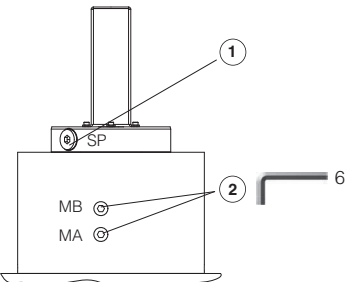
Size 25 to 40



Size 50



Sizes 63 to 80



1 Plugged port - do not open

2 Air bleeding:
N° 2 plugs G1/4"

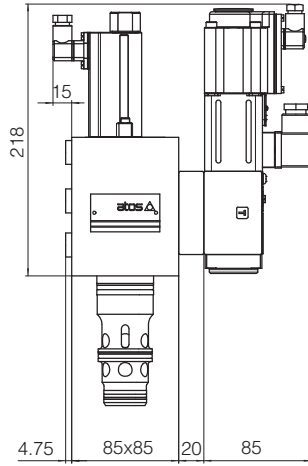
At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture. Operate the valve for few seconds at low pressure and then lock the plugs.

11 FASTENING BOLTS AND VALVE MASS

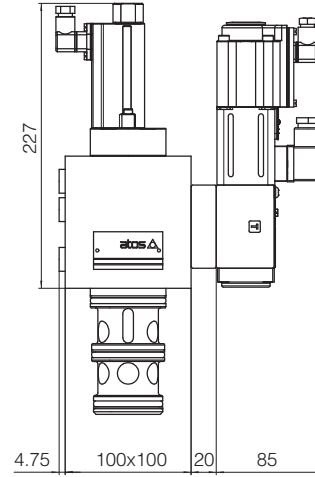
Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	11,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	17,3
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	24,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	72,2

(1) Fastening bolts supplied with the valve

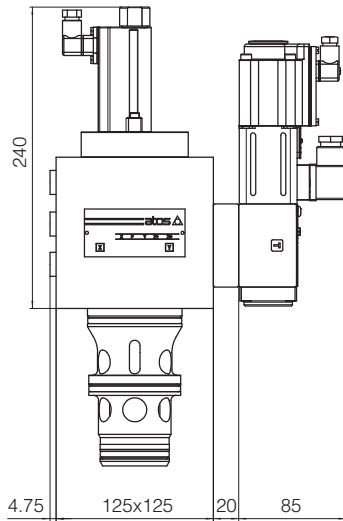
LIQZO-L-253



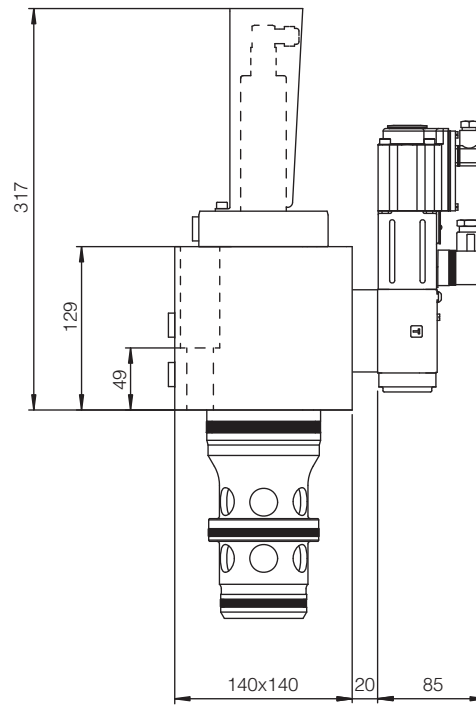
LIQZO-L-353

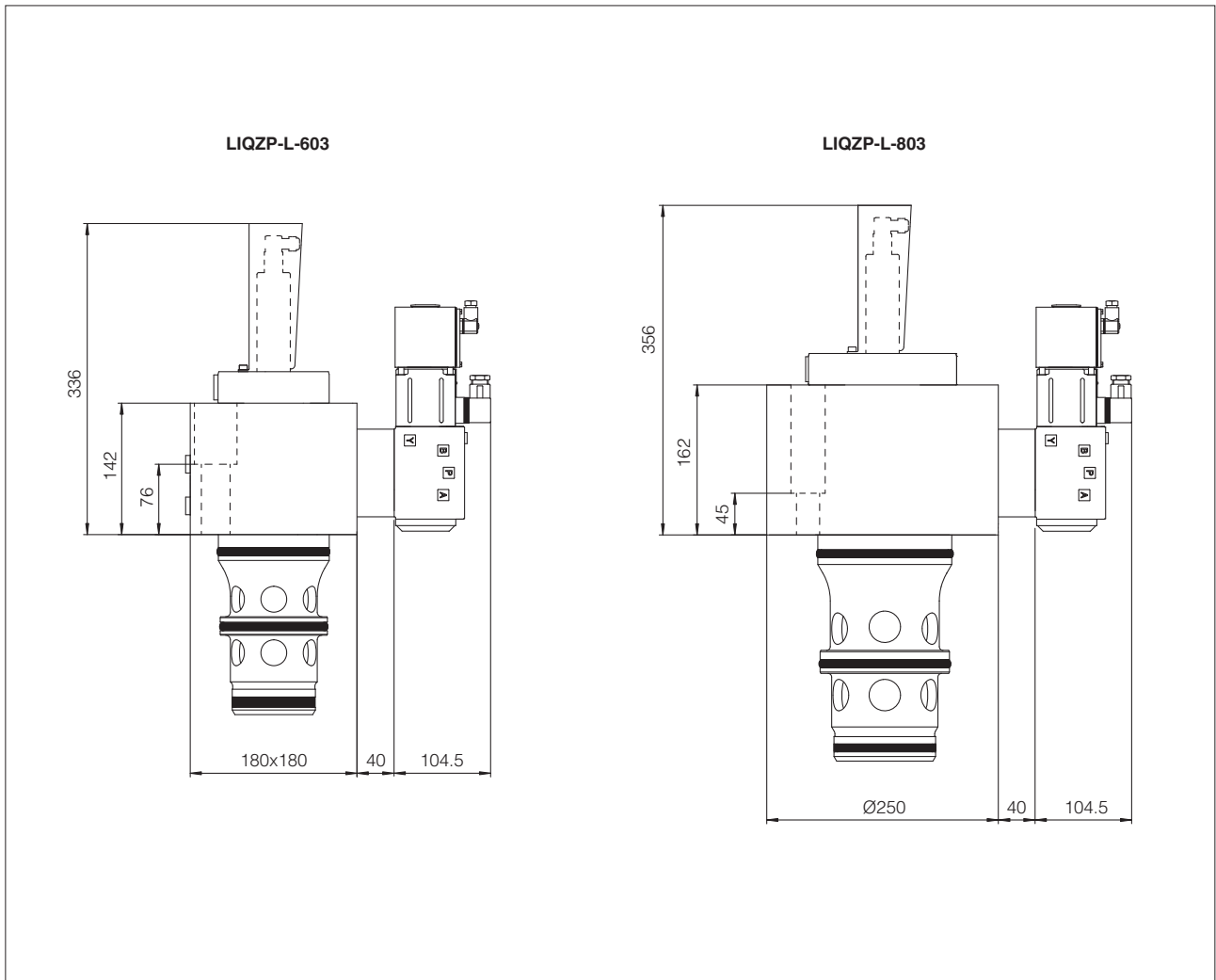


LIQZO-L-403



LIQZP-L-503





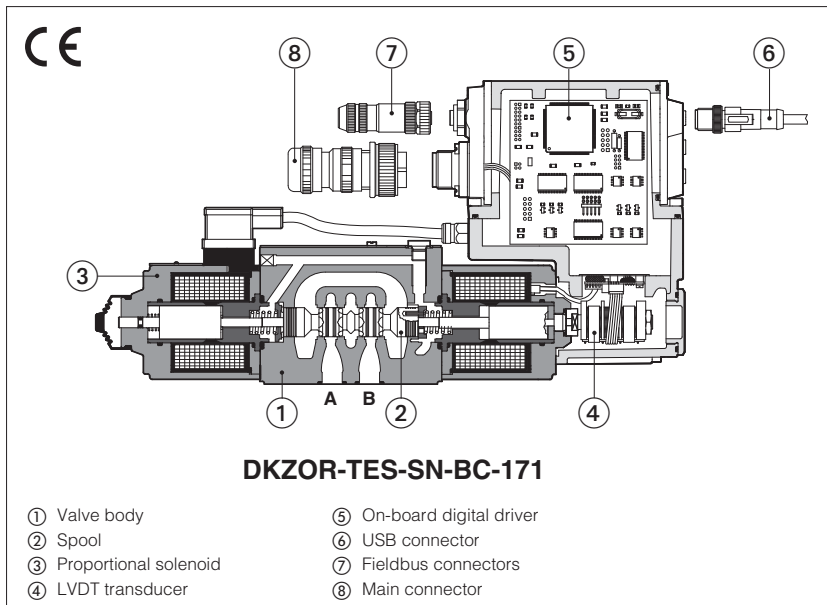
Note: for mounting surface and cavity dimensions, see table P006

13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS235	E-BM-LID digital driver	P006	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves high performance

direct, with on-board driver, LVDT transducer and positive spool overlap



DHZO-TEB, DHZO-TEB DKZOR-TEB, DKZOR-TEB

Digital high performance directional proportional valves, direct, specifically designed for high speed closed loop controls.

They are equipped with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	DKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 80 l/min	Max flow: 180 l/min
Max pressure: 350 bar	Max pressure: 315 bar

1 MODEL CODE OF STANDARD SPOOLS

DHZO	-	TES	-	SN	-	NP	-	0		71	-	L		5	/	*		*	/	*
DHZO = size 06 DKZOR = size 10																				Seals material, see section 11 : - = NBR PE = FKM BT = HNBR

TEB = basic on-board digital driver (1)
TES = full on-board digital driver

Alternated P/Q controls, see section 6 :

- SN** = none
- SP** = pressure control (1 pressure transducer)
- SF** = force control (2 pressure transducers)
- SL** = force control (1 load cell)

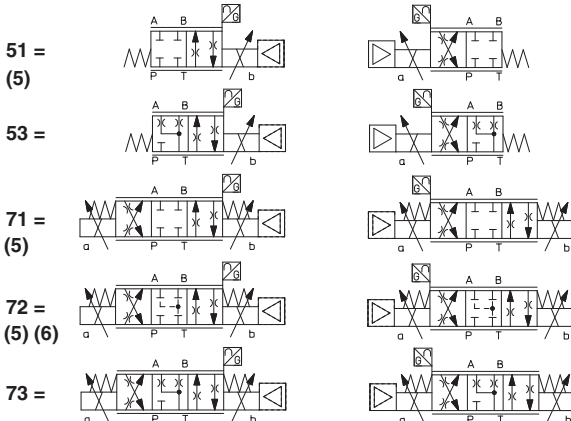
Fieldbus interfaces, USB port always present:

- NP** = Not present
- BC** = CANopen
- BP** = PROFIBUS DP
- EH** = EtherCAT
- EW** = POWERLINK
- EI** = EtherNet/IP
- EP** = PROFINET RT/IRT

Valve size ISO 4401: 0 = 06 1 = 10

Configuration: Standard

Option /B



Hydraulic options (2):

- B** = solenoid with on-board digital driver and LVDT transducer at side of port A
- Y** = external drain

Electronics options (2):

- C** = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only **TES-SP, SF, SL**
- F** = fault signal
- I** = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)
- Q** = enable signal
- Z** = double power supply, enable, fault and monitor signals - 12 pin connector (3)

Safety options TÜV certified - only TES (2):

- U** = safe double power supply
- K** = safe on/off signals

**SAFETY
CERTIFIED**

Spool size: 14 (L) 1 (L) 2 (S) 3 (L,S,D) 5 (L,S,D)

DHZO =	1	4,5	8	17	28
DKZOR =	-	-	-	45	75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics (4):

L = linear

S = progressive

D = differential-progressive



P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) Only in version **SN-NP**

(2) For possible combined options, see section 15

(3) Double power supply only for **TES**

(4) Spools for P/Q control, see section 2

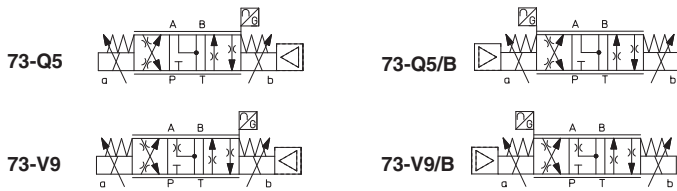
(5) Do not use for P/Q control

(6) Only for **DKZOR-*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section **1**

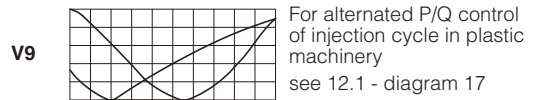
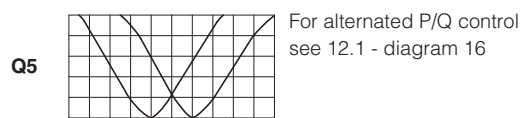
DHZO - **TES** - **SP** - **NP** - **0** **73 - V9** / * * / *

Configuration and spool:



Spool size:	Q5	V9
DHZO	= 30	30
DKZOR	= 75	75

Nominal flow (l/min) at Δp 10 bar P-T



3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

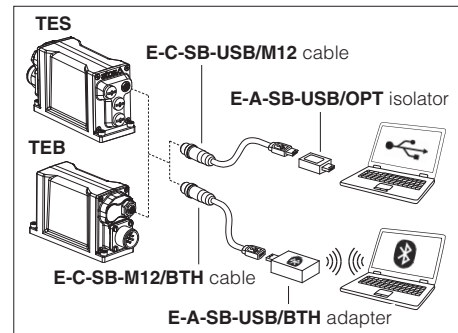
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for **TES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for **TES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**



8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO						DKZOR					
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10						ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10					
Configuration	51, 53, 71, 73						73	51, 53, 71, 73		72	73	
Spool type	standard	L14	L1	S2	L3,S3,D3	L5,S5,D5		L3,S3,D3	L5,S5,D5	S5		
	P/Q							Q5,V9				Q5,V9
Nominal flow Δp P-T [l/min] (1)	Δp = 10 bar	1	4,5	8	18	28	30	45	75	75	75	
	Δp = 30 bar	1,7	8	14	30	50	52	80	130	130	130	
	Δp = 70 bar	2,6	12	21	45	75	80	120	170	170	170	
Max permissible flow (2)		4	18	30	50	80	80	130	180	180	180	
Leakage [cm ³ /min]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)				
Response time (3) [ms]		≤ 15						≤ 20				
Hysteresis		≤ 0,2 [% of max regulation]										
Repeatability		± 0,1 [% of max regulation]										
Thermal drift		zero point displacement < 1% at ΔT = 40°C										

(1) For different Δp , the max flow is in accordance to the diagrams in section 12.2

(2) See detailed diagrams in section 12.3

(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	DHZO = 2,6 A		DKZOR = 3 A	
Coil resistance R at 20°C	DHZO = 3 ÷ 3,3 Ω		DKZOR = 3,8 ÷ 4,1 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

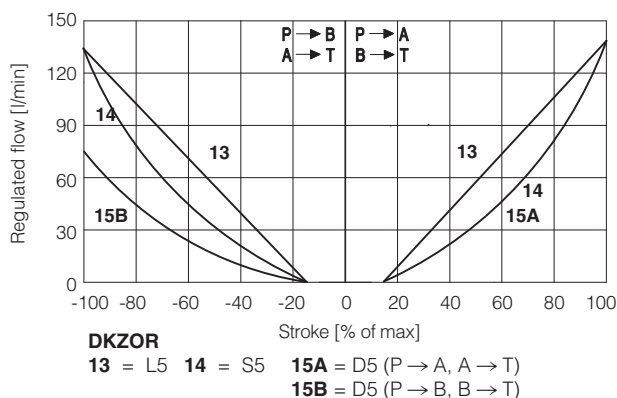
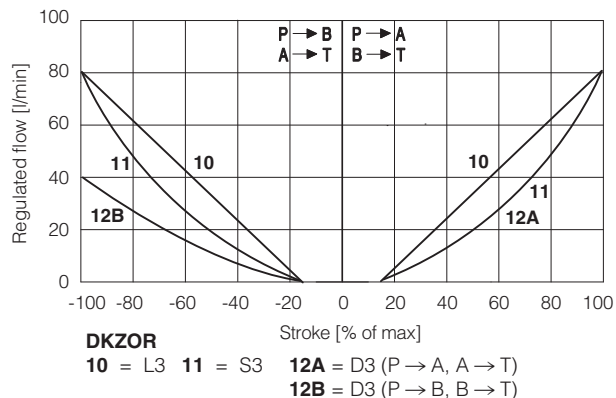
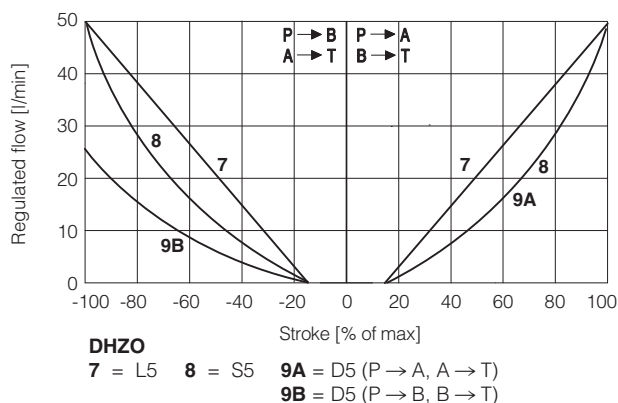
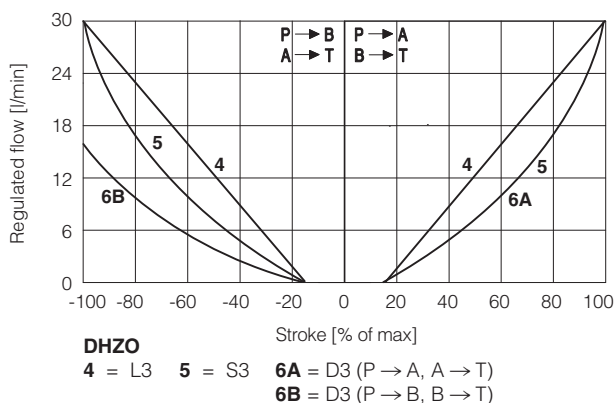
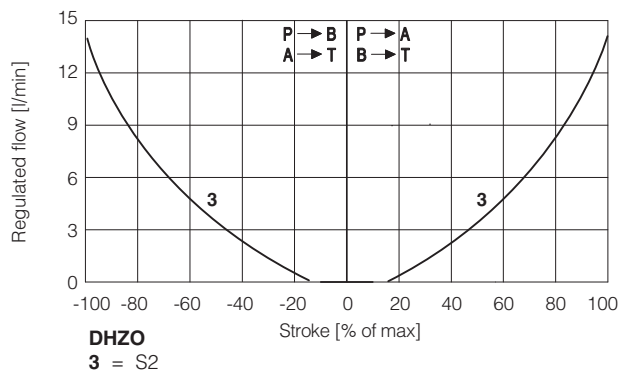
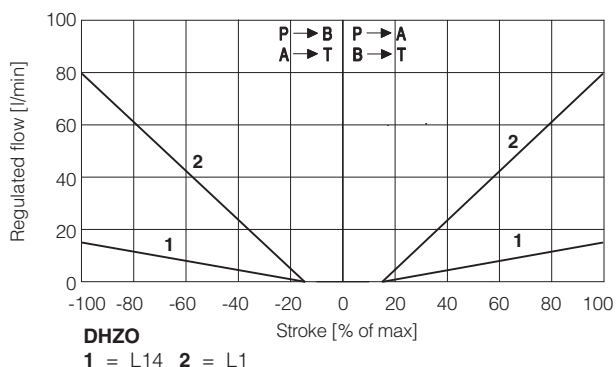
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7
	longer life	ISO4406 class 16/14/11	NAS1638 class 5
			see also filter section at www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

12.1 Regulation diagrams - values measure at Δp 30 bar P-T



Note:

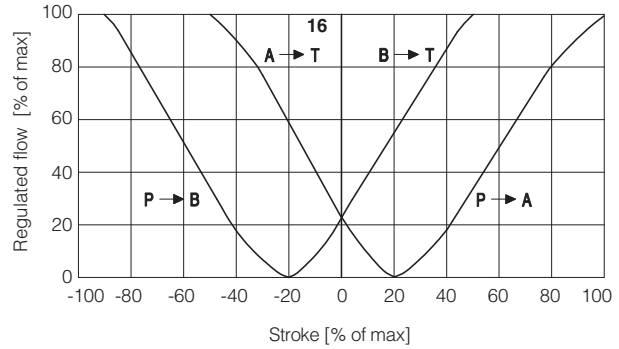
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

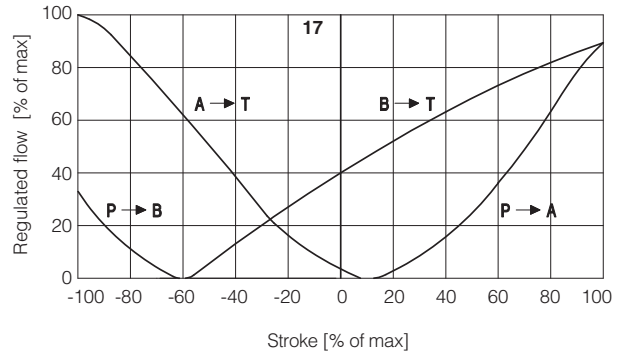
16 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**). It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers. The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers (see tech table **FS500**). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
 - strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
 - safety central position (A-T/B-T) to depressurize the actuator chambers
 - large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



12.2 Flow /Δp diagrams

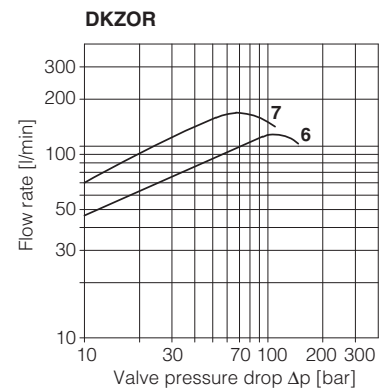
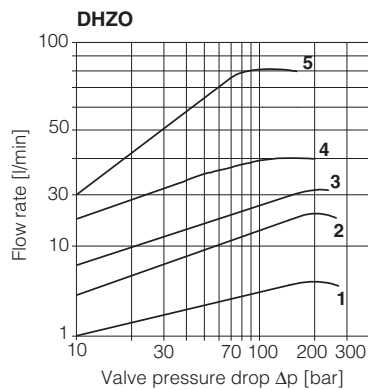
stated at 100% of valve stroke

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5, V9

DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5, V9



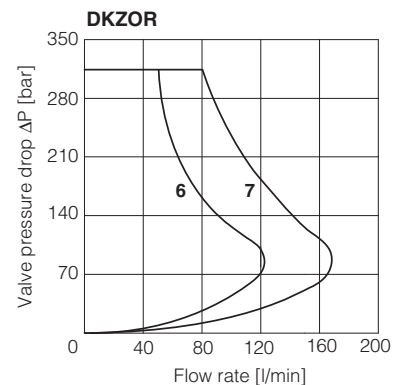
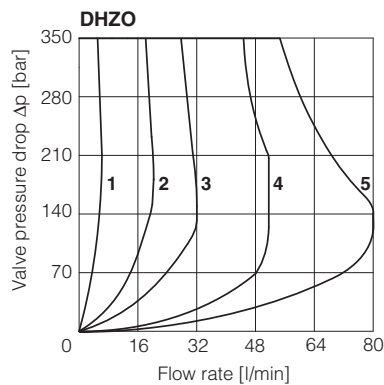
12.3 Operating limits

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5, V9

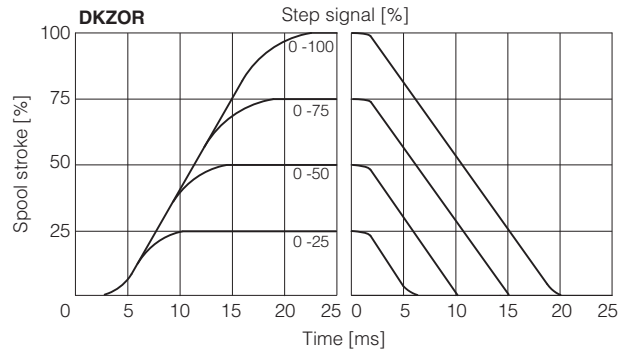
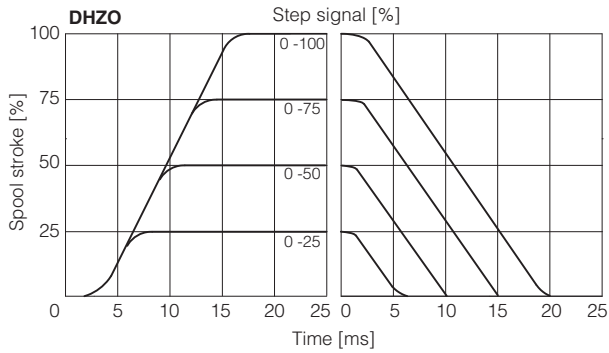
DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5, V9



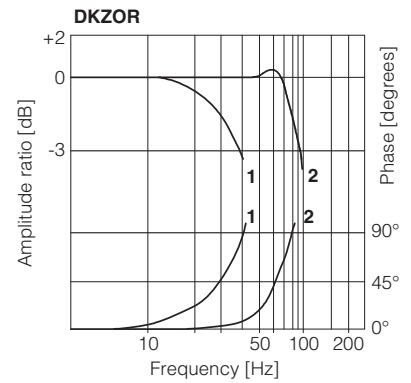
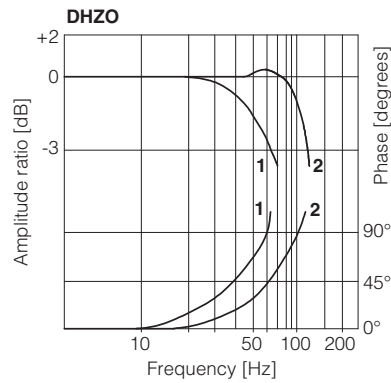
12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



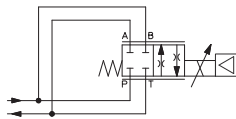
12.5 Bode diagrams

- 1 = 10% ↔ 90% nominal stroke
- 2 = 50% ± 5% nominal stroke



12.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)



Max flow $\Delta p = 15 \text{ bar [l/min]}$	SPOOL TYPE				
	L14	L1	S2	L3 S3	L5 S5
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 12.1
Y = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.
I = This option provides $4 \div 20$ mA current reference and monitor signals, instead of the standard ± 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.
Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **TEB** (see 16.8)
Power supply for driver's logics and communication - only for **TES** (see 16.2)
C = This option is available to connect pressure (force) transducers with $4 \div 20$ mA current output signal, instead of the standard ± 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for **TEB-SN** and **TES-SN**:

/BF, /BFI, /BFIY, /BFY, /BI, /BIQ, /BIQY, /BIY, /BIYZ, /BIZ, /BQ,
/BQY /BY, /BYZ, /BZ,
/FI, /FIY, /FY, /IQ, /IQY,
/IY, /IYZ, /IZ,
/QY, /YZ

Standard versions for **TES-SP, SF, SL**:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for **TES-SN**:

/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /UY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Safety certified versions for **TES-SP, SF, SL**:

/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /UY
/BCK, /BCKI, /BCKIY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CIK, /CIKY, /CKY, /IK, /IKY, /KY

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table **FY100** and /K see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and **TES-SP, SF, SL** with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for **TES-SP, SF, SL**

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for **TES-SP, SF, SL**

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for TES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).

Analog input signal is factory preset according to selected valve code, defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table FS500).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for TES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PID SET SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option and TES-SP, SF, SL

PIN	TEB-SN /Z	TES-SN /Z	TES-SP, SF, SL Fieldbus NP		TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VL0		VL0	V0	Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
	Q_INPUT+				Flow reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VL0		VL0	V0	Flow monitor output signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
	AGND				Analog ground	Gnd - analog signal
7	NC				Do not connect	
			F_INPUT+		Pressure/Force reference input signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
8	R_ENABLE				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
	NC				Do not connect	
9			F_MONITOR referred to: VL0 V0		Pressure/Force monitor output signal: ±10 Vdc / ±20 mA maximum range Defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
	NC				Do not connect	
10	VL+				Power supply 24 Vdc for driver's logic and communication	Input - power supply
			D_IN0		Multiple pressure/force PID selection, referred to V0	Input - on/off signal
11	NC				Do not connect	
	VL0				Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11			D_IN1		Multiple pressure/force PID selection (not available for SF), referred to V0	Input - on/off signal
	FAULT referred to: V0 VL0		VL0	V0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

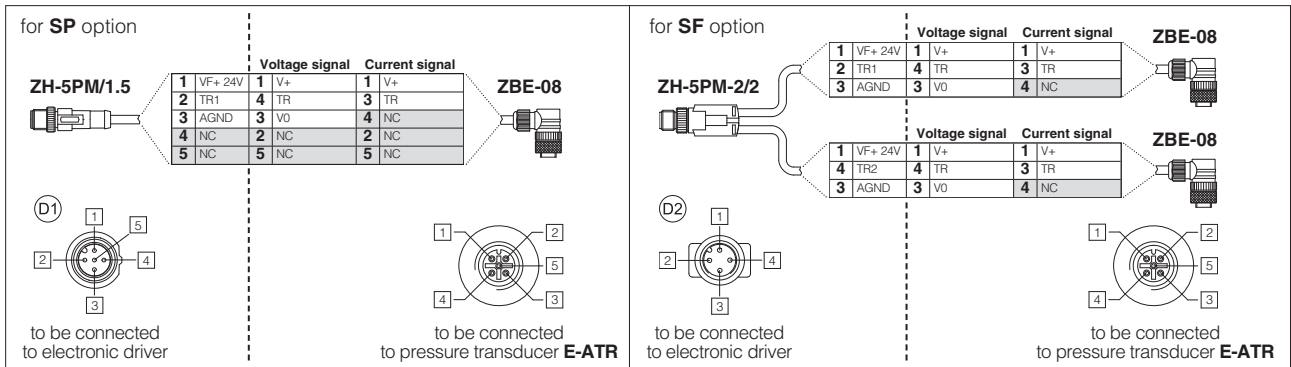
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

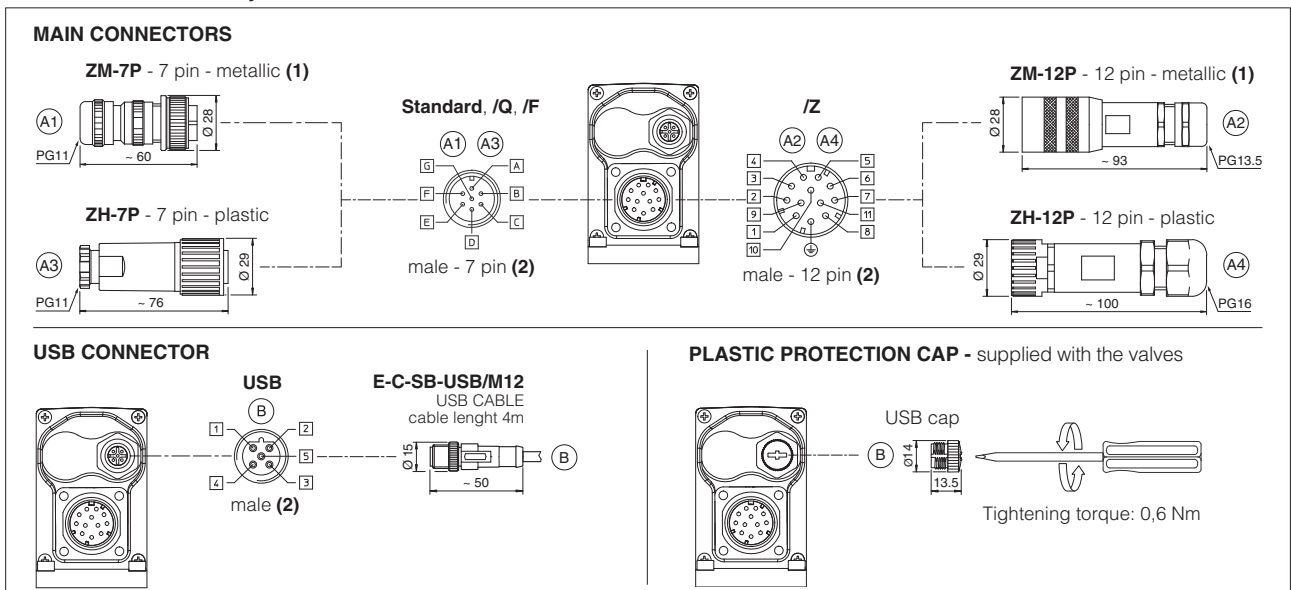
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

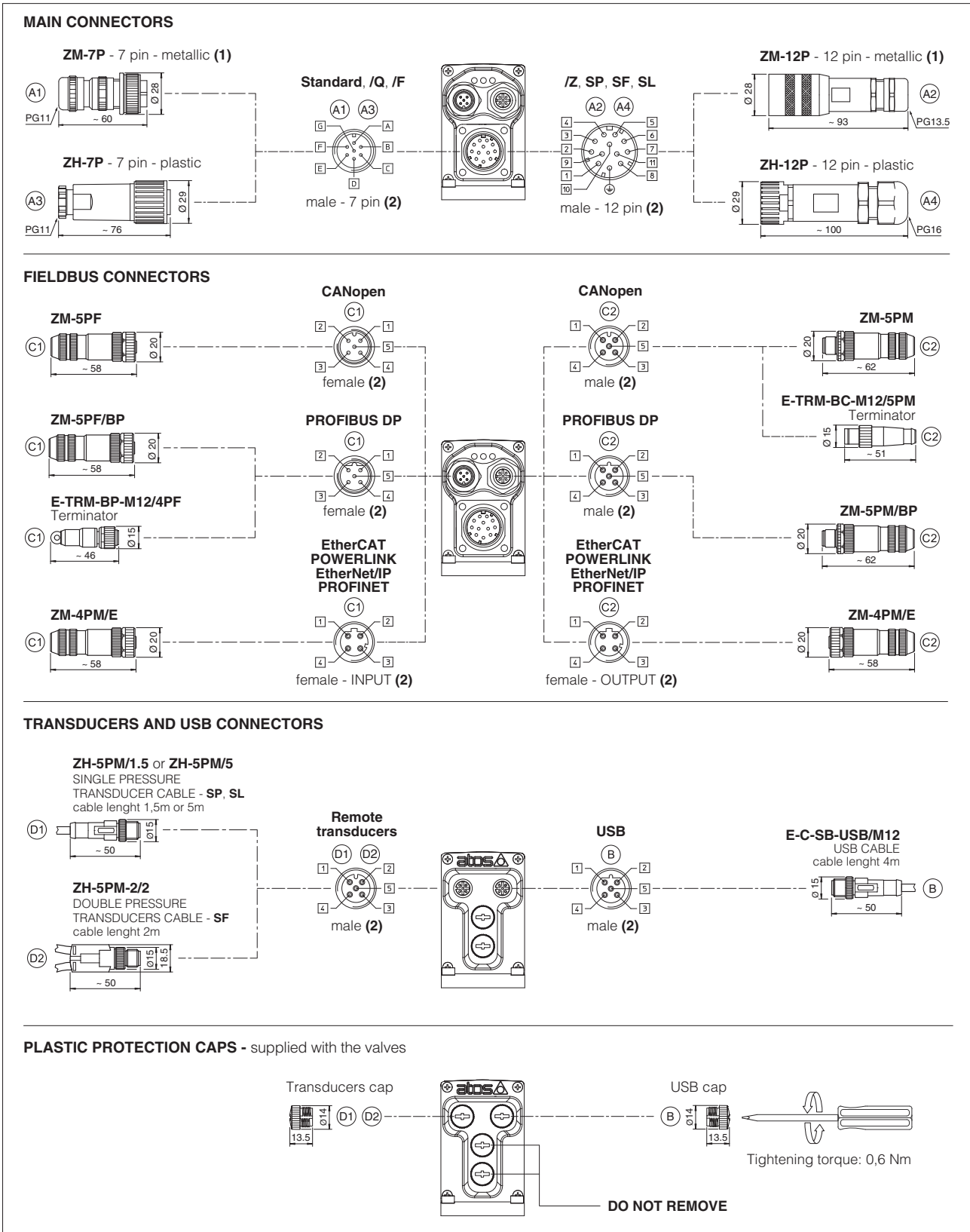
17.5 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

17.6 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	FIELDBUS							L1 L2 L3
	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1		VALVE STATUS				LINK/ACT		
L2		NETWORK STATUS				NETWORK STATUS		
L3		SOLENOID STATUS				LINK/ACT		

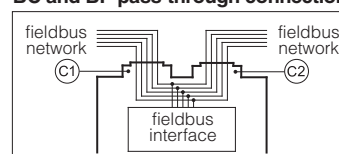
18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20 FASTENING BOLTS AND SEALS

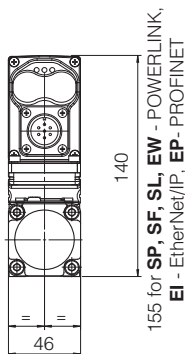
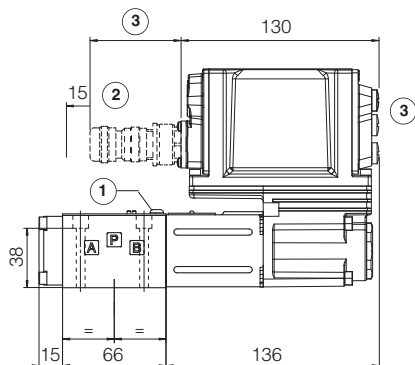
	DHZO	DKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

DHZO-TEB, DHZO-TES

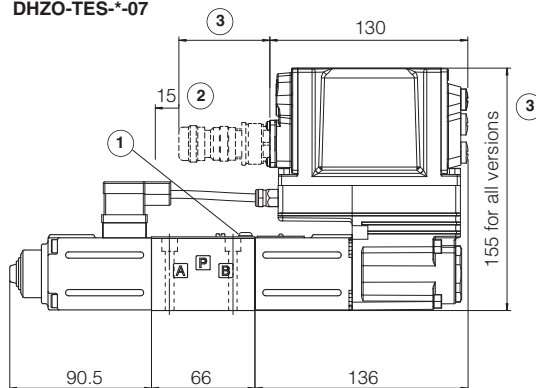
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
 (for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO-*-05	2,3
DHZO-*-07	3,1

DHZO-TEB-*-05
 DHZO-TES-*-05



DHZO-TEB-*-07
 DHZO-TES-*-07



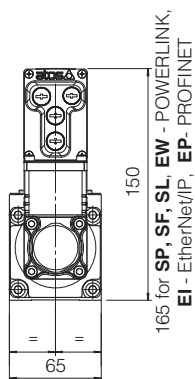
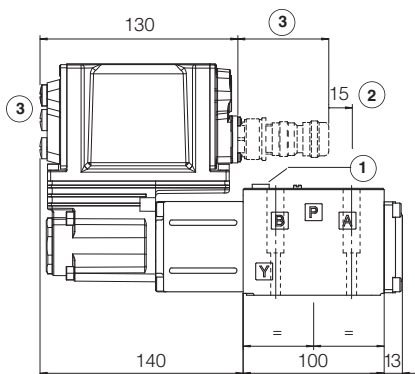
- ① = Air bleeding
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.5 and 18.6

DKZOR-TEB, DKZOR-TES

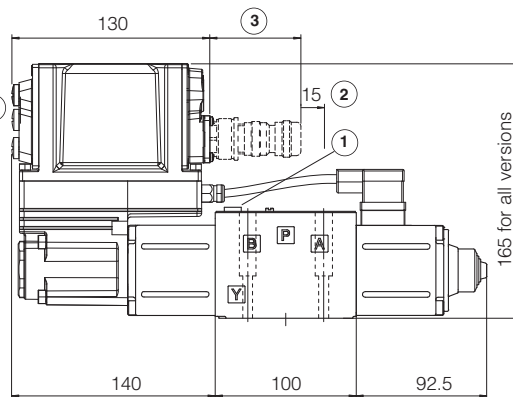
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
 (for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR-*-15	4,3
DKZOR-*-17	5,0

DKZOR-TEB-*-15
 DKZOR-TES-*-15



DKZOR-TEB-*-17
 DKZOR-TES-*-17



- ① = Air bleeding
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

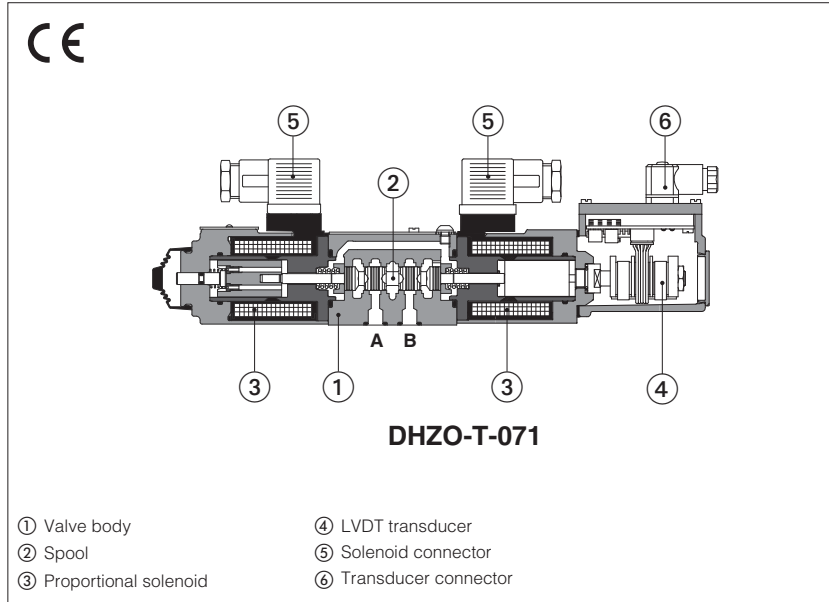
Note: for option /B the solenoid, the LVDT transducer and the on-board digital driver are at side of port A

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB300	Quickstart for TEB valves commissioning
FY100	Safety proportional valves - option /U	QF300	Quickstart for TES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves high performance

direct, with LVDT transducer and positive spool overlap



DHZO-T, DKZOR-T

Proportional directional valves, direct, with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board divers, see section 3.

The LVDT transducer grants very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:

L = linear

S = progressive, for fine low flow control

D = differential-progressive, for control of actuators with area ratio 1:2

Q5 and Q6 = for P/Q control

DHZO:

Size: **06** - ISO 4401

Max flow: **80 l/min**

Max pressure: **350 bar**

DKZOR:

Size: **10** - ISO 4401

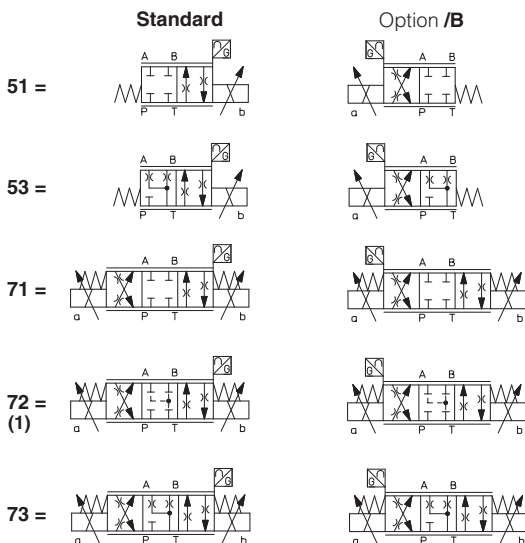
Max flow: **180 l/min**

Max pressure: **315 bar**

1 MODEL CODE OF STANDARD SPOOLS

DHZO	-	T	-	0	71	-	L	5	/	*	/	*
DHZO = size 06 DKZOR = size 10		T = with LVDT transducer		71 = size 06 72 = size 10		L = linear S = progressive D = differential-progressive		5 = for P/Q control		* = Series number		Seals material , see section 7: - = NBR PE = FKM BT = HNBR

Configuration:



Hydraulic options (2):

B = solenoid and LVDT transducer at side of port A
Y = external drain

Spool size: 14 (L) 1 (L) 2 (S) 3 (L,S,D) 5 (L,S,D)

DHZO = 1 4,5 8 17 28

DKZOR = - - - 45 75

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics (3):

L = linear



S = progressive



D = differential-progressive



P-A = Q, B-T = Q/2

P-B = Q/2, A-T = Q

(1) Only for **DKZOR*-S5** the spool overlapping type 2 provides the same characteristic of type 1, but in central position the internal leakages from P to A and B are drained to tank, avoiding the drift of cylinders with differential areas

(2) Possible combined options: /BY

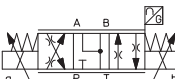
(3) Spools for P/Q control, see section 2

2 MODEL CODE OF SPOOLS FOR ALTERNATED P/Q CONTROL - for valve model code and options, see section **1**

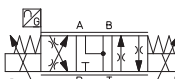
DHZO - **T** - **0** **73 - V9** / * / *

Configuration and spool:

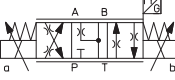
73-Q5



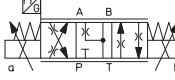
73-Q5/B



73-V9



73-V9/B

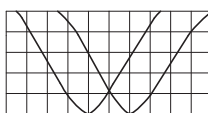


Spool size:

	Q5	V9
DHZO =	30	30
DKZOR =	75	75

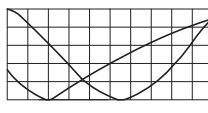
Nominal flow (l/min) at Δp 10 bar P-T

Q5



For alternated P/Q control see 8.1 - diagram 16

V9



For alternated P/Q control of injection cycle in plastic machinery see 8.1 - diagram 17

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO						DKZOR				
Pressure limits [bar]	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10						ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10				
Configuration	51, 53, 71, 73					73	51, 53, 71, 73		72	73	
Spool type	standard	L14	L1	S2	L3,S3,D3	L5,S5,D5	Q5,V9	L3,S3,D3	L5,S5,D5	S5	Q5,V9
Nominal flow Δp= 10 bar		1	4,5	8	18	28	30	45	75	75	75
Δp P-T [l/min] (1)	Δp= 30 bar	1,7	8	14	30	50	52	80	130	130	130
	Δp= 70 bar	2,6	12	21	45	75	80	120	170	170	170
Max permissible flow (2)		4	18	30	50	80	80	130	180	180	180
Leakage [cm³/min]		<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)			
Response time (3) [ms]		≤ 15						≤ 20			
Hysteresis		≤ 0,2 [% of max regulation]									
Repeatability		± 0,1 [% of max regulation]									
Thermal drift		zero point displacement < 1% at ΔT = 40°C									

(1) For different Δp, the max flow is in accordance to the diagrams in section 8.2

(2) See detailed diagrams in section 8.3

(3) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

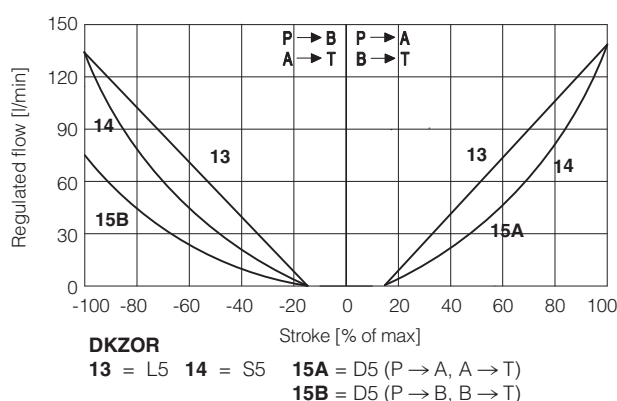
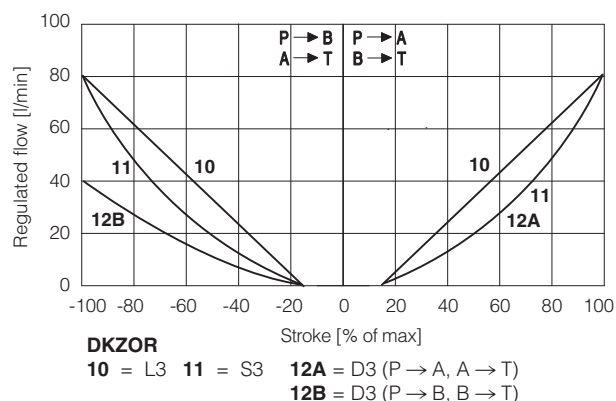
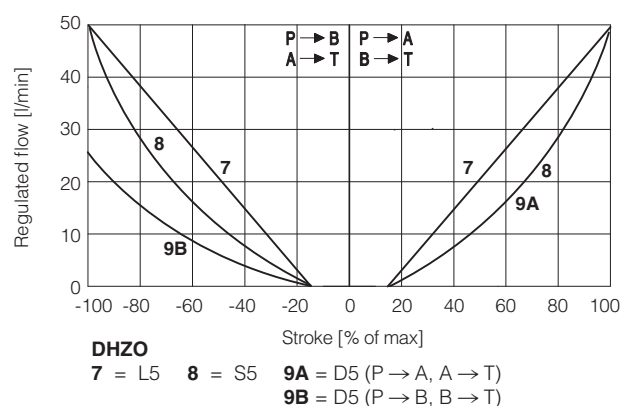
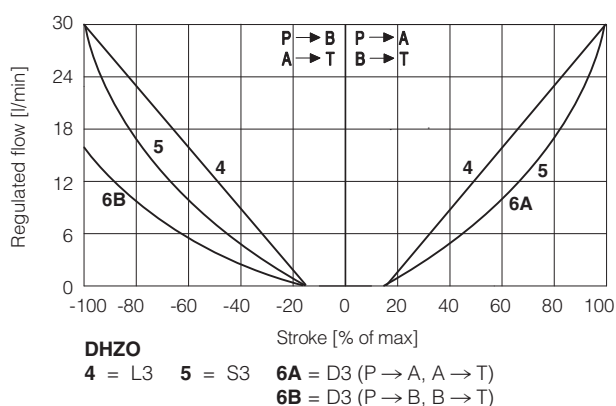
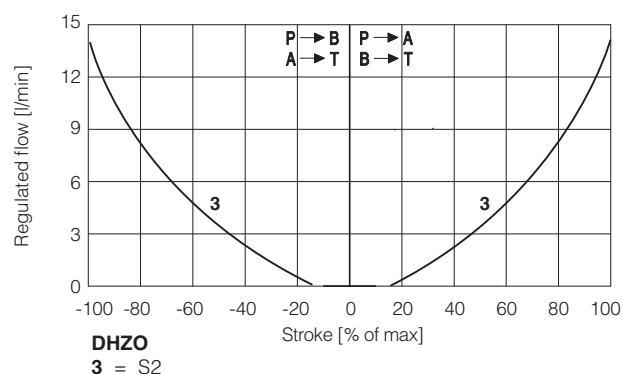
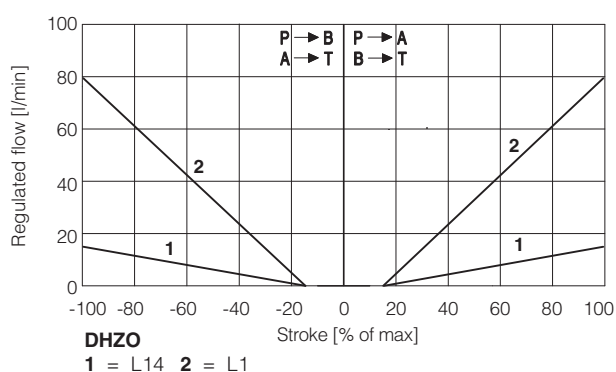
Max power consumption	30 W	
Max. solenoid current	DHZO = 2,6 A	DKZOR = 3 A
Coil resistance R at 20°C	DHZO = 3 ÷ 3,3 Ω	DKZOR = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree to DIN EN60529	IP65 with mating connectors	
Duty factor	Continuous rating (ED=100%)	

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

8.1 Regulation diagrams - values measure at Δp 30 bar P-T



Note:

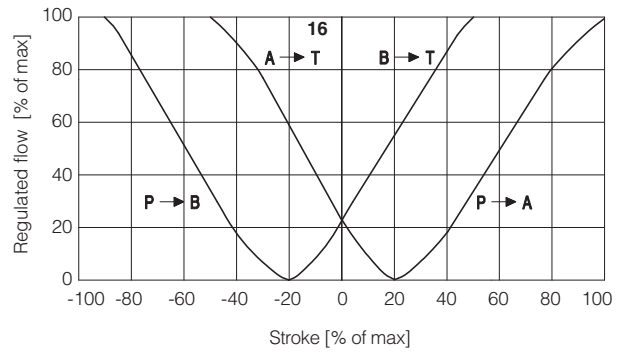
Hydraulic configuration vs. reference signal for configurations 71, 72 and 73 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

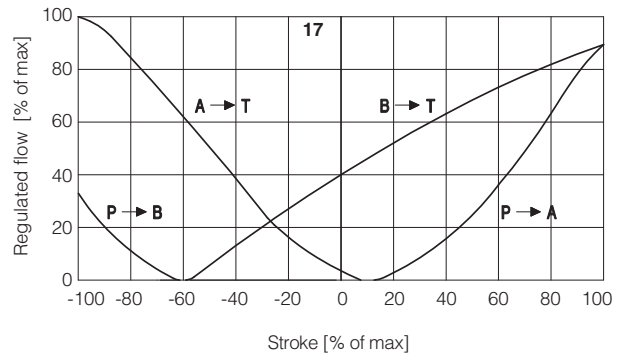
16 = linear spool Q5

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers. The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



17 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**). This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:
 - strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
 - safety central position (A-T/B-T) to depressurize the actuator chambers
 - large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



8.2 Flow /Δp diagrams

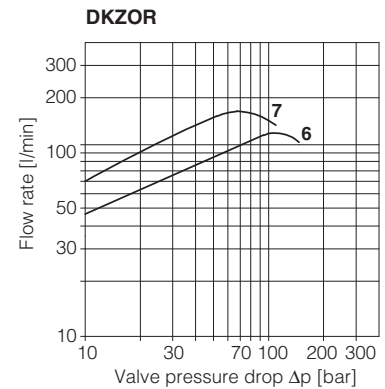
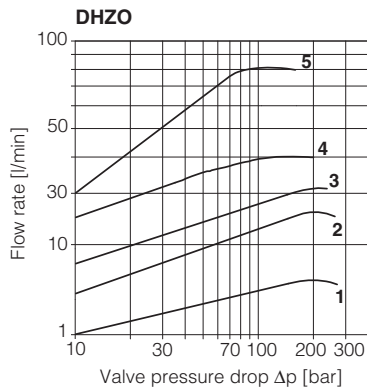
stated at 100% of valve stroke

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5, V9

DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5, V9



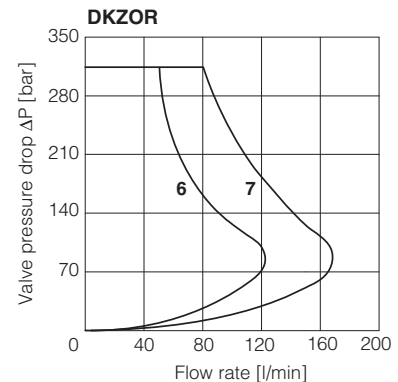
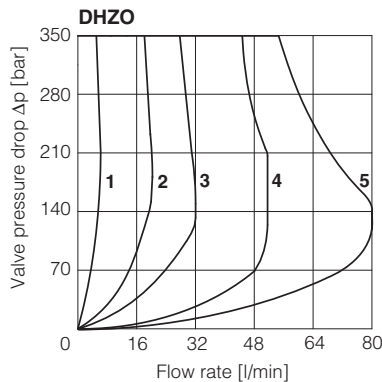
8.3 Operating limits

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5, V9

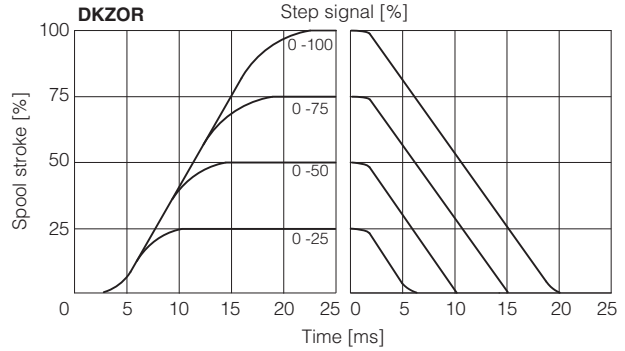
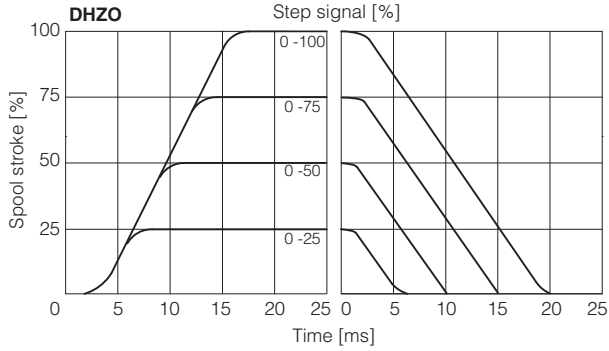
DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5, V9



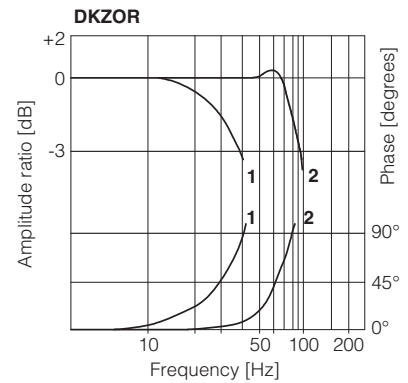
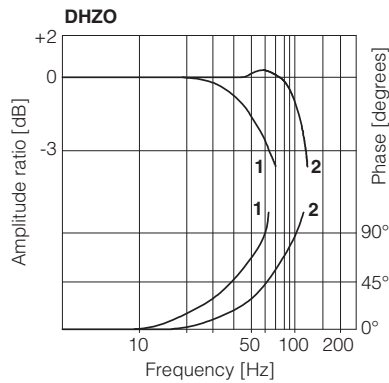
8.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



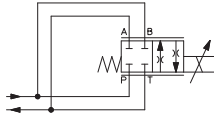
8.5 Bode diagrams

- 1 = 10% ↔ 90% nominal stroke
- 2 = 50% ± 5% nominal stroke



8.6 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option Y advisable)



Max flow $\Delta p = 15 \text{ bar}$ [l/min]	SPOOL TYPE				
	L14	L1	S2	L3 S3	L5 S5
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	260

9 HYDRAULIC OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 8.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

10 ELECTRICAL CONNECTION

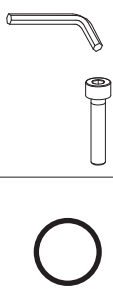
10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

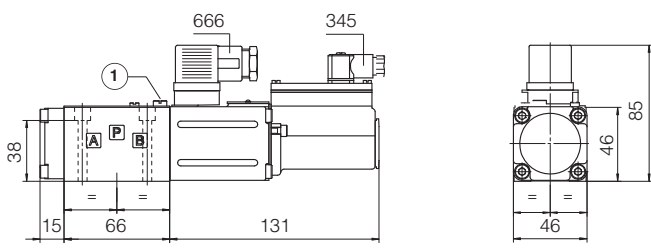
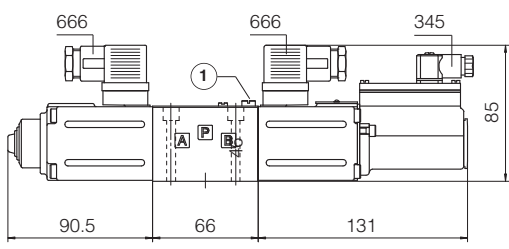
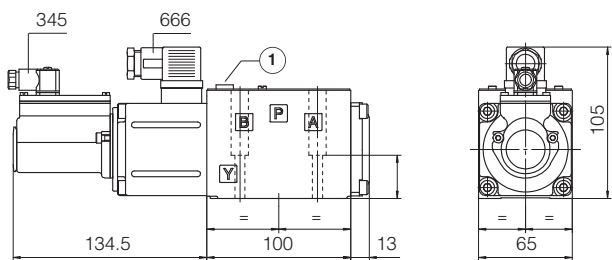
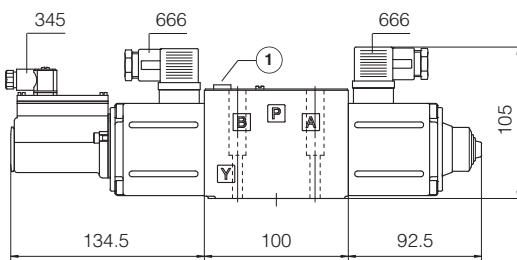
10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

11 FASTENING BOLTS AND SEALS

	DHZO Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	DKZOR Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: \varnothing 7,5 mm (max) 1 OR 2025 Diameter of port Y: \varnothing = 3,2 mm (only for /Y option)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: \varnothing 11,2 mm (max) 1 OR 108 Diameter of port Y: \varnothing = 5 mm (only for /Y option)

12 INSTALLATION DIMENSIONS [mm]

<h3>DHZO-T</h3> <p>ISO 4401: 2005 Mounting surface: 4401-03-02-0-05 (see table P005) (for /Y surface 4401-03-03-0-05 without X port)</p>		<table border="1"> <thead> <tr> <th colspan="2">Mass [kg]</th> </tr> </thead> <tbody> <tr> <td>DHZO-T-05</td> <td>1,9</td> </tr> <tr> <td>DHZO-T-07</td> <td>2,6</td> </tr> </tbody> </table>	Mass [kg]		DHZO-T-05	1,9	DHZO-T-07	2,6
Mass [kg]								
DHZO-T-05	1,9							
DHZO-T-07	2,6							
<p>DHZO-T-05</p> 	<p>DHZO-T-07</p> 							
<h3>DKZOR-T</h3> <p>ISO 4401: 2005 Mounting surface: 4401-05-04-0-05 (see table P005) (for /Y surface 4401-05-05-0-05 without X port)</p>		<table border="1"> <thead> <tr> <th colspan="2">Mass [kg]</th> </tr> </thead> <tbody> <tr> <td>DKZOR-T-15</td> <td>3,8</td> </tr> <tr> <td>DKZOR-T-17</td> <td>4,5</td> </tr> </tbody> </table>	Mass [kg]		DKZOR-T-15	3,8	DKZOR-T-17	4,5
Mass [kg]								
DKZOR-T-15	3,8							
DKZOR-T-17	4,5							
<p>DKZOR-T-15</p> 	<p>DKZOR-T-17</p> 							

Note: for option /B the solenoid and the LVDT transducer are at side of port A

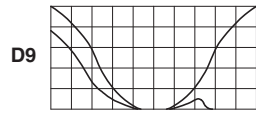
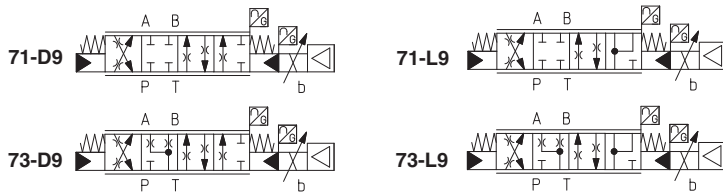
13 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS235	E-BM-TID digital driver	P005	Mounting surfaces for electrohydraulic valves
GS240	E-BM-TES digital driver		

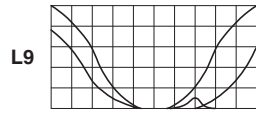
2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. **1**

DPZO - **LES** - **SN** - **NP** - **2** **71 - L9** / * * / *

Configuration and spool for regenerative circuit:

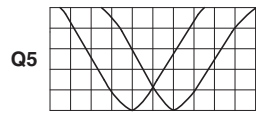


For regenerative circuit (additional external check valve required) see 12.1 - diagram 26

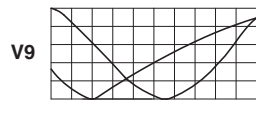


For regenerative circuit internal to the valve see 12.1 - diagram 27

Configuration and spool for alternated P/Q control:



For alternated P/Q control see 12.1 - diagram 28



For alternated P/Q control of injection cycle in plastic machinery see 12.1 - diagram 29

Spool size:	D9	L9	V9	Q5
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

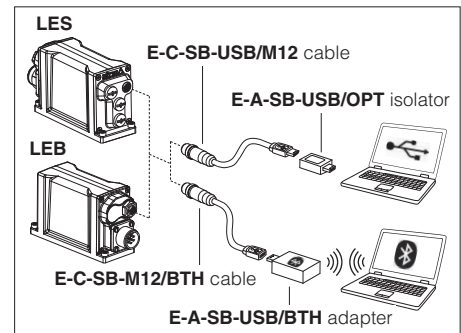
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support:	NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS support:	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ support:	valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers **USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - only for **LES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 ALTERNATED P/Q CONTROLS - only for **LES**, see tech. table **FS500**

S* options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions. Main 12 pin connector is the same as /Z option plus two analog signals specific for the pressure (force) control.

7 SAFETY OPTIONS - only for **LES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems. They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**



8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2	DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;					
Spool type	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5		L5, S5, D5	
standard						
regenerative or P/Q	D9, V9, Q5		D9, L9, V9, Q5	D9, V9, Q5	V9	
Nominal flow Δp P-T [l/min]						
(1)						
Δp= 10 bar	100	160	250	480	550	1200
Δp= 30 bar	160	270	430	830	950	2000
Max permissible flow	180	400	550	1000	1100	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume [cm³]	1,4	3,7	9,0	11,3	21,6	39,8
Piloting flow (2) [l/min]	1,7	3,7	6,8	8	14,4	20
Leakage (3) Pilot [cm³/min]	100 / 300	100 / 300	200 / 500	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,15 / 0,5	0,2 / 0,6	0,3 / 1,0	0,3 / 1,0	1,0 / 3,0	1,2 / 3,6
Response time (4) [ms]	≤ 50	≤ 60	≤ 80	≤ 85	≤ 90	≤ 120
Hysteresis	≤ 0,1 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(3) At p = 100/350 bar

(2) With step reference input signal 0 ÷ 100 %

(4) 0-100% step signal see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 Vdc (OFF state), 9 ÷ 24 Vdc (ON state), 5 ÷ 9 Vdc (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

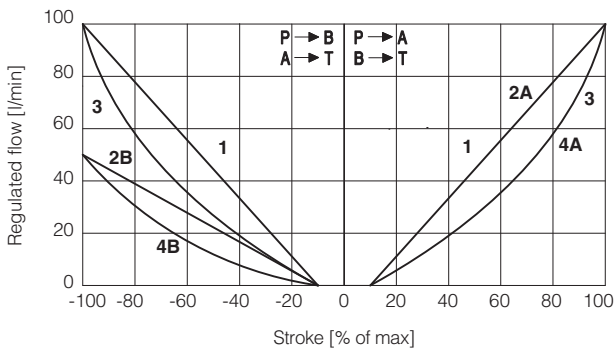
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

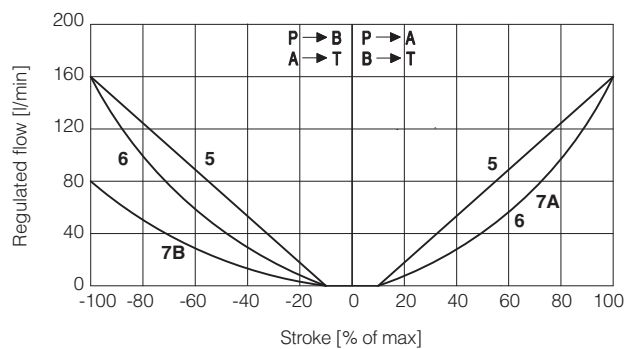
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

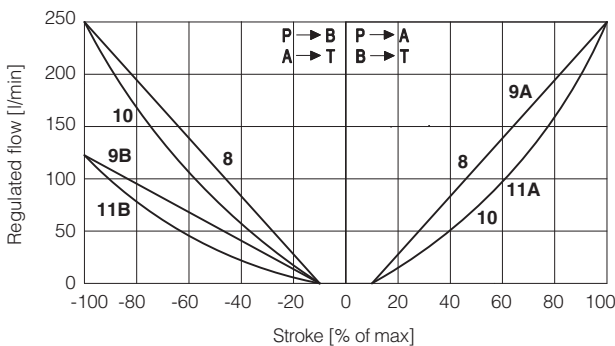
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



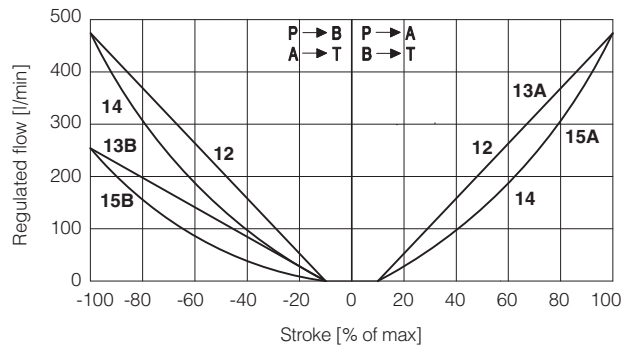
- DPZO-1:**
1 = L5 **2A** = DL5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T)
4A = D5 (P → A, A → T)
4B = D5 (P → B, B → T)



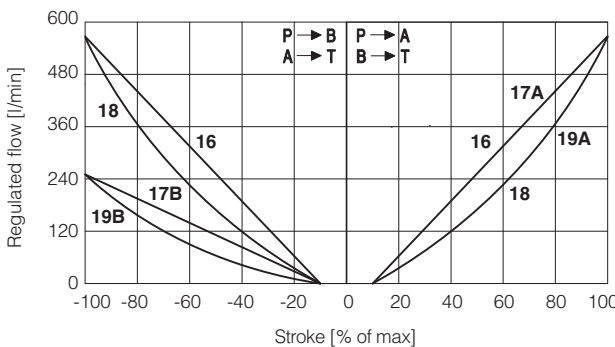
- DPZO-2:**
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



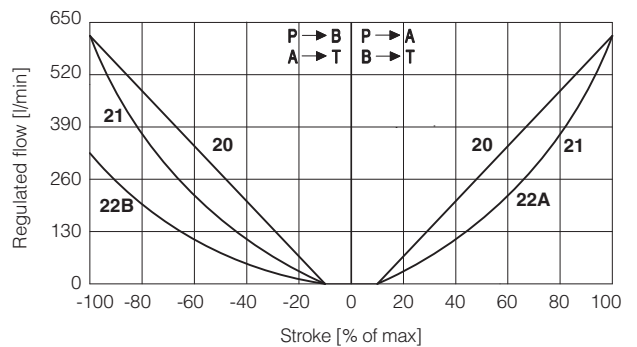
- DPZO-2:**
8 = L5 **9A** = DL5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T)
11A = D5 (P → A, A → T)
11B = D5 (P → B, B → T)



- DPZO-4:**
12 = L5 **13A** = DL5 (P → A, A → T)
14 = S5 **13B** = DL5 (P → B, B → T)
15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)



- DPZO-4M:**
16 = L5 **17A** = DL5 (P → A, A → T)
18 = S5 **17B** = DL5 (P → B, B → T)
19A = D5 (P → A, A → T)
19B = D5 (P → B, B → T)



- DPZO-6:**
20 = L5 **22A** = D5 (P → A, A → T)
21 = S5 **22B** = D5 (P → B, B → T)

Note:

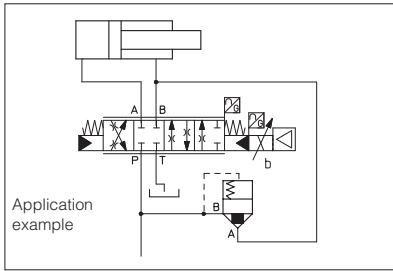
Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

26 = differential - regenerative spool **D9**
(not available for valve size 32 and 35)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



27 = linear - internal regenerative spool **L9**
(available only for valve size 16)

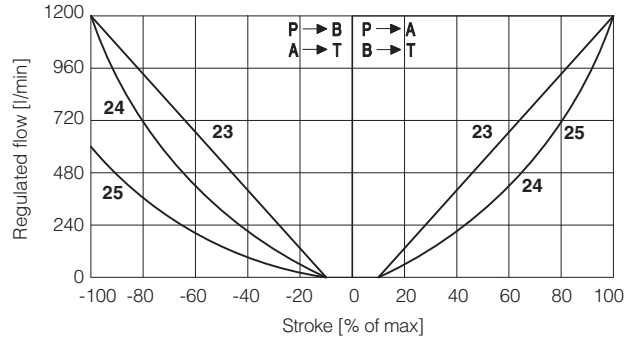
L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

28 = linear spool **Q5**
(not available for valve size 32 and 35)

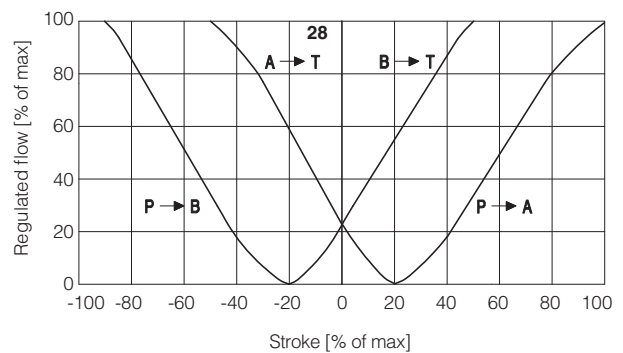
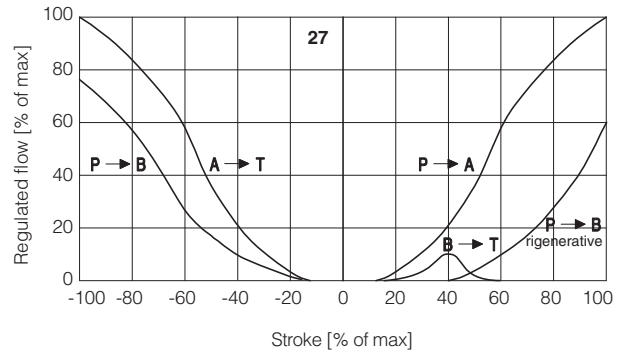
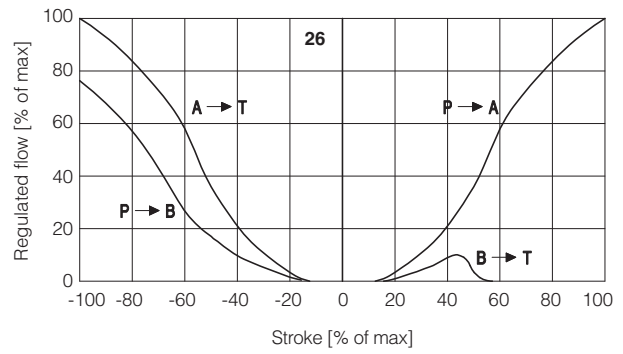
Q5 spool type is specific for alternate P/Q controls in combination with /S* option of digital on-board drivers, (see tech. table **FS500**).

It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers.

The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.



DPZO-8:
23 = L5 **24** = S5
25 = D5

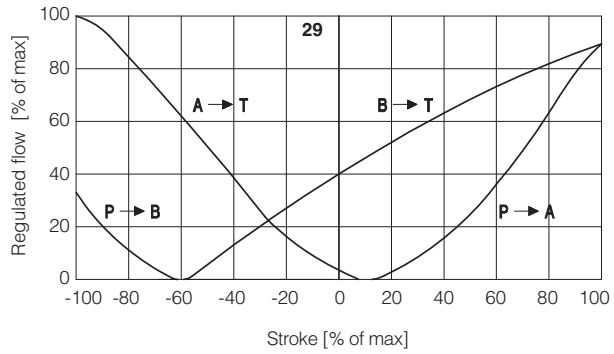


29 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital on-board drivers, (see tech. table **FS500**).

This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

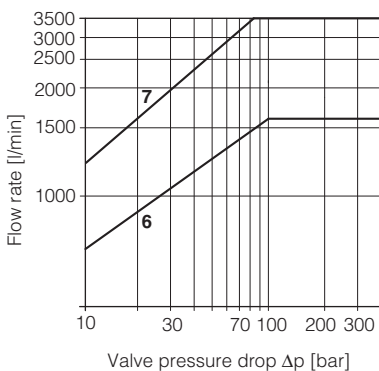
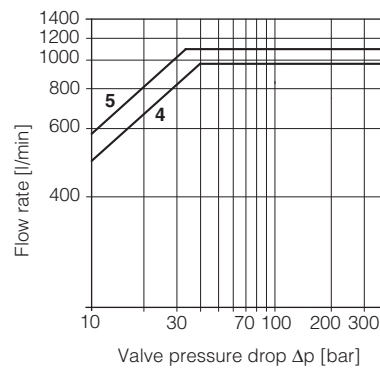
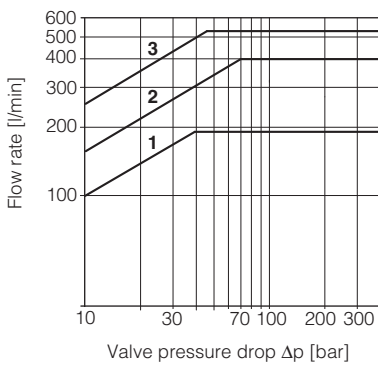
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



12.2 Operating diagrams

Flow /Δp diagram

stated at 100% of spool stroke



DPZO-1:

1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:

2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

DPZO-4:

4 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-4M:

5 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-6:

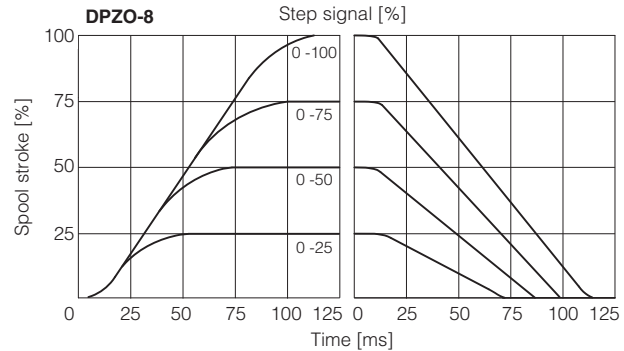
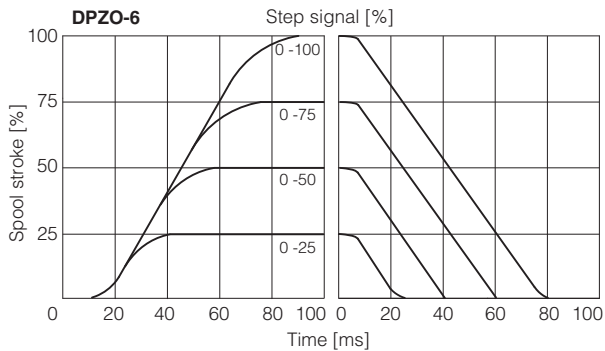
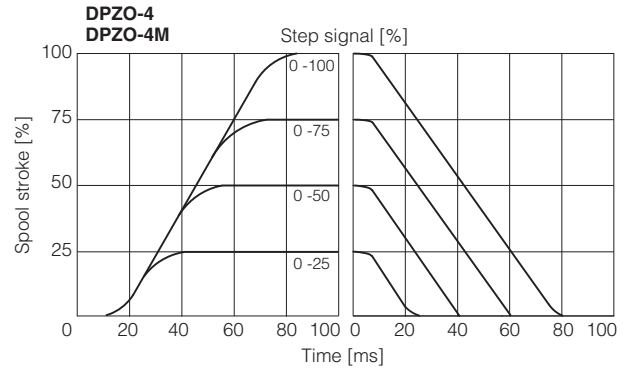
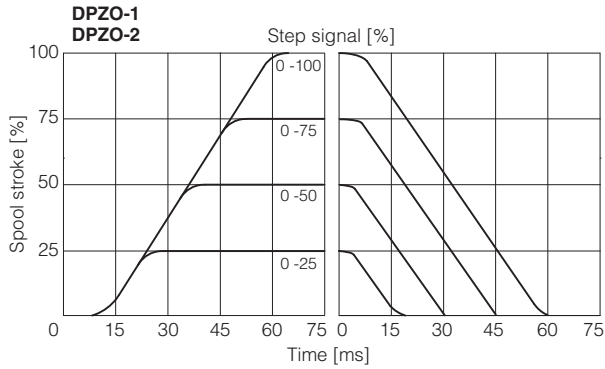
6 = L5, S5, D5, V9

DPZO-8:

7 = L5, S5, D5, V9

12.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 20
The valve's standard configuration provides internal pilot and external drain.

G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

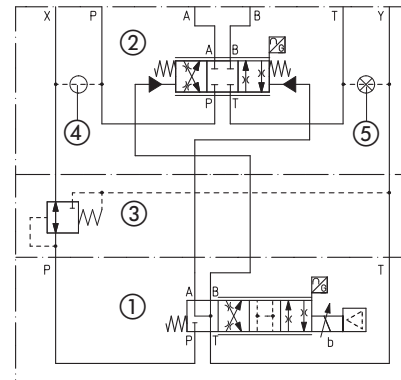
DPZO-2 = **28 bar**

DPZO-1, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.

Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 16.9 for signal specifications.

I = This option provides $4 \div 20$ mA current reference and monitor signals, instead of the standard ± 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see above option /F

Enable input signal - see above option /Q

Repeat enable output signal - only for **LEB** (see 16.8)

Power supply for driver's logics and communication - only for **LES** (see 16.2)

C = This option is available to connect pressure (force) transducers with $4 \div 20$ mA current output signal, instead of the standard ± 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

15 POSSIBLE COMBINED OPTIONS

Hydraulic options:

all combination possible

Electronics options - Standard versions:

LEB-SN, LES-SN **LES-SP, SF, SL**
/FI, /IQ, /IZ /CI

Electronics options - Safety certified versions:

LES-SN **LES-SP, SF, SL**
/IU, /IK /CU, /IU, /CIU, /CK, /IK, /CIK


16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table **FY100** and /K see tech. table **FY200**

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option and LES-SP, SF, SL with fieldbus

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.4 Pressure or force reference input signal (F_INPUT+) - only for LES-SP, SF, SL

Functionality of F_INPUT+ signal (pin 7), is used as reference for the driver pressure/force closed loop (see tech. table **FS500**).

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

16.5 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.6 Pressure or force monitor output signal (F_MONITOR) - only for LES-SP, SF, SL

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

16.8 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 16.7).

16.9 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for $4 \div 20$ mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.10 Remote pressure/force transducer input signal - only for LES-SP, SF, SL

Analog remote pressure transducers or load cell can be directly connected to the driver (see 17.4).

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

16.11 Multiple PID selection (D_IN0 and D_IN1) - only NP execution for LES-SP, SF, SL

Two on-off input signals are available on the main connector to select one of the four pressure (force) PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 VDC on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option and LES-SP, SF, SL

PIN	LEB-SN /Z	LES-SN /Z	LES-SP, SF, SL Fieldbus NP		TECHNICAL SPECIFICATIONS	NOTES
1	V+				Power supply 24 Vdc	Input - power supply
2	V0				Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VLO VLO V0				Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+				Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-				Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VLO VLO V0				Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	AGND				Analog ground	Gnd - analog signal
		NC			Do not connect	
8	R_ENABLE				Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC		F_MONITOR referred to: VLO V0	Pressure/Force monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
9	NC				Do not connect	
		VL+		D_IN0	Power supply 24 Vdc for driver's logic and communication Multiple pressure/force PID selection, referred to V0	Input - power supply Input - on/off signal
10	NC				Do not connect	
		VLO		D_IN1	Power supply 0 Vdc for driver's logic and communication Multiple pressure/force PID selection (not available for SF), referred to V0	Gnd - power supply Input - on/off signal
11	FAULT referred to: V0 VLO VLO V0				Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH				Internally connected to the driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

17.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

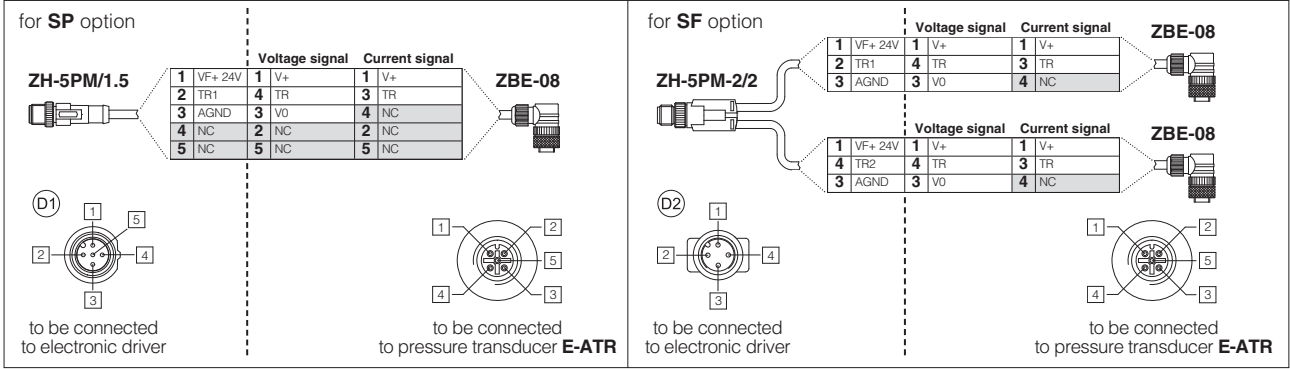
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - only for SP, SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

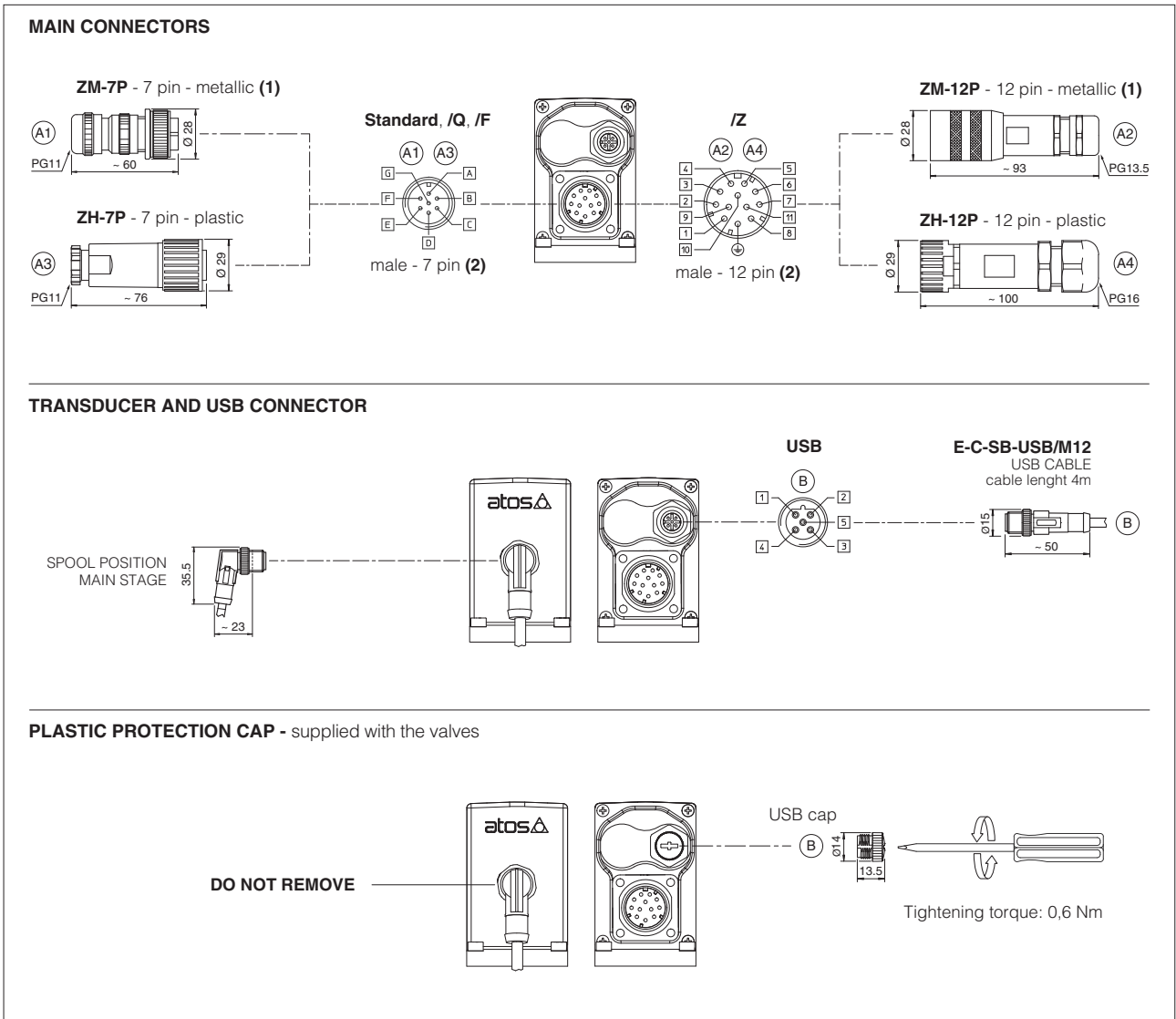
(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



Note: pin layout always referred to driver's view

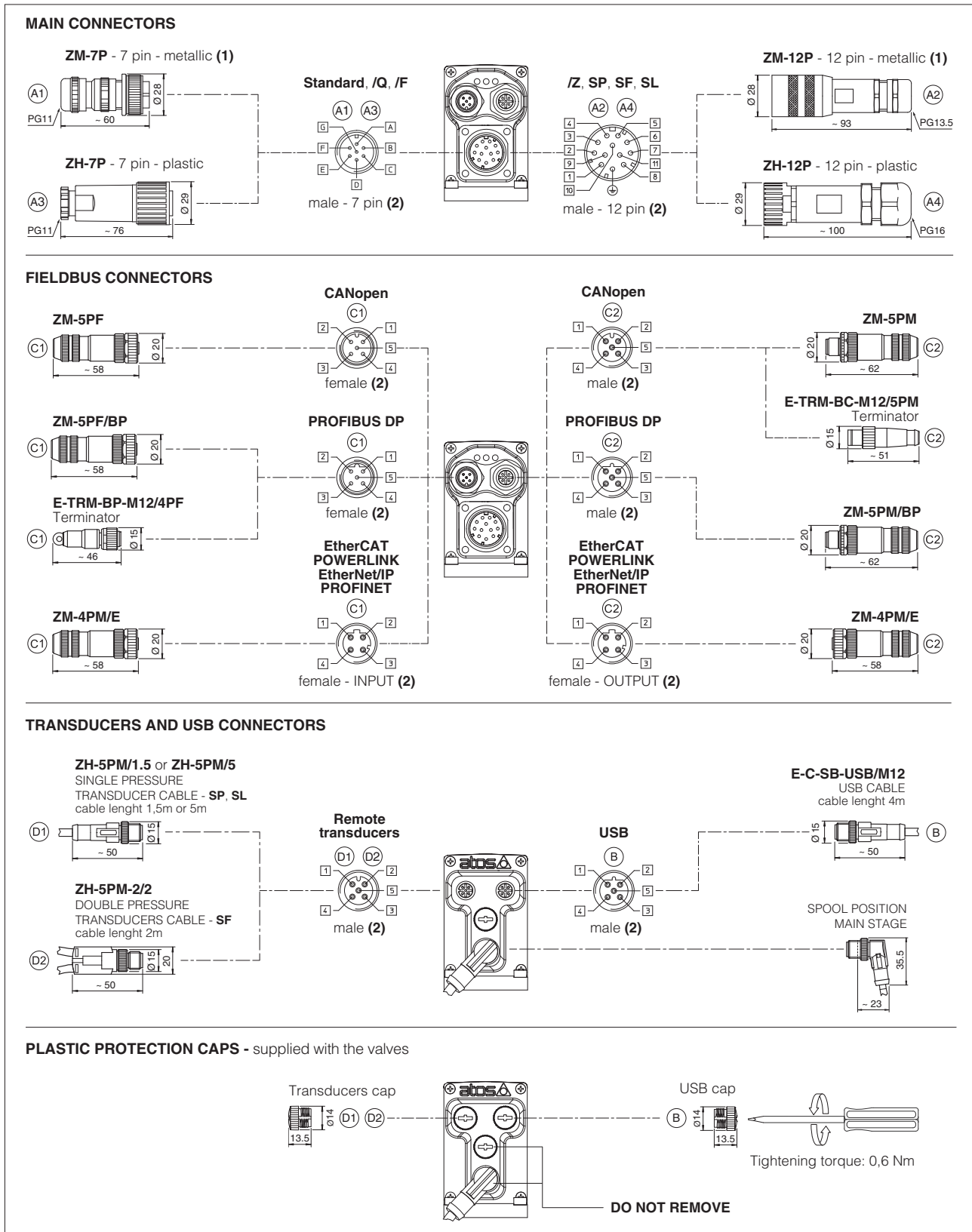
17.5 LEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

17.6 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.7 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

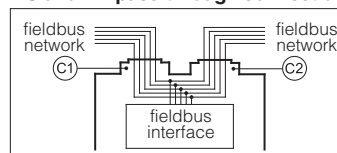
18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

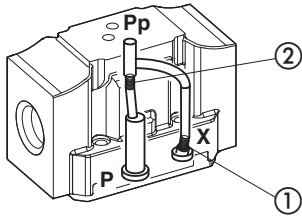
19.4 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

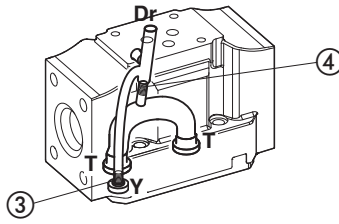
20 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.

DPZO-1 Pilot channels

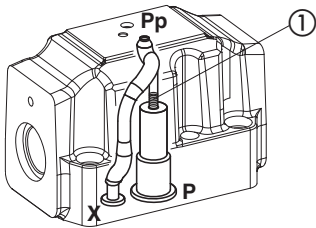


Drain channels

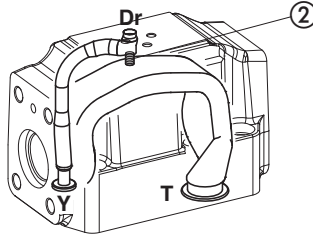


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

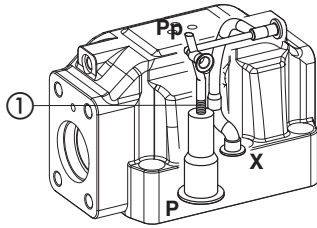


Drain channels

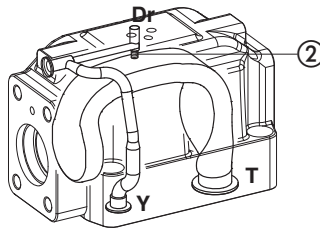


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

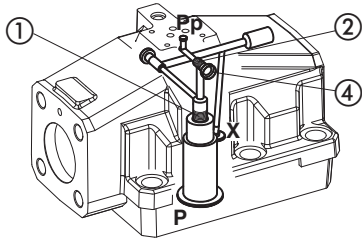


Drain channels

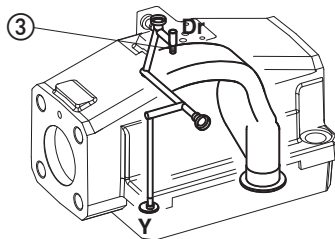


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels

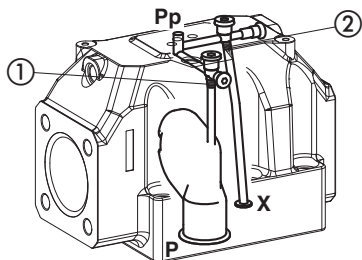


Drain channels

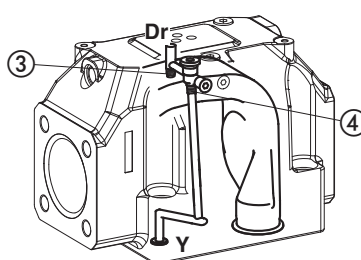


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
 plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
 Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

21 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: \varnothing 11 mm (max) 2 OR 108 Diameter of ports X, Y: \varnothing = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: \varnothing 20 mm (max) 2 OR 2043 Diameter of ports X, Y: \varnothing = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: \varnothing 24 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: \varnothing 32 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: \varnothing 34 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: \varnothing 50 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 9 mm (max)

22 INSTALLATION DIMENSIONS [mm]

DPZO-LEB-*-1
DPZO-LES-*-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)

256
271 for SP, SF, SL
EW - POWERLINK
EI - EtherNet/IP
EP - PROFINET

30
92.5
192

30
70
86

Mass [kg]	
DPZO-*-1	9,5

DPZO-LEB-*-2
DPZO-LES-*-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05 (see table P005)

237
215
115
42

237 for SP, SF, SL
EW - POWERLINK
EI - EtherNet/IP
EP - PROFINET

3
92
97

Mass [kg]	
DPZO-*-2	14

① = Air bleeding 3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

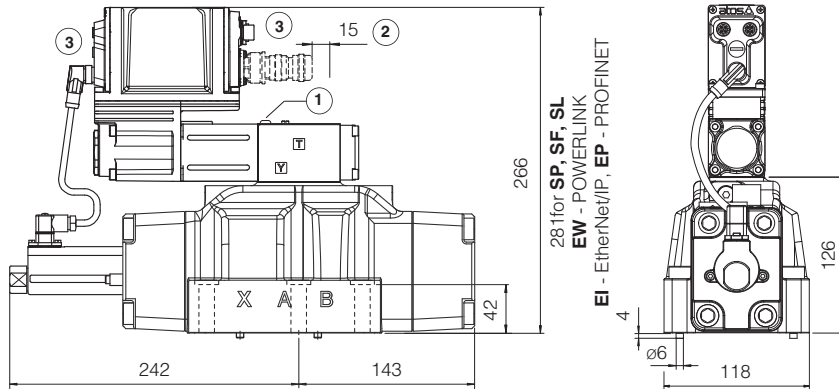
DPZO-LEB-*-4
DPZO-LES-*-4

ISO 4401: 2005
 Mounting surface: 4401-08-08-0-05(see table P005)

DPZO-LEB-*-4M
DPZO-LES-*-4M

ISO 4401: 2005
 Mounting surface: 4401-08-08-0-05(see table P005)
 ports A, B, P, T Ø 32mm

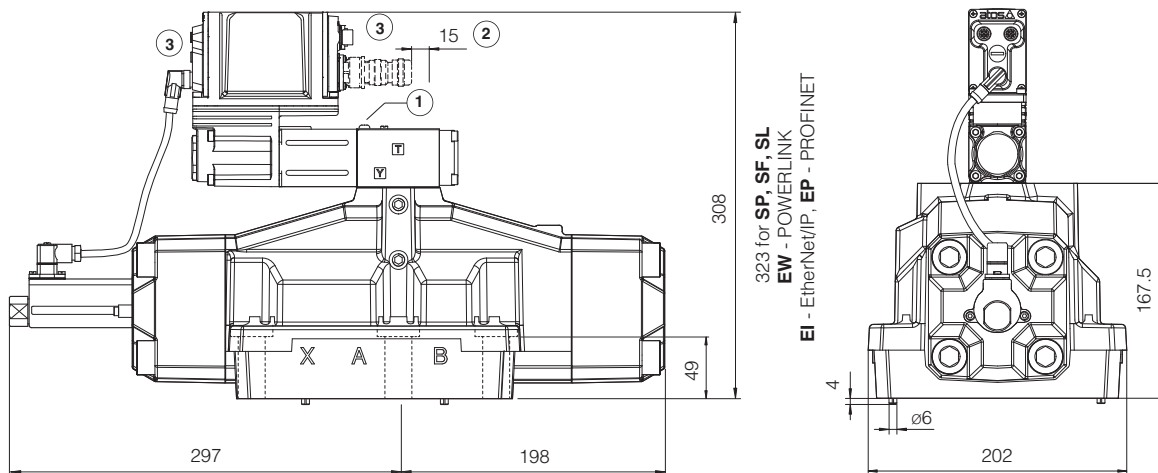
Mass [kg]	
DPZO-*-4	19



DPZO-LEB-*-6
DPZO-LES-*-6

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-6	43



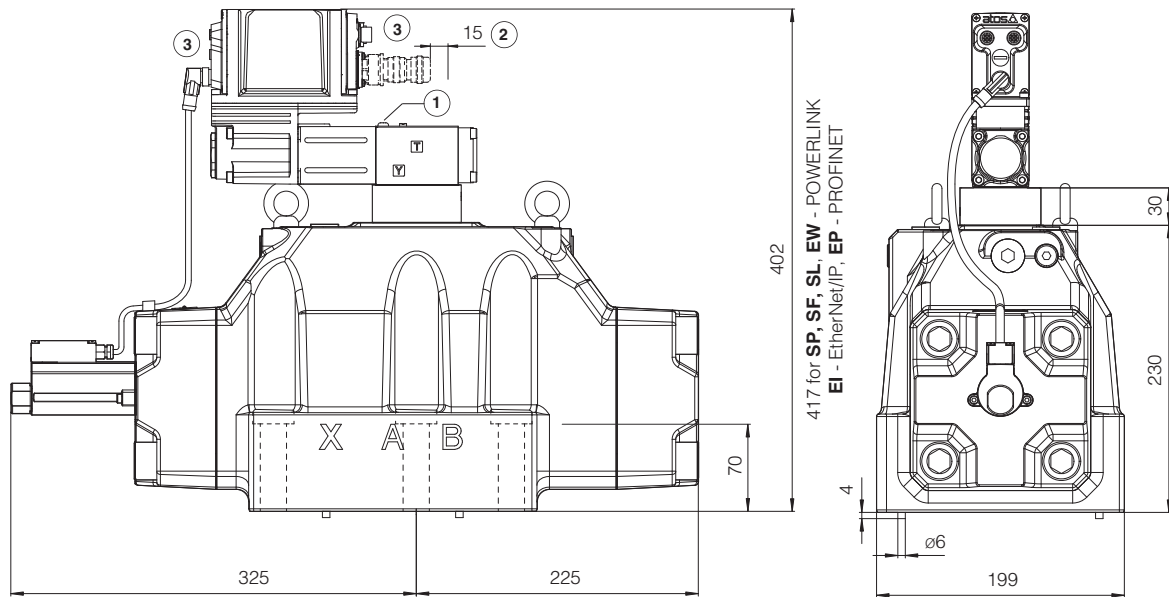
- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6


Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
 for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

DPZO-LEB-*-8
DPZO-LES-*-8

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

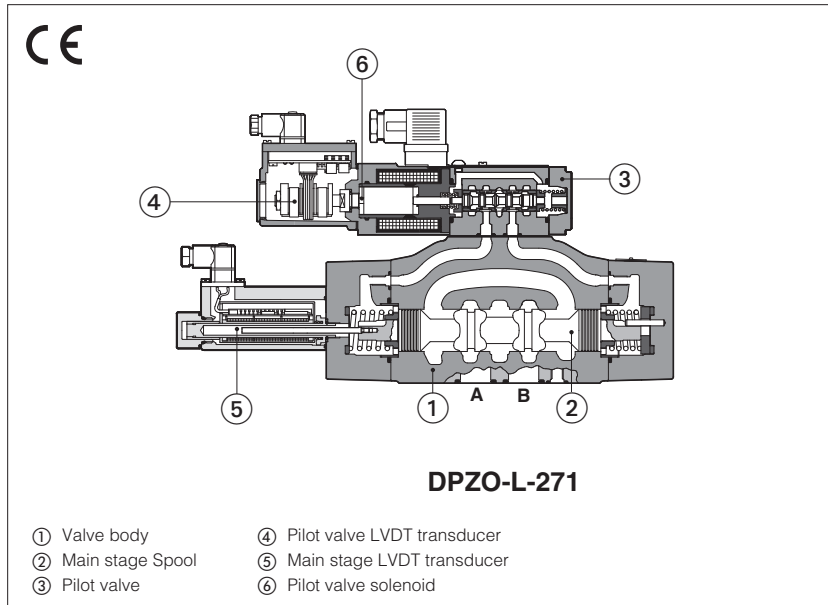
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
 for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port B of the main stage

23 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB320	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	QF320	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves high performance

piloted, with two LVDT transducers and positive spool overlap



DPZO-L

Proportional directional valves, piloted, with two LVDT position transducers and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

The valves operate in association with digital off-board drivers, see section [3].

The two LVDT transducers (pilot and main stage) grant very high regulation accuracy and response sensitivity.

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs

Spools regulation characteristics:

L = linear

S = progressive for fine low flow control

D and DL = differential, for control of actuators with area ratio 1:2

D9 and L9 = for regenerative circuit

Q5 and V9 = for alternate P/Q control

Size: **10 ÷ 32** - ISO 4401

Max flow: **180 ÷ 1600 l/min**

Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	L	-	2	-	71	-	L	/	5	/	*	/	*	/	*				
<p>Proportional directional valve, piloted</p> <p>L = two LVDT transducers</p> <p>Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 4M = 27 6 = 32</p> <p>Configuration:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Standard</p> </div> <div style="text-align: center;"> <p>Option /B</p> </div> </div> <p>Spool type, regulating characteristics (1):</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> <p>L = linear</p> </td> <td style="width: 50%;"> <p>DL = differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p> </td> </tr> <tr> <td> <p>S = progressive</p> </td> <td> <p>D = differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p> </td> </tr> </table>																	<p>L = linear</p>	<p>DL = differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>	<p>S = progressive</p>	<p>D = differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>
<p>L = linear</p>	<p>DL = differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>																			
<p>S = progressive</p>	<p>D = differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>																			
<p>Seals material, see section [7]:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR <p>Series number</p>																				

Hydraulic options (2):

B = solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve)

D = internal drain

E = external pilot pressure

G = pressure reducing valve for piloting

Spool size:	3 (L,S,D)	5 (L,DL,S,D)	5 (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-4M =	-	550	-
DPZO-6 =	-	-	640

Nominal flow (l/min) at Δp 10bar P-T

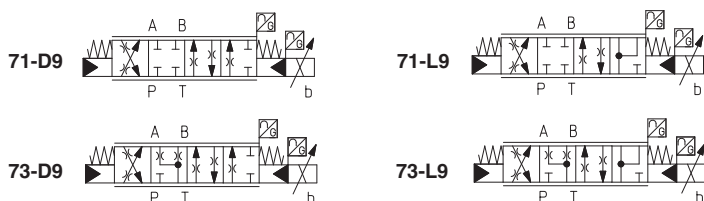
(1) Spools for regenerative circuit or alternated P/Q control, see section [2]

(2) All combination possible

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT OR ALTERNATED P/Q CONTROL - for valve model code and options, see sect. 1

DPZO - **L** - **2** **71 - L9** / * * *

Configuration and spool for regenerative circuit:

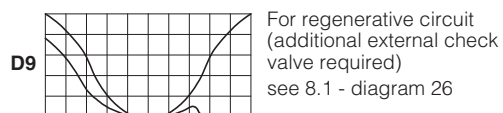


Configuration and spool for alternated P/Q control:



Spool size:	D9	L9	V9	Q5
DPZO-1 =	100	-	100	100
DPZO-2 =	250	250	250	250
DPZO-4 =	480	-	480	480
DPZO-4M =	550	-	550	550
DPZO-6 =	-	-	640	-

Nominal flow (l/min) at Δp 10bar P-T



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-L-1	DPZO-L-2	DPZO-L-4	DPZO-L-4M	DPZO-L-6	
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;					
Spool type standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5		L5, S5, D5	
regenerative or P/Q	D9, V9, Q5		D9, L9, V9, Q5	D9, V9, Q5	V9	
Nominal flow Δp P-T [l/min] (1)						
$\Delta p = 10$ bar	100	160	250	480	550	640
$\Delta p = 30$ bar	160	270	430	830	950	1100
Max permissible flow [l/min]	180	400	550	1000	1100	1600
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)					
Piloting volume [cm ³]	1,4	3,7	9,0	11,3	21,6	
Piloting flow (2) [l/min]	1,7	3,7	6,8	8	14,4	
Leakage (3) Pilot [cm ³ /min]	100 / 300	100 / 300	200 / 500	200 / 600	900 / 2800	
Main stage [l/min]	0,15 / 0,5	0,2 / 0,6	0,3 / 1,0	0,3 / 1,0	1,0 / 3,0	
Response time (4) [ms]	≤ 50	≤ 60	≤ 80	≤ 85	≤ 90	
Hysteresis	≤ 0,1 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$					

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2

(3) At $p = 100/350$ bar

(2) With step reference input signal $0 \div 100\%$

(4) 0-100% step signal see detailed diagrams in section 8.3

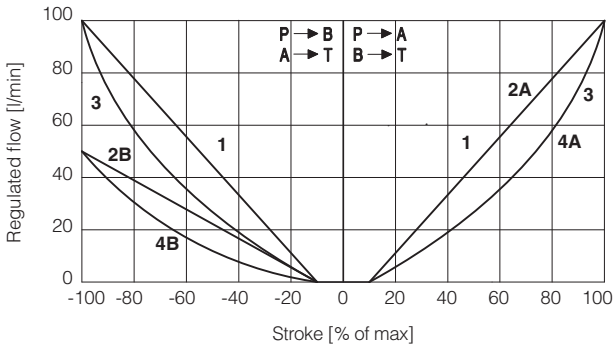
6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 \div 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

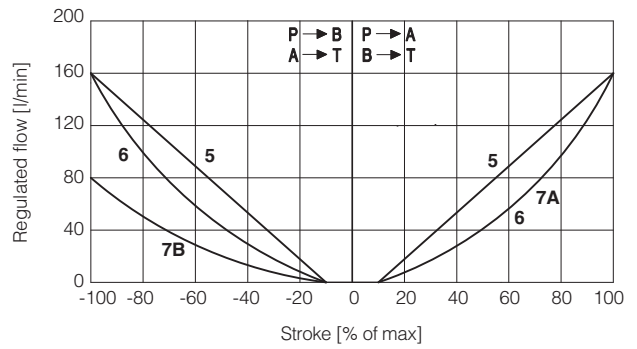
7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +80°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

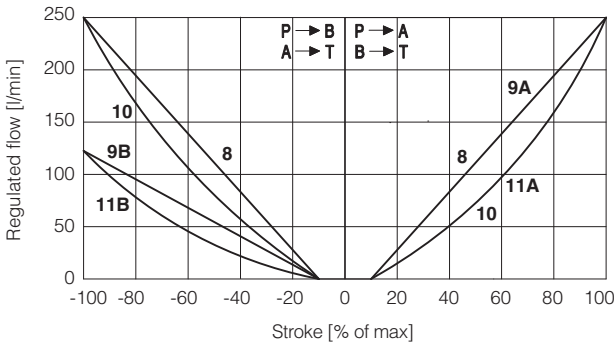
8.1 Regulation diagrams (values measure at Δp 10 bar P-T)



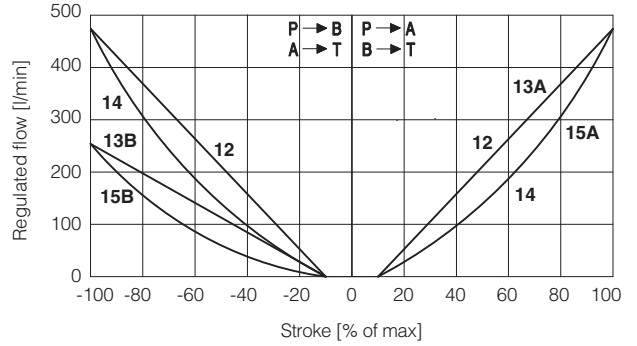
DPZO-1:
 1 = L5 2A = DL5 (P → A, A → T)
 3 = S5 2B = DL5 (P → B, B → T)
 4A = D5 (P → A, A → T)
 4B = D5 (P → B, B → T)



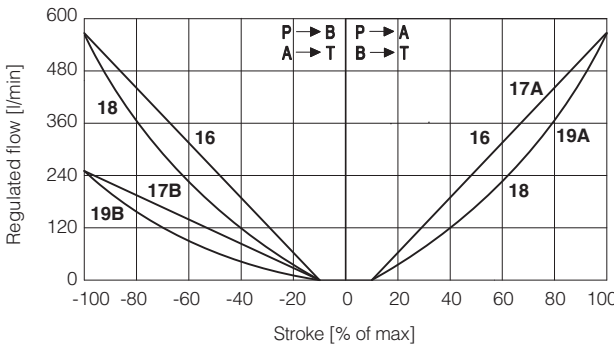
DPZO-2:
 5 = L3 7A = D3 (P → A, A → T)
 6 = S3 7B = D3 (P → B, B → T)



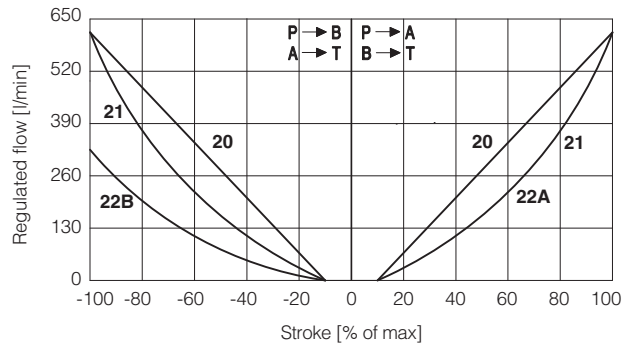
DPZO-2:
 8 = L5 9A = DL5 (P → A, A → T)
 10 = S5 9B = DL5 (P → B, B → T)
 11A = D5 (P → A, A → T)
 11B = D5 (P → B, B → T)



DPZO-4:
 12 = L5 13A = DL5 (P → A, A → T)
 14 = S5 13B = DL5 (P → B, B → T)
 15A = D5 (P → A, A → T)
 15B = D5 (P → B, B → T)



DPZO-4M:
 16 = L5 17A = DL5 (P → A, A → T)
 18 = S5 17B = DL5 (P → B, B → T)
 19A = D5 (P → A, A → T)
 19B = D5 (P → B, B → T)



DPZO-6:
 20 = L5 22A = D5 (P → A, A → T)
 21 = S5 22B = D5 (P → B, B → T)

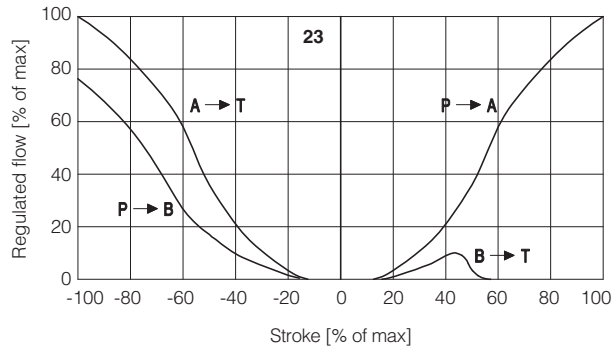
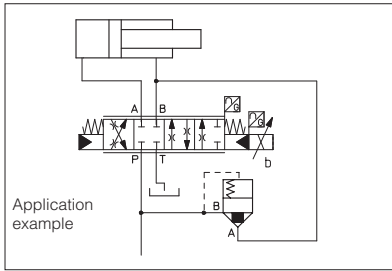
Note:
 Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

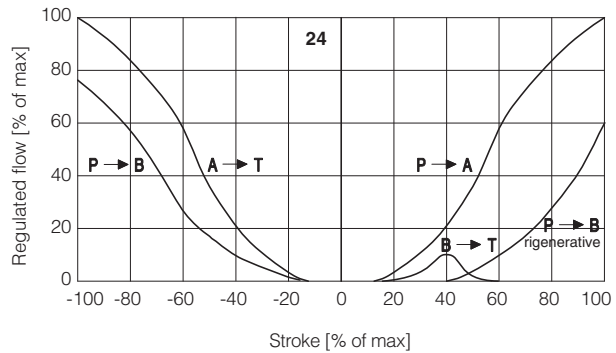
23 = differential - regenerative spool D9
(not available for valve size 32 and 35)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



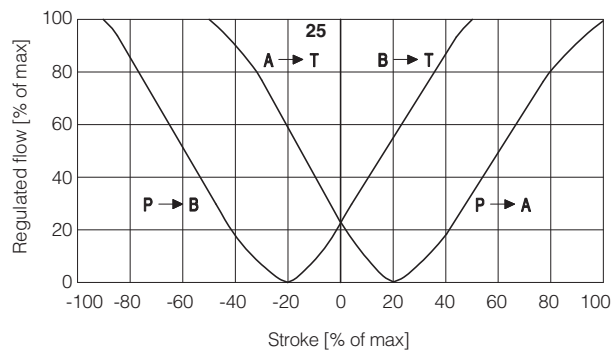
24 = linear - internal regenerative spool L9
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



25 = linear spool Q5
(not available for valve size 32 and 35)

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers, (see tech. table **FS500**). It allows to control the pressure in A port or B port and it provides a safety central position (A-T/B-T) to depressurize the actuator chambers. The strong meter-in characteristic makes the spool suitable for both pressure control and motion regulations in several applications.

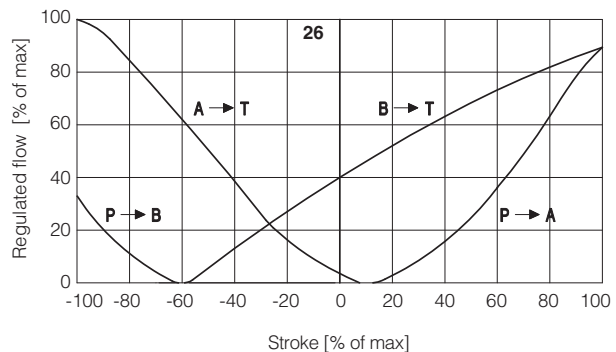


26 = differential - progressive spool V9

V9 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FS500**).

This spool is specially designed to manage the whole injection cycle in plastic machinery, thanks to the following specific features:

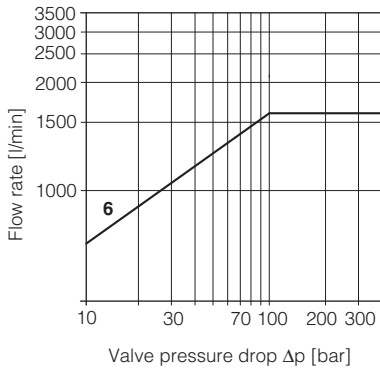
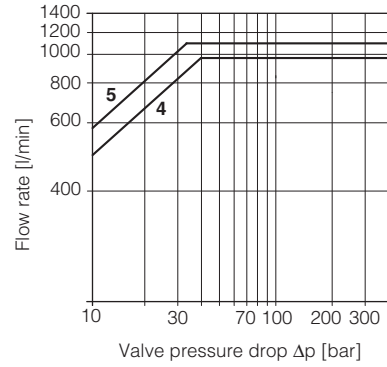
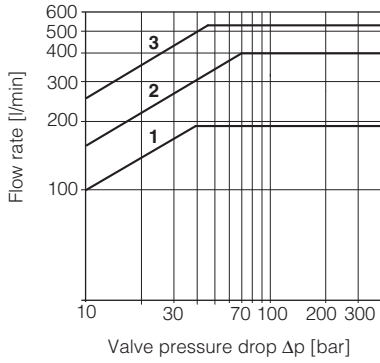
- strong meter-in characteristic to allow the pressure control in A port during the holding pressure (P-A) and the plasticizing (A-T) phases
- safety central position (A-T/B-T) to depressurize the actuator chambers
- large A-T and B-T flow capability, required during the plasticizing phase, to discharge big volumes from high differential injection cylinders with low pressure drops and permitting the contemporary oil suction from tank



8.2 Operating diagrams

Flow / Δp diagram

stated at 100% of spool stroke



DPZO-1:

1 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-2:

2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9, V9, Q5

DPZO-4:

4 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-4M:

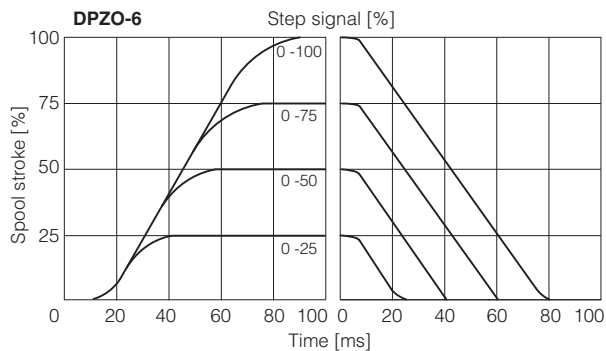
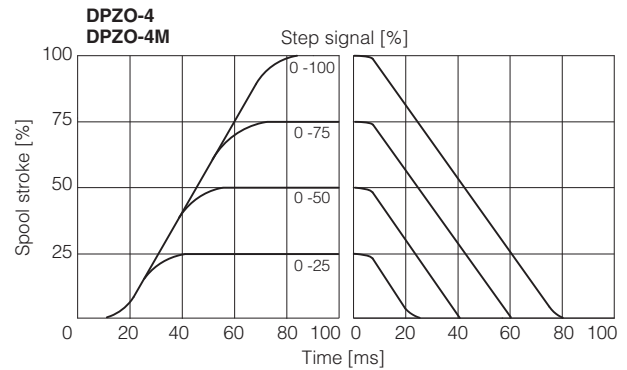
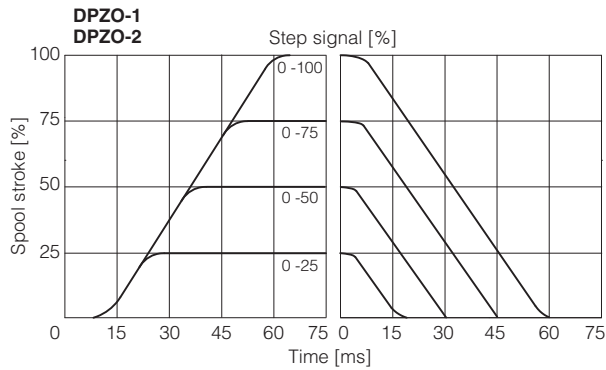
5 = spools L5, S5, D5, DL5, D9, V9, Q5

DPZO-6:

6 = L5, S5, D5, V9

8.3 Response time

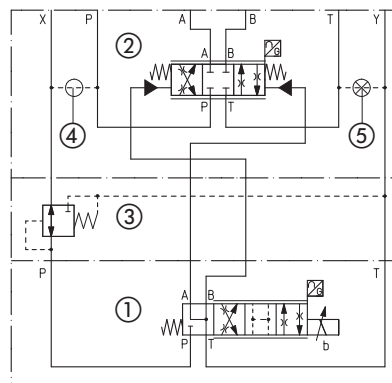
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



9 HYDRAULIC OPTIONS

- B** = Solenoid and LVDT transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 8.1
- D** = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.
- E** = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 12
The valve's standard configuration provides internal pilot and external drain.
- G** = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:
DPZO-2 = **28 bar**
DPZO-1, DPZO-4(M) and DPZO-6 = **40 bar**
It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.
Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 71



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

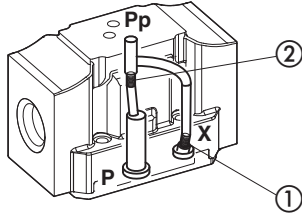
11 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

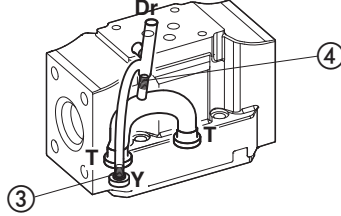
12 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.

DPZO-1 Pilot channels

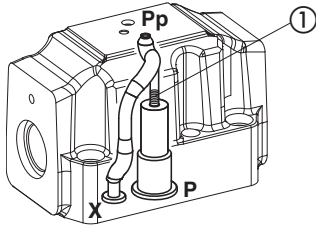


Drain channels

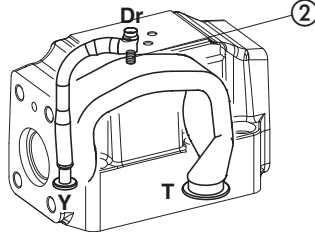


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

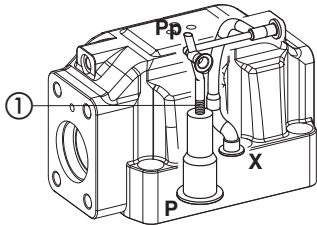


Drain channels

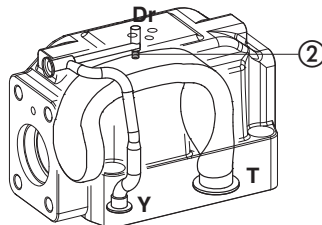


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

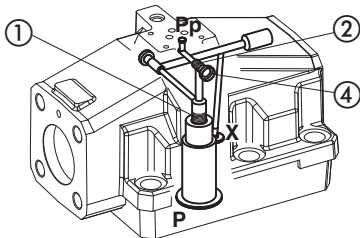


Drain channels

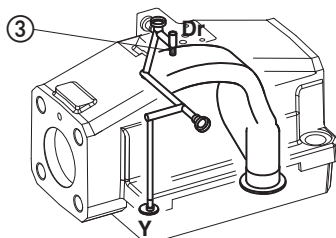


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

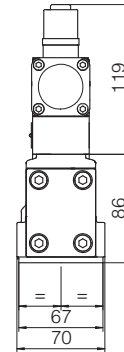
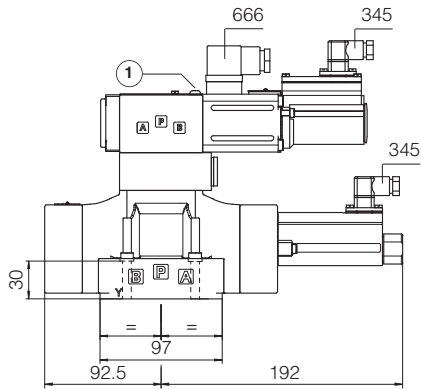
13 INSTALLATION DIMENSIONS [mm]


DPZO-L-1

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-L-1	9



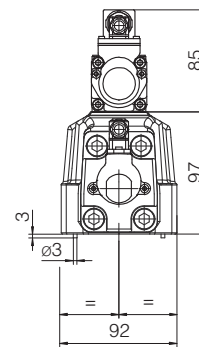
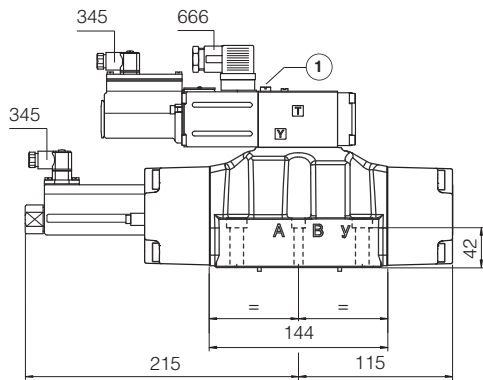
① = Air bleeding 

DPZO-L-2

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-L-2	13,5



① = Air bleeding 

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

DPZO-L-4

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

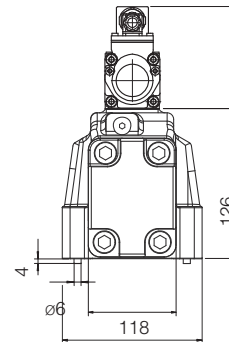
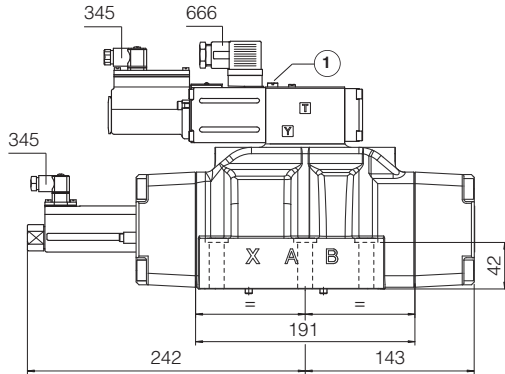
Mass [kg]	
DPZO-L-4	17,5


DPZO-L-4M

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

ports A, B, P, T Ø 32mm



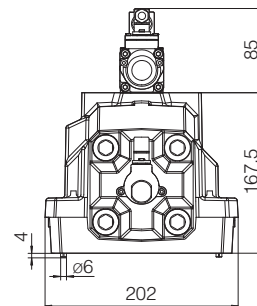
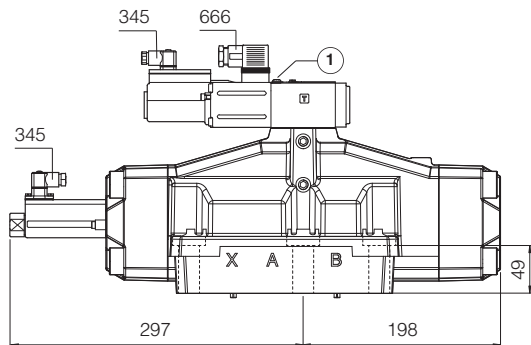
① = Air bleeding 

DPZO-L-6

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-L-6	42,5



① = Air bleeding 

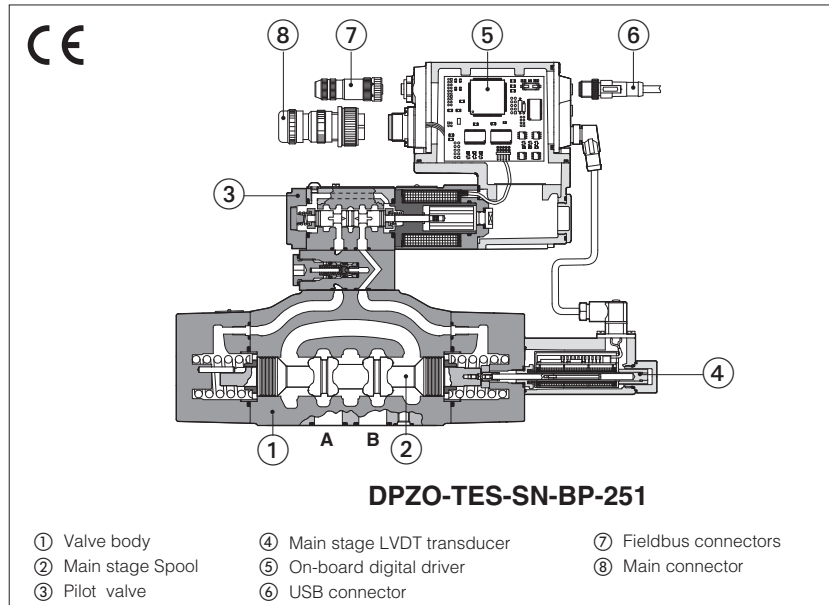
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port B of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS235	E-BM-LID digital driver	P005	Mounting surfaces for electrohydraulic valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

piloted, with on-board driver, LVDT transducer and positive spool overlap



DPZO-TEB, DPZO-TES

Digital proportional directional valves, piloted, specifically designed for directional and speed controls.

They are equipped with one LVDT position transducer (main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

TEB basic execution with analog reference signals and USB port for software functional parameters setting.

TES full execution which includes also optional alternated P/Q controls and fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

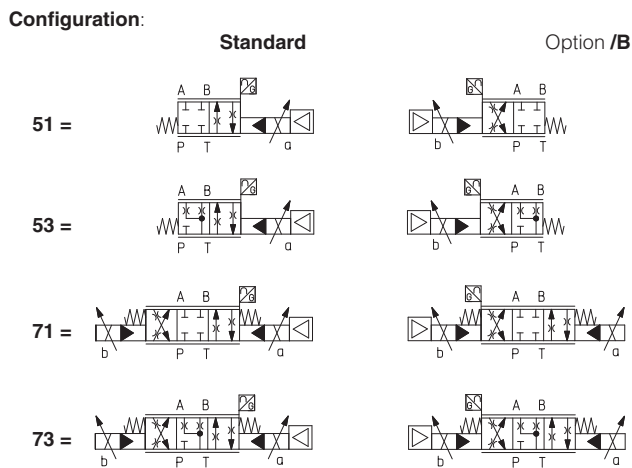
Size: **10 ÷ 32** - ISO 4401

Max flow: **180 ÷ 1600 l/min**

Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	TES	-	SN	-	NP	-	2		71	-	L		5	/	*		*	/	*				
Proportional directional valve, piloted																	Series number		Seals material, see sect. 10:					
TEB = basic on-board digital driver (1) TES = full on-board digital driver																	- = NBR		PE = FKM		BT = HNBR			
Alternated P/Q controls: SN = none																	Hydraulic options (2): B = solenoid with on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve) D = internal drain E = external pilot pressure		Electronics options (2): F = fault signal I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector (3)		Safety options TÜV certified - only TES (2): U = safe double power supply K = safe on/off signals See section 6		SAFETY CERTIFIED	
Fieldbus interfaces, USB port always present: NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK EI = EtherNet/IP EP = PROFINET RT/IRT																	Spool size: 3 (L,S,D) 5 (L,DL,S,D) 5 (L,S,D)		DPZO-1 = - 100 - DPZO-2 = 160 250 - DPZO-4 = - 480 - DPZO-6 = - - 640		Nominal flow (l/min) at Δp 10 bar P-T			
Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 6 = 32																	Spool type, regulating characteristics (4):		L linear		DL differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q			
Configuration:																	S progressive		D differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q					



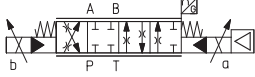
(1) Only in version SN-NP
 (2) For possible combined options, see section 14

(3) Double power supply only for TES
 (4) Spools for regenerative circuit, see section 2

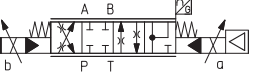
2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section **1**

DPZO - **TES** - **SN** - **NP** - **2** **71 - L9** / * * / *

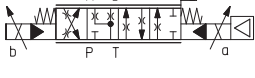
Configuration and spool:



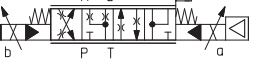
71-D9



71-L9



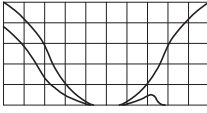
73-D9



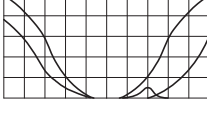
73-L9

Spool size:	D9	L9
DPZO-1 =	100	-
DPZO-2 =	250	250
DPZO-4 =	480	-

Nominal flow (l/min) at Δp 10bar P-T



D9 For regenerative circuit (additional external check valve required) see 11.1 - diagram 19



L9 For regenerative circuit internal to the valve see 11.1 - diagram 20

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

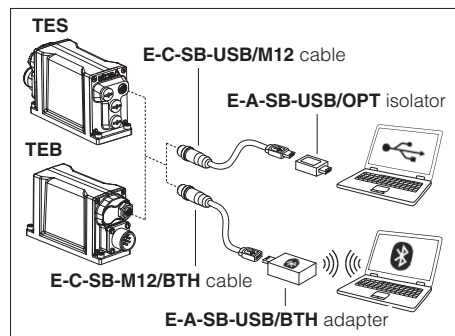
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers **USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - only for **TES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 SAFETY OPTIONS - only for **TES**

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**

Safe double power supply, option **/U**: the driver has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the driver checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

**SAFETY
CERTIFIED**



7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2	DPZO-*-4	DPZO-*-6		
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;					
Spool type	standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5	L5, S5, D5	
	regenerative	D9		D9, L9	D9	
Nominal flow Δp P-T (1)	$\Delta p = 10$ bar	100	160	250	480	640
	$\Delta p = 30$ bar	160	270	430	830	1100
	Max permissible flow	180	400	550	1000	1600
	Piloting pressure [bar]	min. = 25; max = 350				
Piloting volume [cm ³]	1,4	3,7	9,0	21,6		
Piloting flow (2) [l/min]	1,7	3,7	6,8	14,4		
Leakage (3)	Pilot [cm ³]	100 / 300	100 / 300	200 / 500	900 / 2800	
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6	0,3 / 1,0	1,0 / 3,0	
Response time (4) [ms]	≤ 60	≤ 75	≤ 90	≤ 120		
Hysteresis	≤ 1 [% of max regulation]					
Repeatability	± 0,5 [% of max regulation]					
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$					

(1) For different Δp , the max flow is in accordance to the diagrams in section 11.2

(3) At $p = 100/350$ bar

(2) With step reference input signal 0 ÷ 100 %

(4) 0-100% step signal see detailed diagrams in section 11.3

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 V_{MAX} tollerant) Current: range ±20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 ÷ 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

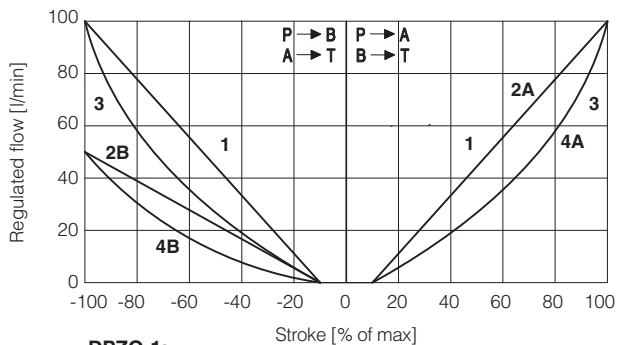
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

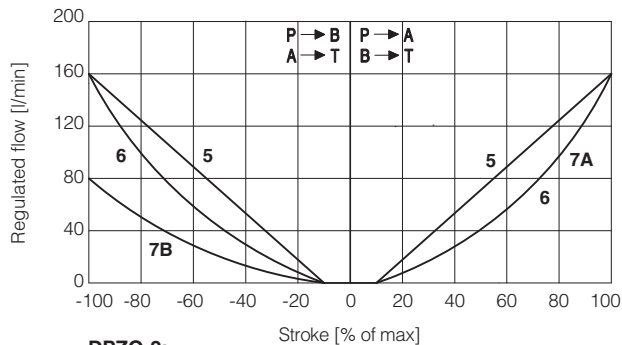
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

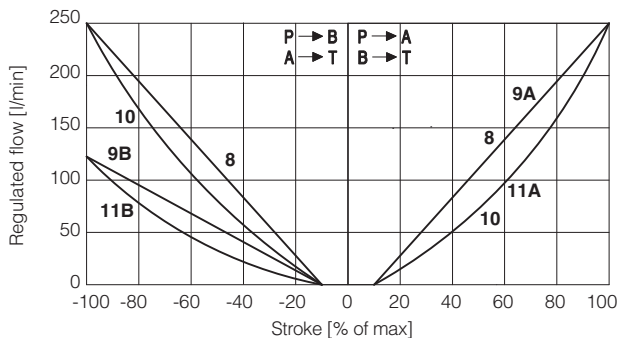
11.1 Regulation diagrams (values measure at p 10 bar P-T)



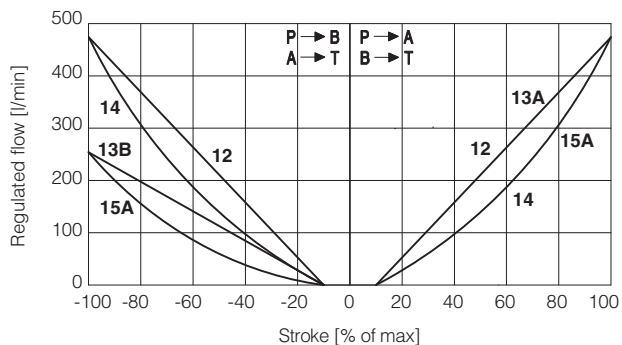
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



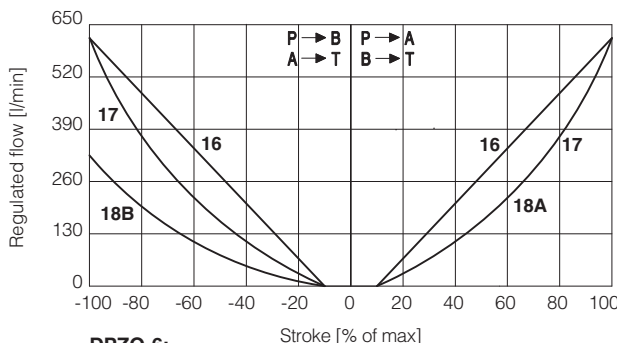
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-3:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



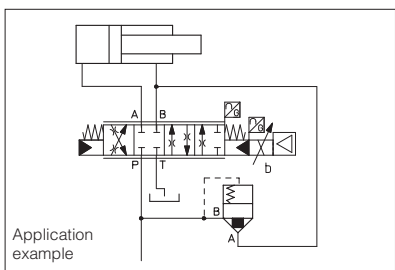
DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-5:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

19 = differential - regenerative spool **D9**
 (not available for valve size 32)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



20 = linear - internal regenerative spool **L9**
 (available only for valve size 16)

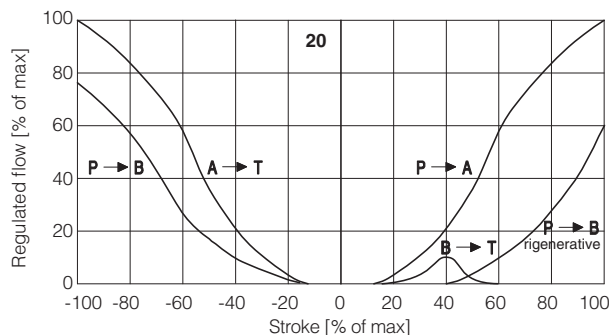
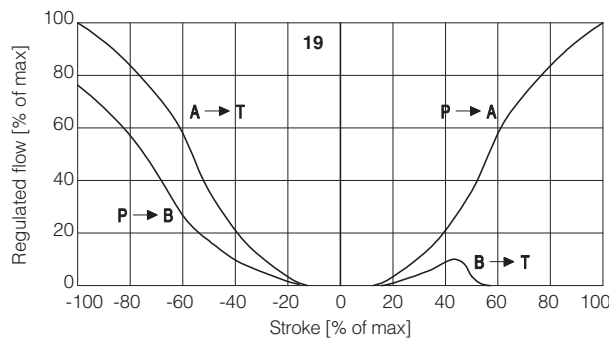
L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

Note:

Hydraulic configuration vs. reference signal (standard and option /B)

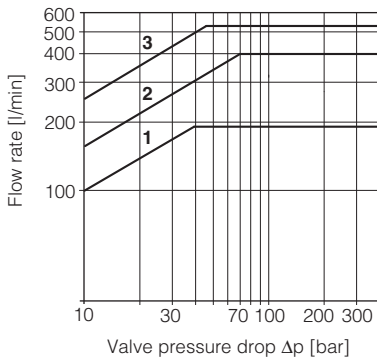
Reference signal $0 \div +10 \text{ V}$ } P → A / B → T
 $12 \div 20 \text{ mA}$

Reference signal $0 \div -10 \text{ V}$ } P → B / A → T
 $12 \div 4 \text{ mA}$



11.2 Operating diagrams

Flow / Δp diagram stated at 100% of spool stroke



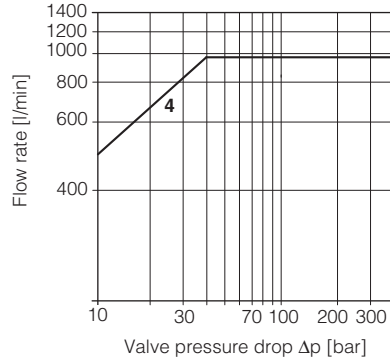
DPZO-1:

1 = spools L5, S5, D5, DL5, D9

DPZO-2:

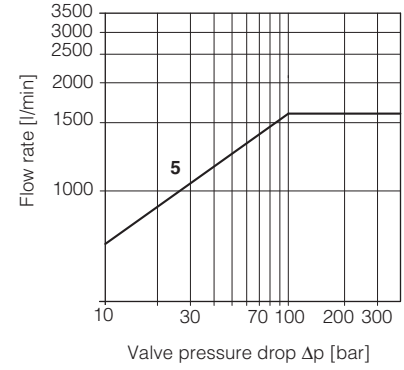
2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9



DPZO-4:

4 = spools L5, S5, D5, DL5, D9



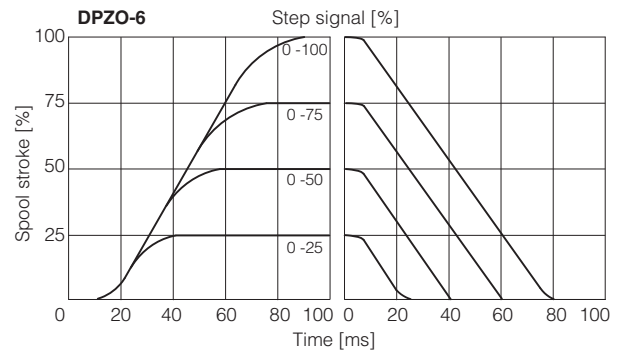
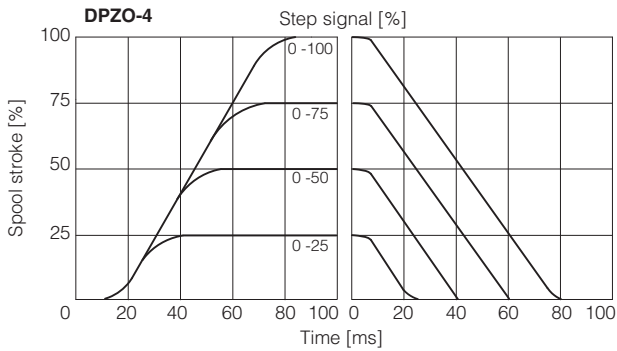
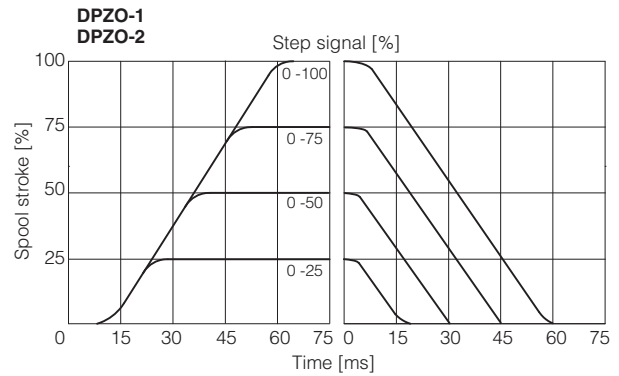
DPZO-6:

6 = L5, S5, D5

11.3 Response time

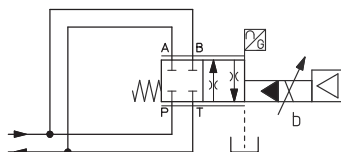
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



11.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
 $P_{max} = 250 \text{ bar}$



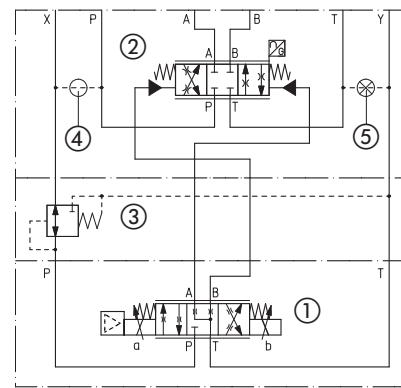
DPZO-*	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	860	1600	2200
$\Delta p = 15 \text{ bar}$				

12 HYDRAULIC OPTIONS

- B** = Solenoid, on-board digital driver and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 12.1
- D** = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.
- E** = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 19
The valve's standard configuration provides internal pilot and external drain.

- | | |
|---------------|--|
| ① Pilot valve | ③ Pressure reducing valve |
| ② Main stage | ④ Plug to be added for external pilot trough port X |
| | ⑤ Plug to be removed for internal drain through port T |

Functional Scheme - example of configuration 71



13 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 15.9 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.7 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **TEB** (see 15.8)
Power supply for driver's logics and communication - only for **TES** (see 15.2)
- C** = This option is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

14 POSSIBLE COMBINED OPTIONS

Hydraulic options:
all combination possible

Electronics options - Standard versions:
TEB-SN, TES-SN
/FI, /IQ, /IZ

Electronics options - Safety certified versions:
TES-SN
/IU, /IK

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: /U see tech. table **FY100** and /K see tech. table **FY200**

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for TES with /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA. Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ Vdc.

15.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position). Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

15.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

15.6 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 15.5).

15.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for $4 \div 20$ mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16 ELECTRONIC CONNECTIONS AND LEDS

16.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

16.2 Main connector signals - 12 pin (A2) /Z option

PIN	TEB /Z	TES /Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VLO		Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VLO		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	AGND		Analog ground	Gnd - analog signal
		NC	Do not connect	
8	R_ENABLE		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	NC		Do not connect	
		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	NC		Do not connect	
		VLO	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0 VLO		Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH		Internally connected to the driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

16.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

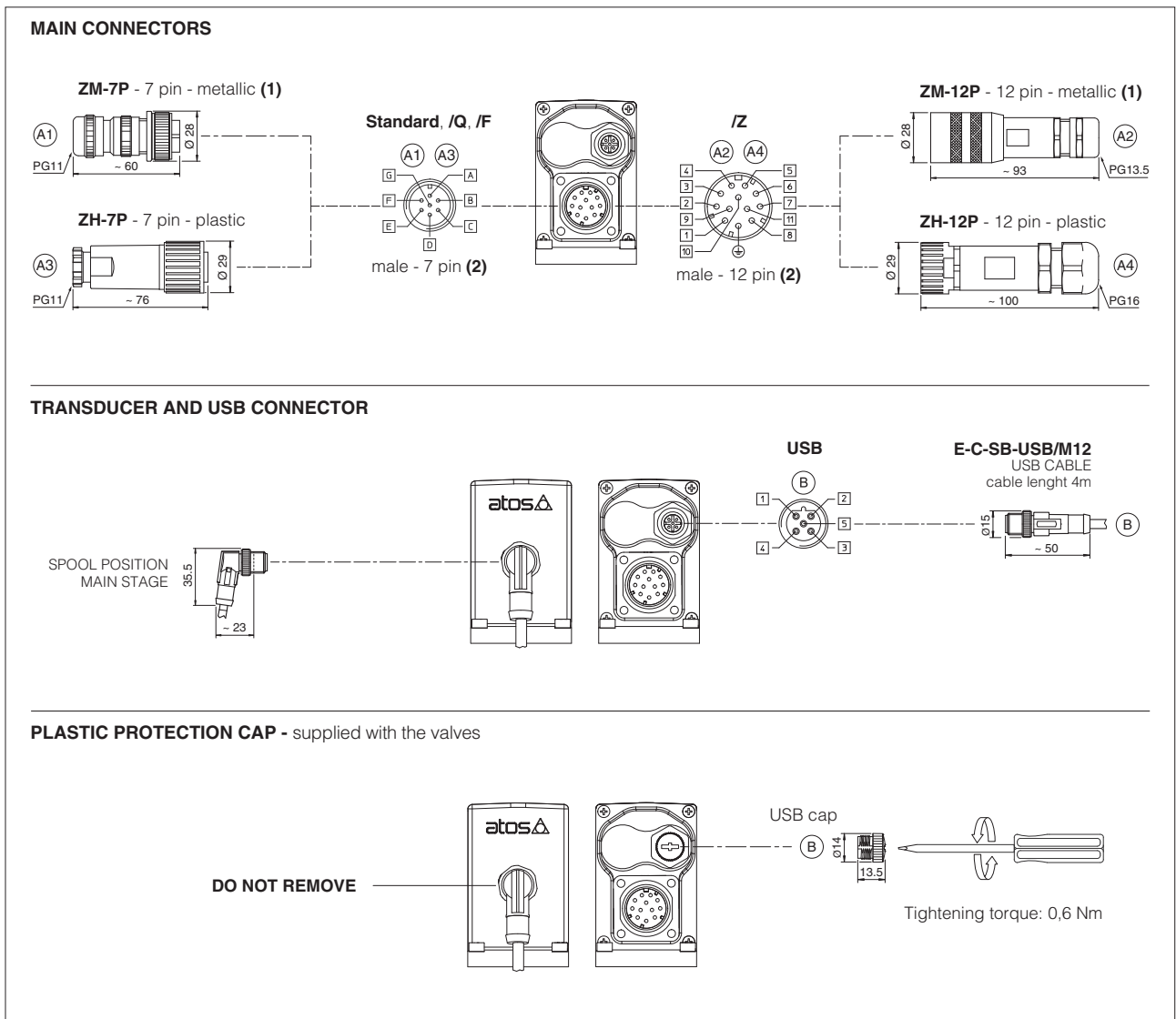
(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

(2) Pin 2 can be fed with external +5V supply of CAN interface

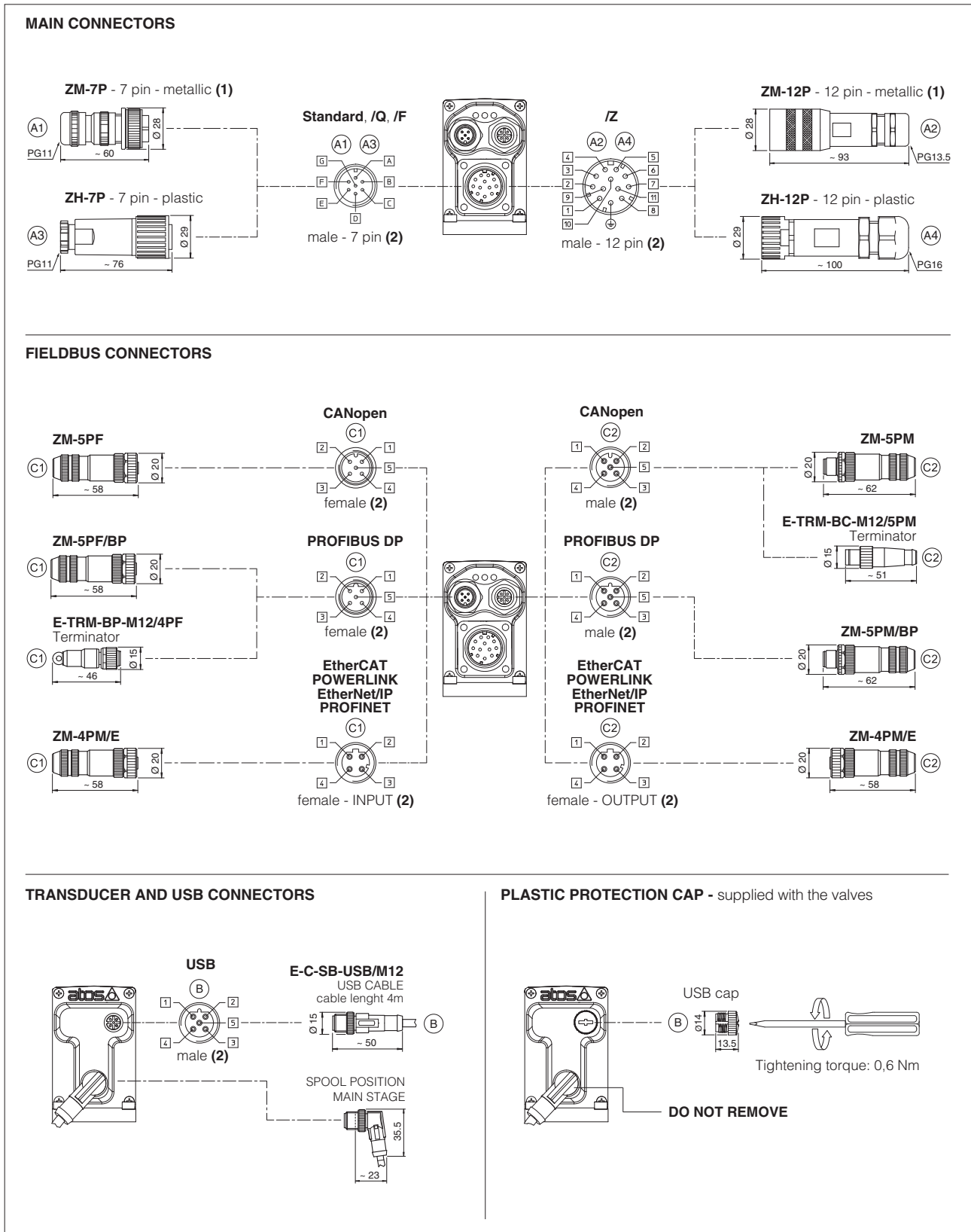
16.4 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

16.5 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

16.6 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELD BUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

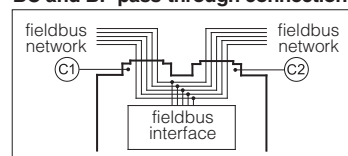
17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This feature allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

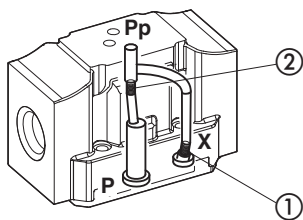
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

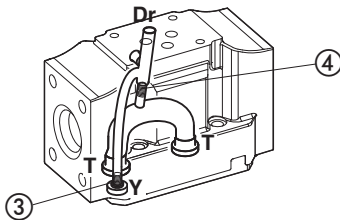
19 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain

DPZO-1 Pilot channels

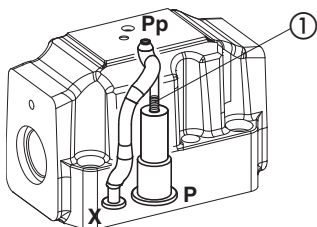


Drain channels

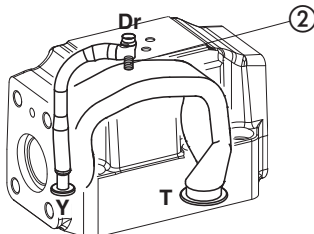


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

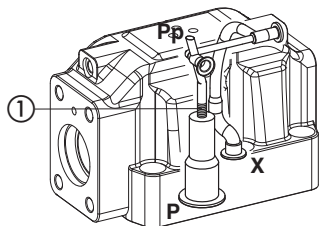


Drain channels

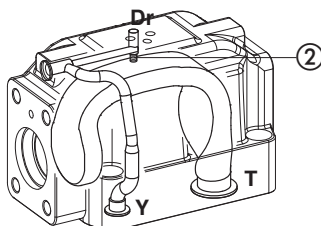


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

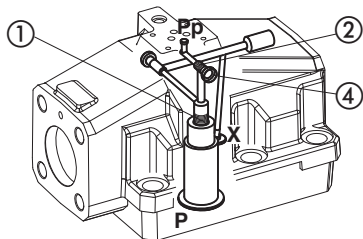


Drain channels

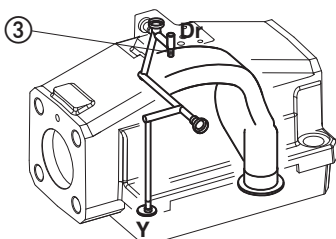


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



Drain channels

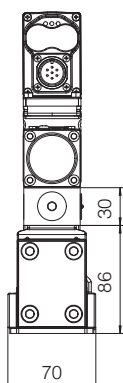


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

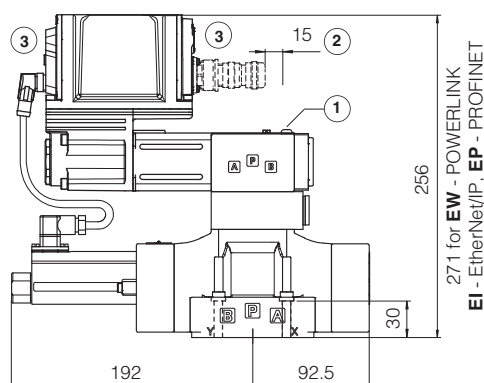
20 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: \varnothing 11 mm (max) 2 OR 108 Diameter of ports X, Y: \varnothing = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: \varnothing 20 mm (max) 2 OR 2043 Diameter of ports X, Y: \varnothing = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: \varnothing 24 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: \varnothing 34 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)

21 INSTALLATION DIMENSIONS [mm]

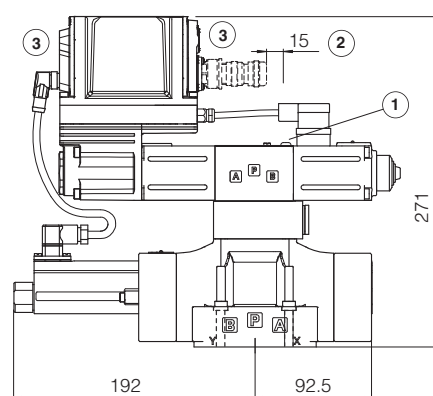


DPZO-TEB-*-15*
DPZO-TES-*-15*



271 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

DPZO-TEB-*-17*
DPZO-TES-*-17*

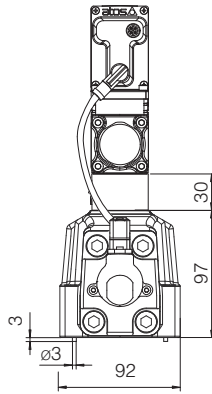


ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

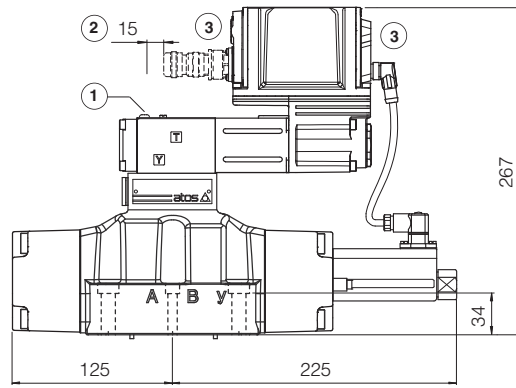
Mass [kg]	
DPZO-*-15	9
DPZO-*-17	9,8

- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage



DPZO-TEB*-25*
DPZO-TES*-25*

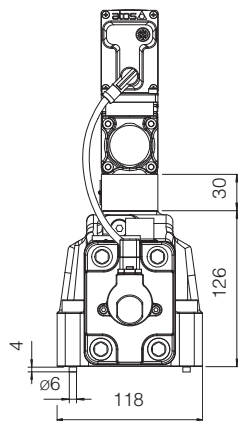
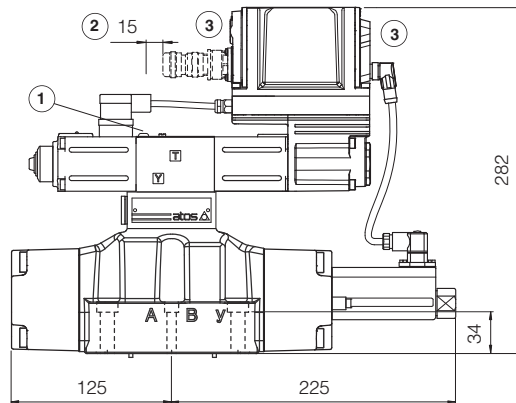


282 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

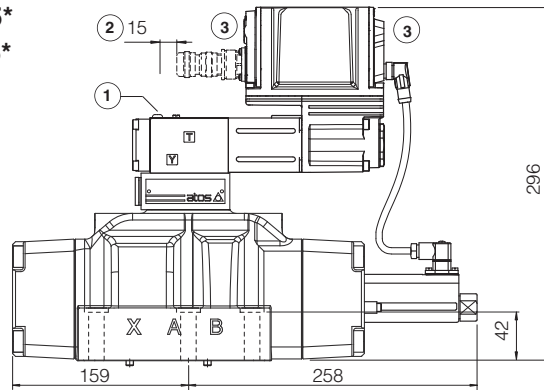
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

Mass [kg]	
DPZO*-25	14
DPZO*-27	14,8

DPZO-TEB*-27*
DPZO-TES*-27*



DPZO-TEB*-45*
DPZO-TES*-45*

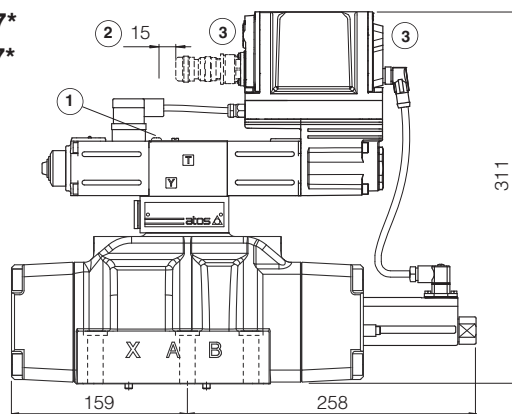


311 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

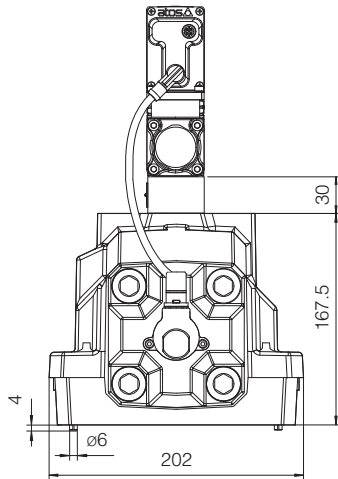
Mass [kg]	
DPZO*-45	18,5
DPZO*-47	19,3

DPZO-TEB*-47*
DPZO-TES*-47*

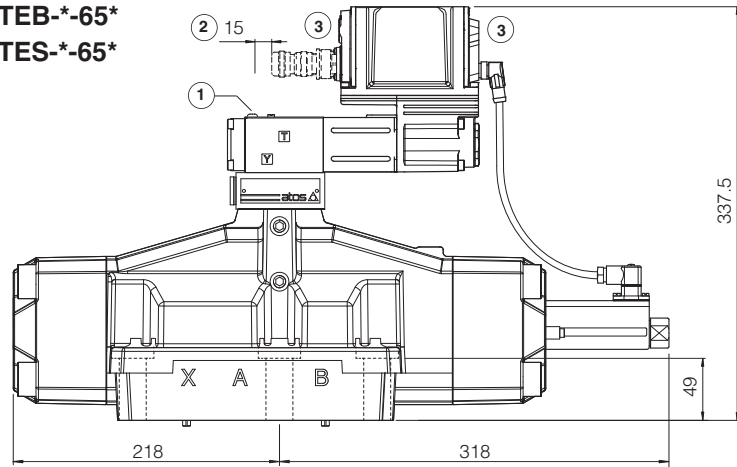


- ① = Air bleeding
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage



DPZO-TEB-*-65*
DPZO-TES-*-65*

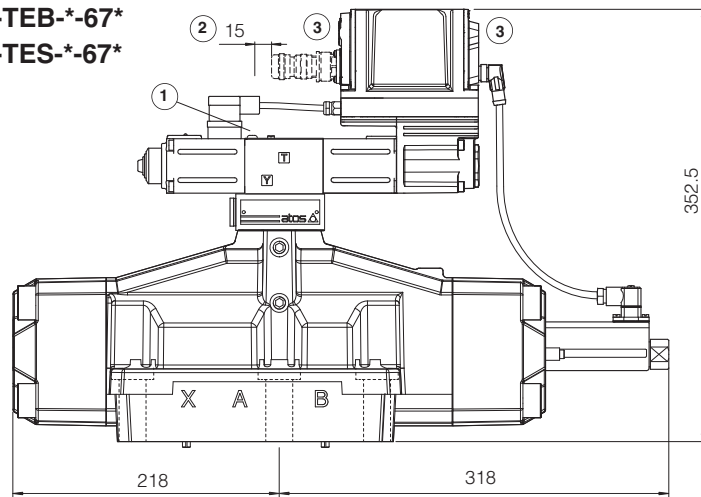



352.5 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(see table P005)

Mass [kg]	
DPZO-*-65	42,5
DPZO-*-67	43,3

DPZO-TEB-*-67*
DPZO-TES-*-67*



- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

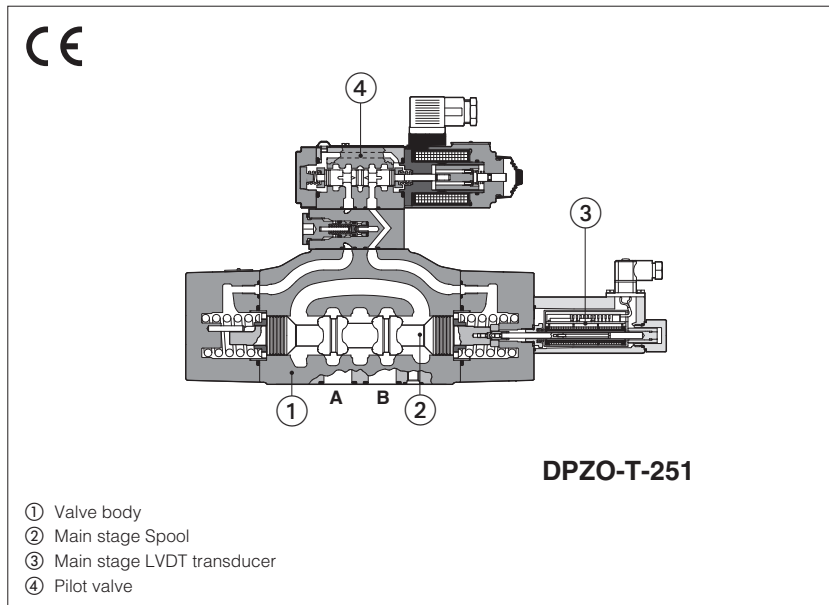
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage

22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS500	Digital proportional valves with P/Q control	P005	Mounting surfaces for electrohydraulic valves
FS900	Operating and maintenance information for proportional valves	QB320	Quickstart for LEB valves commissioning
FY100	Safety proportional valves - option /U	QF320	Quickstart for LES valves commissioning
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		
GS510	Fieldbus		

Proportional directional valves

piloted, with LVDT transducer and positive spool overlap



DPZO-T

Proportional directional valves, piloted, with LVDT position transducer (main stage) and positive spool overlap for directional controls and not compensated flow regulations.

The valves operate in association with digital off-board drivers, see section [3].

With de-energized proportional solenoids, mechanical central position of the spool is performed by centering springs.

Spools regulation characteristics:

L = linear

S = progressive for fine low flow control

D and DL = differential-progressive, for control of actuators with area ratio 1:2

D9 and L9 = for regenerative circuit

Size: **10 ÷ 32** - ISO 4401

Max flow: **180 ÷ 1600 l/min**

Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZO	-	T	-	2	-	71	-	L	/	5	/	*	/	*	*																			
<p>Proportional directional valve, piloted</p> <p>T = with LVDT transducer</p> <p>Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 6 = 32</p> <p>Configuration:</p> <table style="width: 100%;"> <tr> <th style="text-align: left;">Standard</th> <th style="text-align: left;">Option /B</th> </tr> <tr> <td> <p>51 =</p> </td> <td> <p>51 =</p> </td> </tr> <tr> <td> <p>53 =</p> </td> <td> <p>53 =</p> </td> </tr> <tr> <td> <p>71 =</p> </td> <td> <p>71 =</p> </td> </tr> <tr> <td> <p>73 =</p> </td> <td> <p>73 =</p> </td> </tr> </table>															Standard	Option /B	<p>51 =</p>	<p>51 =</p>	<p>53 =</p>	<p>53 =</p>	<p>71 =</p>	<p>71 =</p>	<p>73 =</p>	<p>73 =</p>										
Standard	Option /B																																	
<p>51 =</p>	<p>51 =</p>																																	
<p>53 =</p>	<p>53 =</p>																																	
<p>71 =</p>	<p>71 =</p>																																	
<p>73 =</p>	<p>73 =</p>																																	
<p>Seals material, see section [7]:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR <p>Series number</p> <p>Hydraulic options (1):</p> <ul style="list-style-type: none"> B = solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve) D = internal drain E = external pilot pressure <table style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="text-align: left;">Spool size</th> <th style="text-align: left;">3 (L,S,D)</th> <th style="text-align: left;">5 (L,DL,S,D)</th> <th style="text-align: left;">5 (L,S,D)</th> </tr> </thead> <tbody> <tr> <td>DPZO-1 =</td> <td style="text-align: center;">-</td> <td style="text-align: center;">100</td> <td style="text-align: center;">-</td> </tr> <tr> <td>DPZO-2 =</td> <td style="text-align: center;">160</td> <td style="text-align: center;">250</td> <td style="text-align: center;">-</td> </tr> <tr> <td>DPZO-4 =</td> <td style="text-align: center;">-</td> <td style="text-align: center;">480</td> <td style="text-align: center;">-</td> </tr> <tr> <td>DPZO-6 =</td> <td style="text-align: center;">-</td> <td style="text-align: center;">-</td> <td style="text-align: center;">640</td> </tr> </tbody> </table> <p>Nominal flow (l/min) at Δp 10 bar P-T</p>															Spool size	3 (L,S,D)	5 (L,DL,S,D)	5 (L,S,D)	DPZO-1 =	-	100	-	DPZO-2 =	160	250	-	DPZO-4 =	-	480	-	DPZO-6 =	-	-	640
Spool size	3 (L,S,D)	5 (L,DL,S,D)	5 (L,S,D)																															
DPZO-1 =	-	100	-																															
DPZO-2 =	160	250	-																															
DPZO-4 =	-	480	-																															
DPZO-6 =	-	-	640																															
<p>Spool type, regulating characteristics (2):</p> <table style="width: 100%;"> <tr> <td style="text-align: center;"> L linear </td> <td style="text-align: center;"> DL differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q </td> </tr> <tr> <td style="text-align: center;"> S progressive </td> <td style="text-align: center;"> D differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q </td> </tr> </table>															 L linear	 DL differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q	 S progressive	 D differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q																
 L linear	 DL differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q																																	
 S progressive	 D differential-progressive P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q																																	

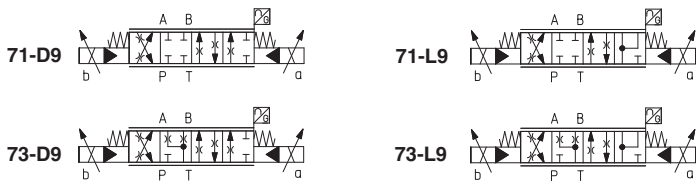
(1) All combination possible

(2) Spools for regenerative circuit, see section [2]

2 MODEL CODE OF SPOOLS FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

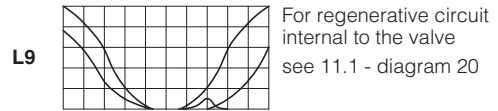
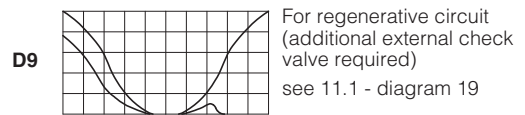
DPZO - **T** - **2** **71 - L9** / * * / *

Configuration and spool:



Spool size:	D9	L9
DPZO-1 =	100	-
DPZO-2 =	250	250
DPZO-4 =	480	-

Nominal flow (l/min) at Δp 10bar P-T



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: $R_a \leq 0,8$, recommended $R_a 0,4$ – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = $-20^\circ\text{C} \div +60^\circ\text{C}$ / PE option = $-20^\circ\text{C} \div +60^\circ\text{C}$ / BT option = $-40^\circ\text{C} \div +60^\circ\text{C}$
Storage temperature range	Standard = $-20^\circ\text{C} \div +70^\circ\text{C}$ / PE option = $-20^\circ\text{C} \div +70^\circ\text{C}$ / BT option = $-40^\circ\text{C} \div +70^\circ\text{C}$
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-T-1	DPZO-T-2	DPZO-T-4	DPZO-T-6
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;			
Spool type	standard	L5, DL5, S5, D5	L3, S3, D3	L5, DL5, S5, D5
	regenerative	D9		D9, L9
Nominal flow Δp P-T (1) [l/min]	$\Delta p = 10$ bar	100	160	250
	$\Delta p = 30$ bar	160	270	430
	Max permissible flow	180	400	550
				1000
Piloting pressure [bar]	min. = 25; max = 350			
Piloting volume [cm³]	1,4	3,7	9,0	21,6
Piloting flow (2) [l/min]	1,7	3,7	6,8	14,4
Leakage (3)	Pilot [cm³]	100 / 300	100 / 300	200 / 500
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6	0,3 / 1,0
Response time (4) [ms]	≤ 60	≤ 75	≤ 90	≤ 120
Hysteresis	≤ 1 [% of max regulation]			
Repeatability	$\pm 0,5$ [% of max regulation]			
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ\text{C}$			

(1) For different Δp , the max flow is in accordance to the diagrams in section 8.2

(2) With step reference input signal 0 \div 100 %

(3) At $p = 100/350$ bar

(4) 0-100% step signal see detailed diagrams in section 8.3

6 ELECTRICAL CHARACTERISTICS

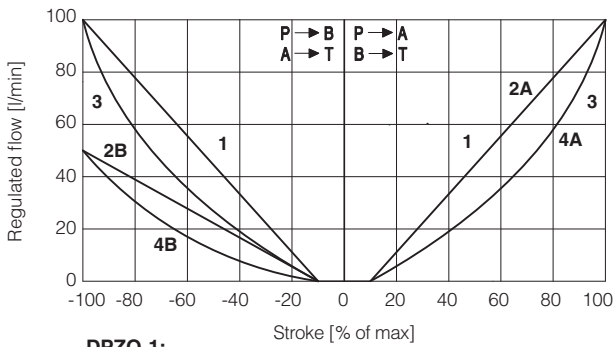
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

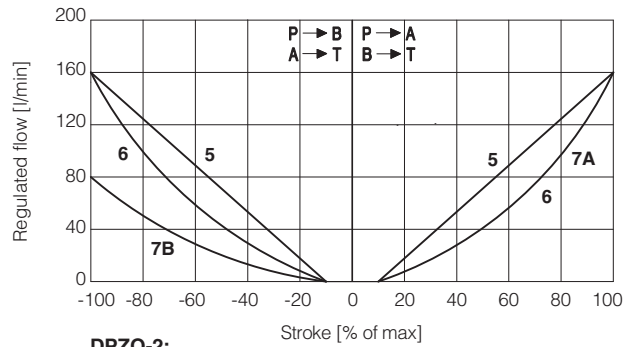
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation longer life	ISO4406 class 18/16/13 NAS1638 class 7 ISO4406 class 16/14/11 NAS1638 class 5	see also filter section at www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

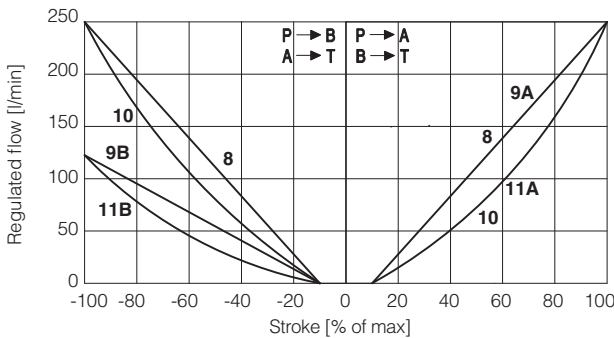
8.1 Regulation diagrams (values measure at p 10 bar P-T)



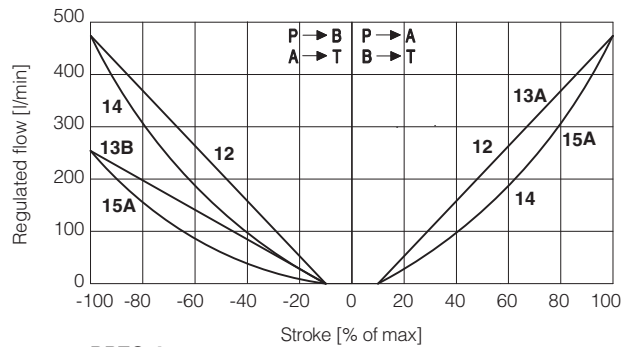
DPZO-1:
1 = L5 **2A** = DL5 (P → A, A → T) **4A** = D5 (P → A, A → T)
3 = S5 **2B** = DL5 (P → B, B → T) **4B** = D5 (P → B, B → T)



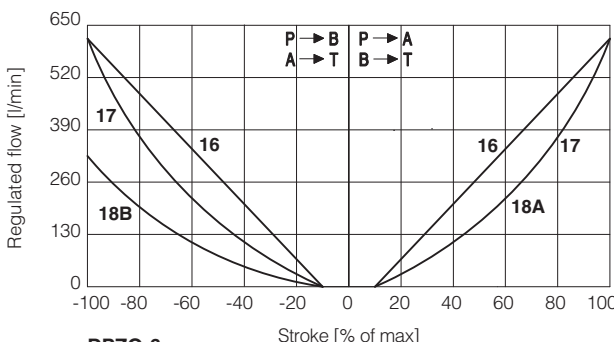
DPZO-2:
5 = L3 **7A** = D3 (P → A, A → T)
6 = S3 **7B** = D3 (P → B, B → T)



DPZO-2:
8 = L5 **9A** = DL5 (P → A, A → T) **11A** = D5 (P → A, A → T)
10 = S5 **9B** = DL5 (P → B, B → T) **11B** = D5 (P → B, B → T)



DPZO-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



DPZO-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

Note:

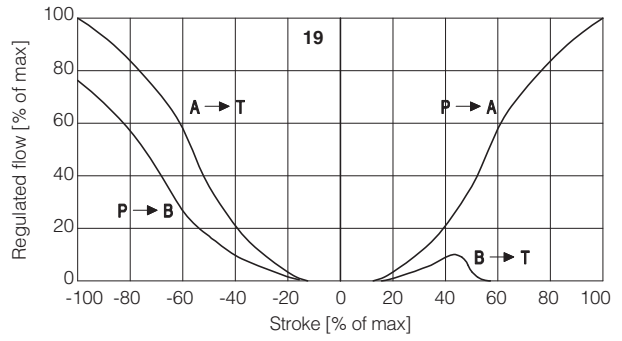
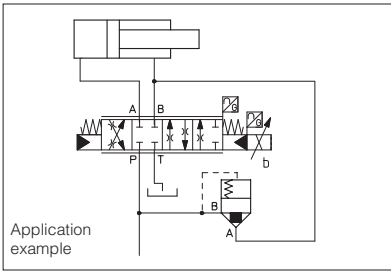
Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \left. \vphantom{\begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix}} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \left. \vphantom{\begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix}} \right\} P \rightarrow B / A \rightarrow T$

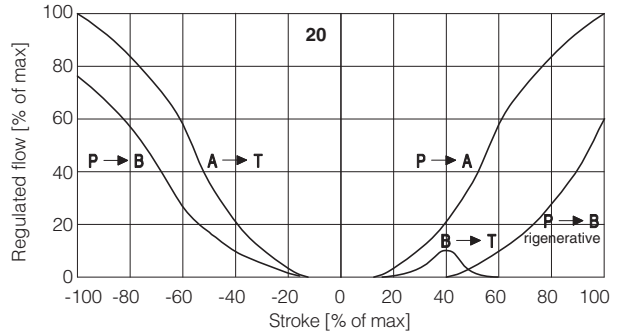
19 = differential - regenerative spool **D9**
(not available for valve size 32)

D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.



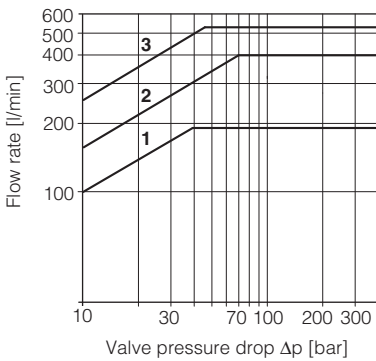
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.



8.2 Operating diagrams

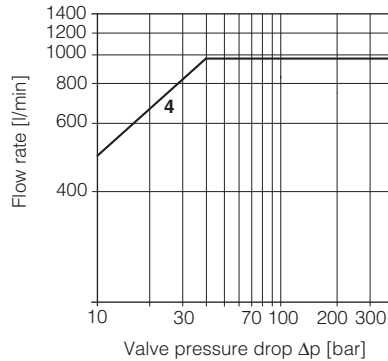
Flow / Δp diagram stated at 100% of spool stroke



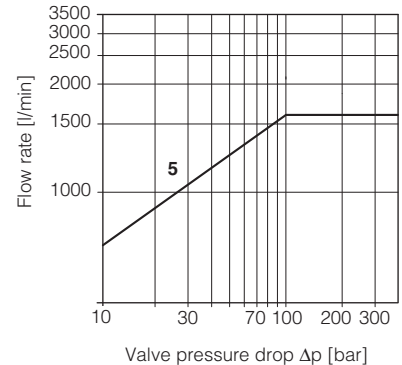
DPZO-1:
1 = spools L5, S5, D5, DL5, D9

DPZO-2:
2 = spools L3, S3, D3

3 = spools L5, S5, D5, DL5, D9, L9



DPZO-4:
4 = spools L5, S5, D5, DL5, D9

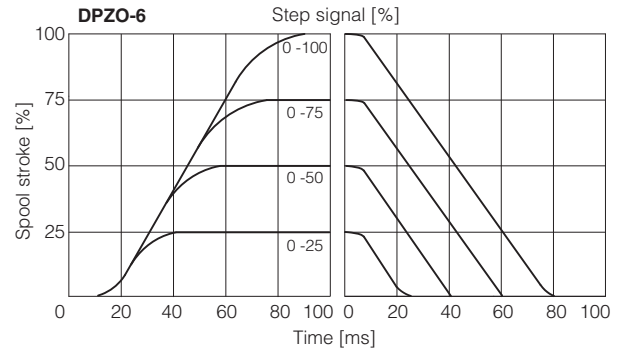
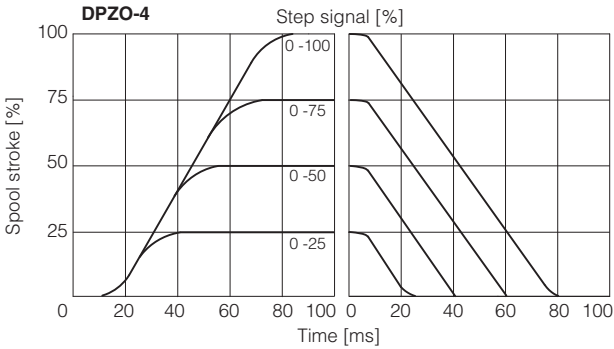
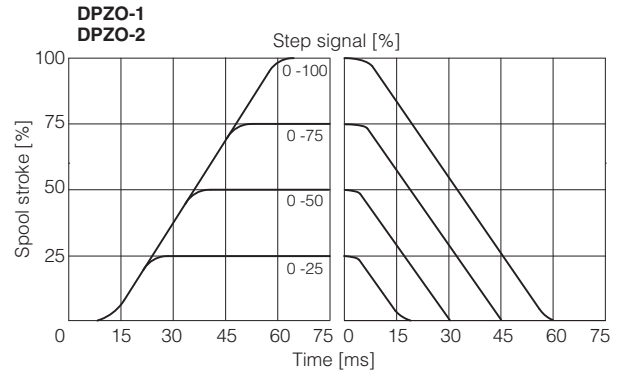


DPZO-6:
6 = L5, S5, D5

8.3 Response time

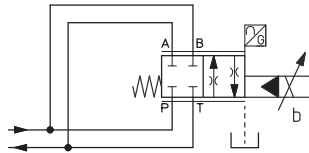
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



8.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar



DPZO-*	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	860	1600	2200
$\Delta p = 15$ bar				

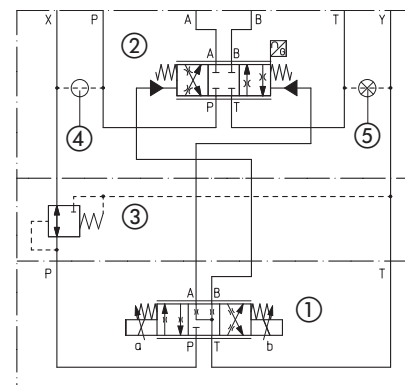
9 HYDRAULIC OPTIONS

B = Solenoid and LVDT transducer at side of port A of the main stage (side B of pilot valve). For hydraulic configuration vs reference signal, see 8.1

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 11
The valve's standard configuration provides internal pilot and external drain.

Functional Scheme - example of configuration 71



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

10 ELECTRICAL CONNECTION

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

11 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain

DPZO-1	Pilot channels	Drain channels	<p>Internal piloting: blinded plug SP-X300F ① in X; External piloting: blinded plug SP-X300F ② in Pp; Internal drain: blinded plug SP-X300F ③ in Y; External drain: blinded plug SP-X300F ④ in Dr.</p>
DPZO-2	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X300F ①; External piloting: Add blinded plug SP-X300F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-4	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X500F ①; External piloting: Add blinded plug SP-X500F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-6	Pilot channels	Drain channels	<p>Internal piloting: Without plug ①; External piloting: Add DIN-908 M16x1,5 in pos ①; Internal drain: Without blinded plug SP-X300F ③; External drain: Add blinded plug SP-X300F ③.</p>

12 FASTENING BOLTS AND SEALS

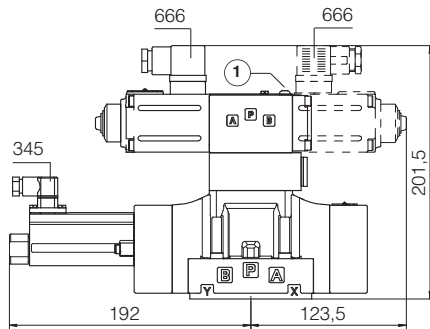
Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050 Diameter of ports A, B, P, T: \varnothing 11 mm (max) 2 OR 108 Diameter of ports X, Y: \varnothing = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: \varnothing 20 mm (max) 2 OR 2043 Diameter of ports X, Y: \varnothing = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112 Diameter of ports A, B, P, T: \varnothing 24 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144 Diameter of ports A, B, P, T: \varnothing 34 mm (max) 2 OR 3056 Diameter of ports X, Y: \varnothing = 7 mm (max)

13 INSTALLATION DIMENSIONS [mm]

DPZO-T-1 (dotted line = double solenoid version)

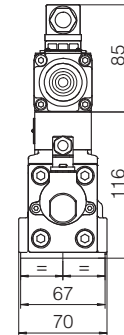
ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)



① = Air bleeding 

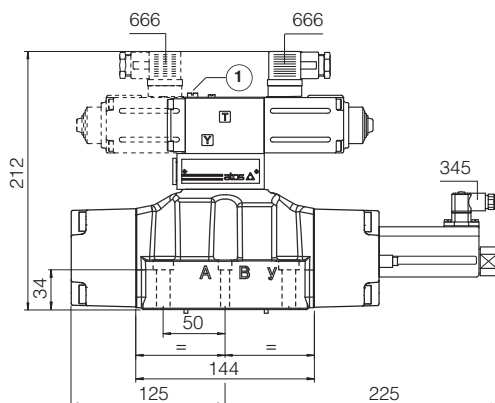
Mass [kg]	
DPZO-T-15	8,5
DPZO-T-17	9,4



DPZO-T-2 (dotted line = double solenoid version)

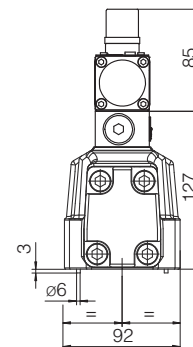
ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)



① = Air bleeding 

Mass [kg]	
DPZO-T-25	13,5
DPZO-T-27	14,4



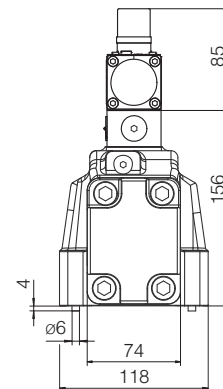
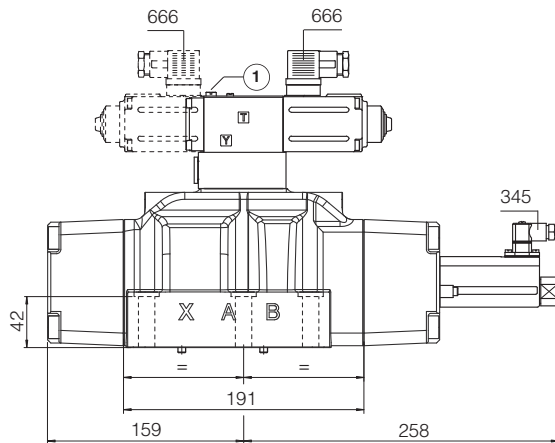
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

DPZO-T-4 (dotted line = double solenoid version)

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

Mass [kg]	
DPZO-T-45	17,6
DPZO-T-47	18,5



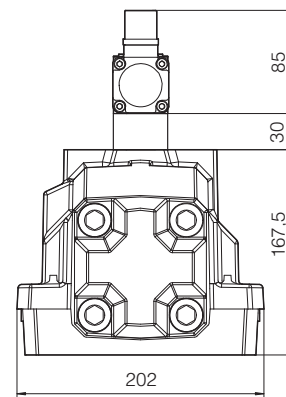
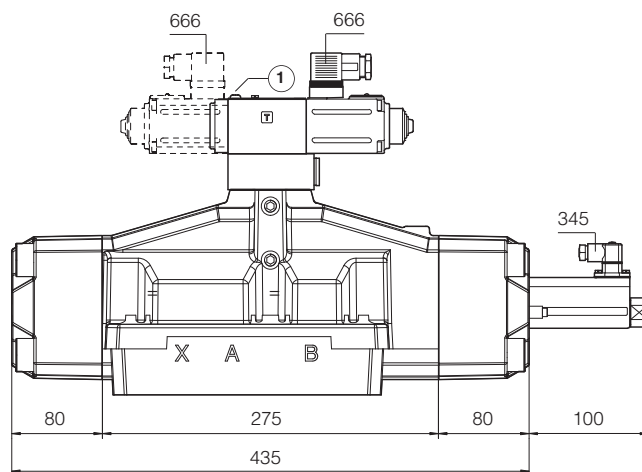
① = Air bleeding 

DPZO-T-6 (dotted line = double solenoid version)

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-T-65	42,3
DPZO-T-67	43,1



① = Air bleeding 

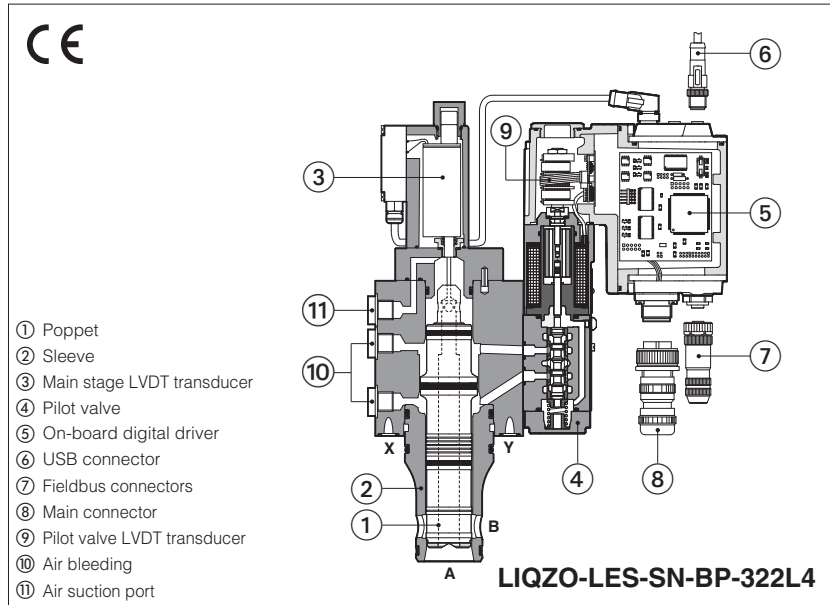
Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid and the LVDT transducer are at side of port A of the main stage

14 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-TEB digital driver	K800	Electric and electronic connectors
GS235	E-BM-TID digital driver	P005	Mounting surfaces for electrohydraulic valves
GS240	E-BM-TES digital driver		

Digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers



- ① Poppet
- ② Sleeve
- ③ Main stage LVDT transducer
- ④ Pilot valve
- ⑤ On-board digital driver
- ⑥ USB connector
- ⑦ Fieldbus connectors
- ⑧ Main connector
- ⑨ Pilot valve LVDT transducer
- ⑩ Air bleeding
- ⑪ Air suction port

LIQZO-LEB, LIQZP-LEB LIQZO-LES, LIQZP-LES

Digital high performance 2-way proportional cartridges specifically designed for high speed closed loop controls. They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations. The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

LEB basic execution with analog reference signal and USB port for software functional parameters setting.

LES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

LIQZO: Size: **16 ÷ 40** - ISO 7368
Max flow: **600 ÷ 2500 l/min**
Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 100** - ISO 7368
Max flow: **4000 ÷ 16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	LES	-	SN	-	NP	-	25	2	L4	/	*	/	*	/	*
<p>Proportional 2-way cartridge, piloted</p> <p>LIQZO = size 16 to 40, Pmax 350 bar</p> <p>LIQZP = size 50 to 100, Pmax 420 bar</p>																

LEB = basic on-board digital driver (1)
LES = full on-board digital driver

Alternated P/Q controls:
SN = none

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen **EW** = POWERLINK
BP = PROFIBUS DP **EI** = EtherNet/IP
EH = EtherCAT **EP** = PROFINET RT/IRT

Valve size ISO 7368, see section 6:

LIQZO =	16	25	32	40
l/min	250	500	800	1200
LIQZP =	50	63	80	100
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

(1) Only in version **SN-NP**

(2) Possible combined options: /FI, /IQ, /IZ

Electronics options (2):

- F** = fault signal
- I** = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 Vdc)
- Q** = enable signal
- Z** = double power supply, enable, fault and monitor signals - 12 pin connector (3)

Poppet type, regulating characteristics:

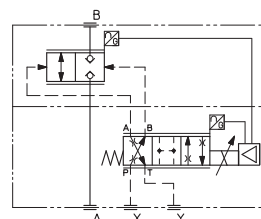
L4 = linear



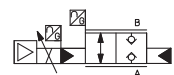
Configuration:

2 = 2 way

functional symbol



simplified symbol



(3) Double power supply only for **LES**

2 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver (option /Q or /Z). A safety fuse 2,5 A installed on 24VDC power supply of each valve is always recommended, see also power supply note at sections **13**.

WARNING

The loss of the pilot pressure causes the undefined position of the main poppet. The sudden interruption of the power supply during the valve operation causes the immediate shut-off of the main poppet. This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

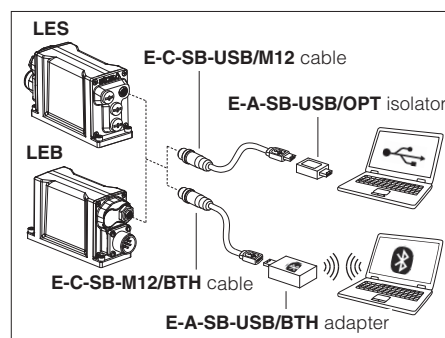
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

 **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

 **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



4 FIELDBUS - only for LES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	16	25	32	40	50	63	80	100
Nominal flow Δp A-B [l/min]								
$\Delta p = 5$ bar	250	500	800	1200	2000	3000	4500	7200
$\Delta p = 10$ bar	350	700	1100	1700	2800	4250	6350	10200
Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	LIQZO		Ports A, B = 350		X = 350	Y \leq 10		
	LIQZP		Ports A, B = 420		X = 350	Y \leq 10		
Nominal flow of pilot valve at $\Delta p = 70$ bar [l/min]	4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 \div 160							
Piloting volume [cm ³]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow (1) [l/min]	4	5,3	14	19	35,5	56	60	60
Response time 0 \div 100% step signal (2) [ms]	24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]	$\leq 0,1$							
Repeatability [% of the max regulation]	$\pm 0,1$							
Thermal drift	zero point displacement < 1% at $\Delta T = 40^\circ C$							

(1) With step reference input 0-100%

(2) With pilot pressure = 140 bar, see detailed diagrams in section 9.2

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 \div 3,3 Ω			
Analog input signals	Voltage: range ± 10 VDC (24 V_{MAX} tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ± 10 VDC @ max 5 mA current ± 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 5 VDC (OFF state), 9 \div 24 VDC (ON state), 5 \div 9 VDC (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 \div 24 VDC (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO 11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 16			

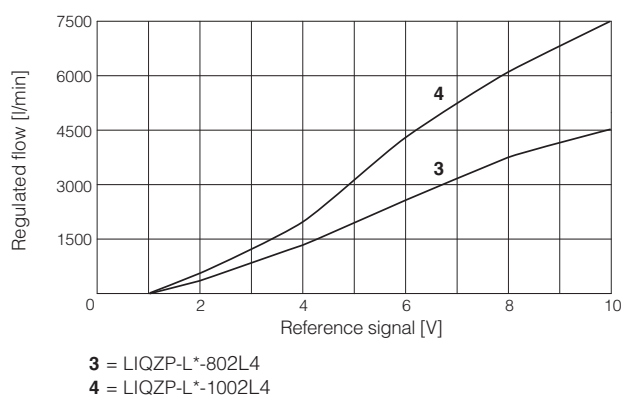
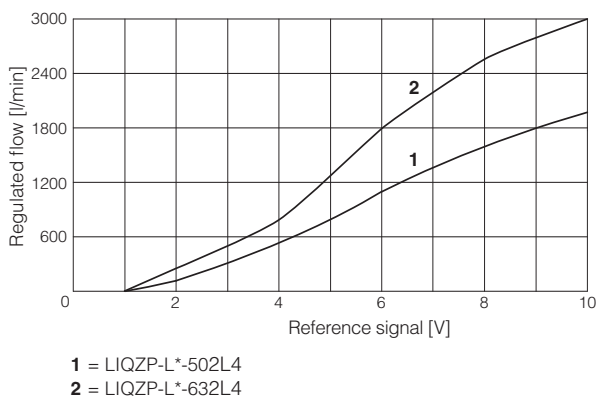
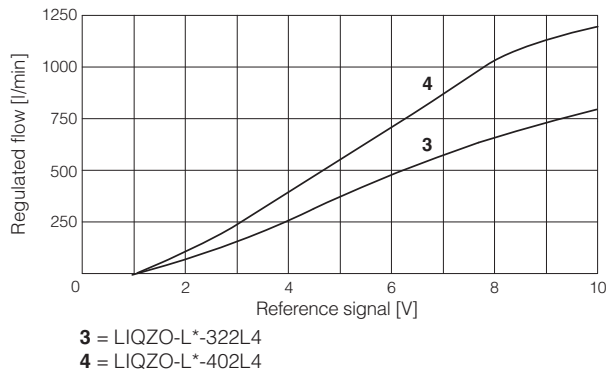
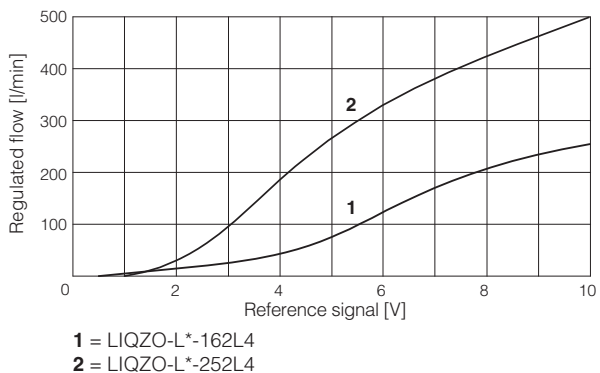
Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

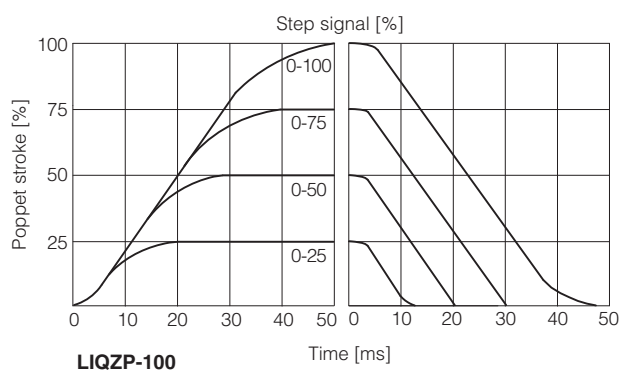
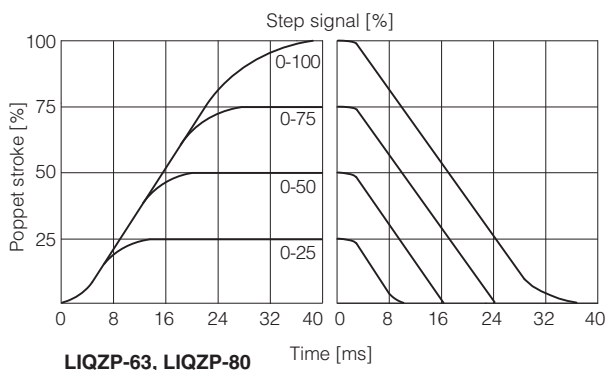
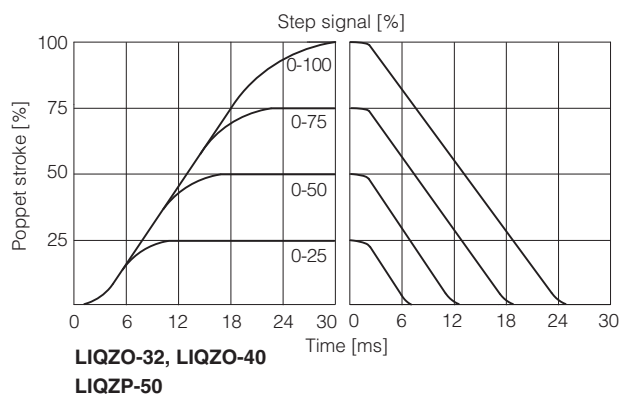
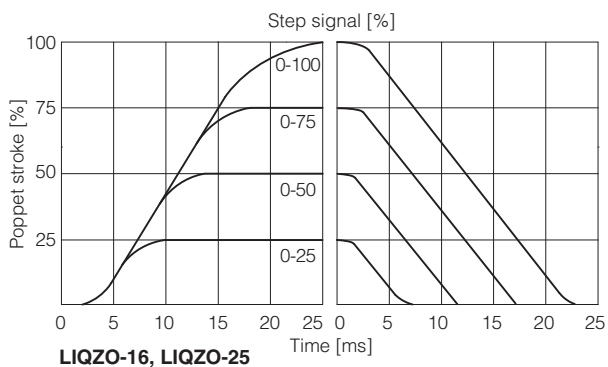
9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

9.1 Regulation diagrams (values measured at Δp 5 bar)

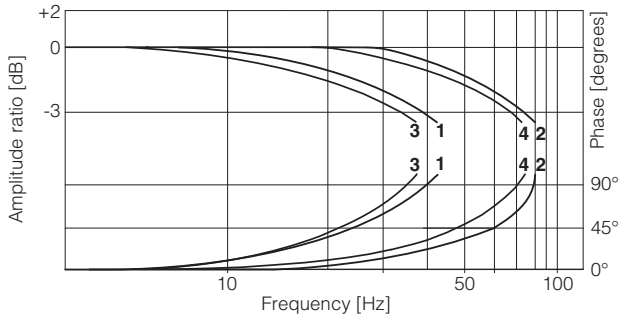


9.2 Response time

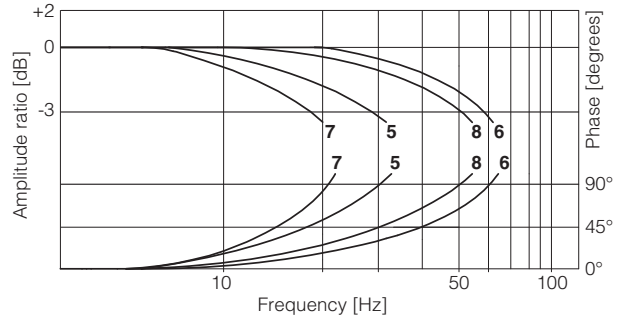
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



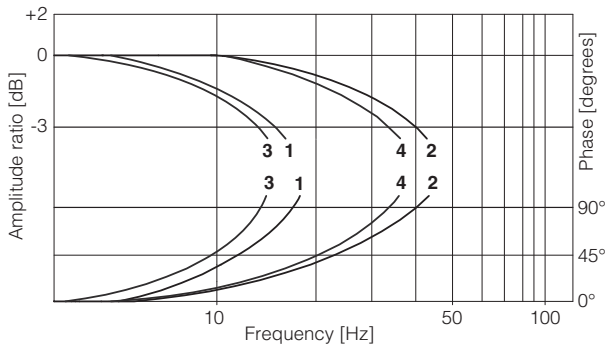
9.3 Bode diagrams - stated at nominal hydraulic conditions



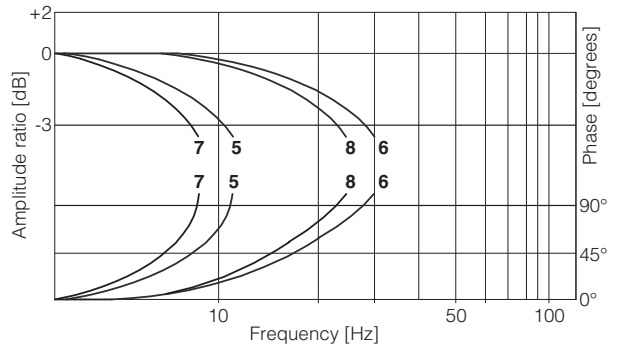
- 1 = LIQZO-L*-162L4: 10% ↔ 90%
- 2 = LIQZO-L*-162L4: 50% ± 5%
- 3 = LIQZO-L*-252L4: 10% ↔ 90%
- 4 = LIQZO-L*-252L4: 50% ± 5%



- 5 = LIQZO-L*-322L4: 10% ↔ 90%
- 6 = LIQZO-L*-322L4: 50% ± 5%
- 7 = LIQZO-L*-402L4: 10% ↔ 90%
- 8 = LIQZO-L*-402L4: 50% ± 5%



- 1 = LIQZP-L*-502L4: 10% ↔ 90%
- 2 = LIQZP-L*-502L4: 50% ± 5%
- 3 = LIQZP-L*-632L4: 10% ↔ 90%
- 4 = LIQZP-L*-632L4: 50% ± 5%



- 5 = LIQZP-L*-802L4: 10% ↔ 90%
- 6 = LIQZP-L*-802L4: 50% ± 5%
- 7 = LIQZP-L*-1002L4: 10% ↔ 90%
- 8 = LIQZP-L*-1002L4: 50% ± 5%

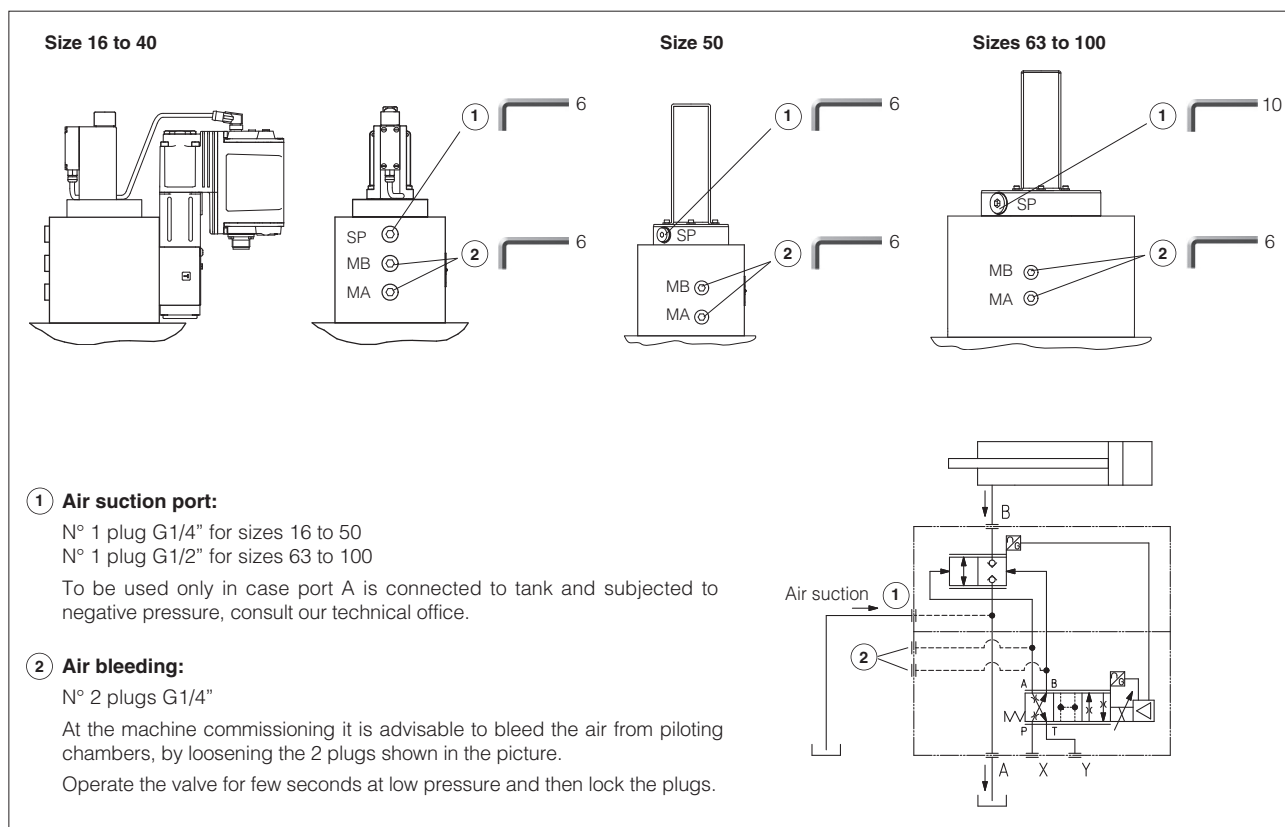
10 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 13.7 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 13.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
 - Fault output signal** - see above option /F
 - Enable input signal** - see above option /Q
 - Repeat enable output signal** - only for **LEB** (see 13.6)
 - Power supply for driver's logics and communication** - only for **LES** (see 13.2)

11 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

12 AIR BLEEDING



13 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

13.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 13.2.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

13.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

13.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

13.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are $0 \div 10$ VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

13.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

13.6 Repeat enable output signal (R_ENABLE) - only for LEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 13.5).

13.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for $4 \div 20$ mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

14 ELECTRONIC CONNECTIONS

14.1 Main connector signals - 7 pin (A1) Standard, /Q and /F options

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND V0			Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

14.2 Main connector signals - 12 pin (A2) /Z option

PIN	LEB-SN /Z	LES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0 VL0		Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND VL0		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
7	AGND		Analog ground	Output - analog signal
		NC	Do not connect	Gnd - analog signal
8	R_ENABLE		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
		NC	Do not connect	
9	NC		Do not connect	
10		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
	NC		Do not connect	
11		VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
	FAULT referred to: V0 VL0		Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

14.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

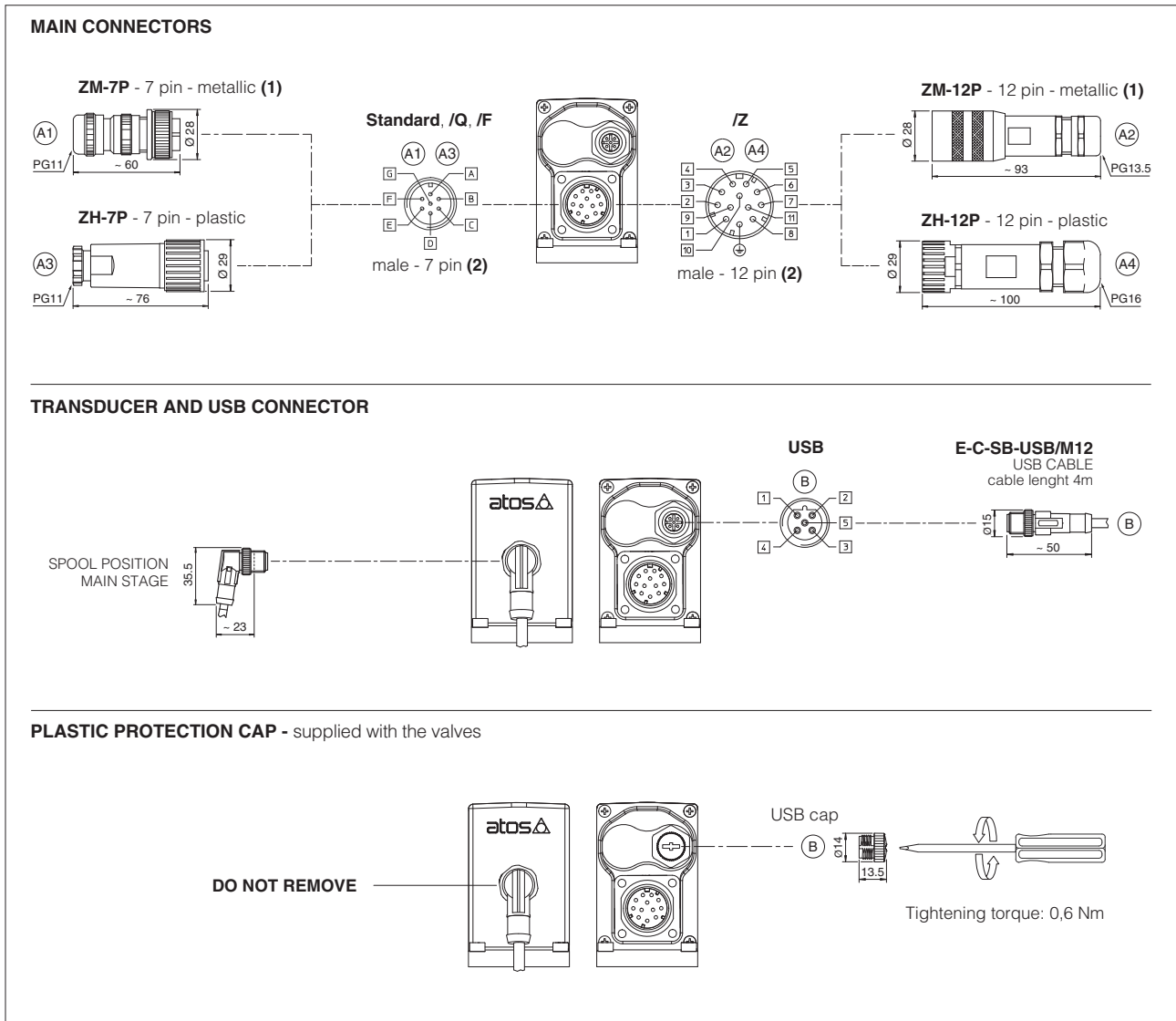
(1) Shield connection on connector's housing is recommended

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Pin 2 can be fed with external +5V supply of CAN interface

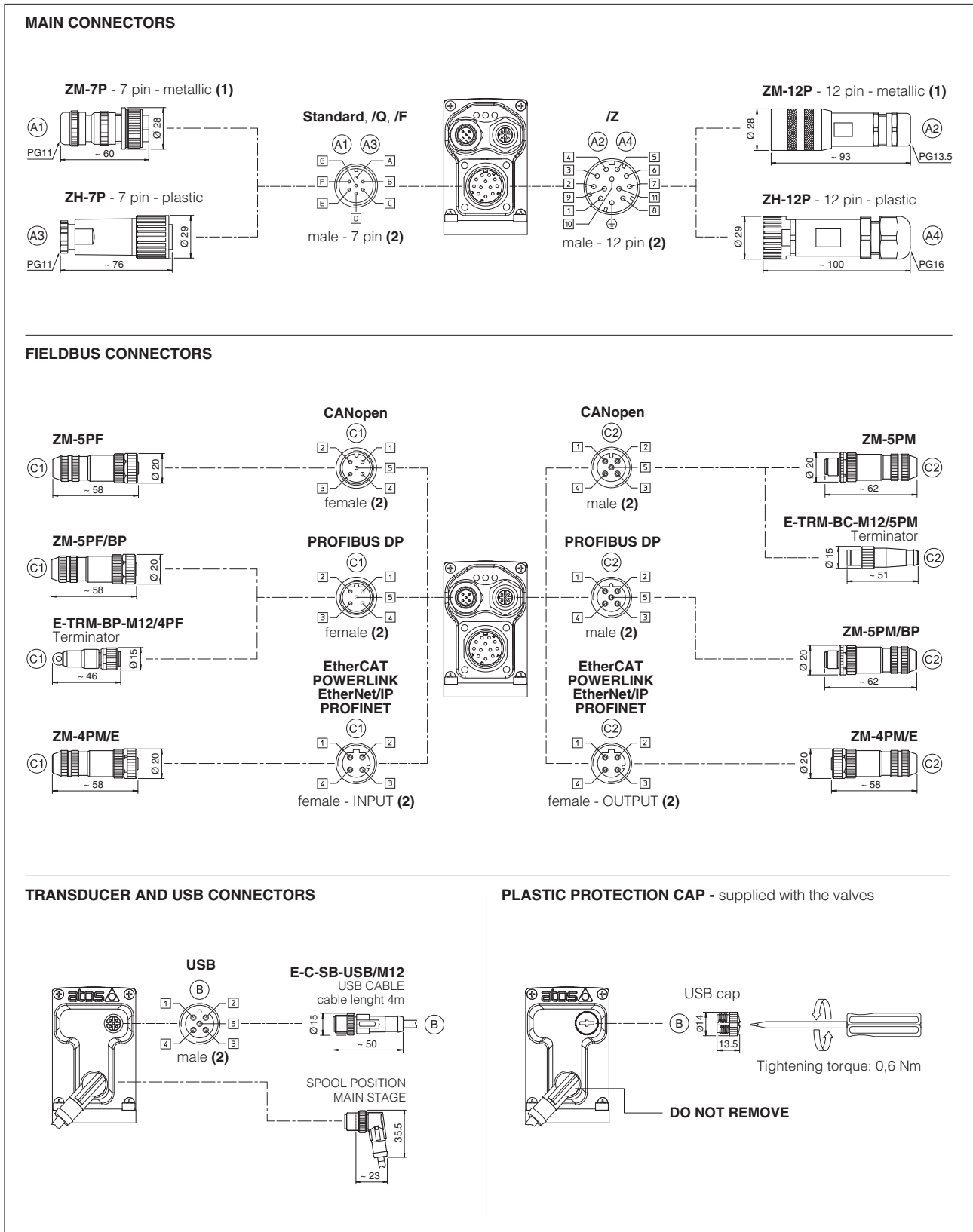
14.4 LEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

14.5 LES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

14.6 Diagnostic LEDs - only for LES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	Ei EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS						
L2		NETWORK STATUS			LINK/ACT			
L3		SOLENOID STATUS			NETWORK STATUS			
								LINK/ACT

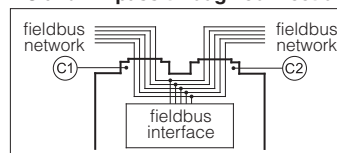
15 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



16 CONNECTORS CHARACTERISTICS - to be ordered separately

16.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

16.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

16.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

17 FASTENING BOLTS AND VALVE MASS

Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

(1) Fastening bolts supplied with the valve

18 MAIN CONNECTORS INSTALLATION DIMENSIONS

Installation 1 - possible interference between manifold and main connector

A = 15 mm space to remove the 7 or 12 pin main connectors
B = Clearance between main connector to valve's mounting surface.
 See the below table to verify eventual interferences, depending to the valve size and connector type

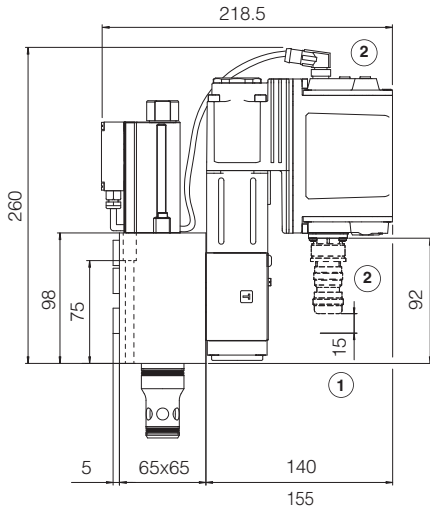
Installation 2 - no interference

C = Max manifold dimension to avoid interference with the main connector, see below table

Reference dimension	Main connector code	Valve size							
		16	25	32	40	50	63	80	100
B	ZM-7P	32	32	32	32	45	68	68	80
	ZH-7P	(1)	(1)	(1)	(1)	29	52	52	64
	ZM-12P	(1)	(1)	(1)	(1)	(1)	35	35	47
	ZH-12P	(1)	(1)	(1)	(1)	(1)	(1)	(2)	40
C (max)	-	104	114	121	134	141	172	202	229
D	-	124	134	141	154	161	192	222	249

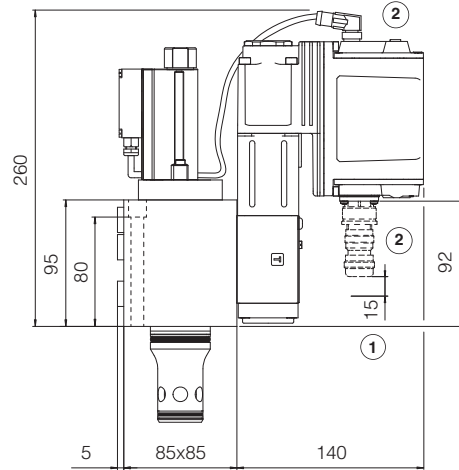
Above dimensions refer to the main connector fully screwed to driver's connector. The space **A** = 15 mm to remove the connector must be considered
(1) The connector installation can be performed only if the valve's driver protrudes from the edge of the relevant mounting manifold as represented in above "Installation 2"
(2) The connector installation may be critical, depending to the cable size and bending radius

LIQZO-LEB-162
LIQZO-LES-162



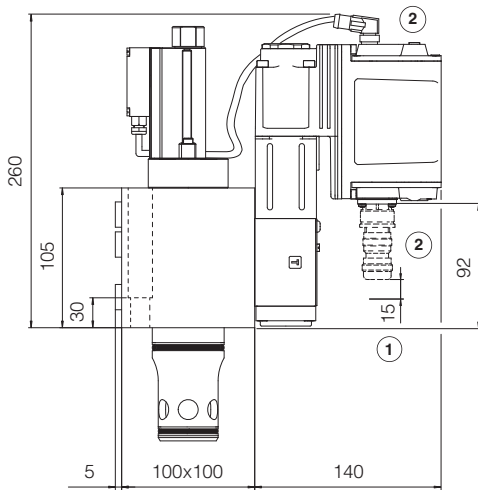
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZO-LEB-252
LIQZO-LES-252



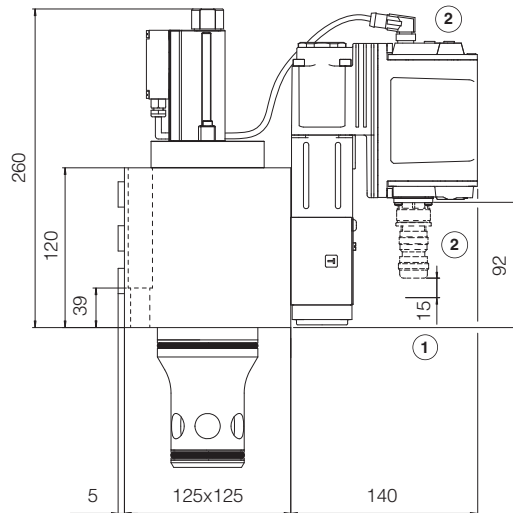
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZO-LEB-322
LIQZO-LES-322



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZO-LEB-402
LIQZO-LES-402



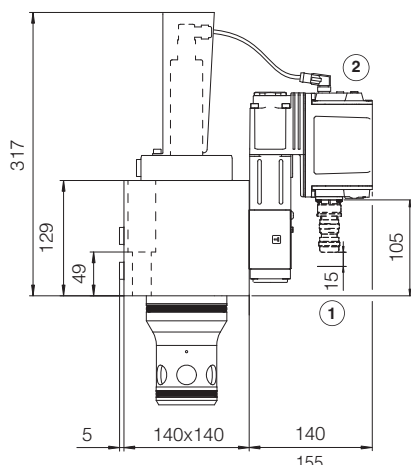
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section 18.

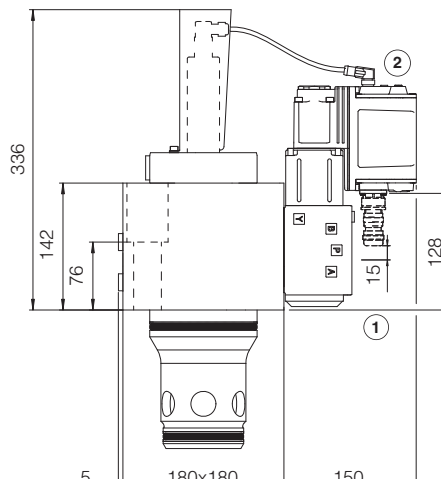
Note: for mounting surface and cavity dimensions, see table P006

LIQZP-LEB-502
LIQZP-LES-502



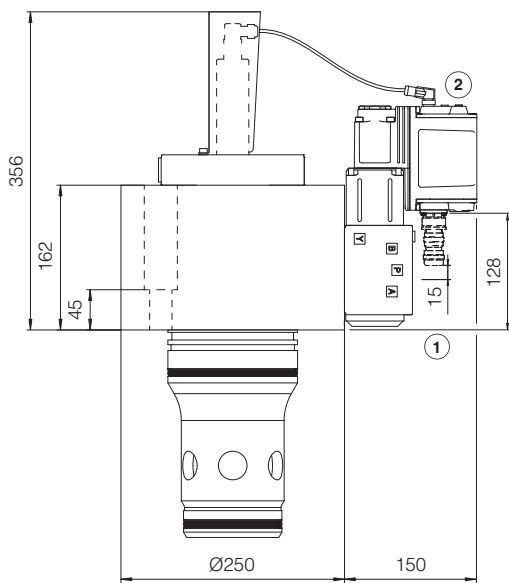
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZP-LEB-632
LIQZP-LES-632



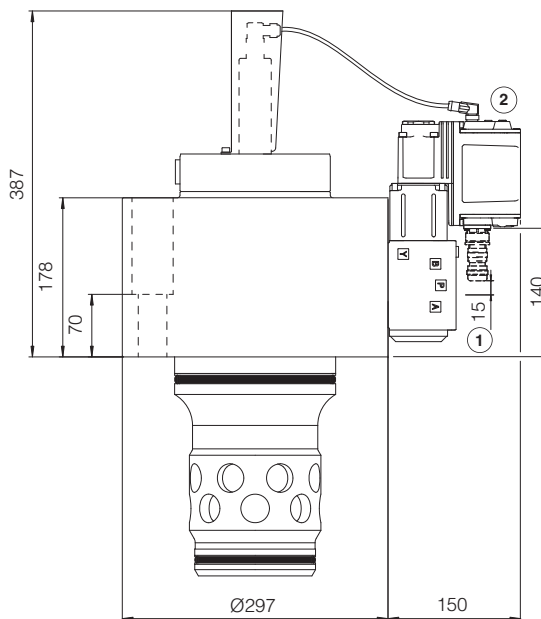
for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZP-LEB-802
LIQZP-LES-802



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

LIQZP-LEB-1002
LIQZP-LES-1002



for **EW** - POWERLINK,
EI - EtherNet/IP,
EP - PROFINET IRT

① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 14.4 and 14.5
For main connectors installation, see also section 18.

Note: for mounting surface and cavity dimensions, see table P006

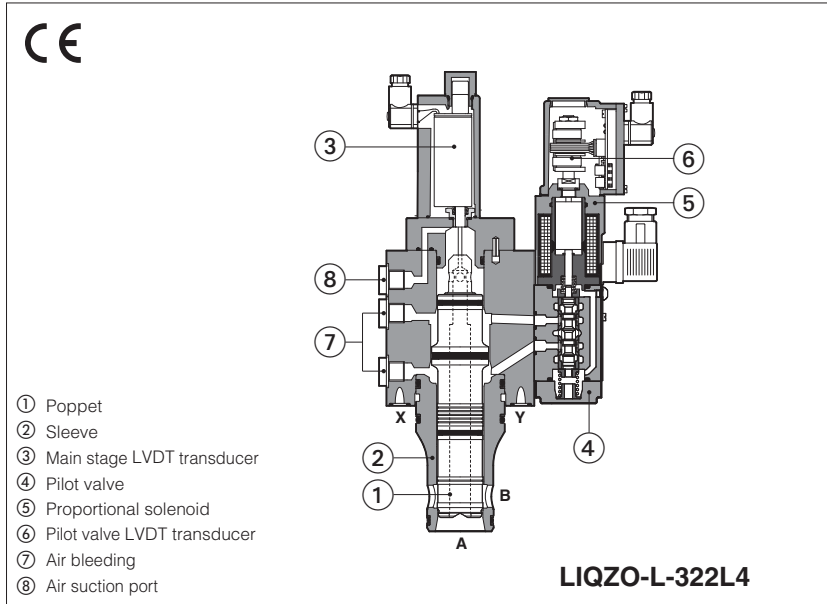
20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus

K800	Electric and electronic connectors
P006	Mounting surfaces and cavities for cartridge valves
QB340	Quickstart for LEB valves commissioning
QF340	Quickstart for LES valves commissioning

Proportional 2-way cartridges high performance

piloted, with two LVDT transducers, ISO 7368 sizes from 16 to 100



- ① Poppet
- ② Sleeve
- ③ Main stage LVDT transducer
- ④ Pilot valve
- ⑤ Proportional solenoid
- ⑥ Pilot valve LVDT transducer
- ⑦ Air bleeding
- ⑧ Air suction port

LIQZO-L, LIQZP-L

High performance 2-way proportional cartridge valves specifically designed for high speed closed loop controls.

The valves operate in association with digital off-board drivers, see section 2.

They are equipped with two LVDT position transducers for best dynamics in not compensated flow regulations.

The cartridge execution for blocks installation grants high flow capabilities and minimized pressure drops.

Spool regulation characteristics: L = linear

LIQZO: Size: **16 ÷ 40** - ISO 7368
 Max flow: **600 ÷ 2500 l/min**
 Max pressure: **350 bar**

LIQZP: Size: **50 ÷ 100** - ISO 7368
 Max flow: **4000 ÷ 16000 l/min**
 Max pressure: **420 bar**

1 MODEL CODE

LIQZO	-	L	-	32	2	/	L4	/	*	/	*
Proportional cartridge, piloted LIQZO = size 16 to 40, Pmax 350 bar LIQZP = size 50 to 100, Pmax 420 bar											

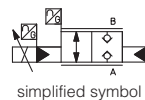
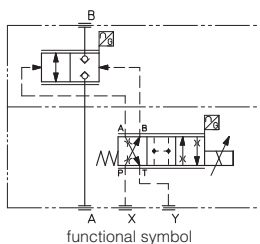
L = two LVDT transducers

Valve size ISO 7368, see section 4 :

LIQZO =	16	25	32	40
l/min	250	500	800	1200
LIQZP =	50	63	80	100
l/min	2000	3000	4500	7200

Nominal flow (l/min) at Δp 5 bar

Configuration: **2** = 2 way



Seals material,
 see section 6 :
 - = NBR
PE = FKM
BT = HNBR

Series number

Spool type, regulating characteristics:

L4 = linear



2 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-LID	E-BM-LEB	E-BM-LES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240



WARNING

To avoid overheating and possible damage of the electronic driver, the valves must be never energized without hydraulic supply to the pilot stage. In case of prolonged pauses of the valve operation during the machine cycle, it is always advisable to disable the driver.

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Size	16	25	32	40	50	63	80	100
Nominal flow Δp A-B [l/min]								
Δp = 5 bar	250	500	800	1200	2000	3000	4500	7200
Δp = 10 bar	350	700	1100	1700	2800	4250	6350	10200
Max permissible flow	600	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	LIQZO Ports A, B = 350 X = 350 Y ≤ 10 LIQZP Ports A, B = 420 X = 350 Y ≤ 10							
Nominal flow of pilot valve at Δp = 70 bar [l/min]	4	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]	0,2	0,2	0,3	0,7	0,7	1	1	1
Piloting pressure [bar]	min: 40% of system pressure max 350 recommended 140 ÷ 160							
Piloting volume [cm³]	1,6	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow (1) [l/min]	4	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal (2) [ms]	24	25	28	30	30	35	40	50
Hysteresis [% of the max regulation]	≤ 0,1							
Repeatability [% of the max regulation]	± 0,1							
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

(1) With step reference input 0÷100%

(2) With pilot pressure = 140 bar, see detailed diagrams in section 7.2



WARNING

The loss of the pilot pressure causes the undefined position of the main spool.

The sudden interruption of the power supply during the valve operation causes the immediate main spool opening A → T or P → A (for option /A). This could cause pressure surges in the hydraulic system or high decelerations which may lead to machine damages.

5 ELECTRICAL CHARACTERISTICS

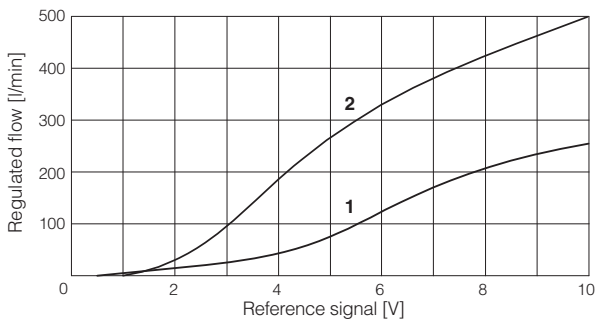
Max power consumption	30 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

6 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

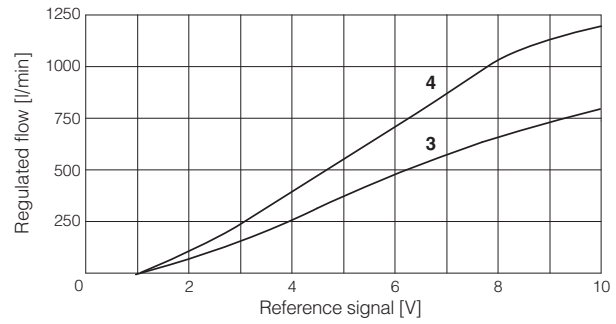
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7
	longer life	ISO4406 class 16/14/11	NAS1638 class 5
			see also filter section at www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

7 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

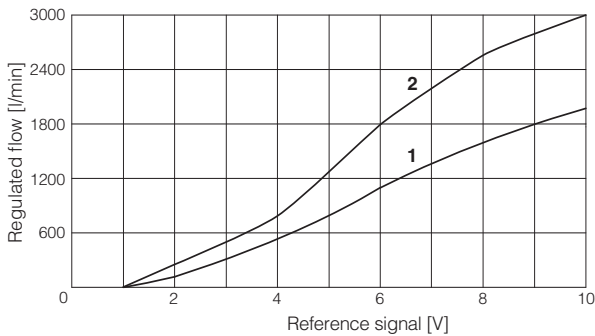
7.1 Regulation diagrams (values measured at Δp 5 bar)



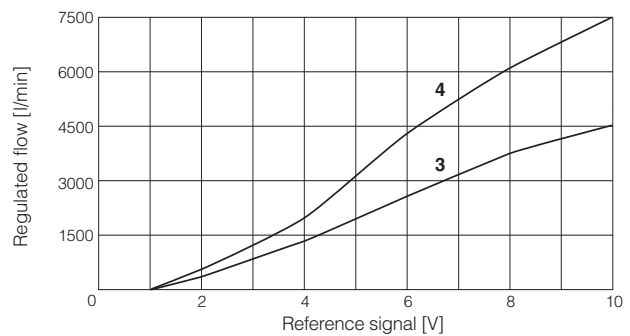
1 = LIQZO-L-162L4
2 = LIQZO-L-252L4



3 = LIQZO-L-322L4
4 = LIQZO-L-402L4



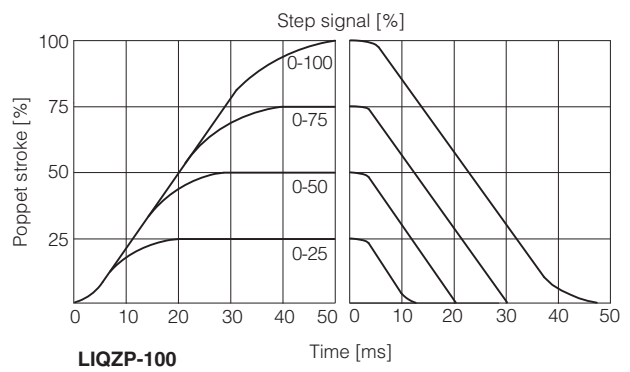
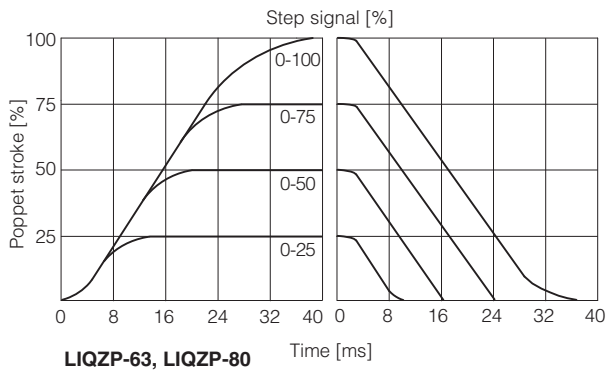
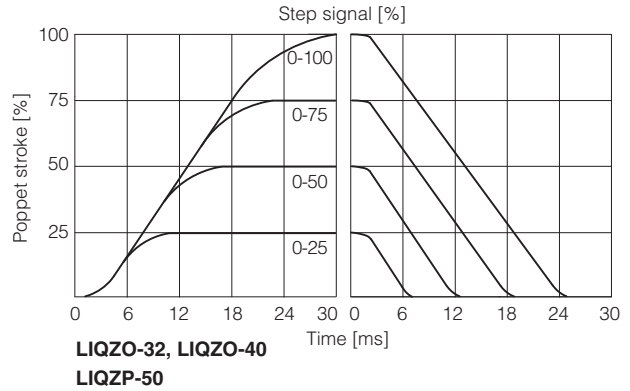
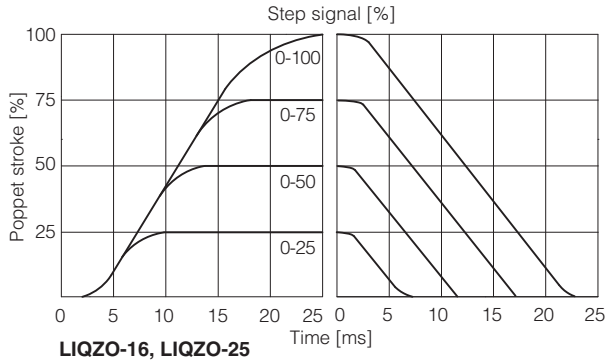
1 = LIQZP-L-502L4
2 = LIQZP-L-632L4



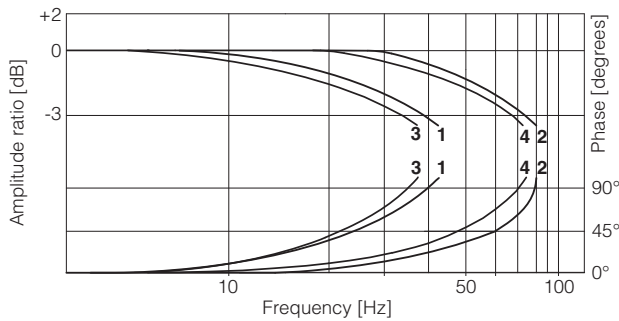
3 = LIQZP-L-802L4
4 = LIQZP-L-1002L4

7.2 Response time

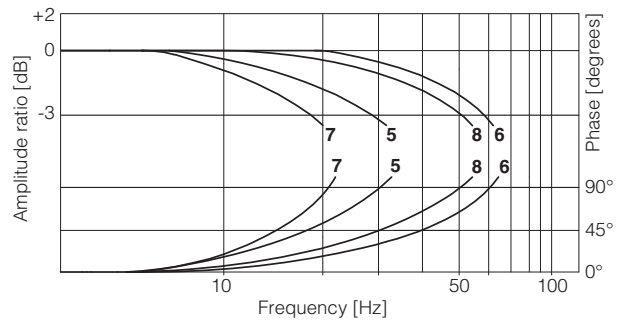
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



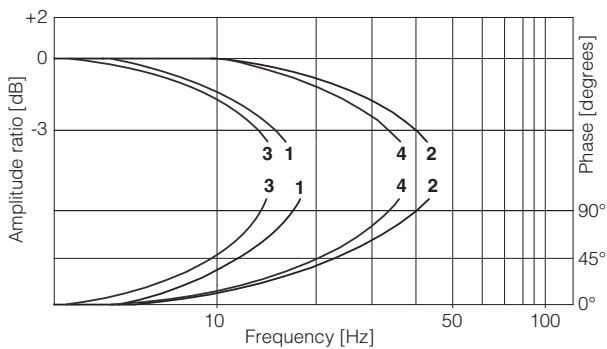
7.3 Bode diagrams - stated at nominal hydraulic conditions



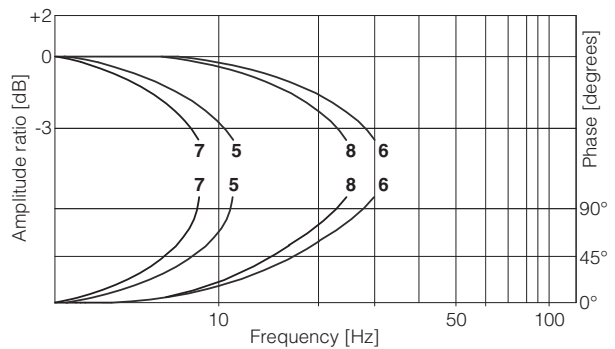
- 1 = LIQZO-L-162L4: 10% ↔ 90%
- 2 = LIQZO-L-162L4: 50% ± 5%
- 3 = LIQZO-L-252L4: 10% ↔ 90%
- 4 = LIQZO-L-252L4: 50% ± 5%



- 5 = LIQZO-L-322L4: 10% ↔ 90%
- 6 = LIQZO-L-322L4: 50% ± 5%
- 7 = LIQZO-L-402L4: 10% ↔ 90%
- 8 = LIQZO-L-402L4: 50% ± 5%



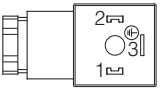
- 1 = LIQZP-L-502L4: 10% ↔ 90%
- 2 = LIQZP-L-502L4: 50% ± 5%
- 3 = LIQZP-L-632L4: 10% ↔ 90%
- 4 = LIQZP-L-632L4: 50% ± 5%



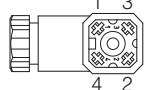
- 5 = LIQZP-L-802L4: 10% ↔ 90%
- 6 = LIQZP-L-802L4: 50% ± 5%
- 7 = LIQZP-L-1002L4: 10% ↔ 90%
- 8 = LIQZP-L-1002L4: 50% ± 5%

8 ELECTRICAL CONNECTION - connectors supplied with the valve

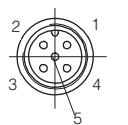
8.1 Solenoid connector

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

8.2 LVDT transducer connector - for LIQZO

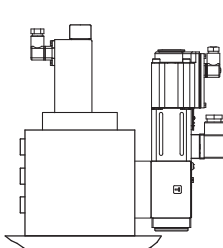
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345 
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

8.3 LVDT transducer connector - for LIQZP

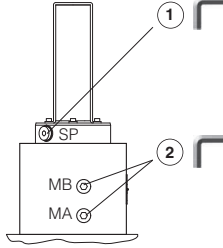
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08 
1	PROG	Do not connect	
2	VT+	Power supply +15Vdc	
3	AGND	Ground	
4	TR	Output signal	
5	VT-	Power supply -15Vdc	

9 AIR BLEEDING

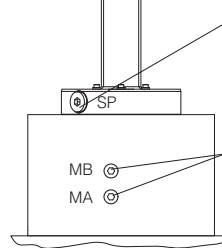
Size 16 to 40



Size 50

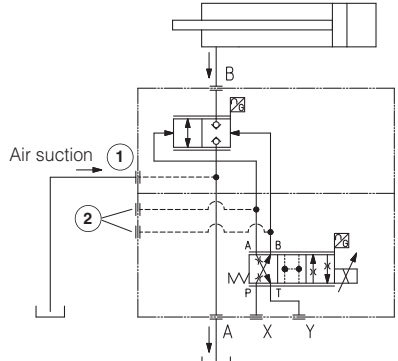


Sizes 63 to 100



1 Air suction port:
 N° 1 plug G1/4" for sizes 16 to 50
 N° 1 plug G1/2" for sizes 63 to 100
 To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

2 Air bleeding:
 N° 2 plugs G1/4"
 At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.
 Operate the valve for few seconds at low pressure and then lock the plugs.

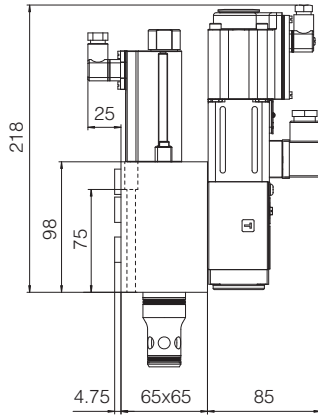


10 FASTENING BOLTS AND VALVE MASS

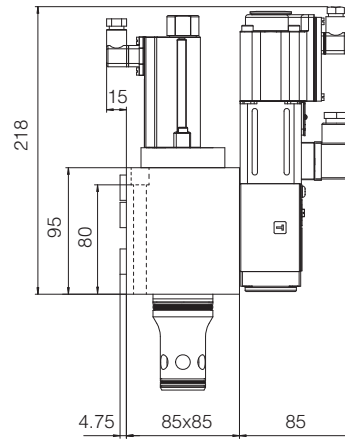
Type	Size	Fastening bolts (1)	Mass [kg]
LIQZO	16	4 socket head screws M8x90 class 12.9 Tightening torque = 35 Nm	5,6
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	8,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	10,9
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	16,7
LIQZP	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	23,9
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	44,0
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	71,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	122,5

(1) Fastening bolts supplied with the valve

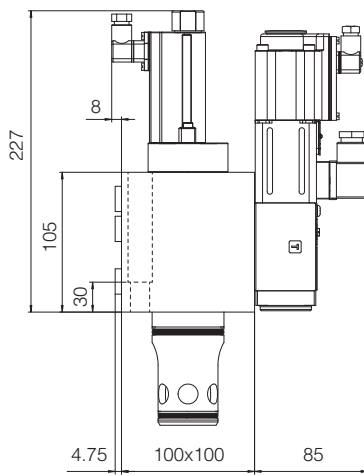
LIQZO-L-162



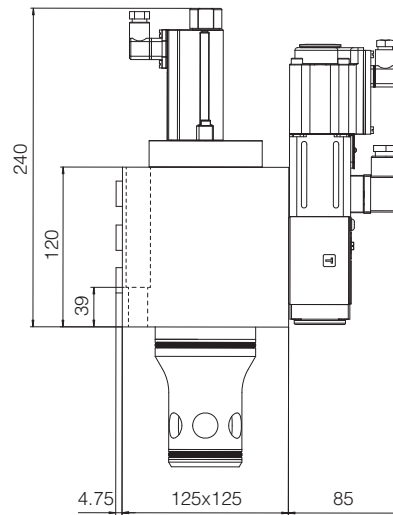
LIQZO-L-252

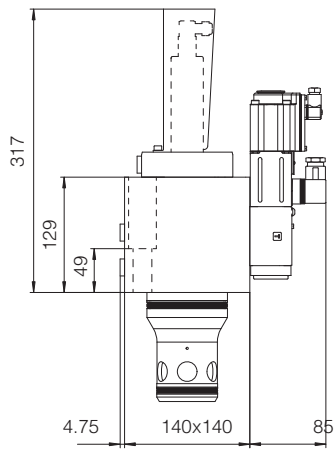
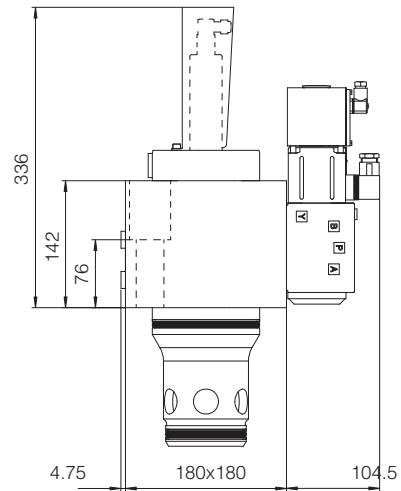
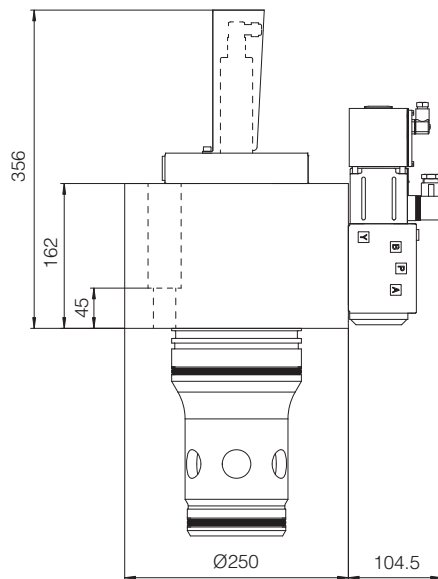
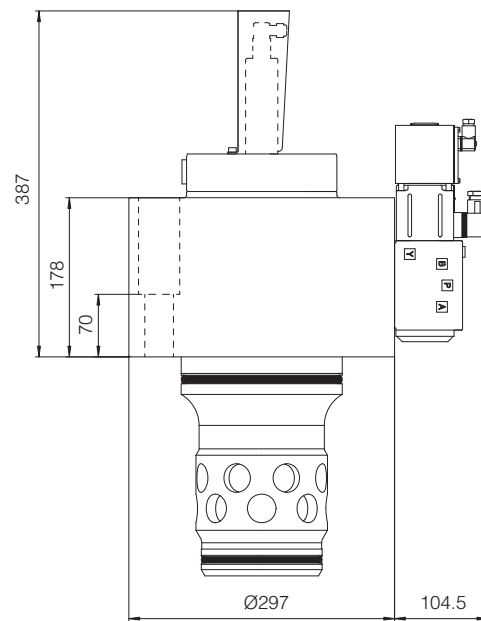


LIQZO-L-322



LIQZO-L-402



LIQZP-L-502**LIQZP-L-632****LIQZP-L-802****LIQZP-L-1002**

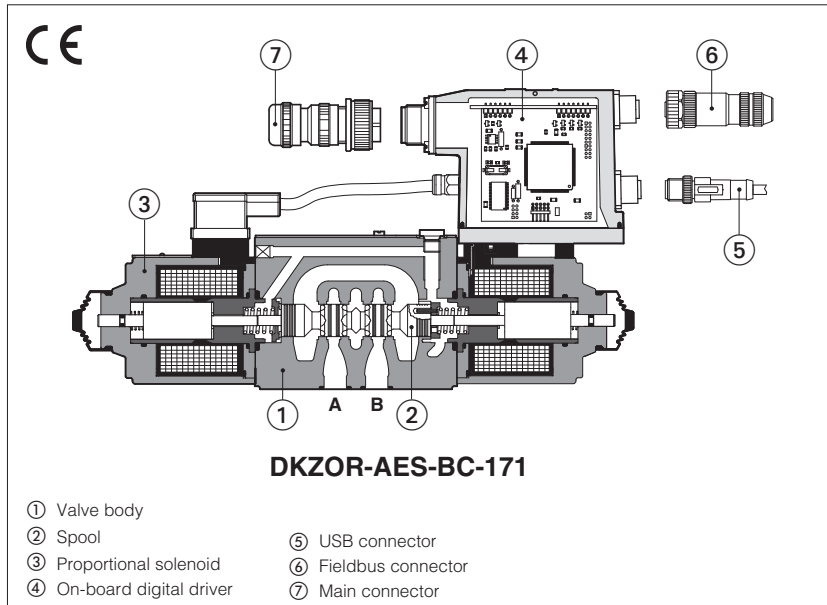
Note: for mounting surface and cavity dimensions, see table P006

12 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
GS230	E-BM-LEB digital driver	K800	Electric and electronic connectors
GS235	E-BM-LID digital driver	P006	Mounting surfaces and cavities for cartridge valves
GS240	E-BM-LES digital driver		

Digital proportional directional valves

direct, without transducer, with positive spool overlap



DHZO-A, DHZO-AEB, DHZO-AES DKZOR-A, DKZOR-AEB, DKZOR-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

DHZO:	DKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 70 l/min	Max flow: 160 l/min
Max pressure: 350 bar	Max pressure: 315 bar

- ① Valve body
- ② Spool
- ③ Proportional solenoid
- ④ On-board digital driver
- ⑤ USB connector
- ⑥ Fieldbus connector
- ⑦ Main connector

1 MODEL CODE for STANDARD SPOOLS

DHZO	-	AES	-	BP	-	0	71	-	L	/	5	/	*	/	*	/	*									
<p>DHZO = size 06 DKZOR = size 10</p>																										
<p>A = for off-board driver, see section 2 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)</p>																										
<p>Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p>																										
<p>Valve size ISO 4401: 0 = 06 1 = 10</p>																										
<p>Configuration (4):</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center; width: 50%;">Standard</td> <td style="text-align: center; width: 50%;">Option /B</td> </tr> <tr> <td style="text-align: center;">51 = </td> <td style="text-align: center;">51 = </td> </tr> <tr> <td style="text-align: center;">53 = </td> <td style="text-align: center;">53 = </td> </tr> <tr> <td style="text-align: center;">71 = </td> <td style="text-align: center;">71 = </td> </tr> <tr> <td style="text-align: center;">73 = </td> <td style="text-align: center;">73 = </td> </tr> </table>		Standard	Option /B	51 =	51 =	53 =	53 =	71 =	71 =	73 =	73 =															
Standard	Option /B																									
51 =	51 =																									
53 =	53 =																									
71 =	71 =																									
73 =	73 =																									
<p>Spool type, regulating characteristics:</p> <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">L = linear</td> <td style="text-align: center;">S = progressive</td> <td style="text-align: center;">D = differential-progressive</td> </tr> <tr> <td style="text-align: center;"></td> <td style="text-align: center;"></td> <td style="text-align: center;"></td> </tr> </table> <p>P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q</p>		L = linear	S = progressive	D = differential-progressive																						
L = linear	S = progressive	D = differential-progressive																								
		<p>Seals material, see section 9:</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR <p>Series number</p>																								

Coil voltage, only for **A** - see section 14:

- = standard coil for 24 VDC Atos drivers
- 6** = optional coil for 12 Vdc Atos drivers
- 18** = optional coil for low current drivers

Hydraulic options (5):

B = solenoid and on-board digital driver at side of port A
Y = external drain

Hand lever options, only for **A**:

MO = horizontal hand lever
MV = vertical hand lever
BMO = horizontal hand lever installed at side of port A
BMV = vertical hand lever installed at side of port A

Electronic options, only for **AEB** and **AES** (5):

C = current feedback for pressure transducer 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC) - only for **W**
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector
W = power limitation function - 12 pin connector

Spool size:	14 (L)	1 (L)	2 (S)	3 (L,S,D)	5 (L,S,D)
DHZO =	1	4,5	8	18	28
DKZOR =	-	-	-	45	60

Nominal flow (l/min) at Δp 10bar P-T

(1) Only for **NP**
(2) Only for **BC, BP, EH**
(3) Omit for **A** execution

(4) Hydraulic symbols are represented with on-board digital driver
(5) For possible combined options, see section 13

2 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (Vdc)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

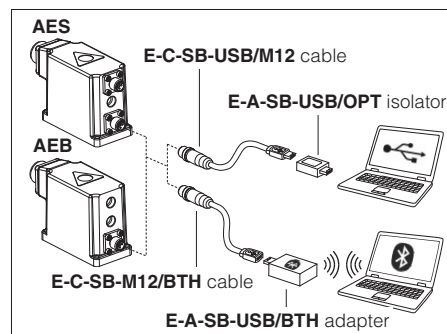


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO					DKZOR	
	ports P, A, B = 350; T = 210 (250 with internal drain /Y) Y = 10					ports P, A, B = 315; T = 210 (250 with internal drain /Y) Y = 10	
Pressure limits [bar]	L14	L1	S2	L3, S3, D3	L5, S5, D5	L3, S3, D3	L5, S5, D5
Nominal flow Δp P-T [l/min] (1)							
Δp= 10 bar	1	4,5	8	18	28	45	60
Δp= 30 bar	1,7	8	14	30	50	80	105
Δp= 70 bar	2,6	12	21	45	70	120	160
Max permissible flow (2)	4	18	30	50	70	120	160
Leakage [cm³/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)					<80 (at p = 100 bar); <600 (at p = 315 bar)	
Response time (3) [ms]	≤ 30					≤ 40	
Hysteresis	≤ 5 [% of max regulation]						
Repeatability	± 1 [% of max regulation]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) For different Δp, the max flow is in accordance to the diagrams in section 10.2

(2) See detailed diagrams in section 10.3

(3) 0-100% step signal, see detailed diagrams in section 10.4

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	DHZO			DKZOR		
	A = 30 W	AEB, AES = 50 W		A = 35 W	AEB, AES = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA			Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω		
Monitor output	Output range: voltage ±5 Vdc @ max 5 mA					
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 Vdc (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24Vdc @ max 100 mA (E-ATR-8 see tech table GS465)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 17					

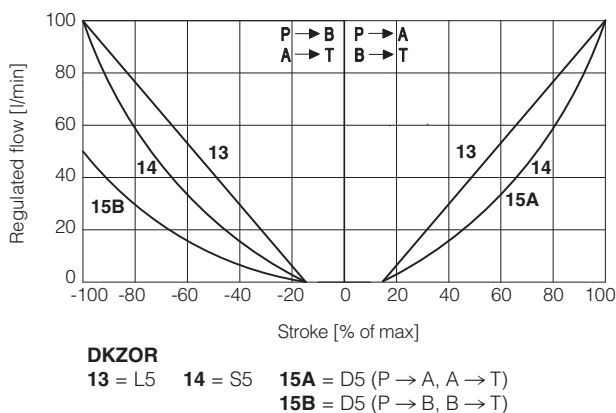
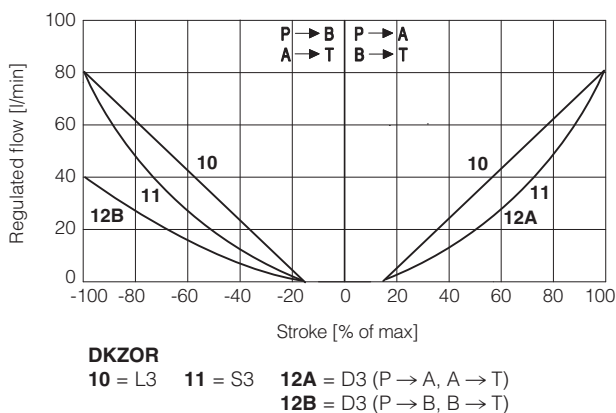
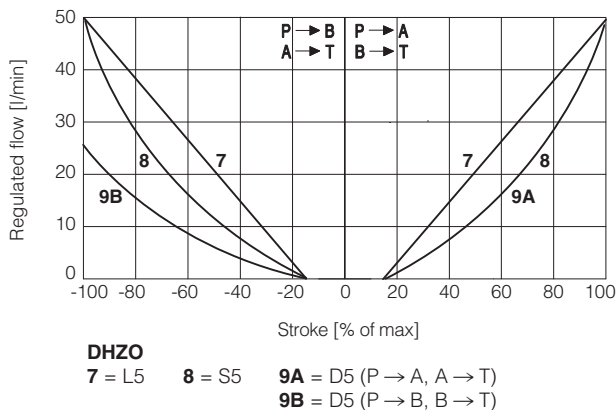
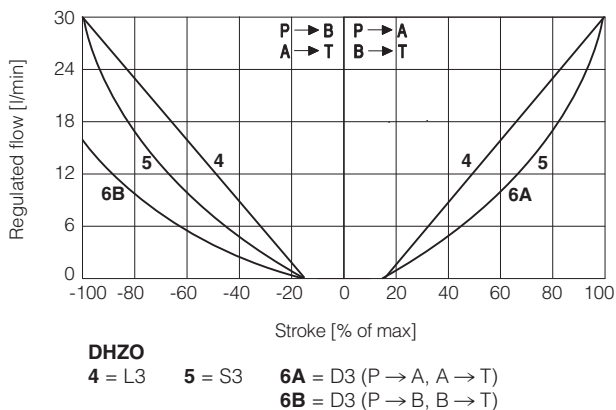
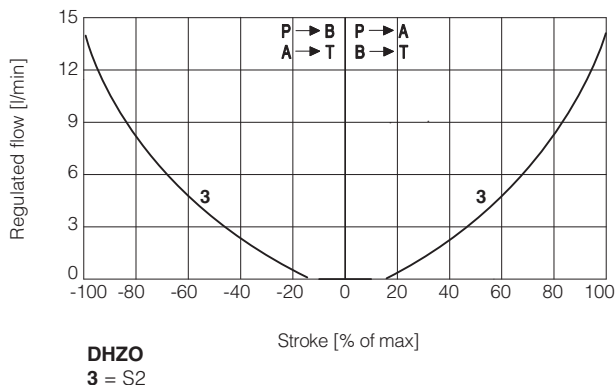
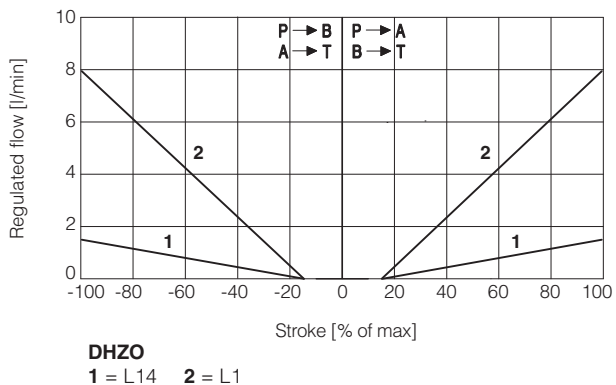
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13	NAS1638 class 7
	longer life	ISO4406 class 16/14/11	NAS1638 class 5
			see also filter section at www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

10 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

10.1 Regulation diagrams - values measure at Δp 30 bar P-T



Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

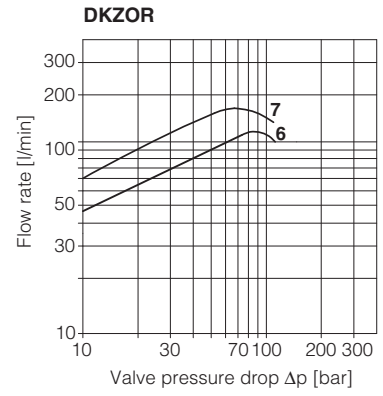
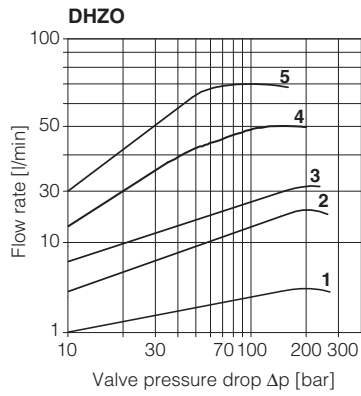
10.2 Flow / Δp diagrams - stated at 100% of valve stroke

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5

DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5



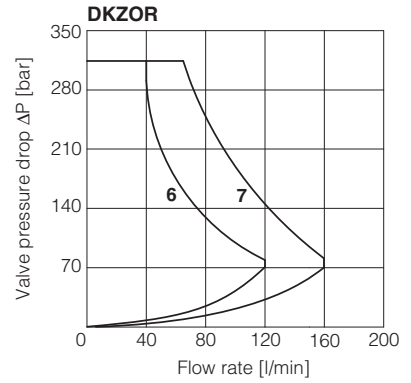
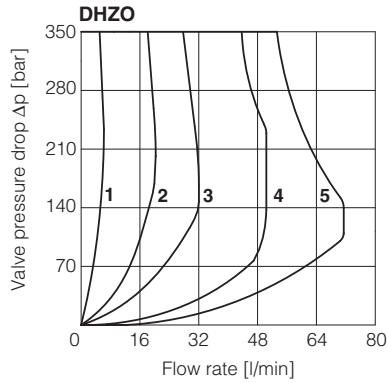
10.3 Operating limits

DHZO

- 1 = spool L14
- 2 = spool L1
- 3 = spool S2
- 4 = spool L3, S3, D3
- 5 = spool L5, S5, D5

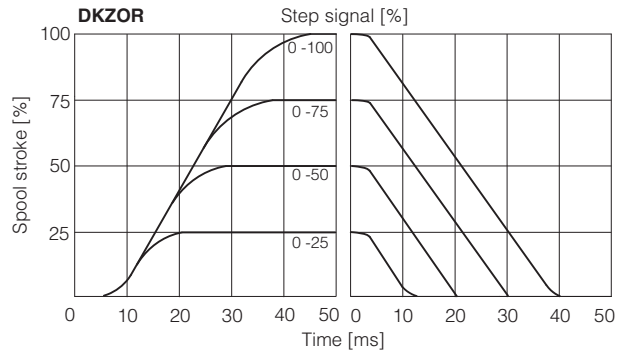
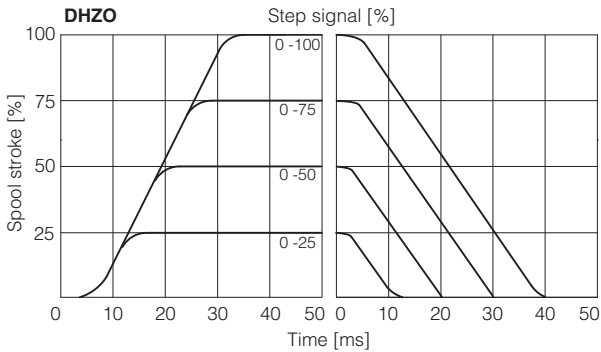
DKZOR

- 6 = spool S3, L3, D3
- 7 = spool S5, L5, D5



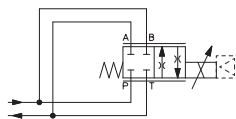
10.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



10.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option Y advisable)



Max flow $\Delta p = 15 \text{ bar}$ [l/min]	SPOOL TYPE				
	L14	L1	S2	L3 S3	L5 S5
DHZO	4	16	28	60	100
DKZOR	-	-	-	160	200

11 HYDRAULIC OPTIONS

- B** = DHZO-05 and DKZOR-15 = solenoid and on-board digital driver at side of port A.
DHZO-07 and DKZOR-17 = on-board digital driver at side of port A.
- Y** = External drain advisable when the valve is used in double flow path, see section 10.5.
This option is mandatory if the pressure in port T exceeds 210 bar.

Hand lever option - only for **DHZO-A** with spool type S3, S5, D3, D5, L3, L5.

It allows to operate the valve in absence of electrical power supply.

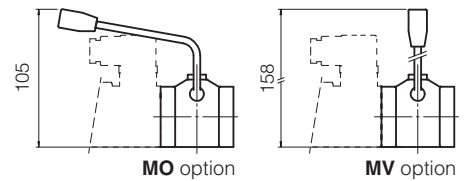
For detailed description of DHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

BMO = Horizontal hand lever installed at side of port A

MV = Vertical hand lever

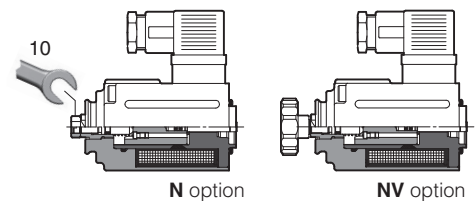
BMV = Vertical hand lever installed at side of port A



The following supplementary options allow to operate **DHZO-A** and **DKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



12 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.

The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see 15.6

Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 15.2

C = Only in combination with option /W

This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

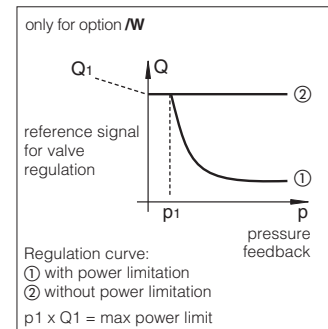
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.

It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power $p \times Q$ (TR x INPUT+) reaches the max power limit ($p_1 \times Q_1$), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation



13 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu\text{F}/40\text{ V}$ capacitance to single phase rectifiers or a 4700 $\mu\text{F}/40\text{ V}$ capacitance to three phase rectifiers. In case of separate power supply see 15.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu\text{F}/40\text{ V}$ capacitance to single phase rectifiers or a 4700 $\mu\text{F}/40\text{ V}$ capacitance to three phase rectifiers. The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are $\pm 10\text{ V}_{\text{DC}}$ for standard and $4 \div 20\text{ mA}$ for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of $\pm 10\text{ V}_{\text{DC}}$ or $\pm 20\text{ mA}$. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24\text{V}_{\text{DC}}$.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, default settings is $\pm 5\text{ V}_{\text{DC}}$ ($1\text{V} = 1\text{A}$). Output signal can be reconfigured via software, within a maximum range of $\pm 5\text{ V}_{\text{DC}}$.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure. The output maximum range is $\pm 5\text{ V}_{\text{DC}}$; default setting is $0 \div 5\text{ V}_{\text{DC}}$.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{DC} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for $4 \div 20\text{ mA}$ input, etc.). Fault presence corresponds to 0 V_{DC} , normal working corresponds to 24 V_{DC} . Fault status is not affected by the Enable input signal.

15.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 16.4). Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10\text{ V}_{\text{DC}}$ for standard and $4 \div 20\text{ mA}$ for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of $\pm 10\text{ V}_{\text{DC}}$ or $\pm 20\text{ mA}$. Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is ± 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE		Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
4	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR		Monitor output signal: ± 5 Vdc maximum range, referred to V0 Default is ± 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC		Do not connect	
8	NC		Do not connect	
		MONITOR2	2nd monitor output signal: ± 5 Vdc maximum range, referred to V0. Default is $0 \div 5$ Vdc	Output - analog signal
9	VL+		Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	V0		Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to V0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect V0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

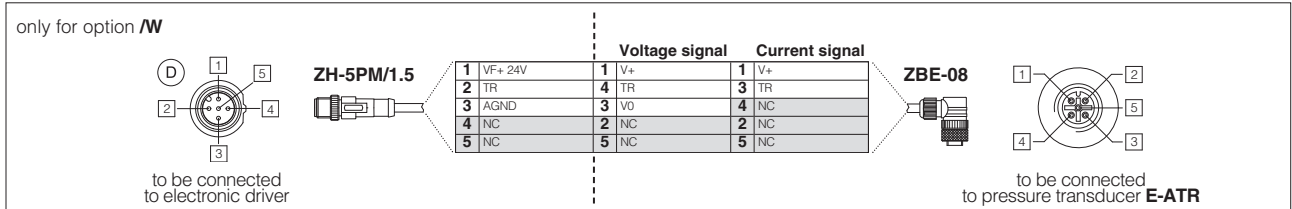
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vdc / ± 20 mA, software selectable Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example

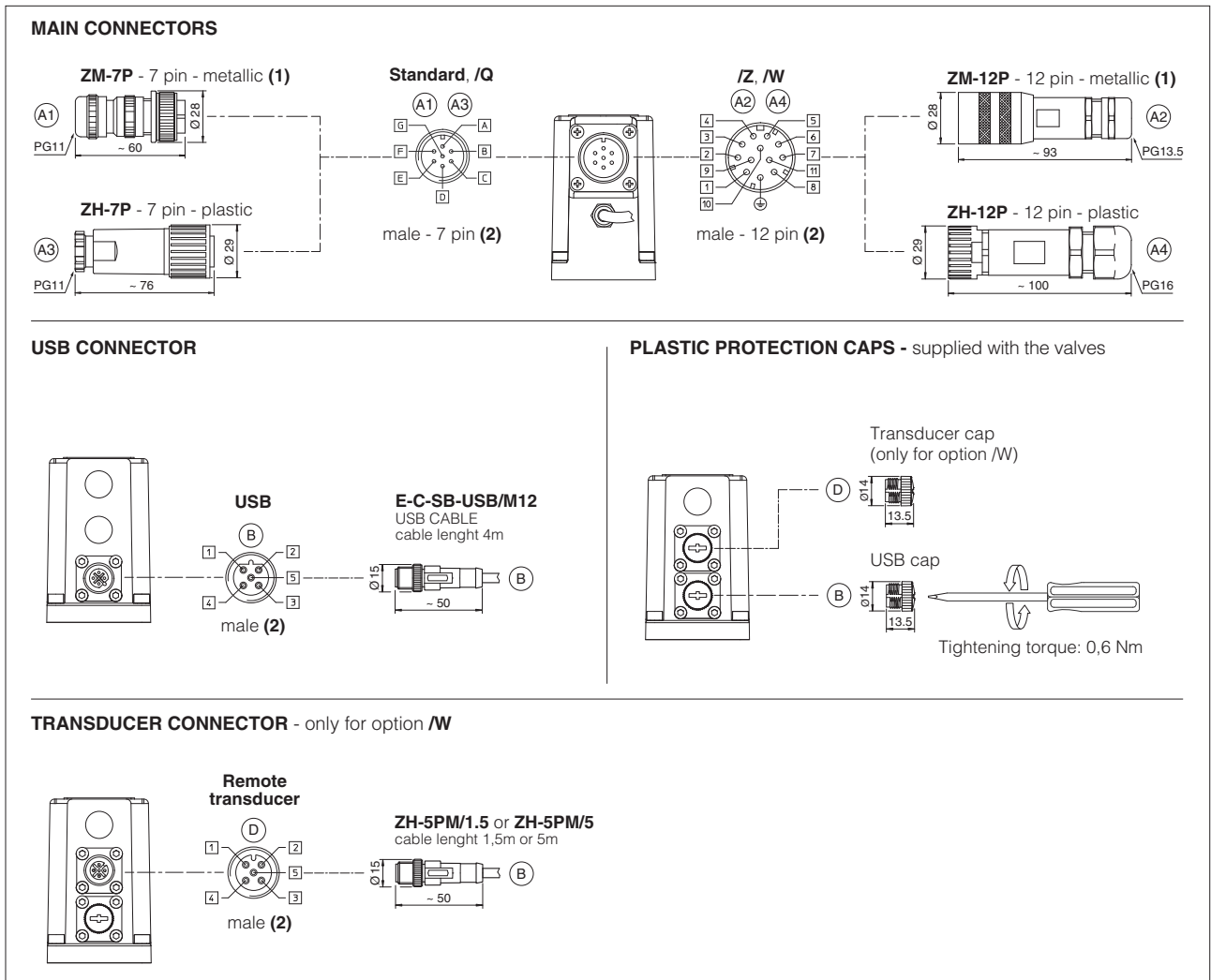


Note: connectors front view

16.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

16.6 AEB connections layout

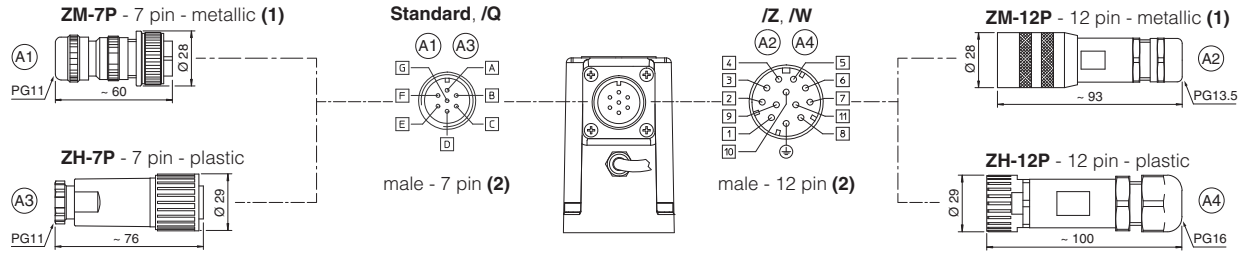


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

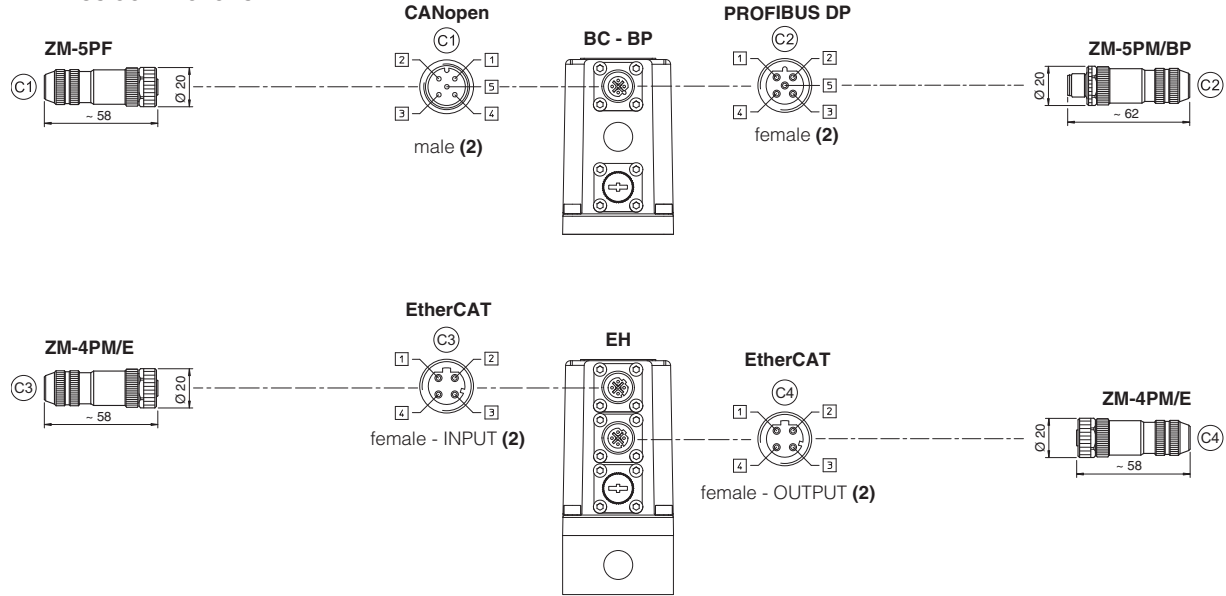
(2) Pin layout always referred to driver's view

16.7 AES connections layout

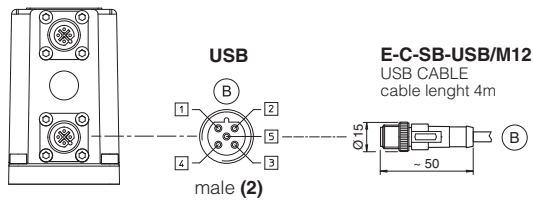
MAIN CONNECTORS



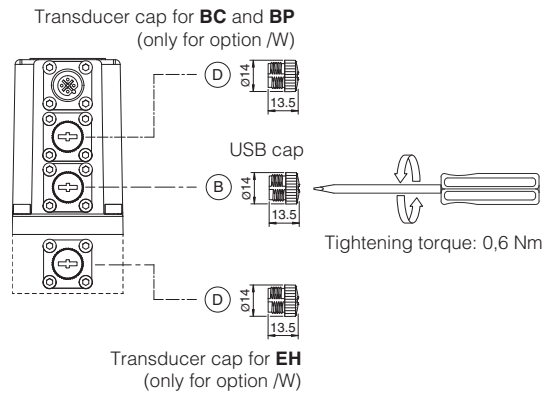
FIELDBUS CONNECTORS



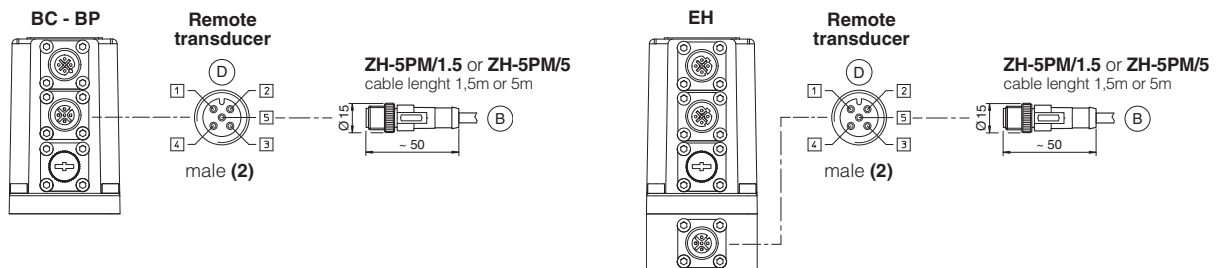
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

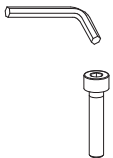

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

17.4 Pressure transducer connectors - only for /W option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables	
	1,5 m lenght	5 m lenght
Cable	5 x 0,25 mm ²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

18 FASTENING BOLTS AND SEALS

	DHZO Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	DKZOR Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	 Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø 3,2 mm (only for /Y option)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm (only for /Y option)

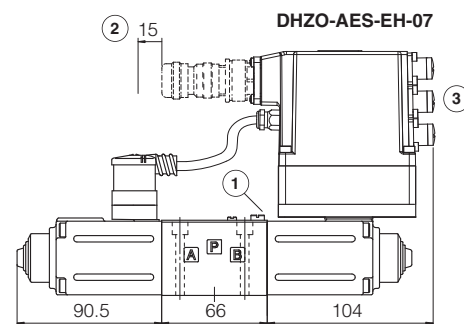
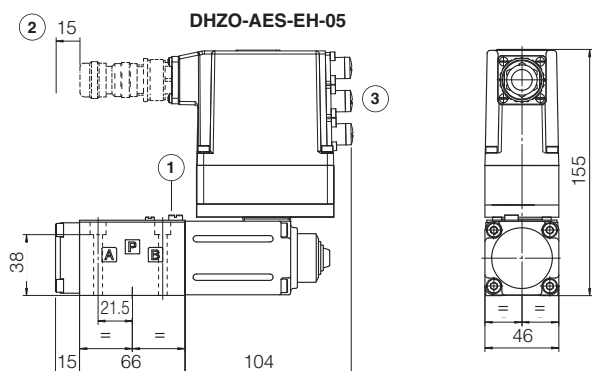
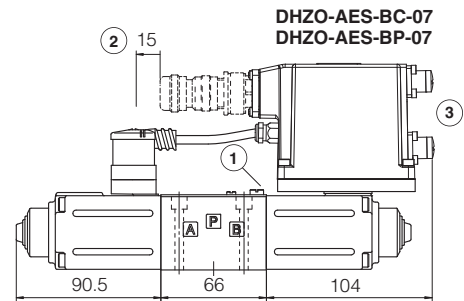
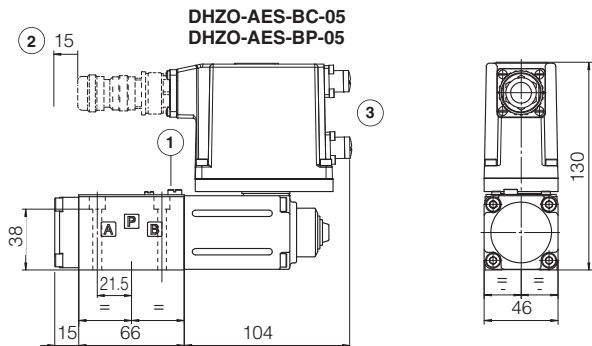
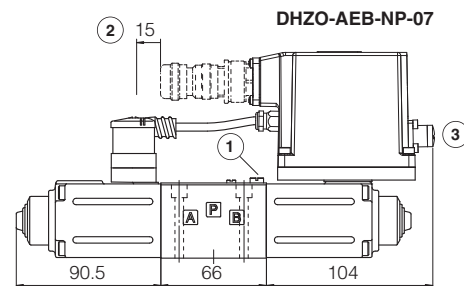
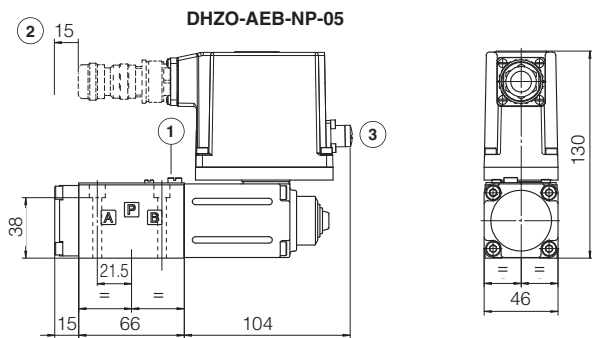
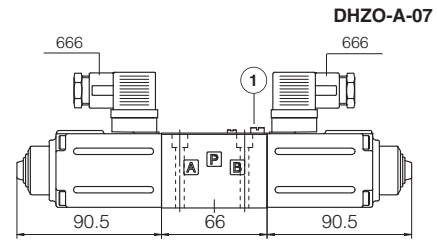
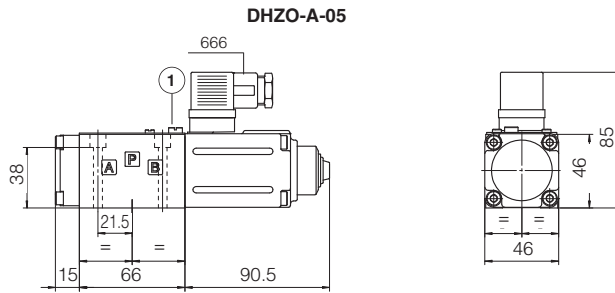
19 INSTALLATION DIMENSIONS FOR DHZO [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)

(for /Y version, surface 4401-03-03-0-05 without X port)

	Mass [kg]		
	A	AEB, AES	AES-EH
DHZO-*-05	1,9	2,3	2,4
DHZO-*-07	2,6	3,1	3,2



- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

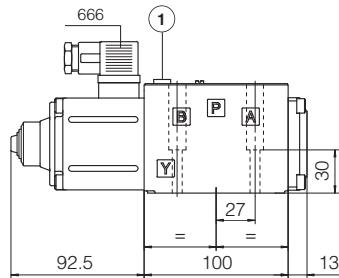
Note: for option /B the solenoid and the on-board digital driver are at side of port A

20 INSTALLATION DIMENSIONS FOR DKZOR [mm]

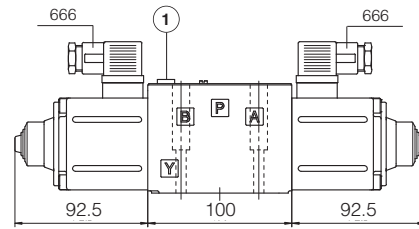
ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05 (see table P005)
 (for /Y version, surface 4401-05-05-0-05 without X port)

	Mass [kg]		
	A	AEB, AES	AES-EH
DKZOR-*-15	3,8	4,3	4,4
DKZOR-*-17	4,5	5,0	5,1

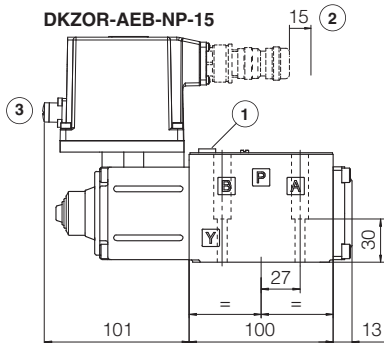
DKZOR-A-15



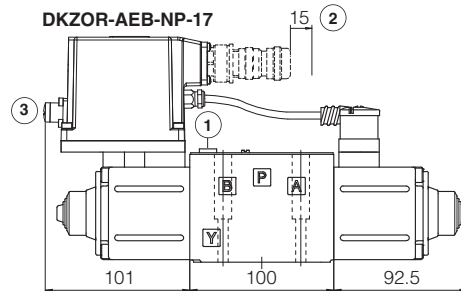
DKZOR-A-17



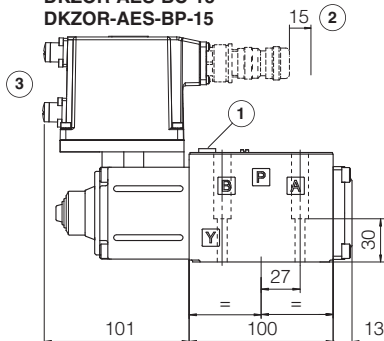
DKZOR-AEB-NP-15



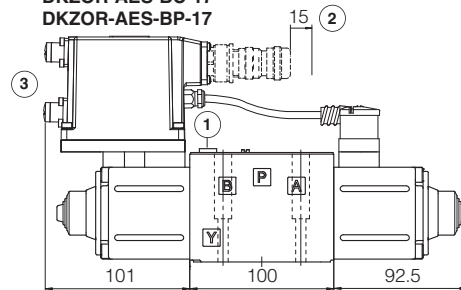
DKZOR-AEB-NP-17



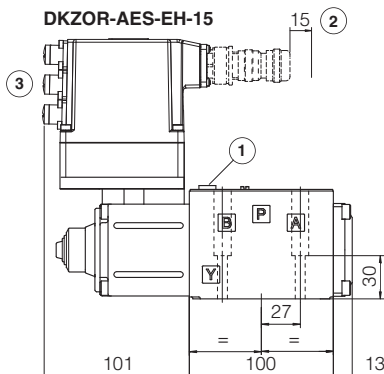
DKZOR-AES-BC-15
DKZOR-AES-BP-15



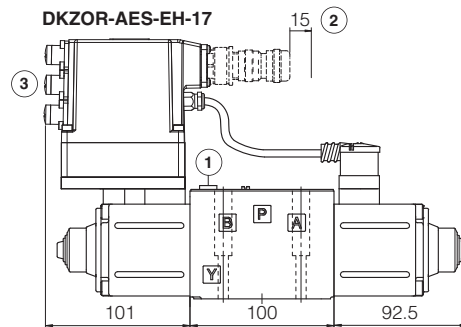
DKZOR-AES-BC-17
DKZOR-AES-BP-17



DKZOR-AES-EH-15



DKZOR-AES-EH-17



- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

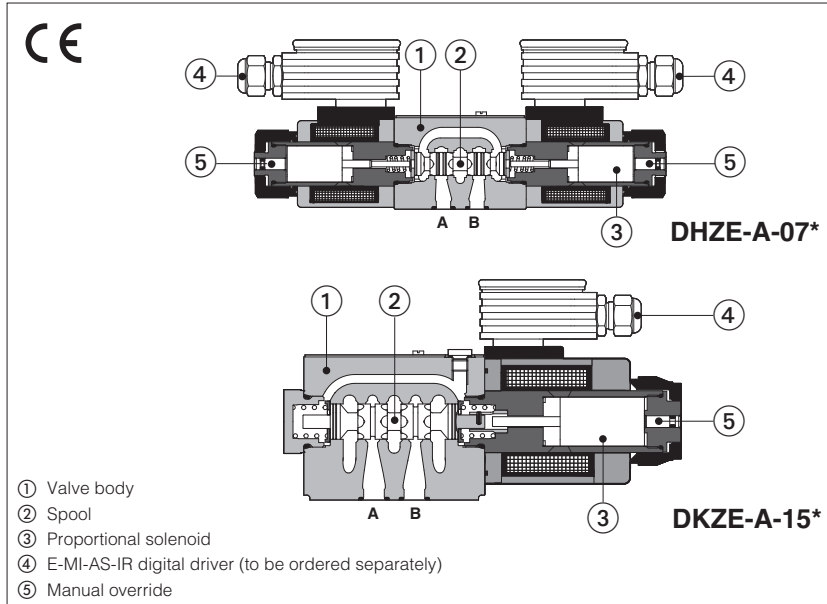
Note: for option /B the solenoid and the on-board digital driver are at side of port A

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
G010	E-MI-AC analog driver	P005	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	QB100	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	QF100	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Proportional directional valves

direct, without transducer



DHZE-A, DKZE-A

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

Spool regulation characteristics:

- L = linear
- S = progressive
- D = differential-progressive

Valve body characteristics:

- 3 chambers type for DHZE
- 5 chambers type for DKZE

The solenoids are certified according to North American standard **cURus**.

DHZE:

Size: **06** - ISO 4401
 Max flow: **70 l/min**
 Max pressure: **350 bar**

DKZE:

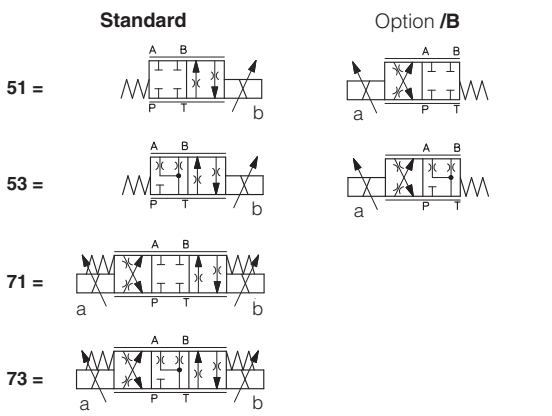
Size: **10** - ISO 4401
 Max flow: **160 l/min**
 Max pressure: **315 bar**

1 MODEL CODE

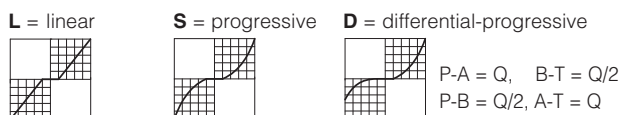
DHZE	-	A	-	0	71	-	S	5	/	*	-	*	/	*	/	*	/	*	
DHZE = size 06 DKZE = size 10		A = for off-board driver, see section 2		Valve size ISO 4401: 0 = 06 1 = 10		Configuration: Standard Option /B		51 =		53 =		71 =		73 =		Seals material, see section 7 : - = NBR PE = FKM BT = HNBR		Coil voltage, see section 10 : - = standard coil for 24 Vdc Atos drivers 6 = optional coil for 12 Vdc Atos drivers 18 = optional coil for low current drivers	

Valve size ISO 4401:
 0 = 06 1 = 10

Configuration:



Spool type, regulating characteristics:



Coil with special connectors, see section 12 :

- = omit for standard DIN connector
- J** = AMP Junior Timer connector
- K** = Deutsch connector
- S** = Lead Wire connection

Hydraulic options:

B = solenoid at side of port A (only for valve configuration 5)

Hand lever options (1):

- MO** = horizontal hand lever
- MV** = vertical hand lever
- BMO** = horizontal hand lever installed at side of port A
- BMV** = vertical hand lever installed at side of port A

Spool size:	14 (L)	1 (L)	3 (L,S,D)	5 (L,S,D)
DHZE =	1	4,5	17	28
DKZE =	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

(1) Only for DHZE with spool type S3, S5, D3, D5, L3, L5

2 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog			Digital			
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS

Valve model	DHZE				DKZE	
Pressure limits [bar]	ports P, A, B = 350; T = 210				ports P, A, B = 315; T = 210	
Spool type and size	L14	L1	S3, L3, D3	S5, L5, D5	S3, L3, D3	S5, L5, D5
Nominal flow (1) [l/min]						
at Δp = 10 bar (P-T)	1	4,5	18	28	45	60
at Δp = 30 bar (P-T)	1,7	8	30	50	80	105
at Δp = 70 bar (P-T)	3	12	45	70	120	160
Response time (2) [ms]	≤ 30				≤ 40	
Hysteresis [%]	5 [% of max regulation]					
Repeatability [%]	± 1 [% of max regulation]					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2; the flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations; to keep constant the regulated flow under different load conditions, modular pressure compensators are available - see tech. table D150

(1) For different Δp, the max flow is in accordance to the diagrams in sections 8.2 and 9.2

(2) 0-100% step signal

6 ELECTRICAL CHARACTERISTICS

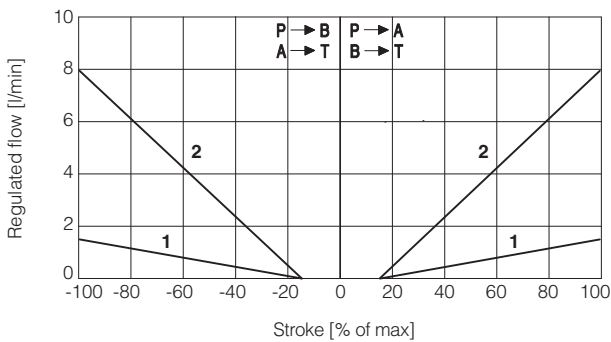
Max power consumption	DHZE			DKZE		
	30 W			35 W		
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	IP65 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Certification	cURus North American Standard					

7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

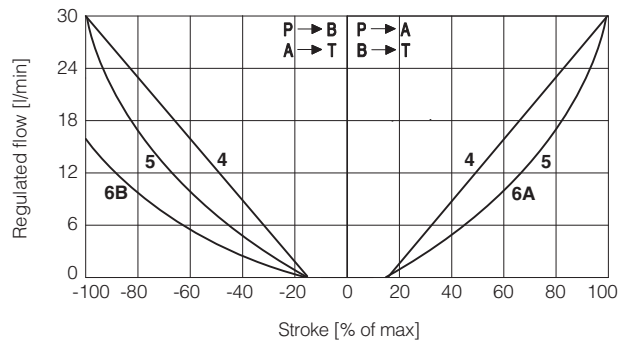
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS FOR DHZE (based on mineral oil ISO VG 46 at 50 °C)

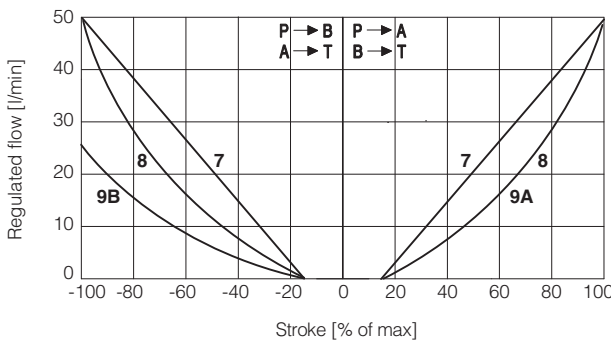
8.1 Regulation diagrams



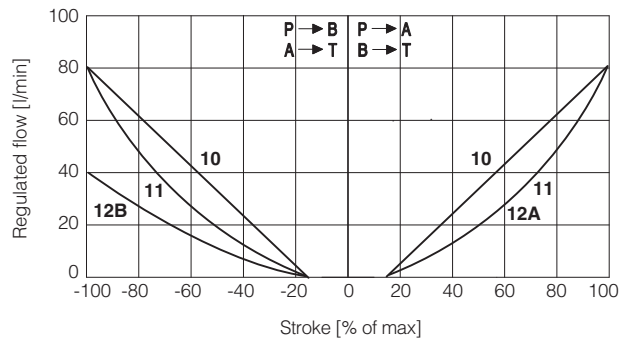
DHZE
1 = L14 2 = L1



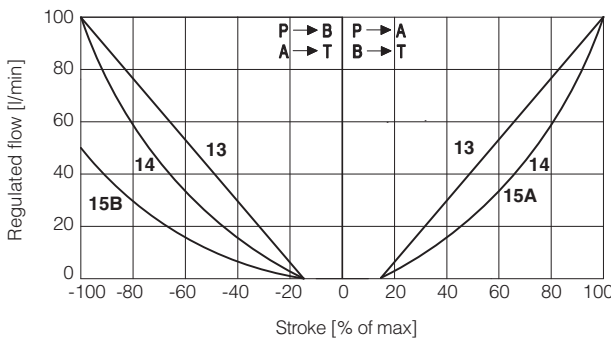
DHZE
4 = L3 5 = S3 6A = D3 (P → A, A → T)
6B = D3 (P → B, B → T)



DHZE
7 = L5 8 = S5 9A = D5 (P → A, A → T)
9B = D5 (P → B, B → T)



DKZE
10 = L3 11 = S3 12A = D3 (P → A, A → T)
12B = D3 (P → B, B → T)



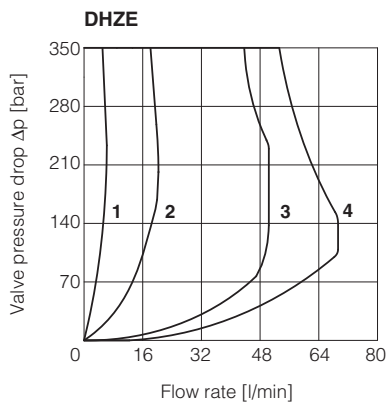
DKZE
13 = L5 14 = S5 15A = D5 (P → A, A → T)
15B = D5 (P → B, B → T)

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

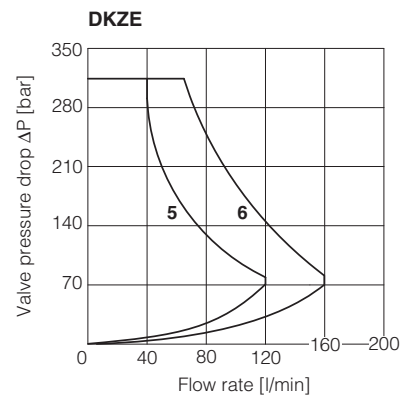
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

8.2 Operating limits



- 1 = spool L14
- 2 = spool L1
- 3 = spool L3, S3, D3
- 4 = spool L5, S5, D5



- 5 = spool S3, L3, D3
- 6 = spool S5, L5, D5

9 HYDRAULIC OPTIONS

B = DHZE-05 and DKZE-15 = solenoid at side of port A of the main stage.
 DHZO-07 and DKZE-17 = E-MI-AS-IR electronics at side of port A of the main stage.

Hand lever option - only for **DHZE** with spool type S3, S5, D3, D5, L3, L5.

It allows to operate the valve in absence of electrical power supply.

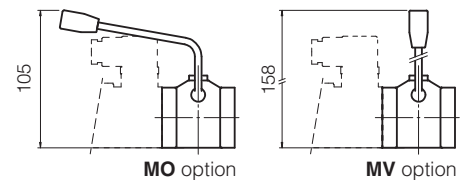
For detailed description of DHZE with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

BMO = Horizontal hand lever installed at side of port A

MV = Vertical hand lever

BMV = Vertical hand lever installed at side of port A



10 COIL VOLTAGE OPTIONS

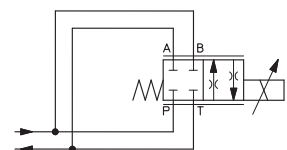
6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

11 OPERATION AS THROTTLE VALVE

Single solenoid valves
 DHZE-A-051 and DKZE-A-151
 can be used as simple throttle valves:
 $P_{max} = 210$ bar

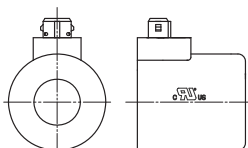
Max flow $\Delta p = 15$ bar [l/min]	SPOOL TYPE					
	L14	L1	L3	S3	L5	S5
DHZE	4	16	60	100		
DKZE	-	-	160	200		



12 COILS WITH SPECIAL CONNECTORS

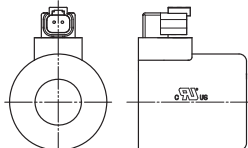
J option

Coil type COZEJ (DHZE)
 Coil type CAZEJ (DKZE)
 AMP Junior Timer connector
 Protection degree IP67



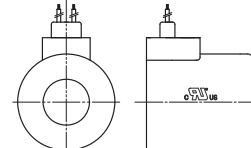
K option

Coil type COZEK (DHZE)
 Coil type CAZEK (DKZE)
 Deutsch connector, DT-04-2P male
 Protection degree IP67

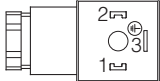


S option

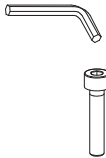

Coil type COZES (DHZE)
 Coil type CAZES (DKZE)
 Lead Wire connection
 Cable length = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

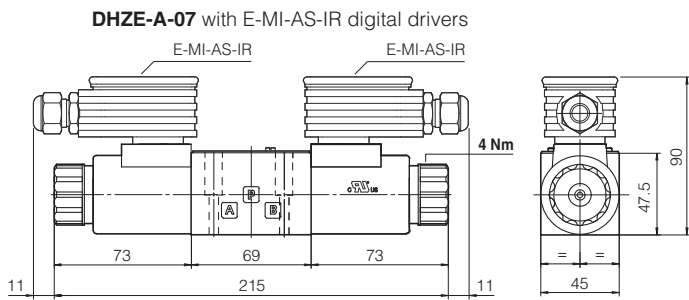
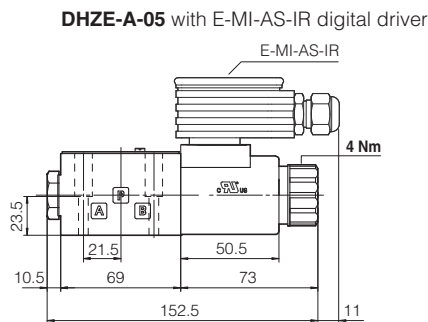
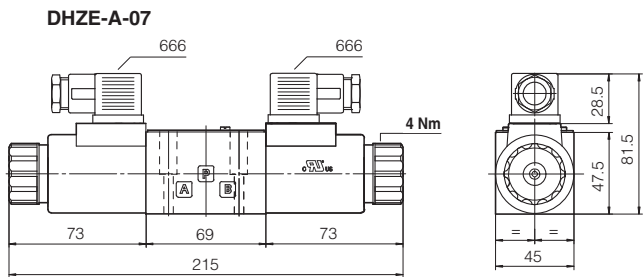
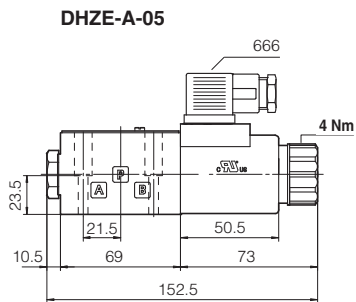
14 FASTENING BOLTS AND SEALS

	DHZE	DKZE
	Fastening bolts: 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR DHZE [mm]

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]	
DHZE-A-05	1,5
DHZE-A-07	2
DHZE-A-05 with E-MI-AS-IR	2
DHZE-A-07 with E-MI-AS-IR	3

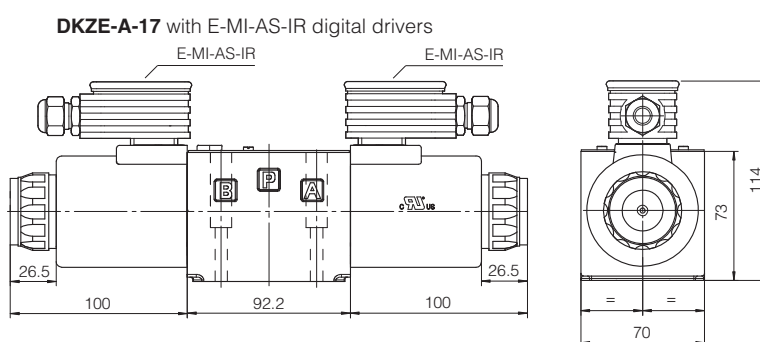
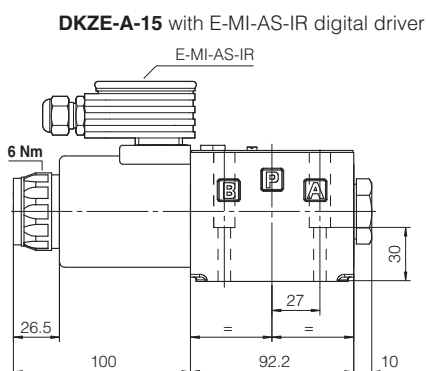
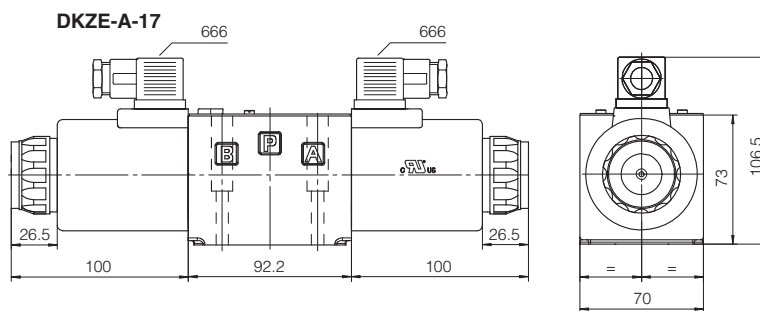
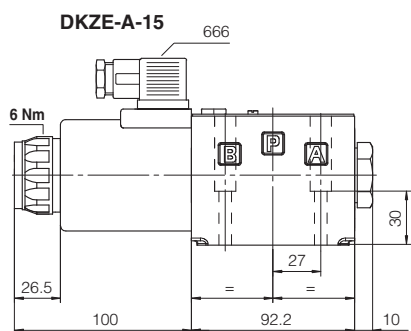


Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

16 INSTALLATION DIMENSIONS FOR DKZE [mm]

ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05 (see table P005)

Mass [kg]	
DKZE-A-15	4,5
DKZE-A-17	6,1
DKZE-A-15 with E-MI-AS-IR	5
DKZE-A-17 with E-MI-AS-IR	7,1



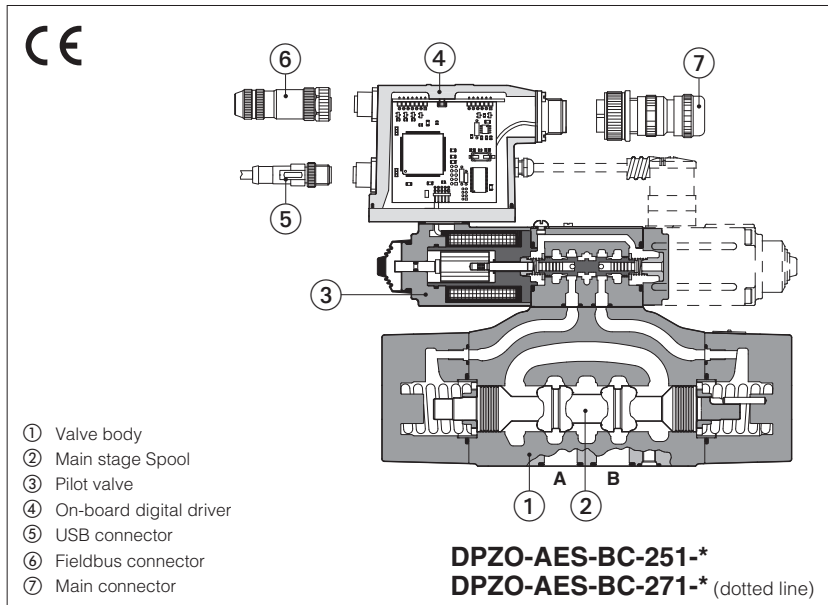
Note: for option /B the solenoid is at side of port A (only for DHZE-A-05 and DKZE-A-15)

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		
GS050	E-BM-AES digital driver		

Digital proportional directional valves

piloted, without transducer, with positive spool overlap



DPZO-A, DPZO-AEB, DPZO-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10 ÷ 32** - ISO 4401

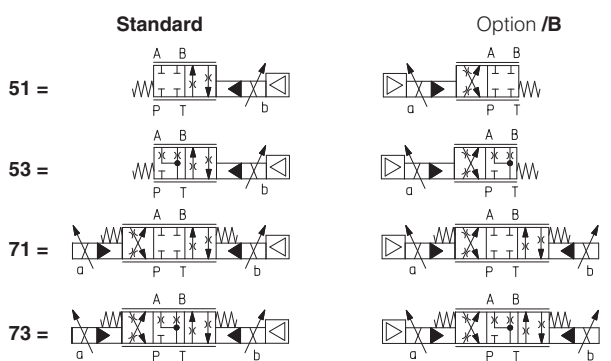
Max flow: **180 ÷ 1500 l/min**

Max pressure: **350 bar**

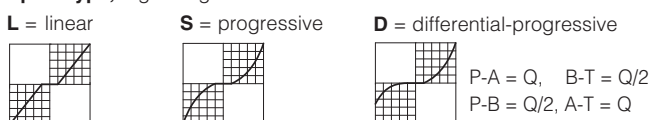
1 MODEL CODE

DPZO	-	AES	-	BC	-	2		71	-	L		5	/	*	/	*	/	*	/	*
Proportional directional valve, piloted																				
A = for off-board driver, see section 2 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)																				
Fieldbus interfaces , USB port always present (5): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT																				
Valve size ISO 4401: 1 = 10 2 = 16 4 = 25 6 = 32																				
																		Seals material , see section 8: - = NBR PE = FKM BT = HNBR		
																		Series number		
																		Coil voltage , only for A - see section 14: - = standard coil for 24Vdc Atos drivers 6 = optional coil for 12Vdc Atos drivers 18 = optional coil for low current drivers		

Configuration (3):



Spool type, regulating characteristics:



Hydraulic options (4):

- B** = solenoid and on-board digital driver at side of port B of the main stage (side A of pilot valve)
- D** = internal drain
- E** = external pilot pressure
- G** = pressure reducing valve for piloting

Electronics options, only for AEB and AES (4):

- C** = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 Vdc) - only for **W**
- I** = current reference input 4÷20 mA (omit for std voltage ±10 Vdc)
- Q** = enable signal
- Z** = double power supply, enable, fault and monitor signals -12 pin connector
- W** = power limitation function - 12 pin connector

Spool size: 3 (L,S,D) 5 (L,S,D)

DPZO-1 =	-	100
DPZO-2 =	160	250
DPZO-4 =	-	480
DPZO-6 =	-	640

Nominal flow (l/min) at Δp 10bar P-T

(1) Only for NP

(2) Only for BC, BP, EH

(3) Hydraulic symbols are represented with on-board digital driver

(4) For possible combined options, see section 13

(5) Omit for A execution

2 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (Vdc)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

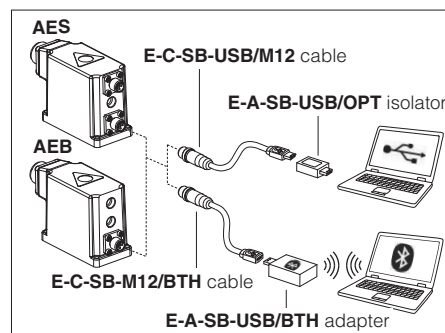


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2		DPZO-*-4	DPZO-*-6
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 with internal drain /D) Y = 10				
Spool type	L5, S5, D5	L3, S3, D3		L5, S5, D5	
Nominal flow Δp P-T [l/min] (1)					
Δp= 10 bar	100	160	250	480	640
Δp= 30 bar	160	270	430	830	1100
Max permissible flow	180	400	550	900	1500
Piloting pressure [bar]	min = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume [cm³]	1,4	3,7		9,0	21,6
Piloting flow (2) [l/min]	1,7	3,7		6,8	14,4
Leakage (3) [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time (4) [ms]	≤ 80	≤ 100		≤ 120	≤ 180
Hysteresis	≤ 5 [% of max regulation]				
Repeatability	± 1 [% of max regulation]				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **2**

(1) For different Δp, the max flow is in accordance to the diagrams in section 9.2

(2) With step reference input signal 0 ÷ 100 %

(3) At p = 100/350 bar

(4) 0-100% step signal

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,2 A	2,75 A	1 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 Vdc @ max 5 mA			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply (only for /W option)	+24Vdc @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

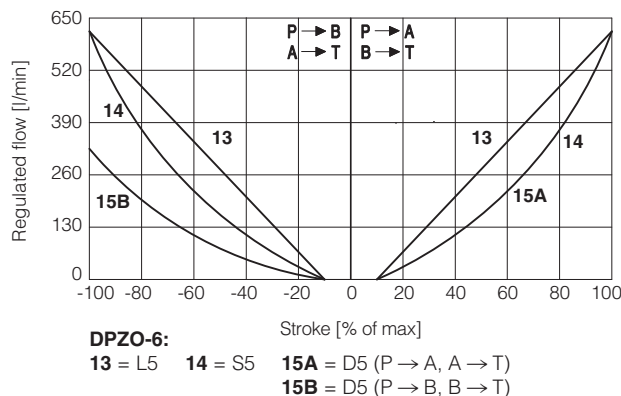
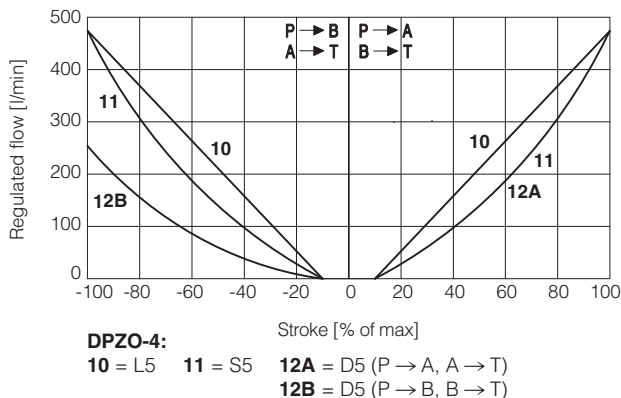
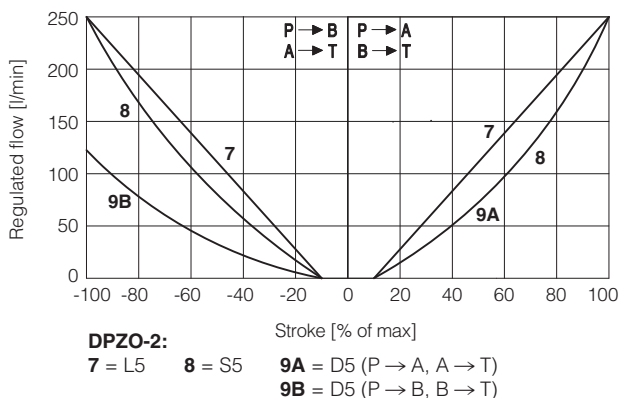
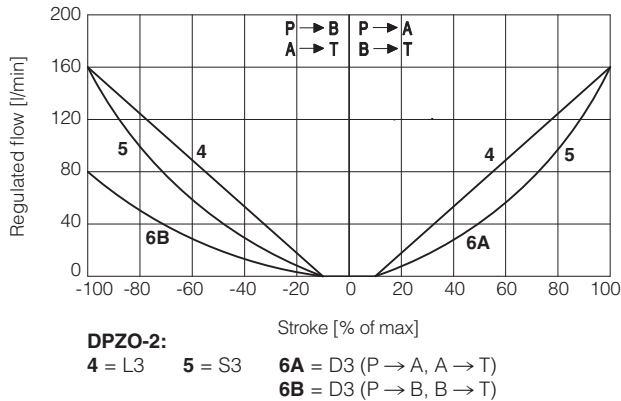
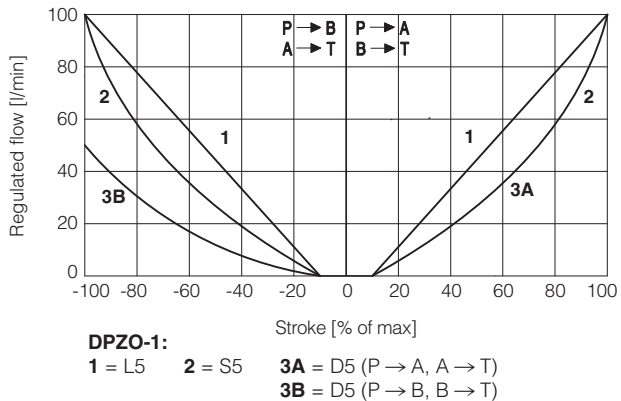
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

10 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

10.1 Regulation diagrams (values measure at Δp 10 bar P-T)



Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

10.2 Flow / Δp diagram

stated at 100% of spool stroke

DPZO-1:

1 = spools L5, S5, D5

DPZO-2:

2 = spools L3, S3, D3

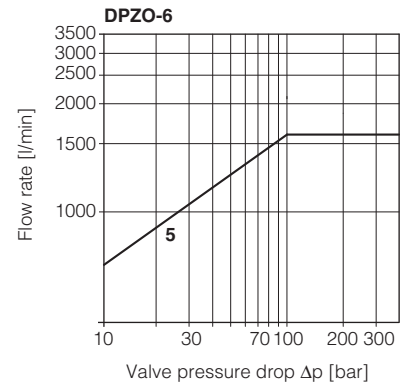
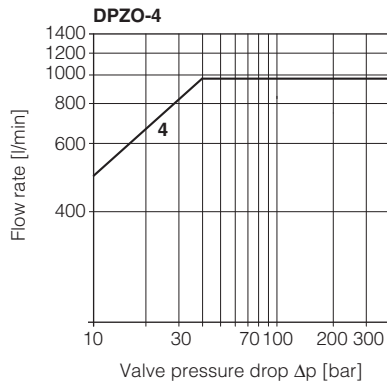
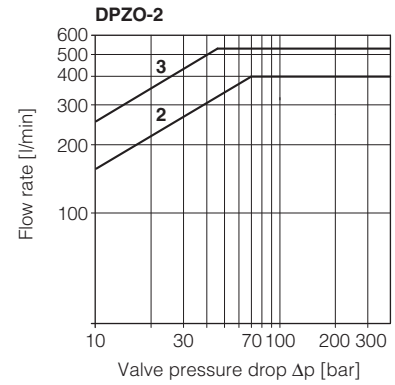
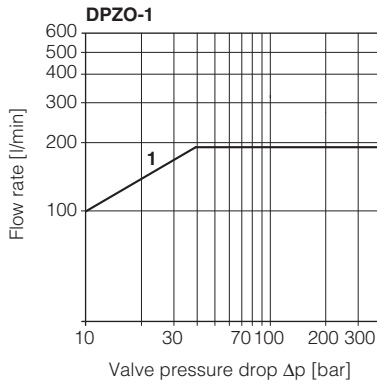
3 = spools L5, S5, D5

DPZO-4:

4 = spools L5, S5, D5

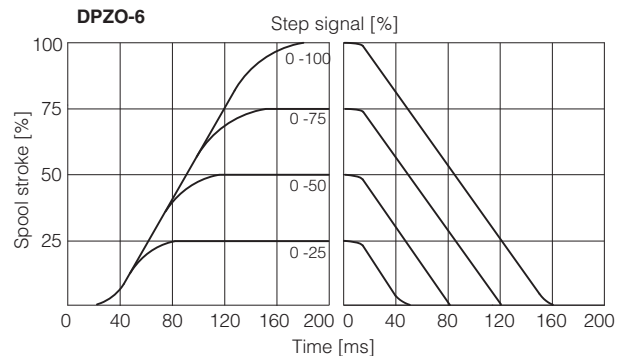
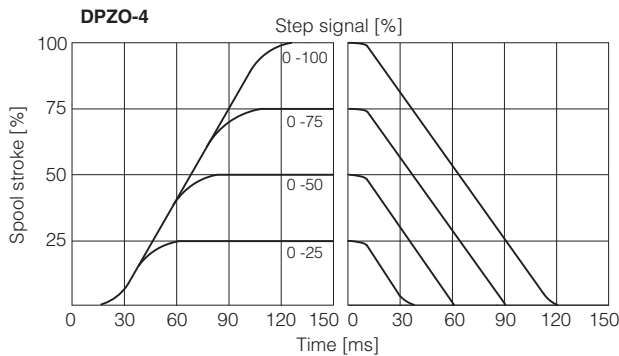
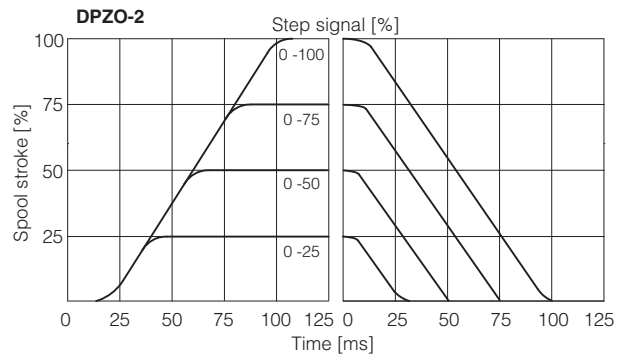
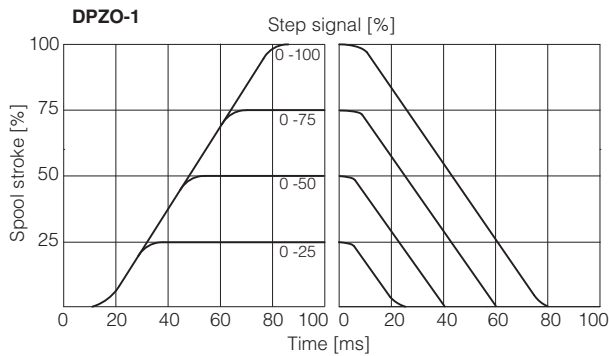
DPZO-6:

5 = spools L5, S5, D5



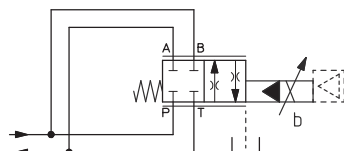
10.3 Response time (measured at pilot pressure = 100 bar)

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.



10.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
 $P_{max} = 250 \text{ bar}$
 For this application, the use of valve -TEB or -TES (see tab. FS172) is advisable (consult our technical office)



DPZO-*	151-L5	251-L5	451-L5	651-L5
Max flow [l/min]	320	860	1600	2200
$\Delta p = 15 \text{ bar}$				

11 HYDRAULIC OPTIONS

- B** = DPZO-*-*5 = solenoid and on-board digital driver at side B of the main stage (side A of pilot valve).
 DPZO-*-*7 = on-board digital driver at side of port B of the main stage (side A of pilot valve).
- D** = Internal drain.
 Pilot and drain configuration can be modified as shown in section 18.
 The valve's standard configuration provides internal pilot and external drain.
- E** = External pilot (through port X).
 Pilot and drain configuration can be modified as shown in section 18.
 The valve's standard configuration provides internal pilot and external drain.
- G** = Standard for size 10.
 Pressure reducing valve installed between pilot valve and main body with fixed setting:
 DPZO-1 and DPZO-2 = **40 bar**
 DPZO-4 and DPZO-6 = **100 bar**
 It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

12 ELECTRONICS OPTIONS - only for AEB and AES

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 Vdc.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.
 It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver.
 Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
 The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 15.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 15.2
- C** = Only in combination with option /W
 This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 Vdc.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.
- W** = Only for valves coupled with pressure compensator, see tech table D150.
 It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR. When the actual requested hydraulic power $p \times Q$ (TR x INPUT+) reaches the max power limit ($p_1 \times Q_1$), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

13 POSSIBLE COMBINED OPTIONS

- Hydraulic options:** all combination possible
Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 Vdc.
18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 Vdc and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
 The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



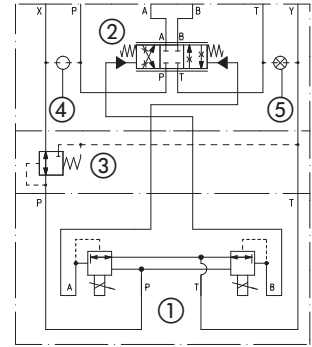
A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
 Reference input signal is factory preset according to selected valve code, defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.
 Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vdc.

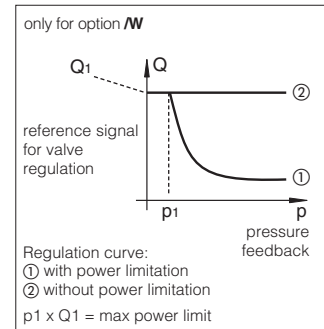
Functional Scheme

Example of configuration 7*
 3 positions, spring centered



- ① Pilot valve
 ② Main stage
 ③ Pressure reducing valve
 ④ Plug to be added for external pilot trough port X
 ⑤ Plug to be removed for internal drain through port T

Hydraulic Power Limitation



13 POSSIBLE COMBINED OPTIONS

- Hydraulic options:** all combination possible
Electronics options: /IQ, /IZ, /IW, /CW, /CWI

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 Vdc.
18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 Vdc and with max current limited to 1A.

15 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
 The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

15.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
 Reference input signal is factory preset according to selected valve code, defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /I option.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.
 Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vdc.

15.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
 Monitor output signal is factory preset according to selected valve code, default settings is $\pm 5 V_{DC}$ ($1V = 1A$).
 Output signal can be reconfigured via software, within a maximum range of $\pm 5 V_{DC}$.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
 The output maximum range is $\pm 5 V_{DC}$; default setting is $0 \div 5 V_{DC}$.

15.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a $24 V_{DC}$ on pin 3 (pin C); Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
 Enable input signal can be used as generic digital input by software selection.

15.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for $4 \div 20$ mA input, etc.).
 Fault presence corresponds to $0 V_{DC}$, normal working corresponds to $24 V_{DC}$.
 Fault status is not affected by the Enable input signal.

15.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 16.4).
 Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10 V_{DC}$ for standard and $4 \div 20$ mA for /C option.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of $\pm 10 V_{DC}$ or ± 20 mA.
 Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

16 ELECTRONIC CONNECTIONS

16.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply $24 V_{DC}$	Input - power supply
B	V0		Power supply $0 V_{DC}$	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable ($24 V_{DC}$) or disable ($0 V_{DC}$) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: $\pm 10 V_{DC}$ / ± 20 mA maximum range Defaults are $\pm 10 V_{DC}$ for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR	referred to: AGND V0	Monitor output signal: $\pm 5 V_{DC}$ maximum range Default is $\pm 5 V_{DC}$ ($1V = 1A$)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

16.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply $24 V_{DC}$	Input - power supply
2	V0		Power supply $0 V_{DC}$	Gnd - power supply
3	ENABLE		Enable ($24 V_{DC}$) or disable ($0 V_{DC}$) the driver, referred to V0	Input - on/off signal
4	INPUT+		Reference input signal: $\pm 10 V_{DC}$ / ± 20 mA maximum range Defaults are $\pm 10 V_{DC}$ for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR		Monitor output signal: $\pm 5 V_{DC}$ maximum range, referred to V0 Default is $\pm 5 V_{DC}$ ($1V = 1A$)	Output - analog signal Software selectable
7	NC		Do not connect	
8	NC		Do not connect	
		MONITOR2	2nd monitor output signal: $\pm 5 V_{DC}$ maximum range, referred to V0. Default is $0 \div 5 V_{DC}$	Output - analog signal
9	VL+		Power supply $24 V_{DC}$ for driver's logic and communication	Input - power supply
10	V0		Power supply $0 V_{DC}$ for driver's logic and communication	Gnd - power supply
11	FAULT		Fault ($0 V_{DC}$) or normal working ($24 V_{DC}$), referred to V0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect V0 before VL+ when the driver is connected to PC USB port

16.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

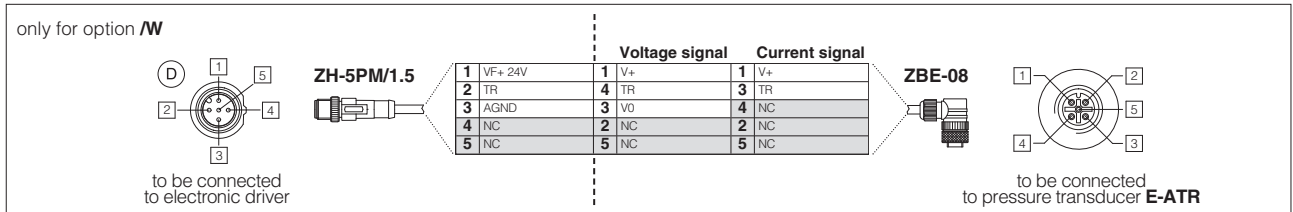
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

16.4 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vdc / ± 20 mA, software selectable Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example

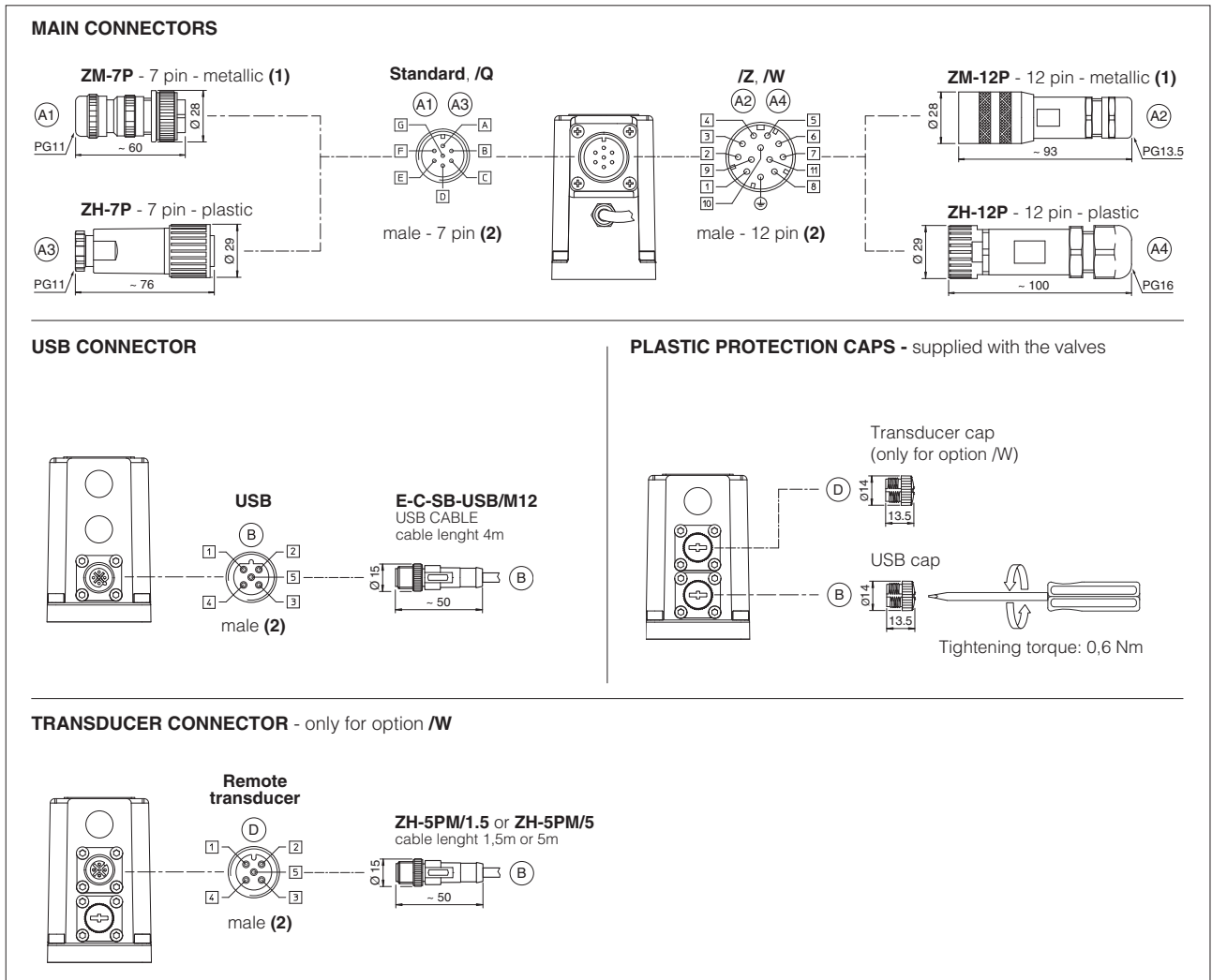


Note: connectors front view

16.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

16.6 AEB connections layout

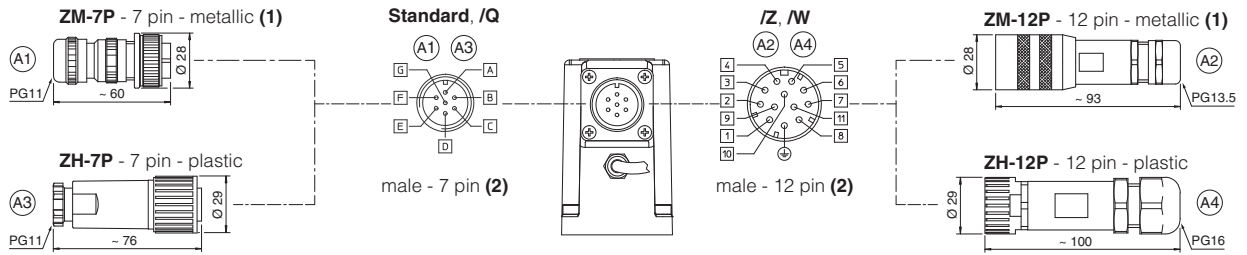


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

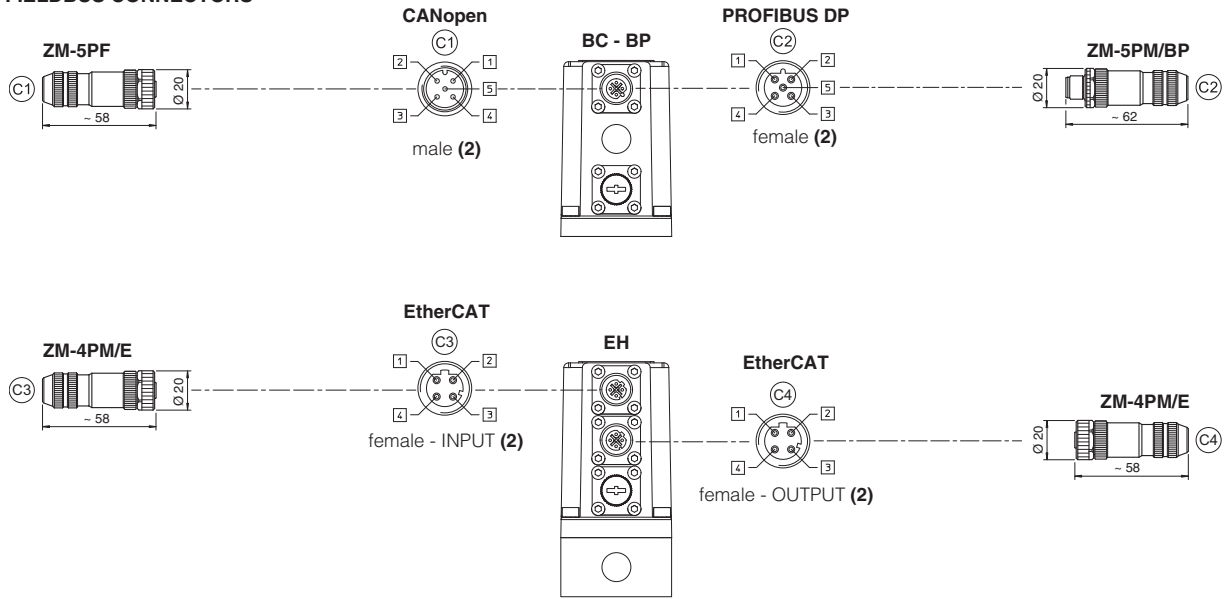
(2) Pin layout always referred to driver's view

16.7 AES connections layout

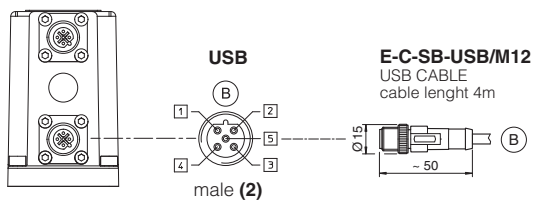
MAIN CONNECTORS



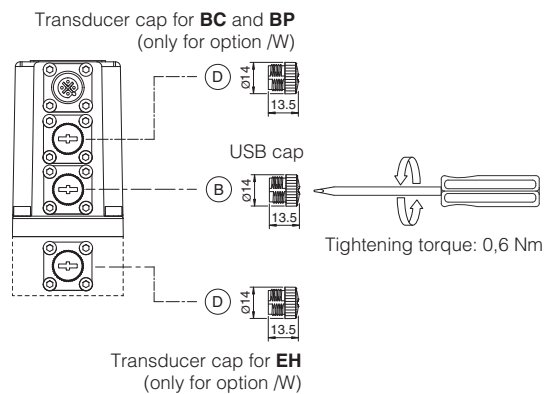
FIELDBUS CONNECTORS



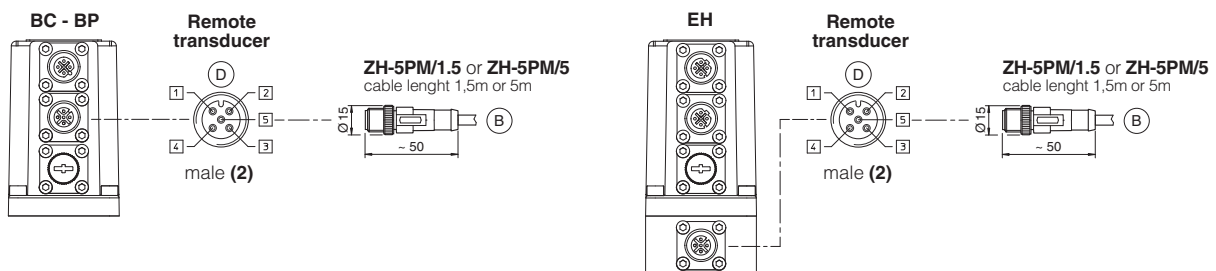
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

17.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

17.4 Pressure transducer connectors - only for IW option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght	
Cable	5 x 0,25 mm ²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

18 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain

DPZO-1	Pilot channels	Drain channels	<p>Internal piloting: blinded plug SP-X300F ① in X; External piloting: blinded plug SP-X300F ② in Pp; Internal drain: blinded plug SP-X300F ③ in Y; External drain: blinded plug SP-X300F ④ in Dr.</p>
DPZO-2	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X300F ①; External piloting: Add blinded plug SP-X300F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-4	Pilot channels	Drain channels	<p>Internal piloting: Without blinded plug SP-X500F ①; External piloting: Add blinded plug SP-X500F ①; Internal drain: Without blinded plug SP-X300F ②; External drain: Add blinded plug SP-X300F ②.</p>
DPZO-6	Pilot channels	Drain channels	<p>Internal piloting: Without plug ①; External piloting: Add DIN-908 M16x1,5 in pos ①; Add plug SP-X325A in pos ②; Internal drain: Without blinded plug SP-X300F ③; External drain: Add blinded plug SP-X300F ③.</p> <p>To reach the orifice ② remove plug ④ = G1/8"</p>

19 FASTENING BOLTS AND SEALS

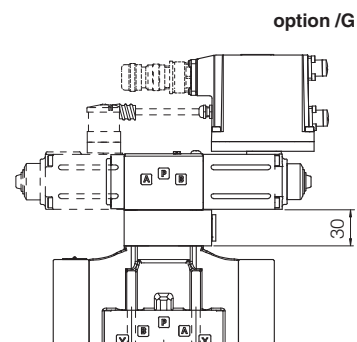
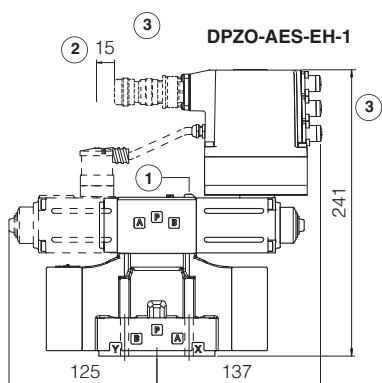
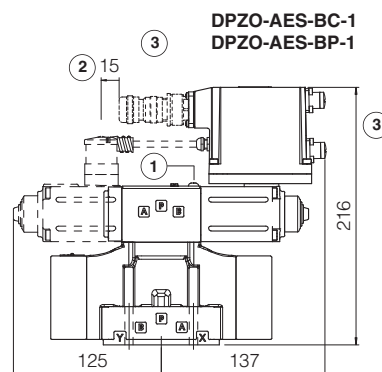
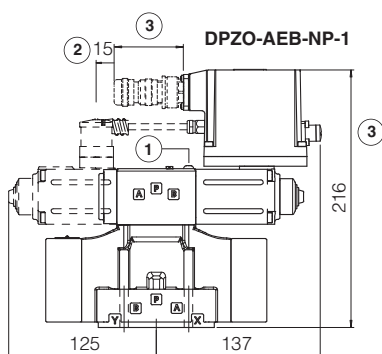
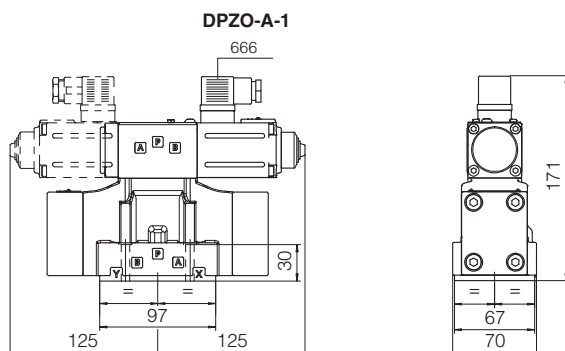
Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)

20 INSTALLATION DIMENSIONS FOR DPZO-1 [mm]

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)

	Mass [kg]		
	A	AEB, AES	AES-EH
DPZO-*-15	7,7	8,1	8,2
DPZO-*-17	8,6	9	9,1
Option /G	+0,9		



Dotted line = double solenoid version

① = Air bleeding 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

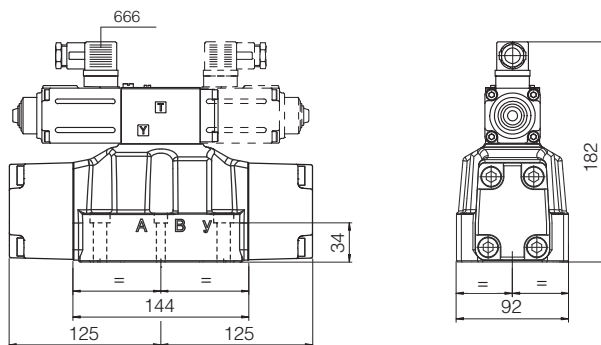
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

21 INSTALLATION DIMENSIONS FOR DPZO-2 [mm]

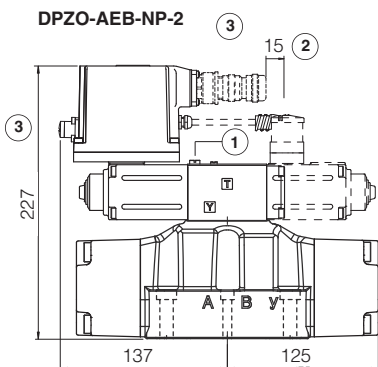
ISO 4401: 2005
 Mounting surface: 4401-07-0-05 (see table P005)

	Mass [kg]		
	A	AEB, AES	AES-EH
DPZO-* -25	11,9	12,3	12,4
DPZO-* -27	12,8	13,2	13,3
Option /G	+0,9		

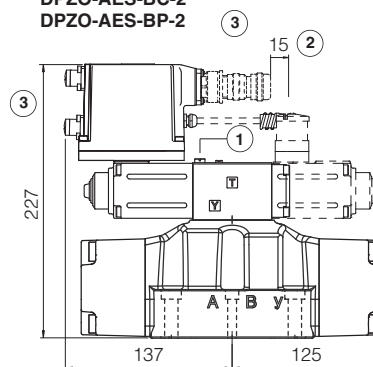
DPZO-A-2



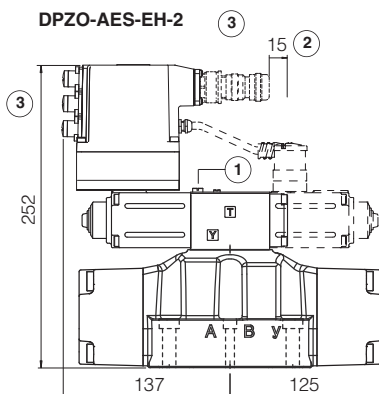
DPZO-AEB-NP-2



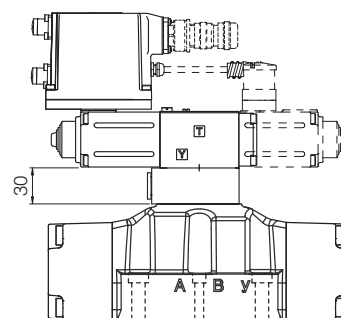
DPZO-AES-BC-2
 DPZO-AES-BP-2



DPZO-AES-EH-2



option /G



Dotted line = double solenoid version

- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

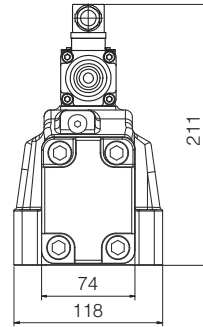
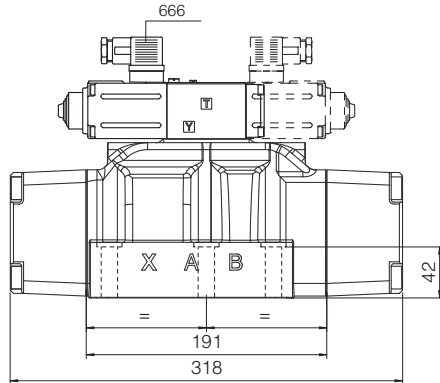
Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

ISO 4401: 2005

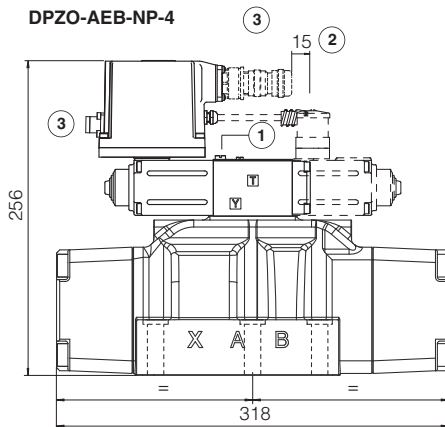
Mounting surface: 4401-08-08-0-05 (see table P005)

	Mass [kg]		
	A	AEB, AES	AES-EH
DPZO-*-45	17,1	18	18,1
DPZO-*-47	18	18,9	19
Option /G	+0,9		

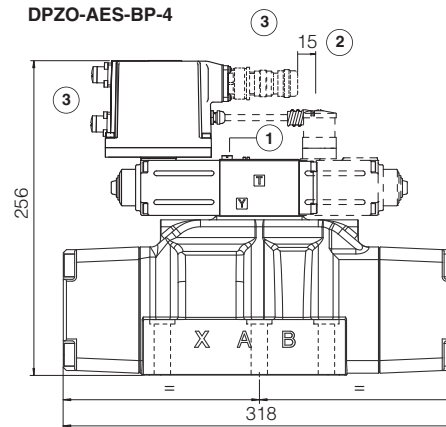
DPZO-A-4



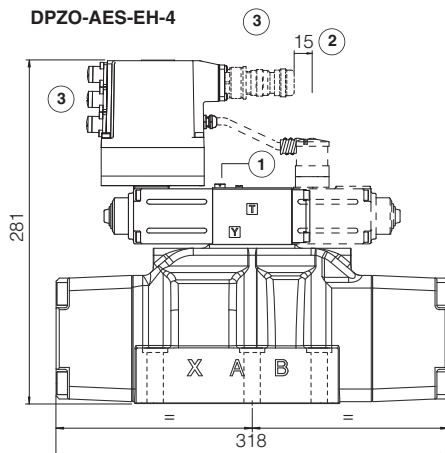
DPZO-AEB-NP-4



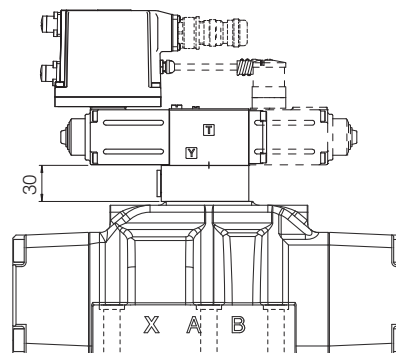
DPZO-AES-BC-4
DPZO-AES-BP-4



DPZO-AES-EH-4



option /G



Dotted line = double solenoid version

① = Air bleeding 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

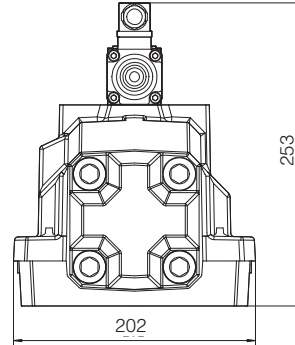
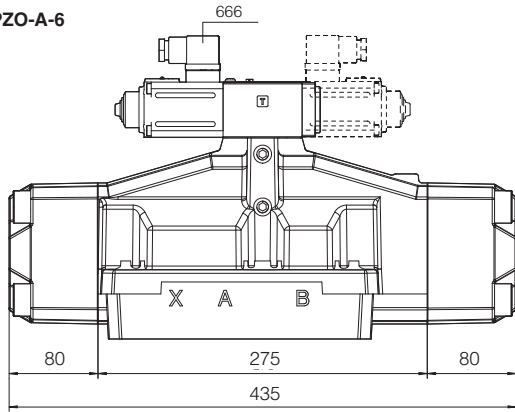
23 INSTALLATION DIMENSIONS FOR DPZO-6 [mm]

ISO 4401: 2005

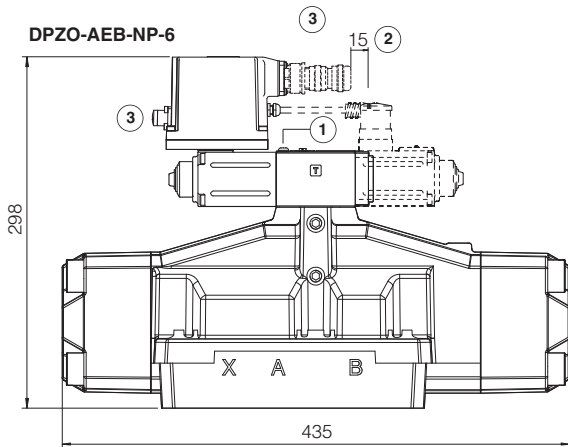
Mounting surface: 4401-10-09-0-05 (see table P005)

	Mass [kg]		
	A	AEB, AES	AES-EH
DPZO-*65	42,1	42,5	42,6
DPZO-*67	42,7	43,1	43,2
Option /G	+2,3		

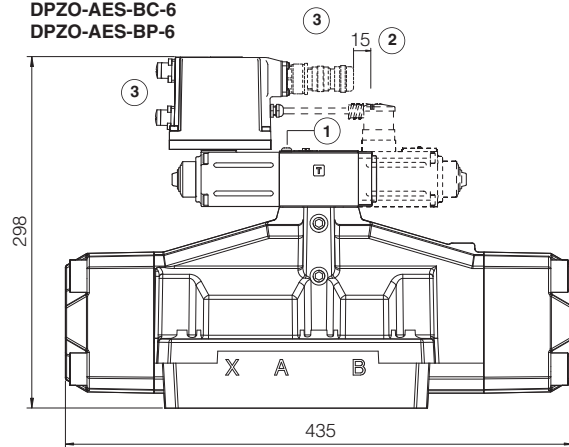
DPZO-A-6



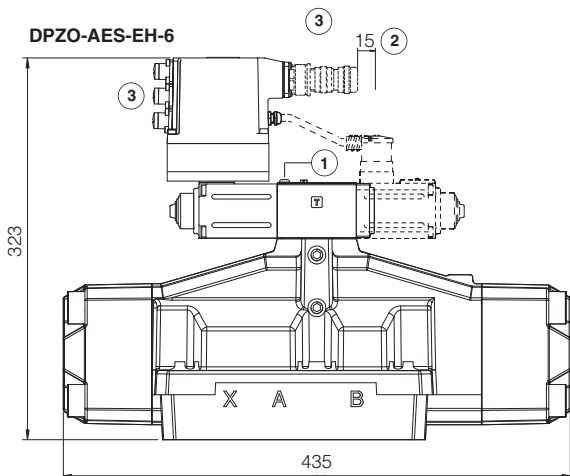
DPZO-AEB-NP-6



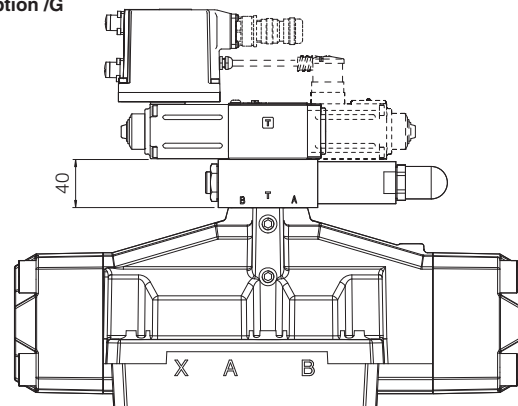
DPZO-AES-BC-6
DPZO-AES-BP-6




DPZO-AES-EH-6



option /G



Dotted line = double solenoid version

- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 16.6 and 16.7

Note: for option /B the solenoid and the on-board digital driver are at side of port B of the main stage

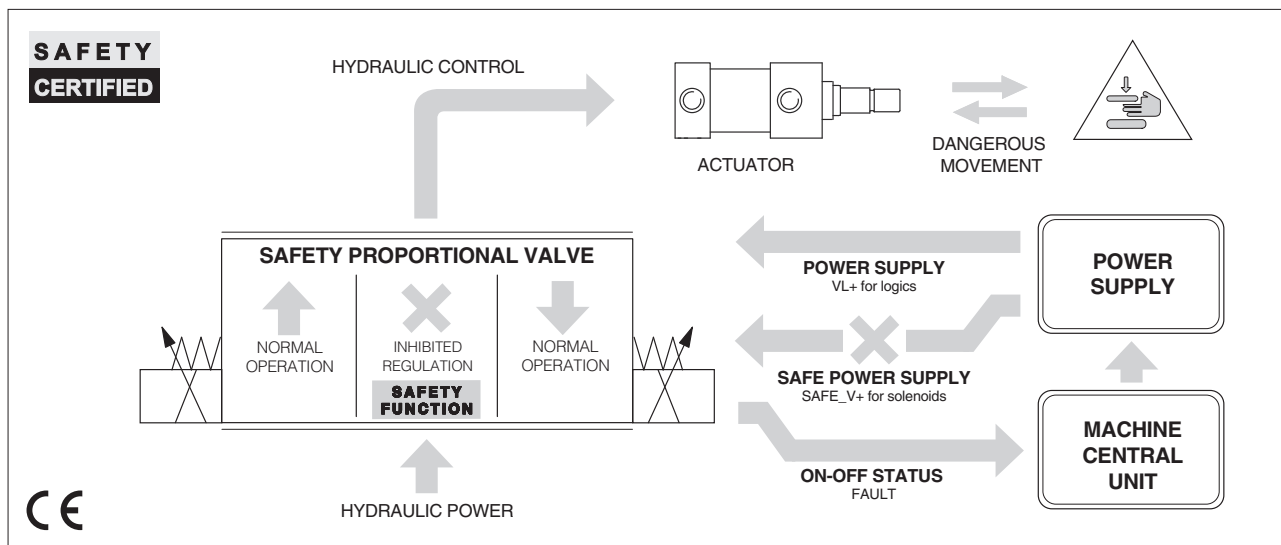
24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
G010	E-MI-AC analog driver	P005	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	QB120	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	QF120	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Safety proportional valves with double power supply

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with double power supply are identified by option /U and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle. It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /U by removing the safe power supply to the valve solenoids in case of emergency or for specific requirements along the working cycle.

Upon solenoid power supply interruption, the valve driver remains active thanks to the separated power supply for logics, thus providing fault signal and communication to the machine central unit (PLC) which manages these information as diagnostic signals.

Safety proportional valves with option /U are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max SIL3	See technical table Y010 for details about SIL, PL and safety architectures
ISO 13849	category 1, PL c for non-redundant safety architecture category 4, PL e for redundant safety architecture	

3 VALVES RANGE

Option /U is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High performance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**

DPZO-TES - piloted, positive spool overlap - technical table **FS172**

DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:

DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**

DPZO-LES - piloted, zero spool overlap - technical table **FS178**

DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**

DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /U are designed to receive separated power supplies for logic VL+ and solenoids SAFE_V+.

When the solenoid power supply SAFE_V+ is removed, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited.

The valve's diagnostics and communication remain active thanks to the logic power supply VL+ and then the valve can continuously exchange spool position and status with the machine central unit.

The time required by the valve's spool to reach the safe position is detailed in section 5

Safe power supply - SAFE_V+

The SAFE_V+ feeds only the valve solenoids. It can be removed to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_V+ = 0 Vdc
- permitted regulation: SAFE_V+ = 24 Vdc

For double solenoids valves the power supply SAFE_V+ feeds both solenoids, then when it is removed the valve regulation is completely inhibited.

Power supply - VL+

The VL+ feeds the logic and communication functions. It must always be kept ON = 24Vdc to allow the real-time diagnostics of the valve status and spool position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve status.

This signal must be monitored by the machine central unit to intercept failures which may compromise the valve safety function.

The FAULT signal is switched OFF (0 Vdc) when the internal diagnostics detects valve failures or incorrect behaviour (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc).

For piloted valves the FAULT signal = 0 Vdc indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The switch-off time is the time between the power supply SAFE_V+ interruption and the achievement of the spool safety rest position. It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:

- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm²/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

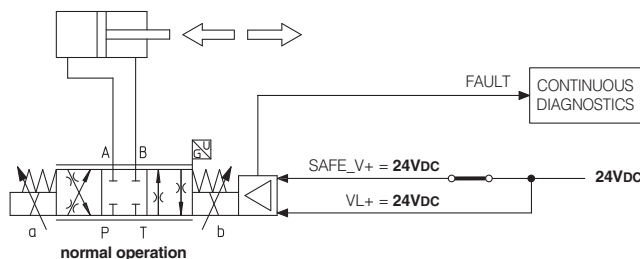
Valve model	DHZO	DKZOR	DLHZO	DLKZOR	DPZO-1	DPZO-2	DPZO-4 DPZO-4M	DPZO-6	DPZO-8
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

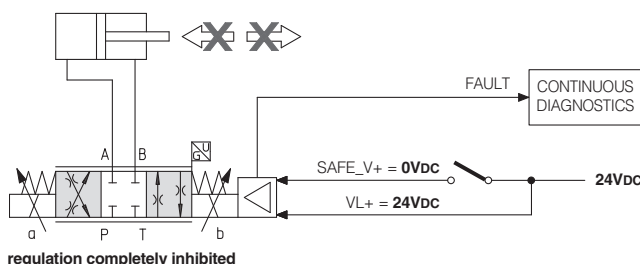
Valve normal operation

Safe Power Supply [Vdc]	Power Supply [VDC]
SAFE_V+	VL+
24	24



Valve safe operation with regulation completely inhibited

Safe Power Supply [Vdc]	Power Supply [VDC]
SAFE_V+	VL+
0	24



INHIBITED SPOOL POSITION
SAFE_V+ = 0Vdc

PERMITTED SPOOL POSITION
SAFE_V+ = 24Vdc

INHIBITED DIRECTION

PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_V+ status for all models of safety proportional valves.

Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /U is applied must be considered.

7.1 High performance proportionals

-  INHIBITED SPOOL POSITION
-  PERMITTED SPOOL POSITION

DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table FS165

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 51, 53		Configuration 71, 72, 73	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	①	①

DPZO-TES - pilot operated, positive spool overlap - technical table FS172

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 51, 53		Configuration 71, 73	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				
		①	①	①	①

DPZO-LES - pilot operated, positive spool overlap - technical table FS175

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 71, 73	
		standard	option /B
SAFE_V+	VL+		
24	24		
0	24		
		①	①

① = Spool safety rest position

7.2 Servoproportionals

- INHIBITED SPOOL POSITION
- PERMITTED SPOOL POSITION

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168, FS620**

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 70	
		standard	option /B
SAFE_V+	VL+		
24	24		
0	24		

②
②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178, FS630**

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 60		Configuration 70	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				

①
①
②
②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Safe Power Supply [Vdc]	Power Supply [Vdc]	Configuration 40 with fail safe 1 or 3		Configuration 60 without fail safe	
		standard	option /B	standard	option /B
SAFE_V+	VL+				
24	24				
0	24				

①
①
①
①

① = Spool safety rest position

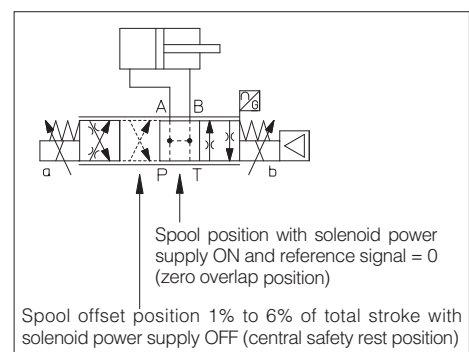
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_V+ = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /U

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	SAFE_V+		Safe power supply 24 Vdc for solenoid	Input - power supply
2	SAFE_V0		Safe power supply 0 Vdc for solenoid	Gnd - power supply
3	ENABLE		Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	Q_INPUT+		Flow (spool position) reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
		P_INPUT+	Position reference input signal: ± 10 Vdc / ± 20 mA maximum range	
5	INPUT-		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR		Flow (spool position) monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to VL0. Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
		P_MONITOR	Position monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to VL0	
7	F_INPUT+ (1)		Pressure/force reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
8	F_MONITOR (1)		Pressure/force monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to VL0 Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
9	VL+		Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0		Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

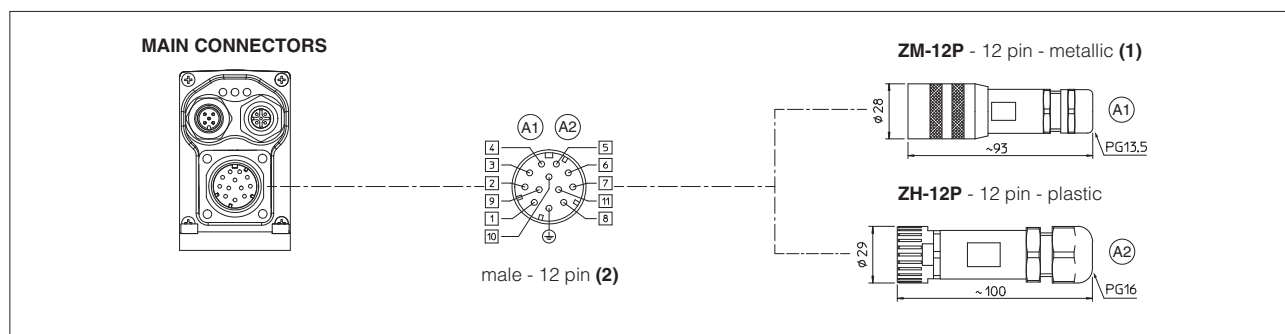
(1) Connection NOT available for TES/LES in SN execution

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_V+ VL+	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)	Input - power supply
FAULT	ON state depends on input power supply VL+: ON state > VL+ - 2V @ max 50 mA e.g. in case of VL+ = 24V, the ON state > 22V OFF state < 1 V; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

General tables:

Y010	Basics for safety components
FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165	DHZO-TES, DKZOR-TES, direct operated
FS172	DPZO-TES, pilot operated
FS175	DPZO-LES, pilot operated
FS168	DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180	DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178	DPZO-LES, pilot operated, zero spool overlap
FS610	DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620	DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630	DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300	Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320	Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES	- TES and LES drivers user manual
E-MAN-RI-LES-S	- TES and LES drivers with P/Q control user manual
E-MAN-S-BC	- CANopen protocol programming manual
E-MAN-S-BP	- PROFIBUS DP protocol programming manual
E-MAN-S-EH	- EtherCAT protocol programming manual
E-MAN-S-EW	- POWERLINK protocol programming manual
E-MAN-S-EI	- EtherNet/IP protocol programming manual
E-MAN-S-EP	- PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ	- TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S	- TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC	- CANopen protocol programming manual
Z-MAN-S-BP	- PROFIBUS DP protocol programming manual
Z-MAN-S-EH	- EtherCAT protocol programming manual
Z-MAN-S-EW	- POWERLINK protocol programming manual
Z-MAN-S-EI	- EtherNet/IP protocol programming manual
Z-MAN-S-EP	- PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

TT366	DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367	DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368	DPZO-TES/LES/LEZ

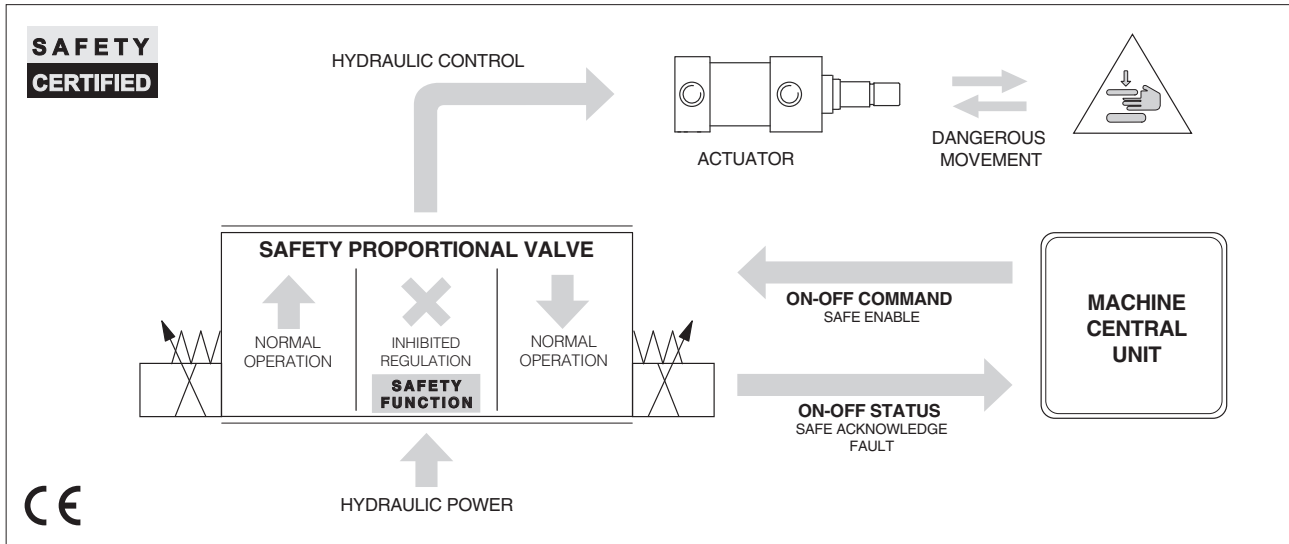
TÜV certificates (on request):

C-IS-722117697-01	Safety proportional valves, direct operated
C-IS-722117689-01	Safety proportional valves, piloted operated

Safety proportional valves with on-off signals

directional valves with on-board driver and LVDT transducer

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by



1 GENERAL DESCRIPTION

Safety proportional valves with on-off signals are identified by option /K and are intended for use in hydraulic circuits of machines which must comply with safety requirements of Machine Directive 2006/42/EC.

They are designed to perform **Safety Functions**, in addition to the standard control of direction, speed, pressure/force or position of hydraulic actuators, depending to the valve features.

The Safety Function is operated to reduce the potential dangerous risks which may happen in a specific phase of the machine cycle. It is activated by the machine central unit (PLC) which inhibits the regulation of proportional valve /K via on-off enable signals in case of emergency or for specific requirements along the working cycle.

Upon valve's disable command input, the valve driver generates on-off output signals as soon the spool has reached the safety position, confirming that hydraulic regulation has been inhibited. The machine central unit (PLC) manages this information as "safe condition".

Safety proportional valves with option /K are certified by TÜV in compliance with IEC 61508 and ISO 13849

2 CERTIFICATION

IEC 61508, IEC 61511, IEC 62061	max SIL 2 for non-redundant safety architecture max SIL 3 for redundant safety architecture	See technical table Y010 for details about SIL, PL and safety architectures
ISO 13849	category 1, PL c for non-redundant safety architecture category 4, PL e for redundant safety architecture	

3 VALVES RANGE

Option /K is available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.

It adds the safety functions to standard control of direction, speed, pressure/force (for SP, SF, SL version) and position (for TEZ, LEZ versions).

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

High performance proportionals:

DHZO-TES, DKZOR-TES - direct, positive spool overlap - technical table **FS165**

DPZO-TES - piloted, positive spool overlap - technical table **FS172**

DPZO-LES - piloted, positive spool overlap - technical table **FS175**

Servoproportionals:

DHZO-TES, DKZOR-TES - direct, zero spool overlap - technical tables **FS168**

DPZO-LES - piloted, zero spool overlap - technical table **FS178**

DLHZO-TES, DLKZOR-TES - direct, zero spool overlap - technical tables **FS180**

Servoproportionals with TEZ/LEZ axis controller:

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**

DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap - technical tables **FS610**

4 FUNCTIONAL DESCRIPTION

Valves with option /K are designed to receive on-off enable signals from the machine central unit in order to inhibit the valve's regulation. When this enable signal is switched OFF, the current to the valve's solenoid is safely cut-off, while the valve's diagnostics and communication remain active to continuously exchange its status with the machine central unit. In consequence of the solenoid current cut-off, the valve's spool is moved by the spring towards the safe rest position and then the valve regulation is consequently inhibited. When the spool has reached the safe position, the valve's driver generates an on-off output signal confirming to the machine central unit that the valve is in SAFE condition. The time required by the valve's spool to reach the safe position is detailed in section 5

Safe enable input signal - SAFE_ENABLE

The SAFE_ENABLE is the command signal to cut-off the current to the solenoids in order to inhibit the valve's regulation:

- inhibited regulation: SAFE_ENABLE = 0 Vdc
- permitted regulation: SAFE_ENABLE = 24 Vdc

Double solenoid valves are equipped with two independent enable circuits SAFE_ENABLE 1 and SAFE_ENABLE 2 permitting to:

- a) cut-off the current to both solenoids when the valve regulation must be inhibited in both directions
- b) cut-off the current to one solenoid when only one side of the valve regulation must be inhibited. This condition permits to intercept the actuator movement in one direction, permitting the actuator movement in the opposite direction (typical in motion/non-motion controls)

Safe enable acknowledge output signal - SAFE_ENABLE_ACK

The SAFE_ENABLE_ACK is the output signal generated by the driver to confirm that the valve has effectively reached the safe position in consequence of SAFE_ENABLE command switch-off. SAFE_ENABLE_ACK is switched ON (24 Vdc) when the internal diagnostics verifies that solenoid current has been cut-off and the spool, monitored by the LVDT transducer, has reached the safe position.

Fault output signal – FAULT

Fault signal is a diagnostic output which states faults or warning according to the valve's status. This signal must be monitored by the machine central unit in addition to the SAFE_ENABLE_ACK signal, to intercept failures which may compromise the valve safety function. The FAULT signal is switched OFF (0 Vdc) when the internal diagnostics detects valve failures or incorrect behavior (e.g. : spool sticking, solenoid short circuits, missing coils connection, reference signal cable broken for 4 ÷ 20 mA input, etc). For piloted valves the FAULT signal = 0 Vdc indicates also the absence of pilot pressure.

5 SWITCH-OFF TIME

The valve switch-off time is the time between the SAFE_ENABLE signal = 0 Vdc and the SAFE_ENABLE ACK signal = 24 Vdc. It is influenced by the working conditions like flow, pressure and fluid viscosity.

The switch-off times shown in the table are considered in the following conditions:

- max flow and max pressure values as per specific technical table of each valve model
- fluid viscosity 46 mm²/s
- fluid contamination level: ISO4406 CLASS 18/16/13

The following switch-off times can be considered as the longest ones.

For different working conditions, consult Atos technical office.

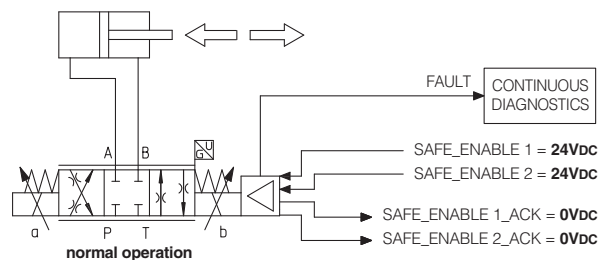
Valve model	DHZO	DKZOR	DLHZO	DLKZOR	DPZO-1	DPZO-2	DPZO-4 DPZO-4M	DPZO-6	DPZO-8
Switch-off time [ms]	50	80	40	60	180	250	300	350	400

6 FUNCTIONAL EXAMPLES

The following examples show the condition of a double solenoid valve and of the controlled actuator depending to the SAFE_ENABLE status.

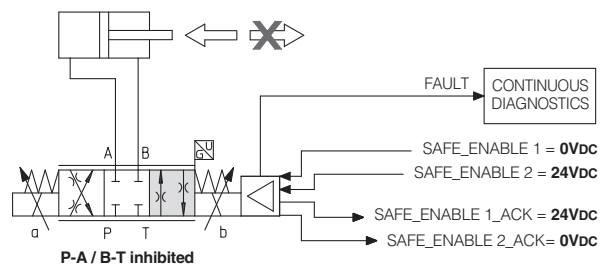
Valve normal operation

Input signals [Vdc]		Output signals [Vdc]	
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK
24	24	0	0



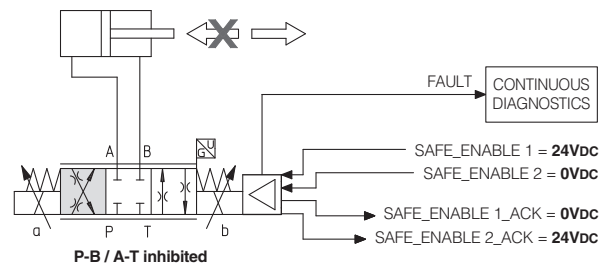
Valve safe operation with P-A/B-T regulation inhibited to prevent the actuator forward movement

Input signals [Vdc]		Output signals [Vdc]	
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK
0	24	24	0



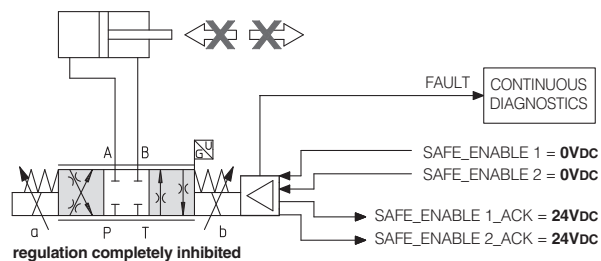
Valve safe operation with P-B/A-T regulation inhibited to prevent the actuator backward movement


Input signals [Vdc]		Output signals [Vdc]	
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK
24	0	0	24




Valve safe operation with regulation completely inhibited

Input signals [Vdc]		Output signals [Vdc]	
SAFE_ENABLE 1	SAFE_ENABLE 2	SAFE_ENABLE 1_ACK	SAFE_ENABLE 2_ACK
0	0	24	24



 INHIBITED SPOOL POSITION
SAFE_ENABLE = 0Vdc

 PERMITTED SPOOL POSITION
SAFE_ENABLE = 24Vdc

 INHIBITED DIRECTION


 PERMITTED DIRECTION

7 INHIBITED / PERMITTED SPOOL POSITION

The below tables show the inhibited / permitted spool position depending to the SAFE_ENABLE status for all models of safety proportional valves.

Note: the inhibition of the actuator direction may be affected by other valves present in the circuit, then the whole hydraulic system where the valve /K is applied must be considered.

7.1 High performance proportionals

-  INHIBITED SPOOL POSITION
-  PERMITTED SPOOL POSITION

DHZO-TES, DKZOR-TES - direct operated, positive spool overlap - technical table FS165

Input signals [Vdc]		Output signals [Vdc]		Configuration 51, 53		Configuration 71, 72, 73	
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK	standard	option /B	standard	option /B
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24				

DPZO-TES - pilot operated, positive spool overlap - technical table FS172

Input signals [Vdc]		Output signals [Vdc]		Configuration 51, 53		Configuration 71, 73	
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK	standard	option /B	standard	option /B
24		0					
0		24					
24	24	0	0	①	①		
0	24	24	0				
24	0	0	24				
0	0	24	24				

DPZO-LES - pilot operated, positive spool overlap - technical table FS175

Input signals [Vdc]	Output signals [Vdc]	Configuration 71, 73	
SAFE ENABLE 1	SAFE ENABLE 1_ACK	standard	option /B
24	0		
0	24		

① = Spool safety rest position

7.2 Servoproportionals

- INHIBITED SPOOL POSITION
- PERMITTED SPOOL POSITION

DHZO-TES/TEZ, DKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS168, FS620**

Input signals [Vdc]		Output signals [Vdc]		Configuration 70	
SAFE ENABLE 1	SAFE ENABLE 2	SAFE ENABLE 1_ACK	SAFE ENABLE 2_ACK	standard	option /B
24	24	0	0		
0	24	24	0		
24	0	0	24		
0	0	24	24		

②
②

DPZO-LES, DPZO-LEZ - pilot operated, zero spool overlap - technical table **FS178, FS630**

Input signals [Vdc]	Output signals [Vdc]	Configuration 60		Configuration 70	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				

①
①
②
②

DLHZO-TES/TEZ, DLKZOR-TES/TEZ - direct operated, zero spool overlap - technical tables **FS180, FS610**

Input signals [Vdc]	Output signals [Vdc]	Configuration 40 with fail safe 1 or 3		Configuration 60 without fail safe	
		standard	option /B	standard	option /B
SAFE ENABLE 1	SAFE ENABLE 1_ACK				
24	0				
0	24				

①
①
①
①

① = Spool safety rest position

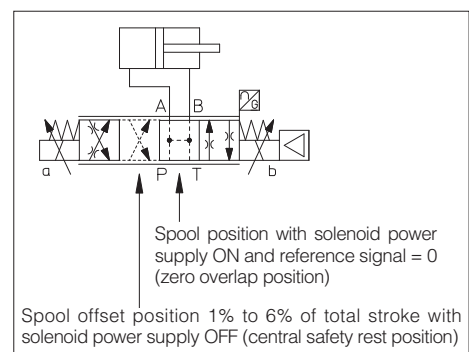
② = Spool safety rest position for valves with zero spool overlap, configuration 70 - see 7.3

7.3 Safety rest position - for valves with zero spool overlap, configuration 70

In absence of solenoid power supply (SAFE_ENABLE1 = 0 and SAFE_ENABLE2 = 0), the valve spool is moved by the springs force to the **safety rest position** characterized by a small offset of about 1% to 6% of the total stroke in P-B / A-T configuration.

This is specifically designed to avoid that in case of interruption of solenoid power supply, the actuator moves towards an undefined direction (due to the tolerances of the zero spool overlap), with potential risk of damages or personnel injury.

Thanks to the **safety rest position** the actuator movement is suddenly stopped and it is recovered at very low speed towards the direction corresponding to the P-B/ A-T connection.



8 ELECTRONIC CONNECTIONS

8.1 Main connector signals - 12 pin - options /K

PIN	TES LES	TEZ LEZ	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	SAFE_ENABLE1		Enable (24 Vdc) or disable (0 Vdc) the solenoid at side of the driver and position transducer, referred to V0	Input - on/off signal
4	Q_INPUT+		Flow (spool position) reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
		P_INPUT+	Position reference input signal: ± 10 Vdc / ± 20 mA maximum range	
5	INPUT-		Negative reference input signal for Q_INPUT+, F_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR		Flow (spool position) monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to V0. Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
		P_MONITOR	Position monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to V0	
7	F_INPUT+	(1)	Pressure/force reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
8	SAFE_ENABLE1_ACK		Safe condition acknowledged (24 Vdc) or unacknowledged (0 Vdc) for solenoid at side of the driver and position transducer, referred to V0	Output - on/off signal
9	SAFE_ENABLE2_ACK	(2)	Safe condition acknowledged (24 Vdc) or unacknowledged (0 Vdc) for solenoid at the opposite side of the driver and position transducer, referred to V0	Output - on/off signal
10	SAFE_ENABLE2	(2)	Enable (24 Vdc) or disable (0 Vdc) the solenoid at the opposite side of the driver and position transducer, referred to V0	Input - on/off signal
11	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to V0	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

(1) Connection NOT available for TES/LES in SN execution

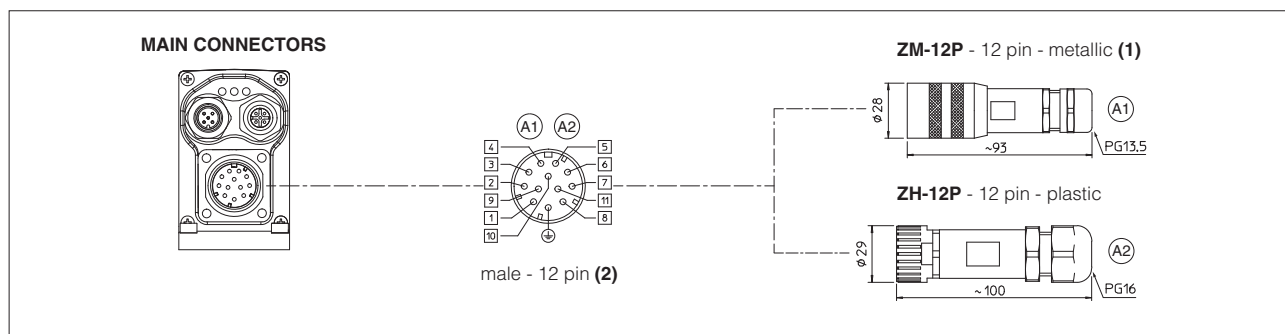
(2) Connections available only for double solenoid valves

9 ELECTRICAL CHARACTERISTICS

SIGNALS	SPECIFICATIONS	NOTES
SAFE_ENABLE1 SAFE_ENABLE2	Input range: $-3 \div 5$ Vdc (OFF state), $15 \div 30$ Vdc (ON state), $5 \div 15$ Vdc (not accepted) Input impedance: $R_i > 10$ kW	Input - on/off signal
SAFE_ENABLE1_ACK SAFE_ENABLE2_ACK	ON state depends on input power supply V+: ON state $> V+ - 2V$ @ max 50 mA e.g. in case of $V+ = 24V$, the ON state $> 22V$ OFF state $< 1V$; External negative voltage not allowed (e.g. due to inductive loads)	Output - on/off signal
FAULT		

Note: for the electrical characteristic of all other signals, refer to the technical table of each valve model - see section 3

9.1 Connections layout



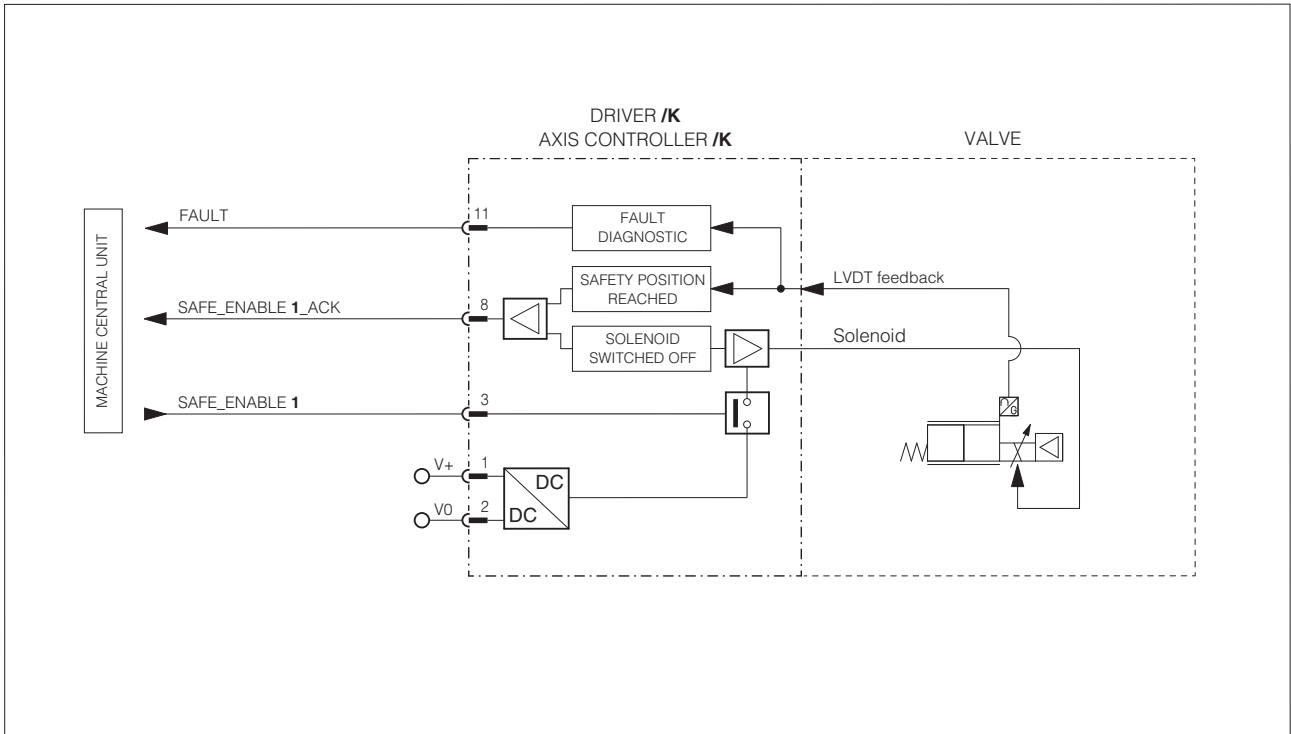
(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

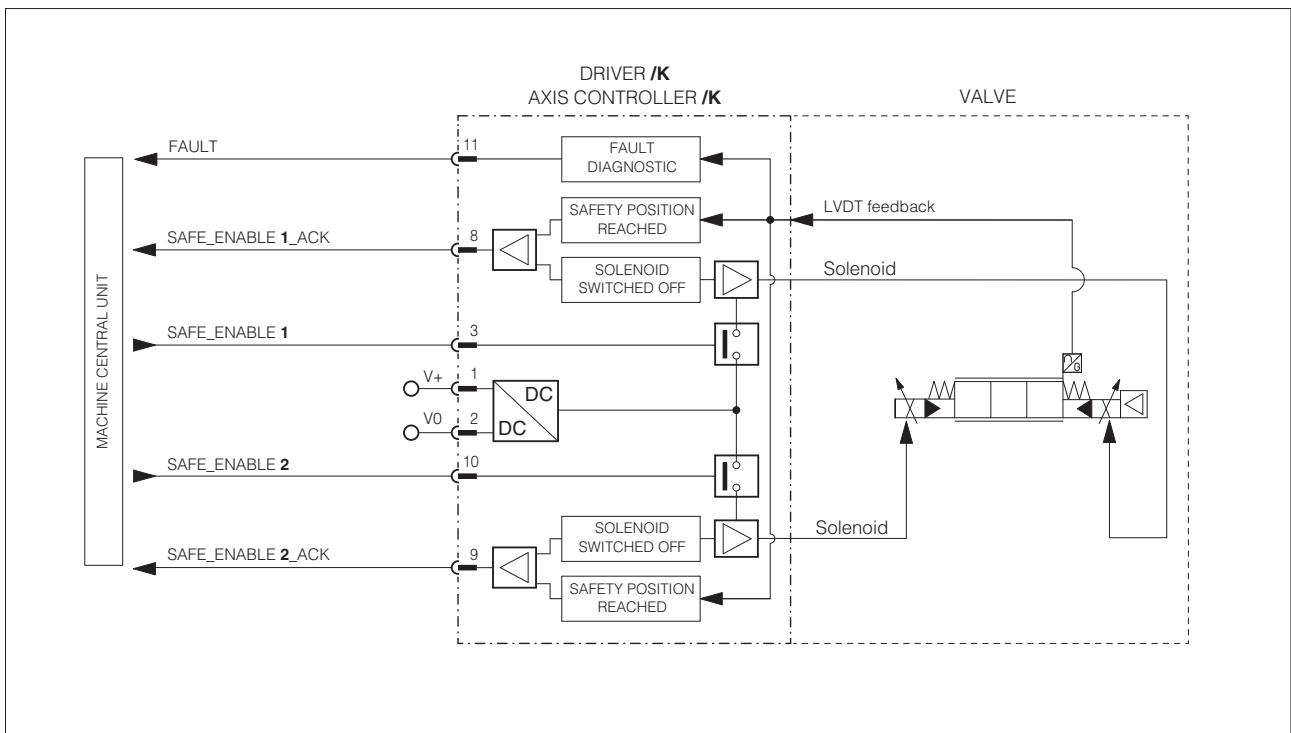
For fieldbus and/or transducers connections, refer to specific technical tables of each valve model - see section 3

10 BLOCK DIAGRAMS

10.1 Single solenoid valves



10.2 Double solenoid valves



General tables:

Y010	Basics for safety components
FS001	Basics for digital electrohydraulics
FS500	Digital proportional valves with P/Q control
FS900	Operating and maintenance information for proportional valves
GS500	Programming tools
GS510	Fieldbus
K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves

Valves technical tables:

FS165	DHZO-TES, DKZOR-TES, direct operated
FS172	DPZO-TES, pilot operated
FS175	DPZO-LES, pilot operated
FS168	DHZO-TES, DKZOR-TES, direct operated, zero spool overlap
FS180	DLHZO-TES, DLKZOR-TES, direct operated, sleeve execution
FS178	DPZO-LES, pilot operated, zero spool overlap
FS610	DLHZO-TEZ, DLKZOR-TEZ digital proportional valves with on-board axis card
FS620	DHZO-TEZ, DKZOR-TEZ digital proportional valves with on-board axis card
FS630	DPZO-LEZ digital proportional valves with on-board axis card

Commissioning and troubleshooting tables:

QF300	Quickstart for TES direct operated proportional valves (supplied with the valve)
QF320	Quickstart for TES/LES pilot operated proportional valves (supplied with the valve)

Operating and fieldbus manuals for TES and LES:

E-MAN-RI-LES	- TES and LES drivers user manual
E-MAN-RI-LES-S	- TES and LES drivers with P/Q control user manual
E-MAN-S-BC	- CANopen protocol programming manual
E-MAN-S-BP	- PROFIBUS DP protocol programming manual
E-MAN-S-EH	- EtherCAT protocol programming manual
E-MAN-S-EW	- POWERLINK protocol programming manual
E-MAN-S-EI	- EtherNet/IP protocol programming manual
E-MAN-S-EP	- PROFINET IRT protocol programming manual

Operating and fieldbus manuals for TEZ and LEZ:

Z-MAN-RI-LEZ	- TEZ and LEZ controllers user manual
Z-MAN-RI-LEZ-S	- TEZ and LEZ controllers with P/Q control user manual
Z-MAN-S-BC	- CANopen protocol programming manual
Z-MAN-S-BP	- PROFIBUS DP protocol programming manual
Z-MAN-S-EH	- EtherCAT protocol programming manual
Z-MAN-S-EW	- POWERLINK protocol programming manual
Z-MAN-S-EI	- EtherNet/IP protocol programming manual
Z-MAN-S-EP	- PROFINET IRT protocol programming manual

SIL safety manuals for operating, installation and maintenance (on request):

TT366	DHZO-TES/TEZ, DKZOR-TES/TEZ
TT367	DLHZO-TES/TEZ, DLKZOR-TES/TEZ
TT368	DPZO-TES/LES/LEZ

TÜV certificates (on request):

C-IS-722117697-01	Safety proportional valves, direct operated
C-IS-722117689-01	Safety proportional valves, piloted operated

3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

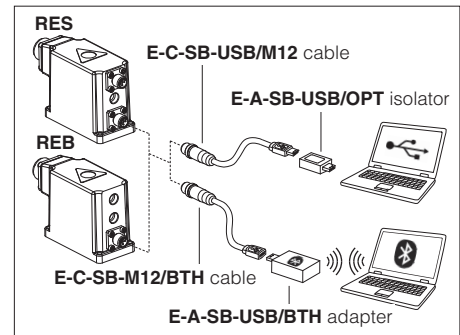


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZMO-*010
Max regulated pressure [bar]	100; 210; 315; 350
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure [bar]	see min. pressure / flow diagram at section 11
Max flow [l/min]	4
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 55
Hysteresis	≤ 0,3 [% of max pressure]
Linearity	≤ 1,0 [% of max pressure]
Repeatability	≤ 0,2 [% of max pressure]
Thermal drift	zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 \div 3,3 Ω			
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor output	Voltage: maximum range 0 \div 10 VDC @ max 5 mA Current: maximum range 0 \div 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 9 VDC (OFF state), 15 \div 24 VDC (ON state), 9 \div 15 VDC (not accepted); Input impedance: $R_i > 87$ k Ω			
Fault output	Output range : 0 \div 24 VDC (ON state \equiv VL+ [logic power supply] ; OFF state \equiv 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 \div 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO 11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

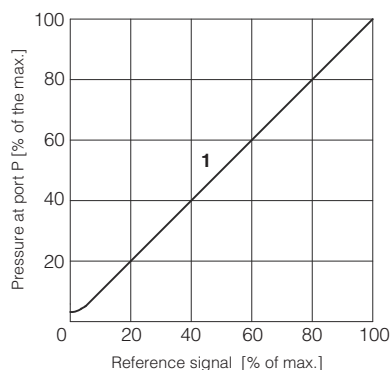
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

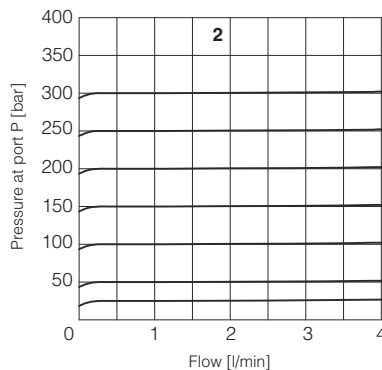
Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C (+80°C for R), with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

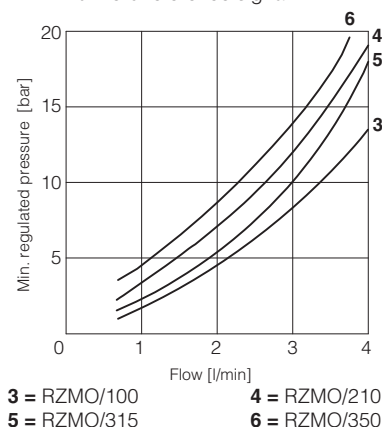
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-6 Min. pressure/flow diagrams
with zero reference signal



12 ELECTRONIC OPTIONS - only for **REB** and **RES**

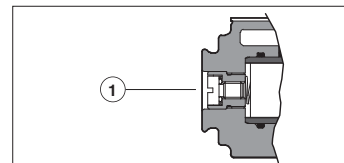
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

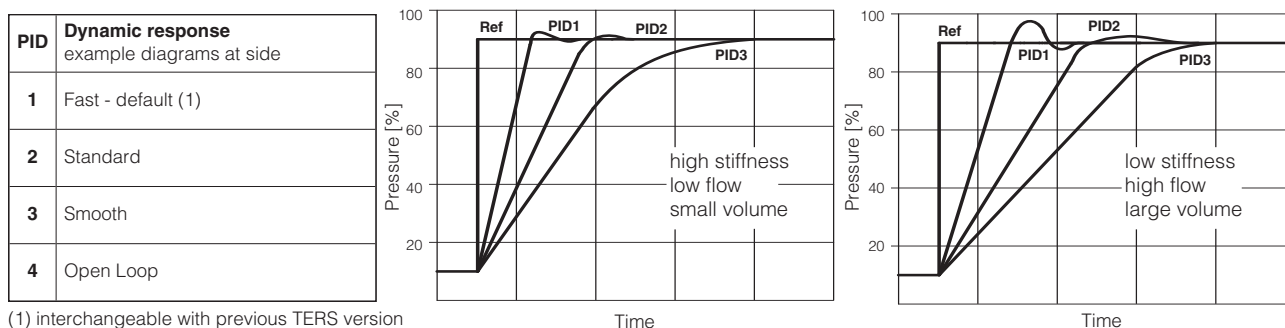
14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.



Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 Vdc.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷ 10 Vdc or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VL0 Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

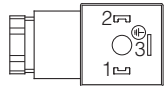
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

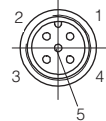
(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

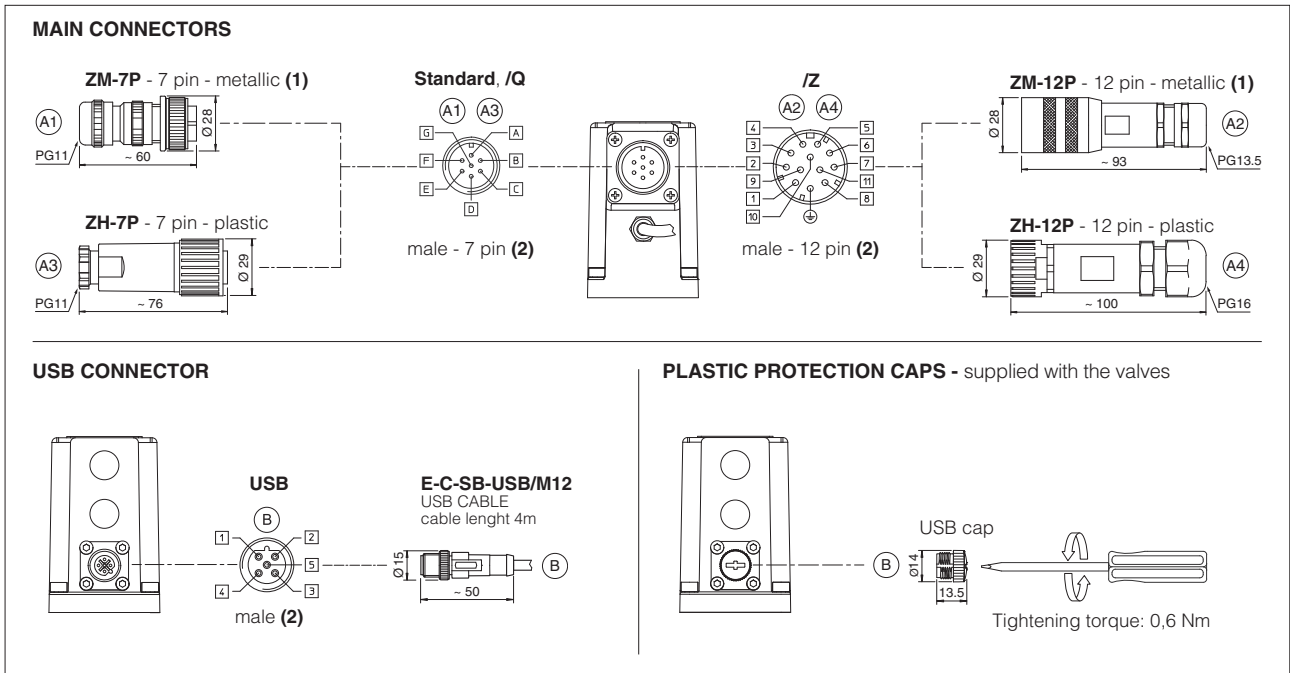
18.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18.5 Pressure transducer connection - only for R

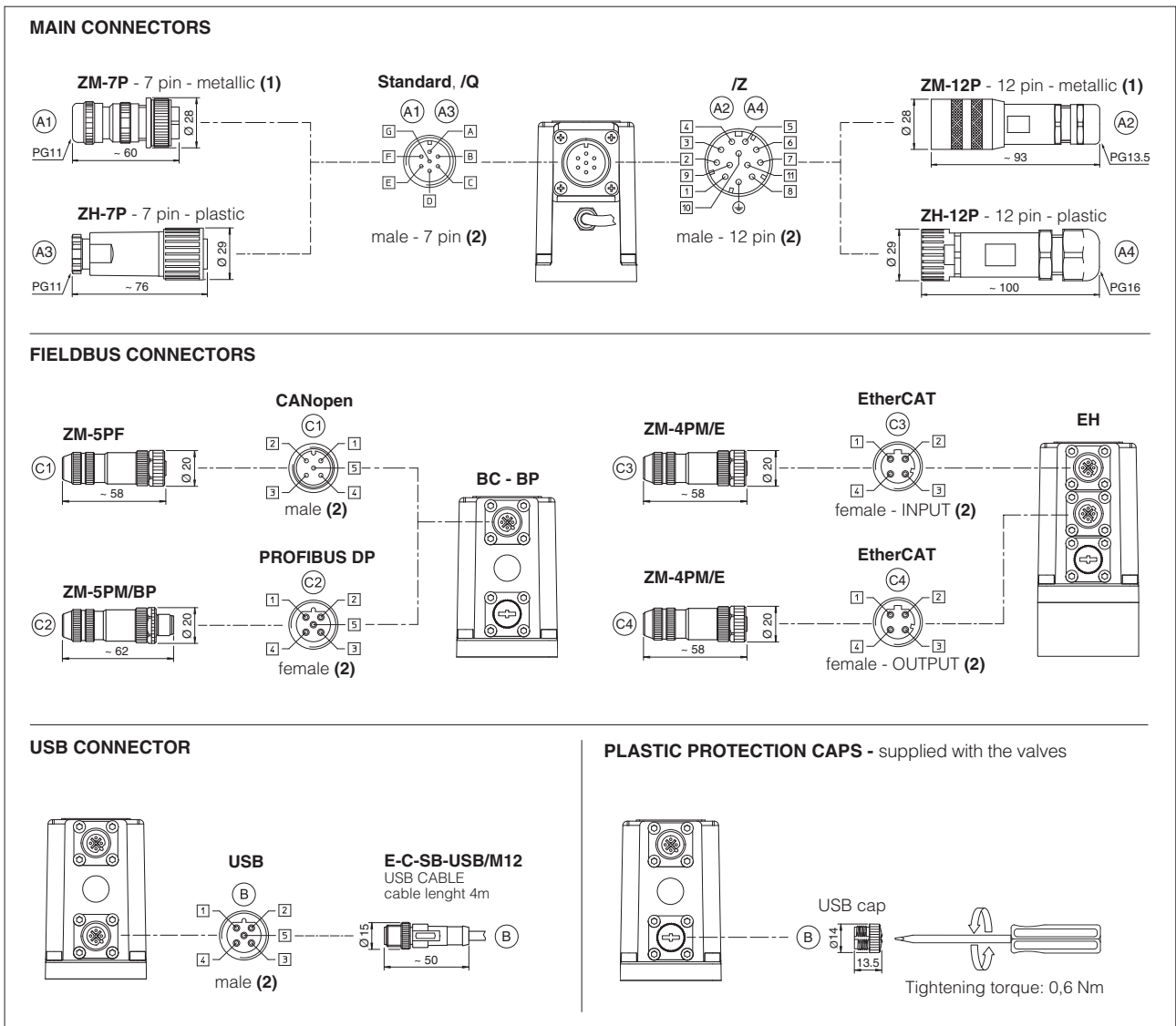
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

18.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

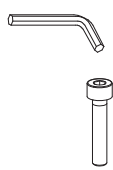

19.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS

	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals: 2 OR 108 Diameter of ports P, T: Ø 5 mm</p>

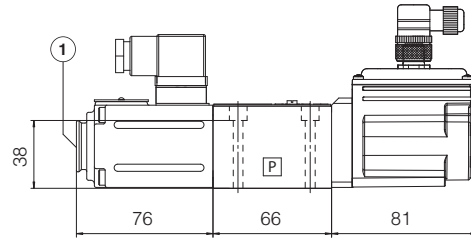
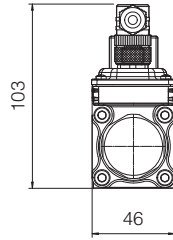
21 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

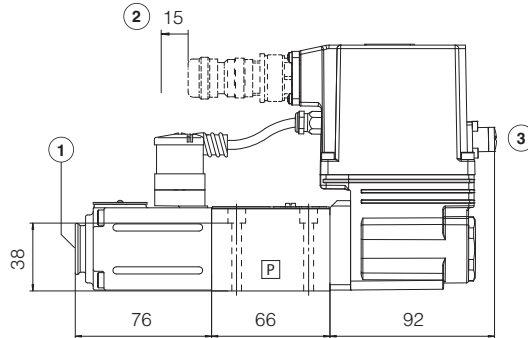
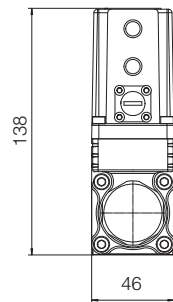
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
R	REB, RES	RES-EH
2,1	2,6	2,7

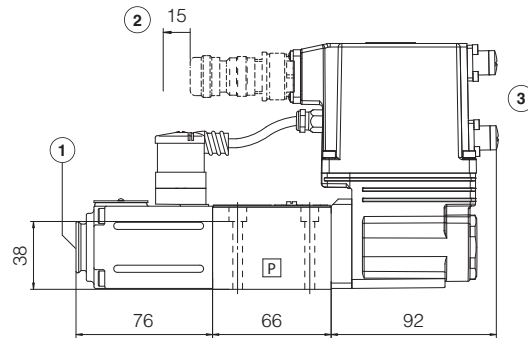
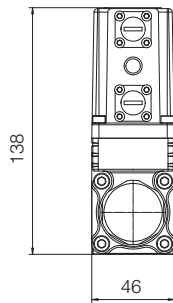
RZMO-R-P



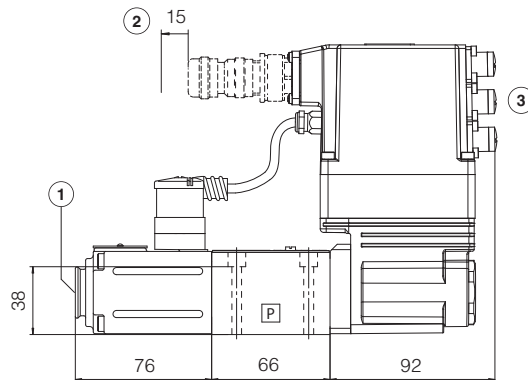
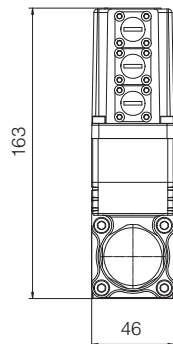
RZMO-REB-P-NP




RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



① = Air bleeding, see section 14 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

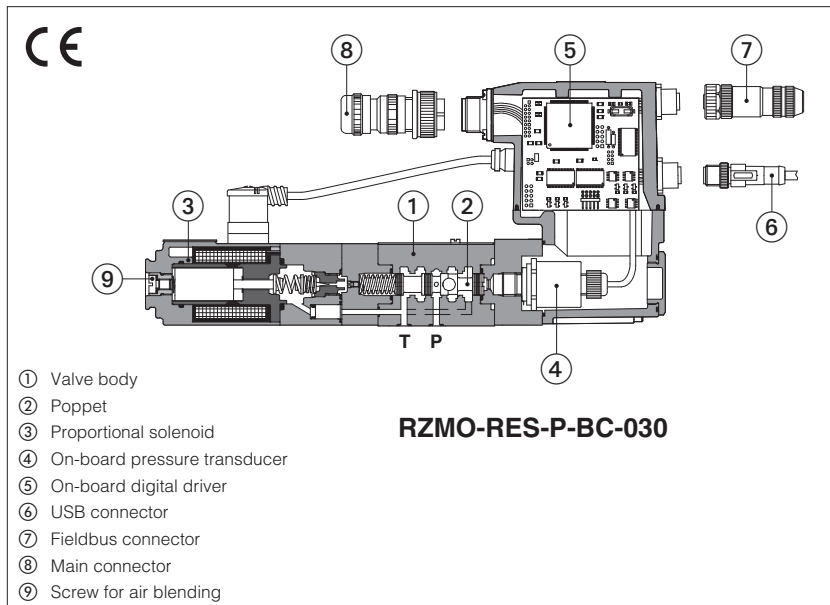
22 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
GS203 E-BM-RES digital driver
GS500 Programming tools
GS510 Fieldbus

K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
QB400 Quickstart for REB valves commissioning
QF400 Quickstart for RES valves commissioning

Digital proportional relief valves high performance

piloted, with on-board pressure transducer



RZMO-R , RZMO-REB, RZMO-RES

Spool type piloted digital proportional relief valves with on-board pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401

Max flow: **40 l/min**

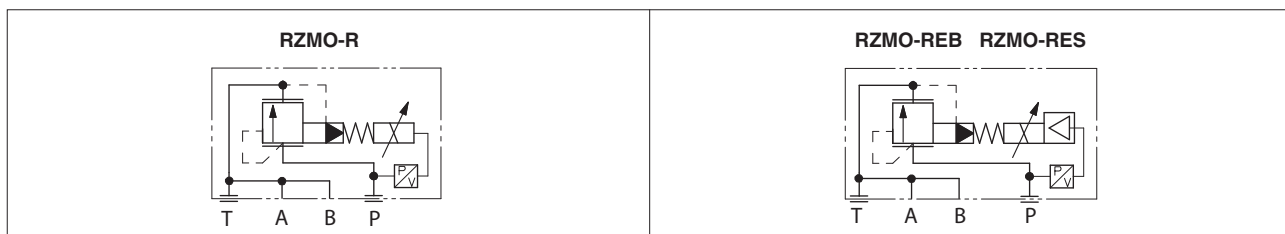
Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	REB	-	P	-	NP	-	030	/	210	/	*	/	*	/	*	/	*	
Proportional pressure relief valve, piloted																		Seals material , see section 10: - = NBR PE = FKM BT = HNBR	
R = for off-board driver, see section 3 REB = basic on-board digital driver (1) RES = full on-board digital driver (2)																		Series number	
P = with integral pressure transducer																		Dynamic response preset , see section 15: - = omit for PID 1 fast (default) 2 = PID 2 standard 3 = PID 3 smooth	
Fieldbus interfaces , USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT																		Electronic options , only for REB and RES (4): I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector	
Configuration: 030 = regulation on port P, discharge in T (piloted operated version)																		Max regulated pressure: 100 = 100 bar 315 = 315 bar 210 = 210 bar 350 = 350 bar	

- (1) Only for **NP**
- (2) Only for **BC, BP, EH**
- (3) Omit for **R** execution
- (4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

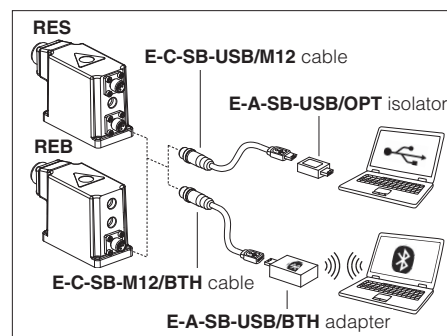


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZMO-*-030
Max regulated pressure [bar]	100; 210; 315; 350
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure [bar]	see min. pressure / flow diagram at section 11
Min ÷ Max flow [l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 45
Hysteresis	≤ 0,5 [% of max pressure]
Linearity	≤ 1,0 [% of max pressure]
Repeatability	≤ 0,2 [% of max pressure]
Thermal drift	zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Voltage: maximum range 0 ÷ 10 Vdc @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

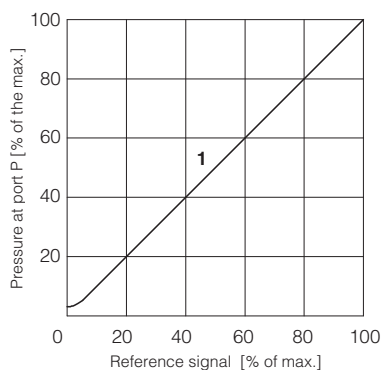
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

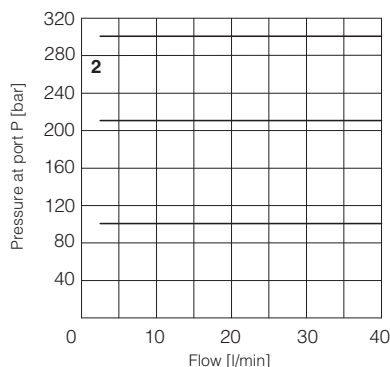
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for R), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

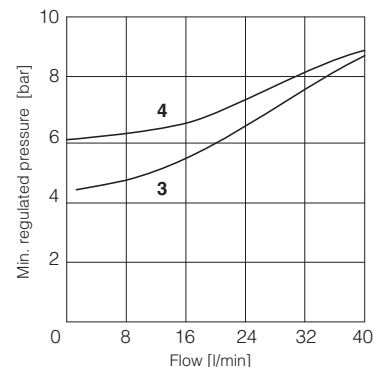
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Minimum pressure/flow diagrams
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

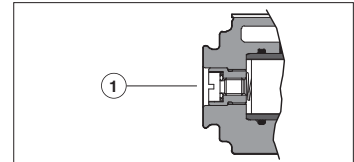
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

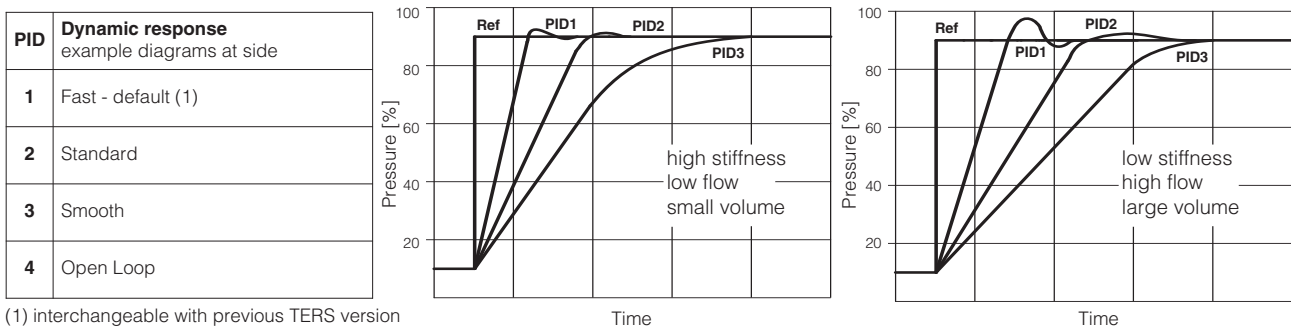
14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.



Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 VDC.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷ 10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VL0 Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

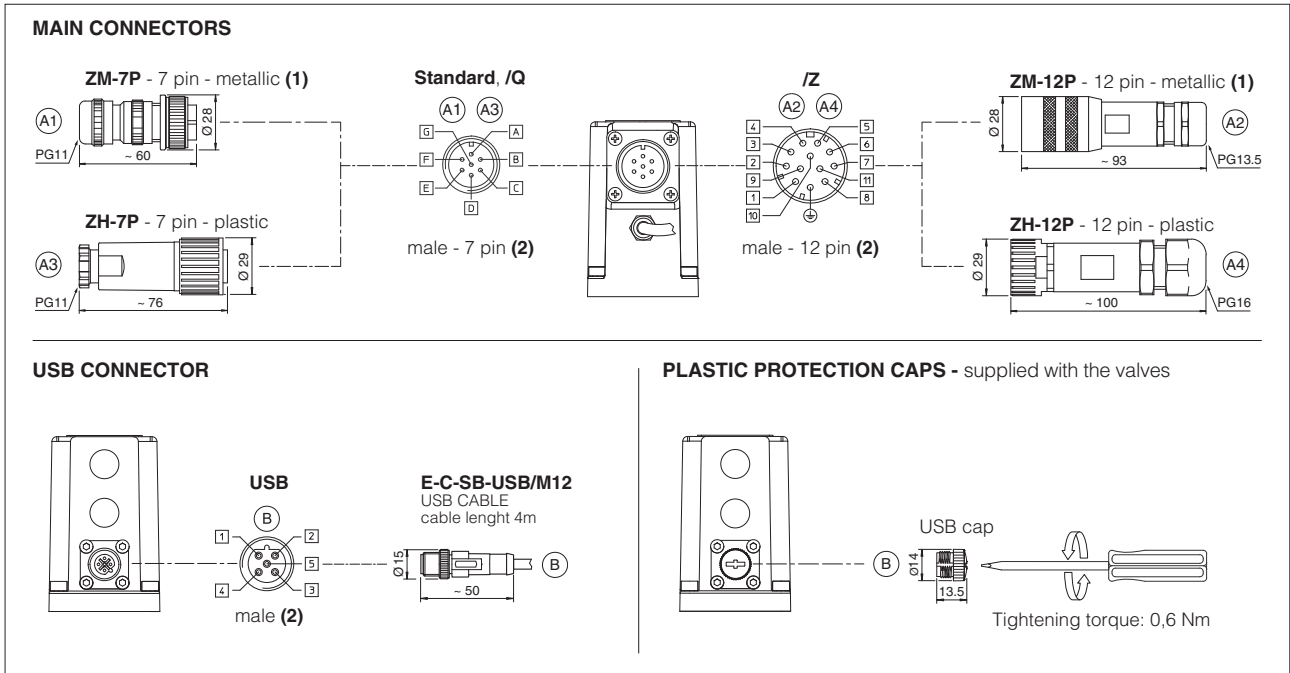
18.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18.5 Pressure transducer connection - only for R

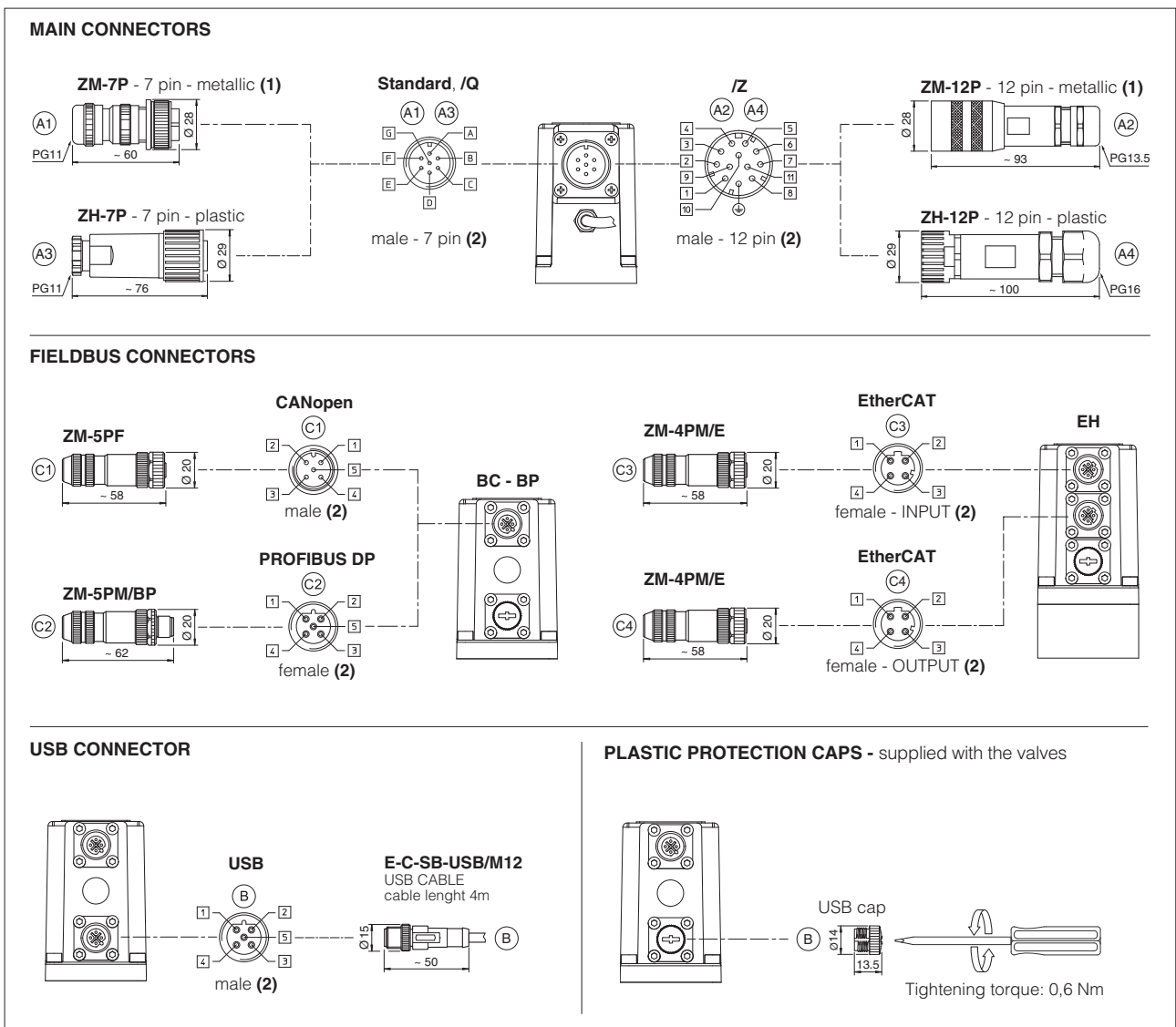
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

18.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67


19.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS

	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals:</p> <p>2 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T</p>

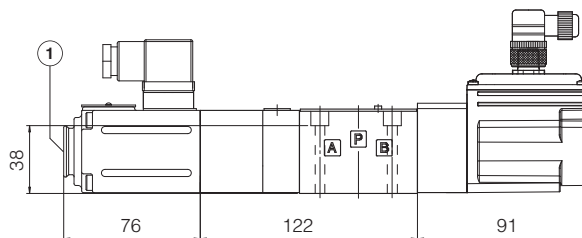
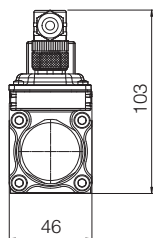
21 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

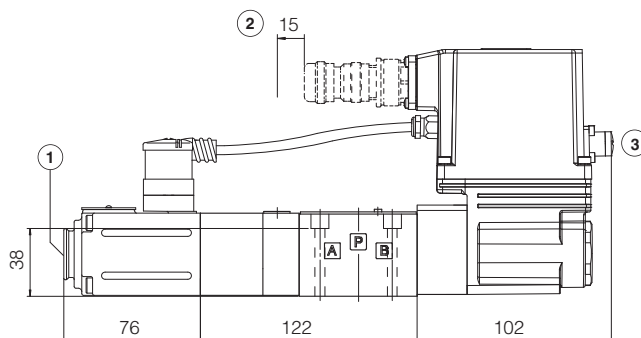
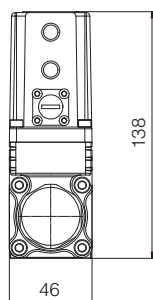
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	REB, RES	RES-EH
3,1	3,6	3,7

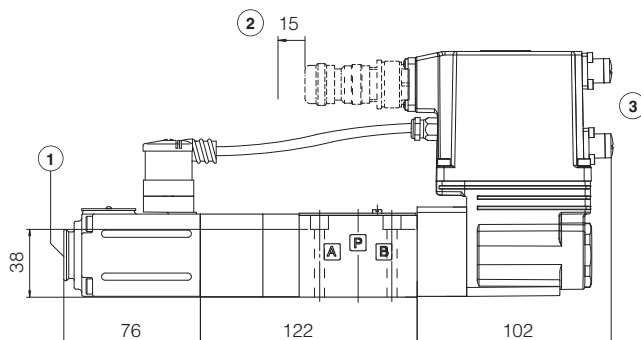
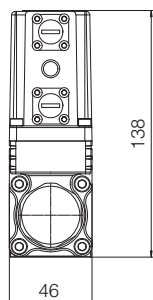
RZMO-R-P



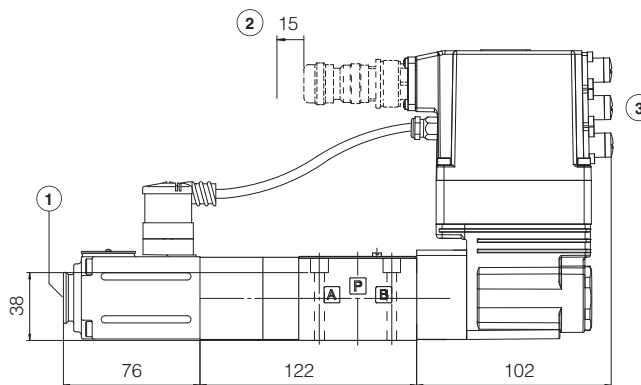
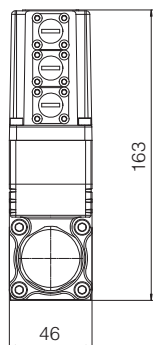
RZMO-REB-P-NP




RZMO-RES-P-BP
RZMO-RES-P-BC



RZMO-RES-P-EH



① = Air bleeding, see section 14 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
GS203 E-BM-RES digital driver
GS500 Programming tools
GS510 Fieldbus

K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
QB400 Quickstart for REB valves commissioning
QF400 Quickstart for RES valves commissioning

3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

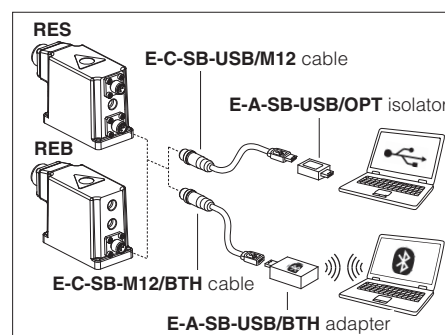
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
Max regulated pressure [bar]	100; 210; 315; 350		
Max pressure at port P [bar]	350		
Max pressure at port T [bar]	210		
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11		
Max flow [l/min]	200	400	600
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 80	≤ 100	≤ 115
Hysteresis	≤ 0,5 [% of max pressure]		
Linearity	≤ 1,0 [% of max pressure]		
Repeatability	≤ 0,2 [% of max pressure]		
Thermal drift	zero point displacement < 1% at ΔT = 40°C		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 18

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Voltage: maximum range 0 ÷ 10 Vdc @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8*/I Output signal: 4 ÷ 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

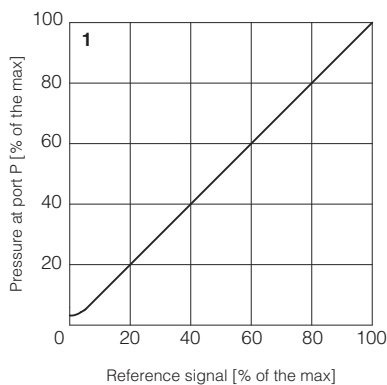
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

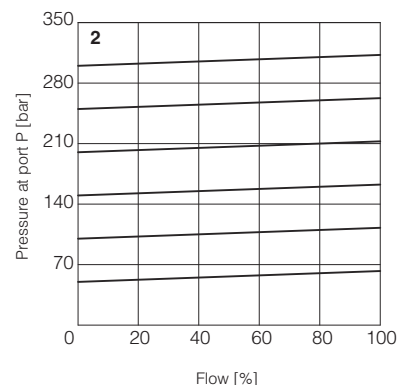
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for R), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

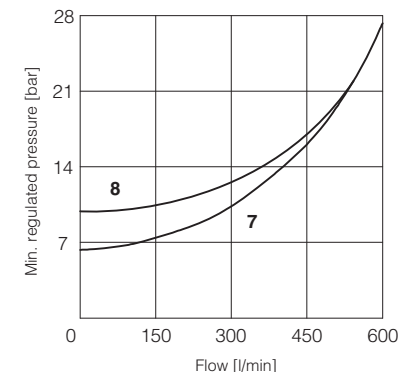
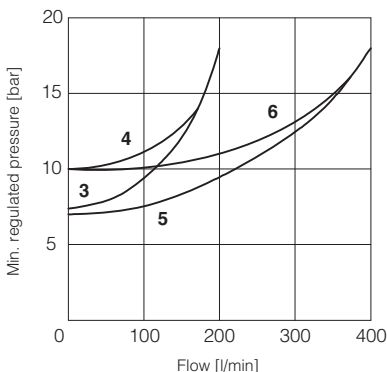


2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



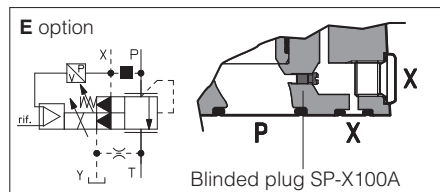
3-8 = Min. pressure/flow diagrams
with zero reference signal

- 3 = AGMZO*-10/100, 210, 315
- 4 = AGMZO*-10/350
- 5 = AGMZO*-20/100, 210, 315
- 6 = AGMZO*-20/350
- 7 = AGMZO*-32/100, 210, 315
- 8 = AGMZO*-32/350



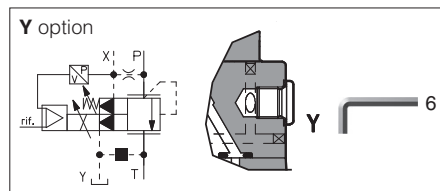
12 HYDRAULIC OPTIONS

- E** = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G 1/4").
- Y** = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G 1/4" available on the pilot stage body.



13 ELECTRONICS OPTIONS - only for **REB** and **RES**

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2



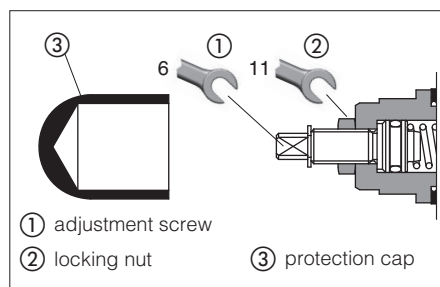
14 POSSIBLE COMBINED OPTIONS

- Hydraulic options:** all combination possible
- Electronics options:** /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

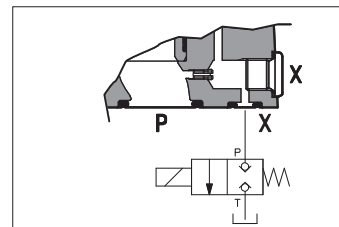
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



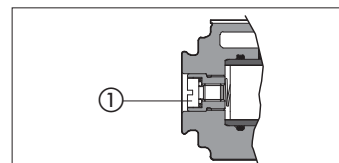
16 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve). This function can be used in emergency to unload the system pressure by-passing the proportional control.



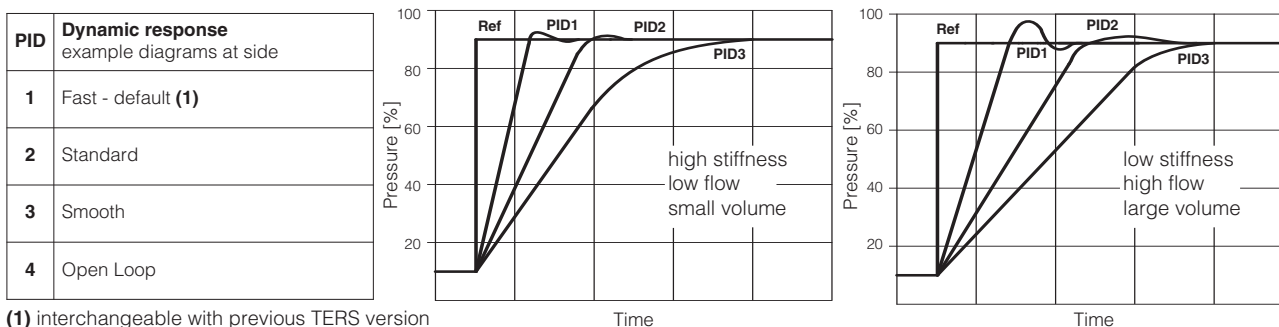
17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.



(1) interchangeable with previous TERS version

Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z**

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 Vdc or \pm 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24 Vdc.

20.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 \div 10 Vdc or 0 \div 20 mA.

20.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for **/Z** option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 \div 20 mA input, etc.).

Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the Enable input signal.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc Rectified and filtered: $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

21.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc Rectified and filtered: $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VL0 Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

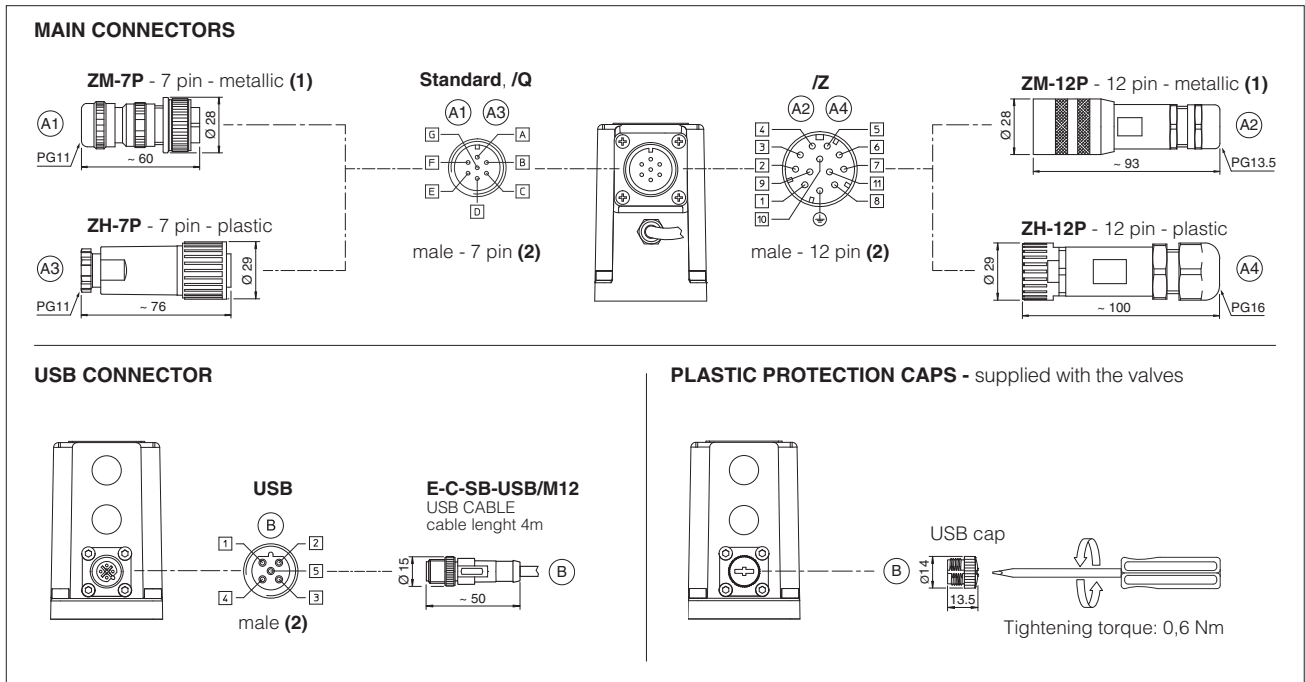
21.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

21.5 Pressure transducer connection - only for R

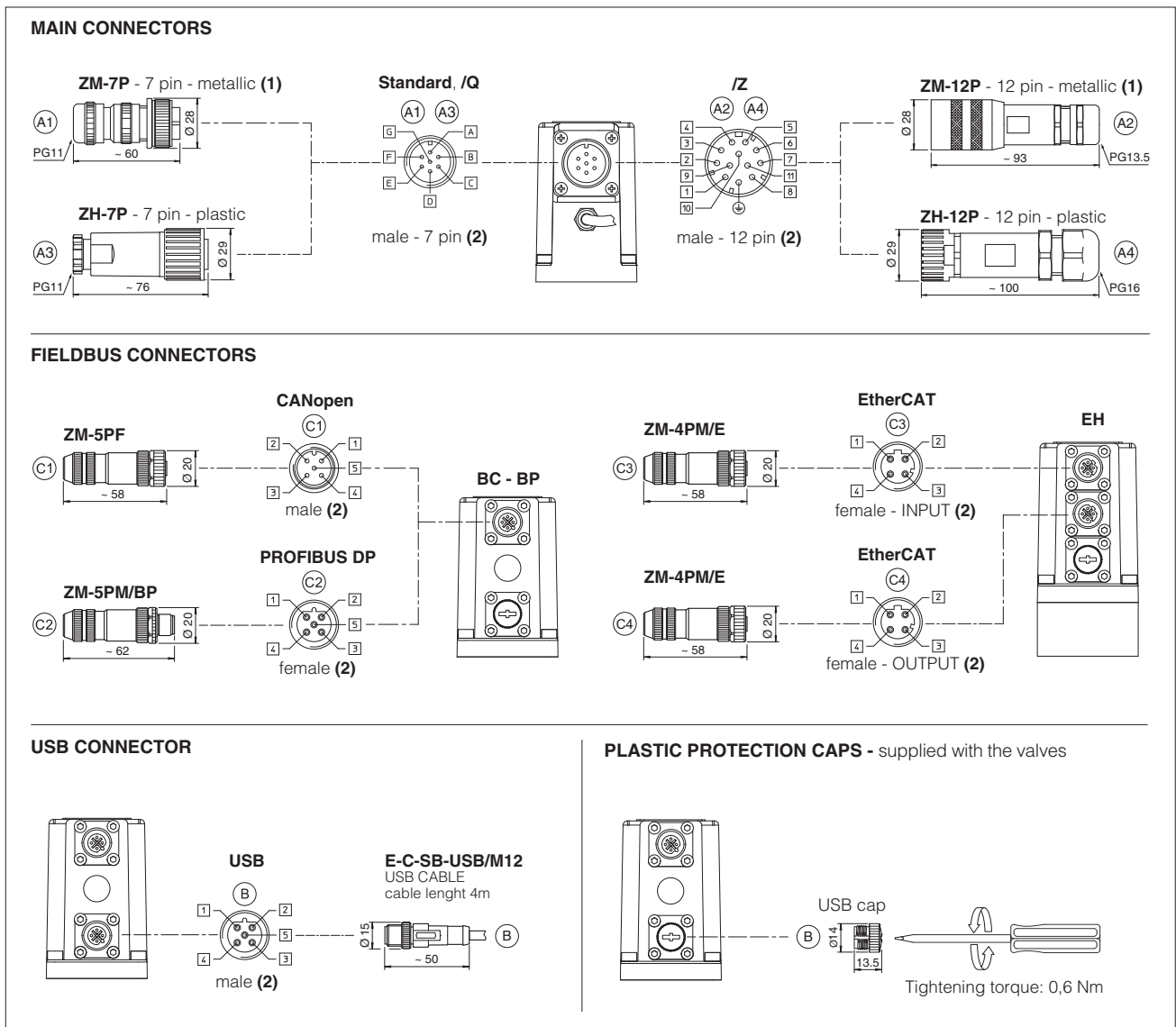
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

21.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for **REB** and **RES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

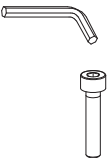

22.3 Fieldbus communication connectors - only for **RES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

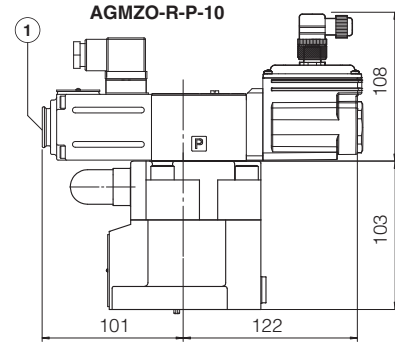
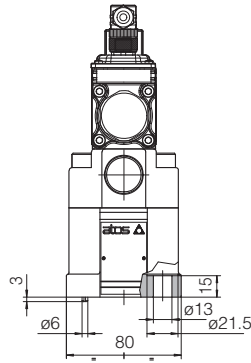
23 FASTENING BOLTS AND SEALS

	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
	<p>Fastening bolts: 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm</p>	<p>Fastening bolts: 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm</p>	<p>Fastening bolts: 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm</p>
	<p>Seals: 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm</p>	<p>Seals: 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm</p>	<p>Seals: 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm</p>

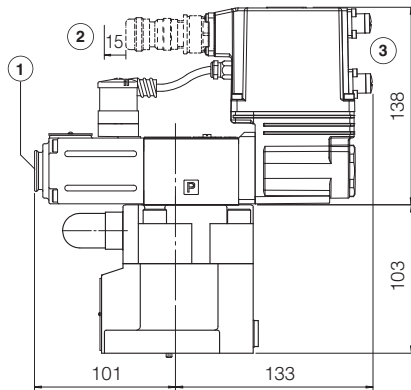
SIZE 10

ISO 6264: 2007
 Mounting surface: 6264-06-09-1-97
 (see table P005)

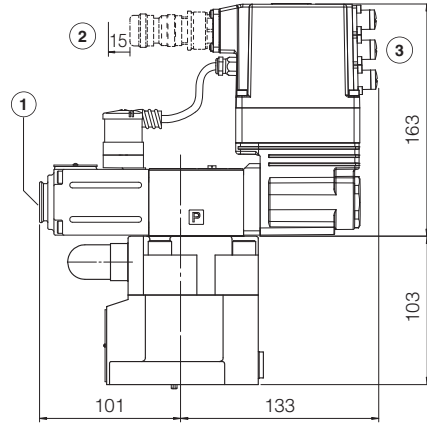
	Mass [kg]		
	R	REB, RES	RES-EH
AGMZO-*-10	5,7	6,2	6,3



AGMZO-REB-P-NP-10
 AGMZO-RES-P-BC-10
 AGMZO-RES-P-BP-10



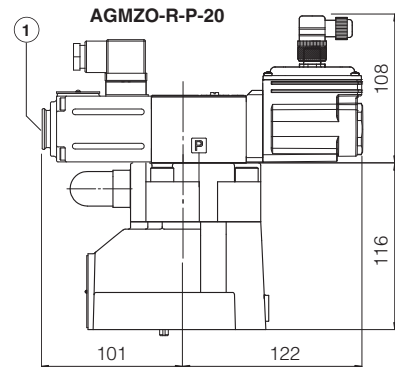
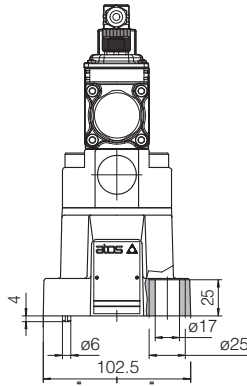
AGMZO-RES-P-EH-10



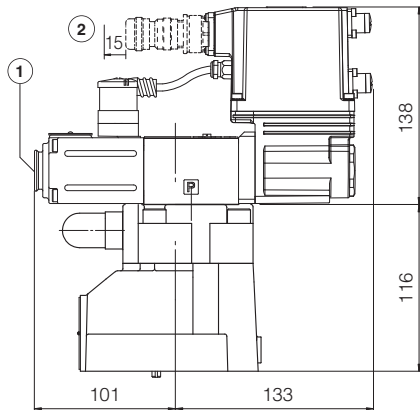
SIZE 20

ISO 6264: 2007
 Mounting surface: 6264-08-13-1-97
 (see table P005)

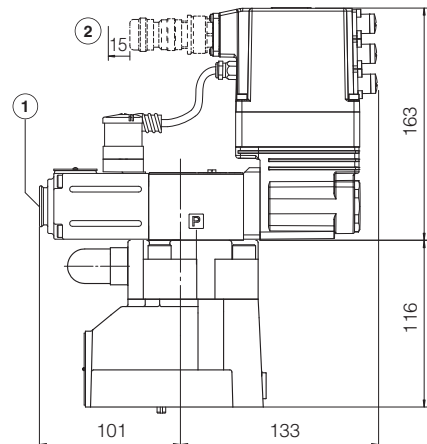
	Mass [kg]		
	R	REB, RES	RES-EH
AGMZO-*-20	6,9	7,4	7,5



AGMZO-REB-P-NP-20
 AGMZO-RES-P-BC-20
 AGMZO-RES-P-BP-20



AGMZO-RES-P-EH-20



- ① = Air bleeding, see section 17
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

SIZE 32

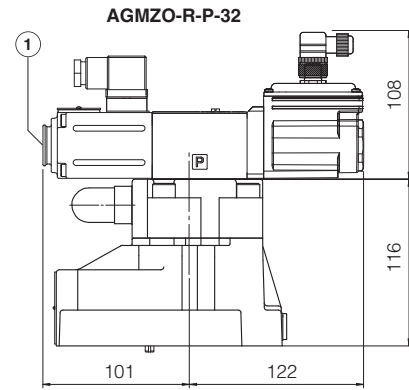
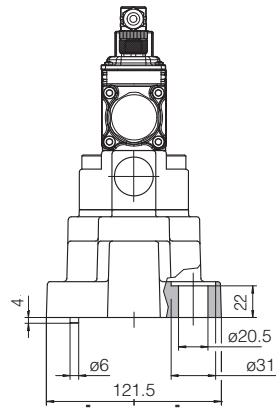
ISO 6264: 2007

Mounting surface: 6264-10-17-1-97

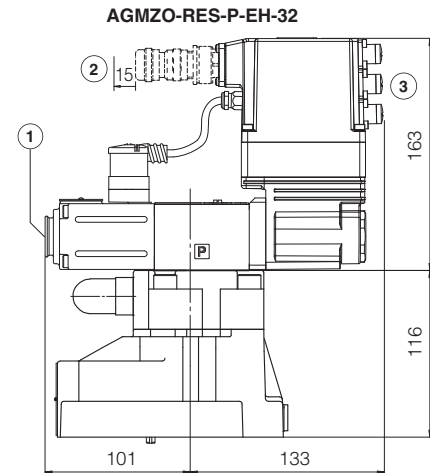
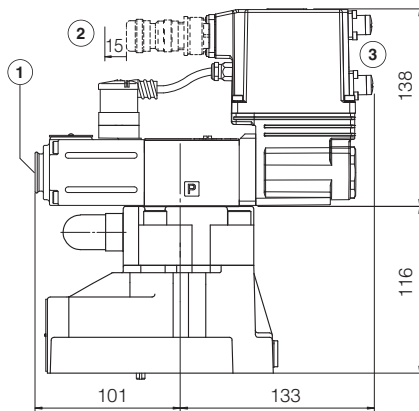
(see table P005)


(with M20 fixing holes instead of standard M18)

	Mass [kg]		
	R	REB, AES	RES-EH
AGMZO-*32	8,3	8,8	8,9



AGMZO-REB-P-NP-32
AGMZO-RES-P-BC-32
AGMZO-RES-P-BP-32



① = Air bleeding, see section 17 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

25 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics

FS900 Operating and maintenance information for proportional valves

GS203 E-BM-RES digital driver

GS500 Programming tools

GS510 Fieldbus

K800 Electric and electronic connectors

P005 Mounting surfaces for electrohydraulic valves

QB400 Quickstart for REB valves commissioning

QF400 Quickstart for RES valves commissioning

3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

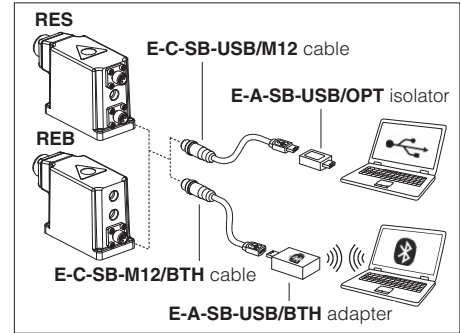


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZGO-*-010
Max regulated pressure [bar]	32; 100; 210
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure (1) [bar]	0,8
Max flow [l/min]	12
Response time 0-100% step signal (depending on installation) (2) [ms]	≤ 40
Hysteresis	≤ 0,3 [% of max pressure]
Linearity	≤ 1,0 [% of max pressure]
Repeatability	≤ 0,2 [% of max pressure]
Thermal drift	zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section **15**

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,4 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Voltage: maximum range 0 ÷ 10 Vdc @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

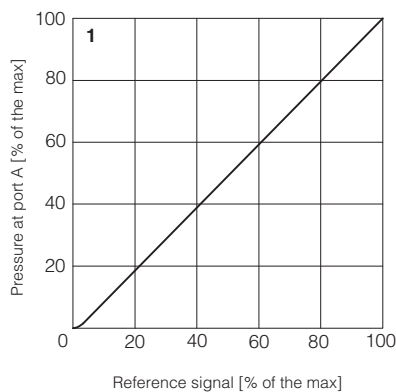
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{dc} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

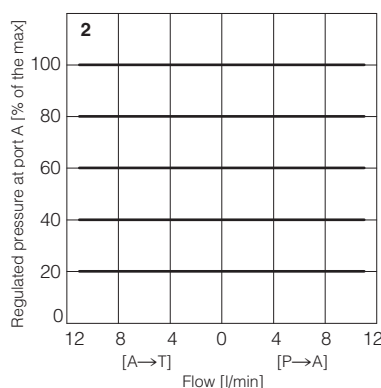
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for R), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

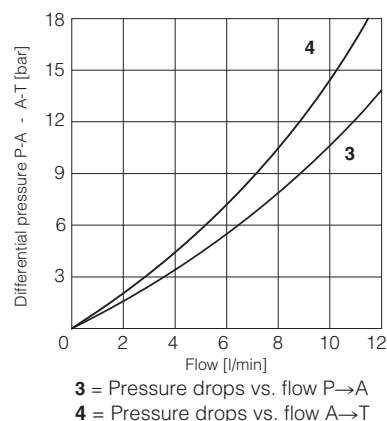
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



12 ELECTRONIC OPTIONS - only for **REB** and **RES**

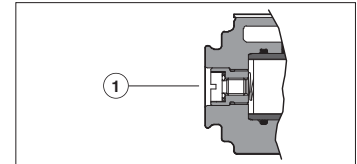
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

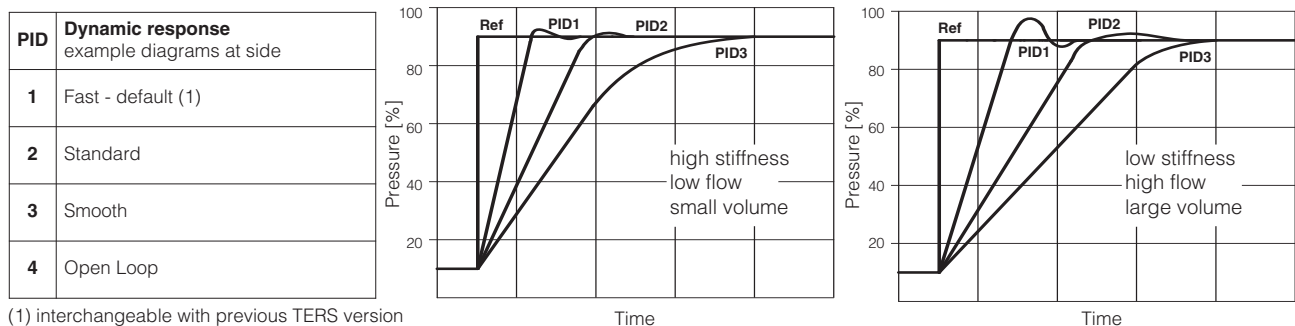
14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.



Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 Vdc.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷ 10 VDC or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VLO	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VLO Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VLO	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VLO	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

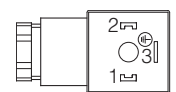
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

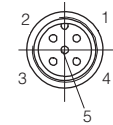
(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

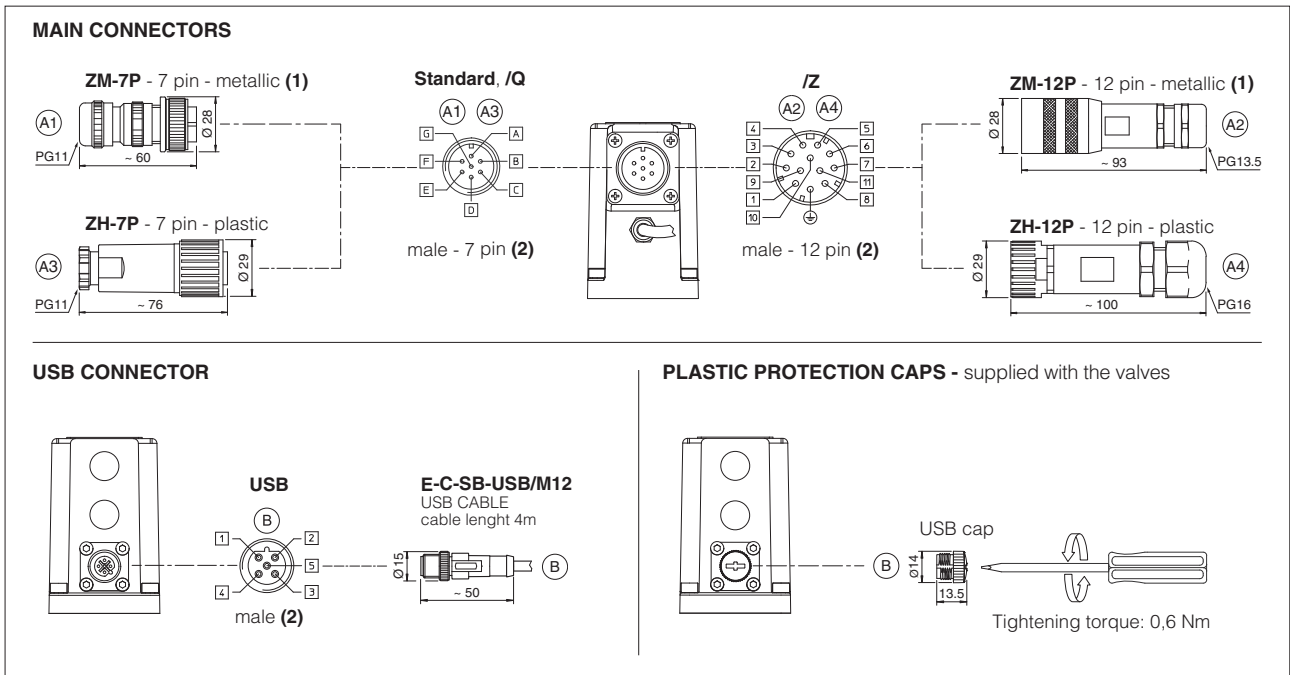
18.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18.5 Pressure transducer connection - only for R

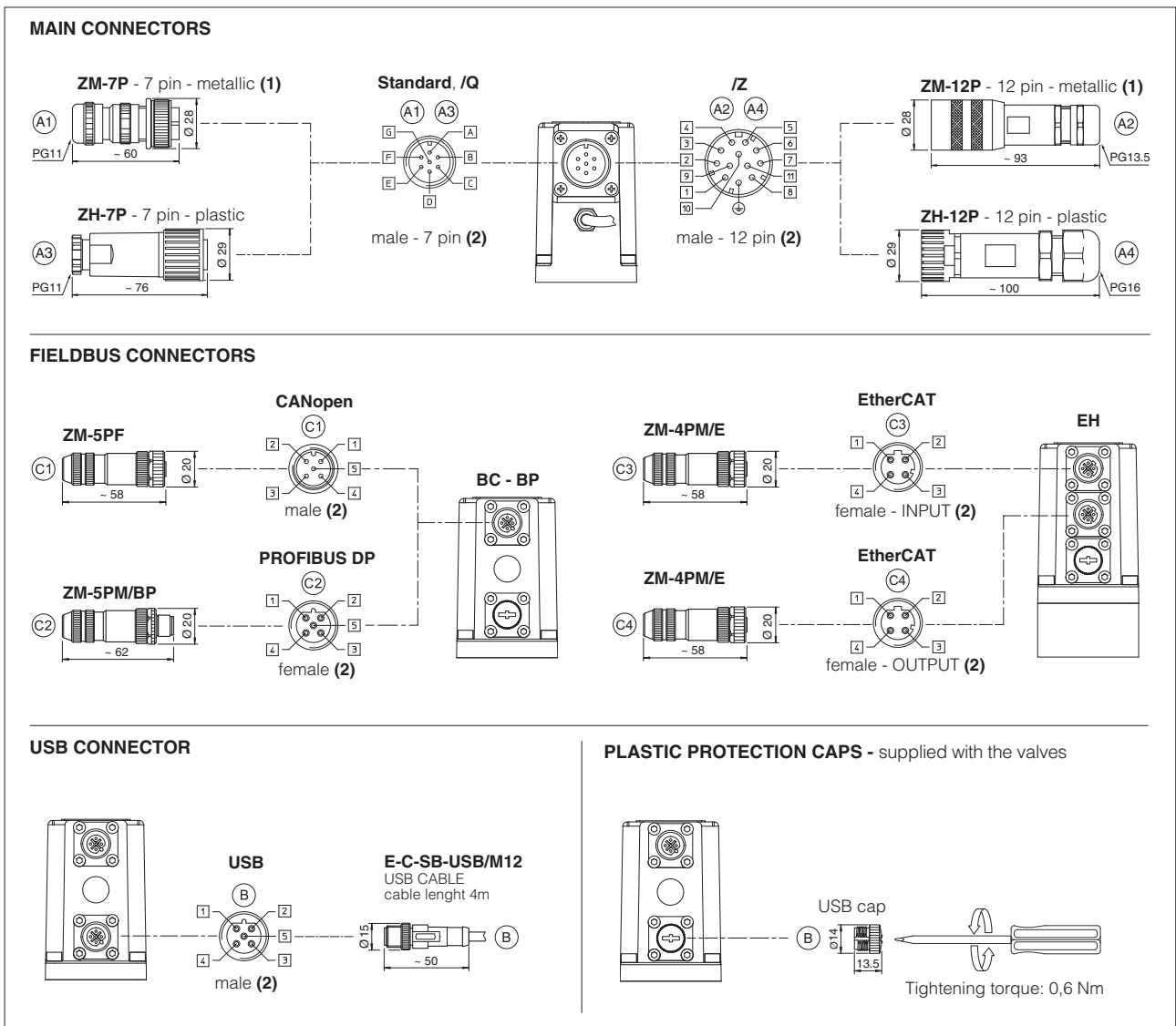
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08 
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

18.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

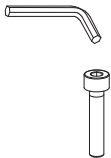

19.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS

	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals:</p> <p>4 OR 108 Diameter of ports P, A, T: Ø5 mm Port B not used</p>

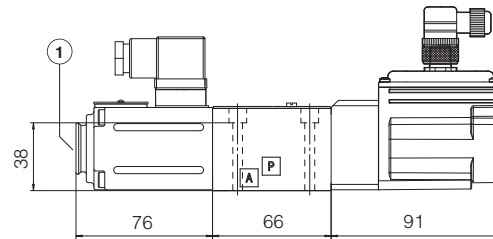
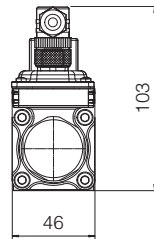
21 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

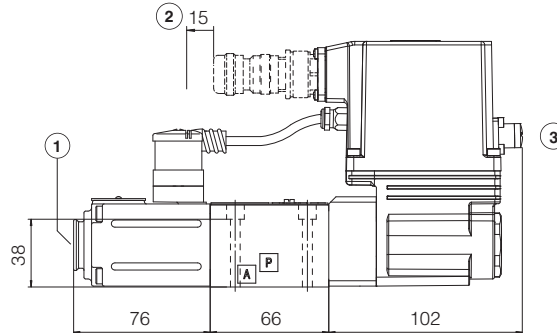
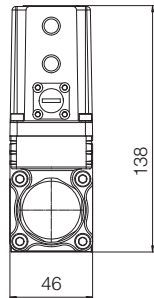
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	REB, RES	RES-EH
2,2	2,7	2,8

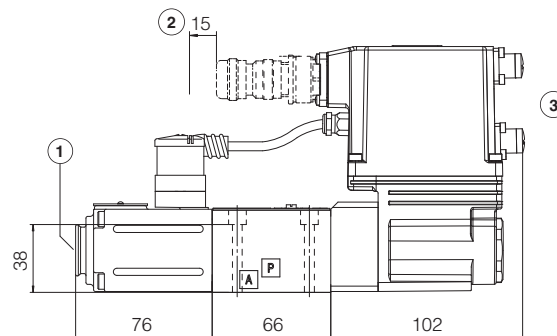
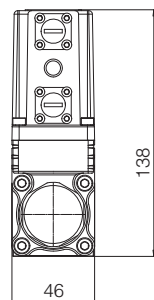
RZGO-R-P



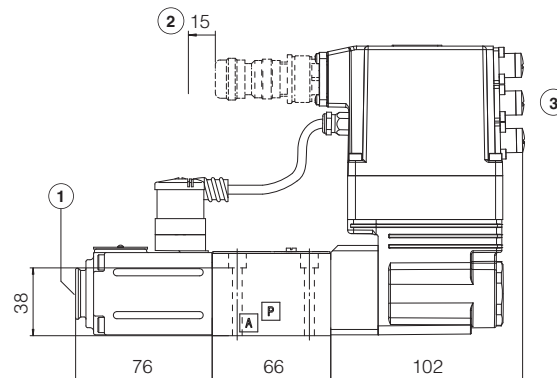
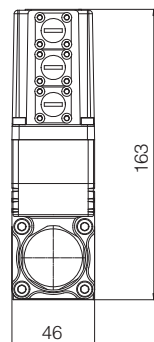
RZGO-REB-P-NP




RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



① = Air bleeding, see section 14 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

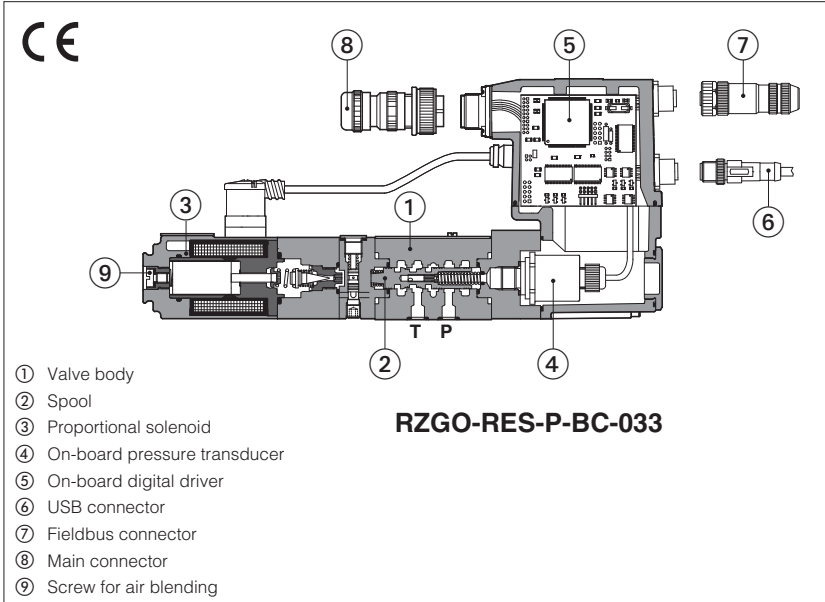
22 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
GS203 E-BM-RES digital driver
GS500 Programming tools
GS510 Fieldbus

K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
QB400 Quickstart for REB valves commissioning
QF400 Quickstart for RES valves commissioning

Proportional reducing valves high performance

piloted, with on-board pressure transducer



- ① Valve body
- ② Spool
- ③ Proportional solenoid
- ④ On-board pressure transducer
- ⑤ On-board digital driver
- ⑥ USB connector
- ⑦ Fieldbus connector
- ⑧ Main connector
- ⑨ Screw for air blending

RZGO-RES-P-BC-033

RZGO-R , RZGO-REB, RZGO-RES

Spool type, piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R to be coupled with off-board driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401

Max flow: **40 l/min**

Max pressure: **350 bar**

1 MODEL CODE

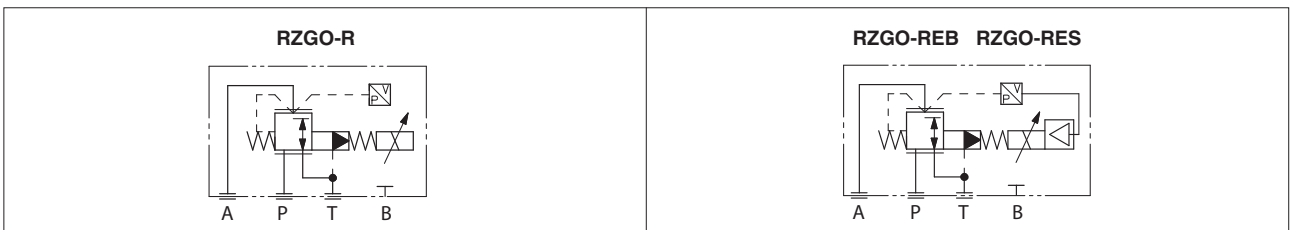
RZGO	-	REB	-	P	-	NP	-	033	/	210	/	*	/	*	/	*	/	*
<p>Proportional pressure reducing valve, piloted</p> <p>R = for off-board driver, see section [3] REB = basic on-board digital driver (1) RES = full on-board digital driver (2)</p> <p>P = with integral pressure transducer</p> <p>Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p> <p>Seals material, see section [10]: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Dynamic response preset, see section [15]: - = omit for PID 1 fast (default) 2 = PID 2 standard 3 = PID 3 smooth</p> <p>Electronic options, only for REB and RES (4): I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC) Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector</p> <p>Max regulated pressure: 100 = 100 bar 315 = 315 bar 210 = 210 bar 350 = 350 bar</p>																		

Configuration:

033 = regulation on port A, discharge in T (piloted operated version)

- (1) Only for **NP**
- (2) Only for **BC, BP, EH**
- (3) Omit for **R** execution
- (4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

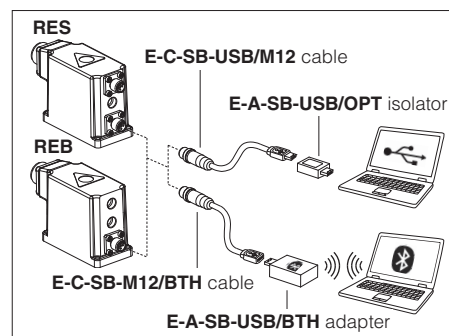


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZGO-*/033
Max regulated pressure [bar]	100; 210; 315; 350
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11
Min ÷ Max flow [l/min]	2,5 ÷ 40
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 35
Hysteresis	≤ 0,5 [% of max pressure]
Linearity	≤ 1,0 [% of max pressure]
Repeatability	≤ 0,5 [% of max pressure]
Thermal drift	zero point displacement < 1% at ΔT = 40°C

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section 15

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 \div 3,3 Ω			
Analog input signals	Voltage: range ± 10 VDC (24 V_{MAX} tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor output	Voltage: maximum range 0 \div 10 VDC @ max 5 mA Current: maximum range 0 \div 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 9 Vdc (OFF state), 15 \div 24 Vdc (ON state), 9 \div 15 VDC (not accepted); Input impedance: $R_i > 87$ k Ω			
Fault output	Output range : 0 \div 24 VDC (ON state \cong VL+ [logic power supply] ; OFF state \cong 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 \div 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

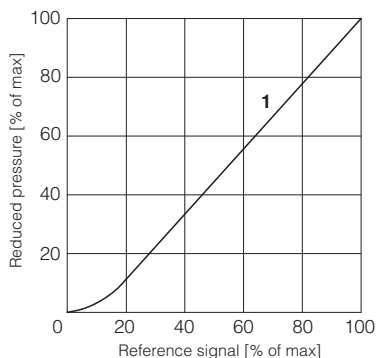
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

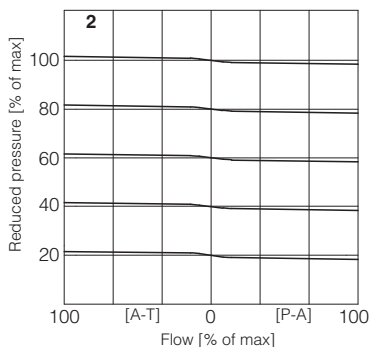
Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C (+80°C for R), with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

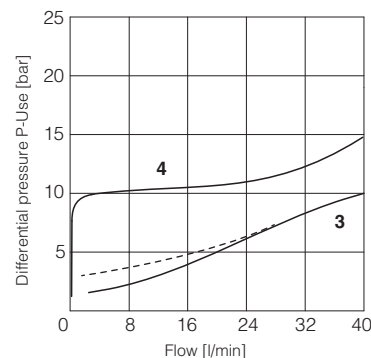
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = A \rightarrow T (dotted line for pressure range /350)
4 = Pressure drops vs. flow P n A

12 ELECTRONIC OPTIONS - only for **REB** and **RES**

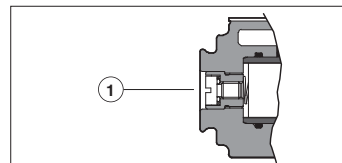
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 17.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 17.2

13 POSSIBLE COMBINED OPTIONS

Electronics options: /IQ, /IZ

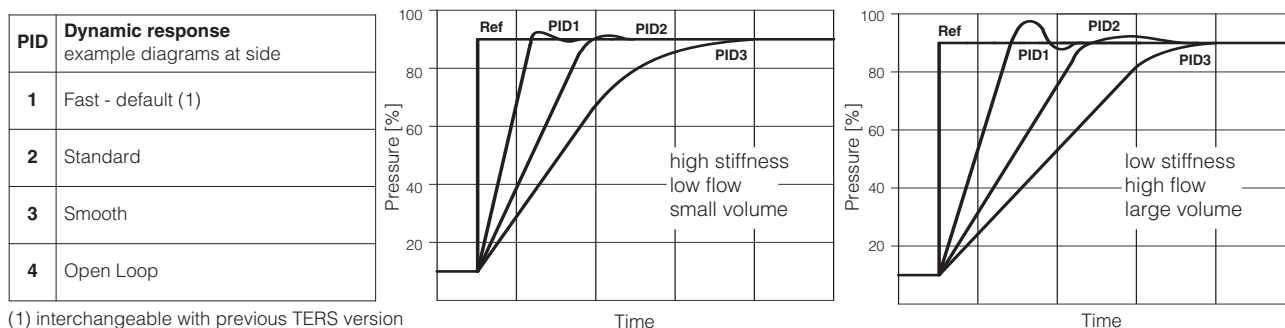
14 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



15 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.



Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

16 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

⚠ A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 Vdc.

17.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷ 10 Vdc or 0 ÷ 20 mA.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VLO	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VLO Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VLO	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VLO	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

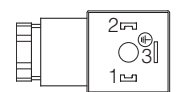
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

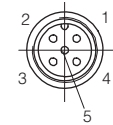
(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

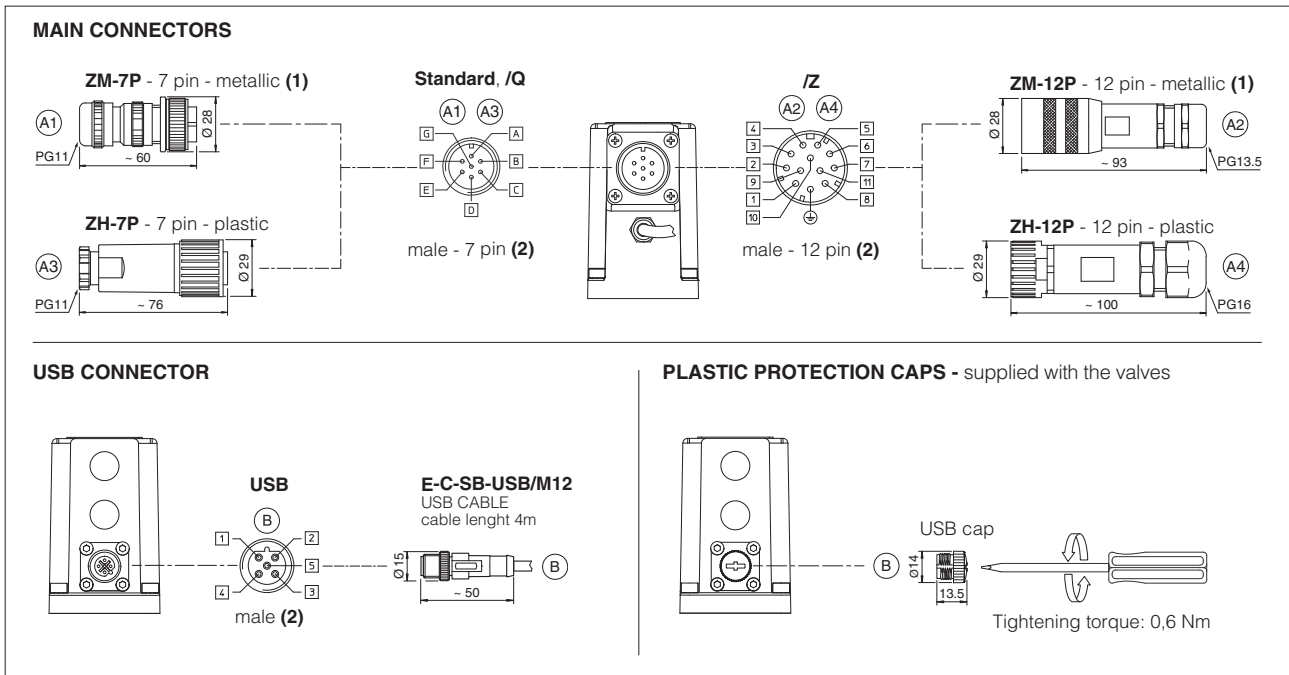
18.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18.5 Pressure transducer connection - only for R

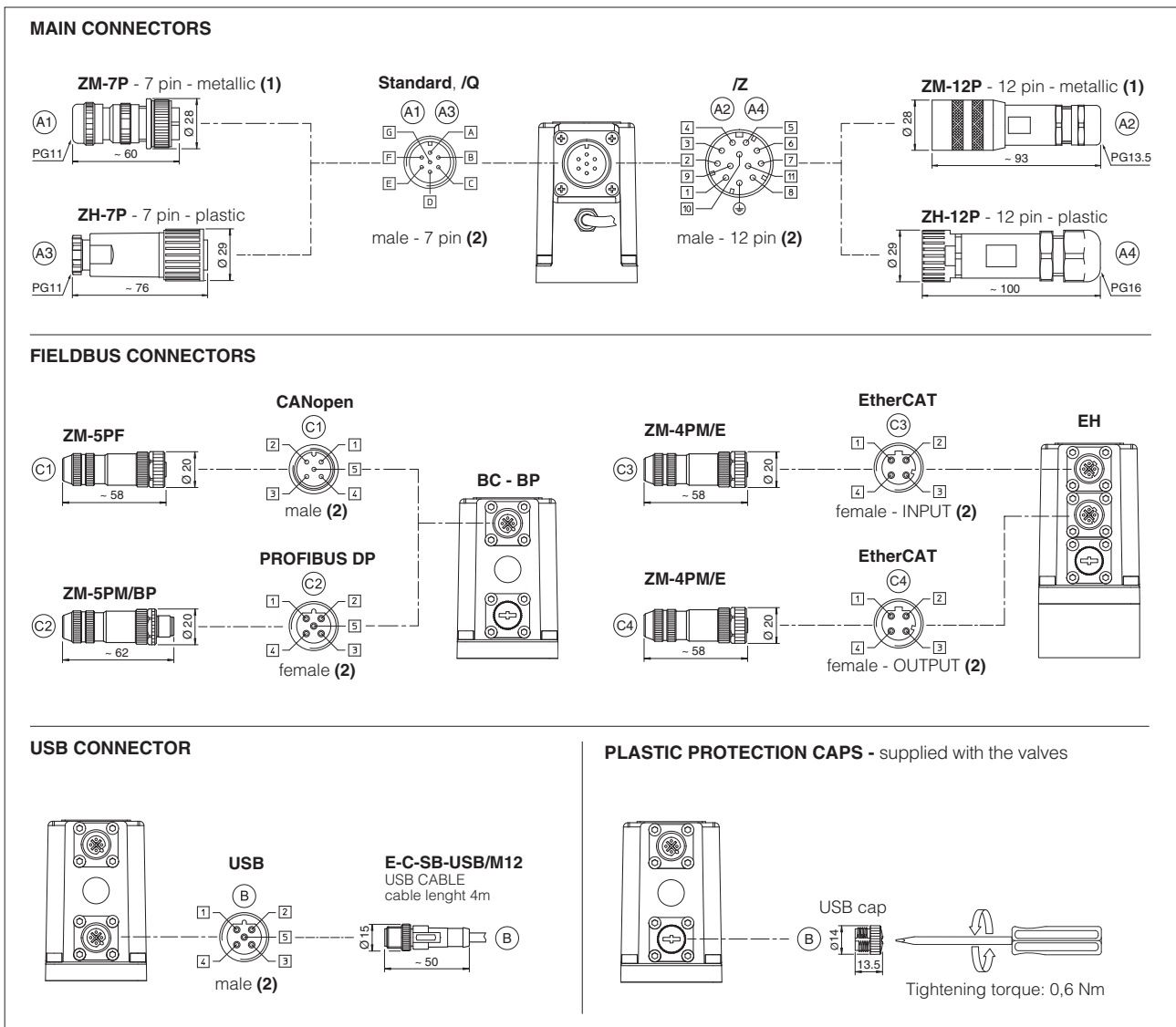
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08 
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

18.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

20 FASTENING BOLTS AND SEALS

	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals:</p> <p>4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used</p>

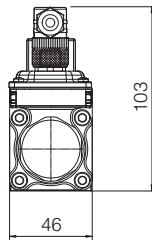
21 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

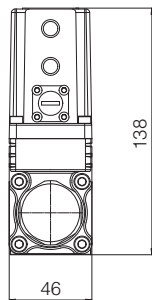
Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
R	REB, RES	RES-EH
3,0	3,5	3,6

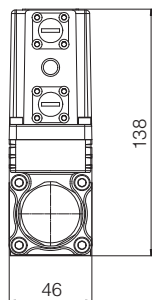
RZGO-R-P



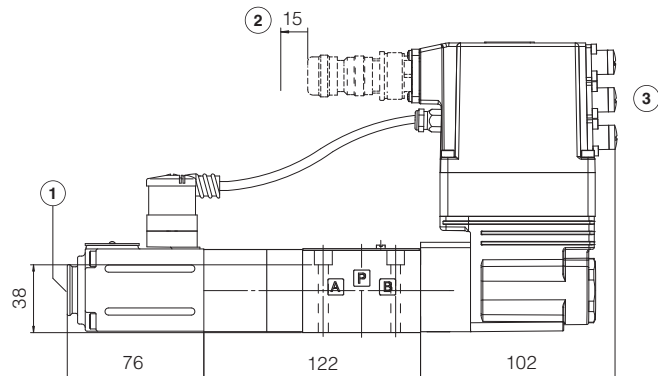
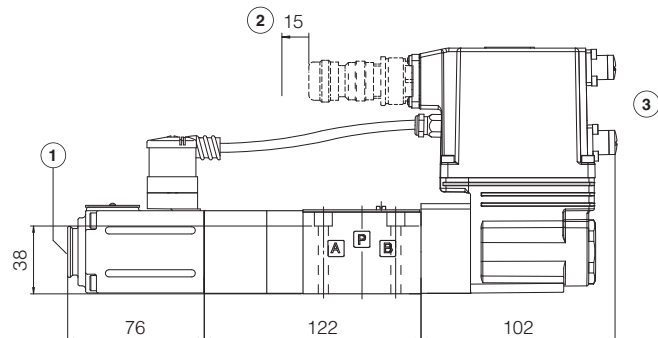
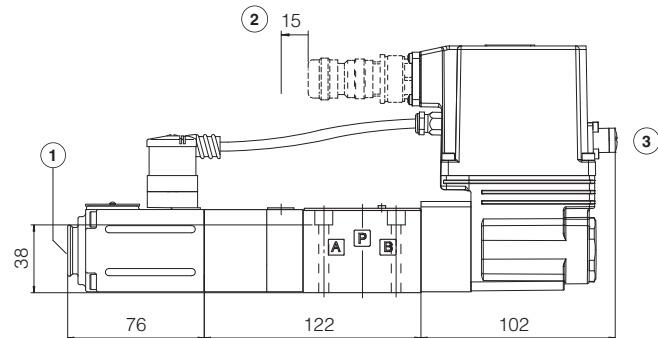
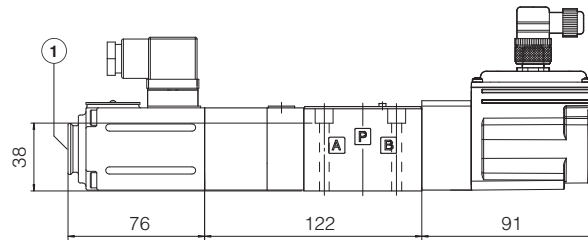
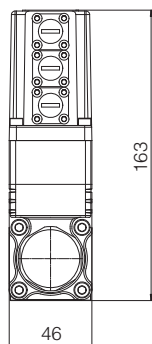
RZGO-REB-P-NP




RZGO-RES-P-BP
RZGO-RES-P-BC



RZGO-RES-P-EH



① = Air bleeding, see section 14 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 18.6 and 18.7

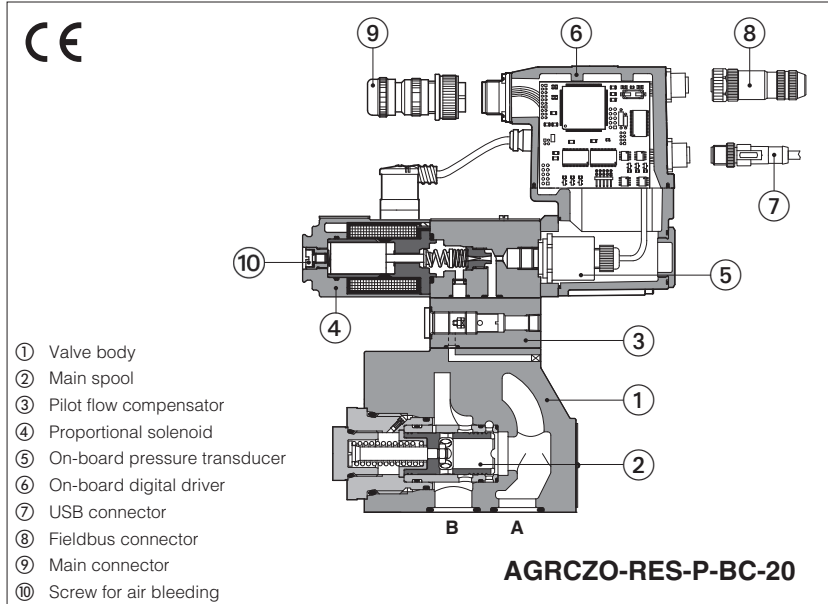
22 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics
FS900	Operating and maintenance information for proportional valves
GS203	E-BM-RES digital driver
GS500	Programming tools
GS510	Fieldbus

K800	Electric and electronic connectors
P005	Mounting surfaces for electrohydraulic valves
QB400	Quickstart for REB valves commissioning
QF400	Quickstart for RES valves commissioning

Proportional reducing valves high performance

piloted, with on-board pressure transducer



AGRCZO-R, AGRCZO-REB, AGRCZO-RES

Piloted, digital proportional reducing valves with integral pressure transducer for pressure closed loop controls.

R without on-board digital driver, to be coupled with separated driver.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

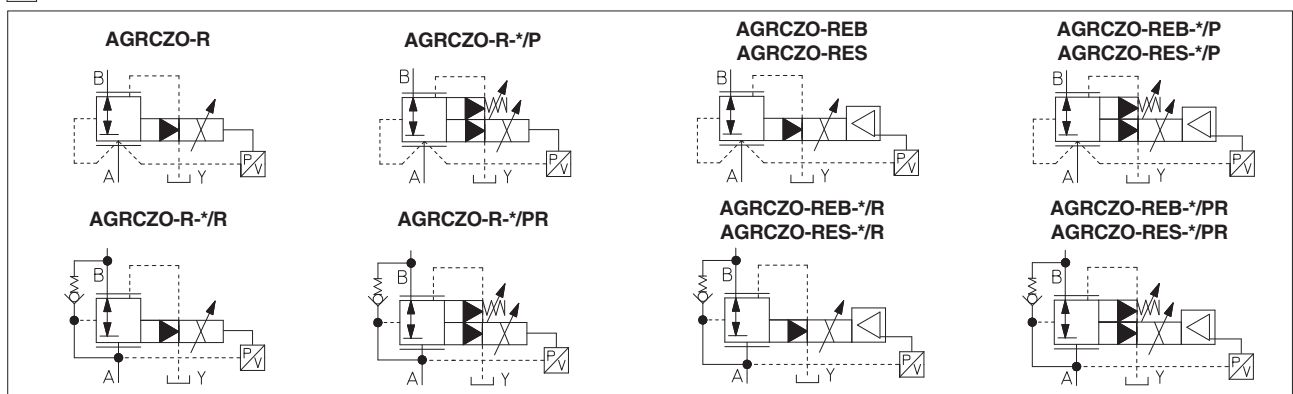
Size: **10** and **20** - ISO 5781
 Max flow: **160** and **300 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	RES	-	P	-	BC	-	10	/	315	/	*	/	*	/	*	/	*
Proportional pressure reducing valve, piloted																Seals material, see section 10: - = NBR PE = FKM BT = HNBR		
R = for separated driver, see section 3 REB = basic on-board digital driver (1) RES = full on-board digital driver (2)																Dynamic response preset, see section 16: - = omit for PID 1 fast (default) 2 = PID 2 standard 3 = PID 3 smooth		
P = with integral pressure transducer																Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT		
Valve size ISO 5781: 10, 20																Hydraulic options (4): P = with integral mechanical pressure limiter R = with integral check valve for free reverse flow		
Max regulated pressure: 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar																Electronics options, only for REB and RES (4): I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector		

- (1) Only for NP
- (2) Only for BC, BP, EH
- (3) Omit for R execution
- (4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

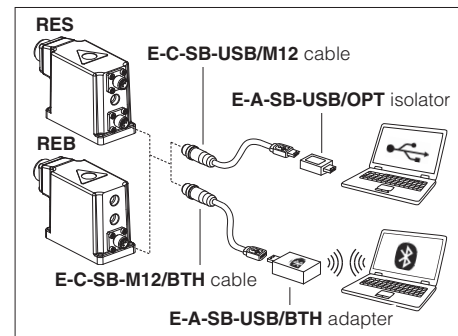


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for RES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model		AGRCZO-*-10	AGRCZO-*-20
Max regulated pressure [bar]		100; 210; 315; 350	
Min regulated pressure [bar]		1; 3 (only for /350)	
Max pressure at port A or B [bar]		350	
Max pressure at port Y [bar]		pilot drain always external, to be directly connected to tank at zero pressure	
Max flow [l/min]		160	300
Response time 0-100% step signal (depending on installation) (1) [ms]		≤ 45	≤ 50
Hysteresis		≤ 0,5 [% of max pressure]	
Linearity		≤ 1,0 [% of max pressure]	
Repeatability		≤ 0,2 [% of max pressure]	
Thermal drift		zero point displacement < 1% at ΔT = 40°C	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section **16**

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Voltage: maximum range 0 ÷ 10 Vdc @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

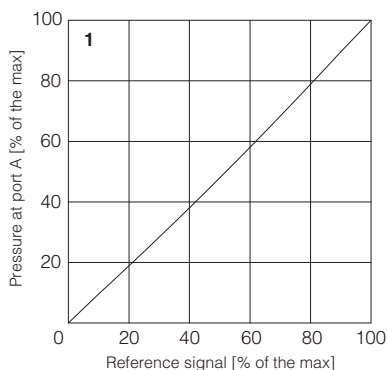
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{dc} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

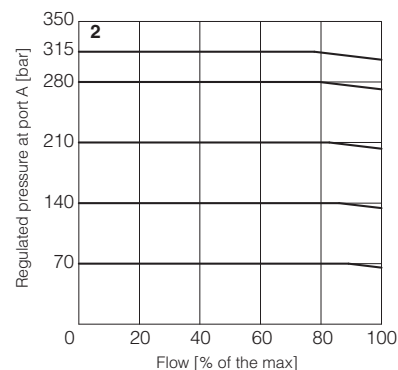
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for R), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min



3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A

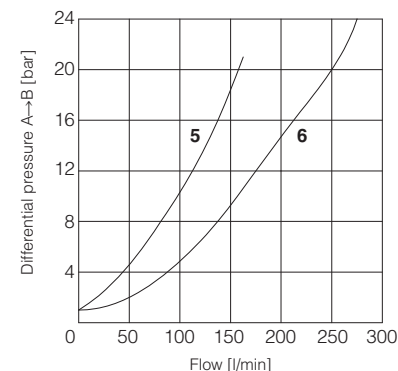
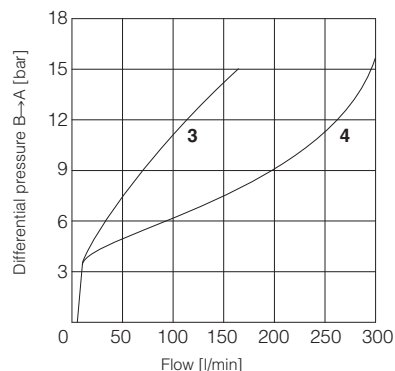
3 = AGRCZO-*-10

4 = AGRCZO-*-20

Differential pressure A→B (through check valve)

5 = AGRCZO-*-10*/R

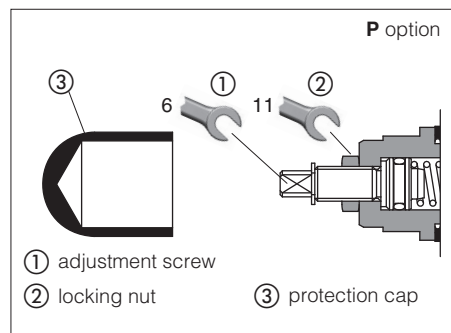
6 = AGRCZO-*-20*/R



12 HYDRAULIC OPTIONS

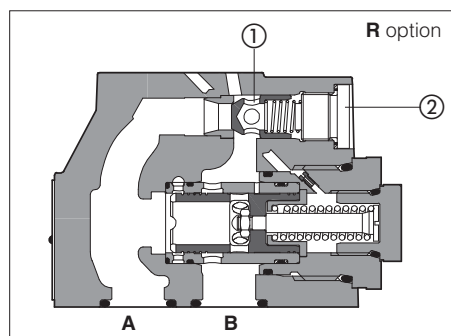
P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control. For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



R = This option provides a integral check valve for free reverse flow A→B

- ① Check valve - cracking pressure = 0,5 bar
- ② Plug



13 ELECTRONICS OPTIONS - only for **REB** and **RES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see 18.6

Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 18.2

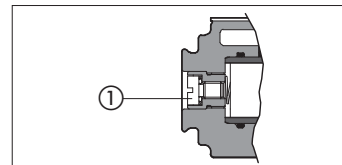
14 POSSIBLE COMBINED OPTIONS

for **R**: /PR

for **REB** and **RES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING

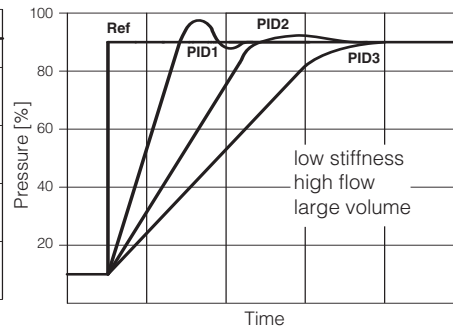
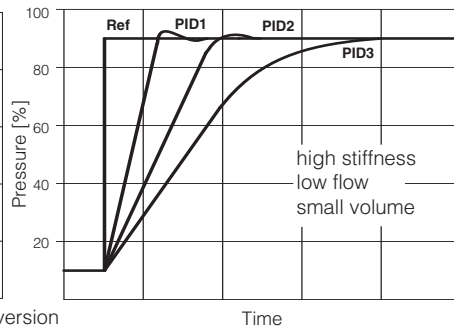
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



16 DYNAMIC RESPONSE - 4 pressure PIDs - only for REB and RES

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop



(1) interchangeable with previous TERS version

Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

17 PRESSURE TRANSDUCER FAILURE - only for REB and RES

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for REB and RES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 18.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 VDC for standard and 4 \div 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 VDC or \pm 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 \div 24 Vdc.

18.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 \div 10 VDC or 0 \div 20 mA.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 \div 20 mA input, etc.).

Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the Enable input signal.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div 10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND	V0	Pressure monitor output signal: $0 \div 10$ Vdc / $0 \div 20$ mA maximum range Defaults are $0 \div 10$ Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VLO	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div 10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: $0 \div 10$ Vdc / $0 \div 20$ mA maximum range, referred to VLO Defaults are $0 \div 10$ Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VLO	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VLO	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

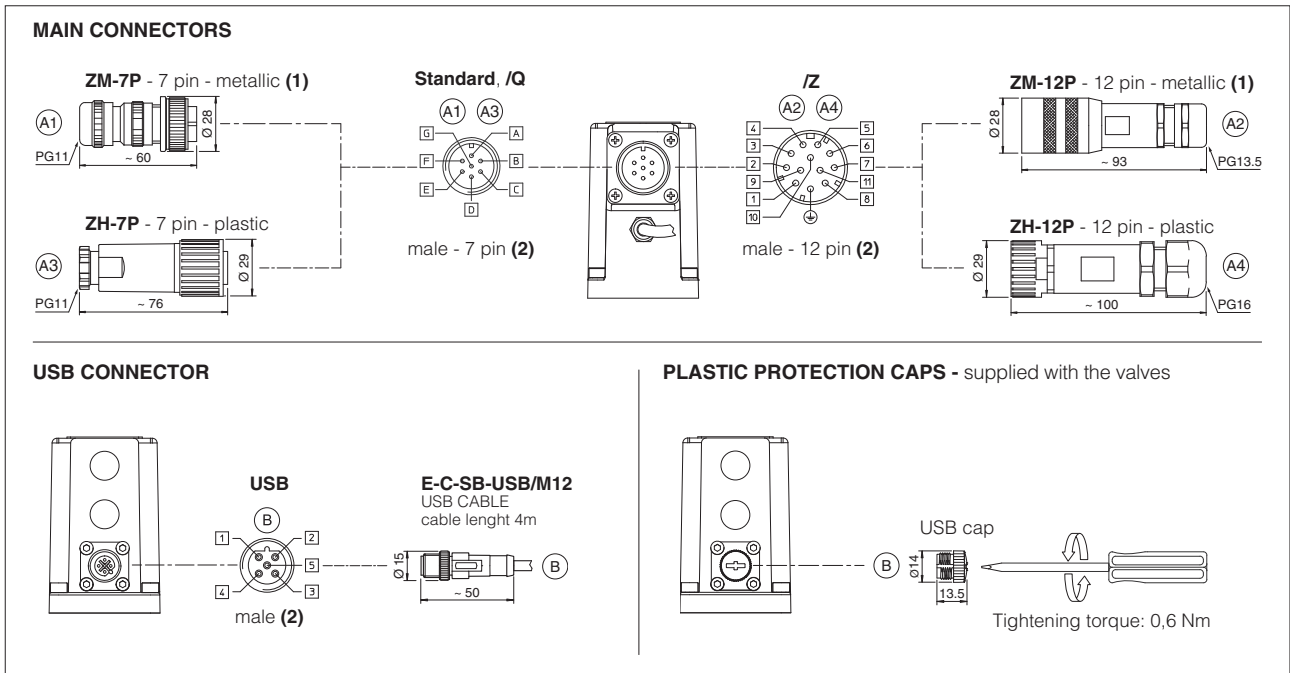
19.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

19.5 Pressure transducer connection - only for R

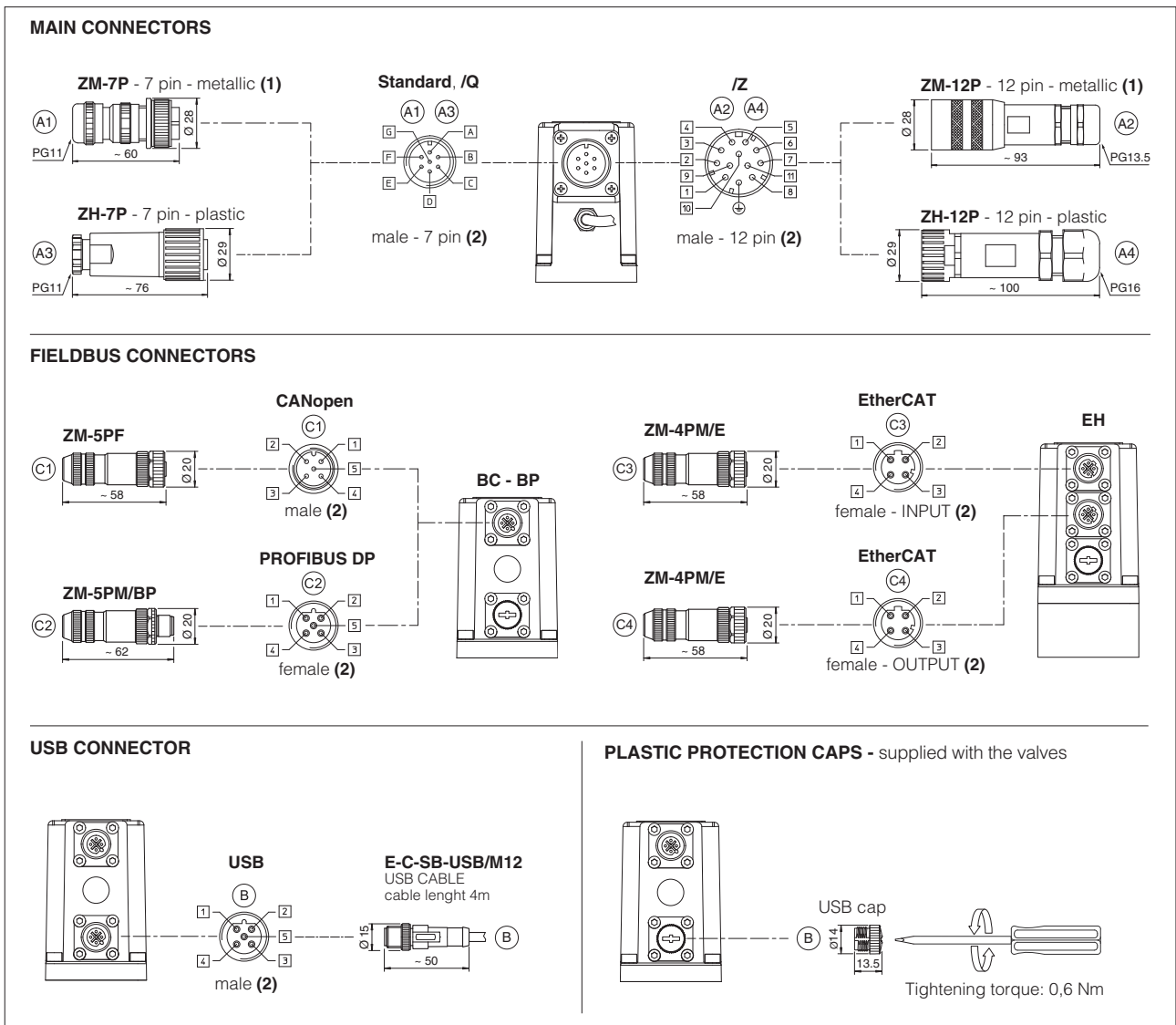
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal $4 \div 20$ mA	
4	NC	Not connected	
5	NC	Not connected	

19.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

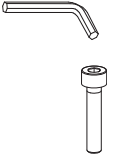

20.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 FASTENING BOLTS AND SEALS

	AGRCZO-*-10 Fastening bolts: 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	AGRCZO-*-20 Fastening bolts: 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	 Seals: 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	Seals: 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

22 RELATED DOCUMENTATION

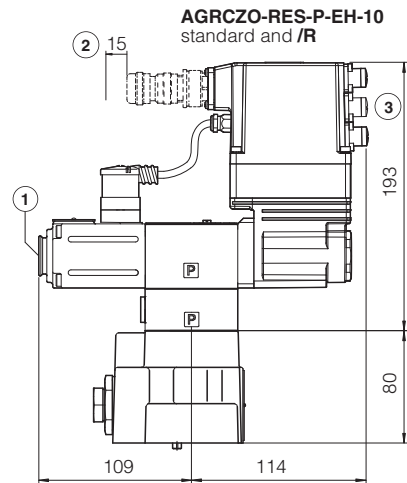
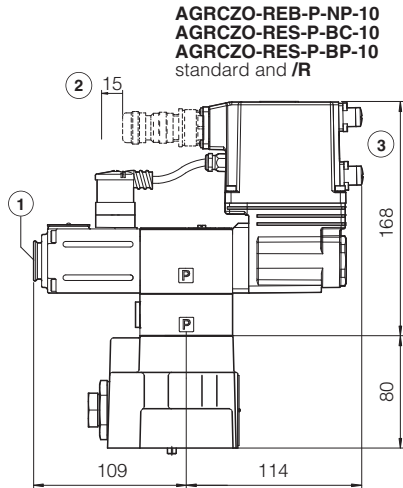
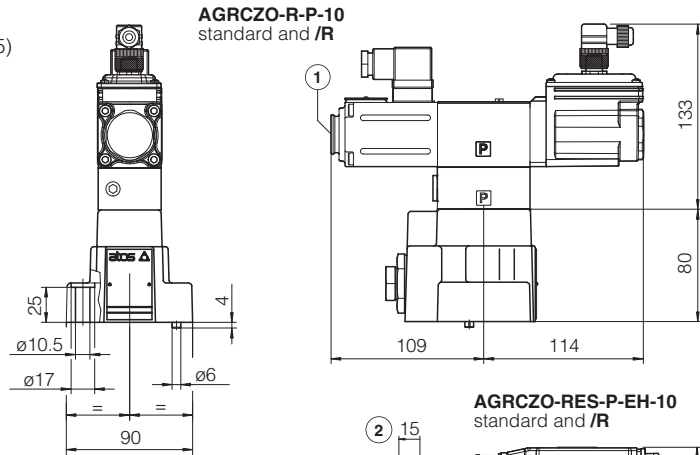
FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
GS203	E-BM-RES digital driver	QB400	Quickstart for REB valves commissioning
GS500	Programming tools	QF400	Quickstart for RES valves commissioning
GS510	Fieldbus		

23 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

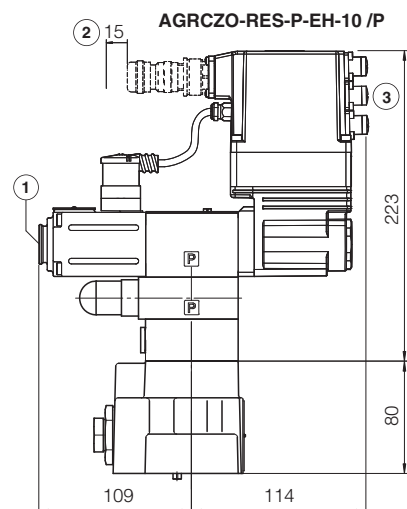
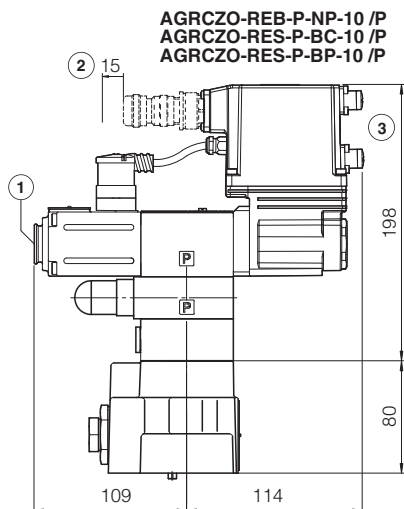
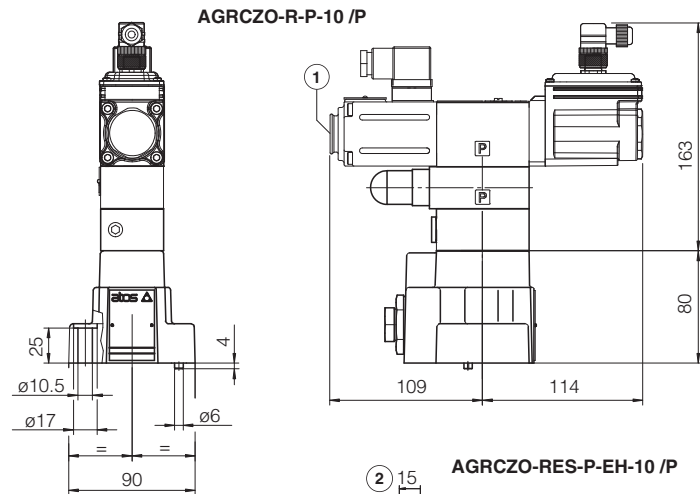
ISO 5781: 2000

Mounting surface: 5781-06-07-0-00 (see table P005)

	Mass [kg]		
	R	REB, RES	RES-EH
AGRCZO-*-10	5,8	6,3	6,4
Option /P	+0,5		



- ① = Air bleeding, see section 15
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 19.6 and 19.7

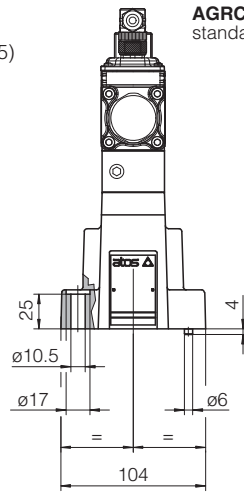


24 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

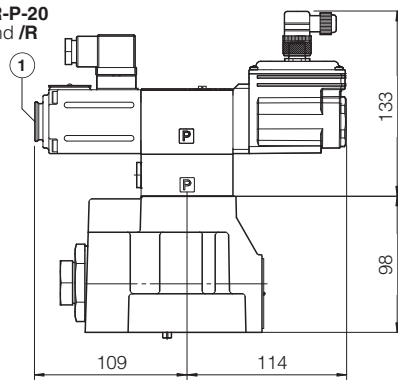
ISO 5781: 2000

Mounting surface: 5781-08-10-0-00 (see table P005)

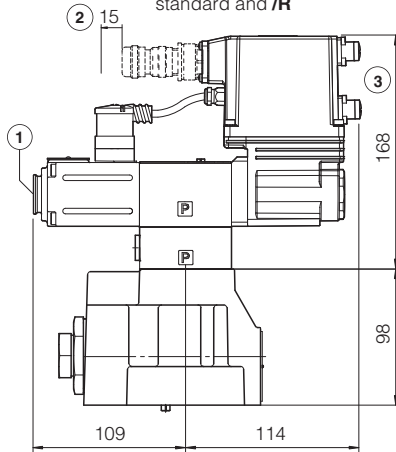
	Mass [kg]		
	R	REB, RES	RES-EH
AGRCZO-*-20	8,3	8,8	8,9
Option /P		+0,5	



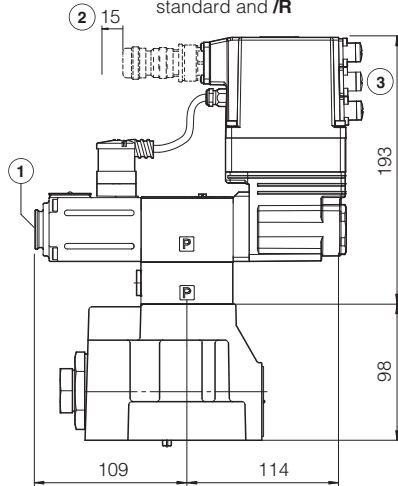
AGRCZO-R-P-20
standard and /R



AGRCZO-REB-P-NP-20
AGRCZO-RES-P-BC-20
AGRCZO-RES-P-BP-20
standard and /R

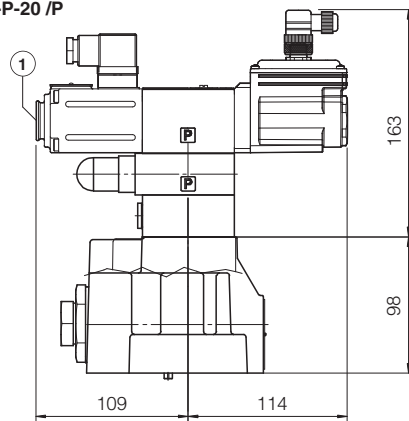
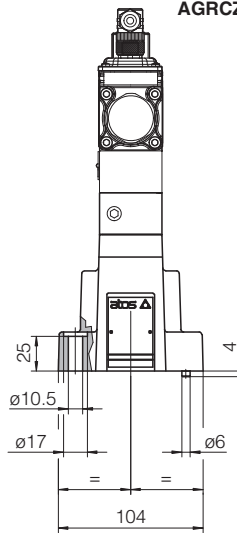


AGRCZO-RES-P-EH-20
standard and /R

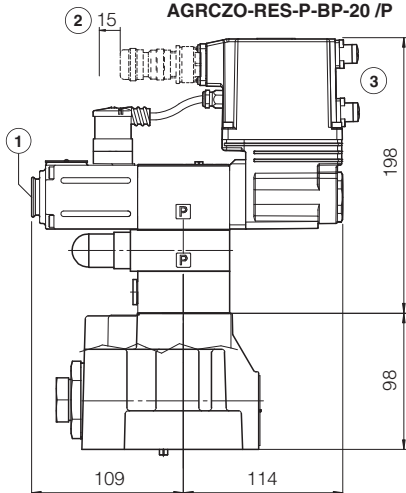


- ① = Air bleeding, see section 15
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 19.6 and 19.7

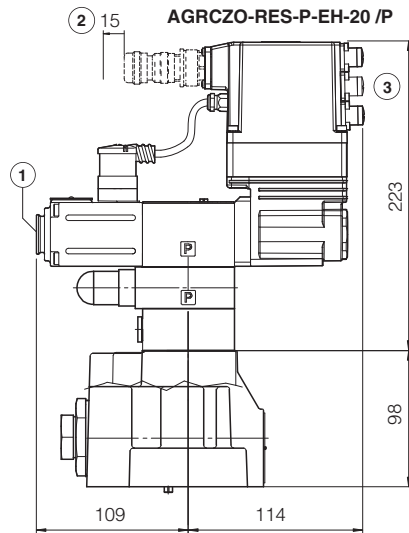
AGRCZO-R-P-20 /P



AGRCZO-REB-P-NP-20 /P
AGRCZO-RES-P-BC-20 /P
AGRCZO-RES-P-BP-20 /P

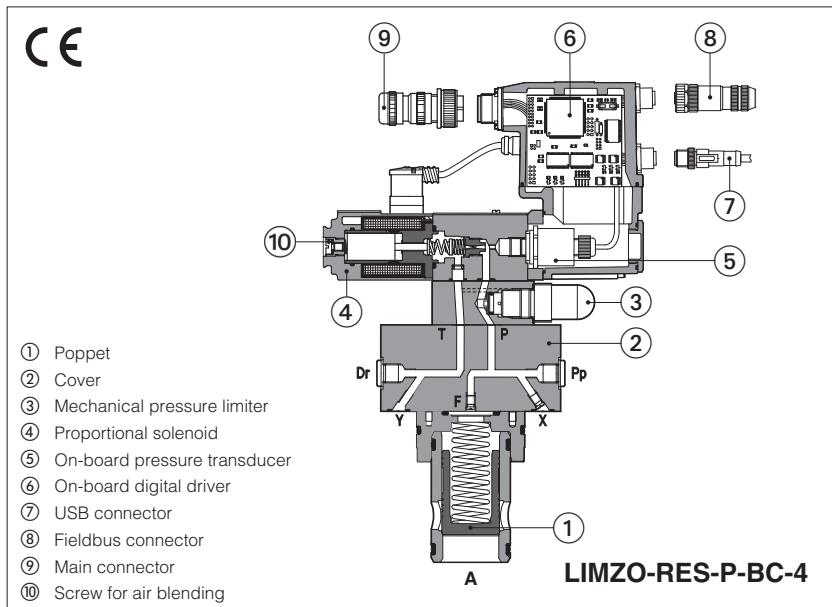


AGRCZO-RES-P-EH-20 /P



Digital proportional pressure cartridges high performance

piloted, with on-board pressure transducer - compensator, relief, reducing functions



LICZO, LIMZO, LIRZO

2-way digital proportional cartridges with on-board pressure transducer, respectively performing: pressure compensator, relief and reducing closed loop functions.

R to be coupled with off-board drivers.

REB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

RES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: 16 ÷ 80 - ISO 7368

Max flow: up to 4500 l/min

Max pressure: 350 bar

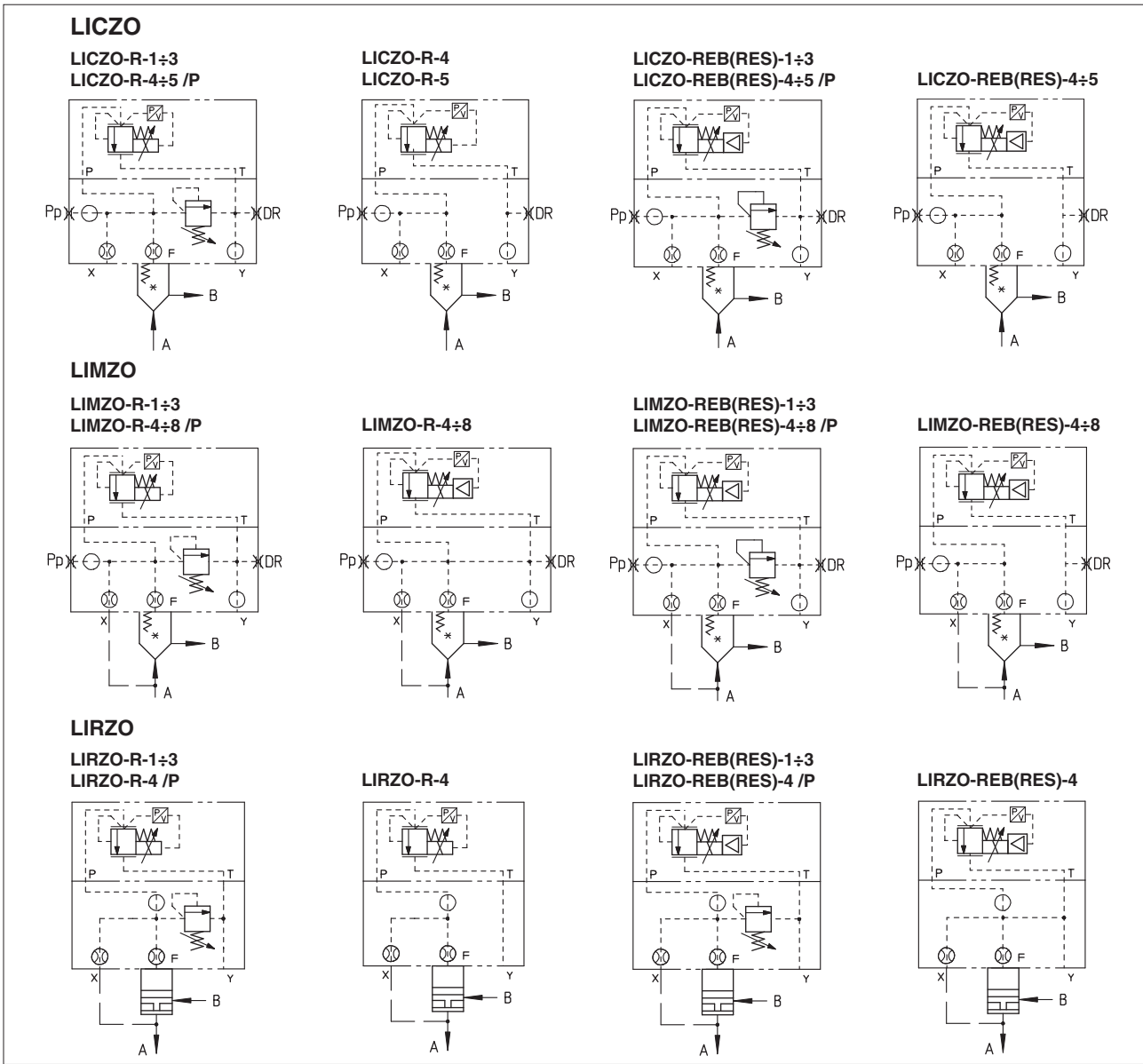
1 MODEL CODE OF COVERS

LIMZO	-	RES	-	P	-	BC	-	4	/	315	/	*	/	*	/	*	*	
<p>Proportional pressure cartridges, piloted</p> <p>LICZO = pressure compensator LIMZO = pressure relief LIRZO = pressure reducing</p> <p>R = for off-board driver, see section 5 REB = basic on-board digital driver (1) RES = full on-board digital driver (2)</p> <p>P = with integral pressure transducer</p> <p>Fieldbus interfaces USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p> <p>Valve size ISO 7368: 1 = 16 2 = 25 3 = 32 4 = 40 5 = 50 (not for LIRZO) 6 = 63 (only for LIMZO) 8 = 80 (only for LIMZO)</p>																	<p>Seals material, see section 12: - = NBR PE = FKM BT = HNBR</p> <p>Dynamic response preset, see section 18: - = omit for PID 1 fast (default) 2 = PID 2 standard 3 = PID 3 smooth</p> <p>Hydraulic options (4): P =with on-board mechanical pressure limiter (standard for size 1, 2 and 3)</p> <p>Electronics options, only for REB and RES (4): I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector</p>	
																		<p>Max regulated pressure: 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar</p>

(1) Only for NP
 (2) Only for BC, BP, EH

(3) Omit for R execution
 (4) For possible combined options, see section 16

2 HYDRAULIC SYMBOLS



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	*	/	*
Cartridge according to ISO 7368				Series number			
Cartridge size ISO 7368: 16; 25; 32; 40; 50; 63; 80				Seals material, see section 12: - = NBR PE = FKM BT = HNBR			
Type of poppet: 31 = for LIMZO and LICZO 36 = for LICZO 37 = for LIRZO				Spring cracking pressure: 2 = 1,5 bar for poppet 31 3 = 3 bar 4 = 4 bar 6 = 6 bar for poppet 31 and 36 7 = 7 bar for poppet 37			

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	1:1	1:1	1:1

5 OFF-BOARD ELECTRONIC DRIVER - only for R

Drivers model	E-BM-RES
Type	Digital
Format	DIN rail panel format
Tech table	GS203

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

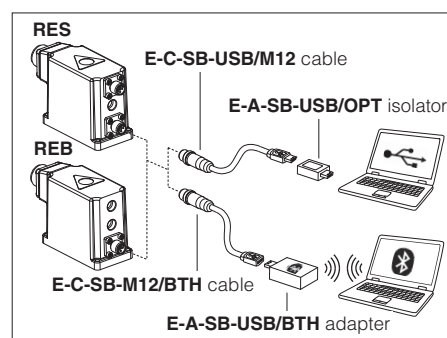
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



8 FIELDBUS - only for RES, see tech. table GS510

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	R: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C REB, RES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	R: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C REB, RES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for REB and RES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	LICZO					LIMZO								LIRZO			
	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4	
valve size																	
Max flow [l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800	
Min regulated pres. at port A [bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	12	7				
Min regulated pres. at port A for /350 [bar]	11	10	10	13	16	10	10	9	12	13	13	16	12				
Max regulated pres. at port A [bar]	100; 210; 315; 350					100; 210; 315; 350								100; 210; 315; 350			
Response time 0-100% step signal (depending on installation) (1) [ms]	80 ÷ 300					80 ÷ 350								80 ÷ 200			
Hysteresis [% of the regulated max flow]	≤ 0,5																
Linearity [% of the regulated max flow]	≤ 1,0																
Repeatability [% of the regulated max flow]	≤ 0,2																
Thermal drift	zero point displacement < 1% at ΔT = 40°C																

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **5**

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response, see section **18**.

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	R = 30 W REB, RES = 50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 ÷ 3,3 Ω			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Voltage: maximum range 0 ÷ 10 VDC @ max 5 mA Current: maximum range 0 ÷ 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer	E-ATR-8/*/I Output signal: 4 ÷ 20 mA (see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	R = IP65; REB, RES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 22			

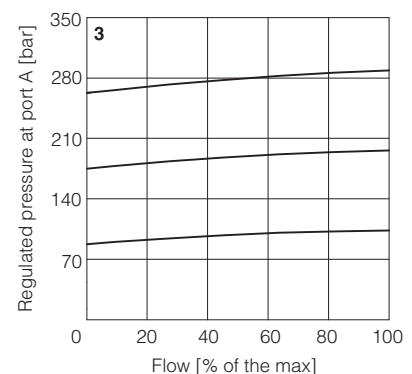
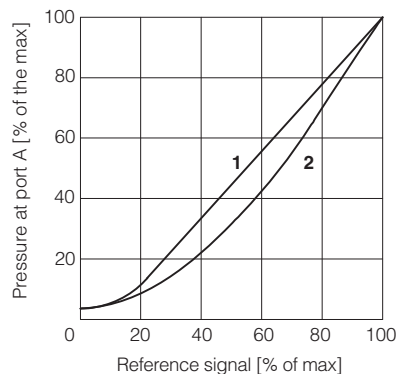
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for R), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

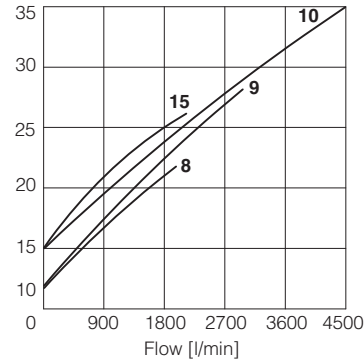
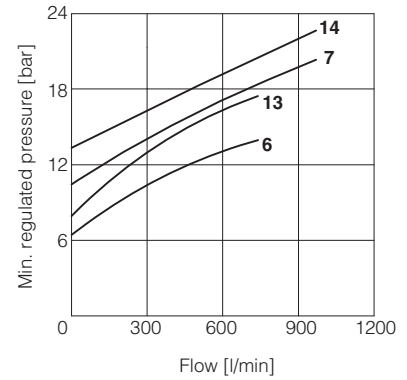
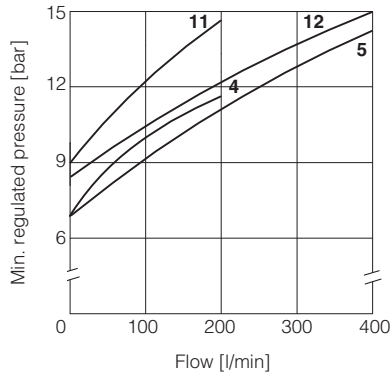
- 1 Regulation diagrams LIMZO
- 2 Regulation diagrams LICZO
- 3 Pressure/flow diagrams LICZO, LIMZO



4-14 Min. pressure/flow diagrams

with zero reference signal

- | | |
|----------------|----------------|
| 4 = LIMZO-*-1 | 11 = LICZO-*-1 |
| 5 = LIMZO-*-2 | 12 = LICZO-*-2 |
| 6 = LIMZO-*-3 | 13 = LICZO-*-3 |
| 7 = LIMZO-*-4 | 14 = LICZO-*-4 |
| 8 = LIMZO-*-5 | 15 = LICZO-*-5 |
| 9 = LIMZO-*-6 | |
| 10 = LIMZO-*-8 | |



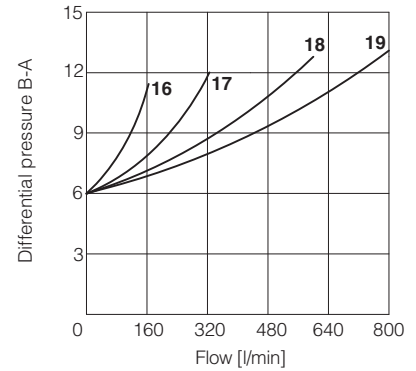
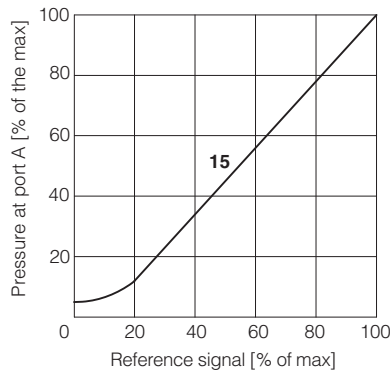
Regulation diagrams LIRZO

15 = LIRZO-A

16-19 Min. pressure/flow diagrams

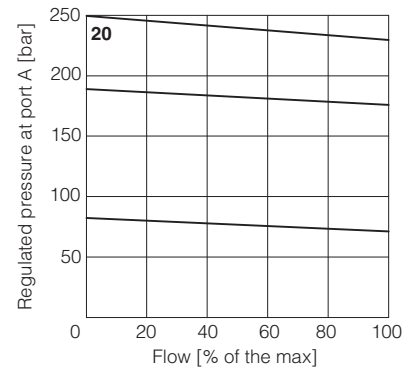
with reference signal "null"

- | |
|----------------|
| 16 = LIRZO-*-1 |
| 17 = LIRZO-*-2 |
| 18 = LIRZO-*-3 |
| 19 = LIRZO-*-4 |



Pressure/flow diagrams

20 = LIRZO-A



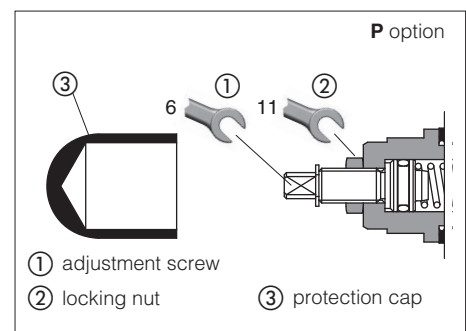
14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



15 ELECTRONIC OPTIONS - only for **REB** and **RES**

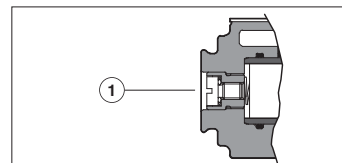
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 20.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 20.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 20.2

16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible; **Electronics options:** /IQ, /IZ

17 AIR BLEEDING

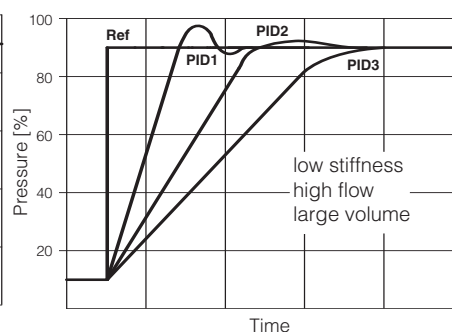
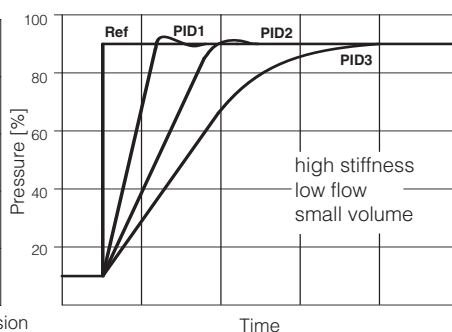
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 DYNAMIC RESPONSE - 4 pressure PIDs - only for **REB** and **RES**

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected before the valve commissioning, through Atos E-SW software via USB port. Only for **RES** the PID can be also selected in real time, through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast - default (1)
2	Standard
3	Smooth
4	Open Loop



(1) interchangeable with previous TERS version

Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

19 PRESSURE TRANSDUCER FAILURE - only for **REB** and **RES**

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1, 2, 3) to open loop (PID 4), to let the valve to temporarily operate with reduced regulation accuracy

20 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **REB** and **RES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

20.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 20.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

20.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

20.3 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24 Vdc.

20.4 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, defaults settings are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 ÷ 10 VDC or 0 ÷ 20 mA.

20.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

20.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC. Fault status is not affected by the Enable input signal.

21 ELECTRONIC CONNECTIONS

21.1 Main connector signals - 7 pin (A1) Standard and /Q option - for REB and RES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for P_INPUT+	Input - analog signal
F	P_MONITOR referred to: AGND V0		Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

21.2 Main connector signals - 12 pin (A2) /Z option - for REB and RES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	P_INPUT+	Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	P_MONITOR	Pressure monitor output signal: 0 \div 10 Vdc / 0 \div 20 mA maximum range, referred to VL0 Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

21.3 Communication connectors - for REB (B) and RES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

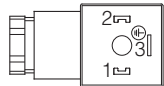
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

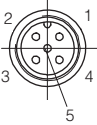
(1) Shield connection on connector's housing is recommended

(2) Only for RES execution

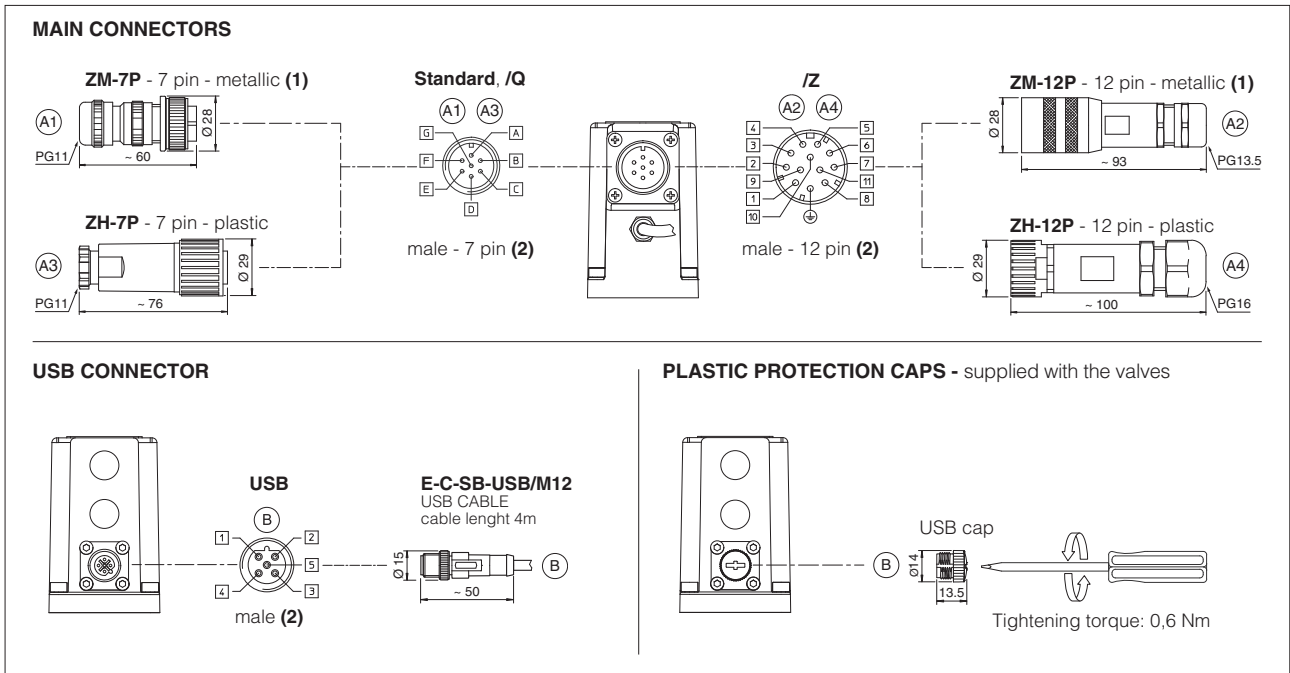
21.4 Solenoid connection - only for R

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

21.5 Pressure transducer connection - only for R

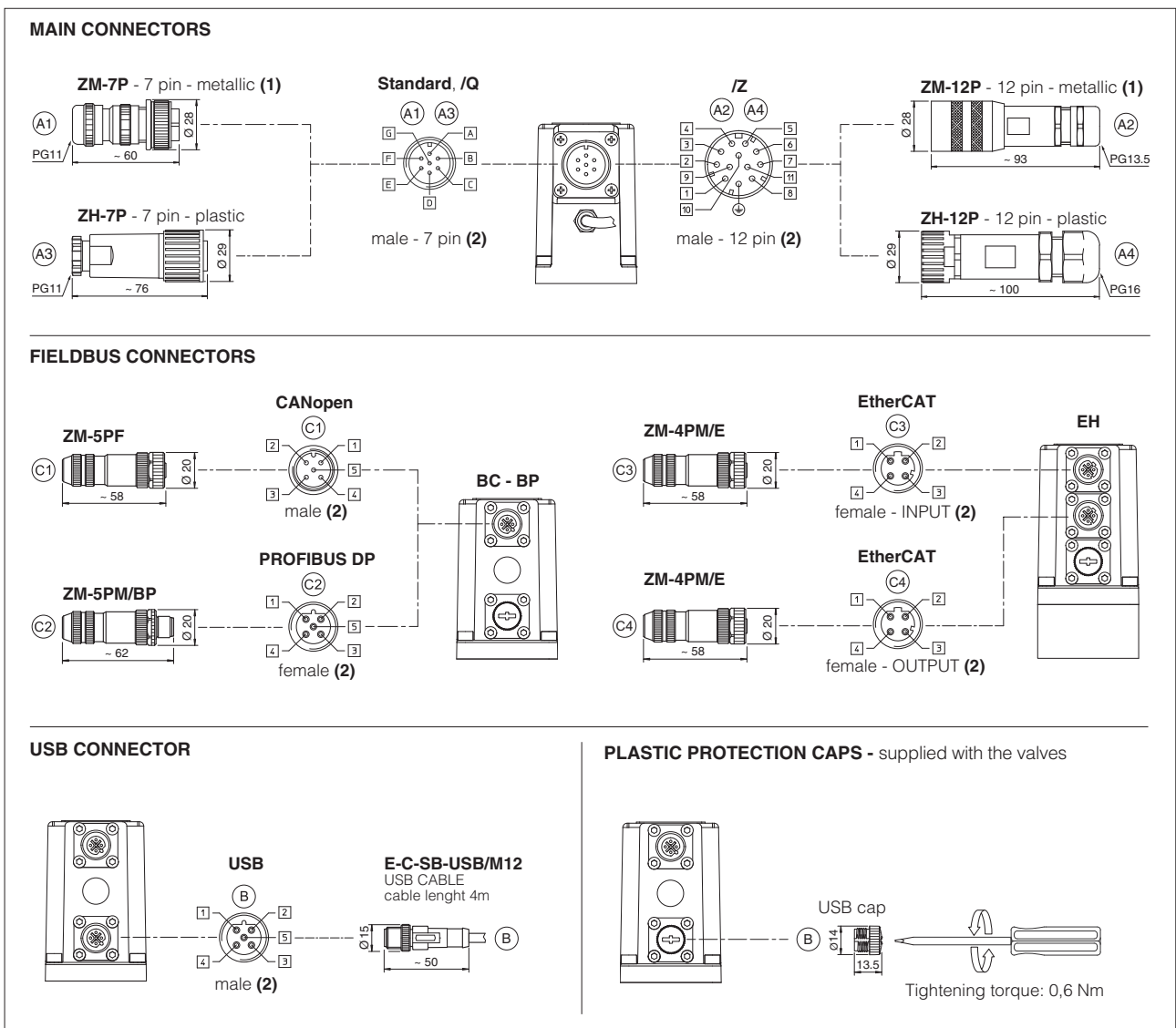
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code ZBE-08
1	V+	Power supply	
2	NC	Not connected	
3	TR	Output signal 4 \div 20 mA	
4	NC	Not connected	
5	NC	Not connected	

21.6 REB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21.7 RES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

22 CONNECTORS CHARACTERISTICS - to be ordered separately

22.1 Main connectors - 7 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

22.2 Main connectors - 12 pin - for REB and RES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

22.3 Fieldbus communication connectors - only for RES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

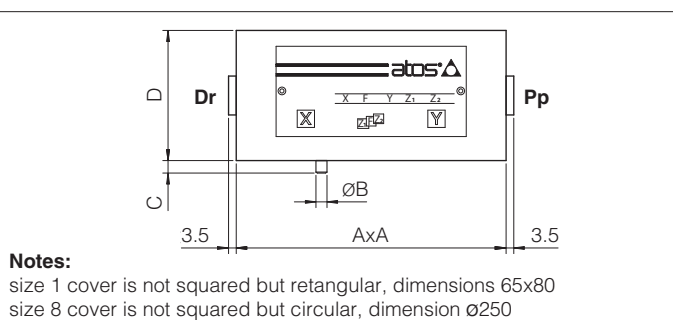
(2) Internally terminated

23 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZO LICZO LIRZO	1 = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO LICZO	5 = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	6 = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

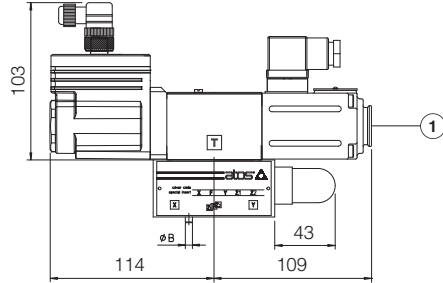
24 COVERS DIMENSIONS [mm]

Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	Ø250	8	6	80	G 3/8"



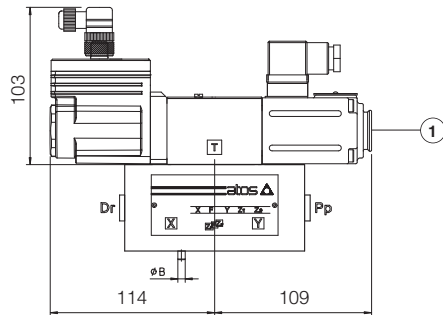
Version **R** for off-board driver

LICZO-R-1 LIMZO-R-1 LIRZO-R-1
 LICZO-R-2 LIMZO-R-2 LIRZO-R-2
 LICZO-R-3 LIMZO-R-3 LIRZO-R-3

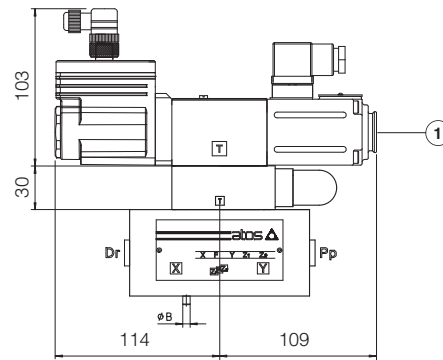


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,8	-	0,2
2 = 25	4,3	-	0,5
3 = 32	5,6	-	0,9
4 = 40	11,0	12,0	1,7
5 = 50	14,5	15,5	2,9
6 = 63	24,0	25,0	6,7
8 = 80	32,6	33,6	13,1

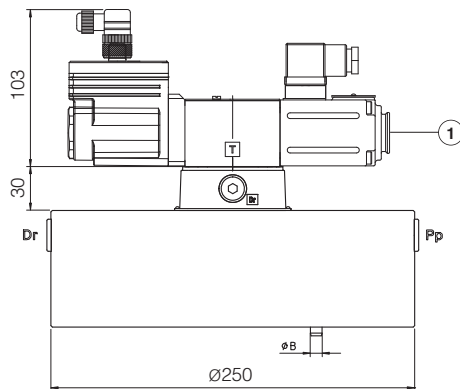
LICZO-R-4 LIMZO-R-4 LIRZO-R-4
 LICZO-R-5 LIMZO-R-5
 LIMZO-R-6



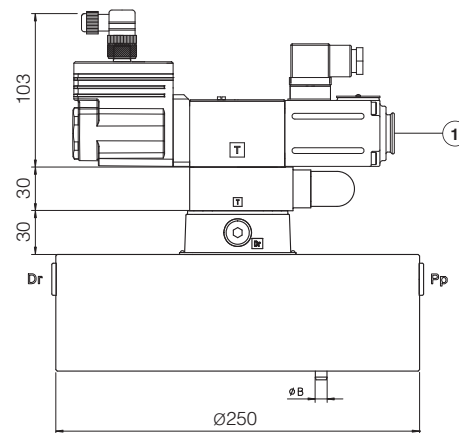
LICZO-R-4/P LIMZO-R-4/P LIRZO-R-4/P
 LICZO-R-5/P LIMZO-R-5/P
 LIMZO-R-6/P




LIMZO-R-8



LIMZO-R-8/P

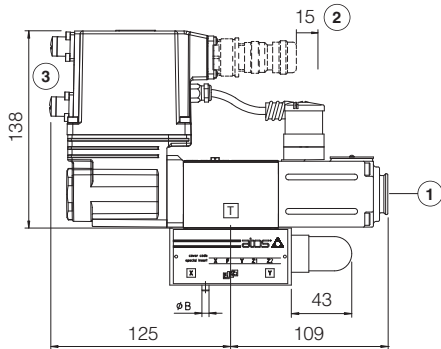


① = Air bleeding, see section 17 

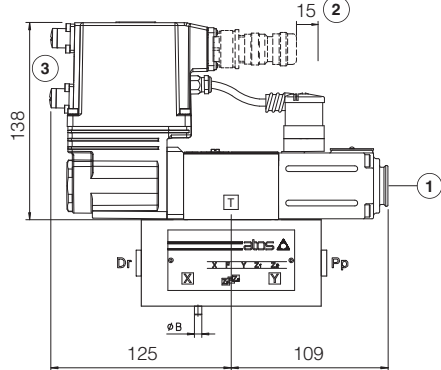
Note: for mounting surface and cavity dimensions, see tech. table P006

Versions **REB** and **RES** for on-board driver

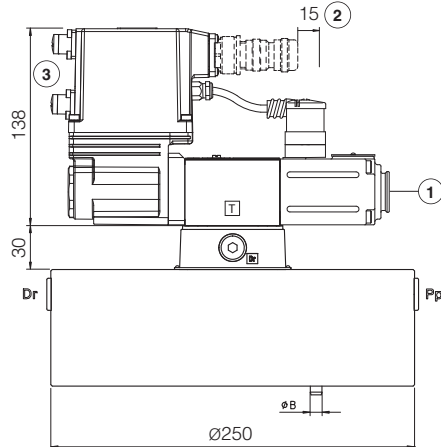
LICZO-RE*-1 LIMZO-RE*-1 LIRZO-RE*-1
 LICZO-RE*-2 LIMZO-RE*-2 LIRZO-RE*-2
 LICZO-RE*-3 LIMZO-RE*-3 LIRZO-RE*-3



LICZO-RE*-4 LIMZO-RE*-4 LIRZO-RE*-4
 LICZO-RE*-5 LIMZO-RE*-5
 LIMZO-RE*-6

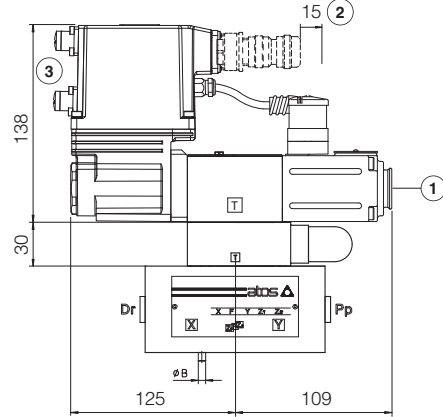


LIMZO-RE*-8

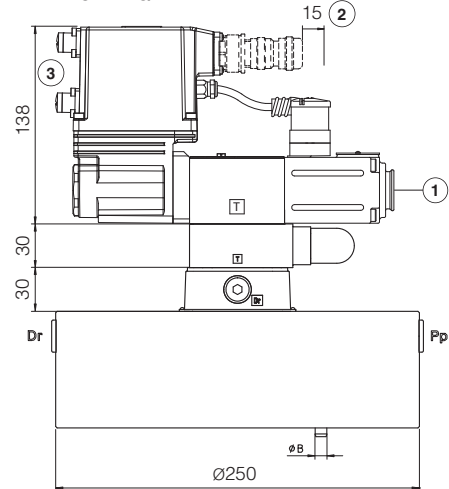


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,3	-	0,2
2 = 25	4,8	-	0,5
3 = 32	6,1	-	0,9
4 = 40	11,5	12,5	1,7
5 = 50	15,0	16,0	2,9
6 = 63	24,5	25,5	6,7
8 = 80	33,1	34,1	13,1

LICZO-RE*-4/P LIMZO-RE*-4/P LIRZO-RE*-4/P
 LICZO-RE*-5/P LIMZO-RE*-5/P
 LIMZO-RE*-6/P



LIMZO-RE*-8/P

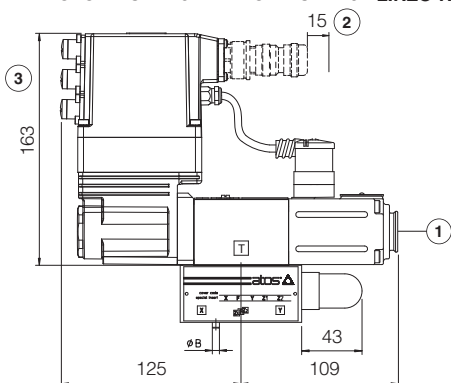


- ① = Air bleeding, see section 17
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

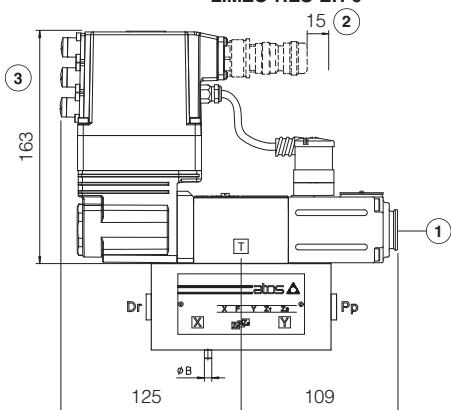
Note: for mounting surface and cavity dimensions, see tech. table P006

Version **RES-EH** for on-board driver

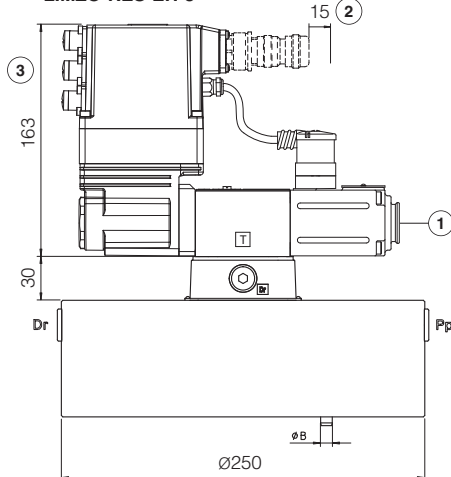
LICZO-RES-EH-1 LIMZO-RES-EH-1 LIRZO-RES-EH-1
LICZO-RES-EH-2 LIMZO-RES-EH-2 LIRZO-RES-EH-2
LICZO-RES-EH-3 LIMZO-RES-EH-3 LIRZO-RES-EH-3



LICZO-RES-EH-4 LIMZO-RES-EH-4 LIRZO-RES-EH-4
LICZO-RES-EH-5 LIMZO-RES-EH-5 LIMZO-RES-EH-6

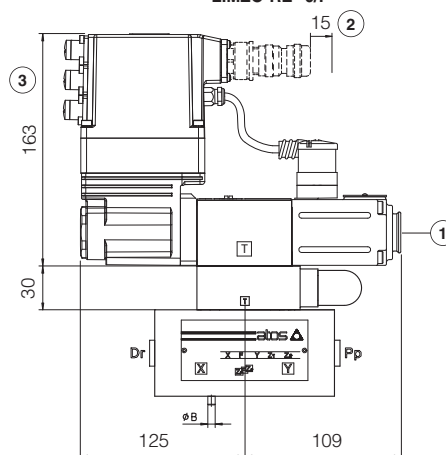


LIMZO-RES-EH-8

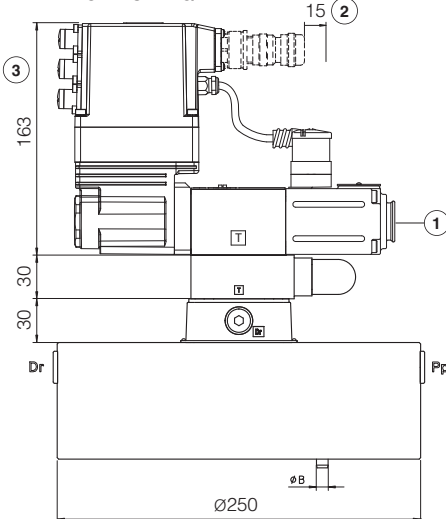


Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,4	-	0,2
2 = 25	4,9	-	0,5
3 = 32	6,2	-	0,9
4 = 40	11,6	12,6	1,7
5 = 50	15,1	16,1	2,9
6 = 63	24,6	25,6	6,7
8 = 80	33,2	34,2	13,1

LICZO-RES-EH-4/P LIMZO-RES-EH-4/P LIRZO-RES-EH-4/P
LICZO-RES-EH-5/P LIMZO-RES-EH-5/P LIMZO-RE*-6/P



LIMZO-RES-EH-8/P



① = Air bleeding, see section 17

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 21.6 and 21.7

Note: for mounting surface and cavity dimensions, see tech. table P006

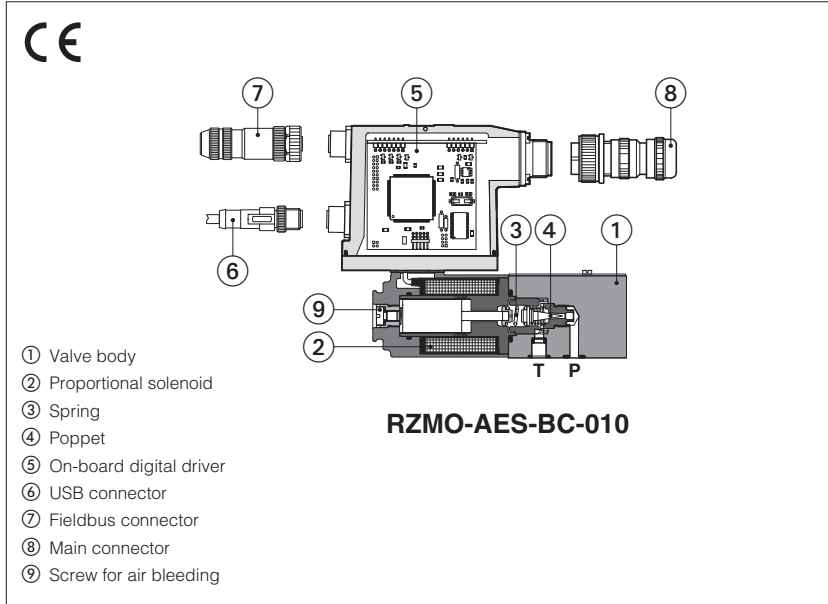
26 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
GS203 E-BM-RES digital driver
GS500 Programming tools
GS510 Fieldbus

K800 Electric and electronic connectors
P006 Mounting surfaces and cavities for cartridge valves
QB420 Quickstart for REB valves commissioning
QF420 Quickstart for RES valves commissioning

Digital proportional relief valves

direct, without transducer



RZMO-A , RZMO-AEB, RZMO-AES

Poppet type, direct, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401

Max flow: **4 l/min**

Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	AEB	-	NP	-	010	/	210	/	*	/	*	/	*	/	*
<p>Proportional pressure relief valve, direct</p>																
<p>A = for off-board driver, see section 3 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)</p>																
<p>Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p>																
<p>Seals material, see section 10: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p>																
<p>Coil voltage, only for A - see section 14: - = standard coil for 24VDC Atos drivers 6 = optional coil for 12VDC Atos drivers 18 = optional coil for low current drivers</p>																
<p>Electronic options, only for AEB and AES (4): I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC) Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector</p>																
<p>Configuration: 010 = regulation on port P, discharge in T (direct operated version)</p>																
<p>Max regulated pressure (5): 50 = 50 bar 210 = 210 bar 350 = 350 bar 100 = 100 bar 315 = 315 bar</p>																

(1) Only for **NP**

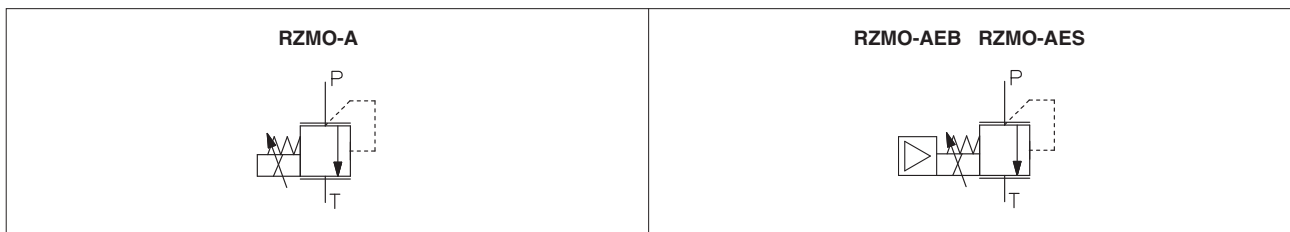
(2) Only for **BC, BP, EH**

(3) Omit for **A** execution

(4) Possible combined options: IQ, IZ

(5) Special execution with max regulated pressure **500 bar** available on request

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

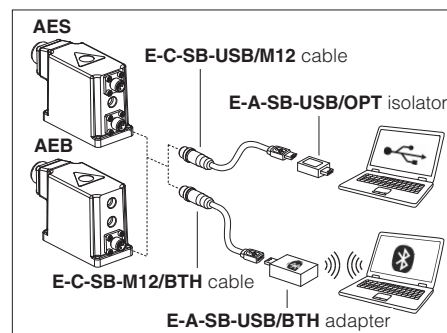
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n° 1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZMO-*-010	
Max regulated pressure [bar]	50; 100; 210; 315; 350	
Max pressure at port P [bar]	350	
Max pressure at port T [bar]	210	
Min regulated pressure [bar]	see min. pressure / flow diagram at section 11	
Max flow [l/min]	4	
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 70	
Hysteresis	≤ 1,5 [% of max pressure]	
Linearity	≤ 3,0 [% of max pressure]	
Repeatability	≤ 2,0 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 Vdc @ max 5 mA			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 Vdc (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (W option)			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

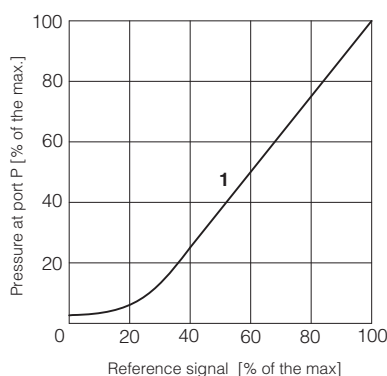
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

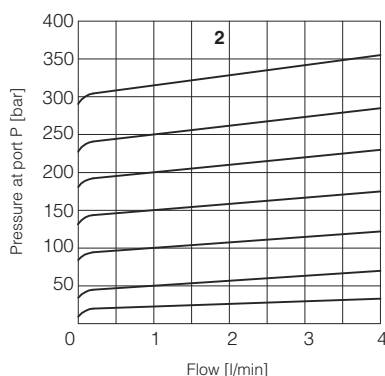
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

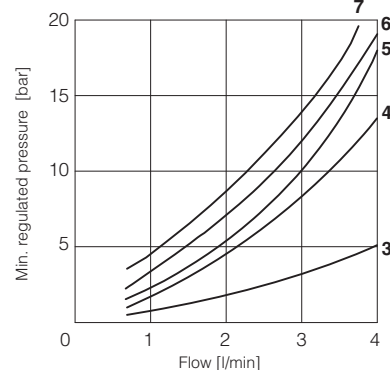
1 Regulation diagrams with flow rate Q = 1 l/min



2 Pressure/flow diagrams with reference signal set at Q = 1 l/min



3-6 Min. pressure/flow diagrams with zero reference signal



3 = RZMO/50 **4** = RZMO/100
5 = RZMO/210 **6** = RZMO/315
7 = RZMO/350

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for AEB and AES

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

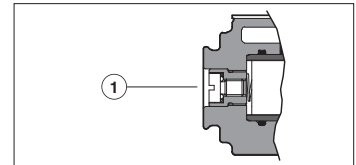
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

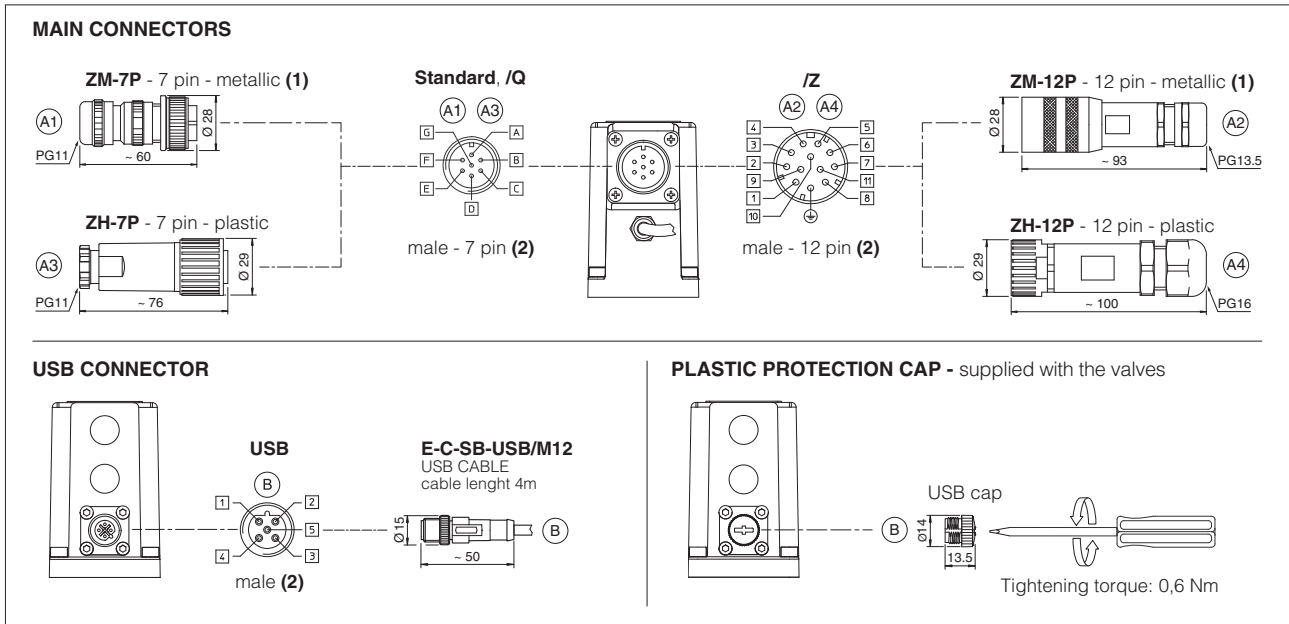
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

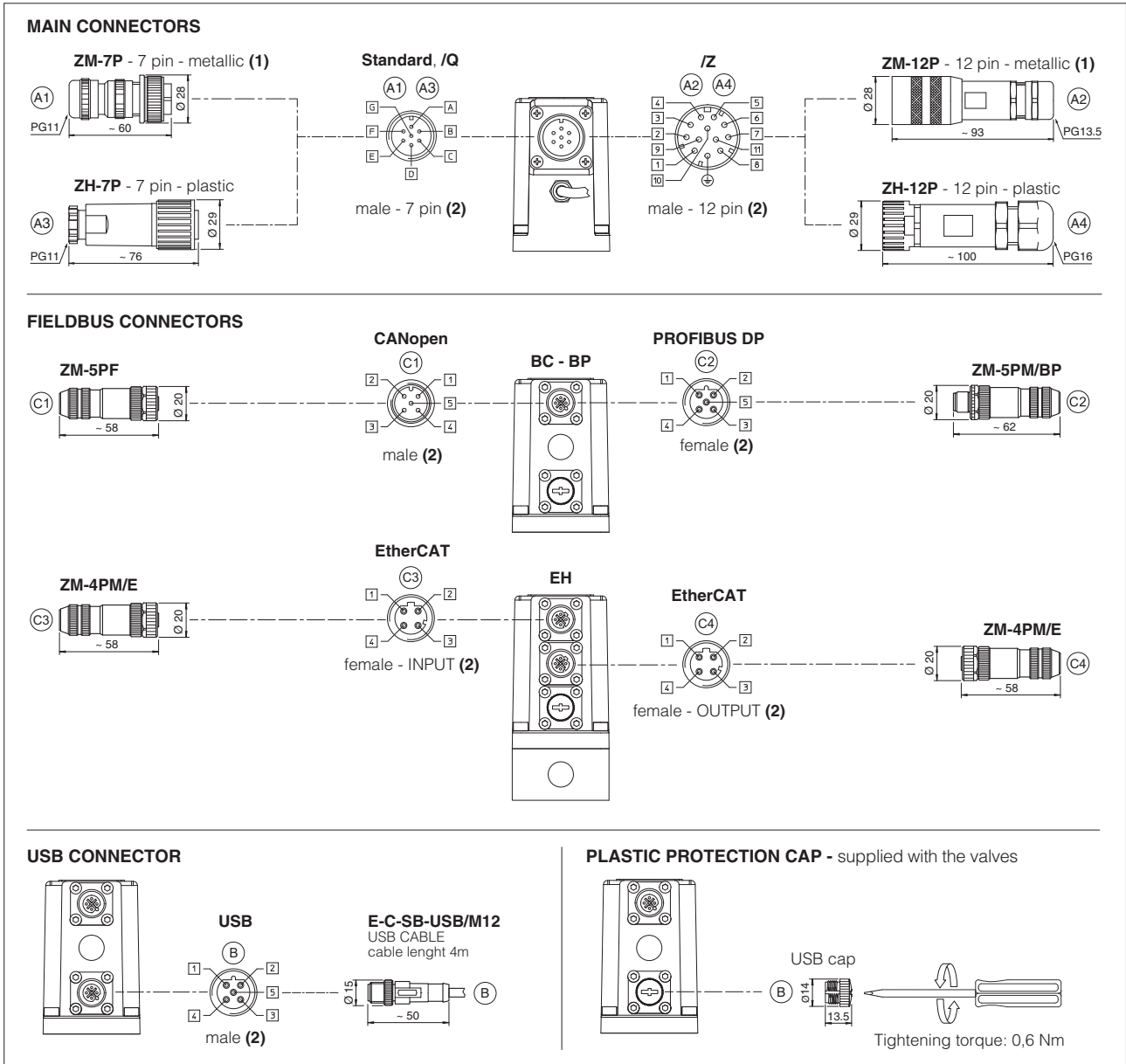
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67



18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS

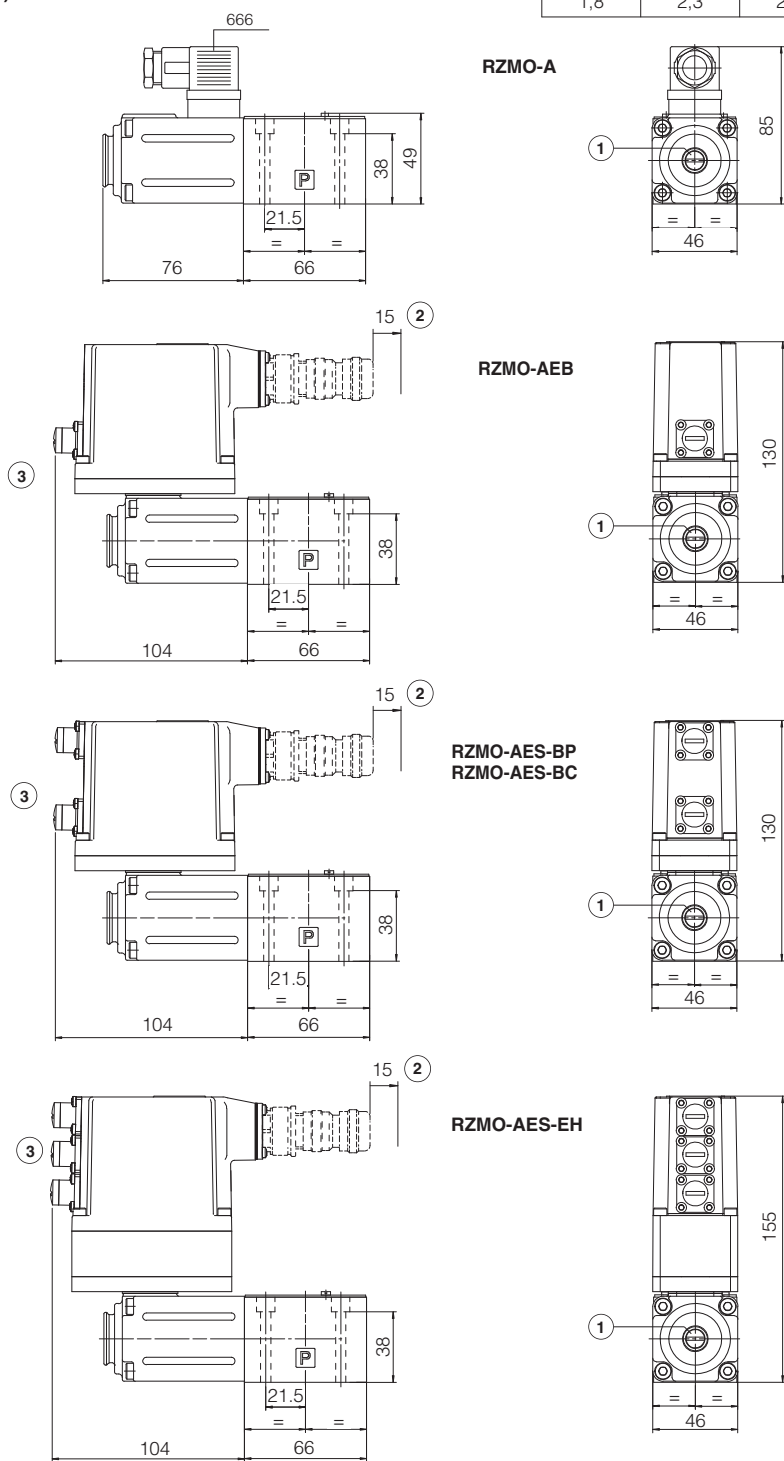
	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9</p> <p>Tightening torque = 8 Nm</p>
	<p>Seals:</p> <p>2 OR 108</p> <p>Diameter of ports P, T: Ø 5 mm</p>

20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]		
A	AEB, AES	AES-EH
1,8	2,3	2,4



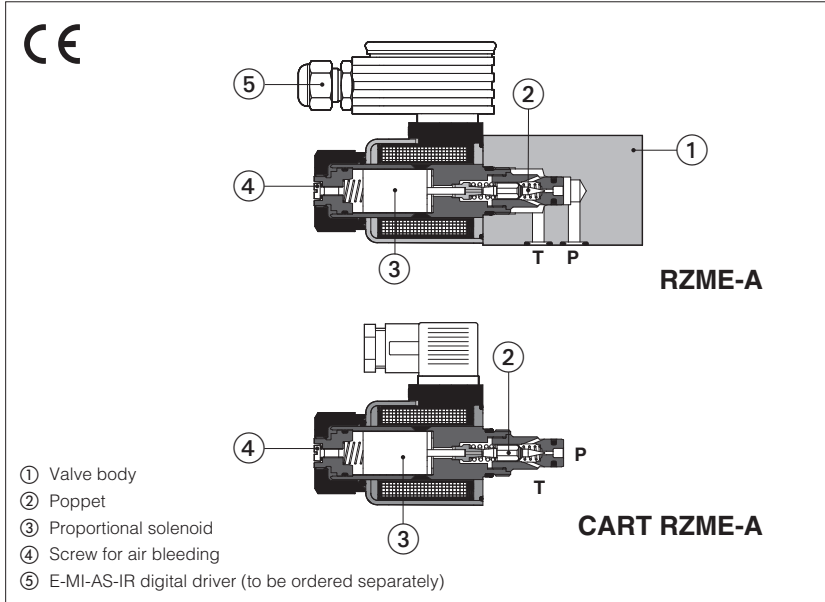
- ① = Air bleeding, see section 15
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
G010	E-MI-AC analog driver	P005	Mounting surfaces for electrohydraulic valves
G020	E-MI-AS-IR digital driver	QB200	Quickstart for AEB valves commissioning
G030	E-BM-AS digital driver	QF200	Quickstart for AES valves commissioning
GS050	E-BM-AES digital driver		
GS500	Programming tools		

Proportional relief valves

direct, without transducer



RZME-A, CART RZME-A

Poppet type, direct, proportional pressure relief valves for open loop pressure controls. They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:

RZME: subplate mounting, ISO size 06

CART RZME: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZME); **M20** (CART RZME)

Max flow: **4 l/min**

Max pressure: **350 bar**

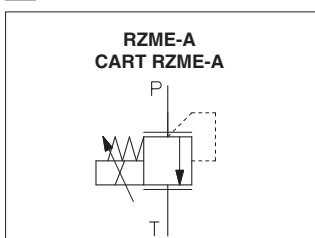
For cavity CART RZME see section 16

1 MODEL CODE

RZME	-	A	-	010	/	315	-	*	/	*	/	*	/	*
<p>Proportional pressure relief valve, direct</p> <p>RZME = subplate mounting CART RZME = cartridge execution</p> <p>A = for off-board driver, see section 3</p> <p>Configuration: 010 = reduced pressure on port A, discharge in T</p> <p>Max regulated pressure: 32 = 32 bar 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar</p> <p>Seals material, see section 8: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Coil voltage, see section 10: - = standard coil for 24 VDC Atos drivers 6 = optional coil for 12 VDC Atos drivers 18 = optional coil for low current drivers (1)</p> <p>Coil with special connectors, see section 12: - = omit for standard DIN connector J = AMP Junior Timer connector K = Deutsch connector S = Lead Wire connection</p>														

(1) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F (1)		E-MI-AS-IR (1)		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZME** the electronic driver may interfere with the manifold surface. Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	RZME-A-010		
Max regulated pressure	50; 100; 210; 315; 350;		
Min. regulated pressure [bar]	see min. pressure / flow diagrams at section 9		
Max. pressure at port P [bar]	350		
Max. pressure at port T [bar]	210		
Max. flow [l/min]	4		
Response time 0-100% step signal (1) [ms] (depending on installation)	≤ 70		
Hysteresis [% of the max pressure]	≤ 1,5		
Linearity [% of the max pressure]	≤ 3		
Repeatability [% of the max pressure]	≤ 2		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	cURus North American Standard		

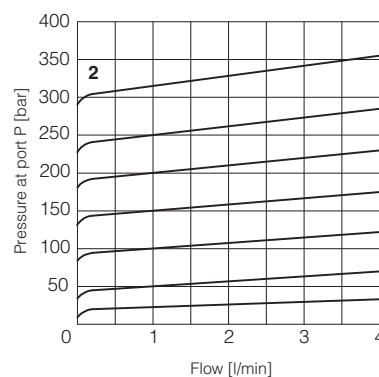
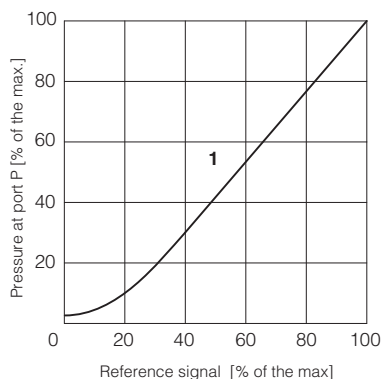
8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate $Q = 1 \text{ l/min}$

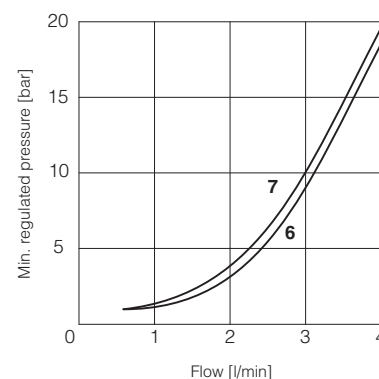
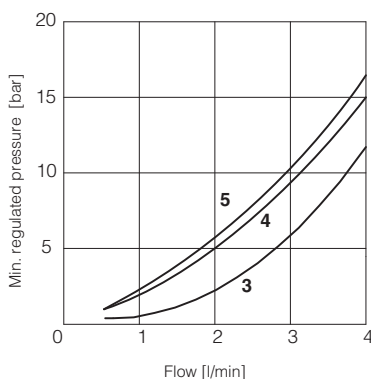
Note: the presence of counter pressure at port T can affect the effective pressure regulation



2 = Pressure/flow diagrams
with reference signal set at $Q = 1 \text{ l/min}$

3-7 = Min. pressure/flow diagrams
with zero reference signal

- 3 = pressure range: 50
- 4 = pressure range: 100
- 5 = pressure range: 210
- 6 = pressure range: 315
- 7 = pressure range: 350



10 COIL VOLTAGE OPTIONS

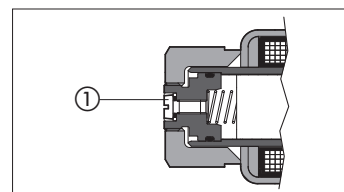
6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.

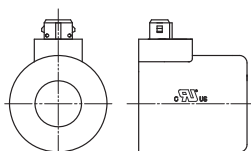
The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS

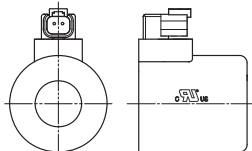
J option

Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



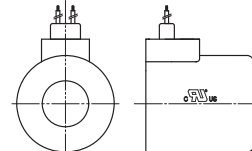
K option

Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67

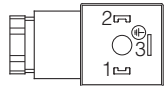


S option

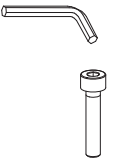

Coil type COZES
Lead Wire connection
Cable length = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS FOR RZME

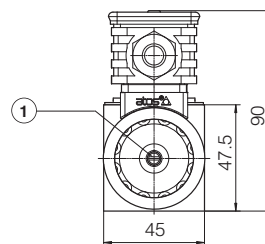
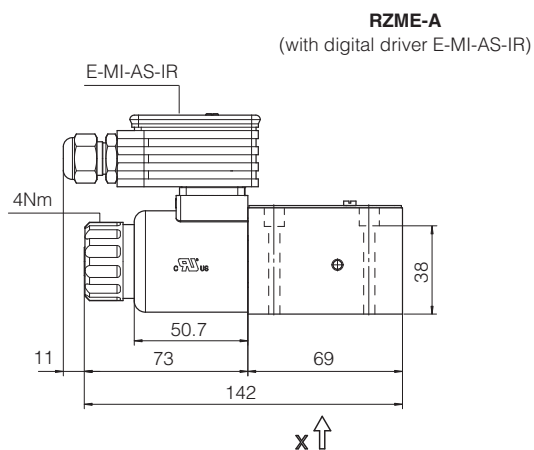
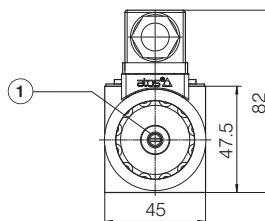
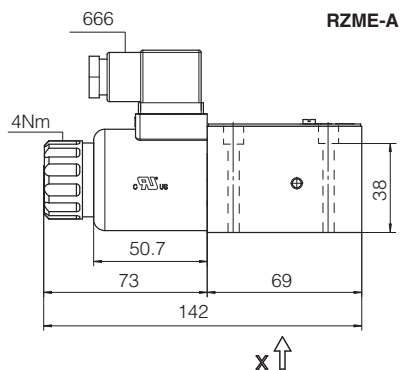
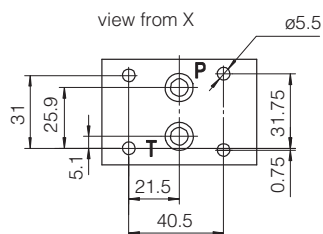
	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals: 2 OR 108 Diameter of ports P, T: $\varnothing 5$ mm</p>


15 INSTALLATION DIMENSIONS FOR RZME [mm]

ISO 4401: 2005

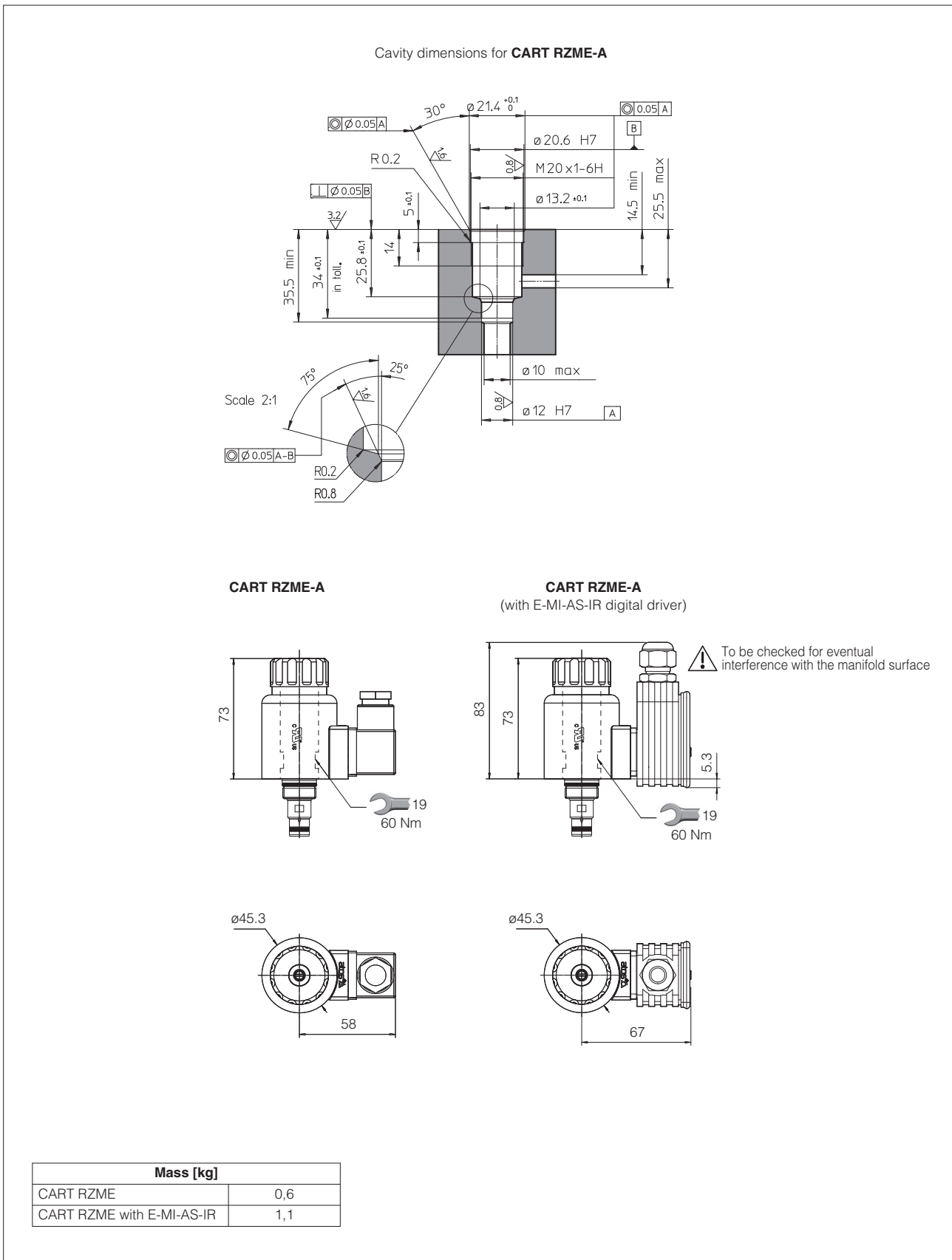
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

Mass [kg]	
RZME	1,5
RZME with E-MI-AS-IR	2,0



① = Air bleeding, see section 11 

16 INSTALLATION DIMENSIONS FOR CART RZME [mm]

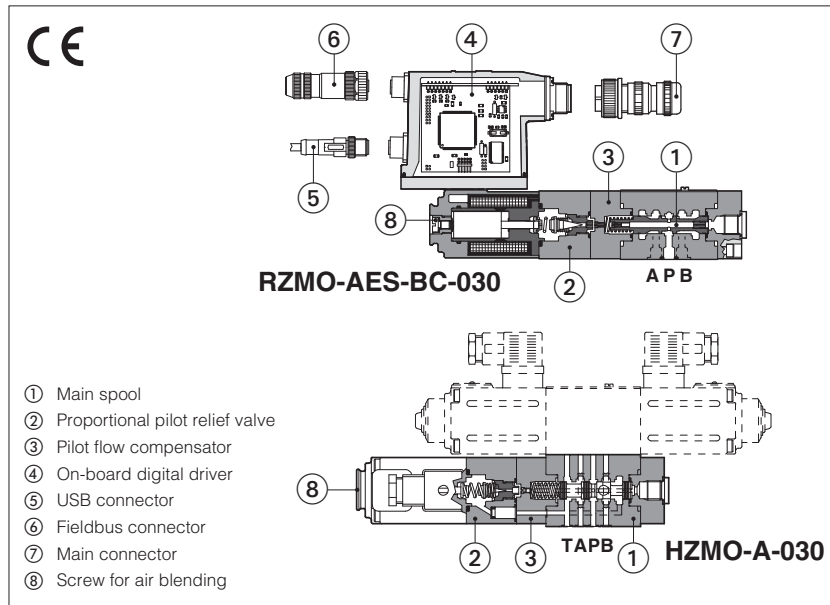


17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional relief valves

piloted, without transducer, subplate or modular mounting



RZMO-A , RZMO-AEB, RZMO-AES HZMO-A

Spool type piloted digital proportional reducing valves for pressure open loop controls, available in subplate or modular mounting.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **06** - ISO 4401

Max flow: **40 l/min**

Max pressure: **350 bar**

1 MODEL CODE

RZMO	-	AEB	-	NP	-	030	/	210	/	*	/	*	/	*	/	*
Proportional pressure relief valve, piloted RZMO = subplate HZMO = modular														Seals material, see section 10: - = NBR PE = FKM BT = HNBR		
Series number																
Coil voltage, only for A - see section 14: - = standard coil for 24VDC Atos drivers 6 = optional coil for 12VDC Atos drivers 18 = optional coil for low current drivers																
Electronic options, only for AEB and AES (4): I = current reference input 4÷20 mA (omit for std voltage 0÷10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector																
Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT																
Max regulated pressure: 50 = 50 bar 210 = 210 bar 350 = 350 bar 100 = 100 bar 315 = 315 bar																
Configuration: 030 = regulation on port P, discharge in T (pilot operated version)																

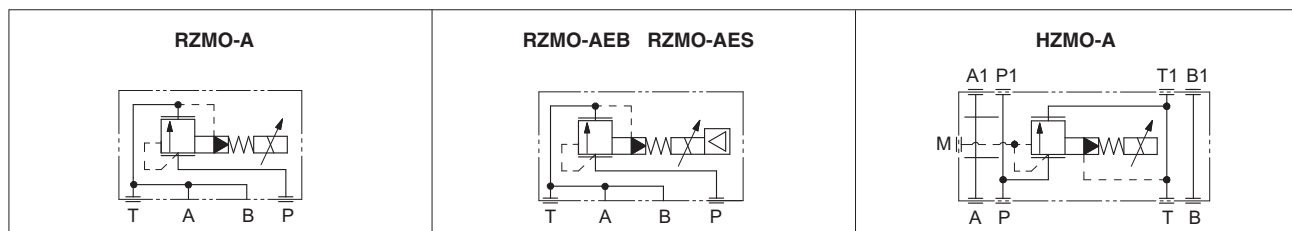
(1) Only for **NP**

(2) Only for **BC, BP, EH**

(3) Omit for **A** execution

(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

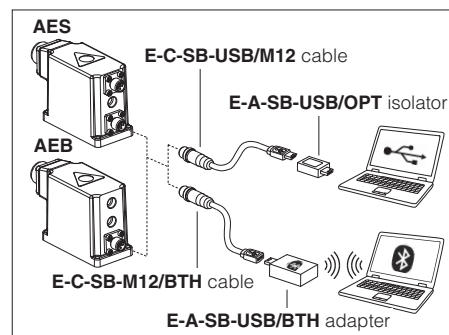


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZMO-*-030, HZMO-A-30	
Max regulated pressure [bar]	50; 100; 210; 315; 350	
Max pressure at port P [bar]	350	
Max pressure at port T [bar]	210	
Min regulated pressure [bar]	see min. pressure / flow diagram at section 11	
Min ÷ Max flow [l/min]	2,5 ÷ 40	
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 60	
Hysteresis	≤ 2 [% of max pressure]	
Linearity	≤ 3 [% of max pressure]	
Repeatability	≤ 2 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 Vdc @ max 5 mA			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 Vdc (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

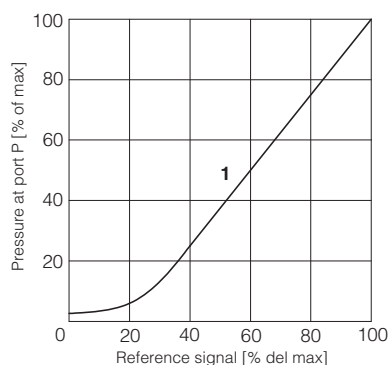
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

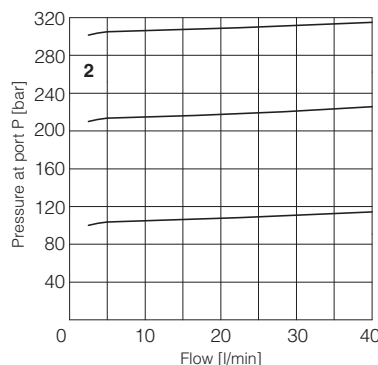
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

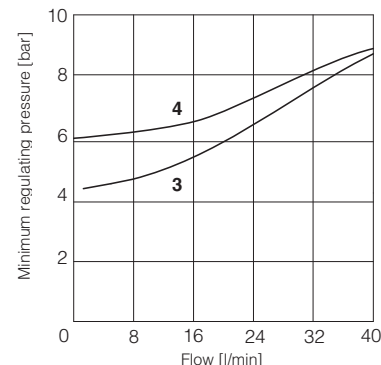
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = All the models (except /350)
4 = All the models (only /350)

Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

12 ELECTRONIC OPTIONS - only for AEB and AES

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 V_{DC}.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

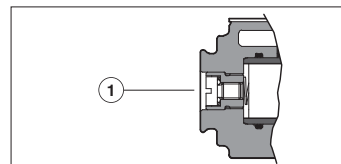
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 V_{DC}.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 V_{DC} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 V_{DC}.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{DC} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

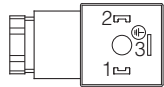
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

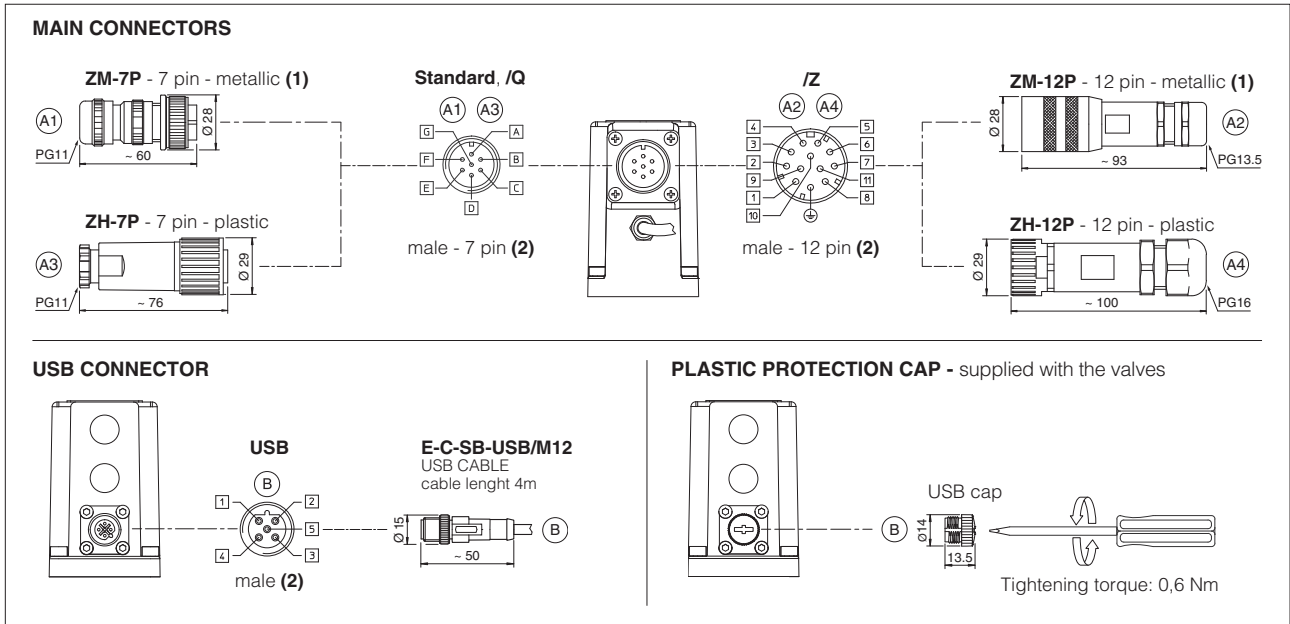
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

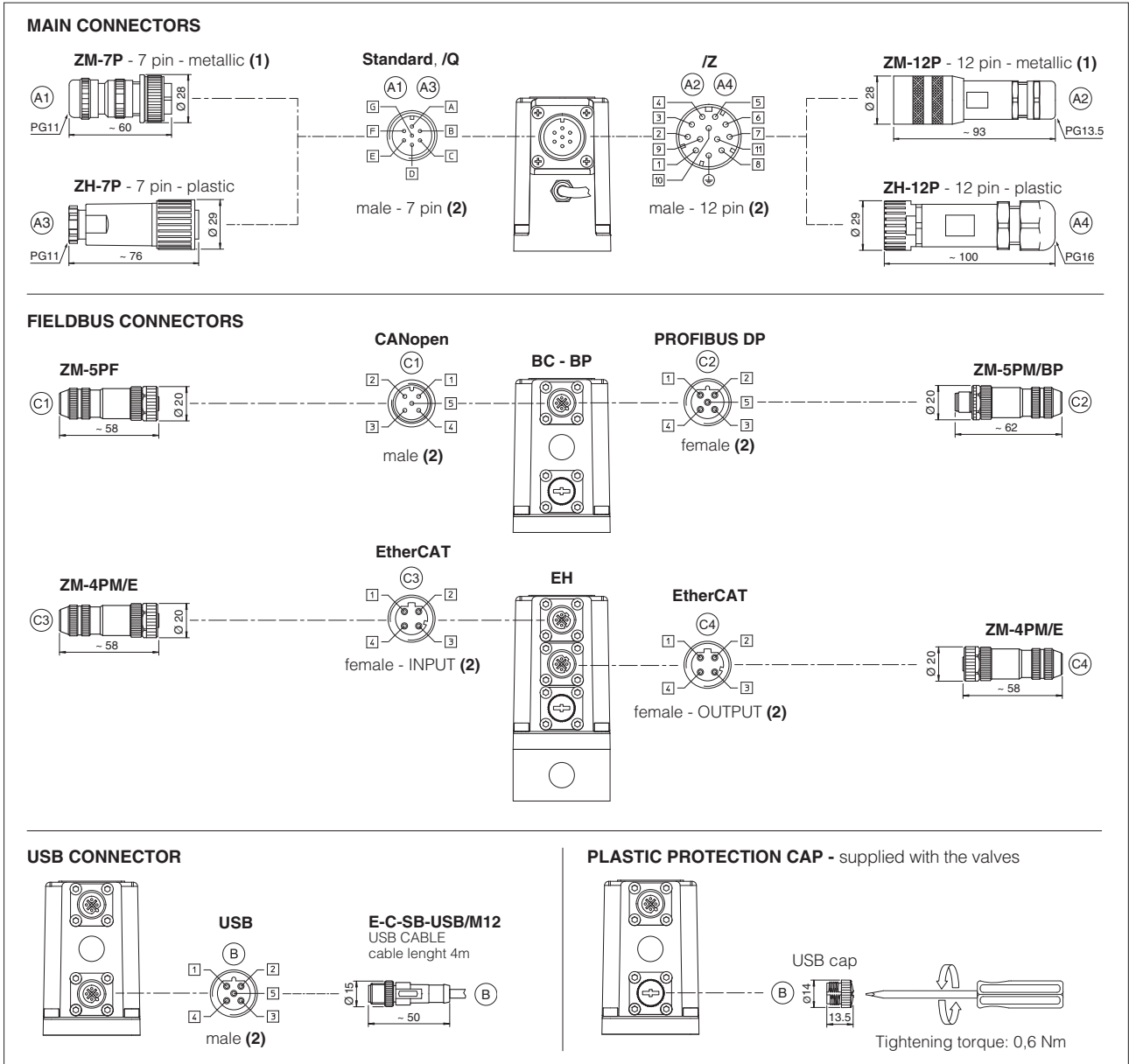
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	



(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	QB200	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	QF200	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

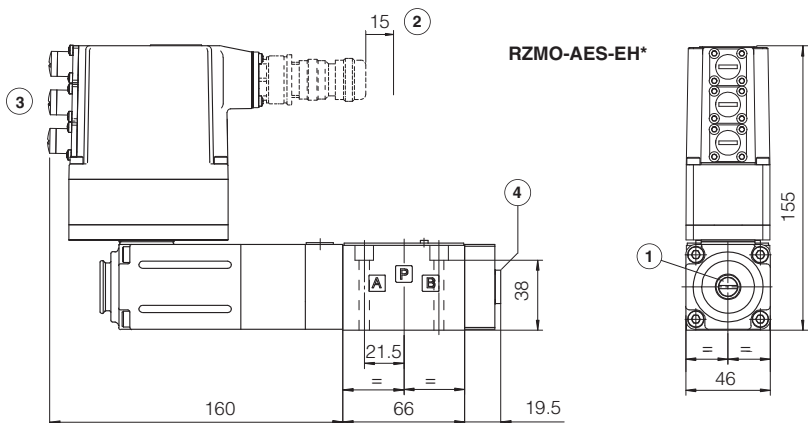
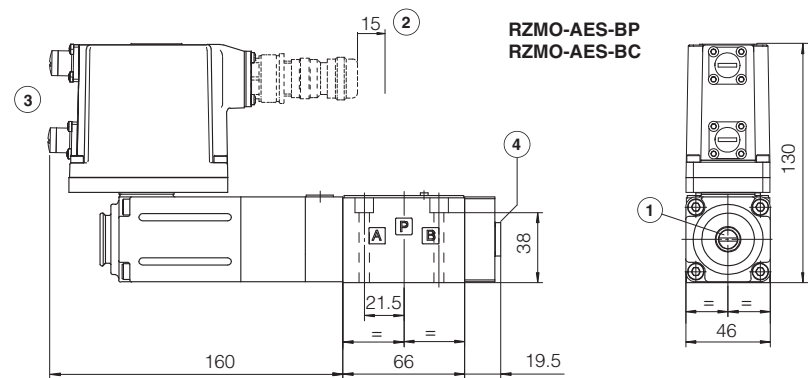
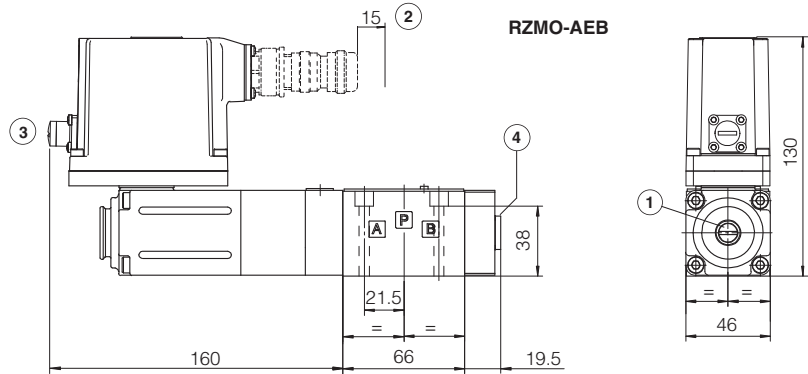
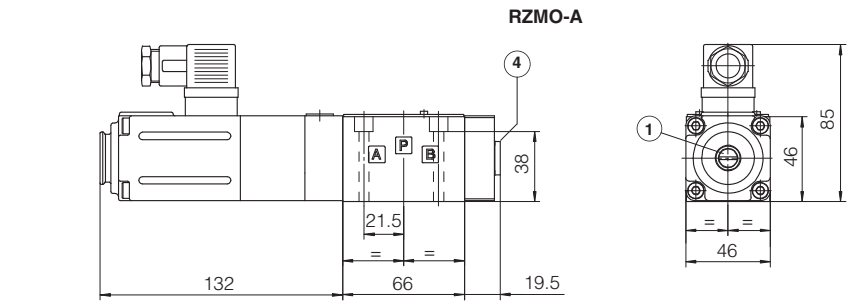
	RZMO	HZMO
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: Not available
	Seals: 4 OR 108 Diameter of ports P, T: Ø 7,5 mm Ports A, B connected to port T	Seals: 4 OR 108 Diameter of ports P, T, A, B: Ø 6,5 mm

RZMO

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]		
A	AEB, AES	AES-EH
2,8	3,3	3,4

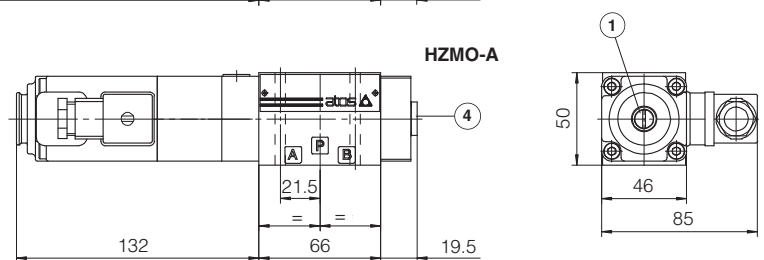


HZMO

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05
(see table P005)

Mass [kg]
A
2,8



① = Air bleeding, see section 15

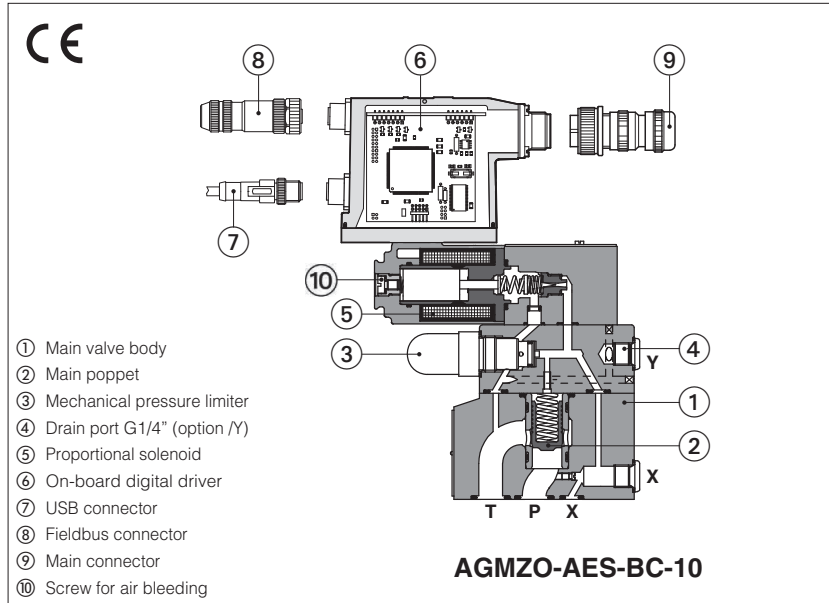
② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

④ = Pressure gauge port = G1/4"

Digital proportional relief valves

piloted, without transducer



- ① Main valve body
- ② Main poppet
- ③ Mechanical pressure limiter
- ④ Drain port G1/4" (option Y)
- ⑤ Proportional solenoid
- ⑥ On-board digital driver
- ⑦ USB connector
- ⑧ Fieldbus connector
- ⑨ Main connector
- ⑩ Screw for air bleeding

AGMZO-AES-BC-10

AGMZO-A, AGMZO-AEB, AGMZO-AES

Poppet type, piloted, digital proportional relief valves for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

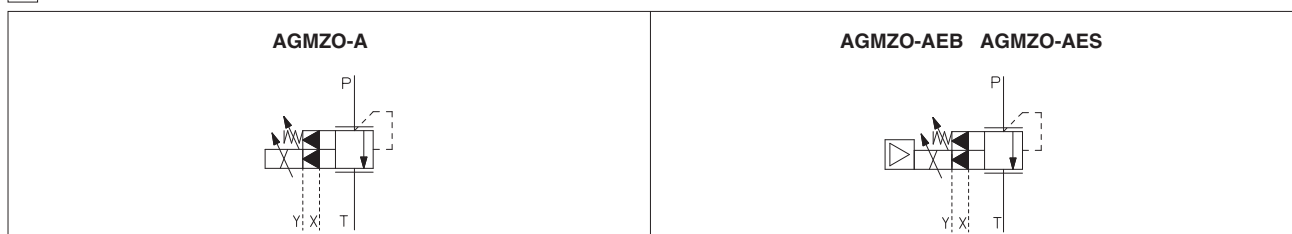
Size: **10, 20, 32** - ISO 6264
 Max flow: **200, 400, 600 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

AGMZO	-	AES	-	BC	-	10	/	315	/	*	/	*	/	*	/	*
<p>Proportional pressure relief valve, piloted</p> <p>A = for off-board driver, see section 3 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)</p> <p>Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p> <p>Valve size ISO 6264: 10, 20, 32</p> <p>Max regulated pressure: 50 = 50 bar 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar</p>																
<p>Seals material, see section 10:</p> <p>- = NBR PE = FKM BT = HNBR</p> <p>Coil voltage, only for A - see section 14: - = standard coil for 24 VDC Atos drivers 6 = optional coil for 12 VDC Atos drivers 18 = optional coil for low current drivers</p> <p>Hydraulic options (4): E = external pilot Y = external drain (only pipe connection G 1/4")</p> <p>Electronics options, only for AEB and AES (4): I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector</p>																

- (1) Only for NP
- (2) Only for BC, BP, EH
- (3) Omit for A execution
- (4) For possible combined options, see section 14

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

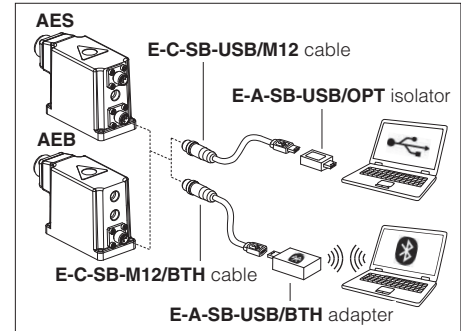


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
Max regulated pressure [bar]	50; 100; 210; 315; 350		
Max pressure at port P [bar]	350		
Max pressure at port T [bar]	210		
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11		
Max flow [l/min]	200	400	600
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 120	≤ 135	≤ 150
Hysteresis	≤ 0,5 [% of max pressure]		
Linearity	≤ 1,0 [% of max pressure]		
Repeatability	≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

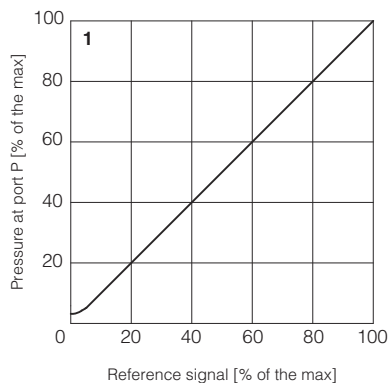
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

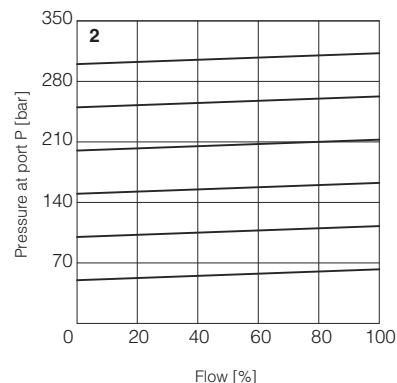
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s			
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water	NBR, HNBR	HFC		

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

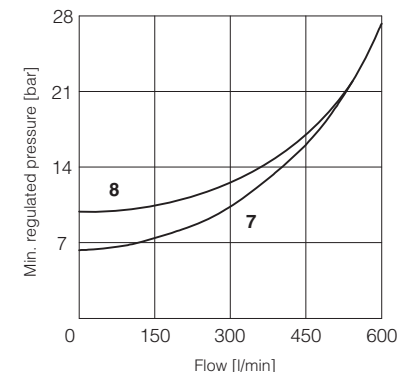
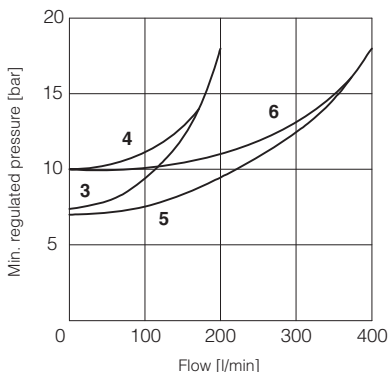


2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



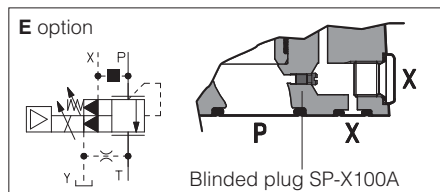
3-8 = Min. pressure/flow diagrams
with zero reference signal

- 3 = AGMZO-*-10/50, 100, 210, 315
- 4 = AGMZO-*-10/350
- 5 = AGMZO-*-20/50, 100, 210, 315
- 6 = AGMZO-*-20/350
- 7 = AGMZO-*-32/50, 100, 210, 315
- 8 = AGMZO-*-32/350



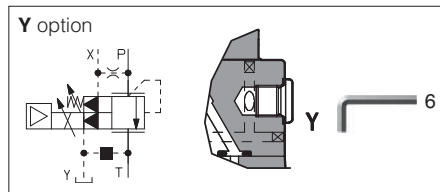
12 HYDRAULIC OPTIONS

- E** = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G 1/4").
- Y** = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G 1/4" available on the pilot stage body.



13 ELECTRONICS OPTIONS - only for **AEB** and **AES**

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 18.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 18.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 18.2



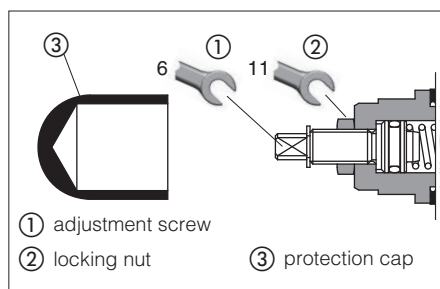
14 POSSIBLE COMBINED OPTIONS

- Hydraulic options:** all combination possible
- Electronics options:** /IQ, /IZ

15 MECHANICAL PRESSURE LIMITER

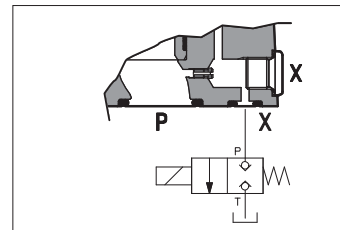
The AGMZO are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.
For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



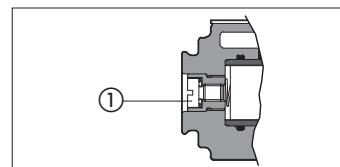
16 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve). This function can be used in emergency to unload the system pressure by-passing the proportional control.



17 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



18 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

18.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu\text{F}/40\text{ V}$ capacitance to single phase rectifiers or a 4700 $\mu\text{F}/40\text{ V}$ capacitance to three phase rectifiers. In case of separate power supply see 18.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

18.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu\text{F}/40\text{ V}$ capacitance to single phase rectifiers or a 4700 $\mu\text{F}/40\text{ V}$ capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

18.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of $\pm 10\text{ V}_{\text{DC}}$ or $\pm 20\text{ mA}$.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

18.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 V_{DC} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of $\pm 5\text{ V}_{\text{DC}}$.

18.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{DC} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

18.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.

Fault status is not affected by the Enable input signal.

19 ELECTRONIC CONNECTIONS

19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

19.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

19.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

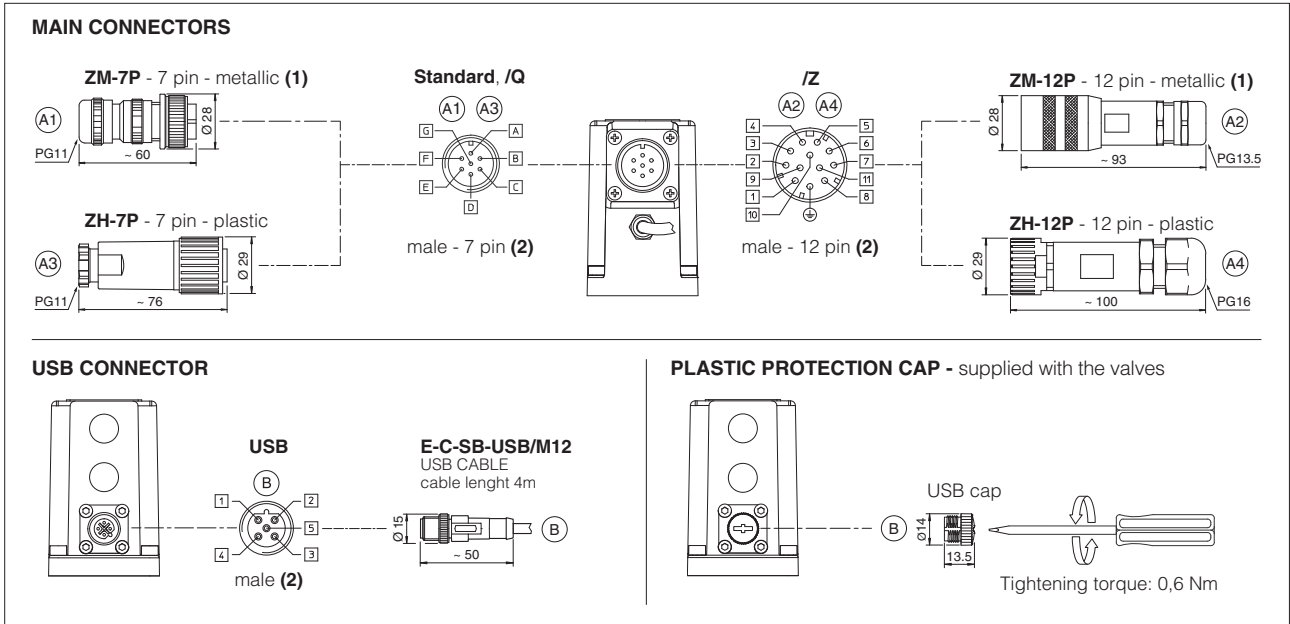
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

19.4 Solenoid connection - only for A

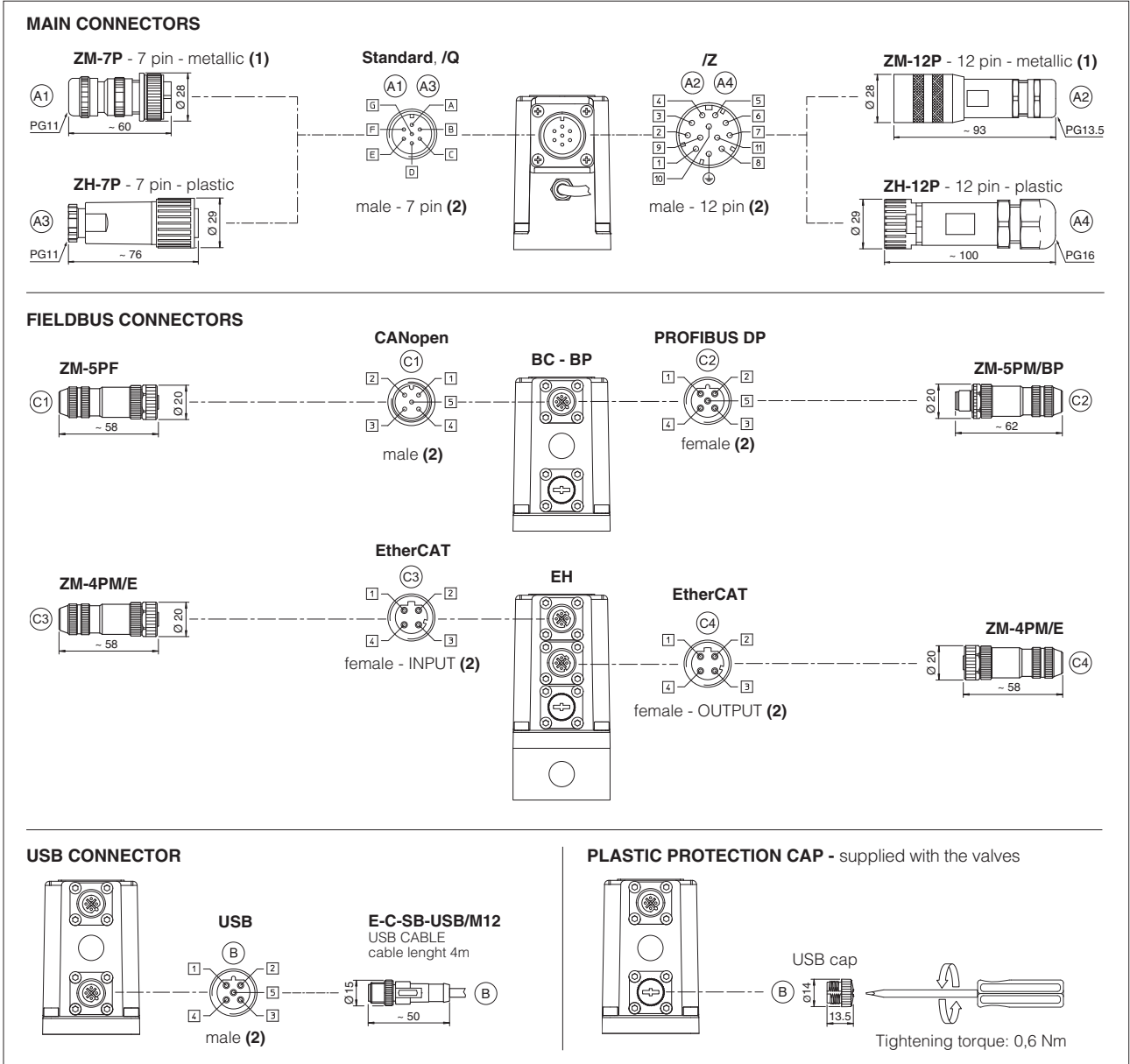
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

19.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

19.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors - 7 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

20.2 Main connectors - 12 pin - for **AEB** and **AES**

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

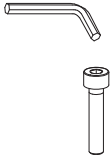

20.3 Fieldbus communication connectors - only for **AES**

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

21 FASTENING BOLTS AND SEALS

	AGMZO-*-10	AGMZO-*-20	AGMZO-*-32
	Fastening bolts: 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	Fastening bolts: 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	Fastening bolts: 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	Seals: 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	Seals: 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	Seals: 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

SIZE 32

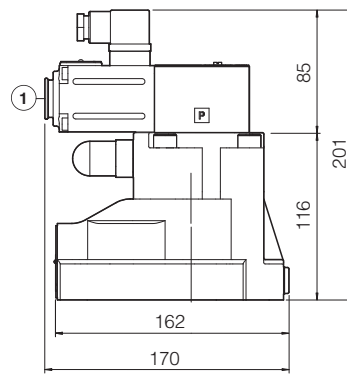
ISO 6264: 2007

Mounting surface: 6264-10-17-1-97

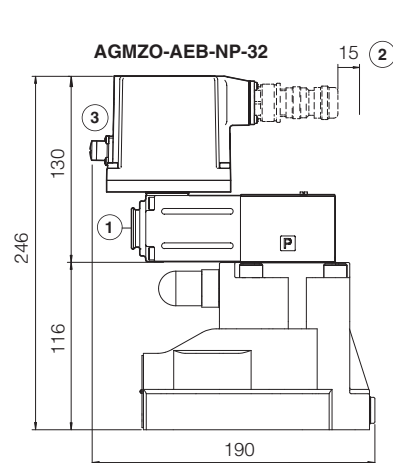
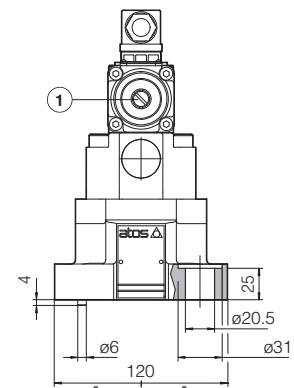
(see table P005)

(with M20 fixing holes instead of standard M18)

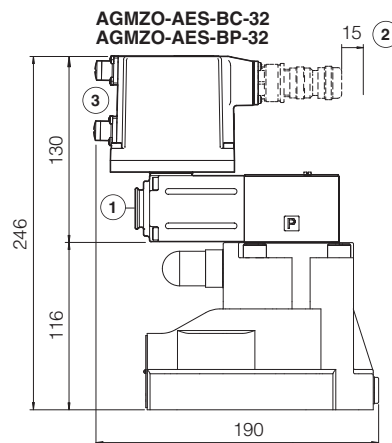
	Mass [kg]		
	A	AEB, AES	AES-EH
AGMZO-*-32	8,0	8,5	8,6



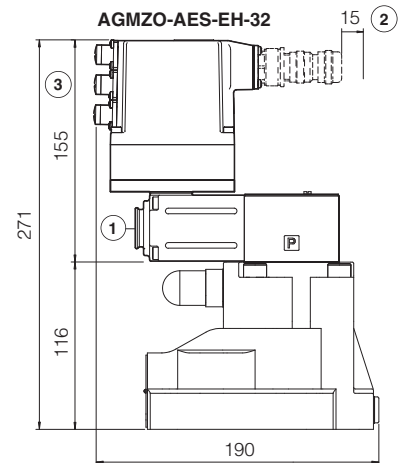
AGMZO-A-32




AGMZO-AEB-NP-32



AGMZO-AES-BC-32
AGMZO-AES-BP-32



AGMZO-AES-EH-32

① = Air bleeding, see section 17 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 19.5 and 19.6

23 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics

FS900 Operating and maintenance information for proportional valves

G010 E-MI-AC analog driver

G020 E-MI-AS-IR digital driver

G030 E-BM-AS digital driver

GS050 E-BM-AES digital driver

GS500 Programming tools

GS510 Fieldbus

K800 Electric and electronic connectors

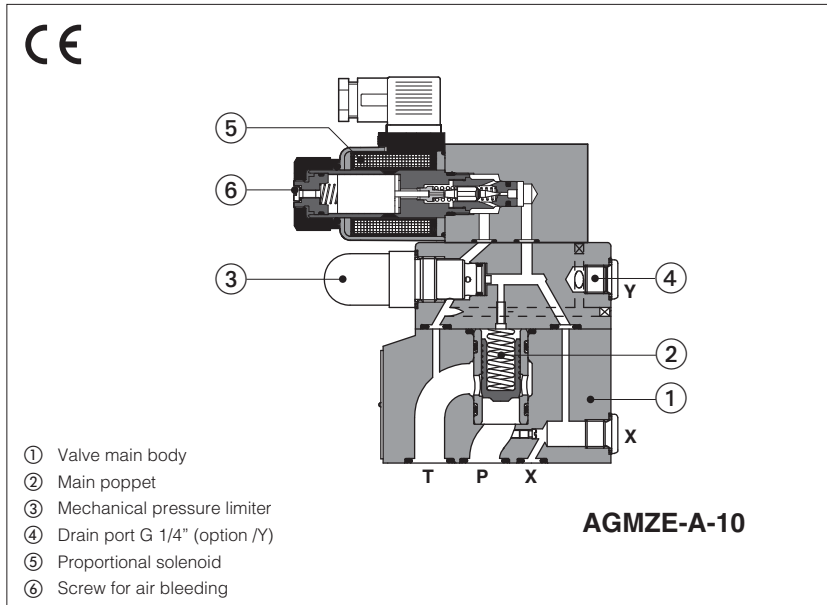
P005 Mounting surfaces for electrohydraulic valves

QB200 Quickstart for AEB valves commissioning

QF200 Quickstart for AES valves commissioning

Proportional relief valves

piloted, without transducer



AGMZE-A

Poppet type, piloted, proportional pressure relief valves for open loop pressure controls. They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

The solenoids are certified according to North American standard **cURus**.

Size: **10, 20, 32** - ISO 6264
 Max flow: **200, 400, 600 l/min**
 Max pressure: **350 bar**

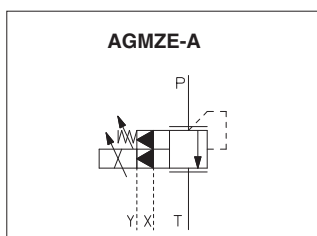
1 MODEL CODE

AGMZE	-	A	-	10	/	315	/	*	-	*	/	*	/	*	/	*
Proportional pressure relief valve, piloted														Seals material, see section 8: - = NBR PE = FKM BT = HNBR		
A = for off-board driver, see section 3														Series number		
Valve size ISO 6264: 10, 20, 32																
Max regulated pressure: 50 = 50 bar 210 = 210 bar 350 = 350 bar 100 = 100 bar 315 = 315 bar																
Hydraulic options (1): E = external pilot Y = external drain (only pipe connection G 1/4")																
Coil voltage, see section 12: - = standard coil for 24 Vdc Atos drivers 6 = optional coil for 12 Vdc Atos drivers 18 = optional coil for low current drivers (2)																
Coil with special connectors, see section 16: - = omit for standard DIN connector J = AMP Junior Timer connector K = Deutsch connector S = Lead Wire connection																

(1) Possible combined options: /EY

(2) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 Vdc and with max current limited to 1A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (Vdc)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	AGMZE-A-10	AGMZE-A-20	AGMZE-A-32
Max regulated pressure [bar]	50; 100; 210; 315; 350		
Max pressure at port P [bar]	350		
Max pressure at port T [bar]	210		
Min regulated pressure [bar]	see min. pressure / flow diagrams at section 11		
Max flow [l/min]	200	400	600
Response time 0-100% step signal (depending on installation) (1) [ms]	≤ 120	≤ 135	≤ 150
Hysteresis	≤ 0,5 [% of max pressure]		
Linearity	≤ 1,0 [% of max pressure]		
Repeatability	≤ 0,2 [% of max pressure]		

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

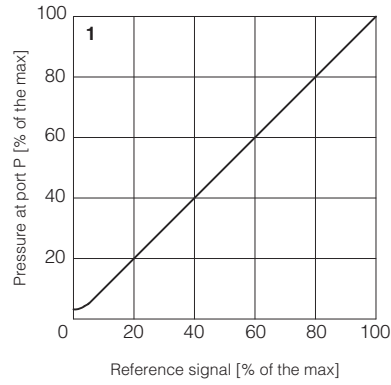
Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	cURus North American Standard		

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

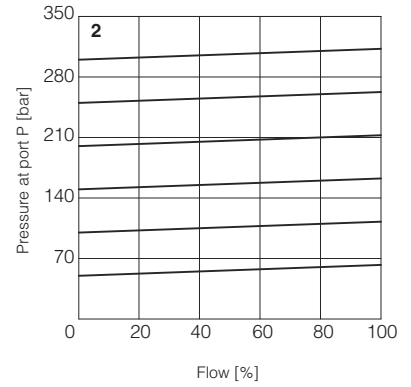
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 50 l/min

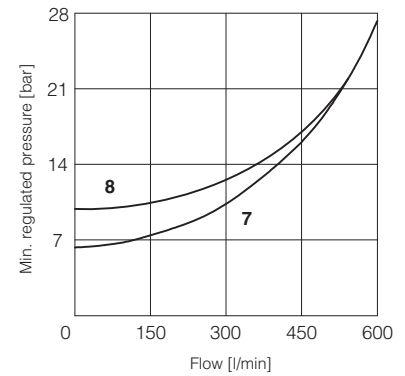
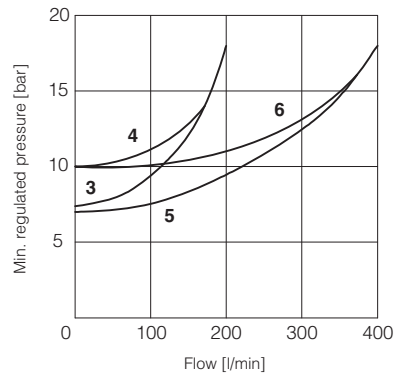


2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min



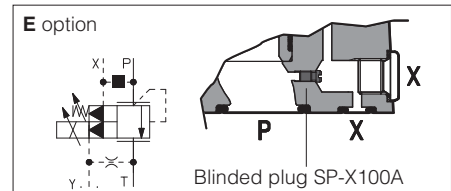
3-8 = Min. pressure/flow diagrams
with zero reference signal

- 3 = AGMZE-A-10/50, 100, 210, 315
- 4 = AGMZE-A-10/350
- 5 = AGMZE-A-20/50, 100, 210, 315
- 6 = AGMZE-A-20/350
- 7 = AGMZE-A-32/50, 100, 210, 315
- 8 = AGMZE-A-32/350

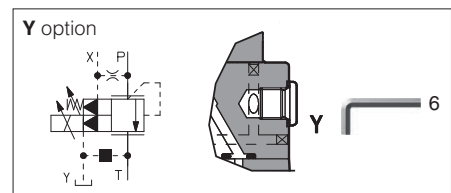


10 HYDRAULIC OPTIONS

E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G 1/4").



Y = The external drain is mandatory in case the main line T is subjected to pressure peaks or it is pressurized.
The Y drain port has a threaded connection G 1/4" available on the pilot stage body.



11 POSSIBLE COMBINED OPTIONS

/EY

12 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

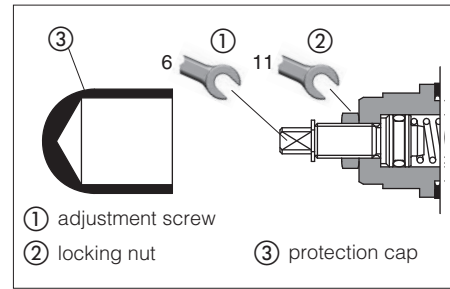
18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

13 MECHANICAL PRESSURE LIMITER

The AGMZE are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

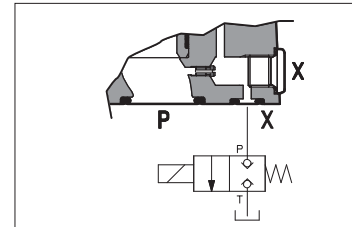
- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded.
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal.
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working.



14 REMOTE PRESSURE UNLOADING

The **P** main line can be remotely unloaded by connecting the valve X port to a solenoid valve as shown in the below scheme (venting valve).

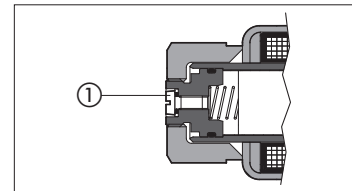
This function can be used in emergency to unload the system pressure by-passing the proportional control.



15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.

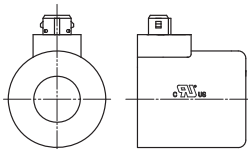
The presence of air may cause pressure instability and vibrations.



16 COILS WITH SPECIAL CONNECTORS

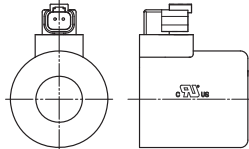
J option

Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



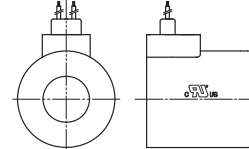
K option

Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67

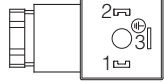


S option

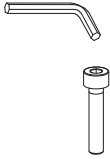

Coil type COZES
Lead Wire connection
Cable length = 180 mm



17 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

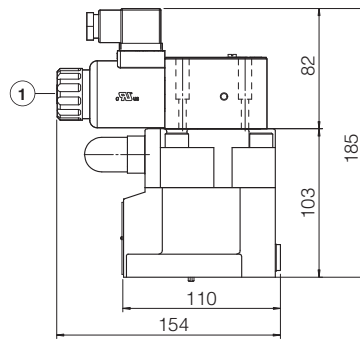
18 FASTENING BOLTS AND SEALS

	AGMZE-A-10	AGMZE-A-20	AGMZE-A-32
	Fastening bolts: 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	Fastening bolts: 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	Fastening bolts: 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	Seals: 2 OR 123 Diameter of ports P, T: Ø 14 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	Seals: 2 OR 4112 Diameter of ports P, T: Ø 24 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm	Seals: 2 OR 4131 Diameter of ports P, T: Ø 28 mm 1 OR 109/70 Diameter of port X: Ø 3,2 mm

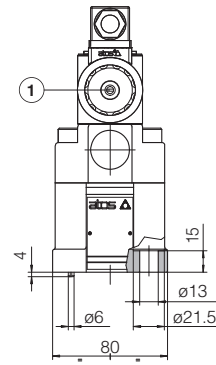
SIZE 10

ISO 6264: 2007
 Mounting surface: 6264-06-09-1-97
 (see table P005)

Mass [kg]	
AGMZE-A-10	5,4



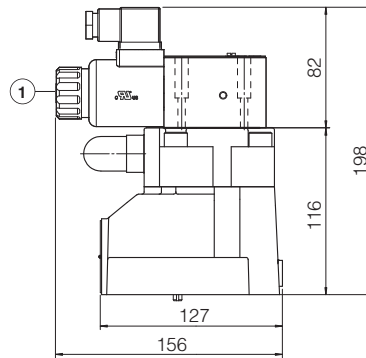
AGMZE-A-10



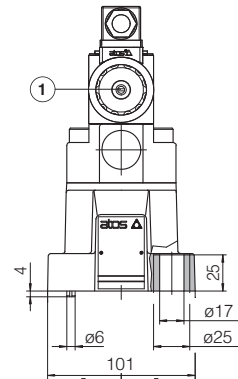
SIZE 20

ISO 6264: 2007
 Mounting surface: 6264-08-13-1-97
 (see table P005)

Mass [kg]	
AGMZE-A-20	6,6



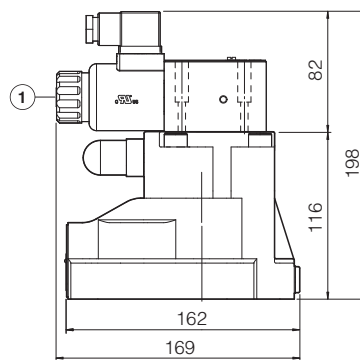
AGMZE-A-20



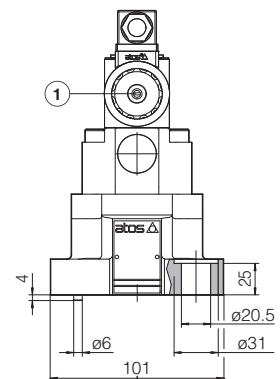
SIZE 32


ISO 6264: 2007
 Mounting surface: 6264-10-17-1-97
 (see table P005)
 (with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZE-A-32	8



AGMZE-A-32



① = Air bleeding, see section 15 

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

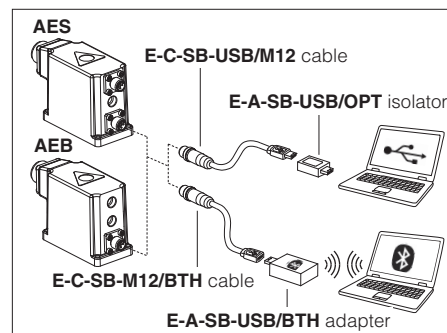


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZGO-*-010
Max regulated pressure [bar]	32; 100; 210
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure (1) [bar]	0,8
Max flow [l/min]	12
Response time 0-100% step signal (depending on installation) (2) [ms]	≤ 45
Hysteresis	≤ 1,5 [% of max pressure]
Linearity	≤ 3,0 [% of max pressure]
Repeatability	≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar	3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

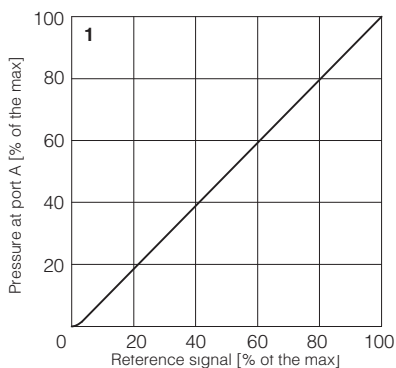
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 V_{dc} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

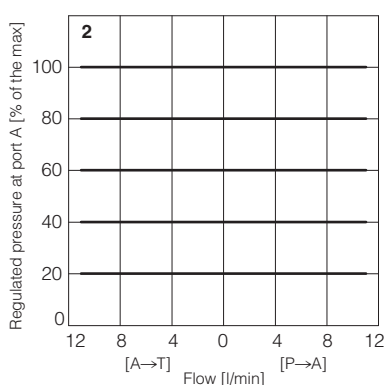
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

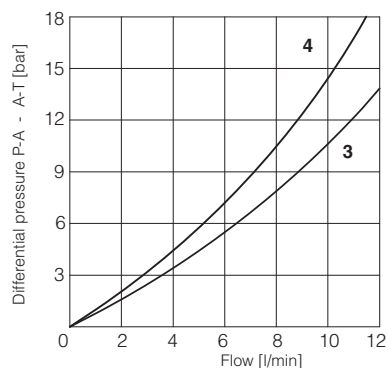
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

12 ELECTRONIC OPTIONS - only for AEB and AES

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

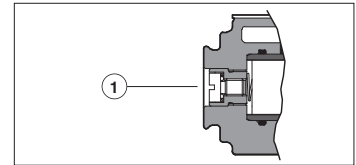
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.




16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)


The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

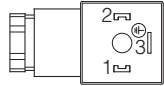
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

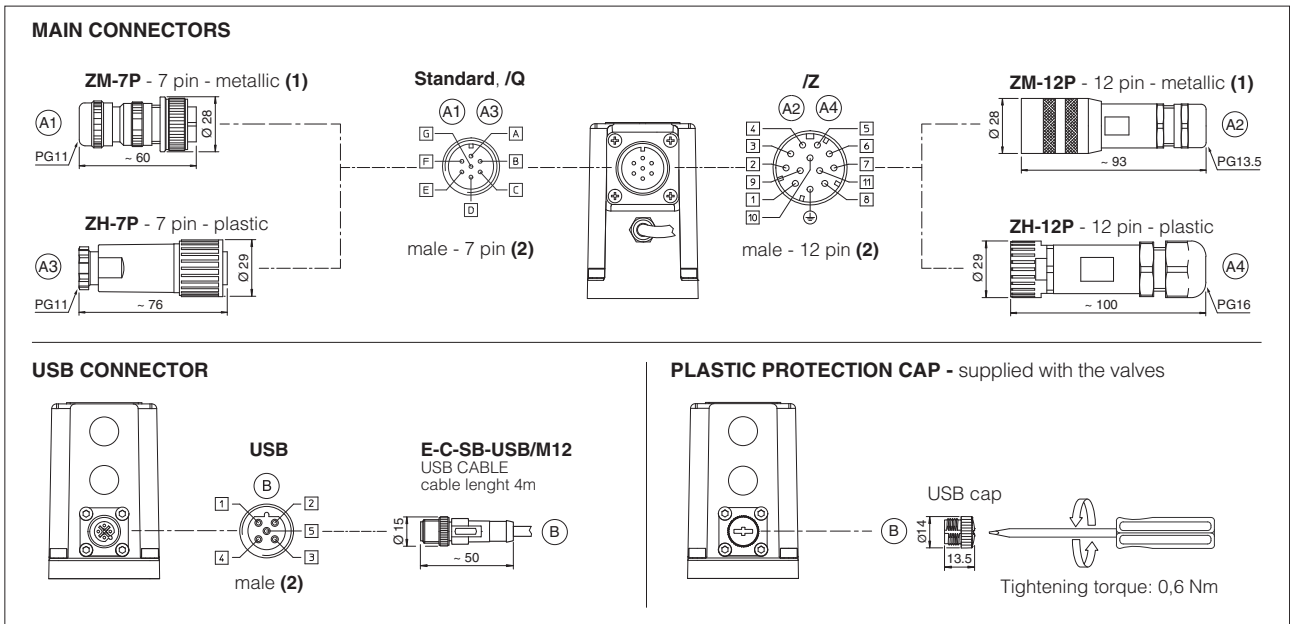
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

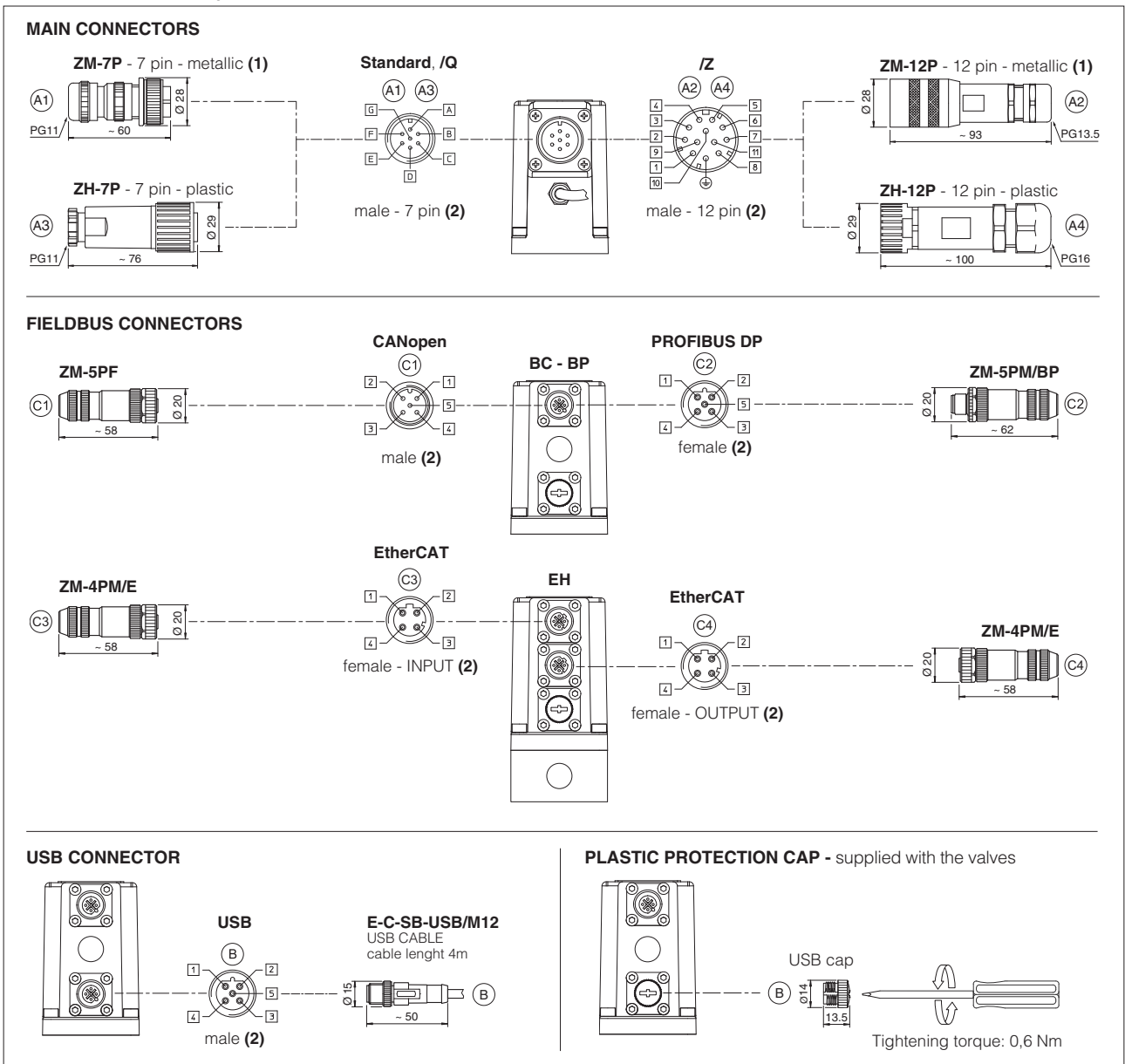
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

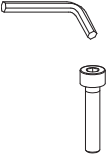

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

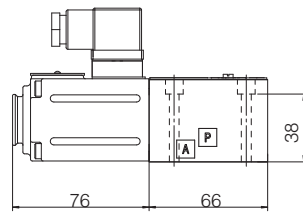
19 FASTENING BOLTS AND SEALS

	<p>Fastening bolts:</p> <p>4 socket head screws M5x50 class 12.9</p> <p>Tightening torque = 8 Nm</p>
	<p>Seals:</p> <p>4 OR 108</p> <p>Diameter of ports P, A, T: Ø 5 mm</p> <p>Port B not used</p>

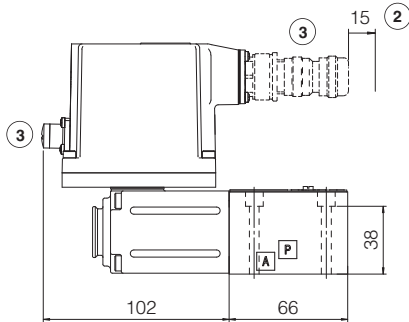
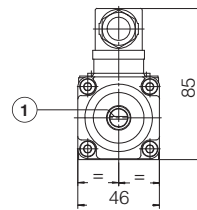
20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see table P005)

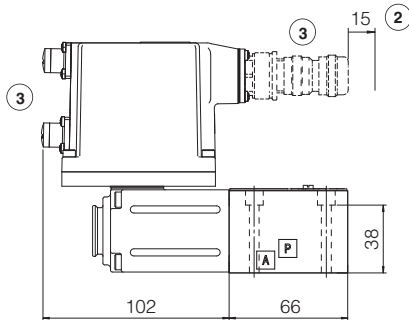
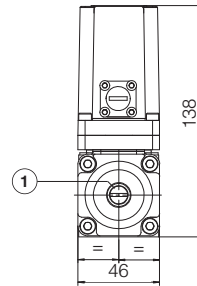
Mass [kg]		
A	AEB, AES	AES-EH
1,8	2,3	2,4



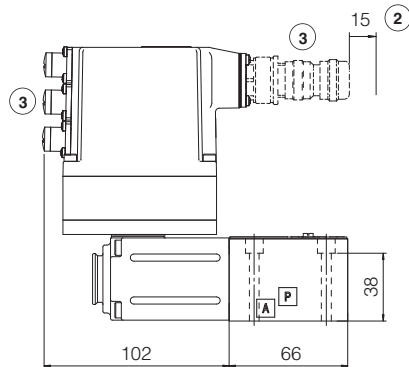
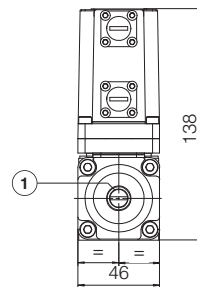
RZGO-A



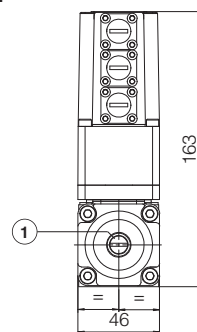
RZGO-AEB-NP



**RZGO-AES-BP
 RZGO-AES-BC**



RZGO-AES-EH



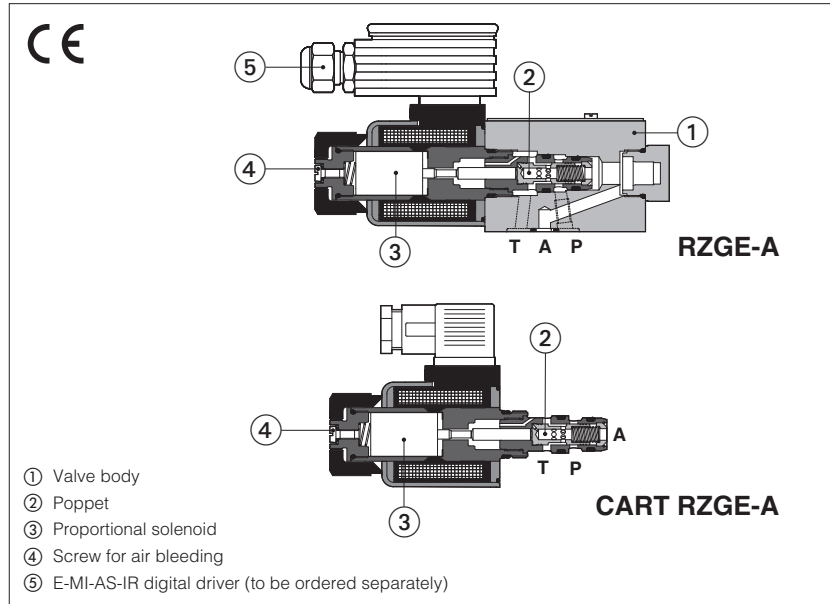
- ① = Air bleeding, see section 15
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

21 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics	GS510 Fieldbus
FS900 Operating and maintenance information for proportional valves	K800 Electric and electronic connectors
G010 E-MI-AC analog driver	P005 Mounting surfaces for electrohydraulic valves
G020 E-MI-AS-IR digital driver	QB200 Quickstart for AEB valves commissioning
G030 E-BM-AS digital driver	QF200 Quickstart for AES valves commissioning
GS050 E-BM-AES digital driver	
GS500 Programming tools	

Proportional reducing valves

direct, without transducer



RZGE-A, CART RZGE-A

Poppet type, direct, proportional pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They are available in following executions:

RZGE: subplate mounting, ISO size 06

CART RZGE: M20 cartridge execution

The solenoids are certified according to North American standard **cURus**.

Size: **06** - ISO 4401 (RZGE); **M20** (CART RZGE)

Max flow: **12 l/min**

Max pressure: **350 bar**

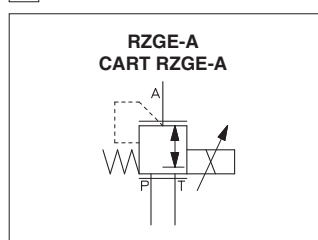
For cavity CART RZGE see section 16

1 MODEL CODE

RZGE	-	A	-	010	/	210	-	*	/	*	/	*
Proportional pressure reducing valve, direct RZGE = subplate mounting CART RZGE = cartridge execution												Seals material, see section 8: - = NBR PE = FKM BT = HNBR
A = for off-board driver, see section 3												Series number
Configuration: 010 = reduced pressure on port A												Coil voltage, see section 10: - = standard coil for 24 Vdc Atos drivers 6 = optional coil for 12 Vdc Atos drivers 18 = optional coil for low current drivers (1)
Max regulated pressure: 32 = 32 bar 100 = 100 bar 210 = 210 bar												Coil with special connectors, see section 12: - = omit for standard DIN connector J = AMP Junior Timer connector K = Deutsch connector S = Lead Wire connection

(1) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 Vdc and with max current limited to 1A

2 HYDRAULIC SYMBOL



3 OFF-BOARD ELECTRONIC DRIVERS

Drivers model	E-MI-AC-01F (1)		E-MI-AS-IR (1)		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

(1) For **CART RZGE** the electronic driver may interfere with the manifold surface. Please check the installation dimensions at section 16

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: $R_a \leq 0,8$, recommended $R_a 0,4$ – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$
Storage temperature range	Standard = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +70^{\circ}\text{C}$
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	RZGE-A-010
Max regulated pressure	32; 100; 210
Min. regulated pressure [bar]	0,8 (or actual value at T port)
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	12
Response time 0-100% step signal (1) [ms] (depending on installation)	≤ 70
Hysteresis [% of the max pressure]	$\leq 1,5$
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Note: above performance data refer to valves coupled with Atos electronic drivers, see section [3](#)

(1) Average response time values; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32$ V_{MAX} (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	$3 \div 3,3 \Omega$	$2 \div 2,2 \Omega$	$13 \div 13,4 \Omega$
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	cURus North American Standard		

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

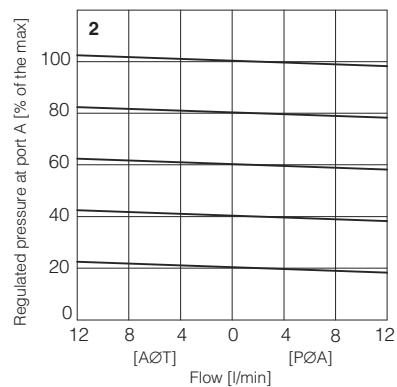
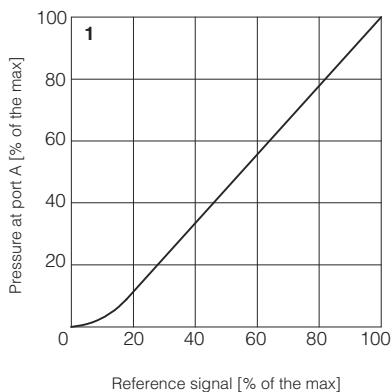
Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$, with HFC hydraulic fluids = $-20^{\circ}\text{C} \div +50^{\circ}\text{C}$ FKM seals (/PE option) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ HNBR seals (/BT option) = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$, with HFC hydraulic fluids = $-40^{\circ}\text{C} \div +50^{\circ}\text{C}$		
Recommended viscosity	$20 \div 100$ mm ² /s - max allowed range $15 \div 380$ mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

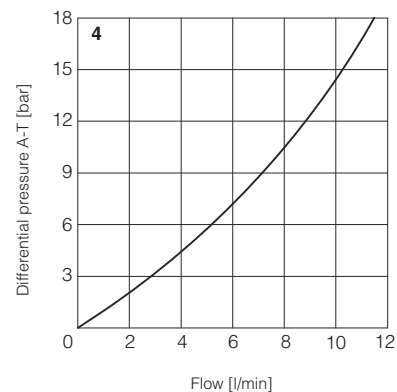
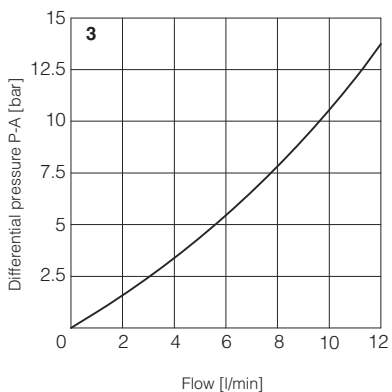
Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 = Min. pressure/flow diagrams
with zero reference signal

3 = Pressure drops vs. flow P-A
4 = Pressure drops vs. flow A-T



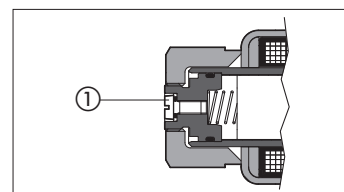
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

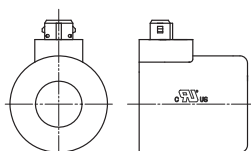
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS

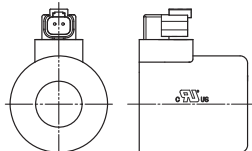
J option

Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



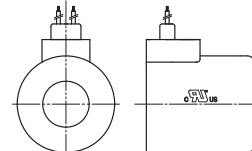
K option

Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67

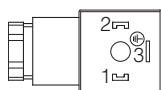


S option

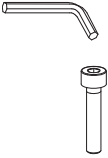

Coil type COZES
Lead Wire connection
Cable length = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS FOR RZGE

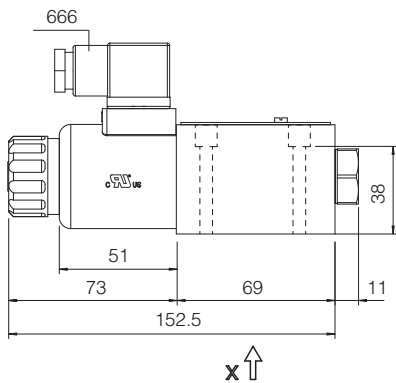
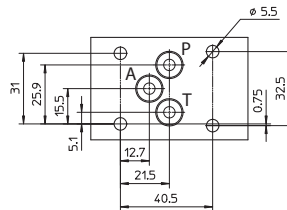
	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals: 3 OR 108 Diameter of ports P, T, A: \varnothing 5 mm Port B not used</p>

15 INSTALLATION DIMENSIONS FOR RZGE [mm]

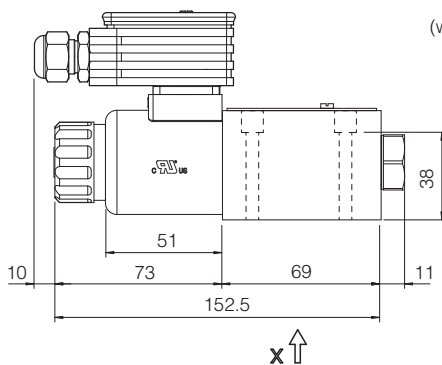
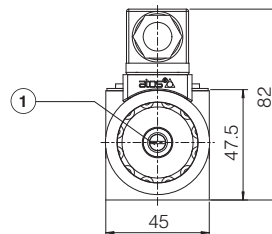
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without port B)

Mass [kg]	
RZGE	1,5
RZGE with E-MI-AS-IR	2,0

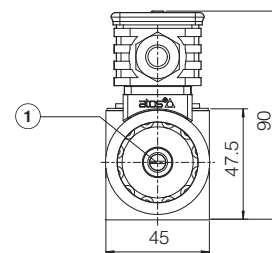
view from X




RZGE-A



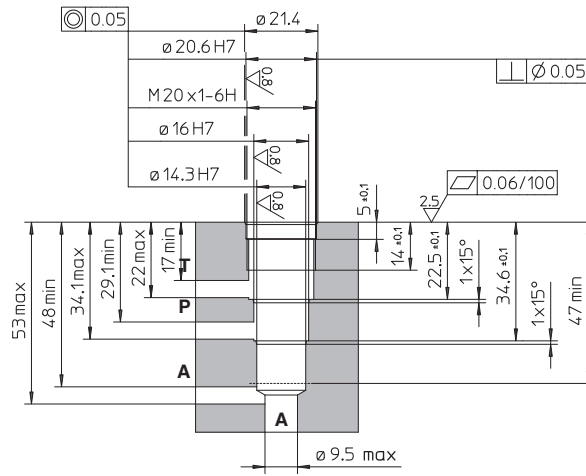
RZGE-A
(with E-MI-AS-IRdigital driver)



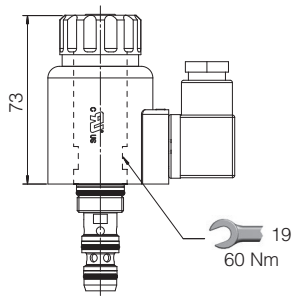
① = Air bleeding, see section 11 

16 INSTALLATION DIMENSIONS FOR CART RZGE [mm]

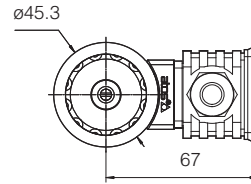
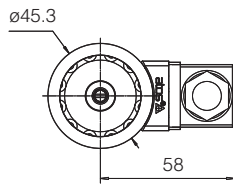
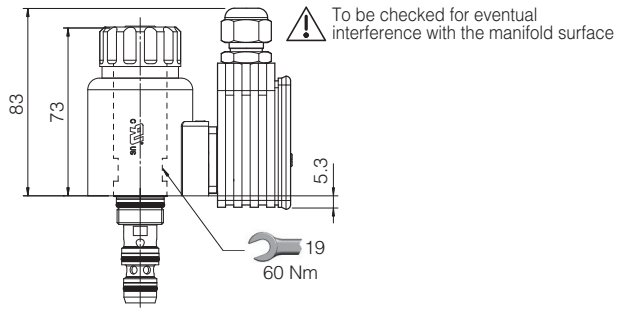
Cavity dimensions for **CART RZGE-A**



CART RZGE-A



CART RZGE-A
(with E-MI-AS-IR digital driver)



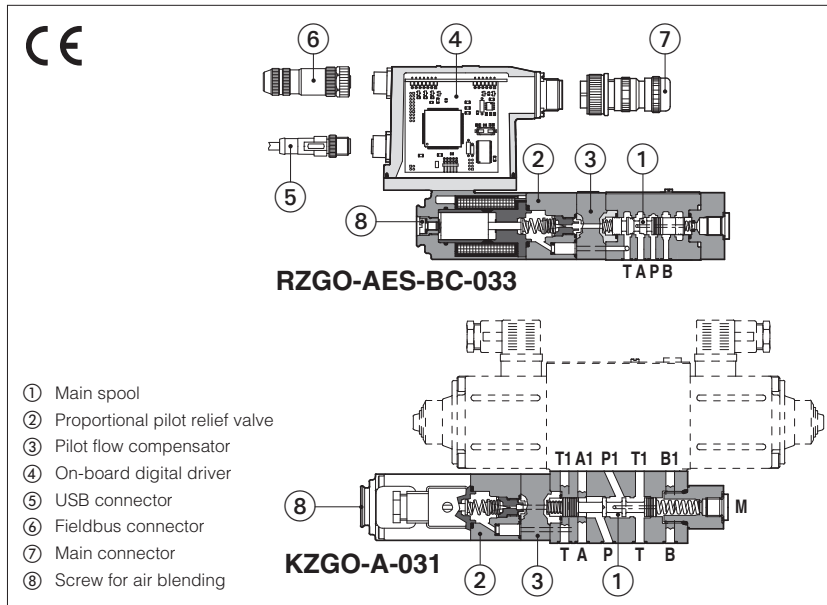
Mass [kg]	
CART RZGE	0,6
CART RZGE with E-MI-AS-IR	1,1

17 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional reducing valves

piloted, without transducer, subplate or modular mounting



RZGO-A , RZGO-AEB, RZGO-AES HZGO-A , KZGO-A

Spool type, piloted, digital proportional reducing valves for pressure open loop controls, available in subplate size 06 or modular mounting size 06 and 10

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

RZGO, HZGO:

Size: **06** - ISO 4401

Max flow: **40 l/min**

Max pressure: **350 bar**

KZGO:

Size: **10** - ISO 4401

Max flow: **100 l/min**

Max pressure: **350 bar**

1 MODEL CODE

RZGO	-	AEB	-	NP	-	033	/	210	/	*	/	*	/	*	/	*
Proportional pressure reducing valve, piloted RZGO = subplate, size 06 HZGO = modular, size 06 KZGO = subplate, size 10														Seals material, see section 10: - = NBR PE = FKM BT = HNBR		
A = for off-board driver, see section 3														Series number		
Only for RZGO : AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)														Coil voltage, only for A - see section 14: - = standard coil for 24VDC Atos drivers 6 = optional coil for 12VDC Atos drivers 18 = optional coil for low current drivers		
Fieldbus interfaces , USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT														Electronic options , only for AEB and AES (4): I = current reference input 4÷20 mA (omit for std voltage 0÷10 VDC) Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector		
Configuration : 031 = regulation on port P1, discharge in T (only for HZGO, KZGO) 033 = regulation on port A, discharge in T (only for RZGO)														Max regulated pressure : 50 = 50 bar (not for KZGO) 210 = 210 bar 350 = 350 bar 100 = 100 bar 315 = 315 bar		

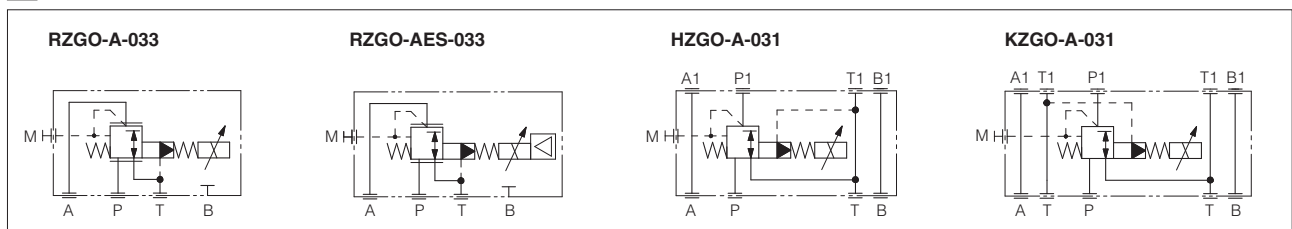
(1) Only for **NP**

(2) Only for **BC, BP, EH**

(3) Omit for **A** execution

(4) Possible combined options: IQ, IZ

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

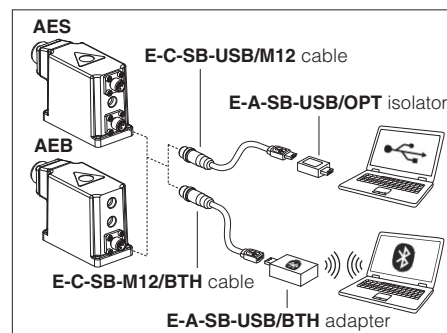
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	RZGO, HZGO	KZGO
Max regulated pressure [bar]	50; 100; 210; 315; 350	100; 210; 315; 350
Max pressure at port P [bar]	350	
Max pressure at port T [bar]	210	
Min regulated pressure (1) [bar]	1,0; 3,0 (only for /350)	
Min flow [l/min]	2,5	3
Max flow [l/min]	40	100
Response time 0-100% step signal (depending on installation) (2) [ms]	≤ 50	≤ 80
Hysteresis	≤ 2 [% of max pressure]	
Linearity	≤ 3 [% of max pressure]	
Repeatability	≤ 2 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6		option /18
Max. solenoid current	2,6 A	3,25 A		1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 Vdc (OFF state), 15 ÷ 24 Vdc (ON state), 9 ÷ 15 Vdc (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 Vdc (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (W option)			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s			
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard	
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water	NBR, HNBR	HFC		

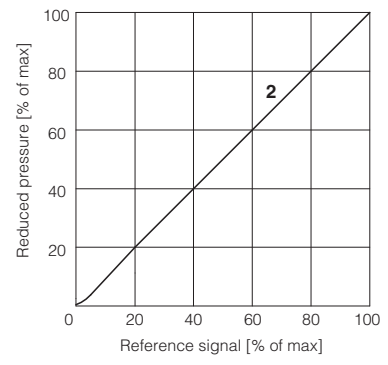
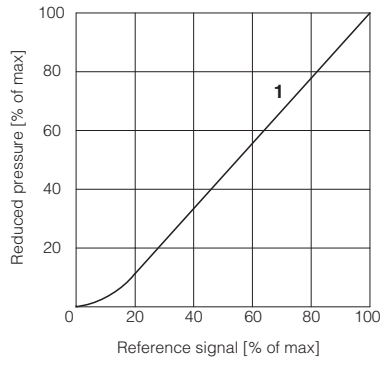
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

11.1 Regulation diagrams
with flow rate $Q = 10$ l/min

1 = RZGO, HZGO

2 = KZGO

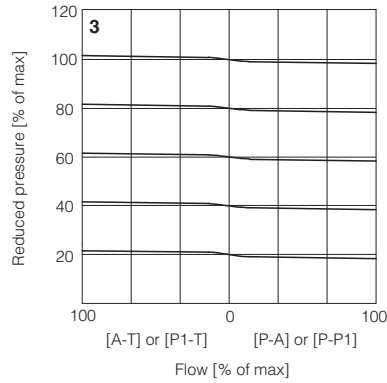
Note: the presence of counter pressure at port T can affect the effective pressure regulation



11.2 Pressure/flow diagrams

with reference pressure set with $Q = 10$ l/min

3 = RZGO, KZGO



11.3 Pressure drop/flow diagram

RZGO, HZGO

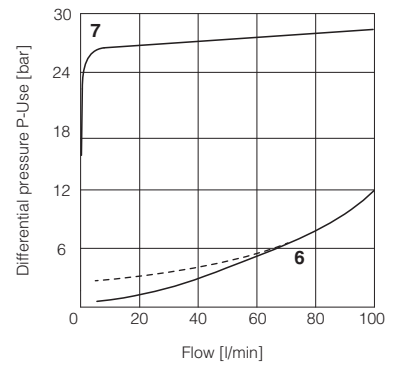
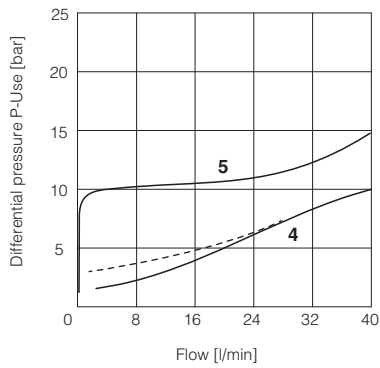
4 = A-T or P1-T (dotted line /350)

5 = P-P1 or P-A

KZGO

6 = P1-T (dotted line /350)

7 = P-P1



12 ELECTRONIC OPTIONS - only for AEB and AES

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 16.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 16.2

13 POSSIBLE COMBINED OPTIONS

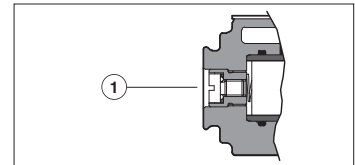
Electronics options: /IQ, /IZ

14 COIL VOLTAGE OPTIONS - only for A

- 6** = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 VDC.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

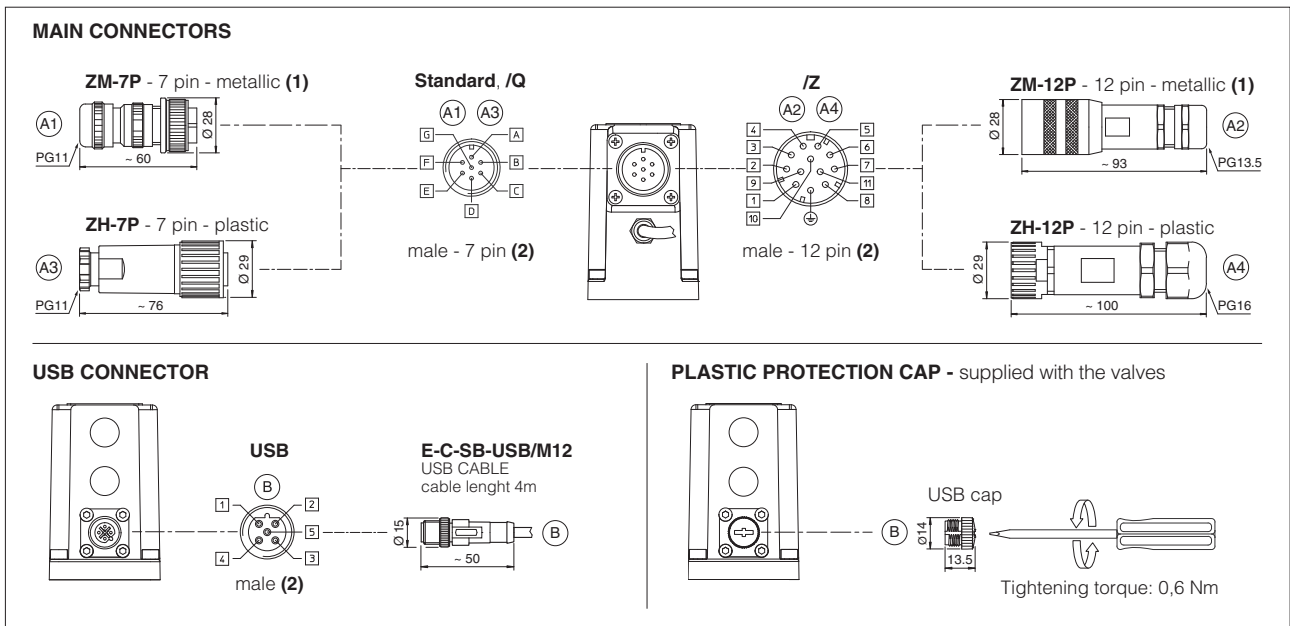
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

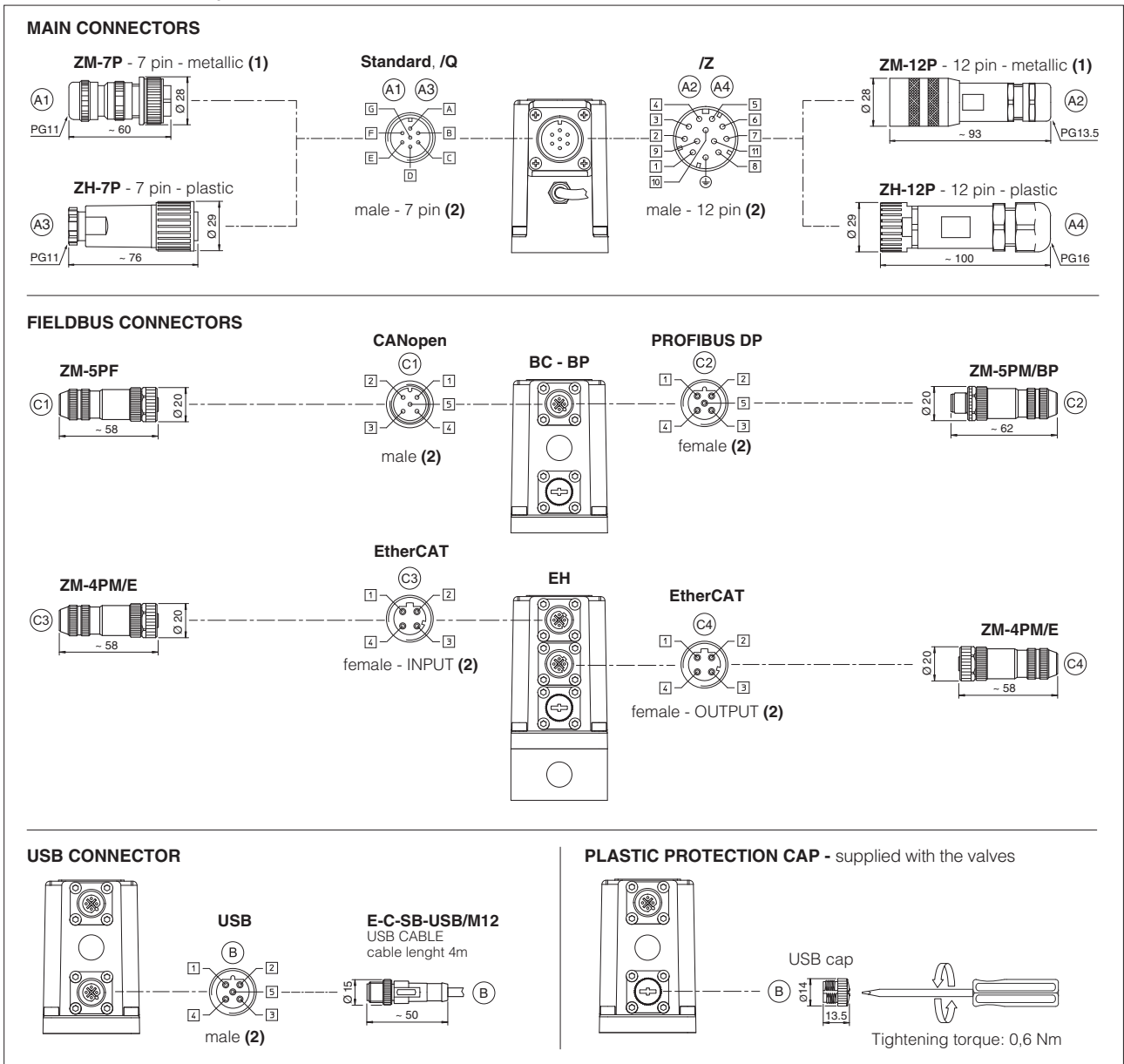
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4-8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

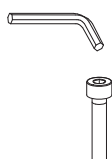

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	QB200	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	QF200	Quickstart for AES valves commissioning

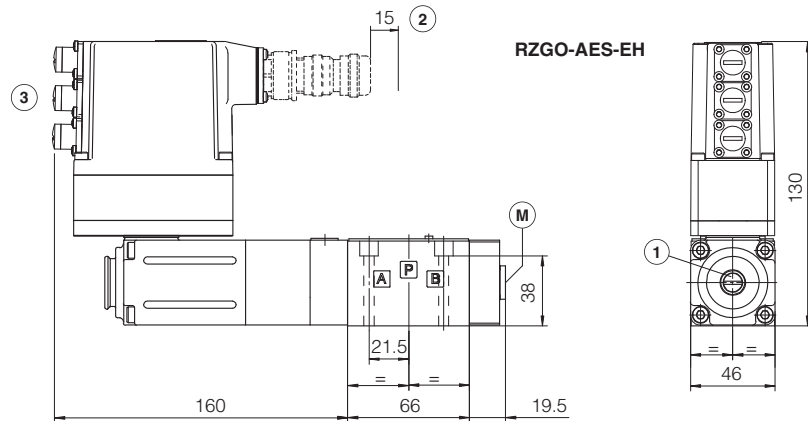
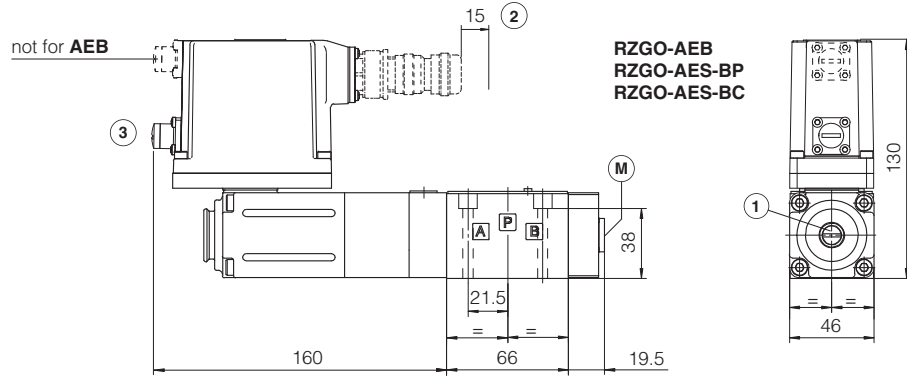
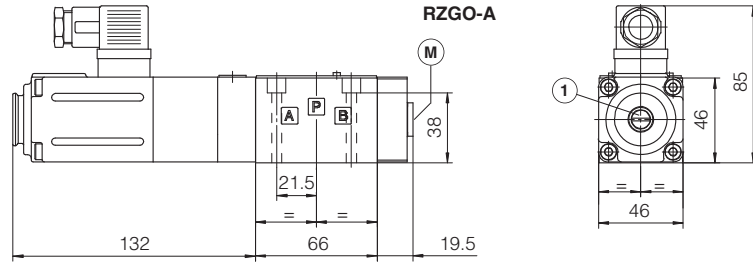
20 FASTENING BOLTS AND SEALS

	RZGO	HZGO	KZGO
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: M5 class 12.9 Tightening torque = 8 Nm	Fastening bolts: M6 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm Port B not used	Seals: 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm	Seals: 5 OR 2050; 1 OR 108 Diameter of ports P, A, B, T: Ø 10,5 mm (max)

RZMO

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05
 (see table P005)

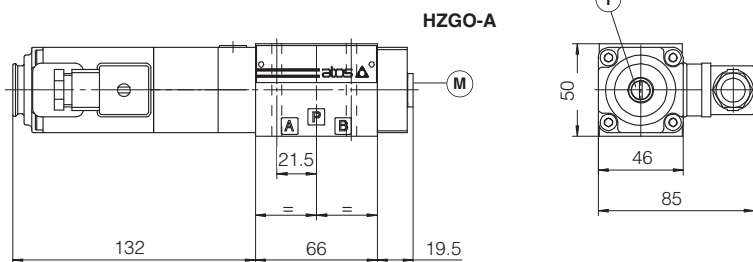
Mass [kg]		
A	AEB, AES	AES-EH
2,8	3,3	3,4



HZGO

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05
 (see table P005)

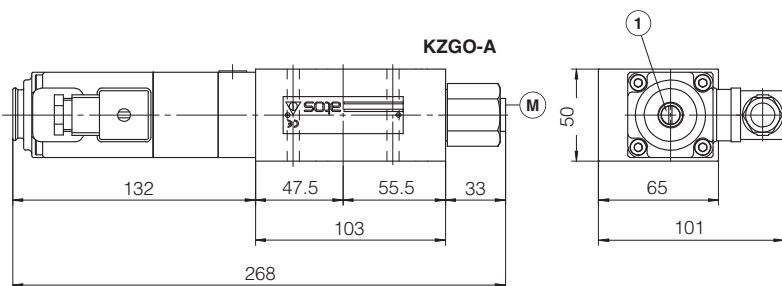
Mass [kg]
A
2,8



KZGO

ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05
 (see table P005)

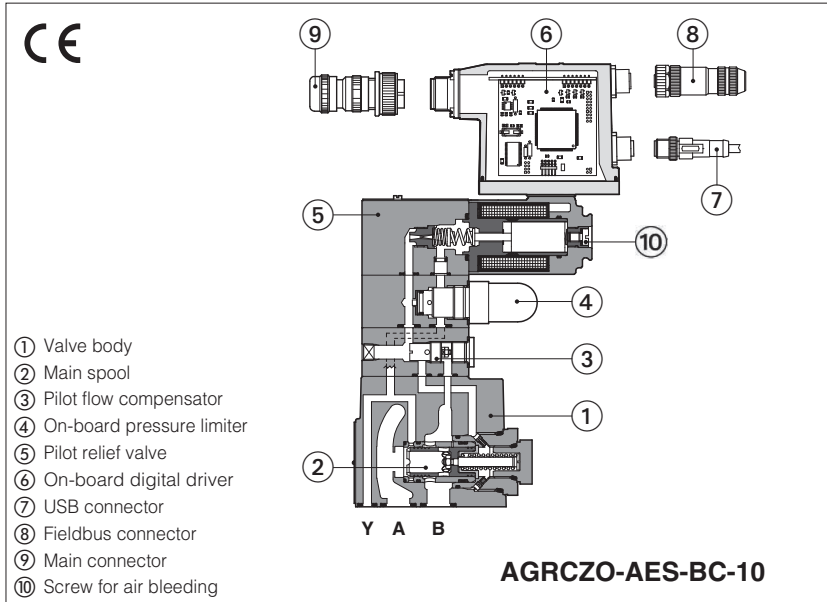
Mass [kg]
A
3,8



- ① = Air bleeding, see section 15
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6
- Ⓜ = Pressure gauge connection port = G¹/₄"

Digital proportional reducing valves

piloted, without transducer



- ① Valve body
- ② Main spool
- ③ Pilot flow compensator
- ④ On-board pressure limiter
- ⑤ Pilot relief valve
- ⑥ On-board digital driver
- ⑦ USB connector
- ⑧ Fieldbus connector
- ⑨ Main connector
- ⑩ Screw for air bleeding

AGRCZO-A, AGRCZO-AEB, AGRCZO-AES

Digital proportional reducing valves, piloted, for pressure open loop controls.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

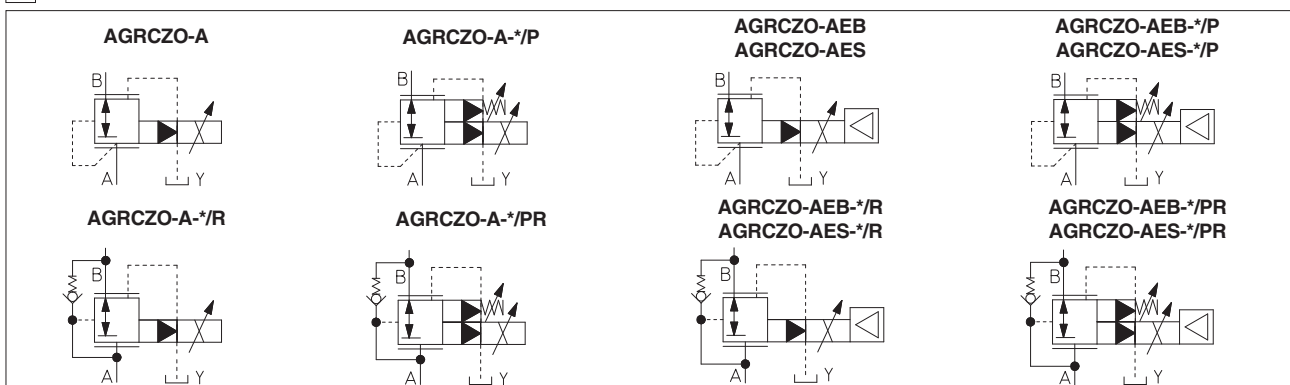
AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **10** and **20** - ISO 5781
 Max flow: **160** and **300 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

AGRCZO	-	AES	-	BC	-	10	/	315	/	*	/	*	/	*
Proportional pressure reducing valve, piloted A = for off-board driver, see section [3] AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)														Seals material, see section [10]: - = NBR PE = FKM BT = HNBR Coil voltage, only for A - see section [14]: - = standard coil for 24Vdc Atos drivers 6 = optional coil for 12Vdc Atos drivers 18 = optional coil for low current drivers
Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT														
Valve size ISO 5781: 10, 20														
Max regulated pressure: 50 = 50 bar 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar														
(1) Only for NP (2) Only for BC, BP, EH				(3) Omit for A execution (4) For possible combined options, see section [14]										

2 HYDRAULIC SYMBOLS



3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

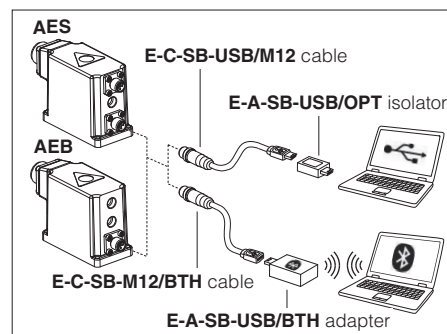
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	AGRCZO-*-10	AGRCZO-*-20
Max regulated pressure [bar]	50; 100; 210; 315; 350	
Min regulated pressure (1) [bar]	1; 3 (only for /350)	
Max pressure at port A or B [bar]	350	
Max pressure at port Y [bar]	pilot drain always external, to be directly connected to tank at zero pressure	
Max flow [l/min]	160	300
Response time 0-100% step signal (depending on installation) (2) [ms]	≤ 45	≤ 50
Hysteresis	≤ 2,0 [% of max pressure]	
Linearity	≤ 3,0 [% of max pressure]	
Repeatability	≤ 2,0 [% of max pressure]	

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6		option /18
Max. solenoid current	2,6 A	3,25 A		1,5 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω		13 ÷ 13,4 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

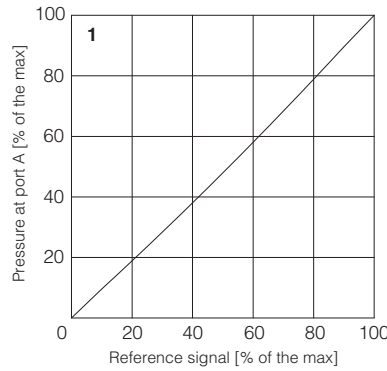
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

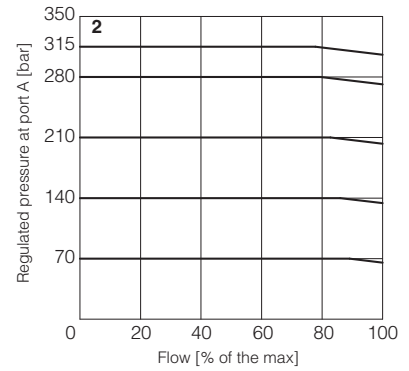
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s			
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7		see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5		www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type		Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR		HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM		HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR		HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate $Q = 10 \text{ l/min}$



2 Pressure/flow diagrams
with reference pressure set with $Q = 10 \text{ l/min}$



3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A

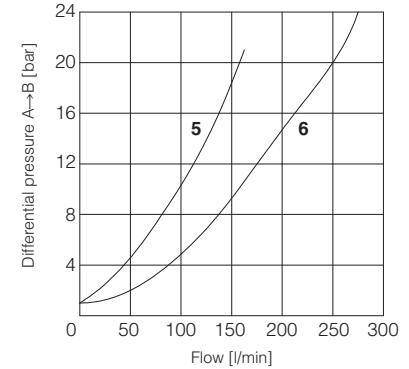
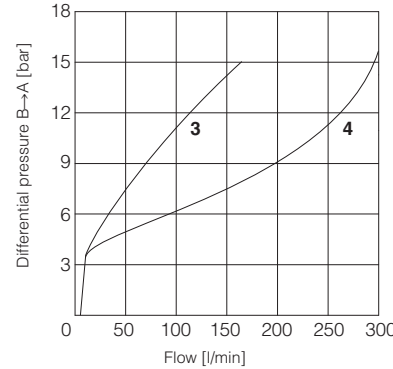
3 = AGRCZO-*-10

4 = AGRCZO-*-20

Differential pressure A→B (through check valve)

5 = AGRCZO-*-10*/R

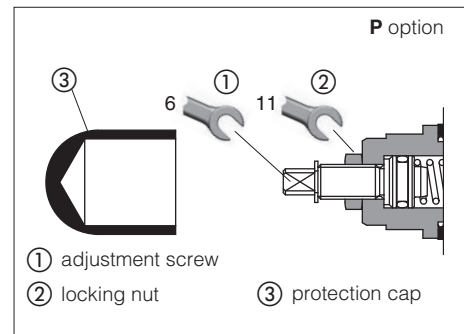
6 = AGRCZO-*-20*/R



12 HYDRAULIC OPTIONS

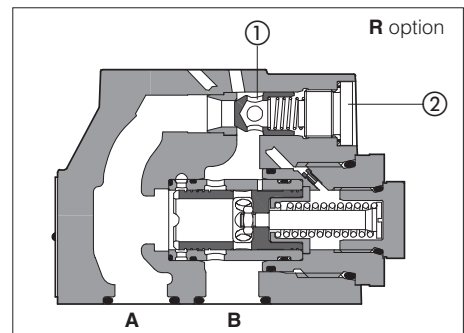
P = This option provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure). At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control. For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



R = This option provides a integral check valve for free reverse flow A→B

- ① Check valve - cracking pressure = 0,5 bar
- ② Plug



13 ELECTRONICS OPTIONS - only for AEB and AES

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see 16.6

Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 16.2

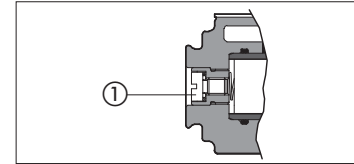
14 POSSIBLE COMBINED OPTIONS

for **A**: /PR

for **AEB** and **AES**: /IP, /IQ, /IR, /IZ, /PQ, /PR, /PZ, /QR, /RZ, /IPQ, /IPR, /IPZ, /IQR, /IRZ, /PQR, /PRZ, /IPQR, /IPRZ

15 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.




16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)


The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 V_{dc} for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{dc}.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is 0 ÷ 5 V_{dc} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 V_{dc}.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{dc} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 V_{dc}, normal working corresponds to 24 V_{dc}.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc Rectified and filtered: $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

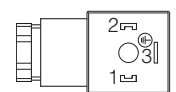
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

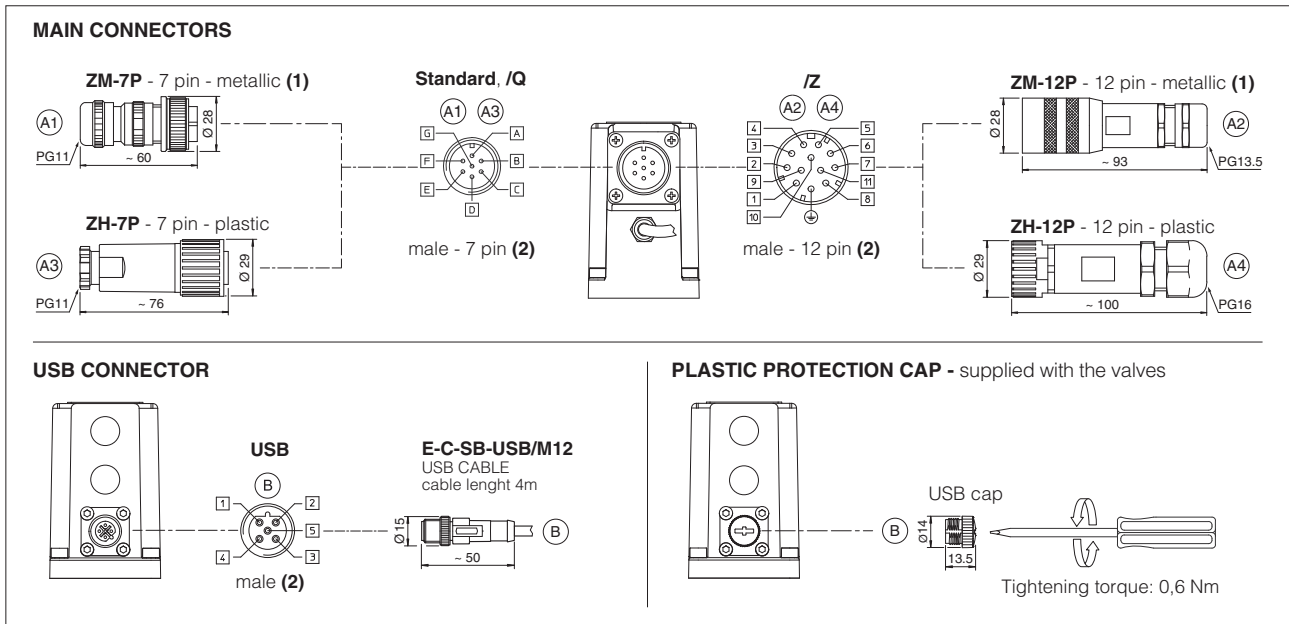
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

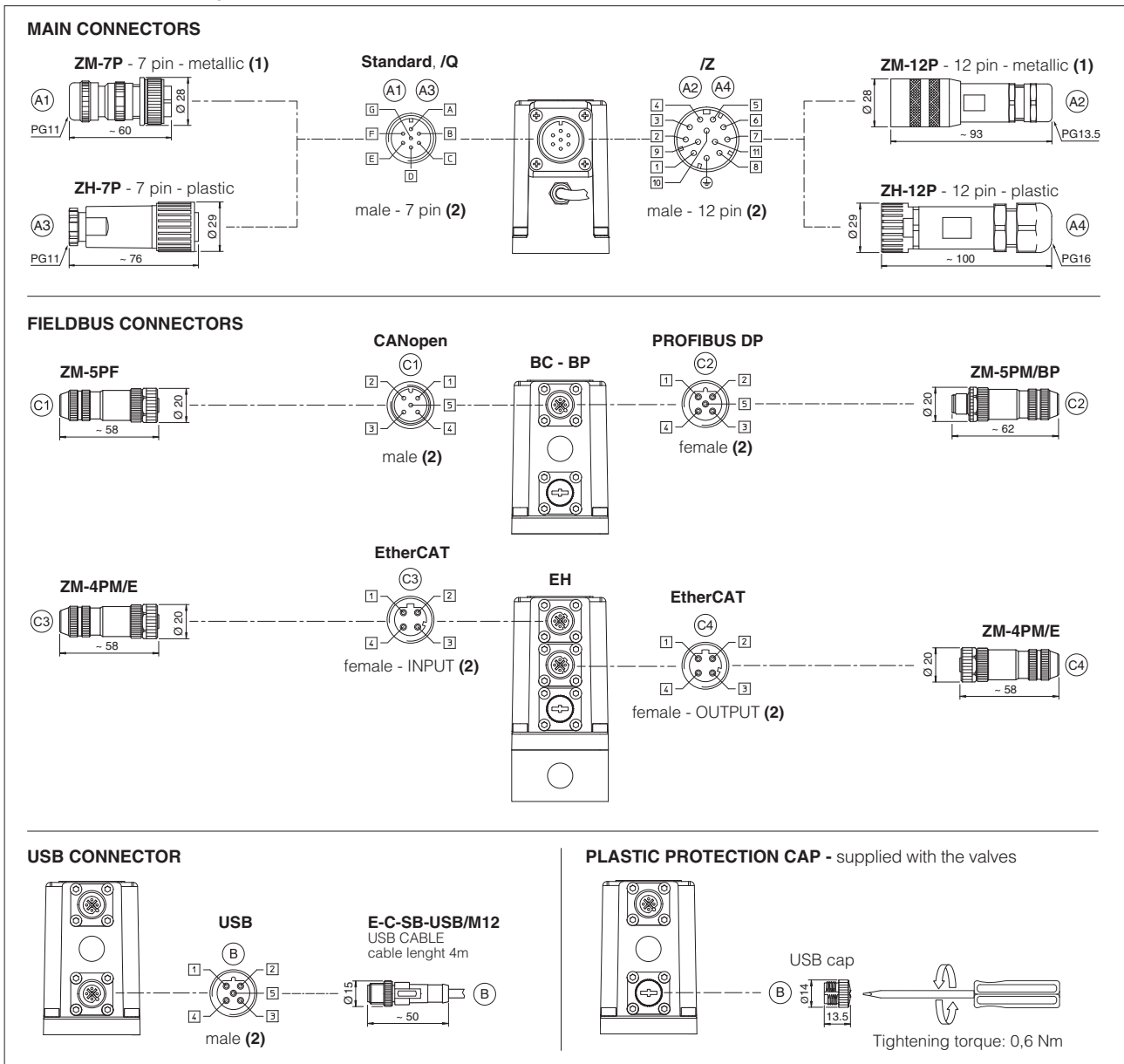
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

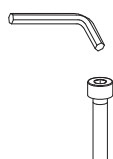

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver	QB200	Quickstart for AEB valves commissioning
GS050	E-BM-AES digital driver	QF200	Quickstart for AES valves commissioning

20 FASTENING BOLTS AND SEALS

	AGRCZO-*-10	AGRCZO-*-20
	<p>Fastening bolts:</p> <p>4 socket head screws M10x45 class 12.9</p> <p>Tightening torque = 70 Nm</p>	<p>Fastening bolts:</p> <p>4 socket head screws M10x45 class 12.9</p> <p>Tightening torque = 70 Nm</p>
	<p>Seals:</p> <p>2 OR 3068</p> <p>Diameter of ports A, B: Ø 14 mm</p> <p>2 OR 109/70</p> <p>Diameter of port X, Y: Ø 5 mm</p>	<p>Seals:</p> <p>2 OR 4100</p> <p>Diameter of ports A, B: Ø 22 mm</p> <p>2 OR 109/70</p> <p>Diameter of port X, Y: Ø 5 mm</p>

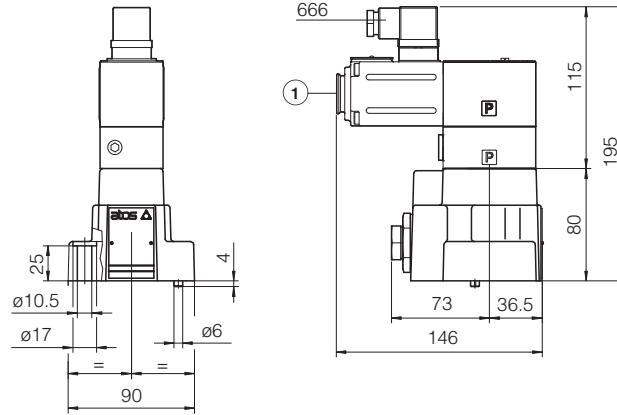
21 INSTALLATION DIMENSIONS FOR AGRCZO-10 [mm]

ISO 5781: 2000

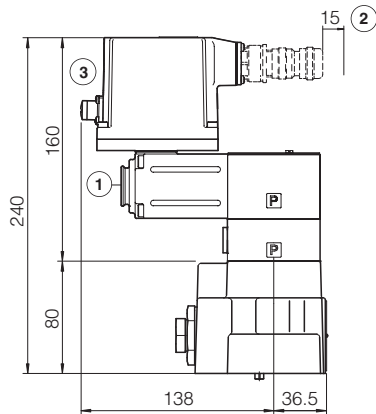
Mounting surface: 5781-06-07-0-00 (see table P005)

	Mass [kg]		
	A	AEB, AES	AES-EH
AGRCZO-*10	5,0	5,6	5,7
Option /P	+0,5		

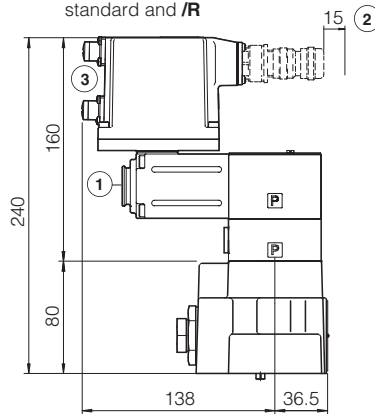
AGRCZO-A-10
standard and /R



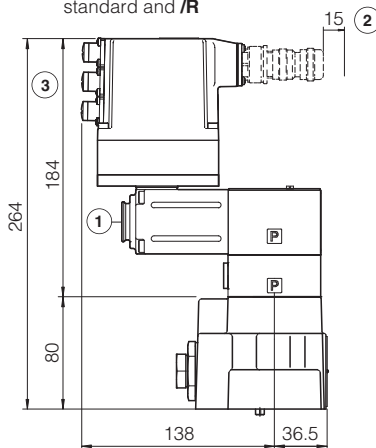
AGRCZO-AEB-NP-10
standard and /R



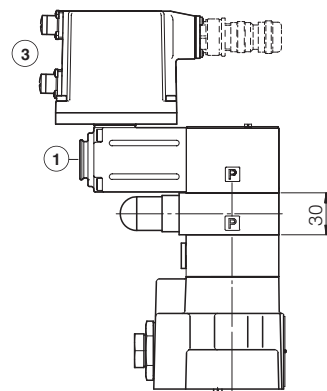
AGRCZO-AES-BC-10
AGRCZO-AES-BP-10
standard and /R




AGRCZO-AES-EH-10
standard and /R



Option /P



① = Air bleeding, see section 15 

② = Space to remove the connectors

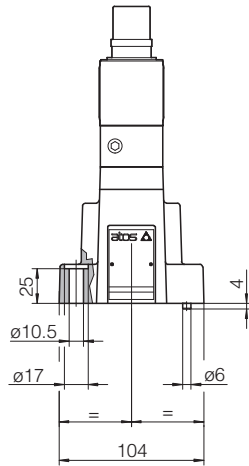
③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

22 INSTALLATION DIMENSIONS FOR AGRCZO-20 [mm]

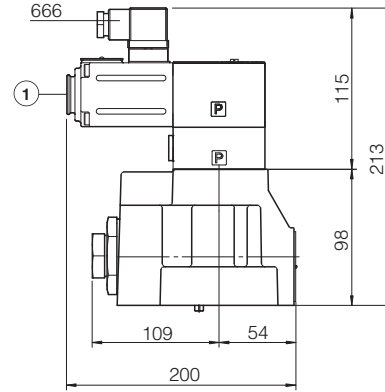
ISO 5781: 2000

Mounting surface: 5781-08-10-0-00 (see table P005)

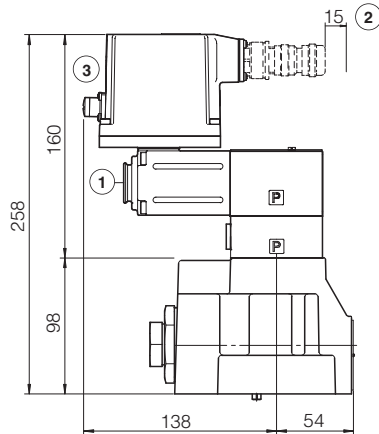
	Mass [kg]		
	A	AEB, AES	AES-EH
AGRCZO-*20	7,5	8,1	8,2
Option /P	+0,5		



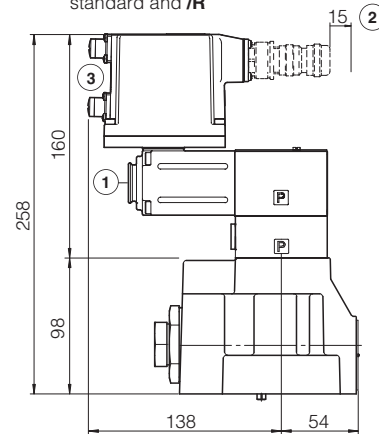
AGRCZO-A-20
standard and /R



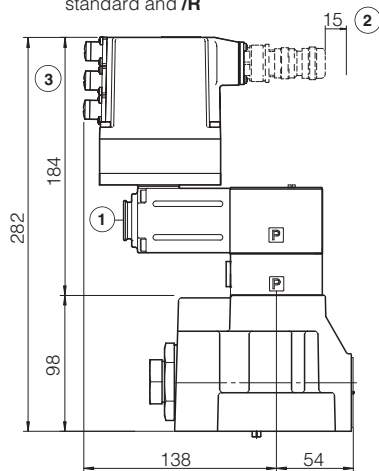
AGRCZO-AEB-NP-20
standard and /R



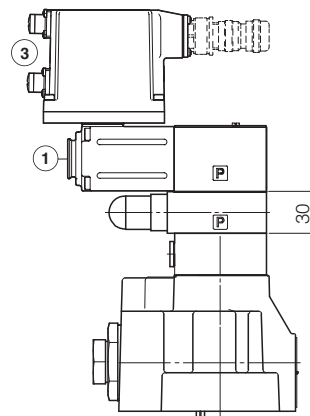
AGRCZO-AES-BC-20
AGRCZO-AES-BP-20
standard and /R




AGRCZO-AES-EH-20
standard and /R



Option /P



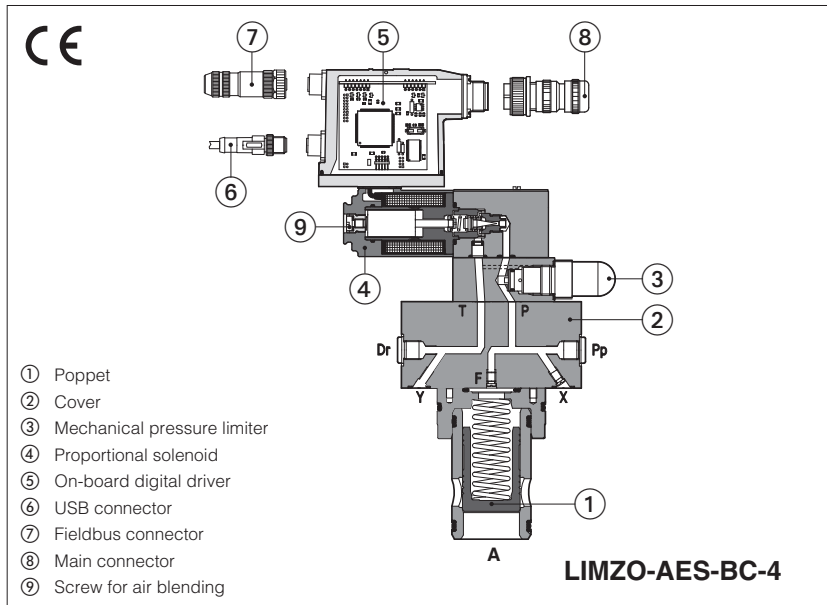
① = Air bleeding, see section 15 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

Digital proportional pressure cartridges

piloted, without transducer - compensator, relief, reducing functions



LICZO, LIMZO, LIRZO

2-way digital proportional cartridges respectively performing: pressure compensator, relief and reducing open loop functions.

A to be coupled with off-board driver.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

Size: **16 ÷ 80** - ISO 7368

Max flow: up to **4500 l/min**

Max pressure: **350 bar**

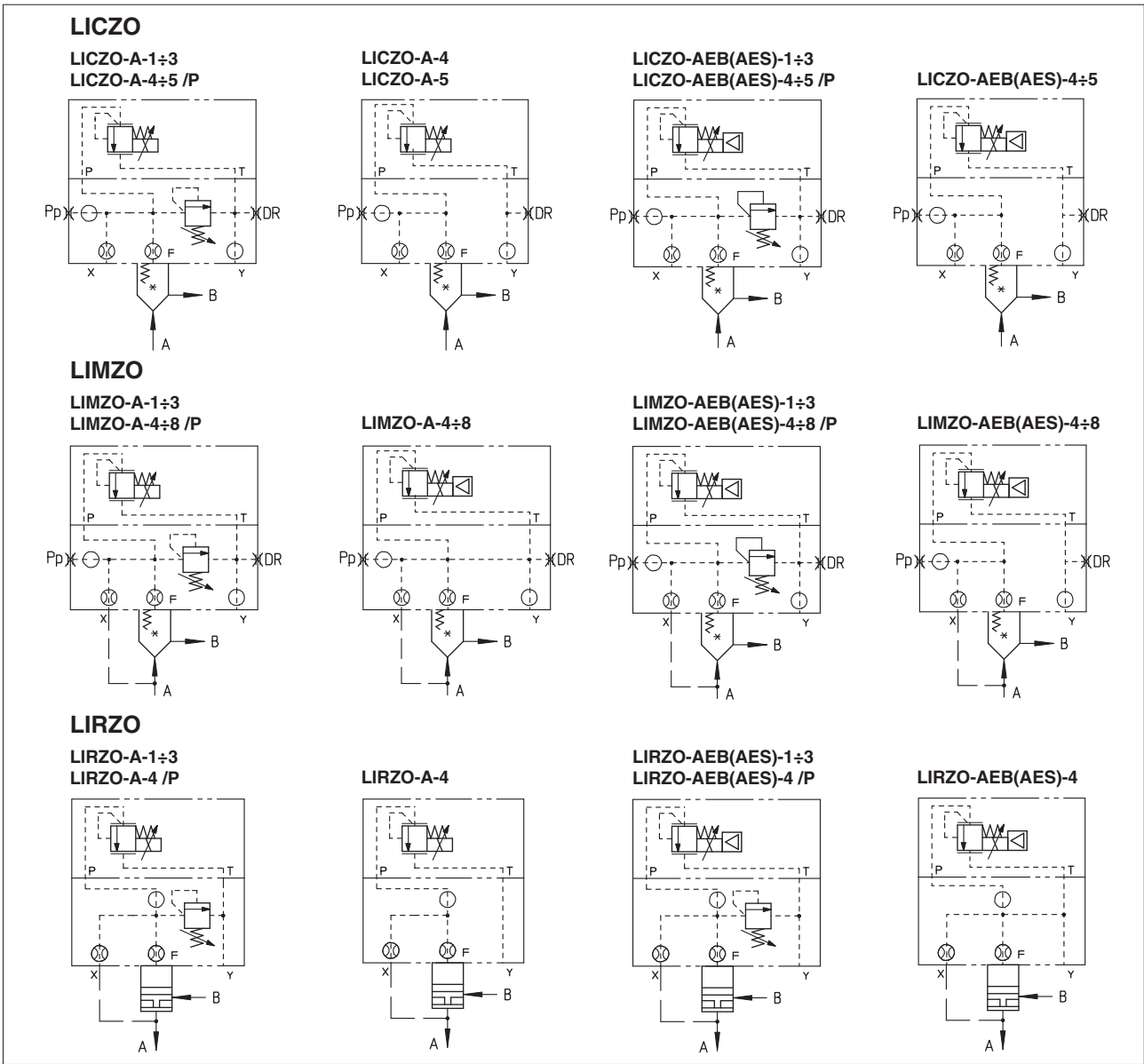
1 MODEL CODE OF COVERS

LIMZO	-	AES	-	BC	-	4	/	315	/	*	/	*	/	*	*
<p>Proportional pressure cartridges, piloted</p> <p>LICZO = pressure compensator</p> <p>LIMZO = pressure relief</p> <p>LIRZO = pressure reducing</p>															<p>Seals material, see section 12 :</p> <ul style="list-style-type: none"> - = NBR PE = FKM BT = HNBR
<p>A = for off-board driver, see section 5</p> <p>AEB = basic on-board digital driver (1)</p> <p>AES = full on-board digital driver (2)</p>															<p>Coil voltage, only for A - see section 17 :</p> <ul style="list-style-type: none"> - = standard coil for 24VDC Atos drivers 6 = optional coil for 12VDC Atos drivers 18 = optional coil for low current drivers
<p>Fieldbus interfaces USB port always present (3):</p> <p>NP = Not present</p> <p>BC = CANopen</p> <p>BP = PROFIBUS DP</p> <p>EH = EtherCAT</p>															<p>Hydraulic options (4):</p> <p>P = with integral mechanical pressure limiter (standard for size 1, 2 and 3)</p> <p>Electronics options, only for AEB and AES (4):</p> <ul style="list-style-type: none"> I = current reference input 4÷20 mA (omit for std voltage 0÷10 V) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector
<p>Valve size ISO 7368:</p> <ul style="list-style-type: none"> 1 = 16 2 = 25 3 = 32 4 = 40 5 = 50 (not for LIRZO) 6 = 63 (only for LIMZO) 8 = 80 (only for LIMZO) 															<p>Max regulated pressure:</p> <ul style="list-style-type: none"> 50 = 50 bar 100 = 100 bar 210 = 210 bar 315 = 315 bar 350 = 350 bar

(1) Only for **NP**
(2) Only for **BC, BP, EH**

(3) Omit for **A** execution
(4) For possible combined options, see section [16](#)

2 HYDRAULIC SYMBOLS



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	*	/	*	
Cartridge according to ISO 7368				Series number				Seals material, see section 12:
Cartridge size ISO 7368: 16; 25; 32; 40; 50; 63; 80				Spring cracking pressure: 2 = 1,5 bar for poppet 31 3 = 3 bar 4 = 4 bar				6 = 6 bar for poppet 31 and 36 7 = 7 bar for poppet 37
Type of poppet: 31 = for LIMZO and LICZO 36 = for LICZO 37 = for LIRZO				-				• = NBR PE = FKM BT = HNBR

4 TYPE OF POPPET

Type of poppet	31	36	37
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A: AP	1:1	1:1	1:1

5 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

6 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

7 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

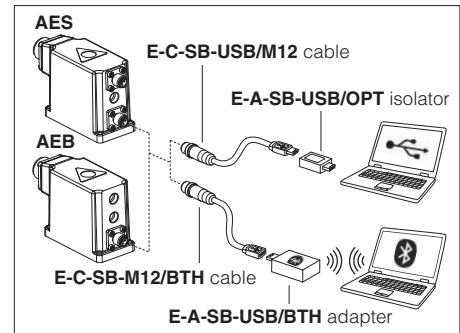
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



8 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

9 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

10 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	LICZO					LIMZO								LIRZO			
	1	2	3	4	5	1	2	3	4	5	6	8	1	2	3	4	
valve size																	
Max flow [l/min]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800	
Min regulated pres. at port A [bar]	9	8,5	8	13	15	7	7	7	10,5	12	12	(2)	7				
Min regulated pres. at port A for /350 [bar]	11	10	10	13	16	10	10	9	12	13	13	16	12				
Max regulated pres. at port A [bar]	50; 100; 210; 315; 350					50; 100; 210; 315; 350						50; 100; 210; 315; 350					
Response time 0-100% step signal (depending on installation) (1) [ms]	100 ÷ 400					100 ÷ 450						100 ÷ 350					
Hysteresis [% of the regulated max flow]	≤ 2					≤ 1,5						≤ 2					
Linearity [% of the regulated max flow]	≤ 3					≤ 3						≤ 3					
Repeatability [% of the regulated max flow]	≤ 2					≤ 2						≤ 2					

Note: above performance data refer to valves coupled with Atos electronic drivers, see section **5**

- (1) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response.
- (2) Consult our technical office.

11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,6 A	3,25 A	1,5 A	
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor output	Output range: voltage ±5 VDC @ max 5 mA			
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ			
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (N option)			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21			

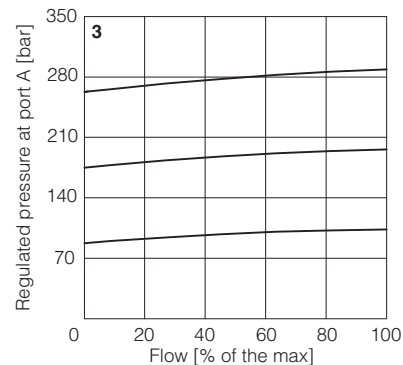
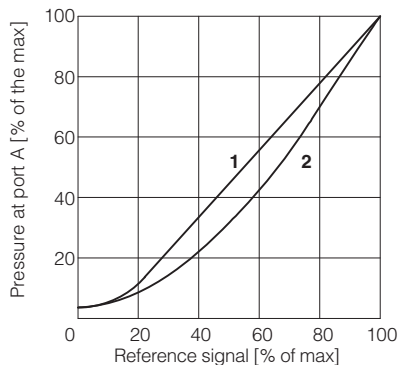
Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

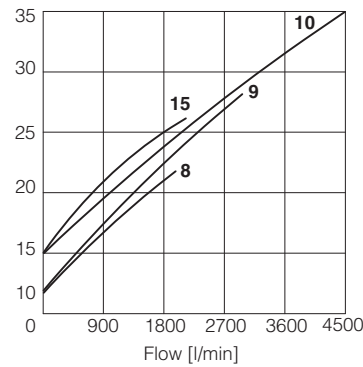
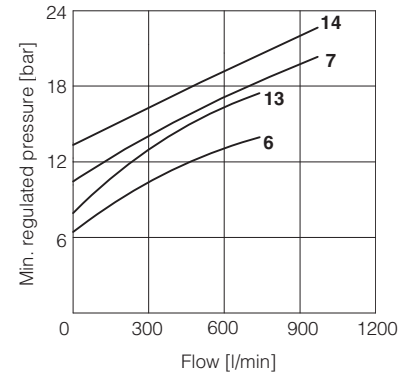
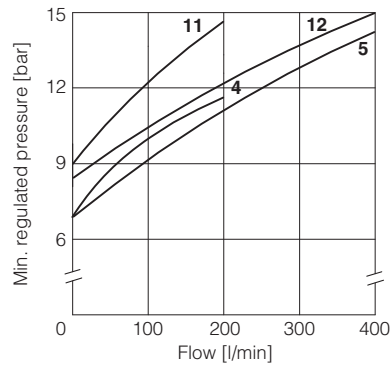
13 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

- 1 Regulation diagrams LIMZO
- 2 Regulation diagrams LICZO
- 3 Pressure/flow diagrams LICZO, LIMZO



4-14 Min. pressure/flow diagrams
with zero reference signal

- | | |
|---------------|---------------|
| 4 = LIMZO*-1 | 11 = LICZO*-1 |
| 5 = LIMZO*-2 | 12 = LICZO*-2 |
| 6 = LIMZO*-3 | 13 = LICZO*-3 |
| 7 = LIMZO*-4 | 14 = LICZO*-4 |
| 8 = LIMZO*-5 | 15 = LICZO*-5 |
| 9 = LIMZO*-6 | |
| 10 = LIMZO*-8 | |

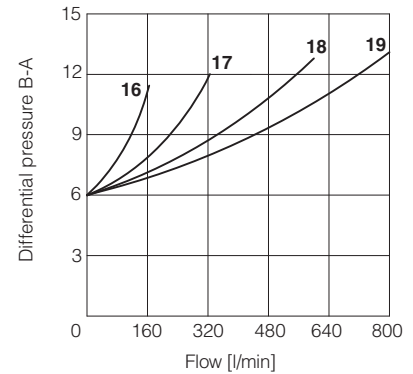
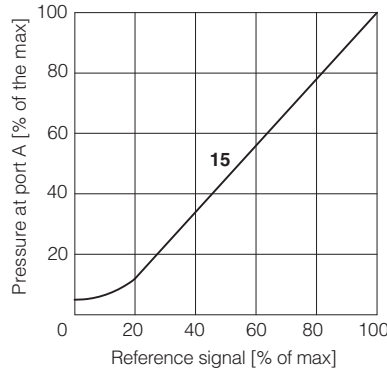


Regulation diagrams LIRZO

15 = LIRZO-A

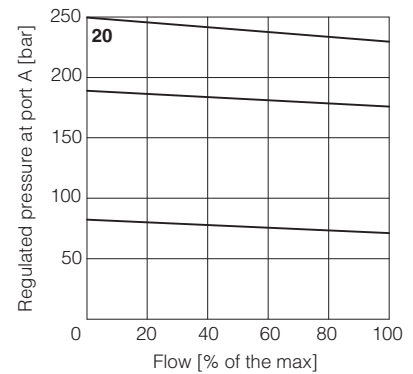
16-19 Min. pressure/flow diagrams
with reference signal "null"

- | |
|---------------|
| 16 = LIRZO*-1 |
| 17 = LIRZO*-2 |
| 18 = LIRZO*-3 |
| 19 = LIRZO*-4 |



Pressure/flow diagrams

20 = LIRZO-A



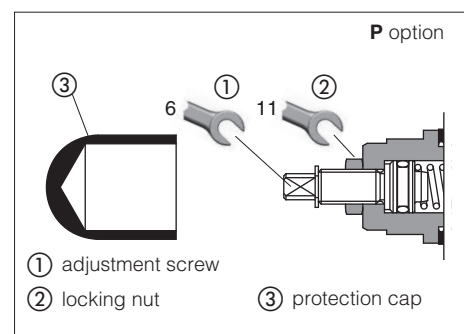
14 HYDRAULIC OPTIONS

P = This option (standard for size 1, 2 and 3) provides a mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).

At the first commissioning it must be set at a value lightly higher than the max pressure regulated with the proportional control.

For the pressure setting of the mechanical pressure limiter, proceed according to following steps:

- apply the max reference input signal to the valve's driver. The system pressure will not increase until the mechanical pressure limiter remains unloaded
- turn clockwise the adjustment screw ① until the system pressure will increase up to a stable value corresponding to the pressure setpoint at max reference input signal
- turn clockwise the adjustment screw ① of additional 1 or 2 turns to ensure that the mechanical pressure limiter remains closed during the proportional valve working



15 ELECTRONIC OPTIONS - only for **AEB** and **AES**

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position. The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 19.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see 19.6
Enable input signal - see above option /Q
Power supply for driver's logics and communication - see 19.2

16 POSSIBLE COMBINED OPTIONS

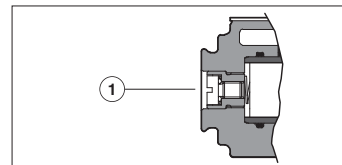
- Hydraulic options:** all combination possible
Electronics options: /IQ, /IZ

17 COIL VOLTAGE OPTIONS - only for **A**

- 6** = Optional coil to be used with Atos drivers with power supply 12 VDC.
18 = Optional coil to be used with electronic drivers not supplied by Atos.

18 AIR BLEEDING

At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing. The presence of air may cause pressure instability and vibrations.



19 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

19.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 19.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

19.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

19.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24Vdc.

19.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 Vdc (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 Vdc.

19.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 Vdc on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849. Enable input signal can be used as generic digital input by software selection.

19.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the Enable input signal.

20 ELECTRONIC CONNECTIONS

20.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

20.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

20.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

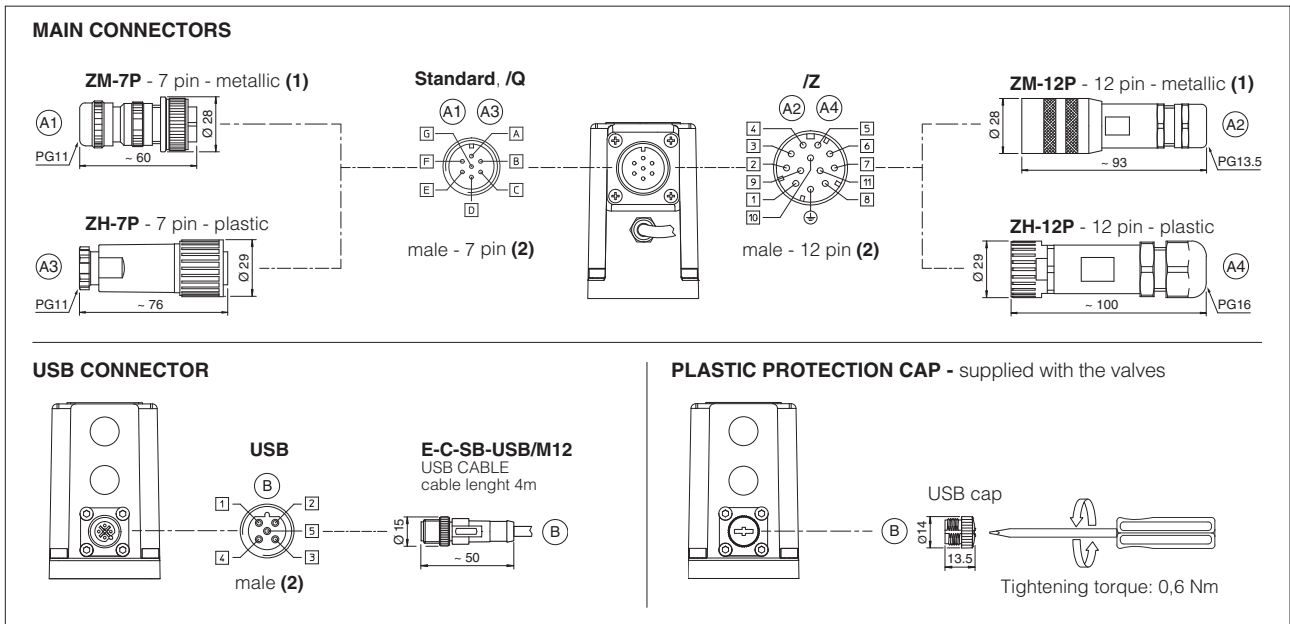
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

20.4 Solenoid connection - only for A

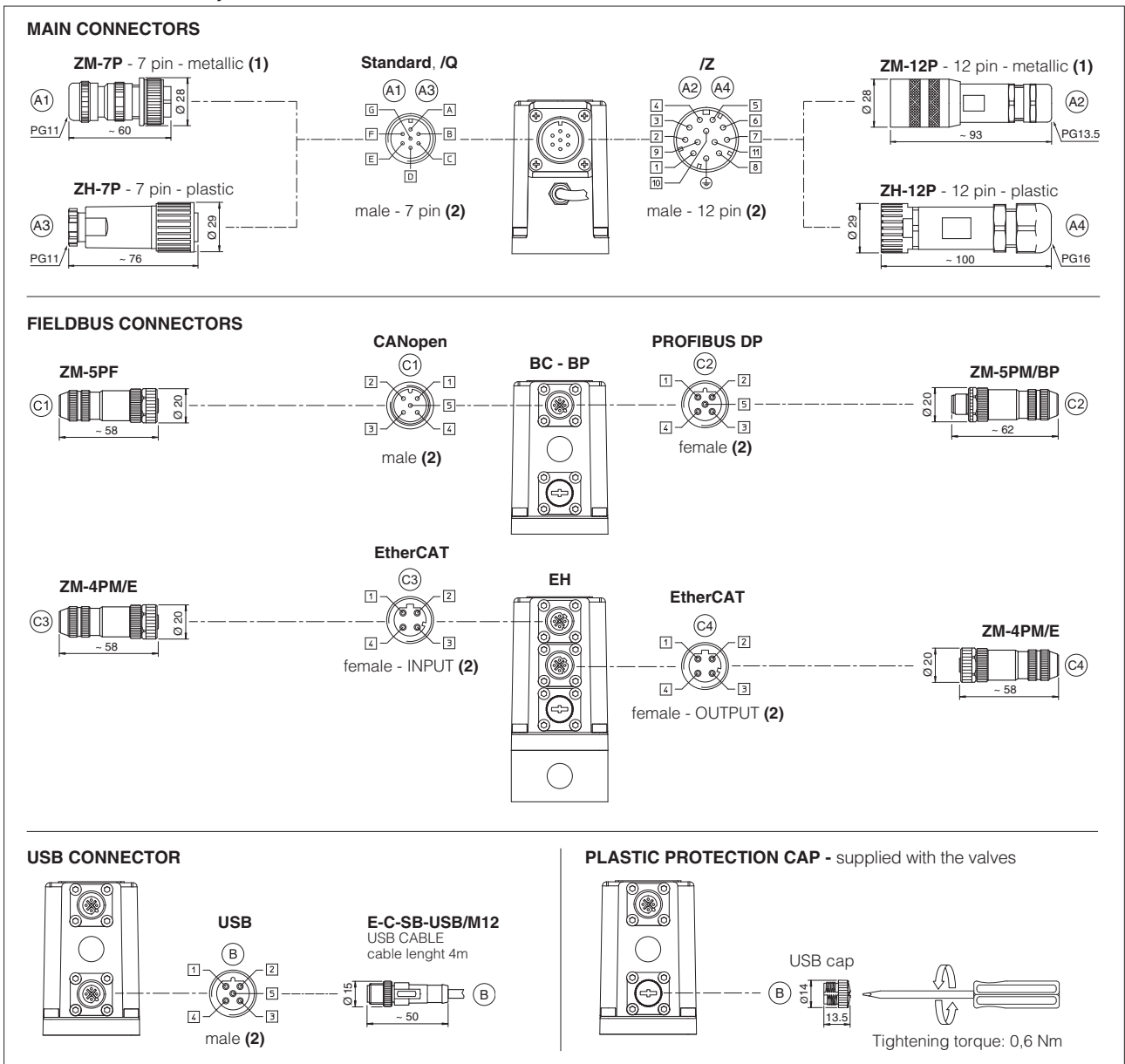
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

20.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

20.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

21.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

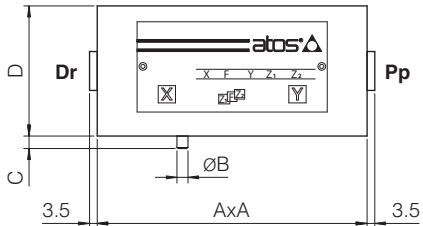
(2) Internally terminated

22 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZO LICZO LIRZO	1 = 16	4 socket head screws M8x45 class 12.9 Tightening torque = 35 Nm	2 OR 108
	2 = 25	4 socket head screws M12x45 class 12.9 Tightening torque = 125 Nm	2 OR 108
	3 = 32	4 socket head screws M16x55 class 12.9 Tightening torque = 300 Nm	2 OR 2043
	4 = 40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO LICZO	5 = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZO	6 = 63	4 socket head screws M30x90 class 12.9 Tightening torque = 2100 Nm	2 OR 3050
	8 = 80	8 socket head screws M24x90 class 12.9 Tightening torque = 1000 Nm	2 OR 4075

23 COVERS DIMENSIONS [mm]

Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	Ø250	8	6	80	G 3/8"

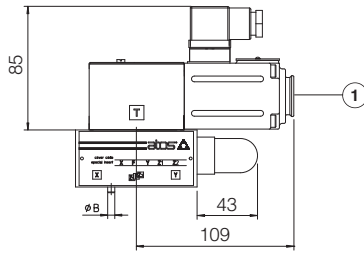


Notes:
size 1 cover is not squared but rectangular, dimensions 65x80
size 8 cover is not squared but circular, dimension Ø250

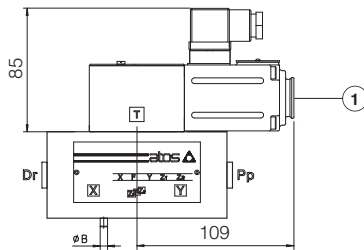
Version **A** for off-board driver

Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	3,3	-	0,2
2 = 25	4,0	-	0,5
3 = 32	5,3	-	0,9
4 = 40	10,7	11,7	1,7
5 = 50	14,2	15,2	2,9
6 = 63	23,7	24,7	6,7
8 = 80	32,3	33,3	13,1

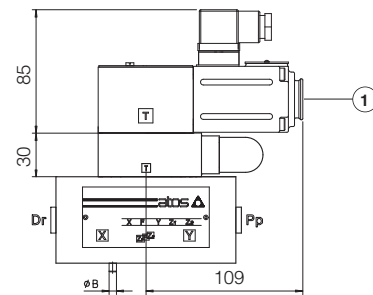
LICZO-A-1 LIMZO-A-1 LIRZO-A-1
 LICZO-A-2 LIMZO-A-2 LIRZO-A-2
 LICZO-A-3 LIMZO-A-3 LIRZO-A-3



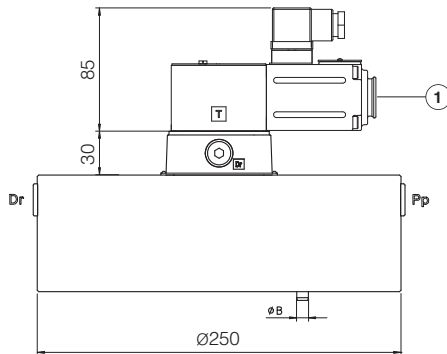
LICZO-A-4 LIMZO-A-4 LIRZO-A-4
 LICZO-A-5 LIMZO-A-5
 LIMZO-A-6



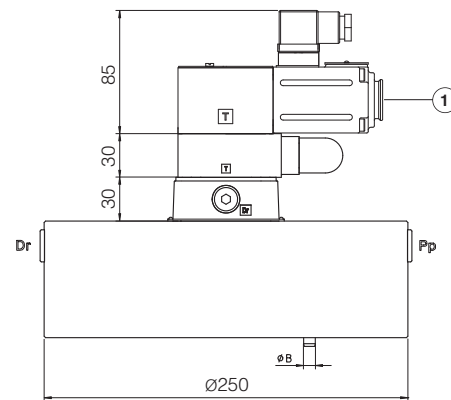
LICZO-A-4/P LIMZO-A-4/P LIRZO-A-4/P
 LICZO-A-5/P LIMZO-A-5/P
 LIMZO-A-6/P




LIMZO-A-8



LIMZO-A-8/P

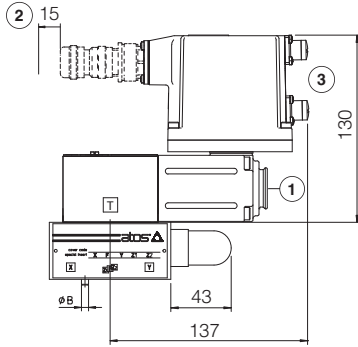


① = Air bleeding, see section 18 

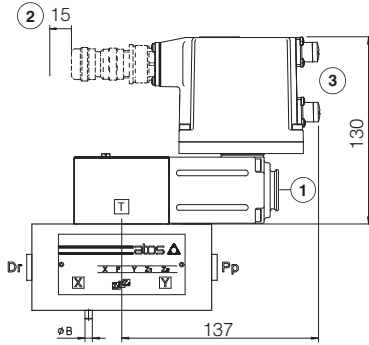
Note: for mounting surface and cavity dimensions, see tech. table P006

Versions **AEB** and **AES** for on-board driver

LICZO-AE*-1 LIMZO-AE*-1 LIRZO-AE*-1
 LICZO-AE*-2 LIMZO-AE*-2 LIRZO-AE*-2
 LICZO-AE*-3 LIMZO-AE*-3 LIRZO-AE*-3

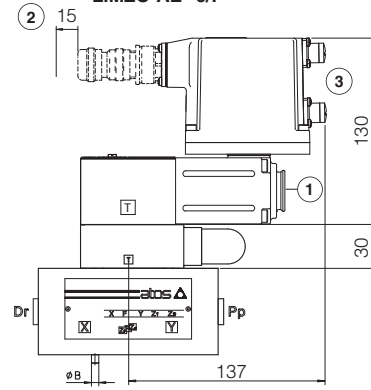


LICZO-AE*-4 LIMZO-AE*-4 LIRZO-AE*-4
 LICZO-AE*-5 LIMZO-AE*-5
 LIMZO-AE*-6

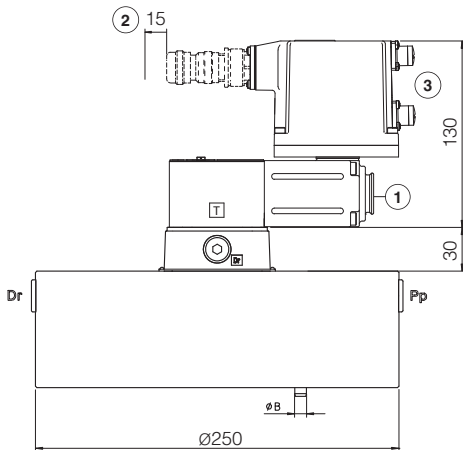


Mass [kg]			
	LICZO, LIMZO, LIRZO		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,0	-	0,2
2 = 25	4,5	-	0,5
3 = 32	5,8	-	0,9
4 = 40	11,2	12,2	1,7
5 = 50	14,7	15,7	2,9
6 = 63	24,2	25,2	6,7
8 = 80	32,8	33,8	13,1

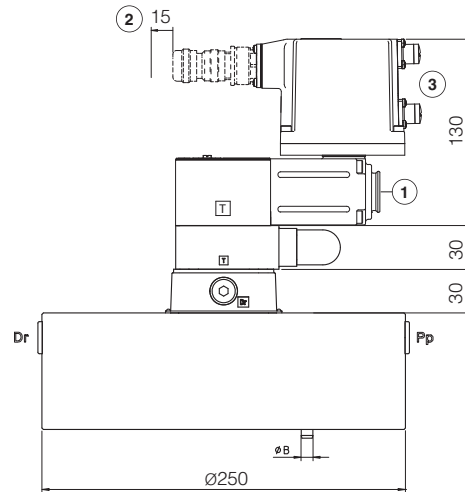
LICZO-AE*-4/P LIMZO-AE*-4/P LIRZO-AE*-4/P
 LICZO-AE*-5/P LIMZO-AE*-5/P
 LIMZO-AE*-6/P



LIMZO-AE*-8



LIMZO-AE*-8/P

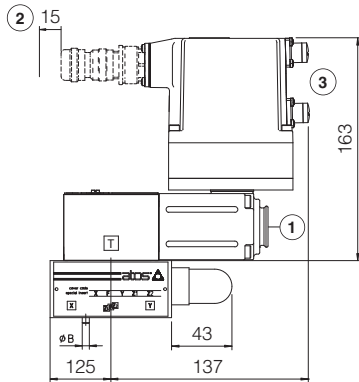


- ① = Air bleeding, see section 18
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 20.5 and 20.6

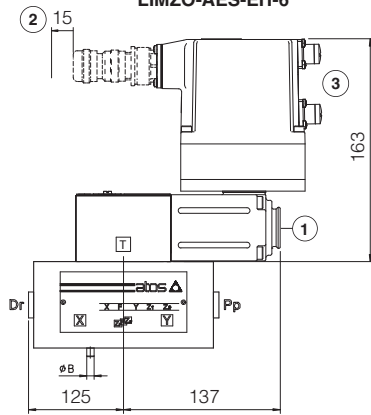
Note: for mounting surface and cavity dimensions, see tech. table P006

Version **AES-EH** for on-board driver

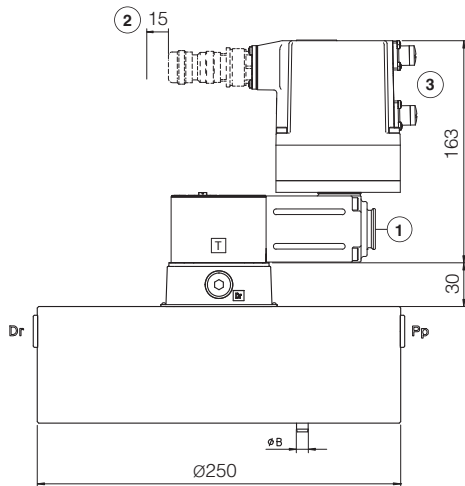
LICZO-AES-EH-1 LIMZO-AES-EH-1 LIRZO-AES-EH-1
LICZO-AES-EH-2 LIMZO-AES-EH-2 LIRZO-AES-EH-2
LICZO-AES-EH-3 LIMZO-AES-EH-3 LIRZO-AES-EH-3



LICZO-AES-EH-4 LIMZO-AES-EH-4 LIRZO-AES-EH-4
LICZO-AES-EH-5 LIMZO-AES-EH-5 LIMZO-AES-EH-6

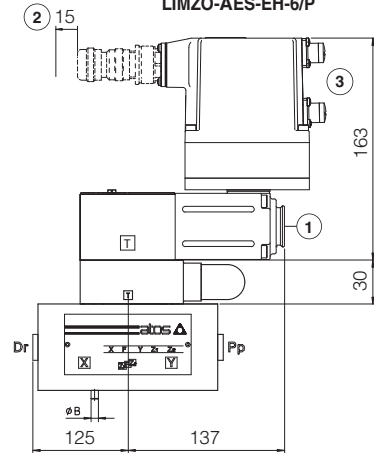


LIMZO-AES-EH-8

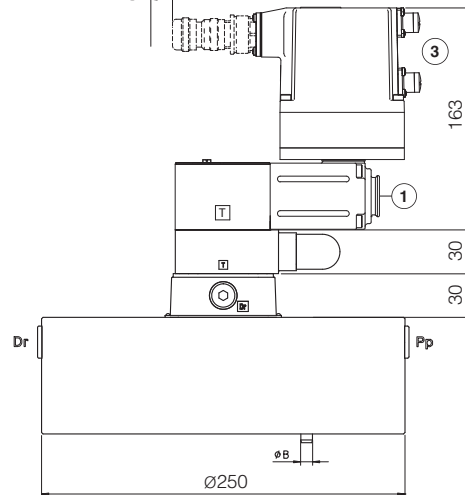



Mass [kg]			
LICZO, LIMZO, LIRZO			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	4,1	-	0,2
2 = 25	4,6	-	0,5
3 = 32	5,9	-	0,9
4 = 40	11,3	12,3	1,7
5 = 50	14,8	15,8	2,9
6 = 63	24,3	25,3	6,7
8 = 80	32,9	33,9	13,1

LICZO-AES-EH-4/P LIMZO-AES-EH-4/P LIRZO-AES-EH-4/P
LICZO-AES-EH-5/P LIMZO-AES-EH-5/P LIMZO-AES-EH-6/P



LIMZO-AES-EH-8/P



① = Air bleeding, see section 18 

③ = The dimensions of all connectors must be considered, see section 20.5 and 20.6

② = Space to remove the connectors

Note: for mounting surface and cavity dimensions, see tech. table P006

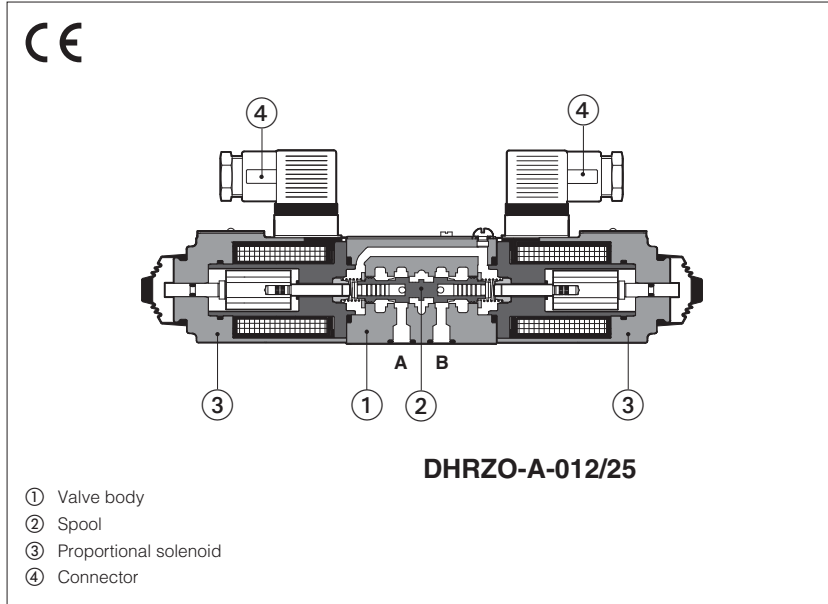
25 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
G010 E-MI-AC analog driver
G020 E-MI-AS-IR digital driver
G030 E-BM-AS digital driver
GS050 E-BM-AES digital driver

GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P006 Mounting surfaces and cavities for cartridge valves
QB200 Quickstart for AEB valves commissioning
QF200 Quickstart for AES valves commissioning

Digital proportional reducing valves

3-way, direct, without transducer



DHRZO-A, DHRZO-AEB, DHRZO-AES

3 way, direct, digital proportional reducing valves for pressure open loop controls.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

They provide the pressure reduction on ports A, or B, or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis.

Size: **06** - ISO 4401

Max flow: **24 l/min**

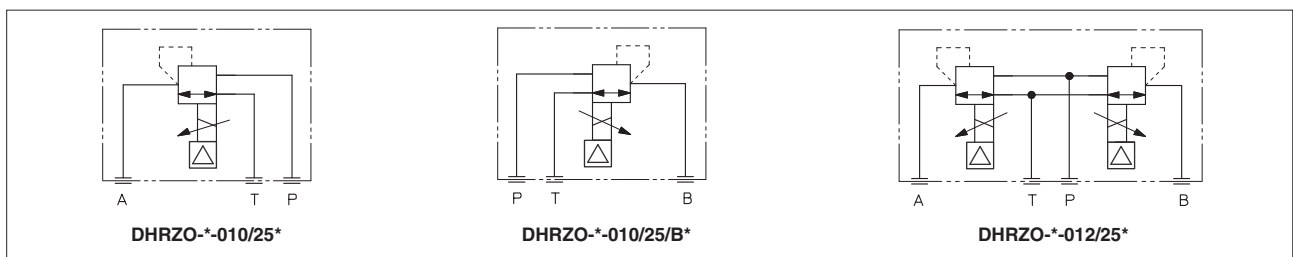
Max pressure: **25 bar**

1 MODEL CODE

DHRZO	-	A	-	*	-	010	/	25	/	*	/	*	/	*	/	*
<p>Proportional pressure reducing valve, direct</p> <p>A = off-board driver, see section 3 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)</p> <p>Fieldbus interfaces, USB port always present (3): NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT</p> <p>Configuration: 010 = reduced pressure on port A 012 = reduced pressure on port A and B</p> <p>Max regulated pressure: 25 = 25 bar</p>																
<p>Seals material, see section 10: - = NBR PE = FKM BT = HNBR</p> <p>Coil voltage, only for A - see section 15: - = standard coil for 24VDC Atos drivers 6 = optional coil for 12VDC Atos drivers 18 = optional coil for low current drivers</p> <p>Hydraulic options: For configuration 010: B = reduced pressure on port B, solenoid at side of port A For configuration 012: B = solenoid with on-board digital driver at side of port A</p> <p>Electronic options, only for AEB and AES (4): I = current reference input 4÷20 mA (omit for std voltage 0÷10 Vdc) Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector</p>																

(1) Only for NP (2) Only for BC, BP, EH (3) Omit for A execution (4) Possible combined options: see section 14

2 HYDRAULIC SYMBOLS (representation according to ISO 1219-1)



Hydraulic symbols are represented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

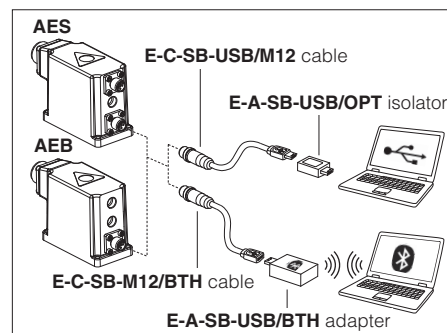
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHRZO
Max regulated pressure [bar]	25
Max pressure at port P [bar]	350
Max pressure at port T [bar]	210
Min regulated pressure (1) [bar]	3
Max flow [l/min]	24
Response time 0-100% step signal (depending on installation) (2) [ms]	≤ 45
Hysteresis	≤ 1,5 [% of max pressure]
Linearity	≤ 3,0 [% of max pressure]
Repeatability	≤ 2,0 [% of max pressure]

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	A = 30 W AEB, AES = 50 W			
Coil voltage code	standard	option /6	option /18	
Max. solenoid current	2,4 A 1,8 A for /32 - max pressure 32 bar	3 A 2,25 A for /32 - max pressure 32 bar	1 A 0,8 A for /32 - max pressure 32 bar	
Coil resistance R at 20°C	3 \div 3,3 Ω	2 \div 2,2 Ω	13 \div 13,4 Ω	
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor output	Output range: voltage ± 5 VDC @ max 5 mA			
Enable input	Range: 0 \div 9 VDC (OFF state), 15 \div 24 VDC (ON state), 9 \div 15 VDC (not accepted); Input impedance: $R_i > 87$ k Ω			
Fault output	Output range : 0 \div 24 VDC (ON state \equiv VL+ [logic power supply] ; OFF state \equiv 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 18			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

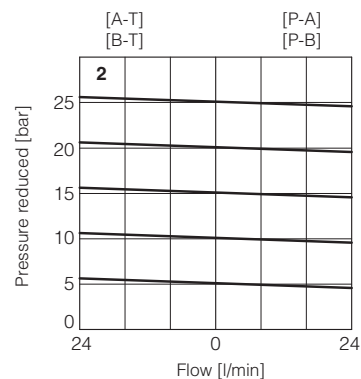
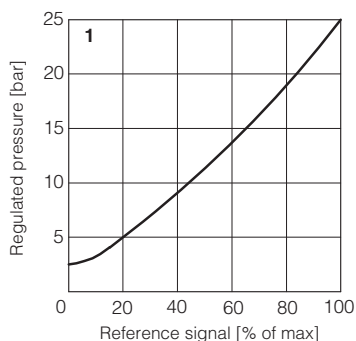
Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C (+80°C for A), with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = Pressure/flow diagrams
reference signal set at Q = 1 l/min



12 HYDRAULIC OPTIONS

For configuration **010**:

B = reduced pressure on port B, solenoid at side of port A

For configuration **012**:

B = solenoid with on-board digital driver at side of port A (only for AEB and AES version)

13 ELECTRONIC OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.

The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 16.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see 16.6

Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 16.2

14 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ

15 COIL VOLTAGE OPTIONS - only for **A**

6 = Optional coil to be used with Atos drivers with power supply 12 VDC.


18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z option

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

16.4 Monitor output signal (MONITOR)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ±5 V_{DC} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of 0 ÷ 5 V_{DC}.

16.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{DC} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

16.6 Fault output signal (FAULT) - only for /Z option

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).

Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.

Fault status is not affected by the Enable input signal.

17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND V0		Monitor output signal: ± 5 Vdc maximum range Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

17.2 Main connector signals - 12 pin (A2) /Z option - for AEB and AES

PIN	/Z	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VL0	Input - on/off signal
4	INPUT+	Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR	Monitor output signal: ± 5 Vdc maximum range, referred to VL0 Default is 0 ÷ 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC	Do not connect	
8	NC	Do not connect	
9	VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

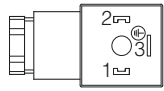
(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

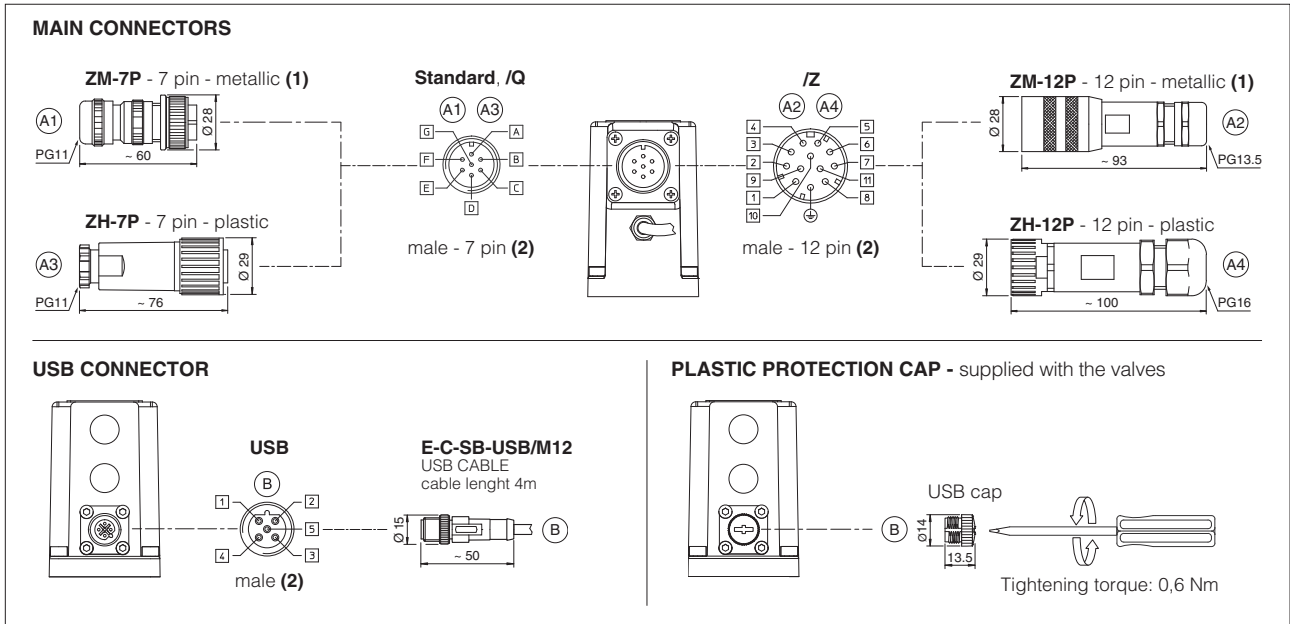
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

17.4 Solenoid connection - only for A

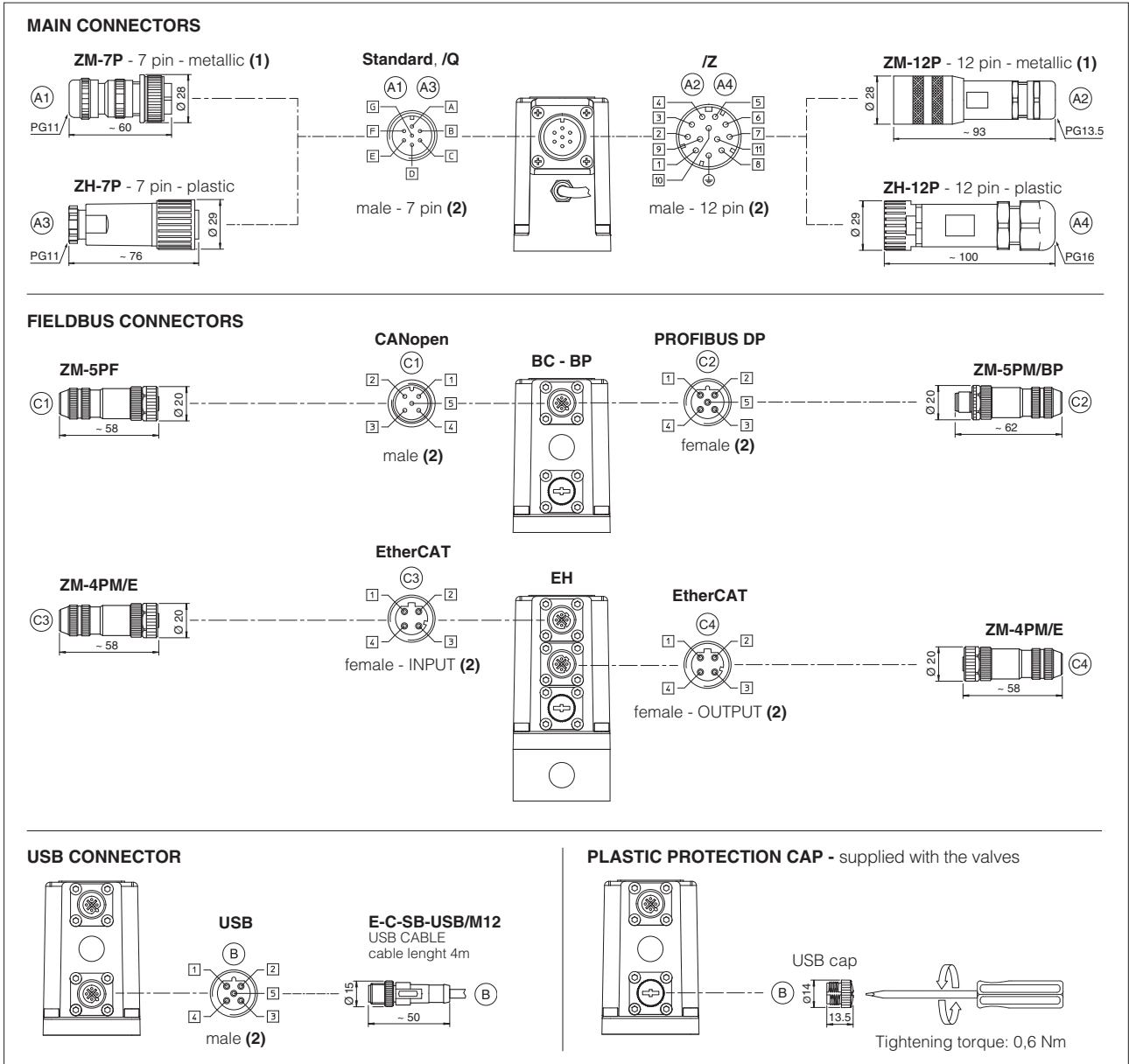
PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.5 AEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.6 AES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

18.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

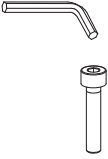

18.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19 FASTENING BOLTS AND SEALS

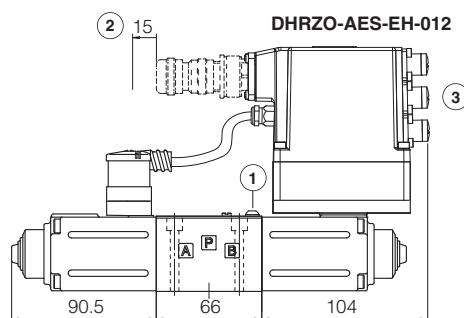
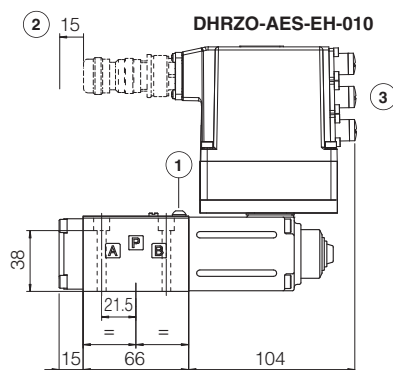
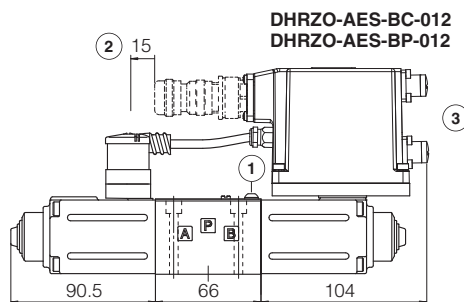
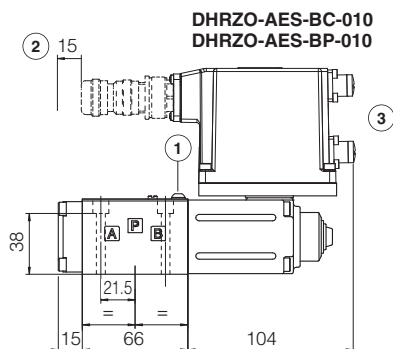
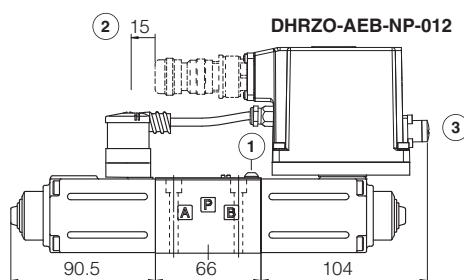
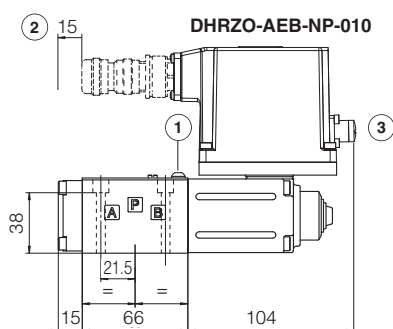
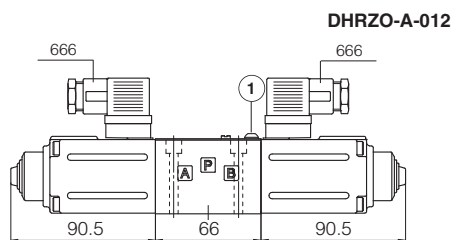
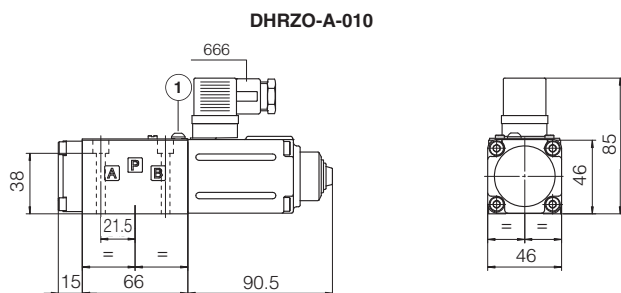
	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals: 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm</p>

20 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]		
A	AEB, AES	AES-EH
1,8	2,3	2,4



① = Air bleeding 

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 17.5 and 17.6

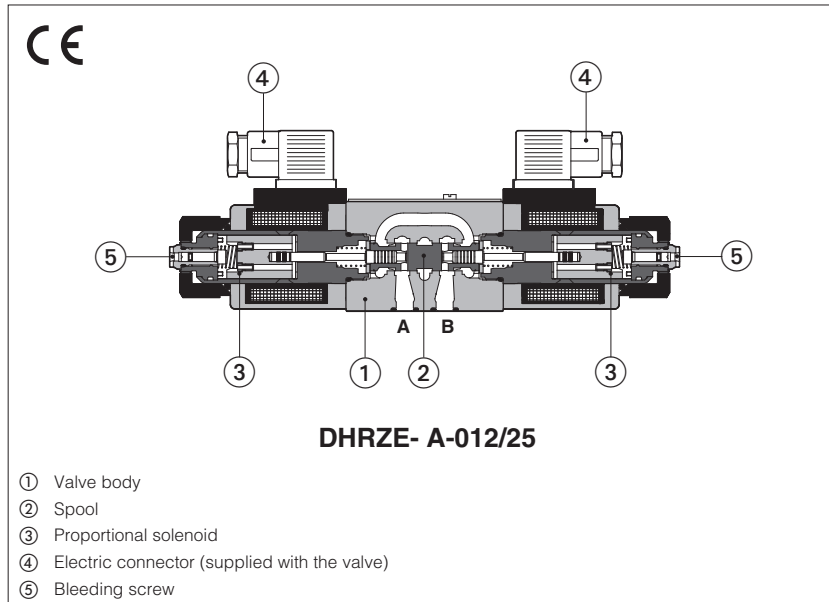
21 RELATED DOCUMENTATION

- FS001** Basics for digital electrohydraulics
- FS900** Operating and maintenance information for proportional valves
- G010** E-MI-AC analog driver
- G020** E-MI-AS-IR digital driver
- G030** E-BM-AS digital driver
- GS050** E-BM-AES digital driver
- GS500** Programming tools

- GS510** Fieldbus
- K800** Electric and electronic connectors
- P005** Mounting surfaces for electrohydraulic valves
- QB200** Quickstart for AEB valves commissioning
- QF200** Quickstart for AES valves commissioning

Proportional reducing valves

3-way, direct, without transducer



DHRZE-A

3 way, direct, pressure reducing valves for open loop pressure controls.

They operate in association with off-board driver, which supply the proportional valves with proper current to align the valve regulation to the reference signal supplied to the driver.

They provide the pressure reduction on ports A, or B or A and B, depending on the valve model.

The direct execution performs low internal leakages, fast response and low hysteresis. The solenoids are certified according to North American standard **cURus**.

Typical applications:

- Pressure reduction in low flow systems
- Pilot stage of pilot operated valves

Size: **06** - ISO 4401

Max flow: **24 l/min**

Max pressure: **315 bar**

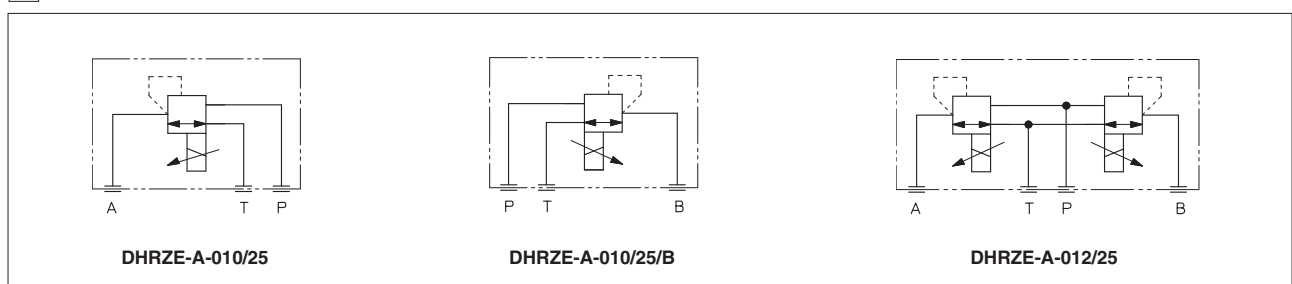
Max regulated pressure: **25 bar**

1 MODEL CODE

DHRZE	-	A	-	010	/	25	/	*	-	*	/	*	/	*	
Proportional pressure reducing valve, direct		A = off-board driver, see section 3		Configuration: 010 = reduced pressure on port A (port B for option /B) 012 = reduced pressure on port A and B		Regulated pressure: 25 = reduced pressure range 3÷25 bar		Hydraulic option: B = reduced pressure on port B, solenoid side of port A (only for valve configuration 010)		Seals material, see section 8: - = NBR PE = FKM BT = HNBR		Series number		Coil voltage, see section 10: - = standard coil for 24Vdc Atos drivers 6 = optional coil for 12Vdc Atos drivers 18 = optional coil for 24Vdc low current drivers (1)	
Coil with special connectors, see section 12:										- = omit for standard DIN connector J = AMP Junior Timer connector K = Deutsch connector S = Lead Wire connection					

(1) Select valve's coil voltage /18 in case of electronic drivers not supplied by Atos, with power supply 24 Vdc and with max current limited to 1A

2 HYDRAULIC SYMBOL (representation according to ISO 1219-1)



3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the installation notes supply with relevant components.

5 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Conformity	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Valve model	DHRZE
Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) (1) [bar]	3
Max. pressure at port P [bar]	315
Max. pressure at port T [bar]	210
Max. flow [l/min]	24
Response time 0-100% step signal (2) (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3,0
Repeatability [% of the max pressure]	≤ 2,0

Notes: above performance data refer to valves coupled with Atos electronic drivers, see section **3**

(1) Min pressure value to be increased of T line pressure

(2) Average response time value; the pressure variation in consequence of a modification of the reference input signal to the valve is affected by the stiffness of the hydraulic circuit: greater is the stiffness of the circuit, faster is the dynamic response

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)		
Max power consumption	30 W		
Coil voltage code	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account		
Protection degree to DIN EN60529	IP65 with mating connectors		
Duty factor	Continuous rating (ED=100%)		
Certification	cURus North American Standard		

8 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

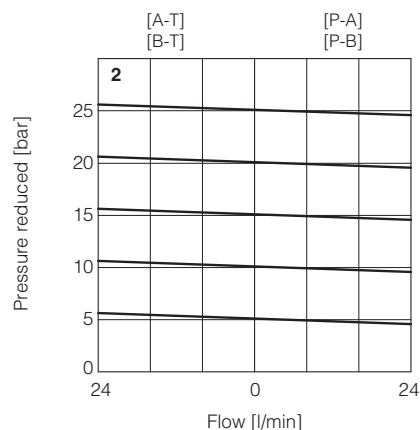
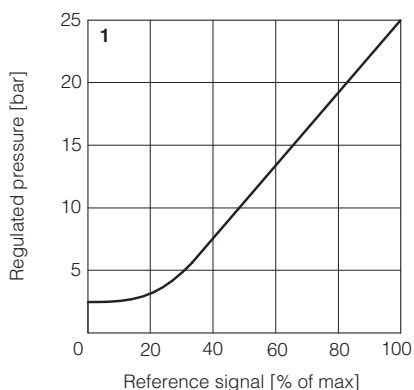
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 µm (β10 ≥ 75 recommended)		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

1 = Regulation diagrams
with flow rate Q = 1 l/min

Note: the presence of counter pressure at port T can affect the effective pressure regulation

2 = Pressure/flow diagrams
reference signal set at Q = 1 l/min



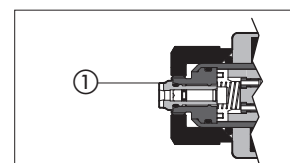
10 COIL VOLTAGE OPTIONS

6 = Optional coil to be used with Atos drivers with power supply 12 Vdc.

18 = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

11 AIR BLEEDING

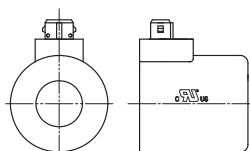
At the first valve commissioning the air eventually trapped inside the solenoid must be bled-off through the screw ① located at the rear side of the solenoid housing.
The presence of air may cause pressure instability and vibrations.



12 COILS WITH SPECIAL CONNECTORS

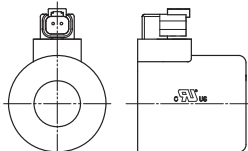
J option

Coil type COZEJ
AMP Junior Timer connector
Protection degree IP67



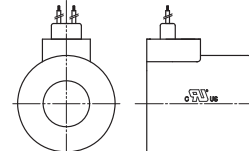
K option

Coil type COZEK
Deutsch connector, DT-04-2P male
Protection degree IP67

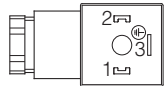


S option

Coil type COZES
Lead Wire connection
Cable length = 180 mm



13 SOLENOID CONNECTION

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666 
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

14 FASTENING BOLTS AND SEALS FOR DHRZE

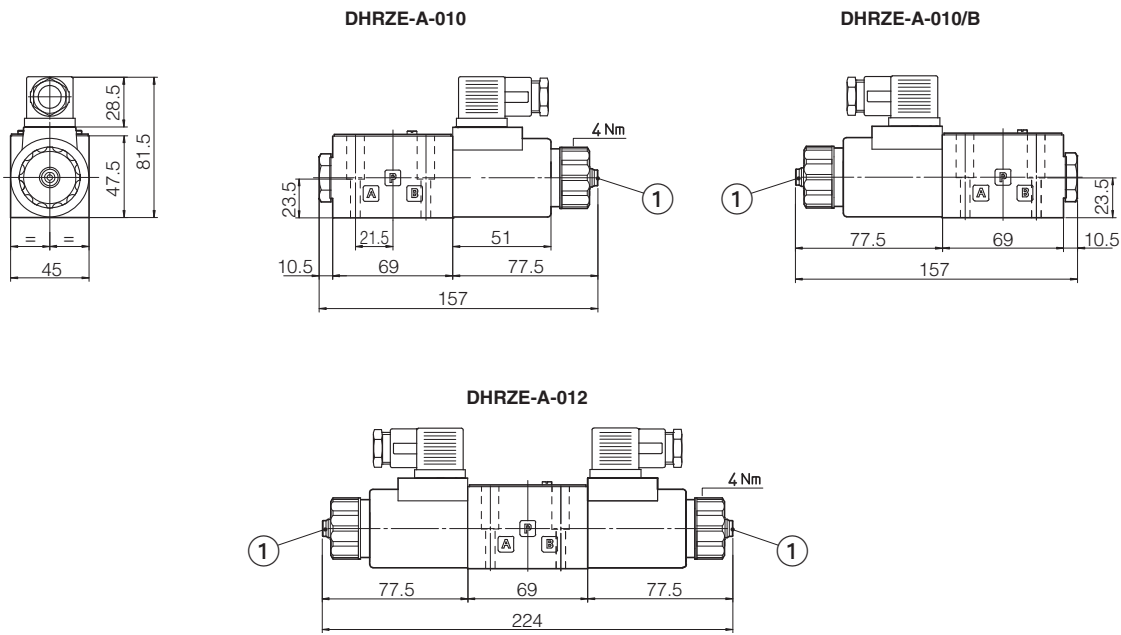
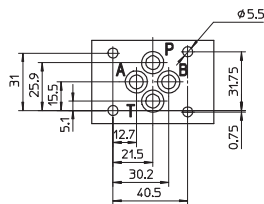
	<p>Fastening bolts: 4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm</p>
	<p>Seals: 4 OR 108 Diameter of ports P, T, A: \varnothing 7,5 mm</p>


15 INSTALLATION DIMENSIONS FOR DHRZE [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)

Mass [kg]	
DHRZE-A-010	1,9
DHRZE-A-012	2,6



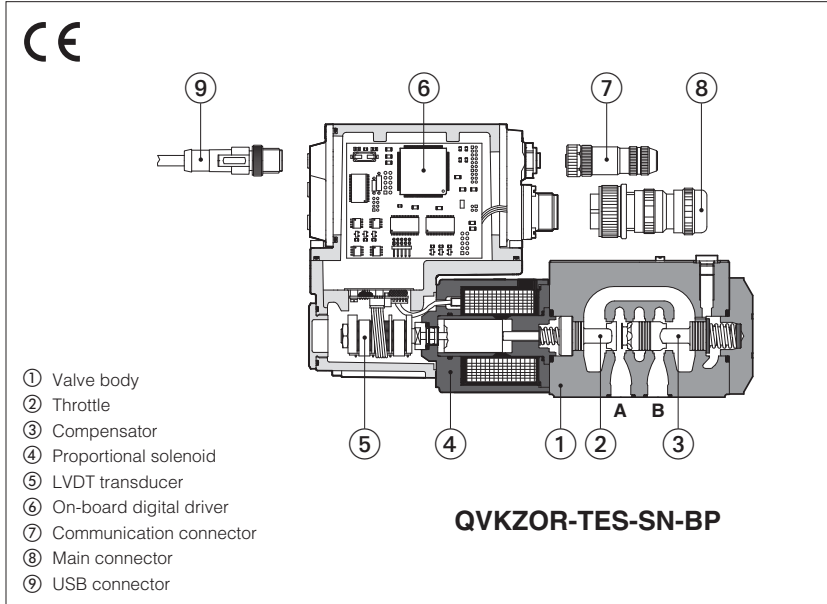
① = Air bleeding, see section 11 

16 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS900	Operating and maintenance information for proportional valves	GS500	Programming tools
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves
G030	E-BM-AS digital driver		

Digital proportional flow valves

direct, pressure compensated, with on-board driver and LVDT transducer



QVHZO-TEB, QVHZO-TEB QVKZOR-TEB, QVKZOR-TEB

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

TEB basic execution with analog reference signal and USB port for software functional parameters setting.

TES full execution which includes also optional fieldbus interfaces for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:	QVKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 45 l/min	Max flow: 90 l/min
Max pressure: 210 bar	Max pressure: 210 bar

1 MODEL CODE

QVKZOR	-	TES	-	SN	-	NP	-	10	/	65	/	*	/	*												
<p>Proportional flow control valves, direct, pressure compensated</p> <p>QVHZO = size 06 QVKZOR = size 10</p> <p>TEB = basic on-board digital driver (1) TES = full on-board digital driver</p> <p>Alternated P/Q controls: SN = none</p> <p>Fieldbus interfaces, USB port always present: NP = Not present BC = CANopen EW = POWERLINK BP = PROFIBUS DP EI = EtherNet/IP EH = EtherCAT EP = PROFINET RT/IRT</p> <p>Valve size ISO 4401: 06 = size 06 10 = size 06</p>																										
<p>Seals material, see section 9:</p> <p>- = NBR PE = FKM BT = HNBR</p> <p>Series number</p>																										
<p>Electronic options (2): I = current reference input and monitor 4±20 mA (omit for std voltage and monitor 0÷10 VDC) F = fault signal Q = enable signal Z = double power supply, enable, fault and monitor signals -12 pin connector (3)</p>																										
<p>Max regulated flow:</p> <table border="0"> <tr> <td>QVHZO:</td> <td>3 = 3,5 l/min</td> <td>36 = 35 l/min</td> <td>65 = 65 l/min</td> </tr> <tr> <td></td> <td>12 = 12 l/min</td> <td>45 = 45 l/min</td> <td>90 = 90 l/min</td> </tr> <tr> <td></td> <td>18 = 18 l/min</td> <td></td> <td></td> </tr> </table>															QVHZO:	3 = 3,5 l/min	36 = 35 l/min	65 = 65 l/min		12 = 12 l/min	45 = 45 l/min	90 = 90 l/min		18 = 18 l/min		
QVHZO:	3 = 3,5 l/min	36 = 35 l/min	65 = 65 l/min																							
	12 = 12 l/min	45 = 45 l/min	90 = 90 l/min																							
	18 = 18 l/min																									

(1) Only in version SN-NP

(2) Possible combined options: /FI, /IQ, /IZ

(3) Double power supply only for TES

2 HYDRAULIC SYMBOLS

<p>2 way connection</p>	<p>3 way connection</p>
<p>The valves can be used in 2 or 3 way connection, depending to the application requirements.</p> <p>In 2 way the P port must not be connected (blocked) In 3 way the P port has to be connected to tank or to other user lines The port T must be always not connected (blocked)</p> <p>For application examples of 2 and 3 way connections, see section 11</p>	

3 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

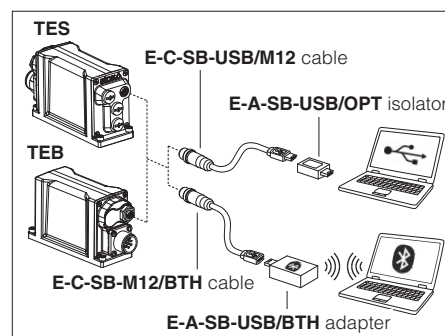
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

USB or Bluetooth connection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

5 FIELDBUS - only for TES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	QVHZO						QVKZOR	
	3,5	12	18	35	45	65	90	
Max regulated flow [l/min]	3,5	12	18	35	45	65	90	
Min regulated flow [cm³/min]	15	20	30	50	60	85	100	
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12	
Max flow on port A [l/min]	50				60	70	100	
Max pressure [bar]	210						210	
Response time 0÷100% step signal [ms]	25						35	
Hysteresis [% of the regulated max flow]	0,5						0,5	
Linearity [% of the regulated max flow]	0,5						0,5	
Repeatability [% of the regulated max flow]	0,1						0,1	
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	QVHZO = 2,6 A		QVKZOR = 3 A	
Coil resistance R at 20°C	QVHZO = 3 \div 3,3 Ω		QVKZOR = 3,8 \div 4,1 Ω	
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ± 10 VDC @ max 5 mA current ± 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 5 VDC (OFF state), 9 \div 24 VDC (ON state), 5 \div 9 VDC (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 17			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

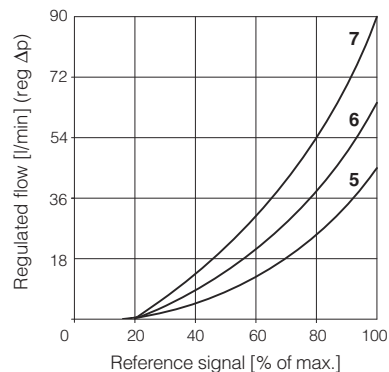
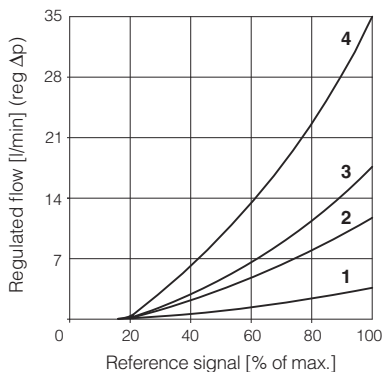
9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

10 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

10.1 Regulation diagrams

- 1 = QVHZO-*-06/3
- 2 = QVHZO-*-06/12
- 3 = QVHZO-*-06/18
- 4 = QVHZO-*-06/36
- 5 = QVHZO-*-06/45
- 6 = QVKZOR-*-10/65
- 7 = QVKZOR-*-10/90

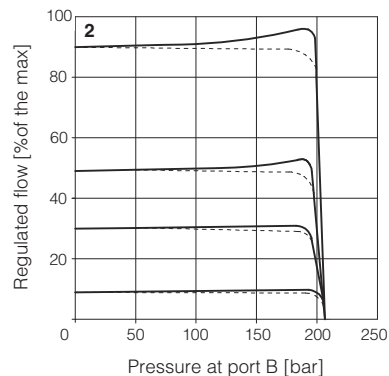
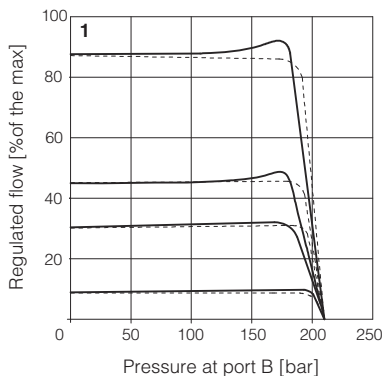


10.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

- 1 = QVHZO
- 2 = QVKZOR

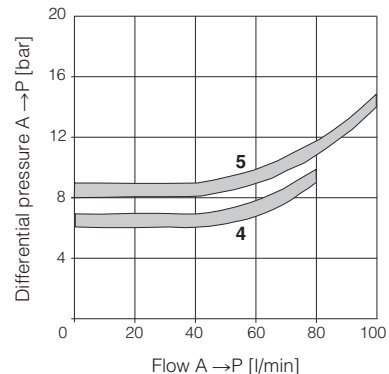
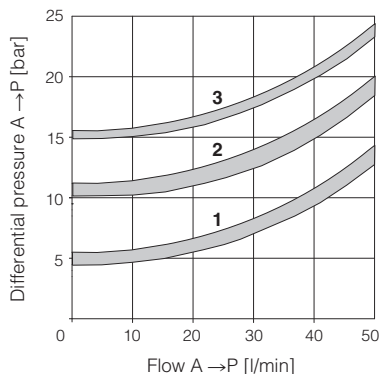
Dotted line for 3-way versions



10.3 Flow A → P/Δp diagrams

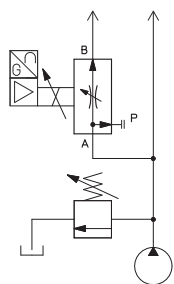
3-way configuration

- 1 = QVHZO-*-06/3
- 2 = QVHZO-*-06/12
- 3 = QVHZO-*-06/18
- 4 = QVKZOR-*-10/65
- 5 = QVKZOR-*-10/90



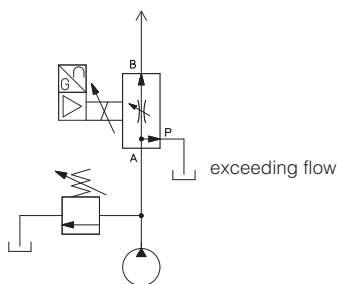
11 APPLICATIONS AND CONNECTIONS

compensated flow



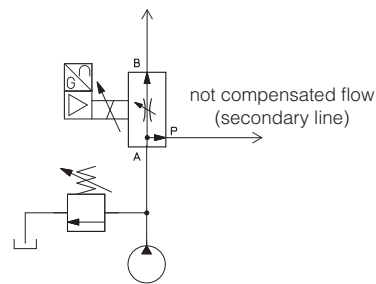
2 way connection

compensated flow



3 way connection

compensated flow
primary circuit (priority)



priority connection

2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations. If the valve is directly installed on the pump main line, the exceeding flow is returned to tank through the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line). The metered flow in the controlled line is kept constant, independently to the load variations. The exceeding flow (not metered by the valve) it is returned to tank through the valve P port = T line (3rd way).

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit. The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

12 ELECTRONICS OPTIONS

- F** = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 14.7 for signal specifications.
- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 14.5 for signal specifications.
- Z** = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option /F
Enable input signal - see above option /Q
Repeat enable output signal - only for **TEB** (see 14.6)
Power supply for driver's logics and communication - only for **TES** (see 14.2)

13 POSSIBLE COMBINED OPTIONS

/FI, /IQ, /IZ

14 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

14.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 14.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

14.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

14.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

14.4 Flow monitor output signal (Q_MONITOR) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

14.5 Enable input signal (ENABLE) - not for standard and /F

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

14.6 Repeat enable output signal (R_ENABLE) - only for TEB with /Z option

Repeat enable is used as output repeater signal of enable input signal (see 14.5).

14.7 Fault output signal (FAULT) - not for standard and /Q

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

15 ELECTRONIC CONNECTIONS AND LEDS

15.1 Main connector signals - 7 pin - standard, /F and /Q options (A1)

PIN	Standard	/Q	/F	TECHNICAL SPECIFICATIONS	NOTES
A	V+			Power supply 24 Vdc	Input - power supply
B	V0			Power supply 0 Vdc	Gnd - power supply
C	AGND		AGND	Analog ground	Gnd - analog signal
		ENABLE		Enable (24 Vdc) or disable (0 Vdc) the valve, referred to V0	Input - on/off signal
D	Q_INPUT+			Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-			Negative reference input signal for Q_INPUT+	Input - analog signal
F	Q_MONITOR referred to: AGND	V0		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
			FAULT	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
G	EARTH			Internally connected to the driver housing	

15.2 Main connector signal - 12 pin - /Z option (A2)

PIN	TEB-SN /Z	TES-SN /Z	TECHNICAL SPECIFICATIONS	NOTES
	V+		Power supply 24 Vdc	Input - power supply
1	V0		Power supply 0 Vdc	Gnd - power supply
2	ENABLE referred to: V0	VL0	Enable (24 Vdc) or disable (0 Vdc) the valve	Input - on/off signal
3				
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+	Input - analog signal
6	Q_MONITOR referred to: AGND	VL0	Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 ÷ 10 Vdc for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
7	AGND		Analog ground	Output - analog signal
8		NC	Do not connect	Gnd - analog signal
	R_ENABLE		Repeat enable, output repeter signal of enable input, referred to V0	Output - on/off signal
9		NC	Do not connect	
		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10		NC	Do not connect	
		VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0	VL0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE				
	EARTH		Internally connected to the driver housing	

Note: do not disconnect VL0 before VL+ when the driver is connected to PC USB port

15.3 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

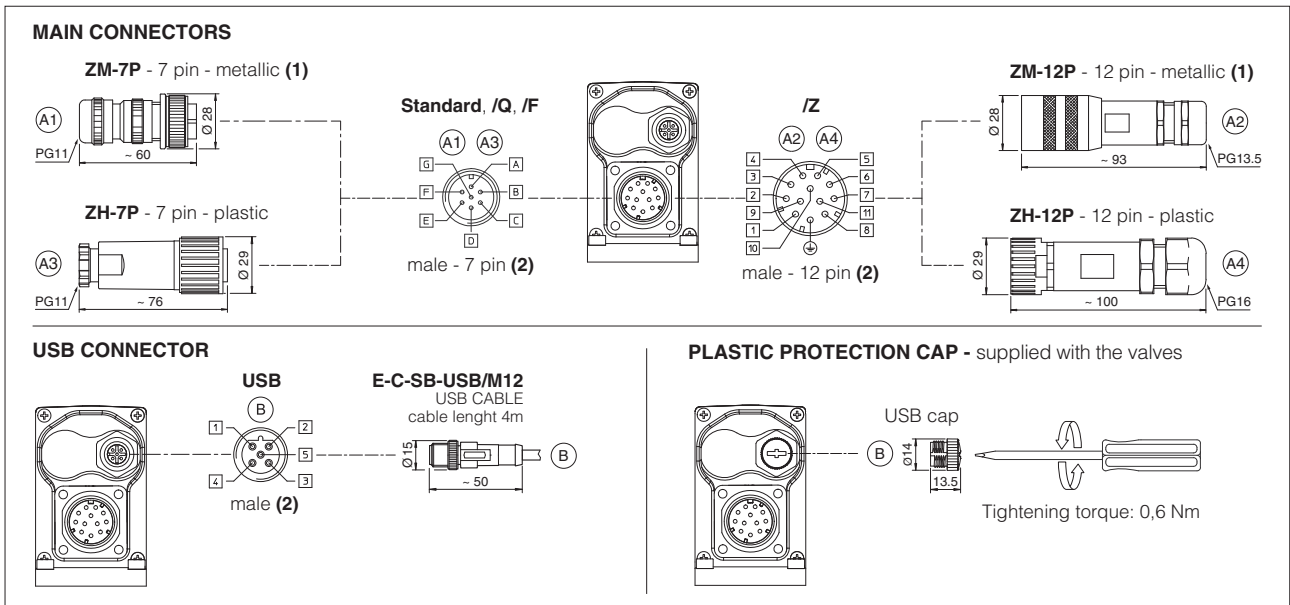
(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
	SHIELD	

(1) shield connection on connector's housing is recommended

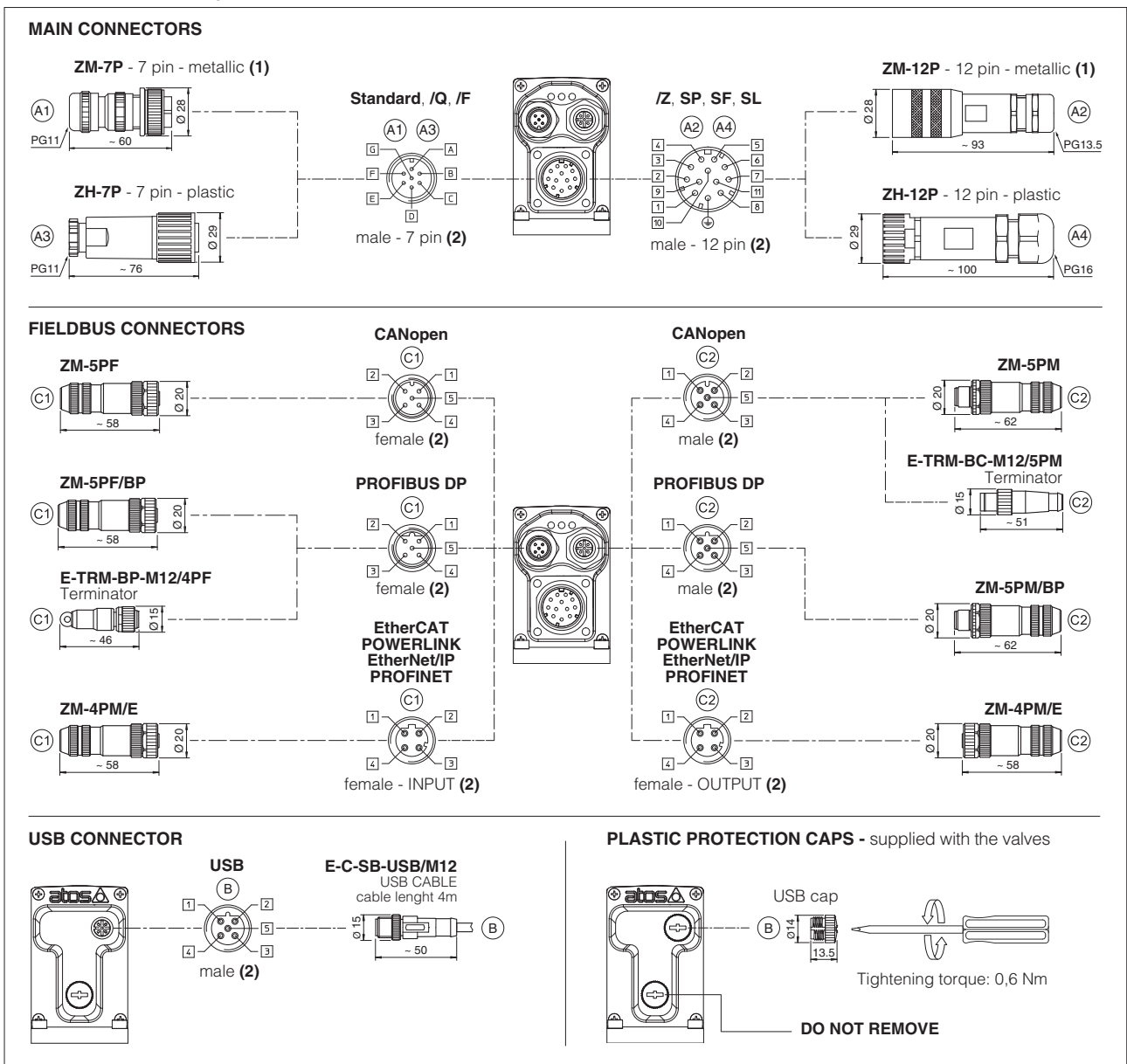
(2) Pin 2 can be fed with external +5V supply of CAN interface

15.4 TEB connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

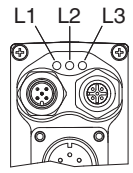
15.5 TES connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

15.6 Diagnostic LEDs - only for TES

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	
L1		VALVE STATUS		LINK/ACT				
L2		NETWORK STATUS		NETWORK STATUS				
L3		SOLENOID STATUS		LINK/ACT				

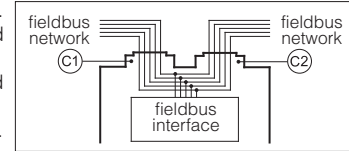
16 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital drivers executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP executions the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



17 CONNECTORS CHARACTERISTICS - to be ordered separately

17.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

17.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

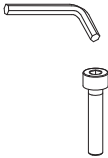

17.3 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

18 FASTENING BOLTS AND SEALS

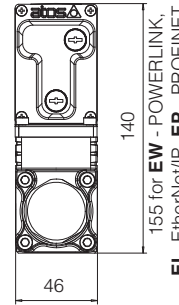
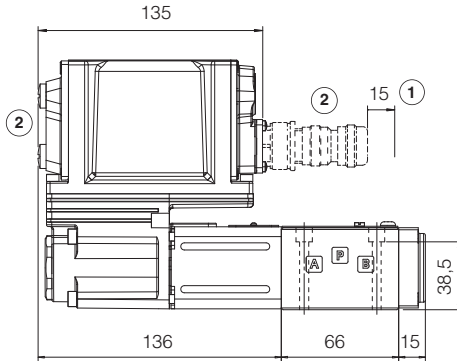
	QVHZO Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	QVKZOR Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

QVHZO-TEB, QVHZO-TES

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-*	2,3

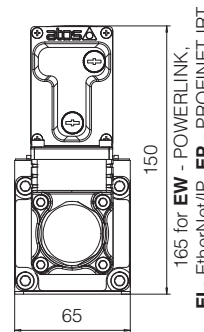
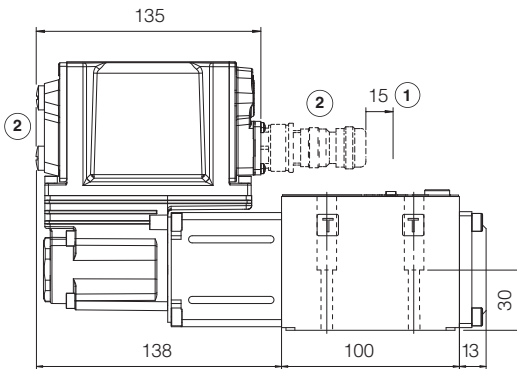


QVKZOR-TEB, QVKZOR-TES

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-*	4,3



Mass: 4,3 kg

① = Space to remove the connectors

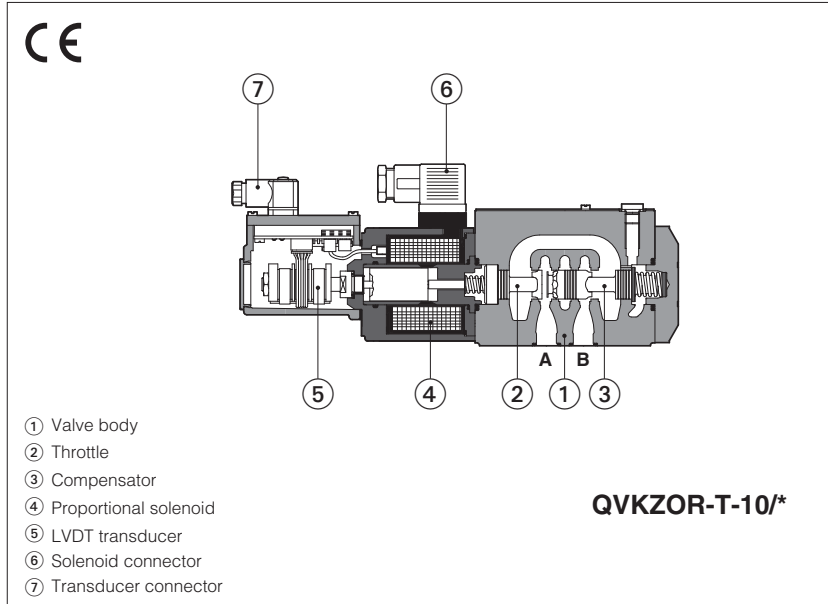
② = The dimensions of all connectors must be considered, see section 15.4 and 15.5

20 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	K800	Electric and electronic connectors
FS900	Operating and maintenance information for proportional valves	P005	Mounting surfaces for electrohydraulic valves
GS500	Programming tools	QB300	Quickstart for TEB valves commissioning
GS510	Fieldbus	QF300	Quickstart for TES valves commissioning

Proportional flow valves

direct, pressure compensated, with LVDT transducer



QVHZO-T, QVKZOR-T

Proportional flow control valves, direct, pressure compensated, equipped with LVDT position transducer for best accuracy in flow regulations.

The valves operate in association with digital off-board divers, see section 2.

The mechanical pressure compensator keeps a constant Δp across the proportional throttle, thus the regulated flow is independent to the load conditions.

The valves can be connected in 2-way or in 3-way, in this last the exceeding flow, not regulated from A to B ports, returns to tank through the P port (3rd way).

QVHZO:	QVKZOR:
Size: 06 - ISO 4401	Size: 10 - ISO 4401
Max flow: 45 l/min	Max flow: 90 l/min
Max pressure: 210 bar	Max pressure: 210 bar

1 MODEL CODE

QVKZOR	-	T	-	10	/	65	/	*	/	*
Proportional flow control valves, direct, pressure compensated QVHZO = size 06 QVKZOR = size 10										
T = with LVDT transducer										
Valve size ISO 4401: 06 = size 06 10 = size 10										
Seals material, see section 7: - = NBR PE = FKM BT = HNBR										
Series number										
Max regulated flow: QVHZO: 3 = 3,5 l/min 36 = 35 l/min 12 = 12 l/min 45 = 45 l/min 18 = 18 l/min										
QVKZOR: 65 = 65 l/min 90 = 90 l/min										

2 HYDRAULIC SYMBOLS

2 way connection

3 way connection

The valves can be used in 2 or 3 way connection, depending to the application requirements.

In **2 way** the P port must not be connected (blocked)
 In **3 way** the P port has to be connected to tank or to other user lines
 The port T must be always not connected (blocked)

For application examples of 2 and 3 way connections, see section 9

3 OFF-BOARD ELECTRONIC DRIVERS

Please include in the driver order also the complete code of the connected proportional valve.

Drivers model	E-BM-TID	E-BM-TEB	E-BM-TES
Type	digital	digital	digital
Format	DIN-rail panel	DIN-rail panel	DIN-rail panel
Tech table	GS235	GS230	GS240

4 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	QVHZO					QVKZOR		
	Max regulated flow [l/min]	3,5	12	18	35	45	65	90
Min regulated flow [cm³/min]	15	20	30	50	60	85	100	
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12	
Max flow on port A [l/min]	50				60	70	100	
Max pressure [bar]	210					210		
Response time 0÷100% step signal [ms]	25					35		
Hysteresis [% of the regulated max flow]	0,5					0,5		
Linearity [% of the regulated max flow]	0,5					0,5		
Repeatability [% of the regulated max flow]	0,1					0,1		
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

6 ELECTRICAL CHARACTERISTICS

Max power consumption	30 W
Max. solenoid current	QVHZO = 2,6 A QVKZOR = 3 A
Coil resistance R at 20°C	QVHZO = 3 ÷ 3,3 Ω QVKZOR = 3,8 ÷ 4,1 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP65 with mating connectors
Duty factor	Continuous rating (ED=100%)

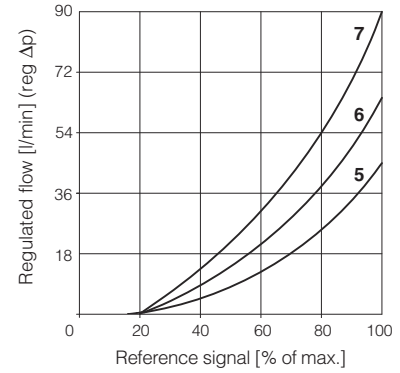
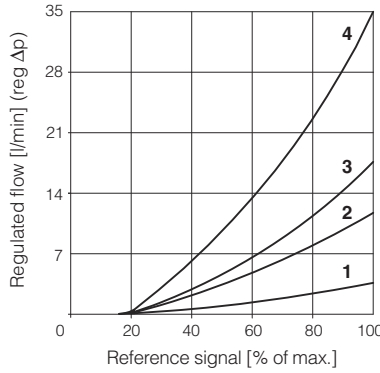
7 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

8 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

8.1 Regulation diagrams

- 1 = QVHZO-T-06/3
- 2 = QVHZO-T-06/12
- 3 = QVHZO-T-06/18
- 4 = QVHZO-T-06/36
- 5 = QVHZO-T-06/45
- 6 = QVKZOR-T-10/65
- 7 = QVKZOR-T-10/90

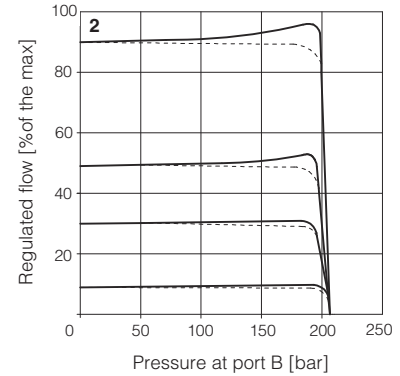
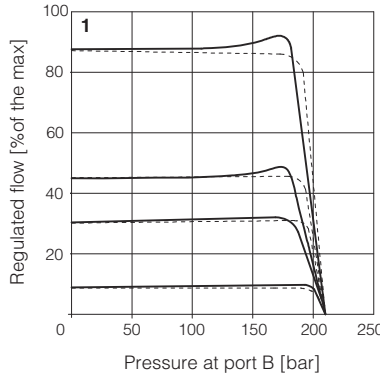


8.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

- 1 = QVHZO
- 2 = QVKZOR

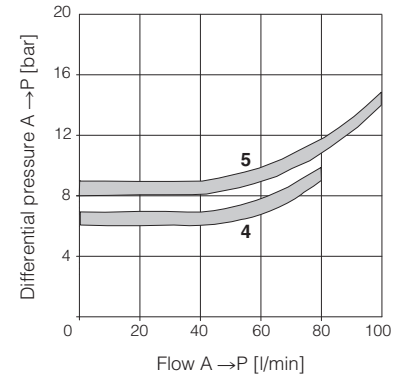
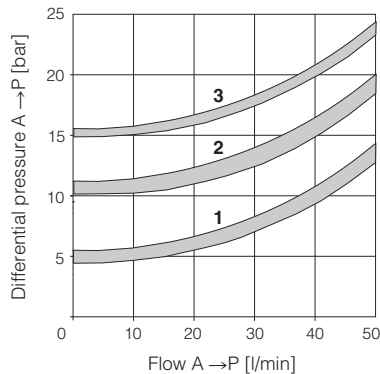
Dotted line for 3-way versions



8.3 Flow A → P/Δp diagrams

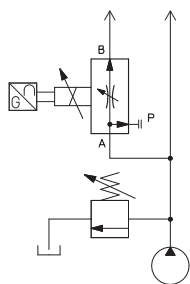
3-way configuration

- 1 = QVHZO-T-06/3
- 2 = QVHZO-T-06/12
- 3 = QVHZO-T-06/18
- 4 = QVKZOR-T-10/65
- 5 = QVKZOR-T-10/90



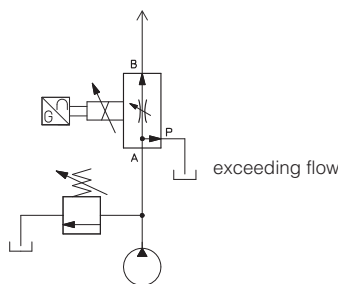
9 APPLICATIONS AND CONNECTIONS

compensated flow



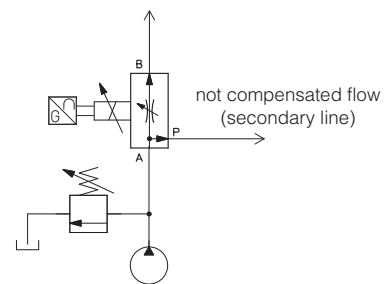
2 way connection

compensated flow



3 way connection

compensated flow
primary circuit (priority)



priority connection

2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations. If the valve is directly installed on the pump main line, the exceeding flow is returned to tank through the pressure relief valve.

3 way connection

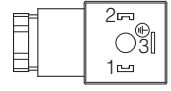
The 3 way connection is normally used when the valve directly controls the pump flow (main line). The metered flow in the controlled line is kept constant, independently to the load variations. The exceeding flow (not metered by the valve) it is returned to tank through the valve P port = T line (3rd way).

Priority connection

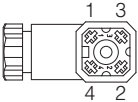
The priority connection guarantees the pressure compensated flow supply to the primary circuit. The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

10 ELECTRICAL CONNECTION

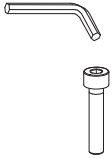

10.1 Solenoid connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

10.2 LVDT transducer connector - supplied with the valve

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 345
1	TR	Output signal	
2	VT-	Power supply -15Vdc	
3	VT+	Power supply +15Vdc	
4	GND	Ground	

11 FASTENING BOLTS AND SEALS

	QVHZO	QVKZOR
	Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	Seals: 4 OR 108; Diameter of ports A, B, P, T: \varnothing 7,5 mm (max)	Seals: 5 OR 2050; Diameter of ports A, B, P, T: \varnothing 11,2 mm (max)

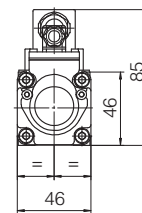
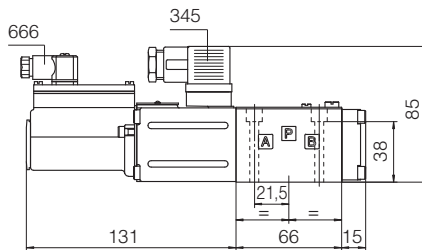
12 INSTALLATION DIMENSIONS [mm]

QVHZO-T

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZO-T	2,3

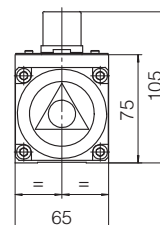
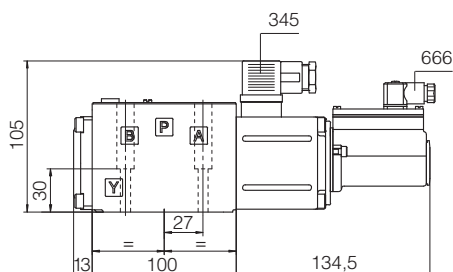


QVKZOR-T

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZOR-T	3,9



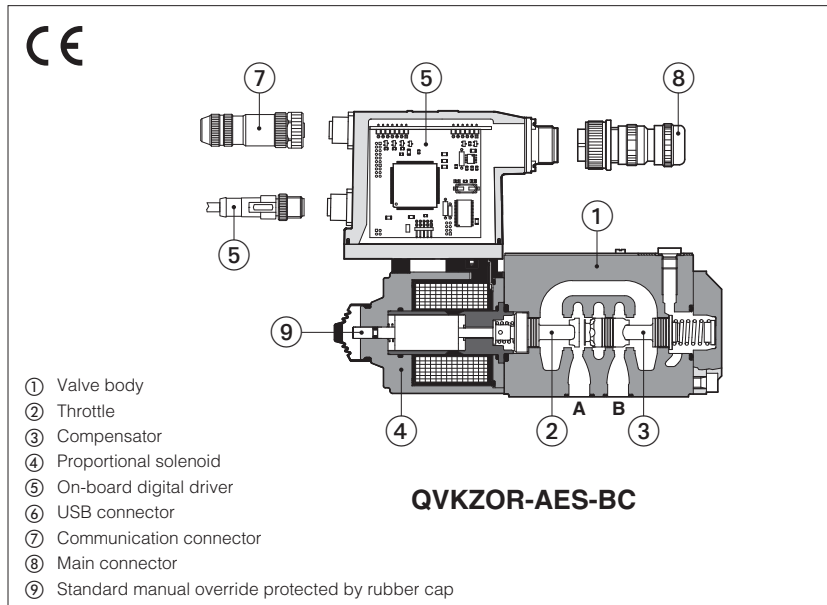
13 RELATED DOCUMENTATION

FS900 Operating and maintenance information for proportional valves
GS230 E-BM-TEB digital driver
GS235 E-BM-TID digital driver
GS240 E-BM-TES digital driver

GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves

Digital proportional flow valves

direct, pressure compensated, without transducer



QVHZO-A, QVHZO-AEB, QVHZO-AES QVKZOR-A, QVKZOR-AEB, QVKZOR-AES

Proportional flow control valves, direct, pressure compensated without position transducer for open loop flow regulations.

A to be coupled with off-board drivers.

AEB basic execution, with on-board digital driver, analog reference signals and USB port for software functional parameters setting.

AES full execution, with on-board digital driver which includes also fieldbus interface for functional parameters setting, reference signals and real-time diagnostics.

QVHZO:

Size: **06** - ISO 4401

Max flow: **45 l/min**

Max pressure: **210 bar**

QVKZOR:

Size: **10** - ISO 4401

Max flow: **90 l/min**

Max pressure: **210 bar**

1 MODEL CODE

QVKZOR	-	AES	-	BC	-	10	/	65	/	*	/	*	/	*	/	*
Pressure compensated flow control valves, direct QVHZO = size 06 QVKZOR = size 10																Seals material , see section 10: - = NBR PE = FKM BT = HNBR
<p>A = for off-board driver, see section 3 AEB = basic on-board digital driver (1) AES = full on-board digital driver (2)</p> <p>Fieldbus interfaces, USB port always present (3): NP = Not present BP = PROFIBUS DP BC = CANopen EH = EtherCAT</p> <p>Valve size ISO 4401: 0 = 06 1 = 10</p>																

Max regulated flow:

QVHZO:

3 = 3,5 l/min **36** = 35 l/min

12 = 12 l/min **45** = 45 l/min

18 = 18 l/min

QVKZOR:

65 = 65 l/min

90 = 90 l/min

Hydraulic options (4):

D = quick venting of port B

Hand lever options, only for QVHZO-A - see section 13:

MO = horizontal hand lever

MV = vertical hand lever

Electronics options, only for AEB and AES (4):

C = current feedback for pressure transducer 4÷20 mA (omit for std voltage 0÷10 VDC) - only for **W**

I = current reference input 4÷20 mA (omit for std voltage ±10 VDC)

Q = enable signal

Z = double power supply, enable, fault and monitor signals - 12 pin connector

W = power limitation function - 12 pin connector

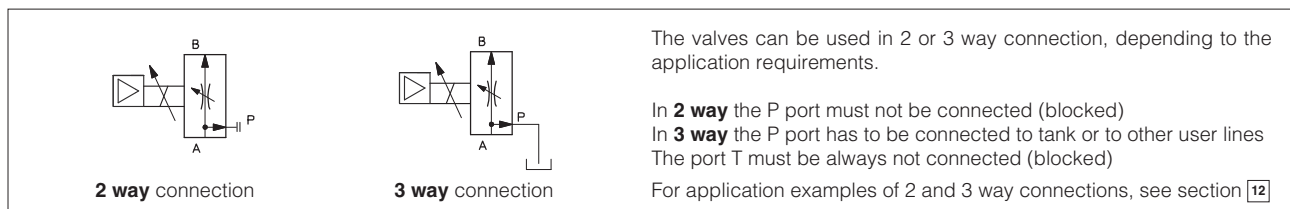
(1) Only for **NP**

(2) Only for **BC, BP, EH**

(3) Omit for **A** execution

(4) For possible combined options, see section 15

2 HYDRAULIC SYMBOLS



Note: hydraulic symbols are represented with on-board digital driver

3 OFF-BOARD ELECTRONIC DRIVERS - only for A

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog		Digital				
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Tech table	G010		G020		G030		GS050

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

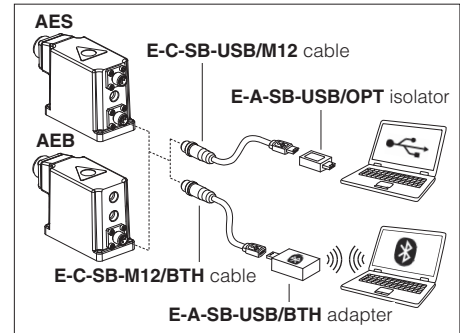
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - only for AES, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	A: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +60°C AEB, AES: Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	A: Standard = -20°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C AEB, AES: Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	QVHZO					QVKZOR	
Max regulated flow [l/min]	3,5	12	18	35	45	65	90
Min regulated flow [cm ³ /min]	15	20	30	50	60	85	100
Regulating Δp [bar]	4 - 6		10 - 12		15	6 - 8	10 - 12
Max flow on port A [l/min]	40			50	55	70	100
Max pressure [bar]	210						
Response time 0-100% step signal [ms]	≤ 30					≤ 45	
Hysteresis	≤ 5 [% of the regulated max flow]						
Linearity	≤ 3 [% of the regulated max flow]						
Repeatability	≤ 1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section [3](#)

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)					
Max power consumption	QVHZO			QVKZOR		
	A = 30 W	AEB, AES = 50 W		A = 35 W	AEB, AES = 50 W	
Coil voltage code	standard	option /6	option /18	standard	option /6	option /18
Max. solenoid current	2,2 A	2,75 A	1,2 A	2,6 A	3,25 A	1,2 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω	2 ÷ 2,2 Ω	13 ÷ 13,4 Ω	3,8 ÷ 4,1 Ω	2,2 ÷ 2,4 Ω	12 ÷ 12,5 Ω
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA			Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω		
Monitor output	Output range: voltage ±5 VDC @ max 5 mA					
Enable input	Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ					
Fault output	Output range : 0 ÷ 24 VDC (ON state ≡ VL+ [logic power supply] ; OFF state ≡ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)					
Pressure transducer power supply (only for /W option)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)					
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option)					
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account					
Protection degree to DIN EN60529	A = IP65; AEB, AES = IP66 / IP67 with mating connectors					
Duty factor	Continuous rating (ED=100%)					
Tropicalization	Tropical coating on electronics PCB					
Additional characteristics	Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply					
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT EC 61158		
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX		
Recommended wiring cable	LiYCY shielded cables, see section 19					

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

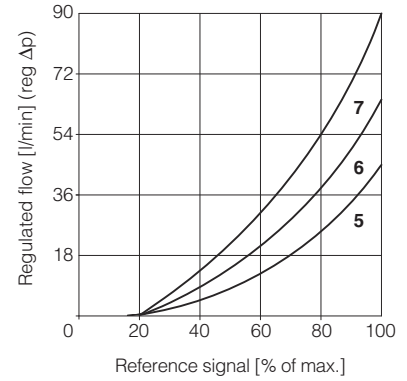
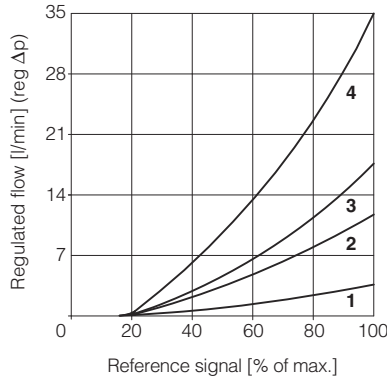
10 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C (+80°C for A), with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
		see also filter section at www.atos.com or KTF catalog	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

11 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

11.1 Regulation diagrams

- 1 = QVHZO-*-06/3
- 2 = QVHZO-*-06/12
- 3 = QVHZO-*-06/18
- 4 = QVHZO-*-06/36
- 5 = QVHZO-*-06/45
- 6 = QVKZOR-*-10/65
- 7 = QVKZOR-*-10/90

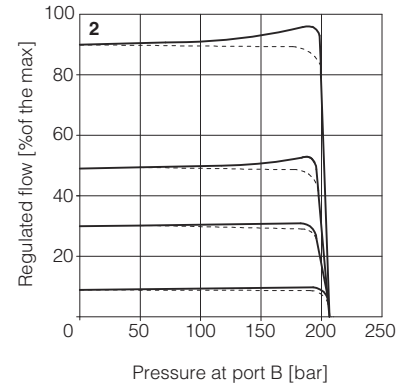
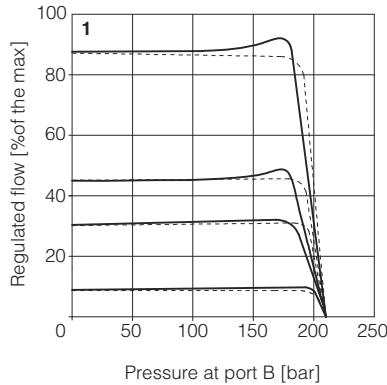


11.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

- 1 = QVHZO
- 2 = QVKZOR

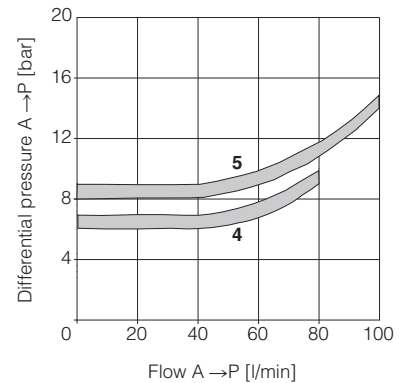
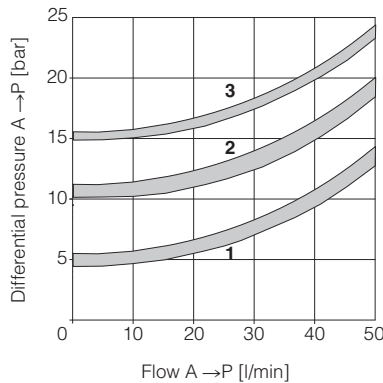
Dotted line for 3-way versions



11.3 Flow A → P/Δp diagrams

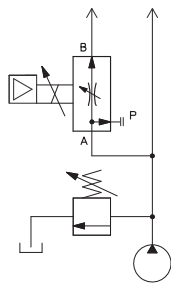
3-way configuration

- 1 = QVHZO-*-06/3
- 2 = QVHZO-*-06/12
- 3 = QVHZO-*-06/18
- 4 = QVHZO-*-06/36
- 5 = QVHZO-*-06/45
- 6 = QVKZOR-*-10/65
- 7 = QVKZOR-*-10/90



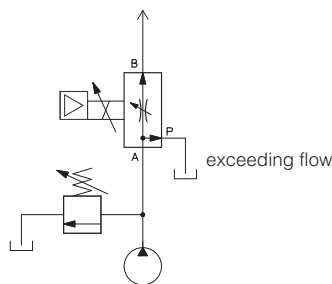
12 APPLICATIONS AND CONNECTIONS

compensated flow



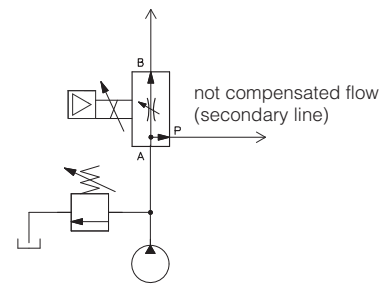
2 way connection

compensated flow



3 way connection

compensated flow
primary circuit (priority)



priority connection

2 way connection

The 2 way connection is normally used to control the flow in one part of the hydraulic circuit or to regulate the speed of a specific actuator. The metered flow in the controlled line is kept constant, independently to the load variations. If the valve is directly installed on the pump main line, the exceeding flow is returned to tank through the pressure relief valve.

3 way connection

The 3 way connection is normally used when the valve directly controls the pump flow (main line). The metered flow in the controlled line is kept constant, independently to the load variations. The exceeding flow (not metered by the valve) it is returned to tank trough the valve P port = T line (3rd way).

Priority connection

The priority connection guarantees the pressure compensated flow supply to the primary circuit. The exceeding flow (not required by the primary circuit) is bypassed through the valve P port, to secondary circuit operating at lower pressure and not requiring compensated flow regulations.

13 HYDRAULIC OPTIONS

D = This option provides a quick venting of the use port B when the valve is closed or de-energized.

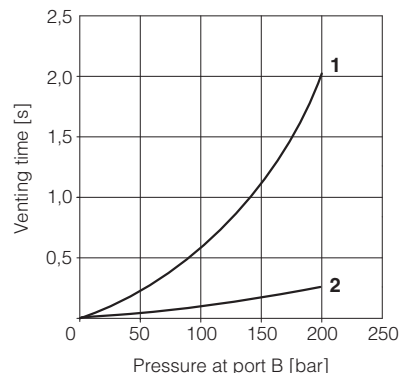
The valve must be connected in 3 way, with P port connected to tank.

When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.

In the diagram aside are represented the venting times of **QVHZO** and **QVKZOR** with option /D respect to standard versions:

1 = standard version

2 = option /Q



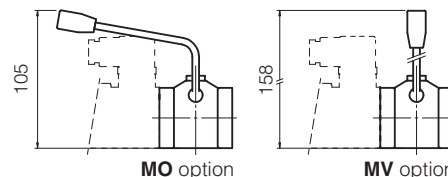
Hand lever option - only for **QVHZO-A**

It allows to operate the valve in absence of electrical power supply.

For detailed description of QVHZO-A with hand lever option see tech. table **E138**.

MO = Horizontal hand lever

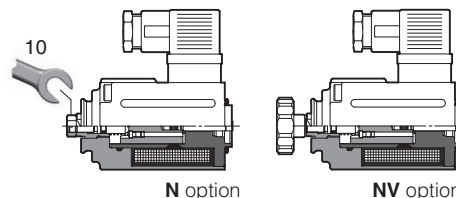
MV = Vertical hand lever



The following supplementary options allow to operate **QVHZO-A** and **QVKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

N = Manual micrometric adjustment

NV = As option /N plus handwheel and graduated scale



14 ELECTRONICS OPTIONS - only for **AEB** and **AES**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.

The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:

Fault output signal - see 17.6

Enable input signal - see above option /Q

Power supply for driver's logics and communication - see 17.2

C = Only in combination with option /W

This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

W = Only for valves coupled with pressure compensator, see tech table **D150**.

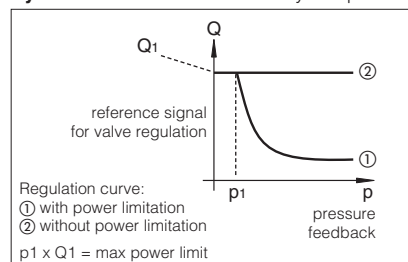
It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR.

When the actual requested hydraulic power $p \times Q$ (TR x INPUT+) reaches the max power limit ($p_1 \times Q_1$), internally set by software, the driver automatically reduces the flow regulation of the valve.

The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

Hydraulic Power Limitation - only for option /W



15 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

Electronics options: /IQ, /IZ, /IW, /CW, /CWI

16 COIL VOLTAGE OPTIONS - only for A

6 = Optional coil to be used with Atos drivers with power supply 12 V_{dc}.

18 = Optional coil to be used with electronic drivers not supplied by Atos.

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for AEB and AES

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /Z and /W options

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 V_{dc} for standard and 4 \div 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 V_{dc} or \pm 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 \div 24V_{dc}.

17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is 0 \div 5 V_{dc} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of \pm 5 V_{dc}.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.

The output maximum range is \pm 5 V_{dc}; default setting is 0 \div 5 V_{dc}.

17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 V_{dc} on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

17.6 Fault output signal (FAULT) - only for /Z and /W options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 \div 20 mA input, etc.).

Fault presence corresponds to 0 V_{dc}, normal working corresponds to 24 V_{dc}.

Fault status is not affected by the Enable input signal.

17.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver (see 18.4).

Analog input signal is factory preset according to selected driver code, defaults are 0 \div 10 V_{dc} for standard and 4 \div 20 mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 V_{dc} or \pm 20 mA.

Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

18 ELECTRONIC CONNECTIONS

18.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB and AES

PIN	Standard	/Q	TECHNICAL SPECIFICATIONS	NOTES
A	V+		Power supply 24 Vdc	Input - power supply
B	V0		Power supply 0 Vdc	Gnd - power supply
C	AGND		Analog ground	Gnd - analog signal
		ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to V0	Input - on/off signal
D	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
E	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
F	MONITOR referred to: AGND	V0	Monitor output signal: ± 5 Vdc maximum range Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
G	EARTH		Internally connected to driver housing	

18.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB and AES

PIN	/Z	/W	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE		Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VLO	Input - on/off signal
4	INPUT+		Reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for INPUT+	Input - analog signal
6	MONITOR		Monitor output signal: ± 5 Vdc maximum range, referred to VLO Default is 0 \div 5 Vdc (1V = 1A)	Output - analog signal Software selectable
7	NC		Do not connect	
8	NC		Do not connect	
		MONITOR2	2nd monitor output signal: ± 5 Vdc maximum range, referred to VLO. Default is 0 \div 5 Vdc	Output - analog signal
9	VL+		Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	VLO		Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to VLO	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Note: do not disconnect VLO before VL+ when the driver is connected to PC USB port

18.3 Communication connectors - for AEB (B) and AES (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) BC fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	NC	do not connect
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C2) BP fieldbus execution, connector - M12 - 5 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2)		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

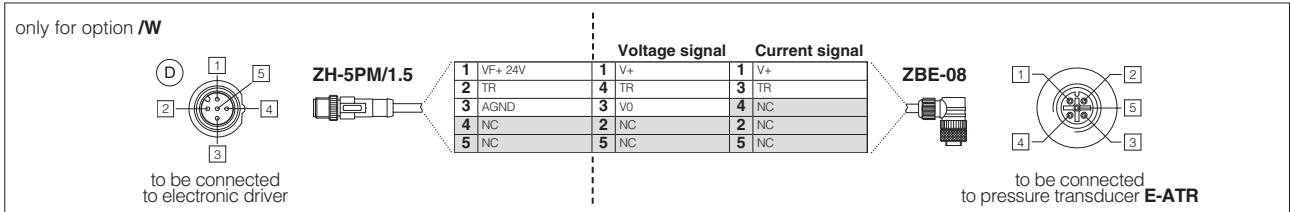
(1) Shield connection on connector's housing is recommended

(2) Only for AES execution

18.4 Remote pressure transducer connector - M12 - 5 pin - only for /W option - for AEB and AES (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	Voltage	Current
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR	Signal transducer maximum range ± 10 Vdc / ± 20 mA, software selectable Defaults are 0 \div 10 Vdc for standard and 4 \div 20 mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	/
4	NC	Not Connect	/	/
5	NC	Not Connect	/	/

Remote pressure transducer connection - example

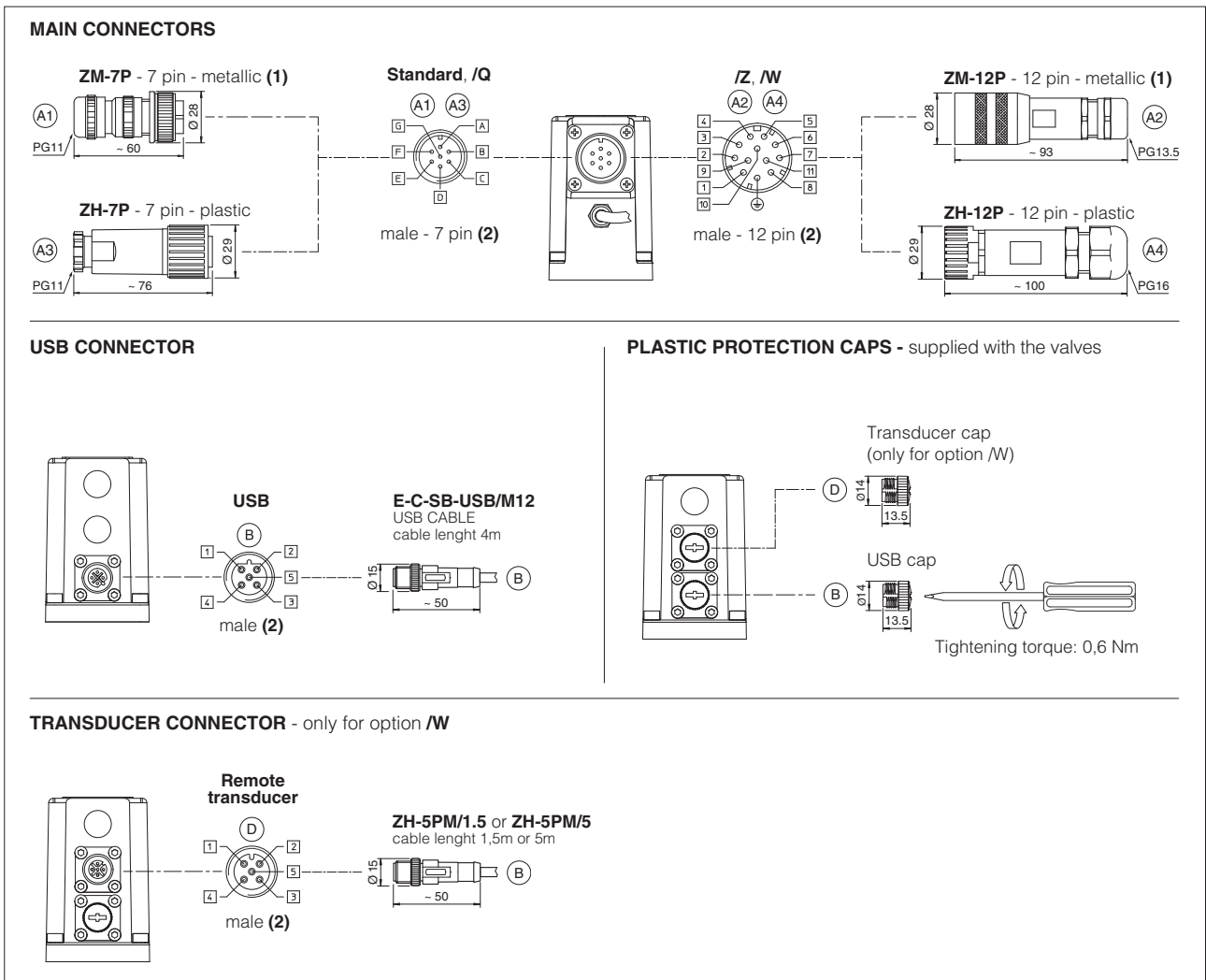


Note: connectors front view

18.5 Solenoid connection - only for A

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

18.6 AEB connections layout

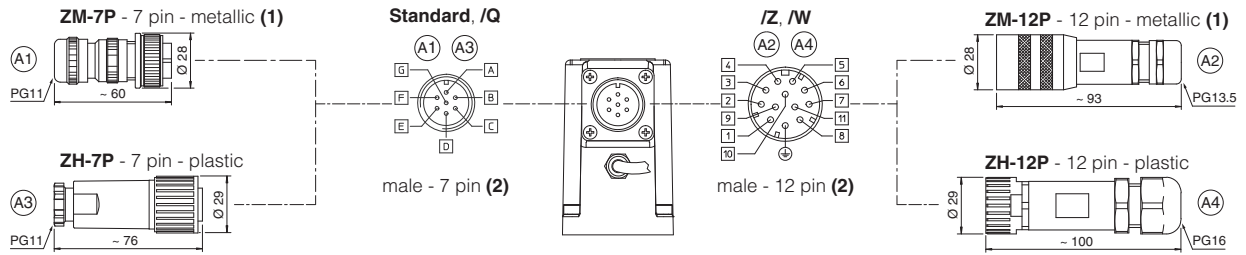


(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

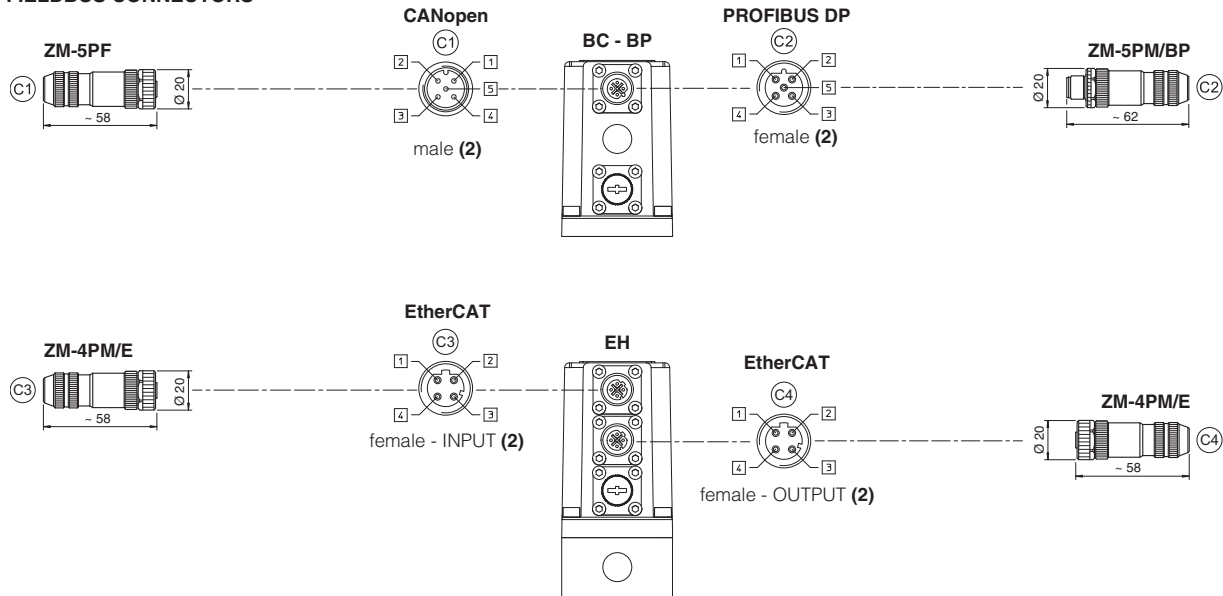
(2) Pin layout always referred to driver's view

18.7 AES connections layout

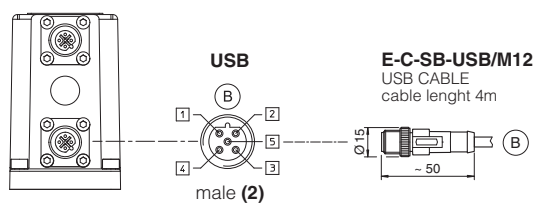
MAIN CONNECTORS



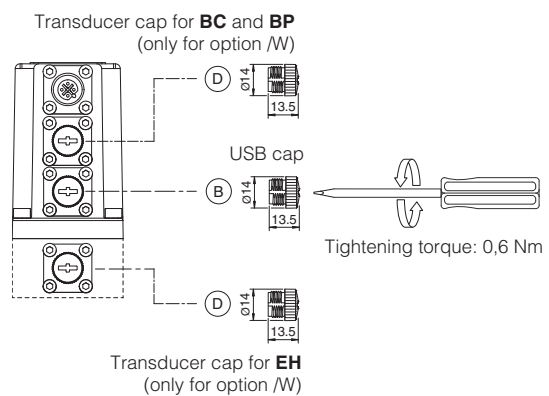
FIELDBUS CONNECTORS



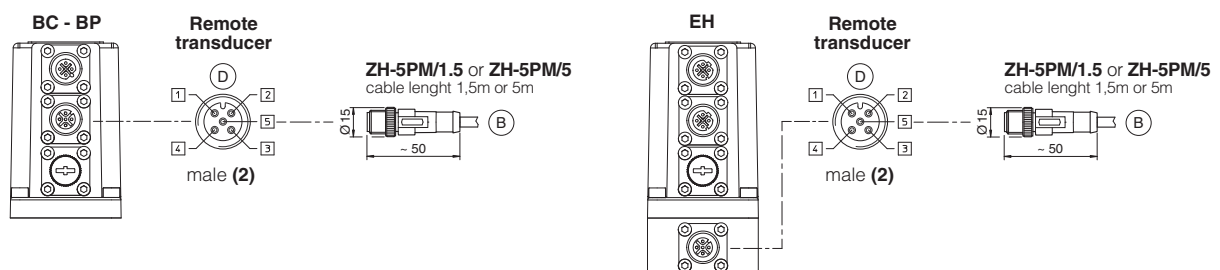
USB CONNECTOR



PLASTIC PROTECTION CAPS - supplied with the valves



TRANSDUCER CONNECTOR - only for option /W



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements

(2) Pin layout always referred to driver's view

19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors - 7 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
Conductor size	up to 1 mm ² - available for 7 wires	up to 1 mm ² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

19.2 Main connectors - 12 pin - for AEB and AES

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.3 Fieldbus communication connectors - only for AES

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

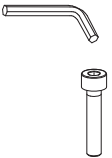
(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**

(2) Internally terminated

19.4 Pressure transducer connectors - only for /W option

CONNECTOR TYPE	TRANSDUCER	
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5
Type	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	
Material	Plastic	
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght	
Cable	5 x 0,25 mm ²	
Connection type	molded cable	
Protection (EN 60529)	IP 67	

20 FASTENING BOLTS AND SEALS

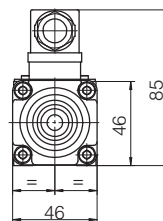
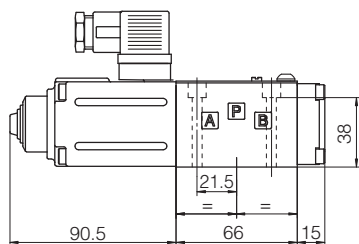
	<p>QVHZO</p> <p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>	<p>QVKZOR</p> <p>Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>
	<p>Seals: 4 OR 108 Diameter of ports A, B, P, T: Ø 7,5 mm</p>	<p>Seals: 5 OR 2050 Diameter of ports A, B, P, T: Ø 11,2 mm</p>

21 INSTALLATION DIMENSIONS FOR QVHZO [mm]

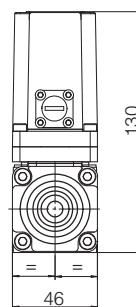
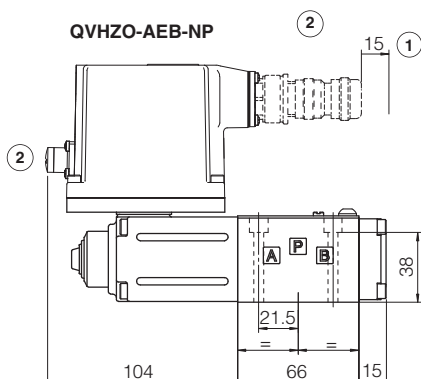
ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]		
A	AEB, AES	AES-EH
2,3	2,8	2,9

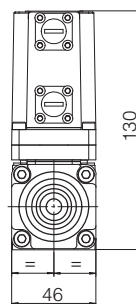
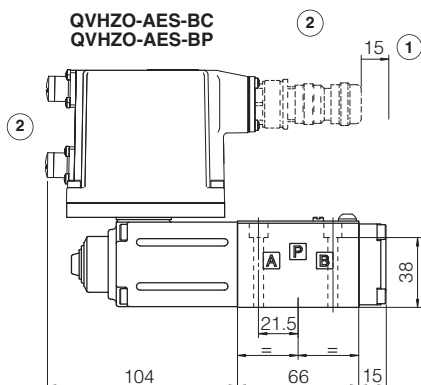
QVHZO-A



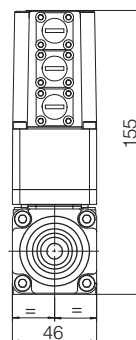
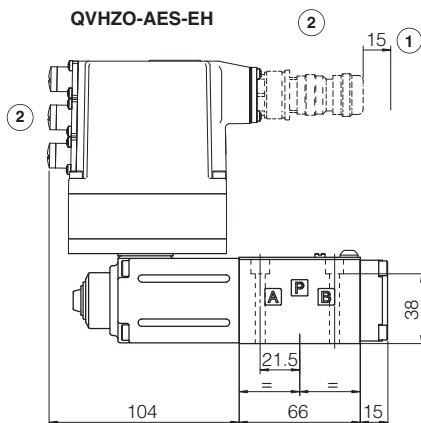
QVHZO-AEB-NP



QVHZO-AES-BC
 QVHZO-AES-BP



QVHZO-AES-EH



① = Space to remove the connectors

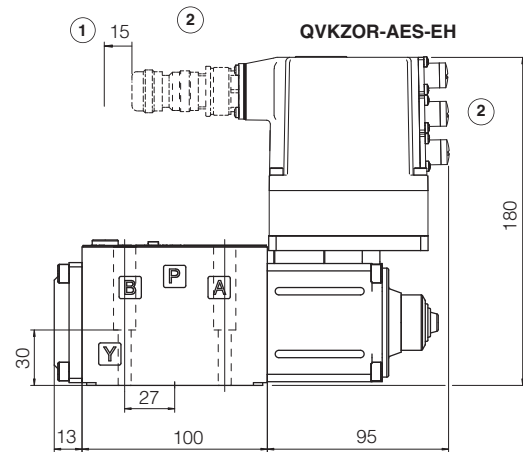
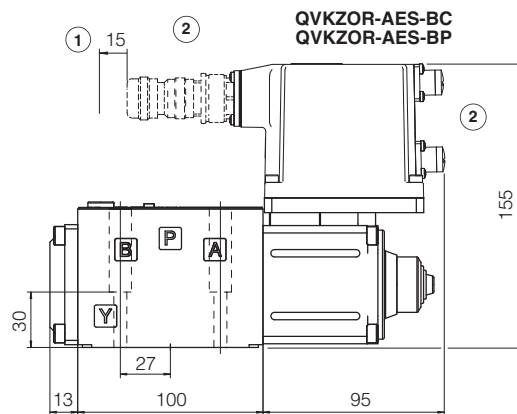
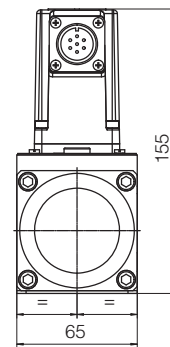
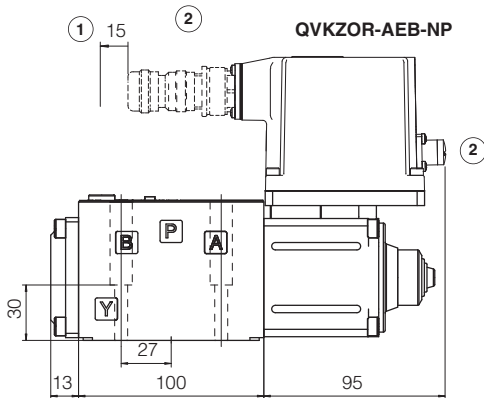
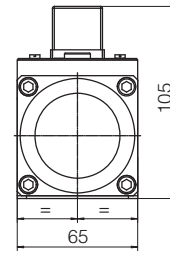
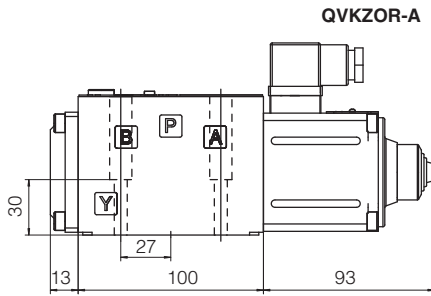
② = The dimensions of all connectors must be considered, see section 18.6 and 18.7

22 INSTALLATION DIMENSIONS FOR QVHZOR [mm]

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]		
A	AEB, AES	AES-EH
3,8	4,3	4,4



① = Space to remove the connectors

② = The dimensions of all connectors must be considered, see section 18.6 and 18.7

23 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
G010 E-MI-AC analog driver
G020 E-MI-AS-IR digital driver
G030 E-BM-AS digital driver
GS050 E-BM-AES digital driver
GS500 Programming tools

GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
QB200 Quickstart for AEB valves commissioning
QF200 Quickstart for AES valves commissioning

Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

E-BM-TES-N- NP Not Present

E-BM-TES-N- BC BP CANopen PROFIBUS DP

E-BM-TES-S- EH EW EI EP EtherCAT POWERLINK EtherNet/IP PROFINET RT/IRT

Scale
 Bias
 Linearization
 Ramps

Real-time Fieldbus Reference
 Alternated Control **P/Q**
 Enhanced Diagnostic
 USB port

atos
 DVD E-SW-FIELDBUS/PO Programming Software
E-SW programming software

Connectors ② included

E-BM-TES/LES

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TES execution controls direct operated directional/flow valves with one LVDT transducer.

LES execution controls pilot operated directional valves with two LVDT transducers.

Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section [4]).

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- up to 9 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 6.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +50$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

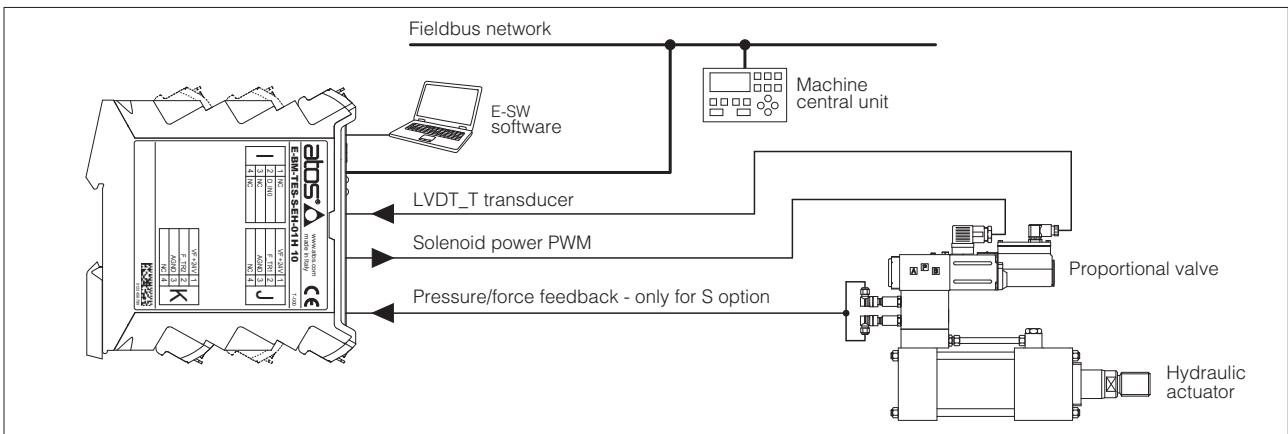
Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	TES	-	N	-	NP	-	01H	/	*	/	*	/	*
<p>Off-board electronic driver in DIN rail format</p> <p>TES = digital full driver, for valves with one LVDT transducer LES = digital full driver, for valves with two LVDT transducers</p> <p>Alternated P/Q control: N = none S = closed loop pressure/force (see tech table FS500)</p> <p>Fieldbus interface, USB port always present: NP = Not Present BC = CANopen EW = POWERLINK BP = PROFIBUS DP EI = EtherNet/IP EH = EtherCAT EP = PROFINET RT/IRT</p>									<p>Set code (see section [7])</p> <p>Series number</p> <p>Options, see section [6]: A = max current limitation for Ex-proof valves C = current feedback $4 \div 20$ mA for remote transducers (only for option S) and LVDT transducers (only for option A) I = current reference input and monitor $4 \div 20$ mA (omit for voltage reference and monitor input ± 10 V_{DC})</p> <p>- = omit for direct valves and for pilot operated valves with two LVDT transducers P = for pilot operated valves with one LVDT transducer (only for TES-N)</p> <p>01H = for single solenoid proportional valves 05H = for double solenoid proportional valves (only for TES)</p>					

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	DHZO-T, DKZOR-T F165, F168	DLHZO-T, DLKZOR-T F180	DPZO-T F172	QVHZO-T, QVKZOR-T F412	DPZO-L F175, F178	LIQZO-L, LIQZP-L F330, F340
Ex-proof Tech table	DHZA-T, DKZA-T FX120	DLHZA-T, DLKZA-T FX140	DPZA-T FX220	QVHZA-T, QVKZA-T FX420	-	LIQZA-L FX350, FX370
Driver model	E-BM-TES				E-BM-LES	

Option S not available

4 ALTERNATED P/Q CONTROL - only for S option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation.

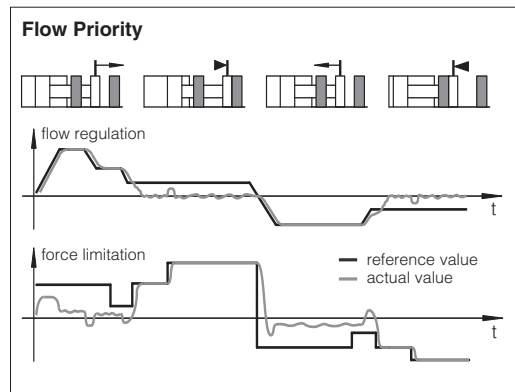
The alternated P/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.

Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer.

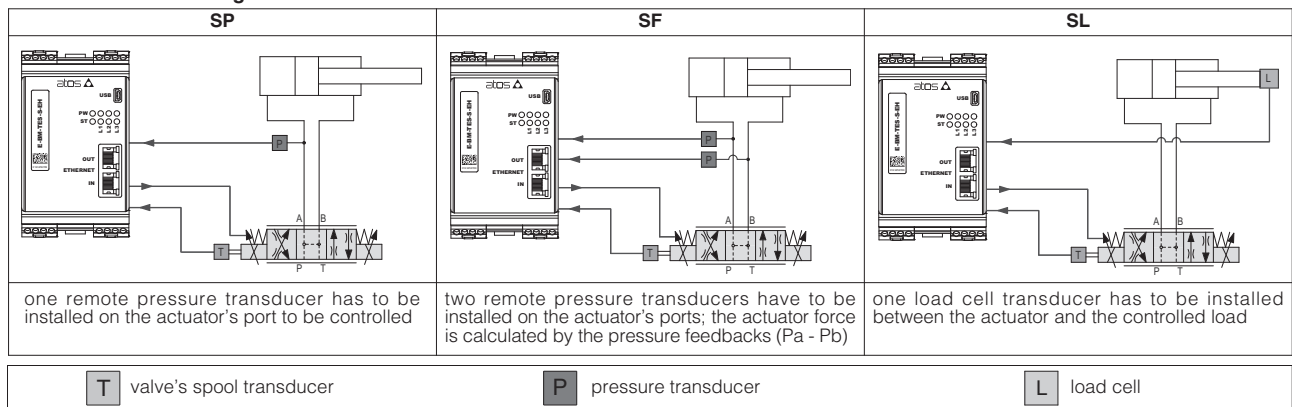
Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve's flow regulation in order to keep steady the system pressure/force. If the pressure/force tends to decrease under its input reference signal, the flow control returns active.

The dynamic response of pressure/force control can be adapted to different system's characteristics, by setting the internal PID parameters using Atos PC software.

Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.



Alternated control configurations - software selectable



SP – flow/pressure control

Adds pressure control to standard flow control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.

SF – flow/force control

Adds force control to standard flow control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

SL – flow/force control

Adds force control to standard flow control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

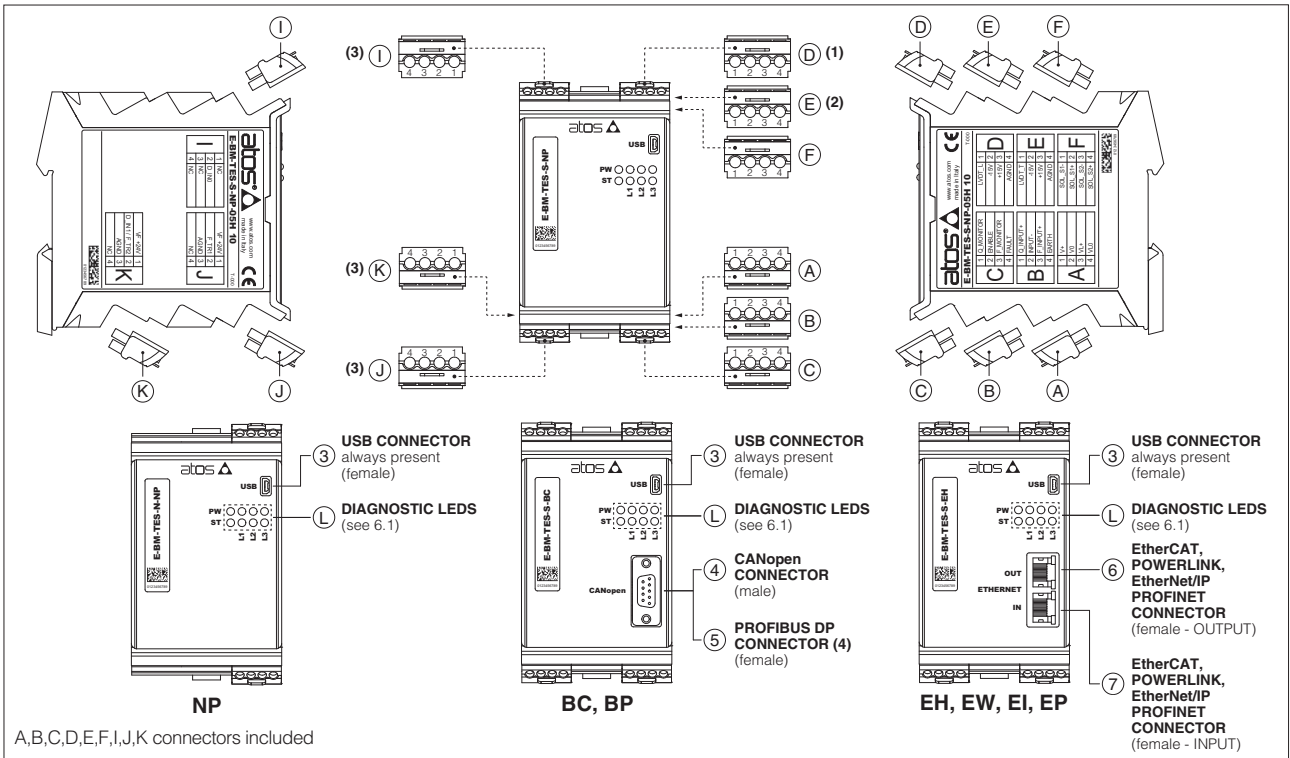
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

5 MAIN CHARACTERISTICS

Power supplies (see 8.1, 8.2)	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})
Max power consumption	50 W
Current supplied to solenoids	$I_{MAX} = 3.0 A$ for standard driver $I_{MAX} = 2.5 A$ for ex-proof driver (IA option)
Analog input signals (see 8.3, 8.4)	Voltage: range $\pm 10 V_{dc}$ ($24 V_{MAX}$ tollerant) Input impedance: $R_i > 50 k\Omega$ Current: range $\pm 20 mA$ Input impedance: $R_i = 500 \Omega$
Monitor outputs (see 8.5, 8.6)	Output range: voltage $\pm 10 V_{dc}$ @ max 5 mA current $\pm 20 mA$ @ max 500 Ω load resistance
Enable input (see 8.7)	Range: 0 \div 5 Vdc (OFF state), 9 \div 24 Vdc (ON state), 5 \div 9 Vdc (not accepted); Input impedance: $R_i > 10 k\Omega$
Digital inputs (see 8.11)	
Fault output (see 8.8)	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Pressure/Force transducers power supply (only for S option)	+24Vdc @ max 100 mA (E-ATR-8 see tech table GS465)
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 \div +50 $^{\circ}C$ (storage -25 \div +85 $^{\circ}C$)
Mass	Approx. 400 g
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB CANopen PROFIBUS DP EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	Atos ASCII coding EN50325-4 + DS408 EN50170-2/IEC61158
Communication physical layer	not insulated optical insulated optical insulated Fast Ethernet, insulated USB 2.0 + USB OTG CAN ISO11898 RS485 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 12)	2,5 mm ²

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

6 CONNECTIONS AND LEDS



- (1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
- (2) E connector is available only for TES-* versions 01H / 05H and LES-*
- (3) I , J and K connectors are available only for TES-S and LES-S

- (4) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector:
DG909MF1 - the connector will be oriented upwards
DG909MF3 - the connector will be oriented downwards

6.1 Diagnostic LEDs (L)

Eight leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1		VALVE STATUS			LINK/ACT			GREEN
L2		NETWORK STATUS			NETWORK STATUS			RED
L3		SOLENOID STATUS			LINK/ACT			
PW	OFF = Power supply OFF	ON = Power supply ON						
ST	OFF = Fault present	ON = No fault						

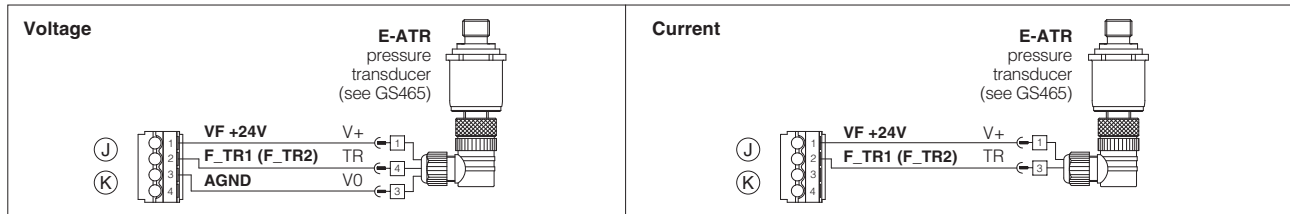
6.2 Connectors - 4 pin

CONNECTOR	PIN	ALTERNATED P/Q CONTROL		TECHNICAL SPECIFICATIONS	NOTES
		N none	S pressure/force		
A	A1	V+		Power supply 24 Vdc (see 8.1)	Input - power supply
	A2	V0		Power supply 0 Vdc (see 8.1)	Gnd - power supply
	A3	VL+		Power supply 24 Vdc for driver's logic and communication (see 8.2)	Input - power supply
	A4	VL0		Power supply 0 Vdc for driver's logic and communication (see 8.2)	Gnd - power supply
B	B1	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 8.3)	Input - analog signal Software selectable
	B2	INPUT-		Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	B3	NC		Do not connect	
			F_INPUT+	Pressure/Force reference input signal ± 10 Vdc / ± 20 mA maximum range Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 8.4)	Input - analog signal Software selectable
B4	EARTH		Connect to system ground		
C	C1	Q_MONITOR		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to AGND. Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 8.5)	Output - analog signal Software selectable
	C2	ENABLE		Enable (24 Vdc) or disable (0 Vdc) the controller, referred to VL0 (see 8.7)	Input - on/off signal
	C3	NC		Do not connect	
			F_MONITOR	Pressure/Force monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to AGND Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 8.6)	Output - analog signal Software selectable
C4	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to VL0 (see 8.8)	Output - on/off signal	
D ⁽¹⁾	D1	LVDT_L		Main stage valve position transducer signal (see 8.9)	Input - analog signal
	D2	-15V		Main stage valve position transducer power supply -15V	Output power supply
	D3	+15V		Main stage valve position transducer power supply +15V	Output power supply
	D4	AGND		Common gnd for transducer power and monitor outputs	Common gnd
E ⁽²⁾	E1	LVDT_T		Direct valve or pilot valve position transducer signal (see 8.9)	Input - analog signal
	E2	-15V		Direct valve or pilot valve position transducer power supply -15V	Output power supply
	E3	+15V		Direct valve or pilot valve position transducer power supply +15V	Output power supply
	E4	AGND		Common gnd for transducer power and monitor outputs	Common gnd
F	F1	SOL_S1-		Negative current to solenoid S1	Output - power PWM
	F2	SOL_S1+		Positive current to solenoid S1	Output - power PWM
	F3	SOL_S2-		Negative current to solenoid S2	Output - power PWM
	F4	SOL_S2+		Positive current to solenoid S2	Output - power PWM
I	I1		NC	Do not connect	
	I2		D_IN0	NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 \div 24Vdc, referred to VL0 (see 8.11)	Input - on/off signal
	I3		NC	Do not connect	
	I4		NC	Do not connect	
J	J1		VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	J2		F_TR1	1st signal pressure/force transducer: ± 10 Vdc / ± 20 mA maximum range Default are ± 10 Vdc for standard and $4 \div 20$ mA for /C option (see 8.10)	Input - analog signal Software selectable
	J3		AGND	Common gnd for transducer power and signals	Common gnd
	J4		NC	Do not connect	
K	K1		VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	K2		F_TR2	2nd signal pressure transducer (only for SF): ± 10 Vdc / ± 20 mA maximum range Default are ± 10 Vdc for standard and $4 \div 20$ mA for /C option (see 8.10)	Input - analog signal Software selectable
			D_IN1	NP execution: multiple pressure/force PID selection (only for SP and SL), referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 \div 24Vdc, referred to VL0 (see 8.11)	Input - on/off signal
	K3		AGND	Common gnd for transducer power and signals	Common gnd
K4	NC	Do not connect			

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*

(2) E connector is available only for TES-* versions 01H / 05H and LES-*

6.3 Pressure/force transducers connection - example - only for S option



6.4 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ USB connector - Mini USB type B always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	D-	Data line -
3	D+	Data line +
4	ID	Identification
5	GND_USB	Signal zero data line

④ BC fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	CAN_L	Bus line (low)
3	CAN_GND	Signal zero data line
5	CAN_SHLD	Shield
7	CAN_H	Bus line (high)

⑤ BP fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	SHIELD	
3	LINE-B	Bus line (low)
5	DGND	Data line and termination signal zero
6	+5V	Termination supply signal
8	LINE-A	Bus line (high)

⑥ ⑦ EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter - white/orange
2	RX+	Receiver - white/green
3	TX-	Transmitter - orange
6	RX-	Receiver - green

(1) shield connection on connector's housing is recommended

7 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

8 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table FS900 and in the user manuals included in the E-SW-* programming software. Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

8.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

8.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

8.3 Flow reference input signals (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{DC} for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ V_{DC}.

8.4 Pressure or force reference input signal (F_INPUT+) - only for S option

Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver pressure/force closed loop, see section 4.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{DC} for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range $0 \div 24$ V_{DC}.

8.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position).
 Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.
 Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

8.6 Pressure or force monitor output signal (F_MONITOR) - only for S option

The driver generates an analog output signal (C3) proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
 Monitor output signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /I option.
 Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.

8.7 Enable input signal (ENABLE)

To enable the driver, supply 24 Vdc on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.
 Enable input signal can be used as digital input by software selection.

8.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.
 Fault status is not affected by the status of the Enable input signal.
 Fault output signal can be used as digital output by software selection.

8.9 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ± 15 Vdc supply output available at pin D2, D3 and pin E2, E3.
 Note: transducer input signals working range is ± 10 Vdc for standard or $4 \div 20$ mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

8.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - only for S option

Analog remote pressure transducers or load cell can be directly connected to the driver.
 Analog input signal is factory preset according to selected driver code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /C option.
 Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 Vdc or ± 20 mA.
 Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **FS500**).

8.11 Multiple PID selection or digital input signals (D_IN0 and D_IN1) - only for S option

Two on-off input signals are available on the connectors I and K.
 For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 Vdc or a 0 Vdc on pin I2 and/or pin K2, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.
 For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
I2	0	24 Vdc	0	24 Vdc
K2	0	0	24 Vdc	24 Vdc

8.12 Possible combined options: /AC, /AI, /ACI, /CI - combined options /CI is available only for E-BM-TES/LES-S.

9 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).
 For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
 Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

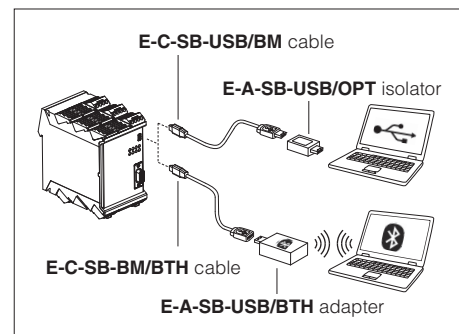
E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
 Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
 Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

USB or Bluetooth connection



10 MAIN SOFTWARE PARAMETER SETTINGS

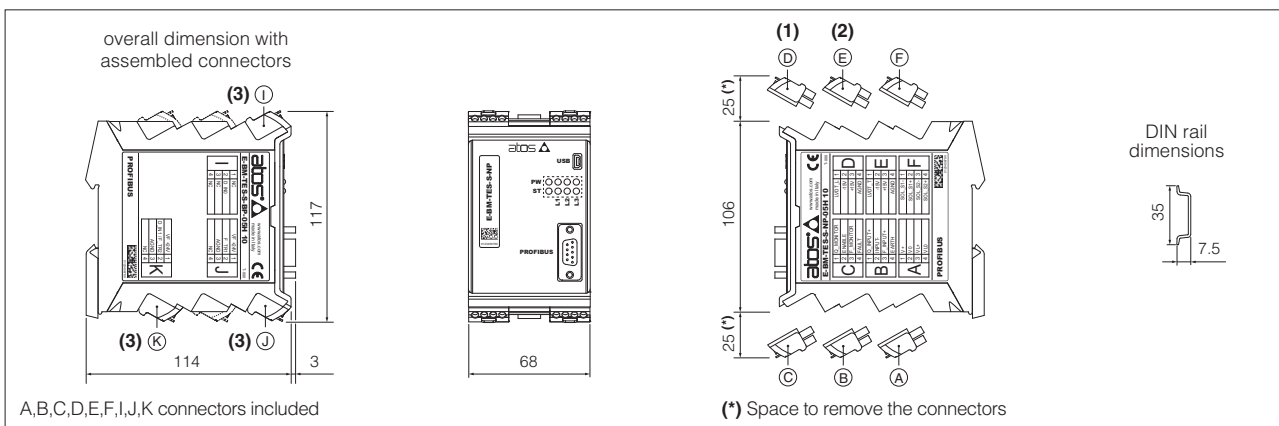
For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LES - user manual for **E-BM-TES-N** and **E-BM-LES-N** digital drivers

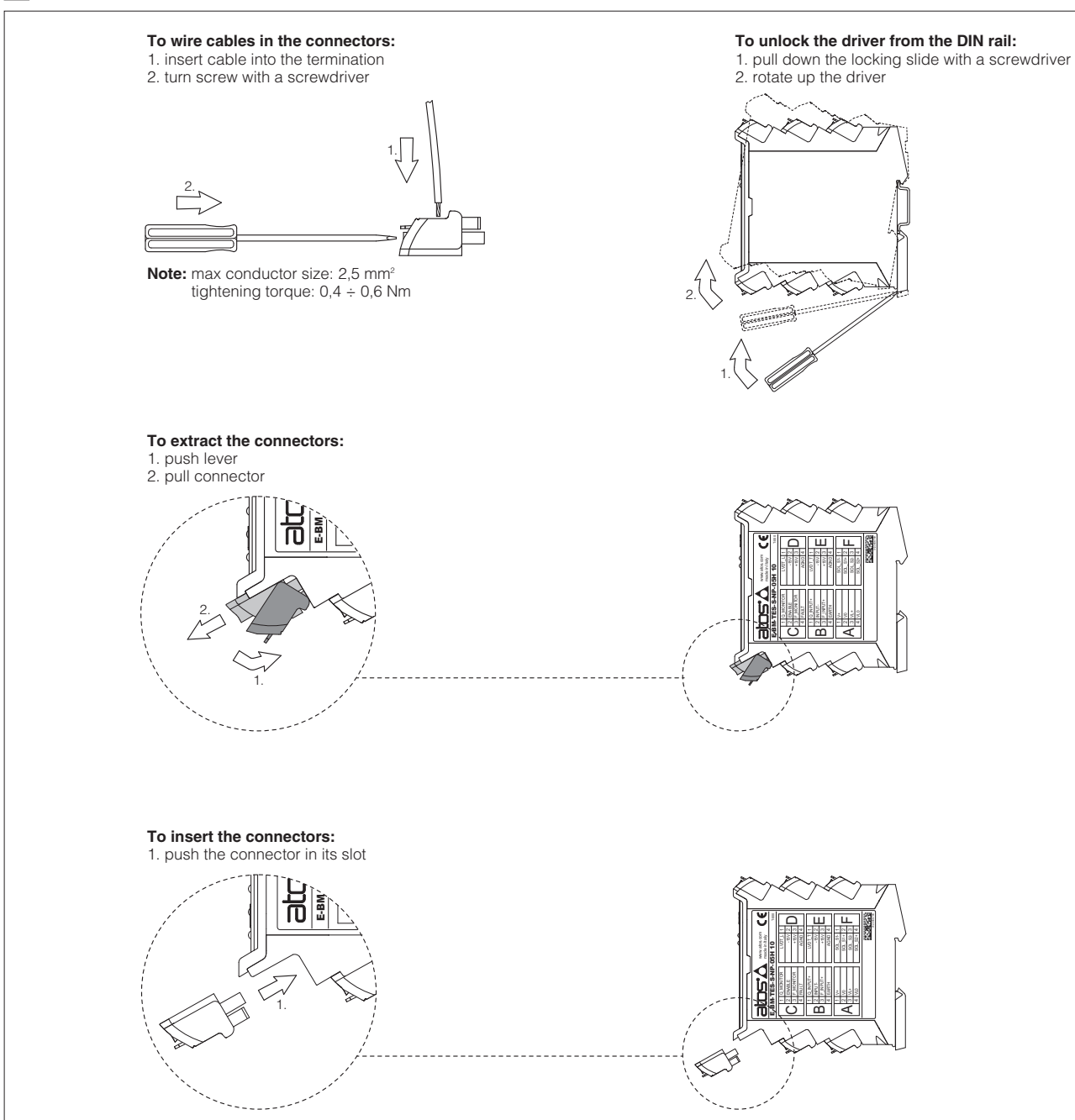
E-MAN-BM-LES-S - user manual for **E-BM-TES-S** and **E-BM-LES-S** digital drivers

11 OVERALL DIMENSIONS [mm]



- (1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
- (2) E connector is available only for TES-* versions 01H / 05H and LES-*
- (3) I, J and K connectors are available only for TES-S and LES-S

12 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

E-BM-TEB-N-NP

Scale

Bias

Linearization

Ramps

Enhanced Diagnostic

USB port

E-SW
programming software

Connectors ② included

E-BM-TEB/LEB

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TEB execution controls direct operated directional/flow valves with one LVDT transducer.

LEB execution controls pilot operated directional valves with two LVDT transducers.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 6 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +60$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

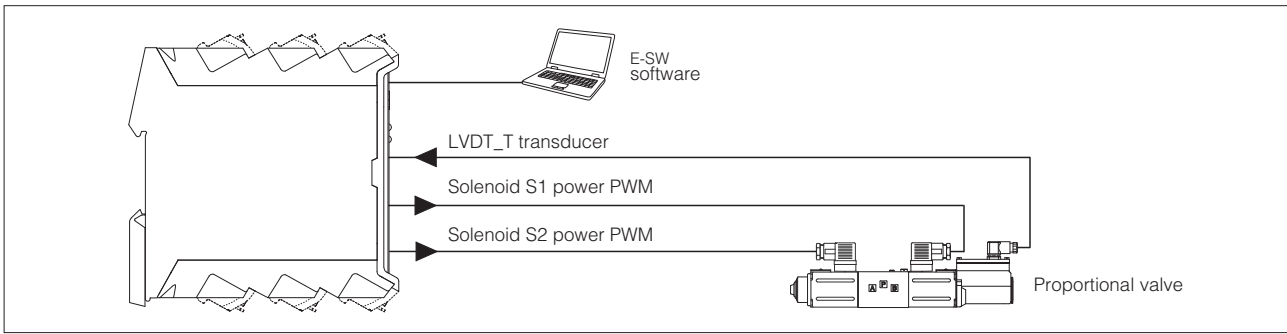
Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	TEB	-	N	-	NP	-	01H	/	*	/	*	*	*
Off-board electronic driver in DIN rail format														
TEB = digital basic driver, for valves with one LVDT transducer LEB = digital basic driver, for valves with two LVDT transducers														
Alternated P/Q control: N = none														
Fieldbus interface , USB port always present: NP = Not Present														
Set code (see section 6)														
Series number														
Options , see section 5 : A = max current limitation for Ex-proof valves C = current feedback $4 \div 20$ mA for LVDT transducers only in combination with option A I = current reference input and monitor $4 \div 20$ mA (omit for voltage reference and monitor input ± 10 V _{DC})														
- = omit for direct valves and for pilot operated valves with two LVDT transducers P = for pilot operated valves with one LVDT transducer (only for TEB)														
01H = for single solenoid proportional valves 05H = for double solenoid proportional valves (only for TEB)														

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

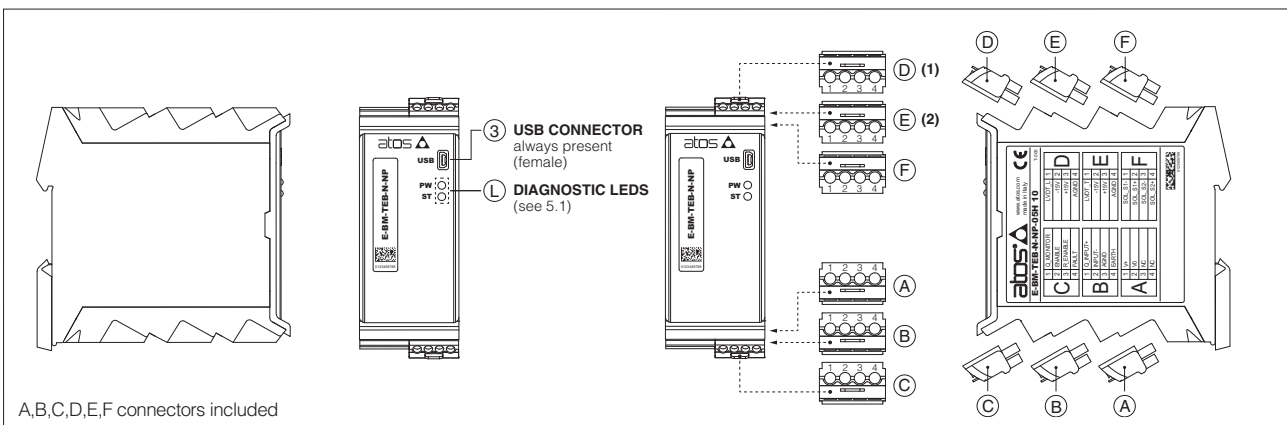
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	DHZO-T, DKZOR-T F165, F168	DLHZO-T, DLKZOR-T F180	DPZO-T F172	QVHZO-T, QVKZOR-T F412	DPZO-L F175, F178	LIQZO-L, LIQZP-L F330, F340
Ex-proof Tech table	DHZA-T, DKZA-T FX120	DLHZA-T, DLKZA-T FX140	DPZA-T FX220	QVHZA-T, QVKZA-T FX420	-	LIQZA-L FX350, FX370
Driver model	E-BM-TEB				E-BM-LEB	

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 V _{DC} Rectified and filtered : V _{RMS} = 20 ÷ 32 V _{MAX} (ripple max 10 % V _{PP})
Max power consumption	50 W
Current supplied to solenoids	I _{MAX} = 3.0 A for standard driver I _{MAX} = 2.5 A for ex-proof driver (IA option)
Analog input signal (see 7.2)	Voltage: range ±10 V _{DC} (24 V _{MAX} tollerant) Input impedance: R _i > 50 kΩ Current: range ±20 mA Input impedance: R _i = 500 Ω
Monitor output (see 7.3)	Output range: voltage ±10 V _{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 ÷ 5 V _{DC} (OFF state), 9 ÷ 24 V _{DC} (ON state), 5 ÷ 9 V _{DC} (not accepted); Input impedance: R _i > 10 kΩ
Repeat enable output (see 7.5) Fault output (see 7.6)	Output range: 0 ÷ 24 V _{DC} (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 ÷ +60 °C (storage -25 ÷ +85 °C)
Mass	Approx. 400 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm ²

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

5 CONNECTIONS AND LEDS

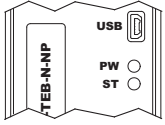


(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N

(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

5.1 Diagnostic LEDs

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	
ST	OFF = Fault present	ON = No fault	

5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	V+	Power supply 24 Vdc (see 7.1)	Input - power supply
	A2	V0	Power supply 0 Vdc (see 7.1)	Gnd - power supply
	A3	NC	Do not connect	
	A4	NC	Do not connect	
B	B1	Q_INPUT+	Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 7.2)	Input - analog signal Software selectable
	B2	INPUT-	Negative reference input signal for Q_INPUT+	Input - analog signal
	B3	AGND	Common gnd for monitor output	Common gnd
	B4	EARTH	Connect to system ground	
C	C1	Q_MONITOR	Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to AGND Default are ± 10 Vdc for standard and $4 \div 20$ mA for /I option (see 7.3)	Output - analog signal Software selectable
	C2	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the controller, referred to V0 (see 7.4)	Input - on/off signal
	C3	R_ENABLE	Repeat enable, output repeater signal of enable input, referred to V0 (see 7.5)	Output - on/off signal
	C4	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to V0 (see 7.6)	Output - on/off signal
D ⁽¹⁾	D1	LVDT_L	Main stage valve position transducer signal (see 7.7)	Input - analog signal
	D2	-15V	Main stage valve position transducer power supply -15V	Output power supply
	D3	+15V	Main stage valve position transducer power supply +15V	Output power supply
	D4	AGND	Common gnd for transducer power	Common gnd
E ⁽²⁾	E1	LVDT_T	Direct valve or pilot valve position transducer signal (see 7.7)	Input - analog signal
	E2	-15V	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	+15V	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	AGND	Common gnd for transducer power	Common gnd
F	F1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	F2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	F3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	F4	SOL_S2+	Positive current to solenoid S2	Output - power PWM

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N

(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section [1](#)). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.


7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin B1) for the valve's spool position. Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{dc} for standard and $4 \div 20$ mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 V_{dc} for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{dc} on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Repeat enable output signal (R_ENABLE)

Repeat enable (pin C3) is used as output repeater signal of enable input signal (see 7.4).

7.6 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 V_{dc}, normal working corresponds to 24 V_{dc}.

Fault status is not affected by the status of the Enable input signal.

7.7 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ± 15 V_{dc} supply output available at pin D2, D3 and pin E2, E3.

Note: transducer input signals working range is ± 10 V_{dc} for standard or $4 \div 20$ mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).


7.8 Possible combined options: /AC, /AI, /ACI


8 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

 **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

 **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/-NPQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

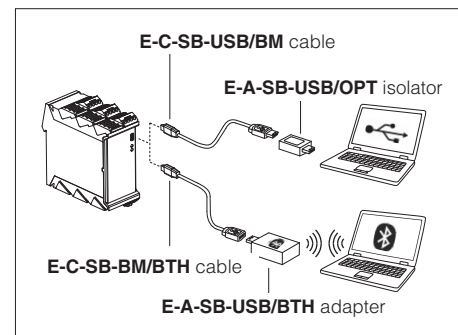
9 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

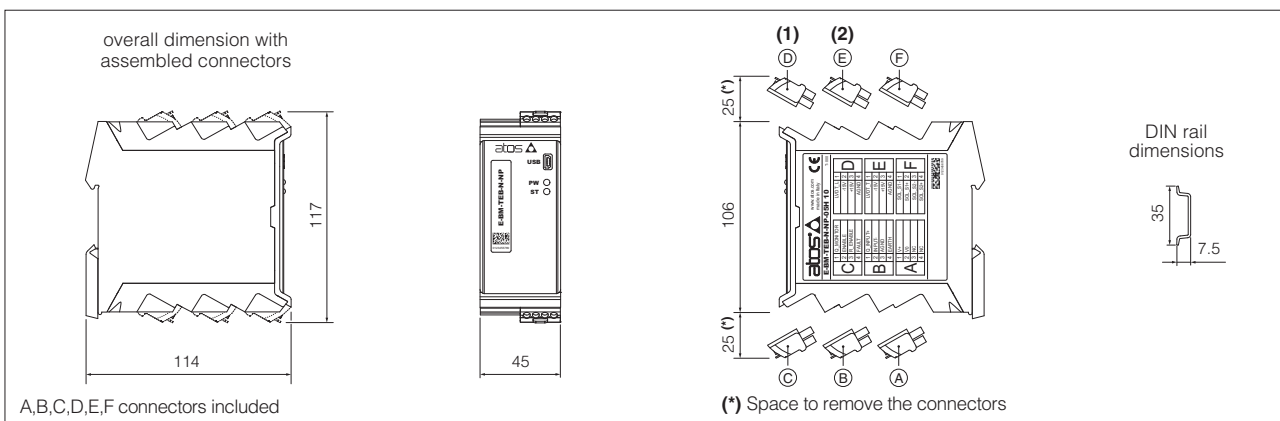
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LEB - user manual for **E-BM-TEB** and **E-BM-LEB** digital drivers

USB or Bluetooth connection



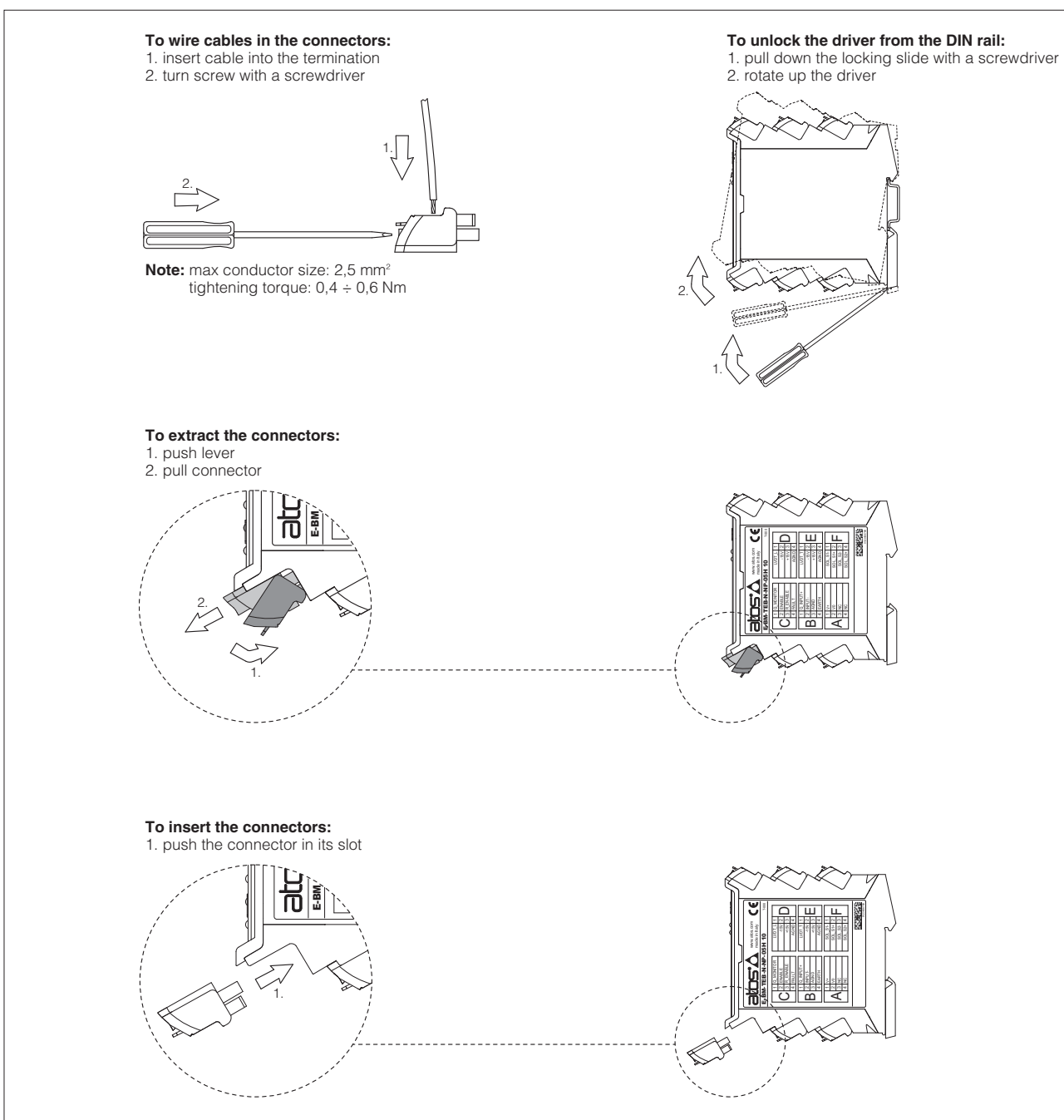
10 OVERALL DIMENSIONS [mm]



(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N

(2) E connector is available only for TEB-N versions 01H / 05H and LEB-N

11 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,C,D,E,F)

Digital E-BM-TID/LID drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

Scale

Bias

Linearization

Ramps

Enhanced Diagnostic

USB port

DVD E-SW-BASIC Programming Software

E-SW programming software

Connectors ② included

E-BM-TID/LID

Digital drivers ① control in closed loop the position of the spool or poppet of direct and pilot operated proportional valves, according to the electronic reference input signal.

TID execution controls direct operated directional/flow valves with one LVDT transducer.

LID execution controls pilot operated directional valves with two LVDT transducers.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 5 fast plug-in connectors ②
- Mini USB port ③ always present
- 2 leds for diagnostics ④ (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +60 \text{ }^\circ\text{C}$
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

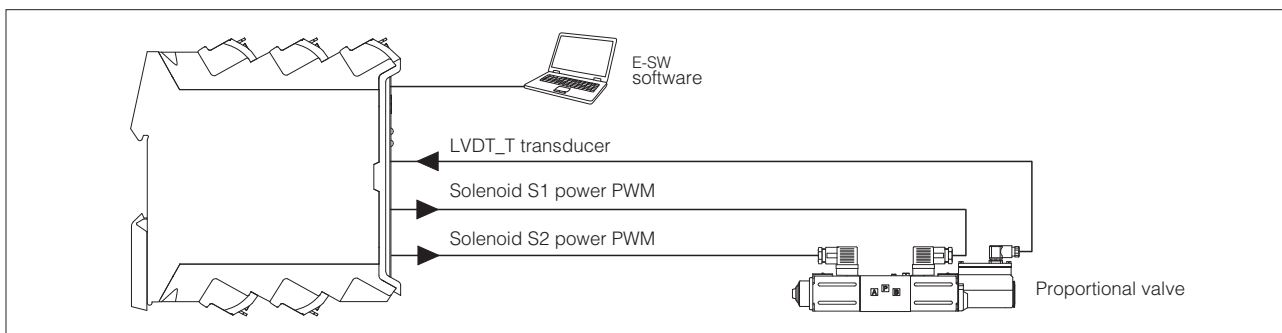
- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

E-BM	-	TID	-	N	-	NP	-	01H	/	*	/	*	/	*
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Off-board electronic driver in DIN rail format</p> <p>TID = digital basic driver, for valves with one LVDT transducer LID = digital basic driver, for valves with two LVDT transducers</p> <p>Alternated P/Q control: N = none</p> <p>Fieldbus interface, USB port always present: NP = Not Present</p> </div> <div style="width: 45%; border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Set code (see section 6)</p> <p style="text-align: center;">Series number</p> <p>Options, see section 5:</p> <p>A = max current limitation for Ex-proof valves C = current feedback $4 \div 20 \text{ mA}$ for LVDT transducers only in combination with option A I = current reference input and monitor $4 \div 20 \text{ mA}$ (omit for voltage reference and monitor input $\pm 10 \text{ VDC}$) (1)</p> <p>- = omit for direct valves and for pilot operated valves with two LVDT transducers P = for pilot operated valves with one LVDT transducer (only for TID)</p> <p>01H = for single solenoid proportional valves 05H = for double solenoid proportional valves (only for TID)</p> </div> </div>														

(1) No software selectable

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

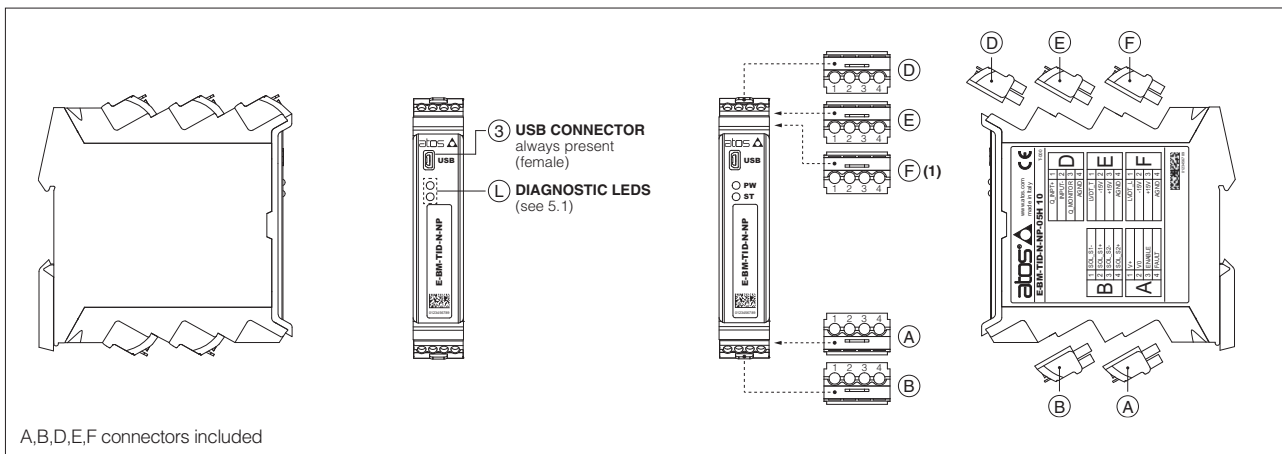
Valves	Directional			Flow	Directional	Cartridge
Industrial Tech table	DHZO-T, DKZOR-T F165, F168	DLHZO-T, DLKZOR-T F180	DPZO-T F172	QVHZO-T, QVKZOR-T F412	DPZO-L F175, F178	LIQZO-L, LIQZP-L F330, F340
Ex-proof Tech table	DHZA-T, DKZA-T FX120	DLHZA-T, DLKZA-T FX140	DPZA-T FX220	QVHZA-T, QVKZA-T FX420	-	LIQZA-L FX350, FX370
Driver model	E-BM-TID			E-BM-LID		

4 MAIN CHARACTERISTICS

Power supply (see 7.1)	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})
Max power consumption	50 W
Current supplied to solenoids	$I_{MAX} = 3.0$ A for standard driver $I_{MAX} = 2.5$ A for ex-proof driver (/A option)
Analog input signal (see 7.2)	Voltage: range ± 10 Vdc (24 V_{MAX} tollerant) Input impedance: $R_i > 50$ k Ω Current: range ± 20 mA Input impedance: $R_i = 500$ Ω
Monitor output (see 7.3)	Output range: voltage ± 10 Vdc @ max 5 mA current ± 20 mA @ max 500 Ω load resistance
Enable input (see 7.4)	Range: 0 \div 5 Vdc (OFF state), 9 \div 24 Vdc (ON state), 5 \div 9 Vdc (not accepted); Input impedance: $R_i > 10$ k Ω
Fault output (see 7.5)	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 \div +60 $^{\circ}C$ (storage -25 \div +85 $^{\circ}C$)
Mass	Approx. 300 g
Additional characteristics	2 leds for diagnostic; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding
Communication physical layer	USB 2.0 + USB OTG not insulated
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
Max conductor size (see 11)	2,5 mm ²

Note: a maximum time of 400 ms have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.


5 CONNECTIONS AND LEDS



(1) F connector is available only for LID

5.1 Diagnostic LEDs

Two leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LEDS	DESCRIPTION		
PW	OFF = Power supply OFF	ON = Power supply ON	
ST	OFF = Fault present	ON = No fault	

5.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNALS	TECHNICAL SPECIFICATIONS	NOTES
A	A1	V+	Power supply 24 Vdc (see 7.1)	Input - power supply
	A2	V0	Power supply 0 Vdc (see 7.1)	Gnd - power supply
	A3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the controller, referred to V0 (see 7.4)	Input - on/off signal
	A4	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to V0 (see 7.5)	Output - on/off signal
B	B1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	B2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	B3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	B4	SOL_S2+	Positive current to solenoid S2	Output - power PWM
D	D1	Q_INPUT+	Flow reference input signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option (see 7.2)	Input - analog signal
	D2	INPUT-	Negative reference input signal for Q_INPUT+	Input - analog signal
	D3	Q_MONITOR	Flow monitor output signal: ±10 VDC for standard and 4 ÷ 20 mA for /I option, referred to AGND (see 7.3)	Output - analog signal
	D4	AGND	Common gnd for monitor output	Common gnd
E	E1	LVDT_T	Direct valve or pilot valve position transducer signal (see 7.6)	Input - analog signal
	E2	-15V	Direct valve or pilot valve stage position transducer power supply -15V	Output power supply
	E3	+15V	Direct valve or pilot valve tage position transducer power supply +15V	Output power supply
	E4	AGND	Common gnd for transducer power	Common gnd
F ⁽¹⁾	F1	LVDT_L	Main stage valve position transducer signal (see 7.6)	Input - analog signal
	F2	-15V	Main stage valve position transducer power supply -15V	Output power supply
	F3	+15V	Main stage valve position transducer power supply +15V	Output power supply
	F4	AGND	Common gnd for transducer power	Common gnd

(1) F connector is available only for LID

6 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.


7 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

7.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

7.2 Flow reference input signal (Q_INPUT+)

The driver is designed to receive an analog reference input signal (pin D1) for the valve's spool position.

Standard (voltage reference input)

Default is ±10 Vdc and can be reconfigured via software, within a maximum range of ±10 Vdc.

Option /I (current reference input)

Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.3 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal (pin D3) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, valve spool position).

Standard (voltage monitor output)

Default is ±10 Vdc and can be reconfigured via software, within a maximum range of ±10 Vdc.

Option /I (current monitor output)

Default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 Vdc on pin A3: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

7.5 Fault output signal (FAULT)

Fault output signal (pin A4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.

Fault status is not affected by the status of the Enable input signal.

7.6 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin F1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the driver using ±15 Vdc supply output available at pin F2, F3 and pin E2, E3.

Note: transducer input signals working range is ±10 Vdc for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the driver set code).

7.7 Possible combined options: /AC, /AI, /ACI

8 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

 **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

 **WARNING:** see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

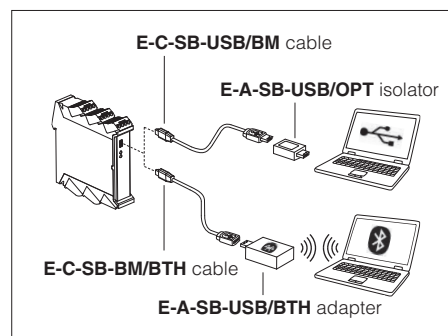
9 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **FS900**

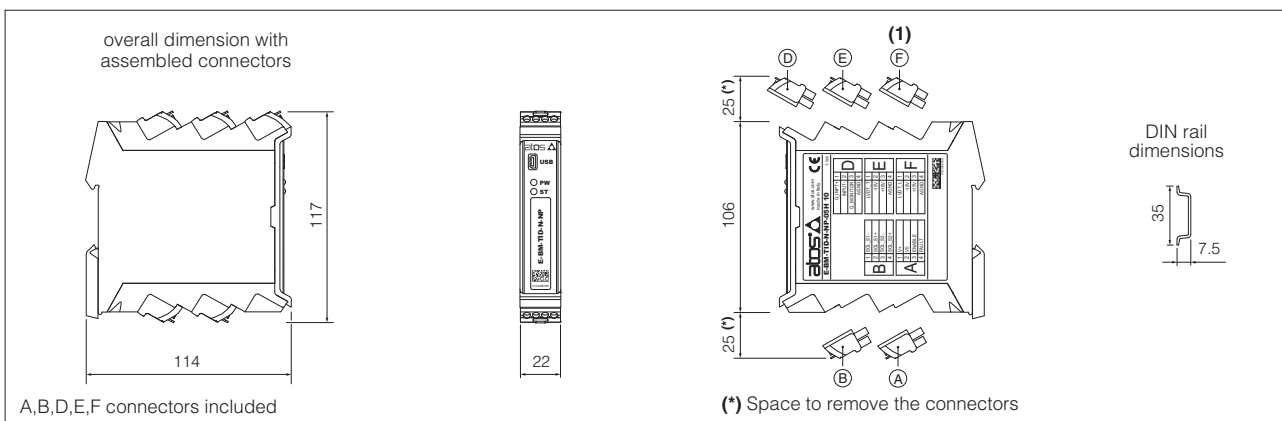
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-LID - user manual for **E-BM-TID** and **E-BM-LID** digital drivers

USB or Bluetooth connection

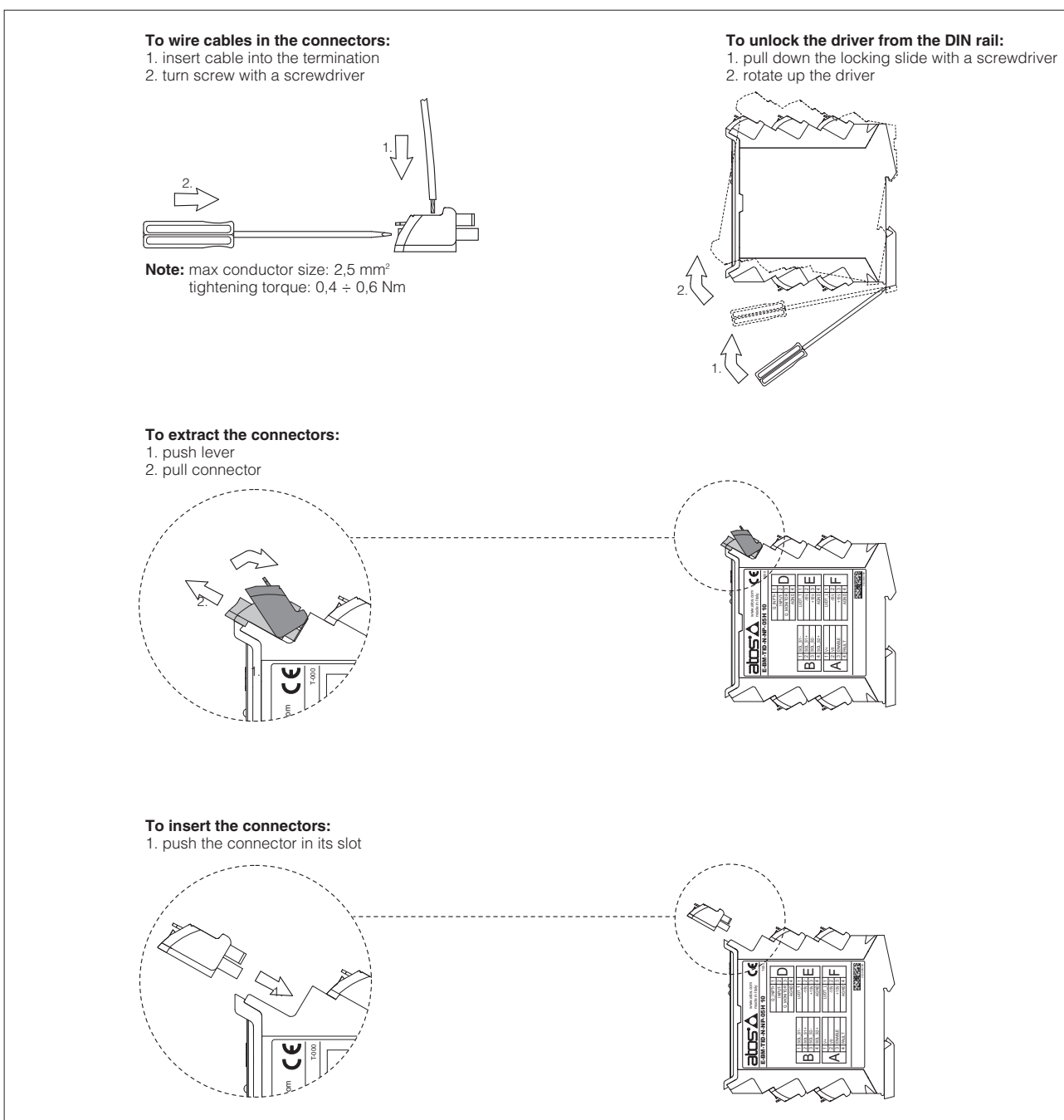


10 OVERALL DIMENSIONS [mm]



(1) F connector is available only for LID

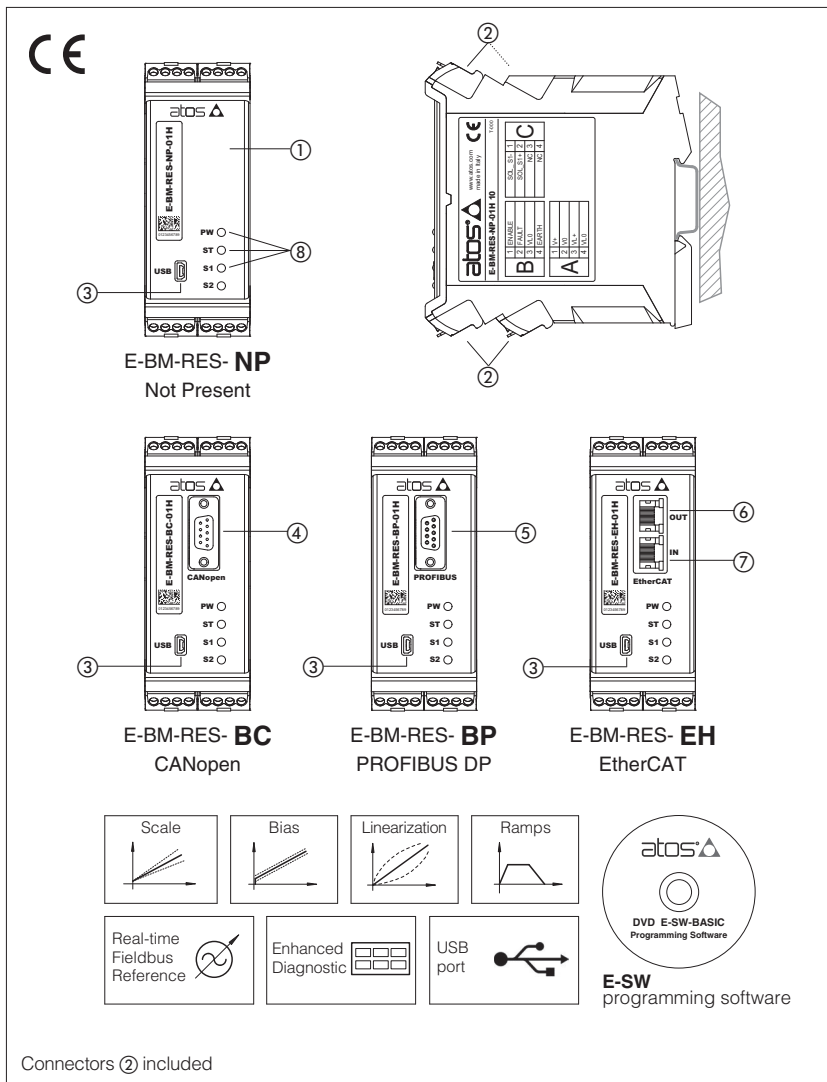
11 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (e.g. connector A can not be inserted into connector slot of B,D,E,F)

Digital electronic E-BM-RES drivers

DIN-rail format, for proportional valves with integral pressure transducer



E-BM-RES

Digital drivers ① control, in closed loop, the regulated pressure of direct and pilot operated proportional valves according to the electronic reference input signal. E-BM-RES operate direct and pilot operated relief/reducing control valves ZO-R with integral pressure transducer. Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 3 leds for diagnostics ⑧ (see 4.1)
- Pressure transducer input signal $4 \div 20$ mA
- ± 5 Vdc output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +60$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

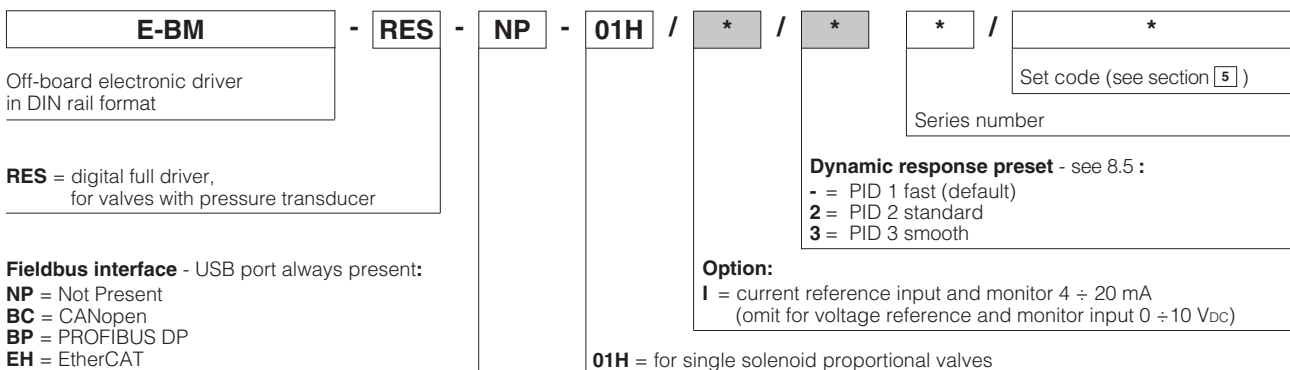
Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- 4 factory pre-set dynamic response setting to match different hydraulic conditions (see 8.5)
- Linearization function for hydraulic regulation
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE



2 VALVES RANGE

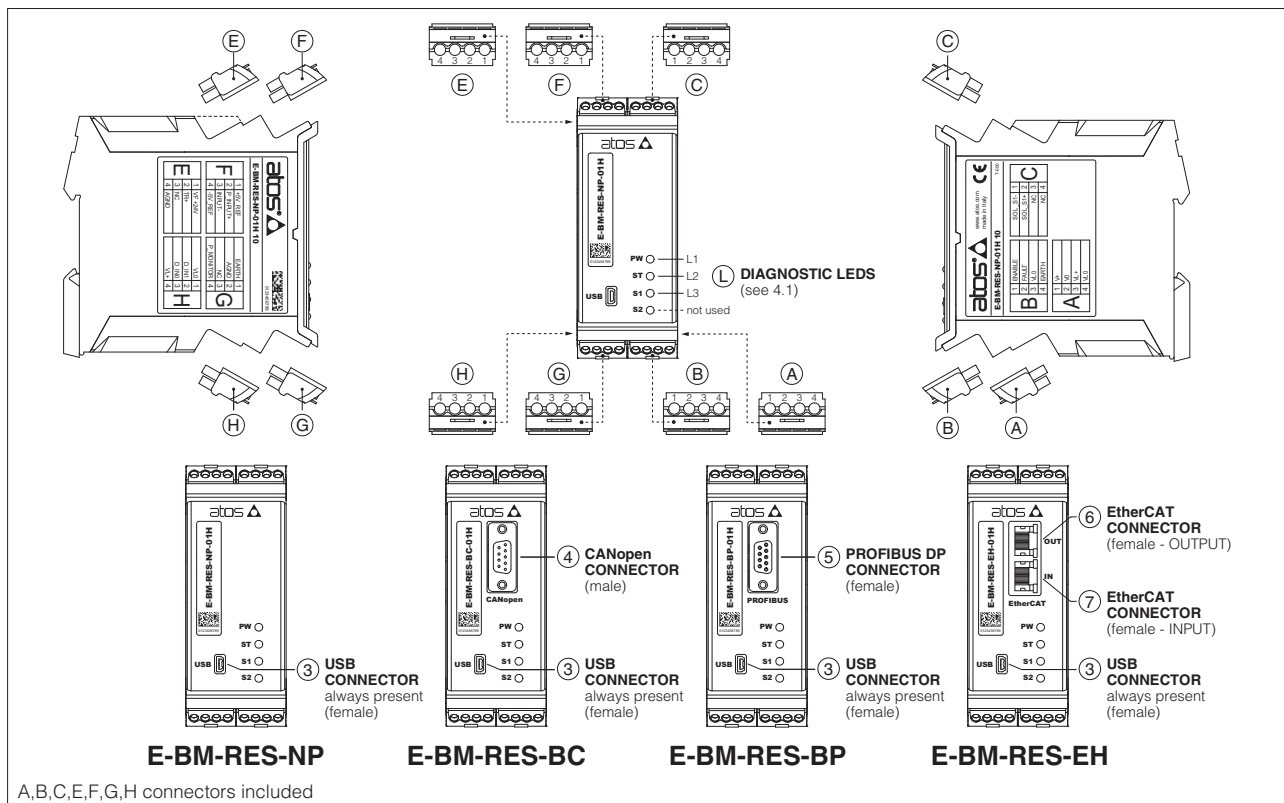
Valves model	Relief			Reducing			Compensator
	RZMO	AGMZO	LIMZO	RZGO	AGRCZO	LIRZO	LICZO
Tech table	FS010 FS067	FS040	FS305	FS020 FS075	FS055	FS305	FS305

3 MAIN CHARACTERISTICS

Power supply (see 6.1, 6.4)	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})			
Max power consumption	50 W			
Current supplied to solenoids	$I_{MAX} = 2.7 A$ with +24 Vdc power supply to drive standard proportional valves (3,2 Ω solenoid)			
Analog input signals (see 6.2)	Voltage: maximum range $\pm 10 Vdc$ Input impedance: $R_i > 50 k\Omega$ Current: maximum range $\pm 20 mA$ Input impedance: $R_i = 500 \Omega$			
Monitor output (see 6.3)	Voltage: maximum range $0 \div 10 Vdc$ @ max 5 mA Current: maximum range $0 \div 20 mA$ @ max 500 Ω load resistance			
Enable input (see 6.5)	Range : $0 \div 9 Vdc$ (OFF state), $15 \div 24 Vdc$ (ON state), $9 \div 15 Vdc$ (not accepted); Input impedance: $R_i > 87 k\Omega$			
Output supply (see 6.8)	$\pm 5 Vdc$ @ max 10 mA : output supply for external potentiometer			
Fault output (see 6.6)	Output range : $0 \div 24 Vdc$ (ON state $\equiv VL+$ [logic power supply] ; OFF state $\equiv 0 V$) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24Vdc @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure, alarms history storage function			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	$-20 \div +60 ^\circ C$ (storage $-25 \div +85 ^\circ C$)			
Mass	Approx. 330 g			
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/85/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP IEC50170-2/IEC61158	EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply and solenoids			
Max conductor size (see 10)	2,5 mm ²			

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

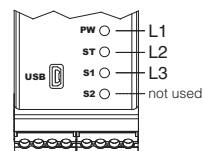
4 CONNECTIONS AND LEDS



4.1 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

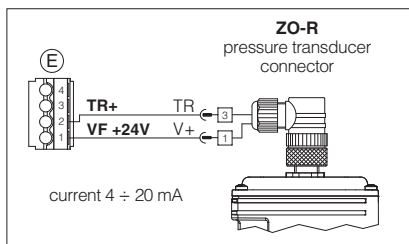
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3	YELLOW	S1	OFF	PWM command OFF
			ON	PWM command ON



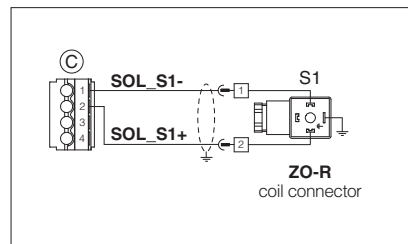
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	V+	Power supply 24 V _{DC} (see 6.1)	Input - power supply
	A2	V0	Power supply 0 V _{DC} (see 6.1)	Gnd - power supply
	A3	VL+	Power supply 24 V _{DC} for driver's logic and communication (see 6.4)	Input - power supply
	A4	VL0	Power supply 0 V _{DC} for driver's logic and communication (see 6.4)	Gnd - power supply
B	B1	ENABLE	Enable (24 V _{DC}) or disable (0 V _{DC}) the driver, referred to VL0 (see 6.5)	Input - on/off signal
	B2	FAULT	Fault (0 V _{DC}) or normal working (24 V _{DC}), referred to VL0 (see 6.6)	Output - on/off signal
	B3	VL0	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	EARTH	Connect to system ground	
C	C1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	C2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	C3	NC	Do not connect	
	C4	NC	Do not connect	
E	E1	VF +24V	Power supply +24 V _{DC}	Output - power supply
	E2	TR+	Positive pressure transducer input signal: ±20 mA maximum range (see 6.7) Default is 4 ÷ 20 mA	Input - analog signal Software selectable
	E3	NC	Do not connect	
	E4	AGND	Common GND for transducer power, signals and external potentiometer	
F	F1	+5V_REF	External potentiometer power supply +5 V _{DC} @ 10mA (see 6.8)	Output - power supply
	F2	P_INPUT+	Positive pressure reference input signal: ±10 V _{DC} / ±20 mA maximum range (see 6.2) Defaults are 0 ÷ 10 V _{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal Software selectable
	F3	INPUT-	Negative pressure reference input signal for P_INPUT+	Input - analog signal
	F4	-5V_REF	External potentiometer power supply -5 V _{DC} @ 10mA (see 6.8)	Output - power supply
G	G1	EARTH	Connect to system ground	
	G2	AGND	Analog ground for P_MONITOR and external potentiometer	Gnd - analog signal
	G3	NC	Do not connect	
	G4	P_MONITOR	Pressure monitor output signal: 0 ÷ 10 V _{DC} / 0 ÷ 20 mA maximum range (see 6.3) Default are 0 ÷ 10 V _{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal Software selectable
H	H1	VL0	Power supply 0 V _{DC} for digital input (see 6.4)	Gnd - power supply
	H2	D_IN1	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H3	D_IN0	Pressure PID selection, referred to VL0 (see 6.9)	Input - on/off signal
	H4	VL+	Power supply 24 V _{DC} for digital input (see 6.4)	Output - power supply

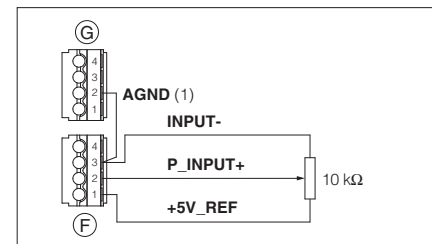
Pressure transducer connection



Coil connection



Potentiometer connection



(1) As alternative the AGND on pin E4 can be used

4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ USB connector - Mini USB type B always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	D-	Data line -
3	D+	Data line +
4	ID	Identification
5	GND_USB	Signal zero data line

⑤ BP fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	SHIELD	
3	LINE-B	Bus line (low)
5	DGND	Data line and termination signal zero
6	+5V	Termination supply signal
8	LINE-A	Bus line (high)

④ BC fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	CAN_L	Bus line (low)
3	CAN_GND	Signal zero data line
5	CAN_SHLD	Shield
7	CAN_H	Bus line (high)

⑥ ⑦ EH fieldbus execution, connector - RJ45 - 8 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter - white/orange
2	RX+	Receiver - white/green
3	TX-	Transmitter - orange
6	RX-	Receiver - green

(1) shield connection on connector's housing is recommended

5 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve **ZO-R** to be coupled. These pre-calibrations are identified by the set code at the end of driver's model code (see section 1). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve **ZO-R**. For further information about set code, please contact Atos technical office.

6 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software. Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

6.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of double power supply see 6.4.
A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

6.2 Pressure reference input signal (P_INPUT+)

The driver controls in closed loop the current to the valve pressure proportionally to the external reference input signal. Reference input signal is factory preset according to selected valve code, defaults are 0 \div 10 V_{DC} for standard and 4 \div 20 mA for /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of \pm 10 V_{DC} or \pm 20 mA. Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly by the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 \div 24V_{DC}.

6.3 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to the actual pressure of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference). Monitor output signal is factory preset according to selected valve code, defaults settings are 0 \div 10 V_{DC} for standard and 4 \div 20 mA for /I option. Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of 0 \div 10 V_{DC} or 0 \div 20 mA.

6.4 Power supply for driver's logic and communication (VL+ and VLO)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.
A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

6.5 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{DC} on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

6.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 \div 20 mA input, etc.). Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}.
Fault status is not affected by the Enable input signal.

6.7 Pressure transducer integrated to the valve, input signal (TR+)

Analog pressure transducer integrated to the valve, has to be directly connected to the driver. Analog input signal is factory preset according to selected driver code, default is 4 \div 20 mA. Input signal can be reconfigured via software, within a maximum range of \pm 20 mA.

6.8 Output supply for external potentiometer (\pm 5V_REF) - not available for EH version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the \pm 5 V_{DC} supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at 0 \div 5 V_{DC} (default 0 \div 10 V_{DC}, see 6.2)

6.9 PID selection (D_IN0 and D_IN1)

Two on-off input signals are available on the pin H2 and H3 to select one of the four pressure PID parameters setting, stored into the driver. Supply a 24 V_{DC} or a 0 V_{DC} on pin H2 and/or pin H3, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software. Refer to dynamic response for function description (see 8.5).

PID SET SELECTION				
PIN	SET 1	SET 2	SET 3	SET 4
H2	0	24 V _{DC}	0	24 V _{DC}
H3	0	0	24 V _{DC}	24 V _{DC}

7 PROGRAMMING TOOLS - see tech table GS500

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com; service and DVD not included
 Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

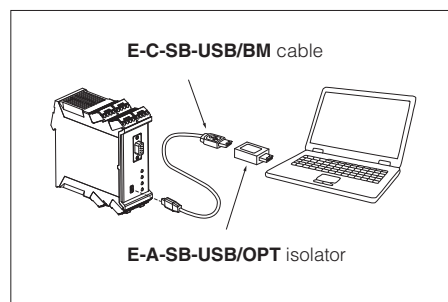
E-SW-*PQ DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
 Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*-N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
 Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

USB connection



8 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

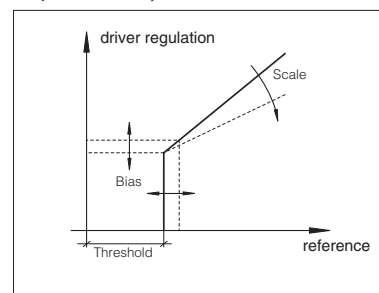
E-MAN-BM-RES - user manual for **E-BM-RES**

8.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max pressure valve regulation, at maximum reference value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the pressure proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

8.1, 8.2 - Scale, Bias & Threshold



8.2 Bias and Threshold

Pressure proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the pressure valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).

The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current to the specific pressure proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If fieldbus reference signal is active (see 6.2), threshold should be set to zero.

Refer to the programming manuals for a detailed description of other software selectable Bias functions.

8.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

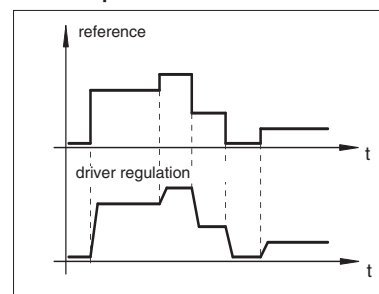
Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the pressure proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

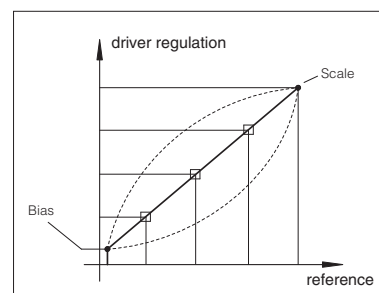
8.3 - Ramps



8.4 Linearization - E-SW level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's pressure regulation. Linearization is useful for applications where it is required to linearize the valve's pressure regulation in a defined working condition.

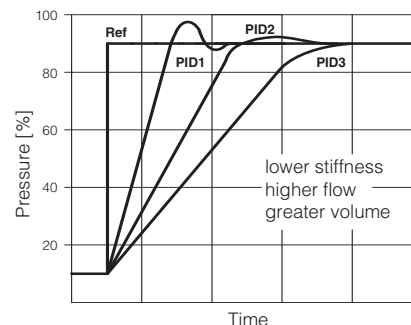
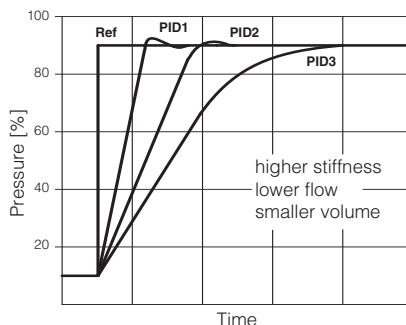
8.4 - Linearization



8.5 Dynamic response – 4 pressure PIDs

The valve is provided with 4 PIDs configurations to match different hydraulic conditions. The required PID configuration can be selected in real time through digital inputs (see 6.9). Only for BC, BP, EH execution, the PID can be also selected in real time through PLC via fieldbus.

PID	Dynamic response example diagrams at side
1	Fast (default) interchangeable with TERS version
2	Standard
3	Smooth
4	Open Loop



Above indications have to be considered as a general guideline, being affected by hydraulic circuit stiffness, working flow and dead volume. The valve's dynamics can be further optimized on the specific application, customizing PIDs parameters.

In case of pressure instability, select PID4 to operate the valve in open loop.

If the instability still persists, check eventual anomalies in the hydraulic circuit as the presence of air.

If the instability disappears, select an alternative configuration within PID selection 1, 2 or 3 which better matches the application requirements.

If no one of the above selection fulfills the application, tune P - I - D parameters at E-SW software level 2 to obtain the desired dynamic response.

8.6 Pressure transducer failure

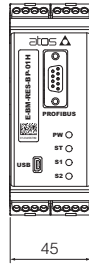
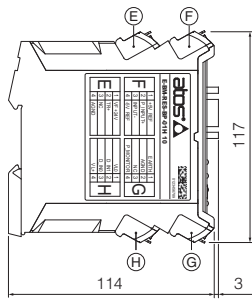
This function is available only for pressure transducer input configured in current as $4 \div 20$ mA.

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

9 OVERALL DIMENSIONS [mm]

overall dimension with assembled connectors



DIN rail dimensions



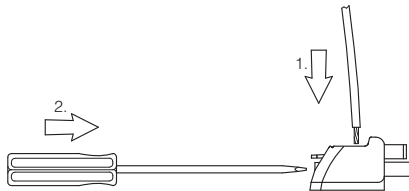
A, B, C, E, F, G, H connectors included

(*) Space to remove the connectors

10 INSTALLATION

To wire cables in the connectors:

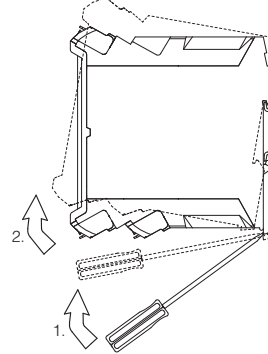
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ± 0,6 Nm

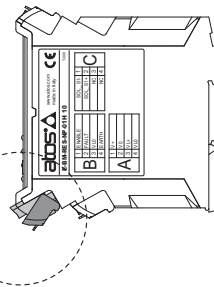
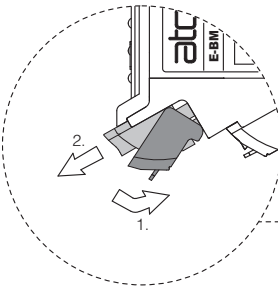
To unlock the driver from the DIN rail:

1. pull down the locking slide with a screwdriver
2. rotate up the driver



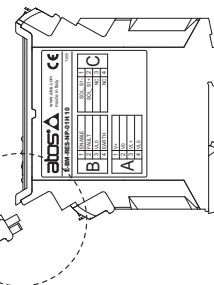
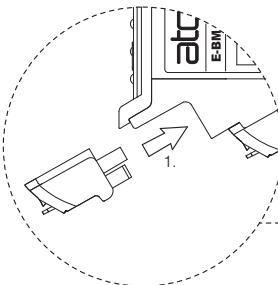
To extract the connectors:

1. push lever
2. pull connector



To insert the connectors:

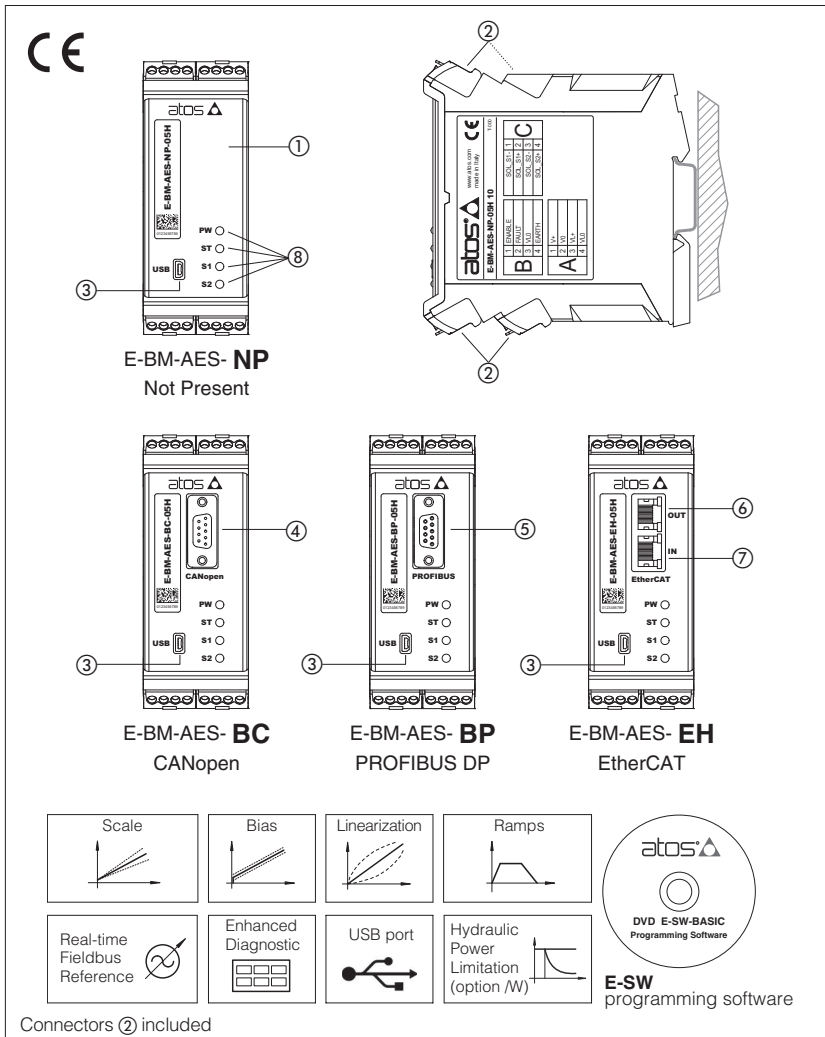
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AES drivers

DIN-rail format, for proportional valves without transducer



E-BM-AES

Digital drivers ① control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.

E-BM-AES operate direct and pilot operated proportional valves ZO-A without transducer.

Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:

- 7 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 CANopen ④ and PROFIBUS DP ⑤ communication connector
- RJ45 EtherCAT communication connectors ⑥ output and ⑦ input
- 4 leds for diagnostics ⑧ (see 4.1)
- ± 5 V_{dc} output supply for external reference potentiometer
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +60$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

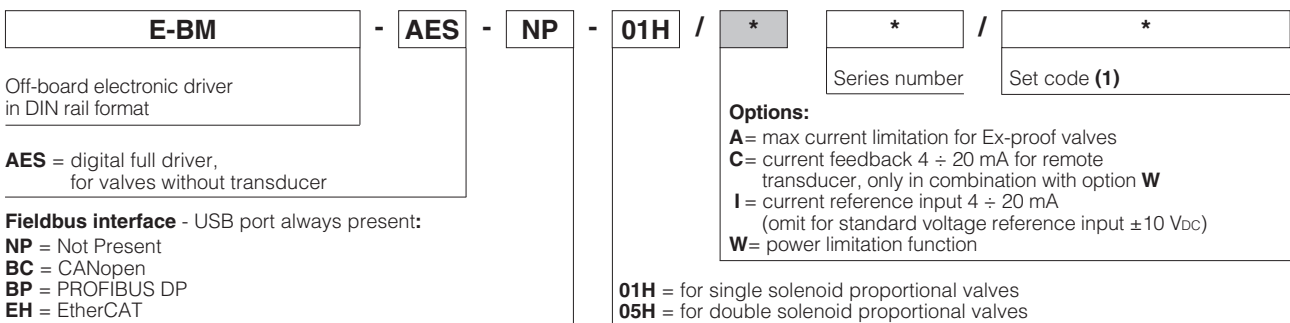
Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither, PID gains
- Linearization function for hydraulic regulation
- *W* option max power limitation function
- Complete diagnostics of driver status
- Internal oscilloscope function
- In field firmware update through USB port

Fieldbus Features:

- Valve direct communication with machine control unit for digital reference, diagnostics and settings
- Fieldbus execution allow to operate the valves via fieldbus or via analog signals available on the connectors (see 4.2)

1 MODEL CODE



(1) set code identifies the correspondence between the driver and the relevant valve

2 VALVES RANGE

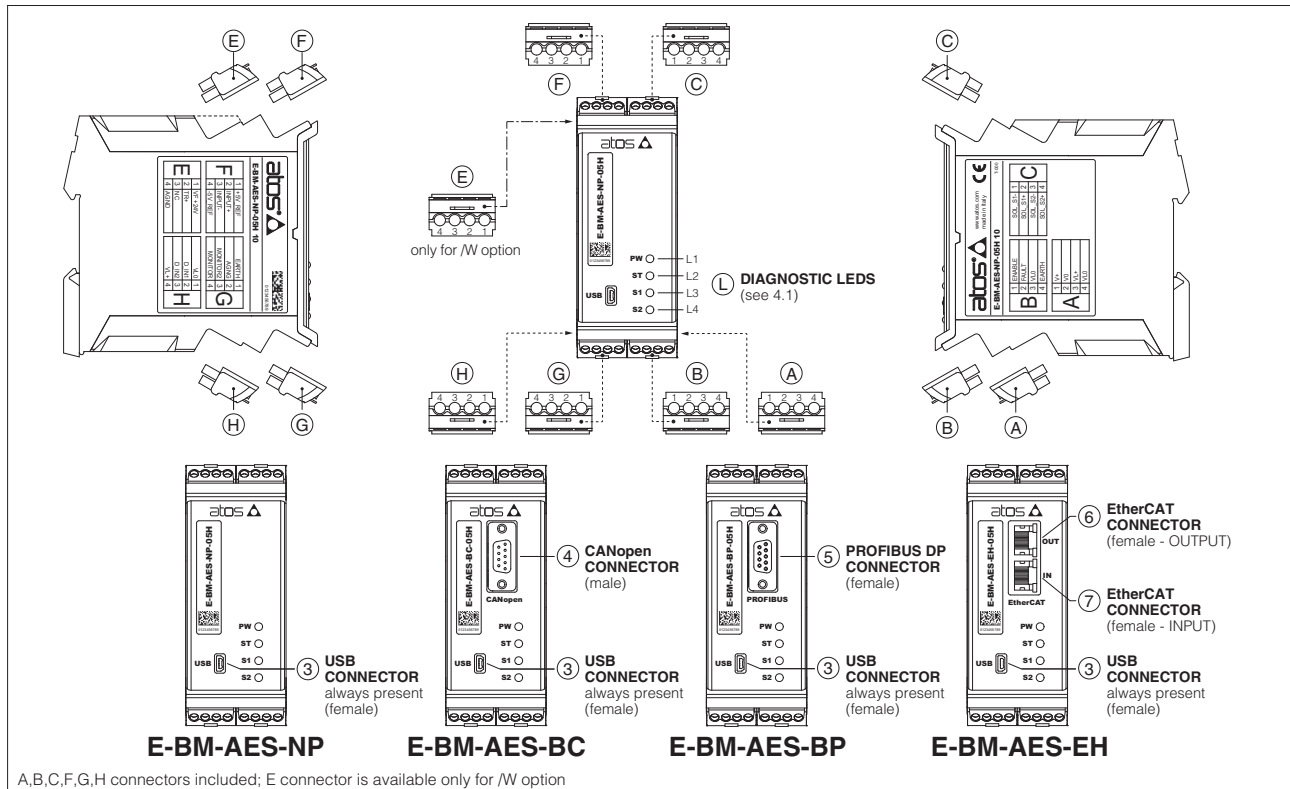
Valves	Pressure										Directional			Cartridge	Flow
Industrial	RZMO	RZME	RZGO	RZGE	AGMZO	AGMZE	AGRCZO	DHRZO	DHRZE	DHZO	DHZE	DPZO	LI*ZO	QVHZO	
Tech table	FS007, FS065	F005	FS015, FS070	CART RZGE F012	FS035	F030	FS050	FS025	F022	FS160	F150	FS170	FS300	FS410	
Ex-proof	RZMA	-	RZGA	-	AGMZA	-	AGRCZA	DHRZA	-	DHZA	-	DPZA	LI*ZA	QVHZA	
Tech table	FX010	-	HZGA, KZGA FX040	-	FX010	-	FX040	FX070	-	FX100	-	FX200	FX300	FX400	

3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{PP})
Max power consumption	50 W
Current supplied to solenoids	$I_{MAX} = 2.7 A$ with +24 Vdc power supply to drive standard proportional valves (3,2 Ω solenoid) $I_{MAX} = 2.5 A$ with +24 Vdc power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for /A option
Analog input signals (see 5.3)	Voltage: maximum range $\pm 10 Vdc$ Input impedance: $R_i > 50 k\Omega$ Current: maximum range $\pm 20 mA$ Input impedance: $R_i = 500 \Omega$
Monitor output (see 5.4)	Voltage: maximum range $\pm 5 Vdc$ @ max 5 mA
Enable input (see 5.5)	Range : 0 \div 9 Vdc (OFF state), 15 \div 24 Vdc (ON state), 9 \div 15 Vdc (not accepted); Input impedance: $R_i > 87 k\Omega$
Output supply (see 5.8)	$\pm 5 Vdc$ @ max 10 mA : output supply for external potentiometer
Fault output (see 5.6)	Output range : 0 \div 24 Vdc (ON state $\cong V_{L+}$ [logic power supply] ; OFF state $\cong 0 V$) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
Pressure transducer power supply (only for /W option)	+24Vdc @ max 100 mA (E-ATR-8 see tech table GS465)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715
Operating temperature	-20 \div +60 °C (storage -25 \div +85 °C)
Mass	Approx. 330 g
Additional characteristics	Short circuit protection of solenoid current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	USB Atos ASCII coding CANopen EN50325-4 + DS408 PROFIBUS DP EN50170-2/IEC61158 EtherCAT IEC61158
Communication physical layer	not insulated USB 2.0 + USB OTG optical insulated CAN ISO11898 optical insulated RS485 Fast Ethernet 100 Base TX
Recommended wiring cable	LIYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply and solenoids
Max conductor size (see 9)	2,5 mm ²

Note: a maximum time of 500 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

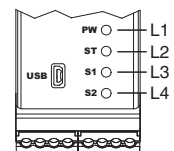
4 CONNECTIONS AND LEDS



4.1 Diagnostic LEDs (L)

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

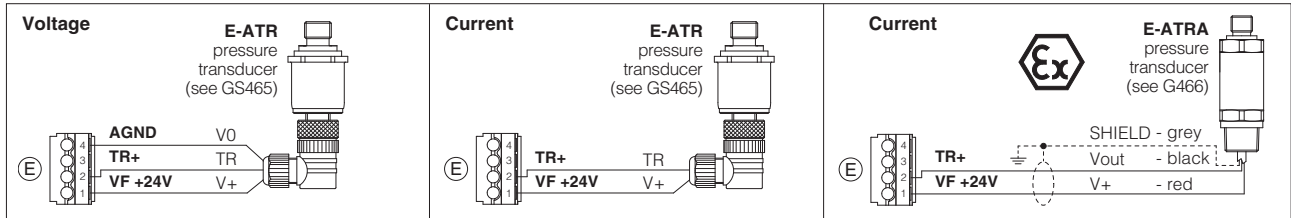
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON



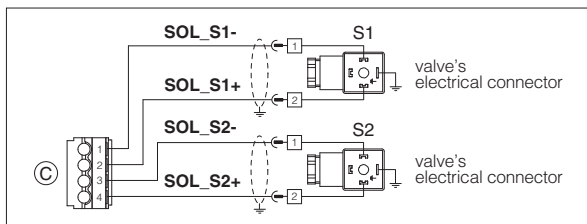
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	V+	Power supply 24 Vdc (see 5.1)	Input - power supply
	A2	V0	Power supply 0 Vdc (see 5.1)	Gnd - power supply
	A3	VL+	Power supply 24 Vdc for driver's logic and communication (see 5.2)	Input - power supply
	A4	VLO	Power supply 0 Vdc for driver's logic and communication (see 5.2)	Gnd - power supply
B	B1	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver, referred to VLO (see 5.5)	Input - on/off signal
	B2	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VLO (see 5.6)	Output - on/off signal
	B3	VLO	Ground for ENABLE and FAULT	Gnd - digital signals
	B4	EARTH	Connect to system ground	
C	C1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	C2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	C3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	C4	SOL_S2+	Positive current to solenoid S2	Output - power PWM
E available only for /W option	E1	VF +24V	Power supply +24 Vdc	Output - power supply
	E2	TR+	Positive pressure transducer input signal: ± 10 Vdc / ± 20 mA maximum range (see 5.7) Default are 0 \div 10 Vdc for standard and 4 \div 20 mA for /C option	Input - analog signal Software selectable
	E3	NC	Do not connect	
	E4	AGND	Common GND for transducer power, signals and external potentiometer	
F	F1	+5V_REF	External potentiometer power supply +5 Vdc @ 10mA (see 5.8)	Output - power supply
	F2	INPUT+	Positive reference input signal: ± 10 Vdc / ± 20 mA maximum range (see 5.3) Default are ± 10 Vdc for standard and 4 \div 20 mA for /I option	Input - analog signal Software selectable
	F3	INPUT-	Negative reference input signal for INPUT+	Input - analog signal
	F4	-5V_REF	External potentiometer power supply -5 Vdc @ 10mA (see 5.8)	Output - power supply
G	G1	EARTH	Connect to system ground	
	G2	AGND	Analog ground for MONITOR and external potentiometer	Gnd - analog signal
	G3	MONITOR2	Only for /W option, 2nd monitor output signal: ± 5 Vdc maximum range (see 5.4) Default is 0 \div 5 Vdc	Output - analog signal Software selectable
	G4	MONITOR	Monitor output signal: ± 5 Vdc maximum range (see 5.4) Default is ± 5 Vdc (1V = 1A)	Output - analog signal Software selectable
H	H1	VLO	Power supply 0 Vdc for digital input (see 5.2)	Gnd - power supply
	H2	D_IN1	Digital input 0 \div 24Vdc, referred to VLO	Input - on/off signal
	H3	D_IN0	Digital input 0 \div 24Vdc, referred to VLO	Input - on/off signal
	H4	VL+	Power supply 24 Vdc for digital input (see 5.2)	Output - power supply

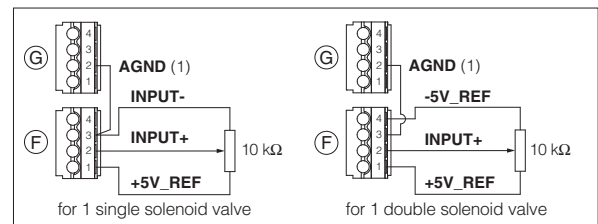
Pressure transducer connections - only for /W option



Coils connection



Potentiometer connection



4.3 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ USB connector - Mini USB type B always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	D-	Data line -
3	D+	Data line +
4	ID	Identification
5	GND_USB	Signal zero data line

⑤ BP fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	SHIELD	
3	LINE-B	Bus line (low)
5	DGND	Data line and termination signal zero
6	+5V	Termination supply signal
8	LINE-A	Bus line (high)

④ BC fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	CAN_L	Bus line (low)
3	CAN_GND	Signal zero data line
5	CAN_SHLD	Shield
7	CAN_H	Bus line (high)

⑥ ⑦ EH fieldbus execution, connector - RJ45 - 8 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter - white/orange
2	RX+	Receiver - white/green
3	TX-	Transmitter - orange
6	RX-	Receiver - green

(1) shield connection on connector's housing is recommended


5 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital drivers are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

5.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.
In case of double power supply see 5.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

5.2 Power supply for driver's logic and communication (VL+ and VL0)

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin A3 and A4, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

5.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 V_{dc} for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA.

Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range $0 \div 24$ V_{dc}.

5.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).

Monitor output signal is factory preset according to selected valve code, default settings is ± 5 V_{dc} (1V = 1A).

Output signal can be reconfigured via software, within a maximum range of ± 5 V_{dc}.

Option /W

The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.

The output maximum range is ± 5 V_{dc}; default setting is $0 \div 5$ V_{dc}.

5.5 Enable input signal (ENABLE)

To enable the driver, supply 24 V_{dc} on pin B1: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

5.6 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for $4 \div 20$ mA input, etc.).

Fault presence corresponds to 0 V_{dc}, normal working corresponds to 24 V_{dc}.

Fault status is not affected by the Enable input signal.

5.7 Remote pressure transducer input signal (TR+) - only for /W option

Analog pressure transducers can be directly connected to the driver.

Analog input signal is factory preset according to selected driver code, defaults are $0 \div 10$ V_{dc} for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA.

Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

5.8 Output supply for external potentiometer (± 5 V_REF) - not available for EH version

The reference analog signal can be generated by one external potentiometer directly connected to the driver, using the ± 5 V_{dc} supply output available at pin F1 and F4.

Note: using an external potentiometer, the reference input signal must be set via software at ± 5 V_{dc} (default ± 10 V_{dc}, see 5.3)

5.9 Possible combined options: /AI, /AW, /IW, /AIW, /ACW, /CIW, /ACIW, /CW

6 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**).

For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC	support: NP (USB)	PS (Serial)	IR (Infrared)
E-SW-FIELDBUS	support: BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)
E-SW-*/PQ	support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)		

 **WARNING: drivers USB port is not isolated!** For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

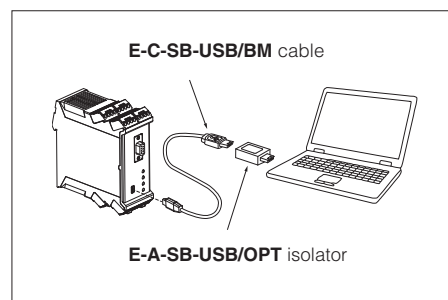
E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

USB connection



7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AES - user manual for **E-BM-AES**

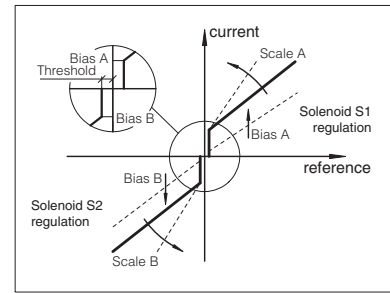
7.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

Two different Scale regulations are available for double solenoid valves: ScaleA for positive reference signal and ScaleB for negative reference signal.

7.1, 7.2 - Scale, Bias & Threshold



7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (analog or fieldbus external input).

The Bias function is activated when the reference signal overcomes the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current to the specific proportional valve to which the driver is coupled.

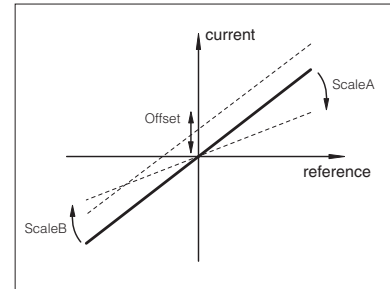
The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If fieldbus reference signal is active (see 5.3), threshold should be set to zero.

Two different Bias regulations are available for double solenoid valves: positive reference signals activate BiasA and negative reference signals activate BiasB.

Refer to the programming manuals for a detailed description of other software selectable Bias functions.

7.3 - Offset



7.3 Offset

Proportional valves may be provided with zero overlapping in the hydraulic regulation corresponding to zero reference input signal (valve's central spool position).

The Offset function allows to calibrate the Offset current, required to obtain valve's spool central position, to the specific hydraulic system setup (e.g. valve applied to cylinder with differential areas).

7.4 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

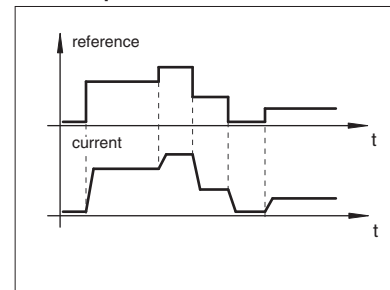
Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

7.4 - Ramps

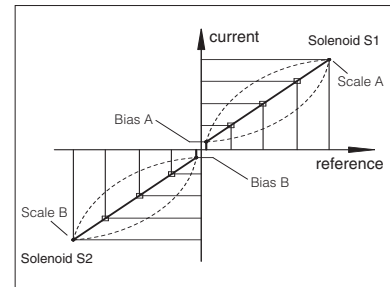


7.5 Linearization - E-SW level 2 functionality

Linearization function allows to set the relation between the reference input signal and the controlled valve's regulation.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition.

7.5 - Linearization



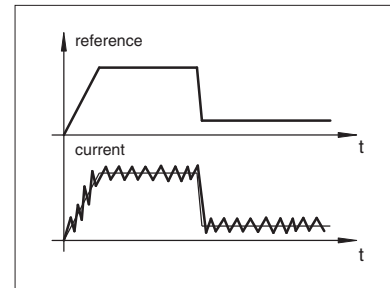
7.6 Variable Dither

The dither is the frequency modulation of the current supplied to the solenoid. To reduce the hysteresis should be selected a lower value of frequency, despite a lower regulation stability, because a small vibration in the valve regulating parts considerably reduces static friction effects.

To improve the regulation stability, should be selected a high value of frequency, despite a higher hysteresis. This solution in some application can lead to vibration and noise. Normally, the right setting is a compromise and depends on system setup.

E-BM-AES drivers allow to realize a variable dither frequency that linearly depends on the demanded current: variable dither frequency allows an higher degree to optimize the valve hysteresis.

7.6 - Variable Dither



7.7 Hydraulic Power Limitation - only for /W option

Digital E-BM-AES drivers with /W option electronically perform hydraulic power limitation on:

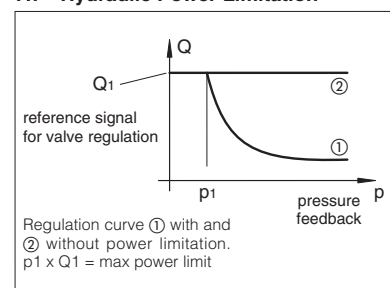
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech table A170)

The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).

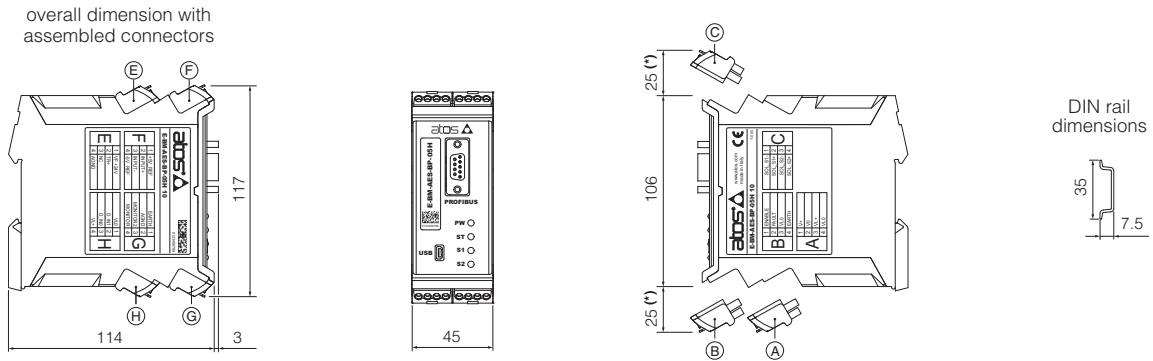
When the actual requested hydraulic power $p \times Q$ ($TR \times INPUT+$) reaches the max power limit ($p1 \times Q1$), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} ; \text{Flow Reference [INPUT+]} \right)$$

7.7 - Hydraulic Power Limitation



8 OVERALL DIMENSIONS [mm]



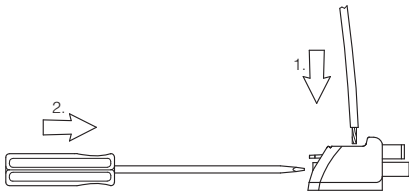
A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

9 INSTALLATION

To wire cables in the connectors:

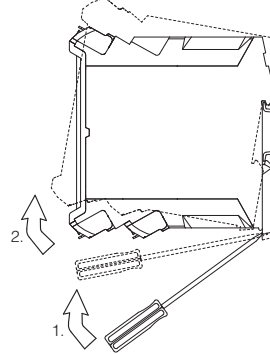
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

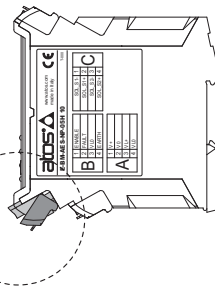
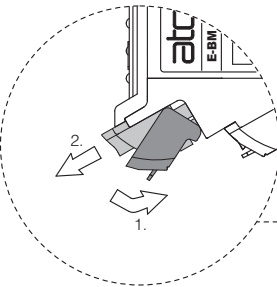
To unlock the driver from the DIN rail:

1. pull down the locking slide with a screwdriver
2. rotate up the driver



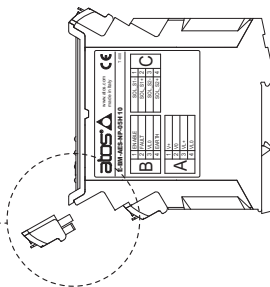
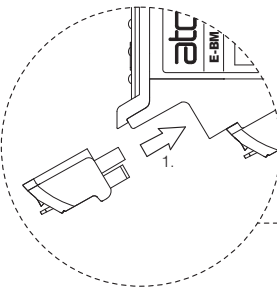
To extract the connectors:

1. push lever
2. pull connector



To insert the connectors:

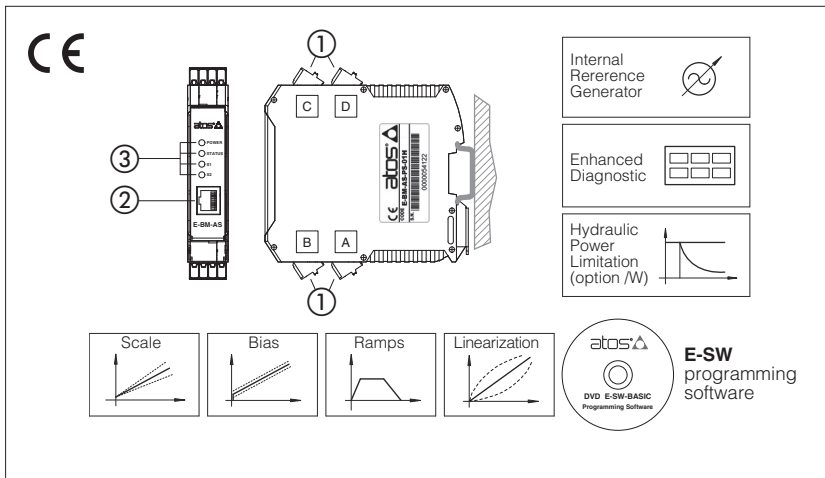
1. push the connector in its slot



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B, C, E, F, G, H)

Digital electronic E-BM-AS drivers

DIN-rail format, for proportional valves without transducer



1 MODEL CODE

E-BM	-	AS	-	PS	-	01H	/	*		*
-------------	---	-----------	---	-----------	---	------------	---	---	--	---

Off-board electronic driver in DIN rail format

AS = digital basic driver, for valves without transducer

PS = Serial communication interface

01H = for single solenoid proportional valves
05H = for double solenoid or two single solenoid proportional valves

Options:

- = standard 24 Vdc power supply
- 12 = 12 Vdc power supply
- A = max current limitation for ex-proof valves
- C = current feedback 4 ± 20 mA for remote transducer, only for **IW**
- I = current reference input 4 ± 20 mA (omit for standard voltage reference input ± 10 Vdc)
- P = electrical supply for external potentiometers to generate reference signal, not available with I option (see 4.4)
- W = power limitation function, only for **05H** (see 7.7)

E-BM-AS

Digital drivers control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal.

The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation.

E-BM-AS can drive up to two single or one double solenoid proportional valves.

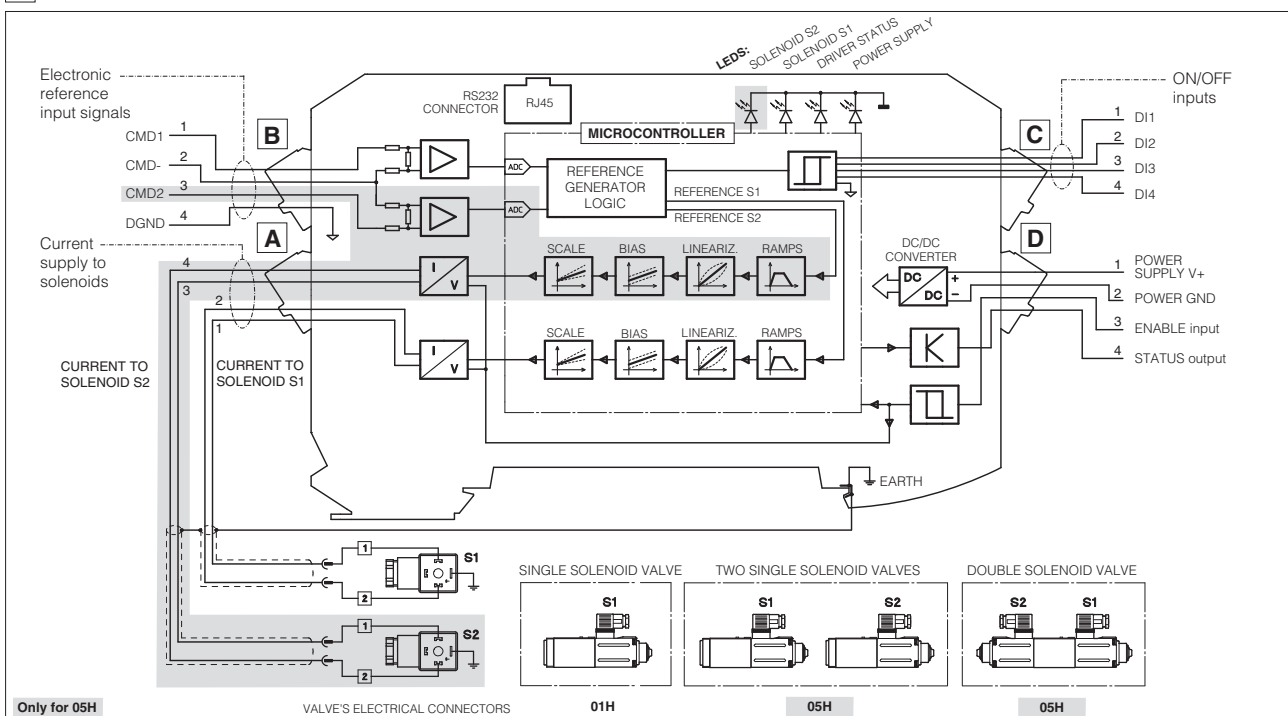
Electrical Features:

- 4 fast plug-in connectors ①
- RJ45 connector ② for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics ③ (see section 10)
- ± 5 Vdc output supply for external reference potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \pm +60$ °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:

- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function
- Complete diagnostics of driver status

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Standard Nominal: +24 Vdc Rectified and filtered: $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP) option /12 Nominal: +12 VDC Rectified and filtered: $V_{RMS} = 10 \div 14 V_{MAX}$ (ripple max 10 % VPP)
Max power consumption	50 W 01H single solenoid valve and 05H double solenoid valve 100 W 05H two single solenoid valves
Current supplied to solenoids	$I_{MAX} = 2.7 A$ with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) $I_{MAX} = 3.3 A$ with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) $I_{MAX} = 2.5 A$ with +24 VDC power supply for ex-proof proportional valves (3,2 Ω solenoid) for /A option
Analog input signal (see 4.2)	Voltage: range $\pm 10 Vdc$ Input impedance: $R_i > 50 k\Omega$ Current: range $\pm 20 mA$ Input impedance: $R_i = 500 \Omega$
Enable and optical insulated ON/OFF inputs (see 4.5, 4.7)	Range : $0 \div 24 Vdc$ (OFF state: $0 \div 5 Vdc$; ON state: $9 \div 24 Vdc$) Input impedance: $R_i > 10 k\Omega$
Output supply (see 4.4)	$\pm 5 Vdc$ @ max 10 mA : output supply for external potentiometers (only for /P option)
Status output (see 4.6)	Output range : $0 \div 24 Vdc$ (ON state $> [power\ supply - 2 V]$; OFF state $< 1 V$) @ max 1,4 A
Alarms	Solenoid not connected, short circuit and cable break with current reference signal
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm rail mounting as per EN60715
Operating temperature	$-20 \div +60 ^\circ C$ ($-20 \div +40 ^\circ C$ for 05H version if drive two single solenoid proportional valves; storage $-25 \div +85 ^\circ C$)
Mass	130 g
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Communication interface	RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 9)
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² for length up to 40 m [1,5 mm ² for power supply and solenoids]
Max conductor size (see section 12)	2,5 mm ²

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu F/40 V$ capacitance to single phase rectifiers or a 4700 $\mu F/40 V$ capacitance to three phase rectifiers.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
5 A time lag fuse for 05H two single solenoid valves

Option /12

This driver execution is designed to receive a 12 Vdc power supply and it is commonly used in mobile application.
A safety fuse is required in series to each driver power supply:



A safety fuse is required in series to each power supply: 4 A time lag fuse for 01H single solenoid valve and 05H double solenoid valve
6,3 A time lag fuse for 05H two single solenoid valves

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)

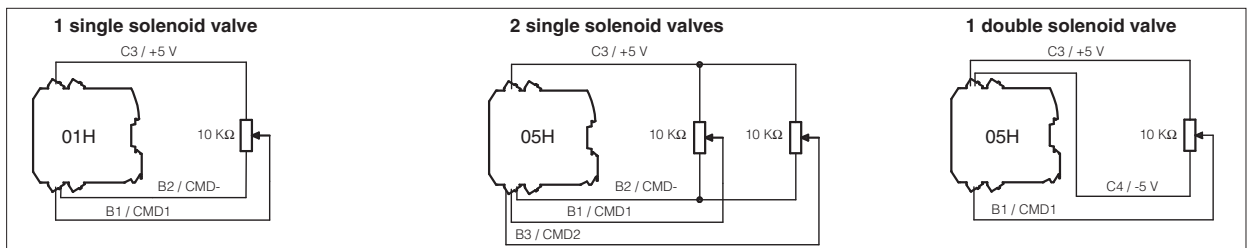
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). CMD1 has to be used in case of 05H version that drives one double solenoid valve. CMD2 has to be used in case of 05H version that drives two single solenoid valves or transducer input for /W option (see 4.3).
The input range is software selectable among voltage ($0 \div \pm 10 VDC$) or current ($4 \div 20 mA$ with cable break detection or $0 \div \pm 20 mA$).
Defaults for standard: $0 \div 10 VDC$ for two position valves; $0 \div \pm 10 VDC$ for three position valves (see valve's tech. table).
Default for /I option: $4 \div 20 mA$ (see valve's tech. table)
Other ranges can be set by software. Internal reference generation is software selectable (see 7.6).
Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2) only for, /W option)

When hydraulic power limitation is active (see 7.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range $0 \div 10 VDC$.

4.4 Output supply Signal for external reference potentiometers (/P option)

The reference analog signals can be generated by one (01H) or two (05H) external potentiometers directly connected to the driver, using the $\pm 5 VDC$ supply output available at pin C3 and C4. Reference input signal can be set up via software to $\pm 5 Vdc$, in order to match potentiometer output signal.



4.5 Enable Input Signal (pin D3 referred to pin D2)

Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24Vdc on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)

Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for $4 \div 20mA$ input) and is not affected by Enable input signal status: fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.
When hydraulic power limitation function is active (see 7.7), status output signal can be software configured to indicate power limitation status: not active (0 Vdc) or active (24 Vdc).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)

Analog Drivers Compatibility - default for series 12 or higher

The four ON/OFF digital input signals (DI) can be used to activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers (see section 5). If digital inputs are not connected, the driver behavior corresponds to an E-BM-AS series 11 or lower

or

Internal Reference Generation - software selectable

When the driver is configured in internal reference generation mode (see 7.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: active status = 24 Vdc is the default setting.

Note: for /P option DI3 and DI4 are not available

4.8 Possible combined options:

/12W, /12PW, /12CIW, /AW, /ACIW, /APW, /CIW, /PW only for 05H

/12I, /12P, /AI, /AP for 01H and 05H

5 ANALOG DRIVERS COMPATIBILITY - only for E-BM-AS series 12 or higher

E-BM-AS digital inputs (DI1..DI4) activate compatibility functionalities with E-BM-AC and E-ME-AC analog drivers:

REFERENCE COMPATIBILITY

Digital Inputs Signals		Digital driver	Analog driver	24 Vdc to DI1:	0 Vdc to DI1:
DI1	24 Vdc	E-BM-AS 01H E-BM-AS 05H	E-BM-AC 01F E-BM-AC 05F E-BM-AC 011F E-ME-AC 01F E-ME-AC 05F	01H Voltage 0 ÷ 5 Vdc / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100% 05H Voltage ± 5 Vdc / ± 100% Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2
DI2	0 Vdc				
DI3	0 Vdc				
DI4	0 Vdc				

Note: set 0 VDC to DI1 and power-off/on the driver to restore latest settings

REFERENCE INVERSION

Digital Inputs Signals		Digital driver	Analog driver	24 Vdc to DI2:	0 Vdc to DI2:
DI1	24 Vdc	E-BM-AS 05H	E-BM-AC 05F	Voltage 0 ÷ 5 Vdc / 0 ÷ -100% Current 4 ÷ 20 mA / 0 ÷ -100%	Voltage 0 ÷ 5 Vdc / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100%
DI2	24 Vdc				
DI3	0 Vdc				
DI4	0 Vdc				

Note: to enable reference inversion, set 24 Vdc to DI1 before driver power-on

RAMP SWITCH OFF

Digital Inputs Signals		Digital driver	Analog driver	24 Vdc to DI3:	0 Vdc to DI3:
DI1	24 Vdc	E-BM-AS 01H E-BM-AS 05H	E-ME-AC 01F E-ME-AC 05F	Ramp excluded	Ramp activated
DI2	0 Vdc				
DI3	24 Vdc				
DI4	0 Vdc				

Notes: to enable ramp switch off, set 24 Vdc to DI1 before driver power-on; DI3 not available for /P option

011F CONFIGURATION

Digital inputs signals		Digital driver	Analog driver	24 Vdc to DI4:	0 Vdc to DI4:
DI1	(*)	E-BM-AS 05H	E-BM-AC 011F	Driver configuration 011F (*) = don't care	Driver configuration 05H (*) = don't care
DI2	(*)				
DI3	(*)				
DI4	24 Vdc				

Notes: set 0 VDC to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option

6 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table FS900). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table GS500):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers RS232 port is not isolated!

Free programming software, web download:

E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com; service and DVD not included
 Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area

DVD programming software, to be ordered separately:

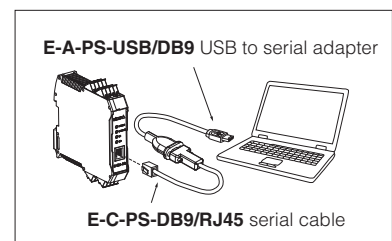
E-SW-*/PQ DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
 Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

E-SW-*/N/PQ DVD next supplies = only for supplies after the first; service not included, web registration not allowed
 Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

Connection



7 MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-BM-AS - user manual for **E-BM-AS**

7.1 Scale

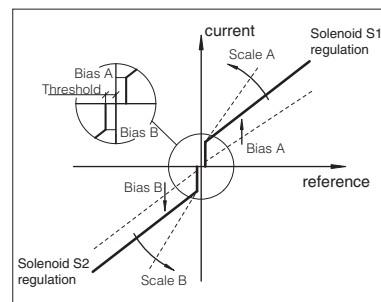
Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value.

This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

For double solenoid valves two different Scale regulations are available:

ScaleA for positive reference signal and ScaleB for negative reference signal

7.1, 7.2 - Scale, Bias & Threshold



7.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.

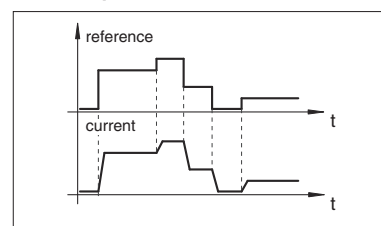
The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If internal reference generation is active (see 7.6), threshold should be set to 0.

For double solenoid valves two different Bias regulations are available: positive reference signal activates BiasA for solenoid S1 and negative reference signal activates BiasB for solenoid S2

7.3 - Ramps



7.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

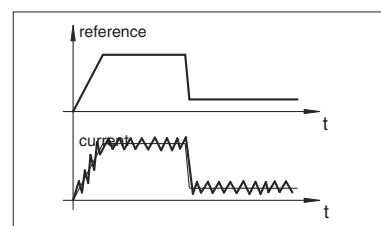
Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations
- four ramps for positive/negative signal values and increasing/decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

7.4 - Dither



7.4 Dither

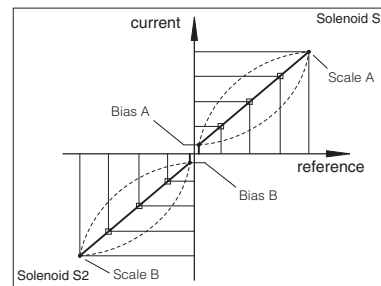
The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.

Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).

Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.

Default dither is a valid setting for a wide range of hydraulic applications

7.5 - Linearization



7.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

7.6 Internal Reference Generation

Internal generation of reference values is software selectable.

In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver's stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).

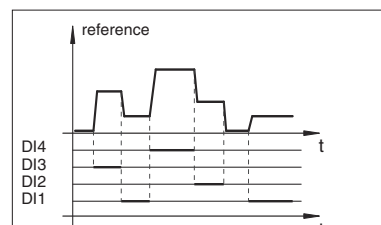
The digital inputs are software configurable into 2 different reference selection mode:

- *Standard mode*
each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
- *Binary mode*
each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H when driving two single solenoid valves)

A dedicated ramp time value can be set by software for each available stored reference value.

Note: with all input signals (DI) set to zero, the driver can be commanded by external analog reference also if internal reference generation is selected (for more information please refer to the programming manual E-MAN-BM-AS).

7.6 - Internal Reference Generation



Single internal generator selection (standard mode)				
DI1	DI2	DI3	DI4	Reference
OFF	OFF	OFF	OFF	External
ON	OFF	OFF	OFF	Generation 1
(*)	ON	OFF	OFF	Generation 2
(*)	(*)	ON	OFF	Generation 3
(*)	(*)	(*)	ON	Generation 4

Double internal generator selection (standard mode)					
DI1	DI2	S1	DI3	DI4	S2
OFF	OFF	External	OFF	OFF	External
ON	OFF	Generation 1	ON	OFF	Generation 1
(*)	ON	Generation 2	(*)	ON	Generation 2

(*) don't care

7.7 Hydraulic Power Limitation (/W option, only for drivers E-BM-AS-PS-05H)

E-BM-AS drivers with /W option electronically perform hydraulic power limitation on:

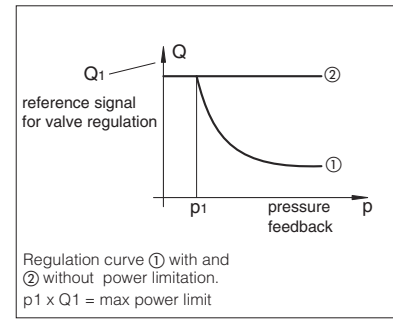
- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tech. table A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 7.6) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2.

When the actual requested hydraulic power $p \times Q$ (CMD2xCMD1) reaches the max power limit ($p_1 \times Q_1$), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}; \text{Flow Reference [CMD1]} \right)$$

7.7 - Hydraulic Power Limitation



8 CONNECTIONS

The 4 fast plug-in connectors (A,B,C,D), included in the supply, provide simple wirings, easy driver's replacement and the possibility to test the signals directly on the connectors.

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS		NOTES				
A	A1	SOL S1	Current to solenoid S1		Output - power PWM				
	A2								
	A3	SOL S2	Current to solenoid S2 (only for 05H version)						
	A4								
B	B1	CMD1	Reference analog input: $\pm 10 \text{ Vdc} / \pm 20 \text{ mA}$ maximum range software selectable (see 4.2)		Input - analog signal				
	B2	CMD-	Standard	/P option (see 4.4)					
			Zero signal, ground for reference signals	Reference for $\pm 5 \text{ Vdc}$ output (AGND)					
	B3	CMD2 (1)	Reference analog input: $\pm 10 \text{ Vdc} / \pm 20 \text{ mA}$ maximum range software selectable (see 4.2)						
B4	DGND	Optical insulated ground for on/off inputs (DI1 ÷ DI4)							
C			Standard	/P option (see 4.4)	Standard	Option /P			
	C1	DI1	Optical insulated on/off input 0 ÷ 24 Vdc referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Optical insulated on/off input 0 ÷ 24 Vdc referred to pin B4 DGND (see 4.7) For analog driver compatibility see section 5	Input - on/off signal				
	C2	DI2							
	C3	DI3					+5 Vdc @ 10 mA output supply to pin B2 (AGND)	Input - on/off	Output - reference analog
	C4	DI4					-5 Vdc @ 10 mA output supply to pin B2 (AGND)		
D	D1	V+	Power supply 24 Vdc (see 4.1)		Input - power supply				
	D2	V0					Power supply 0 Vdc		
	D3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the driver (see 4.5)		Input - on/off signal				
	D4	STATUS	Fault (default) or software selected output (see 4.6)		Output - on/off signal				

(1) Only for 05H version, when used to drive two single solenoid valves or transducer input for /W option

WARNING: if CMD2 is not used has to be connect to CMD- (ground)

9 RJ45 CONNECTOR

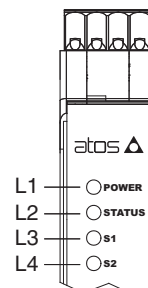
RJ45 CONNECTOR		
PIN	SIGNAL	DESCRIPTION
1	/	Not connected
2	/	Not connected
3	/	Not connected
4	GND	Signal zero data line
5	RX	Driver receiving data line
6	TX	Driver transmitting data line
7	/	Not connected
8	/	Not connected

RJ45 connector (IEC 60603 standard) for RS232 serial communication

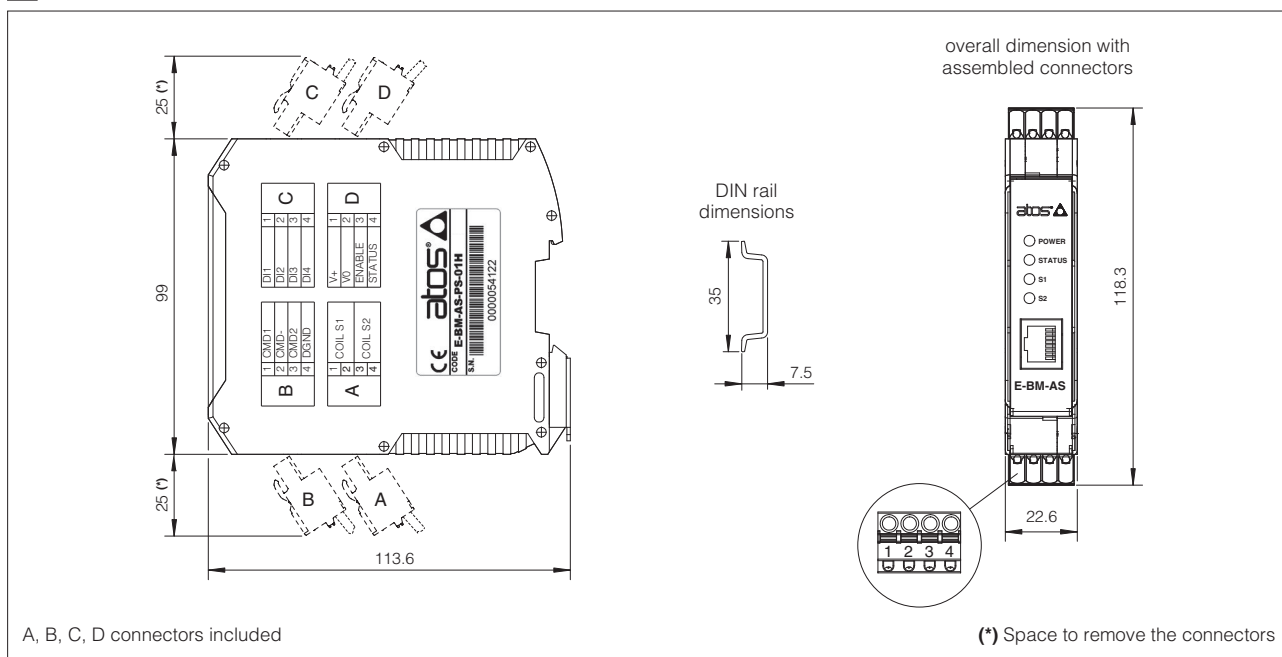
10 DIAGNOSTIC LEDS

Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	POWER	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	STATUS	OFF or ON	Fault conditions
			Slow blinking	Driver disabled
			Fast blinking	Driver enabled
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON
			Slow blinking	Coil not connected
			Fast blinking	Short circuit on the solenoid



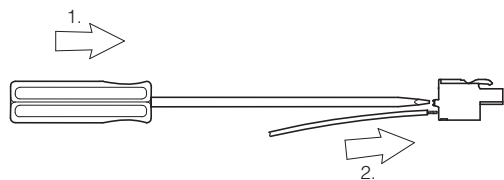
11 OVERALL DIMENSIONS [mm]



12 INSTALLATION

To wire cables in the connectors:

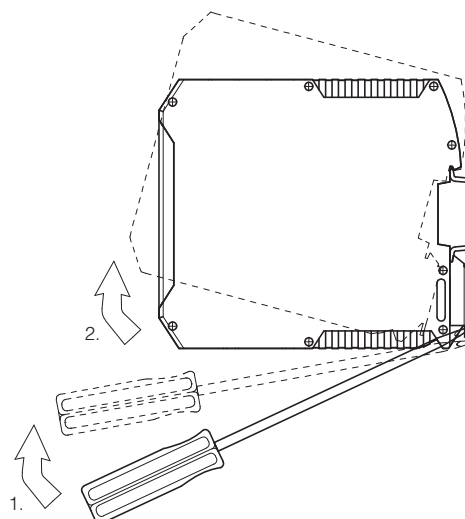
1. press the button with a screwdriver
2. insert the cable termination



Note: max conductor size: 2,5 mm²

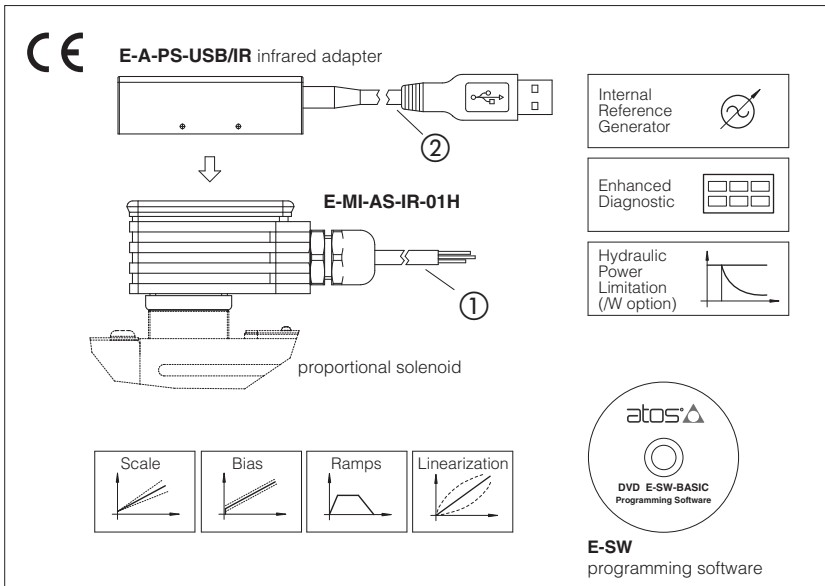
To unlock the driver from the DIN rail:

1. pull down the locking slide with a screwdriver
2. rotate up the driver



Digital electronic E-MI-AS-IR drivers

DIN 43650 plug-in format, for proportional valves without transducer



E-MI-AS-IR

Digital drivers are designed for mounting on the solenoid's DIN connector of proportional valves without transducer. They supply and control the current to the solenoid according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the valve's hydraulic regulation.

E-MI-AS drivers can drive single or double solenoid proportional valve.

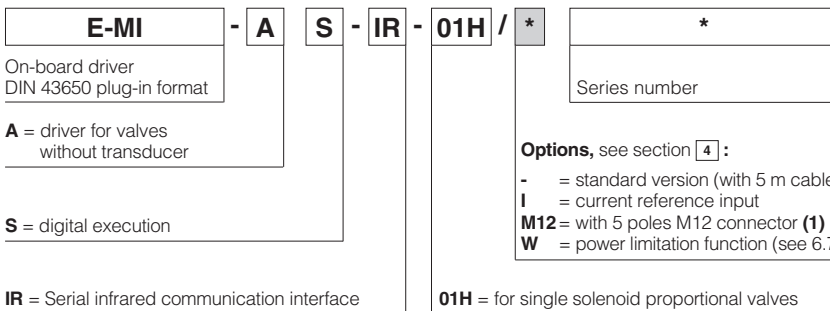
Electrical Features:

- Standard 5m cable connection ① or M12 connector (/M12 option)
- Infrared communication interface ② to program the driver with Atos PC software
- 2 leds for diagnostics (see 9)
- +5 Vdc output supply for external reference potentiometer (not available for /M12 option)
- Operating temperature range: $-20^{\circ} \div +50^{\circ}$
- Current reference input (/I option)
- Plastic box with IP65 protection degree and standard DIN43650 plug-in format with double earth connection to allow double-side orientation
- CE mark according to EMC directive

Software Features:

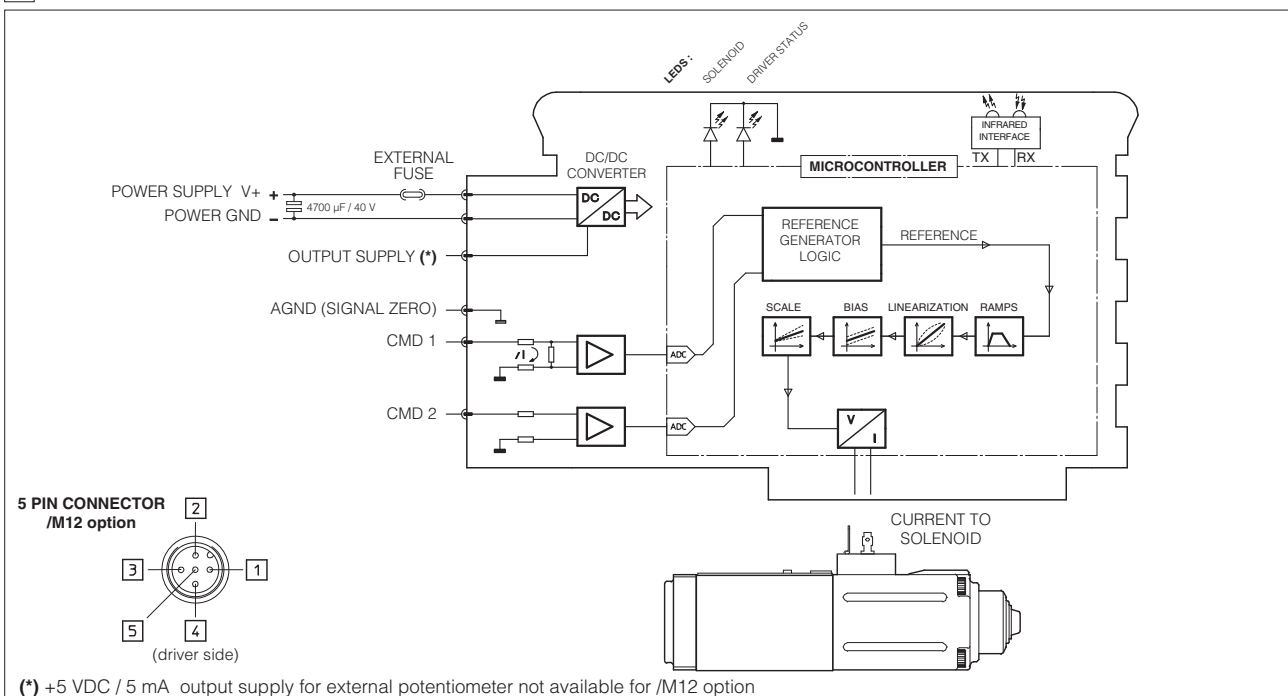
- Intuitive graphic interface
- Setting of valve's functional parameters: bias, scale, ramps, diather
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- /W option max power limitation function (see 6.7)
- Complete diagnostics of driver status

1 MODEL CODE



(1) ZH-5P female connector must be ordered separately

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 Vdc Nominal: +12 Vdc	Rectified and filtered: $V_{RMS} = 20 \div 27 V_{MAX}$ (ripple max 10 % V_{PP}) Rectified and filtered: $V_{RMS} = 10 \div 14 V_{MAX}$ (ripple max 10 % V_{PP})
Max power consumption	50 W	
Current supplied to solenoids	$I_{MAX} = 2.7 A$ with +24 Vdc power supply to drive standard proportional valves (3,2 Ω solenoid) $I_{MAX} = 3.3 A$ with +12 Vdc power supply to drive proportional valves with /6 option (2,1 Ω solenoid)	
Reference input signal (1) (CMD1 - see 4.2)	Standard (voltage) Input range: 0 \div 10 Vdc /I option (current) Input range: 4 \div 20 mA / 0 \div 20 mA	Input impedance: $R_i > 50 k\Omega$ Input impedance: $R_i = 500 \Omega$
Enable Input Signal (CMD2 - see 4.5) ON/OFF Input Signal (CMD1,CMD2 - see 4.6)	Input range: 0 \div 24 Vdc (OFF state: 0 \div 5 Vdc; ON state: 9 \div 24 Vdc) Input impedance: $R_i > 10 k\Omega$	
Pressure transducer input (CMD2 - see 4.3)	/W option	Input range: 0 \div 10 Vdc Input impedance: $R_i > 50 k\Omega$
Output supply (see 4.4)	+5 V @ max 5 mA: output supply for external potentiometer (not available for /M12 option)	
Alarms	Solenoid coil not connected, short circuit and cable break with current reference signal (/I option)	
Format	Plastic box ; IP65 protection degree (when fixed on solenoid); DIN43650 format	
Operating temperature	-20 \div +50 $^{\circ}C$ (storage -25 \div +85 $^{\circ}C$)	
Mass	Standard version: 450 g; /M12 option: 70 g	
Additional characteristics	Short circuit protection of current output to solenoid	
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	
Communication interface	Infrared, Atos protocol with ASCII coding; E-A-PS-USB/IR adapter is required (see section 5)	
Wiring cable characteristics	2 poles x 0,5 mm ² plus 4 poles x 0,35 mm ² , external diameter 7,4 mm	

(1) Negative reference input signal not allowed

4 POWER SUPPLY AND SIGNALS SPECIFICATIONS

4.1 Power supply

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 $\mu F/40 V$ capacitance to single phase rectifiers or a 4700 $\mu F/40 V$ capacitance to three phase rectifiers.

According to power supply value, a safety fuse is required in series to each driver:

+24 Vdc - 2,5 A time lag fuse

+12 Vdc - 4 A time lag fuse

4.2 Reference Input Signal (CMD1: yellow/pin 4, referred to AGND: white/pin 3)

The driver proportionally transforms the external reference signal input into the current supplied to the solenoid.

The driver is designed to receive one analog reference input (CMD1 on yellow/pin 4) referred to the analog electric ground (AGND on white/pin3) and with a maximum range of 0 \div 10 Vdc . Internal reference generation is software selectable (see 6.6).

Option /I (current reference input)

The reference input signal maximum range is software selectable among current 4 \div 20 mA (with cable break detection) or 0 \div 20 mA.

4.3 Pressure Input Signal (CMD2: blue/pin 5) - only for /W option

When hydraulic power limitation is active (see 6.7), enable input (CMD2) is managed as an analog input and has to be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 \div 10 Vdc.

4.4 Output supply for external potentiometer - (OUTPUT SUPPLY: green, referred to AGND: white) - not available for /M12 option

The reference analog signal can be generated by an external potentiometer directly connected to the driver, using the +5Vdc supply output available at green wire thus generating the desired reference signal.

4.5 Enable Input Signal (CMD2: blue/pin 5, referred to AGND: white/pin 3)

Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to maintain active the infrared connection and the other driver functions when the valve must be disabled for safety reasons.

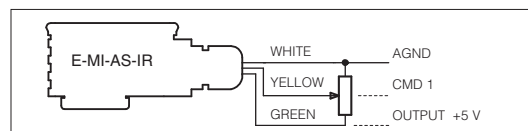
To enable the driver, supply a 24Vdc on CMD2 (blue/pin 5, referred to white/pin 3).

The polarity of the enable input can be customized and the enable function can be deactivated, see table at side.

4.6 ON/OFF Input Signals (CMD1: yellow/pin 4, CMD2: blue/pin 5)

When the driver is configured in internal reference generation mode (see 6.6), both reference input (CMD1) and enable input (CMD2) are managed as ON/OFF input signals. In this mode they are used to select the active reference signal, among the available stored values.

4.7 Possible combined options: /IM12, /IM12W, /IW and /M12W



ENABLE CONFIGURATION

Signal	default polarity	reverse polarity	deactivated
9 \div 24 Vdc	solenoid ON	solenoid OFF	solenoid ON
0 \div 5 V	solenoid OFF	solenoid ON	solenoid ON

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table FS900).

For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table GS500):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)

E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)

EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

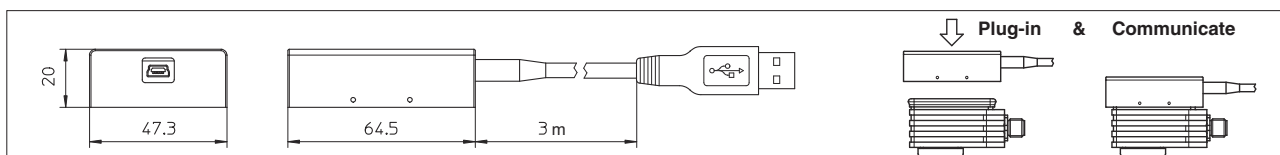
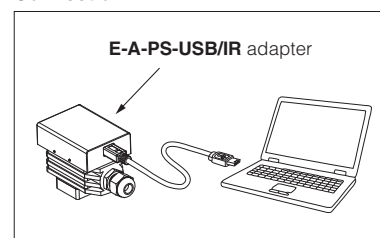


WARNING: drivers USB port is not isolated!

Adapter, to be ordered separately :

E-A-PS-USB/IR = adapter from USB connector (PC communication port) to driver infrared communication interface: plug the adapter on the driver to establish the infrared communication

Connection



6 MAIN SOFTWARE PARAMETER SETTINGS

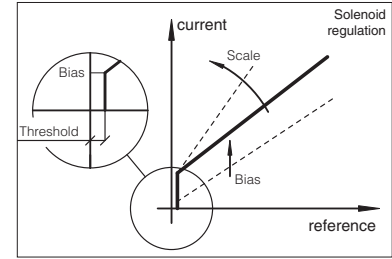
The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-MI-AS - user manual for **E-MI-AS-IR**

6.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value. This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled; it is also useful to reduce the maximum valve regulation in front of maximum reference signal.

6.1, 6.2 - Scale, Bias & Threshold



6.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status.

This dead band discontinuity in the valve's regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

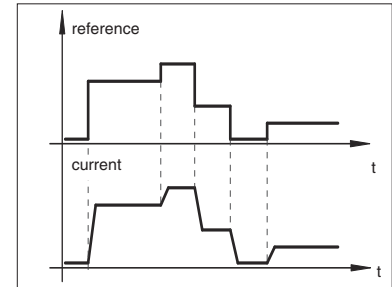
The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If internal reference generation is active (see 6.6), threshold should be set to 0.

6.3 - Ramps



6.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:

- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting)

6.4 Dither

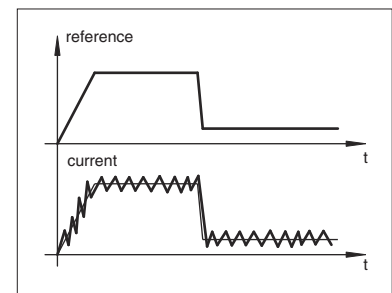
The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve's regulation: a small vibration in the valve's regulating parts considerably reduces static friction effects.

Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).

Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some application this can lead to vibration and noise: right setting usually depends on system setup.

Default dither is a valid setting for a wide range of hydraulic applications

6.4 - Dither

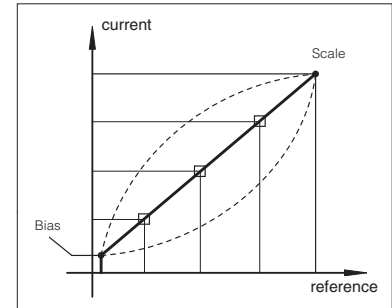


6.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.

Linearization is useful for applications where it is required to linearize the valve's regulation in a defined working condition (e.g. maximum pressure control at defined working flow)

6.5 - Linearization



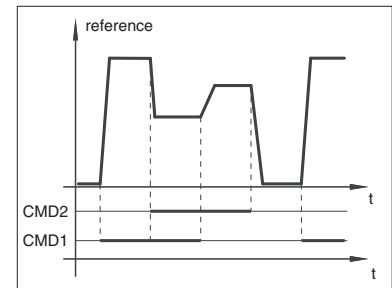
6.6 Internal Reference Generation

Internal generation of reference values is software selectable.

In this mode the 2 driver inputs (see 4.6) allow to select the desired solenoid current reference signal, among the different internal stored values: external control unit can thus manage complex machine profile by simple switching of the reference signal, by 2 digital inputs (see 4.6).

Each digital input combination corresponds to a different reference value; up to 4 different internal values are available:

6.6 - Internal Reference Generation



	Internal generated references			
	REF1	REF2	REF3	REF4
CMD1	0	24 Vdc	24 Vdc	0
CMD2	0	0	24 Vdc	24 Vdc

A different ramp time value can be set by software for each available stored reference value.

6.7 Hydraulic Power Limitation (/W option)

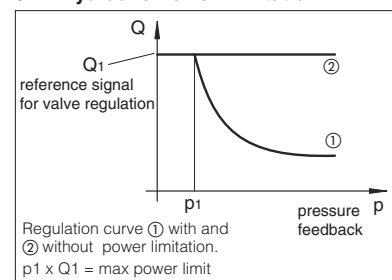
E-MI-AS drivers with /W option electronically perform hydraulic power limitation on single solenoid valves:

- flow control valves (direct and pilot operated)
- directional control valves (direct and pilot operated) + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-*-LQZ, tab. A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input CMD2 (see 4.3).

When the actual requested hydraulic power $p \times Q$ (CMD2 x CMD1) reaches the max power limit ($p_1 \times Q_1$), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure transducer feedback the lower is the valve's regulated flow:

6.7 - Hydraulic Power Limitation



$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}; \text{Flow Reference [CMD1]} \right)$$

Regulation curve ① with and ② without power limitation.
 $p_1 \times Q_1 = \text{max power limit}$

7 CONNECTIONS

Standard cable wire color	/M12 option pin	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
RED	1	V+	Power supply +24 V _{DC} or +12 V _{DC} (see 4.1)	Input - power supply
BLACK	2	V0	Power supply 0 V _{DC}	
WHITE	3	AGND (Signal zero)	Ground for CMD1, CMD2 and OUTPUT SUPPLY	Input - analog signal
GREEN	N.A.	OUTPUT SUPPLY	+5 V _{DC} @ 5 mA output supply for external potentiometer (not available for option /M12) (see 4.4)	Output - analog signal

The two input signals CMD1 and CMD2 can be managed as analog input or ON/OFF signals; their function depends on the selected software setting:

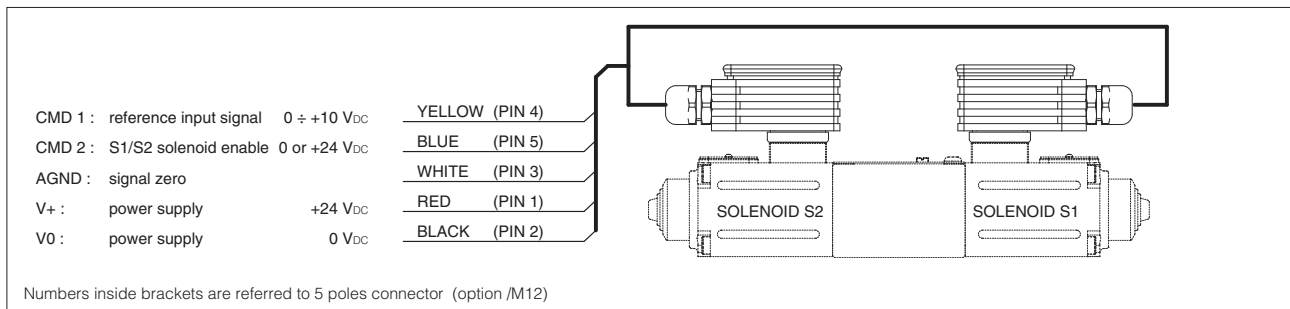
Standard cable wire color	/M12 option pin	SIGNAL	TECHNICAL SPECIFICATIONS (software setting dependent)			NOTES
			Default (see 4.2 ; 4.5)	Internal Reference Generation (see 4.6 ; 6.6)	Hydraulic Power Limitation (only for /W option - see 4.3 ; 6.7)	
YELLOW	4	CMD 1	Reference analog input: 0 ÷ 10 V _{DC} (4 ÷ 20 mA; 0 ÷ 20 mA for /I option)	ON/OFF: 24 V _{DC} / 0 V _{DC}	Reference analog input: 0 ÷ 10 V _{DC} (4 ÷ 20 mA; 0 ÷ 20 mA for option /I)	Input - analog or digital
BLUE	5	CMD 2	Enable/disable the driver: 24V _{DC} / 0V _{DC}	ON/OFF: 24 V _{DC} / 0 V _{DC}	Pressure transducer input: 0 ÷ 10 V _{DC}	

8 DOUBLE SOLENOID VALVES OPERATION

It is possible to use two E-MI-AS drivers to operate one double solenoid proportional valve supplying the same analog signal to both CMD1 inputs reference. The enable input signal is used to select which driver/solenoid has to be active.

To operate double solenoid valves it is required to:

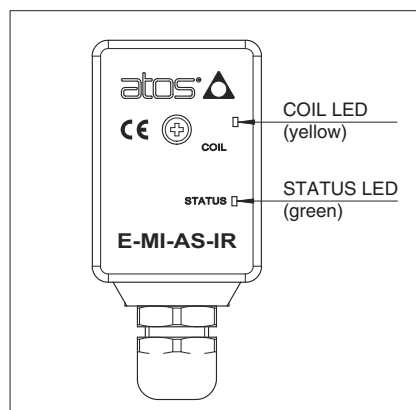
- parallel wire the two drivers (see following scheme).
- select opposite polarity (default and reverse) for the two enable signals (see 4.5)
- manage from PLC or machine unit: 1 analog reference signal corresponding to desired valve's regulation and 1 ON/OFF signal to select the active solenoid.



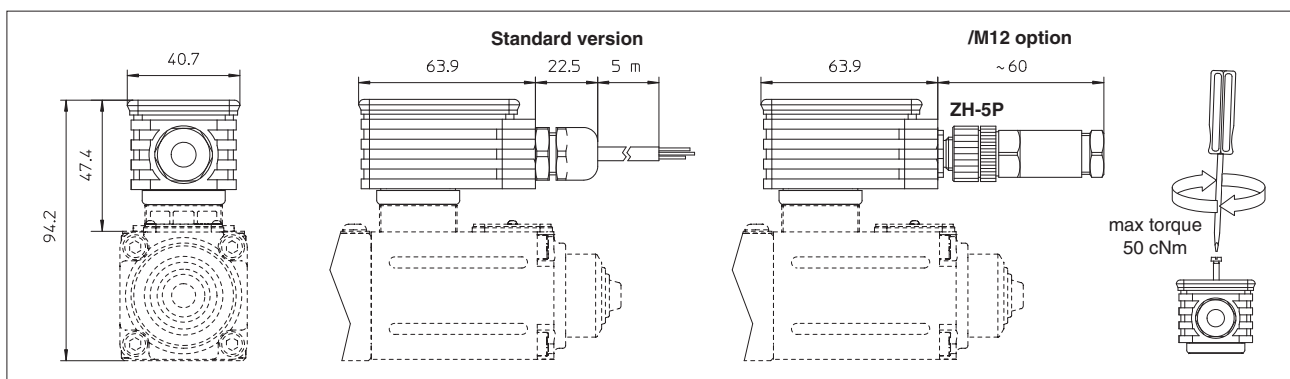
9 DIAGNOSTIC LEDS

It is possible to verify the actual status of solenoid command (yellow LED) and the driver status (green LED). The following table details the possible displayed conditions:

COIL (YELLOW LED)	
Light signal displayed	Coil status
Light Off	PWM command OFF
Light On	PWM command ON
Slow blinking	Solenoid not connected
Fast blinking	Short circuit on the solenoid
STATUS (GREEN LED)	
Light signal displayed	Driver status
Light Off	Absence of power supply
Light On	Malfunctioning
Slow blinking	Driver disabled or Alarm present
Fast blinking	Driver enabled

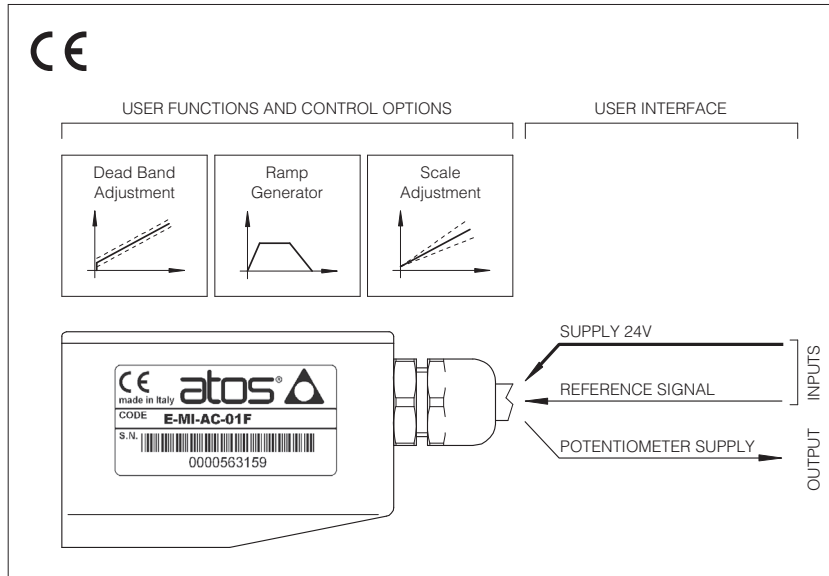


10 OVERALL DIMENSIONS [mm] AND INSTALLATION



Analog electronic E-MI-AC drivers

DIN 43650 plug-in format, for proportional valves without transducer



E-MI-AC

Analog drivers control the current to the solenoid of Atos proportional valves without pressure or LVDT position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

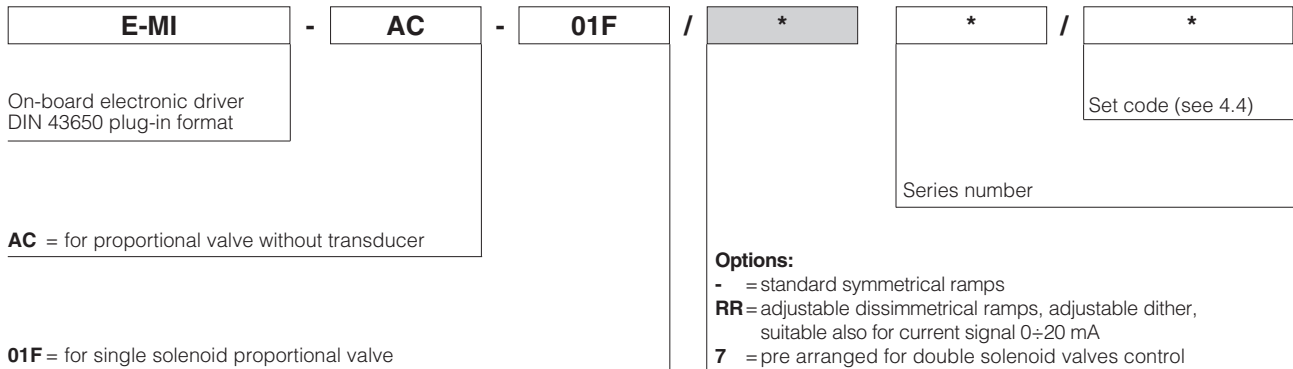
Features:

- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-set
- aluminium box with IP65 protection degree
- electronic filters on input and output lines
- CE mark according to EMC directive

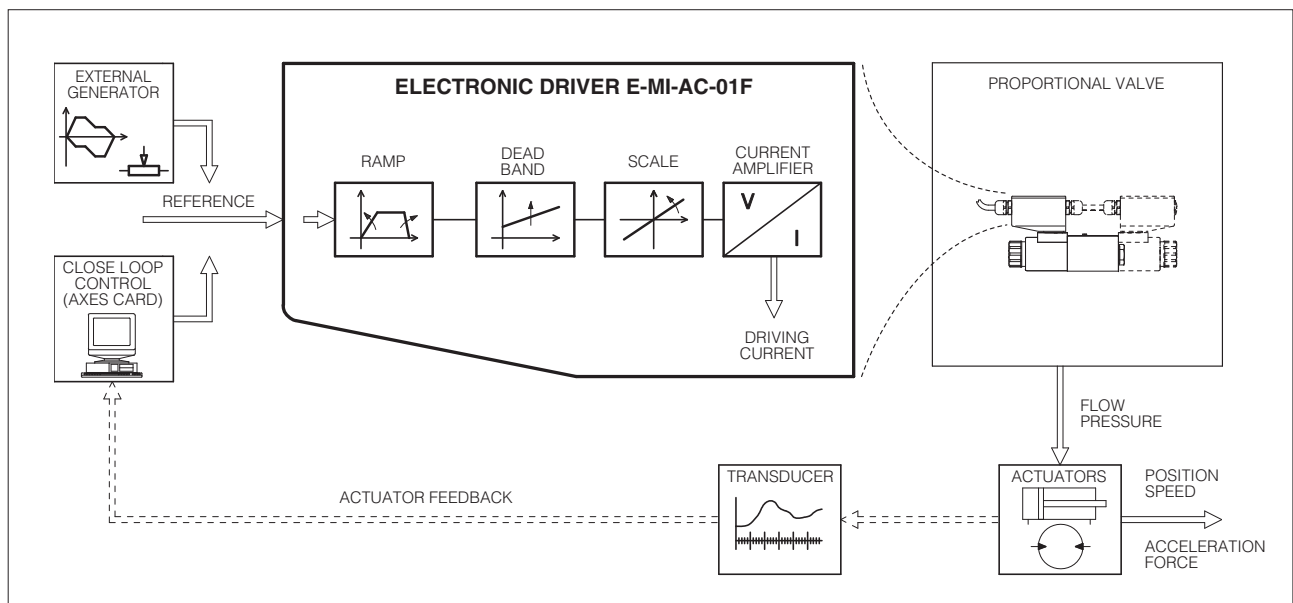
Applications:

Pressure, flow, position open or closed-loop systems, according to the block diagram [2].

1 MODEL CODE



2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	Nominal: +24 Vdc Rectified and filtered: $V_{RMS} = 21 \div 33 V_{MAX}$ (ripple max 10 % VPP) Nominal: +12 Vdc Rectified and filtered: $V_{RMS} = 10 \div 14 V_{MAX}$ (ripple max 10 % VPP)
Max power consumption	50 W
Current supplied to solenoid	$I_{MAX} = 2,7$ A type PWM square wave (with solenoid type ZO(R)-A with resistance 3,2 Ω)
Nominal reference signal (factory preset)	0 \div 10 Vdc
Reference signal variation range (scale adjustment)	0 \div 10 Vdc (0 \div 5 V_{MIN}) – (0 \div 20 mA for current signal)
Input signal impedance	Voltage signal $R_i > 50$ k Ω – ($R_i = 250$ Ω for current signal)
Potentiometers supply	+5 V / 10 mA at contact 3
Ramp time	10 sec. max (0 \div 10 V of reference signal)
Format	Box equipped with DIN 43650-IP65 plug; VDE 0110 wired on solenoid
Operating temperature	0 \div +50 $^{\circ}C$ (storage -20 \div +70 $^{\circ}C$)
Mass	190 g
Additional characteristics	Outputs to solenoids protected against accidental short circuits
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-4) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n $^{\circ}$ 1907/2006
Connections	7 contacts – terminal strip
Recommended wiring cable	LIYCY shielded cables: 0,5 mm 2 up to 1,0 mm 2 (20 AWG - 18 AWG)

4 GENERAL SPECIFICATIONS

4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 $\mu F/40V$ capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 μF capacitor (see [11]).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC), connecting the shield to noiseless earth (TE), see [13]. It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

The 12 Vdc electric voltage supply is allowed only after evaluation of the performances required from the proportional valves, and however after check with our technical office.

According to power supply value, a safety fuse is required in series to each driver:

- +24 Vdc - 2,5 A time lag fuse
- +12 Vdc - 4 A time lag fuse

4.2 Reference signal, see [5].

The electronic driver is designed to receive a voltage reference signal according to the following options:

- potentiometers mounted externally and wired according to the application diagrams.
- external reference signals generated by PLC, see [11].
- voltage from 0 to 10V
- current from 0 to 20 mA (only with /RR option).

4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test point M and pin 2 (see [9]).

Reading scale is 1 mV = 10 mA (eg.: if the voltage signal is 70 mV, coil current is 700 mA). To visualize the signals use voltmeters with impedance >10 K Ω .

4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

- 1 = RZGO (KZGO) 2 = RZMO, AG*ZO, LI*ZO
- 3 = DHZE, DHZO, DKZOR 4 = DPZO-A*5
- 6 = QV*ZO(R), LEQZO 8 = DKZE

4.5 Calibrations available to the user, see [7], [8], [9], [11].

Scale

The relation between driving current and reference signal can be regulated with the Scale adjustment.

Bias (dead band)

Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to the corresponding electrical zero. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). An output current is obtained when the input voltage is 100 mV or greater.

Ramps see [7], [9].

The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current).

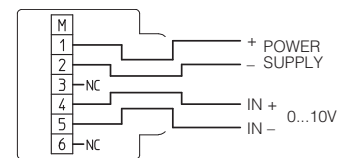
The rise/fall time of the current is set via internal potentiometer P1 up to a max. time of 10 sec. for 0-10V of reference signal. The /RR option provides dissymmetrical ramps, ramp up is set via P1 potentiometer and ramp down is set via P2.

Dither

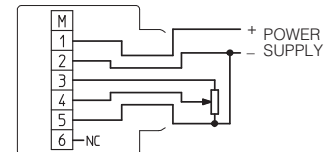
With the /RR option the dither frequency adjust is allowed from 100 Hz to 500 Hz.

5 EXTERNAL REFERENCE SIGNALS

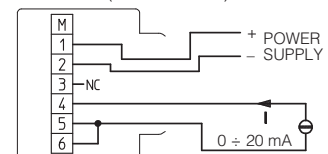
EXTERNAL GENERATOR VOLTAGE SIGNAL



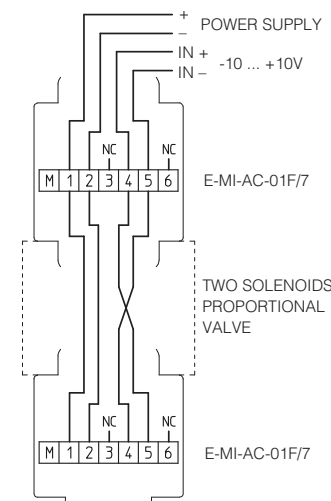
EXTERNAL POTENTIOMETER CONNECTION POTENTIOMETER



EXTERNAL GENERATOR CURRENT SIGNAL (/RR OPTION)



CONNECTION FOR TWO SOLENOIDS PROPORTIONAL VALVE (/7 OPTION, necessary two /7 drivers)



6 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below:

6.1 Warning

- Never insert or remove the driver while the electronic system is powered on.
- Refer to [9] to identify components mentioned in calibration procedures.
- The E-MI-AC electronic drivers are designed to work in open loop system, where the coupled proportional valve is not required to work at its limits.

6.2 Start-up

Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and Ramps potentiometers, in sequence.

- Remove the cover and connect the electronic driver according to the desired connection diagram, see [5].

For double solenoid valves two electronic drivers type E-MI-AC-01F/7 must be used connected as shown in [5].

Start-up instructions are the same for each driver.

On the first driver two cable clamps must be mounted, one for the external wirings and one to give power and signal to the second driver which is equipped with one cable clamp and one blind plug.

A differential voltage signal $-10\text{ V} \div +10\text{ V}$ must be supplied to the first driver.

Note that the first driver will work with signal from 0 to 10V while the second driver will work with signal from 0 to -10 V.

- The current supplied to the coil can be measured by a voltmeter connected between pins M and 2 of the screw terminal. The reading range will be: $I[\text{mA}] = 10 \times V[\text{mV}]$ (for example reading 70 mV the current in the coil will be 700 mA).

Bias adjustment (dead band compensation) see [8], [9].

- Supply electrical power to the driver; supply a reference signal voltage = 0,1 VDC. Gradually turn the P4 bias potentiometer until a movement of the controlled actuator is obtained.
- Turn in the opposite direction until the actuator is stopped.

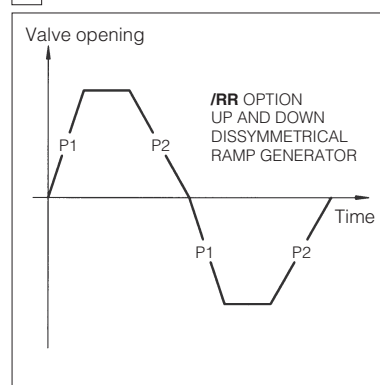
Scale adjustment, see [8], [9].

Supply max. current reference signal; check if the current in the coil reaches the max. value desired, turning P3 clockwise (see the regulation curve of the employed valve used).

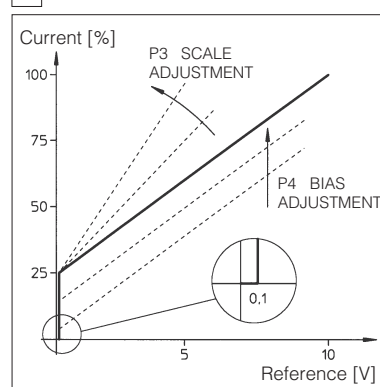
Ramps see [7], [9].

Turning the ramp potentiometer clockwise, acceleration and deceleration time can be increased to obtain the optimization of the complete system.

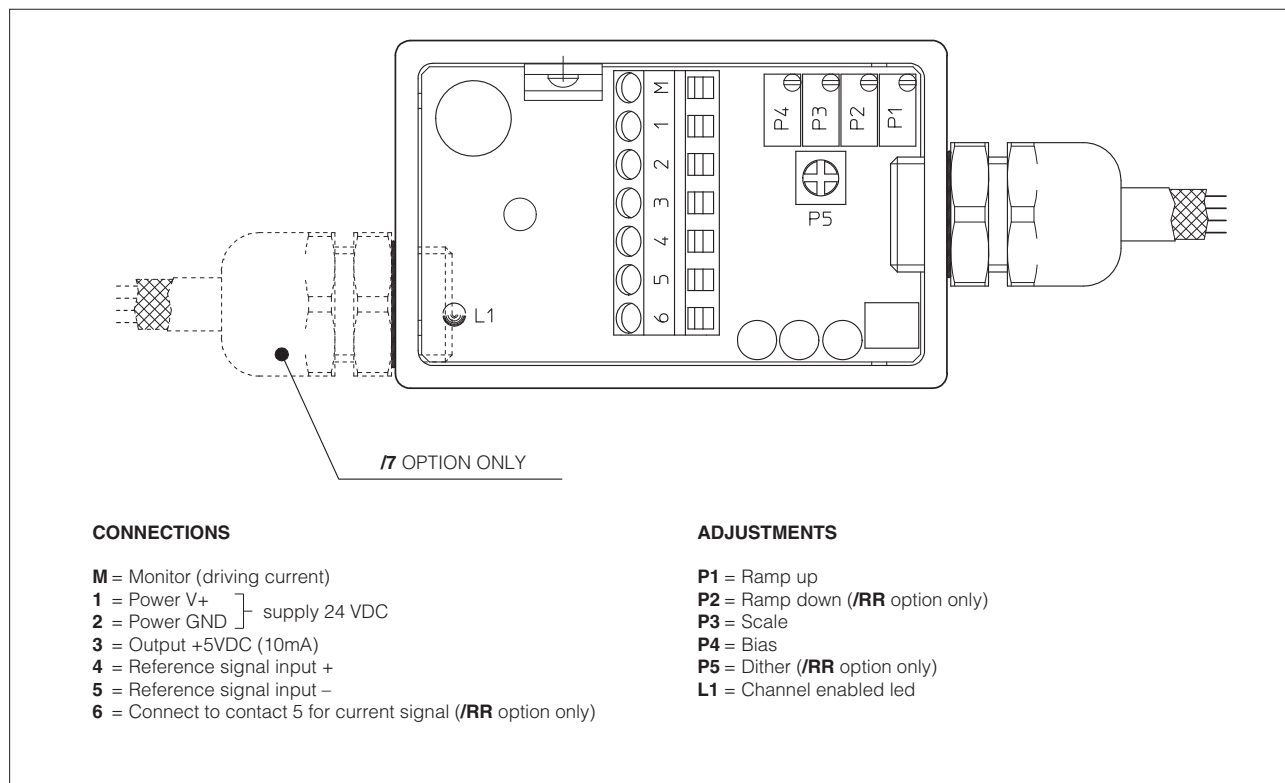
7 RAMPS



8 BIAS AND SCALE



9 REGULATIONS LAYOUT



10 IMPORTANT INSTRUCTIONS

ELETTROMAGNETIC COMPATIBILITY

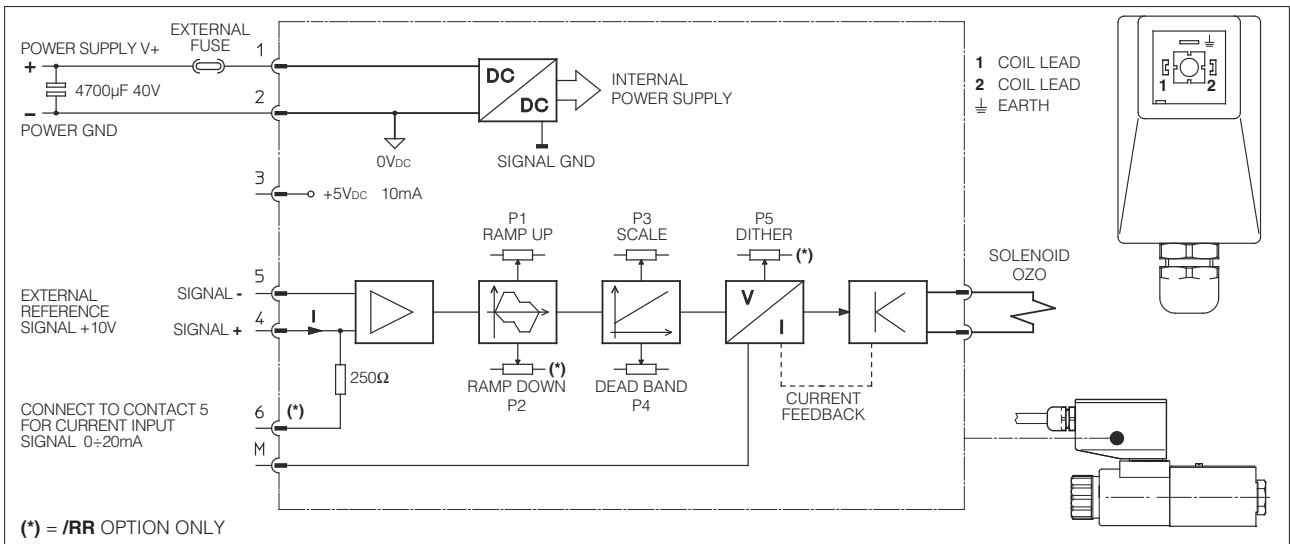
Atos electronic drivers and proportional valves are designed according to the 2014/30/JE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

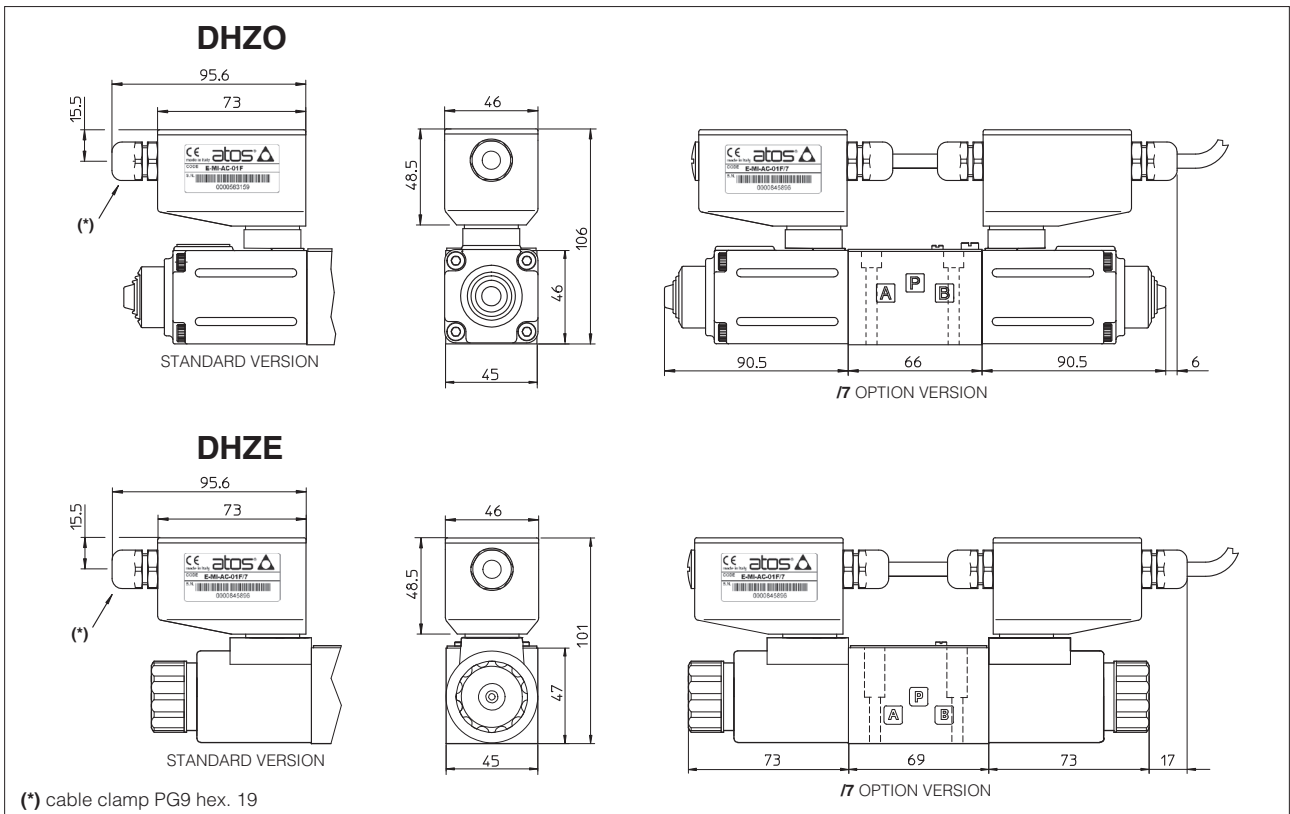
SAFETY

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be paid to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

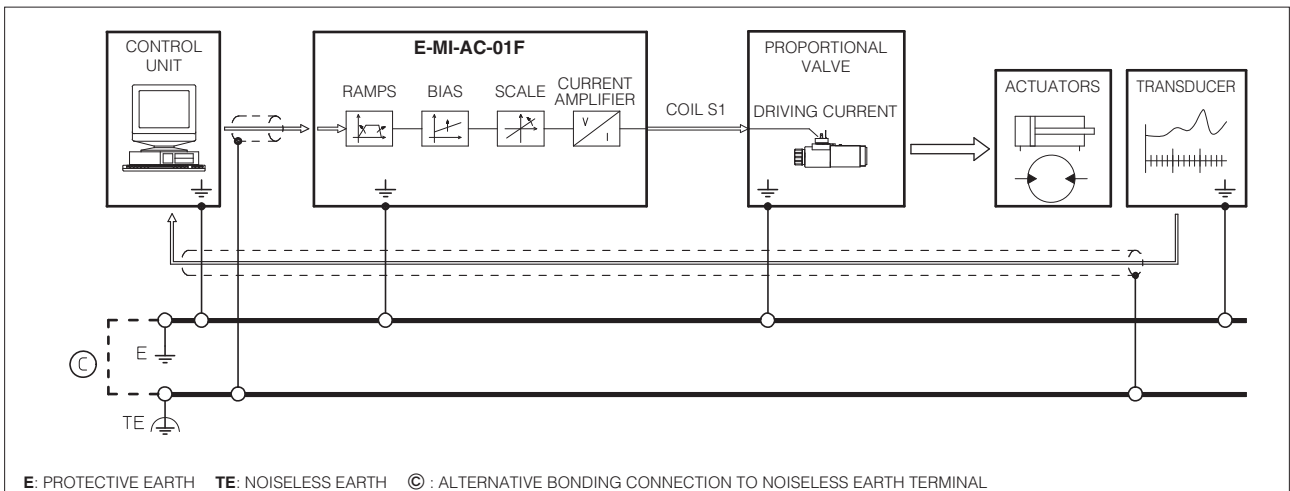
11 WIRING BLOCK DIAGRAM



12 OVERALL DIMENSIONS [mm]



13 EARTH CONNECTIONS

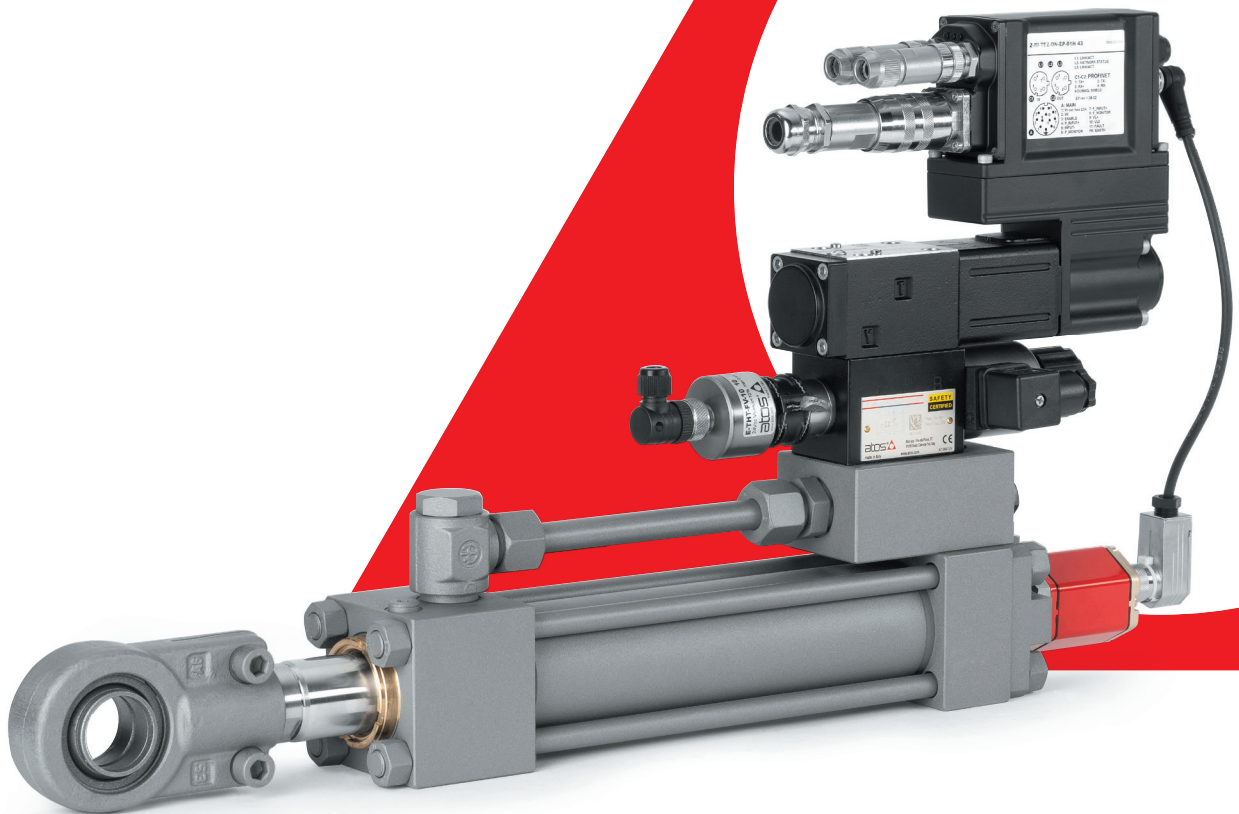


E: PROTECTIVE EARTH TE: NOISELESS EARTH © : ALTERNATIVE BONDING CONNECTION TO NOISELESS EARTH TERMINAL

2

AXIS & P/Q CONTROLS

AXIS & P/Q
CONTROLS



INDEX

AXIS & P/Q CONTROLS

Size Qmax [l/min] Table **Page**

TECHNICAL INFORMATION

Basics for digital proportionals electrohydraulics				FS001	839
Basics for safety components				Y010	845
Programming tools for digital electronics				GS500	851
Fieldbus features				GS510	859
Mounting surface for electrohydraulic valves				P005	867
Mounting surface and cavities for cartridge valves				P006	871

AXIS CONTROLS

servoproportional directionals

DLHZO-TEZ, DLKZOR-TEZ	direct, zero overlap, sleeve execution, on-board driver & axis card	06 ÷ 10	70 ÷ 160	FS610	465
DHZO-TEZ, DKZOR-TEZ	direct, zero overlap, on-board driver & axis card	06 ÷ 10	80 ÷ 180	FS620	481
DPZO-LEZ	piloted, zero overlap, on-board driver & axis card	10 ÷ 35	180 ÷ 3500	FS630	495

electronics, DIN-rail EN 60715

Z-BM-TEZ, Z-BM-LEZ	off-board driver & axis card for servoproportional directionals			GS330	513
Z-BM-KZ	off-board axis card for servoproportional directionals			GS340	525

servoactuators

AZC	servocylinder plus servoproportional directional with on-board driver & axis card			FS700	535
-----	---	--	--	-------	------------

P/Q CONTROLS

servoproportional & high performance directionals

DLHZO-TEZ, DLKZOR-TEZ	direct, zero overlap, sleeve execution, on-board driver	06 ÷ 10	70 ÷ 160		
DHZO-TEZ, DKZOR-TEZ	direct, positive or zero overlap, on-board driver	06 ÷ 10	80 ÷ 180	FS500	537
DPZO-LES	piloted, positive or zero overlap, on-board driver	10 ÷ 35	180 ÷ 3500		
LIQZO-LES, LIQZP-LES	3 way cartridge, piloted, on-board driver	25 ÷ 80	500 ÷ 5000		

electronics, DIN-rail EN 60715

E-BM-TEZ, E-BM-LES	off-board driver for servoproportional & high performance directionals			GS240	415
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pumps

PVPC-PES, PVPC-PERS	axial piston, proportional P/Q control, on-board driver			AS170	781
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ACCESSORIES

E-ATR-8	pressure transducer with amplified analog output signal			GS465	813
BA	single station subplates, mounting surfaces ISO 4401, 6264 and 5781			K280	819
BA-214, BA-314, BA-244	multi-station subplates, mounting surface ISO 4401			K290	823
BA-214/AL	multi-station subplates, mounting surface ISO 4401, aluminium			K295	827
CONNECTORS	for transducers, on-off and proportional valves			K800	833

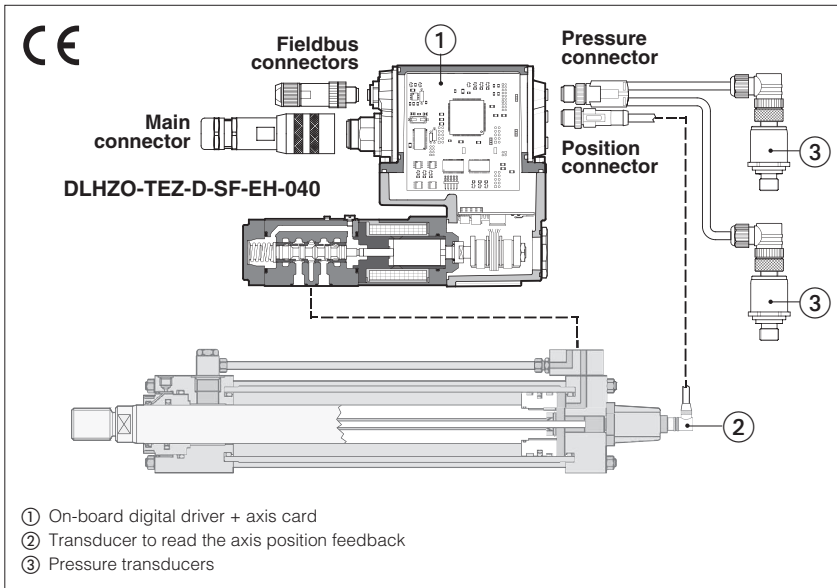
OPERATING INFORMATION

Operating and maintenance information for proportional valves				FS900	877
Operating and maintenance information for pumps				A900	897

Supplementary components range available on www.atos.com

Digital servoproportionals with on-board axis card

direct, single solenoid, sleeve execution, with LVDT transducer and zero spool overlap



DLHZO-TEZ, DLKZOR-TEZ

Digital servoproportional directional valves, direct, single solenoid, sleeve execution, with on-board digital driver + axis card, LVDT position transducer and zero spool overlap for best performances in any position closed loop controls of linear or rotative hydraulic actuator. The sleeve execution grants high regulation accuracy and response sensitivity. The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback. The valve can be operated via an external reference signal or automatic cycle, see section 2.

Alternated P/Q controls, see 3 :
SF, SL = alternated force control added to the basic position one

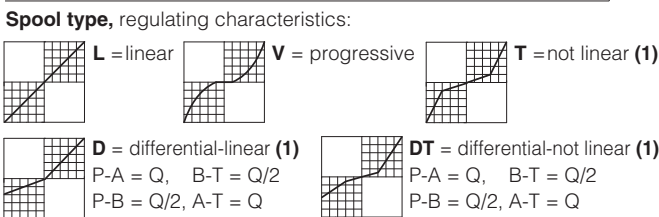
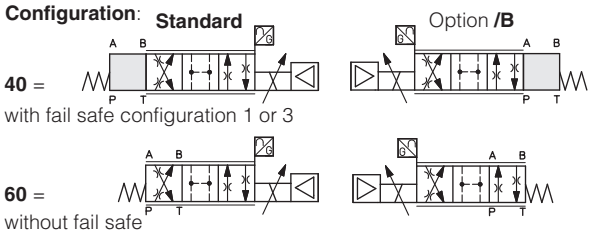
Safety options TÜV certified, see 7 :

U = safe double power supply
K = safe on/off signals

DLHZO:	DLKZOR:
Size: 06 -ISO 4401	Size: 10 -ISO 4401
Max flow: 70 l/min	Max flow: 160 l/min
Max pressure: 350 bar	Max pressure: 315 bar

1 MODEL CODE

DLHZO	-	TEZ	-	D	-	SN	-	NP	-	0	-	40	-	L	-	7	-	3	/	*	/	*	
Servoproportional directional valves, direct DLHZO = size 06 DLKZOR = size 10		TEZ = on-board digital driver + axis card, one LVDT transducer		Position transducer type: A = Analog (standard, potentiometer) D = Digital (SSI, Encoder)		Alternated P/Q controls: SN = none SF = force control (2 pressure transducers) SL = force control (1 load cell)		Fieldbus interface, USB port always present: NP = Not Present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK EI = EtherNet/IP EP = PROFINET RT/IRT		Valve size ISO 4401: 0 = 06 1 = 10		Configuration: Standard		Option /B								Seals material, see section 11: - = NBR PE = FKM BT = HNBR	
												with fail safe configuration 1 or 3											
												without fail safe											
																						SAFETY CERTIFIED	



Fail safe configuration, see section 13 :



Note: select 1 for configuration 60 even without fail safe

Spool size: 0(L) 1(L) 1(V) 3(L) 3(T) 3(V) 5(L,T) 7(L,T,V,DT)

DLHZO =	4	7	8	14	-	20	28	40
DLKZOR =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Not available for configuration 60 (2) For possible combined options, see section 16

2 POSITION CONTROL

2.1 External reference signal

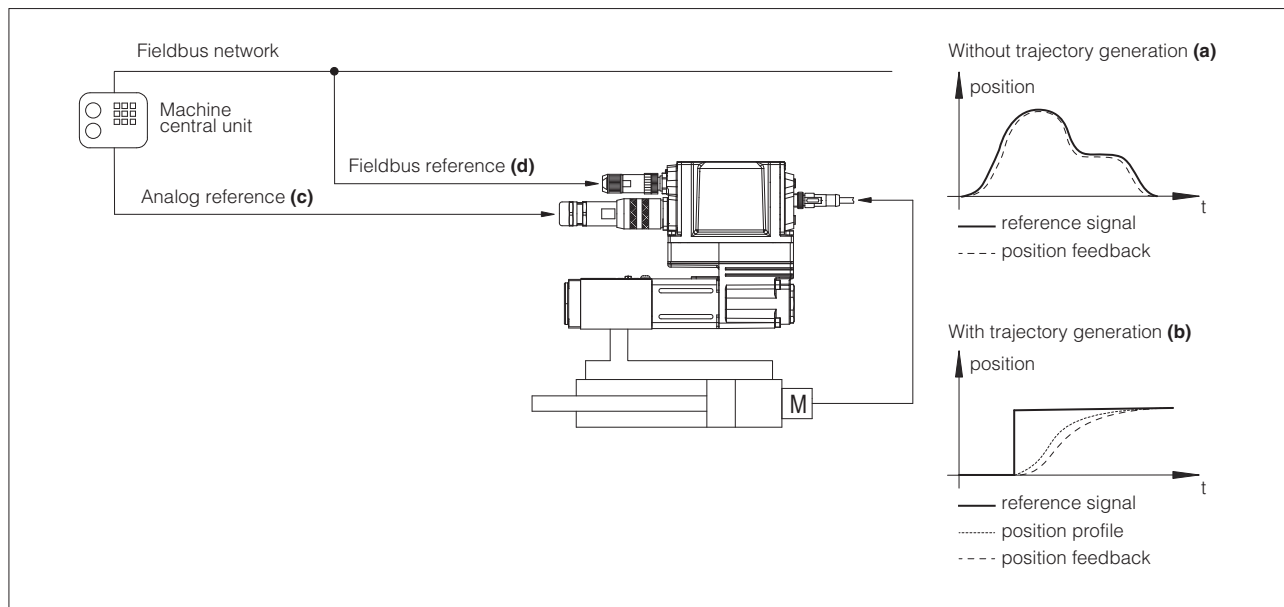
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

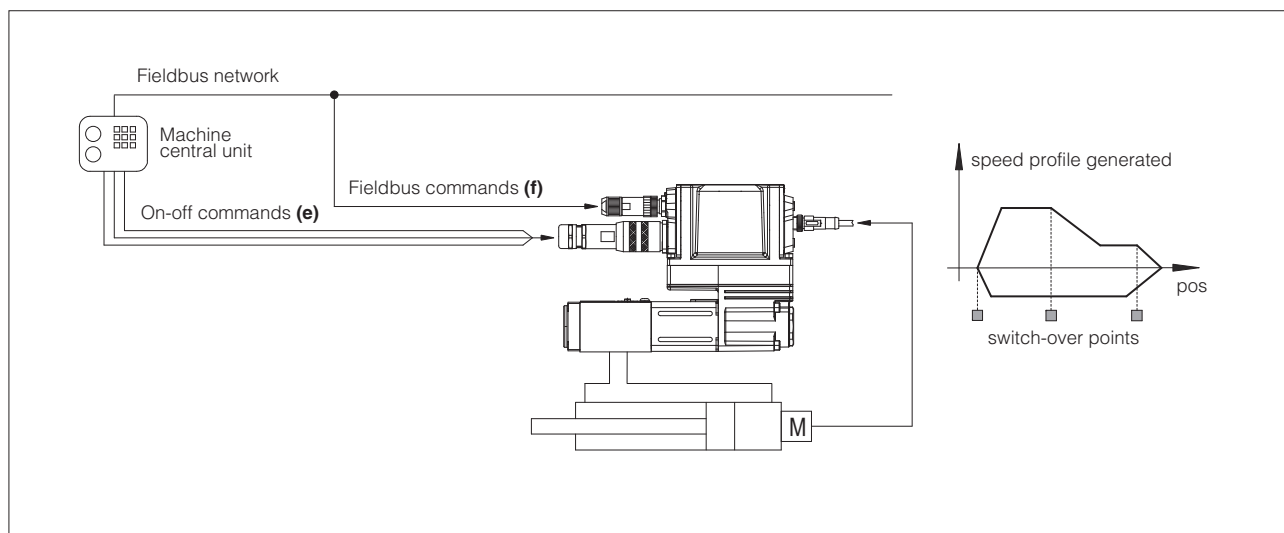
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

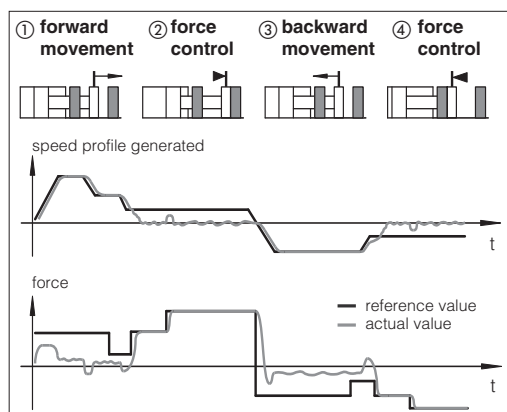
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
<p>two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks ($P_a - P_b$)</p>	<p>one load cell transducer has to be installed between the actuator and the controlled load</p>
<p> T valve spool transducer M actuator position transducer P pressure transducer L load cell </p>	

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportional valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the axis card (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support:	NP (USB)	PS (Serial)	
	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

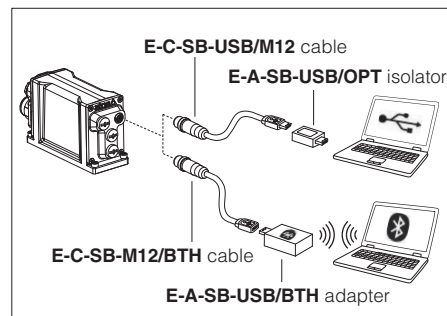


WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**



Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides on-off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position	
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100	
MTTFd valves according to EN ISO 13849	150 years, see technical table P007	
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C	
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C	
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)	
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h	
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DLHZO											DLKZOR							
	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10											ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10							
Pressure limits [bar]	L0	L1	V1	L3	V3	L5	T5	L7	T7	V7	D7	DT7	L3	T3	L7	T7	V7	D7	DT7
Spool type																			
Nominal flow Δp P-T [l/min]																			
(1)																			
Δp= 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
Δp= 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
Max permissible flow	8	14	16	30	40	50		70			70÷40		90		160			160÷80	
Leakage (2) [cm³/min]	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time (3) [ms]	≤ 10											≤ 15							
Hysteresis	≤ 0,1 [% of max regulation]																		
Repeatability	± 0,1 [% of max regulation]																		
Thermal drift	zero point displacement < 1% at ΔT = 40°C																		

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(2) Referred to spool in neutral position and 50°C oil temperature

(3) 0-100% step signal

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	DLHZO = 2,6 A		DLKZOR = 3 A	
Coil resistance R at 20°C	DLHZO = 3 ÷ 3,3 Ω		DLKZOR = 3,8 ÷ 4,1 Ω	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 Vdc (OFF state), 9 ÷ 24 Vdc (ON state), 5 ÷ 9 Vdc (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 Vdc @ max 100 mA and +5 Vdc @ max 100 mA are software selectable; ±10 Vdc @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 21			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

12.1 Regulation diagrams

- 1 = Linear spools L
- 2 = Differential - linear spool D7
- 3 = Differential non linear spool DT7
- 4 = Non linear spool T5 (only for DLHZO)
- 5 = Non linear spool T3 (only for DLHZO) and T7
- 6 = Progressive spool V

T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.

The non linear characteristics of the spool is compensated by the axis card, so the final valve regulation is resulting linear respect the reference signal (dotted line).

DT7 has the same characteristic of T7 but it is specific for applications with cylinders with area ratio 1:2

Note:

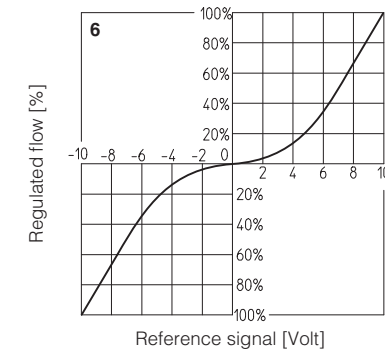
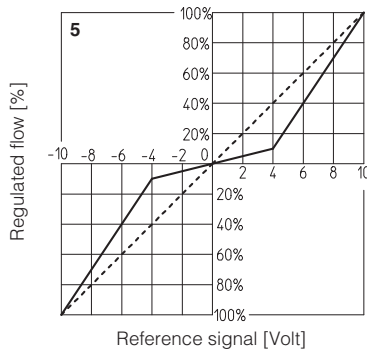
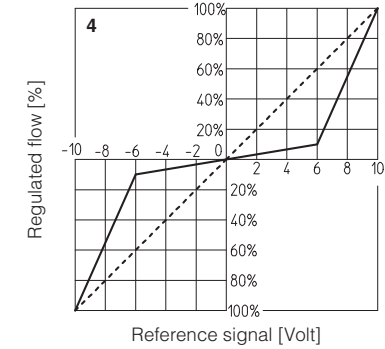
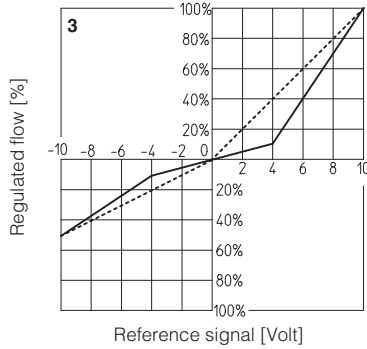
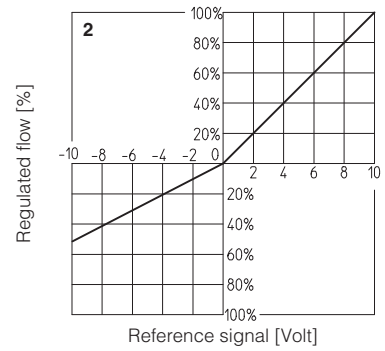
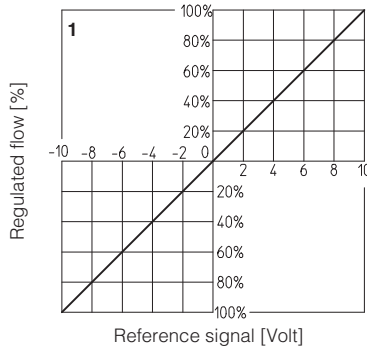
Hydraulic configuration vs. reference signal:

Standard:

- Reference signal $0 \div +10 \text{ V}$ } P → A / B → T
- Reference signal $12 \div 20 \text{ mA}$ }
- Reference signal $0 \div -10 \text{ V}$ } P → B / A → T
- Reference signal $12 \div 4 \text{ mA}$ }

option /B:

- Reference signal $0 \div +10 \text{ V}$ } P → B / A → T
- Reference signal $12 \div 20 \text{ mA}$ }
- Reference signal $0 \div -10 \text{ V}$ } P → A / B → T
- Reference signal $12 \div 4 \text{ mA}$ }



12.2 Flow /Δp diagrams

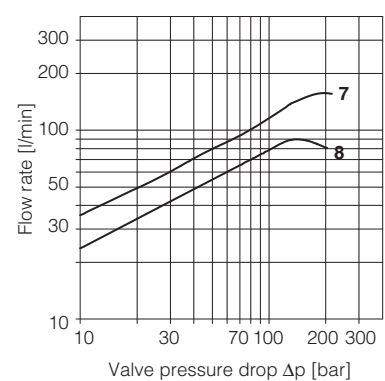
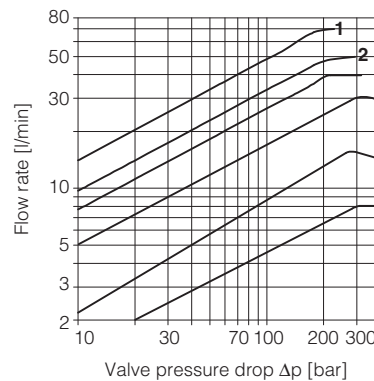
Stated at 100% of spool stroke

DLHZO:

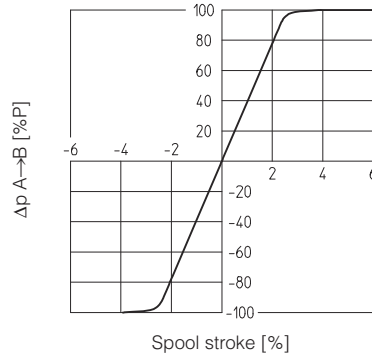
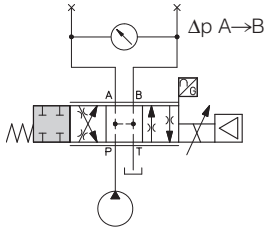
- 1 = spool L7, T7, V7, D7, DT7
- 2 = spool L5, T5
- 3 = spool V3
- 4 = spool L3
- 5 = spool L1, V1
- 6 = spool L0

DLKZOR:

- 7 = spool L7, T7, V7, D7, DT7
- 8 = spool L3

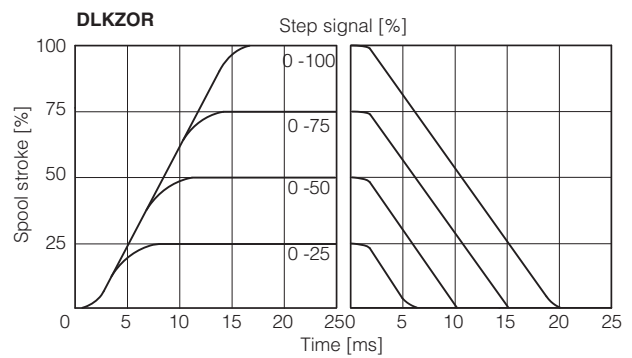
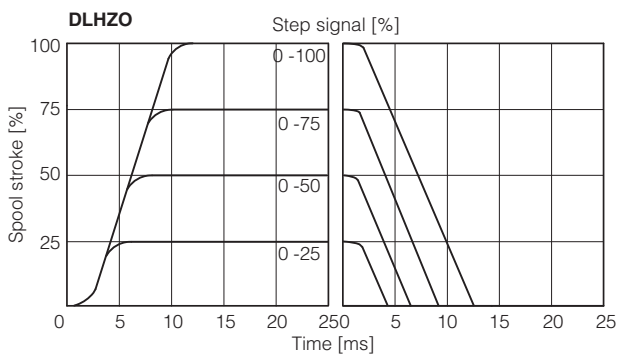


12.3 Pressure gain



12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.



12.5 Bode diagrams

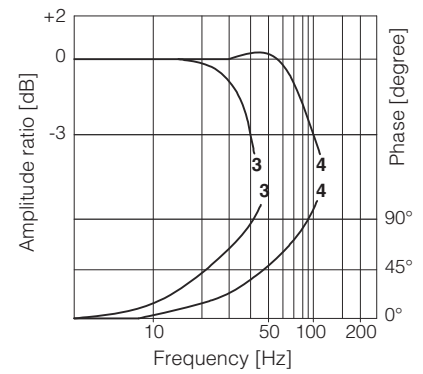
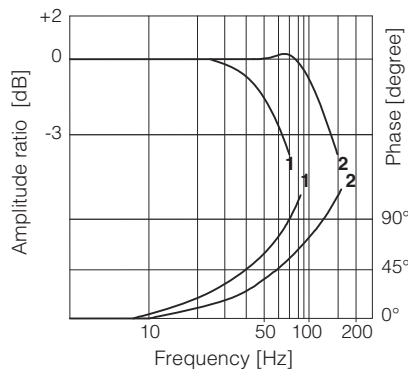
Stated at nominal hydraulic conditions

DLHZO:

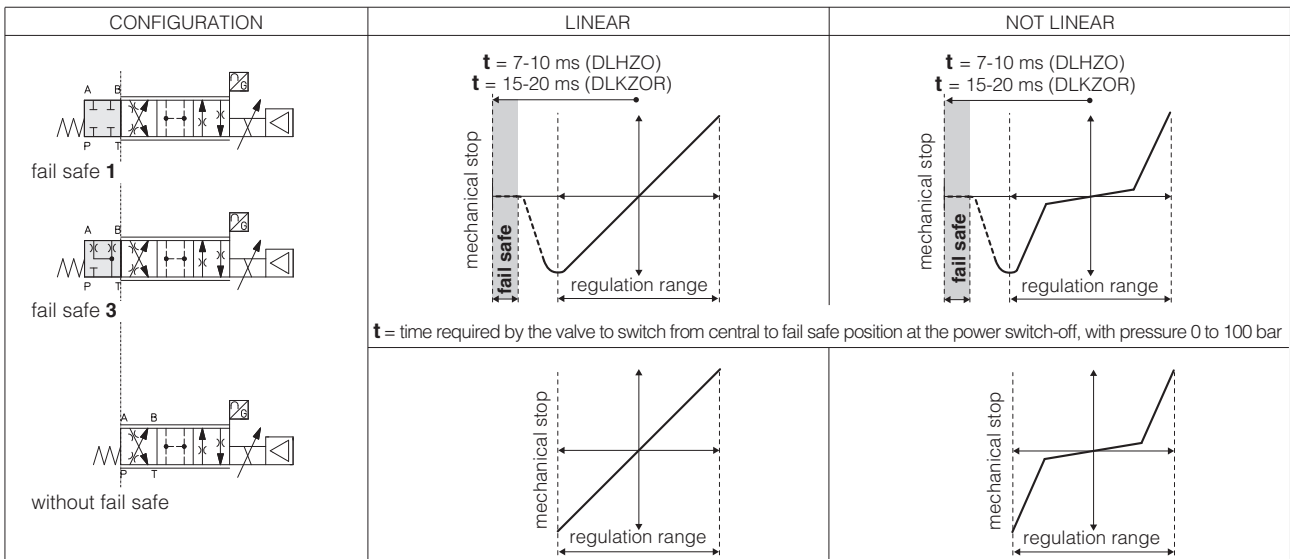
- 1 = ± 100% nominal stroke
- 2 = ± 5% nominal stroke

DLKZOR:

- 3 = ± 100% nominal stroke
- 4 = ± 5% nominal stroke



13 FAIL SAFE POSITION



Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm ³ /min] at P = 100 bar (1)	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] (2)	DLHZO	-	-	15÷30	10÷20
	DLKZOR	-	-	40÷60	25÷40

(1) Referred to spool in fail safe position and 50°C oil temperature

(2) Referred to spool in fail safe position at Δp = 35 bar per edge

14 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A.

For hydraulic configuration vs reference signal, see 12.1

Y = This option is mandatory if the pressure in port T exceeds 210 bar.

15 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 Vdc.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ±20 mA.

16 POSSIBLE COMBINED OPTIONS

Standard versions for D-SN:

/BI, /BIY, /BY, /IY

Safety certified versions for D-SN:

/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /IY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Standard versions for A-SN, A-SF, A-SL and D-SF, D-SL:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for A-SN, A-SF, A-SL and D-SF, D-SL:

/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /IY
/BCK, /BCKI, /BCKIY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CKI, /CKIY, /CKY, /IK, /IKY, /KY


17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

17.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 17.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

17.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

17.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2 :

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or *automatic cycle* (see 2.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

17.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3 :

SL, SF controls and external analog reference selected : input is used as reference for the axis card force closed loop.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

17.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

17.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ± 10 VDC or ± 20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

17.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

17.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

17.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).

Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.

Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 18.1).

17.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Analog input signal is factory preset according to selected valve code, defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 18.2).

18 ACTUATOR'S TRANSDUCER CHARACTERISTICS

18.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).

Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.

Transducers with analog interface grant simple and cost effective solutions.

18.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3.

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).

Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

18.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Execution	Position				Pressure/Force
	A		D		SF, SL
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

19 ELECTRONIC CONNECTIONS

19.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the axis card, referred to VL0	Input - on/off signal
4	P_INPUT+	Position reference input signal: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	P_MONITOR	Position monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to VL0	Output - analog signal Software selectable
7	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 Vdc / ±20mA maximum range, referred to VL0	Output - analog signal Software selectable
9	VL+	Power supply 24 Vdc for axis card logic and communication	Input - power supply
10	VL0 (1)	Power supply 0 Vdc for axis card logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

19.2 Communication connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

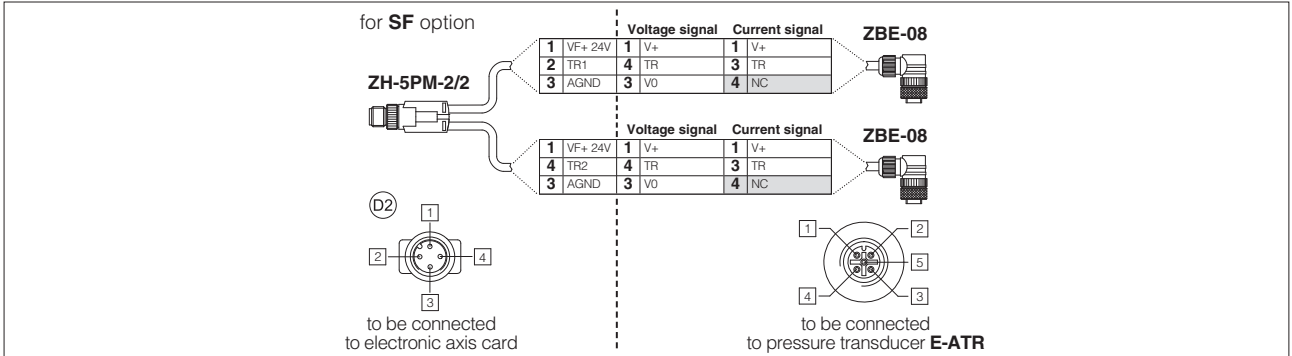
(2) Pin 2 can be fed with external +5V supply of CAN interface

19.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



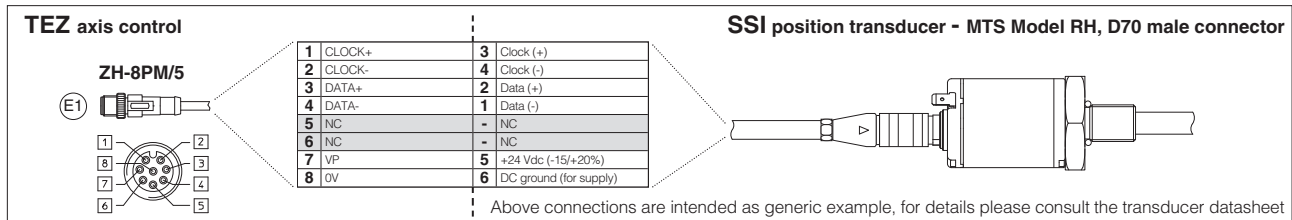
Note: pin layout always referred to axis card view

19.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	CLOCK+	Serial synchronous clock (+)	Input - digital signal	R	Input channel R	Input - digital signal
2	CLOCK-	Serial synchronous clock (-)		/R	Input channel /R	
3	DATA+	Serial position data (+)		A	Input channel A	
4	DATA-	Serial position data (-)		/A	Input channel /A	
5	NC	Not connect	Do not connect	B	Input channel B	Input - digital signal
6	NC			/B	Input channel /B	
7	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
8	0V	Common gnd for transducer power and signals	Common gnd	0V	Common gnd for transducer power and signals	Common gnd

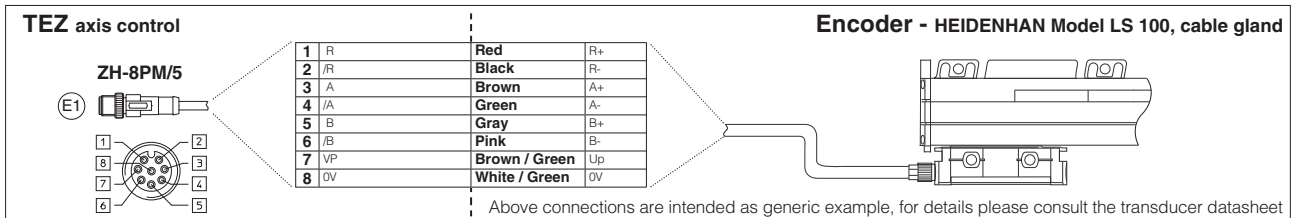
(1) Digital position transducer type is software selectable: Encoder or SSI, see 17.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



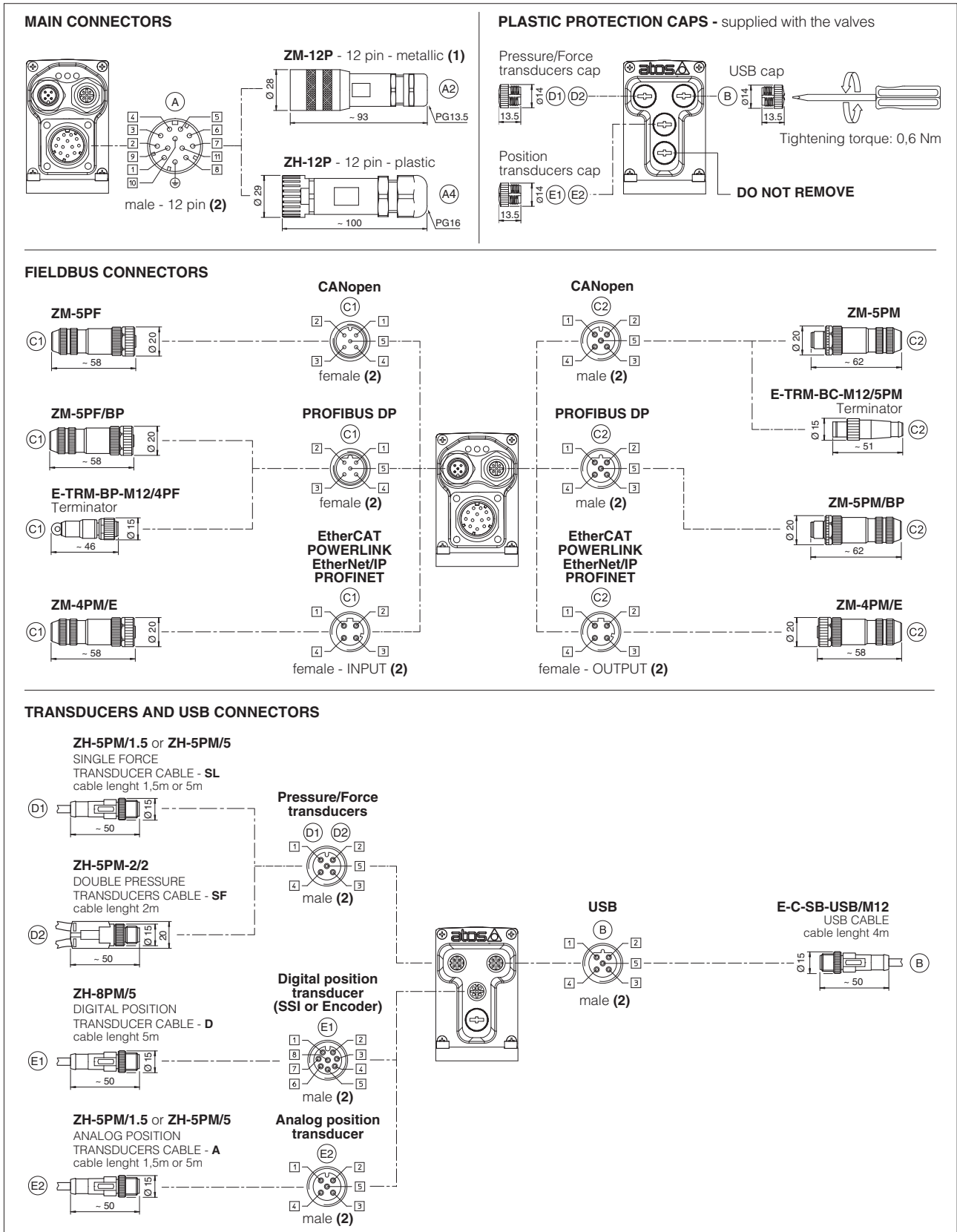
Note: pin layout referred to axis card view

19.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vdc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vdc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 17.9

19.6 TEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to axis card view

19.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

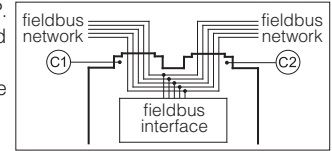
20 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



21 CONNECTORS CHARACTERISTICS - to be ordered separately

21.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-12P	(A2) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

21.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500**

(2) Internally terminated

21.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

21.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 19.4	ANALOG POSITION TRANSDUCER A execution - see 19.5	
CODE	(E1) ZH-8PM/5	(E2) ZH-5PM/1.5	(E2) ZH-5PM/5
Type	8 pin male straight circular	5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101	
Material	Plastic	Plastic	
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght 5 m lenght	
Cable	8 x 0,25 mm ²	5 x 0,25 mm ²	
Connection type	molded cable	molded cable	
Protection (EN 60529)	IP 67	IP 67	

22 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

- Z-MAN-RI-LEZ** - user manual for **TEZ** and **LEZ** with **SN**
- Z-MAN-RI-LEZ-S** - user manual for **TEZ** and **LEZ** with **SF, SL**

22.1 External reference and transducer parameters

- Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
 - *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
 - *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

22.2 PID control dynamics parameters

- Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

22.3 Monitoring parameters

- Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 22.4)

22.4 Fault parameters

- Allow to configure how the axis card detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
 - *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

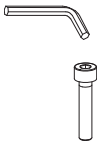

22.5 Valve characteristics compensation

- Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

22.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

23 FASTENING BOLTS AND SEALS

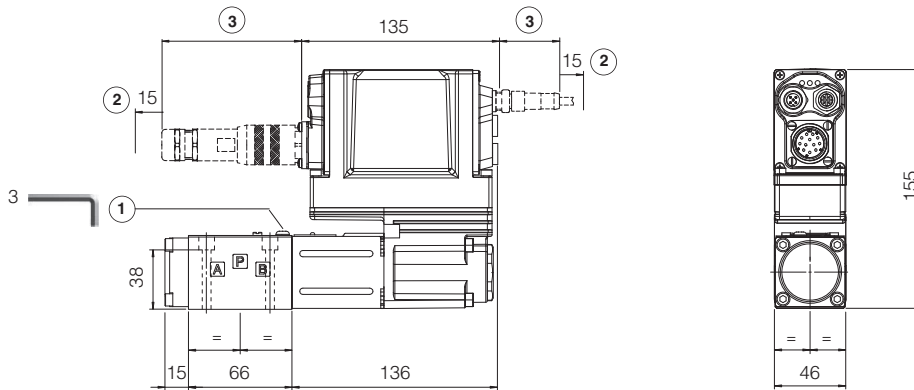
	DLHZO	DLKZOR
	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>	<p>Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>
	<p>Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)</p>	<p>Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)</p>

24 INSTALLATION DIMENSIONS [mm]

DLHZO-TEZ

ISO 4401: 2005
 Mounting surface: 4401-03-02-0-05 (see table P005)
 (for /Y surface 4401-03-03-0-05 without X port)

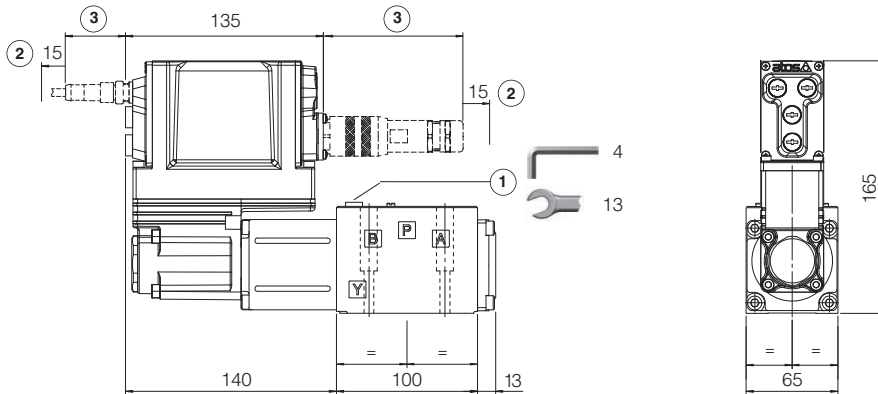
Mass [kg]	
DLHZO	2,3



DLKZOR-TEZ

ISO 4401: 2005
 Mounting surface: 4401-05-04-0-05 (see table P005)
 (for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DLKZOR	4,3



- ① = Air bleeding
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 19.6

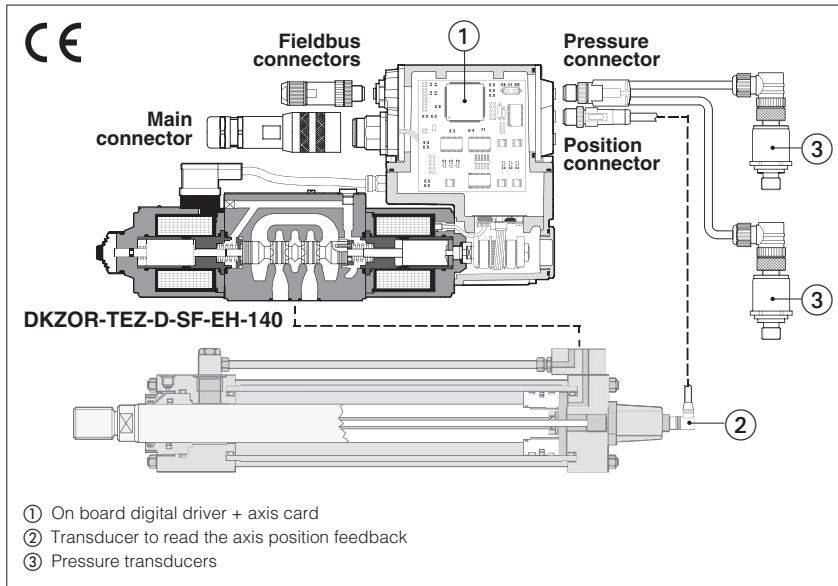
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

25 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
FY100	Safety proportional valves - option /U	P005	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Digital servoproportionals with on-board axis card

direct, double solenoid, with LVDT transducer and zero spool overlap



DHZO-TEZ, DKZOR-TEZ

Digital servoproportional directional valves, direct, double solenoid, with on-board digital driver + axis card, LVDT position transducer and zero spool overlap for position closed loop controls of linear or rotative hydraulic actuator. The double solenoid execution grants larger flow capacity and central safety rest position.

The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

The valve can be operated via an external reference signal or automatic cycle, see section 2.

Alternated P/Q controls option, see 3 :
SF, SL = alternated force control added to the basic position one

Safety options TÜV certified, see 7 :

U = safe double power supply

K = safe on/off signals

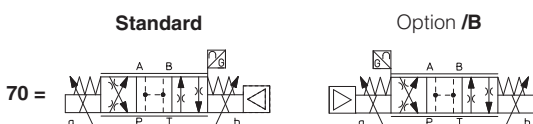
DHZO:	DKZOR:
Size: 06 -ISO 4401	Size: 10 -ISO 4401
Max flow: 80 l/min	Max flow: 180 l/min
Max pressure: 350 bar	Max pressure: 315 bar

1 MODEL CODE

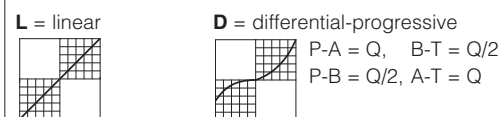
DHZO	-	TEZ	-	D	-	SN	-	NP	-	0	70	-	L	5	/	*	/	*							
<p>Servoproportional directional valves, direct DHZO = size 06 DKZOR = size 10</p> <p>TEZ = on-board digital driver + axis card, one LVDT transducer</p> <p>Position transducer type: A = Analog (standard, potentiometer) D = Digital (SSI, Encoder)</p> <p>Alternated P/Q controls: SN = none SF = force control (2 pressure transducers) SL = force control (1 load cell)</p> <p>Fieldbus interface, USB port always present: NP = Not Present EW = POWERLINK BC = CANopen EI = EtherNet/IP BP = PROFIBUS DP EP = PROFINET RT/IRT EH = EtherCAT</p> <p>Valve size ISO 4401: 0 = 06 1 = 10</p>																									
<p>Seals material, see section 11 : - = NBR PE = FKM BT = HNBR</p> <p>Series number</p>																									
<p>Hydraulic options (1): B = solenoid with on-board digital driver + axis card and LVDT transducer at side of port A Y = external drain</p> <p>Electronics options (1): C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10Vdc) - only for SF, SL I = current reference input and monitor 4÷20mA (omit for std voltage ±10Vdc)</p> <p>Safety options TÜV certified (1): U = safe double power supply K = safe on/off signals See section 7</p>																									
<p>Spool size:</p> <table border="0"> <tr> <td></td> <td style="text-align: center;">3 (L)</td> <td style="text-align: center;">5 (L,D)</td> </tr> <tr> <td>DHZO</td> <td style="text-align: center;">= 17</td> <td style="text-align: center;">28</td> </tr> <tr> <td>DKZOR</td> <td style="text-align: center;">= 45</td> <td style="text-align: center;">75</td> </tr> </table> <p>Nominal flow (l/min) at Δp 10bar P-T</p>																		3 (L)	5 (L,D)	DHZO	= 17	28	DKZOR	= 45	75
	3 (L)	5 (L,D)																							
DHZO	= 17	28																							
DKZOR	= 45	75																							

**SAFETY
CERTIFIED**

Configuration:



Spool type - regulating characteristics:



(1) For possible combined options, see section 15

2 POSITION CONTROL

2.1 External reference signal

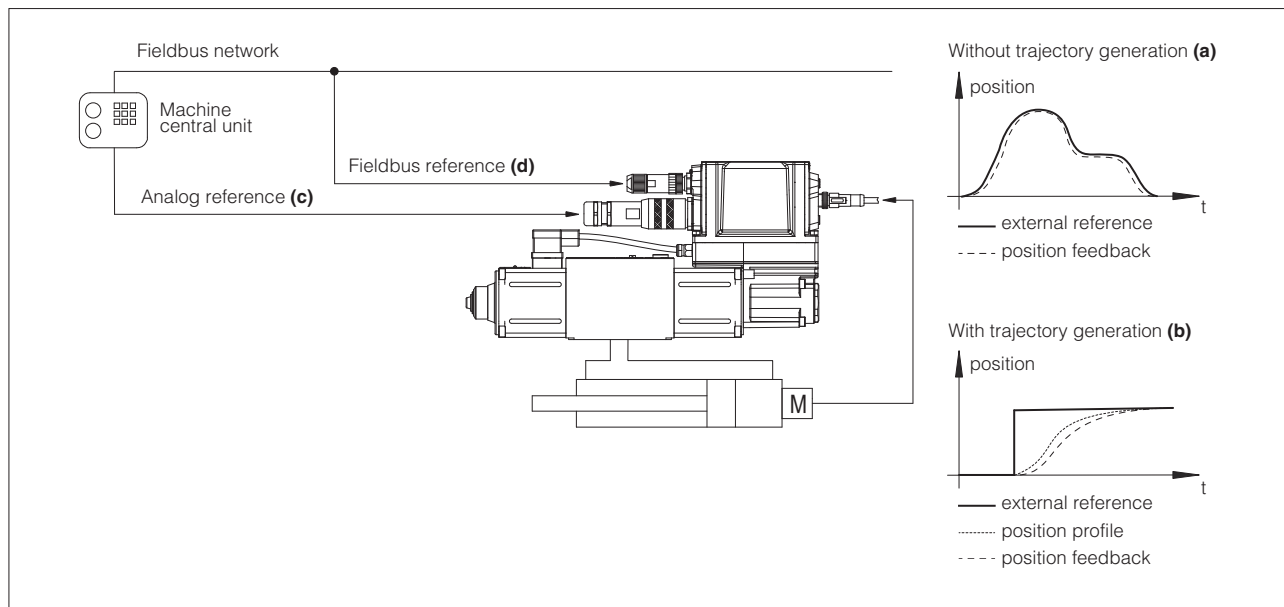
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

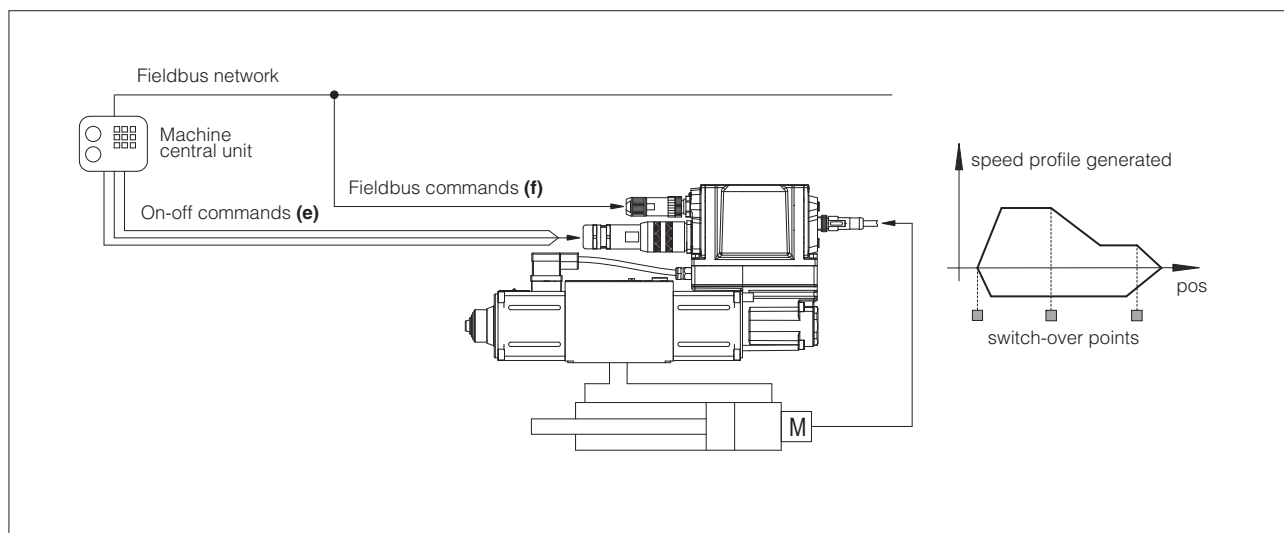
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

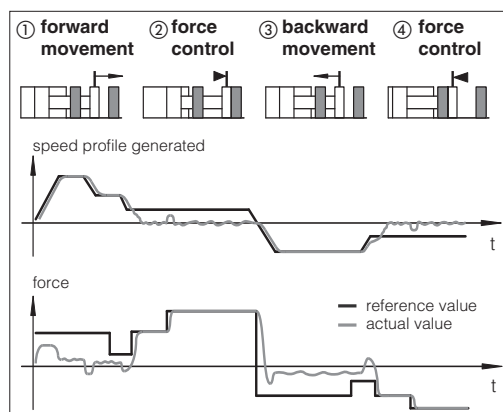
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
<p>two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks ($P_a - P_b$)</p>	<p>one load cell transducer has to be installed between the actuator and the controlled load</p>
<p>T valve spool transducer M actuator position transducer P pressure transducer L load cell</p>	

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support:	NP (USB)	PS (Serial)		
	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)	
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)	

Note: Z-SW programming software supports valves with option SF, SL for alternated control

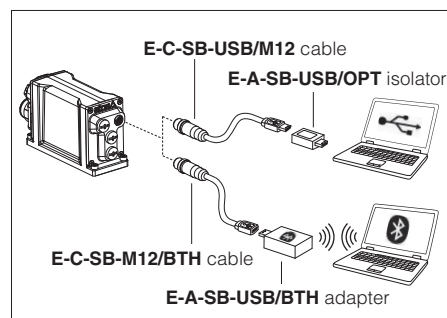


WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**



Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position		
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100		
MTTFd valves according to EN ISO 13849	150 years, see technical table P007		
Ambient temperature range	Standard = -20°C ÷ +60°C	/PE option = -20°C ÷ +60°C	/BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C	/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DHZO			DKZOR		
	ports P, A, B = 350; T = 210 (250 with external drain /Y) Y = 10			ports P, A, B = 315; T = 210 (250 with external drain /Y) Y = 10		
Pressure limits [bar]	L3	L5	D5	L3	L5	D5
Spool type						
Nominal flow Δp P-T [l/min] (1)						
Δp= 10 bar	18	28	28	45	75	75
Δp= 30 bar	30	50	50	80	130	130
Δp= 70 bar	45	75	75	120	170	170
Max permissible flow (2)	50	80	80	130	180	180
Leakage [cm³/min]	<500 (at p = 100 bar); <1500 (at p = 350 bar)			<800 (at p = 100 bar); <2500 (at p = 315 bar)		
Response time (3) [ms]	≤ 15			≤ 20		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

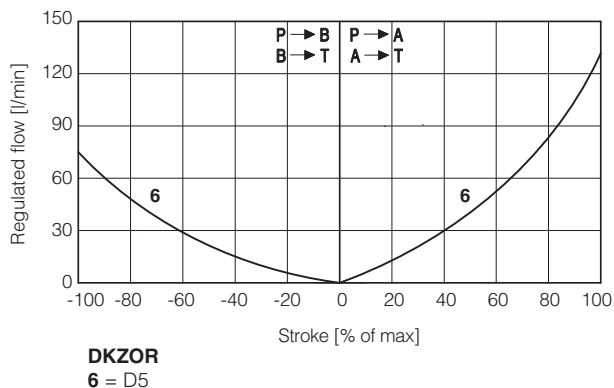
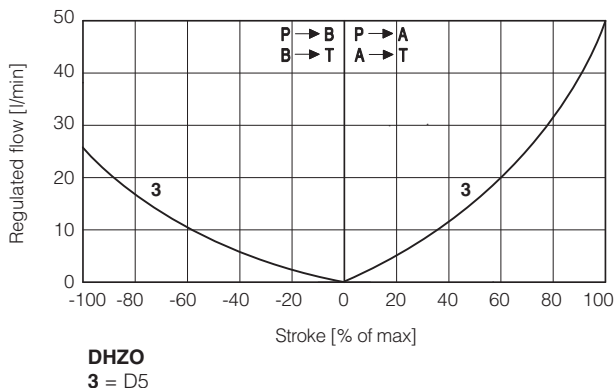
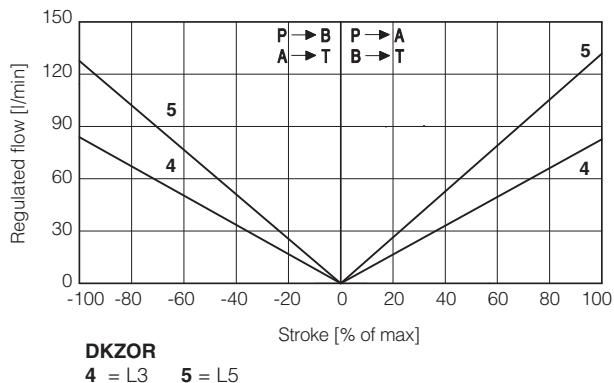
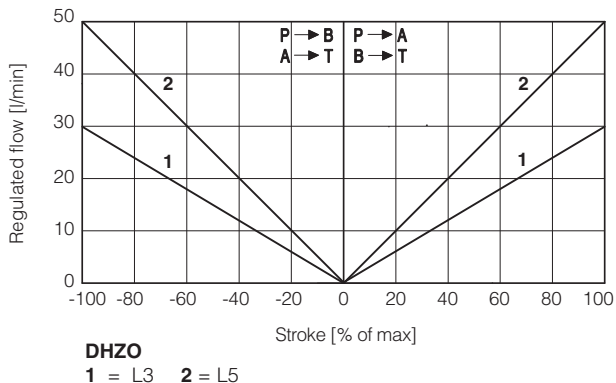
(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(2) See detailed diagrams in section 12.3

(3) 0-100% step signal

12 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

12.1 Regulation diagrams (values measure at Δp 30 bar P-T)



Note:

Hydraulic configuration vs. reference signal for configurations 70 (standard and option /B)

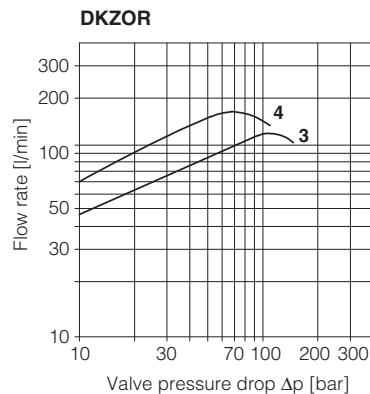
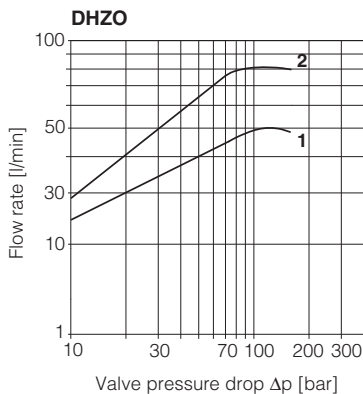
Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$ Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

12.2 Flow / Δp diagrams

stated at 100% of valve stroke

DHZO
1 = spool L3,
2 = spool L5, D5

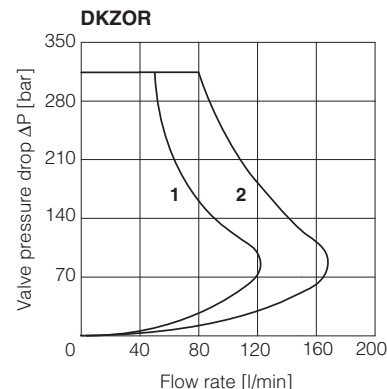
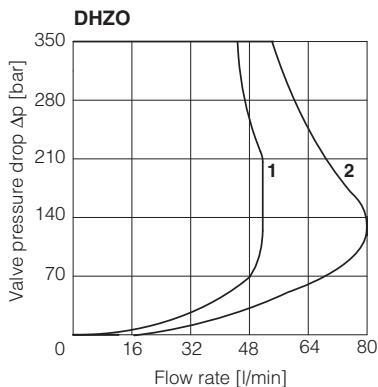
DKZOR
3 = spool L3
4 = spool L5, D5



12.3 Operating limits

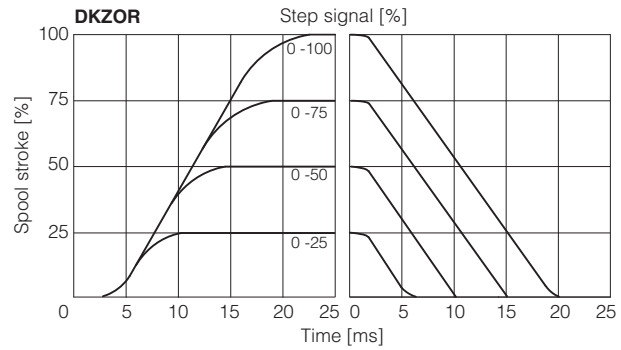
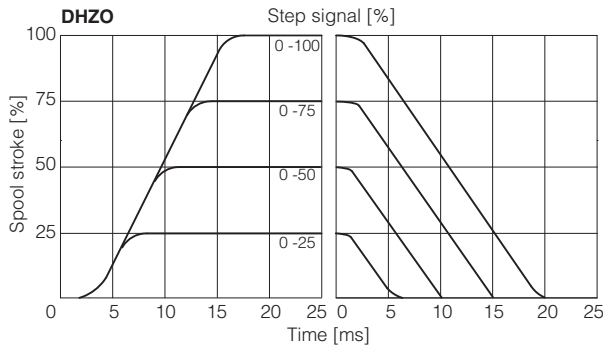
DHZO
1 = spool L3
2 = spool L5, D5

DKZOR
3 = spool L3
4 = spool L5, D5



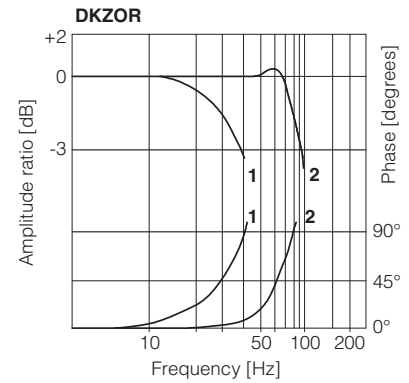
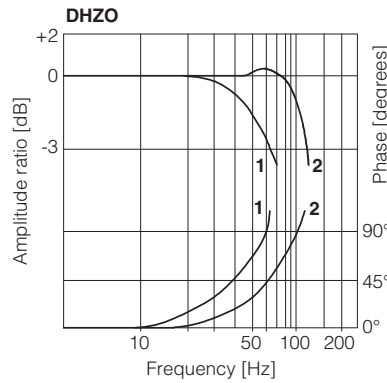
12.4 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.



12.5 Bode diagrams

- 1 = 10% ↔ 90% nominal stroke
- 2 = 50% ± 5% nominal stroke



13 HYDRAULIC OPTIONS

- B** = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port A.
For hydraulic configuration vs reference signal, see 12.1
- Y** = This option is mandatory if the pressure in port T exceeds 210 bar.

14 ELECTRONICS OPTIONS

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- C** = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

Standard versions for D-SN:

/BI, /BIY, /BY, /IY

Safety certified versions for D-SN:

/BIU, /BIUY, /BU, /BUY, /IU, /IUY, /IY
/BIK, /BIKY, /BK, /BKY, /IK, /IKY, /KY

Standard versions for A-SN, A-SF, A-SL and D-SF, D-SL:

/BC, /BCI, /BCIY, /BCY, /BI, /BIY, /BY,
/CI, /CIY, /CY,
/IY

Safety certified versions for A-SN, A-SF, A-SL and D-SF, D-SL:

/BCU, /BCIU, /BCIUY, /BCUY, /BIU, /BIUY, /BU, /BUY,
/CU, /CIU, /CIUY, /CUY, /IU, /IUY, /IY
/BCK, /BCKI, /BCKIY, /BCKY, /BIK, /BIKY, /BK, /BKY,
/CK, /CKI, /CKIY, /CKY, /IK, /IKY, /KY


16 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

16.1 Power supply (V+ and V0)


The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

16.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2:

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or *automatic cycle* (see 2.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3:

SL, SF controls and external analog reference selected: input is used as reference for the axis card force closed loop.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

16.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ± 10 VDC or ± 20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

16.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

16.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).

Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.

Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 17.1).

16.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 17.2).

17 ACTUATOR'S TRANSDUCER CHARACTERISTICS

17.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

17.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected pressure/force transducer, see section 3. Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values. Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control. The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

17.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Execution	Position				Pressure/Force
	A		D		SF, SL
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

18 ELECTRONIC CONNECTIONS

18.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the axis card, referred to VL0	Input - on/off signal
4	P_INPUT+	Position reference input signal: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	P_MONITOR	Position monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to VL0	Output - analog signal Software selectable
7	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 Vdc / ±20mA maximum range, referred to VL0	Output - analog signal Software selectable
9	VL+	Power supply 24 Vdc for axis card logic and communication	Input - power supply
10	VL0 (1)	Power supply 0 Vdc for axis card logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

18.2 Communication connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

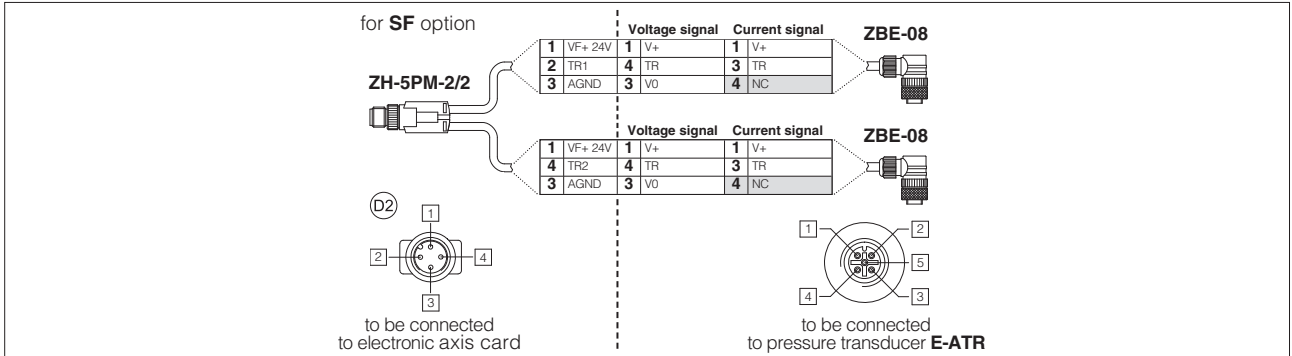
(2) Pin 2 can be fed with external +5V supply of CAN interface

18.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



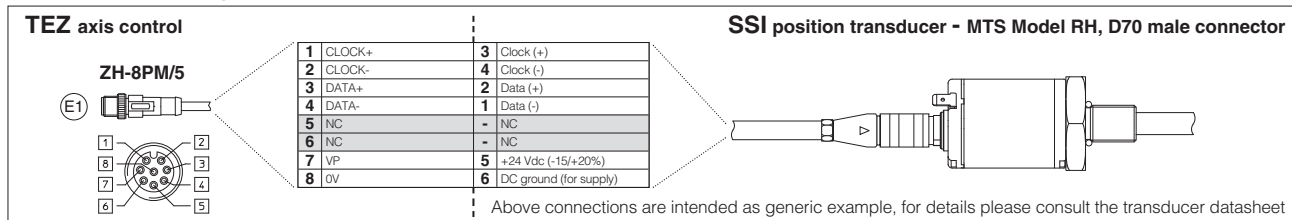
Note: pin layout always referred to axis card view

18.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	CLOCK+	Serial synchronous clock (+)	Input - digital signal	R	Input channel R	Input - digital signal
2	CLOCK-	Serial synchronous clock (-)		/R	Input channel /R	
3	DATA+	Serial position data (+)		A	Input channel A	
4	DATA-	Serial position data (-)		/A	Input channel /A	
5	NC	Not connect	Do not connect	B	Input channel B	
6	NC		Do not connect	/B	Input channel /B	
7	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
8	0V	Common gnd for transducer power and signals	Common gnd	0V	Common gnd for transducer power and signals	Common gnd

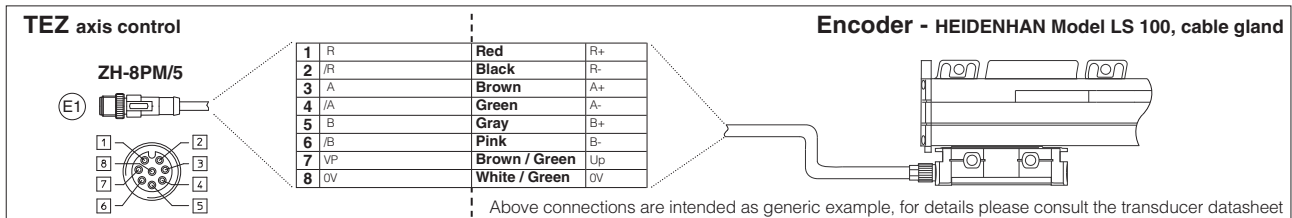
(1) Digital position transducer type is software selectable: Encoder or SSI, see 16.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



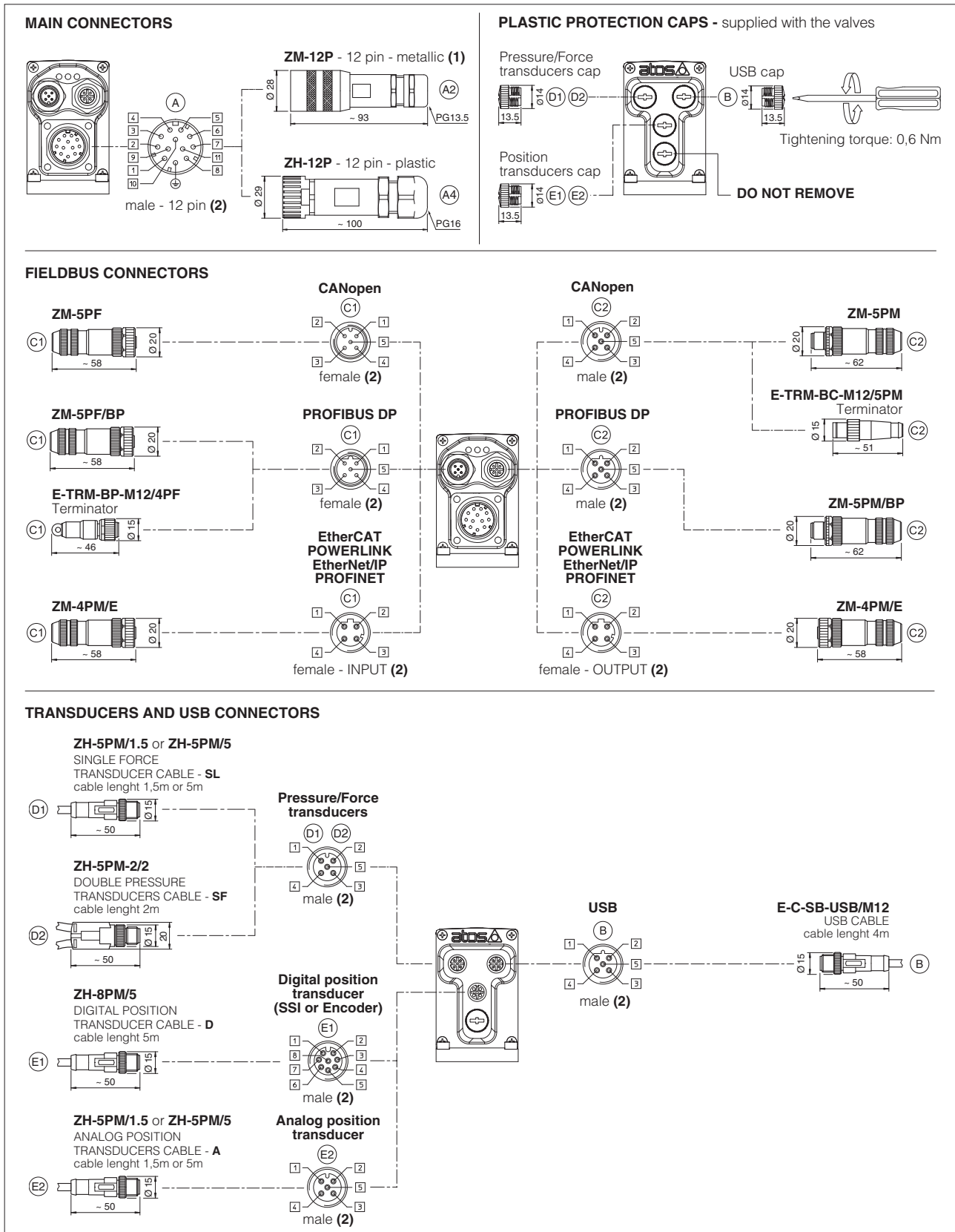
Note: pin layout referred to axis card view

18.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vdc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vdc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 16.9

18.6 TEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to axis card view

18.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

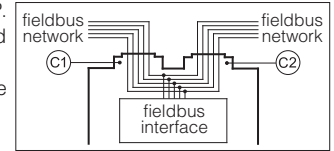
19 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This feature allows considerable technical advantages in terms of installation simplicity, wiring reduction and also avoids the use of expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like an end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



20 CONNECTORS CHARACTERISTICS - to be ordered separately

20.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-12P	(A2) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

20.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)	
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E	
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101	
Material	Metallic		Metallic		Metallic	
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm	
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5	
Connection type	screw terminal		screw terminal		terminal block	
Protection (EN 60529)	IP67		IP 67		IP 67	

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500**

(2) Internally terminated

20.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m length 5 m length		Connector moulded on cables 2 m length
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 18.4	ANALOG POSITION TRANSDUCER A execution - see 18.5
CODE	(E1) ZH-8PM/5	(E2) ZH-5PM/1.5 (E2) ZH-5PM/5
Type	8 pin male straight circular	5 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101
Material	Plastic	Plastic
Cable gland	Connector moulded on cables 5 m length	Connector moulded on cables 1,5 m length 5 m length
Cable	8 x 0,25 mm ²	5 x 0,25 mm ²
Connection type	molded cable	molded cable
Protection (EN 60529)	IP 67	IP 67

21 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

- Z-MAN-RI-LEZ** - user manual for **TEZ** and **LEZ** with **SN**
- Z-MAN-RI-LEZ-S** - user manual for **TEZ** and **LEZ** with **SF, SL**

21.1 External reference and transducer parameters

- Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:
- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
 - *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
 - *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

21.2 PID control dynamics parameters

- Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:
- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

21.3 Monitoring parameters

- Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:
- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 21.4)

21.4 Fault parameters

- Allow to configure how the axis card detect and react to alarm conditions:
- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
 - *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

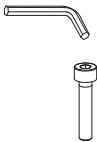

21.5 Valve characteristics compensation

- Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

21.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

22 FASTENING BOLTS AND SEALS

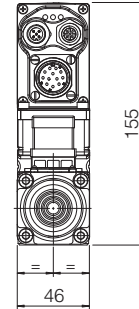
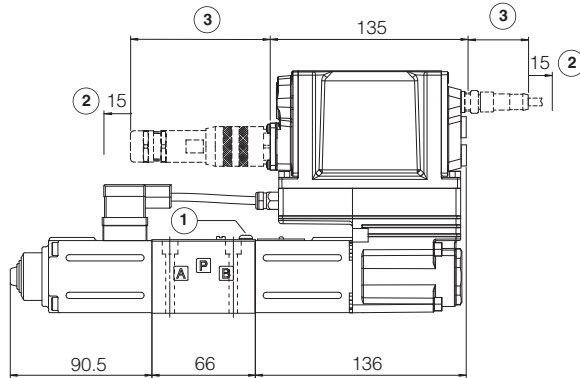
	DHZO	DKZOR
	<p>Fastening bolts: 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm</p>	<p>Fastening bolts: 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm</p>
	<p>Seals: 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y option)</p>	<p>Seals: 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)</p>


DHZO-TEZ

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)
(for /Y surface 4401-03-03-0-05 without X port)

Mass [kg]	
DHZO	3,1



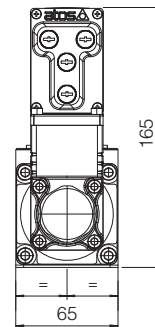
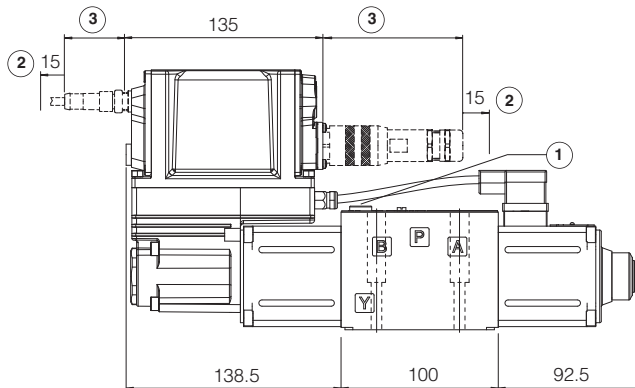
- ① = Air bleeding  3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.6



DKZOR-TEZ

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

Mass [kg]	
DKZOR	5,0



- ① = Air bleeding  4  13
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.6

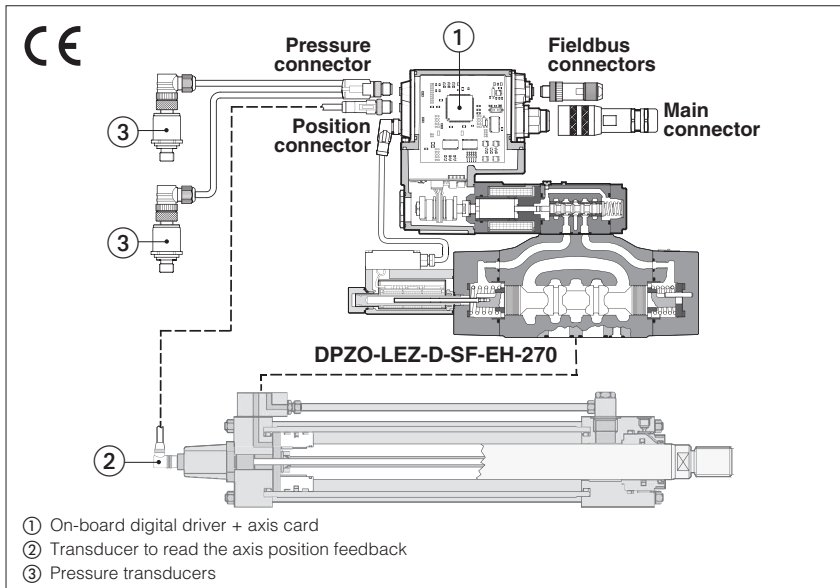
Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port A

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
FY100	Safety proportional valves - option /U	P005	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Digital servoproportionals with on-board axis card

piloted, single solenoid, with two LVDT transducers and zero spool overlap



DPZO-LEZ

Digital servoproportional directional valves, piloted, single solenoid, with on-board digital driver + axis card, two LVDT position transducers and zero spool overlap for position closed loop controls of linear or rotative hydraulic actuator.

The controlled actuator has to be equipped with transducer (analog, potentiometer, SSI or Encoder) to read the axis position feedback.

The valve can be operated via an external reference signal or automatic cycle, see section [2].

Alternated P/Q controls, see [3]:

SF, SL = alternated force control added to the basic position one

Safety options TÜV certified, see [7]:

U = safe double power supply

K = safe on/off signals

Size: **10 ÷ 35** - ISO 4401

Max flow: **180 ÷ 3500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZO	-	LEZ	-	D	-	SN	-	NP	-	2		70	-	L		5	/	*		/	*
-------------	---	------------	---	----------	---	-----------	---	-----------	---	----------	--	-----------	---	----------	--	----------	---	---	--	---	---

Servoproportional directional valves, piloted

LEZ = on-board digital driver + axis card, two LVDT transducers

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

Alternated P/Q controls:
SN = none
SF = force control (2 pressure transducers)
SL = force control (1 load cell)

Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen **EW** = POWERLINK
BP = PROFIBUS DP **EI** = EtherNet/IP
EH = EtherCAT **EP** = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Configuration:

	Standard	Option /B
60 =		
70 =		

Spool type, regulating characteristics:

L =	linear	DL =	differential-linear P-A = Q, B-T = Q/2 P-B = Q/2, A-T = Q
T =	non linear (1)		

Seals material, see section [11]:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid with on-board digital driver + axis card and LVDT transducer at side of port B of the main stage (side A of pilot valve)
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

Electronics options (2):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) - only for **SF, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Safety options TÜV certified (2):
U = safe double power supply
K = safe on/off signals

See section [7]

SAFETY CERTIFIED

Spool size	3 (L)	5 (L,DL)	5 (L)	5 (T)
DPZO-1 =	-	100	-	-
DPZO-2 =	160	250	-	190
DPZO-4 =	-	480	-	-
DPZO-4M =	-	550	-	-
DPZO-6 =	-	-	640	-
DPZO-8 =	-	-	1200	-

Nominal flow (l/min) at Δp 10bar P-T

(1) Not available for configuration 60

(2) For possible combined options consult Atos technical office

2 POSITION CONTROL

2.1 External reference signal

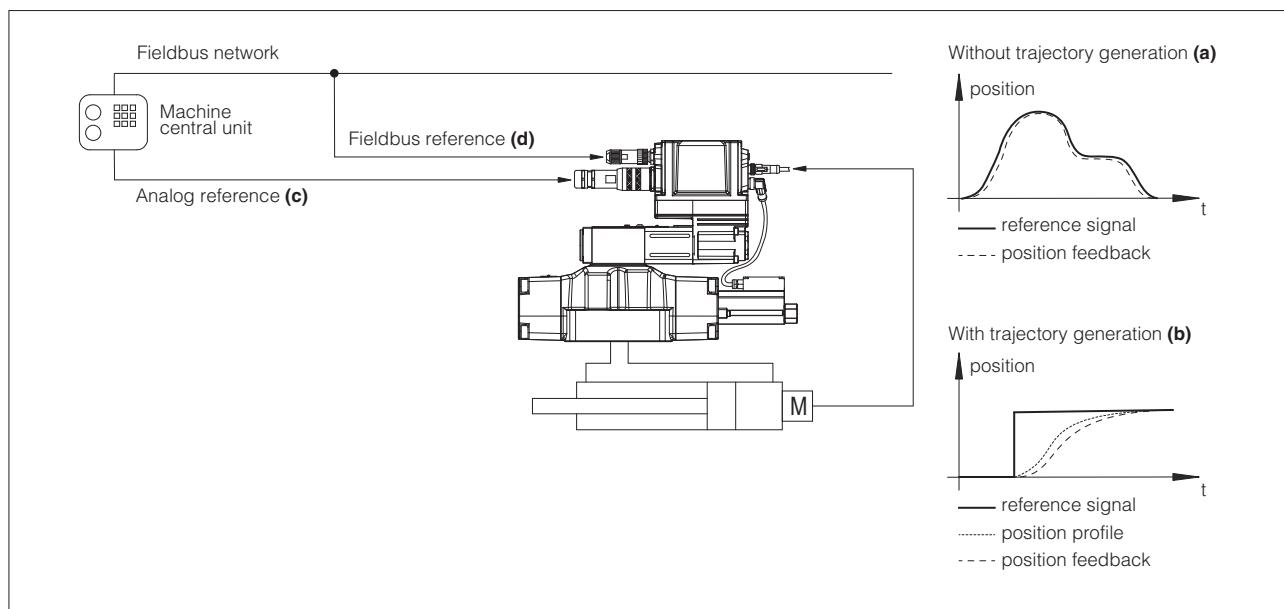
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

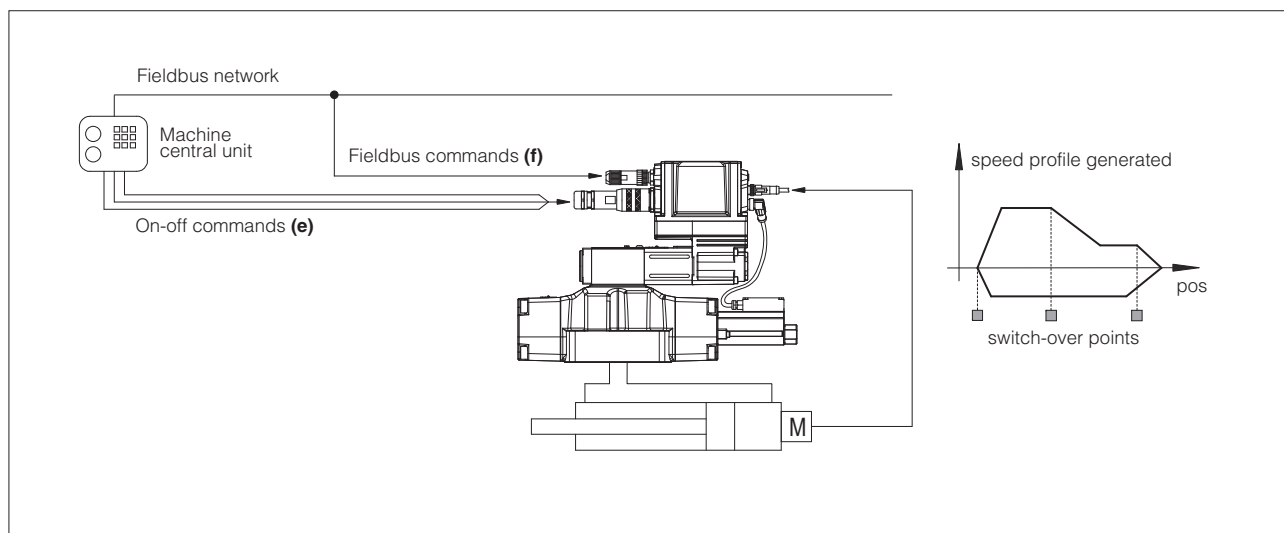
Refer to the axis card user manual for further details on position control features.



2.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



3 ALTERNATED POSITION / FORCE CONTROL

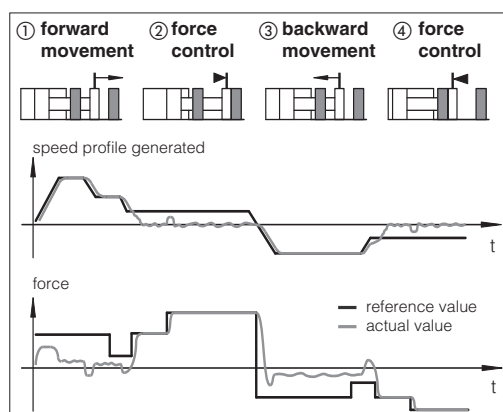
SF and **SL** controls add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations

SF	SL
<p>two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks ($P_a - P_b$)</p>	<p>one load cell transducer has to be installed between the actuator and the controlled load</p>
<p>T valve spool transducer M actuator position transducer P pressure transducer L load cell</p>	

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on A and B hydraulic lines.

SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on the hydraulic actuator.

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault
- Atos technical office is available for additional evaluations related to specific applications

4 GENERAL NOTES

Atos digital proportional valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB) PS (Serial)
 BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)

Note: Z-SW programming software supports valves with option SF, SL for alternated control

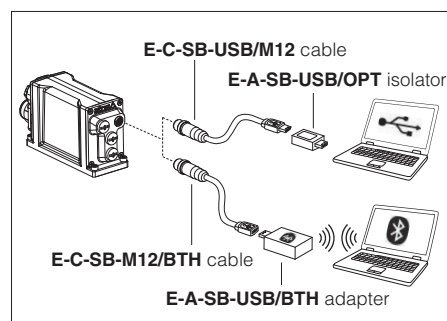


WARNING: axis card USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



6 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

7 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**



Safe double power supply, option **/U**: the axis card has separate power supplies for logic and solenoids. The safe condition is reached by cutting the electrical supply to solenoids, while electronics remains active for monitoring functions and fieldbus communication, see tech table **FY100**

Safety function via on/off signals, option **/K**: upon a disable command, the axis card checks the spool position and it provides an on/off acknowledgement signal only when the valve is in safe condition, see tech table **FY200**

8 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	75 years, see technical table P007
Ambient temperature range	Standard = -20°C ÷ +60°C /PE option = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C
Storage temperature range	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation, galvanic treatment (axis card housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

Valve model	DPZO-*-1	DPZO-*-2			DPZO-*-4	DPZO-*-4M	DPZO-*-6	DPZO-*-8
Pressure limits [bar]	ports P, A, B, X = 350; T = 250 (10 for option /D); Y = 10;							
Spool type	L5, DL5	L3	L5, DL5	T5	L5, DL5		L5	
Nominal flow Δp P-T [l/min] (1)								
Δp= 10 bar	100	160	250	190	480	550	640	1200
Δp= 30 bar	160	270	430	330	830	950	1100	2000
Max permissible flow [l/min]	180	400	550	550	1000	1100	1600	3500
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 200 bar)							
Piloting volume [cm³/min]	1,4	3,7			9	11,3	21,6	39,8
Piloting flow (2) [l/min]	3,5	9			18	20	19	24
Leakage (3) Pilot [cm³/min]	100 / 300	150 / 450			200 / 600	200 / 600	900 / 2800	900 / 2800
Main stage [l/min]	0,4 / 1,2	0,6 / 2,5			1,0 / 4,0	1,0 / 4,0	3,0 / 9,0	6,0 / 20
Response time (4) [ms]	≤ 25	≤ 25			≤ 30	≤ 35	≤ 80	≤ 100
Hysteresis	≤ 0,1 [%of max regulation]							
Repeatability	± 0,1 [%of max regulation]							
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

(1) For different Δp, the max flow is in accordance to the diagrams in section 12.2

(3) At p = 100/350 bar

(2) With step reference input signal 0 ÷ 100 %

(4) 0-100% step signal, see detailed diagrams in section 12.3

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	2,6 A			
Coil resistance R at 20°C	3 \div 3,3 Ω			
Analog input signals	Voltage: range ± 10 VDC (24 VMAX tollerant) Current: range ± 20 mA		Input impedance: $R_i > 50$ k Ω Input impedance: $R_i = 500$ Ω	
Monitor outputs	Output range: voltage ± 10 VDC @ max 5 mA current ± 20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 \div 5 Vdc (OFF state), 9 \div 24 Vdc (ON state), 5 \div 9 Vdc (not accepted); Input impedance: $R_i > 10$ k Ω			
Fault output	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 Vdc @ max 100 mA and +5 Vdc @ max 100 mA are software selectable; ± 10 Vdc @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducer power supply (only for SF, SL)	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control, force control (SF, SL) by axis P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 19			

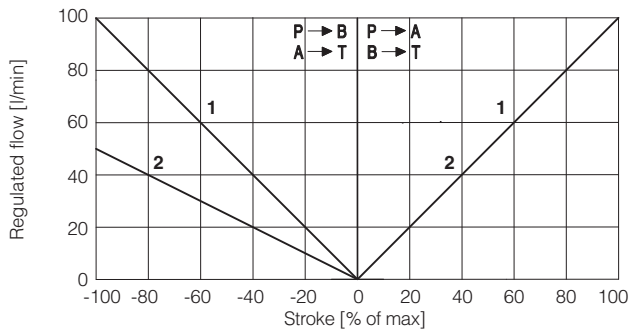
Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

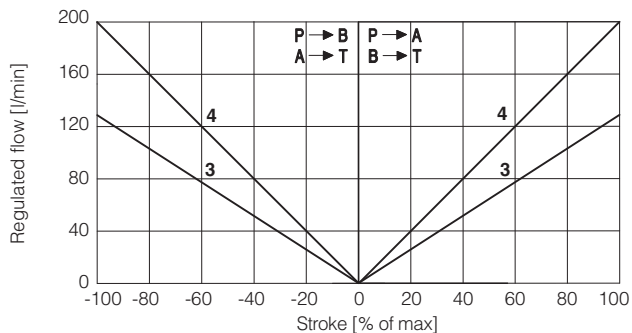
Seals, recommended fluid temperature	NBR seals (standard) = -20°C \div +60°C, with HFC hydraulic fluids = -20°C \div +50°C FKM seals (/PE option) = -20°C \div +80°C HNBR seals (/BT option) = -40°C \div +60°C, with HFC hydraulic fluids = -40°C \div +50°C		
Recommended viscosity	20 \div 100 mm ² /s - max allowed range 15 \div 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

12 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

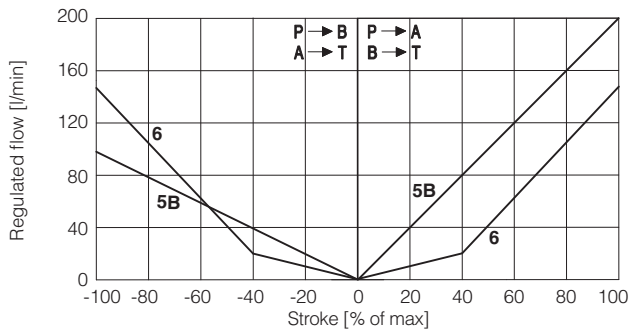
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



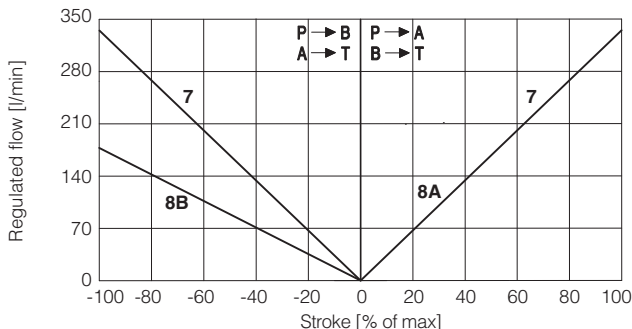
DPZO-1: 1 = L5 2 = DL5



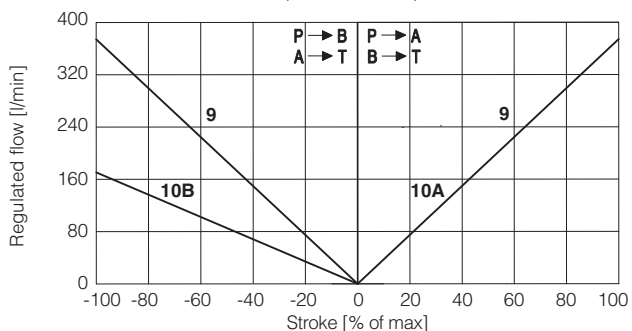
DPZO-2: 3 = L3 4 = L5



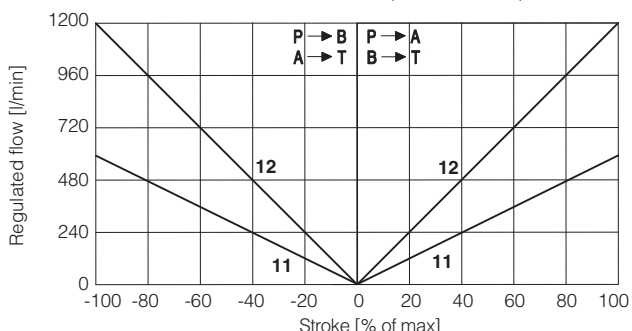
DPZO-2: 5A = DL5 (P → A, A → T) 6 = T5
5B = DL5 (P → B, B → T)



DPZO-4: 7 = L5 8A = DL5 (P → A, A → T)
8B = DL5 (P → B, B → T)

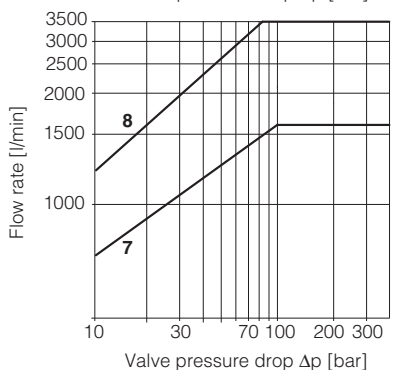
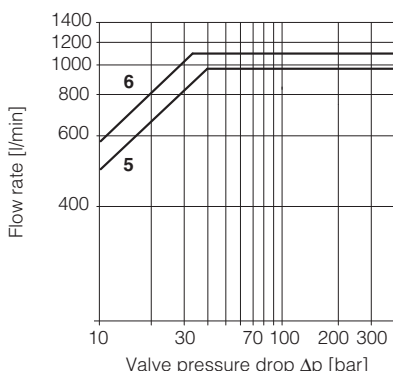
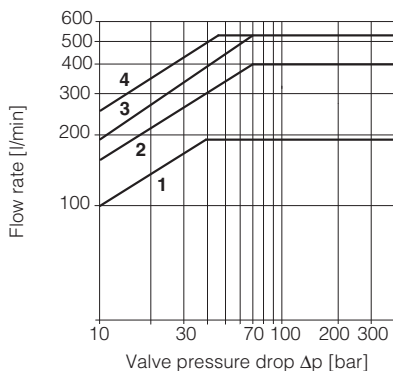


DPZO-4M: 9 = L5 10A = DL5 (P → A, A → T)
10B = DL5 (P → B, B → T)



DPZO-6: 11 = L5
DPZO-8: 12 = L5

12.2 Flow / Δp diagram - stated at 100% of spool stroke



- DPZO-1:** 1 = spools L5, DL5
- DPZO-2:** 2 = spools L3
3 = spool T5
4 = spools L5, DL5
- DPZO-4:** 5 = spools L5, DL5
- DPZO-4M:** 6 = spools L5, DL5
- DPZO-6:** 7 = L5
- DPZO-8:** 8 = L5

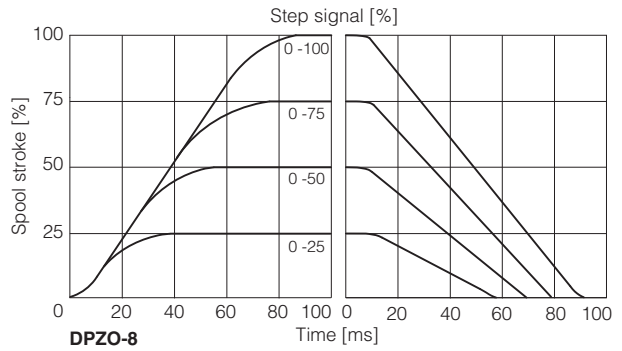
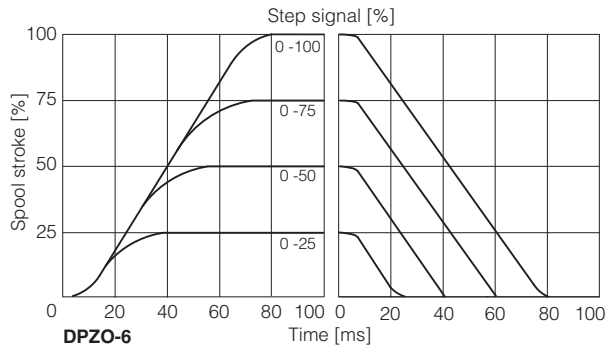
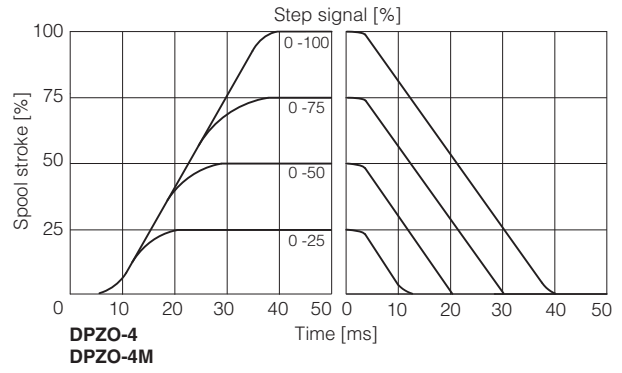
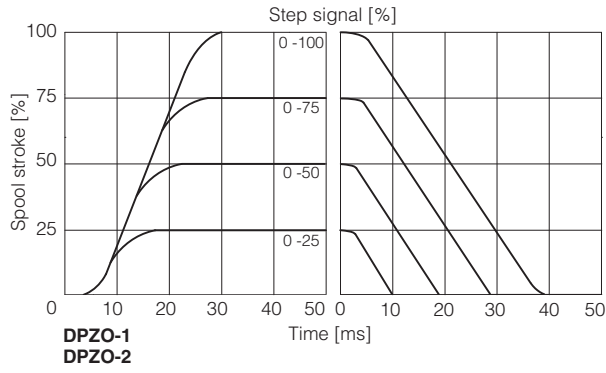
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option B)

Reference signal $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

Reference signal $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 4 \div 12 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

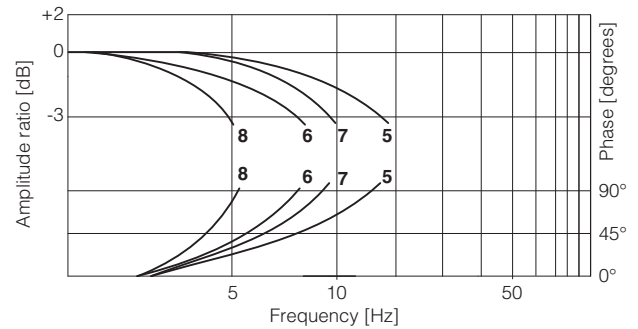
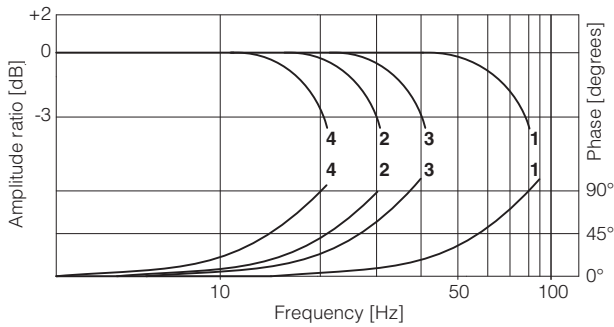
12.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For valves with on-board digital driver + axis card the dynamics performances can be optimized by setting the internal software parameters.



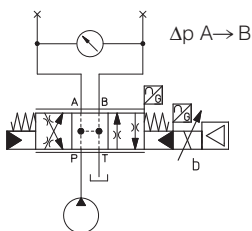
12.4 Bode diagrams

Stated at nominal hydraulic conditions.

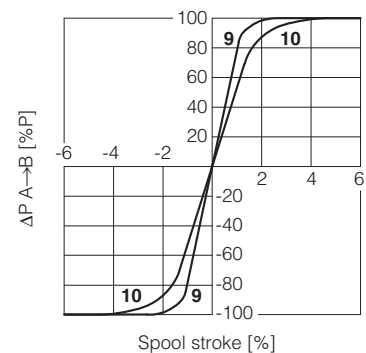


- | | |
|--------------------------|----------------------------|
| 1 = DPZO-1 } ± 5% | 2 = DPZO-1 } ± 100% |
| DPZO-2 } ± 5% | DPZO-2 } ± 100% |
| 3 = DPZO-4 } ± 5% | 4 = DPZO-4 } ± 100% |
| DPZO-4M } ± 5% | DPZO-4M } ± 100% |
| 5 = DPZO-6 ± 5% | 6 = DPZO-6 ± 100% |
| 7 = DPZO-8 ± 5% | 8 = DPZO-8 ± 100% |

12.5 Pressure gain



- 9** = DPZO-1
10 = DPZO-2
DPZO-4
DPZO-4M
DPZO-6
DPZO-8



13 HYDRAULIC OPTIONS

B = Solenoid, on-board digital driver + axis card and LVDT position transducer at side of port B of the main stage (side A of pilot valve). For hydraulic configuration vs reference signal, see 12.1

D = Internal drain (through port T).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 22

The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).

Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section 22

The valve's standard configuration provides internal pilot and external drain.

G = Pressure reducing valve ③ with fixed setting, installed between pilot valve and main body. Reduced pressure setting:

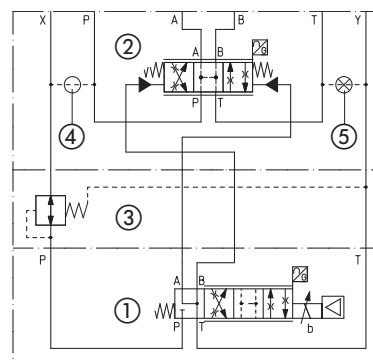
DPZO-2 = **28 bar**

DPZO-1, DPZO-2, DPZO-4(M), DPZO-6 and DPZO-8 = **40 bar**

It is advisable for valves with internal pilot in case of system pressure higher than 200 bar.

Pressure reducing valve ③ is standard for DPZO-1, for other sizes add /G option.

Functional Scheme - example of configuration 70



- ① Pilot valve
- ② Main stage
- ③ Pressure reducing valve
- ④ Plug to be added for external pilot trough port X
- ⑤ Plug to be removed for internal drain through port T

14 ELECTRONICS OPTIONS

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = This option is available to connect pressure/force transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.


15 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

15.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

 A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

15.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

 A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

15.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on axis card reference mode, see section 2:

external analog reference (see 2.1): input is used as reference for control in closed loop the actuator position.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

external fieldbus reference (see 2.1) or *automatic cycle* (see 2.2): analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

15.4 Force reference input signal (F_INPUT+) - only for SF, SL

Functionality of F_INPUT+ signal (pin 7), depends on selected axis card reference mode and alternated control options, see section 3:

SL, SF controls and external analog reference selected: input is used as reference for the axis card force closed loop.

Reference input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range $0 \div 24$ VDC.

15.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

15.6 Force monitor output signal (F_MONITOR) - only for SF, SL

The axis card generates an analog output signal according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ± 10 VDC or ± 20 mA.

Monitor output signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

15.7 Enable input signal (ENABLE)

To enable the axis card, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

15.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

15.9 Position transducer input signal

A position transducer must be always directly connected to the axis card. Select the correct axis card execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).

Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.

Position analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 16.1).

15.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Analog input signal is factory preset according to selected valve code, defaults are ± 10 VDC for standard and $4 \div 20$ mA for /C option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 VDC or ± 20 mA.

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 16.2).

16 ACTUATOR'S TRANSDUCER CHARACTERISTICS

16.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

16.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section [3]. Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values. Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

16.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Execution	Position				Pressure/Force
	A	D		SF, SL	
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Axis card interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos axis card (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

17 ELECTRONIC CONNECTIONS

17.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the axis card, referred to VL0	Input - on/off signal
4	P_INPUT+	Position reference input signal: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
5	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	P_MONITOR	Position monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to VL0	Output - analog signal Software selectable
7	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable
8	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 Vdc / ±20mA maximum range, referred to VL0	Output - analog signal Software selectable
9	VL+	Power supply 24 Vdc for axis card logic and communication	Input - power supply
10	VL0 (1)	Power supply 0 Vdc for axis card logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to axis card housing	

(1) Do not disconnect VL0 before VL+ when the axis card is connected to PC USB port

17.2 Communication connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(1) Shield connection on connector's housing is recommended

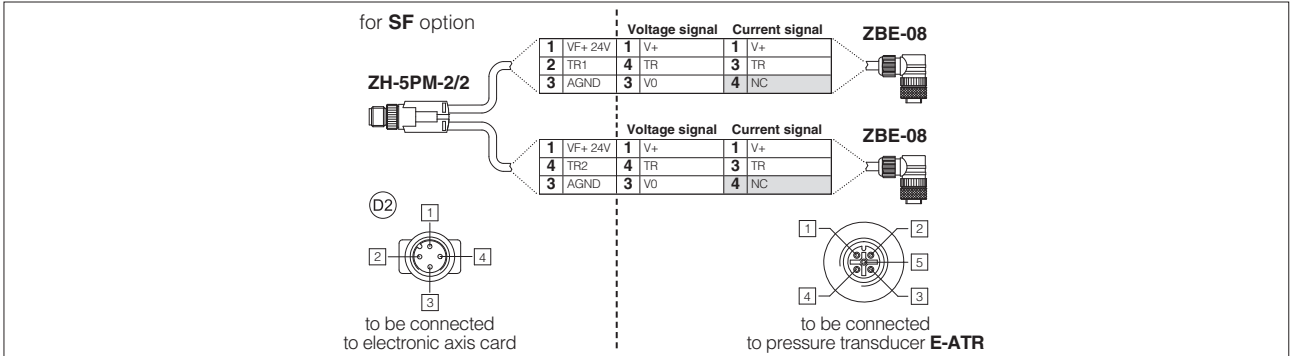
(2) Pin 2 can be fed with external +5V supply of CAN interface

17.3 Remote pressure/force transducer connector - M12 - 5 pin - only for SF, SL (D)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal Software selectable	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



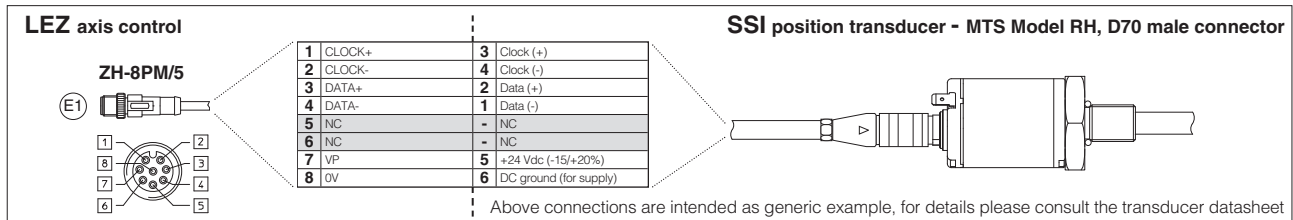
Note: pin layout always referred to axis card view

17.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	CLOCK+	Serial synchronous clock (+)	Input - digital signal	R	Input channel R	Input - digital signal
2	CLOCK-	Serial synchronous clock (-)		/R	Input channel /R	
3	DATA+	Serial position data (+)		A	Input channel A	
4	DATA-	Serial position data (-)		/A	Input channel /A	
5	NC	Not connect	Do not connect	B	Input channel B	
6	NC			/B	Input channel /B	
7	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
8	0 V	Common gnd for transducer power and signals	Common gnd	0 V	Common gnd for transducer power and signals	Common gnd

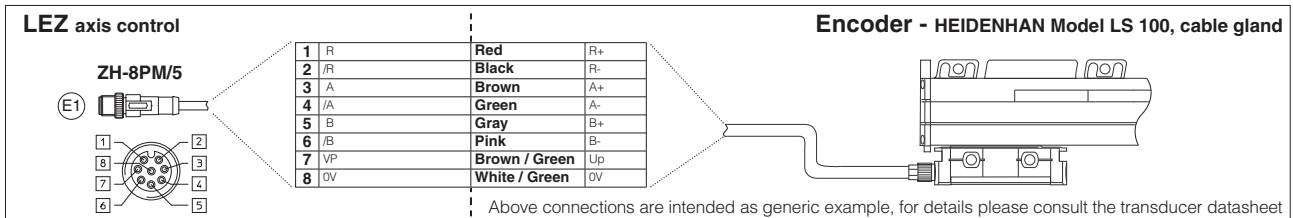
(1) Digital position transducer type is software selectable: Encoder or SSI, see 15.9

SSI connection - example



Note: pin layout referred to axis card view

Encoder connection - example



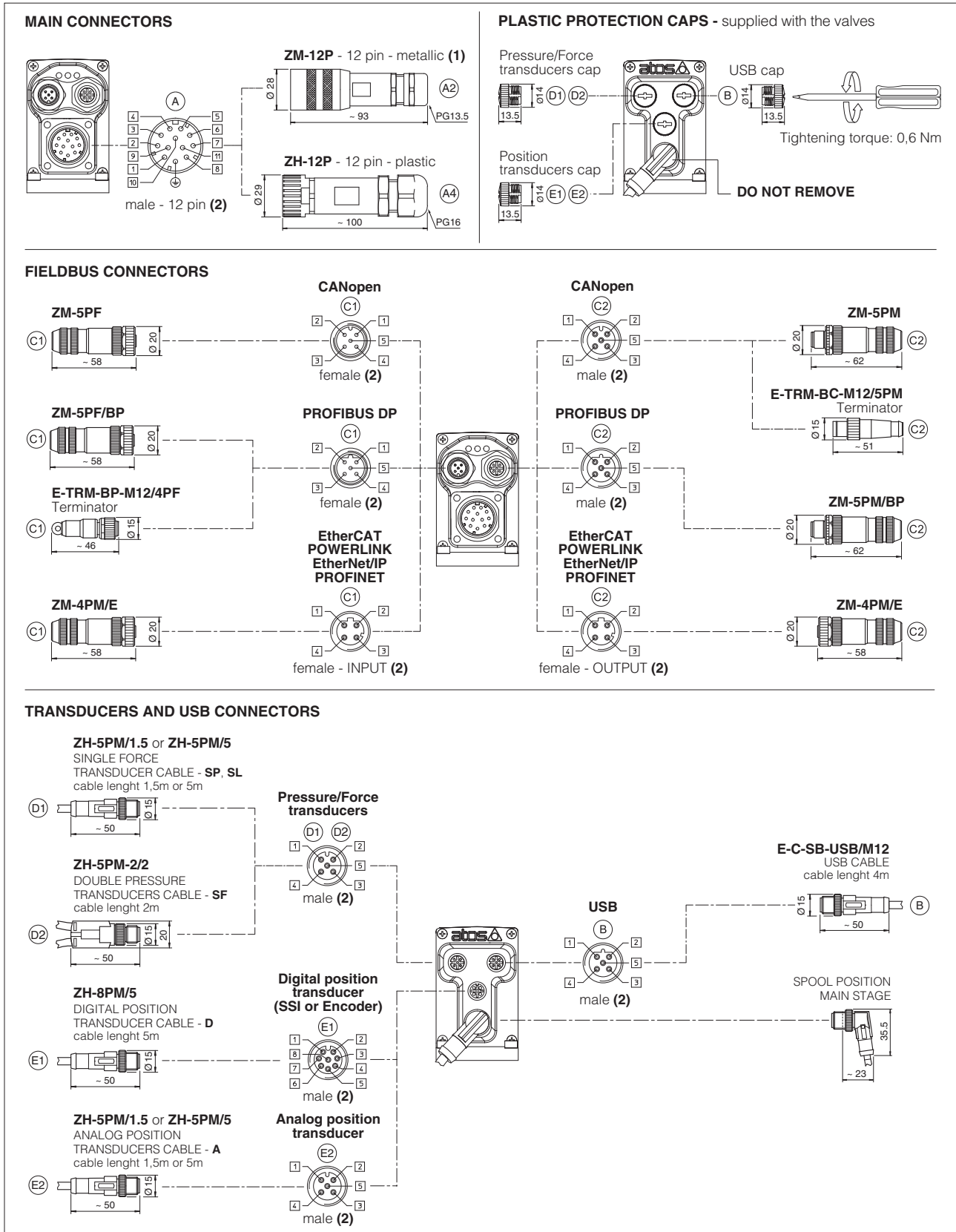
Note: pin layout referred to axis card view

17.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable	/	Connect
2	VP +10V	Power supply reference +10Vdc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vdc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 15.9

17.6 LEZ connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to axis card view

17.7 Diagnostic LEDs (L)

Three leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

LED	FIELDBUS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1			VALVE STATUS			LINK/ACT			
L2			NETWORK STATUS			NETWORK STATUS			
L3			SOLENOID STATUS			LINK/ACT			

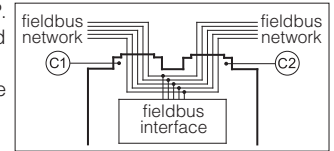
18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital axis card executions BC, BP, EH, EW, EI, EP. This feature allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-12P	(A2) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500**

(2) Internally terminated

19.3 Pressure/Force transducer connectors - only for SF, SL

CONNECTOR TYPE	SL - Single transducer		SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D1) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m lenght 5 m lenght		Connector moulded on cables 2 m lenght
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

19.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 17.4	ANALOG POSITION TRANSDUCER A execution - see 17.5
CODE	(E1) ZH-8PM/5	(E2) ZH-5PM/1.5 (E2) ZH-5PM/5
Type	8 pin male straight circular	5 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101	M12 coding A – IEC 61076-2-101
Material	Plastic	Plastic
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght 5 m lenght
Cable	8 x 0,25 mm ²	5 x 0,25 mm ²
Connection type	molded cable	molded cable
Protection (EN 60529)	IP 67	IP 67

20 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-RI-LEZ - user manual for **TEZ** and **LEZ** with **SN**

Z-MAN-RI-LEZ-S - user manual for **TEZ** and **LEZ** with **SF, SL**

20.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

20.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

20.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 20.4)

20.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

20.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

20.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

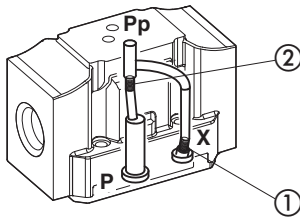
21 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZO	1 = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 2 OR 2043 Diameter of ports X, Y: Ø = 7 mm (max)
	4 = 25	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	4M = 27	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 3137; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	6 = 32	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	8 = 35	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

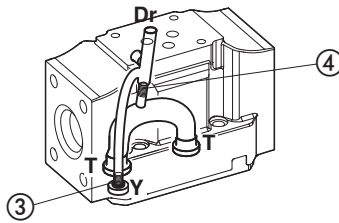
22 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain.

DPZO-1 Pilot channels

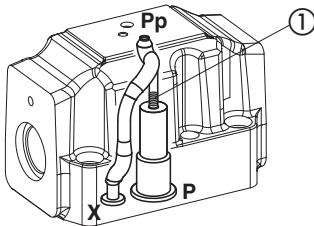


Drain channels

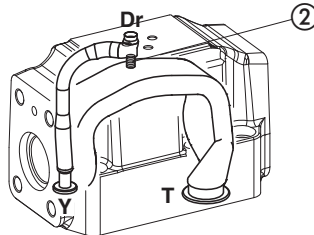


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2 Pilot channels

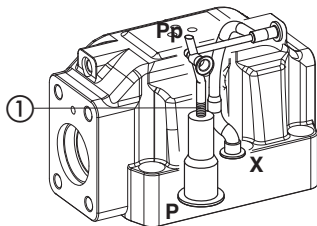


Drain channels

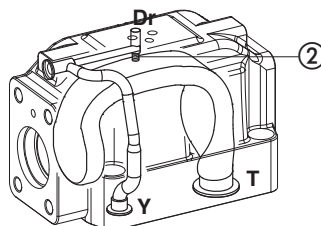


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-4 Pilot channels

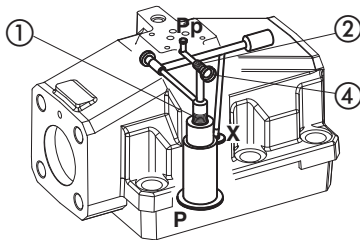


Drain channels

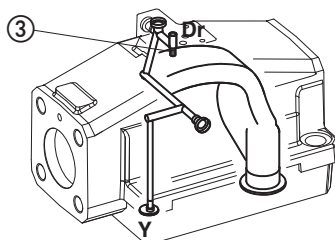


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels

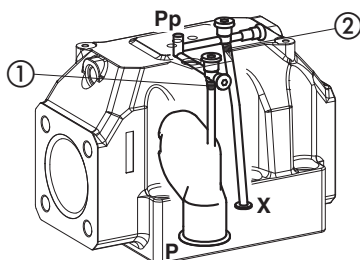


Drain channels

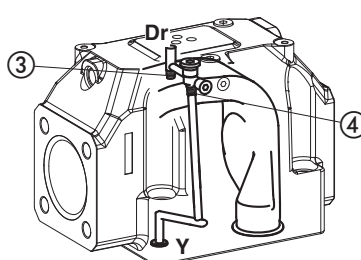


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZO-8 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add NPTF 1/8 in pos ①;
 plug NPTF 1/8 in pos ②;
Internal drain: Without plug NPTF 1/8 in pos ③;
 Add plug NPTF 1/8 in pos ④;
External drain: Add plug NPTF 1/8 in pos ③.

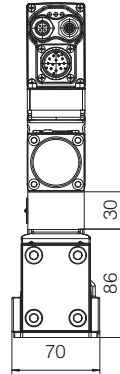
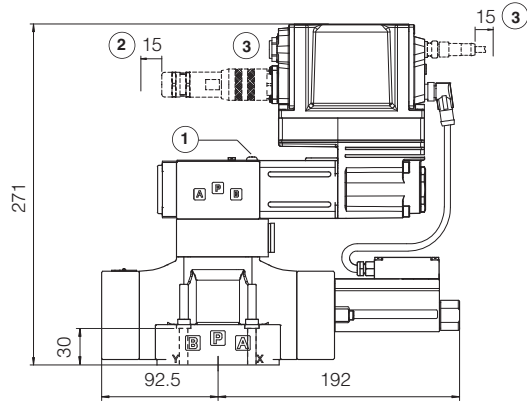
23 INSTALLATION DIMENSIONS [mm]

DPZO-LEZ-*-1

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)

Mass [kg]	
DPZO-*-1	9,5

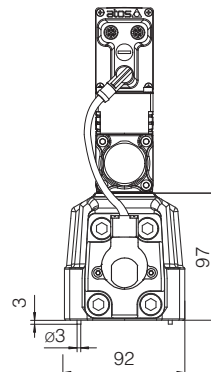
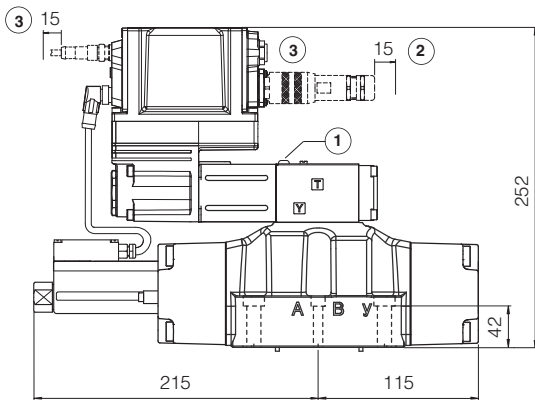



DPZO-LEZ-*-2

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

Mass [kg]	
DPZO-*-2	14



- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

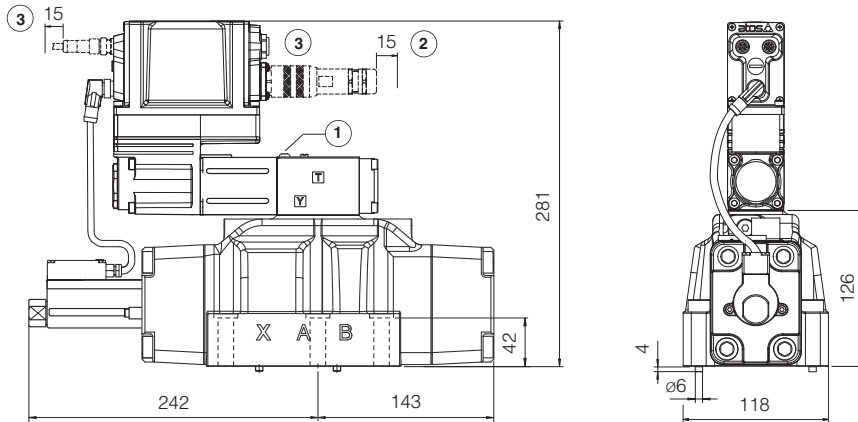
DPZO-LEZ-*-4

ISO 4401: 2005
 Mounting surface: 4401-08-08-0-05(see table P005)

Mass [kg]	
DPZO-*-4*	19

DPZO-LEZ-*-4M

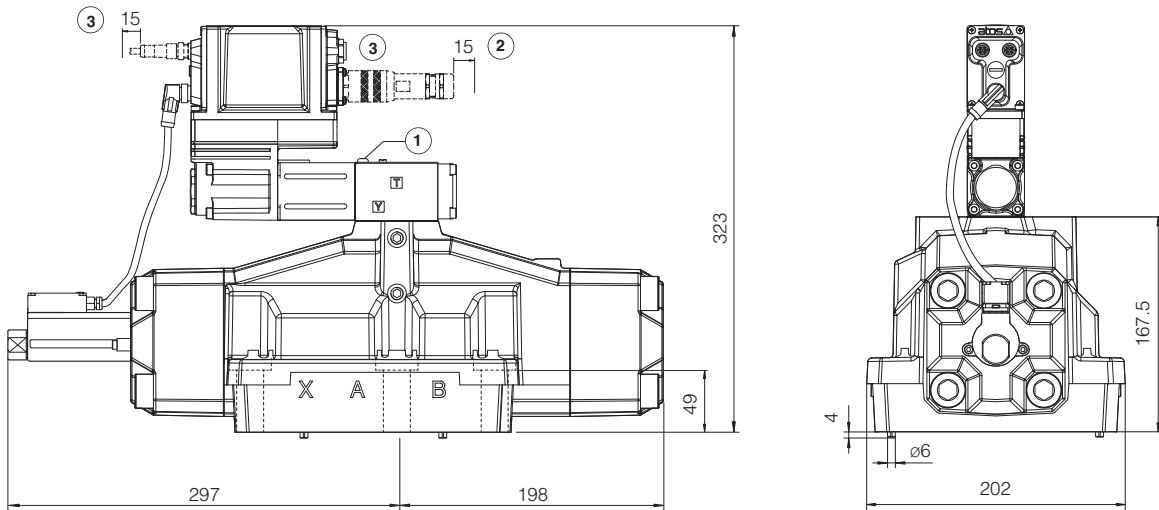
ISO 4401: 2005
 Mounting surface: 4401-08-08-0-05(see table P005)
 ports A, B, P, T Ø 32mm




DPZO-LEZ-*-6

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-6	43



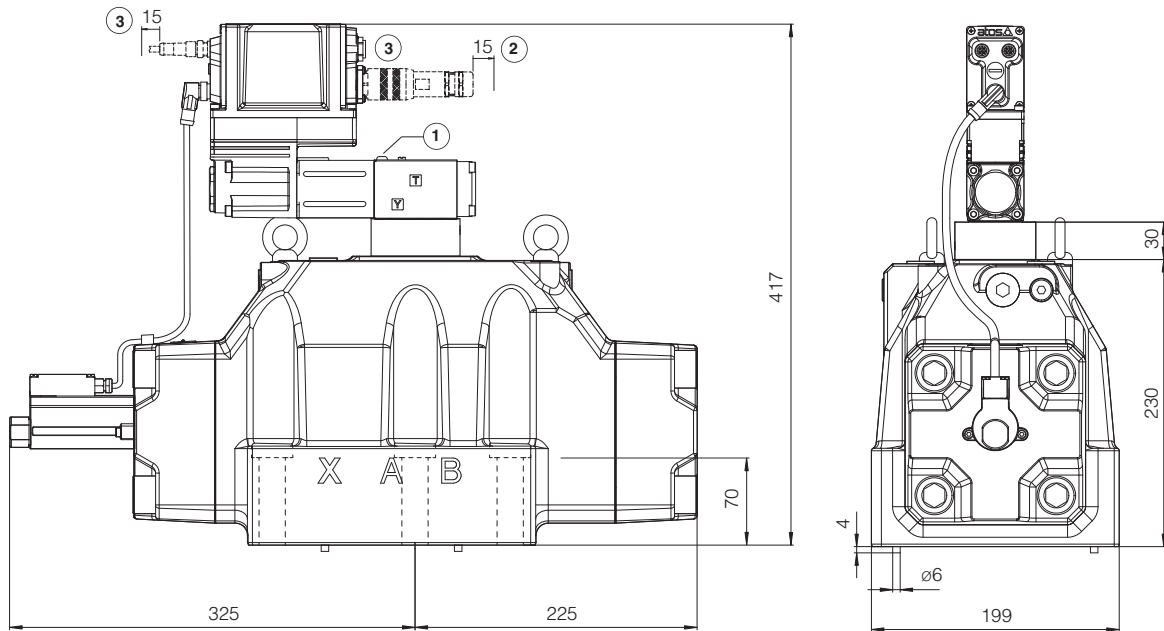
- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
 for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

DPZO-LEZ-*-8

ISO 4401: 2005
 Mounting surface: 4401-10-09-0-05 (see table P005)

Mass [kg]	
DPZO-*-8	80



- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 18.6

Notes: the overall height is increased by 40 mm for /G option (0,9 kg);
 for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver + axis card are at side of port B of the main stage

24 RELATED DOCUMENTATION

FS001	Basics for digital electrohydraulics	GS510	Fieldbus
FS900	Operating and maintenance information for proportional valves	K800	Electric and electronic connectors
FY100	Safety proportional valves - option /U	P005	Mounting surfaces for electrohydraulic valves
FY200	Safety proportional valves - option /K	Y010	Basics for safety components
GS500	Programming tools		

Digital Z-BM-TEZ/LEZ axis cards with driver functionality

DIN-rail format, for position and force controls

Z-BM-TEZ- NP Not Present

Z-BM-TEZ- BC BP CANopen
PROFIBUS DP

Z-BM-TEZ- EH EW EI EP EtherCAT
POWERLINK
EtherNet/IP
PROFINET RT/IRT

Position Control	Alternated Control P/Q	Internal Reference	<p>Z-SW-FULL programming software</p>
Real-time Fieldbus Reference	Enhanced Diagnostic	USB port	

Connectors ② included

Z-BM-TEZ/LEZ

Digital axis cards ① perform the driver functions for proportional valves plus the position closed loop control of the linear or rotative actuator to which the proportional valve is connected.

Z-BM-TEZ execution controls direct and pilot operated directional valves with one LVDT transducer.

Z-BM-LEZ execution controls directional pilot operated valves with two LVDT transducers. The controlled actuator has to be equipped with transducer (analog, SSI or Encoder) to read the axis position feedback.

The axis card can be operated via an external reference signal or automatic cycle, see section 4.

A force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the axis card; a second pressure/force reference signal is required.

Atos PC software allows to customize the axis card configuration to the specific application requirements.

Electrical Features:

- up to 11 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

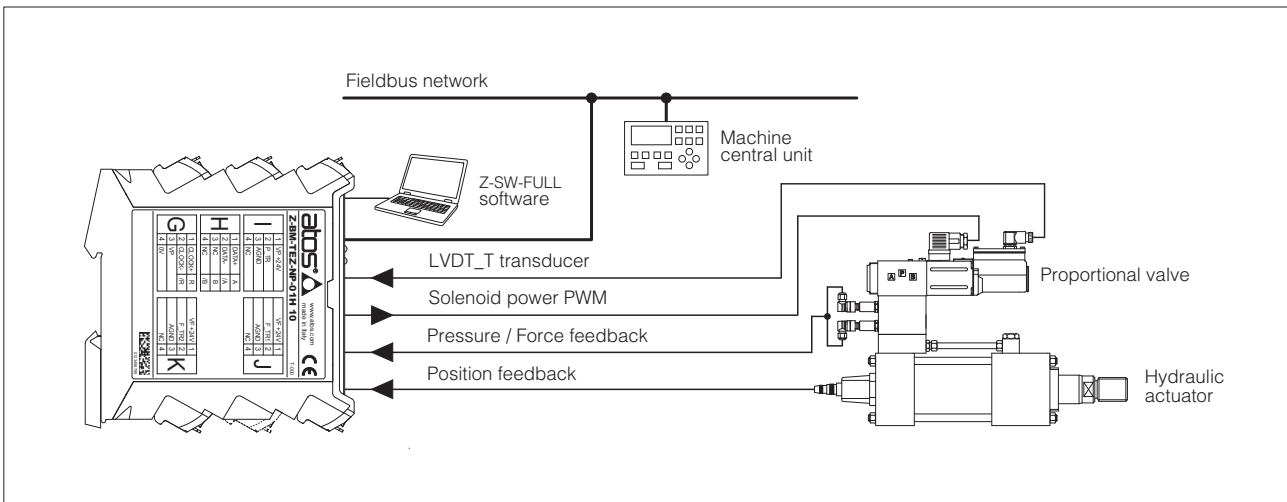
Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

Z-BM	-	TEZ	-	NP	-	01H / *	/	*
Off-board electronic axis card in DIN rail format								Set code (see section 9)
TEZ = digital full driver + axis card, for valves with one LVDT transducer LEZ = digital full driver + axis card, for valves with two LVDT transducers						Series number		
Fieldbus interface , USB port always present: NP = Not Present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK EI = EtherNet/IP EP = PROFINET RT/IRT						Options , see section 3 : A = max current limitation for Ex-proof valves C = current feedback 4 ÷ 20 mA for LVDT transducers, only in combination with option A		
01H = for single solenoid proportional valves 05H = for double solenoid proportional valves (only for TEZ)								

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional		
Industrial Tech table	DHZO-T, DKZOR-T F168	DLHZO-T, DLKZOR-T F180	DPZO-L F178
Ex-proof Tech table	-	DLHZA-T, DLKZA-T FX140	-
Axis card model	Z-BM-TEZ		Z-BM-LEZ

4 POSITION CONTROL

4.1 External reference signal

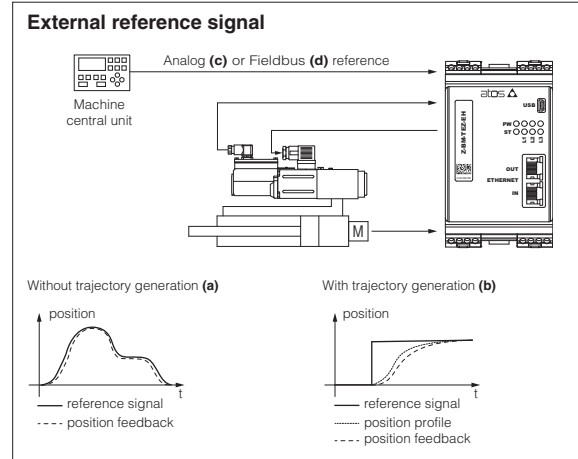
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

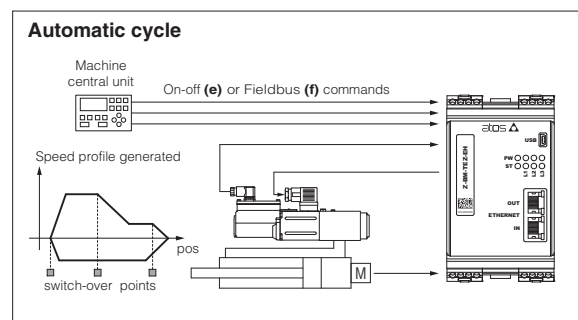
Refer to the axis card user manual for further details on position control features.



4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



5 ALTERNATED POSITION / FORCE CONTROL

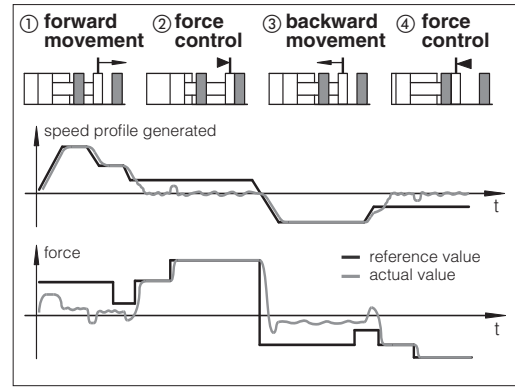
The alternated pressure or force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable

SF	SL
<p>two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)</p>	<p>one load cell transducer has to be installed between the actuator and the controlled load</p>
<p>T valve's spool transducer M actuator's position transducer P pressure transducer L load cell</p>	

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

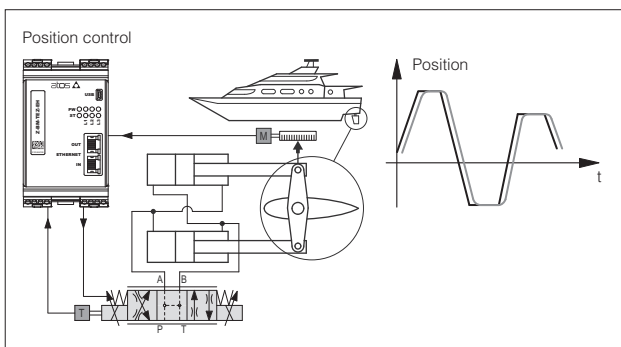
SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications see tech tables **F180, F175**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

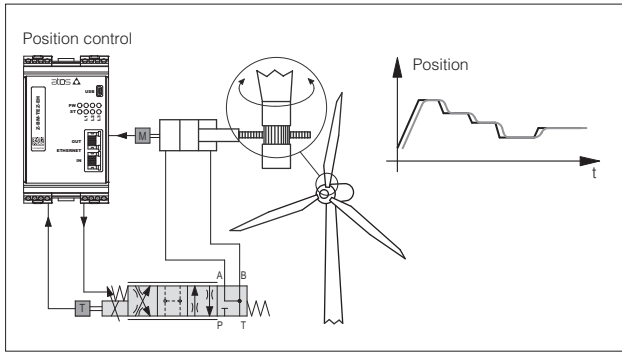


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

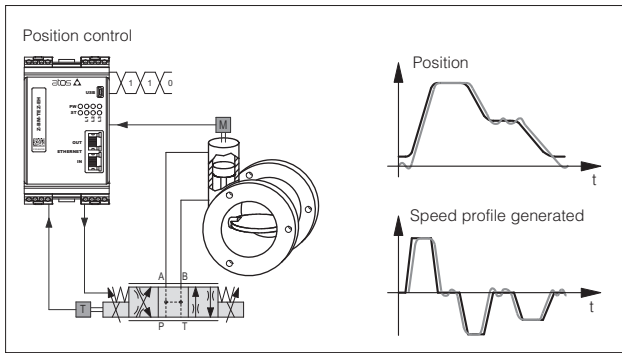


Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-TEZ/LEZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

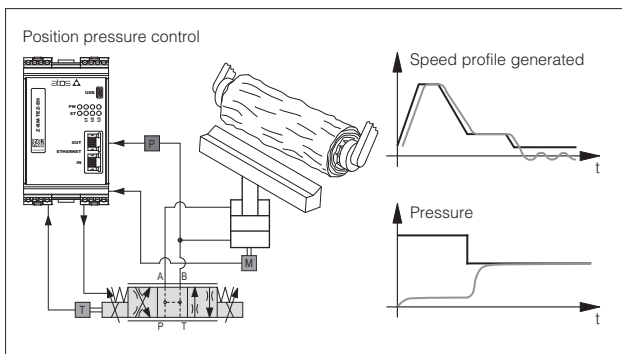


Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings for standing alone axis control
- potentiometer position transducer for compact and cost effective solution
- fieldbus connection for easy parameterization and remote commands

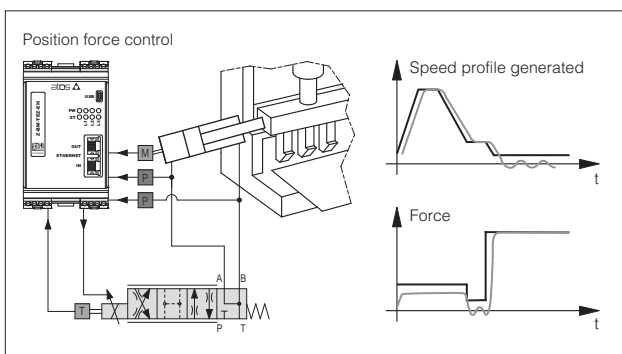


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and axis card state indication

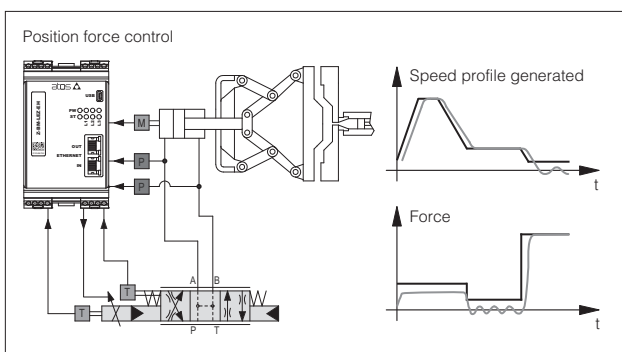


Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-TEZ/LEZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-TEZ/LEZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

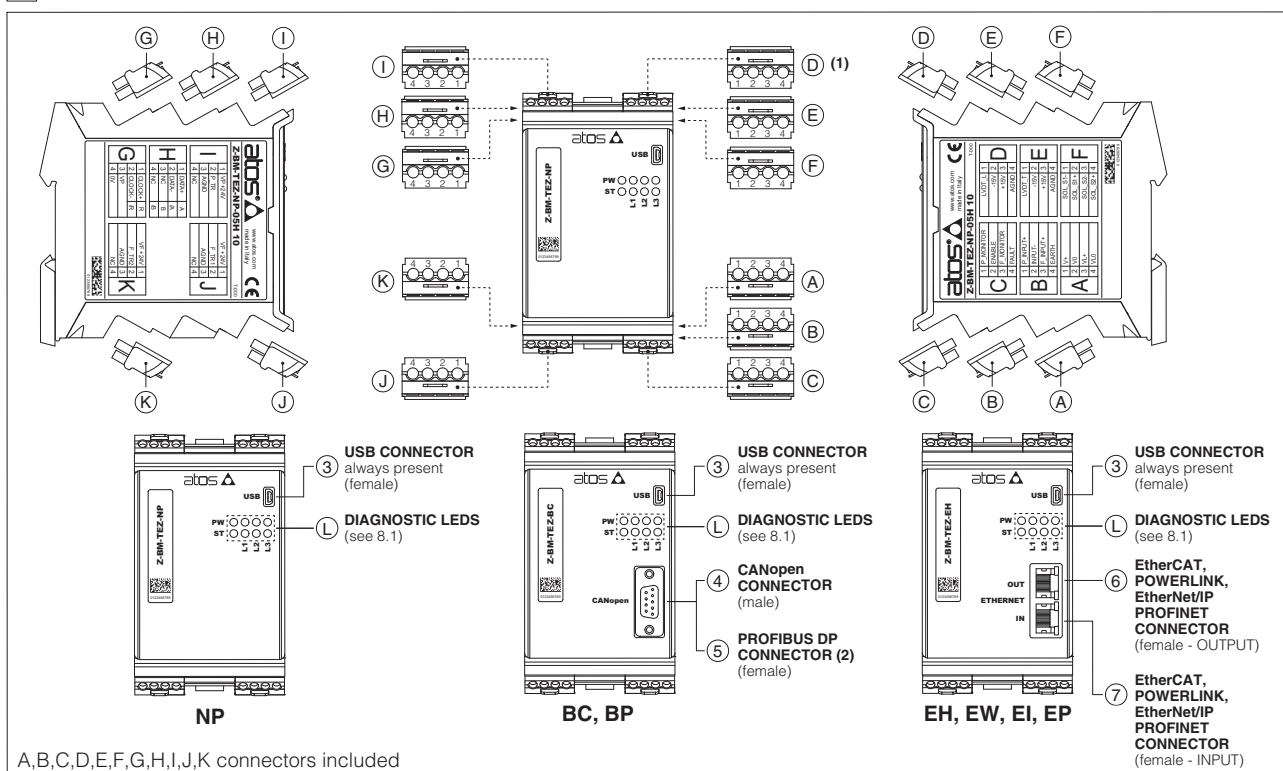
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supplies (see 10.1, 10.2)	Nominal : +24 V _{DC} Rectified and filtered : V _{RMS} = 20 ÷ 32 V _{MAX} (ripple max 10 % V _{PP})			
Max power consumption	50 W			
Current supplied to solenoids	I _{MAX} = 3,0 A for standard axis card I _{MAX} = 2,5 A for ex-proof axis card (IA option)			
Analog input signals (see 10.3, 10.4)	Voltage: range ±10 V _{DC} (24 V _{MAX} tollerant) Input impedance: R _i > 50 kΩ Current: range ±20 mA Input impedance: R _i = 500 Ω			
Monitor outputs (see 10.5, 10.6)	Output range: voltage ±10 V _{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 10.7)	Range: 0 ÷ 5 V _{DC} (OFF state), 9 ÷ 24 V _{DC} (ON state), 5 ÷ 9 V _{DC} (not accepted); Input impedance: R _i > 10 kΩ			
Fault output (see 10.8)	Output range: 0 ÷ 24 V _{DC} (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, position control monitoring, valve spool transducer malfunctions, alarms history storage function			
Position transducers power supply	+24 V _{DC} @ max 100 mA or +5 V _{DC} @ max 100 mA are software selectable			
Pressure/Force transducers power supply	+24 V _{DC} @ max 100 mA			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 450 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 15)	2,5 mm ²			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the axis card energizing with the 24 V_{DC} power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 CONNECTIONS AND LEDS



8.1 Diagnostic LEDs (L)

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1	VALVE STATUS			LINK/ACT				
L2	NETWORK STATUS			NETWORK STATUS				
L3	SOLENOID STATUS			LINK/ACT				
PW	OFF = Power supply OFF ON = Power supply ON							
ST	OFF = Fault present ON = No fault							

8.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	V+	Power supply 24 Vdc (see 10.1)	Input - power supply
	A2	V0	Power supply 0 Vdc (see 10.1)	Gnd - power supply
	A3	VL+	Power supply 24 Vdc for axis card logic and communication (see 10.2)	Input - power supply
	A4	VLO	Power supply 0 Vdc for axis card logic and communication (see 10.2)	Gnd - power supply
B	B1	P_INPUT+	Position reference input signal: ± 10 Vdc / ± 20 mA maximum range. default is ± 10 Vdc (see 10.3)	Input - analog signal Software selectable
	B2	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	F_INPUT+	Force reference input signal (SF, SL controls): ± 10 Vdc / ± 20 mA maximum range; default is ± 10 Vdc (see 10.4)	Input - analog signal Software selectable
	B4	EARTH	Connect to system ground	
C	C1	P_MONITOR	Position monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to AGND; default is ± 10 Vdc (see 10.5)	Output - analog signal Software selectable
	C2	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the axis card, referred to VLO (see 10.7)	Input - on/off signal
	C3	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ± 10 Vdc / ± 20 mA maximum range, referred to AGND; default is ± 10 Vdc (see 10.6)	Output - analog signal Software selectable
	C4	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VLO (see 10.8)	Output - on/off signal
D ⁽¹⁾	D1	LVDT_L	Main stage valve LVDT position transducer signal (see 10.11)	Input - analog signal
	D2	-15V	Main stage valve LVDT position transducer power supply -15V	Output power supply
	D3	+15V	Main stage valve LVDT position transducer power supply +15V	Output power supply
	D4	AGND	Common gnd for transducer power supply and monitor outputs	Common gnd
E	E1	LVDT_T	Direct valve or pilot valve LVDT position transducer signal (see 10.11)	Input - analog signal
	E2	-15V	Direct valve or pilot valve LVDT position transducer power supply -15V	Output power supply
	E3	+15V	Direct valve or pilot valve LVDT position transducer power supply +15V	Output power supply
	E4	AGND	Common gnd for transducer power supply and monitor outputs	Common gnd
F	F1	SOL_S1-	Negative current to solenoid S1	Output - power PWM
	F2	SOL_S1+	Positive current to solenoid S1	Output - power PWM
	F3	SOL_S2-	Negative current to solenoid S2	Output - power PWM
	F4	SOL_S2+	Positive current to solenoid S2	Output - power PWM
G	G1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	G2			
	G3			
	G4			
H	H1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	H2			
	H3			
	H4			
I	I1	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	I2	P_TR1	Analog position transducer input signal ± 10 Vdc / ± 20 mA maximum range; default is ± 10 Vdc (see 10.9)	Input - analog signal Software selectable
	I3	AGND	Common gnd for transducer power supply and signals	Common gnd
	I4	NC	Do not connect	
J	J1	VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	J2	F_TR1	1st signal pressure/force transducer: ± 10 Vdc / ± 20 mA maximum range; default is ± 10 Vdc (see 10.10)	Input - analog signal Software selectable
	J3	AGND	Common gnd for transducer power supply and signals	Common gnd
	J4	NC	Do not connect	
K	K1	VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	K2	F_TR2	2nd signal pressure transducer (only for SF): ± 10 Vdc / ± 20 mA maximum range; default is ± 10 Vdc (see 10.10)	Input - analog signal Software selectable
	K3	AGND	Common gnd for transducer power supply and signals	Common gnd
	K4	NC	Do not connect	

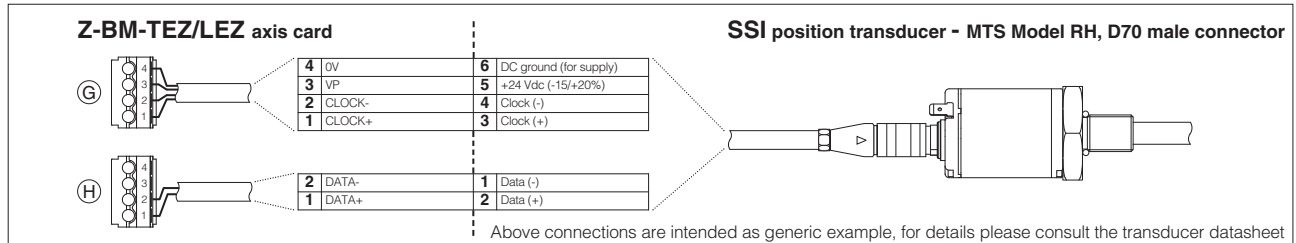
(1) D connector is available only for Z-BM-LEZ-**-01H

8.3 SSI connectors signals - 4 pin

G	G1	CLOCK+	Serial synchronous clock (+)	Output - on/off signal
	G2	CLOCK-	Serial synchronous clock (-)	Output - on/off signal
	G3	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power and signals	Common gnd
H	H1	DATA+	Serial position data (+)	Input - on/off signal
	H2	DATA-	Serial position data (-)	Input - on/off signal
	H3	NC	Do not connect	
	H4	NC	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

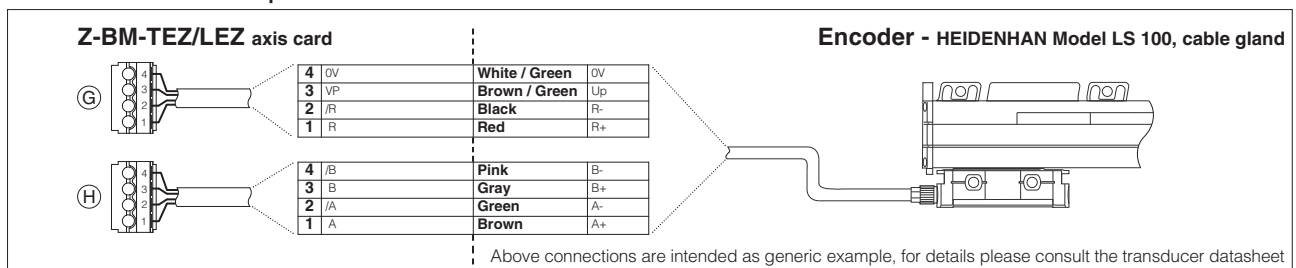
SSI connection - example



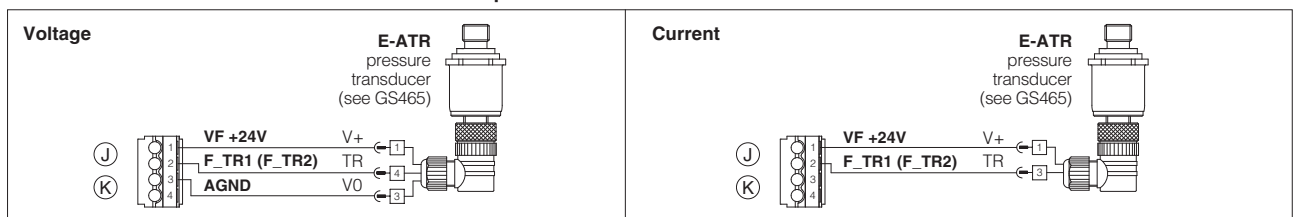
8.4 Encoder connectors signals - 4 pin

G	G1	R	Input channel R	Input - on/off signal
	G2	/R	Input channel /R	Input - on/off signal
	G3	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power and signals	Common gnd
H	H1	A	Input channel A	Input - on/off signal
	H2	/A	Input channel /A	Input - on/off signal
	H3	B	Input channel B	Input - on/off signal
	H4	/B	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ USB connector - Mini USB type B always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	D-	Data line -
3	D+	Data line +
4	ID	Identification
5	GND_USB	Signal zero data line

⑤ BP fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	SHIELD	
3	LINE-B	Bus line (low)
5	DGND	Data line and termination signal zero
6	+5V	Termination supply signal
8	LINE-A	Bus line (high)

④ BC fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	CAN_L	Bus line (low)
3	CAN_GND	Signal zero data line
5	CAN_SHLD	Shield
7	CAN_H	Bus line (high)

⑥ ⑦ EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter - white/orange
2	TX-	Transmitter - orange
3	RX+	Receiver - white/green
6	RX-	Receiver - green

(1) Shield connection on connector's housing is recommended

9 SET CODE

The basic calibration of axis card is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of axis card model code (see section 1). For correct set code selection, please include in the axis card order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 POWER SUPPLY AND SIGNALS SPECIFICATIONS

Atos digital axis card are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

10.2 Power supply for axis card logic and communication (VL+ and VL0)

The power supply (pin A3 and A4) for axis card logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.

The separate power supply for axis card logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each axis card logic and communication power supply: 500 mA fast fuse.

10.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section 4:

external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

external fieldbus reference (see 4.1) or *automatic cycle* (see 4.2): analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{dc}.

10.4 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section 5:

SL, SF controls and external analog reference selected: input is used as reference for the axis card pressure/force closed loop.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{dc}

10.5 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).

The output range and polarity are software selectable within the maximum range ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

10.6 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual pressure/force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

10.7 Enable Input Signal (ENABLE)

To enable the axis card, a 24V_{dc} voltage has to be applied on pin C2

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

10.8 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 V_{dc}, normal working corresponds to 24 V_{dc}

Fault status is not affected by the status of the Enable input signal.

Fault output signal can be used as digital output by software selection.

10.9 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.

Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 11.

10.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{dc} or ± 20 mA; default is ± 10 V_{dc}

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 11.

10.11 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the axis card using ± 15 V_{dc} supply output available at pin D2, D3 and pin E2, E3.

Note: transducer input signals working range is ± 10 V_{dc} for standard or 4 ÷ 20 mA for /C option and **cannot** be reconfigured via software (input signals setting depends to the axis card set code).

10.12 Possible combined options: /AC

11 ACTUATOR'S TRANSDUCER CHARACTERISTICS

11.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis cards, depending to the system requirements: analog signal (analog), SSI or Encoder (digital). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

11.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5). Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

11.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Input type	Position			Pressure/Force
	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	+24 Vdc	+5 Vdc or +24 Vdc	+5 Vdc or +24 Vdc	+24 Vdc
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card (2) percentage of total stroke (3) for Balluff BTL7 with SSI interface only special code SA433 is supported

12 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

The software is available in different versions according to the axis card options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial)
 BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)



WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

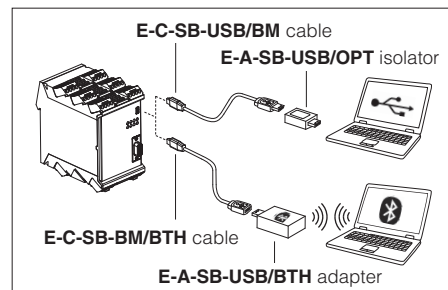
Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
 Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
 Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

USB or Bluetooth connection



13 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-BM-LEZ - user manual for **Z-BM-LEZ** and **Z-BM-TEZ**

13.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

13.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

13.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 13.4)

13.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

13.5 Valve characteristics compensation

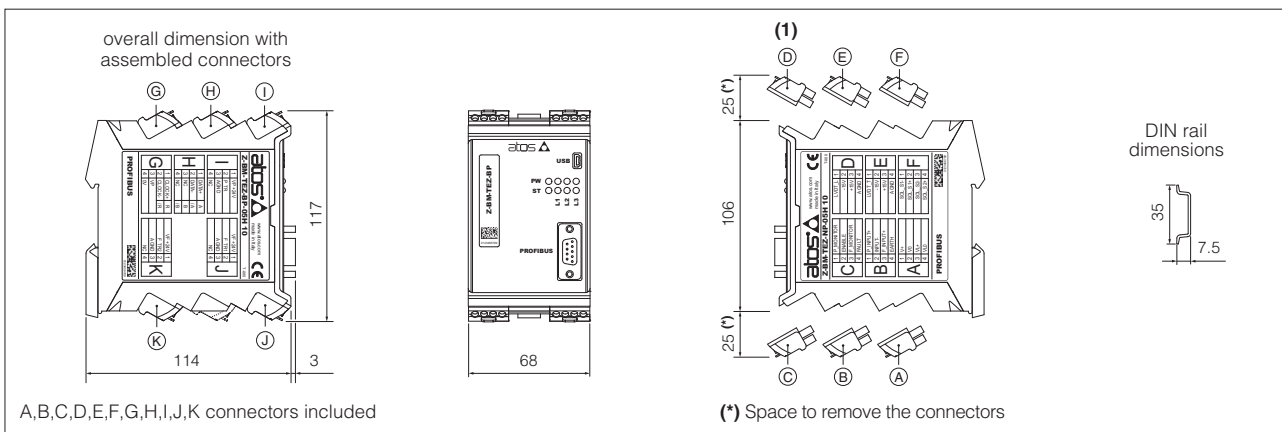
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

13.6 Motion phases parameters

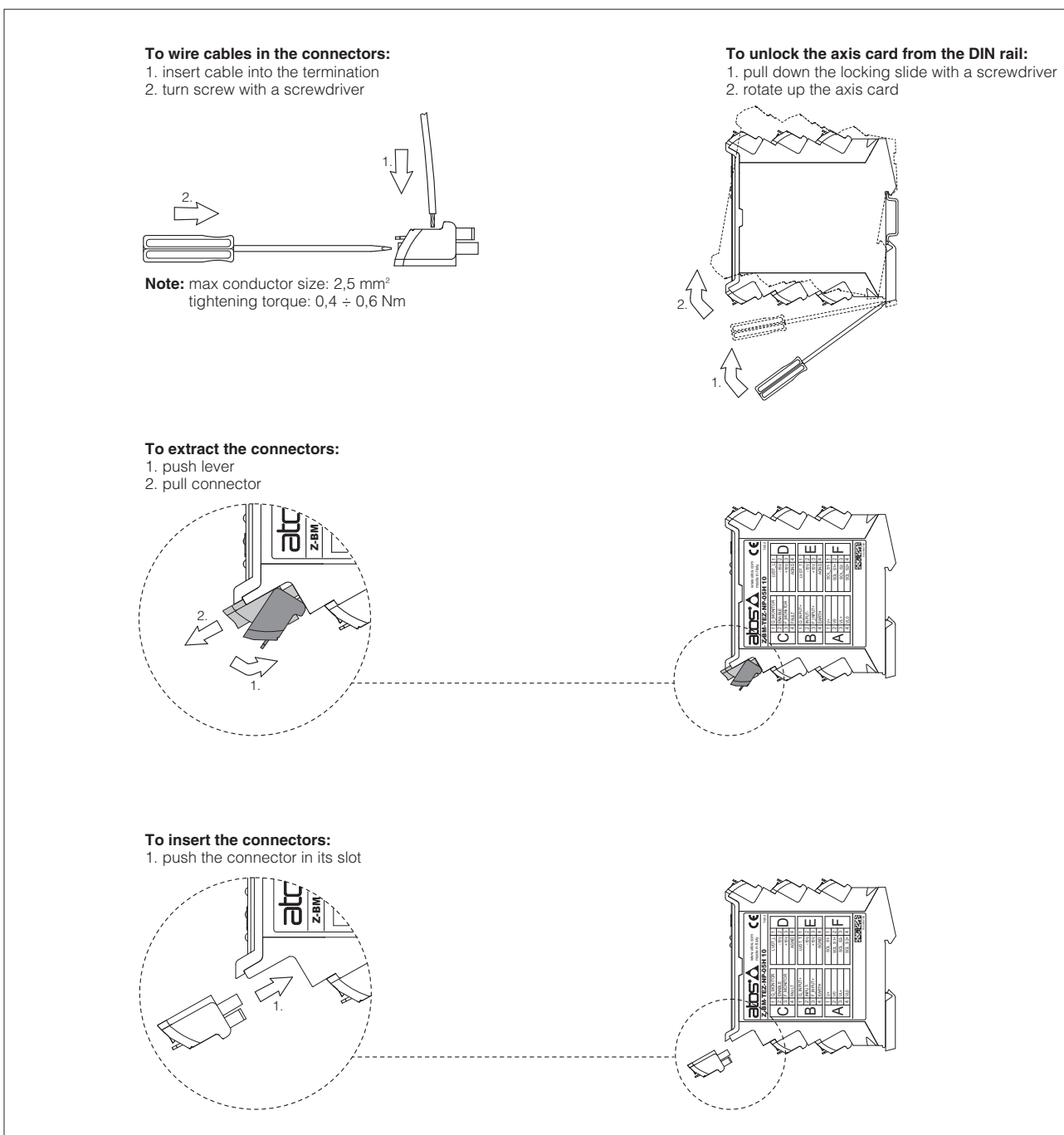
When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

14 OVERALL DIMENSIONS [mm]



(1) D connector is available only for Z-BM-LEZ-**-01H

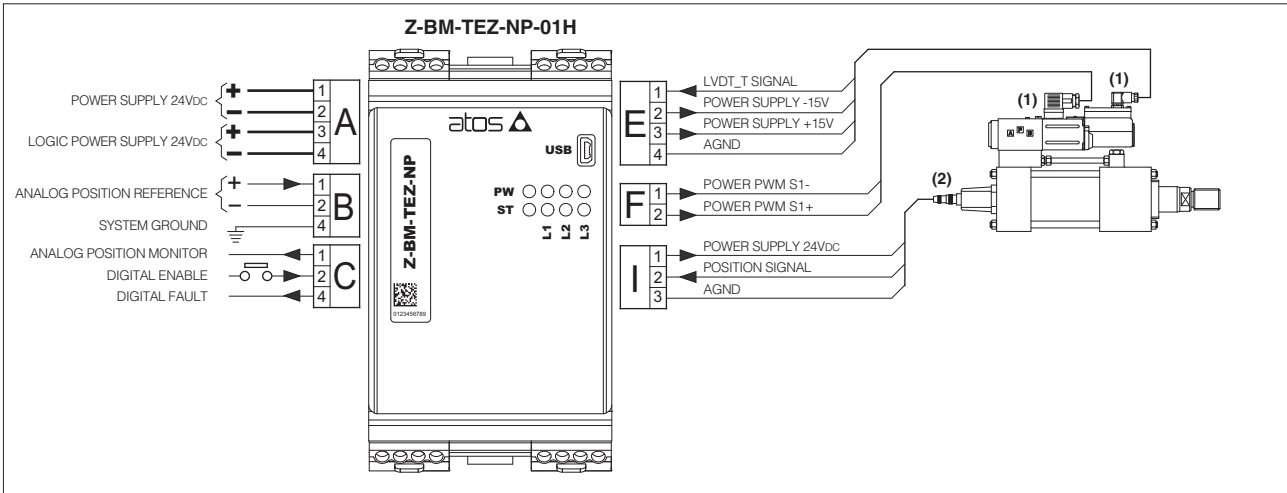
15 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (eg. connector A can not be inserted into connector slot of B,C,D,E,F,G,H,I,J,K)

16 WIRING EXAMPLES

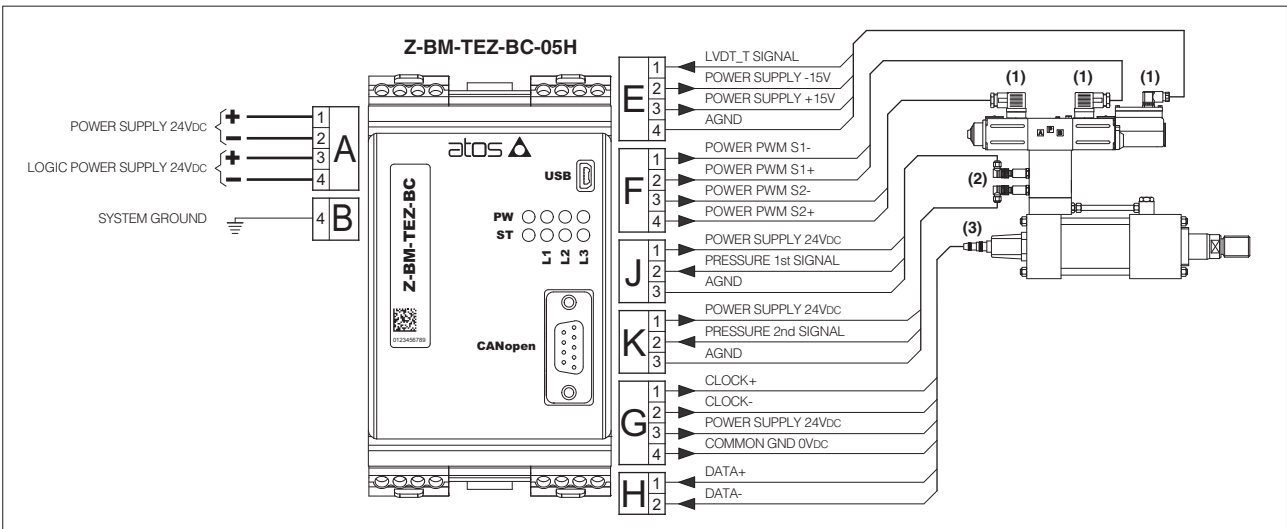
16.1 Position control - analog reference - analog position transducer



(1) For valve electrical connections please refer to the specific technical table

(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

16.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers

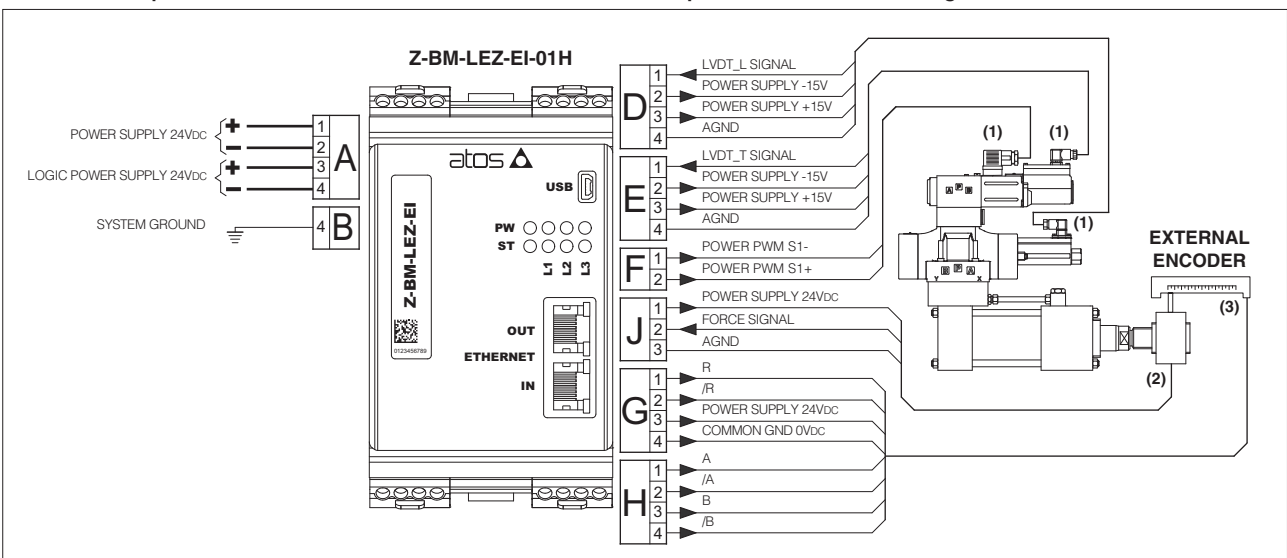


(1) For valve electrical connections please refer to the specific technical table

(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5

(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

16.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



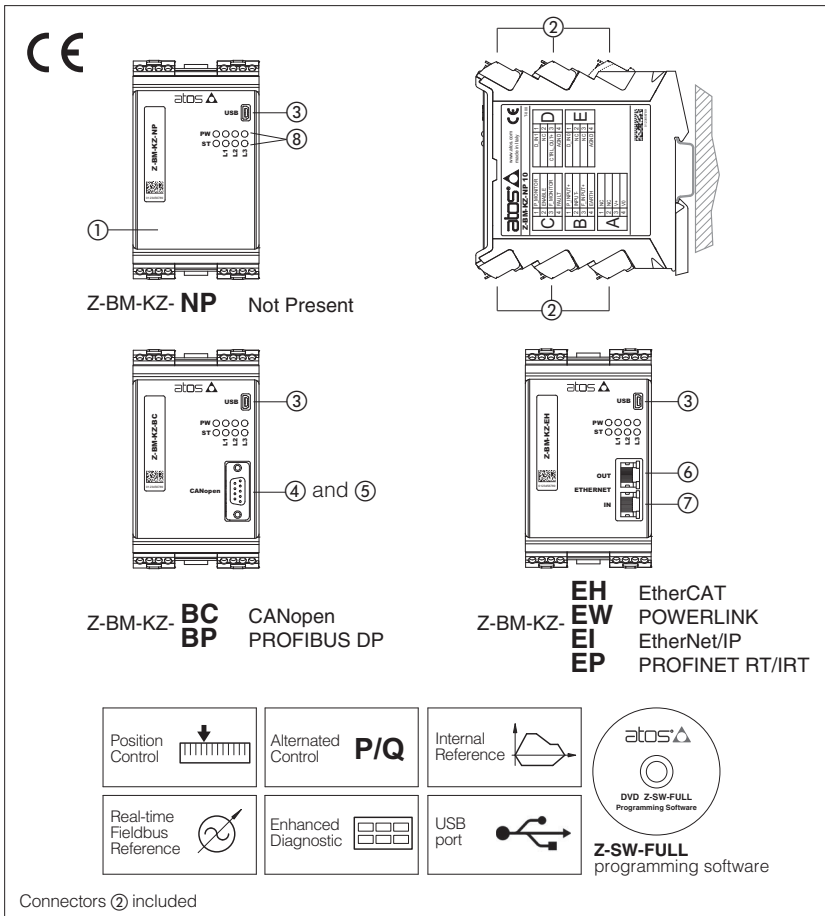
(1) For valve electrical connections please refer to the specific technical table

(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections

(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

Digital Z-BM-KZ axis cards

DIN-rail format, for position and force controls



Z-BM-KZ

Digital axis cards ① perform the position closed loop of linear or rotative hydraulic axes.

The axis card generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The controlled actuator has to be equipped with transducer (analog, SSI or Encoder) to read the axis position feedback.

The axis card can be operated via an external reference signal or automatic cycle, see section [4].

A force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the axis card; a second pressure/force reference signal is required.

Atos PC software allows to customize the axis card configuration to the specific application requirements.

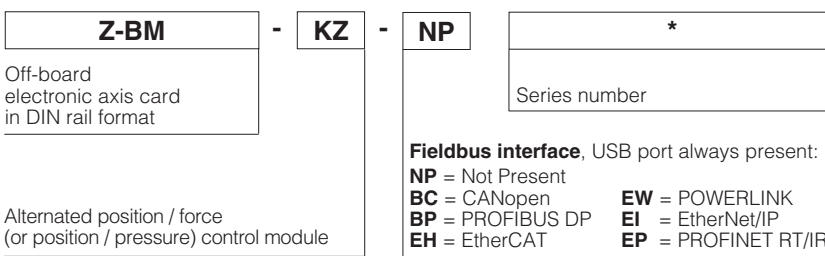
Electrical Features:

- 10 fast plug-in connectors ②
- Mini USB port ③ always present
- DB9 fieldbus communication connector ④ for CANopen and ⑤ PROFIBUS DP
- RJ45 ethernet communication connectors ⑥ output and ⑦ input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics ⑧ (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: $-20 \div +50 \text{ }^\circ\text{C}$
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

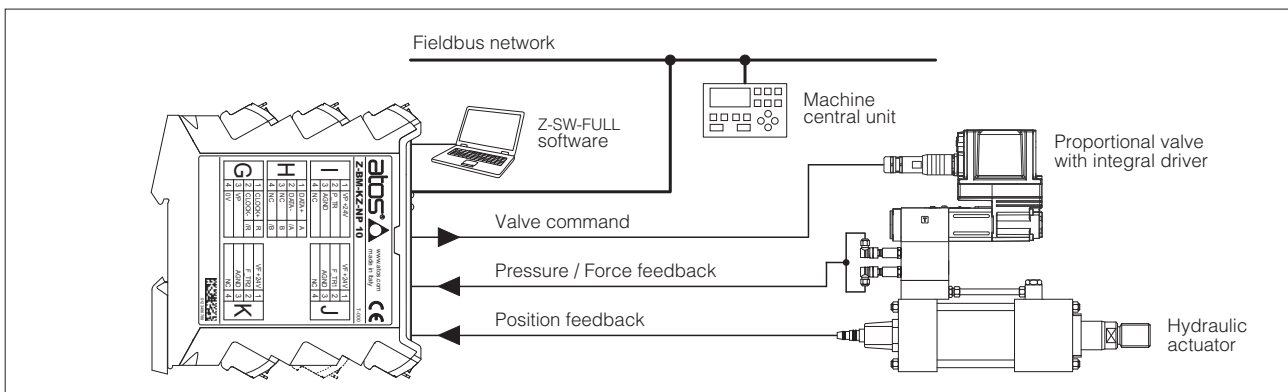
Software Features:

- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis's dynamic response (PID) to optimize the application performances
- Setting of valve's functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE



2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional					
Industrial Tech table	DHZO-TEB, DKZOR-TEB FS168	DHZO-TES, DKZOR-TES FS168	DLHZO-TEB, DLKZOR-TEB FS180	DLHZO-TES, DLKZOR-TES FS180	DPZO-LEB FS178	DPZO-LES FS178
Ex-proof Tech table	-	DHZA-TES, DKZA-TES FX135	-	DLHZA-TES, DLKZA-TES FX150	-	DPZA-LES FX235

4 POSITION CONTROL

4.1 External reference signal

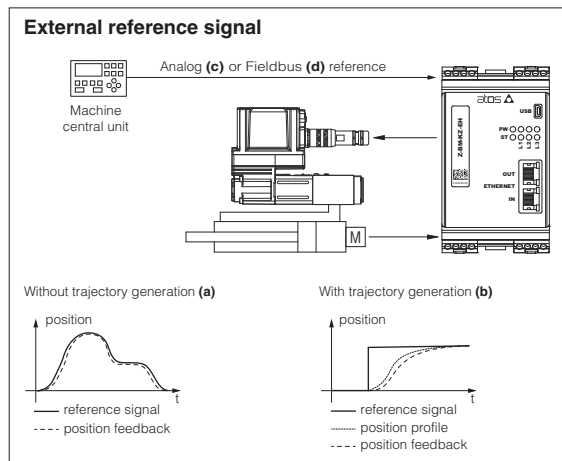
Axis card controls in closed loop the actuator position according to a reference signal from the machine central unit.

Position profile can be managed in two ways (software selectable):

- Without trajectory generation **(a)**: the axis card receives from the machine central unit the reference signal and follows it at any given instant
- With trajectory generation **(b)**: the axis card receives from the machine central unit just the final target position and internally generates a position profile limiting acceleration, velocity and deceleration

The reference signal can be software selected between Analog reference **(c)** and Fieldbus reference **(d)**.

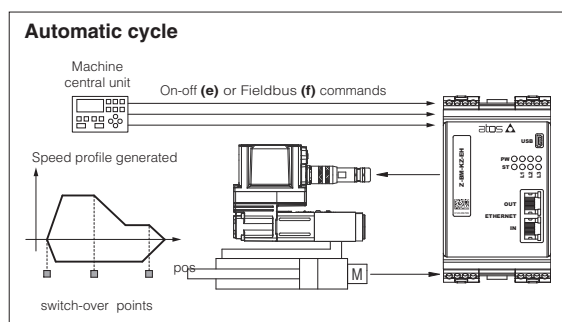
Refer to the axis card user manual for further details on position control features.



4.2 Automatic cycle

Axis card controls in closed loop the actuator position according to an internally generated automatic cycle: only start, stop and switch-over commands are required from the machine electronic central unit by means On-off commands **(e)** or Fieldbus commands **(f)**.

Atos PC software allows to realize an automatic cycle according to the application requirements. Refer to the axis card user manual for further details on automatic cycle features.



5 ALTERNATED POSITION / FORCE CONTROL

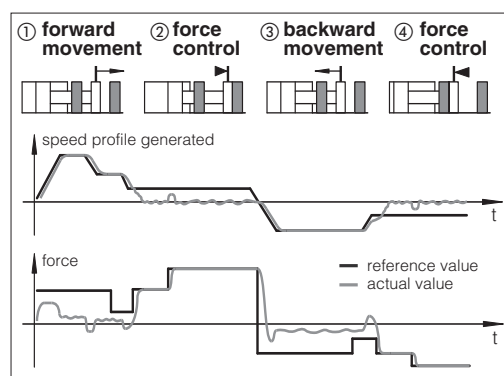
The alternated force closed loop control can be added to the actuator standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the axis card reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



Alternated control configurations - software selectable

SF	SL		
two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load		
T valve's spool transducer	M actuator's position transducer	P pressure transducer	L load cell

SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

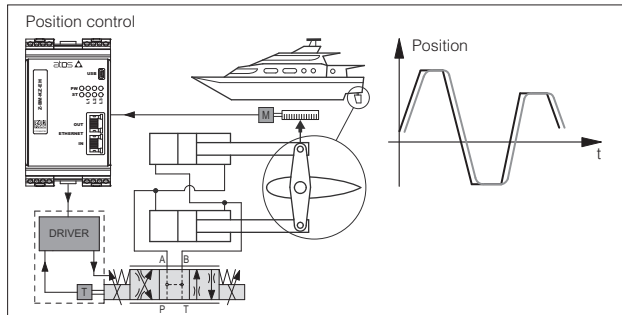
SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

General Notes:

- servoproportional type DLHZO, DLKZOR, DPZO-L are strongly recommended for high accuracy applications - see tech tables **FS180**, **FS178**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **FS500**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

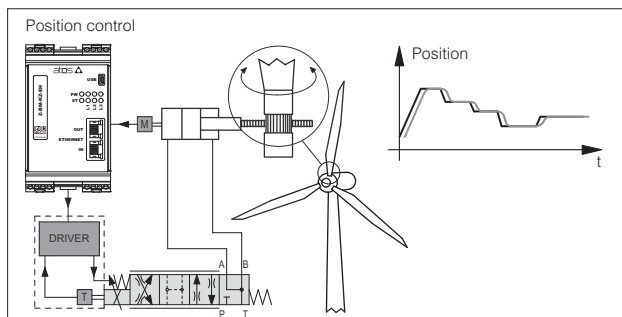


Hydraulic steering wheel in marine applications

Rudder axis card on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-KZ axis cards perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring

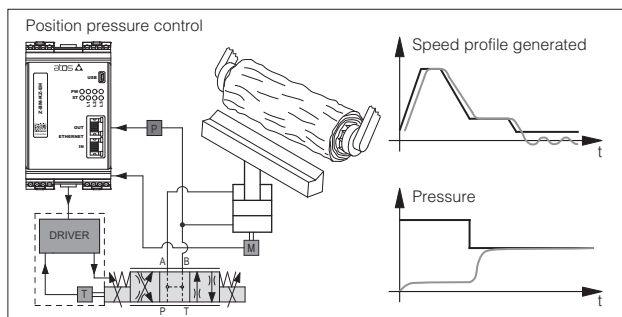


Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-KZ axis cards perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:

- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

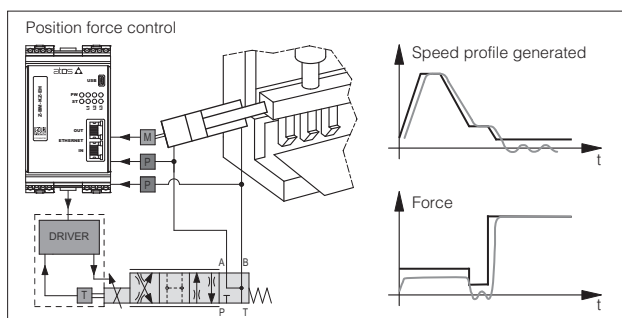


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-KZ axis cards allow remote control, thanks to:

- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote parameterization, commands, and axis card state indication

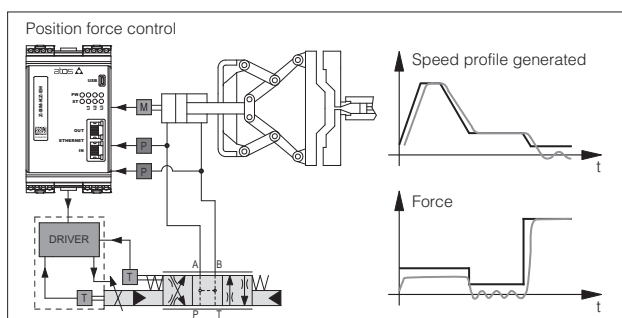


Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-KZ axis cards combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:

- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternated force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)



Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

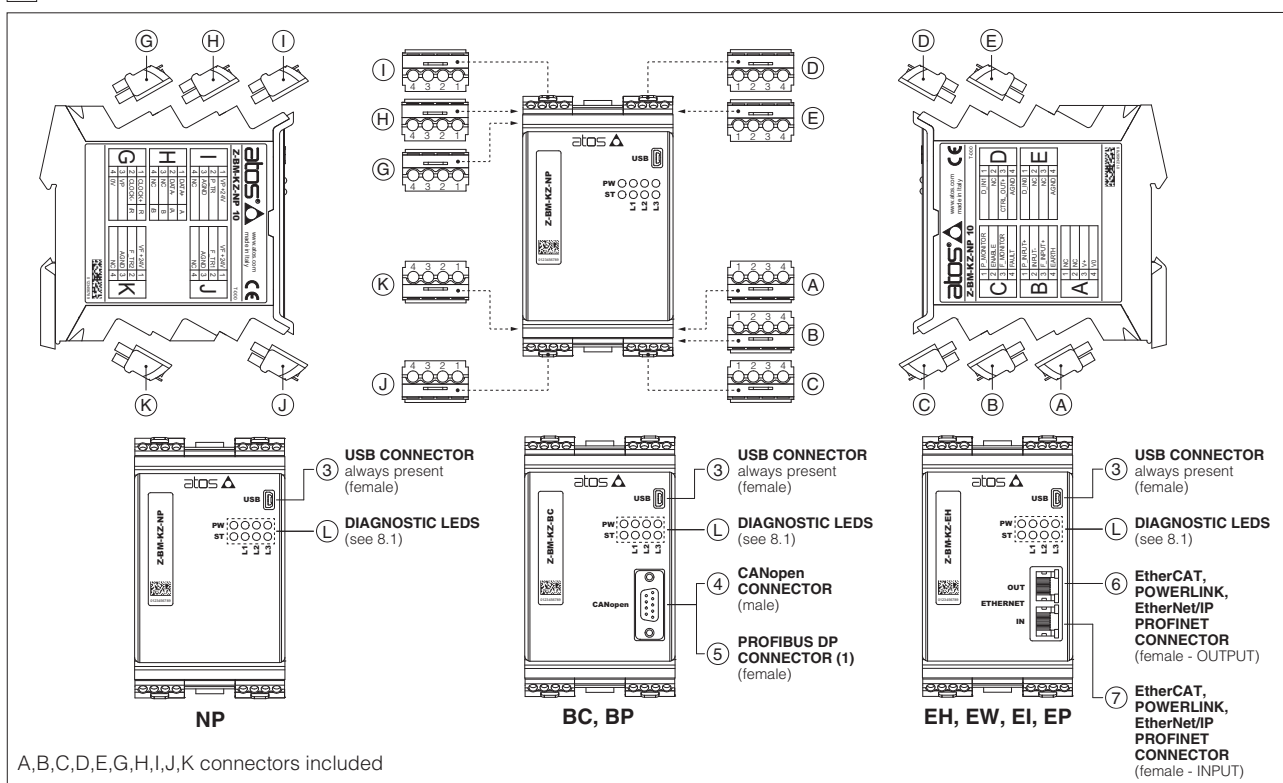
Z-BM-KZ axis cards, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics

7 MAIN CHARACTERISTICS

Power supply (see 9.1)	Nominal : +24 Vdc Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % V_{FP})			
Max power consumption	10 W			
Analog input signals (see 9.2, 9.3)	Voltage: range $\pm 10 V_{dc}$ (24 V_{MAX} tollerant) Input impedance: $R_i > 50 k\Omega$ Current: range $\pm 20 mA$ Input impedance: $R_i = 500 \Omega$			
Monitor outputs (see 9.4, 9.5) Control output (see 9.10)	Output range: voltage $\pm 10 V_{dc}$ @ max 5 mA current $\pm 20 mA$ @ max 500 Ω load resistance			
Enable input (see 9.6) Digital inputs (see 9.11)	Range: 0 \div 5 Vdc (OFF state), 9 \div 24 Vdc (ON state), 5 \div 9 Vdc (not accepted); Input impedance: $R_i > 10 k\Omega$			
Fault output (see 9.7)	Output range: 0 \div 24 Vdc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Alarms	Cable break with current reference signal, over/under temperature, position control monitoring			
Position transducers power supply	+24 Vdc @ max 100 mA or +5 Vdc @ max 100 mA are software selectable			
Pressure/Force transducers power supply	+24 Vdc @ max 100 mA			
Format	Plastic box ; IP20 protection degree ; L 35 - H 7,5 mm DIN-rail mounting as per EN60715			
Operating temperature	-20 \div +50 $^{\circ}C$ (storage -25 \div +85 $^{\circ}C$)			
Mass	Approx. 450 g			
Additional characteristics	8 leds for diagnostic; protection against reverse polarity of power supply			
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables: 0,5 mm ² max 50 m for logic - 1,5 mm ² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 14)	2,5 mm ²			

8 CONNECTIONS AND LEDS



(1) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDS (L)

Eight leds show axis card operative conditions for immediate basic diagnostics. Please refer to the axis card user manual for detailed information.

FIELDBUS LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	PW L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		ALARM STATUS			LINK/ACT			
PW	OFF = Power supply OFF	ON = Power supply ON						
ST	OFF = Fault present	ON = No fault						

8.2 Connectors - 4 pin

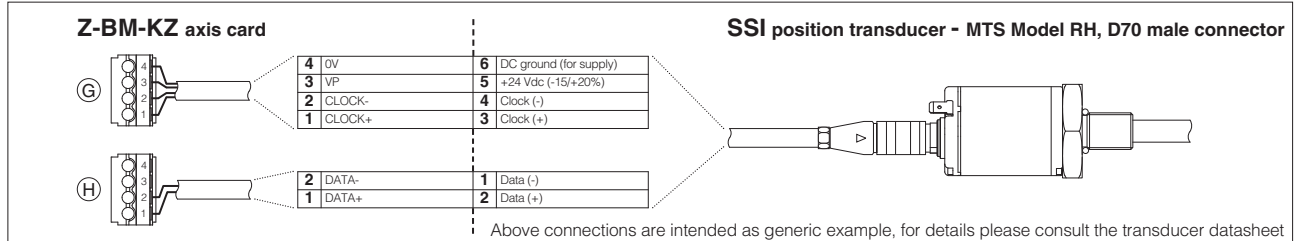
CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	NC	Do not connect	
	A2	NC	Do not connect	
	A3	V+	Power supply 24 Vdc (see 9.1)	Input - power supply
	A4	V0	Power supply 0 Vdc (see 9.1)	Gnd - power supply
B	B1	P_INPUT+	Position reference input signal: ±10 Vdc / ±20 mA maximum range; default is ±10 Vdc (see 9.2)	Input - analog signal Software selectable
	B2	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	B3	F_INPUT+	Force reference input signal (SF, SL controls): ±10 Vdc / ±20 mA maximum range; default is ±10 Vdc (see 9.3)	Input - analog signal Software selectable
	B4	EARTH	Connect to system ground	
C	C1	P_MONITOR	Position monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to AGND; default is ±10 Vdc (see 9.4)	Output - analog signal Software selectable
	C2	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the axis card, referred to V0 (see 9.6)	Input - on/off signal
	C3	F_MONITOR	Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to AGND; default is ±10 Vdc (see 9.5)	Output - analog signal Software selectable
		NC	For EW, EI, EP executions the F_MONITOR is not available: do not connect	
	C4	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to V0 (see 9.7)	Output - on/off signal
D	D1	D_IN1	Digital input 0 ÷ 24Vdc, referred to AGND (see 9.11)	Input - on/off signal
	D2	NC	Do not connect	
	D3	CTRL_OUT+	Control output signal for external valve driver, referred to AGND (see 9.10)	Output - analog signal Software selectable
	D4	AGND	Common gnd for digital input and control output	Common gnd
E	E1	D_IN0	Digital input 0 ÷ 24Vdc, referred to AGND (see 9.11)	Input - on/off signal
	E2	NC	Do not connect	
	E3	NC	Do not connect	
	E4	AGND	Common gnd for digital input and monitor outputs	Common gnd
G	G1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	G2			
	G3			
	G4			
H	H1		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
	H2			
	H3			
	H4			
I	I1	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	I2	P_TR1	Analog position transducer input signal ±10 Vdc / ±20 mA maximum range; default is ±10 Vdc (see 9.8)	Input - analog signal Software selectable
	I3	AGND	Common gnd for transducer power supply and signals	Common gnd
	I4	NC	Do not connect	
J	J1	VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	J2	F_TR1	1st signal pressure/force transducer: ±10 Vdc / ±20 mA maximum range; default is ±10 Vdc (see 9.9)	Input - analog signal Software selectable
	J3	AGND	Common gnd for transducer power supply and signals	Common gnd
	J4	NC	Do not connect	
K	K1	VF +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply Software selectable
	K2	F_TR2	2nd signal pressure transducer (only for SF): ±10 Vdc / ±20 mA maximum range; default is ±10 Vdc (see 9.9)	Input - analog signal Software selectable
	K3	AGND	Common gnd for transducer power supply and signals	Common gnd
	K4	NC	Do not connect	

8.3 SSI connectors signals - 4 pin

G	G1	CLOCK+	Serial synchronous clock (+)	Output - on/off signal
	G2	CLOCK-	Serial synchronous clock (-)	Output - on/off signal
	G3	VP	Power supply: +24Vdc , +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power supply and signals	Common gnd
H	H1	DATA+	Serial position data (+)	Input - on/off signal
	H2	DATA-	Serial position data (-)	Input - on/off signal
	H3	NC	Do not connect	
	H4	NC	Do not connect	

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

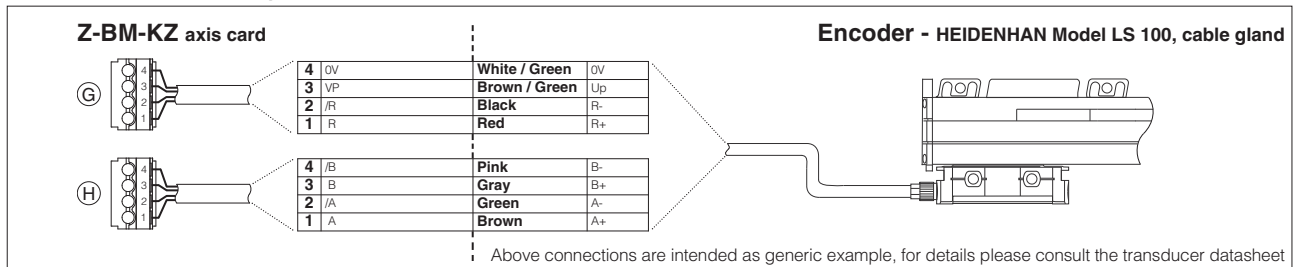
SSI connection - example



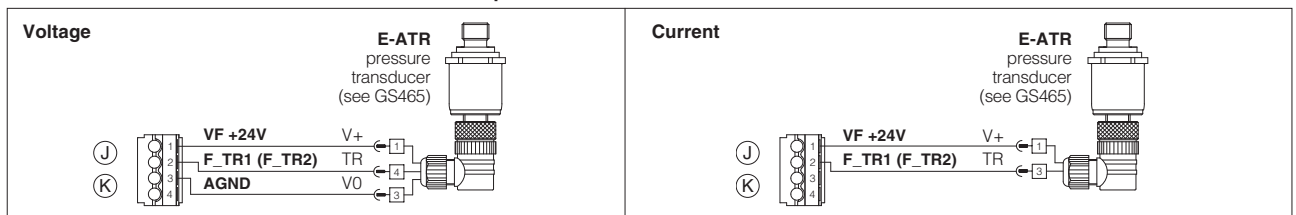
8.4 Encoder connectors signals - 4 pin

G	G1	R	Input channel R	Input - on/off signal
	G2	/R	Input channel /R	Input - on/off signal
	G3	VP	Power supply: +24Vdc , +5Vdc or OFF (default OFF)	Output - power supply Software selectable
	G4	0V	Common gnd for transducer power and signals	Common gnd
H	H1	A	Input channel A	Input - on/off signal
	H2	/A	Input channel /A	Input - on/off signal
	H3	B	Input channel B	Input - on/off signal
	H4	/B	Input channel /B	Input - on/off signal

Encoder connection - example



8.5 Pressure/force transducers connection - example



8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

③ USB connector - Mini USB type B always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	D-	Data line -
3	D+	Data line +
4	ID	Identification
5	GND_USB	Signal zero data line

⑤ BP fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	SHIELD	
3	LINE-B	Bus line (low)
5	DGND	Data line and termination signal zero
6	+5V	Termination supply signal
8	LINE-A	Bus line (high)

④ BC fieldbus execution, connector - DB9 - 9 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
2	CAN_L	Bus line (low)
3	CAN_GND	Signal zero data line
5	CAN_SHLD	Shield
7	CAN_H	Bus line (high)

⑥ ⑦ EH, EW, EI, EP fieldbus execution, connector - RJ45 - 8 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter - white/orange
2	RX+	Receiver - white/green
3	TX-	Transmitter - orange
6	RX-	Receiver - green

(1) Shield connection on connector's housing is recommended

9 SIGNALS SPECIFICATIONS

Atos digital axis card are CE marked according to the applicable directives (e.g. Immunity/Emission EMC Directive).

Installation, wirings and start-up procedures must be performed according to the prescriptions shown in tech table **FS900** and in the user manuals included in the Z-SW programming software.

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

9.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers.



A safety fuse is required in series to each power supply: 500 mA fast fuse.

9.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on axis card reference mode, see section [4](#) :

external analog reference (see 4.1): input is used as reference for control in closed loop the actuator position.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

external fieldbus reference (see 4.1) or *automatic cycle* (see 4.2): analog reference input signal can be used as on-off commands with input range 0 ÷ 24 V_{DC}.

9.3 Force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected axis card reference mode and alternated control options, see section [5](#) :

SL, SF controls and external analog reference selected : input is used as reference for the axis card pressure/force closed loop.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

SN control or fieldbus reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24 V_{DC}

9.4 Position monitor output signal (P_MONITOR)

The axis card generates an analog output signal (pin C1) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the axis card (e.g. analog reference, fieldbus reference, position error, valve spool position).

The output range and polarity are software selectable within the maximum range ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

9.5 Force monitor output signal (F_MONITOR)

The axis card generates an analog output signal (pin C3) according to alternated force control option:

SN control: output signal is proportional to the actual valve spool position

SL, SF controls: output signal is proportional to the actual pressure/force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the axis card (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

9.6 Enable Input Signal (ENABLE)

To enable the axis card, a 24 V_{DC} voltage has to be applied on pin C2.

When the Enable signal is set to zero the axis card can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

9.7 Fault output signal (FAULT)

Fault output signal (pin C4) indicates fault conditions of the axis card (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 V_{DC}, normal working corresponds to 24 V_{DC}

Fault status is not affected by the status of the Enable input signal.

Fault output signal can be used as digital output by software selection.

9.8 Position transducer input signals

A position transducer must be always directly connected to the axis card. Position digital input signals are factory preset to binary SSI, they can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.

Input signals can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section [10](#) .

9.9 Remote pressure/force transducer input signals (F_TR1 and F_TR2) -SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the axis card.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ± 10 V_{DC} or ± 20 mA; default is ± 10 V_{DC}

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section [10](#) .

9.10 Control output signal (CTRL_OUT+)

The error signal processed by the control algorithms generates the control output signal (pin D3) for the external driver of the proportional valve which operates the hydraulic flow to the actuator.

The output range and polarity are software selectable within ± 10 V_{DC} (for voltage) or ± 20 mA (for current) maximum range referred to the analog ground AGND on pin D4; default setting is ± 10 V_{DC}

9.11 Digital input signals (D_IN0 and D_IN1)

Two on-off input signals are available on the pin E1 and D1. For each input by the Z-SW software, it is possible to set the polarity and to match a proper condition within the following:

- pressure/force PID selection (default)
- start/stop/switch-over command in case of internal reference generation (see 4.2)
- specific operative command for hydraulic axis mode (referencing mode, jog mode, automatic mode)
- jog command
- disable force alternated control

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
E1	0	24 V _{DC}	0	24 V _{DC}
D1	0	0	24 V _{DC}	24 V _{DC}

10 ACTUATOR'S TRANSDUCER CHARACTERISTICS

10.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the axis card, depending to the system requirements: analog signal (analog), SSI or Encoder (digital).

Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

10.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 5).

Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details).

Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

10.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Input type	Position			Pressure/Force
	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	+24 Vdc	+5 Vdc or +24 Vdc	+5 Vdc or +24 Vdc	+24 Vdc
Axis card interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc or 4 ÷ 20 mA
Max speed	1 m/s	2 m/s	2 m/s	-
Max resolution	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) power supply provided by Atos axis card (2) percentage of total stroke (3) for Balluff BTL7 with SSI interface only special code SA433 is supported

11 VALVE SETTINGS AND PROGRAMMING TOOLS

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital axis card (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the axis card is connected to the central machine unit via fieldbus.

The software is available in different versions according to the axis card options (see table **GS500**):

Z-SW-FULL support: NP (USB) PS (Serial)
 BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)



WARNING: axis card USB port is not isolated! For E-C-SB-USB/BM cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

DVD programming software, to be ordered separately:

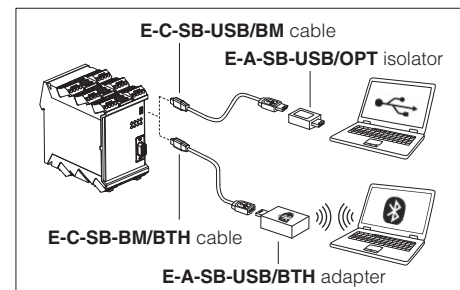
Z-SW-FULL DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
 Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area

Z-SW-FULL-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
 Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

USB or Bluetooth connection



12 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

Z-MAN-BM-KZ - user manual for **Z-BM-KZ**

12.1 External reference and transducer parameters

Allow to configure the axis card reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

12.2 PID control dynamics parameters

Allow to optimize and adapt the axis card closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

12.3 Monitoring parameters

Allow to configure the axis card monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 12.4)

12.4 Fault parameters

Allow to configure how the axis card detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, axis card disabling, etc.)

12.5 Valve characteristics compensation

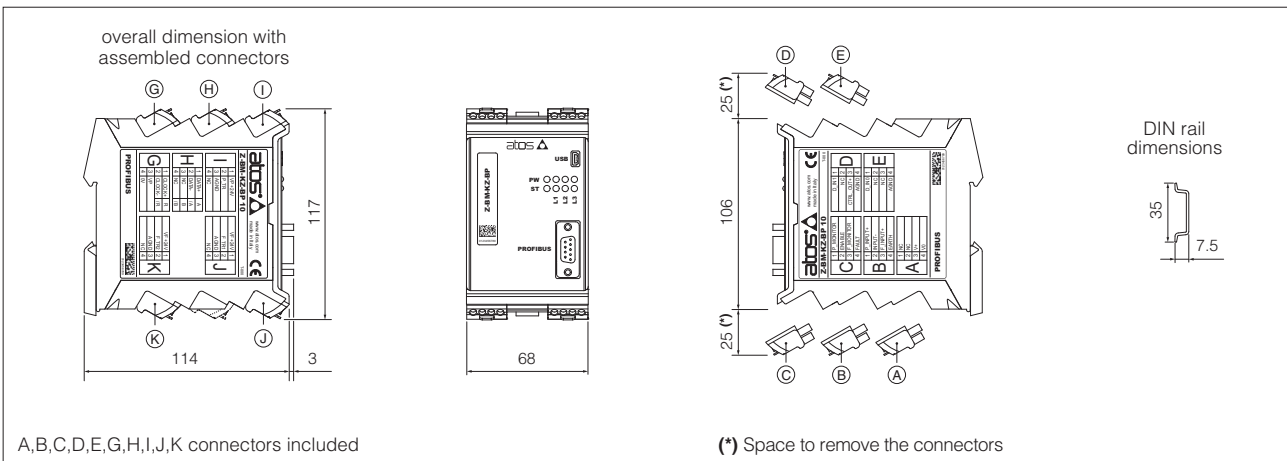
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

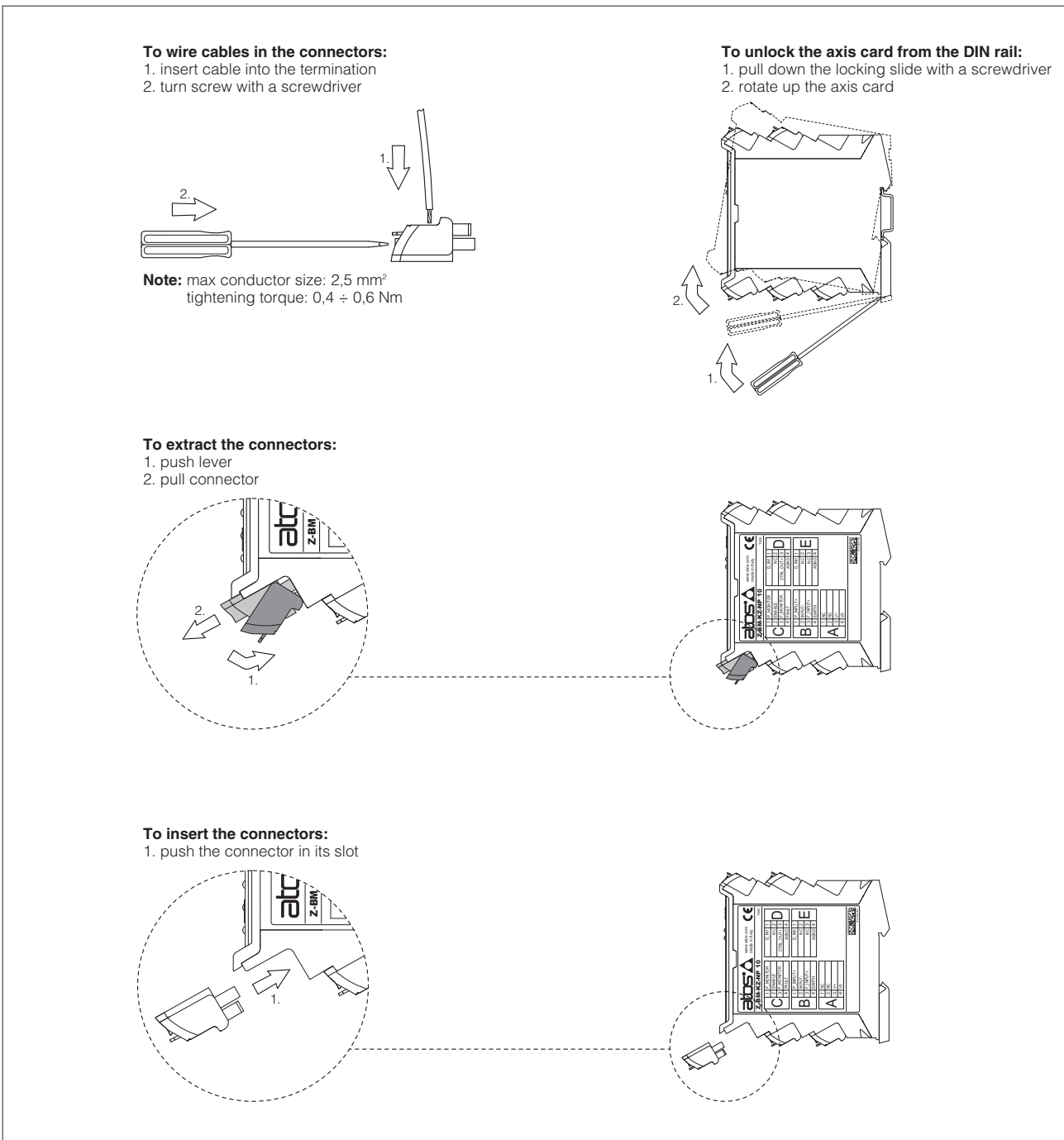
12.6 Motion phases parameters

When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 4.2).

13 OVERALL DIMENSIONS [mm]



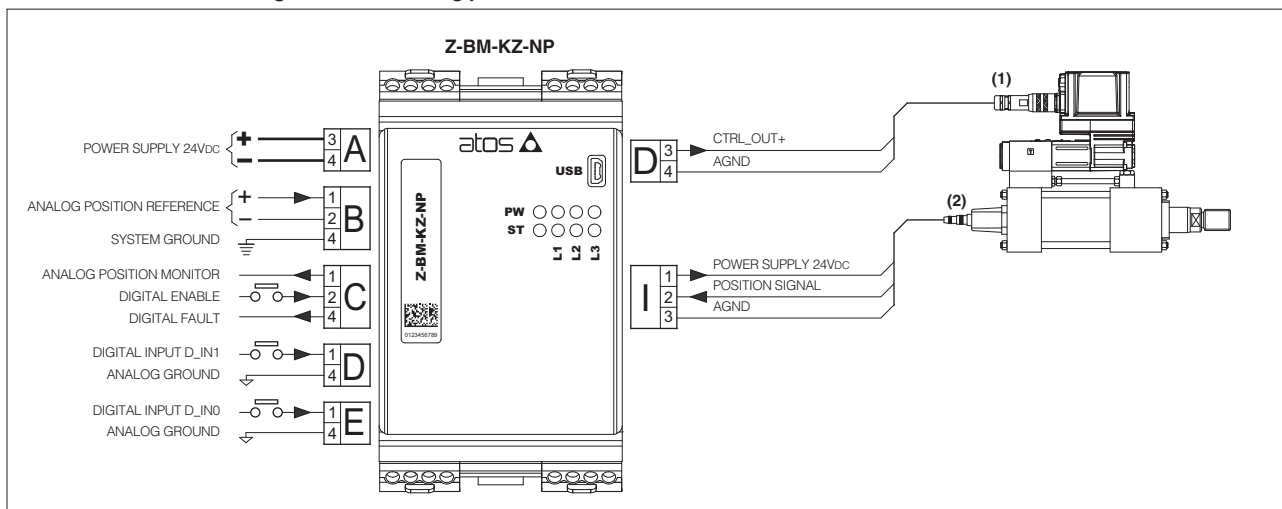
14 INSTALLATION



Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot (eg. connector A can not be inserted into connector slot of B,C,D,E,G,H,I,J,K)

15 WIRING EXAMPLES

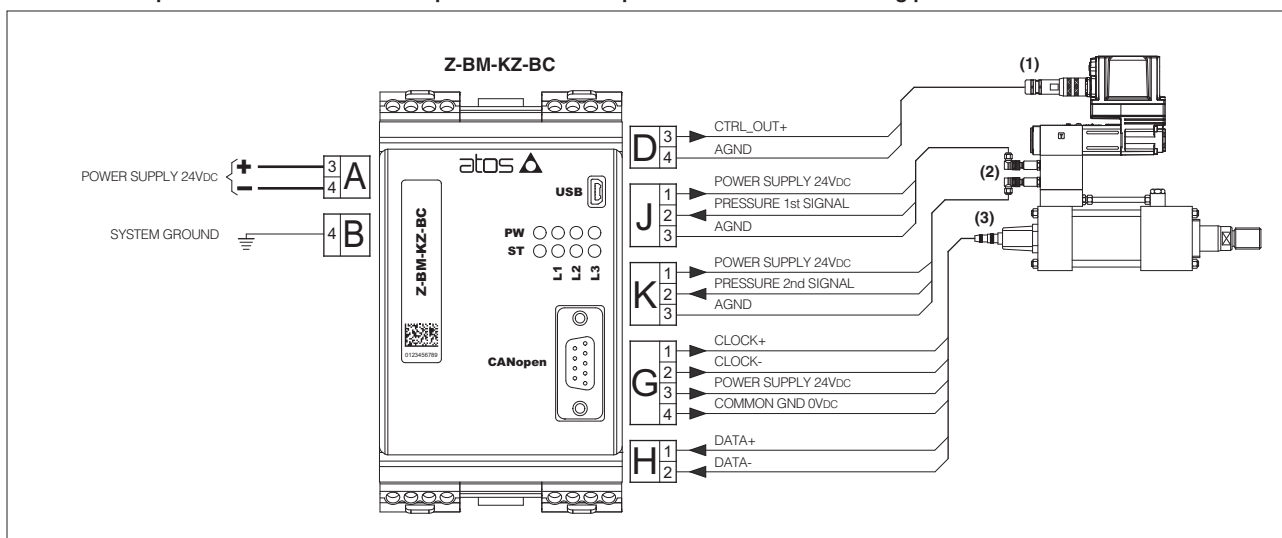
15.1 Position control - analog reference - analog position transducer



(1) For valve driver electrical connections please refer to the specific technical table

(2) The analog position transducer connections are intended as generic example, for details please consult the transducer datasheet

15.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers

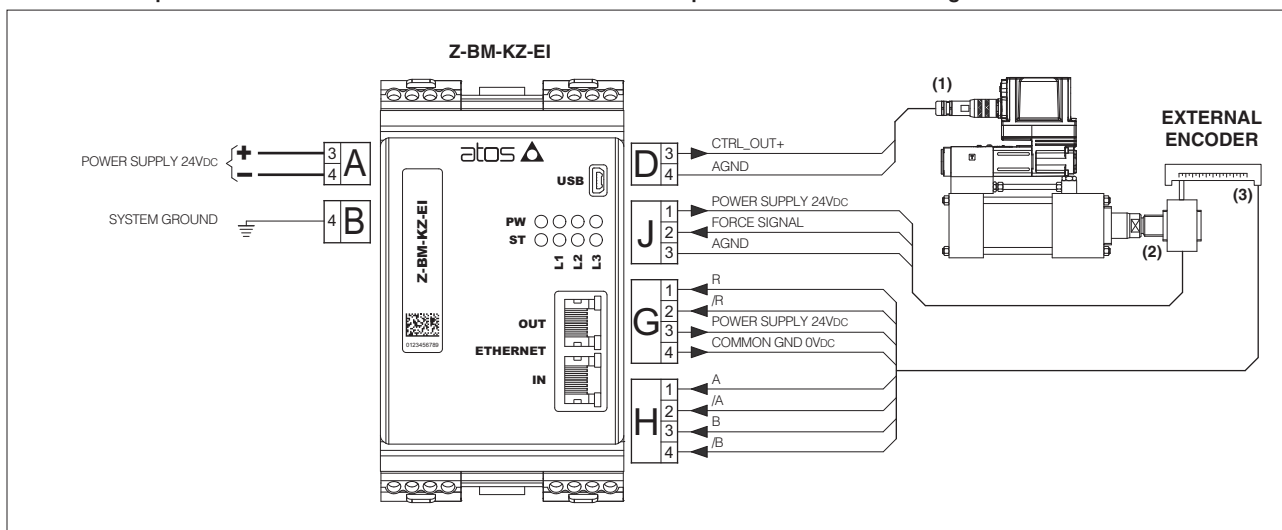


(1) For valve driver electrical connections please refer to the specific technical table

(2) Pressure transducers connections are shown with voltage signal output; for connections with current signal output see 8.5

(3) The SSI position transducer connections are intended as generic example, for details please consult the transducer datasheet

15.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



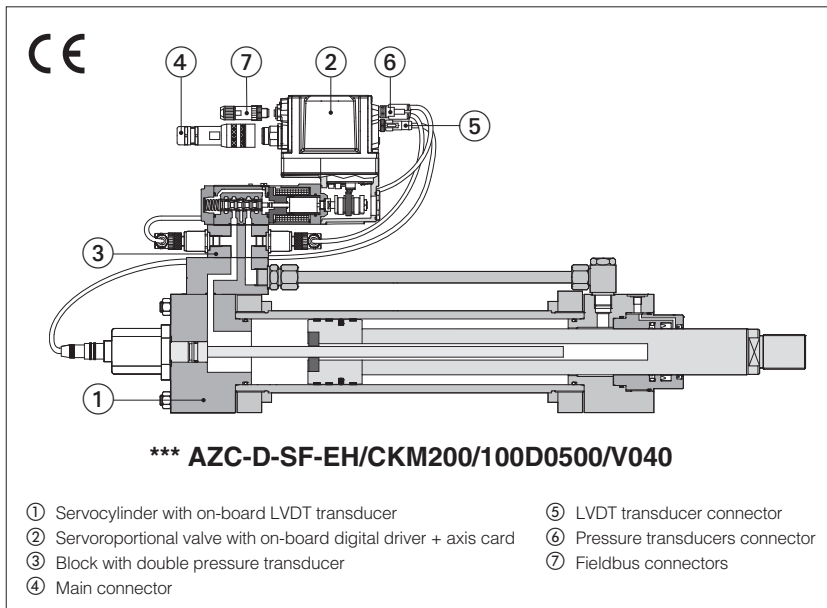
(1) For valve driver electrical connections please refer to the specific technical table

(2) Load cell connections is shown with voltage signal output; please consult the load cell datasheet for details about connections

(3) The Encoder position transducer connections are intended as generic example, for details please consult the transducer datasheet

Digital electrohydraulic servoactuators

servocylinder plus servoproportional directional with on-board driver & axis card



AZC

Digital electrohydraulic servoactuators are stand-alone units performing closed loop position controls.

The complete motion control cycle can be operated by external signals (from machine PLC) or programmed internally to the controller.

Alternate force control added to the basic position one with pressure transducers or load cell factory pre-assembled and wired.

The servoactuators are composed by a servocylinder with position transducer, servoproportional valve with on-board driver plus axis card, factory assembled and tested.

They can be provided with optional fieldbus interfaces for functional parameters setting, reference signals and real time diagnostics. The USB interface is always present for connection to Atos PC software which allows to easily customize the AZC configuration to the specific application requirements.

1 MODEL CODE

***	AZC	M	- D -	SF	- EH /	CK	M	200 /	100	D	0500 /	V0	40
<p>Design number</p> <p>Digital electrohydraulic servoactuator for linear axis position control</p> <p>Cycle Generation type: - = none I = injection M = mold P = parison S = synchronism X = positioning 9 = customized</p> <p>Position transducer type: A = analog D = digital</p> <p>Alternated P/Q controls: SN = none SF = with on-board double pressure transducer SL = with on-board load cell transducer XL = with remote load cell transducer</p> <p>Fieldbus interfaces, USB port always present: NP = Not present BC = CANopen BP = PROFIBUS DP EH = EtherCAT EW = POWERLINK EI = EtherNet/IP EP = PROFINET RT/IRT</p> <p>Servocylinder Type, tech table B310: CN = ISO 6020-1, Pmax 250 bar - tech table B180 CK = ISO 6020-2, Pmax 250 bar - tech table B137 CH = ISO 6020-3, Pmax 250 bar - tech table B160 CC = ISO 6022, Pmax 320bar - tech table B241</p>													<p>Servoproportional valve configuration, zero spool overlap: 40 = with fail safe, sleeve execution, direct (tech table FS610) 60 = without fail safe, sleeve execution, direct (tech table FS610) or piloted (tech table FS630) 70 = spring central position, direct (tech table FS620) or piloted (tech table FS630)</p> <p>Servoproportional valve size with axis controller: V0 = direct, size 06 V1 = direct or piloted, size 10 V2 = piloted size 16 V4 = piloted size 25 or size 27</p>
<p>Stroke [mm]</p>													
<p>Rod: S = single rod D = double rod</p>													
<p>Rod diameter [mm]</p>													
<p>Bore diameter [mm]</p>													
<p>Cylinder position transducer type, see section 6 : Analog (only for AZC-A) P = potentiometer, max stroke 900mm F = analog magnetostrictive, max stroke 2500mm N = analog magnetostrictive, max stroke 4000mm T = LVDT, max stroke 16mm L = LVDT, max stroke 30mm V = inductive, max stroke 900mm Digital (only for AZC-D) M = SSI magnetostrictive, max stroke 900mm Analog or Digital 9 = special X = remoted</p>													

2 MAIN CHARACTERISTICS

Assembly position	Any position		
Ambient temperature range	standard execution = -20°C ÷ +60°C		
Storage temperature range	Standard execution = -20°C ÷ +70°C		
Protection degree to EN60529	IP66 / IP67		
Duty factor	Continuous rating (ED=100%)		
Recommended fluid temperature	-20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Classification	Ref. Standard	
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	HFDU, HFDR	ISO 12922	
Flame resistant with water	HFC		

3 AXIS CONTROLLER

Digital servoproportionals direct or pilot operated include valve with on-board digital driver plus axis card to perform the position closed loop of hydraulic actuator. Axis controllers are operated by an external or internally generated reference position signal.

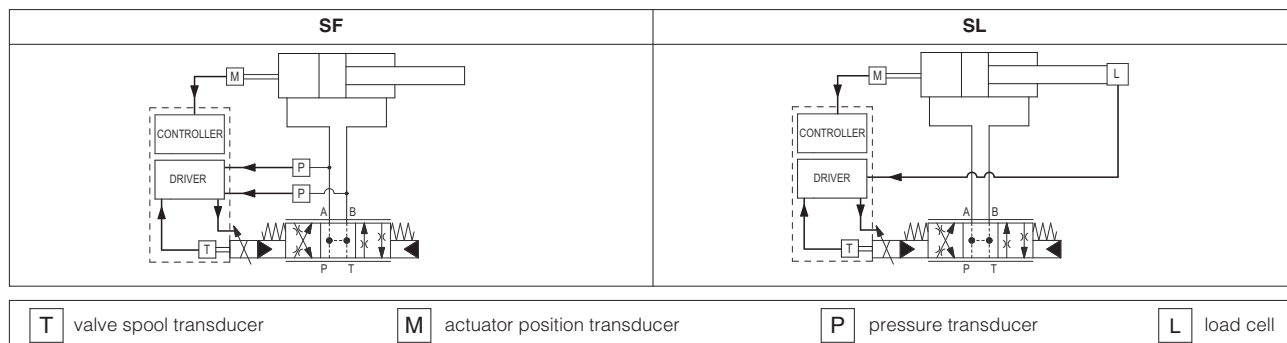
For detailed information about integral axis controller see tech tables **FS610**, **FS620**, **FS630**.

4 ALTERNATED P/Q CONTROLS

SF and **SL** controls add the alternated force closed loop control to the actuator standard position control.

A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions.

For detailed information about SF, SL controls, see tech table **FS500**.



5 FIELDBUS

Fieldbus allows the direct communication of the servoactuator with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance.

For detailed information about fieldbus features and specification see tech table **GS510**.

6 ACTUATOR TRANSDUCER CHARACTERISTICS

6.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution).

Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances.

Transducers with analog interface grant simple and cost effective solutions.

6.2 Pressure/force transducers

The accuracy of the force control is strongly dependent to the selected force transducer. Alternated force controls require to install pressure transducers or load cell to measure the actual pressure/force values.

Pressure transducers allow easy system integration and cost effective solution for alternated position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control.

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

6.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Execution	Position				Pressure/Force
	A	Analog	D	D	SF, SL
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0,4 % FS	< 0,2 % FS	1 µm	1 µm (@ 0,15 m/s)	< 0,4 % FS
Linearity error (2)	± 0,1% FS	< ±0,03% FS	< ± 0,01 % FS	< ± 0,001 % FS	< ±0,25% FS
Repeatability (2)	± 0,05% FS	< ± 0,005% FS	< ± 0,001 % FS	< ± 0,001 % FS	< ±0,1% FS

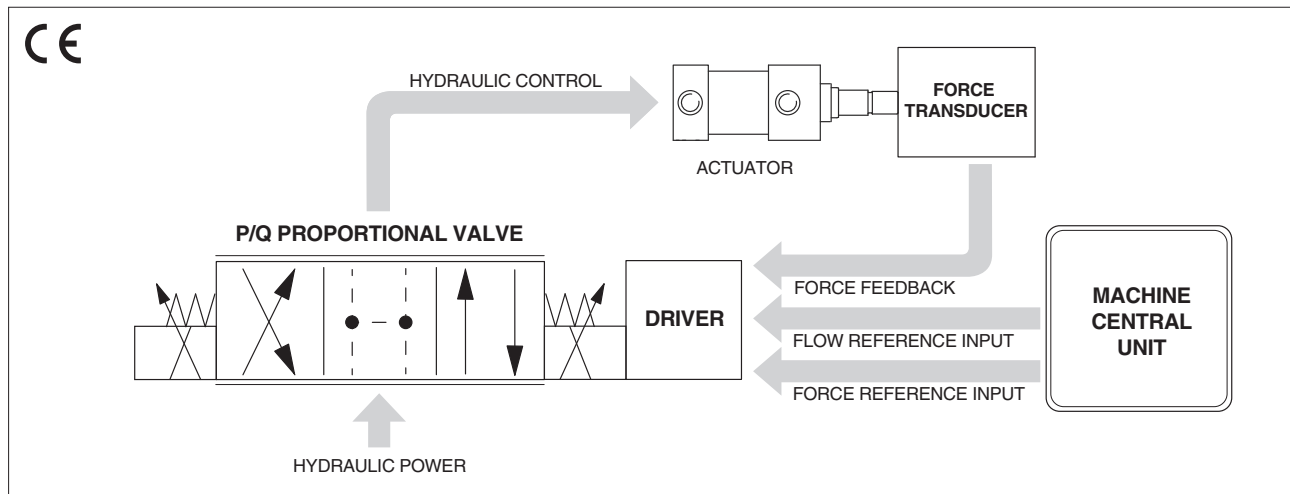
(1) power supply provided by digital controller

(2) percentage of total stroke

(3) Balluff BTL7 with SSI interface is not supported

Digital proportional valves with P/Q control

directional valves with LVDT transducer and on-board driver



1 GENERAL DESCRIPTION

Proportional directional valves with P/Q control are identified by option SP, SF or SL and they are designed to perform the alternated regulation of speed/position/force of hydraulic actuators.

These options add the closed loop control of pressure (for SP) or force (for SF and SL) to the standard direction and flow regulation operated by the servoproportional and high performance proportional directional valves.

Note: for simplification, the following description always refers to the “force control”, even if for the SP option the control is the “pressure”.

The switching from the flow control to the force control is automatically performed by the valve thanks to a sophisticated algorithm.

The advantage offered by this solution is the high accurate and high dynamic control of the machine actuator in terms of direction, speed, position and force, all performed by a single valve.

2 FUNCTIONAL DESCRIPTION

The alternated P/Q control is operated by means of two electronic reference signals sent from the machine central unit to the valve driver: one for flow regulation and one for regulation. The valve driver has to be interfaced to a remote pressure transducer or to a load cell for the measurement and feedback of the actual pressure or force.

The SP option controls the pressure on A user port and it has to be interfaced to a single pressure transducer.

The SF option controls the force by measuring the delta p across A and B user ports and it has to be interfaced to two pressure transducers.

The SL option directly controls the actuator force and it has to be interfaced to a load cell.

See section 4 for configuration examples.

A dedicated algorithm automatically selects which control (flow or force) will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.

The flow regulation is active when the actual system force measured by the force transducer is lower than the relevant input reference signal.

The valve normally works to regulate the flow by controlling in closed-loop the spool position through the integral LVDT transducer.

The force control is activated when the actual system force, measured by remote transducers, reaches the setpoint defined by the relevant force reference input signal and meets the regulation requirements defined within the control algorithm.

The flow regulation is consequently reduced to keep steady the closed loop regulation of the force.

If the force decreases below its input reference signal, the flow control returns active.

The dynamic response of the force control can be adapted to different system characteristics, by setting the internal PID parameters using Atos PC software. Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

3 VALVES RANGE

Options SP, SF, SL are available for high performance proportional directional valves and servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ on-board digital driver + axis card.

Valve's performance characteristics and overall dimensions remains unchanged as per standard valve models, refer to specific FS** technical tables.

Servoproportionals:

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap, sleeve execution - technical tables **FS180**

DHZO-TEZ, DKZO-TEZ - direct, zero spool overlap - technical tables **FS168**

DPZO-LES - piloted, zero spool overlap - technical table **FS178**

LIQZO-LES, LIQZP-LES - 3-way servocartridges - technical table **FS340**

Servoproportionals with TEZ/LEZ on-board digital driver + axis card:

DLHZO-TEZ, DLKZOR-TEZ - direct, zero spool overlap, sleeve execution - technical tables **FS610**

DHZO-TEZ, DKZOR-TEZ - direct, zero spool overlap - technical tables **FS620**

DPZO-LEZ - piloted, zero spool overlap - technical tables **FS630**

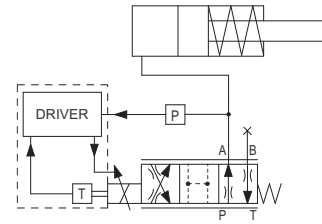
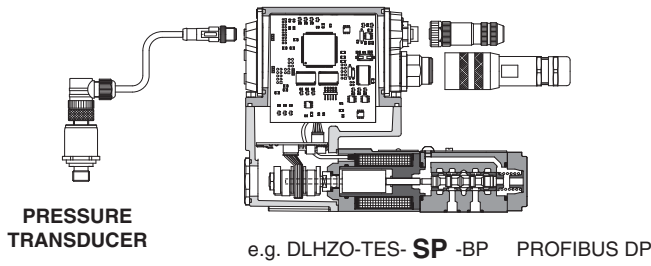
High performance proportionals:

DHZO-TEZ, DKZOR-TEZ - direct, positive spool overlap - technical table **FS165**

DPZO-LES - piloted, positive spool overlap - technical table **FS175**

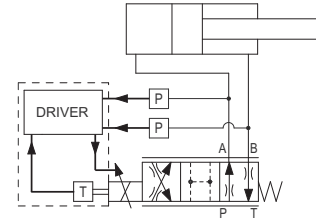
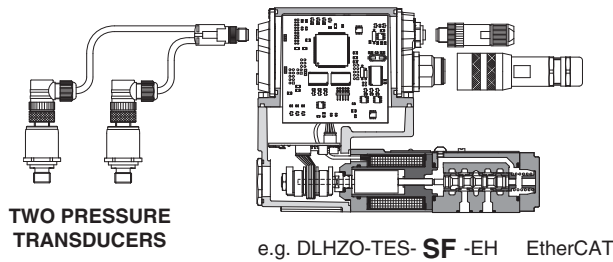
4 SP, SF, SL CONFIGURATION EXAMPLES

SP - Pressure Control - 1 pressure transducer



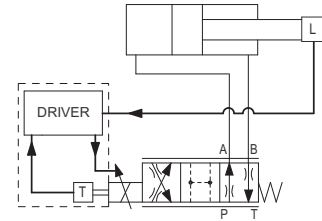
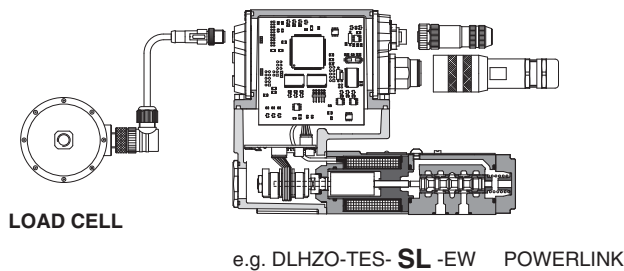
one remote pressure transducer has to be installed on the actuator's port to be controlled. In this example the SP option regulates the pressure on port A

SF - Force Control - 2 pressure transducers



two remote pressure transducers have to be installed on the actuator's ports A and B. The bore and rod dimensions of the actuator have to be input into the valve software, which calculates the relevant areas: A1 = bore area; A2 = ring area. The SF option directly controls the actuator force (F) as result of the following calculation: $F = (Pa \times A1) - (Pb \times A2)$

SL - Force Control - 1 load cell



one load cell transducer has to be installed between the actuator and the controlled load. The SL option directly control the actuator force

5 GENERAL NOTES

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

6 VALVE SETTINGS AND PROGRAMMING TOOLS



WARNING: the below operation must be performed in a safety area

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC/PQ supports: NP (USB)

E-SW-FIELDBUS/PQ and **Z-SW-FULL** support:

NP (USB)

BC (CANopen)

EW (POWERLINK)

BP (PROFIBUS DP)

EI (EtherNet/IP)

EH (EtherCAT)

EP (PROFINET)

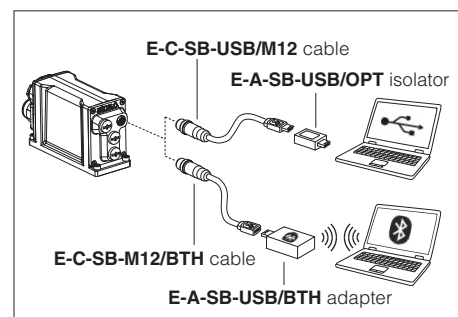


WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



7 FUNCTIONAL EXAMPLES

The following functional examples are just generic reference of the possible applications of with proportional directional valves with alternated P/Q control, **SP**, **SF**, **SL**.

Please contact Atos technical department for additional evaluations related to specific applications usage.

7.1 High-dynamic pressure reducing controls - only for **SP**

Directional proportional valves with zero spool overlap and SP control, are operated in 3-way hydraulic configuration to obtain high-dynamic pressure reducing control on the A (or B) user port:

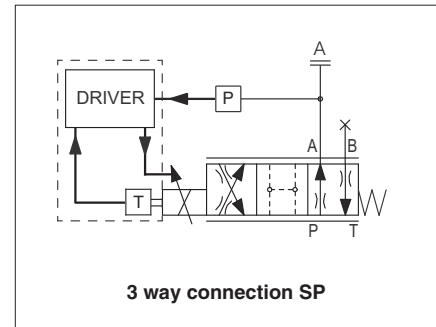
- flow reference signal is used to limit the maximum flow during the pressure regulation
- pressure reference signal is used to regulate the pressure on the valve's A user port; the rapid/repeatable response of the pressure control is performed in high dynamics by the directional valve's closed loop regulation

Requirements:

- an remote pressure transducer has to be installed in the hydraulic system on the controlled user port (when using 4 way valves either A or B port can be used while the not controlled port must be plugged)
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

High-dynamic - only for **SP**



7.2 Single effect actuators with speed/pressure/force controls - only for **SP** or **SL**

Directional proportional valves with SP or SL control, are operated in 3-way hydraulic configuration to control speed/pressure (force) on single effect actuators:

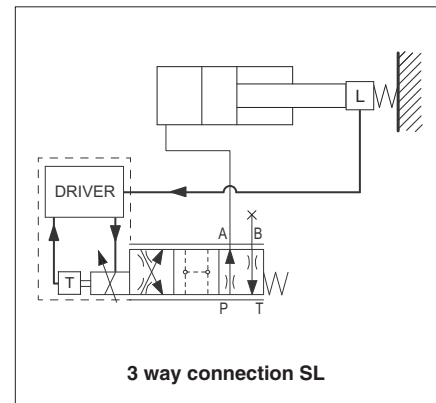
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure (force) reference signal is used to limit the maximum pushing pressure (force) to the actuator
or
- pressure (force) reference signal is used to regulate the actuator pushing pressure (force) while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SP control a remote pressure transducer has to be installed in the hydraulic system on the actuator pushing port
- for SL control a remote force transducer has to be installed between the actuator and the controlled load
- zero overlap valves without fail safe position are recommended;

⚠ Positive overlap valves with PABT ports closed in central position are not suitable for this application

Single effect - only for **SP** or **SL**



7.3 Double effect actuators with speed/pressure controls - only for **SP**

Directional proportional valves with SP control, regulate speed/pressure on double effect actuators:

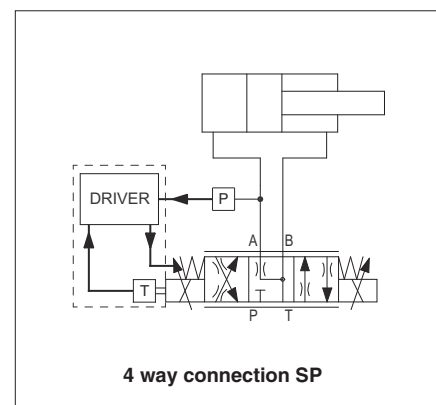
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure reference signal is used to limit the maximum pushing pressure of the actuator
or
- pressure reference signal is used to regulate the actuator pushing pressure while flow reference signal is used to limit the maximum forward and backward actuator speed

Requirements:

- a remote pressure transducer has to be installed on the actuator's pushing port
- a dedicated Q5 spool with strong "meter-in" characteristic in central position has to be used; during pressure regulation, the not controlled port remains connected to T line to avoid any back pressure - see section 7.4

⚠ Positive overlap valves with PABT ports closed are not suitable for this application

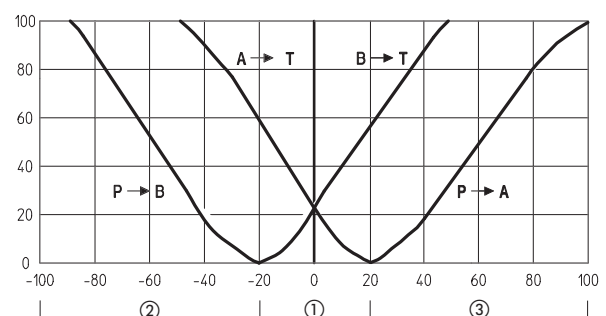
Double effect - only for **SP**



7.4 Q5 spool for 4 way connection with SP control

Spool type **Q5** allows fast direction reverse during motion phases (e.g. ejector motion with max strain limitation)

- ① depressuring (pressure control active)
- ② backward movements (flow control active)
- ③ forward movements (flow or pressure control active)



7.5 Double effect actuators with force limit/regulation - only for SF or SL

4 way directional proportional valves with SF or SL control, regulate speed/force on double effect actuators:

- flow reference signal is used to regulate the actuator's forward and backward speed while force reference signal is used to limit the maximum pushing and pulling force of the actuator or
- force reference signal is used to regulate the actuator pushing and pulling force while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SF two remote pressure transducers have to be installed on the both actuator's ports
- for SL one push/pull load cell transducer has to be installed between the actuator and the controlled load
- zero overlap valves are recommended;



positive overlap valves with PABT ports closed in central position are not suitable for this application

Advantages:

- force control is possible in both push and pull directions
- SL allows a more precise force control despite of a more complex installation of the load cell transducer
- SF allows to add force control also into existing systems thanks to the simple installation of pressure transducers

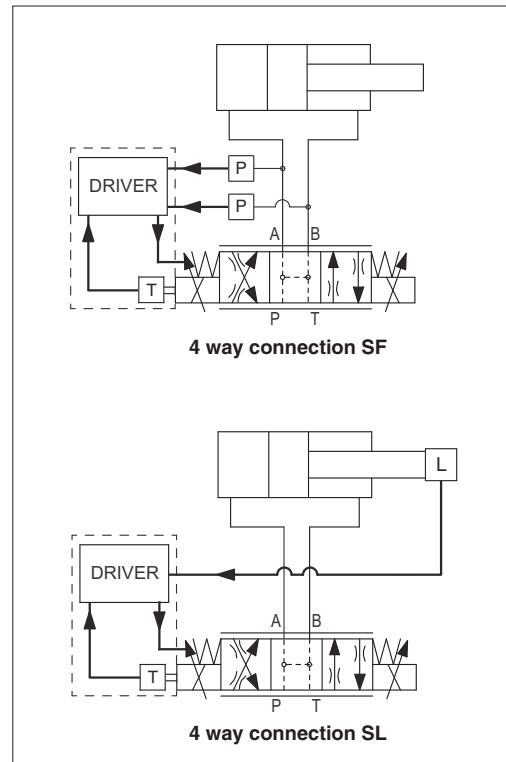
Control modes:

- Flow priority: flow reference signal is used to move forward and backward the actuator while force is limited/regulated in both push and pull direction
- Force priority: force reference signal is used to control both push and pull forces while flow is limited/regulated in both direction

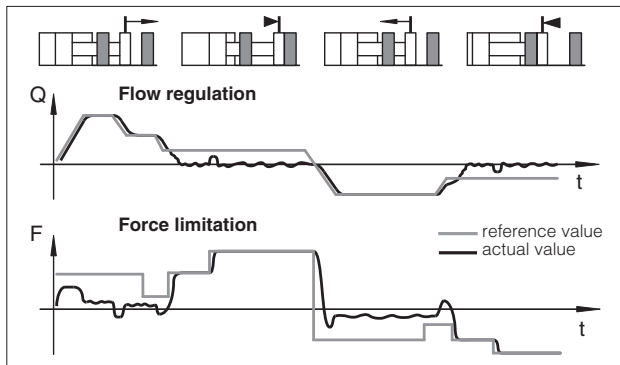
Notes:

auxiliary check valves are recommended to intercept A and B lines in case of specific hydraulic configuration requirements in absence of power supply or fault

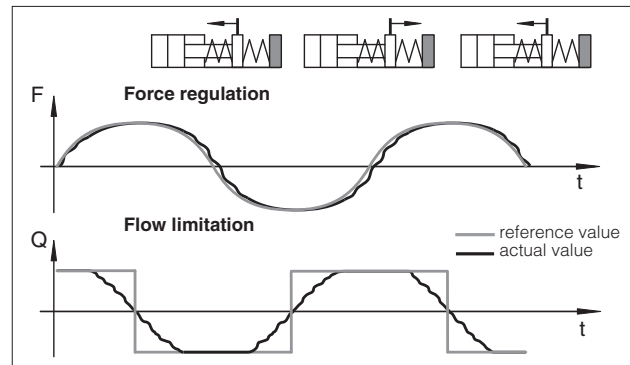
Double effect - only for SF or SL



7.6 Flow priority



7.7 Force priority



8 PRESSURE/FORCE TRANSDUCER CHARACTERISTICS

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducers.

Pressure/force controls require to install remote pressure transducers or load cell to measure the actual pressure/force values:

- **Pressure Transducers:** allow easy system integration and cost effective solution for both pressure and force controls, see tech table **GS465** for E-ATR-8 pressure transducer details
- **Load Cell Transducers:** allow the user to get high accuracy and precise regulations for force control, but it increases the complexity of the mechanical installation

The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115÷120 % of the maximum regulated pressure/force.

3

ON-OFF VALVES

ON-OFF VALVES



INDEX

ON-OFF VALVES

Size Qmax [l/min] Table **Pag**

TECHNICAL INFORMATION

Basics for on-off solenoid directional valves				E001	843
Basics for safety components				Y010	845
Mounting surface for electrohydraulic valves				P005	867
Mounting surface and cavities for cartridge valves				P006	871

DIRECTIONAL VALVES

solenoid operated

DHL	direct, spool type, subplate, AC or DC solenoids, compact execution	06	60	E018	545
DHI	direct, spool type, subplate, AC or DC solenoids	06	60	E010	551
DHE	direct, spool type, subplate, AC or DC solenoids, high flow	06	80	E015	555
DKE	direct, spool type, subplate, AC or DC solenoids	10	150	E025	559
DPHI, DPHE	piloted, spool type, subplate, AC or DC solenoids	10 ÷ 32	160 ÷ 1000	E085	563

leak free, solenoid operated

DLEH, DLEHM, CART LEH, CART LEHM	direct, poppet type, subplate, AC or DC solenoids	06	12 ÷ 30	E045	571
JO-DL	piloted, poppet type, screw-in cartridge, DC solenoids	M20 UNF 3/4" ÷ 1 5/16"	40 ÷ 300	E105	575

mechanical, hydraulic, pneumatic operated

DH, DK, DP Mechanical	hand lever or cam operated, spool type, subplate	06 ÷ 25	50 ÷ 700	E150	579
DH, DK, DP Hydraulic	spool type, subplate	06 ÷ 32	50 ÷ 1000	E225	585
DH, DK, DP Pneumatic	spool type, subplate	06 ÷ 32	50 ÷ 1000	E255	589

PRESSURE VALVES

CART M, CART ARE	relief, direct, screw-in cartridge	G1/2" ÷ M35	2,5 ÷ 150	C010	593
ARE	relief, direct, in line	G1/4" ÷ G1/2"	40 ÷ 100	C020	599
ARAM	relief, piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	350 ÷ 500	C045	603
AGAM	relief, piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	C066	609
REM	relief, piloted, flanged, optional AC or DC solenoids	SAE 3/4" ÷ 1 1/4"	200 ÷ 600	C073	615
AGIR	reducing, piloted, subplate	10 ÷ 32	160 ÷ 400		
AGIS	sequence, piloted, subplate	10 ÷ 32	200 ÷ 600	C070	621
AGIU	unloading, piloted, subplate, optional AC or DC solenoids	10 ÷ 32	100 ÷ 300		

FLOW VALVES

QV	pressure compensated, 2 way, subplate	06	24	C210	627
AQFR	throttle, in line	G3/8" ÷ 1 1/4"	30 ÷ 250	C280	629

		Size	Qmax [l/min]	Table	Pag
CHECK VALVES					
DB, DR	direct, screw-in cartridge	G1/4" ÷ G1/2	95	C400	631
ADR	direct, in line	G1/4" ÷ G1 1/4"	500	C406	633
ADRL	piloted, in line	G3/8" ÷ G1 1/4"	300	C450	635
AGRL	piloted, subplate	10 ÷ 32	160 ÷ 500		

SAFETY VALVES

directionals, machine directive 2006/42/EC

DHI/FV, DHE/FV, DKE/FV DHI/FI, DHE/FI, DKE/FI	direct, spool type, subplate, AC or DC solenoids	06 ÷ 10	60 ÷ 150	EY010	639
HF/FV	direct, spool type, modular, AC or DC solenoids	06	60	EY050	649
JO-DL/FV	piloted, poppet type, leak free screw-in cartridge, DC solenoids	UNF 3/4" ÷ 1 5/16"	40 ÷ 300	EY105	653
DPHI/FV, DPHE/FV	piloted, spool type, subplate, AC or DC solenoids	10 ÷ 25	160 ÷ 700	EY030	657
LIFI, LIDA/FV, LIDAS/FV	piloted, poppet type, ISO cartridge, optional AC or DC solenoids	16 ÷ 50	120 ÷ 1800	EY120	667

pressure relief, PED 2014/68/UE

CART M/PED CART ARE/PED	direct, screw-in cartridge	G1/2" ÷ M35	2,5 ÷ 150	CY010	675
ARE/PED	direct, in line	G3/8" ÷ G1/2"	60 ÷ 100	CY020	679
ARAM/PED	piloted, in line, optional AC or DC solenoids	G3/4" ÷ G1 1/4"	350 ÷ 500	CY045	683
AGAM/PED	piloted, subplate, optional AC or DC solenoids	10 ÷ 32	200 ÷ 600	CY066	689

MODULAR VALVES

directionals

HF	direct, spool type, modular, AC or DC solenoids	06	60	D050	695
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pressure

HMP, HM, KM	relief, direct or piloted, poppet type	06 ÷ 10	35 ÷ 120	D120	699
HS, KS	sequence, direct or piloted, spool type	06 ÷ 10	40 ÷ 80	D130	703
HG, KG, JPG	reducing, direct or piloted, spool type, 3 or 2 way	06 ÷ 25	50 ÷ 300	D140	705
HC, KC, JPC	compensator, direct or piloted, spool type, 2 way	06 ÷ 16	50 ÷ 200	D150	709

flow

DHQ	direct, pressure compensated, by-pass solenoid valve	06	36	D170	711
HQ, KQ, JPQ	throttle, reverse free flow	06 ÷ 25	80 ÷ 300	D160	713

check

HR, KR, JPR	direct or piloted	06 ÷ 25	60 ÷ 300	D180	717
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ISO CARTRIDGES

SC LI	2 way, slip-in	16 ÷ 100	270 ÷ 9000	H003	721
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directionals

LIDEW, LIDBH	functional covers, optional AC or DC solenoids	16 ÷ 100	270 ÷ 9000	H030	725
LIDAS, LIDASH	2 way, active piloting, optional AC or DC solenoids	16 ÷ 50	240 ÷ 2100	H050	731

pressure

LIMM	relief, functional covers, optional AC or DC solenoids	16 ÷ 80	180 ÷ 4900		
LIRA	reducing, functional covers	16 ÷ 40	140 ÷ 750	H010	735
LIC	compensator, functional covers	16 ÷ 80	180 ÷ 4900		

flow

LIDD	functional covers, throttle with stroke limiter	16 ÷ 63	270 ÷ 4000	H020	741
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check

LIDA	normally closed, functional covers	16 ÷ 100	270 ÷ 9000		
LIDO	normally open, functional covers	16 ÷ 50	160 ÷ 1800	H040	745
LIDB	normally closed, functional covers, shuttle valve	16 ÷ 63	270 ÷ 4000		
LIDR	normally closed, functional covers, check valve	16 ÷ 63	270 ÷ 4000		

ACCESSORIES

E-ATR-8	pressure transducer with amplified analog output signal			GS465	813
E-DAP-2	electronic pressure switch with digital output signals and display			GS470	815
MAP	manual pressure switch with fixed differential switching pressure			D250	817
BA	single station subplates, mounting surfaces ISO 4401, 6264 and 5781			K280	819
BA-214, BA-314, BA-244	multi-station subplates, mounting surface ISO 4401			K290	823
BA-214/AL	multi-station subplates, mounting surface ISO 4401, aluminium			K295	827
HAND LEVERS	for on-off and proportional valves			E138	829
HANDWHEELS & KNOBS	for on-off and proportional valves			K150	831
CONNECTORS	for transducers, on-off and proportional valves			K800	833

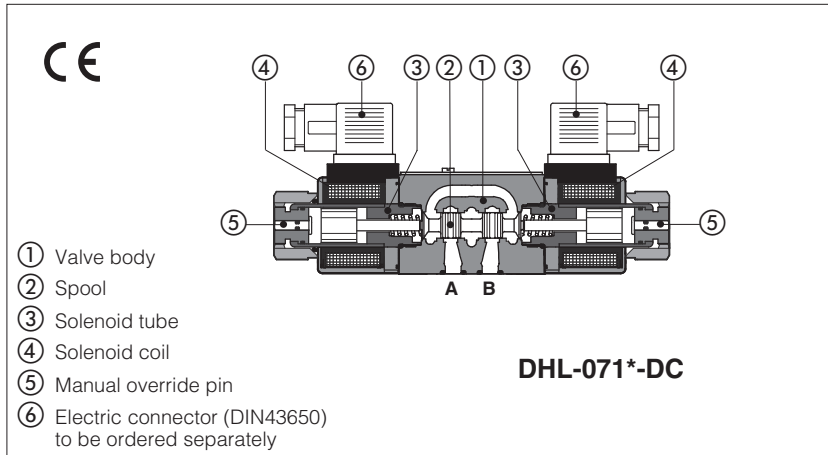
OPERATING INFORMATION

Operating and maintenance information for on-off valves	E900	885
Operating and maintenance information for safety PED pressure relief valves	CY900	891

Supplementary components range available on www.atos.com

Solenoid directional valves type DHL

direct, spool type, compact execution



Spool type, 4/3, 4/2, 3/2 way version.

Wet type solenoids made by:

- screwed tube ③, different for AC and DC power supply
- interchangeable coils ④, specific for AC or DC power supply, easily replaceable without tools - see section ⑥ for available voltages

The valve body ① is 3 chamber type made by shell-moulding casting with wide internal passages ensuring low pressure drops.

Mounting surface: **ISO 4401 size 06**

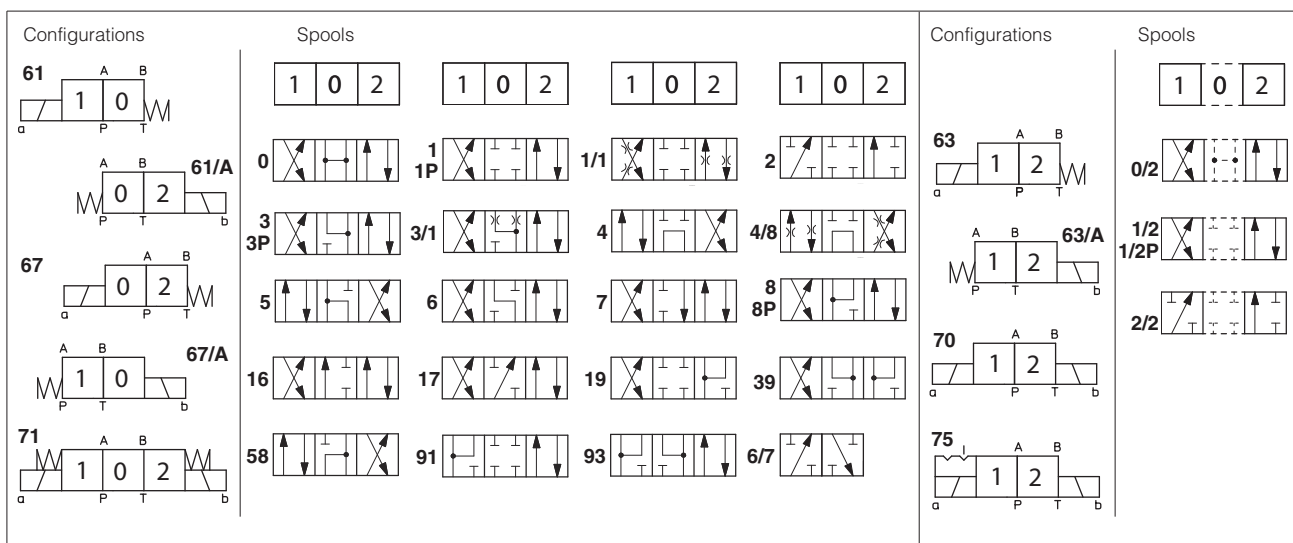
Max flow: **60 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DHL - 0	61	1 / A - X	24 DC	*	*
Solenoid directional valves size 06			Voltage code, see section ⑥	Series number	Seals material, see section ⑭: - = NBR PE = FKM
Valve configuration, see section ②			00-AC = AC solenoids without coils 00-DC = DC solenoids without coils X = without connector		
61 = single solenoid, center plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, center plus external position, spring offset 70 = double solenoid, 2 external positions, without springs 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent			See section ⑫ for available connectors, to be ordered separately Coils with special connectors, see section ⑬		
Spool type, see section ②		Options, see section ⑦			

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



- Note:** Spool type **6/7** is available only for configuration **61**, not available for version **/A**
 Spool type **3/1** has restricted oil passages in central position, from user ports to tank.
 Spools type **1/1** and **4/8** are properly shaped to reduce water-hammer shocks during the switching.
 Spools type **1P**, **3P**, **8P** and **1/2P** reduced the valve internal leakages

3 GENERAL CHARACTERISTICS

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160 bar for AC version
Max flow	60 l/min , see Q/Δp diagram at section 8 and operating limits at section 9

5 ELECTRICAL CHARACTERISTICS

Insulation class	H (180°C) for DC coils; F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See section 6
Supply voltage tolerance	± 10%

6 COIL VOLTAGE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHL
12 DC	12 DC	666 or 667	29W	COL-12DC
14 DC	14 DC			COL-14DC
24 DC	24 DC			COL-24DC
28 DC	28 DC			COL-28DC
110 DC	110 DC			COL-110DC
220 DC	220 DC			COL-220DC
110/50 AC (1)	110/50/60 AC	669	58VA (3)	COL-110/50/60AC
115/60 AC	115/60 AC			COL-115/60AC
230/50 AC (1)	230/50/60 AC			COL-230/50/60AC
230/60 AC	230/60 AC			COL-230/60AC
110/50 AC - 120/60 AC	110 DC	669	29W	COL-110DC
230/50 AC - 230/60 AC	220 DC			COL-220DC

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA.

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

7 OPTIONS

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see section 18

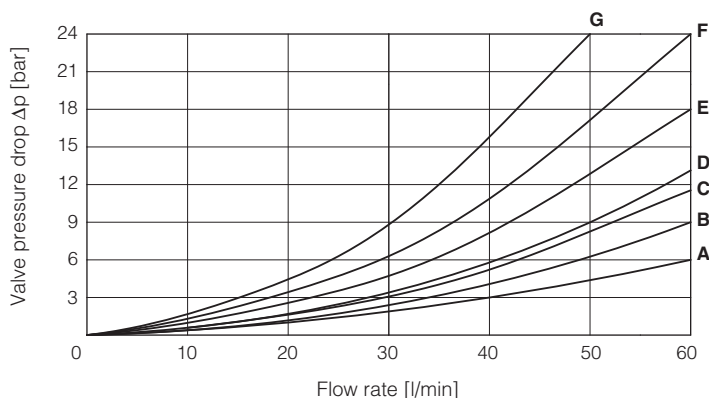
WP = prolonged manual override protected by rubber cap.

WPD/HL = manual override operation with detent, to be ordered separately, see section 18

⚠ The manual override operation can be possible only if the pressure at T port is lower than 50 bar

8 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

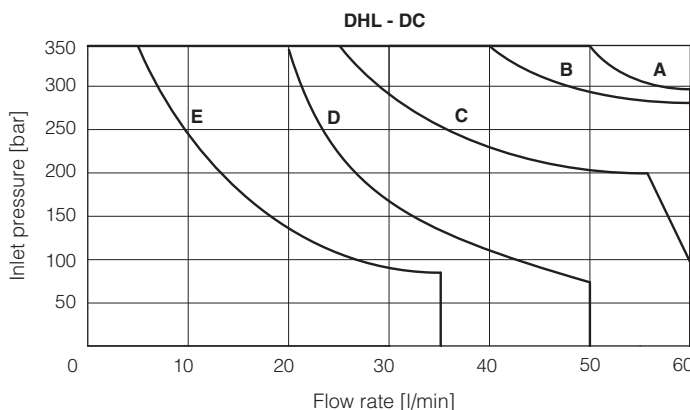
Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0	A	A	C	C	D
1, 1P, 1/1	C	C	C		
3, 3P, 3/1	D	D	A	A	
4, 4/8, 5	F	F	G	C	E
0/2, 1/2, 1/2P	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8, 8P	A	A	E	E	
2, 6/7	D	D			
2/2	F	F			
19, 91	E	E	D	D	
39, 93	F	F	G	G	



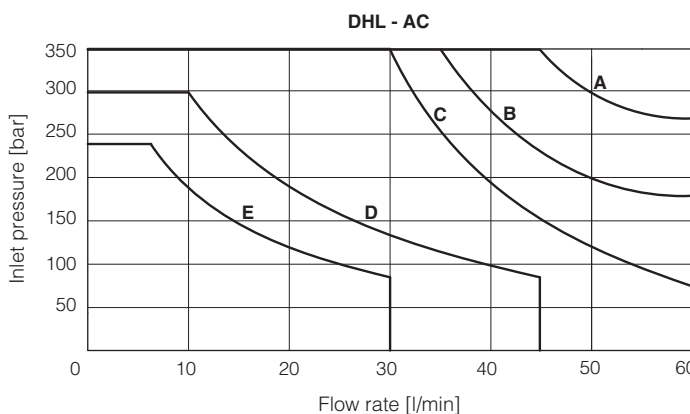
9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	DC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 4/8, 16, 17, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7



Curve	AC version, spool type:
A	0, 0/2, 1/2, 1/2P, 8, 8P
B	1, 1P, 1/1
C	3, 3P, 3/1, 6, 7
D	4, 16, 17, 4/8, 5, 19, 39, 58, 91, 93
E	2, 2/2, 6/7



10 SWITCHING TIMES (average values in msec)

- Test conditions: - 20 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHL	10 - 25	20 - 40	30 - 50	15 - 25

11 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHL + 666 / 667	7200	15000

12 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

- 666** = standard connector IP-65, suitable for direct connection to electric supply source
- 667** = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
- 669** = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)
- E-SD** = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

13 COILS WITH SPECIAL CONNECTORS only for voltage supply **12, 14, 24, 28** Vdc

Deutsch connector DT-04-2P

45
45.5

36.5
52.5
73

Options -XK

Coil type COLK, Deutsch connector DT-04-2P male
Protection degree **IP67**

Note: For the electric characteristics refer to standard coils features - see section 6

14 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

15 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary in case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H

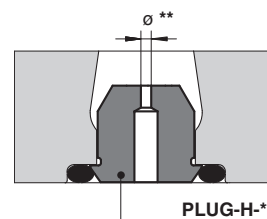
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**

A

08, 10, 12, 15 calibrated orifice diameter in tenths of mm
Example PLUG-H-**12** = orifice diameter **1,2 mm**
Other orifice dimensions are available on request

Short calibrated orifice



16 FASTENING BOLTS AND SEALS

Fastening bolts	Seals
4 socket head screws M5x30 class 12.9 Tightening torque = 8 Nm	4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)

17 DIMENSIONS [mm]

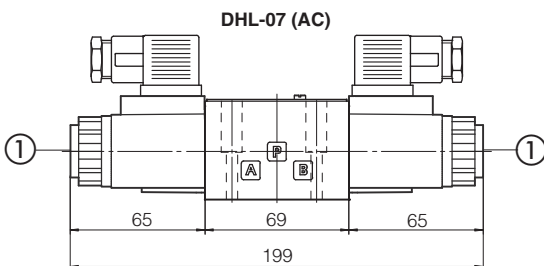
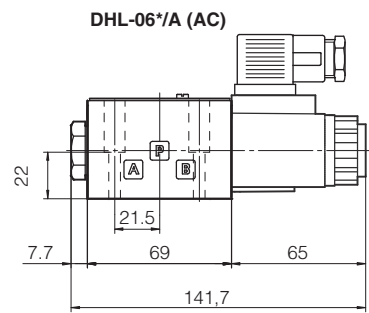
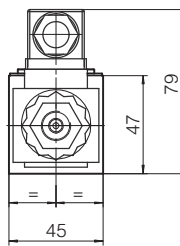
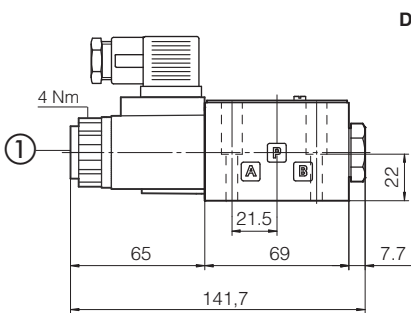
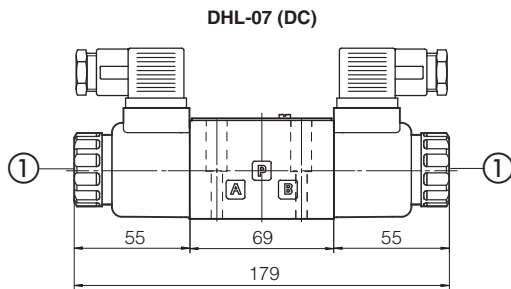
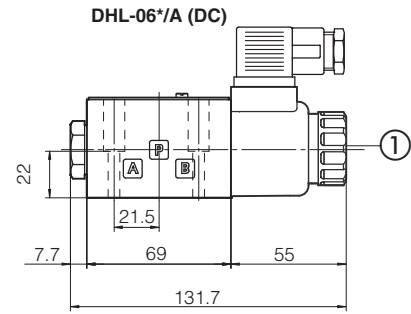
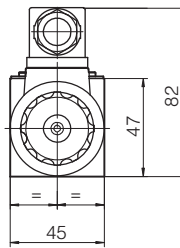
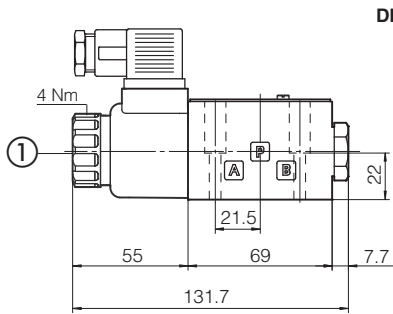
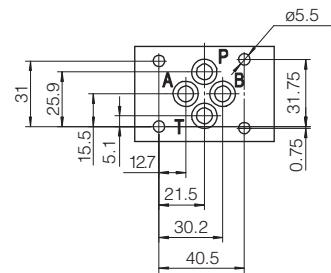
ISO 4401: 2005

Mounting surface: 4401-03-02-0-05

Mass (Kg)		
	DC	AC
DHL-06	1,3	1,2
DHL-07	1,6	1,4

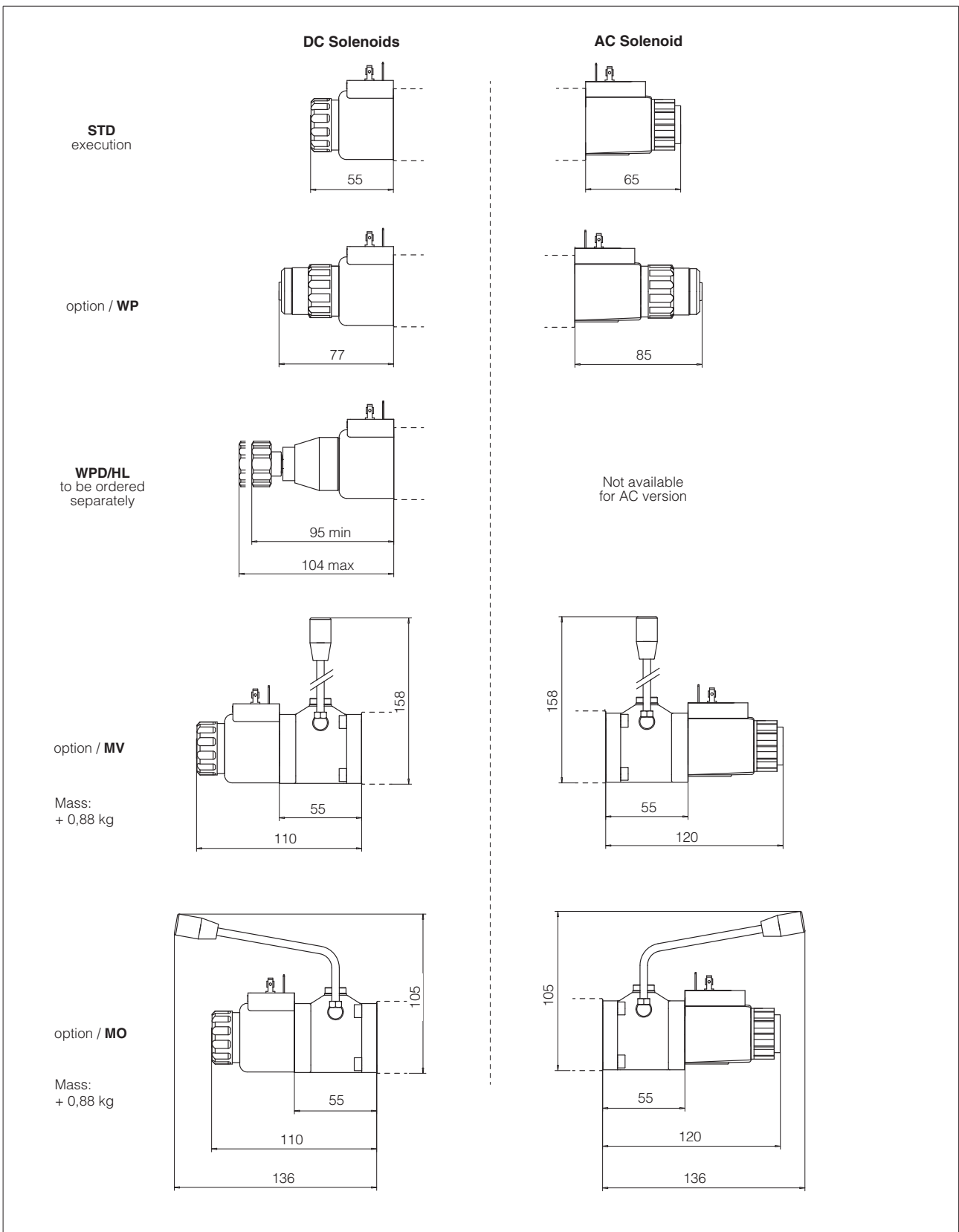
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Valve's bottom view



① Standard manual override PIN

⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

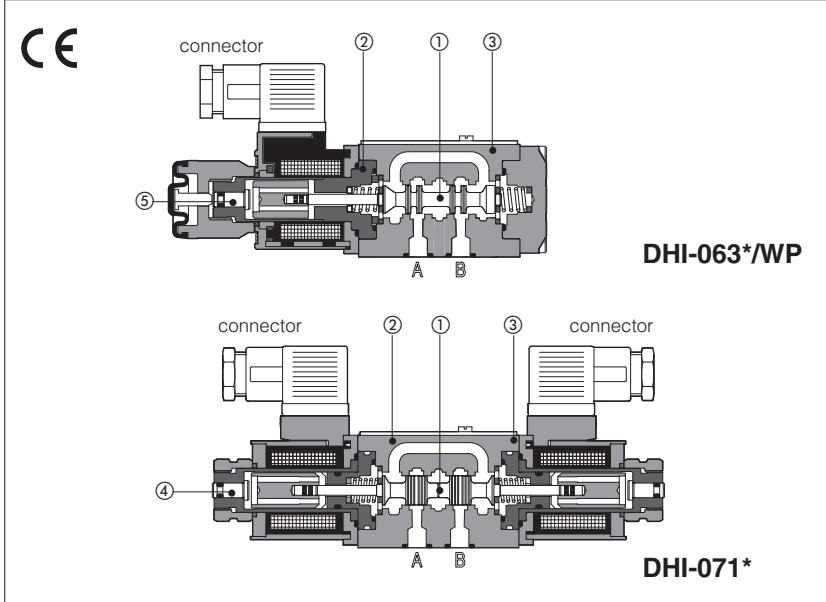


19 RELATED DOCUMENTATION

E001	Basics for solenoid directional valves	P005	Mounting surfaces for electrohydraulic valves
K150	Handwheels for hydraulic controls	E900	Operating and maintenance information
K280	Single and modular subplates		
K800	Electric and electronic connectors		

Solenoid directional valves type DHI

direct, spool type



Spool type, two or three position, direct operated valves with solenoids certified according to the North American standard **cURus**.

Solenoids ② are made by:

- wet type flanged tube, same for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section 5 for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer, XK Deutsch or Lead Wire connections.

Wide range of interchangeable spools ①, see section 2

The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**

Max flow: **60 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DHI - 0	61	1	/	A	-	X	24 DC	*	/	*
Directional control valves size 06										Seals material, see section 3: - = NBR PE = FKM BT = HNBR
Valve configuration, see section 2								Series number		
61 = single solenoid, center plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, center plus external position, spring offset 70 = double solenoid, 2 external positions, without springs 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent 77 = double solenoid, center plus external position, without springs								Voltage code, see section 5		
Spool type, see section 2										Options, see note 1 at section 4
										00 = valve without coils X = without connector See section 13 for available connectors, to be ordered separately Coils with special connectors, see section 10 XJ = AMP Junior Timer connector XK = Deutsch connector XS = Lead Wire connection

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations	Spools	Configurations	Spools
61 61/A 67 67/A 71 77 	 		

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 70 and 77 (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard = -30°C ÷ +70°C	/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Storage temperature	Standard = -30°C ÷ +80°C	/PE option = -20°C ÷ +80°C	/BT option = -40°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: plastic incapsulation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: 350 bar; Port T 120 bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	60 l/min , see operating limits at section 7		

3.1 Coils characteristics

Insulation class	H (180°C) Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	cURus

4 NOTES

1 Options

- A** = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap - see section 11.

 The manual override operation can be possible only if the pressure at T port is lower than 50 bar.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/H = manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1**. They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 3, 8** and 1/2 are available as **1P, 3P, 8P** and **1/2P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

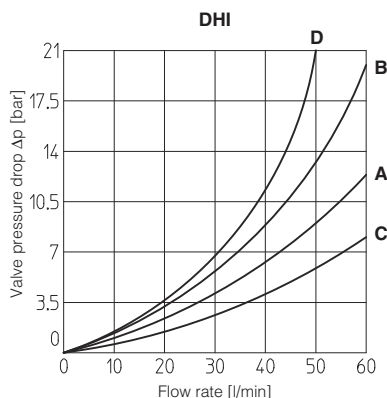
5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil			
				DHI	Colour of coil label		
6 DC	6 DC	666 or 667	33 W	COU-6DC / 80	brown		
9 DC	9 DC			COU-9DC / 80	light blue		
12 DC	12 DC			COU-12DC / 80	green		
14 DC	14 DC			COU-14DC / 80	brown		
18 DC	18 DC			COU-18DC / 80	blue		
24 DC	24 DC			COU-24DC / 80	red		
28 DC	28 DC			COU-28DC / 80	silver		
48 DC	48 DC			COU-48DC / 80	silver		
110 DC	110 DC			COU-110DC / 80	black		
125 DC	125 DC			COU-125DC / 80	silver		
220 DC	220 DC			COU-220DC / 80	black		
24/50 AC 24/60 AC	24/50/60 AC			669	60 VA (3)	COI-24/50/60AC / 80 (1)	pink
48/50 AC 48/60 AC	48/50/60 AC					COI-48/50/60AC / 80 (1)	white
110/50 AC 120/60 AC	110/50/60 AC 120/60 AC					COI-110/50/60AC / 80 (1) COI-120/60AC / 80	yellow white
230/50 AC 230/60 AC	230/50/60 AC 230/60 AC	COI-230/50/60AC / 80 (1) COI-230/60AC / 80	light blue silver				
110/50 AC 120/60 AC	110RC	COU-110RC / 80	gold				
230/50 AC 230/60 AC	230RC	COU-230RC / 80	blue				

- (1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA
(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

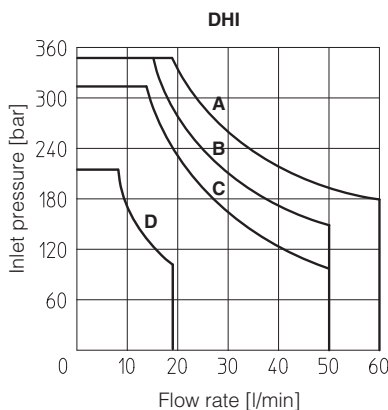
Flow direction \ Spool type	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
9, 19, 90, 91	B	B	A	A	
1/9, 39, 93	D	D	D	D	



7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	Spool type
A	0, 1, 1/2, 8
B	0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2



8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off
DHI + 666 / 667	30	45	20
DHI + 669	45	—	80
DHI + E-SD	30	45	50

Test conditions:

- 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C.

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHI + 666 / 667	7200	15000

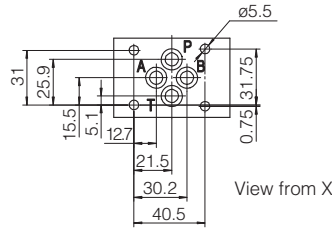
10 COILS WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 VDC

AMP Junior timer connector	Deutsch connector DT-04-2P	Lead Wire connection
<p>Options -XJ Coil type COUJ, AMP Junior Timer connector Protection degree IP67</p>	<p>Options -XK Coil type COURK Deutsch connector DT-04-2P male Protection degree IP67</p>	<p>Options -XS Coil type COUS, Lead Wire connection Cable length = 180 mm</p>

Note: For the electric characteristics refer to standard coils features - see section 5

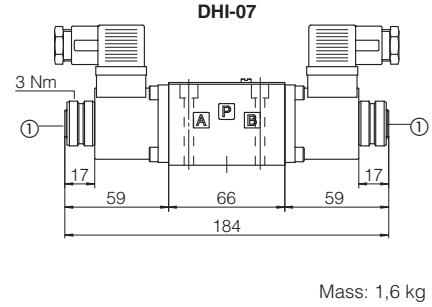
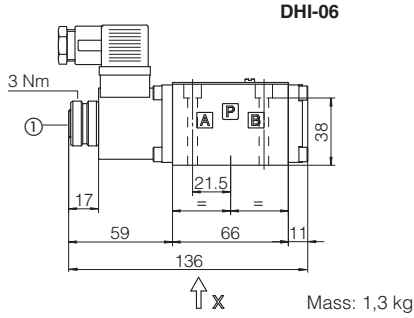
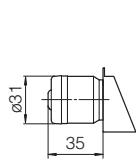
11 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
 Fastening bolts:
 4 socket head screws M5x50 class 12.9
 Tightening torque = 8 Nm
 Seals: 4 OR 108
 Ports P,A,B,T: Ø = 7.5 mm (max).



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

OPTION /WP



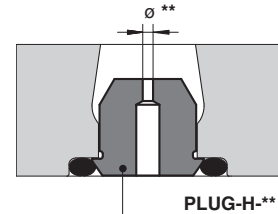
① Standard manual override PIN
 ⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connectors type 666

12 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary in case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A
<p>08, 10, 12, 15 calibrated orifice diameter in tenths of mm Example PLUG-H-12 = orifice diameter 1,2 mm Other orifice dimensions are available on request</p>			
<p>Short calibrated orifice</p>			



13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source
667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)
E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

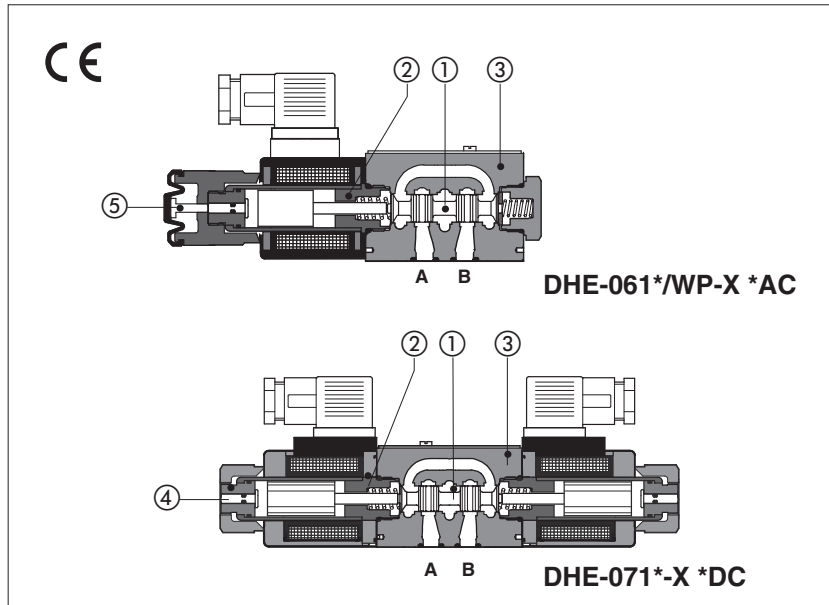
14 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	-	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DHE

direct, spool type, high flow



Spool type, two or three position direct operated valves with high performance threaded solenoids certified according to the North American standard **cURus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section ⑤ for available voltages

Standard coils protection **IP65** optional coils with IP67 AMP Junior Timer or lead wire connections.

Wide range of interchangeable spools ①, see section ②.

The valve body ③ is 3 chamber type made by shell-moulding casting with wide internal passages.

Mounting surface: **ISO 4401 size 06**

Max flow: **80 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DHE - 0	61	1	/ A	- X	24 DC	*	/ *
Directional control valves size 06						Series number	Seals material, see section ③: - = NBR PE = FKM BT = HNBR
Valve configuration, see section ②							
61 = single solenoid, center plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, center plus external position, spring offset 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent							
Spool type, see section ②.							
Options, see note 1 at section ④.							
Voltage code, see section ⑤						00-AC = AC solenoids without coils 00-DC = DC solenoids without coils X = without connector See section ④ for available connectors, to be ordered separately Coils with special connectors, see section ①① XJ = AMP Junior Timer connector XK = Deutsch connector XS = Lead Wire connection	

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

Configurations	Spools	Configurations	Spools
61 61/A 67 67/A 71 	 	63 63/A 75 	
<p>(1): spool type 6/7 available only for configuration 61, not available for version /A</p> <p>(2): not available for configuration 75</p>			

Note: see also section ④, note 3, for special shaped spools

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard = -30°C ÷ +70°C	/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Storage temperature	Standard = -30°C ÷ +80°C	/PE option = -20°C ÷ +80°C	/BT option = -40°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version; 160 bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	80 l/min , see operating limits at section 7		


3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

4 NOTES

1 Options

A = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
WP = prolonged manual override protected by rubber cap.

 The manual override operation can be possible only if the pressure at T port is lower than 50 bar - see section 12.

L1, L2, L3 = (only for DHE-DC) device for switching time control, installed in the valve solenoid, see section 9.
For spools 4 and 4/8 only device L3 is available.

FI, FV = with proximity or inductive position switch for monitoring spool position: see tab. E110.

MV, MO = auxiliary hand lever positioned vertically (MV) or horizontally (MO). For available configuration and dimensions see table E138.

2 Accessories

WPD/HE-DC = (only for DHE-DC) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5** and **58** are also available as **1/1, 4/8, 5/1** and **58/1**. They are properly shaped to reduce water-hammer shocks during the swiching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** to limit valve internal leakages.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- Other types of spools can be supplied on request.

5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil DHE	
12 DC	12 DC	666 or 667	30 W	COE-12DC	
14 DC	14 DC			COE-14DC	
24 DC	24 DC			COE-24DC	
28 DC	28 DC			COE-28DC	
48 DC	48 DC			COE-48DC	
110 DC	110 DC			COE-110DC	
125 DC	125 DC			COE-125DC	
220 DC	220 DC			COE-220DC	
110/50 AC	110/50/60 AC			58 VA (3)	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC				COE-230/50/60AC (1)
115/60 AC	115/60 AC	80 VA (3)	COE-115/60AC		
230/60 AC	230/60 AC		COE-230/60AC		
110/50 AC - 120/60 AC	110 RC	669	30 W	COE-110RC	
230/50 AC - 230/60 AC	230 RC			COE-230RC	

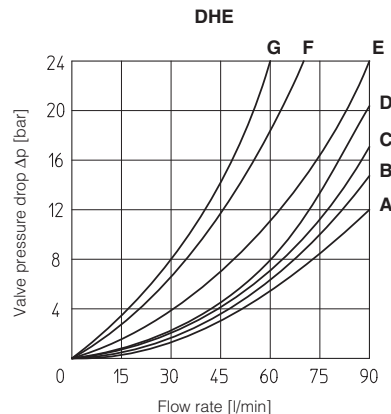
(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 52 VA.

(2) Average values based on tests preformed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

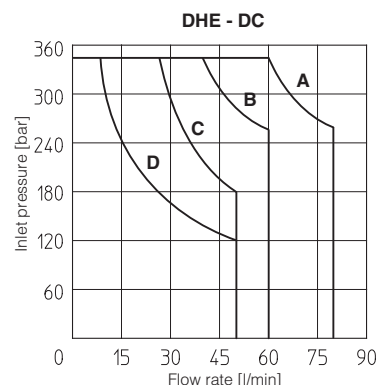
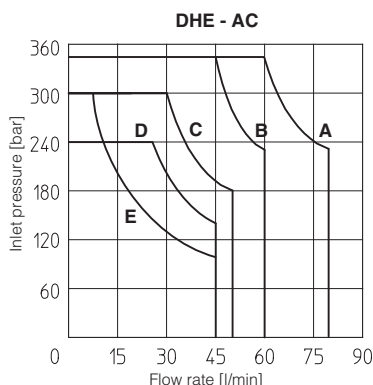
Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
1/9, 39, 93	F	F	G	G	



7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

Curve	Spool type	
	AC	DC
A	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-



8 SWITCHING TIMES (average values in msec)

- Test conditions: - 36 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- mineral oil: ISO VG 46 at 50°C

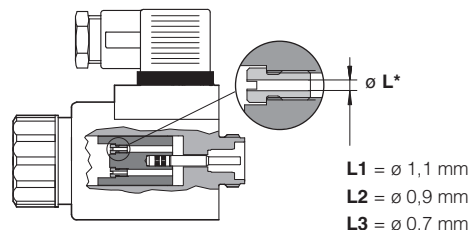
The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

Valve	Switch-on AC	Switch-off AC	Switch-on DC	Switch-off DC
DHE	10 - 25	20 - 40	30 - 50	15 - 25
DHE-*/L1	—	—	60	60
DHE-*/L2	—	—	80	80
DHE-*/L3	—	—	150	150

9 DEVICES FOR THE SWITCHING TIME CONTROL

These devices are used to control the valve's switching time (only for DC version) and therefore reduce the hammering shocks in the hydraulic circuit.

Options L1, L2, L3 control the switching time in both moving directions of the valve spool by means of calibrated restrictors installed in the solenoid anchor.



10 SWITCHING FREQUENCY

Valve	AC (cycles/h)	DC (cycles/h)
DHE + 666 / 667	7200	15000

11 COIL WITH SPECIAL CONNECTORS only for voltage supply 12, 14, 24, 28 Vdc

AMP Junior timer connector	Deutsch connector DT-04-2P	Lead Wire connection
<p>Options -XJ Coil type COEJ AMP Junior Timer connector Protection degree IP67</p>	<p>Options -XK Coil type COEK Deutsch connector DT-04-2P male Protection degree IP67</p>	<p>Options -XS Coil type COES Lead Wire connection Cable length = 180 mm</p>

Note: for the electric characteristics refer to standard coils features - see section 5

12 DIMENSIONS [mm]

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05

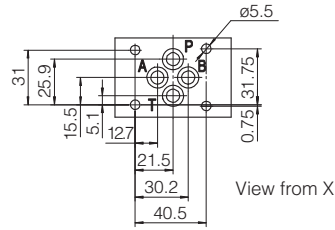
Fastening bolts: 4 socket head screws:

M5x30 class 12.9

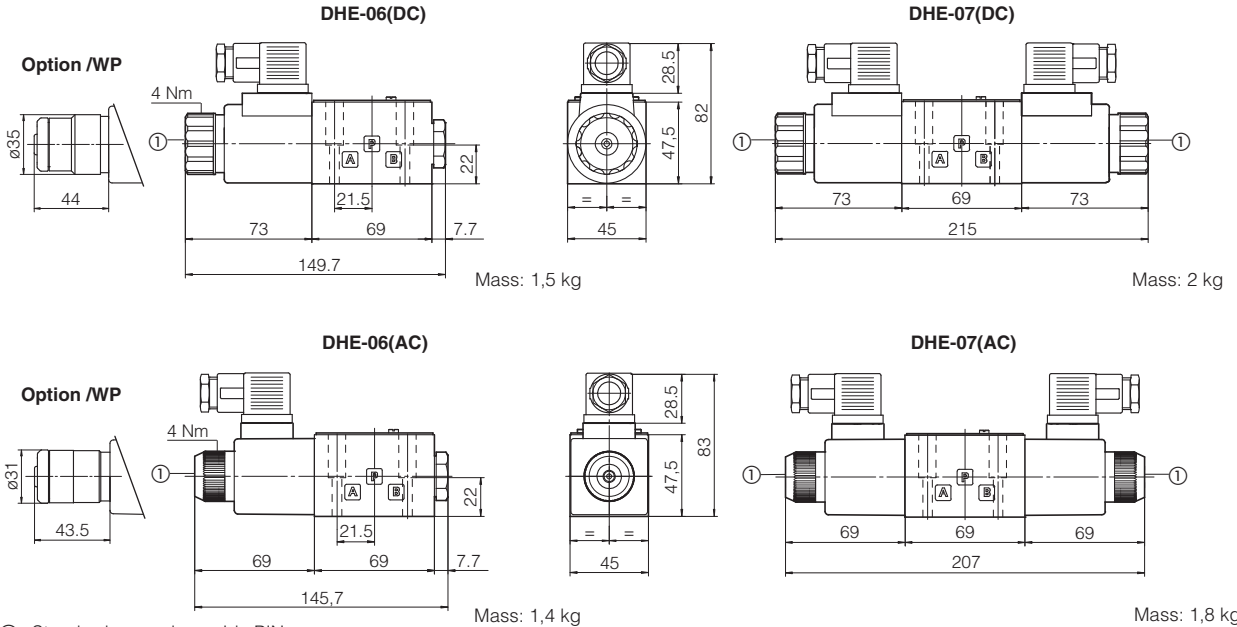
Tightening torque = 8 Nm

Seals: 4 OR 108

Ports P,A,B,T: $\varnothing = 7.5$ mm (max)



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT



① Standard manual override PIN

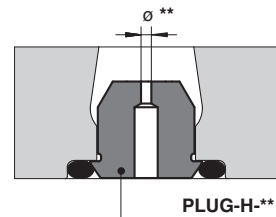
⚠ The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

Overall dimensions refer to valves with connector 666

13 PLUG-IN RESTRICTOR (to be ordered separately)

The use of plug-in restrictors in valve's ports P or A or B may be necessary in case of particular conditions as long flexible hoses or the presence of accumulators which could cause at the valve switching instantaneous high flow peaks over the max valve's operating limits.

PLUG-H	-	**	A
<p>08, 10, 12, 15 calibrated orifice diameter in tenths of mm Example PLUG-H-12 = orifice diameter 1,2 mm Other orifice dimensions are available on request</p>			
<p>Short calibrated orifice</p>			



14 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)

E-SD = electronic connector which eliminates electric disturbances when solenoid valves are de-energized

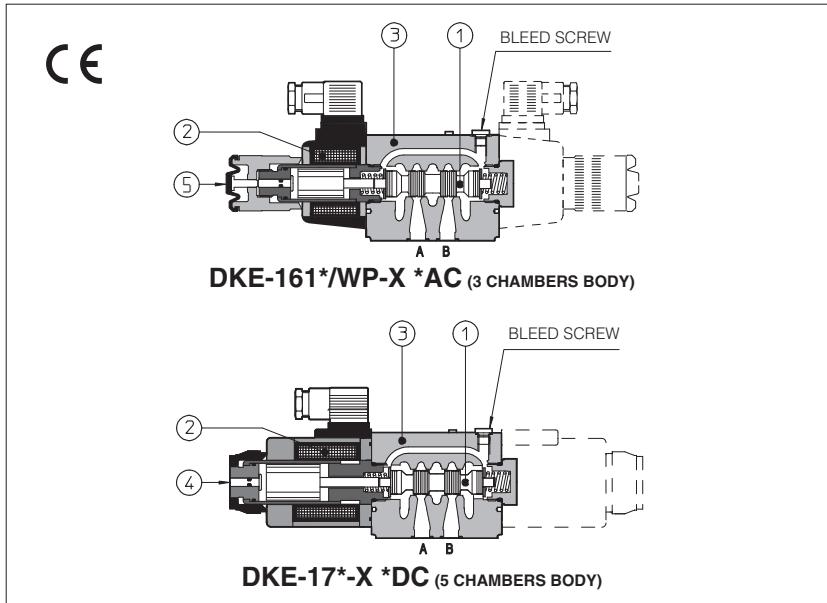
15 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T	Ø Counterbore [mm] A-B-P-T	Mass [kg]
BA-202	Ports A, B, P, T underneath;	3/8"	-	1,2
BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
BA-302	Ports A, B, P, T underneath	1/2"	30	1,8

The subplates are supplied with 4 fastening bolts M5x50. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type **DKE**

direct, spool type



Spool type, two or three position direct operated valves with threaded solenoids certified according to the North American standard **curus**.

Solenoids ② are made by:

- wet type screwed tube, different for AC and DC power supply, with integrated manual override pin ④
- interchangeable coils, specific for AC or DC power supply, easily replaceable without tools - see section ⑤ for available voltages

Standard coils protection **IP65**, optional coils with IP67 AMP Junior Timer or lead wire connections.

The valve body ③ is 5 chamber type for all DC versions and for AC safety version /FI and FV

Standard AC version uses 3 chamber type body

Wide range of interchangeable spools ①, see section ②.

The body is made by shell-moulding casting with wide internal passages ensuring low pressure drops

Mounting surface: **ISO 4401 size 10**

Max flow: **150 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DKE - 1	61	1 / A	- X	24 DC	*	*
Directional control valves size 10					Series number	Seals material, see section ④: - = NBR PE = FKM BT = HNBR
Valve configuration, see section ②					Voltage code, see section ⑤	
<p>61 = single solenoid, center plus external position, spring centered</p> <p>63 = single solenoid, 2 external positions, spring offset</p> <p>67 = single solenoid, center plus external position, spring offset</p> <p>70 = double solenoid, 2 external positions, without springs</p> <p>71 = double solenoid, 3 positions, spring centered</p> <p>75 = double solenoid, 2 external positions, with detent</p>						
Spool type, see section ②.						
Options, see note 1 at section ④.						
						<p>00-AC = AC solenoids without coils</p> <p>00-DC = DC solenoids without coils</p> <p>X = without connector</p> <p>See section ④ for available connectors, to be ordered separately</p> <p>Coils with special connectors, see section ①</p> <p>XJ = AMP Junior Timer connector</p> <p>XK = Deutsch connector</p> <p>XS = Lead Wire connection</p>

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)

<p>Configurations</p>	<p>Spools</p>	<p>Configurations</p>	<p>Spools</p>
<p>Note: see also section ④ note 3 for special shaped spools</p>			

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type - 170* (without springs) that must be installed with horizontal axis if operated by impulses		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard = -30°C ÷ +70°C	/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Storage temperature	Standard = -30°C ÷ +80°C	/PE option = -20°C ÷ +80°C	/BT option = -40°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation	Coil: zinc nickel coating (DC version) plastic incapsulation (AC version)	
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	Ports P,A,B: 350 bar; Port T 210 bar for DC version (250 bar with option /Y); 160 bar for AC version		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	150 l/min , see operating limits at section 7		

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

4 NOTES

1 Options

- A** = Solenoid mounted at side of port B (only for single solenoid valves). In standard versions, solenoid is mounted at side of port A.
- WP** = prolonged manual override protected by rubber cap - see section 12.
- L, L1, L2, L3, LR, L7, L8** see section 10 = device for switching time control (only for DC solenoids).
L7 and L8 are available only for spool type 0/1, 1/1, 3/1, 4 and 5.
- FI, FV** = 5 chambers body for DC and AC versions with proximity switch for spool position monitoring: see tab. E110.
- Y** = external drain, only for DC version, to be selected if the pressure at T port is higher than the max allowed limits.

2 Accessories

- WPD/KE-DC** = (only for DC supply) manual override with detent, to be ordered separately, see tab. K150

3 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spool type **1** is also available as **1/1**, properly shaped to reduce the water-hammer shocks during the switching.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.

5 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil	
12 DC	12 DC	666 or 667	36 W	CAE-12DC	
14 DC	14 DC			CAE-14DC	
24 DC	24 DC			CAE-24DC	
28 DC	28 DC			CAE-28DC	
110 DC	110 DC			CAE-110DC	
125 DC	125 DC			CAE-125 DC	
220 DC	220 DC			CAE-220DC	
110/50/60 AC	110/50/60 AC			100 VA (3)	CAE-110/50/60AC (1)
230/50/60 AC	230/50/60 AC				CAE-230/50/60AC (1)
115/60 AC	115/60 AC				130 VA (3)
230/60 AC	230/60 AC	CAE-230/60AC			
110/50/60 AC	110 DC	669	36 W	CAE-110DC	
230/50/60 AC	220 DC			CAE-220DC	

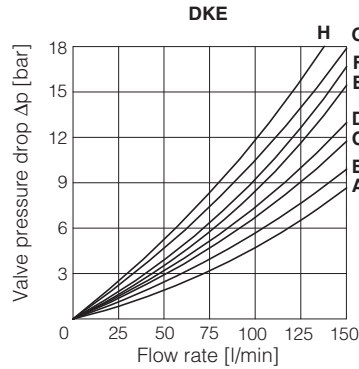
(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

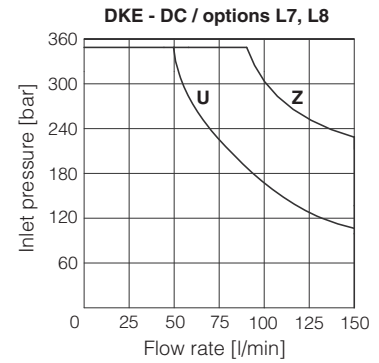
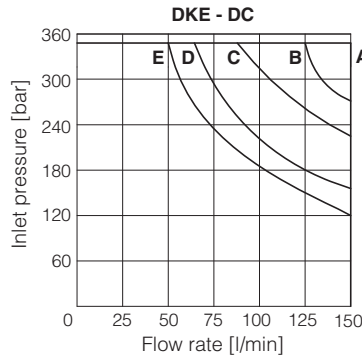
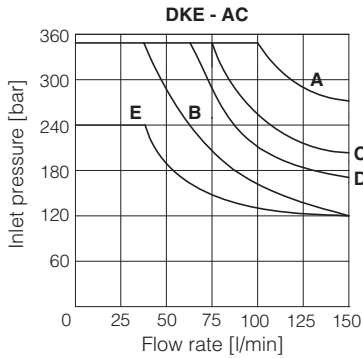
6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

Spool type	Flow direction					
	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	F	F	G	G		H
1/9, 39, 93	F	F	G	G		H



7 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.



Curve	Spool type	
	AC	DC
A	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
B	4, 5, 19, 91	6, 7
C	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2
U	-	4, 5
Z	-	0/1, 1/1, 3/1

8 SWITCHING TIMES (average values in msec)

Valve	Switch-on AC	Switch-on DC	Switch-off AC	Switch-off DC
DKE + 666 / 667	40	60	25	35
DKE + 669	60	—	90	—
DKE-*/L*	—	75÷150	—	45÷150
DKE-*/L7 - DKE-*/L8	—	100÷150	—	100÷150

Test conditions:

- 50 l/min; 150 bar
- nominal supply voltage
- 2 bar of back pressure on port T
- mineral oil ISO VG 46 at 50°C

The elasticity of the hydraulic circuit and the variations of the hydraulic characteristics and temperature affect the response time.

9 SWITCHING FREQUENCY

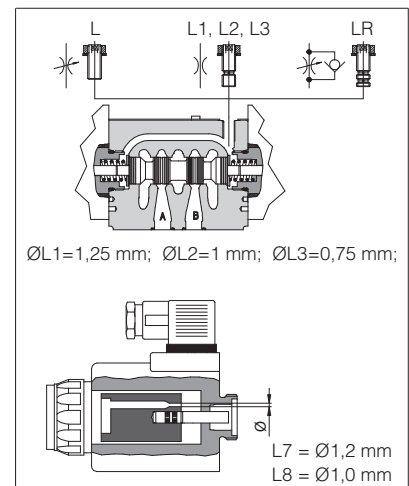
Valve	AC (cycles/h)	DC (cycles/h)
DKE + 666 / 667	7200	15000

10 DEVICES FOR SWITCHING TIME CONTROL

These devices are only available for DC valve version (5 chambers body) and can control the switching time and therefore reduce the coil hammering in the hydraulic circuit. The different types are available shown in the figure.

- **L**: controls and regulates the switching time in both moving directions of the spool: regulation is carried out by screwing/unscrewing the element itself (regulating choke);
- **L1/L2/L3**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is positioned in the valve's body $\varnothing L1 = 1,25$ mm; $\varnothing L2 = 1$ mm; $\varnothing L3 = 0,75$ mm;
- **LR**: controls and regulates the switching time in the B→A direction of the spool movement. The device does not control the switching time (standard time) in the opposite direction A→B of the spool movement.
- **L7/L8**: controls the switching time in both moving directions of the spool by means of fixed calibrated restrictor (gauged flow). The restrictor is installed in the solenoid's anchor.

For a correct operation of the switching time control, the passage in which the control device is installed must be completely filled with oil.



11 COILS TYPE CAE WITH SPECIAL CONNECTORS (only for 12DC, 14DC, 24DC and 28DC)

<p>Options -XJ Coil type CAEJ AMP Junior Timer connector Protection degree IP67</p>	<p>Options -XK Coil type CAEK Deutsch connector, DT-04-2P male Protection degree IP67</p>	<p>Options -XS Coil type CAES Lead Wire connection Cable length = 180 mm</p>
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12 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface according to 4401-05-05-05
(without X port, Y port optional)

Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT (only for option /Y)
For the max pressures on ports, see section 3

DKE-16*-AC

Mass: 3,9 kg

DKE-17*-AC

Mass: 4,7 kg

DKE-16*-DC

Mass: 4,5 kg

DKE-17*-DC

Mass: 6,1 kg

① Standard manual override PIN. The manual override operation can be possible only if the pressure at T ports is lower than 50 bar

⊕ Bleed screw

13 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

- 666** = standard connector IP-65, suitable for direct connection to electric supply source
- 667** = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC
- 669** = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)

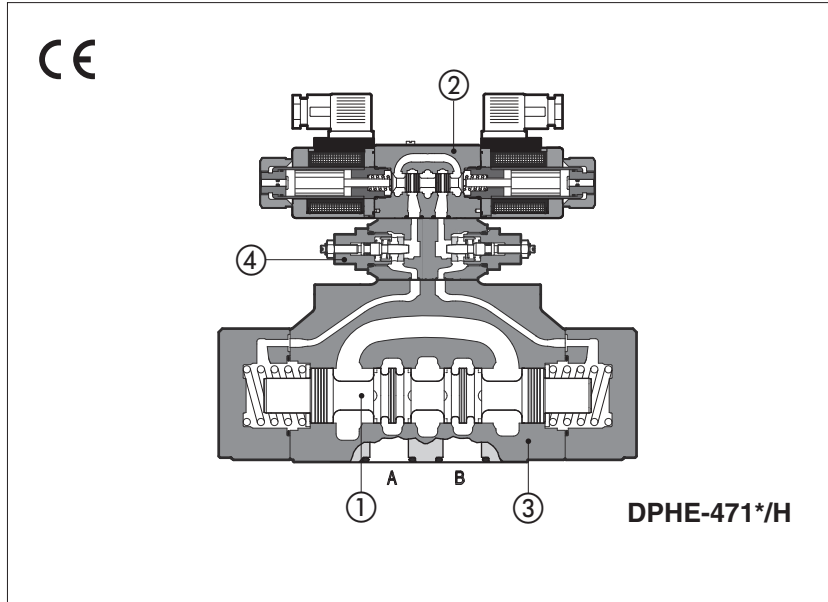
14 MOUNTING SUBPLATES

Model	Ports location	GAS Ports A-B-P-T (X-Y)	Ø Counterbore [mm] A-B-P-T (X-Y)	Mass [kg]
BA-308	(/Y) Ports A, B, P, T (X, Y) underneath	1/2" (1/4")	30 (21,5)	2,5
BA-428	(/Y) Ports A, B, P, T (X, Y) underneath	3/4" (1/4")	36,5 (21,5)	5,5
BA-434	(/Y) Ports P, T, (X, Y) underneath; ports A, B on lateral side	3/4" (1/4")	36,5 (21,5)	8,5

The subplates are supplied with 4 fastening bolts M6x40. Also available are multi-station subplates and modular subplates. For further details see table K280.

Solenoid directional valves type DPHI and DPHE

piloted, spool type



Spool type, two stage directional valves with solenoids certified according to North American standard **cURus**, available in two different executions:

- DPHI for AC and DC supply, solenoid pilot ② type DHI, see tech. table E010
- DPHE high performances, for AC and DC supply, solenoid pilot ② type DHE see tech. table E015

Single and double solenoids versions are available in two or three position configurations and with a wide range of interchangeable spools ①, see section ②.

Standard coils protection **IP65**.

The valve body is made by shell-moulding casting ③ with wide internal passages.

The valves can be supplied with optional devices, see section ④ for available options.

Mounting surface: **ISO 4401, size 10, 16, 25 and 32**

Max flow: **160, 300, 700, 1000 l/min.**

Max pressure: **350 bar**

1 MODEL CODE

DPH	E	- 2	61	1 /	A -	X	24 DC	*	/	*
Two stage directional control valve								Series number		Seals material, see section ③: - = NBR PE = FKM BT = HNBR
Solenoid pilot valve: I = DHI for AC and DC supply with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids								Voltage code, see section ⑤		
Valve size: 1 = 10 2 = 16 4 = 25 6 = 32										
Valve configuration, see section ② 61 = single solenoid, center plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, center plus external position, spring offset 70 = double solenoid, 2 external positions, without springs 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent								X = without connector See section ④ for available connectors, to be ordered separately 00 = solenoid valve without coils (for DPHI) 00-AC = AC solenoid valve without coils (for DPHE) 00-DC = DC solenoid valve without coils (for DPHE)		
								Options, see note 1 at section ④		
								Spool type, see section ②.		

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1, for functional scheme, see section ④)

Configurations	Spools	Configurations	Spools

NOTES (see also section 4,2 for special shaped spools):
 - For **DP*-1** are available only spools: **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
 - For **DP*-6** are available only spools: **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type -*70 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007		
Ambient temperature	Standard = -30°C ÷ +70°C	/PE option = -20°C ÷ +70°C	/BT option = -40°C ÷ +70°C
Storage temperature	Standard = -30°C ÷ +80°C	/PE option = -20°C ÷ +80°C	/BT option = -40°C ÷ +80°C
Surface protection	Body: zinc coating with black passivation		
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	P, A, B, X = 350 bar (for pilot pressure see also option /L9 at section 4) T = 250 bar for external drain (standard) T and Y with internal drain (option /D) = 120 bar DPHI; 210 bar DPHE (DC); 160 bar DPHE (AC) Ports Y and L (if required): 0 bar Minimum pilot pressure for correct operation is 8 bar		
Rated flow	See diagrams Q/Δp at section 6		
Maximum flow	DPH*-1: 160 l/min ; DPH*-2: 300 l/min ; DPH*-4: 700 l/min ; DPH*-6: 1000 l/min (see rated flow at section 6 and operating limits at section 7)		

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils (all versions) and AC coils (only DPHI) F (155°C) for AC coils (only DPHE) Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 NOTES

4.1 Options

/A = Solenoid mounted at side of port A of main body (only for single solenoid valves).
In standard version, solenoid is mounted at side of port B.

/D = Internal drain (standard configuration is external drain)

/E = External pilot pressure (standard configuration is internal pilot pressure).

/FV = With proximity switch for spool position monitoring: see tab. E110.

/R = Pilot pressure generator (4 bar on port P - not for DPH*-1, see section 9).

/S = Main spool stroke adjustment (not for DPH*-1).

/WP = Prolonged manual override protected by rubber cap.

The manual override operation can be possible only if the pressure at T port is lower than 50 bar

Devices for main spool switching control and to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).

/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve: **L1** = 0,8mm, **L2** = 1mm, **L3** = 1,25mm)

/L9 = (only for DP-2 and DP-4) plug with calibrated restrictor in P port of pilot valve - see section 10

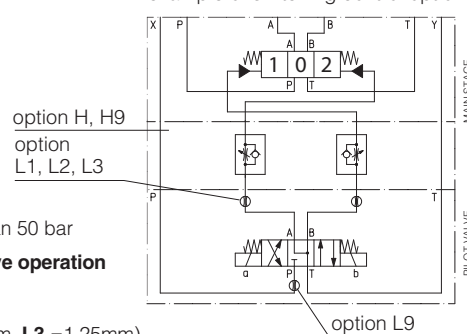
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

4.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.

- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching (to use with option /L*).

FUNCTIONAL SCHEME (config. 71)
example of switching control options



Shaped spool availability	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•
DPH*-6		•	•	•				

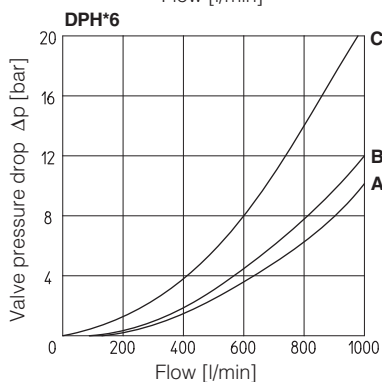
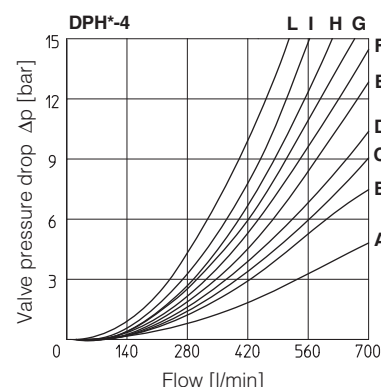
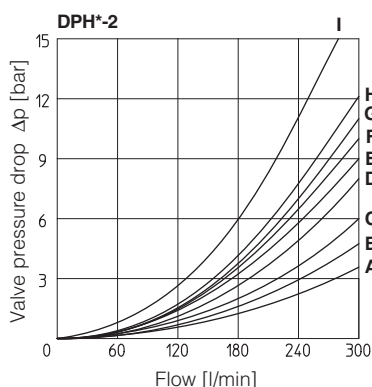
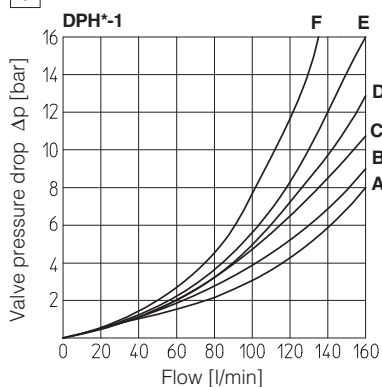
5 ELECTRIC FEATURES

Valve	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (3)		Code of spare coil					
				DHI	DHE	DPHI	Colour of coil label	DPHE			
DPHI DPHE	6 DC	6 DC (4)	666 or 667	33 W	30 W	COU-6DC	brown	-			
	12 DC	12 DC				COU-12DC	green	COE-12DC			
	14 DC	14 DC				COU-14DC	brown	COE-14DC			
	24 DC	24 DC				COU-24DC	red	COE-24DC			
	28 DC	28 DC				COU-28DC	silver	COE-28DC			
	48 DC	48 DC				COU-48DC	silver	COE-48DC			
	110 DC	110 DC				COU-110DC	gold	COE-110DC			
	125 DC	125 DC				COU-125DC	blue	COE-125DC			
	220 DC	220 DC				COU-220DC	black	COE-220DC			
	24/50 AC	24/50/60 AC (4)				COI-24/50/60AC (1)	pink	-			
	24/60 AC					COI-48/50/60AC (1)	white	-			
	48/50 AC	48/50/60 AC (4)				58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC		
	48/60 AC					80 VA	-	-	COE-115/60AC		
	110/50 AC	110/50/60 AC				-	COI-120/60AC	white	-		
	115/60 AC (5)	115/60 AC				60 VA	58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC	
	120/60 AC (4)	120/60 AC				-	80 VA	COI-230/60AC	silver	COE-230/60AC	
	230/50 AC	230/50/60 AC				669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/60 AC	230/60 AC							COU-230RC	blue	COE-230RC
110/50 AC	110RC										
120/60 AC											
230/50 AC											
230/60 AC	230RC										

- (1) Coil can be supplied also with 60 Hz of voltage frequency; in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DPHI) and 58 VA (DPHE)
- (2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

- (3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
- (4) Only for DPHI
- (5) Only for DPHE

6 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C



DPH*-2

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	C	D	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPH*-4

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	C	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D	-	-
93	-	G	D	-	-

DPH*-1

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-6

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0	A	A	B	B	B
1	A	A	A	B	-
3	A	-	A	B	-
4	A	A	C	C	C

7 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*6

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

8 SWITCHING TIMES (average values in m sec)

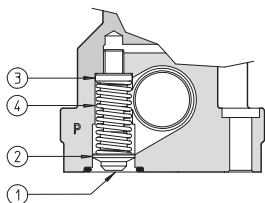
Valve model	Configuration		Piloting pressure					
			70 bar		140 bar		250 bar	
			Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	71, 61, 67, 61*/A, 67*/A	Switch ON	35	50	30	45	20	35
		Switch OFF	50					
	63, 63*/A	Switch ON	50	75	40	65	30	50
		Switch OFF	80					
DPH*-2	71, 61, 67, 61*/A, 67*/A	Switch ON	40	55	30	50	20	40
		Switch OFF	60					
	63, 63*/A	Switch ON	55	80	45	70	35	55
		Switch OFF	95					
DPH*-4	71, 61, 67, 61*/A, 67*/A	Switch ON	60	80	45	60	30	45
		Switch OFF	80					
	63, 63*/A	Switch ON	95	115	75	95	50	65
		Switch OFF	130					
DPH*-6	71, 61, 67, 61*/A, 67*/A	Switch ON	70	95	55	70	40	55
		Switch OFF	150					
	63, 63*/A	Switch ON	115	145	95	110	70	90
		Switch OFF	280					

Notes:

- For configuration 75, times of switching ON and switching OFF are the same: this value is equal to time of switch ON of configuration 63.
- TEST CONDITIONS
 - Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
 - 2 bar of counter pressure on port T;
 - mineral oil: ISO VG 46 at 50°C
- The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature.

9 PILOT PRESSURE GENERATOR (OPTION /R)

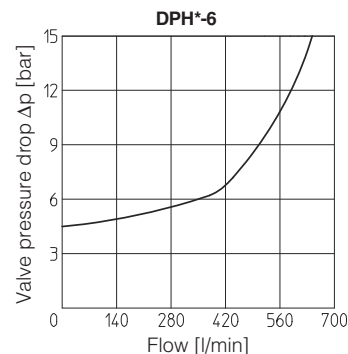
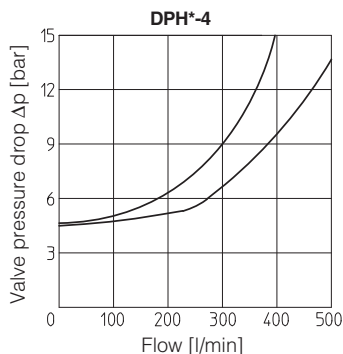
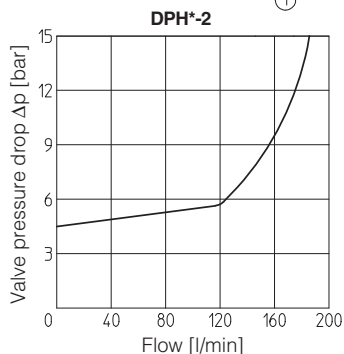
The device /R generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49**. The device /R has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.



- Flapper-guide
- Flapper
- Spring stop-washer
- Spring

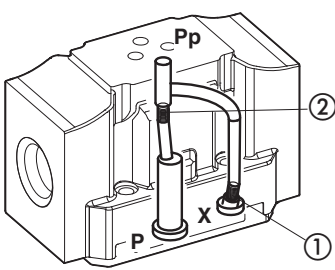
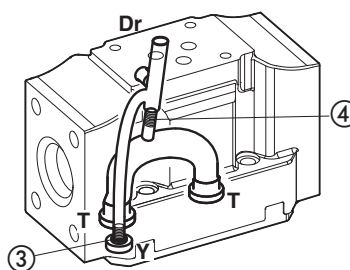
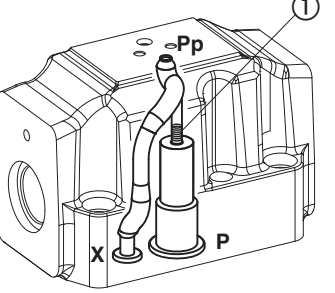
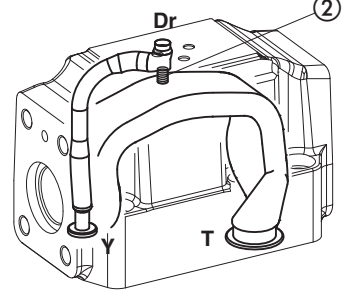
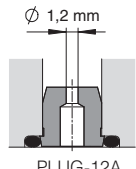
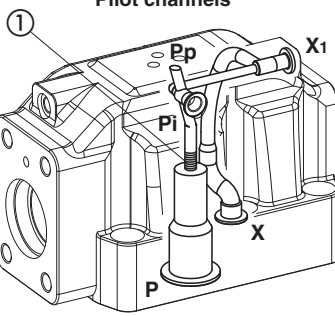
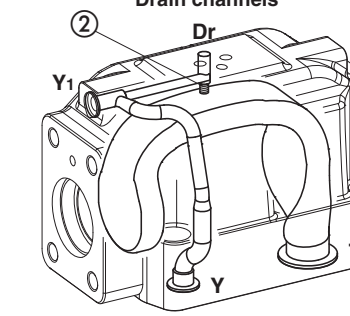
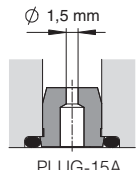
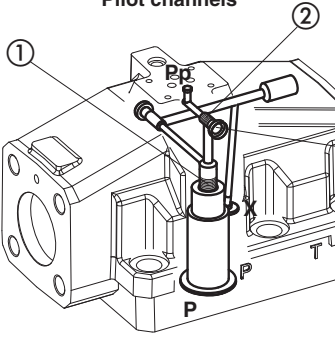
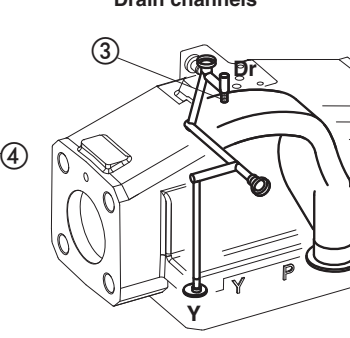
Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: 2 for DP-2 4 for DP-4 6 for DP-6



10 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270. Standard valves configuration provides internal pilot and external drain

<p>DPH*-1</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: blinded plug SP-X300F ① in X; plug SP-X310F ② in Pp;</p> <p>External piloting: blinded plug SP-X300F ② in Pp; plug SP-X310F ① in X;</p> <p>Internal drain: blinded plug SP-X300F ③ in Y;</p> <p>External drain: blinded plug SP-X300F ④ in Dr.</p>	
<p>DPH*-2</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: Without blinded plug SP-X300F ①;</p> <p>External piloting: Add blinded plug SP-X300F ①;</p> <p>Internal drain: Without blinded plug SP-X300F ②;</p> <p>External drain: Add blinded plug SP-X300F ②.</p>	<p>Option L9 This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve</p>  <p>PLUG-12A</p>
<p>DPH*-4</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: Without blinded plug SP-X500F ①;</p> <p>External piloting: Add blinded plug SP-X500F ①;</p> <p>Internal drain: Without blinded plug SP-X300F ②;</p> <p>External drain: Add blinded plug SP-X300F ②.</p>	<p>Option L9 This option provides a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve</p>  <p>PLUG-15A</p>
<p>DPH*-6</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: Without plug ①; plug SP-X325A in pos ②;</p> <p>External piloting: Add DIN-908 M16x1,5 in pos ①; plug SP-X325A in pos ②;</p> <p>Internal drain: Without blinded plug SP-X300F ③;</p> <p>External drain: Add blinded plug SP-X300F ③.</p>	<p>To reach the orifice ②, remove plug ④ = G 1/8"</p>

DPH*-1*

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05

Fastening bolts:

4 socket head screws M6x40 class 12.9

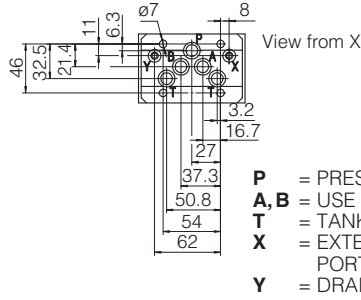
Tightening torque = 15 Nm

Diameter of ports A,B, P, T: $\varnothing = 11$ mm;

Diameter of ports X, Y: $\varnothing = 5$ mm;

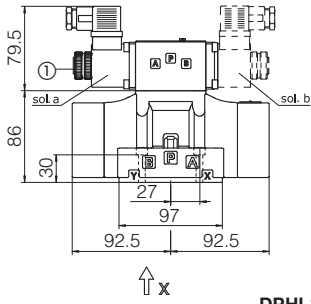
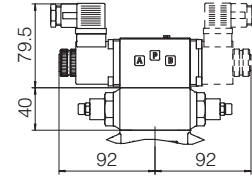
Seals: 5 OR 2050, 2 OR 108

Mass (Kg)	
DPHI-16	6,8
DPHI-17	7,1
DPHE-16	6,9
DPHE-17	7,3
Option H, H9	+1,0

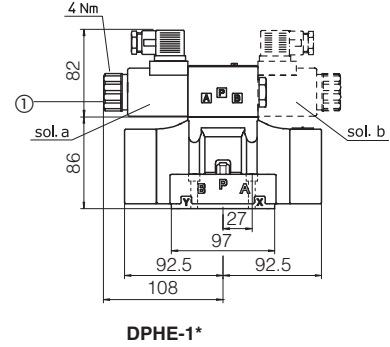
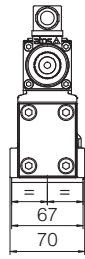


- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- X** = EXTERNAL OIL PILOT PORT
- Y** = DRAIN PORT

DPHI-1*/H
/H9



DPHI-1*



DPHE-1*

① Standard manual override PIN

DPH*-2*

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

Fastening bolts:

4 socket head screws M10x50 class 12.9

Tightening torque = 70 Nm

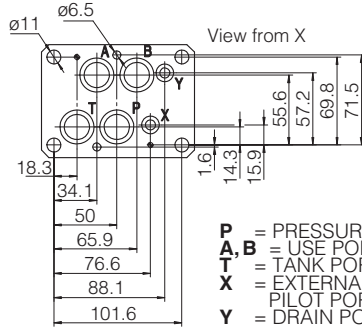
2 socket head screws M6x45 class 12.9

Tightening torque = 15 Nm

Diameter of ports A, B, P, T: $\varnothing = 20$ mm;

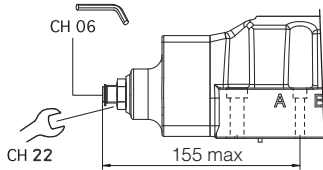
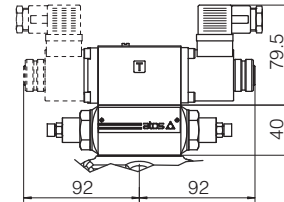
Diameter of ports X, Y: $\varnothing = 7$ mm;

Seals: 4 OR 130, 2 OR 2043



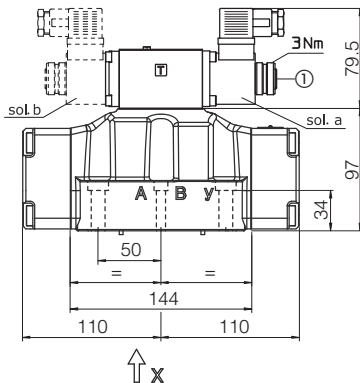
- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- X** = EXTERNAL OIL PILOT PORT
- Y** = DRAIN PORT

DPHI-2*/H
/H9

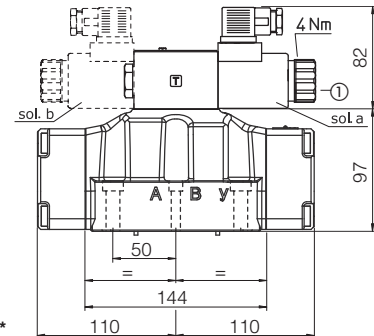
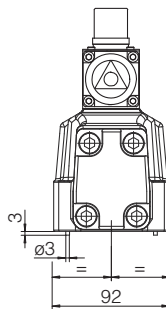


Stroke adjustment device for option /S

Mass (Kg)	
DPHI-26	9,8
DPHI-27	10,1
DPHE-26	9,9
DPHE-27	10,3
Option /S	+1,0
Option H, H9	+1,0



DPHI-2*



DPHE-2*

① Standard manual override PIN

12 DIMENSIONS FOR DPH*-4 [mm]

DPH*-4*

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

Fastening bolts:

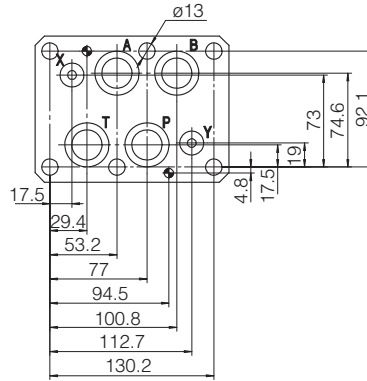
6 socket head screws M12x60 class 12.9

Tightening torque = 125 Nm

Seals: 4 OR 4112; 2 OR 3056

Diameter of ports A, B, P, T: $\varnothing = 24$ mm;

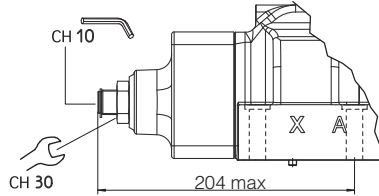
Diameter of ports X, Y: $\varnothing = 7$ mm;



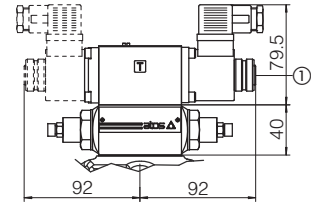
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT
 For the max pressures on ports, see section

Mass (Kg)	
DPHI-46	17,3
DPHI-47	17,6
DPHE-46	17,4
DPHE-47	17,8
Option /S	+1,5
Option H, H9	+1,0

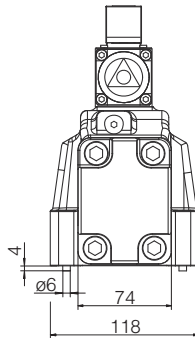
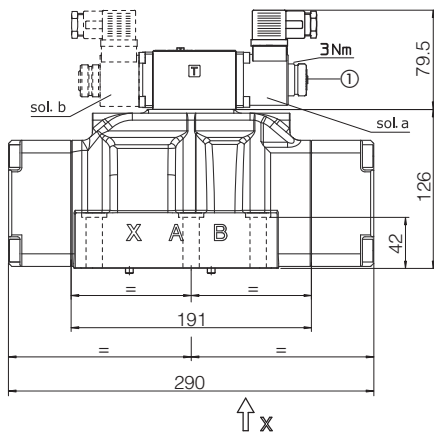
DPHI-4*
Stroke adjustment device for option /S



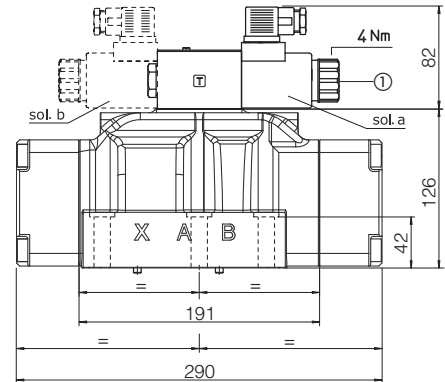
DPHI-4*/H /H9



DPHI-4*



DPHE-4*



① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

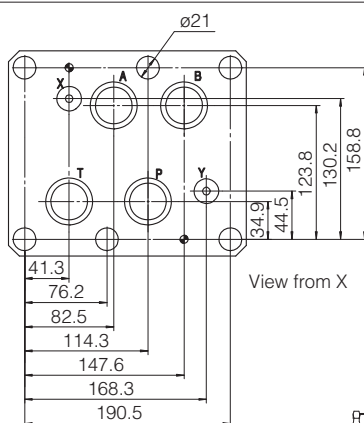
13 DIMENSIONS FOR DPH*-6 [mm]

DPH*-6*

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05

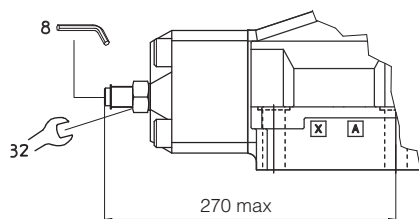
Fastening bolts:
 6 socket head screws M20x80 class 12.9
 Tightening torque = 600 Nm
 Diameter of ports A, B, P, T: $\varnothing = 34$ mm;
 Diameter of ports X, Y: $\varnothing = 7$ mm;
 Seals: 4 OR 144, 2 OR 3056



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL
 PILOT PORT
Y = DRAIN PORT

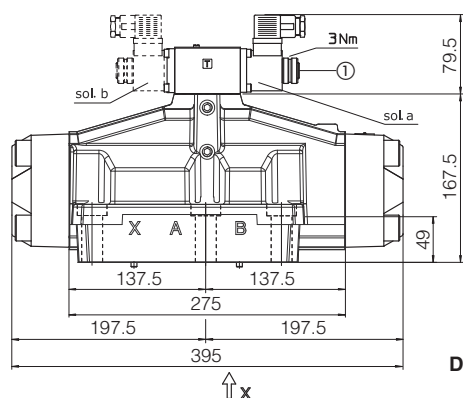
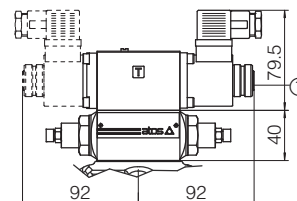
View from X

Stroke adjustment device for option/S

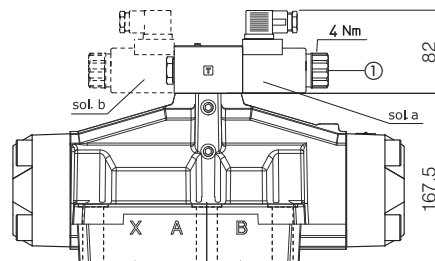
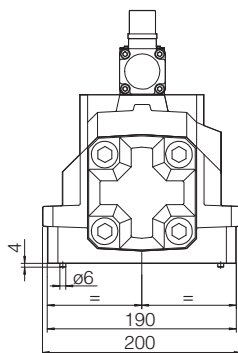


Mass (Kg)	
DPHI-66	43,8
DPHI-67	44,1
DPHE-66	44
DPHE-67	44,5
Option /S	+3,5
Option H, H9	+1,0

DPHI-6*/H/H9



DPHI-6*



DPHE-6*

① Standard manual override PIN

Overall dimensions refer to valves with connectors type 666

14 ELECTRONIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Connector code	Function
666	Connector IP65, suitable for direct connection to electric supply source
667	As 666 connector IP65 but with built-in signal led, suitable for direct connection to electric supply source
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - I _{max} 1A)

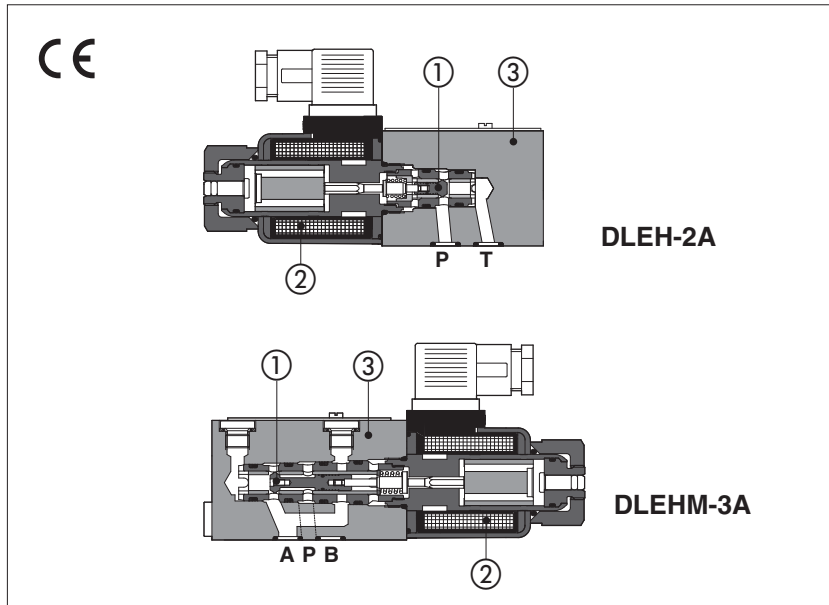
For other available connectors, see tab. E010, E015 and K500

15 MOUNTING SUBPLATES FOR DPH*-1, DPH*-2, DPH*-4 AND DPH*-6

Valve	Subplate model	Ports location	Ports		\varnothing Counterbore [mm]		Mass [Kg]
			A, B, P, T	X, Y	A, B, P, T	X, Y	
DPH*-1	BA-428	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	5,6
DPH*-1	BA-434	Ports P, T, X, Y underneath; ports A, B on lateral side	G 3/4"	G 1/4"	36,5	21,5	5,5
DPH*-2	BA-418	Ports A, B, P, T, X, Y underneath;	G 3/4"	G 1/4"	36,5	21,5	3,5
DPH*-2	BA-518	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	8
DPH*-2	BA-519	Ports P, T, X, Y underneath; ports A, B on lateral side	G 1"	G 1/4"	46	21,5	8
DPH*-4	BA-508	Ports A, B, P, T, X, Y underneath;	G 1"	G 1/4"	46	21,5	7
DPH*-4	BA-509	Ports P, T, X, Y underneath; ports A, B on lateral	G 1"	G 1/4"	46	21,5	12,5
DPH*-6	BA-708	Ports A, B, P, T, X, Y underneath;	G 1 1/2"	G 1/4"	63,5	21,5	17

Solenoid directional valves type DLEH and DLEHM

direct, poppet type, leak free



Poppet type ① direct operated valves, designed for applications in oil hydraulic systems with leak free requirements.

Following models are available in a wide range of configurations, see section ②

size 06 subplate version

- **DLEH**: two and three way execution, Qmax 12 l/min
- **DLEHM**: three way execution, Qmax 30 l/min

M20 screw-in cartridge version for easy assembling in hydraulic blocks

- **CART LEH**: two and three way execution, Qmax 12 l/min
- **CART LEHM**: three way execution, Qmax 30 l/min

They are operated by wet type, screwed solenoids ② for DC or RC (rectified) current supply and certified according to the North American standard **cURus**

Standard coils protection **IP65**

Max flow: **12 l/min (DLEH, LEH)**
30 l/min (DLEHM, LEHM)

Max pressure: **350 bar (DLEH, LEH)**
315 bar (DLEHM, LEHM)

1 MODEL CODE

DLEH	-	2	A	/	WP	-	X	24 DC	*	/	*
Directional control valve poppet type: DLEH = ISO size 06, max flow: 12 l/min DLEHM = ISO size 06, max flow: 30 l/min CART LEH = cartridge version max flow 12 l/min CART LEHM = cartridge version max flow 30 l/min											
2 = two way (only DLEH and LEH) 3 = three way											
Valve configuration, see table ②											
Seals material, see section ③: - = NBR PE = FKM BT = HNBR											
Series number											
Voltage code, see section ④											
00-DC = DC solenoids without coils X = without connector See section ⑤ for available connectors, to be ordered separately											
Options, see section ④											

2 VALVE CONFIGURATION

DLEH-2A CART LEH-2A 	DLEH-2A/R 	DLEH-2C CART LEH-2C 	DLEH-2C/R 	DLEHM-3A CART LEHM-3A
DLEH-3A CART LEH-3A 	DLEH-3A/R 	DLEH-3C CART LEH-3C 	DLEH-3C/R 	DLEHM-3C CART LEHM-3C

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVL, HVPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Operating pressure	DLEH, LEH: Ports P, A, B 350 bar ; DLEHM, LEHM: Ports P, A 315 bar ; Port T 210 bar ;		
Rated flow	See diagrams Q/Δp at section 7		
Max flow	DLEH, LEH: 12 l/min , DLEHM, LEHM: 30 l/min , see operating limits at section 8		
Internal leakage	Less than 5 drops/min (≤ 0,36 cm ³ /min) at max working pressure		

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 5
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

4 NOTES

Options

WP = prolonged manual override protected by rubber cap



The manual override operation can be possible only if the pressure at T port is lower than 50 bar

R = (only for DLEH) with check valve on P port, see section 2.

S = (only for DLEH and CART LEH) poppet with positive overlapping in the intermediate position to reduce the internal leakage at the valve switching and without manual override pin for safety applications (blind locking ring)

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately, see tech table K500)

666 = standard connector IP-65, suitable for direct connection to electric supply source

667 = as 666, but with built-in signal led. Available for power supply voltage 24 AC or DC, 110 AC or DC, 220 AC or DC

669 = with built-in rectifier bridge for supplying DC coils by alternate current (AC 110V and 230V - I_{max} 1A)

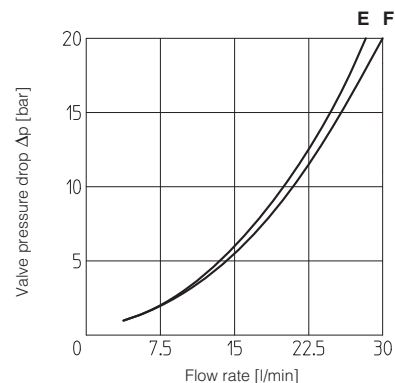
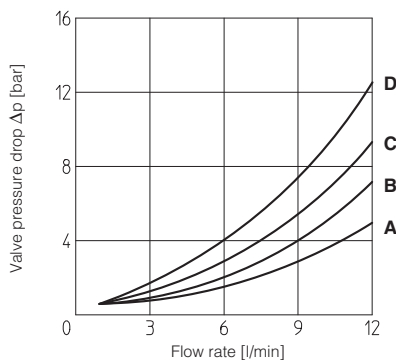
6 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption	Code of spare coil
12 DC	12 DC	666 or 667	30 W	COE-12DC
14 DC	14 DC			COE-14DC
24 DC	24 DC			COE-24DC
28 DC	28 DC			COE-28DC
48 DC	48 DC			COE-48DC
110 DC	110 DC			COE-110DC
125 DC	125 DC			COE-125DC
220 DC	220 DC			COE-220DC
110/50 AC - 120/60 AC	110 RC	669		COE-110RC
230/50 AC - 230/60 AC	230 RC			COE-230RC

7 $\Delta p/Q$ DIAGRAM based on mineral oil ISO VG 46 at 50°C

Flow direction Valve type	P → A (1) (P → B)	A → T (B → T)
DLEH-2A	B	-
DLEH-2C	C	-
DLEH-3A	D	C
DLEH-3C	C	A
DLEHM-3A	F	E
DLEHM-3C	F	E

(1) For two-way valves, pressure drop refers to P \rightarrow T



8 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

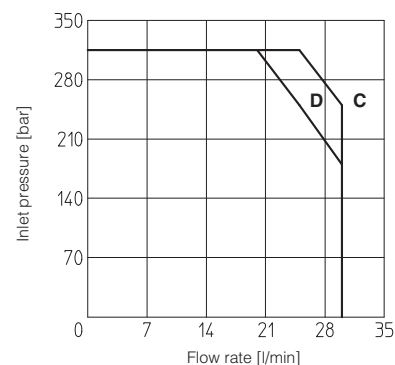
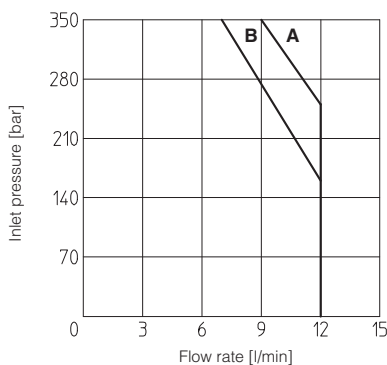
The diagram has been obtained with warm solenoids and power supply at lowest value (V_{nom} - 10%).

A = DLEH-3A, DLEH-2C

B = DLEH-2A, DLEH-3C

C = DLEHM-3A

D = DLEHM-3C



9 SWITCHING TIMES (average values in msec)

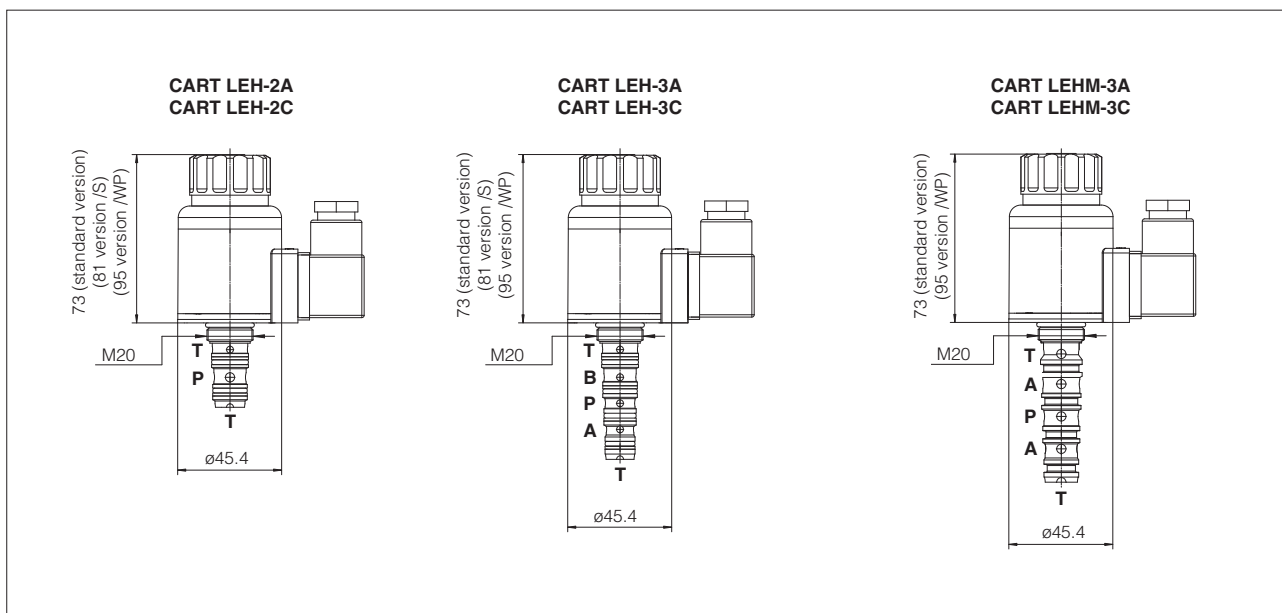
Valve type	Connector	Switch-on AC	Switch-on DC	Switch-off
DLEH(M)-* DC	666, 667	-	45	25
DLEH(M)-* RC	669	30	-	75

TEST CONDITIONS:

- 8 l/min; 150 bar
- nominal voltage
- 2 bar of counter pressure on port T
- based on mineral oil ISO VG 46 at 50°C

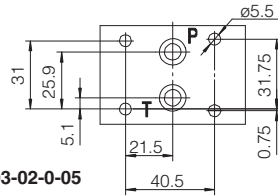
The response time is affected by elasticity of the hydraulic circuit, by variation of hydraulic characteristics and temperature

10 DIMENSIONS OF CARTRIDGE VERSIONS [mm] - for cavity dimensions see table P006



11 DIMENSIONS [mm]

DLEH-2*
DLEH-2*/R



ISO 4401: 2005

Mounting surface: 4401-03-02-0-05
without A and B ports

Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals: 2 OR 108

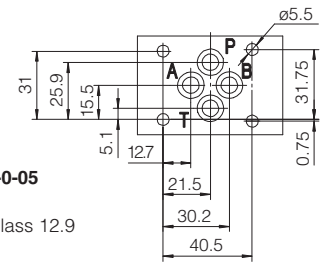
Ports P, T: Ø = 7,5 mm (max)

P = PRESSURE PORT

T = USE PORT

For the max pressures on ports, see section 3

DLEH-3*
DLEH-3*/R
DLEHM-3*
DLEHM-3*/R



ISO 4401: 2005

Mounting surface: 4401-03-02-0-05

Fastening bolts:

4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Seals: 4 OR 108

Ports P, A, B, T: Ø = 7,5 mm (max)

P = PRESSURE PORT

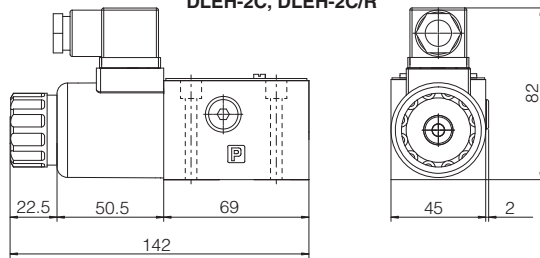
A = USE PORT (not used for DLEH and LEH -3C versions)

B = USE PORT (not used for DLEH and LEH -3A versions)
(not used for DLEHM and LEHM)

T = TANK PORT

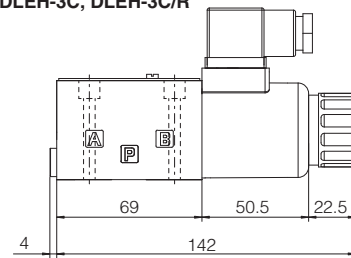
For the max pressures on ports, see section 3

DLEH-2A, DLEH-2A/R
DLEH-2C, DLEH-2C/R



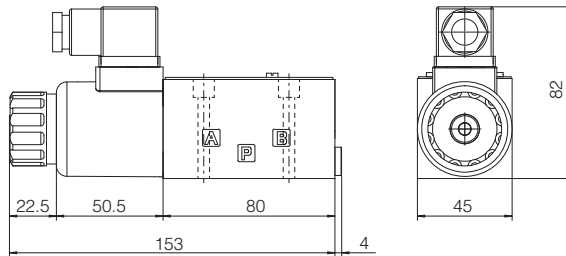
Mass: 1,5 Kg

DLEH-3A, DLEH-3A/R
DLEH-3C, DLEH-3C/R



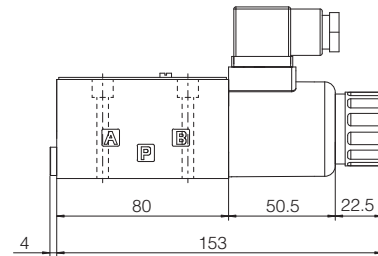
Mass: 1,5 Kg

DLEHM-3C



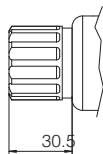
Mass: 1,7 Kg

DLEHM-3A

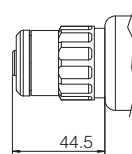


Mass: 1,7 Kg

Option /S



Option /WP



option /S = blind locking ring without manual override

option /WP = prolonged manual override, protected by rubber cap

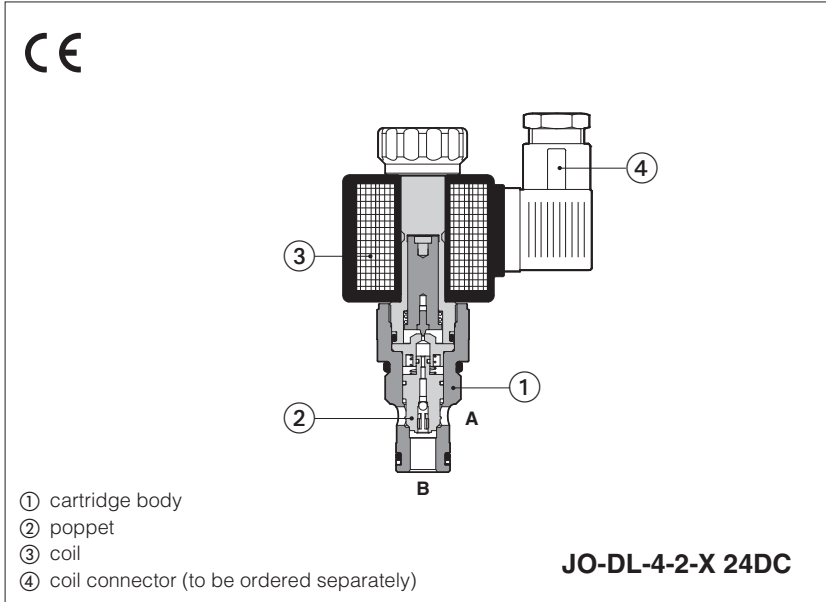
Overall dimensions refer to valves with connectors type 666

12 MOUNTING SUBPLATES - see table K280

Valve	Subplate model	Ports location	GAS ports	Ø Counterbore	Mass [Kg]
			A-B-P-T	[mm] A-B-P-T	
DLEH-* DLEHM-*	BA-202	Ports A, B, P, T underneath;	3/8"	-	1,2
	BA-204	Ports P, T underneath; ports A, B on lateral side	3/8"	25,5	1,8
	BA-302	Ports A, B, P, T underneath;	1/2"	30	1,8

Solenoid cartridge valves

screw-in, 2-way, poppet type, leak free



JO-DL

Leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC, or normally open NO configurations.

Max flow: **300 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

JO	-	D		L	-	4	-	2	/	NC	-	X	24 DC		**	/	*
Cartridge valve screw-in type UNF		D = Directional control		L = Poppet type		Size: 4 = 3/4"-16UNF-2A 6 = 7/8"-14UNF-2A 10 = 1 5/16"-12UNF-2A		2 = Two-way		Version: NC = normally closed in rest position NO = normally open in rest position		X = Without connector, see section 5 for available connector		Voltage code: 12DC = 12 VDC 24DC = 24 VDC		Seals material, see section 4: - = NBR PE = FKM BT = HNBR	
Series number																	

2 HYDRAULIC SYMBOL



3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature	Standard execution = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Model	JO-DL-4-2/NC	JO-DL-4-2/NO	JO-DL-6-2/NC	JO-DL-6-2/NO	JO-DL-10-2/NC	JO-DL-10-2/NO
Operating pressure [bar]	Ports A and B 350					
Max flow [l/min]	40		75		300	
Response time: energizing [ms]	35	50	30	50	35	150
de-energizing [ms]	50	35	60	35	70	35
Internal leakage	less than 5 drops/min ($\leq 0,36 \text{ cm}^3/\text{min}$) max at 350 bar					

5 ELECTRIC CHARACTERISTICS

Relative duty factor	100%
Supply voltage	See model code at section 1
Supply voltage tolerance	$\pm 10\%$
Max power	19 Watt
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max \varnothing 11 mm
Connectors features	DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C

to be ordered separately

6 INSTALLATION NOTES

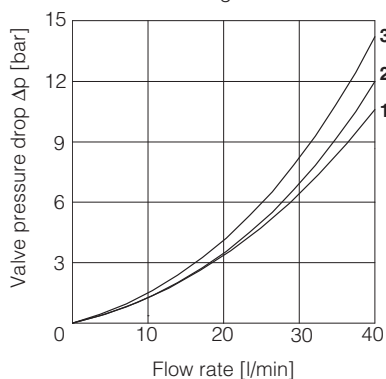
- The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section [10](#)). Excessive values can cause anomalous deformation and poppet sticking.
- The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

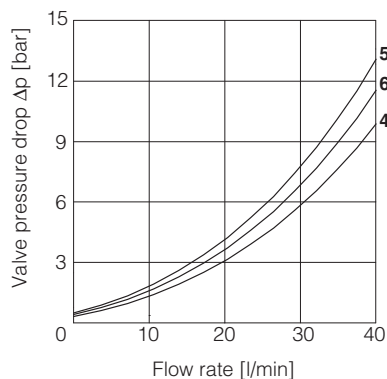
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

9.1 JO-DL-4

Valve pressure drop - NO version
1 = A → B de-energized
2 = B → A de-energized
3 = B → A energized

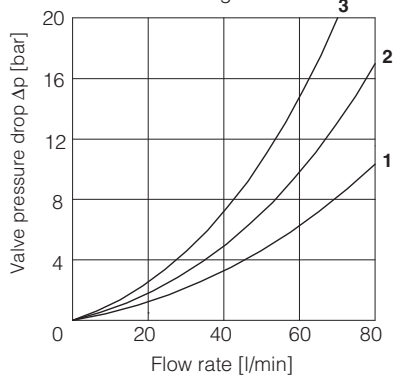


Valve pressure drop - NC version
4 = A → B energized
5 = B → A de-energized
6 = B → A energized

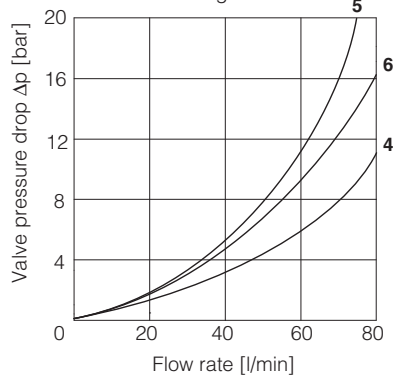


9.2 JO-DL-6

Valve pressure drop - NO version
1 = A → B de-energized
2 = B → A de-energized
3 = B → A energized

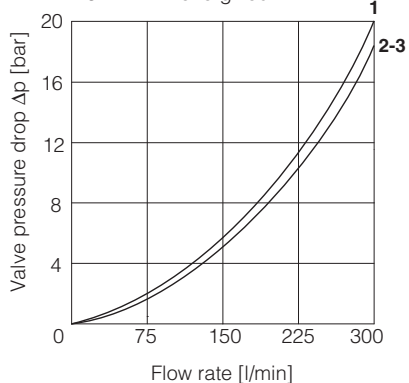


Valve pressure drop - NC version
4 = A → B energized
5 = B → A de-energized
6 = B → A energized

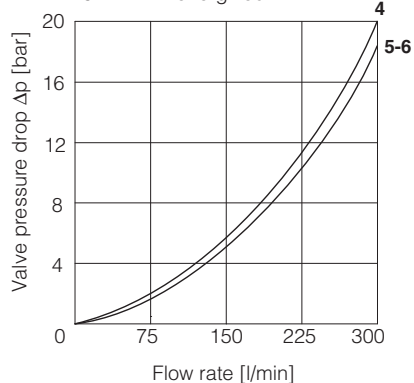


9.3 JO-DL-10

Valve pressure drop - NO version
1 = A → B de-energized
2 = B → A de-energized
3 = B → A energized

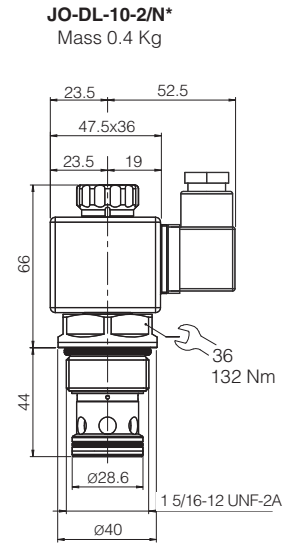
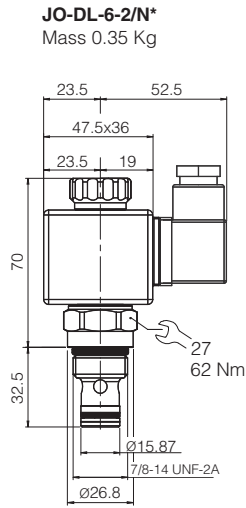
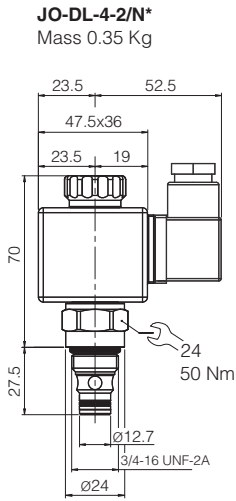


Valve pressure drop - NC version
4 = A → B energized
5 = B → A de-energized
6 = B → A energized



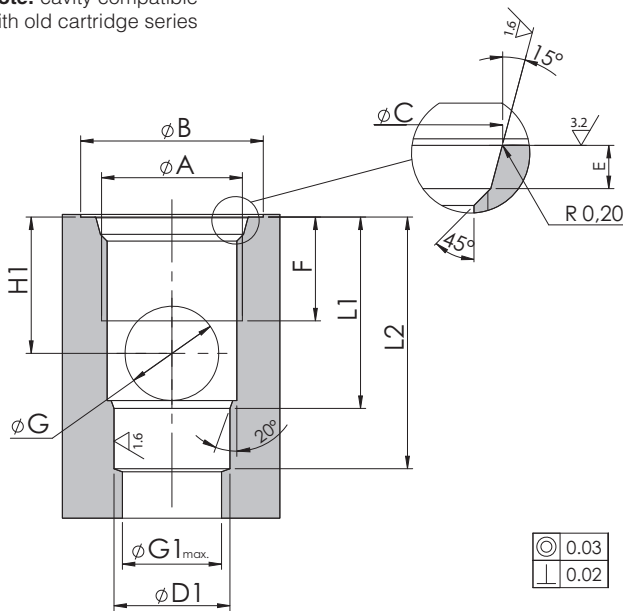
9 INSTALLATION DIMENSIONS [mm]

Version /NO and /NC



10 CAVITY DIMENSIONS

Note: cavity compatible with old cartridge series

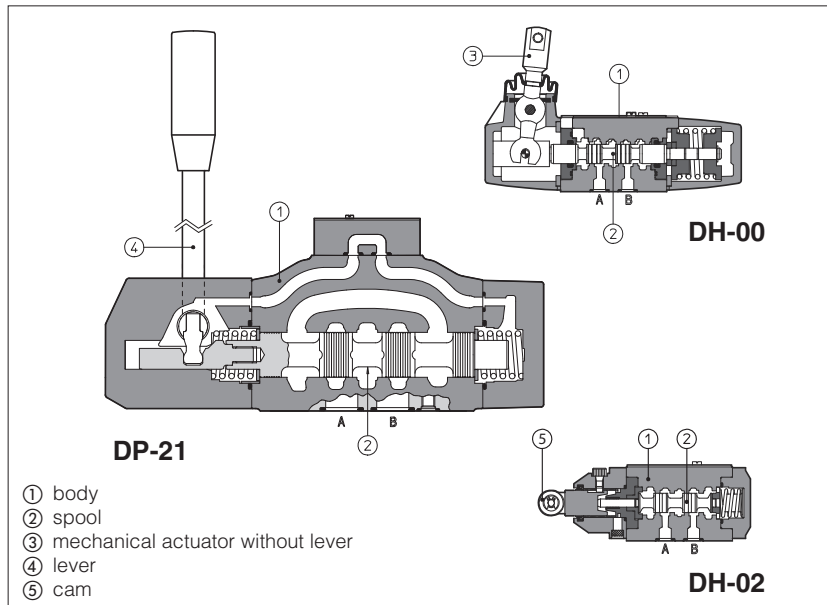


	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	20.6 ^{+0.1} ₀	23.9 ^{+0.1} ₀	35.5 ^{+0.1} ₀
D1	12.7 ^{+0.05} ₀	15.87 ^{+0.05} ₀	28.60 ^{+0.05} ₀
E	2.6 ^{+0.3} ₀	2.6 ^{+0.3} ₀	3.3 ^{+0.3} ₀
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

⊙	0.03
⊥	0.02

Hand & mechanical directional valves

ISO 4401 sizes 06, 10, 16 and 25



Hand & mechanical operated directional valves are spool type, three or four way, two or three position valves, available with following actuator types:

- mechanical actuator: general purpose execution for the connection to customer device for the valve's remote operation
- hand-lever
- cam (only for DH and DK).

Valve sizes and max flow:

- DH-0** = size 06, flow up to 50 l/min
- DK-10 (11)** = size 10, flow up to 100 l/min
- DK-12** = size 10, flow up to 140 l/min
- DP-2** = size 16, flow up to 300 l/min
- DP-4** = size 25, flow up to 700 l/min

Max pressure:

- 350 bar** for DH-0, DP-2, DP-4
- 315 bar** for DK-1*

1 MODEL CODE

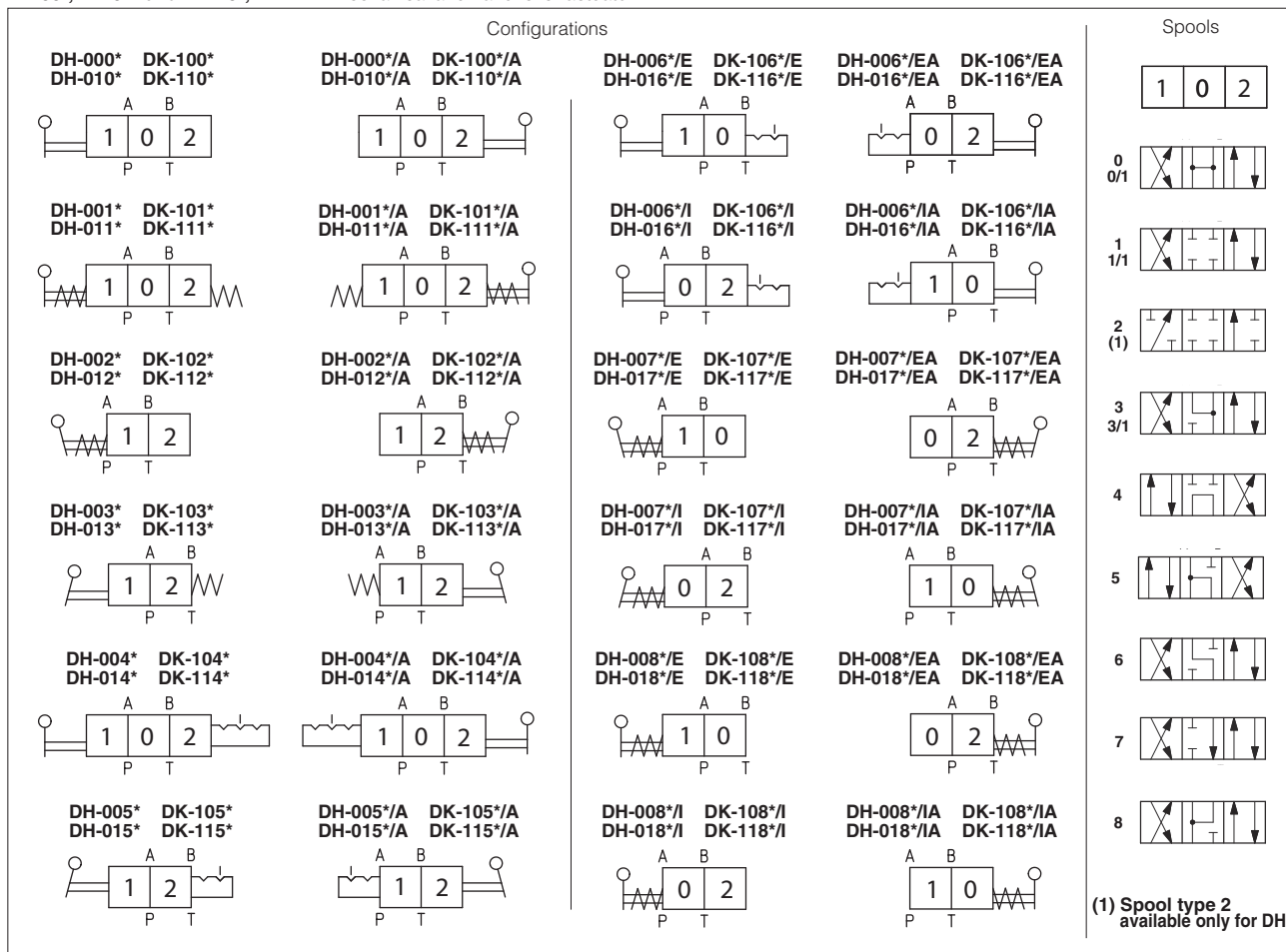
DH-0	1	1	3	/	C	/	A	/	**	/	*
Directional control valve, size: DH-0 = 06 DK-1 = 10 DP-2 = 16 DP-4 = 25											Seals material: - = NBR PE = FKM
Type of actuator: 0 = mechanical, without lever 1 = hand-lever 2 = cam (only for DH-0 and DK-1)											Series number
Valve configuration, see sections 2 and 3 0 = free, without springs 1 = spring centered, without detent 2 = return to internal position 3 = return to external position 4 = 3 position, with detent 5 = 2 external positions, with detent 6 = centre plus external positions, with detent 7 = return to external position from the centre position 8 = return to the centre position from the external position											Options: /A = actuator device mounted on side of port B Lever position to be specified for DH-00, DH-01 and DK-00, DK-01 with configuration 6, 7, 8, see section 3 for hydraulic connections: /I = in rest position the lever is inclined towards the valve body * * /E = in rest position the lever is inclined in opposite side * * Only for DK-1: /Y = external drain
											Only for DH-01 hand-lever valves: /C = short hand - lever and reduced actuation force
											Spool type, see section 3

2 RANGE OF VALVE'S MODELS

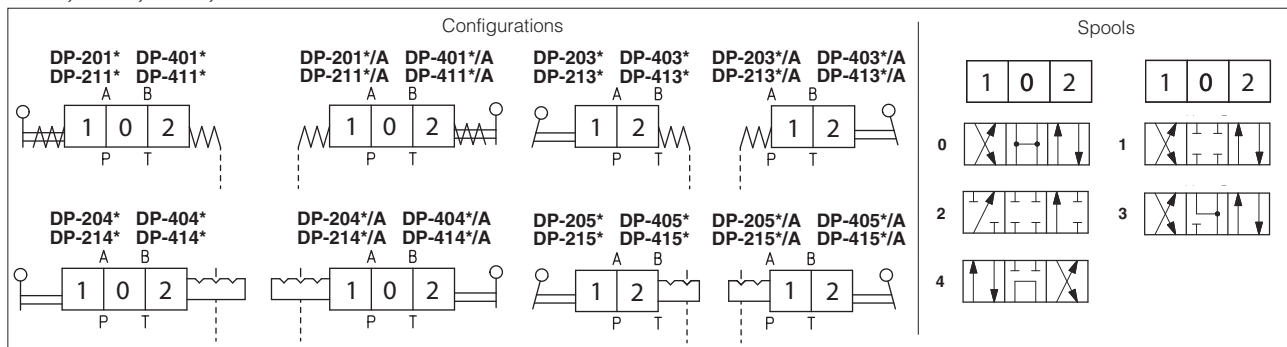
VALVE TYPE	SIZE	VALVE CONFIGURATION									
		0	1	2	3	4	5	6	7	8	
DH-00	06	•	•	•	•	•	•	•	•	•	•
DH-01		•	•	•	•	•	•	•	•	•	•
DH-02					•				•		•
DK-10	10	•	•	•	•	•	•	•	•	•	•
DK-11		•	•	•	•	•	•	•	•	•	•
DK-12					•				•		•
DP-20	16		•		•	•	•				
DP-21			•		•	•	•				
DP-40				•		•	•	•			
DP-41	25		•		•	•	•				

3 CONFIGURATIONS and SPOOLS - for intermediate passages, see tab. E001

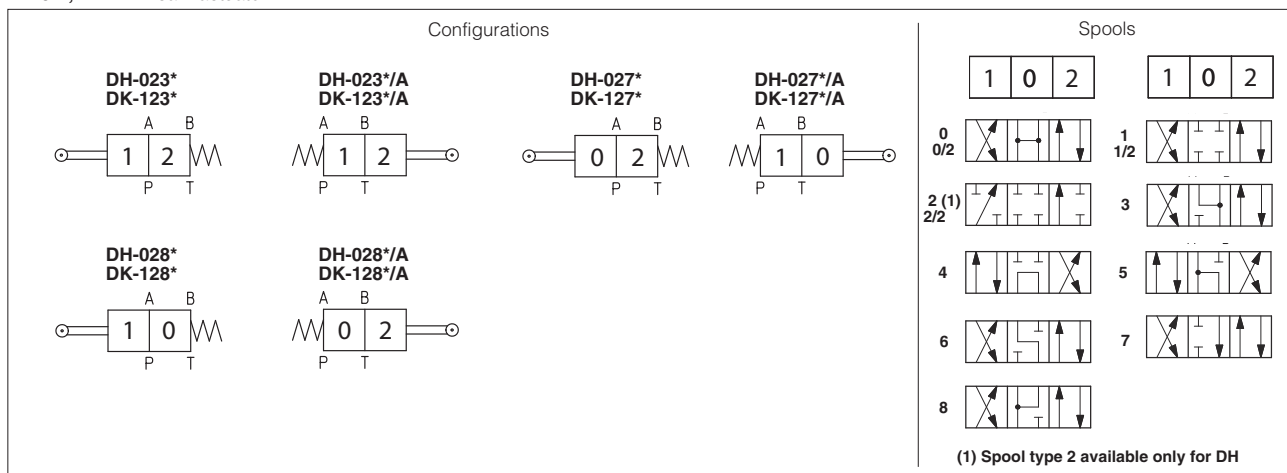
DH-00*, DH-01* and DK-10*, DK-11* - mechanical and hand lever actuator



DP-20*, DP-21*, DP-40*, DP-41* - hand lever actuator



DH-02*, DK-12* - cam actuator



NOTE

- Spools type 0/2, 1/2, 2/2 are only used for valves type DH-023*/2 and DK 123*/2;

4 GENERAL CHARACTERISTICS

Assembly position	Any position except for configuration 7 (without spring) that must be installed with horizontal axis	
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100	
MTTFd valves according to EN ISO 13849	150 years, see technical table P007	
Ambient temperature range	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C	
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C	
Flow direction	As shown in the symbols of tables 3	
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	
Operating pressure	DH	P, A, B = 350 bar T = 160 bar
	DK	P, A, B = 315 bar T = 160 bar
	DP	P, A, B, X = 350 bar T = 250 bar for external drain (standard); Ports Y = 0 bar
Maximum flow	DH	50 l/min
	DK-10, DK-11	100 l/min
	DK-12	140 l/min
	DP-2 DP-4	300 l/min 700 l/min

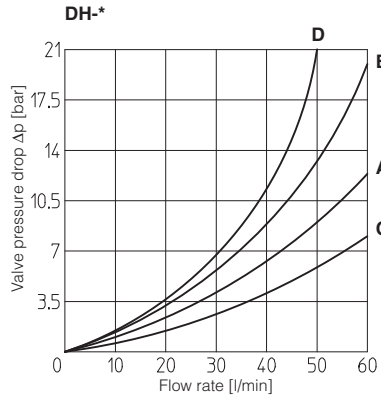
5 SEALS AND HYDRAULIC FLUIDS - For other fluids not included in above table, consult our technical office

Seals, recommended fluid temperature	NBR seals = (standard) -30°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals = (/PE option) -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

6 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

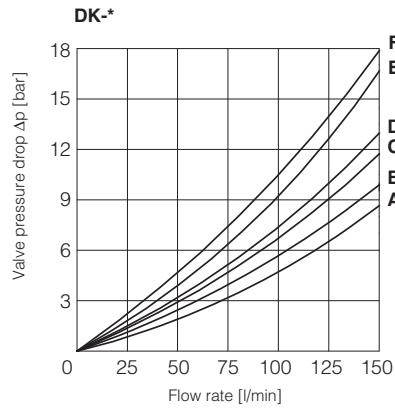
DH-*

Spool type \ Flow direction	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	C	C	C	C	
1, 1/1, 1/2	A	A	A	A	
2, 2/2, 3, 3/1	A	A	C	C	
4, 5	D	D	D	D	A
6, 7	A	A	C	A	
8	C	C	B	B	



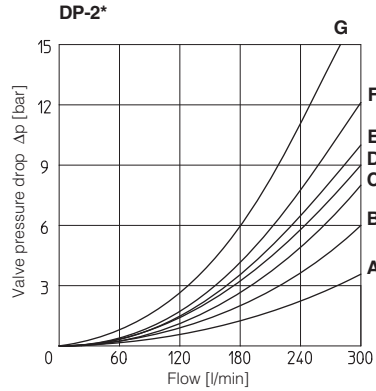
DK-*

Spool type \ Flow direction	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/1, 0/2	A	A	B	B	
1, 1/1, 1/2, 6, 8	A	A	D	C	
3, 3/1, 7	A	A	C	D	
4	B	B	B	B	E
5	A	B	C	C	F



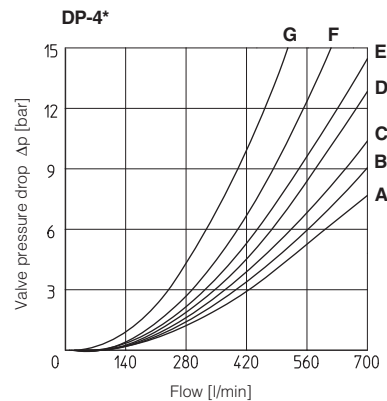
DP-2*

Spool type \ Flow direction	Flow direction				
	P→A	P→B	A→T	B→T	P→T
1, 3	A	A	C	A	-
0	A	A	C	D	B
2	A	A	-	-	-
4	B	B	F	G	E



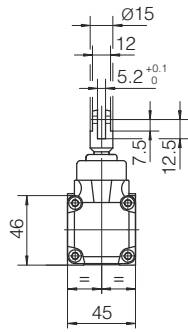
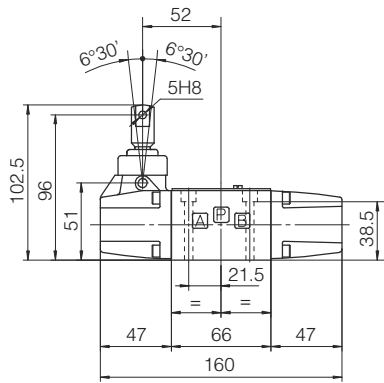
DP-4*

Spool type \ Flow direction	Flow direction				
	P→A	P→B	A→T	B→T	P→T
1	A	A	A	C	-
0	C	B	C	D	E
2	A	A	-	-	-
3	A	A	C	E	-
4	B	B	F	G	G



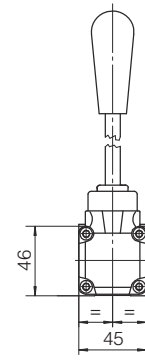
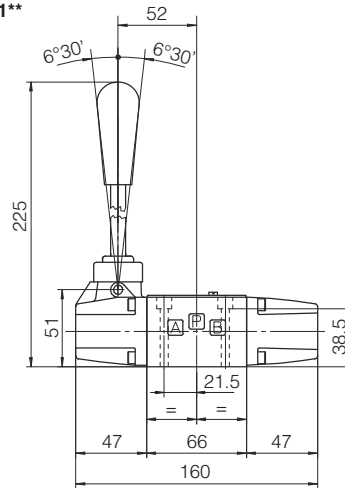
7 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 06 [mm]

DH-00**



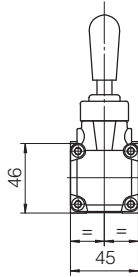
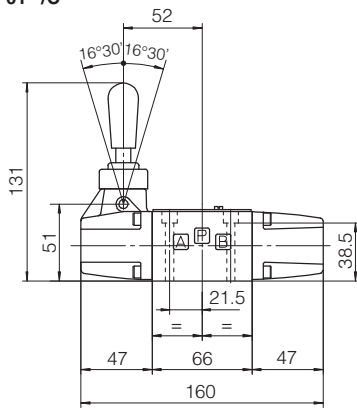
Mass: 1,2 Kg

DH-01**

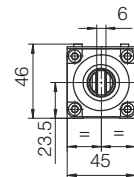
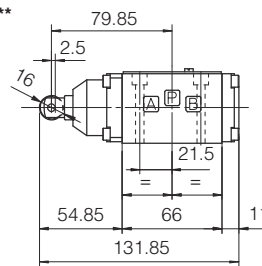


Mass: 1,6 Kg

DH-01/C**



DH-02**



Mass: 1,2 Kg

Working stroke: 2,5 mm; extra-stroke: 0,5 mm max.

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05 (see table P005)

Fastening bolts: 4 socket head screws M5x50 class 12.9

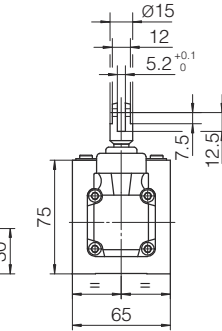
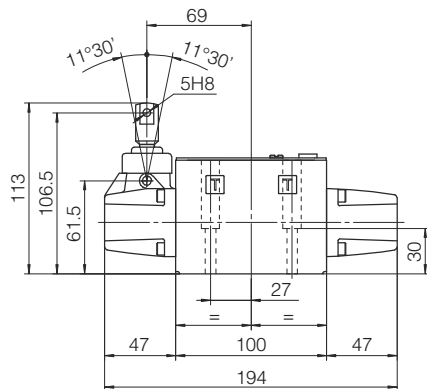
Tightening torque = 8 Nm

Diameter of ports A, B, P, T: Ø = 7,5 mm (max)

Seals: 4 OR 108

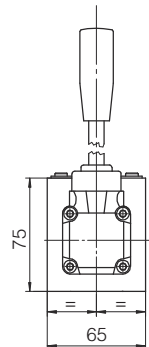
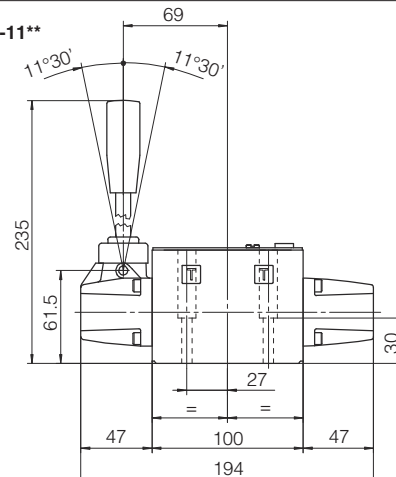
8 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 10 [mm]

DK-10**



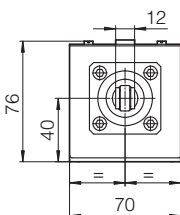
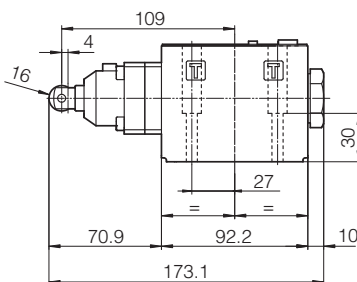
Mass: 2,5 Kg

DK-11**



Mass: 2,8 Kg

DK-12**



Mass: 2,5 Kg

ISO 4401: 2005

Mounting surface: 4401-05-05-0-05 (see table P005)

(Without X port, Y port optional)

Fastening bolts: 4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

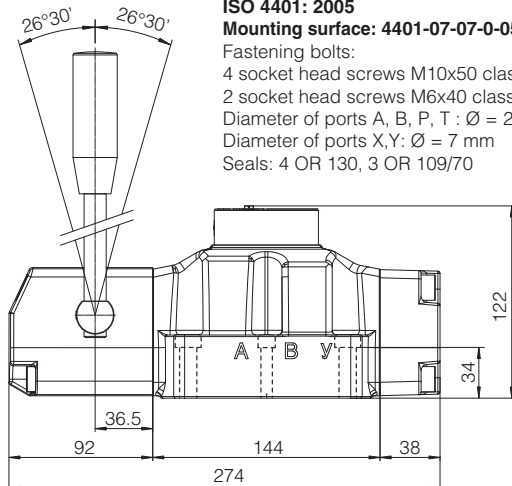
Diameter of ports A, B, P, T: Ø = 11,2 mm (max)

Seals: 5 OR 2050

Working stroke: 4 mm; extra-stroke: 0,5 mm max.

9 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 16 [mm]

DP-21



ISO 4401: 2005

Mounting surface: 4401-07-07-0-05 (see table P005)

Fastening bolts:

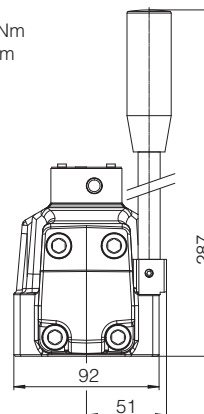
4 socket head screws M10x50 class 12.9, Tightening torque = 70 Nm

2 socket head screws M6x40 class 12.9, Tightening torque = 15 Nm

Diameter of ports A, B, P, T : $\varnothing = 20$ mm

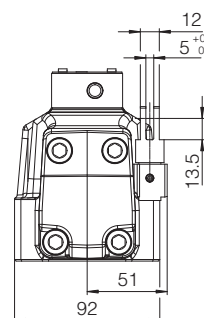
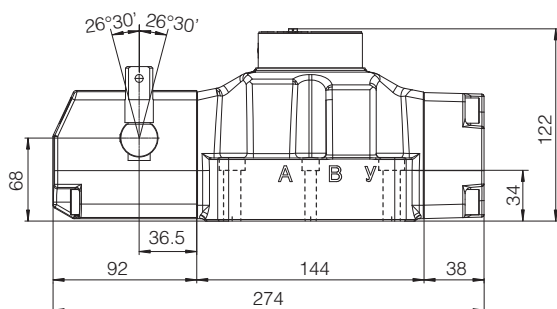
Diameter of ports X,Y: $\varnothing = 7$ mm

Seals: 4 OR 130, 3 OR 109/70



Mass: 10 Kg

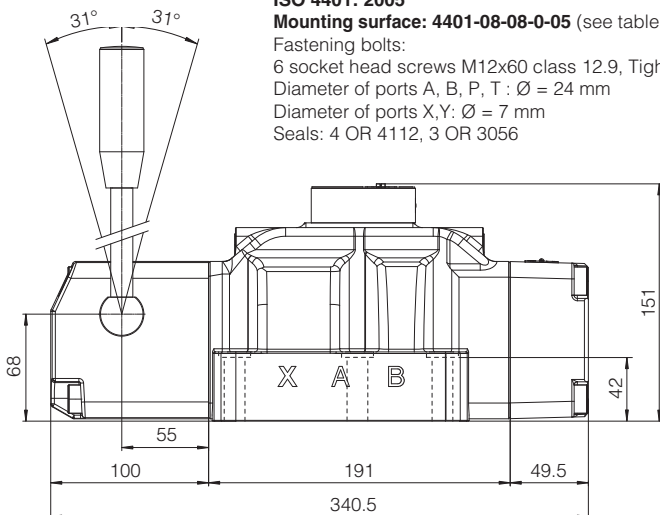
DP-20



Mass: 9,7 Kg

10 DIMENSIONS OF HAND & MECHANICAL OPERATED VALVES ISO 4401 SIZE 25 [mm]

DP-41



ISO 4401: 2005

Mounting surface: 4401-08-08-0-05 (see table P005)

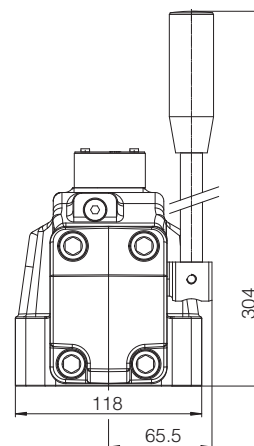
Fastening bolts:

6 socket head screws M12x60 class 12.9, Tightening torque = 125 Nm

Diameter of ports A, B, P, T : $\varnothing = 24$ mm

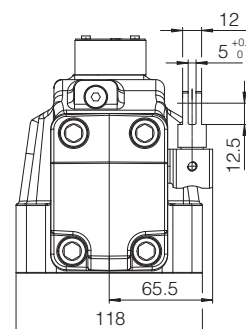
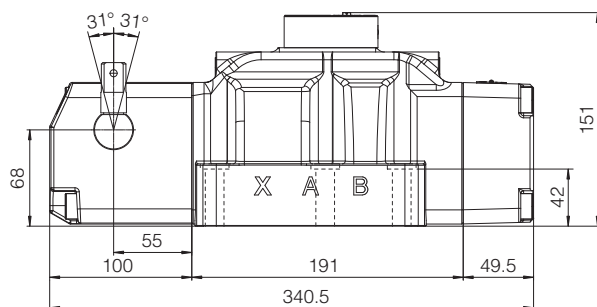
Diameter of ports X,Y: $\varnothing = 7$ mm

Seals: 4 OR 4112, 3 OR 3056



Mass: 15,5 Kg

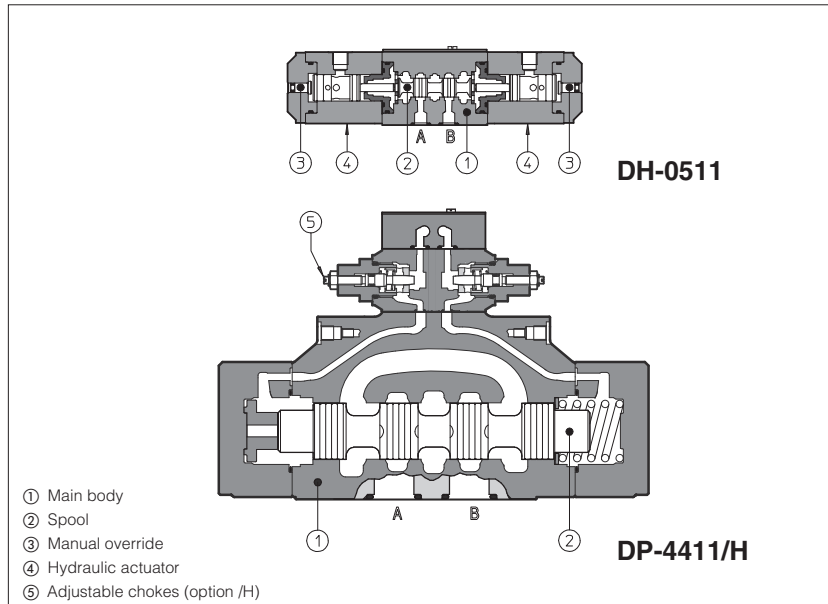
DP-40



Mass: 15,2 Kg

Hydraulic operated directional valves

ISO 4401 size 06, 10, 16, 25 and 32



Hydraulic operated directional valves are spool type, three or four way, two or three position, designed to operate in oil hydraulic systems.

Available with single or double hydraulic actuator.

Valve sizes and max flow:

DH-0 = size 06, flow up to 50 l/min

DK-1 = size 10, flow up to 160 l/min

DP-1 = size 10, flow up to 160 l/min

DP-2 = size 16, flow up to 300 l/min

DP-4 = size 25, flow up to 700 l/min

DP-6 = size 32, flow up to 1000 l/min

Max pressure:

350 bar for DH-0, DP-1, DP-2, DP-4, DP-6

315 bar for DK-1

1 MODEL CODE

DH-0	4	1	3	/	A	**	/	*
Directional control valve, size: DH-0 = 06 DK-1 = 10 DP-1 = 10 DP-2 = 16 DP-4 = 25 DP-6 = 32								Seals material, see section 3: - = NBR PE = FKM BT = HNBR (only for DP)
Type of actuator: 4 = single actuator 5 = double actuator								Series number
Valve configuration, see section 5 0 = free, without springs 1 = spring centered, without detent 3 = spring offset external position 5 = 2 external positions, with detent (only for DH and DK) 7 = center and external positions								Options: only for DH-04 and DK-14, see section 4: /A = actuator device mounted on side of port B only for DP: /H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve) /H9 = adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve) /R = with check valve on port P (not available for DP-1*) /S = main spool stroke adjustment (not available for DP-1*)
								Spool type, see section 4

2 HYDRAULIC CHARACTERISTICS

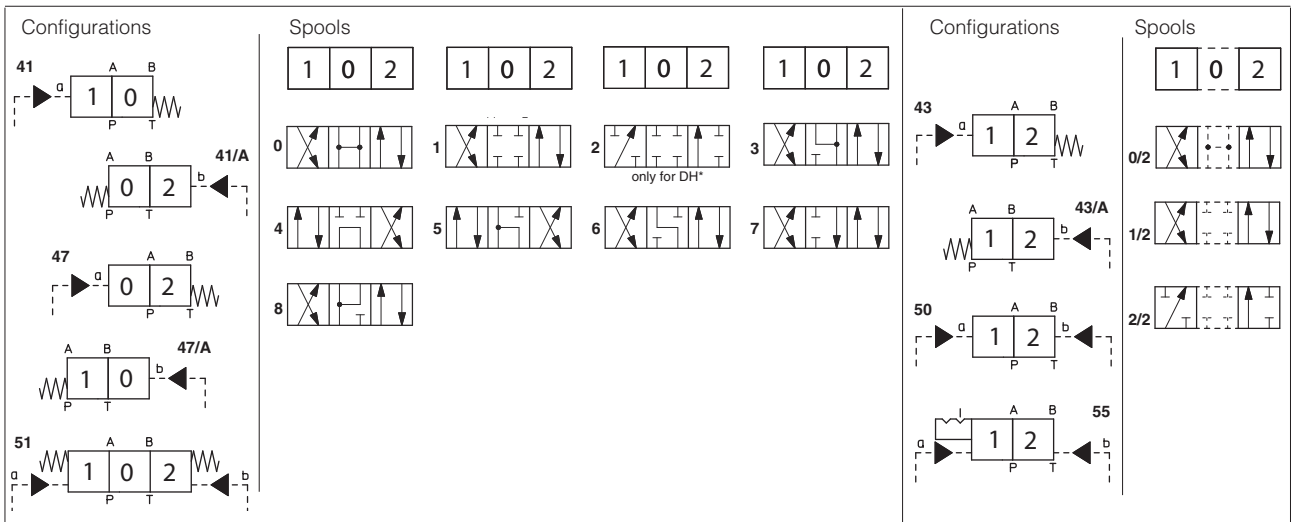
Valve model	DH-0	DK-1	DP-1	DP-2	DP-4	DP-6
Max recommended flow [l/min]	50	160	160	300	700	1000
Max pressure on port P, A, B [bar]	350	315	350			
Max pressure on port T (also X, Y for DP) [bar]	see note (1)			250		
Minimum pilot pressure [bar]	3 (min)	5 (suggested)	4			
Max recommended pressure on piloting line [bar]	70			250		

(1) The max pressure on port T has to be not over 50% of pilot pressure

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	any position except for valves type DH-050, DK-150, DP-*50 (without springs) that must be installed with their longitudinal axis horizontal		
Subplate surface finishing	roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature range	standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

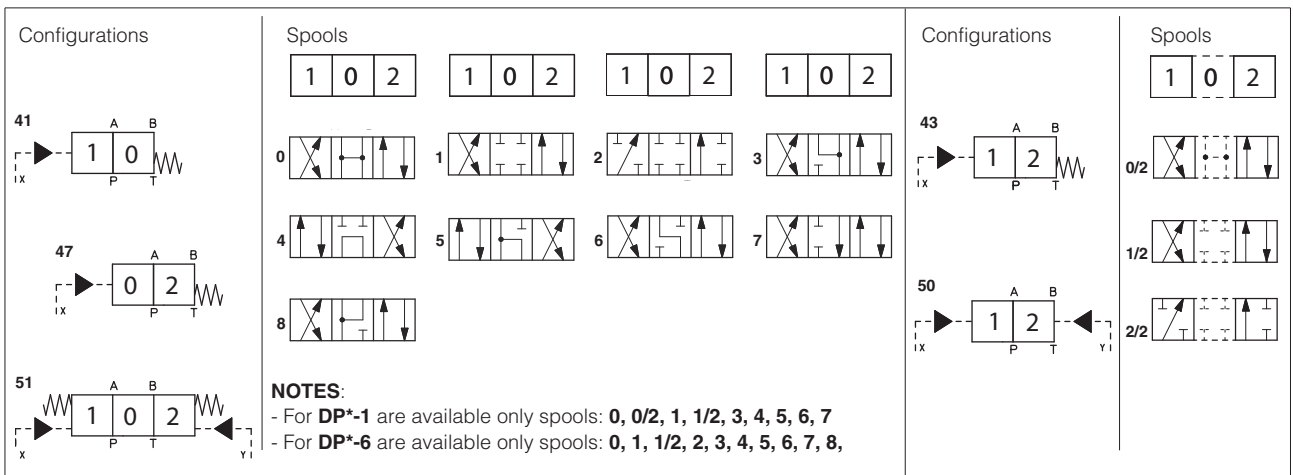
4 CONFIGURATIONS and SPOOLS valves type DH*, DK*



NOTES

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1**, **4** and **5** are also available as **1/1**, **4/8** (only for DH), and **5/1**. They are properly shaped to reduce water-hammer shocks during the switching.
- spools type **1**, **1/2**, **3**, **8** are available as **1P**, **1/2P**, **3P**, **8P** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS valves type DP*



Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1**, **4** and **5** are also available as **1/1**, **4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

6 Q/ΔP DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derived
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derived
DP-1	See note and diagrams on table E085 relating the DPH*-1 valve from which DP-1* are derived
DP-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derived
DP-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derived
DP-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derived

7 DIMENSIONS OF HYDRAULIC OPERATED VALVES ISO 4401 size 06 and 10 [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
 Fastening bolts: 4 socket head screws M5x50 class 12.9
 Tightening torque = 8 Nm
 Diameter of ports A, B, P, T: Ø = 7,5 mm (max)
 Seals: 4 OR 108

① Pilot pressure port G1/8"
 ② Manual override

Mounting subplates: see tab. E010

DH-04**

Mass: 1,2 Kg

DH-05**

Mass: 1,6 Kg

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05 (see table P005)
(without X port)
 Fastening bolts: 4 socket head screws M6x40 class 12.9
 Tightening torque = 15 Nm
 Diameter of ports A, B, P, T: Ø = 11,2 mm (max)
 Diameter of port Y: Ø = 5 mm
 Seals: 5 OR 2050, 1 OR 108

① Pilot pressure port G1/4"
 ② Air bleed

Mounting subplates: see tab. E025 (only version /Y)

Note: Line Y must be always present and no counter pressure are allowed on this line.

DK-14**

Mass: 3,4 Kg

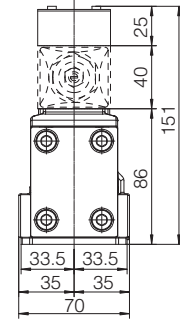
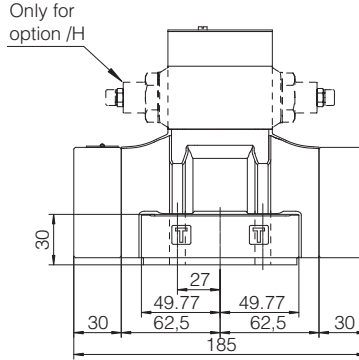
DK-15**

Mass: 4,2 Kg

DP-1

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

Fastening bolts:
 4 socket head screws M6x40 class 12.9
 Tightening torque = 15 Nm
 Diameter of ports A, B, P, T : $\varnothing = 11$
 Diameter of ports X, Y: $\varnothing = 5$ mm
 Seals: 5 OR 2050, 2 OR 108



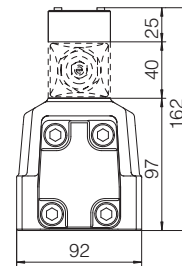
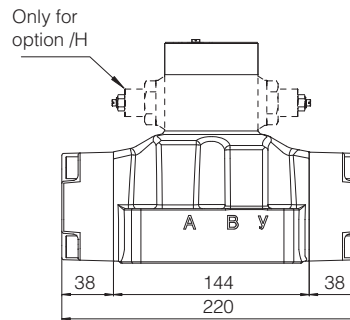
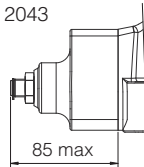
Mass: 7,1 Kg

DP-2

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05

Fastening bolts:
 4 socket head screws M10x50 class 12.9
 Tightening torque = 70 Nm
 2 socket head screws M6x45 class 12.9
 Tightening torque = 15 Nm
 Diameter of ports A, B, P, T : $\varnothing = 20$
 Diameter of ports X, Y: $\varnothing = 7$ mm
 Diameter of port L: $\varnothing = 5$ mm
 Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S



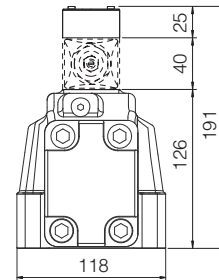
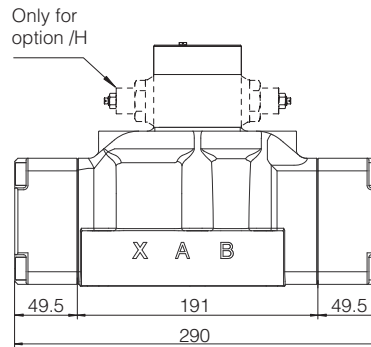
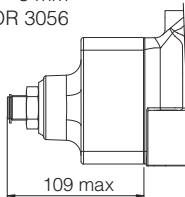
Mass: 10 Kg

DP-4

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05

Fastening bolts:
 6 socket head screws M12x60 class 12.9
 Tightening torque = 125 Nm
 Diameter of ports A, B, P, T : $\varnothing = 24$
 Diameter of ports X, Y: $\varnothing = 7$ mm
 Diameter of port L: $\varnothing = 5$ mm
 Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S



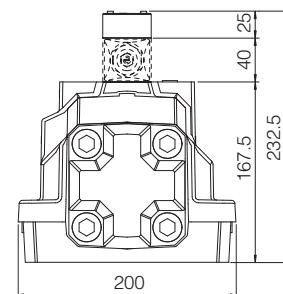
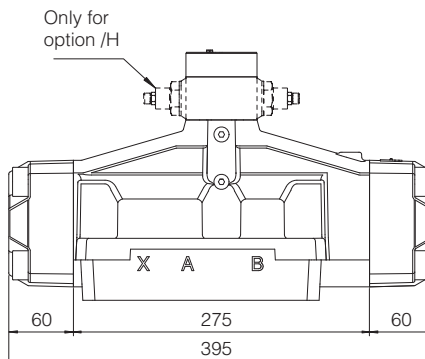
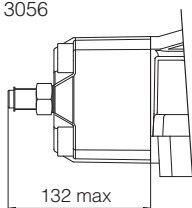
Mass: 16,5 Kg

DP-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(port L optional)

Fastening bolts:
 6 socket head screws M20x80 class 12.9
 Tightening torque = 600 Nm
 Diameter of ports A, B, P, T : $\varnothing = 34$ mm
 Diameter of ports X, Y: $\varnothing = 7$ mm
 Diameter of port L: $\varnothing = 5$ mm
 Seals: 4 OR 144, 2 OR 3056

Stroke adjustment device for option /S

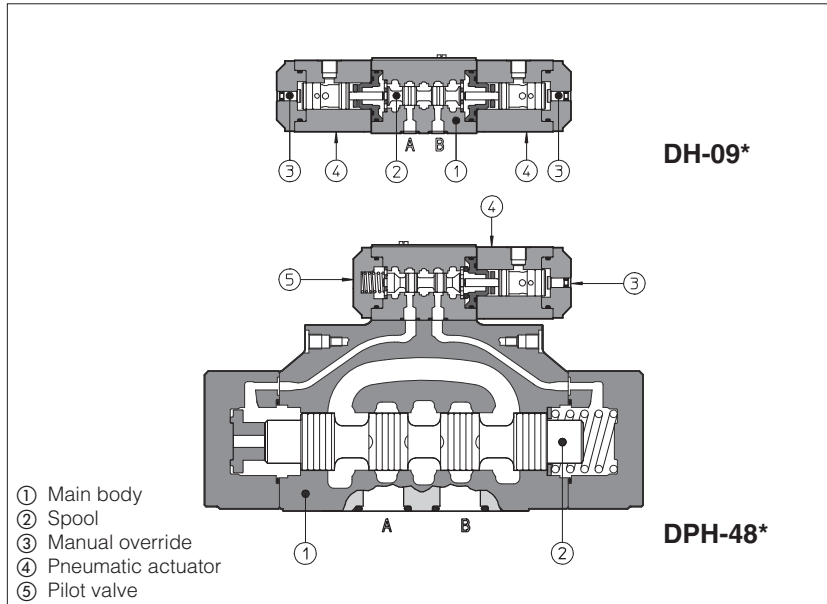


Mass: 38 Kg

Mounting subplates: see tab. K280

Pneumatic operated directional valves

ISO 4401 sizes 06, 10, 16, 25 and 32



Pneumatic operated directional valves are spool type ②, three or four way, two or three position, designed to operate in oil hydraulic systems. Available with single or double pneumatic actuator ④ with manual override.

Valve sizes and max flow:

- DH-0** = size 06, flow up to 50 l/min
- DK-1** = size 10, flow up to 160 l/min
- DPH-2** = size 16, flow up to 300 l/min
- DPH-4** = size 25, flow up to 700 l/min
- DPH-6** = size 32, flow up to 1000 l/min

Max pressure:

- 350 bar** for DH-0, DPH-2, DPH-4, DPH-6
- 315 bar** for DK-1

1 MODEL CODE

DH-0	8	1	3	/ A	**	/	*
Directional control valve, size: DH-0 = 06 DK-1 = 10 DPH-2 = 16 DPH-4 = 25 DPH-6 = 32							Seals material, see section ⑧: - = NBR PE = FKM
Type of actuator: 8 = single actuator 9 = double actuator							Series number
Valve configuration, see sections ④ and ⑤ 0 = free, without springs 1 = spring centered, without detent 3 = spring offset external position 5 = 2 external positions, with detent 7 = center and external positions							
Spool type, see sections ④ and ⑤							
				Options: only for valve with single actuator: /A = Actuator device mounted on side of port B (for DH and DK). Actuator device mounted on side of port A of main body (for DPH) only for DPH: /D = internal drain /E = external pressure /H = adjustable chokes for controlling the main spool shifting time (meter-out to the pilot chambers of the main valve) /H9 = adjustable chokes for controlling the main spool shifting time (meter-in to the pilot chambers of the main valve) /R = pilot pressure generator on port P at 4 bar /S = main spool stroke adjustment			

2 HYDRAULIC CHARACTERISTICS

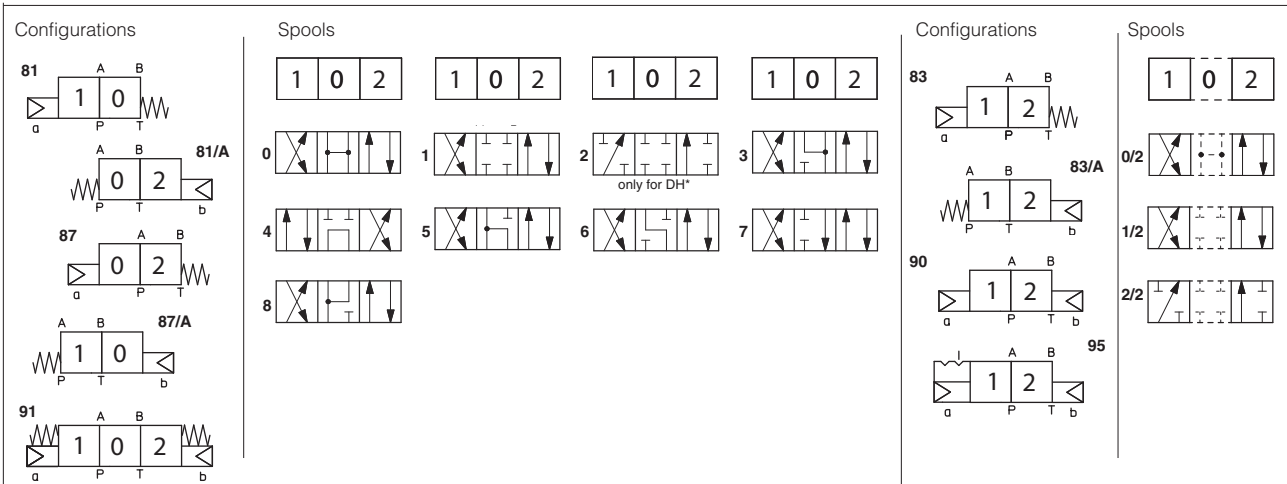
Valve model	DH-0	DK-1	DPH-2	DPH-4	DPH-6
Max recommended flow [l/min]	50	160	300	700	1000
Max pressure on port P, A, B (also X for DP) [bar]	350	315	350		
Max pressure on port T [bar]		210	250		
Max pressure on port L and Y [bar]	-		null pressure		
Recommended oil pressure on piloting line [bar]	-		Min = 4 Max = 250		
Recommended pneumatic pressure (1) [bar]			Min = 2 Max = 12		

(1) filtered and lubricated air

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position for all valves except for type *-90 (without springs) that must be installed with horizontal axis if operated by impulses.		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C;		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

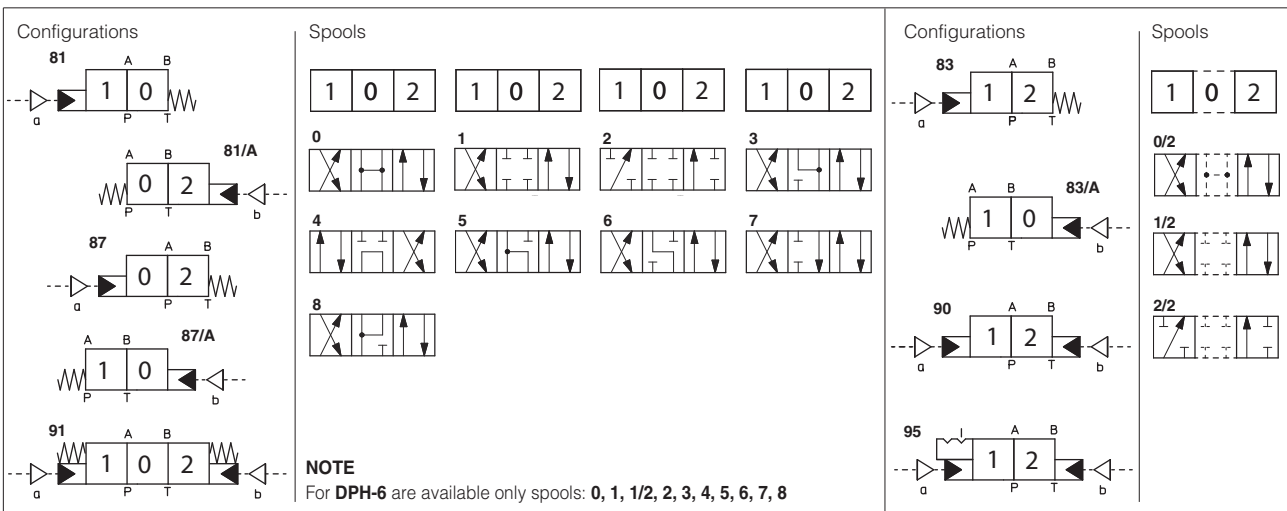
4 CONFIGURATIONS and SPOOLS of valves type DH-*, DK-*



NOTES

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4** and **5** are also available as **1/1, 4/8** (only for DH-0) and **5/1**. They are properly shaped to reduce water-hammer shocks during the switching.
- spools type **1, 1/2, 3, 8** are available as **1P, 1/2P, 3P, 8P** (only for DH-0) to limit valve internal leakages.

5 CONFIGURATIONS and SPOOLS of valves type DPH-*



Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4**, and **5** are also available as **1/1, 4/8** and **5/1** are properly shaped to reduce water-hammer shocks during the switching.

6 Q/Δp DIAGRAMS

DH-0	See note and diagrams on table E010 relating the DH* valve from which DH-0* are derived
DK-1	See note and diagrams on table E025 relating the DKE valve from which DK-1* are derived
DPH-2	See note and diagrams on table E085 relating the DPH*-2 valve from which DP-2* are derived
DPH-4	See note and diagrams on table E085 relating the DPH*-4 valve from which DP-4* are derived
DPH-6	See note and diagrams on table E085 relating the DPH*-6 valve from which DP-6* are derived

7 INSTALLATION DIMENSIONS of VALVES type DH and DK [mm]

ISO 4401: 2005

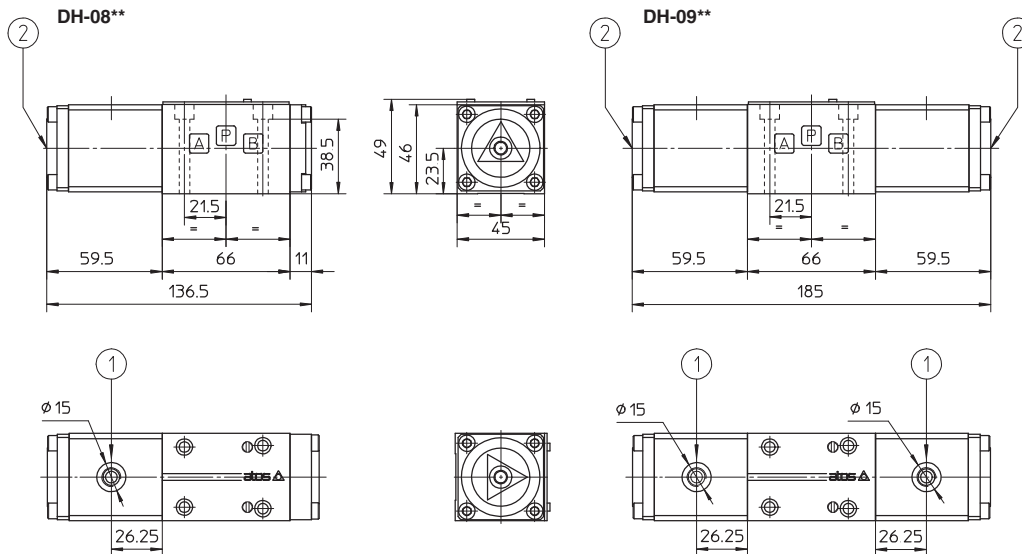
Mounting surface: 4401-03-02-0-05

Fastening bolts: 4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

Diameter of ports A, B, P, T: $\varnothing = 7,5$ mm (max)

Seals: 4 OR 108



Mass: 1,2 Kg

Mass: 1,6 Kg

- ① Pilot pressure port G1/8"
- ② Manual override

Mounting subplates: see tab. E010

ISO 4401: 2005

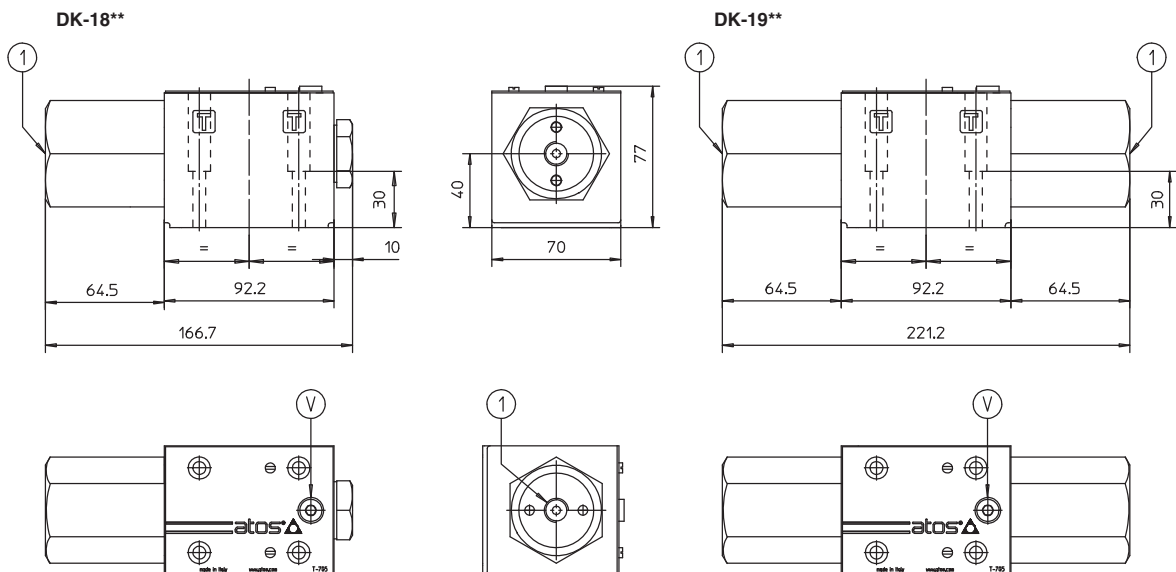
Mounting surface: 4401-05-04-0-05

Fastening bolts: 4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

Diameter of ports A, B, P, T: $\varnothing = 11,2$ mm (max)

Seals: 5 OR 2050



Mass: 3,4 Kg

Mass: 4,2 Kg

- ① Pilot pressure port G1/4"
- Ⓥ Air bleed

Mounting subplates: see tab. E025

8 INSTALLATION DIMENSIONS of VALVES type DP [mm]

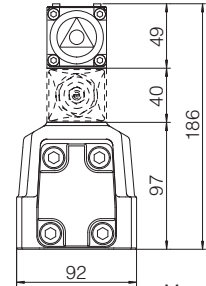
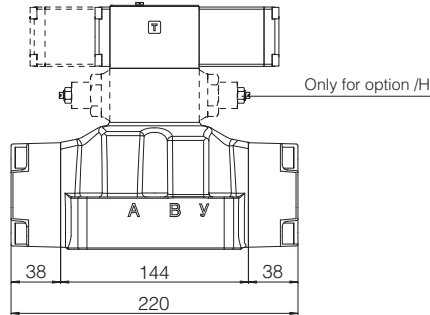
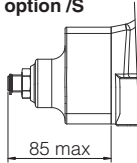
DPH-2

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

Fastening bolts:
 4 socket head screws M10x50 class 12.9
 Tightening torque = 70 Nm
 2 socket head screws M6x45 class 12.9
 Tightening torque = 15 Nm
 Diameter of ports A, B, P, T : $\varnothing = 20$
 Diameter of ports X,Y: $\varnothing = 7$ mm
 Seals: 4 OR 130, 2 OR 2043

Stroke adjustment device for option /S



Mass: 11,5 Kg

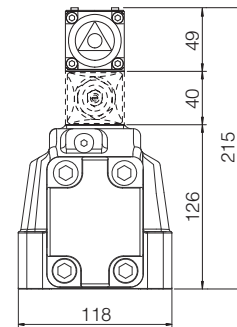
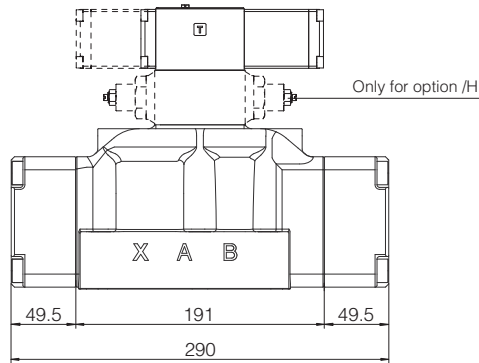
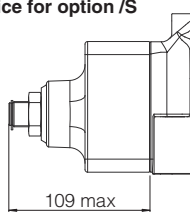
DPH-4

ISO 4401: 2005

Mounting surface: 4401-08-08-0-05

Fastening bolts:
 6 socket head screws M12x60 class 12.9
 Tightening torque = 125 Nm
 Diameter of ports A, B, P, T : $\varnothing = 24$
 Diameter of ports X,Y: $\varnothing = 7$ mm
 Seals: 4 OR 4112, 2 OR 3056

Stroke adjustment device for option /S



Mass: 18 Kg

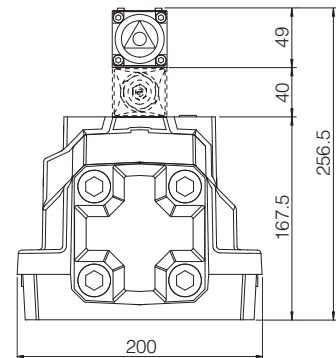
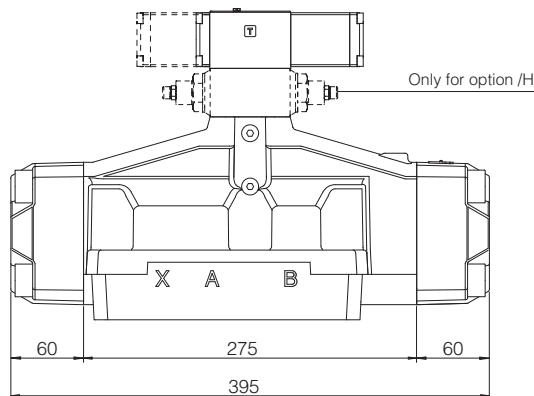
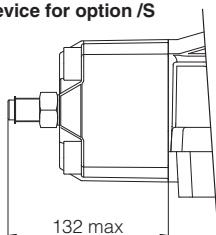
DPH-6

ISO 4401: 2005

Mounting surface: 4401-10-09-0-05

Fastening bolts:
 6 socket head screws M20x80 class 12.9
 Tightening torque = 600 Nm
 Diameter of ports A, B, P, T : $\varnothing = 34$ mm
 Diameter of ports X,Y: $\varnothing = 7$ mm
 Seals: 4 OR 144, 2 OR 3056

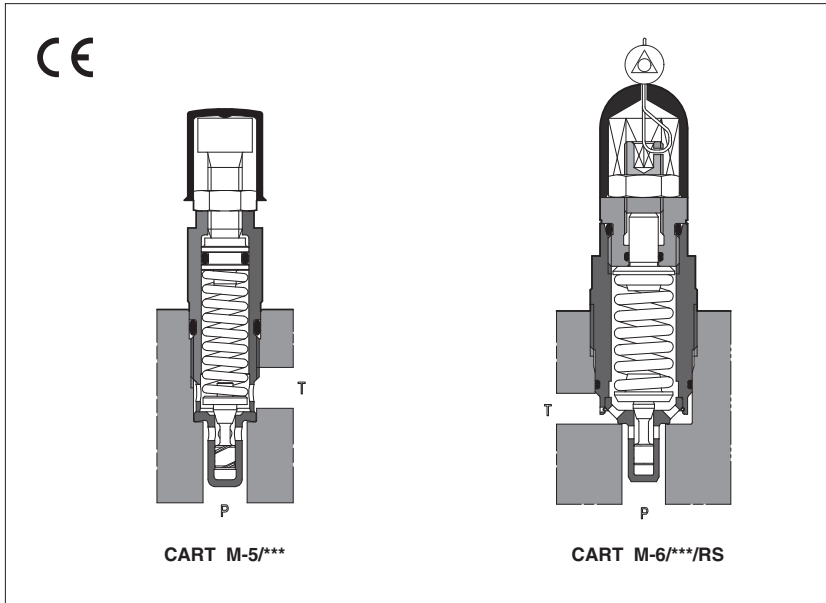
Stroke adjustment device for option /S



Mass: 39,5 Kg

Cartridge pressure relief valves type CART

screw-in mounting, direct operated



CART are screw-in, direct operated pressure relief valves. They are used to limit the max pressure in the hydraulic systems or to protect part of the circuit from overpressure. They are available in six sizes for different flow and pressure ranges.

The cartridge execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation. The factory pressure setting required by the customer corresponds to the valve's cracking pressure.

Max flow: **150 l/min**
Max pressure: up to **420 bar**

1 MODEL CODE

CART	M-6	/	420	/	RS	/	*	**	/	*
Screw-in relief cartridges										Seals material, see section 4: - = NBR PE = FKM BT = HNBR
Size: M-3 = G1/2 (1) M-4 = M14x1 M-5 = M20x1,5 M-6 = M33x1,5 (1) ARE-15 = M32x1,5 ARE-20 = M35x1,5 (1)										Series number
Max pressure: see section 3										Only for RS option: 280 = factory pressure setting to be defined by the customer min step: 1 bar - min pressure setting: 25 bar (example 280 = 280 bar)
										Options: see section 5 for options availability and combination: R = leak free execution (2) RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE Manual override only for standard and /R option (3): V = regulating handwheel VF = regulating knob VS = regulating knob with safety locking

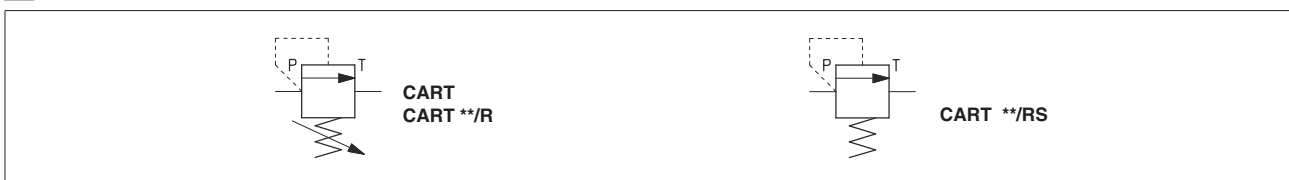
For **PED** version see technical table CY010

(1) Available also in stainless steel execution, see technical table CW010

(2) Standard execution of CART M-4 and CART ARE-20 provides the leak free feature, then the /R is always present in the valve model code, with the exception in case of RS options

(3) For handwheel and knob features, see sections 7, 8. For their availability see section 5

2 HYDRAULIC SYMBOLS



3 HYDRAULIC CHARACTERISTICS

Valve model	CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
STANDARD	50 100 210 350 420		50 100 210 250 350	50 100 210 350 500	15 50 75 150 250 350 420	50 100 210
Max pressure setting [bar]	R	350 420		50 100 210 350 500	15 50 75 150 250 420	315 400
	RS	220 270 350		220 270 330 350	150 190 230	
STANDARD (1)	4÷50 6÷100 7÷210 8÷350 15÷420		2÷50 3÷100 5÷210 7÷250 8÷350	2÷50 3÷100 8÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 8÷350 15÷420	3÷50 5÷100 6÷210
Pressure range [bar]	R (1)	8÷350 15÷420		2÷50 3÷100 10÷210 15÷350 15÷500	2÷15 3÷50 4÷75 8÷150 8÷250 15÷420	8÷315 10÷400
	RS (1)	210÷260 260÷300 300÷370		200÷250 250÷290 290÷350 310÷370	130÷170 170÷210 210÷250	
Max pressure on port T [bar]	50	50	50	50	50	50
Max flow [l/min]	STANDARD	2,5	35	40	75	120
	RS	2,5	50	60	100	150

(1) The values correspond to the min and max regulation of the valve's craking pressure

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

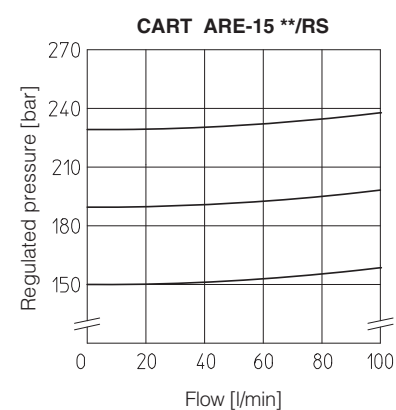
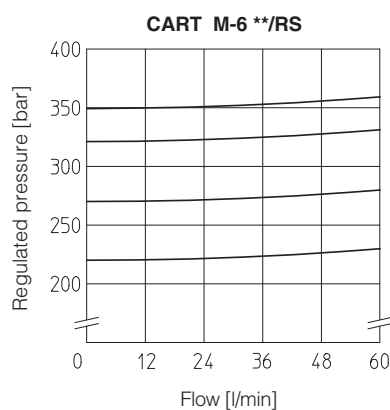
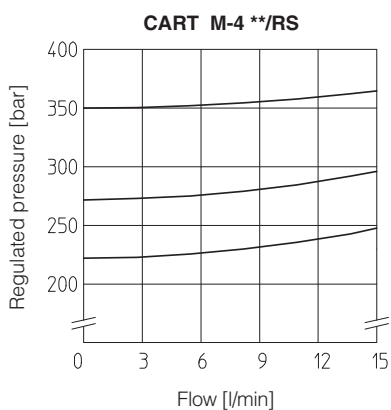
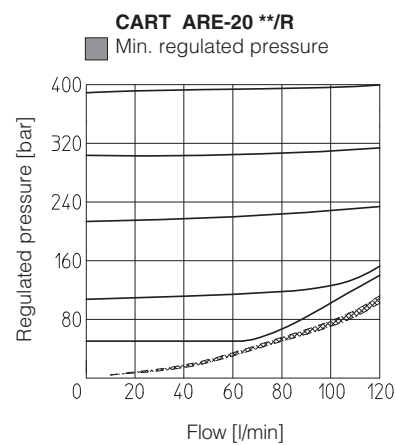
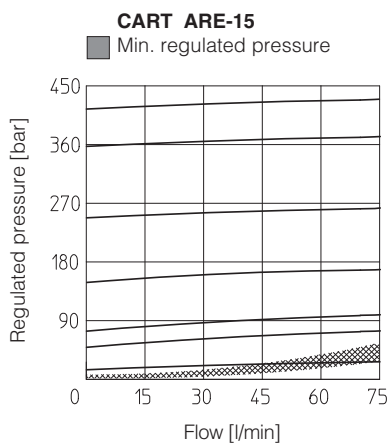
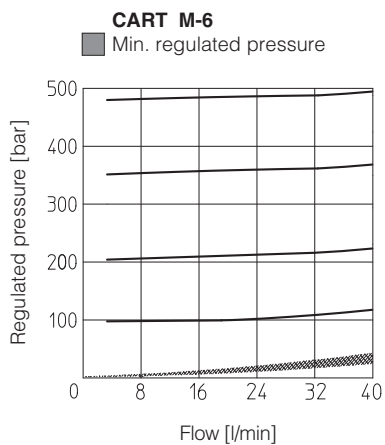
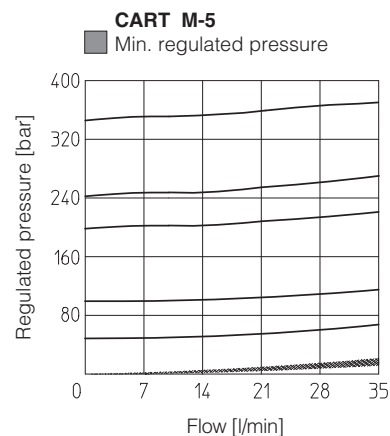
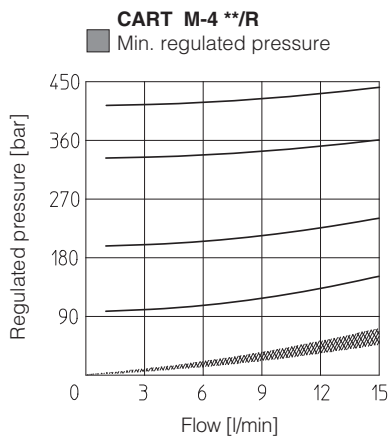
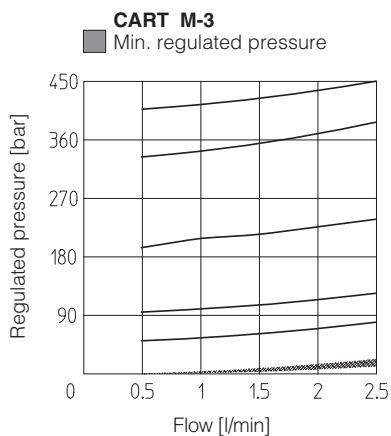
Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 OPTIONS AVAILABILITY

Valve model	CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Option	/R	STANDARD		●	●	STANDARD
	/RS		●	●	●	
	/V	●			●	●
	/VF				●	●
	/VS				●	●
Combinated option (1)	/RV			●	●	●
	/RVF			●	●	
	/RVS			●	●	

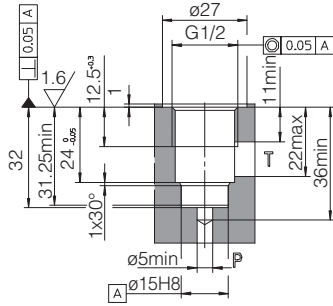
(1) **RV** = leak free and regulating handwheel
RVF = leak free and regulating knob
RVS = leak free and regulating knob with safety lock

6 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

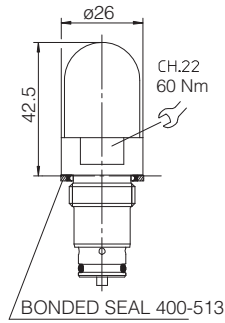


7 CAVITY AND DIMENSIONS FOR CART M-3, M-4 AND M-5 [mm]

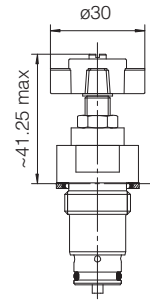
CART M-3



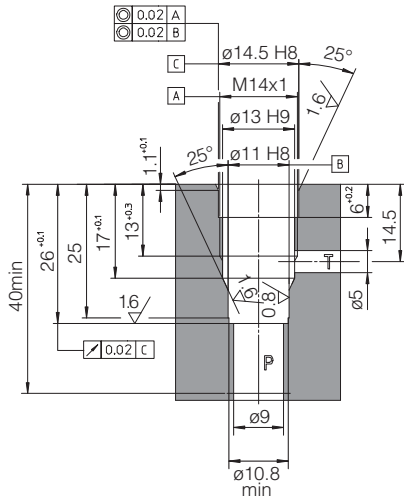
Standard



Option /V

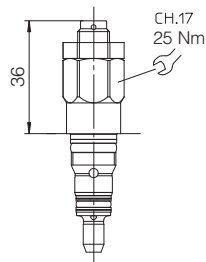


CART M-4

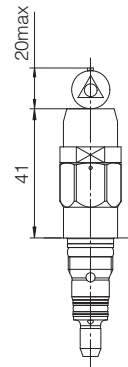


Cavity drawing not in scale with the cartridge

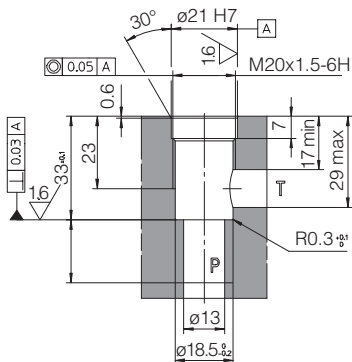
Standard



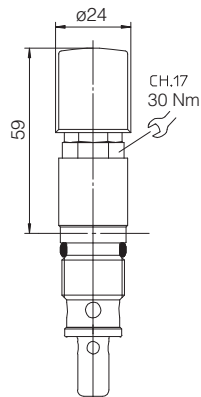
Option /RS



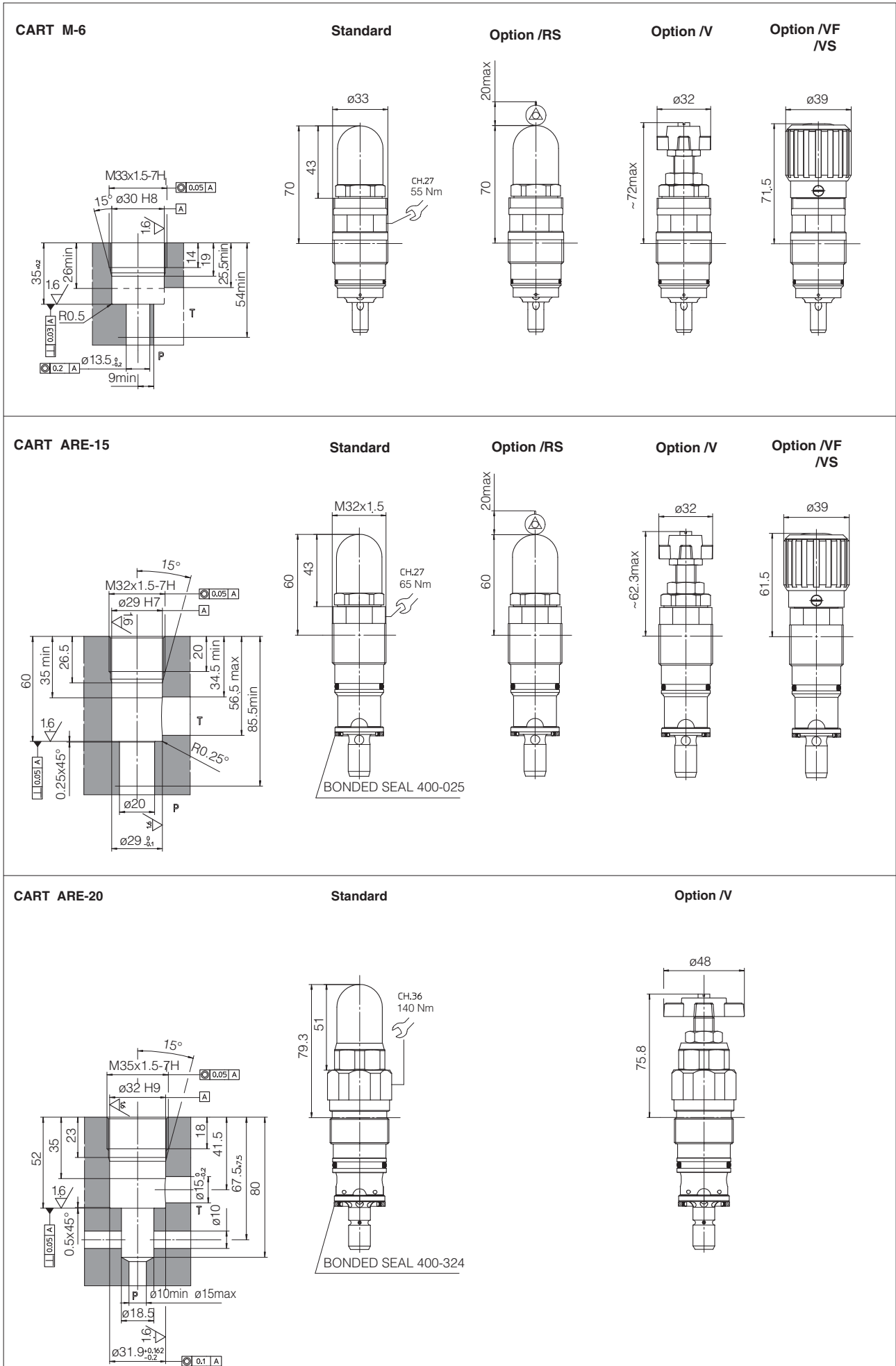
CART M-5



Standard

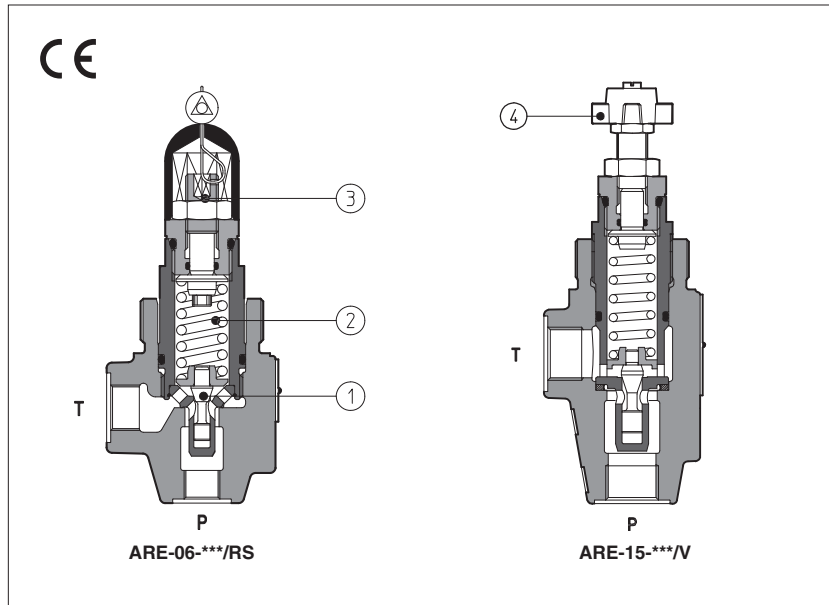


8 CAVITY AND DIMENSIONS FOR CART M-6, CART ARE-15 AND ARE-20 [mm]



Pressure relief valves type ARE

direct operated, in line mounting



ARE are poppet type, directed operated pressure relief valves, with threaded ports for in line mounting.

The flow P→T is permitted when pressure force acting on the poppet (1) overcomes the force of the spring (2).

Regulation is operated by means of a screw (3) or optionally by means of a handwheel (4) acting on the spring.

Clockwise rotation increases the pressure.

These valves are available in two sizes, with port P=G 1/4" or G 1/2".

Option **RS**, conforms to the Machine Directive (2006/42/CE), with factory preset and lead sealed regulation.

The factory pressure setting required by the customer corresponds to the valve's cracking pressure.

Max flow: **100 l/min:**

Max pressure: ARE-06 up to **500 bar**

ARE-15 up to **420 bar**

1 MODEL CODE

ARE	-	06	/	350	/	RS	/	*	/	**	/	*
<p>ARE = pressure relief valve with thread connections</p> <p>Available also in cartridge execution, see tab. C010</p>										<p>Series number</p>		<p>Seals material, see section 4:</p> <p>- = NBR</p> <p>PE = FKM</p> <p>BT = HNBR</p>
<p>Size:</p> <p>06 = port P G 1/4"</p> <p>15 = port P G 1/2"</p>												<p>Only for RS options:</p> <p>280 = factory pressure setting to be defined depending to the customer requirement (example 280 = 280 bar)</p>
<p>Max pressure: see section 3</p>												<p>Options (2):</p> <p>R = leak free execution (2)</p> <p>RS = leak free execution plus lead sealed regulation conforming to 2006/42/CE</p> <p>Manual override only for standard and /R option:</p> <p>V = regulating handwheel</p> <p>VF = regulating knob</p> <p>VS = regulating knob with safety locking</p>

For **PED** version see technical table CY020

(1) Possible combined options:

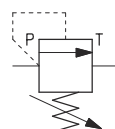
RV = reduced leakages and regulating handwheel

RVF = reduced leakages and regulating knob

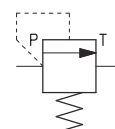
RVS = reduced leakages and regulating knob with safety locking

2 HYDRAULIC SYMBOLS

Hydraulic symbol



ARE-06
ARE-15



ARE-06 **/RS
ARE-15 **/RS

3 HYDRAULIC CHARACTERISTICS

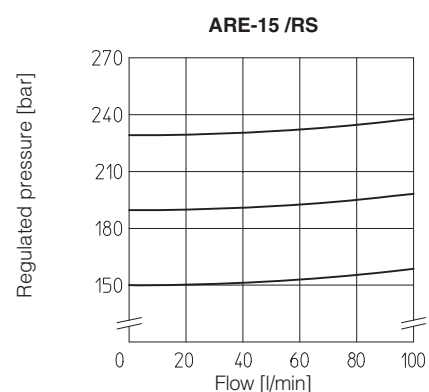
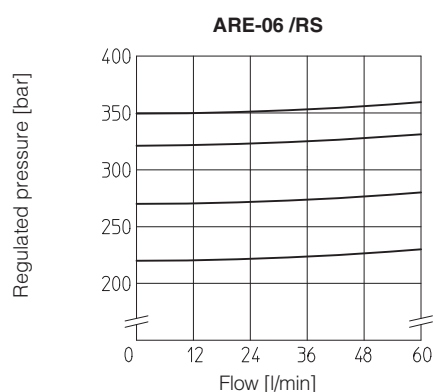
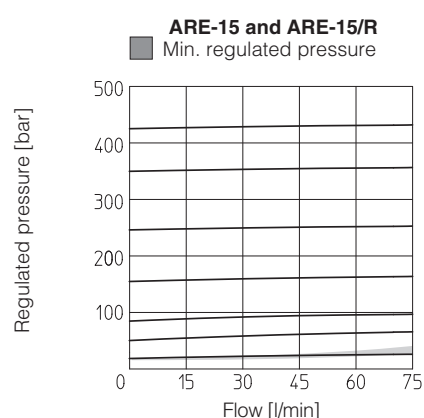
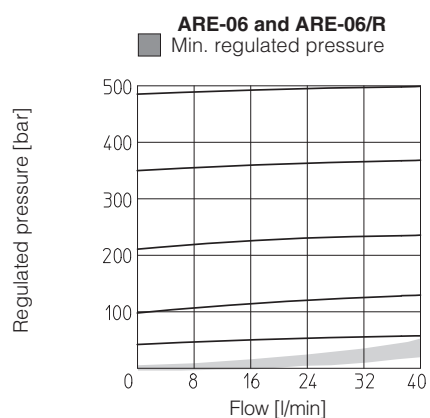
Valve model		ARE-06					ARE-15						
Max pressure setting [bar]	Standard	50	100	210	350	500	15	50	75	150	250	350	420
	/R	50	100	210	350	500	15	50	75	150	250	350	420
	/RS	220		270	330	350	150 190 230						
Pressure range [bar]	Standard	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250	30÷350	30÷420
	/R (1)	2÷50	3÷100	10÷210	15÷350	30÷500	2÷15	3÷50	4÷75	8÷150	8÷250	30÷350	30÷420
	/RS (1)	200÷250		250÷290	290÷350	310÷370	130÷170 170÷210 210÷250						
Max pressure port T [bar]		50					50						
Max flow [l/min]	Standard, /R	40					75						
	/RS	60					100						

(1) The values correspond to the min and max regulation of the valve's craking pressure

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β ₂₅ ≥75 recommended)		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils		NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD
Flame resistant without water		FKM	HFDU, HFDR
Flame resistant with water		NBR, HNBR	HFC
			Ref. Standard
			DIN 51524
			ISO 12922

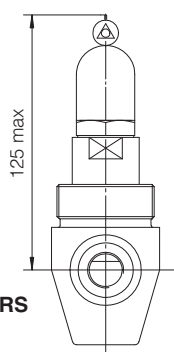
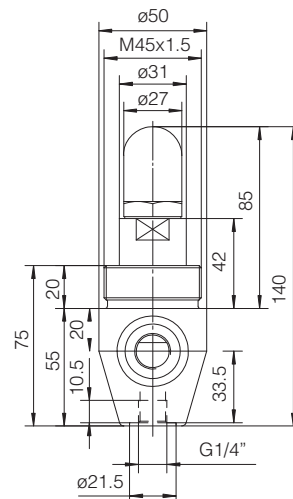
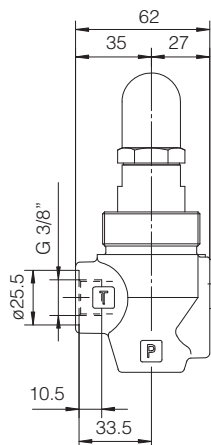
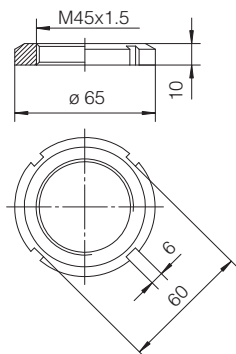
5 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)



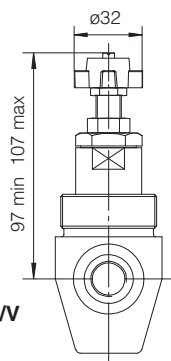
6 DIMENSIONS [mm]

ARE-06

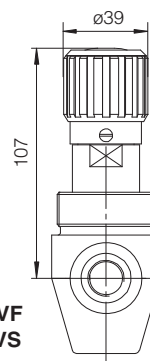
P = INLET PORT G 1/4"
T = OUTLET PORT G 3/8"
 Locking ring for fastening the valve.
 Model code: SP-6-RE-310030



Option /RS



Option /V

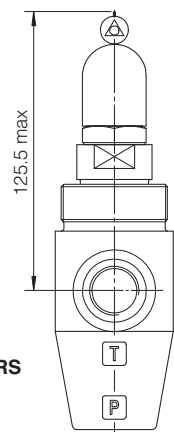
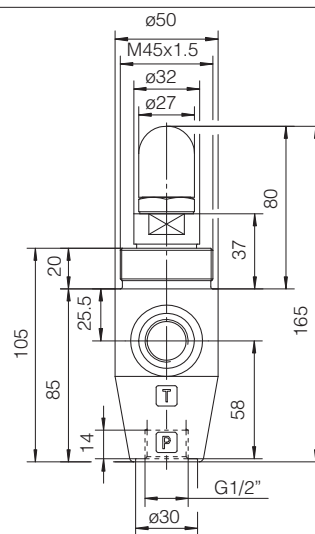
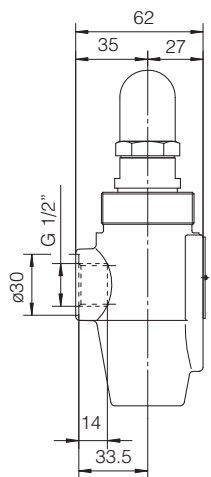
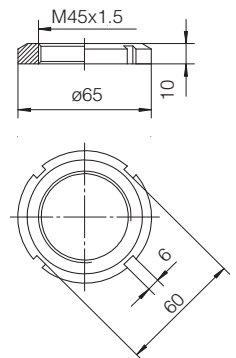


Option /VF /VS

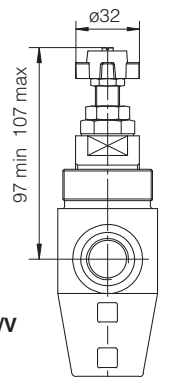
Mass: 1 Kg

ARE-15

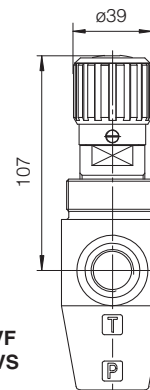
P = INLET PORT G 1/2"
T = OUTLET PORT G 1/2"
 Locking ring for fastening the valve.
 Model code: SP-6-RE-310030



Option /RS



Option /V



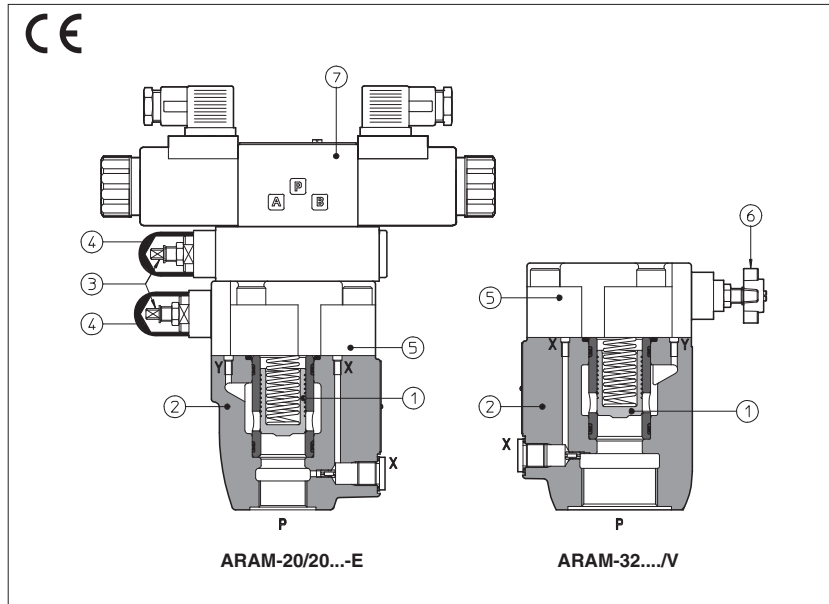
Option /VF /VS

Mass: 1,3 Kg

Note:
 For handwheel features, see technical table K150.

Pressure relief valves type ARAM

two stage, in line mounting - G 3/4" and G 1 1/4" threaded ports



ARAM are two stage pressure relief valves with balanced poppet, designed with threaded ports for in-line mounting.

In standard versions the piloting pressure of the poppet (1) of the main stage (2) is regulated by means of a grub screw (3) protected by cap (4) installed in the cover (5).

Optional versions with setting adjustment by handwheel (6) instead of the grub screw are available on request. Clockwise rotation increases the pressure.

ARAM can be equipped with a pilot solenoid valve (7) for venting or for different pressure setting, type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Threaded ports: **G 3/4", G 1 1/4"**

Max flow: **350, 500 l/min**

Max pressure up to **350 bar**

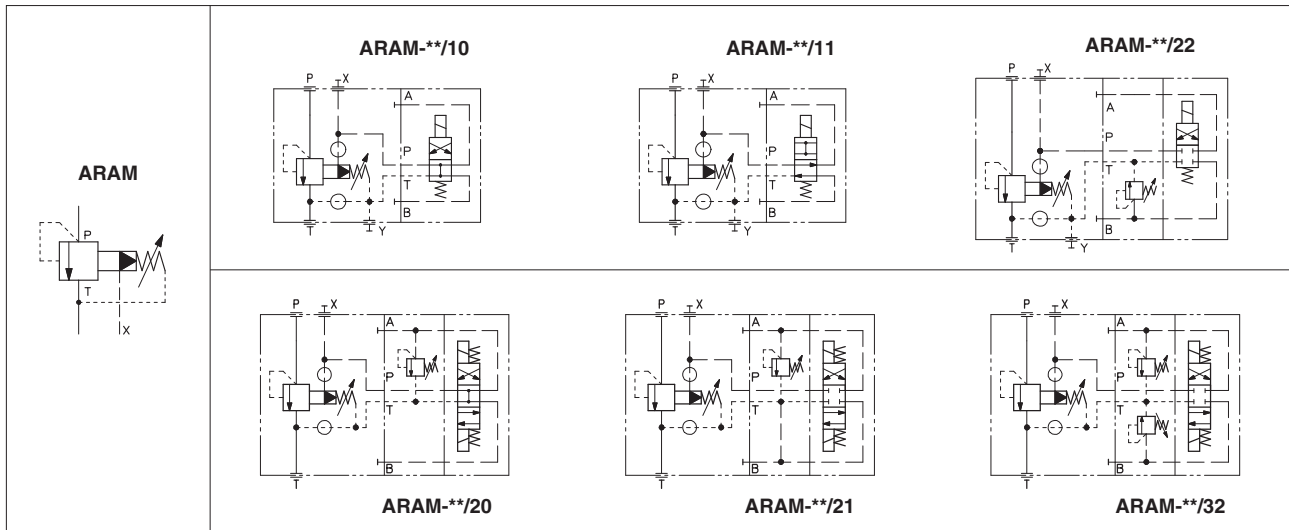
1 MODEL CODE

ARAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*
<p>ARAM = pressure relief valve threaded port connections</p> <p>Size: 20= port P - G 3/4" 32= port P - G 1 1/4"</p> <p>Setting pressure and venting option (1): - = one setting pressure without option 10= one setting pressure with venting, with de-energized solenoid 11= one setting pressure with venting, with energized solenoid 20= two setting pressure with venting, with de-energized solenoid 21= two setting pressure with venting, with energized solenoid 22= two setting pressure without venting 32= three setting pressure without venting</p> <p>Setting: see section 3 for available setting</p> <p>Pressure range of second/third setting (1): 50 = 4÷50 bar 100 = 6÷100 bar 210 = 7÷210 bar 350 = 8÷350 bar</p>														<p>Seals material, see section 4: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Voltage code, see section 7 (1):</p>			
<p>X = without connector (1): See section 4 for available connectors, to be ordered separately -00 = solenoid valve without coils (for -I) -00-AC = AC solenoid valve without coils (for -E) -00-DC = DC solenoid valve without coils (for -E)</p>																	
<p>Pilot valve (1): I = DHI for AC and DC supply, with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids</p>																	
<p>Options, see section 5 E V WP Y</p>																	

For **PE** version see technical table CY045

(1) Only for ARAM with solenoid valve for venting and/or for the selection of the setting pressure.

2 HYDRAULIC SYMBOL



3 HYDRAULIC CHARACTERISTICS

Valve model	ARAM-20				ARAM-32			
Setting [bar]	50; 100; 210; 350							
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350							
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015							
Max flow [l/min]	350				500			

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β ₂₅ ≥ 75 recommended)		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4.1 Coils characteristics (for ARAM with pilot solenoid valve)

Insulation class	DHI pilot	H (180°C)	Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See electric feature 7		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

5 OPTIONS

- /E** = external pilot
- /V** = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)
- /WP** = prolonged manual override protected by rubber cap (only for ARAM with pilot solenoid valve)
- /Y** = external drain (only for ARAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR ARAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

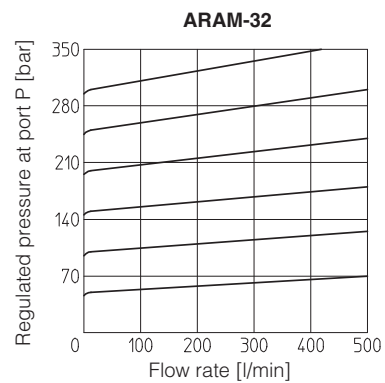
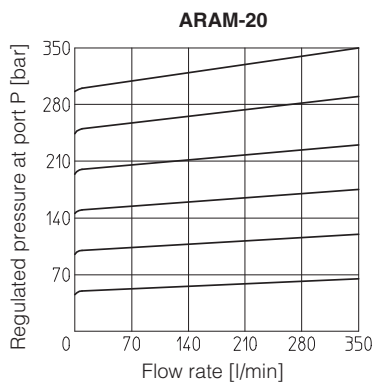
For other available connectors see tab. E010 and K500

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

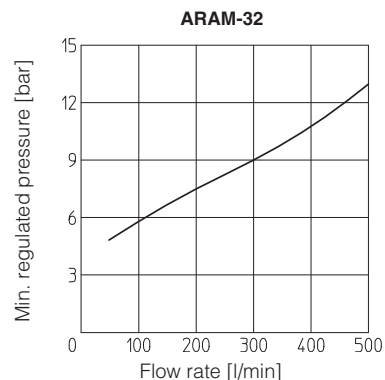
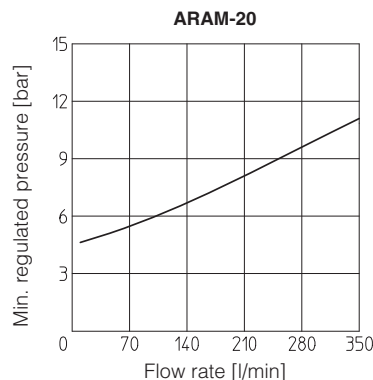
Solenoid valve type	External supply nominal voltage $\pm 10\%$ (1)		Voltage code	Type of connector	Power consumption (3)		Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
					DHI	DHE			
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC

- (1) For other supply voltages available on request see technical tables E010, E015.
- (2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA
- (3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
- (4) When solenoid is energized, the inrush current is approx 3 times the holding current.
- (5) Only for DHE
- (6) Only for DHI

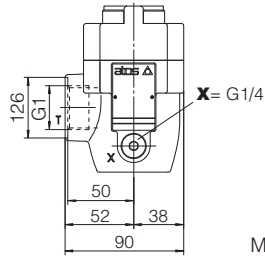
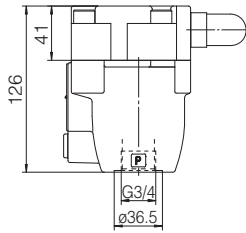
8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



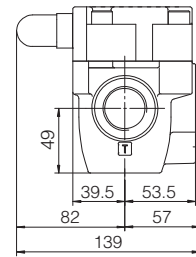
9 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



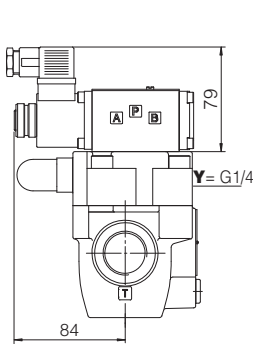
ARAM-20



Mass: 3,9 Kg

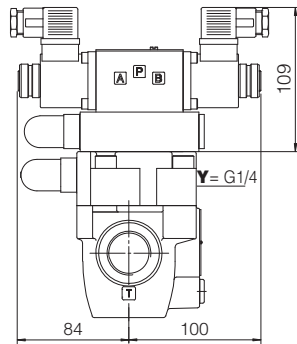


X = port connection for external pilot
Y = port connection for external drain



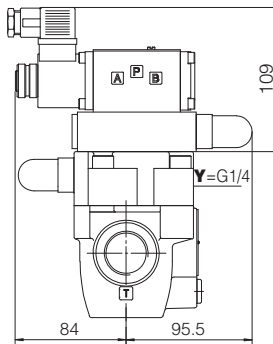
ARAM-20/10/-IX**
ARAM-20/11/-IX**

Mass: 5,4 Kg



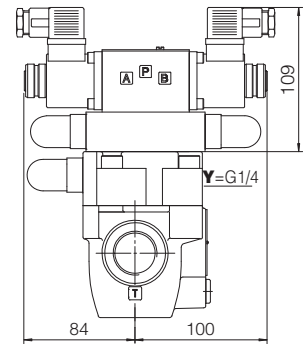
ARAM-20/20/-IX**
ARAM-20/21/-IX**

Mass: 7,1 Kg



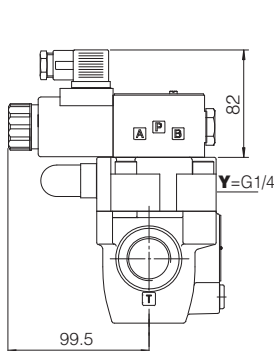
ARAM-20/22/-IX**

Mass: 6,8 Kg



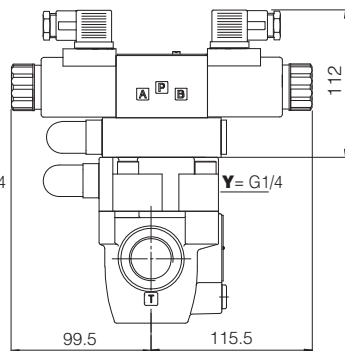
ARAM-20/32/-IX**

Mass: 7,4 Kg



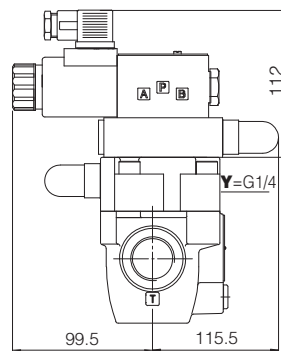
ARAM-20/10/-EX**
ARAM-20/11/-EX**

Mass: 5,7 Kg



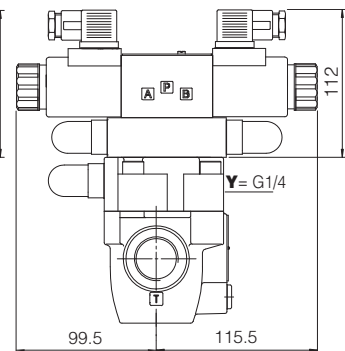
ARAM-20/20/-EX**
ARAM-20/21/-EX**

Mass: 7,7 Kg



ARAM-20/22/-EX**

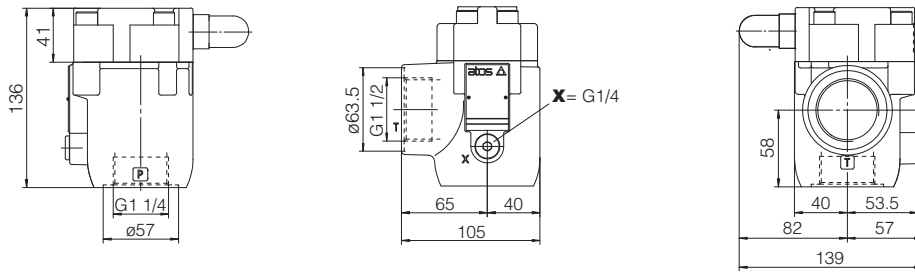
Mass: 7,2 Kg



ARAM-20/32/-EX**

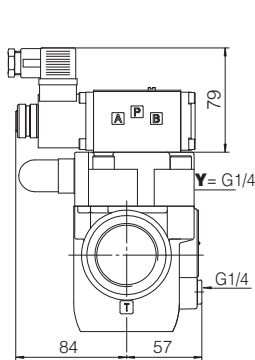
Mass: 8 Kg

ARAM-32



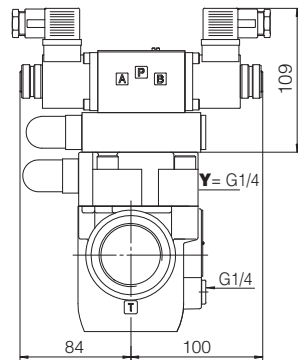
X = port connection for external pilot
Y = port connection for external drain

Mass: 4,7 Kg



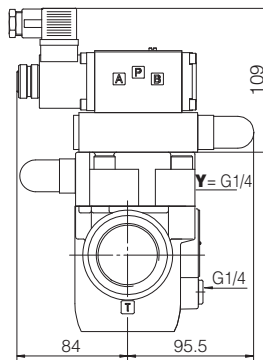
ARAM-32/10/-IX**
ARAM-32/11/-IX**

Mass: 6,2 Kg



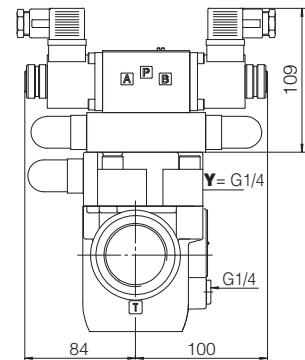
ARAM-32/20/-IX**
ARAM-32/21/-IX**

Mass: 7,9 Kg



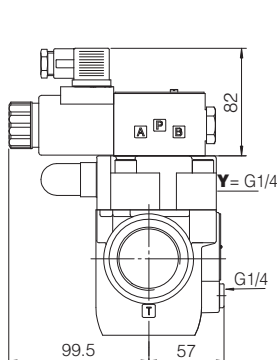
ARAM-32/22/-IX**

Mass: 7,6 Kg



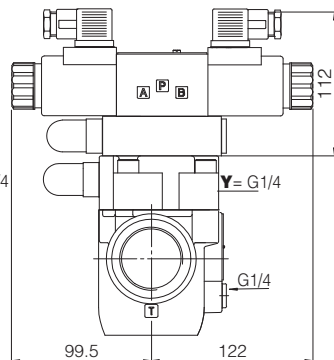
ARAM-32/32/-IX**

Mass: 8,2 Kg



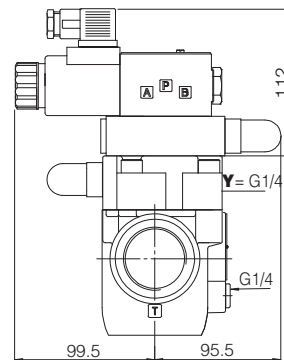
ARAM-32/10/-EX**
ARAM-32/11/-EX**

Mass: 6,5 Kg



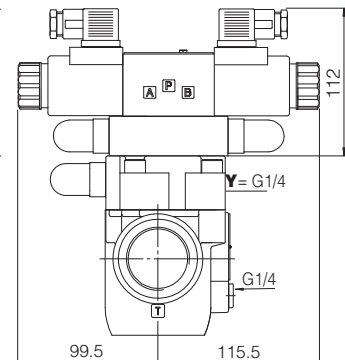
ARAM-32/20/-EX**
ARAM-32/21/-EX**

Mass: 8,5 Kg



ARAM-32/22/-EX**

Mass: 7,9 Kg



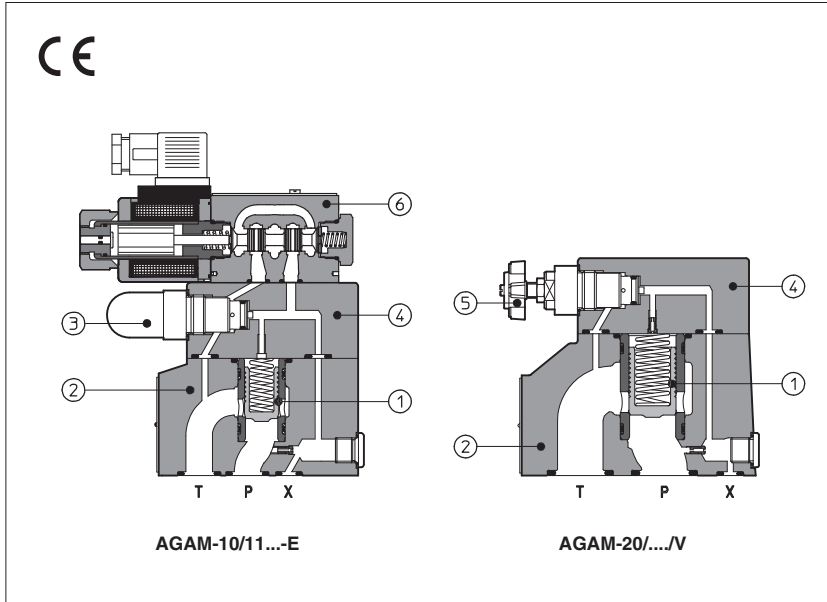
ARAM-32/32/-EX**

Mass: 8,8 Kg

Overall dimensions refer to valves with connectors type 666

Pressure relief valves type AGAM

two stage, subplate mounting - ISO 6264 size 10, 20 and 32



AGAM are two stage pressure relief valves with balanced poppet, designed to operate in oil hydraulic systems.

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw protected by cap ③ in the cover ④.

Optional versions with setting adjustment by handwheel ⑤ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

AGAM can be equipped with a pilot solenoid valve ⑥ for venting or for different pressure setting type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances with **cURus** certified solenoids

Mounting surface: **ISO 6264 size 10, 20 and 32**

Max flow: **200, 400 and 600 l/min**

Max pressure up to **350 bar**

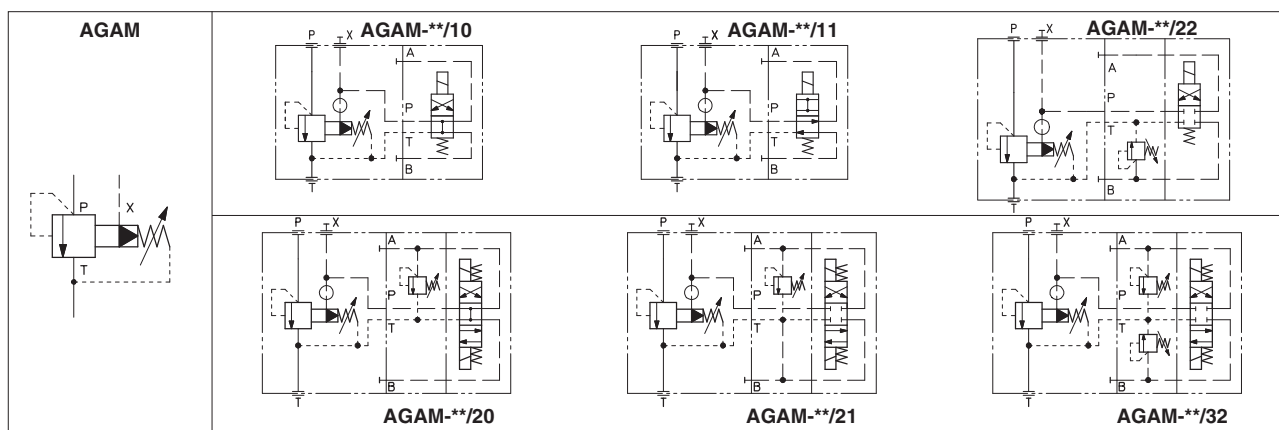
1 MODEL CODE

AGAM	-	20	/	20	/	210	/	100/100	/	V	-	I	X	24DC	**	/	*
<p>AGAM = pressure relief valve subplate mounting</p> <p>Size: 10 20 32</p> <p>Setting pressure and venting option: - = one setting pressure without option 10 = one setting pressure with venting, with de-energized solenoid 11 = one setting pressure with venting, with energized solenoid 20 = two setting pressure with venting, with de-energized solenoid 21 = two setting pressure with venting, with energized solenoid 22 = two setting pressure without venting 32 = three setting pressure without venting</p> <p>Setting: see section 3 for available setting (1)</p> <p>Pressure range of second/third setting (1): 50 = 4÷50 bar 100 = 6÷100 bar 210 = 7÷210 bar 350 = 8÷350 bar</p>																	
<p>Seals material, see section 4:</p> <p>- = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Voltage code, see section 8 (1):</p> <p>X = without connector (1): See section 7 for available connectors, to be ordered separately</p> <p>-00 = solenoid valve without coils (for -I) -00-AC = AC solenoid valve without coils (for -E) -00-DC = DC solenoid valve without coils (for -E)</p> <p>Pilot valve (1): I = DHI for AC and DC supply, with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids</p> <p>Options, see section 5: E V WP Y</p>																	

For **PED** version see technical table CY066

(1) Only for AGAM with solenoid valve for venting and/or for the selection of the setting pressure

2 HYDRAULIC SYMBOLS



3 HYDRAULIC CHARACTERISTICS

Valve model	AGAM-10	AGAM-20	AGAM-32
Setting [bar]	50; 100; 210; 350		
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350		
Max pressure [bar]	ports P, X = 350 Ports T, Y = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		
Max flow [l/min]	200	400	600

4 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4.1 Coils characteristics (for AGAM with pilot solenoid valve)

Insulation class	DHI pilot	H (180°C)	Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See electric feature		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

5 OPTIONS

/E = external pilot

/V = regulating handwheel instead of grub screw protected by cap (for handwheel features, see table K150)

/WP = prolonged manual override protected by rubber cap (only for AGAM with pilot solenoid valve)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

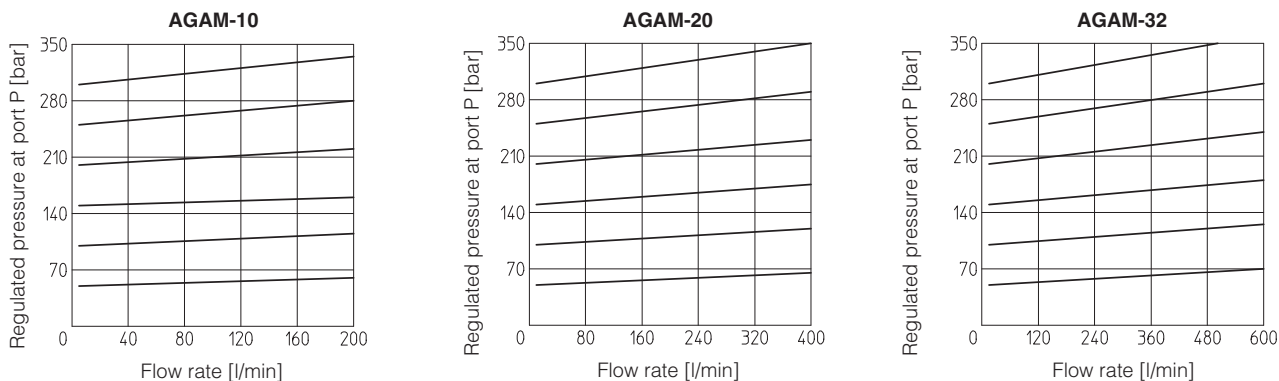
For other available connectors, see tab. E010 and K500

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

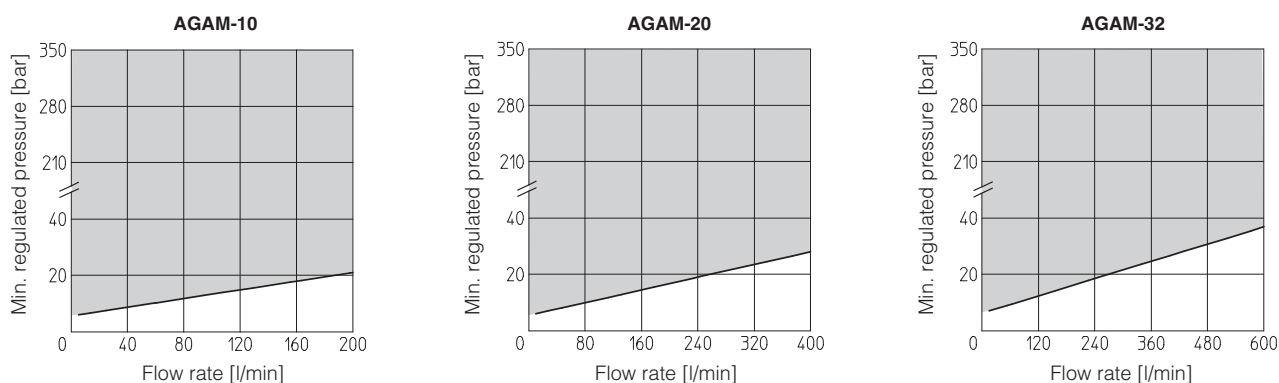
Solenoid valve type	External supply nominal voltage $\pm 10\%$ (1)		Voltage code	Type of connector	Power consumption (3)		Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
					DHI	DHE			
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
		AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC (5) 120/60 AC (6) 230/50/60 AC 230/60 AC	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver

- (1) For other supply voltages available on request see technical tables E010, E015.
- (2) Coil can be supplied also with 60 Hz of voltage frequency; in this case the performances are reduced by $10 \div 15\%$ and the power consumption is 55 VA (DHI) and 58 VA
- (3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
- (4) When AC solenoid is energized, the inrush current is approx 3 times the holding current.
- (5) Only for DHE
- (6) Only for DHI

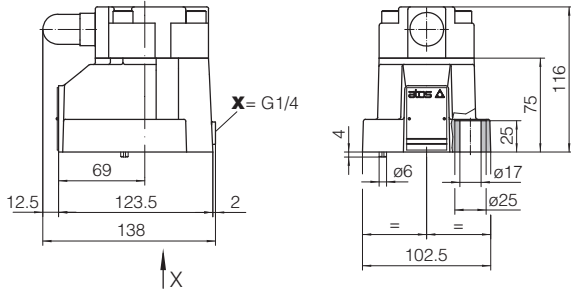
8 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



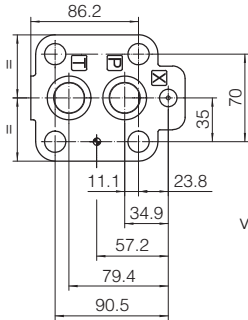
9 PERMISSIBLE RANGE (shared area) based on mineral oil ISO VG 46 at 50°C



AGAM-20



Mass: 4,8Kg



view from X

ISO 6264: 2007

Mounting surface: 6264-08-11-1-97

Fastening bolts:

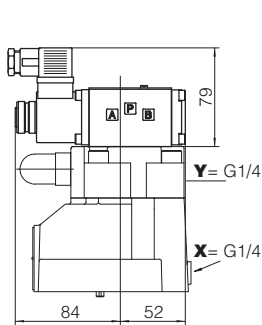
4 socket head screws M16x50 class 12.9

Tightening torque = 300 Nm

Seals: 2 OR 4112; 1 OR 109/70

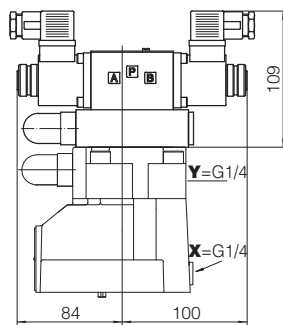
Ports P, T: $\varnothing = 24$ mm

Ports X: $\varnothing = 3,2$ mm



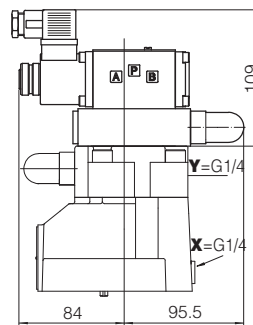
AGAM-20/10/-IX**
AGAM-20/11/-IX**

Mass: 6,3 Kg



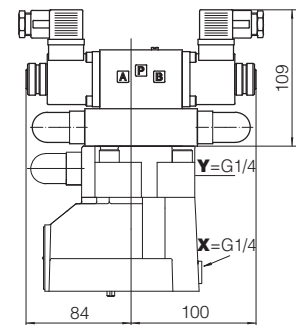
AGAM-20/20/-IX**
AGAM-20/21/-IX**

Mass: 7,4Kg



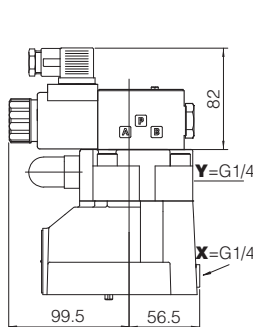
AGAM-20/22/-IX**

Mass: 7,1 Kg



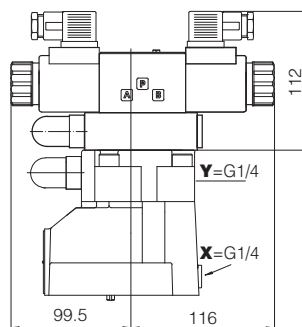
AGAM-20/32/-IX**

Mass: 7,5 Kg



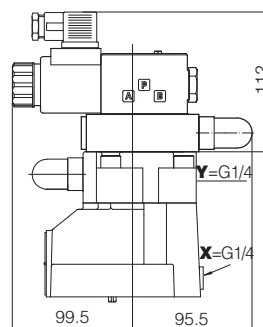
AGAM-20/10/-EX**
AGAM-20/11/-EX**

Mass: 6,3 Kg



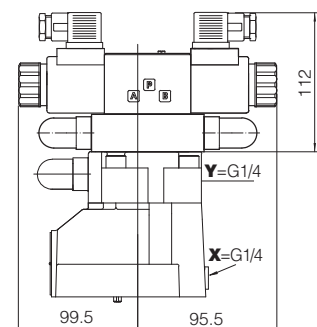
AGAM-20/20/-EX**
AGAM-20/21/-EX**

Mass: 7,4 Kg



AGAM-20/22/-EX**

Mass: 7,1 Kg

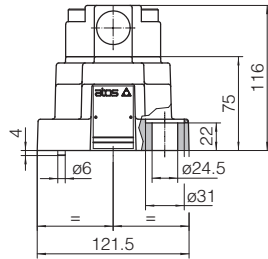
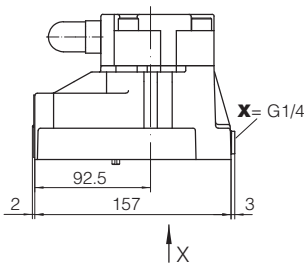


AGAM-20/32/-EX**

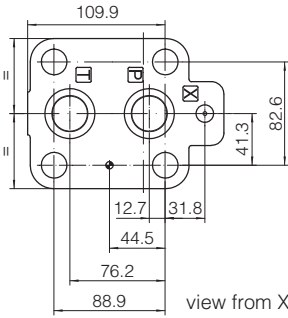
Mass: 7,5 Kg

Overall dimensions refer to valves with connectors type 666

AGAM-32



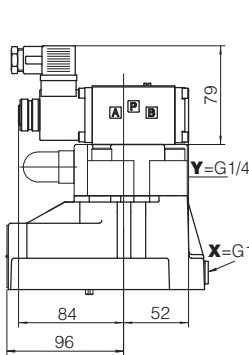
Mass: 6,2 Kg



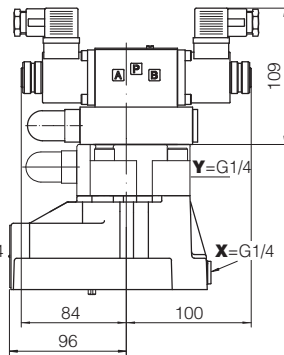
view from X

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)

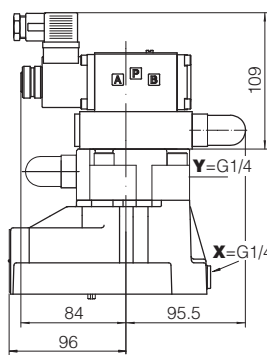
Fastening bolts:
 4 socket head screws
 M20x60 class 12.9
 Tightening torque = 600 Nm
 Seals: 2 OR 4131; 1 OR 109/70
 Ports P, T: $\varnothing = 28,5$ mm
 Ports X: $\varnothing = 3,2$ mm



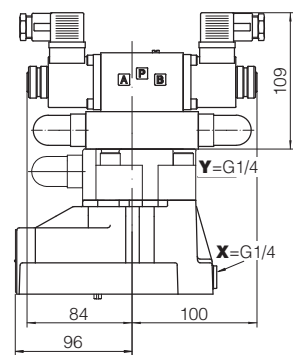
AGAM-32/10/-IX**
AGAM-32/11/-IX**
 Mass: 7,7 Kg



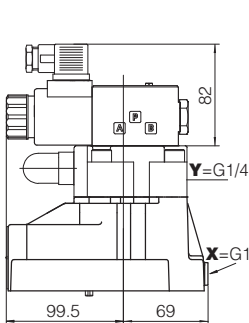
AGAM-32/20/-IX**
AGAM-32/21/-IX**
 Mass: 8,8 Kg



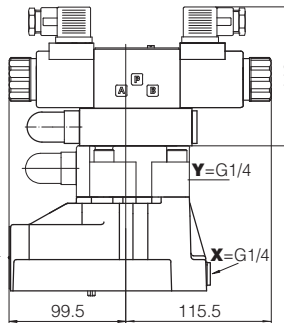
AGAM-32/22/-IX**
 Mass: 8,5 Kg



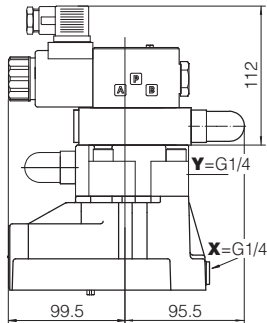
AGAM-32/32/-IX**
 Mass: 8,9 Kg



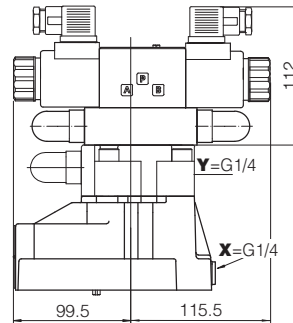
AGAM-32/10/-EX**
AGAM-32/11/-EX**
 Mass: 7,7 Kg



AGAM-32/20/-EX**
AGAM-32/21/-EX**
 Mass: 8,8 Kg



AGAM-32/22/-EX**
 Mass: 8,5 Kg



AGAM-32/32/-EX**
 Mass: 8,9 Kg

Overall dimensions refer to valves with connectors type 666

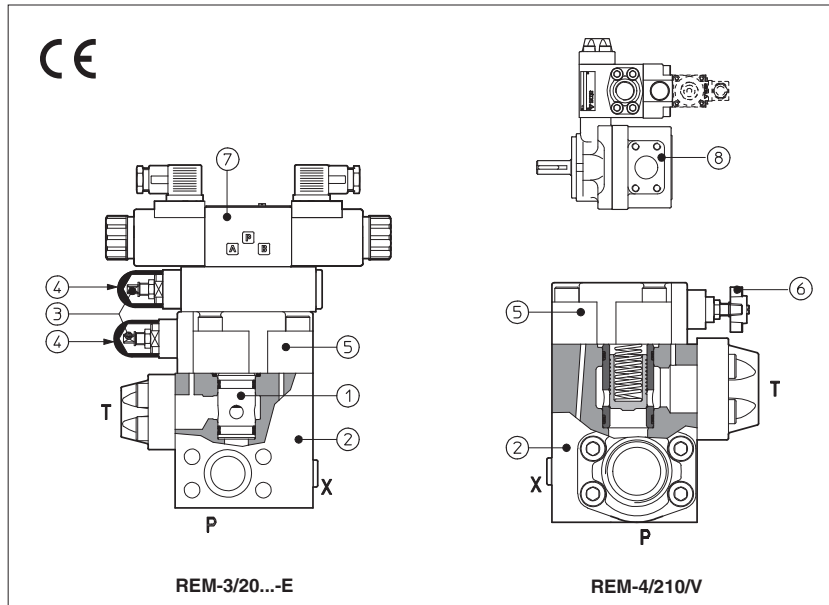
12 MOUNTING SUBPLATES

Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

The subplates are supplied with fastening bolts. For further details see table K280

Pressure relief valves type REM

two stage, flange mounting SAE 3/4", 1", 1 1/4"



REM are two stage pressure relief valves with balanced poppet and SAE flange connection, designed to operate in oil hydraulic systems.

They can be directly mounted with SAE flange attachments on the pumps outlet ports ⑧ and, in particular, on the PFE pumps (see tab. A005, A007).

In standard versions the piloting pressure of the poppet ① of the main stage ② is regulated by means of a grub screw ③ protected by cap ④ in the cover ⑤.

Optional versions with setting adjustment by handwheel ⑥ instead of the grub screw are available on request.

Clockwise rotation increases the pressure.

REM can be equipped with a venting solenoid valve ⑦ type:

- DHI for AC and DC supply, with **cURus** certified solenoids
- DHE for AC and DC supply, high performances, with **cURus** certified solenoids

Mounting surface:

SAE flange connection: **3/4", 1", 1 1/4"**

Max flow: **200, 400 and 600 l/min** respectively

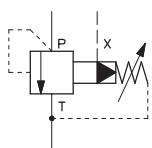
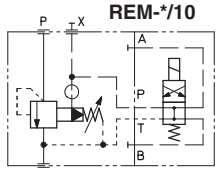
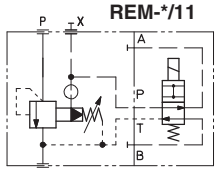
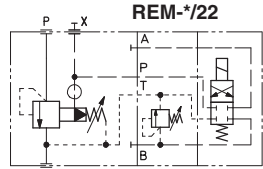
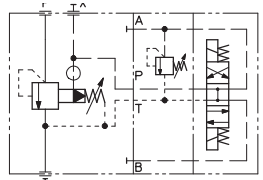
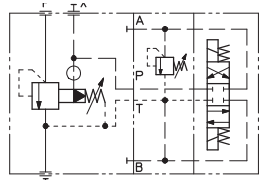
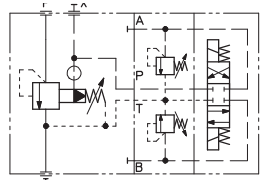
Pressure up to **350 bar** (depending on models)

1 MODEL CODE														
REM	-	4	/	20		210	/	100/100	/	V - I	X	24DC	** /	*
REM = pressure relief valve SAE flange mounting Size: 3 = SAE 3/4" 4 = SAE 1" 5 = SAE 1 1/4"											Seals material, see section 4: - = NBR PE = FKM BT = HNBR Series number Voltage code, see section 7			
Setting pressure and venting option (1): - = one setting pressure without option 10 = one setting pressure with venting, with de-energized solenoid 11 = one setting pressure with venting, with energized solenoid 20 = two setting pressure with venting, with de-energized solenoid 21 = two setting pressure with venting, with energized solenoid 22 = two setting pressure without venting 32 = three setting pressure without venting											X = without connector (1): See section 7 for available connectors, to be ordered separately -00 = solenoid valve without coils (for -I) -00-AC = AC solenoid valve without coils (for -E) -00-DC = DC solenoid valve without coils (for -E)			
Pressure range: 50 = 4÷50 bar; 100 = 6÷100 bar; 210 = 7÷210 bar; 350 = 8÷350 bar (only for REM-3)											Pilot valve (1): -I = DHI for AC and DC supply with cURus certified solenoids -E = DHE for AC and DC supply, high performances with cURus certified solenoids			
Pressure range of second/third setting (1): 50 = 4÷50 bar; 100 = 6÷100 bar; 210 = 7÷210 bar; 350 = 8÷350 bar (only for REM-3)											Options (2): WP = prolonged manual override protected by rubber cap (1) V = regulating by handwheel instead of a grub screw protected by cap			

(1) Only for REM with solenoid valve for venting and/or for the selection of the setting pressure

(2) For handwheel features, see technical table K150


2 HYDRAULIC CHARACTERISTICS

			
			
Valve model	REM-3	REM-4	REM-5
Max flow [l/min]	200	400	600
Pressure range [bar]	4-50; 6-100; 7-210; 8-350	4-50; 6-100; 7-210	
Max pressure [bar]	ports P, X = 350 Port T = 210 (without pilot solenoid valve) For version with pilot solenoid valve, see technical tables E010 and E015		

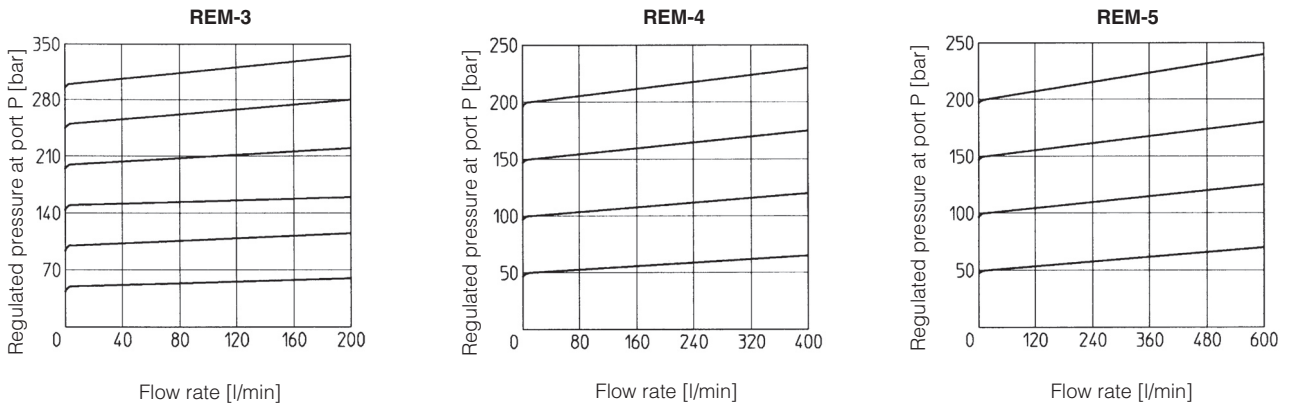
3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in above table, consult our technical office

Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVL, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	
Flame resistant with water	NBR, HNBR	HFC	ISO 12922

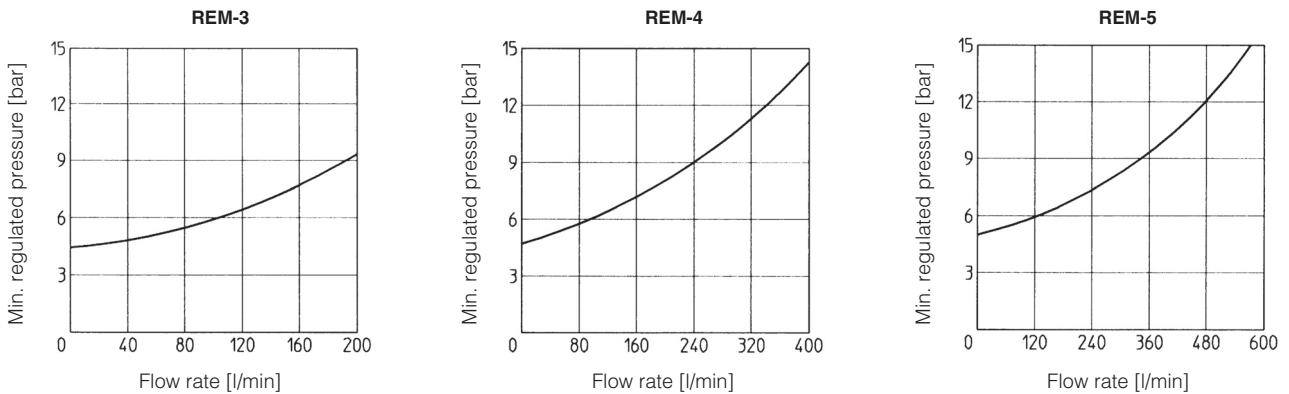
3.1 Coils characteristics (for ARAM with pilot solenoid valve)

Insulation class	DHI pilot	H (180°C)	Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See electric feature 		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40°



5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on fluid viscosity of 25 mm²/s at 40° C



6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR REM WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500.

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)	Voltage code	Type of connector	Power consumption (3)		Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
				DHI	DHE			
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC (5) 120/60 AC (6) 230/50 AC (2) 230/60 AC	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages available on request see technical tables E010, E015.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

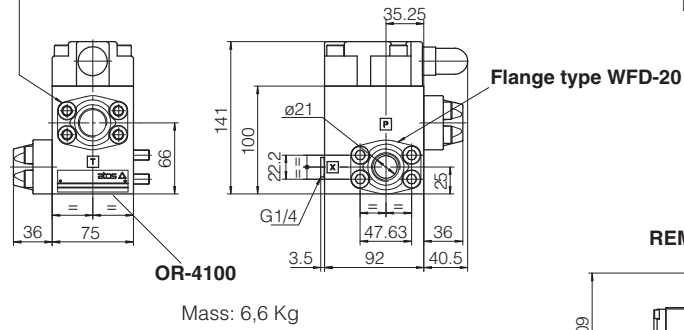
(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

(5) Only for DHE

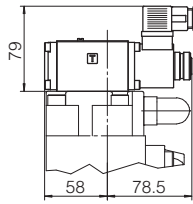
(6) Only for DHI

REM-3

Flange type WFD-20

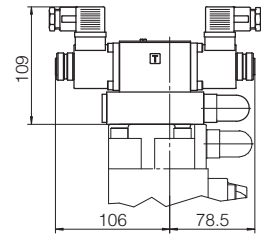


REM-3/10/**-IX
REM-3/11/**-IX



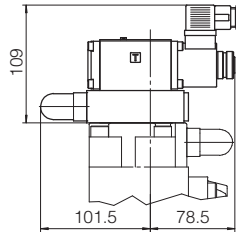
Mass: 8,1 Kg

REM-3/20/**-IX
REM-3/21/**-IX



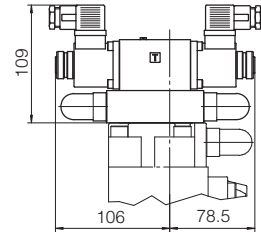
Mass: 9,2 Kg

REM-3/22/**-IX



Mass: 8,9 Kg

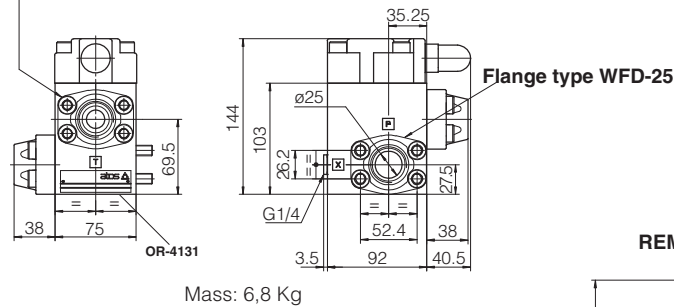
REM-3/32/**-IX



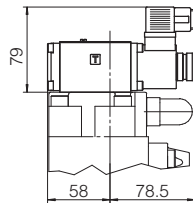
Mass: 9,3 Kg

REM-4

Flange type WFD-25

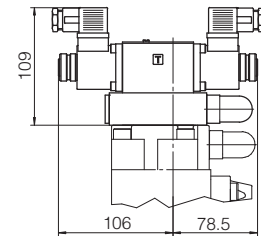


REM-4/10/**-IX
REM-4/11/**-IX



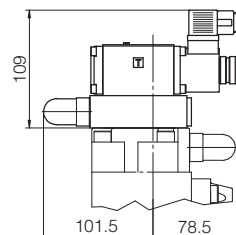
Mass: 8,3 Kg

REM-4/20/**-IX
REM-4/21/**-IX



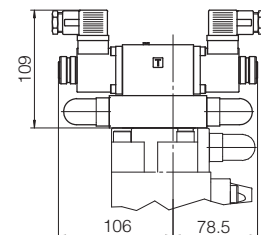
Mass: 9,4 Kg

REM-4/22/**-IX



Mass: 9,1 Kg

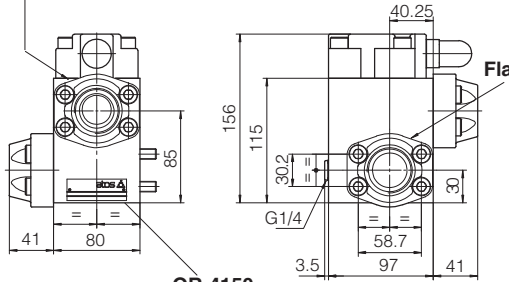
REM-4/32/**-IX



Mass: 9,5 Kg

REM-5

Flange type WFD-32

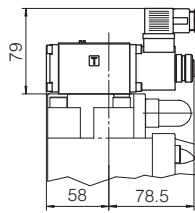


OR-4150

Mass: 8,2 Kg

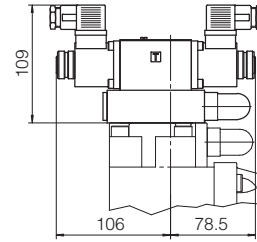
Flange type WFD-32

REM-5/10/-IX
REM-5/11/**-IX**



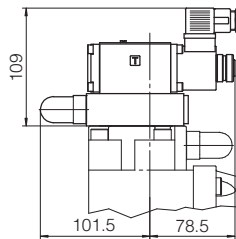
Mass: 9,7 Kg

REM-5/20/-IX
REM-5/21/**-IX**



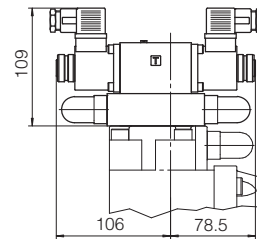
Mass: 10,8 Kg

REM-5/22/-IX**



Mass: 10,5 Kg

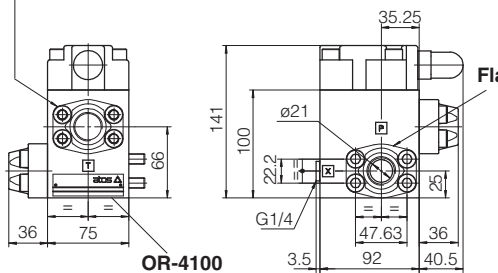
REM-5/32/-IX**



Mass: 10,9 Kg

REM-3

Flange type WFD-20

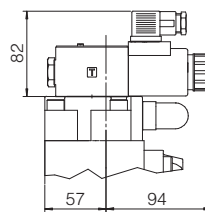


OR-4100

Mass: 6,6 Kg

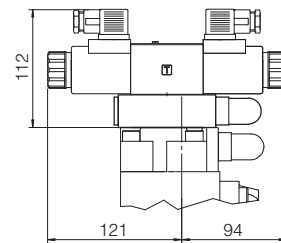
Flange type WFD-20

REM-3/10/-EX
REM-3/11/**-EX**



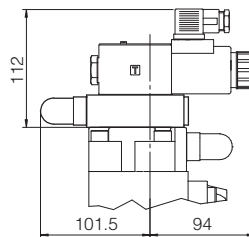
Mass: 8,1 Kg

REM-3/20/-EX
REM-3/21/**-EX**



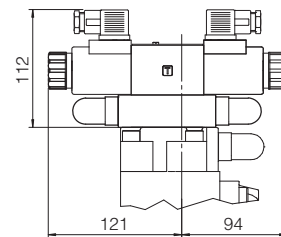
Mass: 9,2 Kg

REM-3/22/-EX**



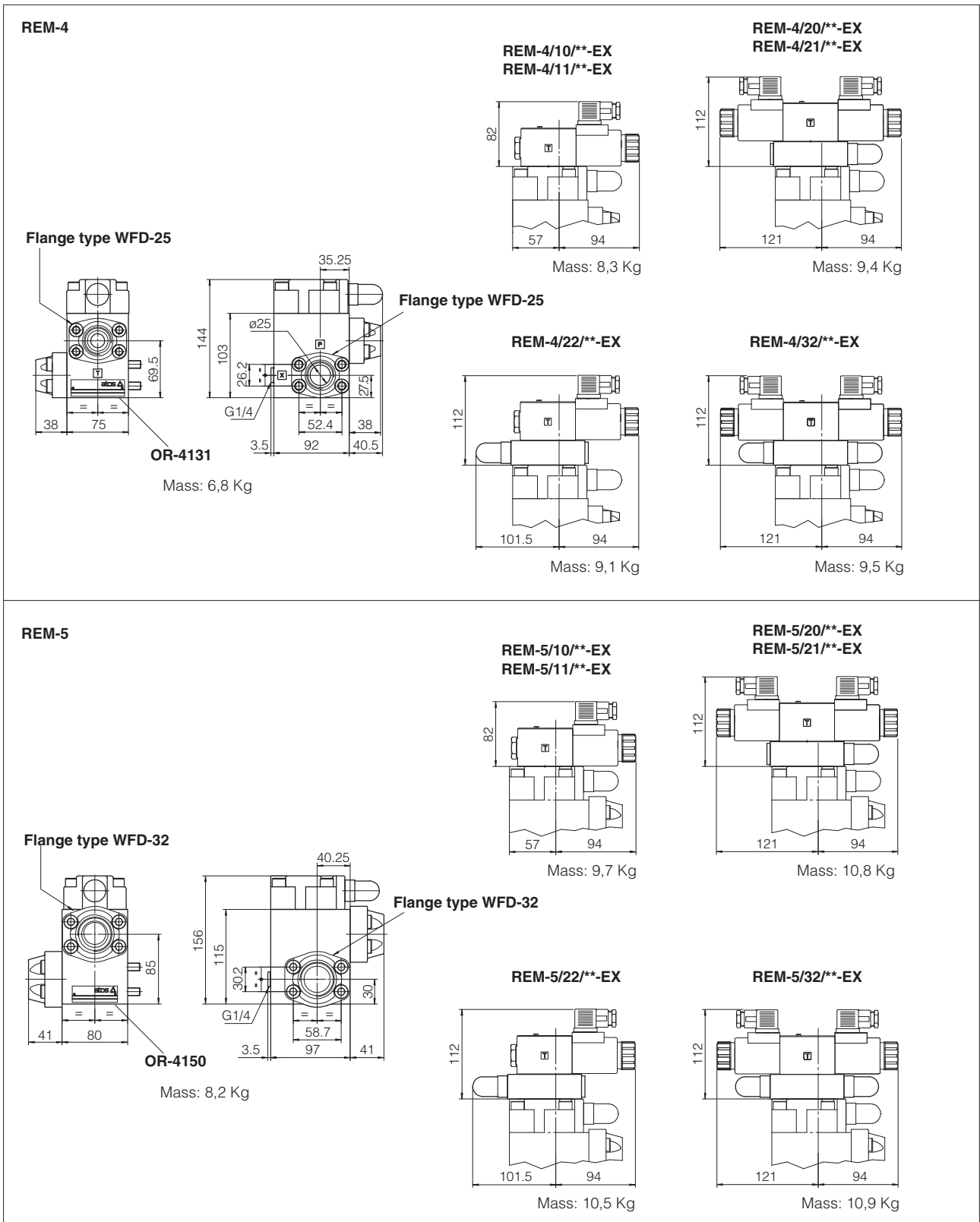
Mass: 8,9 Kg

REM-3/32/-EX**



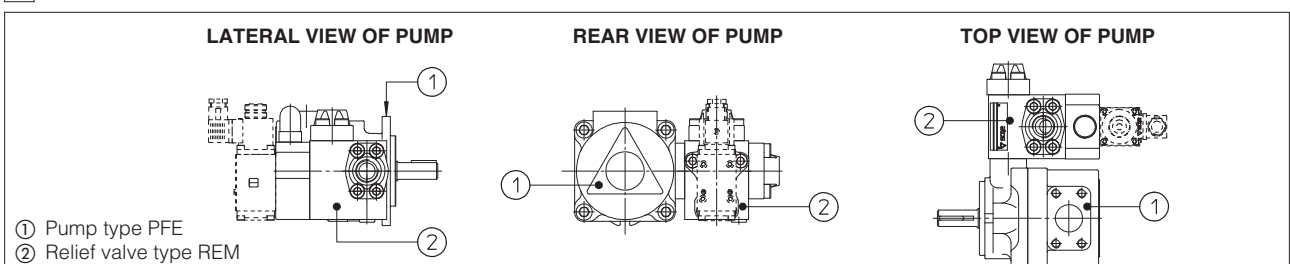
Mass: 9,3 Kg

9 DIMENSIONS [mm]



Overall dimensions refer to valves with connectors type 666

10 ASSEMBLY EXAMPLE OF A REM VALVE ON A PFE PUMP



2 HYDRAULIC CHARACTERISTICS

Valve model	AGIR-10	AGIR-20	AGIR-32	AGIS-10	AGIS-20	AGIS-32	AGIU-10	AGIU-20	AGIU-32
Max flow [l/min]	160	300	400	200	400	600	100	200	300
Pressure range [bar]	4÷50 (AGIR*);			6÷100;		7÷210;	8÷350		
Max pressure [bar]	Ports A, B, X = 350 bar					Port Y = 0			

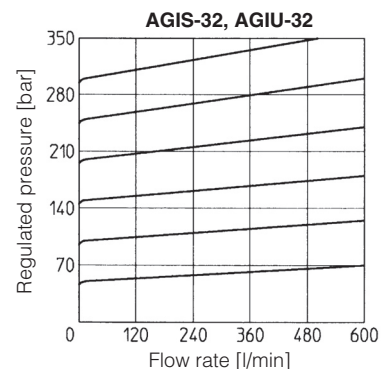
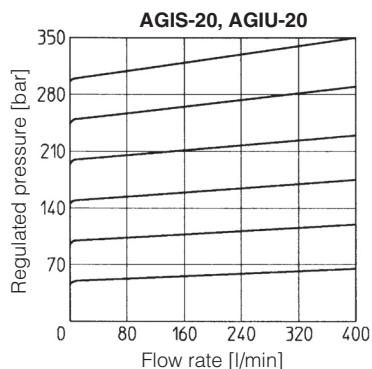
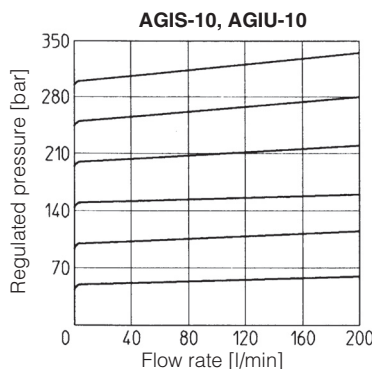
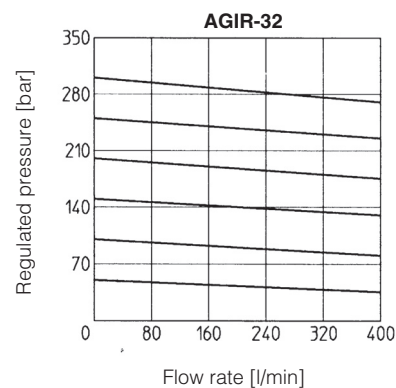
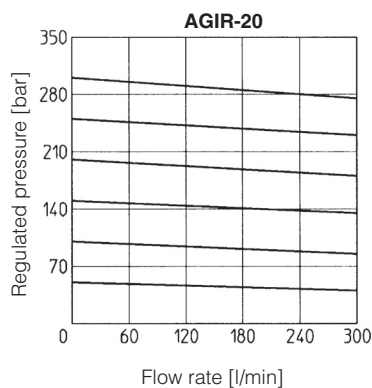
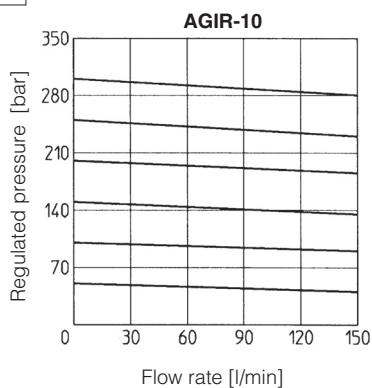
3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

3.1 Coils characteristics

Insulation class	DHI pilot	H (180°C)	Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See electric feature		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C



Note: for AGIU-10, the max flow rate is 100 l/min

Note: for AGIU-20, the max flow rate is 200 l/min

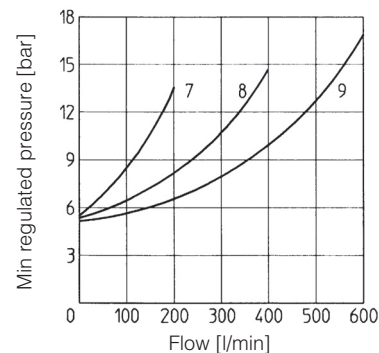
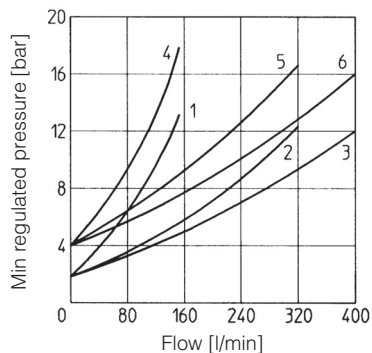
Note: for AGIU-32, the max flow rate is 300 l/min

5 OPERATING DIAGRAM

based on mineral oil ISO VG 46 at 50°C

- 1 = AGIR-10 A → B
- 2 = AGIR-20 A → B
- 3 = AGIR-32 A → B
- 4 = AGIR-10 B → A
- 5 = AGIR-20 B → A
- 6 = AGIR-32 B → A

- 7 = AGIS-10
- 8 = AGIS-20
- 9 = AGIS-32

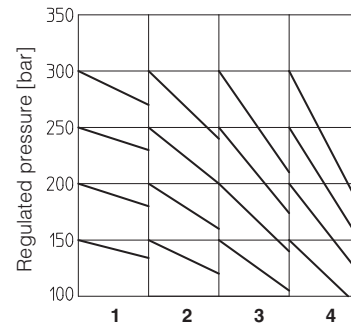
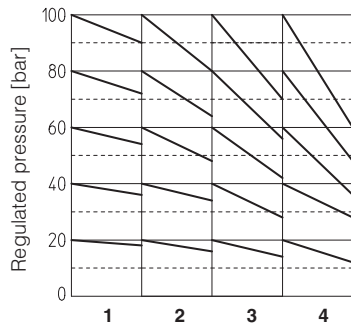


Opening/closing diagram for AGIU

- 1 = AGIU-*/... (standard) 3 = AGIU-*/.../6
- 2 = AGIU-*/.../5 4 = AGIU-*/.../7

NOTES

- 1) Short pipes with low resistance must be used between the unloading valve and the accumulator;
- 2) When the resistance is high, the hydraulic pilot signal must be taken as closed as possible to the accumulator;
- 3) With high pump flow and small valve differential pressure of intervention it is advisable to use the version with external drain;
- 4) When to use the BA-*25 subplates:
 - a) in applications with working frequencies >10 Hz use subplates type BA-*25/4 (spring with 4 bar of cracking pressure);
 - b) in applications with working frequencies <10 Hz use subplates type BA-*25/2 (spring with 2 bar of cracking pressure);



6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGIU WITH SOLENOID VALVE

The connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tab. E010 and K500

7 ELECTRIC FEATURES FOR AGAM WITH SOLENOID VALVE

Solenoid valve type	External supply nominal voltage ± 10% (1)		Voltage code	Type of connector	Power consumption (3)		Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE
					DHI	DHE			
DHI DHE	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
		AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC (5) 120/60 AC (6) 230/50/60 AC 230/60 AC	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver

(1) For other supply voltages available on request see technical tables E010, E015.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI) and 58 VA

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current.

(5) Only for DHE

(6) Only for DHI

8 DIMENSIONS [mm]

AGIR, AGIS, AGIU size 10

ISO 5781: 2000

Mounting surface: 5781-06-07-0-00

Fastening bolts:

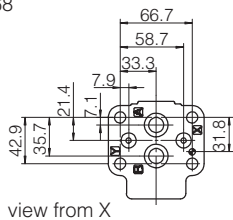
4 socket head screws M10x45 class 12.9

Tightening torque = 70 Nm

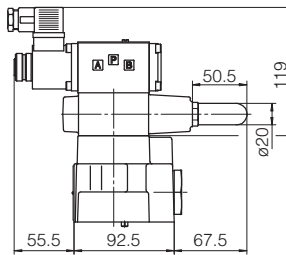
Seals: 2 OR 109/70, 2 OR 3068

Ports A, B: Ø = 14 mm

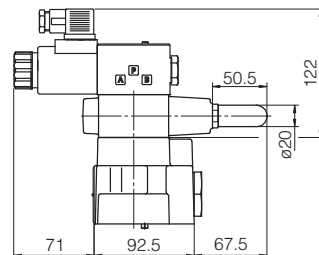
Ports X, Y: Ø = 5 mm



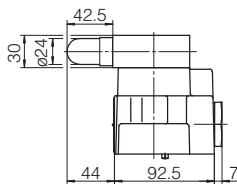
view from X



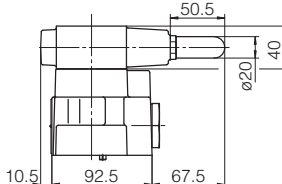
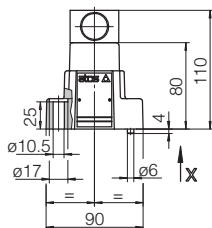
AGIU-10/10/-IX**
Mass = 5,3 Kg



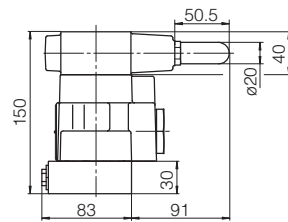
AGIU-10/10/-EX**
Mass = 5,6 Kg



AGIR-10; Mass= 3,3 Kg
AGIRR-10; Mass= 3,5 Kg



AGIS-10; Mass= 3,8 Kg
AGIU-10; Mass= 3,8 Kg



AGISR-10; Mass= 5,3 Kg

AGIR, AGIS, AGIU size 20

ISO 5781: 2000

Mounting surface: 5781-08-10-0-00

Fastening bolts:

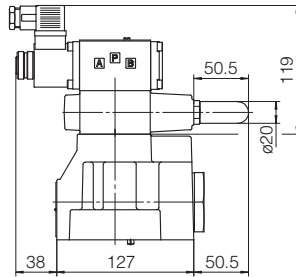
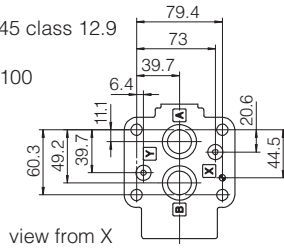
4 socket head screws M10x45 class 12.9

Tightening torque = 70 Nm

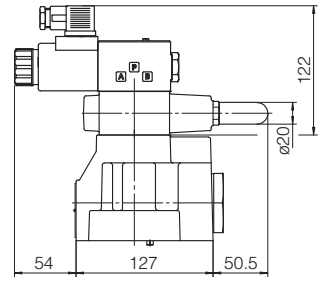
Seals: 2 OR 109/70, 2 OR 4100

Ports A, B: Ø = 22 mm

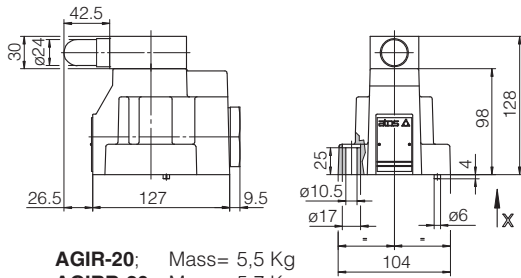
Ports X, Y: Ø = 5 mm



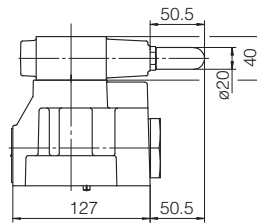
AGIU-20/10/-IX**
Mass = 7,5 Kg



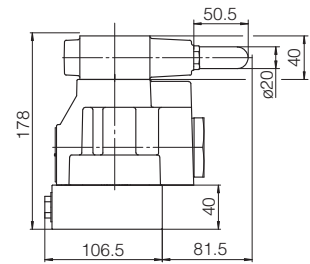
AGIU-20/10/-EX**
Mass = 7,8 Kg



AGIR-20; Mass= 5,5 Kg
AGIRR-20; Mass= 5,7 Kg



AGIS-20; Mass= 6 Kg
AGIU-20; Mass= 6 Kg



AGISR-20; Mass= 9 Kg

AGIR, AGIS, AGIU size 32

ISO 5781: 2000

Mounting surface: 5781-10-13-0-00

Fastening bolts:

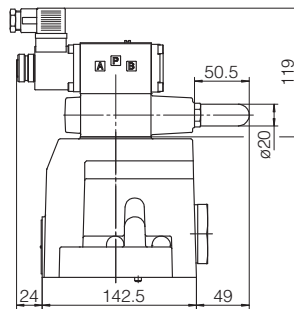
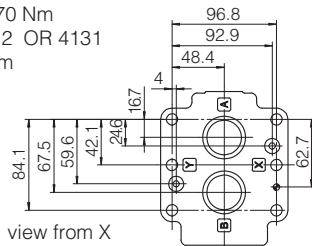
6 socket head screws M10x45 class 12.9

Tightening torque = 70 Nm

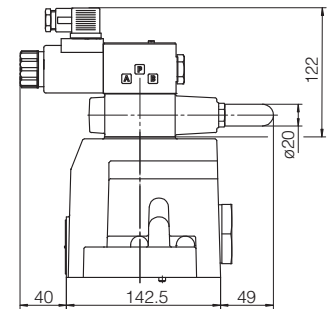
Seals: 2 OR 109/70, 2 OR 4131

Ports A, B: Ø = 28 mm

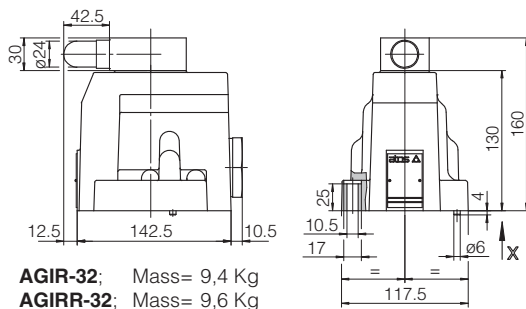
Ports X, Y: Ø = 5 mm



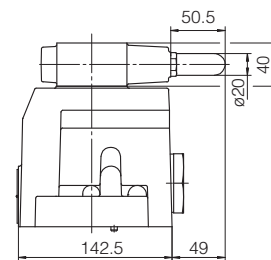
AGIU-32/10/-IX**
Mass = 11,4 Kg



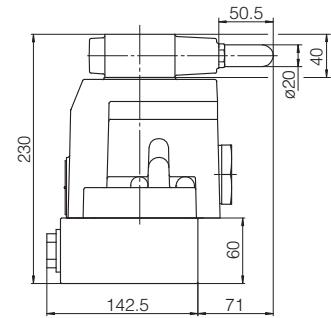
AGIU-32/10/-EX**
Mass = 11,7 Kg



AGIR-32; Mass= 9,4 Kg
AGIRR-32; Mass= 9,6 Kg



AGIS-32; Mass= 9,9 Kg
AGIU-32; Mass= 9,9 Kg



AGISR-32; Mass= 15.5 Kg

Overall dimensions refer to valves with connectors type 666

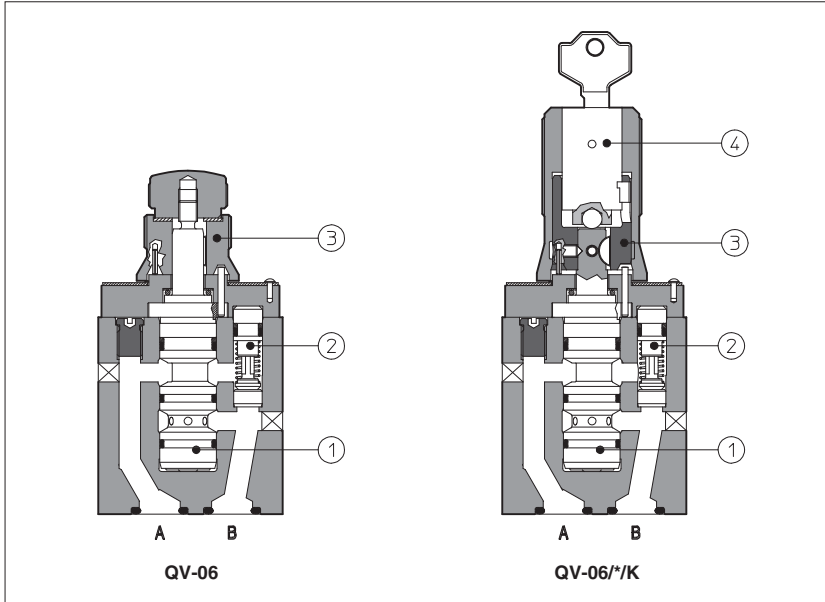
9 MOUNTING SUBPLATES

Valves	Subplate model	Port location	Ports				Ø Counterbore [mm]				Mass [Kg]
			A	B	X-Y	OUT	A	B	X-Y	OUT	
AGI*-10	BA-305	Ports A, B, Y underneath;	G 1/2"	G 1/2"	G 1/4"	-	30	30	21,5	-	1
AGI*-20	BA-505		G 1"	G 1"	G 1/4"	-	46	46	21,5	-	2
AGI*-32	BA-705		G 1 1/2"	G 1 1/2"	G 1/4"	-	63,5	63,5	21,5	-	7,5
AGIU-10	BA-325 (with incorporated check valve)	G 1/2"	G 3/4"	G 1/4"	G 1/2"	30	36,5	21,5	30	5	
AGIU-20	BA-425 (with incorporated check valve)	Ports A, B, Y underneath;	G 1"	G 1"	G 1/4"	G 1"	46	46	21,5	46	6,5
AGIU-32	BA-625 (with incorporated check valve)		G 1 1/2"	G 1 1/2"	G 1/4"	G 1 1/2"	63,5	63,5	21,5	63,5	13

The subplates are supplied with fastening bolts. For further details see table K280

Flow control valves type QV-06

pressure compensated, two way, ISO 4401 size 06



QV are flow control valves with pressure compensator ①: the controlled flow rate is independent of pressure variations.

They are usually supplied with a built-in check valve ② to allow the free flow in the opposite direction.

The flow is regulated by turning a graduate micrometer knob ③. Clockwise rotation increases the flow regulation.

Optional versions with locking key ④ on the adjustment knob are available on request.

ISO 4401 size 06.

Flow up to 1,5; 6; 11; 16; 24 l/min (depending on models).
Pressure up to 250 bar.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

QV	-	06	/	6	/	K	**	/	*
Pressure compensated flow control valve						Series number			
Size: 06						Seals material, see section 3:			
Maximum adjustable flow rate:						- = NBR PE = FKM BT = HNBR			
1 = 1,5 l/min 11 = 11 l/min 24 = 24 l/min 6 = 6 l/min 16 = 16 l/min						Options:			
						K = with lock key for the setting knob V = without by-pass check valve			

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols					
	with check valve (standard)		without check valve (option V)		
Valve model	QV-06/1	QV-06/6	QV-06/11	QV-06/16	QV-06/24
Max regulated flow [l/min]	1,5	6	11	16	24
Min regulated flow [cm³/min]	50				
Max flow B→A through check valve [l/min]	24				
Regulating Δp [bar]	3	3	5	6,5	8
Max flow on port A [l/min]	24				
Max pressure [bar]	250				

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

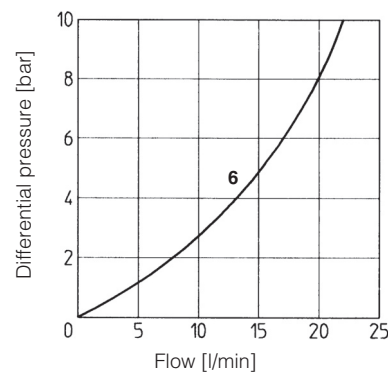
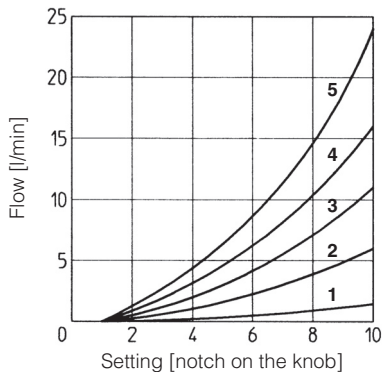
4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

4.1 Regulation diagram

- 1 = QV-06/1
- 2 = QV-06/6
- 3 = QV-06/11
- 4 = QV-06/16
- 5 = QV-06/24

4.2 Q/Δp diagram through the check valve for free flow B→A

- 6 = QV-06/*



5 DIMENSIONS [mm]

Option /K

Mass: 1,2 Kg

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see note 1)
 Fastening bolts:
 4 socket head screws M5x60 class 12.9
 Tightening torque = 8 Nm
 Seals: 2 OR 117
 Diameter of ports A, B: Ø = 7 mm

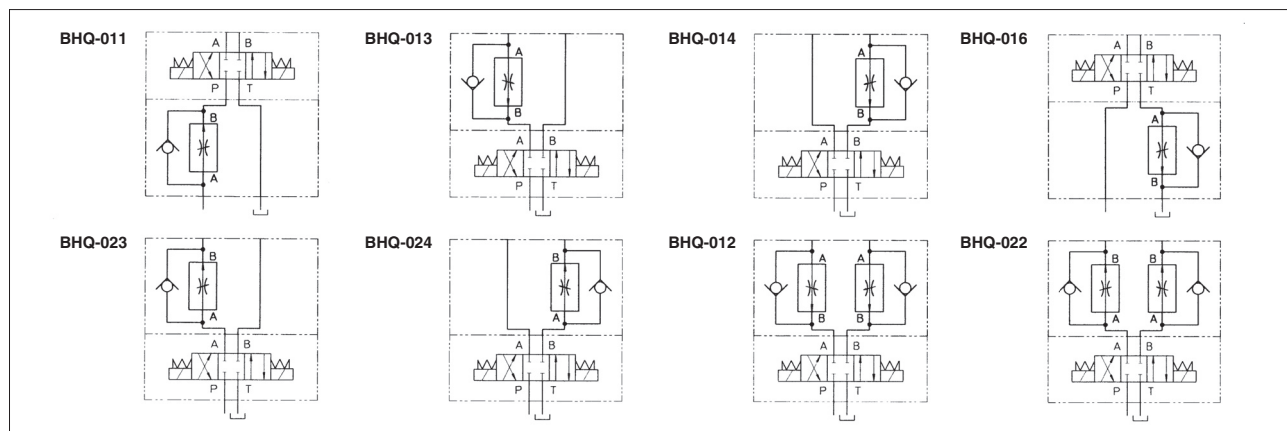
ASSEMBLY IN MODULAR STACK
see section 6

- ① = Flow control valve type QV-06
 Note that the valve(s) is (are) mounted:
 - on side port A for BHQ-011, BHQ-013, BHQ-016 and BHQ-023
 - on side port B for BHQ-014 and BHQ-024
 - on both sides for BHQ-012 and BHQ-022
- ② = Modular plate type BHQ, see section 6
- ③ = Closing element. This element can be on side port A or side port B depending on models. It is not present on BHQ-011, BHQ-016, BHQ-012 and BHQ-022
- ④ = Directional valve type DH* (ISO 4401 size 06)

note 1: the manifold interface has to be provided only of the A and B ports.
 The valve cannot be installed on manifolds with ISO 4401-AB-03 interface with P and T ports.

6 MODULAR PLATES TYPE BHQ

The modular plates type BHQ allow the assembling of valves type QV-06 in a modular stack with other components having ISO 4401 size 06 mounting surface. See below for model code and functional sketches; see section 5 for dimensions and example of assembly.



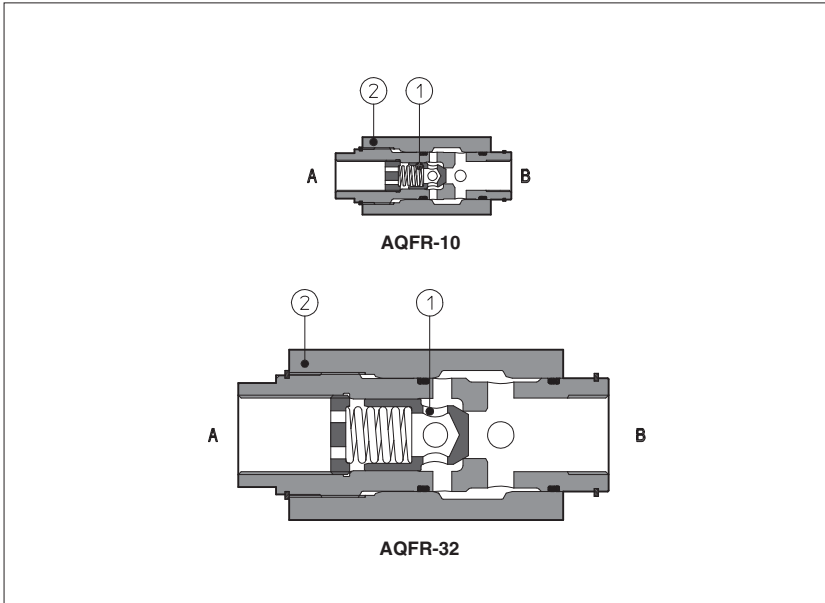
Available also version for phosphate ester (add /PE at the end of the model code).

7 MOUNTING PLATES TYPE BA

Valve	Subplate model	Ports location	Ports A, B, P, T	Ø Counterbore [mm] A, B, P, T	Mass [Kg]
QV-06	BA-202/Q	Ports A, B, P, T underneath;	G 3/8"	-	1,2
	BA-204/Q	Ports P, T underneath; Ports A, B on lateral side	G 3/8"	25,5	1,2
	BA-302/Q	Ports A, B, P, T underneath;	G 1/2"	30	1,8

Flow restrictor valves type AQFR

in-line mounting - from G 3/8" to G 1 1/4" threaded ports



AQFR are not compensated flow throttling valves with a built-in check valve (1) to allow the free flow in the opposite direction.

The flow adjustment is done by turning the external hexagon (2). Clockwise rotation increases the throttling (reduced passage). The regulated flow is a function of the pressure drop existing between the inlet and outlet ports.

They are available in five sizes: from 3/8" to 1 1/4" GAS with flow up 30, 50, 80, 160, 250 l/min respectively and pressure up to 400/350 bar (depending on size).

Max pressure: **350 bar**

1 MODEL CODE

AQF	R	-	10
Throttling valve in-line mounting			
R = with check valve for free reverse flow			
Size and ports dimensions:			
10 = G 3/8"	15 = G 1/2"	20 = G 3/4"	25 = G 1" 32 = G 1 1/4"

**	/	*
Seals material, see section 3:		
- = NBR		
PE = FKM		
BT = HNBR		
Series number		

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol					
Valve model	AQFR-10	AQFR-15	AQFR-20	AQFR-25	AQFR-32
Max recommended flow [l/min]	30	50	80	160	250
Max pressure [bar]	400	350			

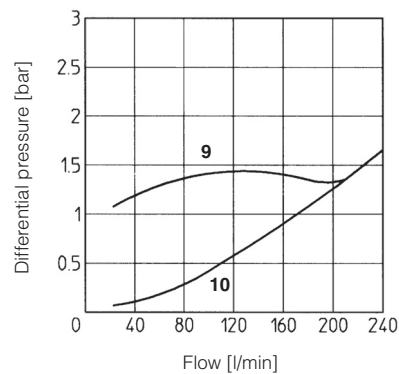
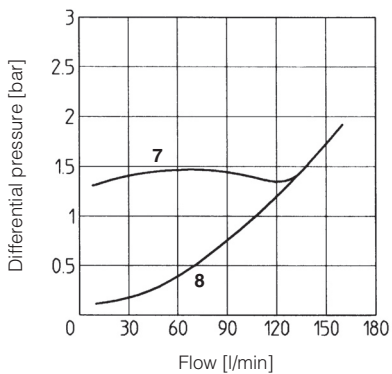
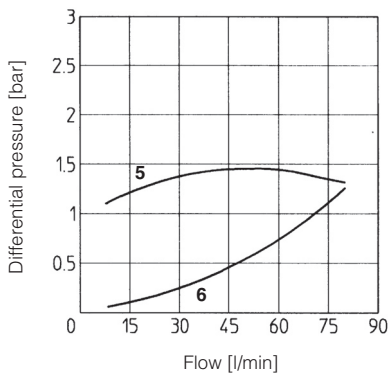
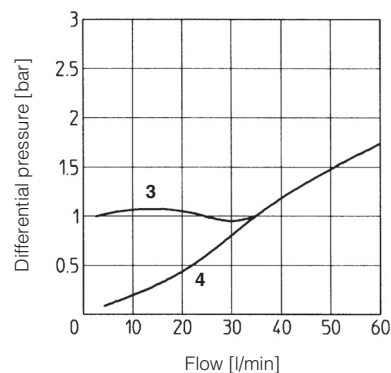
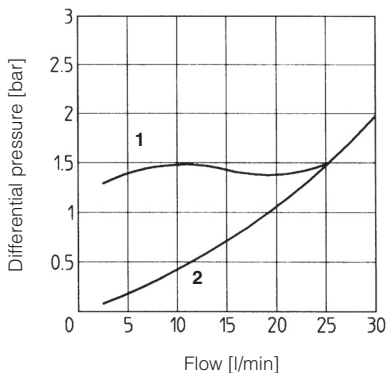
3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C; /PE option = -20°C ÷ +70°C; /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

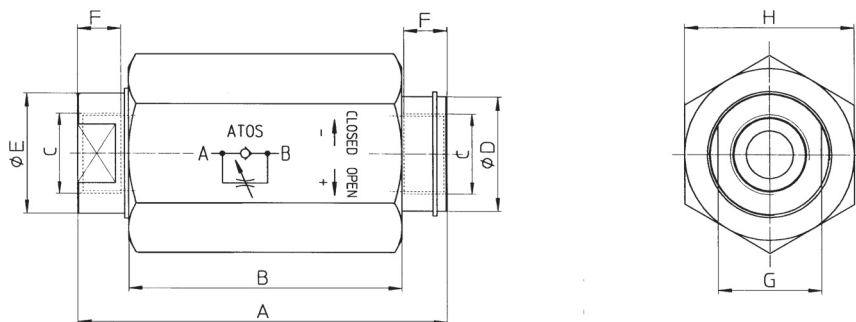
4 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

4.1 Q/Δp diagram through the check valve for free flow B→A with the throttle valve fully open and fully closed

- 1 = AQFR-10 fully closed
- 2 = AQFR-10 fully open
- 3 = AQFR-15 fully closed
- 4 = AQFR-15 fully open
- 5 = AQFR-20 fully closed
- 6 = AQFR-20 fully open
- 7 = AQFR-25 fully closed
- 8 = AQFR-25 fully open
- 9 = AQFR-32 fully closed
- 10 = AQFR-32 fully open



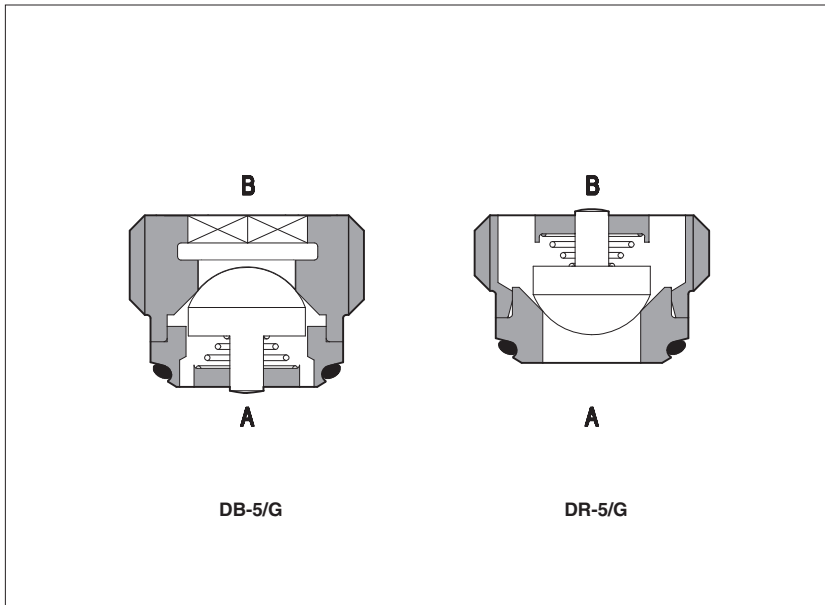
5 DIMENSIONS [mm]



Valve model	A	B	C	ØD	ØE	F	G	H	Mass [Kg]
AQFR-10	93	68	G 3/8"	28	25	13	24	41	0,7
AQFR-15	105	78	G 1/2"	32	30	15	27	46	1
AQFR-20	127	95,5	G 3/4"	36	34	17	32	55	1,6
AQFR-25	153	112	G 1"	48	45	19	42	75	3,5
AQFR-32	196	145	G 1 1/4"	63	60	21	55	90	6,5

Cartridge check valves type DB, DR

screw-in mounting - from G1/4" to G1/2"



DB, DR are direct operated check valves for screw-in mounting in cavities from G1/4" to G1/2".

They are specifically designed to reduce the manifold dimensions and simplify the installation.

Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.



Flow up to **95 l/min.**

Max pressure: **350 bar**

1 MODEL CODE

D	B	-	10	/	G	/	**	/	*
Screw-in check valve						Series number		Seals material, see section 3:	
B = function A → B R = function B → A								- = NBR PE = FKM BT = HNBR	
Size/threated connections:									
5 = G 1/4"		10 = G 3/8"		15 = G 1/2"				G = Gas threading	

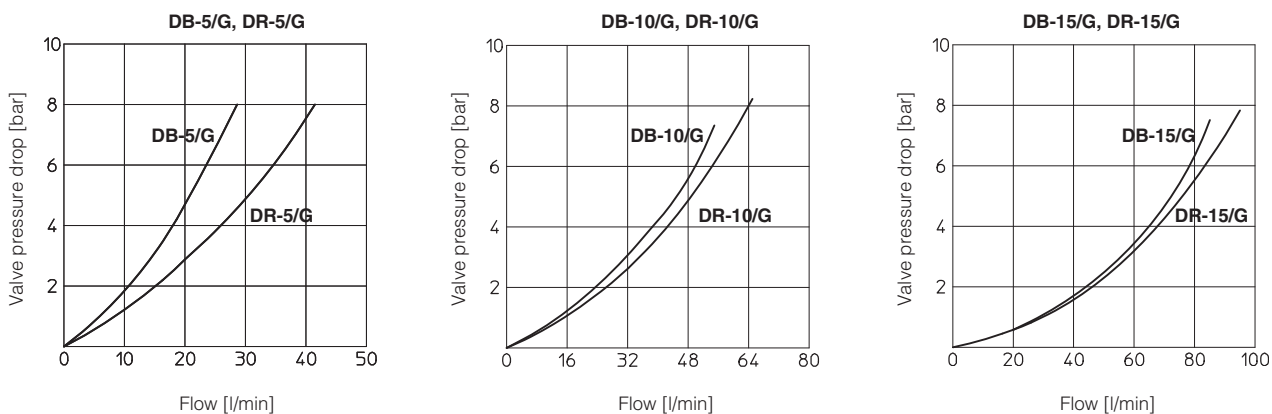
2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol	DB-*/G	A  B	DR-*/G	A  B			
Valve model	DB-5/G	DR-5/G	DB-10/G	DR-10/G	DB-15/G	DR-15/G	
Nominal flow (at Δp = 8 bar) [l/min]	25	35	55	65	85	95	
Max pressure [bar]	350						
Cracking pressure [bar]	0,3						

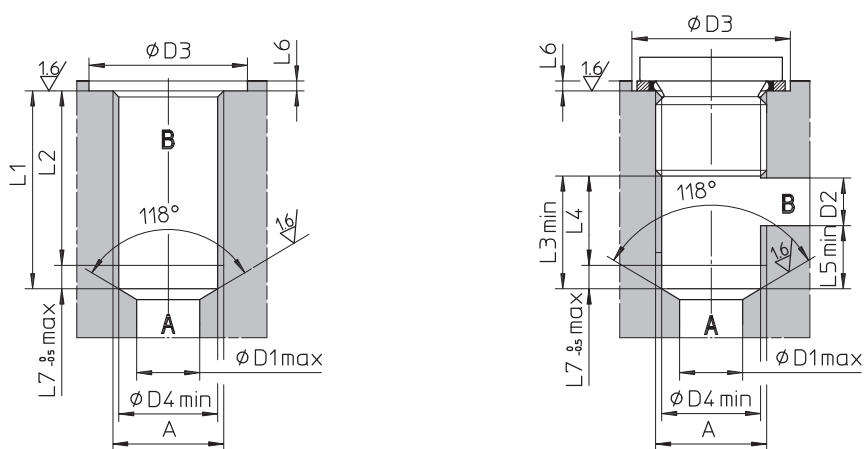
3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Flow direction	As shown in the symbol at section 2		
Rated flow	See diagrams Q/Δp at section 4		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 FLOW VERSUS PRESSURE DROP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

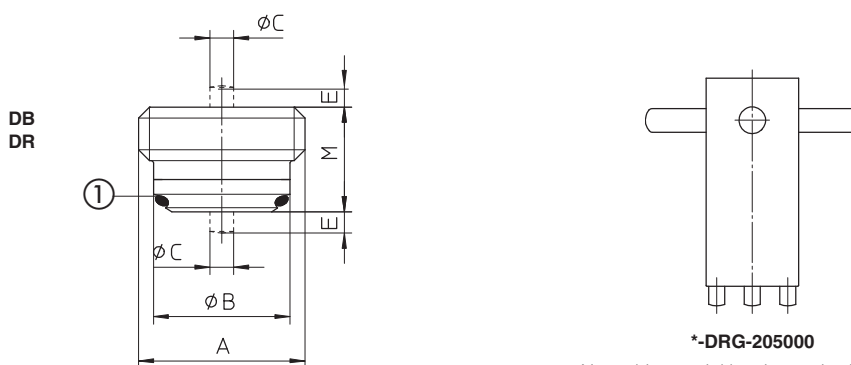


5 RECESS DIMENSIONS [mm]



	A	D1	D2	D3	D4	L1	L2	L3	L4	L5	L6	L7
DB-5/G	G 1/4"	8	6	22	11,6	22	19	14	11	8	1,5	3
DR-5/G												
DB-10/G	G 3/8"	9	8	26	15	24	21	17	14	9	1,5	3
DR-10/G												
DB-15/G	G 1/2"	12	12	30	18,75	28	24,5	22	18,5	10	1,5	3,5
DR-15/G												

6 VALVE DIMENSIONS [mm]



***-DRG-205000**

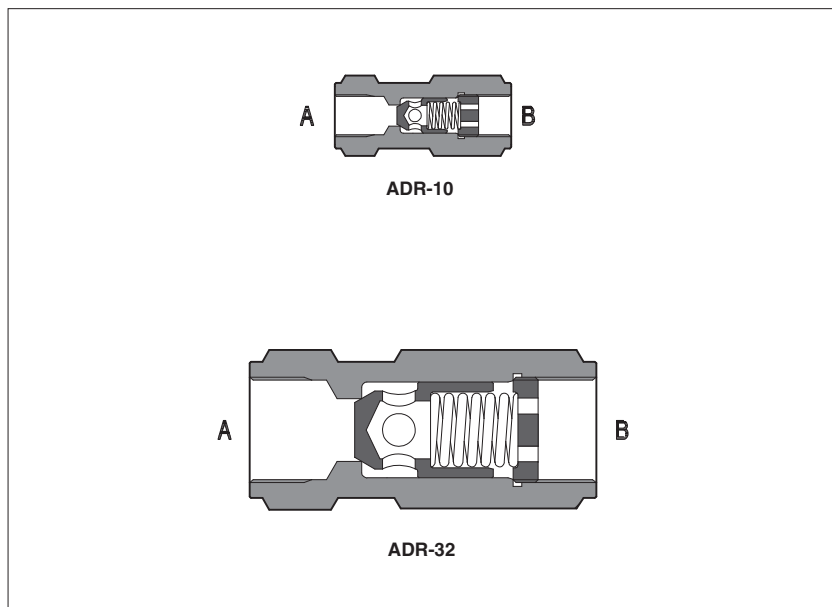
Note: this special key is required for assembling the valve in the cavity

	A	B	C	E	M	①	Mass (Kg)
DB-5/G	G 1/4"	11,5	2,1	1,5	10,3	OR-9x1/70	0,060
DR-5/G			2,4		9		
DB-10/G	G 3/8"	15	2,8	2	11,3	OR-11x1,5/70	0,012
DR-10/G			3,3	2,5	11,4		
DB-15/G	G 1/2"	18,5	3,2	2,5	12,9	OR-14x1,5/70	0,020
DR-15/G			4	2,5	13,6		

	A	KEY	Tightening torque (Nm)
DB-5/G	G 1/4"	CH 7 ◻	15
DR-5/G		5-DRG-205000	
DB-10/G	G 3/8"	CH 6 ◻	20
DR-10/G		10-DRG-205000	
DB-15/G	G 1/2"	CH 8 ◻	40
DR-15/G		15-DRG-205000	

Check valves type ADR

in-line mounting - from G 1/4" to G 1 1/4" threaded ports



ADR are direct operated check valves for in-line mounting available with port size from 1/4" to 1 1/4" GAS.

Cartridge designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

Flow up to **500 l/min**
Pressure up to **400 bar**

1 MODEL CODE

ADR	-	10	/	4	**
Check valve in-line mounting					Series number
Size/threaded connections:		Cracking pressure:			
06 = G 1/4"		- = 0,5 bar			
10 = G 3/8"		/2 = 2 bar			
15 = G 1/2"		/4 = 4 bar			
20 = G 3/4"		/8 = 8 bar			
25 = G 1"					
32 = G 1 1/4"					

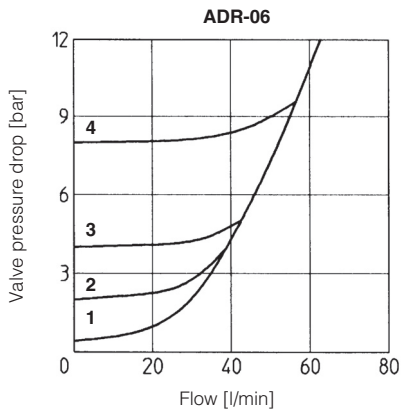
2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol						
Valve model	ADR-06	ADR-10	ADR-15	ADR-20	ADR-25	ADR-32
Max recommended flow [l/min]	40	80	150	300	360	500
Max pressure [bar]	400			350		

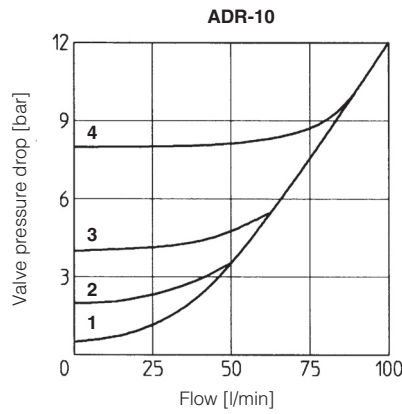
3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Fluid	Hydraulic oil as per DIN 51524 ... 535;
Fluid temperature	≤ 80°C
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog
Flow direction	As shown in the symbol at section 2
Rated flow	See diagrams Q/Δp at section 4

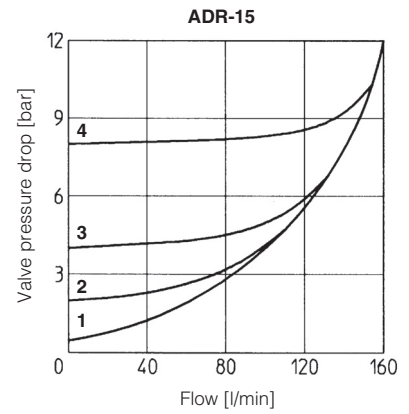
4 FLOW VERSUS PRESSURE DROP DIAGRAMS Based on based on mineral oil ISO VG 46 at 50°C



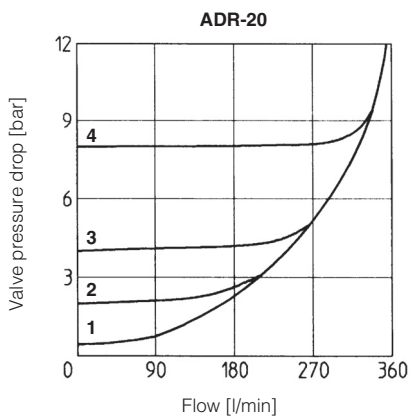
- 1 = ADR-06
- 2 = ADR-06/2
- 3 = ADR-06/4
- 4 = ADR-06/8



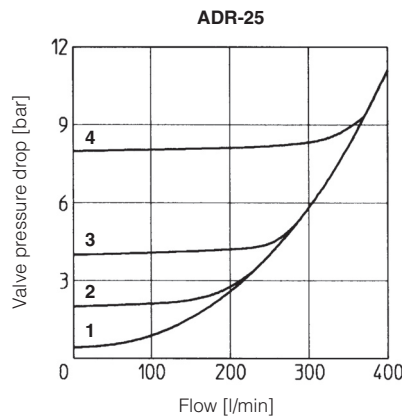
- 1 = ADR-10
- 2 = ADR-10/2
- 3 = ADR-10/4
- 4 = ADR-10/8



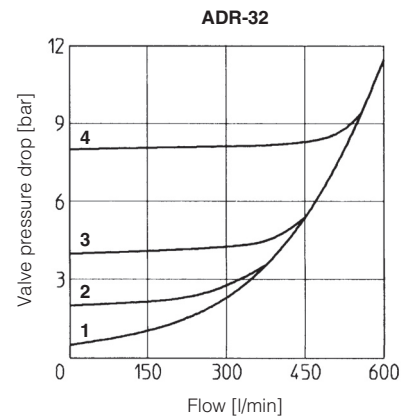
- 1 = ADR-15
- 2 = ADR-15/2
- 3 = ADR-15/4
- 4 = ADR-15/8



- 1 = ADR-20
- 2 = ADR-20/2
- 3 = ADR-20/4
- 4 = ADR-20/8

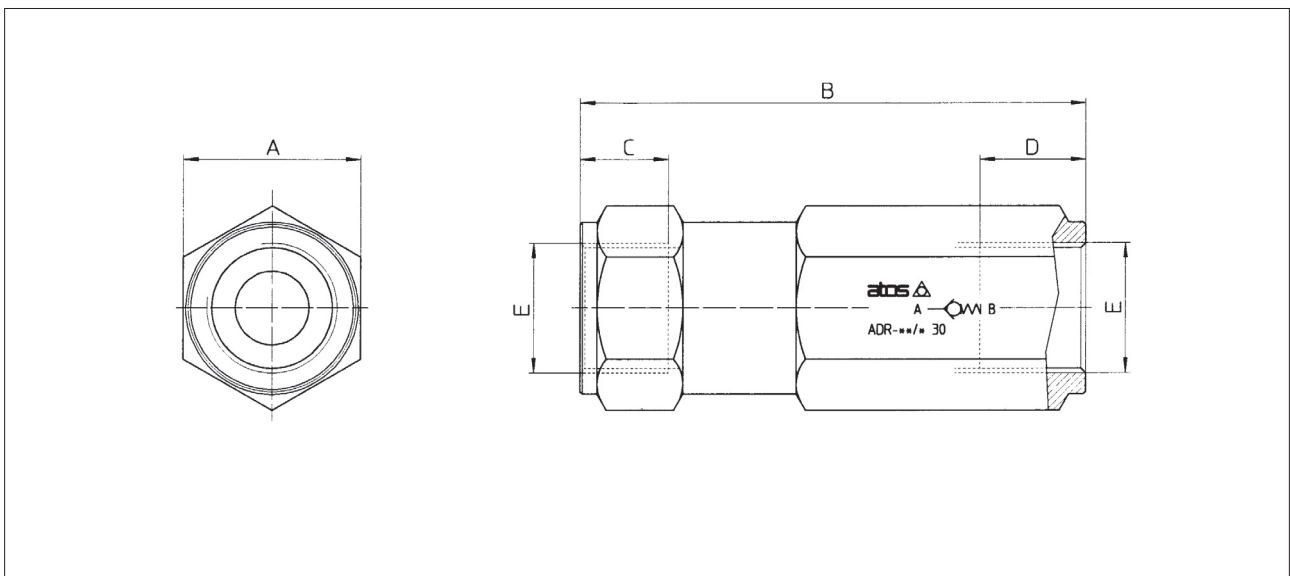


- 1 = ADR-25
- 2 = ADR-25/2
- 3 = ADR-25/4
- 4 = ADR-25/8



- 1 = ADR-32
- 2 = ADR-32/2
- 3 = ADR-32/4
- 4 = ADR-32/8

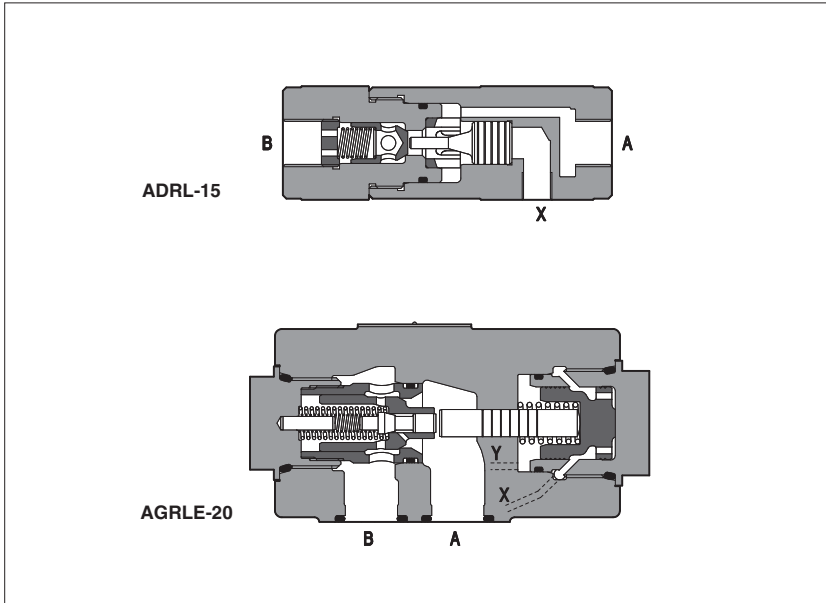
5 DIMENSIONS [mm]



Model	A	B	C	D	E	Mass [kg]
ADR - 06	22	67	12	13	G 1/4"	0,2
ADR - 10	27	70	12	13	G 3/8"	0,4
ADR - 15	32	82,5	14	17	G 1/2"	0,6
ADR - 20	36	102,5	16	21,5	G 3/4"	0,9
ADR - 25	46	120	18	24,5	G 1"	2,1
ADR - 32	55	137,5	20	23	G 1 1/4"	2,5

Pilot operated check valves type ADRL, AGRL, AGRLE

in-line mounting, port size from G 3/8" to G 1 1/4"
 subplate mounting, ISO 5781 size 10, 20 and 32



ADRL are pilot operated (port X) check valves for in-line mounting available with port size from 3/8" GAS to 1 1/4" GAS.

Flow up to 300 l/min.
 Pressure up to 400 bar.

AGRL and **AGRLE** are pilot operated (port X) check valves for subplate mounting available with mounting surface ISO 5781 size 10, 20 and 32.

Flow up to 500 l/min.
 Max pressure: 315 bar.

AGRLE versions have an external drain (port Y) of the pilot chamber to permit a correct use of pilot operated check valve in systems where valve must open in presence of pressure at port A: in fact pressure at port A, on regular pilot operated check valves, may affect the check opening by acting against the pilot device.

Valves designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

AGRL	E	-	10	/	*	/	**	/	*
<p>ADRL = pilot operated check valve in-line mounting AGRL = pilot operated check valve subplate mounting</p> <p>Only for AGRL: - = without external drain E = with external drain</p> <p>Threaded connections for ADRL: 10 = G 3/8" 15 = G 1/2" 20 = G 3/4" 32 = G 1 1/4"</p> <p>Size for AGRL and AGRLE: 10 20 32</p>									<p>Seals material, see section 4: - = NBR PE = FKM BT = HNBR</p>
					Cracking pressure				Series number
					for ADRL - = 0,5 bar 2 = 2 bar 4 = 4 bar 8 = 8 bar				for AGRL - = 0,5 bar

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbols										
Model	ADRL-10	ADRL-15	ADRL-20	ADRL-32	AGRL-10	AGRL-20	AGRL-32	AGRLE-10	AGRLE-20	AGRLE-32
Piloting ratio (1)	2,8	2,7	2,5	2,3	13,6	14,0	14,4	13,6	14,0	14,4
Max recommended flow [l/min]	30	60	100	300	160	300	500	160	300	500
Max pressure [bar]	400	350			315					

(1) Applying the pilot pressure through the pilot port X, the pilot spool opens the check valve, allowing free flow B→A.

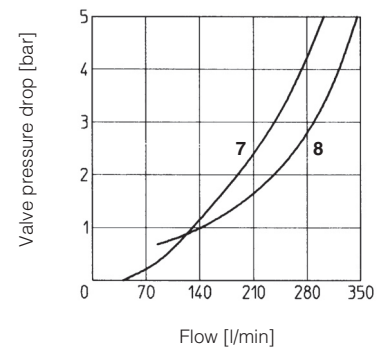
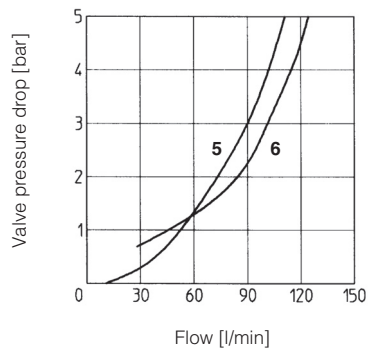
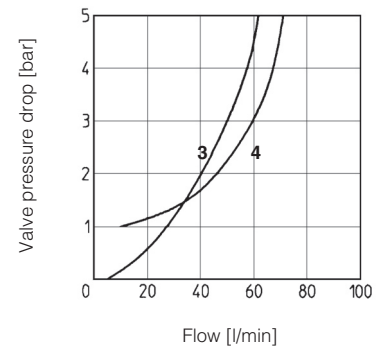
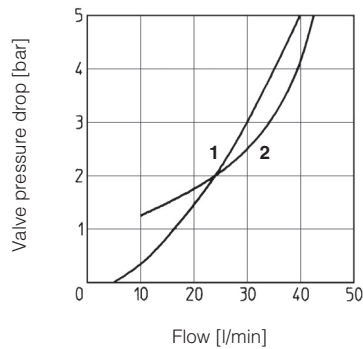
The minimum pilot pressure for correct operation depends on the pilot ratio indicated in the table and on the pressure closing the check. i.e.: the pilot pressure for ADRL-20 is the pressure on the check divided by 2,5. The valves AGRL-* and AGRLE-*, are equipped with a decompression system.

3 MAIN CHARACTERISTICS, SEALS AND FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position	Any position. For AGRLE valves, the drain port Y has to be connected directly to the tank without counter pressure		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

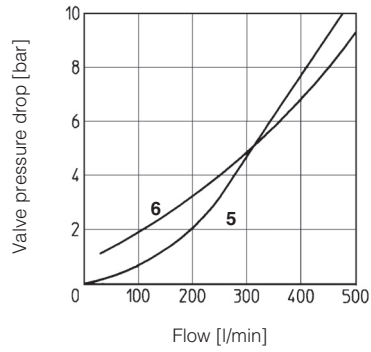
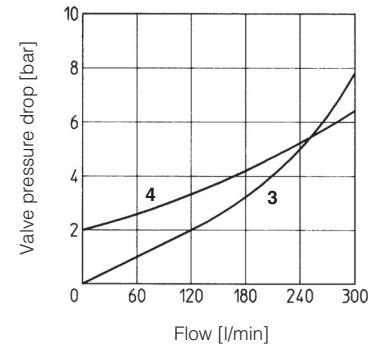
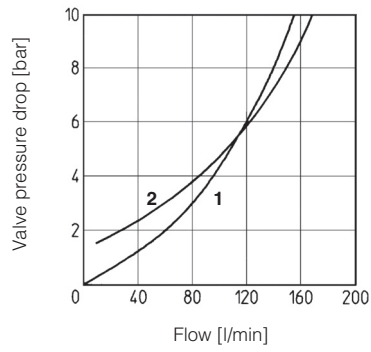
4 FLOW VERSUS PRESSURE DROP DIAGRAMS FOR ADRL based on mineral oil ISO VG 46 at 50°C

- 1 = ADRL-10 B→A
- 2 = ADRL-10 A→B
- 3 = ADRL-15 B→A
- 4 = ADRL-15 A→B
- 5 = ADRL-20 B→A
- 6 = ADRL-20 A→B
- 7 = ADRL-32 B→A
- 8 = ADRL-32 A→B

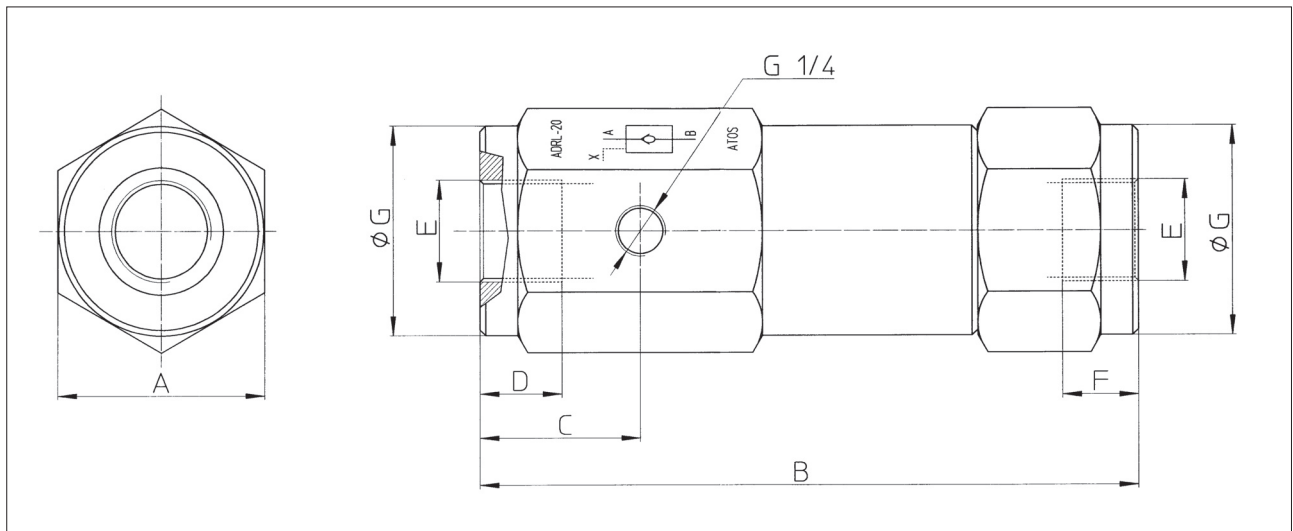


5 FLOW VERSUS PRESSURE DROP DIAGRAMS FOR AGRL AND AGRLE based on mineral oil ISO VG 46 at 50°C

- 1 = AGRL-10, AGRLE-10 B→A
- 2 = AGRL-10, AGRLE-10 A→B
- 3 = AGRL-20, AGRLE-20 B→A
- 4 = AGRL-20, AGRLE-20 A→B
- 5 = AGRL-32, AGRLE-32 B→A
- 6 = AGRL-32, AGRLE-32 A→B



6 DIMENSIONS FOR ADRL VALVES [mm]



Model	A	B	C	D	E	F	ØG	Mass [Kg]
ADRL-10	41	120	30	14	G 3/8"	12	40	1
ADRL-15	50	145	33	16	G 1/2"	16	49	2
ADRL-20	55	175	42,5	18,5	G 3/4"	19	54,5	2,5
ADRL-32	90	245	53	23,5	G 1 1/4"	25	87,5	7

7 DIMENSIONS FOR AGRL AND AGRLE VALVES [mm]

**AGRL-10
AGRLE-10**

ISO 5781: 2000

Mounting surface: 5781-06-07-0-00

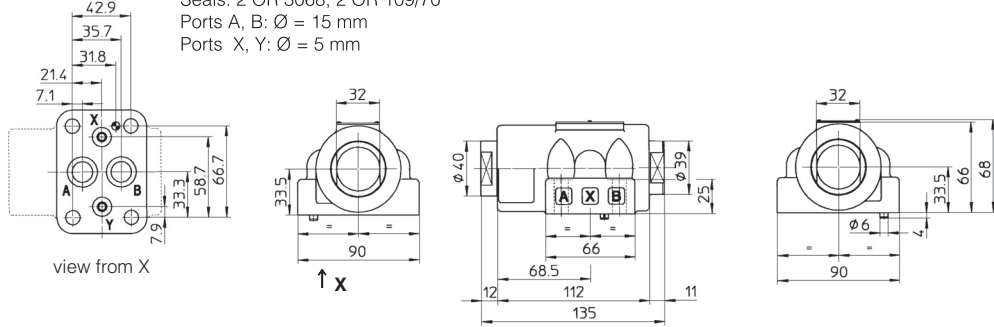
Fastening bolts: 4 socket head screws M10x45 class 12.9

Tightening torque = 70 Nm

Seals: 2 OR 3068; 2 OR 109/70

Ports A, B: Ø = 15 mm

Ports X, Y: Ø = 5 mm



Mass: 4 Kg

**AGRL-20
AGRLE-20**

ISO 5781: 2000

Mounting surface: 5781-08-10-0-00

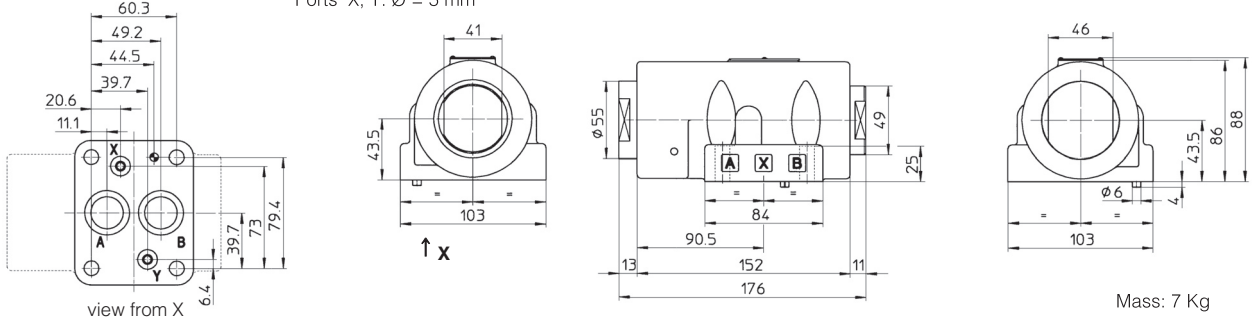
Fastening bolts: 4 socket head screws M10x45 class 12.9

Tightening torque = 70 Nm

Seals: 2 OR 4100; 2 OR 109/70

Ports A, B: Ø = 23 mm

Ports X, Y: Ø = 5 mm



Mass: 7 Kg

**AGRL-32
AGRLE-32**

ISO 5781: 2000

Mounting surface: 5781-10-13-0-00

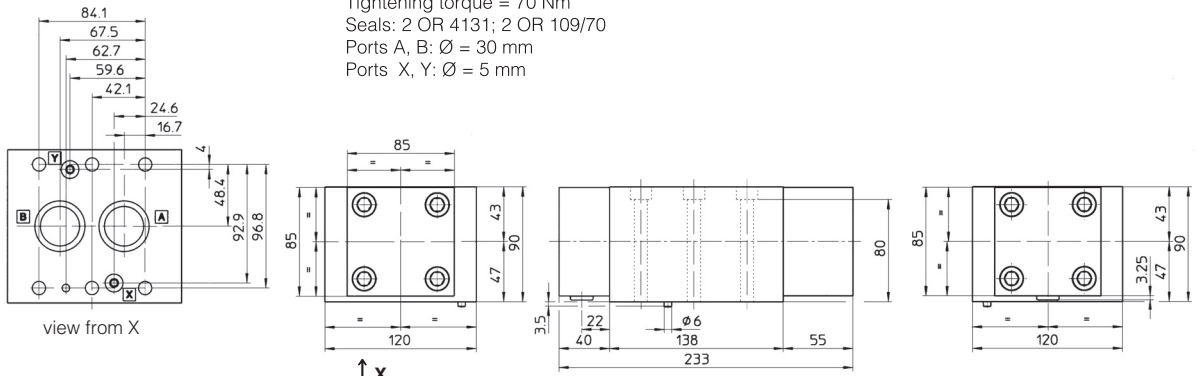
Fastening bolts: 6 socket head screws M10x100 class 12.9

Tightening torque = 70 Nm

Seals: 2 OR 4131; 2 OR 109/70

Ports A, B: Ø = 30 mm

Ports X, Y: Ø = 5 mm



Mass: 14,8 Kg

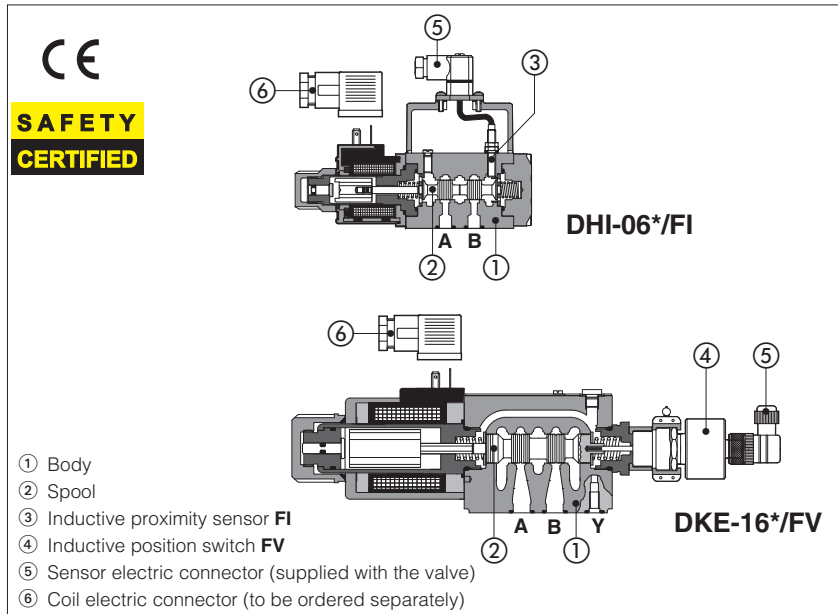
8 MOUNTING SUBPLATES FOR AGRL AND AGRLE VALVES

Valve	Subplate model	Port location	GAS ports				Ø Counterbore [mm]				Mass [kg]
			A	B	X	Y	A	B	X	Y	
AGRL-10, AGRLE-10	BA-305	Ports A, B, X, Y underneath;	1/2"	1/2"	1/4"	1/4"	30	30	21,5	21,5	1
AGRL-20, AGRLE-20	BA-505		1"	1"	1/4"	1/4"	46	46	21,5	21,5	2
AGRL-32, AGRLE-32	BA-705 A		1 1/2"	1 1/2"	1/4"	1/4"	63,5	63,5	21,5	21,5	7,5

The subplates are supplied with fastening bolts. For further details see table K280.

Safety directional valves with spool position monitoring

On-off, direct operated, conforming to Machine Directive 2006/42/EC - certified by



Direct operated safety directional valves with spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

DHI, size 06, for AC and DC supply, with cURus certified solenoids

DHE, size 06, high performances, for AC and DC supply with cURus certified solenoids

DKE, size 10, for AC and DC supply with cURus certified solenoids

The valves are equipped with **FI** inductive proximity sensor or **FV** inductive position switch for the spool position monitoring, see section 1 and 11 for sensors availability and technical characteristics.

Certification

The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: **ISO 4401**, size **06** and **10**

Max flow: **DHI 60 l/min**

DHE 80 l/min

DKE 150 l/min

Max pressure: **350 bar**

1 RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			/FI	/FV	/FI	/FV
DHI-06	06	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DHI-07	06	direct operated solenoid valves, on-off, double solenoid	•		•	
DHE-06	06	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DHE-07	06	direct operated solenoid valves, on-off, double solenoid	•	•	•	
DKE-16	10	direct operated solenoid valves, on-off, single solenoid	•	•	•	•
DKE-17	10	direct operated solenoid valves, on-off, double solenoid	•	•	•	

Notes:

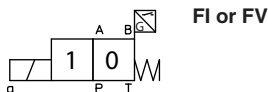
FI = inductive proximity sensor, type NO (normally open) or NC (normally closed)

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

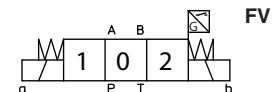
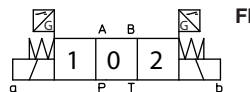
See section 11 for sensor's characteristics

1.1 FI sensor & FV switch configurations

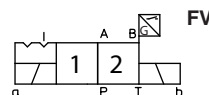
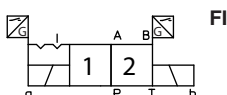
Single solenoid valves size 06 & 10 are provided with n°1 FI sensor or n° 1 FV switch for the spool position monitoring



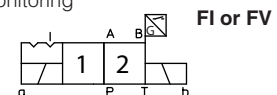
Double solenoid valves size 06 & 10 are provided with n° 2 FI sensors or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 06 with detent are provided with n°2 FI sensors or n° 1 FV switch for the spool position monitoring



Double solenoid valves size 10 with detent are provided with n° 1 FI sensor or n° 1 FV switch for the spool position monitoring



For model code of DHI and DHE safety valves, see section 2

For model code of DKE safety valves, see section 4

2 MODEL CODE OF DHI AND DHE

DHI	- 0	63	1/2	/ A	/ FV	*	- X	24DC	**	/ *
Directional control valve size 06 DHI = max flow 60 l/min DHE = max flow 80 l/min										Seals material see sect. 6, 7 - = NBR PE = FKM
Size ISO 4401 0 = size 06										Series number
Valve configuration , see section 3 61 = single solenoid, central plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, external plus central position, spring offset 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent										Voltage code , see section 9 X = without connector, see section 10 for available connectors, to be ordered separately
Spool type , see section 3										Electrical signal - only for FI version (1): /NC = electric contact is closed when the valve is de-energized /NO = electric contact is open when the valve is de-energized
Options , see section 8										Spool position monitor : FI = inductive proximity switch FV = inductive position switch (double contact)

(1) the **FV** inductive position switch provides both NC and NO contacts

3 CONFIGURATIONS AND SPOOLS FOR DHI AND DHE (representation according to ISO 1219-1)

Configurations	Spoils	Configurations	Spoils
<p>61</p>	<p>1 0 2</p>	<p>63</p>	<p>1 0 2</p>
<p>61/A</p>	<p>0 1 2 3 4 5 6 7 8 90 09 91</p> <p>only for /FI</p>	<p>63/A</p>	<p>0/2 1/2 2/2</p>
<p>67</p>	<p>19 93 39 94</p> <p>only for /FI</p>	<p>75 (for /FI)</p>	<p>1 0 2</p>
<p>67/A</p>	<p>49 16 17 58</p> <p>only for /FI</p>	<p>75 (for /FV)</p>	<p>0/2 1/2</p>
<p>71 (for valves /FV)</p>	<p>1/9 2/7 5/7 6/7</p> <p>(1)</p>		
<p>71 (for valves /FI)</p>	<p>7/7</p> <p>(1)</p>		

(1) only for configuration 61, not available for configuration 61/A
 (2) only for DHI-0711/9/FI and DHE-0711/9/FI

3.2 Special shaped spools for DHI and DHE

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1**, **4**, **5** and **58** are also available as **1/1**, **4/8**, **5/1** and **58/1**. They are properly shaped to reduce water-hammer shocks during the switching.
- spools type **1**, **1/2**, **3**, **8** are available as **1P**, **1/2P**, **3P**, **8P** to limit valve internal leakages.
- Other types of spools can be supplied on request.

3.1 Standard spool availability for DHI and DHE - spools not listed in the table are available for all valves models

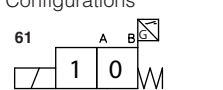
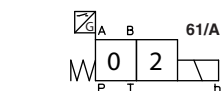
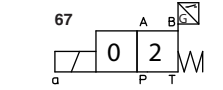
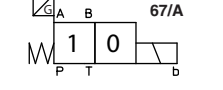
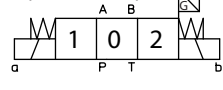
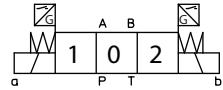
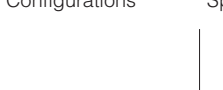
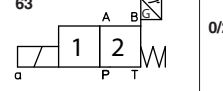

Valve type	standard spool						
	09	90	39	93	49	94	1/9
DHI/FI	•	•	•	•	•	•	•
DHI/FV							
DHE/FI	•	•	•	•	•	•	•
DHE/FV							

4 MODEL CODE OF DKE

<p>DKE</p> <p>Directional control valve size 10</p> <p>Size ISO 4401 1 = size 10</p> <p>Valve configuration, see section 5</p> <p>61 = single solenoid, central plus external position, spring centered</p> <p>63 = single solenoid, 2 external positions, spring offset</p> <p>67 = single solenoid, external plus central position, spring offset</p> <p>71 = double solenoid, 3 positions, spring centered</p> <p>75 = double solenoid, 2 external positions, with detent</p> <p>Spool type, see section 5</p> <p>Options, see section 8</p>	-	1	63	1/2	/	A	/	FV	*	-	X	24DC	**	/	*
<p>Seals material see sect. 6, 7</p> <p>- = NBR</p> <p>PE = FKM</p> <p>Series number</p> <p>Voltage code, see section 9</p> <p>X = without connector, see section 10 for available connectors, to be ordered separately</p> <p>Electrical signal - only for FI version (1):</p> <p>/NC = electric contact is closed when the valve is de-energized</p> <p>/NO = electric contact is open when the valve is de-energized</p> <p>Spool position monitor:</p> <p>FI = inductive proximity switch</p> <p>FV = inductive position switch (double contact)</p>															

DKE/FI and /FV are always provided with Y drain port
(1) the **FV** inductive position switch provides both NC and NO contacts

5 CONFIGURATIONS AND SPOOLS FOR DKE (representation according to ISO 1219-1)

Configurations	Spools	Configurations	Spools
<p>61</p>  <p>61/A</p>  <p>67</p>  <p>67/A</p>  <p>71 (for valves /FV)</p>  <p>71 (for valves /FI)</p> 	<p>1 0 2 1 0 2 1 0 2 1 0 2</p> <p>0 1 3 4</p> <p>5 6 7 8</p> <p>91 19 93 39</p> <p>58 1/9 (2) 1/3 (1) 7/7</p>	<p>63</p>  <p>63/A</p>  <p>75</p> 	<p>1 0 2</p> <p>0/2</p> <p>1/2</p> <p>2/2</p> <p>2/7 (3)</p> <p>5/7 (3)</p> <p>1 0 2</p> <p>0/2</p> <p>1/2</p>
<p>(1) only for DKE-1611/3/*DC</p> <p>(2) only for DKE-1711/9/FI</p> <p>(3) only for configuration 63, not available for configuration 63/A</p>			

5.1 Special shaped spools for DKE

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1** is also available as **1/1**, properly shaped to reduce the water-hammer shocks during the switching.
- spool type **1/9** has closed center in rest position but it avoids the pressurization of A and B ports due to the internal leakages.
- other types of spools can be supplied on request.

6 MAIN CHARACTERISTICS

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C		
Flow direction	As shown in the symbols of table 3 and 5		
Operating pressure	DHI	P, A, B = 350 bar T = 100 bar (version /FI); 120 bar (version /FV)	
	DHE	P, A, B = 350 bar T = 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 160 bar (AC solenoid - version /FV)	
	DKE	P, A, B = 350 bar T = (with Y port not connected to tank) 100 bar (version /FI); 210 bar (DC solenoid - version /FV); 120 bar (AC solenoid - version /FV) T = (with Y port drained to tank) 250 bar	
Rated flow	see diagrams Q/Δp at section 14		
Maximum flow	DHI	60 l/min see section 15	
	DHE	80 l/min see section 15	
	DKE	150 l/min see section 15	

(1) The type-examination certificate can be download from www.atos.com

6.1 Coils characteristics

Insulation class	H (180°C) for DC coils (all versions) and AC coils (only DHI) F (155°C) for AC coils (DHE, DKE) Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 9
Supply voltage tolerance	± 10%
Certification	cURus North American standard

7 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
	Hydraulic fluid	Suitable seals type	Classification
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	
Flame resistant with water	NBR	HFC	ISO 12922

8 OPTIONS

A = Single solenoid valves: solenoid mounted at side of port B. In standard versions the solenoid is mounted at side of port A.
Double solenoid valves DHE/FV(DC), DKE/FV(DC): FV inductive position switch mounted at side of port A. In standard versions the position switch is mounted at side of port B.

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available



WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury



Safety valves must be installed and commissioned only by qualified personnel
Safety valves must not be disassembled
The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers
Valve's components cannot be interchanged
The valves must operate without switching shocks and spool vibrations

9 ELECTRIC FEATURES

9.1 COILS FOR DHI AND DHE VALVES

Valve	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (3)		Code of spare coil		
				DHI	DHE	DHI	Colour of coil label	DHE
DHI DHE	6 DC	6 DC (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	12 DC				COU-12DC	green	COE-12DC
	14 DC	14 DC				COU-14DC	brown	COE-14DC
	24 DC	24 DC				COU-24DC	red	COE-24DC
	28 DC	28 DC				COU-28DC	silver	COE-28DC
	48 DC	48 DC				COU-48DC	silver	COE-48DC
	110 DC	110 DC				COU-110DC	gold	COE-110DC
	125 DC	125 DC				COU-125DC	blue	COE-125DC
	220 DC	220 DC				COU-220DC	black	COE-220DC
	24/50 AC	24/50/60 AC				60 VA	-	COI-24/50/60AC (1)
	24/60 AC	(4)	COI-48/50/60AC (1)	white	-			
	48/50 AC	48/50/60 AC	-	80 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC	
	48/60 AC	(4)			COI-120/60AC	white	-	
	110/50 AC	110/50/60 AC	60 VA	-	58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC
	115/60 AC (5)	115/60 AC			80 VA	COI-230/60AC	silver	COE-230/60AC
	120/60 AC (4)	120/60 AC	669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/50 AC	230/50/60 AC				COU-230RC	blue	COE-230RC
	230/60 AC	230/60 AC						
	110/50 AC	110RC						
	120/60 AC							
230/50 AC								
230/60 AC								

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DHI) and 58 VA (DHE)

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

(4) Only for DHI

(5) Only for DHE

9.2 COILS FOR DKE VALVE

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil
12 DC	12 DC	666 or 667	36 W	CAE-12DC
14 DC	14 DC			CAE-14DC
24 DC	24 DC			CAE-24DC
28 DC	28 DC			CAE-28DC
110 DC	110 DC			CAE-110DC
125 DC	125 DC			CAE-125 DC
220 DC	220 DC			CAE-220DC
110/50/60 AC	110/50/60 AC	100 VA (3)	130 VA (3)	CAE-110/50/60AC (1)
230/50/60 AC	230/50/60 AC			CAE-230/50/60AC (1)
115/60 AC	115/60 AC	669	36 W	CAE-115/60AC
230/60 AC	230/60 AC			CAE-230/60AC
110/50/60 AC	110 DC			CAE-110DC
230/50/60 AC	220 DC			CAE-220DC

(1) In case of 60 Hz voltage frequency the performances are reduced by 10÷15% and the power consumption is 90 VA

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current.

10 COILS ELECTRIC CONNECTORS - according to din 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	669 (for AC supply)	CONNECTOR WIRING	
		666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	669 1,2 = Supply voltage VAC 3 = Coil ground
		SUPPLY VOLTAGES	
666 All voltages	667 24 AC or DC 110 AC or DC 220 AC or DC	669 110/50 AC 110/60 AC 230/50 AC 230/60 AC	

11 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

Type of switch	/FI proximity sensor		/FV position switch	
Supply voltage [V]	10÷30		20÷32	
Ripple max [%]	≤ 20		≤ 10	
Max current [mA]	200		400	
Max peak pressure [bar]	100		400	
Mechanical life	virtually infinite		virtually infinite	
Switch logic	PNP		PNP	
		1 output signal 2 supply +24 Vdc 4 GND	1 supply +24 Vdc 2 output signal	3 GND 4 output signal

12 CONNECTING SCHEMES OF INDUCTIVE PROXIMITY AND POSITION SWITCHES - FI and FV sensor's connector are always supplied with the valve

DH*/FI single solenoid / double solenoid (dotted line)	/FV (all valves) single solenoid	/FV (all valves) double solenoid	DKE/FI single solenoid	DKE/FI double solenoid
Connector type 345 IP65 	Connector type ZBE-06 IP65 	Connector type ZBE-06 IP65 	Connector type 666 IP65 	Connector type 664 IP65
1 = output signal 2 = supply +24 VDC 3 = output signal for double solenoid 4 = GND	1 = supply +24 VDC 2 = output signal NC 3 = GND 4 = output signal NO	1 = supply +24 VDC 2 = output signal sol. b 3 = GND 4 = output signal sol. a	1 = output signal S 2 = supply +24 VDC ⊕ = GND	1 = output signal sol. a 2 = supply +24 VDC 3 = output signal sol. b ⊕ = GND

NOTE: the /FI proximity and /FV position switch are not provided with a protective earth connection

13 STATUS OF OUTPUT SIGNAL

13.1 Signal status for FI versions

	Configuration 61 monitored position "0"	Configuration 63 monitored position "1"	Configuration 67 monitored position "2"	Configuration 71 monitored position "0"	Configuration 75 monitored position "2"
HYDRAULIC CONFIGURATION					
spool position	1 0	1 2	0 2	1 0 2	1 2
sensor signal					
sensor a signal					
sensor b signal					

Diagrams show the behaviour of the output signal for inductive switches type **FI/NO**.

For inductive switches type **FI/NC** the behaviour is opposite (high level signal instead of low level signal and viceversa)

13.2 Signal status for FV versions

DH - DK	Configuration 61	Configuration 63	Configuration 67	Configuration 71	Configuration 75
Hydraulic configuration					
spool position	1 0	1 2	0 2	1 0 2	1 2
pin 2					
pin 4					

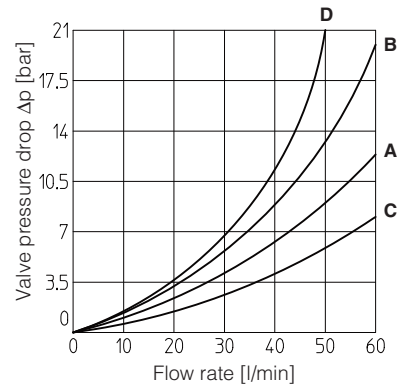
Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

14 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

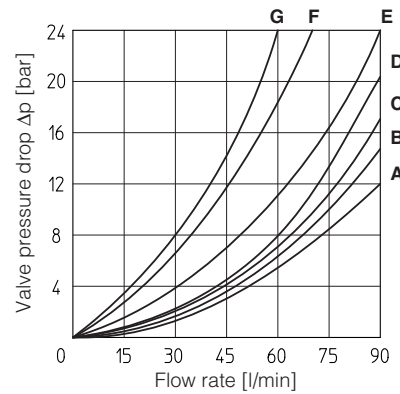
DHI

Flow direction Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/1	C	C	C	C	
0/2, 1, 1/1, 1/2, 1/9	A	A	A	A	
2, 3, 3/1	A	A	C	C	
2/2, 4, 4/8, 5, 5/1, 58, 58/1, 94	D	D	D	D	A
6, 7, 16, 17	A	A	C	A	
8	C	C	B	B	
09, 19, 90, 91	B	B	A	A	
39, 93	D	D	D	D	



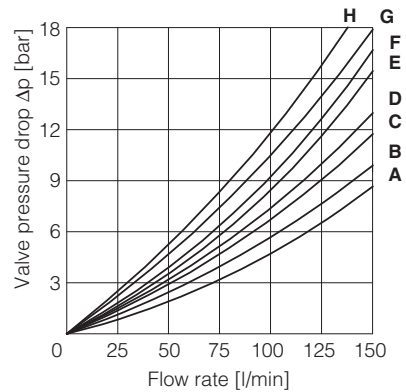
DHE

Flow direction Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0, 0/1	A	A	C	C	D
1, 1/1, 1/9	D	C	C	C	
3, 3/1	D	D	A	A	
4, 4/8, 5, 5/1, 49, 58, 58/1, 94	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7, 16, 17	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			
09, 19, 90, 91	E	E	D	D	
39, 93	F	F	G	G	



DKE

Flow direction Spool type	Flow direction					
	P→A	P→B	A→T	B→T	P→T	B→A
0, 0/1, 0/2, 2/2	A	A	B	B		
1, 1/1, 1/9, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5, 58	A	B	C	C	G	
1/2	B	C	C	B		
19, 91	E	E	G	G		H
39, 93	F	F	G	G		H

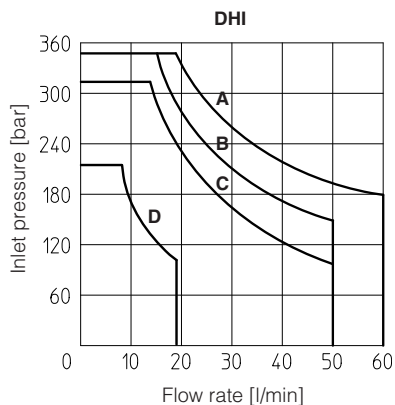


15 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$). The curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T). In case of asymmetric flow and if the valves have the devices for controlling the switching times the operating limits must be reduced.

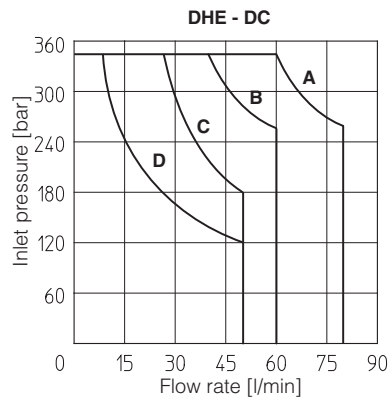
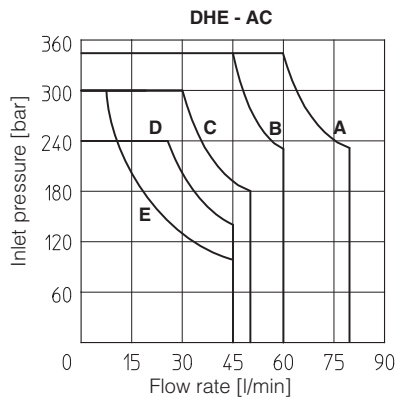
DHI

Curve	Spool type
A	0, 1, 1/2, 8
B	0/1, 0/2, 1/1, 1/9, 3, 3/1
C	4, 4/8, 5, 5/1, 6, 7, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	2, 2/2



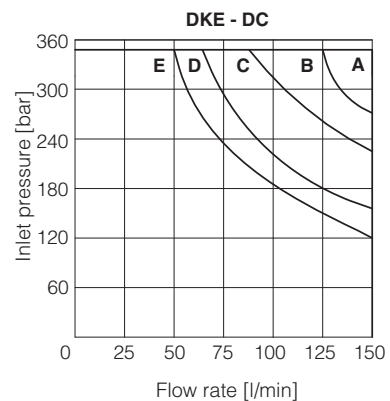
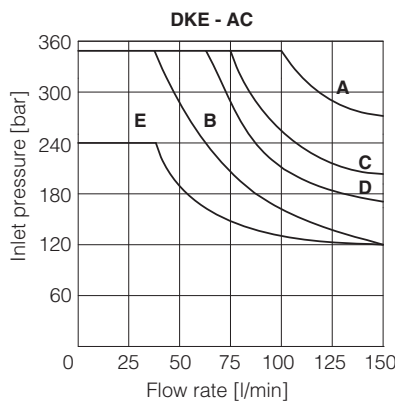
DHE

Curve	Spool type	
	AC	DC
A	1, 1/2, 8	0, 0/1, 1, 1/2, 3, 8
B	0, 0/1, 0/2, 1/1, 1/9, 3	0/2, 1/1, 6, 7, 1/9, 19
C	3, 3/1, 6, 7	3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39, 49, 58, 58/1, 09, 90, 91, 93, 94
D	4, 4/8, 5, 5/1, 16, 17, 19, 39, 58, 58/1, 09, 90, 91, 93, 94	2, 2/2
E	2, 2/2	-

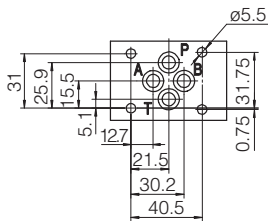


DKE

Curve	Spool type	
	AC	DC
A	0/1	0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
B	4, 5, 19, 91	6, 7
C	0, 1/1, 3, 3/1	19, 91
D	1, 1/2, 0/2	4, 5
E	6, 7, 8, 2/2	2/2



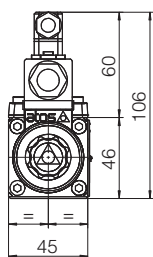
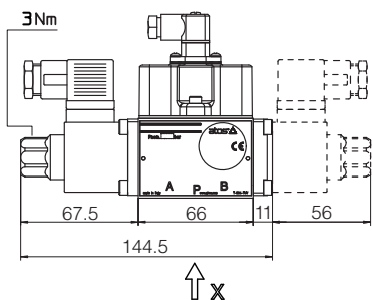
16 DIMENSIONS FOR DHI AND DHE SOLENOID SAFETY VALVES [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
 Fastening bolts:
 4 socket head screws: M5x50 class 12.9 (DHI)
 M5x30 class 12.9 (DHE)
 Tightening torque = 8 Nm
 Seals: 4 OR 108
 Ports P,A,B,T: Ø = 7.5 mm (max)

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DHI-06*/FI (DC, AC)
DHI-07*/FI (DC, AC) dotted line

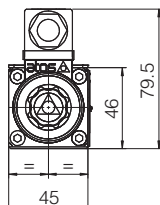
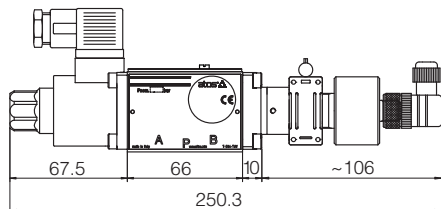


Mass:
 kg 1,6 (one solenoid)
 kg 1,9 (two solenoids)

option /A

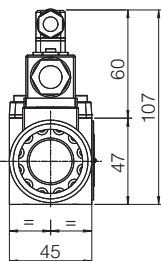
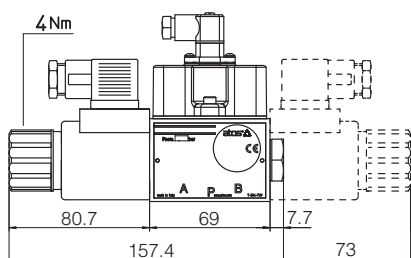
Single solenoid valves: solenoid mounted at side of port B.
 Double solenoid valves DHE/FV(DC): FV inductive position switch mounted at side of port A

DHI-06*/FV (DC, AC)



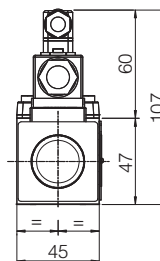
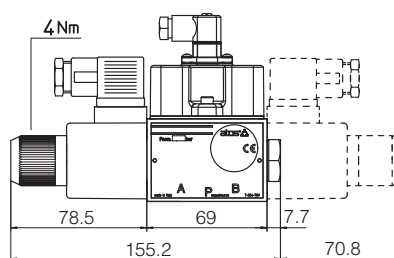
Mass: kg 1,7

DHE-06*/FI (DC)
DHE-07*/FI (DC) dotted line



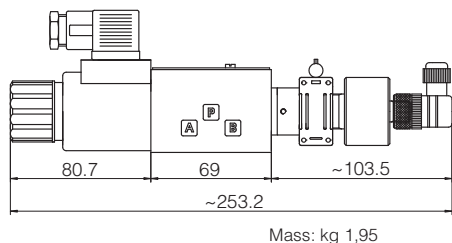
Mass:
 kg 1,85 (one solenoid)
 kg 2,1 (two solenoids)

DHE-06*/FI (AC)
DHE-07*/FI (AC) dotted line

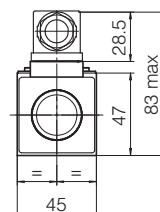
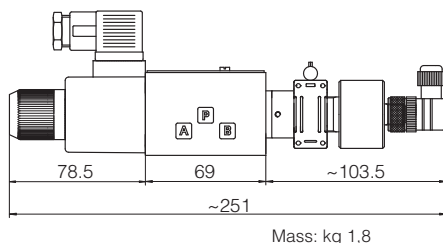


Mass:
 kg 1,85 (one solenoid)
 kg 2,1 (two solenoids)

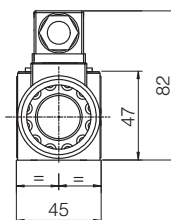
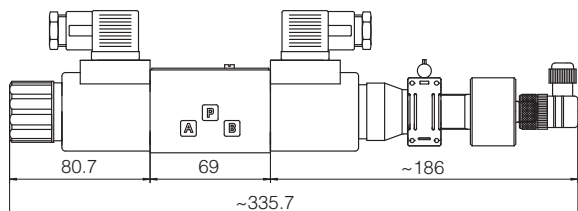
DHE-06*/FV (DC)



DHE-06*/FV (AC)

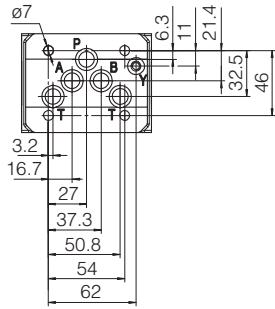


DHE-07*/FV (DC)



Mass: kg 2,2

17 DIMENSIONS OF DKE SOLENOID SAFETY VALVES [mm]



ISO 4401: 2005
Mounting surface:
4401-05-05-05
(without port X)

Fastening bolts:
 4 socket head screws M6x40 class 12.9
 Tightening torque = 15 Nm
 Seals: 5 OR 2050. 1 OR 108
 Ports P,A,B,T: $\varnothing = 11.5$ mm (max)
 Ports Y: $\varnothing = 5$ mm

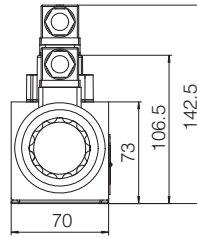
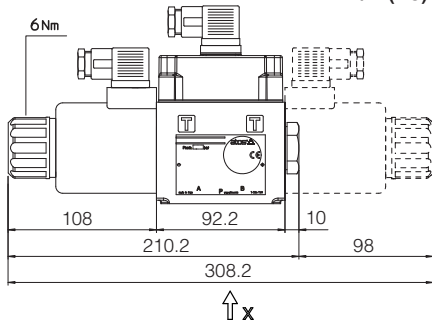
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
Y = DRAIN PORT

option /A

Single solenoid valves: solenoid mounted at side of port B.

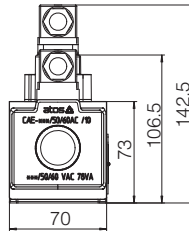
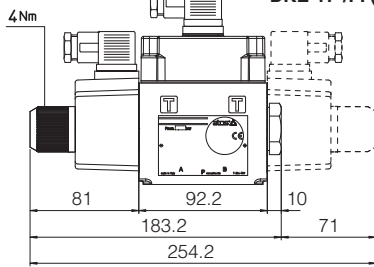
Double solenoid valves DKE/FV(DC):
 FV inductive position switch mounted at side of port A

DKE-16*/FI (DC)
DKE-17*/FI (DC) dotted line



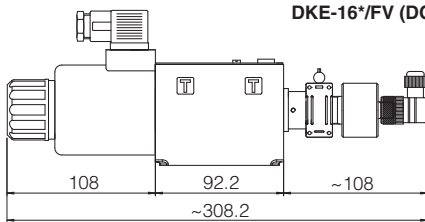
Mass:
 kg 4,4 (one solenoid)
 kg 5,8 (two solenoids)

DKE-16*/FI (AC)
DKE-17*/FI (AC) dotted line



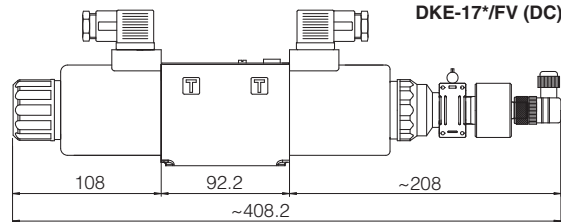
Mass:
 kg 3,7 (one solenoid)
 kg 4,4 (two solenoids)

DKE-16*/FV (DC)



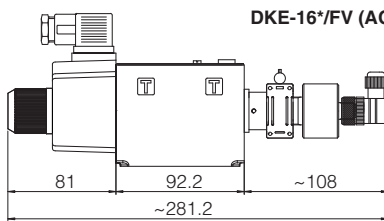
Mass: kg 4,4

DKE-17*/FV (DC)



Mass: kg 5,9

DKE-16*/FV (AC)



Mass: kg 3,8

Safety modular valves with spool position monitoring

On-off, direct, conforming to Machine Directive 2006/42/EC - certified by



CE

SAFETY CERTIFIED

HF-0611/FV

- ① Body
- ② Spool
- ③ Inductive position switch **FV**
- ④ Sensor electric connector (supplied with the valve)
- ⑤ Coil electric connector (to be ordered separately)

HF are spool type, direct operated solenoid valves in modular execution, normally used for safety functions to shut-off or to by-pass the hydraulic user lines.

They are provided with **FV** inductive position switch for spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

Applications

Syncro press brakes, vertical presses, plastic injection, ceramic presses.

Certification

The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting Surface: **ISO 4401 size 06**

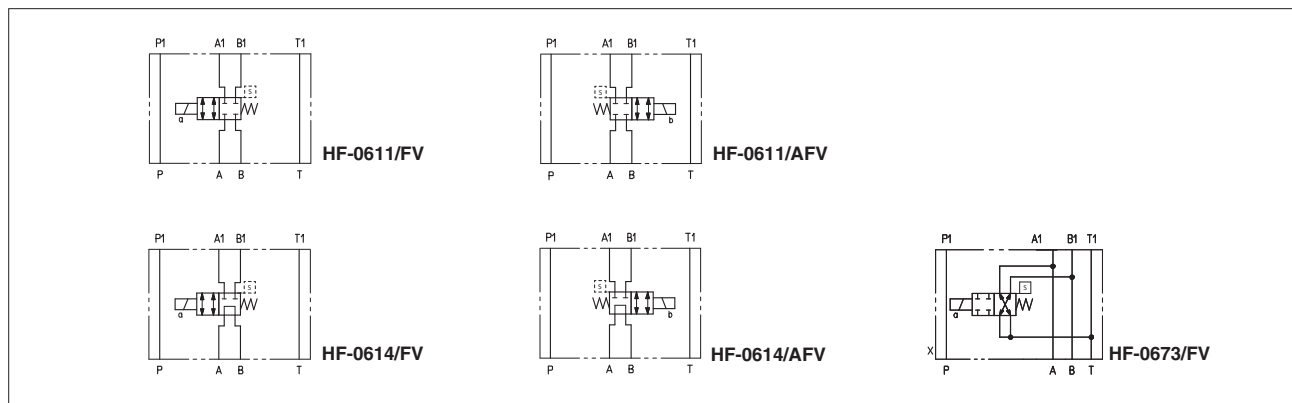
Max flow: **60 l/min**

Max pressure: **350 bar**

1 MODEL CODE

HF-0	61	1	/ A	/ FV	- E	X	24DC	**	/*
Modular directional valve size 06								Series number	Seals material, see section 4: - = NBR PE = FKM
<p>Valve configuration, see section 2</p> <p>61 = single solenoid, central plus external position, spring centered</p> <p>67 = single solenoid, central plus external position, spring offset</p> <p>Spool type: 1, 3, 4 see section 2</p> <p>Options: A = solenoid mounted at side of port B B = orientation of coil and proximity connectors rotated of 180°</p> <p>Optional spool position monitor: FV = inductive position switch (only for HF-0611, HF-0614, HF-0673)</p>							<p>Voltage code, see section 7</p> <p>X = without connector See section 6 for available connectors, to be ordered separately</p> <p>E = solenoid OE for AC and DC supply</p>		

2 CONFIGURATION



3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. - EC type-examination certificate for safety components (1) - ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: 350 bar; Port T: 210 bar (DC solenoid); 160 bar (AC solenoid)
Maximum flow	60 l/min

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR	HFC	

5 OPTIONS

- A** = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.
B = Orientation of coil and proximity connectors rotated of 180°



the manual operation is not permitted for safety valves, than they are provided with solenoid blind rings to prevent the access to the manual override.

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	669 (for AC supply)	CONNECTOR WIRING	
		666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	669 1,2 = Supply voltage V _{AC} 3 = Coil ground
		SUPPLY VOLTAGES	
666 All voltages	667 24 AC or DC 110 AC or DC 220 AC or DC	669 110/50 AC 110/60 AC 230/50 AC 230/60 AC	

Note: for electronic connectors type **E-SD**, see tab. K500

7 ELECTRIC FEATURES

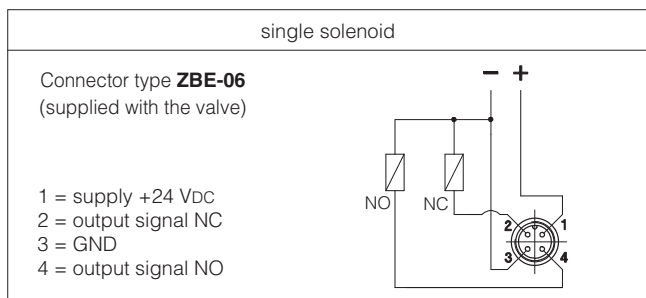
External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil	
12 DC	12 DC	666 or 667	30 W	COE-12DC	
14 DC	14 DC			COE-14DC	
24 DC	24 DC			COE-24DC	
28 DC	28 DC			COE-28DC	
48 DC	48 DC			COE-48DC	
110 DC	110 DC			COE-110DC	
125 DC	125 DC			COE-125DC	
220 DC	220 DC			COE-220DC	
110/50 AC	110/50/60 AC			58 VA (3)	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC			80 VA (3)	COE-230/50/60AC (1)
115/60 AC	115/60 AC	669	30 W	COE-115/60AC	
230/60 AC	230/60 AC			COE-230/60AC	
110/50 AC - 120/60 AC	110 RC			COE-110RC	
230/50 AC - 230/60 AC	230 RC			COE-230RC	

- (1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 - 15% and the power consumption is 52 VA.
- (2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
- (3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

Type of switch	contactless inductive position switch with integrated amplifier		
Supply voltage [V]	20÷32		
Ripple max [%]	≤ 10		
Max current [mA]	400		
Reaction time [ms]	15		
Max peak pressure [bar]	400		
Mechanical life	virtually infinite		
Switch logic	PNP		

9 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH



Note: the /FV position switch is not provided with a protective earth connection

10 STATUS OF OUTPUT SIGNAL FOR MODULAR VALVES WITH /FV INDUCTIVE POSITION SWITCH

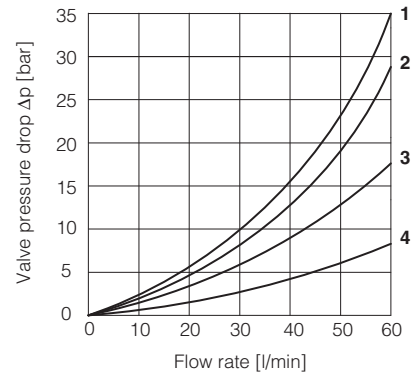
	Configuration 611	Configuration 614	Configuration 673
Hydraulic configuration			
spool position			
pin 2	ON:	ON:	ON:
	OFF:	OFF:	OFF:
pin 4	ON:	ON:	ON:
	OFF:	OFF:	OFF:

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

11 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

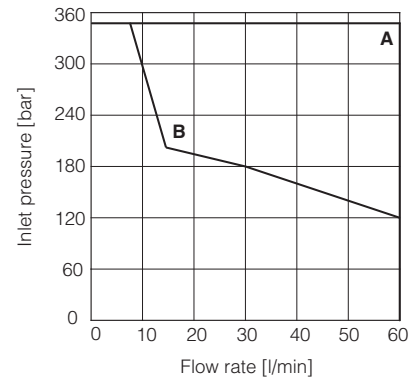
Flow direction \ Valve type	A→A1	B→B1	A→B	A1→T	B1→T
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



12 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$)

Valve type	Curve
HF-0611	A
HF-0614, HF-0673	B



13 DIMENSIONS [mm]

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
 Seals: 4 OR 108
 Ports P, A, B, T: $\varnothing = 7.5$ mm (max).

HF-0611/FV
HF-0614/FV
HF-0673/FV

① = Power supply connector code 666, 667 or 669, to be ordered separately
 ② = Inductive position switch connector code ZBE-06, supplied with the valve

Safety cartridge valves with poppet position monitoring

screw-in, 2-way, poppet type, leak free, conforming to Machine Directive 2006/42/CE - certified by



CE

**SAFETY
CERTIFIED**

JO-DL-4-2/FV-X 24DC

① cartridge body
 ② poppet
 ③ coil
 ④ coil connectors
 ⑤ inductive position switch
 ⑥ sensor connector (to be ordered separately)

JO-DL are leak free, poppet type solenoid cartridges in screw-in execution normally used to cut off the hydraulic power supply line. They are available in normally closed NC configuration.

They are provided with **/FV** inductive position switch (double contact NC/NO) ⑤ which supplies the output electrical on-off signal indicating the poppet ② position (open/closed), and therefore they can be used as safety valves for emergency conditions.

They are **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/CE.

Certification

The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Max flow: **300 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

JO	-	D		-	L	-	4	-	2	/	FV	-	X	24 DC	/	**	/	*	
Cartridge valve screw-in type UNF		D = Directional control		L = Poppet type		Size: 4 = 3/4"-16UNF-2A 6 = 7/8"-14UNF-2A 10 = 1 5/16"-12UNF-2A								Voltage code: 12DC = 12 VDC 24DC = 24 VDC		Series number		Seals material, see section 4: - = NBR PE = FKM	
2 = Two-way																		X = Without connector, see section 5 for available connector	
																		Version: FV = normally closed in rest position, with inductive position switch (double contact)	

2 HYDRAULIC CHARACTERISTICS

Hydraulic symbol

Model	JO-DL-4-2/FV	JO-DL-6-2/FV	JO-DL-10-2/FV
Operating pressure [bar]	Ports A and B 350		
Max flow [l/min]	40	75	300
Response time: energizing [ms]	35	30	35
de-energizing [ms]	50	60	70
Internal leakage	less than 5 drops/min (≤ 0,36 cm³/min) max at 350 bar		

3 GENERAL CHARACTERISTICS

Installation position	Any position
Cavity	JO-DL-4 = SAE-08-2N; JO-DL-6 = SAE-10-2N; JO-DL-10 = SAE-16-2N
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC.
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C

(1) The type-examination certificate can be download from www.atos.com

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult Atos Technical Office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β10 ≥75 recommended)		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVL, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

5 ELECTRIC CHARACTERISTICS

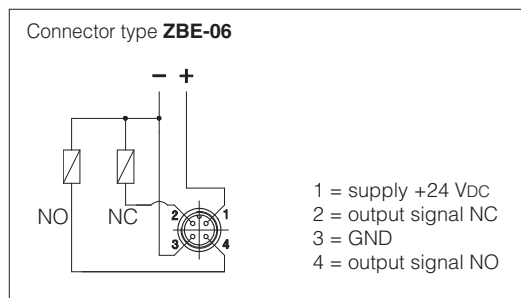
Relative duty factor	100%	
Supply voltage	See model code at section 11	
Supply voltage tolerance	±10%	
Max power	19 Watt	
Power connector	666 (plastic - black); 3 pins, cable clamp PG11, cable max ø 11 mm	to be ordered separately
Type of connector for /FV version	Type ZBE-06 (plastic); 4 pins, cable clamp PG9, cable max ø 8 mm	
Connectors features	666: DIN 43650 - ISO 4400; IP65 (DIN 40050); VDE 0110C ZBE-06: M12 - IEC60947-5-2; IP67 (DIN 40050)	

6 INSTALLATION NOTES

- The assembling of cartridges inside manifolds must be done tightening the valve exagonal ring (for tightening torque, see section 10). Excessive values can cause anomalous deformation and poppet sticking.
For the /FV versions avoid to tighten through the position sensor.
- The CE certification is valid only with shielded electric cables and connector. Consult also tab. P004.
These safety valves must be supplied only and always as one complete component, proximity sensor is factory adjusted.
The supply of subcomponents invalidates the certification.

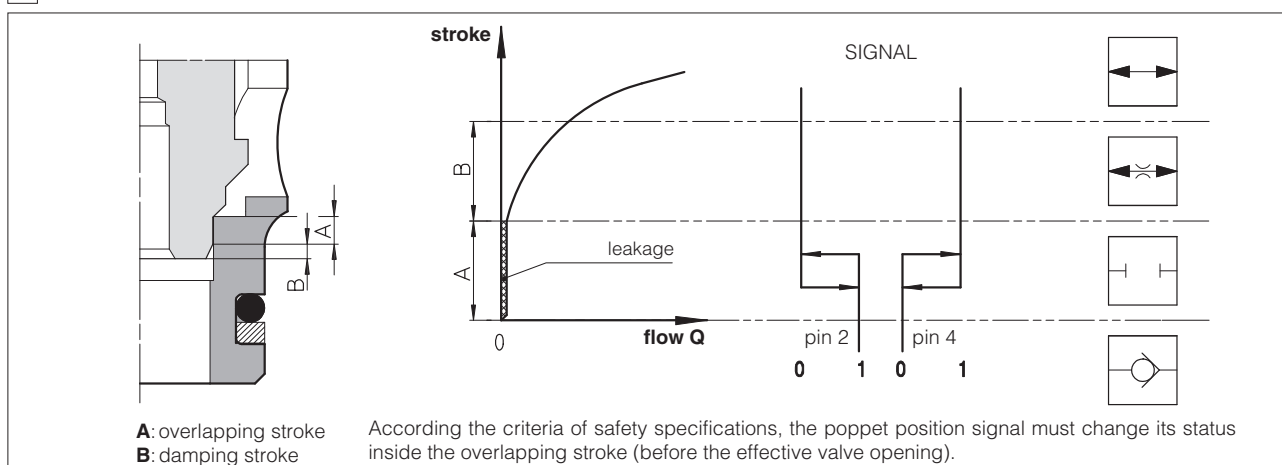
7 TECHNICAL CHARACTERISTICS AND CONNECTING SCHEME OF INDUCTIVE POSITION SWITCH /FV

Type of switch	position switch /FV
Supply voltage [V]	20 ÷ 32
Ripple max [%]	≤ 10
Max current [mA]	400
Max peak pressure [bar]	400
Mechanical life	virtually infinite
Switch logic	PNP



Note: the /FV position switch are not provided with a protective earth connection

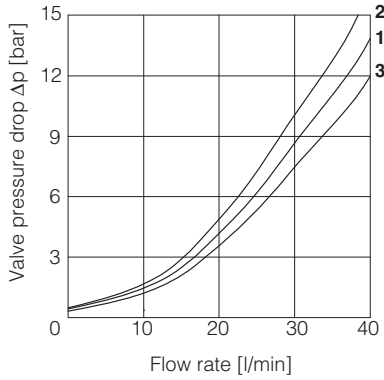
8 SIGNAL STATUS - VERSIONS /FV



9 DIAGRAMS based on mineral oil ISO VG 46 at 50°C

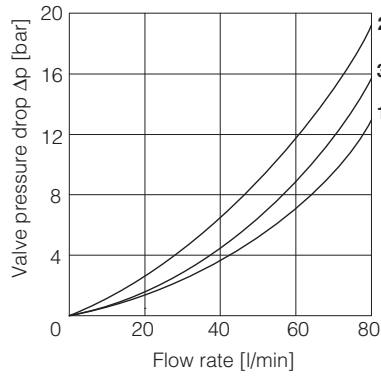
9.1 JO-DL-4

Valve pressure drop - FV version
1 = A → B energized
2 = B → A de-energized
3 = B → A energized



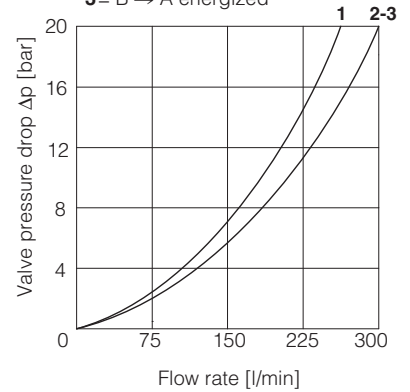
9.2 JO-DL-6

Valve pressure drop - FV version
1 = A → B energized
2 = B → A de-energized
3 = B → A energized

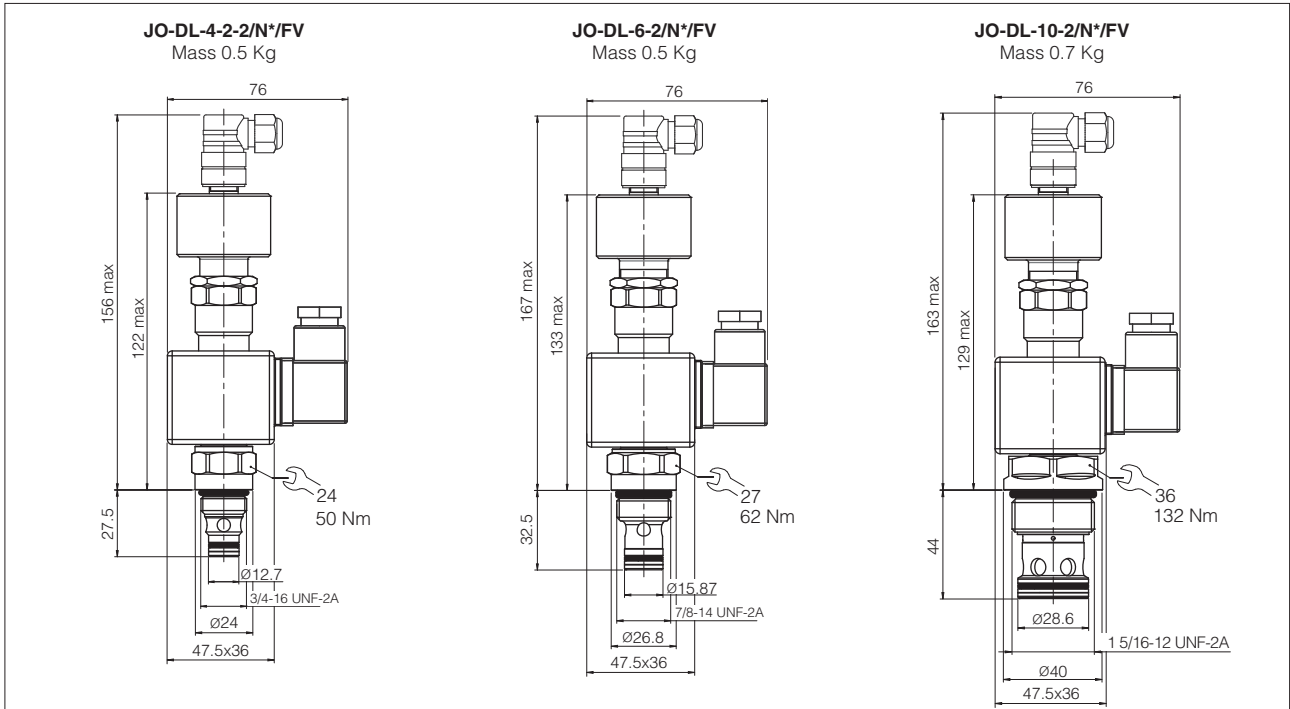


9.3 JO-DL-10

Valve pressure drop - FV version
1 = A → B energized
2 = B → A de-energized
3 = B → A energized

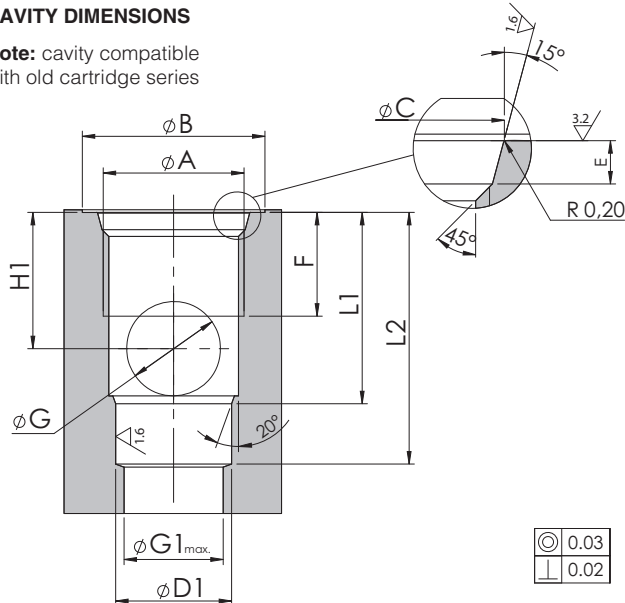


10 DIMENSIONS [mm]



CAVITY DIMENSIONS

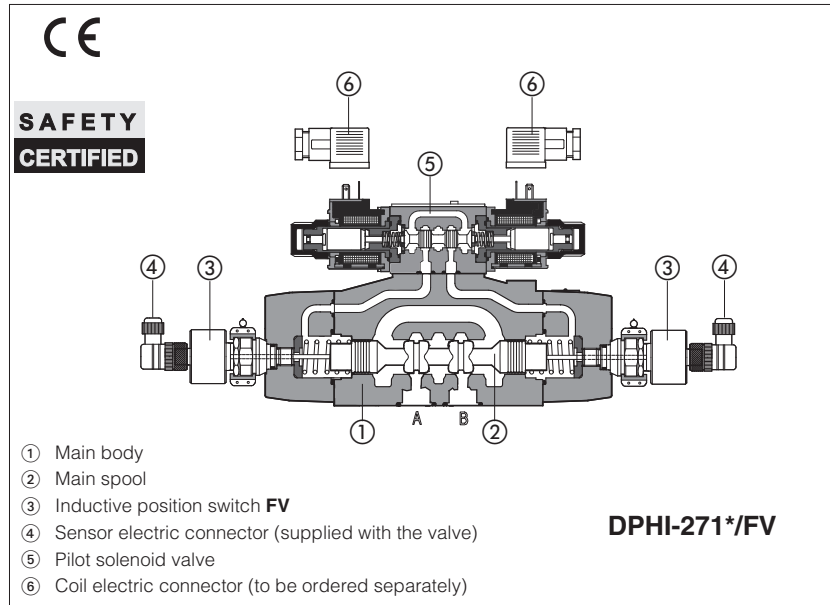
Note: cavity compatible with old cartridge series



	SAE-08-2N	SAE-10-2N	SAE-16-2N
A	3/4-16 UNF	7/8-14 UNF	1 5/16-12 UNF
B	26	30	42
C	20.6 ^{+0.1} ₀	23.9 ^{+0.1} ₀	35.5 ^{+0.1} ₀
D1	12.7 ^{+0.05} ₀	15.87 ^{+0.05} ₀	28.60 ^{+0.05} ₀
E	2.6 ^{+0.3} ₀	2.6 ^{+0.3} ₀	3.3 ^{+0.3} ₀
F	13	15	20
G	9	12	19
G1	12	15	24
H1	14	18	25
L1	20.5	25.5	36
L2	29	34.5	49

Safety directional valves with spool position monitoring

On-off, pilot operated, conforming to Machine Directive 2006/42/EC - certified by



Pilot operated safety directional valves with main spool position monitoring, **CE** marked and certified by **TÜV** in accordance with safety requirements of Machine Directive 2006/42/EC.

Two models are available depending to the pilot valve execution:

DPFI for AC and DC supply, solenoid pilot valve ⑤ type DHI, with cURus certified solenoids, see tech. table E010

DPHE high performances, for AC and DC supply, solenoid pilot valve ⑤ type DHE with cURus certified solenoids, see tech. table E015

The valves are equipped with **FV** inductive position switch for the main spool position monitoring, see section ② for sensor's technical characteristics.

Certification

The **TÜV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface: **ISO 4401, size 10, 16, 25**

Max flow: **160, 300, 700 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPH	I	-	2	71	1	/	A	/	FV	X	24DC	**	/	*
Pilot operated directional control valve														
Solenoid pilot valve: I = DHI for AC and DC supply with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids														
Valve size, ISO 4401: 1 = 10 2 = 16 4 = 25														
Valve configuration, see section ②: 61 = single solenoid, center plus external position, spring centered 63 = single solenoid, 2 external positions, spring offset 67 = single solenoid, center plus external position, spring offset 71 = double solenoid, 3 positions, spring centered 75 = double solenoid, 2 external positions, with detent														
Spool type, see section ②														
											Seals material see sect. ③, ④ - = NBR PE = FKM Series number			
											Voltage code, see section ⑦			
											X = without connector, see section ⑧ for available connectors, to be ordered separately			
											Spool position monitor FV = inductive position switch (double contact)			
											Hydraulic options, see section ⑤ A, D, E, R Optional devices for main spool switching control, see section ⑥ H, H9, L9			

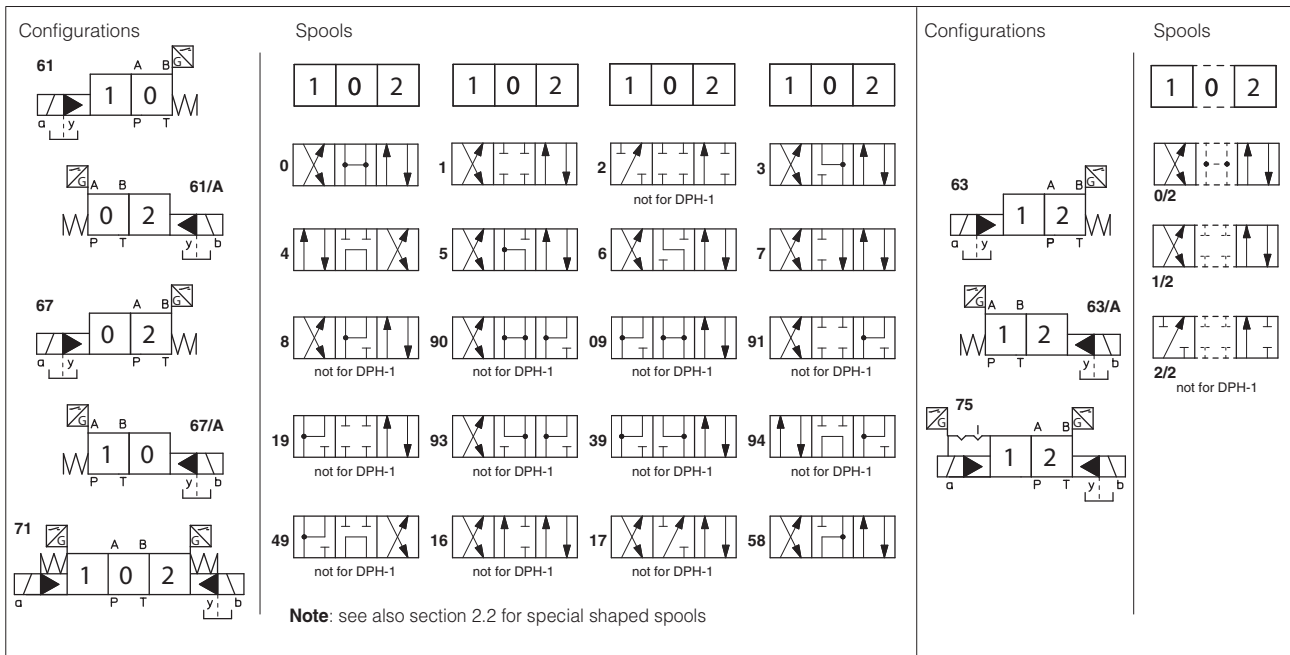
Notes:

FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

The FV inductive position switch is directly connected to the valve main spool

In pilot operated valves only the main spool position is monitored; the pilot solenoid valve is not monitored

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



2.1 Standard spools availability

- DPH*-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPH*-2 and DPH*-4 are available with all spools shown in the above table

2.2 Special shaped spools

- spools type **0** and **3** are also available as **0/1** and **3/1** with restricted oil passages in central position, from user ports to tank.
- spools type **1, 4, 5, 58, 6** and **7** are also available as **1/1, 4/8, 5/1, 58/1, 6/1** and **7/1** that are properly shaped to reduce water-hammer shocks during the switching.

2.3 Special spool availability

Valve size	special shaped spool							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPH*-1	•	•		•				
DPH*-2, DPH*-4	•	•	•	•	•	•	•	•

3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. - EC type-examination certificate for safety components (1) - ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	P, A, B, X = 350 bar (for pilot pressure see also option /L9 at section 6) T = 250 bar for external drain (standard) T with internal drain (option /D) = 120 bar DPHI; 210 bar DPHE (DC); 160 bar DPHE (AC) Y = 0 bar Minimum pilot pressure for correct operation is 8 bar
Maximum flow	DPH*-1: 160 l/min ; DPH*-2: 300 l/min ; DPH*-4: 700 l/min (see Q/Δp diagrams at section 12 and operating limits at section 13)

(1) The type-examination certificate can be download from www.atos.com

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils (all versions) and AC coils (only DPHI) F (155°C) for AC coils (only DPHE) Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR	HFC	

5 HYDRAULIC OPTIONS

5.1 option /A = Solenoid mounted at side of port A of main body (only for single solenoid valves)
In standard version the solenoid is mounted at side of port B
For sensor position, see sect [16](#)

5.2 option /D = Internal drain (standard configuration is external drain)

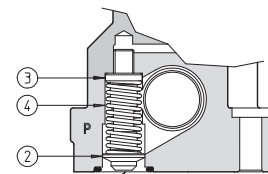
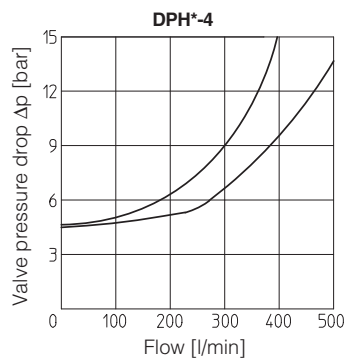
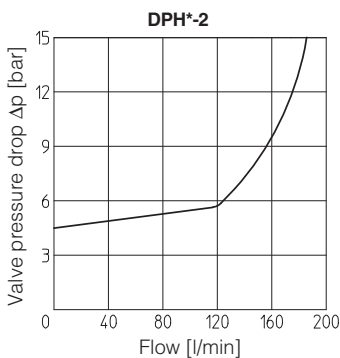
5.3 option /E = External pilot pressure (standard configuration is internal pilot pressure)

5.4 option /R = Pilot pressure generator (4 bar on port P - not for DPH*-1)

The device **/R** generates an additional pressure drop, in order to ensure the minimum pilot pressure, for correct operation of the valves with internal pilot and fitted with spools type **0, 0/1, 4, 4/8, 5, 58, 09, 90, 94, 49**.

The device **/R** has to be fitted when the pressure drop in the valve, verified on flow versus pressure diagrams, is lower than the minimum pilot pressure value.

Pressure drop through the pilot pressure generator /R



- ① Flapper-guide ③ Spring stop-washer
- ② Flapper ④ Spring

Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: 2 for DP-2 4 for DP-4

WARNING: the manual operation is not permitted for safety valves, than the valve is provided with solenoid blind rings to prevent the access to the manual override. The manual override protected by rubber cup (option /WP) is not available



WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury

Safety valves must be installed and commissioned only by qualified personnel

Safety valves must not be disassembled

The inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers

Valve's components cannot be interchanged

The valves must operate without switching shocks and spool vibrations



6 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Following options are suggested to reduce the hydraulic shocks at the valve operation

6.1 option /H = Adjustable chokes (meter-out to the pilot chambers of the main valve)

6.2 option /H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve)

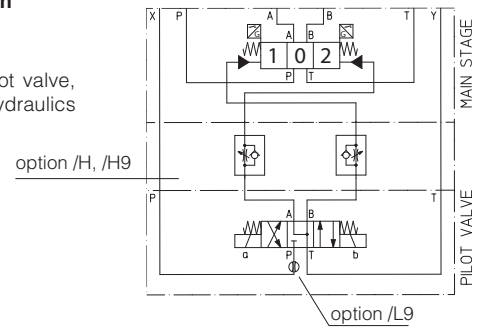
6.3 option /L9 = Only for DP-2 and DP-4: plug with calibrated restrictor in P port of pilot valve, suggested in case of pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

Plug code:

PLUG-12A ø1,2 mm for DP-2

PLUG-15A ø1,5 mm for DP-4

FUNCTIONAL SCHEME (config. 71) example of switching control options



7 ELECTRIC FEATURES

Valve	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (3)		Code of spare coil		
				DPHI	DPHE	DPHI	Colour of coil label	DPHE
DPHI DPHE	6 DC	6 DC (4)	666 or 667	33 W	30 W	COU-6DC	brown	-
	12 DC	12 DC				COU-12DC	green	COE-12DC
	14 DC	14 DC				COU-14DC	brown	COE-14DC
	24 DC	24 DC				COU-24DC	red	COE-24DC
	28 DC	28 DC				COU-28DC	silver	COE-28DC
	48 DC	48 DC				COU-48DC	silver	COE-48DC
	110 DC	110 DC				COU-110DC	gold	COE-110DC
	125 DC	125 DC				COU-125DC	blue	COE-125DC
	220 DC	220 DC				COU-220DC	black	COE-220DC
	24/50 AC	24/50/60 AC				COI-24/50/60AC (1)	pink	-
	24/60 AC	(4)	COI-48/50/60AC (1)	white	-			
	48/50 AC	48/50/60 AC	58 VA	yellow	COE-110/50/60AC			
	48/60 AC	(4)				80 VA	-	COE-115/60AC
	110/50 AC	110/50/60 AC	-	-	COI-120/60AC	white	-	
	115/60 AC (5)	115/60 AC	60 VA	58 VA	COI-230/50/60AC (1)	light blue	COE-230/50/60AC	
	120/60 AC (4)	120/60 AC						80 VA
	230/50 AC	230/50/60 AC	669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/60 AC	230/60 AC						
	110/50 AC	110RC						
	120/60 AC							
230/50 AC	230RC							
230/60 AC								

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DPHI) and 58 VA (DPHE)

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

(4) Only for DPHI

(5) Only for DPHE

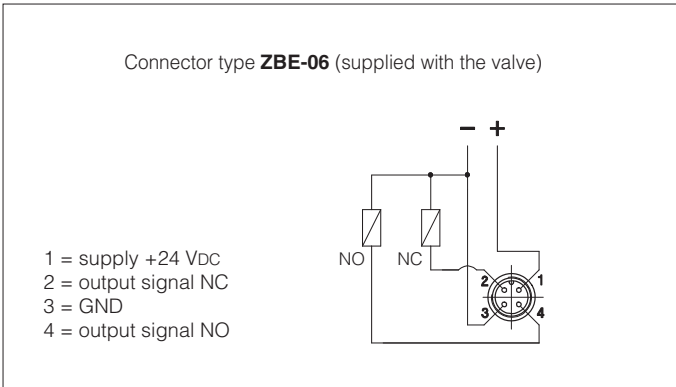
8 COILS ELECTRIC CONNECTORS according to din 43650 (to be ordered separately)

666, 667 (for AC or DC supply)		669 (for AC supply)		CONNECTOR WIRING		
				666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground		669 1,2 = Supply voltage VAC 3 = Coil ground
SUPPLY VOLTAGES						
666 All voltages		667 24 AC or DC 110 AC or DC 220 AC or DC		669 110/50 AC 110/60 AC 230/50 AC 230/60 AC		

9 TECHNICAL CHARACTERISTICS OF FV INDUCTIVE POSITION SWITCH

Type of switch	contactless inductive position switch with integrated amplifier		
Supply voltage [V]	20÷32		
Ripple max [%]	≤ 10		
Max current [mA]	400		
Reaction time [ms]	15		
Max peak pressure [bar]	400		
Mechanical life	virtually infinite		
Switch logic	PNP		

10 CONNECTING SCHEME OF FV INDUCTIVE POSITION SWITCH



Note: the /FV position switch is not provided with a protective earth connection

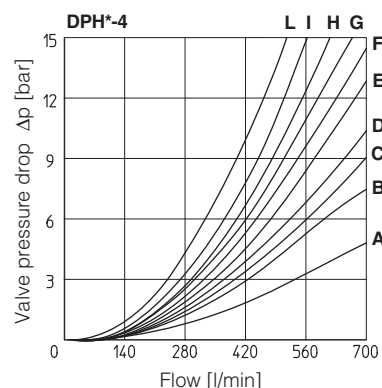
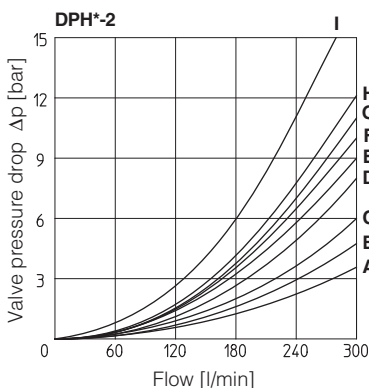
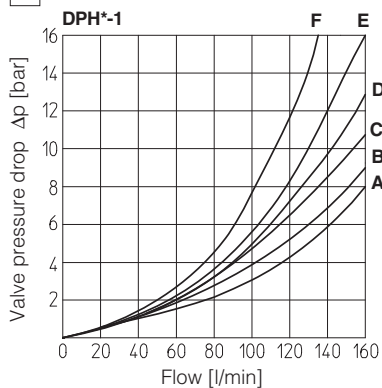
11 STATUS OF OUTPUT SIGNAL

DPHI - DPHE	Configuration 61 monitored position "0"	Configuration 63 monitored position "2"	Configuration 67 monitored position "2"	Configuration 71 monitored position "0"	Configuration 75 monitored position "2"	
Hydraulic configuration						
spool position	1 0	1 2	0 2	1 0 2	1 2	
sensor	pin 2 ON					
	pin 2 OFF					
pin 4	ON					
	OFF					
sensor side a	pin 2 ON					
	pin 2 OFF					
pin 4	ON					
	OFF					
sensor side b	pin 2 ON					
	pin 2 OFF					
pin 4	ON					
	OFF					

Note: FV position switch can be electrically wired by the customer as NO or NC and then the status of the output signal will be in accordance to the selected configuration

= intermediate spool position corresponding to the hydraulic configuration change

12 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C



DPH*-1

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1/2	D	E	D	C	-
0	D	E	C	C	E
1	A	B	D	C	-
3, 6, 7	A	B	C	C	-
4, 4/8	B	C	D	D	-
5, 58	A	E	C	C	F

DPH*-2

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
0/2, 1, 3, 6, 7, 8	A	A	D	A	-
1/1, 1/2, 7/1	B	B	D	E	-
0	A	A	D	E	C
0/1	A	A	D	-	-
2	A	A	-	-	-
2/2	B	B	-	-	-
3/1	A	A	D	D	-
4	C	C	H	I	F
4/8	C	C	G	I	F
5	A	B	F	H	G
5/1	A	B	D	F	-
6/1	B	B	C	E	-
09	A	-	-	G	-
16	A	C	D	F	-
17	C	A	E	F	-
19	C	-	-	G	-
39	C	-	-	H	-
49	-	D	-	-	-
58	B	A	F	H	H
58/1	B	A	D	F	-
90	A	A	E	-	D
91	C	C	E	-	-
93	-	C	D	-	-
94	D	-	-	-	-

DPH*-4

Spool type	Flow direction				
	P→A	P→B	A→T	B→T	P→T
1	B	B	B	D	-
1/1	D	E	E	F	-
1/2	E	D	B	C	-
0	D	C	D	E	F
0/1, 3/1, 5/1, 6, 7	D	D	D	F	-
0/2	D	D	D	E	-
2	B	B	-	-	-
2/2	E	D	-	-	-
3	B	B	D	F	-
4	C	C	H	L	L
5	A	D	D	D	H
6/1	D	E	D	F	-
7/1	D	E	F	F	-
8	D	D	E	F	-
09	D	-	-	F	F
16	C	D	E	F	-
17	E	D	E	F	-
19	F	-	-	E	-
39	G	F	-	F	-
58	E	A	B	F	H
58/1	E	D	D	F	-
90	D	D	D	-	F
91	F	F	D	-	-
93	-	G	D	-	-

13 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPH*-1

Spool	Inlet pressure [bar]			
	70	160	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7	160	160	160	145
4, 4/8	160	160	135	100
5, 58	160	160	145	110
0/1, 0/2, 1/2	160	160	145	135

DPH*-2

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
0, 1, 3, 6, 7, 8	300	300	300	300
2, 4, 4/8	300	300	240	140
5	260	220	180	100
0/1, 0/2, 1/2	300	250	210	180
16, 17, 56, *9, 9*	300	300	270	200

DPH*-4

Spool	Inlet pressure [bar]			
	70	140	210	350
	Flow rate [l/min]			
1, 6, 7, 8	700	700	700	600
2, 4, 4/8	500	500	450	400
5, 0/1, 0/2, 1/2	600	520	400	300
0, 3	700	700	600	540
16, 17, 58, *9, 9*	500	500	500	450

14 SWITCHING TIMES (average values in m sec)

TEST CONDITIONS:

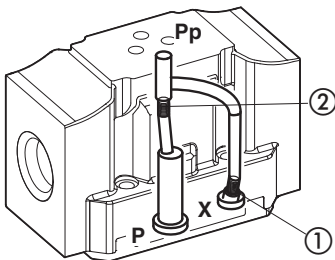
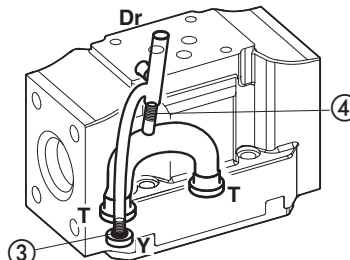
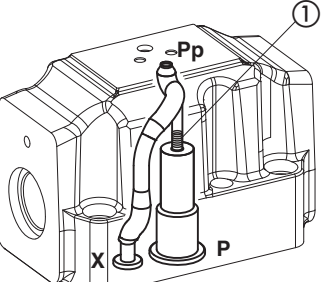
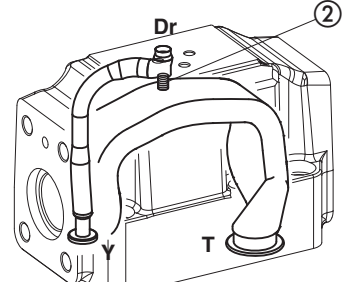
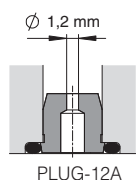
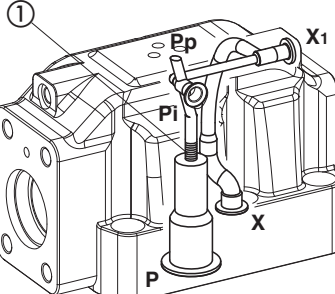
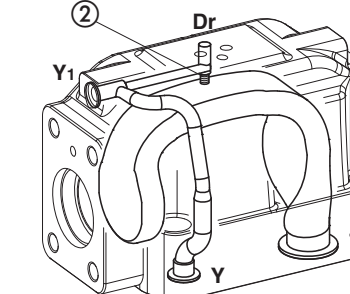
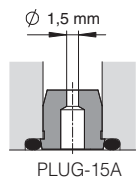
- Nominal voltage supply DC (direct) and AC (alternating) with connector type SP-666. The use of other connectors can affect the switching time;
- 2 bar of counter pressure on port T;
- mineral oil: ISO VG 46 at 50°C

Piloting pressure		70 bar		140 bar		250 bar	
Valve model		Alternating current	Direct current	Alternating current	Direct current	Alternating current	Direct current
DPH*-1	Switch ON	35 ÷ 50	50 ÷ 75	30 ÷ 40	45 ÷ 65	20 ÷ 30	35 ÷ 50
	Switch OFF	50 ÷ 80					
DPH*-2	Switch ON	40 ÷ 55	55 ÷ 80	30 ÷ 45	50 ÷ 70	20 ÷ 35	40 ÷ 55
	Switch OFF	60 ÷ 95					
DPH*-4	Switch ON	60 ÷ 95	80 ÷ 115	45 ÷ 75	60 ÷ 95	30 ÷ 50	45 ÷ 65
	Switch OFF	80 ÷ 130					

15 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below. To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.

Standard valves configuration provides internal pilot and external drain

<p>DPH*-1</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: blinded plug SP-X300F ① in X; plug SP-X310F ② in Pp;</p> <p>External piloting: blinded plug SP-X300F ② in Pp; plug SP-X310F ① in X;</p> <p>Internal drain: blinded plug SP-X300F ③ in Y;</p> <p>External drain: blinded plug SP-X300F ④ in Dr.</p>
<p>DPH*-2</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: Without blinded plug SP-X300F ①;</p> <p>External piloting: Add blinded plug SP-X300F ①;</p> <p>Internal drain: Without blinded plug SP-X300F ②;</p> <p>External drain: Add blinded plug SP-X300F ②.</p> <p>Option L9 This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve</p>  <p>PLUG-12A</p>
<p>DPH*-4</p> <p>Pilot channels</p> 	<p>Drain channels</p> 	<p>Internal piloting: Without blinded plug SP-X500F ①;</p> <p>External piloting: Add blinded plug SP-X500F ①;</p> <p>Internal drain: Without blinded plug SP-X300F ②;</p> <p>External drain: Add blinded plug SP-X300F ②.</p> <p>Option L9 This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve</p>  <p>PLUG-15A</p>

DPH*-1/FV

ISO 4401: 2005

Mounting surface:

4401-05-05-0-05

Fastening bolts:

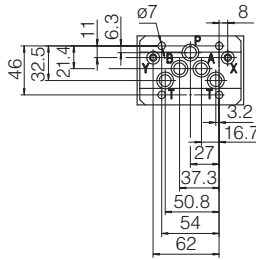
4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

Seals: 5 OR 2050, 2 OR 108

Ports P,A,B,T: Ø = 11 mm (max)

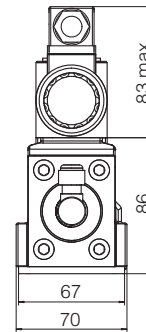
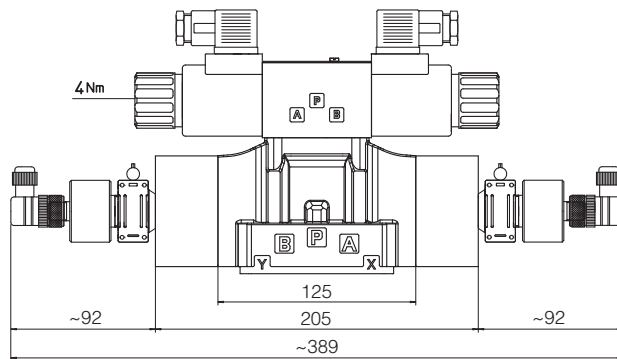
Ports X, Y: Ø = 5 mm



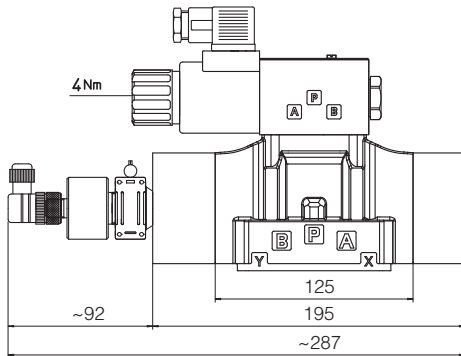
Mass (Kg)	
DPHI-16	7,1
DPHI-17	7,7
DPHE-16	7,2
DPHE-17	7,9
Option H, H9	+1,0

- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- X** = EXTERNAL OIL PILOT PORT
- Y** = DRAIN PORT

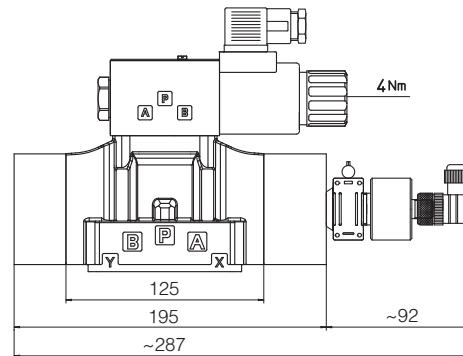
**DPH*-171*
DPH*-175***



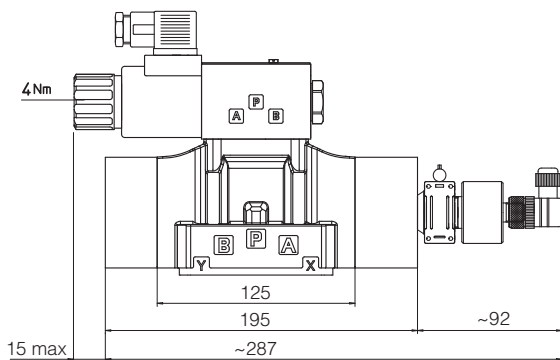
DPH*-161*



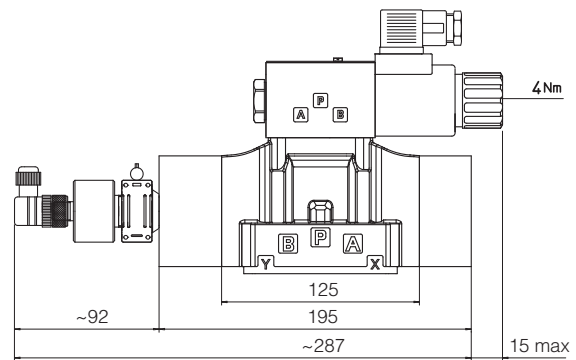
DPH*-161*/A



**DPH*-163*
DPH*-167***



**DPH*-163*/A
DPH*-167*/A**



DPH*-2*/FV

ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

Fastening bolts:

4 socket head screws M10x50 class 12.9

Tightening torque = 70 Nm

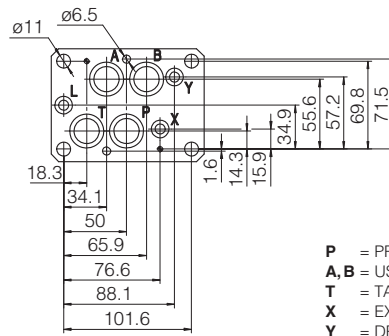
2 socket head screws M6x45 class 12.9

Tightening torque = 15 Nm

Diameter of ports A, B, P, T: $\varnothing = 20$ mm;

Diameter of ports X, Y: $\varnothing = 7$ mm;

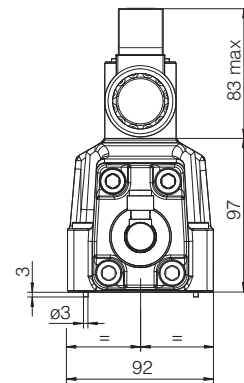
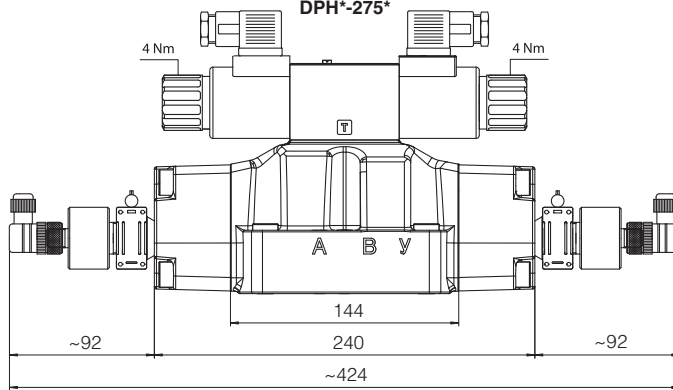
Seals: 4 OR 130, 2 OR 2043



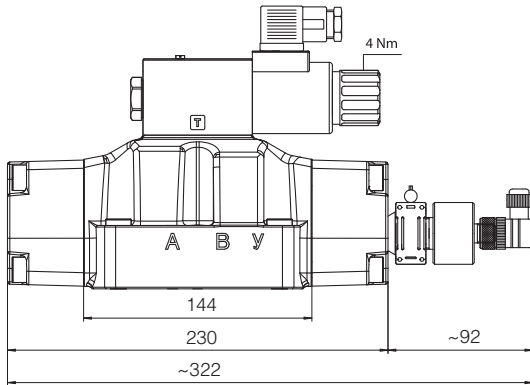
Mass (Kg)	
DPHI-26	10.1
DPHI-27	10.7
DPHE-26	10.2
DPHE-27	10.9
Option H, H9	+1.0

- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- X** = EXTERNAL OIL PILOT PORT
- Y** = DRAIN PORT

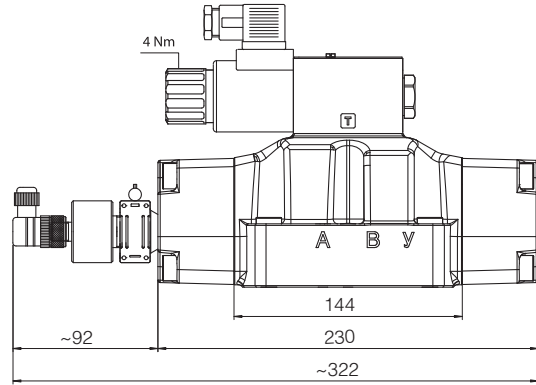
DPH*-271* DPH*-275*



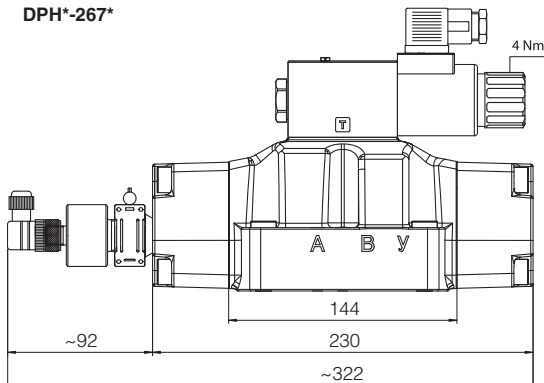
DPH*-261*



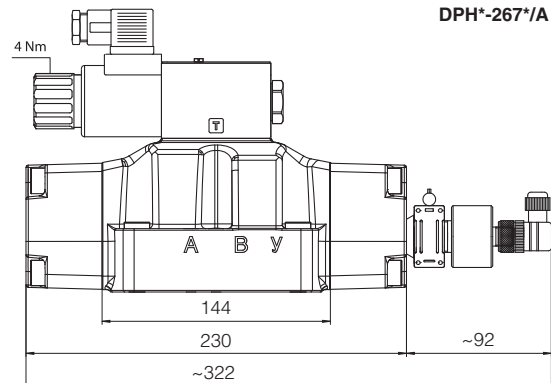
DPH*-261*/A



DPH*-263* DPH*-267*



DPH*-263*/A DPH*-267*/A

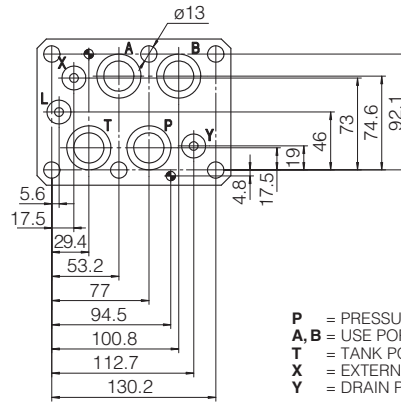


DPH*-4*/FV

ISO 4401: 2005

Mounting surface: 4401-08-08-05

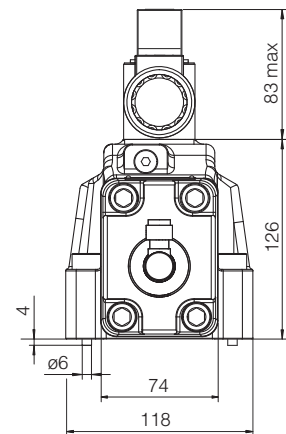
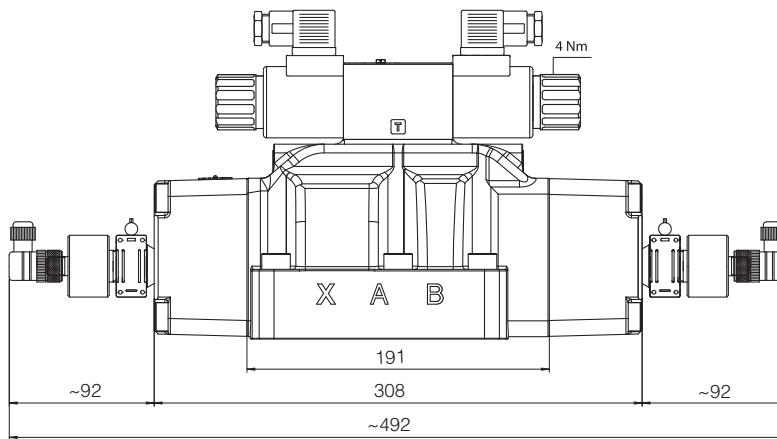
Fastening bolts:
 6 socket head screws M12x60 class 12.9
 Tightening torque = 125 Nm
 Diameter of ports A, B, P, T: $\varnothing = 24$ mm;
 Diameter of ports X, Y: $\varnothing = 7$ mm;
 Seals: 4 OR 4112, 2 OR 3056



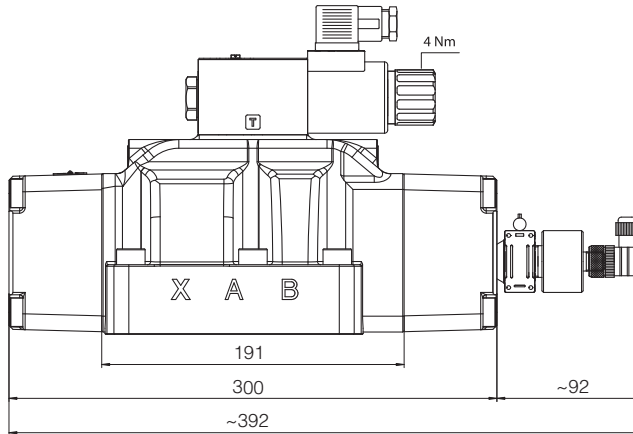
Mass (Kg)	
DPHI-46	17,6
DPHI-47	18,2
DPHE-46	17,7
DPHE-47	18,4
Option H, H9	+1,0

- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- X** = EXTERNAL OIL PILOT PORT
- Y** = DRAIN PORT

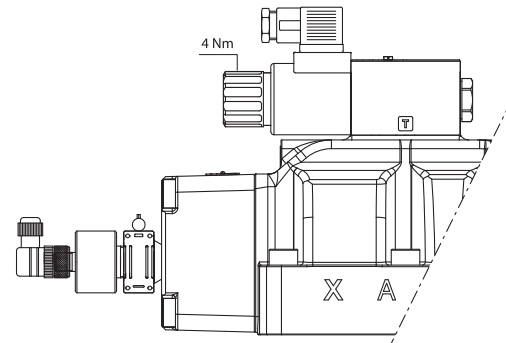
DPH*-471*
DPH*-475*



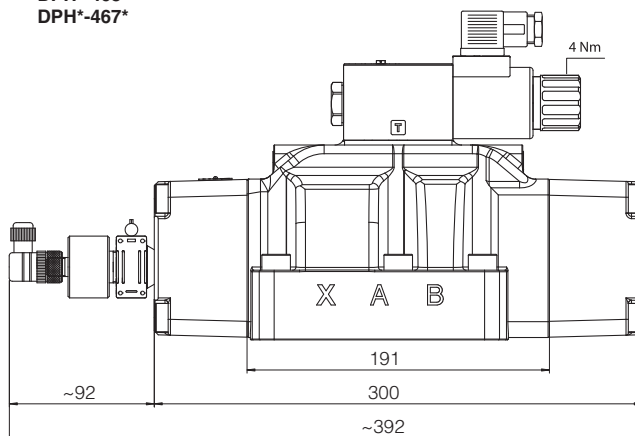
DPH*-461*



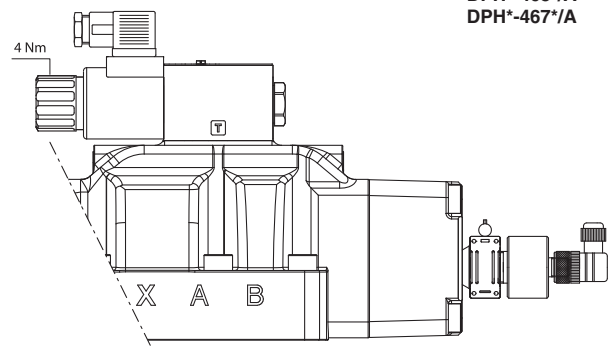
DPH*-461*/A




DPH*-463*
DPH*-467*

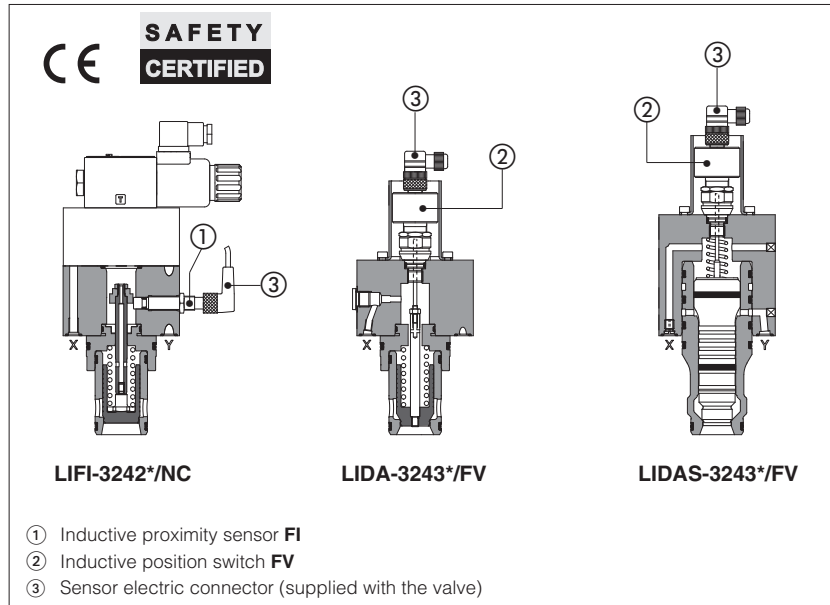


DPH*-463*/A
DPH*-467*/A



Safety cartridge valves with poppet position monitoring

ISO standard, on-off, poppet type, conforming to Machine Directive 2006/42/EC - certified by 



Safety cartridge valves with poppet position monitoring, **CE** marked and certified by **TUV**, in accordance with safety requirements of Machine Directive 2006/42/EC.

LIFI: intermediate safety element with **FI** inductive proximity sensor, to be coupled with functional covers

LIDA: safety valve with integral cover design and with **FV** inductive position switch, available with optional solenoid pilot valve (LIDAH)

LIDAS: active pilot operated safety valve with **FV** inductive position switch, available with optional solenoid pilot valve (LIDASH), see section 12 for sensors technical characteristics.

These valves are normally used to cut off the hydraulic power line in case of emergency condition, thus avoiding dangerous movements of the machines actuators.

Certification

The **TUV** certificate can be downloaded from www.atos.com, catalog on line, technical information section.

Mounting surface & cavity: ISO 7368 size **16 to 50**

Max flow: **1800 l/min** at $\Delta p = 5$ bar

Max pressure: up to **420 bar**

- ① Inductive proximity sensor **FI**
- ② Inductive position switch **FV**
- ③ Sensor electric connector (supplied with the valve)

1 RANGE OF VALVE'S MODELS

Valve code	Size	Description	DC solenoids		AC solenoids	
			Sensor type			
			/FI	/FV	/FI	/FV
LIFI	16÷50	intermediate elements with cartridge, to be coupled with a functional cover	•		•	
LIDA(H)	16÷50	cartridges valve		•		•
LIDAS(H)	16÷50	active cartridges valve		•		•

Notes: **FI** = inductive proximity sensor, type NO (normally open or NC (normally closed)

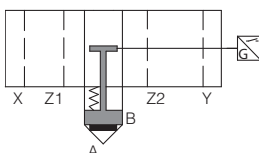
FV = inductive position switch providing both NO and NC contacts to be wired on the electric connector

See section 12 for sensor's characteristics

2 MODEL CODE OF LIFI INTERMEDIATE SAFETY ELEMENT - to be coupled with covers in section 3

<p>LIF</p> <p>Intermediate safety element and cartridge according to ISO 7368</p> <p>Poppet position monitor: I = inductive proximity switch</p> <p>Size ISO 7368 16; 25; 32; 40; 50 Other dimensions available on request</p> <p>Type of poppet, see sect. 9 for Q/Δp diagrams 42 = with damping nose, area ratio 1:1,1 43 = with damping nose, area ratio 1:1,6</p>	<p>I</p>	<p>-</p>	<p>25</p>	<p>42</p>	<p>1</p>	<p>/</p>	<p>NC</p>	<p>**</p>	<p>/</p>	<p>*</p>
<p>Seals material: omit for NBR (mineral oil & water glycol) PE = FKM</p> <p>Series number</p> <p>/NC = closed contact with poppet in resting position</p> <p>Spring cracking pressure: 1 = 0,3 bar for poppet 42; 0,6 bar for poppet 43 2 = 1,5 bar for poppet 42 3 = 3 bar for all poppets 6 = 5,5 bar for all poppets</p>										

2.1 Hydraulic symbols of LIFI



Note: in LIFI safety valves the cartridge and the intermediate element with poppet position sensor cannot be separated

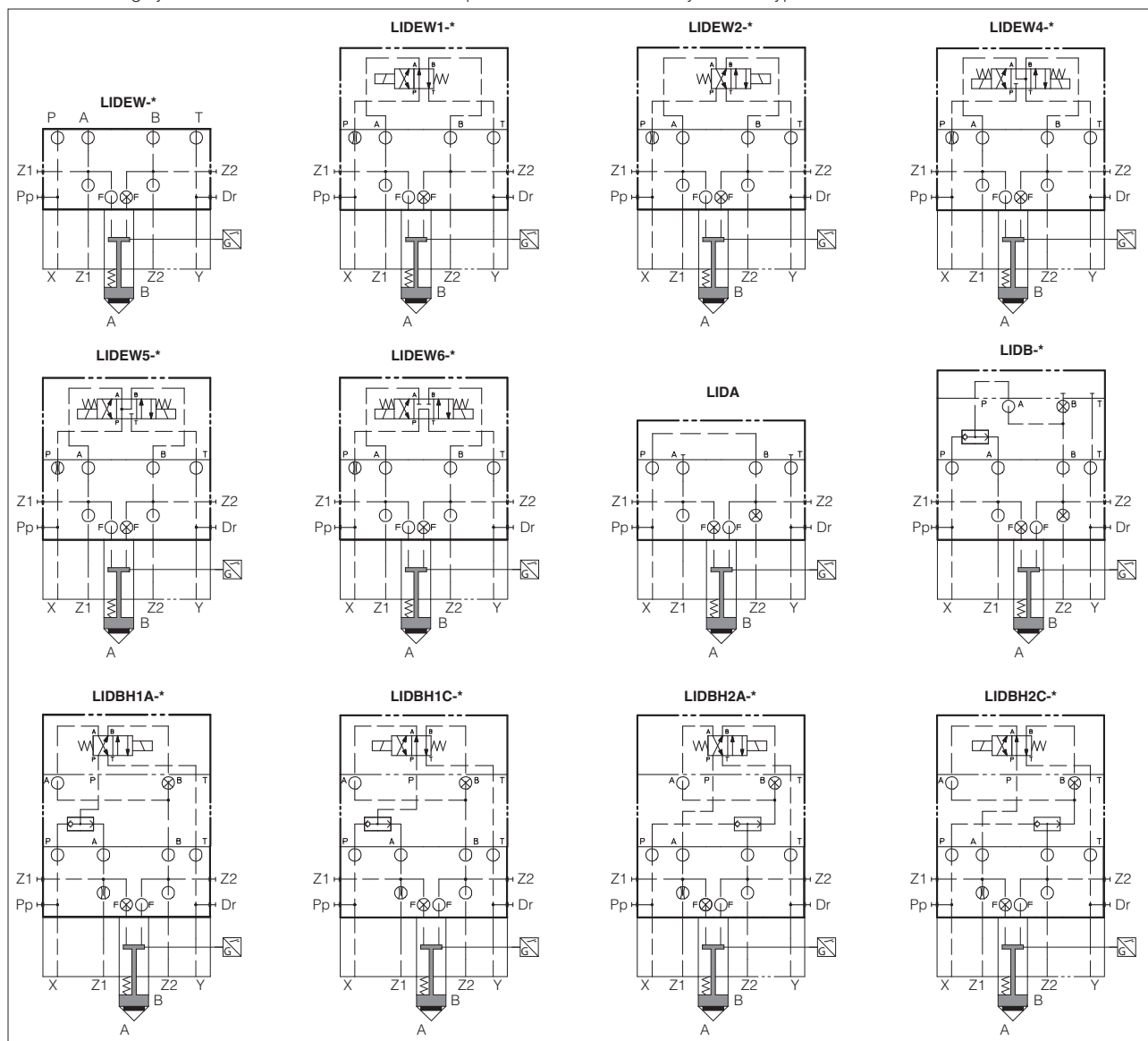
3 MODEL CODE OF FUNCTIONAL COVERS TO BE COUPLED WITH LIFI SAFETY VALVES

LID	A	-	2	/	*	F	-	I	X	24DC	**	/	*	/	*
Cover according to ISO 7368 Cover type , see section 3.1 for hydraulic configuration: A = direct pilot B = with shuttle valve for pilot selection; EW* = with solenoid valve for pilot selection BH** = as EW* but with shuttle valve for pilot selection;															
Size ISO 7368 1 = 16; 2 = 25; 3 = 32; 4 = 40; 5 = 50;															
Options: B = cartridge piloted via port B of solenoid valve (only for LIDEW* and LIDBH**) E = with external attachment X (1/4" GAS) and underneath port X plugged															
F = prearranged for coupling with LIFI cover															
															Optional different setting of calibrated plugs in the pilot channels (see tech. tables H030, H040) Seals material: omit for NBR (mineral oil & water glycol) PE = FKM Series number
															Voltage code only for LIDEW* and LIDBH**: see section 10
															Only for LIDEW* and LIDBH**: X = without connector, to be order separately see section 11
															Type of pilot solenoid valve only for LIDBH** and LIDEW*: I = DHI Pmax 350 bar E = DHE Pmax 350 bar EP = DHEP Pmax 420 bar

For valve type LIDB, LIDEW (in the configuration with external pilot line) Atos can supply leak free poppet type directional pilot valves type DLEH-3*. Consult our technical office for detailed information.

3.1 HYDRAULIC SYMBOLS OF FUNCTIONAL COVERS

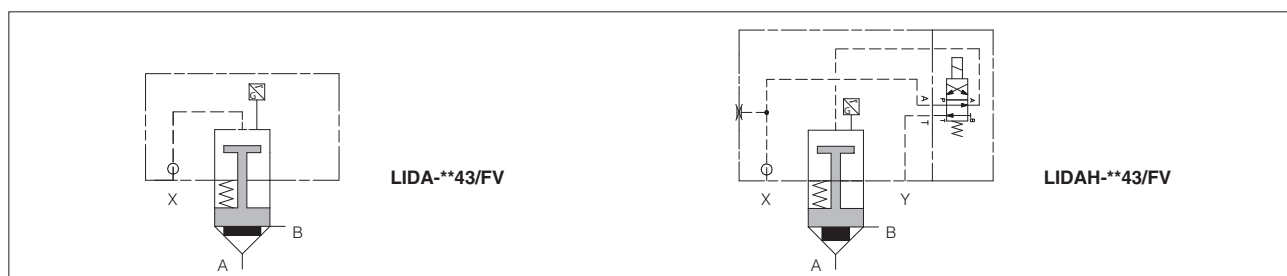
the following symbols show the functional covers coupled with intermediate safety element type LIFI



4 MODEL CODE OF LIDA SAFETY VALVES (integral design cover)

LIDA	H	- 25	43	3	/ FV	- I	X	24DC	**	/ *
Safety cartridge valve according to ISO 7368										
optional pilot valve: - = omit if not required H = with NG 6 pilot valve										
Size ISO 7368: 16; 25; 32; 40; 50										
poppet type: 43 = with damping nose area ratio 1:1,6										
spring cracking pressure: 1 = 0,6 bar 3 = 3 bar 6 = 5,5 bar										
Poppet position monitor: FV = inductive position switch (double contact)										
										Seals material: omit for NBR (mineral oil & water glycol) PE = FKM
										Series number
										Only for LIDAH Voltage code, see section [10]
										Only for LIDAH X = without connector, to be order separately see section [11]
										Pilot solenoid valve only for LIDAH I = DHI Pmax 350 bar E = DHE Pmax 350 bar EP = DHEP Pmax 420 bar

4.1 HYDRAULIC SYMBOLS OF LIDA /FV



5 MAIN CHARACTERISTICS OF LIFI AND LIDA(H)/FV

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C
Flow direction	A→B or B→A
Operating pressure	LIFI A, B, X, Z1, Z2 = 420 bar
	LIDA/FV A, B, X = 420 bar ;
	LIDAH/FV A, B, X = LIDAH-I = 350 bar ; LIDAH-E = 350 bar ; LIDAH-EP = 420 bar Y = LIDAH-I = 120 bar ; LIDAH-E, -EP (DC) = 210 bar ; LIDAH-E, -EP (AC) = 160 bar

(1) The type-examination certificate can be download from www.atos.com

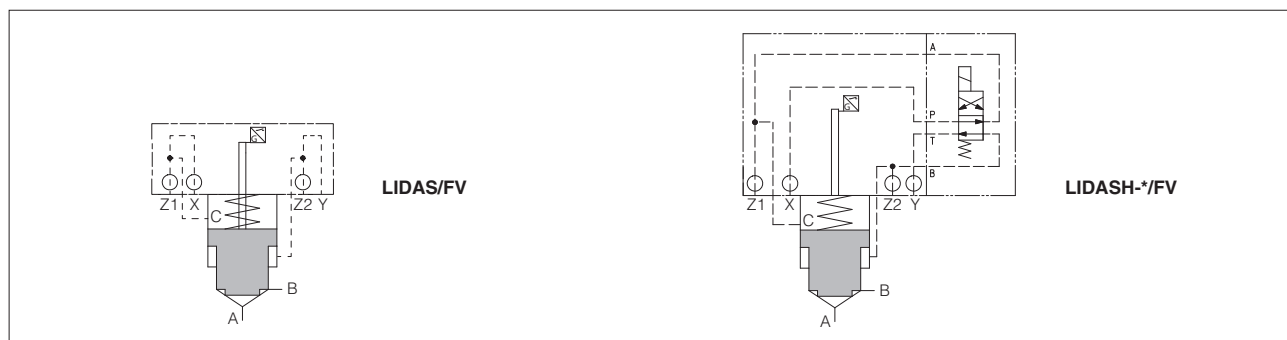
5.1 poppet characteristics of LIFI and LIDA(H)/FV

Poppet type	42 (only LIFI)	43
Functional sketch (Hydraulic symbol)		
Operating pressure	420 bar	
Nominal flow Size 16	140	120
at Δp 5bar (l/min)	300	280
see diagrams Q/Δp at section [15]	550	440
	1150	860
	1800	1370
Area ratio A:Ap	1:1,1	1:2 for size 16, 25 1:1,6 for size 32, 40,50

6 MODEL CODE OF LIDAS ACTIVE SAFETY PILOT OPERATED VALVES

LIDAS	H	-	40	43	3	/	FV	-	I	X	24DC	**	/	*
Active safety cartridges, according to ISO 7368														
Optional pilot valve: - = without pilot solenoid valve H = with pilot solenoid valve														
Size ISO 7368: 16; 25; 32; 40; 50														
Poppet type: 43 = with damping nose														
Spring cracking pressure 3 = 3 bar														
Poppet position monitor: FV = inductive position switch (double contact)														
	Only for LIDASH X = without connector, to be order separately see section 11													
	Only for LIDASH voltage code, see section 10													
	Pilot solenoid valve only for LIDASH I = DHI Pmax 350 bar E = DHE Pmax 350 bar EP = DHEP Pmax 420 bar													
	Seals material: omit for NBR (mineral oil & water glycol) PE = FKM													
	Series number													

6.1 HYDRAULIC SYMBOLS OF LIDAS

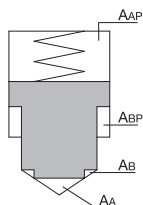


7 MAIN CHARACTERISTICS OF LIDAS/FV

Assembly position / location	Any position				
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)				
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007				
Compliance	CE to Machine Directive 2006/42/EC. -EC type-examination certificate for safety components (1) -ISO 13849 category 1, PLC in high demand mode CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006				
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C				
Flow direction	A→B or B→A				
Operating pressure	LIDAS/FV	A, B, X, Z1, Z2 = 420 bar			
	LIDASH/FV	A, B, X, Z1, Z2 = LIDASH-I 350 bar ; LIDASH-E 350 bar ; LIDASH-EP 420 bar Y = LIDASH-I 120 bar ; LIDASH-E, -EP (DC) = 210 bar ; LIDASH-E, -EP (AC) = 160 bar ;			
Size	16	25	32	40	50
Maximum flow at Δp = 5 bar [l/min]	200	360	550	1100	1800
Poppet characteristics [cm²]					
AA	1,43	3,46	5,30	8,04	13,85
AB (% of AA)	58,6	41,7	51,5	56,3	41,7
ABP (% of AA)	107,0	90,5	85,2	87,9	97,8
AAP (% of AA)	265,6	232,2	236,7	244,1	239,2
AA / (AA + AB) poppet ratio	0,6				
AAP / (AA + AB) piloting ratio	1,6				

(1) The type-examination certificate can be download from www.atos.com

7.1 Poppet areas of LIDAS/FV



Poppet areas

- AA** = main flow (side A)
- AB** = main flow (side B)
- AAP** = piloting area (close)
- ABP** = piloting area (open)

Thanks to the areas ratio $A_{AP}/(A_A+A_B)$, the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).

8 COILS CHARACTERISTICS

Insulation class	Pilot valve E, EP: H (180°C) for DC coils F (155°C) for AC coils Pilot valve I: H (180°C) for DC or AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 10
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

9 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C			
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog			
	Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils		NBR, FKM	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR	HFC	

10 ELECTRIC FEATURES - coils for pilot solenoid valves

Valve	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (3)		Code of spare coil				
				DHI	DHEP	DHI	DHI	DHE, DHEP		
DHI DHE DHEP	6 DC	6 DC (4)	666 or 667	33 W	30 W	COU-6DC	brown	-		
	12 DC	12 DC				COU-12DC	green	COE-12DC		
	14 DC	14 DC				COU-14DC	brown	COE-14DC		
	24 DC	24 DC				COU-24DC	red	COE-24DC		
	28 DC	28 DC				COU-28DC	silver	COE-28DC		
	48 DC	48 DC				COU-48DC	silver	COE-48DC		
	110 DC	110 DC				COU-110DC	gold	COE-110DC		
	125 DC	125 DC				COU-125DC	blue	COE-125DC		
	220 DC	220 DC				COU-220DC	black	COE-220DC		
	24/50 AC	24/50/60 AC				60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC	(4)	COI-48/50/60AC (1)	white	-					
	48/50 AC	48/50/60 AC	-	58 VA	COI-110/50/60AC (1)	yellow	COE-110/50/60AC			
	48/60 AC	(4)			-	80 VA	-	COE-115/60AC		
	110/50 AC	110/50/60 AC	60 VA	-	COI-120/60AC	white	-			
	115/60 AC (5)	115/60 AC			COI-230/50/60AC (1)	light blue	COE-230/50/60AC			
	120/60 AC (4)	120/60 AC			COI-230/60AC	silver	COE-230/60AC			
	230/50 AC	230/50/60 AC			669	33 W	30 W	COU-110RC	gold	COE-110RC
	230/60 AC	230/60 AC						COU-230RC	blue	COE-230RC
	110/50 AC	110RC								
	120/60 AC									
230/50 AC										
230/60 AC	230RC									

(1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (DHI) and 58 VA (DHE and DHEP)

(2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

(4) Only for pilot valve DHI

(5) Only for pilot valve DHE and DHEP

11 COILS ELECTRIC CONNECTORS FOR PILOT SOLENOID VALVES according to DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)		669 (for AC supply)		CONNECTOR WIRING		
				666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground		669 1,2 = Supply voltage VAC 3 = Coil ground
SUPPLY VOLTAGES						
666 All voltages		667 24 AC or DC 110 AC or DC 220 AC or DC		669 110/50 AC 110/60 AC 230/50 AC 230/60 AC		

12 TECHNICAL CHARACTERISTICS OF INDUCTIVE PROXIMITY AND POSITION SWITCHES

Valve type	LIFI	/FI scheme	LIDA*/FV, LIDAS*/FV	/FV scheme
Type of switch	/FI proximity sensor		/FV position switch	
Supply voltage [V]	10÷30	1 supply +24 VDC	20÷32	1 supply +24 VDC
Ripple max [%]	≤ 20	3 GND	≤ 10	2 output signal
Max current [mA]	200	4 output signal	400	3 GND
Max peak pressure [bar]	500		400	4 output signal
Mechanical life	virtually infinite		virtually infinite	
Switch logic	PNP		PNP	

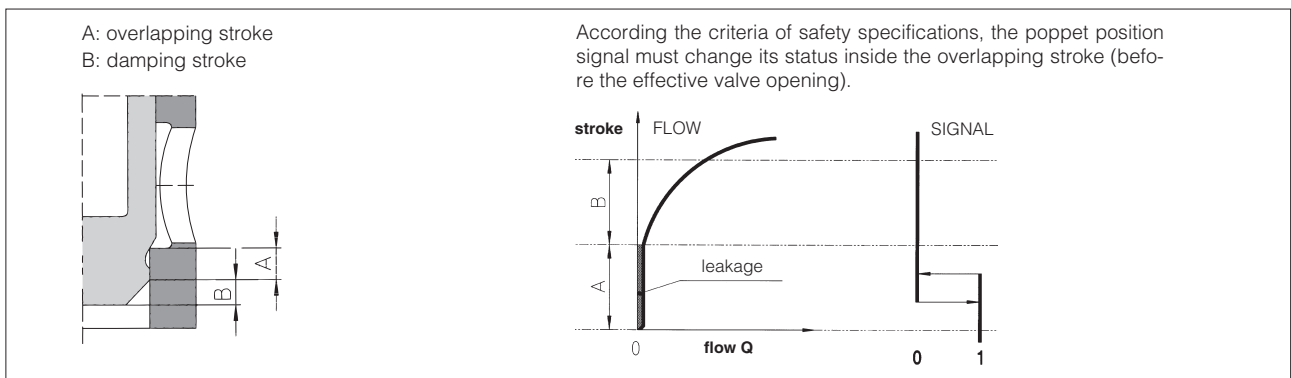
13 CONNECTING SCHEMES OF FI INDUCTIVE PROXIMITY AND FV POSITION SWITCHES

LIFI	LIDA*/FV, LIDAS*/FV
Connector type BKS-B-20-4-03 	Connector type ZBE-06 IP65
1 (brown) = supply +24 Vdc 3 (blue) = GND 4 (black) = output signal CABLE LENGHT = 3 m	1 = supply +24 Vdc 2 = output signal NC 3 = GND 4 = output signal NO

Notes:

- FI and FV sensor's connector are always supplied with the valve
- The /FI and /FV sensors are not provided with a protective earth connection

14 STATUS OF OUTPUT SIGNALS

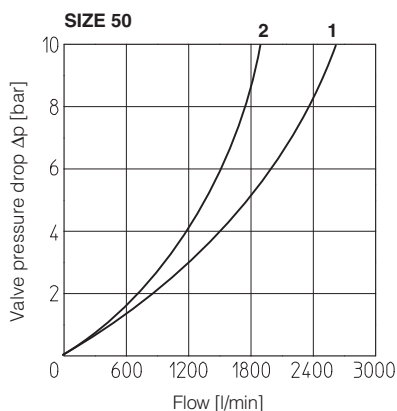
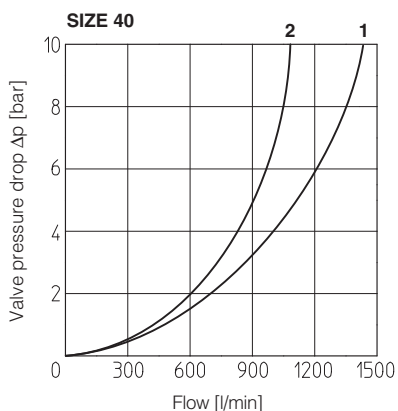
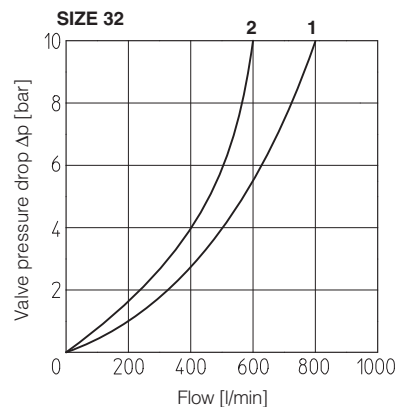
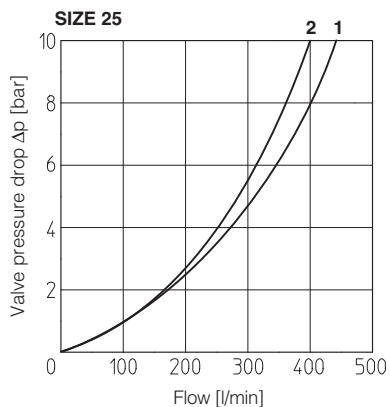
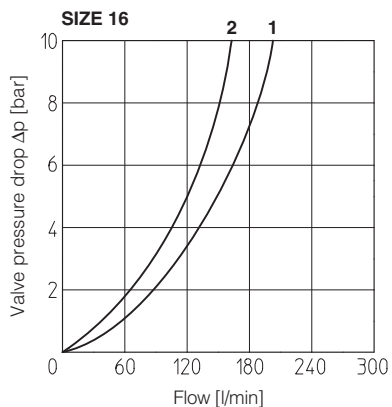


WARNING: the inobservance of following prescriptions invalidates the certification and may represent a risk for personnel injury



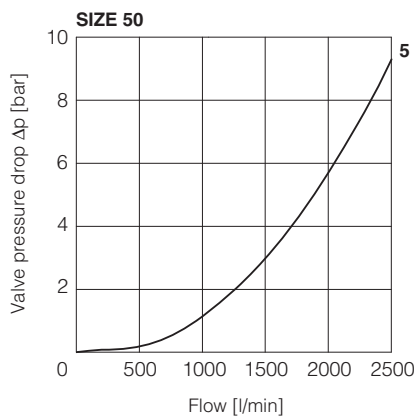
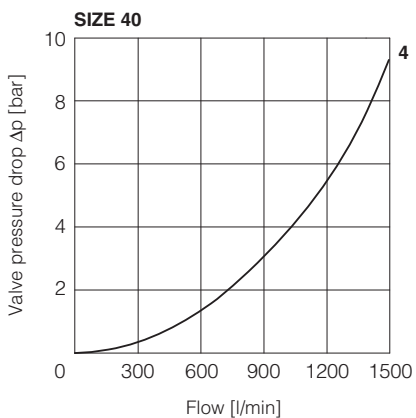
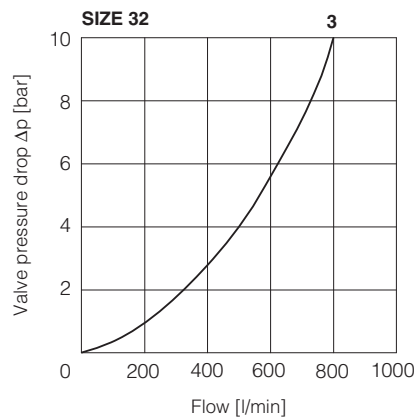
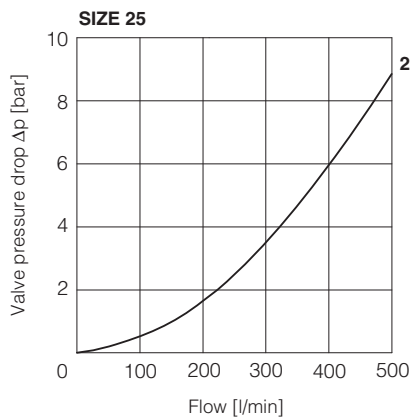
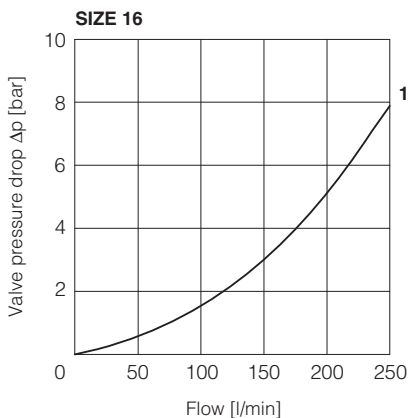
- Safety valves must be installed and commissioned only by qualified personnel
- Safety valves must not be disassembled
- The inductive proximity FI or the inductive position switch FV can be adjusted only by the valve's manufacturer or Atos authorized service centers
- Valve's components cannot be interchanged
- The valves must operate without switching shocks and spool vibrations

15.1 Q/Δp DIAGRAMS of LIFI and LIDA(H)/FV



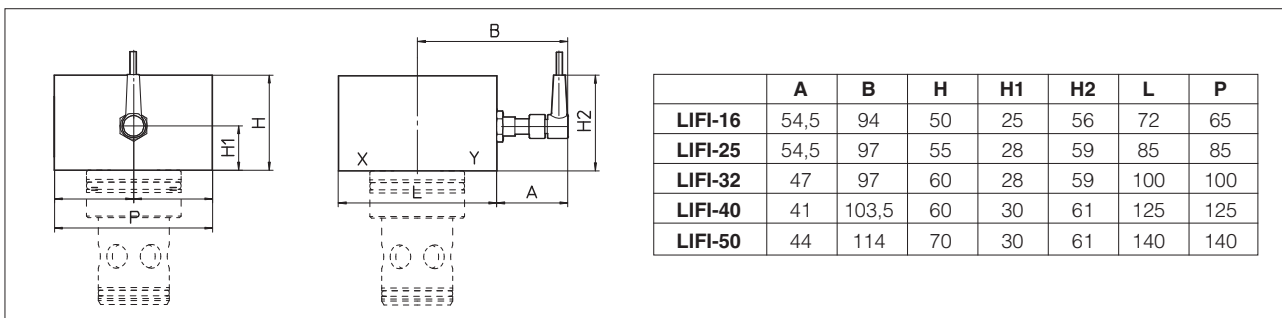
1 = poppet type 42
2 = poppet type 43

15.2 Q/Δp DIAGRAMS OF LIDAS/FV



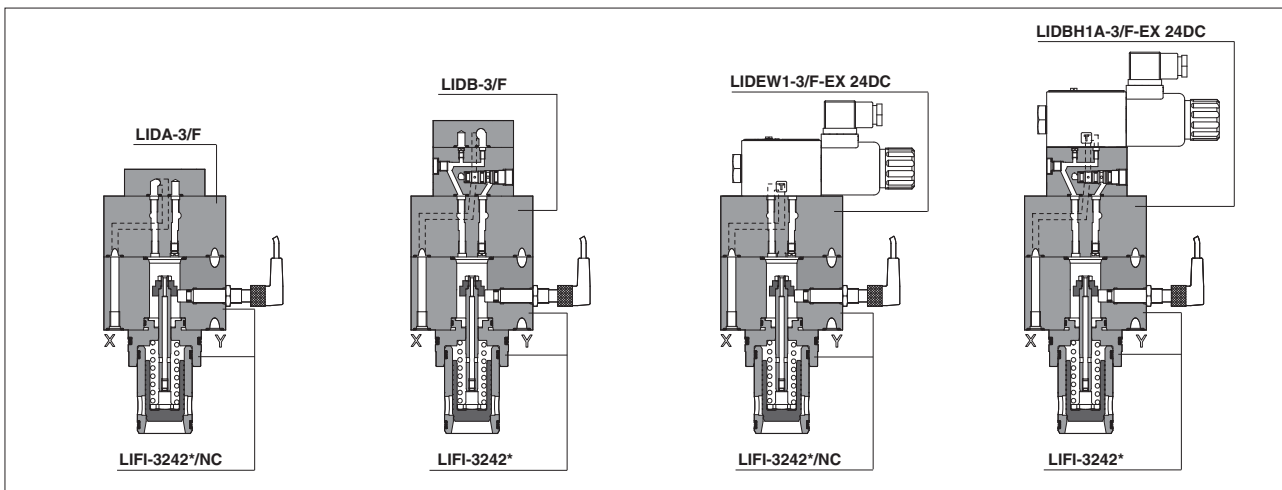
1 = LIDAS*-1643
2 = LIDAS*-2543
3 = LIDAS*-3243
4 = LIDAS*-4043
5 = LIDAS*-5043

16 DIMENSIONS of LIFI SAFETY COVERS [mm]

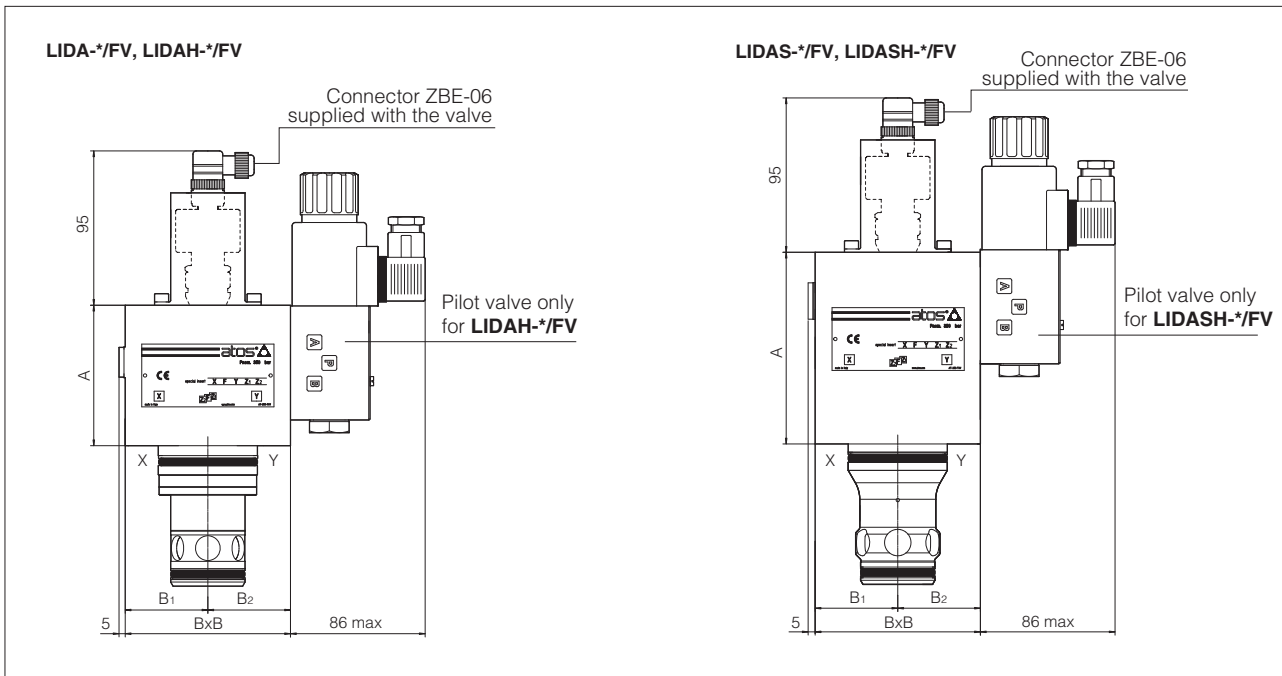


Note: for cover interface and cavity dimensions ISO 7368, see table P006

17 EXAMPLES OF LIFI COUPLED WITH OTHER COVERS (examples in size 32)



18 INSTALLATION DIMENSIONS of LIDA*/FV and LIDAS*/FV SAFETY CARTRIDGES [mm] (examples in size 32)

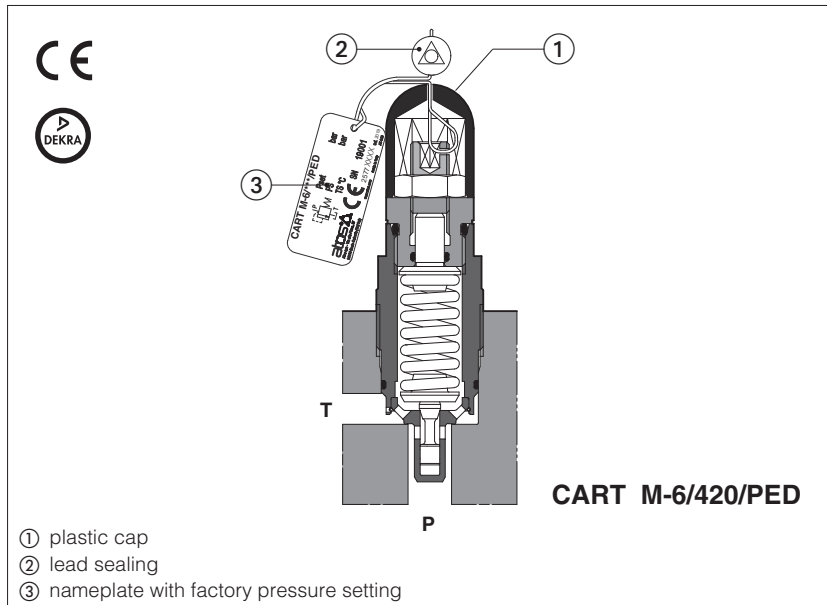


Note: for cover interface and cavity dimensions ISO 7368, see table P006

Size	LIDA				LIDAH				LIDAS				LIDASH				Seal		Fastening bolts				Tightening torque (Nm)
	A	B	B ₁	B ₂	A	B	B ₁	B ₂	A	B	B ₁	B ₂	A	B	B ₁	B ₂	LIDA	OTHER	LIDA	LIDAH	LIDAS, LIDASH		
16	50	65x85	40.5	39.5	85	65x80	40.5	39.5	85	65	39.5	39.5	95	65x72	32.5	39.5	1 OR 108	4 OR 108	4 M8x50	4 M8x70	4 M8x80	35	
25	50	85	42.5	42.5	85	85	42.5	42.5	102	85	42.5	42.5	115	85	42.5	42.5	1 OR 108	4 OR 108	4 M12x55	4 M12x80	4 M12x95	125	
32	65	100	50	50	85	100	50	50	104	100	50	50	116	100	50	50	1 OR 2043	4 OR 2043	4 M16x70	4 M16x70	4 M16x90	300	
40	65	125	62.5	62.5	85	125	62.5	62.5	111	125	62.5	62.5	125	125	62.5	62.5	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x70	600	
50	65	140	70	70	85	140	70	70	50	140	70	70	135	140	70	70	1 OR 3043	4 OR 3043	4 M20x80	4 M20x80	4 M20x80	600	

Safety pressure relief valves

direct, screw-in, conforming to PED Directive 2014/68/EU - certified by



CART /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the customer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

The screw-in execution is specifically designed to reduce the dimension of blocks and manifolds, without penalizing the functional characteristics.

Size: **G1/2" ÷ M35**

Max flow: **2,5 ÷ 150 l/min**

Max pressure: up to **420 bar**

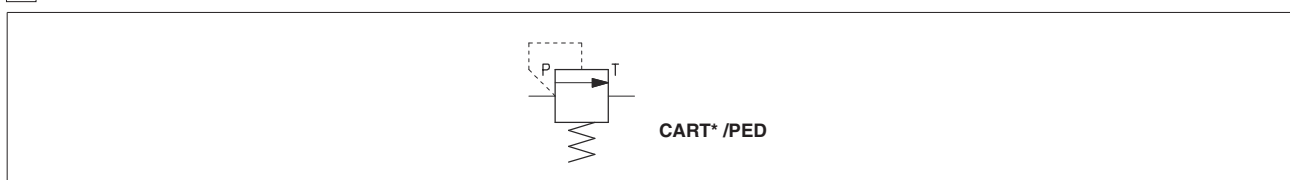
1 MODEL CODE

CART	M-6	/	420	/	PED	/	280	/	*	*
Safety pressure relief valves, screw-in										Seals material, see section 5: - = NBR PE = FKM BT = HNBR (2)
Size: M-3 = G1/2 (1) M-4 = M14x1 M-5 = M20x1,5 M-6 = M33x1,5 (1) ARE-15 = M32x1,5 ARE-20 = M35x1,5 (1)										Series number
Max pressure (bar): 420 = for CART M-3, M-4, M-6, ARE-15 350 = for CART M-5 400 = for CART ARE-20										Factory pressure setting (bar): to be defined by the customer min step 1 bar (example 280 = 280 bar) min pressure setting: 25 = for CART-M* and CART ARE-15 30 = for CART ARE-20
										PED = EU Type examination to 2014/68/EU - certified by DEKRA

(1) Available also in stainless steel execution, see technical table CWY010

(2) BT option is not available for **CART M5/PED** and **CART ARE-20/PED**

2 HYDRAULIC SYMBOL



3 GENERAL CHARACTERISTICS

Assembly position	Any position
Cavity	See section 9
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range (not for CART M-5 and ARE-20)	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Ambient temperature range (only for CART M-5 and ARE-20)	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate (1) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	CART M-3	CART M-4	CART M-5	CART M-6	CART ARE-15	CART ARE-20
Max pressure [bar] on port P	420	420	350	420	420	400
Factory pressure setting range [bar]	25÷420	25÷420	25÷350	25÷420	25÷420	30÷400
Max pressure on port T [bar] (1)	50	50	50	50	50	50
Max flow [l/min] (2)	2,5	15	50	60	100	150

(1) The valves should be operated without counterpressure on T line, see note 2 at section 9

(2) Max flow without conterpressure on T line, see diagrams at section 9 for max ammissible flow

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

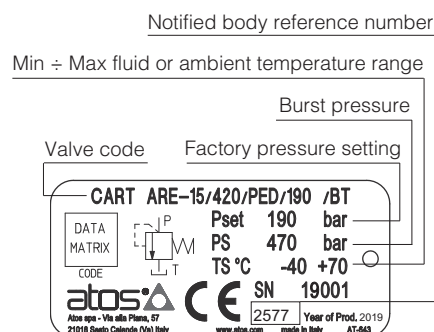
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 7

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
CART M-3	0.5
CART M-4	0.5
CART M-5	2
CART M-6	2
CART ARE-15	2
CART ARE-20	2

7 NAMEPLATE MARKING

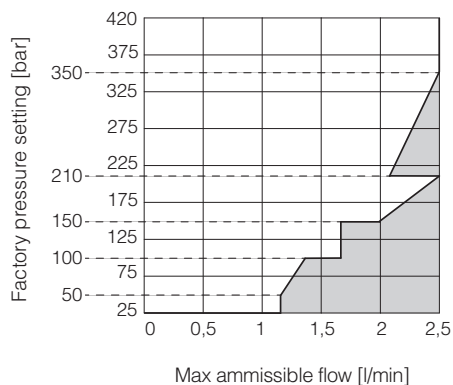


⚠ Any tampering of the lead sealing invalidates the certification

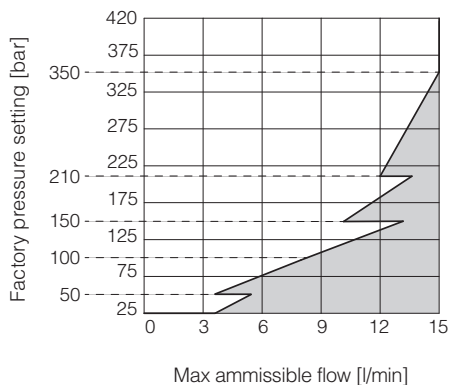
Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)

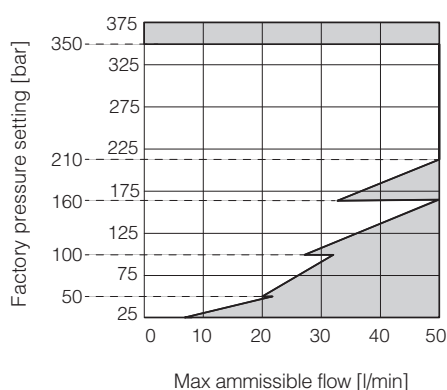
CART M-3 **/PED



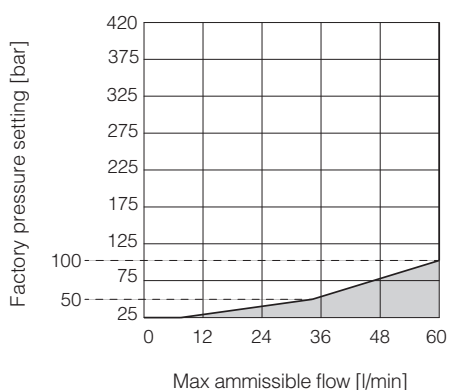
CART M-4 **/PED



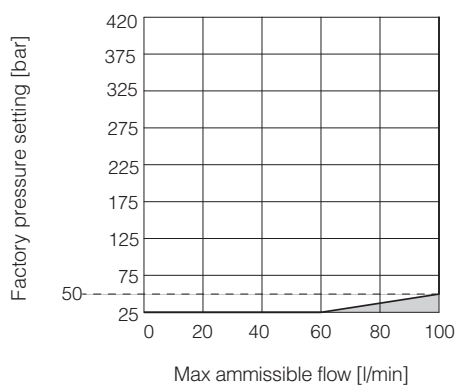
CART M-5 **/PED



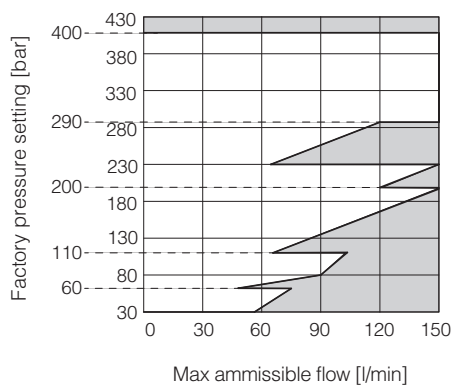
CART M-6 **/PED



CART ARE-15 **/PED




CART ARE-20 **/PED



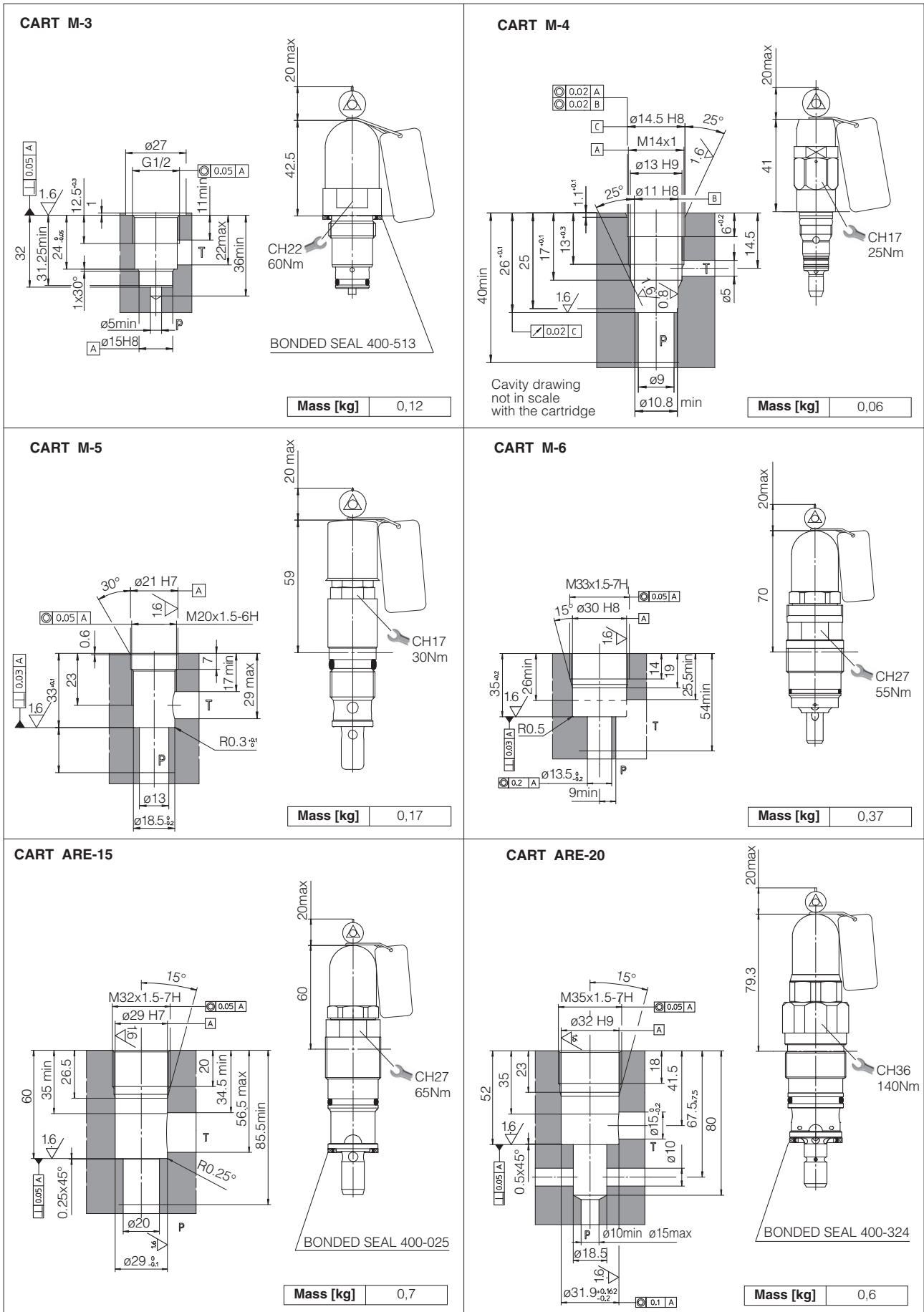
Notes:

- 1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting**.
Pressure / flow values located in gray areas cannot be performed.

 Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

- 2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

9 CAVITY AND INSTALLATION DIMENSIONS [mm]

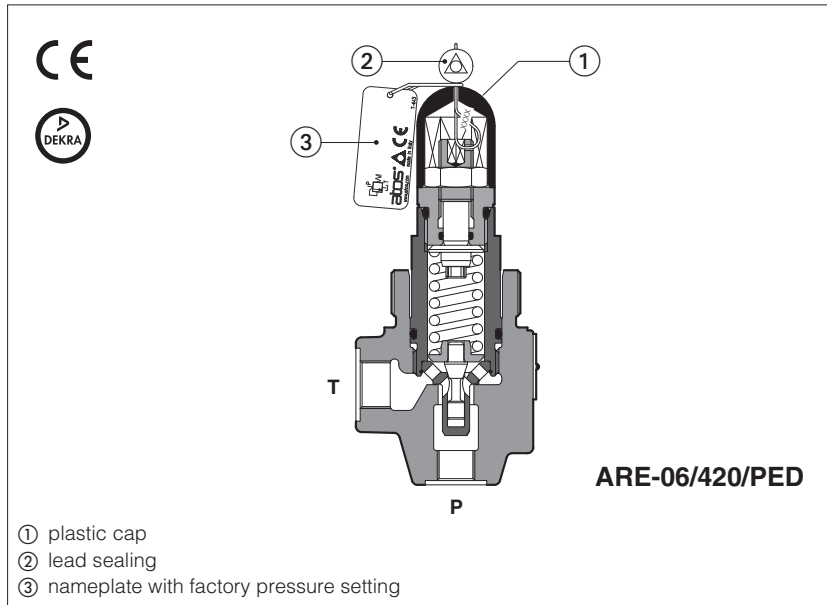


10 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

Safety pressure relief valves

in line, direct, conforming to PED Directive 2014/68/EU - certified by 



ARE /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are provided with threaded ports for in-line mounting.

The valves are factory set at the pressure level required by the customer, see section 6.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

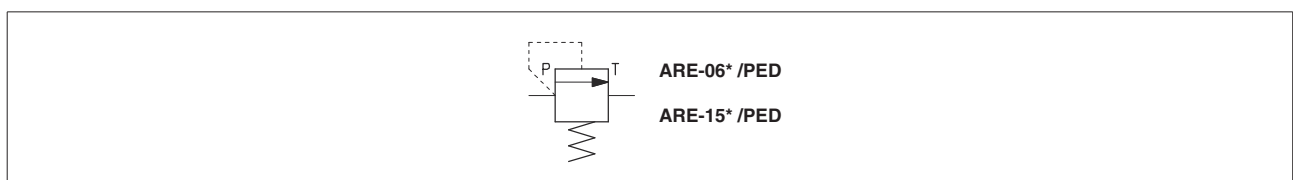
ARE-06: Size: **G 3/8"**
Max flow: **60 l/min**
Max pressure: **420 bar**

ARE-15: Size: **G 1/2"**
Max flow: **100 l/min**
Max pressure: **420 bar**

1 MODEL CODE

ARE	-	06	/	420	/	PED	/	280	/	*	/	*
Safety pressure relief valves, in-line										Seals material, see section 5: - = NBR PE = FKM BT = HNBR		
Size: 06 = Port P G 3/8" 15 = Port P G 1/2"										Series number		
Max pressure (bar): 420										Factory pressure setting (bar): to be defined by the customer min step 1 bar (example 280 = 280 bar) min pressure setting 25 bar		
										PED = EU Type examination to 2014/68/EU - certified by DEKRA		

2 HYDRAULIC SYMBOL



3 GENERAL CHARACTERISTICS

Assembly position	Any position
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Ambient temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C /BT option = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate (1) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model		ARE-06	ARE-15
Max pressure on port P [bar]		420	420
Factory pressure setting range [bar]		25÷420	25÷420
Max pressure on port T (1) [bar]		50	50
Max flow (2) [l/min]		60	100

(1) Ped valves should be operated without counterpressure on T line, see note 2 at section **8**

(2) For PED valves see diagrams at section **8**


5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

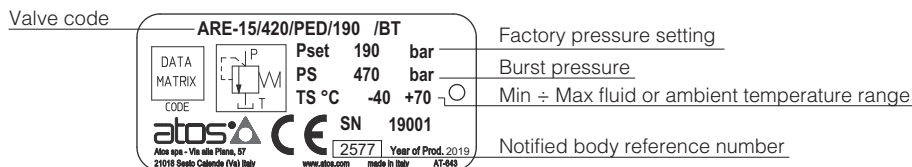
6 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the costumer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section **7**

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
ARE-06	2
ARE-15	2

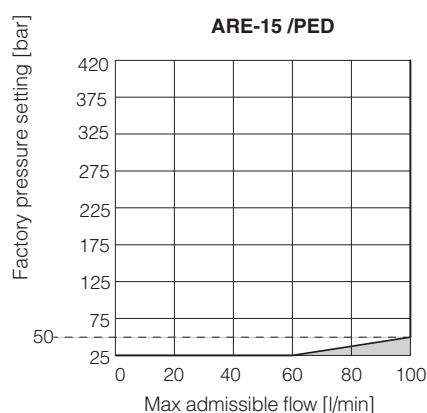
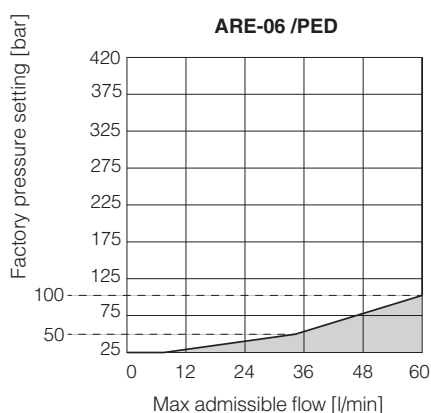
 Any tampering of the lead sealing invalidates the certification

7 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

8 PERMITTED WORKING RANGE (based on mineral oil ISO VG 46 at 50°C)



Notes:

- 1) The valves can operate only in the white area of the above diagrams.
The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting**.
Pressure / flow values located in gray areas cannot be performed.
 Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.
- 2) The working range in above diagrams is valid without counterpressure in T line.
The factory pressure setting is increased by the counterpressure valve in T line.
As general rule PED valves should be operated without counter pressure in the T line.
In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

9 INSTALLATION DIMENSIONS [mm]

ARE-06

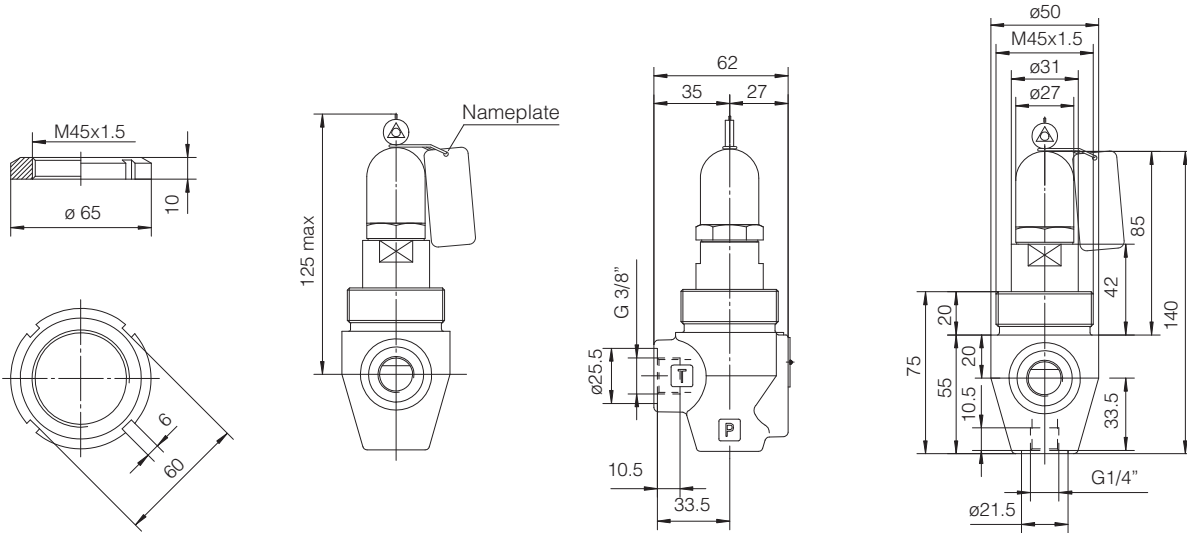
P = INLET PORT G 3/8"

T = OUTLET PORT G 3/8"

Locking ring for fastening the valve.

Model code: SP-6-RE-310030

Mass [kg]	
ARE-06	1,0



ARE-15

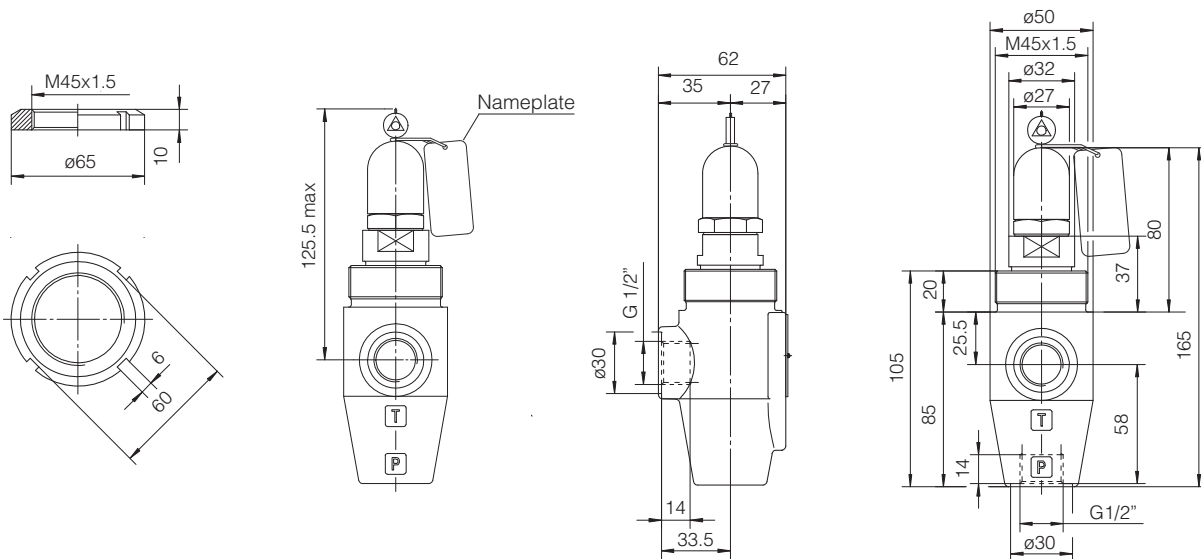
P = INLET PORT G 1/2"

T = OUTLET PORT G 1/2"

Locking ring for fastening the valve.

Model code: SP-6-RE-310030

Mass [kg]	
ARE-15	1,3

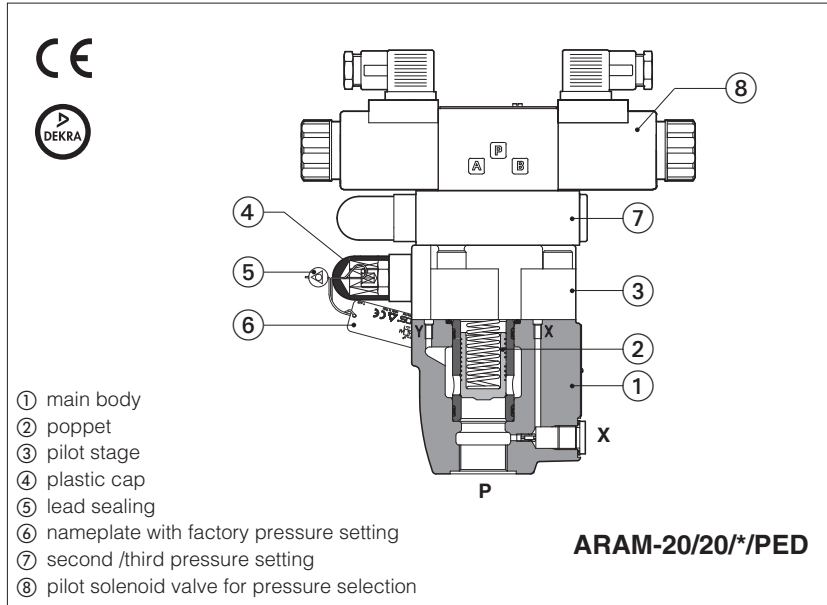


10 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, in-line, conforming to PED Directive 2014/68/EU - certified by 



- ① main body
- ② poppet
- ③ pilot stage
- ④ plastic cap
- ⑤ lead sealing
- ⑥ nameplate with factory pressure setting
- ⑦ second /third pressure setting
- ⑧ pilot solenoid valve for pressure selection

ARAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the customer, see section 10.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

ARAM can be equipped with a pilot solenoid valve for venting or for multiple pressure selection.

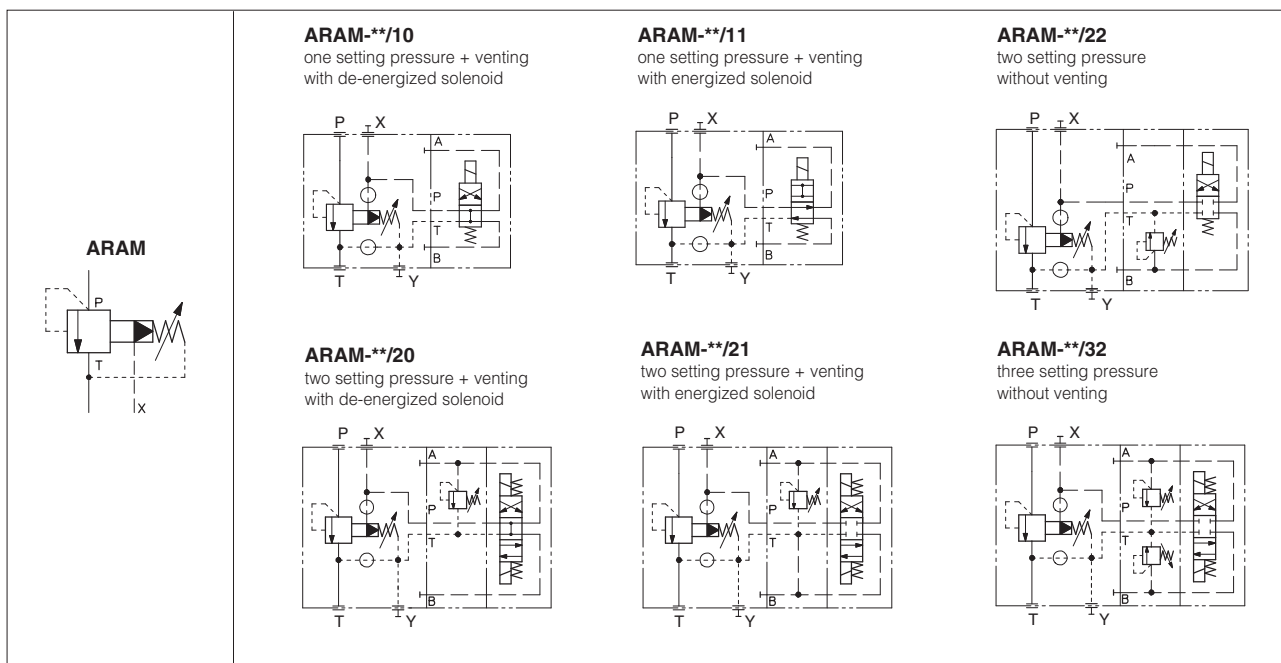
Size: **G 3/4"** and **G 1 1/4"**
 Max flow: **350** and **500 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

ARAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*
Piloted pressure relief valve, in-line																					
Valve size ISO 6264: 20 = port P - G 3/4" 32 = port P - G 1 1/4"																					
Configuration , see section 2 : - = without pilot solenoid valve 10, 11: with pilot solenoid valve for venting 20, 21, 22, 32: with pilot solenoid valve for multiple pressure selection																					
Max pressure: 350 = 350 bar																					
Pressure range of second / third setting (1): 50 = 50 bar 100 = 100 bar 210 = 210 bar 350 = 350 bar																					
		Seals material , see section 8 : - = NBR PE = FKM Series number																			
		Voltage code , see section 6 (2): X = without connector (2): Connectors to be ordered separately: see section 7 -00 = solenoid valve without coils (for -I) -00-AC = AC solenoid valve without coils (for -E) -00-DC = DC solenoid valve without coils (for -E)																			
		Pilot valve (1): I = DHI for AC and DC supply, with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids																			
		Factory pressure setting (bar): to be defined by the customer min step 1 bar (example 280 = 280 bar) min pressure setting 30 bar																			
		PED = EU Type examination to 2014/68/EU - certified by DEKRA																			
		Options , see section 9 : E WP Y																			

(1) Only for ARAM-* /20, /21, /22, /32
 (2) Only for ARAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	Standard = -20°C ÷ +70°C /PE option = -20°C ÷ +70°C
Storage temperature range	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +80°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate (1) RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	ARAM-10	ARAM-32
Max pressure on ports P, X [bar]	350	
Max pressure on ports T, Y (1) [bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid	
Factory pressure setting range [bar]	30÷350	
Max flow (2) [l/min]	350	500

(1) The valves should be operated without counterpressure on T line, see note 2 at section **[12]**

(2) Max flow without conterpressure on T line, see diagrams at section **[12]** for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for ARAM with pilot solenoid valve

Insulation class	DHI pilot	H (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See coil voltage [6]		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

6 COIL VOLTAGE - for ARAM with pilot solenoid valve

External supply nominal voltage ± 10% (1)	Voltage code	Type of connector	Power consumption (3)		ARAM-*-I		ARAM-*-E
			DHI	DHE	Code of spare coil	Colour of coil label	Code of spare coil
12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC (4) 120/60 AC (5) 230/50/60 AC 230/60 AC	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages see technical tables E010, E015

(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%

(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C;

When AC solenoid is energized, the inrush current is approx 3 times the holding current

(4) Only for ARAM-*-E

(5) Only for ARAM-*-I

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - for ARAM with pilot solenoid valve

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 OPTIONS

E = external pilot

WP = prolonged manual override protected by rubber cap - only for ARAM with pilot solenoid valve

Y = external drain - only for ARAM with pilot solenoid valve

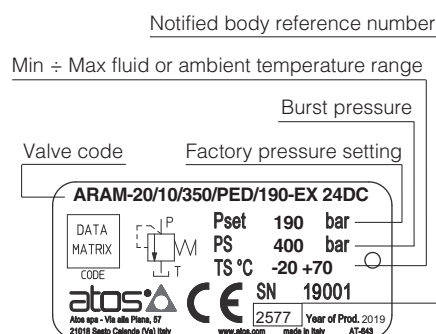
10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the customer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11.

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
ARAM-10	25
ARAM-20	25

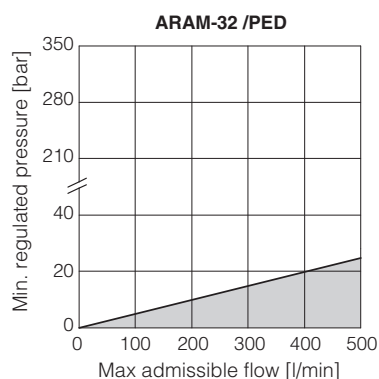
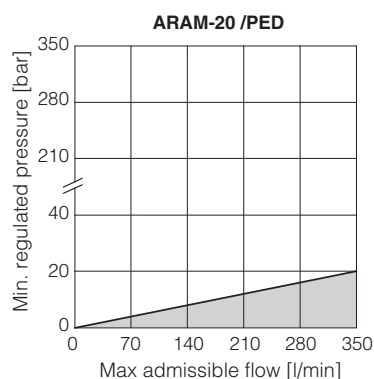
⚠ Any tampering of the lead sealing invalidates the certification

11 NAMEPLATE MARKING



Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C



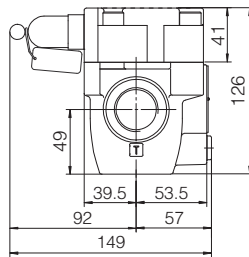
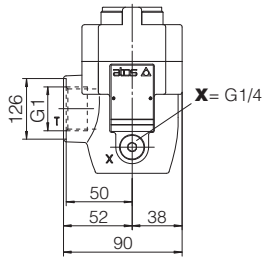
Notes:

- The valves can operate only in the white area of the above diagrams. The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting**. Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

- The working range in above diagrams is valid without counterpressure in T line. The factory pressure setting is increased by the counterpressure valve in T line. As general rule PED valves should be operated without counter pressure in the T line. In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

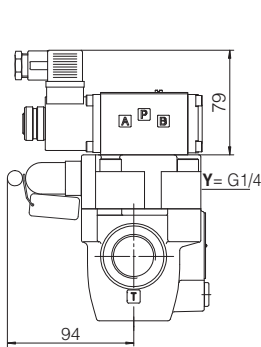
ARAM-20



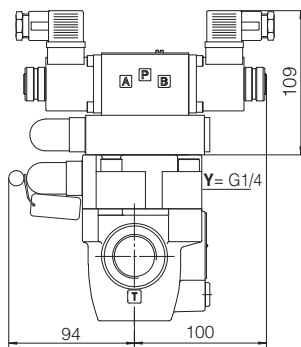
X = port connection for external pilot
 Y = port connection for external drain

Mass [kg]	
ARAM-20	3,9

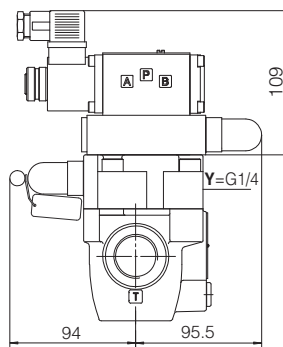
	Mass [kg]	
	with option IX	with option EX
ARAM-20/10	5,4	5,7
ARAM-20/11	5,4	5,7
ARAM-20/20	7,1	7,7
ARAM-20/21	7,1	7,7
ARAM-20/22	6,8	7,2
ARAM-20/32	7,4	8,0



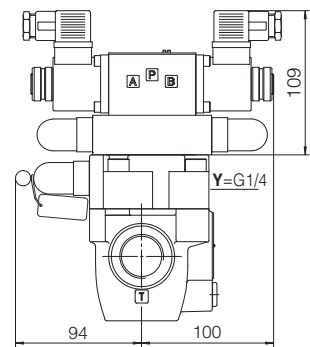
ARAM-20/10/-IX**
ARAM-20/11/-IX**



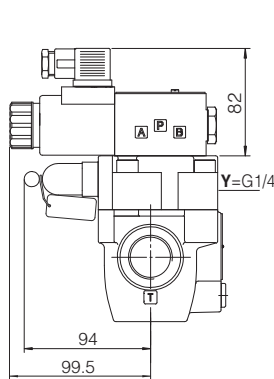
ARAM-20/20/-IX**
ARAM-20/21/-IX**



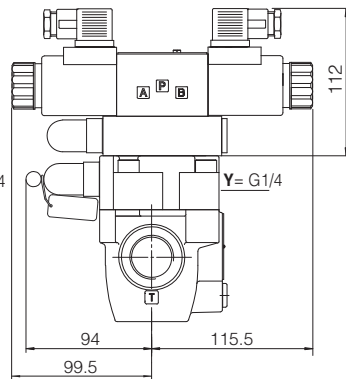
ARAM-20/22/-IX**



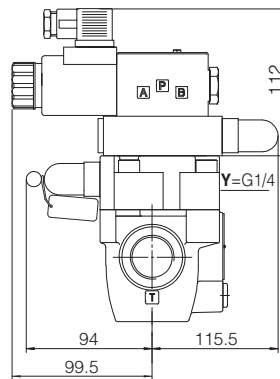
ARAM-20/32/-IX**



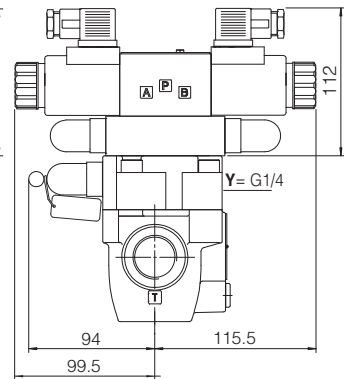
ARAM-20/10/-EX**
ARAM-20/11/-EX**



ARAM-20/20/-EX**
ARAM-20/21/-EX**



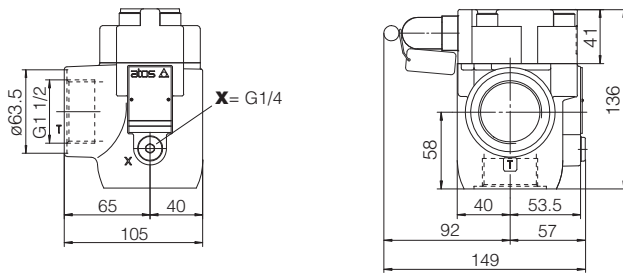
ARAM-20/22/-EX**



ARAM-20/32/-EX**

Overall dimensions refer to valves with connectors type 666

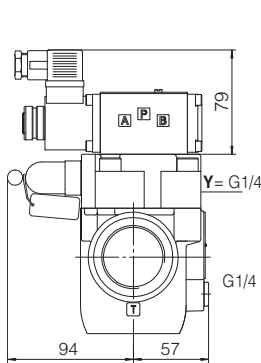
ARAM-32



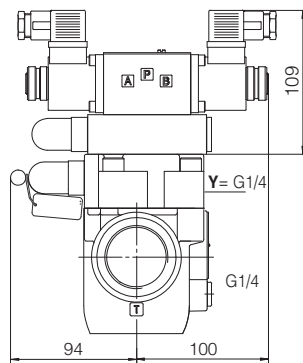
Mass [kg]	
ARAM-32	4,7

	Mass [kg]	
	with option IX	with option EX
ARAM-32/10	6,2	6,5
ARAM-32/11	6,2	6,5
ARAM-32/20	7,9	8,5
ARAM-32/21	7,9	8,5
ARAM-32/22	7,6	7,9
ARAM-32/32	8,8	8,2

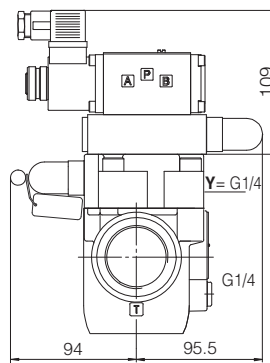
X = port connection for external pilot
Y = port connection for external drain



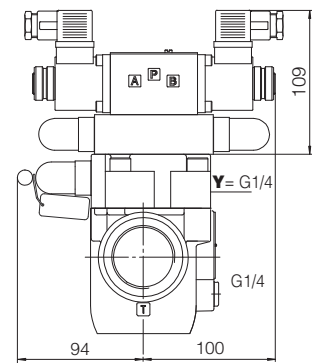
ARAM-32/10/-IX**
ARAM-32/11/-IX**



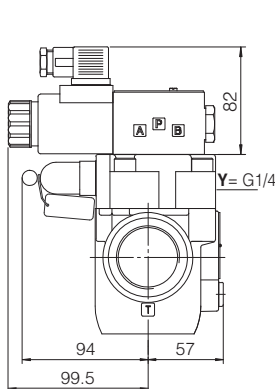
ARAM-32/20/-IX**
ARAM-32/21/-IX**



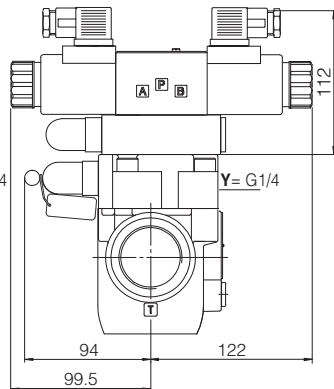
ARAM-32/22/-IX**



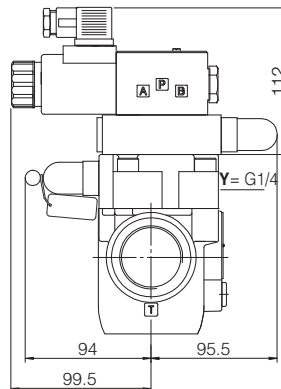
ARAM-32/32/-IX**



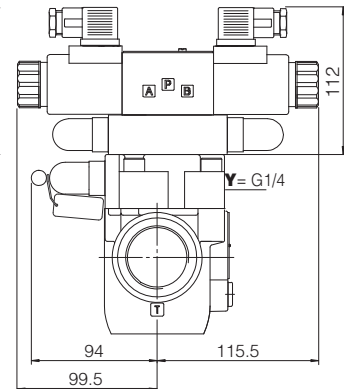
ARAM-32/10/-EX**
ARAM-32/11/-EX**



ARAM-32/20/-EX**
ARAM-32/21/-EX**



ARAM-32/22/-EX**



ARAM-32/32/-EX**

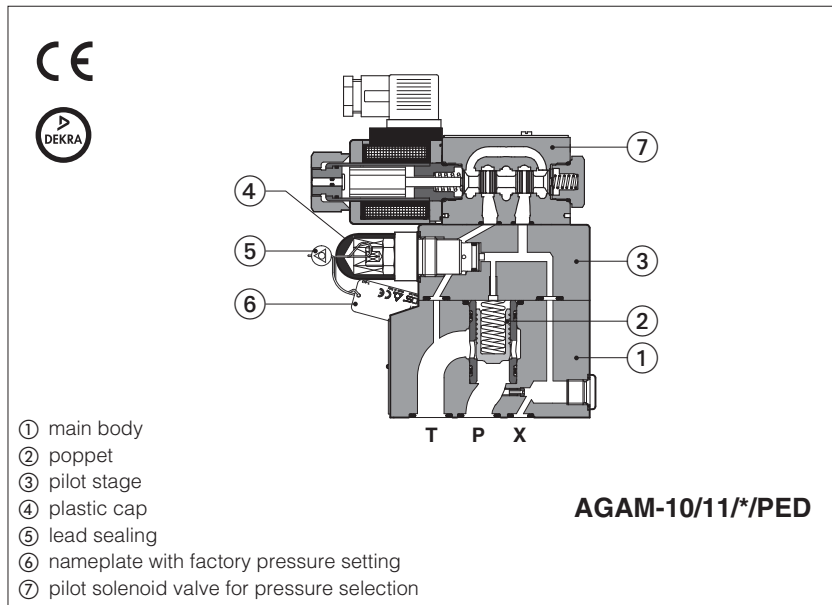
Overall dimensions refer to valves with connectors type 666

14 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

Safety pressure relief valves

piloted, subplate, conforming to PED Directive 2014/68/EU - certified by 



AGAM /PED

Safety pressure relief valves, certified by DEKRA according to Pressure Equipment Directive 2014/68/EU (PED).

They are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the hydraulic circuit and accumulators from overpressure.

The valves are factory set at the pressure level required by the customer, see section 10.

The pressure adjustment screw is protected with a lead sealed plastic cap to avoid any tampering.

AGAM can be equipped with a pilot solenoid valve for venting or for different pressure selection.

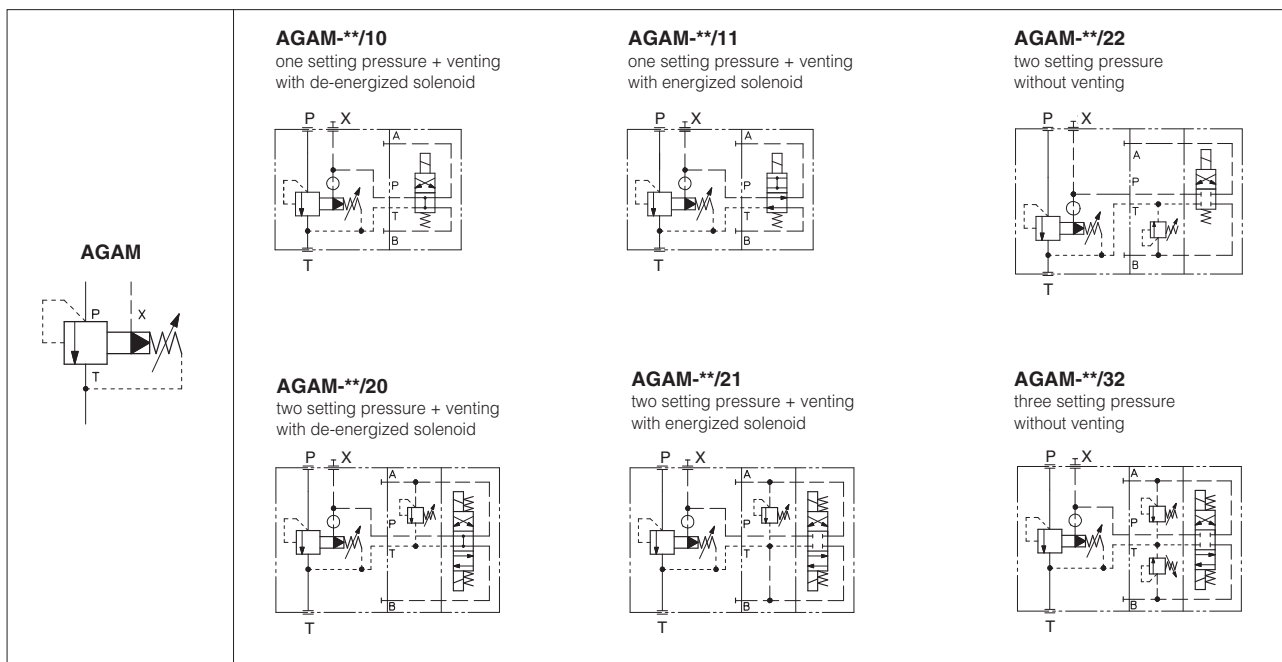
Size: **10, 20** and **32** - ISO 6264
 Max flow: **200, 400** and **600 l/min**
 Max pressure: **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	350	/	210/100	/	E	/	PED	/	280	-	I	X	24DC	*	/	*
<p>Piloted pressure relief valve, subplate</p> <p>Valve size ISO 6264: 10 20 32</p> <p>Configuration, see section 2: - = without pilot solenoid valve 10, 11: with pilot solenoid valve for venting 20, 21, 22, 32: with pilot solenoid valve for multiple pressure selection</p> <p>Max pressure: 350 = 350 bar</p> <p>Pressure range of second / third setting (1): 50 = 50 bar 100 = 100 bar 210 = 210 bar 350 = 350 bar</p>																					
<p>Seals material, see section 8: - = NBR PE = FKM</p> <p>Series number</p> <p>Voltage code, see section 6 (2):</p> <p>X = without connector (2): See section 7 for available connectors, to be ordered separately -00 = solenoid valve without coils (for -I) -00-AC = AC solenoid valve without coils (for -E) -00-DC = DC solenoid valve without coils (for -E)</p> <p>Pilot valve (2): I = DHI for AC and DC supply, with cURus certified solenoids E = DHE for AC and DC supply, high performances with cURus certified solenoids</p> <p>Factory pressure setting (bar): to be defined by the customer min step 1 bar (example 280 = 280 bar) min pressure setting 30 bar</p> <p>PED = EU Type examination to 2014/68/EU - certified by DEKRA</p> <p>Options, see section 9: E WP Y</p>																					

(1) Only for AGAM-* /20, /21, /22, /32
 (2) Only for AGAM with pilot solenoid valve

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS



3 GENERAL CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤ 0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd values according to EN ISO 13849	75 years, for further details see technical table P007
Ambient temperature	Standard = -20°C ÷ +70°C / PE option = -20°C ÷ +70°C
Storage temperature range	Standard = -20°C ÷ +80°C / PE option = -20°C ÷ +80°C
Surface protection	Zinc coating with black passivation -salt spray test (EN ISO9227) > 200h
Compliance	PED Directive 2014/68/EU - EU type-examination certificate (1) RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

(1) The type-examination certificate can be download from www.atos.com

4 HYDRAULIC CHARACTERISTICS

Valve model	AGAM-10	AGAM-20	AGAM-32
Max pressure on ports P, X [bar]	350		
Max pressure on ports T, Y (1) [bar]	210 without pilot solenoid valve 120 with pilot solenoid valve -I 210 with pilot solenoid valve -E with DC solenoid 160 with pilot solenoid valve -E with AC solenoid		
Factory pressure setting range [bar]	30÷350		
Max flow (2) [l/min]	200	400	400

(1) The valves should be operated without counterpressure on T line, see note 2 at section **[12]**

(2) Max flow without conterpressure on T line, see diagrams at section **[12]** for max ammissible flow

5 ELECTRICAL CHARACTERISTICS - for AGAM with pilot solenoid valve

Insulation class	DHI pilot	H (180°C)	Due to the occuring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
	DHE pilot	H (180°C) for DC coils F (155°C) for AC coils	
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 or E-SD correctly assembled)		
Relative duty factor	100%		
Supply voltage and frequency	See coil voltage [6]		
Supply voltage tolerance	± 10%		
Certification	cURus North American standard		

6 COIL VOLTAGE - for AGAM with pilot solenoid valve

External supply nominal voltage $\pm 10\%$ (1)	Voltage code	Type of connector	Power consumption (3)		AGAM-*-I		AGAM-*-E
			DHI	DHE	Code of spare coil	Colour of coil label	Code of spare coil
12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W	30 W	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50/60 AC 115/60 AC (4) 120/60 AC (5) 230/50/60 AC 230/60 AC	666 or 667	60 VA - 60 VA 60 VA 60 VA	58 VA 80 VA - 58 VA 80 VA	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

(1) For other supply voltages see technical tables E010, E015

(2) Coil can be supplied also with 60 Hz: in this case the performances are reduced by 10 ÷ 15%

(3) Average values measured at nominal hydraulic condition and ambient temperature 20°C; When AC solenoid is energized, the inrush current is approx 3 times the holding current

(4) Only for AGAM-*-E

(5) Only for AGAM-*-I

7 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 FOR AGAM WITH SOLENOID VALVE

The connectors must be ordered separately.

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source

For other available connectors, see tech table K800

8 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

9 OPTIONS

E = external pilot

WP = prolonged manual override protected by rubber cap - only for AGAM with pilot solenoid valve

Y = external drain - only for AGAM with pilot solenoid valve

10 FACTORY PRESSURE SETTING

The /PED valves are factory set at the pressure level required by the customer (min step: 1bar). The factory pressure setting is performed at the flow shown in the following table. The factory pressure setting is marked on the valve nameplate, see section 11.

VALVE MODEL	FLOW FOR FACTORY PRESSURE SETTING (l/min)
AGAM-10	25
AGAM-20	25
AGAM-32	25

⚠ Any tampering of the lead sealing invalidates the certification

11 NAMEPLATE MARKING

Notified body reference number

Min ÷ Max fluid or ambient temperature range

Burst pressure

Valve code Factory pressure setting

AGAM-20/10/350/PED/190-EX 24DC

DATA MATRIX CODE

Pset 190 bar

PS 400 bar

TS °C -20 +70

atos logo

CE logo

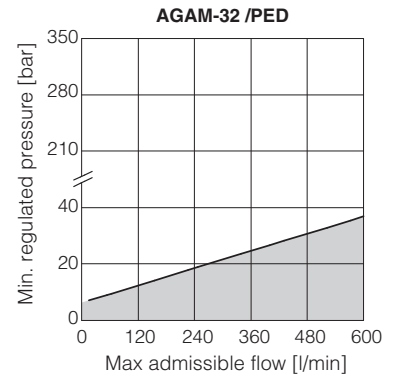
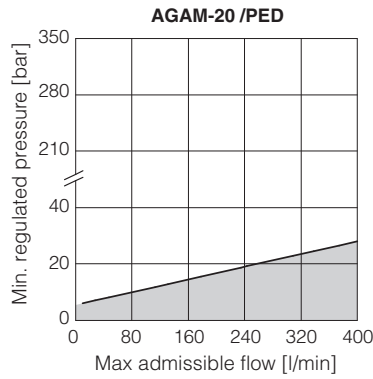
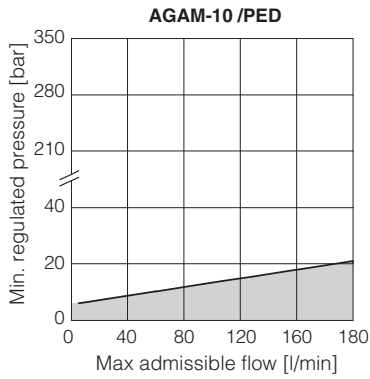
SN 19001

2577 Year of Prod. 2019

atos spa - Via alla Piave, 57 21018 Sesto Calende (VA) Italy www.atos.com made in Italy AT-648

Note: **TS** values are referred to the extreme temperatures, regardless of whether the fluid or the ambient

12 PERMISSIBLE RANGE - based on mineral oil ISO VG 46 at 50°C



Notes:

1) The valves can operate only in the white area of the above diagrams. The max admissible flow values within the white area are those for which the pressure increase remains within **+10% with respect to the factory pressure setting**.

Pressure / flow values located in gray areas cannot be performed.

⚠ Before ordering the valve, check that the maximum admissible flow at the required pressure setting, is greater than the maximum flow rate of the system or the accumulator to be protected.

2) The working range in above diagrams is valid without counterpressure in T line. The factory pressure setting is increased by the counterpressure valve in T line. As general rule PED valves should be operated without counter pressure in the T line. In case of counter pressure in T line, the maximum admissible flow has to be reduced with respect to the values reported in the diagram, so as not to exceed the limit of +10% with respect to the factory pressure setting. Contact Atos technical office for details.

13 INSTALLATION DIMENSIONS [mm]

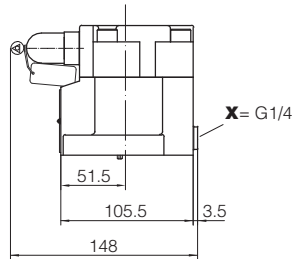
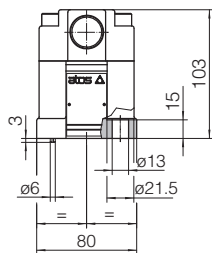
AGAM-10

ISO 6264: 2007 (see table P005)

Mounting surface: 6264-06-09-1-97

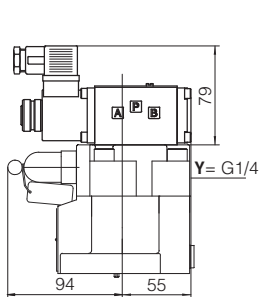
Fastening bolts: 4 socket head screws M12x35 class 12.9

Tightening torque = 125 Nm

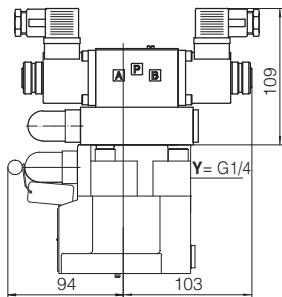


Mass [kg]	
AGAM-10	3,6

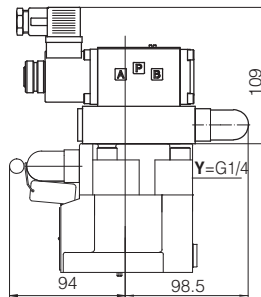
	Mass [kg]	
	with option IX	with option EX
AGAM-10/10	5,1	5,4
AGAM-10/11	5,1	5,4
AGAM-10/20	6,2	6,5
AGAM-10/21	6,2	6,5
AGAM-10/22	5,9	6,2
AGAM-10/32	6,3	6,9



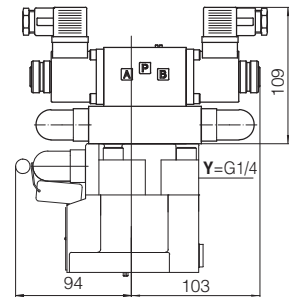
AGAM-10/10/**-IX
AGAM-10/11/**-IX



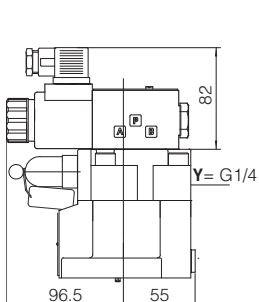
AGAM-10/20/**-IX
AGAM-10/21/**-IX



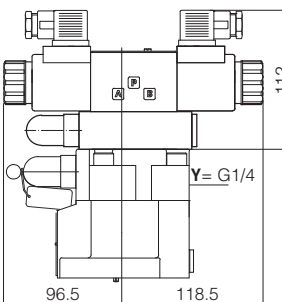
AGAM-10/22/**-IX



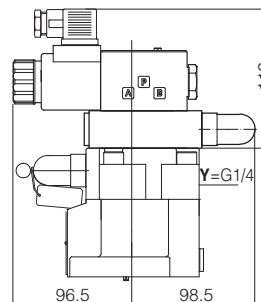
AGAM-10/32/**-IX



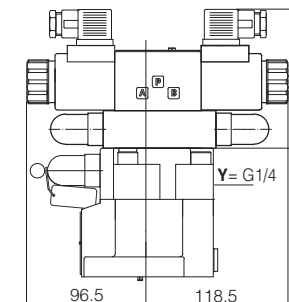
AGAM-10/10/**-EX
AGAM-10/11/**-EX



AGAM-10/20/**-EX
AGAM-10/21/**-EX



AGAM-10/22/**-EX



AGAM-10/32/**-EX

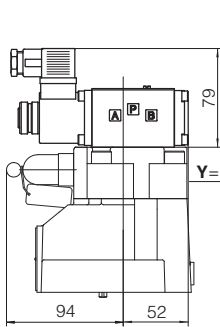
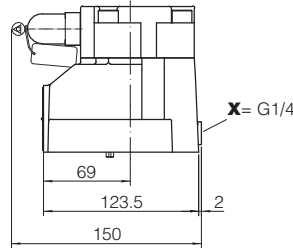
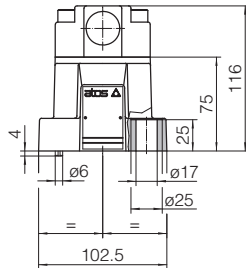
Overall dimensions refer to valves with connectors type 666

AGAM-20

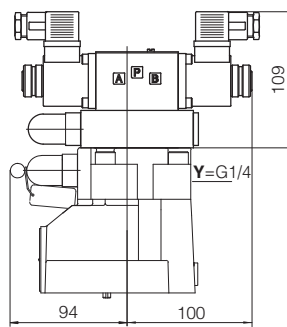
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
 Fastening bolts:
 4 socket head screws M16x50 class 12.9
 Tightening torque = 300 Nm

Mass [kg]	
AGAM-20	4,8

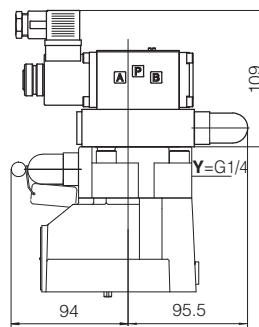
	Mass [kg]	
	with option IX	with option EX
AGAM-20/10	6,3	6,6
AGAM-20/11		
AGAM-20/20	7,4	7,7
AGAM-20/21		
AGAM-20/22	7,1	7,4
AGAM-20/32	7,5	8,1



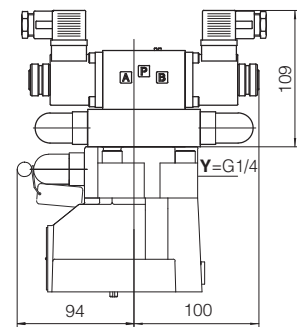
AGAM-20/10/-IX**
AGAM-20/11/-IX**



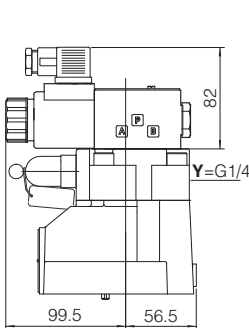
AGAM-20/20/-IX**
AGAM-20/21/-IX**



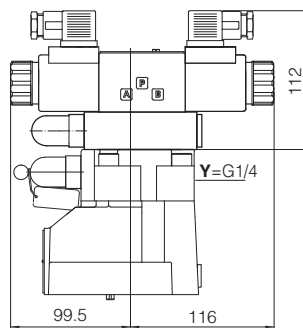
AGAM-20/22/-IX**



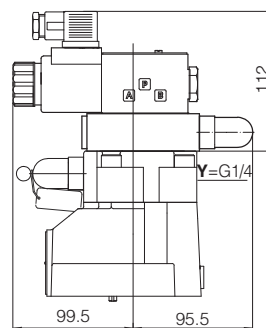
AGAM-20/32/-IX**



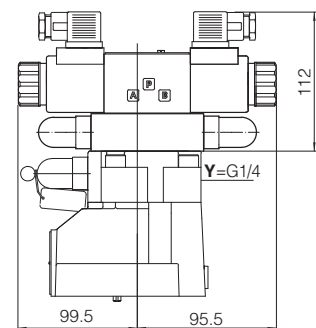
AGAM-20/10/-EX**
AGAM-20/11/-EX**



AGAM-20/20/-EX**
AGAM-20/21/-EX**



AGAM-20/22/-EX**



AGAM-20/32/-EX**

Overall dimensions refer to valves with connectors type 666

AGAM-32

ISO 6264: 2007 (see table P005)

Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)

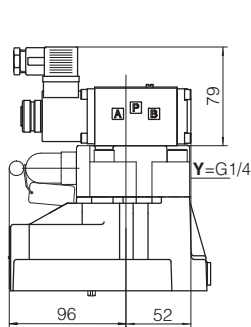
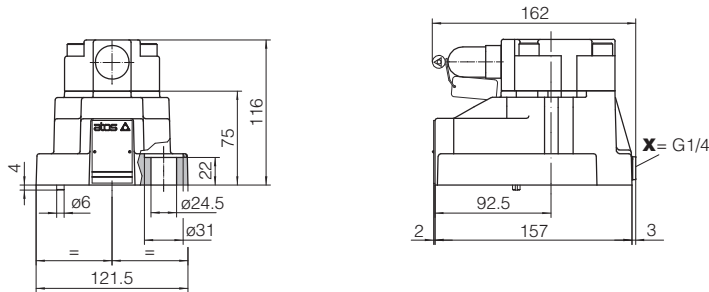
Fastening bolts:

4 socket head screws M20x60 class 12.9

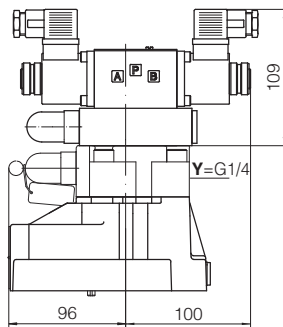
Tightening torque = 600 Nm

Mass [kg]	
AGAM-32	6.2

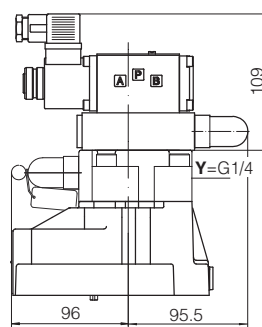
	Mass [kg]	
	with option IX	with option EX
AGAM-32/10	7,7	8
AGAM-32/11		
AGAM-32/20	8,8	8,1
AGAM-32/21		
AGAM-32/22	8,5	8,8
AGAM-32/32	8,9	9,5



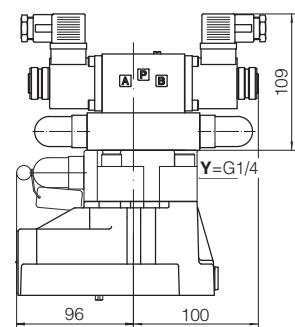
AGAM-32/10/**-IX
AGAM-32/11/**-IX



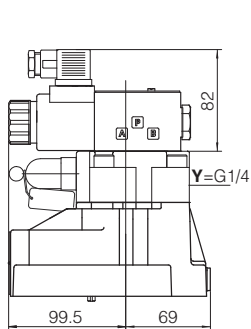
AGAM-32/20/**-IX
AGAM-32/21/**-IX



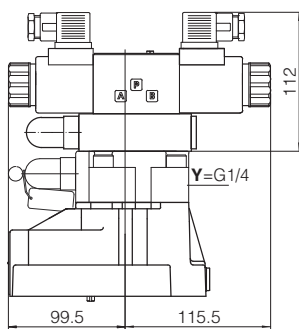
AGAM-32/22/**-IX



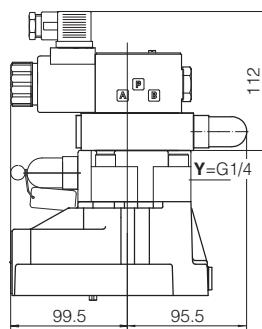
AGAM-32/32/**-IX



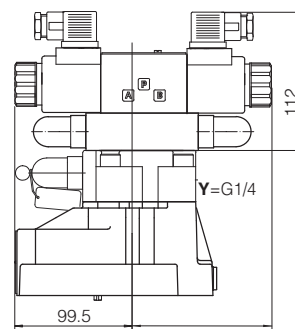
AGAM-32/10/**-EX
AGAM-32/11/**-EX



AGAM-32/20/**-EX
AGAM-32/21/**-EX



AGAM-32/22/**-EX



AGAM-32/32/**-EX

Overall dimensions refer to valves with connectors type 666

14 MOUNTING SUBPLATES - see table K280

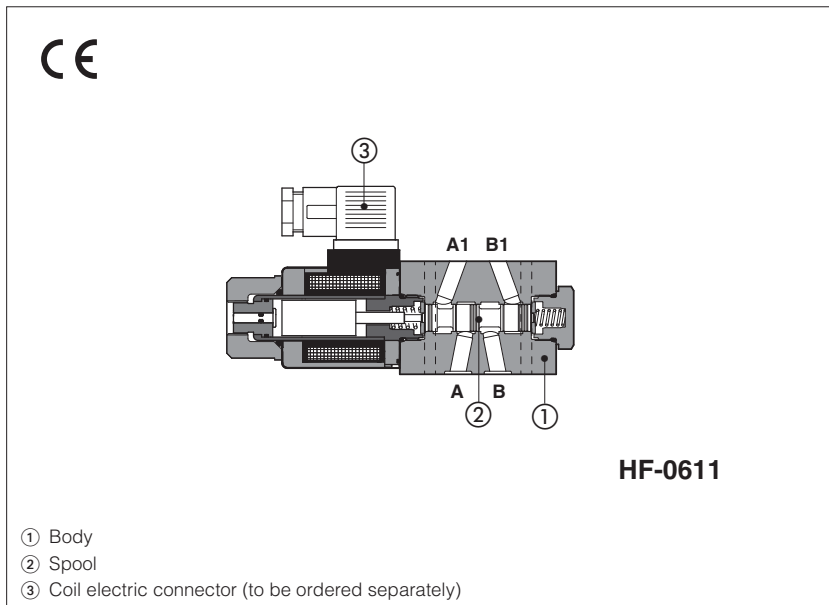
Valve	Subplate model	Port location	Ports			Ø Counterbore [mm]			Mass [Kg]
			P	T	X	P	T	X	
AGAM-10	BA-306	Ports P, T, X underneath;	G 1/2"	G 3/4"	G 1/4"	30	36,5	21,5	1,5
AGAM-20	BA-406		G 3/4"	G 3/4"	G 1/4"	36,5	36,5	21,5	3,5
	BA-506		G 1"	G 1"	G 1/4"	46	46	21,5	3,5
AGAM-32	BA-706		G 1 1/2"	G 1 1/2"	G 1/4"	63,5	63,5	21,5	6

15 RELATED DOCUMENTATION

CY900 Operating and maintenance information for PED certified valves

Solenoid modular valves

direct, modular, spool type



HF are spool type, direct operated solenoid valves in modular execution, normally used for shut-off or to by-pass the hydraulic user lines.

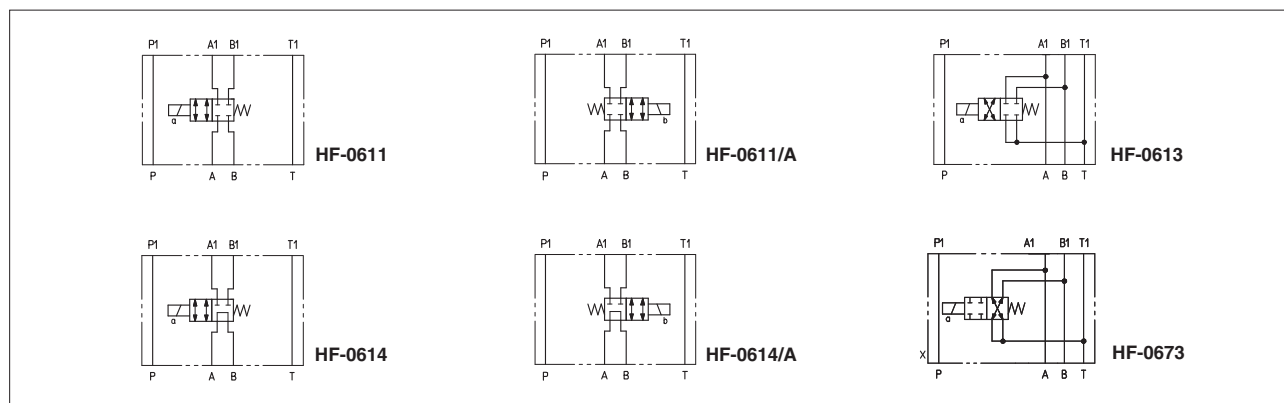
The modular execution permits to make compact functional circuits, by the stack mounting with other modular valves and solenoid valves size 06.

Mounting Surface: **ISO 4401 size 06**
Max flow: **60 l/min**
Max pressure: **350 bar**

1 MODEL CODE

HF-0	61	1	/	A	-	E	X	24DC	**	/*
Modular directional valve, size 06									Series number	Seals material, see section 4: - = NBR PE = FKM BT = HNBR
<p>Valve configuration, see section 2 61 = single solenoid, central plus external position, spring centered 67 = single solenoid, central plus external position, spring offset</p> <p>Spool type: 1, 3, 4 see section 2</p> <p>Options: A = solenoid mounted at side of port B B = orientation of coil and proximity connectors rotated of 180° WP = prolonged manual override protected by a rubber cap</p> <p>Voltage code, see section 7</p> <p>X = without connector, only for E solenoid See section 6 for available connectors, to be ordered separately</p> <p>Coils with special connectors XJ = AMP Junior Timer connector XK = Deutsch connector XS = Lead Wire connection</p> <p>00-AC = AC solenoids without coils 00-DC = DC solenoids without coils E = solenoid OE for AC and DC supply</p>										

2 CONFIGURATION



3 MAIN CHARACTERISTICS

Assembly position / location	Any position
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard -30°C ÷ +70°C /PE option -20°C ÷ +70°C /BT option -40°C ÷ +70°C
Flow direction	As shown in the symbols of table 2
Operating pressure	Ports P,A,B: 350 bar ; Port T: 210 bar (DC solenoid); 160 bar (AC solenoid)
Maximum flow	60 l/min

3.1 Coils characteristics

Insulation class	H (180°C) for DC coils F (155°C) for AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with mating connectors correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric features 7
Supply voltage tolerance	± 10%
Certification	cURus North American standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C			
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s			
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog			
	Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524	
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922	
Flame resistant with water	NBR, HNBR	HFC		

5 OPTIONS

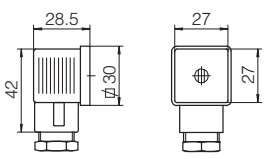
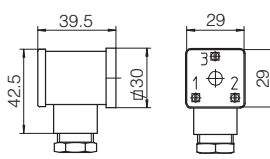
A = Solenoid mounted at side of port B. In standard versions, solenoid is mounted at side of port A.

B = Orientation of coil and proximity connectors rotated of 180°



WP = Prolonged manual override protected by a rubber cap (not for FV)

6 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 (to be ordered separately)

666, 667 (for AC or DC supply)	669 (for AC supply)	CONNECTOR WIRING	
		666, 667 1 = Positive ⊕ 2 = Negative ⊖ ⊕ = Coil ground	669 1,2 = Supply voltage V _{ac} 3 = Coil ground
SUPPLY VOLTAGES			
666 All voltages	667 24 AC or DC 110 AC or DC 220 AC or DC	669 110/50 AC 110/60 AC 230/50 AC 230/60 AC	

Note: for electronic connectors type **E-SD**, see tab. K500

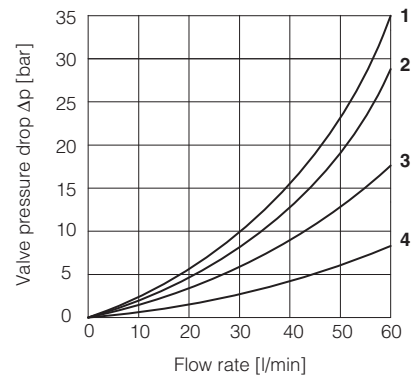
7 ELECTRIC FEATURES

External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (2)	Code of spare coil	
12 DC	12 DC	666 or 667	30 W	COE-12DC	
14 DC	14 DC			COE-14DC	
24 DC	24 DC			COE-24DC	
28 DC	28 DC			COE-28DC	
48 DC	48 DC			COE-48DC	
110 DC	110 DC			COE-110DC	
125 DC	125 DC			COE-125DC	
220 DC	220 DC			COE-220DC	
110/50 AC	110/50/60 AC			58 VA (3)	COE-110/50/60AC (1)
230/50 AC	230/50/60 AC				COE-230/50/60AC (1)
115/60 AC	115/60 AC	80 VA (3)	COE-115/60AC		
230/60 AC	230/60 AC		COE-230/60AC		
110/50 AC - 120/60 AC	110 RC	669	30 W	COE-110RC	
230/50 AC - 230/60 AC	230 RC			COE-230RC	

- (1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 -15% and the power consumption is 52 VA.
 (2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 (3) When solenoid is energized, the inrush current is approx 3 times the holding current.

8 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

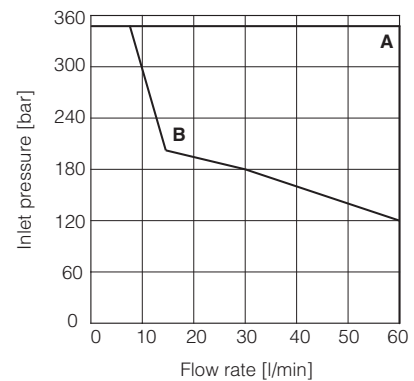
Flow direction	A→A1	B→B1	A→B	A1→T	B1→T
Valve type					
HF-0611	1	2			
HF-0614	1	2	3		
HF-0673	3	3		4	4



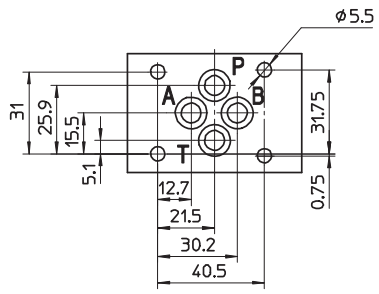
9 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams have been obtained with warm solenoids and power supply at lowest value ($V_{nom} - 10\%$)

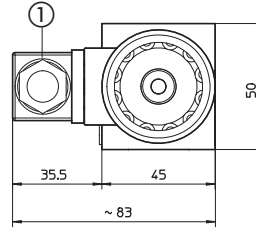
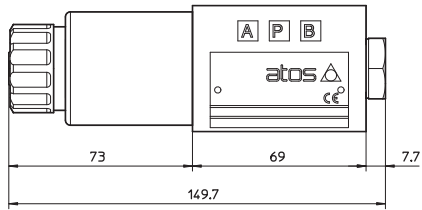
Valve type	Curve
HF-0611	A
HF-0614, HF-0673	B



10 DIMENSIONS [mm]



ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Seals: 4 OR 108
Ports P, A, B, T: $\phi = 7.5$ mm (max).



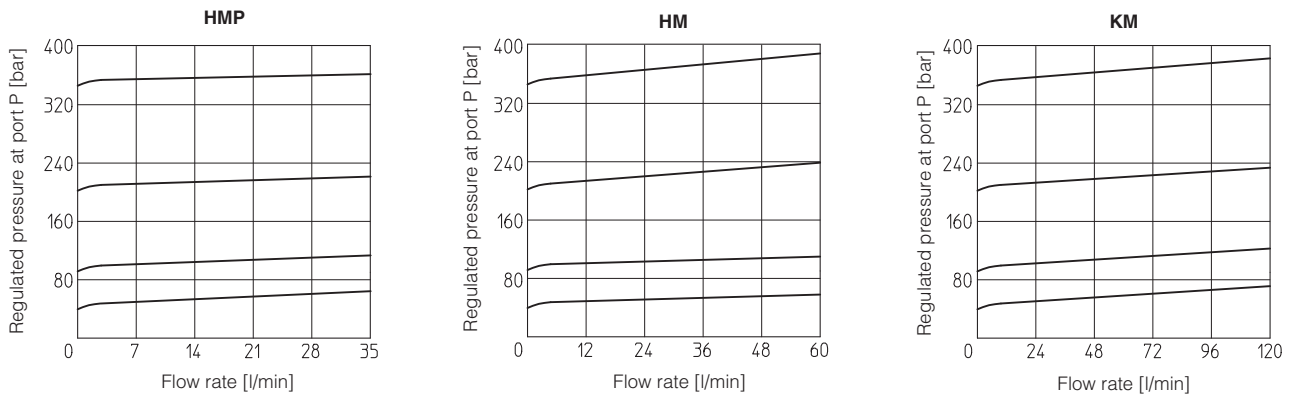
HF-0611
HF-0613
HF-0614
HF-0673

① = Power supply connector code 666, 667 or 669, to be ordered separately

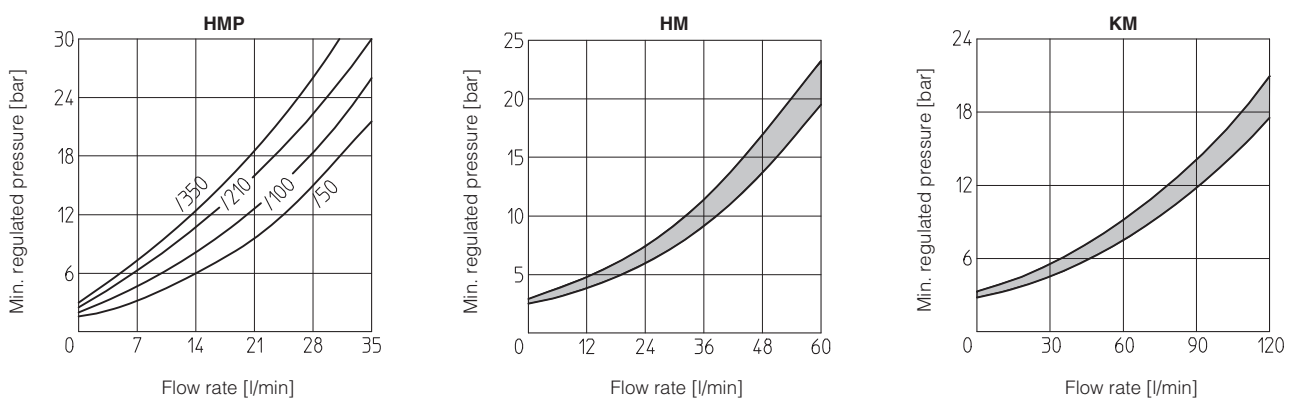
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

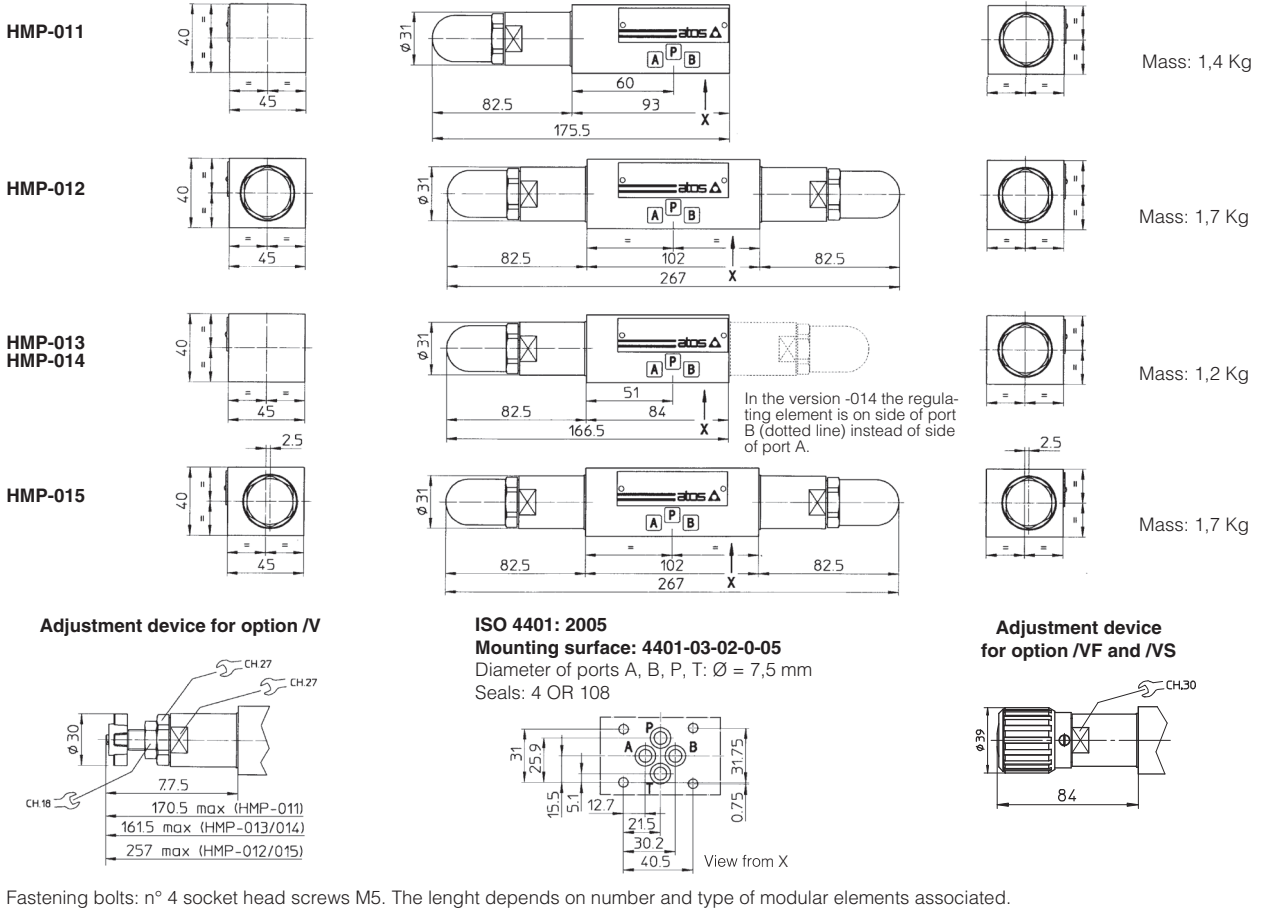
4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS (Based on mineral oil ISO VG 46 at 50°C)



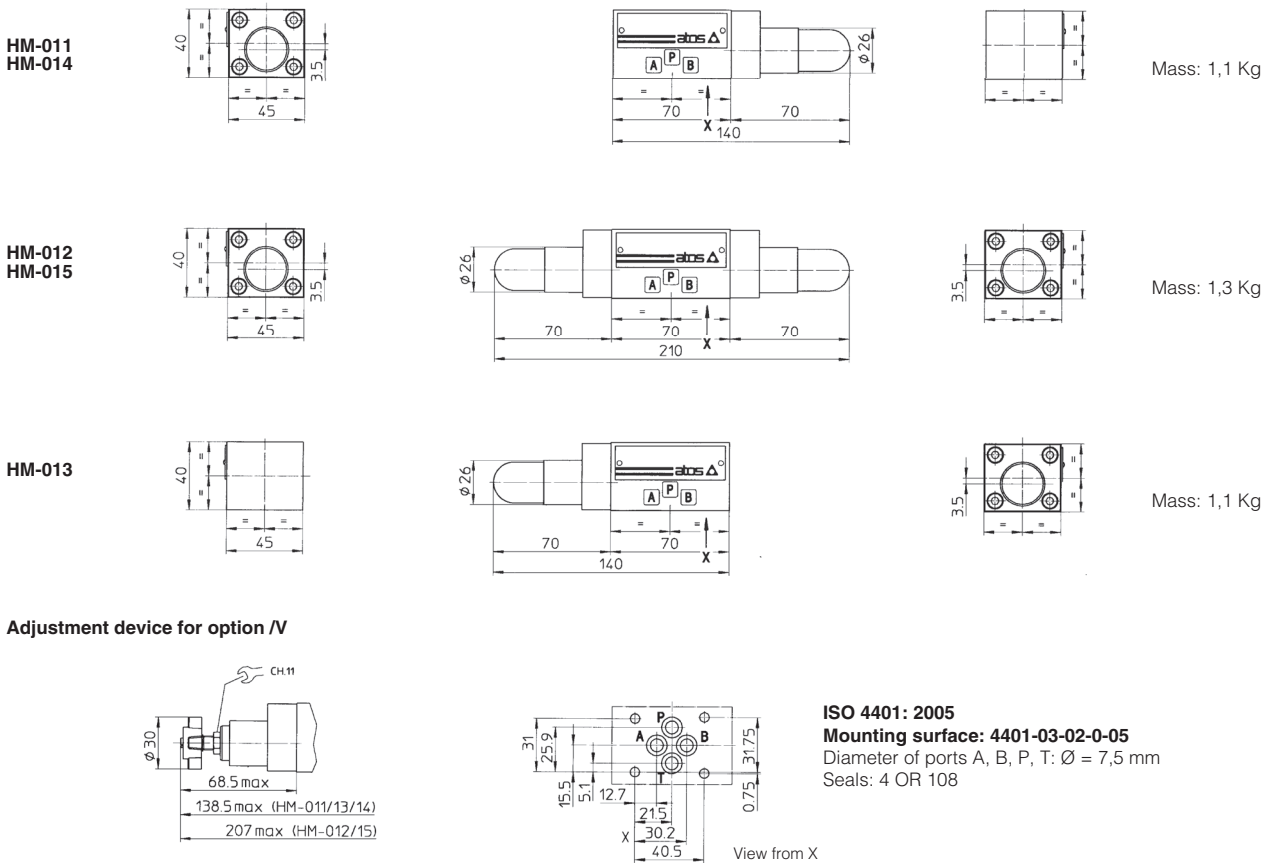
5 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS (Based on fluid viscosity of 25 mm²/s at 40°C)



6 INSTALLATION DIMENSIONS OF HMP VALVES [mm]

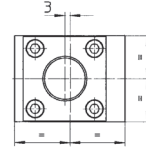
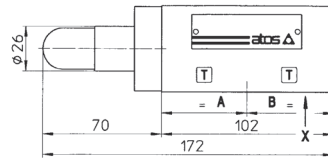
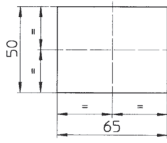


7 INSTALLATION DIMENSIONS OF HM VALVES [mm]



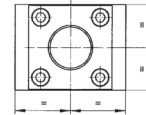
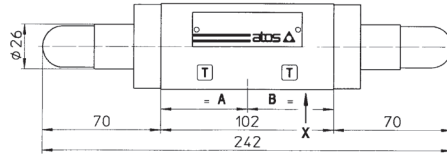
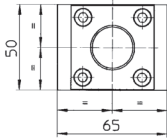
8 INSTALLATION DIMENSIONS OF KM VALVES [mm]

KM-011



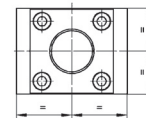
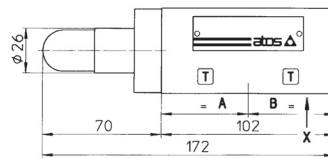
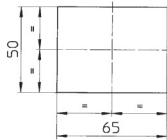
Mass: 2,5 Kg

KM-012



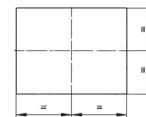
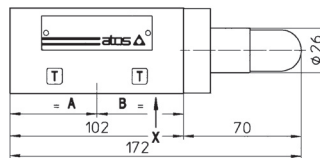
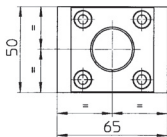
Mass: 2,8 Kg

KM-013



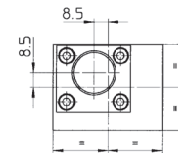
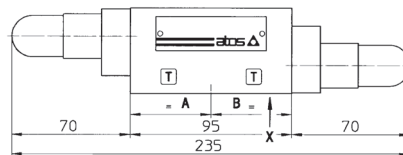
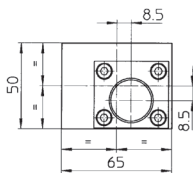
Mass: 2,5 Kg

KM-014



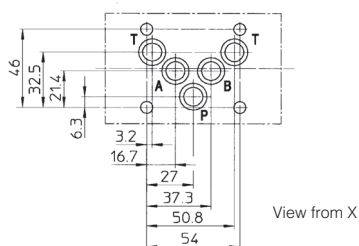
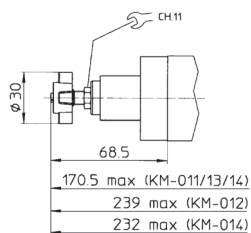
Mass: 2,5 Kg

KM-015



Mass: 2,5 Kg

Adjustment device for option /V



ISO 4401: 2005

Mounting surface: 4401-05-04-0-05

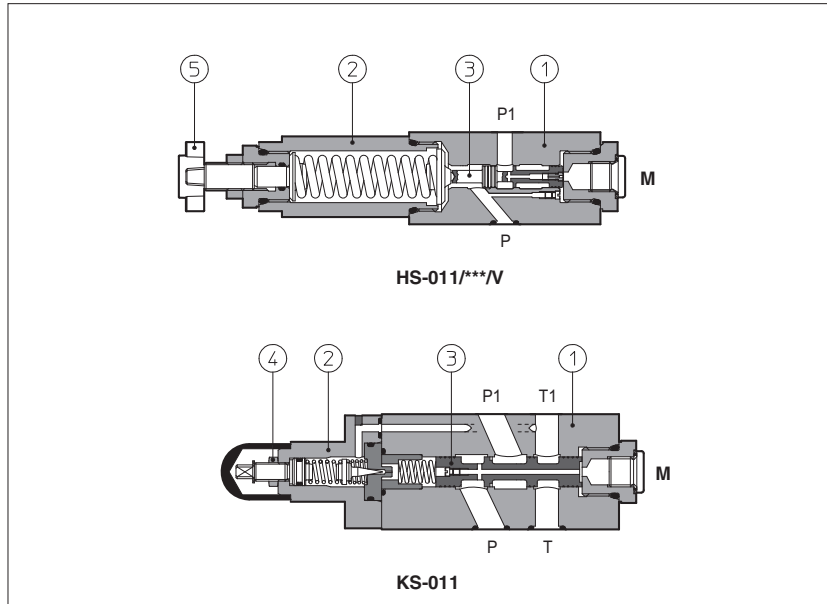
Diameter of ports A, B, P, T: $\varnothing = 11,2$ mm

Seals: 5 OR 2050

Fastening bolts: n° 4 socket head screws M6. The length depends on number and type of modular elements associated.

Modular sequence valves type HS-011 and KS-011

spool type, ISO 4401 size 06 and 10



HS are direct sequence valves, spool type ③.

KS are double stage ① ② sequence valves, spool type ③.

Pressure adjustment is operated by loosening the locking nut ④ and turning the setting screw in the normal model.

Optional versions with a handwheel ⑤ are available on request.

Clockwise rotation increases the pressure.

Valve size and max flow:

HS = size 06, flow up to 40 l/min

KS = size 10, flow up to 80 l/min

Mounting surface: **ISO 4401 size 06, 10**

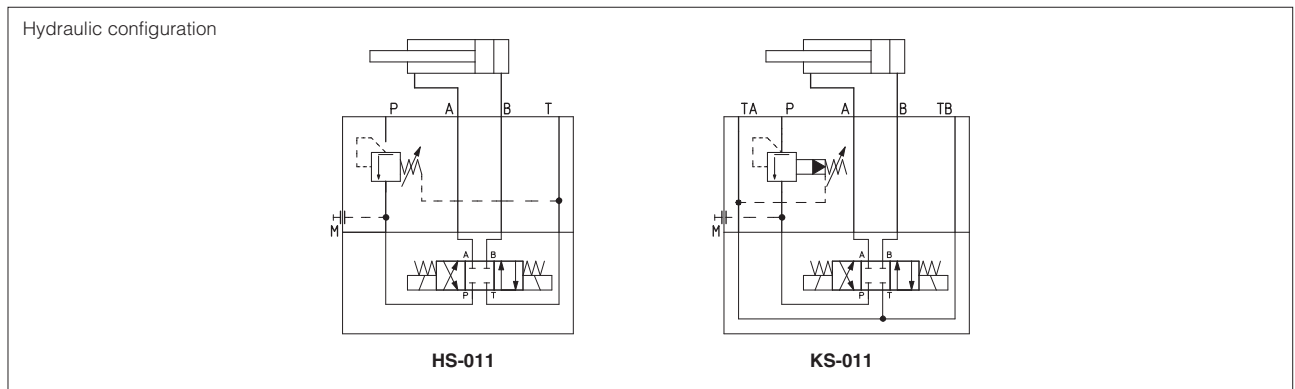
Max pressure: **350 bar (HS)**

315 bar (KS)

1 MODEL CODE

HS	-	011	/	210	/	V	/	**	/	*
Modular sequence valve, size: HS = 06 KS = 10										Seals material, see section ③: - = NBR PE = FKM BT = HNBR
Configuration, see section ② 011 = single, acting on port P, drain to port T										Series number
Pressure range: for HS: for KS: 32 = 3 - 32 bar 100 = 20 - 100 bar 100 = 7 - 100 bar 210 = 50 - 210 bar 210 = 8 - 210 bar										Options: V = setting adjustment by handwheel instead of a grub screw protected by cap Only for HS: VF = regulating knob VS = regulating knob with safety locking

2 HYDRAULIC CHARACTERISTICS



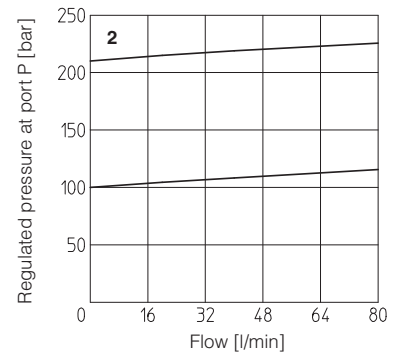
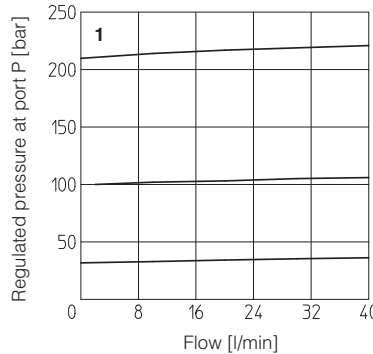
Valve model	HS-011/32	HS-011/100	HS-011/210	KS-011/100	KS-011/210
Max flow [l/min]		40			80
Max drain [cm ³ /min]		50			50
Pressure range [bar]	3 - 32	20 - 100	50 - 210	7 - 100	8 - 210
Max inlet pressure [bar]		350			315
Max pressure on port T [bar]		160			160

3 MAIN CHARACTERISTICS SEALS and HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

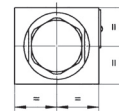
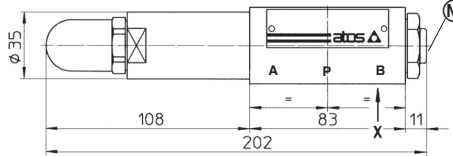
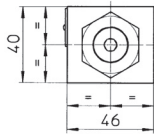
4 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

1 = HS
2 = KS



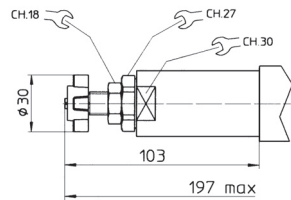
5 INSTALLATION DIMENSIONS [mm]

HS-011



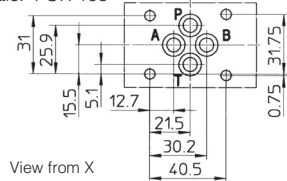
Ⓜ = Pressure gauge port = G 1/4"

Adjustment device for option/V

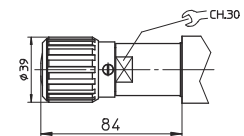


ISO 4401: 2005

Mounting surface: 4401-03-02-0-05
Diameter of ports A, B, P, T: Ø = 7,5 mm
Seals: 4 OR 108



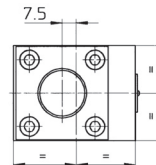
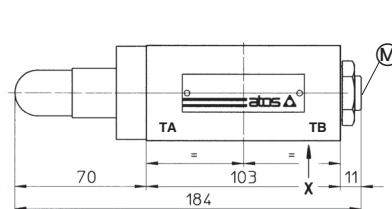
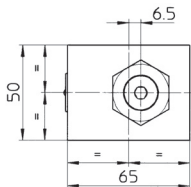
Adjustment device for option /VF and /VS



Fastening bolts: n°4 socket head screws M5. The length depends on number and type of modular elements associated.

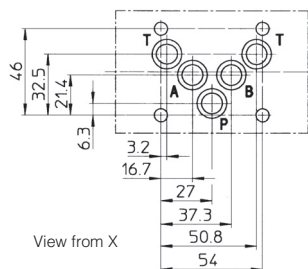
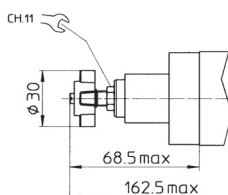
Mass: 2 Kg

KS-011



Ⓜ = Pressure gauge port = G 1/4"

Adjustment device for option/V



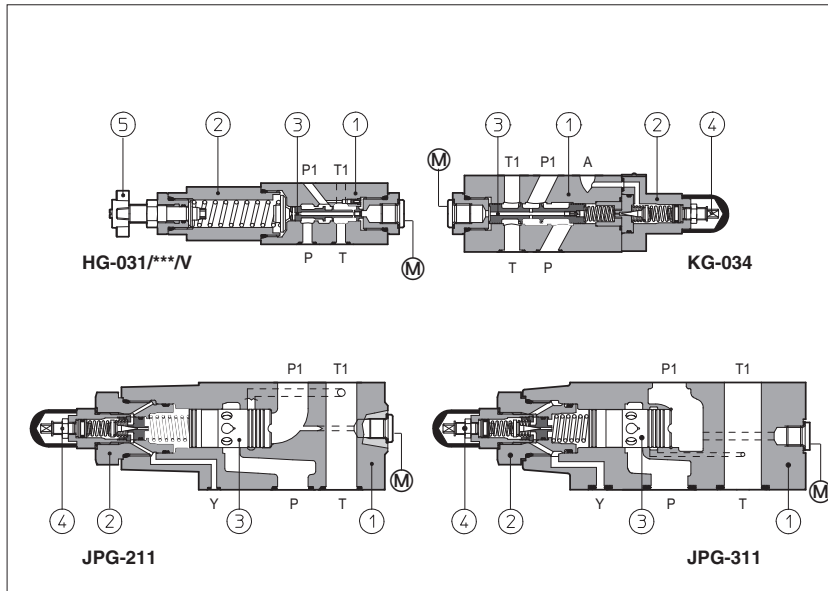
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports A, B, P, T: Ø = 11,2 mm
Seals: 5 OR 2050

Fastening bolts: n°4 socket head screws M6. The length depends on number and type of modular elements associated.

Mass: 3 Kg

Modular reducing valves type HG, KG, JPG-2 and JPG-3

spool type, ISO 4401 sizes 06, 10, 16 and 25



HG, KG, JPG are pressure reducing valves, spool type ③, designed to operate in oil hydraulic systems.

HG are direct, three way valves;
KG are double stage ① ②, three way valves;

JPG are double stage ① ②, two way valves.

Clockwise rotation increases the pressure.

Valve size and max flow:

HG = size 06 flow up to 50 l/min;

KG = size 10 flow up to 100 l/min;

JPG-2 = size 16 flow up to 250 l/min;

JPG-3 = size 25 flow up to 300 l/min;

Mounting surface:

ISO 4401 size 06, 10, 16 and 25

Max pressure: **350 bar** for HG

315 bar for KG and JPG

1 MODEL CODE

HG-0	31	/	210	/	V	/	**	/	*
Modular pressure reducing valve, size: HG-0 = 06 JPG-2 = 16 KG-0 = 10 JPG-3 = 25						Series number		Seals material, see section ③: - = NBR PE = FKM BT = HNBR	
Configuration, see section ② two way (only for JPG): 11 = reduced pressure on P port three way (only for HG-0 and KG-0): 31 = reduced pressure on P port 33 = reduced pressure on A port 34 = reduced pressure on B port				Options: V = setting adjustment by handwheel instead of a grub screw protected by cap Only for HG: VF = regulating knob/ VS = regulating knob with safety locking					
		Pressure range		HG		KG		JPG	
		32 = 3 - 32 bar		100 = 20 - 100 bar		100 = 7 - 100 bar		100 = 6 - 100 bar	
		50 = 2 - 50 bar		210 = 50 - 210 bar		210 = 8 - 210 bar		210 = 70 - 210 bar	
		75 = 10 - 75 bar							

2 HYDRAULIC CHARACTERISTICS

Hydraulic configuration

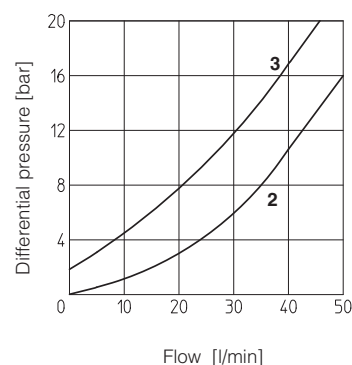
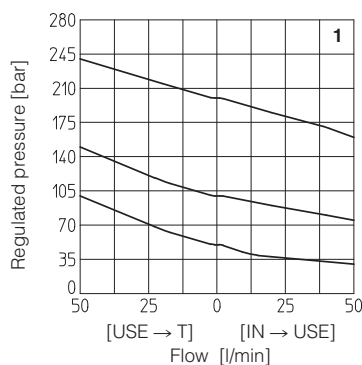
Valve model	HG-03*/32	HG-03*/50	HG-03*/75	HG-03*/100	HG-03*/210	KG-03*/100	KG-03*/210	JPG-211/100	JPG-211/210	JPG-311/100	JPG-311/210
Max flow [l/min]	50					100		250		300	
Pressure range [bar]	3 ÷ 32	2 ÷ 50	10 ÷ 75	20 ÷ 100	50 ÷ 210	7 ÷ 100	8 ÷ 210	6 ÷ 100	70 ÷ 210	6 ÷ 100	70 ÷ 210
Max inlet pressure [bar]	350					315		315		315	
Max pressure on port T [bar]	160					160		160		160	

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

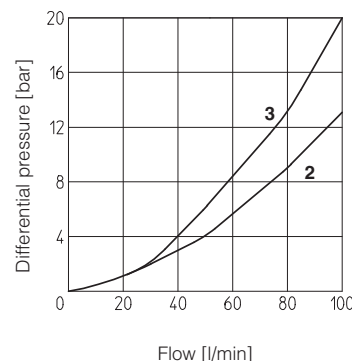
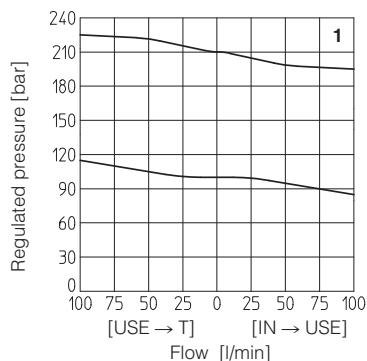
4 DIAGRAMS OF HG-03*
based on mineral oil ISO VG 46 at 50°C

- 1** = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port
- 2** = differential pressure variation versus flow between inlet port and use port
- 3** = differential pressure variation versus flow between use port and discharge port



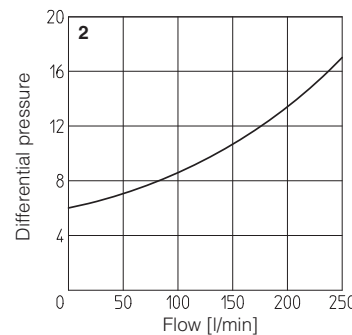
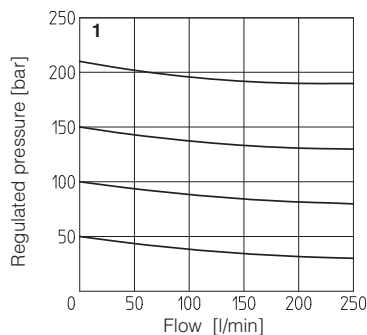
5 DIAGRAMS OF KG-03*
based on mineral oil ISO VG 46 at 50°C

- 1** = regulated pressure variation versus flow:
- between use port and discharge port
- between inlet port and use port
- 2** = differential pressure variation versus flow between inlet port and use port
- 3** = differential pressure variation versus flow between use port and discharge port



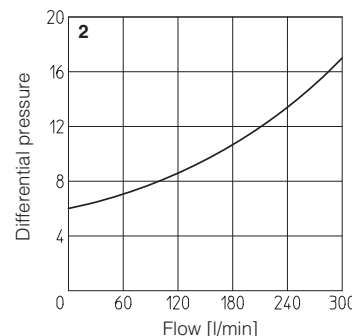
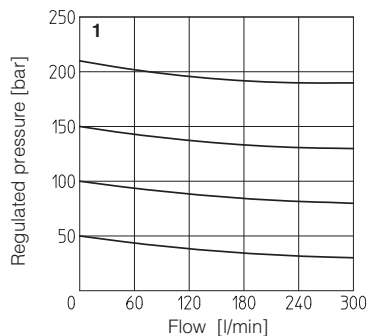
6 DIAGRAMS OF JPG-211
based on mineral oil ISO VG 46 at 50°C

- 1** = regulated pressure variation versus flow between inlet port and use port
- 2** = differential pressure variation versus flow between use port and discharge port



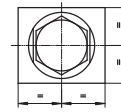
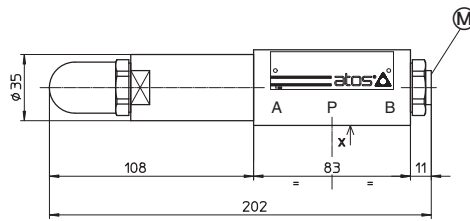
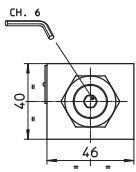
7 DIAGRAMS OF JPG-311
based on mineral oil ISO VG 46 at 50°C

- 1** = regulated pressure variation versus flow between inlet port and use port
- 2** = differential pressure variation versus flow between use port and discharge port



8 INSTALLATION DIMENSIONS OF HG-0 VALVES [mm]

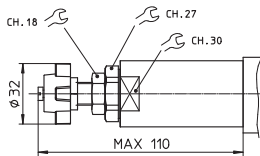
HG-03*



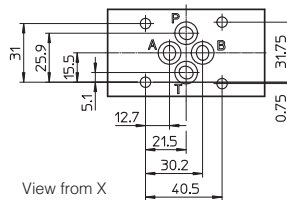
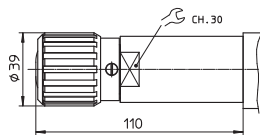
(M) = Pressure gauge port = G 1/4"

Mass: 2,3 Kg

Adjustment device for option /V



Adjustment device for option /VF and /VS



ISO 4401: 2005

Mounting surface: 4401-03-02-0-05

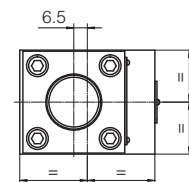
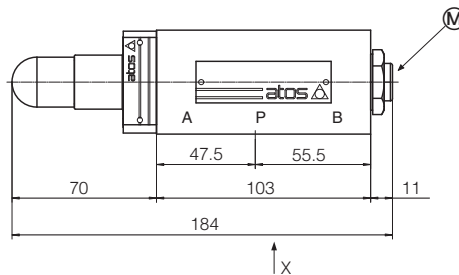
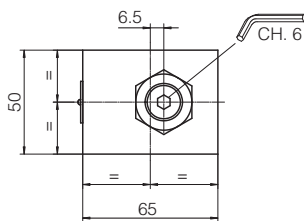
Diameter of ports A, B, P, T: $\varnothing = 7,5$ mm

Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The length depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KG-0 VALVES [mm]

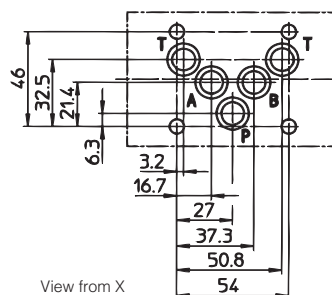
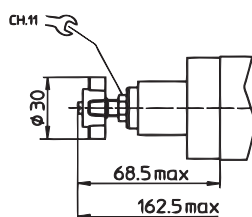
KG-03*



(M) = Pressure gauge port = G 1/4"

Mass: 3,8 Kg

Adjustment device for option /V



ISO 4401: 2005

Mounting surface: 4401-05-04-0-05

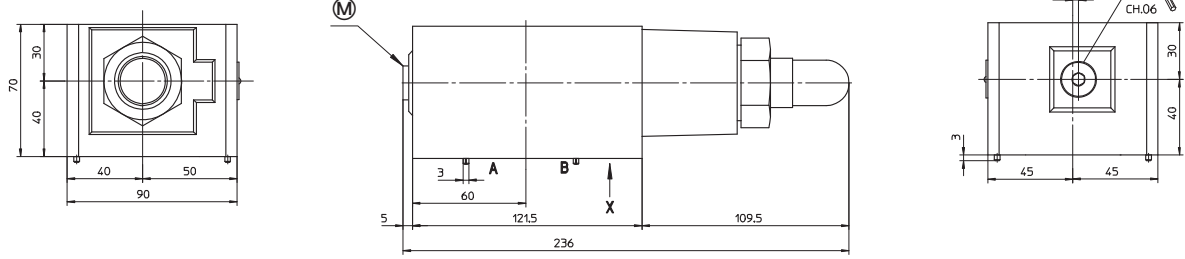
Diameter of ports A, B, P, T: $\varnothing = 11,2$ mm

Seals: 5 OR 2050

Fastening bolts: n° 4 socket head screws M6. The length depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPG-2 VALVES [mm]

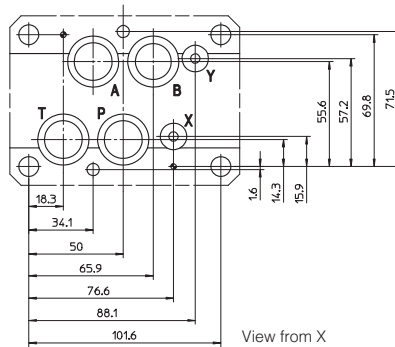
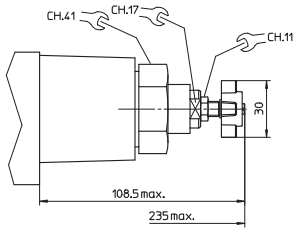
JPG-211



(M) = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V

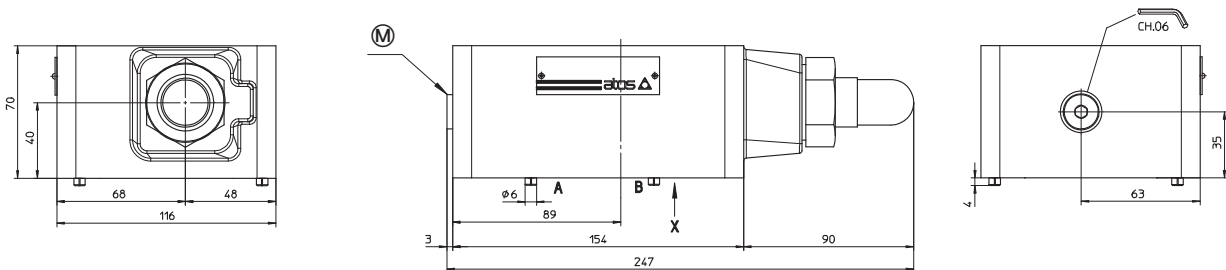


ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
 Diameter of ports A, B, P, T: $\varnothing = 20$ mm
 Diameter of ports X, Y: $\varnothing = 7$ mm
 Seals: 4 OR 130: 2 OR 109

Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The length depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPG-3 VALVES [mm]

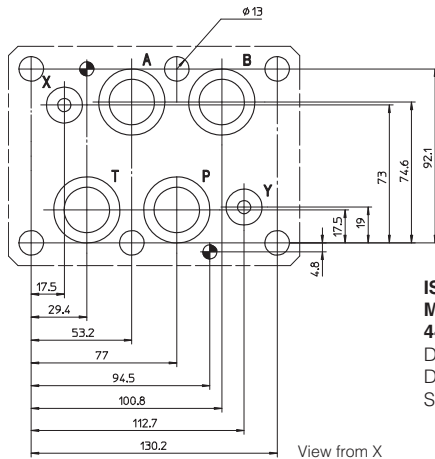
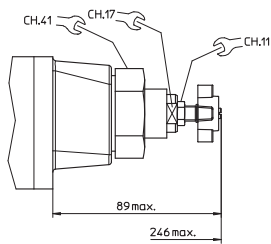
JPG-311



(M) = Pressure gauge port = G 1/4"

Mass: 9 Kg

Adjustment device for option /V

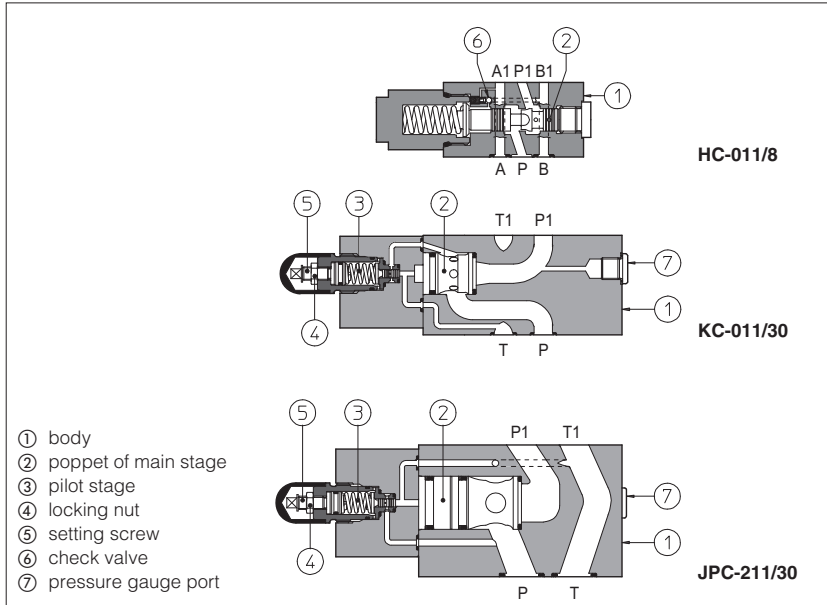


ISO 4401: 2005
Mounting surface: 4401-08-08-0-05 (without port L)
 Diameter of ports A, B, P, T: $\varnothing = 24$ mm
 Diameter of ports X, Y: $\varnothing = 7$ mm
 Seals: 4 OR 130: 2 OR 109

Fastening bolts: n° 6 socket head screws M12. The length depends on number and type of modular elements associated.

Modular pressure compensators type **HC, KC, and JPC-2**

ISO 4401 sizes 06, 10 and 16



HC, KC and **JPC** are two way pressure compensators for modular assembling with on/off and proportional directional control valves.

They keep a constant differential pressure (Δp) across port P and port A or B in order to maintain a constant flow rate against pressure variations. Automatic piloting selection ④ is included.

Fixed Δp is available only for size 06. Adjustment of desired Δp is operated by loosening the locking nut ④ and turning the setting screw ⑤ of pilot device. Clockwise rotation increases Δp .

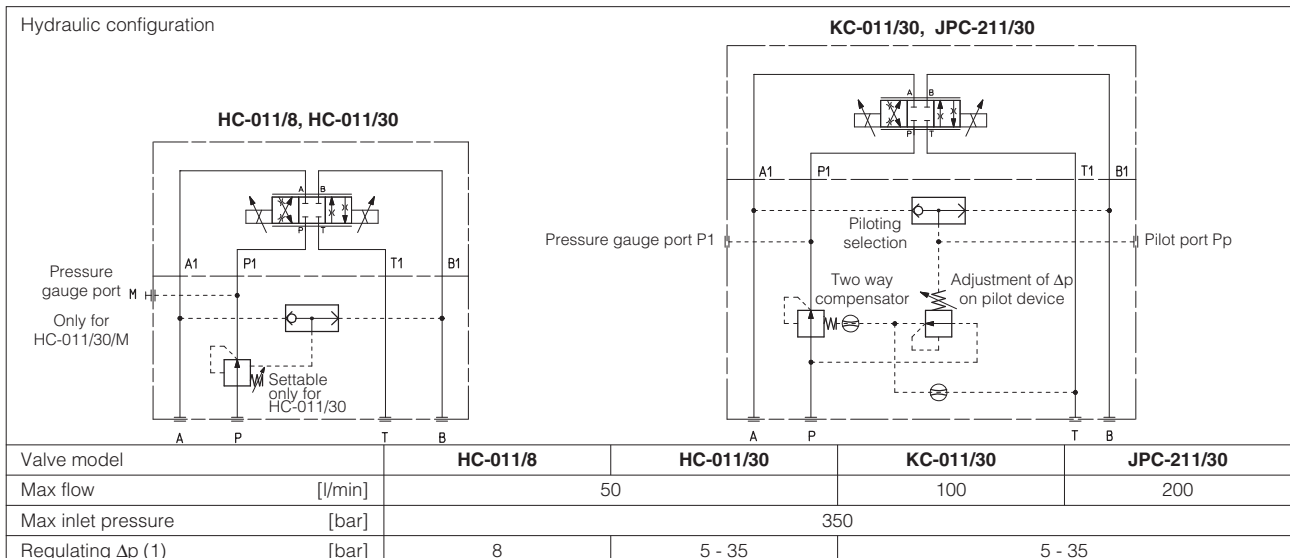
HC = size 06, flow up to 50 l/min.
KC = size 10, flow up to 100 l/min.
JPC = size 16, flow up to 200 l/min.

Mounting surface:
ISO 4401 size 06, 10, 16
 Max pressure: **350 bar**

1 MODEL CODE

HC-0	-	11		30	/	M	**	/	*	
Modular pressure compensator, size: HC-0 = 06 KC-0 = 10 JPC-2 = 16							Seals material, see section ③: - = NBR PE = FKM BT = HNBR			
Configuration, see section ② 11 = two way execution with constant Δp between P port and user port							Series number			
Fixed Δp (only for size 06): 8 = 8 bar			Adjustable Δp (for all sizes): 30 = 5 - 35 bar				Option (only for HC-011/30) M = fit for manometer port P1			

2 HYDRAULIC CHARACTERISTICS



(1) The Δp for single flow path is fixed at 8 bar or is adjustable between 5 and 35 bar; it corresponds to values of total Δp across the valve of 16 bar or between 10 and 70 bar. Threaded plugged ports Pp and P1 are suitable for pressure adjustment or check of Δp value for single flow path (reading difference between Pp and P1 values).

3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +80°C / PE option = -20°C ÷ +70°C / BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 INSTALLATION DIMENSIONS [mm]

HC-011/8

Mass: 1,9 Kg

HC-011/30

Mass: 2 Kg

Fastening bolts: n°4 socket head screws M5.
The length depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Diameter of ports
A, B, P, T: Ø = 7,5 mm (max)
Seals: 4 OR 108

KC

Mass: 4,2 Kg

Fastening bolts: n°4 socket head screws M6.
The length depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
Diameter of ports
A, B, P, T: Ø = 11,2 mm (max)
Seals: 2 OR 108, 5 OR 2050

JPC

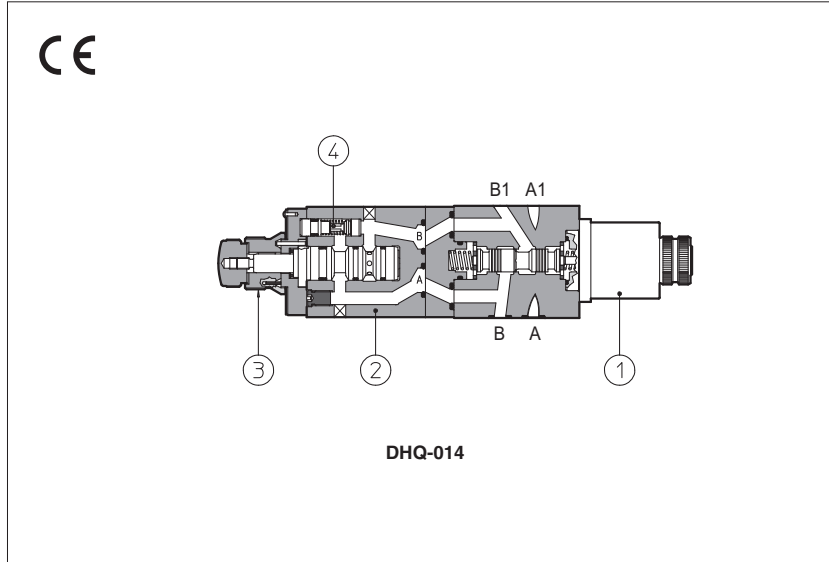
Mass: 6 Kg

Fastening bolts:
n°4 socket head screws M10 and n°2 M6.
The length depends on number and type of modular elements associated.

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Diameter of ports
A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 130; 2 OR 109

Modular fast/slow valves type DHQ

compensated flow control and by-pass solenoid valve, ISO 4401 size 06



DHQ are modular units composed by one by-pass solenoid valve ① and one 2-way pressure compensated flow control valve ② type QV-06 (tab. C210).

The flow control valve is provided with a built-in check valve ④ to allow the free flow in the opposite direction.

The flow adjustment is obtained by turning the graduated micrometer knob ③. Clockwise rotation decreases the throttling (passage reduced).

Optional versions with locking key on the adjustment knob are available on request.

Mounting surface:
ISO 4401 size 06

Max controlled flow: up to 1,5-6-11-16-24 l/min (depending on models);

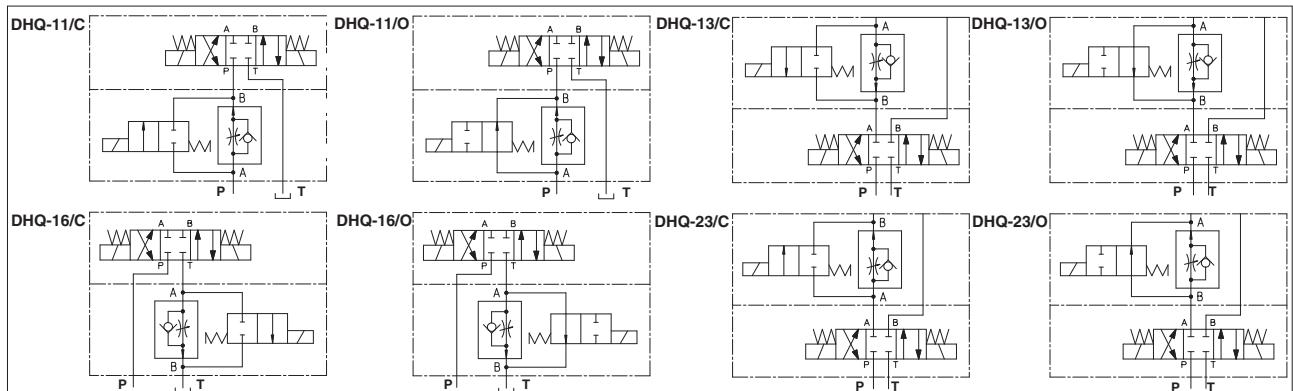
Free flow up to 36 l/min.

Max pressure: up to **250 bar**

1 MODEL CODE

DHQ-0	13	/ C /	6 /	K - I	X	24DC	**	*
Modular flow control unit, pressure compensated, size: DHQ-0 = 06						Supply voltage, see section 4	Series number	Seals material, see section 3: - = NBR PE = FKM BT = HNBR
Configuration, see section 2 control of flow discharged from the actuator 13 = on port A 14 = on port B 16 = on port T control of flow entering the actuator: 11 = on port P 23 = on port A 24 = on port B					X = without connector (1): See section 7 for available connectors, to be ordered separately -00 = solenoid valve without coils			
C = flow controlled when solenoid is de-energized O = flow controlled when solenoid is energized				Options: K = with lock key for the setting knob V = without by-pass check valve				
				Maximum adjustable controlled flow: 1 = 1,5 l/min; 6 = 6 l/min; 11 = 11 l/min; 16 = 16 l/min; 24 = 24 l/min 00 = without flow control valve				

2 HYDRAULIC CHARACTERISTICS



DHQ-014/*, DHQ-024/* are similar to corresponding DHQ-013/*, DHQ-023/* but control the flow through port B of solenoid valve

Valve model		/1	/6	/11	/16	/24
Max regulated flow	[l/min]	1,5	6	11	16	24
Min regulated flow	[cm ³ /min]	50	50	50	50	50
Regulating Δp	[bar]	3	3	5	6,5	8
Max flow through check valve	[l/min]	24				
Max free flow		36 l/min				
Max flow on port A	[l/min]	24				
Max pressure	[bar]	250				

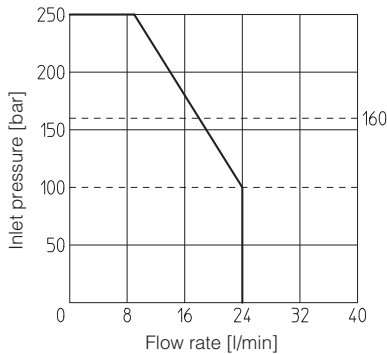
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU and Machine Directive 2006/42/EC. RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 ELECTRIC/ELECTRONIC CONNECTORS AND ELECTRIC FEATURES

For electric/electronic connectors (to be ordered separately) and electric features of DHQ units, see tab. E010.

5 OPERATING LIMITS



6 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005

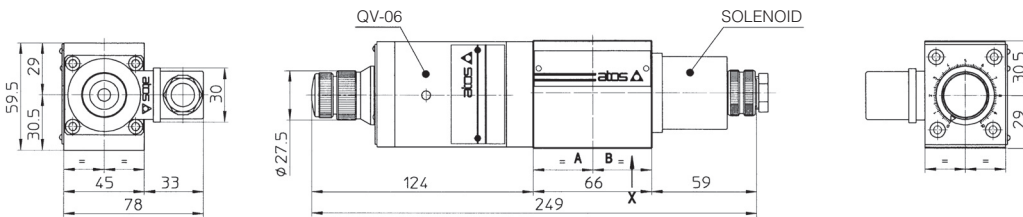
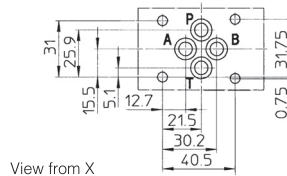
Mounting surface: 4401-03-02-0-05

Diameter of ports P, A, B, T: Ø = 7,5 mm (max)

Seals: 4 OR 108

Fastening bolts: 4 socket head screws M5.

The length depends on number and type of modular elements associated



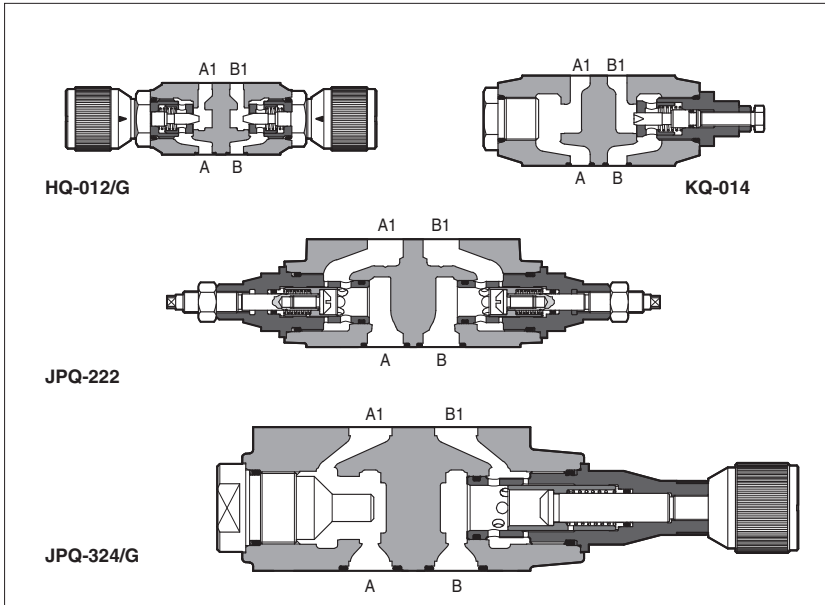
Mass: 2,5 kg

In versions -014 and -024 the position of valve QV-06 and of solenoid are inverted.

Overall dimensions refer to valves with connectors type 666

Modular throttle valves type HQ, KQ, JPQ

flow control, ISO 4401 sizes 06, 10, 16 and 25



HQ, KQ and **JPQ** are flow throttling valves, not compensated, and with check valve to allow free flow in the opposite direction.

The flow adjustment is done by turning the setting screw in the normal model. Optional versions with a graduate micrometer knob are available on request. Clockwise rotation increases the throttling (passage reduced).

Valve size and max flow:

HQ-0 = size 06, flow up to 25 l/min for /U option, up to 80 l/min for standard

KQ-0 = size 10, flow up to 160 l/min

JPQ-2 = size 16, flow up to 200 l/min

JPQ-3 = size 25, flow up to 300 l/min

Mounting surface:

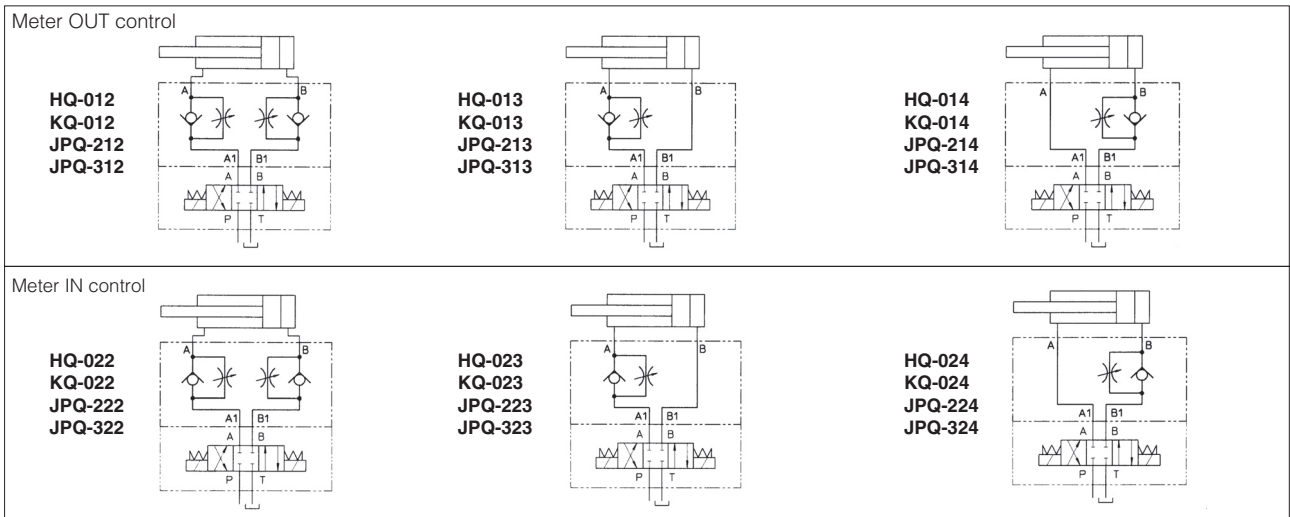
ISO 4401 size 06, 10, 16 and 25

Max pressure: **350 bar** (HQ, JPQ)
315 bar (KQ)

1 MODEL CODE

HQ-0	13	/	G	**	/	*
Modular flow control valve, size: HQ-0 = 06 KQ-0 = 10 JPQ-2 = 16 JPQ-3 = 25						Seals material, see section 3: - = NBR PE = FKM BT = HNBR
Configuration, see section 2 meter OUT control: 12 = double, acting on port A and B 13 = single, acting on port A 14 = single, acting on port B meter IN control: 22 = double, acting on port A and B 23 = single, acting on port A 24 = single, acting on port B				Series number		
			Options: U = better accuracy for reduced flow (only for HQ-0) G = adjustment by graduated micrometer			

2 VALVE CONFIGURATION

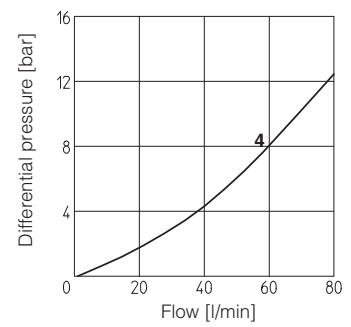
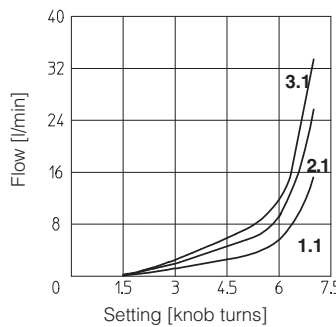
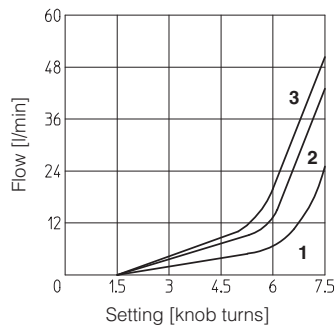


3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

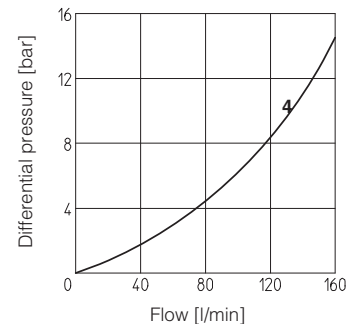
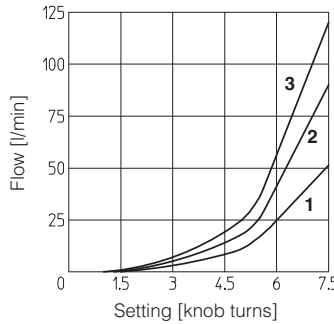
4 DIAGRAMS OF HQ-0 based on mineral oil ISO VG 46 at 50°C

- 1 = Regulation diagram at Δp 10 bar (1.1 = option /U)
- 2 = Regulation diagram at Δp 30 bar (2.1 = option /U)
- 3 = Regulation diagram at Δp 50 bar (3.1 = option /U)
- 4 = Q/Δp diagram for free flow through the non-return valve



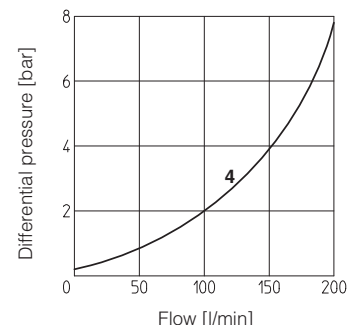
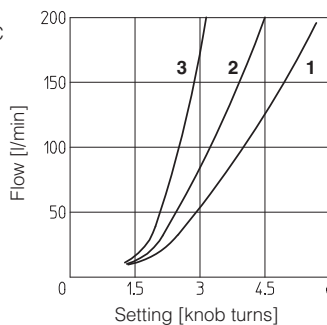
5 DIAGRAMS OF KQ-0 based on mineral oil ISO VG 46 at 50°C

- 1 = Regulation diagram at Δp 10 bar
- 2 = Regulation diagram at Δp 30 bar
- 3 = Regulation diagram at Δp 50 bar
- 4 = Q/Δp diagram for free flow through the non-return valve



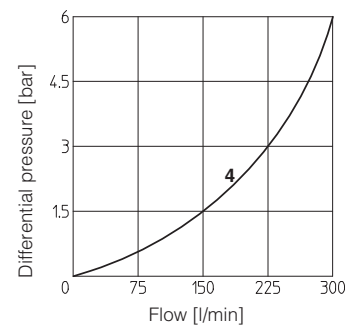
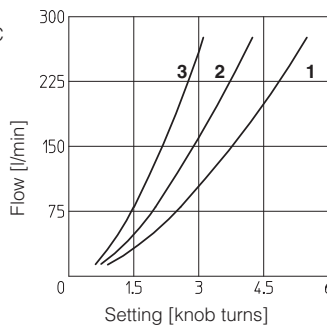
6 DIAGRAMS OF Jpq-2 based on mineral oil ISO VG 46 at 50°C

- 1 = Regulation diagram at Δp 10 bar
- 2 = Regulation diagram at Δp 30 bar
- 3 = Regulation diagram at Δp 50 bar
- 4 = Q/Δp diagram for free flow through the non-return valve



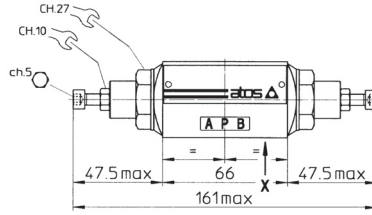
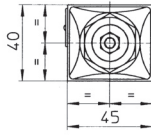
7 DIAGRAMS OF Jpq-3 based on mineral oil ISO VG 46 at 50°C

- 1 = Regulation diagram at Δp 10 bar
- 2 = Regulation diagram at Δp 30 bar
- 3 = Regulation diagram at Δp 50 bar
- 4 = Q/Δp diagram for free flow through the non-return valve



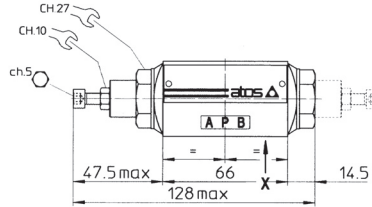
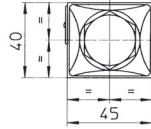
8 INSTALLATION DIMENSIONS OF HQ-0 VALVES [mm]

HQ-012
HQ-022



Mass: 1,1 Kg

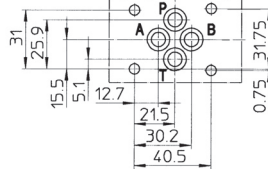
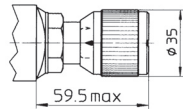
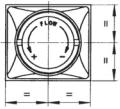
HQ-013
HQ-014
HQ-023
HQ-024



In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 1,2 Kg

/G OPTION



ISO 4401: 2005

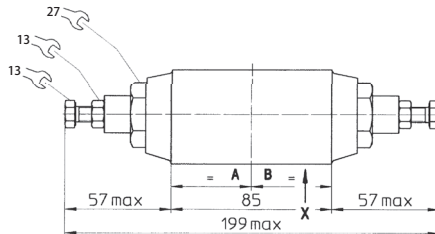
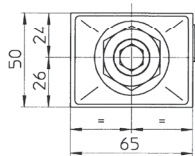
Mounting surface: 4401-03-02-0-05

Diameter of ports A, B, P, T: $\varnothing = 7,5$ mm (max)
Seals: 4 OR 108

Fastening bolts: n° 4 socket head screws M5. The length depends on number and type of modular elements associated.

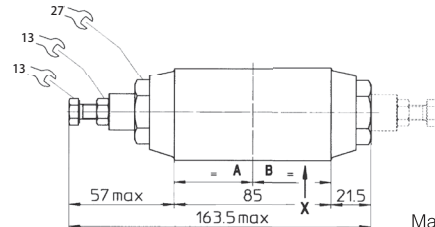
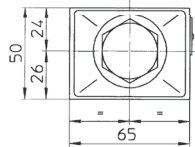
9 INSTALLATION DIMENSIONS OF KQ-0 VALVES [mm]

KQ-012
KQ-022



Mass: 2 Kg

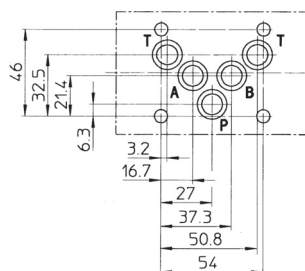
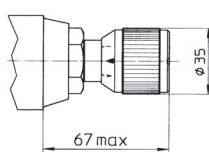
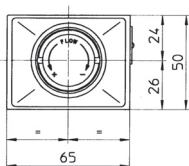
KQ-013
KQ-014
KQ-023
KQ-024



In version -014 and -024 the regulating element is on side of port B (dotted line) instead of side of port A.

Mass: 2,2 Kg

/G OPTION



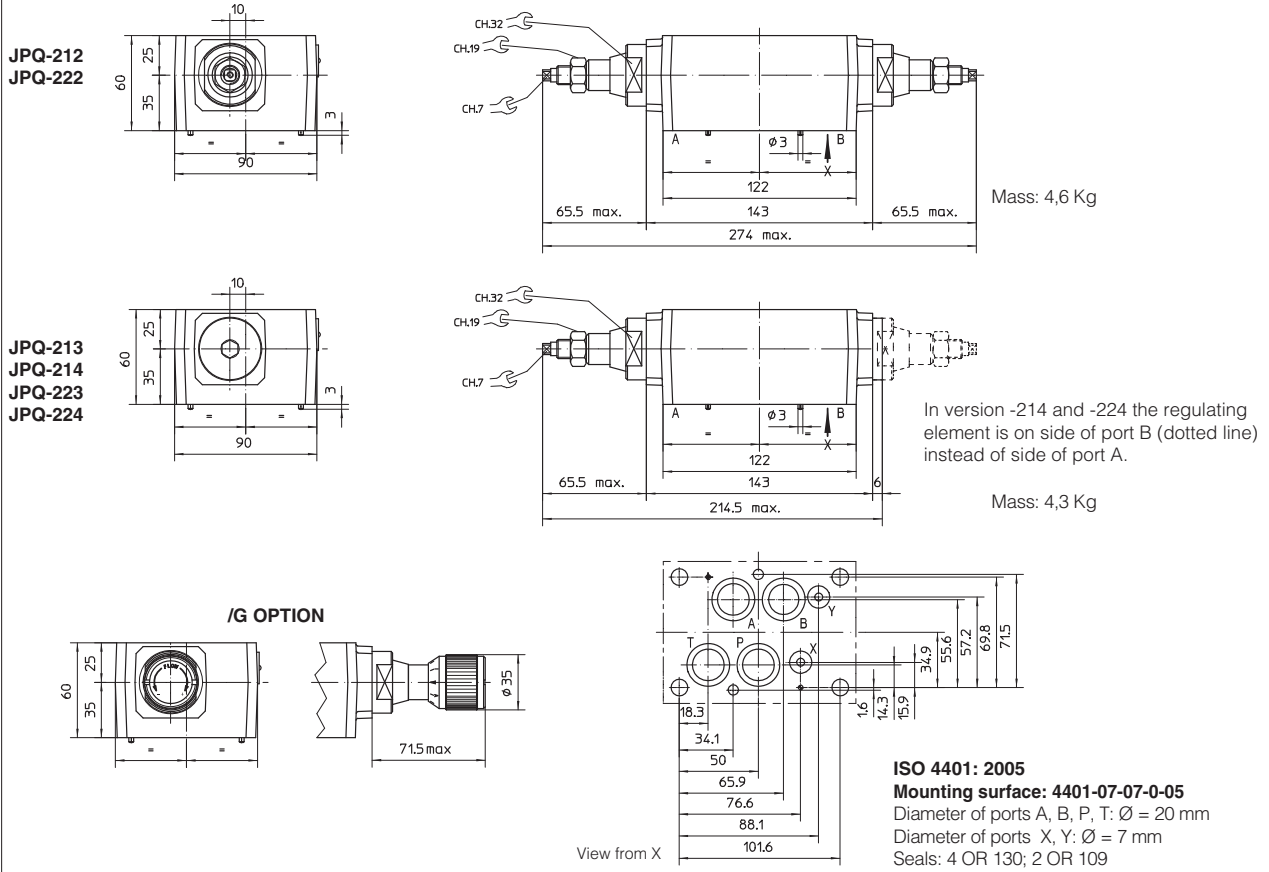
ISO 4401: 2005

Mounting surface: 4401-05-04-0-05

Diameter of ports, A, B, P, T: $\varnothing = 11,2$ mm (max)
Seals: 5 OR 2050

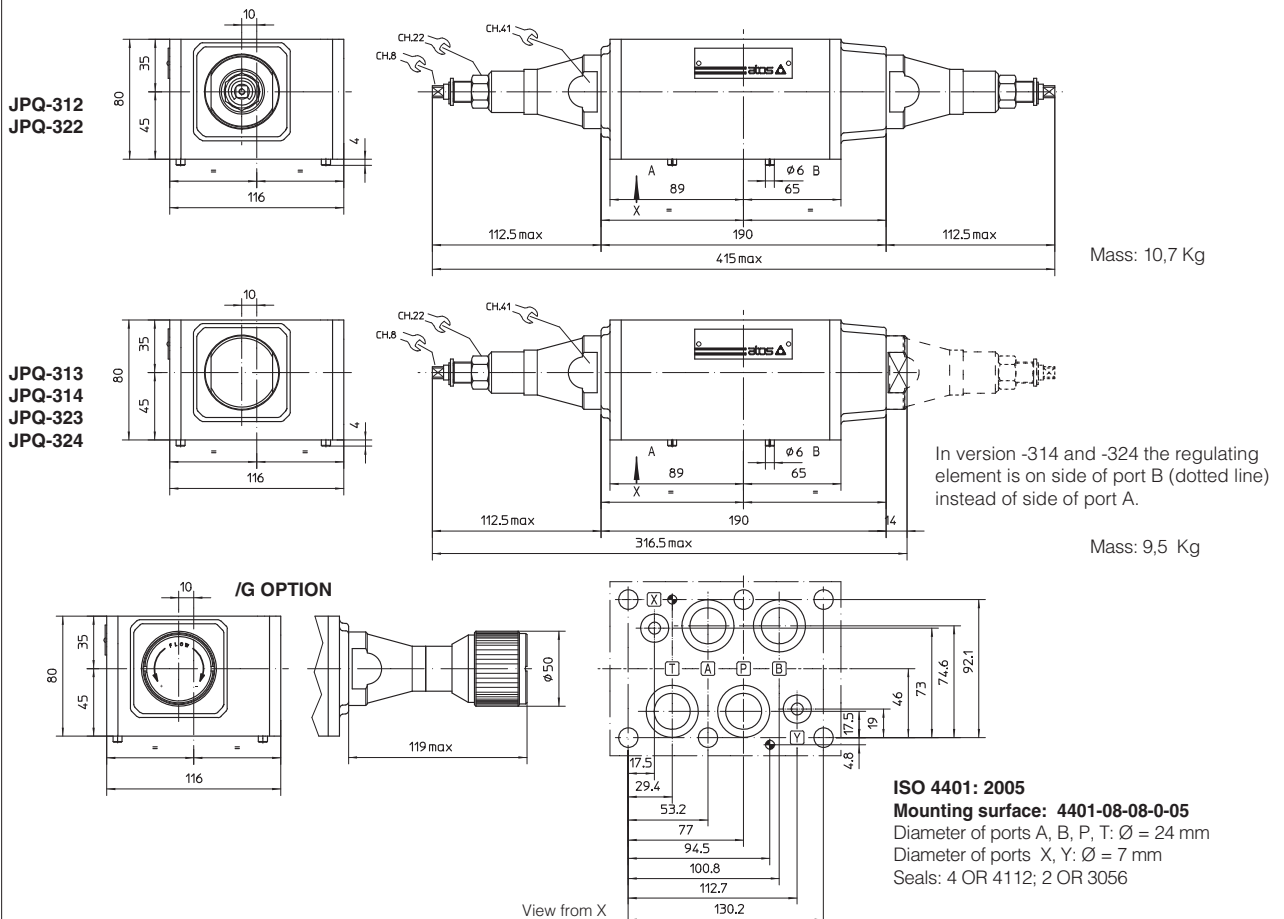
Fastening bolts: n° 4 socket head screws M6. The length depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPQ-2 VALVES [mm]



Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The length depends on number and type of modular elements associated.

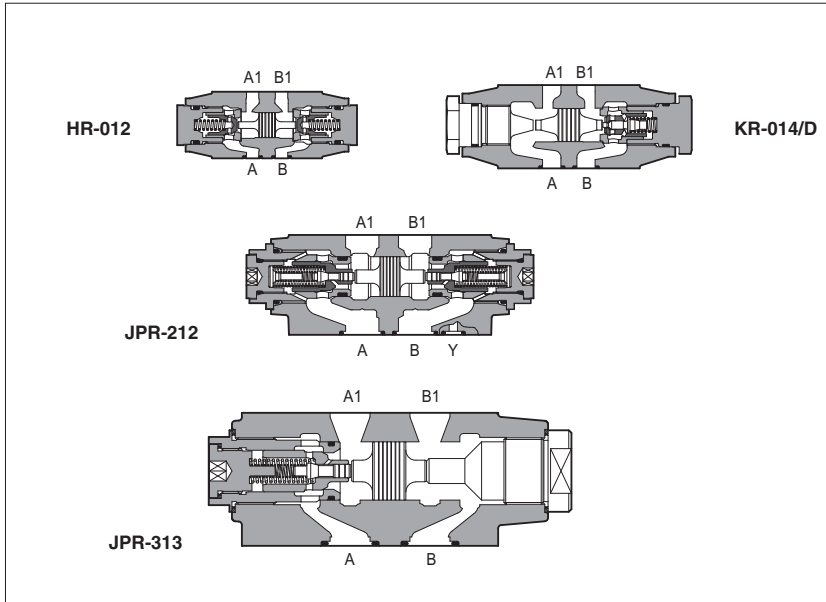
11 INSTALLATION DIMENSIONS OF JPQ-3 VALVES [mm]



Fastening bolts: n° 6 socket head screws M12. The length depends on number and type of modular elements associated.

Modular check valves type HR, KR, JPR

direct or pilot operated, ISO 4401 sizes 06, 10, 16 and 25



HR, KR are check valves available as direct or pilot operated models.
JPR are pilot operated check valves.

Optional versions with decompression are available on request for some models of KR.

HR-0 = size 06: flow up to 60 l/min, pressure up to 350 bar.

KR-0 = size 10: flow up to 120 l/min, pressure up to 315 bar.

JPR-2 = size 16: flow up to 200 l/min, pressure up to 350 bar.

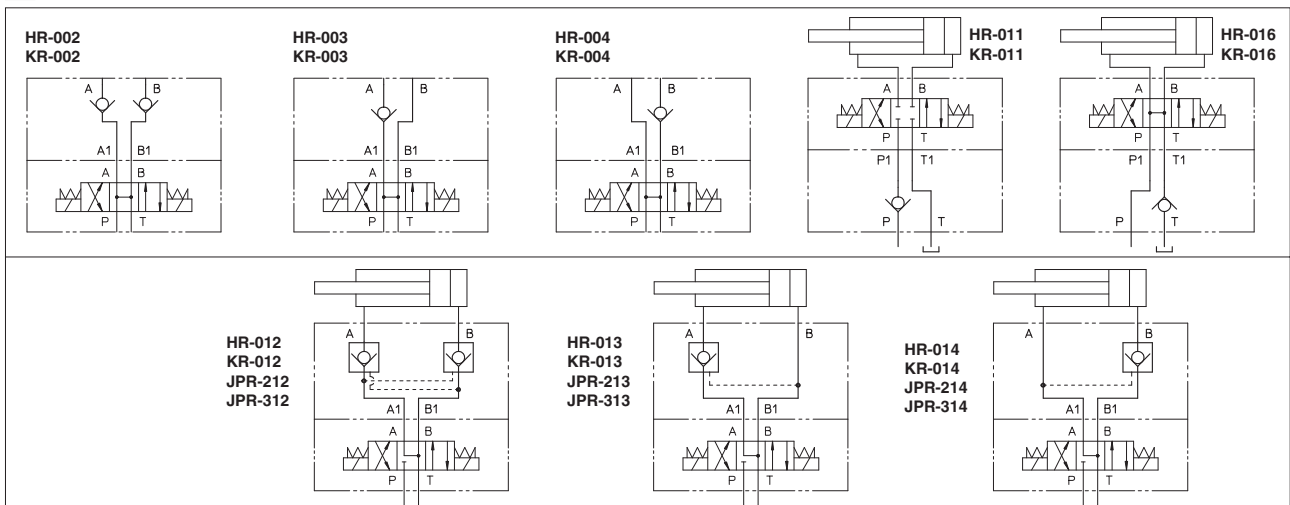
JPR-3 = size 25: flow up to 300 l/min, pressure up to 350 bar.

Valves are designed to operate in hydraulic systems with hydraulic mineral oil or synthetic fluid having similar lubricating characteristics.

1 MODEL CODE

HR-0	12	/	4	/	*	**	/	*
Modular check valve, size: HR-0 = 06 JPR-2 = 16 KR-0 = 10 JPR-3 = 25						Series number		Seals material, see section 3: - = NBR PE = FKM BT = HNBR
Configuration, see section 2 direct operated (only for HR and KR): 02 = double, acting on port A and B 03 = single, acting on port A 04 = single, acting on port B 11 = single, acting on port P 16 = single, acting on port T		pilot operated: 12 = double, acting on port A and B 13 = single, acting on port A 14 = single, acting on port B		Spring cracking pressure: for HR and KR for JPR - = 0,5 bar (std.) 4 = 4 bar - = 0,5 bar (std.) 2 = 2 bar 8 = 8 bar		Options (only for KR-012, -013, -014): D = with decompression (only with cracking pressure standard = 1 bar)		

2 VALVE CONFIGURATION



The pilot pressure applied through ports A or B opens the valve acting on ports B and A, respectively.
The minimum pilot pressure is a function of the area ratio, see the following table.

VALVE TYPE	AREA RATIO
HR	3,3:1
KR	3,3:1 (standard); 11:1 (option /D decompression system)
JPR-2	13,6:1 (standard version equipped with decompression system)
JPR-3	17:1 (standard version equipped with decompression system)

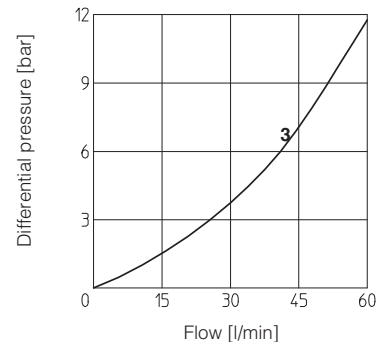
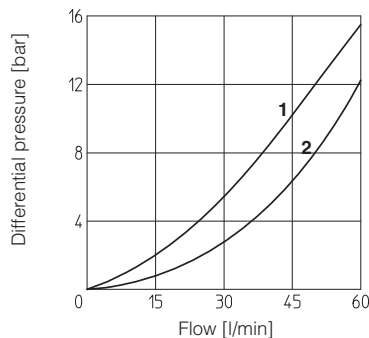
3 MAIN CHARACTERISTICS, SEALS and HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +80°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

4 DIAGRAMS OF HR-0
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

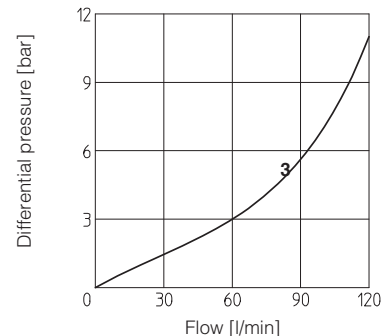
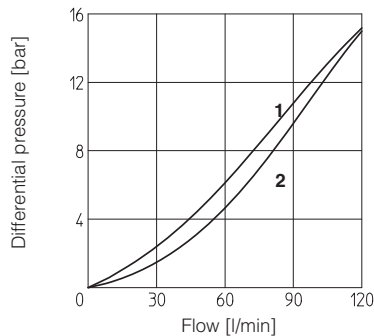
- 1** = A→A₁; B→B₁ of
HR-012, HR-013, HR-014
- 2** = A₁→A; B₁→B of
HR-012, HR-013, HR-014
- 3** = HR-011, HR-016



5 DIAGRAMS OF KR-0
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

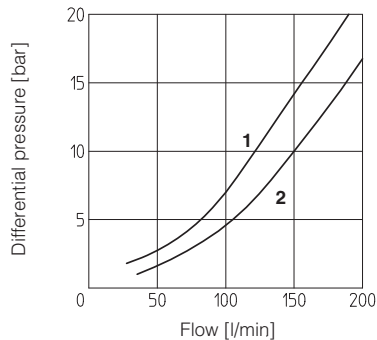
- 1** = A→A₁; B→B₁ of
KR-012, KR-013, KR-014
- 2** = A₁→A; B₁→B of
KR-012, KR-013, KR-014
- 3** = KR-011, KR-016



6 DIAGRAMS OF JPR-2
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

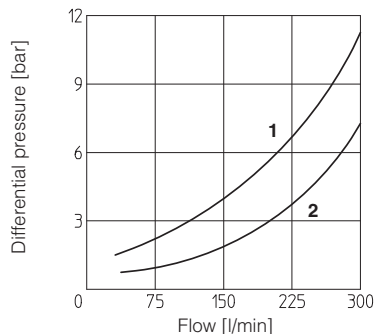
- 1** = A→A₁; B→B₁ of
JPR-212, JPR-213, JPR-214
- 2** = A₁→A; B₁→B of
JPR-212, JPR-213, JPR-214



7 DIAGRAMS OF JPR-3
based on mineral oil ISO VG 46 at 50°C

Flow through check valve:

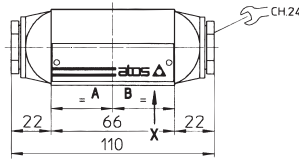
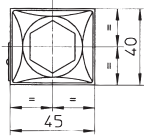
- 1** = A→A₁; B→B₁ of
JPR-312, JPR-313, JPR-314
- 2** = A₁→A; B₁→B of
JPR-312, JPR-313, JPR-314



8 INSTALLATION DIMENSIONS OF HR-0 VALVES [mm]

HR-002
HR-003
HR-004
HR-012
HR-013
HR-014

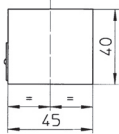
LATERAL VIEW



Mass: 1 Kg

HR-011
HR-016

LATERAL VIEW



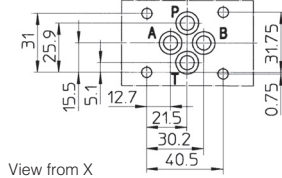
Mass: 0,7 Kg

ISO 4401: 2005

Mounting surface: 4401-03-02-0-05

Diameter of ports A, B, P, T: $\varnothing = 7,5$ mm (max)

Seals: 4 OR 108



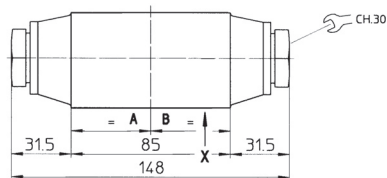
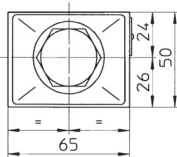
View from X

Fastening bolts: n° 4 socket head screws M5. The length depends on number and type of modular elements associated.

9 INSTALLATION DIMENSIONS OF KR-0 VALVES [mm]

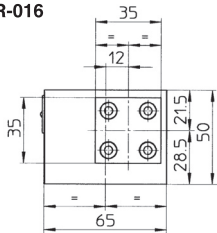
KR-012
KR-002
KR-003
KR-004
KR-013
KR-014

LATERAL VIEW



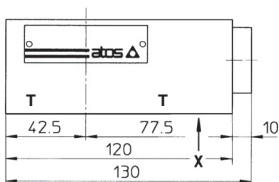
Massa: 2,3 Kg

KR-016



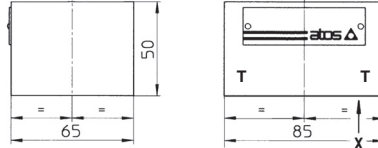
Mass: 2,5 Kg

LATERAL VIEW



KR-011

LATERAL VIEW



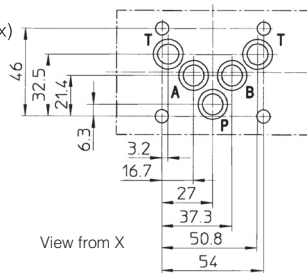
Mass: 1,7 Kg

ISO 4401: 2005

Mounting surface: 4401-05-04-0-05

Diameter of ports, A, B, P, T: $\varnothing = 11,2$ mm (max)

Seals: 5 OR 2050

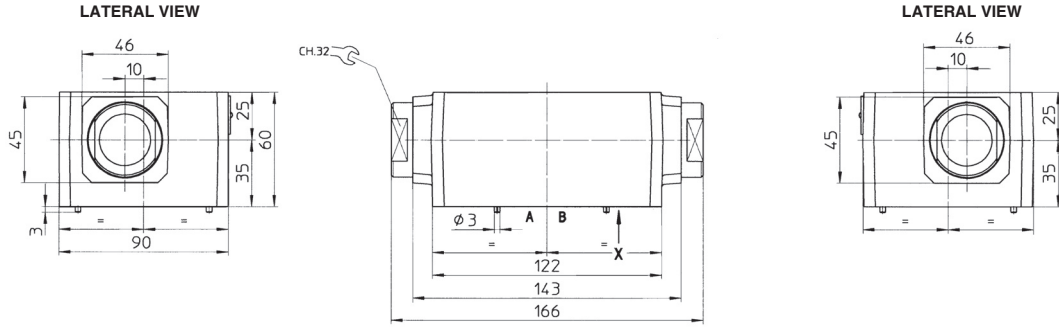


View from X

Fastening bolts: n° 4 socket head screws M6. The length depends on number and type of modular elements associated.

10 INSTALLATION DIMENSIONS OF JPR-2 VALVES [mm]

JPR-212
JPR-213
JPR-214



Mass: 4,4 Kg

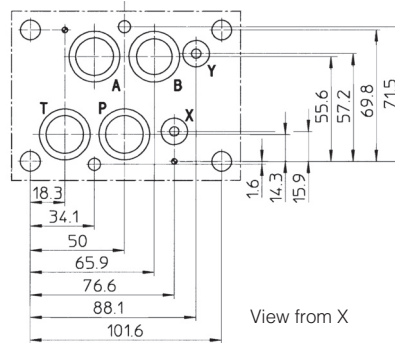
ISO 4401: 2005

Mounting surface: 4401-07-07-0-05

Diameter of ports A, B, P, T: $\phi = 20$ mm

Diameter of ports X, Y: $\phi = 7$ mm

Seals: 4 OR 130; 2 OR 109

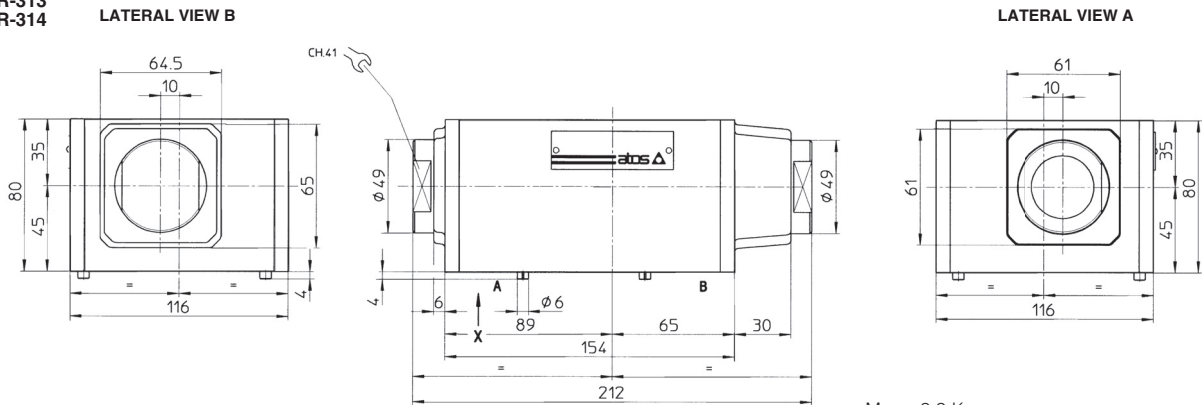


View from X

Fastening bolts: n° 4 socket head screws M10 and n° 2 M6. The length depends on number and type of modular elements associated.

11 INSTALLATION DIMENSIONS OF JPR-3 VALVES [mm]

JPR-312
JPR-313
JPR-314



Mass: 9,9 Kg

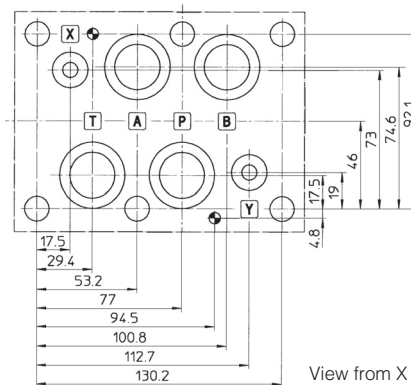
ISO 4401: 2005

Mounting surface: 4401-08-08-0-05

Diameter of ports A, B, P, T: $\phi = 24$ mm

Diameter of ports X, Y: $\phi = 7$ mm

Seals: 4 OR 4112; 2 OR 3056

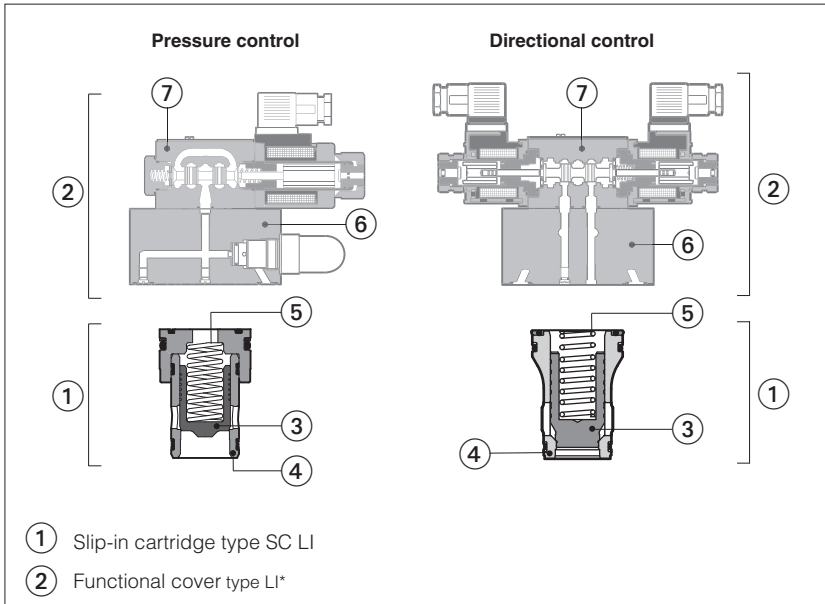


View from X

Fastening bolts: n° 6 socket head screws M12. The length depends on number and type of modular elements associated.

ISO cartridges type SC LI

2 way slip-in directional, pressure, flow, check controls



2way slip-in cartridges are designed in conformity with ISO 7368 standard cavities for installation in compact manifolds. They are available in several versions to perform directional, pressure, flow and check controls in combination with relevant functional covers.

They permit to control very high flow rates at low pressure drops, reducing the manifold dimensions respect to subplate valves.

The slip-in cartridge ① is made by a poppet ③ sliding into a sleeve ④ and kept in closed position by a spring ⑤ available with different cracking pressure valves.

The functional covers ② are made by a closing element with ISO mounting surface ⑥ provided with internal piloting lines for the cartridge operation. They can be equipped with pilot valves ⑦ and devices performing the specific control (pressure relief, flow metering, directional, check)

Sizes: **16 to 100** ISO 7368

Max flow up to **9000 l/min** at Δp 5 bar

Max pressure **420 bar**

1 MODEL CODE

SC LI	-	16	43	1	*	/	*
Cartridge according to ISO 7368							Seals material: - = NBR PE = FKM BT = HNBR
Size - see section 5 16 25 32 40 50 63 80 100							Series number
Type of poppet (1) - see section 5				Spring cracking pressure (1)			

(1) See technical table:

H030 for directional controls

H020 for flow controls

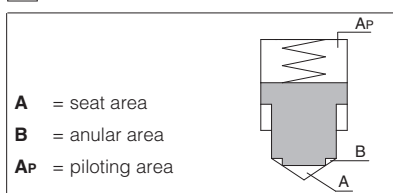
H010 for pressure controls

H040 for check controls

2 MAIN CHARACTERISTICS

Assembly position / location	Any position
Cavity dimensions	ISO 7368, see technical table P006
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Ambient temperature	Standard execution = $-30^{\circ}\text{C} \div +70^{\circ}\text{C}$ /PE option = $-20^{\circ}\text{C} \div +70^{\circ}\text{C}$ /BT option = $-40^{\circ}\text{C} \div +70^{\circ}\text{C}$
Operating pressure	420 bar , see technical table of specific valve
Maximum flow	see section 5

3 SC LI CARTRIDGE AREAS



Pressure applied to areas A and B acts to open the poppet.

Pressure applied to area Ap plus the spring force act to close the poppet

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

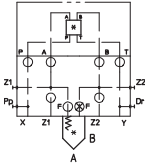
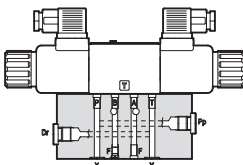


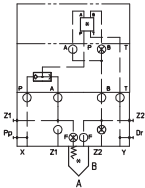



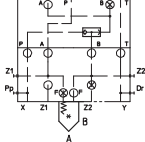

Seals, recommended fluid temperature	NBR seals (standard) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$, with HFC hydraulic fluids = $-20^{\circ}\text{C} \div +50^{\circ}\text{C}$ FKM seals (/PE option) = $-20^{\circ}\text{C} \div +80^{\circ}\text{C}$ HNBR seals (/BT option) = $-40^{\circ}\text{C} \div +60^{\circ}\text{C}$, with HFC hydraulic fluids = $-40^{\circ}\text{C} \div +50^{\circ}\text{C}$		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDD, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 TYPE OF POPPET FOR SC LI SLIP-IN CARTRIDGES

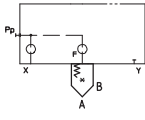
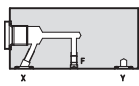
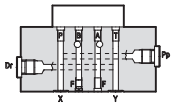
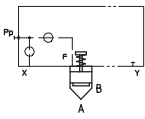
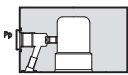
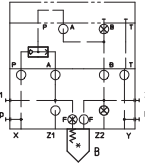
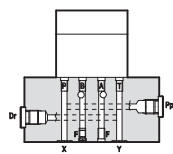
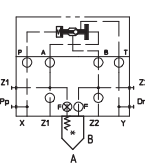
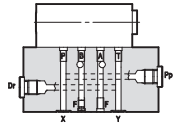
Size Type	SC LI-16	SC LI-25	SC LI-32	SC LI-40	SC LI-50	SC LI-63	SC LI-80	SC LI-100	Functional sketch (hydraulic symbol)	Typical section	Area ratio	Related functional cover
	●	●	●	●	●	●	●	●				
31	●	●	●	●	●	●	●	—			1 : 1	Poppet type LIMM, LIMHA, LIMHC, LIC, LICM
Q _{max} [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
32	●	●	●	●	●	●	●	●			1 : 1,1	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Q _{max} [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
33	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type LIDA, LIDD, LIDB, LIDBH, LIDEW
Q _{max} [l/min] Δp = 5 bar	270	550	1000	1700	2500	4000	5500	9000				
34	●	○	○	—	—	—	—	—			1 : 1	Poppet type LIMM, LIMHA, LIMHC
Q _{max} [l/min] Δp = 5 bar	200											
35	●	●	●	●	●	—	—	—			1 : 1,1	Poppet type LIMM, LIMHA, LIMHC
Q _{max} [l/min] Δp = 5 bar	200	400	670	1200	2200							
36	●	●	●	●	●	●	●	—			1 : 1	Spool type LIC, LICM
Q _{max} [l/min] Δp = 5 bar	180	380	650	1100	2000	3200	5000					
37	●	●	●	●	—	—	—	—			1 : 1	Spool type LIRA
Q _{max} [l/min] Δp = 5 bar	160	270	540	840								
42	●	●	●	●	●	●	●	—			1 : 1,1	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Q _{max} [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000					
43	●	●	●	●	●	●	●	●			1 : 1,5	Poppet type with dumping nose LIDA, LIDD, LIDB, LIDBH, LIDEW
Q _{max} [l/min] Δp = 5 bar	240	500	800	1400	2200	3300	4000	6300				
52	●	●	●	●	●	—	—	—			1 : 1,1	Poppet type LIDA
Q _{max} [l/min] Δp = 5 bar	170	300	450	900	1800							
62	●	●	●	○	●	—	—	—			1 : 1,1	Poppet type LIDO
Q _{max} [l/min] Δp = 5 bar	170	300	450	900	1800							
63	●	●	●	○	●	—	—	—			1 : 1,1	Poppet type with dumping nose LIDO
Q _{max} [l/min] Δp = 5 bar	170	300	450	900	1800							
69	—	●	●	●	●	—	—	—			1 : 1,6	
Mass [kg]	0,2	0,5	0,9	1,7	3,0	7,0	13	22				

- normally available from stock
- on request
- not available

6 FUNCTIONALS COVERS - DIRECTIONAL CONTROL, see table H030

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 100	SC LI cartridges
Direct operated directional control valve with solenoid valve for pilot selection LIDEW*	16			SC LI-**32* SC LI-**33* size 16 ... 100
	25			SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
	32			
	40			
	50			
	63			
Direct operated directional control valve with solenoid valve and shuttle valve for pilot selection LIDBH1A = open when solenoid is de-energized LIDBH1C = closed when solenoid is de-energized	16	1A  1C  		SC LI-**32* SC LI-**33* size 16 ... 100
	25			SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
	32			
	40			
	50			
	63			
Direct operated directional control valve with solenoid and shuttle valve for pilot selection LIDBH2A = when solenoid is de-energized only connections X→F LIDBH2C = when solenoid is de-energized only connections Z1→F	16	2A  2C  		SC LI-**32* SC LI-**33* size 16 ... 100
	25			SC LI-**42* size 16 ... 80 SC LI-**43* size 16 ... 100
	32			
	40			
	50			
	63			
80				
100				

7 FUNCTIONALS COVERS - CHECK FUNCTION, see table H040

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 25	Functional cover size 32 ÷ 80	SC LI cartridges
Direct operated check valve normally closed LIDA	16				SC LI-**32* SC LI-**33* size 16 ... 80
	25				SC LI-**42* SC LI-**43* size 16 ... 80 SC LI-**52* size 16 ... 50
	32				
	40				
	50				
63					
80					
Direct operated check valve normally open LIDO	16				SC LI-**62* SC LI-**63* size 16, 25, 32, 50
	25				
	32				
	40				
	50				
Direct operated check valve with shuttle valve for pilot selection LIDB	16				SC LI-**32* SC LI-**33* size 16 ... 63
	25				SC LI-**42* SC LI-**43* size 16 ... 63
	32				
	40				
	50				
63					
Direct operated check valve with hydraulically operated pilot check valve LIDR	16		01/20 		SC LI-**32* SC LI-**33* size 16 ... 63
	25				SC LI-**42* SC LI-**43* size 16 ... 63
	32				
	40				
	50				
63					

8 TYPICAL FUNCTIONS OF COVERS - PRESSURE CONTROL, see table H010

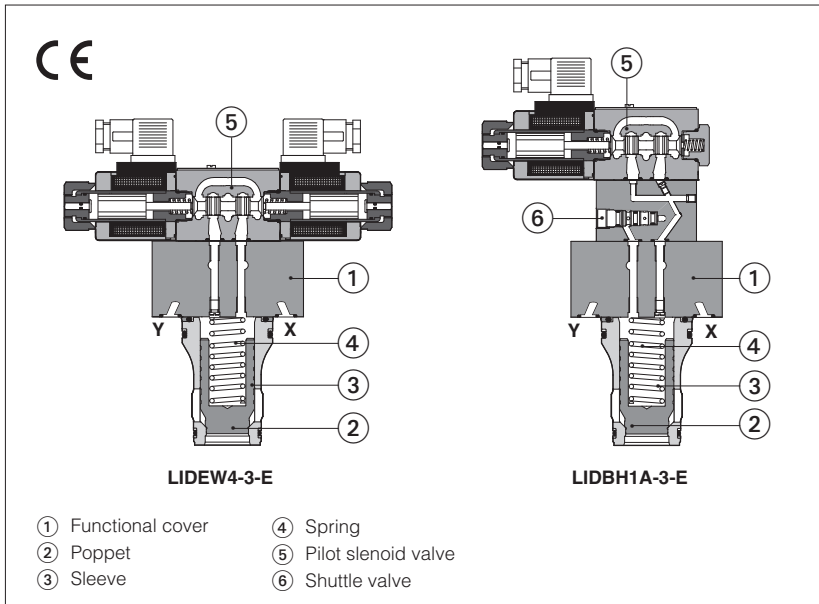
Function and type of control	Size	Hydraulic symbol	Functional cover size 6 ÷ 32	Functional cover size 40 ÷ 80	SC LI cartridges
Pressure relief control with manual setting LIMM	16				SC LI-***31* size 16... 80
	25				SC LI-***34* size 16
	32				
	40				
	50				
63				SC LI-***31* size 16...80	
25				SC LI-***34* size 16	
32					
40					
50				SC LI-***35* size 16...50	
63					
80					
Pressure reducing control with solenoid valve for venting LIMHA = unloading when solenoid is de-energized LIMHC = unloading when solenoid is energized LIMH*	16				SC LI-***31* size 16...80
	25				SC LI-***34* size 16
	32				
	40				
50	SC LI-***35* size 16...50				
63					
80					
Pressure reducing control with manual setting. Open in resting position LIRA	16				SC LI-***37* size 16...40
	25				
	32				
	40				
Pressure compensator to be coupled with flow control valves LIC	16				SC LI-***31* size 16...80
	25				SC LI-***36* size 16...80
	32				
	40				
	50				
63					
80					
Pressure compensator with mechanical max pressure regulation to be coupled with flow control valves. LICM	16				SC LI-***31* size 16...80
	25				SC LI-***36* size 16...80
	32				
	40				
	50				
	63				
80					

9 FUNCTIONAL COVERS - FLOW CONTROL, see table H020

Function and type of control	Size	Hydraulic symbol	Functional cover size 16 ÷ 63	SC LI cartridges
Flow control with stroke limiter LIDD	16			SC LI-***32* SC LI-***33* size 16...63
	25			SC LI-***42* SC LI-***43* size 16...63
	32			
	40			
	50			
63				

ISO cartridge valves type LIDEW* and LIDBH*

directional control, high flow, Pmax 420 bar



Directional control valves in ISO cartridge design, used to intercept or to permit the flow passage according to the selected pilot control. They are made by a functional cover ① and a 2-way SC LI slip-in cartridge.

LIDEW: functional cover with or without pilot solenoid valve for cartridge operation, available in different configurations depending to the function to be performed.

LIDBH as LIDEW plus shuttle valve for pilot pressure selection.

The SC LI slip-in cartridge is available with different poppet shape to optimize the control, see section ④.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16 to 100** ISO 7368

Max flow up to **9000** l/min at Δp = 5 bar

Max pressure up to **420 bar**

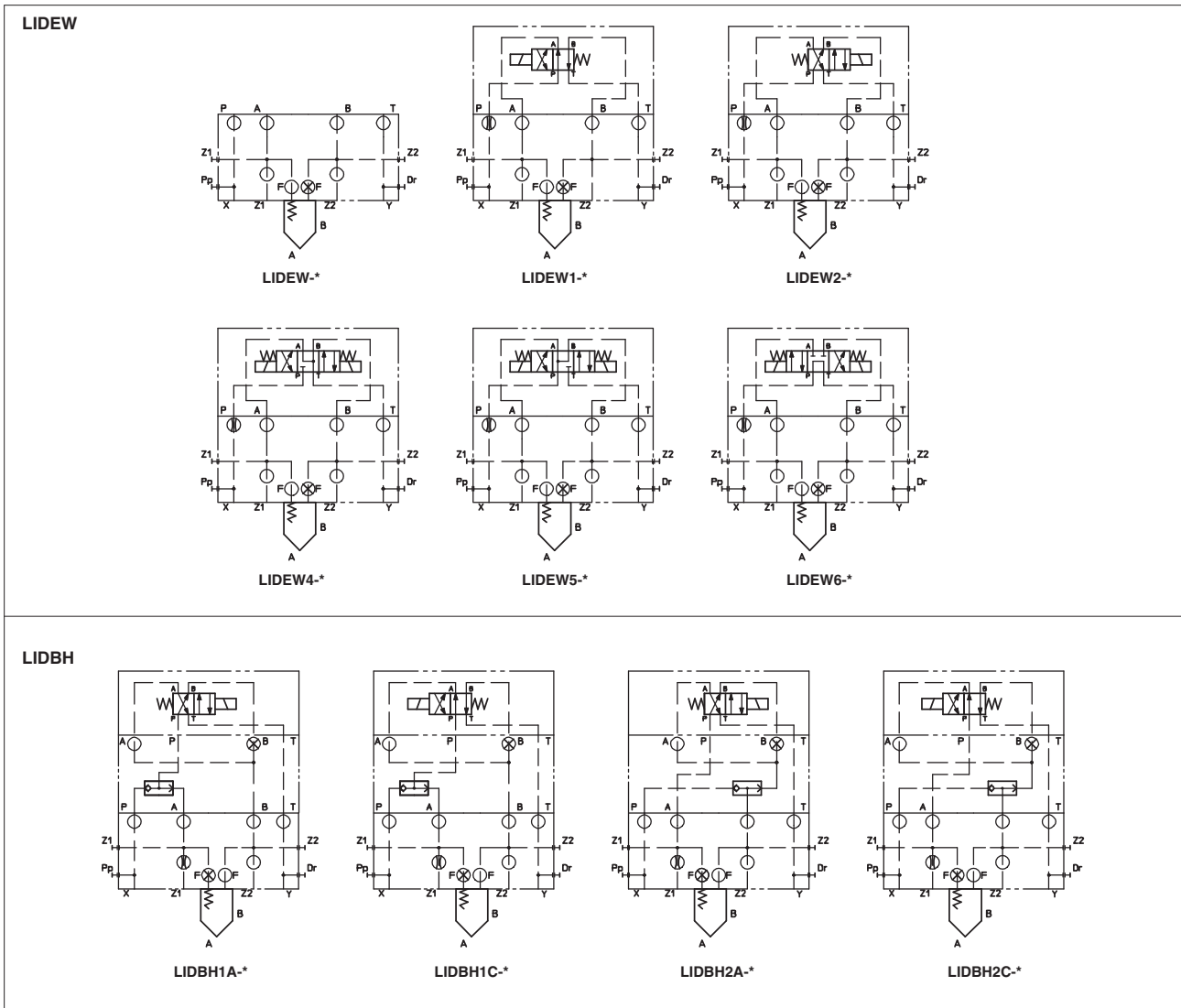
1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section ⑤

LI	D	EW	1 - 3	/	*	-	E	X	24DC	**	/	*	*
Cover according to ISO 7368													Optional different setting of calibrated plugs in the pilot channels, see sections ③, ④
<p>D = directional function</p> <p>EW = with or without pilot solenoid valve</p> <p>BH = as EW plus shuttle valve for pilot selection</p> <p>Cover configuration see section ②</p> <p>LIDEW: - (without pilot valve) LIDEW: 1, 2, 4, 5, 6 LIDBH: 1A, 1C, 2A, 2C</p> <p>Size: 1 = 16 2 = 25 3 = 32 4 = 40 5 = 50 6 = 63 8 = 80 10 = 100</p> <p>Options, see section ③</p>													
<p>X = without connector See section ⑨ for available connectors, to be ordered separately</p> <p>00 = solenoid valve without coils (for I) 00-AC = AC solenoid valve without coils (for E and EP) 00-DC = DC solenoid valve without coils (for E and EP)</p> <p>Pilot solenoid valve (1) for size 1 to 6: I = DHI, Pmax 350 bar E = DHE, Pmax 350 bar EP = DHEP, Pmax 420 bar for size 8 and 10: E = DKE, Pmax 350 bar EP = DKEP, Pmax 420 bar</p>													
<p>Seals material: - = NBR PE = FKM BT = HNBR</p> <p>Series number</p> <p>Voltage code see section ⑧</p>													

(1) for solenoid valve's characteristics, see following technical tables:

- DHI** tech. table E010
- DHE** tech. table E015
- DHEP** tech. table TE030
- DKE** tech. table E025
- DKEP** tech. table TE030

2 HYDRAULIC SYMBOLS (cover configuration)



3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40...100):

/E = with external attachments Pp and underneath port X supplied plugged;

For all the models:

/B = cartridge piloted via port "B" of solenoid pilot valve;

/F = prearranged for coupling to an intermediate element with poppet position detector for safety function. See tab. EY120.

/WP = prolonged manual override protected by rubber cap for solenoid pilot valve. See table K150.

******* = Calibrated plugs different from standard ones reported in section 7. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2	-	1	/*	EX	24DC	**	P	06
							Channel where the orifice has to be provided: P = channel X, port P Z1 = channel Z1 F = channel F Z2 = channel Z2	Size of the throttling hole in tenths of millimeters: 05 = 0,5 mm 10 = 1 mm 17 = 1,7 mm 06 = 0,6 mm 12 = 1,2 mm 20 = 2 mm 08 = 0,8 mm 15 = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

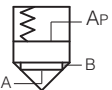


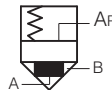
Cover	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6	LIDEW*-8 LIDBH*-8	LIDEW*-10 LIDBH*-10
Port								
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A	M8 20A	M8 25A





M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16		43	1	40	/	*
Cartridge according to ISO 7368								Seals material: - = NBR PE = FKM BT = HNBR
Size, the same of relevant cover: 16 25 32 40 50 63 80 100								Series number
Type of poppet								
32, 33 (size 16 to 100) = without damping nose								
42 (size 16 to 80) = as 32 but with damping nose								
43 (size 16 to 100) = as 33 but with damping nose								
Spring cracking pressure:								
								2 = 1,5 bar for poppet 32, 42
								1 = 0,3 bar for poppet 32, 42 3 = 3 bar for all poppets
								1 = 0,6 bar for poppet 33, 43 6 = 5,5 bar for all poppets

6 TYPE OF POPPET

Type of poppet	32	33	42	43
Functional sketch (Hydraulic symbol)				

Operating pressure		420 bar max			
	Size 16	270	270	240	240
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap		1:1,1	1:1,5	1:1,1	1:1,5
Cracking pressure A→B	Spring 1	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring 1	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option)= -20°C ÷ +80°C HNBR seals (/BT option)= -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	From A→B or B→A		
Functional cover operating pressure	Pilot valve I	Ports A, B, X, Z1, Z2: 350 bar	Port Y: 120 bar
	Pilot valve E	Ports A, B, X, Z1, Z2: 350 bar	Port Y: 210 bar for DC version; 160 bar for AC version
	Pilot valve EP	Ports A, B, X, Z1, Z2: 420 bar	Port Y: 210 bar for DC version; 160 bar for AC version

7.1 Coils characteristics

Insulation class	Pilot valve E, EP: H (180°C) for DC coils F (155°C) for AC coils Pilot valve I: H (180°C) for DC or AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 8
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

8 ELECTRIC FEATURES

Solenoid valve type	External supply nominal voltage ± 10% (1)	Voltage code	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W (DHI) 30 W (DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
	AC	110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	666 or 667	60 VA (DHI) 58 VA (DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC
DKE DKEP	12 DC 14 DC 24 DC 28 DC 110 DC 220 DC	12 DC 14 DC 24 DC 28 DC 110 DC 220 DC	666 or 667	36 W	CAE-12DC CAE-14DC CAE-24DC CAE-28DC CAE-110DC CAE-220DC	-	
	110/50/60 AC (2) 230/50/60 AC (2) 115/60 AC 230/60 AC	110/50/60 AC 230/50/60 AC 115/60 AC 230/60 AC			100 VA (7) 130 VA (7)		
	110/50/60 AC 230/50/60 AC	110 DC 220DC	669	36 W	CAE-110DC CAE-220DC		

(1) For other supply voltages available on request see technical tables E010, E015, E025, TE030.

(2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15%. The power consumption is 55 VA (DHI), 58 VA (DHE, DHEP) and 90 VA (DKE, DKEP)

(3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

(4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.

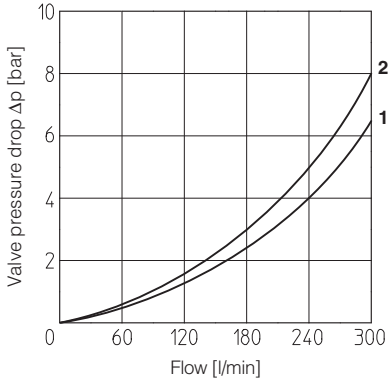
(5) Only for DHE, DHEP

(6) Only for DHI

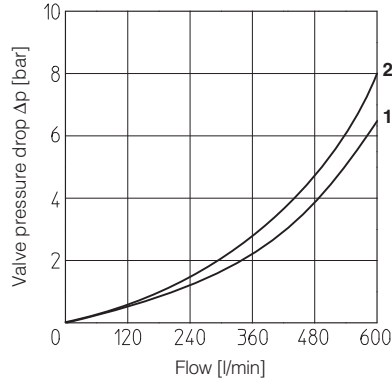
(7) When solenoid is energized, the inrush current is approx 3 times the holding current.

9 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

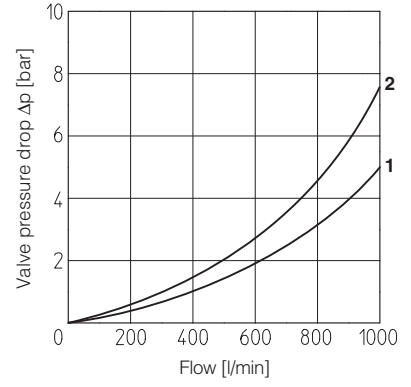
size 16



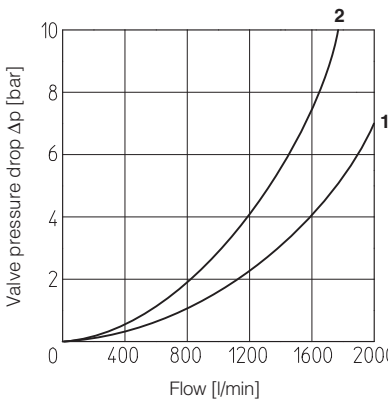
size 25



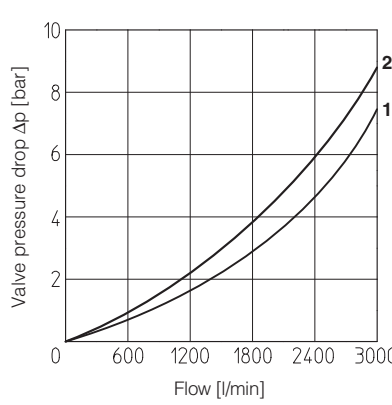
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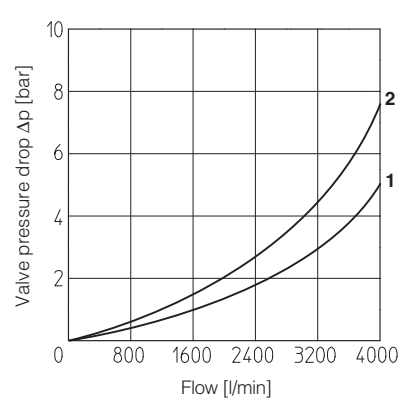
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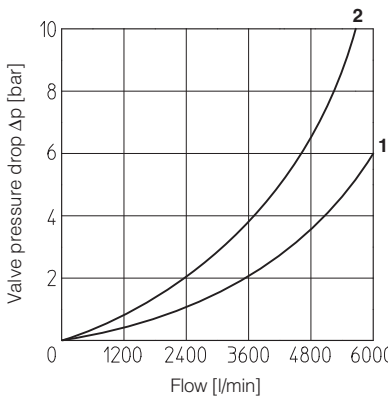
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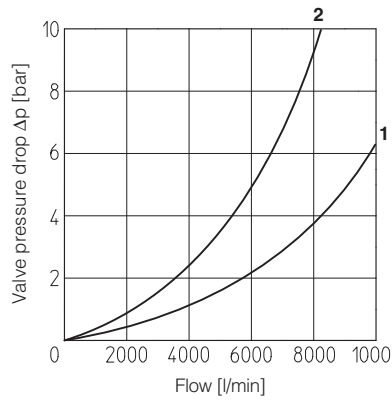
size 63



size 80



size 100

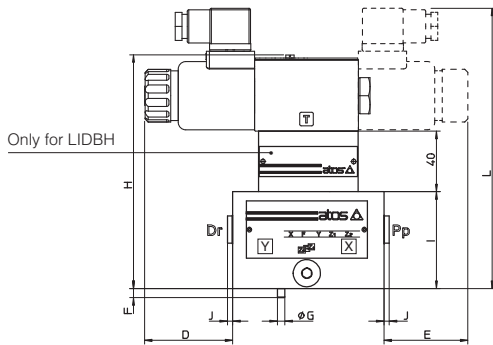


1 = poppet type 32 and 33
2 = poppet type 42 and 43

10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006

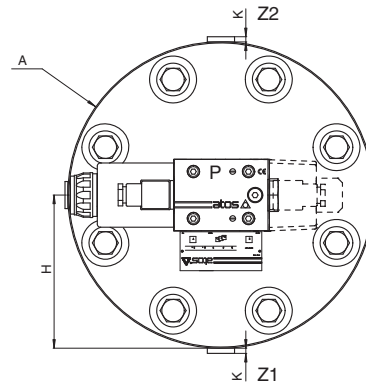
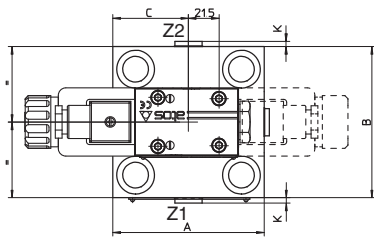
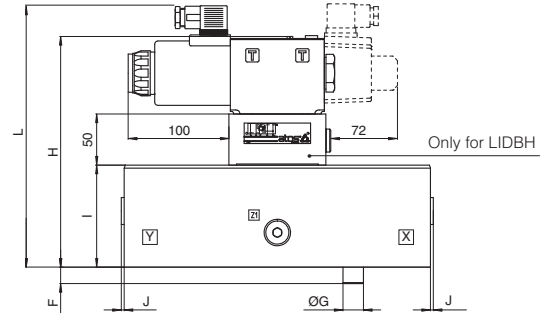
Size 16 ÷ 63

Drawing of size 50
dotted line: example of double solenoid version



Size 80 and 100

dotted line: example of AC solenoid version



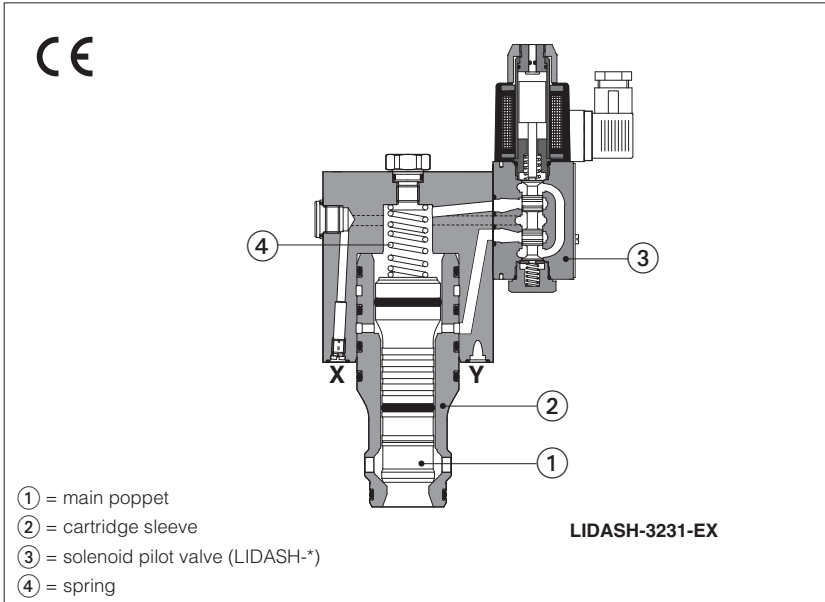
Notes referred to the below table:

- (1) LIDEW1*, LIDBH*A: solenoid at side of port Y of cover;
LIDEW2*, LIDBH*C: solenoid at side of port X of cover;

Size (1)	A	B	C	D max	E max	F	G	H max LIDEW	H max LIDBH	I	L max	J	K	Ports Pp-Dr	Ports Z1-Z2	Seals	Fastening bolts	Tightening torque [Nm]	Mass [Kg]
16	70	65	29	83,5	70,5	4	3	90,5	130,5	40	125	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,6 ÷ 3
25	85	85	42,5	69,5	69,5	6	5	90,5	130,5	40	125	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	3 ÷ 3,4
32	100	100	50	62,5	42,5	6	5	100,5	140,5	50	135	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,5 ÷ 4
40	125	125	62,5	49,5	49,5	6	5	110,5	150,5	60	145	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	6,4 ÷ 6,9
50	140	140	70	42	42	4	6	120,5	160,5	70	155	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	9,5 ÷ 10
63	180	180	90	22	22	4	6	130,5	170,5	80	165	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,3 ÷ 17,7
80	Ø250	-	125	-	-	6	8	152,5	202,5	80	187	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27,1 ÷ 27,7
100	Ø300	-	150	-	-	8	10	182,5	222,5	100	217	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	53 ÷ 54

Overall dimensions refer to the pilot valves with connectors type 666

On-off active cartridges type **LIDAS**, 2-way directional control



LIDAS are 2-way ISO cartridge valves with active pilot control, normally used to shut-off the hydraulic line. The particular poppet sealing grants leak-free characteristics.

The poppet ① is hydraulically operated in both directions, ensuring in this way higher reliability and faster response time respect to the conventional spring operated cartridge valves.

The spring ④ ensures the valve closing in absence of pressure in the system.

They are available in different executions:

LIDAS: without pilot solenoid valve

LIDASH: with on-off pilot solenoid valve

Sizes: **16 to 50** ISO 7368

Max flow up to **2100 l/min** with $\Delta p = 5$ bar

Max pressure: up to **420 bar**

1 MODEL CODE

LIDAS	H	-	40	43	3	-	E	X	24DC	**	*
On-off active cartridges, according to ISO 7368										Series number	Seals material: - = NBR PE = FKM BT = HNBR
Pilot solenoid valve - = without pilot solenoid valve H = with pilot solenoid valve											Only for LIDASH Voltage code, see section 6
Size: 16 25 32 40 50											Only for LIDASH X = without connector See section 4 for available connectors, to be ordered separately -00 = solenoid valve without coils (for I) -00-AC = AC solenoid valve without coils (for E and EP) -00-DC = DC solenoid valve without coils (for E and EP)
Poppet type: see section 2 31, 33 43 (with dumping nose)											Only for LIDASH - Pilot solenoid valve: I = DHI, Pmax 350 bar E = DHE, Pmax 350 bar EP = DHEP, Pmax 420 bar
3 = spring cracking pressure 3 bar											

Note: for certified safety version conforming to 2006/42/EC, with inductive position switch (option /FV) see table EY120

2 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

<p>Hydraulic symbols</p> <p>LIDAS</p> <p>LIDASH</p>	<p>Cartridge areas</p> <p>AA = main flow (side A) AB = main flow (side B) AAP = piloting area (close) ABP = piloting area (open)</p> <p>Thanks to the areas ratio $AAP/(AA+AB)$, the valve closing is always ensured with a piloting pressure (X port) equal to the line pressure (A or B line).</p>
--	--

3 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUIDS

Assembly position / location	Any position										
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)										
MTTFd valves according to EN ISO 13849	LIDAS = 150 years LIDASH = 75 years										
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006										
Flow direction	B → A (preferred) or A → B										
Piloting	LIDAS	Pressure to X = close Pressure to Y = open									
	LIDASH	De-energized = close Energized = open									
Operating pressure	LIDAS	Ports A, B, X, Z1, Z2, Y: 420 bar									
	LIDAS Pilot valve I	Ports A, B, X, Z1, Z2: 350 bar					Port Y: 120 bar				
	LIDASH Pilot valve E	Ports A, B, X, Z1, Z2: 350 bar Port Y: 210 bar for DC version; 160 bar for AC version									
	LIDASH Pilot valve EP	Ports A, B, X, Z1, Z2: 420 bar					Port Y: 210 bar for DC version; 160 bar for AC version				
Size	16		25		32		40		50		
Maximum flow at Δp = 5 bar [l/min]	Poppet 31	240		450		700		1400		2100	
	Poppet 33	220		400		600		1300		2000	
	Poppet 43	200		360		550		1100		1800	
Poppet characteristics	Poppet type	31	33, 43	31	33, 43	31	33, 43	31	33, 43	31	33, 43
		AA [cm ²]	2,27	1,43	4,91	3,46	8,04	5,30	12,56	8,04	19,63
AB (% of AA)		0	58,6	0	41,7	0	51,5	0	56,3	0	41,7
ABP (% of AA)		67,5	107,0	63,8	90,5	56,3	85,2	56,3	87,9	69	97,8
AAP (% of AA)		167,5	265,6	163,8	232,2	156,3	236,7	156,3	244,1	169	239,2
AA / (AA + AB) poppet ratio		1 for poppet 31					0,6 for poppet 33, 43				
AAP / (AA + AB) piloting ratio		1,6 for poppet 31					1,6 for poppet 33, 43				

3.1 Coils characteristics (only for LIDASH)

Insulation class	Pilot valve E, EP : H (180°C) for DC coils F (155°C) for AC coils Pilot valve I : H (180°C) for DC or AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature 6
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

4 SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2,8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

5 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - the connectors must be ordered separately

Code of connector	Function
666	Connector IP-65, suitable for direct connection to electric supply source
667	As 666 connector IP-65 but with built-in signal led, suitable for direct connection to electric supply source.
669	With built-in rectifier bridge for supplying DC coils by alternating current (AC 110V and 230V - I _{max} 1A).

For other available connectors, see tab. K500

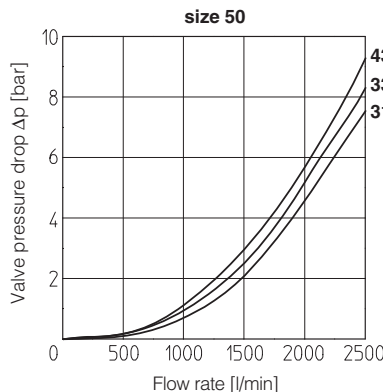
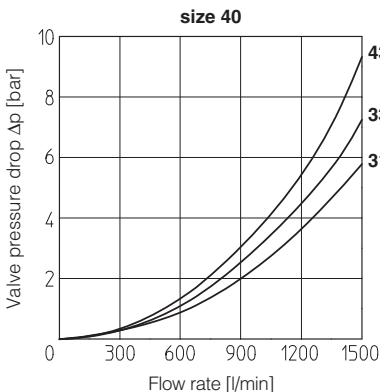
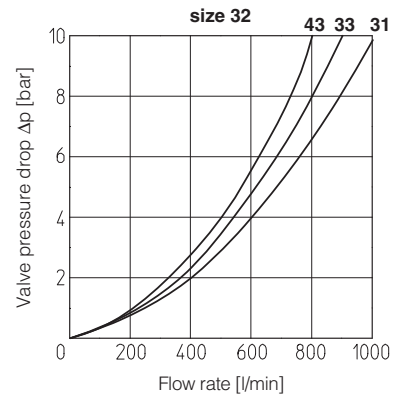
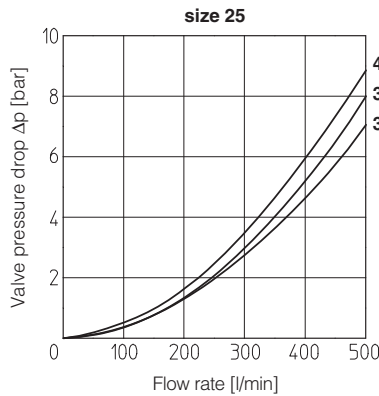
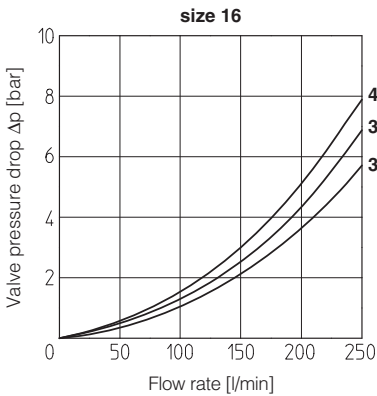
6 ELECTRIC FEATURES - coils for pilot solenoid valves

Valve	External supply nominal voltage ± 10%	Voltage code	Type of connector	Power consumption (3)		Code of spare coil				
				DHI	DHE DHEP	DHI	Colour of coil label	DHE, DHEP		
DHI DHE DHEP	6 DC	6 DC (4)	666 or 667	33 W	30 W	COU-6DC	brown	-		
	12 DC	12 DC				COU-12DC	green	COE-12DC		
	14 DC	14 DC				COU-14DC	brown	COE-14DC		
	24 DC	24 DC				COU-24DC	red	COE-24DC		
	28 DC	28 DC				COU-28DC	silver	COE-28DC		
	48 DC	48 DC				COU-48DC	silver	COE-48DC		
	110 DC	110 DC				COU-110DC	gold	COE-110DC		
	125 DC	125 DC				COU-125DC	blue	COE-125DC		
	220 DC	220 DC				COU-220DC	black	COE-220DC		
	24/50 AC	24/50/60 AC				60 VA	-	COI-24/50/60AC (1)	pink	-
	24/60 AC	(4)	COI-48/50/60AC (1)	white	-					
	48/50 AC	48/50/60 AC	-	-	COI-110/50/60AC (1)	yellow	COE-110/50/60AC			
	48/60 AC	(4)			COI-115/60AC		COE-115/60AC			
	110/50 AC	110/50/60 AC	60 VA	-	COI-120/60AC	white	-			
	115/60 AC (5)	115/60 AC			COI-230/50/60AC (1)	light blue	COE-230/50/60AC			
	120/60 AC (4)	120/60 AC	-	-	COI-230/60AC	silver	COE-230/60AC			
	230/50 AC	230/50/60 AC			COU-110RC	gold	COE-110RC			
	230/60 AC	230/60 AC	669	33 W	30 W	COU-230RC	blue	COE-230RC		
	110/50 AC	110RC				-	-	-	-	-
	120/60 AC									
230/50 AC										
230/60 AC	230RC									

- (1) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10÷15% and the power consumption is 55 VA (-I) and 58 VA (-E, -EP)
 (2) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.

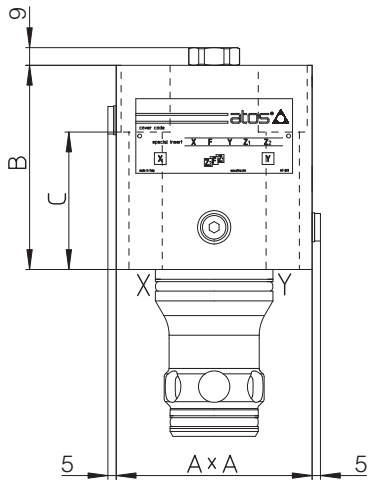
- (3) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
 (4) Only for pilot valve DHI
 (5) Only for pilot valve DHE, DHEP

7 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C

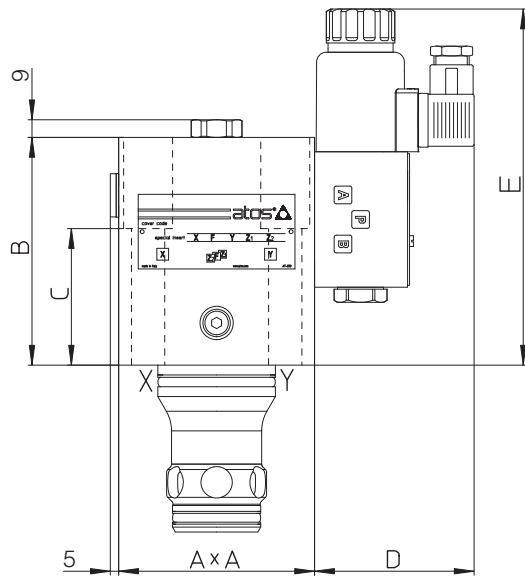


31 = poppet type 31
33 = poppet type 33
43 = poppet type 43

8 INSTALLATION DIMENSIONS [mm]



LIDAS					
Size	A	B	C	Fastening bolts class 12.9	Weight (Kg)
16	65	85	64	N°4 M8x80 35 Nm	2,8
25	85	102	75	N°4 M12x95 125 Nm	5,7
32	100	104	70	N°4 M16x90 300 Nm	7,3
40	125	111	39	N°4 M20x70 600 Nm	14,5
50	140	135	49	N°4 M20x80 600 Nm	120

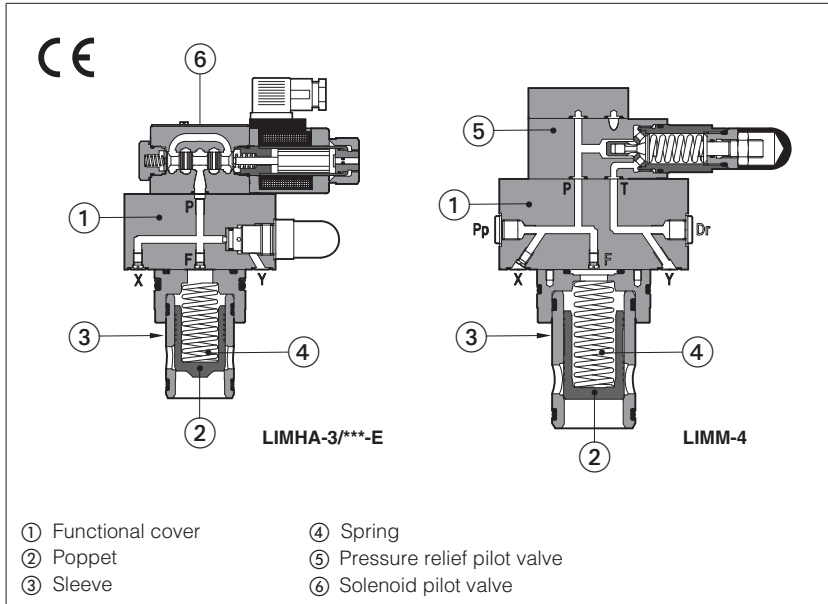


LIDASH								
Size	Pilot valve	A	B	C	D max ①	E max ②	Fastening bolts class 12.9	Weight (Kg)
16	DHI	72x65	95	64	79,5	152	N°4 M8x80 35 Nm	4,3
	DHE(P)				86	167		4,4
25	DHI	85	115	77	79,5	165	N°4 M12x95 125 Nm	7,2
	DHE(P)				86	181		7,3
32	DHI	100	116	70	79,5	176	N°4 M16x90 300 Nm	8,8
	DHE(P)				86	192		8,9
40	DHI	125	125	39	79,5	180	N°4 M20x70 600 Nm	15,5
	DHE(P)				86	196		15,6
50	DHI	140	135	49	79,5	186	N°4 M20x80 600 Nm	20,5
	DHE(P)				86	202		20,6

Note: for mounting interface and cavity dimensions, see tech. table P006

ISO cartridge valves type LIM*, LIRA, LIC*

Pressure controls: relief, reducing, compensator - Pmax 420 bar



Pressure control valves in ISO cartridge design specific for relief, reducing or compensator functions

They are made by a functional cover ① and a 2-way SC LI slip-in cartridge.

Depending to the type of control, the cover is equipped with a pilot relief valve ⑤ for the max pressure regulation and a solenoid valve ⑥ for venting.

The SC LI slip-in cartridge is available with different poppet shape to optimize the pressure control, see section ④

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position by the spring ④ available with different cracking pressure values.

Size: **16 to 80** ISO 7368
 Max flow up to **4900 l/min** at $\Delta p = 5$ bar
 Max pressure: up to **420 bar**

1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section ⑤

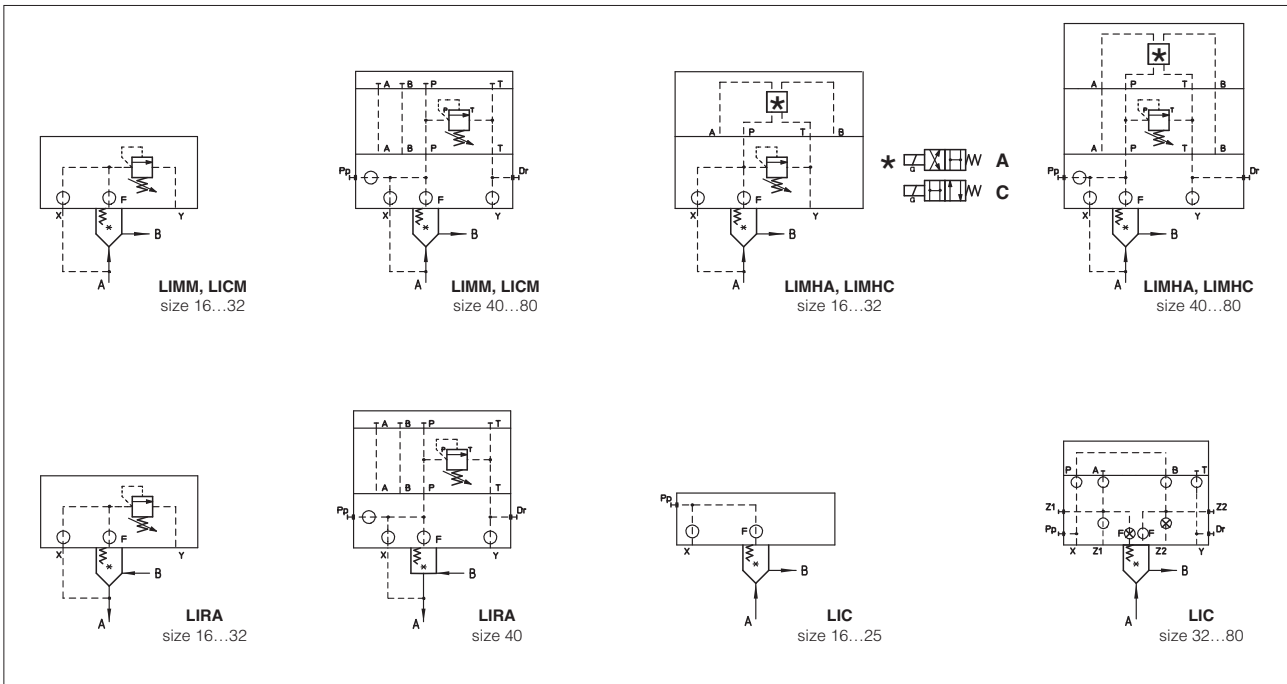
LI	MHA	-	1	/	210	/	V	-	I	X	24DC	**	/	*	F**
Cover according to ISO 7368															Optional different setting of calibrated plugs in the pilot channels, see section ③, ④
<p>Function:</p> <p>MM = pressure relief control with manual setting;</p> <p>MHA = pressure relief control with solenoid valve for venting. Unloading when solenoid is deenergized;</p> <p>MHC = pressure relief control with solenoid valve for venting. Unloading when solenoid is energized;</p> <p>RA = pressure reducing control with manual setting. Open in resting position;</p> <p>C = pressure compensator to be coupled with flow control valves;</p> <p>CM = pressure compensator with mechanical max pressure regulation to be coupled with flow control valves.</p>															
<p>Seals material: - = NBR PE = FKM BT = HNBR</p>															
Series number															
<p>Voltage code only for LIMHA and LIMHC, see section ②</p>															
<p>Only for LIMHA and LIMHC</p> <p>X = without connector</p> <p>00 = solenoid valve without coils (for -I)</p> <p>00-AC = AC solenoid valve without coils (for E and EP)</p> <p>00-DC = DC solenoid valve without coils (for E and EP)</p> <p>See tech. table K500 for available connectors, to be ordered separately</p>															
<p>Pilot solenoid valve only for LIMHA and LIMHC:</p> <p>I = DHI, Pmax 350 bar</p> <p>E = DHE, Pmax 350 bar</p> <p>EP = DHEP, Pmax 420 bar (1)</p>															
Options: see section ③															

Size: **1** = 16; **2** = 25; **3** = 32; **4** = 40;
5 = 50; **6** = 63; **8** = 80
 LIRA is available only in size 16, 25, 32, 40

Pressure range:
50 = 6 ÷ 50 bar;
100 = 8 ÷ 100 bar; **350** = 15 ÷ 350 bar;
210 = 10 ÷ 210 bar; **420** = 25 ÷ 420 bar (1)

(1) Pressure range 420 bar not available for LIMH*-I and LIMH*-E; LIMH*-EP is available only for pressure range 420 bar

2 HYDRAULIC SYMBOLS



3 OPTIONS

Only for LIMM (size 16...32):

/P = predisposed for ISO 4401 size 06 mounting surface

Handwheel for pressure control, only for LIMM, LIMH*, LIRA, LICM (see tech. table K150):

/V = regulating handwheel (available for all the sizes)

/VF = regulating knob (available only for sizes 40...80)

/VS = manual override with safety locking (available only for sizes 40...80)

/WV = prolonged manual override protected by rubber cap for pilot solenoid valve

For all the models:

******* = calibrated plugs different from standard one. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIMHA	-	1	/	210	-	IX	24DC	**	F	06
									Channel where the orifice has to be provided: X = channel X F = channel F	Size of the throttling hole in tenths of millimeters: 05 = 0,5 mm 10 = 1 mm 06 = 0,6 mm 12 = 1,2 mm 08 = 0,8 mm 15 = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Cover \ Port	LIM*-1		LIRA-1		LICM-1		LIC-1		LIM*-2		LIRA-2		LICM-2		LIC-2		LIM*-3		LIRA-3		LICM-3		LIC-3		LIM*-4		LIRA-4		LICM-4		LIC-4		LIM*-5		LICM-5		LIC-5		LIM*-6		LICM-6		LIC-6		LIM*-8		LICM-8		LIC-8	
	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F	X	F								
X	M4 10A	M4 08A	M4 08A	-	M4 10A	M4 08A	M4 08A	-	M6 10A	M6 08A	M6 12A	M6 10A	M6 10A	M6 12A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A	M6 10A					
F	M4 12F	M4 12A	M4 05F	M4 05F	M4 12F	M4 12A	M4 05F	M4 05F	M6 12F	M6 12A	M6 12F	M6 05F	M6 12F	M6 08A	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F	M6 12F						

M4 ÷ M8 = screw size; **10A ÷ 12F** = calibrated orifice diameter in tenths of mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	31	2	**	/*
Cartridge according to ISO 7368					Series number	Seals material: - = NBR PE = FKM BT = HNBR
Size , the same of relevant cover: 16 = 16; 32 = 32; 50 = 50; 80 = 80 25 = 25; 40 = 40; 63 = 63;						
Type of poppet 31 = (sizes 16...80) = for LIMM, LIMH*, LIC, LICM 34 = (size 16) = for LIMM, LIMH* 35 = (sizes 16...50) = for LIMM, LIMH* 36 = (sizes 16...80) = for LIC, LICM 37 = (sizes 16...40) = for LIRA						
				Spring cracking pressure: 1 = 0,3 bar for poppet 35; 2 = 1,2 bar for poppet 31, 34, 35; 3 = 3 bar for poppet 31, 34, 35; 4 = 4 bar for poppet 37; 6 = 6 bar for poppet 31, 34, 35, 36; 7 = 7 bar for poppet 37 (not available for size 40);		

6 TYPE OF POPPET

Type of poppet	31	34	35	36	37
Operating pressure	420 bar				
Nominal flow Size 16	180	180	180	180	140
at Δp 5bar	25 370	-	370	370	250
(l/min)	32 630	-	630	630	500
see	40 1100	-	1100	1100	750
diagrams Q/ Δp	50 1900	-	1900	1900	-
at section ⑧	63 3100	-	-	3100	-
	80 4900	-	-	4900	-
Functional sketch (Hydraulic symbol)					
Typical section					
Area ratio A: Ap	1:1	1:1	1:1,1	1:1	1:1

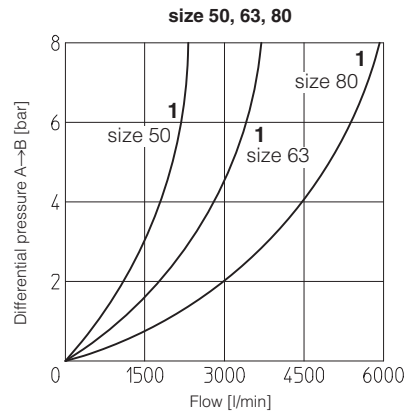
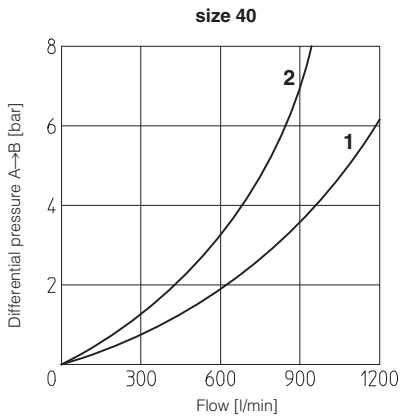
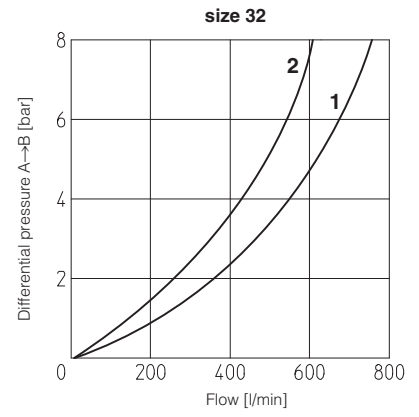
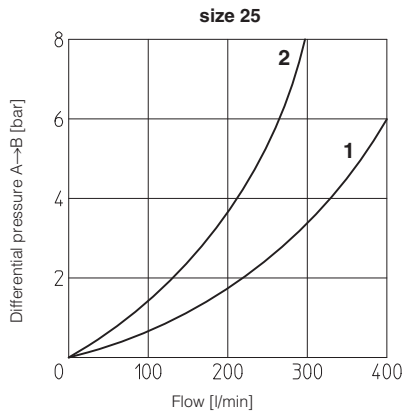
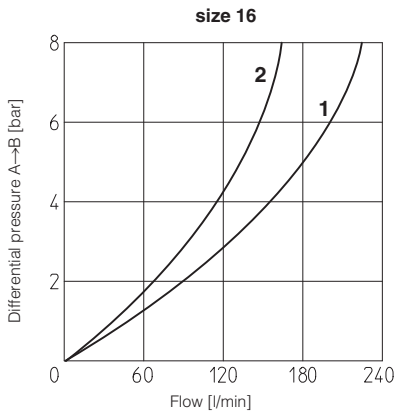
7 MAIN CHARACTERISTICS SEALS AND HYDRAULIC FLUIDS

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β25 ≥75 recommended)		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table ②		
Functional cover	all models except LIMH* Ports A, B, X: 420 bar ;		
operating pressure	LIMH*-I Ports A, B, X: 350 bar ; Port T 120 bar		
pressure	LIMH*-E Ports A, B, X: 350 bar ; Port T 210 bar for DC version; 160 bar for AC version		
	LIMH*-EP Ports A, B, X: 420 bar ; Port T 210 bar for DC version; 160 bar for AC version		

7.1 Coils characteristics

Insulation class	Pilot valve E, EP: H (180°C) for DC coils F (155°C) for AC coils Pilot valve I: H (180°C) for DC or AC coils Due to the occurring surface temperatures of the solenoid coils, the European standards EN ISO 13732-1 and EN ISO 4413 must be taken into account
Protection degree to DIN EN 60529	IP 65 (with connectors 666, 667, 669 correctly assembled)
Relative duty factor	100%
Supply voltage and frequency	See electric feature ②
Supply voltage tolerance	± 10%
Certification	cURus North American Standard

8 FLOW / Δp DIAGRAMS based on mineral oil ISO VG 46 at 50 °C



1 = poppet type 31, 34, 35, 36
2 = poppet type 37

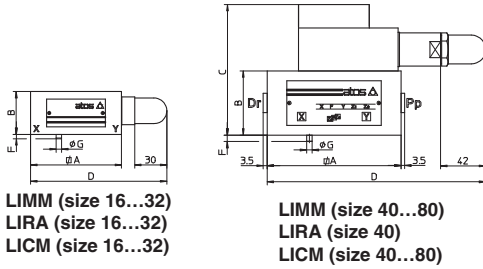
Note:
 poppet type 34 only for size 16
 poppet type 37 for size 16 to 50

9 ELECTRIC FEATURES

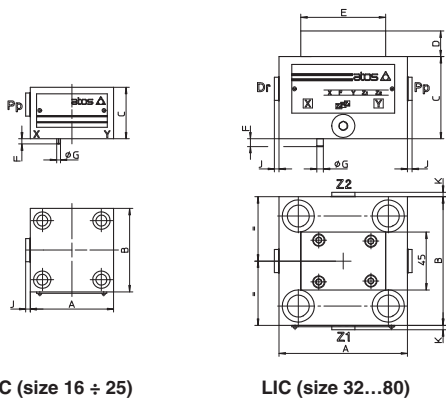
Solenoid valve type	External supply nominal voltage $\pm 10\%$ (1)		Voltage code	Type of connector	Power consumption (3)	Code of spare coil DHI	Colour of coil label DHI	Code of spare coil DHE, DHEP
DHI DHE DHEP	DC	12 DC 24 DC 110 DC 220 DC	12 DC 24 DC 110 DC 220 DC	666 or 667	33 W (DHI) 30 W (DHE, DHEP)	COU-12DC COU-24DC COU-110DC COU-220DC	green red black black	COE-12DC COE-24DC COE-110DC COE-220DC
		110/50 AC (2) 115/60 AC 120/60 AC 230/50 AC (2) 230/60 AC	110/50 AC (5) 115/60 AC (5) 120/60 AC (6) 230/50/60 AC 230/60 AC	666 or 667	60 VA (DHI) 58 VA (DHE, DHEP) (4)	COI-110/50/60AC - COI-120/60AC COI-230/50/60AC COI-230/60AC	yellow - white light blue silver	COE-110/50/60AC COE-115/60AC - COE-230/50/60AC COE-230/60AC

- (1) For other supply voltages available on request see technical tables E010, E015, TE030.
 (2) Coil can be supplied also with 60 Hz of voltage frequency: in this case the performances are reduced by 10 ÷ 15% and the power consumption is 55 VA (DHI)
 (3) Average values based on tests performed at nominal hydraulic condition and ambient/coil temperature of 20°C.
 (4) When solenoid is energized, the inrush current is approx 3 times the holding current. Inrush current values correspond to a power consumption of about 150 VA.
 (5) Only for DHE, DHEP
 (6) Only for DHI

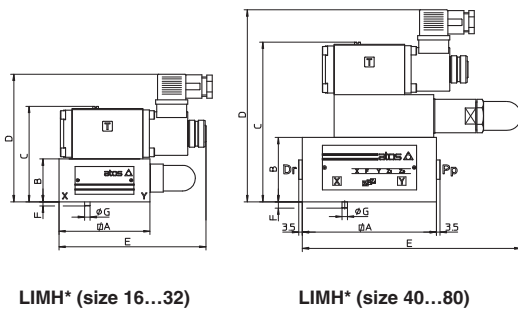
10 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions see tech. table P006



Covers	A	B	C	D	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMM-1 LIRA-1 LICM-1	65	40	-	107,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	1,7
LIMM-2 LIRA-2 LICM-2	85	40	-	127,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	2,2
LIMM-3 LIRA-3 LICM-3	100	50	-	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	3,5
LIMM-4 LIRA-4 LICM-4	125	60	122	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	8,9
LIMM-5 LIRA-5 LICM-5	140	70	132	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	12,4
LIMM-6 LIRA-6 LICM-6	180	80	142	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	21,6
LIMM-8 LIRA-8 LICM-8	Ø250	80	172	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	30,5



Covers	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIC-1	65	65	40	-	4	3	-	3,5	G 1/4	-	-	2 OR 108	Nr. 4 M8x45	35	1,4
LIC-2	85	85	40	-	6	5	-	3,5	G 1/4	-	-	2 OR 108	Nr. 4 M12x45	125	1,8
LIC-3	100	100	50	20	66	6	5	-	3,5	G 1/4	-	4 OR 2043	Nr. 4 M16x55	300	2,3
LIC-4	125	125	60	20	66	6	5	-	3,5	G 1/4	-	4 OR 3043	Nr. 4 M20x70	600	6,2
LIC-5	140	140	70	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR 3043	Nr. 4 M20x80	600	9,3
LIC-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR 3050	Nr. 4 M30x90	2100	17,1
LIC-8	Ø 250	-	80	30	73	6	8	-	3,5	G 3/8	-	4 OR 4075	Nr. 8 M24x90	1000	27



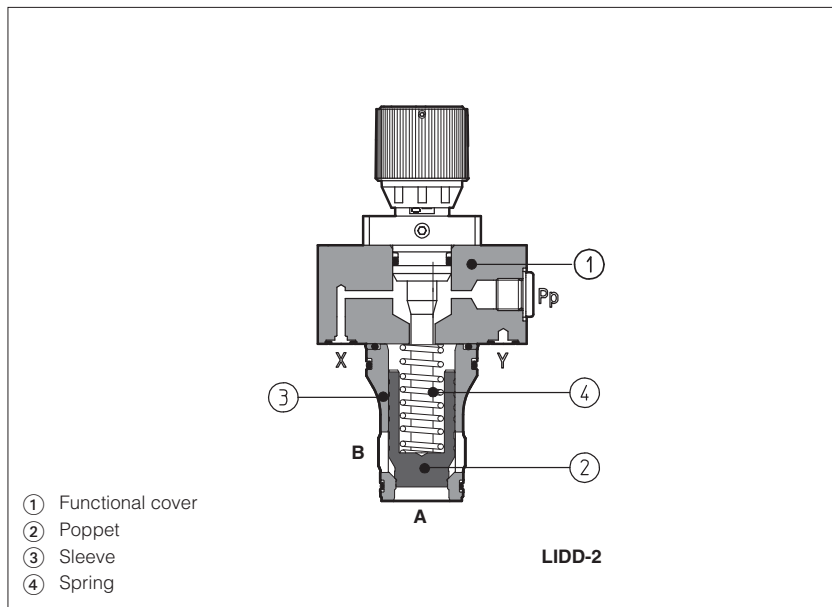
Covers	A	B	C max	D max	E	F	G	Port Pp-Dr	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIMHA-1 LIMHC-1	65 (1)	40	87,5	123,5	124,5	4	3	-	2 OR 108	Nr. 4 M8x45	35	3
LIMHA-2 LIMHC-2	85	40	87,5	123,5	134,5	6	5	-	2 OR 108	Nr. 4 M12x45	125	3,3
LIMHA-3 LIMHC-3	100	50	130,5	153,5	142,5	6	5	-	2 OR 2043	Nr. 4 M16x55	300	5
LIMHA-4 LIMHC-4	125	60	150,5	183,5	195	6	5	G 1/4	2 OR 3043	Nr. 4 M20x70	600	9,2
LIMHA-5 LIMHC-5	140	70	160,5	193,5	202,5	4	6	G 1/4	2 OR 3043	Nr. 4 M20x80	600	13,2
LIMHA-6 LIMHC-6	180	80	170,5	203,5	222,5	4	6	G 3/8	2 OR 3050	Nr. 4 M30x90	2100	22,5
LIMHA-8 LIMHC-8	Ø 250	80	200,5	233,5	257,5	6	8	G 3/8	2 OR 4075	Nr. 8 M24x90	1000	31,3

(1) Cover is not squared: 65x80
 (2) Hexagon socket head screw according to DIN 912 class 12.9

Overall dimensions refer to the pilot valves with connectors type 666

ISO cartridge valves type LIDD

Flow control



LIDD are flow control valves not compensated, in ISO cartridge design, made by a functional "cover" ① and a 2-way SC LI slip-in cartridge.

Covers are provided with regulating screw to adjust the cartridge opening.

The cartridge is made by poppet ② sliding into a sleeve ③. The position of the spool or poppet and then the controlled flow, is manually set on the regulating screw of the cover; the cracking pressure value depends on poppet spring.

Size: **16 to 63** ISO 7368

Max flow up to **4000 l/min** at Δp 5 bar

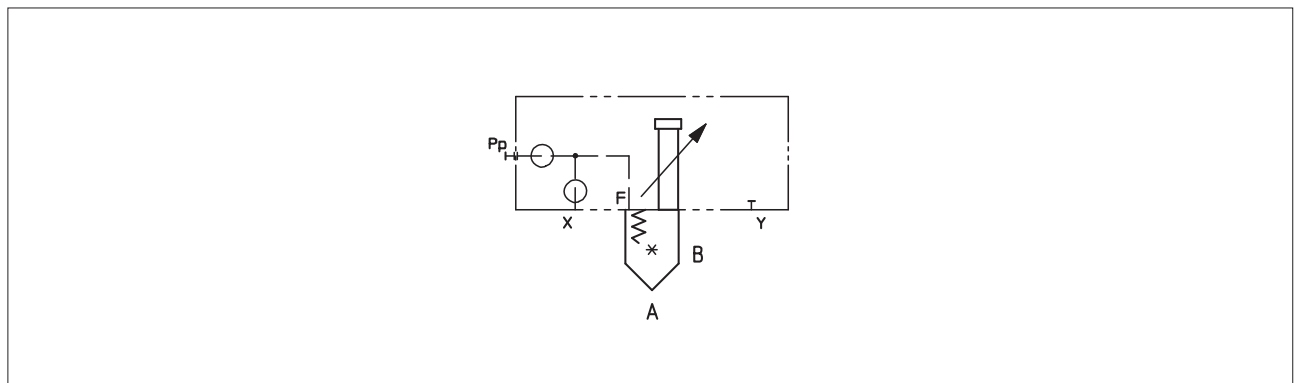
Max pressure: **LIDD 420 bar**

1 MODEL CODE FOR COVERS - for model code of slip-in cartridge/spool, see section 3, 5

LI	DD	-	1	/	*	**	/*
Cover according to ISO 7368							Seals material: - = NBR PE = FKM BT = HNBR
Flow control valve: DD = normally closed with stroke limiter						Series number LIDD = 50 all sizes (1)	
Size for LIDD: 1 = 16 4 = 40 2 = 25 5 = 50 3 = 32 6 = 63						Options: see section 6	

(1): New series 50 of LIDD cover is highly recommended in combination with new high flow cartridges series 40. The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

2 HYDRAULIC SYMBOLS



3 MODEL CODE OF SLIP-IN CARTRIDGES - for LIDD

SC LI	-	16	43	1	40	/	*
Cartridge according to ISO 7368						Seals material: - = NBR PE = FKM BT = HNBR	
Size, the same of relevant cover: 16 25 32 40 50 63						Series number (1) 40 = all sizes	
Type of poppet 32, 33 (size 16 to 100) = without damping nose 42 (size 16 to 80) = as 32 but with damping nose 43 (size 16 to 100) = as 33 but with damping nose							
				Spring cracking pressure: 1 = 0,3 bar for poppet 32, 42 1 = 0,6 bar for poppet 33, 43 2 = 1,5 bar for poppet 32, 42 3 = 3 bar for all poppets 6 = 5,5 bar for all poppets			

(1) New series 40 is mechanically interchangeable with standard flow series 31, 11 and 10 - cavity according to ISO 7368
New series 50 of LIDD cover is highly recommended in combination with new cartridges series 40
The use of old cartridges series 10, 11 and 31 may cause the impossibility to fully close the poppet

4 TYPE OF POPPET

Type of poppet	32	33	42	43	
Functional sketch (Hydraulic symbol)					
Operating pressure	420 bar max				
Nominal flow	Size 16	270	270	240	240
at Δp 5bar (l/min)	25	550	550	500	500
see diagrams Q/ Δp at section [7]	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
Typical section					
Area ratio A:Ap	1:1,1	1:1,5	1:1,1	1:1,5	
Cracking pressure A→B	Spring 1	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring 1	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

5 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Ambient temperature	Standard execution = -30°C ÷ +70°C / PE option = -20°C ÷ +70°C / BT option = -40°C ÷ +70°C		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range 2.8 ÷ 500 mm ² /s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	A to B or B to A		
Functional cover operating pressure	ports X, Y: 420 bar		

6 OPTIONS

/E = with external attachments X and underneath port X supplied plugged;

******* = Calibrated plugs different from standard ones. LIDD covers in standard executions are not equipped with restrictors in the pilot channels.
When ordering covers equipped with restrictors, it must be indicated at the end of the model code:

LIDD	-	1	/E	X	06
				Channel where the restrictor has to be provided: X = channel X	Size of the throttling hole in tenths of millimeters: 05 = 0,5 mm 10 = 1 mm 06 = 0,6 mm 12 = 1,2 mm 08 = 0,8 mm 15 = 1,5 mm

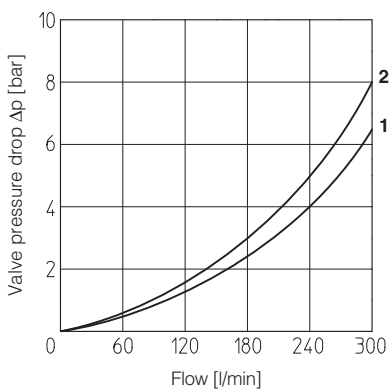
7 Q/ΔP DIAGRAMS - based on mineral oil ISO VG 46 at 50°C

SC LI slip-in cartridges, poppet type 32, 33, 42, 43

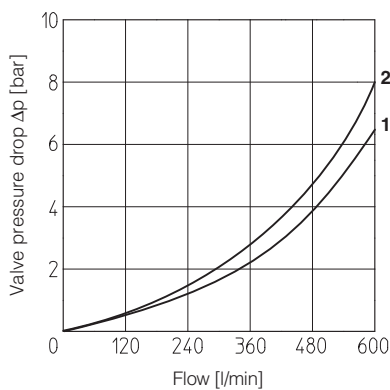
1 = poppet type 32 and 33

2 = poppet type 42 and 43

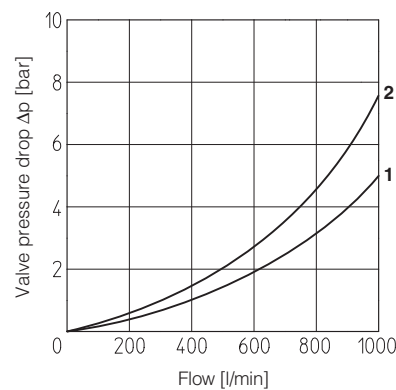
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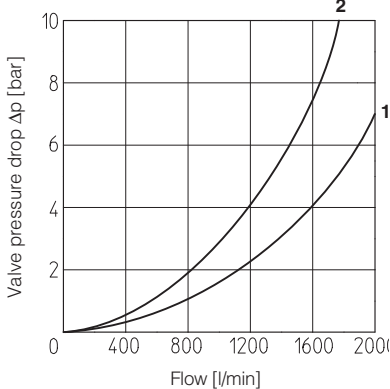
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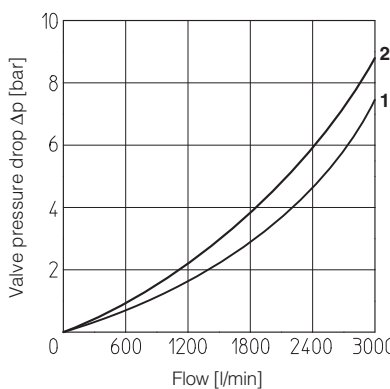
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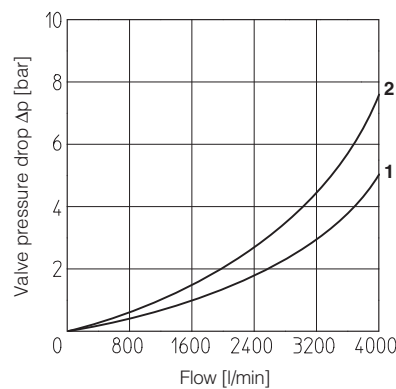
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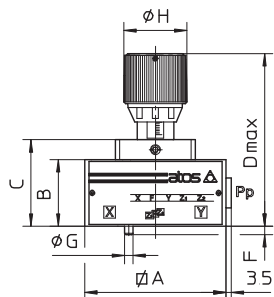
size 50



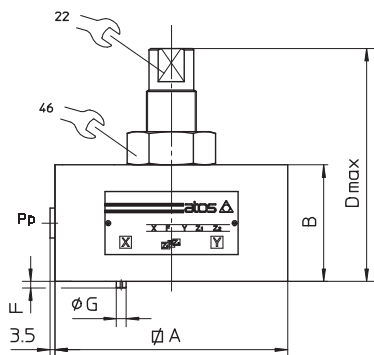
size 63



8 LIDD COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006



LIDD (dim. 16...40)



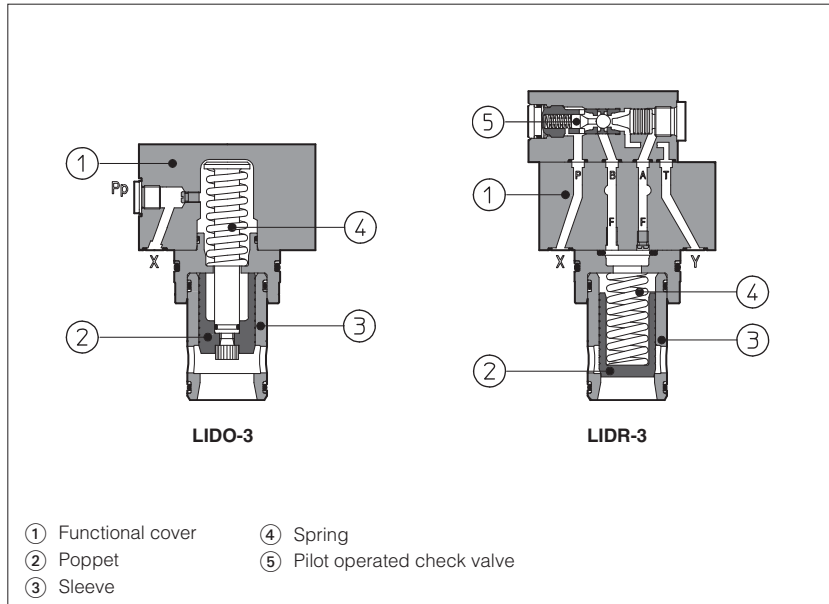
LIDD (size 50 ÷ 63)

Covers	A	B	C	D max	F	G	H	Port Pp	Seals	Fastening bolts (1)	Tightening torque [Nm]	Mass [Kg]
LIDD-1	65	40	52	104	4	3	38	G1/4	2 OR 108	Nr. 4 M8x45	35	2
LIDD-2	85	40	52	104	6	5	38	G1/4	2 OR 108	Nr. 4 M12x45	125	2,4
LIDD-3	100	50	75	156	6	5	50	G1/4	2 OR 2043	Nr. 4 M16x55	300	2,8
LIDD-4	125	60	85	166	6	5	50	G1/4	2 OR 3043	Nr. 4 M20x70	600	6,7
LIDD-5	140	70	-	140	4	6	-	G1/4	2 OR 3043	Nr. 4 M20x80	600	9,8
LIDD-6	180	80	-	151	4	6	-	G3/8	2 OR 3050	Nr. 4 M30x90	2100	17,5

(1) Hexagon socket head screw according to DIN 912 class 12.9

ISO cartridge valves type LID*

Check function, high flow, Pmax 420 bar



Directional control valves in ISO cartridge design, specific for check functions.

They are made by a functional cover ① and a 2-way SC LI slip-in cartridge.

Covers are available with different check functions:

LIDA, normally closed

LIDO, normally open

LIDB, normally closed with shuttle valve for pilot pressure selection

LIDR, normally closed with pilot operated check valve

The SC LI slip-in cartridge is available with different poppet shape to optimize the check control, see section 6.

It is made by a poppet ② sliding into a sleeve ③ and kept in normally closed position (open position for type 62 and 63) by the spring ④ available with different cracking pressure values.

Size: **16 to 100** ISO 7368

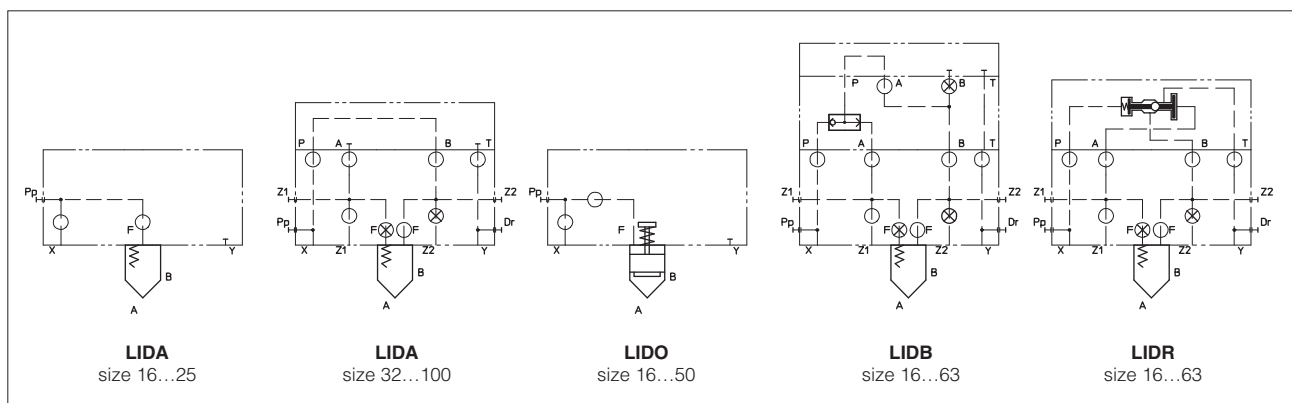
Max flow up to **9000 l/min** at $\Delta p = 5$ bar

Max pressure up to **420 bar**

1 MODEL CODE OF FUNCTIONAL COVERS - for model code of slip-in cartridge, see section 5, 7

LI	D	A	-	1	/	*	**	/	**	*
Cover according to ISO 7368										Optional different setting of calibrated plugs in the pilot channels, see section 3, 4
D = directional function										
<p>Cover configuration see section 2:</p> <p>A = normally closed; O = normally open; B = with shuttle valve for pilot selection; R = with hydraulically operated pilot check valve;</p>										
<p>Size: 1 = 16; 4 = 40; 8 = 80 (only for LIDA) 2 = 25; 5 = 50; 10 = 100 (only for LIDA) 3 = 32; 6 = 63 (not for LIDO)</p>										
LIDO is available only in sizes 16 to 50										
							Series number			
Options: see section 3										

2 HYDRAULIC SYMBOLS (cover configuration)



3 OPTIONS

For LIDA (sizes 16 and 25), for LIDO (all sizes) LIDB (sizes 40 ÷ 63), LIDR (sizes 40 ÷ 63):

/E = with external attachments Pp and underneath port X supplied plugged;

For LIDA, LIDB, LIDR:

/F = prearranged for coupling to an intermediate element with position detector for safety valves, see tab. EY120.

For all models:

******* = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) it must be indicated at the end of the model code:

LIDB	-	4	/E	**	P	06
					Channel where the restrictor has to be provided: P = channel X, port P Z1 = channel Z1 F = channel F Z2 = channel Z2	Size of the throttling hole in tenths of millimeters: 05 = 0,5 mm 10 = 1 mm 17 = 1,7 mm 06 = 0,6 mm 12 = 1,2 mm 20 = 2 mm 08 = 0,8 mm 15 = 1,5 mm

4 STANDARD ORIFICES CONFIGURATION

Cover \ Port	Cover										Cover														
	LIDA-1	LIDO-1	LIDB-1	LIDR-1	LIDA-2	LIDO-2	LIDB-2	LIDR-2	LIDA-3	LIDO-3	LIDB-3	LIDR-3	LIDA-4	LIDO-4	LIDB-4	LIDR-4	LIDA-5	LIDO-5	LIDB-5	LIDR-5	LIDA-6	LIDB-6	LIDR-6	LIDA-8	LIDA-10
X	-	v	-	-	-	M4	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	-	-	-	-	-
P	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	M6	-	-
Z2	-	-	-	M4	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	-	M6	-	-	M6	-	-
	-	-	-	100F	-	-	-	300F	-	-	-	300F	-	-	-	300F	-	-	-	300F	-	-	300F	-	-

M4 ÷ M6 = screw size **10A ÷ 300F** = calibrated orifices diameters in tenths oh mm; **A** = short calibrated hole, **F** = long calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES

SC LI	-	16	43	1	40	*
Cartridge according to ISO 7368						Seals material: - = NBR PE = FKM BT = HNBR
Size, the same of relevant cover: 16 25 32 40 50 63 80 100				Series number		
Type of poppet (not for LIDO) 32, 33 (size 16 to 100) = without damping nose 42 (size 16 to 80) = as 32 but with damping nose 43 (size 16 to 100) = as 33 but with damping nose				Spring cracking pressure: 1 = 0,3 bar for poppet 32, 42 1 = 0,6 bar for poppet 33, 43		2 = 1,5 bar for poppet 32, 42 3 = 3 bar for all poppets 6 = 5,5 bar for all poppets

6 TYPE OF POPPET

Type of poppet	32	33	42	43	
Functional sketch (Hydraulic symbol)					
Operating pressure	420 bar max				
Nominal flow	Size 16	270	270	240	240
at Δp 5bar (l/min)	25	550	550	500	500
	32	1000	1000	800	800
	40	1700	1700	1400	1400
	50	2500	2500	2200	2200
	63	4000	4000	3300	3300
	80	5500	5500	4000	4000
	100	9000	9000	-	6300
Typical section					
Area ratio A:Ap	1:1,1	1:1,5	1:1,1	1:1,5	
Cracking pressure A→B	Spring 1	0,3 bar	0,6 bar	0,3 bar	0,6 bar
	2	1,5 bar	-	1,5 bar	-
	3	3 bar	2,5 bar	3 bar	2,5 bar
	6	6 bar	6 bar	6 bar	6 bar
Cracking pressure B→A	Spring 1	3 bar	0,9 bar	3 bar	0,9 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	3,8 bar	32,5 bar	3,8 bar
	6	59,4 bar	9 bar	59,4 bar	9 bar

7 MODEL CODE OF SLIP-IN CARTRIDGES type 52, 62, 63 for LIDA and LIDO

SC LI	-	16	52	1	**	/*
Cartridge according to ISO 7368					Series number	Seals material: - = NBR PE = FKM BT = HNBR
Size , the same of relevant cover: 16 25 32 40 50						
Type of poppet: 52 = normally closed, only for LIDA; 62 = normally open without damping nose, only for LIDO; 63 = normally open with damping nose, only for LIDO						
				Spring cracking pressure: 1 = 0,3 bar for poppet 52; 3 = 3 bar for all poppets 2 = 1,5 bar for poppet 52; 6 = 5,5 bar for all poppets		

8 TYPICAL FUNCTIONS OF POPPETS

Type of poppet	52	62	63
Operating pressure	420 bar		
Nominal flow Size 16	160		
at Δp 5bar	400		
(l/min)	600		
see diagrams Q/ Δp	1200		
at section 10	1800		
Functional sketch (Hydraulic symbol)			
Typical section			
Area ratio A:AP	1 : 1,1	1 : 1,1	1 : 1,1
Cracking pressure	Spring 1 0,3 bar	-	-
A→B	2 1,5 bar	-	-
(1)	3 3 bar	-	-
	6 6 bar	-	-

(1) Depending on the spring cracking pressure and the area ratio of the poppet

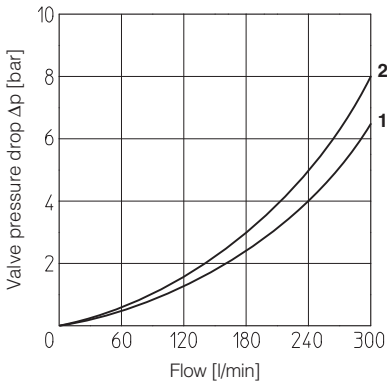
9 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
MTTFd values according to EN ISO 13849	150 years, for further details see technical table P007		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard execution = -30°C ÷ +70°C /PE option = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	
Flow direction	As shown in the symbols of table 2		
Functional cover operating pressure	Ports P, A, B, X, Z1, Z2: 420 bar		

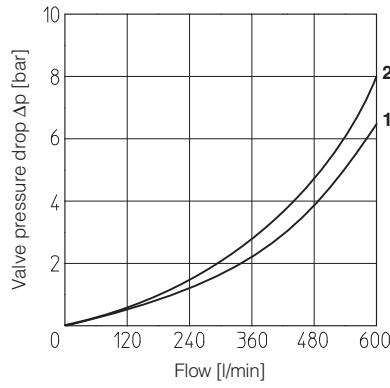
10 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

10.1 SC LI slip-in cartridges, poppet type 32, 33, 42, 43

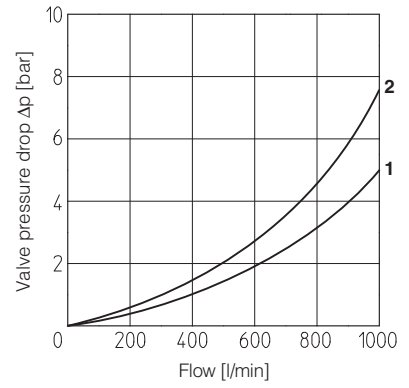
size 16



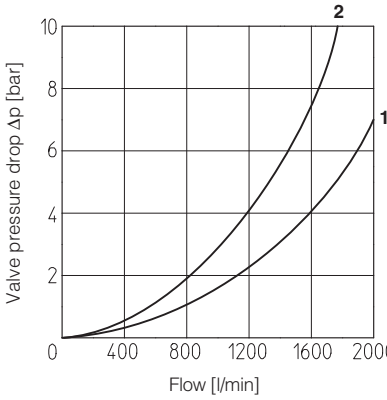
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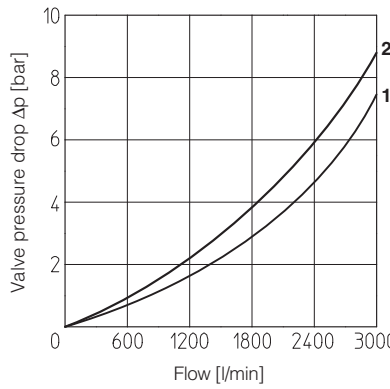
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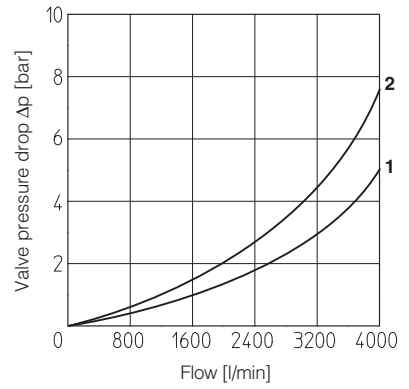
size 40



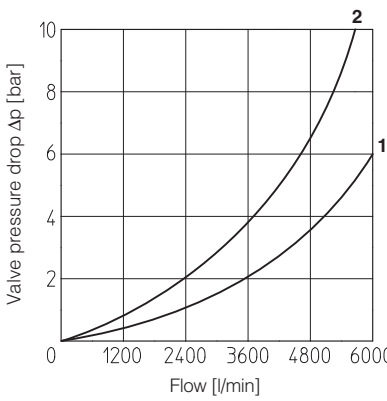
size 50



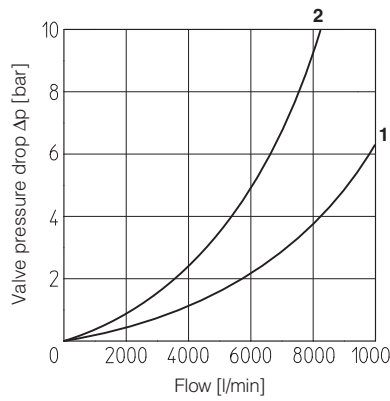
size 63



size 80



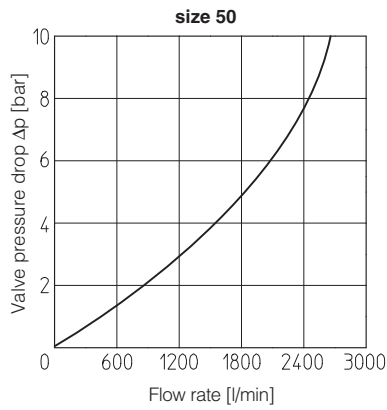
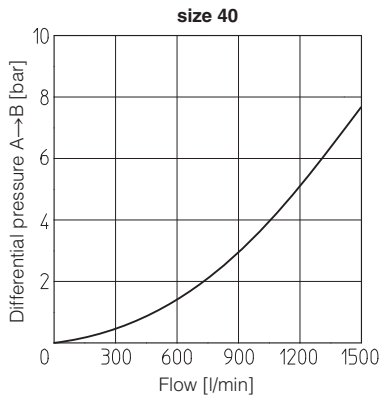
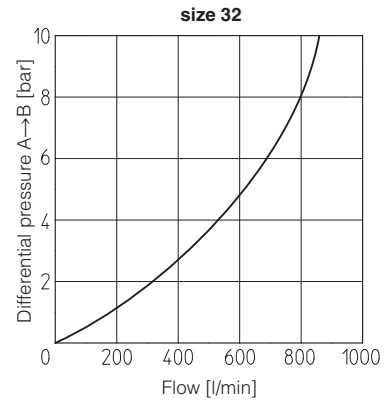
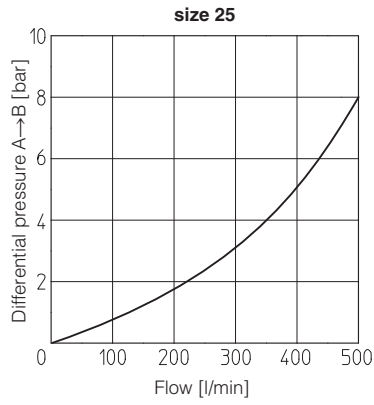
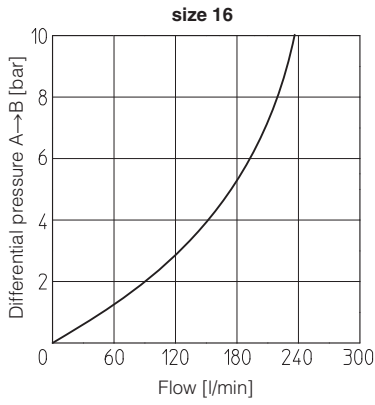
size 100



High flow - series 40

- 1 = poppet type 32 and 33
- 2 = poppet type 42 and 43

10.2 SC LI slip-in cartridges, poppet type 52, 62, 63



11 COVER DIMENSIONS [mm] - for mounting interface and cavity dimensions, see tech. table P006

LIDA

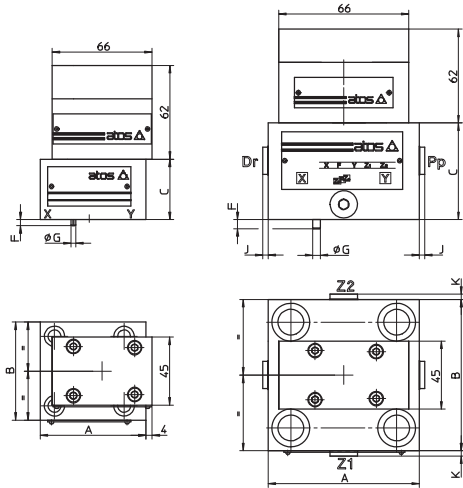
**LIDA (size 16 ÷ 25)
LIDO (size 16...50)**

LIDA (size 32...100)
Note: for LIDA-80 and LIDA-100 the cover has round shape

Covers (1)	A	B	C	D	E	F	G	K	J	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
LIDA-1 LIDO-1	65	65	40	-	-	4	3	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M8x45	35	1,4
LIDA-2 LIDO-2	85	85	40	-	-	6	5	-	3,5	G 1/4	-	2 OR-108 1 OR-108 (2)	Nr. 4 M12x45 (4)	125	1,8
LIDA-3 LIDO-3	100	100	50 60 (2)	20	66	6	5	-	3,5	G 1/4	-	4 OR-2043 1 OR-2043 (2)	Nr. 4 M16x55 (5)	300	2,3
LIDA-4 LIDO-4	125	125	60 100	20	66	6	5	-	3,5 3,5	G 1/4	-	4 OR-3043 1 OR-3043	Nr. 4 M20x70 (6)	600	6,2
LIDA-5 LIDO-5	140	140	70 110 (2)	20	66	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043 1 OR-3043 (2)	Nr. 4 M20x80 (7)	600	9,3
LIDA-6	180	180	80	20	66	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,1
LIDA-8	∅ 250	-	80	30	73	6	8	3,5	3,5	G 3/8	G 3/8	4 OR-4075	Nr. 8 M24x90	1000	27
LIDA-10	∅ 300	-	150	30	73	8	10	3,5	3,5	G 1/2	G 1/2	4 OR-4093	Nr. 8 M30x120	2100	54

(1) For LIDO-2: the external attachment Pp is located at Y port side of the cover;
 (2) Only for LIDO;
 (3) Hexagon socket head screw according to DIN 912 class 12.9
 (4) M12x50 for LIDO-2;
 (5) M16x60 for LIDO-3;
 (6) M20x100 for LIDO-4;
 (7) M20x110 for LIDO-5;

LIDB



LIDB (size 16)

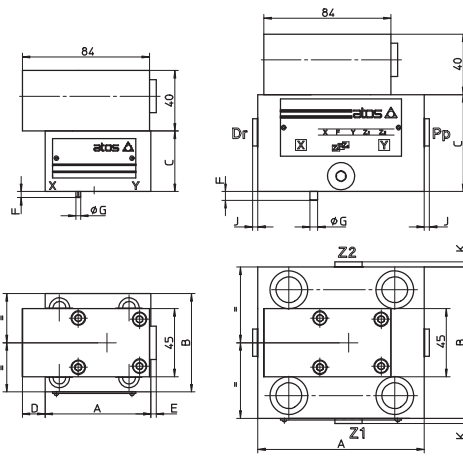
LIDB (size 25...63)

Covers	A	B	C	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDB-1	70	65	40	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,2
LIDB-2	85	85	40	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,6
LIDB-3	100	100	50	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,1
LIDB-4	125	125	60	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7
LIDB-5	140	140	70	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,1
LIDB-6 (1)	180	180	80	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	17,9

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch

(2) Hexagon socket head screw according to DIN 912 class 12.9

LIDR



LIDR (size 16...32)

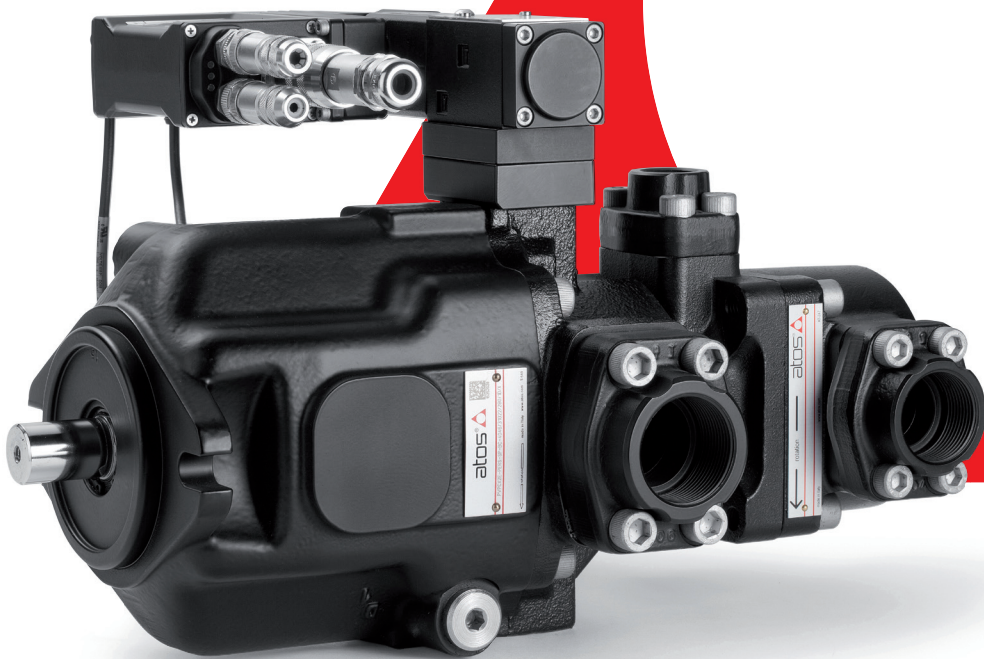
LIDR (size 40...63)

Covers	A	B	C	D	E	F	G	J	K	Port Pp-Dr	Port Z1-Z2	Seals	Fastening bolts (2)	Tightening torque [Nm]	Mass [Kg]
LIDR-1	70	65	40	4	3,5	4	3	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	2,5
LIDR-2	85	85	40	13,5	-	6	5	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	2,9
LIDR-3	100	100	50	6	-	6	5	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	3,4
LIDR-4	125	125	60	-	-	6	5	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,3
LIDR-5	140	140	70	-	-	4	6	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,4
LIDR-6 (1)	180	180	80	-	-	4	6	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,3

(1) The position of external attachments Pp, Dr, Z1 and Z2 are inverted each others respect to the showed sketch

(2) Hexagon socket head screw according to DIN 912 class 12.9

4 PUMPS



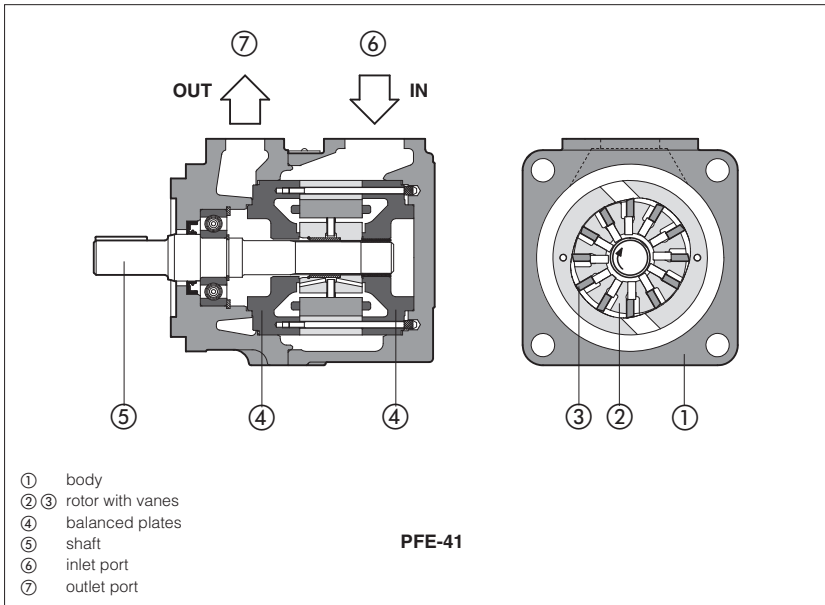
PUMPS

		Disp. [cm ³ /rev]	Pmax [bar]	Table	Pag
TECHNICAL INFORMATION					
Programming tools for digital electronics				GS500	851
Fieldbus features				GS510	859
FIXED DISPLACEMENT					
PFE-31, 41, 51	vane, cartridge design	10,5 ÷ 150,2	160 ÷ 210	A005	755
PFE-32, 42, 52	vane, cartridge design, high pressure	16,5 ÷ 150,2	210 ÷ 300	A007	759
PFR-2, 3, 5	radial piston, high pressure	1,7 ÷ 25,4	350 ÷ 500	A045	763
PM	piston, hand operated, double effect	12 ÷ 20	250	A200	767
VARIABLE DISPLACEMENT					
axial piston					
PVPC mechanical	load sensing, constant power or pressure controls	29 ÷ 140	280 ÷ 350	A160	769
PVPC proportional	flow, pressure or P/Q controls	29 ÷ 140	280 ÷ 350	AS170	781
MULTIPLE					
PFED	double vane cartridges with single body	29,3+16,5 ÷ 150,2+85,3	210	A180	795
PFEX	multiple vane pumps	10,5 ÷ 150,2	160 ÷ 300		
PFRX	radial piston pump + vane pump	8,2+10,5 ÷ 25,4+129,2	160 ÷ 350	A190	799
PVPCX	axial piston pump + vane pump	29+10,5 ÷ 88+150,2	160 ÷ 280		
ACCESSORIES					
E-ATR-8	pressure transducer with amplified analog output signal			GS465	813
CONNECTORS	for transducers, on-off and proportional valves			K800	833
OPERATING INFORMATION					
Operating and maintenance information for pumps				A900	897

Supplementary components range available on www.atos.com

Vane pumps type PFE-31, PFE-41, PFE-51

fixed displacement - cartridge design



PFE-*1 are fixed displacement-twelve-vane pumps, ② ③ cartridge design with integral hydraulic balancing ④ for high pressure operation, long service life and low noise level.

They are available in three different sizes with max displacements up to 44, 85 and 150 cm³/rev and single, multiple or with through-shaft configurations.

Mounting flange according to SAE J744 standard.

Inlet and outlet ports can be oriented in four different positions to match any installation requirement.

Simplified maintenance as the pumping cartridge can be easily replaced.

Max pressure 210 bar.

1 MODEL CODE

PFE	X2	- 31	036	/ 31028	/ 1	D	T	*	/	*
Fixed displacement vane pump										Seals material: omit for NBR (mineral oil & water glycol) PE = FPM
Additional suffix for multiple pumps: X2 = double pump composed of single vane pumps X3 = triple pump composed of single vane pumps Eventual suffix for pumps with through shaft: XA = for coupling one PFE-31 XB = for coupling one PFE-41 (only for PFE-41 and PFE-51) XC = for coupling one PFE-51 (only for PFE-51) XO = with through shaft, without rear flange Note: multiple pumps are assembled in decreasing order of size. See also tab. A190.										
Size, see section 2: 31, 41, 51										
Displacement [cm ³ /rev], see section 2: for PFE 31: 010, 016, 022, 028, 036, 044 for PFE 41: 029, 037, 045, 056, 070, 085 for PFE 51: 090, 110, 129, 150										
Only for multiple pumps PFE*: type of second (and third) pump										
Direction of rotation (viewed from the shaft end): D = clockwise (supplied standard if not otherwise specified) S = counterclockwise Note: PFE are not reversible										
Drive shaft, see section 6 and 7: cylindrical, keyed for single and multiple pump (only first position) 1 = standard 2 = long version (only for PFE-41 and PFE-51) 3 = for high torque applications splined 5 = for single and multiple pumps (any position) 6 = for single and multiple pumps (only first position) 7 = for second and third position in multiple pumps										
Port orientation, see section 5: T = standard U, V, W = on request										
Series number										

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm ³ /rev	Max pressure (1)	Speed range rpm (2)	7 bar (3) l/min kW	70 bar (3) l/min kW	140 bar (3) l/min kW	210 bar (3) l/min kW	
PFE-31010	10,5	210 bar	800-2400	15	0,2	13,5	2	
PFE-31016	16,5			23	0,5	21	3	
PFE-31022	21,6		800-2800	30	0,6	28	4	
PFE-31028	28,1			40	0,8	38	5,5	
PFE-31036	35,6		800-2500	51	1	49	7	
PFE-31044	43,7			63	1,3	61	8	
PFE-41029	29,3		800-2000	41	0,8	39	5,5	
PFE-41037	36,6			52	1	50	7	
PFE-41045	45,0		800-2200	64	1,3	62	8,5	
PFE-41056	55,8			80	1,6	78	11	
PFE-41070	69,9		800-1800	101	2	98	13,5	
PFE-41085	85,3			124	2,4	121	16	
PFE-51090	90,0		800-1800	128	2,7	124	17	
PFE-51110	109,6			157	3,2	152	21	
PFE-51129	129,2			186	3,7	180	25	
PFE-51150	150,2				215	4,2	211	29

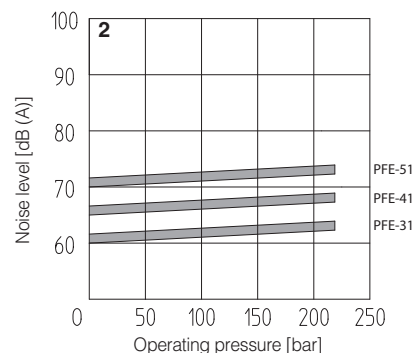
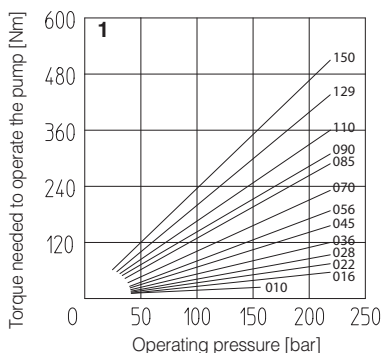
- (1) Max pressure is 160 bar for /PE version and water glycol fluid
- (2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
- (3) Flow rate and power consumption are proportional to the rotation speed, see section 4

3 MAIN CHARACTERISTICS OF VANE PUMPS TYPE PFE-*1

Installation position	Any position		
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.		
Ambient temperature	Standard = -25°C ÷ +80°C /PE option -15°C ÷ +80°C		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section 1		
Recommended viscosity	max at cold start: 800 mm ² /s; max at full power 100 mm ² /s; during operation 24 mm ² /s; min at full power 10 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature	-20°C +60°C -20°C +50°C (water glycol) -20°C +80°C (/PE seals)		
Recommended pressure on inlet port	from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

4 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

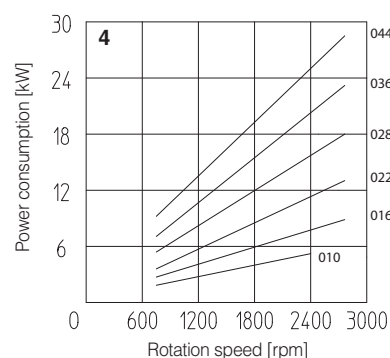
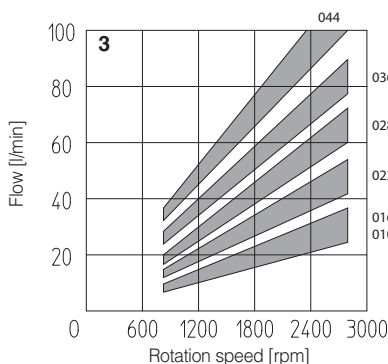
1 = Torque versus pressure diagram



2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps Shaft speed: 1450 rpm.

PFE-31:

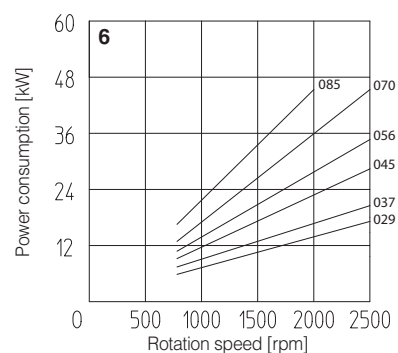
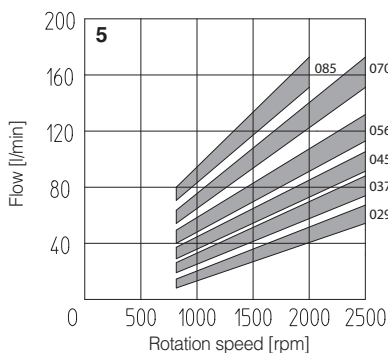
3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.



4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

PFE-41:

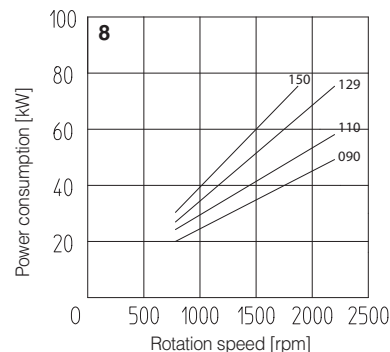
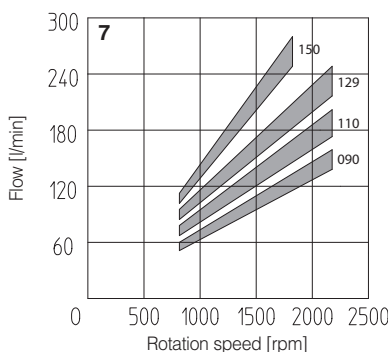
5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.



6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

PFE-51:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.



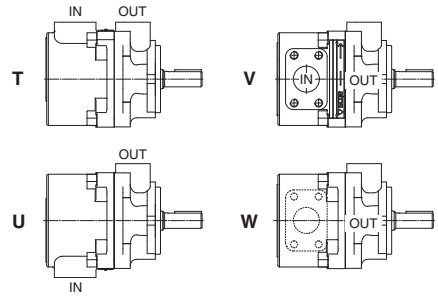
8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

5 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (viewed from the shaft end);

- T** = inlet and outlet ports on the same axis (standard)
- U** = outlet orientated 180° with respect to the inlet
- V** = outlet oriented 90° with respect to the inlet
- W** = outlet oriented 270° with respect to the inlet

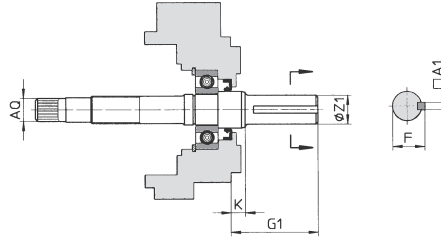
In multiple pumps inlet ports and outlet ports are in line.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.



6 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED

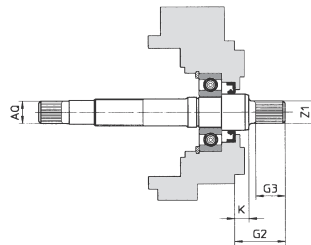
- 1** = for single and multiple pumps (only first position) supplied as standard if not specified in the model code
- 2** = for single and multiple pumps (only first position) long version (only for PFE-41 and PFE-51)
- 3** = for single and multiple pumps (only first position) for high torque applications



Model	Keyed shaft type 1 (standard)						Keyed shaft type 2						Keyed shaft type 3					
	A1	F	G1	K	ØZ1	Ø AQ	A1	F	G1	K	ØZ1	Ø AQ	A1	F	G1	K	ØZ1	Ø AQ
PFE-31	4,78	21,11	56,00	8,00	19,05	SAE 16/32-9T	-	-	-	-	-	-	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	20,94			19,00								4,75	24,41			22,20	
PFE-41	4,78	24,54	59,00	11,40	22,22	SAE 32/64-24T	6,36	25,03	71,00	8,00	22,22	SAE 32/64-24T	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	4,75	24,41			22,20		6,35	24,77			22,20		6,35	28,10			25,36	
PFE-51	7,97	35,33	73,00	14	31,75	SAE 16/32-13T	7,95	35,33	84,00	8,10	31,75	SAE 16/32-13T	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	35,07			31,70		7,94	35,07			31,70		7,94	38,46			34,88	

SPLINED SHAFT

- 5** = for single and multiple pumps (any position) for PFE-31 according to SAE A 16/32 DP, 9 teeth; for PFE-41 according to SAE B 16/32 DP, 13 teeth; for PFE-51 according to SAE C 12/24 DP, 14 teeth;
- 6** = for single and multiple pumps (only first position) for PFE-31 and PFEX*-31 according to SAE B 16/32 DP, 13 teeth; for PFE-41 and PFEX*-41 according to SAE C 12/24 DP, 14 teeth;
- 7** = for second and third position pump in multiple configuration: for PFEX*-31 according to SAE B 16/32 DP, 13 teeth; for PFEX*-41 according to SAE C 12/24 DP, 14 teeth;



Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
	G2	G3	K	Z1	Ø AQ	G2	G3	K	Z1	Ø AQ	G2	G3	K	Z1	Ø AQ
PFE-31	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-41	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-51	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	-	-	-	-	-	-	-	-	-	-

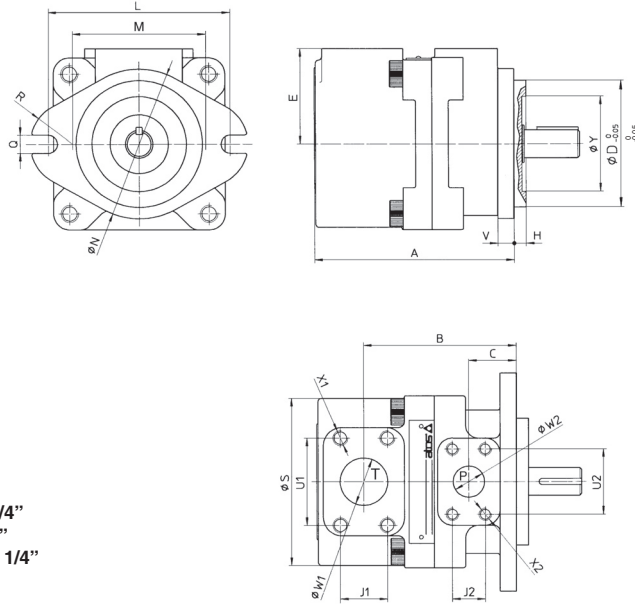
7 LIMITS OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-31	160	-	240	110	240	240	130
PFE-41	250	250	400	200	400	400	250
PFE-51	500	500	850	450	-	-	400

The values of torque required to operate the pumps are shown for each type on the "torque versus pressure" diagram at section 4. In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

8 DIMENSIONS OF SINGLE PUMPS [mm]

T = inlet port
P = outlet port



SAE FLANGES

PFE-31: port T = 1 1/4"; port P = 3/4"
PFE-41: port T = 1 1/2"; port P = 1"
PFE-51: port T = 2; port P = 1 1/4"

Mass:

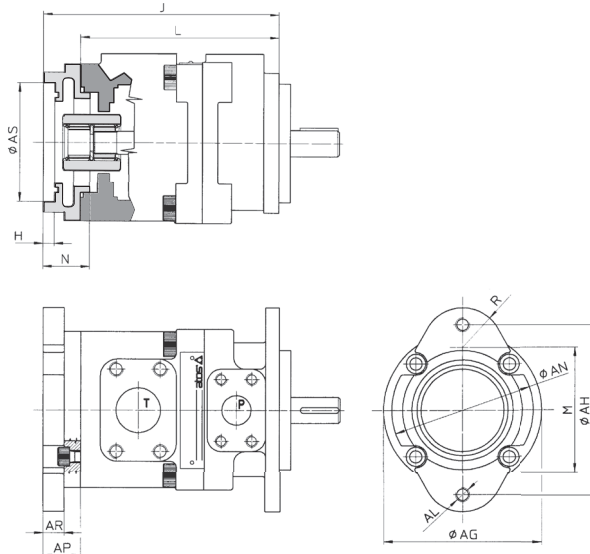
PFE-31 = 9 kg
PFE-41 = 14 kg
PFE-51 = 25,5 kg

SAE flanges can be supplied with the pump

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFE-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFE-51	186,5	125	38	127	82,6	12,7	181	143,5	148	17,5	35
Model	ØS	U1	U2	V	ØW1	ØW2	J1	J2	X1	X2	ØY
PFE-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-51	160	77,8	58	15	51	32	42,9	30,2	M12X20	M10X20	76

9 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (FOR MULTIPLE PUMPS) [mm]

T = inlet port
P = outlet port



SAE FLANGES

PFEX-31: port T = 1 1/4"; port P = 3/4"
PFEX-41: port T = 1 1/2"; port P = 1"
PFEX-51: port T = 2; port P = 1 1/4"

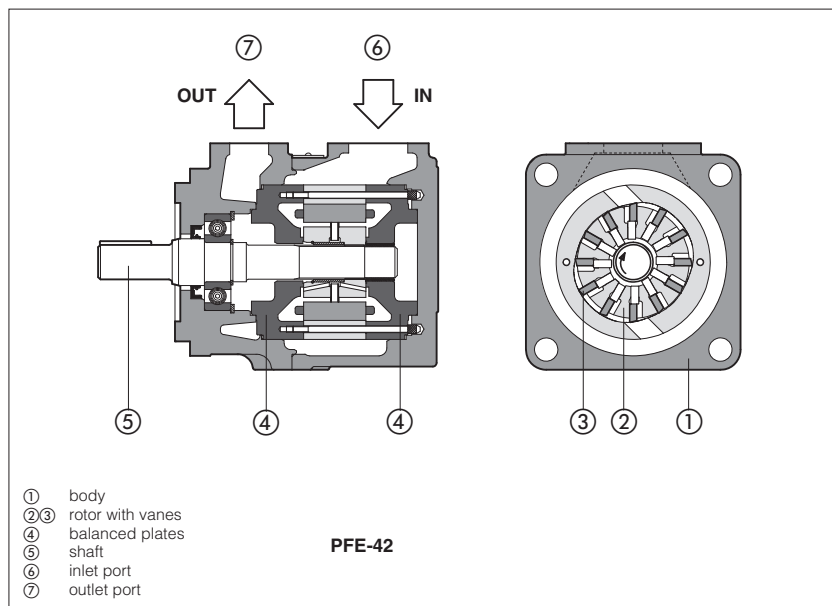
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm) ₍₁₎	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	41	34
PFEXA-51	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	32	28,5
PFEXB-51	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	41	34
PFEXC-51	134	181	M16	300	148	46,5	30,7	127,02 127,02	12,73 12,78	230	183,5	143,5	56	35

(1) Tightening torque for screw class 12.9

Vane pumps type PFE-32, PFE-42, PFE-52

fixed displacement - cartridge design - high pressure and low noise level execution



New PFE-*2 are fixed displacement -twelve-vanes pumps ②③, cartridge design with integral hydraulic balancing ④ for high pressure operation and long service life with further reduction of noise level compared with PFE-*1.

These pumps are available as single, multiple or with through-shaft configuration.

Mounting flange according to SAE J744 standard.

Easy installation as inlet and outlet ports can be assembled in any of four relative positions.

Easy maintenance as the pumping cartridge can be replaced in a few minutes.

Three different sizes with max displacements up to 36, 85 and 150 cm³/rev. Max pressures up to 300 bar.

1 MODEL CODE

PFE	X2	- 42	045	/ 31028	/ 3	D	T	*	/	*
Fixed displacement vane pump										
Additional suffix for multiple pumps: X2 = double pump composed of single vane pumps X3 = triple pump composed of single vane pumps Additional suffix for pumps with through shaft: XA = for coupling one PFE-31 XB = for coupling one PFE-41 (only for PFE-42 and PFE-52) XC = for coupling one PFE-51 (only for PFE-52) XO = with through shaft, without rear flange Note: multiple pumps are assembled in decreasing order of size. See also tab. A190.										
Size, see section ②: 32, 42, 52										
Displacement [cm ³ /rev], see section ② for PFE 32: 016, 022, 028, 036 for PFE 42: 045, 056, 070, 085 for PFE 52: 090, 110, 129, 150										
Only for multiple pumps PFE*: type of second (and third) pump										
Direction of rotation (viewed from the shaft end): D = clockwise (supplied standard if not otherwise specified) S = counterclockwise Note: PFE are not reversible and it is therefore necessary to specify the desired direction of rotation										
Drive shaft, see section ⑥ and ⑦: cylindrical, keyed for single and multiple pump (only first position) 3 = for high torque applications splined 5 = for single and multiple pumps (any position) 6 = for single and multiple pumps (only first position) 7 = for second and third position in multiple pumps										
Seals material: omit for NBR (mineral oil & water glycol) PE = FPM Series number										
Port orientation, see section ⑤: T = standard U, V, W = on request										
only for PFE-32 and PFE-42										

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm ³ /rev	Max pressure (1)	Speed range rpm (2)	7 bar (3)		140 bar (3)		at max. pressure (3)	
				l/min	kW	l/min	kW	l/min	kW
PFE-32016	16,5	300 bar	1000-2500	23	0,35	20	6	16	10
PFE-32022	21,6			30	0,6	26	7	20	16
PFE-32028	28,1			40	0,8	36	10	30	20
PFE-32036	35,6			51	1	46	12,5	40	26
PFE-42045	45	280 bar	1000-2200	64	1,3	60	16	56	31
PFE-42056	55,8			80	1,6	75	21	70	40
PFE-42070	69,9			101	2	95	26	90	42
PFE-42085	85,3	210 bar	800-2000	124	2,4	118	32	114	43
PFE-52090	90	250 bar	1000-2000	128	2,7	119	33	111	54
PFE-52110	109,6			157	3,2	147	40	138	66
PFE-52129	129,2			186	3,7	174	47	163	78
PFE-52150	150,2			215	4,2	204	55	197	80

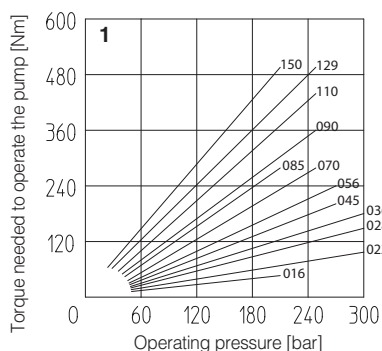
- (1) Max pressure is 160 bar for /PE version and water glycol fluid
- (2) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid
- (3) Flow rate and power consumption are proportional to the rotation speed

3 MAIN CHARACTERISTICS OF VANE PUMPS TYPE PFE-*2

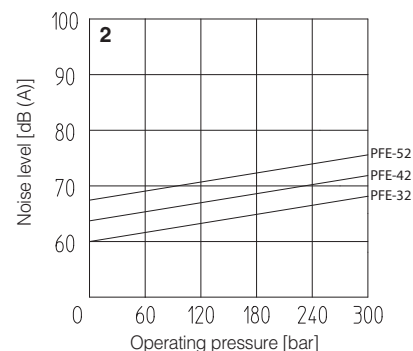
Installation position	Any position		
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the power peak.		
Ambient temperature	Standard = -25°C ÷ +80°C /PE option -15°C ÷ +80°C		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section 1		
Recommended viscosity	max at cold start: 800 mm ² /s; max at full power 100 mm ² /s; during operation 24 mm ² /s; min at full power 10 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid temperature	-20°C +60°C	-20°C +50°C (water glycol)	-20°C +80°C (/PE seals)
Recommended pressure on inlet port	from -0,15 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

4 DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

1 = Torque versus pressure diagram

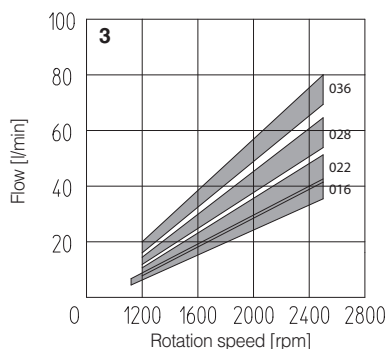


2 = Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps Shaft speed: 1450 rpm.

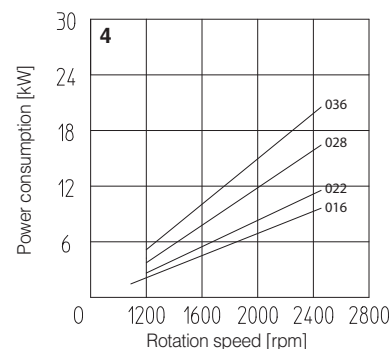


PFE-32:

3 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

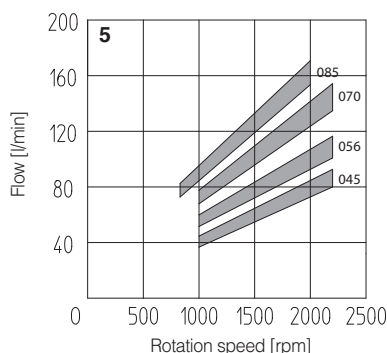


4 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

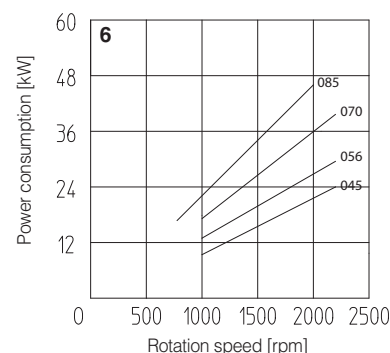


PFE-42:

5 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

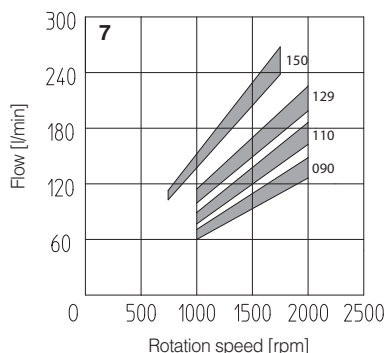


6 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

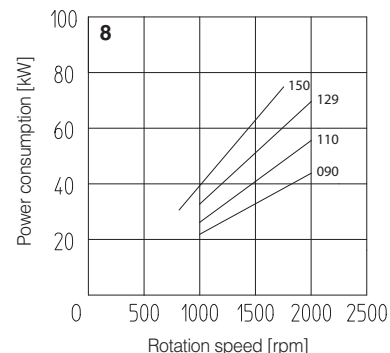


PFE-52:

7 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.



8 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

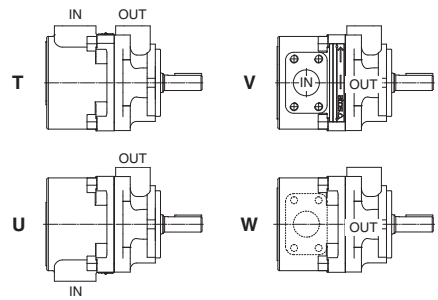


5 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (viewed from the shaft end);

- T** = inlet and outlet ports on the same axis (standard)
- U** = outlet orientated 180° with respect to the inlet
- V** = outlet oriented 90° with respect to the inlet
- W** = outlet oriented 270° with respect to the inlet

In multiple pumps inlet ports and outlet ports are in line.
Ports orientation can be easily changed by rotating the pump body that carries inlet port.

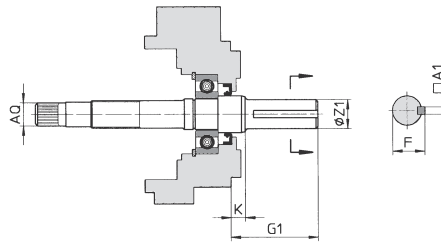


6 DRIVE SHAFT

CYLINDRICAL KEYED SHAFT

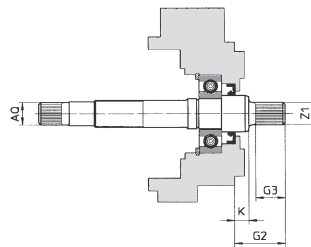
3 = for single and multiple pumps (only first position) for high torque applications

Model	Keyed shaft type 3					Only for through shaft execution Ø AQ
	A1	F	G1	K	ØZ1	
PFE-32	4,78	24,54	56,00	8,00	22,22	SAE 16/32-9T
	4,75	24,41			22,20	
PFE-42	6,38	28,30	78,00	11,40	25,38	SAE 32/64-24T
	6,35	28,10			25,35	
PFE-52	7,97	38,58	84,00	14	34,90	SAE 16/32-13T
	7,94	38,46			34,88	



SPLINED SHAFT

- 5** = for single and multiple pumps (any position)
 - for PFE-32 according to SAE A 16/32 DP, 9 teeth;
 - for PFE-42 according to SAE B 16/32 DP, 13 teeth;
 - for PFE-52 according to SAE C 12/24 DP, 14 teeth;
- 6** = for single and multiple pumps (only first position)
 - for PFE-32 and PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
 - for PFE-42 and PFEX*-42 according to SAE C 12/24 DP, 14 teeth;
- 7** = for second and third position pump in multiple configuration:
 - for PFEX*-32 according to SAE B 16/32 DP, 13 teeth;
 - for PFEX*-42 according to SAE C 12/24 DP, 14 teeth;



Model	Splined shaft type 5				Only for through shaft execution Ø AQ	Splined shaft type 6				Only for through shaft execution Ø AQ	Splined shaft type 7				Only for through shaft execution Ø AQ
	G2	G3	K	Z1		G2	G3	K	Z1		G2	G3	K	Z1	
PFE-32	32,00	19,50	6,50	SAE 16/32-9T	SAE 16/32-9T	41,00	28	8,00	SAE 16/32-13T	SAE 16/32-9T	32,00	19	8,00	SAE 16/32-13T	SAE 16/32-9T
PFE-42	41,25	28	8,00	SAE 16/32-13T	SAE 32/64-24T	55,60	42	8,00	SAE 12/24-14T	SAE 32/64-24T	41,60	28	8,00	SAE 12/24-14T	SAE 32/64-24T
PFE-52	55,60	42	8,10	SAE 12/24-14T	SAE 16/32-13T	-	-	-	-	-	-	-	-	-	-

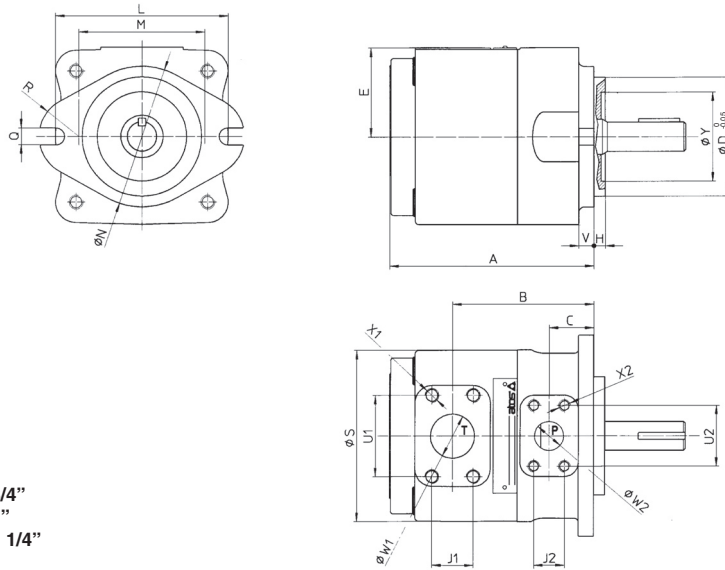
7 LIMITS OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]				Maximum torque available at the end of the through shaft [Nm]
	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
PFE-32	240	110	240	240	130
PFE-42	400	200	400	400	250
PFE-52	850	450	-	-	400

The values of torque required to operate the pumps are shown for each type on the "torque versus pressure diagram" at section 4. In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

8 DIMENSIONS OF SINGLE PUMPS [mm]

T = inlet port
P = outlet port



SAE FLANGES

PFE-32: port T = 1 1/4"; port P = 3/4"
PFE-42: port T = 1 1/2"; port P = 1"
PFE-52: port T = 2; port P = 1 1/4"

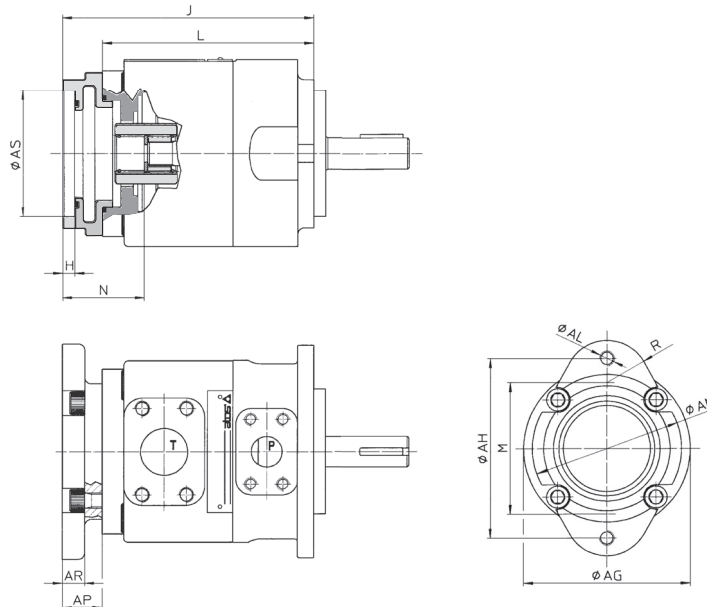
Mass:

PFE-32 = 9 kg
PFE-42 = 20,5 kg
PFE-52 = 32,1 kg

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFE-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFE-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFE-52	189	125	38	127	89	12,7	181	143,5	148	17,5	35
Model	ØS	U1	U2	V	ØW1	ØW2	J1	J2	X1	X2	ØY
PFE-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFE-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFE-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

9 DIMENSIONS OF PUMPS WITH THROUGH-SHAFT (FOR MULTIPLE PUMPS) [mm]

T = inlet port
P = outlet port



SAE FLANGES

PFEX-32: port T = 1 1/4"; port P = 3/4"
PFEX-42: port T = 1 1/2"; port P = 1"
PFEX-52: port T = 2; port P = 1 1/4"

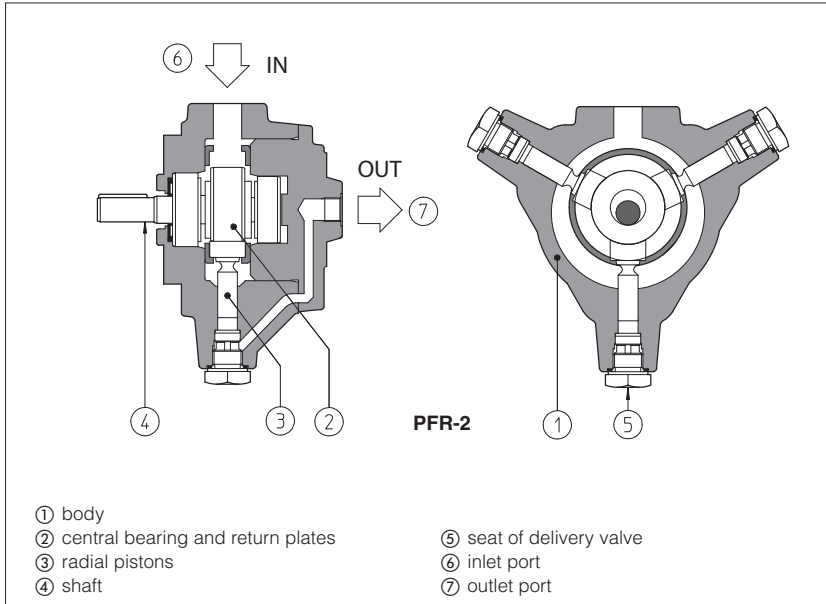
For other dimensions, see section 8

Model	Ø AG	Ø AH	AL	Tightening torque (Nm) ⁽¹⁾	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-32	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	193,7	132,5	79	32	28,5
PFEXA-42	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	194	171	73	34	28,5
PFEXB-42	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	43	34
PFEXA-52	134	106	M10X17	70	95	22,7	11	82,57 82,63	6,42 6,47	206,2	183,5	73	34,5	28,5
PFEXB-52	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	215,5	183,5	107	43,8	34
PFEXC-52	134	181	M16	300	148	46,7	30,7	127,02 127,02	12,73 12,78	230,2	183,5	143,5	58,5	35

(1) Tightening torque for screw class 12.9

Radial piston pumps type PFR

fixed displacement



PFR are fixed displacement radial piston pumps with positive drive construction of the pistons ③ (without return spring) for high performance and low noise level.

Suitable for hydraulic oils according to DIN 51524... 535 or synthetic fluids having similar lubricating characteristics.

These pumps are available as single or with through-shaft configuration in order to be coupled to PFE vane pumps, see table A190.

Wide range of displacements from 1,7 up to 25,4 cm³/rev.
 Max pressure up to 350/500 bar.

1 MODEL CODE

PFR	XA	-	3	08	**	-	*
Fixed displacement radial piston pump							Seals material: omit for NBR (mineral oil & water glycol) PE = FPM
Additional suffix for pumps provided to be coupled with vane pump type PFE (tab. A005), see section 2				Series number			
Only for PFR-3 and PFR-5: XA = provided (throughgoing shaft, flange and joint) to be coupled with PFE-31 XB = provided (throughgoing shaft, flange and joint) to be coupled with PFE-41 XC = provided (throughgoing shaft, flange and joint) to be coupled with PFE-51				Displacement [cm ³ /rev], see section 2: for PFR-2: 02, 03 for PFR-3: 08, 11, 15 for PFR-5: 18, 25			
See table A190 for codes of complete multiple pumps: PFR +PFE = PFRX*E				Conventional size, see section 2: 2, 3, 5			

2 OPERATING CHARACTERISTICS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm ³ /rev	Max pressure bar	Speed range rpm	150 bar ⁽³⁾		250 bar ⁽³⁾		350 bar ⁽³⁾		500 bar ⁽³⁾	
				l/min	kW	l/min	kW	l/min	kW	l/min	kW
PFR-202	1,7	500 (1)	600-1800 (2)	2,4	0,7	2,4	1,1	2,4	1,6	2,4	2,1
PFR-203	3,5			5,0	1,4	5,0	2,2	4,9	3,0	4,9	4,2
PFR-308	8,2	350 (1)		11,8	3,2	11,5	5,6	11,5	7,5	-	-
PFR-311	11,4			16,5	4,5	16,4	7,8	16,2	10	-	-
PFR-315	14,7			21,3	6,3	21,3	10,0	20,9	12,5	-	-
PFR-518	18,1			26	7,7	25,8	12,3	25,6	15,2	-	-
PFR-525	25,4			36,5	11	36	17,3	35,5	21,6	-	-

(1) Max pressure is 250 bar for /PE versions; max pressure is 175 bar for water glycol fluid

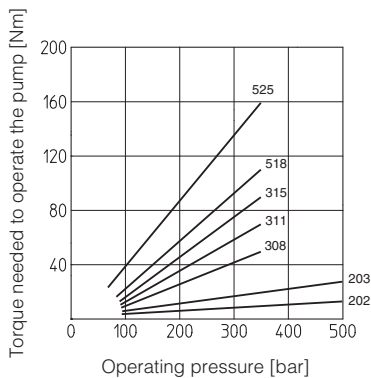
(2) Max speed is 1000 rpm for /PE version and for water glycol fluid

(3) Flow rate and power consumption are proportional to rotation speed

3 MAIN CHARACTERISTICS OF FIXED DISPLACEMENT RADIAL PISTON PUMP TYPE PFR

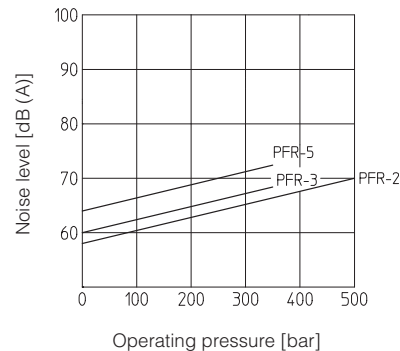
Installation position	Any position. It is advisable to install on the outlet pipe a proper valve for air bleeding. The installation under oil level is recommended. The installation above oil level should be avoided. The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump. See section 10		
Commissioning	PFR pumps can be reversed without changing the flow direction. Therefore both directions of rotation are permitted. It is recommend to start the pump by short impulses, with pump case filled and air bleed plugs unlocked. Pumps type PFR-3 and PFR-5 have 2 air bleeds, normally plugged, ports located near to the P ports. To help filling and air bleeding, it could be advisable to install a vertical pipe connected on the intake line, just before the inlet port flange.		
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the developed peak horsepower.		
Ambient temperature	Standard = -25°C ÷ +80°C /PE option -15°C ÷ +80°C		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section 11		
Recommended viscosity	max at cold start: 800 mm ² /s; max at full power 100 mm ² /s; during operation 24 mm ² /s; min at full power 10 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	www.atos.com or KTF catalog
Fluid temperature	-20°C +60°C	-20°C +50°C (water glycol)	-20°C +80°C (/PE seals)
Recommended pressure on inlet port	from -0,1 to 1,5 bar for speed up to 1800 rpm		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

4 TORQUE VERSUS PRESSURE DIAGRAM



5 NOISE LEVEL

Ambient noise levels measured in compliance with ISO 4412-1 oleo-hydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm. Mineral oil ISO VG 46 at 50°C.

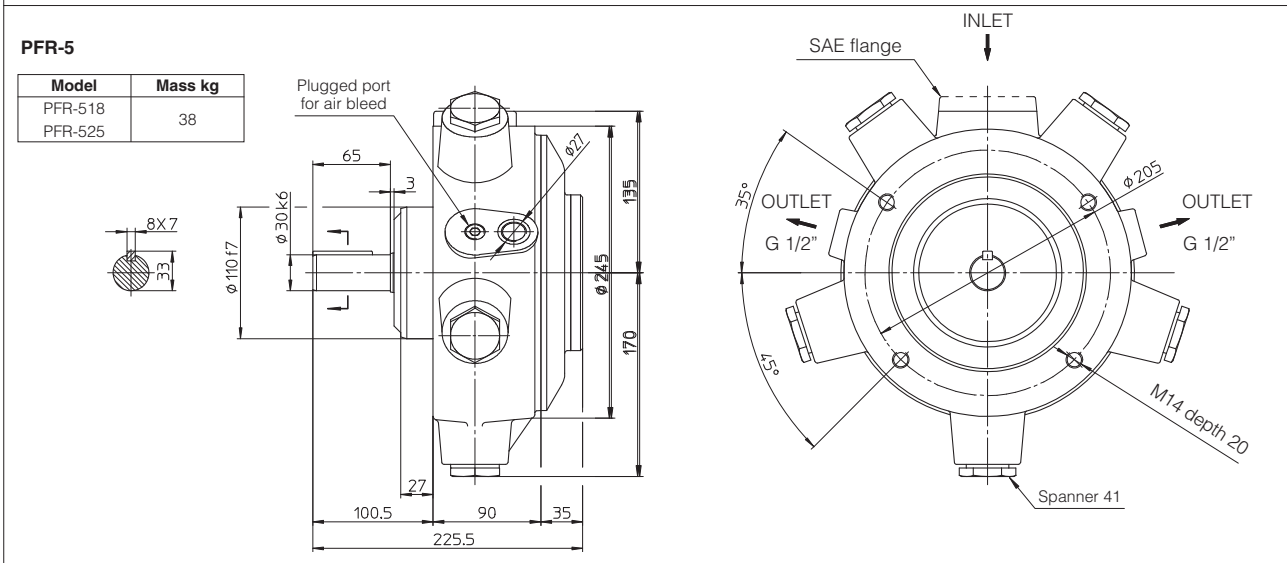
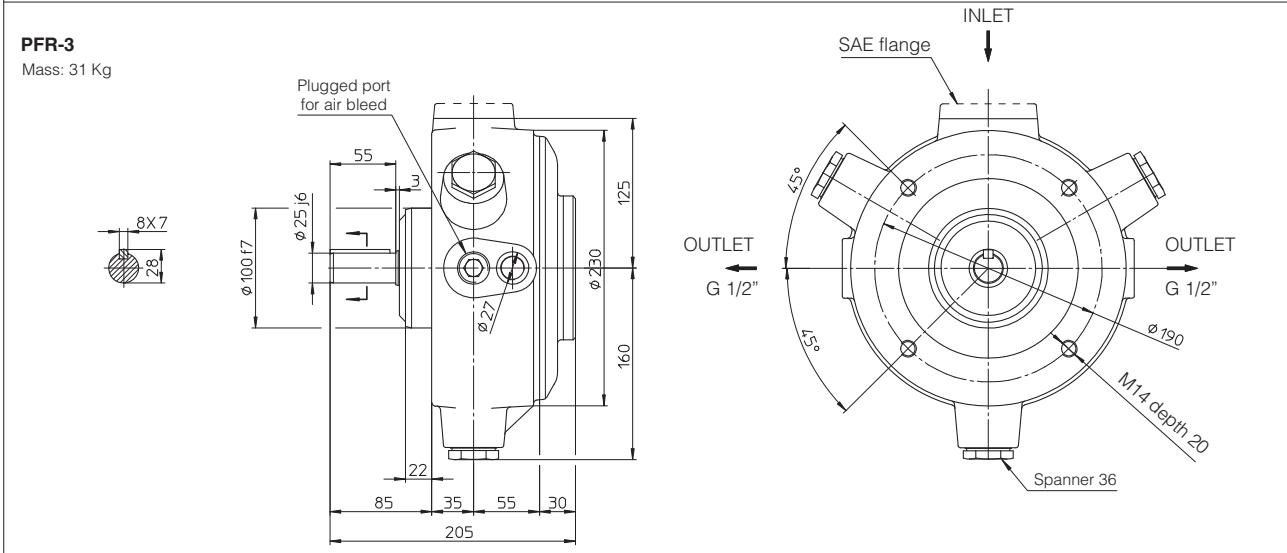
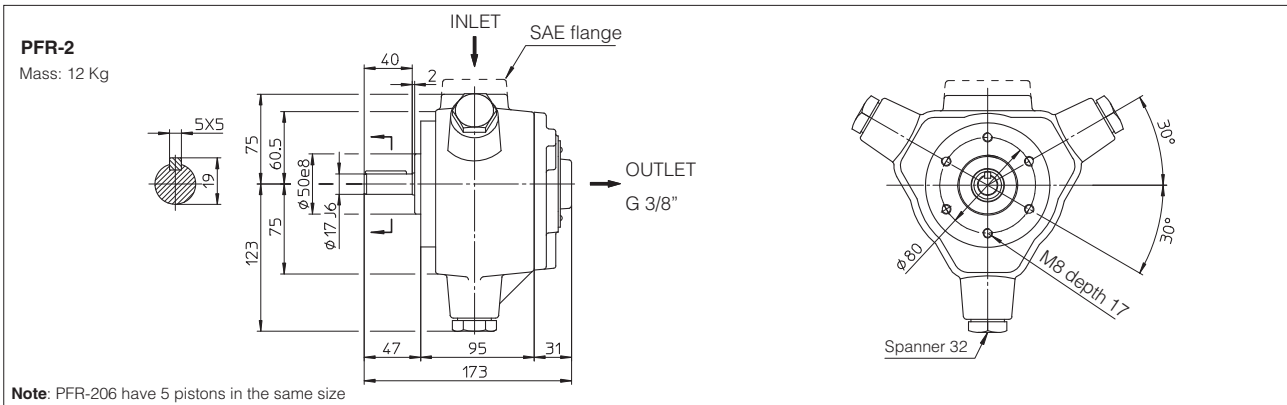


6 LIMIT OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]	Maximum torque available on the end of the through shaft [Nm]
PFR-2	200	=
PFR-3	600	320
PFR-5	800	320

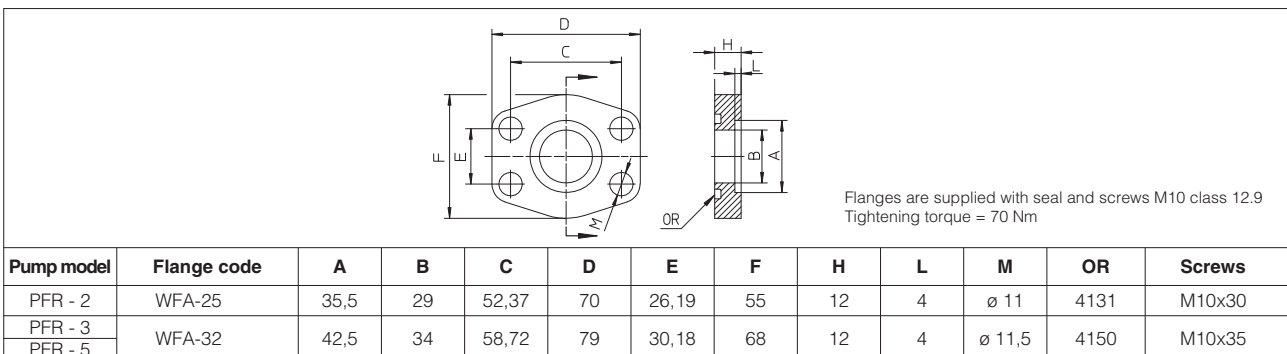
The values of torque needed to operate the pumps are shown for each type on the "torque versus pressure diagram" at section 4. In multiple pumps the total torque applied to the shaft of the first element (drive shaft) is the sum of the single torque needed for operating each single pump and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

7 DIMENSIONS OF SINGLE PUMPS [mm]

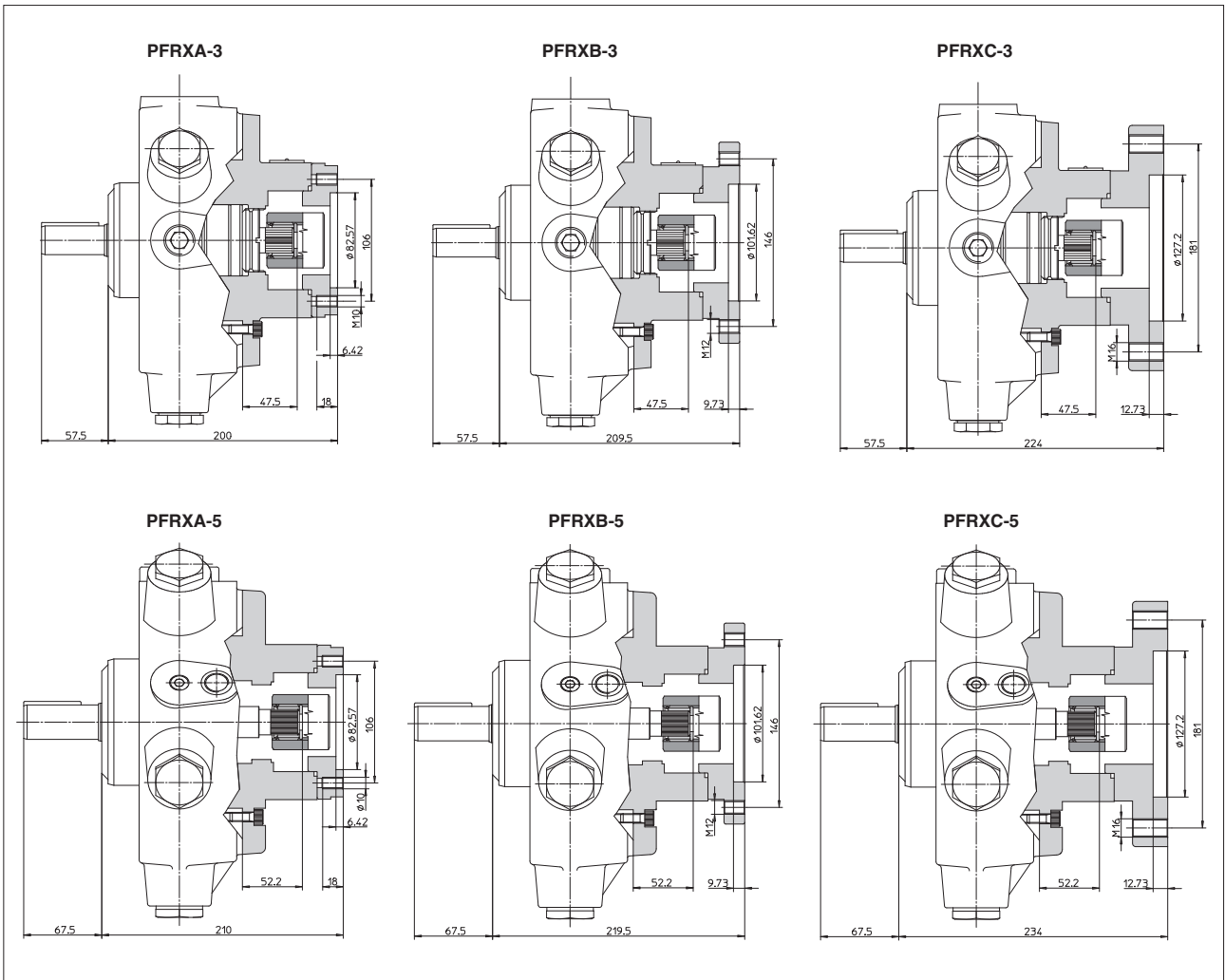


(•) SAE flanges are supplied with the pump

8 SAE-3000 FLANGES supplied with the pump [mm]



9 DIMENSIONS OF PUMPS PROVIDED TO BE COUPLED WITH VANE PUMPS [mm]



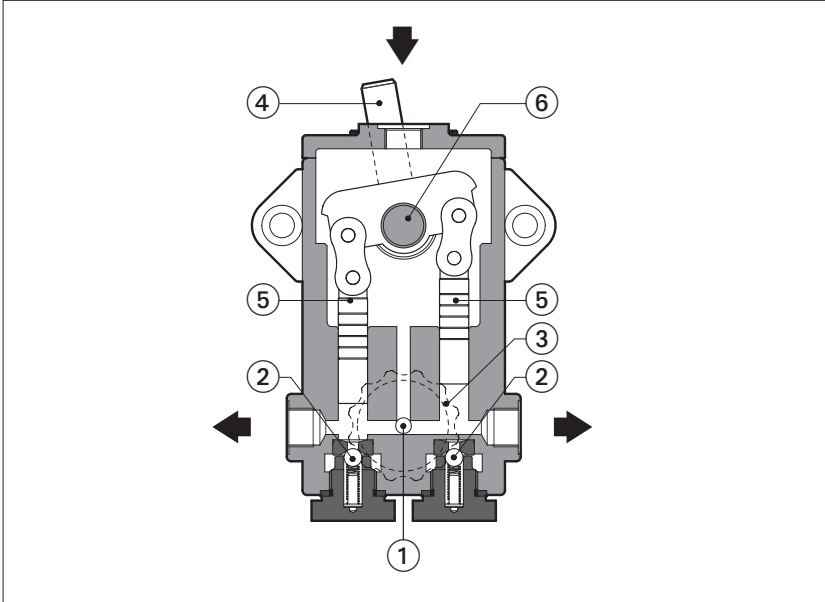
10 BALANCED COUPLING

The balanced couplings permit to minimize the vibrations caused by the unbalanced mass during the pump rotation. The couplings listed in the table, supplied by Atos, must be used together with the relevant bell housing (supplied by Scoda). The table lists the codes of the Atos balanced couplings and the Scoda bell housing, available for the several pumps and for the standardized sizes of the electrical motors.

PUMP MODEL	ELECTRICAL MOTOR	BALANCED COUPLING	BELL HOUSING
PFR-202	UNEL-MEC 100-112	Y-GB-82/02	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/02	Y-LS6P2
PFR-203	UNEL-MEC 100-112	Y-GB-82/03	Y-LS4P2
	UNEL-MEC 132	Y-GB-122/03	Y-LS6P2
PFR-308	UNEL-MEC 100-112	Y-GB-83/08	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/08	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/08	Y-LS7P3
PFR-311	UNEL-MEC 100-112	Y-GB-83/11	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/11	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/11	Y-LS7P3
PFR-315	UNEL-MEC 100-112	Y-GB-83/15	Y-LS4P3
	UNEL-MEC 132	Y-GB-123/15	Y-LS6P3
	UNEL-MEC 160	Y-GB-303/15	Y-LS7P3
PFR-518	UNEL-MEC 132	Y-GB-125/18	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/18	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/18	
PFR-525	UNEL-MEC 132	Y-GB-125/25	Y-LS6P5
	UNEL-MEC 160	Y-GB-305/25	Y-LS7P5
	UNEL-MEC 180	Y-GB-605/25	

Hand pumps type PM

2-plunger



PM are double alternate-acting hand pumps with simple and rugged construction for minimum service and long operating life.

They are provided with one by-pass valve ① which connects directly the delivery ports with the inlet port through the delivery valves ②. The by-pass valve is operated by a handwheel ③. Pumping operation is made by alternative movement of the lever ④ and consequently movement of plungers ⑤, after having locked the by-pass valve by means of the handwheel.

The splined shaft attachment ⑥ permits to turn the lever shaft in the best position.

On the pump body are available two outlet ports (one supplied plugged).

Suitable for hydraulic oils according to DIN 51524...535 or synthetic fluids having similar lubricating characteristics.

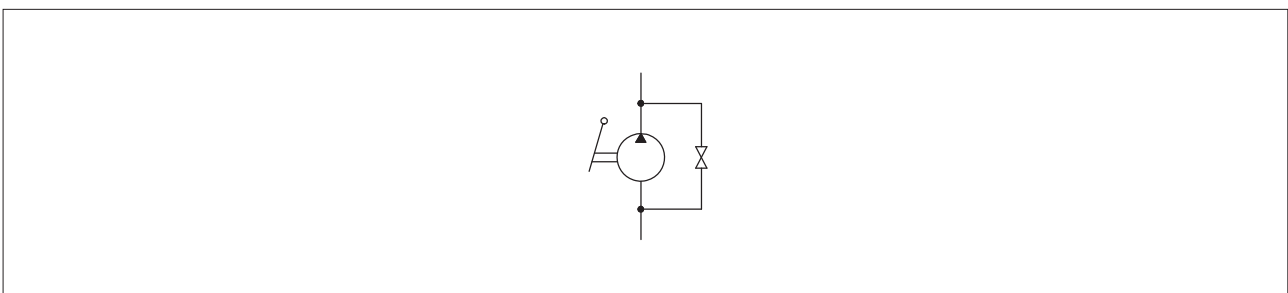
Displacements: from 12 to 20 cm³ for double stroke.

Max pressure 250 bar

1 MODEL CODE

PM	-	112	*	/	*
2-plunger hand pump			Seals material: omit for NBR (mineral oil & water glycol) PE = FPM		
Displacement, see section 2			Series number		
112 = 12 cm ³ /double stroke					
120 = 20 cm ³ /double stroke					

2 OPERATING CHARACTERISTICS with hydraulic fluid having a viscosity of 24 mm²/s and 40°C

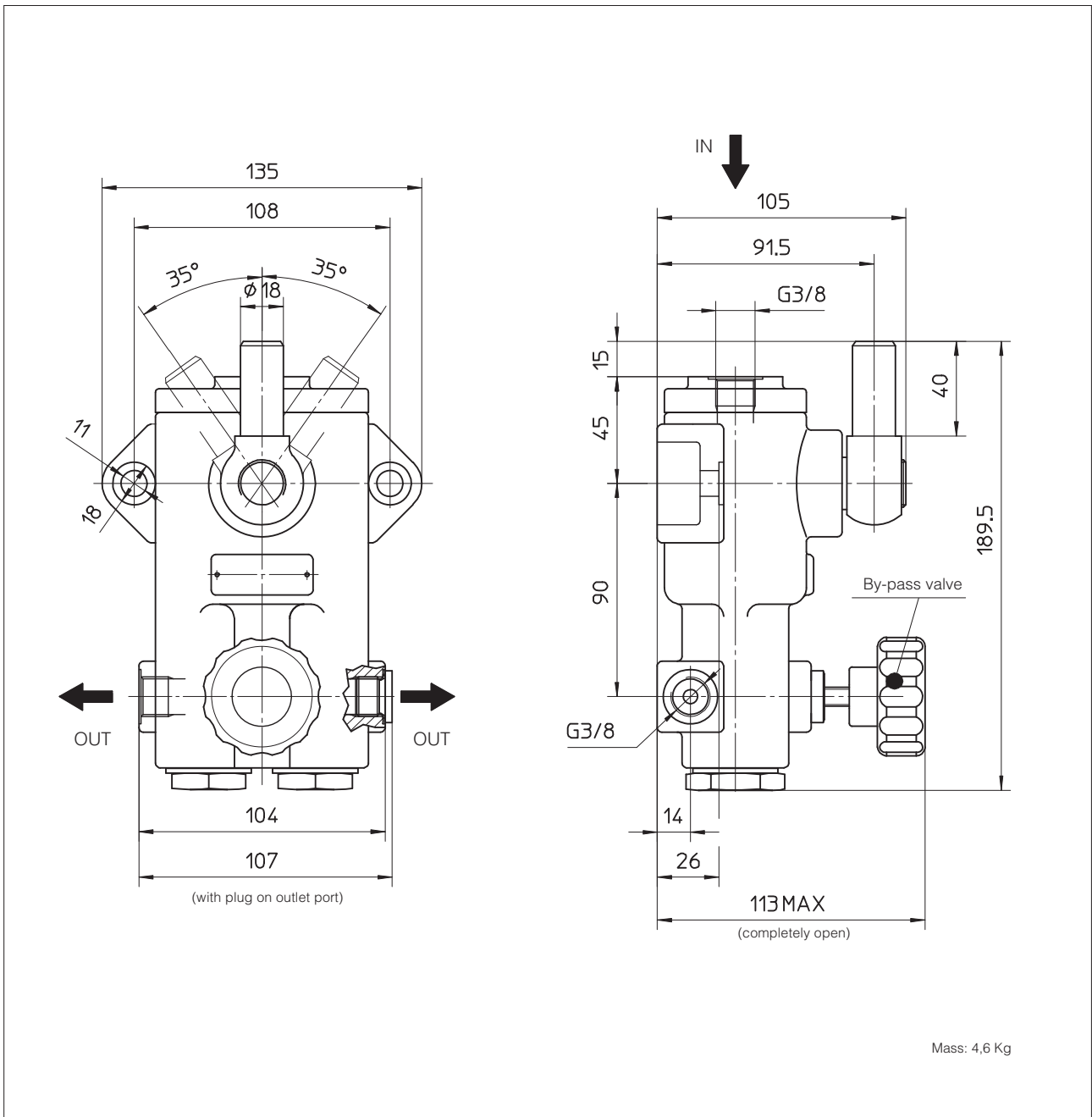


Model	Displacement for double stroke [cm ³]	Max pressure [bar]	Shaft rotation angle [degree]	Maximum torque required [Nm]
PM-112	12	250	± 35°	133
PM-120	20	120	± 35°	116

3 MAIN CHARACTERISTICS OF HAND PUMP TYPE PM

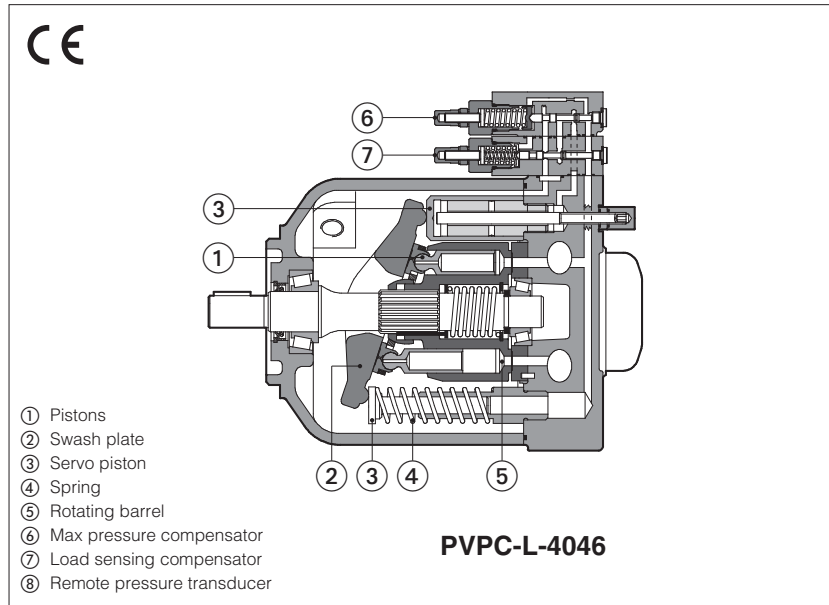
Installation position	Vertical position, with inlet port facing upward to ensure complete case filling		
Commissioning	Pumping operation is made by alternative movement of the lever after closing by-pass valve. Note: the by-pass valve connects the delivery ports with inlet port and when locked it could allow some leakage from outlet ports. Two opposite outlet ports are available for pump delivery: one of these is supplied plugged. The pumps are supplied without lever harm that could made by a simple tube with \varnothing 18 mm inside diameter. Usually a length of 500 to 600 mm is appropriate. Lever position can be selected by proper assembling of lever on splined shaft.		
Ambient temperature	Standard = $-25^{\circ}\text{C} \div +80^{\circ}\text{C}$ / PE option $-15^{\circ}\text{C} \div +80^{\circ}\text{C}$		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section I		
Recommended viscosity	$10 \div 100 \text{ mm}^2/\text{sec}$ at 40°C (ISO VG 15 - 100)		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	www.atos.com or KTF catalog
Fluid temperature	$-20^{\circ}\text{C} +60^{\circ}\text{C}$	$-20^{\circ}\text{C} +50^{\circ}\text{C}$ (water glycol)	$-20^{\circ}\text{C} +80^{\circ}\text{C}$ (/PE seals)
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

4 DIMENSIONS [mm]



Axial piston pumps

variable displacement, mechanical controls



PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits.

They are characterized by low noise emission, short response time and flexible operation thanks to the wide range of mechanical controls, see section 11.

For PVPC pumps with electrohydraulic proportional controls, see tech table AS170.

SAE J744 mounting flange and shaft.

Max displacement (cm ³ /rev)	Max pressure working (bar)	Max pressure peak (bar)
29, 46, 73, 140	280	350
88	250	315

1 MODEL CODE

PVPC	X2E	-	C	-	4046	/	1	-	D	-	X	24DC	*	/	*
Variable displacement axial piston pump															
<p>Option for pumps with through shaft (1): XA = intermediate flange SAE A XB = intermediate flange SAE B XC = intermediate flange SAE C (only for size 5073 and 5090) Additional suffix for double pumps: X2E = with a fixed displacement pump type PFE (see tech table A005)</p>															
<p>Type of control, see section 11: C = manual pressure compensator CH = manual pressure compensator, with venting R = remote pressure compensator L = load sensing (pressure & flow) LW = constant power (combined pressure & flow) For electrohydraulic proportional controls, see tech table AS170</p>															
<p>Seals material, see section 5: - = NBR PE = FKM</p>															
<p>Coil voltage, see section 4 (only for CH version)</p>															
<p>X = without connector (only for CH version) See section 4 for available connectors, to be ordered separately</p>															
<p>Direction of rotation, viewed at the shaft end: D = clockwise S = counterclockwise</p>															
<p>Size and max displacement (2): 3029 = size 3 - displacement 029 cm³/rev 4046 = size 4 - displacement 046 cm³/rev 5073 = size 5 - displacement 073 cm³/rev 5090 = size 5 - displacement 090 cm³/rev 6140 = size 6 - displacement 140 cm³/rev</p>															
<p>Shaft, SAE Standard (3): 1 = keyed 5 = splined</p>															

(1) Not available for PVPC*-6140

(2) Optional intermediate displacements 35 and 53 cm³/rev are available on request

(3) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 GENERAL CHARACTERISTICS

Assembly position - see section 6	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line length is 3 m.
Ambient temperature range	Standard = -25°C ÷ +80°C / PE option -15°C ÷ +80°C
Storage temperature	Standard = -40°C ÷ +50°C / PE option -20°C ÷ +50°C
Surface protection (pump body)	Black painting RAL9005

3 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size	3029		4046		5073		5090		6140	
Max displacement (cm ³ /rev)	29		46		73		88		140	
Theoretical max flow at 1450 rpm (l/min)	42		66,7		105,8		127,6		203	
Max working pressure / Peak (bar)	280/350		280/350		280/350		250/315		280/350 (1)	
Min/Max inlet pressure (bar abs.)	0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port (bar abs.)	1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement (Kw)	19,9		31,6		50,1		54,1		122	
Max torque on the shaft (shaft type) (Nm)	Type 1 210	Type 5 270	Type 1 350	Type 5 440	Type 1 670	Type 5 810	Type 1 670	Type 5 810	Type 1 1000	Type 5 2340
Max torque at max working pressure (Nm)	128		203		328		350		780	
Speed rating (rpm)	500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume (l)	0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 (peak) after detailed analysis of the application and of the pump working cycle

4 ELECTRICAL CHARACTERISTICS - for PVPC-CH

Insulation class	H
Connector protection degree	IP 65
Relative duty factor	100%
Supply voltage tolerance	± 10%

4.1 COIL VOLTAGE - only for CH version

Average values based ambient/coil temperature of 20°C.

External supply nominal voltage ±10%		Voltage code	Power consumption	Nominal current	Coil characteristics
DIRECT CURRENT	12 DC 24 DC	12DC 24DC	19,2 W	1,61 A 0,80 A	Insulation Class: H Protection degree: IP65
ALTERNATE CURRENT	24 / 50 / 60 AC 110 / 50 / 60 AC 220 / 50 / 60 AC	24/50/60AC 110/50/60AC 220/50/60AC	19,0 W	0,89 A 0,19 A 0,09 A	

4.2 ELECTRIC CONNECTORS ACCORDING TO DIN 43650 - to be ordered separately

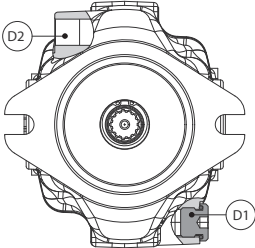
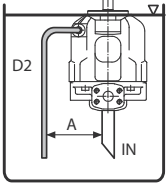
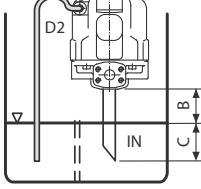
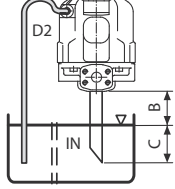
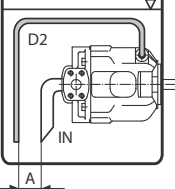
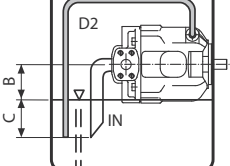
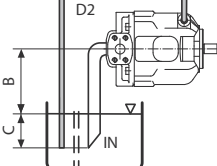
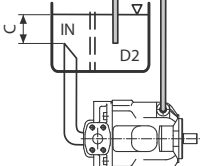
Code of connector	Function
SP-666	Connector IP-65
SP-667	Connector IP-65 but with built-in signal led

5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -25°C ÷ +80°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷35 mm ² /s - max allowed range: min 10 cSt (at 80°C) - max 1500 cSt at cold startup (-25°C)		
Max fluid contamination level	normal operation	ISO4406 class 20/18/13 NAS1638 class 9	see also filter section at
	longer life	ISO4406 class 18/16/11 NAS1638 class 7	www.atos.com or KTF catalog
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDR, HFDR (1)	ISO 12922
Flame resistant with water	NBR, HNBR	HFC (1)	

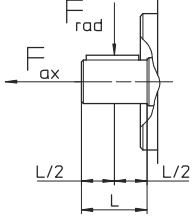
(1) Max working pressure must be reduced to: 180 bar (working) / 210 bar (peak) for HFC fluid
200 bar (working) / 240 bar (peak) for HFDR and HFDR fluid

6 INSTALLATION POSITION

 <p>The pump is supplied with drain D2 open, and D1 plugged. Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position. With exception of pump mounted below the oil level, we recommend to interpose a baffle plate between inlet and drain line.</p>		VERTICAL INSTALLATION		
		 <p>INSIDE THE TANK Minimum oil level equal or above the pump mounting surface. A ≥ 200mm</p>	 <p>INSIDE THE TANK Minimum oil level below the pump mounting surface. Minimum inlet pressure = 0,8 bar absolute B ≤ 800mm, C = 200mm</p>	 <p>OUTSIDE THE TANK, above oil level Minimum inlet pressure = 0,8 bar absolute B ≤ 800mm, C = 200mm</p>
HORIZONTAL INSTALLATION				
 <p>INSIDE THE TANK Minimum oil level equal or above the pump mounting surface. A ≥ 200mm</p>	 <p>INSIDE THE TANK Minimum oil level below the pump mounting surface. Minimum inlet pressure = 0,8 bar (absolute) B ≤ 800mm, C = 200mm</p>	 <p>OUTSIDE THE TANK, above oil level Minimum inlet pressure = 0,8 bar (absolute) B ≤ 800mm, C = 200mm</p>	 <p>OUTSIDE THE TANK, below oil level C = 200mm</p>	

IN: inlet line - **D1:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

7 MAX PERMISSIBLE LOAD ON DRIVE SHAFT

PVPC size		3029	4046	5073	5090	6140
F _{ax} = axial load		N	1000	1500	2000	2000
F _{rad} = radial load		N	1500	1500	3000	3000

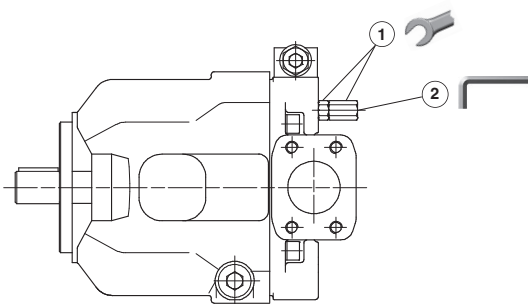
Notes: For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with option /PE is 190 bar.
Max speed with options /PE and for water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

8 VARIATION OF MAX SPEED VS INLET PRESSURE

Inlet pressure	Displacement %						% variation of the max. speed
	bar abs.	65	70	80	90	100	
0,8	120	115	105	97	90		
0,9	120	120	110	103	95		
1,0	120	120	115	107	100		
1,2	120	120	120	113	106		
1,4	120	120	120	120	112		
1,6	120	120	120	120	117		
2,0	120	120	120	120	120		

Example
Displacement: 80% - Inlet pressure: 1,0 bar - Speed: 115%

9 MAX DISPLACEMENT SETTING



① Locking displacement limiter screw

② Displacement setting

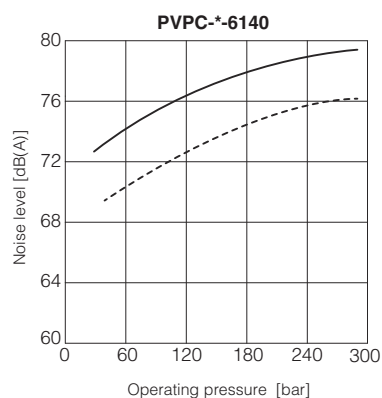
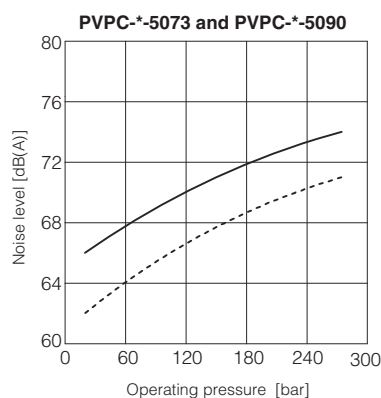
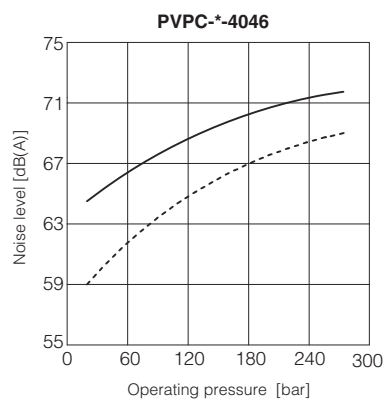
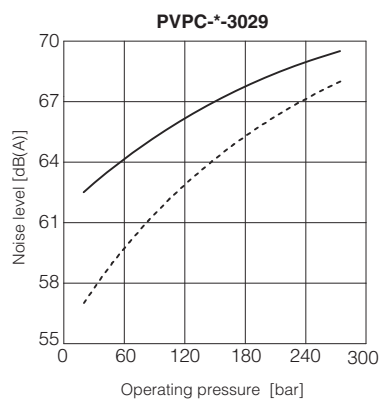
PVPC size		3029	4046	5073	5090	6140
Max displacement setting range	from ÷ to	20,1 ÷ 28,7	31,8 ÷ 45,4	36,8 ÷ 73,6	44,0 ÷ 87,9	70 ÷ 140
One turn of screw changes pump displacement by approximately	cm ³ /rev	1,5	2,2	3,2	3,2	6,0
For locking displacement limiter screw	 mm	14	14	17	17	19
For displacement setting	 mm	4	4	5	5	6
Tightening torque	Nm	15 ± 1	15 ± 1	15 ± 1	15 ± 1	20 ± 1

10 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

10.1 Noise level curves

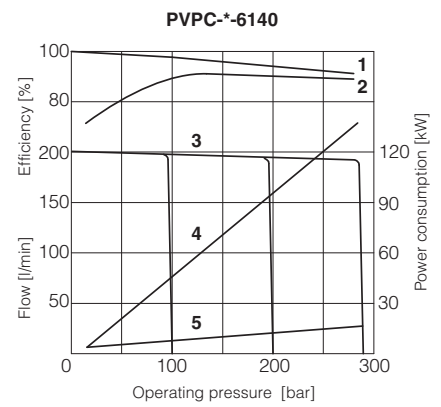
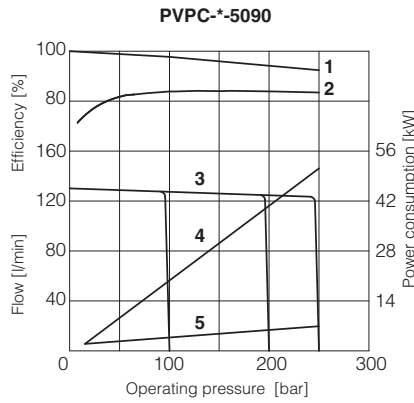
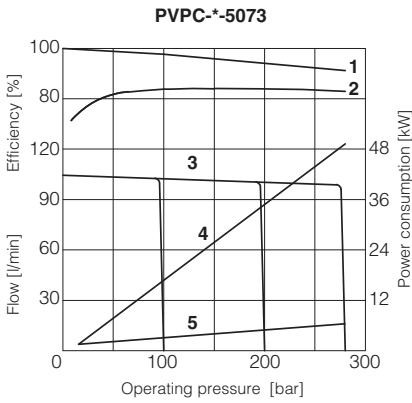
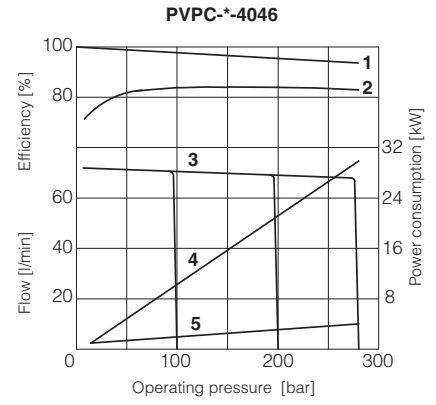
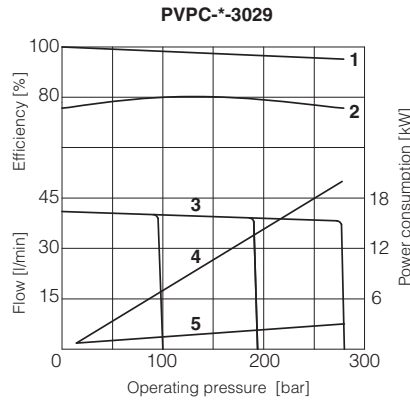
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

— = Qmax - - - - = Qmin



10.2 Operating limits

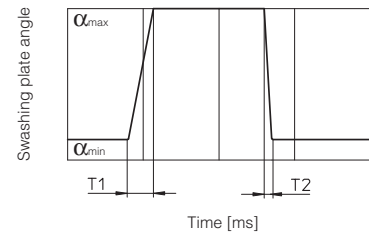
- 1 = Volumetric efficiency
- 2 = Overall efficiency
- 3 = Flow versus pressure curve
- 4 = Power consumption with full flow
- 5 = Power consumption at null flow

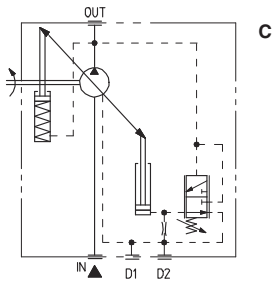


10.3 Response times

Response times and pressure peak due to variation 0% to 100% and 100% to 0% of the pump displacement, obtained with an instantaneously opening and shut-off of the delivery line.

Pump type	T1 (ms)	T2 (ms)
PVPC-*-3029	140	36
PVPC-*-4046	140	42
PVPC-*-5073	160	44
PVPC-*-5090	160	44
PVPC-*-6140	220	150



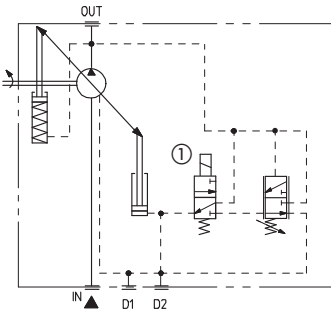
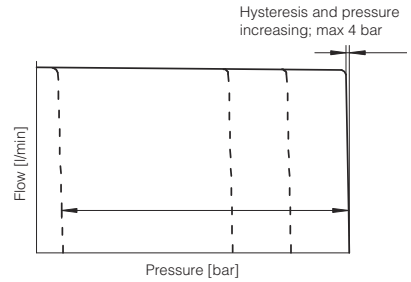


Manual pressure compensator

The pump displacement is zeroed when the line pressure approaches the setting pressure of the compensator.

Compensator setting range:
 20 ÷ 280 bar for 3029, 4046, 5073, 6140
 20 ÷ 250 bar for 5090

Compensator standard setting:
 280 bar for 3029, 4046, 5073, 6140
 250 bar for 5090



CH

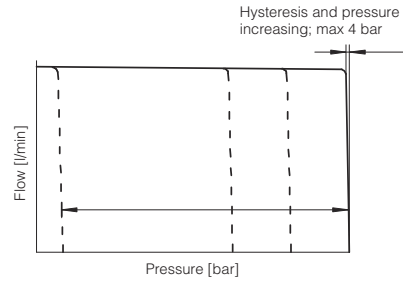
Manual pressure compensator with venting

As C plus venting function, when a long unloading time is required and heat generation and noise have to be kept at lowest level.

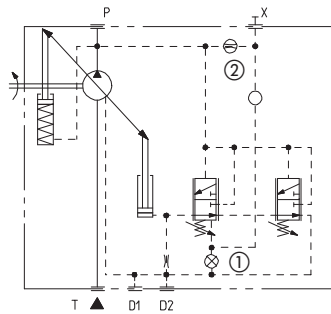
Venting valve solenoid voltage, see section 4
 Venting valve OFF = null displacement
 Venting valve ON = max displacement

Compensator setting range:
 20 ÷ 280 bar for 3029, 4046, 5073
 20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
 280 bar for 3029, 4046, 5073
 250 bar for 5090, 6140



① solenoid venting valve



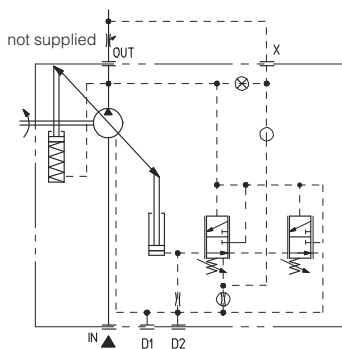
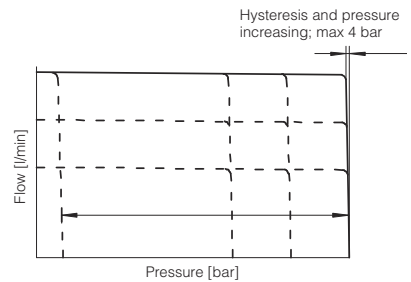
R

Remote pressure compensator

As C, but predisposed with X piloting port for connection of a remote pilot relief valve.

Compensator setting range:
 20 ÷ 280 bar for 3029, 4046, 5073
 20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
 280 bar for 3029, 4046, 5073
 250 bar for 5090, 6140



L

Load sensing

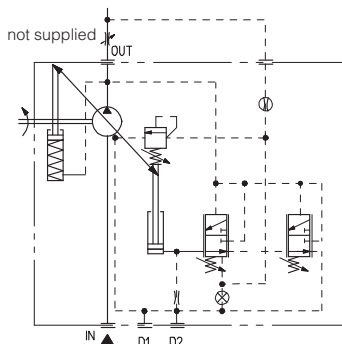
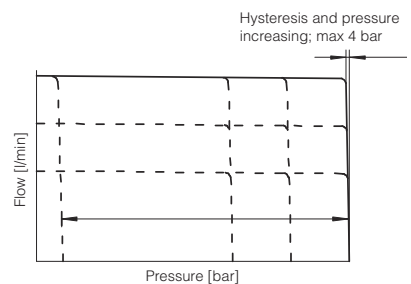
The pump displacement is automatically adjusted to maintain a constant (load independent) pressure drop across an external throttle. Changing the throttle regulation, the pump flow is consequently adjusted.

Load sensing control always incorporates an hydraulic compensator to limit the maximum pressure.

Compensator setting range:
 20 ÷ 280 bar for 3029, 4046, 5073
 20 ÷ 250 bar for 5090, 6140

Compensator standard setting:
 280 bar for 3029, 4046, 5073
 250 bar for 5090, 6140

Differential pressure setting range: 10 ÷ 40 bar
 Differential pressure standard setting: 14 bar

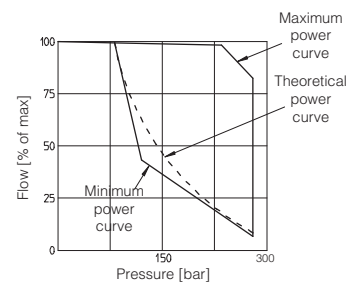


LW

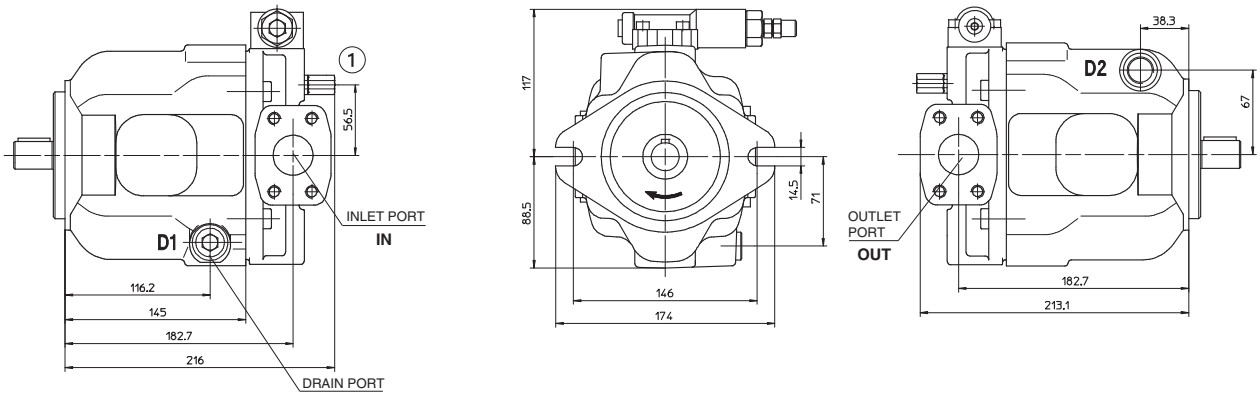
Constant power

In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.

For the best regulation, minimum working pressure is 80 bar.
 While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).



12 INSTALLATION DIMENSIONS OF PVPC-*-3029: BASIC VERSION "C" CONTROL



PORTS DIMENSION

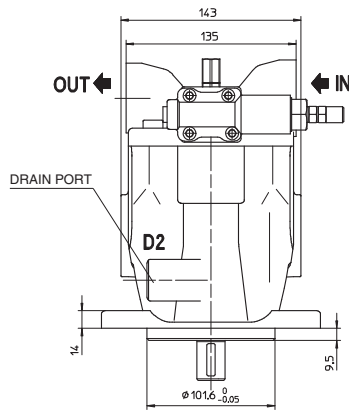
IN = Flange SAE 3000 1 1/4"

OUT = Flange SAE 6000 3/4"

D1, D2 = 1/2" BSPP

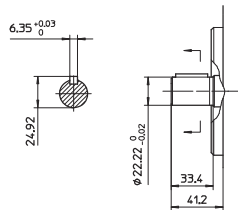
① = Screw for max displacement setting.

In case of double pumps, the screw is not available for version XB

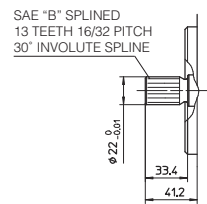


Mass [kg]	
PVPC-*-3029	18

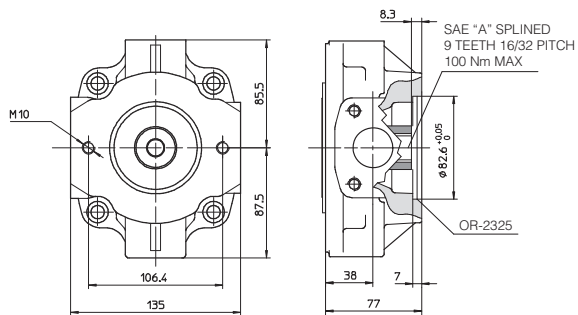
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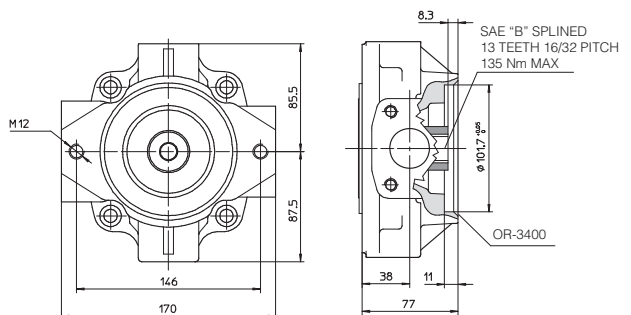
SHAFT TYPE "5"



CODE XA - INTERMEDIATE FLANGE SAE "A" FOR PFE-31

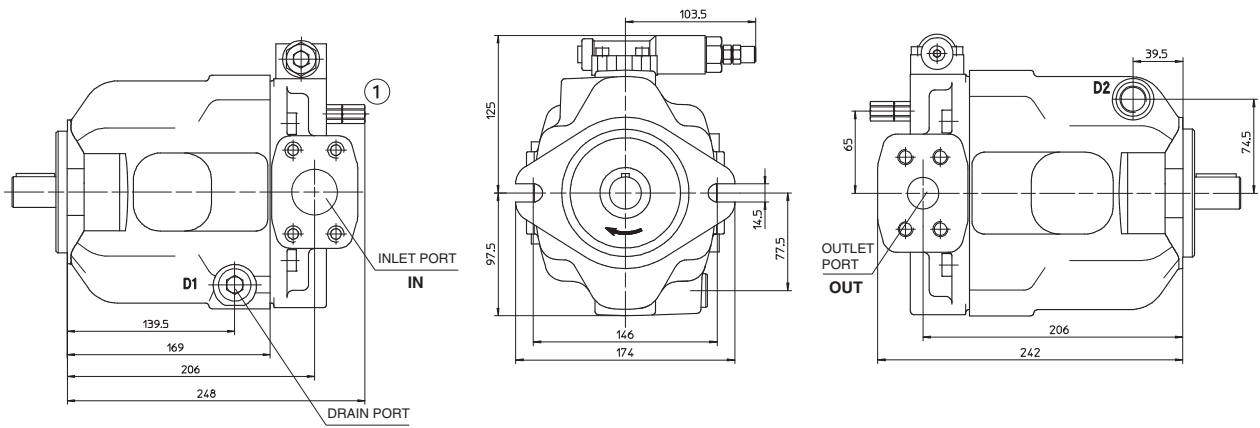


CODE XB - INTERMEDIATE FLANGE SAE "B" FOR PFE-41
screw for max displacement setting not available



Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

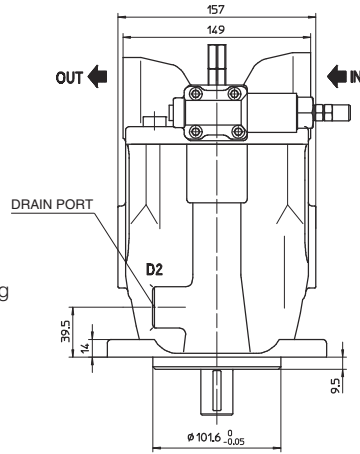
13 INSTALLATION DIMENSIONS OF PVPC-*-4046: BASIC VERSION "C" CONTROL



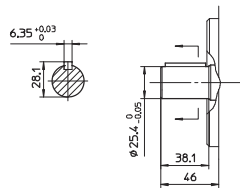
PORTS DIMENSION

- IN = Flange SAE 3000 1 1/2"
- OUT = Flange SAE 6000 1"
- D1, D2 = 1/2" BSPP
- ① = Screw for max displacement setting

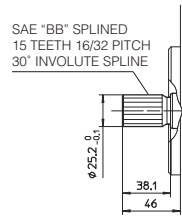
Mass [kg]	
PVPC-*-4046	24



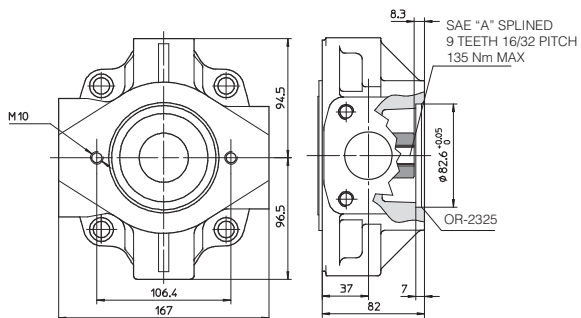
SHAFT TYPE "1"



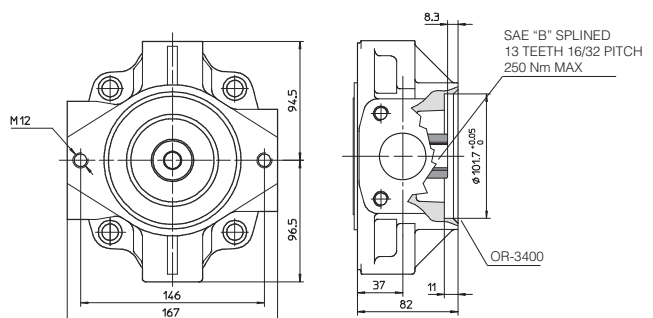
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CODE XA - INTERMEDIATE FLANGE SAE "A" FOR PFE-31

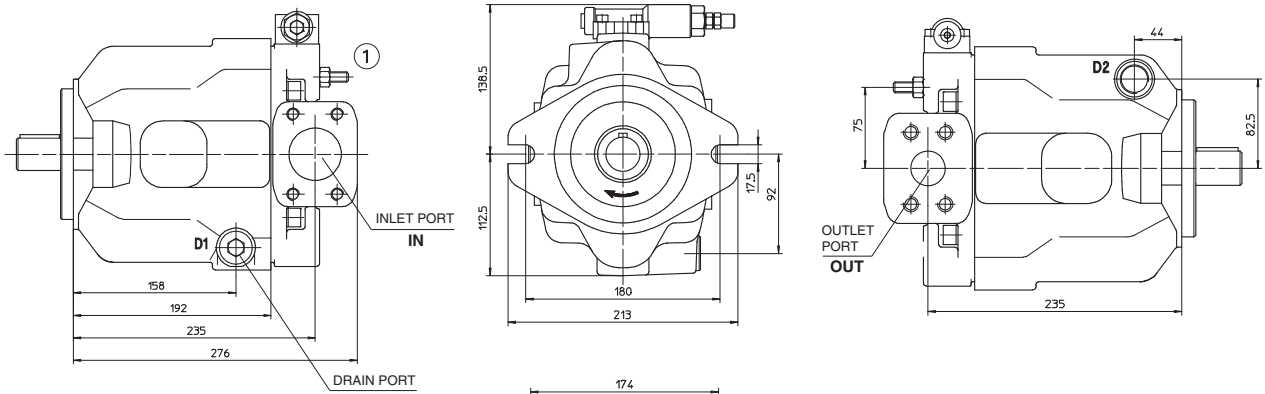


CODE XB - INTERMEDIATE FLANGE SAE "B" FOR PFE-41



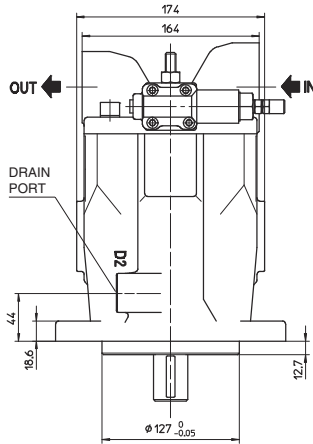
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

14 INSTALLATION DIMENSIONS OF PVPC-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL



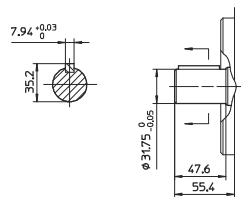
PORTS DIMENSION

IN = Flange SAE 3000 2"
 OUT = Flange SAE 6000 1 1/4"
 D1, D2 = 3/4" BSPP
 ① = Screw for max displacement setting.
 In case of double pump the screw is not available for version XC

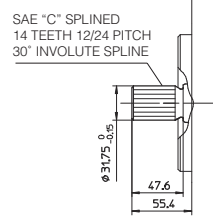


Mass [kg]	
PVPC-*-5073	33
PVPC-*-5090	

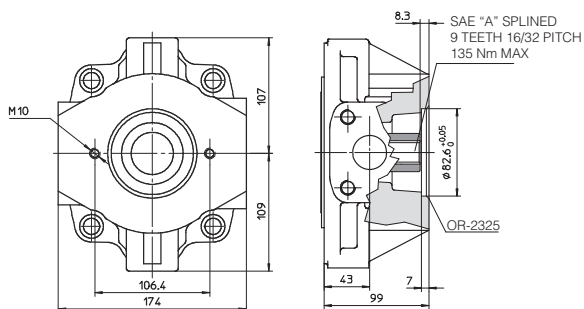
SHAFT TYPE "1"



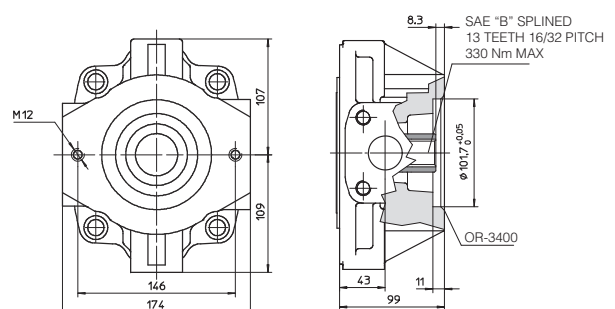
SHAFT TYPE "5"



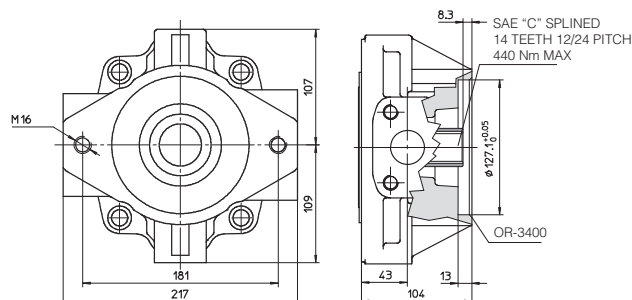
CODE XA - INTERMEDIATE FLANGE SAE "A" FOR PFE-31



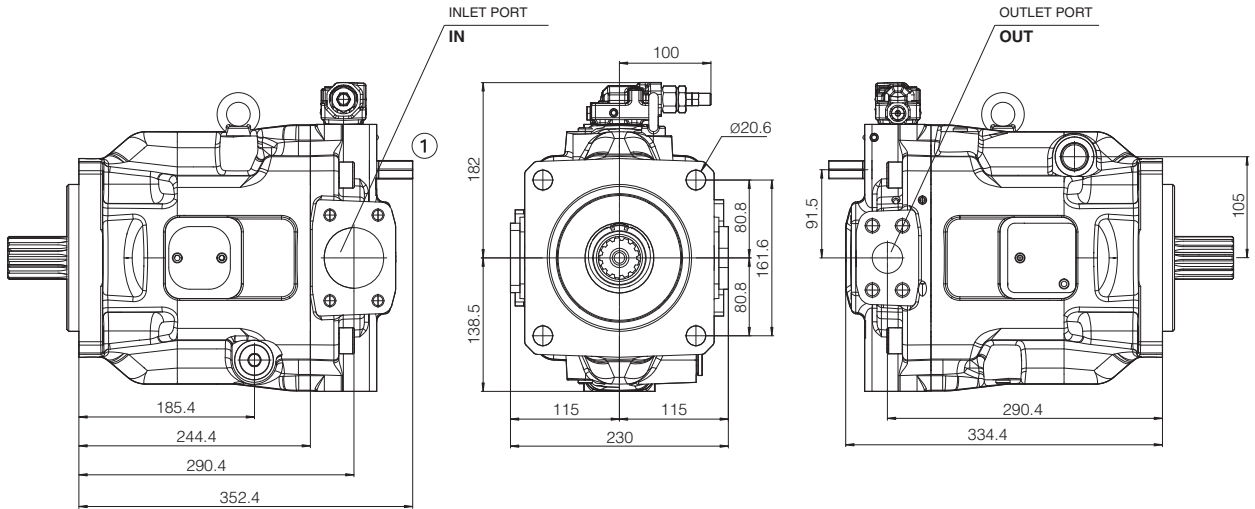
CODE XB - INTERMEDIATE FLANGE SAE "B" FOR PFE-41



CODE XC - INTERMEDIATE FLANGE SAE "C" FOR PFE-51



Drawing show pumps with clockwise rotation (option D); pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted



PORTS DIMENSION

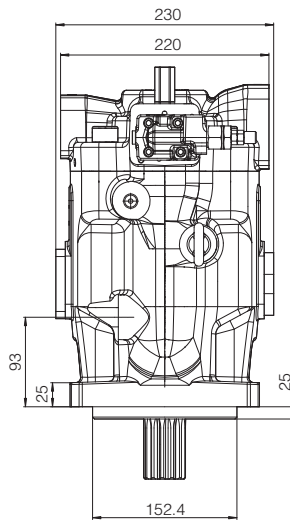
IN = Flange SAE 3000 2 1/2"

OUT = Flange SAE 6000 1 1/4"

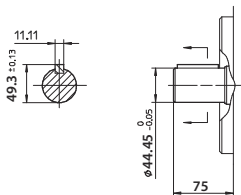
D1, D2= 3/4" BSPP

① = Regulation screw for max displacement setting.

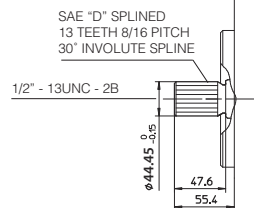
Mass [kg]	
PVPC-*-6140	69



SHAFT TYPE "1"

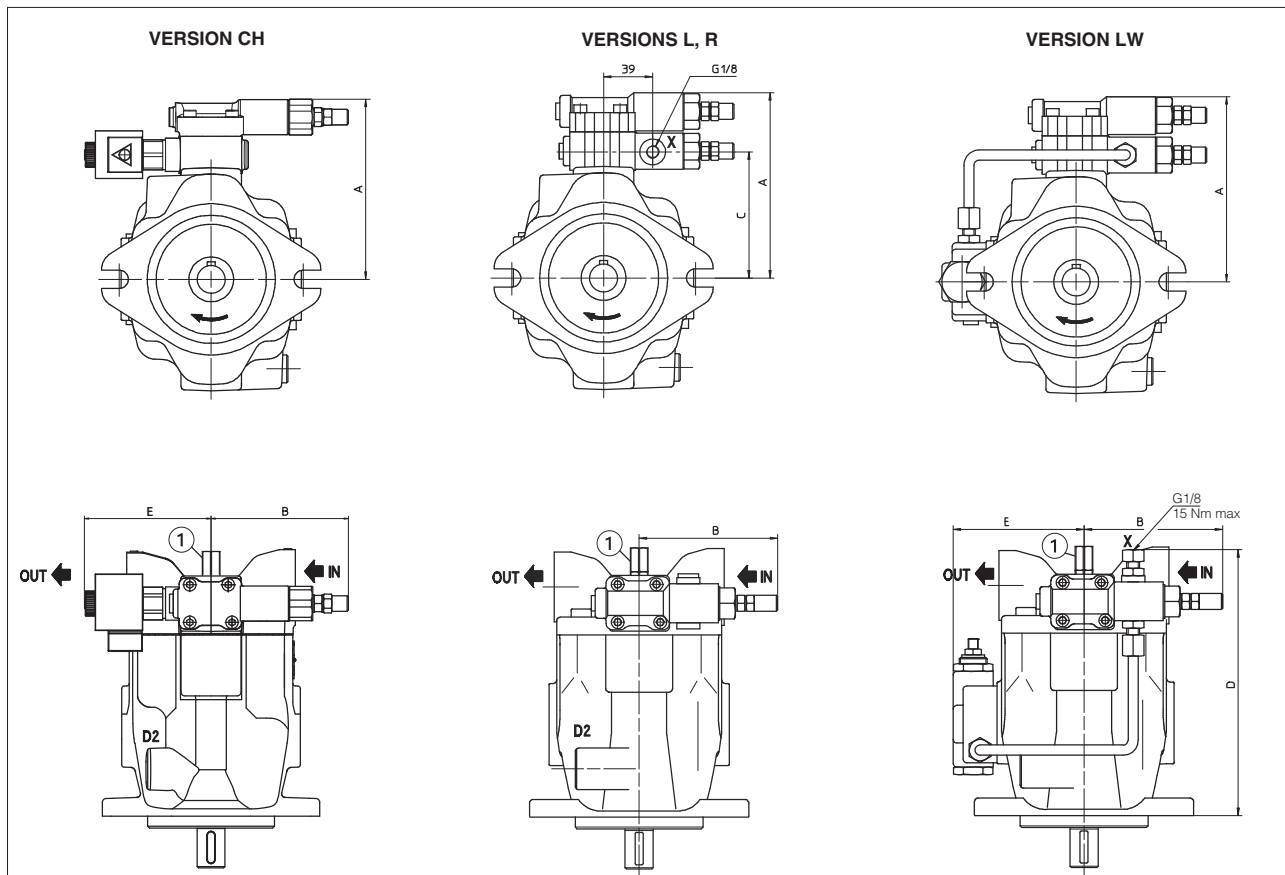


SHAFT TYPE "5"



16 INSTALLATION DIMENSIONS OF OTHER CONTROLS

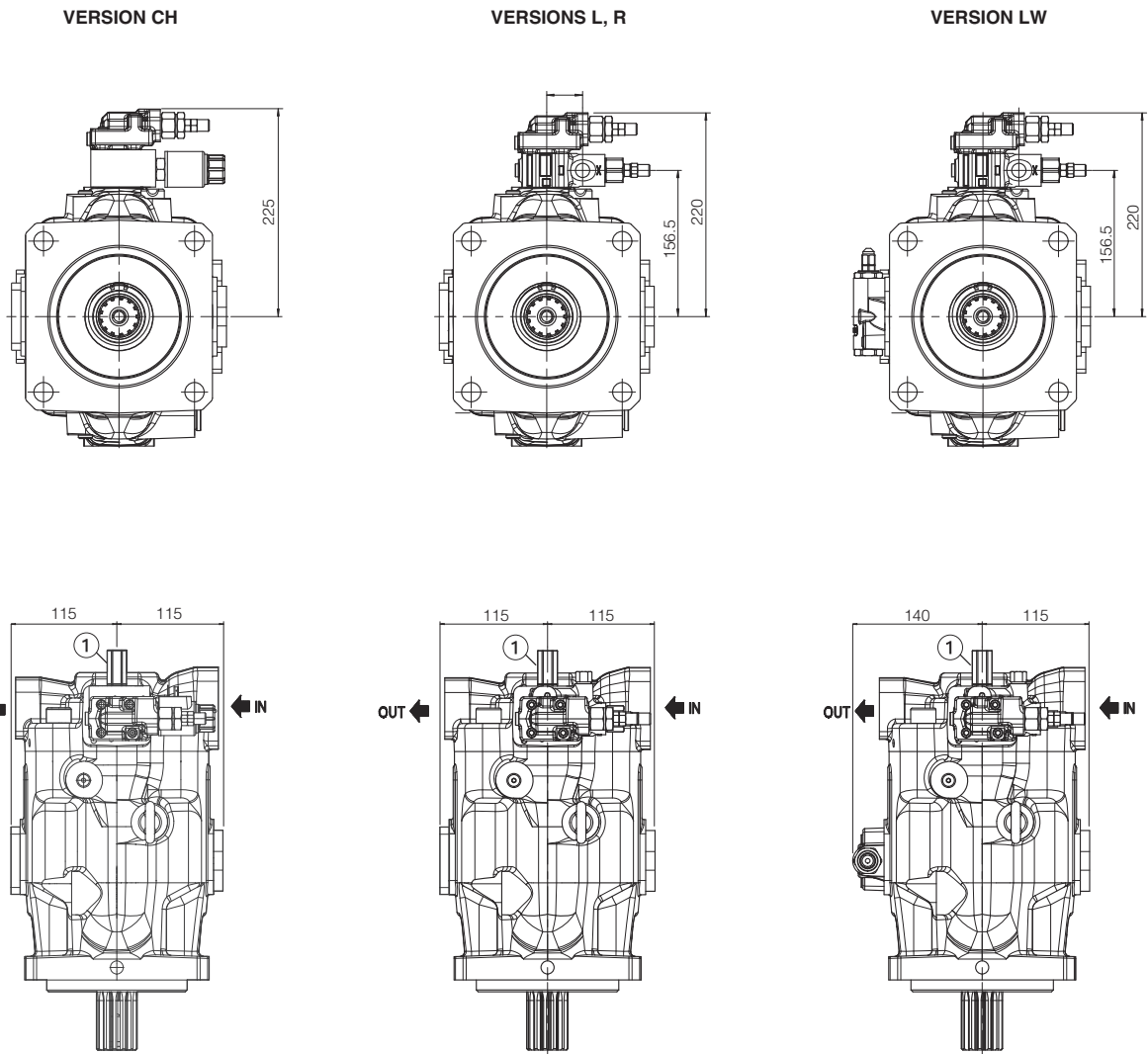
16.1 PVPC size 3, 4 and 5



① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
 In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

Pump type	Version	A	B	C	D	E	Mass (kg)
PVPC-*-3029	CH	144	111	-	-	102	22
	L-R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPC-*-4046	CH	153	111	-	-	102	28
	L-R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPC-*-5073 PVPC-*-5090	CH	166	111	-	-	102	36,9
	L-R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35



① = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement).
 In case of double pump the regulation screw is not always available, please contact our technical office.

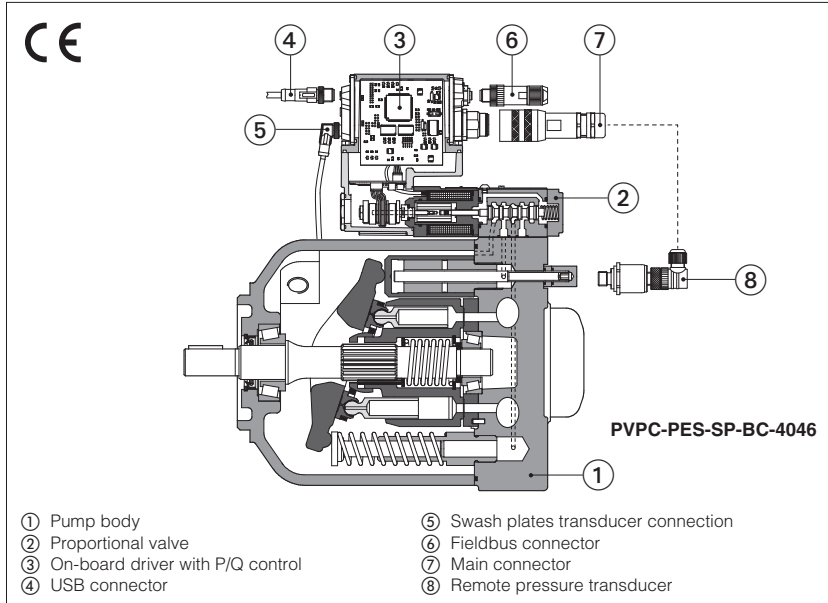
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and also the consequently position of the control groups

17 RELATED DOCUMENTATION

- A900** Operating and maintenance information for pumps
- K800** Electric and electronic connectors

Proportional controls for axial piston pumps

pressure, flow or P/Q controls



PVPC

Variable displacement axial piston pumps with swash plate design suited for high pressure open circuits, they are provided with advanced electrohydraulic proportional controls:

- **CZ** open loop pressure control
- **LQZ** open loop flow control (load sensing)
- **PES** closed loop P/Q control

PES performs alternate closed loop controls of pressure, flow and max power limitation. It is also available with optional sequence module (PERS versions) that allows to reduce close to zero the pressure to the delivery line. SAE J744 mounting flange and shaft.

Max displacement (cm ³ /rev)	Max pressure working (bar)	Max pressure peak (bar)
29, 46, 73, 140	280	350
88	250	315

For technical characteristics and features, see tech table A160.

1 MODEL CODE

PVPC	X2E	- PERS-SP	- BC	- 4046	/ * / 1	D / *	* / *	* / *
<p>Variable displacement axial piston pump</p> <p>Option for pumps with through shaft (1): XA = intermediate flange SAE A XB = intermediate flange SAE B XC = intermediate flange SAE C (only for size 5073 and 5090)</p> <p>Additional suffix for double pumps: X2E = with a fixed displacement pump type PFE (see tech table A005)</p> <p>Type of control, see section [10] and [11]: CZ = proportional pressure control (1) LQZ = proportional flow control (load sensing) (1) PES-SP = closed loop integral digital P/Q driver PERS-SP = as PES plus sequence module</p> <p>Fieldbus interfaces, USB port always present (2): NP = Not present BC = CANopen EW = POWERLINK BP = PROFIBUS DP EI = EtherNet/IP EH = EtherCAT EP = PROFINET RT/IRT</p> <p>Size and max displacement (3): 3029 = size 3 - displacement 029 cm³/rev 4046 = size 4 - displacement 046 cm³/rev 5073 = size 5 - displacement 073 cm³/rev 5090 = size 5 - displacement 090 cm³/rev 6140 = size 6 - displacement 140 cm³/rev</p> <p>Pressure setting, only for PERS: 200 = 200 bar 250 = 250 bar 280 = 280 bar</p>	<p style="text-align: center;">Seals material, see section [9]: - = NBR PE = FKM</p> <p style="text-align: center;">Series number</p> <p>Coil voltage, for CZ, LQZ - see section [15]: 18 = optional coil for low current drivers</p> <p>Electronics options, for PES and PERS (4): C = current feedback for pressure transducer 4±20 mA (omit for std voltage ±10Vdc) I = current reference input and monitor 4±20 mA (omit for std voltage ±10Vdc) X = on-board pressure transducer with pre-configured pressure settings (only for PERS) S = with 2 on-off inputs for multiple pressure PID selection for NP execution or double power supply for fieldbus execution, plus dedicated connector for remote pressure transducer</p> <p>Direction of rotation, viewed at the shaft end: D = clockwise S = counterclockwise</p> <p>Shaft, SAE Standard (5): 1 = keyed 5 = splined</p>							

(1) Not available for PVPC-*6140
 (2) Only for PES and PERS
 (3) Optional intermediate displacements 35 and 53 cm³/rev are available on request
 (4) For possible combined options, see section [14]
 (5) Pumps with ISO 3019/2 mounting flange and shaft (option /M) are available on request

2 OFF-BOARD ELECTRONIC DRIVERS - only for CZ, LQZ

Drivers model	E-MI-AC-01F		E-MI-AS-IR		E-BM-AS-PS		E-BM-AES
Type	Analog				Digital		
Voltage supply (VDC)	12	24	12	24	12	24	24
Valve coil option	/6	std	/6	std	/6	std	std
Format	plug-in to solenoid				DIN-rail panel		
Data sheet	G010		G020		G030		GS050

3 GENERAL NOTES

Atos digital proportionals pumps are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FS900** and in the user manuals included in the E-SW-* programming software.

4 PUMP SETTINGS AND PROGRAMMING TOOLS

Pump's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **FS900**). For fieldbus versions, the software permits pump's parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

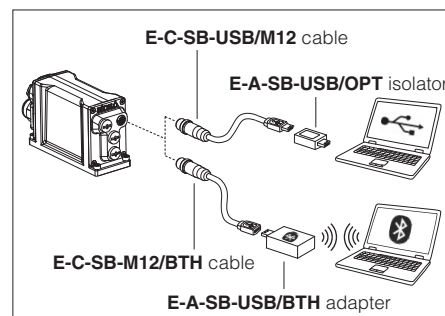
The software is available in different versions according to the driver's options (see table **GS500**):

E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
 EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-*/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

WARNING: drivers USB port is not isolated! For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection

WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

USB or Bluetooth connection



5 FIELDBUS - see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

6 GENERAL CHARACTERISTICS

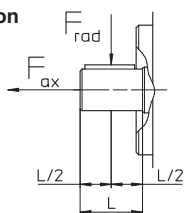
Assembly position	Any position. The drain port must be on the top of the pump. Drain line must be separated and unrestricted to the reservoir and extended below the oil level as far from the inlet as possible. Suggested maximum line length is 3 m.
Subplate surface finishing to ISO 4401	Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	CZ,LQZ: Standard = -25°C ÷ +60°C / PE option = -15°C ÷ +80°C PES, PERS: Standard = -20°C ÷ +60°C / PE option = -20°C ÷ +60°C
Storage temperature range	CZ,LQZ: Standard = -20°C ÷ +80°C / PE option = -20°C ÷ +80°C PES, PERS: Standard = -20°C ÷ +70°C / PE option = -20°C ÷ +70°C
Surface protection (pump body)	Black painting RAL 9005
Surface protection (pilot valve)	Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES)
Corrosion resistance (pilot valve)	Salt spray test (EN ISO 9227) > 200 h
Compliance (proportional pilot valve)	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

PVPC size		3029		4046		5073		5090		6140	
Max displacement (cm ³ /rev)		29		46		73		88		140	
Theoretical max flow at 1450 rpm (l/min)		42		66,7		105,8		127,6		203	
Max working pressure / Peak (bar)		280/350		280/350		280/350		250/315		280/350 (1)	
Min/Max inlet pressure (bar abs.)		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25		0,8 / 25	
Max pressure on drain port (bar abs.)		1,5		1,5		1,5		1,5		1,5	
Power consumption at 1450 rpm and at max pressure and displacement (Kw)		19,9		31,6		50,1		54,1		122	
Max torque on the first shaft (Nm)		Type 1 210	Type 5 270	Type 1 350	Type 5 440	Type 1 670	Type 5 810	Type 1 670	Type 5 810	Type 1 1000	Type 5 2340
Max torque at max working pressure (Nm)		128		203		328		350		780	
Speed rating (rpm)		500 ÷ 3000		500 ÷ 2600		500 ÷ 2600		500 ÷ 2200		500 ÷ 2200	
Body volume (l)		0,7		0,9		1,5		1,5		2,8	

(1) The maximum pressure can be increased to 350 bar (working) and 420 (peak) after detailed analysis of the application and of the pump working cycle

External load position



F_{ax} = axial load
F_{rad} = radial load

Notes:

For speeds over 1800 rpm the inlet port must be under oil level with adequate pipes.
Maximum pressure for all models with water glycol fluid is 160 bar, with /PE options is 190 bar.
Max speed with /PE options and water glycol fluid is 2000/1900/1600/1500 rpm respectively for the four sizes.

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	CZ, LQZ = 35 Watt; PES, PERS = 50 Watt			
Max. solenoid current	2,6 A for standard 12 Vdc coil; 1,5 A for standard 18 Vdc coil (only for CZ, LQZ)			
Coil resistance R at 20°C	Size 3: 3 ÷ 3,3 Ω for standard 12 Vdc coil; 13 ÷ 13,4 Ω for 18 Vdc coil (only for version CZ, LQZ)			
	Size 4, 5: 3,8 ÷ 4,1 Ω for standard 12 Vdc coil; 12 ÷ 12,5 Ω for 18 Vdc coil (only for version CZ, LQZ)			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATR-8 see tech table GS465)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	CZ, LQZ = IP65; PES, PERS = IP66/67 with mating connector			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section 20			

Note: a maximum time of 800 ms (depending on communication type) have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

9 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	20 ÷ 100 mm ² /s - max allowed range 15 ÷ 380 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 NAS1638 class 7	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR (1)	ISO 12922
Flame resistant with water	NBR, HNBR	HFC (1)	

(1) Max working pressure must be reduced to: 180 bar (working) / 210 bar (peak) for HFC fluid
200 bar (working) / 240 bar (peak) for HFDU and HFDR fluid

10 OPEN LOOP ELECTROHYDRAULIC CONTROLS

CZ

Proportional pressure control

Open loop control of the pump max pressure. The pump displacement, and thus the flow, remains constant as far as the pressure in the circuit reaches the value set on the proportional pilot valve (1), then the flow is reduced to maintain the circuit pressure to the value set by the electronic reference signal to the proportional valve. In this conditions the pressure in the circuit can be continuously modulated by means of the reference signal. Proportional pressure setting range: see below pressure control diagram. Compensator setting range (2): 20 ÷ 350 bar (315 bar for 090). Compensator factory setting (2): 280 bar (250 bar for 090).

Hysteresis and pressure increase: max 4 bar

LQZ

Proportional flow (load-sensing)

Open loop control of the pump flow independent to the circuit load. The pump displacement is self adjusted to maintain a constant pressure drop across the proportional flow control valve (1). The pump flow can be continuously regulated by modulating the proportional valve (1).

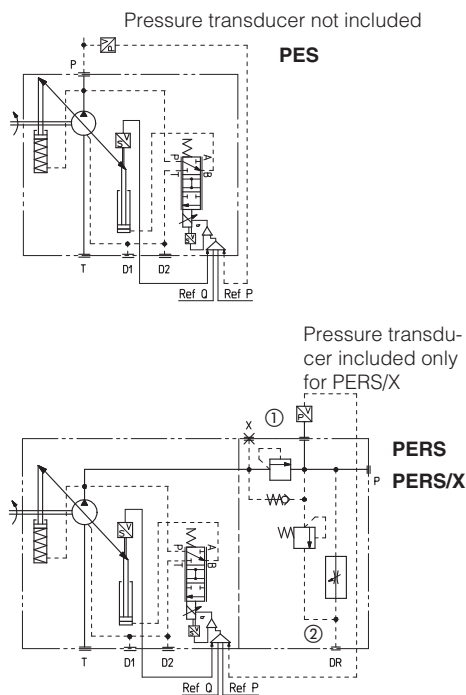
Diagrams for CZ, LQZ

Regulation diagrams
1 = Flow control
2 = Pressure control

(1) for standard 12 Vdc coil
 (2) for 18 Vdc coil

Pump size
88 73 46 29 cm³/rev

11 P/Q CONTROL



P/Q control integrates the alternate pressure and flow regulation with the electronic max power limitation.

A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the pump on-board digital driver.

Flow control is active when the actual system pressure is lower than the pressure reference input signal: the pump flow is regulated according to the flow reference input. Pressure control is activated when the actual pressure grows up to the pressure reference input signal: the pump flow is then reduced in order to regulate and limit the max system pressure (if the pressure tends to decrease under its command value, the flow control returns active). This option allows to realize accurate dynamic pressure profiles.

Following fieldbus interfaces are available:

- BC - CANopen interface
- BP - PROFIBUS DP interface
- EH - EtherCAT interface
- EW - POWRELINK interface
- EI - EtherNet/IP interface
- EP - PROFINET RT/IRT interface

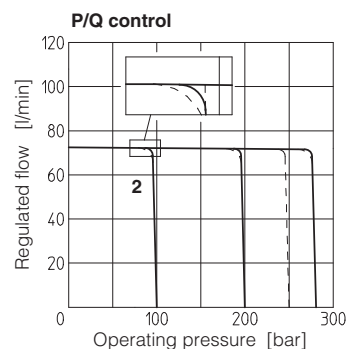
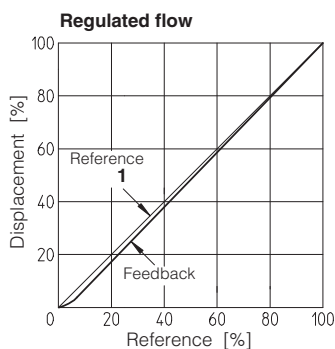
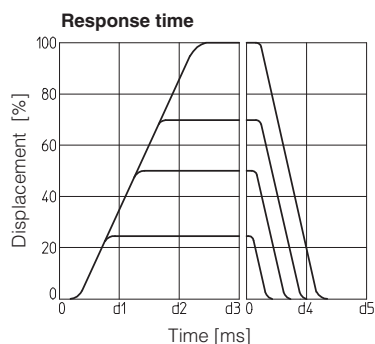
The pumps with BC, BP, EH, EW, EI and EP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.

The digital control ensures high performances as flow and pressure linearity (see diagram 1), better flow knee (see diagram 2), internal leakage compensation (controlled flow independent to the load variations).

PVPC-PES basic version, without sequence module and without pressure transducer, which has to be installed on the main line and wired to the 12 poles connector of the pump on-board digital driver.

PVPC-PERS version with sequence module RESC ② which grant a minimum piloting pressure (18 bar) when the actual pressure falls below that value. Without pressure transducer.

PVPC-PERS/X as PERS version plus integral pressure transducer, with output signal 4÷20 mA, factory wired to the pump on-board digital driver through a cable gland.



Type pump	d1	d2	d3	d4	d5
	[ms]				
PVPC-PE(R)S-3029	30	60	90	30	60
PVPC-PE(R)S-4046	40	80	120	40	80
PVPC-PE(R)S-5073	50	100	150	50	100
PVPC-PE(R)S-5090	60	120	170	60	120
PVPC-PE(R)S-6140	90	180	200	90	180

Response time of displacement variation for a step change of the electronic reference signal.

12 PRESSURE TRANSDUCER SELECTION

The pressure transducer type E-ATR-8 must be ordered separately (see tech table **GS465**)
For /X option the pressure transducer with output signal 4 ÷ 20 mA is on-board to the pump.

Pump code:

PVPC-PE(R)S-*/200
PVPC-PE(R)S-*/250
PVPC-PE(R)S-*/280
PVPC-PE(R)S-*/200*/C
PVPC-PE(R)S-*/250*/C
PVPC-PE(R)S-*/280*/C

Pressure transducer code:

E-ATR-8/250
E-ATR-8/400
E-ATR-8/400
E-ATR-8/250/I
E-ATR-8/400/I
E-ATR-8/400/I

13 ELECTRONICS OPTIONS - only for PES and PERS

- I** = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 Vdc.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
- C** = This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
- X** = This option providing the presence of the pressure transducer, with output signal 4÷20 mA, integral to the pump and factory wired to the PES electronics through a cable gland (see 16.10).
- S** = Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver (see 16.11).

14 POSSIBLE COMBINED OPTIONS

for PES :	for PERS :
/CI, /CS, /IS, /CIS	/CI, /CS, /IS, /IX, /SX, /CIS, /ISX

15 COIL VOLTAGE OPTION - only for CZ and LQZ

- 18** = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

16 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for PES and PERS

Generic electrical output signals of the pump (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

16.1 Power supply (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 16.2.



A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

16.2 Power supply for driver's logic and communication (VL+ and VL0) - only for /S and /SX options for fieldbus executions

The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.



A safety fuse is required in series to each driver's logic and communication power supply: 500 mA fast fuse.

16.3 Flow reference input signal (Q_INPUT+)

Functionality of Q_INPUT+ signal, is used as reference for the pump's flow.

Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.4 Pressure reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal, is used as reference for the driver pressure closed loop.

Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.

Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

Drivers with fieldbus interface can be software set to receive reference signal directly by the machine control unit (fieldbus reference).

Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

16.5 Flow monitor output signal (Q_MONITOR)

The driver generates an analog output signal proportional to the actual pump swashplate position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).

Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.6 Pressure monitor output signal (P_MONITOR)

The driver generates an analog output signal proportional to alternated pressure/force control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).

Monitor output signal is factory preset according to selected pump code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.

Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

16.7 Enable input signal (ENABLE) - only for /S and /SX options

To enable the driver, supply a 24 VDC on pin 3 (pin C): Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

Enable input signal can be used as generic digital input by software selection.

16.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 ÷ 20 mA input, spool position transducer cable broken, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.

Fault status is not affected by the Enable input signal. Fault output signal can be used as digital output by software selection.

16.9 Pressure transducer input signal

Analog pressure transducers can be directly connected to the driver.

Analog input signal is factory preset according to selected pump code, defaults are ±10 Vdc for standard and 4 ÷ 20 mA for /C option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vdc or ± 20 mA. Refer to the pump technical table to transducer characteristics to select the transducer's maximum pressure.

Standard:

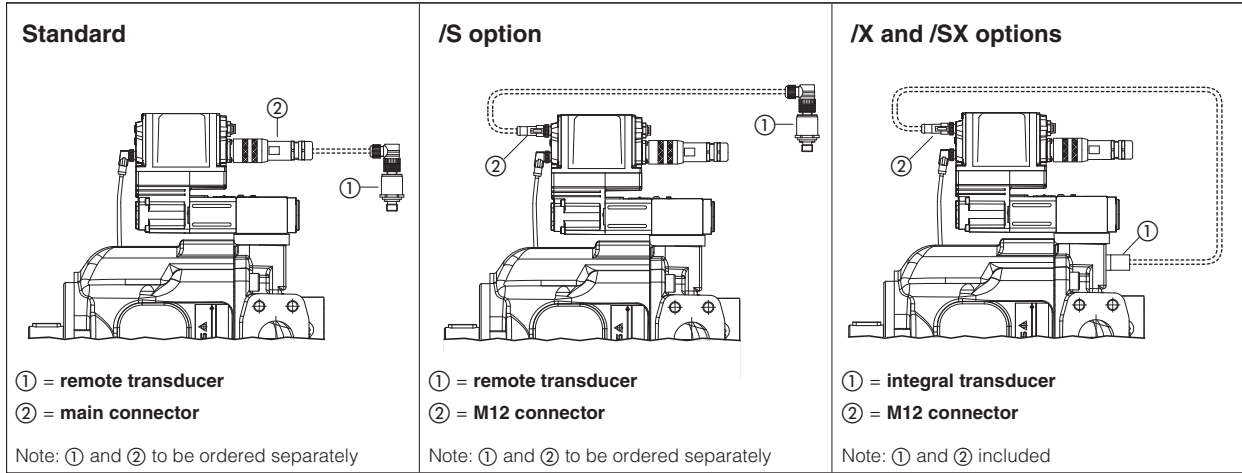
Remote pressure transducer can be directly connected to the main connector on the driver (see 17.1)

/S option

Remote pressure transducer can be directly connected to a dedicated M12 connector (see 17.4)

/X and /SX options

Integral-to-pump transducer is directly connected with a dedicated M12 connector and no remote transducer is required; current input signal (4 ÷ 20 mA) of the integral transducer allows cable break detection functionality



16.10 Logic Input Signal (D_IN) - only for standard and standard with /X option

D_IN on-off input signal can be software set to perform one of the following functions:

- enable and disable the driver functioning; apply 0 Vdc to disable and 24 Vdc to enable the driver - see 16.7
- switch between two pressure PID settings; apply 0 Vdc to select SET1 pressure PID and 24 Vdc to select SET2 - see 16.11
- enable and disable the power limitation function; default setting, apply 0V to disable and 24Vdc to enable the power limitation - see 16.13

16.11 Multiple PID selection (D_IN0 and D_IN1) - only for /S and /SX options in NP execution

Two on-off input signals are available on the main connector to select one of the four pressure PID parameters setting, stored into the driver.

Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

Supply a 24 Vdc or a 0 Vdc on pin 9 and/or pin 10, to select one of the PID settings as indicated by binary code table at side. Gray code can be selected by software.

PIN	PID SET SELECTION			
	SET 1	SET 2	SET 3	SET 4
9	0	24 Vdc	0	24 Vdc
10	0	0	24 Vdc	24 Vdc

16.12 Multiple pressure PID (1)

Four sets for pressure PID parameters are stored into the driver: switching in real-time the active pressure PID parameters during machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

The available commands to switch these PID pressure sets depend on the driver execution:

Fieldbus	Driver	Commands
NP	Standard and Standard with /X option	1 on-off input on main connector allow to switch the 2 PID parameters (SET1 and SET2, see 4.10)
	/S and /SX options	2 on-off inputs allow to switch the 4 PID parameters set (SET1.. SET4 - see 4.11)
BC, BP, EH, EW, EI, EP	All versions	real-time fieldbus communication can switch between the 4 PID parameters set (SET1 - SET4 - see driver manuals)

16.13 Hydraulic Power Limitation (1)

A limit to the maximum pump's hydraulic power can be software set into the driver thus limiting the electric power consumption of the motor coupled to the pump: when the actual requested hydraulic power $p \times Q$ (pressure transducer feedback x flow reference value) reaches the max power limit ($p_1 \times Q_1$), the driver automatically reduces the flow pump regulation.

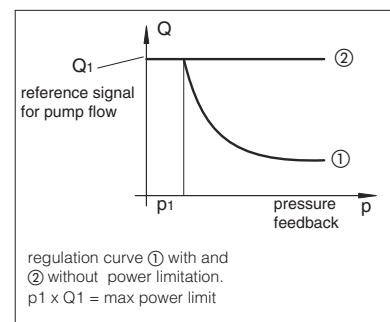
The higher is the pressure feedback the lower is the pumps's regulated flow:

$$\text{Flow regulation} = \text{Min} \left(\frac{\text{PowerLimit [kW]}}{\text{Pressure Feedback [bar]} \times \frac{1}{\text{Flow Full Scale [l/min]}}}; \text{Flow Reference} \right)$$

The hydraulic power limitation, disabled as default, can be enabled using the Atos pc software or the fieldbus communication (fieldbus executions).

Standard and standard with /X option allow also to enable and disable this function during the machine cycle, using the D_IN on-off input available on the main connector (see 16.11).

16.12 - Hydraulic Power Limitation



(1) The sections 16.12 and 16.13 are a brief description of the settings and features of digital drivers with alternated P/Q control. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

E-MAN-RI-PES - user manual for **PES-S** digital drivers

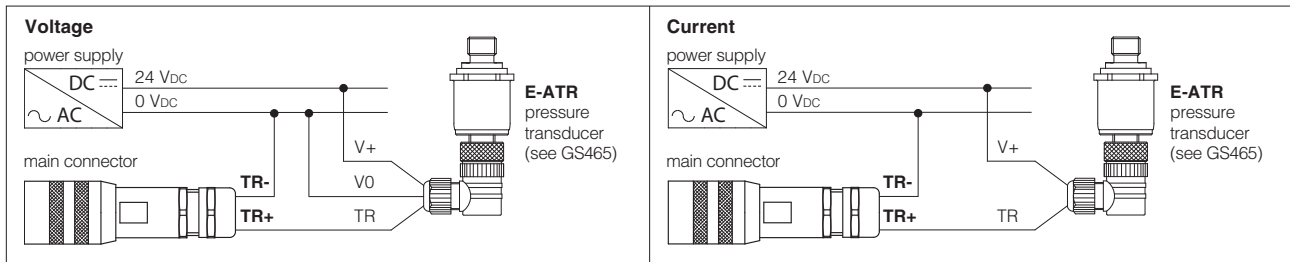
17 ELECTRONIC CONNECTIONS

17.1 Main connector signals - 12 pin (A) Standard and Standard with /X option - for PES and PERS

PIN	Standard	/X	TECHNICAL SPECIFICATIONS	NOTES
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	FAULT		Fault (0 Vdc) or normal working (24 Vdc), referred to V0	Output - on/off signal
4	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Gnd - analog signal
5	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
6	Q_MONITOR		Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option. Referred to V0	Output - analog signal Software selectable
7	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
8	P_MONITOR		Pressure monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option. Referred to V0	Output - analog signal Software selectable
9	D_IN		Function software selectable between: power limitation enable (default), multiple pressure PID selection or pump enable (24 Vdc) / disable (0 Vdc). Referred to V0	Input - on/off signal
10	TR+		Remote pressure transducer input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /C option	Input - analog signal Software selectable
		NC	Do not connect	
11	TR-		Negative pressure transducer input signal for TR+	Input - analog signal
		NC	Do not connect	
PE	EARTH		Internally connected to driver housing	

Note: these connections are the same of Rexroth A10VSO axial piston pumps, model SYDFEE and SYDFEC

Remote pressure transducer connections - only for Standard



17.2 Main connector signals - 12 pin (A) /S and /SX option - for PES and PERS

PIN	/S and /SX		TECHNICAL SPECIFICATIONS	NOTES
	NP	Fieldbus		
1	V+		Power supply 24 Vdc	Input - power supply
2	V0		Power supply 0 Vdc	Gnd - power supply
3	ENABLE referred to: V0	VL0	Enable (24 Vdc) or disable (0 Vdc) the pump	Input - on/off signal
4	Q_INPUT+		Flow reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
5	INPUT-		Negative reference input signal for Q_INPUT+ and P_INPUT+	Input - analog signal
6	Q_MONITOR referred to: V0	VL0	Flow monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
7	P_INPUT+		Pressure reference input signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Input - analog signal Software selectable
8	P_MONITOR referred to: V0	VL0	Pressure monitor output signal: ± 10 Vdc / ± 20 mA maximum range Defaults are $0 \div +10$ Vdc for standard and $4 \div 20$ mA for /I option	Output - analog signal Software selectable
9	D_IN0		Function software selectable between: multiple pressure PID 0 selection (default) or power limitation enable. Referred to V0	Input - on/off signal
		VL+	Power supply 24 Vdc for driver's logic and communication	Input - power supply
10	D_IN1		Function software selectable between: multiple pressure PID 1 selection (default) or power limitation enable. Referred to V0	Input - on/off supply
		VL0	Power supply 0 Vdc for driver's logic and communication	Gnd - power supply
11	FAULT referred to: V0	VL0	Fault (0 Vdc) or normal working (24 Vdc)	Output - on/off signal
PE	EARTH		Internally connected to driver housing	

Notes: these connections are the same of Moog radial piston pumps, model RKP-D;
do not disconnect VL0 before VL+ when the driver is connected to PC USB port

17.3 Communications connectors - for PES and PERS (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Power supply
2	ID	Identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

(C1) (C2) BP fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V	Termination supply signal
2	LINE-A	Bus line (high)
3	DGND	Data line and termination signal zero
4	LINE-B	Bus line (low)
5	SHIELD	

(1) Shield connection on connector's housing is recommended

(C1) (C2) BC fieldbus execution, connector - M12 - 5 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	CAN_SHLD	Shield
2	not used	(C1) - (C2) pass-through connection (2)
3	CAN_GND	Signal zero data line
4	CAN_H	Bus line (high)
5	CAN_L	Bus line (low)

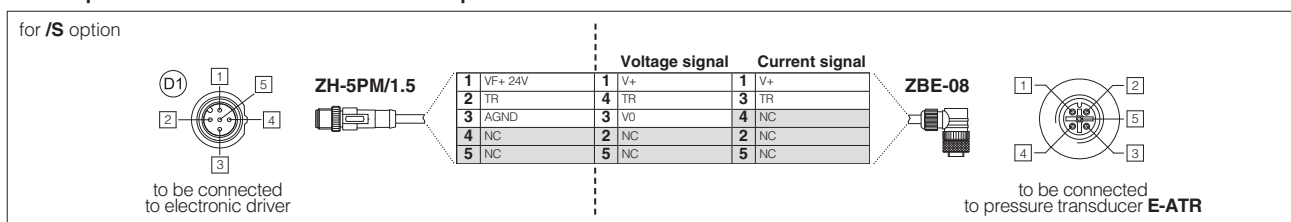
(C1) (C2) EH, EW, EI, EP fieldbus execution, connector - M12 - 4 pin		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	TX+	Transmitter
2	RX+	Receiver
3	TX-	Transmitter
4	RX-	Receiver
Housing	SHIELD	

(2) Pin 2 can be fed with external +5V supply of CAN interface

17.4 Remote pressure/force transducer connector - M12 - 5 pin - for PES and PERS with for /S, /X, /SX options (D1) - (D2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect
2	TR1	Signal transducer: ± 10 Vdc / ± 20 mA maximum range	Input - analog signal Software selectable	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/
4	NC	Not connect		/	/
5	NC	Not connect		/	/

Remote pressure transducer connection - example

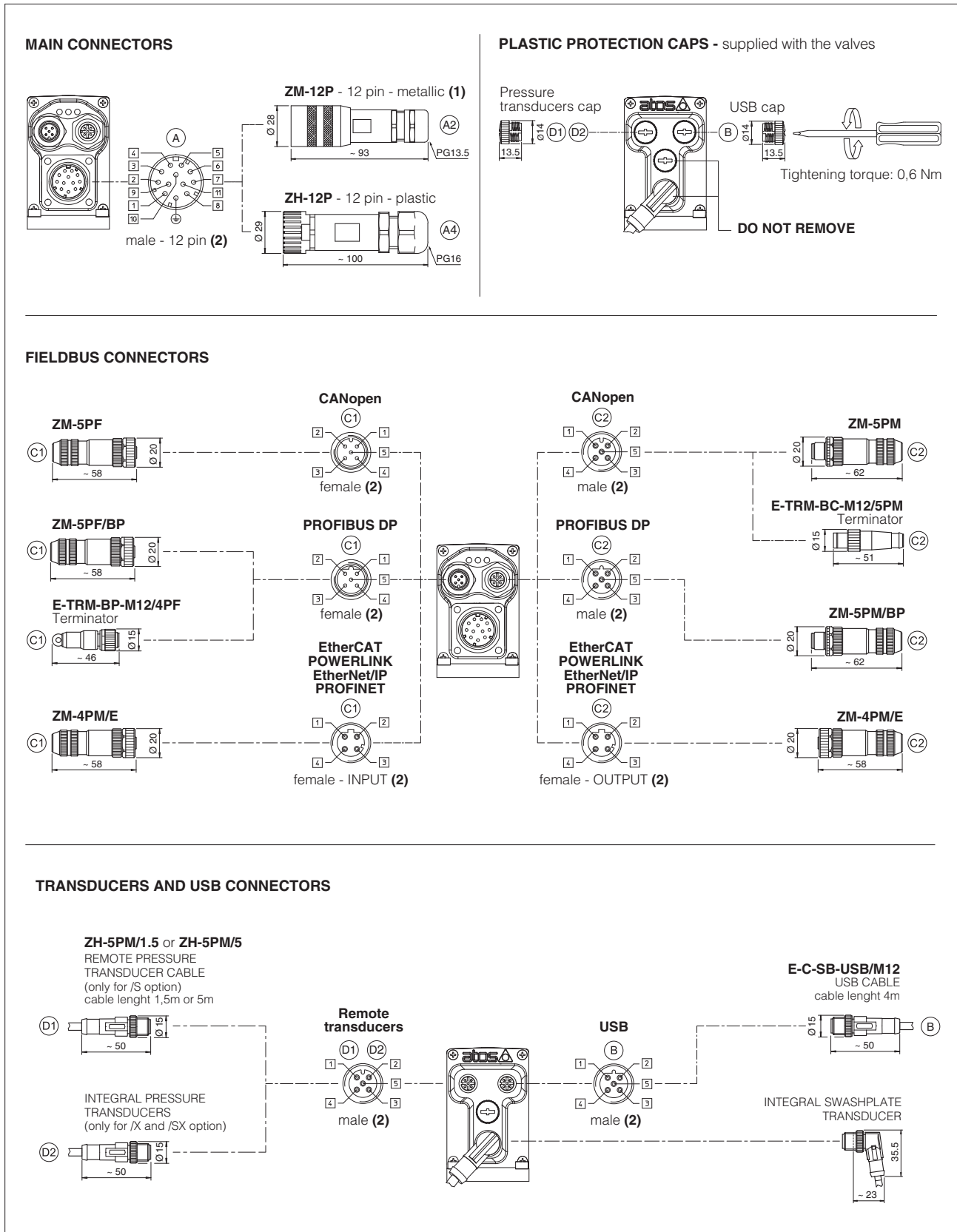


Note: connectors front view

17.5 Solenoid connection - for CZ and LQZ

PIN	SIGNAL	TECHNICAL SPECIFICATION	Connector code 666
1	COIL	Power supply	
2	COIL	Power supply	
3	GND	Ground	

17.6 PES and PERS connections layout



(1) Use of metallic connectors is strongly recommended in order to fulfill EMC requirements (2) Pin layout always referred to driver's view

17.7 Diagnostic LEDs (L)

Three leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

FIELDBUS LEADS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	EW POWERLINK	EI EtherNet/IP	EP PROFINET	L1 L2 L3
L1		VALVE STATUS			LINK/ACT			
L2		NETWORK STATUS			NETWORK STATUS			
L3		SOLENOID STATUS			LINK/ACT			

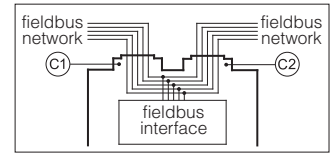
18 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital driver executions BC, BP, EH, EW, EI, EP. This feature allows considerable technical advantages in terms of installation simplicity, wiring reduction and also avoids the use of expensive T-connectors.

For BC and BP executions the fieldbus connectors have an internal pass-through connection and can be used like an end point of the fieldbus network, using an external terminator (see tech table **GS500**).

For EH, EW, EI and EP execution the external terminators are not required: each connector is internally terminated.

BC and BP pass-through connection



19 CONNECTORS CHARACTERISTICS - to be ordered separately

19.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-12P	(A2) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm ² max 40 m (logic) LiYY 3 x 1mm ² max 40 m (power supply)
Conductor size	0,5 mm ² to 1,5 mm ² - available for 12 wires	0,14 mm ² to 0,5 mm ² - available for 9 wires 0,5 mm ² to 1,5 mm ² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

19.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT, EW POWERLINK, EI EtherNet/IP, EP PROFINET (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/E
Type	5 pin female straight circular	5 pin male straight circular	5 pin female straight circular	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding B – IEC 61076-2-101		M12 coding D – IEC 61076-2-101
Material	Metallic		Metallic		Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 6÷8 mm		Pressure nut - cable diameter 4÷8 mm
Cable	CANbus Standard (DR 303-1)		PROFIBUS DP Standard		Ethernet standard CAT-5
Connection type	screw terminal		screw terminal		terminal block
Protection (EN 60529)	IP67		IP 67		IP 67

(1) E-TRM-** terminators can be ordered separately, see tech table **GS500**

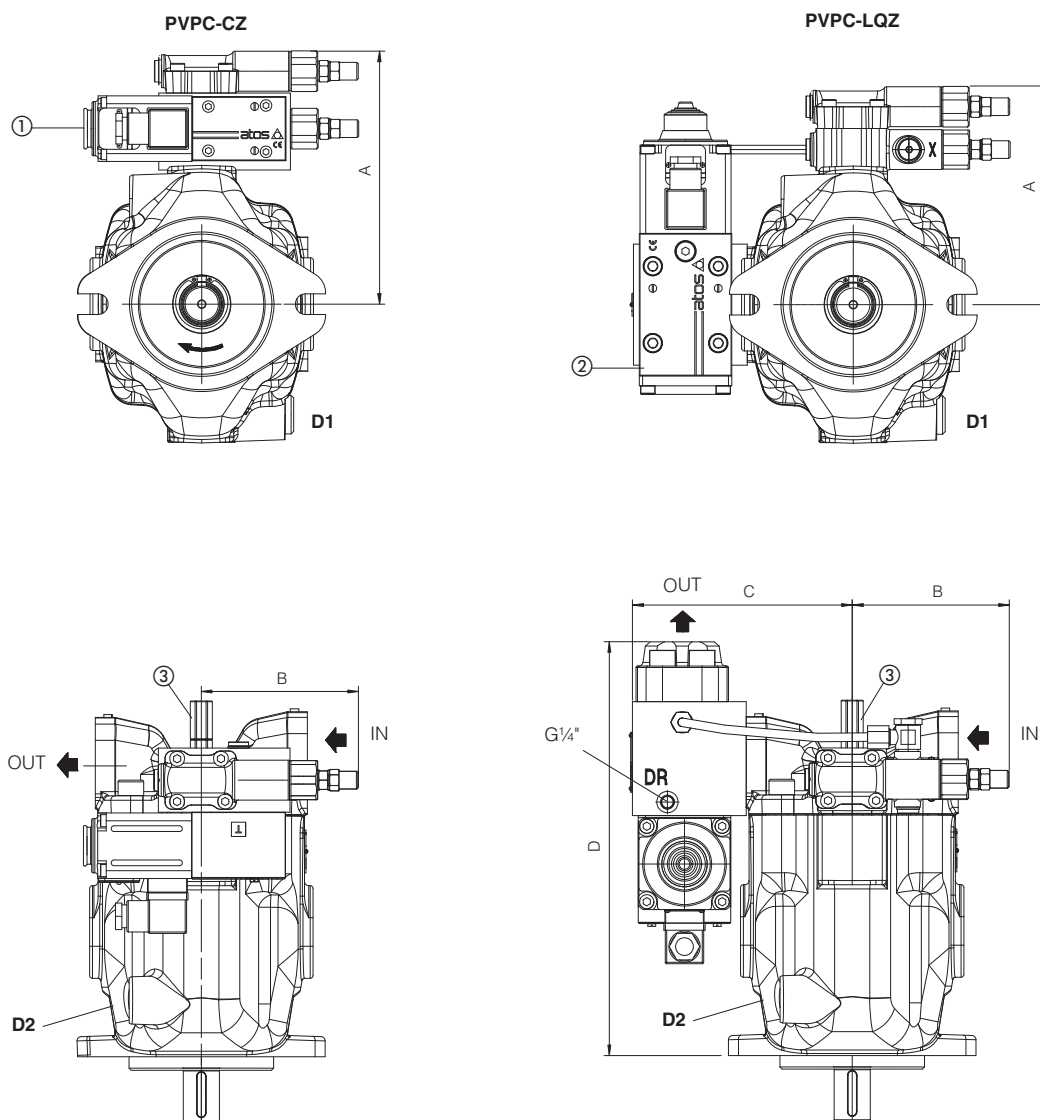
(2) Internally terminated

19.3 Remote pressure transducer connectors

CONNECTOR TYPE	PRESSURE TRANSDUCER		SF - Double transducers
CODE	(D1) (D2) ZH-5PM/1.5	(D1) (D2) ZH-5PM/5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m length 5 m length		Connector moulded on cables 2 m length
Cable	5 x 0,25 mm ²		3 x 0,25 mm ² (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

20 INSTALLATION DIMENSION [mm]

DIMENSIONS OF PVPC size 3, 4 and 5

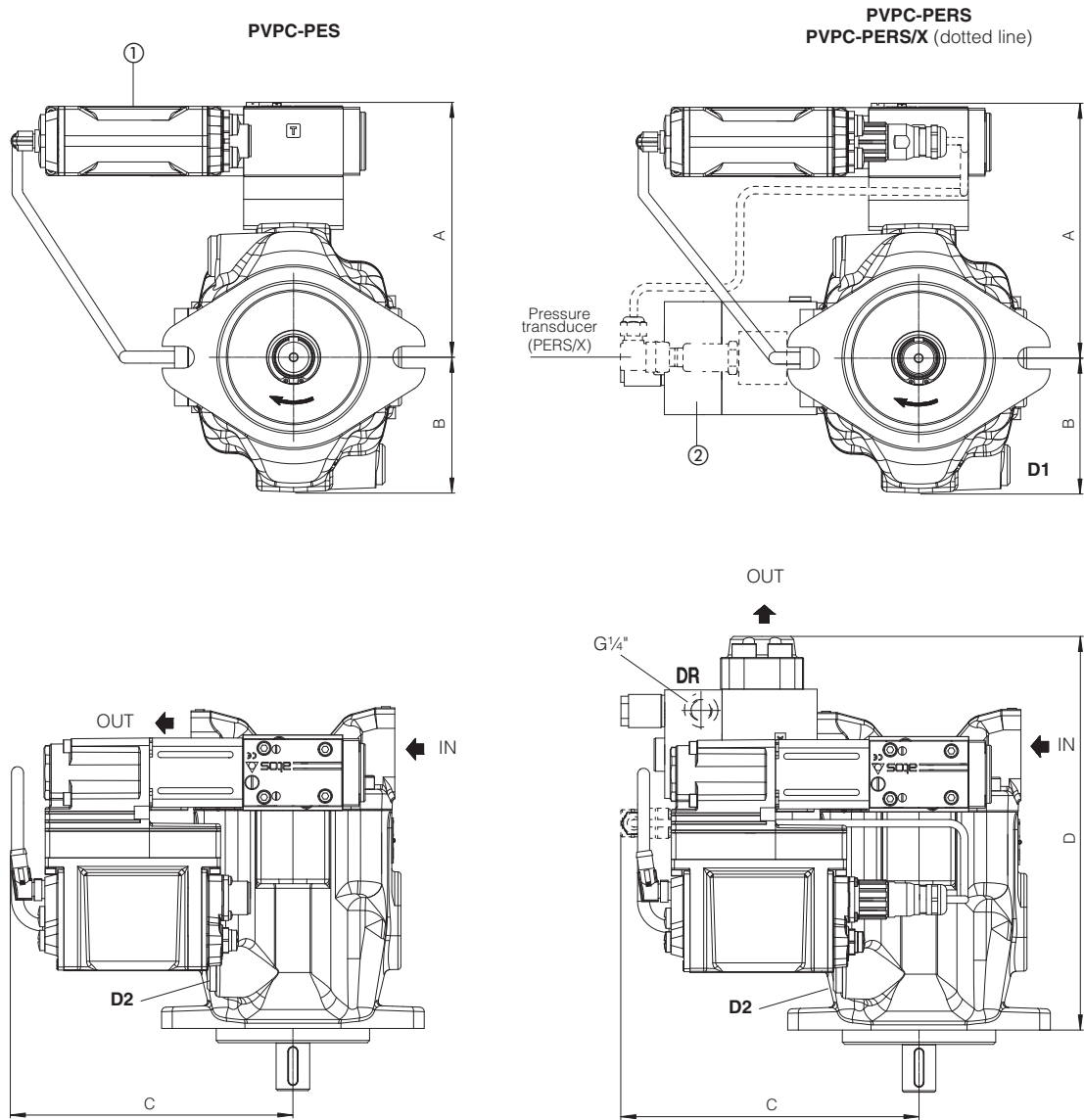


- ① = Proportional pressure control valve
- ② = Proportional flow control valve
- ③ = Regulation screw for max displacement. Adjustable range 50% to 100% of max displacement (not available for versions PES, PERS and PERS(X). In case of double pump the regulation screw is not always available, please contact our technical office.

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	CZ	168	111	-	-	Flange SAE 3000 1 1/4"	Flange SAE 6000 3/4"	1/2" BSPP	22
	LQZ	144	111	132	257				24
PVPC-*-4046	CZ	177	111	-	-	Flange SAE 3000 1 1/2"	Flange SAE 6000 1"	1/2" BSPP	28
	LQZ	153	111	156	293				33,6
PVPC-*-5073 PVPC-*-5090	CZ	190	111	-	-	Flange SAE 3000 2"	Flange SAE 6000 1 1/4"	3/4" BSPP	36,9
	LQZ	166	111	163	328				44

DIMENSIONS OF PVPC size 3, 4 and 5

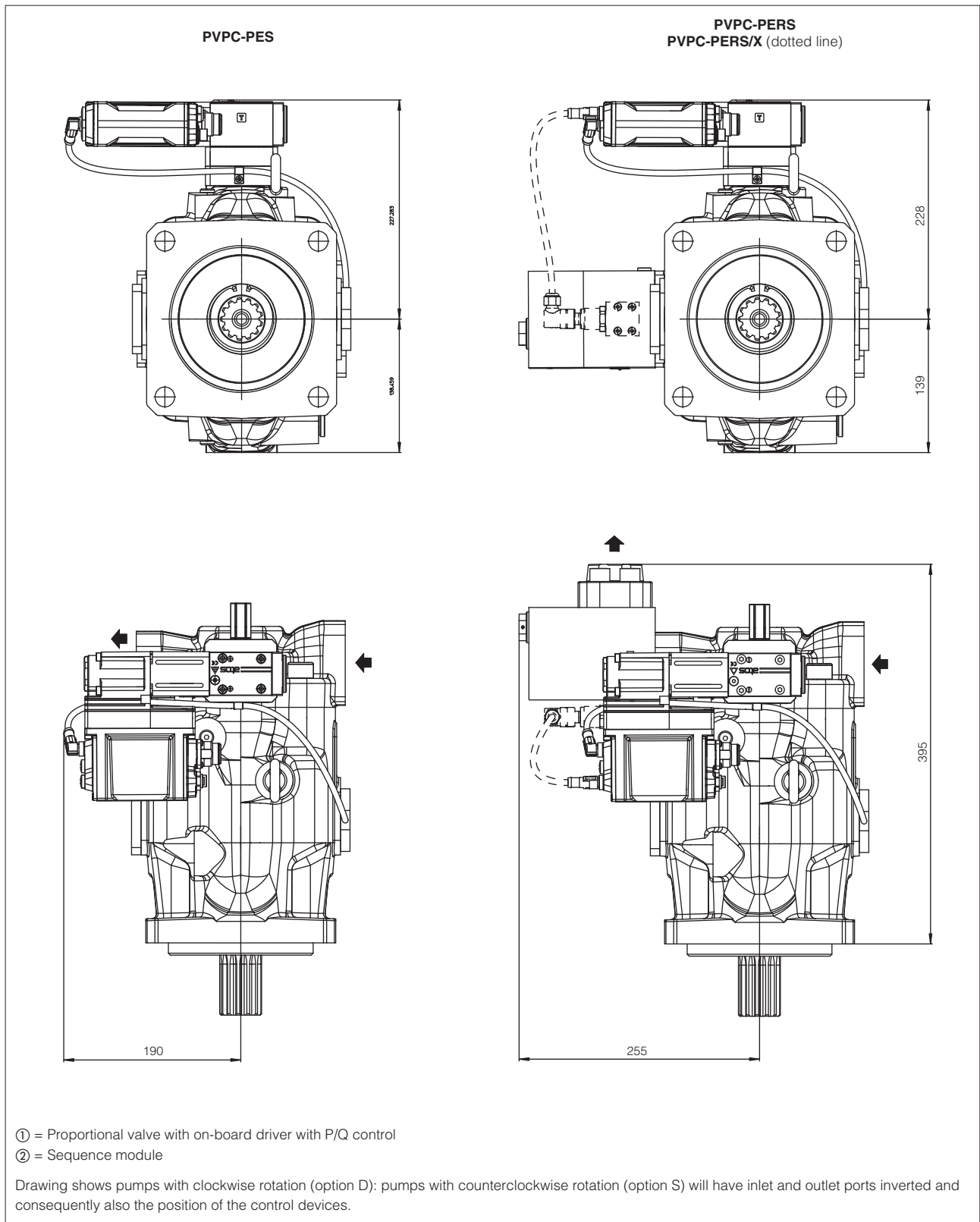


- ① = Proportional valve with on-board driver with P/Q control
- ② = Sequence module

Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted and consequently also the position of the control devices.

Pump type	Version	A	B	C	D	IN	OUT	D1, D2	Mass (kg)
PVPC-*-3029	PES	170	103,5	190	-	Flange SAE 3000 1 1/4"	Flange SAE 6000 3/4"	1/2" BSPP	21,6
	PERS	170	103,5	200	262,5				26
	PERS/X	190	103,5	200	262,5				26,4
PVPC-*-4046	PES	178	103,5	190	-	Flange SAE 3000 1 1/2"	Flange SAE 6000 1"	1/2" BSPP	27,6
	PERS	178	103,5	220	299				33,7
	PERS/X	178	103,5	220	299				34,1
PVPC-*-5073 PVPC-*-5090	PES	190	103,5	190	-	Flange SAE 3000 2"	Flange SAE 6000 1 1/4"	3/4" BSPP	36,6
	PERS	190	103,5	230	337				46,7
	PERS/X	190	103,5	230	337				47,1

DIMENSIONS OF PVPC size 6

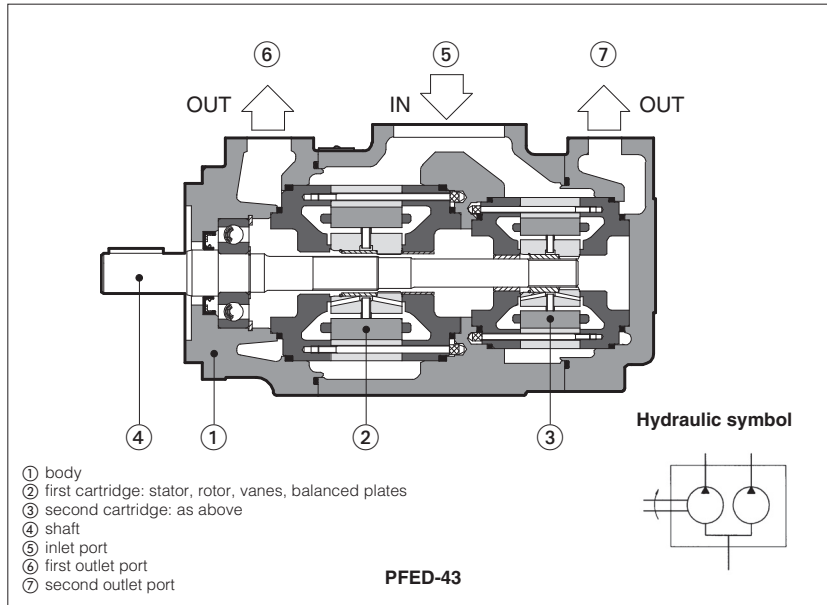


21 RELATED DOCUMENTATION

A900	Operating and maintenance information for pumps	G030	E-BM-AS digital driver
FS001	Basics for digital electrohydraulics	GS050	E-BM-AES digital driver
FS500	Digital proportional valves with P/Q control	GS500	Programming tools
FS900	Operating and maintenance information for proportional valves	GS510	Fieldbus
G010	E-MI-AC analog driver	K800	Electric and electronic connectors
G020	E-MI-AS-IR digital driver	P005	Mounting surfaces for electrohydraulic valves

Double vane pumps type PFED

fixed displacement



PFED are fixed displacement double vane pumps (2)(3) composed by two cartridges of pumps type PFE (see tab. A005) assembled in a main body having one inlet port (5) and two outlet ports (6)(7).

PFED-43 are composed by one cartridge of PFE-41 and one cartridge of PFE-31. PFED-54 are composed by one cartridge of PFE-51 and one cartridge of PFE-41.

Suitable for hydraulic oils according to DIN 51524...535 or synthetic fluids having similar lubricating characteristics.

These pumps can be assembled, as second element, with PFE-4 and PFE-5 to obtain triple pumps, see tab A190.

Mounting according to SAE J744. Easy installation as inlet and outlet ports can be assembled in any of four relative positions. Easy maintenance as pumping cartridge can be replaced in a few minutes.

Wide variety of displacements: from 29+16 up to 150+85 cm³/rev. Max pressure up to 210 bar.

1 MODEL CODE

PFED	-	42	045	/	022	/	1	D	TA	*	/	*	
Fixed displacement double vane pump									Ports orientation, see section 4	Series number		Seals material: omit for NBR (mineral oil & water glycol) PE = FPM	
Size of cartridges: 43 = composed by: one cartridge of PFE-41 + one cartridge of PFE-31 54 = composed by: one cartridge of PFE-51 + one cartridge of PFE-41								Direction of rotation (as viewed at the shaft end): D = clockwise (supplied standard if not otherwise specified) S = counterclockwise Note: PFED are not reversible					
Displacement of first element [cm ³ /rev], see sec. 3								Drive shaft, see section 6 and 7: cylindrical, keyed 1 = supplied standard if not otherwise specified 2 = according to ISO/DIN 3019 3 = for high torque applications splined 5 = for PFED-43: according to SAE B 13T 16/32 DP (13 teeth) for PFED-54: according to SAE C 14T 12/24 DP (14 teeth) 6 = (only for PFED-43) = according to SAE C 14T 12/24 DP (14 teeth) 7 = (only for PFED-43) = similar to shaft type 6. It is used when PFED-43 is the last element of a multiple pump					
Displacement of second element [cm ³ /rev], see sec. 3													

2 MAIN CHARACTERISTICS OF DOUBLE VANE PUMPS TYPE PFED

Installation position	Any position.		
Loads on the shaft	Axial and radial loads are not allowed on the shaft. The coupling should be sized to absorb the peak horsepower developed.		
Ambient temperature	Standard = -25°C ÷ +80°C /PE option -15°C ÷ +80°C		
Fluid	Hydraulic oil as per DIN 51524...535; for other fluids see section 1		
Recommended viscosity	max at cold start: 800 mm ² /s; max at full power 100 mm ² /s; during operation 24 mm ² /s; min at full power 10 mm ² /s		
Max fluid contamination level	normal operation	ISO4406 class 21/19/16 NAS1638 class 10	see also filter section at www.atos.com or KTF catalog
	longer life	ISO4406 class 18/16/13 NAS1638 class 8	
Fluid contamination class	ISO 4401 class 21/19/16 NAS 1638 class 10 (filters at 25 µm value with B25 ≥ 75 recommended)		
Fluid temperature	-20°C +60°C	-20°C +50°C (water glycol)	-20°C +80°C (/PE seals)
Recommended suction line pressure	from -0,5 to 1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm		
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		

3 OPERATING CHARACTERISTICS at 1450 rpm with hydraulic oil having viscosity of 24 mm²/sec and 40°C

Model	7 bar				70 bar				140 bar				210 bar				Speed range min/max rpm
	1°flow		2°flow		1°flow		2°flow		1°flow		2°flow		1°flow		2°flow		
	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	l/min	Kw	
PFED-43																	
PFED-43 029/016	41	0,8	23	0,5	39	5,5	21	3	37	10	19	5	34	14	16	6,5	
PFED-43 029/022	41	0,8	30	0,6	39	5,5	28	4	37	10	26	7	34	14	23	10	
PFED-43 029/028	41	0,8	40	0,8	39	5,5	38	5,5	37	10	36	10	34	14	33	14	
PFED-43 037/016	52	1	23	0,5	50	7	21	3	48	12,5	19	5	45	18	16	6,5	
PFED-43 037/022	52	1	30	0,6	50	7	28	4	48	12,5	26	7	45	18	23	10	
PFED-43 037/028	52	1	40	0,8	50	7	38	5,5	48	12,5	36	10	45	18	33	14	
PFED-43 037/036	52	1	51	1	50	7	49	7	48	12,5	46	12,5	45	18	43	18	
PFED-43 045/016	64	1,3	23	0,5	62	8,5	21	3	60	16	19	5	57	24	16	6,5	
PFED-43 045/022	64	1,3	30	0,6	62	8,5	28	4	60	16	26	7	57	24	23	10	
PFED-43 045/028	64	1,3	40	0,8	62	8,5	38	5,5	60	16	36	10	57	24	33	14	
PFED-43 045/036	64	1,3	51	1	62	8,5	49	7	60	16	46	12,5	57	24	43	18	
PFED-43 045/044	64	1,3	63	1,3	62	8,5	61	8	60	16	58	15,5	57	24	55	23	
PFED-43 056/016	80	1,6	23	0,5	78	11	21	3	75	21	19	5	72	30	16	6,5	
PFED-43 056/022	80	1,6	30	0,6	78	11	28	4	75	21	26	7	72	30	23	10	
PFED-43 056/028	80	1,6	40	0,8	78	11	38	5,5	75	21	36	10	72	30	33	14	
PFED-43 056/036	80	1,6	51	1	78	11	49	7	75	21	46	12,5	72	30	43	18	
PFED-43 056/044	80	1,7	63	1,3	78	11	61	8	75	21	58	15,5	72	30	55	23	
PFED-43 070/016	101	2	23	0,5	98	13,5	21	3	95	26	19	5	91	37	16	6,5	
PFED-43 070/022	101	2	30	0,6	98	13,5	28	4	95	26	26	7	91	37	25	10	
PFED-43 070/028	101	2	40	0,8	98	13,5	38	5,5	95	26	36	10	91	37	33	14	
PFED-43 070/036	101	2	51	1	98	13,5	49	7	95	26	46	12,5	91	37	43	18	
PFED-43 070/044	101	2	63	1,3	98	13,5	61	8	95	26	58	15,5	91	37	55	23	
PFED-43 085/016	124	2,4	23	0,5	121	16	21	3	118	32	19	5	114	46	16	6,5	
PFED-43 085/022	124	2,4	30	0,6	121	16	28	4	118	32	26	7	114	46	23	10	
PFED-43 085/028	124	2,4	40	0,8	121	16	38	5,5	118	32	36	10	114	46	33	14	
PFED-43 085/036	124	2,4	51	1	121	16	49	7	118	32	46	12,5	114	46	43	18	
PFED-43 085/044	124	2,4	63	1,3	121	16	61	8	118	32	58	15,5	114	46	55	23	
PFED-54																	
PFED-54 090/029	128	2,7	41	0,8	124	17	39	5,5	119	33	37	10	114	48	34	14	
PFED-54 090/037	128	2,7	52	1	124	17	50	7	119	33	48	12,5	114	48	45	18	
PFED-54 090/045	128	2,7	64	1,3	124	17	62	8,5	119	33	60	16	114	48	57	24	
PFED-54 090/056	128	2,7	80	1,6	124	17	78	11	119	33	75	21	114	48	72	30	
PFED-54 090/070	128	2,7	101	2	124	17	98	13,5	119	33	95	26	114	48	91	37	
PFED-54 090/085	128	2,7	124	2,4	124	17	121	16	119	33	118	32	114	48	114	46	
PFED-54 110/029	157	3,2	41	0,8	152	21	39	5,5	147	40	37	10	141	58	34	14	
PFED-54 110/037	157	3,2	52	1	152	21	50	7	147	40	48	12,5	141	58	45	18	
PFED-54 110/045	157	3,2	64	1,3	152	21	62	8,5	147	40	60	16	141	58	57	24	
PFED-54 110/056	157	3,2	80	1,6	152	21	78	11	147	40	75	21	141	58	72	30	
PFED-54 110/070	157	3,2	101	2	152	21	98	13,5	147	40	95	26	141	58	91	37	
PFED-54 110/085	157	3,2	124	2,4	152	21	121	16	147	40	118	32	141	58	114	46	
PFED-54 129/029	186	3,7	41	0,8	180	25	39	5,5	174	47	37	10	168	69	34	14	
PFED-54 129/037	186	3,7	52	1	180	25	50	7	174	47	48	12,5	168	69	45	18	
PFED-54 129/045	186	3,7	64	1,3	180	25	62	8,5	174	47	60	16	168	69	57	24	
PFED-54 129/056	186	3,7	80	1,6	180	25	78	11	174	47	75	21	168	69	72	30	
PFED-54 129/070	186	3,7	101	2	180	25	98	13,5	174	47	95	26	168	69	91	37	
PFED-54 129/085	186	3,7	124	2,4	180	25	121	16	174	47	118	32	168	69	114	46	
PFED-54 150/029	215	4,2	41	0,8	211	29	39	5,5	204	55	37	10	197	80	34	14	
PFED-54 150/037	215	4,2	52	1	211	29	50	7	204	55	48	12,5	197	80	45	18	
PFED-54 150/045	215	4,2	64	1,3	211	29	62	8,5	204	55	60	16	197	80	57	24	
PFED-54 150/056	215	4,2	80	1,6	211	29	78	11	204	55	75	21	197	80	72	30	
PFED-54 150/070	215	4,2	101	2	211	29	98	13,5	204	55	95	26	197	80	91	37	
PFED-54 150/085	215	4,2	124	2,4	211	29	121	16	204	55	118	32	197	80	114	46	

(1) Max pressure is 160 bar for /PE and /WG versions (2) Max speed is 1800 rpm for /PE versions; 1500 rpm for /WG versions

4 PORT ORIENTATION (pumps viewed from the shaf end)

Pumps can be supplied with the oil ports oriented in different configuration in relation to the drive shaft. Port orientation of the first element is designated as follows (as viewed at the shaft end);

T = inlet and outlet ports on the same axis (standard)

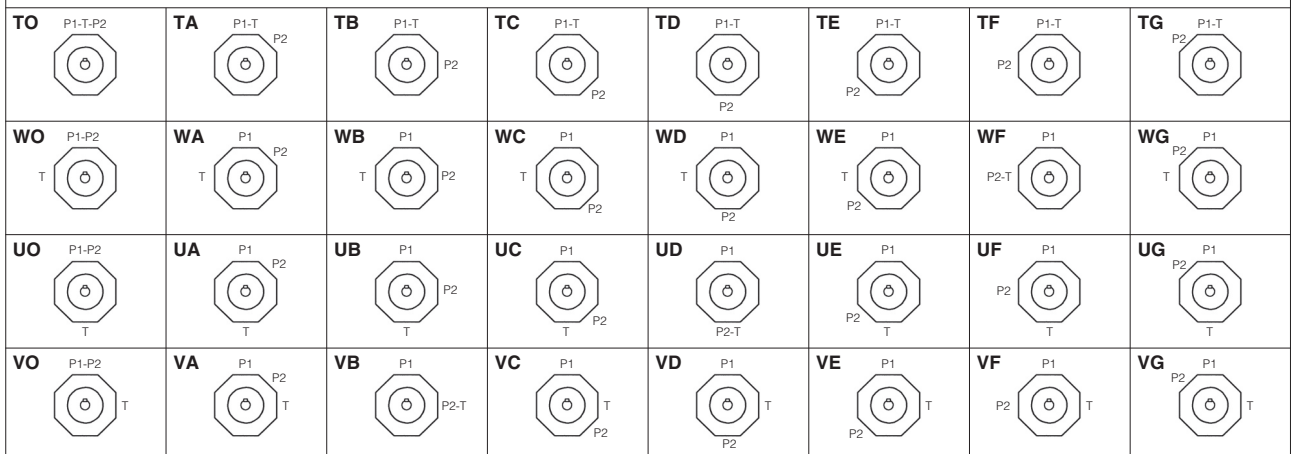
U = outlet orientated 180° with respect to the inlet

V = outlet oriented 90° with respect to the inlet

W = outlet oriented 270° with respect to the inlet

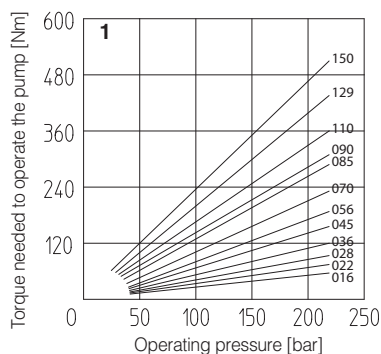
Outlet port of second element can be orientated, relative to the inlet port, in 8 positions at 45° (**O, A, B, C, D, E, F, G**)

Ports orientation can be easily changed by rotating the pump body that carries inlet port.



5 DIAGRAMS

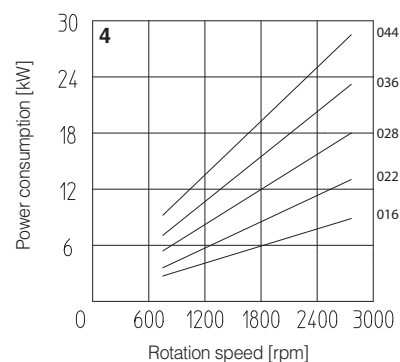
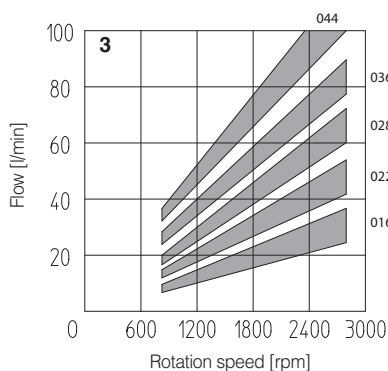
1 = Torque versus pressure diagram



PFED-43: Second element (cartridge SC-PFED-31)**

2 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

3 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.

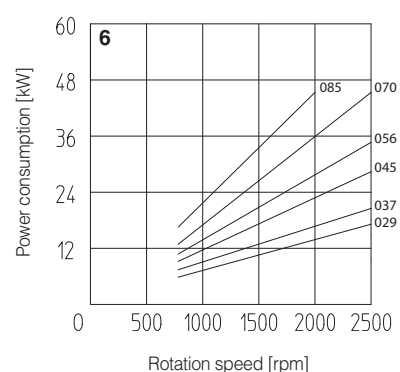
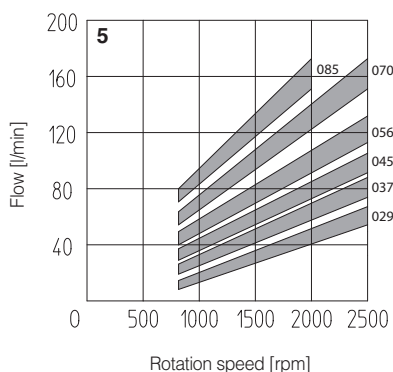


PFED-43: First element (cartridge SC-PFE-41)**

PFED-54: Second element (cartridge SC-PFED-41)**

4 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

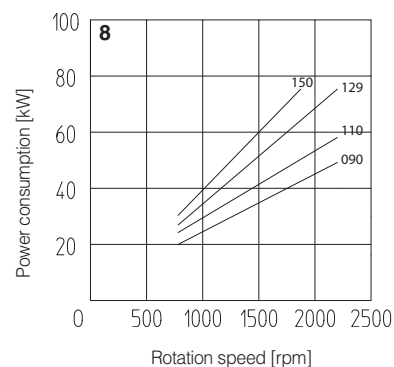
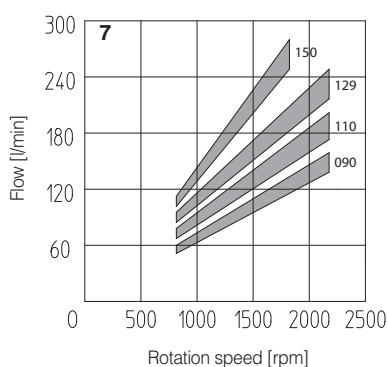
5 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.



PFED-54: First element (cartridge SC-PFE-51)**

6 = Flow versus speed diagram with pressure variation from 7 bar to 210 bar.

7 = Power consumption versus speed diagram at 140 bar. Power consumption is proportional to operating pressure.



6 LIMITS OF SHAFT TORQUE

Pump model	Maximum driving torque [Nm]					
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7
PFED-43	250	250	400	200	400	400
PFED-54	500	500	850	450	-	-

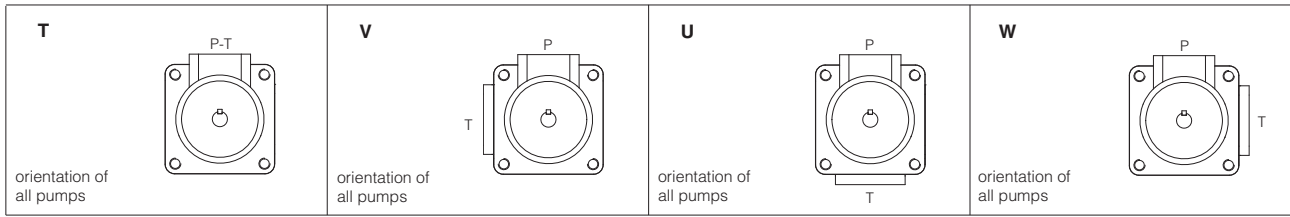
The values of torque needed to operate each single cartridge are shown on the "torque versus pressure diagram" at section 5. The total torque applied to the shaft of the pump is the sum of the single torque needed for operating each single cartridge and it is necessary to verify that this total torque applied to the drive shaft is not higher than the values indicated in the table.

1.2 PORT ORIENTATION

-PFEX2, PFEX3

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated.
In PFEX2 and PFEX3 multiple pumps, the port orientation is the same for first, second (third) pumps.

Model code example: PFEX2-42045/41037/5DT



P1 outlet port ; T1 inlet port

-PFEXD

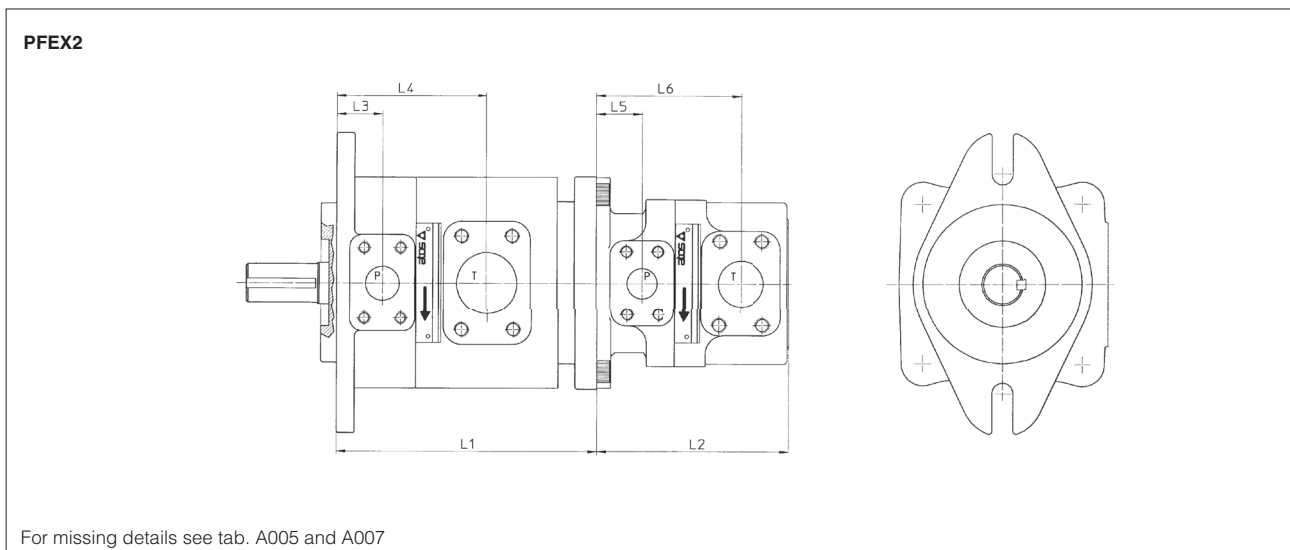
Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated..
In PFEXD, the ports orientation of second / third pump (PFED), can be selected according following table.
The ports orientation of first pump depends to the selected orientation of second / third pumps.

Model code example: PFEXD-42045/43037/016/5DTO

1 st PUMP PFEX*	2 nd / 3 th PUMP PFED*							
	TO P2-T2-P3	TA P2-T2 P3	TB P2-T2 P3	TC P2-T2 P3	TD P2-T2 P3	TE P2-T2 P3	TF P2-T2 P3	TG P2-T2 P3
	WO P2-P3 T2	WA P2 P3 T2	WB P2 P3 T2	WC P2 P3 T2	WD P2 P3 T2	WE P2 P3 T2	WF P2 P3 T2	WG P2 P3 T2
	UO P2-P3 T2	UA P2 P3 T2	UB P2 P3 T2	UC P2 P3 T2	UD P2 P3 T2	UE P2 P3 T2	UF P2 P3 T2	UG P2 P3 T2
	VO P2-P3 T2	VA P2 P3 T2	VB P2 P3 T2	VC P2 P3 T2	VD P2 P3 T2	VE P2 P3 T2	VF P2 P3 T2	VG P2 P3 T2

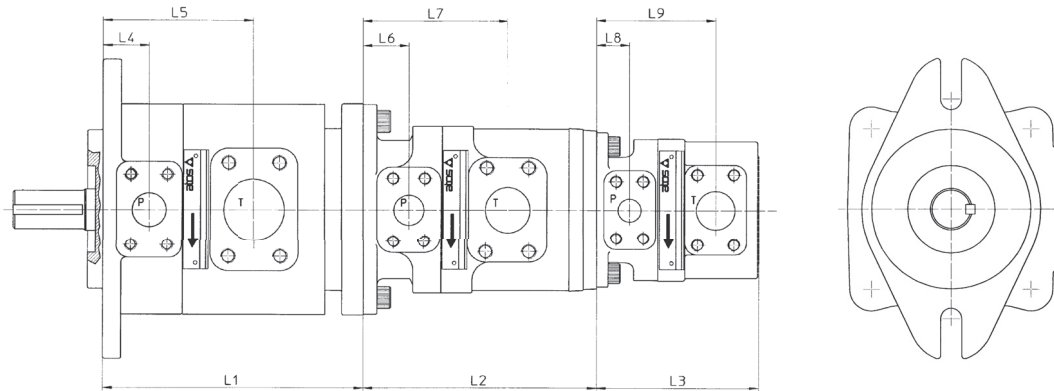
P1 outlet port of first element; P2 outlet port of second element; P3 outlet port of third element; T1 inlet port of first element; T2 inlet port of second element

1.3 DIMENSIONS OF MULTIPLE PUMPS TYPE PFEX2, PFEX3, PFEXD [mm]



Composed pump	First element	Second element	L1	L2	L3	L4	L5	L6
PFEX2-32***/31***/*	PFEXA-32***/*	PFE-31***/5	164	134,5	27,5	98,5	27,5	98,5
PFEX2-42***/31***/*	PFEXA7-42***/*	PFE-31***/7	194	134,5	38	120	27,5	98,5
PFEX2-42***/41***/*	PFEXB7-42***/*	PFE-41***/7	203	160	38	120	38	120
PFEX2-52***/31***/*	PFEXA7-52***/*	PFE-31***/7	206	134,5	38	125	27,5	98,5
PFEX2-52***/41***/*	PFEXB7-52***/*	PFE-41***/7	215,5	160	38	125	38	120
PFEX2-52***/51***/*	PFEXC-52***/*	PFE-51***/5	230	186,5	38	125	38	125

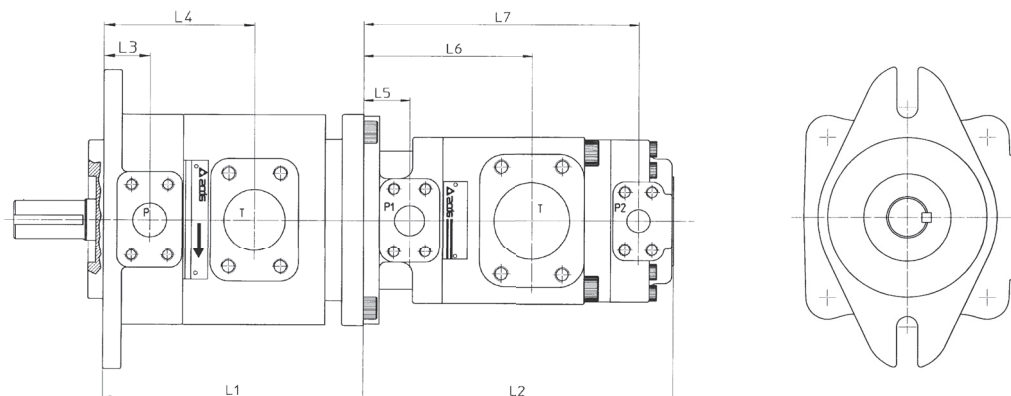
PFEX3



For missing details see tab. A005 and A007

Composed pump	First elem.	Second elem.	Third elem.	L1	L2	L3	L4	L5	L6	L7	L8	L9
PFEX3-32***/31***/31***/*	PFEXA-32***/*	PFEXA-31***/5	PFE-31***/5	164	164	134,5	27,4	98,5	27,4	98,5	24,7	98,5
PFEX3-42***/31***/31***/*	PFEXA7-42***/*	PFEXA-31***/7	PFE-31***/5	203	164	134,5	38	120	27,4	98,5	24,7	98,5
PFEX3-42***/41***/31***/*	PFEXB7-42***/*	PFEXA7-41***/7	PFE-31***/7	203	194	134,5	38	120	38	120	24,7	98,5
PFEX3-42***/41***/41***/*	PFEXB7-42***/*	PFEXB7-41***/7	PFE-41***/7	203	203	160	38	120	38	120	38	120
PFEX3-52***/31***/31***/*	PFEXA7-52***/*	PFEXA-31***/7	PFE-31***/5	206	164	134,5	38	125	24,7	98,5	24,7	98,5
PFEX3-52***/41***/31***/*	PFEXB7-52***/*	PFEXA7-41***/7	PFE-31***/7	215,5	194	134,5	38	125	38	120	24,7	98,5
PFEX3-52***/41***/41***/*	PFEXB7-52***/*	PFEXB7-41***/7	PFE-41***/7	215,5	203	160	38	125	38	120	38	120
PFEX3-52***/51***/31***/*	PFEXC-52***/*	PFEXA7-51***/5	PFE-31***/7	230	206	134,5	38	125	38	125	24,7	98,5
PFEX3-52***/51***/41***/*	PFEXC-52***/*	PFEXB7-51***/5	PFE-41***/7	230	206	160	38	125	38	125	38	120
PFEX3-52***/51***/51***/*	PFEXC-52***/*	PFEXC-51***/5	PFE-51***/5	230	230	186,5	38	125	38	125	38	125

PFEXD

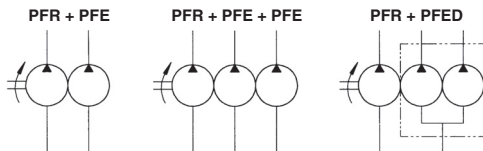


For missing details see tab. A005 and A007, A180

Composed pump	First element	Second element	L1	L2	L3	L4	L5	L6	L7
PFEXD-42***/43***/0**	PFEXB7-42***	PFED-43***/0**/7	203	256	38	120	38	139,6	227,7
PFEXD-52***/43***/0**	PFEXB7-52***	PFED-43***/0**/7	215,5	256	38	125	38	199,6	227,7
PFEXD-52***/54***/0**	PFEXC-52***	PFED-54***/0**/5	230	288	38	125	38	152,3	261,8

2 PFRX2E, PFRX3E, PFRXDE MULTIPLE RADIAL PISTON/VANE PUMPS

PFRX*E are fixed displacement multiple piston/vane pumps. They can be double (composed by one pump type PFR and one pump type PFE) or triple pumps (composed by one pump type PFR and one pump type PFE2 or by one PFR and one PFED).



For technical characteristics of PFR pumps see tab. A045, for technical characteristics of PFE-1* pumps see tab. A005; for technical characteristics of PFE-*2 see tab. A007, for technical characteristics of PFED pumps, see tab. A180.

2.1 MODEL CODE FOR PFRX*E

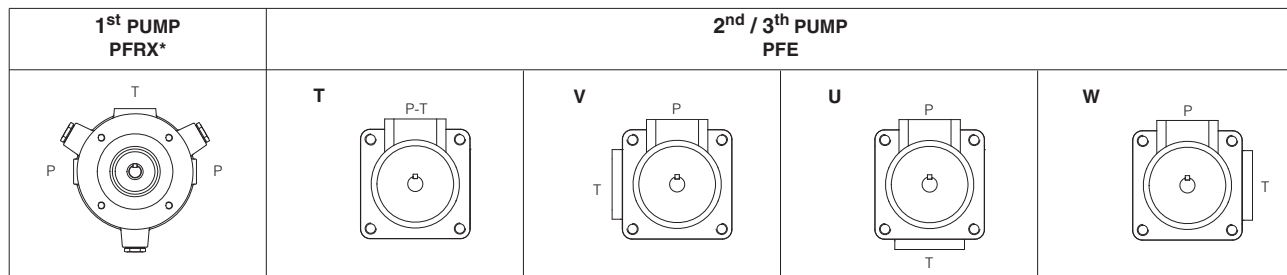
PFRX	2E	-	5	25	/	31044	/	D	*	/	*	*
Multiple fixed displacement piston/vane pump											Series number	Seals material: omit for NBR (mineral oil & water glycol) PE = FPM
Composition: 2E = double: PFR + PFE 3E = triple: PFR + PFE2 DE = triple: PFR + PFED The pumps are assembled in decreasing order of size.									Port orientation, see section 2.2			
Size of first pump type PFR: 3, 5									Direction of rotation (as viewed at the shaft end): D = clockwise (supplied standard if not otherwise specified) S = counter clockwise Note: PFRX*E are not reversible			
Displacement of first pump type PFR [cm ³ /rev] for PFR-3: 08, 11, 15 for PFR-5: 18, 25						Size and displacement [cm ³ /rev] of PFE second (and third) pump for PFE 31: 010, 016, 022, 028, 036, 044 for PFE 41: 029, 037, 045, 056, 070, 085 for PFE 51: 090, 110, 129, 150 for PFE 32: 016, 022, 028, 036 for PFE 42: 045, 056, 070, 085 for PFE 52: 090, 110, 129, 150						

2.2 PORT ORIENTATION

-PFRX2E, PFRX3E

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated. Referred to the first element (PFRX*), in second / third pumps the ports can be oriented as indicated in the picture. The third element is always oriented as the second element.

Model code example: PFRX2E-525/31044/DT

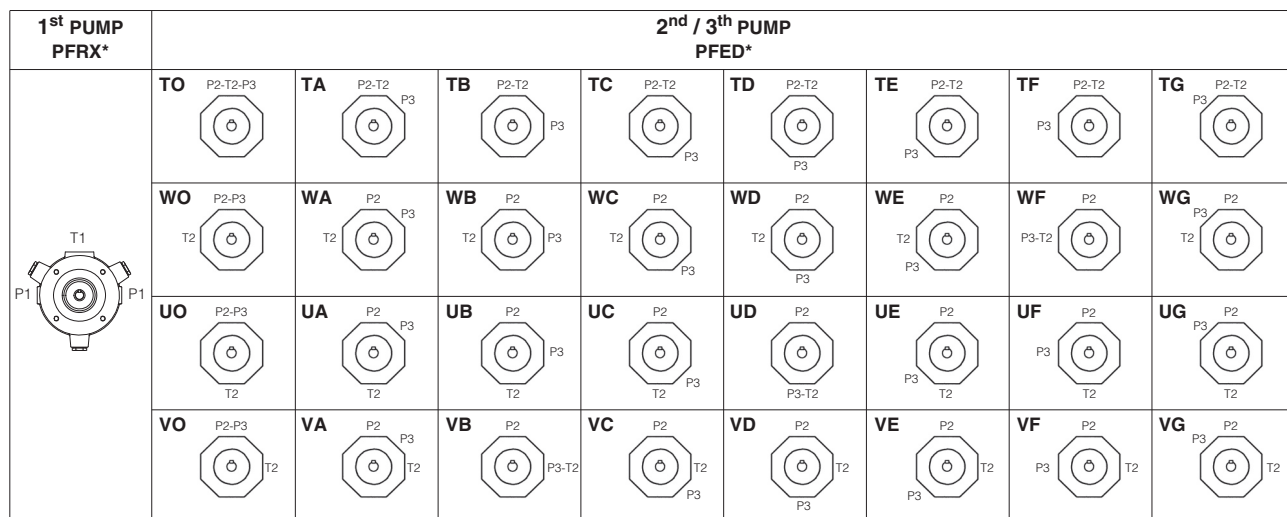


P1 outlet port ; T1 inlet port

-PFRXDE

Pumps can be supplied with oil ports oriented in different configurations viewed from shaft end, as below indicated. In PFRXDE, can be select the orientation of second / third pump (PFED)

Model code example: PFRXDE-525/43045/022/DTO



P1 outlet port of first element; P2 outlet port of second element; P3 outlet port of third element; T1 inlet port of first element; T2 inlet port of second element

2.3 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PFRX2E

(at 1450 rpm and based on mineral oil ISO VG46 at 50° C)

Standard model (1)	Speed range [rpm] (2)	RADIAL PISTON PUMP			VANE PUMP			Total flow [l/min]			
		Displacement [cm ³ /rev]	Flow [l/min] (3)	Max pressure [bar] (4)	Displacement [cm ³ /rev]	Flow [l/min] (3)	Max pressure [bar] (5)				
PFRX2E-308/31010	600-1800	8	12,6	350	10,5	15	160	27,6			
PFRX2E-308/31016					16,5	23		35,6			
PFRX2E-308/31022					21,6	30		42,6			
PFRX2E-308/31028					28,1	40		52,6			
PFRX2E-308/31036					36,5	51		63,6			
PFRX2E-308/31044					43,7	63		75,6			
PFRX2E-308/41029					29,3	41		53,6			
PFRX2E-308/41037					36,6	52		64,6			
PFRX2E-308/41045					45	64		76,6			
PFRX2E-308/41056					55,8	80		92,6			
PFRX2E-308/41070					69,9	101		113,6			
PFRX2E-308/41085					85,3	124		136,6			
PFRX2E-308/51090					90	128		140,6			
PFRX2E-308/51110					109,6	157		169,6			
PFRX2E-308/51129					129,2	186		198,6			
PFRX2E-311/31044					11,4	16,5		350	43,7	63	210
PFRX2E-311/41070		69,9	101	117,5							
PFRX2E-311/41085		85,3	124	140,5							
PFRX2E-311/51110		109,6	157	173,5							
PFRX2E-311/51129		129,2	186	202,5							
PFRX2E-315/41056		14,7	21,5	350			55,8		80	101,5	
PFRX2E-315/41070							69,9		101	122,5	
PFRX2E-315/51110							109,6		157	178,5	
PFRX2E-315/51129					129,2	186	207,5				
PFRX2E-518/31044		18,1	26	350	43,7	63	89				
PFRX2E-518/41070					69,9	101	127				
PFRX2E-518/41085					85,3	124	150				
PFRX2E-518/51110					109,6	157	183				
PFRX2E-518/51129					129,2	186	212				
PFRX2E-525/41070					25,4	37	350	69,9	101	138	
PFRX2E-525/51110		109,6	157	194							
PFRX2E-525/51129		129,2	186	233							

(1) Further composition of PFR and PFE double pumps are available on request. Other composition of PFRX2E must subject to verification of max torque limits allowed by the drive shafts of PFR and PFE and by the through shaft of PFR (320 Nm).

(2) Max speed is 1800 rpm for /PE versions; 1000 rpm for water glycol fluid

(3) Flow rate and power consumption are proportional to revolution speed

(4) Max pressure is 250 bar for /PE versions, 175 bar for water glycol fluid

(5) Max pressure is 160 bar for /PE and water glycol fluid.

The shaft of the PFR pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate.

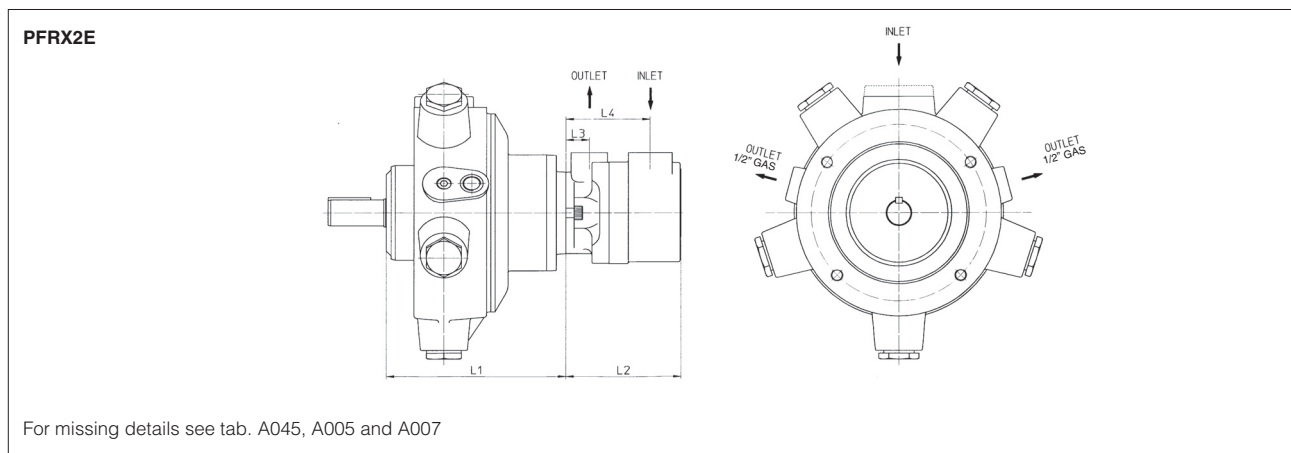
For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.

See tab. A045

2.4 TRIPLE PUMPS TYPE PFRX3E AND PFRXDE

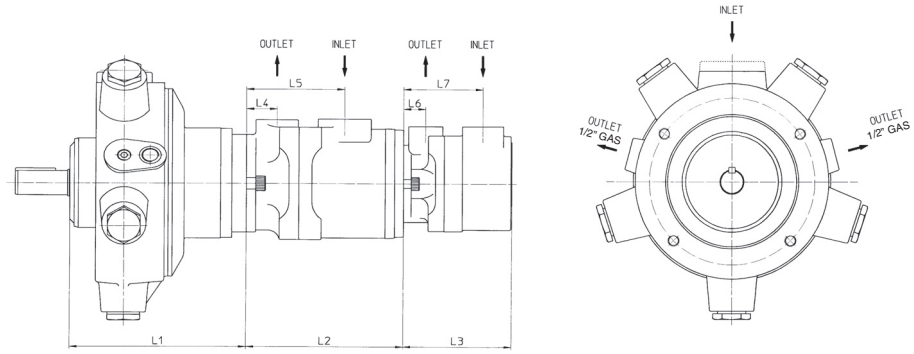
Many triple pump compositions PFRX3E = PFR + PFEX2 or PFRXDE = PFR + PFED can be realized but they must be subject to verification of max torque-limits allowed by drive shaft and through shaft of each individual basic pump according to description of first page.

2.5 DIMENSIONS OF MULTIPLE PUMPS TYPE PFRX2, PFRX3, PFRXD [mm]



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4
PFRX2E-3**/31***	PFRXA-3**	PFE-31***	200	134,5	27,5	98,5
PFRX2E-3**/41***	PFRXB-3**	PFE-41***	209	160	38	120
PFRX2E-3**/51***	PFRXC-3**	PFE-51***	224	186,5	38	125
PFRX2E-5**/31***	PFRXA-5**	PFE-31***	210	134,5	27,5	98,5
PFRX2E-5**/41***	PFRXB-5**	PFE-41***	219,5	160	38	120
PFRX2E-5**/51***	PFRXC-5**	PFE-51***	234	134,5	38	125

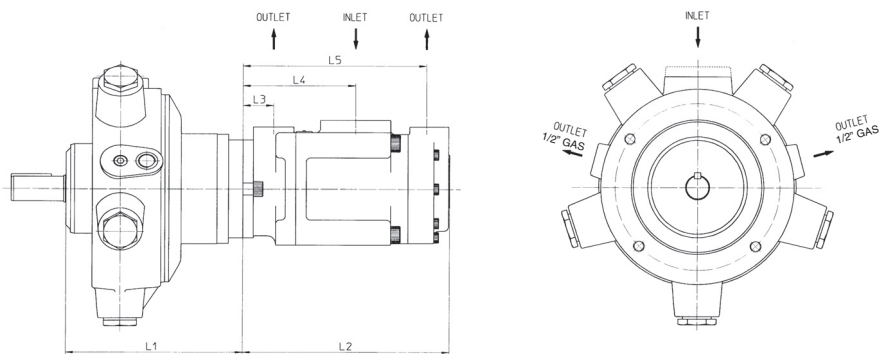
PFRX3E



For missing details see tab. A045, A005 and A007

Composed pump	First element - piston pump -	Second element - vane pump -	Third element - vane pump -	L1	L2	L3	L4	L5	L6	L7
PFRX3E-3**/31**/31**	PFRXA-3**	PFEXA-31**	PFE-31**	200	164	134,5	27,5	98,5	27,5	98,5
PFRX3E-3**/41**/31**	PFRXB-3**	PFEXA-41**	PFE-31**	209	194	134,5	38	120	27,5	98,5
PFRX3E-3**/41**/41**	PFRXB-3**	PFEXB-41**	PFE-41**	209	203	160	38	120	38	120
PFRX3E-3**/51**/31**	PFRXC-3**	PFEXA-51**	PFE-31**	224	206	134,5	38	125	27,5	98,5
PFRX3E-3**/51**/41**	PFRXC-3**	PFEXB-51**	PFE-41**	224	215,5	160	38	125	38	120
PFRX3E-3**/51**/51**	PFRXC-3**	PFEXC-51**	PFE-51**	224	230	186,5	38	125	38	125
PFRX3E-5**/31**/31**	PFRXA-5**	PFEXA-31**	PFE-31**	210	164	134,5	27,5	98,5	27,5	98,5
PFRX3E-5**/41**/31**	PFRXB-5**	PFEXA-41**	PFE-31**	219,5	194	134,5	38	120	27,5	98,5
PFRX3E-5**/41**/41**	PFRXB-5**	PFEXB-41**	PFE-41**	219,5	203	160	38	120	38	120
PFRX3E-5**/51**/31**	PFRXC-5**	PFEXA-51**	PFE-31**	234	206	134,5	38	125	27,5	98,5
PFRX3E-5**/51**/41**	PFRXC-5**	PFEXB-51**	PFE-41**	234	215,5	160	38	125	38	120
PFRX3E-5**/51**/51**	PFRXC-5**	PFEXC-51**	PFE-51**	234	230	186,5	38	125	38	125

PFRXDE



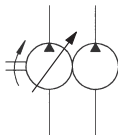
For missing details see tab. A045 and A180

Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PFRXDE-3**/43**/0**	PFRXB-3**	PFED-43**/0**	209	256,5	38	139,6	227,7
PFRXDE-3**/54**/0**	PFRXC-3**	PFED-54**/0**	224	288	38	152,3	261,8
PFRXDE-5**/43**/0**	PFRXB-5**	PFED-43**/0**	219,5	256,5	38	139,6	227,7
PFRXDE-5**/54**/0**	PFRXC-5**	PFED-54**/0**	234	288	38	152,3	261,8

PFRX*E pumps are supplied with WFA-32 inlet flange for PFR, and set of inlet, outlet flanges for PFE or PFED;

3 PVPCX2E MULTIPLE AXIAL PISTON/VANE PUMPS

PVPCX2E are double pumps composed by one variable displacement axial piston pump type PVPC and one vane pump type PFE. They have two separated inlet ports and two separated outlet ports.



For technical characteristics of PVPC pumps, see tab. A160; for technical characteristics of PFE pumps see tab. A005 and A007.

3.1 MODEL CODE FOR PVPCX2E with standard hydraulic controls

PVPC	X2E	-	C	-	4	046	/	31044	/	1	D	X	24DC	10	/	*
Variable displacement axial piston pump																
X2E = coupled with a fixed displacement pump type PFE (see tab. A005)																
Type of control: C = manual pressure compensator CH = manual pressure compensator, with venting R = remote pressure compensator L = load sensing (pressure & flow) LW = constant power (combined pressure & flow)																
Size: 3 = for displacement 029 4 = for displacement 046 5 = for displacement 073 and 090																
Max displacement of axial piston pump: 029 = 29 cm ³ /rev 073 = 73 cm ³ /rev 046 = 46 cm ³ /rev 090 = 88 cm ³ /rev																
Size and displacement [cm ³ /rev] of PFE second (and third) pump for PFE 31 : 010, 016, 022, 028, 036, 044 for PFE 32 : 016, 022, 028, 036 for PFE 41 : 029, 037, 045, 056, 070, 085 for PFE 42 : 045, 056, 070, 085 for PFE 51 : 090, 110, 129, 150 for PFE 52 : 090, 110, 129, 150																
	Seals material: - = NBR PE = FKM See notes under sect. 2 Series number Supply voltage: 24/50 AC 12 DC 110/50 AC 24 DC 220/50 AC X = without connector Direction of rotation (viewed at the shaft end) D = clockwise S = counterclockwise Shaft (SAE Standard): 1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090) 5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)															

3.2 MODEL CODE FOR PVPCX2E with electrohydraulic proportional controls

PVPC	X2E	-	PERS	-	SP	-	BC	-	4	046	/	31044	/	*	/	1	D	/	18	10	/	*
Variable displacement axial piston pump																						
X2E = coupled with a fixed displacement pump type PFE (see tab. A005)																						
Type of control (see section 5, 6 and 7): CZ = proportional pressure compensator LQZ = proportional flow control (load sensing) LZQZ = proportional pressure & flow control (load sensing) LZQZR = as LZQZ plus sequence module PES-SP = closed loop integral digital P/Q driver PERS-SP = as PES plus sequence module																						
Fieldbus interfaces for PES and PERS: USB interface always present NP = Not present BP = PROFIBUS DP BC = CANopen EH = EtherCAT																						
Size: 3 = for displacement 029 4 = for displacement 046 5 = for displacement 073 and 090																						
Max displacement of axial piston pump: 029 = 29 cm ³ /rev 046 = 46 cm ³ /rev 073 = 73 cm ³ /rev 090 = 88 cm ³ /rev																						
Size and displacement [cm ³ /rev] of PFE second (and third) pump for PFE 31 : 010, 016, 022, 028, 036, 044 for PFE 32 : 016, 022, 028, 036 for PFE 41 : 029, 037, 045, 056, 070, 085 for PFE 42 : 045, 056, 070, 085 for PFE 51 : 090, 110, 129, 150 for PFE 52 : 090, 110, 129, 150																						
	Seals material: - = NBR PE = FKM See notes under sect. 2 Series number Options, see sections 4 and 7: 18 = with 18 VDC coil instead of standard 12 VDC coil (only for CZ, LQZ, LZQZ) for versions PES and PERS: C = current feedback for pressure transducer 4÷20 mA I = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V) X = with integral pressure transducer (only for PERS) S = with two on-off inputs for multiple pressure PID selection (NP execution) or double power supply (BC, BP and EH execution). Direction of rotation (viewed at the shaft end) D = clockwise S = counterclockwise Shaft (SAE Standard): 1 = keyed (7/8" for 029 - 1" for 046 - 1 1/4" for 073 and 090) 5 = splined (13 teeth for 029 - 15 for 046 - 14 for 073 and 090)																					
Pressure setting (only for PERS): 200 = 200 bar 250 = 250 bar 280 = 280 bar (not available for 090)																						

3.3 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PVPCX2E (with PFE-31, 41 and 51)

(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Standard model	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			Total flow [l/min]
		Displacement [cm ³ /rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm ³ /rev]	Flow [l/min] (2)	Max pressure [bar] (4)	
PVPCX2E*-3029/31010	800-2400	29	42	280/350	10,5	15	160	57
PVPCX2E*-3029/31016	800-2800				16,5	23	210	65
PVPCX2E*-3029/31022					21,6	30		72
PVPCX2E*-3029/31028					28,1	40		82
PVPCX2E*-3029/31036					35,6	51		93
PVPCX2E*-3029/31044	800-2500				43,7	63		105
PVPCX2E*-3029/41029					29,3	41		83
PVPCX2E*-3029/41037					36,6	52		94
PVPCX2E*-3029/41045					45,0	64		106
PVPCX2E*-3029/41056	800-2000				55,8	80		122
PVPCX2E*-3029/41070					69,9	101		143
PVPCX2E*-3029/41085					85,3	124		166
PVPCX2E*-4046/31010		800-2400	46	66,7	280/350	10,5		15
PVPCX2E*-4046/31016	800-2600	16,5				23	89,7	
PVPCX2E*-4046/31022		21,6				30	92,7	
PVPCX2E*-4046/31028		28,1				40	102,7	
PVPCX2E*-4046/31036		35,6				51	113,7	
PVPCX2E*-4046/31044	800-2500	43,7				63	129,7	
PVPCX2E*-4046/41029		29,3				41	107,7	
PVPCX2E*-4046/41037		36,6				52	118,7	
PVPCX2E*-4046/41045		45,0				64	130,7	
PVPCX2E*-4046/41056	800-2000	55,8				80	146,7	
PVPCX2E*-4046/41070		69,9				101	167,7	
PVPCX2E*-4046/41085		85,3				124	190,7	
PVPCX2E*-5073/31010		800-2400	73	105,8	280/350	10,5	15	160
PVPCX2E*-5073/31016	800-2200	16,5				23	128,8	
PVPCX2E*-5073/31022		21,6				30	135,8	
PVPCX2E*-5073/31028		28,1				40	145,8	
PVPCX2E*-5073/31036		35,6				51	156,8	
PVPCX2E*-5073/31044	800-2200	43,7				63	168,8	
PVPCX2E*-5073/41029		29,3				41	146,8	
PVPCX2E*-5073/41037		36,6				52	157,8	
PVPCX2E*-5073/41045		45,0				64	169,8	
PVPCX2E*-5073/41056	800-2000	55,8				80	185,8	
PVPCX2E*-5073/41070		69,9				101	206,8	
PVPCX2E*-5073/41085		85,3				124	229,8	
PVPCX2E*-5073/51090		800-2200	90,0	128	233,8			
PVPCX2E*-5073/51110	109,6		157	262,8				
PVPCX2E*-5073/51129	129,2		186	291,8				
PVPCX2E*-5073/51150	150,2		215	320,8				
PVPCX2E*-5090/31010	800-2400	88	127,6	250/315	10,5	15	160	142,6
PVPCX2E*-5090/31016	800-2200				16,5	23	150,6	
PVPCX2E*-5090/31022					21,6	30	157,6	
PVPCX2E*-5090/31028					28,1	40	167,6	
PVPCX2E*-5090/31036					35,6	51	178,6	
PVPCX2E*-5090/31044	800-2200				43,7	63	190,6	
PVPCX2E*-5090/41029					29,3	41	168,6	
PVPCX2E*-5090/41037					36,6	52	179,6	
PVPCX2E*-5090/41045					45,0	64	191,6	
PVPCX2E*-5090/41056	800-2000				55,8	80	207,6	
PVPCX2E*-5090/41070					69,9	101	228,6	
PVPCX2E*-5090/41085					85,3	124	251,6	
PVPCX2E*-5090/51090		800-2200	90,0	128	255,6			
PVPCX2E*-5090/51110	109,6		157	284,6				
PVPCX2E*-5090/51129	129,2		186	313,6				
PVPCX2E*-5090/51150	150,2		215	342,6				

(1) Max speed is 1800 rpm for /PE versions; 1000 rpm for water glycol fluid

(2) Flow rate and power consumption are proportional to revolution speed

(3) Max pressure is 190 bar for /PE versions, 160 bar for water glycol fluid

(4) Max pressure is 160 bar for /PE and water glycol fluid

3.4 OPERATING CHARACTERISTICS OF STANDARD DOUBLE PUMPS TYPE PVPCX2E (with PFE-32, 42 and 52)

(at 1450 rpm and based on mineral oil ISO VG46 at 40° C)

Standard model	Speed range [rpm] (1)	AXIAL PISTON PUMP			VANE PUMP			Total flow [l/min]						
		Displacement [cm ³ /rev]	Flow [l/min] (2)	Max pressure [bar] (3)	Displacement [cm ³ /rev]	Flow [l/min] (2)	Max pressure [bar] (4)							
PVPCX2E*-3029/32016	1200-2500	29	42	280/350	16,5	23	210	65						
PVPCX2E*-3029/32022					21,6	30	300	72						
PVPCX2E*-3029/32028					28,1	40		82						
PVPCX2E*-3029/32036					35,6	51		93						
PVPCX2E*-3029/42045	45,0				64	280		106						
PVPCX2E*-3029/42056	55,8				80		122							
PVPCX2E*-3029/42070	69,9				101		143							
PVPCX2E*-3029/42085	85,3				124		166							
PVPCX2E*-4046/32016	1200-2500	46	66,7	280/350	16,5	23	210	89,7						
PVPCX2E*-4046/32022					21,6	30	300	92,7						
PVPCX2E*-4046/32028					28,1	40		102,7						
PVPCX2E*-4046/32036					35,6	51		113,7						
PVPCX2E*-4046/42045	45,0				64	280		130,7						
PVPCX2E*-4046/42056	55,8				80		146,7							
PVPCX2E*-4046/42070	69,9				101		167,7							
PVPCX2E*-4046/42085	85,3				124		190,7							
PVPCX2E*-5073/32016	1200-2500	73	105,8	280/350	16,5	23	210	128,8						
PVPCX2E*-5073/32022					21,6	30	300	135,8						
PVPCX2E*-5073/32028					28,1	40		145,8						
PVPCX2E*-5073/32036					35,6	51		156,8						
PVPCX2E*-5073/42045	45,0				64	280		169,8						
PVPCX2E*-5073/42056	55,8				80		185,8							
PVPCX2E*-5073/42070	69,9				101		206,8							
PVPCX2E*-5073/42085	85,3				124		229,8							
PVPCX2E*-5073/52090	800-2000	73	105,8	280/350	90,0	128	250	233,8						
PVPCX2E*-5073/52110					109,6	157		262,8						
PVPCX2E*-5073/52129					129,2	186		291,8						
PVPCX2E*-5073/52150	800-1800				73	105,8	280/350	150,2	215	210	320,8			
PVPCX2E*-5090/32016	1200-1850							88	127,6	280/350	16,5	23	210	150,6
PVPCX2E*-5090/32022											21,6	30	300	157,6
PVPCX2E*-5090/32028											28,1	40		167,6
PVPCX2E*-5090/32036											35,6	51		178,6
PVPCX2E*-5090/42045	45,0	64	280	191,6										
PVPCX2E*-5090/42056	55,8	80		207,6										
PVPCX2E*-5090/42070	69,9	101		228,6										
PVPCX2E*-5090/42085	85,3	124		251,6										
PVPCX2E*-5090/52090	800-1850	88	127,6	280/350	90,0	128	250	255,6						
PVPCX2E*-5090/52110					109,6	157		284,6						
PVPCX2E*-5090/52129					129,2	186		313,6						
PVPCX2E*-5090/52150	800-1800				88	127,6	280/350	150,2	215	210	342,6			

(1) Max speed is 1800 rpm for /PE versions; 1500 rpm for water glycol fluid

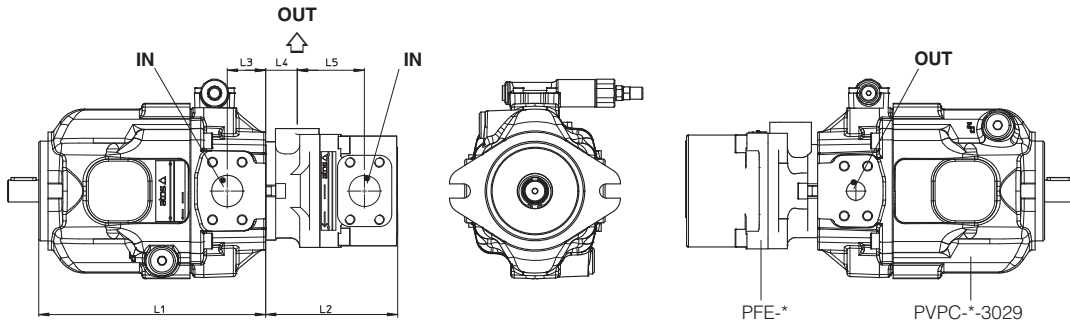
(2) Flow rate and power consumption are proportional to revolution speed

(3) Max pressure is 190 bar for /PE versions, 160 bar for water glycol fluid

(4) Max pressure is 160 bar for /PE and water glycol fluid.

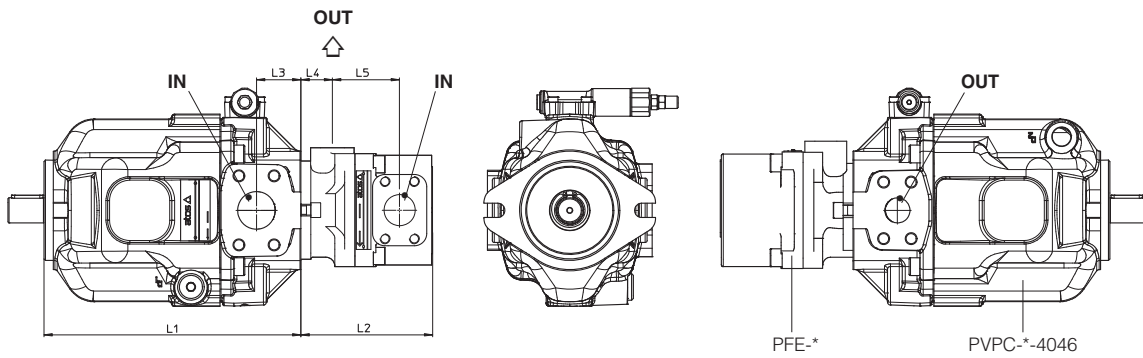
3.5 DIMENSIONS OF MULTIPLE PUMPS TYPE PVPCX2E [mm]

PVPCX2E-*-3029



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-3029/3****	PVPCXA-*-3029	PFE-3****	231,2	134,5	39	27,5	71
PVPCX2E-*-3029/4****	PVPCXB-*-3029	PFE-4****	231,2	160	39	38	82

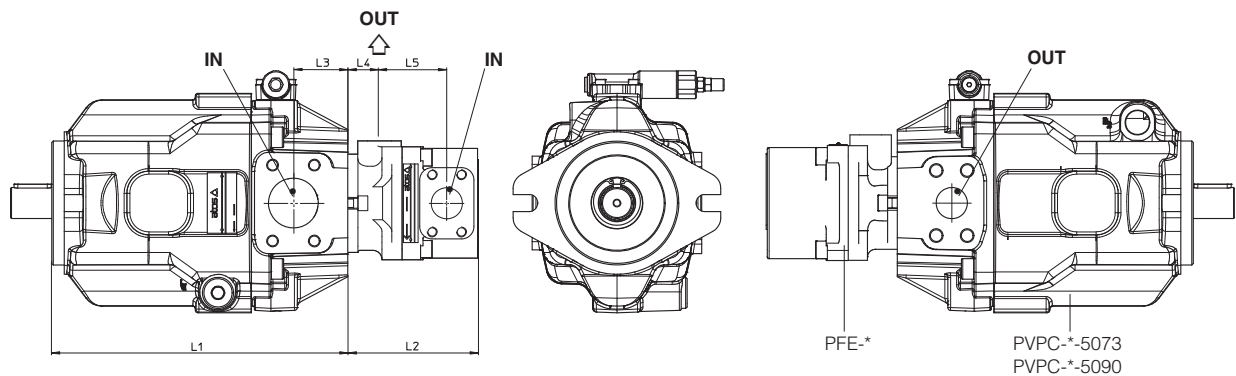
PVPCX2E-*-4046



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-4046/3****	PVPCXA-*-4046	PFE-3****	259	134,5	45	27,5	71
PVPCX2E-*-4046/4****	PVPCXB-*-4046	PFE-4****	259	160	45	38	82

PVPCX2E-*-5073

PVPCX2E-*-5090



Composed pump	First element - piston pump -	Second element - vane pump -	L1	L2	L3	L4	L5
PVPCX2E-*-5073/3****	PVPCXA-*-5073	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5073/4****	PVPCXB-*-5073	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5073/5****	PVPCXC-*-5073	PFE-5****	303,6	186,5	55,7	38	87
PVPCX2E-*-5090/3****	PVPCXA-*-5090	PFE-3****	303,6	134,5	55,7	27,5	71
PVPCX2E-*-5090/4****	PVPCXB-*-5090	PFE-4****	303,6	160	55,7	38	82
PVPCX2E-*-5090/5****	PVPCXC-*-5090	PFE-5****	303,6	186,5	55,7	38	87

5

ACCESSORIES

INDEX

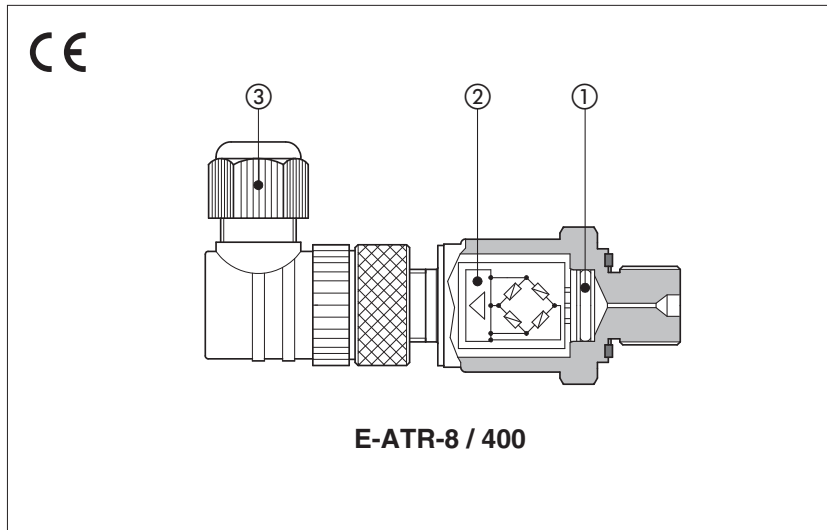
ACCESSORIES

		Size	Pmax [bar]	Table	Pag
SENSORS					
E-ATR-8	pressure transducer with amplified analog output signal		400	GS465	813
PRESSURE SWITCHES					
E-DAP-2	electronic pressure switch with digital output signals and display		400	GS470	815
MAP	manual pressure switch with fixed differential switching pressure		630	D250	817
SUBPLATES					
BA	single station, mounting surfaces ISO 4401, 6264 and 5781	06 ÷ 32	350	K280	819
BA-214					
BA-314	multi-station, mounting surface ISO 4401	06 ÷ 10	350	K290	823
BA-244					
BA-214/AL	multi-station, mounting surface ISO 4401, aluminium	06	250	K295	827
HAND LEVERS					
Auxiliary hand levers for on-off and proportional valves				E138	829
HANDWHEELS & KNOBS					
Regulating handwheels and knobs for on-off and proportional valves				K150	831
CONNECTORS					
Electric and electronic connectors for transducers, on-off and proportional valves				K800	833

Supplementary components range available on www.atos.com

Pressure transducers type E-ATR-8

analog, for open and closed loop systems



E-ATR-8

This pressure transducers measure the static and dynamic pressure of the hydraulic fluid, supplying a voltage or current output signal.

The sensor is composed by a thin-film circuit ①, with high resistance to overloads and pressure peaks.

The integrated electronic circuit ② supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

E-ATR-8 equip pressure control digital proportional valves with integral transducer and electronics, REB/RES execution (see tech table GS205).

They are also used in association with other Atos digital proportionals to perform closed loop pressure controls:

- variable displacement axial piston pumps, PE(R)S execution (see tech table AS170)
- directional control valves with additional closed loop pressure control, SP and SF options on TES/LES execution (see tech table FS500)

Features:

- Factory preset and calibrated
- Standard 5 pin M12 main connector ③
- IP67 protection degree
- CE mark according to EMC directive

1 MODEL CODE

E-ATR-8	/	400	/	*	/	*
Pressure transducer						Series number
Pressure measuring range: 60 = 0 ÷ 60 bar 100 = 0 ÷ 100 bar 160 = 0 ÷ 160 bar 250 = 0 ÷ 250 bar 400 = 0 ÷ 400 bar						
Options: - = voltage output signal 0 ÷ 10 V I = current output signal 4 ÷ 20 mA						

2 MAIN CHARACTERISTICS

Pressure measuring range	0 ÷ 60/100/160/250/400 bar; other values available on request Note: negative pressure can damage the pressure transducer
Overload pressure	2 x FS without exceeding 600 bar
Burst pressure	5 x FS without exceeding 1700 bar
Response time	≤ 2 ms
Temperature range	Operating -40 ÷ +100 °C; Storage -40 ÷ +100 °C; Fluid: -40 ÷ +100 °C
Thermal drift	@ zero: ≤ ±0,025 % FS/°C max; @ FS: ≤ ±0,025 % FS/°C max
Accuracy	≤ ±1,2 % FS
Non-Linearity	≤ ±0,5 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524...535; for water-glycol, phosphate ester and skydrol®, please contact Atos technical department
Power supply	24 Vdc nominal; 14 ÷ 30 Vdc for standard (8 ÷ 30 Vdc for /I option); I _{max} 25 mA
Output signal	Standard: voltage output signal 0 ÷ 10 V (3 pins); Min load > maximum output signal / 1 mA /I option: current output signal 4 ÷ 20 mA (2 pins); Max load ≤ (power supply - 8 V) / 0,02 mA
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM
Mass	Approx. 57 g
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006
Vibration resistance	20 g according to DIN EN 60068-2-6 from 20 to 2000 Hz
Shock resistance	40 g / 6 ms / half-sinusoid, according to DIN EN 60068-2-27
Protection class	IP67 with mating connector
Hydraulic connection	1/4" GAS - DIN 3852 (pressure port orifice Ø 0,6 mm)
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C

Notes: FS = Full Scale; BFSL = Best Fit Straight Line

3 INSTALLATION AND COMMISSIONING

3.1 Warning

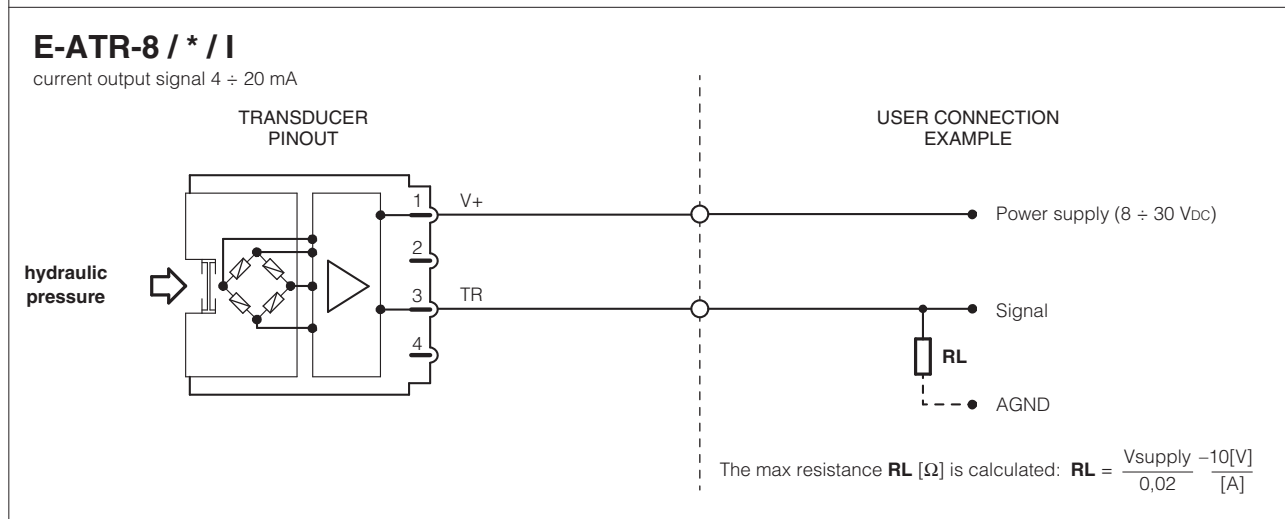
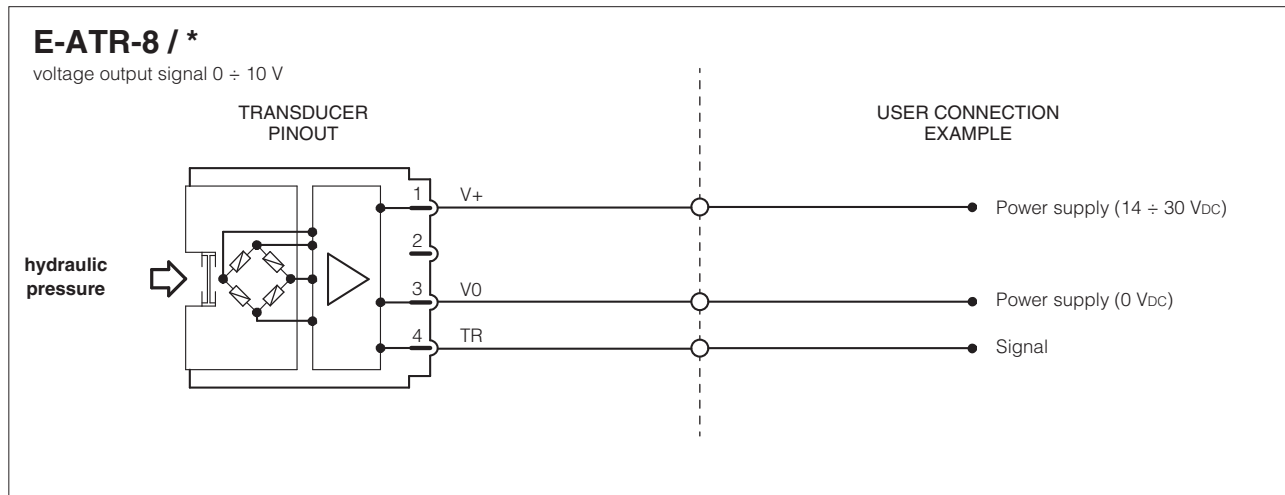
E-ATR-8 transducers have to be installed as near as possible to the point where the pressure have to be measured, taking care that the oil flow is not turbulent.

3.2 Commissioning

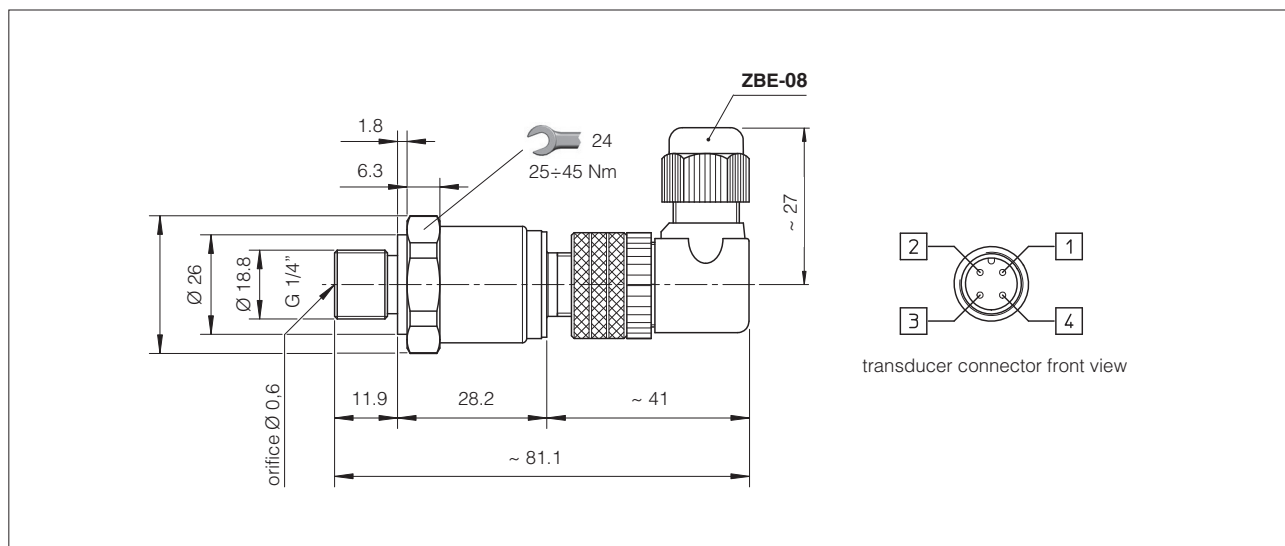
Install the transducer in the hydraulic circuit.

Switch-off the power supply before connecting and disconnecting the transducer connector as shown in scheme 4.

4 ELECTRONIC CONNECTIONS

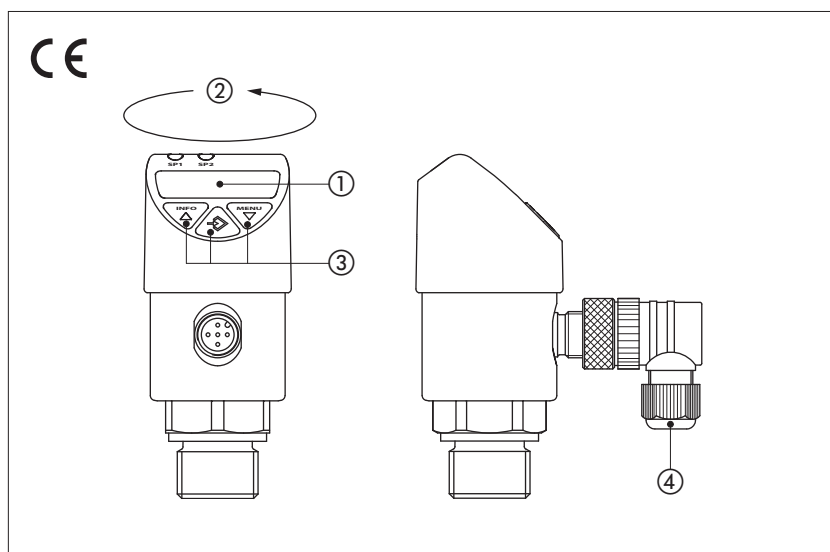


5 OVERALL DIMENSIONS [mm]



Electronic pressure switches type **E-DAP-2**

digital, with integral digital display



1 MODEL CODE

E-DAP-2	-	250	/	2	*
Electronic pressure switch					Series number
Pressure range:					
100 = 100 bar					
250 = 250 bar					
400 = 400 bar					
				2 = 2 switching outputs	

2 MAIN CHARACTERISTICS

Model	E-DAP-2-100	E-DAP-2-250	E-DAP-2-400
Pressure measuring range [bar] (1)	0,5 ÷ 100	1,25 ÷ 250	2 ÷ 400
Overload pressure	2 x FS		
Response time	≤ 10 ms		
Temperature range	Operating -40 ÷ +80 °C; Storage -40 ÷ +80 °C; Fluid: -40 ÷ +85 °C		
Thermal drift	Zero ±0,02 % FS / °C (typ); span ±0,01 % FS / °C (typ)		
Accuracy display	≤ ±1,0 % of FS ±1 digit		
Non-Linearity	≤ ±0,5 % of span BFSL as per IEC 61298-2		
Fluid compatibility	Hydraulic oil as per DIN51524...535; for water-glycol, phosphate ester and skydrol®, please contact Atos technical department		
Power supply	15 ÷ 35 VDC; I _{max} 600 mA		
N° of outputs	2		
Output type	PNP transistor output (ON state ≡ power supply - 1 V)		
Switching current	250 mA max per output (resistive load)		
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal		
Display	4 digit, 14 segment led, red, height 9 mm		
Materials	Wetted parts: stainless steel 316L (13-8 PH for sensor); seals: FPM/FKM		
Mass	174 g		
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE EN 61326 emission (group 1, class B) and immunity (industrial application)		
Compliance	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Vibration resistance	10 g according to IEC 60068-2-6, under resonance		
Shock resistance	50 g according to IEC 60068-2-27		
Protection class	IP65 / IP67 with mating connector		
Hydraulic connection	1/4" GAS - DIN 3852 form E (pressure port orifice Ø 0,6 mm)		
Electrical connection	Type: plastic 5 pins M12 at 90° (DIN 43650-C) with cable gland type PG7 for cable max Ø 6 mm Protection: IP67 according to EN 60529; Insulation: according to VDE 0110-C		

Notes: FS = Full Scale; BFSL = Best Fit Straight Line; (1) negative pressure lower than -1 bar can damage the device

E-DAP-2

Compact electronic pressure switch with integral digital display, available for 3 different pressure ranges.

The working pressure is real time measured and monitored on a 4 digits display (1) in bar, Mpa, kPa, psi or kg/cm². The display can be mechanically rotated on 1 axis (2) and turned electronically through 180°.

It provides two independent output with electronic contacts which are triggered when the pressure in the hydraulic circuit reaches the switch point or window (see section (4)).

The functional parameters as the pressure switching point, hysteresis range, pressure measuring units and others additional functions can be easily set by the end user trough proper programming keys (3).

For detailed instructions about the use of the electronic pressure switch refer to the operating manual supplied with the instrument.

Features:

- Standard 5 pin M12 main connector (4)
- IP65 / IP67 protection degree
- CE mark according to EMC directive

3 FEATURES

- Two independent PNP transistor switching outputs. I_{max} up to 250 mA per output
- 4 digit display, adjustable on one axes without tools for best visual position or visualized digits can be turned electronically of 180°
- Pressure reading selectable in: bar, Mpa, kPa, psi, kg/cm²
- Selection of different display modes: unit switching, offset adjustment, actual pressure value, minimum or maximum pressure value, function switch points, function reset points, display updates/second.
- Hydraulic connection G1/4"
- Electric connector M12x1 supplied with the pressure switch

4 OUTPUTS SWITCHING FUNCTION

The independent outputs can be settable using two different functions: Hysteresis and Windows.

Hysteresis function - see 4.1

If the system pressure fluctuates around the set point, the hysteresis keeps the switching status of the outputs stable. With increasing system pressure, the output switches when reaching the switch point (SP).

- HNO - contact normally open: active
- HNC - contact normally closed: inactive

With system pressure falling again, the output will not switch back before the reset point (RP) is reached.

- HNO - contact normally open: inactive
- HNC - contact normally closed: active

Window function - see 4.2

The window function allows for the control of a defined range.

When the system pressure is between window High (FH) and window Low (FL), the output switches on.

- FNO - contact normally open: active
- FNC - contact normally closed: inactive

When the system pressure is outside window High (FH) and window Low (FL), the output does not switch on.

- FNO - contact normally open: inactive
- FNC - contact normally closed: active

Delay times (0 ... 50 s) - see 4.3

This makes it possible to filter out unwanted pressure peaks of a short duration or a high frequency (damping).

The pressure must be present for at least a certain pre-set time for the output to switch on. The output does not immediately change its status when it reaches the switching event (SP), but rather only after the pre-set delay time (DS).

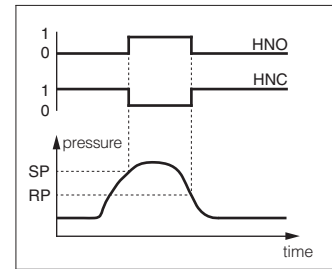
If the switching event is no longer present after the delay time, the switch output does not change.

The output only switches back when the system pressure has fallen down to the reset point (RP) and stays at or below the reset point (RP) for at least the pre-set delay time (DR).

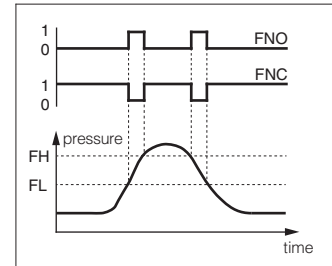
If the switching event is no longer present after the delay time, the switch output does not change.

Delay times is available for Hysteresis and Window functions.

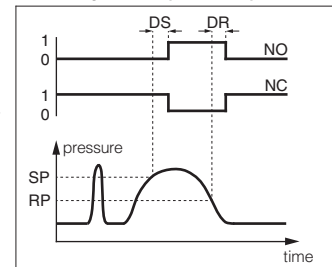
4.1 Hysteresis Function



4.2 Window Function



4.3 Delay times (0 ... 50 s)



5 INSTALLATION AND USE

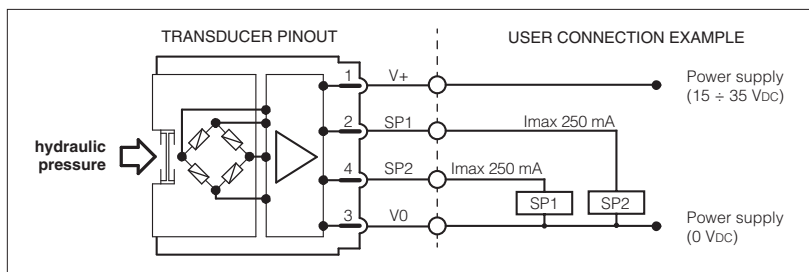
E-DAP-2 can be installed in any position.

Rotate the 4 digit display in order to provide the best visual orientation.

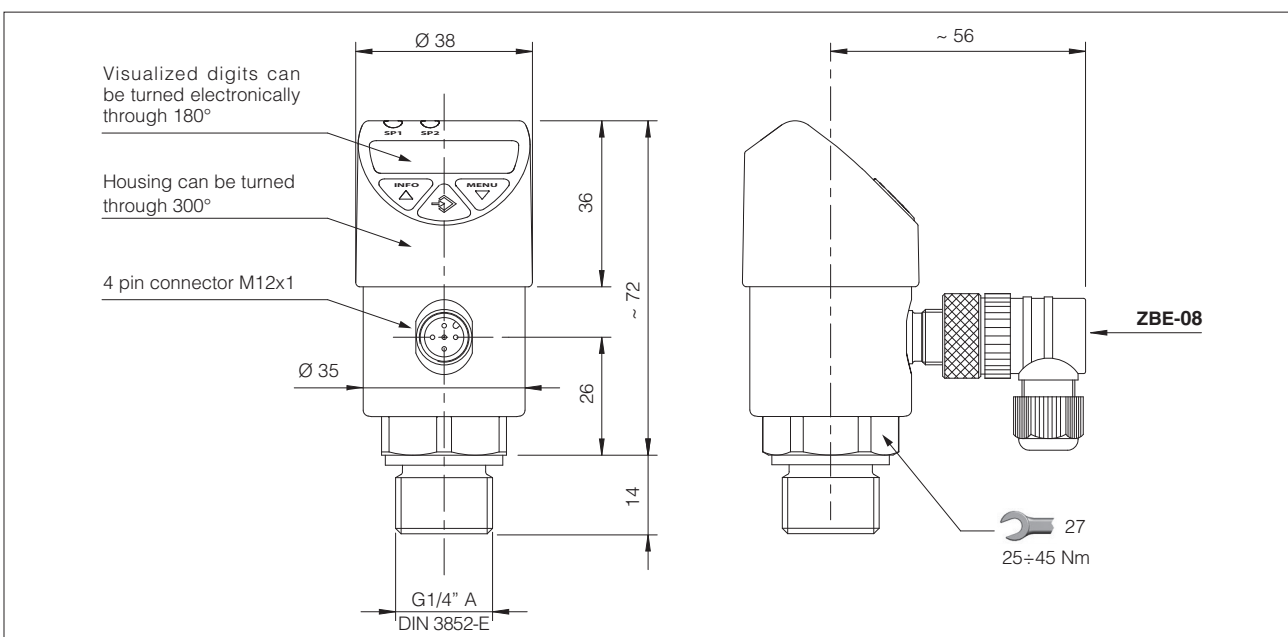
Connect M12 electric connector according the wiring diagram in section 6.

Consult the operating manual, supplied with the electronic pressure switch, for the parameters setting.

6 ELECTRONIC CONNECTIONS

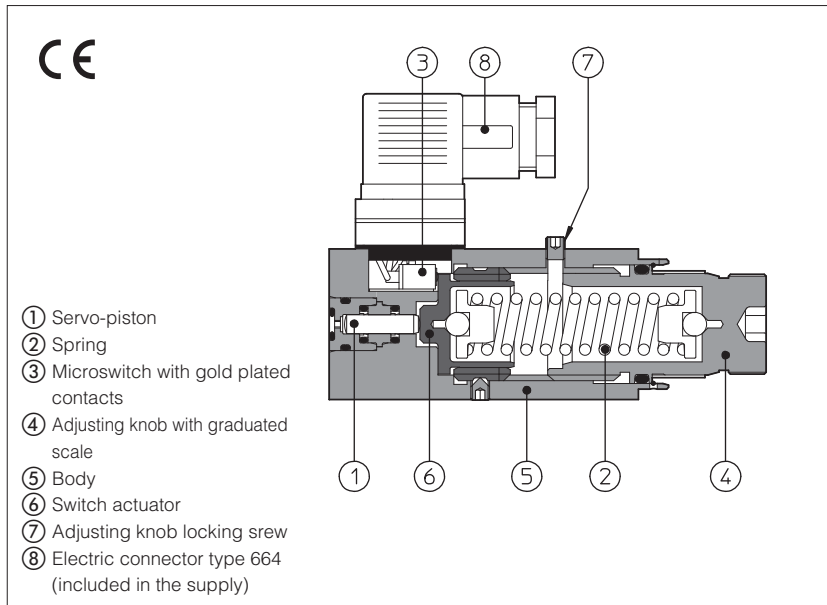


7 OVERALL DIMENSIONS [mm]



Pressure switches type **MAP**

with fixed switching pressure differential and microswitch with gold plated contacts



MAP are hydro-electric pressure switches with fixed switching pressure differential. The mechanical microswitch with gold plated contacts grants high reliability and long life service.

The microswitch changes its status when the pressure in the hydraulic circuit reaches the switching value set on the adjusting knob. The microswitch returns to the original rest position when the pressure in the hydraulic circuit drops below the nominal fixed switching pressure differential (hysteresis). The electric connector provides both NC or NO contacts.

The pressure in the circuit operates the piston (1) acting against the adjustable spring (2); once the pressure setting is reached, the piston (6) actuates the microswitch (3).

The pressure switching value is selectable by a graduated adjusting knob (4).

Clockwise rotation increases the setting pressure.

Max pressure: **630 bar**

1 MODEL CODE

MAP	-	160	/	E	/	**	/	*
Fixed differential pressure switch					Series number	Seals material, see section 2: - = NBR PE = FKM BT = HNBR		
Pressure range:	160	= 10 ÷ 160 bar						
	40	= 5 ÷ 40 bar						
	80	= 7 ÷ 80 bar						
	320	= 30 ÷ 320 bar						
	630	= 50 ÷ 630 bar						
				Options:				
				E = Common electric contact connected to pin 1, see section 3				

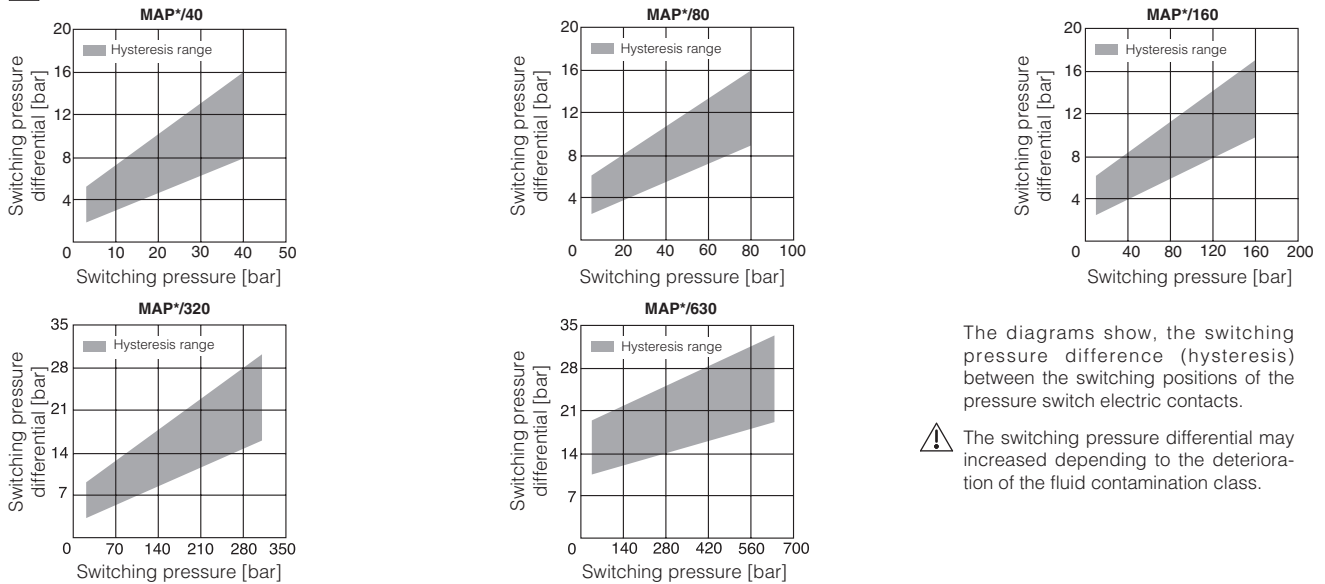
2 MAIN CHARACTERISTICS, SEALS AND HYDRAULIC FLUID - for other fluids not included in below table, consult our technical office

Assembly position / location	Any position		
Subplate surface finishing	Roughness index Ra 0,4 - flatness ratio 0,01/100 (ISO 1101)		
Compliance	CE to Low Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006		
Ambient temperature	Standard = -30°C ÷ +70°C / /PE option = -20°C ÷ +70°C / /BT option = -40°C ÷ +70°C		
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	15 ÷ 100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s		
Fluid contamination class	ISO 4406 class 21/19/16 NAS 1638 class 10, in line filters of 25 µm (β25 ≥75 recommended)		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

3 CHARACTERISTICS AND WIRING OF INTERNAL MICROSWITCH

	Supply voltage [V]						Rest position	Pressure operated position
	125 AC	250 AC	30 DC	250 DC				
Max current resistive load [A]	7	5	5	0,2	STD			
Max current inductive load (Cos φ = 0,4) [A]	4	2	3	0,02				
Insulating resistance	≥100MΩ				/E			
Contact resistance	15 mΩ							
Electrical life-expectancy	≥1.000.000 switchings							
Mechanical life-expectancy	≥10.000.000 switchings							

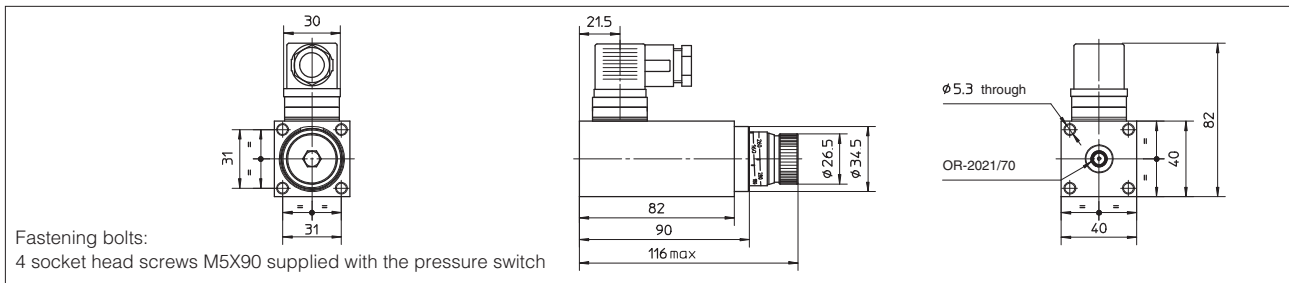
4 DIAGRAMS



The diagrams show, the switching pressure difference (hysteresis) between the switching positions of the pressure switch electric contacts.

⚠ The switching pressure differential may increase depending to the deterioration of the fluid contamination class.

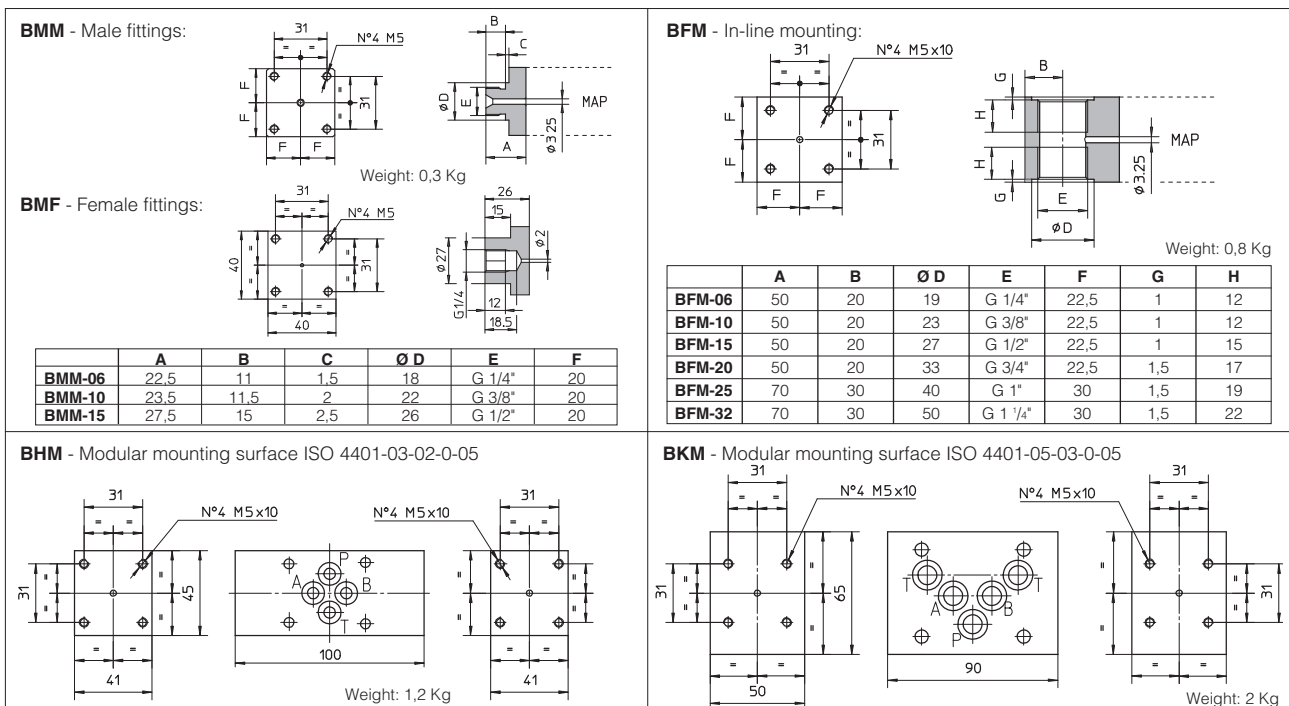
5 DIMENSIONS OF MAP WITHOUT ADAPTORS [mm]



6 MODEL CODE FOR ADAPTORS WHEN SUPPLIED SEPARATELY - BHM and BKM with option /PE or /BT are available on request

BHM	-	**
Type of adaptor BMM = male BMF = female BFM = in-line BHM = ISO 4401 size 06 BKM = ISO 4401 size 10		Threated connections for BMM and BFM adaptors, see section 7 BHM and BKM adaptors, see section 7
	06 = G 1/4" (BMM, BMF, BFM) 20 = G 3/4" (BFM) 10 = G 3/8" (BMM, BFM) 25 = G 1" (BFM) 15 = G 1/2" (BMM, BFM) 32 = G 1 1/4" (BFM)	11 = port P 14 = port B 12 = port A and B 17 = port P and A 13 = port A 18 = port P and B

7 DIMENSIONS OF ADAPTORS [mm]



For versions 11 and 13 the pressure switch is mounted on side of port A. For version 14 the pressure switch is mounted on side of port B. For versions 12, 17, 18 the pressure switch is mounted on both sides.

Mounting subplates type BA

single, for ISO valves size 06 to 32

BA-* are single subplates with ISO mounting surface for installation of Atos valves and they are provided with threaded ports for connection to pressure, tank and users lines. They are characterized by low pressure drops and they are specific for directional, flow and pressure control valves ISO size 06, 10, 16, 20, 25 and 32;

Special subplates or manifolds for customized applications are available upon request.

The set of screws for the valve installation on the BA subplate must be ordered separately, see the code SET SC-* specified in the following sections.

1 TECHNICAL CHARACTERISTICS

Installation position	Any position
Operating pressure	Ports P, T, A, B = 350 bar See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Surface protection	zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

2 SINGLE STATION SUBPLATES FOR VALVES SIZE 06

ISO 4401:2005
Mounting surface: 4401-03-03-0-05

Matching valves

DH-00, DH-01	SET SC-DHZ
DH-02, DH-04	SET SC-DHZ
DH-05, DH-08	SET SC-DHZ
DH-09	SET SC-DHZ
DHI, DHA, DHW	SET SC-DHZ
DHE, DHL	SET SC-DH
DHQ	SET SC-DHZ
DLEH, DLEHM	SET SC-DH
DLAH, DLAHM	SET SC-DHZ
DLWH	SET SC-DHZ
QV-06	SET SC-QV
RZMO, RZMA	SET SC-DHZ
RZME	SET SC-DH
RZGO, RZGA	SET SC-DHZ
RZGE	SET SC-DH
DHZO, DHZA	SET SC-DHZ
DHZE, DHRZE	SET SC-DH
DLHZO, DLHZA	SET SC-DHZ
QVHZO-*06	SET SC-DHZ
QVHZA	SET SC-DHZ

Set of screw
(to be ordered separately)

BA-202 **BA-204**

BA-302/Y

VERSIONS

BA-202: basic version without ports X and Y; ports P, A, B, T (3/8") on the base.

BA-204: basic version without ports X and Y; ports P and T (3/8") on the base; ports A and B (3/8") on the side.

BA-302: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

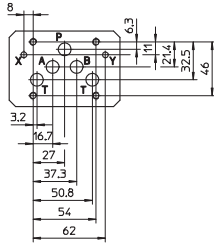
BA-302/Y: version dimensionally identical to the corresponding basic version with the addition of X and Y ports (1/8") on the base (see figure on the left).
The /Y version is always used for DHZO and DLHZO valves when drain from port Y is required.

X and Y ports are only present in the /Y versions.

Code	Ports (GAS) A,B,P,T (X-Y)	Ø Counterbore S [mm]	R [mm]	Mass [Kg]
BA-202	3/8"	-	-	1,2
BA-204	3/8"	-	25,5	1,8
BA-302 (Y)	1/2"	(1/8")	30	16,5

3 SINGLE STATION SUBPLATES FOR VALVES SIZE 10

ISO 4401:2005
Mounting surface: 4401-05-05-0-05

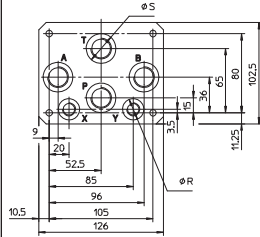


Matching valves

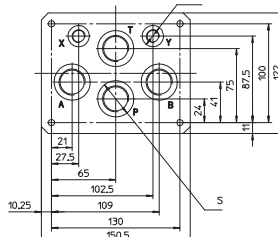
Set of screw
(to be ordered separately)

DK-11	SET SC-DK/DP-1
DK-12	SET SC-DK/DP-1
DKE	SET SC-DK/DP-1
DKQ	SET SC-DK/DP-1
DKZOR	SET SC-DK/DP-1
DKZA	SET SC-DK/DP-1
DLKZOR	SET SC-DK/DP-1
DLKZA	SET SC-DK/DP-1

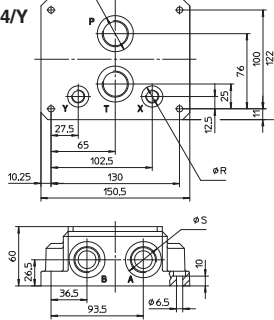
BA-308/Y



BA-428/Y



BA-434/Y



VERSIONS

BA-308: basic version without ports X and Y; ports P, A, B, T (1/2") on the base.

BA-428: basic version without ports X and Y; ports P, A, B, T (3/4") on the base.

BA-434: basic version without ports X and Y; ports P and T (3/4") on the base; ports A and B (3/4") on the side.

BA-*/Y:** versions dimensionally analogous to the corresponding basic versions with the addition of X and Y ports (1/4") on the base (see figure on the left).

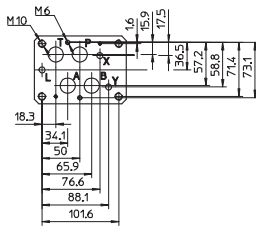
The /Y versions are always used for valves type DKZOR, DLKZO, when drainage from port Y is required.

X and Y ports are only present in the /Y versions.

Code	Ports (GAS) A,B,P,T, (X-Y)	Ø Counterbore S [mm]	R [mm]	Mass [Kg]
BA-308 (Y)	1/2" (1/4")	30	21,5	2,5
BA-428 (Y)	3/4" (1/4")	36,5	21,5	5,5
BA-434 (Y)	3/4" (1/4")	36,5	21,5	8,5

4 SINGLE STATION SUBPLATES FOR VALVES SIZE 16

ISO 4401:2005
Mounting surface: 4401-07-07-0-05

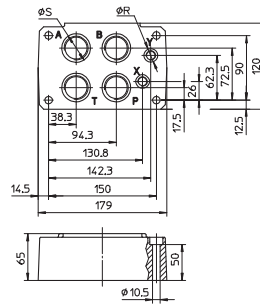


Matching valves

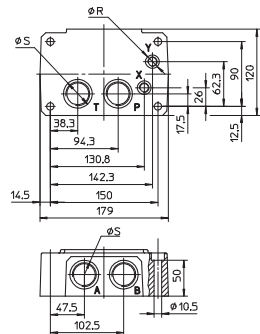
Set of screw
(to be ordered separately)

DP-21	SET SC-DP2
DP-24	SET SC-DP2
DP-25	SET SC-DP2
DPH-28	SET SC-DP2
DPH-29	SET SC-DP2
DPHI-2	SET SC-DP2
DPHE-2	SET SC-DP2
DPHA-2	SET SC-DP2
DPHW-2	SET SC-DP2
DPZO-*-2	SET SC-DP2
DPZA-*-2	SET SC-DP2

BA-518



BA-519



VERSIONS

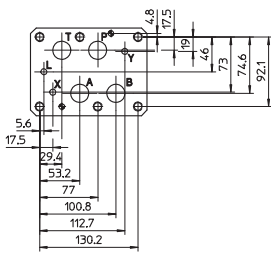
BA-518: basic version with ports P, A, B, T (1") and X, Y (1/4") on the base.

BA-519: basic version with ports P, T (1") and X, Y (1/4") on the base; ports A, B (1") on the side.

Code	Ports (GAS) A,B,P,T, X-Y	Ø Counterbore S [mm]	R [mm]	Mass [Kg]
BA-518	1" 1/4"	46	21,5	8
BA-519	1" 1/4"	46	21,5	8

5 SINGLE STATION SUBPLATES FOR VALVES SIZE 25

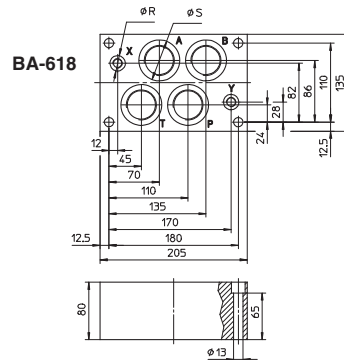
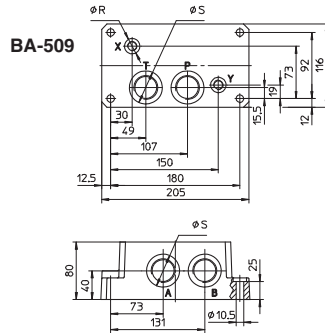
ISO 4401:2005
Mounting surface: 4401-08-08-0-05



Matching valves

Set of screw
(to be ordered separately)

DP-41	SET SC-DP4
DP-44	SET SC-DP4
DP-45	SET SC-DP4
DPH-48	SET SC-DP4
DPH-49	SET SC-DP4
DPHI-4	SET SC-DP4
DPHE-4	SET SC-DP4
DPHA-4	SET SC-DP4
DPHW-4	SET SC-DP4
DPZO-*-4	SET SC-DP4
DPZA-*-4	SET SC-DP4



VERSIONS

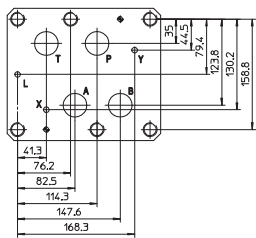
BA-509: basic version with ports P, T (1") and X, Y (1/4") on the base, ports A, B (1") on the side.

BA-618: basic version with ports P, A, B, T (1 1/4") and X, Y (1/4") on the base.

Code	Ports (GAS)		Ø Counterbore		Mass [Kg]
	A,B,P,T	X-Y	S [mm]	R [mm]	
BA-509	1"	1/4"	46	21,5	12,5
BA-618	1 1/4"	1/4"	57	21,5	13,5

6 SINGLE STATION SUBPLATES FOR VALVES SIZE 32

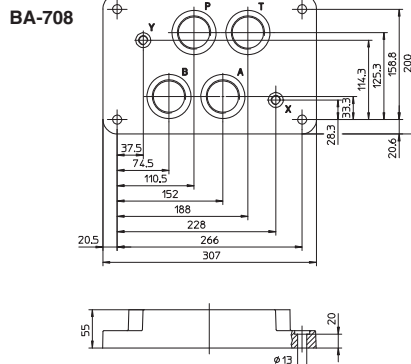
ISO 4401:2005
Mounting surface: 4401-10-09-0-05



Matching valves

Set of screw
(to be ordered separately)

DP-64	SET SC-DP6
DP-65	SET SC-DP6
DPH-68	SET SC-DP6
DPH-69	SET SC-DP6
DPHI-6	SET SC-DP6
DPHE-6	SET SC-DP6
DPHA-6	SET SC-DP6
DPZO-*-6	SET SC-DP6
DPZA-*-6	SET SC-DP6



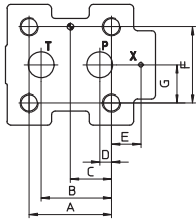
VERSIONS

BA-708: basic version with ports P, A, B, T (1 1/2") and X, Y (1/4") on the base.

Code	Ports (GAS)		Ø Counterbore		Mass [Kg]
	A,B,P,T	X-Y	S [mm]	R [mm]	
BA-708	1 1/2"	1/4"	63,5	21,5	17

7 SINGLE STATION SUBPLATES FOR PRESSURE CONTROL VALVE SIZE 10, 20 AND 32

Mounting surface
ISO 6264: 1998



Matching valves Set of screw
to be ordered separately

AGAM-10	SET SC-AGA-10
AGMZO-10	SET SC-AGA-10
AGMZA-10	SET SC-AGA-10
AGAM-20	SET SC-AGA-20
AGMZO-20	SET SC-AGA-20
AGMZA-20	SET SC-AGA-20
AGAM-32	SET SC-AGA-32
AGMZO-32	SET SC-AGA-32
AGMZA-32	SET SC-AGA-32

size	A	B	C	D	E	F	G
10	53,8	47,5	22,1	22,1	-	53,8	26,9
20	66,7	55,6	33,4	11,1	23,8	70	35
32	88,9	76,2	44,5	12,7	31,8	82,6	41,3

BA-306
Mounting surface
ISO 6264-06-09-0-97

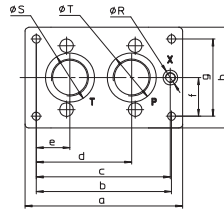
matching valves:
AGAM-10
AGMZO---10
AGMZA---10

BA-506
Mounting surface
ISO 6264-08-13-0-97

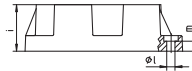
matching valves:
AGAM-20
AGMZO--20
AGMZA--20

BA-706
Mounting surface
ISO 6264-10-17-0-97

matching valves:
AGAM-32
AGMZO--32
AGMZA--32



BA-306
BA-506
BA-706



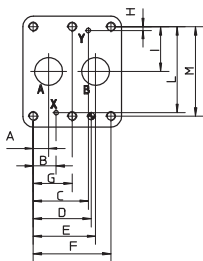
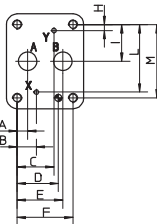
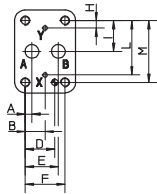
Code	a	b	c	d	e	f	g	h	i	l	m	Ø Blade		
												S	R	T
BA - 306	130	104	97	64,5	19,5	27	54	80	40	8,4	15	36,5	21,5	30
BA - 506	180	150	133,25	92,25	37,25	37,5	75	105	50	10,5	13	46	21,5	46
BA - 706	204	175	173,5	123,5	43,5	50	100	130,5	60	10,5	13	63,5	21,5	63,5

VERSIONS

BA-306, BA-506, BA-706: basic version, see figure on left and dimensional tables.

Code	size	Ports (GAS)			Mass [Kg]
		P	T	X	
BA - 306	10	1/2"	3/4"	1/4"	1,5
BA - 506	20	1"	1"	1/4"	3,5
BA - 706	32	1 1/2"	1 1/2"	1/4"	6

Mounting surface
ISO 5781: 2000



Matching valves Set of screw
to be ordered separately

AGI*-10(20)	SET SC-AGI
AGRL(E)-10(20)	SET SC-AGI
AGRCZO-10(20)	SET SC-AGI
AGRCZA-10(20)	SET SC-AGI
AGI*-32	SET SC-AGI-32
AGRL(E)-32	SET SC-AGRL-32

Mounting surface
ISO 5781-06-07-0-00

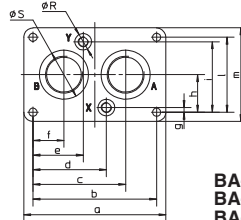
matching valves:
AGI*-10
AGRL-10
AGRL-10
AGRZO---10

Mounting surface
ISO 5781-08-10-0-00

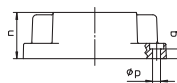
matching valves:
AGI*-20
AGRL-20
AGRL-20
AGRZO--20

Mounting surface
ISO 5781-10-13-0-00

matching valves:
AGI*-32
AGRL-32
AGRL-32



BA-305
BA-505
BA-705



Code	a	b	c	d	e	f	g	h	i	l	m	n	p	q	Ø Blade	
															S	R
BA - 305	113	90	67	45	45	23	8	33,3	58,7	66,7	90	30	10,5	10	30	21,5
BA - 505	133	110	82,5	64,5	45,5	27,5	6,4	39,7	73	79,4	102,5	42	10,5	10	46	21,5
BA - 705	184	160	120	95	65	40	6	48,5	91	97	121	60	10,5	13	63,5	21,5

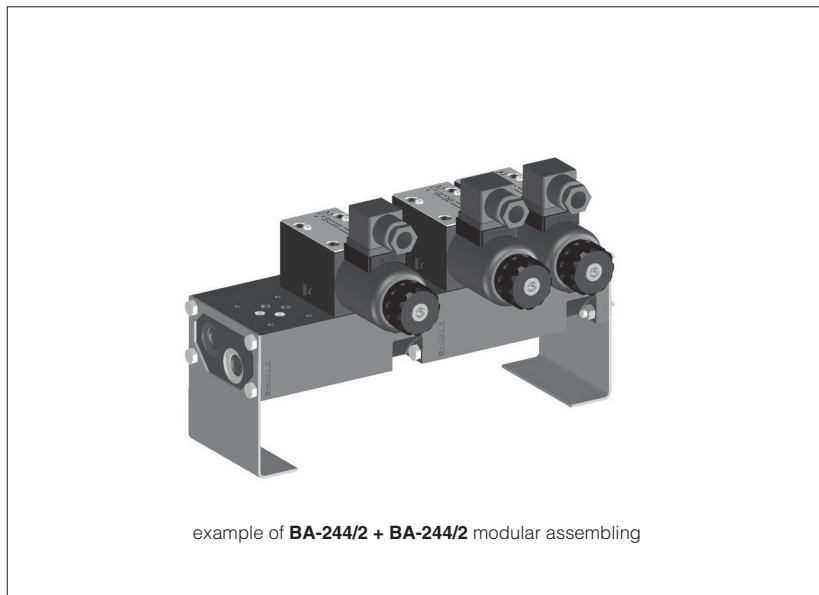
VERSIONS

BA-305, BA-506 and BA-705: see figure on left and dimensional tables.

Code	size	Ports (GAS)			Mass [Kg]
		A	B	X-Y	
BA - 305	10	1/2"	1/2"	1/4"	1
BA - 505	20	1"	1"	1/4"	2
BA - 705	32	1 1/2"	1 1/2"	1/4"	7,5

Mounting subplates type **BA-214, 314 and 244**

Multi-station, for valves ISO 4401 size 06 and 10



BA-214, BA-314 and **BA-244** are multi-station subplates for assembling of directional and modular valves with mounting surface ISO 4401, size 06 and 10. They are made in cast iron with high corrosion protection black zinc surface treatment, and they are provided with P, T passing through lines and A, B user ports connections.

BA-214 are **multistation subplates** with 1 to 10 stations for valves ISO size 06.

BA-314 are **multistation subplates** with 1 to 6 stations for valves ISO size 10.

BA-244 are **modular subplates** with 1 to 4 stations for valves ISO 4401 size 06.

They are designed for installation on power units cover and they can be easily assembled together by means of n° 4 screws M6 class 12.9 (included in the supply), combining up to max 12 stations.

1 MODEL CODE OF SUBPLATES TYPE BA-214 and BA-314

BA-214	/	5	/	P	*
Type of subplate: BA-214 = for valves ISO size 06 BA-314 = for valves ISO size 10				Series number	
Number of stations , see section 4 5 6: 1 = one station 6 = six stations 2 = two stations 7 = seven stations (only for BA-214) 3 = three stations 8 = eight stations (only for BA-214) 4 = four stations 9 = nine stations (only for BA-214) 5 = five stations 10 = ten stations (only for BA-214)				- = with A and B lateral ports P = with A and B rear ports (not for BA-214/1 and all BA-314)	

Model	Port P	Port T	Ports A, B	Qmax	Qmax ports A, B	Pmax
BA-214	G 1/2"	G 1/2"	G 3/8" lateral	80 l/min	60 l/min	350 bar
BA-214/*P	G 1/2"	G 1/2"	G 3/8" rear	80 l/min	60 l/min	350 bar
BA-314	G 3/4"	G 1"	G 3/4" lateral	150 l/min	100 l/min	300 bar

2 MODEL CODE OF SUBPLATES TYPE BA-244

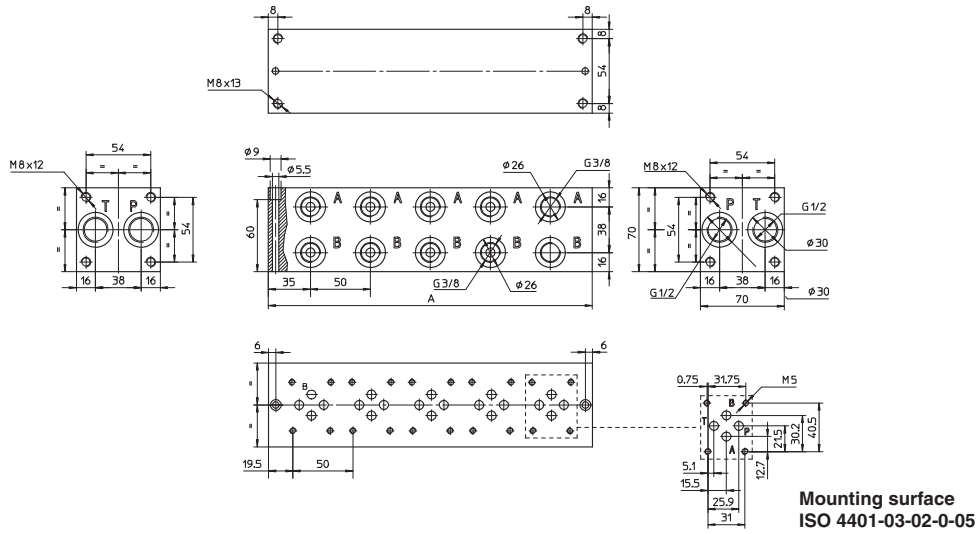
BA-244	/	4	*
Type of subplate: BA-244 = modular subplate for valves ISO size 06		Number of stations: 1 = one station 3 = three stations 2 = two stations 4 = four stations	
		Series number	

3 TECHNICAL CHARACTERISTICS

Installation position	Any position. For BA-244, a maximum of 12 stations can be combined; in case of horizontal mounting proper brackets are recommended.
Operating pressure	Ports P, T, A, B = 350 bar (BA-214), 300 bar (BA-314), 250 bar (BA-244) See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15÷100 mm ² /s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Surface protection	zinc coating with black passivation
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214 [mm]

Ports P and T = G 1/2" (passing through)
 Ports A and B = G 3/8"
 $Q_{max} = 80$ l/min
 Q_{max} A and B ports = 60 l/min
 $P_{max} = 350$ bar



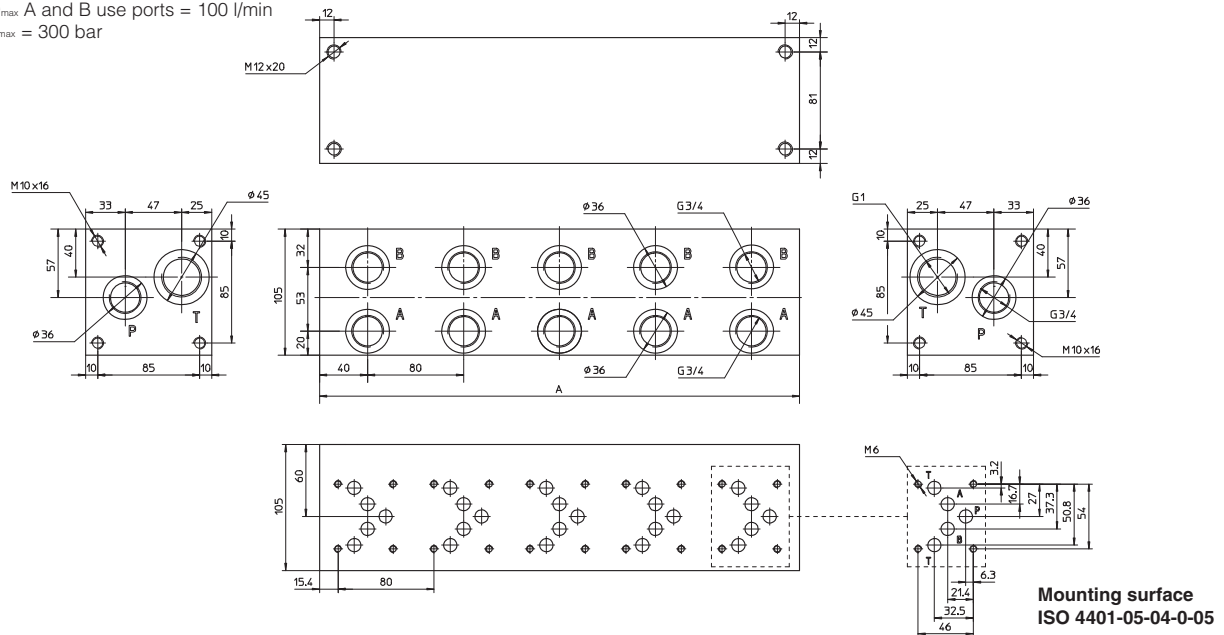
The length of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	2	3,5	5	6,5	8	9,5	11	12,5	14	15,5

The 5-station version is shown in the drawing

5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-314 [mm]

Ports P = G 3/4" (passing through)
 Ports T = G 1" (passing through)
 Ports A and B = G 3/4"
 $Q_{max} = 150$ l/min
 Q_{max} A and B use ports = 100 l/min
 $P_{max} = 300$ bar



The length of the subplate depends to the number of stations as shown in the table below

Stations	1	2	3	4	5	6
Dimension A	80	160	240	320	400	480
Mass [Kg]	4	8,5	13	17,5	22	26,5

The 5-station version is shown in the drawing

Mounting subplates type BA-214/*-AL

multi-station, for valves ISO 4401 size 06, in aluminium

The multi-stations subplates type BA-214/*-AL for directional control valves are in aluminium and their mounting surface are in accordance with the international standards ISO 4401.

They perform limited pressure drop and are made by a **single subplate** from 1 to 10 stations for directional valves and modular elements ISO 4401 size 06.

Main characteristics:

P and T ports = G 1/2; A and B lateral use ports G 3/8; M pressure gauge connection G1/4; Q_{max} = 80 l/min; Q_{max} use ports = 60 l/min; P_{max} = 250 bar

Note: for versions /M and /MH Q_{max} = 35 l/min;

For other technical characteristics, see section [2] and [3].

1 MODEL CODE OF SUBPLATES TYPE BA-214/*-AL

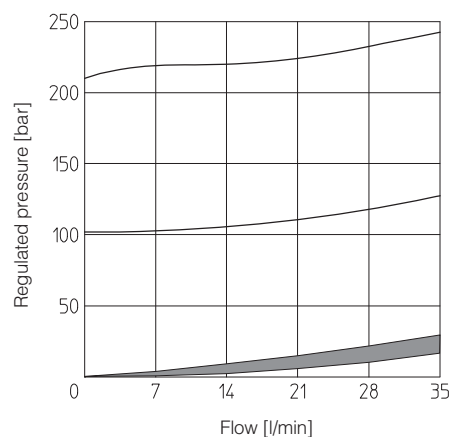
BA-214	/	5	/	MH	/	210	-	AL	*	PE
Type of subplate: BA-214 = for valves ISO size 06 On request, available with rear ports A and B									Series number	
Number of stations: 1 = one station 6 = six stations 2 = two stations 7 = seven stations 3 = three stations 8 = eight stations 4 = four stations 9 = nine stations 5 = five stations 10 = ten stations						Pressure range of pressure relief valve, for versions /M and /MH: 100 = 100 bar 210 = 210 bar 250 = 250 bar			Seals material: only for M, MH - = HNBR PE = HNBR	
						AL = in aluminium On request, available with anodizing				
						M = with direct operated pressure relief cartridge CART M-5/** - see tab. C010 (available also as spare part)				
						MH = with pressure relief valve type CART M-5, arranged with venting solenoid valve				

2 TECHNICAL CHARACTERISTICS

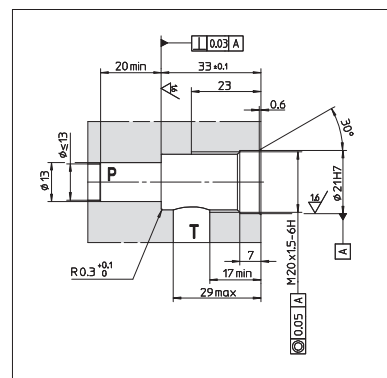
Installation position	Any position.
Operating pressure	Ports P, T, A, B = 250 bar See technical table of the valves to be assembled
Ambient temperature range	-30°C ÷ +70°C
Fluid	Hydraulic oil as per DIN 51524...535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm ² /s - max allowed range: see the technical table of the valves to be assembled
Max fluid contamination level	See technical table of the valves to be assembled and filter section at www.atos.com or KTF catalog
Fluid temperature	See technical table of the valves to be assembled
Compliance	RoHS Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

3 REGULATED PRESSURE/FLOW DIAGRAM FOR VERSIONS /M and /MH

MAIN CHARACTERISTICS OF ENCLOSED PRESSURE RELIEF VALVE	
Model code	Regulation range
CART M-5/100	3 ÷ 100 bar
CART M-5/210	5 ÷ 210 bar
CART M-5/250	7 ÷ 250 bar
Q_{max} = 35 l/min	

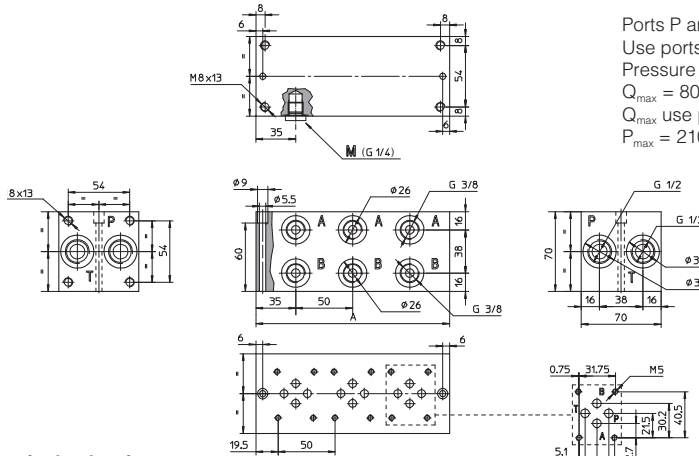
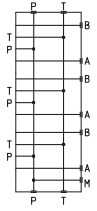


4 INSTALLATION DIMENSIONS OF CART M-5/**



5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*-AL [mm]

Hydraulic scheme



Ports P and T = G 1/2
 Use ports A and B = G 3/8
 Pressure gauge port M = G 1/4 (plugged)
 $Q_{max} = 80$ l/min
 Q_{max} use ports = 60 l/min
 $P_{max} = 210$ bar

The 3-stations subplate is shown in the drawing

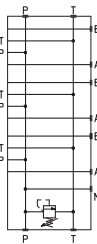
The length of the subplate varies with the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	1	1,4	2	2,6	3,2	3,8	4,4	5	5,6	6,2

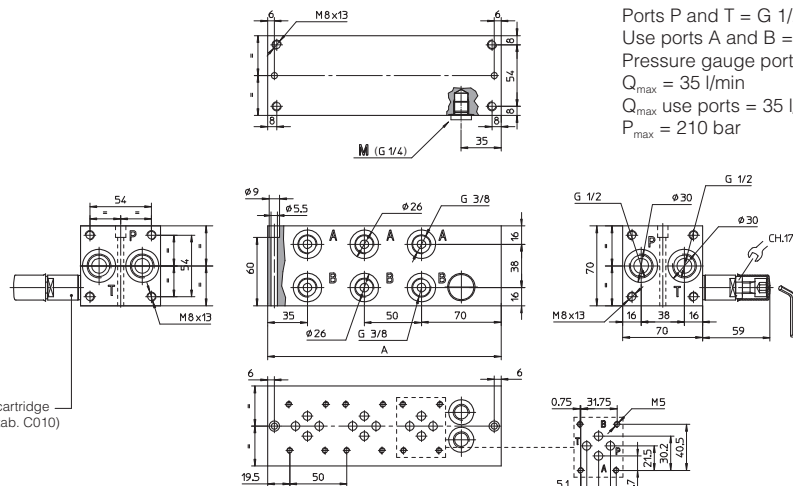
Mounting surface
 ISO 4401-03-02-0-05

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214*/M/*-AL [mm]

Hydraulic scheme



Pressure relief cartridge
 CART M5 (see tab. C010)



Ports P and T = G 1/2
 Use ports A and B = G 3/8
 Pressure gauge port M = G 1/4 (plugged)
 $Q_{max} = 35$ l/min
 Q_{max} use ports = 35 l/min
 $P_{max} = 210$ bar

The 3-stations subplate is shown in the drawing

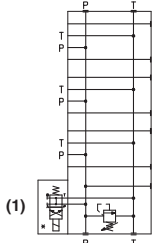
The length of the subplate varies with the number of stations as shown in the table below

Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	105	155	205	255	305	355	405	455	505	555
Mass [Kg]	1,1	1,5	2,1	2,7	3,3	3,9	4,5	5,1	5,7	6,3

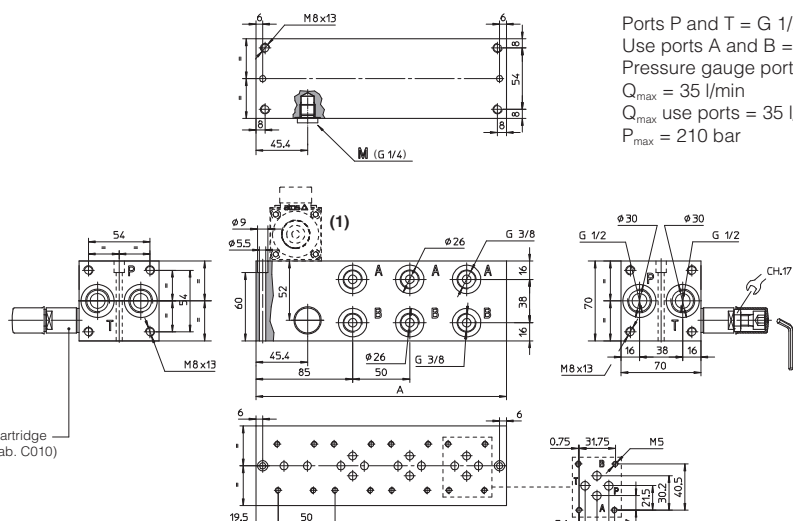
Mounting surface
 ISO 4401-03-02-0-05

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214*/MH/*-AL [mm]

Hydraulic scheme



Pressure relief cartridge
 CART M5 (see tab. C010)



Ports P and T = G 1/2
 Use ports A and B = G 3/8
 Pressure gauge port M = G 1/4 (plugged)
 $Q_{max} = 35$ l/min
 Q_{max} use ports = 35 l/min
 $P_{max} = 210$ bar

The 3-stations subplate is shown in the drawing

The length of the subplate varies with the number of stations as shown in the table below

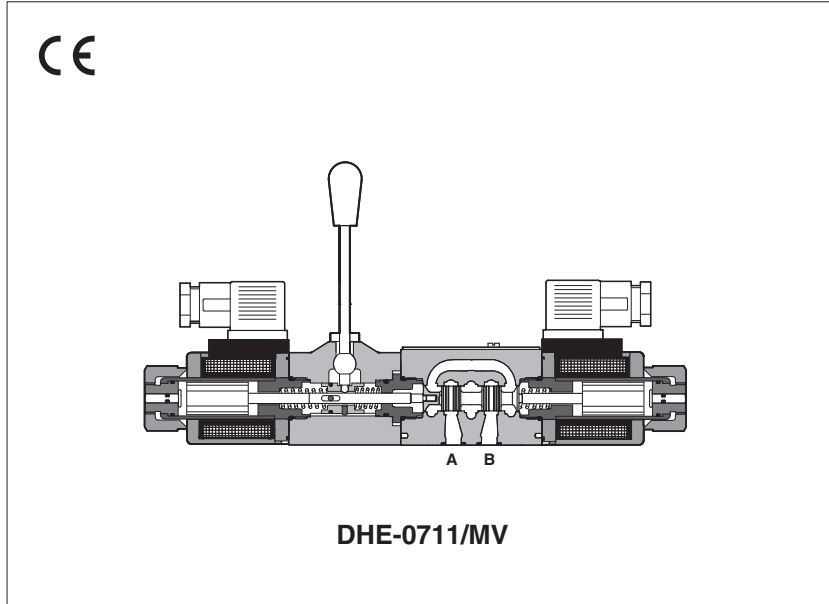
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	120	170	220	270	320	370	420	470	520	570
Mass [Kg]	1,2	1,6	2,2	2,8	3,4	4	4,6	5,2	5,8	6,4

Mounting surface
 ISO 4401-03-02-0-05

(1) The venting directional valve in the dashed line must be ordered separately

Auxiliary hand levers for solenoid valves

direct operated on-off and proportional, ISO 4401 size 06



Auxiliary hand levers for direct operated on-off solenoid valves size 06, type DHI, DHE, DHA and proportional valves size 06, type DHZO, DHZE, DHZA and QVHZO.

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.

It is available with two different configurations depending to the installation requirements:

- MV** = lever positioned vertically (perpendicular to the valve axis)
- MO** = lever positioned horizontally (parallel to the valve axis)

When the valve is electrically operated the hand lever remains stopped in its rest position

The hand lever execution does not affect the performances of the original valves.

1 MODEL CODE FOR ON-OFF DIRECTIONAL VALVES (for the details, see indicated tech. table)

DHE - 0	63	1/2	/ MV	- X	24 DC	**	/*
Directional control valves size 06 DHI-0= for AC and DC supply, with cURus certified solenoids - see table E010 DHE-0= for AC and DC supply, high performances, with cURus certified solenoids - see table E015 DHA-0= ex-proof - see table EX010						Series number	Seals material: - = NBR PE = FKM BT = HNBR
Valve configuration: 61 - 63 - 71 Available spools: 0 - 0/2 - 1 - 1P - 1/2 - 1/2P - 3 - 3P - 4 - 7 Options, hand lever configuration: MO = horizontal hand lever (not for DHA) MV = vertical hand lever AMO = horizontal hand lever installed at the side of port B (not for DHA) AMV = vertical hand lever installed at the side of port B							
						Voltage code: see relevant tech. table	
					Only for DHI and DHE: 00 = solenoids without coils, for DHI valve 00-AC = AC solenoids without coils, for DHE valve 00-DC = DC solenoids without coils, for DHE valve X = without connector		

(1) For DHA model code see table E120 (Multicertification) or E125 (UL)

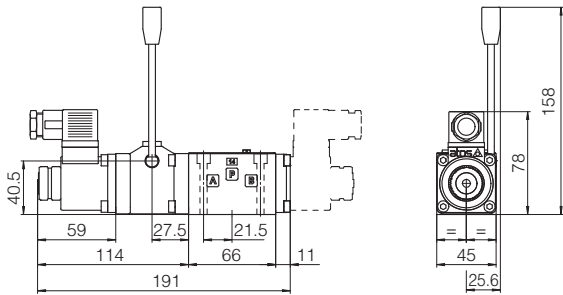
2 MODEL CODE FOR PROPORTIONAL DIRECTIONAL VALVES AND FLOW CONTROL VALVES (for the details, see indicated tech.table)

DHZO	- A	- 0	71	- S5	/ MV	/*	**	/*
Directional proportional valves size 06 DHZO = see table F160 DHZE = see table F150 DHZA = ex-proof - see table FX010 Flow control valves size 06 QVHZO = see tab F410						Series number		Seals material: - = NBR PE = FKM BT = HNBR
A = without position transducer (2)								
Valve size 0 = ISO 4401 size 06 (for DHZ*) 06 = ISO 4401 size 06 (for QVHZO)								
Valve configuration (only DHZ*): 51, 53, 71, 73								
						Options: MO = horizontal hand lever (not for DHA, DHZA) MV = vertical hand lever BMO = horizontal hand lever installed at the side of port A (not for DHZA, QVHZO) BMV = vertical hand lever installed at the side of port A (not for QVHZO) O = Horizontal cable entrance (only for DHZA) Y = External drain (only for DHZA, DHZO)		
						Spool size (for DHZ*): S3 - S5 - D3 - D5 - L3 - L5 Max regulated flow (for QVHZO): 3-12-18-36-45 l/min		

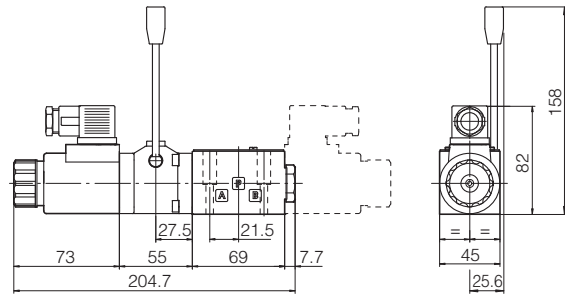
3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

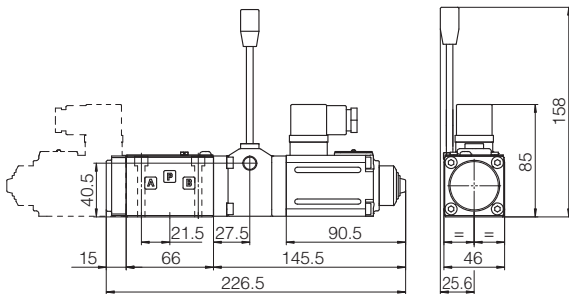
4 INSTALLATION DIMENSIONS [mm]



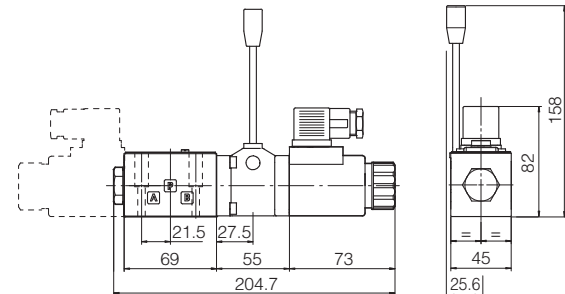
DHI-06*/MV Mass: 2,4 kg (single solenoid)
DHI-07*/MV (dotted line) Mass: 2,7 kg (double solenoid)



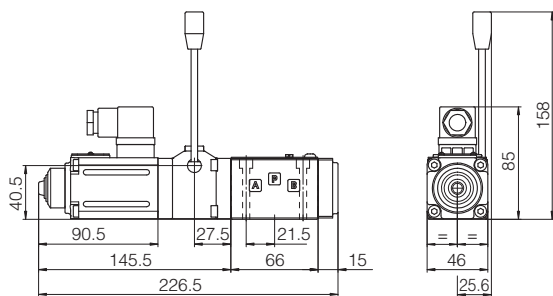
DHE-06*/MV Mass: 2,7 kg (single solenoid)
DHE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



DHZO-A-05*/MV Mass: 2,8 kg (single solenoid)
DHZO-A-07*/MV (dotted line) Mass: 3,5 kg (double solenoid)

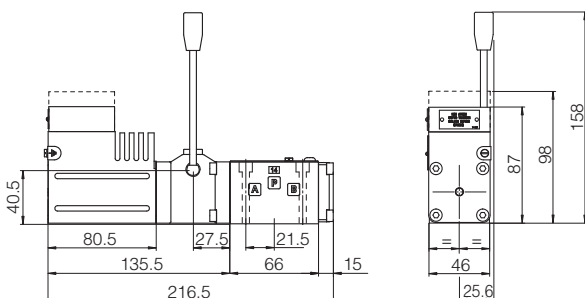
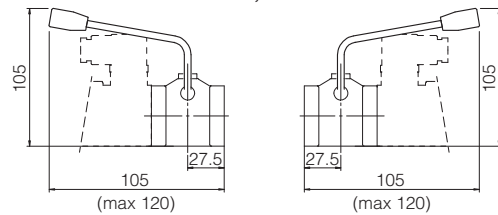


DHZE-05*/MV Mass: 2,7 kg (single solenoid)
DHZE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



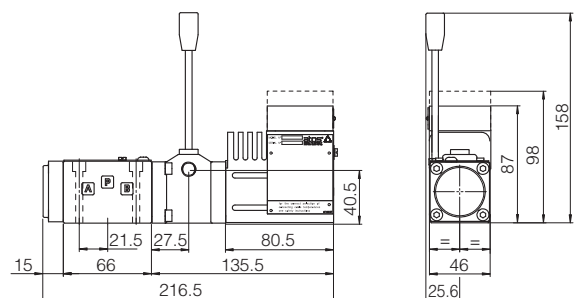
QVHZO-A-06*/MV Mass: 3,2 kg

Horizontal hand lever device /MO, /AMO



DHA/*-06*/MV Mass: 3,4 kg
DHA/UL-*06*/MV (dotted line)

Note: see tech. table FX010 for DHA/MV models



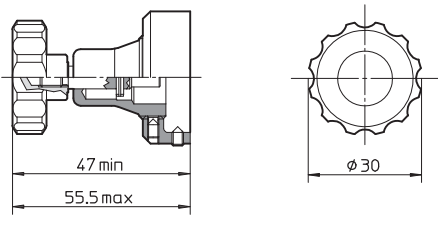
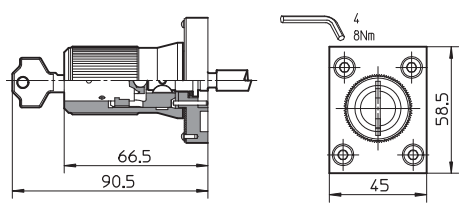
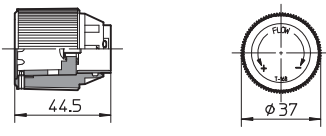
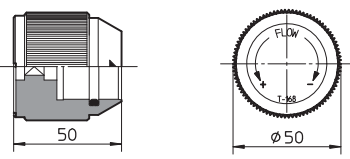
DHZA/*-06*/MV Mass: 3,4 kg
DHZA/UL-*06*/MV (dotted line)

Note: see tech. table FX100 for DHZA/MV models

Handwheels for hydraulic controls

on-off and proportional valves

	OPTIONS CODES AND DIMENSIONS	FEATURES	VALVE TYPE
OPTION	<p>IV</p>	Regulating handwheel	ARE, CART ARE, CART M-6, ARAM, AGAM, REM, AGIR, AGIS, AGIU, HMP, HM, KM, HS, KS, HG, KG, LIMM, LIRA, LICM
OPTION	<p>IVF</p>	Regulating knob	ARE, CART ARE, CART M-6, AGIS, AGIU (as spare part, code VFG instead of VF and VSG instead of VS), HMP, HS, HG.
OPTION	<p>VS</p>	Manual override with safety locking. Regulation possible only with pushed knob.	ARE, CART ARE, CART M-6, AGIS, AGIU (as spare part, code VFG instead of VF and VSG instead of VS), HMP, HS, HG.
OPTION	<p>IVP</p>	Prolonged manual override protected by rubber cap	DHI, DHE DKE DLEH, DLEHM DPHI, DPHE LID*
SPARE PART	<p>WPD/H (size 06)</p> <p>Groove only for WPD/K</p>		DHI
SPARE PART	<p>WPD/HE-DC</p>	Manual override with detent, for mechanical operation and fixed actuation of spools	DHE (only DC version)
SPARE PART	<p>WPD/KE-DC</p>		DKE-DC

	OPTIONS CODES AND DIMENSIONS	FEATURES	VALVE TYPE
SPARE PART	<p>WPD/Z</p> 	<p>Manual override with detent, for mechanical operation and fixed actuation of spools. Only for open-loop valves.</p>	<p>DHZO, DKZOR, DPZO, QVHZO, QVKZOR</p>
OPTION	<p>/K</p> 	<p>Lock key for the setting knob</p>	<p>DHQ, DKQ QV-06,</p>
OPTION	<p>/G</p> 	<p>Adjustment by graduated micrometer</p>	<p>HQ, KQ, JPQ-2</p>
OPTION	<p>/G</p> 		<p>JPQ-3</p>

Electric and electronic connectors

for transducers, on/off and proportional valves

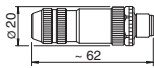


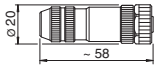


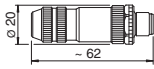


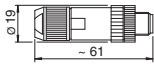


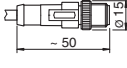

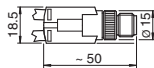

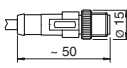

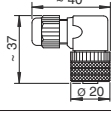


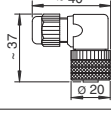


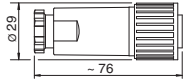
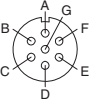

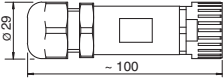


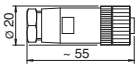





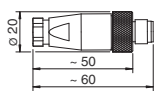


1 CONNECTORS FOR ON/OFF VALVES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - inductive proximity sensor, /FI option for DHI, DHE			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
664 666 (black) 666/A (grey) 667-24 667-110 667-220 	Female plastic connector - 4 pin: - pressure switch type MAP - inductive proximity sensor, /FI option for DKE-17* Female plastic connector - 3 pin: - standard coil connector for on/off valves - inductive proximity sensor, /FI option for DKE-16* Female plastic connector - 3 pin: - standard coil connector for on/off valves with built-in led			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZBE-06 	Female plastic connector - 4 pin: - inductive position switch, /FV option			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
BKS-B-20-4-03 	Female plastic connector - 4 pin (3 wire): - inductive proximity sensor for LIFI Cable length: 3 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
669 (black) 669/A (grey) 	Female plastic connector - 3 pin: - optional electronic connector for on/off valves with built-in rectifier bridge for supplying DC coils by AC current			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
E-SD/AC 	Female plastic connector - 3 pin: - electronic connector which eliminate electric disturbances when AC solenoid valves are deenergized Power supply: 110/50, 115/60, 220/50, 230/60 V _{AC}			PG11 ø 8 ÷ 10 mm	DIN 43650 Protection degree IP 65 EN 60529
E-SD/DC 	Female plastic connector - 3 pin: - electronic connector which eliminate electric disturbances when DC solenoid valves are deenergized Power supply: 12, 24, 48 V _{DC}			PG11 ø 8 ÷ 10 mm	DIN 43650 Protection degree IP 65 EN 60529

(1) the wiring of electrical terminals has to be made according to specific valve's technical table



2 CONNECTORS FOR PROPORTIONAL VALVES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
345 	Female plastic connector - 4 pin: - position transducer for ZO(R)-T and ZO-L valves			PG7 ø 4 ÷ 6 mm	Protection degree IP 65 EN 60529
666 (black) 	Female plastic connector - 4 pin: - standard coil connector for proportional valves			PG11 ø 8 ÷ 10 mm	DIN 43650-A/ISO 4400 Protection degree IP 65 EN 60529
ZM-7P 	Female metallic connector - 7 pin: - main connector for integral electronic driver			PG11 ø 7 ÷ 9 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZM-12P 	Female metallic connector - 12 pin: - main connector for integral electronic driver			PG13,5 ø 8 ÷ 11 mm	DIN 43651 Protection degree IP 67 EN 60529
ZM-5PF 	Female metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 60947-5-2 Protection degree IP 67 EN 60529

ZM-5PM		Male metallic connector - 5 pin: - CANbus for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PF/BP		Female metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-5PM/BP		Male metallic connector - 5 pin: - PROFIBUS DP for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZM-4PM/E		Male metallic connector - 4 pin: - EtherCAT, POWERLINK, EtherNet/IP, PROFINET RT/IRT for integral electronic driver			Pressure nut ø 6 ÷ 8 mm	M12 - coding D IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM/1.5 ZH-5PM/5		Male plastic connector - 5 pin - single pressure/force transducer - analog position transducer Cable length: 1.5 m or 5 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM-2.2		Male plastic connector - 4 pin: - double pressure/force transducers Splitting cable length: 2 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-8PM/5 ZH-8PM/10		Male plastic connector - 8 pin: - digital position transducer Cable length: 5 m or 10 m			Moulded on cable	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-06		Female plastic connector - 4 pin: - position transducer (LIQZO-T* size 50) - integral pressure transducer (TERS)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZBE-08		Female plastic connector - 5 pin: - position transducer E-THT-15 (LIQZP)			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-7P		Female plastic reinforced with fiber glass connector - 7 pin: - main connector for integral electronic driver			PG11 ø 8 ÷ 10 mm	According to MIL-C-5015 Protection degree IP 67 EN 60529
ZH-12P		Female plastic reinforced with fiber glass connector - 12 pin: - main connector for integral electronic driver			PG16 ø 6 mm x 2 cable	DIN 43651 Protection degree IP 67 EN 60529
ZH-5P		Female plastic connector - 5 pin: - RS232 Serial, CANbus - digital electronic driver E-MI-AS-IR, /M12 option			PG9 ø 6 ÷ 8 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5P/BP		Male plastic connector - 5 pin: - PROFIBUS DP			PG9 ø 6 ÷ 8 mm	M12 - coding B IEC 61076-2-101 Protection degree IP 67 EN 60529
ZH-5PM		Male plastic connector - 5 pin: - pressure, force, position transducers (TEZ/LEZ series 10 or lower)			PG7 ø 4 ÷ 6 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be realized according to specific valve's technical table

3 CONNECTOR FOR PRESSURE TRANSDUCERS AND PRESSURE SWITCHES

CODE AND DIMENSIONS	APPLICATION	INTERNAL VIEW PINOUT (1)	FRONT VIEW	CABLE GLAND Ø CABLE	REFERENCE RULES
ZBE-08	Female plastic connector - 5 pin: - pressure transducer E-ATR8 - electronic pressure switch type E-DAP-2			PG7 ø 2,5 ÷ 6,5 mm	M12 - coding A IEC 61076-2-101 Protection degree IP 67 EN 60529

(1) the wiring of electrical terminals has to be made according to specific transducer's technical table

6 GENERAL INFORMATION

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GENERAL INFORMATION

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TECHNICAL INFORMATION		
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Basics for digital proportional electrohydraulics

Digital electrohydraulics enables new functionalities within the conventional control architectures and represents the fundamental premise to realize machines with high technological contents.

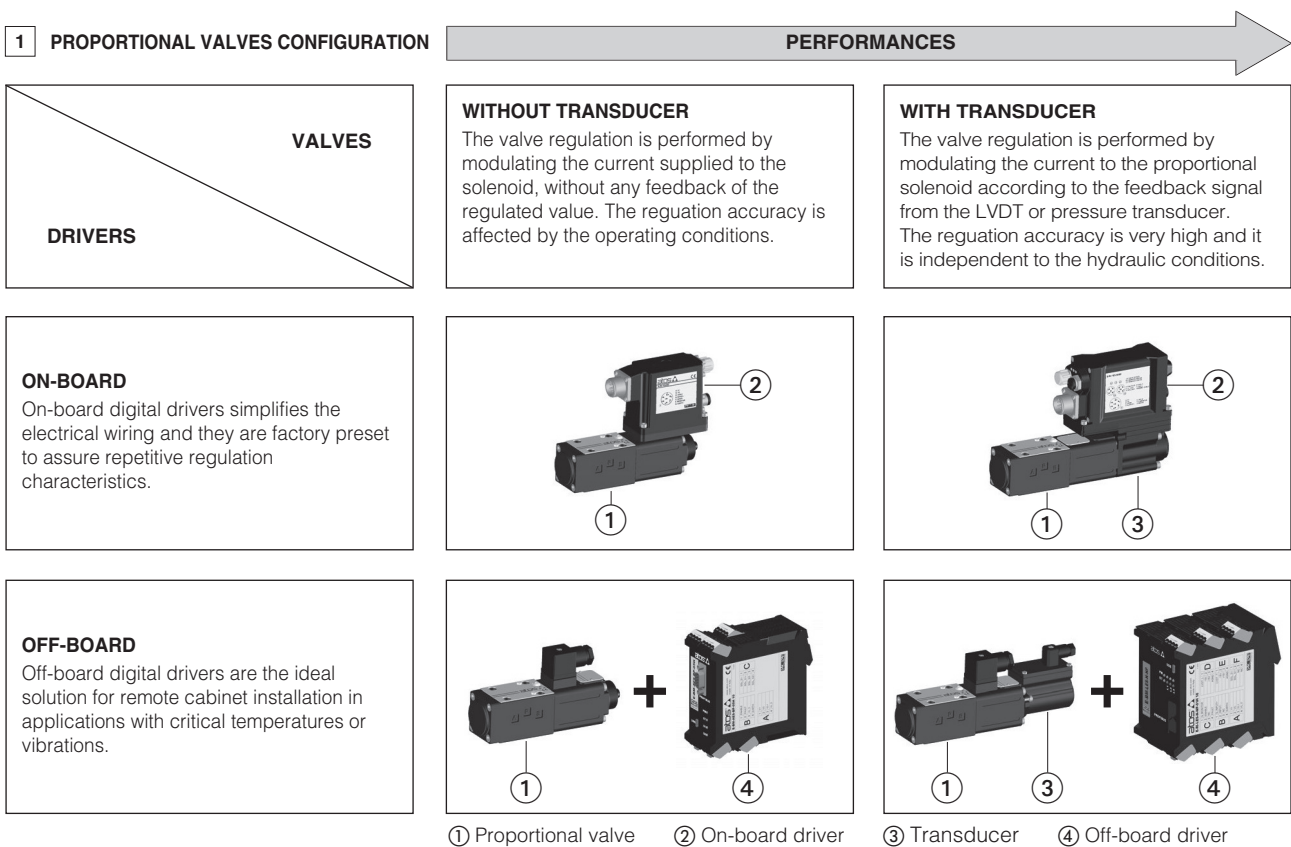
The digital electronics integrates several logic and control functions (distributed intelligence) and allows the introduction into the hydraulic system of the most modern fieldbus communication networks.

The integration of advanced digital technologies into Atos proportional valves brings important advantages and innovative features:

- better performances of electrohydraulic components: hysteresis, response time, linearity, repeatability, valve to valve reproducibility
- numerical software setting of hydraulic parameters (scale, bias, ramp, compensation of non-linearities) for full valve to valve reproducibility
- advanced diagnostics (alarms history, built-in oscilloscope function) and computer assisted maintenance
- industry 4.0 connectivity through direct interfacing with fieldbus networks

Atos digital components range includes:

- proportional valves and drivers, see sections [1](#) and [2](#)
- proportional P/Q pumps, see 4.3
- axis controls and servoactuators, see section [5](#)



2 PROPORTIONAL VALVES CLASSIFICATION - with on-board or off-board driver

PERFORMANCES	Valve classification	Type of valve	Transducer	Hydraulic features	Application
	Servoproportionals	Directional	LVDT	Zero spool overlap	Actuator position and speed control P/Q control
	High performance proportionals	Directional	LVDT	Positive spool overlap	Actuator direction and speed control P/Q control
		Flow	LVDT	Pressure compensated	System flow regulation, actuator speed control
	Proportionals	Pressure	Pressure	Relief Reducing Compensator	System pressure control Actuator force control Load sensing control
		Directional	None	Positive spool overlap	Actuator direction and speed control
		Flow		Pressure compensated	System flow regulation, actuator speed control
		Pressure		Relief Reducing Compensator	System pressure control Actuator force control Load sensing control

3 **FIELDBUS INTERFACES** - see tech table **GS510**

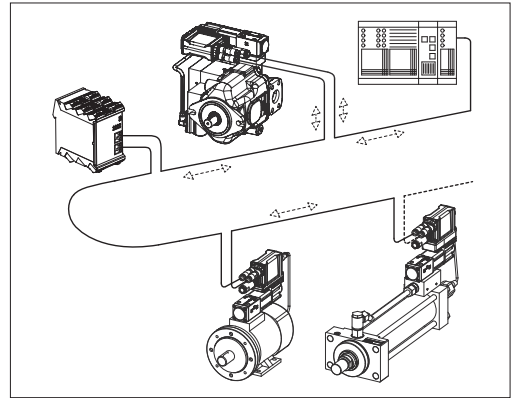
Drivers with fieldbus communication interface allow an higher level of integration with the machine automation architecture: machine central unit (fieldbus master), wired with all the controlled devices (fieldbus node).

Fieldbus available:

BC = CANopen **BP** = PROFIBUS DP **EH** = EtherCAT
EW = POWERLINK **EI** = EtherNet/IP **EP** = PROFINET RT/IRT

Fieldbus interface allows:

- complete diagnostic of the driver status
- improved information available for machine operation
- improved accuracy and robustness of digital transmitted information
- real time modification of the valve parameters
- direct access to all driver parameters
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance



4 **P/Q CONTROLS** - see tech table **FS500**

4.1 P/Q controls for servoproportional and high performance directional valves

In most of the machines functions, the typical movement of a single actuator requires direction, speed and sometime force regulations, normally performed by different type of valves.

Digital proportional valves with SP, SF, SL options add the pressure or force closed loop control to the basic directional control.

A single proportional valve with P/Q control allows to manage complex machine operations requiring high performance combined regulations (typical application: injection cycle or mould motion in plastic machinery).

The closed loop pressure or force control requires the installation in the system of one/two remote pressure transducers or a load cell, to be connected to the valve digital driver.

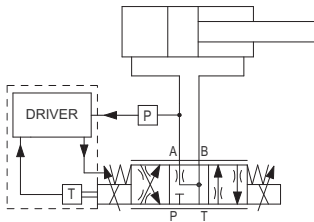
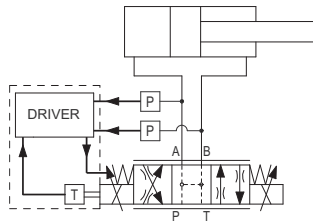
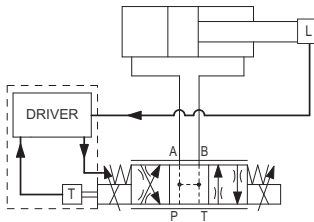



The option SP performs the closed loop pressure control on one side of the actuator by using one remote pressure transducer.

The other two options perform the closed loop force control by two remote pressure transducers (SF) or one load cell (SL).

Pressure/force and flow are regulated according to two different command signals.

The selection from pressure-force to flow control and vice versa is self performed by the digital driver through dedicated algorithm.

P/Q control configurations

SP = pressure control	SF = force control	SL = force control
		
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load
 valve spool transducer	 pressure transducer	 load cell

4.2 Proportional valves with P/Q control - with on-board or off-board driver/axis card

Valve classification	Application
Servoproportionals	SF, SL SP only in 3-way connection
High performance proportionals	SP, SF, SL



4.3 P/Q controls for variable piston pumps - see tech table **AS170**

PVPC-PERS/PES variable displacement axial piston pumps, integrate the digital combined closed loop pressure and flow control with the electronic max power limitation.

A multiple set of PID parameters can be real time selected during the axis motion via the 12 pin connector (option /S) or through the fieldbus interface, to optimize the P/Q control performances.

The PVPC-PES pumps allow the accurate and dynamic closed loop control of the delivered flow and the system pressure.









5 AXIS CONTROLS

The modern architecture of industrial machinery strongly increases the demand of accuracy, repeatability and performance. This leads to the need of devices that integrate to the traditional axis positioning also the pressure/force controls.

Atos focuses the integration of axis cards functions with proportional electrohydraulics either in on-board or off-board format.

They improve motion performances, simplify the automation architecture and may be integrated in the fieldbus network.

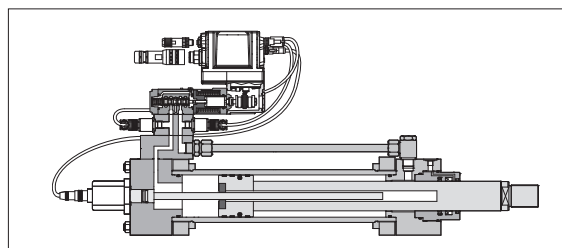
5.1 Synthetic comparison

TYPE		ON BOARD AXIS CARD AND DRIVER	AXIS CARD WITH DRIVER FUNCTION	AXIS CARD
FORMAT			 DIN-rail format	 DIN-rail format
MAIN FUNCTION			 DIN-rail format	 DIN-rail format
Technical table		FS610 FS620 FS630	GS330	GS340
Valve's driver function		●	●	n.a.
Nr. of controlled axis		1	1	1
Internal programmable cycles		simple	simple	complete
Graphic programming software		●	●	●
Position control		●	●	●
Position transducer interface:	Analog	●	●	●
	Digital (SSI or Encoder)	●	●	●
P/Q control		●	●	●
Analog transducer interface, pressure or force		2	2	2
Performance parameters setting (e.g. Dither, PID)		●	●	●
Valve parameters setting (e.g. Bias, Ramp, Scale)		● factory preset	● factory preset	●
Alternated control		●	●	●
USB interface		●	●	●
CANopen		●	●	●
PROFIBUS DP		●	●	●
EtherCAT		●	●	●
POWERLINK		●	●	●
EtherNet/IP		●	●	●
PROFINET RT/IRT		●	●	●
Digital input		1	1	3
Digital output		1	1	1
Analog input reference		2	2	2
Analog output monitor		2	2	up to 3

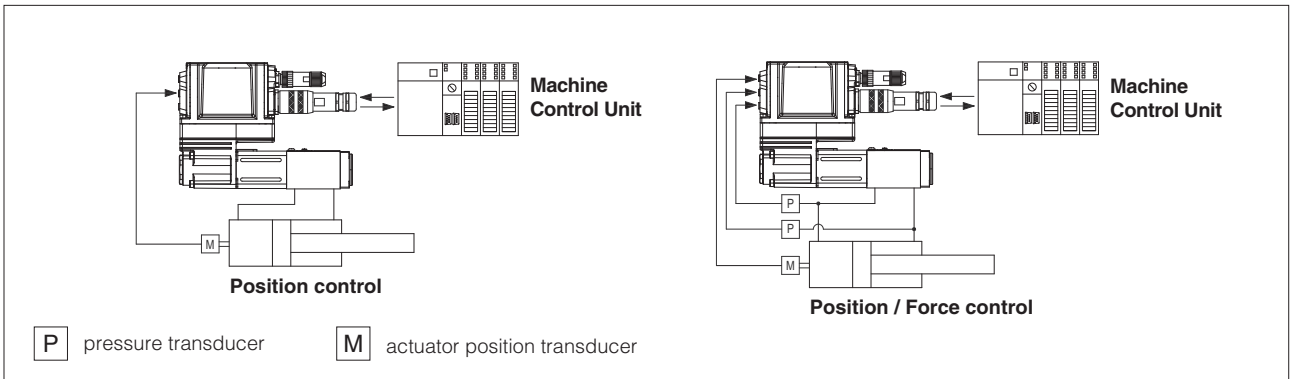
 = options

5.2 Servoactuators - see tech table FS700

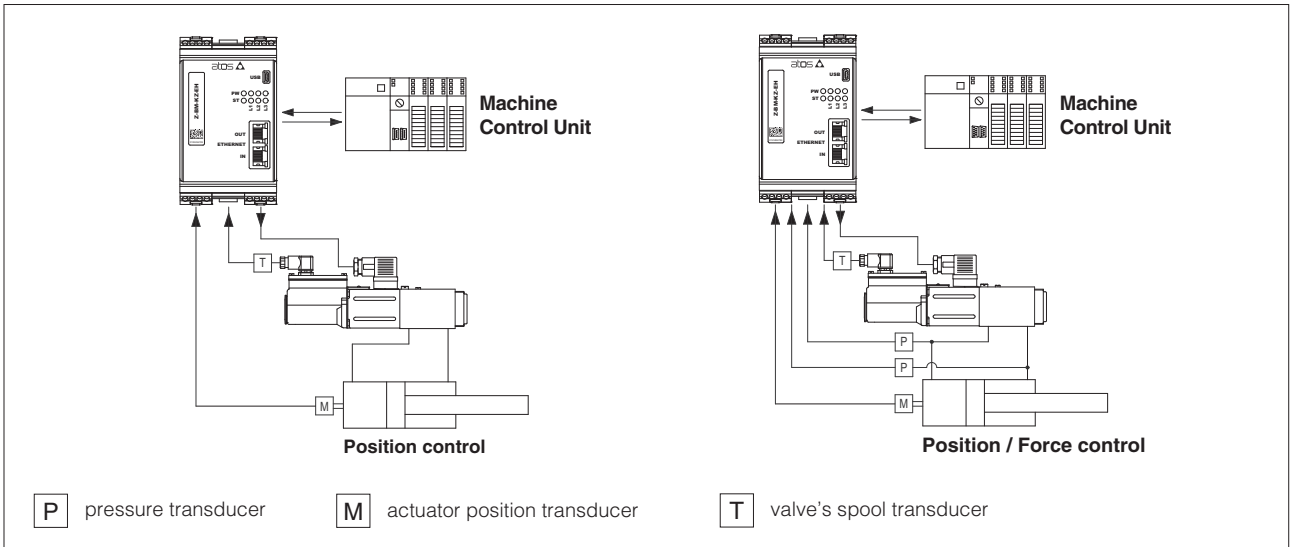
They are stand-alone units performing closed loop position plus optional alternated P/Q controls. These units are made by a servocylinder with position transducer and a servoproportional valve with on-board driver + axis card, factory assembled and tested.



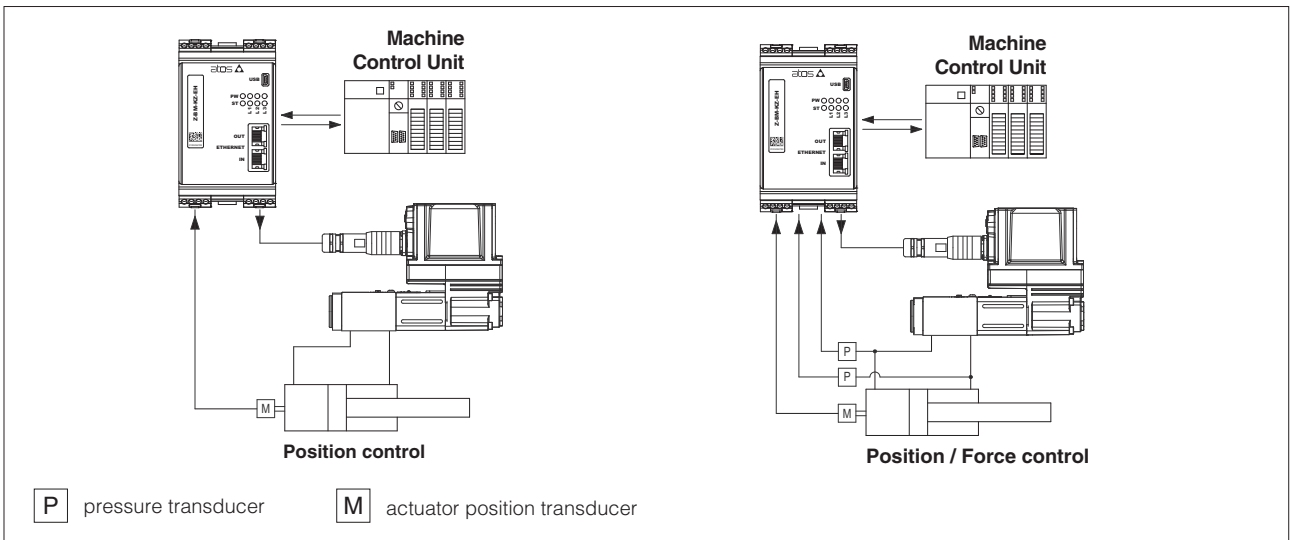
5.3 Digital servoproportionals with on-board axis card and driver, application example - see FS610, FS620, FS630



5.4 DIN-rail axis card with driver function, application example - see tech table GS330



5.5 DIN-rail axis card, application example - see tech table GS340



6 ATOS PROGRAMMING SOFTWARE - see tech table GS500

The valve functional parameters and configurations can be easily set and optimized using Atos programming software. E-SW and Z-SW software are supplied in DVD format and can be easily installed on a desktop or a notebook computer.

The software graphic interface is organized in pages and levels related to different specific functional groups and allows to:

- simply access all the functional parameters of Atos digital proportional valves and drivers
- numerically adapt the factory preset parameters to the application requirements
- verify the actual working conditions
- identify and quickly solve fault conditions
- store the customized setting into the valve/driver or into the PC

The software automatically recognizes the connected valve model and adapts the displayed parameters.

Basics for on-off solenoid directional valves

Atos solenoid valves have been designed and tested with innovative concepts to satisfy the advanced needs of modern machines: rapid or damped switching, quiet operation, reduced power absorbed, versatility, reliability and safety of use. This table gives engineers, in condensed form, a series of useful information for the choice and the use of modern solenoid valves.

1 DESCRIPTION OF FUNCTION

Solenoid directional valves are used for changing flow direction in hydraulic systems.

Main features are:

- 1.1 New integrated design between hydraulic and electrical parts with more compact construction and better efficiencies.
- 1.2 Wet solenoids for maximum reliability, also available in flame-proof, intrinsically safe and stainless steel execution.
- 1.3 All seals are static and all the moving parts are protected and lubricated by the fluid.
- 1.4 Smoother switching with effective regulation thanks to optional switching control devices.
- 1.5 Plastic encapsulated coils easily interchangeable and UL certified.
- 1.6 Electric or electronic connectors, depending on the application and on electric control board interface.
- 1.7 Cored oil passages with low pressure drops.
- 1.8 Interchangeable spools for various directional functions.

2 SOLENOID IDENTITY

According to European Convention, solenoid "A" is close to "A" port and solenoid "B" is close to "B" port of the valve body (pilot valve body for two stage valves).

3 SPOOLS CHARACTERISTICS

Standard interchangeable spools are available in a wide range of configurations, as indicated in table 3.

Specific spools to reduce water hammer-shocks during switching: variants 1/1, 4/8 and 5/1. Their special shape reduces water hammer-shocks during switching. Use of these spools is not recommended with maximum flow greater than 80% of the nominal values, because of higher pressure drops generated in the valve.

Response times and control of switching time: direct operated solenoid valves.

The solenoid valve response times can be controlled by the use of specific devices (option L); associated with the spools */1 and */8 it is possible to control smooth acceleration/deceleration of the connected actuator. The L* devices allow an effective control of the solenoid valve switching time, slowing down the spool speed without reducing the solenoid force.

They are available in different configurations. For correct use a slight backpressure (2 bar) on solenoid valve T port is recommended. Valve response time is also influenced by operating conditions (oil characteristics and temperature), elasticity of the hydraulic circuit and by use of electronic connectors.

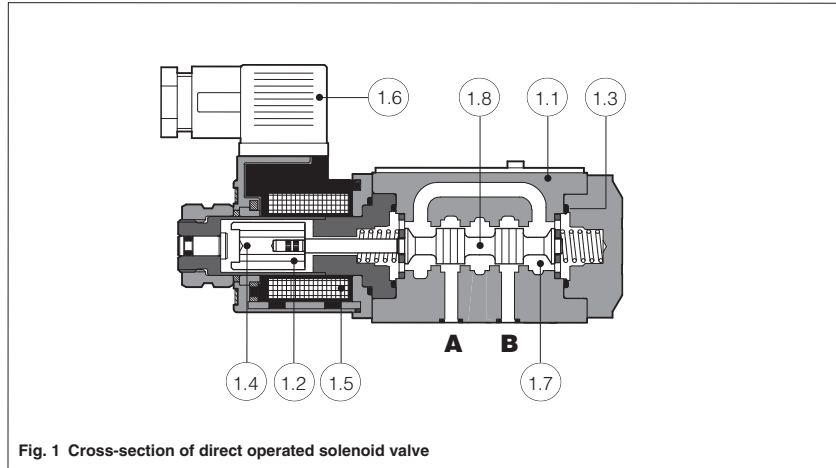


Fig. 1 Cross-section of direct operated solenoid valve

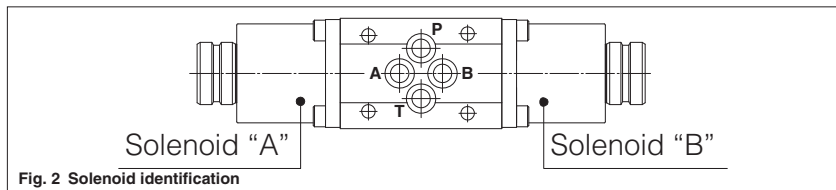


Fig. 2 Solenoid identification

Type	Scheme	Intermediate passages
0		
1		
2		
3		
4		
5		
58		
6		
7		
8		
0/2		
1/2		
2/2		
16		
17		

Table 3 Basic spools, schemes and intermediate passages between central and external positions. **The spools are not available for all the directional valves. For their availability see the relevant valve table.**

Response time and control of switching time: pilot operated solenoid valves.

The response time of the piloted valves can be adjusted by means of the options /H (meter-out control) or /H9 (meter-in control). This options provide the installation between the main stage and the pilot valve of a modular throttle valve, type HQ-*/U specific for fine pilot flow control.

Associated with */1 and */8 spools, smooth acceleration/deceleration can be controlled on loads.

***P spools for direct operated solenoid valves to reduce leakage.**

They are normally used on pilot valve for pressure and directional control valves, for cartridge valves and systems with specific requirements.

Use of these spools is not recommended with maximum flow greater than 70% of the nominal values, because of the higher pressure drops generated in the valve.

Following types available: 1P, 3P, 1/2 P, 8P (for ISO size O6 valves).

4 COIL CHARACTERISTICS

Solenoid valves are available both with DC and AC coils.

- OI solenoids for DHI valves are available for AC and DC supply (only replacing coils)
- OE-AC and OE-DC solenoids for DHE valves are available respectively for AC and DC supply
- AE-AC and AE-DC solenoids for DKE valves are available respectively for AC and DC supply

For solenoids OE and AE, the coils of different voltages are interchangeable only for the same type of power supply AC or DC.

The DC solenoids can be also fed with AC supply, by using 669 connector.

5 ELECTRICAL CONNECTORS TO ISO 4400 (DIN 43650)

The cable entry on electrical plugs can be fitted at 90° intervals by reassembling the contact holder relative to the plug housing.

The cable entry is Pg. 11 suitable for cable Ø 6-10 mm.

Following types are available:

- Standard connectors, IP65 protection degree (666);
- Connectors with built in LED (667);
- Connectors with built in rectifier bridge (669) to supply DC coils by alternating current AC.

In addition to the above DIN connectors, other type of electrical interfaces are available on request:

- Lead Wire connection
- Deutsch connector DT-04-2P (IP67)
- AMP Junior Timer connector (IP67)

6 ELECTRONIC CONNECTORS

Operational principle

E-SD to eliminate electric disturbances when solenoids are deenergized;

7 OPERATING NOTES

Tightening of the fixing screws to the subplates and of the plastic coil ringnut.

It is particularly important to check that the tightening of the fixing screws respects the torque limits indicated in table 4.

Higher values may cause anomalous deformations of the body and prevent sli-

Table 3.2 Spools to reduce water hammer shocks associated with switching

Type	Scheme	Intermediate passages
0/1		
1/1		
3/1		
4/8		

Table 3.3 Specific spools for special uses or in regenerative circuits

Type	Scheme	Intermediate passages
09		
90		
19		
91		
39		
93		
49		
94		

ding of the spool. 12.9 class fixing screws are recommended. The plastic coil ringnuts will be fixed on the solenoid with a torque 4Nm: this deforms properly the seals and protects against external particles and water entrance.

Operation in circuits with flow exceeding the nominal valve flow

In circuits with flow rates greater than the nominal values and in circuits with accumulators, where the instantaneous flow can exceed nominal values, is recommended a plug-in restrictor on P port of solenoid valve to limit the maximum flow on the valve.

Dilatation and contraction of flexible hoses subjected to variations of system pressure can generate high instantaneous flow rates.

The version indicated in fig.5 can be directly inserted into P port of the valve but also in other valve ports.

The plug-in restrictors can be ordered separately:

PLUG H-** (for DH* valves)

PLUG K-** (for DKE* valves)

** the double asterisk identifies the dimension in tenths of a millimeter.

Example: PLUG H-05 = 0,5 mm diameter

Limits on two-way and three-way operation for direct operated solenoid valves.

When used as two-way and three-way valves with P, A or B ports blocked or not subject to flow, or with flow much lower than flow on other ports, maximum catalogue performance cannot be assured.

Minimum pilot pressure for pilot operated solenoid valves.

A minimum pressure value must be guaranteed for piloting the valve. This value is 8 bar. For spools with P-T connection in rest position, the option /R should be used.

Operation combined with hydraulic cylinders with high section ratios.

Operational limits may occur with cylinders with section ratios (piston/rod) greater than 1.25. In these cases multiplications or demultiplications of flow and pressure may disturb the correct operation of the solenoid valve.

8 SPECIAL VERSION SOLENOID VALVES

- for explosion-proof environments
- for intrinsically safe operation
- stainless steel execution for marine or aggressive environments or water base fluids
- for operation beyond the allowed temperature limits.

Table 4 Recommended torque for the fixing screws

Valve type	Fixing screws class 12.9	Torque
DH*	M5	8 Nm
DKE*	M6	15 Nm
DP**-2	M10 & M6	70 Nm & 15 Nm
DP**-4	M12	125 Nm
DP**-6	M20	600 Nm

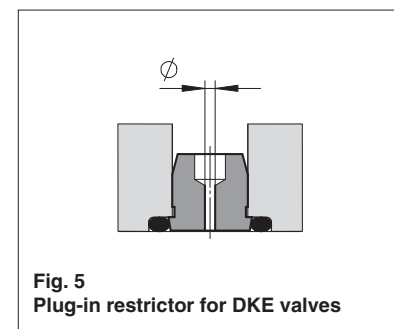
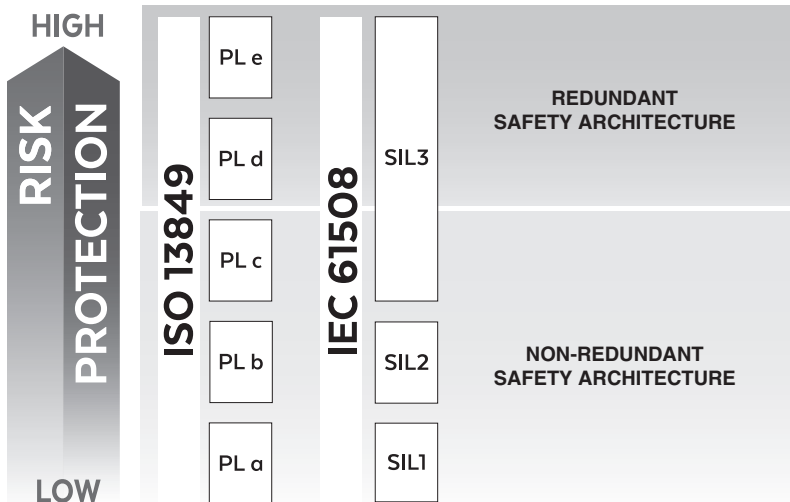


Fig. 5 Plug-in restrictor for DKE valves

Basics for safety components

IEC 61508 Safety Integrity Level and ISO 13849 Performance Level - certified by



Safety in engineering of modern machinery is becoming a primary issue to protect people from potential risks caused by accidental failures of machines and systems.

The **Machine Directive 2006/42/EC** with relevant norms **IEC 61508 Safety Integrity Level (SIL)** and **ISO 13849 Performance Level (PL)**, represents the framework of the functional safety, which is a key aspect in terms of general principles of prevention concerning safety of devices or systems with health implications.

It defines the safety requirements that the machine manufacturer must comply with, in order to obtain the certification and thus the possibility to apply the CE mark required to sell the machine within the European market.

Machine Directive 2006/42/EC replaces the existing 98/37/EC and it is universally applicable to machinery, safety components, and other specific equipment.

1 SAFETY NORMS

IEC 61508 and relevant norms **IEC 61511** (process control system) plus **IEC 62061** (machine control systems) introduce the integrated probabilistic approach to the functional safety. They specify the Safety Integrity Levels (SIL) required to perform safety functions.

ISO 13849 norm provides safety requirements and guidance on the principles for the design and integration of safety-related parts of control systems including the design of software.

It specifies the Performance Level (PL) required to perform safety functions.

PL: discrete value that specify the ability of safety related parts of control systems to perform a safety function under foreseeable conditions.

The requirements are classified into five Performance Levels, where **PL e** identifies the highest protection level.

2 CERTIFICATION



Atos safety valves (on-off and proportionals) are certified by TÜV in compliance with IEC 61508, IEC 61511, IEC 62061, ISO 13849

The certification guarantees the valve compliance with related safety norms and it proves that all requirements have been met for the SIL and PL levels claimed for the specific valve.

The certification also confirms the following data which can be used by the machine manufacturer for the certification of the whole system:

- the design process used by the valve manufacturer to avoid failures
- the design techniques and measures used to control failures
- the methods used to define hardware fault tolerances
- the methods used to measure the safe failure fractions
- the methods used to measure the probabilities of failure

⚠ The use of non-certified products invests the machine manufacturer of the responsibility for validating that all above aspects have been carried out according to the applicable standards.

Without valve's certification the machine manufacturer has to alternatively:

- collect from valve's manufacturer all the reliability data necessary to evaluate the safety level of the whole system
- consider the worst case concerning the safety level (e.g. assign to valves the lower safety level **PL a** or **SIL 1** in order to calculate system safety)

3 RISK ASSESSMENT

The first step for determining the necessary risk reduction is the Risk Assessment.

It is a procedure carried out to identify which risks in the machine require a mitigation by means of safety control systems (e.g. laser barriers, shut-off valves, enabling devices, etc). Each of these control systems become a Safety Function.

At that point the safety functions must be defined and satisfied by the machine design (see 3.1).

⚠ It is the responsibility of the machine manufacturer to ensure that all safety requirements are satisfied and to conduct a documented risk assessment to ensure that all potential machine hazards are covered.

3.1 Machine Manufacturer

With the name of "Machine Manufacturers" are identified OEMs or end users who manufacture machinery for their own needs or everybody who performs "significant modifications" as:

- change the machine function
- change the machine application area
- change the equipment
- change the machine performance

If changing any of the above parameters results in either change of intended use or change of safety system or safety component, a machine modification should be treated as "significant".

Example:

Adding air-gun pneumatic connection = NOT significant modification

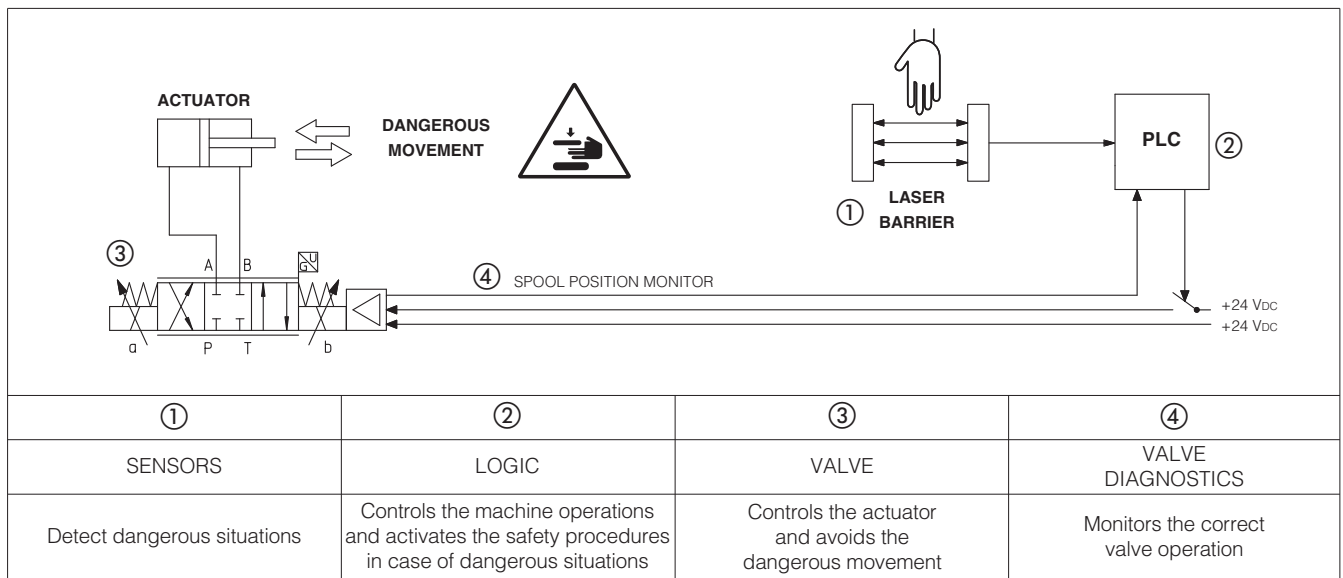
Adding hydraulic accumulator to increase the speed and improve cycle time of the machine = significant modification

4 SAFETY RELATED PARTS

They are parts of machine control systems performing safety functions, allowing the system to achieve or maintain a safe status.

These parts consist of either hardware or software and stand-alone or integrated components of the machine control system.

Safety-related parts incorporate the entire effective chain of a safety function provided by control unit, valves, sensors and actuator.



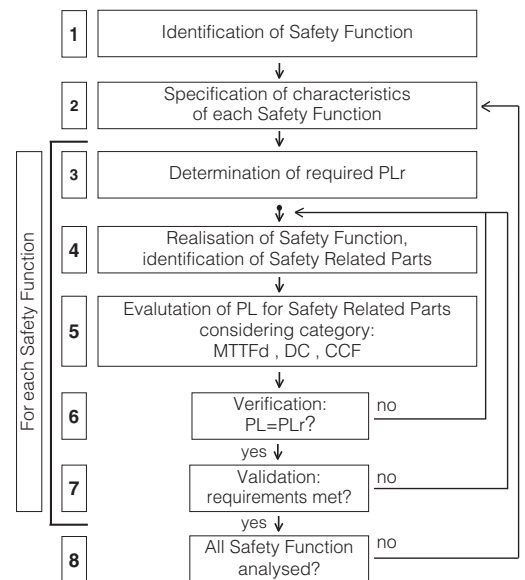
5 SAFETY ANALYSIS

The second step after the identification of the risk is the Safety Analysis.

The process for the design of the safety-related parts of control systems, is iterative.

The aside scheme shows the one used by EN ISO 13849-1:

- The first step consists in the identification of the Safety Functions.
- Any characteristics of all safety functions must be described and documented.
- The Performance Level required (PLr) by each safety function must be defined. ISO13849-1 uses a path like the one shown in section 5.1.
- The machine manufacturer must design a system to protect the operator, granting a Performance Level (PL) equal or higher than the Performance Level required (PLr). The Performance Level (PL) must be defined considering following parameters:
 - MTTFd, reliability of safety system – see section 5.2
 - DC, capability to detect faults – see section 5.3
 - CCF, vulnerability of the system to failures – see section 5.4
 - architecture categories of the safety system – see section 6

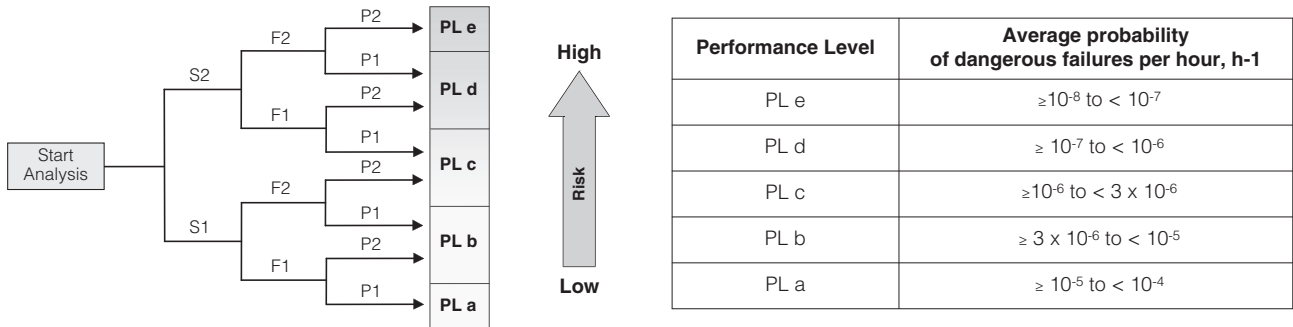


5.1 Performance Level required - PLr

The determination of PLr for ISO 13849-1 is carried out analysing the following parameters:

- Severity of harm:
 - S1** = slight
 - S2** = serious
- Frequency and duration of exposure to the hazard:
 - F1** = not often
 - F2** = frequent
- Possibility of avoiding the hazard or limiting the harm:
 - P1** = possible
 - P2** = rarely possible

Each of five performance levels corresponds to a further parameter scale, based on the probability of a dangerous failure per hour.



5.2 Mean Time to Failure dangerous - MTTFd

The achievement of a specific PL or SIL relies on the reliability of the system. The reliability is quantified by Mean Time to Failure dangerous (MTTFd) which is measured in hours. The MTTFd should be determined from the component manufacturer's data.

5.2 Diagnostic Coverage - DC

The Diagnostic Coverage (DC) is a measure of how effectively the potential dangerous failures can be detected by the monitoring system.

EN ISO 13849-1 suggests how to define DC.

Diagnostic Coverage is defined as the measure of the effectiveness of diagnostics: it is determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures;

- DC = 0%** no dangerous faults are detected
- DC ≅ 100%** most of dangerous faults are detected (it is impossible to reach a DC = 100% because diagnostics are not considered to be completely reliable)

Diagnostic Coverage categories:

Category	Range
None	DC < 60%
Low	60% ≤ DC < 90%
Medium	90% ≤ DC < 99%
High	DC ≥ 99%

5.3 Common Cause Failure - CCF

The CCF value is a parameter for evaluating the measures against the common cause failure. It is a failure in redundant systems where two or more channels fail at the same time in consequence of a single common cause. The redundancy can be compromised if both channels fail simultaneously due to the same cause. EN ISO 13849-1 provides a score for CCF, which is used to determine the Performance score Level (PL).

For this score, EN ISO13849-1 defines a checklist of seven important countermeasures:

- The signal paths of different channels are physically separated (score = 15 points)
- Diversity in the technology, the design or the physical principles of the channels (score = 20 points)
- Protection against possible overloading (15 points) and the use of well-tried components [which are those components which have been widely used or made and verified for safety related application (score = 5 points)]
- Failure mode and effects analysis during development for the identification of potential common cause failures (score = 5 points)
- Training of designer/service personnel in CCF and its avoidance (score = 5 points)
- Protection against common failures caused by contamination (fluid filtration) and electromagnetic interference for electrical parts(score = 25 points)
- Protection about common cause failures caused by unfavorable environmental conditions (score = 10 points)

For architecture categories 2, 3 and 4 a minimum score of 65 points is required (see section 6).

Note: CCF always depends on the system and application.

6 ARCHITECTURE CATEGORIES

SIL and PL levels depend not only on the characteristics of the single component but also on the architecture of the hydraulic system and of the signals diagnostic.

Architecture categories help to define the probability of failure and the PL of the safety related parts of a control system in relation to their resistance to faults and their subsequent behavior in the fault condition

There are five architecture categories, identified as : **B, 1, 2, 3, 4**

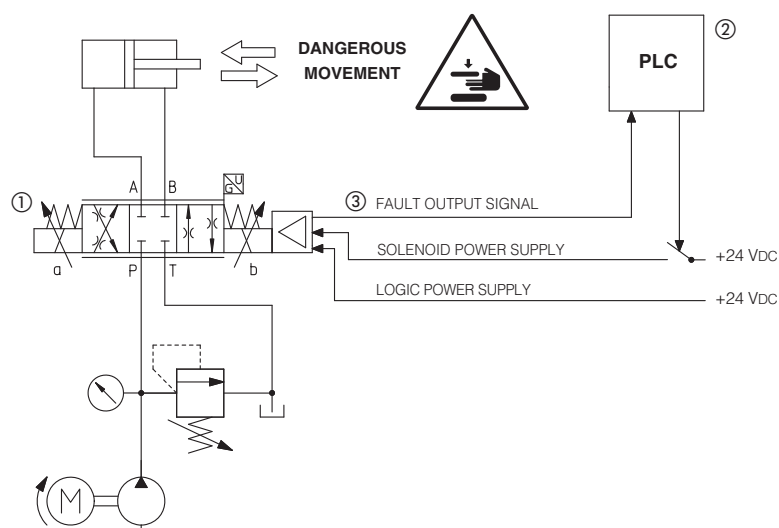
The higher is the number, the higher is the complexity of the safety system and the higher is the achieved Performance Level PL.

6.1 Architecture categories B and 1

In categories B and 1, the resistance to faults is mainly achieved by the selection of proper components. They are not-redundant architecture so the occurrence of a failure may lead to the loss of the safety function.

Category 1 has a greater resistance than category B because of the use of special components and principles which are considered well-tried and tested in a safety system.

Example of architecture category 1



Safety function = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

The safety function is achieved by disabling the current to the solenoids of safety proportional valve so that the spool is moved by the springs to the rest position with positive overlap.

Through the continuous monitoring of the valve's spool position, the machine PLC verifies if the "safe condition" is fully accomplished.

⚠ The safety function is not performed in case of valve ① failure
Fault tolerance HFT = 0

① Digital proportional valve with double power supply - option /U (i.e. DHZO-TES-SN-NP-07*-L5 /U)

② Machine PLC supervising the safety function

③ Fault output signal used for safety diagnostics

6.2 Architecture - category 2

In category 2 all of the requirements of architecture B and 1 are combined. In addition, the system is monitored to intercept faults affecting the safety function.

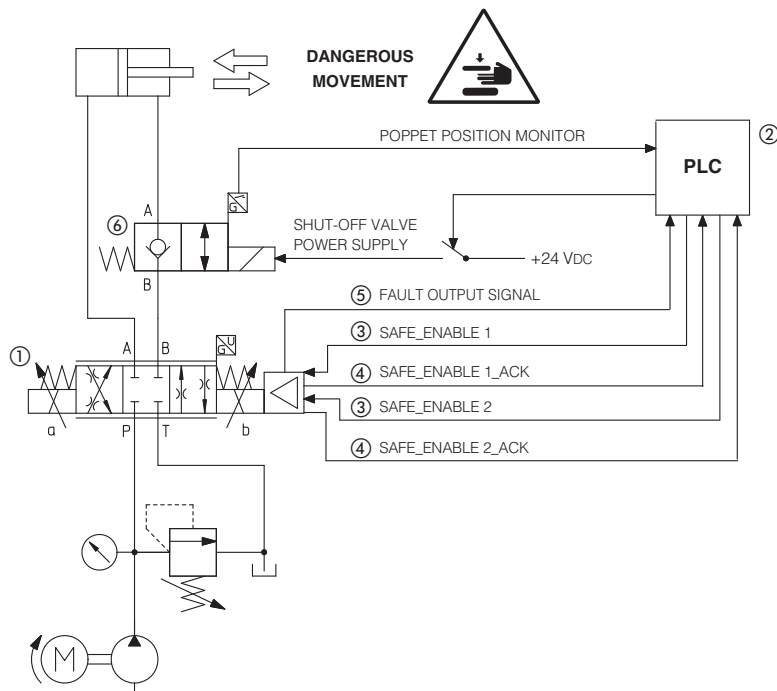
These monitors are made at regular intervals, e.g. at startup or before the next demand on the safety function.

By using an appropriate selection of test intervals, a suitable risk reduction can be obtained.

6.3 Architecture categories 3 and 4

In categories 3 and 4, the occurrence of a single fault does not result in the loss of the safety function.
 In category 4 such faults are detected automatically.
 Accumulation of faults will not lead to a loss of the safety function.

Example of architecture category 4



Safety function = to prevent the dangerous cylinder movement in a certain phase of the cycle or in emergency

In this example a safety shut-off valve with poppet position switch has been added to the safety proportional valves to grant a **redundant safety architecture**.

The safety function is performed by disabling the current to the solenoid of safety proportional valve and safety shut-off valve so that the spool is moved by the springs to the rest position with positive overlap.

The safety condition is confirmed by:

- SAFE_ENABLE_ACK status = 24 VDC
- shut-off valve poppet position monitor signals

⚠ The safety function is performed even in case of failure of one valve, ① or ⑥
Fault tolerance HFT = 1

- ① Digital proportional valve - option /K (i.e. DHZO-TES-SN-NP-07*-L5 /K)
- ② Machine PLC supervising the safety function
- ③ Signals used to enable/disable the current to the valve's solenoids
- ④ Signals confirming the valve safe status
- ⑤ Fault output signal used for safety diagnostics
- ⑥ Safety shut-off valve with poppet position monitor (i.e. JO-DL /FV)

1.1 Programming software versions

Different software versions are available according to the valve drivers and axis cards type to be connected and communication interface.

Note: the E-SW and Z-SW software are supplied in DVD format; E-SW-BASIC software can be free downloaded from the Atos website

Free programming software, web download:

E-SW-BASIC Software can be downloaded upon web registration at www.atos.com; service and DVD not included.
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

DVD first supply of programming software, to be ordered separately:

E-SW-BASIC Software has to be activated via web registration at www.atos.com; 1 year service included.
E-SW-BASIC/PQ Upon web registration user receive via email the Activation Code (software license) and login data to access personal Atos Download Area.
E-SW-FIELDBUS
E-SW-FIELDBUS/PQ The software remains active for 10 days from the installation date
Z-SW-FULL and then it stops until the user inputs the Activation Code.

DVD next supplies of programming software, to be ordered separately:

E-SW-BASIC-N Only for supplies after the first; service not included, web registration not allowed.
E-SW-BASIC/PQ-N Software has to be activated with Activation Code received upon first supply web registration.
E-SW-FIELDBUS-N
E-SW-FIELDBUS/PQ-N
Z-SW-FULL-N

Notes: the E-SW and Z-SW software are NOT interchangeable and have to be ordered separately;
programming software FIELDBUS and FULL can program digital electronics through USB communication port for all industrial and ex-proof versions of drivers/axis cards

1.2 DVD contents

Include software installer, user manuals and fieldbus configuration files:

EDS for BC - GSD for BP - XML for EH - XDD for EW - EDS for EI - GSDML for EP

1.3 Atos Download Area

Direct access to latest releases of programming software, manuals, USB drivers and fieldbus configuration files at www.atos.com

Software and USB drivers can be easily installed following the instruction contained in the "info.txt" files.

An automatic mailing message will inform all the registered users whenever a new software upgrade is available.

1.4 E-SW / Z-SW minimum PC requirements

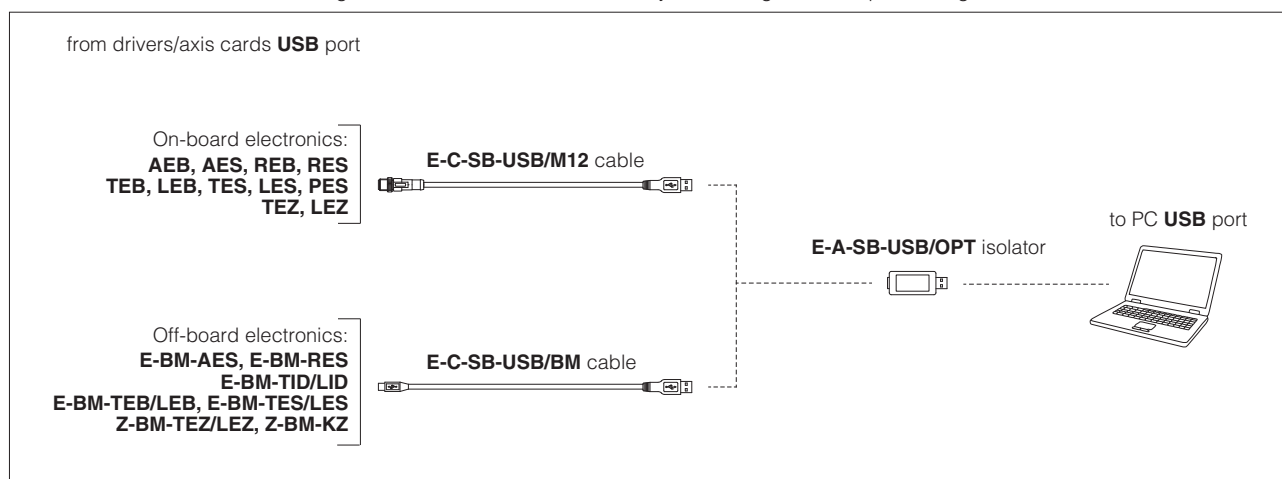
Personal Computer	Pentium® processor 1GHz or equivalent	Memory	512 MB RAM + Hard Disk with 250MB free space
Operating System	Windows XP SP3	Device	DVD reader
Monitor Resolution	1024 x 768	Interface	Serial RS232 port (only for PS) or USB port

2 USB connection - ISOLATOR AND CABLE

E-SW / Z-SW software permit valve's parameterization through USB port.

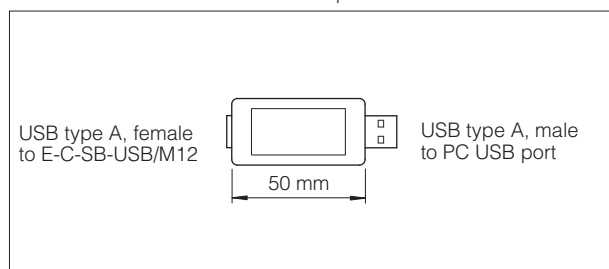
2.1 Connection tools

Isolator and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-USB**



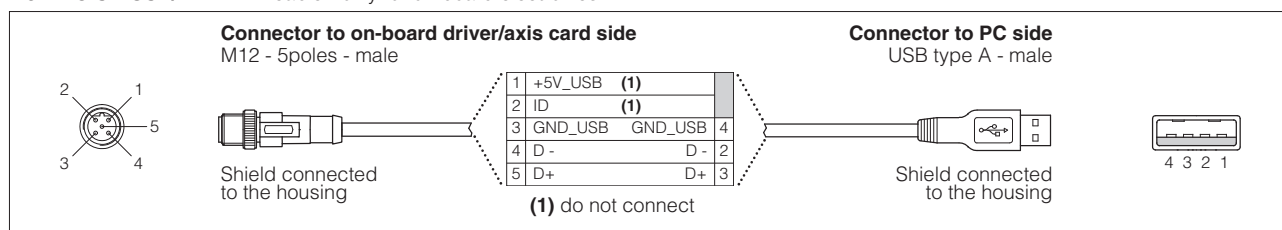
WARNING: drivers/axis cards USB port is not isolated! Use of USB isolator adapter is highly recommended for PC protection: wrong earthing connections may cause high potential difference between GNDs, generating high currents that could damage the PC connected to drivers/axis cards.

2.2 E-A-SB-USB/OPT - isolator adapter

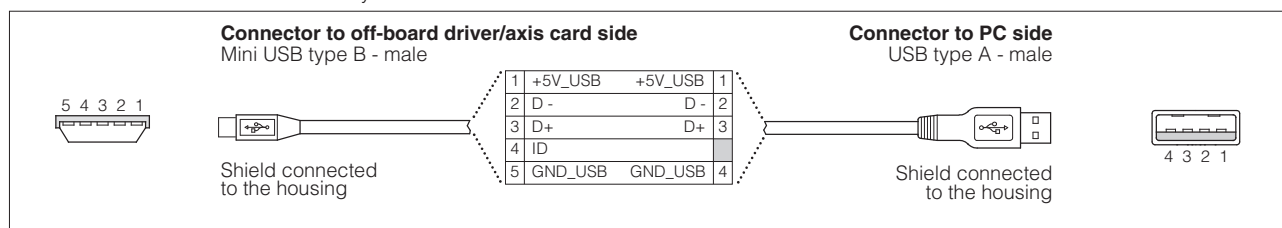


- USB 2.0 Full speed (12 MBps)
- electrical isolation 1 kV
- temperature range, $-40^{\circ} \div +50^{\circ}$ (relative humidity 25% ÷ 75%)
- external power supply not required (power 400 mA output, 5 V \pm 10%)
- MTBF > 1,2 million hours (MIL standard)

2.3 E-C-SB-USB/M12 - 4 m cable - only for on-board electronics



2.4 E-C-SB-USB/BM - 3 m cable - only for off-board electronics

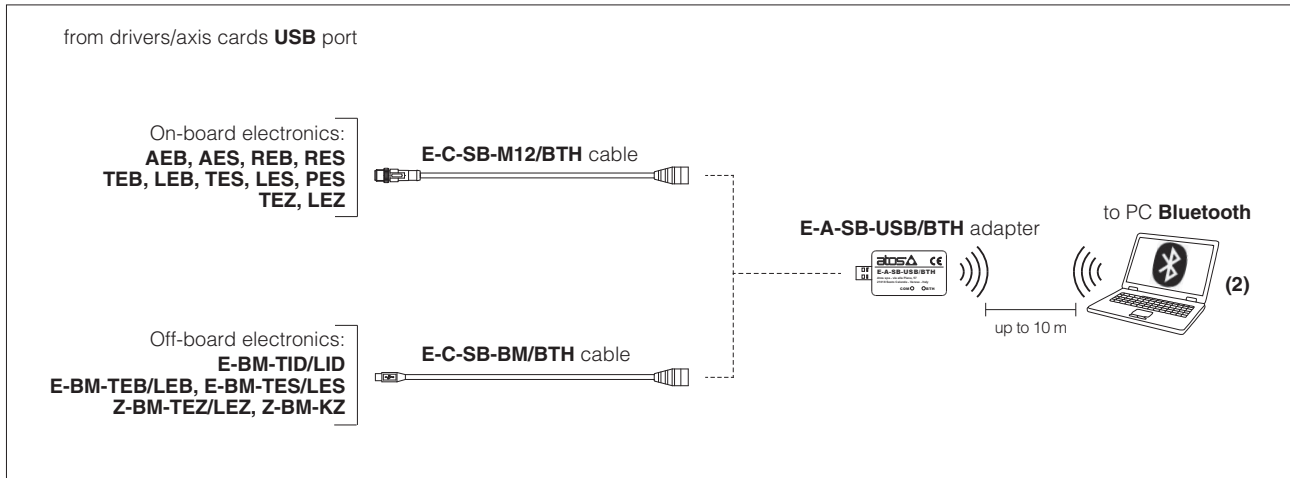


3 BLUETOOTH connection - ADAPTER AND CABLE

E-SW / Z-SW software permit valve's parameterization through Bluetooth (1).

3.1 Connection tools

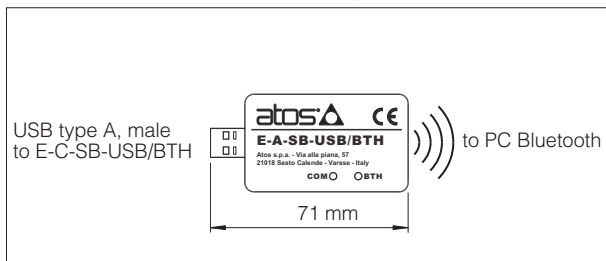
Adapter and cables shown in the image below can be ordered individually or in a single solution purchasing a dedicated kit: **E-KIT-BTH**



(1) Bluetooth adapter is not compatible with E-BM-AES and E-BM-RES drivers

(2) If PC has not built-in Bluetooth, use standard USB to Bluetooth dongle compatible with E-A-SB-USB/BTH specification (please refer to STARTUP-BTH guide)

3.2 E-A-SB-USB/BTH - Bluetooth adapter

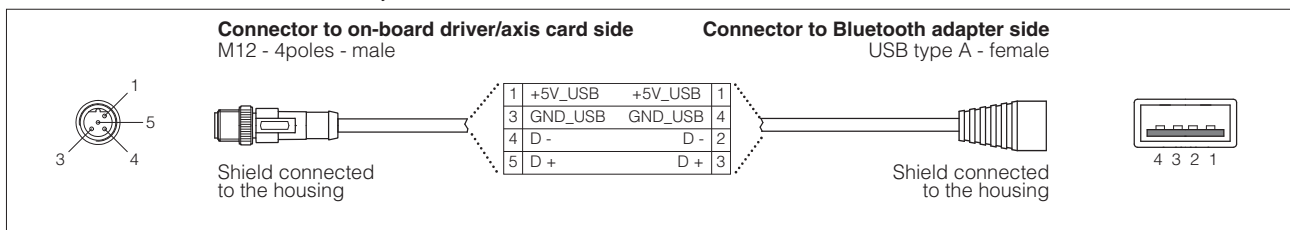


- USB male connector, type A
- type of radio interface: Bluetooth Class 2
- temperature range, $-20 \div +70$ °C (storage $-40 \div +70$ °C)
- external power supply not required (from Atos drivers/axis cards only)
- protocol: Bluetooth Classic Version 2.x , 3.x supporting Serial Port Profile
- max RF transmission power: Class 2 Output Power (+1.5 dBm typical)
- frequency: 2.402 GHz to 2.480 GHz
- LEDs indicate the actual working condition
- IP20 protection degree

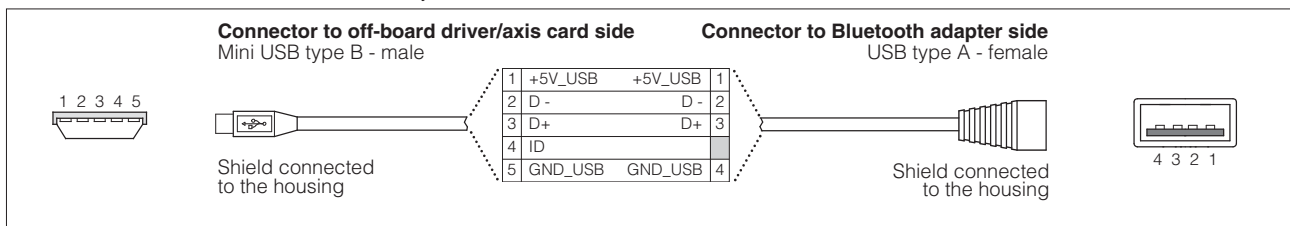
WARNING: Bluetooth adapter is available only for Europe, USA, Canada, China, Japan, India, Korea markets!

Bluetooth adapter is certified according to RED (Europe), FCC (USA), ISED (Canada), SRRC (China), MIC (Japan), BIS (India), KC (Korea) directives

3.3 E-C-SB-M12/BTH - 0,4 m cable - only for on-board electronics



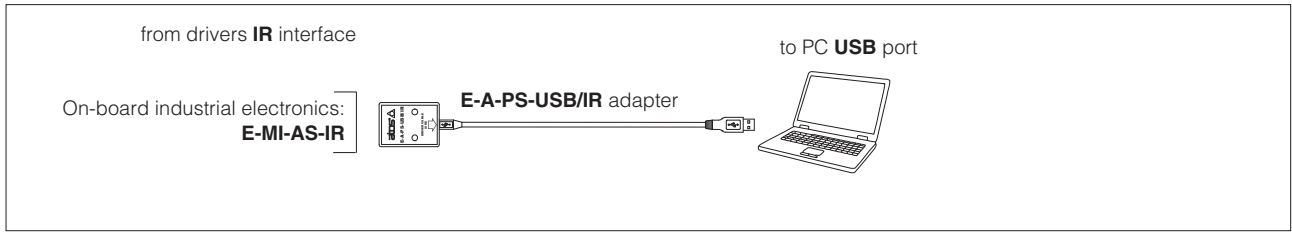
3.4 E-C-SB-BM/BTH - 0,2 m cable OTG - only for off-board electronics



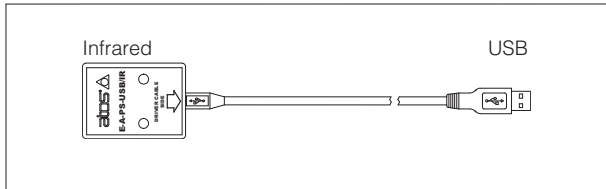
4 IR infrared - USB COMMUNICATION ADAPTER - only for **E-MI-AS-IR** drivers

The adapter have to be connected to the USB communication port of PC to activate the IR infrared communication interface towards Atos digital electrohydraulics.

4.1 Connection tools



4.2 E-A-PS-USB/IR - 3 m adapter

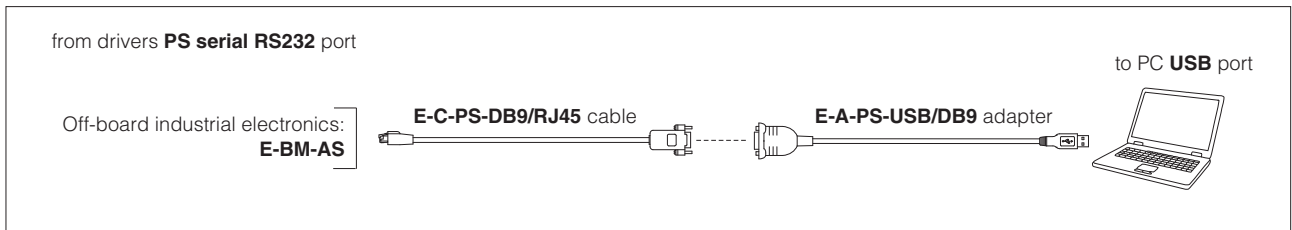


- direct infrared communication with the driver
- USB male connector, type A
- plug-in format for direct infrared connection on the driver
- transmission rate 9,6 kbit/s
- external power supply not required (USB supply)

5 PS serial RS232 - USB COMMUNICATION ADAPTER AND CROSS CABLES - only for **E-BM-AS** drivers

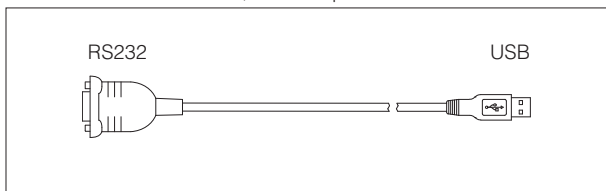
The adapter have to be connected to the USB communication port of PC to activate the PS serial RS232 communication interface towards Atos digital electrohydraulics. The cross cables connect the relevant connector of the USB adapter with the communication port of the digital drivers.

5.1 Connection tools



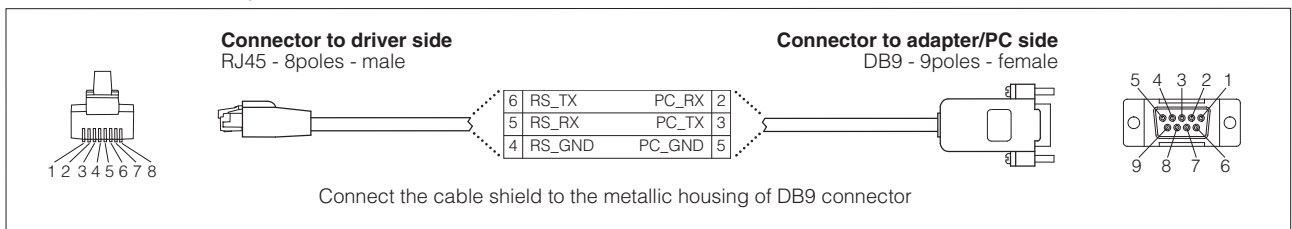
Note: the adapter is not required if PC is already equipped with a serial RS232 communication port

5.2 E-A-PS-USB/DB9 - 0,45 m adapter



- DB9 male connector according to serial RS232 specification
- USB male connector, type A
- transmission rate from 1,6 kbit/s up to 225 kbit/s
- external power supply not required (USB supply)

5.3 E-C-PS-DB9/RJ45 - 2,5 m cable



6 **FIELDBUS TERMINATORS** - only for **BC** and **BP**

The fieldbus terminators are required when output fieldbus connector has to be used as network end point.

Note: fieldbus terminators not available for ex-proof electronics

<p>E - TRM</p> <p>Terminator</p> <p>Fieldbus interfaces: BC = CANopen BP = PROFIBUS DP</p>	-	BC	-	M12	/	<p>5PM</p> <p>Connector: 5PM = to BC executions (1) 4PF = to BP executions (1) DB9 = to DB9 connector, cable side (2)</p> <p>Connector: M12 = from M12 output fieldbus connector (1) DB9 = from DB9 connector, adapter side (2)</p>
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(1) for on-board TES, LES, PES, TEZ, LEZ series 40 or higher

(2) for off-board E-BM-AES, E-BM-RES, E-BM-TID/LID, E-BM-TEB/LEB, E-BM-TES/LES, Z-BM-TEZ/LEZ, Z-BM-KZ

6.1 M12 terminators

E-TRM-BC-M12/5PM network CANopen terminator

E-TRM-BP-M12/4PF network PROFIBUS DP terminator

terminator connection example for **TES, LES, PES, TEZ, LEZ** series 40 or higher

6.2 DB9 terminators

E-TRM-BC-DB9/DB9 CANopen terminator for E-A-BC-USB/DB9 USB adapter

E-TRM-BP-DB9/DB9 PROFIBUS DP terminator for E-A-BP-USB/DB9 USB adapter

7 **FIRMWARE UPDATE**

It is possible to update the firmware of the following digital drivers and axis cards, using proper USB communication port. The firmware update is allowed starting from electronics series listed into the table or higher series:

Industrial electronics

E-RI-AEB s10 E-RI-AES s40	E-RI-REB s10 E-RI-RES s10	E-RI-TEB s10 E-RI-LEB s10	E-RI-TES s40 E-RI-LES s40	E-RI-TES-S s40 E-RI-LES-S s40	E-RI-PES-S s40
E-BM-AES s10	E-BM-RES s10	E-BM-TID s10 E-BM-LID s10	E-BM-TEB s10 E-BM-LEB s10	E-BM-TES s10 E-BM-LES s10	E-BM-TES-S s10 E-BM-LES-S s10
Z-RI-TEZ s40 Z-RI-LEZ s40	Z-BM-KZ s10	Z-BM-TEZ s10 Z-BM-LEZ s10			

Ex-proof electronics

E-RA-AES s40	E-RA-RES s40	E-RA-TES s40 E-RA-LES s40	E-RA-TES-S s40 E-RA-LES-S s40
Z-RA-TEZ s40 Z-RA-LEZ s40	Z-RA-TEZ-S s40 Z-RA-LEZ-S s40		

8 RECOMMENDED TOOLS SELECTION

8.1 Industrial and ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	11			E-A-PS-USB/IR	
PS	E-BM-AS	10 or higher		E-C-PS-DB9/RJ45	E-A-PS-USB/DB9	
NP	E-BM-AES, E-BM-RES	10 or higher	E-SW-BASIC	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	E-BM-TID, E-BM-LID (1)	10 or higher				
	E-BM-TEB, E-BM-LEB, E-BM-TES, E-BM-LES (1)	10 or higher				
	AEB, REB (1)	10 or higher				
	TEB, LEB (1)	10 or higher	E-SW-BASIC/PQ	E-C-SB-USB/M12		
	TES, LES (1)	40 or higher				
	TES, LES, PES with SP, SF, SL options (1)	40 or higher				
	E-BM-TEB, E-BM-LES with SP, SF, SL options (1)	10 or higher				
TEZ, LEZ (1)	40 or higher	Z-SW-FULL	E-C-SB-USB/M12			
Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ (1)	10 or higher		E-C-SB-USB/BM			
BP BC EH	E-BM-AES, E-BM-RES	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	RES (1)	10 or higher		E-C-SB-USB/M12		
	AES (1)	40 or higher				
BC BP EH EW EI EP	E-BM-TEB, E-BM-LES (1)	10 or higher	E-SW-FIELDBUS	E-C-SB-USB/BM	E-A-SB-USB/OPT	
	TES, LES (1)	40 or higher		E-C-SB-USB/M12		
	E-BM-TEB, E-BM-LES with SP, SF, SL options (1)	10 or higher	E-SW-FIELDBUS/PQ	E-C-SB-USB/BM		
	TES, LES, PES with SP, SF, SL options (1)	40 or higher		E-C-SB-USB/M12		
	TEZ, LEZ (1)	40 or higher	Z-SW-FULL	E-C-SB-USB/M12		
	Z-BM-KZ, Z-BM-TEZ, Z-BM-LEZ (1)	10 or higher		E-C-SB-USB/BM		

(1) Drivers and axis cards compatible with Bluetooth adapter E-A-SB-USB/BTH (see 3.1)

8.2 Obsolete industrial electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	10	E-SW-IR		E-A-PS-USB/IR	
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
	TES, LES, PES with SP, SF, SL options	31	E-SW-BASIC/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
	Z-ME-KZ-PS	10 or higher				
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	E-TRM-BP-DB9/DB9
	AERS, TERS, TES, LES	31		E-C-BP-DB9/M12	E-A-BP-USB/DB9	
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL	E-C-PS-DB9/DB9	E-A-PS-USB/DB9	
	Z-ME-KZ-PS/BP	10 or higher				
BC	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	E-TRM-BC-DB9/DB9
	AERS, TERS, TES, LES	31		E-C-BC-DB9/M12	E-A-BC-USB/DB9	
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL			
EH	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	

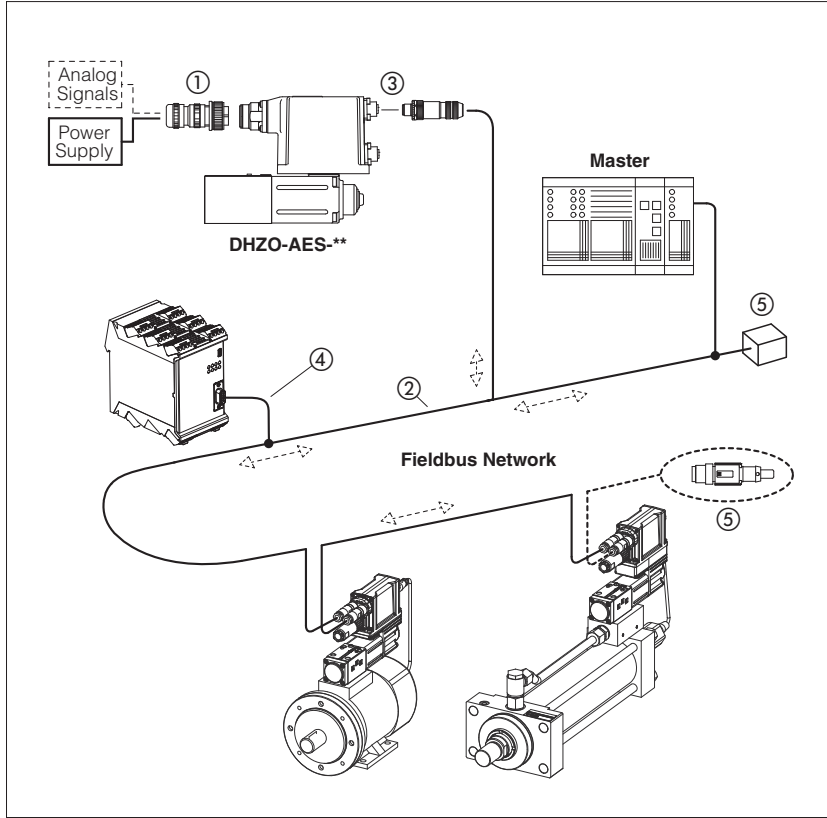
8.3 Obsolete ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M8	E-A-PS-USB/DB9	E-TRM-BP-DB9/DB9
	AERS, TERS, TES, LES	31		E-C-BP-DB9/RA	E-A-BP-USB/DB9	
BC	AES	30		E-C-PS-DB9/M8	E-A-PS-USB/DB9	E-TRM-BC-DB9/DB9
	AERS, TERS, TES, LES	31		E-C-BC-DB9/RA	E-A-BC-USB/DB9	

Fieldbus features

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT),
EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

Typical CANopen or PROFIBUS DP fieldbus network



Fieldbus communication interfaces are available for digital proportional drivers and controllers, granting several plus:

- more information available for machine operation to enhance its performances
- improved accuracy and robustness of digital transmitted information
- costs reduction due to simpler and standardized wiring solutions
- costs reduction due to fast and simple installation and maintenance
- direct integration into machine's communication networks

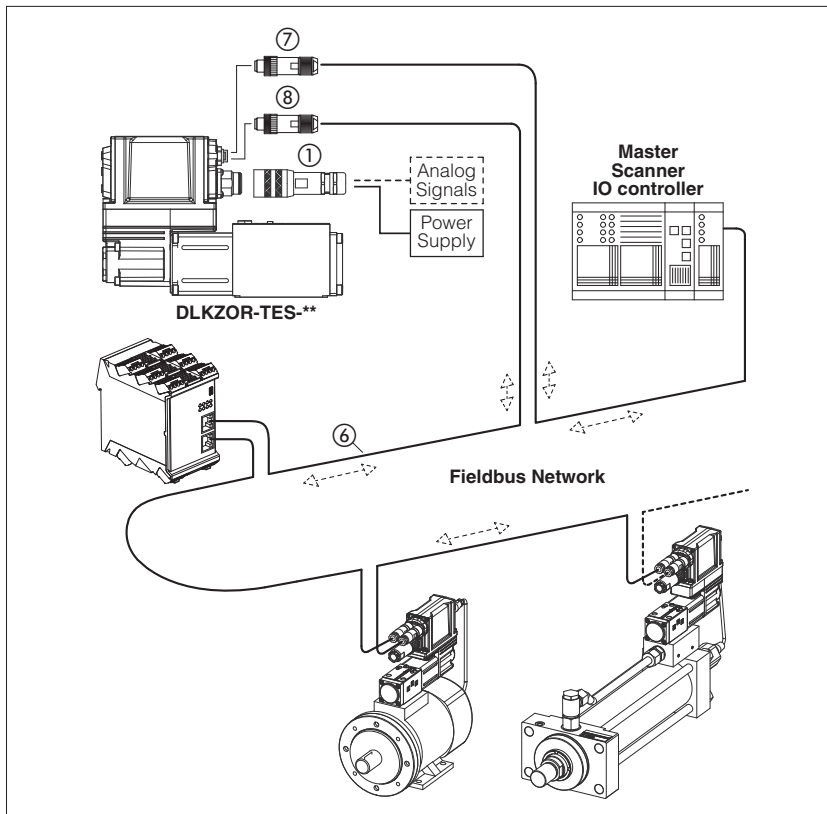
These executions allow to operate proportional valves and pumps through fieldbus or using the analog signals on main connector ①.

Fieldbus distributed-control

Fieldbus communication allows to share all the available information of the digital drivers and controllers (reference, monitor, etc).

This distributed-control design allows to implement powerful machines functionalities for tuning, diagnostic, maintenance, etc.

Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT fieldbus network



CANopen and PROFIBUS DP networks consist of a common cable (2 twisted wire, ②) for digital communication: several devices (node ③) can be connected to this main cable by means of short cable branches ④.

The two endpoints of the main cable must be terminated with specific devices (terminator, ⑤) to dissipate the communication signal's energy thus preventing interferences and degradations of fieldbus transmission.

EtherCAT, POWERLINK, EtherNet/IP and PROFINET RT/IRT networks consist in a Ethernet common cable (4 twisted wire, ⑥) for digital communication. All slave, adapter and IO device have always the double connector for signal input ⑦ and signal output ⑧.

The main Ethernet cable starting from the master, scanner and IO controller has to be connected to the slave, adapter and IO device input connector.

The slave, adapter and IO device output connector has to be connected to the next slave, adapter and IO device input connector.

1 CANopen features for digital drivers and controllers in BC execution

Physical

Serial input format Industrial field-bus with optical insulation type CAN-Bus ISO11898
 Transmission rate Transmission rates from 10 Kbit/s to 1 Mbit/s
 Max node 32 per segment without repeater; 127 per segment with repeater

Communication Protocol

Data Link Layer DS301 V4.2.0 - based on CAN standard frame with 11-bit identifier
 Device Profile DS408 - Fluid Power Technology (EN50325-4)
 Device type Slave

Startup and configuration (as per DS301+DSP305)

Boot up process Minimum boot-up
 Node setting LSS (Layer Setting Services)
 SDO
 E-SW-FIELDBUS and Z-SW-FULL programming software
 Baudrate setting LSS (Layer Setting Services), SDO
 Baudrate 10 / 20 / 50 (default) / 125 / 250 / 500 / 1000Kbit/s

Fieldbus communication diagnostic (as per DS301)

Device Error Emergency
 Network Error Node Guarding
 Heartbeat

Real-time communication (as per DS301 + DS408)

RPDO 4 mappable PDOs to the drivers:
 AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES, PES
 4 mappable PDOs to the controllers:
 TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
 TPDO 4 mappable PDOs from the drivers:
 AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES, PES
 4 mappable PDOs from the controllers:
 TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ
 R(T)PDO types Event Triggered, Remotely requested, Sync(cyclic) and Sync(acyclic)

Non real-time communication (as per DS301 + DS408)

SDO 1 SDO (1 Server + 1 Client)

Standard references

ISO 11898
 Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication
EN50325-4
 Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces
CiA DS301
 CANopen – Application Layer and Communication Profile for Industrial Systems
CiA DR303-1
 Cabling and connector pin assignment
CiA DSP305
 CANopen – Layer Setting Services and Protocol
CiA DS408
 CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.2

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or CANopen master device

Configuration file

EDS (Electronic Data Sheet), enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BC and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
 Z-MAN-S-BC and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

2 PROFIBUS DP features for digital drivers and controllers in BP execution

Physical

Serial input format	Industrial field-bus with optical insulation type PROFIBUS-DP RS485 European fieldbus standard (lev.1 – EN50170-part 2)
Transmission rate	Transmission rates from 9,6 Kbit/s to 12 Mbit/s
Max node	32 per segment without repeater; 126 node with repeater

Communication Protocol

Data Link Layer	PROFIBUS DPV0 - IEC 61158 (type 3)
Device Profile	PROFIBUS-DP Profile for Fluid Power Technology
Device type	Slave

Startup and configuration

Boot up process	SAP 61 for sending parameter setting data SAP 62 for checking configuration data
Node setting	SAP 55 E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate setting	Automatic
Baudrate	9,6 / 19,2 / 45,45 / 93,75 / 187,5 / 500 / 1500 / 3000 / 6000 / 12000 Kbit/s

Fieldbus communication diagnostic

Device error	SAP 60
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Real-time communication

PZD	Process data area of PPO telegram by Data Exchange, default SAP: cyclic transmission of standard Profibus frame
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Standard electronics - drivers

PPO type 3, 113, 213, 230 for:

AES, BM-AES, TES, BM-TEZ, LES, BM-LES, RES, BM-RES

PPO type 5, 115, 214, 240 for:

TES, BM-TEZ, LES, BM-LES, PES with alternated P/Q control

Note: PPO type 213, 230, 214, 240 are customizable by user

Standard electronics - controllers

PPO type 1, 111, 121, 123 for:

TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ

PPO type 1, 101, 103, 111, 121, 123, 223, 227 for:

TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ with alternated P/Q control

Note: PPO type 223, 227 are customizable by user

Cyclic mode	standard, sync and freeze
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Non real-time communication

PKW	Parameter data area of PPO telegram by Data Exchange, default SAP: acyclic transmission of standard Profibus frame
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Standard references

PROFIBUS profile

PROFIBUS Profile,
Fluid Power Technology,
Edition Oct. 2001

VDMA profile

Fluid Power Technology,
Proportional Valves and
Hydrostatic Transmissions, ver 1.1

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFIBUS DP master device

Configuration file

GSD (General Station Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-BP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS

Z-MAN-S-BP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

3 EtherCAT features for digital drivers and controllers in EH execution

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Full-Duplex)
Max node	65535 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88A4 according to IEEE 802.3
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree and star
Termination	Device internally

Communication Protocol

Data Link Layer	EtherCAT use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device Profile	CANopen over EtherCAT (CoE) DS408 - Fluid Power Technology EN 50325-4
Device type	Slave
Supported protocol	CANopen SDO Mailbox-Interface "CoE" Network Management PDO PDO Watchdog Cycle time min 1 msec

Startup and configuration (as per DS301+DSP305)

Node setting	Automatic position addressing Device node addressing
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic (as per DS301)

Device Error	Emergency
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Real-time communication (as per DS301 + DS408)

RPDO	4 PDOs messages to the driver and controller (up to 32 byte for each PDO)
TPDO	4 PDOs messages from the driver and controller (up to 32 byte for each PDO)
R(T)PDO types	Remotely requested

Non real-time communication (as per DS301 + DS408)

SDO	1 SDO (1 Server + 1 Client)
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Standard references

ISO 11898
Road Vehicles – Interchange of digital information controller area network (CAN) for High-speed communication

EN 50325-4
Industrial communication subsystem based on ISO 11898 (CAN) for controller device interfaces

CiA DS301
CANopen – Application Layer and Communication Profile for Industrial Systems

CiA DSP305
CANopen – Layer Setting Services and Protocol

CiA DS408
CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1

IEC 61076-2-101
Connectors for electronic equipment - Product Requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors with screw-locking

IEC 61158-2
Industrial communication networks - Fieldbus specification - Part 2: Physical layer specification and service definition

IEC 61784-2
Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or EtherCAT master device

Configuration file

XML (Extensible Markup Language) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EH and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EH and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

4 POWERLINK features for digital drivers and controllers in EW execution

<p>Physical</p> <p>Serial input format Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2</p> <p>Transmission rate 2 x 100 Mbit/s (Fast Ethernet, Half-Duplex)</p> <p>Max node 239 slaves</p> <p>Ethernet Standard ISO/IEC 8802-3 frame format</p> <p>EtherType 0x88AB according to IEEE 802.3</p> <p>Integrated Hub</p> <p>Cable length 0,2 - 100m (between two slave devices)</p> <p>Cable type CAT5 (4 wire twisted pair) according with T568B</p> <p>Network topology Line, tree, star, daisy chain, ring structure or any combination of these topologies</p> <p>Ethernet Hub Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator</p> <p>Communication Protocol</p> <p>Data Link Layer POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2</p> <p>Comm. Profile EPSG DS 301 v1.2</p> <p>Device Profile CANopen over Ethernet based on DS408 - Fluid Power Technology</p> <p>Device type Slave - supported features: - Ethernet POWERLINK v2.0 - Ring Redundancy - Support PollResponse Chaining - Support Multiplexing - Cycle time min 200 µsec - SDO Multiple Parameter Read/Write</p> <p>Startup and configuration (as per EPSG DS301 + EPSG DS 302-A/B/C/D/E)</p> <p>Node setting E-SW-FIELDBUS and Z-SW-FULL programming software</p> <p>Baudrate 100 Mbit/s (Automatic)</p> <p>Fieldbus communication diagnostic</p> <p>Custom parameters mappable on TPDO for emergency diagnosis</p> <p>Real-time communication (as per EPSG DS301 + DS408)</p> <p>RPDO 1 PDO message to the driver (max number of of mapping parameters is Device specific)</p> <p>TPDO 1 PDO message from the driver (max number of of mapping parameters is Device specific)</p>	<p>Standard references</p> <p><i>EPG DS301</i> Ethernet POWERLINK Communication Profile Specification v 1.2</p> <p><i>EPG DS302-A/B/C/D/E</i> Ethernet POWERLINK Part A: High Availability v1.1 Part B: Multiple ASnd v1.0 Part C: PollResponse Chaining v1.0 Part D: Multiple PReq/Pres v1.0 Part E: Dynamic Node Allocation v1.0</p> <p><i>EPG DS311</i> Ethernet POWERLINK XML Device Description v 1.0</p> <p><i>CiA DS408</i> CANopen – Device Profile for Proportional Hydraulic Valves v 1.5.1</p> <p><i>IEC 61076-2-101</i> Connectors for electronic equipment - Product Requirements - Part 2-101: Circular connectors - Detail specification for M12 connectors with screw-locking</p> <p><i>IEC 61158-2</i> Industrial communication networks - Fieldbus specification - Part 2: Physical layer specification and service definition</p> <p><i>IEC 61784-2</i> Industrial communication networks - Profiles - Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3</p> <p><i>IEC 61784-3</i> Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions</p> <p><i>IEC 61158-300/400/500/600</i> Industrial communication networks - Fieldbus specifications - Part 300: Data Link Layer service definition Part 400: Data Link Layer protocol specification Part 500: Application Layer service definition Part 600: Application Layer protocol specification</p> <p><i>ISO 15745-1</i> Industrial automation systems and integration - Open systems application integration framework - Part 1: Generic reference description</p>
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Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or POWERLINK master device

Configuration file

XDD (XML Device Description) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EW and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EW and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x08E1 according to IEEE 802.3
Transmission rate	10/100 Mbit Full/Half-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Device Level Ring (DLR), linear, star structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

ODVA CIP Object Model

ODVA CIP Object library for Generic Device Profile

- Identity Object (0x01)
- Message Router Object (0x02)
- Assembly Object (0x04)
- Connection Manager Object (0x06)
- Parameter Object (0x0F)
- DLR Object (0x47)
- QoS Object (0x48h)
- Port Object (0xF4)
- TCP/IP Object (0xF5)
- Ethernet Link Object (0xF6)

Valve parameters accessible via Vendor Specific Object 0xA2

IP address setting (range 0.0.0.0 - 255.255.255.255):

- TCP/IP Object (0xF5)
- DHCP
- Auxiliary USB communication + Atos Software

I/O Adapter and Explicit Message Server device type

Cyclic data transmission via Implicit Messages (transport class 1)

- Minimum RPI for Implicit Messages 1ms
- Total number of supported class 1 connections: 4
- Up to 5 parameters and 20 bytes for each connection
- Trigger types: Cyclic CoS

Acyclic data transmission via Connected and Unconnected Explicit Messages (transport class 3)

- Minimum RPI for Explicit Messages 100ms
- No. of simultaneous Class 3 connections: 6

Standard references

IEC 61918

Industrial communication networks
- Installation of communication networks in industrial premises

IEC 61076-2-101

Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking

IEC 61158-1

Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series

IEC 61158-2

Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition

IEC 61784-1

Industrial communication networks
- Profiles -
Part 1: Fieldbus profile

IEC 61784-2

Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

IEC 61784-3

Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses -
General rules and profile definitions

IEC 61784-5-2

Industrial communication networks
- Profiles -
Part 5-2: Installation of fieldbuses -
Installation profiles for CPF 2

ISO 15745-4

Industrial automation systems and integration - Open systems application integration framework -
Part 4: Reference description for Ethernet-based control systems

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adaptor (see tech table **GS500**) or EtherNet/IP scanner device

Configuration file

EDS (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EI and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS

Z-MAN-S-EI and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

6 PROFINET RT/IRT features for digital drivers and controllers in EP execution

Physical

Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x8892 according to IEEE 802.3
Transmission rate	100 Mbit Full-Duplex
Integrated	2-port switch
Cable length	max 100m
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	line, star, tree and ring structure
Ethernet switch	integrated with two ports
Led indicator	2 led for Link/Activity indicator (on each port) and 1 bicolor led for Status/Error indicator

Communication Protocol

Data Link Layer	PROFINET use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Device type	IO device - supported features: - complies with PROFINET IO conformance Class A, B, C - Acyclic parameter Channel - Real Time (RT) and Isochronous Real Time (IRT) communication - Up to 8 input/output parameters for real time data exchange - PROFINET specific diagnostic support - Media Redundancy Protocol (MRP) - DCP Discovery and Configuration Protocol supported - Identification & Maintenance (I&M) - Cycle time min: 1 msec [RT] , 250 µsec [IRT]

Startup and configuration

Address setting	IP Address and Station Name are assigned automatically by IO controller (e.g. Discovery and Configuration Protocol)
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on real time communication for emergency diagnosis

Real-time communication

Modular config	for drivers: AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES, PES up to 5 input parameters for real time data exchange up to 5 output parameters for real time data exchange for controllers: TEZ, BM-TEZ, LEZ, BM-LEZ, BM-KZ up to 8 input parameters for real time data exchange up to 8 output parameters for real time data exchange
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Standard references

- IEC 61918**
Industrial communication networks
- Installation of communication networks in industrial premises
- IEC 61076-2-101**
Connectors for electronic equipment
- Product Requirements -
Part 2-101: Circular connectors
- Detail specification for M12 connectors with screw-locking
- IEC 61158-1**
Industrial communication networks
- Fieldbus specification -
Part 1: Overview and guidance for the IEC 61158 and IEC 61784 series
- IEC 61158-2**
Industrial communication networks
- Fieldbus specification -
Part 2: Physical layer specification and service definition
- IEC 61158-5-10**
Industrial communication networks
- Fieldbus specification -
Part 5-10: Application layer service definition – Type 10 elements
- IEC 61784-1**
Industrial communication networks
- Profiles -
Part 1: Fieldbus profile
- IEC 61784-2**
Industrial communication networks
- Profiles -
Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3
- IEC 61784-5-3**
Industrial communication networks
- Profiles -
Part 5-3: Installation of fieldbuses -
Installation profiles for CPF 3

Programming interface

E-SW-FIELDBUS and Z-SW-FULL software using proper cable/adapter (see tech table **GS500**) or PROFINET controller.

Configuration file

GSDML (Electronic Data Sheet) enclosed in programming software DVD E-SW-FIELDBUS and Z-SW-FULL

Manuals

E-MAN-S-EP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Mounting surfaces for electrohydraulic valves

ISO standard, for directional, pressure and flow control valves plus pressure switches

1 ISO 4401: 2005 - for directional, pressure and flow control valves

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
<p>Y port only for 4401-03-03-0-05</p>	4401-03-02-0-05 P, A, B, T = \varnothing 7,5 max without Y port	DH* DLOH / DLOK DLEH / DLEHM QV-06 RZMO RZGO DHZE / DHZO DLHZO QVH* H* (modular)	DHA / DHW DLAH / DLWH RZMA RZGA DHZA DLHZA QVHZA
	4401-03-03-0-05 P, A, B, T = \varnothing 7,5 max Y = \varnothing 3,3 max	DHZO / Y DLHZO / Y	DHZA / Y DLHZA / Y
<p>X and Y port only for 4401-05-05-0-05</p>	4401-05-04-0-05 P, A, B, T = \varnothing 11,2 max without X and Y port	DKE DKZOR DLKZOR QVKZOR K* (modular)	DKZA DLKZA QVKZA
	4401-05-05-0-05 P, A, B, T = \varnothing 11,2 max X, Y = \varnothing 6,3 max	DKE/Y DKZOR / Y DLKZOR / Y DP-1* DPH-1* DPZO-*1*	DKZA / Y DLKZA / Y DPHA-1* / DPHW-1 DPZA-*1
	4401-07-07-0-05 P, A, B, T = \varnothing 17,5 max Y = \varnothing 6,3 max	DP-2* DPH*-2* DPZO*-2* JP*-2* (modular)	DPHA-2 / DPHW-2 DPZA-*2

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	<p>4401-08-08-0-05</p> <p>P, A, B, T = Ø 25 max X, Y, L = Ø 11,2 max</p>	<p>DP-4* DPH*-4* DPZO*-4* JP*-3* (modular)</p>	<p>DPHA-4 / DPHW-2 DPZA*-4</p>
	<p>4401-08-08-0-05</p> <p>P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max</p>	<p>DPZO*-4M*</p>	<p>DPZA*-4M*</p>
	<p>4401-10-09-0-05</p> <p>P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max</p>	<p>DP-6* DPH*-6* DPZO*-6*</p>	<p>DPHA-6 DPZA*-6</p>
	<p>4401-10-09-0-05</p> <p>P, A, B, T = Ø 50 max X, Y, L = Ø 11,2 max</p>	<p>DPZO*-8*</p>	<p>-</p>

2 ISO 6264: 2007 - for pressure relief valves

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	<p>6264-06-09-1-97</p> <p>P, T = Ø 14,7 max X = Ø 4,8 max</p>	<p>AGAM-10 AGMZO-*-10</p>	<p>AGAM-10 / AO AGAM-10 / WO AGMZA-*-10</p>
	<p>6264-08-11-1-97</p> <p>P, T = Ø 23,4 max X = Ø 6,3 max</p>	<p>AGAM-20 AGMZO-*-20</p>	<p>AGAM -20 / AO AGAM-20 / WO AGMZA-*-20</p>
	<p>6264-10-17-1-97</p> <p>P, T = Ø 32 max X = Ø 6,3 max</p>	<p>AGAM-32 AGMZO-*-32</p>	<p>AGAM-32 / AO AGAM-32 / WO AGMZA-*-32</p>

3 ISO 5781: 2000 - for pressure reducing and piloted check valves

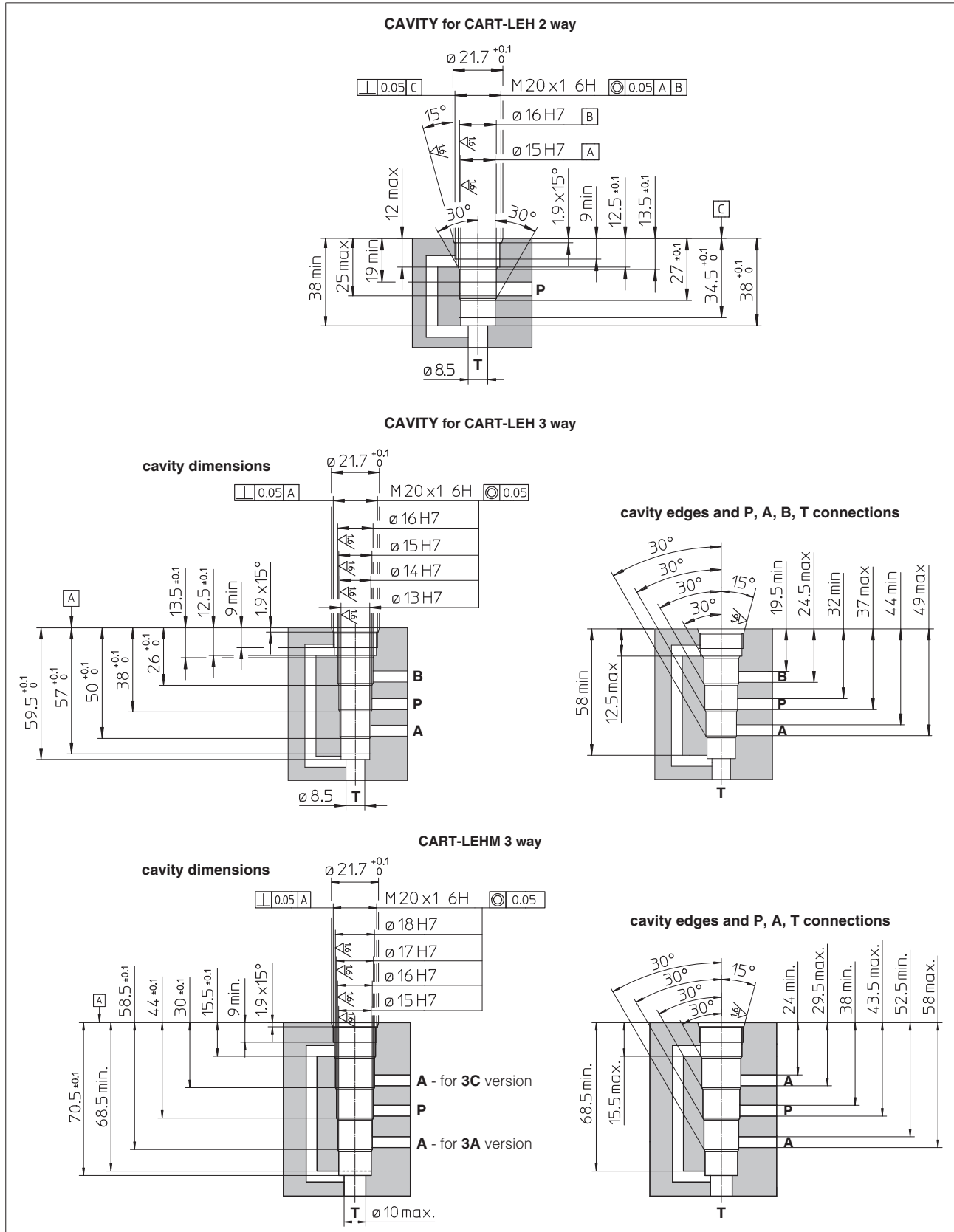
Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	<p>5781-06-07-0-00</p> <p>A, B = Ø 14,7 max X, Y = Ø 4,8 max</p>	<p>AGIS-10 AGIR-10 AGIU-10 AGRL*-10 AGRCZO*-10</p>	<p>AGRCZA*-10</p>
	<p>5781-08-10-0-00</p> <p>A, B = Ø 23,4 max X, Y = Ø 4,8 max</p>	<p>AGIS-20 AGIR-20 AGIU-20 AGRL*-20 AGRCZO*-20</p>	<p>AGRZA*-20</p>
	<p>5781-10-13-0-00</p> <p>A, B = Ø 32 max X, Y = Ø 4,8 max</p>	<p>AGIS-32 AGIR-32 AGIU-32 AGRL*-32</p>	<p>-</p>

4 ISO 16873: 2002 - for pressure switches

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type
	<p>16873-01-01-0-02</p> <p>P = Ø 4 max</p>	<p>MAP</p>

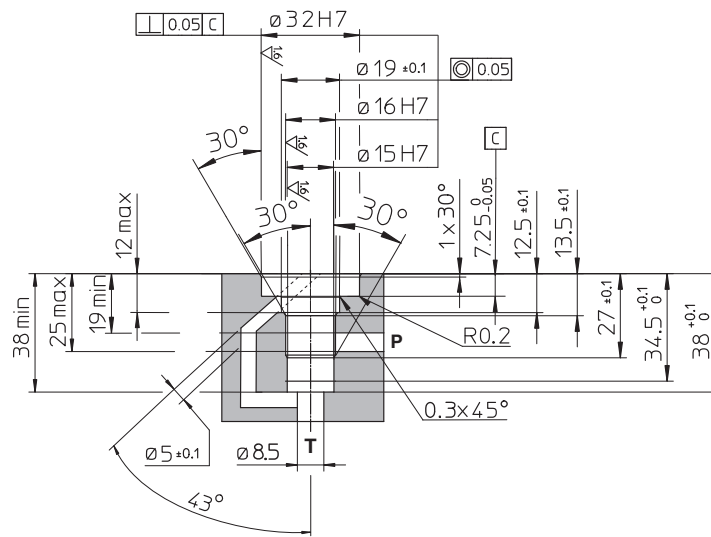
Mounting surfaces and cavities for cartridge valves

1 CAVITIES DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES type CART-LEH, CART-LEHM [mm]



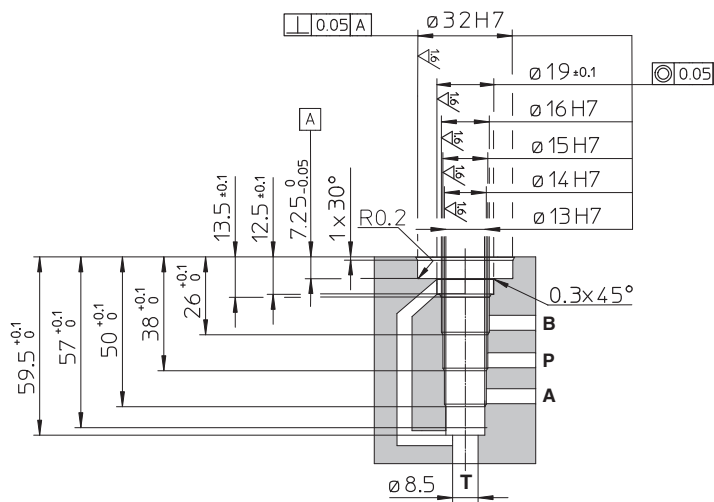
2 CAVITIES DIMENSIONS for 2 WAY and 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAH [mm]

CAVITY for CART-LAH 2 way

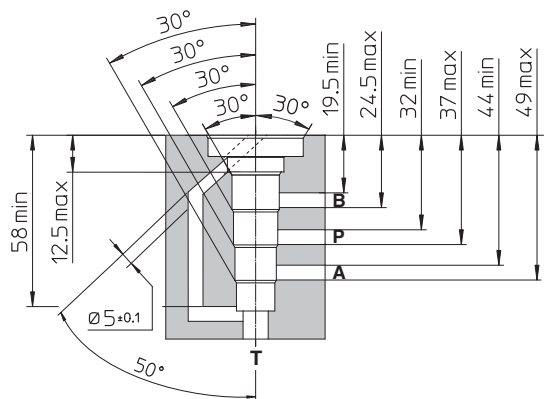


CAVITY for CART-LAH 3 way

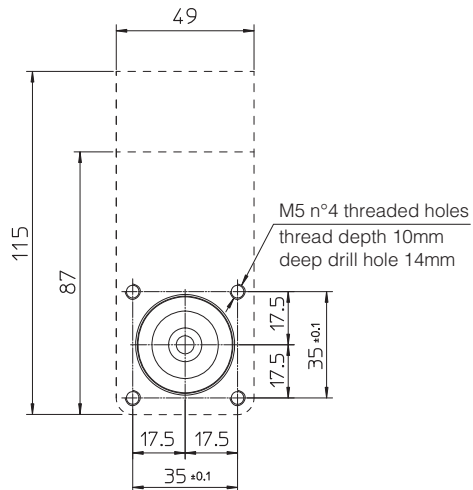
cavity dimensions



cavity edges and P, A, B, T connections



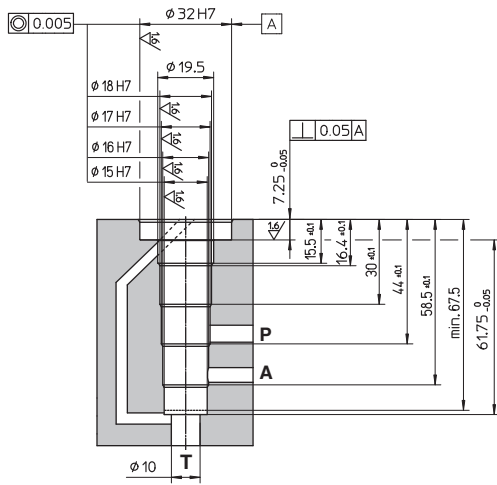
MOUNTING SURFACE for CART-LAH 2 and 3 way



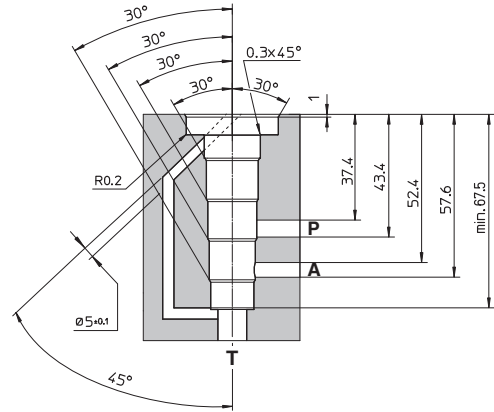
3 CAVITIES DIMENSIONS for 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAHM [mm]

CAVITY for CART-LAHM-3A

cavity dimensions

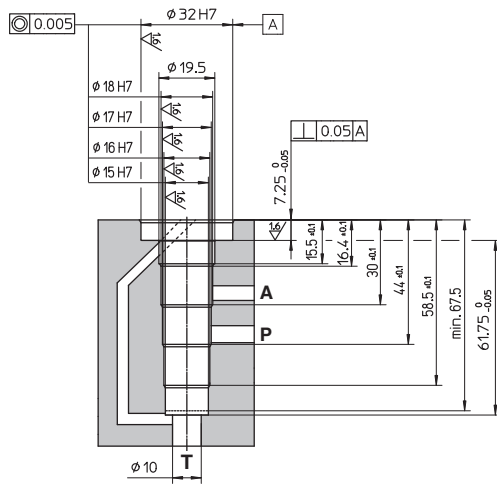


cavity edges and P, A, T connections

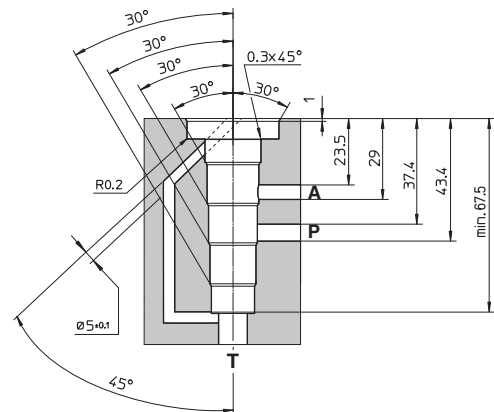


CAVITY for CART-LAHM-3C

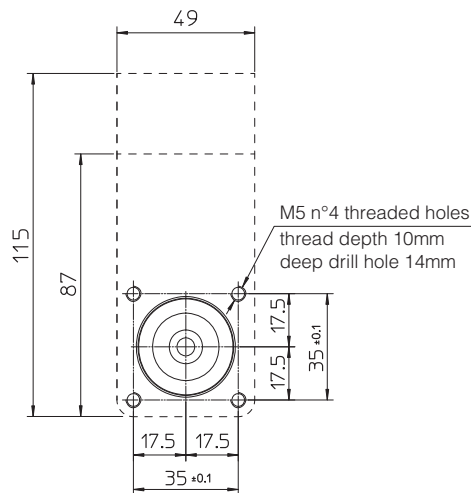
cavity dimensions



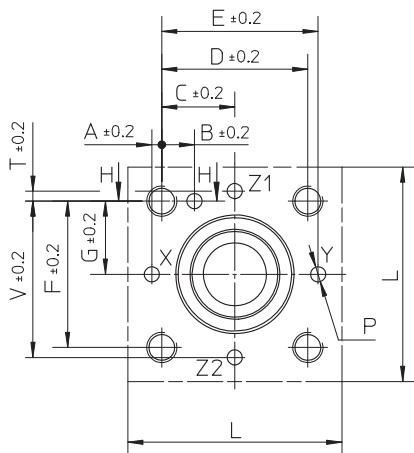
cavity edges and P, A, T connections



MOUNTING SURFACE for CART-LAHM 3 way



Size from 16 to 63



VALVE TYPE

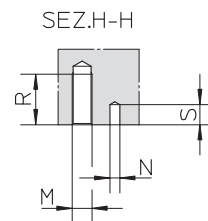
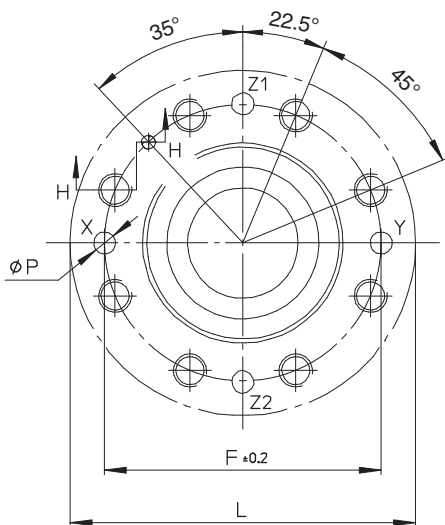
on off

- LIM
- LIR
- LIC
- LIQV
- LIDD
- LIDEW
- LIDBH
- LIDO
- LIDB
- LIDR
- LIDAS

proportional

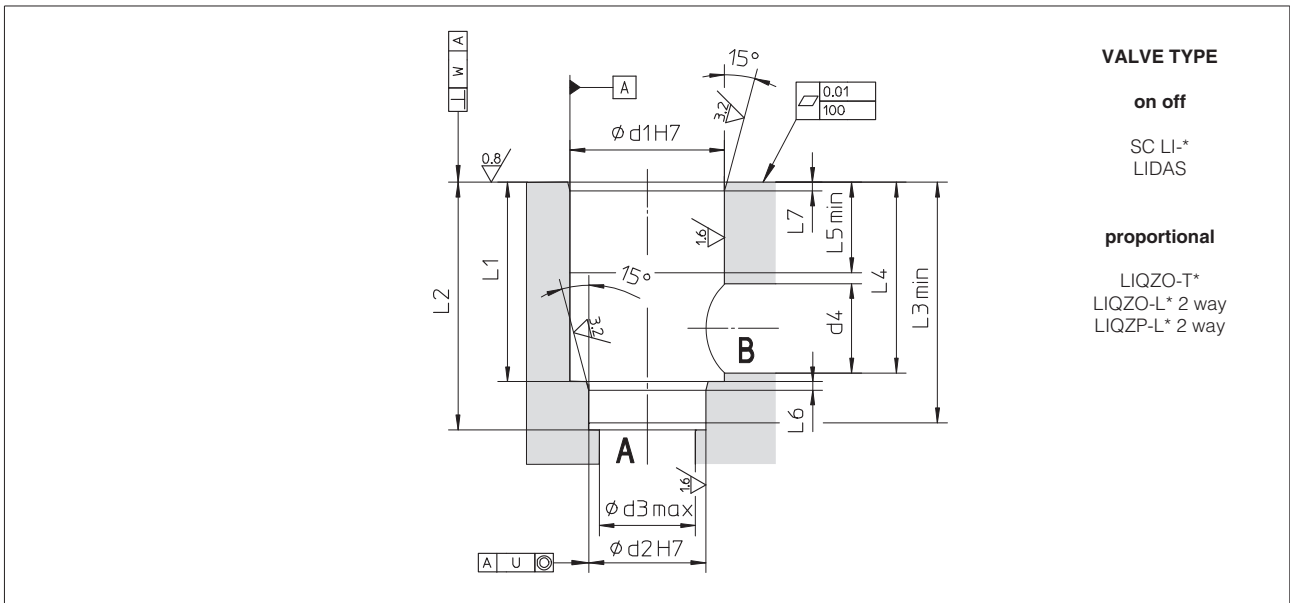
- LIQZO-T*
- LIQZO-L* 2 way
- LIQZO-L* 3 way
- LIQZP-L* 2 way
- LIQZP-L* 3 way

Size 80 and 100



Size	A	B	C	D	E	F	G	L	M	Ø N	P max	R	S min	T	V
16	2	12,5	23	46	48	46	23	65	M8	4	4	20	6	2	48
25	4	13	29	58	62	58	29	85	M12	6	6	30	8	4	62
32	6	18	35	70	76	70	35	102	M16	6	8	38	8	6	76
40	7,5	19,5	42,5	85	92,5	85	42,5	125	M20	6	10	46	8	7,5	92,5
50	8	20	50	100	108	100	50	140	M20	8	10	46	8	8	108
63	12,5	24,5	62,5	125	137,5	125	62,5	180	M30	8	12	66	8	12,5	137,5
80	-	-	-	-	-	Ø200	-	Ø250	M24	10	16	50	10	-	-
100	-	-	-	-	-	Ø245	-	Ø300	M30	10	20	63	10	-	-

5 ISO 7368 CAVITIES DIMENSIONS for 2 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

on off

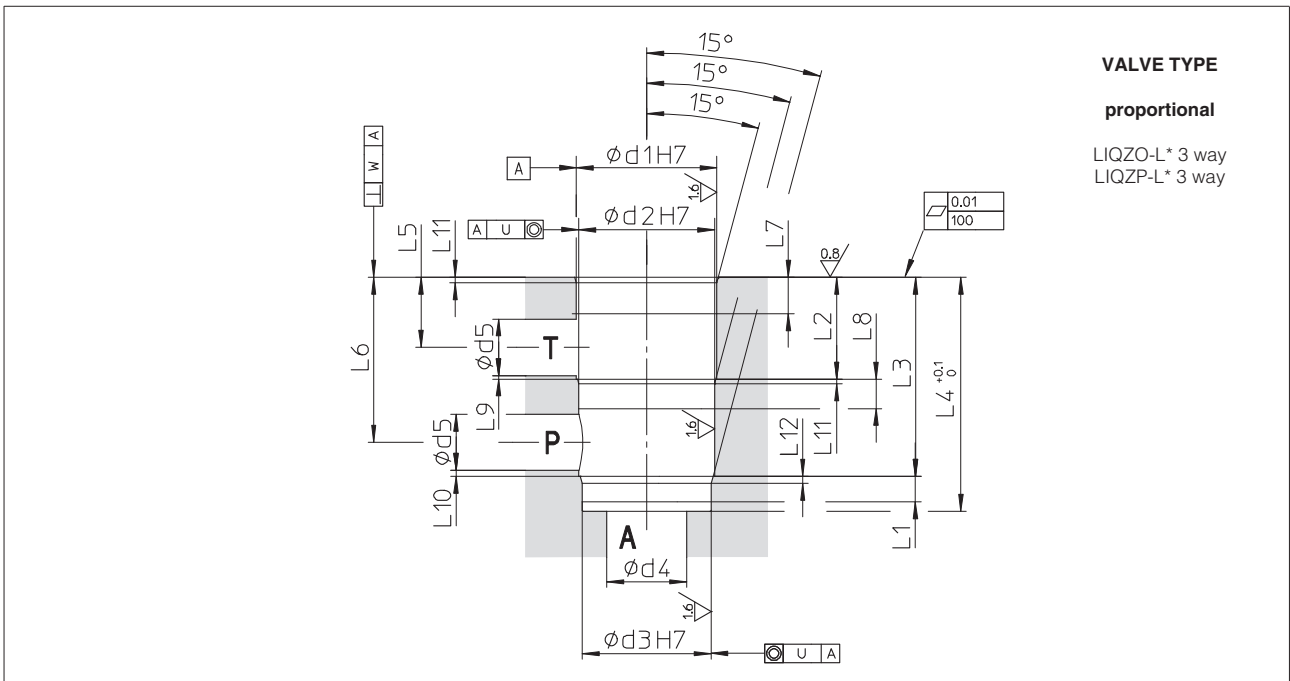
SC LI-*
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZP-L* 2 way

Size	ød1	ød2	ød3 max	ød4 max	L1	L2	L3	L4	L5	L6	L7	U	W
16	32	25	16	22,5	43 ^{+0,1} ₀	56 ^{+0,1} ₀	54	42,5	20	2	2	0,03	0,05
25	45	34	25	27	58 ^{+0,1} ₀	72 ^{+0,1} ₀	70	57	30	2,5	2,5	0,03	0,05
32	60	45	32	38,5	70 ^{+0,1} ₀	85 ^{+0,1} ₀	83	68,5	30	2,5	2,5	0,03	0,1
40	75	55	40	54,5	87 ^{+0,1} ₀	105 ^{+0,1} ₀	102	84,5	30	3	3	0,05	0,1
50	90	68	50	62,5	100 ^{+0,1} ₀	122 ^{+0,1} ₀	117	97,5	35	3	3	0,05	0,1
63	120	90	63	87	130 ^{+0,1} ₀	155 ^{+0,1} ₀	150	127	40	4	4	0,05	0,2
80	145	110	80	100	175 ^{+0,2} ₀	205 ^{+0,2} ₀	200	170,5	40	5	5	0,05	0,2
100	180	135	100	120	210 ^{+0,2} ₀	245 ^{+0,2} ₀	239	205,5	50	5	5	0,05	0,2

6 CAVITIES DIMENSIONS for 3 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

proportional

LIQZO-L* 3 way
LIQZP-L* 3 way

Size	ød1	ød2	ød3	ød4	ød5	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	U	W
25	45	43	34	20	20	11,5	56	89	103	45	78	25	15	1	1	2,5	2,5	0,03	0,05
32	60	58	55	32	24	13	43,5	85	100	30	70,5	18	15	1,5	2,5	2,5	2,5	0,03	0,05
40	75	73	55	40	30	15	54	105	125	36	87	21	18	3	3	3	3	0,03	0,05
50	90	87	68	50	35	17	87	143	165	66	122	48	18	3,5	3,5	4	3	0,05	0,05
63	120	116	90	63	48	20	85	165	195	57	137	33	28	4	4	4	4	0,05	0,05
80	145	140	110	80	60	25	125	215	245	90	180	60	25	5	5	5	5	0,05	0,05

Operating and maintenance information for proportional valves

directional, flow, pressure controls

safety valves conforming to Machine Directive 2006/42/EC

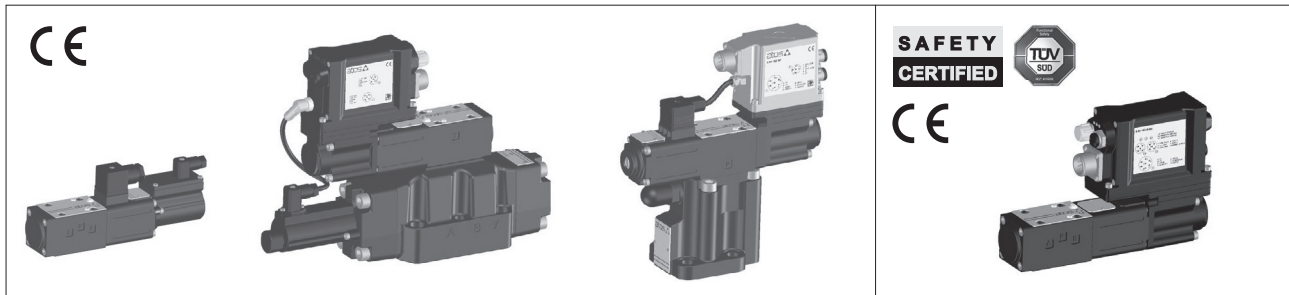
This operating and maintenance information applies to Atos proportional directional, flow, pressure control valves and safety proportional valves.

It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.

It contains important information on the safe and proper installation, commissioning, operation transport and maintenance of the products.

The prescriptions included in this document must be strictly observed to avoid damages and injury.

The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.

In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
	CAUTION	Minor or moderate injury could occur	
NOTICE		Property damage could occur	
		Notes relevant to safety proportional valves	
		Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.



WARNING

Personal injury and property damage may be caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos proportional valves, the following requisites must be met to ensure appropriate use of the products:

- personnel who uses Atos proportional valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section [5](#).
- the products must remain in their original state, no modifications are permitted
- it is not permitted to decompile software products or alter source codes
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section [6](#) and [7](#)

2.1 Warranty

The expiration of warranty results from the following operations:

- incorrect assembly and commissioning
- improper handling and storage, see 9.4
- improper use, see 5.2
- modification of the original condition

3 CERTIFICATION

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**.

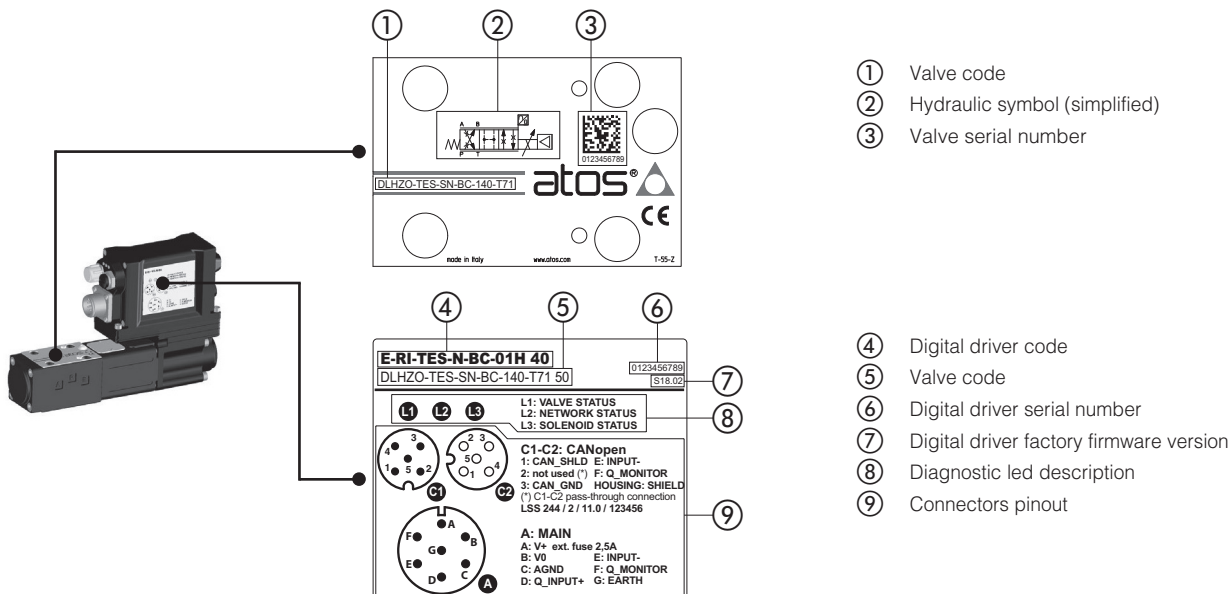
They are designed to accomplish a safety function, intended to reduce the risk in process control systems.

The valves are **TÜV certified** in compliance with **IEC 61508 up to SIL 3** and **ISO 13849 up to category 4, PL e**

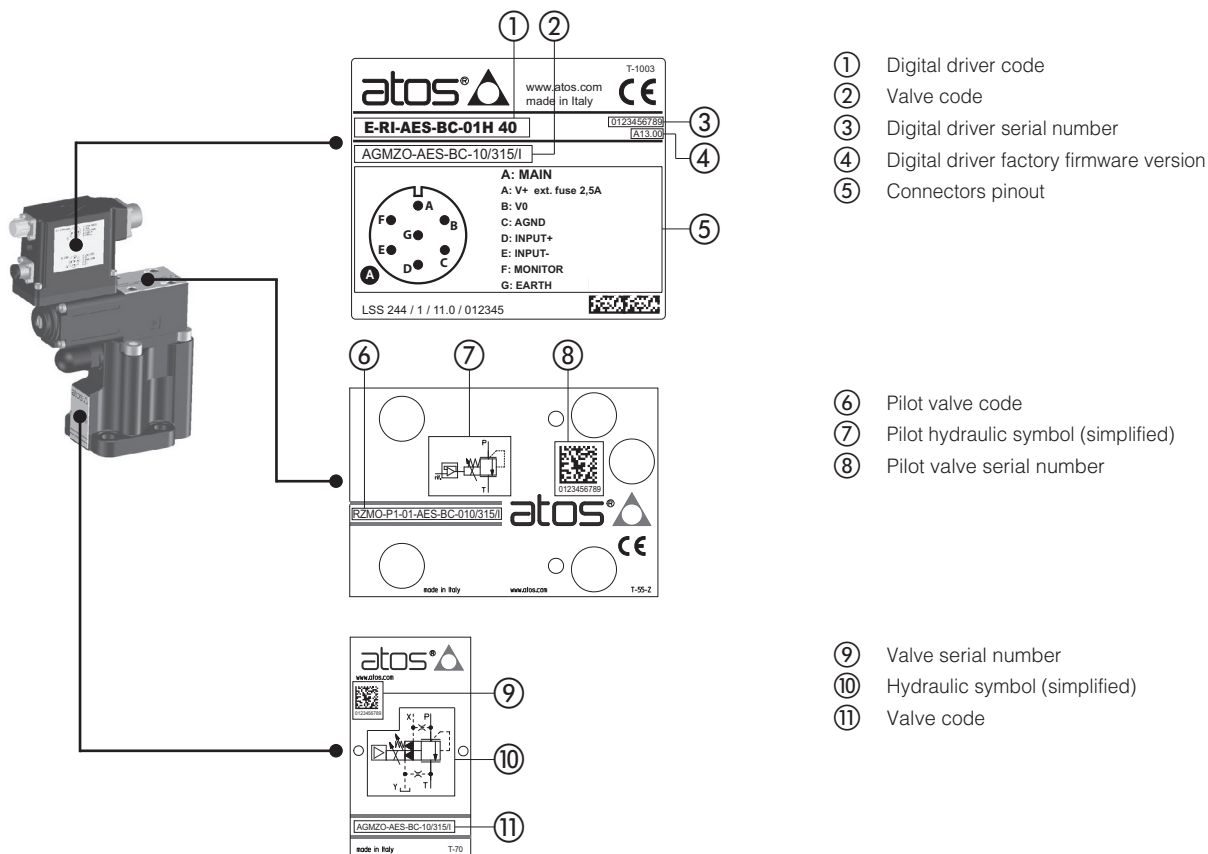


4 PRODUCT IDENTIFICATION EXAMPLES - nameplates

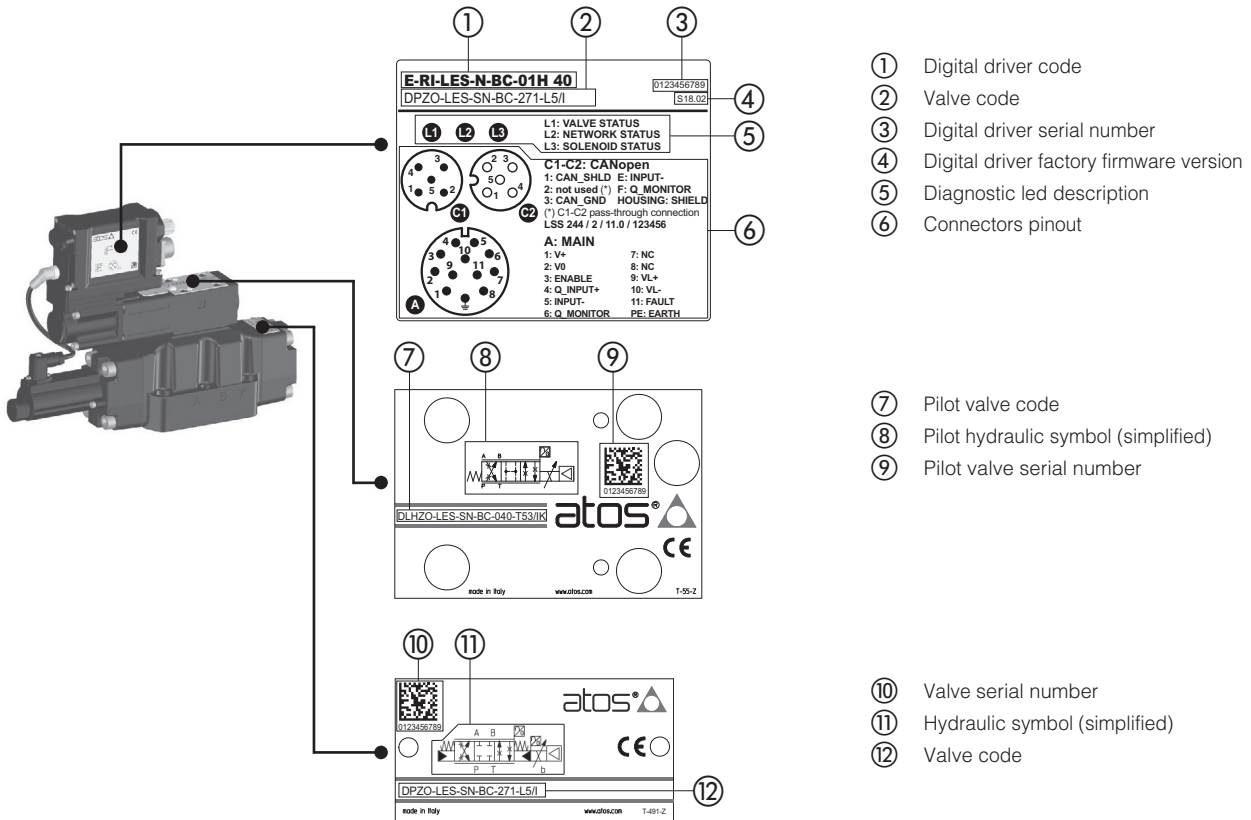
4.1 Direct valve with on-board driver/axis card - DLHZO-TES example



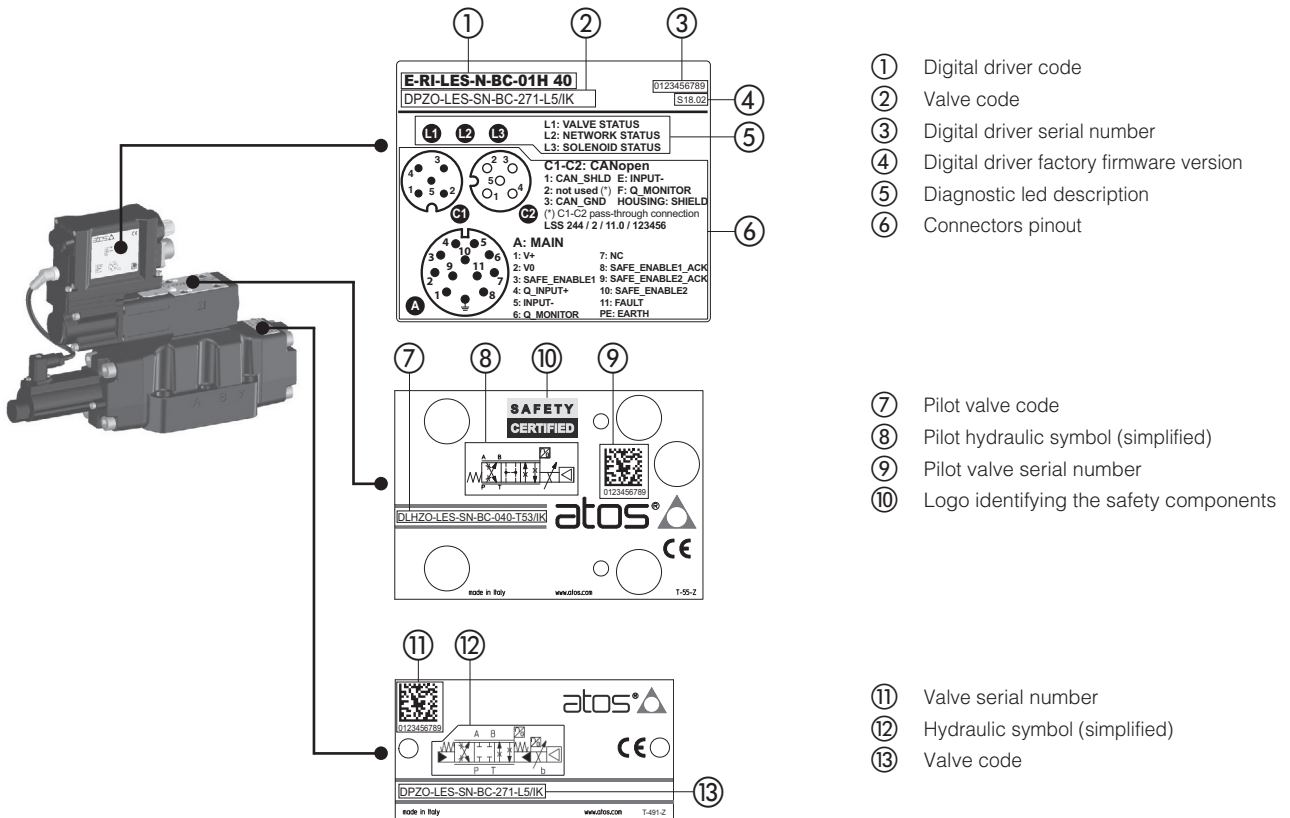
4.2 Piloted valve with on-board driver - AGMZO-AES example



4.3 Piloted valve with on-board driver/axis card - DPZO-LES example



4.4 Safety piloted valve with on-board driver/axis card - DPZO-LES /K example



5 SAFETY NOTES

5.1 Intended use

Atos proportional valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.



For safety-relevant applications, use only safety proportional valves /U or /K, identified by the Safety Certified logo. The superior control logic in connection with the proportional valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.



WARNING: non-compliance with functional safety

SAFETY CERTIFIED In case of mechanical or electric failures, risk of death or persons injury could occur. Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.



WARNING: fixing bolts

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables. Observe the specified tightening torque. Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



WARNING: hot surface

The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it. During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.



CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid/driver. Only use the valve within the specified ambient and fluid temperature range.



CAUTION: pressurized systems

When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), proportional valves may even be pressurized after the hydraulic power supply has been switched off. During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet. Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.



CAUTION: missing equipotential bonding

Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries. Provide for correct earthing or proper equipotential bonding.



CAUTION: penetrating water and humidity

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics. This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the proportional valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE

High-pressure water jets could damage the valve seals. Do not use a high-pressure washer for the valve cleaning.

NOTICE: disconnection and connection of plug-in connectors

Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

NOTICE: impact

Impact or shock may damage the valves. Never use the valves as step.

NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves. During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system. Do not use linting fabric for the valve cleaning.



Environmental protection

Hydraulic fluids are harmful to the environment. Leaking hydraulic fluid may leads to environmental pollution. In case of fluid leakage immediately act to contain the problem. Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment. The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber. Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

6 HYDRAULIC AND MECHANICAL INSTALLATION

6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object. Piping has to be cold bended, burred and pickled. When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants; during this operation the proportional valves have to be removed and replaced with by-pass connections, or on-off valves.

6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and proportional valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injury to the operator, a proper retention (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.

The proportional valve must be installed as close as possible to the actuator, to assure the maximum stiffness of the circuit and so the best dynamic performances.

6.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level.

Return line has to be sized in order to avoid variable counter pressure peaks caused by instantaneous flow variations.

6.4 Fluid conditioning

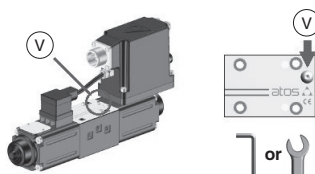
A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation.

The machine working cycle should start after the prescribed temperature has been reached.

6.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it is the cause of malfunctioning and vibrations.

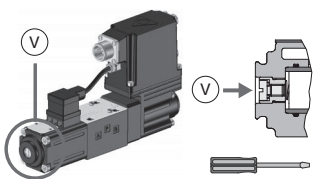
Air bleeds are provided in the proportional valves.



Directional valves air bleeding:

- release 2 or 3 turns the air bleed screw **V**
- cycle the valve at low pressure until the oil leaking from the **V** port is exempted from air bubbles
- lock the air bleed screw **V**

Note: to facilitate bleeding operations, apply a light backpressure (0,5 bar) on T port by adding a check valve on T line



Pressure control valves air bleeding:

- release 2 or 3 turns the air bleed screw **V**
- cycle the valve at low pressure until the oil leaking from the **V** port is exempted from air bubbles
- lock the air bleed screw **V**

Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow removal of air
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

6.6 System flushing

The whole system must be flushed replacing the proportional valves with specific flushing plates or with on-off directional valves. Make sure that also external pilot lines, if present in the system, are flushed.

In order to obtain the required minimum cleanliness level, the hydraulic system must be flushed for a sufficient time.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s



CAUTION: easily inflammable hydraulic fluid

In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.



CAUTION

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury. Ensure adequate hydraulic fluid cleanliness according to the cleanliness class required for the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

- normal operation: ISO4406 class 18/16/13 NAS1638 class 7
- longer life: ISO4406 class 16/14/11 NAS1638 class 5

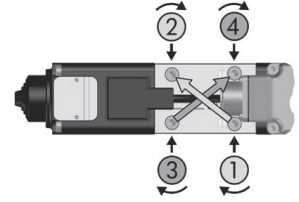
6.9 Valve fastening

Remove the protection pad located on the valve mounting surface.

Check the correct positioning of the seals on the valve ports.

Verify that the valve mounting surface is clean and free from damages and burrs.

Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



7 ELECTRICAL INSTALLATION

7.1 Power supply

The power supply device must be sized in order to generate the correct voltage when all utilities require the max current at same time; in general 50W max power can be considered for each proportional valve.

Following additional notes have to be considered:

- power supply from a battery: overvoltages (typically greater than 34 Volts) damage the electronic circuits; it is recommended the use of suitable filters and voltage suppressors
- the power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers
- a safety fuse is required in series to each power supply: see relevant technical tables for fuses value

7.2 Electrical wiring

The electrical cables must be shielded as indicated in section 8 with shield or cablebraid connected to the ground.

On-board driver/axis card - recommended cables characteristics

Main connector	Cable
7 pin - Metallic / Plastic	LiYCY 7 x 0,75 mm ² max 20 m (logic and power supply) or LiYCY 7 x 1 mm ² max 40 m (logic and power supply)
12 pin - Metallic	LiYCY 12 x 0,75 mm ² max 20 m (logic and power supply)
12 pin - Plastic	LiYCY 10 x 0,14 mm ² max 40 m (logic) plus LiYY 3 x 1 mm ² max 40 m (power supply)

Off-board driver/axis card - recommended cables characteristics

Driver/axis card	Cable
E-BM-AES E-BM-RES E-BM-T*/L* Z-BM-TEZ/LEZ Z-BM-KZ	LiYCY shielded cables: 0,5 mm ² max 50 m for logic 1,5 mm ² max 50 m for power supply
E-MI-AS-IR	2 poles x 0,5 mm ² plus 4 poles x 0,35 mm ² - cable lenght 4 m factory wired external diameter 7,4 mm
E-MI-AC	LiYCY shielded cables: 0,5 mm ² max 40 m for logic 1 mm ² max 40 m for power supply

Note: for transducers wiring cable please consult the transducers datasheet

7.3 Suppression of interferences by electrical noise

When starting the system, it is always advisable to check that feedback, references signal are free from interferences and electrical noise which can affect the characteristics of the signals and generate instability in the whole system.

Electrical noises can be suppressed by shielding and grounding the signal cables, see section 8.

Most of electrical noises are due to external magnetic fields generated by transformers, electric motors, switchboards, etc.

8 SHIELD CONNECTION

The correct shielding of signal cables has to be provided to protect the electronics from electrical noise disturbances, which could affect the valve functioning.

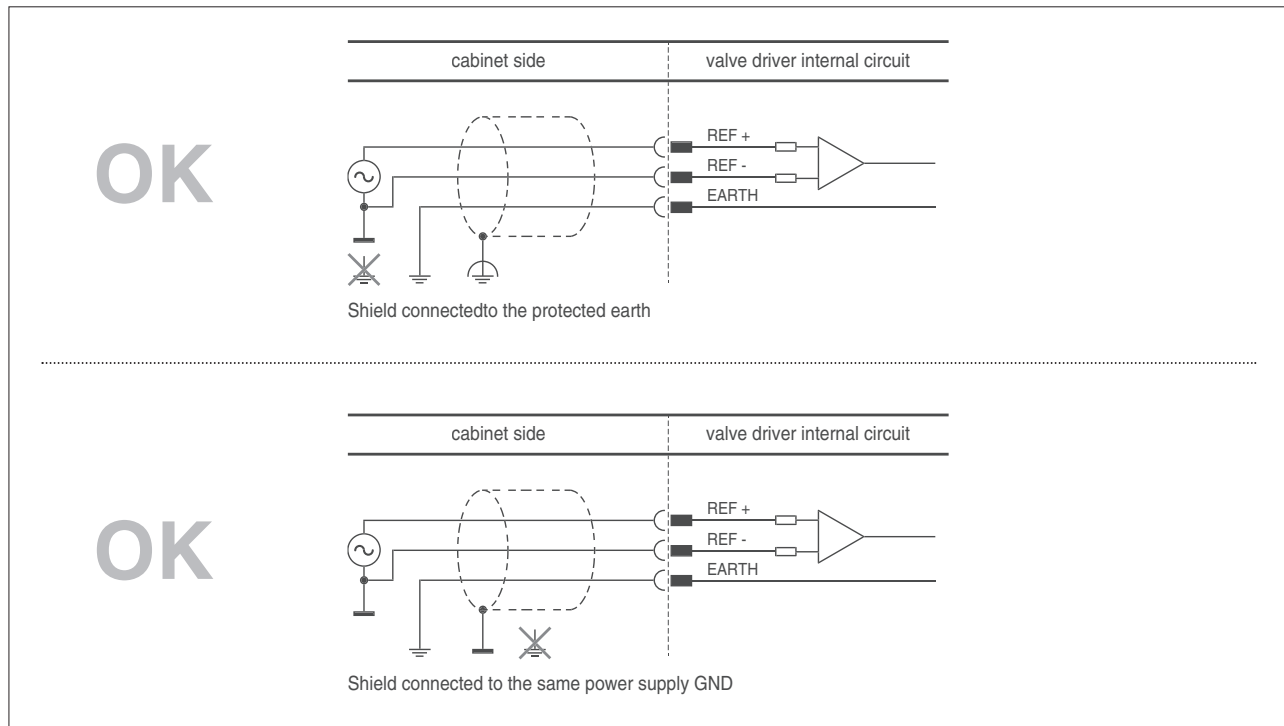
In general following basic rules should be observed:

- power supply cables and signal cables should be routed in separate cable conduits.
- signal cables should be kept far from strong electromagnetic disturbance sources such as electric motor, inverters or transformers.

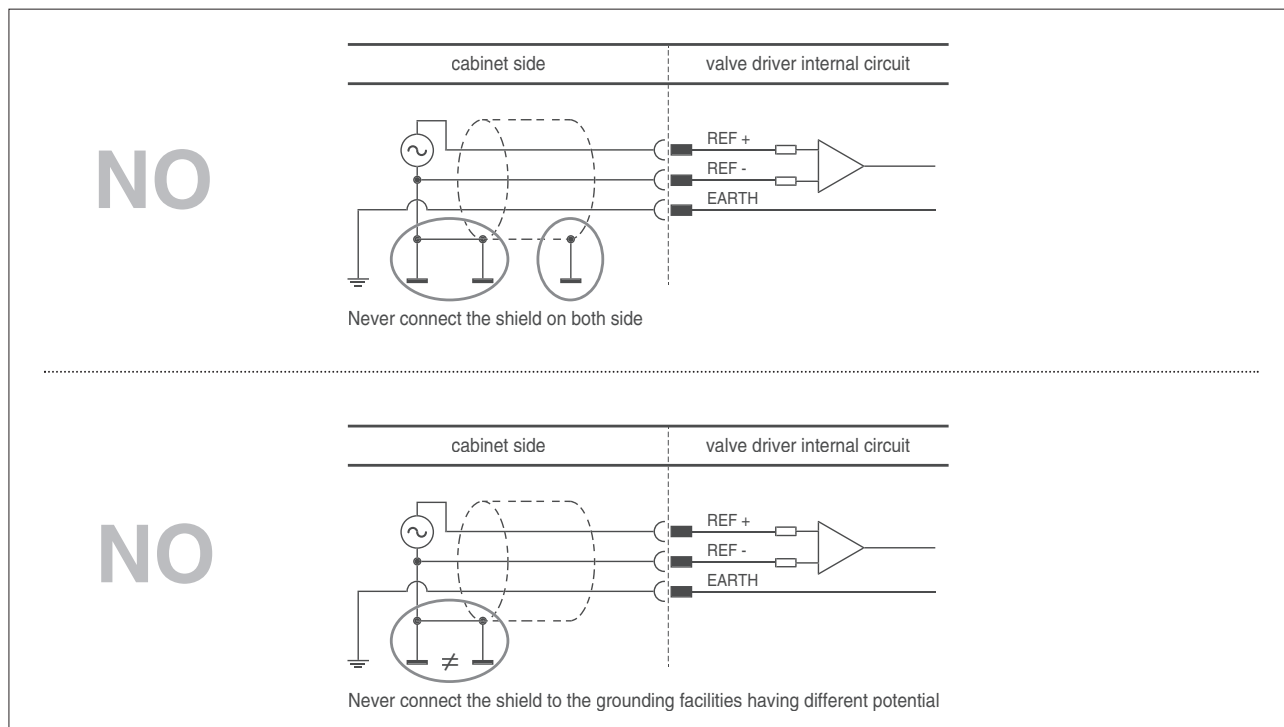
In the following examples are shown simple shielding criteria to avoid ground loops which may enhance the noise effect and in the worst cases they could cause the driver burning.

Refer to the applicable international standards for details about the shielding criteria.

CORRECT SHIELD CONNECTIONS EXAMPLES



WRONG SHIELD CONNECTIONS EXAMPLES



standard earth
 power supply GND
 protected earth

9 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

9.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

9.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.

Unauthorized opening of the valves during the warranty period invalidates the warranty.

9.3 Transport

Atos proportional valves are high-quality products. In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection.

Observe the following guidelines for transportation of valves:

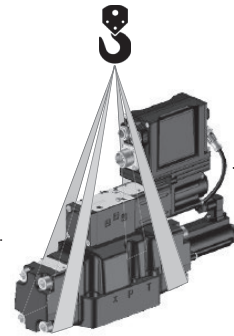
- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages



WARNING

The valve may fall down and cause damage and injuries, if transported improperly.

Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



WARNING

Do not lift the valve, using the transducer cable

9.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information for on-off valves

directional, flow, and pressure controls

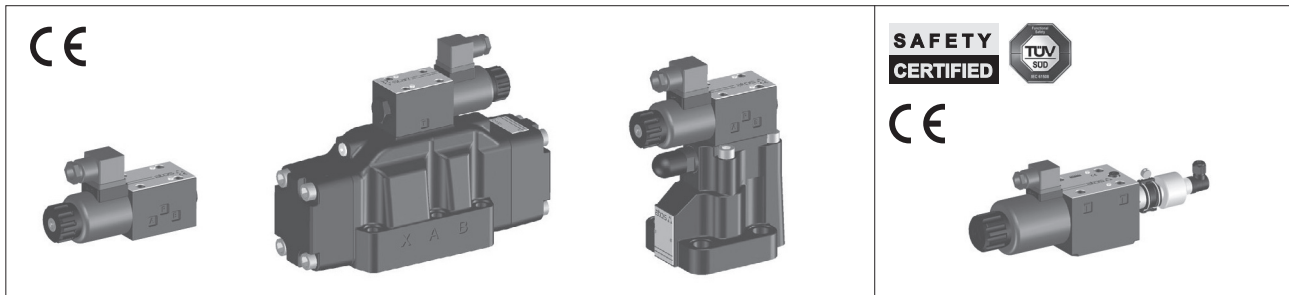
safety valves with spool position monitor, conforming to Machine Directive 2006/42/EC

This operating and maintenance information applies to Atos on-off directional, flow, pressure control valves and safety valves with spool position monitor. It is intended to provide useful guidelines to avoid risks when the valves are installed in the hydraulic system.

It contains important information on the safe and proper installation, commissioning, operation, transport, and maintenance of the products.

The prescriptions included in this document must be strictly observed to avoid damages and injury.

The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.

In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
	CAUTION	Minor or moderate injury could occur	
NOTICE		Property damage could occur	
	SAFETY CERTIFIED	Notes relevant to safety valves	
		Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves. It is intended for machine manufacturers, assemblers and system end-users.

WARNING
Personal injury and property damage may be caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:

- personnel who uses Atos valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section [5](#)
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section [6](#)

2.1 Warranty

The expiration of warranty results from the following operations:

- incorrect assembly and commissioning
- improper handling and storage, see 6.4
- improper use, see 5.2
- modification of the original condition

3 CERTIFICATION

Atos safety valves with spool / poppet position monitor are designed to accomplish a safety function intended to reduce the risk in process control systems.

The valves are **TÜV certified** in compliance with Machine Directive 2006/42/EC Annex IX – EC type-examination certificate for safety components (ref. Annex IV – 21) Norms EN ISO 13849-1 and EN ISO 13849-2

They can be used in applications up to Category 1, PL c in high demand mode.

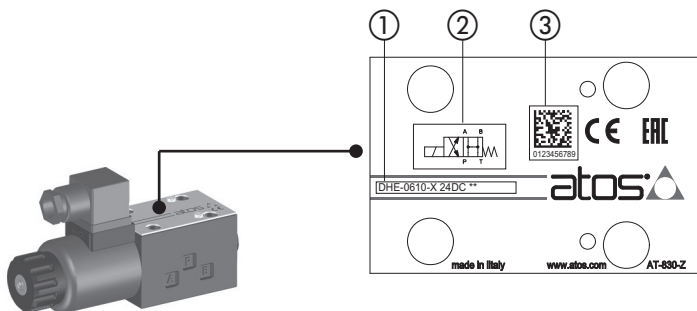
The spool / poppet position monitor is factory set in conformity to the relevant norms, and their regulation is properly sealed.



Any tampering of the sealing invalidates the certification

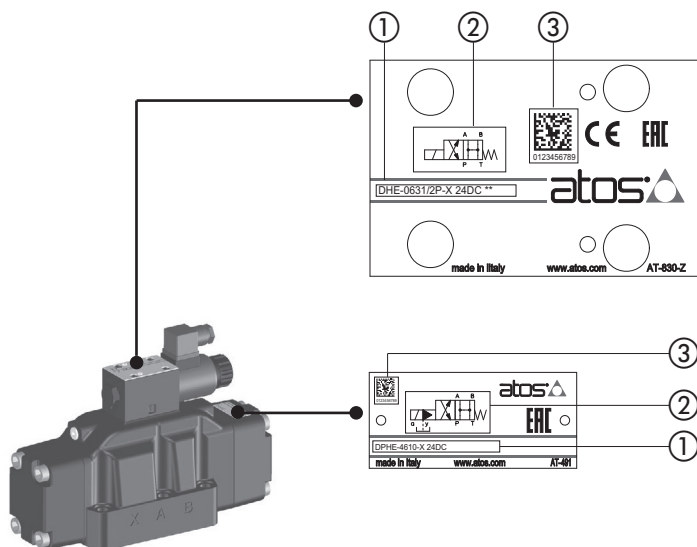
4 PRODUCT IDENTIFICATION EXAMPLES - nameplates

4.1 Directional solenoid valve, direct - DHE example



- ① Valve code
- ② Hydraulic symbol (simplified)
- ③ Valve serial number

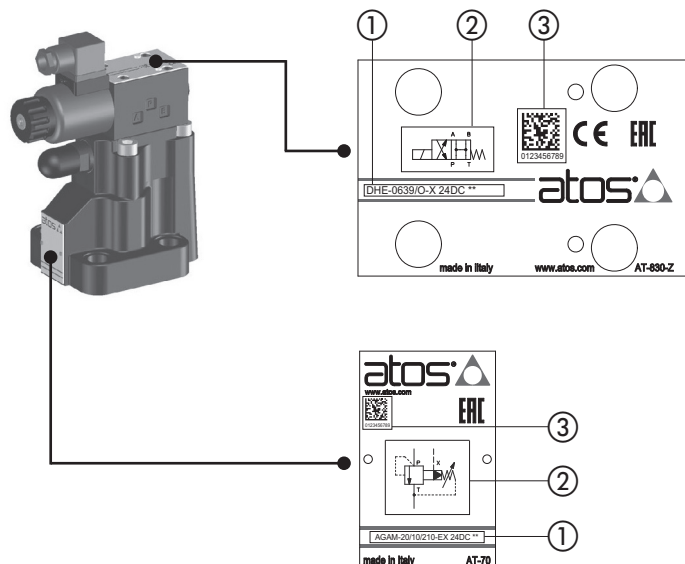
4.2 Directional solenoid valve, piloted - DPHE example



- ① Pilot valve code
- ② Pilot valve hydraulic symbol
- ③ Pilot valve serial number

- ① Valve code
- ② Hydraulic symbol (simplified)
- ③ Valve serial number

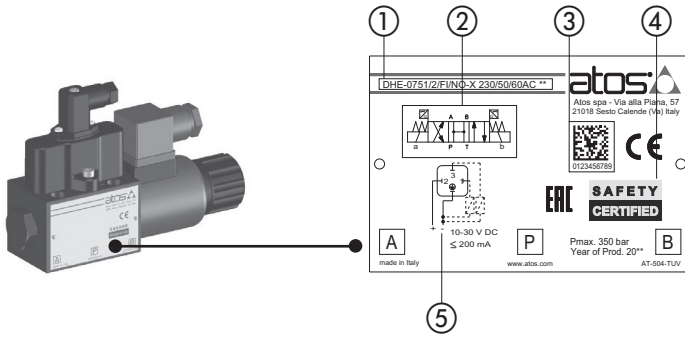
4.3 Pressure relief valve, piloted - AGAM example



- ① Pilot valve code
- ② Pilot valve hydraulic symbol
- ③ Pilot valve serial number

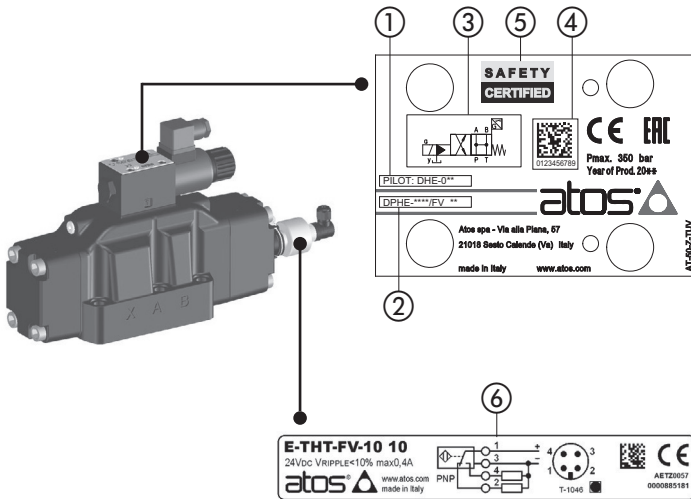
- ① Valve code
- ② Hydraulic symbol (simplified)
- ③ Valve serial number

4.4 Directional solenoid valve, direct - DHE-*/FV example



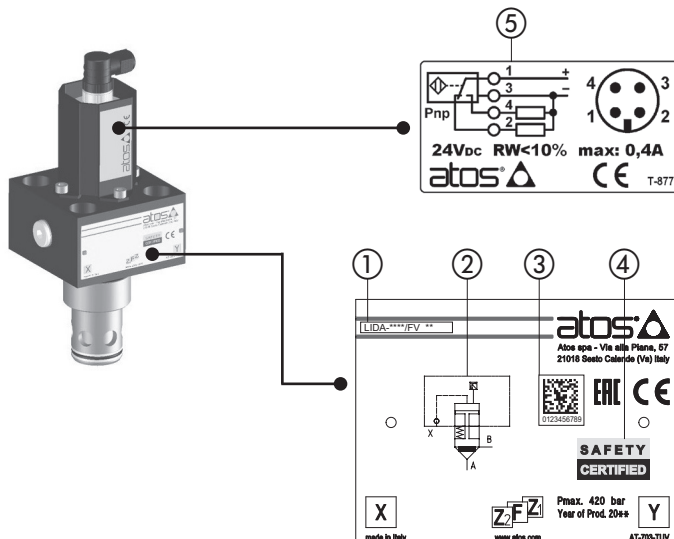
- ① Valve code
- ② Hydraulic symbol (simplified)
- ③ Valve serial number
- ④ Logo identifying the safety component
- ⑤ Sensor electric connection

4.5 Directional solenoid valve, piloted - DPHE-*/FV example



- ① Pilot valve code
- ② Valve code
- ③ Valve hydraulic symbol
- ④ Pilot valve serial number
- ⑤ Logo identifying the safety component
- ⑥ Sensor electric connection

4.6 Pressure relief valve, piloted - LIDA-*/FV example



- ① Valve code
- ② Valve hydraulic symbol
- ③ Pilot valve serial number
- ④ Logo identifying the safety component
- ⑤ Sensor electric connection

5 SAFETY NOTES

5.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.



For safety-relevant applications, use only on-off safety valves identified by the Safety Certified logo. The superior control logic in connection with the safety valve, is responsible for the control of the machine's motion sequence and also for its safety-related monitoring.

5.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and installation
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use.

5.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables.



WARNING: non-compliance with functional safety

SAFETY CERTIFIED In case of mechanical or electric failures, risk of death or persons injury could occur. Functional safety prescriptions according to EN ISO 13849 must be observed in the hydraulic circuit.



WARNING: fixing bolts

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables. Observe the specified tightening torque.

Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



WARNING: hot surface

The valve considerably heats up during operation. Allow the valve to cool down sufficiently before touching it. During operation, touch the valve solenoid only by using protective gloves. Please also observe ISO 13732-1 and EN 982.



CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid. Only use the valve within the specified ambient and fluid temperature range.



CAUTION: pressurized systems

When working at hydraulic systems with stored energy (accumulator or cylinders working under gravity), valves may even be pressurized after the hydraulic power supply has been switched off.

During assembly and disassembly works, serious injury may be caused by a powerful leaking of hydraulic fluid jet. Ensure that the whole hydraulic system is depressurized and the electrical control is de-energized.



CAUTION: missing equipotential bonding

Electrostatic phenomena, an incorrect earthing or missing equipotential bonding may lead to malfunctions or uncontrolled movements at the machine and thus cause injuries. Provide for correct earthing or proper equipotential bonding.



CAUTION: penetrating water and humidity

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.

This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE

High-pressure water jets could damage the valve seals. Do not use a high-pressure washer for the valve cleaning.

NOTICE: disconnection and connection of plug-in connectors

Do not plug-in or disconnect the electric connector as long as the voltage supply is ON.

NOTICE: impact

Impact or shock may damage the valves. Never use the valves as step.

NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.

During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system

Do not use linting fabric for the valve cleaning.



Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may leads to environmental pollution.

In case of fluid leakage immediately act to contain the problem.

Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.

The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber

Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

6 HYDRAULIC AND MECHANICAL INSTALLATION

6.1 Power packs tank and tubes cleaning

The power unit tank has to be accurately cleaned, removing all the contaminants and any extraneous object. When completely assembled an accurate washing of the piping (flushing) is requested to eliminate the contaminants.

6.2 Hydraulic connections

Flexible hoses are normally used on pressure line between powerpack and the valve and on user lines to connect the actuators. If their potential breakage may cause damages to the machine or system or can cause injury to the operator, a proper retention (as the chain locking at both the pipe-ends) or alternately a protecting carter must be provided.

6.3 Hydraulic drains and return lines

Drain lines must be connected to the tank without counter pressure. The drain pipe must end above the oil level. Return line has to be sized in order to avoid pressure peaks caused by instantaneous flow variations.

6.4 Fluid conditioning

A high-performance system must be thermally conditioned to ensure a limited fluid temperature excursion (generically between 40 and 50°C) so that the fluid viscosity remains constant during operation. The machine working cycle should start after the prescribed temperature has been reached.

6.5 Air bleeds

Air in the hydraulic circuits affects the hydraulic stiffness and it causes malfunctioning and vibrations. Following precautions have to be considered:

- at the system start-up all the bleeds must be released to allow the air removal
- untight the connections of the piping
- the system must be bled at first start-up or after maintenance
- a check valve (e.g. 0,5 bar) should be installed on the return line to tank to avoid emptying of the pipes following a long stop of the system

6.6 System flushing

The whole system must be flushed for a sufficient time in order to obtain the required minimum cleanliness level. Make sure that also external pilot lines, if present in the system, are flushed.

A decisive factor for the flushing time is the contamination level of the hydraulic fluid which can only be determined by means of a particle counter.

During the flushing procedure, perform a frequent monitor of the filters clogging indicator, replacing the filter elements when required.

6.7 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s



CAUTION: easily inflammable hydraulic fluid

In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

6.8 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.



CAUTION

Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected actuators movements and thus it constitutes a risk of injury. Ensure an adequate hydraulic fluid cleanliness according to the cleanliness class required for the the valve.

Max fluid contamination level, see also filter section at www.atos.com or KTF catalog:

ISO4406 class 20/18/15 NAS1638 class 9

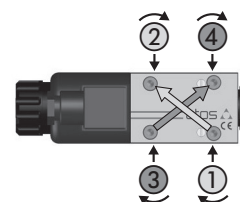
6.9 Valve fastening

Remove the protection pad located on the valve mounting surface.

Check the correct positioning of the seals on the valve ports.

Verify that the valve mounting surface is clean and free from damages and burrs.

Lock the fastening bolts in cross sequence (like in aside example) at the tightening torque specified in the valve technical table.



7 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

7.1 Ordinary maintenance

- The valves does not require other maintenance operations except seals replacement
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer
- Any preventive maintenance should be performed only by experienced personnel authorized by Atos.
- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components

7.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.
Unauthorized opening of the valves during the warranty period invalidates the warranty.

7.3 Transport

In order to prevent damage, the valves have to be transported in the original packaging or with equivalent transport protection.

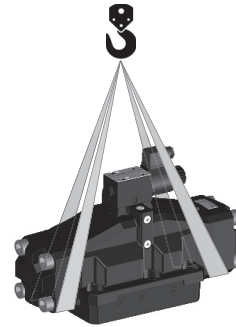
Observe the following guidelines for transportation of valves:

- before any movement check the valve weight reported in the relevant technical table
- use soft lifting belts to move or lift the heavy valves to avoid damages



WARNING

The valve may fall down and cause damage and injuries, if transported improperly.
Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



7.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

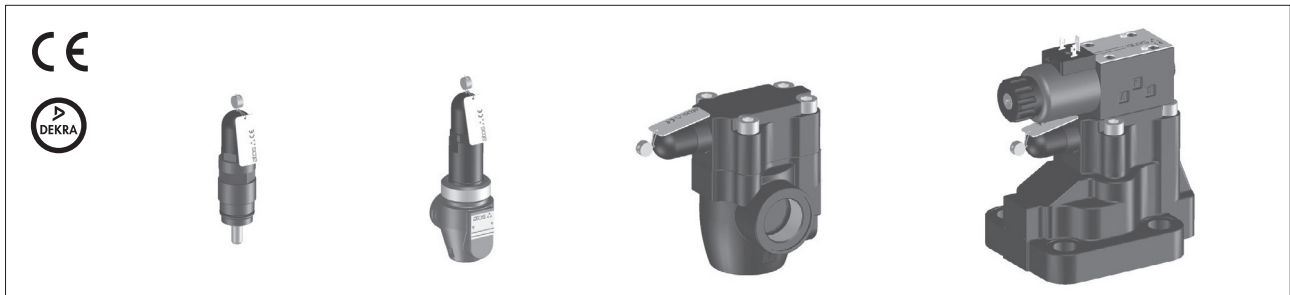
- If there is no specific information in the components technical tables, comply with a storage temperature of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information

safety PED pressure relief valves, conforming to PED Directive 2014/68/EU

This operating and maintenance information applies to Atos safety pressure relief valves conforming to Pressure Equipment Directive (PED) 2014/68/EU. It is intended to provide useful guidelines on the safe and proper assembly, commissioning, operation, use, maintenance and transport of PED valves. The prescriptions included in this document must be strictly observed to avoid damages and injury.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided. In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

	WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
	CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur		
		Information to be observed	

2 GENERAL NOTES

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves. It is intended for machine manufacturers, assemblers and system end-users.



WARNING **Personal injury and property damage may be caused by incorrect use of the products!**

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos valves, the following requirements must be met to ensure the appropriate use of the products:

- personnel who uses Atos valves must first read and understand the operating and maintenance information, particularly the Safety Notes in section **5**
- the products must remain in their original state, no modifications are permitted
- damaged or faulty valves must not be installed or put into operation
- make sure that the products have been installed as described in section **6**

2.1 Warranty

The expiration of warranty results from the following operations:

- incorrect assembly and commissioning
- improper use, see 5.2
- improper handling and storage, see 6.4
- modification of the original condition

3 CERTIFICATION

Safety pressure relief valves are certified by DEKRA, according to Pressure Equipment Directive 2014/68/EU (PED).

They meet the requirements specified in: Module B - EU Type Examination - Production Type (Annex III) of Directive 2014/68/EU - PED category IV

4 COMPONENTS DESCRIPTION

This document applies to direct and pilot operated safety pressure relief valves type CART*/PED, ARE*/PED, ARAM*/PED, AGAM*/PED. These valves are designed to operate as safety components, limiting the maximum system pressure or to protect parts of the circuit from overpressure.

They are also used as safety valves to protect hydraulic accumulators.

The valves are factory set at the pressure level required by the customer.

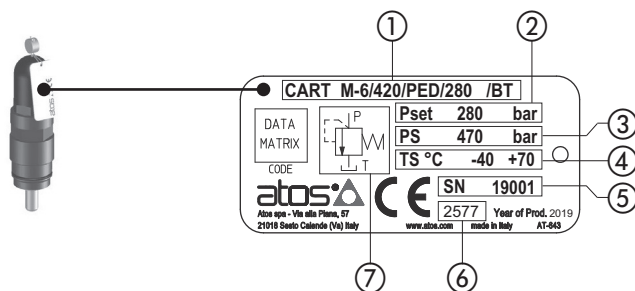
The pressure adjustment screw of the valves is protected with a lead sealed plastic cap to avoid manumission of the factory setting.



Any tampering of the lead sealing invalidates the certification.

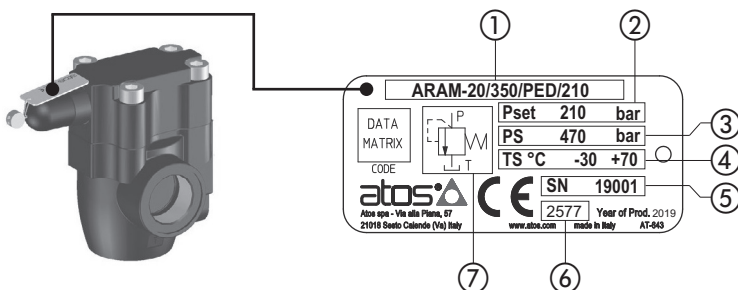
5 PRODUCT IDENTIFICATION EXAMPLES - nameplates

5.1 Screw-in cartridges type CART



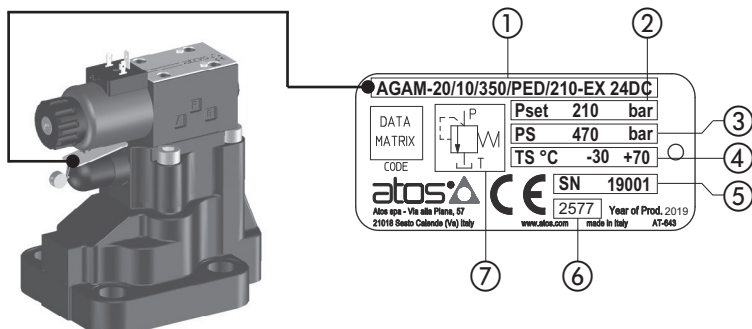
- ① Valve code
- ② Factory pressure setting
- ③ Burst pressure
- ④ Min ÷ Max fluid or ambient temperature range
- ⑤ Valve serial number (1)
- ⑥ Notified body reference number
- ⑦ Hydraulic symbol

5.2 In-line valves type ARE and ARAM



- ① Valve code
- ② Factory pressure setting
- ③ Burst pressure
- ④ Min ÷ Max fluid or ambient temperature range
- ⑤ Valve serial number (1)
- ⑥ Notified body reference number
- ⑦ Hydraulic symbol (simplified)

5.3 Subplate valves type AGAM



- ① Valve code
- ② Factory pressure setting
- ③ Burst pressure
- ④ Min ÷ Max fluid or ambient temperature range
- ⑤ Valve serial number (1)
- ⑥ Notified body reference number
- ⑦ Hydraulic symbol (simplified)

(1) Example for serial number:

19	-	001
Year: 19 = 2019		Progressive number

Note: nameplates may not be painted but must be kept in a readable condition

6 SAFETY NOTES

6.1 Intended use

Atos valves are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system. They may only be operated under the environmental and operating conditions described in the valves technical tables.

6.2 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:

- Wrong installation
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use outside the specified temperature range
- The safety valves must not be used if the maximum system flow exceeds the value indicated as "max admissible" reported in the relevant technical table
- Manumission of the factory pressure setting
- Incorrect transport

6.3 Installation

Installation must be performed following the recommendations contained in the valves technical tables



Any tampering of the lead sealing invalidates the certification.



WARNING: fixing bolts - for AGAM

For the valve mounting, use only class 12.9 bolts, with dimensions and length reported in the valves technical tables.

Observe the specified tightening torque.

Using inappropriate fixing bolts or insufficient tightening torque, can cause the valve to loosen with consequent leakage of fluid under pressure which may cause personal injury and property damage.



CAUTION

Use of the valve outside the approved temperature range may lead to functional failures like overheating of the valve solenoid.

Only use the valve within the specified ambient and fluid temperature range.



CAUTION: penetrating water and humidity - for ARAM with solenoid valve

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors.

This may lead to malfunctions at the valve and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the valve within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear and malfunctions of the valves.

During assembly, be careful to prevent foreign particles such as metal chips getting into the valve or into the hydraulic system

Do not use linting fabric for the valve cleaning.



Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may lead to environmental pollution.

In case of fluid leakage immediately act to contain the problem.

Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.

The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber

Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

7 HYDRAULIC AND MECHANICAL INSTALLATION

Safety pressure relief valves must be used as supplied by Atos, without unduly opening, division and/or substitution of internal parts.

Oil direction: P→T
 Inlet oil port: P
 Outlet oil port: T

Pressure on the discharge line T must be close to zero.

Verify that the seals are in good conditions before install the valves in the system.

Screw-in cartridges type CART, must not be removed from their manifold after commissioning, in order to avoid the loosening of internal parts.




The end user must provide proper systems to avoid the cartridge disassembling.

ARE and ARAM in-line valves have to be assembled with proper fittings as per technical table **CY045**.

AGAM subplate valves have to be mounted on proper surfaces, using screws as per technical table **CY066**.

See also section 7.1 for tightening torque.

7.1 Tightening torque - for CART and AGAM

Valve code			 Class 12.9	Tightening torque (Nm)
CART M-3	22			60
CART M-4	17			25
CART M-5	17			30
CART M-6	27			55
CART ARE-15	27			65
CART ARE-20	36			140
AGAM-10		10	n.4 M12x35	125
AGAM-20		14	n.4 M15x50	300
AGAM-32		17	n.4 M20x60	600

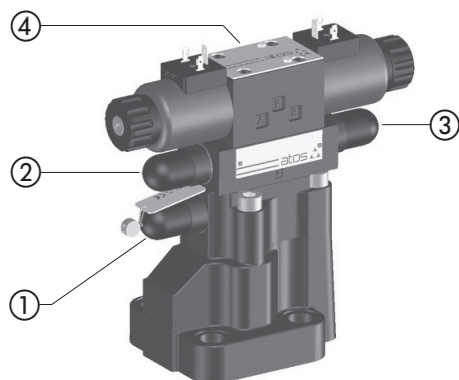
7.2 Application notes for valves ARAM and AGAM with pilot solenoid valve for multiple pressure selection.

The valve main regulation is factory set and lead sealed at the value required by the customer. This regulation corresponds to the max pressure controlled by the valve and it complies with the requirement of PED Directive 2014/68/EU.

The additional second and third pressure settings, selectable by the pilot solenoid valve, are without sealed regulation and they can be adjusted by the end user according to the system requirements.

The second and third pressure setting must be regulated at lower value respect to the lead sealed factory setting.

If the end user tries to adjust the second or third pressure setting at a higher value than the lead sealed factory setting, this last intervenes to limit the pressure according to PED requirements.



- ① Main pressure regulation - lead sealed factory setting
- ② Second pressure setting
- ③ Third pressure setting
- ④ Pilot solenoid valve

7.3 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

Make sure that the working fluid is compatible with gas and dust present in the environment.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s

7.4 Filtration

The correct fluid filtration ensures a long service life of the valves and it prevent anomalous wearing or sticking.



Contamination in the hydraulic fluid may cause functional failures e.g. jamming or blocking of the valve spool / poppet. In the worst case, this may result in unexpected system movements and thus constitute a risk of injury. Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the valve over the entire operating range.

Max fluid contamination level:

ISO 4406 class 20/18/15 NAS 1638 class 9

Note: see also filter section at www.atos.com or KTF catalog

8 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

8.1 Ordinary maintenance

Safety pressure relief valves do not require specific maintenance.

A visual inspection is definitely useful to check the integrity of lead sealing and the absence of external oil leakages.

Periodically the external surface of the valve should be cleaned from dirt to allow a clear readability of the identification plate.

8.2 Repairing

Safety pressure relief valves are supplied as single assembled unit: spare parts are not allowed.

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos which will provide for the reparation.

Only for ARAM and AGAM versions equipped with pilot solenoid valve, the replacement of the pilot solenoid valve with another Atos valve of the same type and with the same function is allowed.

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transportation of valves:

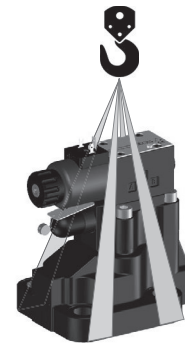
- Before any movement check the valve weight reported in the technical table relevant to the specific component
- Use soft lifting belts to move or lift the heavy valves to avoid damages



WARNING

The valve may fall down and cause damage and injuries, if transported improperly.

Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.



9.2 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

The valve surface is protected with a zinc coating, which guarantees a corrosion resistance of over 200 hours in the salt spray test. Additionally all valves are tested with mineral oil ISO VG 46; the oil film left after testing ensure the internal corrosion protection.

For the valves transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The valves can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of $-20\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$
- Do not store the valves outdoors
- Protect the valves against water and humidity in case of storage in open air
- Store the valves in the shelf or on a pallet
- Store the valves in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office

Operating and maintenance information for pumps

fixed and variable displacement

This operating and maintenance information apply to ATOS fixed vane, fixed piston and variable piston pumps, is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.

It contains important information on the safe and proper installation, transport, commissioning, operation and maintenance of the products.

The prescriptions included in this document must be strictly observed to avoid damages and injury.

The respect of this operating and maintenance information grants an increased working life, trouble-free operation and thus reduced repairing costs.



1 SYMBOL CONVENTIONS

Following symbols are used in this documentation to evidence particular risks to be carefully avoided.

In the following are listed the symbol conventions with their meaning, in case of non-compliance with this operating and maintenance information.

WARNING	Death or serious injury could occur	risk classes to ANSI Z535.6 / ISO 3864
CAUTION	Minor or moderate injury could occur	
NOTICE	Property damage could occur	
	Information to be observed	

2 GENERAL NOTES

This document is intended for machine manufacturers, assemblers and system end-users.



WARNING

Personal injury and property damage caused by incorrect use of the products!

The products have been designed for use in industrial environments and may only be used in the appropriate way.

Before using Atos pumps, the following requisites must be met to ensure appropriate use of the products:

- personnel who uses Atos pumps must first read and understand the operating and maintenance information, particularly the Safety Notes in section [4](#).
- the products must remain in their original state, no modifications are permitted
- damaged or faulty pumps must not be installed or put into operation
- make sure that the products have been installed as described in the relevant documentation

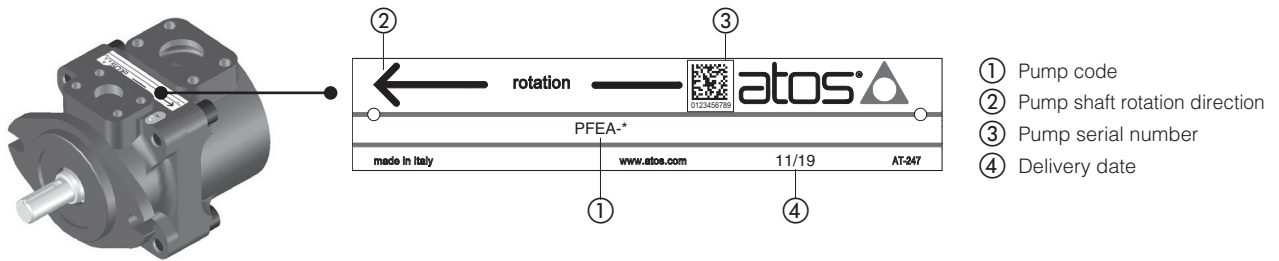
2.1 Warranty

The expiration of warranty results from the following operations:

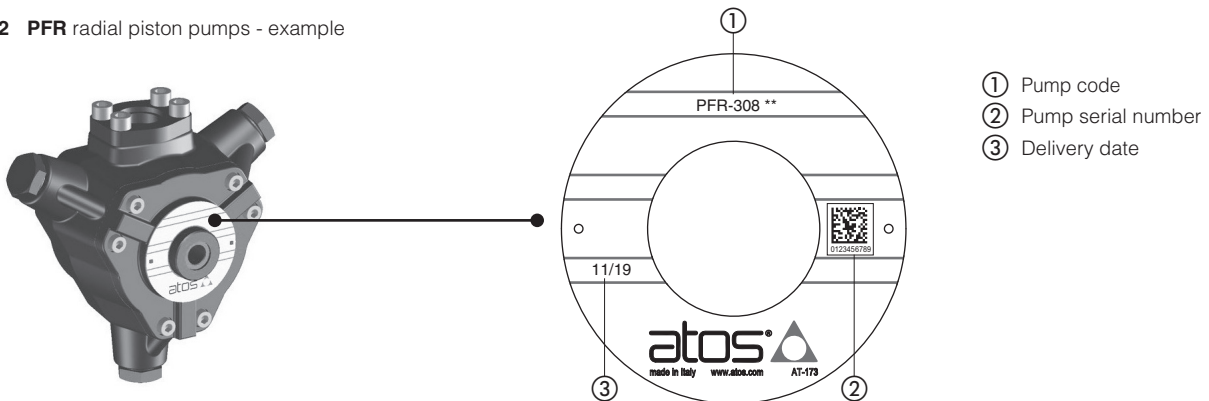
- incorrect assembly and commissioning
- improper use, see 4.2
- improper handling and storage, see 6.4
- modification of the original condition

3 PRODUCT IDENTIFICATION EXAMPLES - nameplates

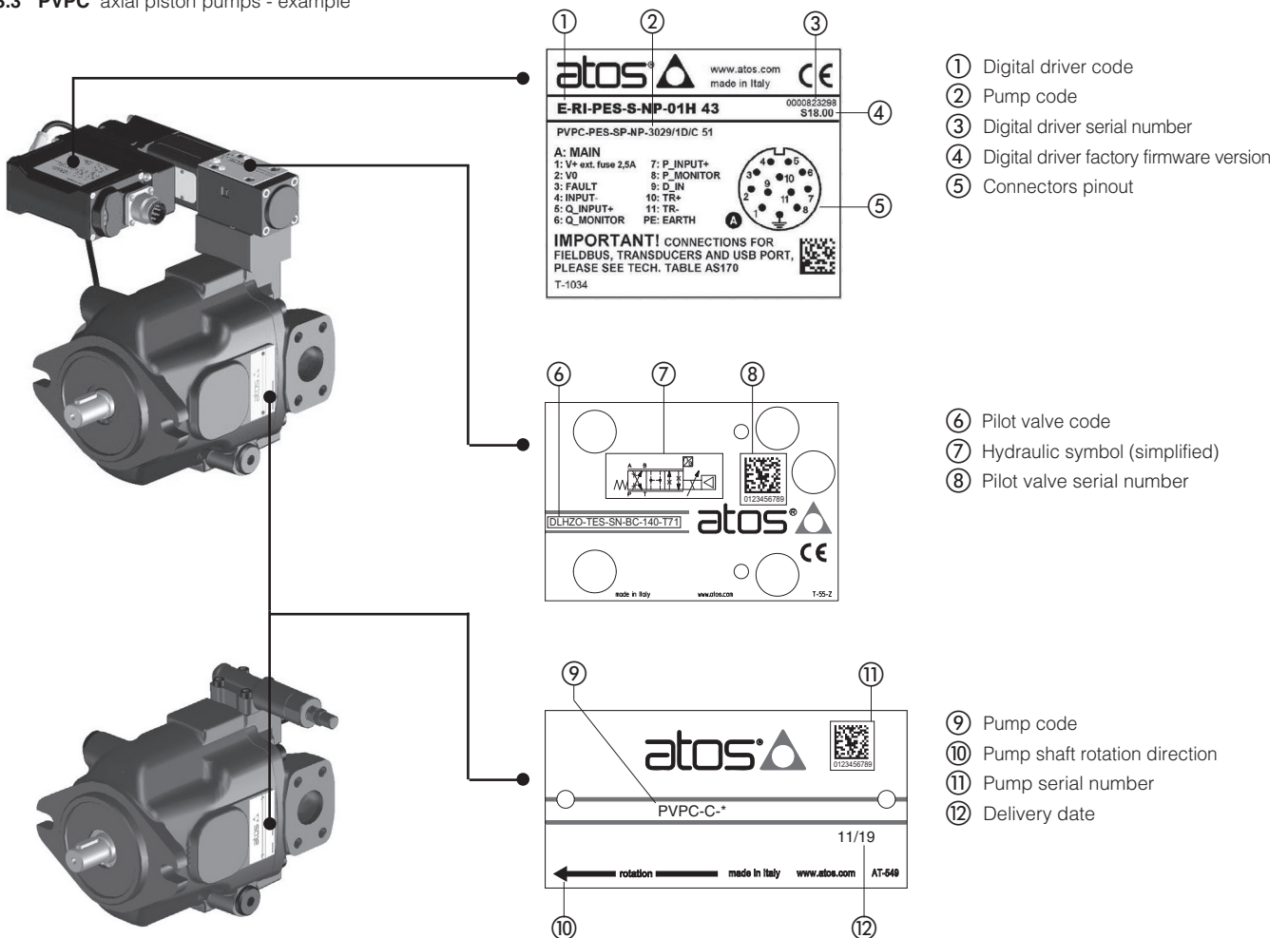
3.1 PFE vane pumps - example



3.2 PFR radial piston pumps - example



3.3 PVPC axial piston pumps - example



4 SAFETY NOTES

4.1 Intended use

Atos pumps are intended for integration in industrial systems and machines or for the assembly with other components to form a machine or a system.

They may only be operated under the operating condition described in the relevant technical table.

Pumps must be used observing following prescriptions:

- complying with the application and environmental conditions according to the relevant technical tables
- complying with operating conditions and performance limits specified in the relevant technical tables
- use in the original condition, without damage

4.2 Improper use

Any improper use of the pumps is not admissible.

Improper use of the product includes:

- use in explosive environments
- incorrect storage
- incorrect transport
- lack of cleanliness during storage and assembly
- incorrect installation
- use of inappropriate or non-admissible fluids
- operation outside the specified performance limits
- operation outside the approved temperature range

Atos spa does not assume any liability for damage caused by improper use.

The user assumes all risks involved with improper use.

4.3 Installation

Installation must be performed following the recommendations contained in the relevant technical tables and in section 5 of this document.



WARNING: hot surface

The pumps may heat up during operation.

Allow the pump to cool down sufficiently before touching it.

During operation, touch the valve solenoid only by using protective gloves.

Please also observe ISO 13732-1 and EN 982.



CAUTION

Use of the pumps outside the approved temperature range may lead to functional failures like overheating and seizure.

Only use the valve within the specified fluid temperature range.



CAUTION: penetrating water and humidity - for PVPC pumps with proportional controls

In case of use in humid or wet environments, water or humidity may penetrate at electrical connectors or into the valve electronics.

This may lead to malfunctions at the pump and to unexpected movements in the hydraulic system which may result in personal injury and damage to property:

- only use the pumps within the intended IP protection class
- ensure that all seals and caps of the plug-in connections are tight and intact

NOTICE: impact

Impact or shock may damage the pumps. Never use the pump as step.

NOTICE: dirt and foreign particles

Penetrating dirt and foreign particles lead to wear, malfunction and seizure

During assembly, be careful to prevent foreign particles such as metal chips getting into the pump or into the hydraulic system

Do not use linting fabric for cleaning, it may release contamination.



Environmental protection

Hydraulic fluids are harmful to the environment.

Leaking hydraulic fluid may lead to environmental pollution.

In case of fluid leakage immediately act to contain the problem.

Dispose of the hydraulic fluid in accordance with the currently applicable national regulations in your country.

Atos components do not contain substances hazardous for the environment.

The materials contained in Atos components are mainly: Copper, Steel, Aluminium, Electronic components, Rubber

Due to the high content of reusable metals, the main components of Atos can be completely recycled after disassembling of the relevant parts.

5 HYDRAULIC AND MECHANIC INSTALLATION

General:

- Before start up make sure that the pump is always filled with the working fluid.
- The pump must never be operated with "OUT" port closed; in order to limit the maximum working pressure a relief valve must be installed on the pressure line.
- Make sure that the maximum working conditions shown in relevant technical tables are not exceed

5.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For PFE:

the pump can operate in any position, the available orientation of the oil ports is according to the below pictures. In the ordering code must be specified the selected orientation.



- For PFR:

- The pumps can be installed in horizontal or in vertical position. In case of vertical position it is advisable to install on the outlet pipe a proper valve for air bleeding (consult our technical dept.).
- These pumps are not self-priming therefore their installation under oil level is recommended. Installation above oil level requires foot valve on inlet line and pump central point located no more than 150 mm above minimum oil level.
- The shaft of the pump has an eccentric cam which rotates with the shaft generating the stroke of the pistons and thus generating the flow rate. For best functioning a balanced coupling should be provided between the shaft of the motor and the shaft of the pump.

- For PVPC:

- The pumps can be installed in horizontal or in vertical position. In case of vertical position the pump shaft must be oriented upward.
- The drain pipe must be oriented so that the pump body always remains filled with the fluid, specially when not working. For this reason the pump is provided with 2 drain connections located in opposite side of the body, so that, depending to the pump orientation, the optimal drain piping can be arranged
- Before the commissioning, the pump body must be filled with the working fluid through one of the drain connections.
- The connection with the electric motor must be performed by means of proper elastic coupling.

5.2 Shaft loads

PFE, PFR: axial and radial loads acting on shaft are not permitted.

PVPC: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table A160, section 2.

The coupling with the electric motor must be sized to absorb the power peaks.

The coupling alignment between the motor and pump shaft must ensured

5.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwise, viewed from the shaft end) must be the same of the arrow on the nameplate.

5.4 Oil level

Make sure that the pump is always filled with fluid. The installer / end user has to provide a level meter to verify the presence of fluid inside the power unit tank.

5.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The piping have to be sized according to the max pressure and max flow rate
- All pipes and surfaces must be cleaned from dirt before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pump IN/OUT ports when connecting the pipes
- Ensure that the pump installation allows an easy acces for maintenance purpose

5.6 Hydraulic fluids and operating viscosity range

Mineral oils type HLP having high viscosity index are recommended.

The hydraulic fluids must be compatible with the selected seals.

The type of fluid has to be selected in consideration of the effective working temperature range, so that the fluid viscosity remains at the optimal level.

Note: for PVPC the temperature of the fluid contained in the pump body (drain line) is always higher than the tank temperature, specially if the pump is working for long time in null flow conditions and at high pressure.

Fluid viscosity: 10 mm²/s for short periods at max fluid temperature on drain line
24 to 100 mm²/s during normal operation
1000 mm²/s for short periods at cold start-up (800 mm²/s for PVPC)

Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDP	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

Fluid viscosity: 15 ÷ 100 mm²/s - max allowed range 2,8 ÷ 500 mm²/s



CAUTION: easily inflammable hydraulic fluid

In connection with fire or other hot sources, leaking hydraulic fluid may lead to fire or explosions.

5.7 Filtration

The correct fluid filtration ensures a long service life of the pumps and it prevent anomalous wearing or sticking. Contamination in the hydraulic fluid may cause functional failures e.g. loss of efficiency and increased noise level. In the worst case, this may result in heavy damages and breakages. Ensure adequate hydraulic fluid cleanliness according to the cleanliness classes of the pumps over the entire operating range.

Max fluid contamination level:

- normal operation: **PFE, PFR** = ISO4406 class 21/19/16 NAS1638 class 10;
- longer life: **PFE, PFR** = ISO4406 class 19/17/14 NAS1638 class 8;

PVPC = ISO4406 class 20/18/15 NAS1638 class 9
PVPC = ISO4406 class 18/16/13 NAS1638 class 7

Note: see also filter section at www.atos.com or KTF catalog

6 MAINTENANCE



Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics.

6.1 Ordinary Maintenance

Service work performed on the valve by end user or not qualified personnel invalidates the certification

- Cleaning the external surfaces using a wet cloth to avoid accumulation of dust layer over 5 mm
- Don't use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires the immediate stop of the system and the inspection of the relevant components
- The pump does not require other maintenance operations except for front shaft seal, and vane cartridge (for PFE)

6.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos or to Atos authorized service centers which will provide for the reparation.

Unauthorized opening of the valves during the warranty period invalidates the warranty.

6.3 Transport

Observe the following guidelines for transportation of pumps:

- Pumps should be transported using a forklift or a lifting gear ensuring a stable position of the pump
- Use soft lifting belts to move or lift the pumps in order to avoid damages
- Before any movement check the pumps weight specified in the relevant technical table



WARNING

The valve may fall down and cause damage and injuries, if transported improperly.

Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.

6.4 Storage

Valves are boxed using a VpCi protective packing system, offering best protection to oxidation during components sea transport or long storage in humid environments.

PFE and PFR surface is protected with zinc coating which guarantees a corrosion resistance over 200h in salt spray test.

PVPC corrosion protection is achieved with surface painting.

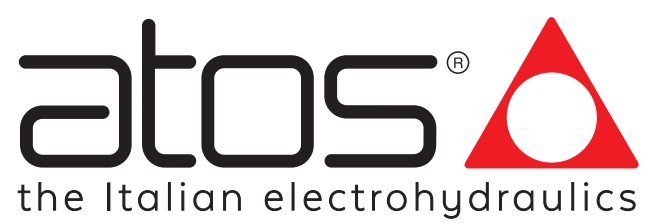
Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

For the pumps transporting and storing always observe the environmental conditions specified in the relevant technical tables. Improper storage may damage the product.

The pumps can be stored for up to 12 months under the following conditions:

- If there is no specific information in the components technical tables, comply with a storage temperature of -20 °C to +50 °C
- Do not store the pumps outdoors
- Protect the pumps against water and humidity in case of storage in open air
- Store the pumps in the shelf or on a pallet
- Store the pumps in the original packaging or comparable packaging in order to protect them from dust and dirt
- Remove the plastic covers from the valves mounting surface only before the assembly

In case of storage period longer than 12 months please contact our technical office



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Find a location near you!



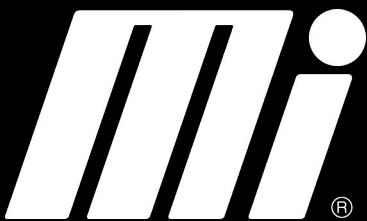
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