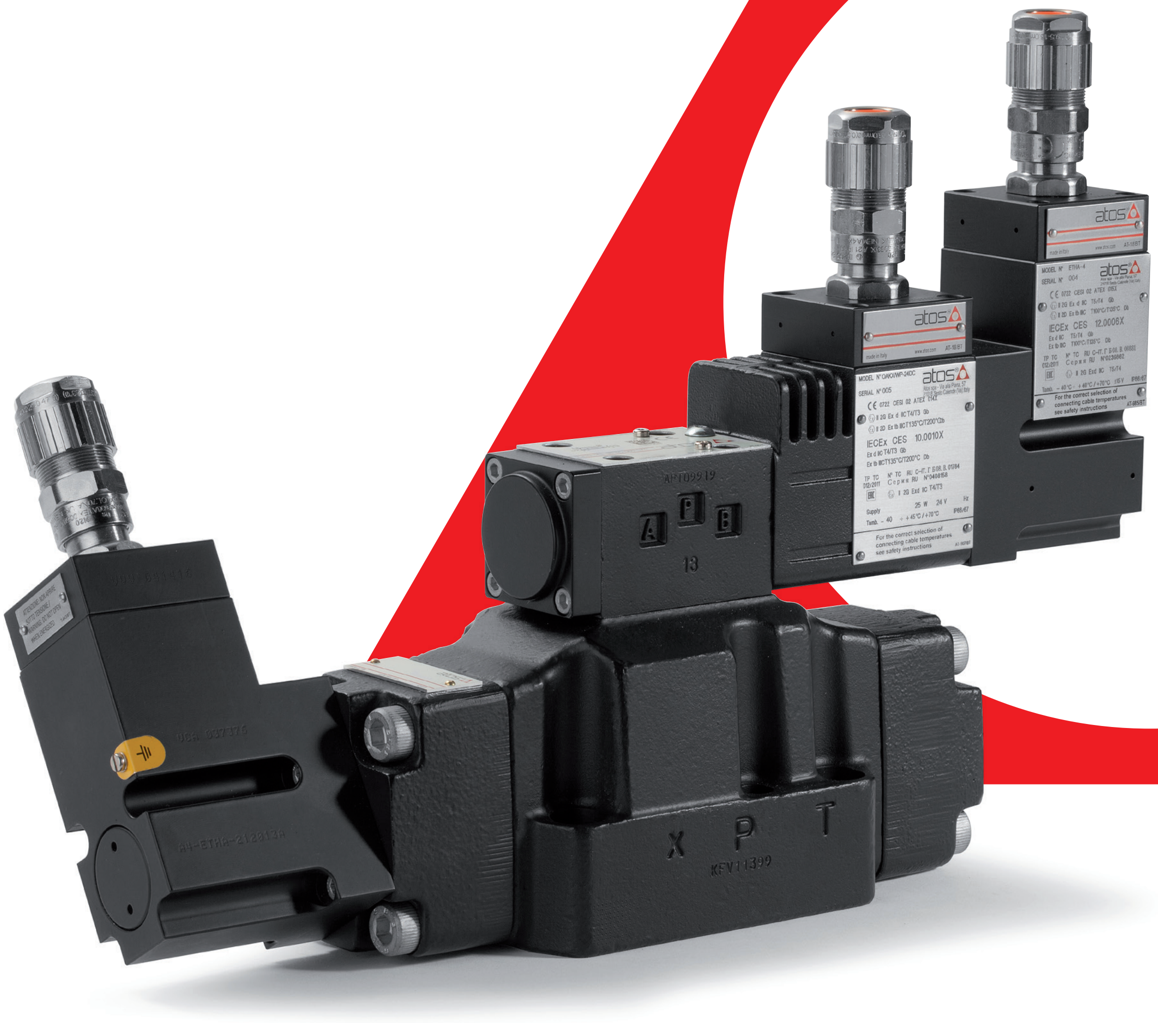
the Italian electrohydraulics

EX-PROOF

ELECTROHYDRAULICS

MASTER CATALOG



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to quickly meet every
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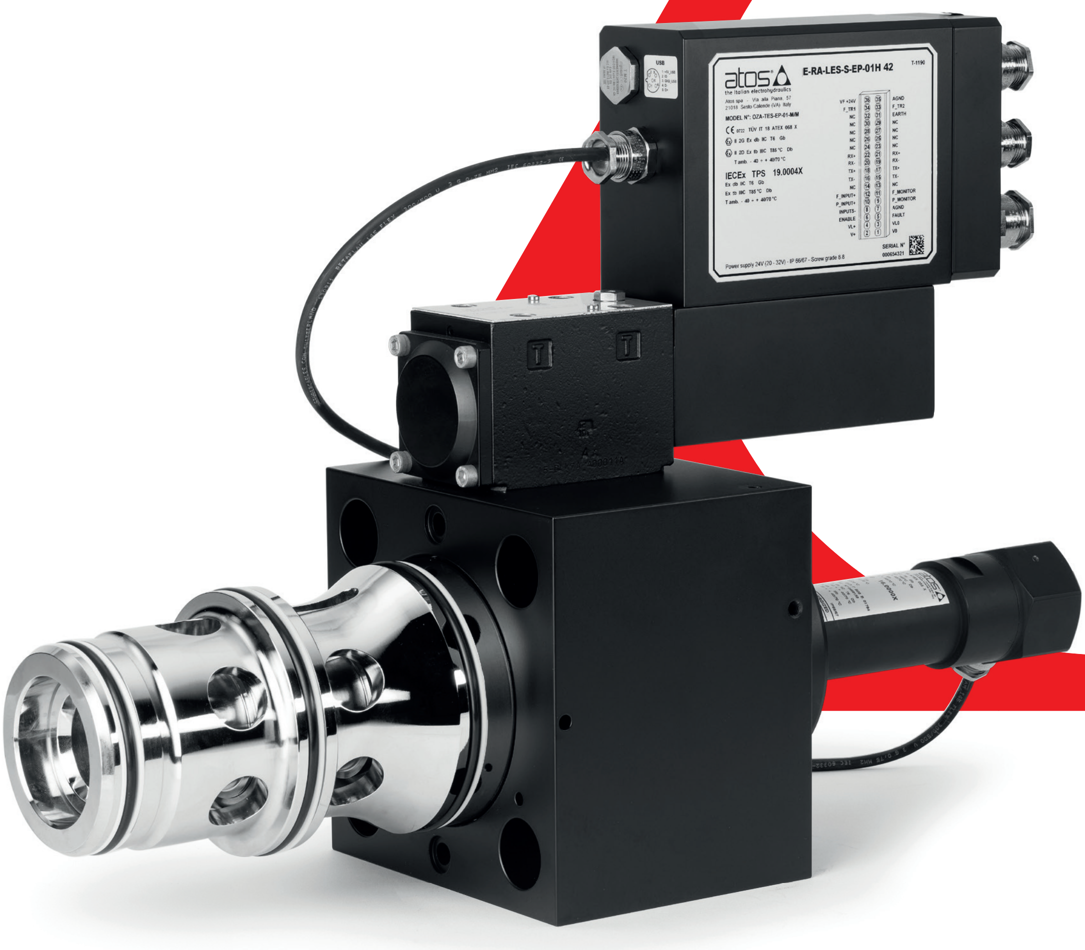
GENERAL INDEX

1 PROPORTIONAL VALVES



INDEX

PROPORTIONAL VALVES

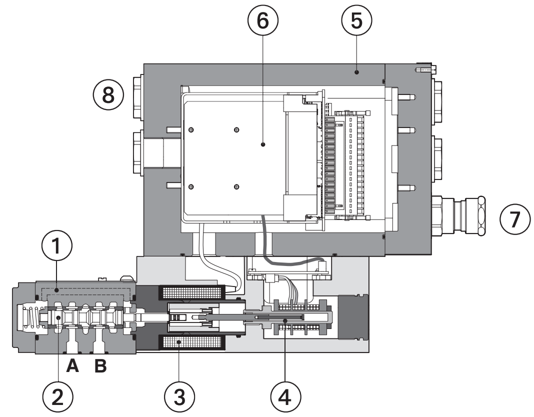
Ex-d

Supplementary components range available on **www.atos.com**

Table **FX150-2/E**

Ex-proof digital servoproportional directional valves sleeve execution

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



DLHZA-TES-SN-EP-040

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DLHZA-TES, DLKZA-TES

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

They are equipped with ex-proof on-board digital driver, LVDT transucer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

TEZ execution includes valve driver plus axis card to perform position control (see section 6).

DLHZA:
Size: **06** -ISO 4401
Max flow: **50 l/min**
Max pressure: **350 bar**

DLKZA:
Size: **10** -ISO 4401
Max flow: **100 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLHZA - TES - SN - NP - 0 40 - L 7 3 / M / * * / *

DLHZA — Ex-proof proportional directional valves, direct
DLHZA = size 06
DLKZA = size 10

TES = on-board driver and LVDT transducer

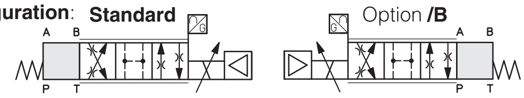
Alternated P/Q controls, see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

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

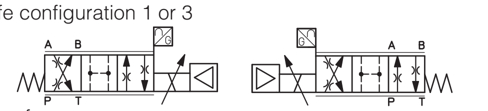
Configuration: **Standard** Option **/B**

40 =



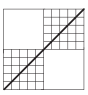
with fail safe configuration 1 or 3

60 =

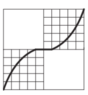


without fail safe

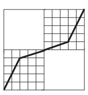
Spool type, regulating characteristics:



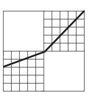
L = linear



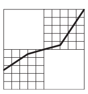
V = progressive



T = not linear **(1)**



D = differential-linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q



DT = differential-not linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

Series number

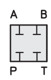
Hydraulic options (2):
B = solenoid with integral electronics and position transducer at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

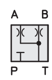
Cable entrance threaded connection:
M = M20x1,5

Fail safe configuration, see section 18:

1 =



3 =



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)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only for configuration **40** **(2)** For possible combined options, see section 16

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

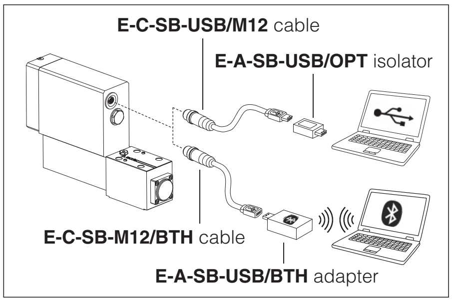
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

4 FIELDBUS - see tech. table GS510

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

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

6 AXIS CONTROLLER - see tech. table FX610

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. Alternated pressure or force closed loop control can be set by software additionally to the position control.
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 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 - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		DLHZA												DLKZA						
Pressure limits	[bar]	ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y)												ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y)						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Nominal flow [l/min]																				
Δp P-T	at Δp = 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	at Δp = 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	max permissible flow	5	9	16	18	26	32		50			50÷28		70		100			100÷50	
Δp max P-T	[bar]	120	120	120	120	120	100		100			100		90		70			70	
Leakage [cm^3/min] at P = 100 bar	**(1)**	<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time	[ms] **(2)**	≤ 13												≤ 20						
Hysteresis	[% of max regulation]	≤ 0,1												≤ 0,1						
Repeatibility	[% of max regulation]	± 0,1												± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) referred to spool in neutral position and 50°C oil temperature
(2) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
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-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 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			
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, 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

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 **(1)**		NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DLHZA, DLKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-TES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1		IEC 60079-0 IEC 60079-31 IEC 60079-1
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SP, SF, SL**
Option /C 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

For SN: /BI, /BY, /IY

For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

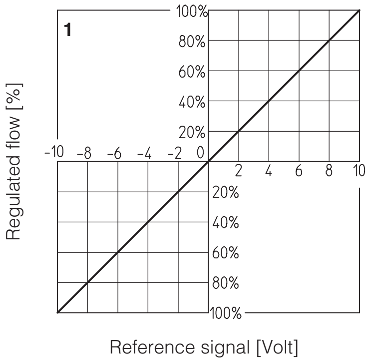
17 **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

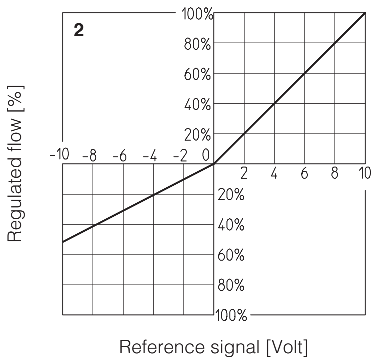
17.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZA)

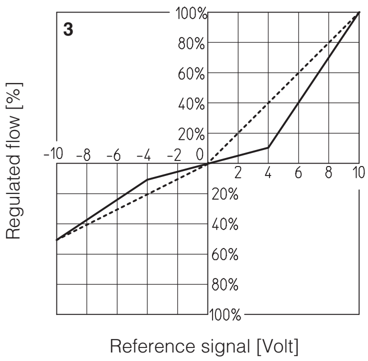
5 = Non linear spool T3 (only for DLKZA) and T7
6 = Progressive spool V

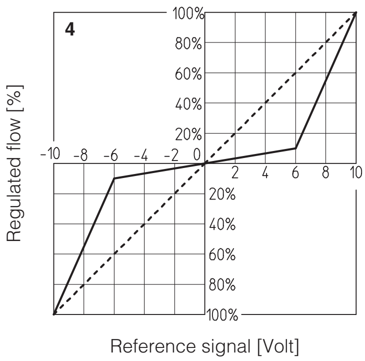




T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal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

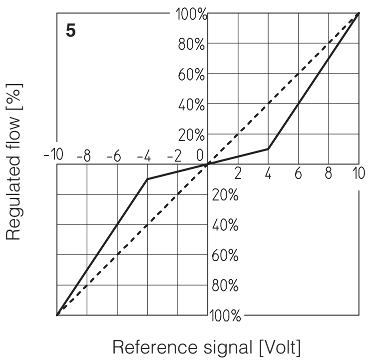
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

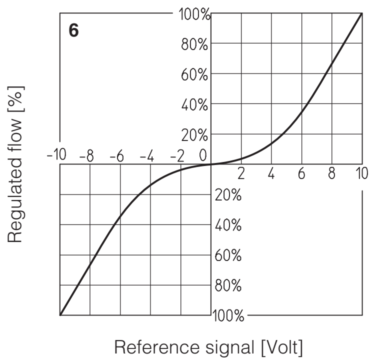
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B

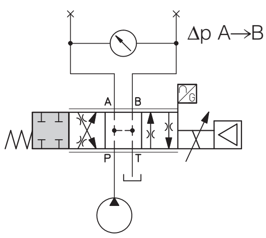
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

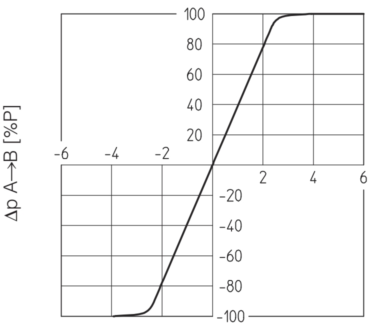
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T





17.2 Pressure gain



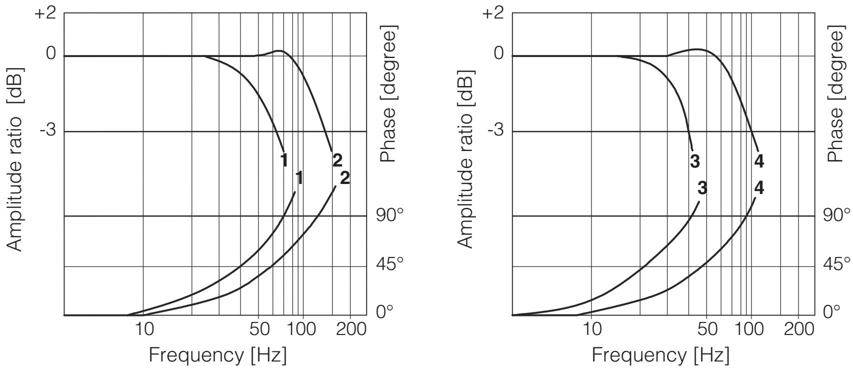


17.3 Bode diagrams

Stated at nominal hydraulic conditions

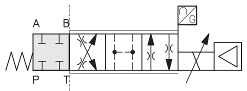
DLHZA:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZA:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke

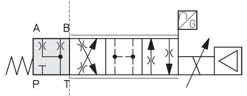


18 FAIL SAFE POSITION

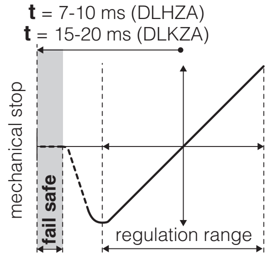
CONFIGURATION | LINEAR | NOT LINEAR

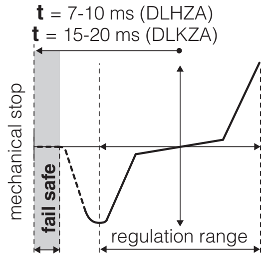


fail safe **1**

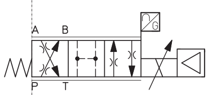


fail safe **3**

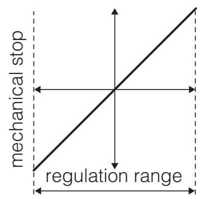


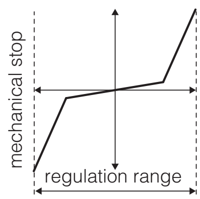


t = time required by the valve to switch from central to fail safe position at the power switch-off, with pressure 0 to 100 bar



without fail safe





Fail safe connections		P → A	P → B	A → T	B → T
Leakage [cm³/min] at P = 100 bar **(1)**	Fail safe 1	50	70	70	50
	Fail safe 3	50	70	-	-
Flow [l/min] **(2)** DLHZA	Fail safe 3	-	-	15÷30	10÷20
Flow [l/min] **(2)** DLKZA	Fail safe 3	-	-	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

19 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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 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 ÷ 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.

19.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

19.5 Flow monitor output signal (Q_MONITOR)

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.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **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 ÷ 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.

19.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

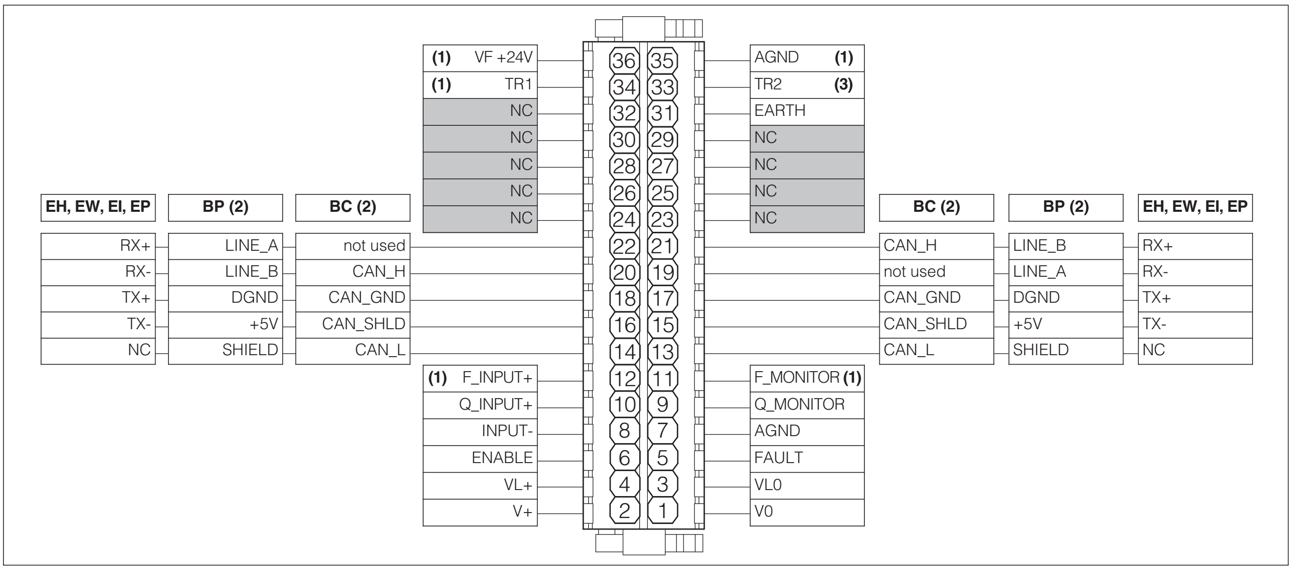
19.8 Fault output signal (FAULT)

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.

19.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

20 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

21 ELECTRONIC CONNECTIONS

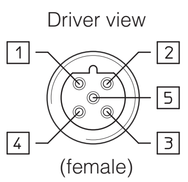
21.1 Main connections signals

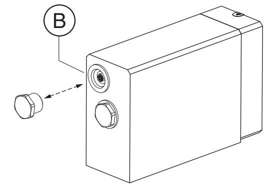
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 V_{DC} / ±20 mA maximum range **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

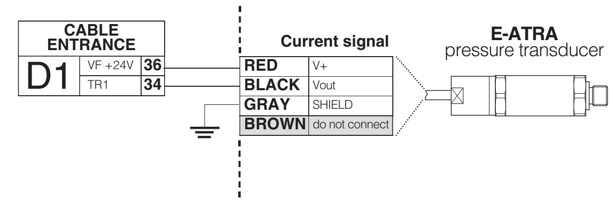
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

21.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

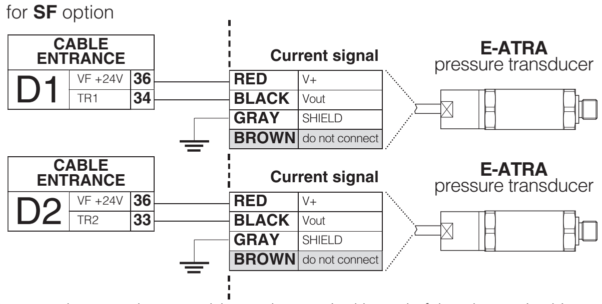
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



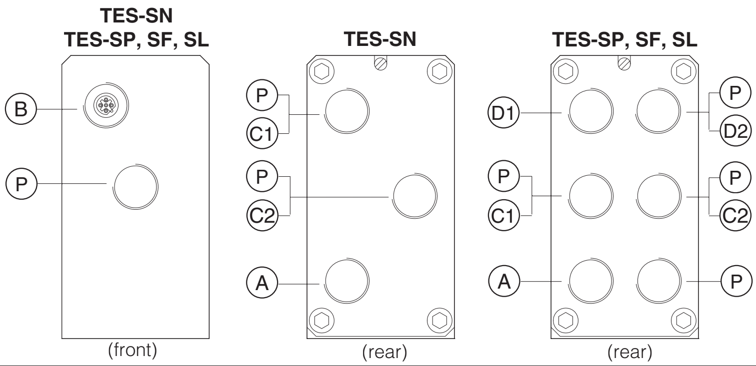
Connect the transducers cables to the terminal board of the electronic driver

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

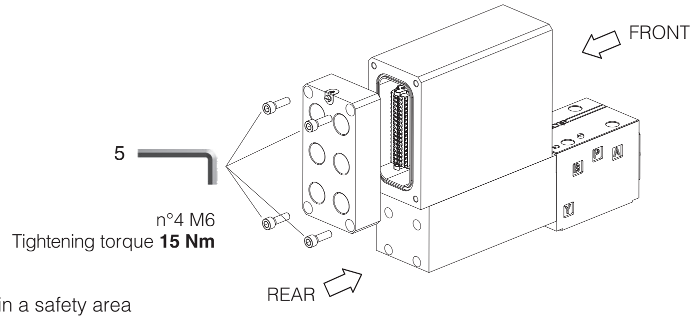
Cables entrance description:

- A main connections
- B USB connector always present (factory plugged)
- C1 fieldbus (input)
- C2 fieldbus (output)
- D1 pressure transducer 1
- D2 pressure transducer 2
- P threaded plug



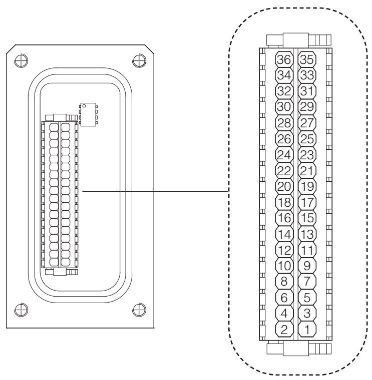
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

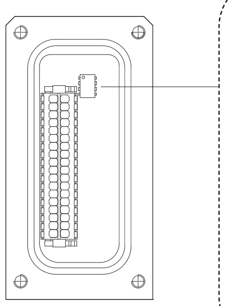


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20



Fieldbus terminator only for BC and BP executions **(1)**



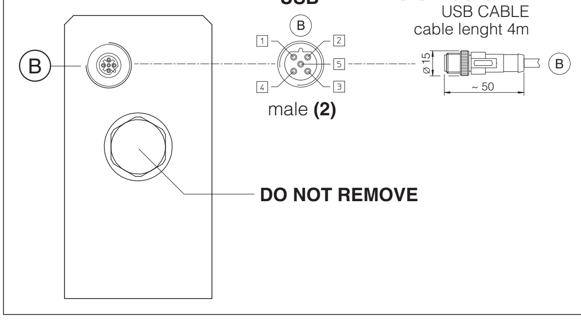
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

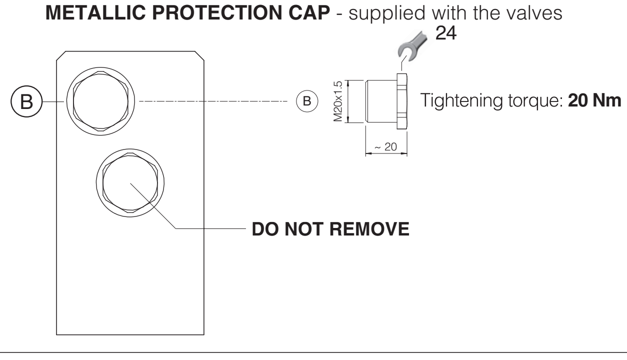
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

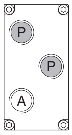
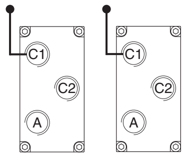
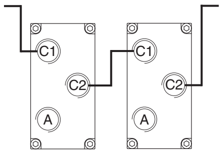


METALLIC PROTECTION CAP - supplied with the valves

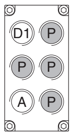
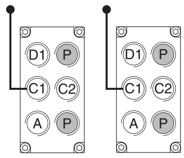
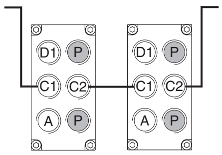


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

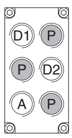
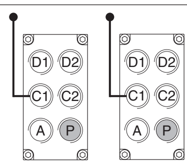
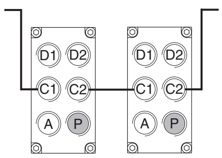
22.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

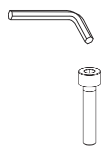
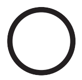
22.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

22.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

23 FASTENING BOLTS AND SEALS

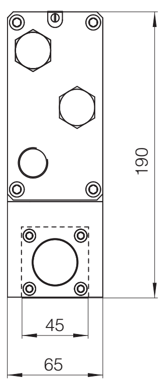
	DLHZA	DLKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y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

24 INSTALLATION DIMENSIONS [mm]

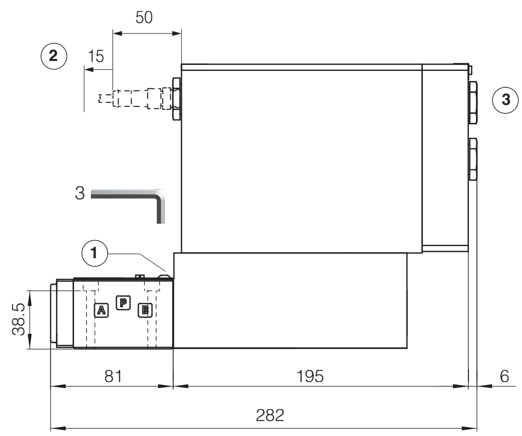
DLHZA-TES

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

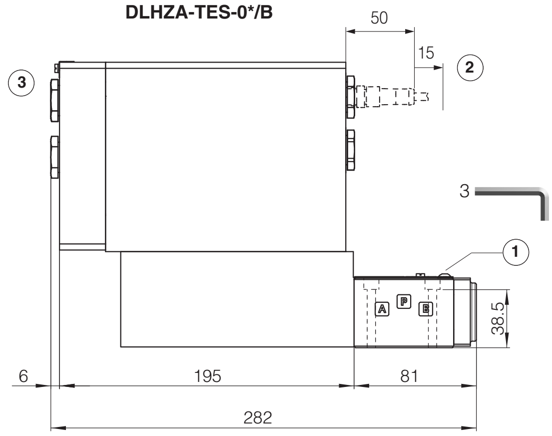
Mass [kg]	
DLHZA-TES	7,2



DLHZA-TES-0*



DLHZA-TES-0*/B



1 = Air bleed off

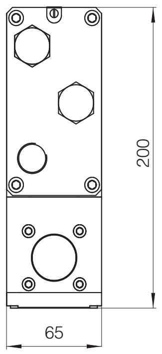
2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

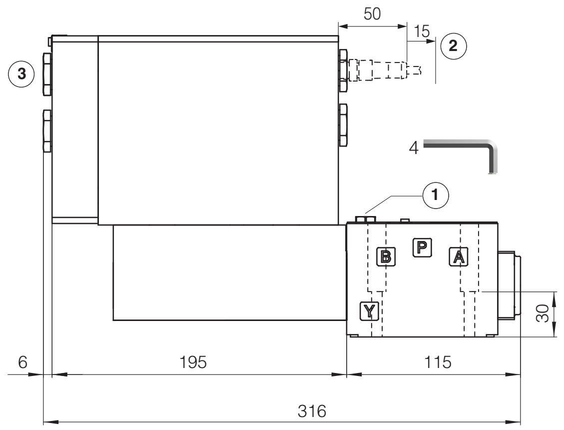
DLKZA-TES

ISO 4401: 2000
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

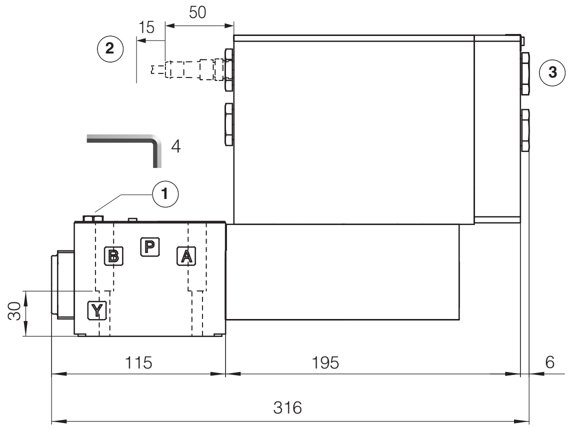
Mass [kg]	
DLKZA-TES	9



DLKZA-TES-1*



DLKZA-TES-1*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

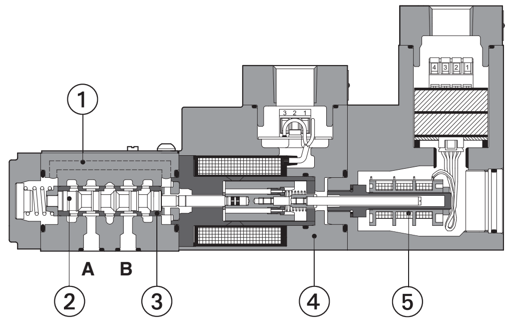
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

25 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX610	Ex-proof servoproportionals with on-board axis card	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof servoproportional directional valves sleeve execution

direct, with LVDT transducer and zero spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DLHZA-T-040

① valve body
② spool
③ sleeve
④ ex-proof solenoid
⑤ ex-proof LVDT transducer

DLHZA-T, DLKZA-T

Ex-proof servoproportional directional valves, direct, sleeve execution, with LVDT position transducer and zero spool overlap for best performances in any position closed loop control.
They are equipped with ex-proof proportional solenoids and LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoids are also designed to limit the surface temperature within the classified limits.

DLHZA:	**DLKZA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **50 l/min**	Max flow: **100 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DLHZA / * - T - 0 40 - L 7 3 / M / * * / *

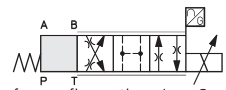
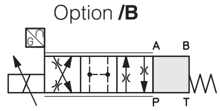
Ex-proof proportional directional valves direct
DLHZA = size 06
DLKZA = size 10

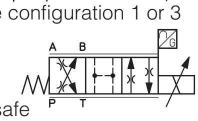
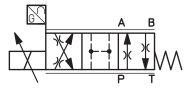
Certification:
Multicertification ATEX, IECEx,EAC, PESO:
- = omit for Group II 2G IID **(1)**
M = Group I (mining)
North American Certification:
UL = cULus

T = with LVDT transducer

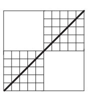
Valve size ISO 4401:
0 = 06 **1** = 10

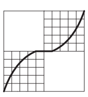
Configuration: **Standard** Option **/B**

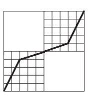
40 =


with fail safe configuration 1 or 3

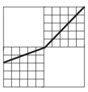
60 =


without fail safe

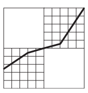
Spool type, regulating characteristics:


L =linear


V = progressive


T =not linear **(2)**


D = differential-linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


DT = differential-not linear **(2)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

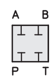
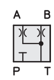
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(3)**

Series number

Options (4):
B =solenoid and position transducer at side of port A **(5)**
C =position transducer with current feedback 4÷20 mA
Y = external drain

Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (6)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Fail safe configuration, see section 12 :

1 =  3 = 

Spool size:	**0**(L)	**1**(L)	**1**(V)	**3**(L)	**3**(T)	**3**(V)	**5**(L,T)	**7**(L,T,V,D,DT)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization)
(2) Only for configuration **40**
(3) Not for multicertification **M** group I (mining)
(4) Possible combined options: /BC, /BY, /CY, /BCY
(5) In standard configuration the solenoid and position transducer are at side of port B
(6) Approved only for the Italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A	Z-BM-TEZ-* /A
Type	digital	digital	digital
Format	DIN-rail panel		
Data sheet	GS230	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 ÷ +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 - salt spray test (EN ISO9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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

<table>
<tr><td>Valve model</td><td colspan="12">DLHZA</td><td colspan="7">DLKZA</td></tr>
<tr><td>Pressure limits [bar]</td><td colspan="12">ports P, A, B = 350;
T = 210 (250 with external drain /Y)</td><td colspan="7">ports P, A, B = 315;
T = 210 (250 with external drain /Y)</td></tr>
<tr><td>Spool type</td><td>L0</td><td>L1</td><td>V1</td><td>L3</td><td>V3</td><td>L5</td><td>T5</td><td>L7</td><td>T7</td><td>V7</td><td>D7</td><td>DT7</td><td>L3</td><td>T3</td><td>L7</td><td>T7</td><td>V7</td><td>D7</td><td>DT7</td></tr>
<tr><td>Max flow [l/min]
Δp P-T at Δp = 30 bar</td><td>2,5</td><td>4,5</td><td>8</td><td>9</td><td>13</td><td colspan="2">18</td><td colspan="3">26</td><td colspan="2">26÷13</td><td colspan="2">40</td><td colspan="3">60</td><td colspan="2">60÷33</td></tr>
<tr><td>Δp P-T at Δp = 70 bar</td><td>4</td><td>7</td><td>12</td><td>14</td><td>20</td><td colspan="2">28</td><td colspan="3">40</td><td colspan="2">40÷20</td><td colspan="2">60</td><td colspan="3">100</td><td colspan="2">100÷50</td></tr>
<tr><td>Δp P-T max permissible flow</td><td>5</td><td>9</td><td>16</td><td>18</td><td>26</td><td colspan="2">32</td><td colspan="3">50</td><td colspan="2">50÷28</td><td colspan="2">70</td><td colspan="3">100</td><td colspan="2">100÷50</td></tr>
<tr><td>Δp max P-T [bar]</td><td>120</td><td>120</td><td>120</td><td>120</td><td>120</td><td colspan="2">100</td><td colspan="3">100</td><td colspan="2">100</td><td colspan="2">90</td><td colspan="3">70</td><td colspan="2">70</td></tr>
<tr><td>Leakage [cm³/min] at P = 100 bar (1)</td><td><100</td><td><200</td><td><100</td><td><300</td><td><150</td><td><500</td><td><200</td><td><900</td><td><200</td><td><200</td><td><700</td><td><200</td><td><1000</td><td><400</td><td><1500</td><td><400</td><td><400</td><td><1200</td><td><400</td></tr>
<tr><td>Response time (2) [ms]</td><td colspan="12">≤ 13</td><td colspan="7">≤ 20</td></tr>
<tr><td>Hysteresis [% of max regulation]</td><td colspan="12">≤ 0,1</td><td colspan="7">≤ 0,1</td></tr>
<tr><td>Repeatibility [% of max regulation]</td><td colspan="12">± 0,1</td><td colspan="7">± 0,1</td></tr>
<tr><td>Thermal drift</td><td colspan="19">zero point displacement < 1% at ΔT = 40°C</td></tr>
</table>

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) Referred to spool in neutral position and 50°C oil temperature **(2)** 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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

<table>
<tr><td colspan="2">Seals, recommended fluid temperature</td><td colspan="3">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</td></tr>
<tr><td colspan="2">Recommended viscosity</td><td colspan="3">20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s</td></tr>
<tr><td rowspan="2">Max fluid
contamination level</td><td>normal operation</td><td colspan="2">ISO4406 class 18/16/13 NAS1638 class 7</td><td rowspan="2">see also filter section at
www.atos.com or KTF catalog</td></tr>
<tr><td>longer life</td><td colspan="2">ISO4406 class 16/14/11 NAS1638 class 5</td></tr>
<tr><td colspan="2">Hydraulic fluid</td><td>Suitable seals type</td><td>Classification</td><td>Ref. Standard</td></tr>
<tr><td colspan="2">Mineral oils</td><td>NBR, FKM, HNBR</td><td>HL, HLP, HLPD, HVLP, HVLPD</td><td>DIN 51524</td></tr>
<tr><td colspan="2">Flame resistant without water</td><td>FKM</td><td>HFDU, HFDR</td><td rowspan="2">ISO 12922</td></tr>
<tr><td colspan="2">Flame resistant with water (1)</td><td>NBR, HNBR</td><td>HFC</td></tr>
</table>

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DLHZA, DLKZA		DLHZA**/M**, DLKZA**/M**	DLHZA**/UL**, DLKZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

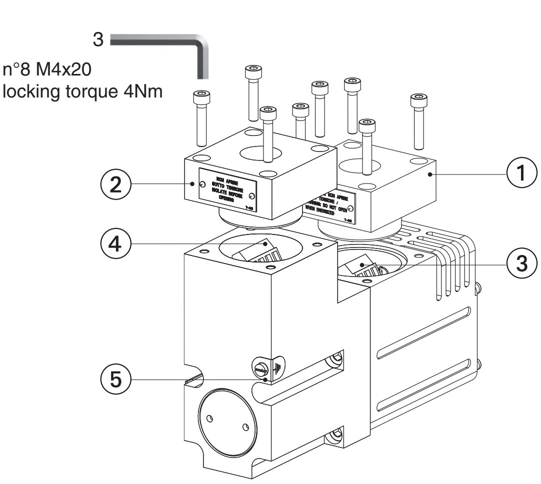
(1) The type examinator certificates can be downloaded from www.atos.com

(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

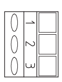
8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

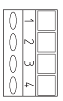
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm^2 (max AWG14)

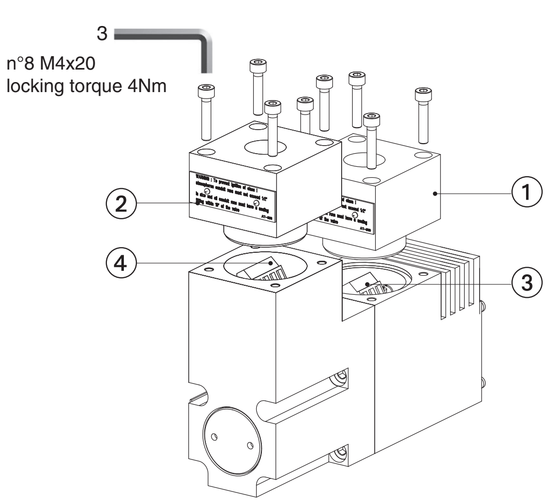
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

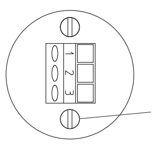
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm^2 (max AWG14)

cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring ⚠ **Pay attention to respect the polarity**

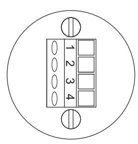


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm^2 (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm^2 (max AWG16), see section 9 note 1

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

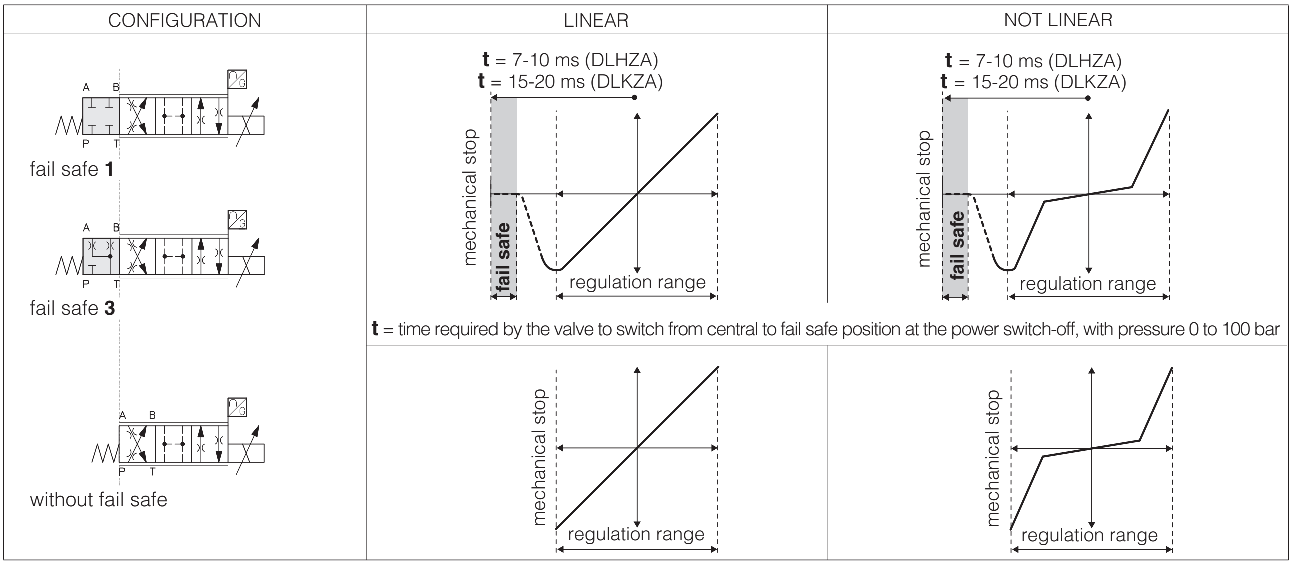
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = Solenoid and position transducer at side of port A of the main stage
C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve
Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

11.1 Possible combined options: /BC, /BY, /CY, /BCY

12 FAIL SAFE POSITION



Fail safe connections			P → A	P → B	A → T	B → T
Leakage [cm³/min] at P = 100 bar **(1)**		Fail safe 1	50	70	70	50
		Fail safe 3	50	70	-	-
Flow [l/min] **(2)**	DLHZA	Fail safe 3	-	-	15÷30	10÷20
	DLKZA		-	-	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

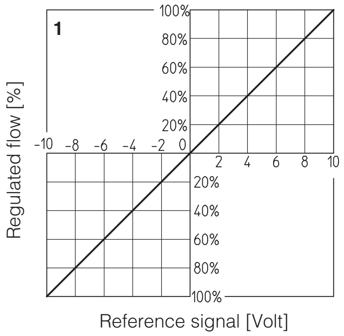
13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

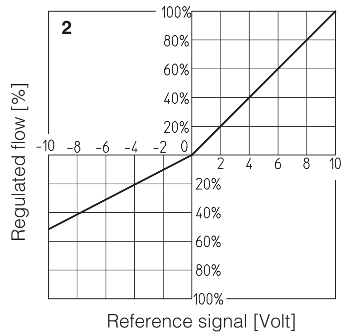
13.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool, T5 (only for DLHZA)

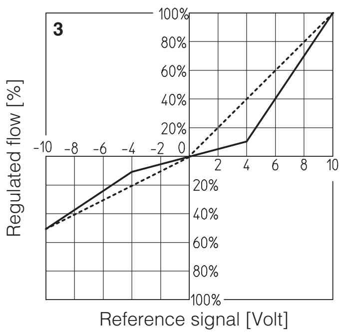
5 = Non linear spool, T3 (only for DLKZA) and T7
6 = Progressive spool V

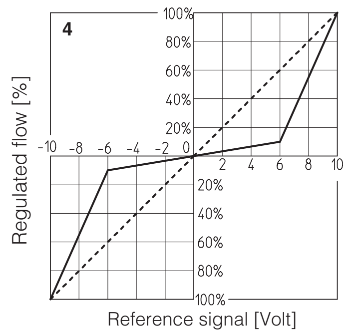




T3, T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal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

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



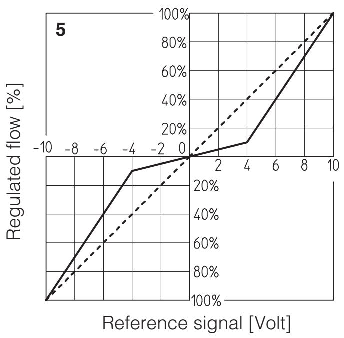


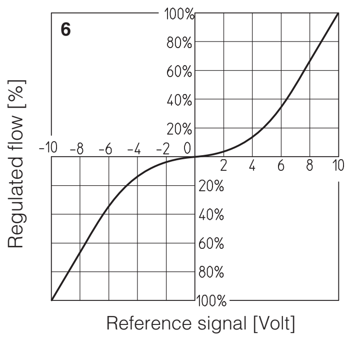
Note:
Hydraulic configuration vs. reference signal:
Standard:

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

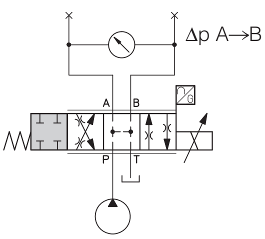
option /B:

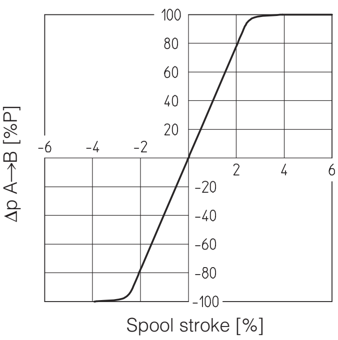
Reference signal	0 ÷ +10 V 12 ÷ 20 mA	} P → B / A → T
Reference signal	0 ÷ -10 V 12 ÷ 4 mA	} P → A / B → T



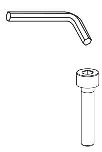
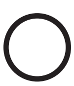


13.2 Pressure gain





14 FASTENING BOLTS AND SEALS

	DLHZA	DLKZA
	**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)

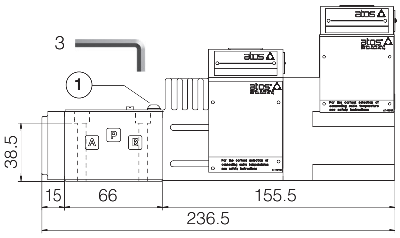
15 **INSTALLATION DIMENSIONS [mm]**

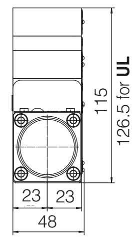
DLHZA

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

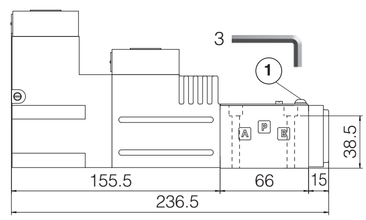
Mass [kg]	
DLHZA-T-*	4,0

DLHZA-T-*





DLHZA-T-*/B

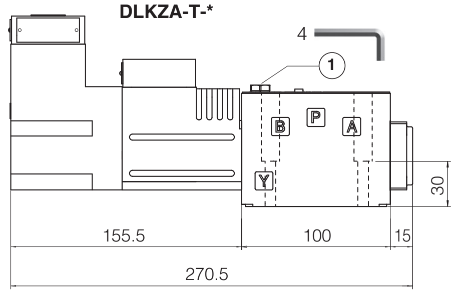


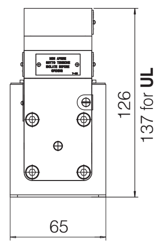
DLKZA

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

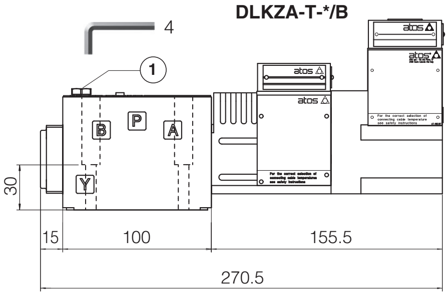
Mass [kg]	
DLKZA-T-*	6,1

DLKZA-T-*





DLKZA-T-*/B



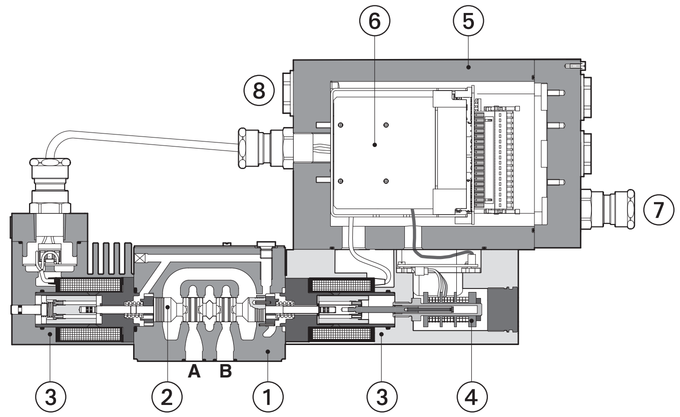
1 = Air bleed off

16 **RELATED DOCUMENTATION**

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional directional valves

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



DKZA-TES-SN-NP-170*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DHZA-TES, DKZA-TES

Ex-proof 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 spool safety rest position.

They are equipped with ex-proof on-board digital driver, LVDT transducer and solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

TEZ execution includes valve driver plus axis card to perform position control (see section 6).

DHZA:
Size: **06** -ISO 4401
Max flow: **60 l/min**
Max pressure: **350 bar**

DKZA:
Size: **10** -ISO 4401
Max flow: **150 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TES	-	SN	-	NP	-	0	70	-	L	5	/	M	/	*	*	/	*

Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

TES = on-board driver and LVDT transducer

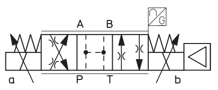
Alternated P/Q controls, see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

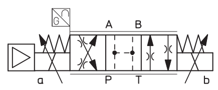
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401: **0** = 06 **1** = 10

Configuration: **Standard** Option **/B**

70 =





Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

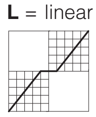
Cable entrance threaded connection:
M = M20x1,5

Spool size:	**3** (L)	**5** (L,D)
DHZA =	18	28
DKZA =	45	75

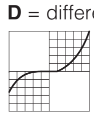
Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

L = linear



D = differential-progressive



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

(1) For possible combined options, see section 16
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

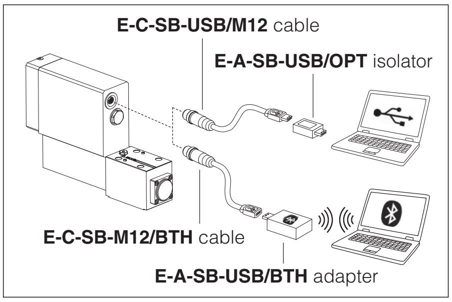
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

4 FIELDBUS - see tech. table GS510

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

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

6 AXIS CONTROLLER - see tech. table FX620

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. Alternated pressure or force closed loop control can be set by software additionally to the position control.
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 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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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	DHZA			DKZA		
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 [l/min] Δp P-T at Δp= 10 bar	18	28	28	45	75	75
at Δp= 30 bar	30	50	50	80	130	130
max permissible flow	40	60	60	90	150	150
Δp max P-T [bar]	70	50	50	40	40	40
Response time [ms] **(1)**	≤ 18			≤ 25		
Leakage [cm³]	<500 (at P = 100 bar); <1500 (at P = 350 bar)			<800 (at P = 100 bar); <2500 (at P = 315 bar)		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
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-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; 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			
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, 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

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 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-TES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X			• IECEx: IECEx TPS 19.0004X	
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db			• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31		IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SP, SF, SL**
Option /C 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.

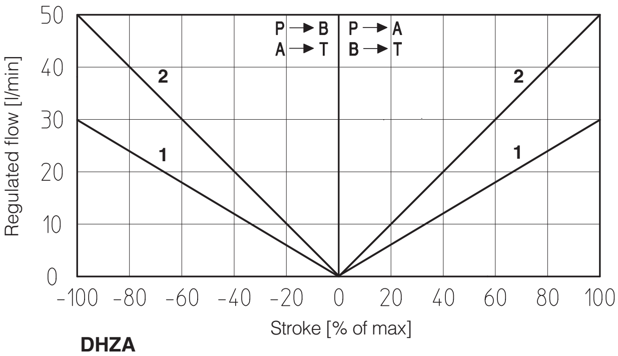
16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

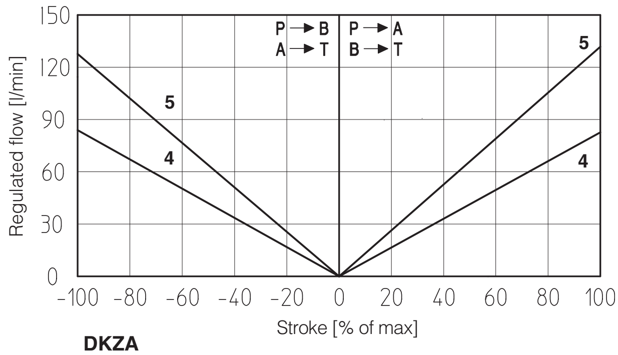
For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

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

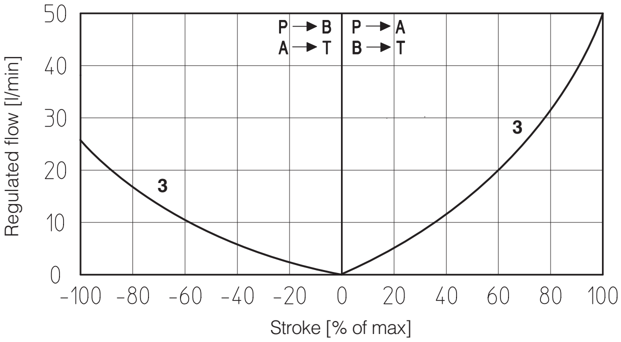
17.1 Regulation diagrams (values measure at Δp 30 bar P-T)



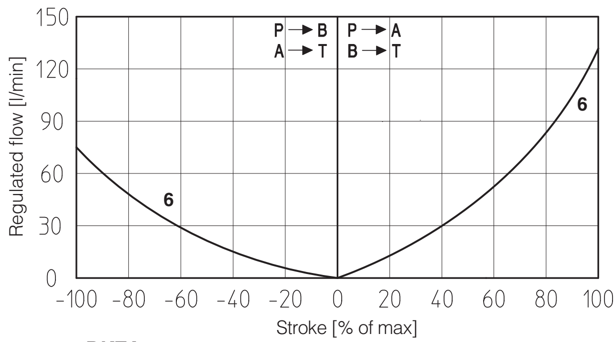
DHZA
1 = L3 **2** = L5



DKZA
4 = L3 **5** = L5



DHZA
3 = D5



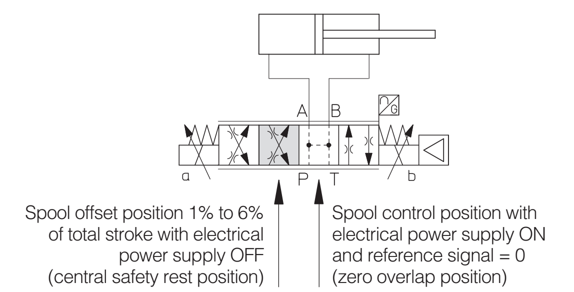
DKZA
6 = D5

Note:
Hydraulic configuration vs. reference signal for configurations 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 → A / B → T   Reference signal $\left.\begin{matrix}0 \div -10\text{ V} \\ 12 \div 4\text{ mA}\end{matrix}\right\}$ P → B / A → T

17.2 Spool safety rest position

In absence of electric power supply (+24 VDC), 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 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.



18 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, EN-982).

18.1 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.

⚠ 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)

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 3 and 4, 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 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 ÷ 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.

18.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

18.5 Flow monitor output signal (Q_MONITOR)

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.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **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 ÷ 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.

18.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

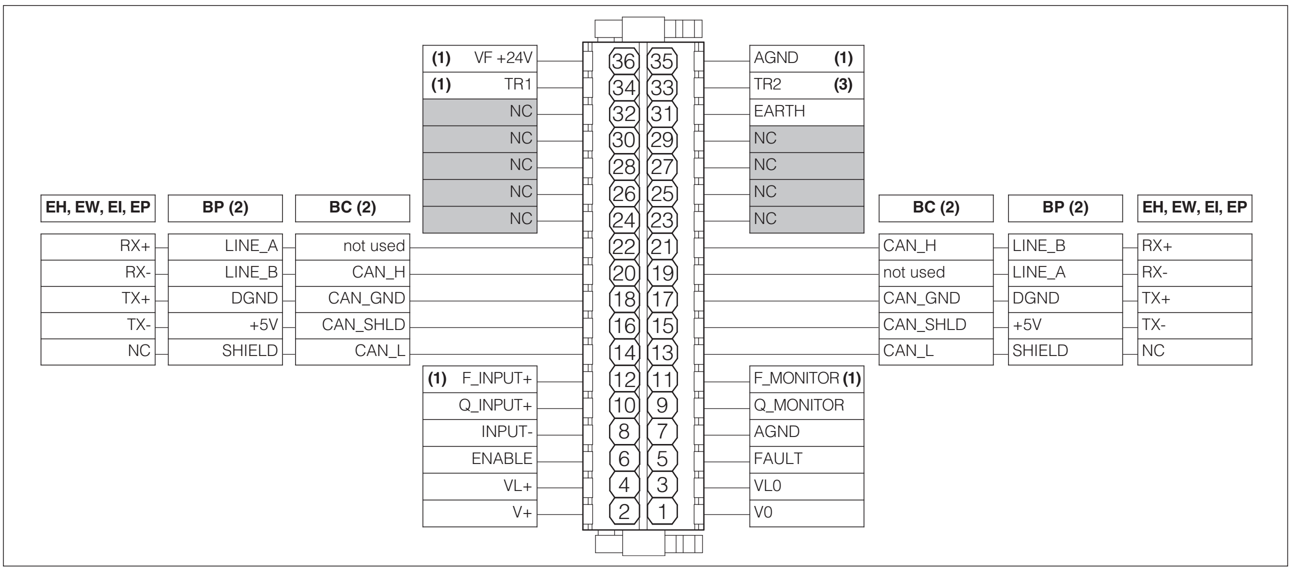
18.8 Fault output signal (FAULT)

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.

18.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

19 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

20 ELECTRONIC CONNECTIONS

20.1 Main connections signals

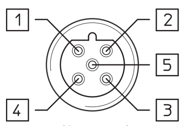
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**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**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

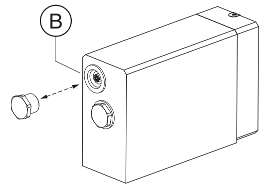
20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

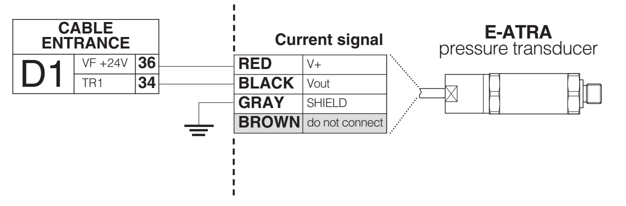
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

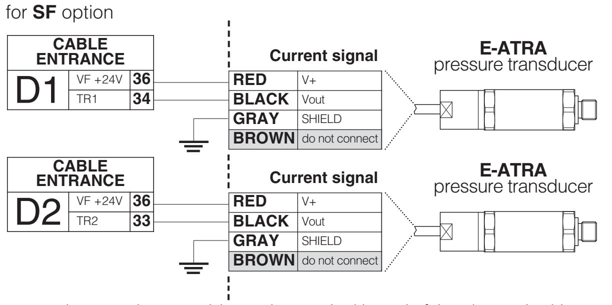
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



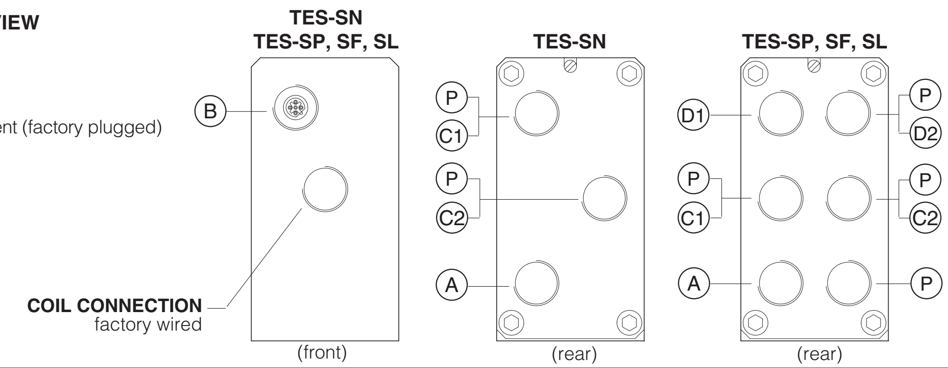
Connect the transducers cables to the terminal board of the electronic driver

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

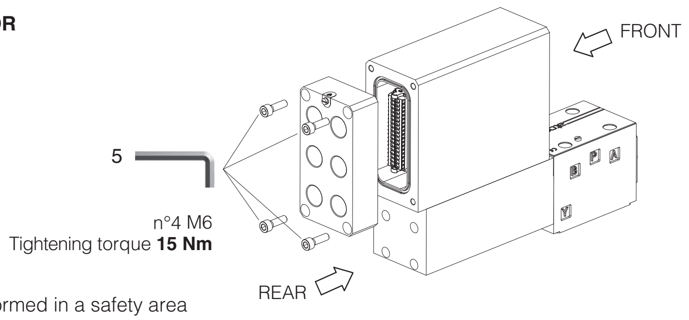
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



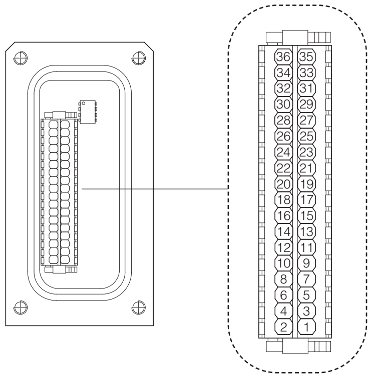
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

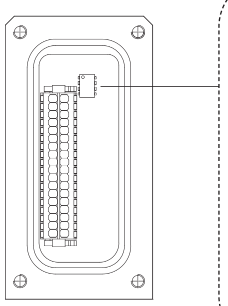


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 19



Fieldbus terminator only for BC and BP executions **(1)**



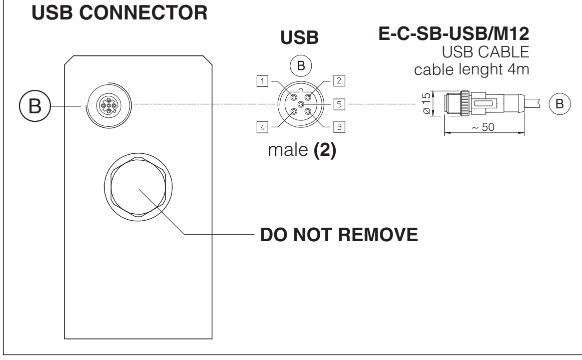
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

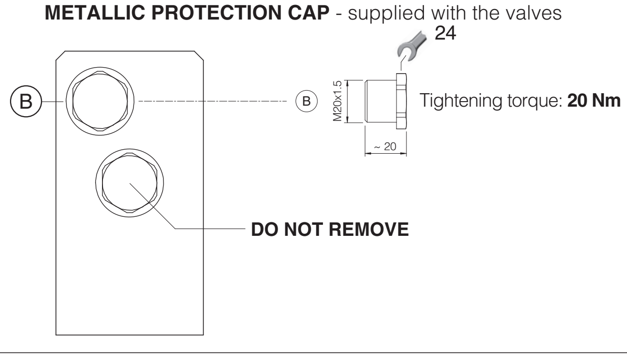
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

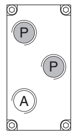
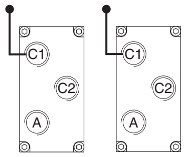
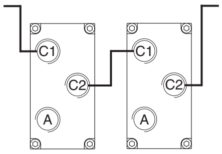


METALLIC PROTECTION CAP - supplied with the valves

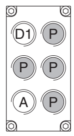
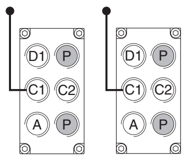
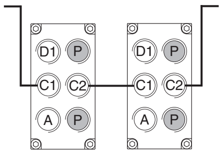


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

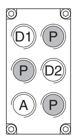
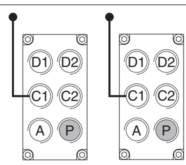
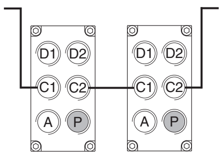
21.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

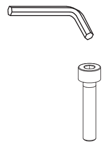
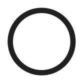
21.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

21.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

22 FASTENING BOLTS AND SEALS

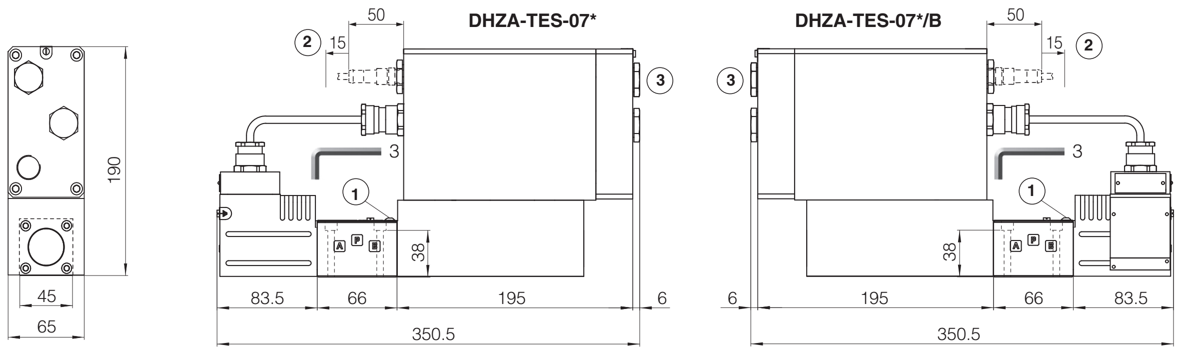
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y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

23 INSTALLATION DIMENSIONS [mm]

DHZA-TES

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

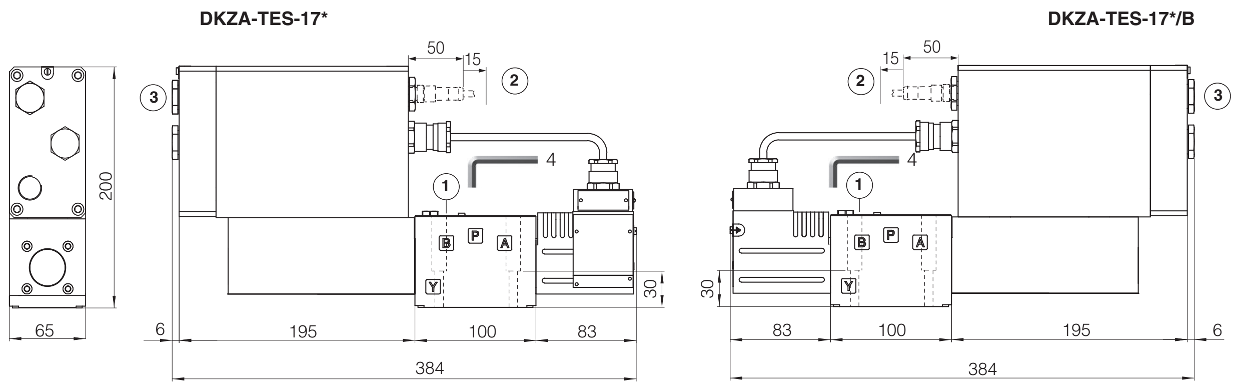
Mass [kg]	
DHZA-TES-07	8,9



DKZA-TES

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

Mass [kg]	
DKZA-TES-17	10,7



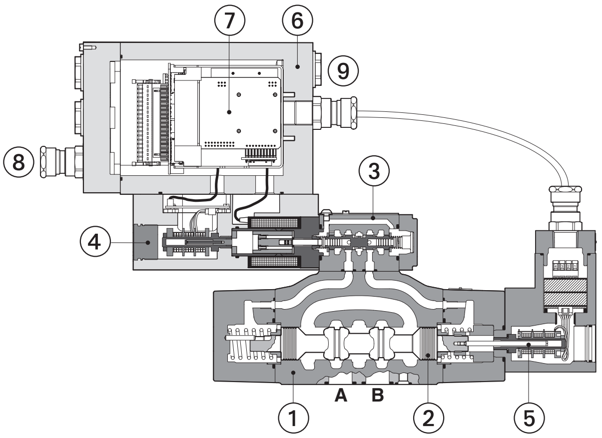
1 = Air bleed off
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX620	Ex-proof servoproportionals with on-board axis c	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional directional valves

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



DPZA-LES-SN-NP-27*

① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid with integral LVDT transducer
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital driver
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

DPZA-LES

Ex-proof digital servoproportional directional valves, piloted with two LVDT position transducers (pilot valve and main stage) and zero spool overlap for position closed loop controls.

They are equipped with ex-proof on-board digital driver, LVDT transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducers, prevents the propagation of accidental internal sparks or fire to the external environment. The driver and solenoid are also designed to limit the surface temperature within the classified limits.

LEZ execution includes valve driver plus axis card to perform position control (see section 6).

Size: **10 ÷ 27** -ISO4401

Max flow: **180 ÷ 800 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	- LES	- SN	- NP	- 2	70	- L	5	/ M	/ *	*	/ *

DPZA = Ex-proof proportional directional valve, piloted

LES = on-board driver and two LVDT transducers

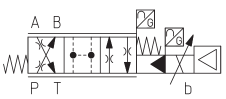
Alternated P/Q controls, see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

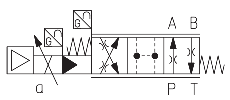
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

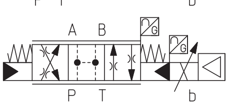
Configuration: **Standard** / Option **/B**

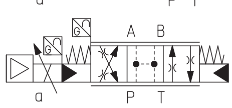
60 =





70 =





Seals material, see section 8:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid at side of port A **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

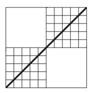
Electronic options (1):
C = current feedback for pressure transducer 4÷20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

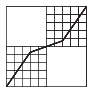
Cable entrance threaded connection:
M = M20x1,5

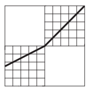
Spool size		**3** (L)	**5** (L,DL)	**5** (T)
DPZA-1	=	-	100	-
DPZA-2	=	130	200	150
DPZA-4	=	-	340	-
DPZA-4M	=	-	390	-

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L =  linear

T =  non linear **(3)**

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) For possible combined options, see section 16
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)
(3) only for configuration 70

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

⚠ **WARNING:** the below operation must be performed in a safety area

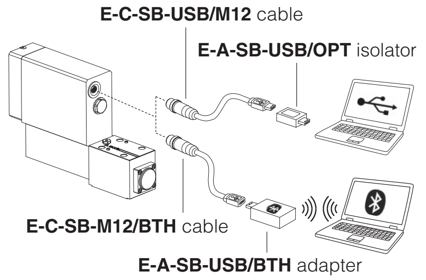
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

4 FIELDBUS - see tech. table GS510

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

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

6 AXIS CONTROLLER - see tech. table FX630

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. Alternated pressure or force closed loop control can be set by software additionally to the position control.
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 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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		DPZA-*-1	DPZA-*-2			DPZA-*-4	DPZA-*-4M
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 [l/min]							
Δp P-T	Δp = 10 bar	100	130	200	150	340	390
	Δp = 30 bar	160	220	350	260	590	670
	Max permissible flow	180	320	440	360	680	800
Δp max P-T	[bar]	50	60	60	60	60	60
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
Piloting flow **(1)**	[l/min]	1,7	3,7			6,8	8
Leakage **(2)**	Pilot [cm³/min]	100/300	150/450			200/600	200/600
	Main stage [l/min]	0,4/1,2	0,6/2,5			1,0/4,0	1,0/4,0
Response time **(1)**	[ms]	≤ 30	≤ 30			≤ 35	≤ 40
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					
Thermal drift		zero point displacement < 1% at ΔT = 40°C					

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
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-ATRA-7 see tech table **GX800**)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) 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, 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

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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DPZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-LES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²   **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

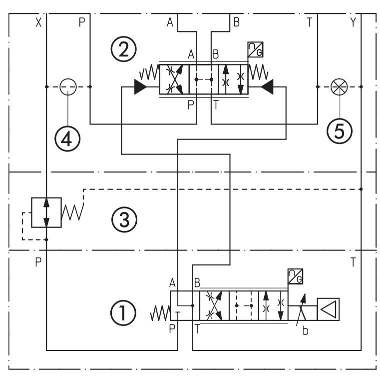
D and **E** = Pilot and drain configuration can be modified as shown in section 21 .
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-2 = 28 bar
DPZA-1, -4 and -4M = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve is standard for DPZA-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

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SP, SF, SL**
Option /C 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.

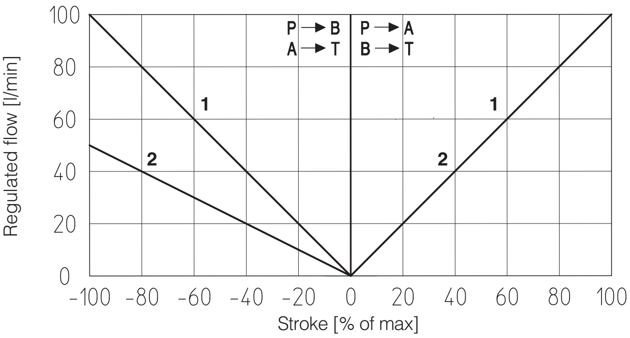
16 POSSIBLE COMBINED OPTIONS

Hydraulic options: all combination possible

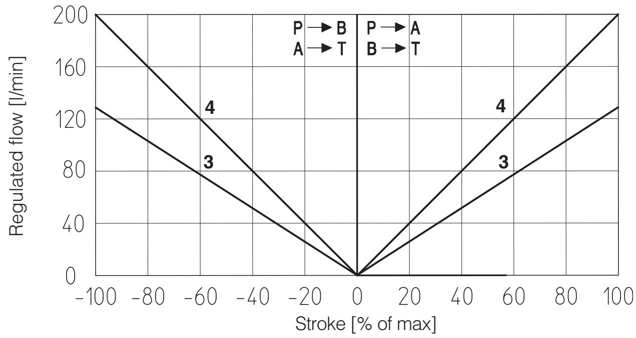
Electronics options: /CI (only for **SP, SF, SL**)

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

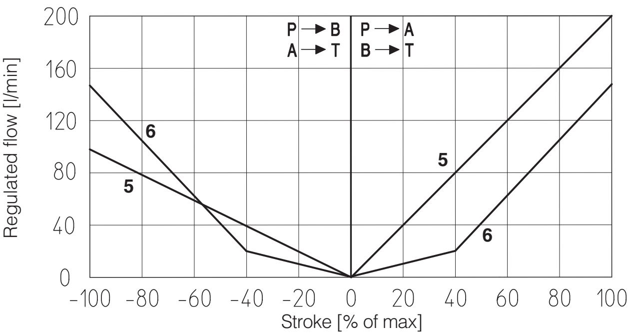
17.1 Regulation diagrams (values measure at Δp 10 bar P-T)



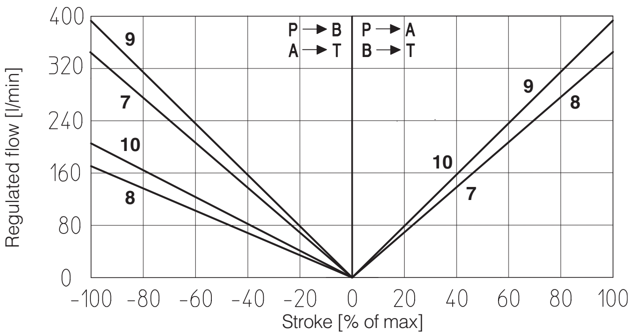
DPZA-1: 1 = L5 **2** = DL5



DPZA-2: 3 = L3 **4** = L5



DPZA-2: 5 = DL5 **6** = T5



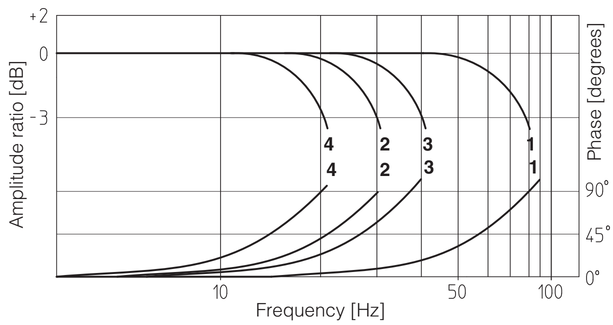
DPZA-4: 7 = L5 **8** = DL5 **DPZA-4M: 9** = L5 **10** = DL5

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

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

17.2 Bode diagrams

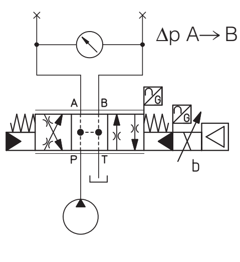
Stated at nominal hydraulic conditions.

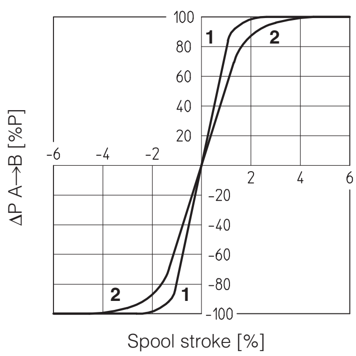


1 = DPZA-1, DPZA-2 } ± 5% **2** = DPZA-1, DPZA-2 } ± 100%

3 = DPZA-4, DPZA-4M } ± 5% **4** = DPZA-4, DPZA-4M } ± 100%

17.3 Pressure gain



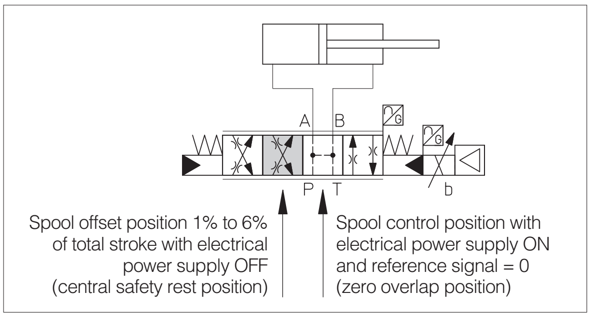


1 = DPZA-1

2 = DPZA-2
DPZA-4
DPZA-4M

17.4 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 **central 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 **central 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.



18 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, EN-982).

18.1 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.

⚠ 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)

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 3 and 4, 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 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 ÷ 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.

18.4 Pressure or force reference input signal (F_INPUT+) - only **SP, SF, SL**

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

18.5 Flow monitor output signal (Q_MONITOR)

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.

18.6 Pressure or force monitor output signal (F_MONITOR) - only for **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 ÷ 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.

18.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

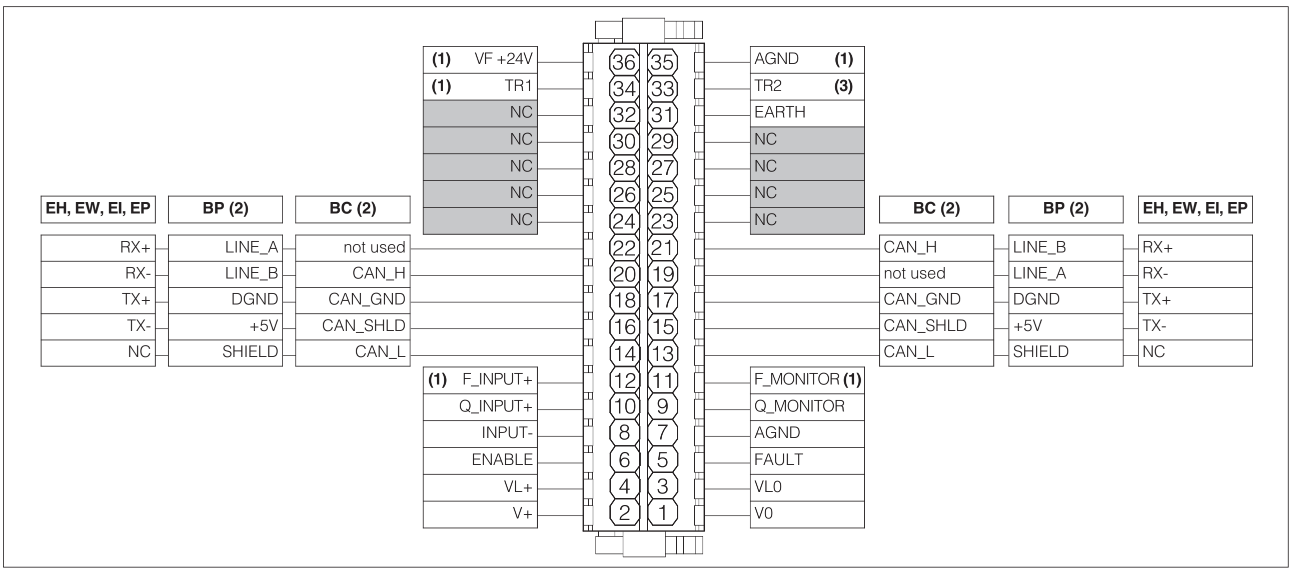
18.8 Fault output signal (FAULT)

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.

18.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

19 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

20 ELECTRONIC CONNECTIONS

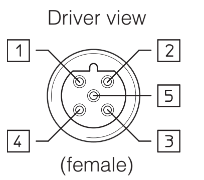
20.1 Main connections signals

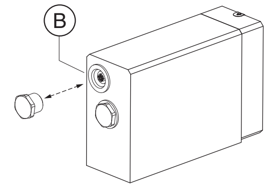
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 V_{DC} / ±20 mA maximum range **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

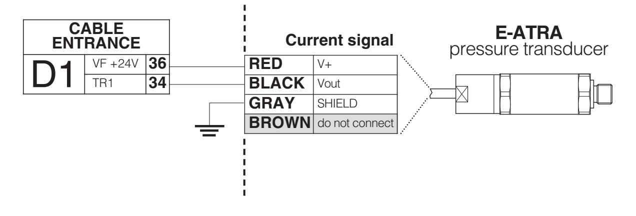
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

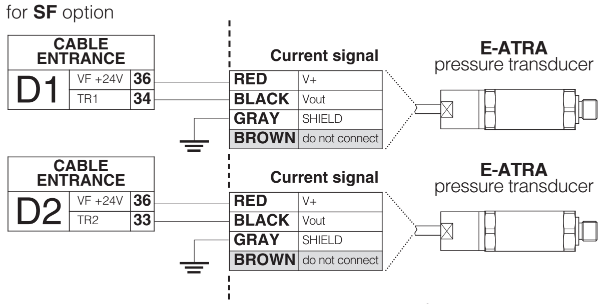
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



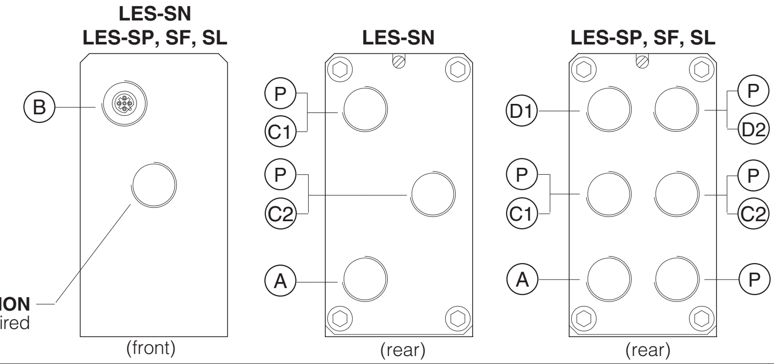
Connect the transducers cables to the terminal board of the electronic driver

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

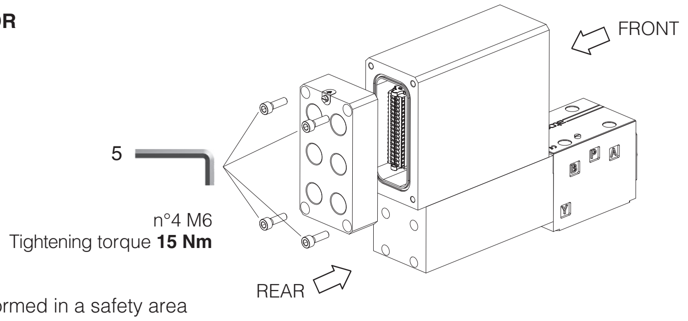
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



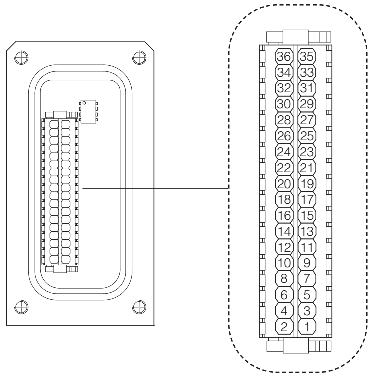
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

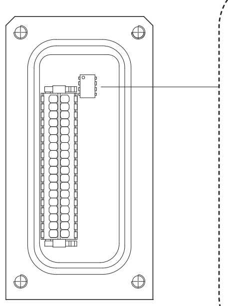


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 19

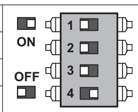


Fieldbus terminator only for BC and BP executions **(1)**



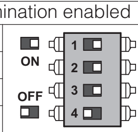
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

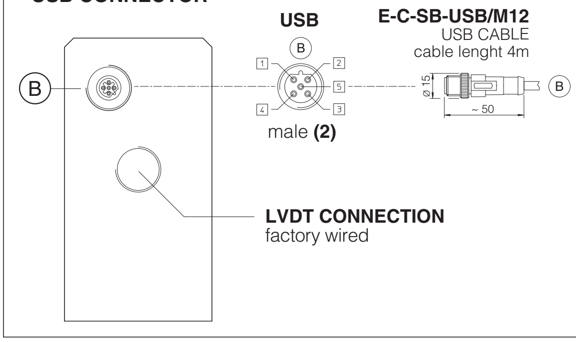


BP - PROFIBUS DP setting:

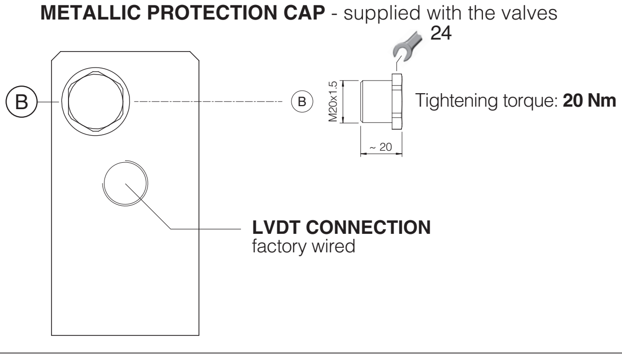
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR



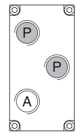
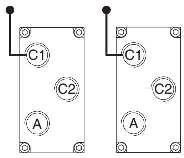
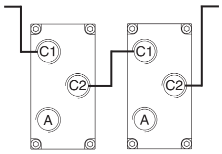
METALLIC PROTECTION CAP - supplied with the valves



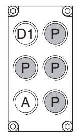
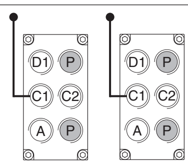
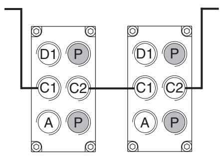
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

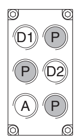
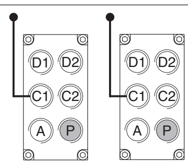
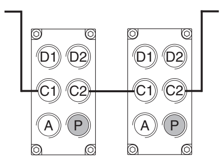
21.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

21.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

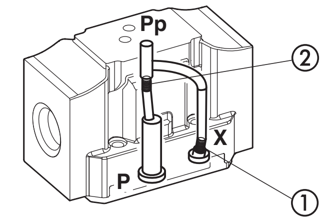
21.3 Cable glands and threaded plug for LES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately: Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance	Cable entrance overview	Notes
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

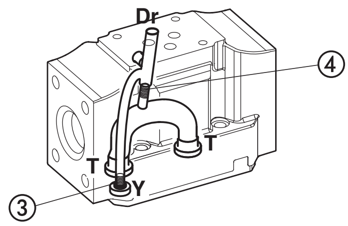
22 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

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

DPZA-1 **Pilot channels**

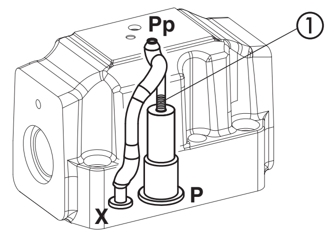


Drain channels

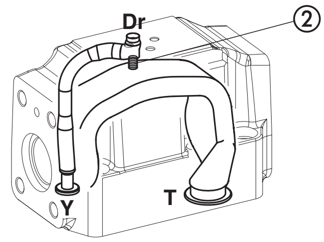


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 **Pilot channels**

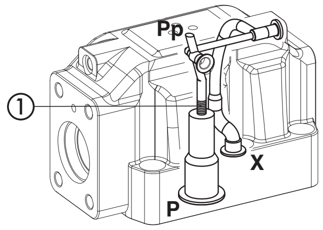


Drain channels

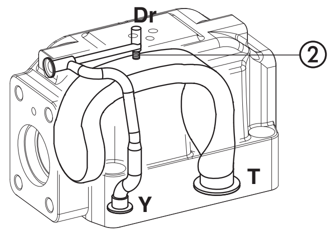


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-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.

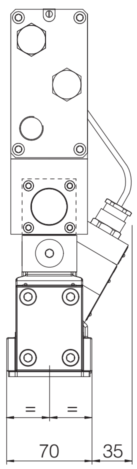
23 FASTENING BOLTS AND SEALS

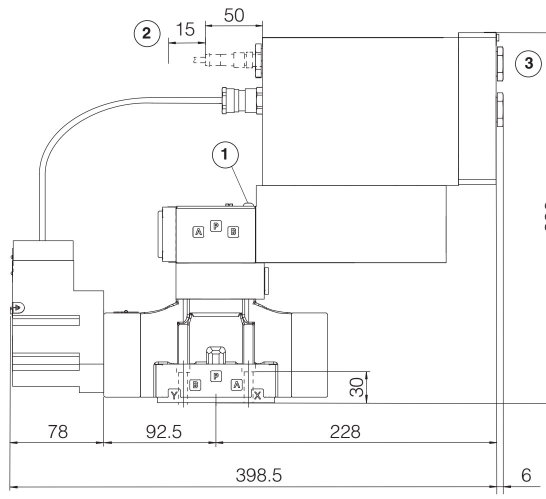
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head 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)

DPZA-LES-*-1

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

Mass [kg]	
DPZA-*-17*	13,7
Option /G	+0,9

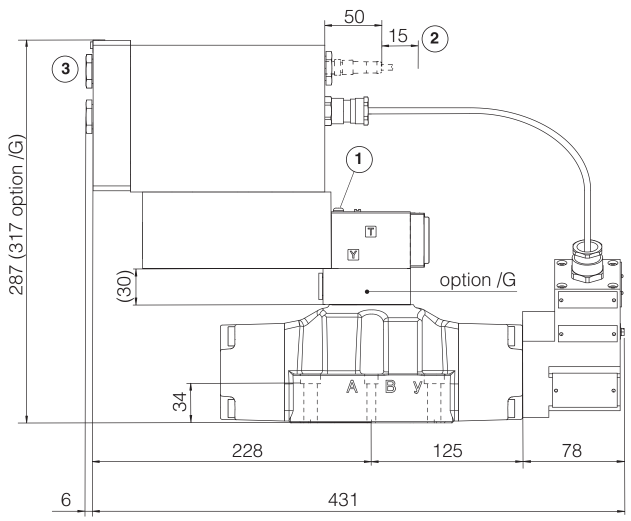


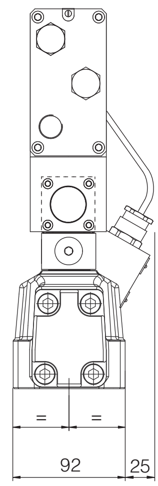


DPZA-LES-*-2

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

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





1 = Air bleed off

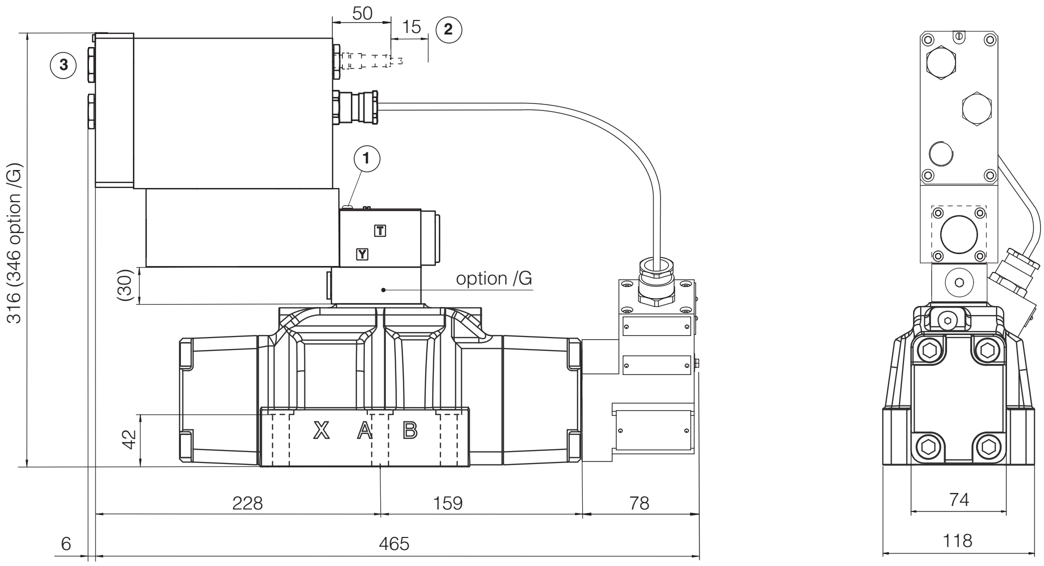
2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LES-*-4
DPZA-LES-*-4M

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

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



(1) = Air bleed off

(2) = Space to remove the USB connector

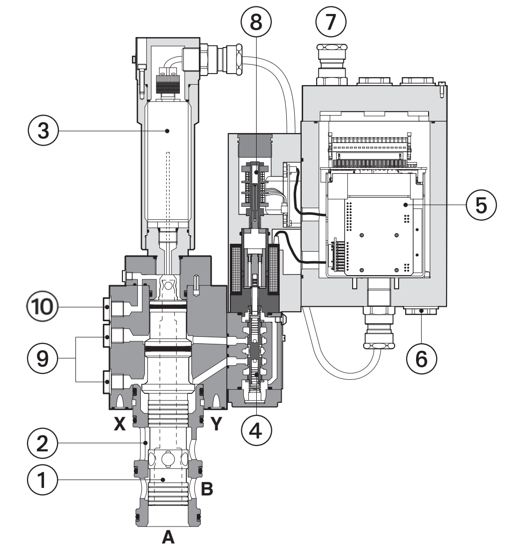
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

25 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX630	Ex-proof servoproportionals with on-board axis card	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportional 3-way cartridges

piloted, with on-board driver and two LVDT transducers - **ATEX and IECEx**



① spool
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof on-board digital driver
⑥ USB connector
⑦ ex-proof cable gland (to be ordered separately)
⑧ ex-proof solenoid with LVDT position transducer
⑨ air bleeding
⑩ plugged port - do not open

LIQZA-LES-SN-NP-323*

LIQZA-LES

Ex-proof digital servoproportional 3-way cartridges, with two LVDT position transducers (pilot valve and main stage) for best accuracy in directional controls and in not compensated flow regulations.

They are equipped with ex-proof on-board digital driver, LVDT transducers and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **80** - not ISO cavity

Max flow: **500** ÷ **5000 l/min**

Max pressure: **420 bar**

1 MODEL CODE

LIQZA	-	LES	-	SN	-	NP	-	32	3	L4	/	M	/	*	*	/	*

Ex-proof proportional cartridge

LES = on-board driver and two LVDT transducers

Alternated P/Q controls:
SN = none
SP = pressure control (1 pressure tranducer)
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 and nominal flow (l/min) at Δp 5 bar:
25 = 185
32 = 330
40 = 420
50 = 780
63 = 1250
80 = 2100

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

Series number

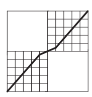
Hydraulic options (1):
A = reversal hydraulic configuration of main spool: P-A in rest position

Electronic options (1):
C = current feedback for pressure transducer 4÷20mA (omit for std voltage ±10VDC) only for **SP, SL**
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Cable entrance threaded connection:
M = M20X1,5

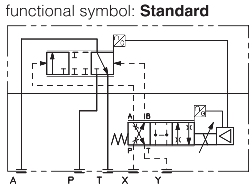
Spool type ,regulating characteristics:

L4 = linear

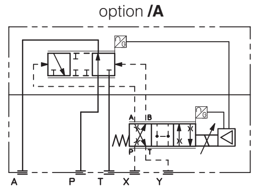


Configuration: 3 = 3 way

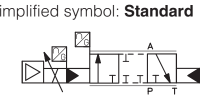
functional symbol: **Standard**



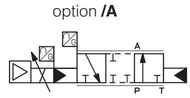
option **/A**



simplified symbol: **Standard**



option **/A**



(1) For possible combined options, see section 15

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

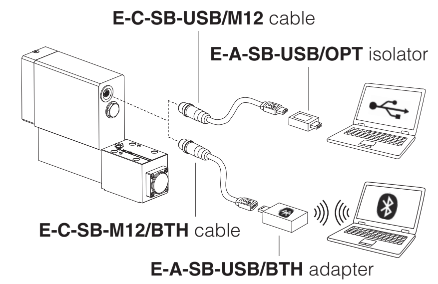
WARNING: the below operation must be performed in a safety area

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 **GS003**).
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)		

USB or Bluetooth connection



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: Bluetooth adapter is available only for European, USA and Canadian markets!
Bluetooth adapter is certified according RED (Europe), FCC (USA) and ISED (Canada) directives

4 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.

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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

	25	**32**	**40**	**50**	**63**	**80**
Max regulated flow [l/min]						
Δp P-A or A-T at Δp = 5 bar	185	330	420	780	1250	2100
Δp P-A or A-T at Δp = 10 bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 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 **(2)** [ms]	≤ 25	≤ 27	≤ 27	≤ 30	≤ 35	≤ 40
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) 0÷100% step signal **(2)** With pilot pressure = 140 bar

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.

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
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, SL)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
Additional characteristics	Short circuit protection of solenoid current supply; 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
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, 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

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 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Components type	Pilot valve solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification **ATEX IECEx**			
Components Certified code	**OZA-LES**			**ETHA-15**
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X			• ATEX: TUV IT 16 ATEX 053 X • IECEx: IECEx TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**	**T6**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			factory wired

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver solenoid and LVDT transducers are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2	**Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

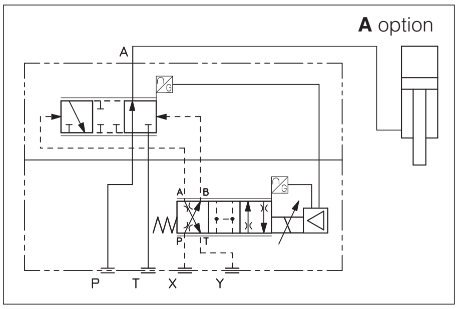
12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 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.



14 ELECTRONICS OPTIONS

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.

C = Only for **SP**, **SL**
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

For SN: /AI
For SP, SL: /AC, AI, /CI, /ACI

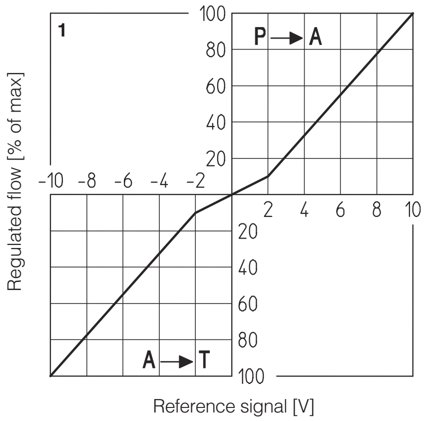
16 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

16.1 Regulation diagrams, see note

1 = LIQZA (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



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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 ÷ 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.

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

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

18.5 Flow monitor output signal (Q_MONITOR)

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.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **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 ±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.

17.7 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

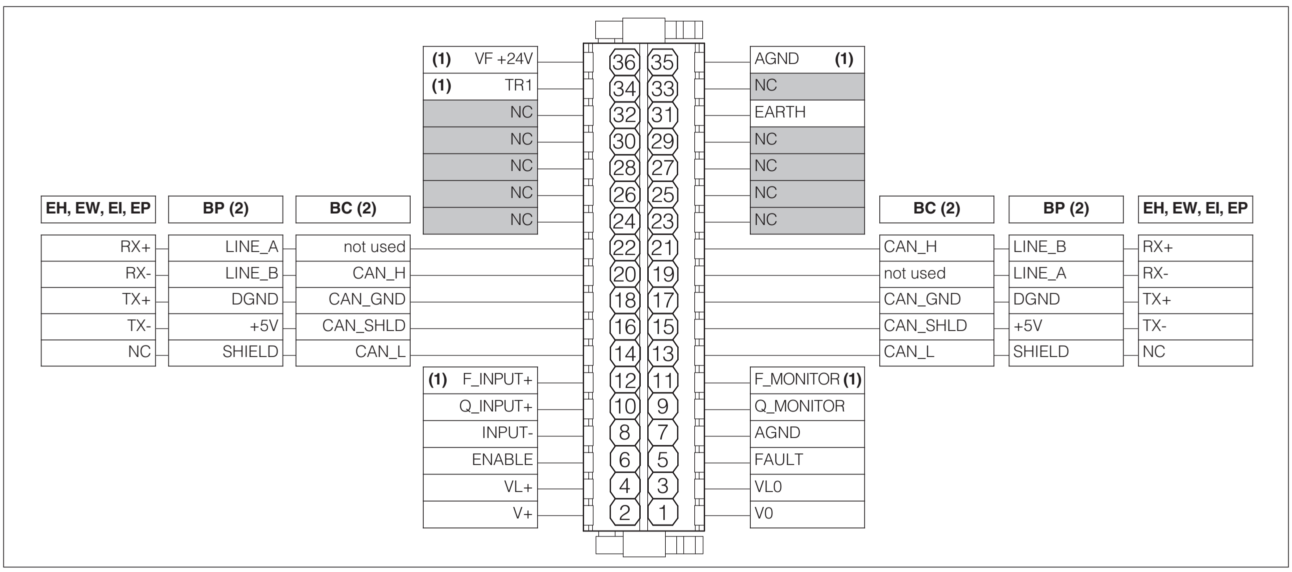
17.8 Fault output signal (FAULT)

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.

17.9 Remote pressure/force transducer input signal - only for **SP, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

18 TERMINAL BOARD OVERVIEW



(1) Connections available only **SP**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

19 ELECTRONIC CONNECTIONS

19.1 Main connections signals

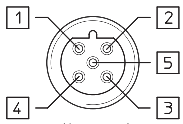
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 V_{DC} / ±20 mA maximum range **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SL**

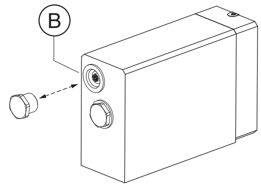
19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

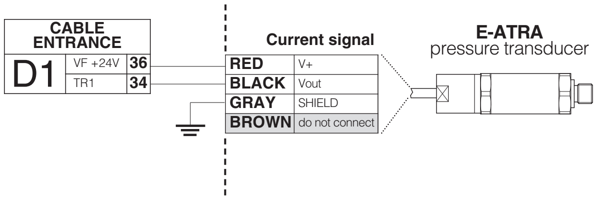
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1	34	**TR1**	1st ignal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



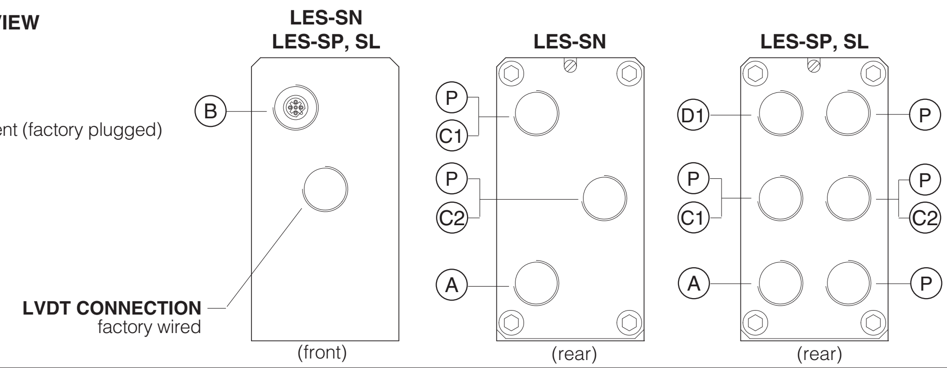
Connect the transducer cable to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

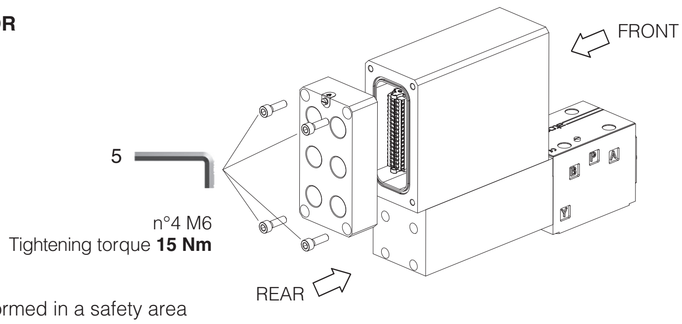
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer
- (P) threaded plug



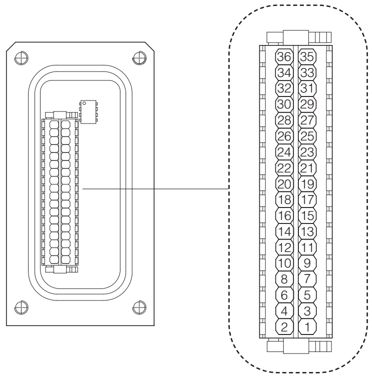
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

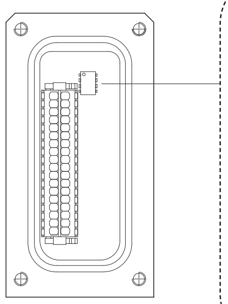


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18



Fieldbus terminator only for BC and BP executions **(1)**



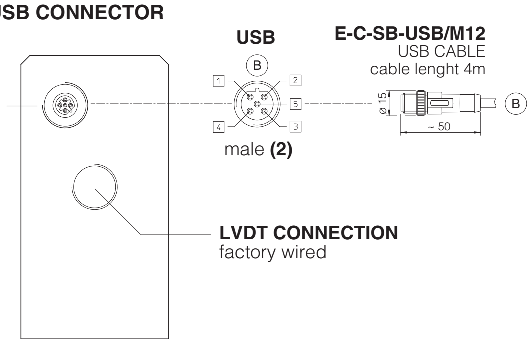
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

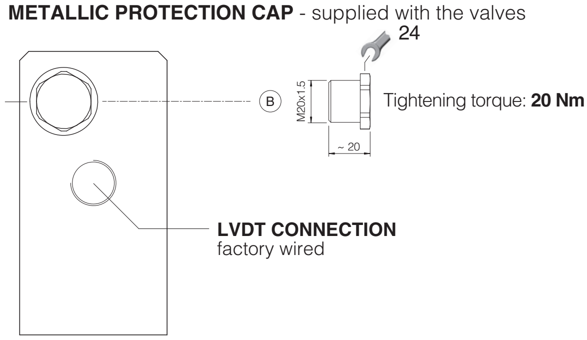
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

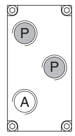
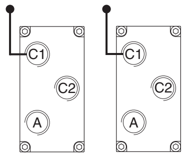
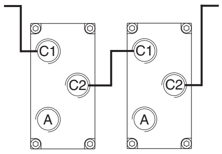


METALLIC PROTECTION CAP - supplied with the valves

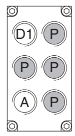
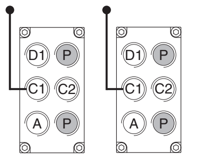
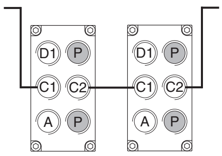


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

20.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

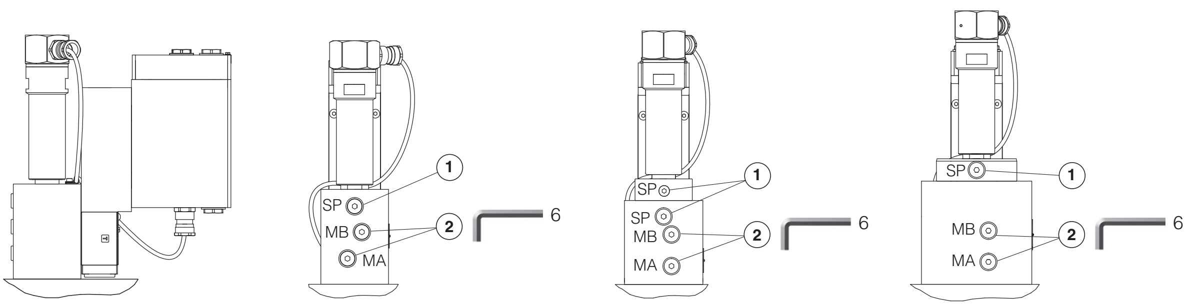
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

20.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

21 AIR BLEEDING

Size 25 **Sizes 32, 40** **Sizes 50 to 80**



(1) **Plugged port - do not open**

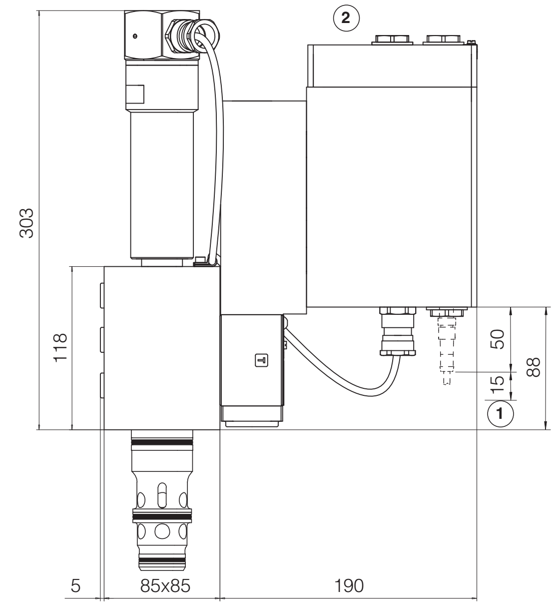
(2) **Air bleeding (MA, MB):**

N° 2 plugs G1/4”

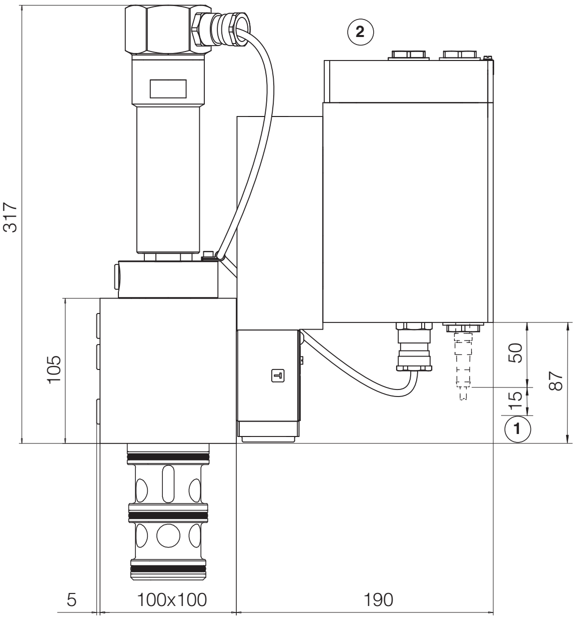
At the machine commissioning it is advisable to bleed the air from piloting chambers, by loosening the 2 plugs shown in the picture.

Operate the valve for few seconds at low pressure and then lock the plugs.

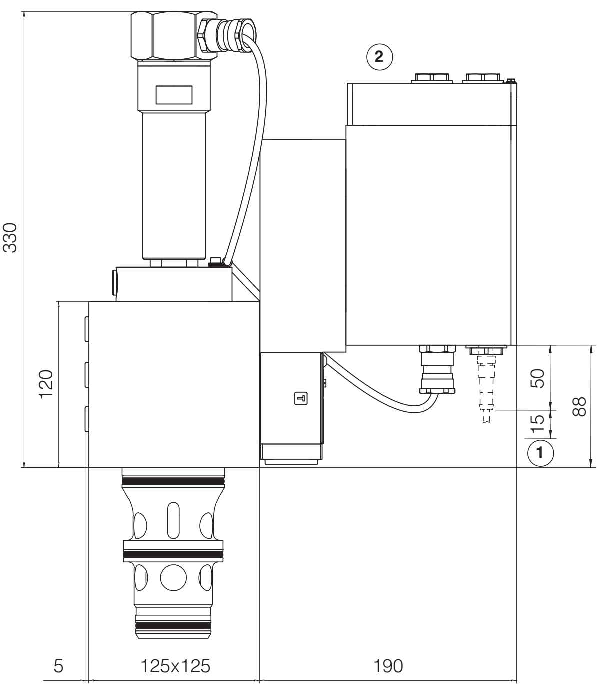
LIQZA-LES-253



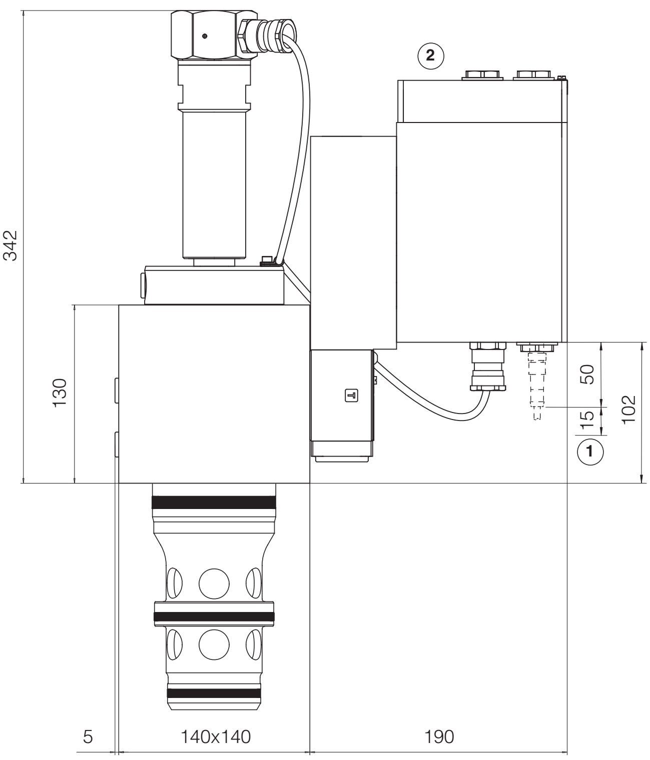
LIQZA-LES-323



LIQZA-LES-403



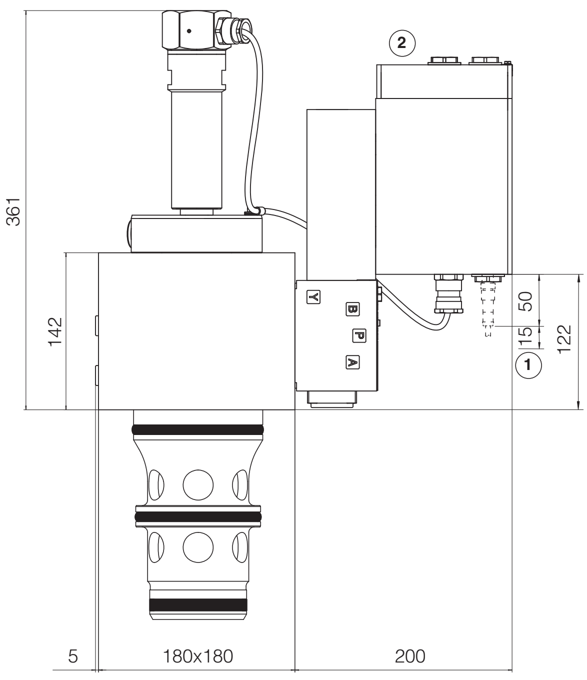
LIQZA-LES-503



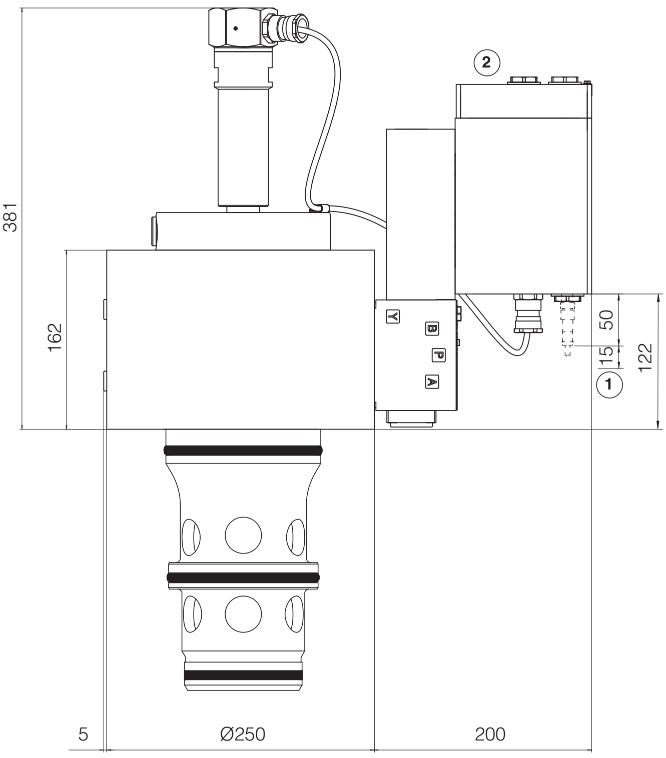
1 = Space to remove the USB connector

2 = The dimensions of all cable glands must be considered (see tech. table KX800)

LIQZA-LES-633



LIQZA-LES-803



(1) = Space to remove the USB connector

(2) = The dimensions of cable glands must be considered (see tech table **KX800**)

23 FASTENING BOLTS AND VALVE MASS

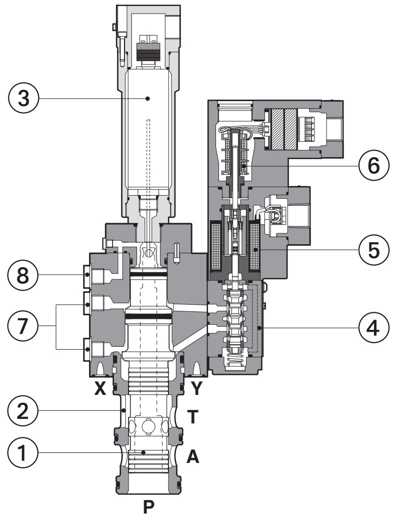
Type	Size	**Fastening bolts (1)** supplied with the valve	Mass [kg]
LIQZA	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	79,2

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
		P006	Mounting surfaces and cavities for cartridge valves

Ex-proof servoproportional 3-way cartridges

piloted, with two LVDT transducers - **ATEX and IECEx**



1. poppet
2. sleeve
3. ex-proof LVDT position transducer (main stage)
4. proportional ex-proof pilot valve
5. ex-proof solenoid
6. ex-proof LVDT position transducer (pilot valve)
7. air bleeding
8. plugged port - do not open

LIQZA-L-SN-NP-323*

LIQZA-L

Ex-proof digital servoproportional 3-way cartridges, with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof proportional solenoid and LVDT transducers certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducers prevent the propagation of accidental internal sparks or fire to the external environment.

They are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **80** - not ISO cavity

Max flow: **500** ÷ **5000 l/min**

Max pressure: **420 bar**

1 MODEL CODE

LIQZA	/	*	-	L	-	25	3	L4	/	M	/	*	*	/	*

Ex-proof proportional cartridge (LIQZA)

Seals material, see section 8:
- **-** = NBR
- **PE** = FKM
- **BT** = HNBR

Series number

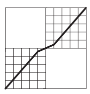
Options:
A = reversal hydraulic configuration of main spool: P-A in rest position

Solenoid and transducer (main stage and pilot valve) **threaded connection** for cable gland fitting:
- **GK** = GK-1/2" **(1)**
- **M** = M20x1,5
- **NPT** = 1/2" NPT

Certification:
Multicertification ATEX, IECEx:
- **-** = omit for Group II 2G
- **M** = Group I (mining)

Poppet type, regulating characteristics:

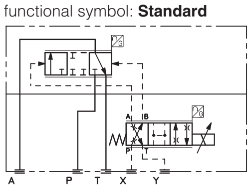
L4 = linear



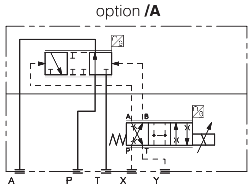
L = with two LVDT transducers

Configuration: 3 = 3 way

functional symbol: **Standard**

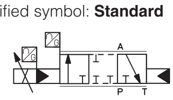


option **/A**

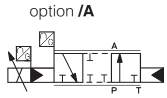


Valve size and nominal flow (l/min) at Δp 5 bar:
- **25** = 185
- **32** = 330
- **40** = 420
- **50** = 780
- **63** = 1250
- **80** = 2100

simplified symbol: **Standard**



option **/A**



(1) Approved only for the italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-LEB-* /A	E-BM-LES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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
Max regulated flow [l/min]						
Δp P-A or A-T at Δp = 5 bar	185	330	420	780	1250	2100
Δp P-A or A-T at Δp = 10 bar	260	470	590	1100	1750	3000
Max permissible flow	500	850	1050	2000	3100	5000
Max pressure [bar]	Ports P, A, T = **420** X = 350 Y ≤ 10					
Nominal flow of pilot valve at Δp = 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 [cm³]	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 **(2)** [ms]	≤ 25	≤ 27	≤ 27	≤ 30	≤ 35	≤ 40
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) 0÷100% step signal **(2)** With pilot pressure = 140 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
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	IP66/67 to DIN EN60529 with relevant cable glandraintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ **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.

7 CERTIFICATION DATA

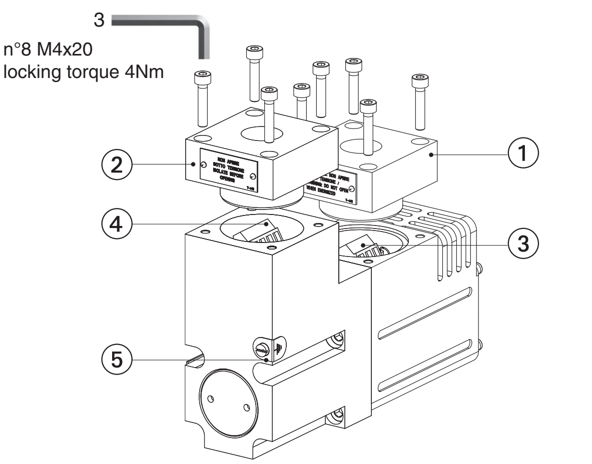
Valve type	LIQZA		LIQZA/**M**	LIQZA, LIQZA/**M**
Component type	Pilot solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification Group II **ATEX IECEx**		Multicertification Group I **ATEX IECEx**	Multicertification Group I and II **ATEX IECEx**
Solenoid certified code	**OZA-T**		**OZAM-T**	**ETHA-15**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	ATEX: TUV IT 16 ATEX 053X ICEX: IECEX TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T4**	**T3**	**-**	**T6**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +70 °C **(3)**
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31			IEC 60079-0 IEC 60079-1 IEC 60079-31
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code
(3) For Group I (mining) the temperaturerange is -20°C ÷ +70°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

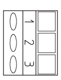
8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Pilot valve solenoid and LVDT transducer



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

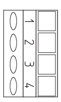
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

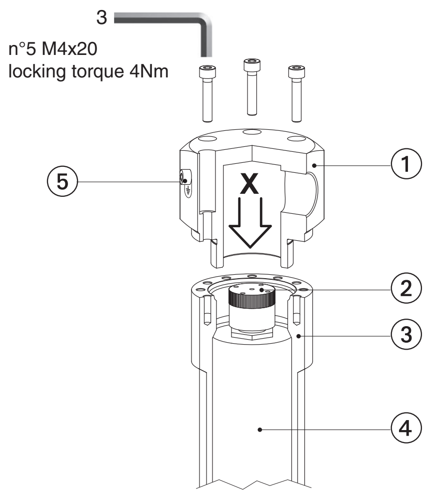
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

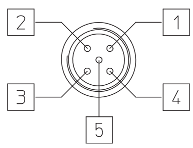
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

LVDT main stage transducer



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply +15 V
3 = GND
4 = Output signal
5 = Supply -15 V

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

10 CABLE GLANDS

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

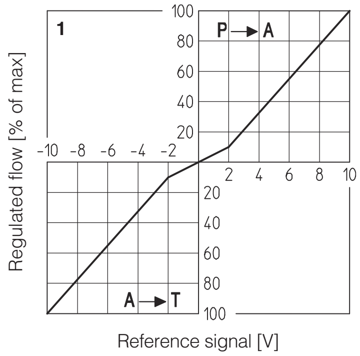
11 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

11.1 Regulation diagrams, see note

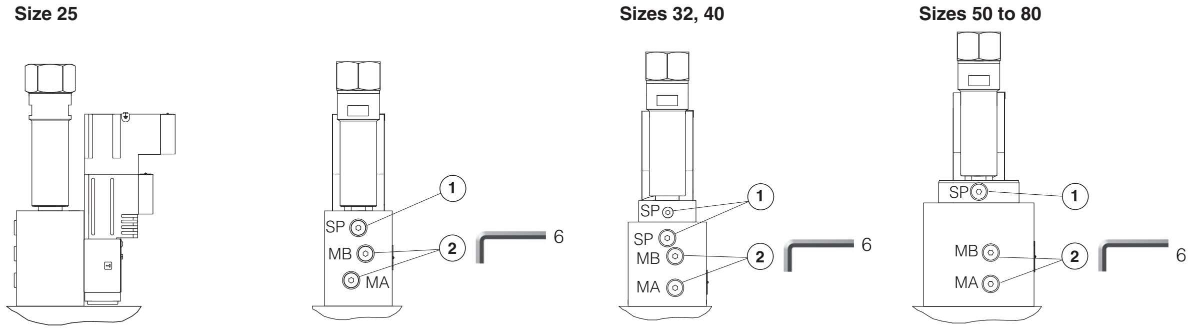
1 = LIQZA (all sizes)

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



12 AIR BLEEDING



(1) **Plugged port - do not open**

(2) **Air bleeding (MA, MB):**

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.

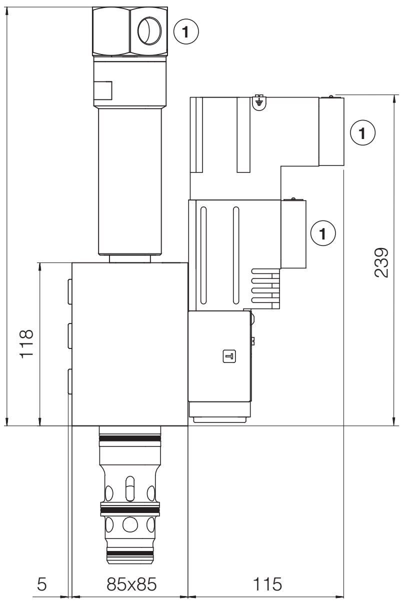
Operate the valve for few seconds at low pressure and then lock the plugs.

13 FASTENING BOLTS AND VALVE MASS

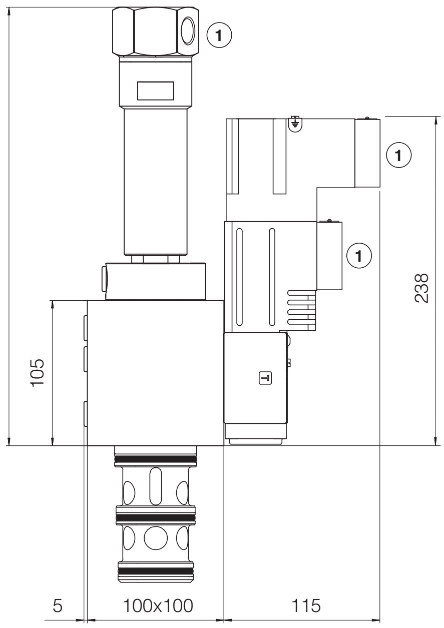
Type	Size	**Fastening bolts (1)** supplied with the valve	Mass [kg]
LIQZA	**25**	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,8
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18,2
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31,6
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51,6
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	79,2

14 INSTALLATION DIMENSIONS [mm]

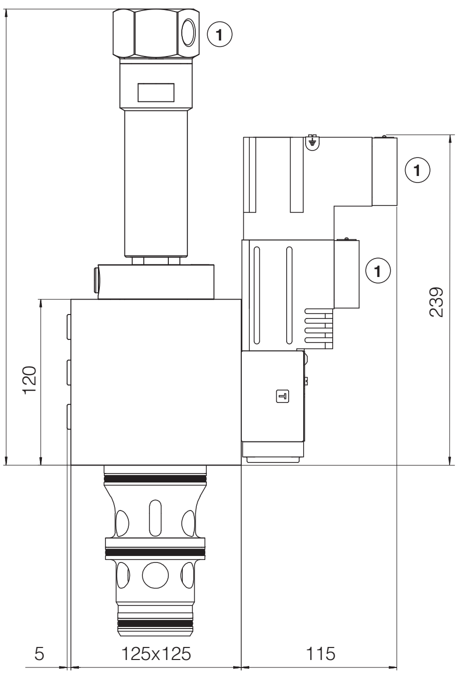
LIQZA-LES-253



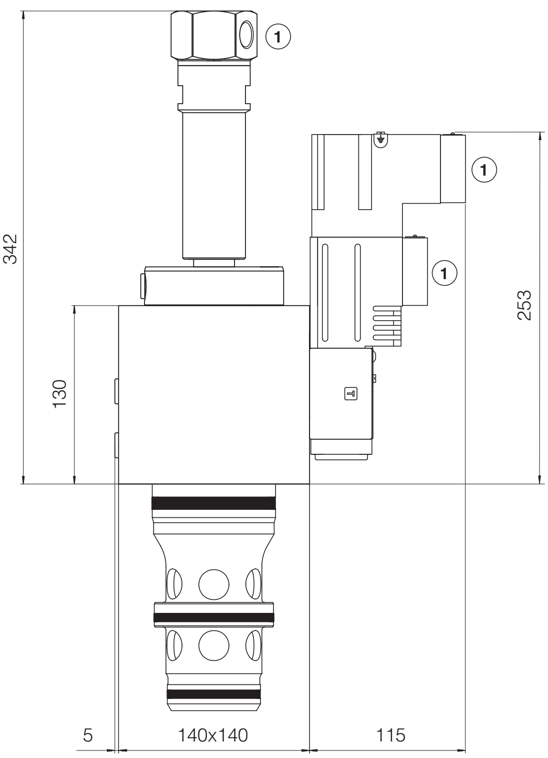
LIQZA-LES-323



LIQZA-LES-403



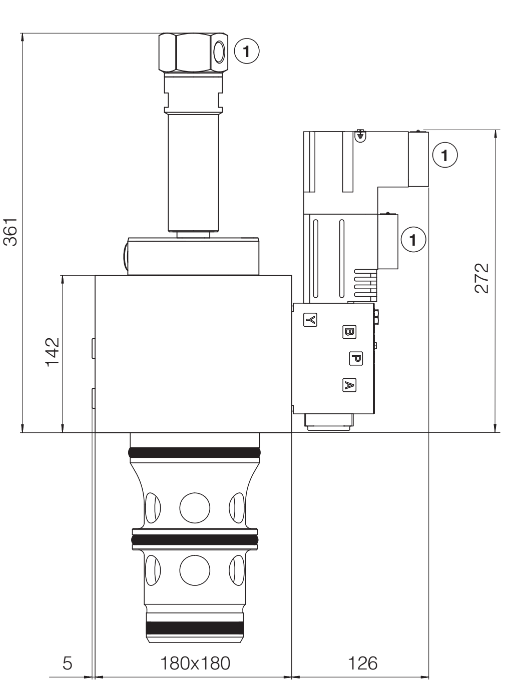
LIQZA-LES-503



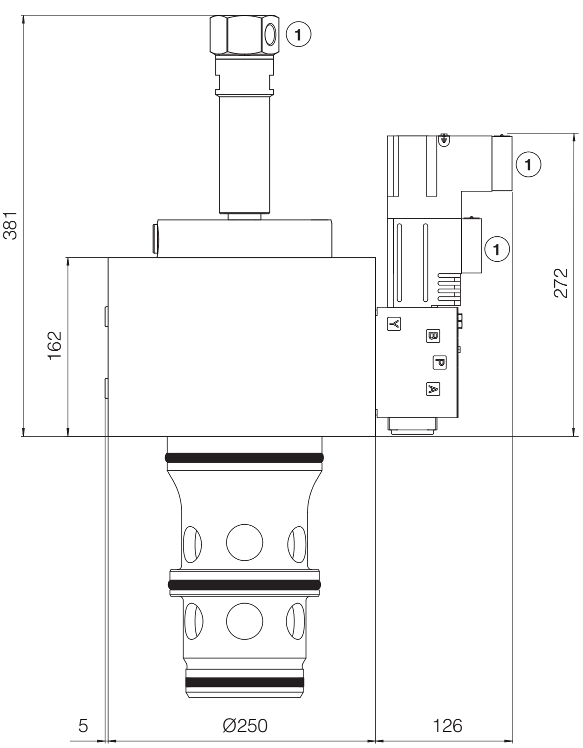
1 = The dimensions of all cable glands must be considered (see tech. table **KX800**)

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

LIQZA-LES-633



LIQZA-LES-803



(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

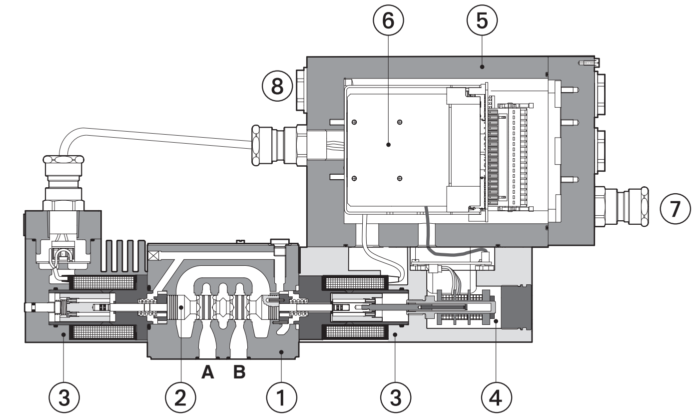
Note: for mounting surface and cavity dimensions, see table P006

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**KX800**	Cable glands for ex-proof valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**P006**	Mounting surfaces and cavities for cartridge valves
FX900	Operating and manintenance information for ex-proof proportional valves		

Ex-proof digital proportional directional valves high performance

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



DKZA-TES-SN-NP-17*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DHZA-TES, DKZA-TES

Ex-proof digital high performances proportional valves, direct, with LVDT position transducer and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver, with LVDT transducer and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

DHZA:	**DKZA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **60 l/min**	Max flow: **150 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TES	-	SN	-	NP	-	0	71	-	L	5	/	M	/	*	*	/	*

Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

TES = on-board driver and LVDT transducer

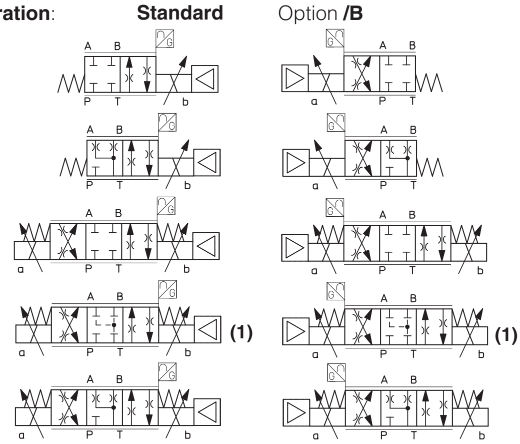
Alternated P/Q controls, see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

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**

51 =
53 =
71 =
72 =
73 =



Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (2):
B = solenoid with integral digital electronics at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

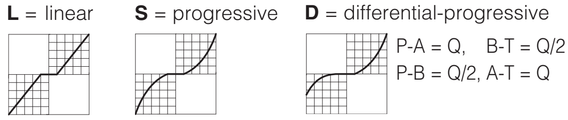
Cable entrance threaded connection:
M = M20x1,5

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D,Q)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	75

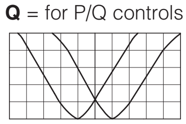
Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

L = linear **S** = progressive **D** = differential-progressive



Q = for P/Q controls



(1) Only for **DKZA-*-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)** For possible combined options, see section 15
(3) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

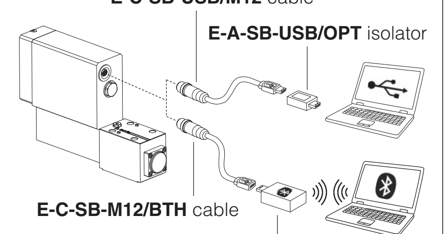
WARNING: the below operation must be performed in a safety area

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 **GS003**).
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)		

USB or Bluetooth connection



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

4 FIELDBUS - see tech. table GS510

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

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	DHZA					DKZA		
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**					**51, 53, 71, 73**		**72**
Spool Type	**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5, Q5**	**L3, S3, D3**	**L5, S5, D5, Q5**	**S5**
Nominal flow [l/min] Δp P-T at Δp= 10 bar	1	4,5	8	18	28	45	75	75
at Δp= 30 bar	1,7	8	14	30	50	80	130	130
max permissible flow	2,6	12	21	40	60	90	150	150
Δp max P-T [bar]	70	70	70	50	50	40	40	40
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 **(1)** [ms]	≤ 20					≤ 25		
Hysteresis	≤ 0,2 [% of max regulation]							
Repeatability	± 0,1 [% of max regulation]							
Thermal drift	zero point displacement < 1% at ΔT = 40°C							

(1) (0-100% step signal)

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
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-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; 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			
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, 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

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 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31	
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com - catalog on line, **technical information** section
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SP, SF, SL**
Option /C 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.

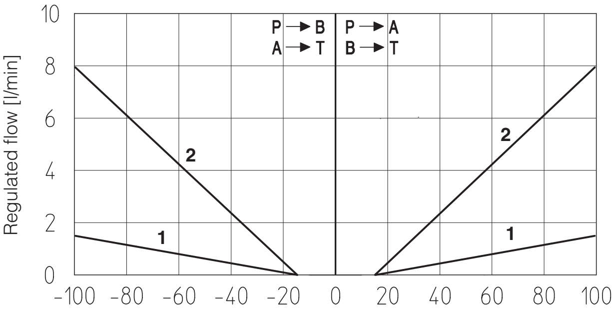
15 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

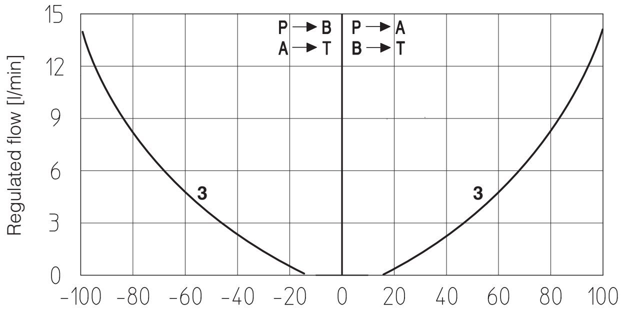
For SP, SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

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

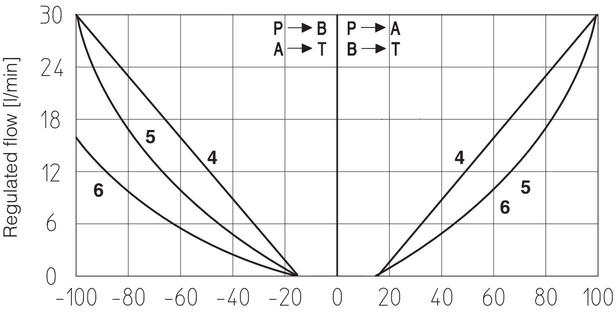
16.1 Regulation diagrams - values measure at Δp 30 bar P-T



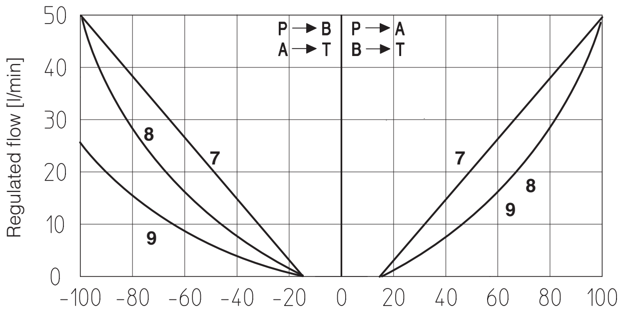
DHZA
1 = L14 **2** = L1



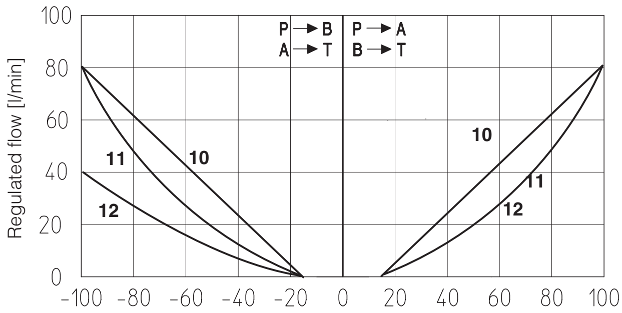
DHZA
3 = S2



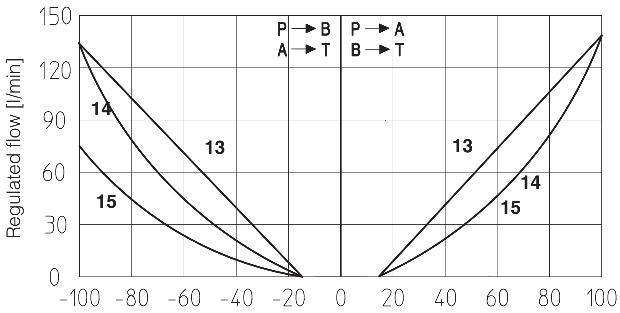
DHZA
4 = L3 **5** = S3 **6** = D3



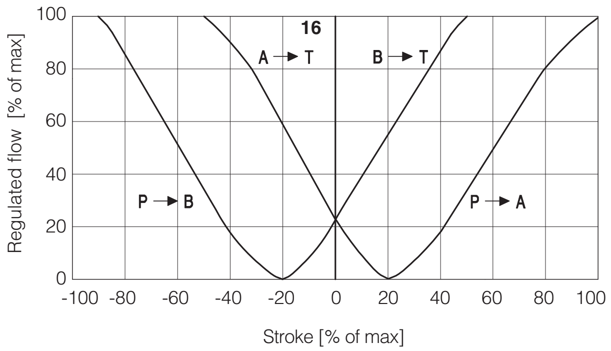
DHZA
7 = L5 **8** = S5 **9** = D5



DKZA
10 = L3 **11** = S3 **12** = D3



DKZA
13 = L5 **14** = S5 **15** = D5



16 = **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with S* option of digital integral drivers (see tech table **FX500**).
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.

Note:
Hydraulic configuration vs. reference signal for configurations 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 → A / B → T Reference signal $\left.\begin{matrix}0 \div -10\text{ V}\\ 12 \div 4\text{ mA}\end{matrix}\right\}$ P → B / A → T

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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 ÷ 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.

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

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

17.5 Flow monitor output signal (Q_MONITOR)

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.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for **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 ÷ 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 driver, supply a 24 VDC on pin 6: 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.

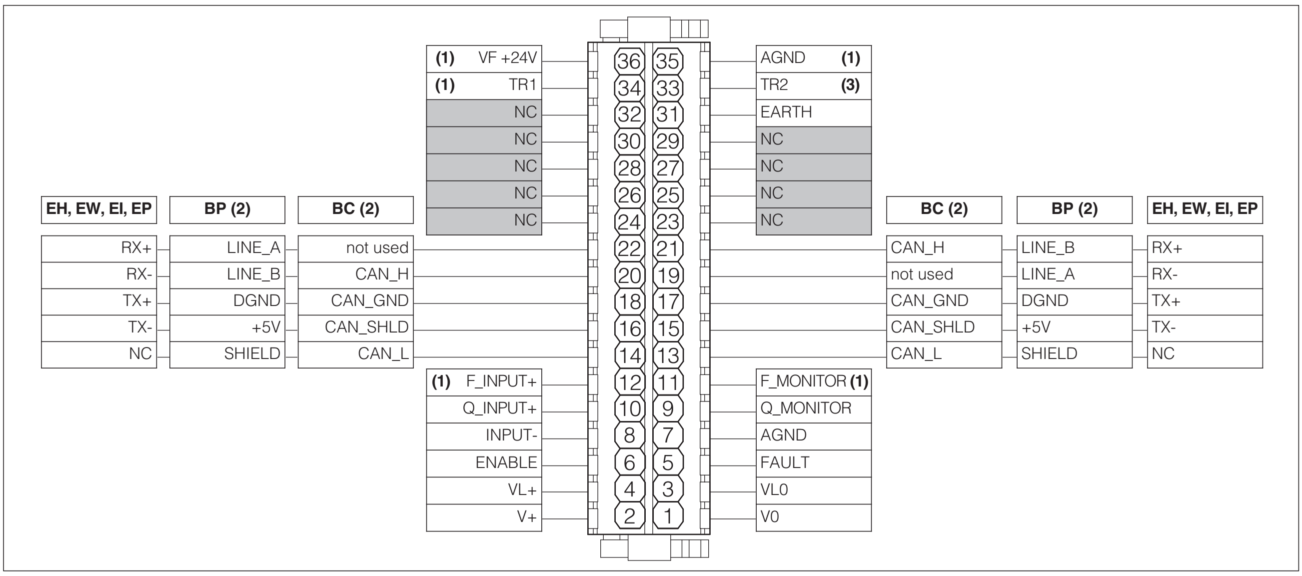
17.8 Fault output signal (FAULT)

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.

17.9 Remote pressure/force transducer input signal - only for **SP, SF, SL**

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

18 TERMINAL BOARD OVERVIEW



(1) Connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only **SF**

19 ELECTRONIC CONNECTIONS

19.1 Main connections signals

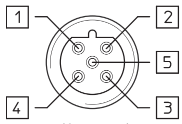
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**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**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 VDC / ±20 mA maximum range **(1)** Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



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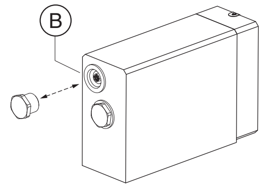


19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

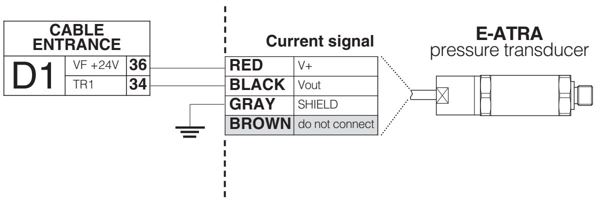
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

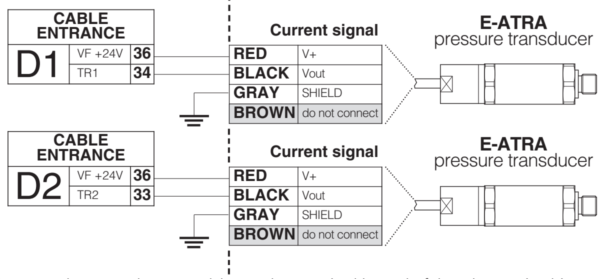
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



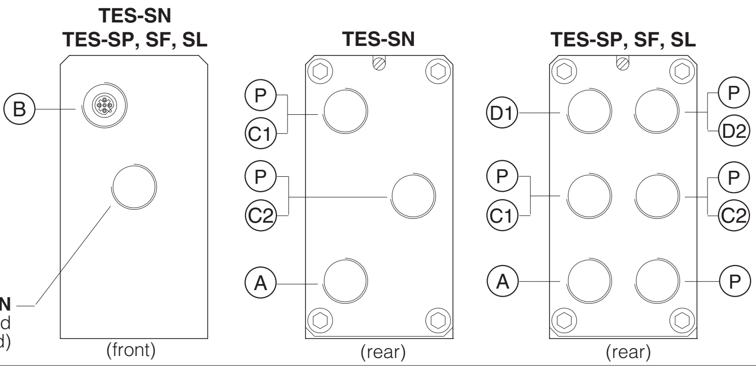
Connect the transducers cables to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

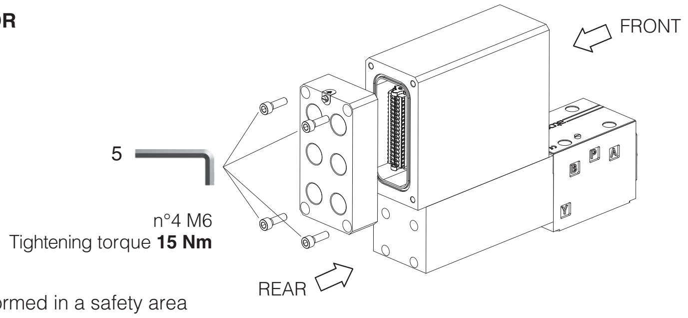
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)

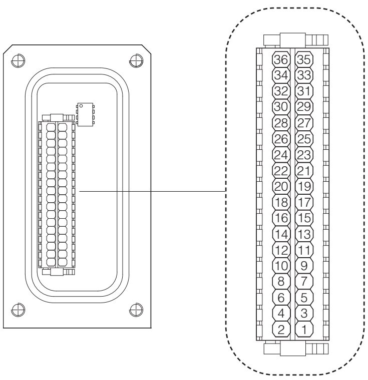
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

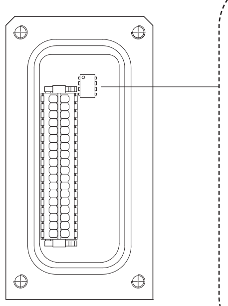


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18



Fieldbus terminator only for BC and BP executions **(1)**



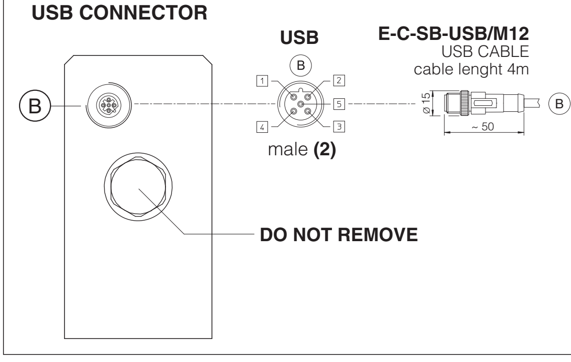
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

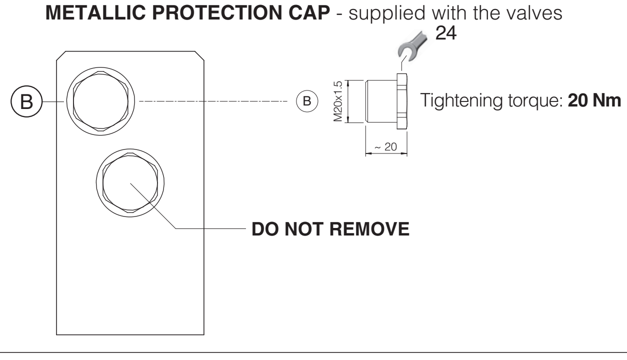
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

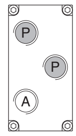
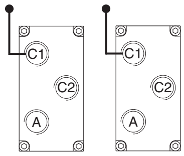
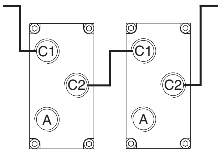


METALLIC PROTECTION CAP - supplied with the valves

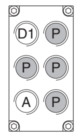
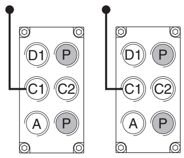
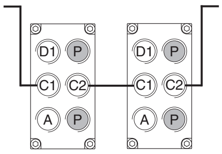


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

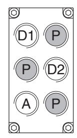
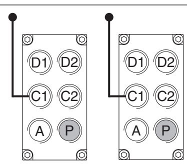
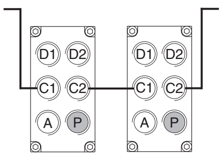
20.1 Cable glands and threaded plug for TES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

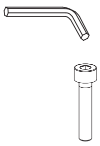
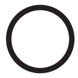
20.2 Cable glands and threaded plug for TES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

20.3 Cable glands and threaded plug for TES-SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

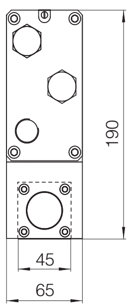
21 FASTENING BOLTS AND SEALS

	DHZA	DKZA
	**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)

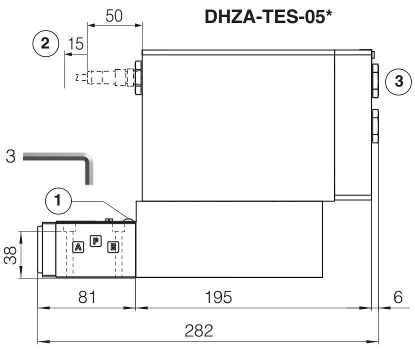
22 INSTALLATION DIMENSIONS FOR DHZA [mm]

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

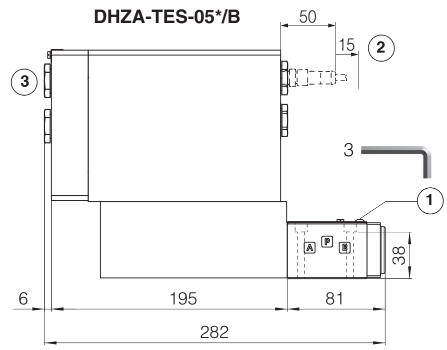
Mass [kg]	
DHZA-TES-05	7,2
DHZA-TES-07	8,9



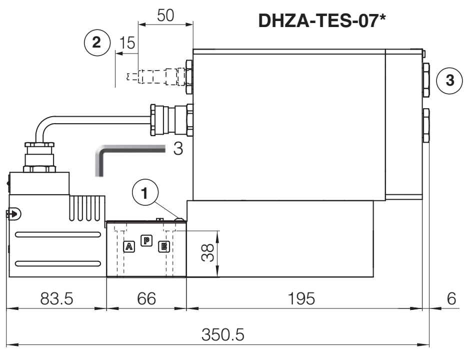
DHZA-TES-05*



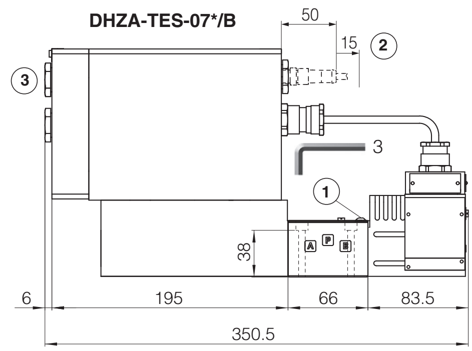
DHZA-TES-05*/B



DHZA-TES-07*



DHZA-TES-07*/B



1 = Air bleed off

2 = Space to remove the USB connector

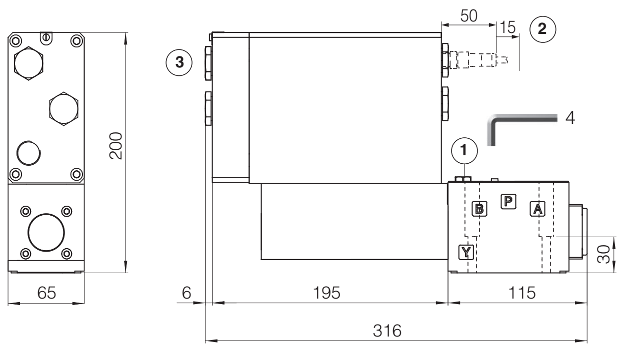
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

23 INSTALLATION DIMENSIONS FOR DKZA [mm]

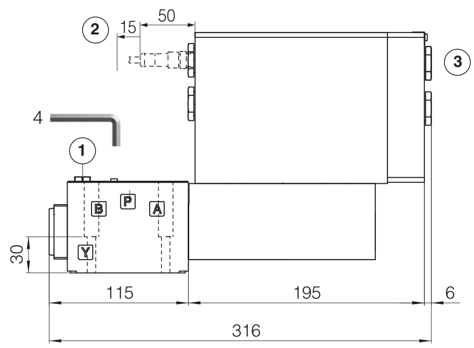
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-TES-15	9
DKZA-TES-17	10,7

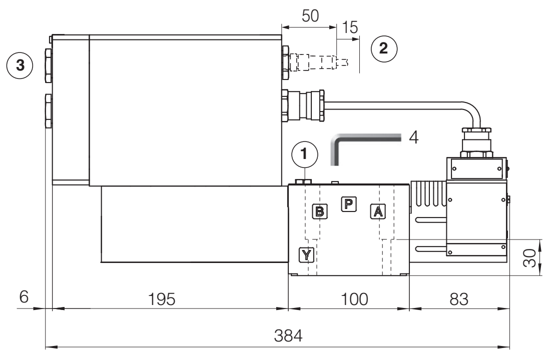
DKZA-TES-15*



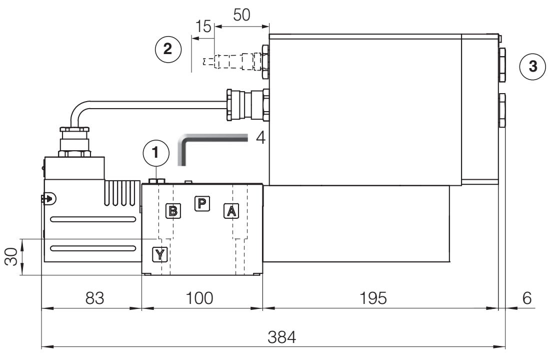
DKZA-TES-15*/B



DKZA-TES-17*



DKZA-TES-17*/B



(1) = Air bleed off

(2) = Space to remove the USB connector

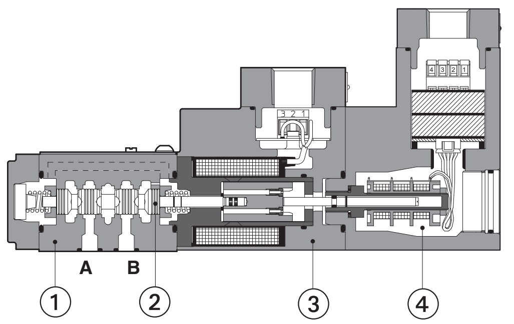
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900 Operating and manintenance norms for ex-proof proportional valves
FX500 Ex-proof for digital proportionals with P/Q control
GS500 Programming tools
GS510 Fieldbus
GX800 Ex-proof pressure transducer type E-ATRA-7
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

Ex-proof proportional directional valves high performance

direct, with LVDT transducer and positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DHZA-T-05*

① valve body
② spool
③ ex-proof solenoid
④ ex-proof LVDT transducer

DHZA-T, DKZA-T

Ex-proof high performance proportional valves direct, with LVDT position transducer and positive spool overlap, for best dynamics in directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids and LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoids are also designed to limit the surface temperature within the classified limits.

DHZA:	**DKZA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **60 l/min**	Max flow: **150 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA / * - T - 0 71 - L 5 / M / * / * * / *

DHZA: Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

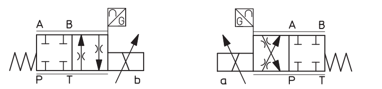
Certification type:
Multicertification ATEX, IECEx, EAC,PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I (mining)
North American Certification:
UL = cULus

T = with LVDT transducer

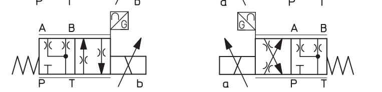
Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

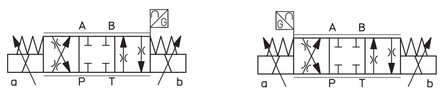
51 =



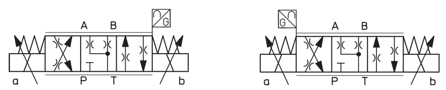
53 =



71 =



73 =



Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR **(2)**

Series number

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Options (3):
B = solenoid and position transducer at side of port A
C = position transducer with current feedback 4÷20 mA
Y = external drain

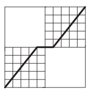
Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	75

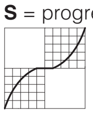
Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

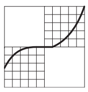
L = linear



S = progressive



D = differential-progressive



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

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /BC, /BY, /CY, /BCY **(4)** Approved only for the Italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

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 ÷ +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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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		DHZA					DKZA	
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**					**51, 53, 71, 73**	
Spool type		**L14**	**L1**	**S2**	**L3, S3, D3**	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**
Max flow [l/min]								
Δp P-T	Δp = 10 bar	1	4,5	8	18	28	45	75
	Δp = 30 bar	1,7	8	14	30	50	80	130
	max permissible flow	2,6	1	21	40	60	90	150
	Δp max P-T [bar]	70	70	70	50	50	40	40
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 **(1)**	[ms]	≤ 20					≤ 25	
Hysteresis	[% of max regulation]	≤ 0,2						
Repeatibility	[% of max regulation]	± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2

(1) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

6 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

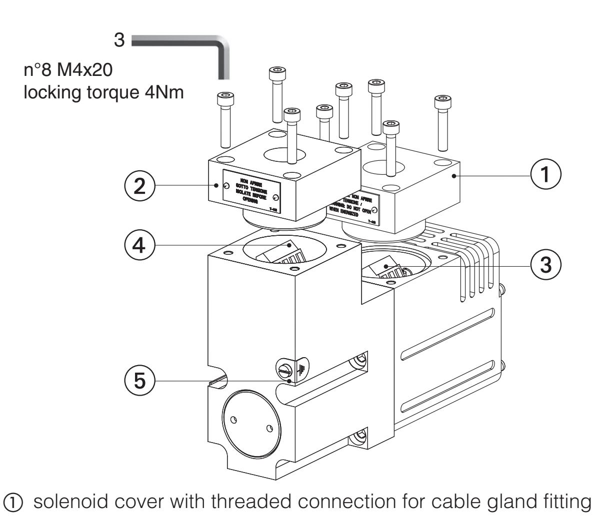
Valve type	DHZA DKZA		DHZA**/M** DKZA**/M**	DHZA**/UL** DKZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid cerified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135°C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

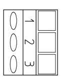
8 EX PROOF SOLENOIDS WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

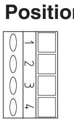
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

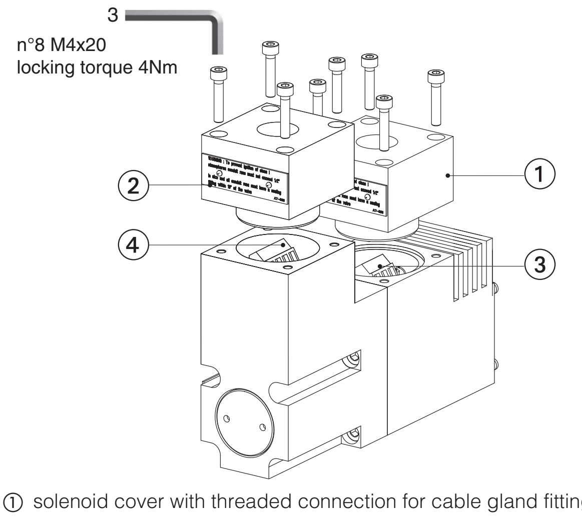
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

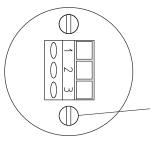
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring ⚠ **Pay attention to respect the polarity**

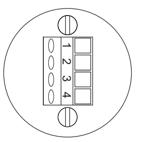


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section **9** note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section **9** note 1

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = Solenoid and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see section 12

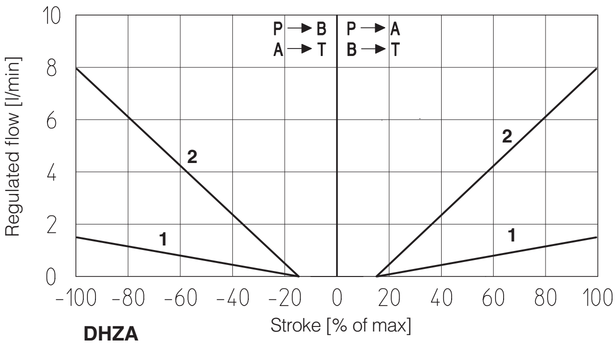
C = Position trasducer with current feedback 4÷20 mA, suggested in case of long distance between the electric driver and the proportional valve

Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

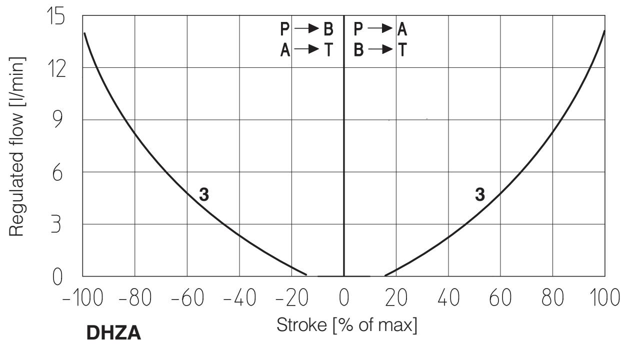
11.1 Possible combined options: /BC, /BY, /CY, /BCY

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

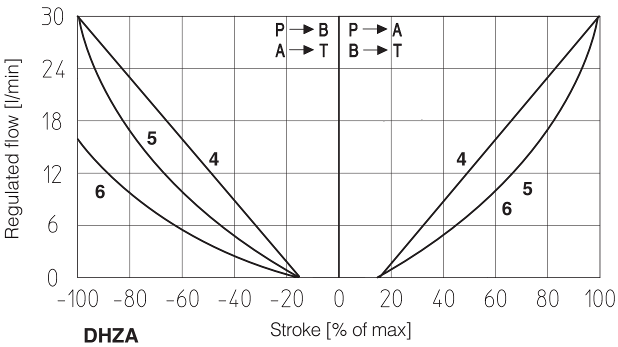
Regulation diagrams of valves with configrations 51, 53, 71, 73 (positive spool overlap) - values measure at Δp 30 bar P-T



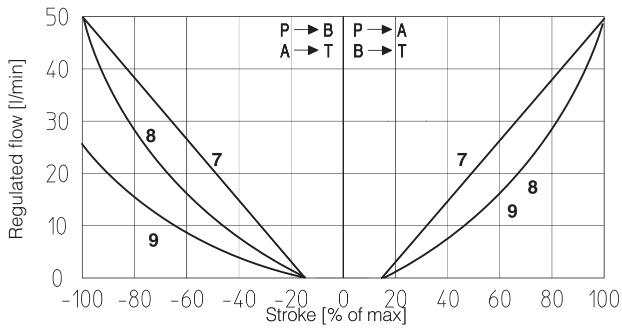
DHZA
1 = L14 **2** = L1



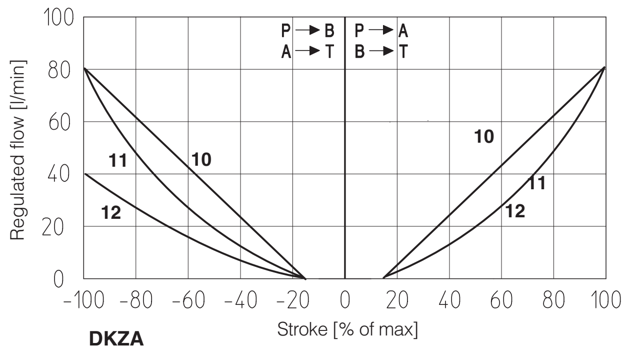
DHZA
3 = S2



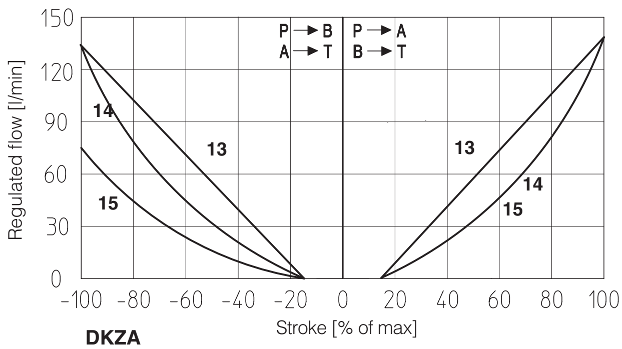
DHZA
4 = L3 **5** = S3 **6** = D3



DHZA
7 = L5 **8** = S5 **9** = D5

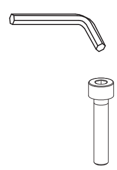
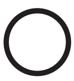


DKZA
10 = L3 **11** = S3 **12** = D3



DKZA
13 = L5 **14** = S5 **15** = D5

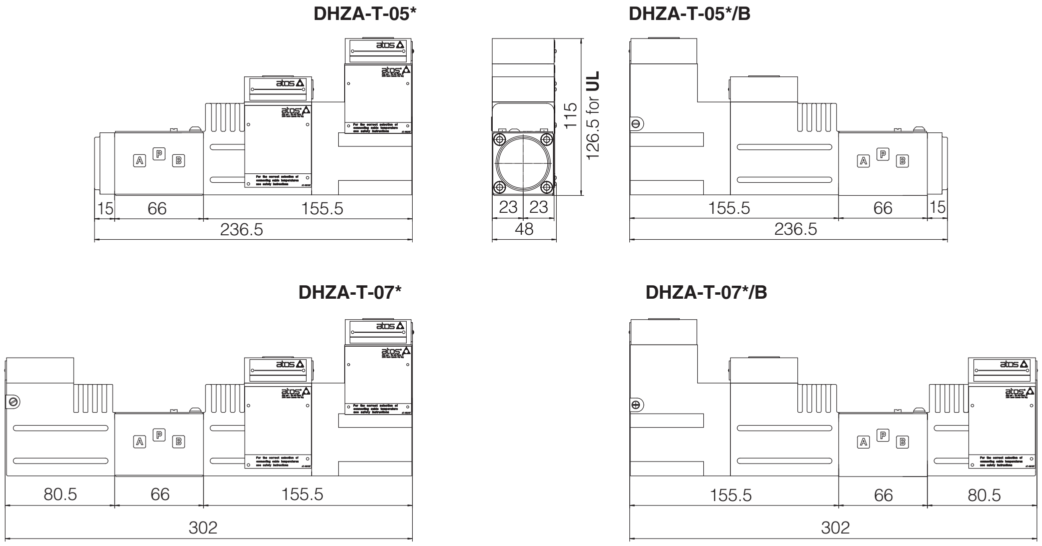
13 FASTENING BOLTS AND SEALS

	DHZA	DKZA
	**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 P, A, B, 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 P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

14 INSTALLATION DIMENSIONS FOR DHZA [mm]

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

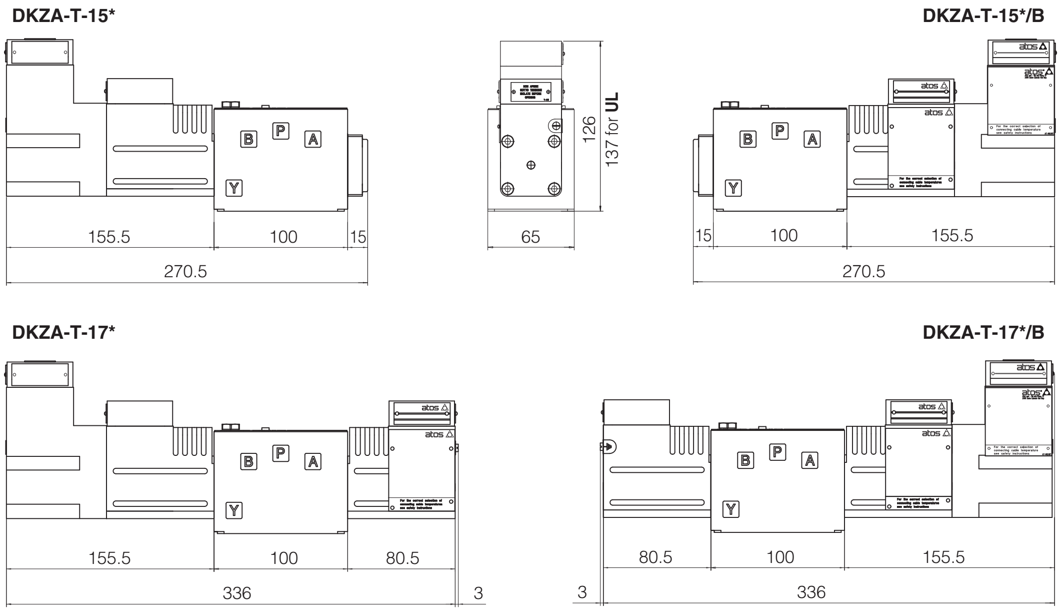
Mass [kg]	
DHZA-T-05	4,0
DHZA-T-07	5,1



15 INSTALLATION DIMENSIONS FOR DKZA [mm]

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-04-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

Mass [kg]	
DKZA-T-15	6,2
DKZA-T-17	7,8

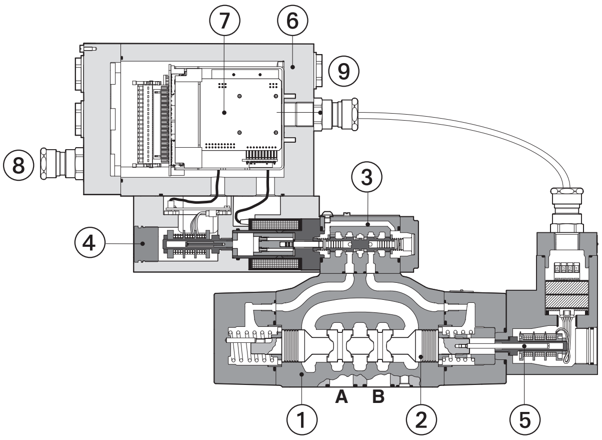


16 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
FX900 Operating and manintenance information for ex-proof proportional valves
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional directional valves high performance

piloted, with on-board driver, two LVDT transducers and positive spool overlap - **ATEX and IECEx**



DPZA-LES-SN-NP-27*

① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid with integral LVDT transducer
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital driver
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

DPZA-LES

Ex-proof digital high performances proportional valves, piloted with two LVDT position transducers (pilot valve and main stage) and positive spool overlap for best dynamics in directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver,LVDT transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and trasducers, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **27** - ISO 4401

Max flow: **180** ÷ **800 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA - LES - SN - NP - 2 71 - L 5 / M / * * / *

DPZA: Ex-proof proportional directional valve, piloted

LES = on-board driver and two LVDT transducers

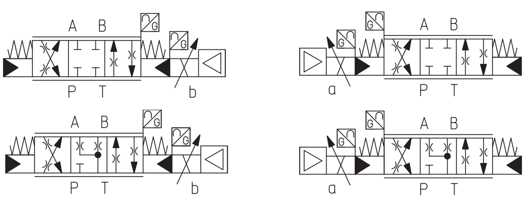
Alternated P/Q controls - see section 5:
SN = none
SP = pressure control (1 pressure tranducer)
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

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:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

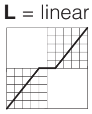
Configuration: Standard / Option **/B**

71 =
73 =

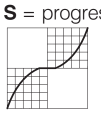


Spool type, regulating characteristics:

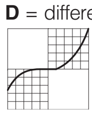
L = linear



S = progressive

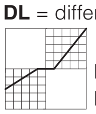


D = differential-progressive



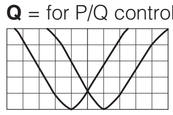
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

DL = differential-linear



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

Q = for P/Q controls



Spool size:

	3 (L,S,D)	5 (L,DL,S,D,Q)
DPZA-1 =	-	100
DPZA-2 =	130	200
DPZA-4 =	-	340
DPZA-4M =	-	390

Nominal flow (l/min) at Δp 10bar P-T

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
B = solenoid at side of port A **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SP, SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

Series number

Seals material, see sect. 9:
- = NBR
PE = FKM
BT = HNBR

(1) For possible combined options, see section 15
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

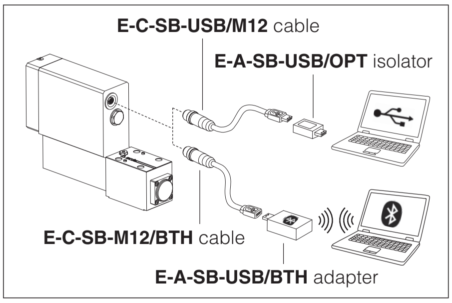
WARNING: the below operation must be performed in a safety area

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 **GS003**).
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)		

USB or Bluetooth connection



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

4 FIELDBUS - see tech. table GS510

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

5 ALTERNATED P/Q CONTROLS - see tech. table FX500

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.

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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		DPZA-*-1	DPZA-*-2		DPZA-*-4	DPZA-*-4M
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type		**L5, DL5, S5, D5, Q5**	**L3, S3, D3**	**L5, DL5, S5, D5, Q5**		
Nominal flow [l/min]						
Δp P-T	Δp = 10 bar	100	130	200	340	390
	Δp = 30 bar	160	220	350	590	670
	Max permissible flow	180	320	440	680	800
Δp max P-T	[bar]	50	60	60	60	60
Piloting pressure	[bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume	[cm³]	1,4	3,7		9,0	11,3
Piloting flow **(1)**	[l/min]	1,7	3,7		6,8	8
Leakage **(2)**	Pilot [cm³/min]	100/300	100/300		200/500	200/600
	Main stage [l/min]	0,15/0,5	0,2/0,6		0,3/1,0	0,3/1,0
Response time **(1)**	[ms]	≤ 55	≤ 65		≤ 85	≤ 90
Hysteresis		≤ 0,1 [% of max regulation]				
Repeatability		± 0,1 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
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-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; 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			
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, 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

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 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	HFDU, HFDR	ISO 12922
Flame resistant with water **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	DPZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-LES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1		IEC 60079-0 IEC 60079-31 IEC 60079-1
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

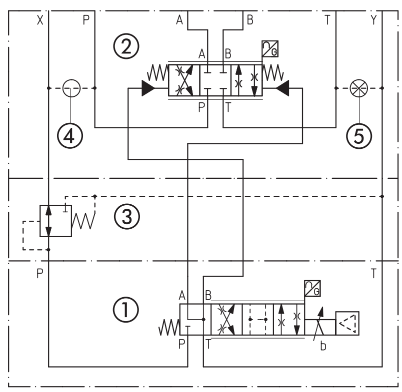
13 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 21 .
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:
Option /D Internal drain.
Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-2 = 28 bar
DPZA-1, -4 and -4M = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve is standard for DPZA-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 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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.

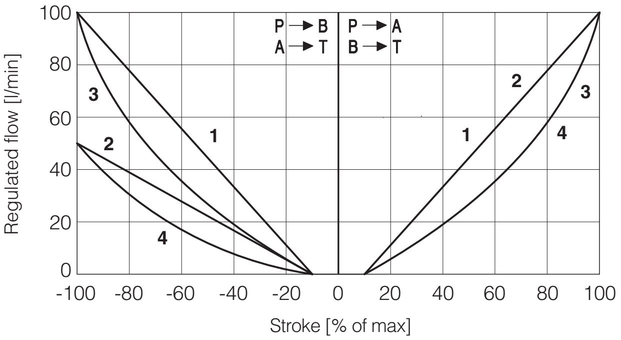
C = Only for **SP, SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

15 POSSIBLE COMBINED OPTIONS

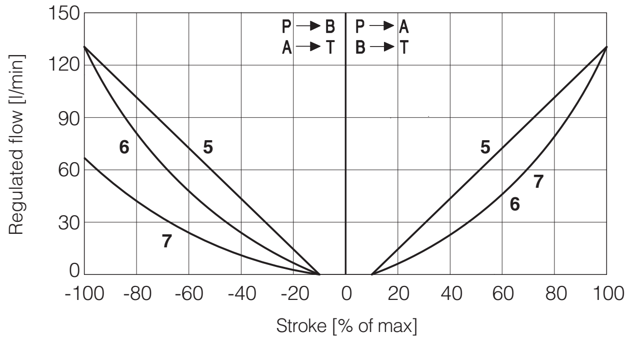
Hydraulic options: all combination possible
Electronics options: /CI (only for **SP, SF, SL**)

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

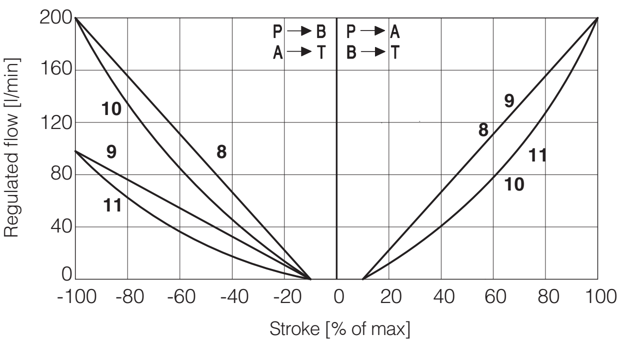
16.1 Regulation diagrams (values measure at Δp 10 bar P-T)



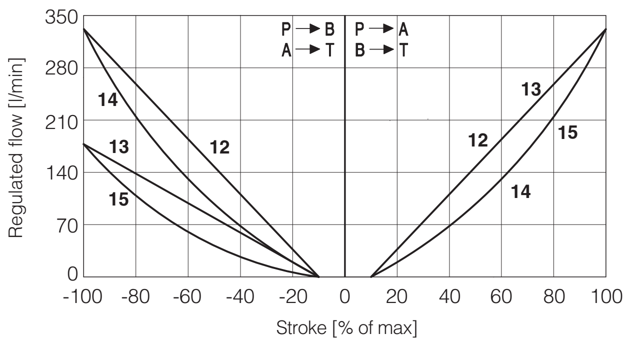
DPZA-1:
1=L5 **2** = DL5
3=S5 **4** = D5



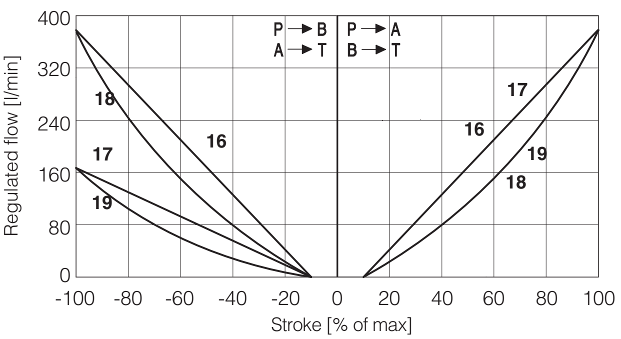
DPZA-2:
5=L3 **6** = S3
7=D3



DPZA-2:
8 = L5 **9** = DL5
10 = S5 **11** = D5



DPZA-4:
12 = L5 **13** = DL5
14 = S5 **15** = D5

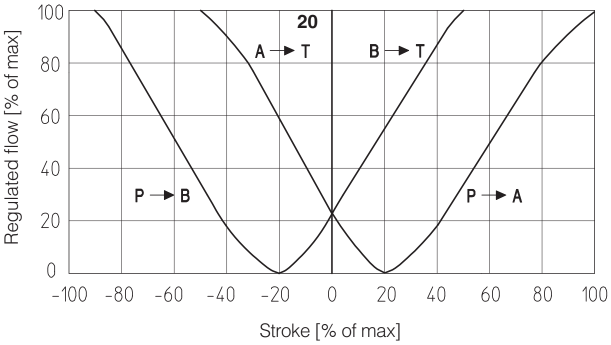


DPZA-4M:
16 = L5 **17** = DL5
18 = S5 **19** = D5

Note: Hydraulic configuration vs. reference signal (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ - 10 V / 12 ÷ 4 mA } P → B / A → T



20 = Q5

20 = linear spool **Q5**

Q5 spool type is specific for alternate P/Q controls in combination with /S* option, (see tech. table **FX500**).
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 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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 ÷ 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.

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

Functionality of F_INPUT+ signal (pin 12), is used as reference for the driver pressure/force closed loop (see tech. table FX500).
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.

17.5 Flow monitor output signal (Q_MONITOR)

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.

17.6 Pressure or force monitor output signal (F_MONITOR) - only for 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 ÷ 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 driver, supply a 24 VDC on pin 6: 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.

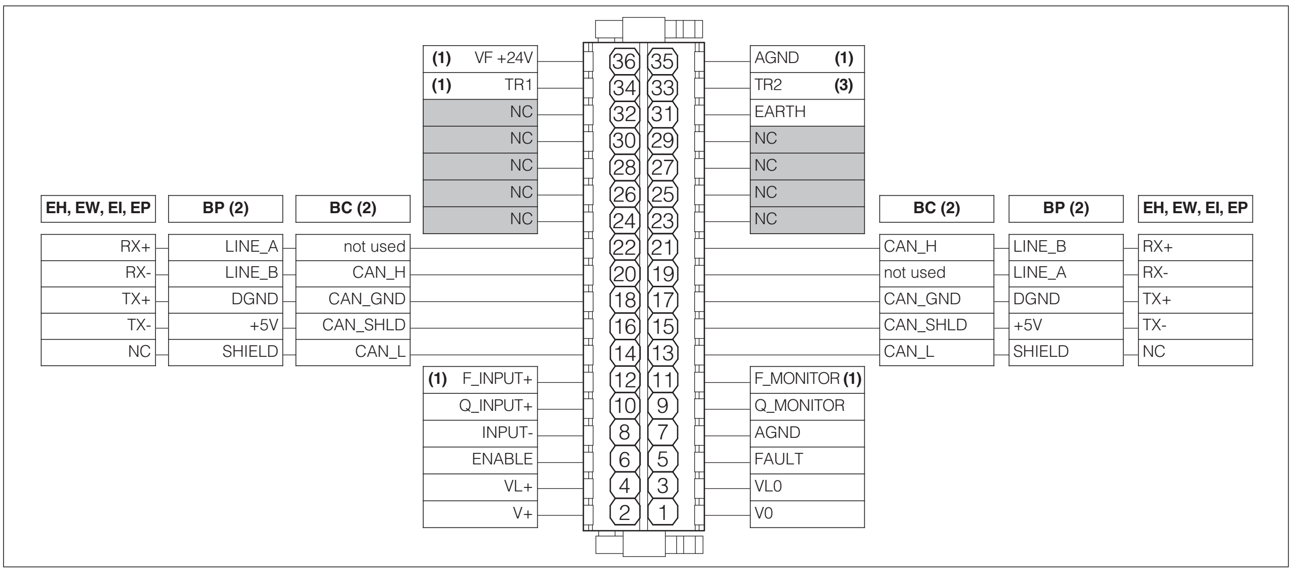
17.8 Fault output signal (FAULT)

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

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

Analog remote pressure transducers or load cell can be directly connected to the driver.
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 table FX500).

18 TERMINAL BOARD OVERVIEW



(1) connections available only **SP**, **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) connection available only **SF**

19 ELECTRONIC CONNECTIONS

19.1 Main connections signals

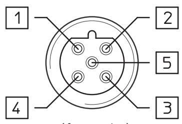
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for Q_INPUT+ and F_INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal: ±10 V_{DC} / ±20 mA maximum range **(1)** Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) Available only for **SP**, **SF**, **SL**

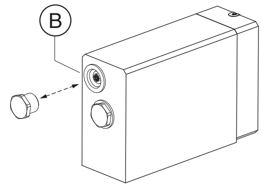
19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

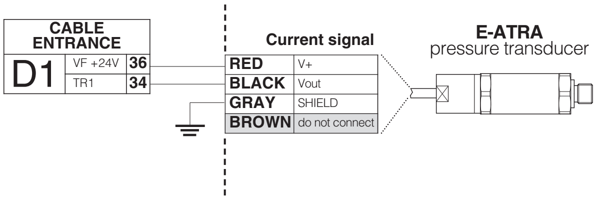
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for **SP**, **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SP, SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st ignal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

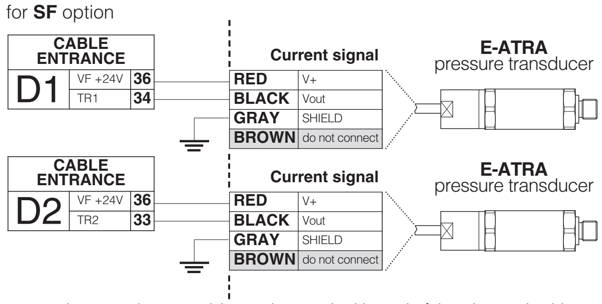
E-ATRA remote pressure transducer connection - see tech table **GX800**

for **SP** option



Connect the transducer cable to the terminal board of the electronic driver

for **SF** option



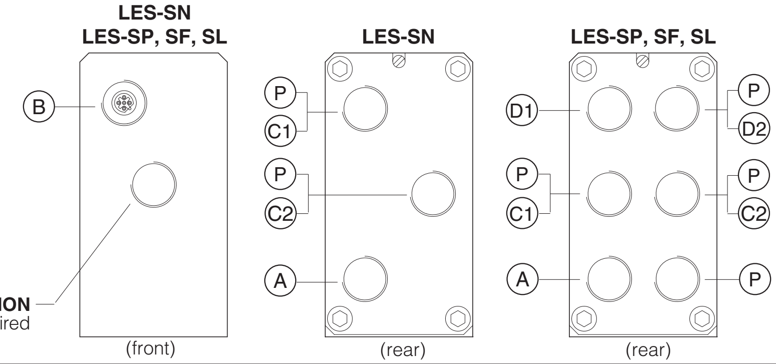
Connect the transducers cables to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

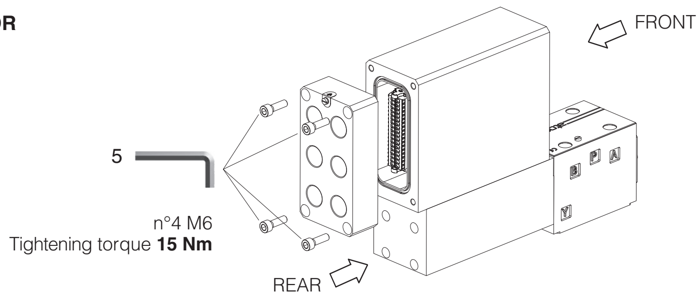
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (P) threaded plug



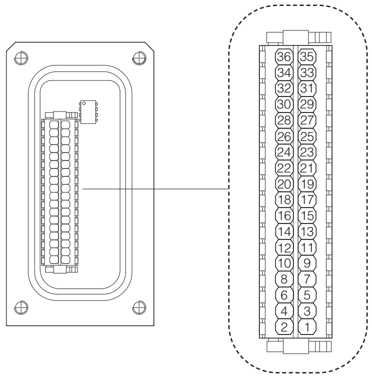
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

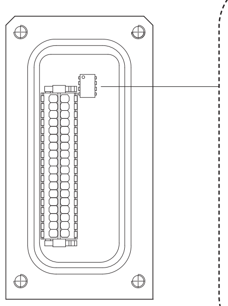


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18

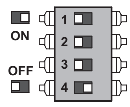


Fieldbus terminator only for BC and BP executions **(1)**



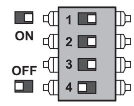
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

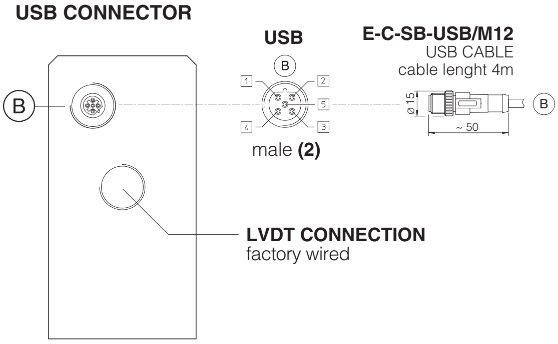


BP - PROFIBUS DP setting:

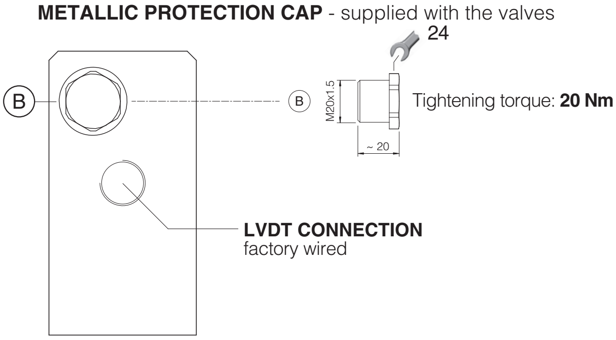
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR



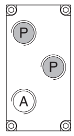
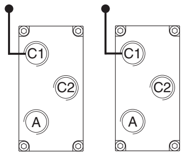
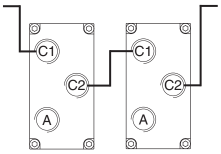
METALLIC PROTECTION CAP - supplied with the valves



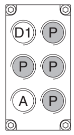
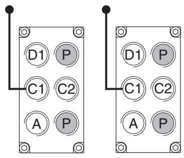
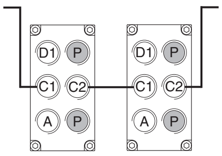
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

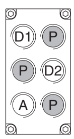
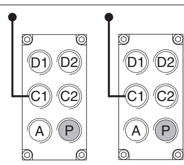
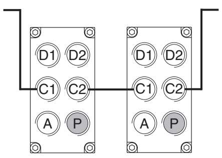
20.1 Cable glands and threaded plug for LES-SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

20.2 Cable glands and threaded plug for LES-SP, SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D1 A	none	none		Cable entrance A, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	D1 C1 A	1	C2		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	D1 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

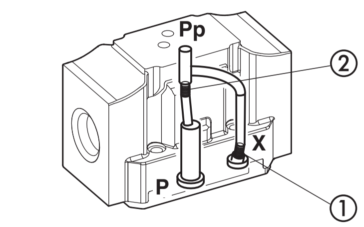
20.3 Cable glands and threaded plug for LES-SF - see tech table **KX800**

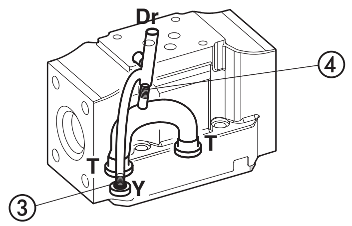
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	3	D1 D2 A	none	none		Cable entrance A, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	4	D1 - D2 C1 A	1	C2		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	5	D1 - D2 C1 - C2 A	none	none		Cable entrance A, C1, C2, D1, D2 are open for costumers Cable entrance P is factory plugged

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

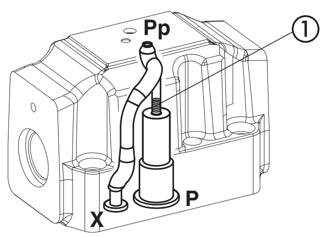
DPZA-1 **Pilot channels** **Drain channels**

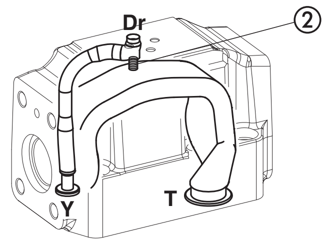




Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

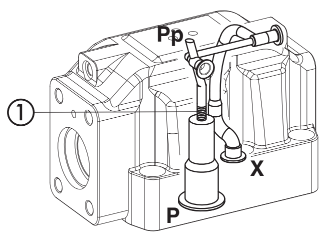
DPZA-2 **Pilot channels** **Drain channels**

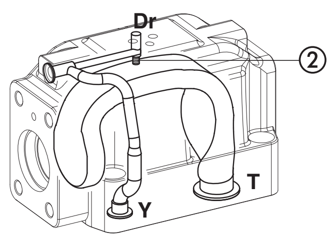




Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4
DPZA-4M **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.

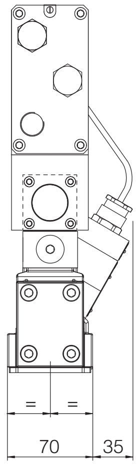
22 FASTENING BOLTS AND SEALS

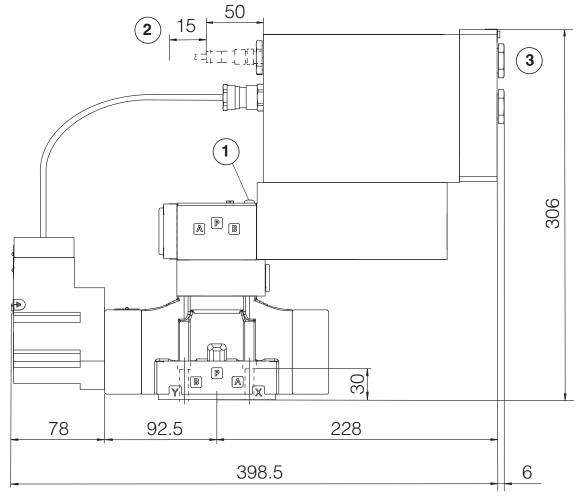
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head 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)

DPZA-LES-*-1

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

Mass [kg]	
DPZA-*-17*	9,5
Option /G	+0,9

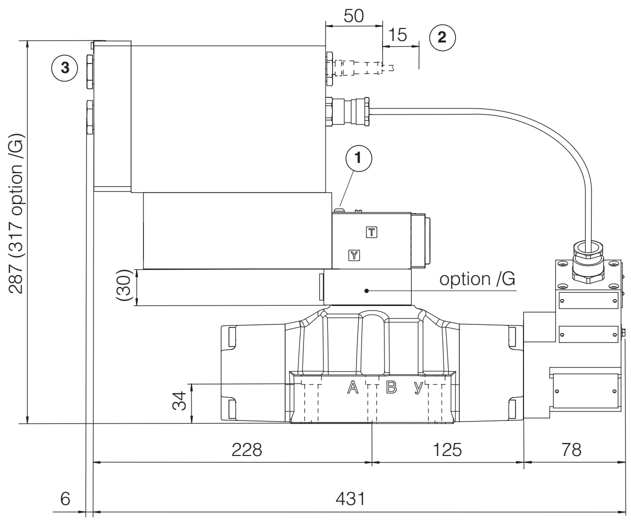


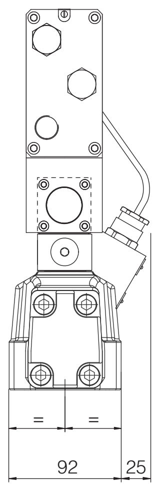


DPZA-LES-*-2

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

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





1 = Air bleed off

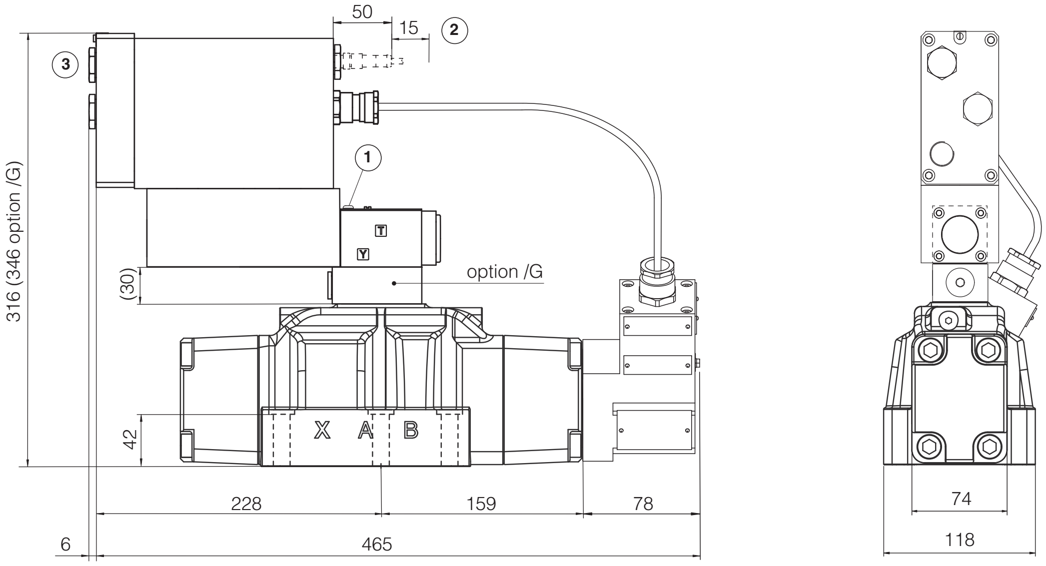
2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LES-*-4
DPZA-LES-*-4M

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

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



1 = Air bleed off

2 = Space to remove the USB connector

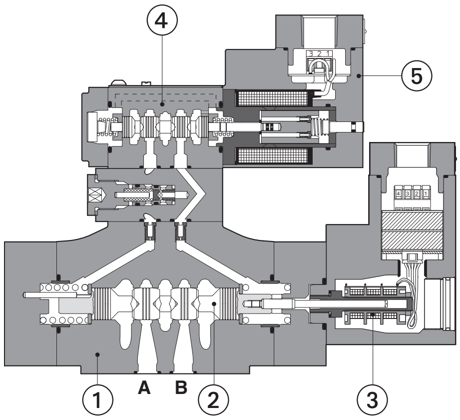
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

24 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS500**	Programming tools
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GS510**	Fieldbus
FX500	Ex-proof digital proportionals with P/Q control	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
		P005	Mounting surfaces for electrohydraulic valves

Ex-proof proportional directional valves

piloted, with LVDT transducer and positive spool overlap - **ATEX, IECEx, EAC, PESO**



① main stage valve body
② main stage spool
③ ex-proof LVDT transducer
④ pilot valve
⑤ ex-proof solenoid

DPZA-T-15*

DPZA-T

Ex-proof proportional valves, piloted, with LVDT position transducer and positive spool overlap, for directional and not compensated speed controls.
They are equipped with ex-proof proportional solenoid and LVDT transducer, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **32** - ISO 4401

Max flow: **180** ÷ **1000 l/min**

Max pressure: **350 l/min**

1 MODEL CODE

DPZA	/	*	-	T	-	2	71	-	L	5	/	M	/	*	*	/	*

DPZA: Ex-proof proportional directional valve, piloted

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group IM2 (mining)

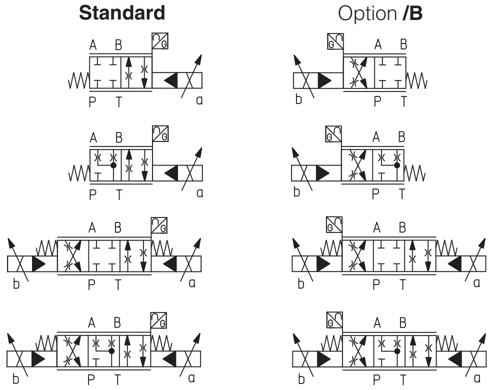
T = with LVDT transducer

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration:

Standard / Option **/B**

51 =
53 =
71 =
73 =



Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR **(2)**

Series number

Options (4):
B = solenoid and position transducer at side of port A of the main stage **(3)**
C = current feedback for position transducer 4 ÷ 20 mA
D = internal drain
E = external pilot pressure

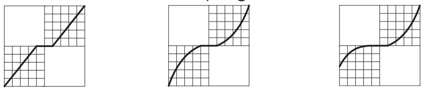
Solenoid and transducer threaded connection for cable gland fitting:
GK = GK-1/2" **(5)**
M = M20x1,5
NPT = 1/2" NPT ANSI B2.1 (tapered)

Spool size:	**3** (L,S,D)	**5** (L,S,D)
DPZA-1 =	-	100
DPZA-2 =	130	200
DPZA-4 =	-	340
DPZA-6 =	-	400

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L = linear **S** = progressive **D** = differential-progressive



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

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining)
(3) In standard configuration the solenoid and transducer are at side B of the main stage
(4) Possible combined options: /BC, /BD, /BE, /CD, /CE, /DE
(5) Approved only for the Italian market

⚠ For valve with internal drain (option /D) the pressure at T port makes difficult the manual override operation that can be possible only if the pressure at T port is lower than 50 bar

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-TEB-* /A	E-BM-TES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - Salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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		DPZA-*-1	DPZA-*-2		DPZA-*-4	DPZA-*-6
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**	**L5, S5, D5**	**L5, S5, D5**
Nominal flow [l/min] Δp P-T	Δp = 10 bar	100	130	200	340	400
	Δp = 30 bar	160	220	350	590	700
	max permissible flow	180	320	440	680	1000
Δp max P-T	[bar]	50	60	60	60	70
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	21,6
Piloting flow **(1)**	[l/min]	1,7	3,7		6,8	14,4
Leakage **(2)**	Pilot [cm^3/min]	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 **(1)**	[ms]	≤ 70	≤ 85		≤ 100	≤ 130
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 2
(1) 0 ÷100 % step signal and pilot pressure 100 bar **(2)** at Δp = 100/350 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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 ÷ +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	
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) performance limitations in case of flame resistant fluids with water:
- max operating pressure = 210 bar - max fluid temperature = 50°C

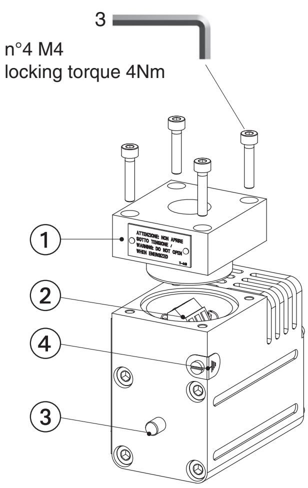
7 CERTIFICATION DATA

Valve type	DPZA		DPZA/**M**
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**
Solenoid certified code	**OZA-A + ETHA-4**		**OZAM-A + ETHAM**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db •PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb
Temperature class	**T4**	**T3**	**-**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C
Mechanical construction Flameproof enclosure Ex d	EN 60079-0, EN 60079-1		
Cable entrance: threaded connection	**GK** = GK-1/2” **M** = M20x1,5 **NPT** = 1/2” NPT		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

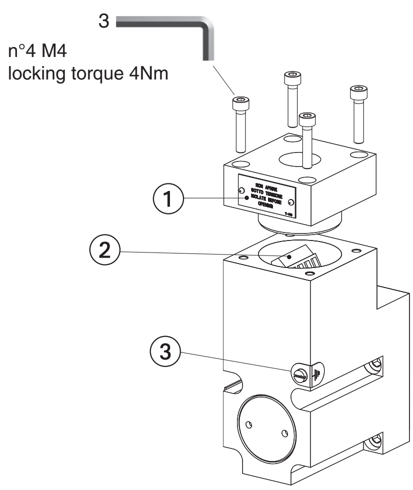
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX PROOF SOLENOIDS AND TRANSDUCERS WIRING



SOLENOID

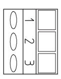
① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ standard manual override
④ screw terminal for additional equipotential grounding



TRANSDUCER

① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ screw terminal for additional equipotential grounding

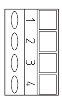
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

SOLENOID - Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	**Goup II**	**Goup I**	**Goup II**	**Goup I**	**Goup II**
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

TRANSDUCER - Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	**Goup II**	**Goup I**	**Goup II**	**Goup I**	**Goup II**
40 °C	N.A.	T6	150 °C	85 °C	-	-
70 °C	N.A.	T6	150 °C	85 °C	90 °C	90 °C

10 **CABLE GLANDS**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **OPTIONS**

B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve

D and **E** = Pilot and drain configuration can be modified as shown in section 13.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

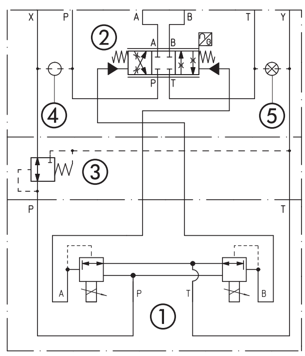
Option /D Internal drain.

Option /E External pilot (through port X).

11.1 Possible combined options: /BC, /BD, /BE, /CD, /CE, /DE

FUNCTIONAL SCHEME

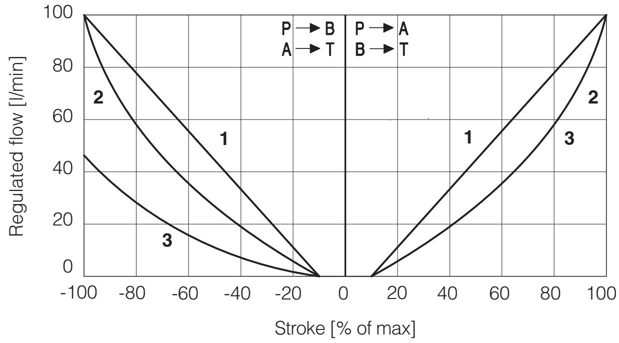
example of configuration 7*
3 positions, spring centered



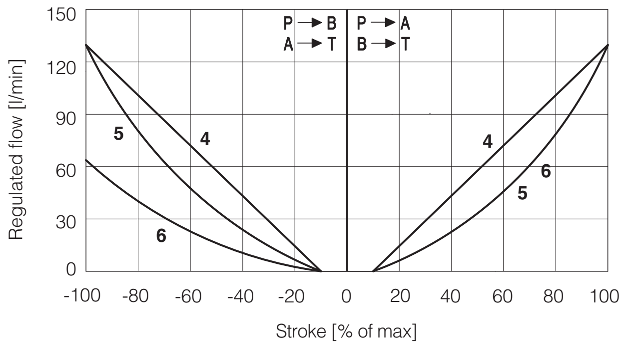
① Pilot valve ② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

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

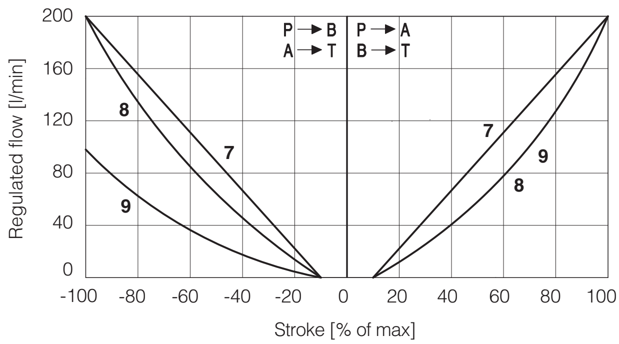
Regulation diagrams (values measure at Δp 10 bar P-T)



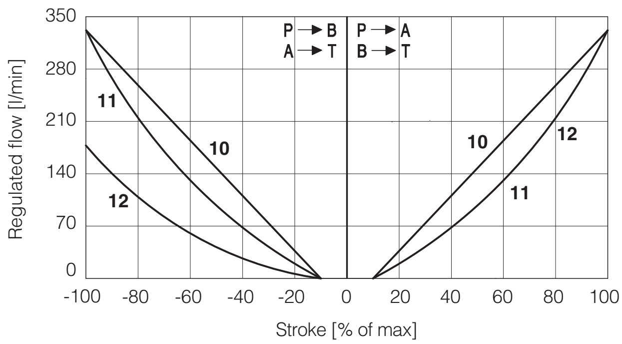
DPZA-1:
1 = L5 **2** = S5 **3** = D5



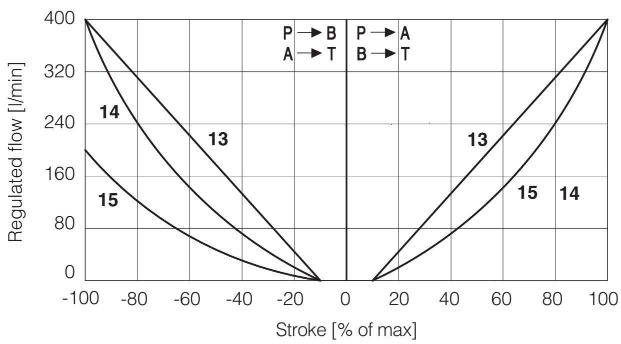
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

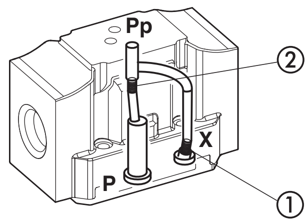
Reference signal $\left.\begin{matrix} 0 \div +10\ \text{V} \\ 12 \div 20\ \text{mA} \end{matrix}\right\}$ P → A / B → T

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

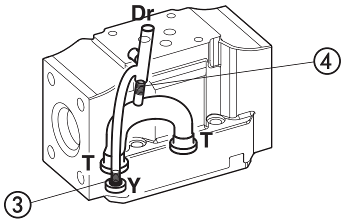
13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

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

DPZA-1 Pilot channels

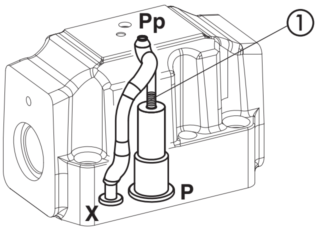


Drain channels

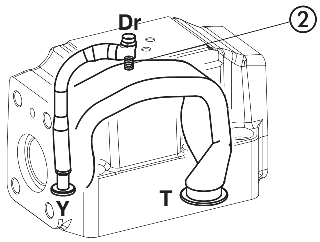


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels

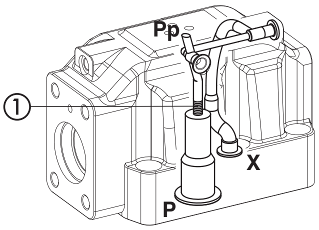


Drain channels

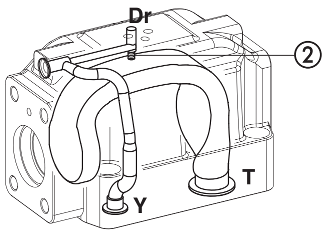


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels

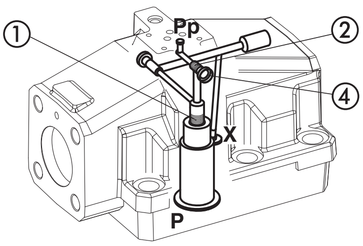


Drain channels

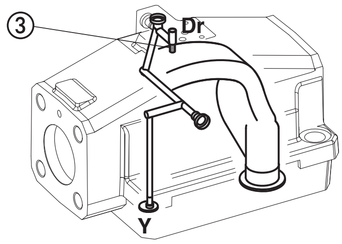


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-6 Pilot channels



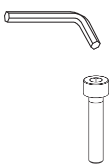
Drain channels



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.

To reach the orefice ② remove plug ④ = G1/8"

14 FASTENING BOLTS AND SEALS

	DPZA-1	DPZA-2	DPZA-4	DPZA-6
	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	**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	**Fastening bolts:** 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm
	**Seals:** 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)	**Seals:** 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)	**Seals:** 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)	**Seals:** 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)

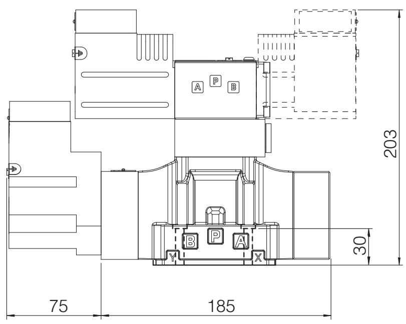
15 INSTALLATION DIMENSIONS FOR DPZA [mm]

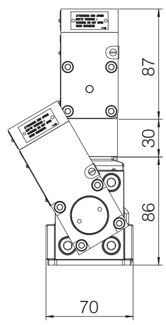
DPZA-1

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

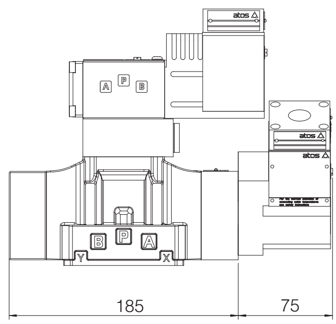
Mass [kg]	
DPZA-*-15*	10,4
DPZA-*-17*	11,8

DPZA-T-15*
DPZA-T-17* (dotted line)





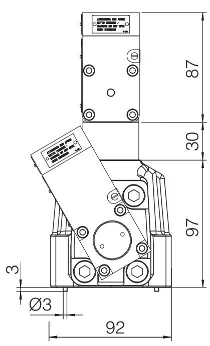
DPZA-T-15* /B



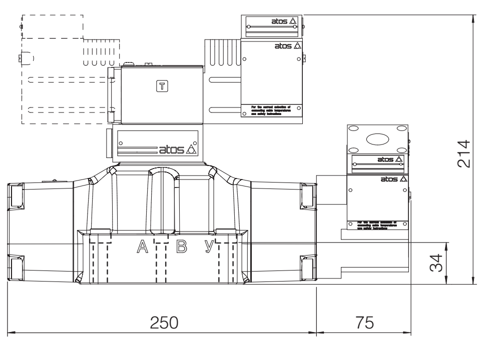
DPZA-2

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

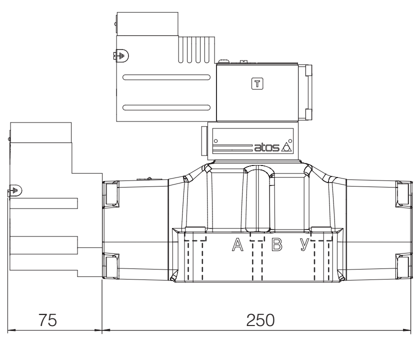
Mass [kg]	
DPZA-*-25*	13,3
DPZA-*-27*	14,7



DPZA-T-25*
DPZA-T-27* (dotted line)



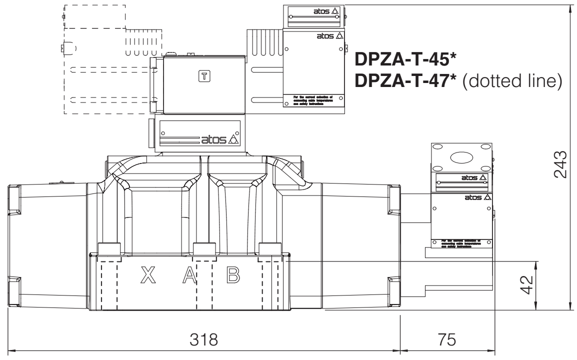
DPZA-T-25* /B

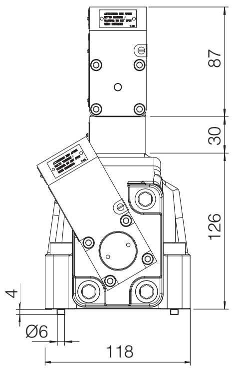


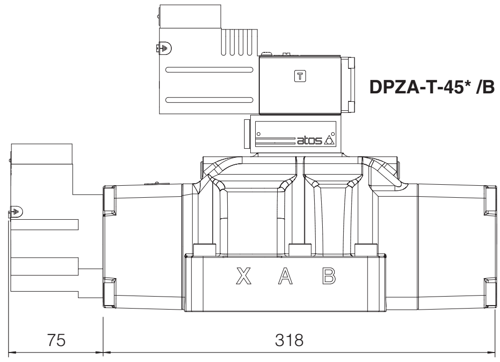
DPZA-4

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

Mass [kg]	
DPZA-*-45*	20,8
DPZA-*-47*	22,2



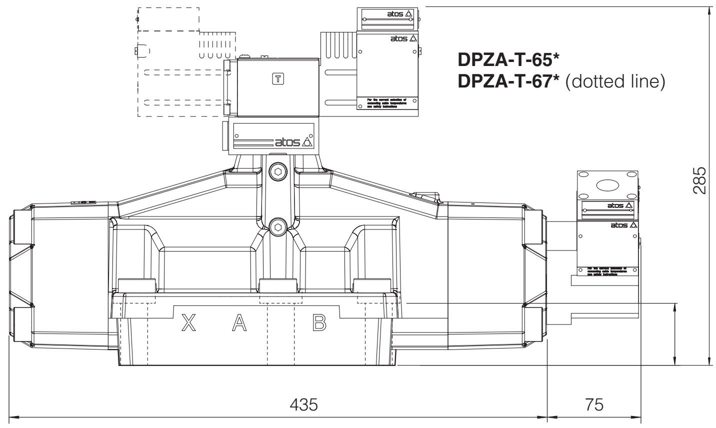


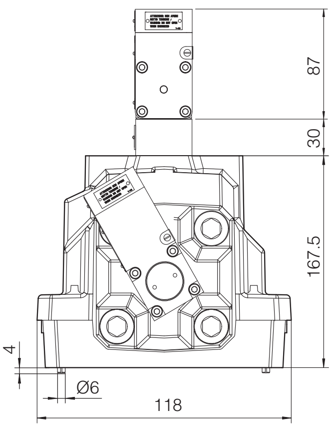


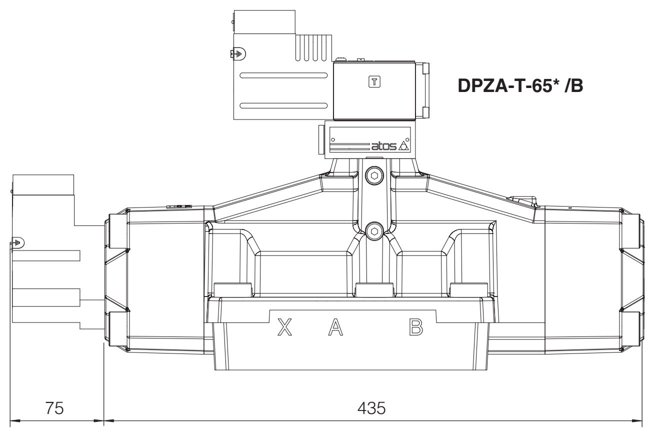
DPZA-6

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

Mass [kg]	
DPZA-*-65*	47,3
DPZA-*-67*	48,7





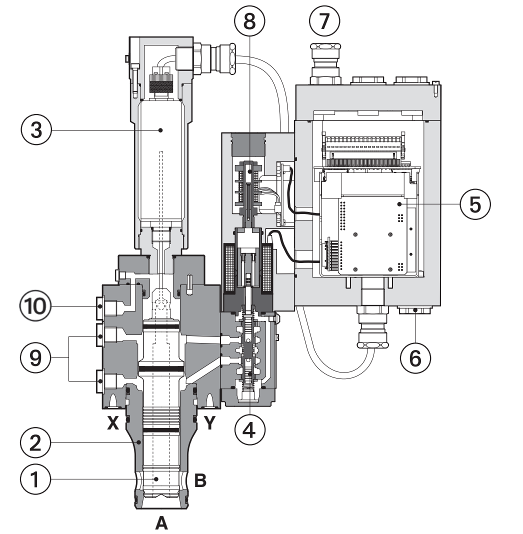


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional 2-way cartridges high performance

piloted, with on-board driver and two LVDT transducers - **ATEX and IECEx**



① poppet
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof on-board digital driver
⑥ USB connector
⑦ ex-proof cable gland (to be ordered separately)
⑧ ex-proof solenoid with LVDT position transducer
⑨ air bleeding
⑩ air suction port

LIQZA-LES-SN-NP-322*

LIQZA-LES

Ex-proof digital proportional 2-way cartridges, high performance with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof on-board digital driver,LVDT transducers and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducers, prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **100** - ISO 7368

Max flow: **1200** ÷ **16000 l/min**

Max pressure: **420 bar**

1 MODEL CODE

LIQZA	-	LES	-	SN	-	NP	-	25	2	L4	/	M	/	*	*	/	*

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Series number

Ex-proof proportional cartridge

Electronic options:
I = current reference input and monitor 4÷20 mA (omit for std voltage 0÷10 VDC)

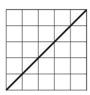
LES = on-board driver and two LVDT transducers

Cable entrance threaded connection:
M = M20X1,5

Alternated P/Q controls:
SN = none

Spool type, regulating characteristics:

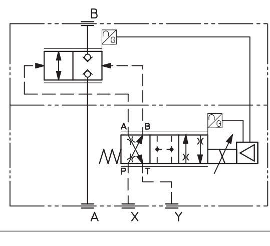
L4 = linear



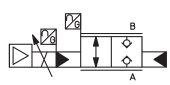
Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT
EW = POWERLINK
EI = EtherNet/IP
EP = PROFINET RT/IRT

Configuration: 2 = 2 way

functional symbol



simplified symbol



Valve size and nominal flow (l/min) at Δp 5 bar:
25=500
32=800
40=1200
50=2000
63=3000
80=4500
100=7200

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 **FX900** and in the user manuals included in the E-SW-* programming software.

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

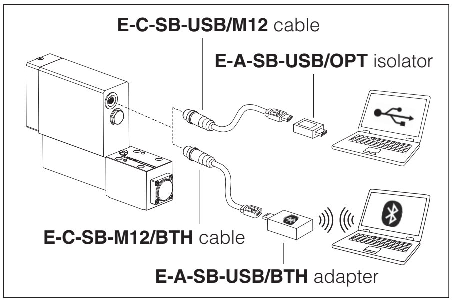
WARNING: the below operation must be performed in a safety area

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 **GS003**).
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)		

USB or Bluetooth connection



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: Bluetooth adapter is available only for European, USA and Canadian markets!
Bluetooth adapter is certified according RED (Europe), FCC (USA) and ISED (Canada) directives

4 FIELDBUS - see tech. table GS510

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

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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		**25**	**32**	**40**	**50**	**63**	**80**	**100**
Max regulated flow	[l/min]							
Δp A-B at Δp = 5 bar		500	800	1200	2000	3000	4500	7200
Δp A-B at Δp = 10 bar		700	1100	1700	2800	4250	6350	10200
Max permissible flow		1200	1800	2500	4000	6000	10000	16000
Max pressure	[bar]	Ports A, B = **420** X = 350 Y ≤ 10						
Nominal flow of pilot valve at Δp = 70 bar	[l/min]	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar	[l/min]	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]	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)**	[l/min]	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)**	[ms]	≤ 30	≤ 32	≤ 35	≤ 35	≤ 40	≤ 45	≤ 55
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) 0÷100% step signal
(2) With pilot pressure = 140 bar

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
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)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
Additional characteristics	Short circuit protection of solenoid current supply; spool position 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, 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

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Components type	Pilot valve solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification **ATEX** **IECEx**			
Components Certified code	**OZA-LES**			**ETHA-15**
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X			• ATEX: TUV IT 16 ATEX 053 X • IECEx: IECEx TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db • IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db			• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T6**	**T5**	**T4**	**T6**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5			factory wired

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver solenoid and LVDT transducers are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2	**Grounding:** section of external ground wire = 4 mm^2

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 **CABLE GLANDS**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

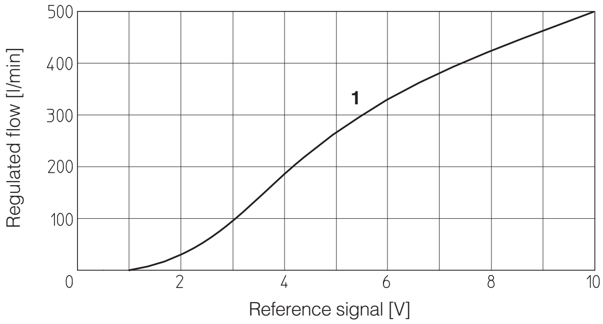
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 **ELECTRONIC OPTIONS**

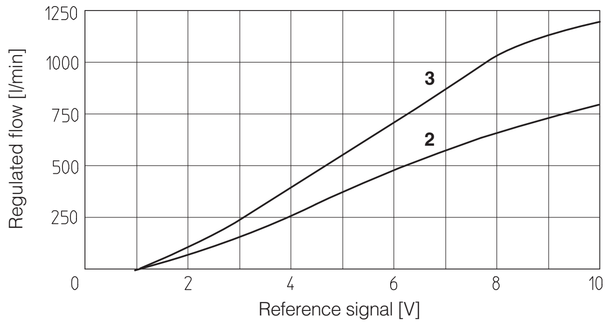
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

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

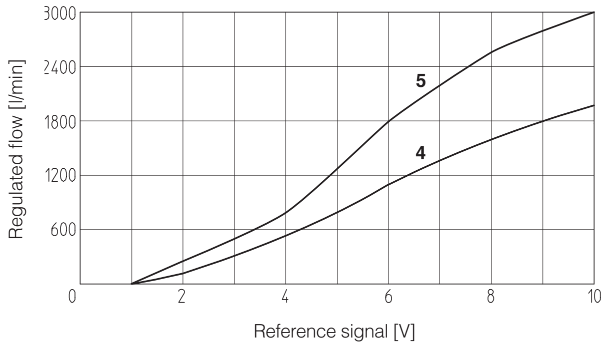
13.1 Regulation diagrams (values measured at Δp 5 bar)



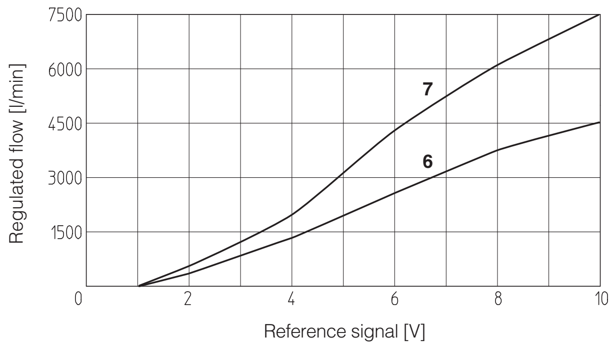
1 = LIQZA-LES-25*



2 = LIQZA-LES-32* **3** = LIQZA-LES-40*



4 = LIQZA-LES-50* **5** = LIQZA-LES-63*



6 = LIQZA-LES-80* **7** = LIQZA-LES-100*

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, EN-982).

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.

⚠ 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)

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 3 and 4, 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)

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 ÷ 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.

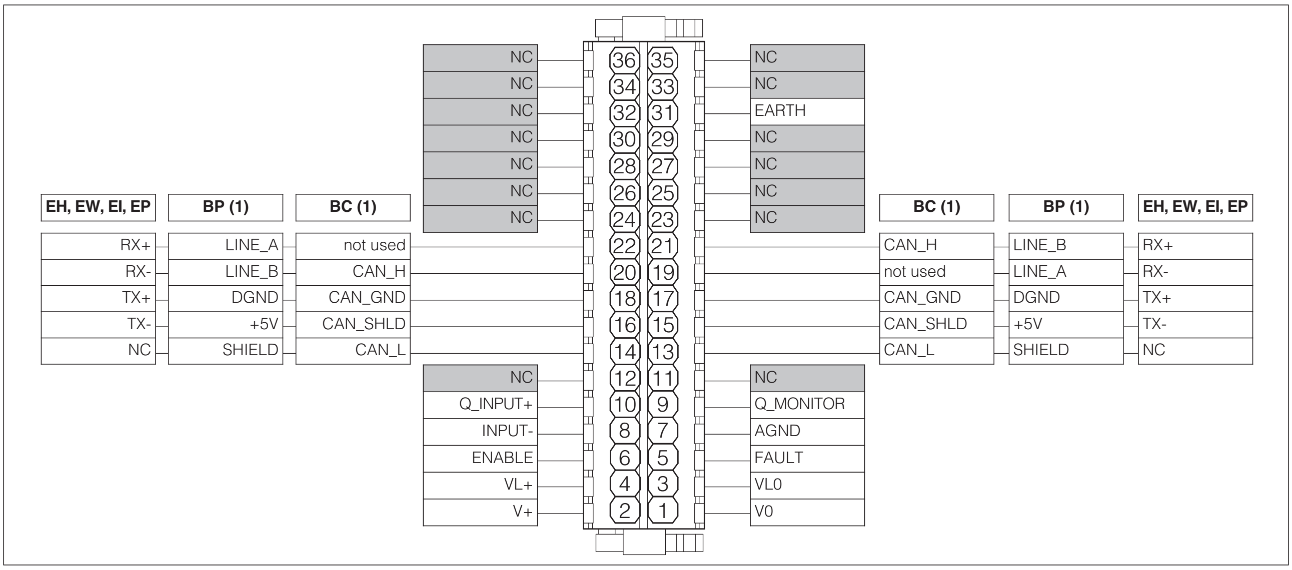
14.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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 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.

15 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

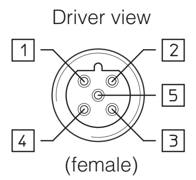
16 ELECTRONIC CONNECTIONS

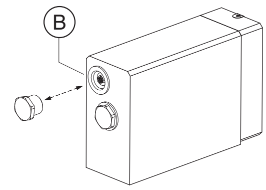
16.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: 0 ÷ 10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: 0 ÷ 10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

16.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





16.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

16.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

16.5 EH, EW, EI, EP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

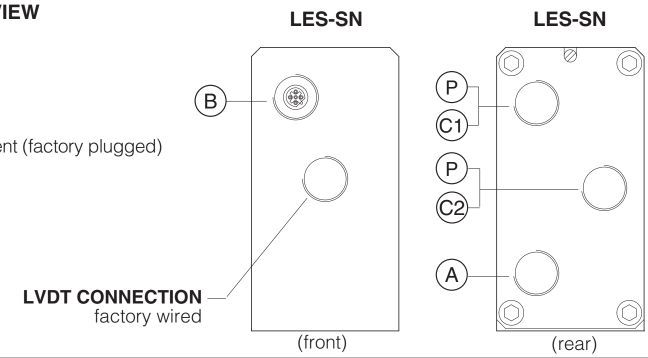
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

17 POWER SUPPLY AND SIGNALS SPECIFICATIONS

CABLE ENTRANCE OVERVIEW

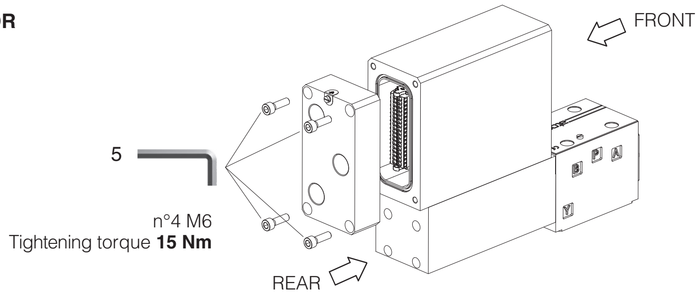
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (P) threaded plug



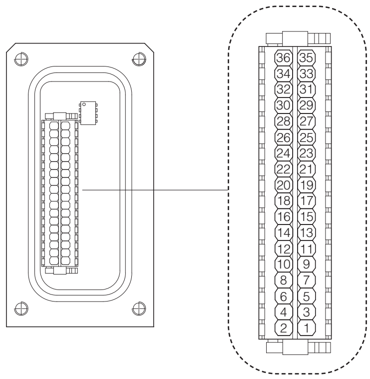
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

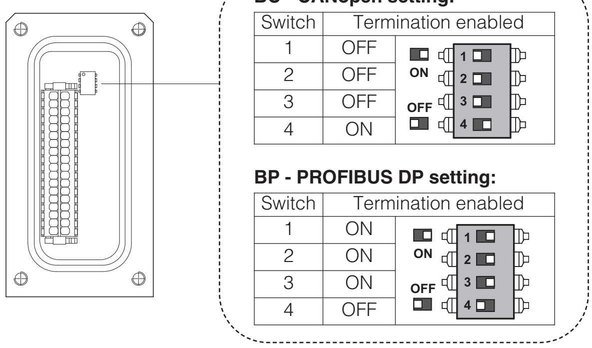


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 15



Fieldbus terminator only for BC and BP executions **(1)**



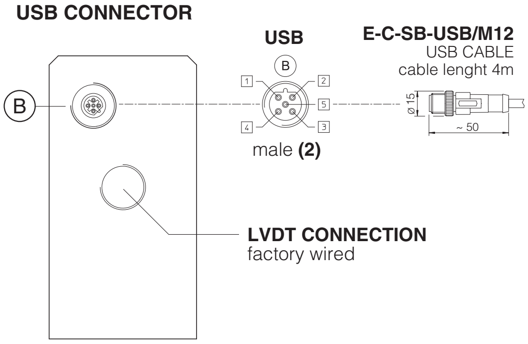
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

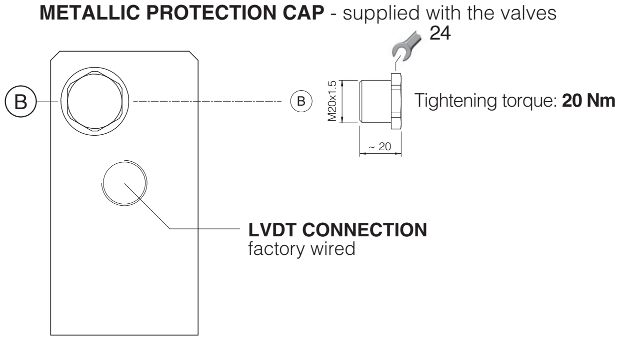
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR



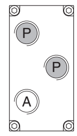
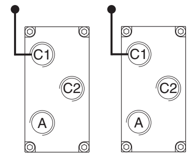
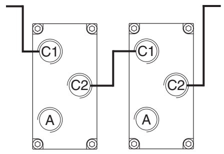
METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

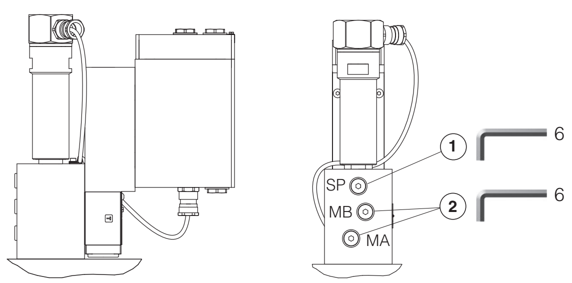
(2) Pin layout always referred to driver's view

17.1 Cable glands and threaded plug - see tech table **KX800**

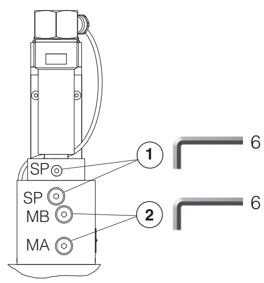
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

18 AIR BLEEDING

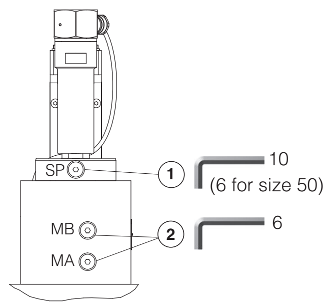
Size 25



Sizes 32, 40



Sizes 50 to 100



(1) **Air suction port (SP):**

N° 1 plug G1/4" for sizes 25 to 50
N° 1 plug G1/2" for sizes 63 to 100

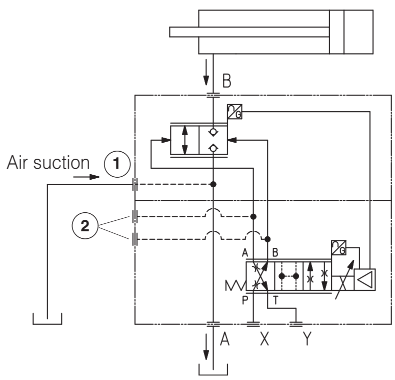
To be used only in case port A is connected to tank and subjected to negative pressure, consult our technical office.

(2) **Air bleeding (MA, MB):**

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.

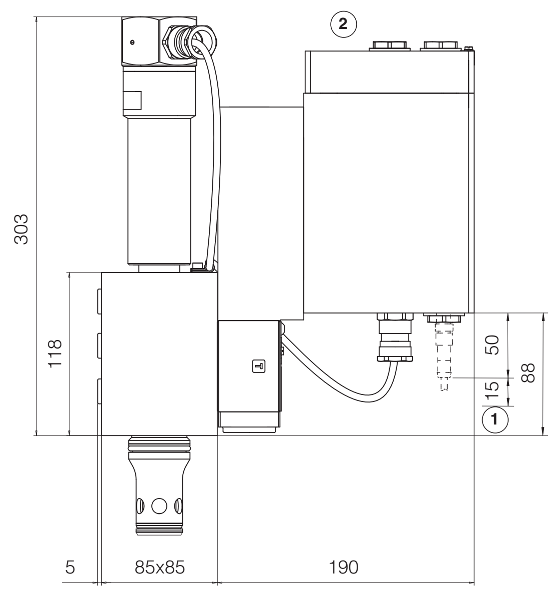


19 FASTENING BOLTS AND VALVE MASS

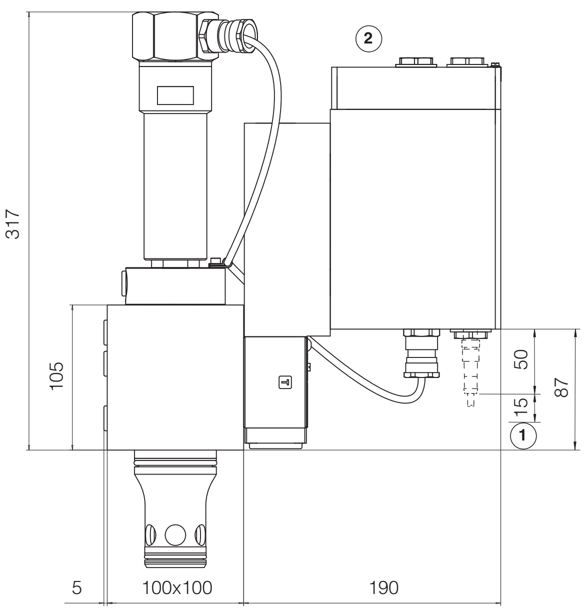
Type	Size	**Fastening bolts** (supplied with the valve)	Mass [kg]
LIQZA	**25**	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	15,2
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	18
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	23,7
	50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	31
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	51
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	78,6
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	130

20 INSTALLATION DIMENSIONS [mm]

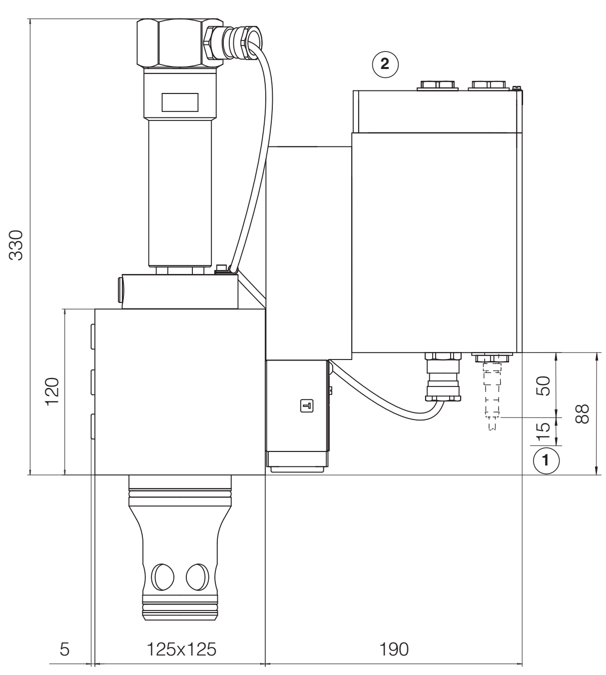
LIQZA-LES-252



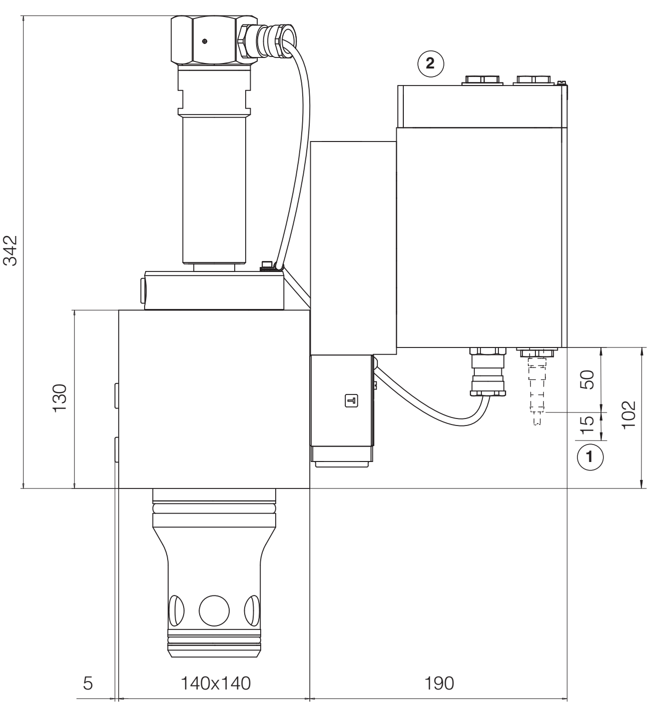
LIQZA-LES-322



LIQZA-LES-402



LIQZA-LES-502

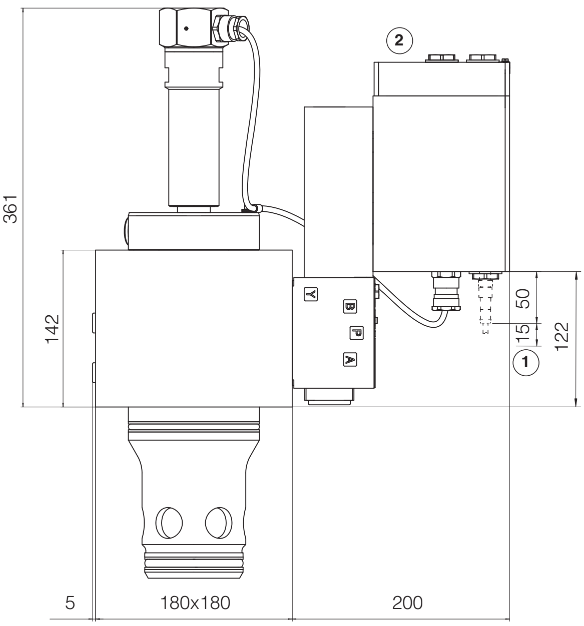


1 = Space to remove the USB connector

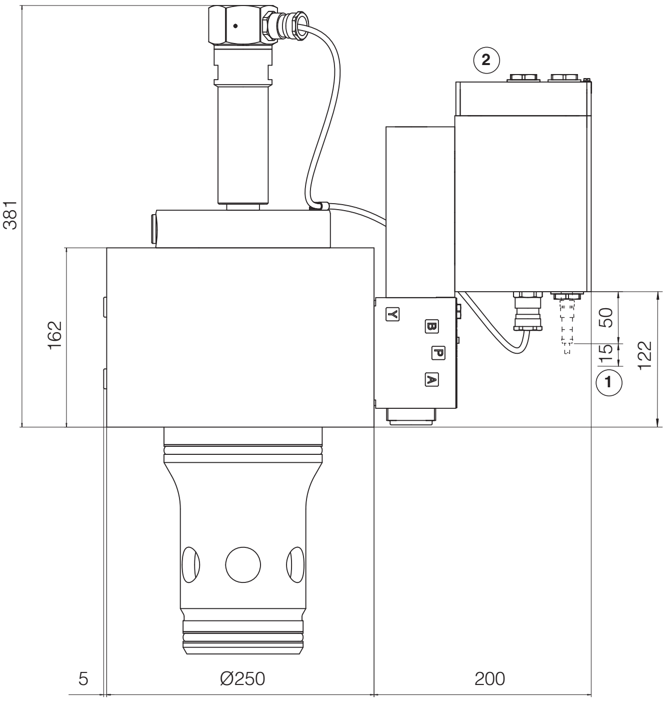
2 = The dimensions of all cable glands must be considered (see tech. table KX800)

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

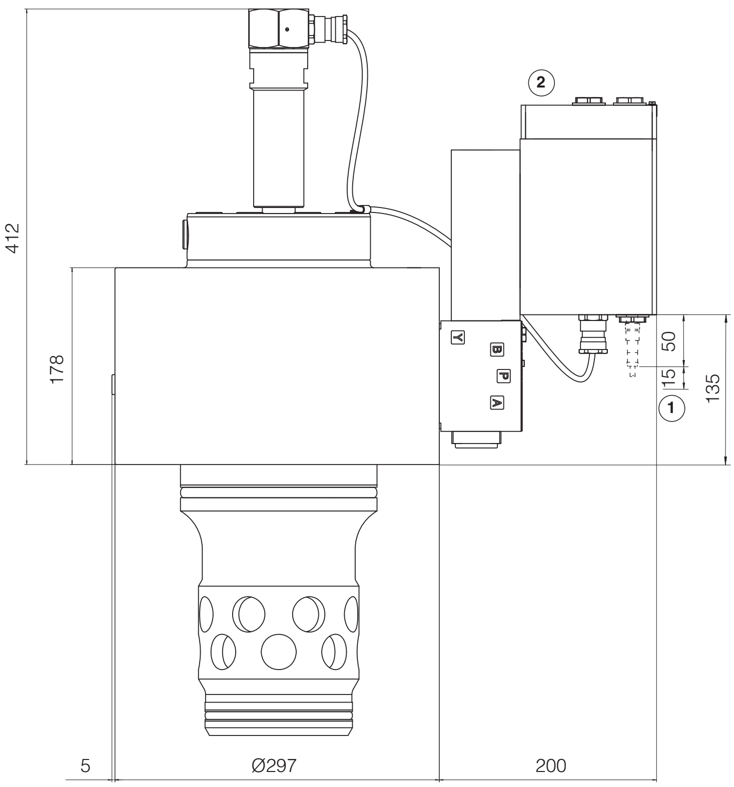
LIQZA-LES-632



LIQZA-LES-802



LIQZA-LES-1002



(1) = Space to remove the USB connector

(2) = The dimensions of all cable glands must be considered (see tech. table KX800)

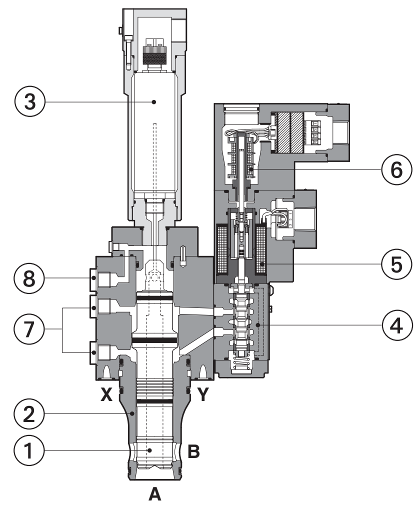
Note: for mounting surface and cavity dimensions, see table P006

21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P006**	Mounting surfaces and cavities for cartridge valves
GS500	Programming tools		

Ex-proof proportional 2-way cartridges high performance

piloted, with two LVDT transducers - **ATEX and IECEx**



① poppet
② sleeve
③ ex-proof LVDT position transducer (main stage)
④ proportional ex-proof pilot valve
⑤ ex-proof solenoid
⑥ ex-proof LVDT position transducer (pilot valve)
⑦ air bleeding
⑧ air suction port

LIQZA-L-322*

LIQZA-L

Ex-proof digital proportional 2-way cartridges, high performance with two LVDT position transducers (pilot valve and main stage) for best accuracy in not compensated flow regulations.

They are equipped with ex-proof proportional solenoid and LVDT transducers certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)

The flameproof enclosure of solenoid and transducers prevent the propagation of accidental internal sparks or fire to the external environment.
They are designed to limit the surface temperature within the classified limits.

Size: **25** ÷ **100** - ISO 7368
Max flow: **1200** ÷ **16000 l/min**
Max pressure: **420 bar**

1 MODEL CODE

LIQZA	/	*	-	L	-	25	2	L4	/	M	/	*	/	*

Ex-proof proportional cartridge

Certification:
Multicertification ATEX, IECEx:
- = omit for Group II 2G
M = Group I (mining)

L = with two LVDT transducers

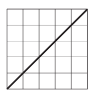
Valve size and nominal flow (l/min) at Δp 5 bar:
25 = 500
32 = 800
40 = 1200
50 = 2000
63 = 3000
80 = 4500
100 = 7200

Series number

Seals material, see section 8:
- = NBR
PE = FKM
BT = HNBR

Solenoid and transducers (main stage and pilot valve) **threaded connection** for cable gland fitting:
GK = GK-1/2" **(1)**
M = M20x1,5
NPT = 1/2" NPT

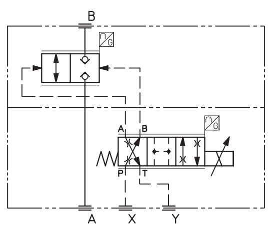
Poppet type, regulating characteristics:



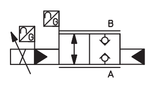
L4 = linear

Configuration: 2 = 2 way

functional symbol



simplified symbol



(1) Approved only for the italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-LEB-* /A	E-BM-LES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	GS230	GS240

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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	100
Max regulated flow [l/min] Δp A-B at Δp = 5 bar	500	800	1200	2000	3000	4500	7200
Max regulated flow [l/min] Δp A-B at Δp = 10 bar	700	1100	1700	2800	4250	6350	10200
Max permissible flow	1200	1800	2500	4000	6000	10000	16000
Max pressure [bar]	Ports A, B = **420** X = 350 Y ≤ 10						
Nominal flow of pilot valve at Δp = 70 bar [l/min]	8	20	40	40	100	100	100
Leakage of pilot valve at P = 100 bar [l/min]	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 [cm^3]	2,2	7,0	9,4	17,7	32,5	39,5	49,5
Piloting flow **(1)** [l/min]	5,3	14	19	35,5	56	60	60
Response time 0 ÷ 100% step signal **(2)** [ms]	≤ 30	≤ 32	≤ 35	≤ 35	≤ 40	≤ 45	≤ 55
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) 0÷100% step signal
(2) With pilot pressure = 140 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W
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 with relevant cable gland	IP66/67 to DIN EN60529
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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 ÷ +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
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

⚠ **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.

7 CERTIFICATION DATA

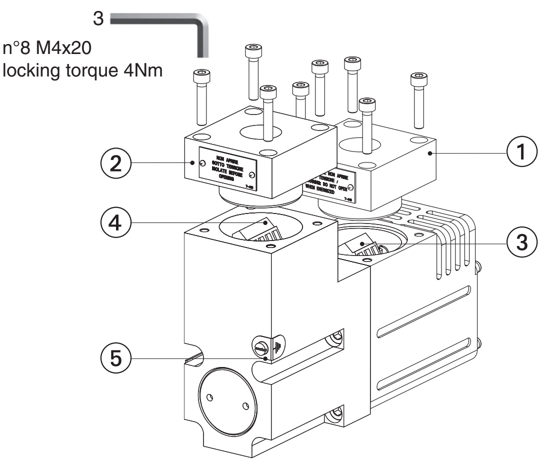
Valve type	LIQZA		LIQZA**/M**	LIQZA, LIQZA**/M**
Component type	Pilot solenoid and LVDT transducer			LVDT main stage transducer
Certifications	Multicertification Group II **ATEX IECEx**		Multicertification Group I **ATEX IECEx**	Multicertification Group I and II **ATEX IECEx**
Solenoid certified code	**OZA-T**		**OZAM-T**	**ETHA-15**
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	ATEX: TUV IT 16 ATEX 053X ICEX: IECEX TPS 16.0003X
Method of protection	• ATEX Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T85°C/T200°C Db		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• ATEX Ex II 2G Ex db IIC T6 Gb Ex II 2D Ex tb IIIC T85°C Db Ex I M2 Ex db IMb • IECEx Ex db IIC T6 Gb Ex tb IIIC T85°C Db Ex db IMb
Temperature class	**T4**	**T3**	**-**	**T6**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 85 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +70 °C **(3)**
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code
(3) For Group I (mining) the temperaturerange is -20°C ÷ +70°C

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

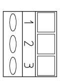
8 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Pilot valve solenoid and LVDT transducer



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

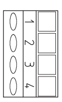
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

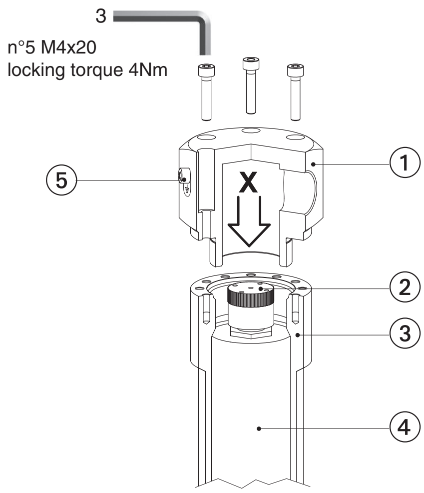
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

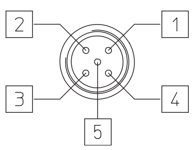
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

LVDT main stage transducer



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply +15 V
3 = GND
4 = Output signal
5 = Supply -15 V

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2
Main LVDT transducer: section of cable connection wires = 1 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]		
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II	LVDT main stage
40 °C	-	T4	150 °C	135 °C	-	90 °C	-
60 °C	-	-	150 °C	-	110 °C	-	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C	90°C

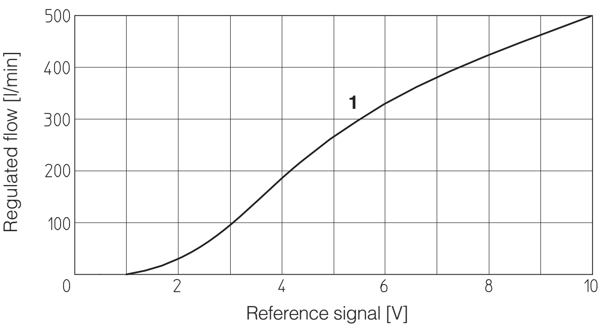
10 CABLE GLANDS

Cable glands with threaded connections GK-1/2”, 1/2”NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

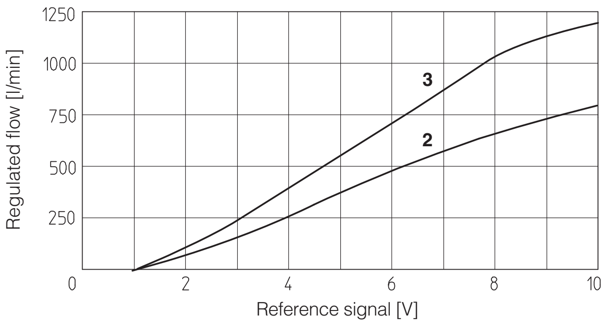
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

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

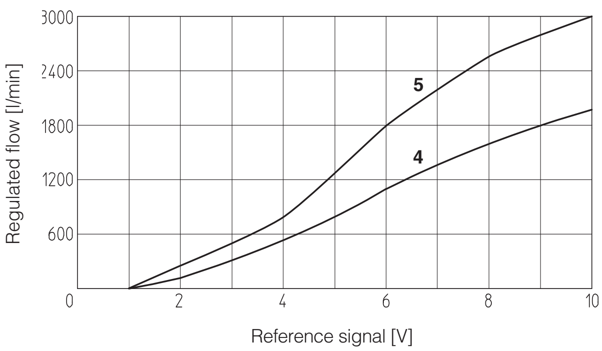
11.1 Regulation diagrams (values measured at Δp 5 bar)



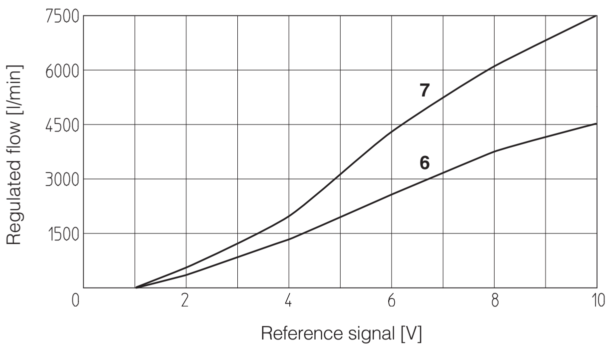
1 = LIQZA-L-25*



2 = LIQZA-L-32* **3** = LIQZA-L-40*



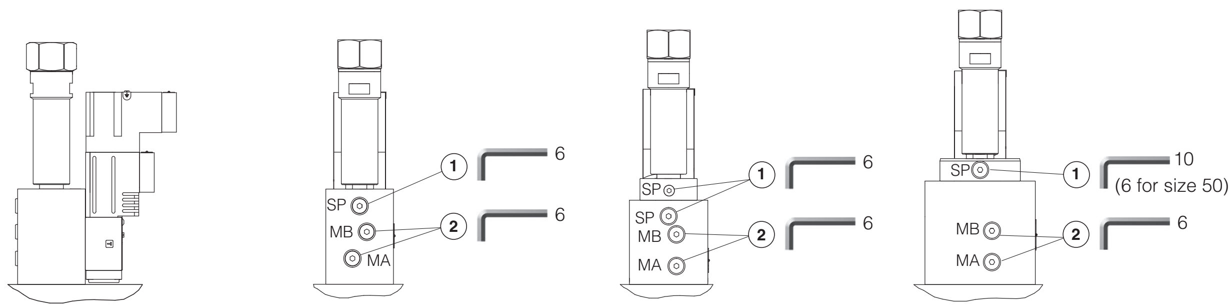
4 = LIQZA-L-50* **5** = LIQZA-L-63*

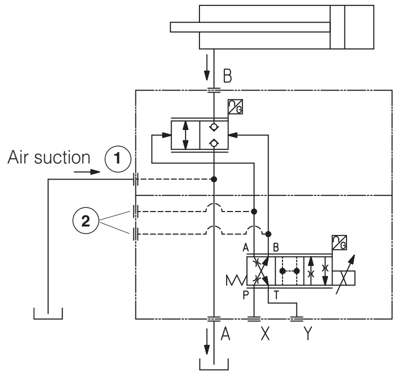


6 = LIQZA-L-80* **7** = LIQZA-L-100*

12 AIR BLEEDING

Size 25 **Sizes 32, 40** **Sizes 50 to 100**





(1) **Air suction port (SP):**

N° 1 plug G1/4” for sizes 25 to 50
N° 1 plug G1/2” for sizes 63 and 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 (MA, MB):**

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.

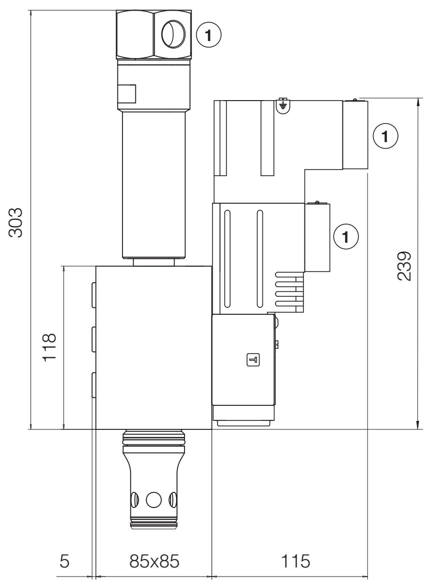
Operate the valve for few seconds at low pressure and then lock the plugs.

13 FASTENING BOLTS AND VALVE MASS

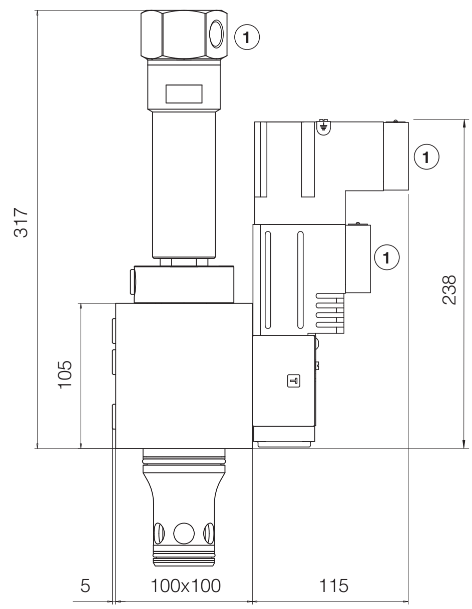
Type	Size	**Fastening bolts** (supplied with the valve)	Mass [kg]
	25	4 socket head screws M12x100 class 12.9 Tightening torque = 125 Nm	12
	32	4 socket head screws M16x60 class 12.9 Tightening torque = 300 Nm	14,8
	40	4 socket head screws M20x70 class 12.9 Tightening torque = 600 Nm	20,5
LIQZA	**50**	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	22,8
	63	4 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	48,1
	80	8 socket head screws M24x80 class 12.9 Tightening torque = 1000 Nm	75,7
	100	8 socket head screws M30x120 class 12.9 Tightening torque = 2100 Nm	127,1

14 **INSTALLATION DIMENSIONS [mm]**

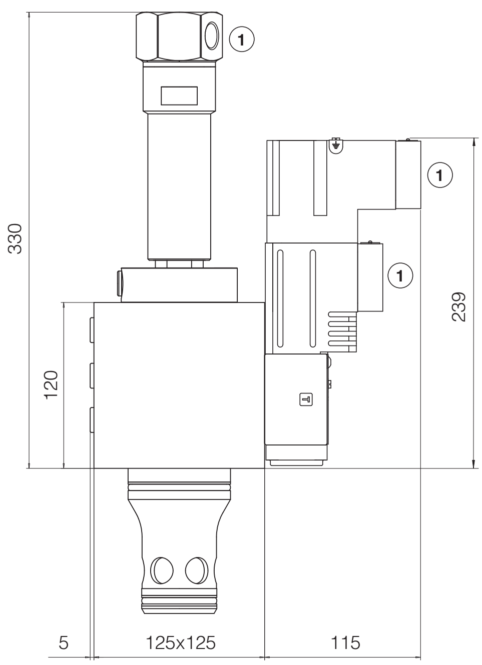
LIQZA-L-252



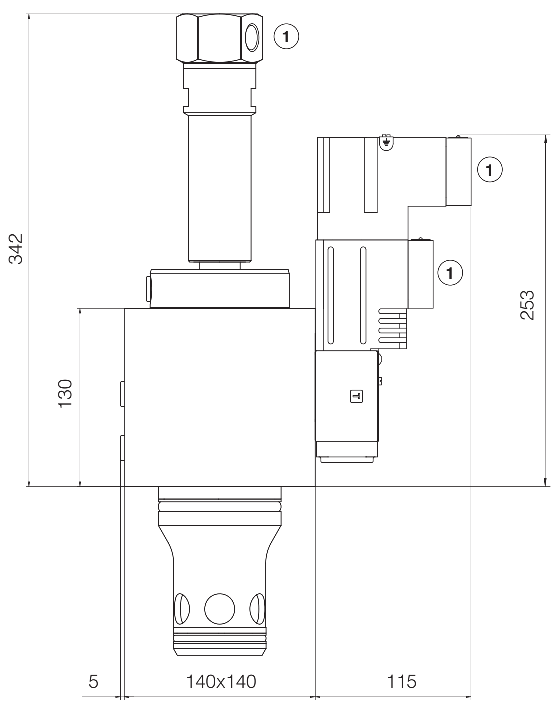
LIQZA-L-322



LIQZA-L-402



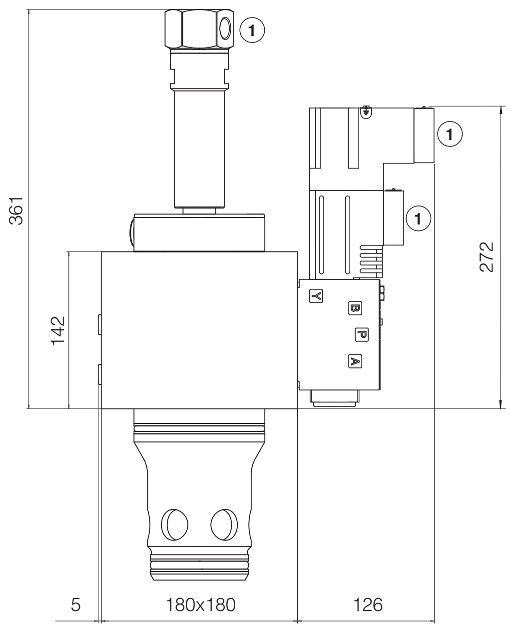
LIQZA-L-502



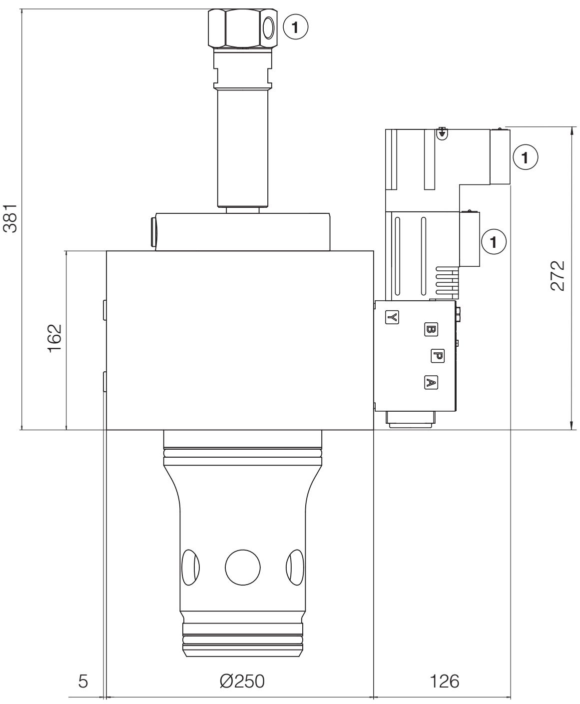
1 = The dimensions of all cable glands must be considered (see tech. table **KX800**)

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

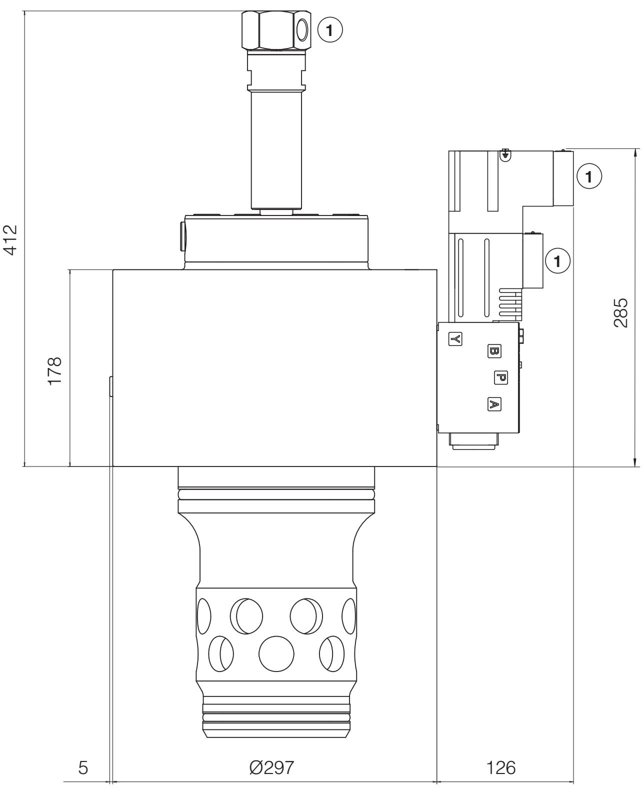
LIQZA-L-632



LIQZA-L-802



LIQZA-L-1002



(1) = The dimensions of all cable glands must be considered (see tech. table **KX800**)

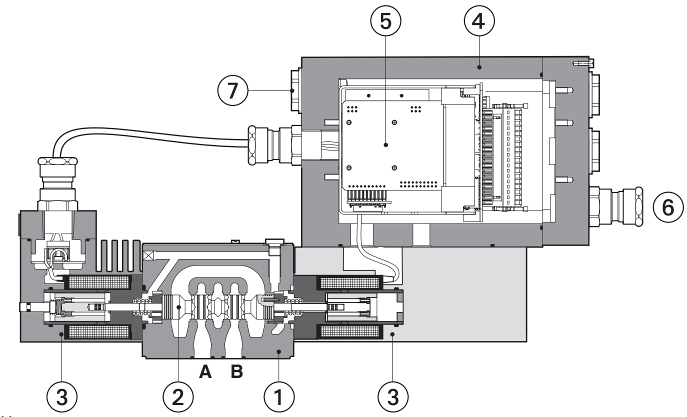
Note: for mounting surface and cavity dimensions, see table P006

15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**KX800**	Cable glands for ex-proof valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**P006**	Mounting surfaces and cavities for cartridge valves
FX900	Operating and manintenance information for ex-proof proportional valves		

Ex-proof digital proportional directional valves

direct, with on-board driver, without transducer and with positive spool overlap **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

DKZA-AES-NP-17*

DHZA-AES, DKZA-AES

Ex-proof digital proportional valves direct, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

DHZA:	**DKZA**:
Size: **06** -ISO 4401	Size: **10** -ISO 4401
Max flow: **60 l/min**	Max flow: **120 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	AES	-	NP	-	0	71	-	L	5	/	M	/	*	*	/	*

Ex-proof proportional directional valves, direct
DHZA = size 06
DKZA = size 10

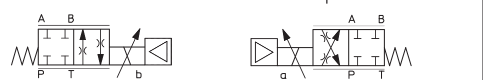
AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

51 =



53 =

71 =

73 =

Seals material, see section 8:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

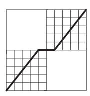
Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 V_{DC})
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 V_{DC})
W = power limitation function

Cable entrance threaded connection:
M = M20x1,5

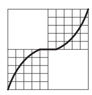
Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

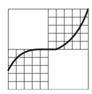
Spool type, regulating characteristics:



L = linear



S = progressive



D = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) For possible combined options, see section 14
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

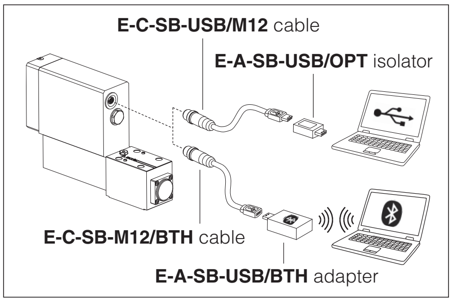
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

4 FIELDBUS - see tech. table GS510

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

5 GENERAL CHARACTERISTICS

Assembly position	Horizontal position only
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; 150 years only for RZMA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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

Valve model		DHZA						DKZA		
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**					**70**	**51, 53, 71, 73**		**70**
Spool type		**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**L5**	**L3,S3,D3**	**L5,S5,D5**	**L3,L5,D5**
Nominal flow [l/min]										
Δp P-T	Δp= 10 bar	1	4,5	8	18	28		45	60	
	Δp= 30 bar	1,7	8	14	30	50		80	100	
Max permissible flow		2,6	12	21	40	60		90	120	
Δp max P-T [bar]		70	70	70	50	50		40	40	
Response time [ms] **(1)**		≤ 35						≤ 45		
Leakage [cm^3/min]		<30 (at P = 100 bar); <135 (at P = 350 bar)						<80 (at P = 100 bar); <600 (at P = 315 bar)		
Hysteresis		≤ 5 [% of max regulation]								
Repeatability		± 1 [% of max regulation]								

(1) 0 ÷ 100% step signal

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ			
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 /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
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)			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
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

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

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 ÷ +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
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X			• IECEx: IECEx TPS 19.0004X	
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db			• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31	
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

10 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2	**Grounding:** section of external ground wire = 4 mm^2

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 **CABLE GLANDS**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 **HYDRAULIC OPTIONS**

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

13 **ELECTRONIC OPTIONS**

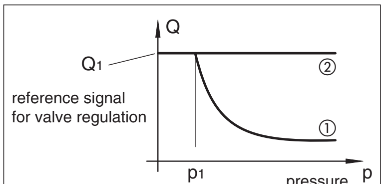
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 V_{DC}. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ±20 mA. It is normally used in case of long distance between the machine control unit and 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.

C = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10V_{DC} .Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ±20 mA.

W = Only for valves coupled with pressure compensator type HC-011 or KC-011 (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**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), 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 - option /W



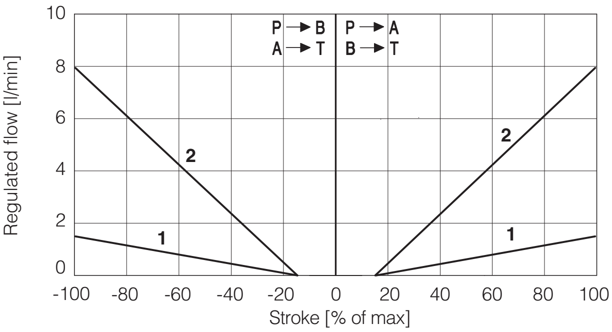
Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

14 **POSSIBLE COMBINED OPTIONS**

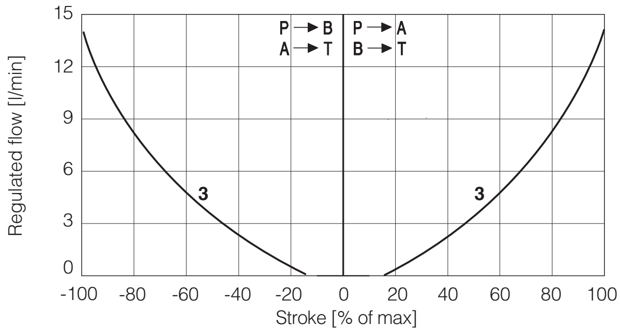
/BI, /BW, /BY, /IW, /IY, /WY, /BIW, /BIY, /BWY, /IWY, /CWB, /CWY,
/BIWY, /CWBY

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

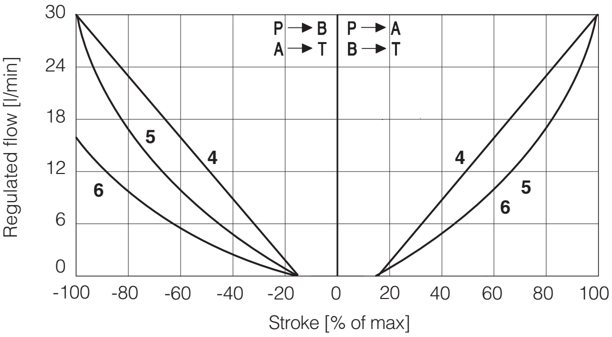
15.1 Regulation diagrams - values measure at Δp 30 bar P-T



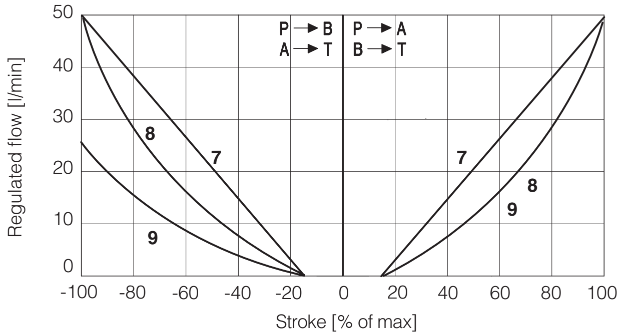
DHZA **1** = L14 **2** = L1



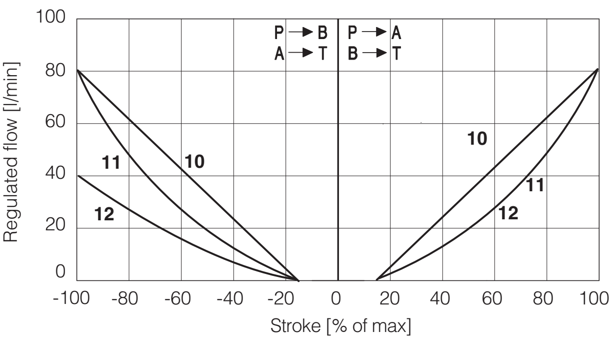
DHZA **3** = S2



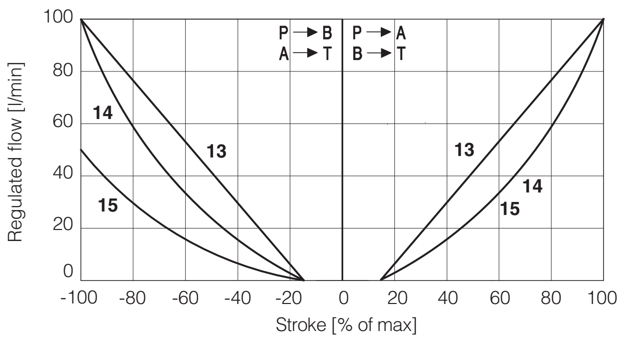
DHZA **4** = L3 **5** = S3 **6** = D3



DHZA **7** = L5 **8** = S5 **9** = D5



DKZA **10** = L3 **11** = S3 **12** = D3



DKZA **13** = L5 **14** = S5 **15** = D5

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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 (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 ÷ 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 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 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

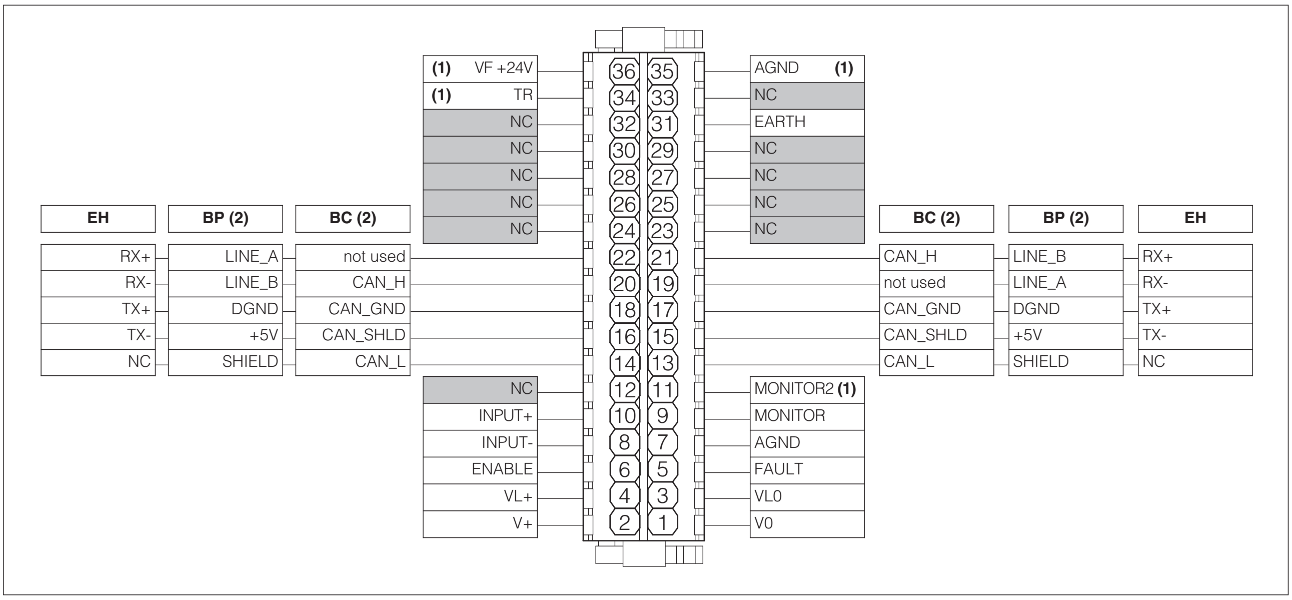
16.6 Fault output signal (FAULT)

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.

16.7 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 valve code, defaults are 0 ÷ 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.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

17 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

18 ELECTRONIC CONNECTIONS

18.1 Main connections signals

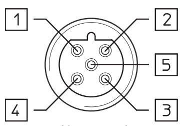
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 VDC maximum range, referred to AGND Default is: ±5 VDC	Output - analog signal **Software selectable**
	10	**INPUT+**	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**
	11	**MONITOR2**	2nd monitor output signal: ±5 VDC maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 VDC	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

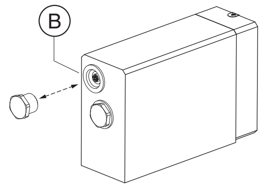
18.2 USB connector - M12 - 5 pin   always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

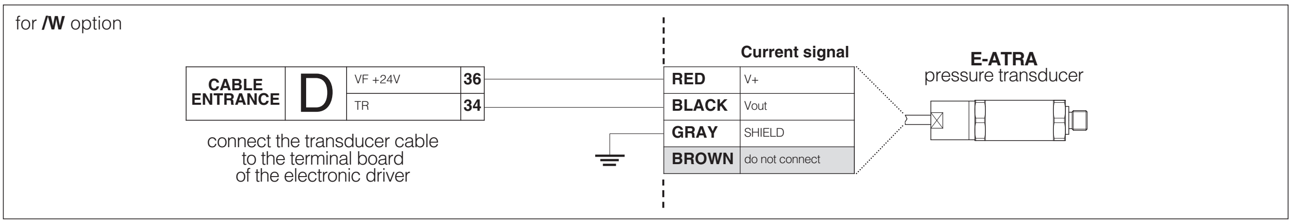
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

18.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**



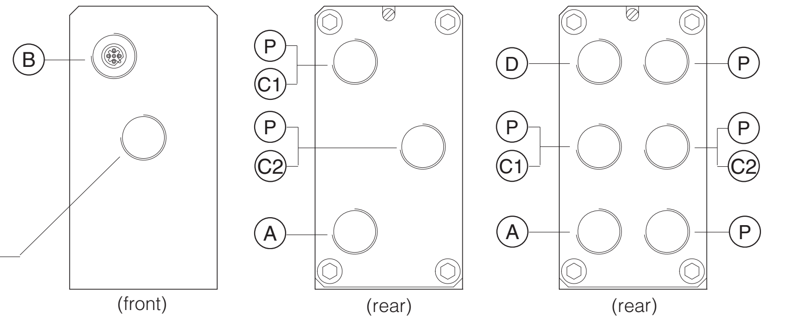
19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

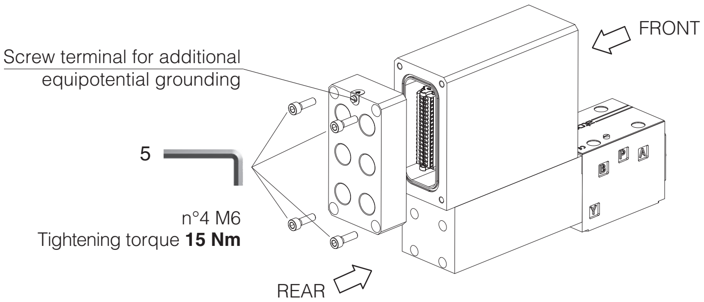
- A main connections
- B USB connector always present (factory plugged)
- C1 fieldbus interface (input)
- C2 fieldbus interface (output)
- D pressure transducer (only /W option)
- P Threaded plug

COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)



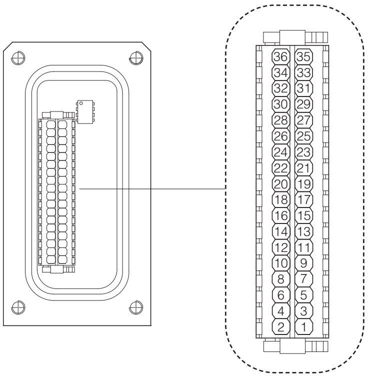
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

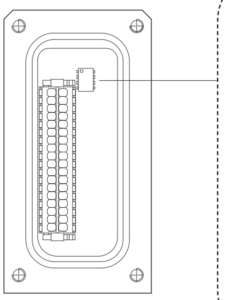


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17



Fieldbus terminator only for BC and BP executions **(1)**



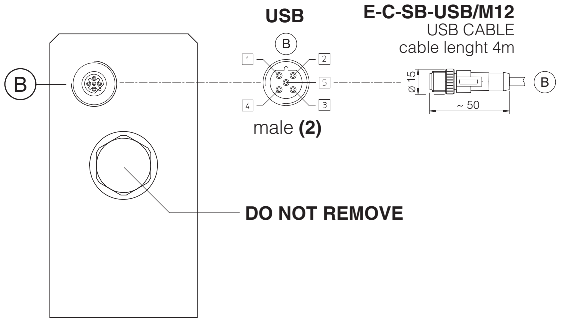
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

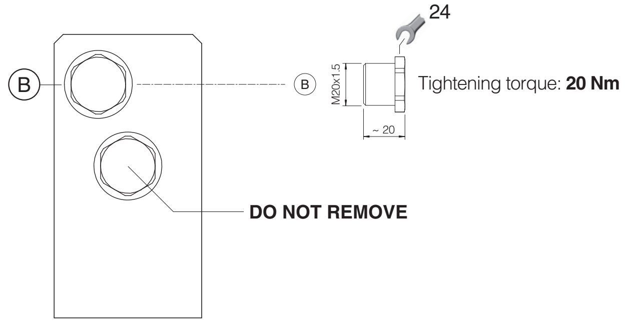
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

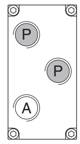
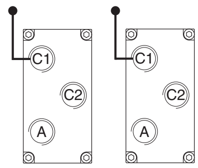
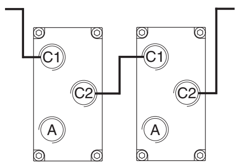


METALLIC PROTECTION CAP - supplied with the valves

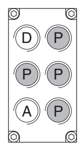
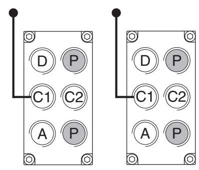
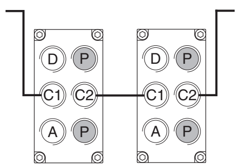


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

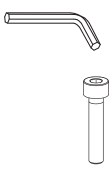
19.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

19.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH "via stub" connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH "daisy chain" connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

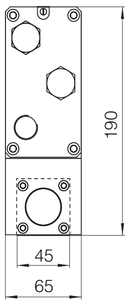
20 FASTENING BOLTS AND SEALS

	DHZA	DKZA
	**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)

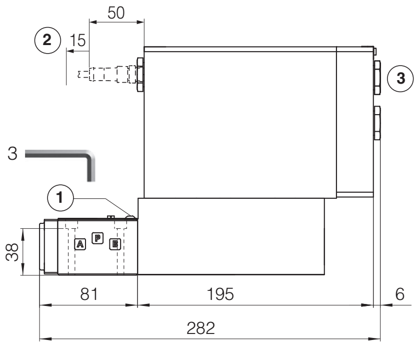
21 INSTALLATION DIMENSIONS FOR DHZA [mm]

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

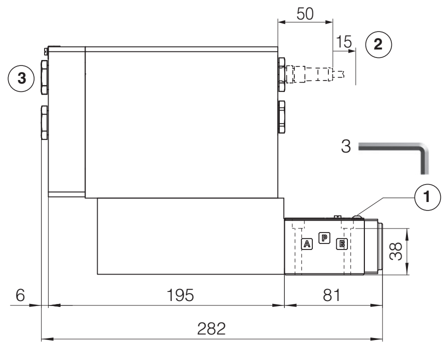
Mass [kg]	
DHZA-AES-05	8,2
DHZA-AES-07	9,9



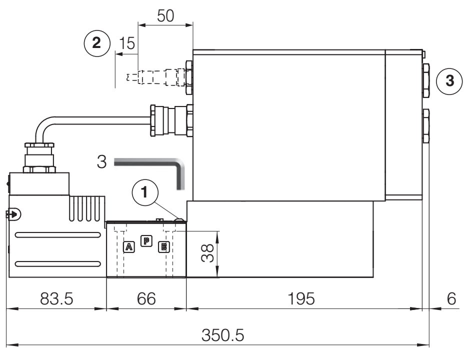
DHZA-AES-05*



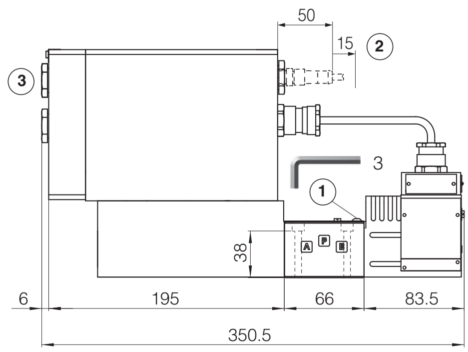
DHZA-AES-05*/B



DHZA-AES-07*



DHZA-AES-07*/B



1 = Air bleed off

2 = Space to remove the USB connector

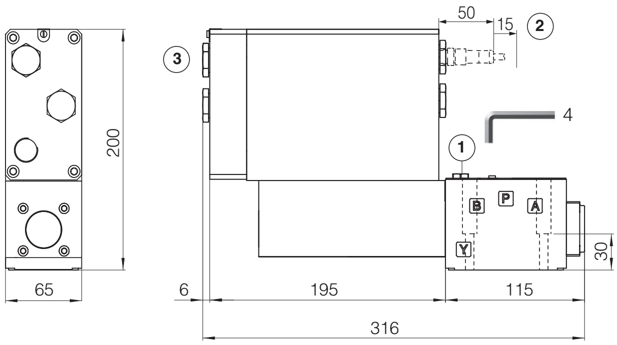
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

22 INSTALLATION DIMENSIONS FOR DKZA [mm]

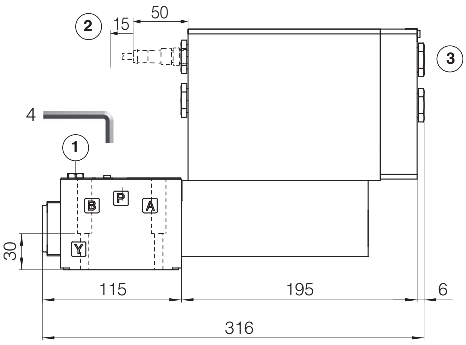
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface: 4401-05-05-0-05 without port X)

Mass [kg]	
DKZA-AES-15	10
DKZA-AES-17	11,7

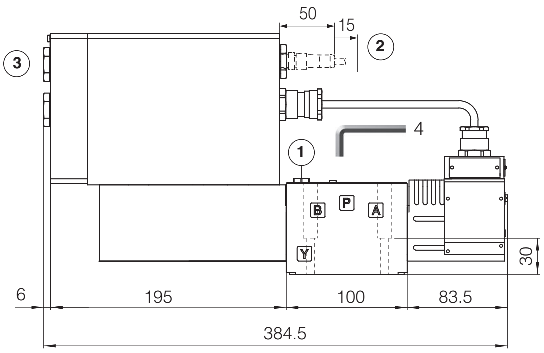
DKZA-AES-15*



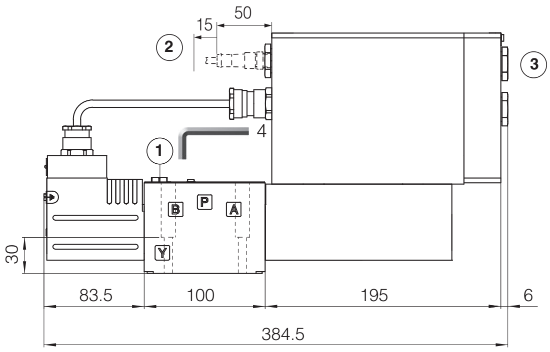
DKZA-AES-15*/B



DKZA-AES-17*



DKZA-AES-17*/B



1 = Air bleed off

2 = Space to remove the USB connector

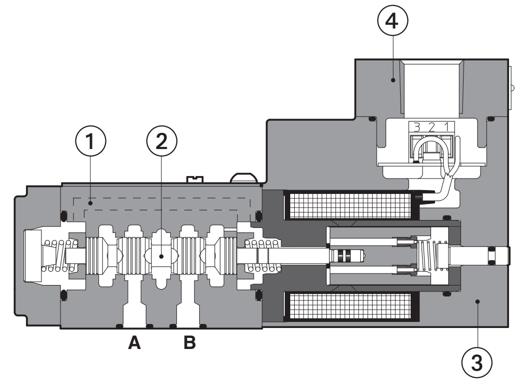
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Ex-proof proportional directional valves

direct, without transducer and with positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



DHZA-A-05*

① valve body
② spool
③ ex-proof solenoid
④ threaded connections for cable clamp or conduit pipe

DHZA-A, DKZA-A

Ex-proof proportional valves direct, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

DHZA:	**DKZA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **60 l/min**	Max flow: **120 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA	/	*	-	A	-	0	51	-	L	5	-	M	/	*	/	*	*	/	*

Ex-proof proportional directional valves, direct

DHZA = size 06
DKZA = size 10

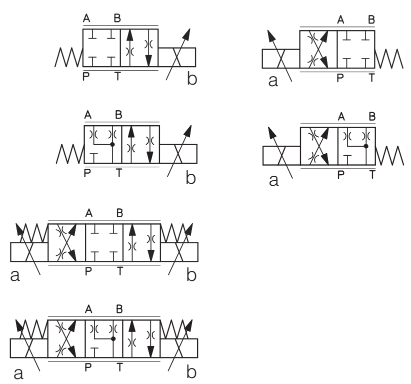
Certification type:
Multicertification ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

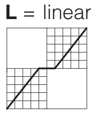
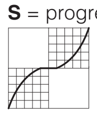
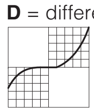
Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

51 =
53 =
71 =
73 =



Spool type - regulating characteristics:
L = linear **S** = progressive **D** = differential-progressive

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

Spool size:	**14** (L)	**1** (L)	**2** (S)	**3** (L,S,D)	**5** (L,S,D)
DHZA =	1	4,5	8	18	28
DKZA =	-	-	-	45	60

Nominal flow (l/min) at Δp 10 bar P-T

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (5)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
B = solenoid at side of port A
MV = vertical hand lever (only for DHZA) **(4)**
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap
Y = external drain

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining)
(3) Possible combined options: all combination are available, with exception of MV + WP
(4) MV option is available only for **DHZA** with spool type **S3, S5, D3, D5, L3, L5**, not available in combination with **WP** option
(5) Approved only for italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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	**DHZA**						**DKZA**		
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**					**70**	**51, 53, 71, 73**		**70**
Spool type	**L14**	**L1**	**S2**	**L3,S3,D3**	**L5,S5,D5**	**L5**	**L3,S3,D3**	**L5,S5,D5**	**L3,L5,D5**
Nominal flow [l/min]									
Δp P-T Δp= 10 bar	1	4,5	8	18	28		45	60	
Δp P-T Δp= 30 bar	1,7	8	14	30	50		80	100	
Max permissible flow	2,6	12	21	40	60		90	120	
Δp max P-T [bar]	70	70	70	50	50		40	40	
Response time **(1)** [ms]	≤ 35						≤ 45		
Leakage [cm³/min]	<30 (at p = 100 bar); <135 (at p = 350 bar)						<80 (at p = 100 bar); <600 (at p = 315 bar)		
Hysteresis	≤ 5 [% of max regulation]								
Repeatability	± 1 [% of max regulation]								

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3

(1) 0-100% step signal

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

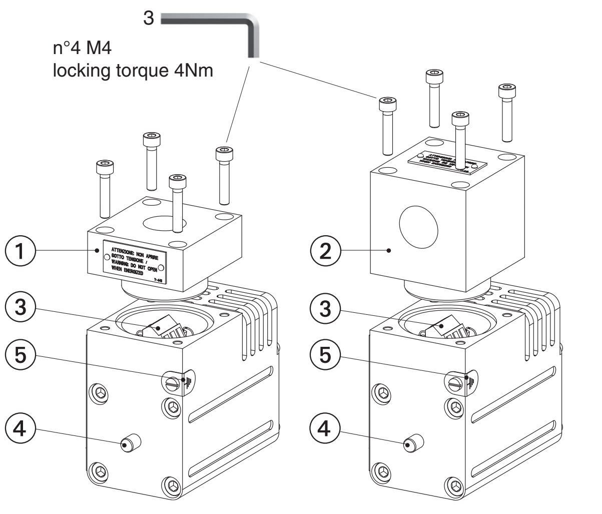
Valve type	DHZA, DKZA		DHZA/**M**, DKZA/**M**	DHZA/**UL**, DKZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

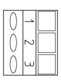
8 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

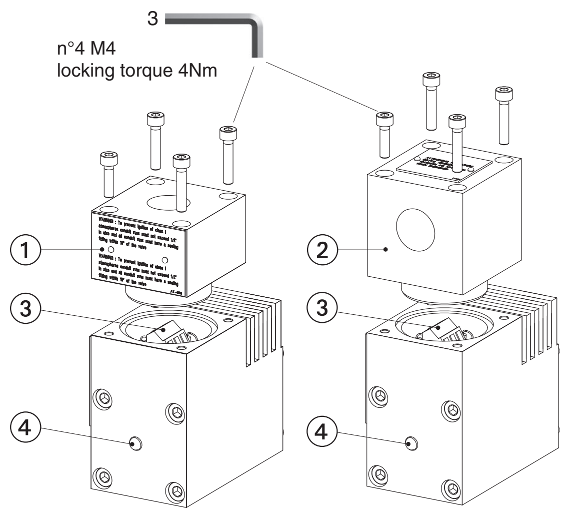
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

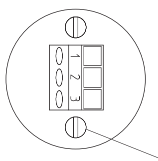
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **OPTIONS**

B = Solenoid at side of port A of the main stage

MV = Auxiliary vertical hand levers (only for DHZA)

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.
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

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

O = Horizontal cable entrance, to be selected in case of limited vertical space

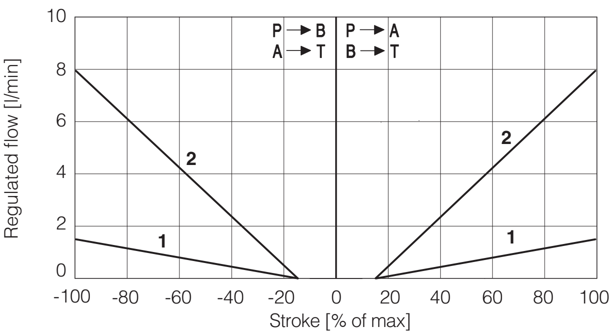
WP = Manual override protect by metallic cap.

Y = External drain, to be selected if the pressure at T port is higher than the max allowed limits

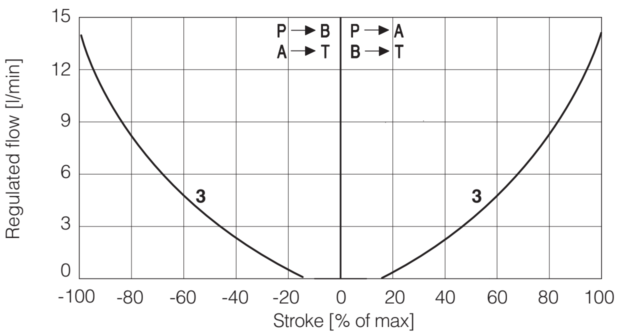
11.1 Possible combined options: all combination are available

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

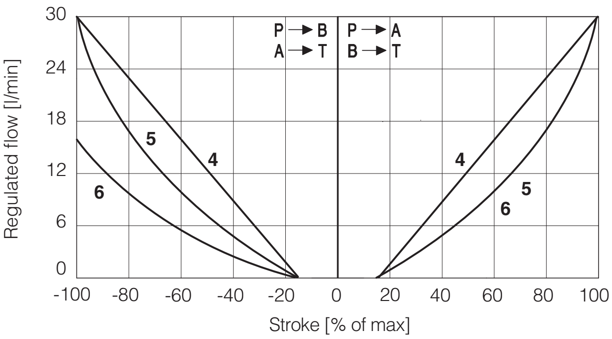
Regulation diagrams - values measure at Δp 30 bar P-T



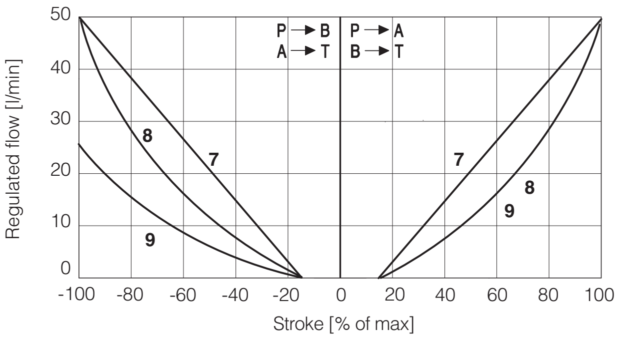
DHZA **1** = L14 **2** = L1



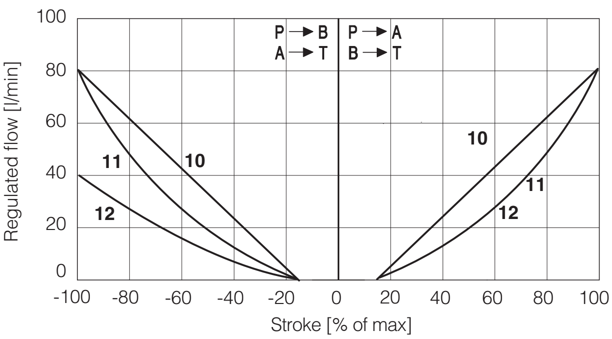
DHZA **3** = S2



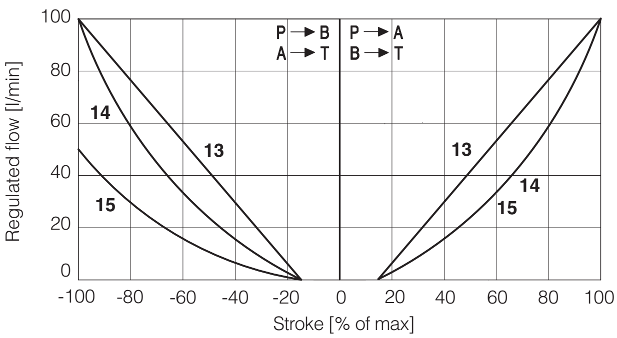
DHZA **4** = L3 **5** = S3 **6** = D3



DHZA **7** = L5 **8** = S5 **9** = D5

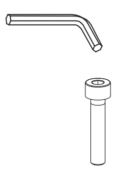


DKZA **10** = L3 **11** = S3 **12** = D3



DKZA **13** = L5 **14** = S5 **15** = D5

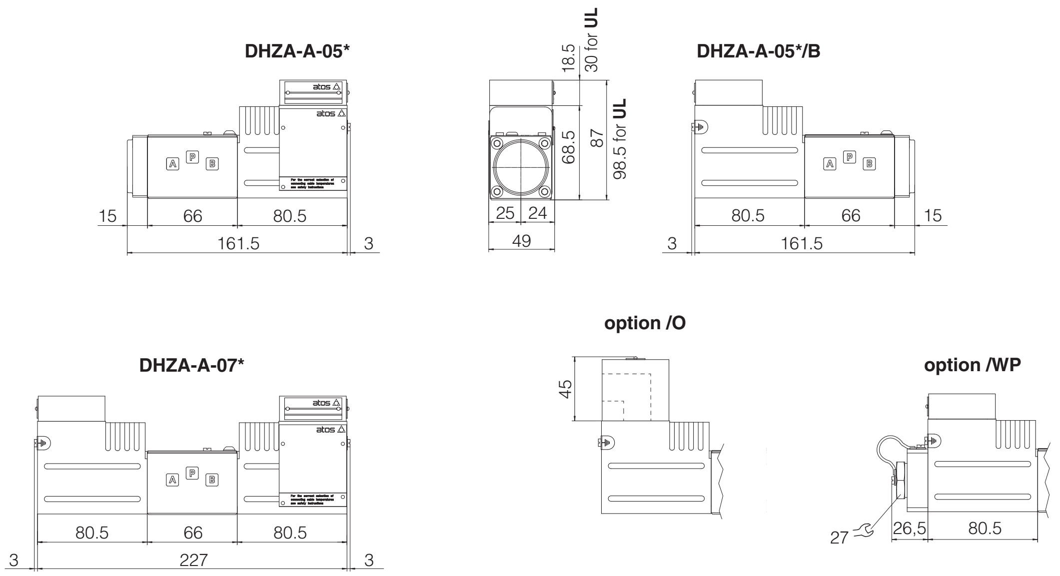
13 FASTENING BOLTS AND SEALS

	DHZA	DKZA
	**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 P, A, B, 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 P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø = 5 mm (only for /Y option)

14 INSTALLATION DIMENSIONS FOR DHZA [mm]

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

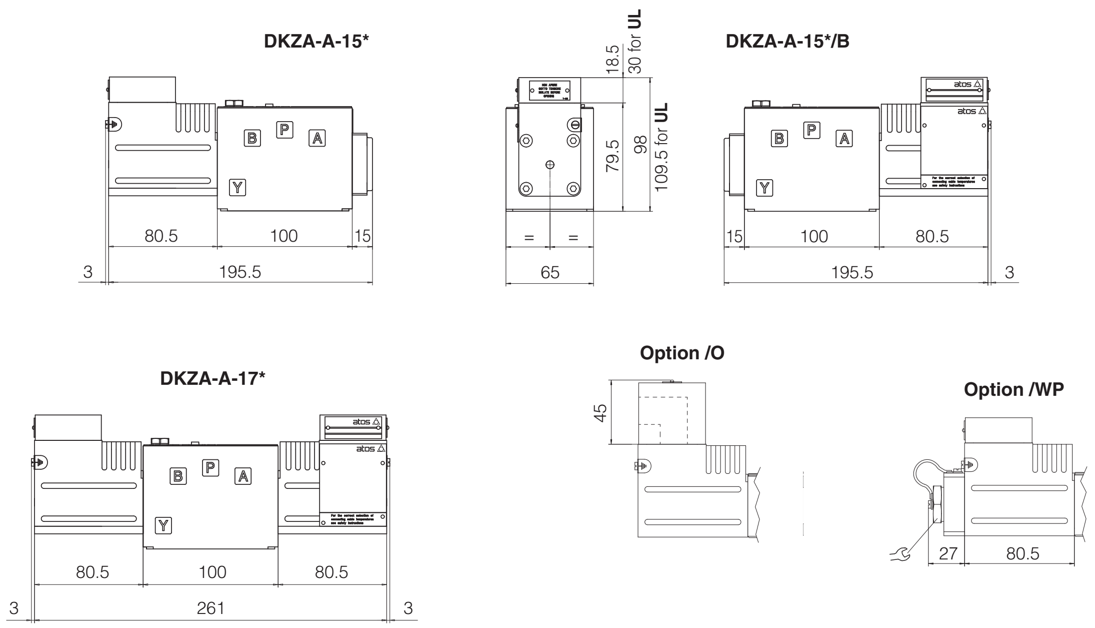
Mass [kg]	
DHZA-A-05	2,65
DHZA-A-07	4,3
Option /O	+0,35
Option /WP	+0,25



15 INSTALLATION DIMENSIONS FOR DKZA [mm]

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

Mass [kg]	
DKZA-A-15	4,8
DKZA-A-17	6,5
Option /O	+0,35
Option /WP	+0,25

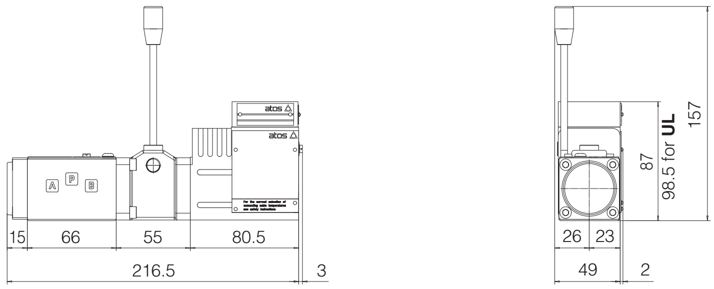


16 INSTALLATION DIMENSIONS FOR DHZA WITH OPTION /MV [mm]

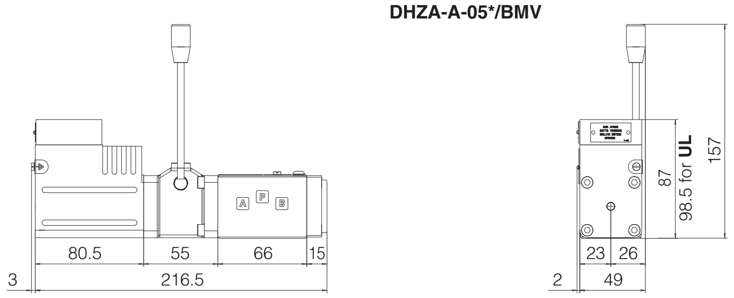
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(for /Y surface: 4401-03-03-0-05 without port X)

Mass [kg]	
DHZA-A-05	2,9
DHZA-A-07	4,6
Option /O	+0,35

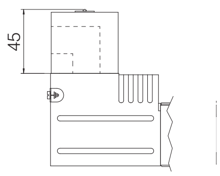
DHZA-A-05*/MV



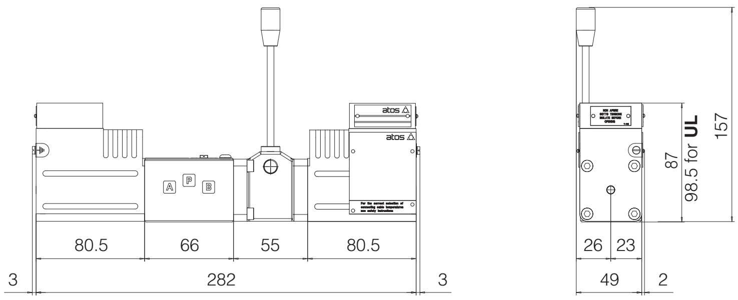
DHZA-A-05*/BMV



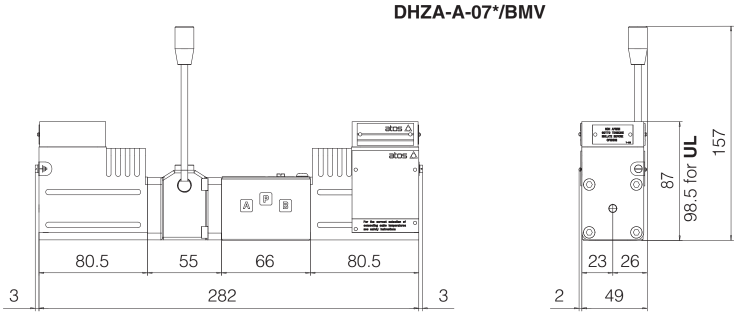
option /O



DHZA-A-07*/MV



DHZA-A-07*/BMV

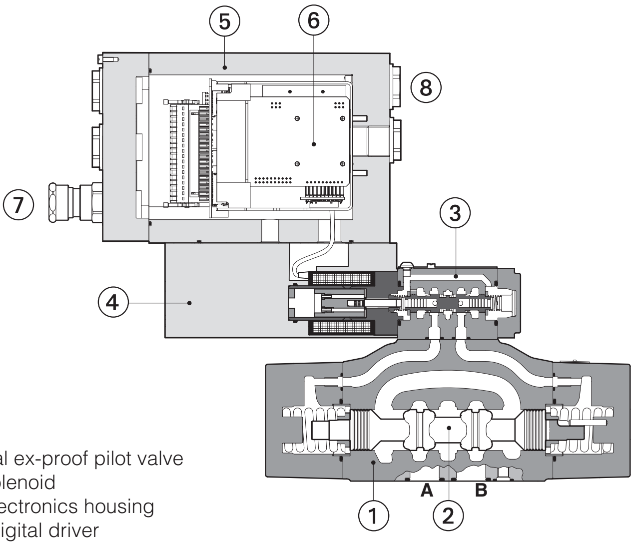


17 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
FX900 Operating and manintenance information for ex-proof proportional valves
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional directional valves

Piloted, with on-board driver, without position transducer and with positive spool overlap **ATEX and IECEx**



① valve body
② spool
③ proportional ex-proof pilot valve
④ ex-proof solenoid
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

DPZA-AES-NP-25*

DPZA-AES

Ex-proof digital proportional valves, piloted, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **10** ÷ **32** -ISO 4401

Max flow: **180** ÷ **1500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA - AES - NP - 1 71 - L 5 / M / * * / *

Ex-proof proportional directional valve, piloted

AES = on-board driver, without transducer

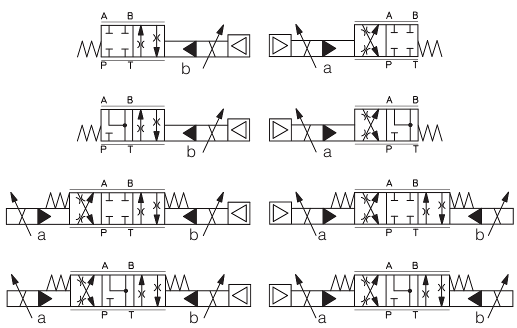
Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration (1):

Standard Option **/B**

51 =
53 =
71 =
73 =



Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR

Hydraulic options (1):
B = solenoid and integral electronics at side of port B of the main stage (side A of pilot valve) **(2)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting

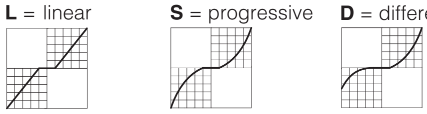
Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 V_{DC})
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 V_{DC})
W = power limitation function

Cable entrance threaded connection:
M = M20x1,5

Spool size:	**3** (L,S,D)	**5** (L,S,D)
DPZA-1 =	-	100
DPZA-2 =	160	250
DPZA-4 =	-	480
DPZA-6 =	-	640

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:
L = linear **S** = progressive **D** = differential-progressive



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

(1) For possible combined options, see section 14
(2) In standard configuration the solenoid (config. 51 and 53) and the on-board digital driver are at side A of the main stage (side B of pilot valve)

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 **FX900** and in the user manuals included in the E-SW-* programming software.

3 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

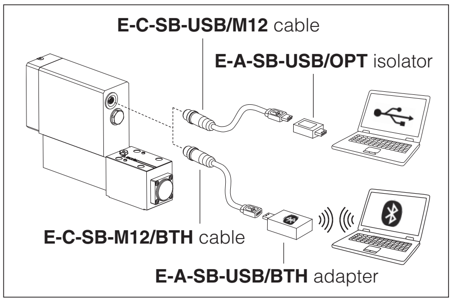
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

4 FIELDBUS - see tech. table GS510

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

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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

Valve model			**DPZA-*-1**	**DPZA-*-2**		**DPZA-*-4**	**DPZA-*-6**
Pressure limits		[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type			**L5, S5, D5**	**L3, S3, D3**	**L5, S5, D5**		
Nominal flow [l/min]							
Δp P-T	Δp = 10 bar		100	160	250	480	640
	Δp = 30 bar		160	270	430	830	1100
	max permissible flow		180	400	550	900	1500
Δp max P-T		[bar]	50	60	60	60	60
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 **(1)**		[l/min]	1,7	3,7		6,8	14,4
Leakage **(2)**	Main stage	[l/min]	0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(1)**		[ms]	≤ 90	≤ 110		≤ 130	≤ 190
Hysteresis			≤ 5 [% of max regulation]				
Repeatability			± 1 [% of max regulation]				

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at p = 100/350 bar

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ
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 /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)
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)
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
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
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

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

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type		DPZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-AES**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X		
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	Single solenoid valve	**T6**	-	**T5**	**T4**	-
	Double solenoid valve	-	**T4**	-	-	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-31 EN 60079-1		IEC 60079-0 IEC 60079-31 IEC 60079-1		
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2	**Grounding:** section of external ground wire = 4 mm^2

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

11 **CABLE GLANDS**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 **HYDRAULIC OPTIONS**

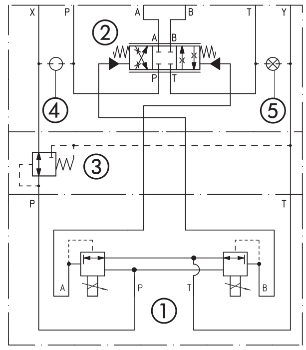
B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 13.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:
Option /D Internal drain.
Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-1 and -2 = 28 bar
DPZA-4 and -6 = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

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

13 **ELECTRONIC OPTIONS**

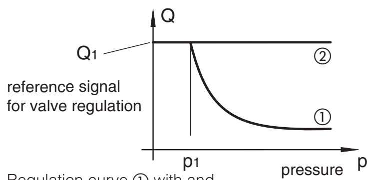
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the 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 = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, 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.

W = Only for valves coupled with pressure compensator type HC-011 or KC-011 (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**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), 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 - option /W



Regulation curve 1 with and 2 without power limitation.
p1 x Q1 = max power limit

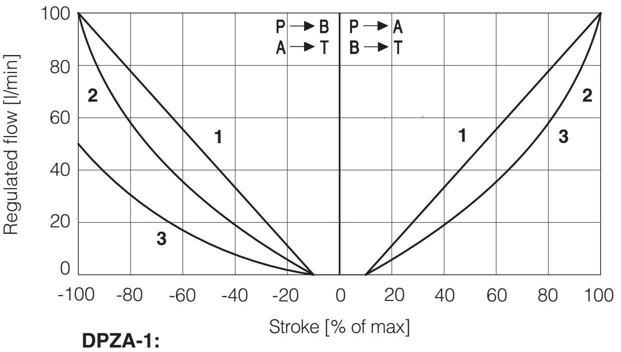
14 **POSSIBLE COMBINED OPTIONS**

Hydraulic options: all combination possible

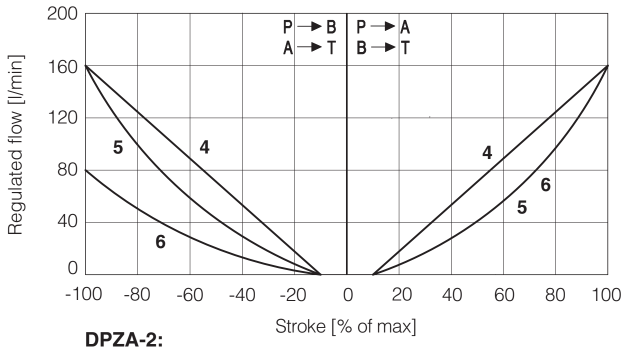
Electronics options: /IW, /CW, /CWI

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

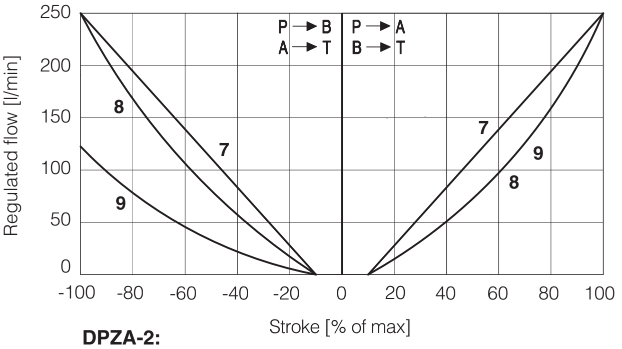
15.1 Regulation diagrams (values measure at Δp 10 bar P-T)



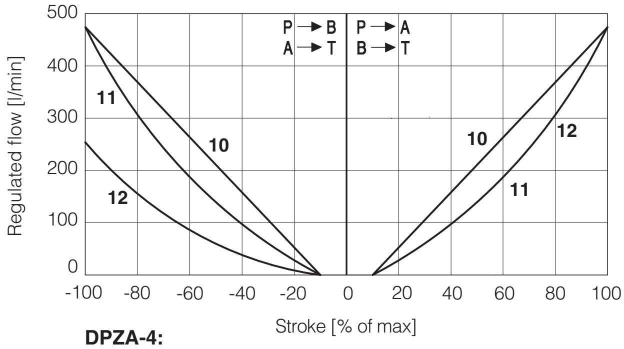
DPZA-1:
1 = L5 **2** = S5 **3** = D5



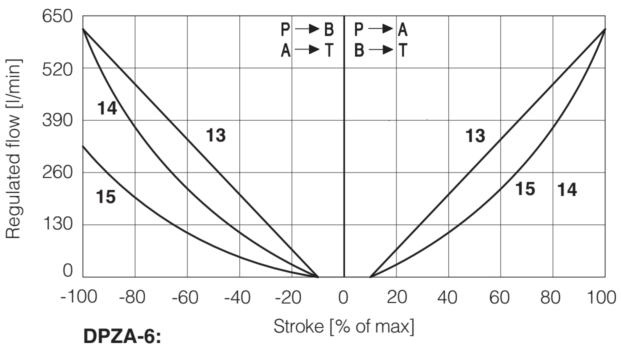
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

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 → A / B → T

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

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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 (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 ÷ 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 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 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

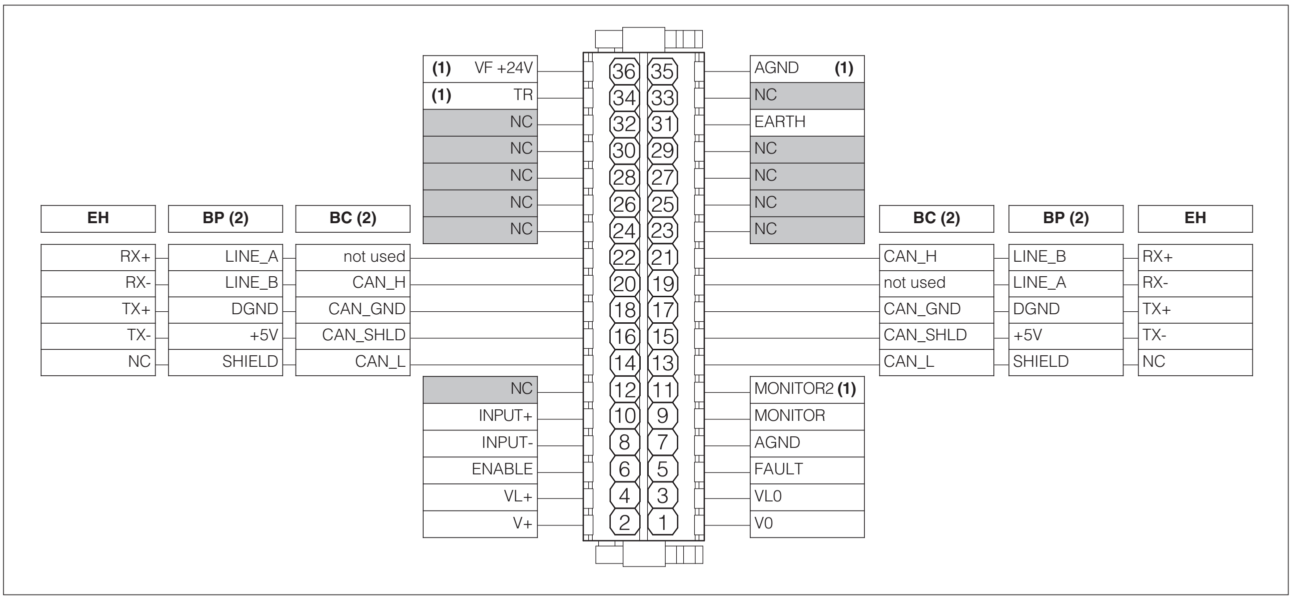
16.6 Fault output signal (FAULT)

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.

16.7 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 valve code, defaults are 0 ÷ 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.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

17 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

18 ELECTRONIC CONNECTIONS

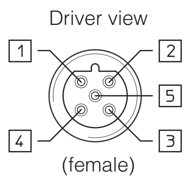
18.1 Main connections signals

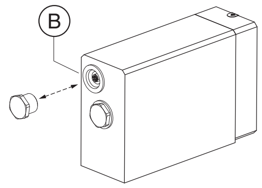
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**MONITOR2**	2nd monitor output signal: ±5 V_{DC} maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 V_{DC}	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

18.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

17.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

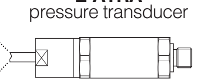
for **/W** option

CABLE ENTRANCE	D		
		VF +24V	36
		TR	34

connect the transducer cable
to the terminal board
of the electronic driver

Current signal	
RED	V+
BLACK	Vout
GRAY	SHIELD
BROWN	do not connect

E-ATRA
pressure transducer

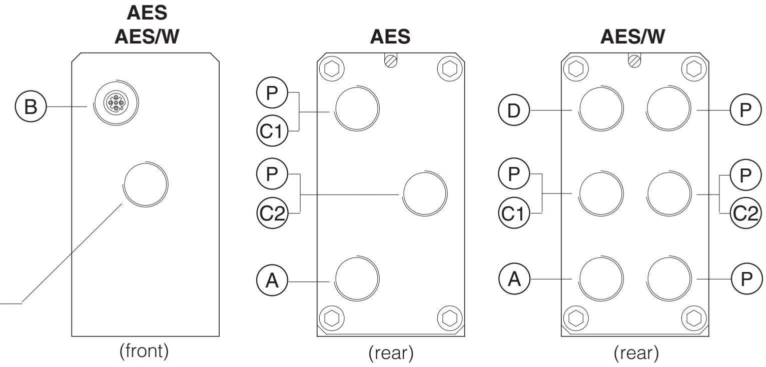


19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

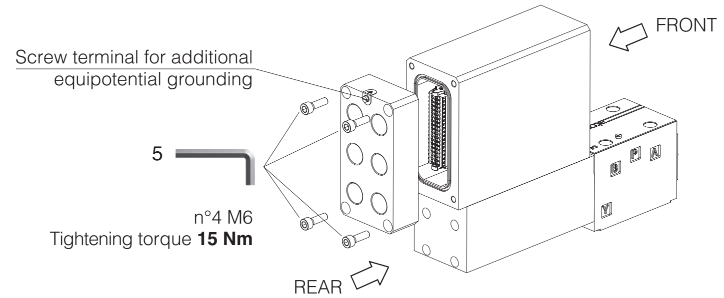
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (D) pressure transducer (only /W option)
- (P) Threaded plug



COIL CONNECTION
only for double solenoid version - factory wired
(for single solenoid version - factory plugged)

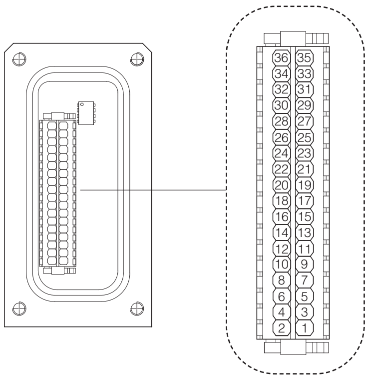
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

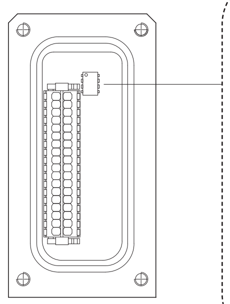


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17



Fieldbus terminator only for BC and BP executions **(1)**



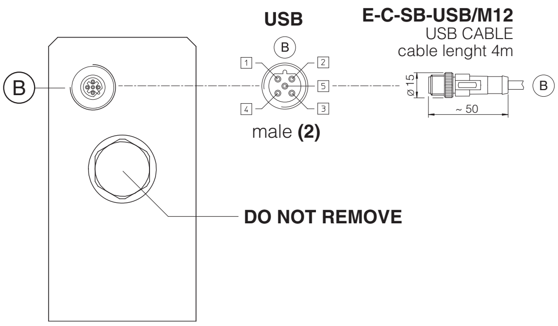
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

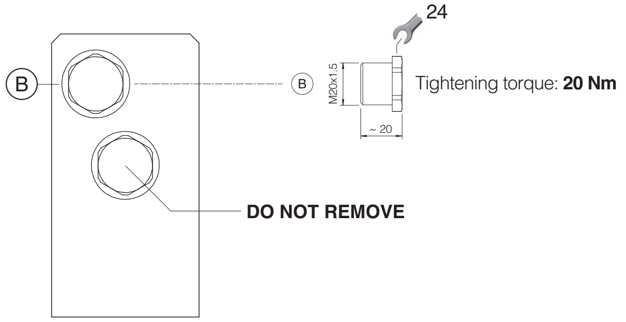
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

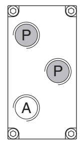
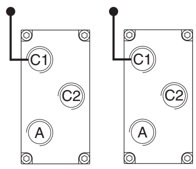
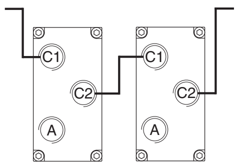


METALLIC PROTECTION CAP - supplied with the valves

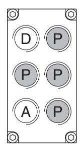
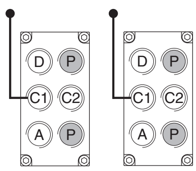
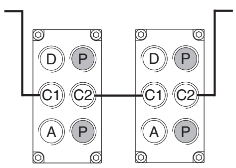


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

19.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

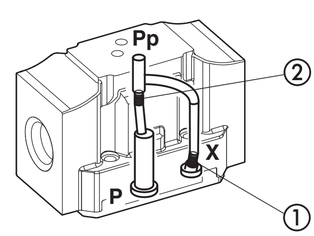
19.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH “via stub” connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH “daisy chain” connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

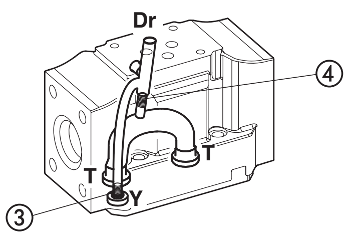
20 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

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

DPZA-1 Pilot channels

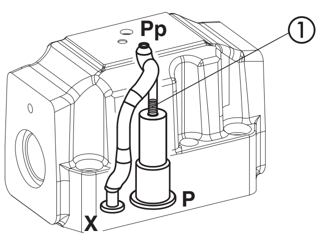


Drain channels

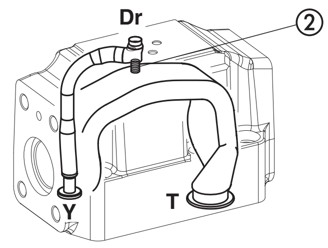


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels

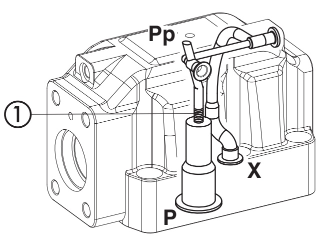


Drain channels

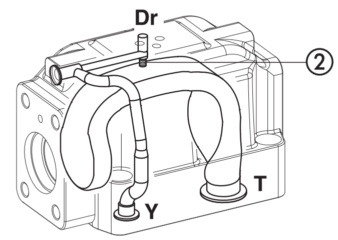


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels

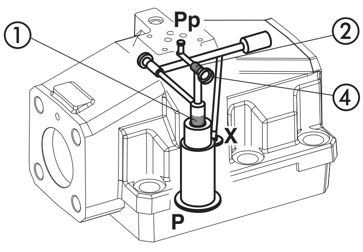


Drain channels

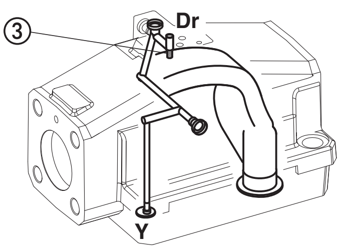


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8”

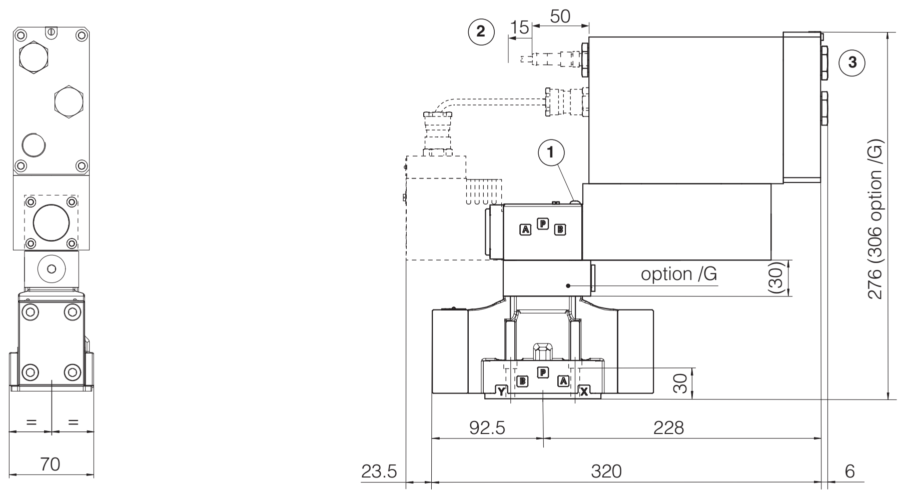
21 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZA	**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)

DPZA-AES-*-1

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

Mass [kg]	
DPZA-*-15*	14,7
DPZA-*-17*	16,4
Option /G	+0,9

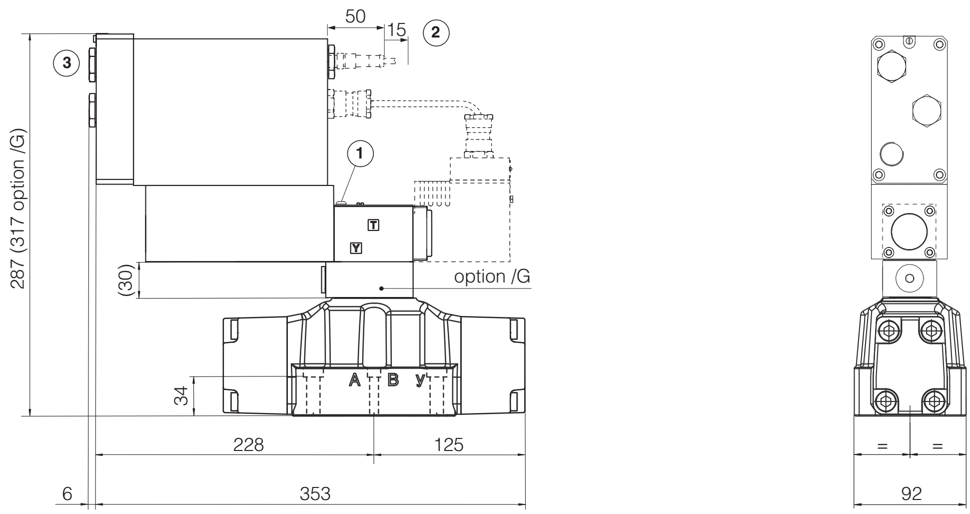


Dotted line = double solenoid version

DPZA-AES-*-2

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

Mass [kg]	
DPZA-*-25*	18,9
DPZA-*-27*	20,6
Option /G	+0,9



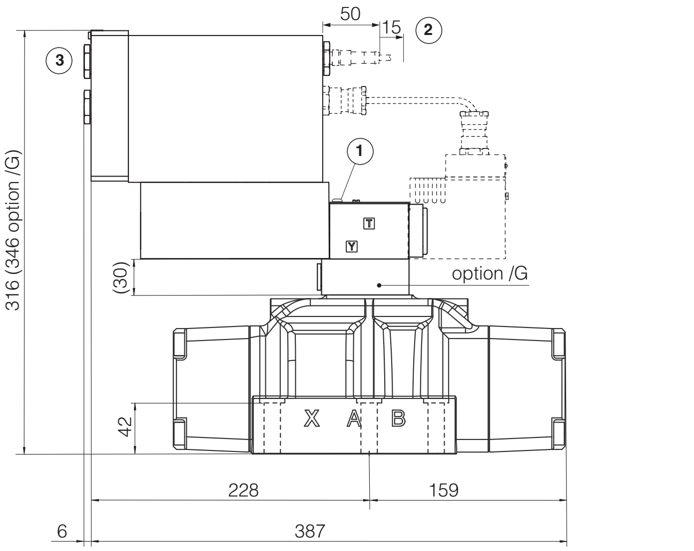
Dotted line = double solenoid version

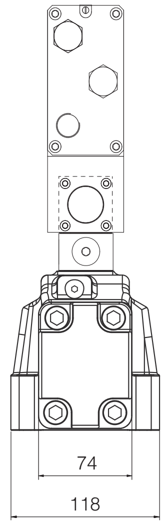
1 = Air bleed off
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-AES-*-4

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

Mass [kg]	
DPZA-*-45*	24,1
DPZA-*-47*	25,8
Option /G	+0,9



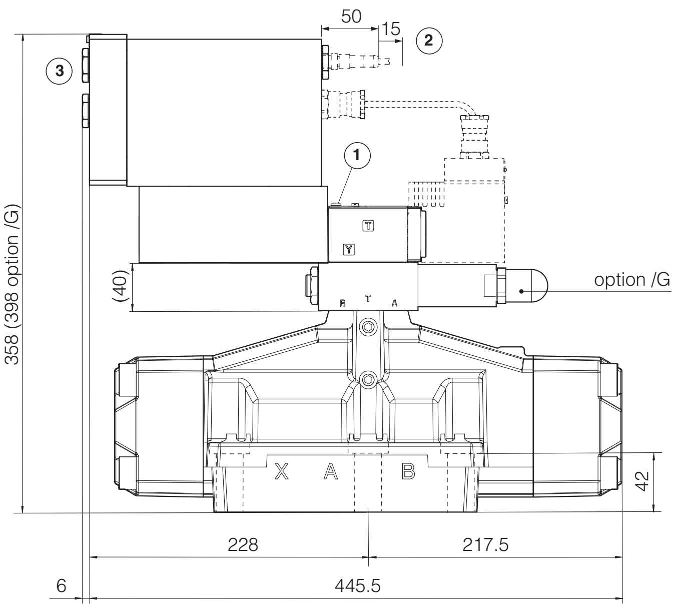


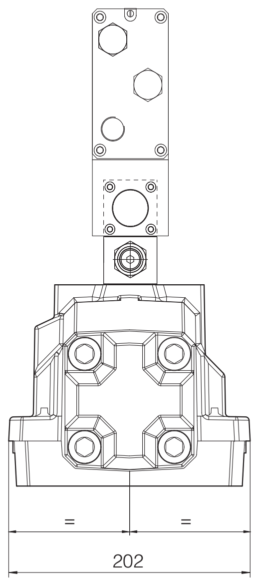
Dotted line = double solenoid version

DPZA-AES-*-6

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05

Mass [kg]	
DPZA-*-65*	49,2
DPZA-*-67*	50,9
Option /G	+0,9





Dotted line = double solenoid version

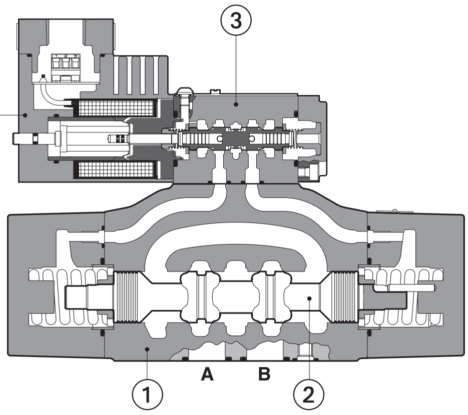
1 = Air bleed off
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof proportional directional valves

piloted, without transducer and with positive spool overlap - **ATEX, IECEx, EAC, PESO** or **cULus**



① main stage valve body
② main stage pool
③ pilot valve
④ ex-proof solenoid

DPZA-A-25*

DPZA-A

Ex-proof proportional valves, piloted, without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx** and **EAC** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10 ÷ 32** - ISO 4401

Max flow: **180 ÷ 1500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

DPZA	/	*	-	A	-	2	71	-	L	5	-	GK	/	*	/	*	*	/	*

DPZA = Ex-proof proportional directional valve, piloted

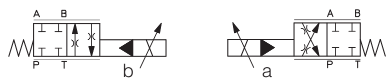
Certification type:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / 2D **(1)**
M = Group IM2 (mining)
North American Certification:
UL = cULus

A = without transducer

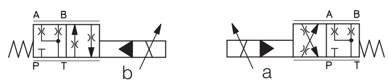
Valve size ISO 4401:
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration: **Standard** Option **/B**

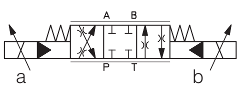
51 =



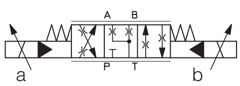
53 =



71 =



73 =



Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR **(2)**

Series number

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

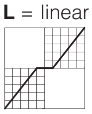
Options (3):
B = solenoid at side of port A
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

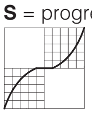
Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

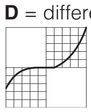
Spool size:	**3** (L,S,D)	**5** (L,S,D)
DPZA-1 =	-	100
DPZA-2 =	160	250
DPZA-4 =	-	480
DPZA-6 =	-	640

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:
L = linear **S** = progressive **D** = differential-progressive







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

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com

(2) Not for multicertification **M** group I (mining)

(3) For possible combined options, see 11.1

⚠ For valve with internal drain (option /D) the pressure at T port makes difficult the manual override operation that can be possible only if the pressure at T port is lower than 50 bar.

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	DPZA-*-1	DPZA-*-2		DPZA-*-4	DPZA-*-6
Pressure limits [bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	L5, S5, D5	L3, S3, D3	L5, S5, D5		
Nominal flow [l/min] Δp P-T Δp = 10 bar	100	160	250	480	640
Δp = 30 bar	160	270	430	830	1100
Max permissible flow	180	400	550	900	1500
Δp max P-T [bar]					
Piloting pressure [bar]	min. = 25; max = 350 (option /G advisable for pilot pressure > 150 bar)				
Piloting volume [cm^3]	1,4	3,7		9,0	21,6
Piloting flow **(1)** [l/min]	1,7	3,7		6,8	14,4
Leakage **(2)** Main stage [l/min]	0,15/0,5	0,2/0,6		0,3/1,0	1,0/3,0
Response time **(1)** [ms]	≤ 90	≤ 110		≤ 130	≤ 190
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) 0-100% step signal and pilot pressure 100 bar **(2)** at p = 100/350 bar

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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 mm²/s - max allowed range 15 ÷ 300 mm²/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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

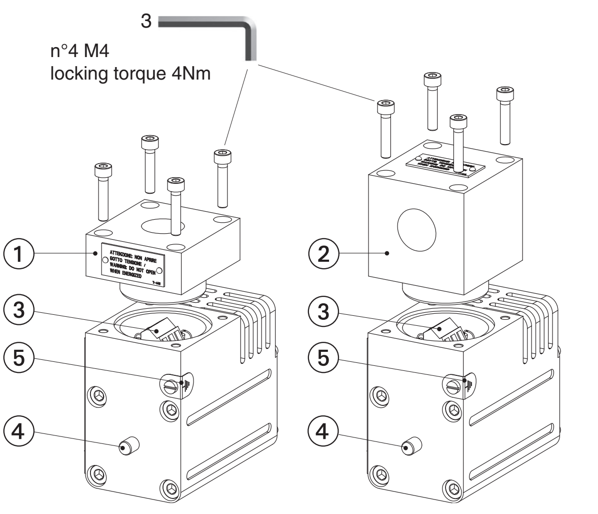
Valve type	DPZA		DPZA/**M**	DPZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX , EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

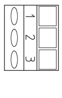
8 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

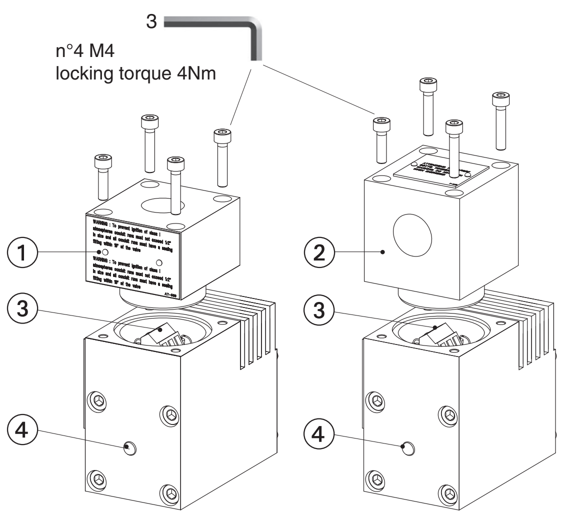
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

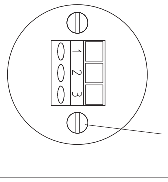
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

9 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

10 CABLE GLANDS - only Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 OPTIONS

B = DPZA-*-*5 = solenoid and integral electronics at side of port B of the main stage.
DPZA-*-*7 = integral electronics at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 13.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:

Option /D Internal drain.

Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-1 and -2 = 28 bar
DPZA-4 and -6 = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.

O = Horizontal cable entrance , to be selected in case of limited verical space.

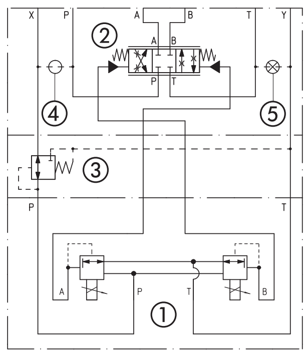
WP = Manual override protected by metallic cap.

11.1 Possible combined options

/BD, /BE, /BG, /BO, /BWP
/BDE, /BDG, /BDO, /BDWP,
/BDEG, /BDEO, /BDEWP, /BDEGO, /BDEGWP, BDEGOWP
/BEG, /BEO, /BEWP, /BEGO, /BEGWP, /BEGOWP
/BGO, /BGWP, BGOWP
/DE, /DG, /DO, /DWP, /DEG, /DEO, /DEWP, /DEGO, /DEGWP, /DEGOWP
/EG, /EO, /EWP, /EGO, /EGWP, /EGOWP
/GO, /GWP, /GOWP
/OWP

FUNCTIONAL SCHEME

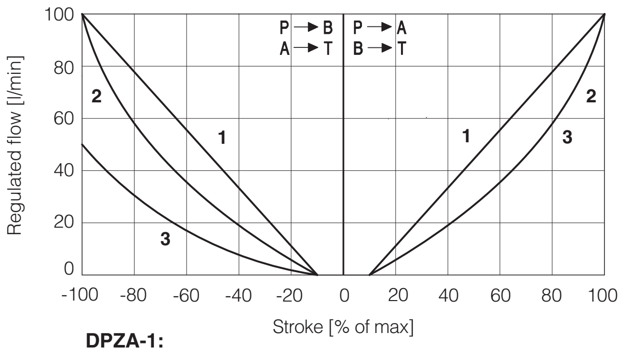
example of configuration 7*
3 positions, spring centered



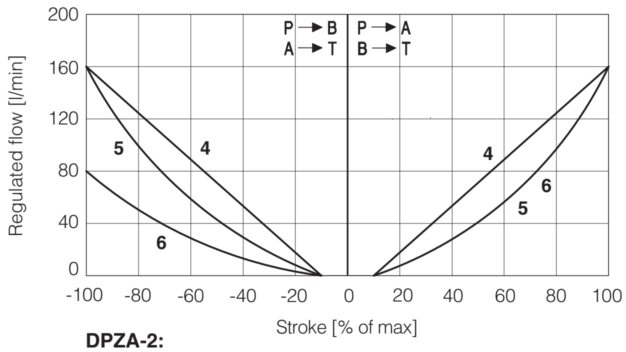
① Pilot valve ② Main stage
③ Pressure reducing valve
④ Plug to be added for external pilot trough port X
⑤ Plug to be removed for internal drain through port T

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

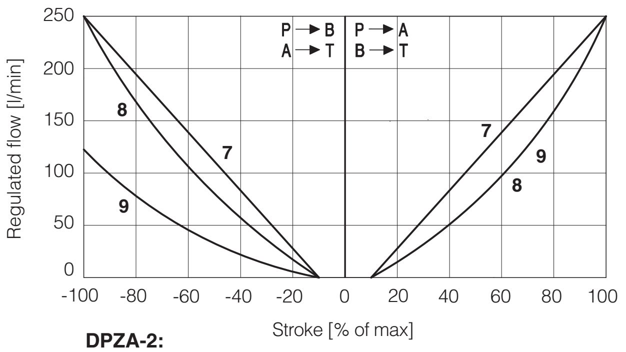
12.1 Regulation diagrams (values measure at Δp 10 bar P-T)



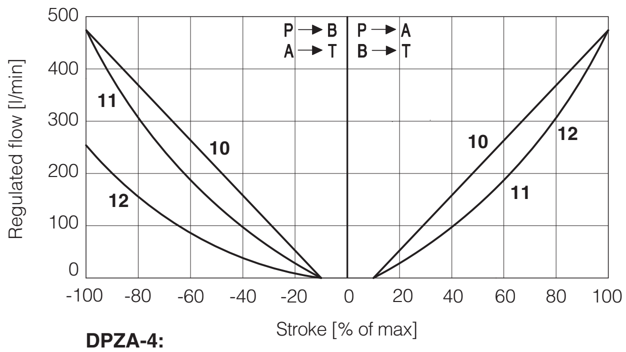
DPZA-1:
1 = L5 **2** = S5 **3** = D5



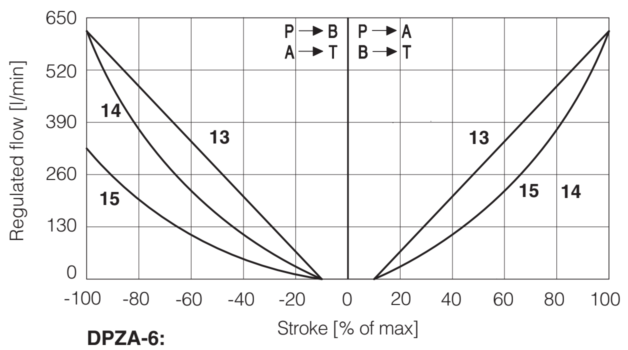
DPZA-2:
4 = L3 **5** = S3 **6** = D3



DPZA-2:
7 = L5 **8** = S5 **9** = D5



DPZA-4:
10 = L5 **11** = S5 **12** = D5



DPZA-6:
13 = L5 **14** = S5 **15** = D5

Note: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

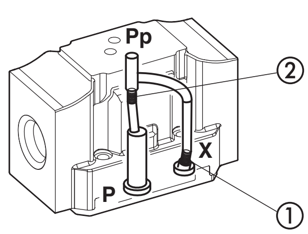
Reference signal $\left.\begin{matrix} 0 \div +10\ \text{V} \\ 12 \div 20\ \text{mA} \end{matrix}\right\}$ P → A / B → T

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

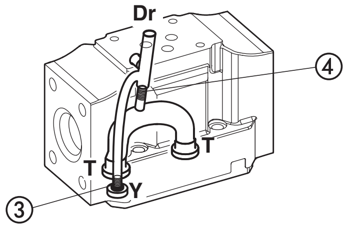
13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

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

DPZA-1 Pilot channels

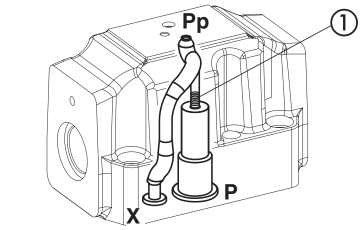


Drain channels

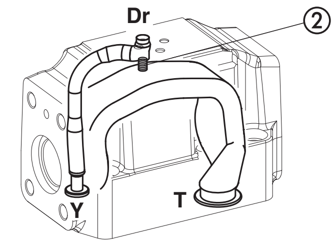


Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZA-2 Pilot channels

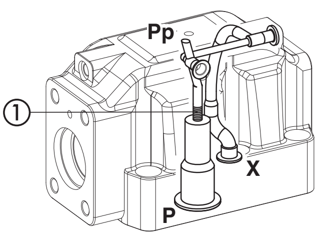


Drain channels

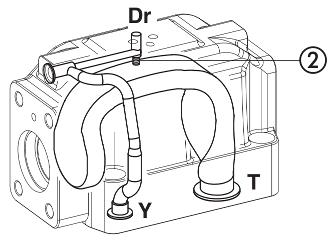


Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-4 Pilot channels

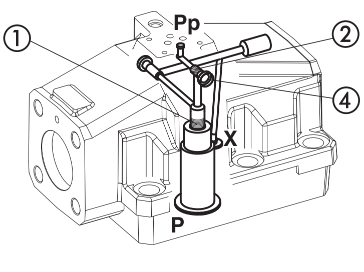


Drain channels

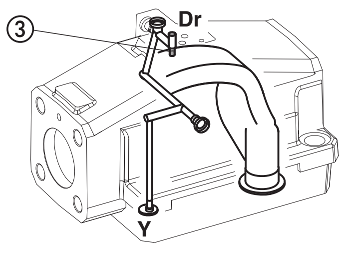


Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6 Pilot channels



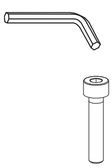
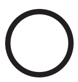
Drain channels



Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Add plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orefice ② remove plug ④ = G1/8"

14 FASTENING BOLTS AND SEALS

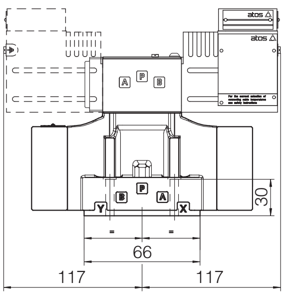
	DPZA-1	DPZA-2	DPZA-4	DPZA-6
	**Fastening bolts:** 4 socket head screws M6x60 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	**Fastening bolts:** 6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm
	**Seals:** 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)	**Seals:** 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)	**Seals:** 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)	**Seals:** 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)

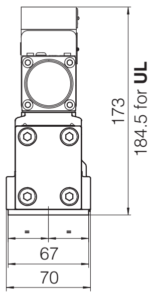
DPZA-1

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

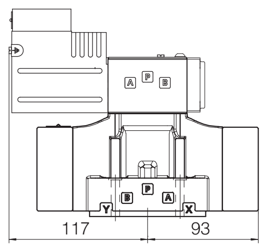
Mass [kg]	
DPZA-*-15*	8,5
DPZA-*-17*	10,2
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-15*
DPZA-A-17* (dotted line)

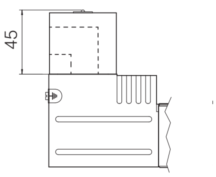




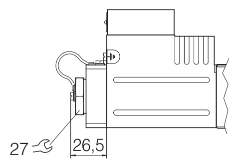
DPZA-A-15* /B



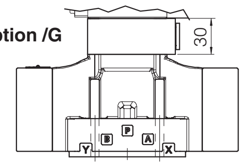
option /O



option /WP



option /G

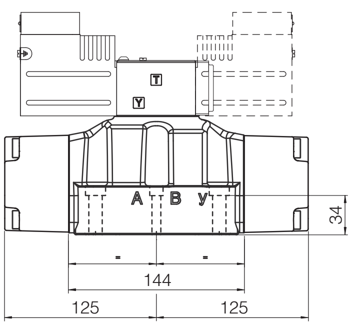


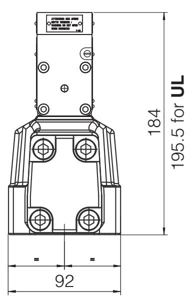
DPZA-2

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

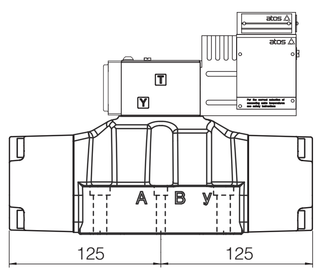
Mass [kg]	
DPZA-*-25*	12,7
DPZA-*-27*	14,4
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-25*
DPZA-A-27* (dotted line)

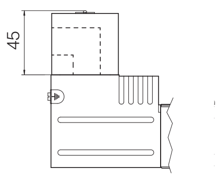




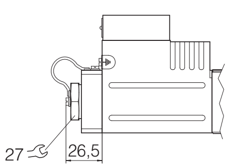
DPZA-A-25* /B



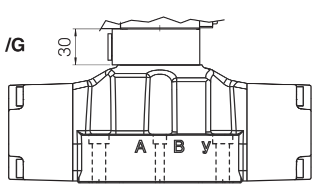
option /O



option /WP



option /G

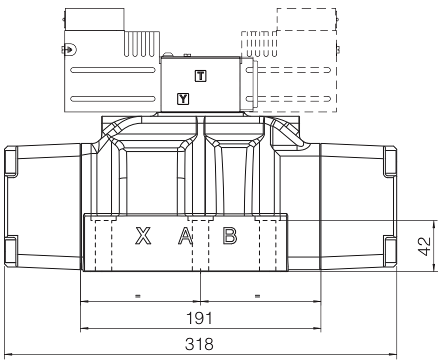


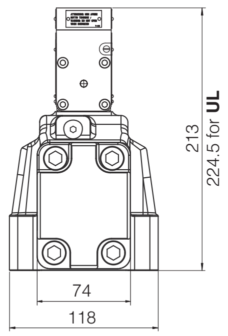
DPZA-4

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

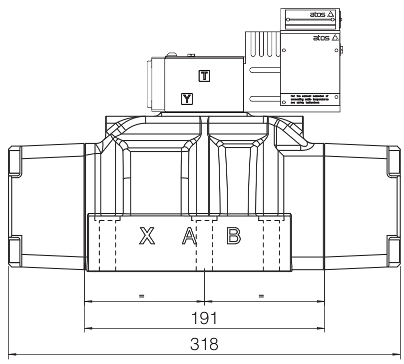
Mass [kg]	
DPZA-*-45*	17,9
DPZA-*-47*	19,6
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-45*
DPZA-A-47* (dotted line)

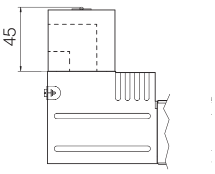




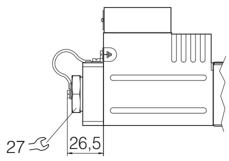
DPZA-A-45* /B



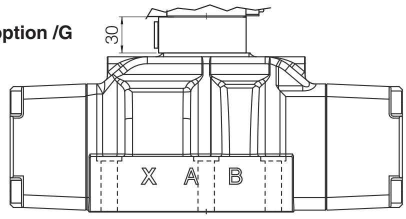
option /O



option /WP



option /G

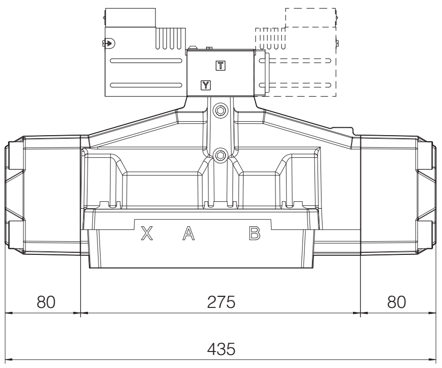


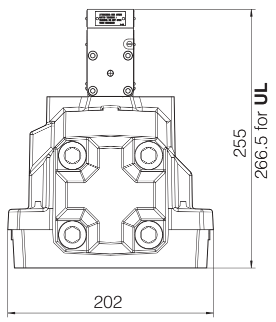
DPZA-6

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

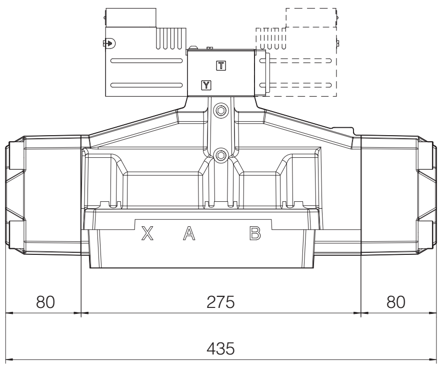
Mass [kg]	
DPZA-*-45*	43,0
DPZA-*-47*	44,7
Option /G	+0,9
Option /O	+0,35
Option /WP	+0,25

DPZA-A-65*
DPZA-A-67* (dotted line)

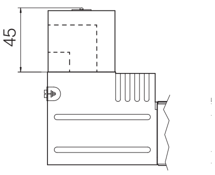




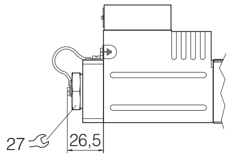
DPZA-A-65* /B



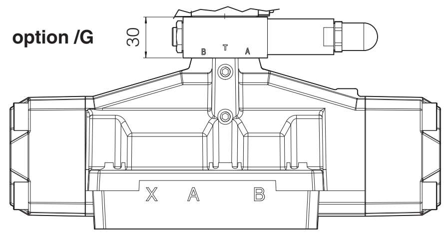
option /O



option /WP



option /G

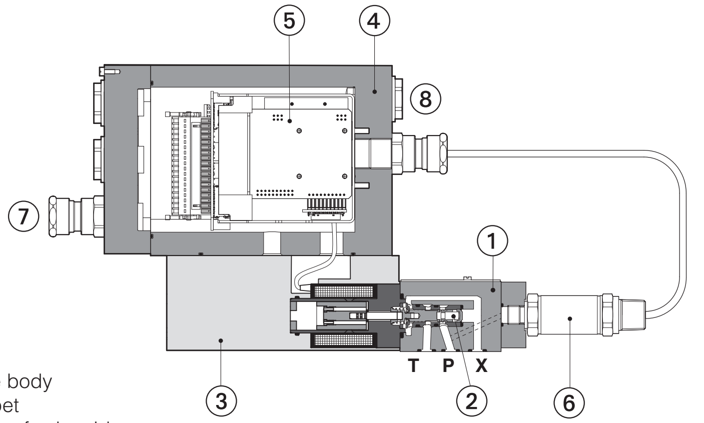


16 **RELATED DOCUMENTATION**

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional relief valves high performance

direct or piloted, with on board driver and pressure transducer - **ATEX and IECEx**



① valve body
② poppet
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof pressure transducer
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

RZMA-RES-P-BC-10-*

RZMA-RES, AGMZA-RES

Ex-proof high performance digital proportional relief valves direct or piloted with pressure transducer for pressure closed loop controls.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **4** and **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** - ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA	-	RES	-	P	-	NP	-	010	/	315	/	M	/	*	*	*	/	*

Ex-proof proportional pressure relief valves
RZMA = subplate size 06
AGMZA = subplate size 10, 20, 32

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:

RZMA: direct	**010** = Qmax 4 l/min	
RZMA: piloted	**030** = Qmax 40 l/min	
AGMZA: piloted	**10, 20, 32** = Qmax 200, 400, 600 l/min	

Max regulated pressure:
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGMZA **(1)**:
E = external pilot
Y = external drain

Electronic options (1):
I = current reference input and monitor 4÷20mA (omit for std voltage 0÷10VDC)

Dynamic response preset, see section 18:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

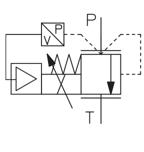
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

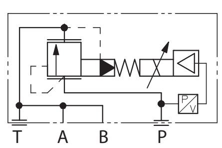
(1) Possible combined options: /EY, /EI, /YI

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

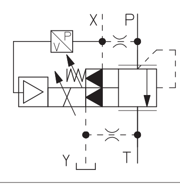
RZMA-RES-*-010



RZMA-RES-*-030



AGMZA-RES-*



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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

⚠ **WARNING:** The below operation must be performed in a safety area

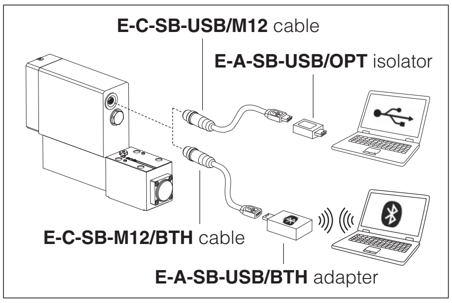
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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	RZMA-010 150 years, RZMA-030 and AGZMA 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 - salt spay test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		RZMA		AGMZA		
Size code		**010**	**030**	**10**	**20**	**32**
Valve size		06		10	20	32
Max regulated pressure	[bar]	**80 180 250**				
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 20 21 22				
Max pressure at port P, A, B, X	[bar]	315				
Max pressure at port T, Y	[bar]	210				
Max flow	[l/min]	4	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 60		≤ 90	≤ 110	≤ 125
Hysteresis[% of the max pressure]		≤ 0,3				
Linearity[% of the max pressure]		≤ 1,0				
Repeatability[% of the max pressure]		≤ 0,2				

(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

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: 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 power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
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

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, 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-RES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-31 EN 60079-1	IEC 60079-0 IEC 60079-31 IEC 60079-1	
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
in case the complete valve must wisthstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

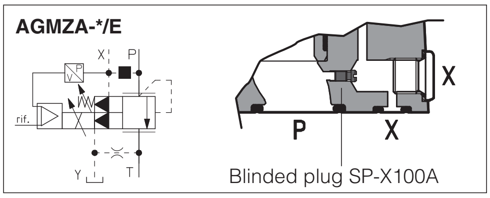
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGMZA

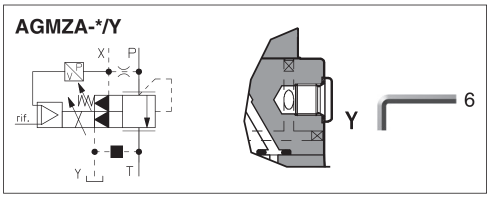
E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve’s mounting surface or on main body (threaded pipe connection G ¼”).

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 ¼” available on the pilot stage body.



14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, 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.



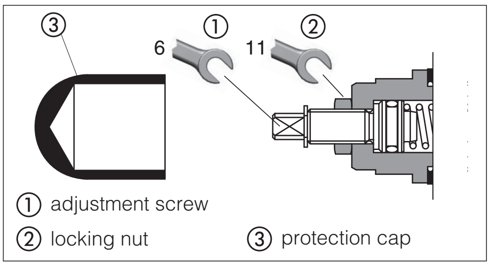
15 POSSIBLE COMBINED OPTIONS

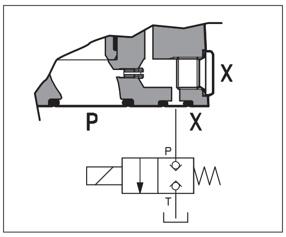
EY, /EI, /YI

16 MECHANICAL PRESSURE LIMITER - only for AGMZA

The AGMZA 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.





17 REMOTE PRESSURE UNLOADING - only for AGMZA

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.

18 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 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

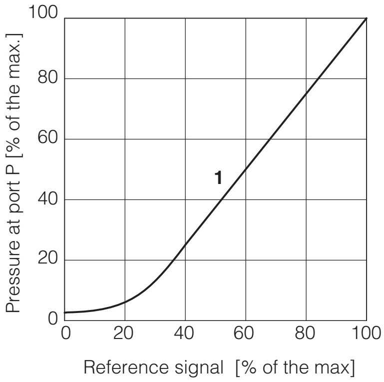
PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

19 PRESSURE TRANSDUCER FAILURE

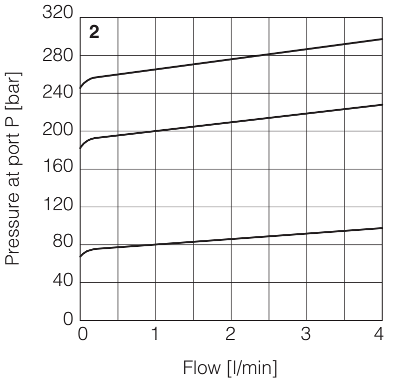
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

20 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

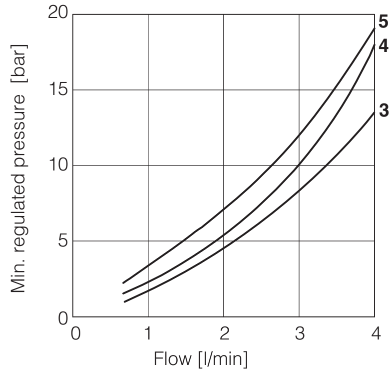
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-5 Min. pressure/flow diagrams
with zero reference signal

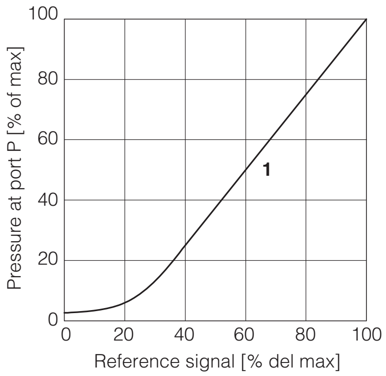


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

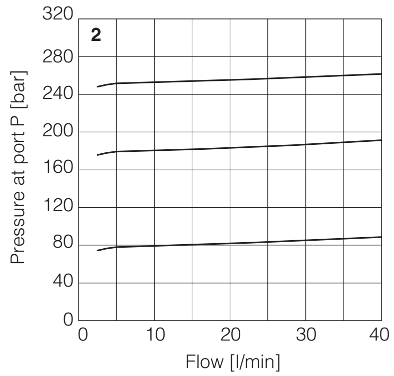
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

21 DIAGRAMS RZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

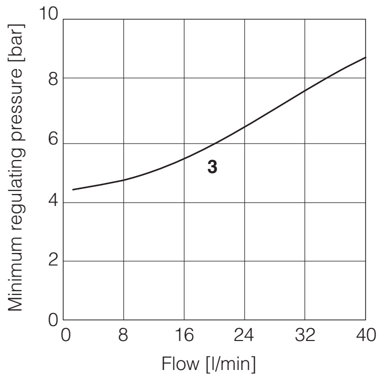
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3 Min. pressure/flow diagrams
with zero reference signal

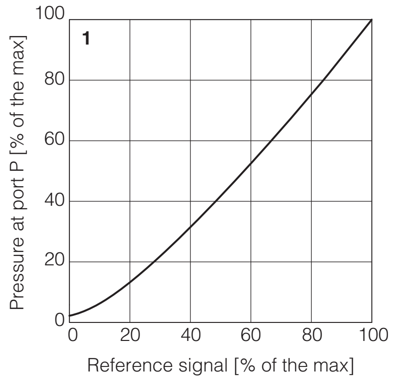


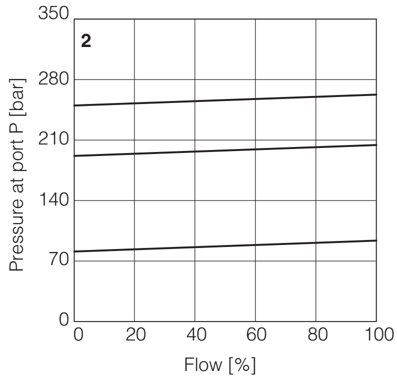
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

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

1 = Regulation diagrams
with flow rate Q = 50 l/min

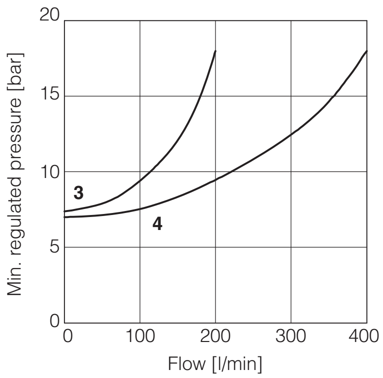
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min

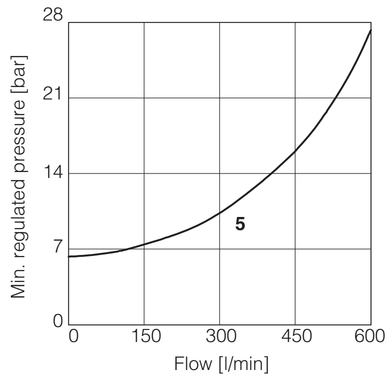




3-5 = Min. pressure/flow diagrams
with zero reference signal

3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32





23 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, EN-982).

23.1 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.

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

23.2 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 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 3 and 4, 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.

23.3 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 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.

23.4 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.

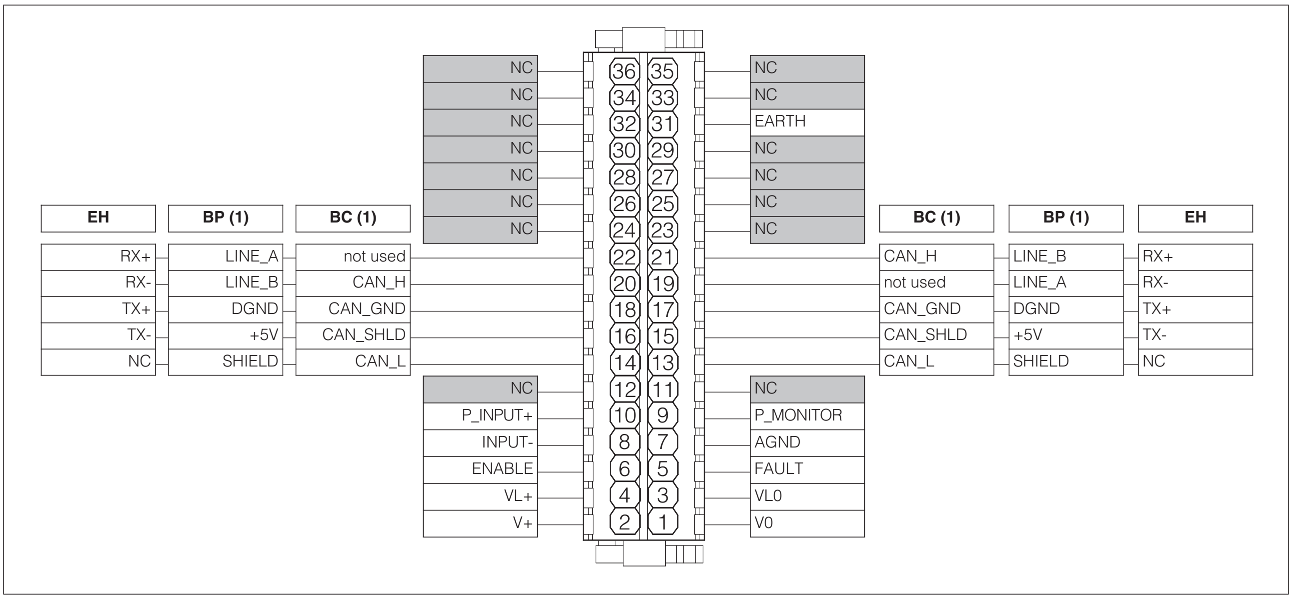
23.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

23.6 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.

24 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

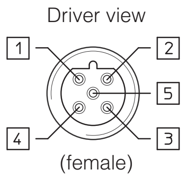
25 ELECTRONIC CONNECTIONS

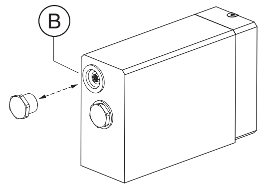
25.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 V_{DC} / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 V_{DC} or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

25.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





25.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

25.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

25.5 EH fieldbus execution connections

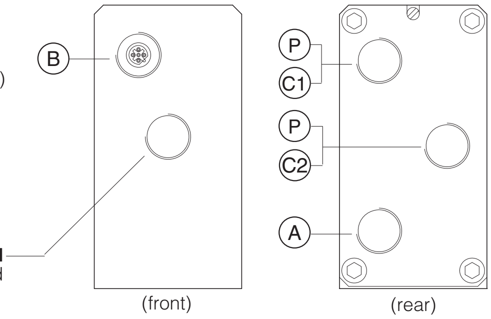
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

CABLE ENTRANCE OVERVIEW

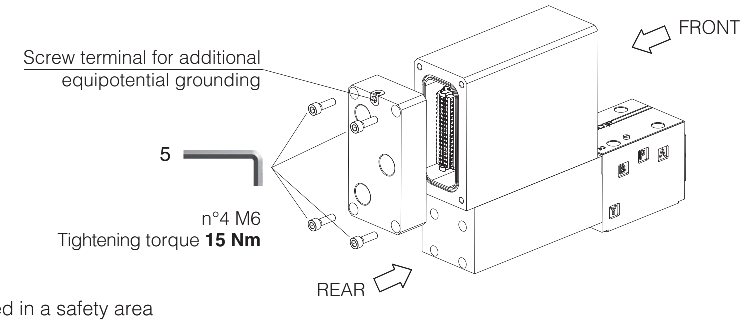
Cables entrance description:

- Ⓐ main connections
- Ⓑ USB connector always present (factory plugged)
- Ⓒ1 fieldbus interface (input)
- Ⓒ2 fieldbus interface (output)
- Ⓟ threaded plug



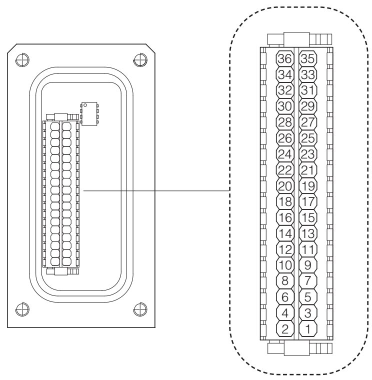
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

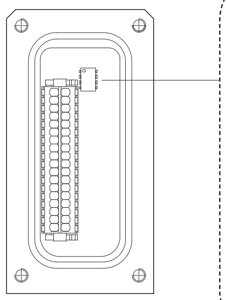


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 24



Fieldbus terminator only for BC and BP executions **(1)**



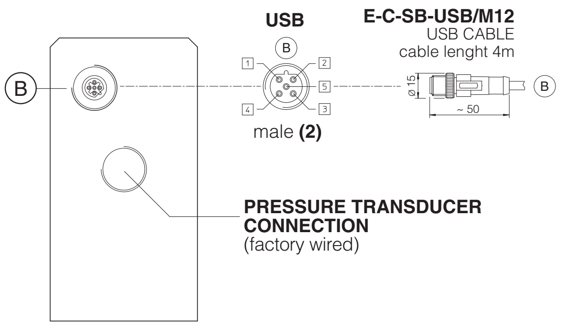
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

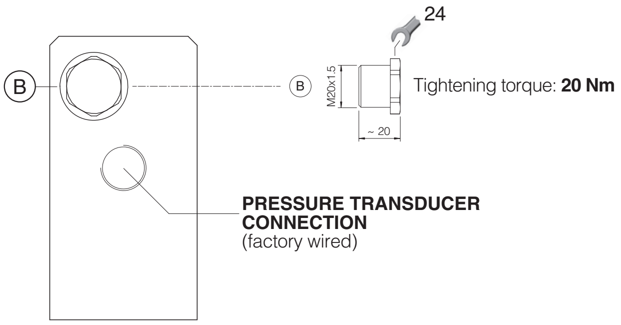
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

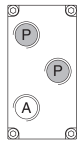
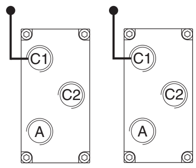
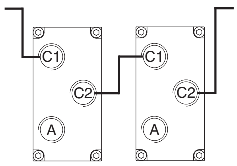


METALLIC PROTECTION CAP - supplied with the valves



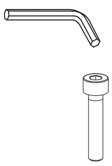
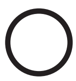
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

26.1 Cable glands and threaded plug - see tech table **KX800**

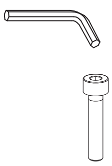
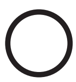
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

27 FASTENING BOLTS AND SEALS

27.1 RZMA valves

	RZMA-RES-*-010	RZMA-RES-*-030
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm

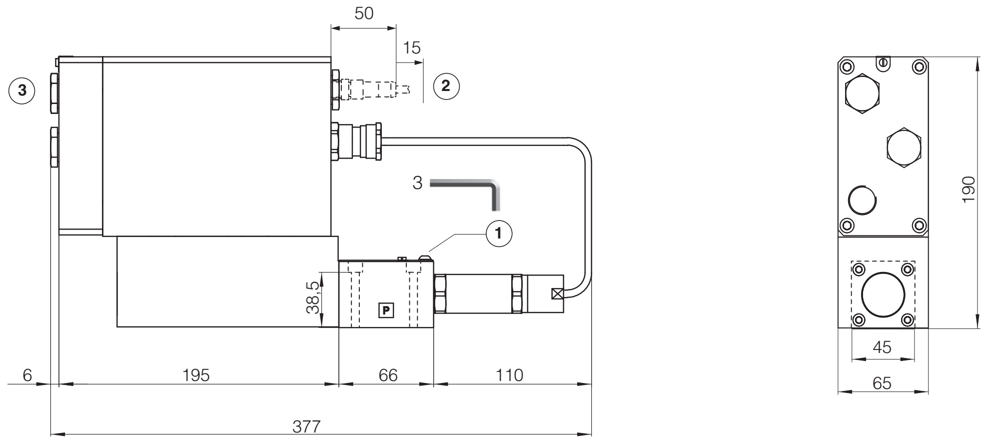
27.2 AGMZA valves

	AGMZA-RES-*-10	AGMZA-RES-*-20	AGMZA-RES-*-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

RZMA-RES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

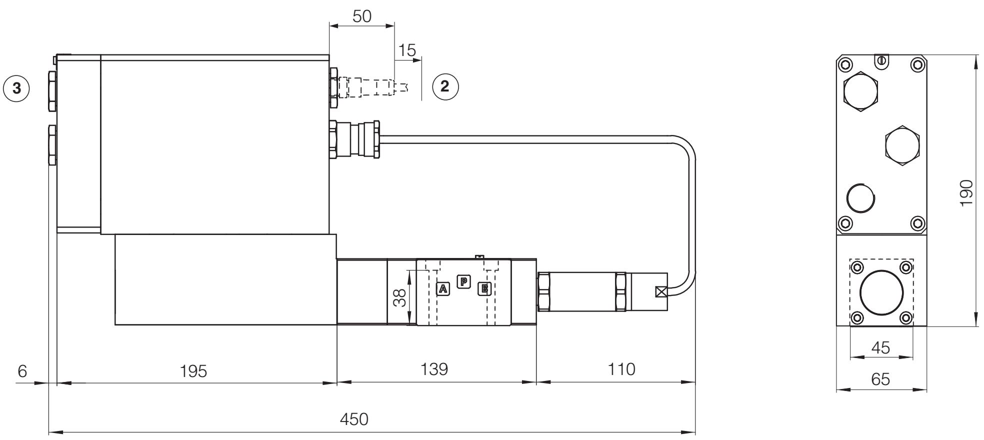
Mass [kg]	
RZMA-RES-*-010	8.5



RZMA-RES-*-030

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZMA-RES-*-030	9,5



(1) = Air bleed off

(2) = Space to remove the USB connector

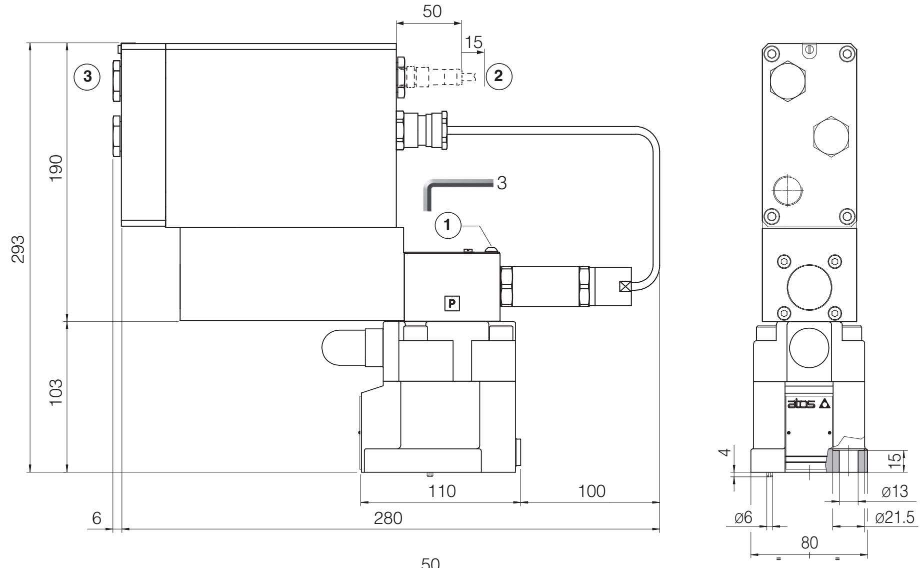
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

29 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-RES-*-10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

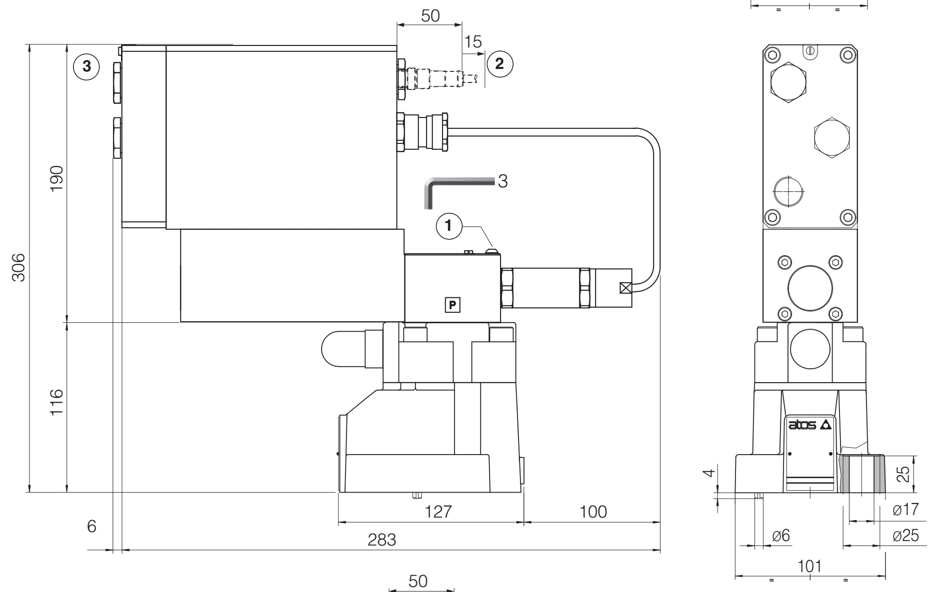
Mass [kg]	
AGMZA-RES-*-10	12,1



AGMZA-RES-*-20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

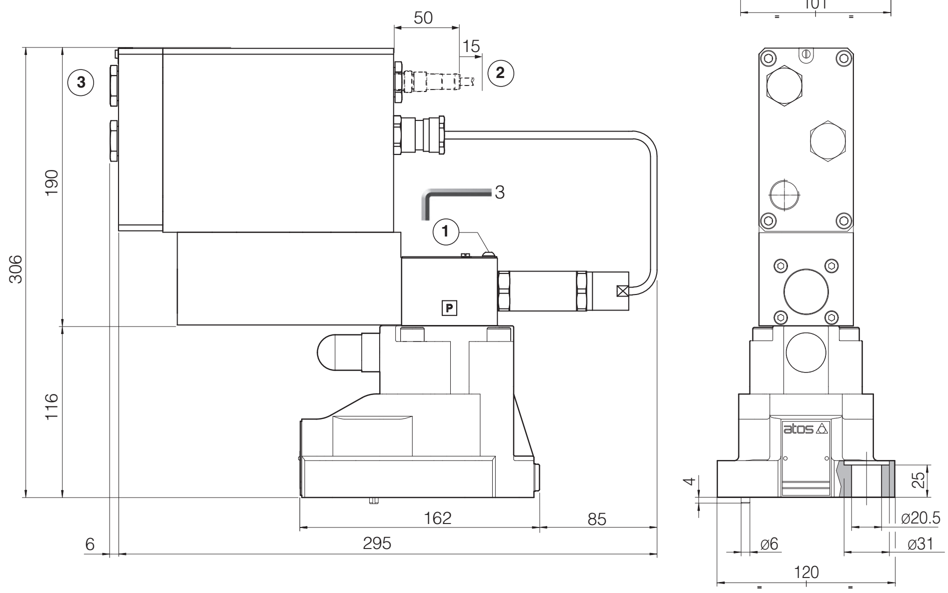
Mass [kg]	
AGMZA-RES-*-20	13,3



AGMZA-RES-*-32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)
(with M20 fixing holes
instead of standard M18)

Mass [kg]	
AGMZA-RES-*-32	15,3



1 = Air bleed off

2 = Space to remove the USB connector

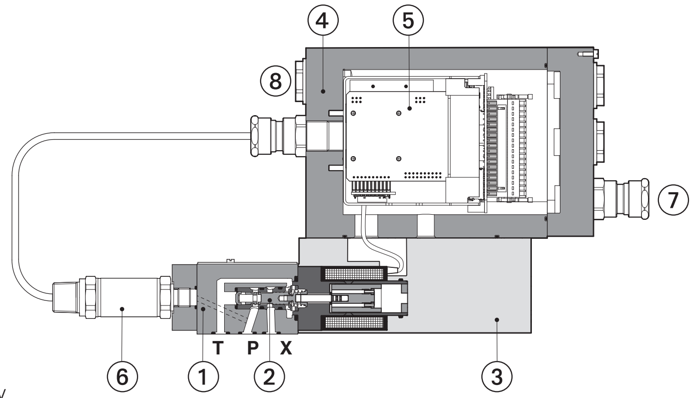
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

30 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional reducing valves high performance

direct or piloted, with on-board driver and pressure transducer - **ATEX and IECEx**



1. valve body
2. spool
3. ex-proof solenoid
4. ex-proof electronics housing
5. on-board digital driver
6. ex-proof pressure transducer
7. ex-proof cable glands (to be ordered separately)
8. USB port always present (factory plugged)

RZGA-RES-P-BC-10-*

RZGA-RES, AGRCZA-RES

Ex-proof digital, high performance proportional reducing valves, direct or piloted, with pressure transducer for pressure closed loop controls.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification ATEX and IECEx for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5871
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA - RES - P - NP - 010 / 210 / M / * * * / *

Ex-proof proportional pressure reducing valves
RZGA = subplate size 06
AGRCZA = subplate size 10, 20

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:

RZGA: direct	**010** = Qmax 12 l/min
RZGA: piloted	**033** = Qmax 40 l/min
AGRCZA: piloted	**10, 20** = Qmax 160, 300 l/min

Max regulated pressure:
only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar
only for RZGA-033 and AGRCZA
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGRCZA **(1)**:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

Electronic options (1):
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

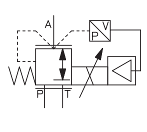
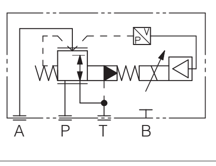
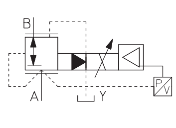
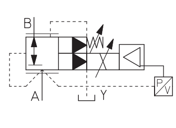
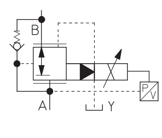
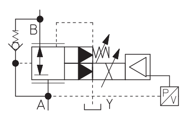
Dynamic response preset, see sect. 16:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP, /IR, /PR

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA-RES-010	RZGA-RES-033	AGRCZA-RES	AGRCZA-RES-*/P	AGRCZA-RES-*/R	AGRCZA-RES-*/PR
					

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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: The below operation must be performed in a safety area

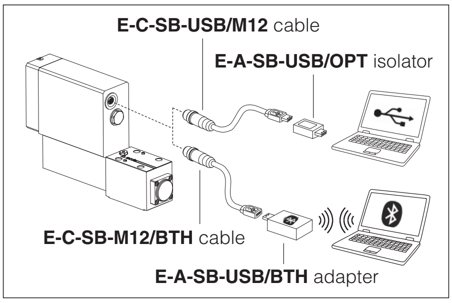
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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	RZGA-010 150 years, RZGA-033 and AGRCZA 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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	RZGA		AGRCZA	
Size code	**010**	**033**	**10**	**20**
Valve size	06	06	10	20
Max regulated pressure [bar]	**32 100 210**	**80**	**180**	**250**
Max pressure at port P, A, B, X [bar]	315			
Max pressure at port T, Y [bar]	210			
Min regulated pressure [bar]	0,8	2,5	1,0	
Max flow [l/min]	12	40	160	300
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 50		≤ 60	
Hysteresis [% of the max pressure]	≤ 0,3			
Linearity [% of the max pressure]	≤ 1,0			
Repeatability [% of the max pressure]	≤ 0,2			

(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

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: 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 power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, power supplies level, pressure transducer failure			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 610006-3)			
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

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, 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 ÷ 500 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-RES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1 — EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

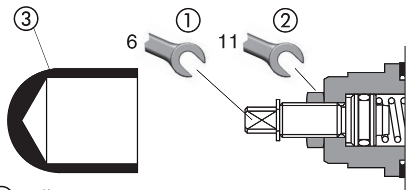
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGRCZA

P = The AGRCZA 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

P option

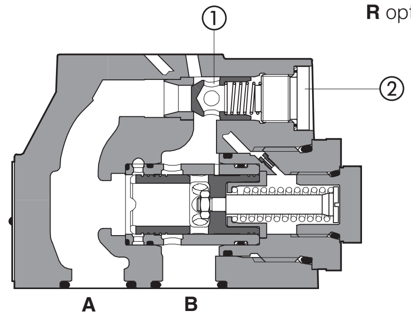


① adjustment screw
② locking nut ③ protection cap

R = The AGRCZA are provided with integral check valve for free reverse flow A→B

① Check valve - cracking pressure = 0,5 bar
② Plug

R option



14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, 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.

15 POSSIBLE COMBINED OPTIONS

/IP, /IR, /PR

16 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 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

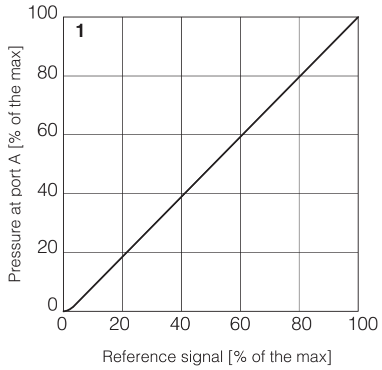
PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

17 PRESSURE TRANSDUCER FAILURE

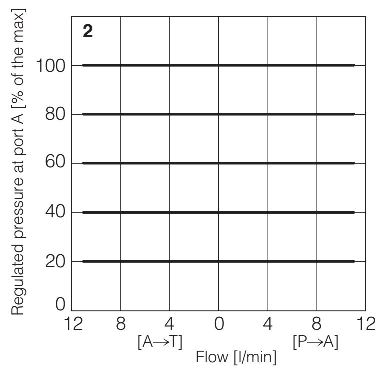
In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

18 DIAGRAMS RZGA-010 (based on mineral oil ISO VG 46 at 50 °C)

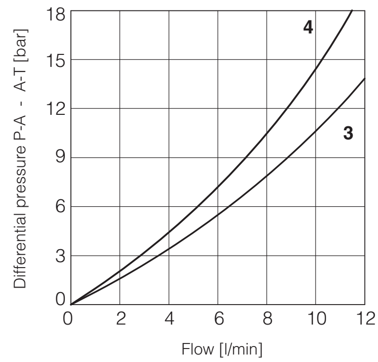
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



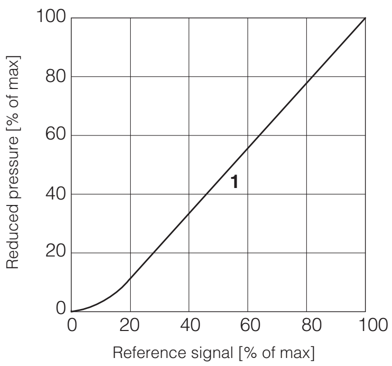
3-4 Min. pressure/flow diagrams
with zero reference signal



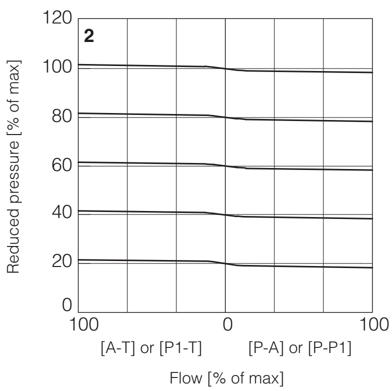
3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

19 DIAGRAMS RZGA-033 (based on mineral oil ISO VG 46 at 50 °C)

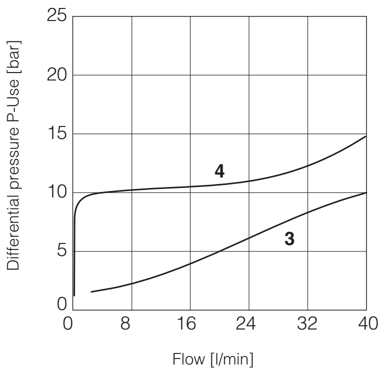
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min



3-4 Pressure drop/flow diagram



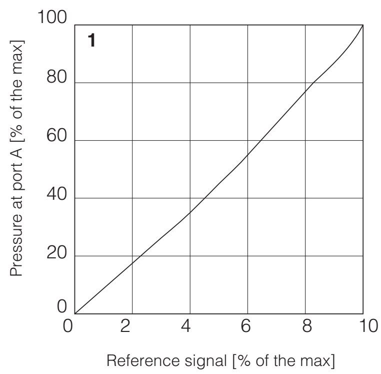
3 = A-T or P1-T (dotted line /350)
4 = P-P1 or P-A

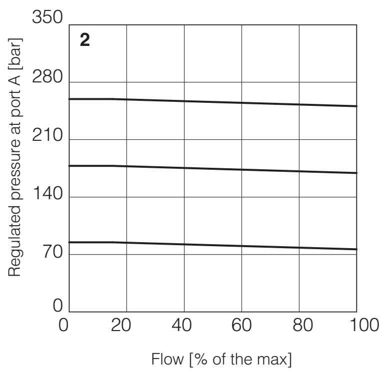
Note: the presence of counter pressure at port T can affect the effective pressure regulation

20 DIAGRAMS AGRCZA (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

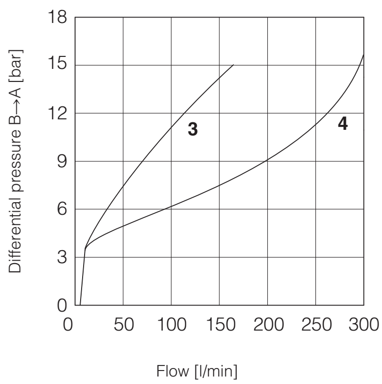


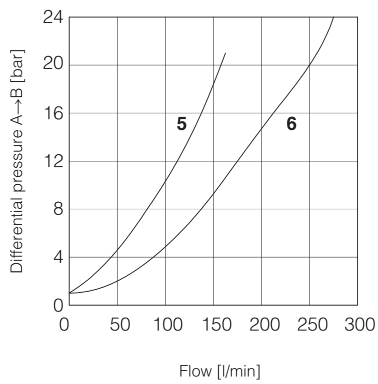


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZA-*-10
4 = AGRCZA-*-20

Differential pressure A→B
(through check valve)
5 = AGRCZA-*-10/*/R
6 = AGRCZA-*-20/*/R





21 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, EN-982).

21.1 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.

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

21.2 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 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 3 and 4, 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.

21.3 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 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.

21.4 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.

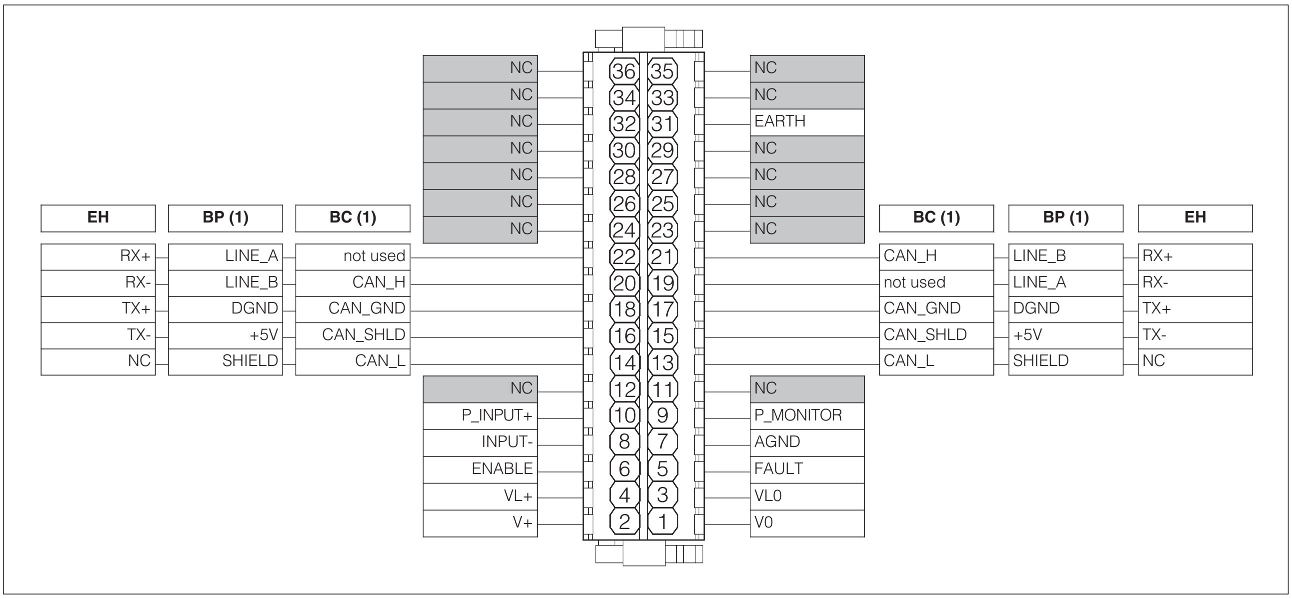
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

21.6 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.

22 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

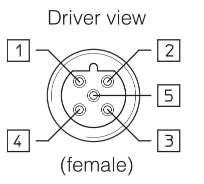
23 ELECTRONIC CONNECTIONS

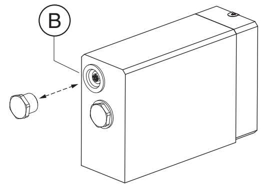
23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 V_{DC} / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 V_{DC} or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

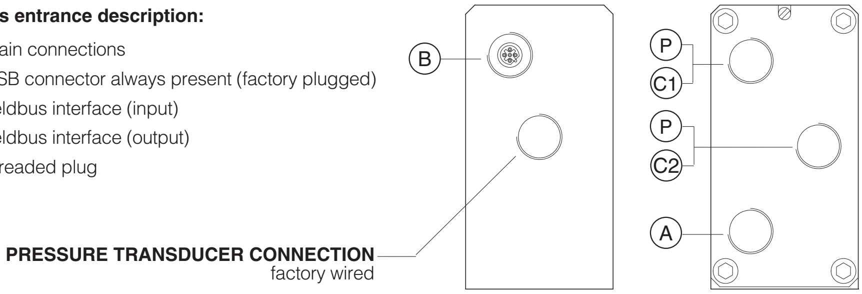
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

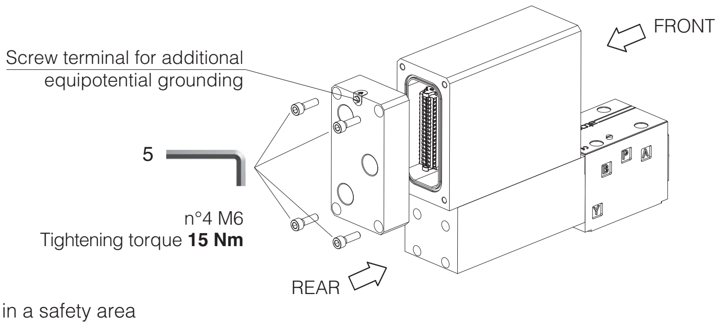
- A main connections
- B USB connector always present (factory plugged)
- C1 fieldbus interface (input)
- C2 fieldbus interface (output)
- P threaded plug



(front) (rear)

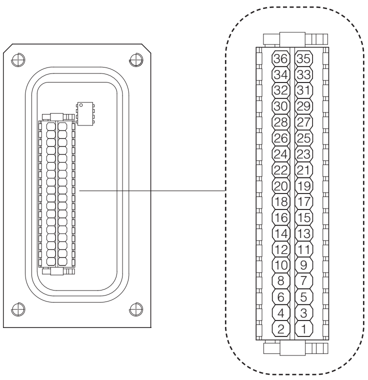
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

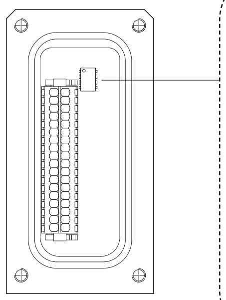


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22

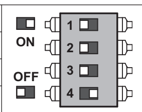


Fieldbus terminator only for BC and BP executions **(1)**



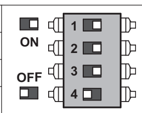
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

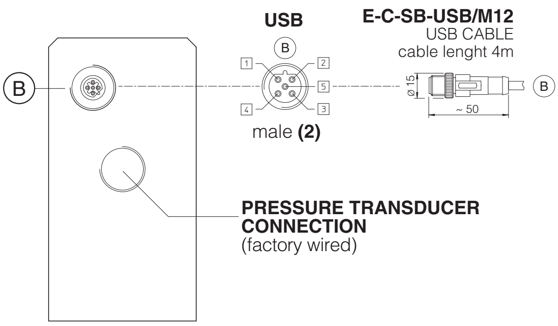


BP - PROFIBUS DP setting:

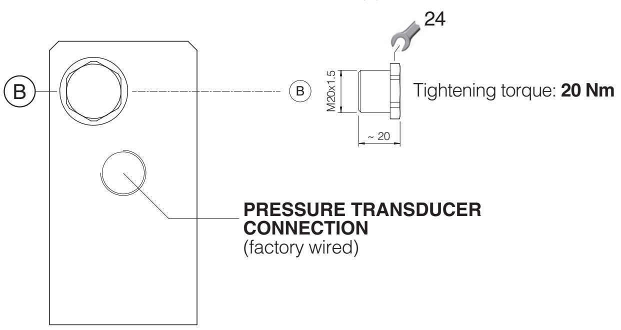
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

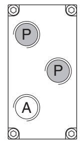
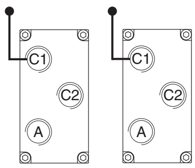
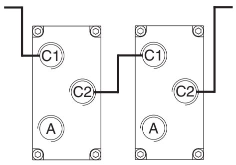


METALLIC PROTECTION CAP - supplied with the valves



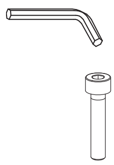
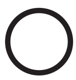
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

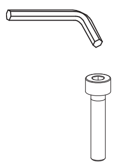
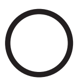
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

25.1 RZGA valves

	RZGA-RES-*-010	RZGA-RES-*-033
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm

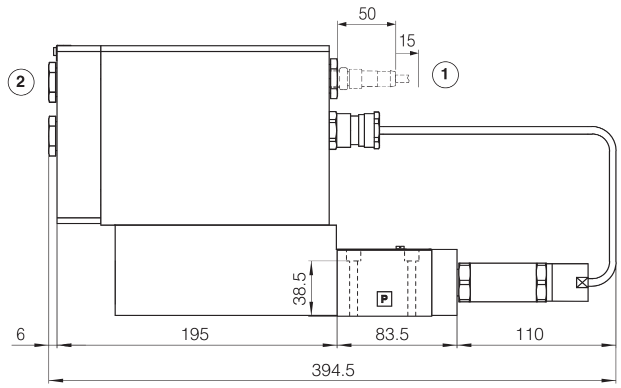
25.2 AGRCZA valves

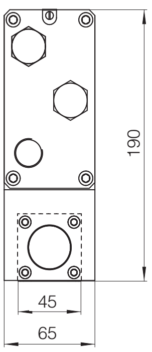
	AGRCZA-RES-*-10	AGRCZA-RES-*-20
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

RZGA-RES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(port B not used)

Mass [kg]	
RZGA-RES-*-010	8,5

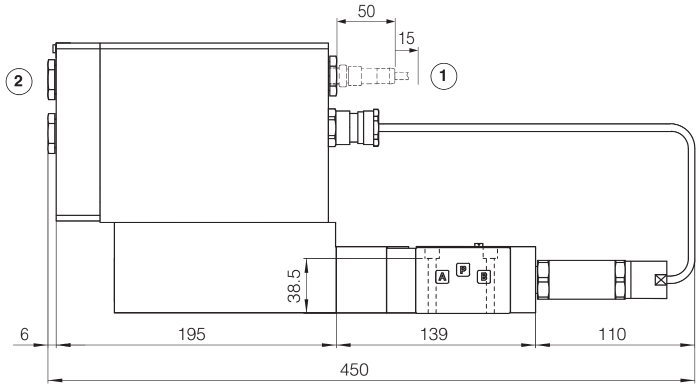


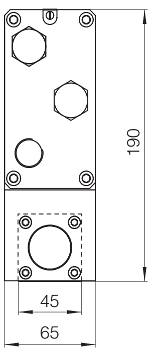


RZGA-RES-*-033

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZGA-RES-*-033	9,5





1 = Space to remove the USB connector

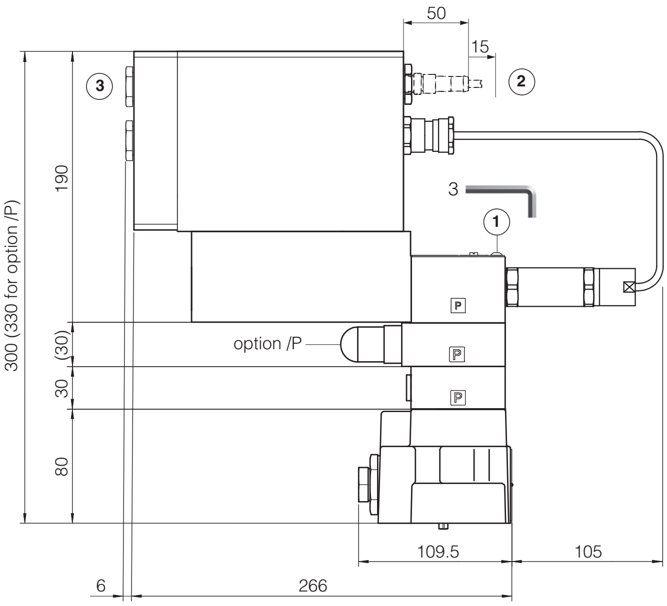
2 = The dimensions of cable glands must be considered (see tech table **KX800**)

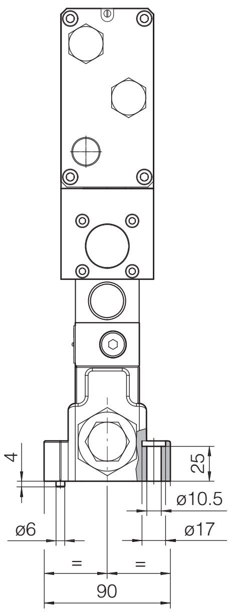
27 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-RES-*-10

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

Mass [kg]	
AGRCZA-RES-*-10	12,1

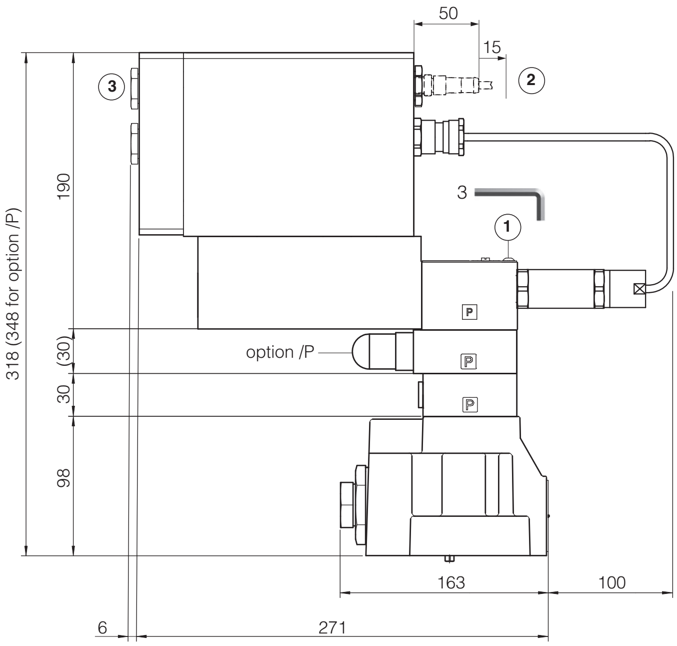


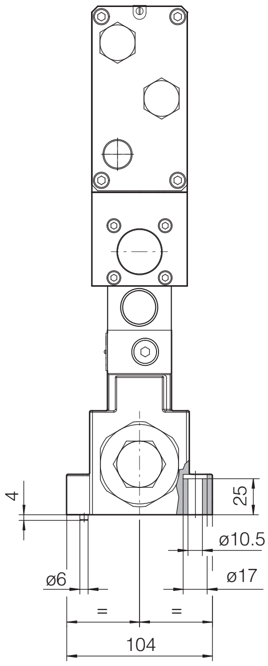


AGRCZA-RES-*-20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

Mass [kg]	
AGRCZA-RES-*-20	13,3





1 = Air bleed off

2 = Space to remove the USB connector

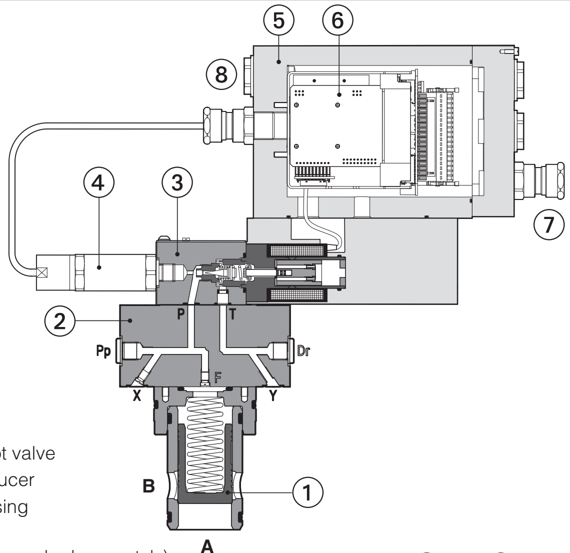
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional pressure cartridges high performance

with on-board driver and pressure transducer - **ATEX and IECEx**



1. poppet
2. functional cover
3. Proportional ex-proof pilot valve
4. ex-proof pressure transducer
5. ex-proof electronics housing
6. on-board digital driver
7. ex-proof cable glands (to be orderd separately)
8. USB port always present (factory plugged)

LIMZA-RES-P-BC-4

LICZA-RES, LIMZA-RES, LIRZA-RES

2-way ex-proof digital proportional pressure cartridges, high performance with pressure transducer, respectively performing: pressure compensator, relief or reducing functions.

They are equipped with ex-proof on-board digital driver, pressure transducer and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** -ISO7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 MODEL CODE FOR COVERS

LIMZA	-	RES	-	P	-	NP	-	3	/	315	/	M	/	*	/	*	*	/	*

Ex-proof proportional pressure cartridges
LICZA = pressure compensator
LIMZA = pressure relief
LIRZA = pressure reducing

RES = on-board driver

P = on-board ex-proof pressure transducer

Fieldbus interfaces, USB port always present:
NP = Not present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 7368:
1 = 16
2 = 25
3 = 32
4 = 40
5 = 50 (not for LIRZA)
6 = 63 (only for LIMZA)
8 = 80; (only for LIMZA)

Max regulated pressure:
80 = 80 bar
180 = 180 bar
250 = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
P =with integral mechanical pressure limiter (standard for size 1, 2, 3)

Electronics options (1):
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 V_{DC})

Dynamic response preset, see section 18:
- = omit for PID 1 fast (default)
2 = PID 2 standard
3 = PID 3 smooth

Series number

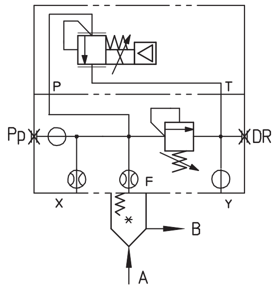
Seals material, see section 11 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP

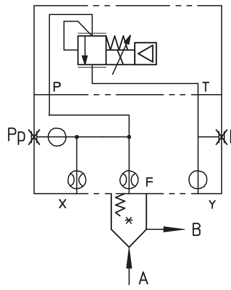
2 HYDRAULICS SYMBOLS

LICZA

LICZA-RES-1÷3
LICZA-RES-4÷5 /P

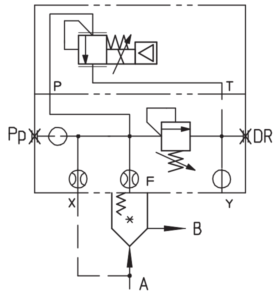


LICZA-RES-4÷5

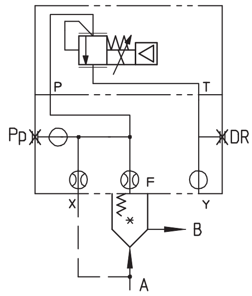


LIMZA

LIMZA-RES-1÷3
LIMZA-RES-4÷8 /P

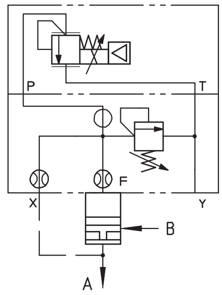


LIMZA-RES-4÷8

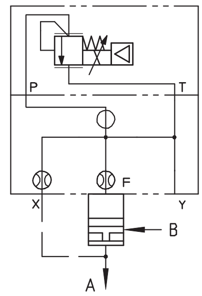


LIRZA

LIRZA-RES-1÷3
LIRZA-RES-4 /P



LIRZA-RES-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

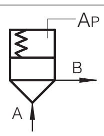
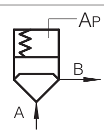
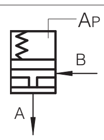
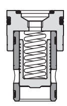
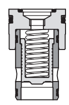
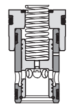
Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

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

Series number

Seals material,
see section 11 :
- = 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 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 **FX900** 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

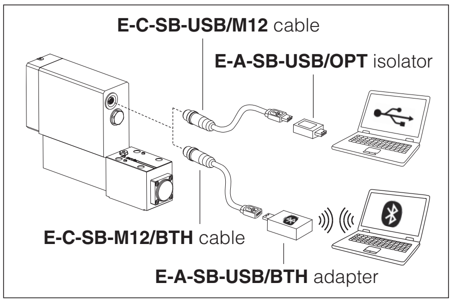
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 IRT)
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

7 FIELDBUS - see tech. table GS510

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

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 12 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	LICZA					LIMZA							LIRZA			
Valve size [l/min]	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow [bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure	see section 20															
Max regulated pres. at port A [bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure [bar]	Ports: T, Y = 210															
	Ports: P, A, B, X = 350															
Response time 0-100% step signal **(1)** (depending on installation) [ms]	≤ 100 ÷ 350					≤ 100 ÷ 350							≤ 100 ÷ 250			
Hysteresis [% of regulated max pres.]	≤ 0,5															
Linearity [% of regulated max pres.]	≤ 1,0															
Repeatibility [% of regulated max pres.]	≤ 0,2															

(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

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
Monitor outputs	Voltage: range 0 ÷ 10 VDC @ max 5 mA Current: 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 power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
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
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

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

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 mm²/s - max allowed range 15 ÷ 500 mm²/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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

12 CERTIFICATION DATA

Valve type	LICZA, LIMZA, LIRZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-RES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31	IEC 60079-0 IEC 60079-1 IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

13 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

14 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

15 HYDRAULIC OPTIONS

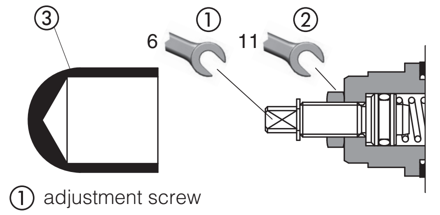
P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA, LIMZA and LIRZA standard size 1, 2, 3 and option /P 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 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, 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.

17 POSSIBLE COMBINED OPTIONS

/IP

18 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 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

PID	Dynamic response
1	Fast - default **(1)**
2	Standard
3	Smooth
4	Open Loop

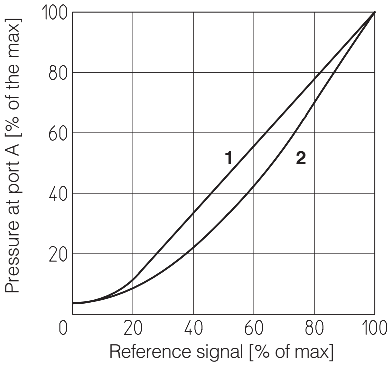
19 PRESSURE TRANSDUCER FAILURE

In case of pressure transducer failure, the valve's reaction can be configured through Atos E-SW software to:

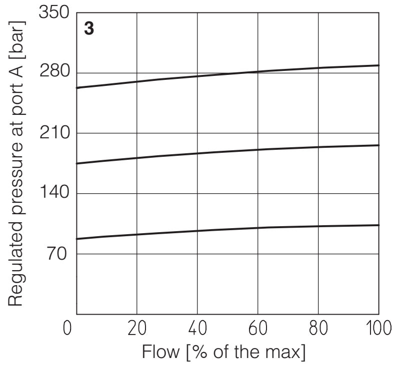
- cut off the current to solenoid, therefore the regulated pressure will be reduced to minimum value (default setting)
- automatically switch the pressure control from closed loop (PID1,2,3) to open loop (PID4), to let the valve to temporarily operate with reduced regulation accuracy

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

1 Regulation diagrams LIMZA
2 Regulation diagrams LICZA



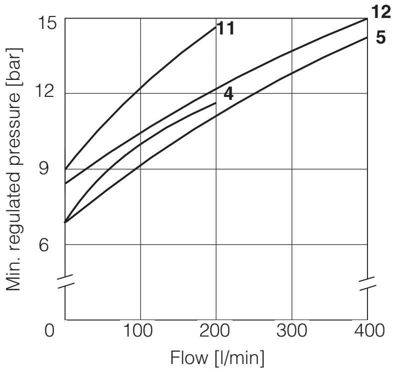
3 Pressure/flow diagrams LICZA, LIMZA

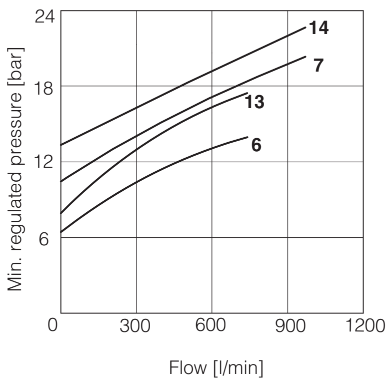


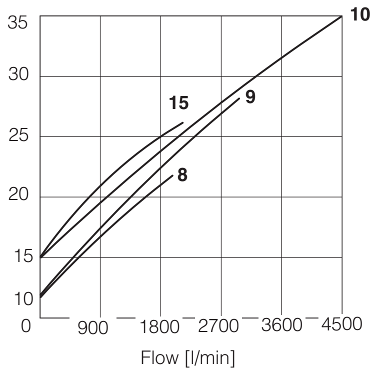
4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1
5 = LIMZA-*-2
6 = LIMZA-*-3
7 = LIMZA-*-4
8 = LIMZA-*-5
9 = LIMZA-*-6
10 = LIMZA-*-8

11 = LICZA-*-1
12 = LICZA-*-2
13 = LICZA-*-3
14 = LICZA-*-4
15 = LICZA-*-5

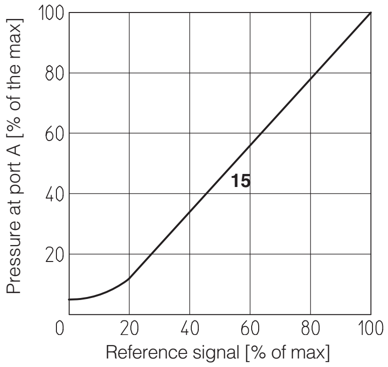






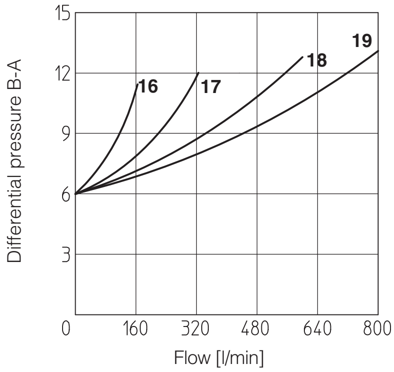
Regulation diagrams LIRZA

15 = LIRZA-A



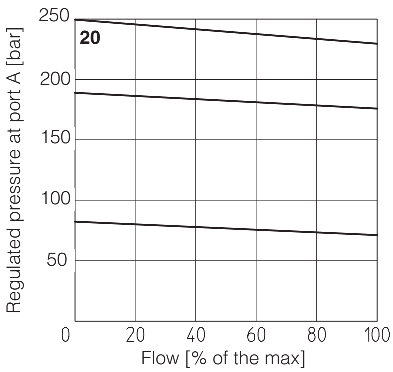
16-19 Min. pressure/flow diagrams
with reference signal "null"

16 = LIRZA-*-1
17 = LIRZA-*-2
18 = LIRZA-*-3
19 = LIRZA-*-4



Pressure/flow diagrams

20 = LIRZA-A



21 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, EN-982).

21.1 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.

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

21.2 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 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 3 and 4, 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.

21.3 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 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.

21.4 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.

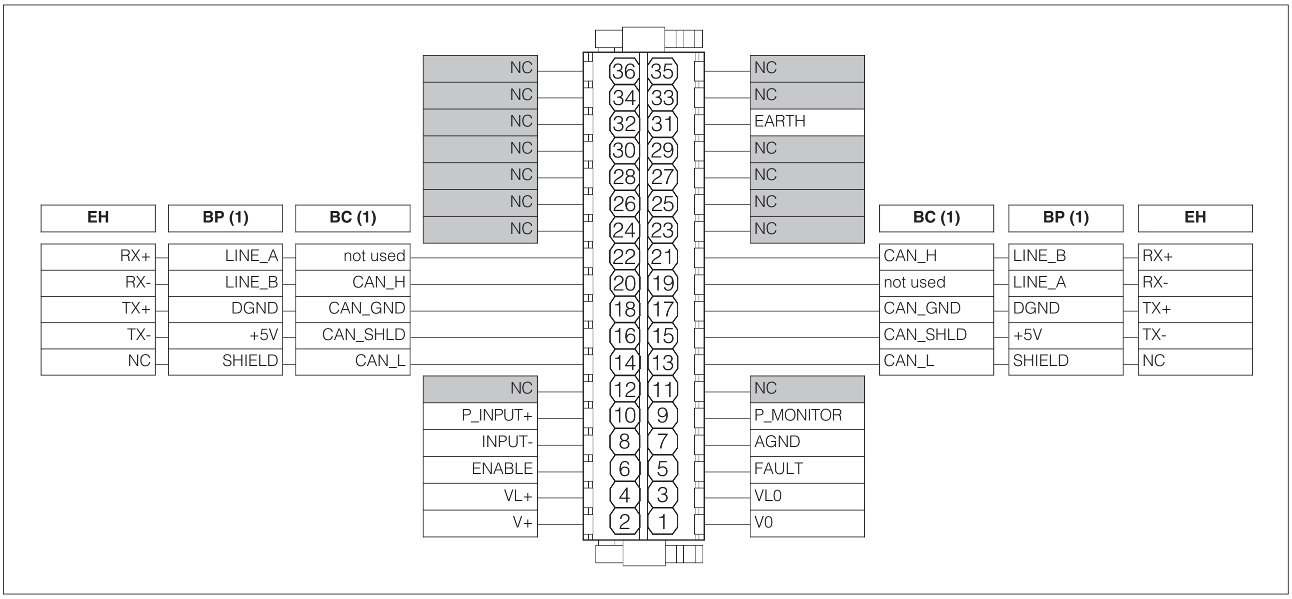
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

21.6 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.

22 TERMINAL BOARD OVERVIEW



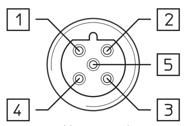
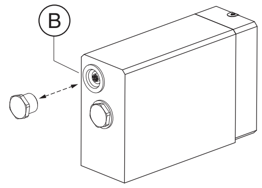
(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

23 ELECTRONIC CONNECTIONS

23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative pressure reference input signal for INPUT+	Input - analog signal
	9	**P_MONITOR**	Pressure monitor output signal: 0 ÷10 V_{DC} / 0 ÷ 20 mA maximum range, referred to AGND Default is: 0 ÷10 V_{DC} or 4 ÷ 20 mA	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Pressure reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	Driver view	
B	1	**+5V_USB**	Power supply	 1 2 5 4 3 (female)	 B
	2	**ID**	Identification		
	3	**GND_USB**	Signal zero data line		
	4	**D-**	Data line -		
	5	**D+**	Data line +		

23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

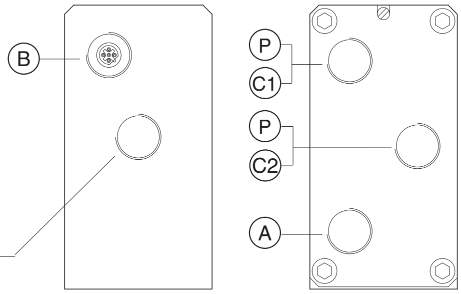
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

24 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug

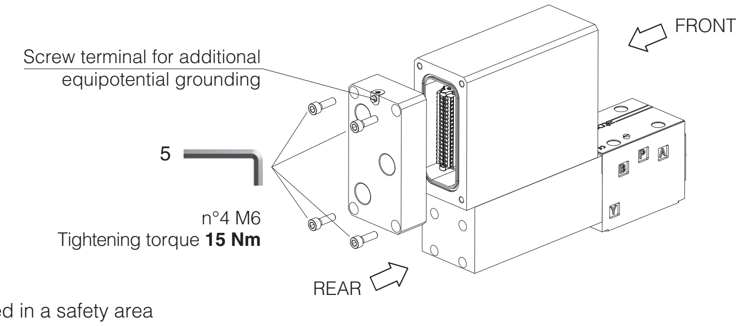


PRESSURE TRANSDUCER CONNECTION
factory wired

(front) (rear)

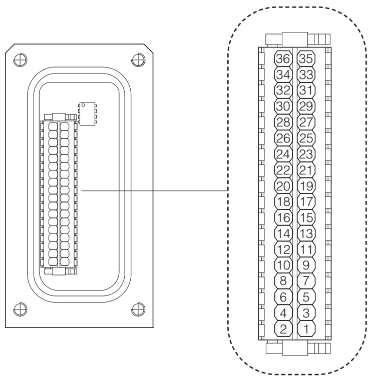
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

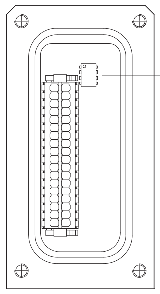


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22



Fieldbus terminator only for BC and BP executions **(1)**



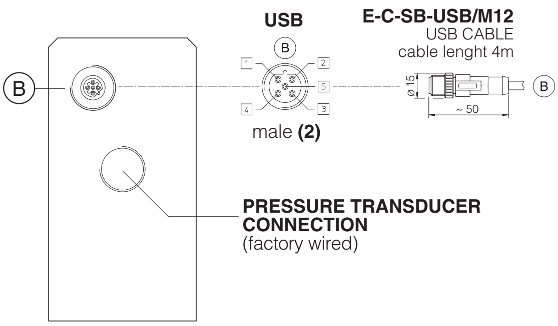
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

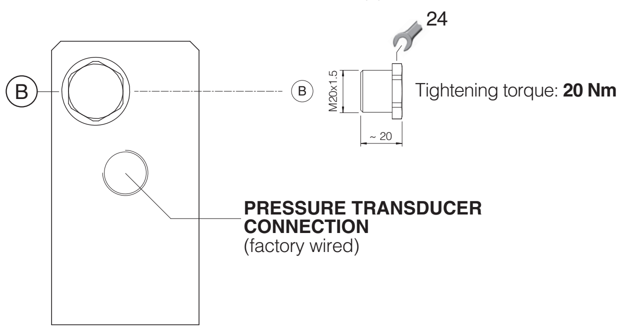
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

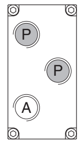
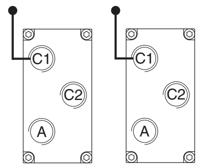
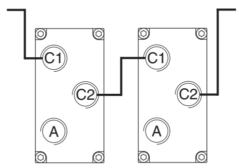


METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

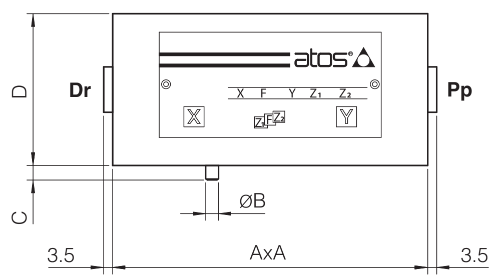
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA **LICZA** **LIRZA**	**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
LIMZA **LICZA**	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**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

26 COVERS DIMENSIONS [mm]

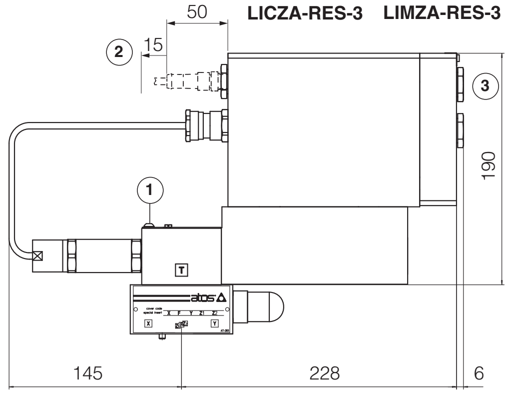
Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4"
5 = 50	140x140	6	4	70	G 1/4"
6 = 63	180x180	6	4	80	G 3/8"
8 = 80	ø250	8	6	80	G 3/8"



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

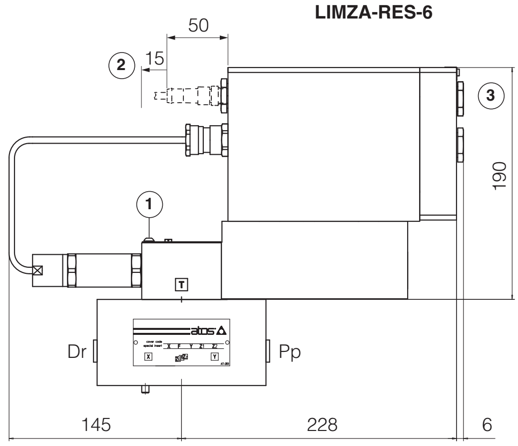
27 INSTALLATION DIMENSIONS [mm]

LICZA-RES-1 LIMZA-RES-1 LIRZA-RES-1
LICZA-RES-2 LIMZA-RES-2 LIRZA-RES-2
LICZA-RES-3 LIMZA-RES-3 LIRZA-RES-3

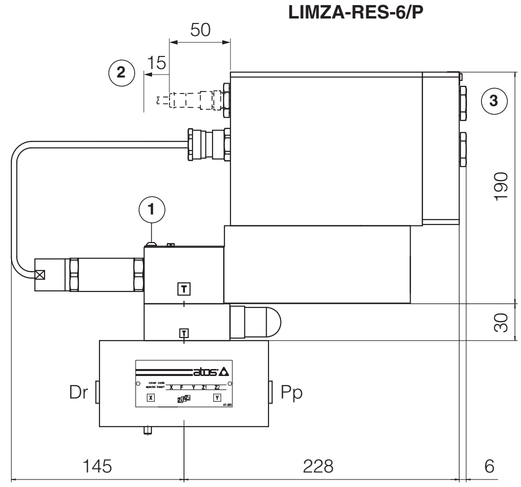


Mass [kg]			
	LICZA, LIMZA, LIRZA		Cartridge
Size	Standard	Option /P	SC LI
1 = 16	11	-	0,2
2 = 25	11,5	-	0,5
3 = 32	12,8	-	0,9
4 = 40	18,2	12,5	1,7
5 = 50	21,7	16	2,9
6 = 63	31,2	25,5	6,7
8 = 80	39,8	34,1	13,1

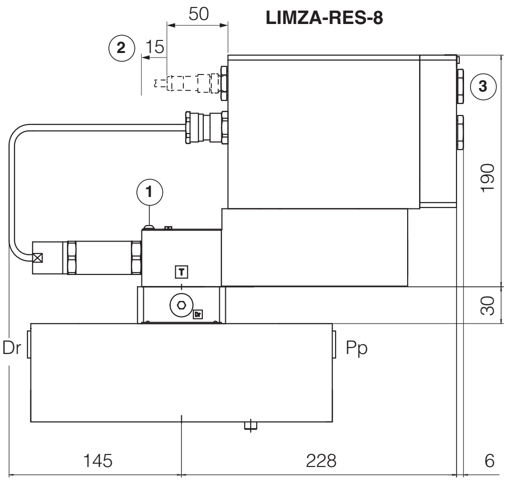
LICZA-RES-4 LIMZA-RES-4 LIRZA-RES-4
LICZA-RES-5 LIMZA-RES-5
LIMZA-RES-6



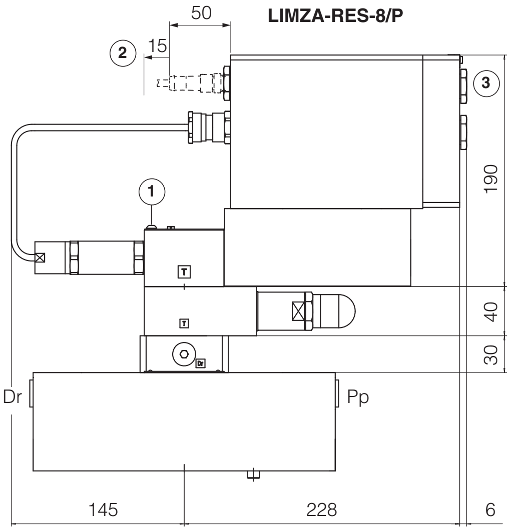
LICZA-RES-4/P LIMZA-RES-4/P LIRZA-RES-4/P
LICZA-RES-5/P LIMZA-RES-5/P
LIMZA-RES-6/P



LIMZA-RES-8



LIMZA-RES-8/P



Note: for ISO 7368 mounting surface and cavity dimensions, see tech. table P006

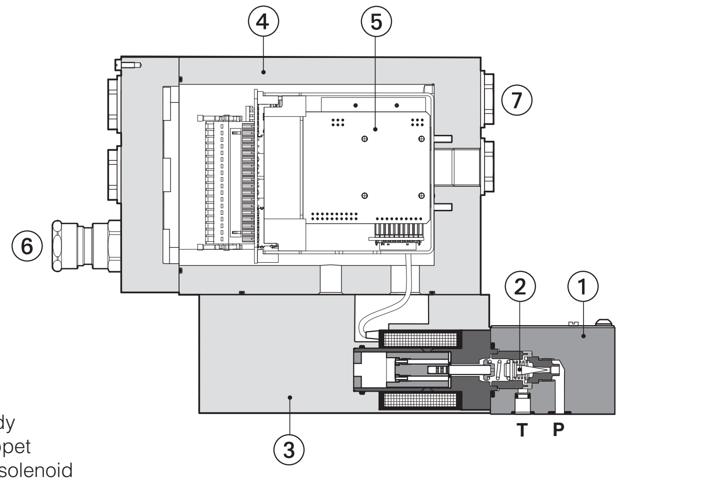
1 = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof digital proportional relief valves

direct or piloted, with on-board driver and without transducer - **ATEX and IECEx**



① valve body
② main poppet
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

RZMA-AES-NP-10-*

RZMA-AES, AGMZA-AES

Ex-proof digital proportional relief valves direct or piloted without transducer for pressure open loop controls.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECE**x for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZMA, direct or piloted:
Size: **06** -ISO 4401
Max flow: **4** and **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** -ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA - AES - NP - 010 / 250 / M / * * / *

RZMA – Ex-proof proportional pressure relief valves
RZMA = subplate size 06
AGMZA = subplate size 10, 20, 32

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:

RZMA: direct	**010** = Qmax 4 l/min	
RZMA: piloted	**030** = Qmax 40 l/min	
AGMZA: piloted	**10, 20, 32** = Qmax 200, 400, 600 l/min	

Max regulated pressure:
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGMZA **(1)**:
E = external pilot
Y = external drain

Electronic options (1):
I = current reference input 4÷20 mA (omit for std voltage 0÷10V_{DC})

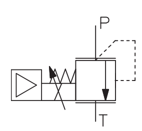
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

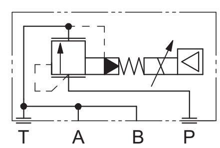
(1) Possible combined options: /EY, /EI, /YI

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

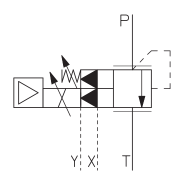
RZMA-AES-*-010



RZMA-AES-*-030



AGMZA-AES-*



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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

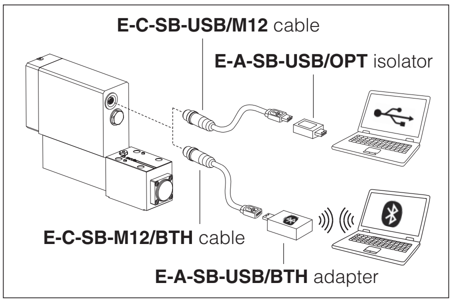
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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	RZMA-010 150 years, RZMA-030 and AGMZA 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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	RZMA		AGMZA		
Size code	**010**	**030**	**10**	**20**	**32**
Valve size	06		10	20	32
Max regulated pressure [bar]	**80 180 250**				
Min regulated pressure [bar]	see min. pressure / flow diagrams at sections 18 19 20				
Max pressure at port P, A, B, X [bar]	315				
Max pressure at port T, Y [bar]	210				
Max flow [l/min]	4	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 80		≤ 130	≤ 145	≤ 160
Hysteresis [% of the max pressure]	≤ 1,5				
Linearity [% of the max pressure]	≤ 3				
Repeatability [% of the max pressure]	≤ 2				

(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

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ			
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			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
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

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, 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1 — EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm²	**Grounding:** section of external ground wire = 4 mm²

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

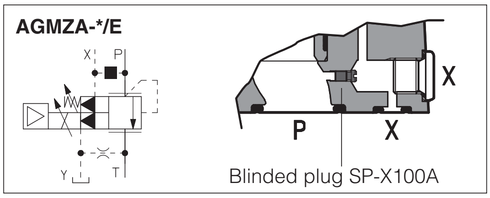
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

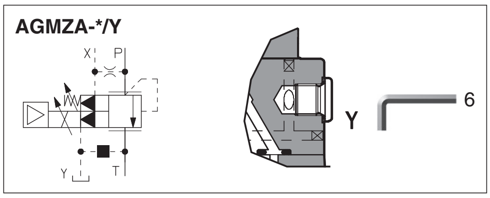
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

13 HYDRAULIC OPTIONS - only for AGMZA

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 ¼").

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 ¼" available on the pilot stage body.





14 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference signal, 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.

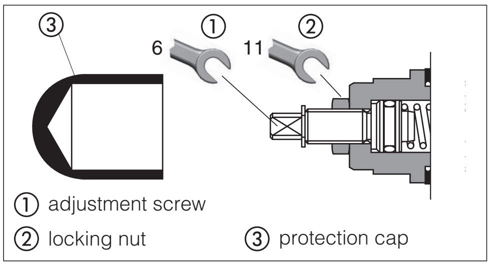
15 POSSIBLE COMBINED OPTIONS

/EY, /EI, /YI

16 MECHANICAL PRESSURE LIMITER - only for AGMZA

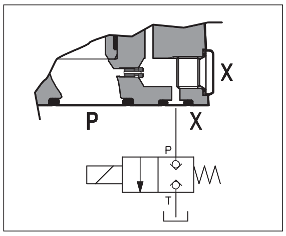
The AGMZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated 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.



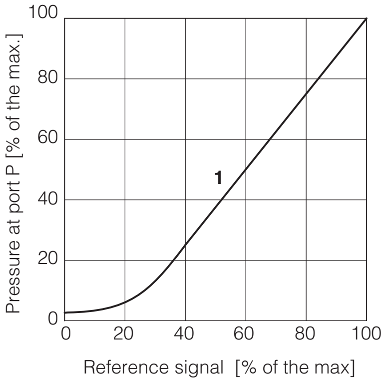
17 REMOTE PRESSURE UNLOADING - only for AGMZA

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.

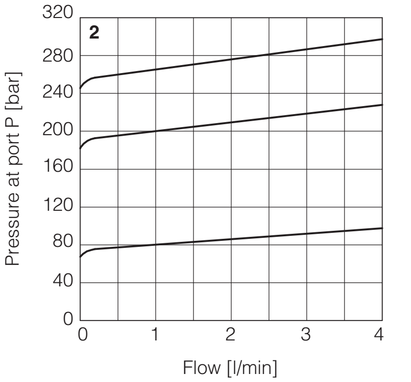


18 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

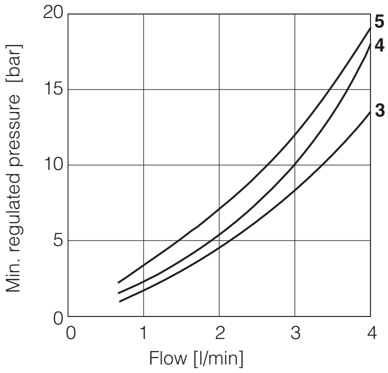
1 **Regulation diagrams**
with flow rate Q = 1 l/min



2 **Pressure/flow diagrams**
with reference signal set at Q = 1 l/min



3-5 **Min. pressure/flow diagrams**
with zero reference signal

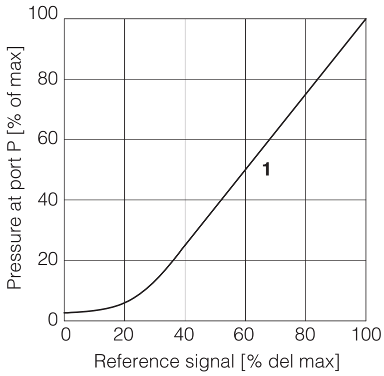


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

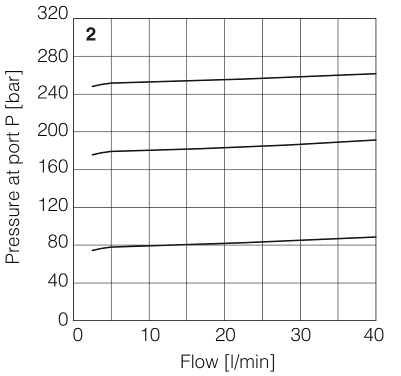
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

19 DIAGRAMS RZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

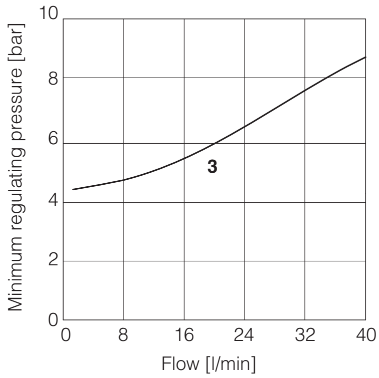
1 **Regulation diagrams**
with flow rate Q = 10 l/min



2 **Pressure/flow diagrams**
with reference signal set at Q = 10 l/min



3 **Min. pressure/flow diagrams**
with zero reference signal

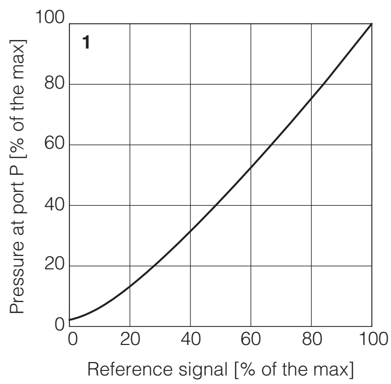


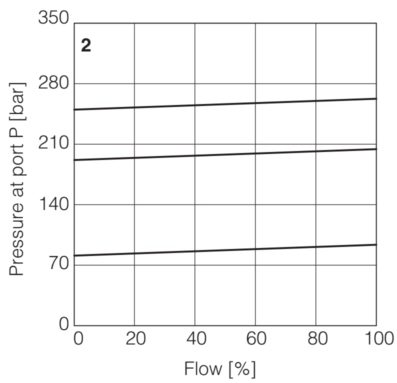
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

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

1 = **Regulation diagrams**
with flow rate Q = 50 l/min

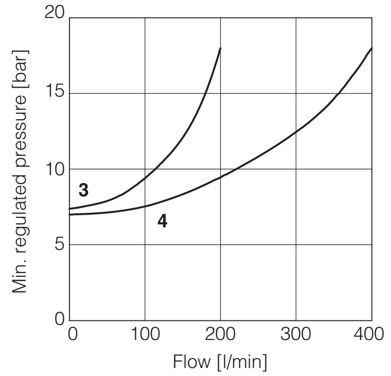
2 = **Pressure/flow diagrams**
with reference signal set at Q = 50 l/min

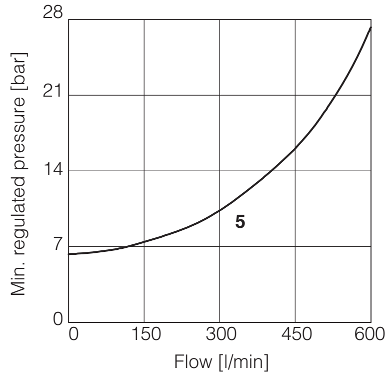




3-5 = **Min. pressure/flow diagrams**
with zero reference signal

3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32





21 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, EN-982).

21.1 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.

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

21.2 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 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 3 and 4, 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.

21.3 Flow reference input signal (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.

21.4 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 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

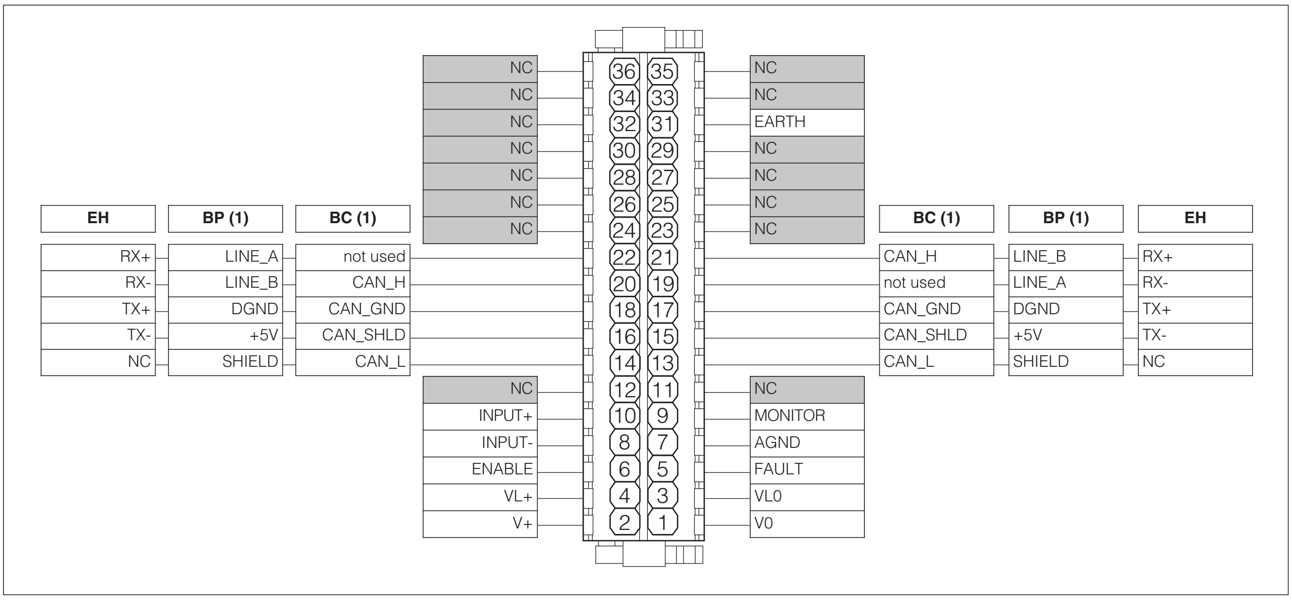
21.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

21.6 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.

22 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

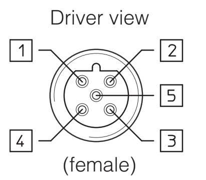
23 ELECTRONIC CONNECTIONS

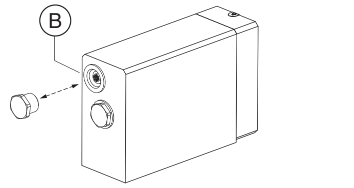
23.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

23.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





23.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

23.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

23.5 EH fieldbus execution connections

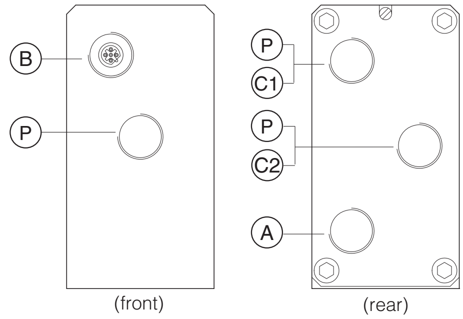
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

CABLE ENTRANCE OVERVIEW

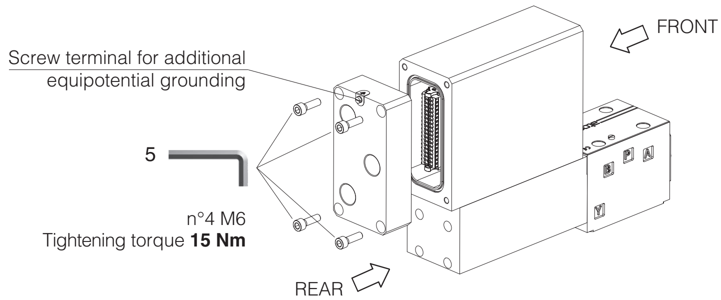
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



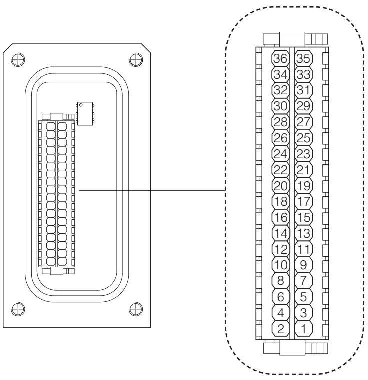
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

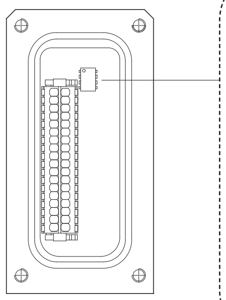


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 22



Fieldbus terminator only for BC and BP executions **(1)**



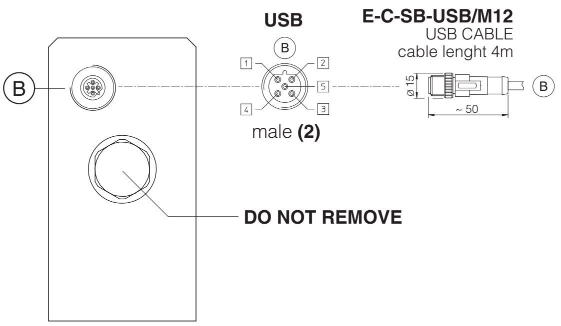
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

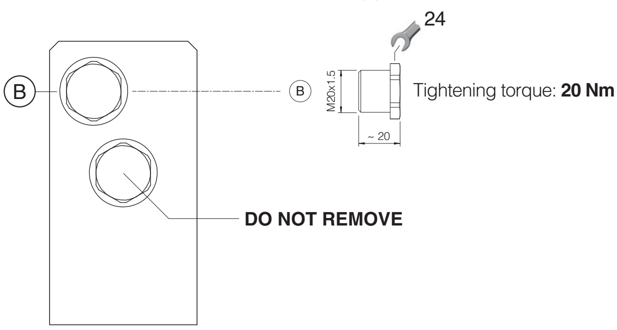
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

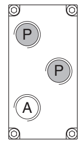
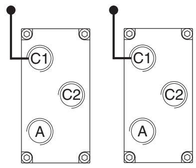
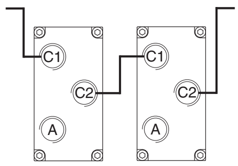


METALLIC PROTECTION CAP - supplied with the valves



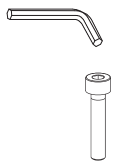
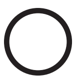
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

24.1 Cable glands and threaded plug - see tech table **KX800**

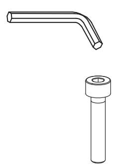
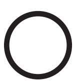
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

25 FASTENING BOLTS AND SEALS

25.1 RZMA valves

	RZMA-AES-*-010	RZMA-AES-*-030
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm

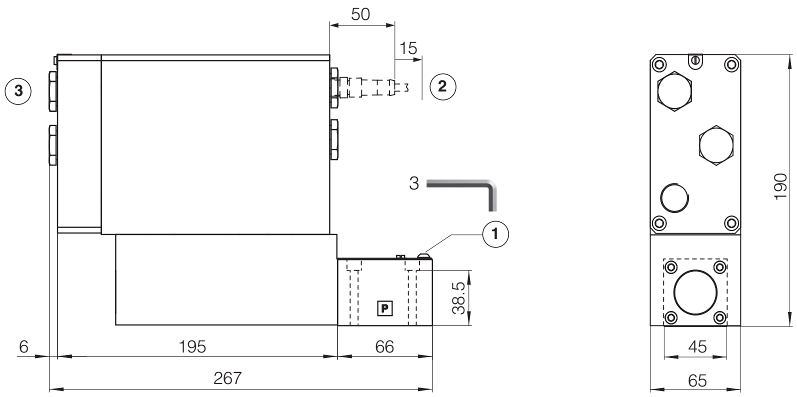
25.2 AGMZA valves

	AGMZA-AES-*-10	AGMZA-AES-*-20	AGMZA-AES-*-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

RZMA-AES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(without ports A and B)

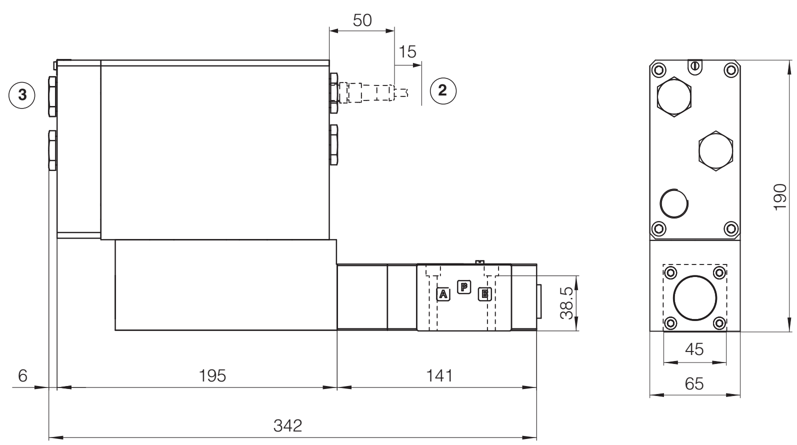
Mass [kg]	
RZMA-AES-*-010	8



RZMA-AES-*-030

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZMA-AES-*-030	9



1 = Air bleed off

2 = Space to remove the USB connector

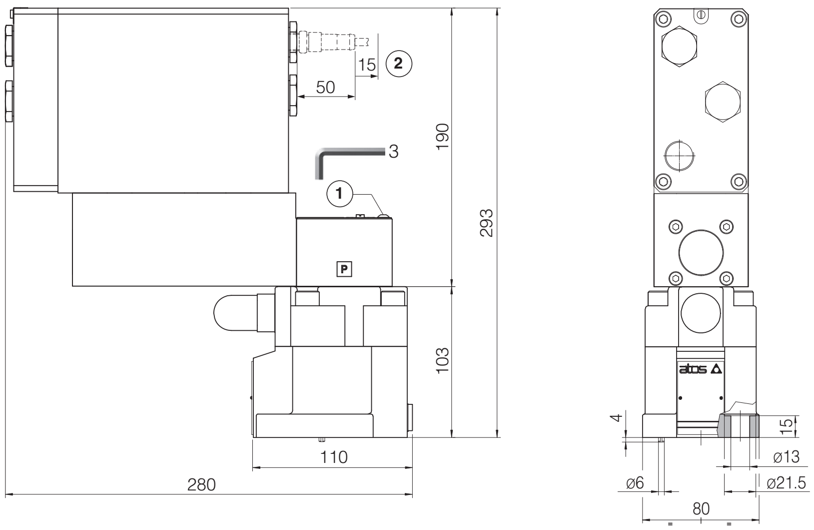
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

27 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-AES-*-10

ISO 6264: 2007
Mounting surface: 6264-06-09-1-97
(see table P005)

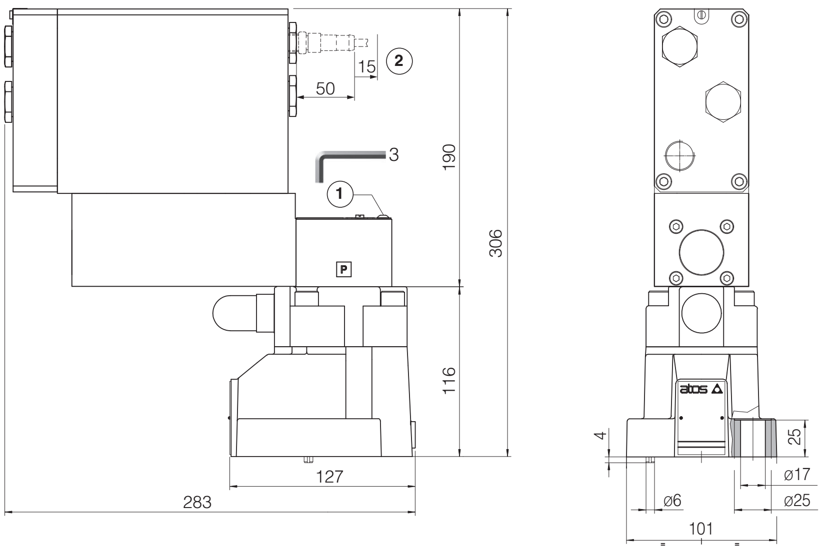
Mass [kg]	
AGMZA-AES-*-10	11,6



AGMZA-AES-*-20

ISO 6264: 2007
Mounting surface: 6264-08-13-1-97
(see table P005)

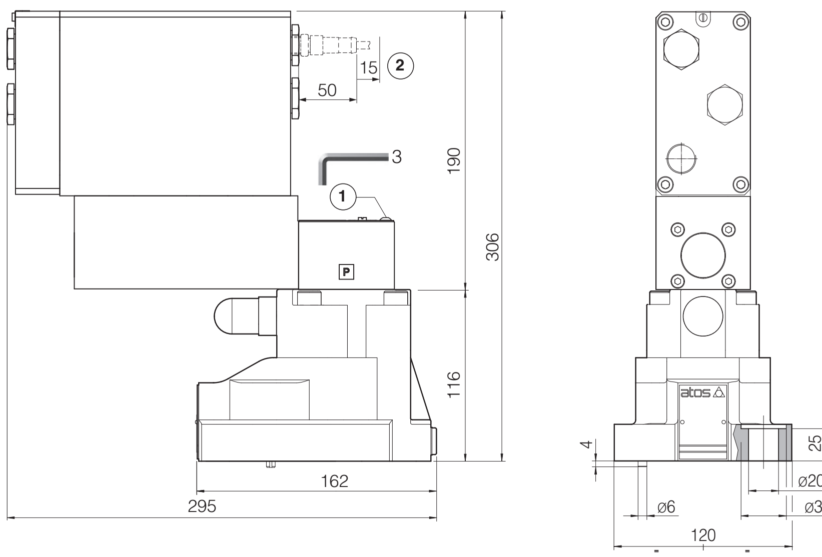
Mass [kg]	
AGMZA-AES-*-20	12,8



AGMZA-AES-*-32

ISO 6264: 2007
Mounting surface: 6264-10-17-1-97
(see table P005)

Mass [kg]	
AGMZA-AES-*-32	14,8



1 = Air bleed off

2 = Space to remove the USB connector

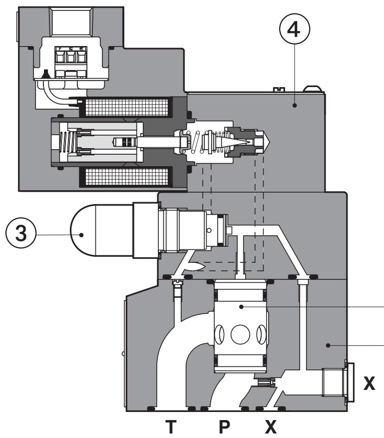
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

28 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof proportional relief valves

direct or piloted, without transducer - **ATEX, IECEx, EAC, PESO** or **cULUS**



AGMZA-A-10-*

① valve main body
② cartridge
③ mechanical pressure limiter
④ ex-proof pilot valve

RZMA-A, HZMA-A, AGMZA-A

Ex-proof proportional relief valves direct or piloted, without transducer for open loop pressure controls.
They are equipped with ex-proof proportional solenoid, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULUS** North American certification for gas group **C&D**

RZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **4** and **40 l/min**

HZMA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **40 l/min**

AGMZA, piloted:
Size: **10**, **20** and **32** - ISO 6264
Max flow: **200**, **400** and **600 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZMA / * - A - 10 - 250 / GK / * / * * / *

RZMA — Ex-proof proportional pressure relief valves
RZMA = subplate size 06
HZMA = modular size 06
AGMZA = subplate size 10, 20, 32

Certification type:
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULUS

A = without transducer

Valve size and configuration:

010 =	RZMA direct	size 06	Qmax 4 l/min
030 =	RZMA piloted	size 06	Qmax 40 l/min
030 =	HZMA piloted	size 06	Qmax 40 l/min
10 =	AGMZA piloted	size 10	Qmax 200 l/min
20 =	AGMZA piloted	size 20	Qmax 400 l/min
32 =	AGMZA piloted	size 32	Qmax 600 l/min

Max regulated pressure:
80 = 80 bar **180**= 180 bar **250**= 250 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULUS** **(4)**
M = M20x1,5 - not for **cULUS**
NPT = 1/2" NPT

Options (3):
E = external pilot (only for AGMZA)
O = horizontal cable entrance **(2)**
Y = external drain (only for AGMZA)

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

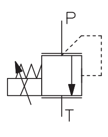
Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /EO, /EY, /OY **(4)** Approved only for the Italian market

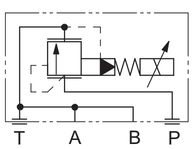
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

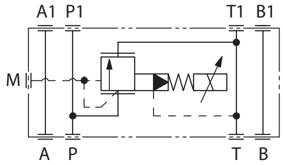
RZMA-A-010



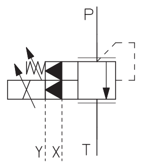
RZMA-A-030



HZMA-A-030



AGMZA-A-*



3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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; 150 years only for RZMA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		RZMA		HZMA	AGMZA		
Size code		**010**	**030**	**030**	**10**	**20**	**32**
Valve size		06			10	20	32
Max regulated pressure	[bar]	**80 180 250**					
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 15 16 17					
Max pressure at port P, A, B, X	[bar]	315					
Max pressure at port T, Y	[bar]	210					
Max flow	[l/min]	4	40	40	200	400	600
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 80			≤ 130	≤ 145	≤ 160
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 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

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

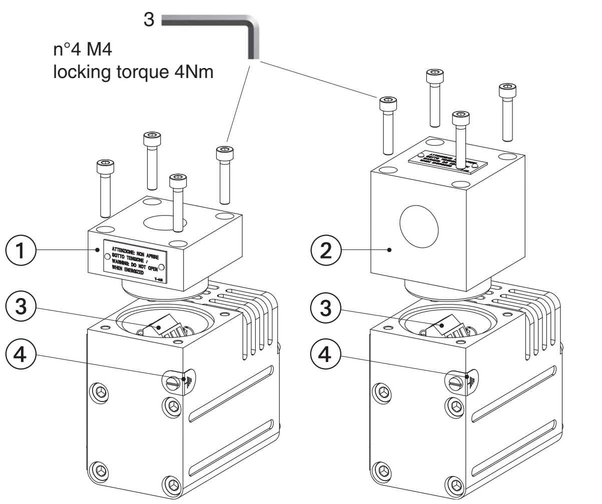
Valve type	RZMA, HZMA, AGMZA		RZMA/**M**, HZMA/**M**, AGMZA/**M**	RZMA/**UL**, HZMA/**UL**, AGMZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**MZA-A**		**MZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX 2014/34/EU Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

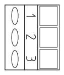
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

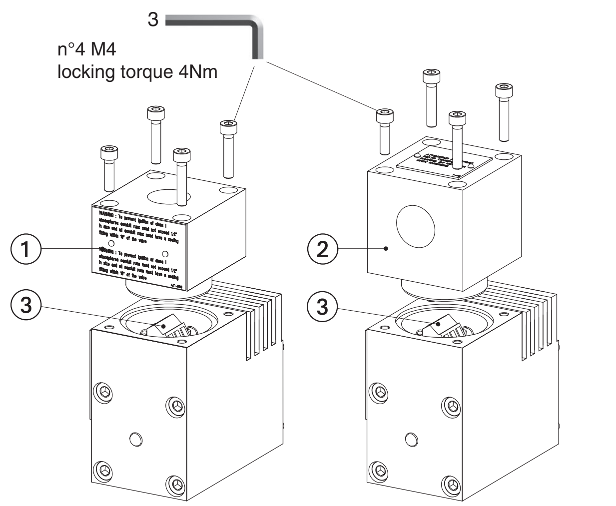
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

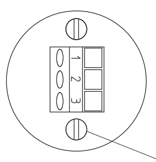
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

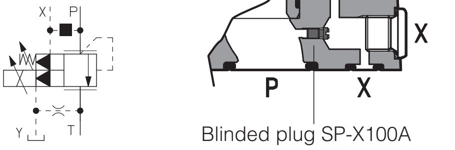
For alla valves:

O = Horizontal cable entrance to be selected in case of limited vertical space.

Only for AGMZA:

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 ¼").

AGMZA-*/E

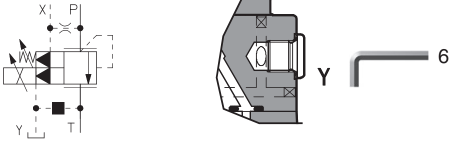


Blinded plug SP-X100A

Only for AGMZA:

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 ¼" available on the pilot stage body.

AGMZA-*/Y

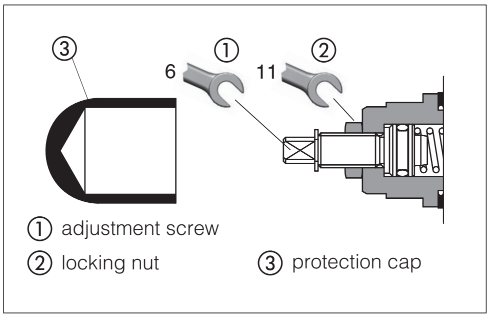


12.1 Possible combined options: /EO, /EY, /OY

13 MECHANICAL PRESSURE LIMITER - only for AGMZA

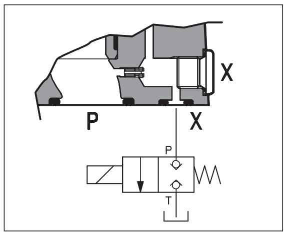
The AGMZA are provided with mechanical pressure limiter acting as protection against overpressure. For safety reasons the factory setting of the mechanical pressure limiter is fully unloaded (min pressure).
At the first commissioning it must be set at a value lightly higher than the max pressure regulated 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.



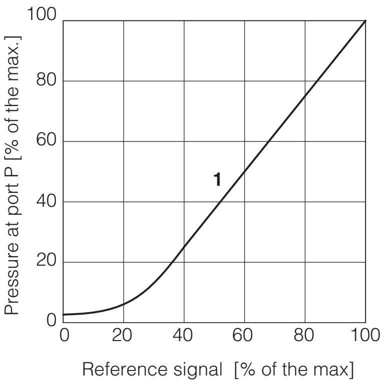
14 REMOTE PRESSURE UNLOADING - only for AGMZA

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.

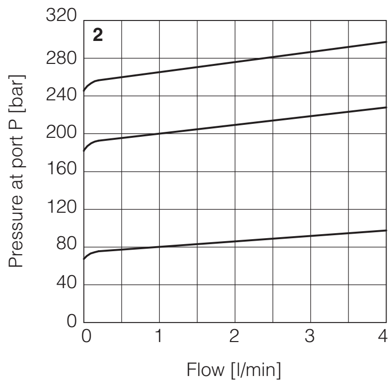


15 DIAGRAMS RZMA-010 (based on mineral oil ISO VG 46 at 50 °C)

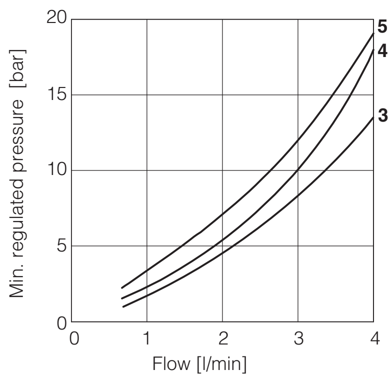
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-5 Min. pressure/flow diagrams
with zero reference signal

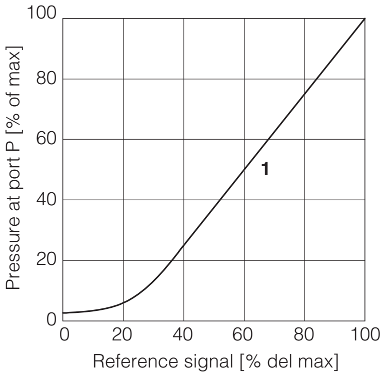


3 = RZMA/80
4 = RZMA/180
5 = RZMA/250

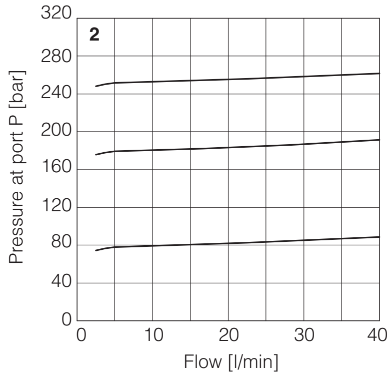
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

16 DIAGRAMS RZMA-030, HZMA-030 (based on mineral oil ISO VG 46 at 50 °C)

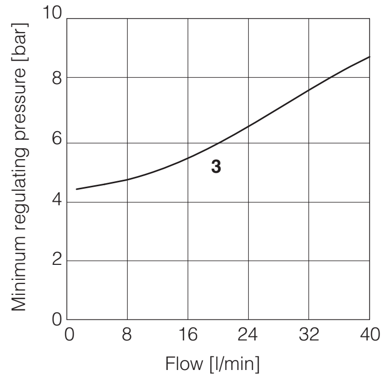
1 Regulation diagrams
with flow rate Q = 10 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 10 l/min



3 Min. pressure/flow diagrams
with zero reference signal

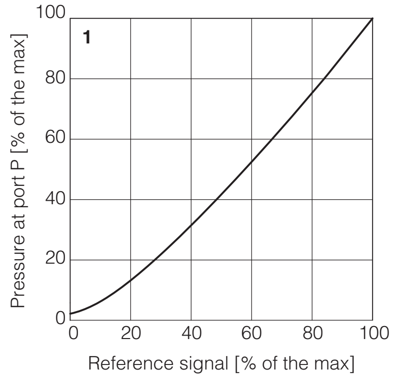


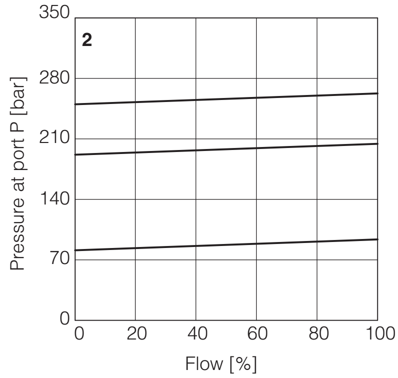
Note: the presence of counter pressure at port T can affect the pressure regulation and the minimum pressure

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

1 = Regulation diagrams
with flow rate Q = 50 l/min

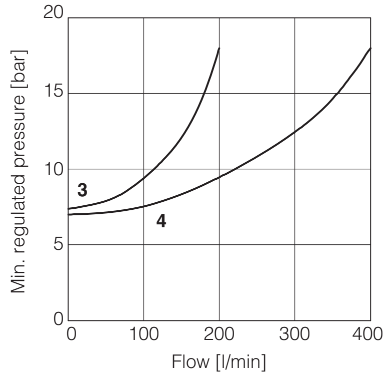
2 = Pressure/flow diagrams
with reference signal set at Q = 50 l/min

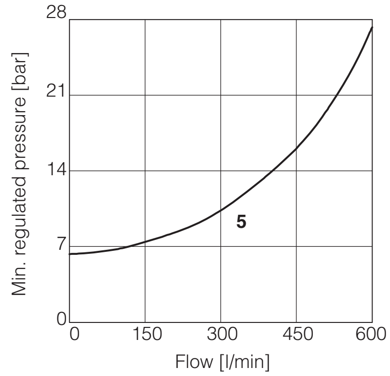




3-5 = Min. pressure/flow diagrams
with zero reference signal

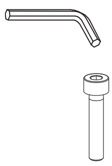
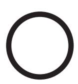
3 = AGMZA-*-10
4 = AGMZA-*-20
5 = AGMZA-*-32



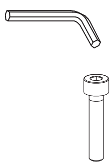
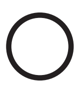


18 **FASTENING BOLTS AND SEALS**

18.1 RZMA and HZMA valves

	RZMA-A-010	**RZMA-A-030**	**HZMA-A-030**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5 class 12.9 Tightening torque = 8 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, B, T: Ø 6,5 mm

18.2 AGMZA valves

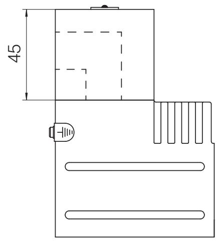
	AGMZA-A-10	**AGMZA-A-20**	**AGMZA-A-32**
	**Fastening bolts:** 4 socket head screws M12x35 class 12.9 Tightening torque = 125 Nm	**Fastening bolts:** 4 socket head screws M16x50 class 12.9 Tightening torque = 300 Nm	**Fastening bolts:** 4 socket head screws M20x60 class 12.9 Tightening torque = 600 Nm
	**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

RZMA-A-010

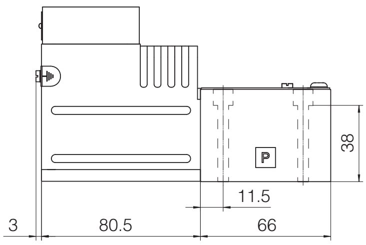
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(without ports A and B)

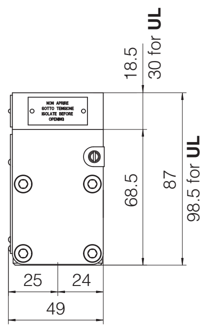
Mass [kg]	
RZMA-A-010	2,7
Option /O	+0,35

option /O



RZMA-A-010*



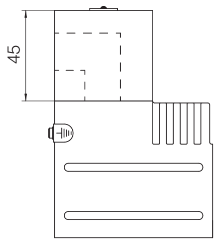


RZMA-A-030

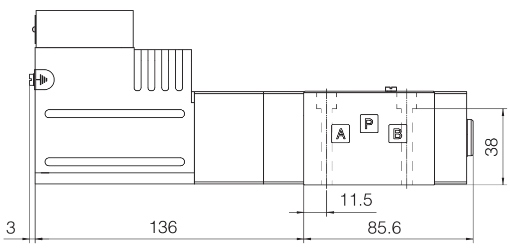
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

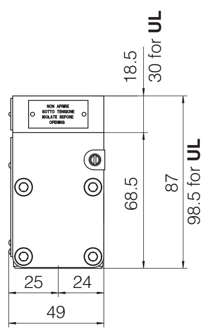
Mass [kg]	
RZMA-A-030	3,7
Option /O	+0,35

option /O



RZMA-A-030*



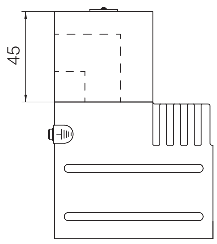


HZMA-A-030

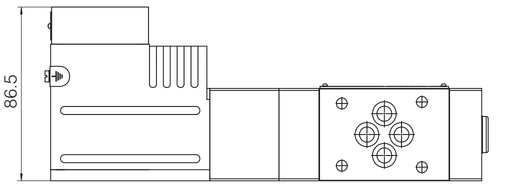
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05

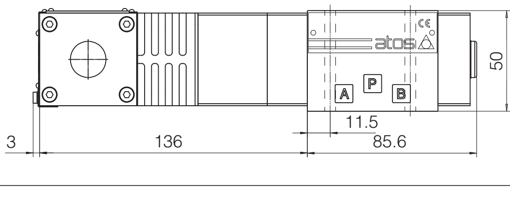
Mass [kg]	
HZMA-A-030	3,7
Option /O	+0,35

option /O



HZMA-A-030*



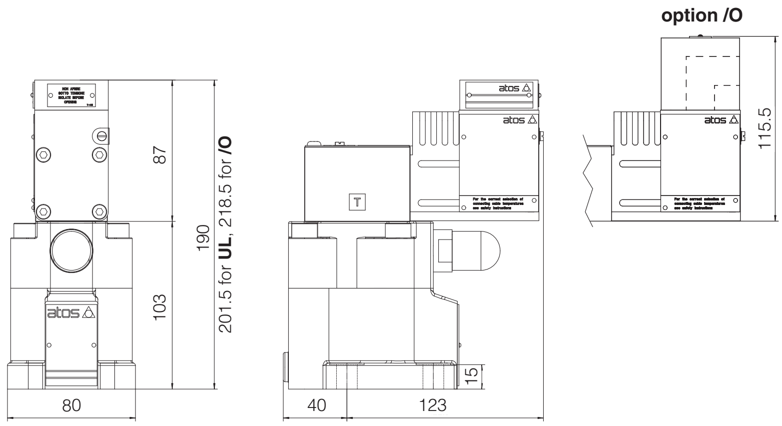


20 INSTALLATION DIMENSIONS FOR AGMZA [mm]

AGMZA-A-10

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97

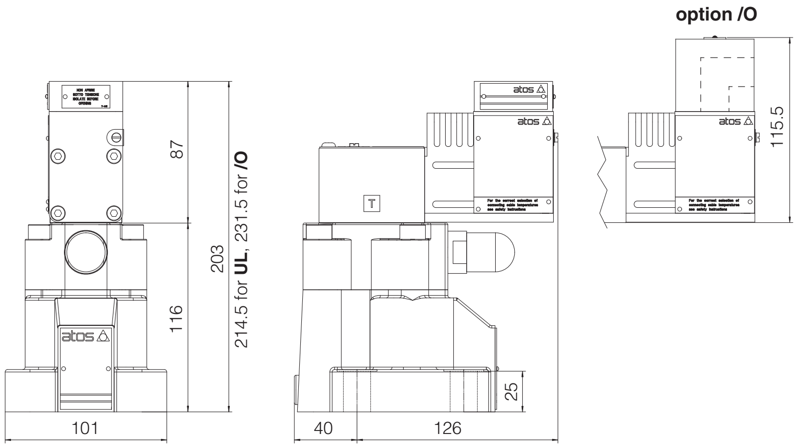
Mass [kg]	
AGMZA-A-10	6,3
Option /O	+0,35



AGMZA-A-20

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-13-1-97

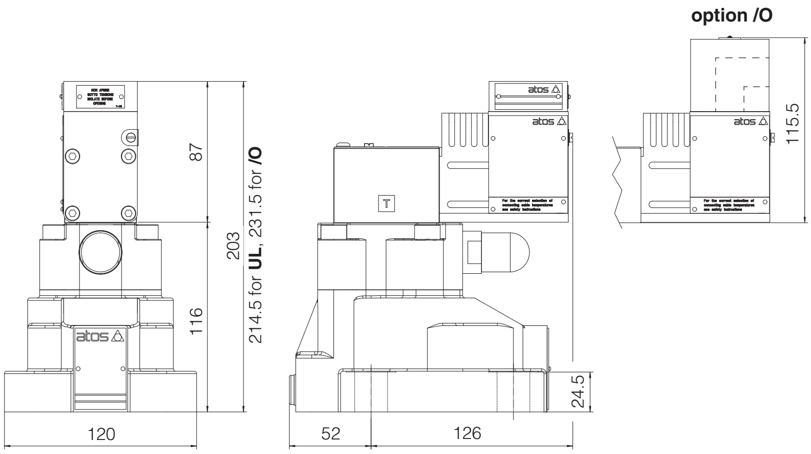
Mass [kg]	
AGMZA-A-20	7,5
Option /O	+0,35



AGMZA-A-32

ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)

Mass [kg]	
AGMZA-A-32	8,9
Option /O	+0,35



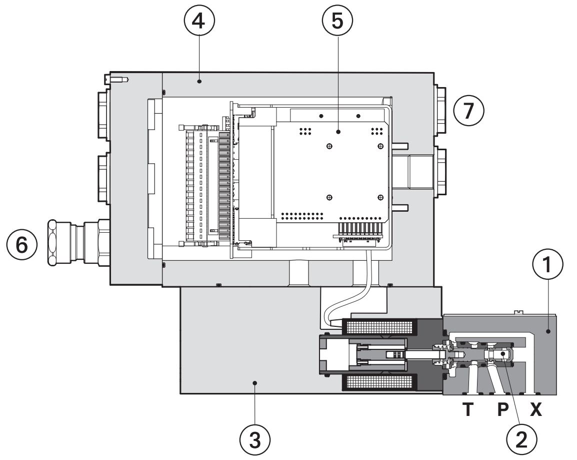
21 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
FX900 Operating and manintenance information for ex-proof proportional valves
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

atos

Ex-proof digital proportional reducing valves

direct or piloted, with on-board driver and without pressure transducer - **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

RZGA-AES-BC-10-*

RZGA-AES, AGRCZA-AES

Ex-proof digital proportional reducing valves, direct or piloted, whithout transducer for pressure open loop controls.

They are equipped with ex-proof on-board digital driver and proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of integral digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

RZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA	-	AES	-	NP	-	010	/	210	/	M	/	*	*	/	*

Ex-proof proportional pressure reducing valves
RZGA = subplate size 06
AGRCZA = subplate size 10, 20

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size and configuration:

RZGA: direct	**010** = Qmax 12 l/min
RZGA: piloted	**033** = Qmax 40 l/min
AGRCZA: piloted	**10, 20** = Qmax 160, 300 l/min

Max regulated pressure:

only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar

only for RZGA-033 and AGRCZA
80 = 80 bar **180** = 180 bar **250** = 250 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options - only AGRCZA **(1)**:
P = with integral mechanical pressure limiter
R = with integral check valve for free reverse flow

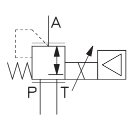
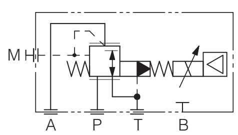
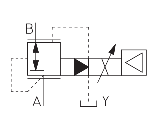
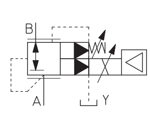
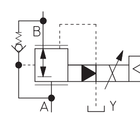
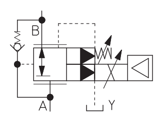
Electronic options (1):
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) Possible combined options: /IP, /IR, /PR

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA-AES-010	RZGA-AES-033	AGRCZA-AES	AGRCZA-AES-*/P	AGRCZA-AES-*/R	AGRCZA-AES-*/PR
					

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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: The below operation must be performed in a safety area

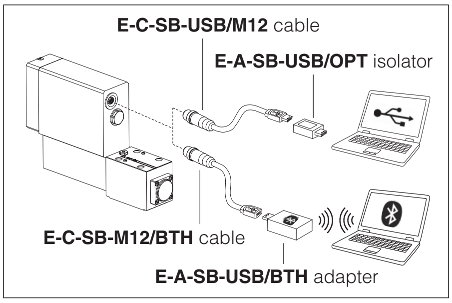
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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	RZGA-010 150 years, RZGA-033 and AGRCZA 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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		RZGA		AGRCZA	
Size code		**010**	**033**	**10**	**20**
Valve size		06	06	10	20
Max regulated pressure	[bar]	**32 100 210**	**80**	**180**	**250**
Min regulated pressure	[bar]	see min. pressure / flow diagrams at sections 16 17 18			
Max pressure at port P, A, B, X	[bar]	315			
Max pressure at port T, Y	[bar]	210			
Max flow	[l/min]	12	40	160	300
Response time 0-100% step signal (depending on installation) **(1)**	[ms]	≤ 55		≤ 70	
Hysteresis[% of the max pressure]		≤ 1,5			
Linearity[% of the max pressure]		≤ 3			
Repeatability[% of the max pressure]		≤ 2			

(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

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ			
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			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
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

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, 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	RZMA, AGMZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

19 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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 Flow reference input signal (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 ÷ 10VDC 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.

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 0 ÷ 10VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

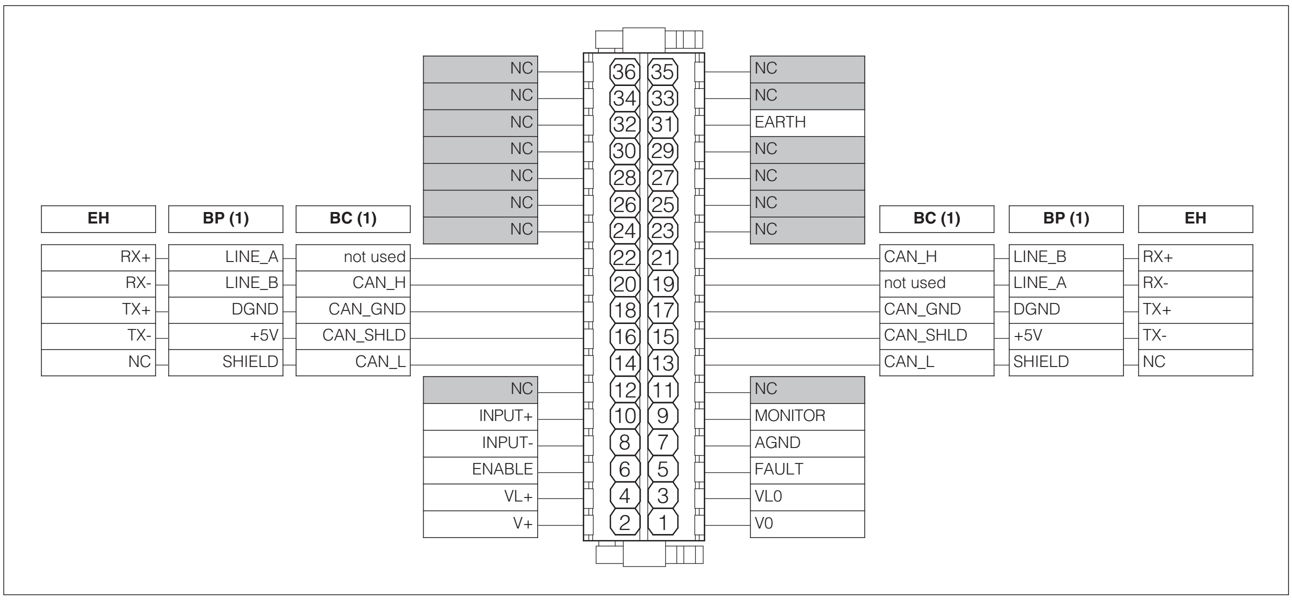
19.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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)

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.

20 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

21 ELECTRONIC CONNECTIONS

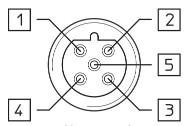
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

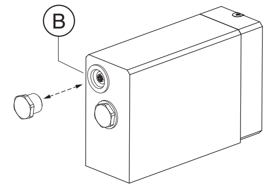
21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH fieldbus execution connections

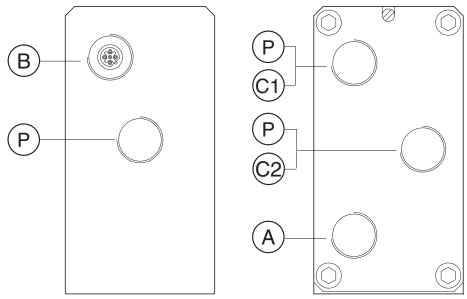
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

CABLE ENTRANCE OVERVIEW

Cables entrance description:

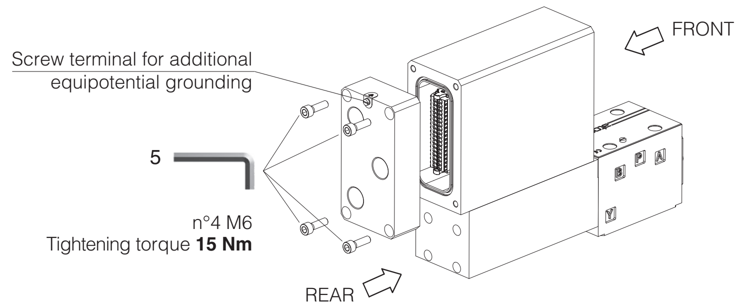
- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



(front) (rear)

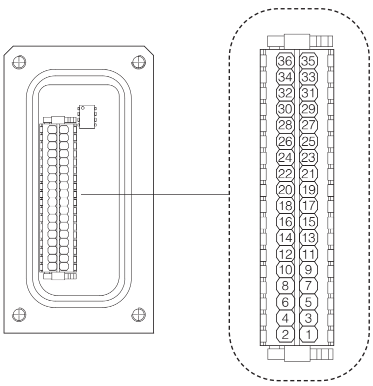
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

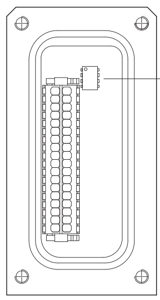


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20



Fieldbus terminator only for BC and BP executions **(1)**



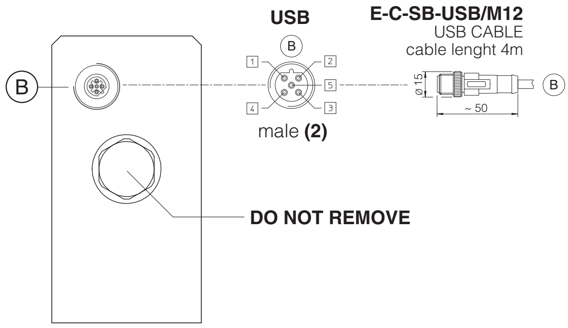
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

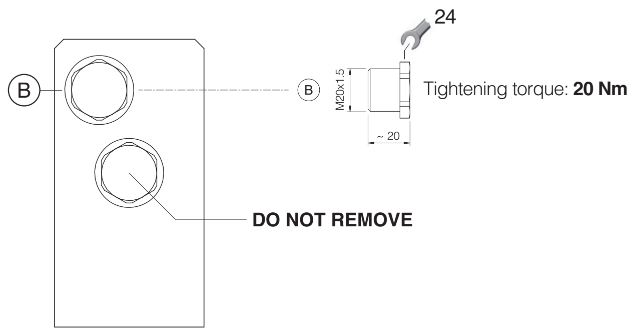
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

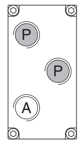
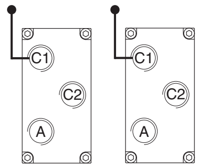
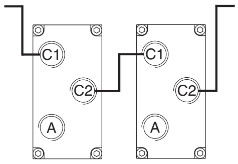


METALLIC PROTECTION CAP - supplied with the valves



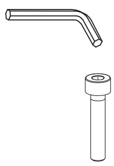
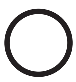
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

22.1 Cable glands and threaded plug - see tech table **KX800**

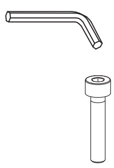
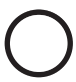
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

23 FASTENING BOLTS AND SEALS

23.1 RZGA valves

	RZGA-AES-*-010	RZGA-AES-*-033
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm
	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 5 mm	**Seals:** 4 OR 108 Diameter of ports P, A, T: Ø 7,5 mm

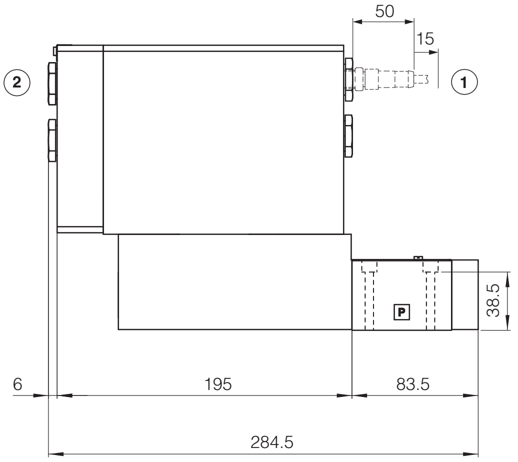
23.2 AGRCZA valves

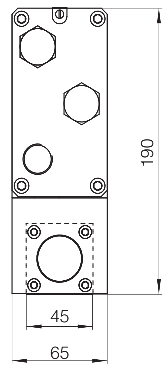
	AGRCZA-AES-*-10	AGRCZA-AES-*-20
	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M10x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of port X, Y: Ø 5 mm

RZGA-AES-*-010

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(port B not used)

Mass [kg]	
RZGA-AES-*-010	8,2

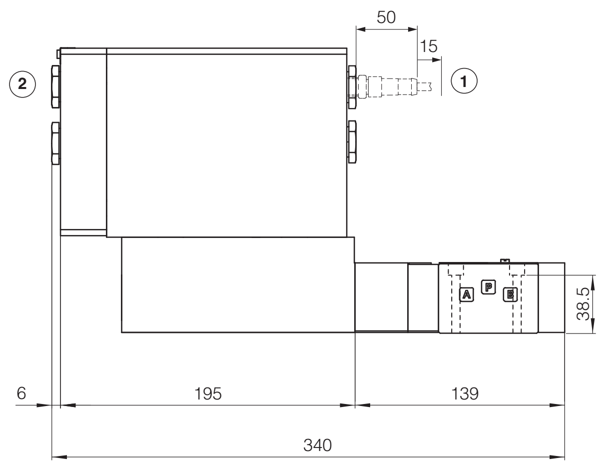


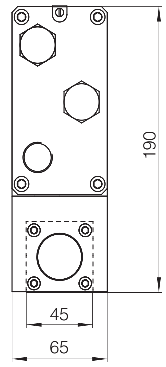


RZGA-AES-*-033

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see table P005)
(ports A and B connected to port T)

Mass [kg]	
RZGA-AES-*-033	9





1 = Space to remove the USB connector

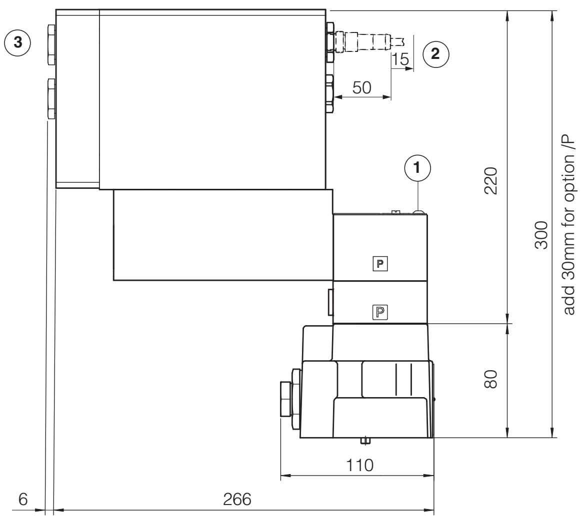
2 = The dimensions of cable glands must be considered (see tech table **KX800**)

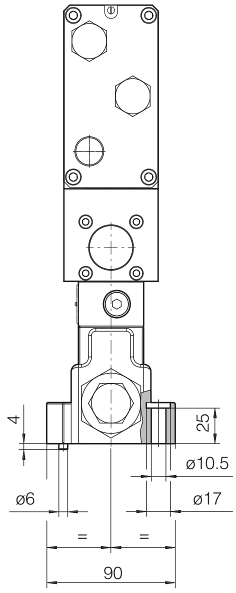
25 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-AES-*-10

ISO 5781: 2000
Mounting surface: 5781-06-07-0-00 (see table P005)

Mass [kg]	
AGRCZA-AES-*-10	11,6

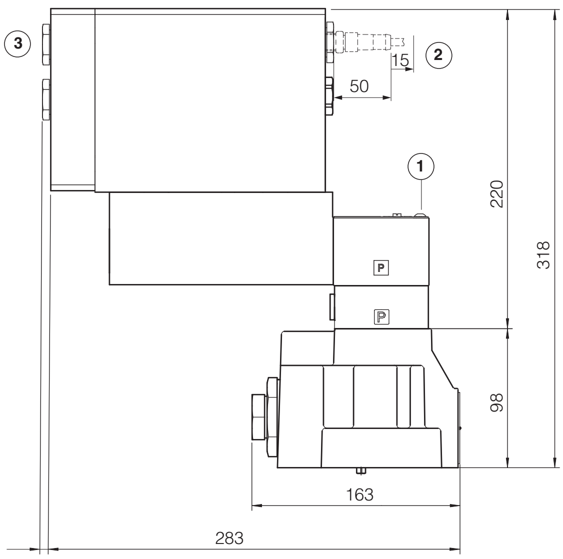


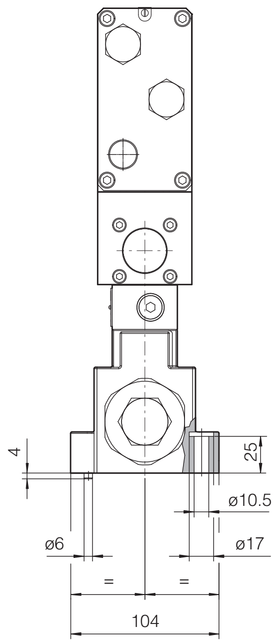


AGRCZA-AES-*-20

ISO 5781: 2000
Mounting surface: 5781-08-10-0-00 (see table P005)

Mass [kg]	
AGRCZA-AES-*-20	12,8





1 = Air bleed off

2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

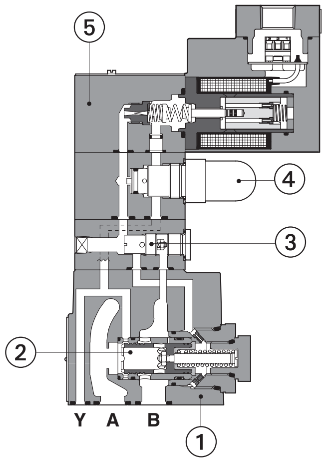
26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Table **FX040-1/E**

Ex-proof proportional reducing valves

direct or piloted, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① main valve body
② main spool
③ pilot flow compensator
④ mechanical pressure limiter
⑤ ex-proof pilot relief valve

AGRCZA-A-010*

RZGA-A, HZGA-A
KZGA-A, AGRCZA-A

Ex-proof proportional reducing valves direct or piloted, for open loop pressure controls.
They are equipped with ex-proof proportional solenoid, certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

RZGA, HZGA, direct or piloted:
Size: **06** - ISO 4401
Max flow: **12** and **40 l/min**

KZGA, piloted:
Size: **10** - ISO 4401
Max flow: **100 l/min**

AGRCZA, piloted:
Size: **10** and **20** - ISO 5781
Max flow: **160** and **300 l/min**

Max pressure: **250 bar**

1 MODEL CODE

RZGA / * - A - 010 / 250 / M / * / * * / *

Ex-proof proportional pressure reducing valves

RZGA = subplate size 06
HZGA = modular size 06
KZGA = modular size 10
AGRCZA = subplate size 10, 20

Certification type
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size and configuration:

010 =	RZGA direct	size 06	Qmax 12 l/min
033 =	RZGA piloted	size 06	Qmax 40 l/min
031 =	HZGA piloted	size 06	Qmax 40 l/min
031 =	KZGA piloted	size 10	Qmax 100 l/min
10 =	AGRCZA piloted	size 10	Qmax 160 l/min
20 =	AGRCZA piloted	size 20	Qmax 300 l/min

Max regulated pressure:
for all versions except RZGA-010
80 = 80 bar **180** = 180 bar **250** = 250 bar
only for RZGA-010
32 = 32 bar **100** = 100 bar **210** = 210 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
P = with integral mechanical pressure limiter (only for AGRCZA)
R = with check valve (only for AGRCZA)

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = with 24 VDC coils

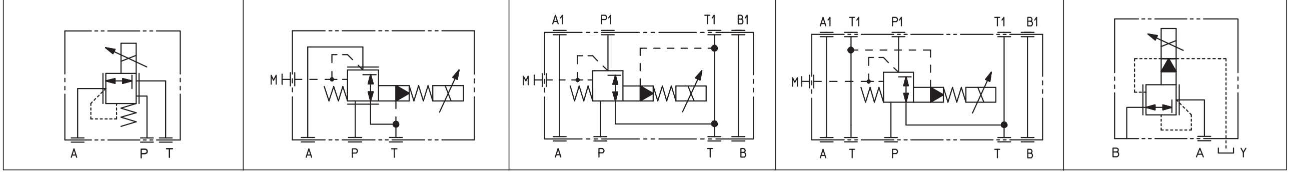
Series number

Seals material, see section 7:
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /OP, /OR, /PR, /OPR **(4)** Approved only for the Italian market

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

RZGA*-A-010	RZGA*-A-033	HZGA*-A-031	KZGA*-A-031	AGRCZA*-A-*



3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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; 150 years only for RZGA-010, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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	**RZGA**		**HZGA**	**KZGA**	**AGRCZA**	
Size code	**010**	**033**	**031**		**10**	**20**
Valve size	06		10			20
Max regulated pressure [bar]	**32; 100; 210**	**80 180 250**				
Max pressure at port P, A, B, X [bar]	315					
Max pressure at port T, Y [bar]	210					
Min regulated pressure [bar]	0,8	2,5	2,5	3	1,0	
Max flow [l/min]	12	40	40	100	160	300
Response time 0-100% step signal (depending on installation) **(1)** [ms]	≤ 55			≤ 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 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

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

8 CERTIFICATION DATA

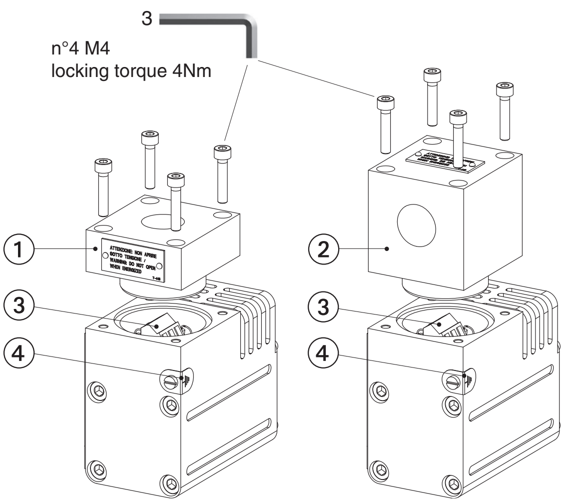
Valve type	RZGA, HZGA, KZGA, AGRCZA		RZGA**/M**, HZGA**/M**, KZGA**/M**, AGRCZA**/M**	RZGA**/UL**, HZGA**/UL**, KZGA**/UL**, AGRCZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**MZA-A**		**MZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

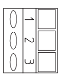
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

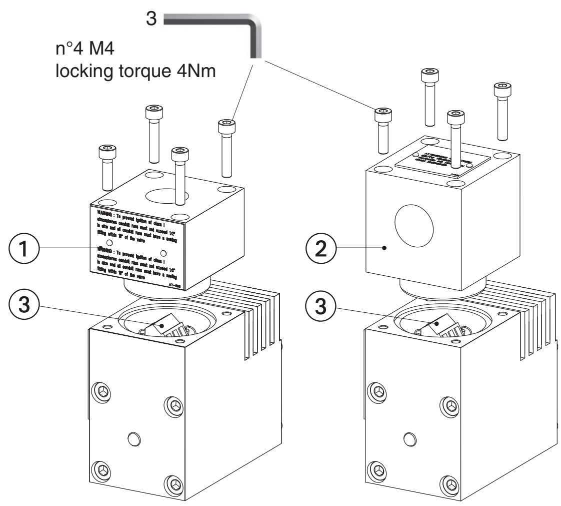
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

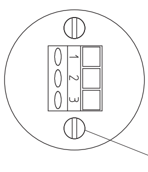
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

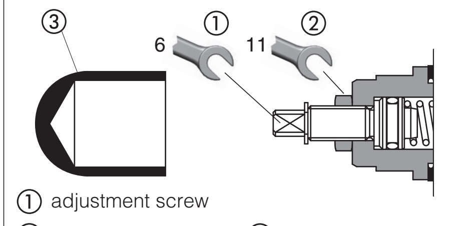
12 **OPTIONS**

O = Horizontal cable entrance , to be selected in case of limited verical space.

P = Integral mechanical pressure limiter

The AGRCZA-***/P** 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.

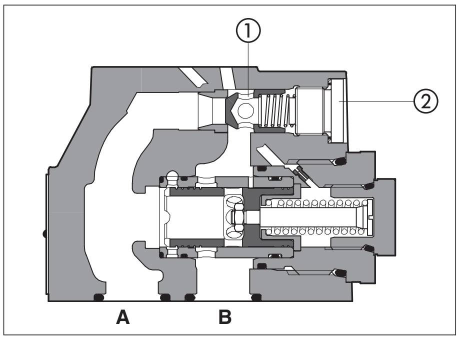


① adjustment screw
② locking nut
③ protection cap

R = Integral check valve for free reverse flow

The AGRCZA-***/R** are provided with integral check valve for free reverse flow A→B

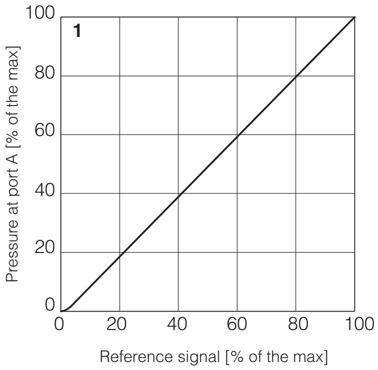
① Check valve - cracking pressure = 0,5 bar
② Plug



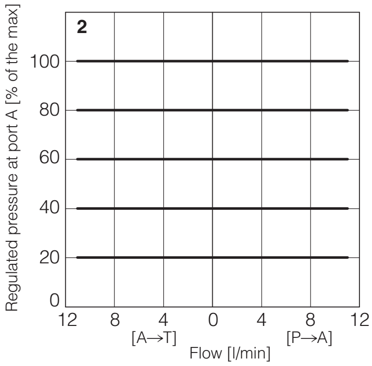
12.1 Possible combined options: /OP, /OR, /PR, /OPR

13 DIAGRAMS RZGA-010 (based on mineral oil ISO VG 46 at 50 °C)

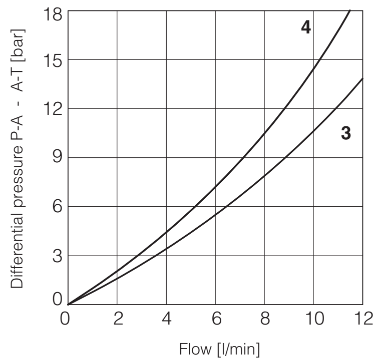
1 Regulation diagrams
with flow rate Q = 1 l/min



2 Pressure/flow diagrams
with reference signal set at Q = 1 l/min



3-4 Min. pressure/flow diagrams
with zero reference signal



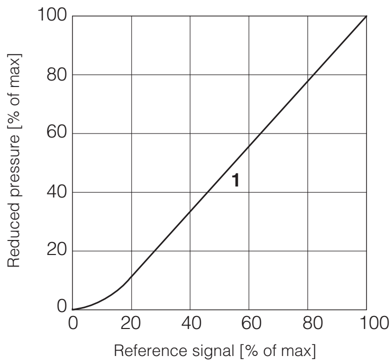
3 = Pressure drops vs. flow P→A
4 = Pressure drops vs. flow A→T

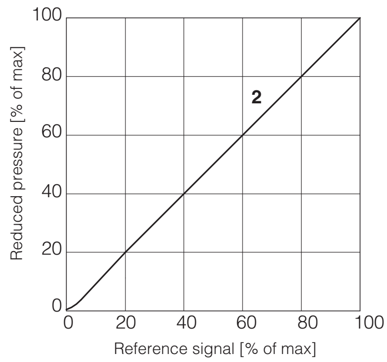
14 DIAGRAMS RZGA-033, HZGA, KZGA (based on mineral oil ISO VG 46 at 50 °C)

14.1 Regulation diagrams
with flow rate Q = 10 l/min

1 = RZGA, HZGA
2 = KZGA

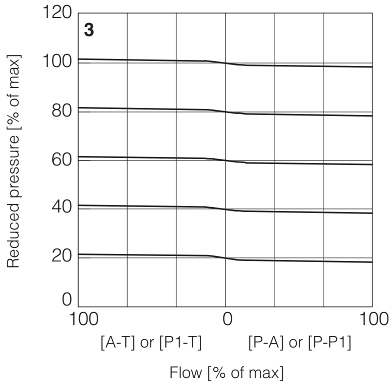
Note:
The presence of counter pressure at port T can affect the effective pressure regulation.





14.2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

3 = RZGA, KZGA



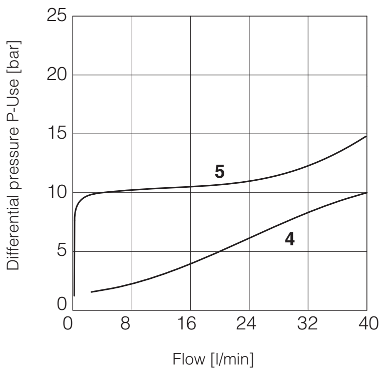
14.3 Pressure drop/flow diagram

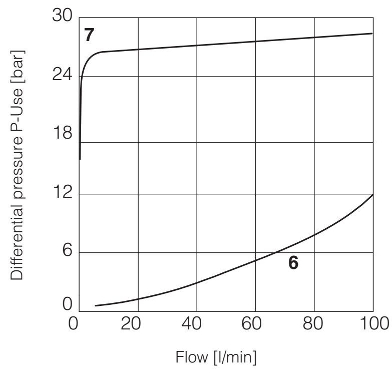
RZGA, HZGA

4 = A-T or P1-T
5 = P-P1 or P-A

KZGA

6 = P1-T
7 = P-P1

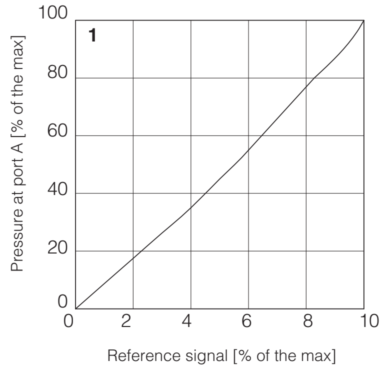


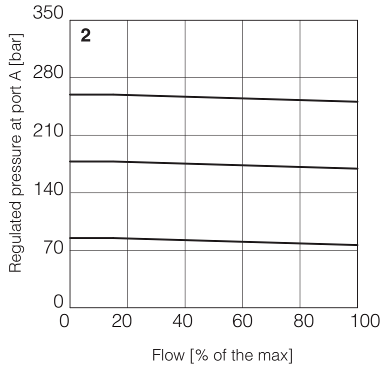


15 DIAGRAMS AGRCZA (based on mineral oil ISO VG 46 at 50 °C)

1 Regulation diagrams
with flow rate Q = 10 l/min

2 Pressure/flow diagrams
with reference pressure set with Q = 10 l/min

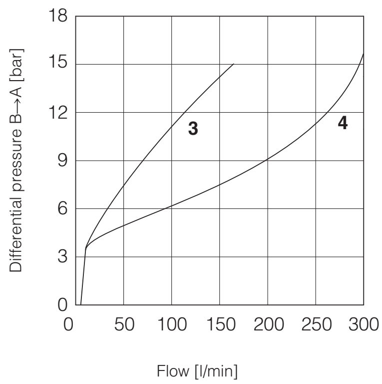


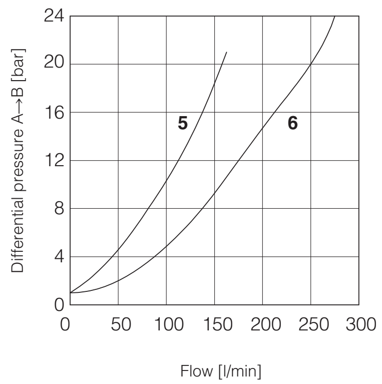


3-6 Pressure drop/flow diagrams
with zero reference signal

Differential pressure B→A
3 = AGRCZA-*-10
4 = AGRCZA-*-20

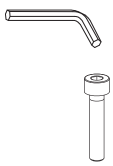
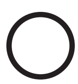
Differential pressure A→B (through check valve)
5 = AGRCZA-*-10/*/R
6 = AGRCZA-*-20/*/R



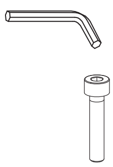
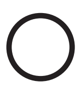


16 FASTENING BOLTS AND SEALS

16.1 RZGA, HZGA and KZGA valves

	RZGA-A-010	RZGA-A-033	HZGA-A-031	KZGA-A-031
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M5 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6 class 12.9 Tightening torque = 16 Nm
	**Seals:** 2 OR 108 Diameter of ports P, T: Ø 5 mm (max)	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm (max)	**Seals:** 4 OR 108 Diameter of ports P, T: Ø 7,5 mm	**Seals:** 5 OR 2050 Diameter of ports P, A, B, T: Ø 11,5 mm (max) 1 OR 108 Diameter of port Y: Ø 5 mm

16.2 AGRCZA valves

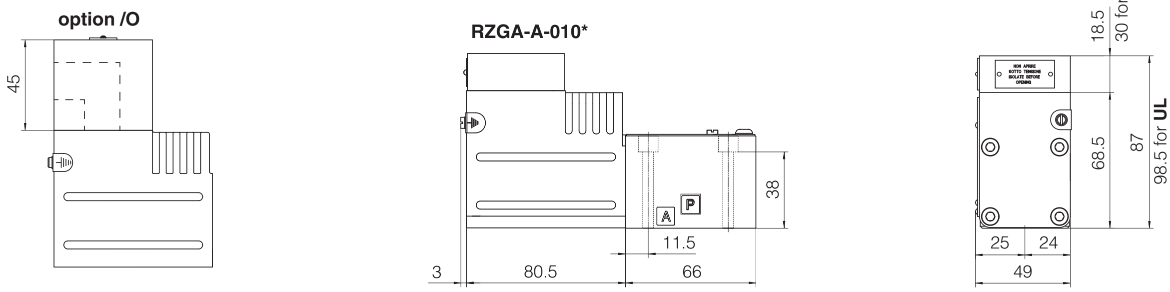
	AGRCZA-A-10	AGRCZA-A-20
	**Fastening bolts:** 4 socket head screws M110x45 class 12.9 Tightening torque = 70 Nm	**Fastening bolts:** 4 socket head screws M110x45 class 12.9 Tightening torque = 70 Nm
	**Seals:** 2 OR 3068 Diameter of ports A, B: Ø 14 mm 2 OR 109/70 Diameter of ports X, Y: Ø 5 mm	**Seals:** 2 OR 4100 Diameter of ports A, B: Ø 22 mm 2 OR 109/70 Diameter of ports X, Y: Ø 5 mm

17 INSTALLATION DIMENSIONS FOR RZGA [mm]

RZGA-A-010

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(without port B)

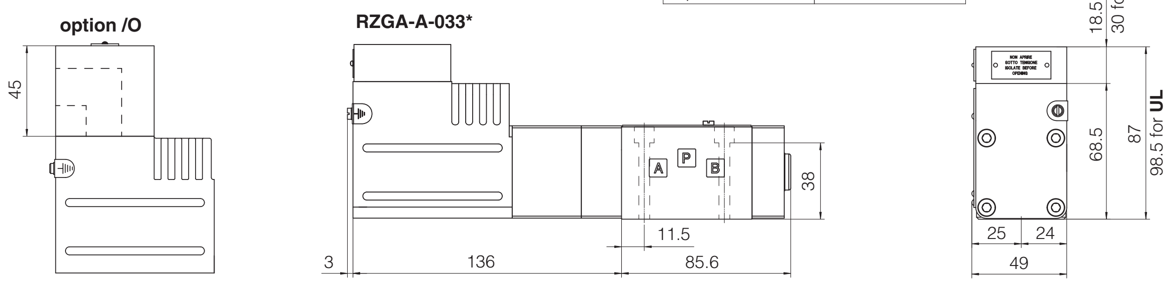
Mass [kg]	
RZGA-A-010	2,7
Option /O	+0,35



RZGA-A-033

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

Mass [kg]	
RZGA-A-033	3,7
Option /O	+0,35

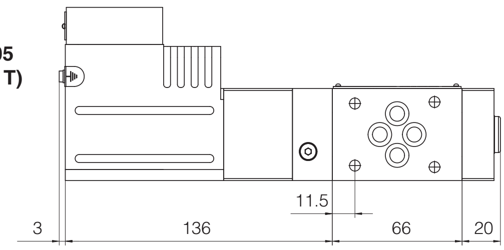


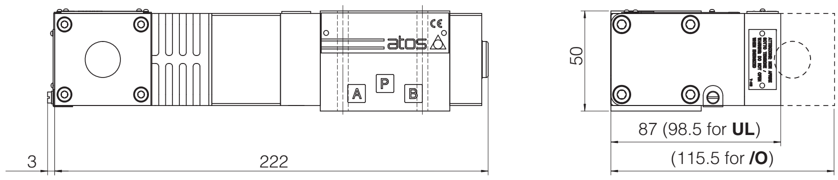
18 INSTALLATION DIMENSIONS FOR HZGA and KZGA [mm]

HZGA-A-031

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
(ports A and B connected to port T)

Mass [kg]	
HZGA-A-031	3,7
Option /O	+0,35

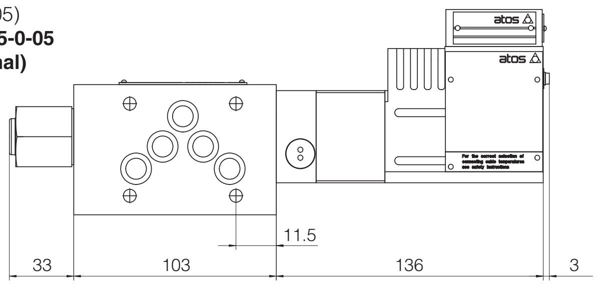


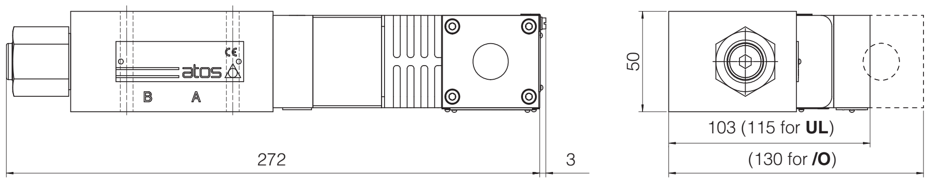


KZGA-A-031

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-05-05-0-05
(without X port, Y port optional)

Mass [kg]	
KZGA-A-031	3,7
Option /O	+0,35



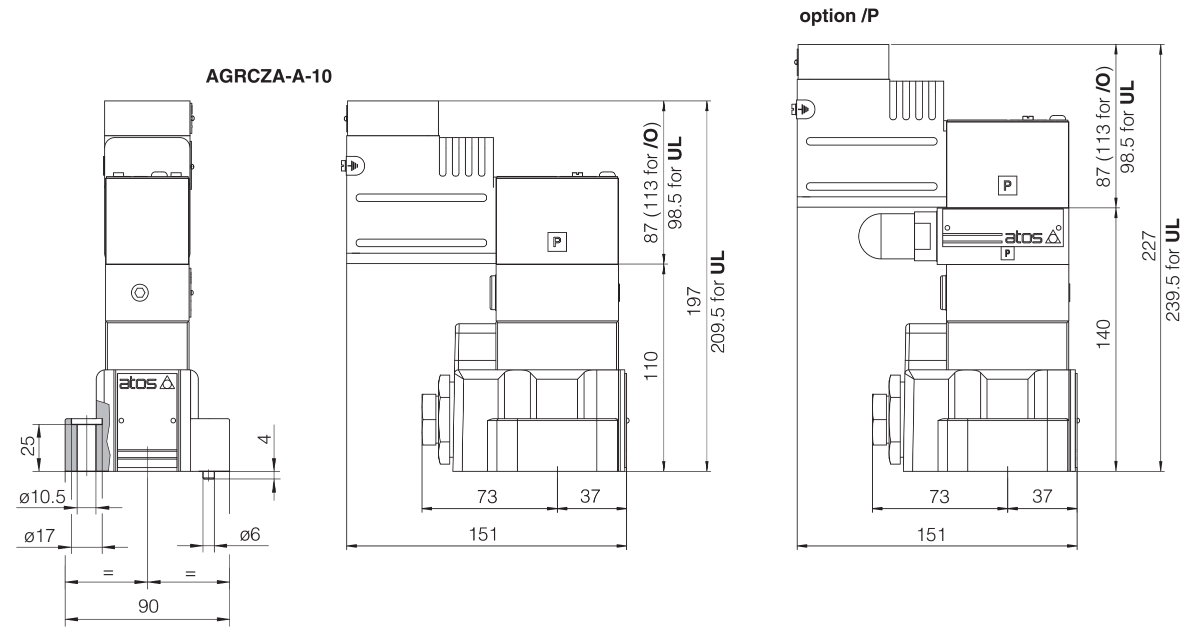


19 INSTALLATION DIMENSIONS FOR AGRCZA [mm]

AGRCZA-A-10

ISO 5781: 2000 (see table P005)
Mounting surface: 5781-06-07-0-00

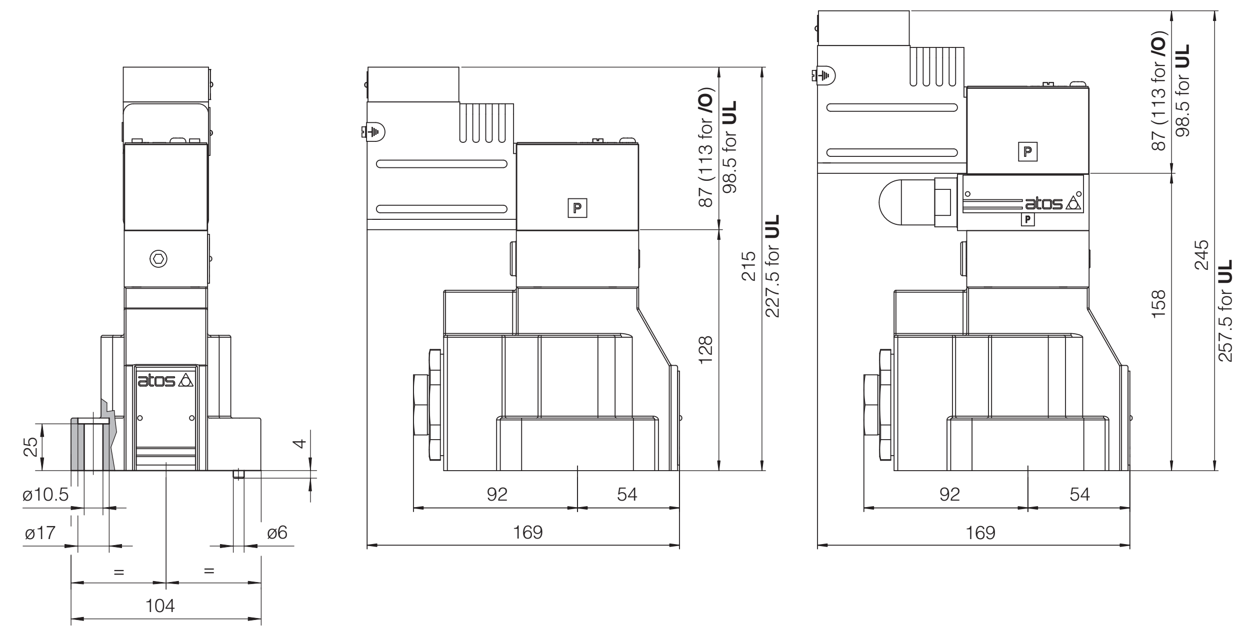
Mass [kg]	
AGRCZA-A-10	5,7
Option /P	+0,5



AGRCZA-A-20

ISO 5781: 2000 (see table P005)
Mounting surface: 5781-08-10-0-00

Mass [kg]	
AGRCZA-A-20	8,2
Option /P	+0,5

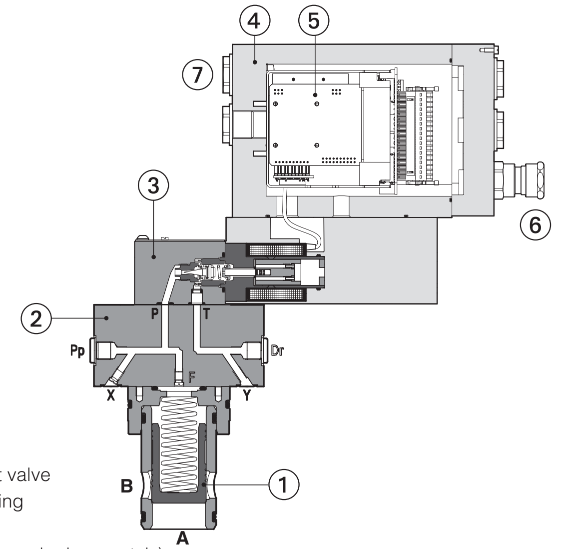


20 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance norms for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional pressure cartridges

with on-board driver and without transducer - **ATEX and IECEx**



1. poppet
2. functional cover
3. Proportional ex-proof pilot valve
4. ex-proof electronics housing
5. on-board digital driver
6. ex-proof cable glands (to be orderd separately)
7. USB port always present (factory plugged)

LIMZA-AES-BC-4

LICZA-AES, LIMZA-AES, LIRZA-AES

2-way ex-proof digital proportional pressure cartridges without transducer respectively performing: pressure compensator, relief or reducing functions.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** -ISO7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 MODEL CODE OF COVERS

LIMZA - AES - NP - 3 / 315 / M / * * / *

LIMZA – Ex-proof proportional pressure cartridges
- **LICZA** = pressure compensator
- **LIMZA** = pressure relief
- **LIRZA** = pressure reducing

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
- **NP** = Not present
- **BC** = CANopen
- **BP** = PROFIBUS DP
- **EH** = EtherCAT

Valve size ISO 7368:
- **1** = 16
- **2** = 25
- **3** = 32
- **4** = 40
- **5** = 50 (not for LIRZA)
- **6** = 63 (only for LIMZA)
- **8** = 80; (only for LIMZA)

Max regulated pressure:
- **80** = 80 bar
- **180** = 180 bar
- **250** = 250 bar

Cable entrance threaded connection:
- **M** = M20x1,5

Hydraulic options (1):
- **P** =with integral mechanical pressure limiter (standard for size 1, 2, 3)

Electronics options (1):
- **I** = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 V_{DC})

Series number

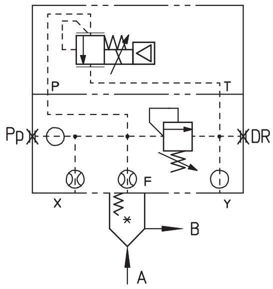
Seals material, see section 11 :
- **-** = NBR
- **PE** = FKM
- **BT** = HNBR

(1) Possible combined options: /IP

2 HYDRAULICS SYMBOLS

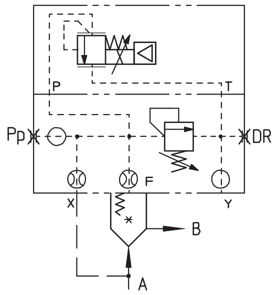
LICZA

LICZA-AES-1÷3
LICZA-AES-4÷5 /P



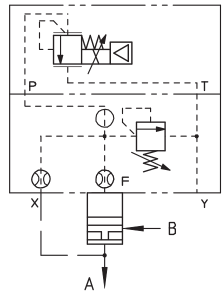
LIMZA

LIMZA-AES-1÷3
LIMZA-AES-4÷8 /P

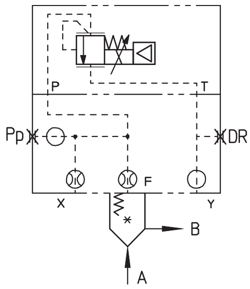


LIRZA

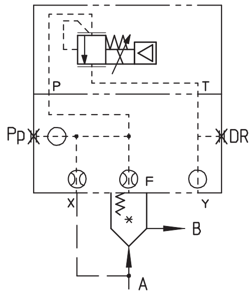
LIRZA-AES-1÷3
LIRZA-AES-4 /P



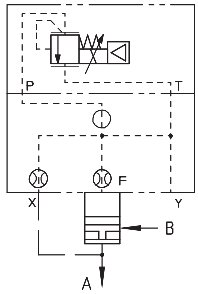
LICZA-AES-4÷5



LIMZA-AES-4÷8



LIRZA-AES-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

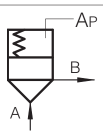
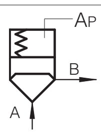
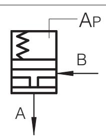
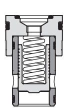
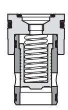
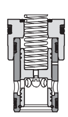
Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

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

Series number

Seals material,
see section 11 :
- = 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 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 **FX900** 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

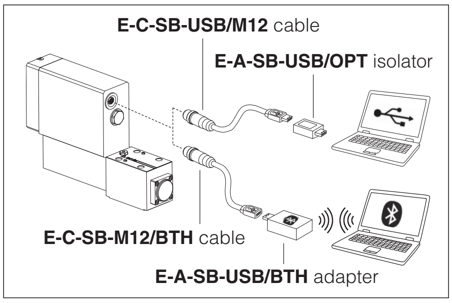
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

7 FIELDBUS - see tech. table **GS510**

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

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 12 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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	LICZA					LIMZA							LIRZA			
Valve size [l/min]	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow [bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure	see section 18															
Max regulated pres. at port A [bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure [bar]	Ports: T, Y = 210															
	Ports: P, A, B, X = 350															
Response time 0-100% step signal **(1)** (depending on installation) [ms]	≤ 120 ÷ 430					≤ 120 ÷ 480							≤ 120 ÷ 380			
Hysteresis [% of regulated max pres.]	≤ 2					≤ 1,5							≤ 2			
Linearity [% of regulated max pres.]	≤ 3					≤ 3							≤ 3			
Repeatibility [% of regulated max pres.]	≤ 2					≤ 2							≤ 2			

(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

10 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
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			
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ			
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			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
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			
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

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

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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

12 CERTIFICATION DATA

Valve type	LICZA, LIMZA, LIRZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31 IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

13 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

14 **CABLE GLANDS**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

15 **HYDRAULIC OPTIONS**

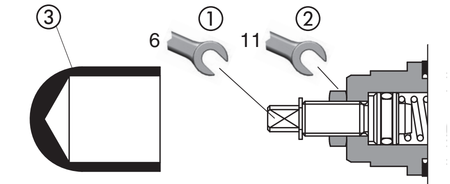
P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA, LIMZA and LIRZA standard size 1, 2, 3 and option /P 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.



① adjustment screw
② locking nut
③ protection cap

16 **ELECTRONIC OPTIONS**

I = It provides 4 ÷ 20 mA current reference signal, 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.

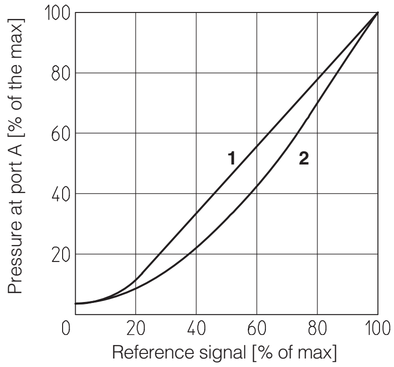
17 **POSSIBLE COMBINED OPTIONS**

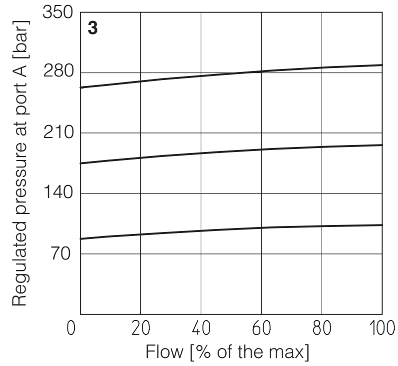
/IP

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

1 Regulation diagrams LIMZA
2 Regulation diagrams LICZA

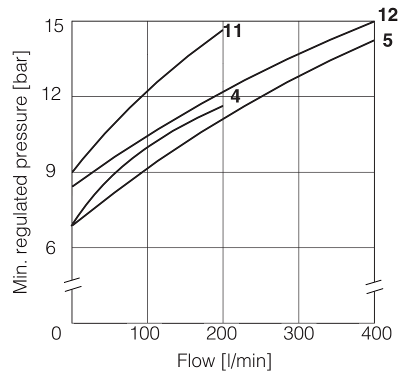
3 Pressure/flow diagrams LICZA, LIMZA

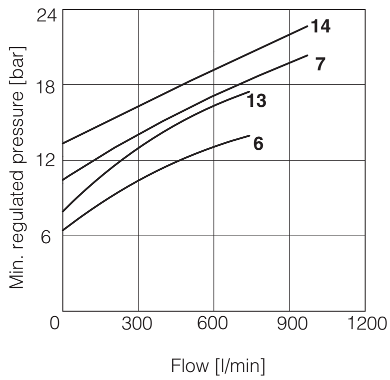


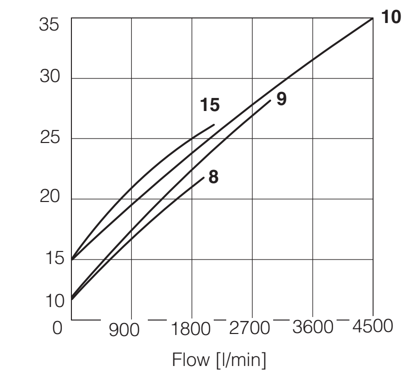


4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1	**11** = LICZA-*-1
5 = LIMZA-*-2	**12** = LICZA-*-2
6 = LIMZA-*-3	**13** = LICZA-*-3
7 = LIMZA-*-4	**14** = LICZA-*-4
8 = LIMZA-*-5	**15** = LICZA-*-5
9= LIMZA-*-6	
10= LIMZA-*-8	





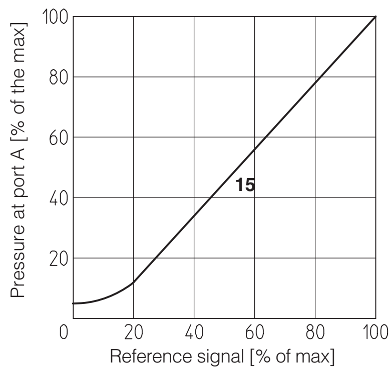


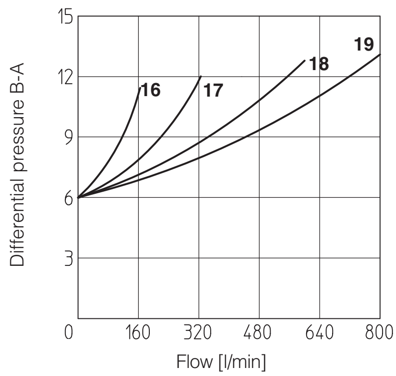
Regulation diagrams LIRZA

15= LIRZA-A

16-19 Min. pressure/flow diagrams
with reference signal "null"

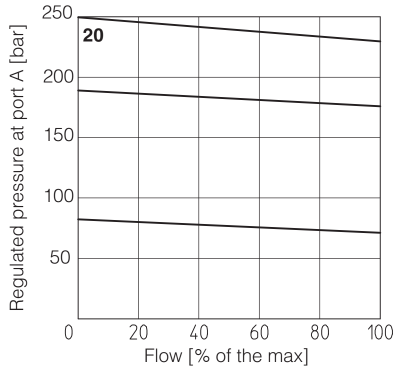
16= LIRZA-*-1
17= LIRZA-*-2
18= LIRZA-*-3
19= LIRZA-*-4





Pressure/flow diagrams

20= LIRZA-A



19 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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 Flow reference input signal (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 ÷ 10VDC 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.

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 ÷ 5VDC.

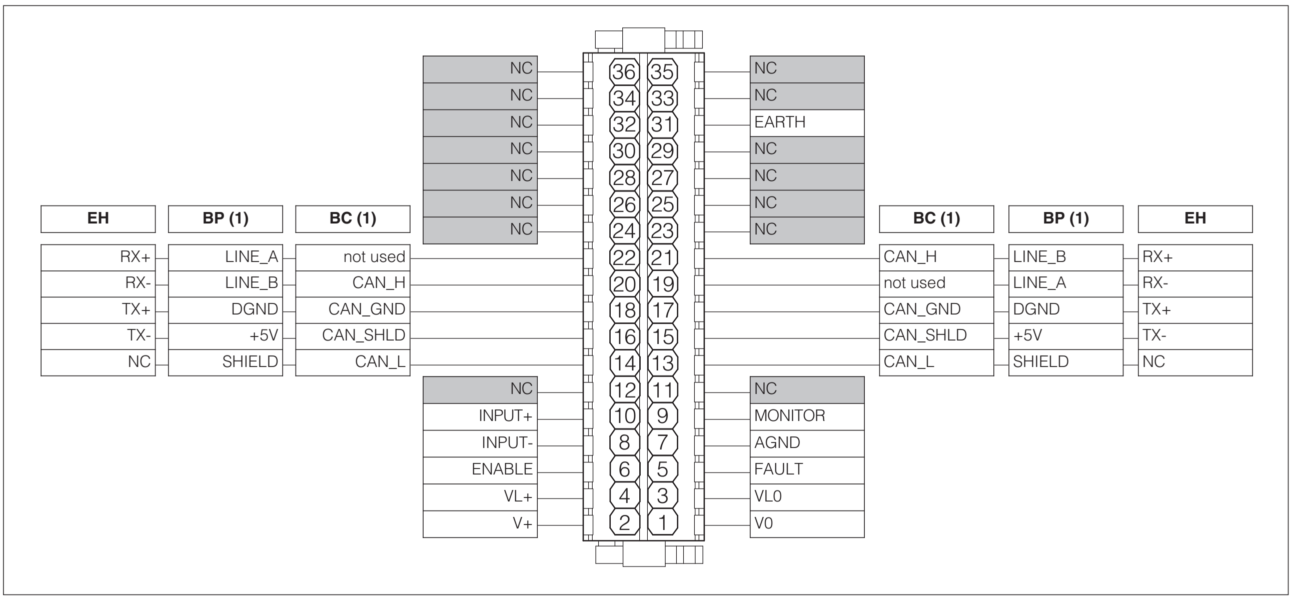
19.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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)

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.

20 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

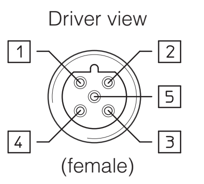
21 ELECTRONIC CONNECTIONS

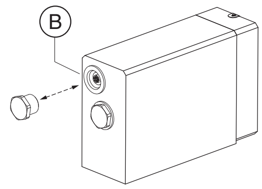
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

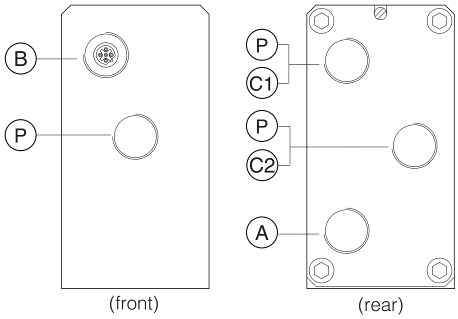
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

22 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

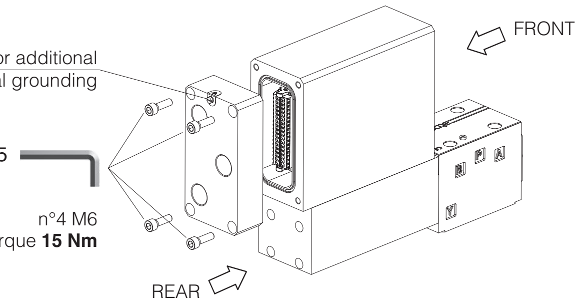
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (P) threaded plug



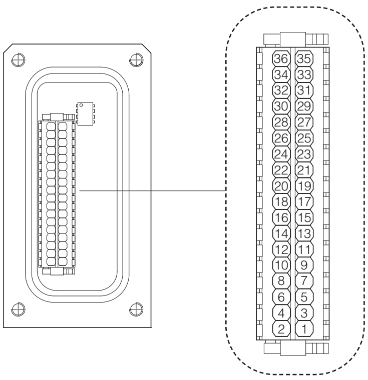
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

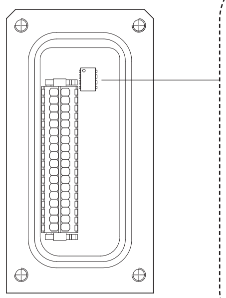


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20

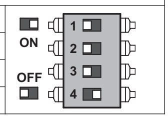


Fieldbus terminator only for BC and BP executions **(1)**



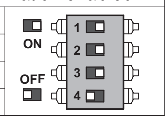
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

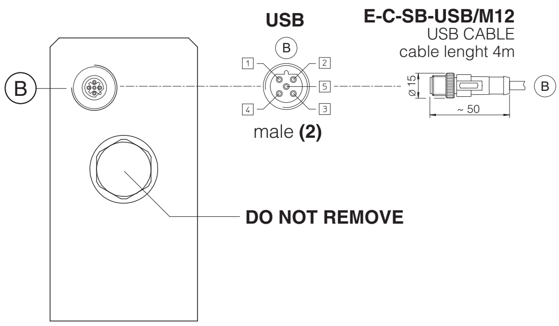


BP - PROFIBUS DP setting:

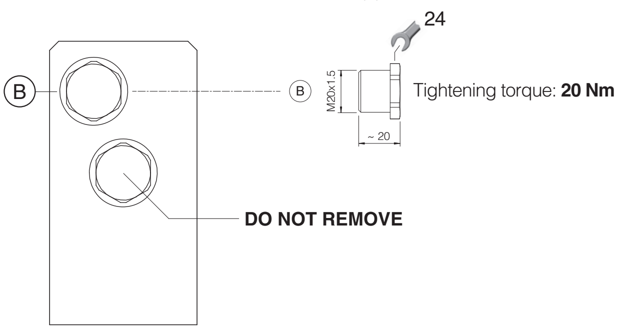
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

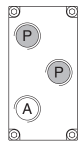
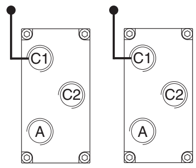
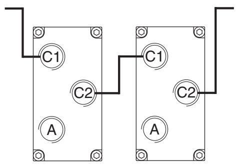


METALLIC PROTECTION CAP - supplied with the valves



(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

22.1 Cable glands and threaded plug - see tech table **KX800**

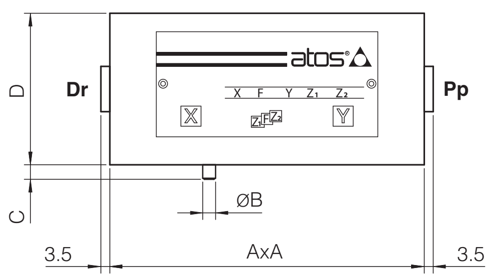
Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

23 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA LICZA LIRZA	**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
LIMZA LICZA	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**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]

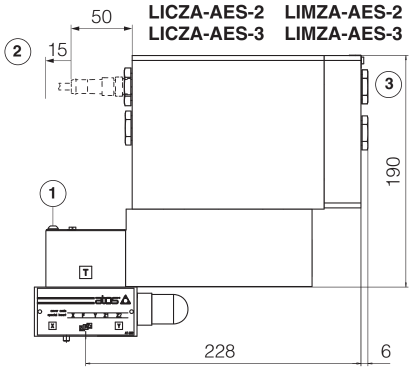
Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4”
5 = 50	140x140	6	4	70	G 1/4”
6 = 63	180x180	6	4	80	G 3/8”
8 = 80	ø250	8	6	80	G 3/8”



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

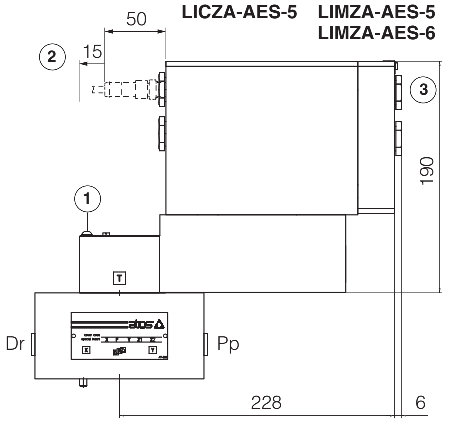
25 INSTALLATION DIMENSIONS [mm]

LICZA-AES-1 LIMZA-AES-1 LIRZA-AES-1
LICZA-AES-2 LIMZA-AES-2 LIRZA-AES-2
LICZA-AES-3 LIMZA-AES-3 LIRZA-AES-3

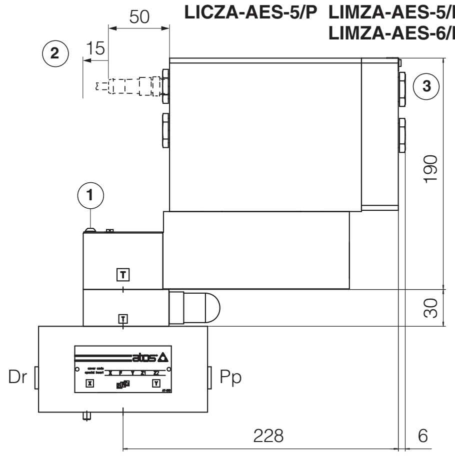


Mass [kg]			
LICZA, LIMZA, LIRZA			Cartridge
Size	Standard	Option /P	SC LI
1 = 16	10,5	-	0,2
2 = 25	11	-	0,5
3 = 32	12,3	-	0,9
4 = 40	17,7	12,5	1,7
5 = 50	21,2	16	2,9
6 = 63	30,7	25,5	6,7
8 = 80	39,3	34,1	13,1

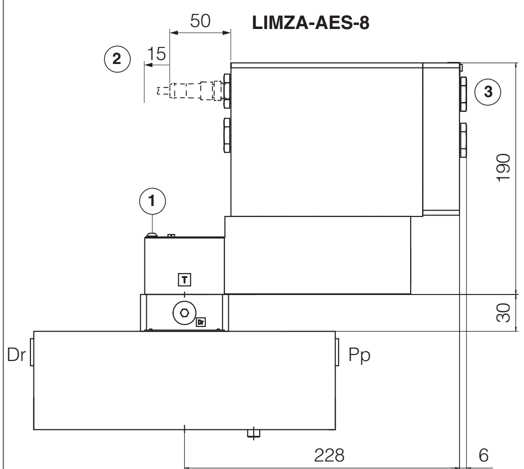
LICZA-AES-4 LIMZA-AES-4 LIRZA-AES-4
LICZA-AES-5 LIMZA-AES-5
LIMZA-AES-6



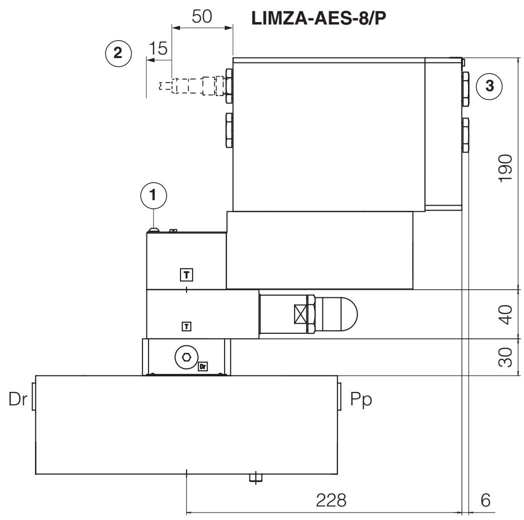
LICZA-AES-4/P LIMZA-AES-4/P LIRZA-AES-4/P
LICZA-AES-5/P LIMZA-AES-5/P
LIMZA-AES-6/P



LIMZA-AES-8



LIMZA-AES-8/P



Note: for ISO 7368 mounting surface and cavity dimensions, see tech. table P006

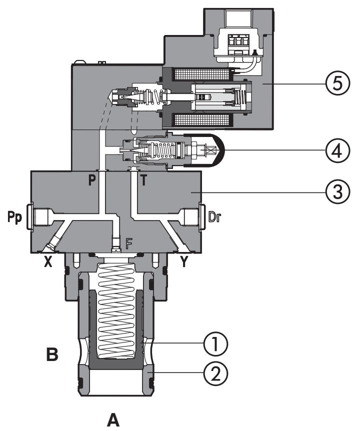
(1) = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw
(2) = Space to remove the USB connector
(3) = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance informationfor ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
KX800	Cable glands for ex-proof valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof proportional pressure cartridges

without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① poppet
② sleeve
③ functional cover
④ mechanical pressure limiter
⑤ proportional ex-proof pilot valve

LIMZA-A-4

LICZA-A, LIMZA-A, LIRZA-A

2-way ex-proof proportional pressure cartridges without transducer respectively performing: pressure compensator, relief or reducing functions.

They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **16** ÷ **80** - ISO 7368

Max flow: up to **4500 l/min**

Max pressure: **250 bar**

1 MODEL CODE OF FUNCTIONAL COVERS

LIMZA	/	*	-	A	-	3	/	180	/	M	/	*	/	*	*	/	*

LIMZA – Ex-proof proportional pressure cartridges valves:
LICZA = pressure compensator
LIMZA = pressure relief
LIRZA = pressure reducing

Certification type:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size ISO 7368:
1 = size 16
2 = size 25
3 = size 32
4 = size 40
5 = size 50 (not for LIRZA)
6 = size 63 (only for LIMZA)
8 = size 80 (only for LIMZA)

Max regulated pressure:
80 = 80 bar
180 = 180 bar
250 = 250 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
P =with integral mechanical pressure limiter (standard. for size 1, 2 and 3)

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com

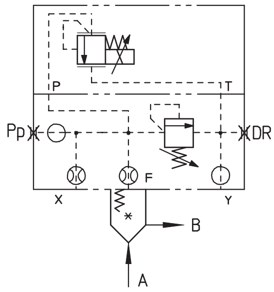
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /OP **(4)** Approved only for italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 HYDRAULICS SYMBOLS

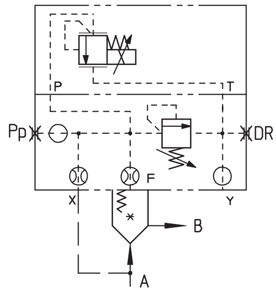
LICZA

LICZA-A-1÷3
LICZA-A-4÷5 /P



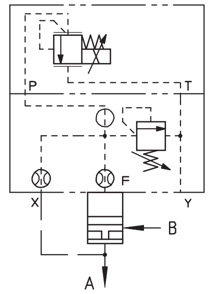
LIMZA

LIMZA-A-1÷3
LIMZA-A-4÷8 /P

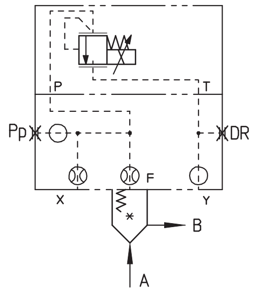


LIRZA

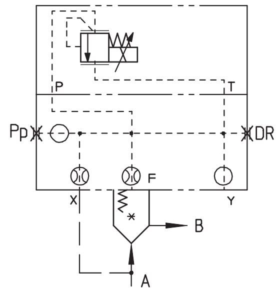
LIRZA-A-1÷3
LIRZA-A-4 /P



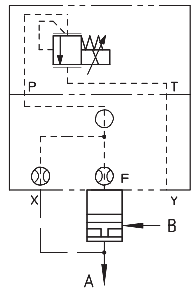
LICZA-A-4
LICZA-A-5



LIMZA-A-4÷8



LIRZA-A-4



3 MODEL CODE OF CARTRIDGES

SC LI	-	32	31	2	**	/	*

Cartridge according to ISO 7368

Cartridges size ISO 7368:
16
25
32
40
50
63
80

Type of poppet:
31 = for LIMZA and LICZA
36 = for LICZA
37 = for LIRZA

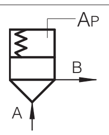
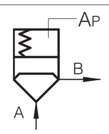
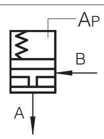
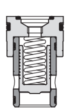
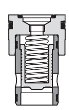
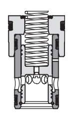
Spring cracking pressure:
2 = 1,5 bar for poppet 31
3 = 3 bar
4 = 4 bar
6 = 6 bar for poppet 31 and 36
7 = 7 bar for poppet 37

Series number

Seals material,
see section 9 :

- = 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 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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		LICZA					LIMZA							LIRZA			
Valve size	[l/min]	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**6**	**8**	**1**	**2**	**3**	**4**
Max flow	[bar]	200	400	750	1000	2000	200	400	750	1000	2000	3000	4500	160	300	550	800
Min regulated pressure		see section 15															
Max regulated pres. at port A	[bar]	80; 180; 250					80; 180; 250							80; 180; 250			
Max pressure	[bar]	Ports: T, Y = 210															
		Ports: P, A, B, X = 315															
Response time 0-100% step signal **(1)** (depending on installation)	[ms]	≤ 120 ÷ 430					≤ 120 ÷ 480							≤ 120 ÷ 380			
Hysteresis	[% of regulated max pres.]	≤ 2					≤ 1,5							≤ 2			
Linearity	[% of regulated max pres.]	≤ 3					≤ 3							≤ 3			
Repeatibility	[% of regulated max pres.]	≤ 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

8 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

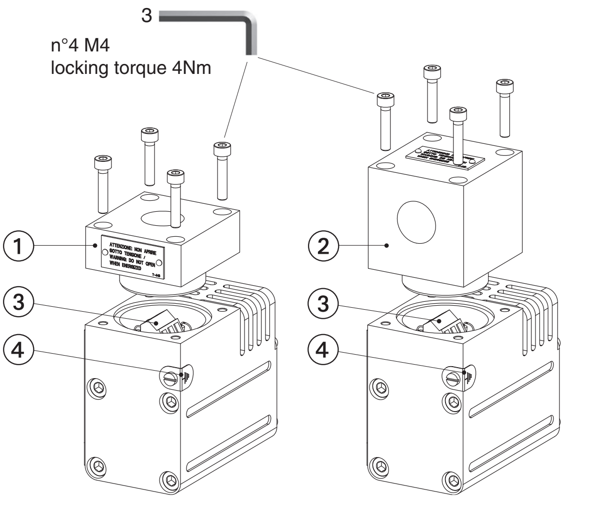
Valve type	DPZA		DPZA**/M**	DPZA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • EAC Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

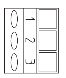
11 EX PROOF SOLENOIDS WIRING OF VALVES -A without integral driver

Multicertification



Standard version **Option /O**

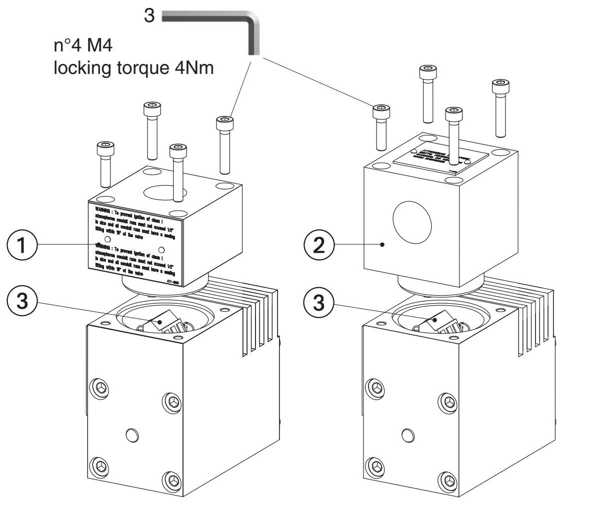
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

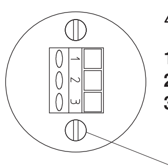
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

12 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

13 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 **OPTIONS**

O = Horizontal cable entrance , to be selected in case of limited verical space.

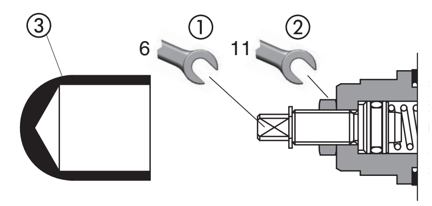
P = Integral mechanical pressure limiter (standard for size 1, 2 and 3)

The LICZA-A*, LIMZA-A* and LIRZA-A* standard size 1, 2, 3 and option /P 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.

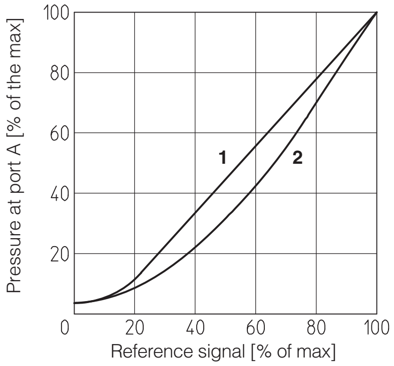


① adjustment screw
② locking nut
③ protection cap

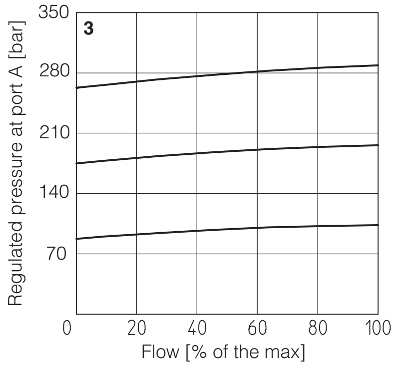
14.1 Possible combined options: /OP

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

1 **Regulation diagrams LIMZA**
2 **Regulation diagrams LICZA**

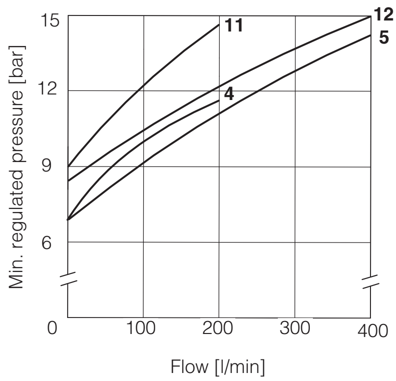


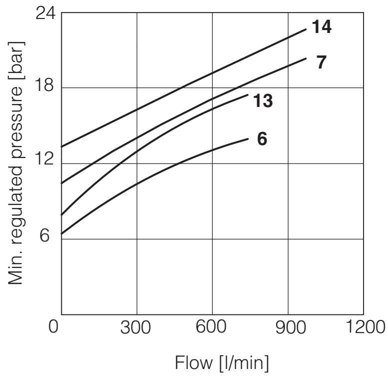
3 **Pressure/flow diagrams LICZA, LIMZA**

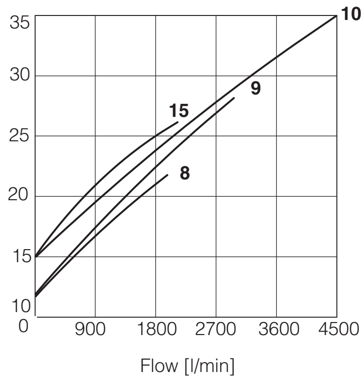


4-14 Min. pressure/flow diagrams
with zero reference signal

4 = LIMZA-*-1	**11** = LICZA-*-1
5 = LIMZA-*-2	**12** = LICZA-*-2
6 = LIMZA-*-3	**13** = LICZA-*-3
7 = LIMZA-*-4	**14** = LICZA-*-4
8 = LIMZA-*-5	**15** = LICZA-*-5
9 = LIMZA-*-6	
10 = LIMZA-*-8	

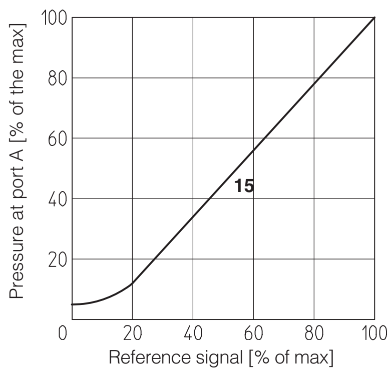






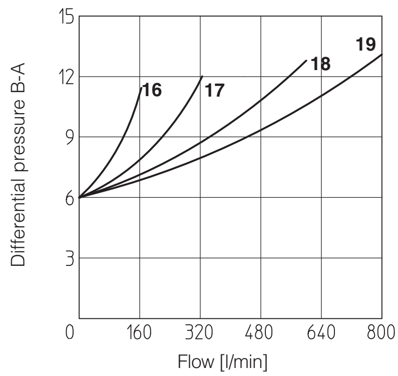
Regulation diagrams LIRZA

15 = LIRZA-A



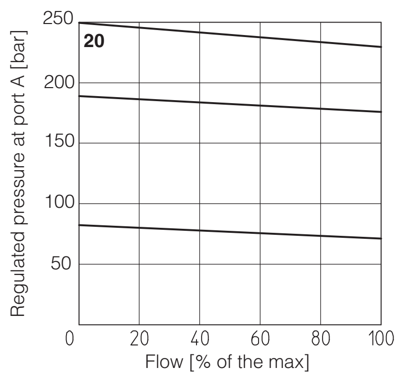
16-19 Min. pressure/flow diagrams
with reference signal “null”

16 = LIRZA-*-1
17 = LIRZA-*-2
18 = LIRZA-*-3
19 = LIRZA-*-4



Pressure/flow diagrams

20 = LIRZA-A

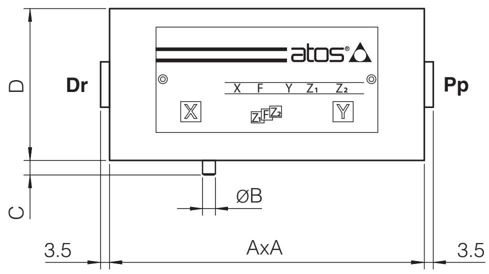


16 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
LIMZA LICZA LIRZA	**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
LIMZA LICZA	**5** = 50	4 socket head screws M20x80 class 12.9 Tightening torque = 600 Nm	2 OR 3043
LIMZA	**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

17 COVERS DIMENSIONS [mm]

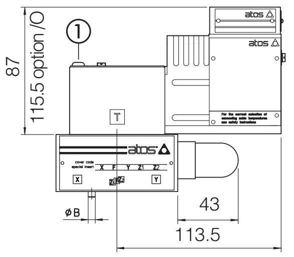
Size	AxA	ØB	C	D	Port Pp - Dr
1 = 16	65x80	3	4	40	-
2 = 25	85x85	5	6	40	-
3 = 32	100x100	5	6	50	-
4 = 40	125x125	5	6	60	G 1/4”
5 = 50	140x140	6	4	70	G 1/4”
6 = 63	180x180	6	4	80	G 3/8”
8 = 80	ø250	8	6	80	G 3/8”



Notes:
size 1 cover is not squared but retangular, dimensions 65x80
size 8 cover is not squared but circular, dimension ø250

18 COVERS INSTALLATION DIMENSIONS [mm]

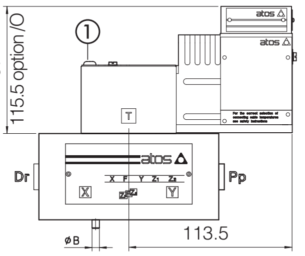
LICZA-A-1 **LIMZA-A-1** **LIRZA-A-1**
LICZA-A-2 **LIMZA-A-2** **LIRZA-A-2**
LICZA-A-3 **LIMZA-A-3** **LIRZA-A-3**



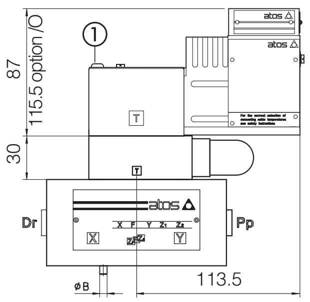
Mass [kg]			
LICZA, LIMZA, LIRZA			**Cartridge**
Size	Standard	Option /P	SC LI
1	4,1	standard	0,2
2	4,8	standard	0,5
3	6,1	standard	0,9
4	11,5	12,5	1,7
5	15	16	2,9
6	24,5	25,5	6,7
8	33,1	34,1	13,1

1 = Screw for air bleeding: at the first valve commissioning the air eventually trapped inside the solenoid must be bled-off though the screw 1

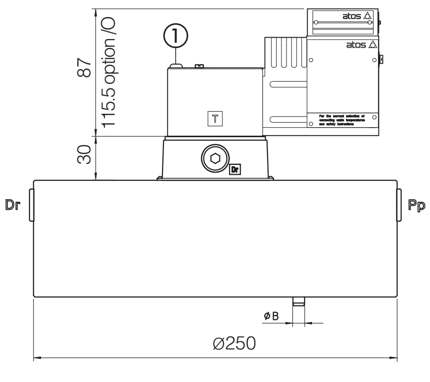
LICZA-A-4 **LIMZA-A-4** **LIRZA-A-4**
LICZA-A-5 **LIMZA-A-5**
LIMZA-A-6



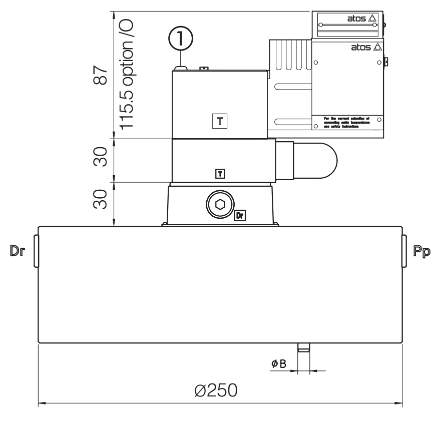
LICZA-A-4/P **LIMZA-A-4/P** **LIRZA-A-4/P**
LICZA-A-5/P **LIMZA-A-5/P**
LIMZA-A-6/P



LIMZA-A-8



LIMZA-A-8/P



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

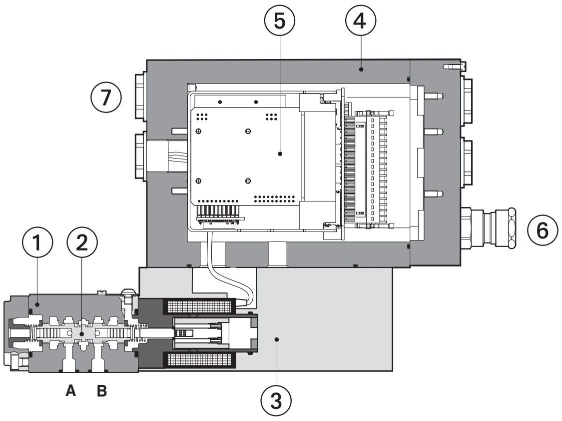
19 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P006	Mounting surfaces and cavities for cartridge valves

Table **FX080-2/E**

Ex-proof digital proportional reducing valves

direct, with on-board driver and without transducer - **ATEX and IECEx**



① valve body
② spool
③ ex-proof solenoid
④ ex-proof electronics housing
⑤ on-board digital driver
⑥ ex-proof cable glands (to be ordered separately)
⑦ USB port always present (factory plugged)

DHRZA-AES-010/25

DHRZA-AES

Ex-proof digital proportional pressure reducing valves, direct, without transducer, for pressure reduction in low flow systems or piloting lines.

They are equipped with ex-proof on-board digital driver and proportional solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZA - AES - NP - 010 / 25 - M / * * / *

DHRZA — Ex-proof proportional pressure reducing valves, direct
DHRZA = size 06

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

010 = reduced port A
012 = reduced ports A and B

25 = reduced pressure range 3÷25 bar

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
B = flow reduced on port B (solenoid on side A)

Electronic options (1):
I = current reference input 4 ÷ 20 mA (omit for std voltage ±10 VDC)

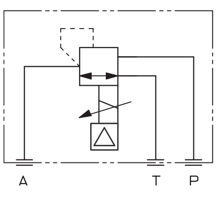
Series number

Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

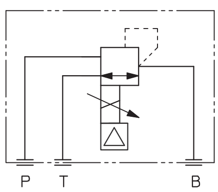
(1) Possible combined options: /BI

2 CONFIGURAZIONS AND HYDRAULIC SYMBOLS (rapresentation according to ISO 1219-1)

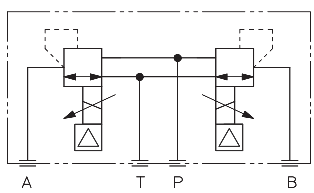
DHRZA-AES-*-010/25*



DHRZA-AES-*-010/25/B*



DHRZA-AES-*-012/25*



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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

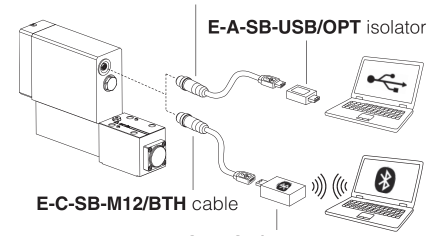
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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 ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

7 HYDRAULIC CHARACTERISTICS

Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) [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 (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ
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)
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
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
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

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, 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	DHRZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-31 EN 60079-1		IEC 60079-0 IEC 60079-31:2013 IEC 60079-1
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

11 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2	**Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 **CABLE GLANDS**

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

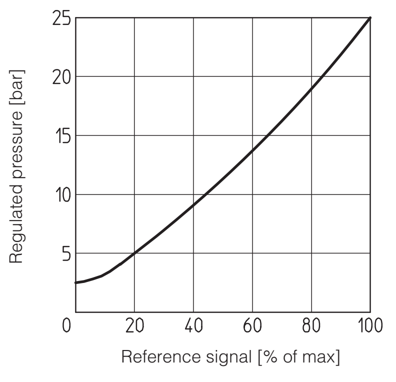
13 **HYDRAULIC OPTIONS**

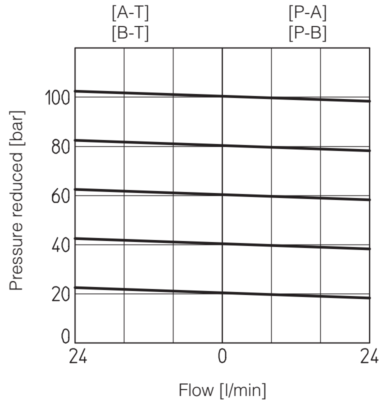
B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 15.1

14 **ELECTRONIC OPTIONS**

I = It provides 4 ÷ 20 mA current reference signal, 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.

15 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C





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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 (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 ÷ 10VDC 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 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 ÷ 5VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

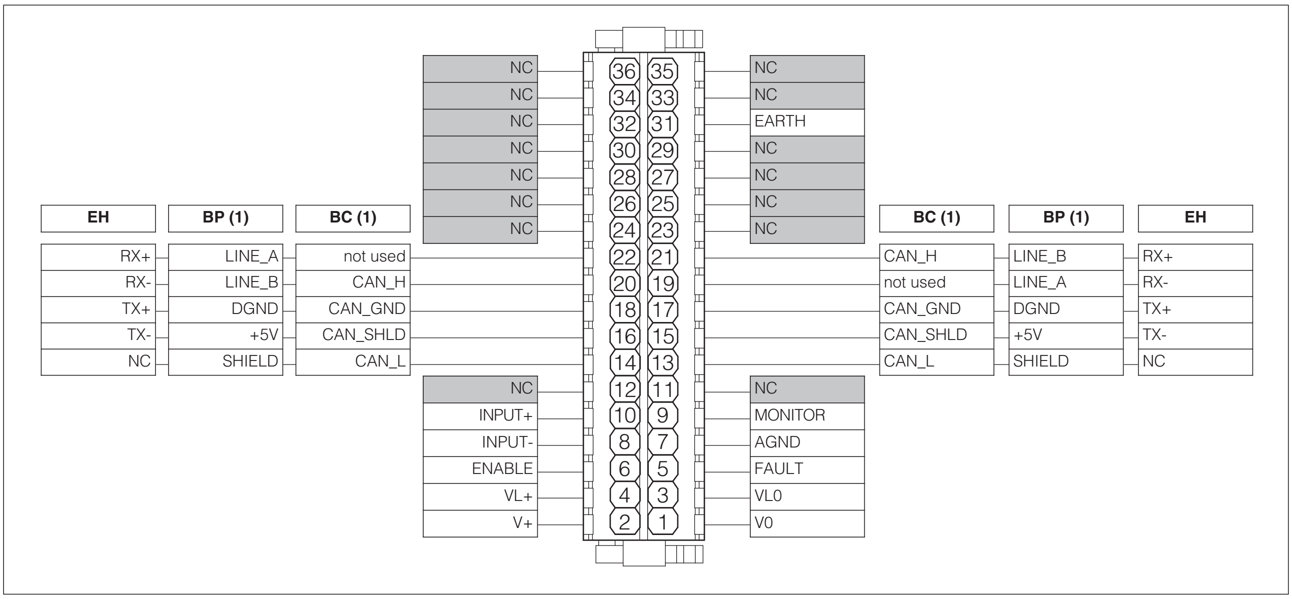
16.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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)

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 TERMINAL BOARD OVERVIEW



(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

18 ELECTRONIC CONNECTIONS

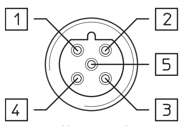
18.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

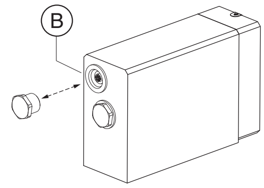
18.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



18.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

18.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

18.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

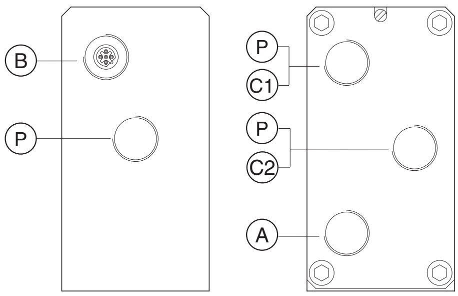
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

Cables entrance description:

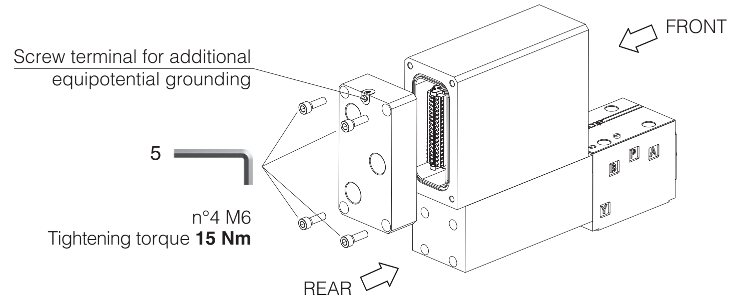
- Ⓐ main connections
- Ⓑ USB connector always present (factory plugged)
- C1 fieldbus interface (input)
- C2 fieldbus interface (output)
- Ⓟ threaded plug



(front) (rear)

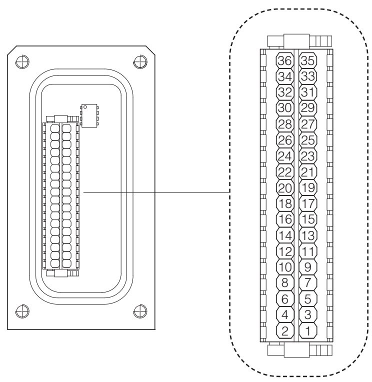
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

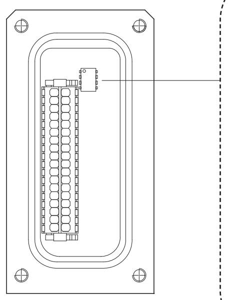


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 17



Fieldbus terminator only for BC and BP executions **(1)**



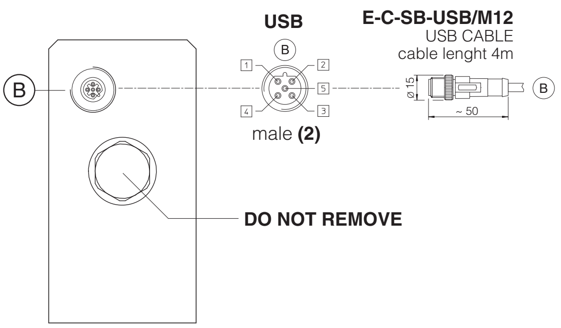
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

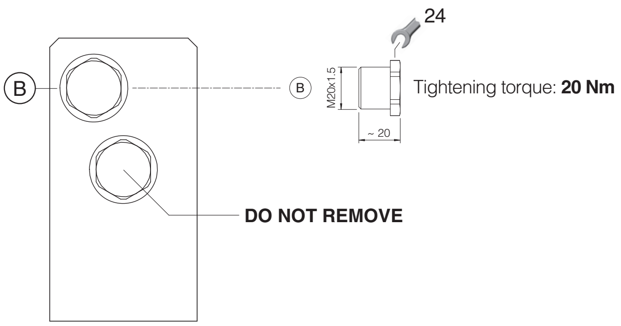
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR



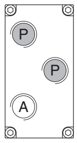
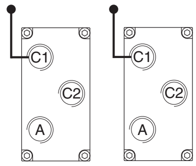
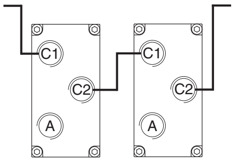
METALLIC PROTECTION CAP - supplied with the valves



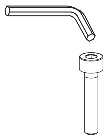
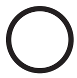
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

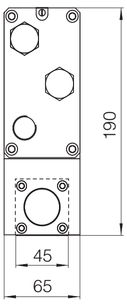
19.1 Cable glands and threaded plug - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

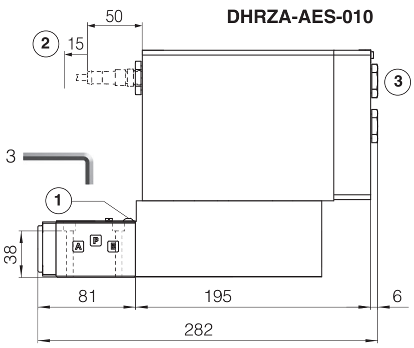
20 FASTENING BOLTS AND SEALS

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

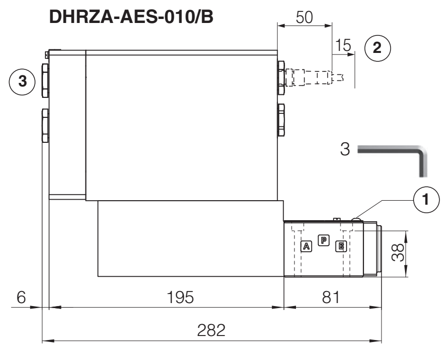
21 INSTALLATION DIMENSIONS FOR DHRZA [mm]



DHRZA-AES-010



DHRZA-AES-010/B

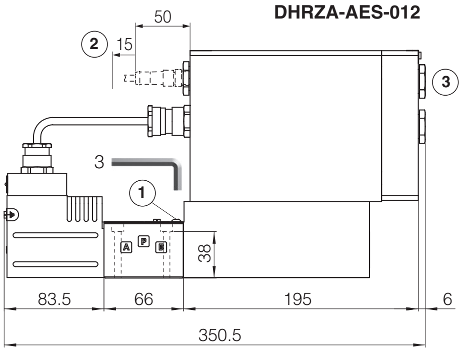


ISO 4401: 2005
(see table P005)

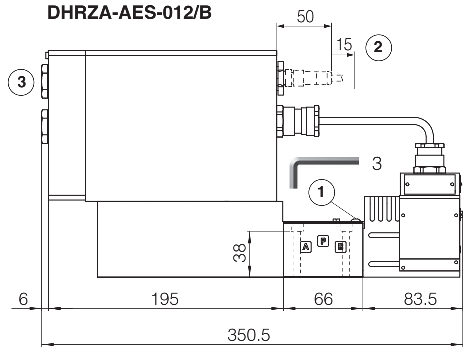
Mounting surface:
4401-03-02-0-05

Mass [kg]	
DHRZA-A-010	8,2
DHRZA-A-012	9,9

DHRZA-AES-012



DHRZA-AES-012/B

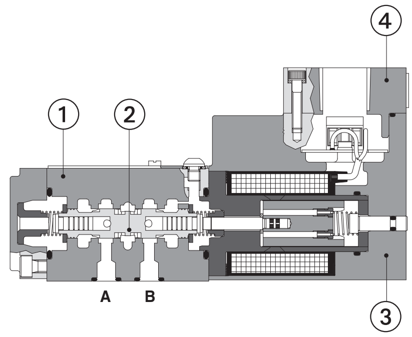


22 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional reducing valves

direct, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



DHRZA-A-010/25

① valve body
② spool
③ ex-proof solenoid
④ threaded connections for cable clamp or conduit pipe

DHRZA-A

Ex-proof proportional pressure reducing valves, direct, without transducer, for pressure reduction in low flow systems or piloting lines.

They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **24 l/min**
Max pressure: **25 bar**

1 MODEL CODE

DHRZA / * - A - 010 / 25 - M / * / * * / *

DHRZA – Ex-proof proportional pressure reducing valves, direct
DHRZA = size 06

Certification type:
Multicertification:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

010 = reduced port A
012 = reduced ports A and B

25 = reduced pressure range 3÷25 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
B = flow reduced on port B (solenoid on side A)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

Seals material, see section 6:
- = NBR
PE = FKM
BT = HNBR

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining)
(3) Possible combined options: all combinations are available
(4) Approved only for italian market

2 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

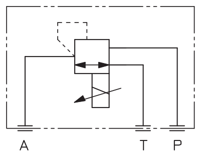
Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

3 GENERAL CHARACTERISTICS

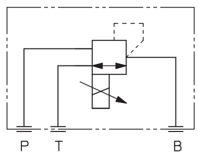
Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

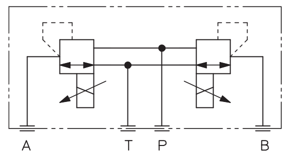
Hydraulic symbols



DHRZA-A-010/25*



DHRZA-A-010/25/B*



DHRZA-A-012/25*

Max regulated pressure (Q=1 l/min) [bar]	25
Min. regulated pressure (Q=1 l/min) [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 (depending on installation) [ms]	≤ 45
Hysteresis [% of the max pressure]	≤ 1,5
Linearity [% of the max pressure]	≤ 3
Repeatability [% of the max pressure]	≤ 2

Above performance data refer to valves coupled with Atos electronic drivers, see section 2

5 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

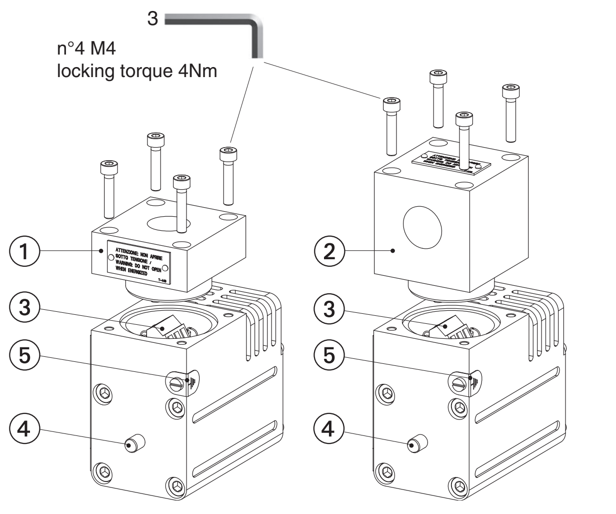
Valve type	DHRZA, DKZA		DHRZA**/M**, DKZA**/M**	DHRZA**/UL**, DKZA**/UL**	
Certifications	Multicertification Group II **TEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

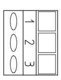
8 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

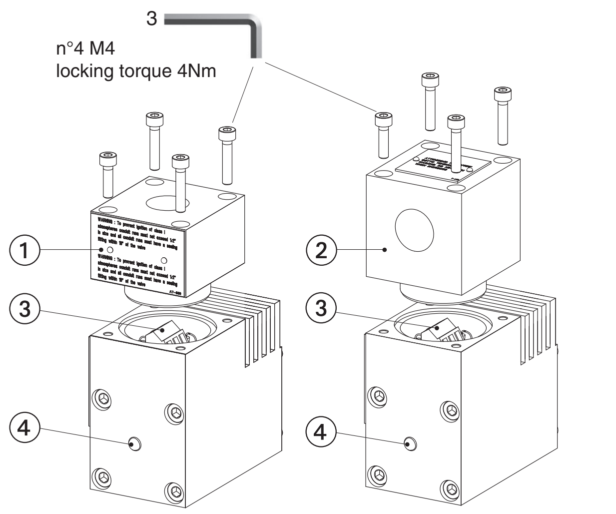
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

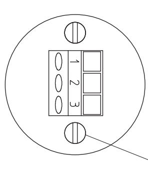
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

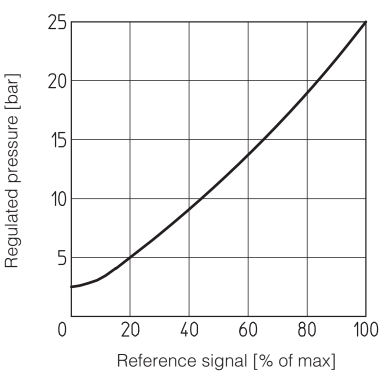
Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

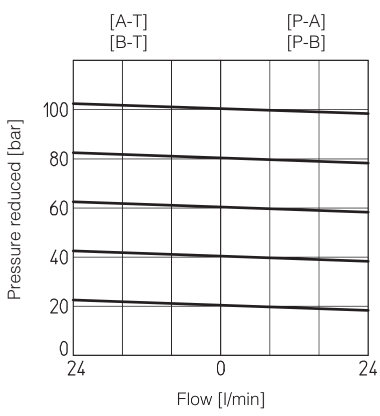
10 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

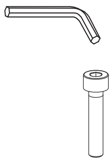
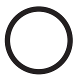
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **DIAGRAMS** based on mineral oil ISO VG 46 at 50°C





12 FASTENING BOLTS AND SEALS

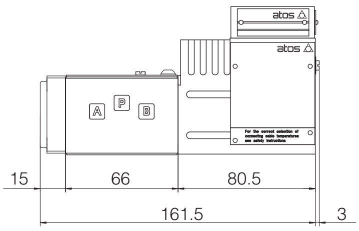
	DHZA	DKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports P, A, B, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for /Y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

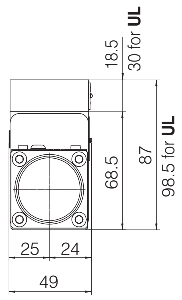
13 INSTALLATION DIMENSIONS FOR DHRZO [mm]

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

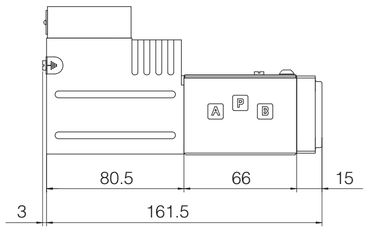
Mass [kg]	
DHRZA-A-05	2,65
DHRZA-A-07	4,3
Option /O	+0,35
Option /WP	+0,25

DHRZA-A-010

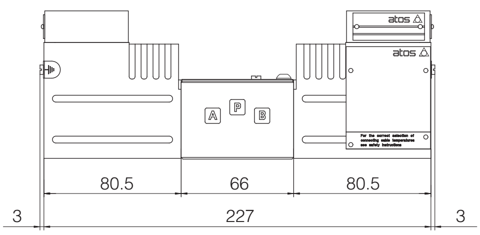




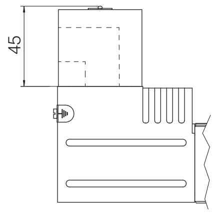
DHRZA-A-010/B



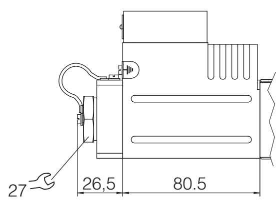
DHRZA-A-012



option /O



option /WP

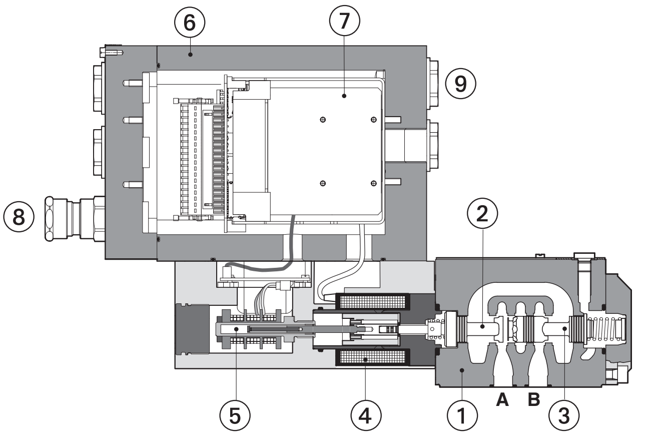


14 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
FX900	Operating and manintenance information for ex-proof proportional valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional flow valves high performance

pressure compensated, with on-board driver and LVDT transducer - **ATEX and IECEx**



QVKZA-TES-SN-NP-10

① valve body
② throttle
③ compensator
④ ex-proof solenoid
⑤ ex-proof LVDT transducer
⑥ ex-proof electronics housing
⑦ on-board digital drivers
⑧ ex-proof cable glands (to be ordered separately)
⑨ USB port always present (factory plugged)

QVHZA-TES, QVKZA-TES

Ex-proof digital high performance proportional flow valves, with LVDT position transducer for pressure compensated flow regulations.

They are equipped with ex-proof on-board digital driver, LVDT transducer and solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver, solenoid and transducer, prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
Size: **06** - ISO4401	Size: **10** - ISO4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZA - TES - SN - NP - 10 / 65 / M * * / *

Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

TES = on-board driver and LVDT transducer

Alternated P/Q controls:
SN = none

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:
06 = size 06
10 = size 10

Max regulated flow:

QVHZA:
3 = 3,5 l/min
12 = 12 l/min
18 = 18 l/min
36 = 35 l/min
45 = 45 l/min

QVKZA:
65 = 65 l/min
90 = 90 l/min

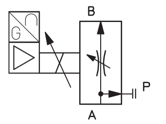
Cable entrance threaded connection:
M = M20x1,5

Electronic options:
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)

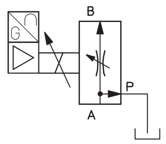
Series number

Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

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)

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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

⚠ **WARNING:** the below operation must be performed in a safety area

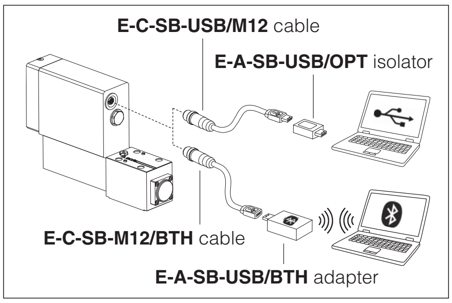
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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		QVHZA					QVKZA	
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 **(1)**	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0÷100% step signal	[ms]	≤ 30					≤ 45	
Hysteresis		≤ 0,5 [% of the regulated max flow]						
Linearity		≤ 0,5 [% of the regulated max flow]						
Repeatability		≤ 0,1 [% of the regulated max flow]						

(1) for different Δp, the max flow is in accordance to diagrams in section 14.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
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)
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
Additional characteristics	Short circuit protection of solenoid current supply; spool position 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, 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

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 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	QVHZA, QVKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-TES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X	• IECEx: IECEx TPS 19.0004X	
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db	• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1 EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

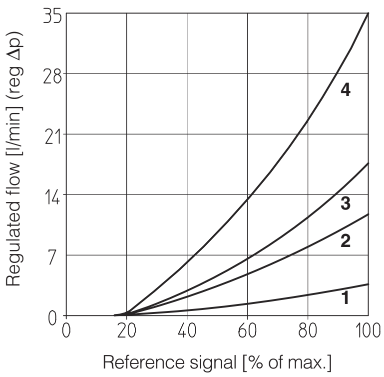
13 ELECTRONIC OPTIONS

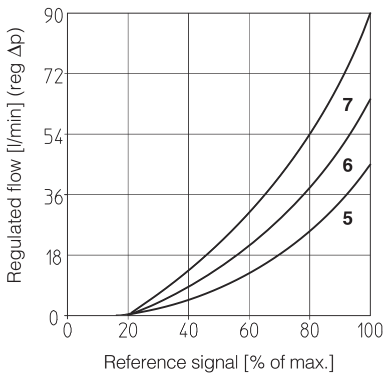
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

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

14.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**



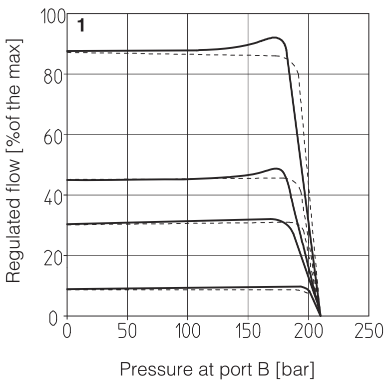


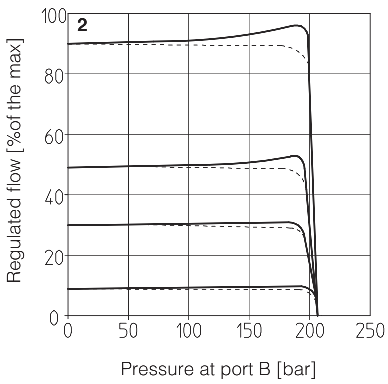
14.2 Regulated flow/outlet pressure diagrams

with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

Dotted line for 3-way versions

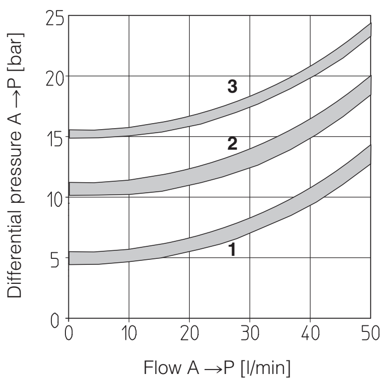


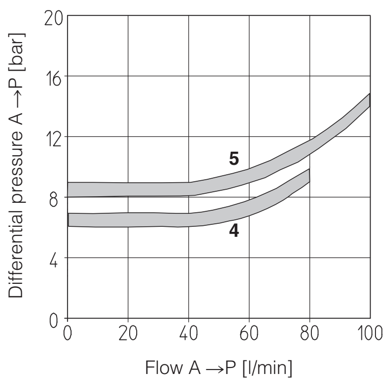


14.3 Flow A → P/Δp diagrams

3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





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, 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 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.

15.2 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 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 3 and 4, 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 ÷ 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.

15.4 Flow monitor output signal (Q_MONITOR)

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 ÷ 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.

15.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 5: 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)

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 **TERMINAL BOARD OVERVIEW**

EH, EW, EI, EP	BP (1)	BC (1)	Pin	Pin	BC (1)	BP (1)	EH, EW, EI, EP
		NC	36	35	NC		
		NC	34	33	NC		
		NC	32	31	EARTH		
		NC	30	29	NC		
		NC	28	27	NC		
		NC	26	25	NC		
		NC	24	23	NC		
RX+	LINE_A	not used	22	21	CAN_H	LINE_B	RX+
RX-	LINE_B	CAN_H	20	19	not used	LINE_A	RX-
TX+	DGND	CAN_GND	18	17	CAN_GND	DGND	TX+
TX-	+5V	CAN_SHLD	16	15	CAN_SHLD	+5V	TX-
NC	SHIELD	CAN_L	14	13	CAN_L	SHIELD	NC
		NC	12	11	NC		
		Q_INPUT+	10	9	Q_MONITOR		
		INPUT-	8	7	AGND		
		ENABLE	6	5	FAULT		
		VL+	4	3	VL0		
		V+	2	1	V0		

(1) For BC and BP executions the fieldbus connections have an internal pass-through connection

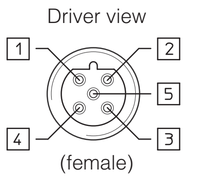
17 ELECTRONIC CONNECTIONS

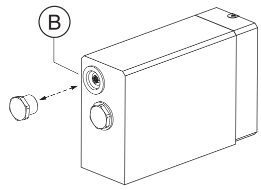
17.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**Q_MONITOR**	Flow monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**Q_INPUT+**	Flow reference input signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

17.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





17.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

17.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

17.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

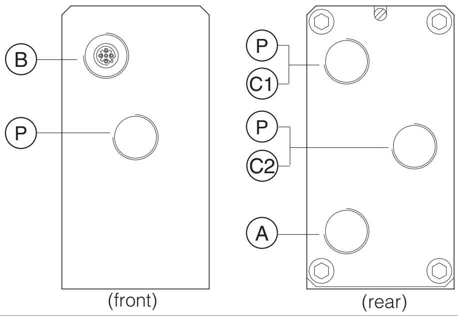
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

18 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

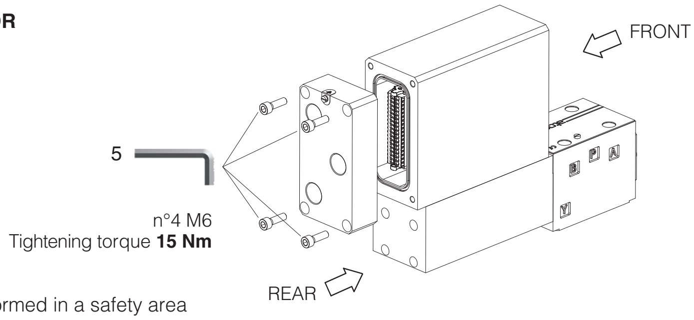
Cables entrance description:

- A main connections
- B USB connector always present (factory plugged)
- C1 fieldbus (input)
- C2 fieldbus (output)
- D1 pressure transducer 1
- D2 pressure transducer 2
- P threaded plug



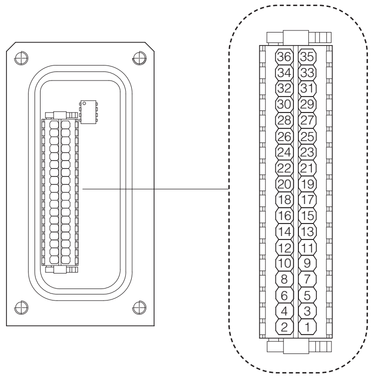
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

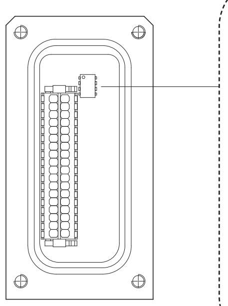


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 16



Fieldbus terminator only for BC and BP executions **(1)**



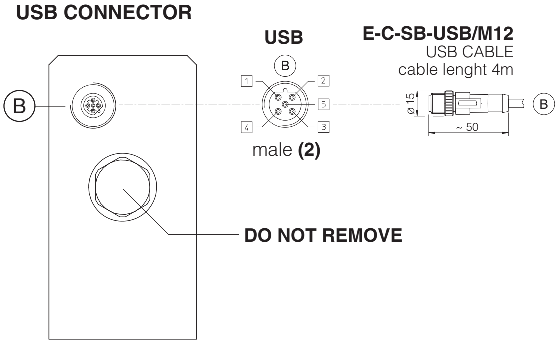
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

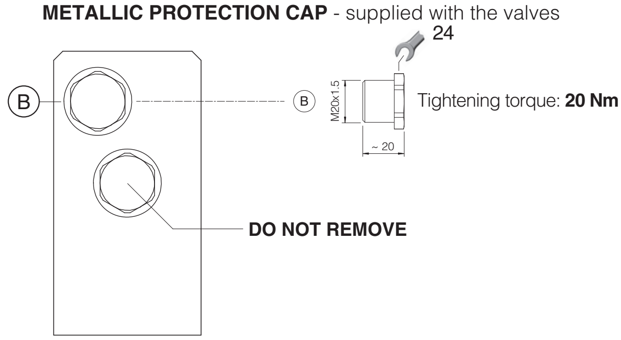
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR

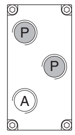
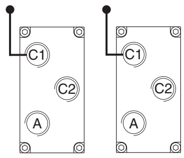
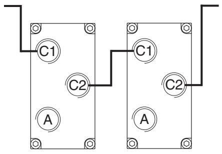


METALLIC PROTECTION CAP - supplied with the valves

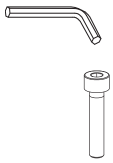
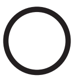


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

18.1 Cable glands and threaded plug - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance A is open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

19 FASTENING BOLTS AND SEALS

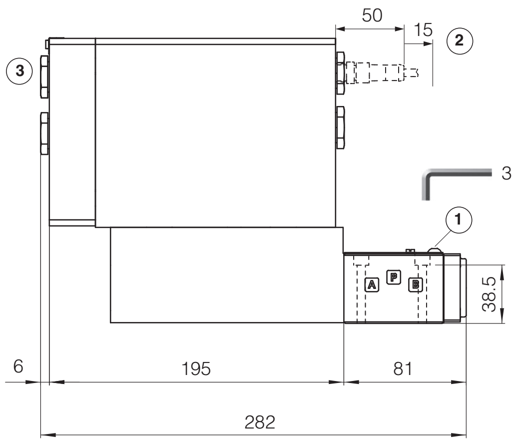
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

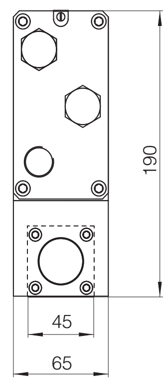
20 INSTALLATION DIMENSIONS [mm]

QVHZA-TES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA-TES	7,2

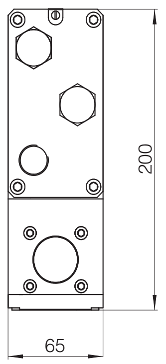


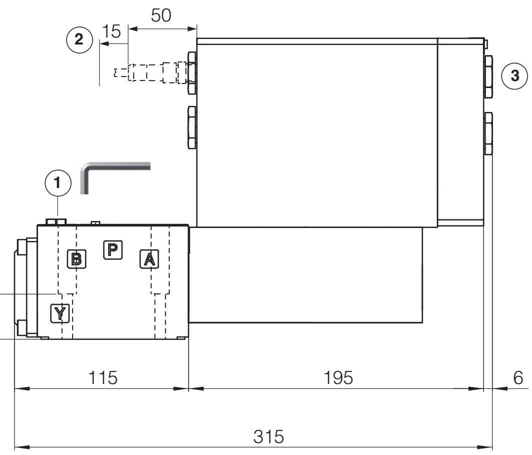


QVKZA-TES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA	9





1 = Air bleed off
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

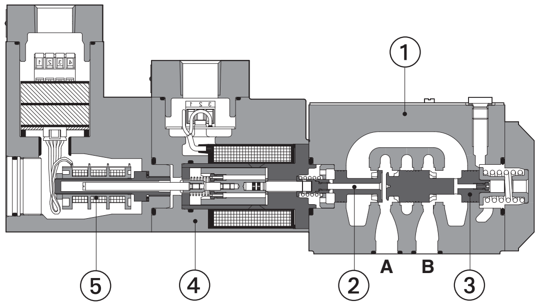
21 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GX800**	Ex-proof pressure transducer type E-ATRA-7
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance information for ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		
GS510	Fieldbus		

Table **FX420-1/E**

Ex-proof proportional flow valves high performance

pressure compensated, with LVDT transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① valve body
② throttle
③ compensator
④ ex-proof proportional solenoid
⑤ ex-proof LVDT transducer

QVKZA-T-10

QVHZA-T, QVKZA-T

Ex-proof high performance proportional flow control valves, with LVDT position transducer for pressure compensated flow regulations.
They are equipped with ex-proof proportional solenoids LVDT transducer certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid and transducer prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
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

QVKZA / * - T - 10 / 90 / M / * * / *

Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

T = with LVDT transducer

Valve size ISO 4401:
06 = size 06 **10** = size 10

Max regulated flow:

QVHZA:	QVKZA:
3 = 3,5 l/min	**65** = 65 l/min
12 = 12 l/min	**90** = 90 l/min
18 = 18 l/min	
36 = 35 l/min	
45 = 45 l/min	

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

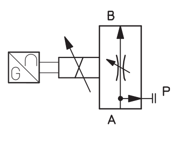
Options (3):
C = position transducer with current feedback 4 ÷ 20mA
D = quick venting of port B

Series number

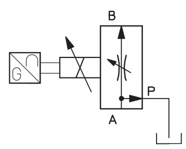
Seals material, see section 7:
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /CD **(4)** Approved only for the Italian market

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

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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 ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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		QVHZA					QVKZA	
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]	40			50	55	70	100
Max pressure	[bar]	210						
Response time **(1)**	[ms]	≤ 30					≤ 40	
Hysteresis		≤ 0,5 [% of the regulated max flow]						
Linearity		≤ 0,5 [% of the regulated max flow]						
Repeatability		≤ 0,1 [% of the regulated max flow]						

Note: above performance data refer to valves coupled with Atos electronic drivers, see section 3
(1) 0 ÷100 % step signal

6 ELECTRICAL CHARACTERISTICS

Max. power	35W
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved
Duty factor	Continuous rating (ED=100%)
Voltage code	standard
Coil resistance R at 20°C	3,2 Ω
Max. solenoid current	2,5 A

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 ÷ +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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 180 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

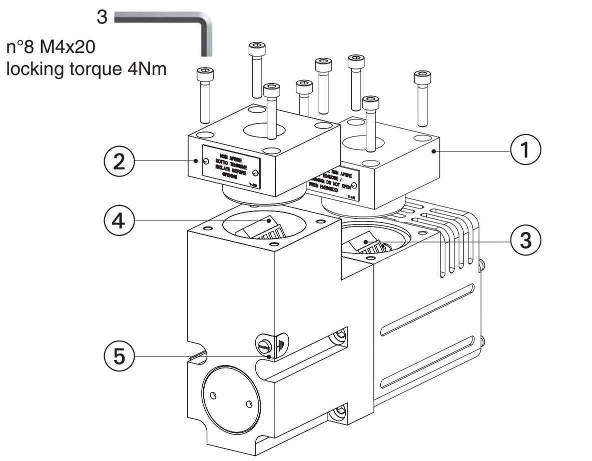
Valve type	QVHZA, QVKZA		QVHZA/**M**, QVHZA/**M**	QVHZA/**UL**, QVHZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid cerified code	**OZA-T**		**OZAM-T**	**OZA-T/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135°C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

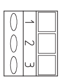
9 EX PROOF SOLENOIDS AND LVDT TRANSDUCER WIRING

Multicertification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

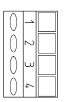
Solenoid wiring



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

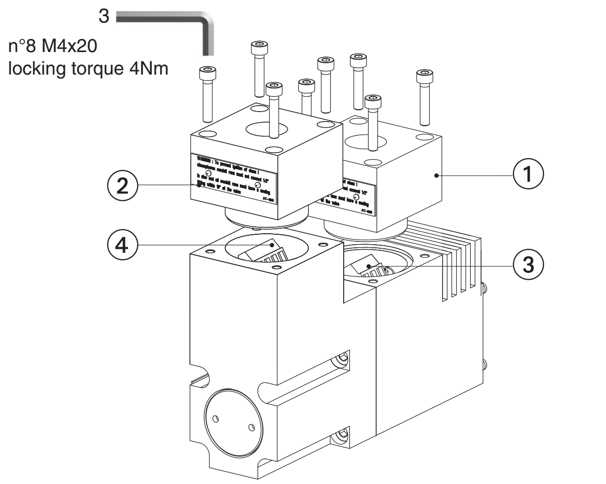
Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

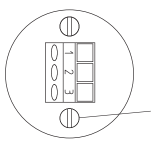
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring

Solenoid wiring ⚠ **Pay attention to respect the polarity**

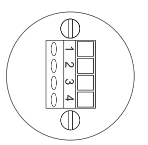


1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring



1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	-	90 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 CABLE GLANDS - only Multicertification

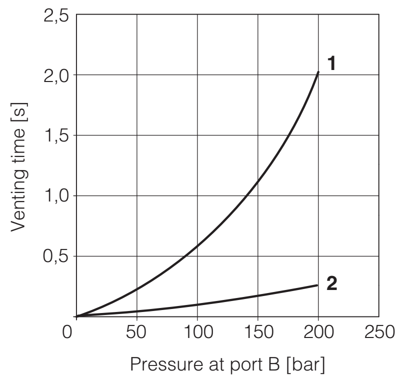
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

C = Position transducer with current feedback 4÷20 mA, suggested in case of long distance between the electronic driver and the proportional valve

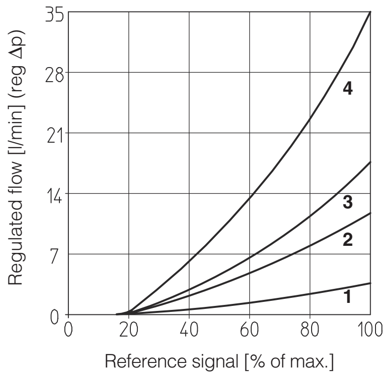
D = This option provides a quick venting of the use port B when the valve is closed or de-energized. The valve must be connected in 3 way, with P port connected to tank. When the proportional throttle is fully closed, the valve's port B is internally connected to port P (tank), permitting a quickly decompression of the pressure in the use line.
In the diagram aside are represented the venting times of **QVHZA** and **QVKZA** option **/D** respect to standard versions:
1 = standard versions
2 = option /D

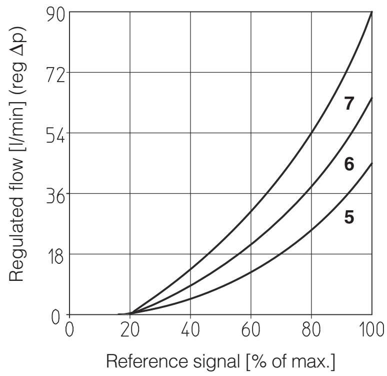


13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

13.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**

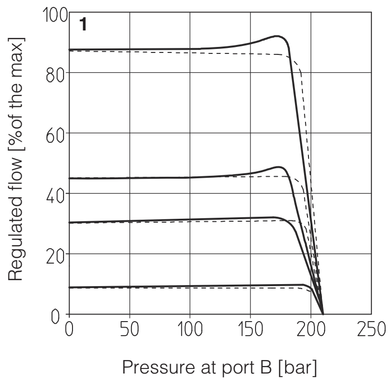


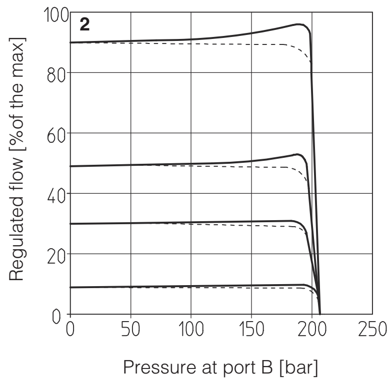


13.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

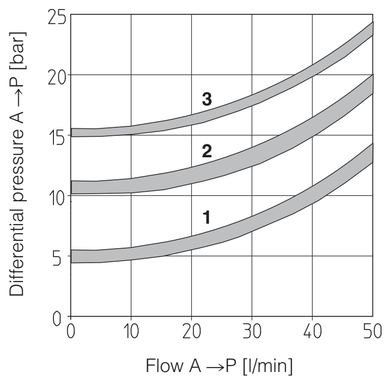
Dotted line for 3-way versions

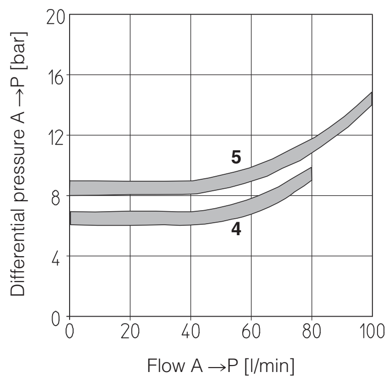




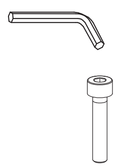
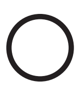
13.3 Flow A → P/Δp diagrams
3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





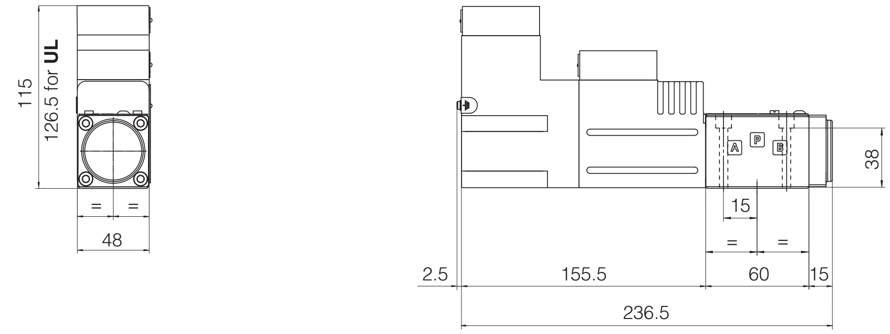
14 FASTENING BOLTS AND SEALS

	QVHZA	QVKZA
	**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)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS FOR QVHZA [mm]

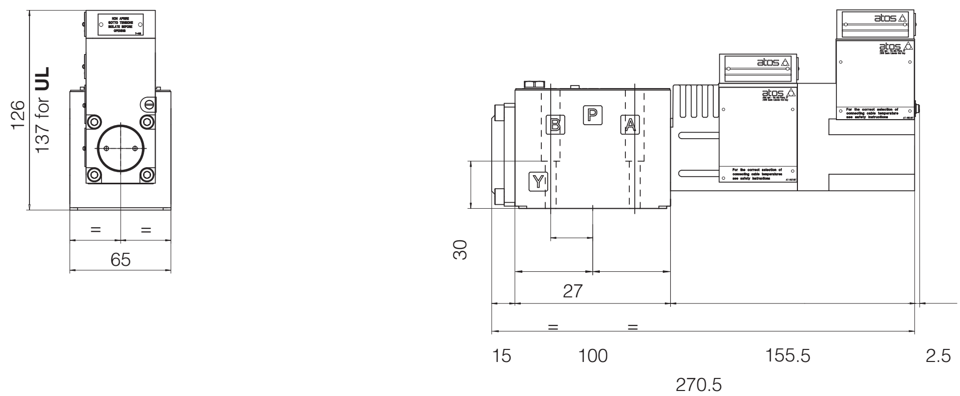
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA	3,4



ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA	4,9

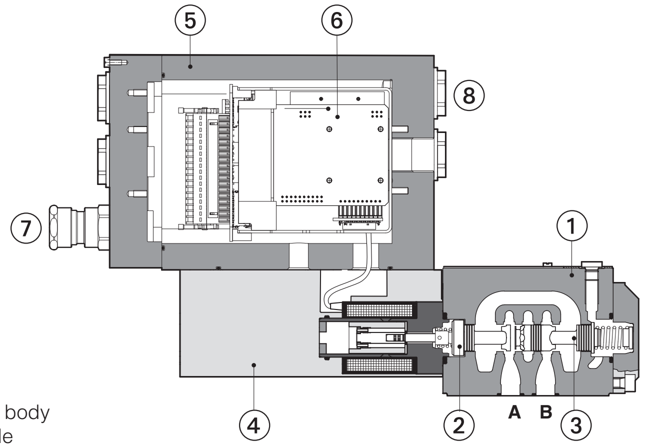


16 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
FX900 Operating and manintenance information for ex-proof proportional valves
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

Ex-proof digital proportional flow valves

pressure compensated with on-board driver and without transducer - **ATEX and IECEx**



① valve body
② throttle
③ compensator
④ ex-proof solenoid
⑤ ex-proof electronics housing
⑥ on-board digital driver
⑦ ex-proof cable glands (to be ordered separately)
⑧ USB port always present (factory plugged)

QVKZA-AES-NP-10

QVHZA-AES, QVKZA-AES

Ex-proof digital proportional flow valves, without position transducer for pressure compensated flow regulations.

They are equipped with ex-proof on-board digital driver and solenoid certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The flameproof enclosure of on-board digital driver and solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The driver and solenoid are also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
Size: **06** - ISO4401	Size: **10** - ISO4401
Max flow: **45 l/min**	Max flow: **90 l/min**
Max pressure: **210 bar**	Max pressure: **210 bar**

1 MODEL CODE

QVKZA - **AES** - **NP** - **10** / **65** / **M** / * * / *

Ex-proof pressure compensate proportional flow valve, direct
QVHZA = size 06
QVKZA = size 10

AES = on-board driver, without transducer

Fieldbus interfaces, USB port always present:
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

Valve size ISO 4401:
06 = size 06
10 = size 10

Max regulated flow:

QVHZA:		QVKZA:
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		

Cable entrance threaded connection:
M = M20x1,5

Hydraulic options (1):
D = quick venting of port B

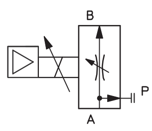
Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **W** (omit for std voltage 0 ÷ 10 VDC)
I = current reference input 4 ÷ 20 mA (omit for std voltage 0 ÷ 10 VDC)
W = power limitation function

Series number

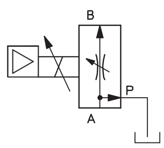
Seals material, see section 9 :
- = NBR
PE = FKM
BT = HNBR

(1) For possible combined options, see section 15

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)

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 **FX900** and in the user manuals included in the E-SW-* programming software.

4 VALVE SETTINGS AND PROGRAMMING TOOLS

WARNING: the below operation must be performed in a safety area

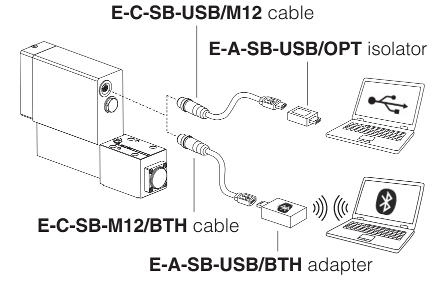
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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 - see tech. table GS510

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

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 10 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		QVHZA					QVKZA	
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 **(1)**	[l/min]	40			50	55	70	100
Max pressure	[bar]	210						
Response time 0÷100% step signal	[ms]	≤ 35					≤ 50	
Hysteresis		≤ 5 [% of the regulated max flow]						
Linearity		≤ 3 [% of the regulated max flow]						
Repeatability		≤ 1 [% of the regulated max flow]						

(1) for different Δp, the max flow is in accordance to diagrams in section 16.3

8 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
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
Monitor outputs	Voltage: maximum range ± 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 > 87kΩ
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 /W option)	+24VDC @ max 100 mA (E-ATRA-7 see tech table **GX800**)
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)
Protection degree to DIN EN60529	IP66/67 with relevant cable gland
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
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
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

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, 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 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

10 CERTIFICATION DATA

Valve type	QVHZA, QVKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-AES**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X • IECEx: IECEx TPS 19.0004X		
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db • IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db		
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1 EN 60079-31	IEC 60079-0 IEC 60079-1	IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The driver and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

11 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

11.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

12 CABLE GLANDS

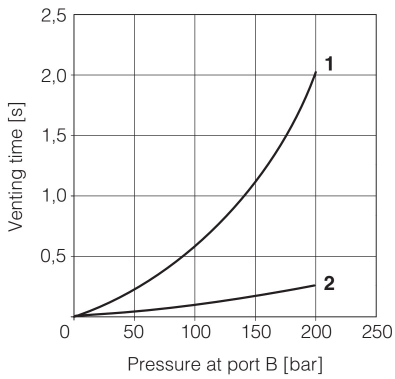
Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX600**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

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 **QVHZA** and **QVKZA** option **/D** respect to standard versions:

1 = standard versions
2 = option /D



14 ELECTRONIC OPTIONS

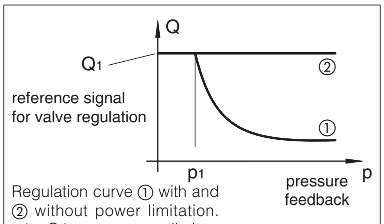
I = It provides 4 ÷ 20 mA current reference signal, instead of the standard 0 ÷ 10 VDC. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA. It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

C = Only in combination with option **/W**
It is available to connect pressure transducer with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10VDC .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 type HC-011 or KC-011 (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**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), 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 - option /W



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

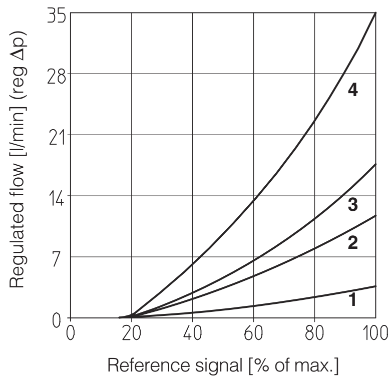
15 POSSIBLE COMBINED OPTIONS

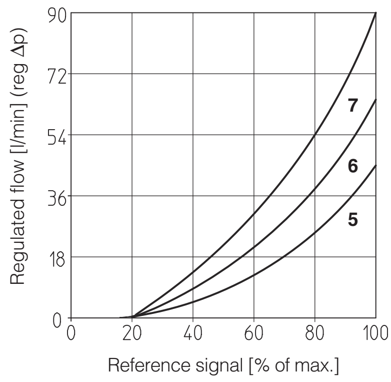
/DI, /DW, /IW, /ICW, /ICWD

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

16.1 Regulation diagrams

1 = QVHZA-*-06**/3**
2 = QVHZA-*-06**/12**
3 = QVHZA-*-06**/18**
4 = QVHZA-*-06**/36**
5 = QVHZA-*-06**/45**
6 = QVKZA-*-10**/65**
7 = QVKZA-*-10**/90**

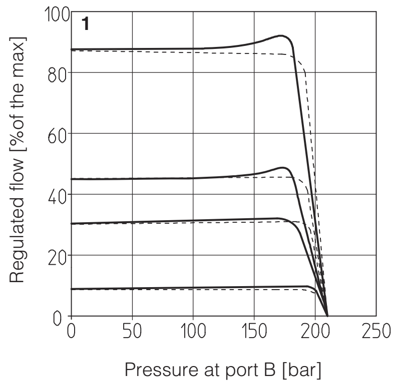


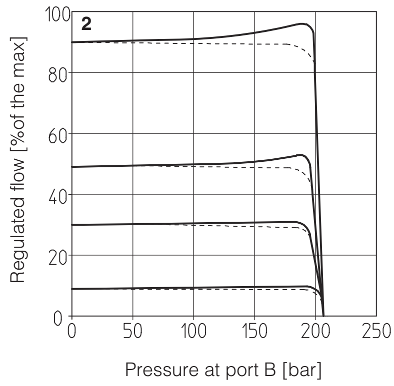


16.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

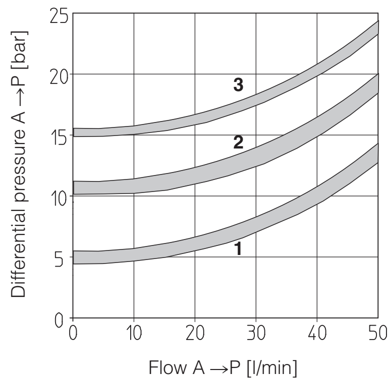
Dotted line for 3-way versions

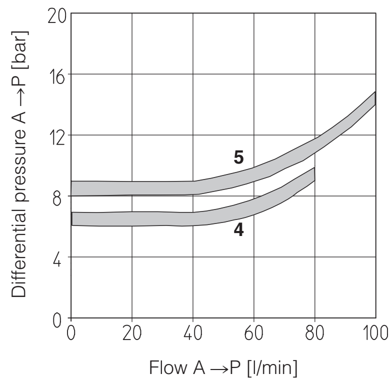




16.3 Flow A → P/Δp diagrams
3-way configuration

1 = QVHZA-*-06**/3**
QVHZA-*-06**/12**
2 = QVHZA-*-06**/18**
QVHZA-*-06**/36**
3 = QVHZA-*-06**/45**
4 = QVKZA-*-10**/65**
5 = QVKZA-*-10**/90**





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, EN-982).

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.

⚠ 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)

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 3 and 4, 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 (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.

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 ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

Option /W
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC

17.5 Enable input signal (ENABLE)

To enable the driver, supply a 24 VDC on pin 6: 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.

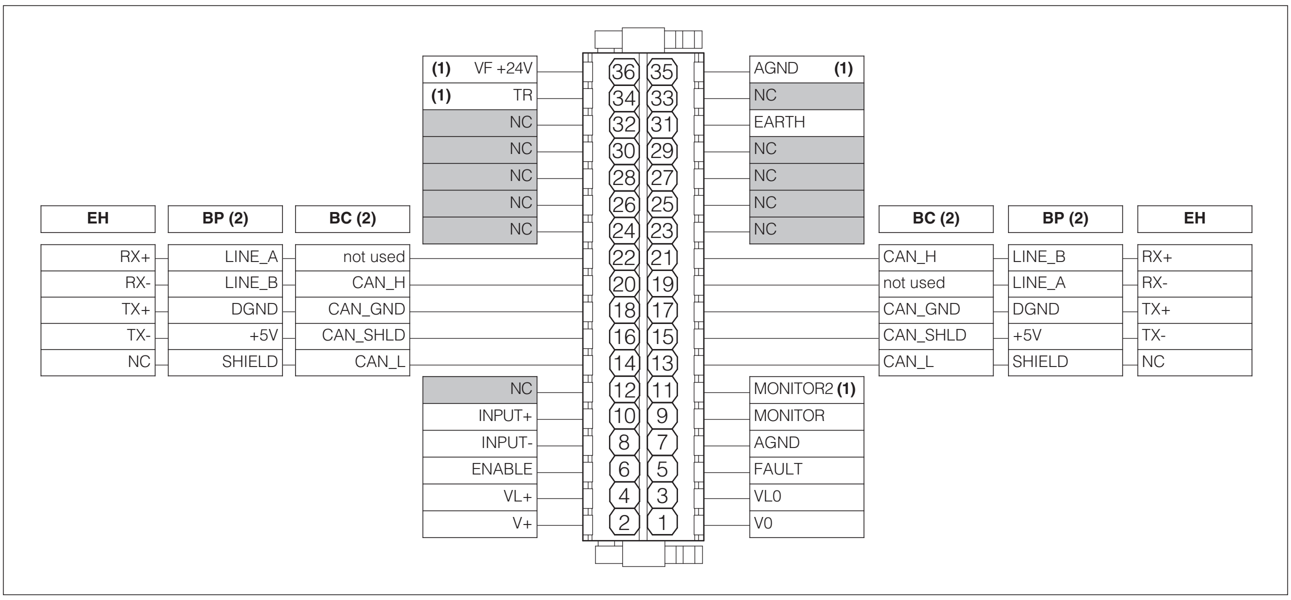
17.6 Fault output signal (FAULT)

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.

17.7 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 valve code, defaults are 0 ÷ 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.
Note: transducer feedback can be read as a digital information through fieldbus communication - software selectable.

18 TERMINAL BOARD OVERVIEW



(1) Connections available only for /W option
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

19 ELECTRONIC CONNECTIONS

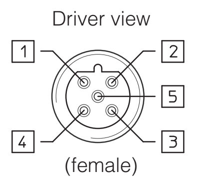
19.1 Main connections signals

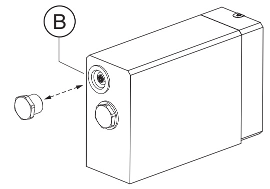
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for INPUT+	Input - analog signal
	9	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range, referred to AGND Default is: ±5 V_{DC}	Output - analog signal **Software selectable**
	10	**INPUT+**	Reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: 0 ÷ 10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**MONITOR2**	2nd monitor output signal: ±5 V_{DC} maximum range, referred to AGND **(1)** Default is: 0 ÷ 5 V_{DC}	Output - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

(1) 2nd monitor output signal is available only for /W option

19.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





19.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) pin 19 and 22 can be fed with external +5V supply of CAN interface

19.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

19.5 EH fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

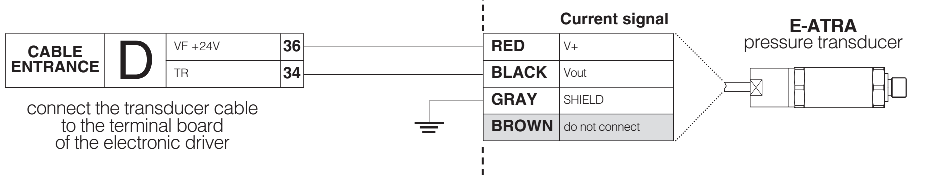
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

19.6 Remote pressure transducer connector - only for /W option

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	Voltage	Current
D	34	**TR**	Signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

for **/W** option



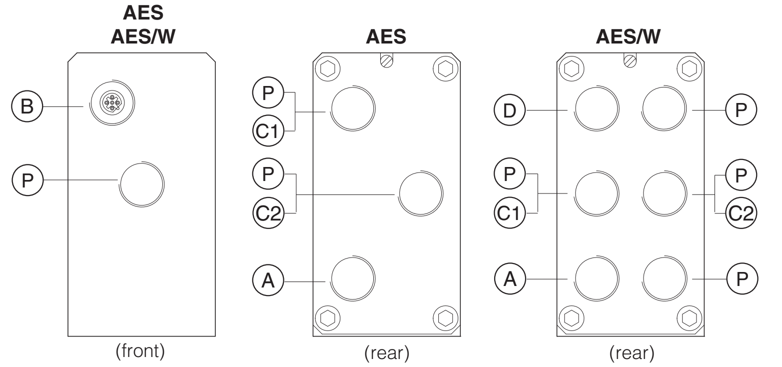
connect the transducer cable to the terminal board of the electronic driver

20 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

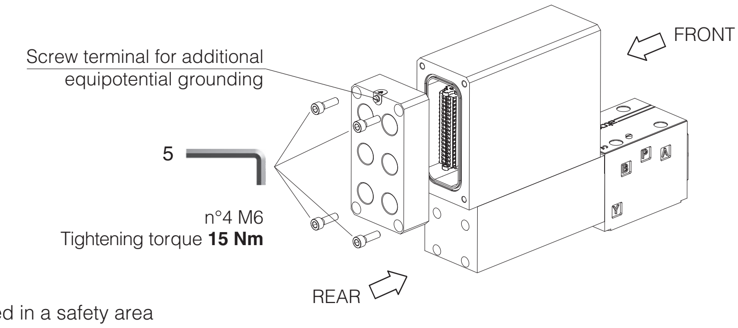
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus interface (input)
- (C2) fieldbus interface (output)
- (D) pressure transducer (only /W option)
- (P) Threaded plug



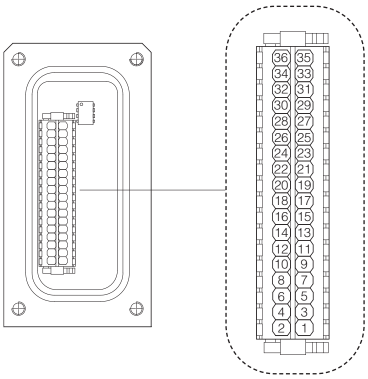
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

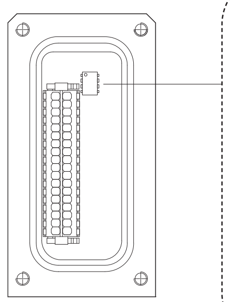


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 18

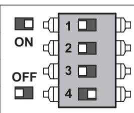


Fieldbus terminator only for BC and BP executions **(1)**



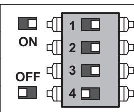
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

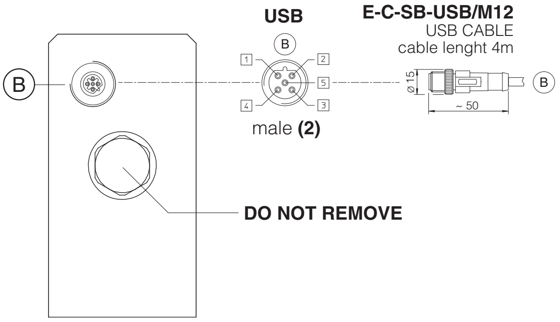


BP - PROFIBUS DP setting:

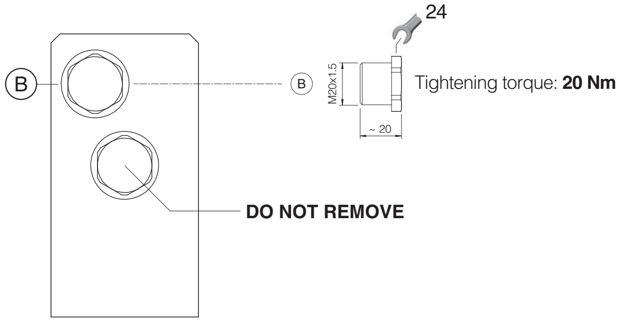
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR



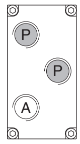
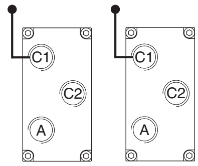
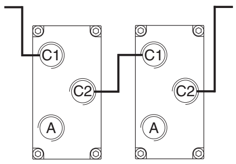
METALLIC PROTECTION CAP - supplied with the valves



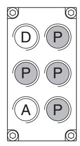
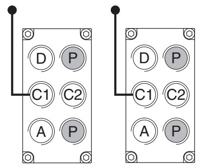
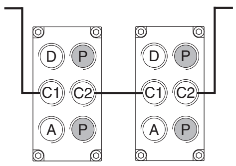
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

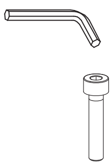
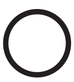
20.1 Cable glands and threaded plug for AES - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	1	A	none	none		Cable entrance P are factory plugged Cable entrance A is open for costumers
BC, BP, EH "via stub" connection	2	C1 A	1	C2		Cable entrance A, C1, C2 are open for costumers
BC, BP, EH "daisy chain" connection	3	C1 C2 A	none	none		Cable entrance A, C1, C2 are open for costumers

20.2 Cable glands and threaded plug for AES with /W option - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	D A	none	none		Cable entrance P are factory plugged Cable entrance A, D are open for costumers
BC, BP, EH "via stub" connection	3	D C1 A	1	C2		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers
BC, BP, EH "daisy chain" connection	4	D C1 - C2 A	none	none		Cable entrance P are factory plugged Cable entrance A, C1, C2, D are open for costumers

21 FASTENING BOLTS AND SEALS

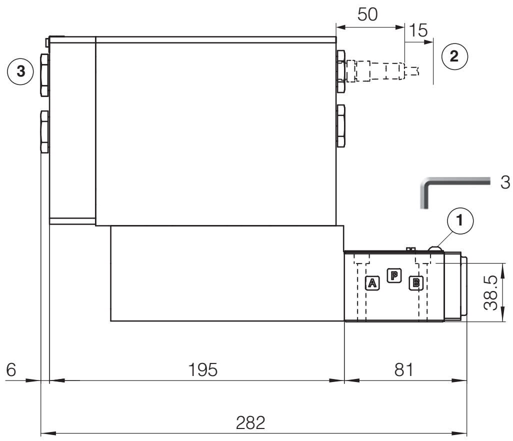
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

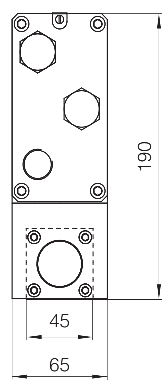
22 INSTALLATION DIMENSIONS [mm]

QVHZA-AES

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05 (see tab. P005)

Mass [kg]	
QVHZA-AES	8,2

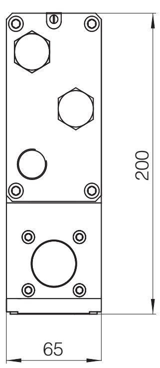


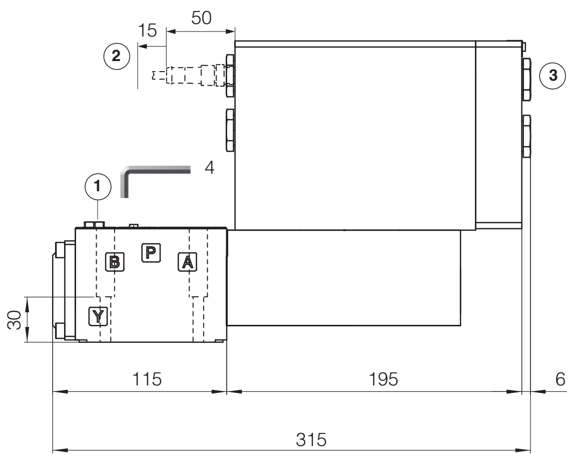


QVKZA-AES

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)

Mass [kg]	
QVKZA-AES	10





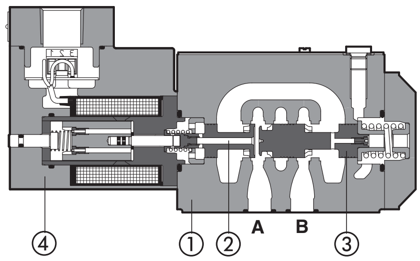
1 = Air bleed off
2 = Space to remove the USB connector
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

23 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
FX900	Operating and manintenance informationfor ex-proof proportional valves	**P005**	Mounting surfaces for electrohydraulic valves
GS500	Programming tools		

Ex-proof proportional flow valves

pressure compensated, without transducer - **ATEX, IECEx, EAC, PESO** or **cULus**



① valve body
② throttle
③ compensator
④ proportional solenoid

QVKZA-A-10

QVHZA-A, QVKZA-A

Ex-proof proportional flow valves, without position transducer for pressure compensated flow regulations.
They are equipped with ex-proof proportional solenoids certified for safe operations in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

QVHZA:	**QVKZA**:
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

QVKZA / * - A - 10 / 90 / M / * / * * / *

Ex-proof pressure compensated proportional flow valves, direct
QVHZA = size 06
QVKZA = size 10

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

A = without transducer

Valve size ISO 4401:
06 = size 06 **10** = size 10

Max regulated flow:

QVHZA	QVKZA
3 = 3,5 l/min	**65** = 65 l/min
12 = 12 l/min	**90** = 90 l/min
18 = 18 l/min	
36 = 35 l/min	
45 = 45 l/min	

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
D = quick venting of port B
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

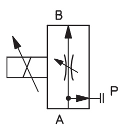
Voltage code:
- = standard coil for 24 VDC Atos drivers
24 = optional coil for 24 VDC low current drivers

Series number

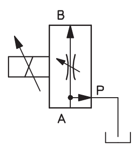
Seals material,
see section 7:
- = NBR
PE = FKM
BT = HNBR **(2)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** Possible combined options: /DO, /DWP, /DOWP, /OWP
(4) Approved only for the Italian market

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

3 ELECTRONIC DRIVERS

Electronic drivers are factory set with max current limitation for ex-proof valves.
Please include in the driver order also the complete code of the connected ex-proof proportional valve.

Drivers model	E-BM-AS-* /A	E-BM-AES-* /A
Type	digital	digital
Format	DIN-rail panel	
Data sheet	G030	GS050

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 ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 8 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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	QVHZA					QVKZA	
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 **(1)** [ms]	≤ 35					≤ 50	
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
(1) 0 ÷100 % step signal

6 ELECTRICAL CHARACTERISTICS

Max. power	35W	
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 with relevant cable gland	**Multicertification**: IP66/67 to DIN EN60529 **UL**: raintight enclosure, UL approved	
Duty factor	Continuous rating (ED=100%)	
Voltage code	standard	option /24
Coil resistance R at 20°C	3,2 Ω	17,6 Ω
Max. solenoid current	2,5 A	1,1 A

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 ÷ +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
Max fluid contamination level — 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 **(1)**	NBR, HNBR	HFC	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 180 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

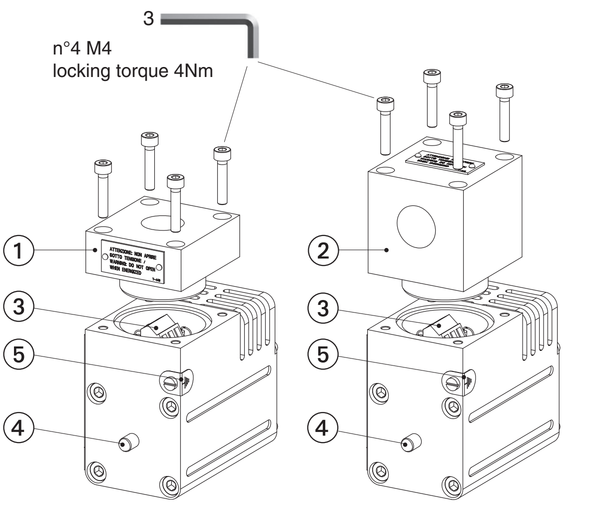
Valve type	QVHZA, QVKZA		QVHZA/**M**, QVHZA/**M**	QVHZA/**UL**, QVHZA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American **cULus**	
Solenoid certified code	**OZA-A**		**OZAM-A**	**OZA-A/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T4/T3 Gb Ex II 2D Ex tb IIIC T135°C/T200°C Db • IECEx Ex d IIC T4/T3 Gb Ex tb IIIC T135°C/T200°C Db • PESO Ex II 2G Ex d IIC T4/T3 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T4**	**T3**	**-**	**T4**	**T3**
Surface temperature	≤ 135 °C	≤ 200 °C	≤ 150 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +70 °C	-20 ÷ +60 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

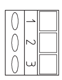
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

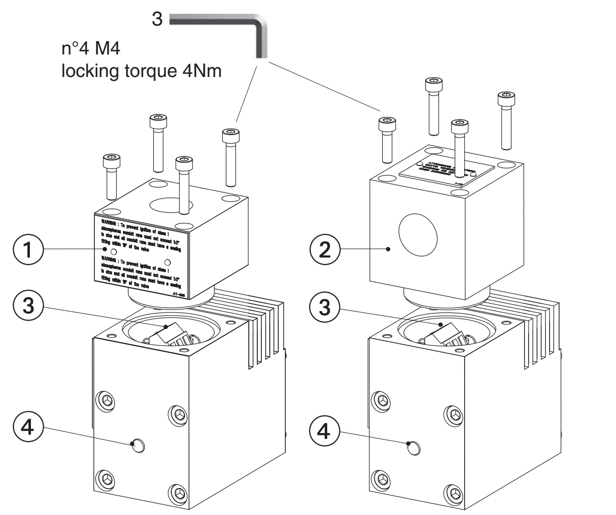
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

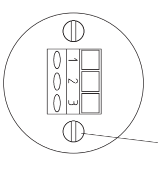
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to respect the polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	135 °C	90 °C	90 °C
45 °C	-	T4	-	135 °C	-	95 °C
55 °C	-	T3	-	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

11 **CABLE GLANDS** - only **Multicertification**

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX600**

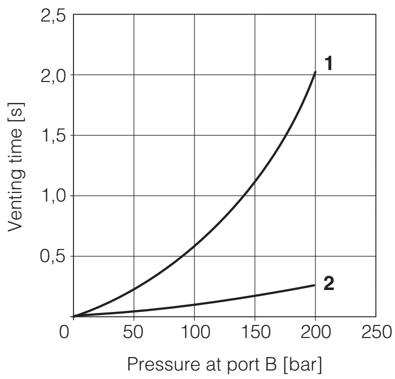
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 **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 **QVHZA** and **QVKZA** option **/D** respect to standard versions:
1 = standard versions
2 = option /D

O = Horizontal cable entrance , to be selected in case of limited verical space.

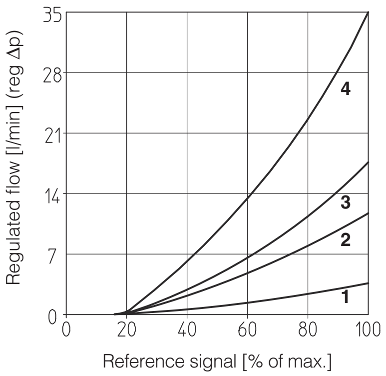
WP = Manual override protected by metallic cap.

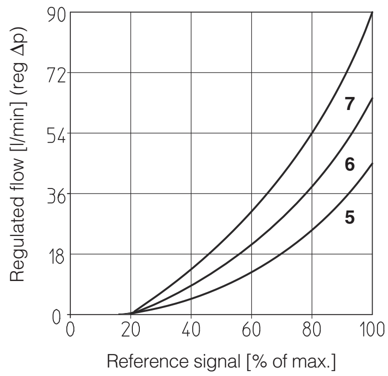


13 DIAGRAMS - based on mineral oil ISO VG 46 at 50 °C

13.1 Regulation diagrams

1 = QVHZA-*-06/**3**
2 = QVHZA-*-06/**12**
3 = QVHZA-*-06/**18**
4 = QVHZA-*-06/**36**
5 = QVHZA-*-06/**45**
6 = QVKZA-*-10/**65**
7 = QVKZA-*-10/**90**

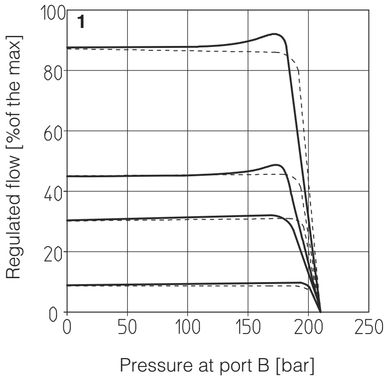


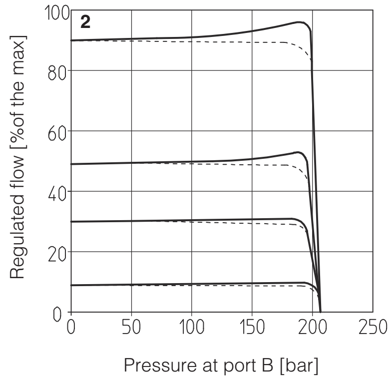


13.2 Regulated flow/outlet pressure diagrams
with inlet pressure = 210 bar

1 = QVHZA
2 = QVKZA

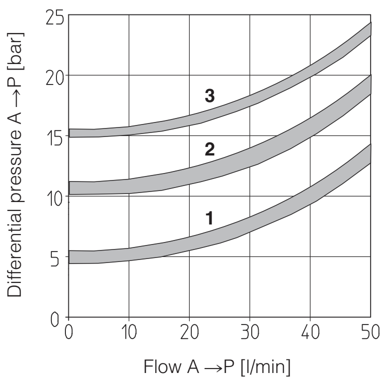
Dotted line for 3-way versions

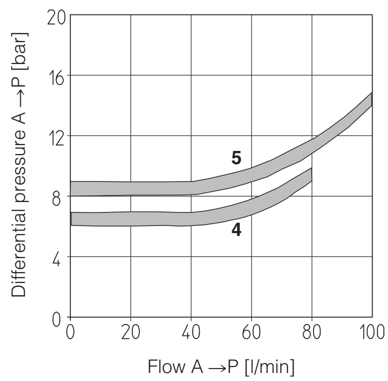




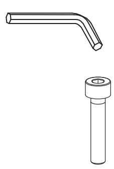
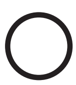
13.3 Flow A → P/Δp diagrams
3-way configuration

1 = QVHZA-*-06/**3**
QVHZA-*-06/**12**
2 = QVHZA-*-06/**18**
QVHZA-*-06/**36**
3 = QVHZA-*-06/**45**
4 = QVKZA-*-10/**65**
5 = QVKZA-*-10/**90**





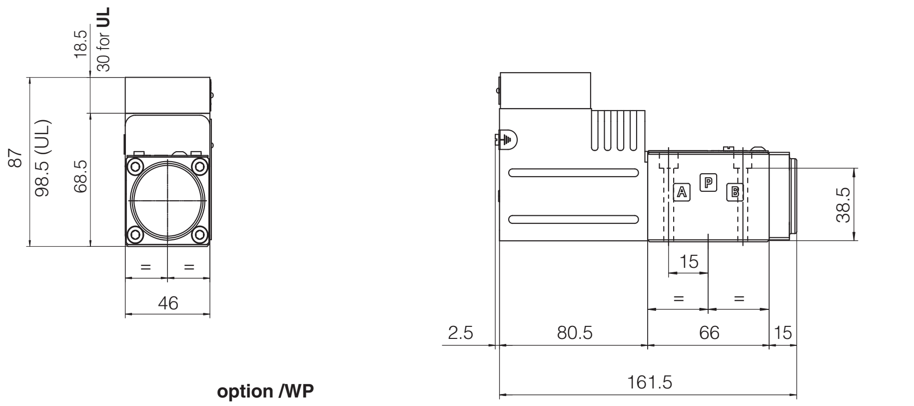
14 FASTENING BOLTS AND SEALS

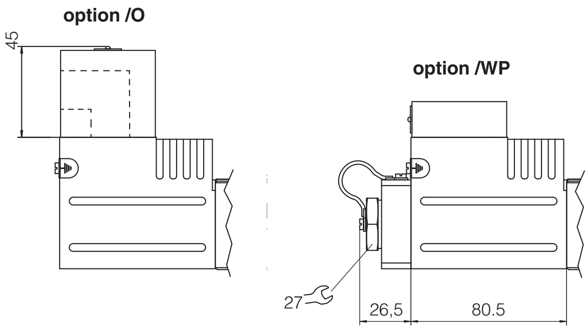
	QVHZA	QVKZA
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max)	**Seals:** 5 OR 2050; Diameter of ports A, B, P, T: Ø 11,2 mm (max)

15 INSTALLATION DIMENSIONS [mm]

QVHZA-A

ISO 4401: 2005 (see tab. P005)
Mounting surface: 4401-03-02-0-05

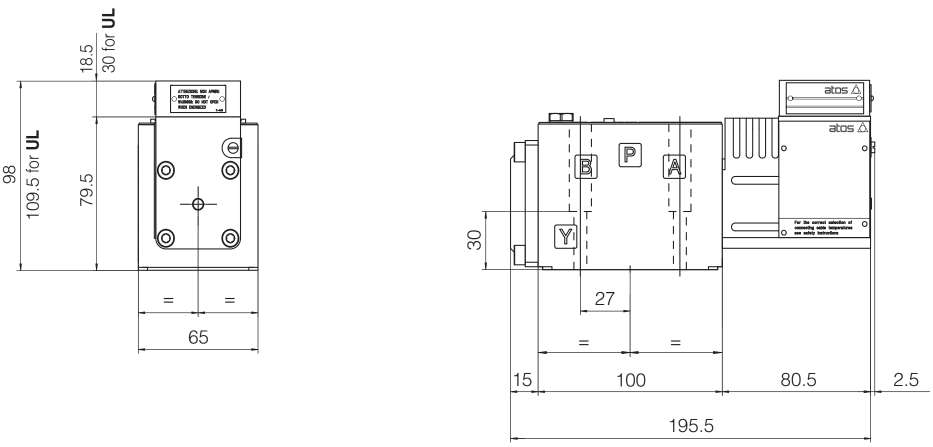


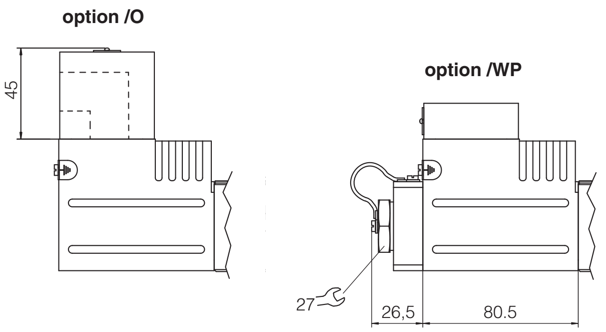


Mass [kg]	
QVHZA	2,3
Option /O	+0,35
Option /WP	+0,25

QVKZA-A

ISO 4401: 2005
Mounting surface: 4401-05-04-0-05 (see tab. P005)





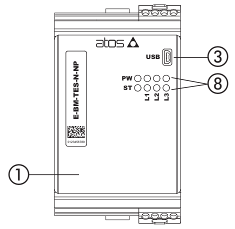
Mass [kg]	
QVKZA	3,8
Option /O	+0,35
Option /WP	+0,25

16 RELATED DOCUMENTATION

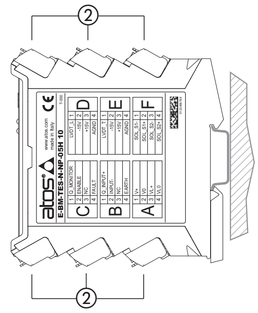
X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEX, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
FX900 Operating and manintenance information for ex-proof proportional valves
KX800 Cable glands for ex-proof valves
P005 Mounting surfaces for electrohydraulic valves

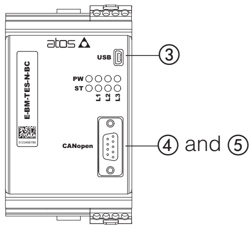
Digital E-BM-TES/LES drivers

DIN-rail format, for proportional valves with one or two LVDT transducers

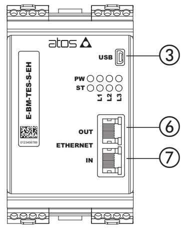


E-BM-TES-N- **NP** Not Present

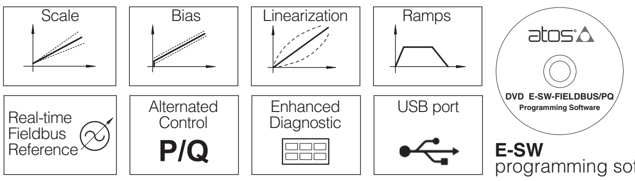




E-BM-TES-N- **BC** CANopen
BP PROFIBUS DP



E-BM-TES-S- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



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 ÷ +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	*	/	*	*	/	*

E-BM = Off-board electronic driver in DIN rail format

TES = digital full driver, for valves with one LVDT transducer
LES = digital full driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none
S = closed loop pressure/force (see tech table **GS002**)

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

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TES**)

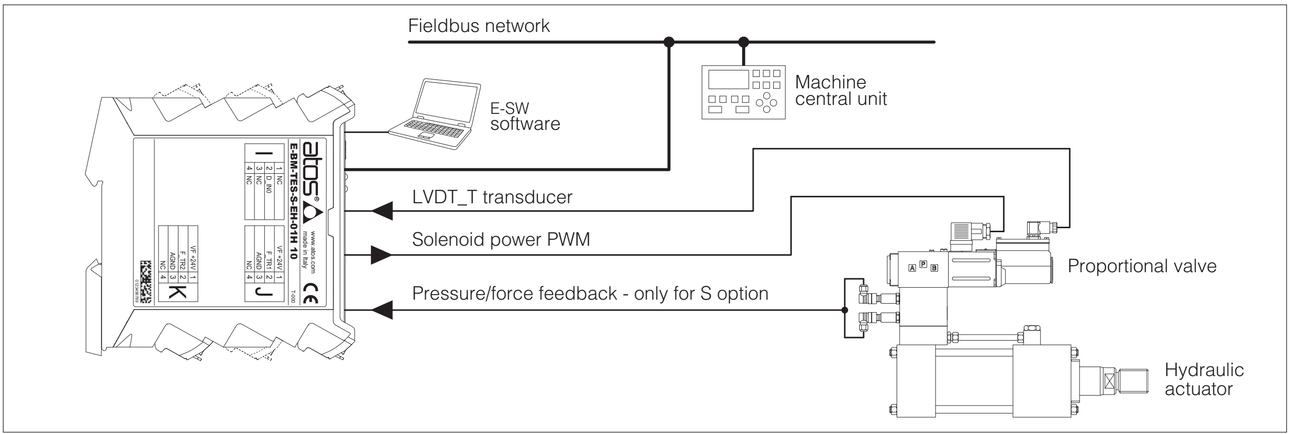
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TES-N**)

Options, see section 6 **:**
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for remote transducers (only for option **S**) and LVDT transducers (only for option **A**)
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 V_{DC})

Series number

Set code (see section 7)

2 BLOCK DIAGRAM EXAMPLE



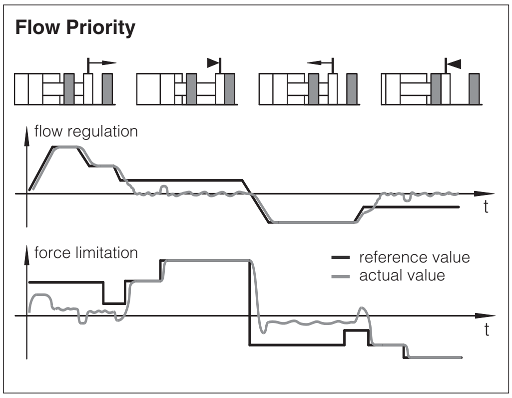
3 VALVES RANGE

Valves	Directional			Flow	Directional	Cartridge
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F1412	**DPZO-L** F175	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Data sheet	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	-
Driver model	**E-BM-TEB**				**E-BM-LEB**	

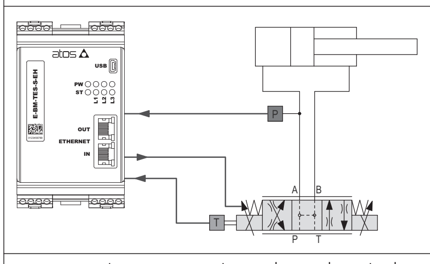
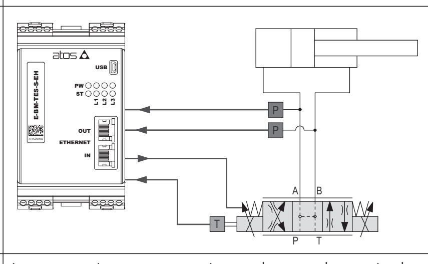
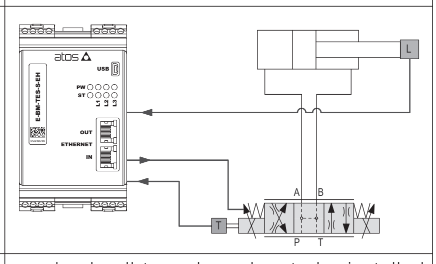
Option S not available

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	SF	SL
		
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

T valve's spool transducer	P pressure transducer	L load cell

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.

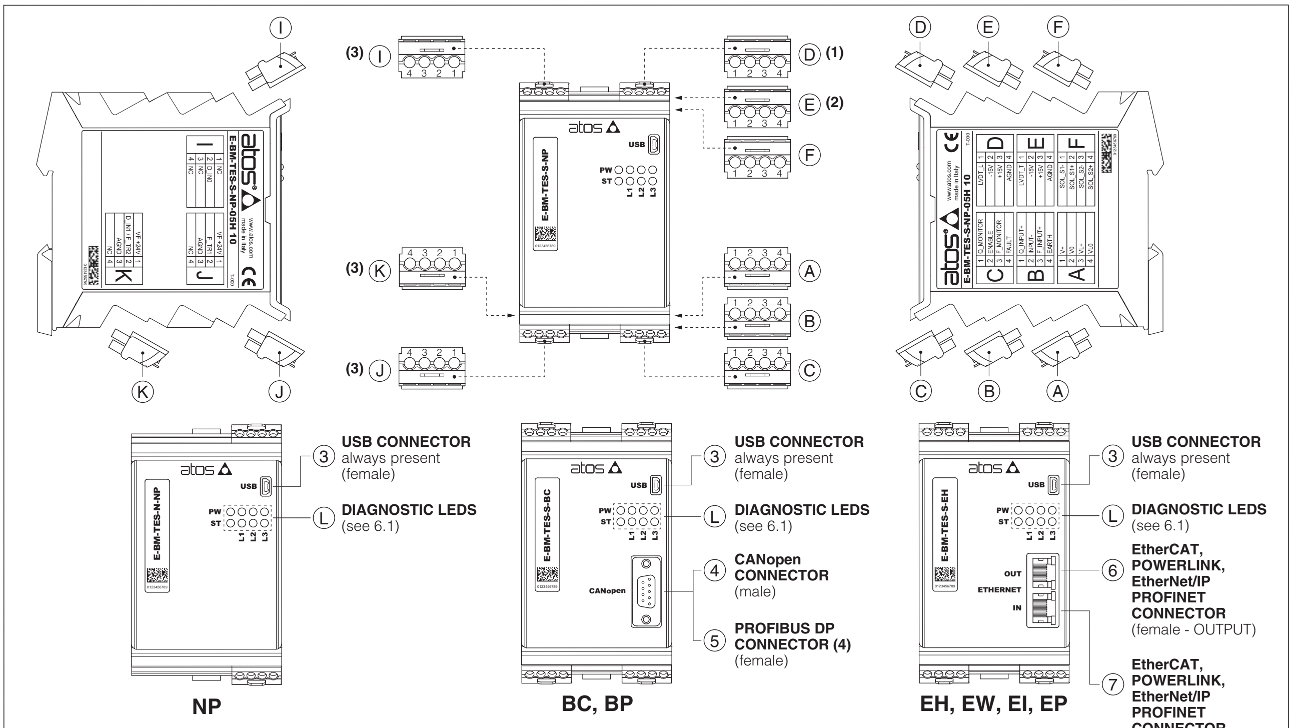
General Notes:
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table **EY105**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

5 MAIN CHARACTERISTICS

Power supplies (see 8.1, 8.2)	Nominal : +24 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 (**/A option**)			
Analog input signals (see 8.3, 8.4)	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 8.5, 8.6)	Output range: voltage ±10 V_{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 8.7) Digital inputs (see 8.11)	Range: 0 ÷ 5 V_{DC} (OFF state), 9 ÷ 24 V_{DC} (ON state), 5 ÷ 9 V_{DC} (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 8.8)	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, valve spool transducer malfunctions, alarms history storage function			
Pressure/Force transducers power supply (only for S option)	+24V_{DC} @ 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 ÷ +50 °C (storage -25 ÷ +85 °C)			
Mass	Approx. 400 g			
Additional characteristics	8 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)			
Compliance	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 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet			
Max conductor size (see 12)	2,5 mm²			

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.

6 CONNECTIONS AND LEDS



A,B,C,D,E,F,I,J,K connectors included

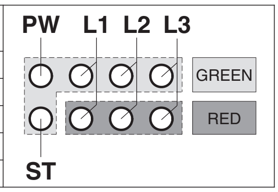
(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I , J and K connectors are available only for TES-S and LES-S

(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
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				

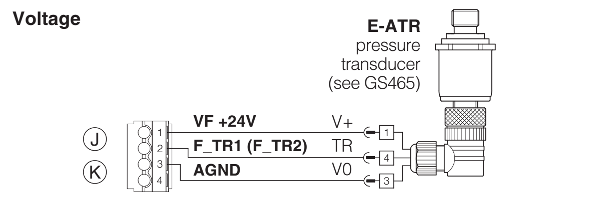


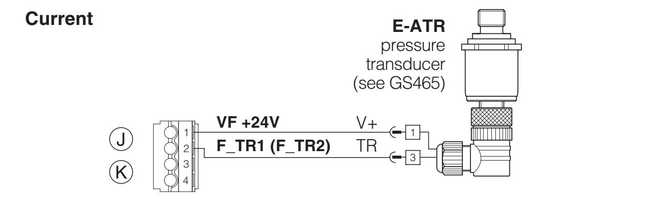
6.2 Connectors - 4 pin

CONNECTOR	PIN	ALTERNATED P/Q CONTROL **N** none	**S** pressure/force	TECHNICAL SPECIFICATIONS	NOTES
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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 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 **F003** 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 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.

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 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, 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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 ÷ 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.

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 V_{DC} 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 V_{DC} or ± 20 mA

8.7 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.
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 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.

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 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 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 V_{DC} 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 V_{DC} or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table **GS002**).

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 V_{DC} or a 0 V_{DC} 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.

	PID SET SELECTION			
PIN	SET 1	SET 2	SET 3	SET 4
I2	0	24 V_{DC}	0	24 V_{DC}
K2	0	0	24 V_{DC}	24 V_{DC}

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

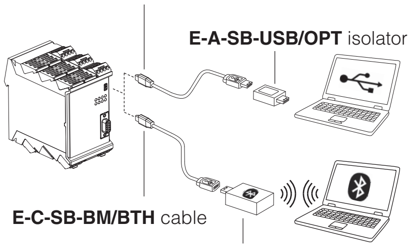
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

USB or Bluetooth connection



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

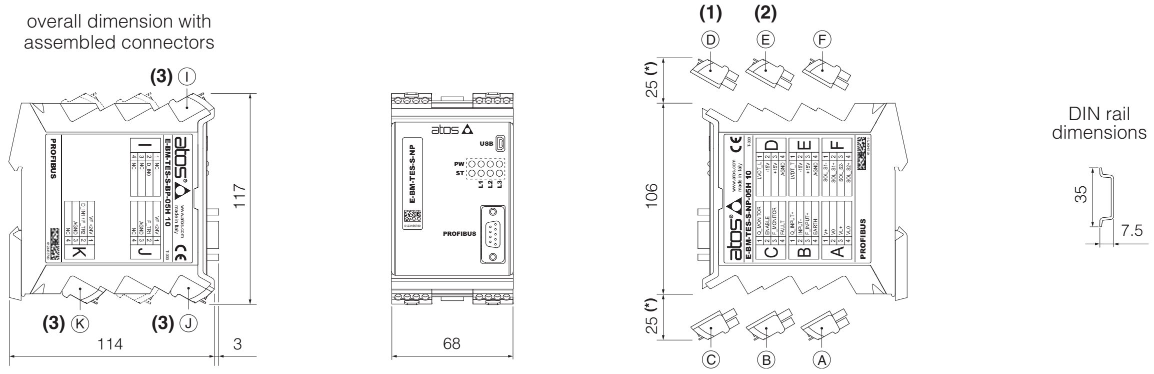
10 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **GS003**

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]



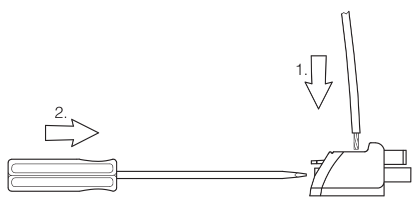
A,B,C,D,E,F,I,J,K connectors included

(*) Space to remove the connectors

(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

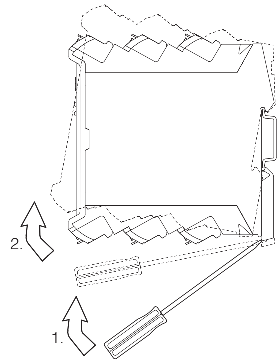
12 INSTALLATION

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



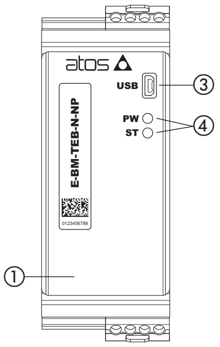
To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

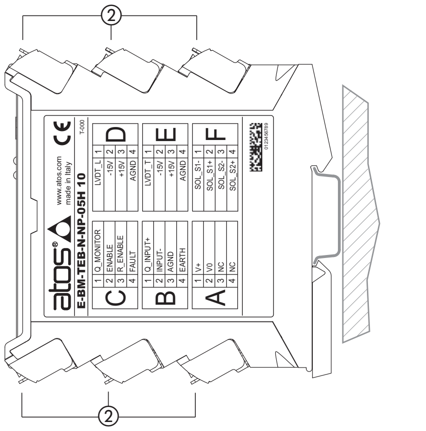
Note: all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F,I,J,K)

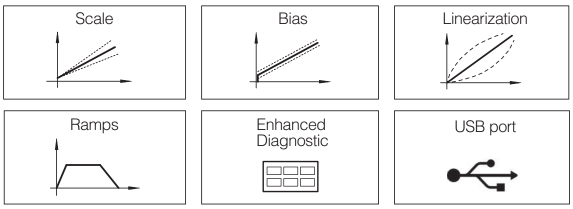
Digital E-BM-TEB/LEB drivers

DIN-rail format, for proportional valves with one or two LVDT transducers



E-BM- **TEB** -N-NP





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 ÷ +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	*	/	*	*	/	*

E-BM: 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

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEB**)

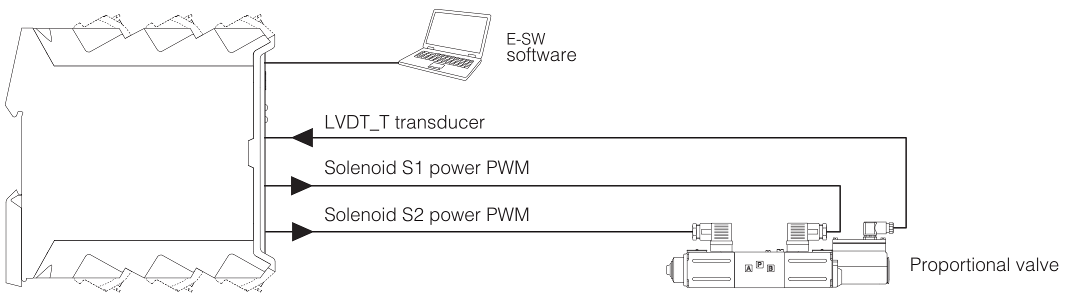
- = omit for direct valves and for pilot operated valves with two LVDT transducers
P = for pilot operated valves with one LVDT transducer (only for **TEB**)

Options, see section 5 :
A = max current limitation for Ex-proof valves
C = current feedback 4 ÷ 20 mA for LVDT transducers only in combination with option A
I = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 V_{DC})

Series number

Set code (see section 6)

2 BLOCK DIAGRAM EXAMPLE



3 VALVES RANGE

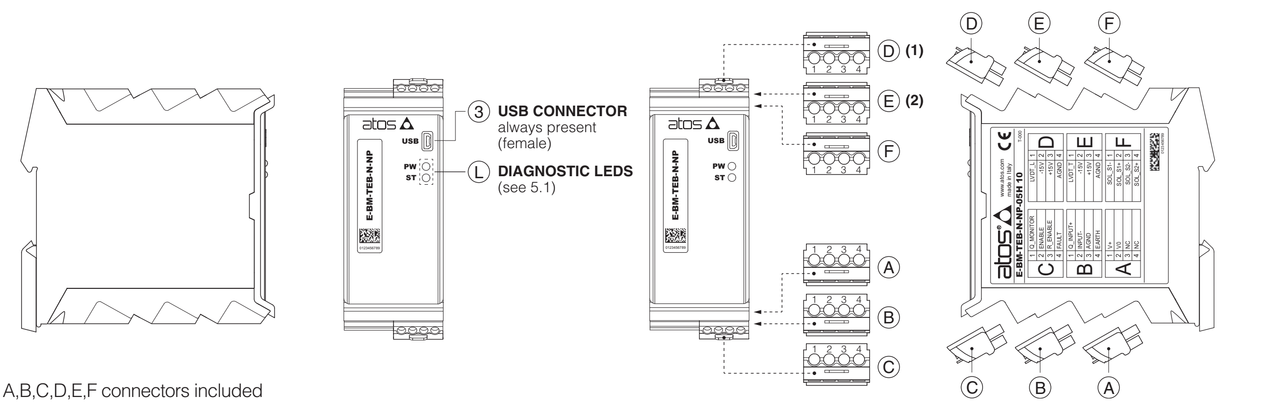
Valves	Directional			Flow	Directional	Cartridge
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-T** F172	**QVHZO-T, QVKZOR-T** F412	**DPZO-L** F175	**LIQZO-L, LIQZP-L** F330, F340
Ex-proof Data sheet	**DHZA-T, DKZA-T** FX120	**DLHZA-T, DLKZA-T** FX140	**DPZA-T** FX220	**QVHZA-T, QVKZA-T** FX420	-	-
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 (**/A option**)
Analog input signal (see 7.2)	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 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: Ri > 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
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)
Compliance	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



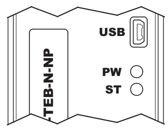
A,B,C,D,E,F connectors included

(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 (L)

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 V_{DC} (see 7.1)	Input - power supply
	A2	**V0**	Power supply 0 V_{DC} (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 V_{DC} / ±20 mA maximum range Default are ±10 V_{DC} for standard and 4 ÷ 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 V_{DC} / ±20 mA maximum range, referred to AGND Default are ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option (see 7.3)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) 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 V_{DC}) or normal working (24 V_{DC}), 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

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 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 **F003** 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 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 ÷ 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 ÷ 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 ÷ 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

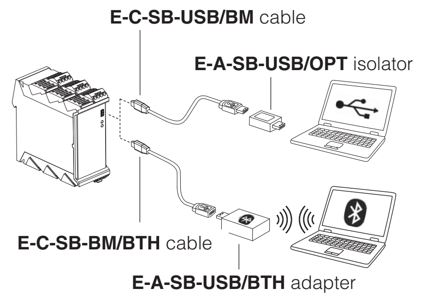
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

USB or Bluetooth connection



⚠ **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

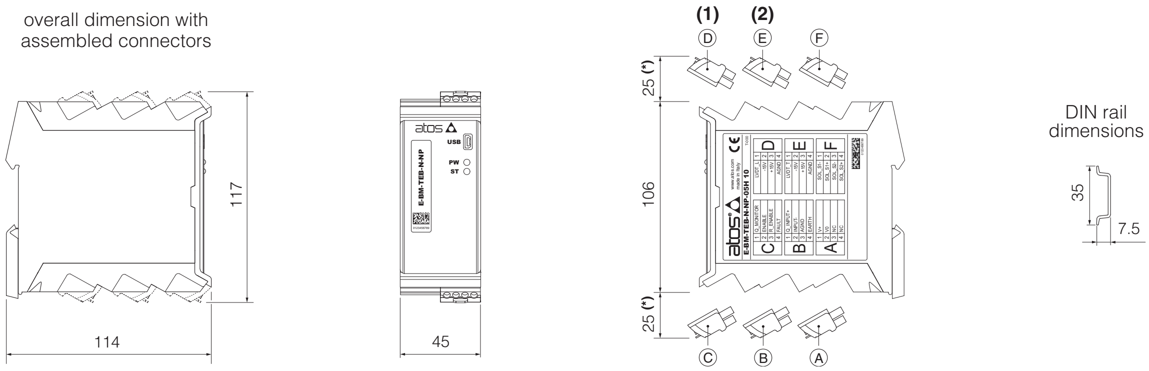
9 MAIN SOFTWARE PARAMETER SETTINGS

For basic information about main setting parameters by E-SW programming software, see tech table **GS003**
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

10 OVERALL DIMENSIONS [mm]

overall dimension with
assembled connectors



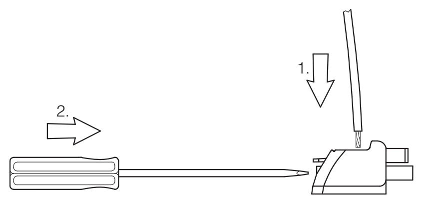
A,B,C,D,E,F connectors included

(*) Space to remove the connectors

(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

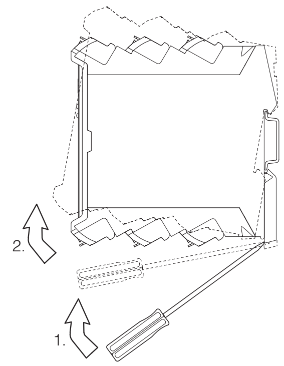
11 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



Note: max conductor size: 2,5 mm^2
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



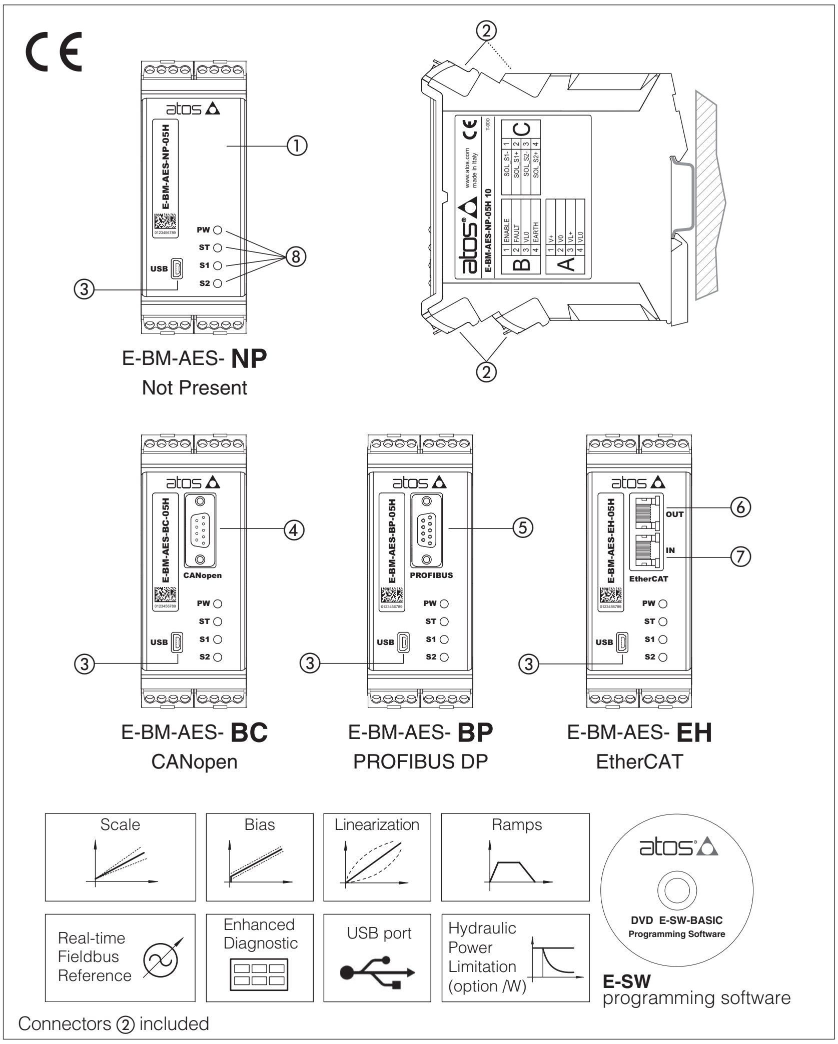
To extract the connectors:
1. push lever
2. pull connector

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.
(e.g. connector A can not be inserted into connector slot of B,C,D,E,F)

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 ÷ +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

E-BM - AES - NP - 01H / * * / *

E-BM: Off-board electronic driver in DIN rail format

AES = digital full driver, for valves without transducer

Fieldbus interface - USB port always present**:**
NP = Not Present
BC = CANopen
BP = PROFIBUS DP
EH = EtherCAT

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves

Options:
A= max current limitation for Ex-proof valves
C= current feedback 4 ÷ 20 mA for remote transducer, only in combination with option **W**
I = current reference input 4 ÷ 20 mA (omit for standard voltage reference input ±10 V_{DC})
W= power limitation function

Series number

Set code **(1)**

(1) set code identifies the corrispondence between the driver and the relevant valve

2 VALVES RANGE

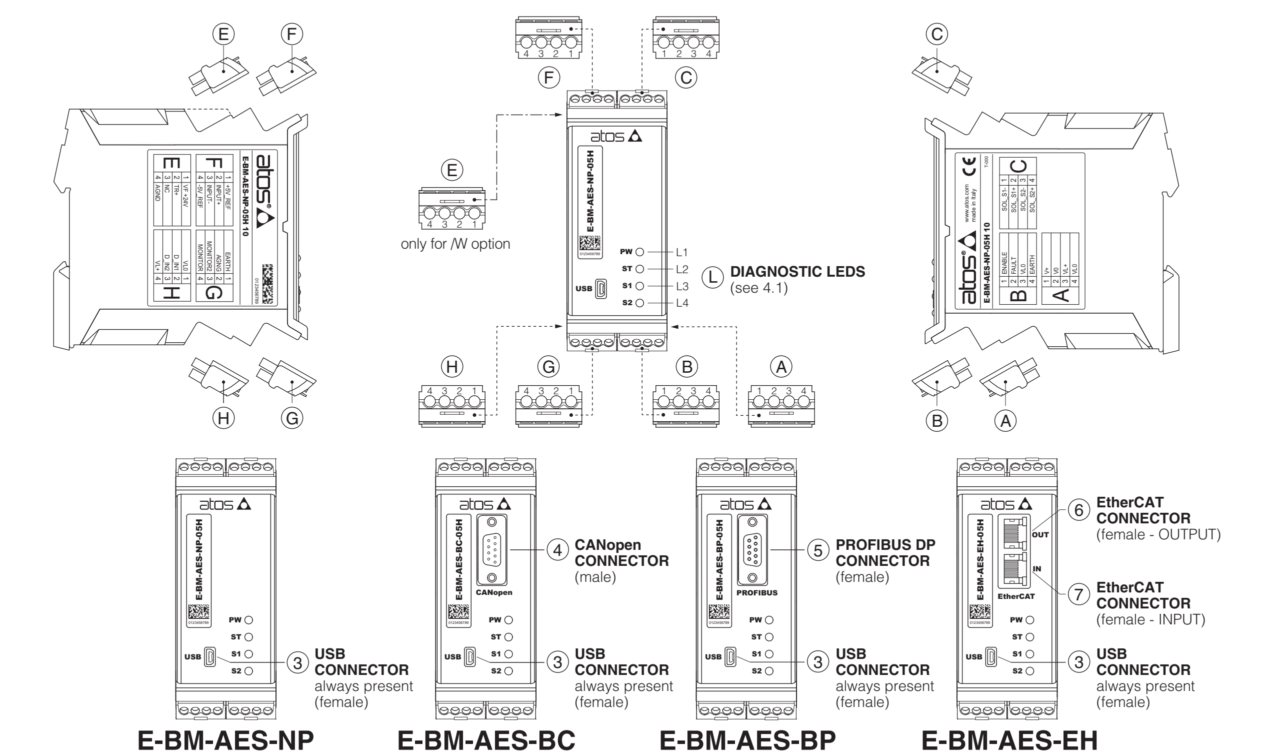
Valves	Pressure					Directional		Cartridge	Flow
Standard Data sheet	**RZMO** FS007, FS065	**RZGO** FS015, FS070	**AGMZO** FS035	**AGRCZO** FS050	**DHRZO** TF040	**DHZO, DKZOR** FS160	**DPZO** FS170	**LICZO, LIMZO, LIRZO** FS300	**QVHZO, QVKZOR** FS410
Ex-proof Data sheet	**RZMA** FX010	**RZGA** FX040	**AGMZA** FX010	**AGRCZA** FX040	**DHRZA** FX070	**DHZA, DKZA** FX100	**DPZA** FX200	**LICZA, LIMZA, LIRZA** FX300	**QVHZA, QVKZA** FX400
Driver model	**E-BM-AES**								

3 MAIN CHARACTERISTICS

Power supply (see 5.1, 5.2)	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} = 2.7 A with +24 V_{DC} power supply to drive standard proportional valves (3,2 Ω solenoid) I_{MAX} = 2.5 A with +24 V_{DC} power supply to drive ex-proof proportional valves (3,2 Ω solenoid) for **/A option**			
Analog input signals (see 5.3)	Voltage: maximum range ±10 V_{DC} Input impedance: Ri > 50 kΩ Current: maximum range ±20 mA Input impedance: Ri = 500 Ω			
Monitor output (see 5.4)	Voltage: maximum range ±5 V_{DC} @ max 5 mA			
Enable input (see 5.5)	Range : 0 ÷ 9 V_{DC} (OFF state), 15 ÷ 24 V_{DC} (ON state), 9 ÷ 15 V_{DC} (not accepted); Input impedance: Ri > 87 kΩ			
Output supply (see 5.8)	±5 V_{DC} @ max 10 mA : output supply for external potentiometer			
Fault output (see 5.6)	Output range : 0 ÷ 24 V_{DC} (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)	+24V_{DC} @ 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 ÷ +60 °C (storage -25 ÷ +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			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	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 mm² max 50 m for logic - 1,5 mm² max 50 m for power supply and solenoids			
Max conductor size (see 9)	2,5 mm²			

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.

4 CONNECTIONS AND LEDS

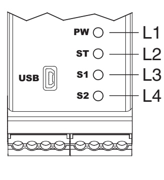


A,B,C,F,G,H connectors included; E connector is available only for /W option

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.

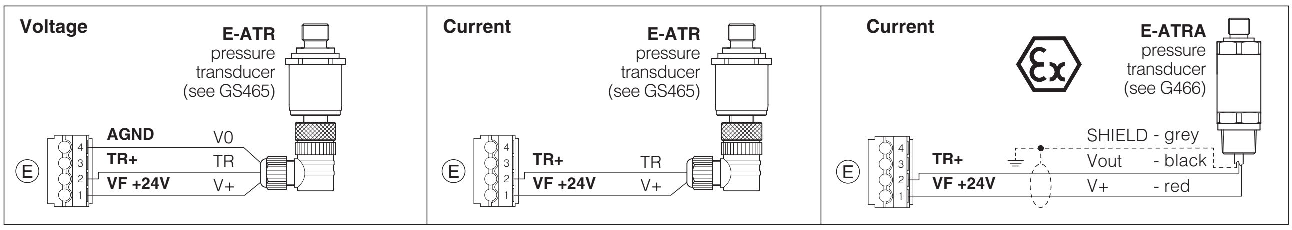
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	PW	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	ST	OFF	Fault present
			ON	No fault
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON



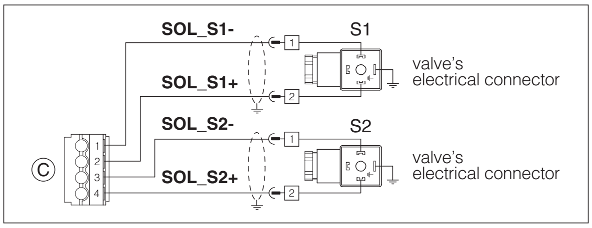
4.2 Connectors - 4 pin

CONNECTOR	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	A1	**V+**	Power supply 24 V_{DC} (see 5.1)	Input - power supply
	A2	**V0**	Power supply 0 V_{DC} (see 5.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 V_{DC} for driver's logic and communication (see 5.2)	Input - power supply
	A4	**VL0**	Power supply 0 V_{DC} for driver's logic and communication (see 5.2)	Gnd - power supply
B	B1	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0 (see 5.5)	Input - on/off signal
	B2	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0 (see 5.6)	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	**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 V_{DC}	Output - power supply
	E2	**TR+**	Positive pressure transducer input signal: ±10 V_{DC} / ±20 mA maximum range (see 5.7) Default are 0 ÷ 10 V_{DC} for standard and 4 ÷ 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 V_{DC} @ 10mA (see 5.8)	Output - power supply
	F2	**INPUT+**	Positive reference input signal: ±10 V_{DC} / ±20 mA maximum range (see 5.3) Default are ±10 V_{DC} for standard and 4 ÷ 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 V_{DC} @ 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 V_{DC} maximum range (see 5.4) Default is 0 ÷ 5 V_{DC}	Output - analog signal **Software selectable**
	G4	**MONITOR**	Monitor output signal: ±5 V_{DC} maximum range (see 5.4) Default is ±5 V_{DC} (1V = 1A)	Output - analog signal **Software selectable**
H	H1	**VL0**	Power supply 0 V_{DC} for digital input (see 5.2)	Gnd - power supply
	H2	**D_IN1**	Digital input 0 ÷ 24V_{DC}, referred to VL0	Input - on/off signal
	H3	**D_IN0**	Digital input 0 ÷ 24V_{DC}, referred to VL0	Input - on/off signal
	H4	**VL+**	Power supply 24 V_{DC} for digital input (see 5.2)	Output - power supply

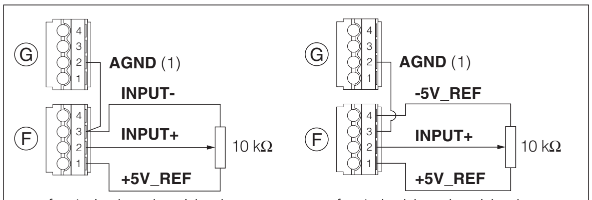
Pressure transducer connections - only for **/W** option



Coils connection



Potentiometer connection



for 1 single solenoid valve   for 1 double solenoid valve

(1) As alternative the AGND on pin E4 can be used (only /W option)

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

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 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 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 **F003** 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, EN-982).

5.1 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 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 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 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 ÷ 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}.

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 ÷ 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 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).

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 ÷ 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 ÷ 10 V_{DC} 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 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 (±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 ±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

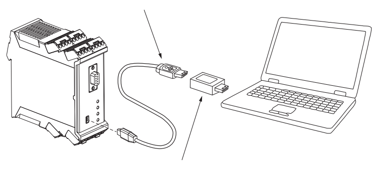
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver is connected 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

USB connection



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

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.

7.2 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

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).

7.5 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.

7.6 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.

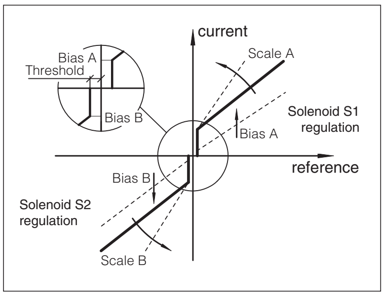
7.7 Hydraulic Power Limitation - only for **/W** option

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**)

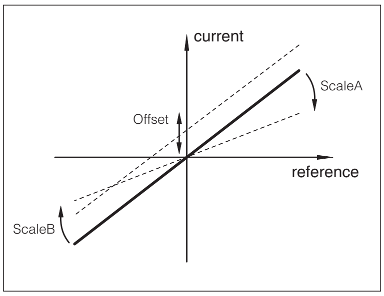
The driver receives the flow reference signal by the analog external input INPUT+ (see 5.3) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR (see 5.7).
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), 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:

$$\text{Flow regulation} = \text{Min}\left(\frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}}\ ;\ \text{Flow Reference [INPUT+]}\right)$$

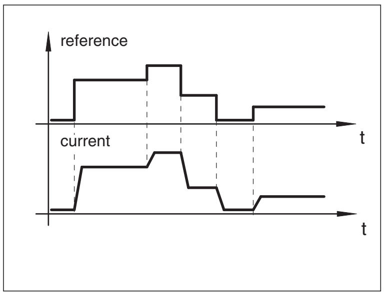
7.1, 7.2 - Scale, Bias & Threshold



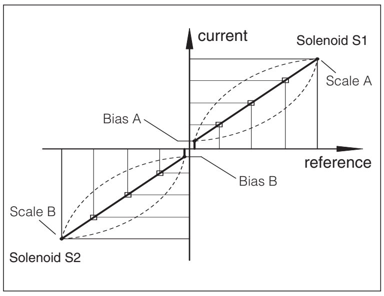
7.3 - Offset



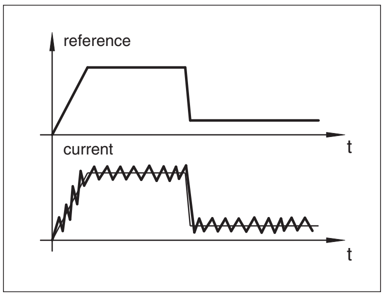
7.4 - Ramps



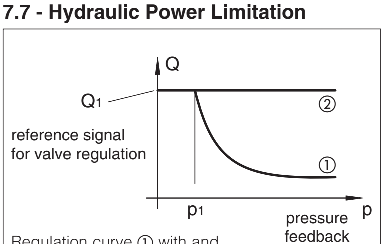
7.5 - Linearization



7.6 - Variable Dither

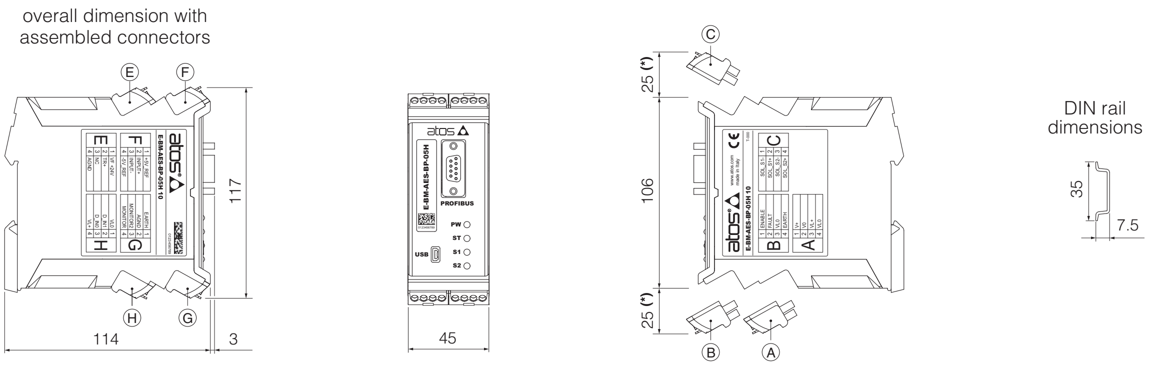


7.7 - Hydraulic Power Limitation



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

8 OVERALL DIMENSIONS [mm]

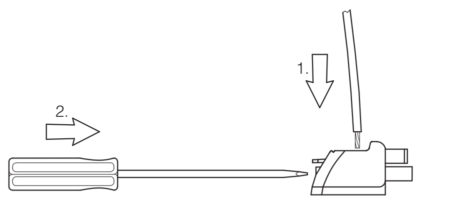


A,B,C,F,G,H connectors included; E connector is available only for /W option

(*) Space to remove the connectors

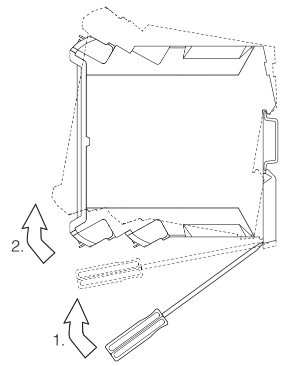
9 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver



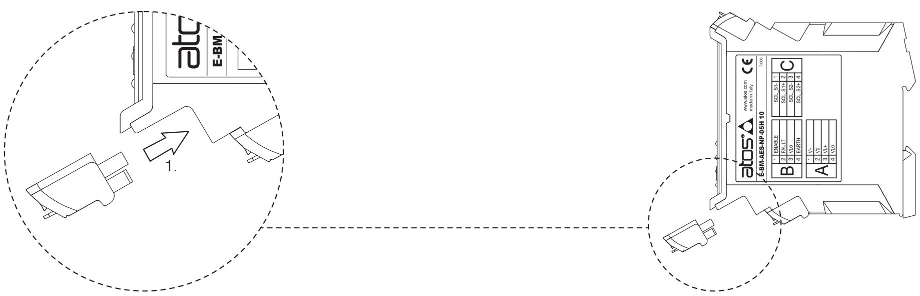
Note: max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

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

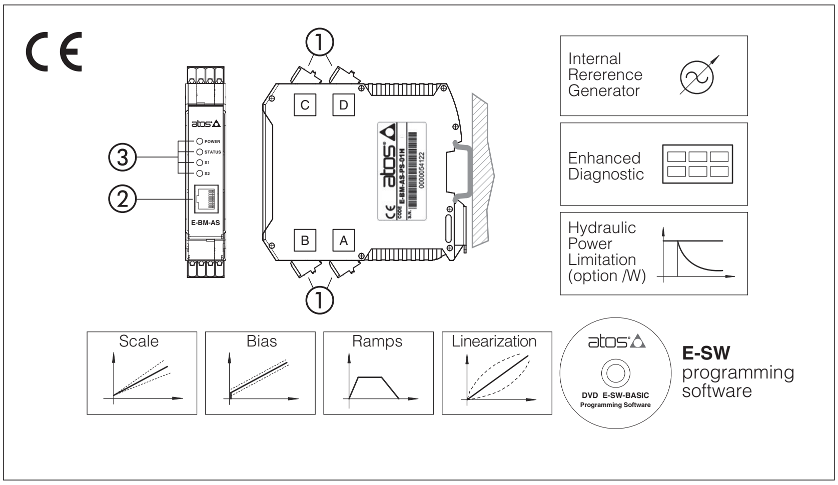
To insert the connectors:
1. push the connector in its slot



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



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 V_{DC} output supply for external reference potentiometers (/P option)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +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

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

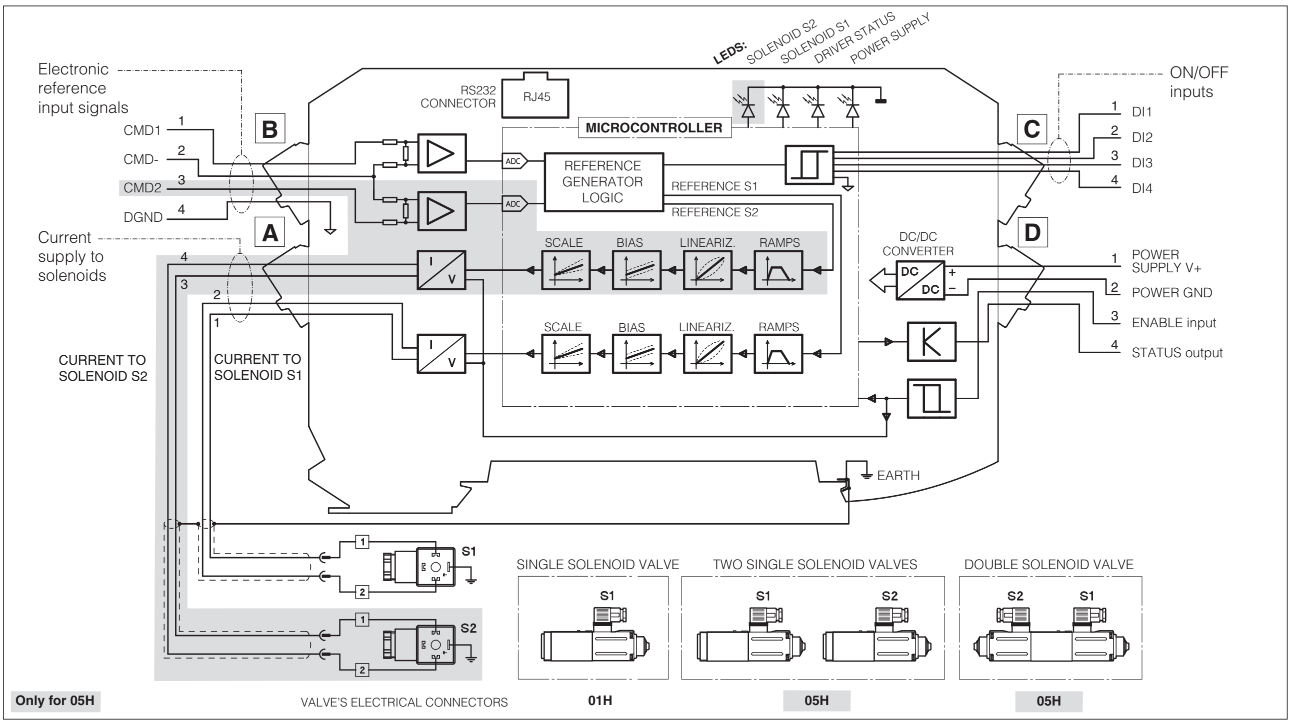
01H = for single solenoid proportional valves
05H = for double solenoid or two single solenoid proportional valves

Options:

- **-** = standard 24 V_{DC} power supply
- **12** = 12 V_{DC} 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 V_{DC})
- **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)

* Series number

2 BLOCK DIAGRAM



3 MAIN CHARACTERISTICS

Power supply (see 4.1)	**Standard** Nominal: +24 VDC Rectified and filtered: VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP) **option /12** Nominal: +12 VDC Rectified and filtered: VRMS = 10 ÷ 14 VMAX (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	IMAX = 2.7 A with +24 VDC power supply for standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply for proportional valves with /6 option (2,1 Ω solenoid) IMAX = 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 ±10 VDC Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω
Enable and optical insulated ON/OFF inputs (see 4.5, 4.7)	Range : 0 ÷ 24 VDC (OFF state: 0 ÷ 5 VDC ; ON state: 9 ÷ 24 VDC) Input impedance: Ri > 10 kΩ
Output supply (see 4.4)	±5 VDC @ max 10 mA : output supply for external potentiometers (only for **/P option**)
Status output (see 4.6)	Output range : 0 ÷ 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 ÷ +60 °C (-20 ÷ +40 °C for 05H version if drive two single solenoid proportional valves; storage -25 ÷ +85 °C)
Mass	130 g
Additional characteristics	Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE - Immunity: EN 61000-6-2 (2005); Emission: EN 61000-6-4 (2001)
Compliance	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 SIGNALS SPECIFICATIONS

4.1 Power supply

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.

⚠ 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)

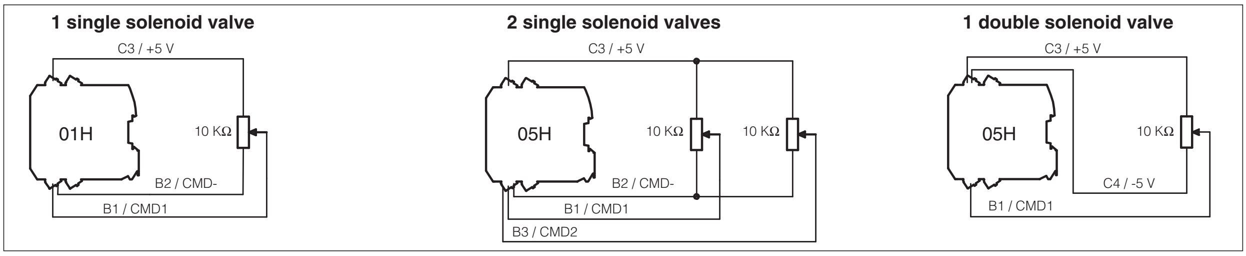
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (05H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CMD- on pin B2). 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 ÷ ±10 VDC) or current (4 ÷ 20 mA with cable break detection or 0 ÷ ±20 mA).
Defaults for standard: 0 ÷ 10 VDC for two position valves; 0 ÷ ±10 VDC for three position valves (see valve's tech. table).
Default for /I option: 4 ÷ 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 ÷ 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 ±5 VDC supply output available at pin C3 and C4. Reference input signal can be set up via software to ±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 ÷ 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 V_{DC} 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 V_{DC} to DI1:	0 V_{DC} to DI1:
DI1	24 V_{DC}	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 V_{DC} / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100% 05H Voltage ± 5 V_{DC} / ± 100% Current 4 ÷ 20 mA / 0 ÷ 100%	See section 4.2
DI2	0 V_{DC}				
DI3	0 V_{DC}				
DI4	0 V_{DC}				

Note: set 0 V_{DC} to DI1 and power-off/on the driver to restore latest settings

REFERENCE INVERSION

Digital Inputs Signals		Digital driver	Analog driver	24 V_{DC} to DI2:	0 V_{DC} to DI2:
DI1	24 V_{DC}	E-BM-AS 05H	E-BM-AC 05F	Voltage 0 ÷ 5 V_{DC} / 0 ÷ -100% Current 4 ÷ 20 mA / 0 ÷ -100%	Voltage 0 ÷ 5 V_{DC} / 0 ÷ 100% Current 4 ÷ 20 mA / 0 ÷ 100%
DI2	24 V_{DC}				
DI3	0 V_{DC}				
DI4	0 V_{DC}				

Note: to enable reference inversion, set 24 V_{DC} to DI1 before driver power-on

RAMP SWITCH OFF

Digital Inputs Signals		Digital driver	Analog driver	24 V_{DC} to DI3:	0 V_{DC} to DI3:
DI1	24 V_{DC}	E-BM-AS 01H E-BM-AS 05H	E-ME-AC 01F E-ME-AC 05F	Ramp excluded	Ramp activated
DI2	0 V_{DC}				
DI3	24 V_{DC}				
DI4	0 V_{DC}				

Notes: to enable ramp switch off, set 24 V_{DC} to DI1 before driver power-on; DI3 not available for /P option

011F CONFIGURATION

Digital inputs dignals		Digital driver	Analog driver	24 V_{DC} to DI4:	0 V_{DC} 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 V_{DC}				

Notes: set 0 V_{DC} to DI4 and power-off/on the driver to restore latest settings; DI4 not available for /P option

6 VALVE SETTINGS AND PROGRAMMING TOOLS

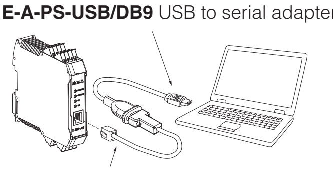
Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via RS232 serial port to the digital driver (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the driver 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)		

Connection

E-A-PS-USB/DB9 USB to serial adapter



E-C-PS-DB9/RJ45 serial cable

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

7 MAIN SOFTWARE PARAMETER SETTINGS

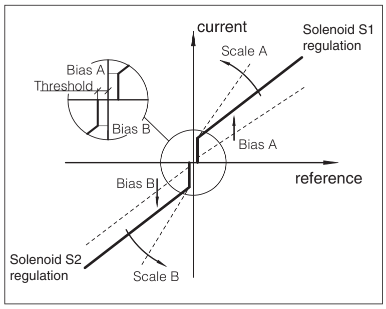
The following is a brief description of the main settings and features of digital drivers. For a detailed descriptions of available settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:

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

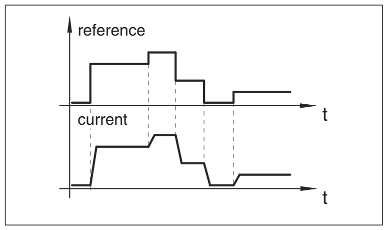
7.1, 7.2 - Scale, Bias & Threshold



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

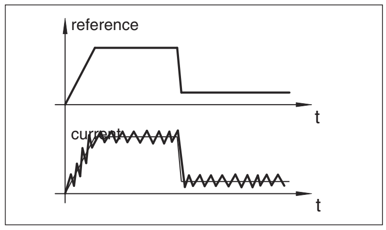


7.3 Ramps

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)

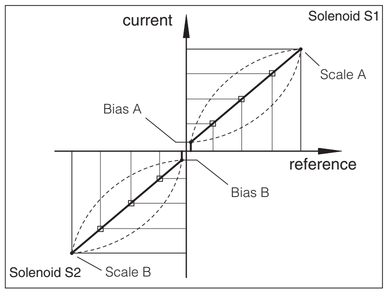
7.4 - Dither



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

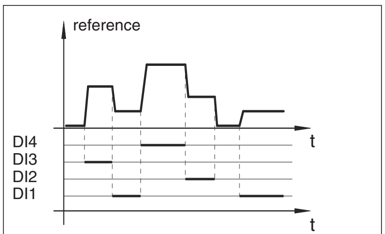
7.5 - Linearization



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



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

7.6 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).

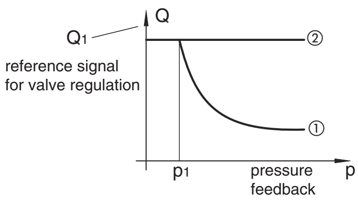
7.7 Hydraulic Power Limitation (**/W option**, only for drivers E-BM-AS-PS-05H)

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**x**Q** (CMD2xCMD1) reaches the max power limit (p1xQ1), 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



Regulation curve ① with and ② without power limitation.
p1 x Q1 = max power limit

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.

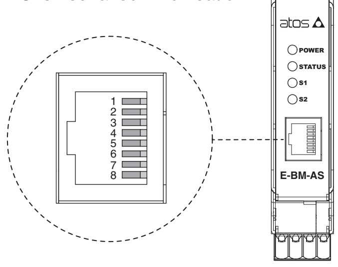
<table>
<tr><th>CONNECTOR</th><th>PIN</th><th>SIGNAL</th><th colspan="2">TECHNICAL SPECIFICATIONS</th><th colspan="2">NOTES</th></tr>
<tr><td rowspan="4">A</td><td>A1</td><td rowspan="2">SOL S1</td><td colspan="2" rowspan="2">Current to solenoid S1</td><td colspan="2" rowspan="4">Output - power PWM</td></tr>
<tr><td>A2</td></tr>
<tr><td>A3</td><td rowspan="2">SOL S2</td><td colspan="2" rowspan="2">Current to solenoid S2 (only for 05H version)</td></tr>
<tr><td>A4</td></tr>
<tr><td rowspan="5">B</td><td>B1</td><td>CMD1</td><td colspan="2">Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)</td><td colspan="2" rowspan="5">Input - analog signal</td></tr>
<tr><td rowspan="2">B2</td><td rowspan="2">CMD-</td><td>Standard</td><td>/P option (see 4.4)</td></tr>
<tr><td>Zero signal, ground for reference signals</td><td>Reference for ±5 VDC output (AGND)</td></tr>
<tr><td>B3</td><td>CMD2 (1)</td><td colspan="2">Reference analog input: ±10 VDC / ± 20 mA maximum range software selectable (see 4.2)</td></tr>
<tr><td>B4</td><td>DGND</td><td colspan="2">Optical insulated ground for on/off inputs (DI1 ÷ DI4)</td></tr>
<tr><td rowspan="5">C</td><td colspan="2"></td><td>Standard</td><td>/P option (see 4.4)</td><td>Standard</td><td>Option /P</td></tr>
<tr><td>C1</td><td>DI1</td><td rowspan="4">Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7)
For analog driver compatibility see section 5</td><td rowspan="2">Optical insulated on/off input 0 ÷ 24 VDC referred to pin B4 DGND (see 4.7)
For analog driver compatibility see section 5</td><td colspan="2" rowspan="2">Input - on/off signal</td></tr>
<tr><td>C2</td><td>DI2</td></tr>
<tr><td>C3</td><td>DI3</td><td>+5 VDC @ 10 mA output supply to pin B2 (AGND)</td><td rowspan="2">Input - on/off</td><td rowspan="2">Output - reference analog</td></tr>
<tr><td>C4</td><td>DI4</td><td>-5 VDC @ 10 mA output supply to pin B2 (AGND)</td></tr>
<tr><td rowspan="4">D</td><td>D1</td><td>V+</td><td colspan="2">Power supply 24 VDC (see 4.1)</td><td colspan="2" rowspan="2">Input - power supply</td></tr>
<tr><td>D2</td><td>V0</td><td colspan="2">Power supply 0 VDC</td></tr>
<tr><td>D3</td><td>ENABLE</td><td colspan="2">Enable (24 VDC) or disable (0 VDC) the driver (see 4.5)</td><td colspan="2">Input - on/off signal</td></tr>
<tr><td>D4</td><td>STATUS</td><td colspan="2">Fault (default) or software selected output (see 4.6)</td><td colspan="2">Output - on/off signal</td></tr>
</table>

(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

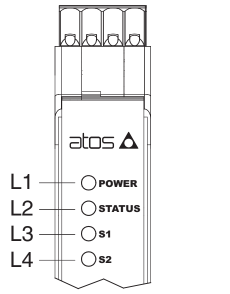
RJ45 connector
(IEC 60603 standard)
for RS232 serial communication



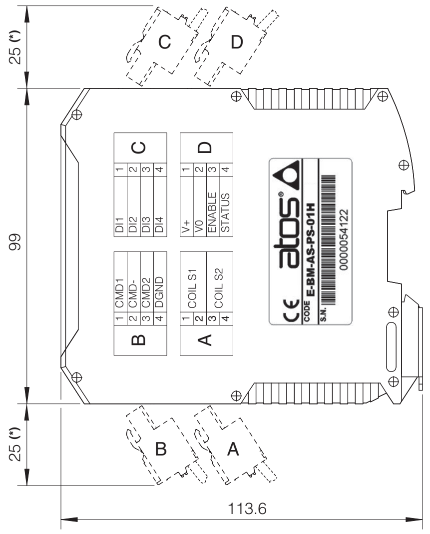
10 DIAGNOSTIC LEDS

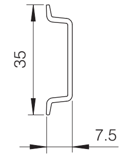
Four leds show driver operative conditions for immediate basic diagnostics. Please refer to the driver user manual for detailed information.

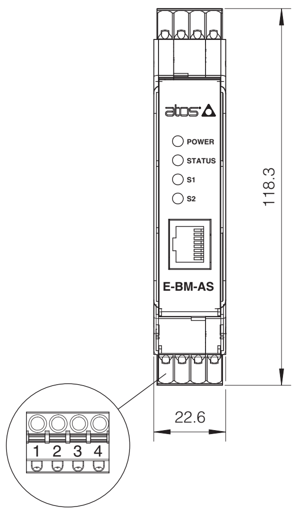
LED	COLOR	FUNCTION	FLASH RATE	DESCRIPTION
L1	GREEN	POWER	OFF	Power supply OFF
			ON	Power supply ON
L2	GREEN	STATUS	OFF or ON	Fault conditions
			Slow blinking	Driver disabled
			Fast blinking	Driver enabled
L3 and L4	YELLOW	S1 and S2	OFF	PWM command OFF
			ON	PWM command ON
			Slow blinking	Coil not connected
			Fast blinking	Short circuit on the solenoid



11 OVERALL DIMENSIONS [mm]





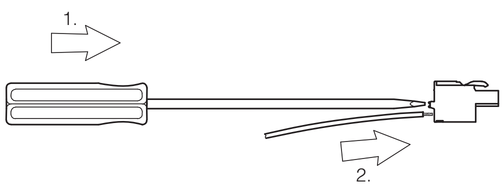


A, B, C, D connectors included

(*) Space to remove the connectors

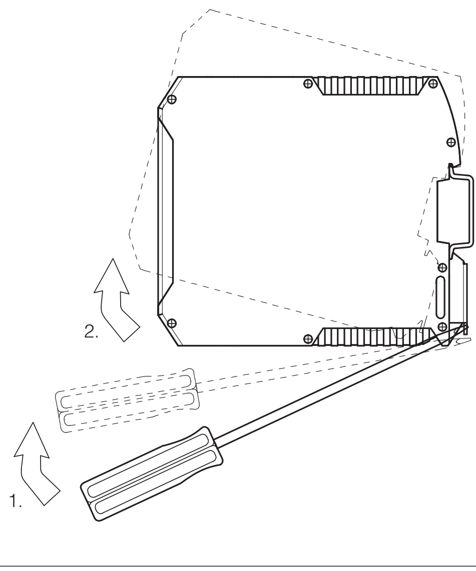
12 INSTALLATION

To wire cables in the connectors:
1. press the button with a screwdriver
2. insert the cable termination

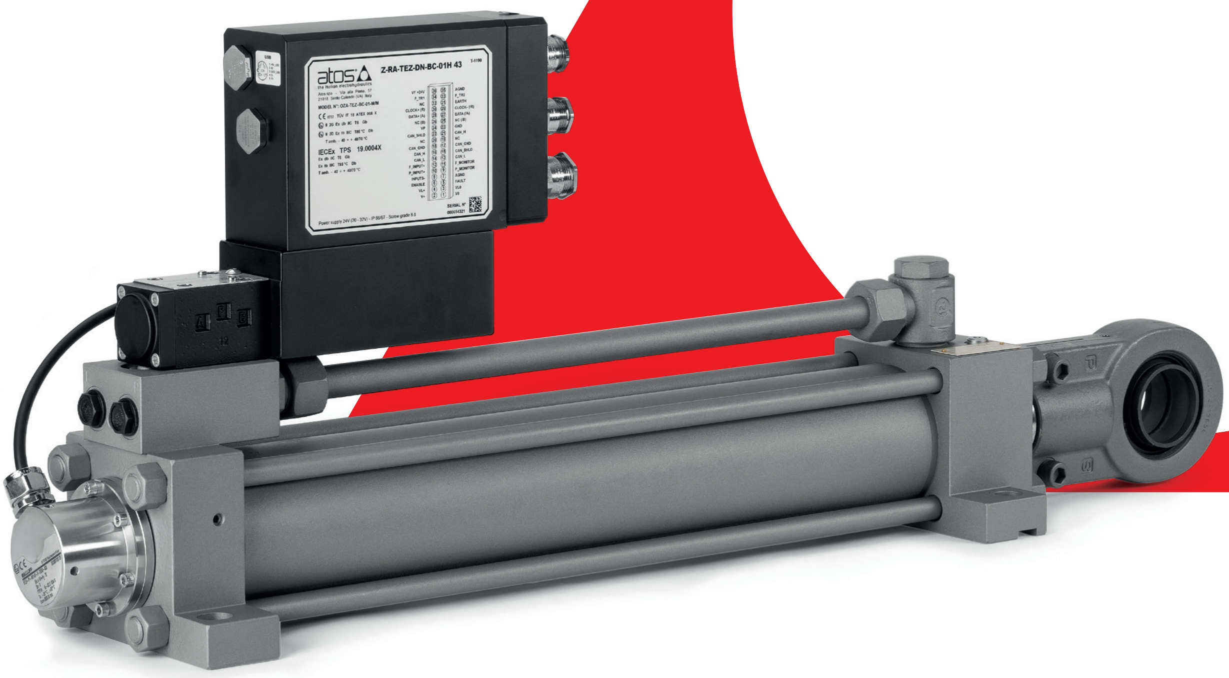


Note: max conductor size: 2,5 mm²

To unlock the driver from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the driver



2 AXIS & P/Q CONTROLS



INDEX

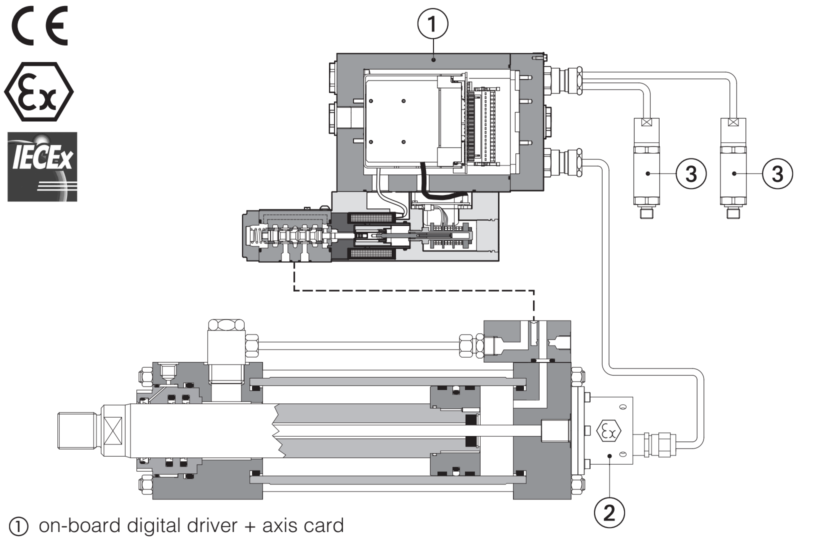
AXIS & P/Q CONTROLS

Ex-d

Supplementary components range available on **www.atos.com**

Ex-proof digital servoproportionals with on-board axis card

direct, sleeve execution, with LVDT transducer and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DLHZA-TEZ-D-SF-EP-040

DLHZA-TEZ, DLKZA-TEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, LVDT position transducer and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

DLHZA:	**DLKZA**:
Size: **06** -ISO 4401	Size: **10** -ISO 4401
Max flow: **50 l/min**	Max flow: **100 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DLHZA - TEZ - D - SN - NP - 0 40 - L 7 3 / M / * * / *

Ex-proof servoproportional directional valves, direct
DLHZA = size 06
DLKZA = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

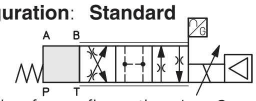
Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

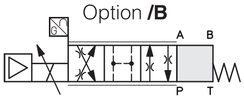
Alternated P/Q controls:
SN = none
SF = force control (2 pressure trandučers)
SL = force control (1 load cell)

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

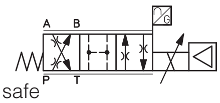
Valve size ISO 4401: **0** = 06 **1** = 10

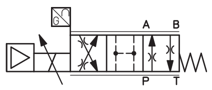
Configuration: **Standard** Option **/B**

40 =




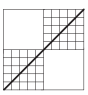
with fail safe configuration 1 or 3

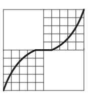
60 =


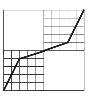


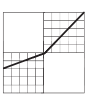
without fail safe

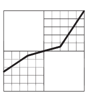
Spool type, regulating characteristics:


L = linear


V = progressive


T = not linear **(1)**


D = differential-linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q


DT = differential-not linear **(1)**
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

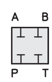
Series number

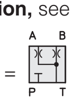
Hydraulic options (2):
B = solenoid with integral electronics and position transducer at side of port A **(3)**
Y = external drain

Electronic options (2):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

Cable entrance threaded connection:
M = M20x1,5

Fail safe configuration, see section 18:

1 =


3 =


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)
DLHZA =	4	7	8	14	-	20	28	40
DLKZA =	-	-	-	60	60	-	-	100

Nominal flow (l/min) at Δp 70bar P-T

(1) Only for configuration **40** **(2)** For possible combined options, see section 16
(3) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 POSITION REFERENCE MODE

2.1 External reference generation

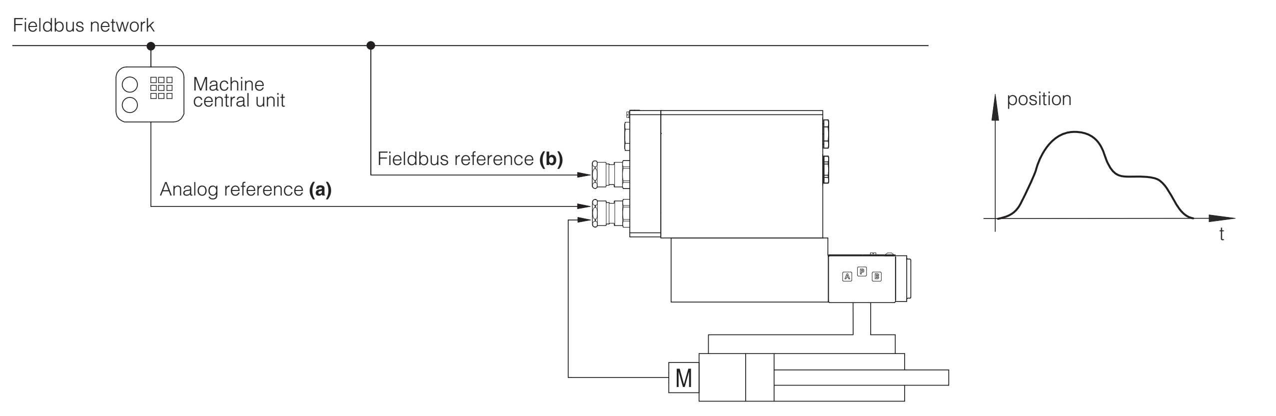
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

Analog reference (a) - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

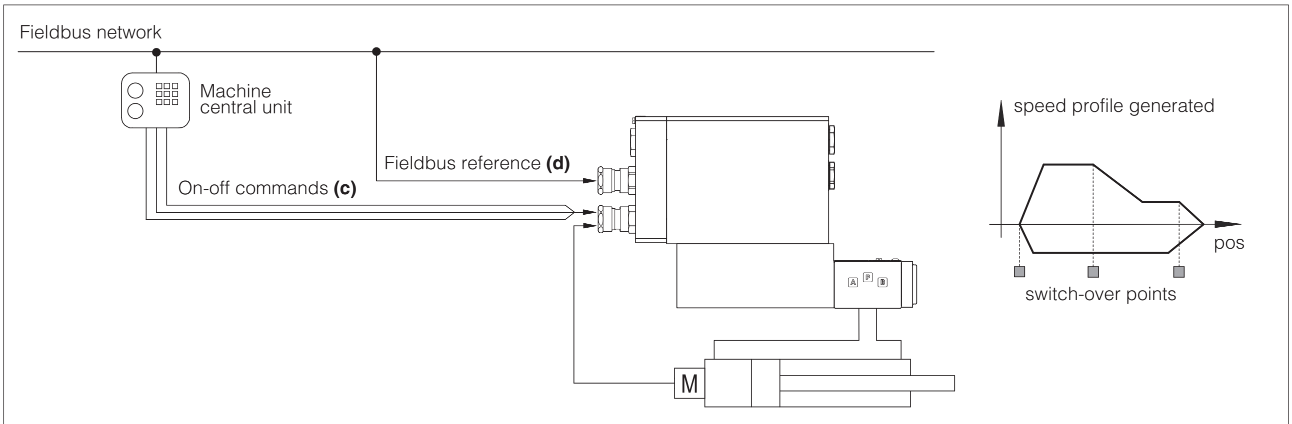
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

- *on-off commands* ***(c)***

- *fieldbus commands* ***(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

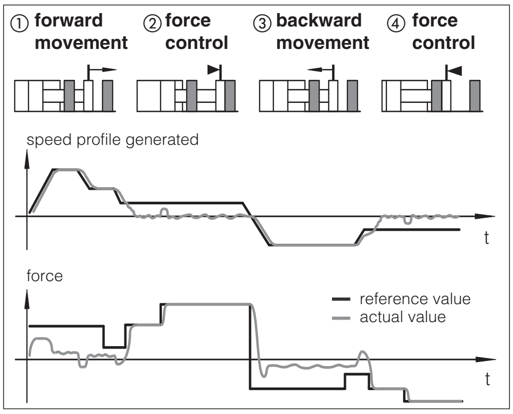
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

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.

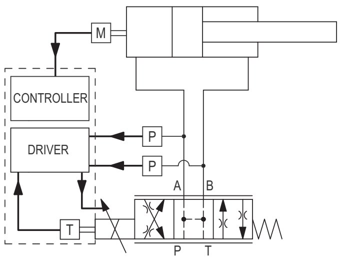
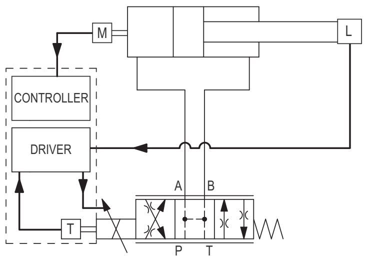
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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 controller 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
	
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 spool transducer	M	actuator 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 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 **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

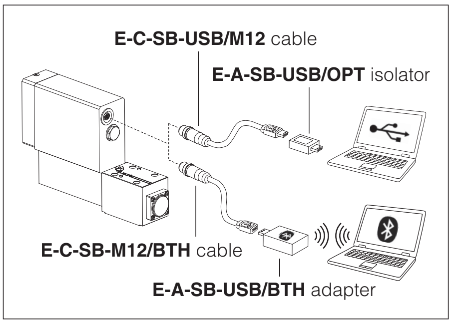
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**). For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL support: NP (USB)
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: drivers 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**)

USB or Bluetooth connection



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

6 FIELDBUS - see tech. table GS510

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

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	**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 - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		DLHZA												DLKZA						
Pressure limits	[bar]	ports **P, A, B** = 350; **T** = 210 (250 with external drain /Y)												ports **P, A, B** = 315; **T** = 210 (250 with external drain /Y)						
Spool type		**L0**	**L1**	**V1**	**L3**	**V3**	**L5**	**T5**	**L7**	**T7**	**V7**	**D7**	**DT7**	**L3**	**T3**	**L7**	**T7**	**V7**	**D7**	**DT7**
Max flow [l/min] Δp P-T	at Δp = 30 bar	2,5	4,5	8	9	13	18		26			26÷13		40		60			60÷33	
	at Δp = 70 bar	4	7	12	14	20	28		40			40÷20		60		100			100÷50	
	max permissible flow	5	9	16	18	26	32		50			50÷28		70		100			100÷50	
Δp max P-T	[bar]	120	120	120	120	120	100		100			100		90		70			70	
Leakage [cm³/min] at P = 100 bar **(1)**		<100	<200	<100	<300	<150	<500	<200	<900	<200	<200	<700	<200	<1000	<400	<1500	<400	<400	<1200	<400
Response time **(2)**	[ms]	≤ 13												≤ 20						
Hysteresis	[% of max regulation]	≤ 0,1												≤ 0,1						
Repeatibility	[% of max regulation]	± 0,1												± 0,1						
Thermal drift		zero point displacement < 1% at ΔT = 40°C																		

(1) referred to spool in neutral position and 50°C oil temperature
(2) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA 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-ATRA-7 see tech table **GX800**)			
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			
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, 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

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller 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 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 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DLHZA, DLKZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-TEZ**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1 EN 60079-31 IEC 60079-0 IEC 60079-1 IEC 60079-31		
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SF, SL**
Option /C 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

For SN: /BI, /BY, /IY

For SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

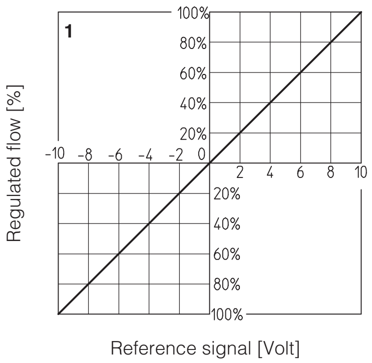
17 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

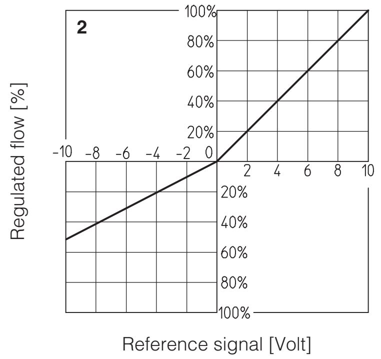
17.1 Regulation diagrams

1 = Linear spools L
2 = Differential - linear spool D7

3 = Differential non linear spool DT7
4 = Non linear spool T5 (only for DLHZA)

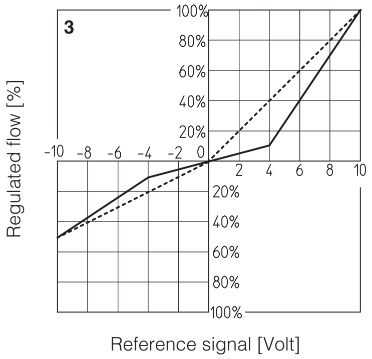
5 = Non linear spool, T3 (only for DLKZA) and T7
6 = Progressive spool V

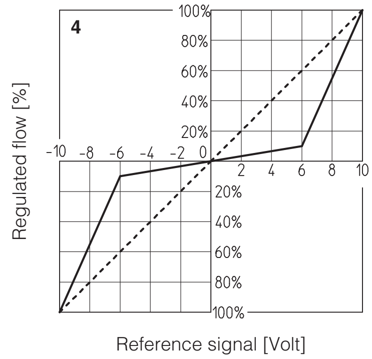




T5 and T7 spool types are specific for fine low flow control in the range from 0 to 60% (T5) and 0 to 40% (T3 and T7) of max spool stroke.
The non linear characteristics of the spool is compensated by the electronic driver, so the final valve regulation is resulting linear respect the reference signal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

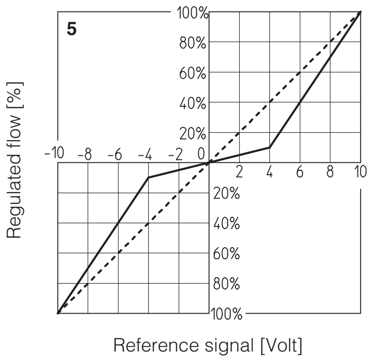
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

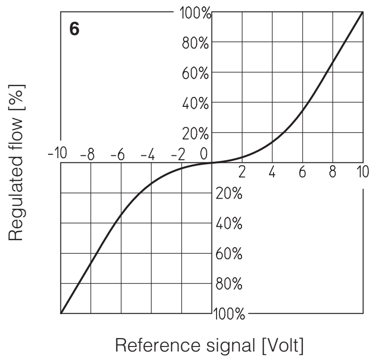
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → B / A → T

option /B:

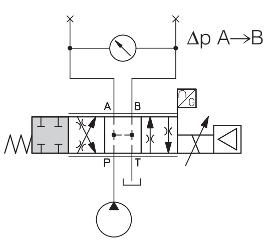
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → B / A → T

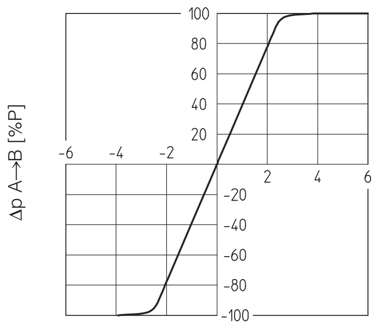
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA } P → A / B → T





17.2 Pressure gain

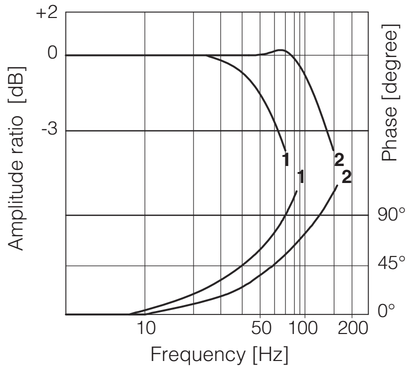


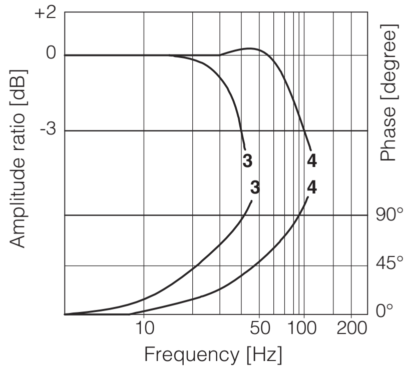


17.3 Bode diagrams
Stated at nominal hydraulic conditions

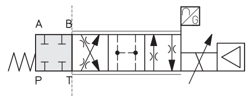
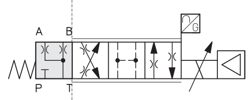
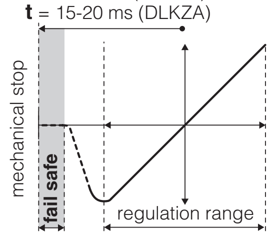
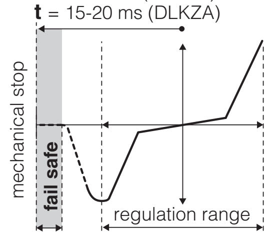
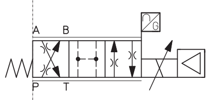
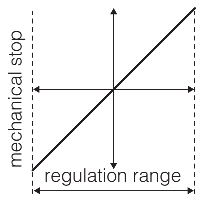
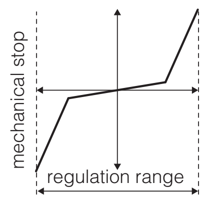
DLHZA:
1 = ± 100% nominal stroke
2 = ± 5% nominal stroke

DLKZA:
3 = ± 100% nominal stroke
4 = ± 5% nominal stroke





18 FAIL SAFE POSITION

CONFIGURATION	LINEAR	NOT LINEAR
 fail safe **1**  fail safe **3**	**t** = 7-10 ms (DLHZA) **t** = 15-20 ms (DLKZA) 	**t** = 7-10 ms (DLHZA) **t** = 15-20 ms (DLKZA) 
	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	
 without fail safe		

Fail safe connections			**P → A**	**P → B**	**A → T**	**B → T**
Leakage [cm³/min] at P = 100 bar **(1)**		Fail safe 1	50	70	70	50
		Fail safe 3	50	70	-	-
Flow [l/min] **(2)**	DLHZA	Fail safe 3	-	-	15÷30	10÷20
	DLKZA		-	-	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

19 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, EN-982).

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.

⚠ 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)

The power supply for controller'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 controller's logic on pin 3 and 4, 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 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position 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.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.4 Pressure or force reference input signal (F_INPUT+) - only for **SF**, **SL**

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :
SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force 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.
SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

19.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (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 ÷ 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.

19.6 Pressure or force monitor output signal (F_MONITOR) - only for **SF**, **SL**

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:

SN control: output signal is proportional to the actual valve spool position

SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (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 ÷ 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.

19.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller 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)

19.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (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.

19.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller 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 ÷ 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 20.1).

19.10 Remote pressure/force transducer input signals - only for **SF**, **SL**

Analog remote pressure transducers or load cell can be directly connected to the controller.
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 20.2).

20 ACTUATOR'S TRANSDUCER CHARACTERISTICS

20.1 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.

20.2 Pressure/force transducers

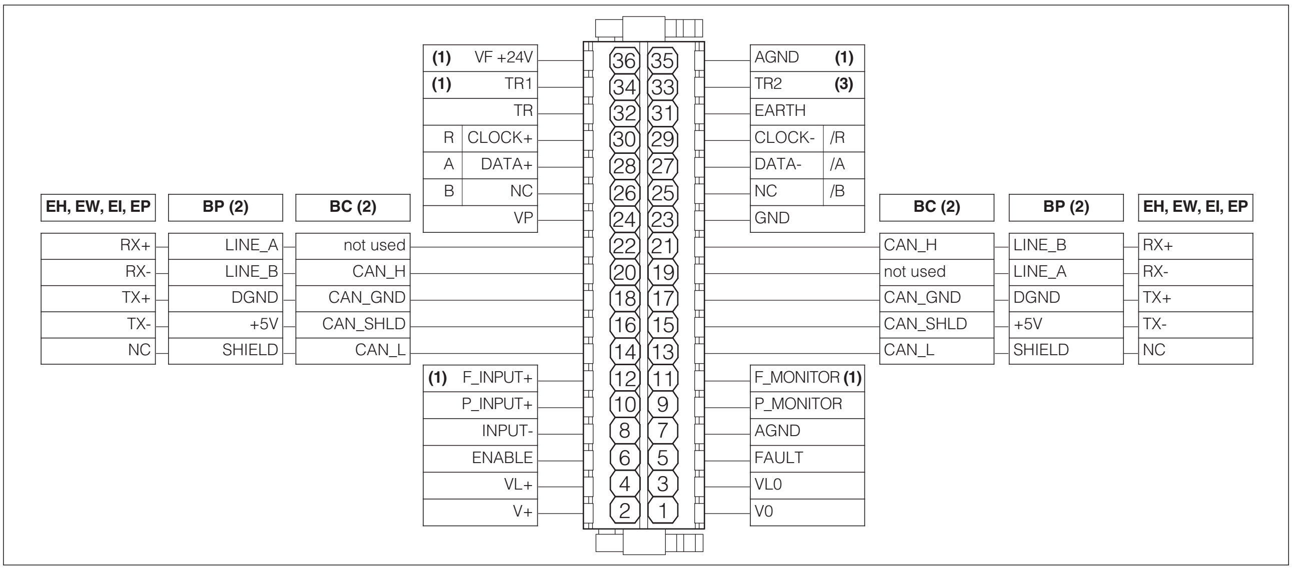
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3.
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** 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.

20.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**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
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 Atos controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

21 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

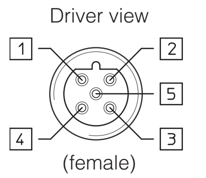
22 ELECTRONIC CONNECTIONS

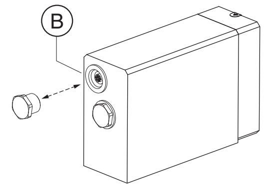
22.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 V_{DC} / ±20mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 V_{DC} / ±20 mA max. range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

22.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +





22.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

22.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

22.5 EH, EW, EI, EP fieldbus execution connections

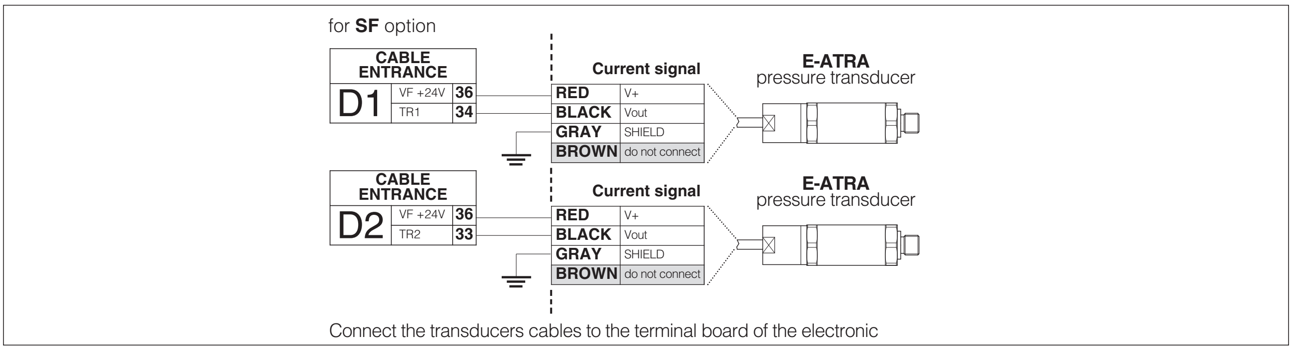
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

22.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	SL - Single transducer (1)		SF - Double transducers (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

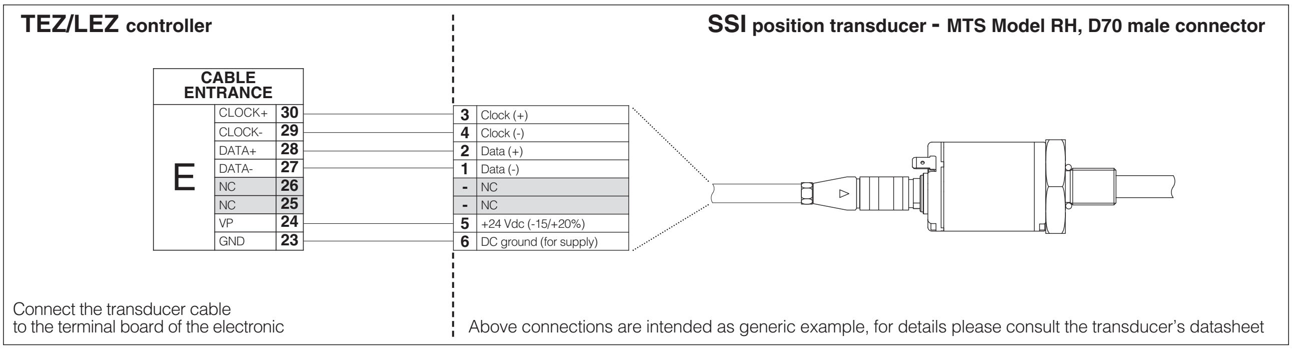


22.7 D execution - Digital position transducers connections

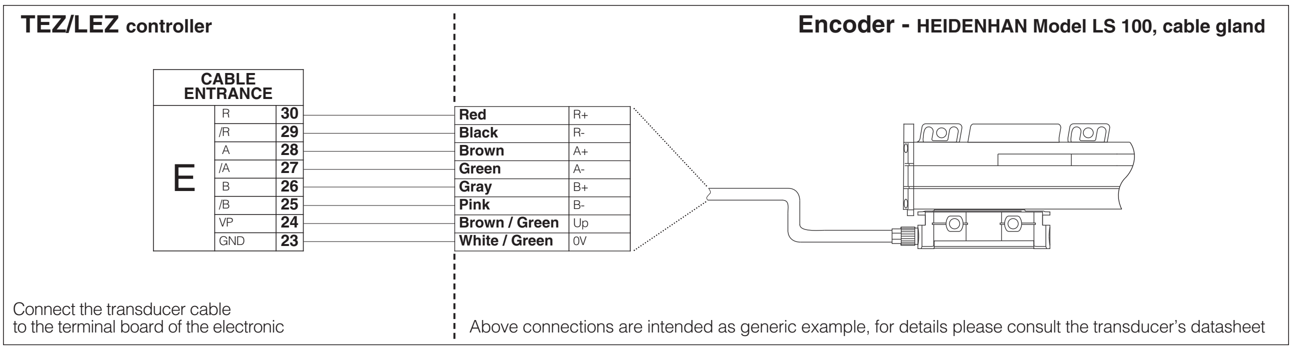
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	**TECHNICAL SPECIFICATION**	**NOTES**	**SIGNAL**	**TECHNICAL SPECIFICATION**	**NOTES**
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**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**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 19.9

SSI connection - example



Encoder connection - example



22.8 A execution - Analog position transducers connector

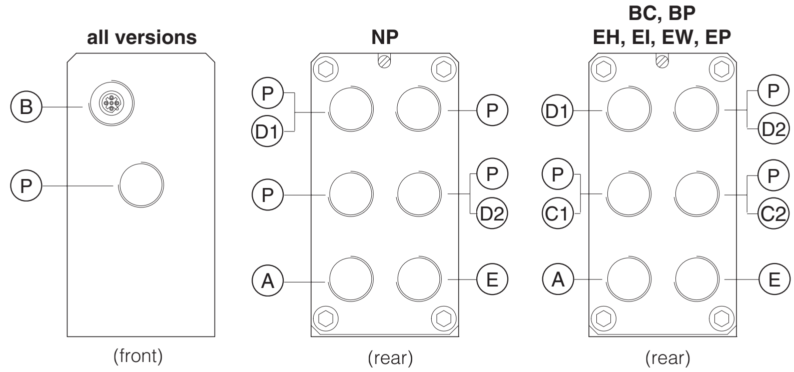
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

23 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

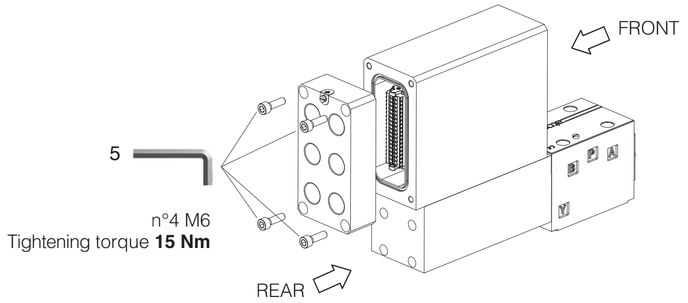
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (E) position transducer
- (P) threaded plug



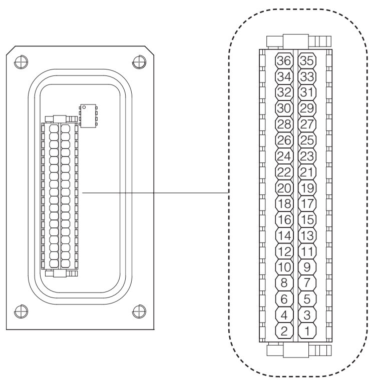
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

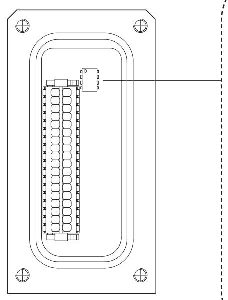


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 21

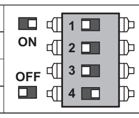


Fieldbus terminator only for BC and BP executions **(1)**



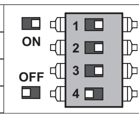
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

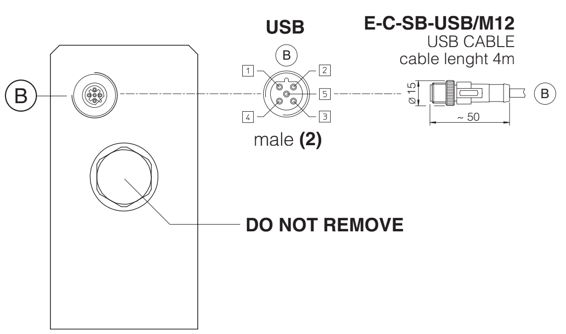


BP - PROFIBUS DP setting:

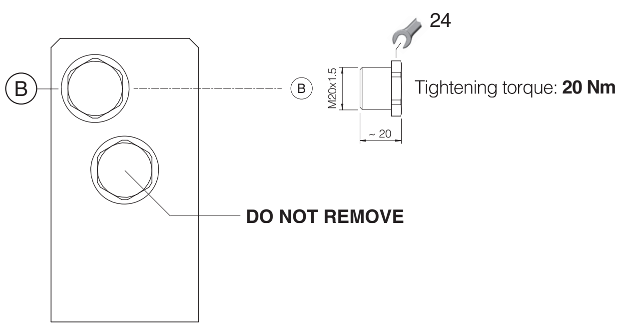
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR

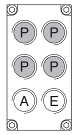
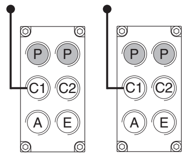
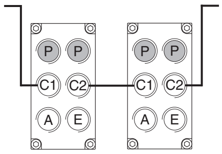


METALLIC PROTECTION CAP - supplied with the valves

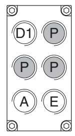
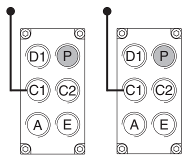
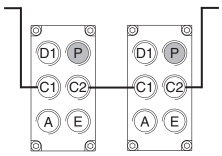


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF
(2) Pin layout always referred to driver's view

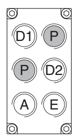
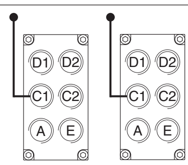
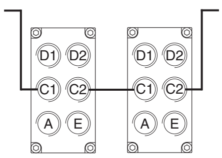
23.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

23.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “daisy chain” connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

23.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP “via stub” connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP “daisy chain” connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

24 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-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

24.1 External reference and transducer parameters

Allow to configure the controller 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)

24.2 PID control dynamics parameters

Allow to optimize and adapt the controller 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

24.3 Monitoring parameters

Allow to configure the controller 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 24.4)

24.4 Fault parameters

Allow to configure how the controller detects and reacts 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, controller disabling, etc.)

24.5 Valve characteristics compensation

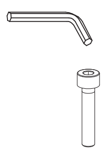
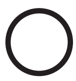
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

24.6 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).

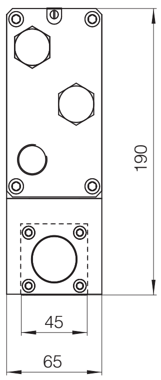
25 FASTENING BOLTS AND SEALS

	DLHZA	DLKZA
	**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)

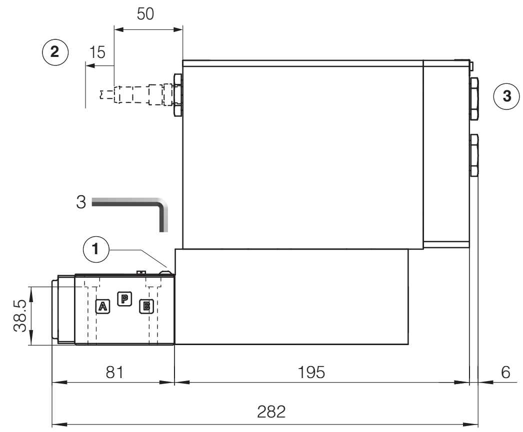
DLHZA-TEZ

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

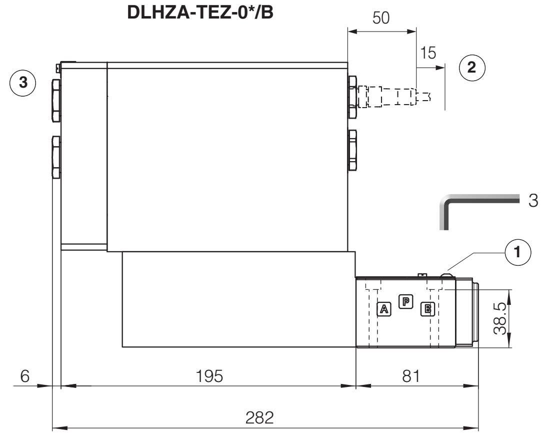
Mass [kg]	
DLHZA-TEZ	7,2



DLHZA-TEZ-0*



DLHZA-TEZ-0*/B



1 = Air bleed off

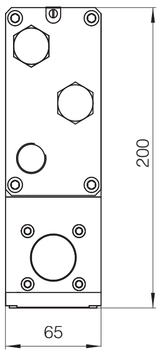
2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

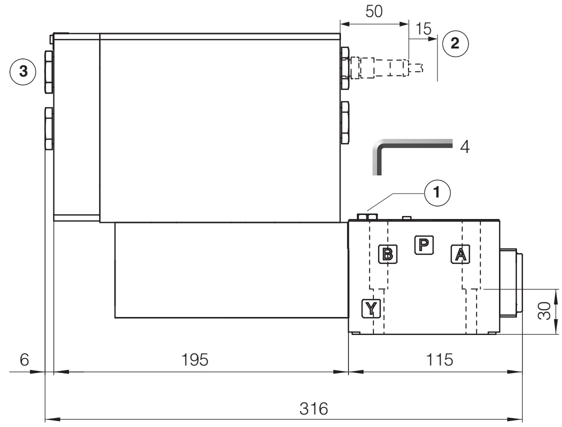
DLKZA-TEZ

ISO 4401: 2000
Mounting surface: 4401-05-04-0-05 (see table P005)
(for /Y surface 4401-05-05-0-05 without X port)

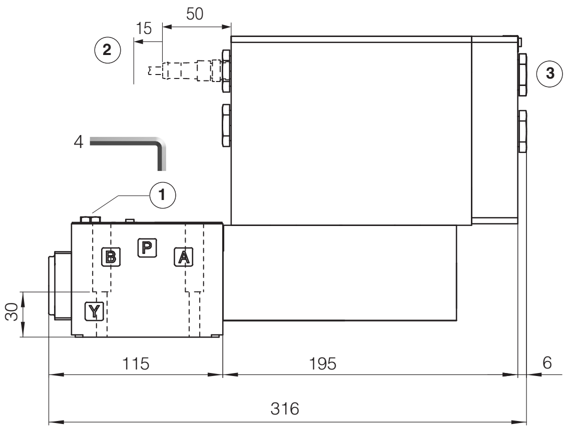
Mass [kg]	
DLKZA-TEZ	9



DLKZA-TEZ-1*



DLKZA-TEZ-1*/B



1 = Air bleed off

2 = Space to remove the USB connector

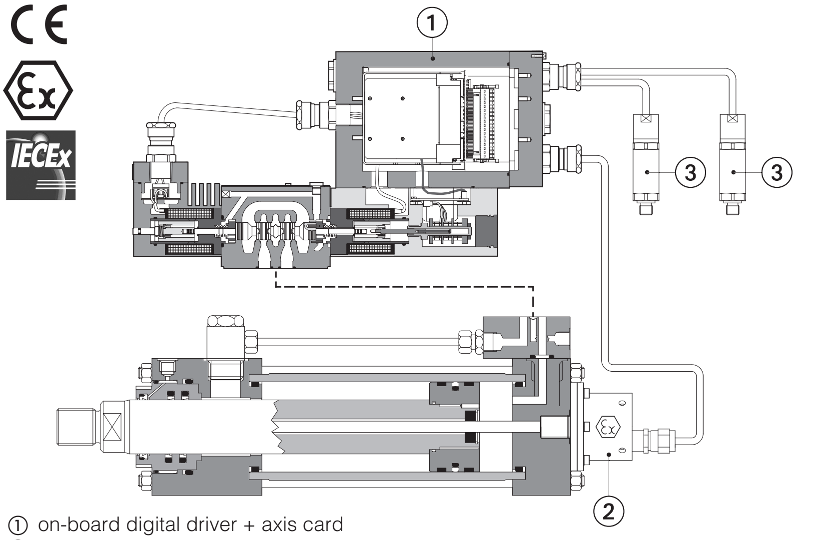
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

27 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
GS500	Programming tools	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportionals with on-board axis card

direct, with LVDT transducer and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DKZA-TEZ-D-SF-NP-170*

DHZA-TEZ, DKZA-TEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, LVDT position transducer and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

DHZA:	**DKZA**:
Size: **06** -ISO 4401	Size: **10** -ISO 4401
Max flow: **60 l/min**	Max flow: **150 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHZA	-	TEZ	-	D	-	SN	-	NP	-	0		70	-	L		5	/	M	/	*		*	/	*

Ex-proof servoproportional directional valves, direct
DHZA = size 06
DKZA = size 10

TEZ = on-board digital driver + axis card, one LVDT transducer

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

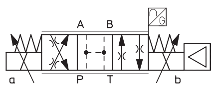
Alternated P/Q controls:
SN = none
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

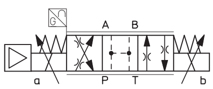
Fieldbus interface, USB port always present:
NP = Not Present
BC = CANopen | **EW** = POWERLINK
BP = PROFIBUS DP | **EI** = EtherNet/IP
EH = EtherCAT | **EP** = PROFINET RT/IRT

Valve size ISO 4401:
0 = 06 **1** = 10

Configuration: **Standard** Option **/B**

70 =





Seals material, see section 9:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (1):
B = solenoid with integral digital electronics at side of port A **(2)**
Y = external drain

Electronic options (1):
C = current feedback for pressure transducer 4 ÷ 20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 VDC)

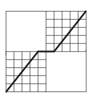
Cable entrance threaded connection:
M = M20x1,5

Spool size:	**3** (L)	**5** (L,D)
DHZA =	18	28
DKZA =	45	75

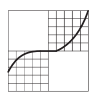
Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics:

L = linear



D = differential-progressive



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

(1) For possible combined options, see section 15
(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

2 POSITION REFERENCE MODE

2.1 External reference generation

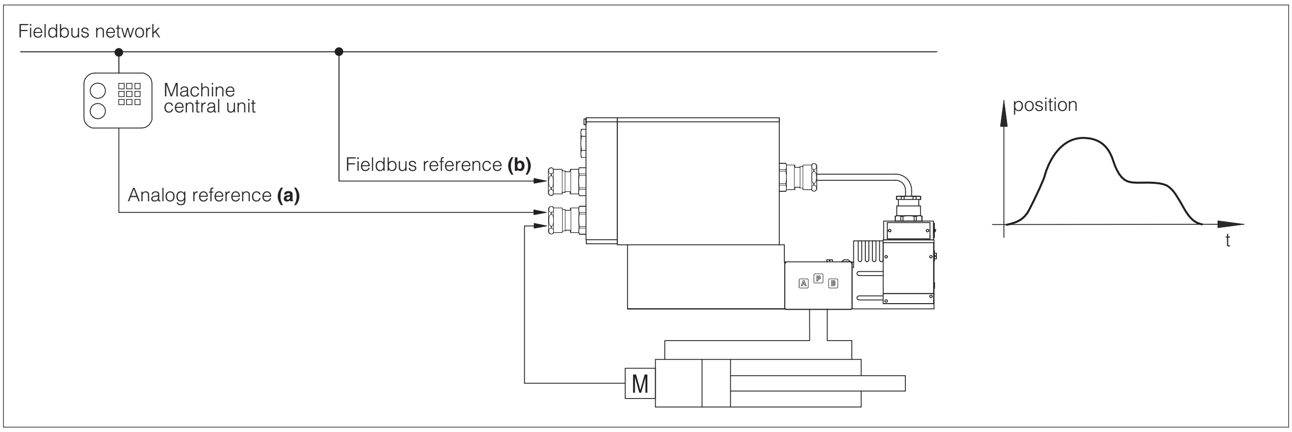
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

*Analog reference **(a)*** - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

*Fieldbus reference **(b)*** - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

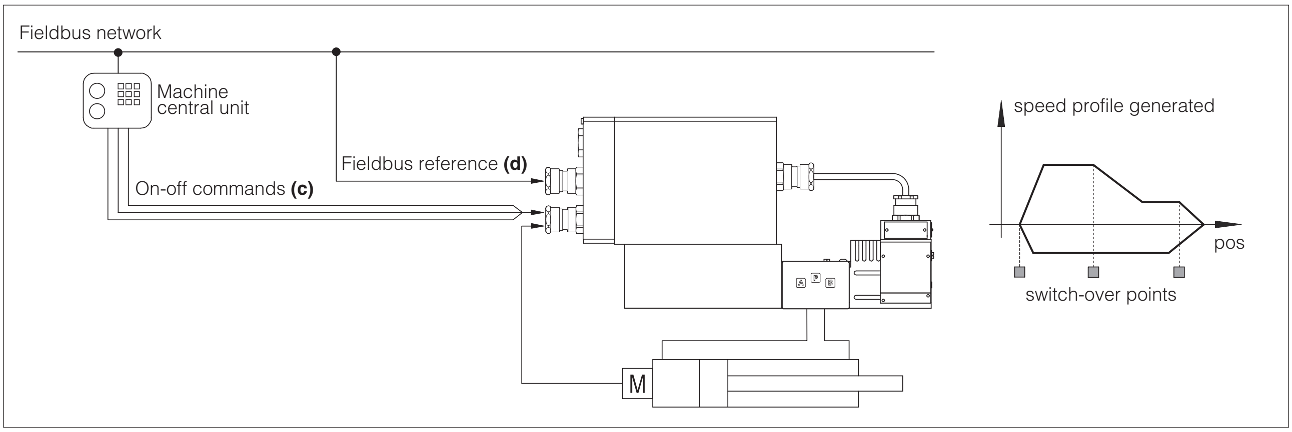
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

*- on-off commands **(c)***

*- fieldbus commands **(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

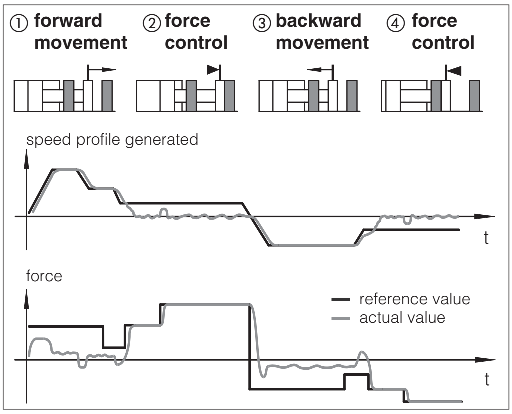
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

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.

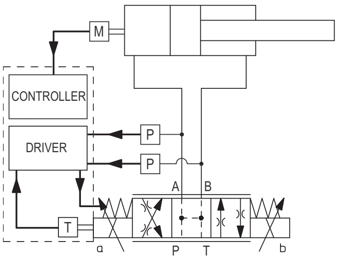
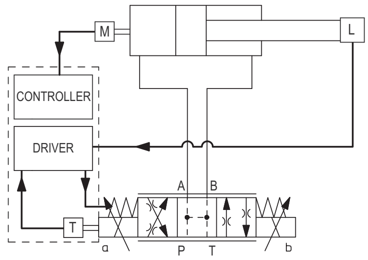
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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 controller 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
	
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 spool transducer	M	actuator 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 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 **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

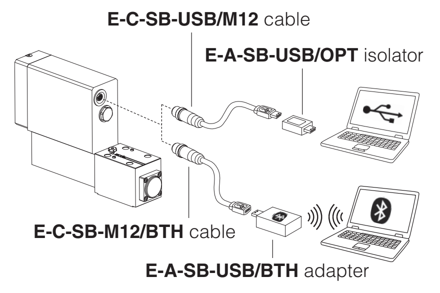
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**). For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL	support:	NP (USB)		
		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: drivers 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**)

USB or Bluetooth connection



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

6 FIELDBUS - see tech. table GS510

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

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	**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 - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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	DHZA			DKZA		
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 [l/min]						
[l/min] at Δp= 10 bar	18	28	28	45	75	75
Δp P-T at Δp= 30 bar	30	50	50	80	130	130
max permissible flow	40	60	60	90	150	150
Δp max P-T [bar]	70	50	50	40	40	40
Response time [ms] **(1)**	≤ 18			≤ 25		
Leakage [cm³]	<500 (at P = 100 bar); <1500 (at P = 350 bar)			<800 (at P = 100 bar); <2500 (at P = 315 bar)		
Hysteresis	≤ 0,2 [% of max regulation]					
Repeatability	± 0,1 [% of max regulation]					
Thermal drift	zero point displacement < 1% at ΔT = 40°C					

(1) 0-100% step signal

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA 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-ATRA-7 see tech table **GX800**)			
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			
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, 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

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller 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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		DHZA, DKZA				
Certifications		Multicertification Group II **ATEX IECEx**				
Solenoid certified code		**OZA-TEZ**				
Type examination certificate **(1)**		• ATEX: TUV IT 18 ATEX 068 X			• IECEx: IECEx TPS 19.0004X	
Method of protection		• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db			• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db	
Temperature class	Single solenoid valve	**T6**	**-**	**T5**	**T4**	**-**
	Double solenoid valve	**-**	**T4**	**-**	**-**	**T3**
Surface temperature		≤ 85 °C	≤ 135 °C	≤ 100 °C	≤ 135 °C	≤ 200 °C
Ambient temperature **(2)**		-40 ÷ +40 °C		-40 ÷ +55 °C	-40 ÷ +70 °C	
Applicable Standards		EN 60079-0 EN 60079-1 EN 60079-31 IEC 60079-0 IEC 60079-1 IEC 60079-31				
Cable entrance: threaded connection		**M** = M20x1,5				

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm^2 **Grounding:** section of external ground wire = 4 mm^2

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port A of the main stage. For hydraulic configuration vs reference signal, see 17.1

Y = Option /Y is mandatory if the pressure in port T exceeds 210 bar

15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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 = Only for **SF, SL**
Option /C 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.

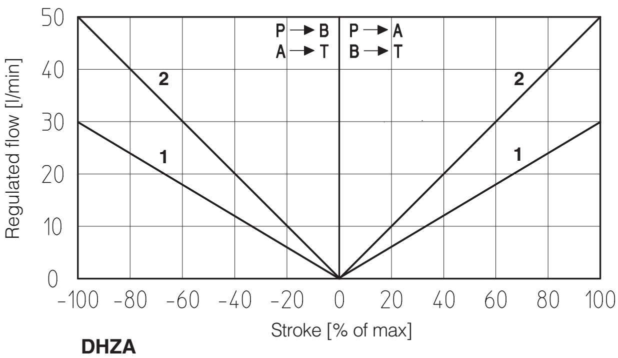
16 POSSIBLE COMBINED OPTIONS

For SN: /BI, /BY, /IY

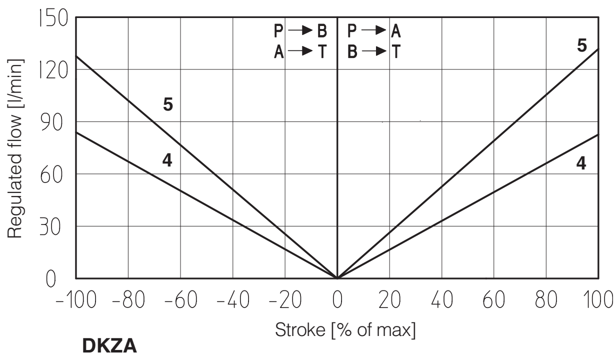
For SF, SL: /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

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

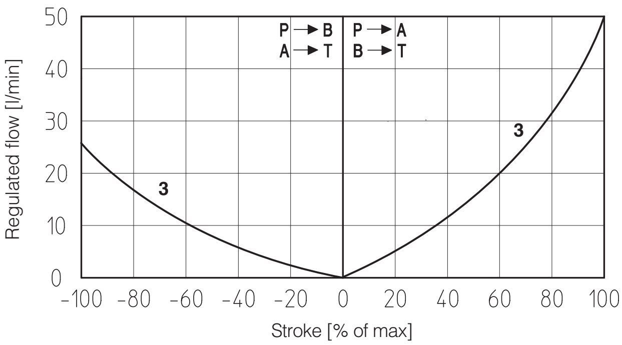
17.1 Regulation diagrams (values measure at Δp 30 bar P-T)



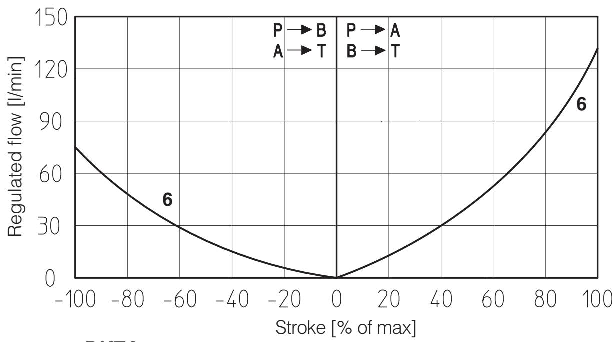
DHZA
1 = L3 **2** = L5



DKZA
4 = L3 **5** = L5



DHZA
3 = D5



DKZA
6 = D5

Note:
Hydraulic configuration vs. reference signal for configurations 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 → A / B → T   Reference signal $\left.\begin{matrix}0 \div -10\text{ V}\\ 12 \div 4\text{ mA}\end{matrix}\right\}$ P → B / A → T

18 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, EN-982).

18.1 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.

⚠ 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)

The power supply for controller'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 controller's logic on pin 3 and 4, 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 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position 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.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

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

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :
SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force 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.
SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

18.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (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 ÷ 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.

18.6 Pressure or force monitor output signal (F_MONITOR) - only for SF, SL

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:

SN control: output signal is proportional to the actual valve spool position

SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (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 ÷ 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.

18.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller 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)

18.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (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.

18.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller 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 ÷ 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 19.1).

18.10 Remote pressure/force transducer input signals - only for SF, SL

Analog remote pressure transducers or load cell can be directly connected to the controller.
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 19.2).

19 ACTUATOR'S TRANSDUCER CHARACTERISTICS

19.1 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.

19.2 Pressure/force transducers

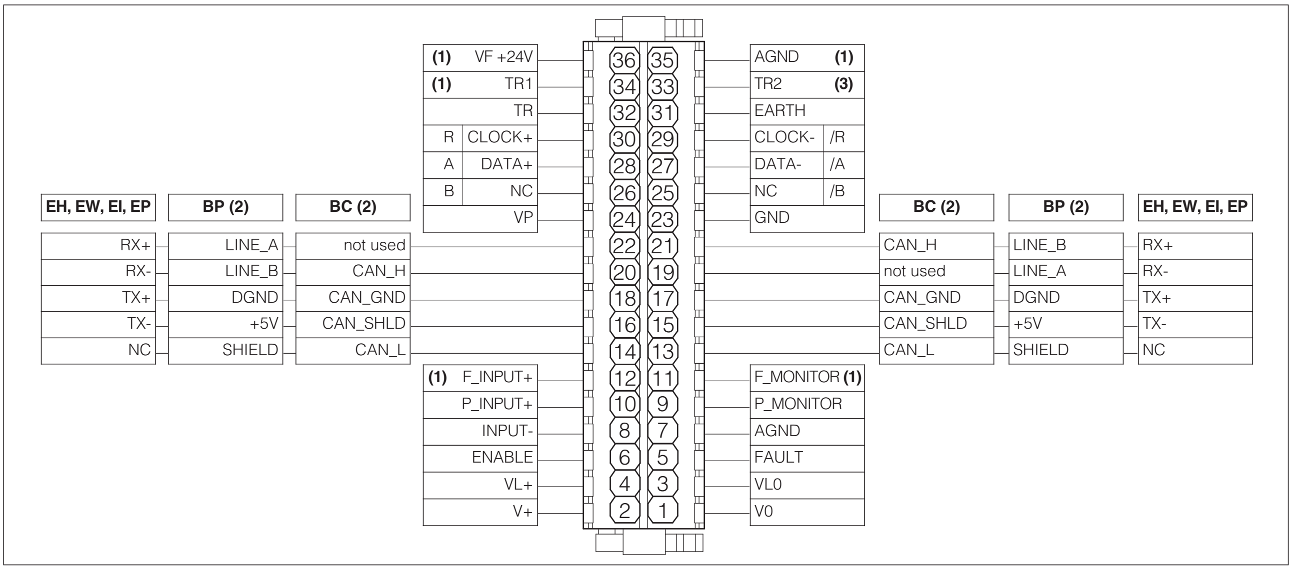
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** 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.

19.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

	Position				**Pressure/Force**
Execution	**A**		**D**		**SF, SL**
Input type	Potentiometer	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	±10 V_{DC}	+24 V_{DC}	+5 V_{DC} / +24 V_{DC}	+5 V_{DC} / +24 V_{DC}	+24 V_{DC}
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 V_{DC} 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 controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

20 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

21 ELECTRONIC CONNECTIONS

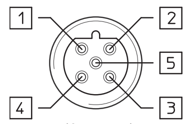
21.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 V_{DC}	Gnd - power supply
	2	**V+**	Power supply 24 V_{DC}	Input - power supply
	3	**VL0**	Power supply 0 V_{DC} for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 V_{DC} for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position reference input signal: ±10 V_{DC} / ±20 mA maximum range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 V_{DC} / ±20mA maximum range, referred to AGND Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 V_{DC} / ±20 mA max. range Defaults are: ±10 V_{DC} for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

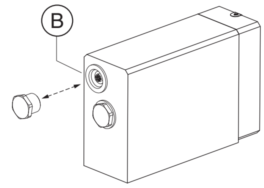
21.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



21.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

21.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

21.5 EH, EW, EI, EP fieldbus execution connections

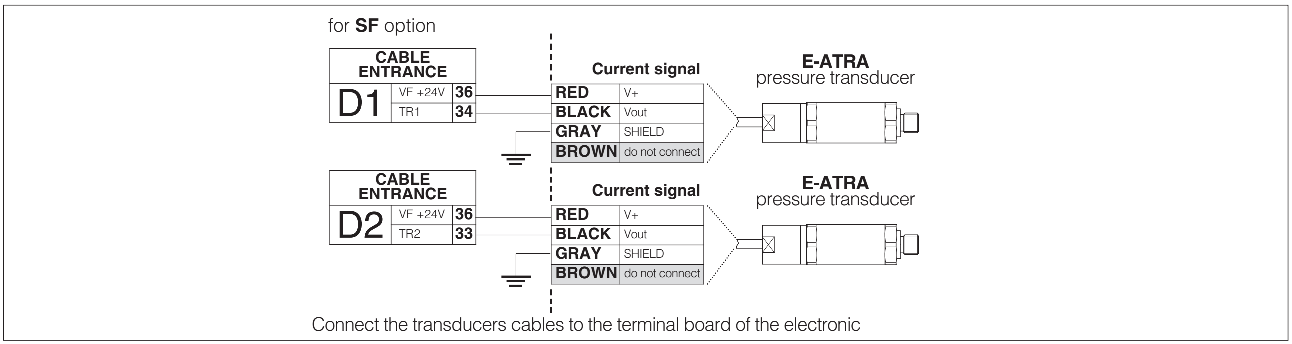
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

21.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st signal transducer ±10 V_{DC} / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24V_{DC}	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

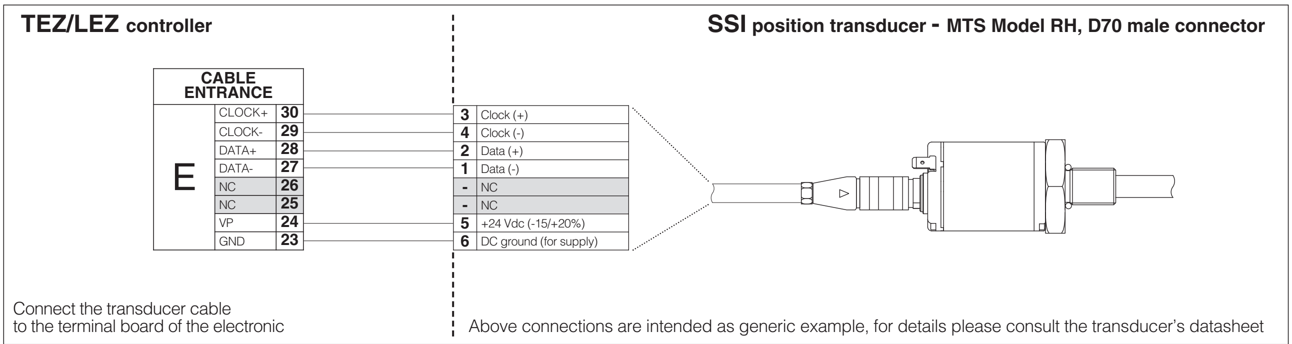


21.7 D execution - Digital position transducers connections

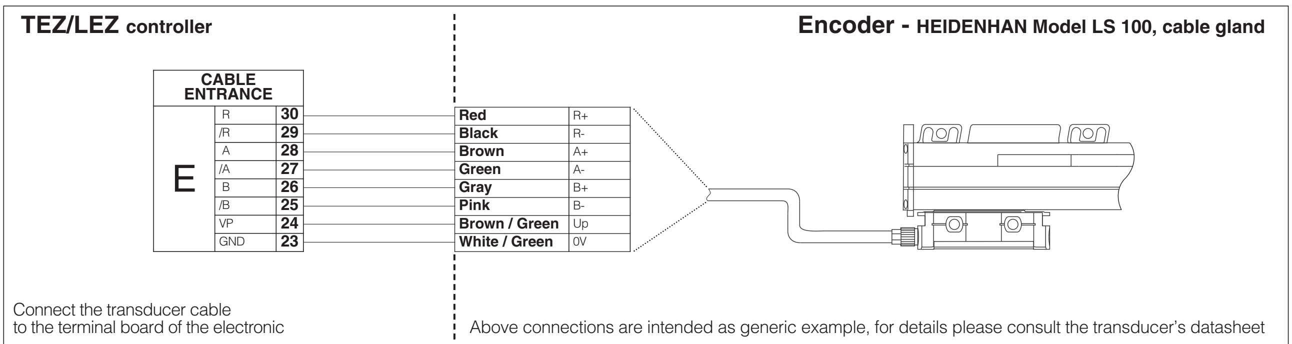
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	**TECHNICAL SPECIFICATION**	**NOTES**	**SIGNAL**	**TECHNICAL SPECIFICATION**	**NOTES**
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**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**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	Common gnd for transducer power and signals	Common gnd

(1) Digital position transducer type is software selectable: Encoder or SSI, see 18.9

SSI connection - example



Encoder connection - example



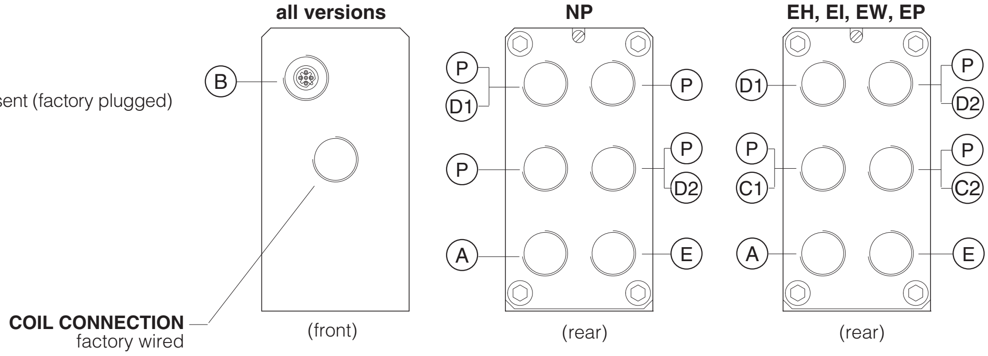
21.8 A execution - Analog position transducers connector

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

CABLE ENTRANCE OVERVIEW

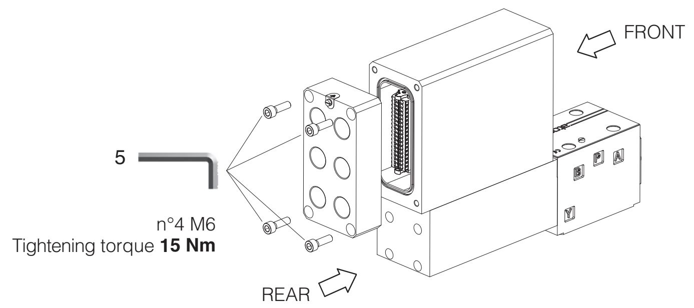
Cables entrance description:

- Ⓐ main connections
- Ⓑ USB connector always present (factory plugged)
- C1 fieldbus (input)
- C2 fieldbus (output)
- D1 pressure transducer 1
- D2 pressure transducer 2
- Ⓔ position transducer
- Ⓟ threaded plug



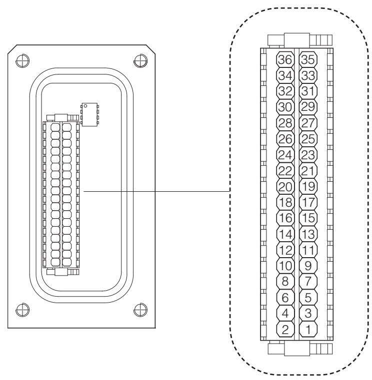
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

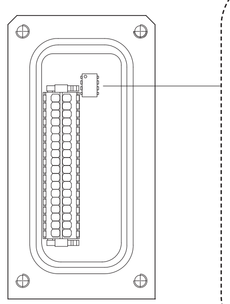


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 20

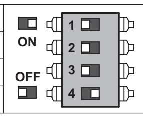


Fieldbus terminator only for BC and BP executions **(1)**



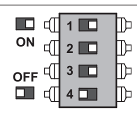
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

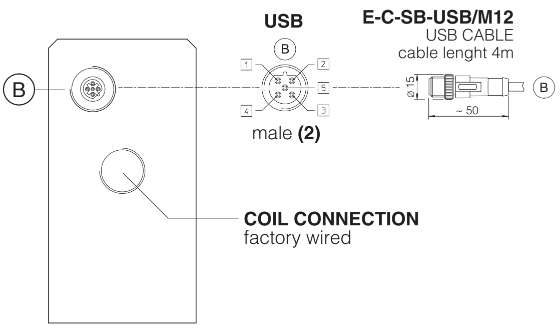


BP - PROFIBUS DP setting:

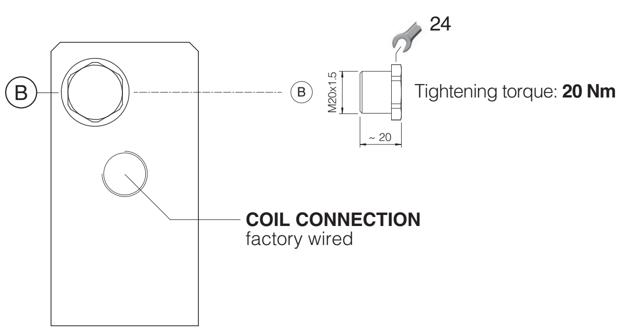
Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF



USB CONNECTOR



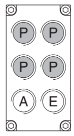
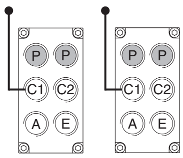
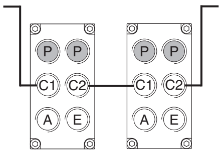
METALLIC PROTECTION CAP - supplied with the valves



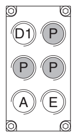
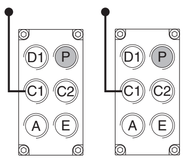
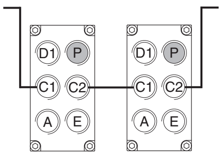
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

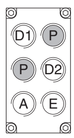
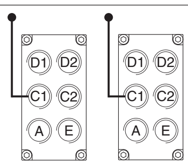
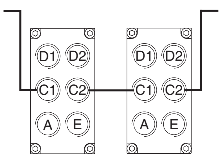
22.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

22.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

22.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland quantity	Cable gland entrance	Threaded plug quantity	Threaded plug entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

23 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-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

23.1 External reference and transducer parameters

Allow to configure the controller 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)

23.2 PID control dynamics parameters

Allow to optimize and adapt the controller 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

23.3 Monitoring parameters

Allow to configure the controller 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 23.4)

23.4 Fault parameters

Allow to configure how the controller detects and reacts 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, controller disabling, etc.)

23.5 Valve characteristics compensation

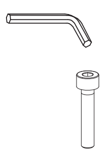
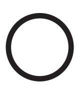
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

23.6 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).

24 FASTENING BOLTS AND SEALS

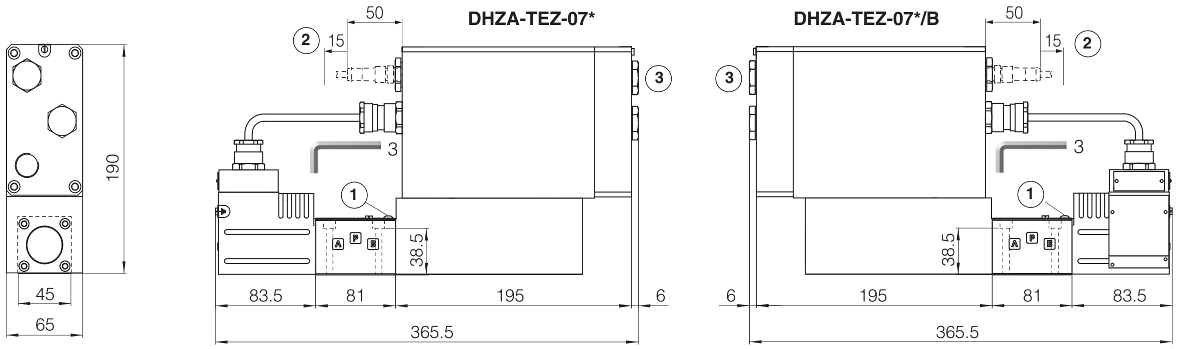
	DHZA	**DKZA**
	**Fastening bolts:** 4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	**Fastening bolts:** 4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm
	**Seals:** 4 OR 108; Diameter of ports A, B, P, T: Ø 7,5 mm (max) 1 OR 2025 Diameter of port Y: Ø = 3,2 mm (only for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

25 INSTALLATION DIMENSIONS [mm]

DHZA-TEZ

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

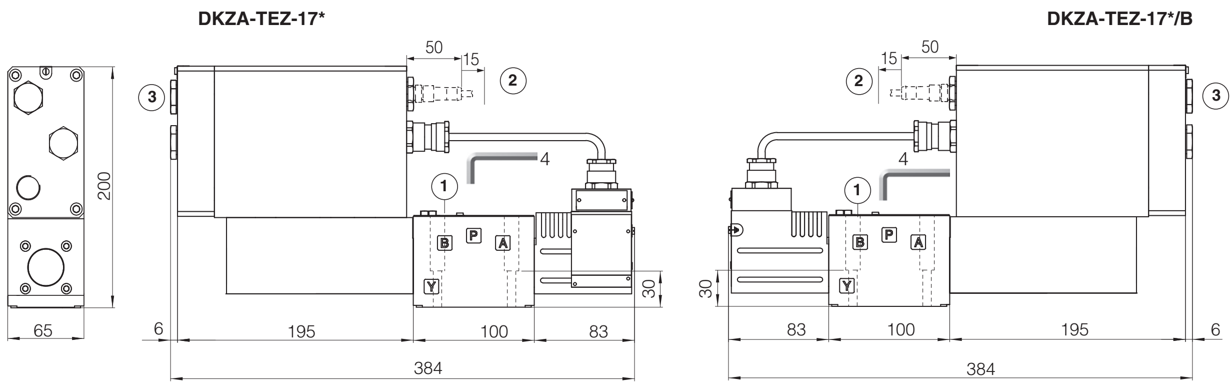
Mass [kg]	
DHZA-TEZ-07	8,9



DKZA-TEZ

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

Mass [kg]	
DKZA-TEZ-17	10,7



1 = Air bleed off

2 = Space to remove the USB connector

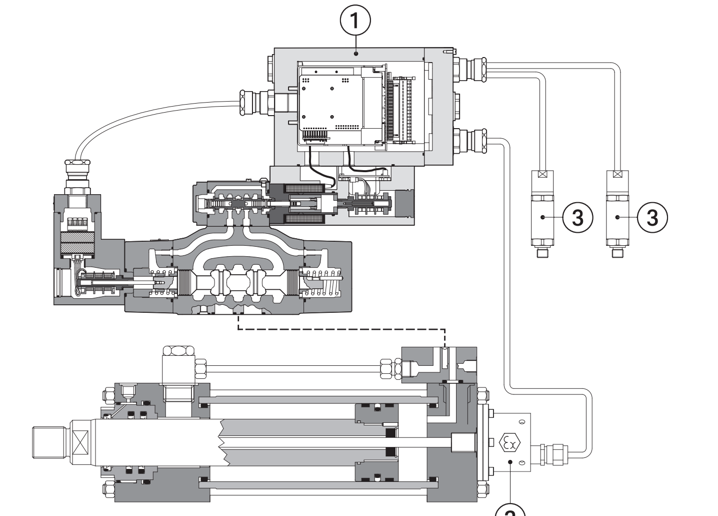
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**GS510**	Fieldbus
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**GX800**	Ex-proof pressure transducer type E-ATRA-7
FX900	Operating and manintenance information for ex-proof proportional valves	**KX800**	Cable glands for ex-proof valves
GS500	Programming tools	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof digital servoproportionals with on-board axis card

piloted, with two LVDT transducers and zero spool overlap - **ATEX and IECEx**



① on-board digital driver + axis card
② transducer to feedback the axis position
③ pressure/force transducers

DPZA-LEZ-D-SF-NP-27*

DPZA-LEZ

Ex-proof digital servoproportional valves equipped with on-board driver plus axis card, two LVDT position transducers (pilot valve and main stage) and zero spool overlap to perform the position control of any linear or rotative hydraulic actuator.

They are certified for safe operations in hazardous environments with potentially explosive atmosphere.

- Multicertification **ATEX** and **IECEx** for gas group **II 2G** and dust category **II 2D**

The controlled actuator has to be equipped with integral or external ex-proof transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

The valve can be operated by an external or internally generated reference position signal, see section 2.

Options SF, SL add the alternated pressure/force control to the basic position one, see section 3.

Size: **10 ÷ 27** ISO 4401
Max flow: **180 ÷ 800 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPZA - LEZ - D - SN - NP - 2 70 - L 5 / M / * * / *

DPZA: Ex-proof servoproportional directional valve, piloted

LEZ = on-board digital driver + axis card, two LVDT transducers

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

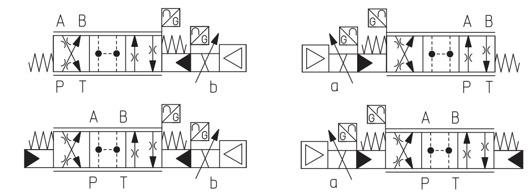
Alternated P/Q controls:
SN = none
SF = force control (2 pressure tranducers)
SL = force control (1 load cell)

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:
1 = 10 **2** = 16 **4** = 25 **4M** = 27

Configuration: **Standard** Option **/B**

60 =
70 =



Seals material, see section 10:
- = NBR
PE = FKM
BT = HNBR

Series number

Hydraulic options (3):
B = solenoid at side of port A **(1)**
D = internal drain
E = external pilot pressure
G = pressure reducing valve for piloting (standard for size 10)

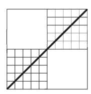
Electronic options (3):
C = current feedback for pressure transducer 4÷20 mA, only for **SF, SL** (omit for std voltage ±10 VDC)
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)

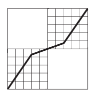
Cable entrance threaded connection:
M = M20x1,5

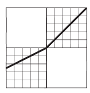
Spool size:	**3** (L)	**5** (L,DL)	**5** (T)
DPZA-1 =	-	100	-
DPZA-2 =	130	200	150
DPZA-4 =	-	340	-
DPZA-4M =	-	390	-

Nominal flow (l/min) at Δp 10bar P-T

Spool type, regulating characteristics:

L =  linear

T =  non linear **(2)**

DL =  differential-linear
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

(1) In standard configuration the solenoid with on-board digital driver and position transducer are at side A of main stage (side B of pilot valve)
(2) Only for configuration 70
(3) For possible combined options consult Atos technical office

2 POSITION REFERENCE MODE

2.1 External reference generation

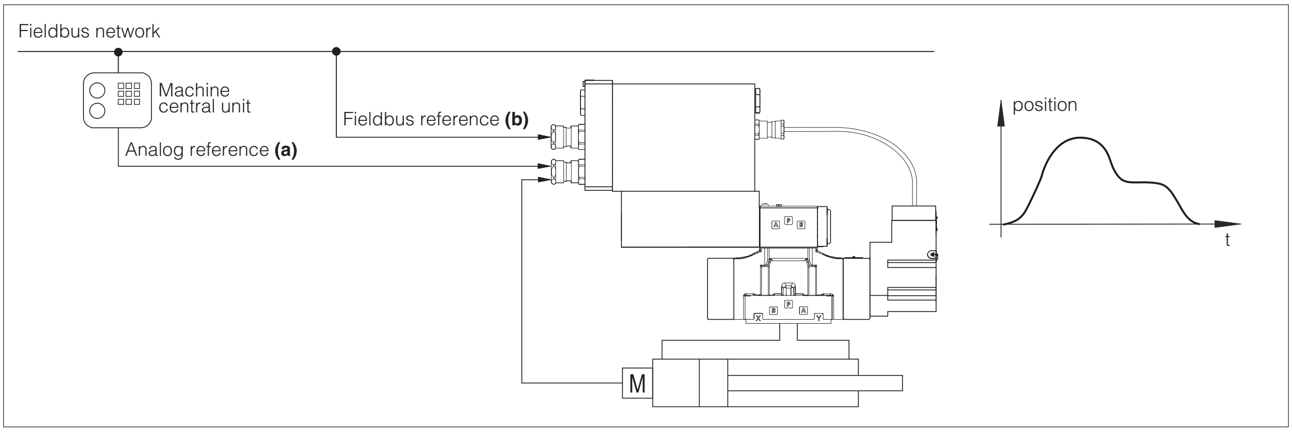
Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

*Analog reference **(a)*** - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the terminal board.

*Fieldbus reference **(b)*** - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.



2.2 Internal reference generation

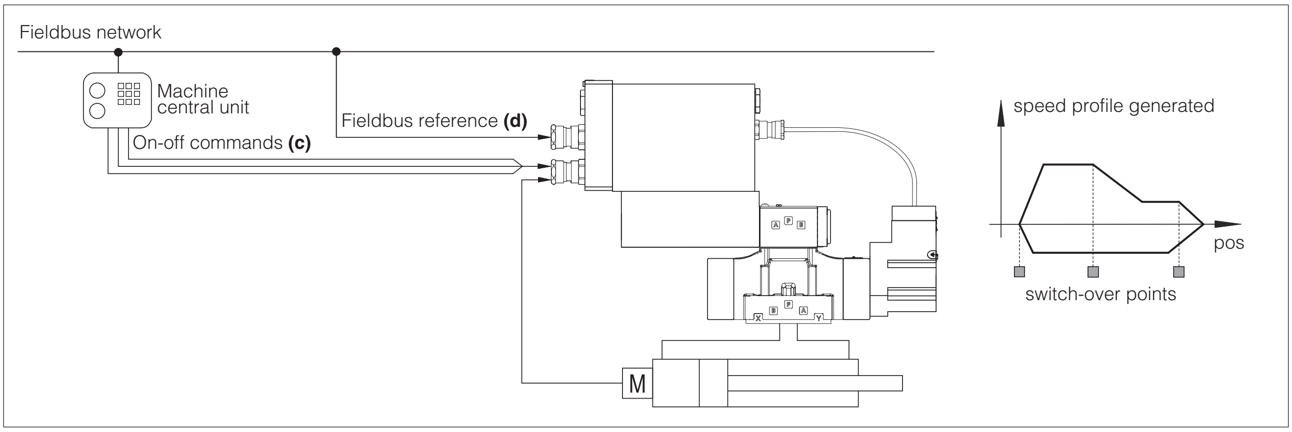
Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

- *on-off commands **(c)***
- *fieldbus commands **(d)***

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



Start / stop / switch-over commands examples

External digital input	on-off commands, on terminal board, are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as ‘Absolute’ but the target position corresponds to the actuator position plus a fixed quote internally set by software
Time	as ‘Absolute’ type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

3 ALTERNATED POSITION / FORCE CONTROL

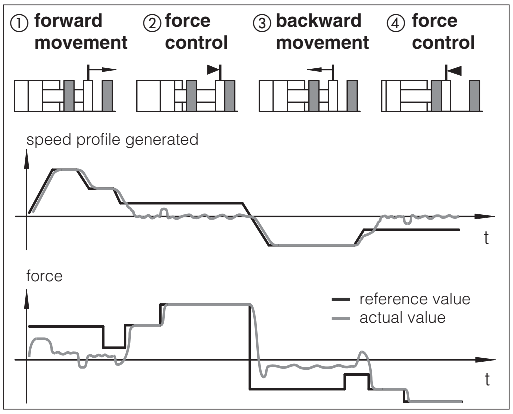
SF and **SL** options add the alternated force closed loop control to the actuator standard position control. Pressure or force remote transducers have to be installed on the actuator and interfaced to the valve driver, see below functional schemes.

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.

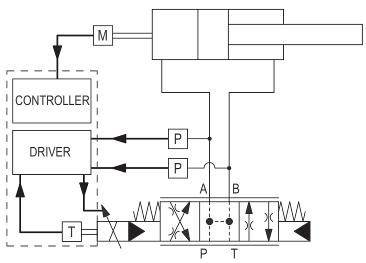
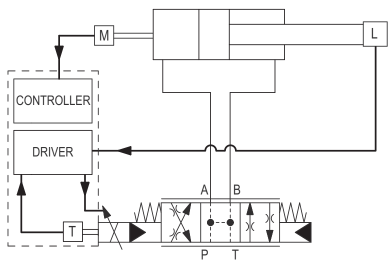
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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 controller 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
	
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 spool transducer	M	actuator 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 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 **FX900** and in the user manuals included in the Z-SW-* programming software.

5 VALVE SETTINGS AND PROGRAMMING TOOLS

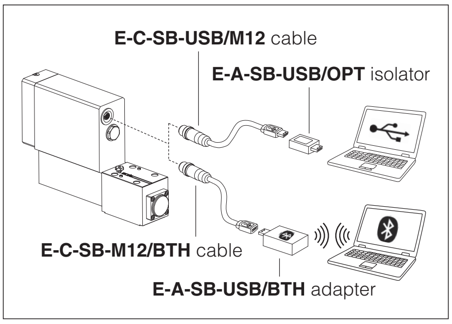
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**).
For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

Z-SW-FULL	support:	NP (USB)		
		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: drivers 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**)

USB or Bluetooth connection



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

6 FIELDBUS - see tech. table GS510

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

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	**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 - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" 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		DPZA-*-1	DPZA-*-2			DPZA-*-4	DPZA-*-4M
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 [l/min]							
Δp P-T	Δp = 10 bar	100	130	200	150	340	390
	Δp = 30 bar	160	220	350	260	590	670
	Max permissible flow	180	320	440	360	680	800
Δp max P-T	[bar]	50	60	60	60	60	60
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
Piloting flow **(1)**	[l/min]	1,7	3,7			6,8	8
Leakage	Pilot [cm^3/min]	100/300	150/450			200/600	200/600
(2)	Main stage [l/min]	0,4/1,2	0,6/2,5			1,0/4,0	1,0/4,0
Response time **(1)**	[ms]	≤ 30	≤ 30			≤ 35	≤ 40
Hysteresis		≤ 0,1 [% of max regulation]					
Repeatability		± 0,1 [% of max regulation]					

(1) 0 ÷100 % step signal and pilot pressure 100 bar
(2) at P = 100/350 bar

9 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)
Max power consumption	35 W
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA 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-ATRA-7 see tech table **GX800**)
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
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, 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

Note: a maximum time of 800 ms (depending on communication type) have be considered between the controller 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 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 www.atos.com or KTF catalog
Max fluid contamination level — 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type	DPZA		
Certifications	Multicertification Group II **ATEX IECEx**		
Solenoid certified code	**OZA-LEZ**		
Type examination certificate **(1)**	• ATEX: TUV IT 18 ATEX 068 X		• IECEx: IECEx TPS 19.0004X
Method of protection	• ATEX 2014/34/EU Ex II 2G Ex db IIC T6/T5/T4 Gb Ex II 2D Ex tb IIIC T85°C/T100°C/T135°C Db		• IECEx Ex db IIC T6/T5/T4 Gb Ex tb IIIC T85°C/T100°C/T135°C Db
Temperature class	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature **(2)**	-40 ÷ +40 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable Standards	EN 60079-0 EN 60079-1	EN 60079-31 IEC 60079-0	IEC 60079-1 IEC 60079-31
Cable entrance: threaded connection	**M** = M20x1,5		

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The controller and solenoids are certified for minimum ambient temperature -40°C.
In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification.**

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Power supply and signals: section of wire = 1,0 mm² **Grounding:** section of external ground wire = 4 mm²

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

13 CABLE GLANDS

Cable glands with threaded connections M20x1,5 for standard or armoured cables have to be ordered separately, see tech table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

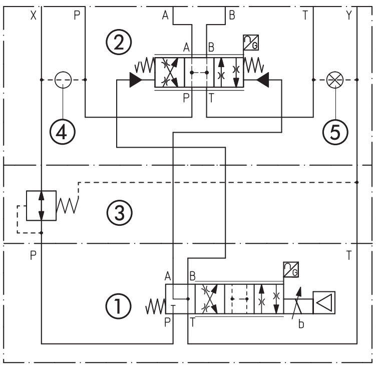
14 HYDRAULIC OPTIONS

B = Solenoid, integral electronics and position transducer at side of port B of the main stage.

D and **E** = Pilot and drain configuration can be modified as shown in section 22.
The valve's standard configuration provides internal pilot and external drain.
For different pilot / drain configuration select:
Option /D Internal drain.
Option /E External pilot (through port X).

G = Pressure reducing valve installed between pilot valve and main body with fixed setting:
DPZA-2 = 28 bar
DPZA-2, -4 and -4M = 40 bar
It is advisable for valves with internal pilot in case of system pressure higher than 150 bar.
Pressure reducing valve is standard for DPZA-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

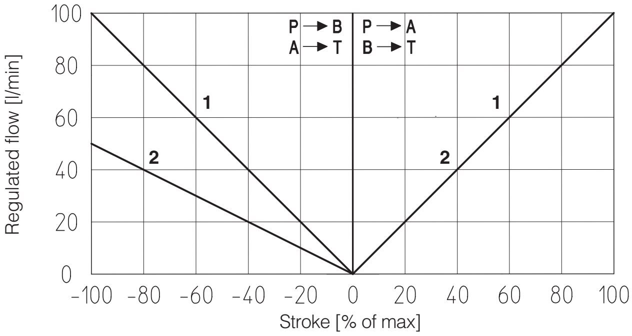
15 ELECTRONIC OPTIONS

I = It provides 4 ÷ 20 mA current reference 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.
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.

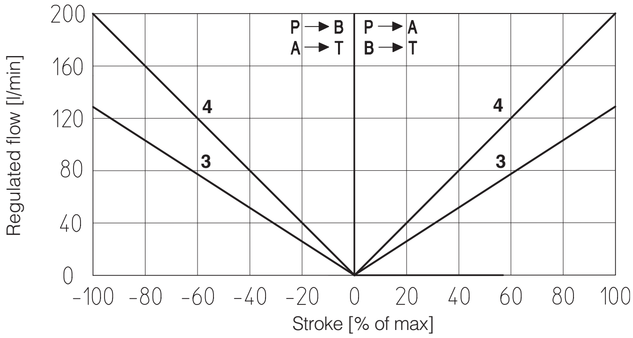
C = Only for **SF, SL**
Option /C is available to connect pressure (force) transducers with 4 ÷ 20 mA current output signal, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

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

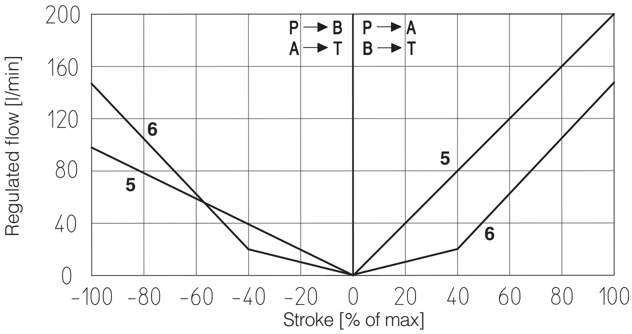
16.1 Regulation diagrams (values measure at Δp 10 bar P-T)



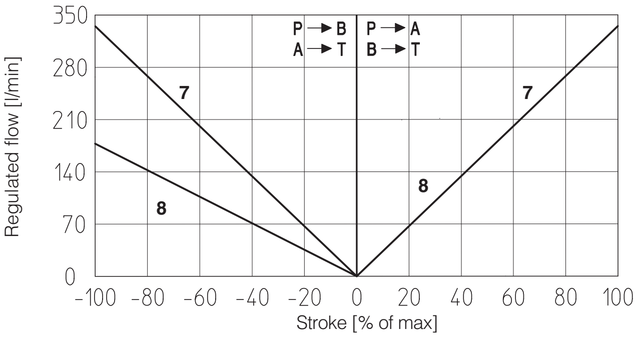
DPZA-1: 1 = L5 **2** = DL5



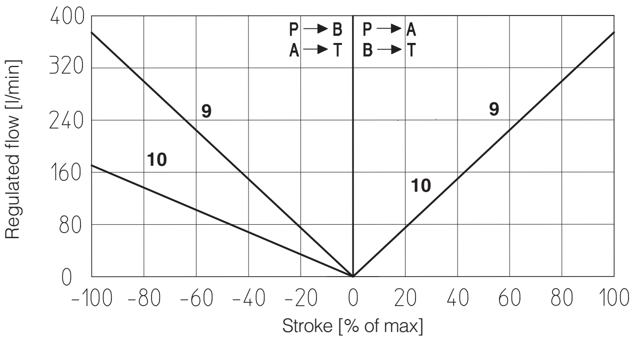
DPZA-2: 3 = L3 **4** = L5



DPZA-2: 5 = DL5 **6** = T5



DPZA-4: 7 = L5 **8** = DL5



DPZA-4M: 9 = L5 **10** = DL5

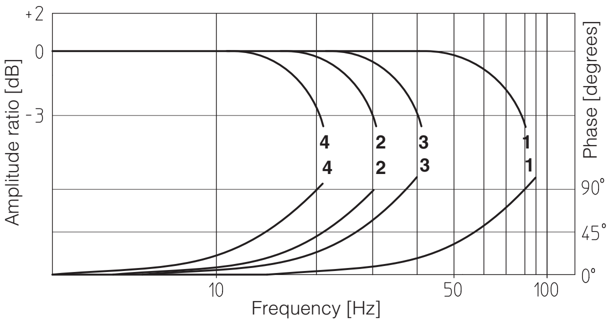
Note: Hydraulic configuration vs. reference signal for configurations 60 and 70 (standard and option /B)

Reference signal 0 ÷ +10 V / 12 ÷ 20 mA } P → A / B → T

Reference signal 0 ÷ - 10 V / 4 ÷ 12 mA } P → B / A → T

16.2 Bode diagrams

Stated at nominal hydraulic conditions.



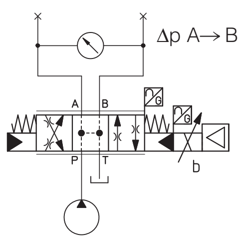
1 = DPZA-1, DPZA-2 } ± 5%

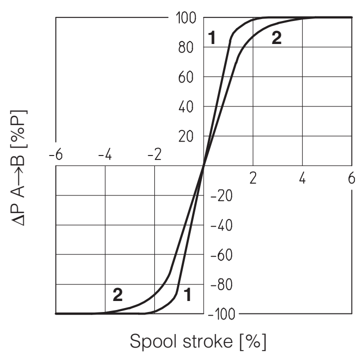
2 = DPZA-1, DPZA-2 } ± 100%

3 = DPZA-4, DPZA-4M } ± 5%

4 = DPZA-4, DPZA-4M } ± 100%

16.3 Pressure gain





1 = DPZA-1

2 = DPZA-2, DPZA-4, DPZA-4M

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, EN-982).

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.

⚠ 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)

The power supply for controller'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 controller's logic on pin 3 and 4, 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 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 10), depends on controller's reference mode, see section 2 :

External analog reference generation (see 2.1): input is used as reference for the controller axis position 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.

Fieldbus/internal reference generation (see 2.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

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

Functionality of F_INPUT+ signal (pin 12), depends on selected controllers' reference mode and alternated control options, see section 3 :
SF, SL controls and external analog reference selected : input is used as reference for the controller pressure/force 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.
SN control or fieldbus/internal reference selected: analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

17.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin 9) proportional to the actual axis position; the monitor output signal can be software set to show other signals available in the controller (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 ÷ 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 **SF**, **SL**

The controller generates an analog output signal (pin 11) according to alternated pressure/force control option:
SN control: output signal is proportional to the actual valve spool position
SF, SL controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the controller (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 ÷ 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 controller, a 24VDC voltage has to be applied on pin 6.
When the Enable signal is set to zero the controller 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 controller (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 controller. Select the correct controller 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 ÷ 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 controller.
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 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 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.

18.2 Pressure/force transducers

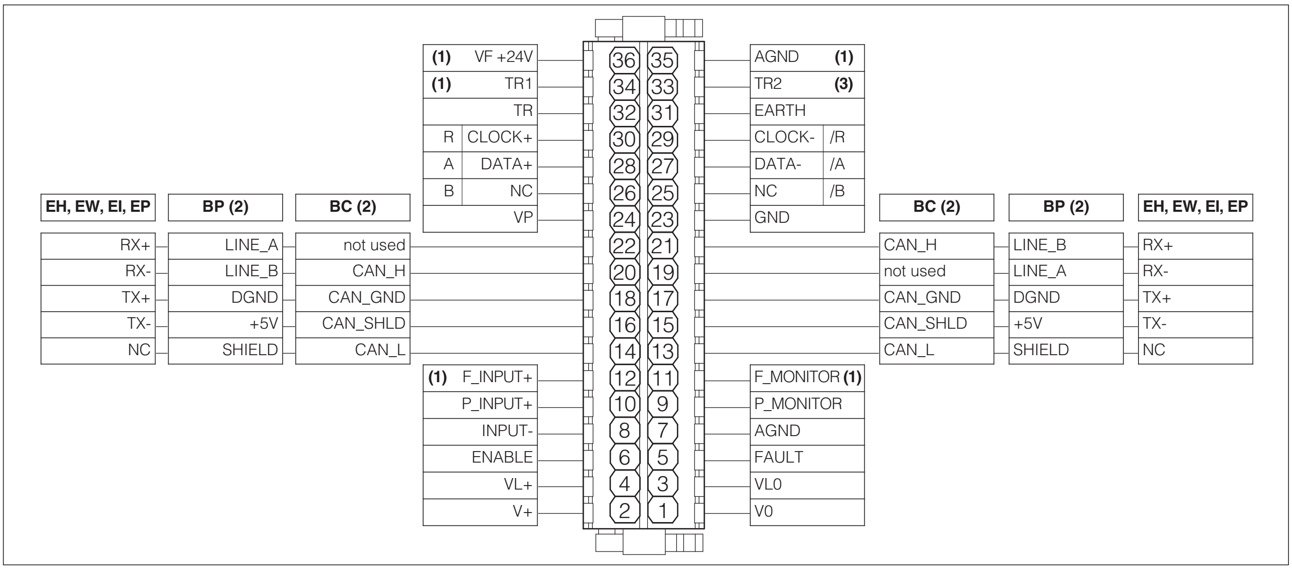
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section 3 .
Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GX800** 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

	Position				**Pressure/Force**
Execution	**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
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 Atos controller **(2)** Percentage of total stroke **(3)** For Balluff BTL7 with SSI interface only special code SA433 is supported

19 TERMINAL BOARD OVERVIEW



(1) Connections available only for **SF**, **SL**
(2) For BC and BP executions the fieldbus connections have an internal pass-through connection
(3) Connection available only for **SF**

20 ELECTRONIC CONNECTIONS

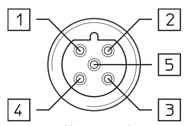
20.1 Main connections signals

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
A	1	**V0**	Power supply 0 VDC	Gnd - power supply
	2	**V+**	Power supply 24 VDC	Input - power supply
	3	**VL0**	Power supply 0 VDC for driver's logic and communication	Gnd - power supply
	4	**VL+**	Power supply 24 VDC for driver's logic and communication	Input - power supply
	5	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to VL0	Output - on/off signal
	6	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0	Input - on/off signal
	7	**AGND**	Analog ground	Gnd - analog signal
	8	**INPUT-**	Negative reference input signal for P_INPUT+ and F_INPUT+	Input - analog signal
	9	**P_MONITOR**	Position monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	10	**P_INPUT+**	Position 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**
	11	**F_MONITOR**	Pressure/Force (SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20mA maximum range, referred to AGND Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Output - analog signal **Software selectable**
	12	**F_INPUT+**	Pressure/Force reference input signal (SF, SL controls): ±10 VDC / ±20 mA max. range Defaults are: ±10 VDC for standard and 4 ÷ 20 mA for /I option	Input - analog signal **Software selectable**
	31	**EARTH**	Internally connected to driver housing	

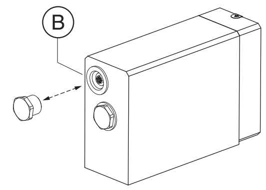
20.2 USB connector - M12 - 5 pin always present

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
B	1	**+5V_USB**	Power supply
	2	**ID**	Identification
	3	**GND_USB**	Signal zero data line
	4	**D-**	Data line -
	5	**D+**	Data line +

Driver view



(female)



20.3 BC fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**CAN_L**	Bus line (low)
	16	**CAN_SHLD**	Shield
	18	**CAN_GND**	Signal zero data line
	20	**CAN_H**	Bus line (high)
	22	**not used**	Pass-through connection **(1)**

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**CAN_L**	Bus line (low)
	15	**CAN_SHLD**	Shield
	17	**CAN_GND**	Signal zero data line
	19	**not used**	Pass-through connection **(1)**
	21	**CAN_H**	Bus line (high)

(1) Pin 19 and 22 can be fed with external +5V supply of CAN interface

20.4 BP fieldbus execution connections

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1	14	**SHIELD**	
	16	**+5V**	Power supply
	18	**DGND**	Data line and termination signal zero
	20	**LINE_B**	Bus line (low)
	22	**LINE_A**	Bus line (high)

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2	13	**SHIELD**	
	15	**+5V**	Power supply
	17	**DGND**	Data line and termination signal zero
	19	**LINE_A**	Bus line (high)
	21	**LINE_B**	Bus line (low)

20.5 EH, EW, EI, EP fieldbus execution connections

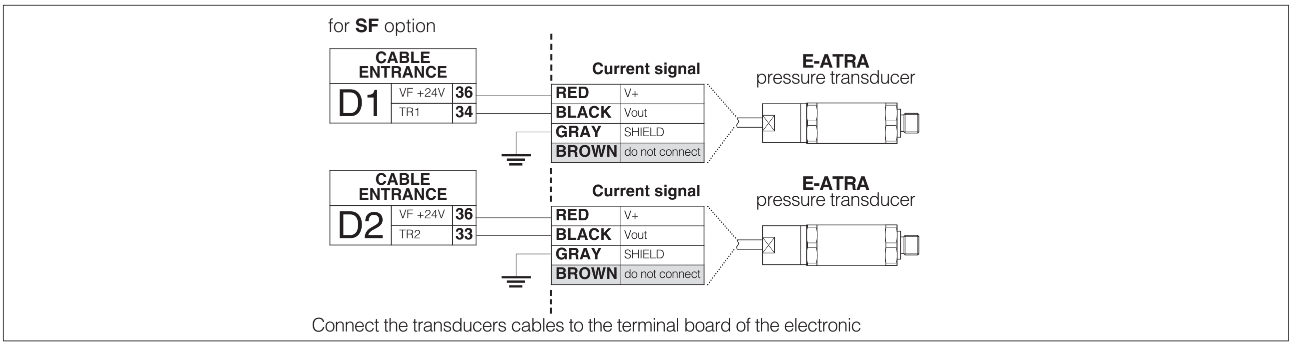
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C1 (input)	14	**NC**	do not connect
	16	**TX-**	Transmitter
	18	**TX+**	Transmitter
	20	**RX-**	Receiver
	22	**RX+**	Receiver

CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
C2 (output)	13	**NC**	do not connect
	15	**TX-**	Transmitter
	17	**TX+**	Transmitter
	19	**RX-**	Receiver
	21	**RX+**	Receiver

20.6 Remote pressure transducer connections - only for **SF**, **SL**

CABLE ENTRANCES	PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	**SL - Single transducer** (1)		**SF - Double transducers** (1)	
					Voltage	**Current**	**Voltage**	**Current**
D1 D2	33	**TR2**	2nd signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	/	/	Connect	Connect
	34	**TR1**	1st signal transducer ±10 VDC / ±20 mA maximum range	Input - analog signal **Software selectable**	Connect	Connect	Connect	Connect
	35	**AGND**	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
	36	**VF +24V**	Power supply +24VDC	Output - power supply	Connect	Connect	Connect	Connect

E-ATRA remote pressure transducer connection - see tech table **GX800**

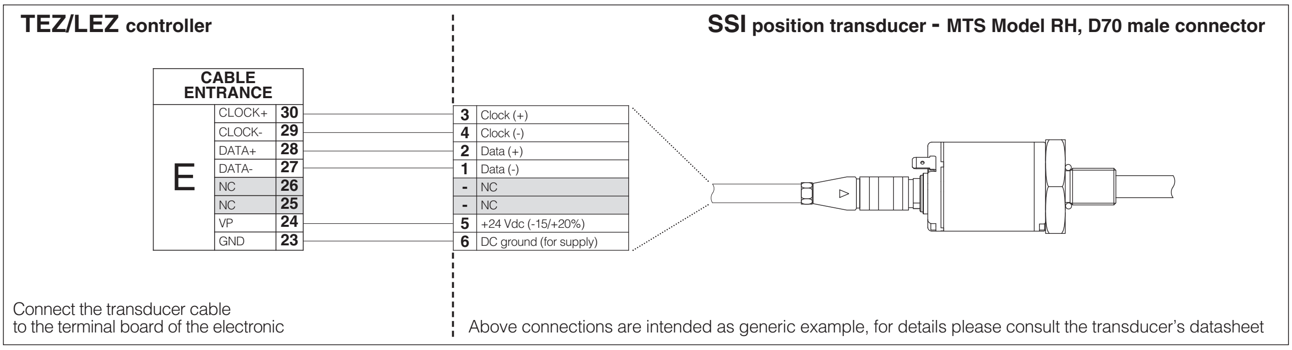


20.7 D execution - Digital position transducers connections

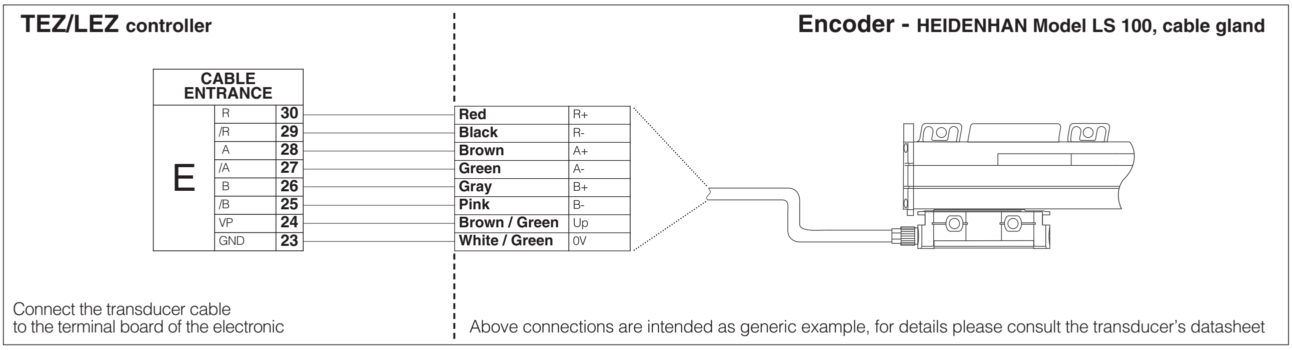
CABLE ENTRANCE	PIN	SSI - default transducer (1)			Encoder (1)		
		SIGNAL	**TECHNICAL SPECIFICATION**	**NOTES**	**SIGNAL**	**TECHNICAL SPECIFICATION**	**NOTES**
E	30	**CLOCK+**	Serial syncronous clock (+)	Input - digital signal	**R**	Input channel R	Input - digital signal
	29	**CLOCK-**	Serial syncronous clock (-)		**/R**	Input channel /R	
	28	**DATA+**	Serial position data (+)		**A**	Input channel A	
	27	**DATA-**	Serial position data (-)		**/A**	Input channel /A	
	26	**NC**	Not connect	Do not connect	**B**	Input channel B	
	25	**NC**			**/B**	Input channel /B	
	24	**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**
	23	**GND**	Common gnd for transducer powerand signals	Common gnd	**GND**	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



Encoder connection - example



20.8 A execution - Analog position transducers connector

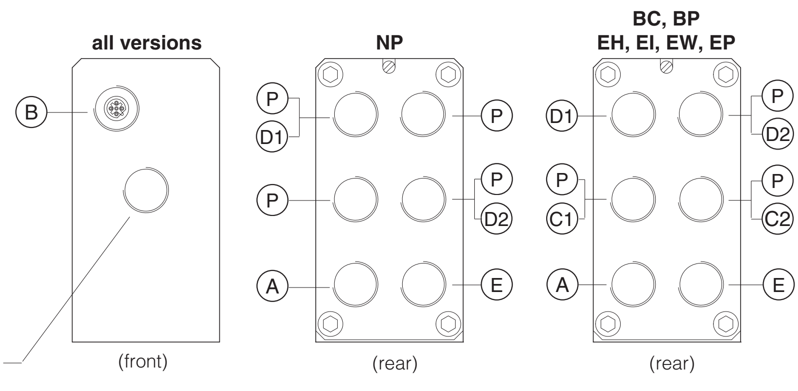
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES
E	32	**TR**	Signal transducer	Input - analog signal
	24	**VP**	Power supply: +24VDC or OFF (default OFF)	Output - power supply **Software selectable**
	23	**GND**	Common gnd for transducer power and signals	Common gnd

21 CONNECTIONS LAYOUT

CABLE ENTRANCE OVERVIEW

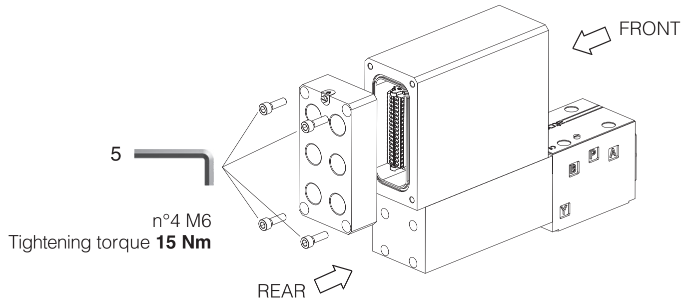
Cables entrance description:

- (A) main connections
- (B) USB connector always present (factory plugged)
- (C1) fieldbus (input)
- (C2) fieldbus (output)
- (D1) pressure transducer 1
- (D2) pressure transducer 2
- (E) position transducer
- (P) threaded plug



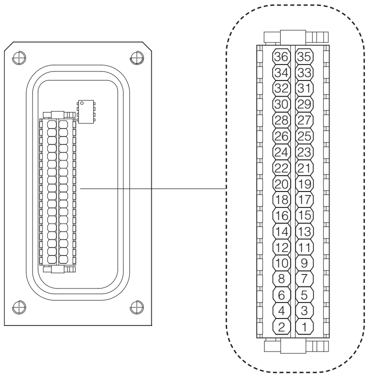
TERMINAL BOARD AND FIELDBUS TERMINATOR

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator

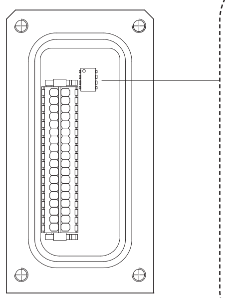


⚠ **WARNING:** the above operation must be performed in a safety area

Terminal board - see section 19



Fieldbus terminator only for BC and BP executions **(1)**



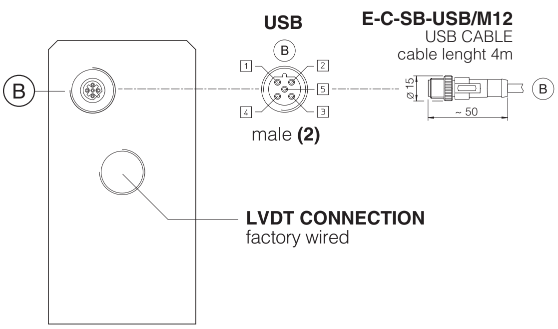
BC - CANopen setting:

Switch	Termination enabled
1	OFF
2	OFF
3	OFF
4	ON

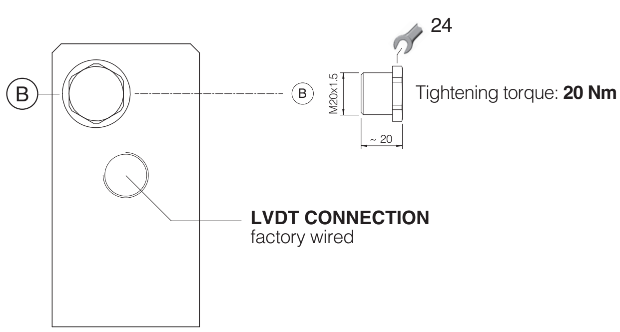
BP - PROFIBUS DP setting:

Switch	Termination enabled
1	ON
2	ON
3	ON
4	OFF

USB CONNECTOR



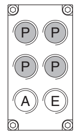
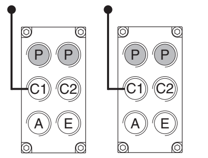
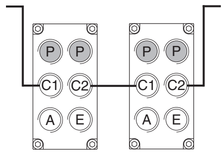
METALLIC PROTECTION CAP - supplied with the valves



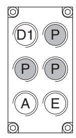
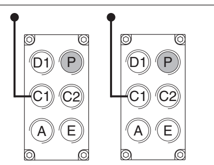
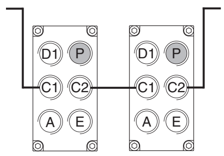
(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF

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

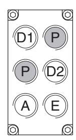
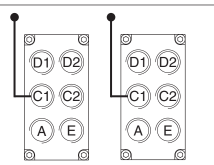
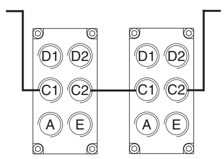
21.1 Cable glands and threaded plug for SN - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	2	A - E	none	none		Cable entrance A, E are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	3	C1 A - E	1	C2		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	4	C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2 are open for costumers Cable entrance P are factory plugged

21.2 Cable glands and threaded plug for SL - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	3	D1 A - E	none	none		Cable entrance A, E, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	4	D1 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "daisy chain" connection	5	D1 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1 are open for costumers Cable entrance P are factory plugged

21.3 Cable glands and threaded plug for SF - see tech table **KX800**

Communication interfaces	To be ordered separately				Cable entrance overview	Notes
	Cable gland		Threaded plug			
	quantity	entrance	quantity	entrance		
NP	4	D1 D2 A - E	none	none		Cable entrance A, E, D1, D2 are open for costumers Cable entrance P are factory plugged
BC, BP, EH, EW, EI, EP "via stub" connection	5	D1 - D2 C1 A - E	1	C2		Cable entrance A, E, C1, C2, D1, D2 are open for costumers
BC, BP, EH, EW, EI, EP "daisy chain" connection	6	D1 - D2 C1 - C2 A - E	none	none		Cable entrance A, E, C1, C2, D1, D2 are open for costumers

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-RA-LEZ - user manual for **TEZ** and **LEZ** with **SN**
Z-MAN-RA-LEZ-S - user manual for **TEZ** and **LEZ** with **SF**, **SL**

22.1 External reference and transducer parameters

Allow to configure the controller 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 controller 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 controller 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 controller detects and reacts 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, controller 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

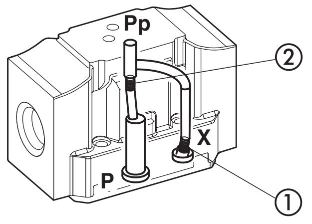
22.6 Motion phases parameters

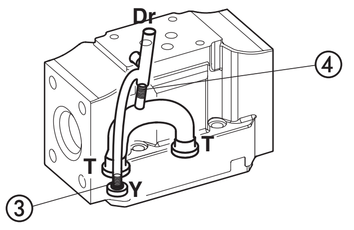
When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

23 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

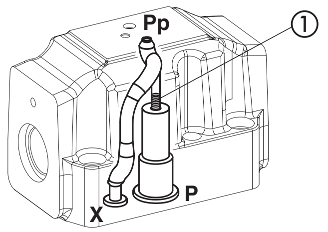
DPZA-1 **Pilot channels** **Drain channels**

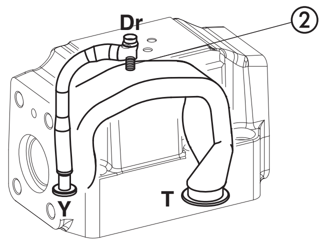




Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

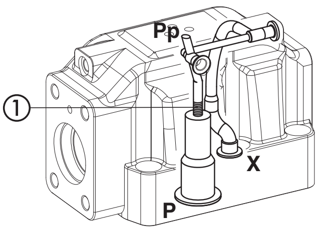
DPZA-2 **Pilot channels** **Drain channels**

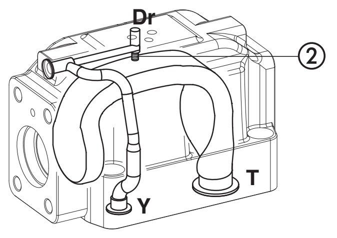




Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZA-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.

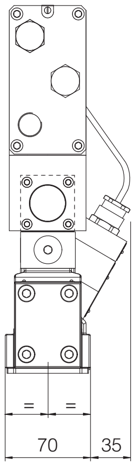
24 FASTENING BOLTS AND SEALS

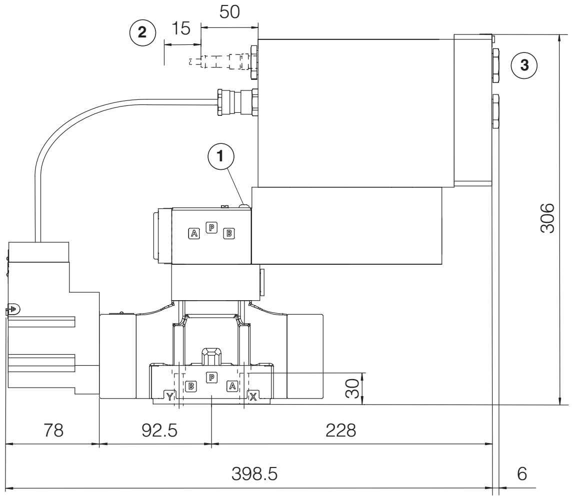
Type	Size	Fastening bolts	Seals
DPZA	**1** = 10	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	2 = 16	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head 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)

DPZA-LEZ-*-1

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

Mass [kg]	
DPZA-*-17*	13,7
Option /G	+0,9

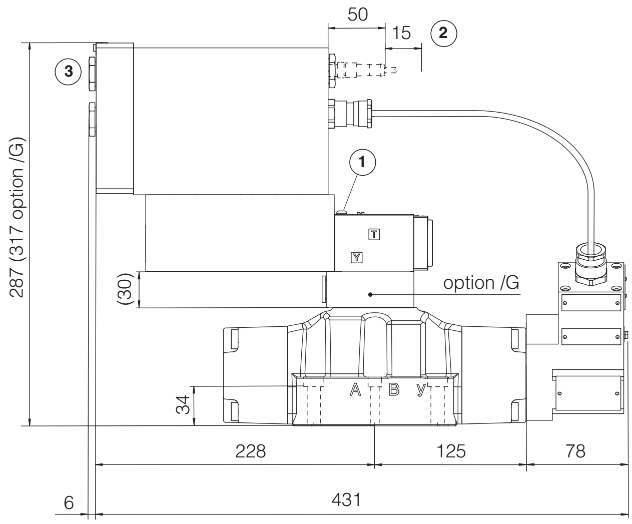


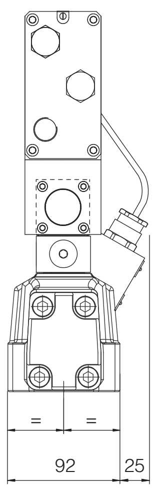


DPZA-LEZ-*-2

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

Mass [kg]	
DPZA-*-27*	17,9
Option /G	+0,9





1 = Air bleed off

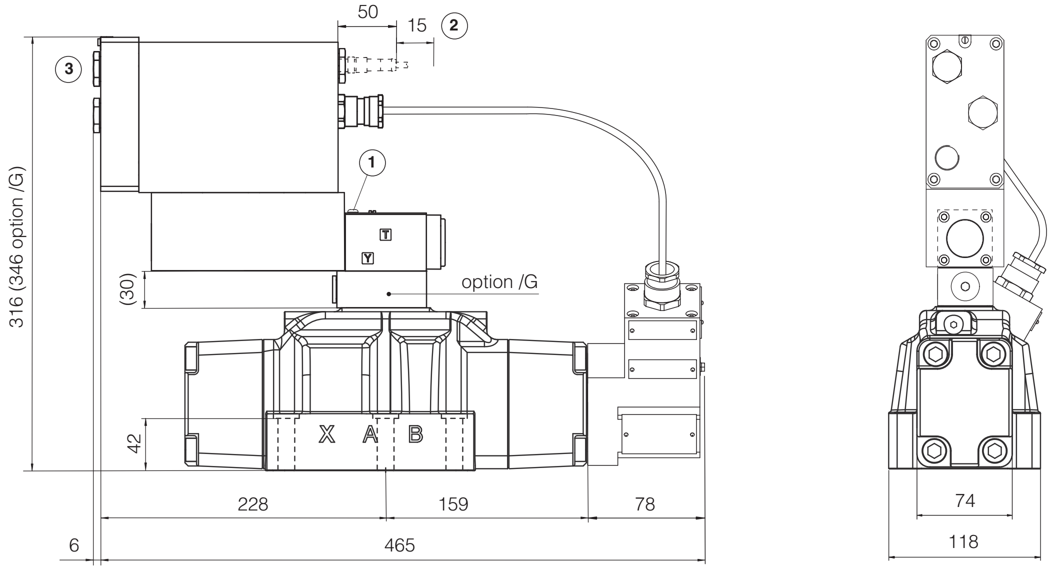
2 = Space to remove the USB connector

3 = The dimensions of cable glands must be considered (see tech table **KX800**)

DPZA-LEZ-*-4
DPZA-LEZ-*-4M

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

Mass [kg]	
DPZA-*-4*	23,1
DPZA-*-4M*	23,1
Option /G	+0,9



1 = Air bleed off

2 = Space to remove the USB connector

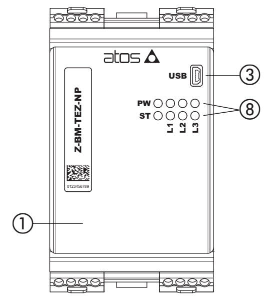
3 = The dimensions of cable glands must be considered (see tech table **KX800**)

26 RELATED DOCUMENTATION

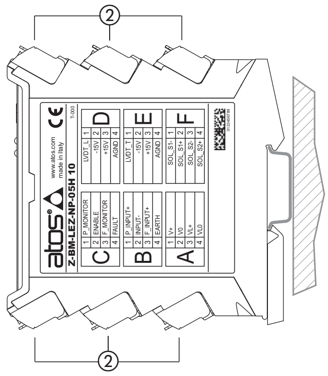
X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
FX900	Operating and manintenance information for ex-proof proportional valves
GS500	Programming tools
GS510	Fieldbus
GX800	Ex-proof pressure transducer type E-ATRA-7
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves

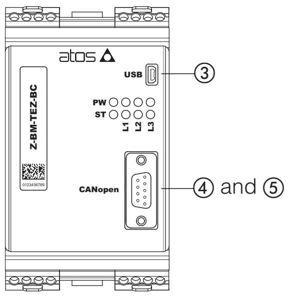
Digital Z-BM-TEZ/LEZ axis cards with driver functionality

DIN-rail format, for position and force controls

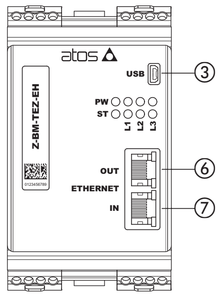


Z-BM-TEZ- **NP** Not Present

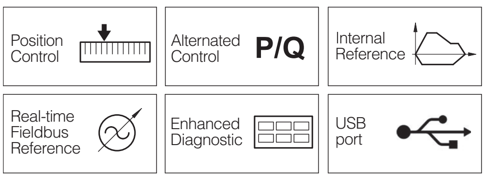




Z-BM-TEZ- **BC** CANopen
BP PROFIBUS DP



Z-BM-TEZ- **EH** EtherCAT
EW POWERLINK
EI EtherNet/IP
EP PROFINET RT/IRT



Z-SW-FULL
programming software

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 integral or external position transducer (analog, SSI or Encoder) to feedback the axis position.
The controller is operated by an external or internally generated reference position signal (see section 4).
A pressure/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 controller; a second pressure/force reference signal is required.
Atos PC software allows to customize the controller 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'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

Z-BM - **TEZ** - **NP** - **01H** / * * / *

Z-BM = Off-board electronic axis card in DIN rail format

TEZ = digital full driver + axis card, for valves with one LVDT transducer
LEZ = digital full driver + axis card, for valves with two LVDT transducers

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

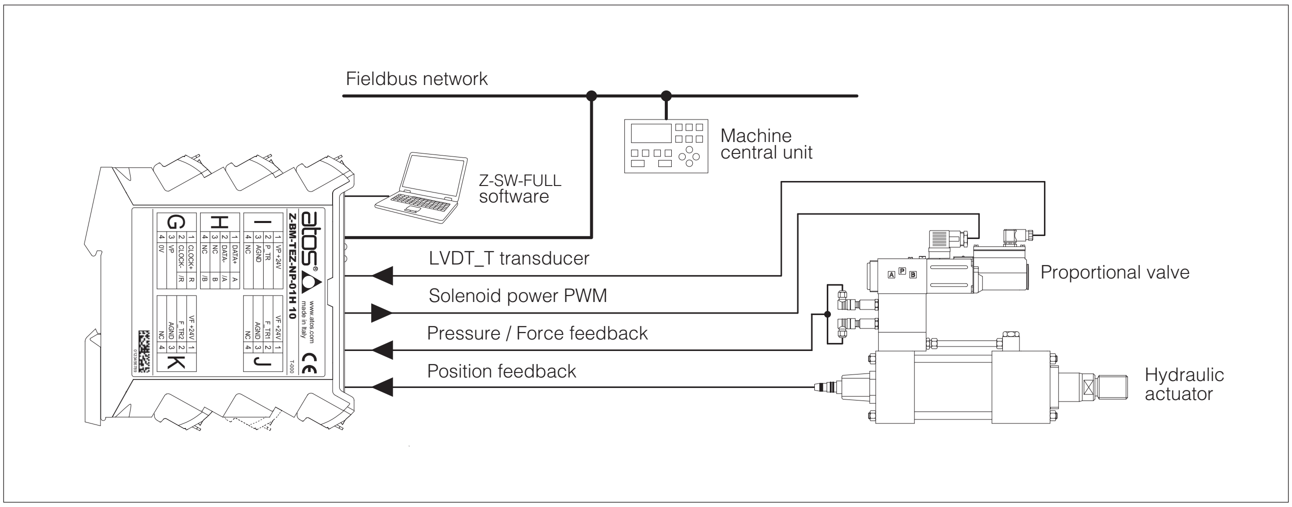
01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for **TEZ**)

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

Series number

Set code (see section 9)

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional		
Standard Data sheet	**DHZO-T, DKZOR-T** F165	**DLHZO-T, DLKZOR-T** F180	**DPZO-L** F175
Ex-proof Data sheet	-	**DLHZA-T, DLKZA-T** FX140	-
Controller model	**Z-BM-TEZ**		**Z-BM-LEZ**

4 POSITION REFERENCE MODE

4.1 External reference generation

Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

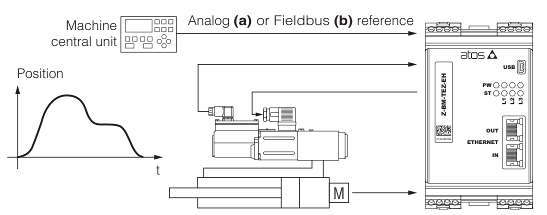
The external reference signal can be software selected among:

*Analog reference **(a)*** - the controller receives in real time the reference signal from the machine electronic central unit by means analog input (see 8.2) limiting speed, acceleration and deceleration values.

*Fieldbus reference **(b)*** - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication limiting speed, acceleration and deceleration values.

For fieldbus communication details, please refer to the controller user manual.

External reference generation



4.2 Internal reference generation

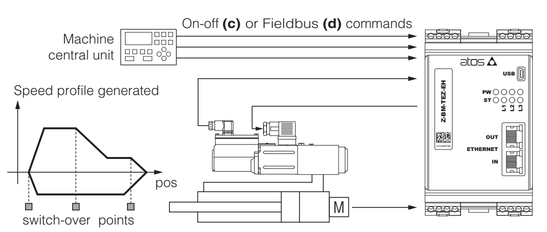
Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer. The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means of:

- *on-off commands **(c)***
- *fieldbus commands **(d)***

Atos PC software allows to design a customized sequence of motion phases through a range of pre-defined standard commands.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.

Internal reference generation



Start / stop / switch-over commands examples

External digital input on-off commands are used to start/stop the cycle generation or to change the motion phase

External fieldbus input on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase

Switch by position switch-over from actual to following motion phase occurs when the actual position reaches a programmed value

Switch by time switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

Switch by internal status switch-over from internal status are used to start/stop the cycle generation or to change the motion phase

Reference generation types examples

Absolute a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control

Relative as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software

5 ALTERNATED POSITION / FORCE CONTROL

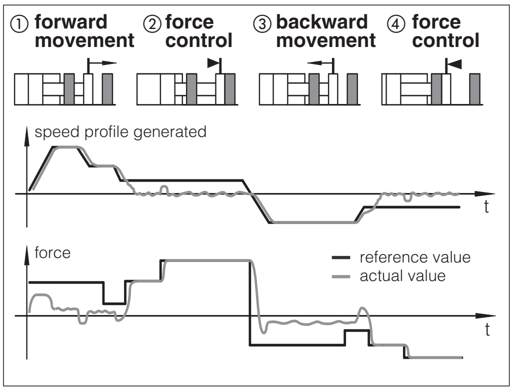
Alternated pressure or force closed loop control can be added to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

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.

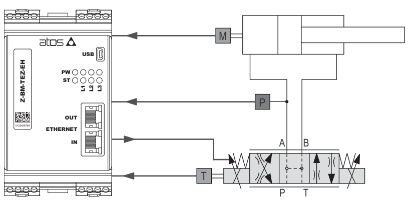
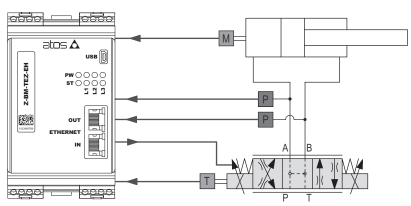
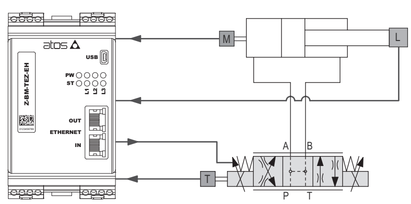
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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 controller 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

SP	SF	SL
		
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

T valve's spool transducer	M actuator's position transducer	P pressure transducer	L load cell

SP – position/pressure control
Adds pressure control to standard position 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.

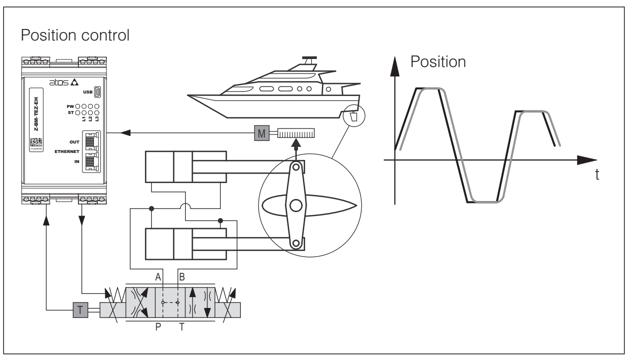
SF – position/force control
Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

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 **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

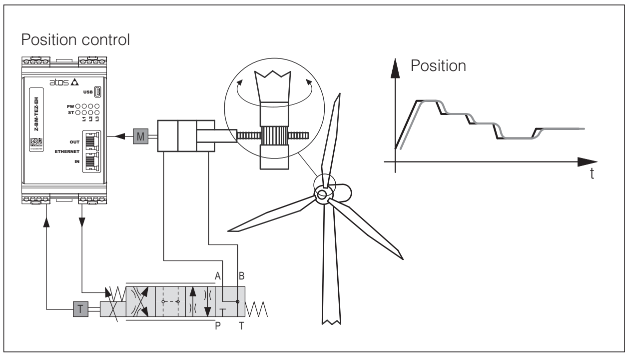


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ controllers 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

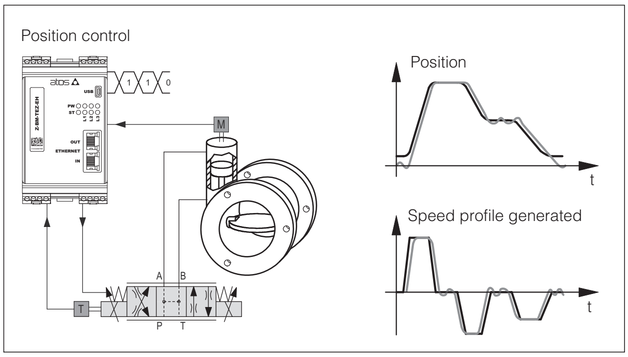


Wind turbines

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 controllers 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

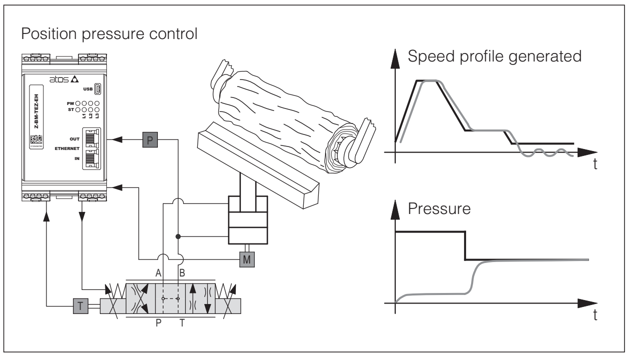


Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

Z-BM-TEZ/LEZ controllers 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

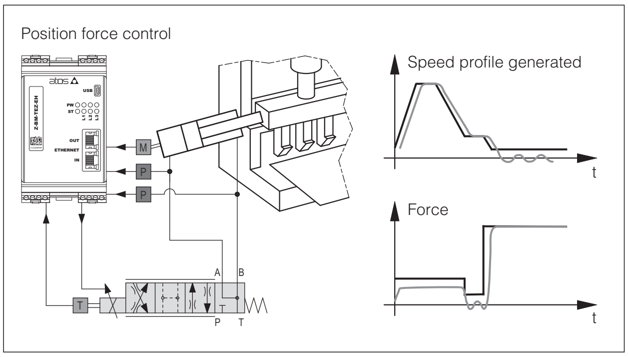


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ controllers 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 controller state indication

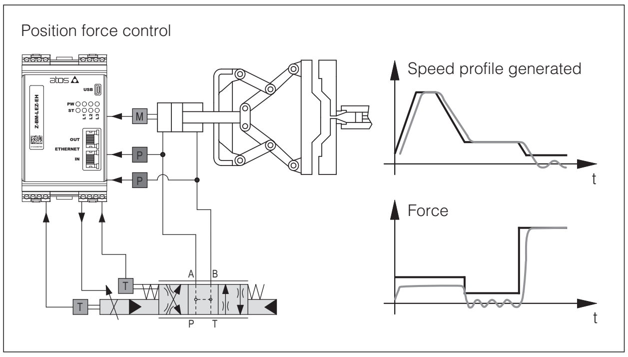


Bending Machines

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 controller 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 controllers, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

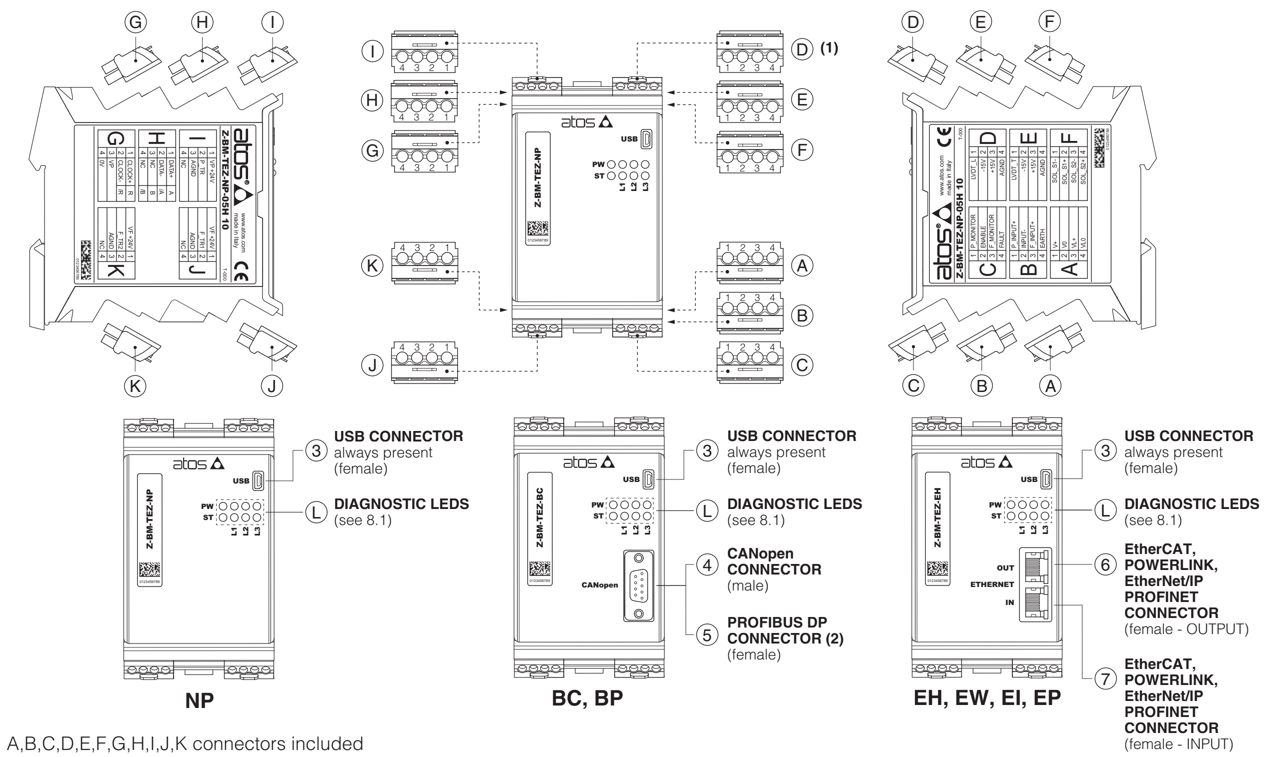
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and 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 driver I_{MAX} = 2.5 A for ex-proof driver (**/A option**)			
Analog input signals (see 10.3, 10.4)	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 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: Ri > 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			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	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 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.

8 CONNECTIONS AND LEDS



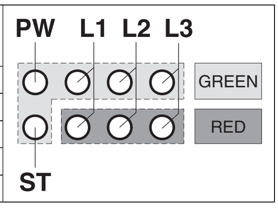
A,B,C,D,E,F,G,H,I,J,K connectors included

(1) D connector is available only for Z-BM-LEZ-**-01H
(2) 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 controller operative conditions for immediate basic diagnostics. Please refer to the controler 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			
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 V_{DC} (see 10.1)	Input - power supply
	A2	**V0**	Power supply 0 V_{DC} (see 10.1)	Gnd - power supply
	A3	**VL+**	Power supply 24 V_{DC} for driver's logic and communication (see 10.2)	Input - power supply
	A4	**VL0**	Power supply 0 V_{DC} for driver's logic and communication (see 10.2)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 V_{DC} / ±20 mA maximum range. default is ±10 V_{DC} (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+**	Pressure/Force reference input signal (SP, SF, SL controls): ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 10.4)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND; default is ±10 V_{DC} (see 10.5)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the controller, referred to VL0 (see 10.7)	Input - on/off signal
	C3	**F_MONITOR**	Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND; default is ±10 V_{DC} (see 10.6)	Output - analog signal **Software selectable**
	C4	**FAULT**	Fault (0 V_{DC}) or normal working (24 V_{DC}), referred to VL0 (see 10.8)	Output - on/off signal
D (1)	D1	**LVDT_L**	Main stage valve position transducer signal (see 10.11)	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	E1	**LVDT_T**	Direct valve or pilot valve position transducer signal (see 10.11)	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
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: +24V_{DC}, +5V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 10.9)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 10.10)	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: +24V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 10.10)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power and signals	Common gnd
	K4	**NC**	Do not connect	

(1) D connector is available only for Z-BM-LEZ-**-01H

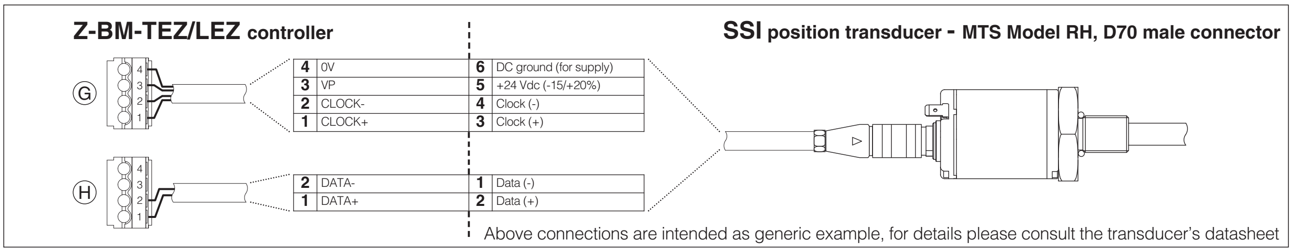
8.3 SSI connectors signals - 4 pin

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

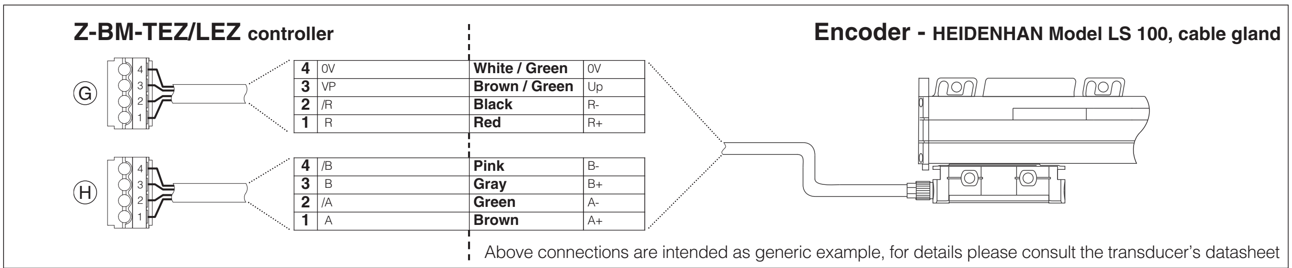


8.4 Encoder connectors signals - 4 pin

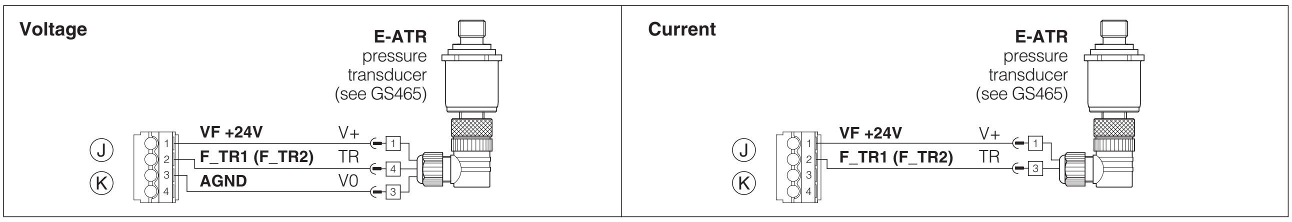
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: +24VDC , +5VDC or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

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

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	**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 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 controllers's model code (see section 1). For correct set code selection, please include in the controller order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 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 **F003** 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 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.

10.2 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 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, 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.

10.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on controllers' reference mode, see section 4 :
external analog reference generation (see 4.1): input is used as reference for the controller position 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}

fieldbus/internal reference generation (see 4.2)*:* analog reference input signal can be used as on-off commands with input range 0 ÷ 24V_{DC}.

10.4 Pressure or force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected controllers' reference mode and alternated control options, see section 5 :
SP, SL, SF controls and external analog reference selected : input is used as reference for the controller 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/internal 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 controller 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 controller (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 Pressure or force monitor output signal (F_MONITOR)

The controller generates an analog output signal (pin C3) according to alternated pressure/force control option:
SN control: output signal is proportional to the actual valve spool positio
SP, SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the controller (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 controller, a 24V_{DC} voltage has to be applied on pin C2
When the Enable signal is set to zero the controller 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 controller (solenoid short circuits/not connected, reference or transducer signalcable 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 controller. 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) - SP, SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the controller.
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 controller 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 driver 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 controllers, 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 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 both alternated position/pressure and 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

	Position			**Pressure/Force**
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 VDC	+5 VDC or +24 VDC	+5 VDC or +24 VDC	+24 VDC
Controller 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 controller **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

12 VALVE SETTINGS AND PROGRAMMING TOOLS

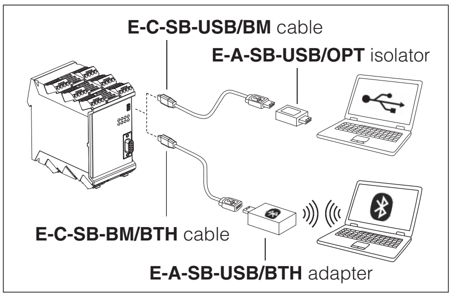
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**). For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

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

Z-SW-FULL	support:	NP (USB)	PS (Serial)	IR (Infrared)
		BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

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

USB or Bluetooth connection



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

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 controller 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 controller 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 controller 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 controller 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, controller disabling, etc.)

13.5 Valve characteristics compensation

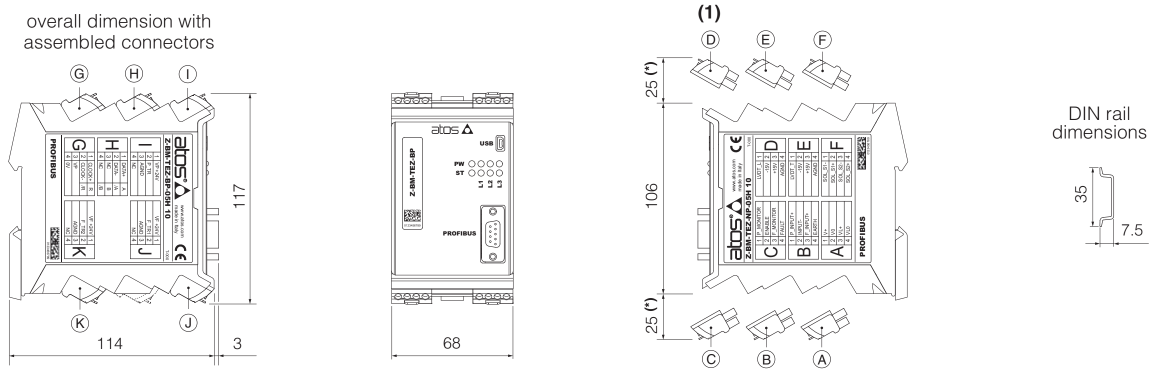
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:
- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

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]

overall dimension with assembled connectors



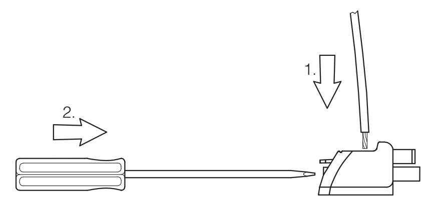
A,B,C,D,E,F,G,H,I,J,K connectors included

(*) Space to remove the connectors

(1) D connector is available only for Z-BM-LEZ-**-01H

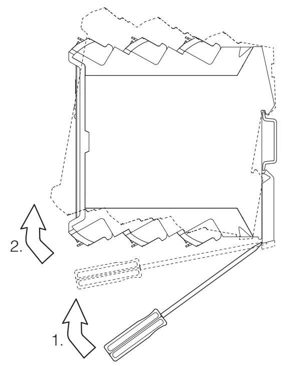
15 INSTALLATION

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 controller from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the controller



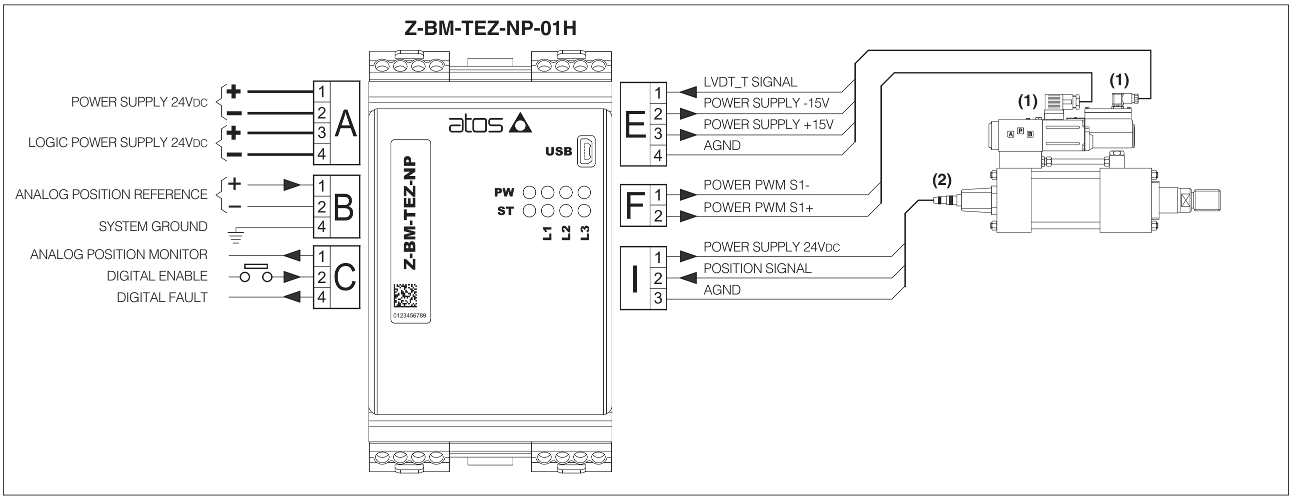
To extract the connectors:
1. push lever
2. pull connector

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,D,E,F,G,H,I,J,K)

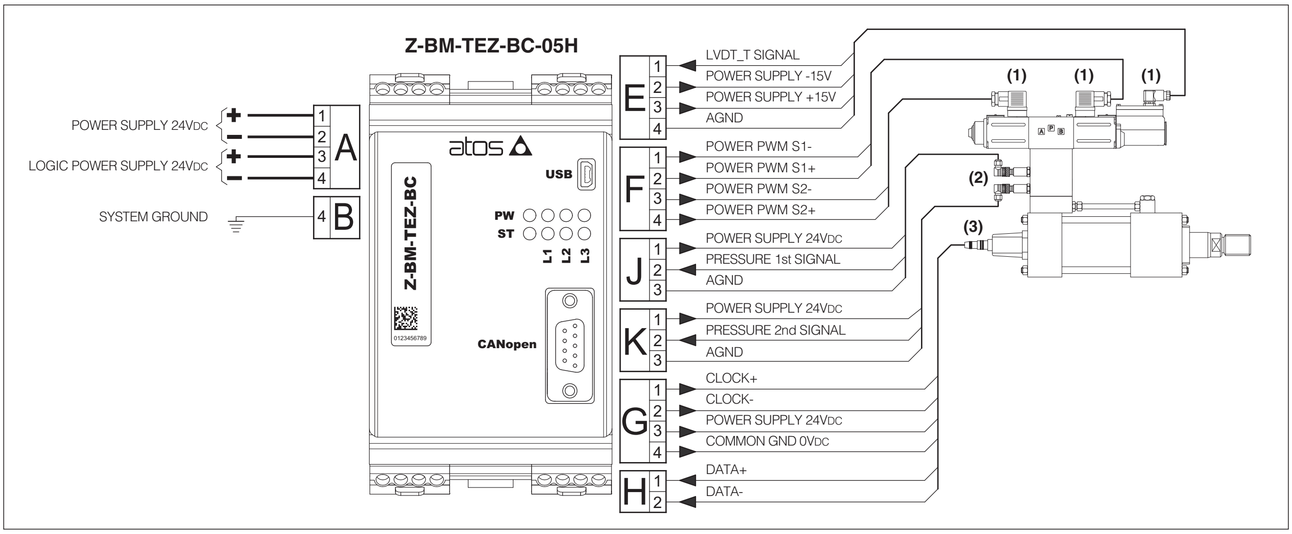
16 WIRING EXAMPLES

16.1 Position control - analog reference - analog position transducer



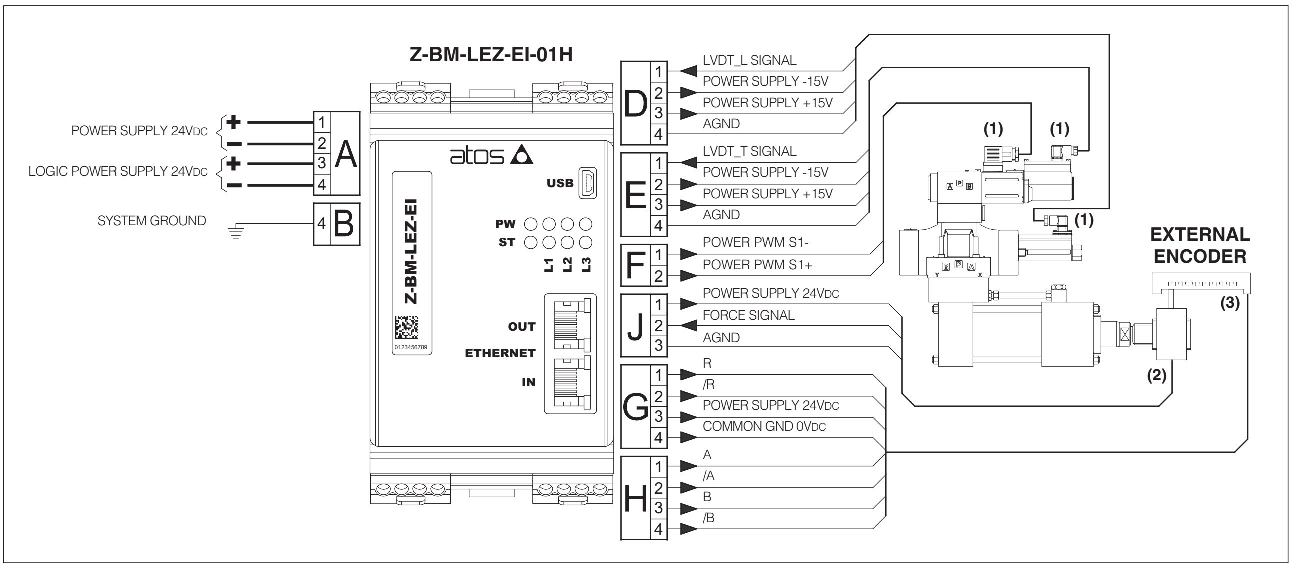
(1) For valve electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer's datasheet

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's datasheet

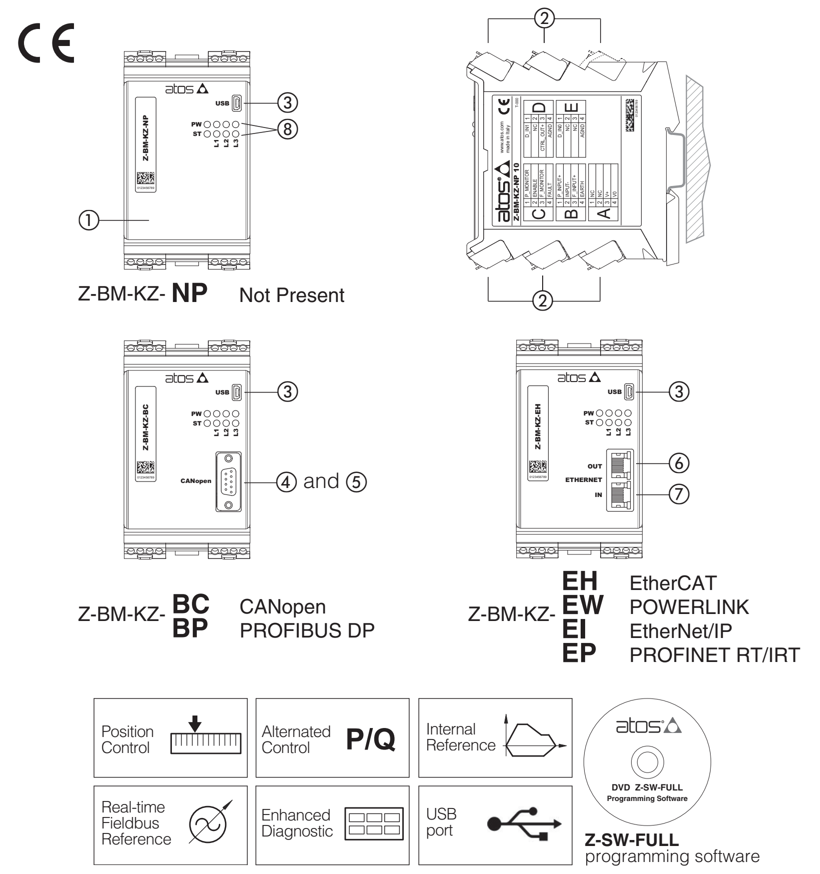
16.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(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's datasheet

Digital Z-BM-KZ axis cards

DIN-rail format, for position and force controls



Connectors ② included

Z-BM-KZ

Digital axis cards ① perform the position closed loop of linear or rotative hydraulic axes.
The controller generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The controlled actuator has to be equipped with integral or external position transducer (analog, SSI or Encoder) to feed-back the axis position.
The controller is operated by an external or internally generated reference position signal (see section 4).
A pressure/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 controller; a second pressure/force reference signal is required.
Atos PC software allows to customize the controller 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 ÷ +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'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

Z-BM - **KZ** - **NP** *

Z-BM: Off-board electronic axis card in DIN rail format

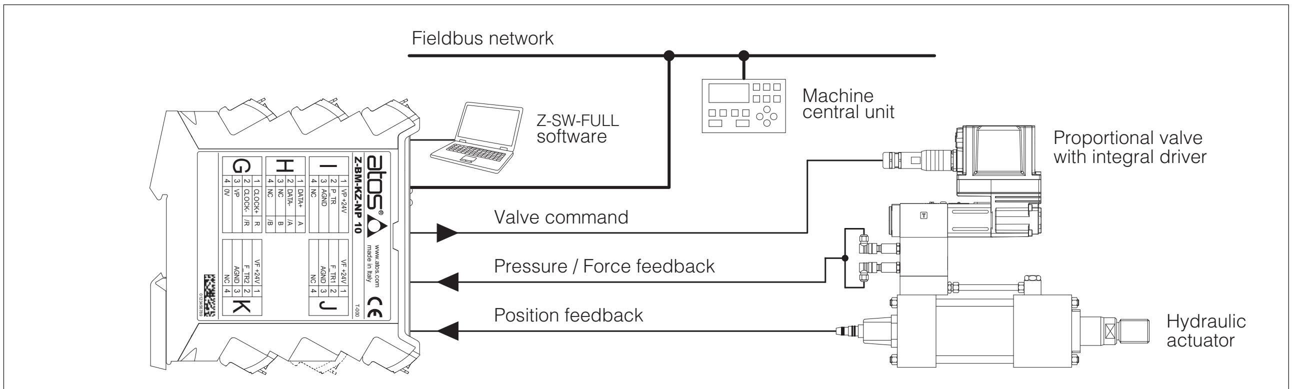
KZ: Alternated position / force (or position / pressure) control module

*: Series number

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

2 BLOCK DIAGRAM EXAMPLE



Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

Valves	Directional					
Standard Data sheet	**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 Data sheet	-	**DHZA-TES, DKZA-TES** FX135	-	**DLHZA-TES, DLKZA-TES** FX150	-	**DPZA-LES** FX235
Controller model	**Z-BM-KZ**					

4 POSITION REFERENCE MODE

4.1 External reference generation

Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer. It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

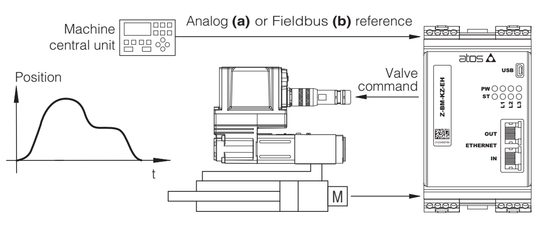
The external reference signal can be software selected among:

*Analog reference **(a)*** - the controller receives in real time the reference signal from the machine electronic central unit by means analog input (see 8.2) limiting speed, acceleration and deceleration values.

*Fieldbus reference **(b)*** - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication limiting speed, acceleration and deceleration values.

For fieldbus communication details, please refer to the controller user manual.

External reference generation



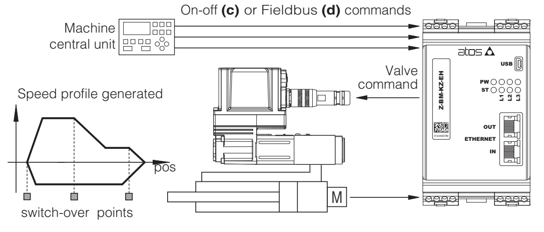
4.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means of:

- *on-off commands **(c)***
- *fieldbus commands **(d)***

Internal reference generation



Atos PC software allows to design a customized sequence of motion phases through a range of pre-defined standard commands.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.

Start / stop / switch-over commands examples

External digital input	on-off commands are used to start/stop the cycle generation or to change the motion phase
External fieldbus input	on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase
Switch by position	switch-over from actual to following motion phase occurs when the actual position reaches a programmed value
Switch by time	switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation
Switch by internal status	switch-over from internal status are used to start/stop the cycle generation or to change the motion phase

Reference generation types examples

Absolute	a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control
Relative	as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software

5 ALTERNATED POSITION / FORCE CONTROL

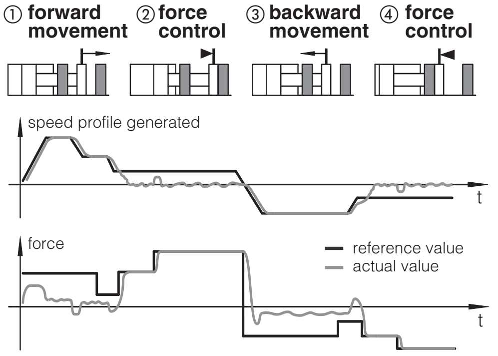
Alternated pressure or force closed loop control can be added to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

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.

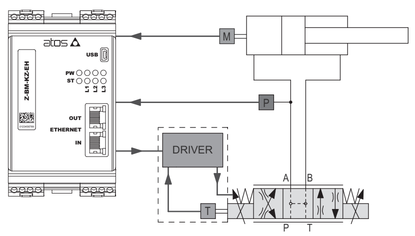
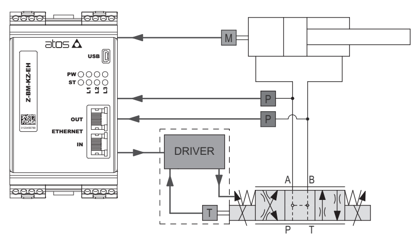
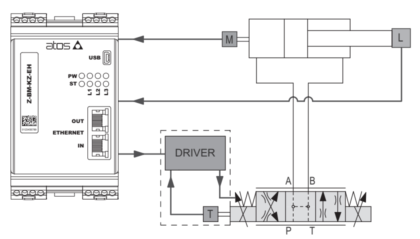
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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 controller 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.



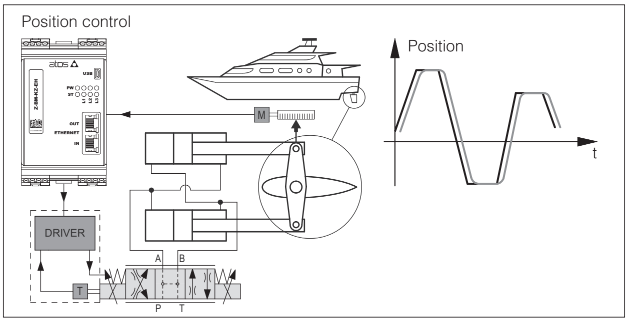
Alternated control configurations - software selectable

SP	SF	SL
		
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

T	valve's spool transducer	M	actuator's position transducer	P	pressure transducer	L	load cell

SP – position/pressure control
Adds pressure control to standard position 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 – 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 **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

6 APPLICATION EXAMPLES

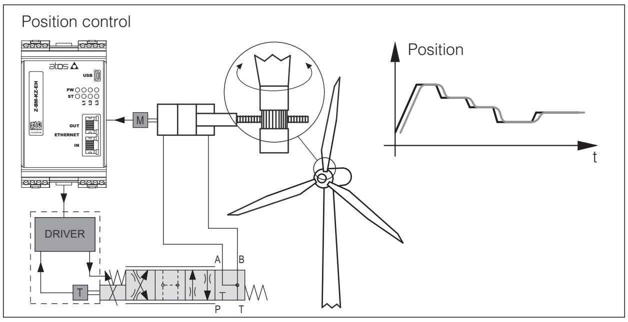


Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-KZ controllers 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

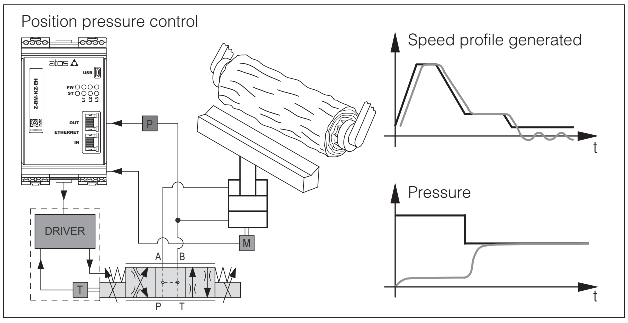


Wind turbines

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 controllers 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

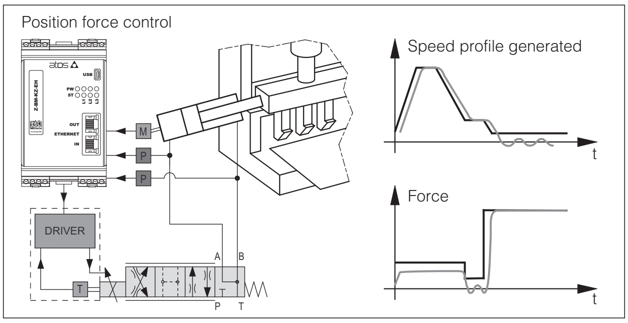


Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-KZ controllers 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 controller state indication

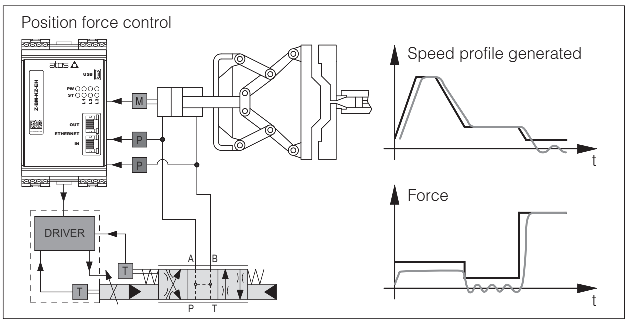


Bending Machines

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 controller 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.

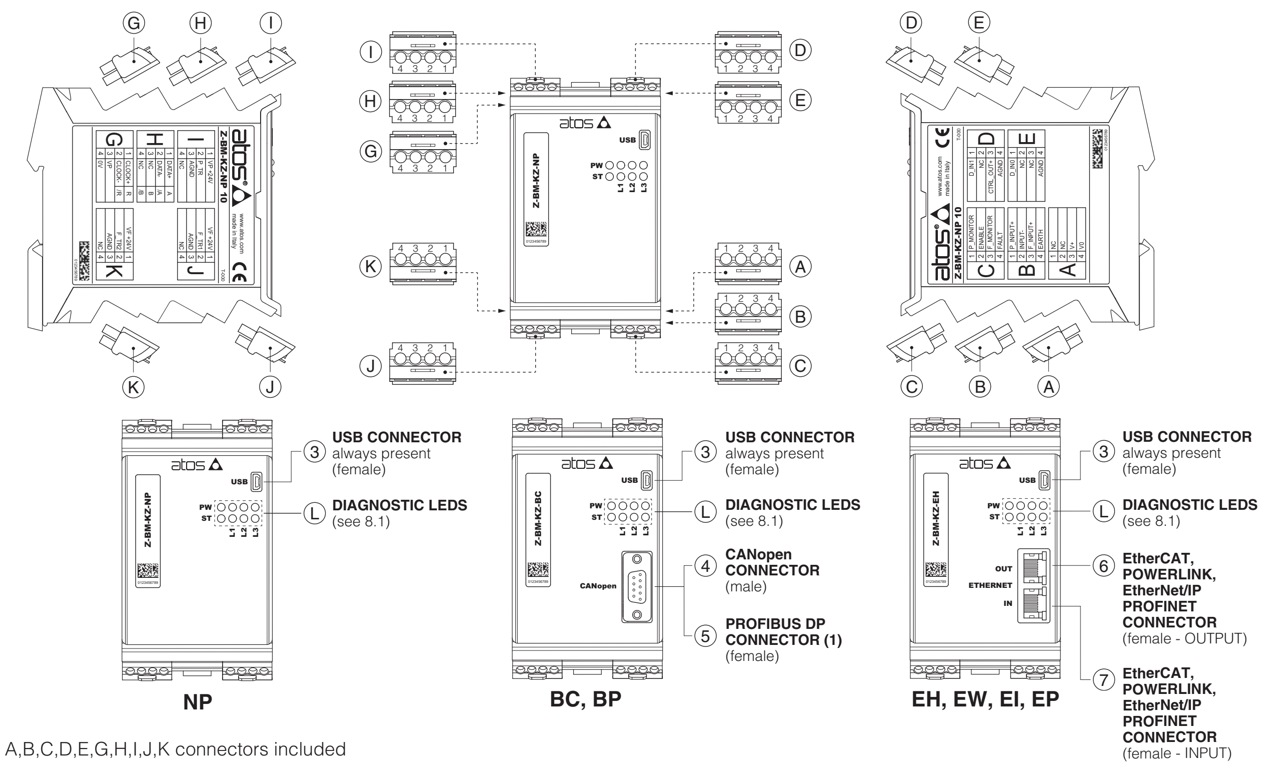
Z-BM-KZ controllers, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:

- 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 V_{DC} Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})			
Max power consumption	10 W			
Analog input signals (see 9.2, 9.3)	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 9.4, 9.5) Control output (see 9.10)	Output range: voltage ±10 V_{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 9.6) Digital inputs (see 9.11)	Range: 0 ÷ 5 V_{DC} (OFF state), 9 ÷ 24 V_{DC} (ON state), 5 ÷ 9 V_{DC} (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 9.7)	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	Cable break with current reference signal, over/under temperature, position control monitoring			
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			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Compliance	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



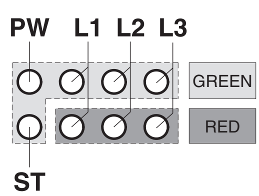
A,B,C,D,E,G,H,I,J,K connectors included

(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 controller operative conditions for immediate basic diagnostics. Please refer to the controler 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	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 V_{DC} (see 9.1)	Input - power supply
	A4	**V0**	Power supply 0 V_{DC} (see 9.1)	Gnd - power supply
B	B1	**P_INPUT+**	Position reference input signal: ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (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+**	Pressure/Force reference input signal (SP, SF, SL controls): ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 9.3)	Input - analog signal **Software selectable**
	B4	**EARTH**	Connect to system ground	
C	C1	**P_MONITOR**	Position monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND; default is ±10 V_{DC} (see 9.4)	Output - analog signal **Software selectable**
	C2	**ENABLE**	Enable (24 V_{DC}) or disable (0 V_{DC}) the controller, referred to V0 (see 9.6)	Input - on/off signal
	C3	**F_MONITOR**	Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 V_{DC} / ±20 mA maximum range, referred to AGND; default is ±10 V_{DC} (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 V_{DC}) or normal working (24 V_{DC}), referred to V0 (see 9.7)	Output - on/off signal
D	D1	**D_IN1**	Digital input 0 ÷ 24V_{DC}, referred to AGND (see 9.11)	Input - on/off signal
	D2	**NC**	Do not connect	
	D3	**CTRL_OUT+**	Control output signal for external 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 ÷ 24V_{DC}, 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 G2 G3 G4		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
H	H1 H2 H3 H4		Digital position transducer SSI or Encoder is software selectable: - SSI connections see 8.3 - Encoder connections see 8.4	
I	I1	**VP**	Power supply: +24V_{DC} , +5V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	I2	**P_TR1**	Analog position transducer input signal ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 9.8)	Input - analog signal **Software selectable**
	I3	**AGND**	Common gnd for transducer power and signals	Common gnd
	I4	**NC**	Do not connect	
J	J1	**VF +24V**	Power supply: +24V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	J2	**F_TR1**	1st signal pressure/force transducer: ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 9.9)	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: +24V_{DC} or OFF (default OFF)	Output - power supply **Software selectable**
	K2	**F_TR2**	2nd signal pressure transducer (only for SF): ±10 V_{DC} / ±20 mA maximum range; default is ±10 V_{DC} (see 9.9)	Input - analog signal **Software selectable**
	K3	**AGND**	Common gnd for transducer power and signals	Common gnd
	K4	**NC**	Do not connect	

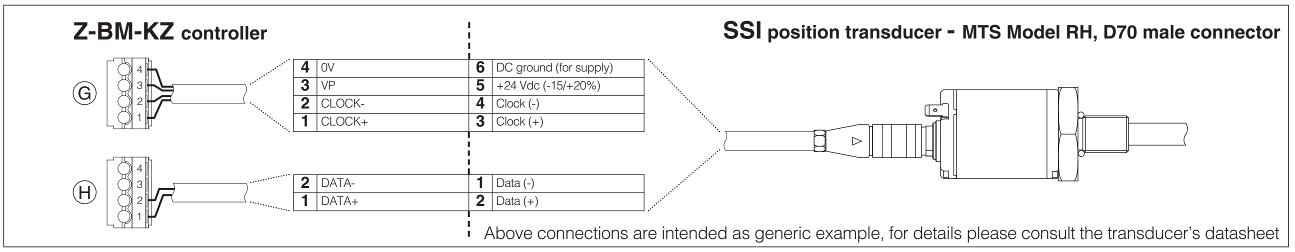
8.3 SSI connectors signals - 4 pin

G	G1	**CLOCK+**	Serial synchronous clock (+)	Output - on/off signal
	G2	**CLOCK-**	Serial synchronous clock (-)	Output - on/off signal
	G3	**VP**	Power supply: $+24V_{DC}$, $+5V_{DC}$ 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

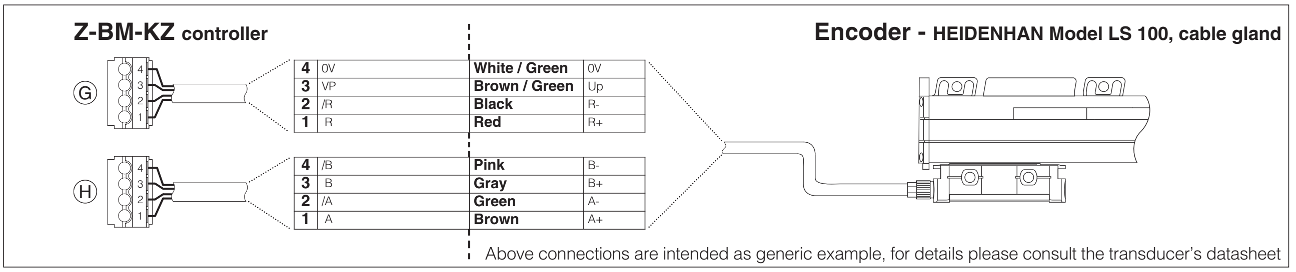


8.4 Encoder connectors signals - 4 pin

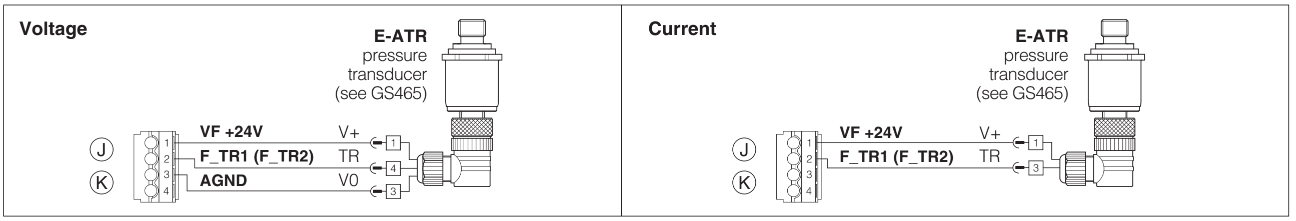
G	G1	**R**	Input channel R	Input - on/off signal
	G2	**/R**	Input channel /R	Input - on/off signal
	G3	**VP**	Power supply: $+24V_{DC}$, $+5V_{DC}$ or OFF (default OFF)	Output - power supply **Software selectable**
	G4	**0V**	Common gnd for transducer power and signals	Common gnd

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

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

9 SIGNALS SPECIFICATIONS

Atos digital controllers 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 **F003** 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 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: 500 mA fast fuse.

9.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on controllers' reference mode, see section 4 :
external analog reference generation (see 4.1): input is used as reference for the controller axis position 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}

fieldbus/internal reference generation (see 4.2): analog reference input signal can be used as on-off commands with input range 0 ÷ 24 V_{DC}.

9.3 Pressure or force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected controllers' reference mode and alternated control options, see section 5 :
SP, SL, SF controls and external analog reference selected : input is used as reference for the controller 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/internal 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 controller 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 controller (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 Pressure or force monitor output signal (F_MONITOR)

The controller generates an analog output signal (pin C3) according to alternated pressure/force control option:
SN control: output signal is proportional to the actual valve spool position
SP, SL, SF controls: output signal is proportional to the actual pressure/forcel applied to the cylinder's rod end
Monitor output signals can be software set to show other signals available in the controller (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 controller, a 24 V_{DC} voltage has to be applied on pin C2.
When the Enable signal is set to zero the controller 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 controller (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 controller. 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) - SP, SF, SL controls

Analog remote pressure transducers or load cell can be directly connected to the controller.
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 pressure / force alternated control

	PID SET SELECTION			
PIN	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 controllers, 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 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 both alternated position/pressure and 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

	Position			**Pressure/Force**
Input type	Analog	SSI **(3)**	Incremental Encoder	Analog
Power supply **(1)**	+24 V_{DC}	+5 V_{DC} or +24 V_{DC}	+5 V_{DC} or +24 V_{DC}	+24 V_{DC}
Controller Interface	0 ÷ 10V or 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 V_{DC} 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 controller **(2)** percentage of total stroke **(3)** for Balluff BTL7 with SSI interface only special code SA433 is supported

11 VALVE SETTINGS AND PROGRAMMING TOOLS

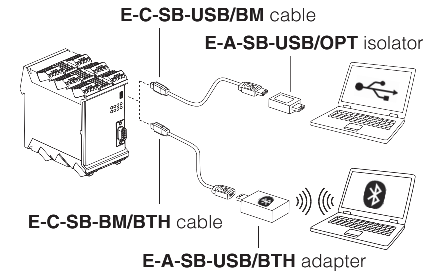
Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB port to the digital controller (see table **GS003**). For fieldbus versions, the software permits valve's parameterization through USB port also if the controller is connected to the central machine unit via fieldbus.

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

Z-SW-FULL	support:	NP (USB)	PS (Serial)	IR (Infrared)
		BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
		EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

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

USB or Bluetooth connection



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

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 controller 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 controller 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 controller 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 controller 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, controller disabling, etc.)

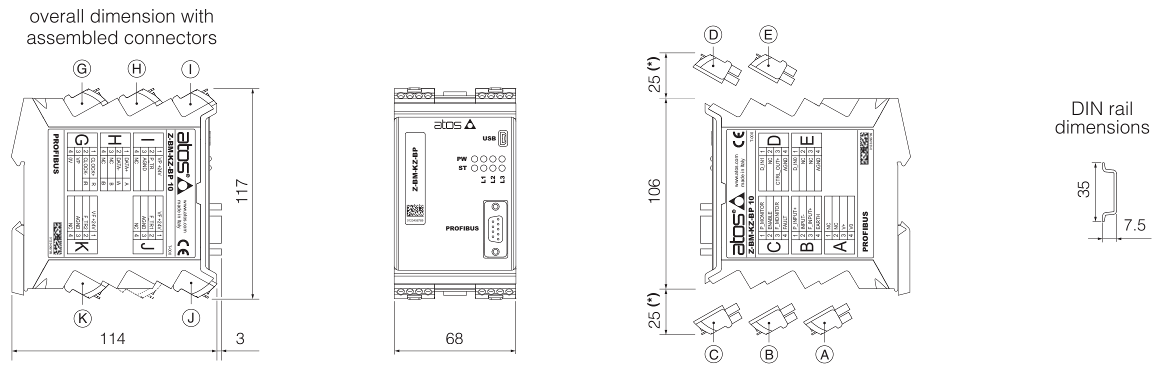
12.5 Valve characteristics compensation

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]

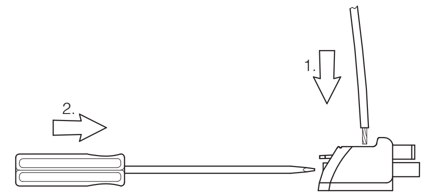


A,B,C,D,E,G,H,I,J,K connectors included

(*) Space to remove the connectors

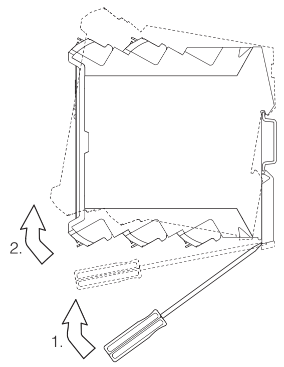
14 INSTALLATION

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

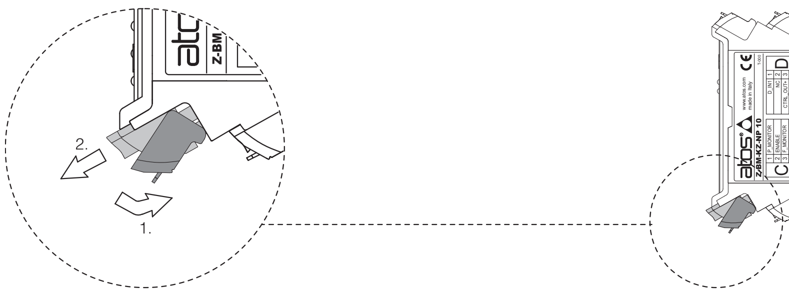


Note: max conductor size: 2,5 mm^2
tightening torque: 0,4 ÷ 0,6 Nm

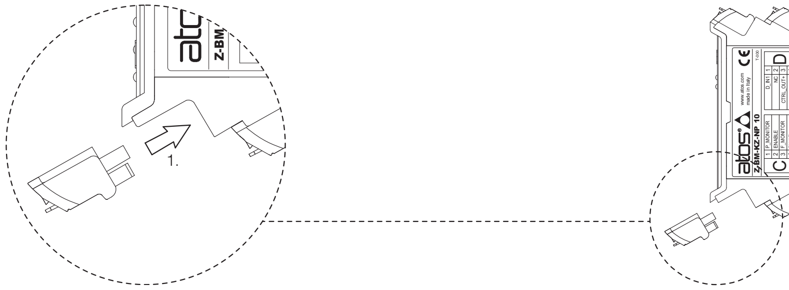
To unlock the controller from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the controller



To extract the connectors:
1. push lever
2. pull connector



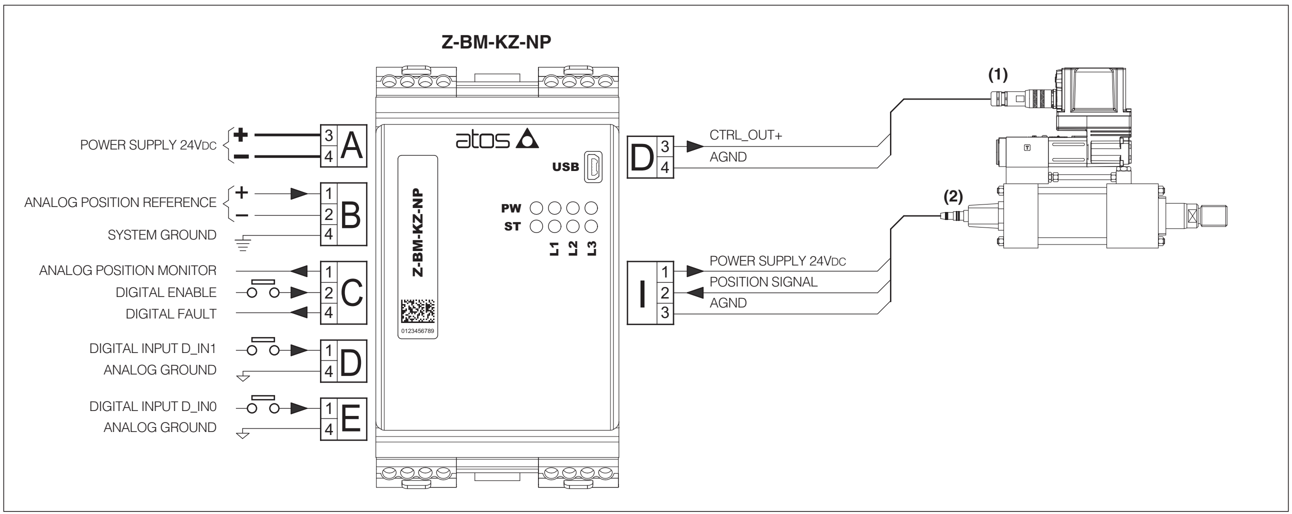
To insert the connectors:
1. push the connector in its slot



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,D,E,G,H,I,J,K)

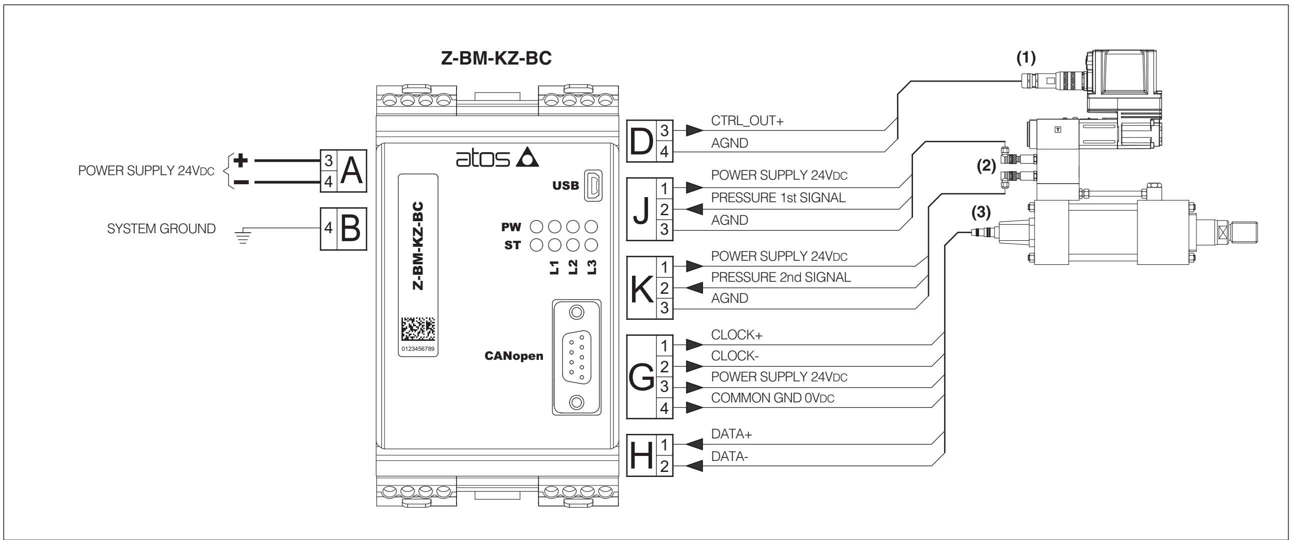
15 WIRING EXAMPLES

15.1 Position control - analog reference - analog position transducer



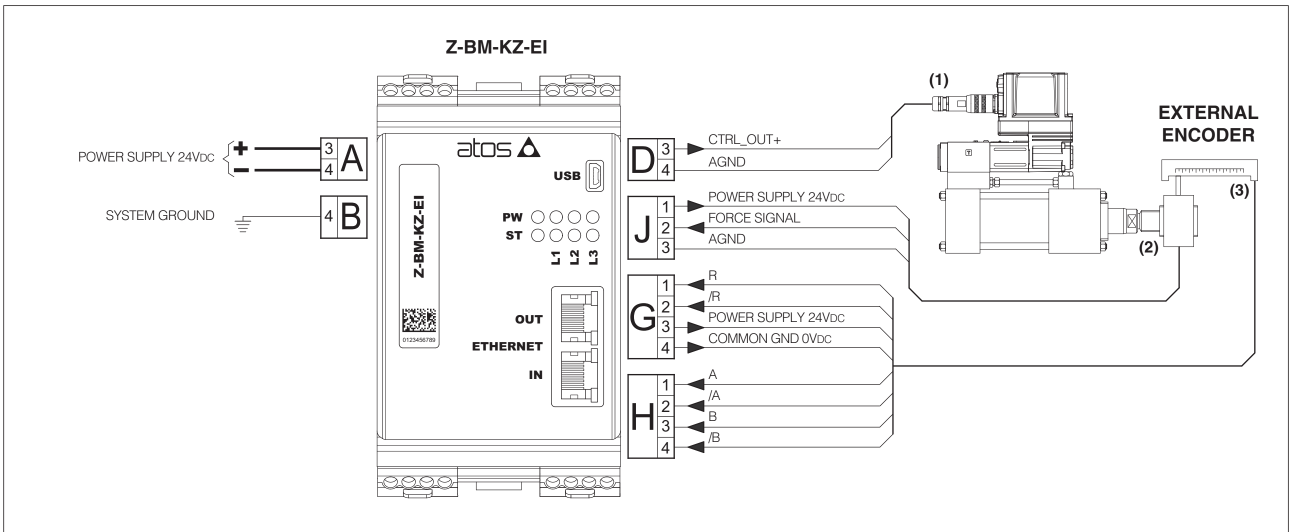
(1) For valve driver electrical connections please refer to the specific technical table
(2) The analog position transducer connections are intended as generic example, for details please consult the transducer's datasheet

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's datasheet

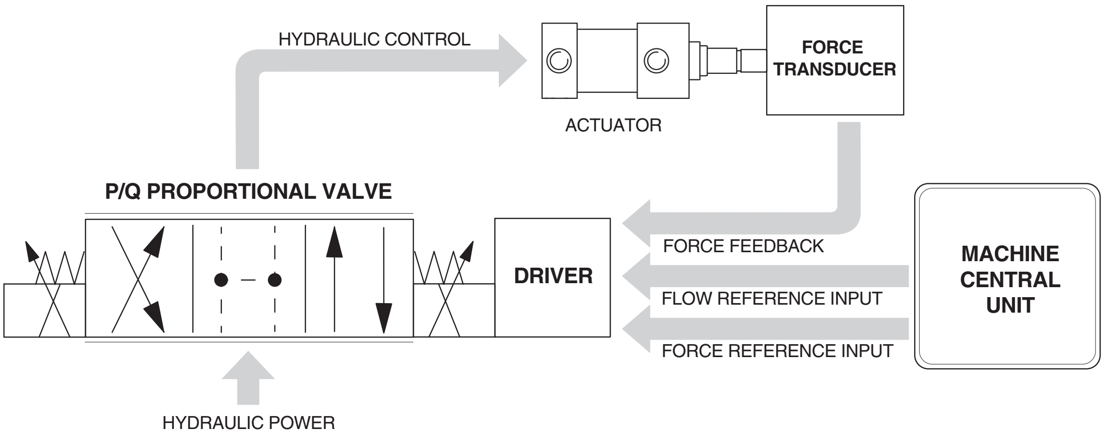
15.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell



(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's datasheet

Ex-proof digital proportional valves with P/Q control

directional valves with LVDT transducer and on board driver



1 GENERAL DESCRIPTION

The ex-proof 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 ex-proof high performance proportional directional valves and ex-proof servoproportional valves with TES/LES on-board digital driver or TEZ/LEZ axis controller.
Valve’s performance characteristics and overall dimensions remains unchanged as per specific FX** technical tables.

Servoproportionals:

DLHZA-TES, DLKZA-TES - direct, zero spool overlap, sleeve execution - technical tables **FX150**
DHZA-TES, DKZA-TES - direct, zero spool overlap - technical tables **FX135**
DPZA-LES - piloted, zero spool overlap - technical table **FX235**
LIQZA-LES - 3-way servocartridges - technical table **FX380**

Servoproportionals with TEZ/LEZ axis controller:

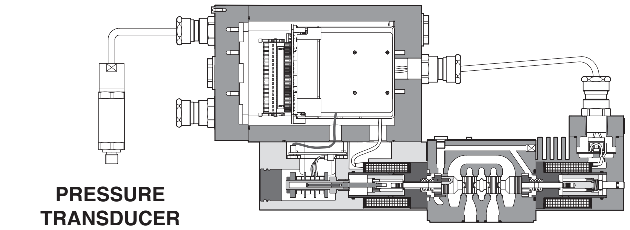
DLHZA-TEZ, DLKZA-TEZ - direct, zero spool overlap, sleeve execution - technical tables **FX610**
DHZA-TEZ, DKZA-TEZ - direct, zero spool overlap - technical tables **FX620**
DPZA-LEZ - piloted, zero spool overlap - technical tables **FX630**

High perfomance proportionals:

DHZA-TES, DKZA-TES - direct, positive spool overlap - technical table **FX130**
DPZA-LES - piloted, positive spool overlap - technical table **FX230**

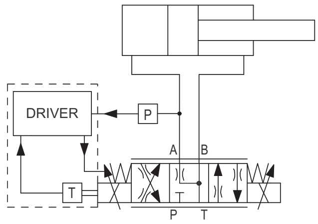
4 SP, SF, SL CONFIGURATION EXAMPLES

SP - Pressure Control - 1 pressure transducer



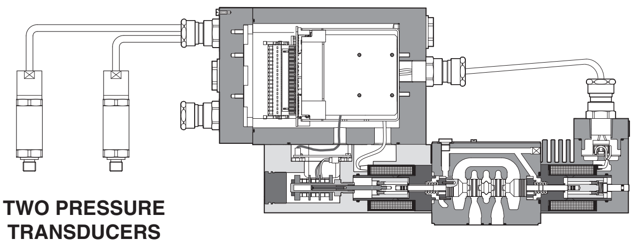
PRESSURE TRANSDUCER

e.g. DHZA-TES- **SP**



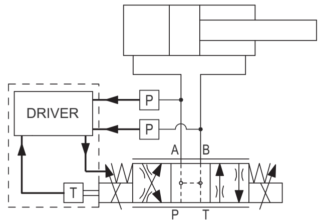
one remote pressure transducer has to be installed on the actuator's port to be controlled. In this example the SP option regulates the pressure on port A

SF - Force Control - 2 pressure transducers



TWO PRESSURE TRANSDUCERS

e.g. DHZA-TES- **SF**

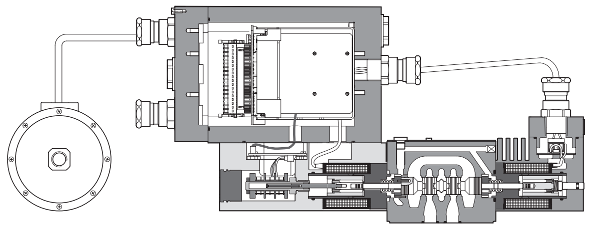


two remote pressure transducers have to be installed on the actuator's ports A and B.

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

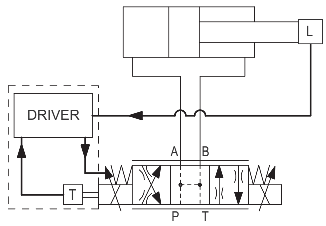
The SF option directly controls the actuator force (F) as result of the following calculation:
F = $\triangle$p (Pa-Pb) x $\triangle$ area (A1 – A2)

SL - Force Control - 1 load cell



LOAD CELL

e.g. DHZA-TES- **SL**



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 **F003** 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 **GS003**).
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)

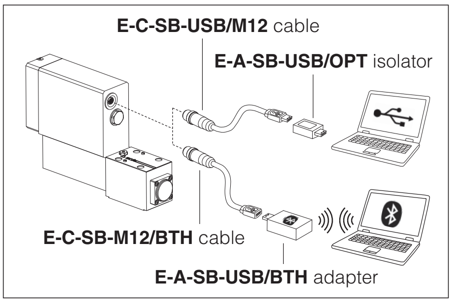
E-SW-FIELDBUS/PQ and **Z-SW-FULL** support:

NP (USB) - only Z-SW-FULL

BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
EW (POWERLINK)	EI (EtherNet/IP)	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

USB or Bluetooth connection



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

7 FUNCTIONAL EXAMPLES

The following functional examples are just generic reference of the possible applications of with ex-proof 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:

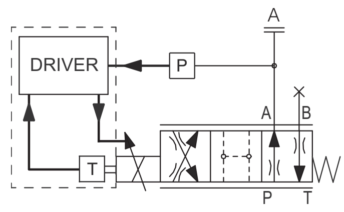
- flow reference signal is used to limit the maximum flow during the pressure regulation
- pressure reference signal is used to regulate the pressure on the valve's A user port; the rapid/repeatable response of the pressure control is performed in high dynamics by the directional valve's closed loop regulation

Requirements:

- an ex-proof 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**



3 way connection 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:

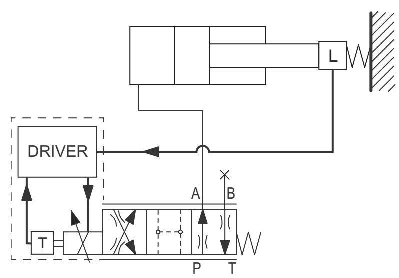
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure (force) reference signal is used to limit the maximum pushing pressure (force) to the actuator
  or
- pressure (force) reference signal is used to regulate the actuator pushing pressure (force) while flow reference signal is used to limit the maximum actuator speed

Requirements:

- for SP control a remote ex-proof 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**



3 way connection 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:

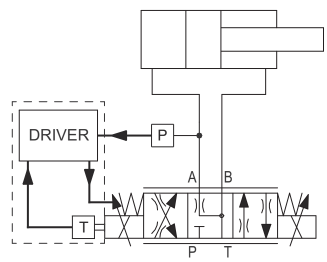
- flow reference signal is used to regulate the actuator's forward and backward speed while pressure reference signal is used to limit the maximum pushing pressure of the actuator
  or
- pressure reference signal is used to regulate the actuator pushing pressure while flow reference signal is used to limit the maximum forward and backward actuator speed

Requirements:

- an ex-proof 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**

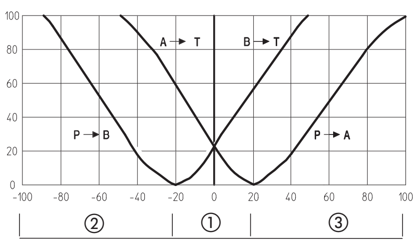


4 way connection SP

7.4 Q5 spool for 4 way connection with SP control

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

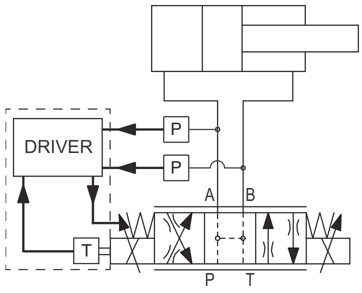
  or
- force reference signal is used to regulate the actuator pushing and pulling force while flow reference signal is used to limit the maximum actuator speed

Requirements:
- for SF two ex-proof remote pressure transducers have to be installed on the both actuator's ports
- for SL one ex-proof 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

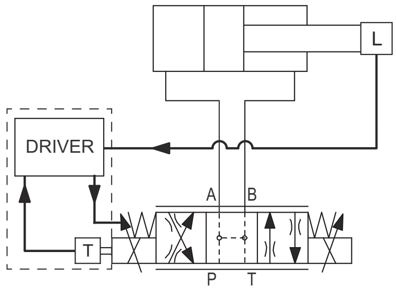
Advantages:
- force control is possible in both push and pull directions
- SL allows a more precise force control despite of a more complex installation of the ex-proof load cell transducer
- SF allows to add force control also into existing systems thanks to the simple installation of pressure transducers

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

Double effect - only for **SF** or **SL**



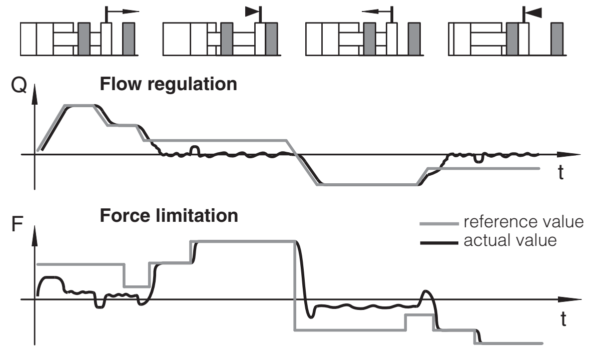
4 way connection SF



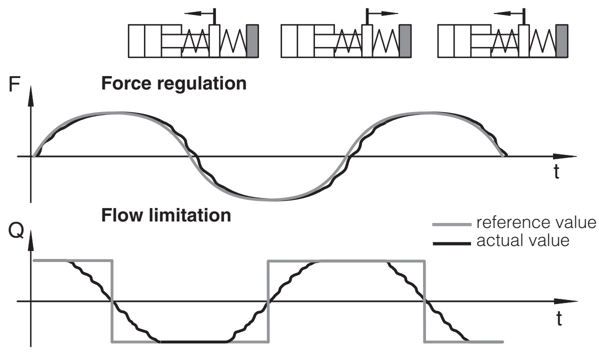
4 way connection SL

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

7.6 Flow priority



7.7 Force priority



8 PRESSURE/FORCE TRANSDUCER CHARACTERISTICS

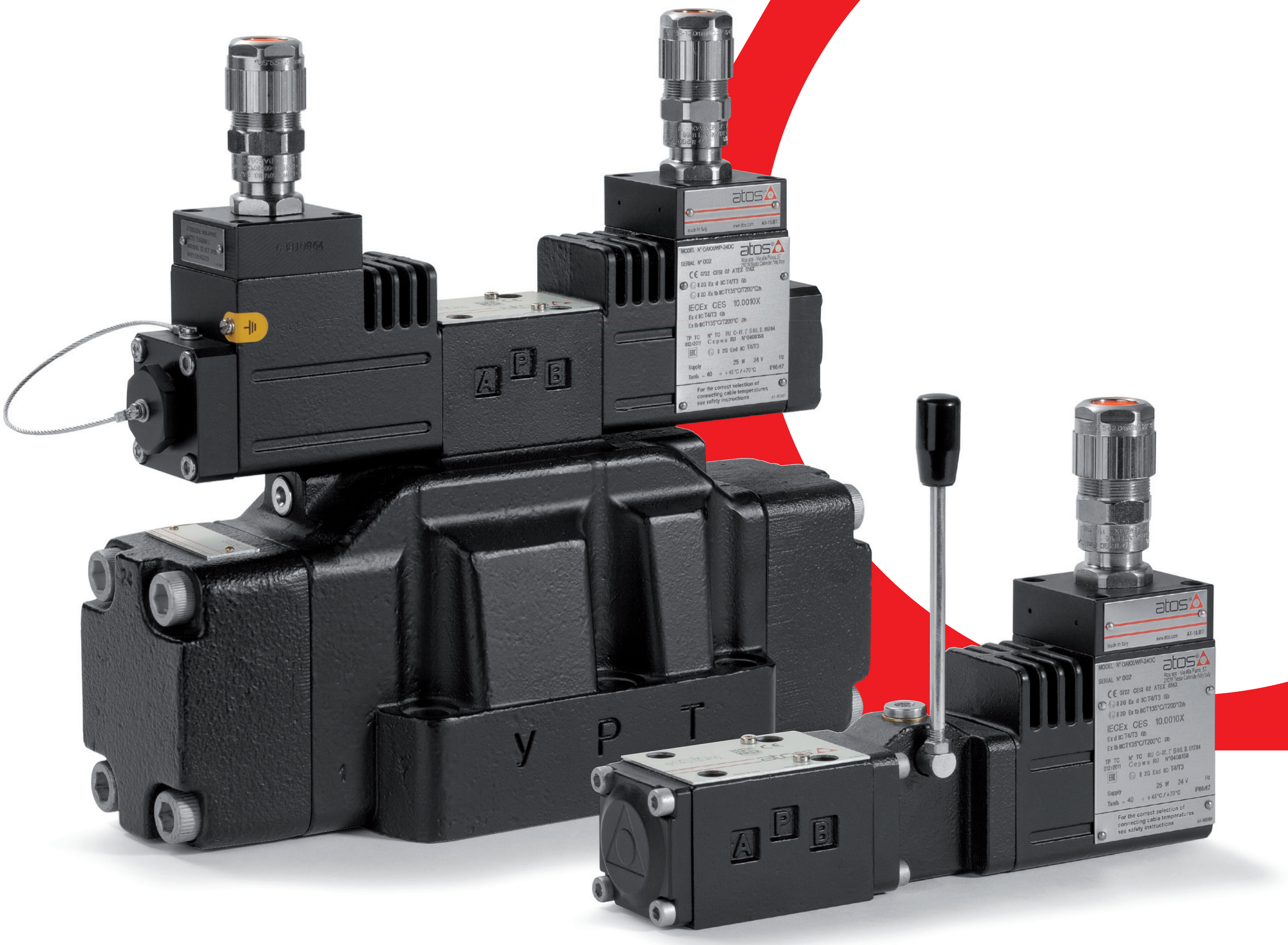
The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducers.

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 **GX800** for E-ATRA-7 ex-proof 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



INDEX

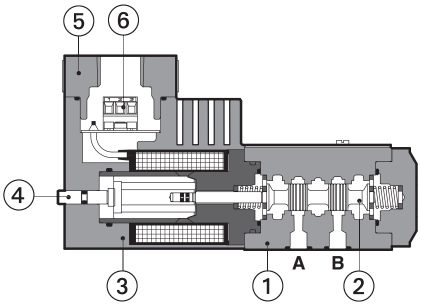
ON-OFF VALVES

Ex-ia

Supplementary components range available on **www.atos.com**

Ex-proof solenoid directional valves

on-off, direct, spool type - **ATEX, IECEx, EAC, PESO** or **cULus**



① valve body
② spool
③ ex-proof solenoid
④ manual override
⑤ threaded connections for cable gland
⑥ internal terminal board for cable connection

DHA-06*

DHA

On-off, spool type directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

DHA valves are **SIL** compliance with IEC 61508 (TÜV certified)

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.

The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **06** - ISO 4401
Max flow: **70 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHA / * - 0 63 1/2 / M / * 24DC * / *

DHA – Ex-proof solenoid directional valve, direct, spool type

Certification type:
Multicertification ATEX, IECEx, EAC:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

Valve size (ISO 4401)
0 = 06

Configuration, see section 2 :

Spool type, see section 2 :

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (5)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
A = solenoid at side of port B (for single solenoid valves)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap
Hand lever options (4):
MV = vertical hand lever
AMV = vertical hand lever installed at side of port B

Voltage code, see section 5

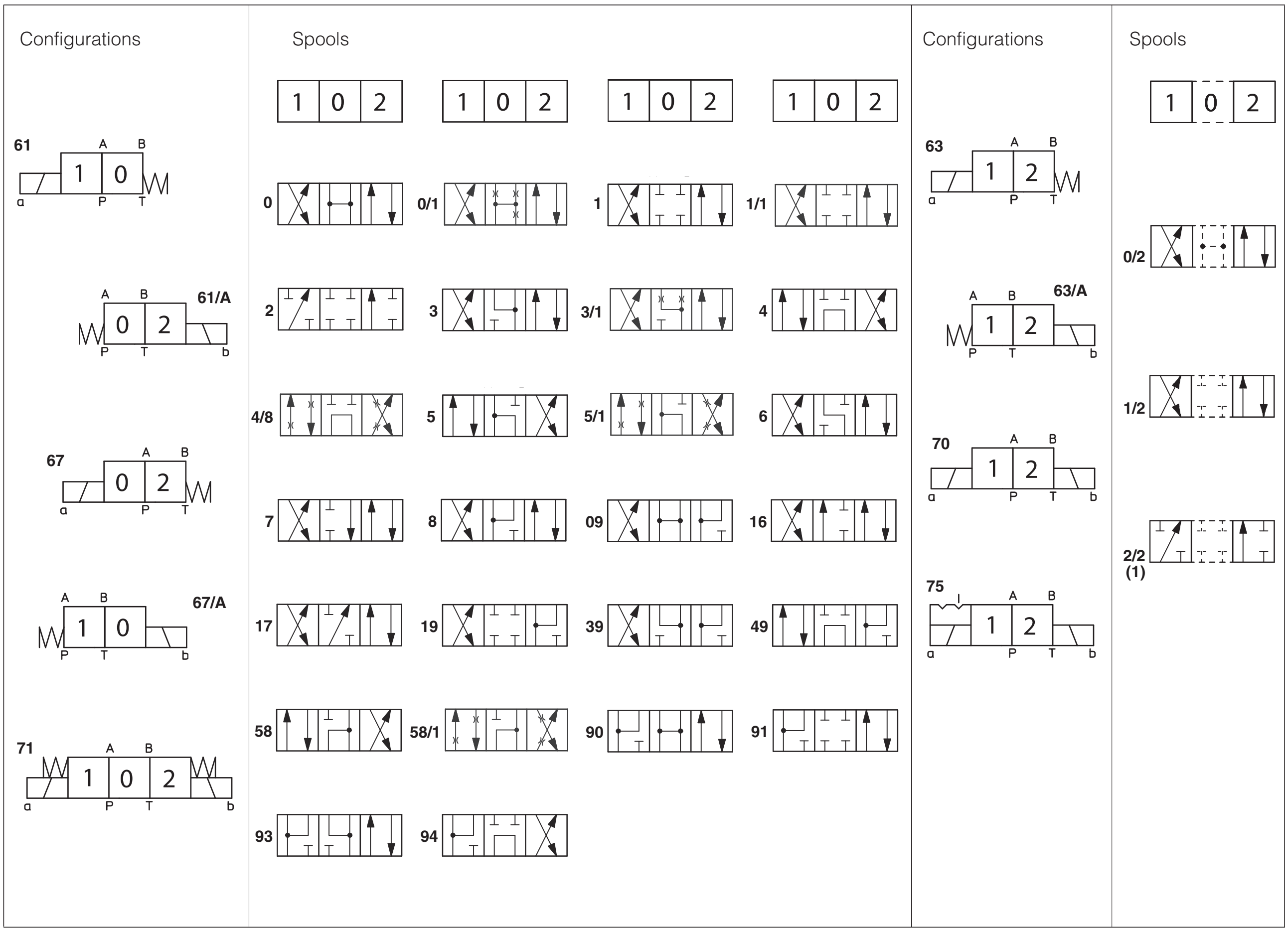
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining)
(3) For possible combined options, see 12.1
(4) Options MV and AMV are available only for configuration **61, 61/A, 63, 63/A, 71** and with spool type **0, 0/2, 1, 1P, 1/2, 1/2P, 3, 3P, 4, 7**. Not available in combination with option **WP**
(5) Approved only for the Italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND SPOOLS (representation according to ISO 1219-1)



For spool type 2 and 2/2 port T of the valve must be connected to tank if the operating pressure exceed the max T pressure reported at section 4
(1): not available for configuration 75

2.1 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.

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	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” 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
Rated flow	See diagrams Q/Δp at section 13
Maximum flow	**70 l/min**, see operating limits at section 14

5 ELECTRICAL CHARACTERISTICS

Valve type		DHA	DHA/**M**	DHA/**UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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 ÷ +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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature.

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DHA		DHA/**M**	DHA/**UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

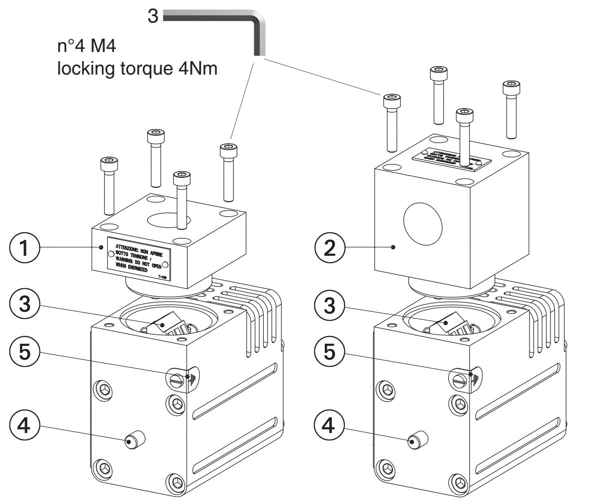
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SIL compliance with IEC 61508: 2010

DHA (multicertified for surface and mining) meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

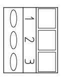
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

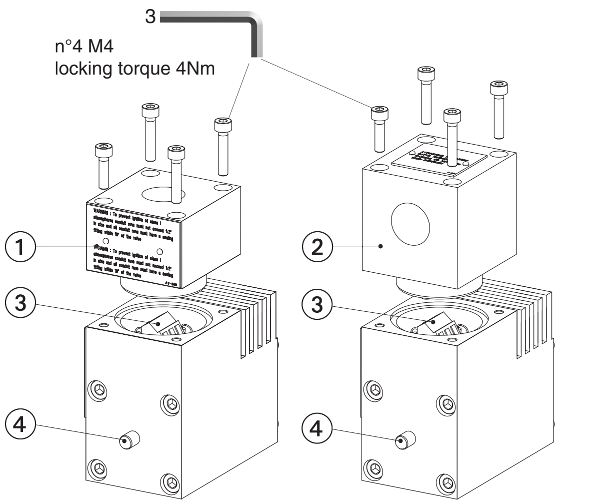
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

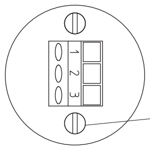
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

11 CABLE GLANDS only for Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 **OPTIONS**

A = solenoid at side of port B (for single solenoid valves)

O = Horizontal cable entrance , to be selected in case of limited verical space

WP = Manual override protected by metallic cap

Hand lever option:

MV = Auxiliary vertical hand levers

This option allows to operate the valves in absence of electrical power supply, i.e. during commissioning, maintenance or in case of emergency.
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

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

AMV= Vertical hand lever installed at side of port B

Notes:

Options **MV** and **AMV** are available only for configuration **61, 61/A, 63, 63/A, 71** and with spool type **0, 0/2, 1, 1P, 1/2, 1/2P, 3, 3P, 4, 7**

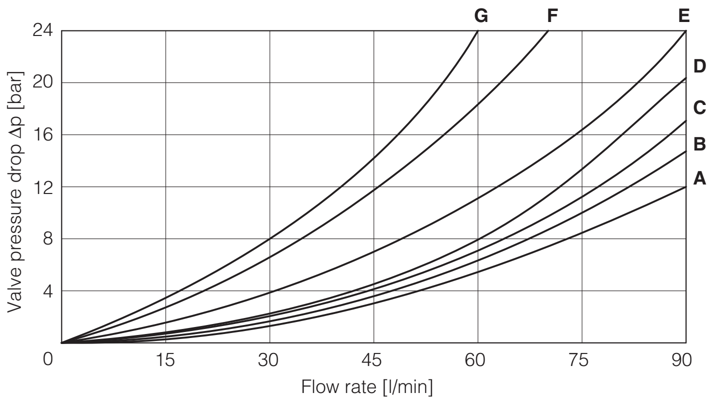
Not available in combination with option **WP**

MV option and **AMV** allow to operate the valve in absence of electrical power supply.
For detailed description of DHA with hand lever option see tech. table **E138**

12.1 Possible combined options: /AO, /AWP, /OWP, /AMV, /OMV, /AOWP, /AOMV

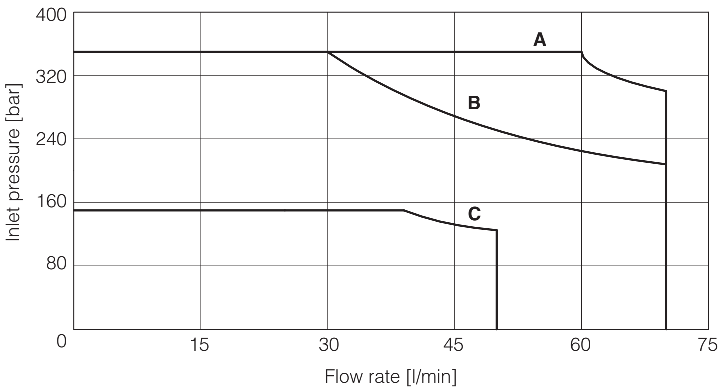
13 **Q/Δp DIAGRAMS** (based on mineral oil ISO VG 46 at 50°C)

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	
39, 93	F	F	G	G	



14 **OPERATING LIMITS** (based on mineral oil ISO VG 46 at 50°C)

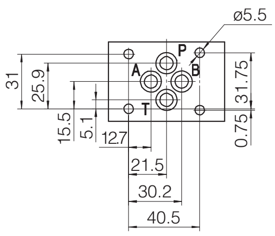
Spool type	diagram
0, 0/1, 1, 1/1, 8	**A**
0/2,1/2, 3, 6, 7	**B**
2, 2/2, 3/1, 4, 4/8, 5, 5/1, 16, 17, 19, 39 49, 58, 58/1, 09, 90, 91, 93, 94	**C**



15 INSTALLATION DIMENSIONS [mm] - Multicertified and UL

ISO 4401: 2005 (see table P005)
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)

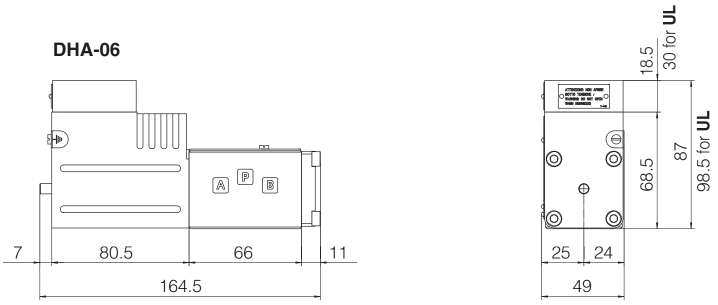
Valve's bottom view



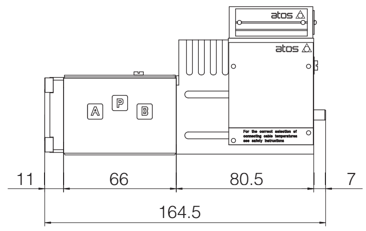
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHA-06	2,65
DHA-07	4,3
Option /O	+0,35
Option /WP	+0,25

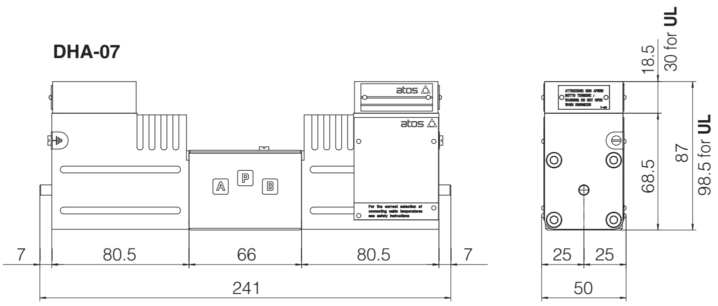
DHA-06



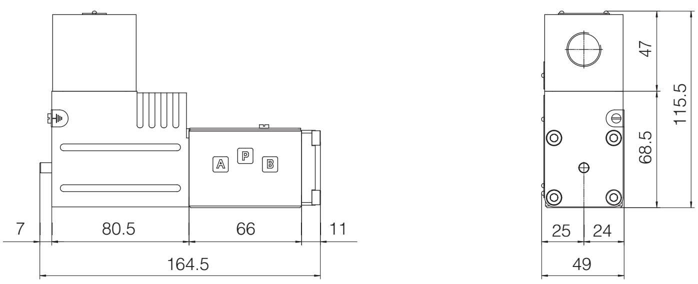
DHA-06 /A



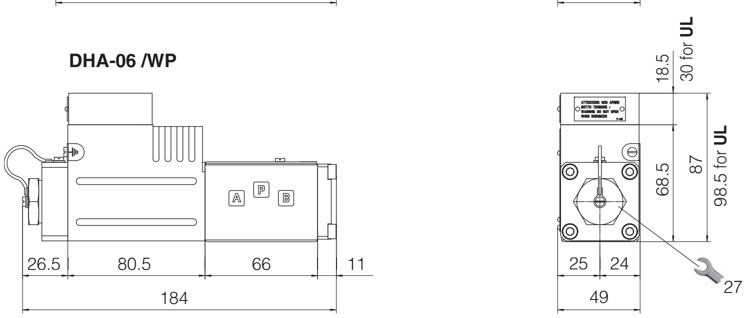
DHA-07



DHA-06 /O

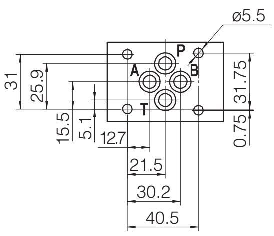


DHA-06 /WP



ISO 4401: 2005 (see table P005)
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: Ø = 7.5 mm (max)

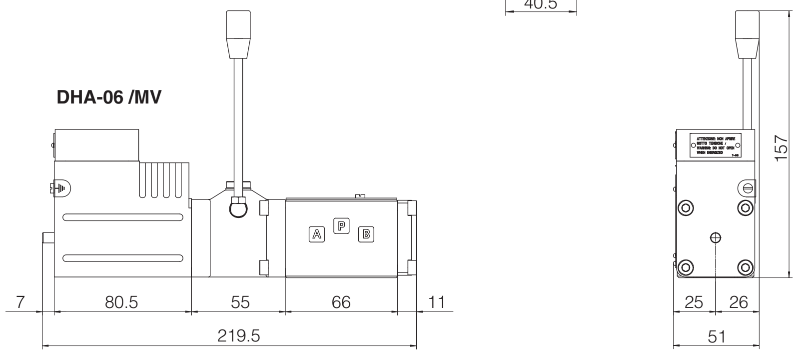
Valve's bottom view



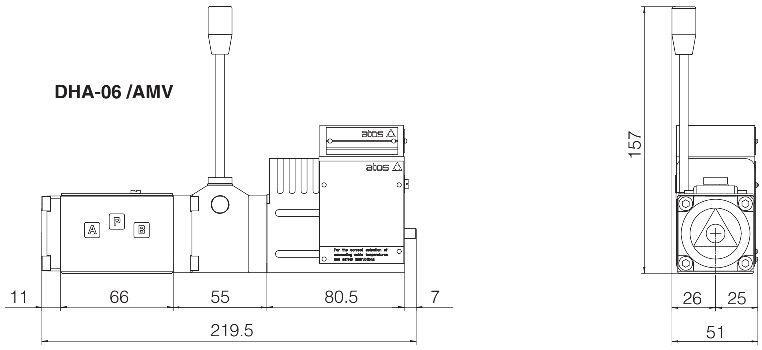
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHA-06/MV	2,9
DHA-07/MV	4,55

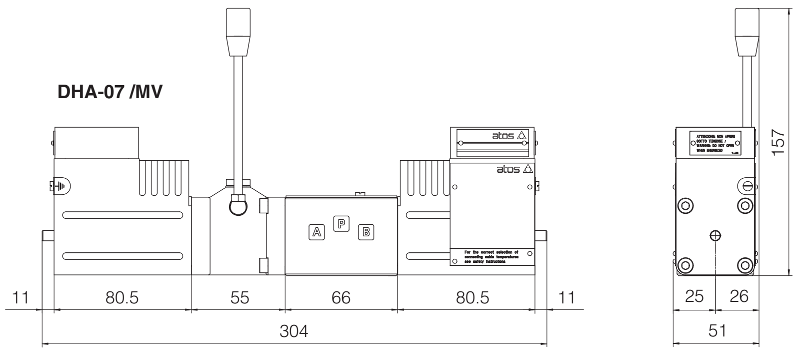
DHA-06 /MV



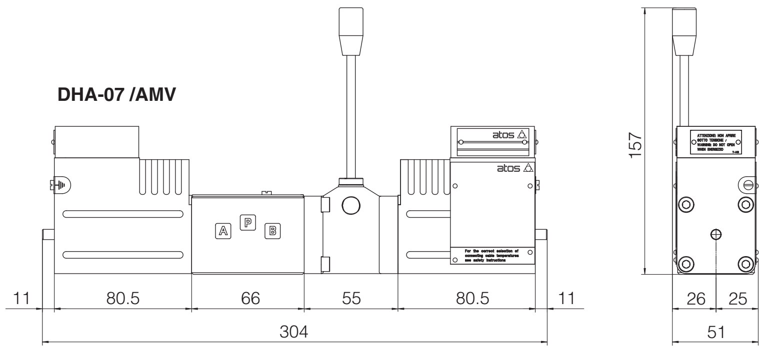
DHA-06 /AMV



DHA-07 /MV



DHA-07 /AMV

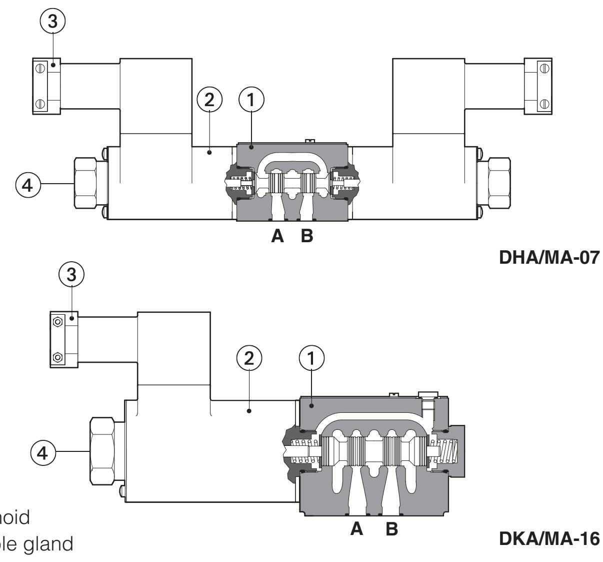


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

On-off, direct, spool type - **MA certification**



① valve body
② ex-proof solenoid
③ horizontal cable gland
④ manual override

On-off directional valves equipped with explosion-proof solenoids certified according to **MA** Chinese mining certification, protection mode:

Ex d I Mb for surface, tunnel or mine plants

The solenoids are provided with cable glands (horizontally oriented) for cable entrance and internal terminal board for power supply coils connections.

The solenoid case classified **Ex d** is designed to contain the possible explosion which could be caused by the presence of the gas mixture inside the housing, thus avoiding dangerous propagation in the external environment.

They are also designed to limit the external temperature according to the certified class to avoid the self ignition of the explosive mixture present in the environment.

DHA/MA:	**DKA/MA**:
Size: **06** - ISO 4401	Size: **10** - ISO 4401
Max flow: **80 l/min**	Max flow: **120 l/min**
Max pressure: **350 bar**	Max pressure: **315 bar**

1 MODEL CODE

DHA / MA - 0 63 1/2 / * 24DC * *

DHA = spool type - direct, size 06
DKA = spool type - direct, size 10

MA = Ex-proof Ma Chinese mining certification

Valve size (ISO 4401)
0 = 06 for DHA
1 = 10 for DKA

Configuration, see section 2

Spool type, see section 2

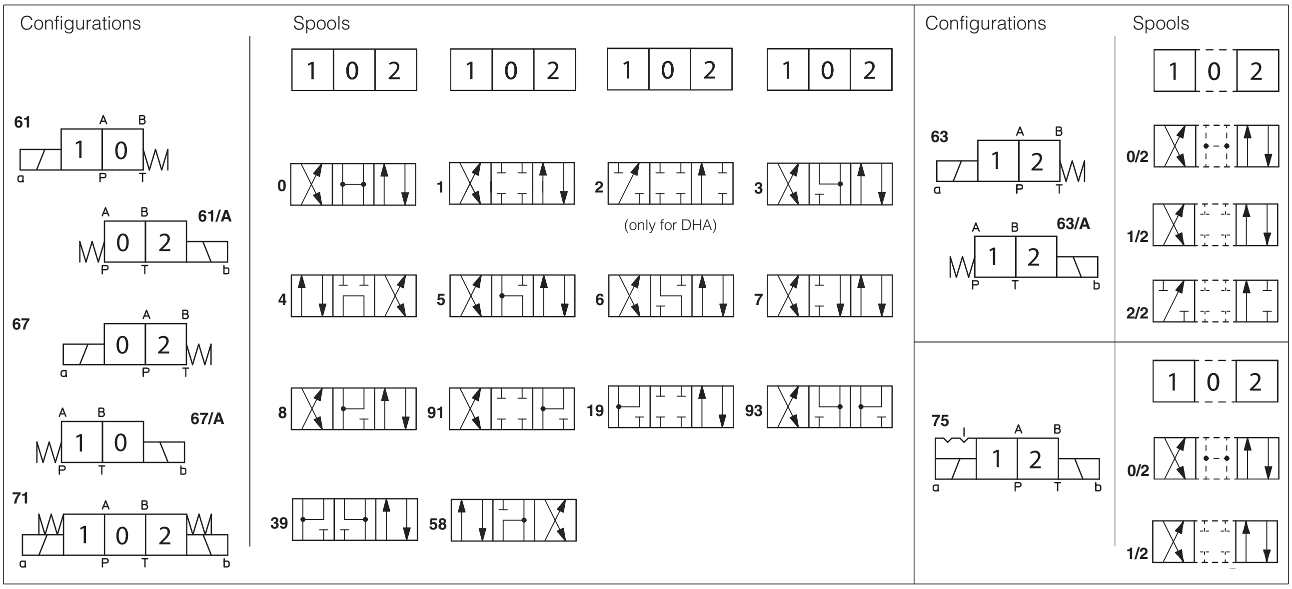
Option:
A = solenoid at side of port B (for single solenoid valves)

Voltage code, see section 5

Series number

Seals material, see sect. 6:
- = NBR
PE = FKM

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



DHA spools **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.
DKA spool **1** is also available as **1/1.** It is properly shaped to reduce water-hammer shocks during the swiching.

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	150 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
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure Ex-d

4 HYDRAULIC CHARACTERISTICS

Operating pressure	**DHA/MA**	P, A, B = **350 bar**	T = **210 bar**
	DKA/MA	P, A, B = **315 bar**	T = **210 bar**
Maximuim flow	**DHA/MA**	**80 l/min**	
	DKA/MA	**120 l/min**	

5 ELECTRICAL CHARACTERISTICS

SOLENOID TYPE	ON/OFF	
Voltage code VDC ±10%	**12DC, 24DC, 110DC**	
Power consumption	16,5 W (DHA)	18W (DKA)
Protection degree	IP 65 to DIN EN 60529	
Duty factor	100%	

6 SEALS AND HYDRAULIC FLUID

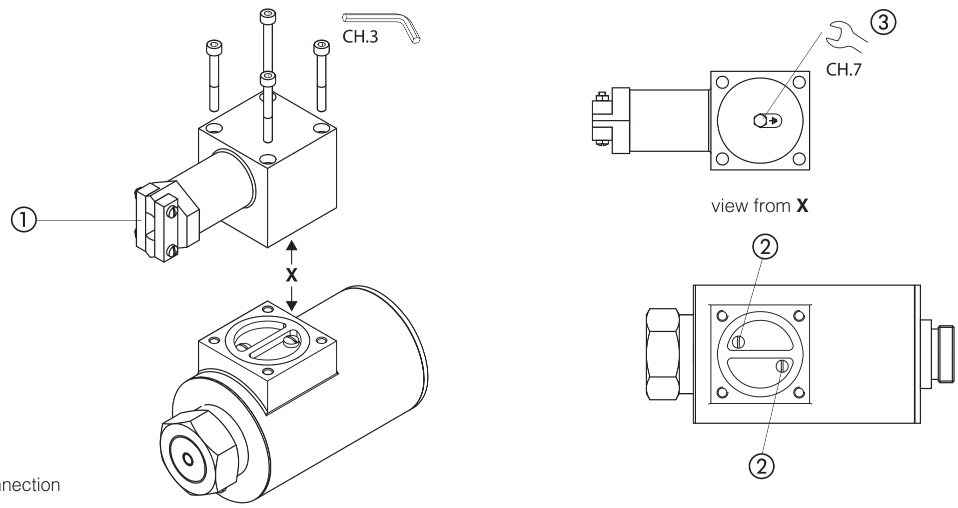
Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm^2/s - max allowed range 2.8 ÷ 500 mm^2/s		
Max fluid contamination level	ISO4406 class 20/18/15 NAS1638 class 9, 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	

7 CERTIFICATION DATA

Valve type	DHA**/MA**	DKA**/MA**
Certification	MA mining	
Solenoid certified code	**DTBZ12 - 37 FYC**	**DTB29 - 90FYC**
Type examination certificate	CNEx 17.4187	CNEx 17.4190
Method of protection	Ex d I Mb	
Ambient temperature	≤ 135 °C	
Ambient temperature	-20 ÷ +40 °C	
Cable entrance:	cable entrance Ø =10.5mm	

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 EX-PROOF SOLENOID WIRING

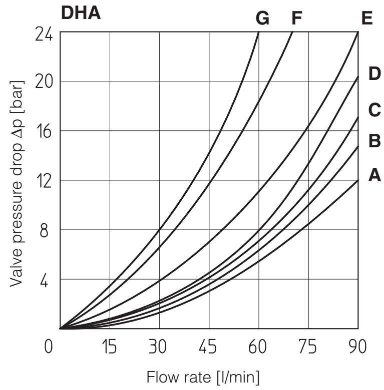


① cable entrance = ø 10,5 mm
② terminal board for power supply coil connection
③ screw terminal for ground connection

9 Q/ΔP DIAGRAMS based on mineral oil ISO VG 46 at 50°C

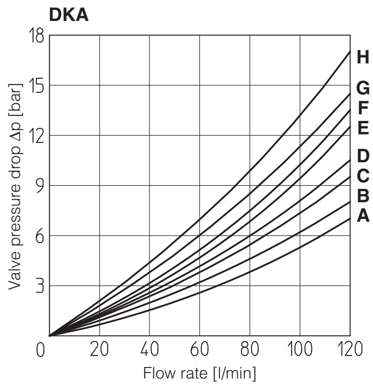
DHA

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, 58, 58/1 19, 91, 93, 39	F	F	G	C	E
1/2, 0/2	D	D	D	D	
6, 7	D	D	D	D	
8	A	A	E	E	
2	D	D			
2/2	F	F			



DKA

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, 1/3, 6, 8	A	A	D	C		
3, 3/1, 7	A	A	C	D		
4	B	B	B	B	F	
5	A	B	C	C	G	
1/2	B	C	C	B		
19	A	D	C			H



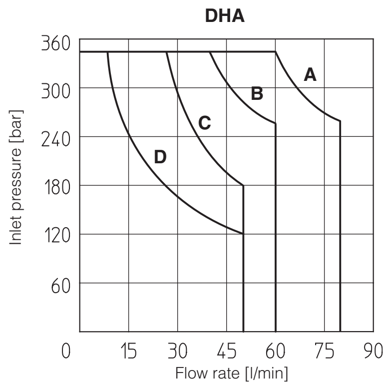
10 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

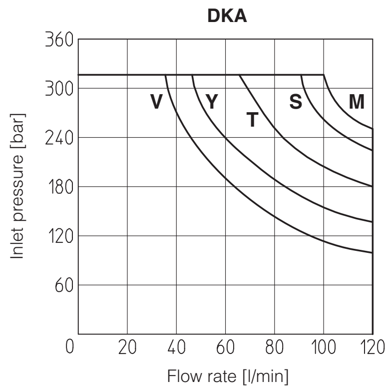
DHA

A = Spools 0, 0/1, 1, 1/2, 3, 8
B = Spools 0/2, 1/1, 6, 7
C = Spools 3/1, 4, 4/8, 5, 5/1, 19, 39, 58, 58/1, 09, 90, 91, 93, 94
D = Spools 2, 2/2

DKA

M = Spools 0, 0/1, 1, 1/1, 3, 3/1, 1/2, 0/2, 8
S = Spools 1/3, 6, 7
Y = Spools 4, 5
V = Spools 2/2
T = Spools 19

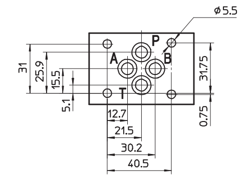




11 INSTALLATION DIMENSIONS FOR DHA/MA AND DKA/MA

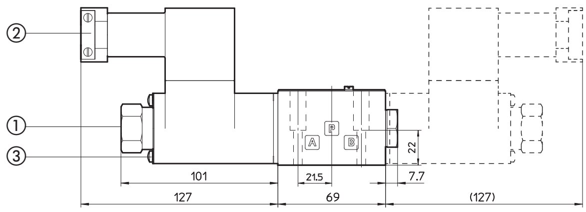
DHA/MA

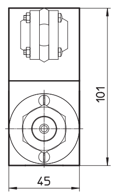
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5x30 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DHA/MA-06
DHA/MA-07 (dotted line)



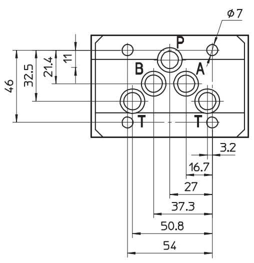


Mass of basic versions:
DHA/MA-06: 3,2 kg
DHA/MA-07: 4,9 kg

① manual override
② horizontal cable gland, cable entrance = ø 10,5 mm
③ screw terminal for additional equipotential grounding

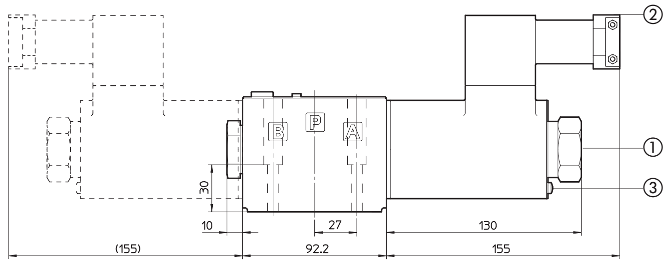
DKA/MA

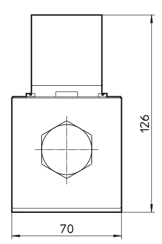
ISO 4401: 2005
Mounting surface according to 4401-05-05-0-05
(without X port, Y port optional)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050 and 1 OR 108
Ports P,A,B,T: Ø = 11.5 mm (max)
Ports Y: Ø = 5 mm



P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

DKA/MA-16
DKA/MA-07 (dotted line)





Mass of basic versions:
DKA/MA-16: 5,7 kg
DKA/MA-17: 8,7 kg

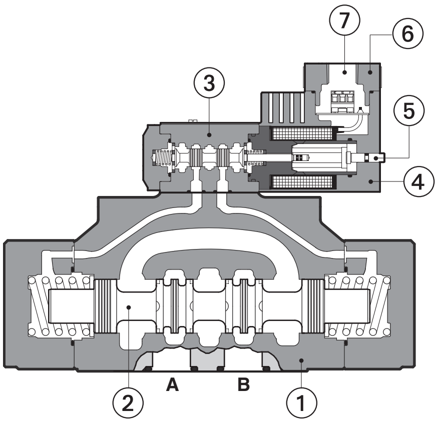
① manual override
② horizontal cable gland, cable entrance = ø 10,5 mm
③ screw terminal for additional equipotential grounding

12 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X040	Summary of Atos ex-proof components certified to MA	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

on-off, piloted - **ATEX, IECEx, EAC, PESO** or **cULus**



DPHA-461*

① main body
② main spool
③ pilot valve
④ ex-proof solenoid
⑤ manual override
⑥ threaded connection for cable gland
⑦ internal terminal board fr cable connection

DPHA

On-off spool type, piloted directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

Size: **10 ÷ 32** - ISO 4401
Max flow: **160 ÷ 1000 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPHA	/	*	-	2	63	1/2	/	M	/	*	24DC	*	/	*

Ex-proof directional valve, piloted

Certification type:
Multicertification
ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)
North American certification
UL = cULus

Valve size (ISO 4401)
1 = 10 **2** = 16 **4** = 25 **6** = 32

Configuration, see section 2

Spool type, see section 2

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (3)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (4):
A = solenoid at side of port B (for single solenoid valves)
O = horizontal cable entrance **(3)**
/D = Internal drain
/E = external pilot pressure
/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 in A and B ports of pilot valve
/L9 = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve
/R = pilot pressure generator (not for DPHA-1)
/S = main spool stroke adjustment (not for DPHA-1)
WP = ⚠ manual override protected by metallic cap

Voltage code, see section 7

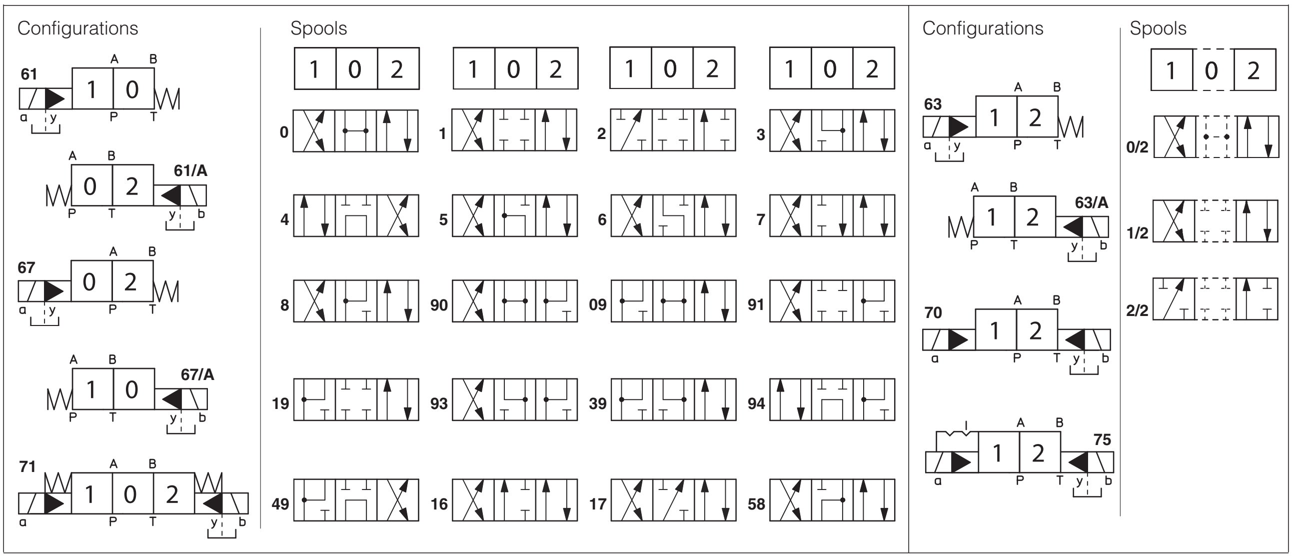
Series number

Seals material, see section 8 :
- = NBR
PE = FKM
BT = HNBR **(3)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Approved only for the Italian market
(3) Not for multicertification **M** group I (mining)
(4) For possible combined options, see 10

⚠ For valves with external drain (option /D), the pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar.

2 CONFIGURATIONS AND SPOOLS



2.1 Standard spools availability

- DPHA-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPHA-2 and DPHA-4 are available with all spools shown in the above table
- DPHA-6 are available only with spools **0, 1, 1/2, 2, 3, 4, 5, 58, 6, 7, 8, 19, 91**

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 (to use with option /L*).

2.3 Special spool availability

Valve size	standard spools							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHA-1	•	•		•				
DPHA-2, DPHA-4	•	•	•	•	•	•	•	•
DPHA-6		•	•	•				

3 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

Folowing options are suggested to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

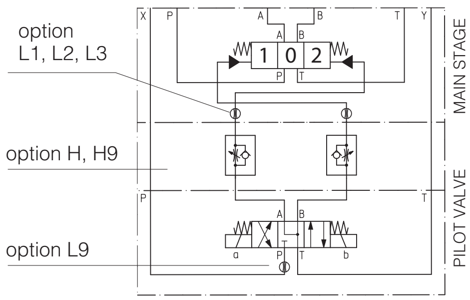
/H9 = Adjustable chokes (meter-in to the pilot chambers of the main valve).

/L1, /L2, /L3 = calibrated restrictors on A and B ports of the pilot valve:
L1 = 0,8 mm, **L2** = 1 mm, **L3** = 1,25 mm

/L9 (only for DPHA-2 and DPHA-4) plug with calibrated restictor in P port of pilot valve see section 16

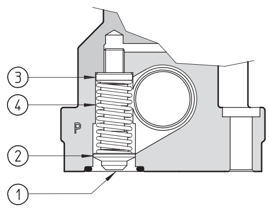
Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4 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.

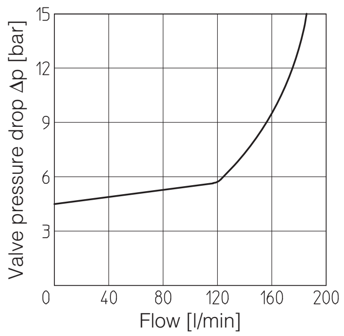


① Flapper-guide
② Flapper
③ Spring stop-washer
④ Spring

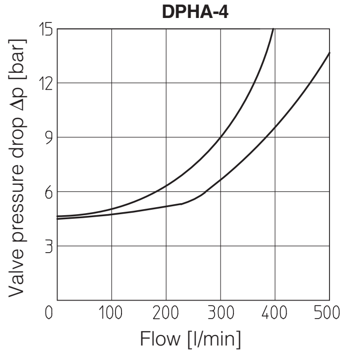
Ordering code of spare pilot pressure generator

R/DP	-	*
Pilot pressure generator		Size: **2** for DPHA-2 **4** for DPHA-4 **6** for DPHA-6 Not available for DPHA-1

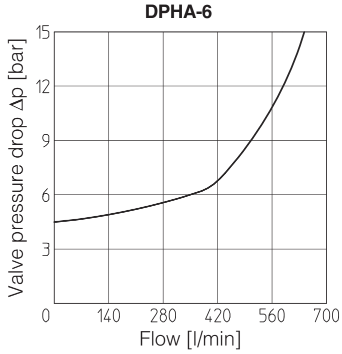
DPHA-2



DPHA-4



DPHA-6



5 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 **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 9 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

Operating pressure	P, A, B, X = **350 bar** T = **250 bar** with external drain (standard) T and Y = **210 bar** with internal drain (option /D) Minimum pilot pressure for correct operation is = **8 bar**
Rated flow	See diagrams Q/Δp at section 14
Maximum flow	DPHA-1: **160 l/min;** DPHA-2: **300 l/min;** DPHA-4: **700 l/min;** DPHA-6: **1000 l/min** see Q/Δp diagrams at section 14 and operating limits at section 15

7 ELECTRICAL CHARACTERISTICS

Valve type		DPHA	DPHA**/M**	DPHA**/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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 ÷ +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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

9 CERTIFICATION DATA

Valve type	DPHA		DPHA**/M**	DPHA**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0: EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

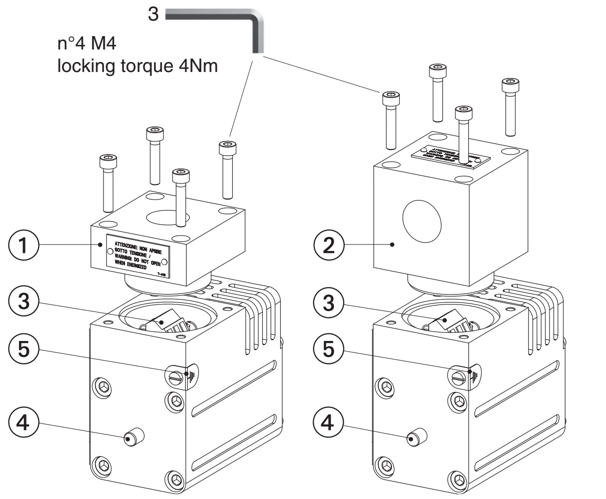
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

10 OPTIONS

A = Solenoid at side of port B of the main stage (for single solenoid valves)
O = Horizontal cable entrance, to be selected in case of limited vertical space
/D = Internal drain
/E = External pilot pressure
/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 in A and B ports of pilot valve
/L9 = (only for DPHA-2 and DPHA-4) plug with calibrated restrictor on port P of pilot valve
/R = Pilot pressure generator (not for DPHA-1)
/S = Main spool stroke adjustment (not for DPHA-1)
WP = Manual override protected by metallic cap

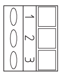
11 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

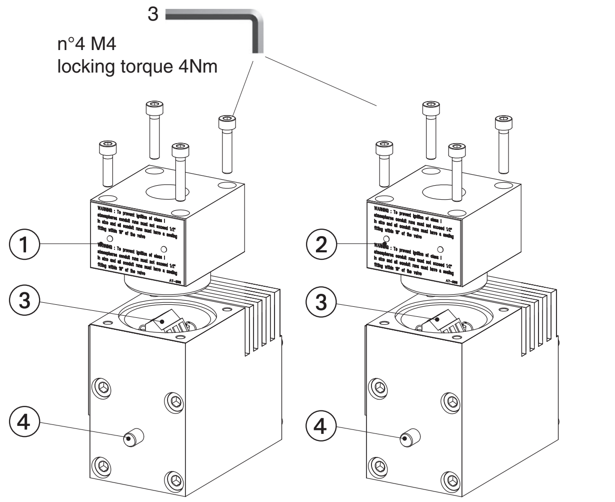
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

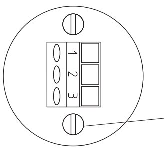
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 12 note 1

alternative GND screw terminal connected to solenoid housing

12 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

12.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

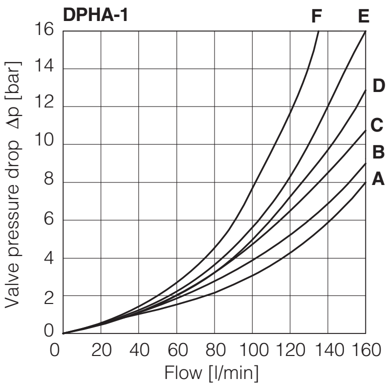
Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

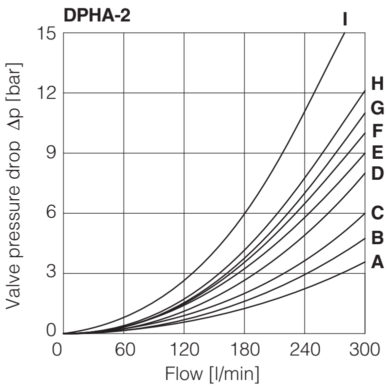
13 CABLE GLANDS only for Multicertification

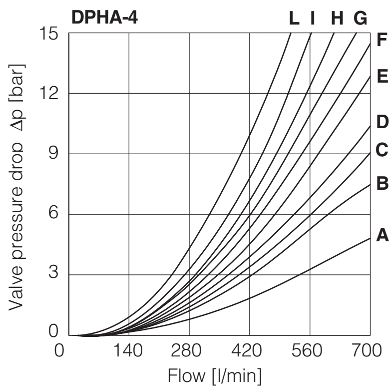
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

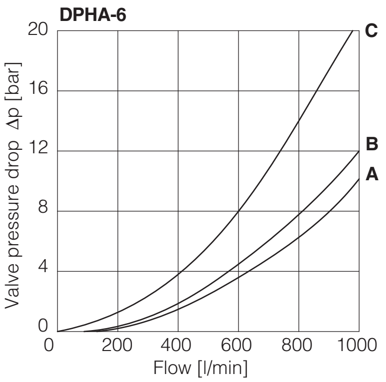
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

14 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C









DPHA-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

DPHA-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

DPHA-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	-	-	-	-

DPHA-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	-	-

15 OPERATING LIMITS For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPHA-1

Spool type	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

DPHA-2

Spool type	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

DPHA-4

Spool type	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

DPHA-6

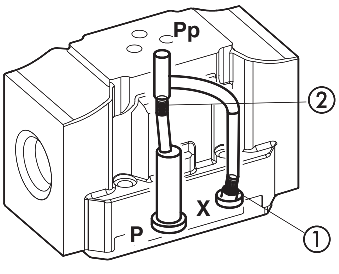
Spool type	Inlet pressure [bar] 70	140	210	350
	Flow rate [l/min]			
1, 3, 6, 7, 8	1000	950	850	700
0	950	900	800	650
2, 4, 4/8, 5	850	800	700	450
0/1, 58, 19, 91	950	850	650	450

16 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

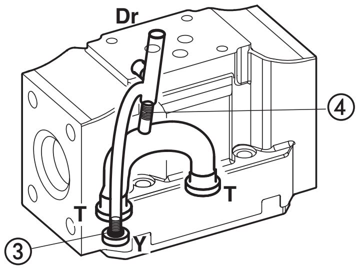
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external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

DPHA-1

Pilot channels



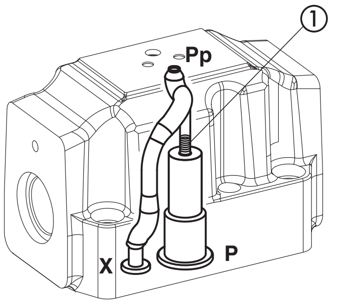
Drain channels



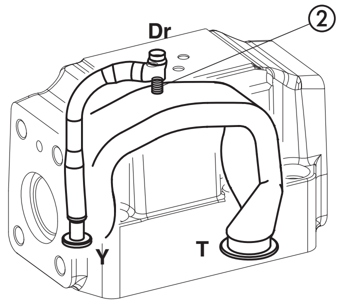
Internal piloting: blinded plug SP-X300F ① in X; plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp; plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPHA-2

Pilot channels

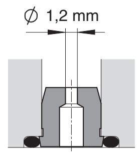


Drain channels



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.

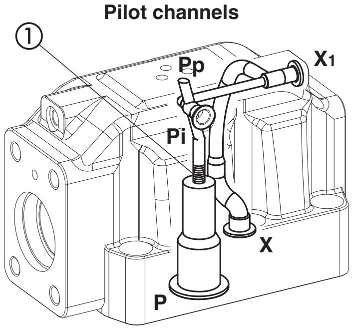
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



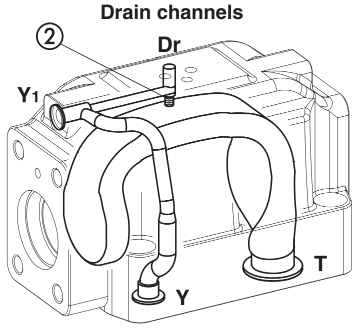
PLUG-12A

DPHA-4

Pilot channels

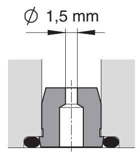


Drain channels



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.

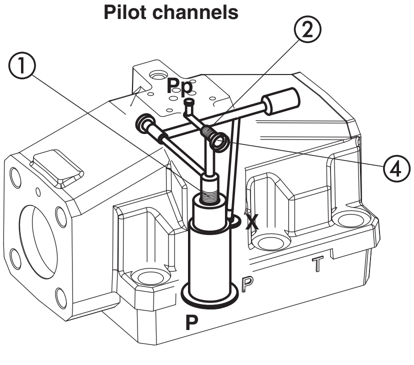
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



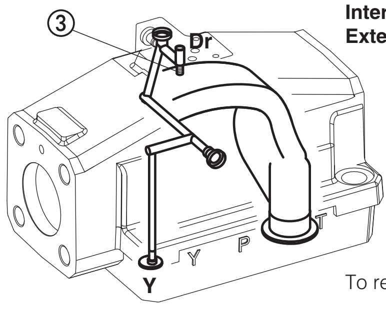
PLUG-15A

DPHA-6

Pilot channels



Drain channels

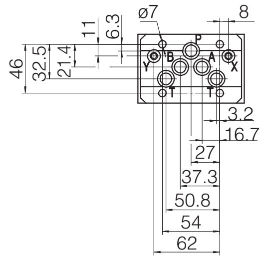


Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①; plug SP-X325A in pos ②;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

To reach the orifice ②, remove plug ④ = G 1/8"

DPHA-1*

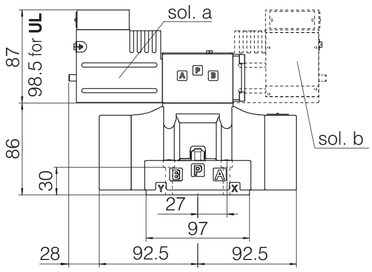
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Diameter of ports A,B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

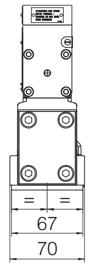


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

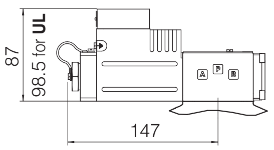
Mass [kg]	
DPHA-16	8,0
DPHA-17	9,5
Option /WP	+0,25
Option /O	+0,35
Option /H, /H9	+1,0

DPHA-16
DPHA-17 (dotted line)

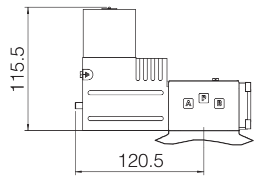




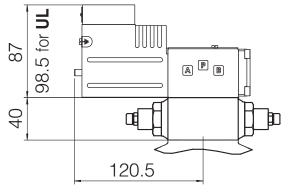
Option /WP



Option /O

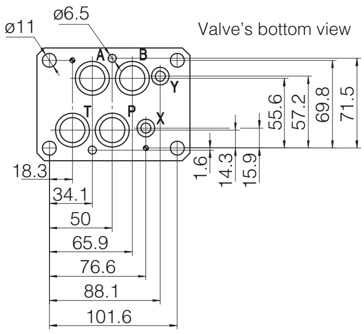


Option /H; /H9



DPHA-2*

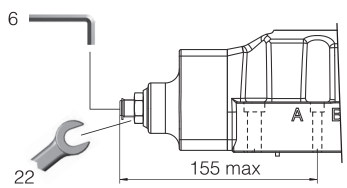
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043



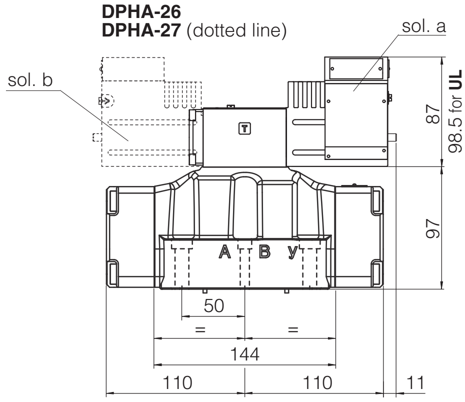
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

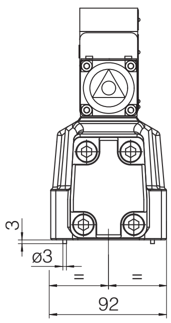
Mass [kg]	
DPHA-26	11
DPHA-27	12,5
Option /WP	+0,25
Option /O	+0,35
Option /S	+1,0
Option /H, /H9	+1,0

Option /S

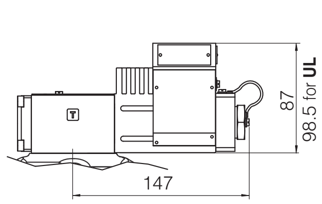


DPHA-26
DPHA-27 (dotted line)

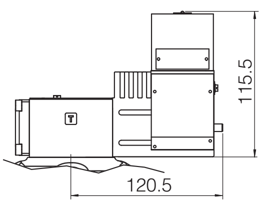




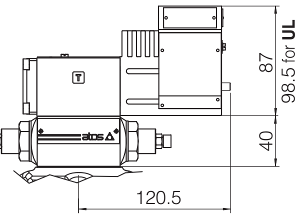
Option /WP



Option /O

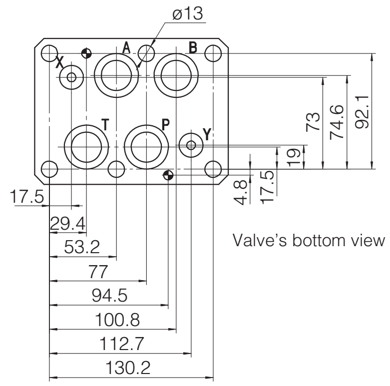


Option /H; /H9



DPHA-4*

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05
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: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;



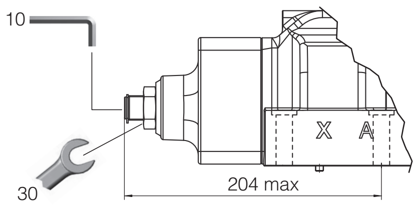
Valve's bottom view

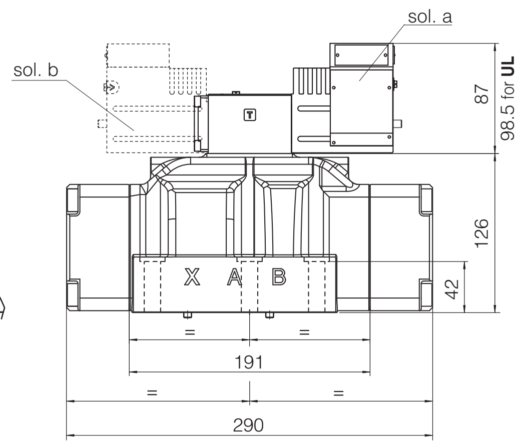
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

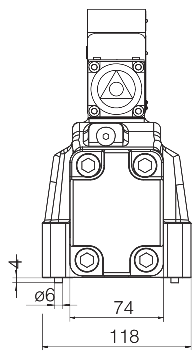
Mass [kg]	
DPHA-46	18,5
DPHA-47	20,0
Option /WP	+0,25
Option /O	+0,35
Option /S	+1,5
Option /H, /H9	+1,0

DPHA-46
DPHA-47 (dotted line)

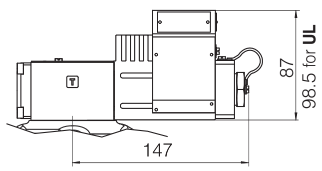
Option /S



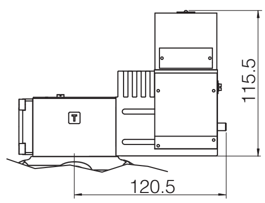




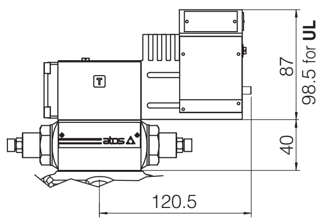
Option /WP



Option /O



Option /H; /H9

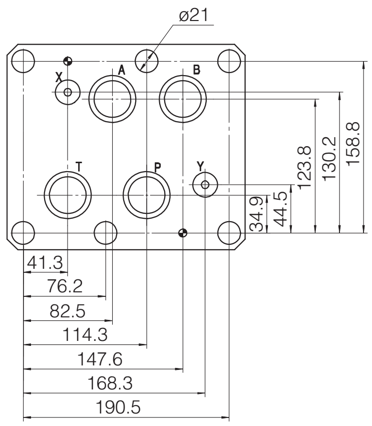


DPHA-6*

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: Ø = 34 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 144, 2 OR 3056

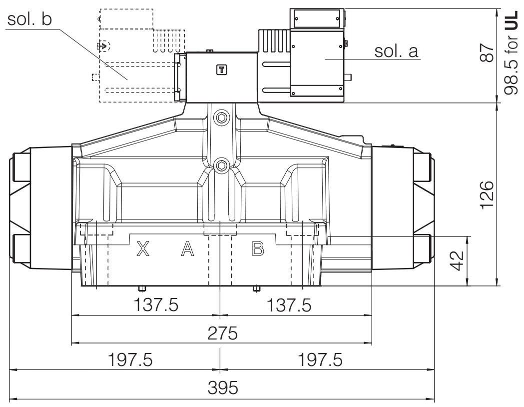
Valve's bottom view

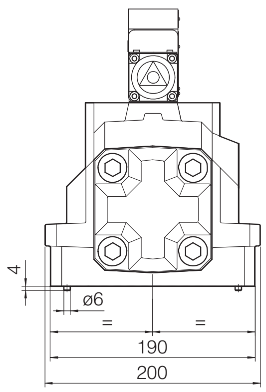


P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL OIL PILOT PORT
Y = DRAIN PORT

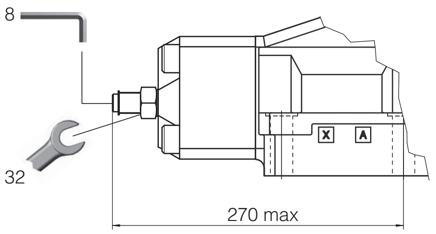
Mass [kg]	
DPHA-66	45,0
DPHA-67	46,5
Option /WP	+0,25
Option /O	+0,35
Option /S	+3,5
Option /H, /H9	+1,0

DPHA-66
DPHA-67 (dotted line)

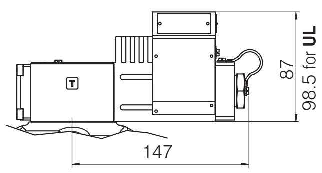




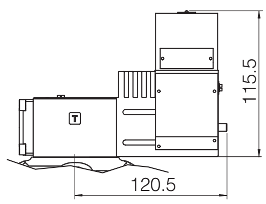
Option /S



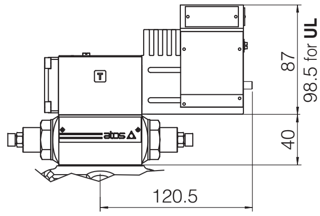
Option /WP



Option /O



Option /H; /H9

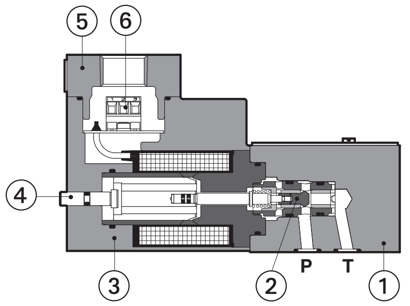


18 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof solenoid directional valves

on-off, direct, poppet type leak free - **ATEX, IECEx, EAC, PESO** or **cULus**



DLAH-2A

① valve body
② poppet
③ ex-proof solenoid
④ manual override
⑤ threaded connections for cable gland
⑥ internal terminal board for cable connection

DLAH, DLAHM, CART LAH, CART LAHM

On-off oppet type, directional valves equipped with ex-proof solenoids certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

They are **SIL** compliance with IEC 61508 (TÜV certified)

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

DLAH subplate, **CART LAH** screw-in
Size: **06** - ISO 4401 (only for DLAH)
Max flow: **12 l/min**
Max pressure: **350 bar**

DLAHM subplate, **CART LAHM** screw-in
Size: **06** - ISO 4401 (only for DLAHM)
Max flow: **30 l/min**
Max pressure: **315 bar**

1 MODEL CODE

DLAH	/	*	-	2	A	/	M	/	*	24DC	/	*	/	*

Ex-proof solenoid directional valves, poppet type

Subplate mounting
DLAH = max flow 12 l/min
DLAHM = max flow 30 l/min

Screw-in mounting
CART LAH = max flow 12 l/min
CART LAHM = max flow 30 l/min

Certification type:
Multicertification ATEX, IECEx, EAC, PESO:
- = omit for Group II 2G / II 2D **(1)**
M = Group I M2 (mining)
North American Certification:
UL = cULus

2 = two way (only for DLAH and CART LAH)
3 = three way

Configuration, see section 2
A **C**

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Options (3):
O = horizontal cable entrance **(2)**
R = with check valve on port P (only for DLAH)
WP = ⚠ manual override protected by metallic cap

Voltage code, see section 5

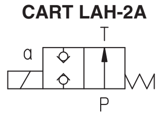
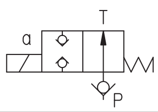
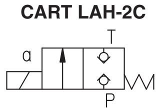
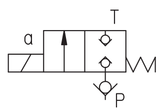
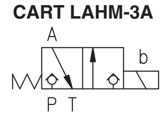
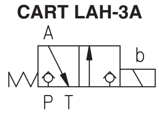
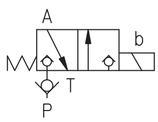
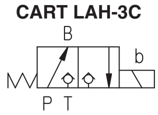
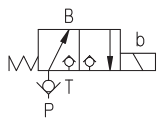
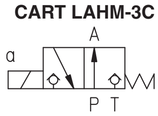
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(2) Not for multicertification **M** group I (mining) **(3)** For possible combined options, see 12.1 **(4)** Approved only for the Italian market

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS (representation according to ISO 1219-1)

DLAH-2A CART LAH-2A	DLAH-2A/R	DLAH-2C CART LAH-2C	DLAH-2C/R	DLAHM-3A CART LAHM-3A
				
DLAH-3A **CART LAH-3A**	**DLAH-3A/R**	**DLAH-3C** **CART LAH-3C**	**DLAH-3C/R**	**DLAHM-3C** **CART LAHM-3C**
				

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	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Operating pressure	DLAH, CART LAH, ports P,A,B: **350** bar; DLAHM, CART LAHM ports P,A: **315** bar; Port T **210** bar
Rated flow	See diagrams Q/Δp at section 13
Maximum flow	DLAH, CART LAH: **12 l/min**, DLAHM, CART LAHM: **30 l/min**, see operating limits at section 14

5 ELECTRICAL CHARACTERISTICS

Valve type		DLAH, DLAHM CART LAH, LAHM	DLAH**/M**, DLAHM**/M** CART LAH**/M**, LAHM**/M**	DLAH**/UL**, DLAHM**/UL** CART LAH**/UL**, LAHM**/UL**
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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 ÷ +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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature.

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DLAH, DLAHM CART LAH, LAHM		DLAH**/M**, DLAHM**/M** CART LAH**/M**, LAHM**/M**	DLAH**/UL**, DLAHM**/UL** CART LAH**/UL**, LAHM**/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

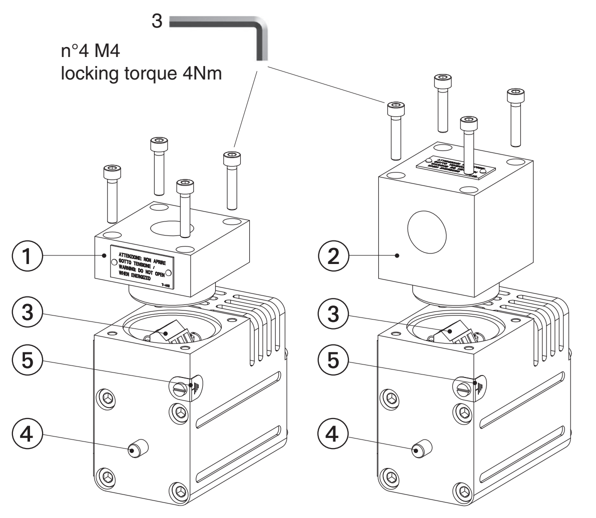
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SIL compliance with IEC 61508: 2010 - only subplate version DLAH and DLAHM

DLAH and DLAHM (multicertified for surface and mining) meets the requirements of:
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

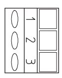
9 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

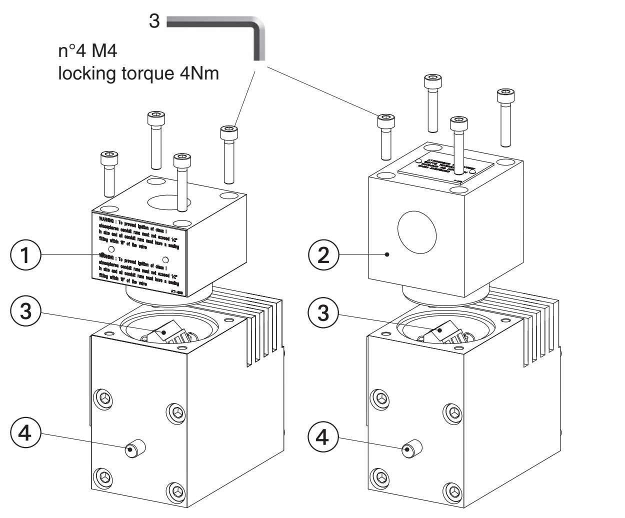
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

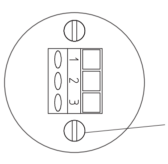
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 10 note 1

alternative GND screw terminal connected to solenoid housing

10 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

10.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

11 CABLE GLANDS only for Multicertification

Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

12 OPTIONS

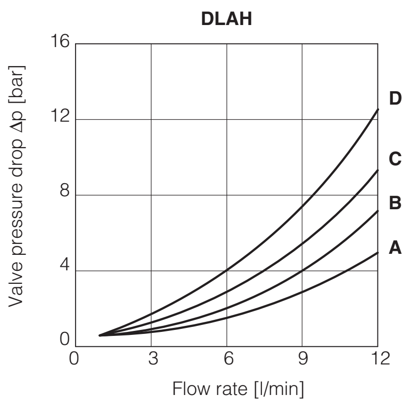
O = Horizontal cable entrance, to be selected in case of limited vertical space
R = Only for DLAH: integral check valve for free reverse flow
The DLAH-***/R** are provided with integral check valve for free reverse flow A→B
WP = Manual override protect by metallic cap

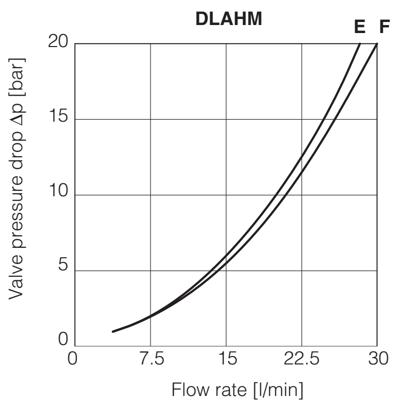
12.1 Possible combined options: /OP, /OR, /PR, /OPR

13 Q/Δp DIAGRAMS (based on mineral oil ISO VG 46 at 50°C)

Valve type \ Flow direction	**P → A**(1) **(P → B)**	**A → T (B → T)**
DLAH-2A CART LAH-2A	B	–
DLAH-2C CART LAH-2C	C	–
DLAH-3A CART LAH-3A	D	C
DLAH-3C CART LAH-3C	C	A
DLAHM-3A CART LAHM-3A	F	E
DLAHM-3C CART LAHM-3C	F	E

(1) For two-way valves, pressure drop refers to P→T





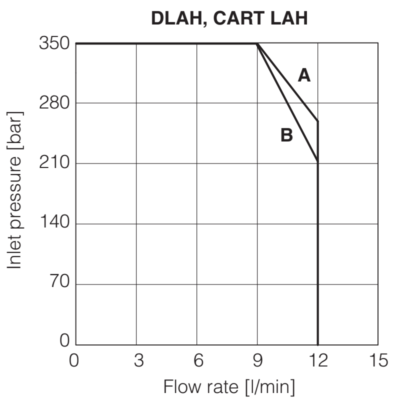
14 OPERATING LIMITS (based on mineral oil ISO VG 46 at 50°C)

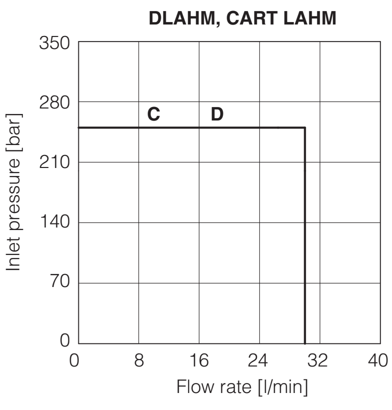
DLAH, CART LAH

A = CART LAH-3A, DLAH-3A;
B = CART LAH-2A, DLAH-2A, CART LAH-3C, DLAH-3C

DLAHM, CART LAHM

C = CART LAHM-3A, DLAHM-3A;
D = CART LAHM-3C, DLAHM-3C

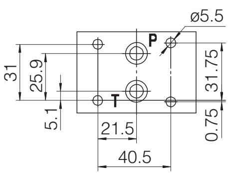




DLAH-2*

ISO 4401: 2005 (see table P005)
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)

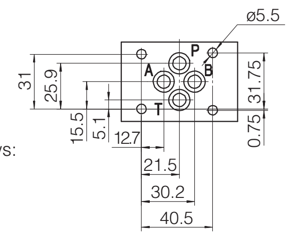
P = PRESSURE PORT
T = USE PORT



DLAH-3*

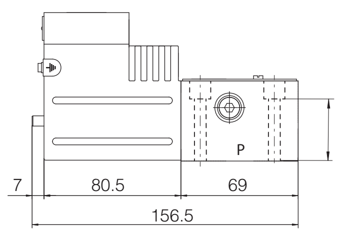
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5X50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

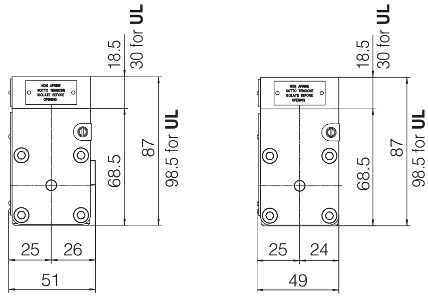
P = PRESSURE PORT
A = USE PORT (not used for DLAH-3C version)
B = USE PORT (not used for DLAH-3A version)
T = TANK PORT



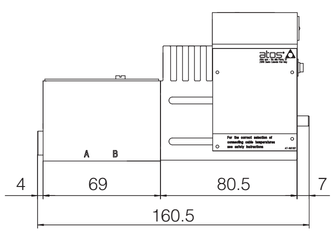
Mass [kg]	
DLAH-2*	2,65
DLAH-3*	2,65
Option /O	+0,35
Option /WP	+0,25

DLAH-2A, DLHA-2C

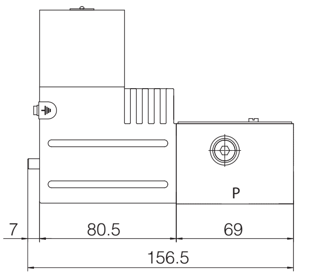


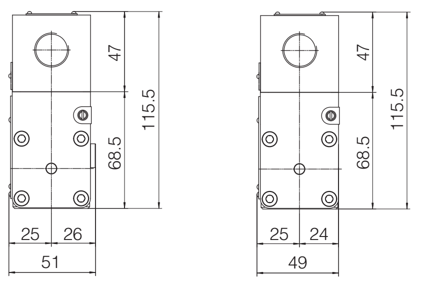


DLAH-3A ,DLAH-3C

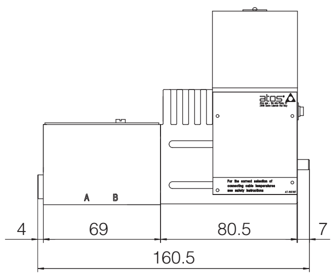


DLAH-2A /O, DLHA-2C /O

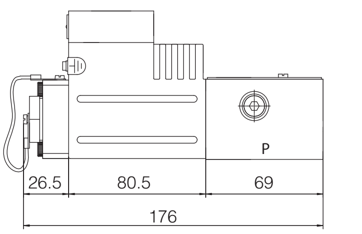


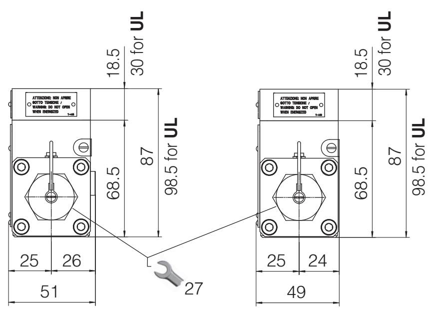


DLAH-3A /O ,DLAH-3C /O

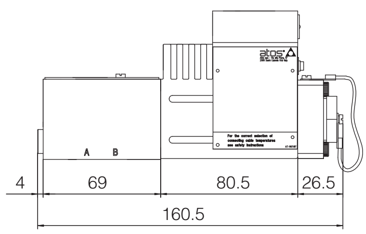


DLAH-2A /WP, DLHA-2C /WP



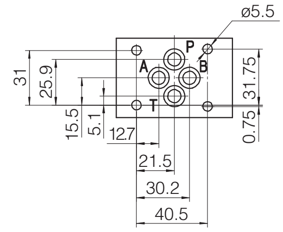


DLAH-3A /WP, DLAH-3C



DLAHM-3*

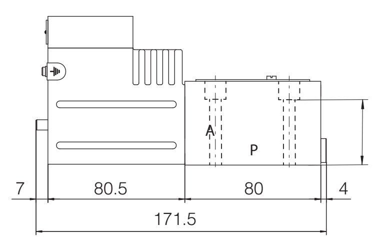
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-03-02-0-05
Fastening bolts: 4 socket head screws:
M5X50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108
Ports P,A,B,T: Ø = 7.5 mm (max)

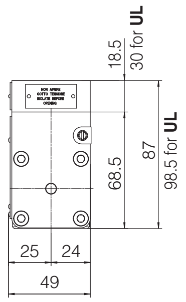


Mass [kg]	
DLAHM-3*	2,85
Option /O	+0,35
Option /WP	+0,25

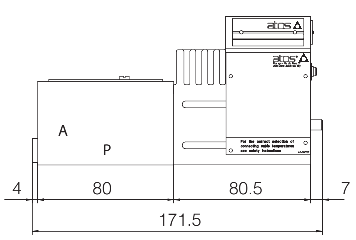
P = PRESSURE PORT
A = USE PORT
B = not used
T = TANK PORT

DLAHM-3C

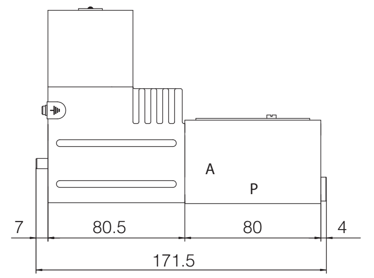


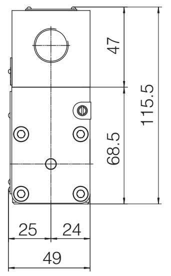


DLAHM-3A

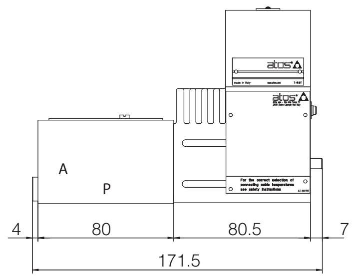


DLAHM-3C /O

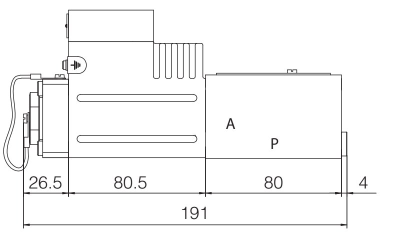


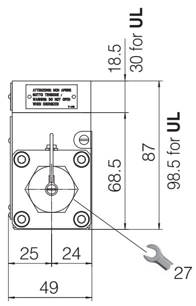


DLAHM-3A /O

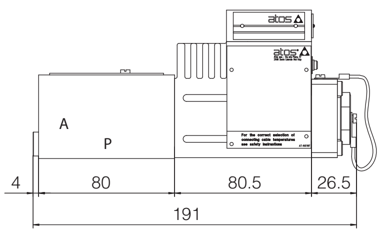


DLAHM-3C /WP



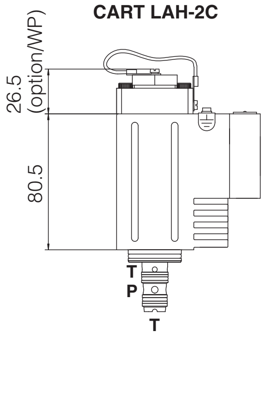


DLAHM-3A /WP

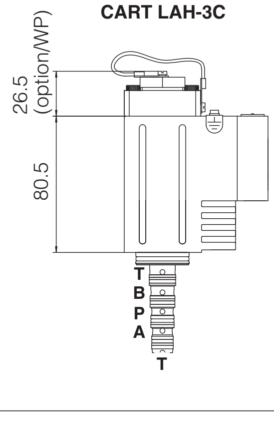


16 INSTALLATION DIMENSIONS FOR SCREW-IN VERSION [mm] - Multicertified and UL

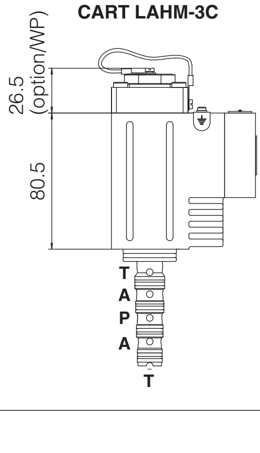
CART LAH-2A
CART LAH-2C



CART LAH-3A
CART LAH-3C



CART LAHM-3A
CART LAHM-3C

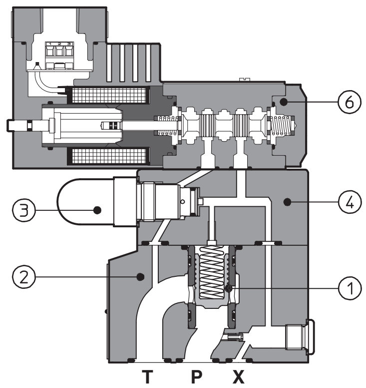


17 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
X030	Summary of Atos ex-proof components certified to cULus
EX900	Operating and manintenance information for ex-proof on-off valves
KX800	Cable glands for ex-proof valves
P005	Mounting surfaces for electrohydraulic valves
P006	Mounting surfaces and cavities for cartridge valves

Ex-proof pressure relief valves

piloted, subplate or in line mounting - **ATEX, IECEx, EAC, PESO** or **cULus**



① main poppet
② valve main body
③ mechanical pressure limiter
④ cover
⑤ ex proof pilot valve

AGAM-10/10/-AO**

AGAM, ARAM
Ex-proof pressure relief valves equipped with solenoid pilot valve for venting or multiple pressure selection, certified for safe operation in hazardous environments with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx**, **EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

AGAM: pressure relief, subplate mounting
Size: **10, 20, 32** - ISO 6264
Max flow: **200, 400, 600 l/min**

ARAM: pressure relief, threaded connections
Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

AGAM	-	20	/	20	/	210/100/100	/	M	-	AO	/	*	/	24DC	*	/	*

Ex-proof pressure relief valves, piloted
AGAM subplate mounting
ARAM threaded connections

Valve size:
10 = AGAM (ISO 6264)
20 = AGAM (ISO 6264)
32 = AGAM (ISO 6264)
20 = ARAM G 3/4"
32 = ARAM G 1 1/4"

Configuration, see section 2 :

10	**20**	**22**
11	**21**	**32**

Max regulated pressure of first (second / third) setting, see section 4 :
50 = 50 bar
100 = 100 bar
210 = 210 bar
350 = 350 bar

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (4)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Certification type:
AO = Multicertification for Group II 2G / II 2D **(3)**
AO/M = Multicertification for Group I M2 (mining)
AO/UL = cULus North American certification

Options (2):
E = external pilot
O = horizontal cable entrance **(1)**
V = regulating handweel for pressure adjustment
WP = ⚠ manual override protected by metallic cap
Y = external drain

Voltage code, see section 5

Series number

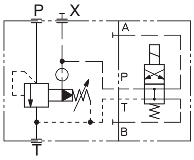
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for multicertification **M** group I (mining) **(2)** For possible combined options, see 11.1 **(3)** The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(4) Approved only for the Italian market

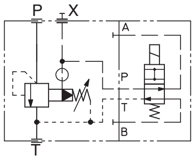
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

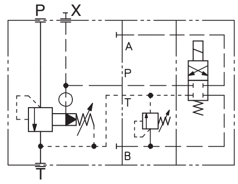
AGAM-/10**
ARAM-/10**
one setting pressure
+ venting with
de-energized solenoid



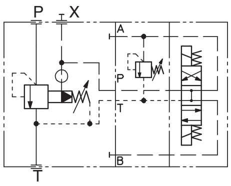
ARAM-/11**
AGAM-/11**
one setting pressure
+ venting with
energized solenoid



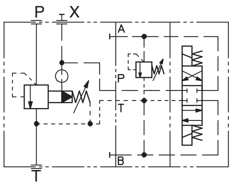
AGAM-/22**
ARAM-/22**
two setting pressure
without venting



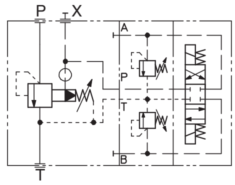
AGAM-/20**
ARAM-/20**
two setting pressure
+ venting with
de-energized solenoid



AGAM-/21**
ARAM-/21**
two setting pressure
+ venting with
energized solenoid



AGAM-/32**
ARAM-/32**
three setting pressure
without venting



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 **/BT** option = -40°C ÷ +70°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 -salt spray test (EN ISO9227) > 200h
Compliance	Explosion proof protection, see section 7 -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t" RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve size	**10**	**20**	**32**
Max operating pressure [bar]	port P = **350** port T, Y = **210**		
Max regulated pressure [bar]	**50** **100** **210** **350**		
Pressure range [bar]	4÷50; 6÷100; 7÷210; 8÷350		
Max flow **AGAM (1)** [l/min]	200	400	600
Max flow **ARAM (1)** [l/min]	-	350	500

(1) see Q/Δp diagrams at section 12 and 13

5 ELECTRICAL CHARACTERISTICS

Valve type	AGAM-***/AO** ARAM-***/AO**	AGAM-***/AO/M** ARAM-***/AO/M**	AGAM-***/AO/UL** ARAM-***/AO/UL**
Voltage code **(1)** VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
Voltage code **(1)** VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C	8W		12W
Coil insulation	class H		
Protection degree with relevant cable gland	IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor	100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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 ÷ +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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

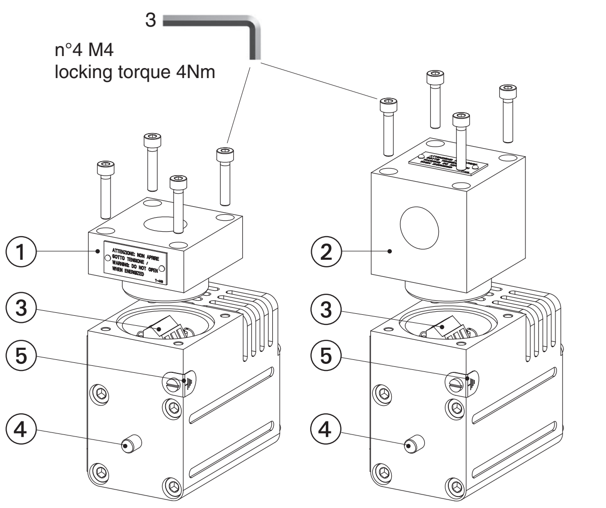
Valve type	AGAM-*/**AO** ARAM-*/**AO**		AGAM-*/**AO/M** ARAM-*/**AO/M**	AGAM-*/**AO/UL** ARAM-*/**AO/UL**	
Certifications	Multicertification Group II **ATEX IECEx EAC PESO**		Multicertification Group I **ATEX IECEx**	North American cULus **cULus**	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	20170324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

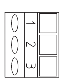
8 EX PROOF SOLENOIDS WIRING

Multicertification



Standard version **Option /O**

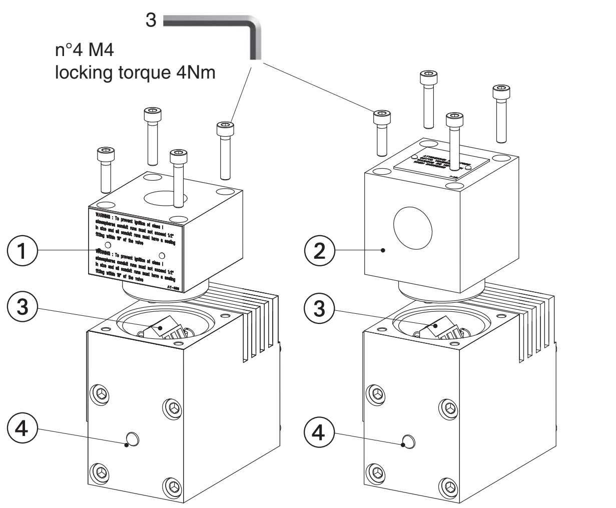
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

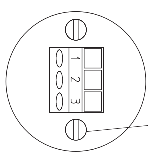
cULus certification



Standard version **Option /O**

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 9 note 1

alternative GND screw terminal connected to solenoid housing

9 **CABLE SPECIFICATION AND TEMPERATURE** - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2

Grounding: section of internal ground wire = 2,5 mm^2
section of external ground wire = 4 mm^2

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

9.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

10 **CABLE GLANDS only for Multicertification**

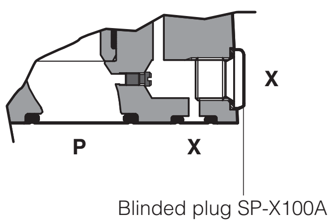
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

11 **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 ¼").

E option



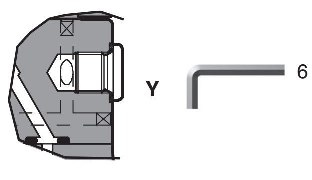
O = Horizontal cable entrance, to be selected in case of limited vertical space

V = Regulating handweel for pressure adjustment

WP = Manual override protect by metallic cap

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 ¼" available on the pilot stage body.

Y option

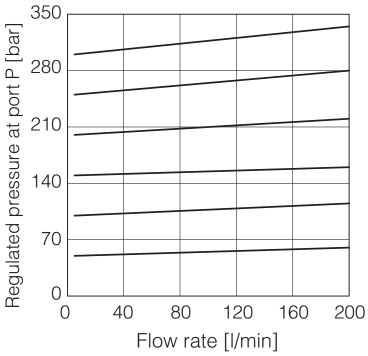


11.1 Possible combined options:

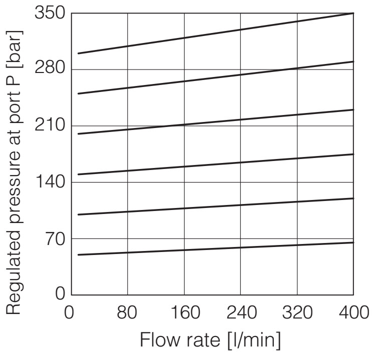
/EO, /EV, /EY, /EW, /EWP, /EOV, /EOY, /EVY
/EOWP, /EWPY, /EOVY, /EOVWP, /EVWPY, /EOVWPY
/OV, /OY, /OWP, /OVY, /OVWP, /OWPY, /OVWPY,
/VY, /VWP, /VWPY
/WPY

12 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

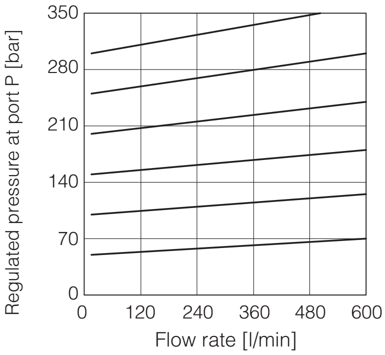
AGAM-10



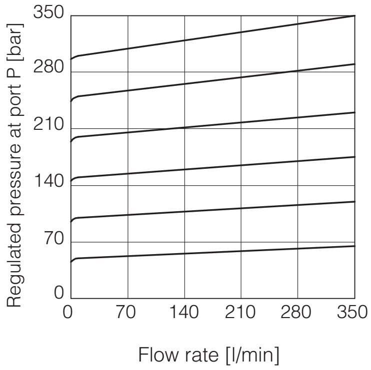
AGAM-20



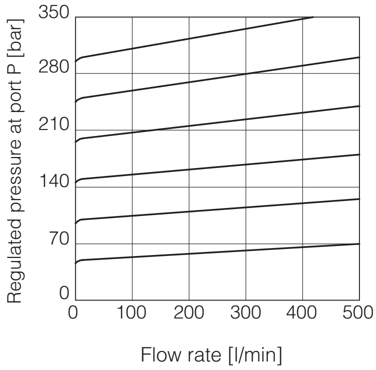
AGAM-32



ARAM-20

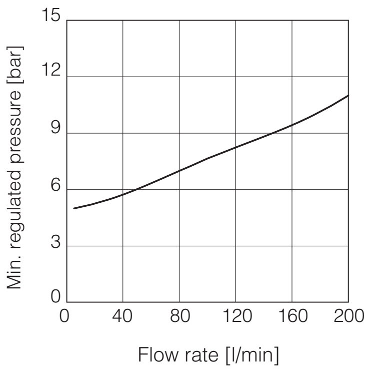


ARAM-32

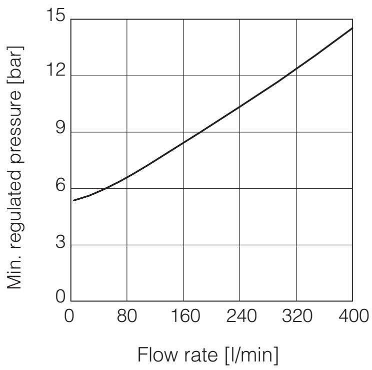


13 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

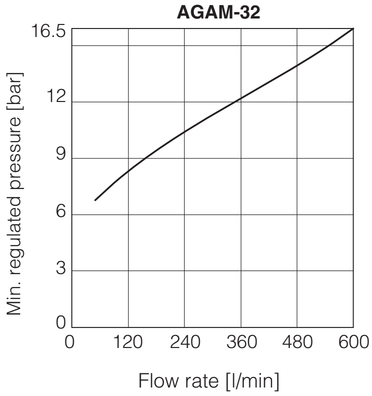
AGAM-10



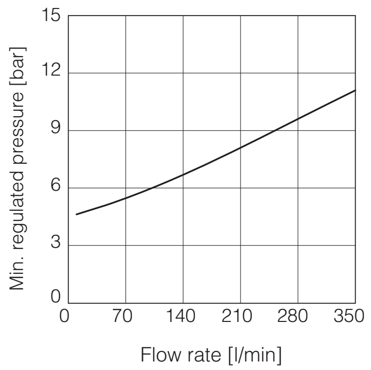
AGAM-20



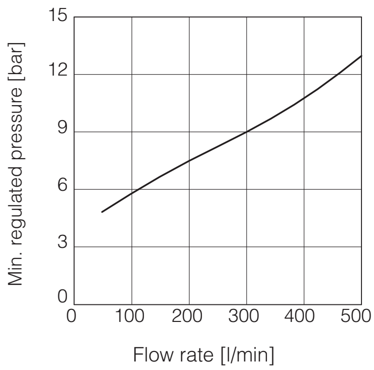
AGAM-32



ARAM-20



ARAM-32

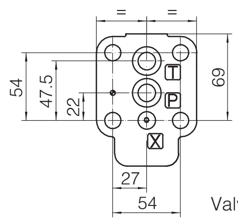


INSTALLATION DIMENSIONS FOR AGAM [mm] - Multicertified and UL

AGAM-10

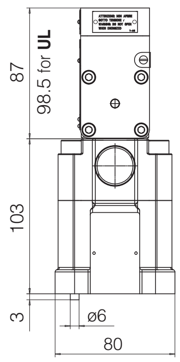
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm

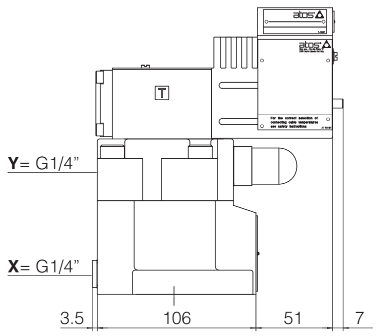
Mass [kg]	
AGAM-10/10 10/11	6,45
AGAM-10/20 10/21	7,55
AGAM-10/22 10/32	7,25 9
option /V	-
option /O	+0,35
option /WP	+0,25



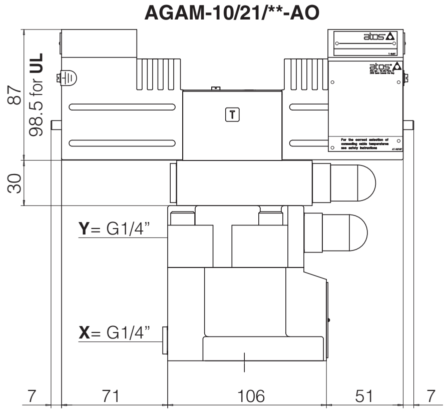
Valve's bottom view

AGAM-10/10/-AO**
AGAM-10/11/-AO**

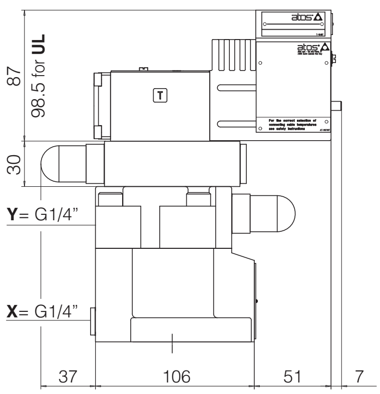




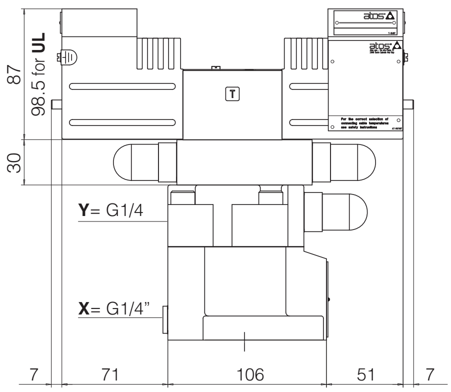
AGAM-10/20/-AO**
AGAM-10/21/-AO**



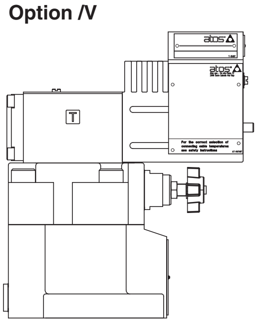
AGAM-10/22/-AO**



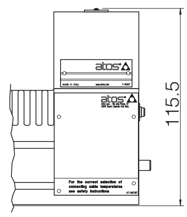
AGAM-10/32/-AO**



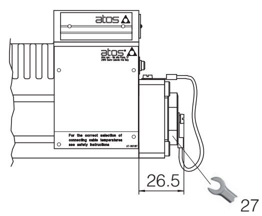
Option /V



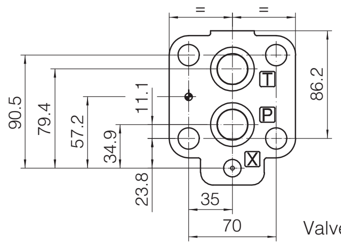
Option /O



Option /WP



AGAM-20

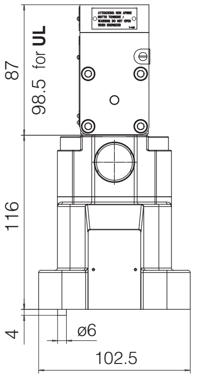


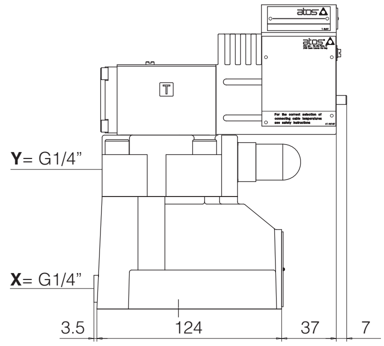
Valve's bottom view

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
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm

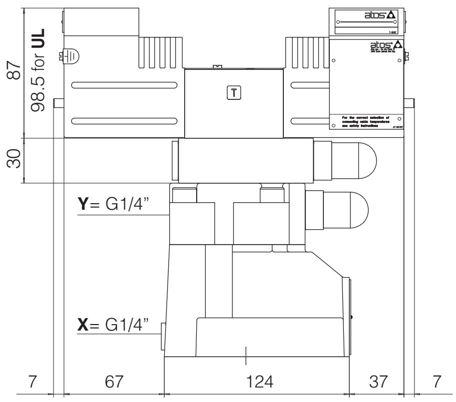
Mass [kg]	
AGAM-20/10 20/11	7,65
AGAM-20/20 20/21	8,75
AGAM-20/22 20/32	8,45 10,2
Option /V	-
Option /O	+0,35
Option /WP	+0,25

AGAM-20/10/-AO**
AGAM-20/11/-AO**

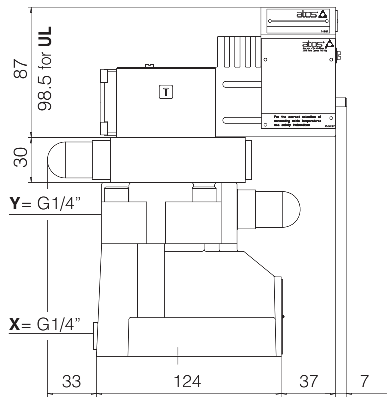




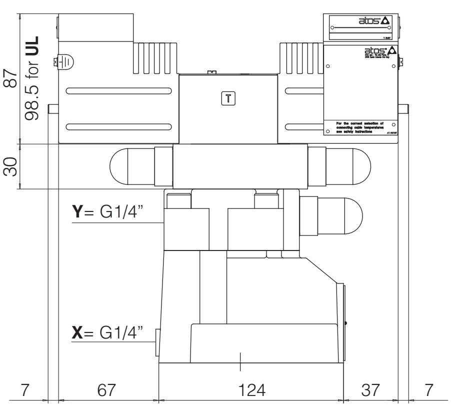
AGAM-20/20/-AO**
AGAM-20/21/-AO**



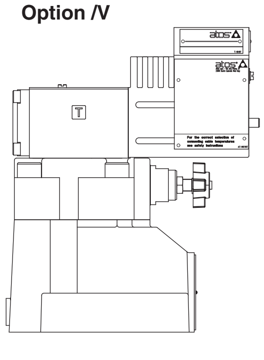
AGAM-20/22/-AO**



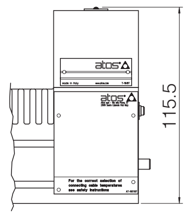
AGAM-20/32/-AO**



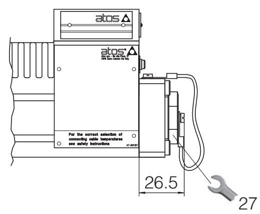
Option /V



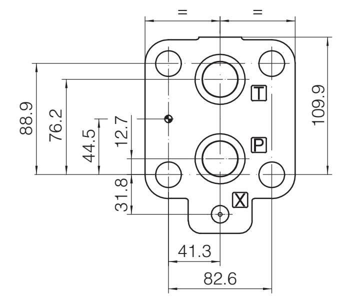
Option /O



Option /WP



AGAM-32



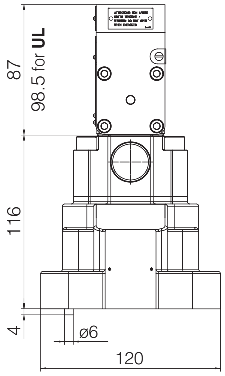
Valve's bottom view

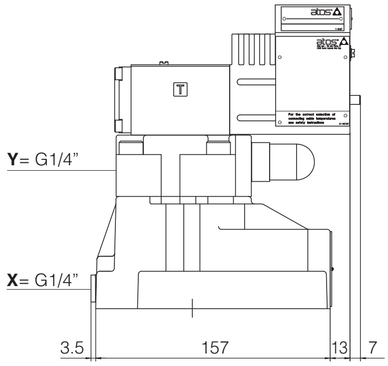
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot
Y = port connection for external drain

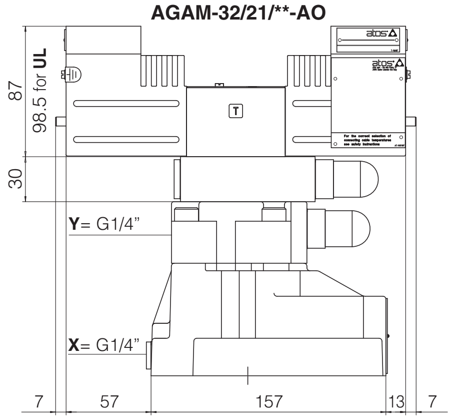
Mass [kg]	
AGAM-32/10 32/11	9,05
AGAM-32/20 32/21	10,05
AGAM-32/22 32/32	9,85 11,6
Option /V	-
Option /O	+0,35
Option /WP	+0,25

AGAM-32/10/-AO**
AGAM-32/11/-AO**

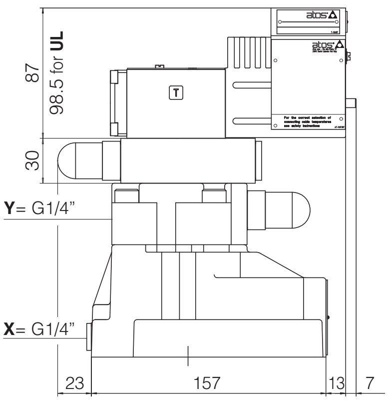




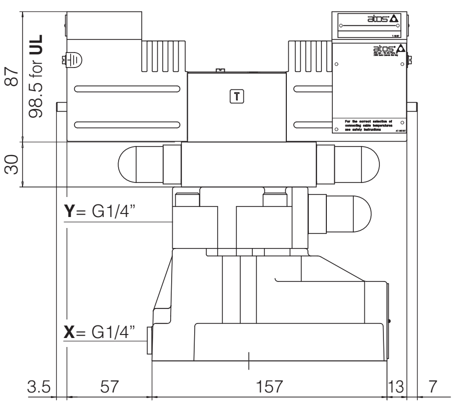
AGAM-32/20/-AO**
AGAM-32/21/-AO**



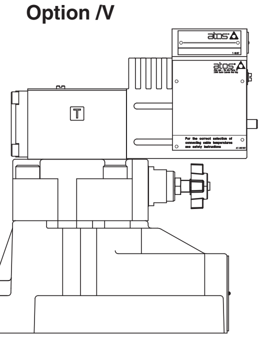
AGAM-32/22/-AO**



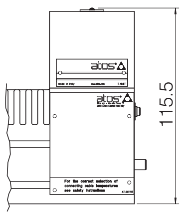
AGAM-32/32/-AO**



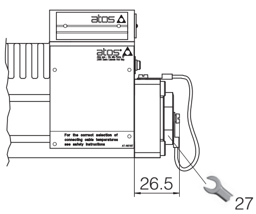
Option /V



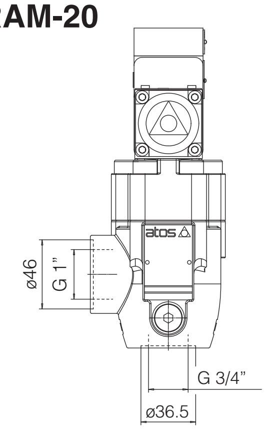
Option /O

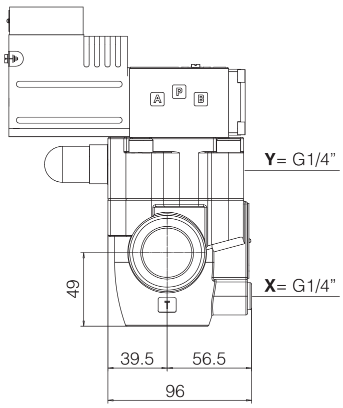


Option /WP



ARAM-20

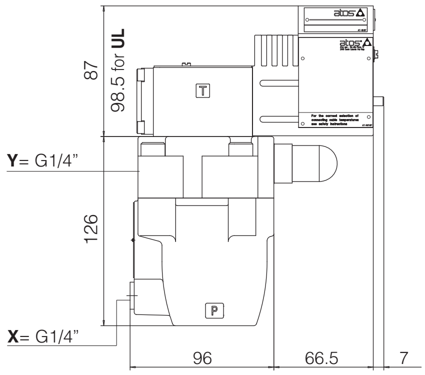




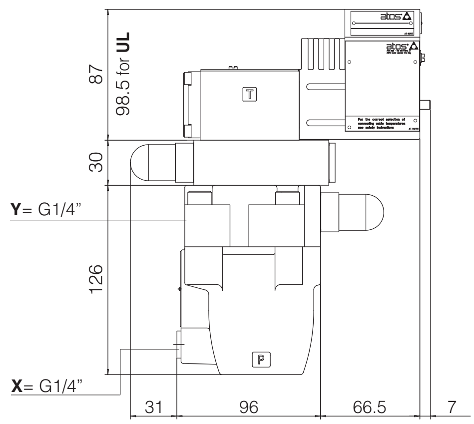
Mass [kg]	
ARAM-20/10 20/11	6,75
ARAM-20/20 20/21	8,45
ARAM-20/22 20/32	8,15 10,1
Option /V	-
Option /O	+0,35
Option /WP	+0,25

X = port connection for external pilot
Y = port connection for external drain

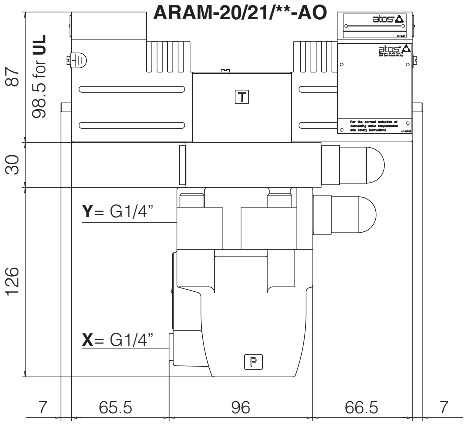
ARAM-20/10/-AO**
ARAM-20/11/-AO**



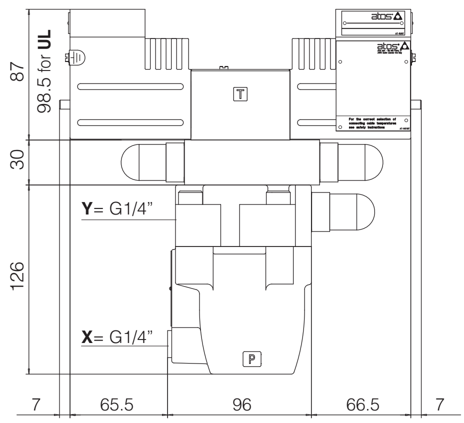
ARAM-20/22/-AO**



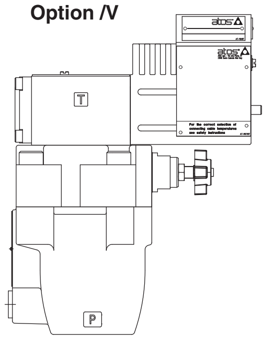
ARAM-20/20/-AO**
ARAM-20/21/-AO**



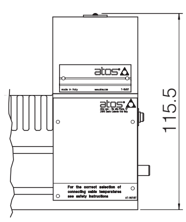
ARAM-20/32/-AO**



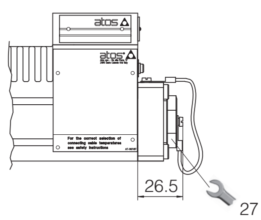
Option /V



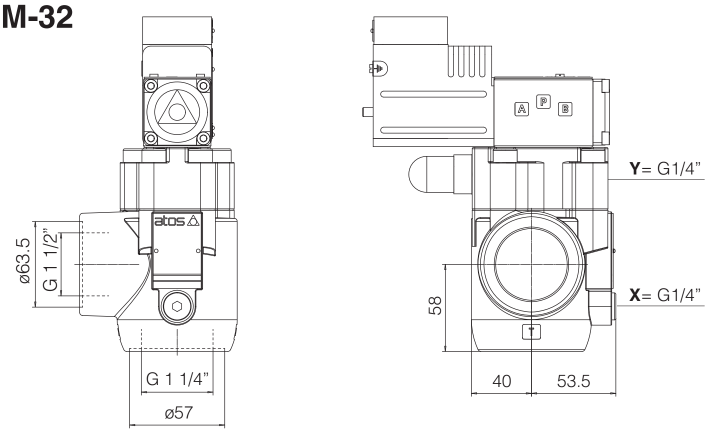
Option /O



Option /WP

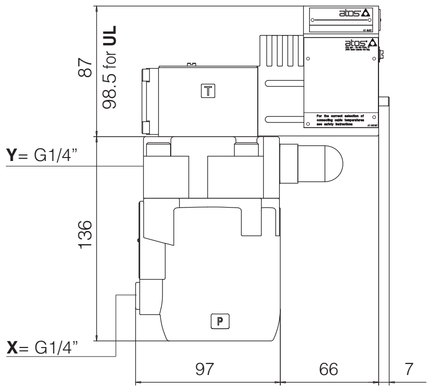


ARAM-32

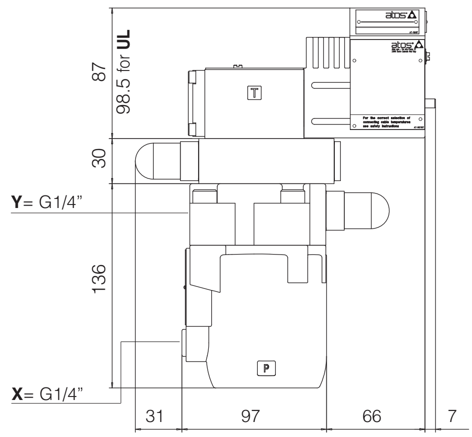


Mass [kg]	
ARAM-32/10 32/11	7,05
ARAM-32/20 32/21	9,05
ARAM-32/22 32/32	8,55 10,7
Option /V	-
Option /O	+0,35
Option /WP	+0,25

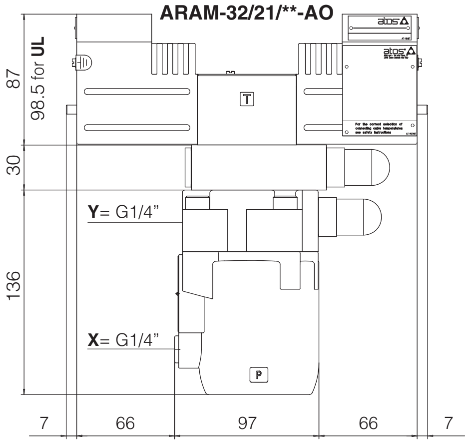
ARAM-32/10/-AO**
ARAM-32/11/-AO**



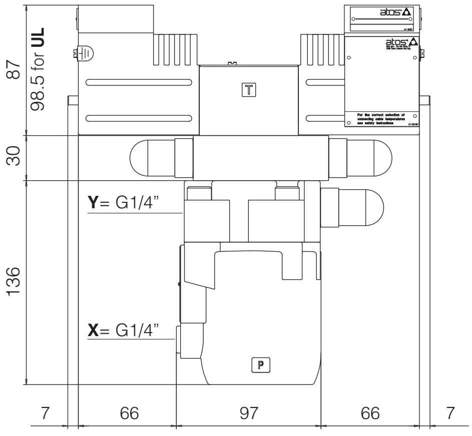
ARAM-32/22/-AO**



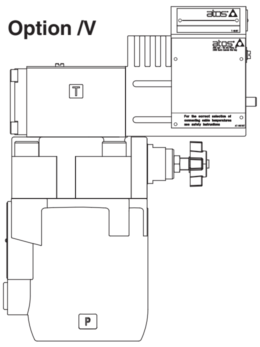
ARAM-32/20/-AO**
ARAM-32/21/-AO**



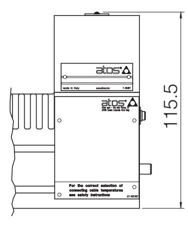
ARAM-32/32/-AO**



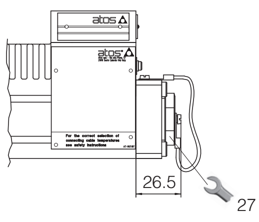
Option /V



Option /O



Option /WP

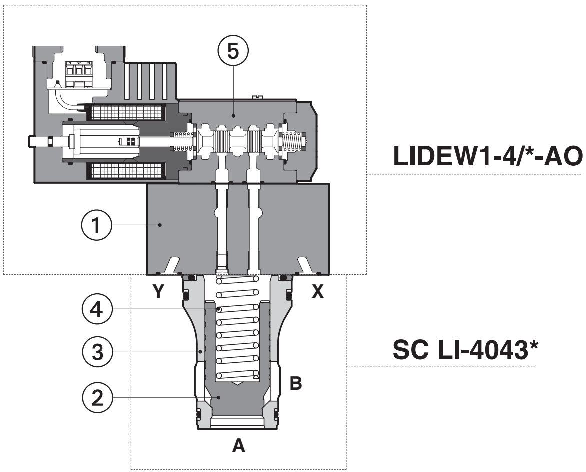


16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments	**EX900**	Operating and manintenance information for ex-proof on-off valves
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	**KX800**	Cable glands for ex-proof valves
X030	Summary of Atos ex-proof components certified to cULus	**P005**	Mounting surfaces for electrohydraulic valves

Ex-proof ISO cartridges

directional control - **ATEX, IECEx, EAC, PESO** or **cULus**



① Functional cover
② Poppet
③ Sleeve
④ Spring
⑤ Ex proof pilot valve

LIDEW, LIDBH

Directional ISO cartridgs equipped with ex-proof solenoid pilot valve, certified for safe operation in hazardous environments, with potentially explosive atmosphere.

Certifications:

- Multicertification **ATEX**, **IECEx, EAC** and **PESO** for gas group **II 2G** and dust category **II 2D**
- Multicertification **ATEX** and **IECEx** for gas group **I M2** (mining)
- **cULus** North American certification for gas group **C&D**

The flameproof enclosure of solenoid prevents the propagation of accidental internal sparks or fire to the external environment.
The solenoid is also designed to limit the surface temperature within the classified limits.

LIDEW: directional control with ex-proof solenoid valve for pilot selection

LIDBH: directional control with ex-proof solenoid valve and shuttle valve for pilot selection

Size: **16** ÷ **63** - ISO 7368
Flow: **240** ÷ **4000 l/min** at Δp 5 bar
Max pressure: **350 bar**

1 MODEL CODE OF COVERS - to be coupled with cartridge in section 5

LI	D	EW	1	-	1	/	M	-	AO	/	*	24DC	*	/	*	*

LI: Cover according to ISO 7368

D = directional function

EW = with pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Cover configuration see section 2 :
LIDEW: **-**, **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Valve size (ISO 7368):

1 = 16	**3** = 32	**5** = 50
2 = 25	**4** = 40	**6** = 63

Solenoid threaded connection for cable gland fitting:
GK = GK-1/2" - not for **cULus (1)**
M = M20x1,5 - not for **cULus**
NPT = 1/2" NPT

Certification type:
AO = Multicertifications for Group II 2G / II 2D **(2)**
AO/M = Multicertifications for Group I M2, ATEX (mining)
AO/UL = cULus North American certification

Options (4):
B = cartridge piloted via port "B" of solenoid pilot valve
E = external attachments X (1/4" GAS) and underneath port X supplied plugged (only for sizes 40...63)
O = horizontal cable entrance **(2)**
WP = ⚠ manual override protected by metallic cap

Voltage code - see section 9

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR **(3)**

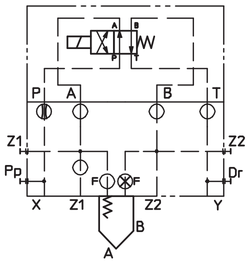
Optional different setting of the calibrated plugs in the pilot channels see section 3

(1) Approved only for the Italian market **(2)** The valves with Multicertification for Group II are also certified for Indian market according to **PESO** (Petroleum and Explosives Safety Organization). The PESO certificate can be downloaded from www.atos.com
(3) Not for multicertification **M** group I (mining) **(4)** For possible combined options, see 3.1

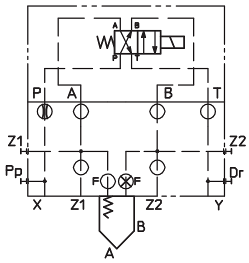
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVES CONFIGURATIONS AND HYDRAULIC SYMBOLS

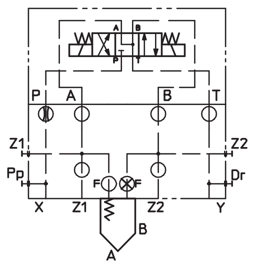
LIDEW



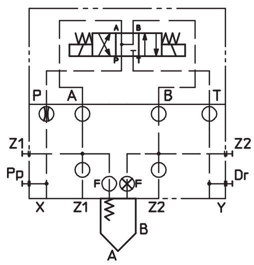
LIDEW1-*



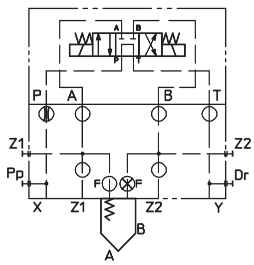
LIDEW2-*



LIDEW4-*

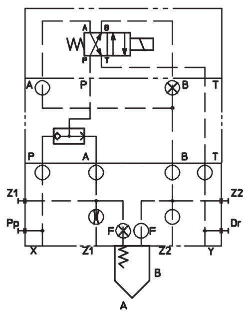


LIDEW5-*

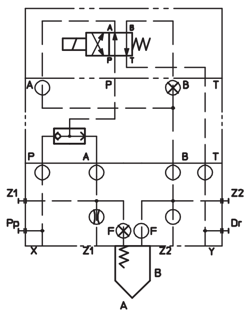


LIDEW6-*

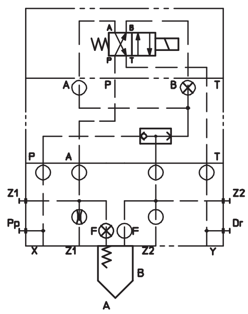
LIDBH



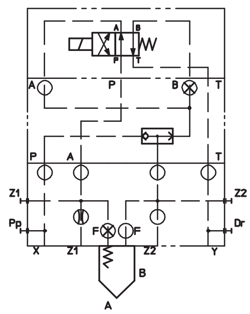
LIDBH1A-*



LIDBH1C-*



LIDBH2A-*



LIDBH2C-*

3 OPTIONS

For LIDEW*, LIDBH* covers (sizes 40…63):

/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 4. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

3.1 Possible combined options:

All combinations are available

LIDEW2	-	1	/*	-	AO	24DC	**	P	06

P: Channel where the orifice has to be provided:
P = channel X, port P **Z1** = channel Z1
F = channel F **Z2** = channel Z2

06: Size of the throttling hole in teths 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	LIDEW*-1 LIDBH*-1	LIDEW*-2 LIDBH*-2	LIDEW*-3 LIDBH*-3	LIDEW*-4 LIDBH*-4	LIDEW*-5 LIDBH*-5	LIDEW*-6 LIDBH*-6
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES, to be coupled with covers in section 1

SC LI	-	16	43	1	40	/*

Cartridge valve

Size (ISO 7368):
16 25 32 40 50 63

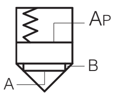
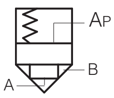
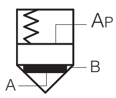
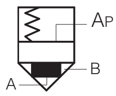
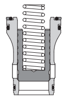
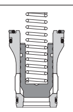
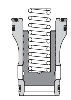
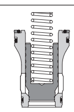
Type of poppet, see section 6 for maximum flow
32, 33
42 = as 32 but with dumping nose
43 = as 33 but with dumping nose

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

High flow:
40 = all sizes

Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet		32	33	42	43
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max** (only SCLI cartridge)			
	Size **16**	270	270	240	240
Nominal flow	**25**	550	550	500	500
at Δp 5bar	**32**	1000	1000	800	800
(l/min)	**40**	1700	1700	1400	1400
see diagrams Q/Δp	**50**	2500	2500	2200	2200
at section 9	**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	3 bar	3 bar	3 bar
	6	5,5 bar	5,5 bar	5,5 bar	5,5 bar
Cracking pressure B→A	Spring **1**	3 bar	1,2 bar	3 bar	1,2 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	6 bar	32,5 bar	6 bar
	6	54,5 bar	11 bar	54,5 bar	11 bar

7 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 **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section 11 -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS

Functional cover operating pressure	port A, B, X, Z1, Z2 = **350**; port Y = **210**
Rated flow	see section 6

9 ELECTRICAL CHARACTERISTICS

Valve type		LIDEW*/AO LIDBH*/AO	LIDEW*/AO/M LIDBH*/AO/M	LIDEW*/AO/UL LIDBH*/AO/UL
Voltage code **(1)**	VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**		**12DC, 24DC, 110DC, 125DC, 220DC**
	VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**		**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C		8W		12W
Coil insulation		class H		
Protection degree with relevant cable gland		IP66/67 to DIN EN60529		raintight enclosure, UL approved
Duty factor		100%		

(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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	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 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 EX-PROOF SOLENOIDS CERTIFICATION DATA

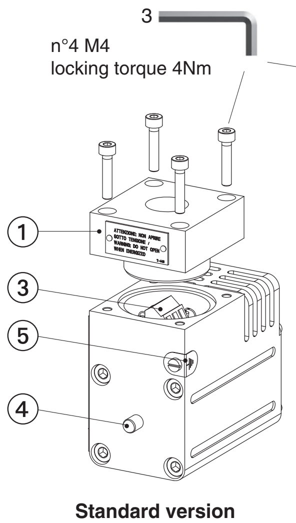
Valve type	LIDEW*/AO LIDBH*/AO		LIDEW*/AO/M LIDBH*/AO/M	LIDEW*/AO/UL LIDBH*/AO/UL	
Certifications	**ATEX IECEx EAC PESO** Multicertification Group II		**ATEX IECEx** Multicertification Group I	**cULus** North American cULus	
Solenoid certified code	**OA**		**OA/M**	**OA/EC**	
Type examination certificate **(1)**	ATEX: CESI 02 ATEX 014 IECEx: IECEx CES 10.0010x EAC: TC RU C-IT. 08.B.01784 PESO: P338131		ATEX: CESI 03 ATEX 057x IECEx: IECEx CES 12.0007x	2017324 - E366100	
Method of protection	• ATEX, EAC Ex II 2G Ex d IIC T6/T4/T3 Gb Ex II 2D Ex tb IIIC T85°C/T200°C Db • IECEx Ex d IIC T6/T4/T3 Gb Ex tb IIIC T85°C/T200°C Db • PESO Ex II 2G Ex d IIC T6/T4 Gb		• ATEX Ex I M2 Ex db I Mb • IECEx Ex db I Mb	• UL 1203 Class I, Div.I, Groups C & D Class I, Zone I, Groups IIA & IIB	
Temperature class	**T6**	**T4**	**-**	**T6**	**T5**
Surface temperature	≤ 85 °C	≤ 135 °C	≤ 150 °C	≤ 85 °C	≤ 100 °C
Ambient temperature **(2)**	-40 ÷ +45 °C	-40 ÷ +70 °C	-20 ÷ +70 °C	-40 ÷ +55 °C	-40 ÷ +70 °C
Applicable standards	EN 60079-0 EN 60079-1 EN 60079-31		IEC 60079-0 IEC 60079-1 IEC 60079-31	UL 1203 and UL429, CSA 22.2 n°30-1986 CSA 22.2 n°139-13	
Cable entrance: threaded connection vertical (standard) or horizontal (option /O)	**GK** = GK-1/2" **M** = M20x1,5 **NPT** = 1/2" NPT			1/2" NPT ANSI/ASME B46.1	

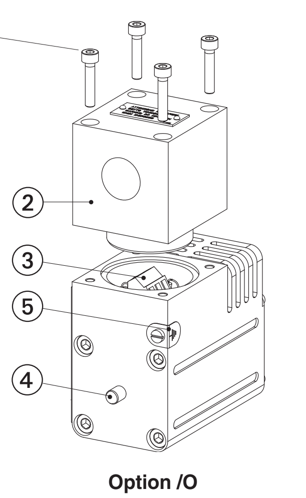
(1) The type examinator certificates can be downloaded from www.atos.com
(2) The solenoids **Group II** and **cULus** are certified for minimum ambient temperature -40°C
In case the complete valve must withstand with minimum ambient temperature of -40°C, select **/BT** in the model code

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

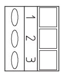
12 EX PROOF SOLENOIDS WIRING

Multicertification





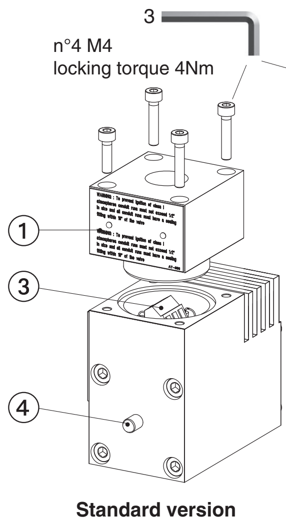
① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

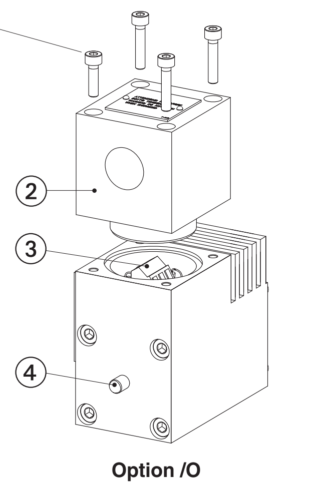


1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

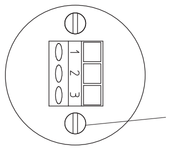
cULus certification





① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override

⚠ **Pay attention to coil polarity**



1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16), see section 13 note 1

alternative GND screw terminal connected to solenoid housing

13 CABLE SPECIFICATION AND TEMPERATURE - Power supply and grounding cables have to comply with following characteristics:

Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²

Grounding: section of internal ground wire = 2,5 mm²
section of external ground wire = 4 mm²

cULus certification:

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

13.1 Cable temperature

The cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of the products.

Multicertification

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min cable temperature
	Group I	Group II	Group I	Group II	
45 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min cable temperature
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

14 CABLE GLANDS only for Multicertification

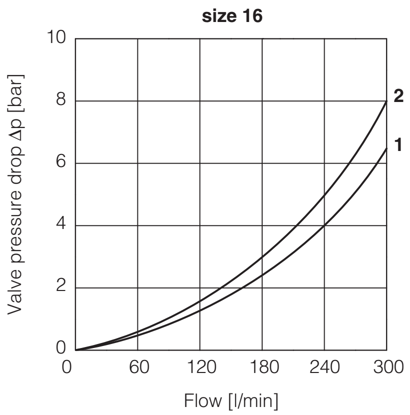
Cable glands with threaded connections GK-1/2", 1/2"NPT or M20x1,5 for standard or armoured cables have to be ordered separately, see tech. table **KX800**

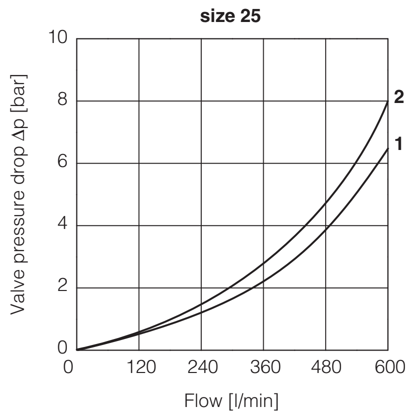
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

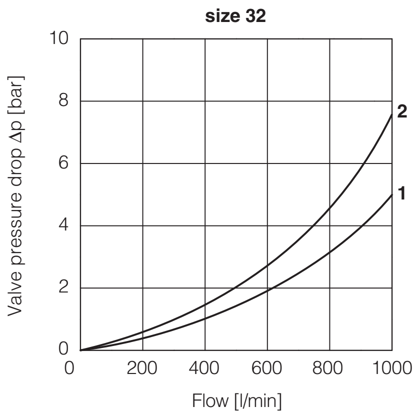
15 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

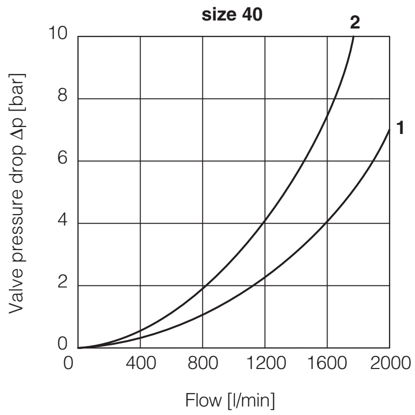
SC LI   High flow - series 40

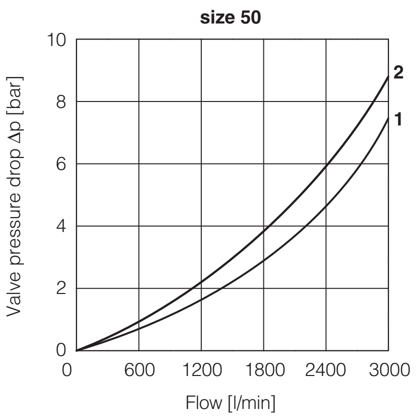
1 = poppet type 32 and 33   **2** = poppet type 42 and 43

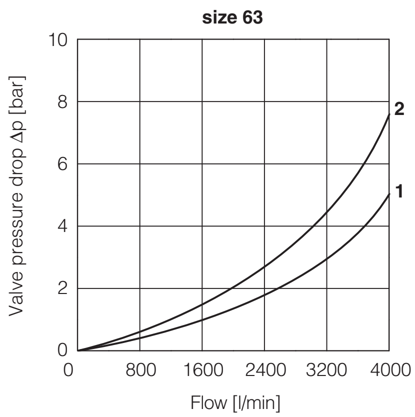










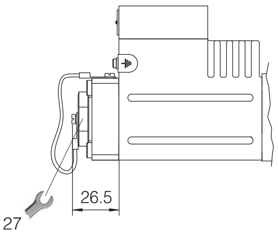


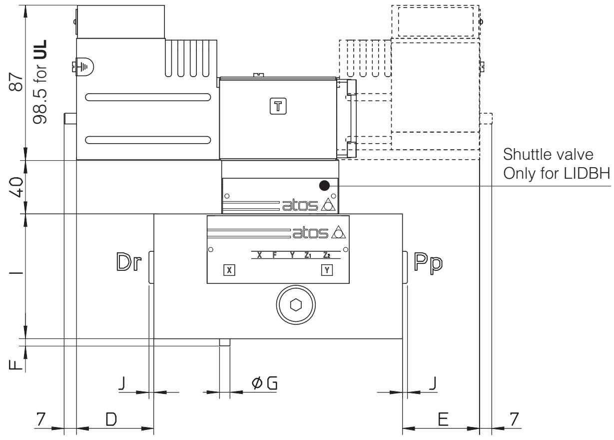
16 COVER INSTALLATION DIMENSIONS [mm] - Multicertified and UL - for cartridge cavity dimensions see tech table P006

Size 16 ÷ 63

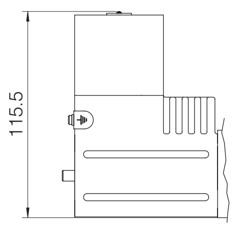
Drawing of size 50
dotted line: example of double solenoid version

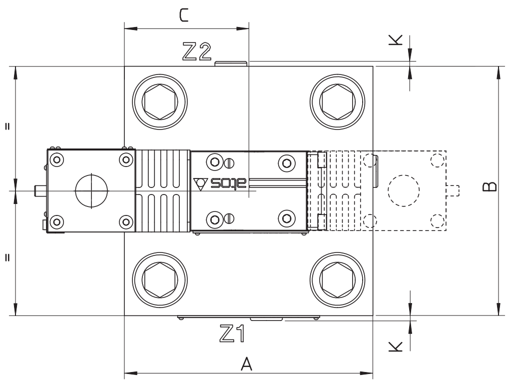
Option /WP





Option /O





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

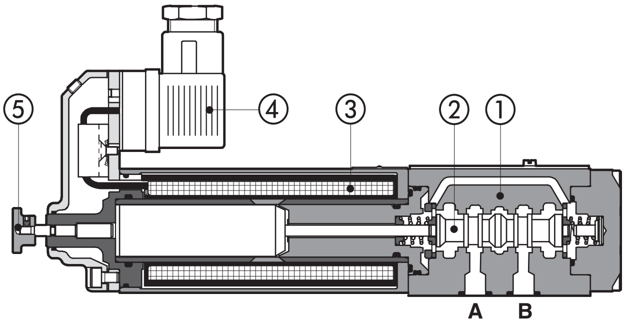
Size (1)	A	B	C	D max	E max	F	G	I	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
16	70	65	41	80	92	4	3	40	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	3,95 ÷ 5,7
25	85	85	42,5	78	78	6	5	40	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	4,35 ÷ 6,1
32	100	100	50	71	71	6	5	50	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	4,85 ÷ 6,7
40	125	125	62,5	58	58	6	5	60	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,75 ÷ 9,6
50	140	140	70	51	51	4	6	70	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,85 ÷ 12,7
63	180	180	90	31	31	4	6	80	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,65 ÷ 20,4

17 RELATED DOCUMENTATION

X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
X030 Summary of Atos ex-proof components certified to cULus
EX900 Operating and manintenance information for ex-proof on-off valves
KX800 Cable glands for ex-proof valves
P006 Mounting surfaces and cavities for cartridge valves

Intrinsically safe solenoid directional valves

on-off spool type, direct - **ATEX** or **IECEx**



DHW-0611/WP/6

① valve body
② valve spool
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

DHW

On-off, spool type, directional valves equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:
- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

DHW are **SIL** compliance with IEC 61508

See section 7 for certification data

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 13

Size: **06**
Max flow: up to **25 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DHW	/	*	-	0	71	3H	/	*	/	6	*	/	*

DHW – Intrinsically safe valve, spool type, direct

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size (ISO 4401):
0 = size 06

Configuration, see section 2 :

Spool type, see section 2 :

Options (2):
A = solenoid at side of port B
WP = prolonged manual override

Connector type
6 = DIN 43650 (standard)

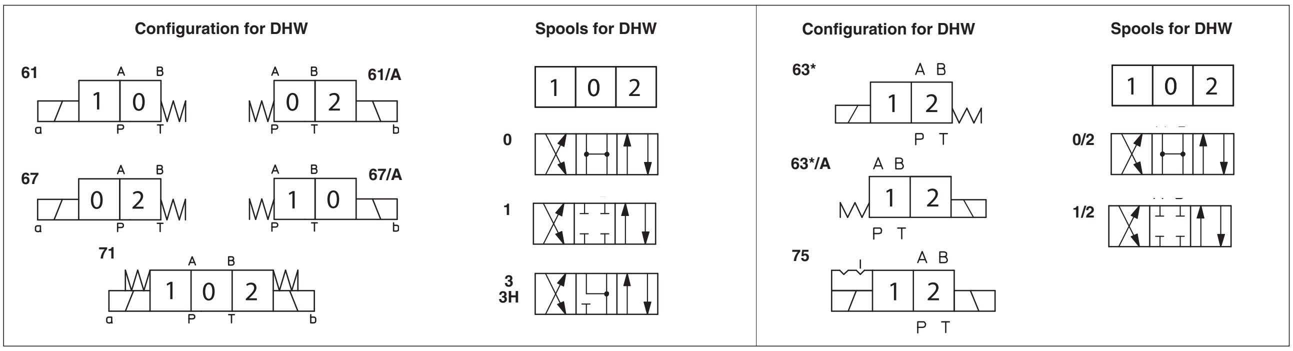
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATION and SPOOLS (representation according to ISO 1219-1)



Note: Spool type 3H is available only for configuration 71. It is similar to spool type 3 but with highetr flow capability A-B → T in central position, see section 10

3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
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	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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 - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 7 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 **160** bar
Rated flow	See Q/Δp diagrams at section 10
Maximum flow	**25 l/min**, see operating limits at section 11

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

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 ÷ +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	ISO 4406 class 20/18/15 NAS 1638 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

Valve type	DHW	DHW**/IE**	DHW**/M**	DHW**/IEM**
Certification	**ATEX** (Group II)	**IECEx** (Group II)	**ATEX (mining)** (Group I)	**IECEx (mining)** (Group I)
Solenoid code	**OW-18/6**	**OWI-18/6**	**OWM-18/6**	**OWIM-18/6**
Type examination certificate **(1)**	CESI 02 ATEX 013	IECEx CES 12.0017	CESI 02 ATEX 013	IECEx CES 12.0017

Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26			IEC 60079-0 IEC 60079-11 IEC 60079-26							

(1) The type examinator certificates can be downloaded from www.atos.com **(2)** Only for **/BT** option

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

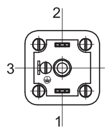
8 SIL compliance with IEC 61508: 2010

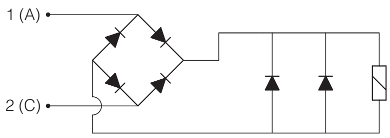
- **SC3** (systematic capability)
- max **SIL 2** (HFT = 0 if the hydraulic system does not provide the redundancy for the specific safety function where the component is applied)
- max **SIL 3** (HFT = 1 if the hydraulic system provides the redundancy for the specific safety function where the component is applied)

9 EX PROOF SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650

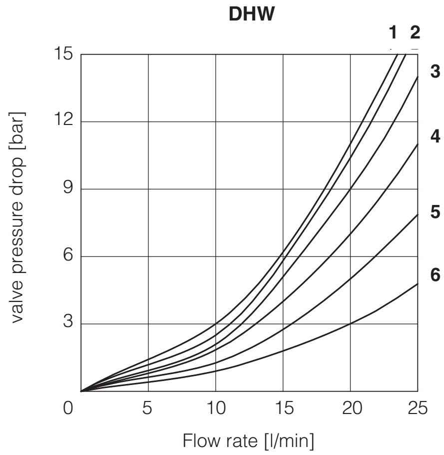




10 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

DHW

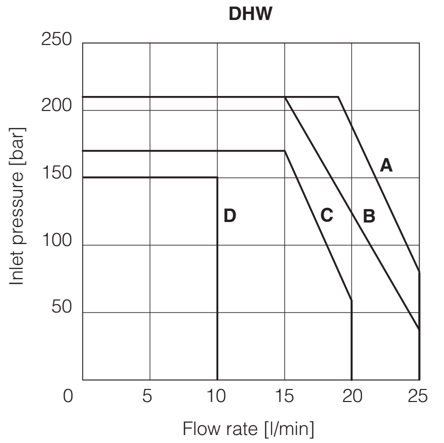
spool type / Flow direction	0	0/2	1/2	1	3	3H
P→A / P→B	4	5	5	3	3	3
A→T / B→T	6	2	1	2	4	5
A - B→T						4



11 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams refer to warm solenoids and power supply provided by the Atos barrier type **Y-BXNE-412**.
For DHW valves the curves refer to application with symmetrical flow through the valve (i.e. P→A and B→T).
In case of asymmetric flow the operating limits must be reduced.

DHW type	0	0/2	1/2	1	3	3H
Diagram	B	B	C	C	A	D



12 INTERNAL LEAKAGES

DHW internal leakages based on mineral oil ISO VG 46 at 50°C
18 cm³/min with P=100 bar - fluid viscosity = 43 cSt at 40 °C
30 cm³/min with P=140 bar - fluid viscosity = 22 cSt at 45 °C

13 INTRINSICALLY SAFE BARRIERS - see tech. table GX010

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 4 .

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

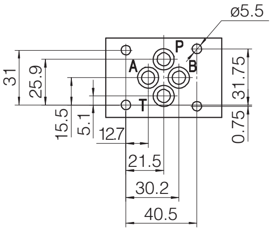
Y-BXNE 412 00	*

Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

14 INSTALLATION DIMENSIONS [mm]

ISO 4401: 2005 (see table P005)
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)

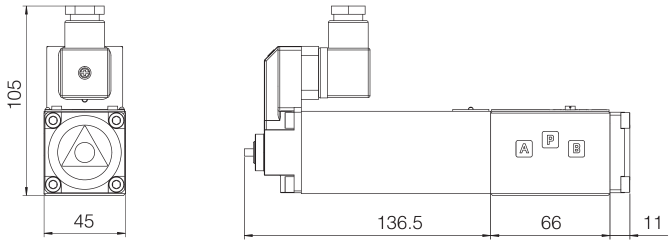
Valve's bottom view



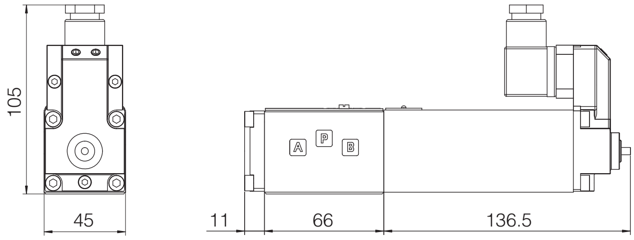
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT

Mass [kg]	
DHW-06	2,4
DHW-06*/A	2,4
DHW-07*	4

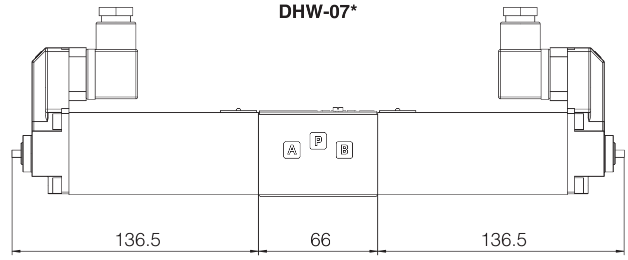
DHW-06



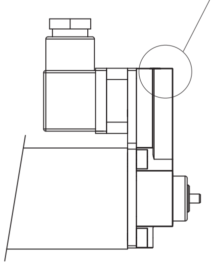
DHW-06*/A



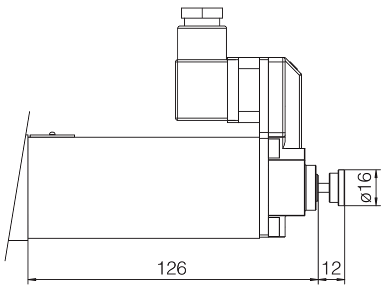
DHW-07*



DHW/M
(different cover shape)



Option **/WP**



Note: the connector is supplied with the valve

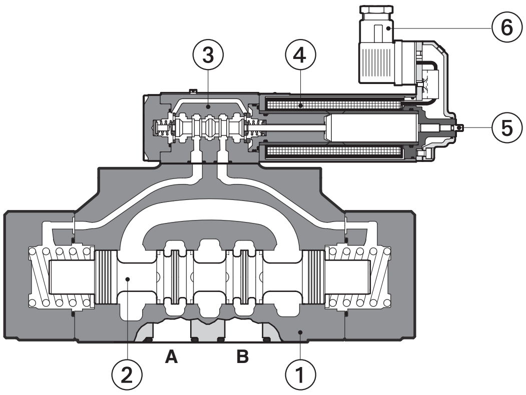
15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Table **EX130-1/E**

Intrinsically safe solenoid directional valves

on-off spool type, piloted - **ATEX** or **IECEx**



① main body
② main spool
③ pilot valve
④ intrinsically safe solenoid
⑤ manual override
⑥ electrical connector

DPHW-461*

DPHW

On-off spool type, piloted directional valves equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 7 for certification data

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 12

Size: **10, 16** and **25**
Max flow: up to **160, 300** and **700 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DPHW	/	*	-	2	61	1	/	*	/	6	*	/	*

Intrinsically safe directional valve, piloted

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size (ISO 4401):
1 = 10 **2** = 16 **4** = 25

Configuration, see section 2

Spool type, see section 2

Options (2):
A = solenoid at side of port B (for single solenoid valves)
WP = ⚠ manual override protected by metallic cap
D = Internal drain
E = external pilot pressure
H = adjustable chokes (meter-out to the pilot chambers of the main valve)
L9 = (only for DPHW-2 and DPHW-4) plug with calibrated restrictor on port P of pilot valve

Connector type
6 = DIN 43650 (standard)

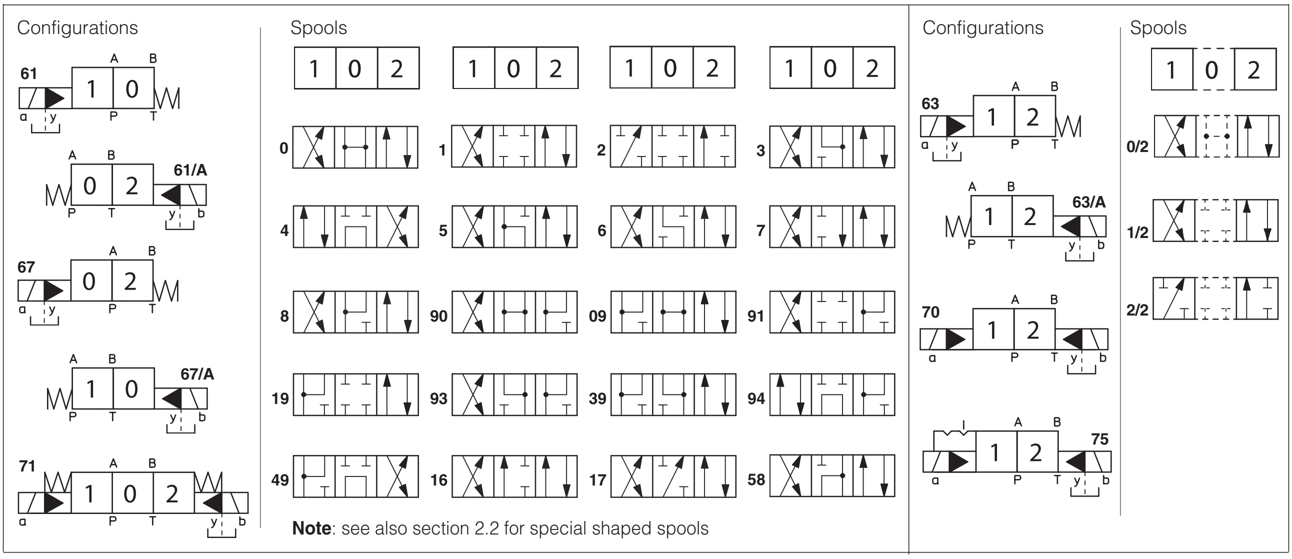
Series number

Seals material, see section 7 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS and SPOOLS (representation according to ISO 1219-1)



Note: see also section 2.2 for special shaped spools

2.1 Standard spools availability

- DPHW-1 are available only with spools **0, 0/2, 1, 1/2, 3, 4, 5, 58, 6, 7**
- DPHW-2 and DPHW-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	standard spools							
	0/1	3/1	1/1	4/8	5/1	58/1	6/1	7/1
DPHW-1	•	•		•				
DPHW-2, DPHW-4	•	•	•	•	•	•	•	•

3 DEVICES FOR MAIN SPOOL SWITCHING CONTROL

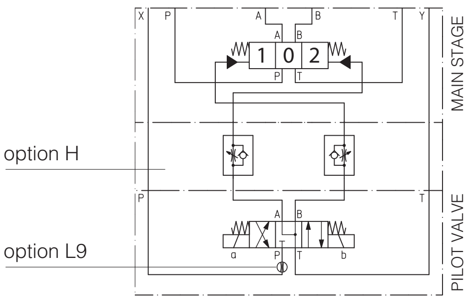
Folowing options are suggested to reduce the hydraulic shocks at the valve operation

/H = Adjustable chokes (meter-out to the pilot chambers of the main valve).

/L9 (only for DPHW-2 and DPHW-4) plug with calibrated restictor in P port of pilot valve

Suggested for pilot pressure higher than 210 bar or to limit the hydraulics shocks caused by the fast main spool switching

FUNCTIONAL SCHEME (config. 71)
example of switching control options



4 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
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 ÷ +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 - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection “Ex ia”, see section 8 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

5 HYDRAULIC CHARACTERISTICS

Operating pressure	P, A, B, X = **350 bar** T = **250 bar** with external drain (standard) T and Y = **160 bar** with internal drain (option /D) Minimum pilot pressure for correct operation is = **8 bar**
Rated flow	See diagrams Q/Δp at section 10
Maximum flow	DPHW-1: **160 l/min;** DPHW-2: **300 l/min;** DPHW-4: **700 l/min;** see Q/Δp diagrams at section 10 and operating limits at section 11

6 ELECTRICAL CHARACTERISTICS - see also section 8

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

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 ÷ +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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

8 CERTIFICATION DATA

Valve type		DPHW		DPHW**/IE**			DPHW**/M**			DPHW**/IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26					IEC 60079-0 IEC 60079-11 IEC 60079-26					

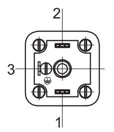
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

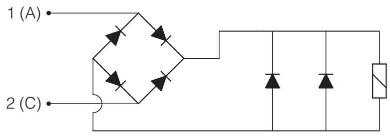
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

9 SOLENOIDS WIRING

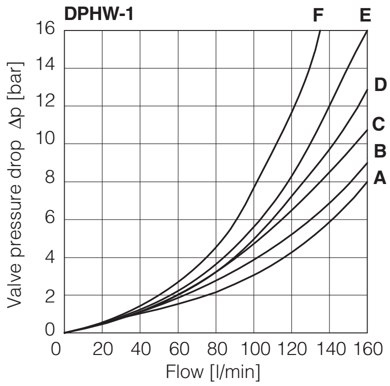
Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

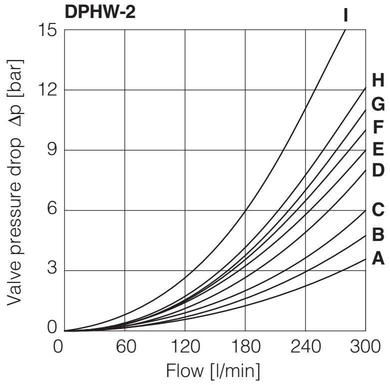
DIN 43650

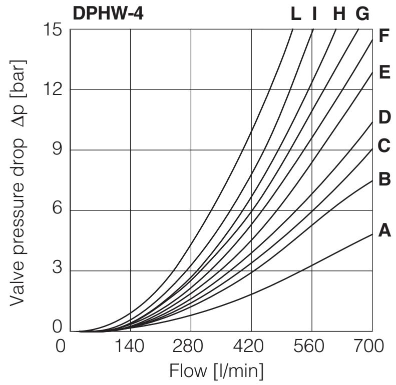




10 FLOW VERSUS PRESSURE DIAGRAMS Based on mineral oil ISO VG 46 at 50°C







DPHW-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

DPHW-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	-	-	-	-

DPHW-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	-	-

11 OPERATING LIMITS

For a correct valve operation do not exceed the max recommended flow rates (l/min) shown in the below tables

DPHW-1

Spool type	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

DPHW-2

Spool type	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

DPHW-4

Spool type	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

12 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:

1) Vmax and Imax of the solenoid as specified in section 8 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 11

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00	*

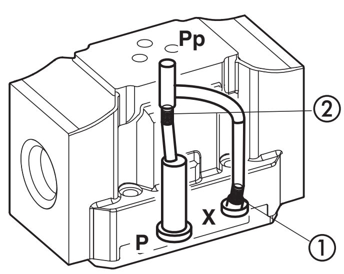
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

13 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

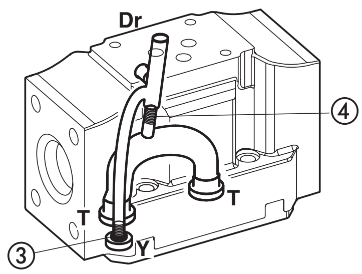
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external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

DPHW-1

Pilot channels



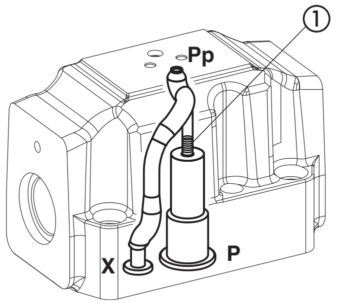
Drain channels



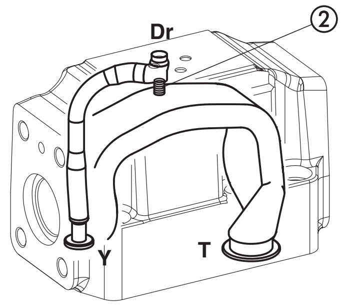
Internal piloting: blinded plug SP-X300F ① in X; plug SP-X310F ② in Pp;
External piloting: blinded plug SP-X300F ② in Pp; plug SP-X310F ① in X;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPHW-2

Pilot channels

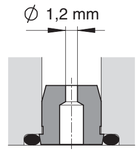


Drain channels



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.

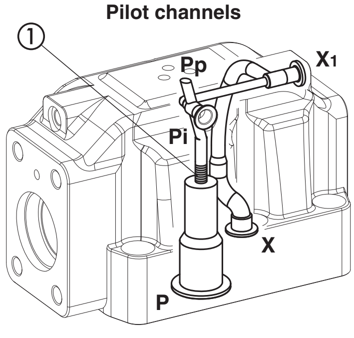
Option L9
This option provides a calibrated restrictor PLUG-H-12A (Ø 1,2 mm) in the P port of the pilot valve



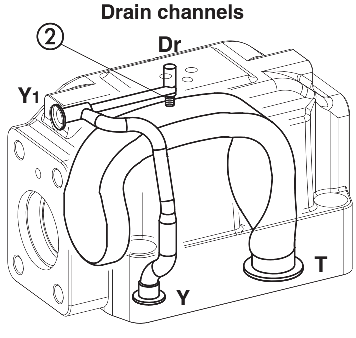
PLUG-12A

DPHW-4

Pilot channels

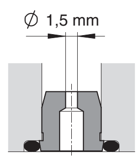


Drain channels



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.

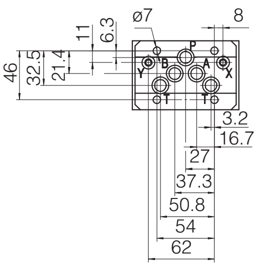
Option L9
This option provides a a calibrated restrictor PLUG-H-15A (Ø 1,5 mm) in the P port of the pilot valve



PLUG-15A

DPHW-1*

ISO 4401: 2005 (see table P005)
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: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;
Seals: 5 OR 2050, 2 OR 108

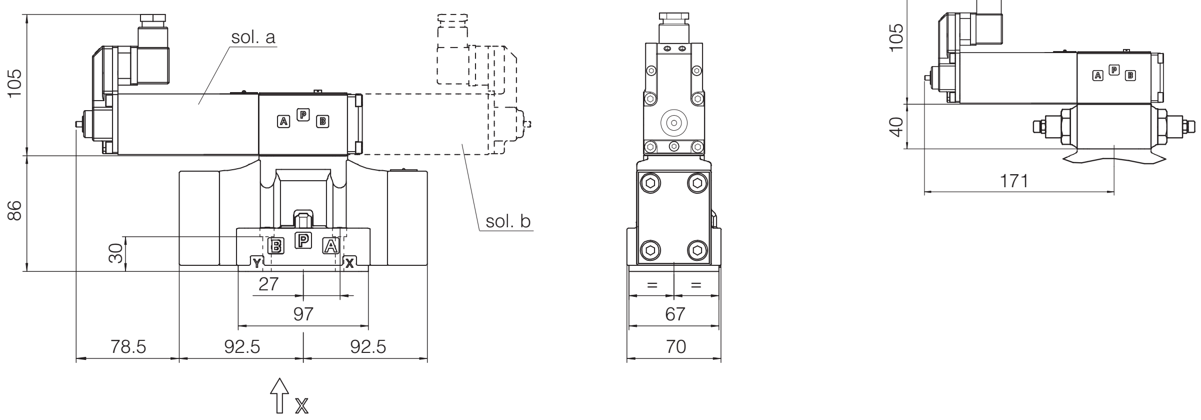


Valve's bottom view

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

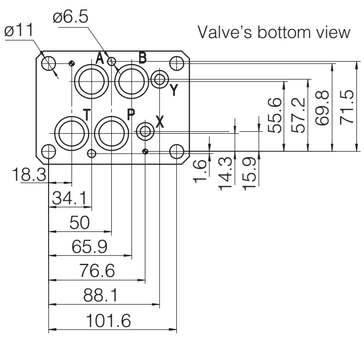
Mass [kg]	
DPHW-16	8,0
DPHW-17	9,5
Option /H	+1,0

DPHW-16
DPHW-17 (dotted line)



DPHW-2*

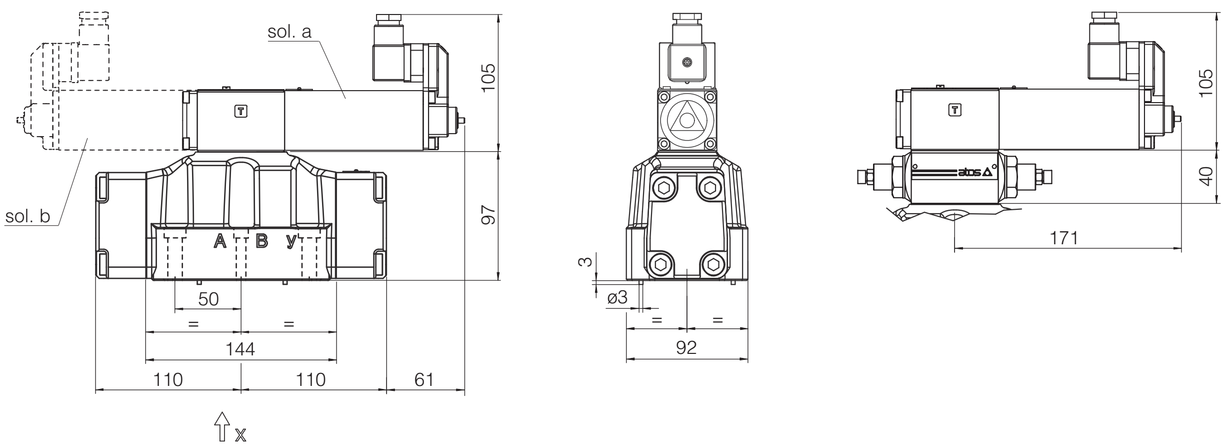
ISO 4401: 2005 (see table P005)
Mounting surface: 4401-07-07-0-05
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;
Seals: 4 OR 130, 2 OR 2043



Valve's bottom view

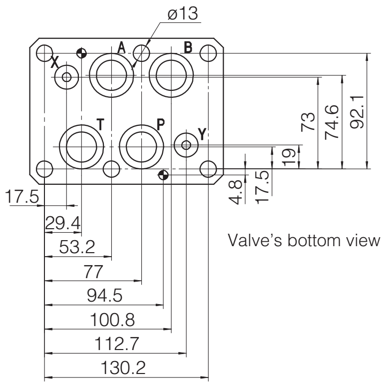
P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

Mass [kg]	
DPHW-26	11
DPHW-27	12,5
Option /H	+1,0



DPHW-4*

ISO 4401: 2005 (see table P005)
Mounting surface: 4401-08-08-0-05
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: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

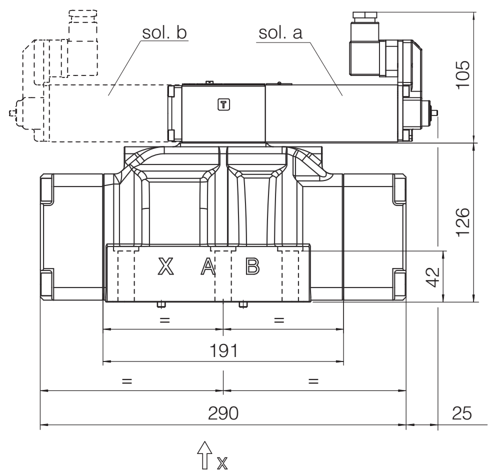


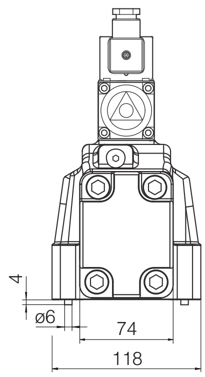
Valve's bottom view

P = PRESSURE PORT
A, B = USE PORT
T = TANK PORT
X = EXTERNAL PILOT PORT
Y = DRAIN PORT

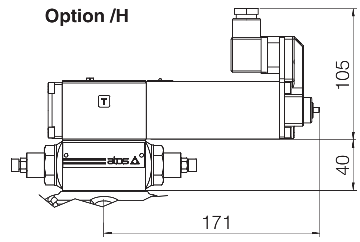
Mass [kg]	
DPHW-46	18,5
DPHW-47	20
Option /H	+1,0

DPHW-46
DPHW-47 (dotted line)



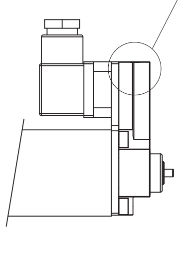


Option /H

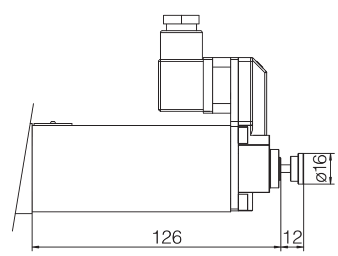


Options for all sizes of DPHW

Pilot of DPHW **/M** and **/IEM**
(different cover shape)



Pilot of DPHW **/WP**



Note: the connector is supplied with the valve

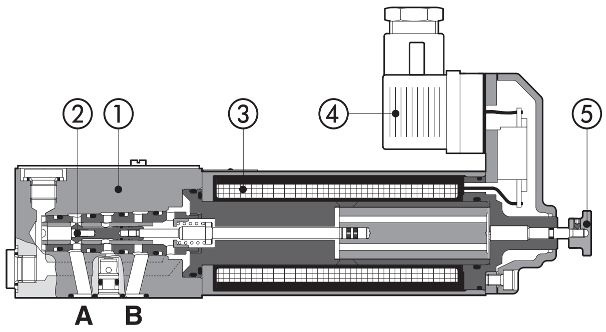
15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Table **EX120-2/E**

Intrinsically safe solenoid directional valves

on-off poppet type, leak free, direct - **ATEX** or **IECEx**



DLWH-3A/6

① valve body
② poppet
③ intrinsically safe solenoid
④ electrical connector
⑤ manual override

DLWH

On-off poppet type, directional valves designed for application in hydraulic systems with leak-free requirements and equipped with intrinsically safe solenoids certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 7 for certification data

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 12

Size: **06**
Max flow: up to **12 l/min**
Max pressure: **350 bar**

1 MODEL CODE

DLWH / * - **2A** / * / **6** * / *

DLWH — Intrinsically safe valve, poppet type, direct

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Configuration:
2A = 2 way, open in rest position
2C = 2 way, closed in rest position
3A = 3 way, A-T connection in rest position
3C = 3 way, P-B connection in rest position

Options (2):
R = with check valve on port P
WP = prolunged manual override

Connector type
6 = DIN 43650 (standard)

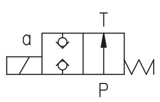
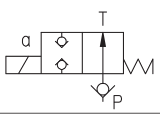
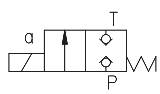
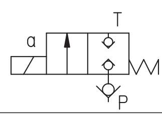
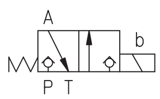
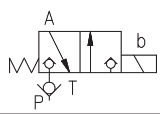
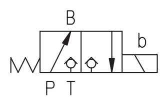
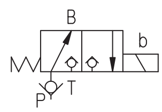
Series number

Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVE CONFIGURATION

DLWH-2A	DLWH-2A/R	DLWH-2C	DLWH-2C/R
			
DLWH-3A	**DLWH-3A/R**	**DLWH-3C**	**DLWH-3C/R**
			

3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
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	150 years, for further details see technical table P007
Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°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
Compliance	Intrinsically safe protection "Ex ia", see section 7 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 **160** bar
Rated flow	See Q/Δp diagrams at section 9
Maximum flow	**12 l/min**, see operating limits at section 10

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

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

<table>
<tr><td>Seals, recommended fluid temperature</td><td colspan="3">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</td></tr>
<tr><td>Recommended viscosity</td><td colspan="3">15÷100 mm²/s - max allowed range 2.8 ÷ 500 mm²/s</td></tr>
<tr><td>Max fluid contamination level</td><td colspan="3">ISO 4406 class 20/18/15 NAS 1638 class 9, see also filter section at www.atos.com or KTF catalog</td></tr>
<tr><td>Hydraulic fluid</td><td>Suitable seals type</td><td>Classification</td><td>Ref. Standard</td></tr>
<tr><td>Mineral oils</td><td>NBR, FKM, HNBR</td><td>HL, HLP, HLPD, HVLP, HVLPD</td><td>DIN 51524</td></tr>
<tr><td>Flame resistant without water</td><td>FKM</td><td>HFDU, HFDR</td><td rowspan="2">ISO 12922</td></tr>
<tr><td>Flame resistant with water</td><td>NBR, HNBR</td><td>HFC</td></tr>
</table>

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar -max fluid temperature = 50°C

7 CERTIFICATION DATA

<table>
<tr><td colspan="2">Valve type</td><td colspan="2">DLWH</td><td colspan="3">DLWH/IE</td><td colspan="3">DLWH/M</td><td colspan="3">DLWH/IEM</td></tr>
<tr><td colspan="2">Certification</td><td colspan="2">ATEX (Group II)</td><td colspan="3">IECEx (Group II)</td><td colspan="3">ATEX (mining) (Group I)</td><td colspan="3">IECEx (mining) (Group I)</td></tr>
<tr><td colspan="2">Solenoid code</td><td colspan="2">OW-18/6</td><td colspan="3">OWI-18/6</td><td colspan="3">OWM-18/6</td><td colspan="3">OWIM-18/6</td></tr>
<tr><td colspan="2">Type examination certificate (1)</td><td colspan="2">CESI 02
ATEX 013</td><td colspan="3">IECEx
CES 12.0017</td><td colspan="3">CESI 02
ATEX 013</td><td colspan="3">IECEx
CES 12.0017</td></tr>
<tr><td colspan="2" rowspan="2">Method of protection</td><td colspan="5">Ex II 1G Ex ia</td><td colspan="6" rowspan="2">Ex I M2 Ex ia I Mb Ex ib I Mb</td></tr>
<tr><td>IIA T5 Ga</td><td>IIB T6 Ga</td><td colspan="3">IIC T6 Ga</td></tr>
<tr><td rowspan="4">Electrical characteristics (max values)</td><td>Ui [V]</td><td>28</td><td>28</td><td>27</td><td>19,5</td><td>19,11</td><td>28</td><td>28</td><td>27</td><td>19,5</td><td>19,11</td><td>12,4</td></tr>
<tr><td>Ii [mA]</td><td>396</td><td>250</td><td>130</td><td>360</td><td>360</td><td>396</td><td>250</td><td>130</td><td>360</td><td>360</td><td>2200</td></tr>
<tr><td>Pi [W]</td><td>2,8</td><td>1,8</td><td>0,9</td><td>1,64</td><td>1,72</td><td>2,8</td><td>1,8</td><td>0,9</td><td>1,64</td><td>1,72</td><td>6,82</td></tr>
<tr><td>Ci , Li</td><td>≅ 0</td><td colspan="4">≅ 0</td><td colspan="6">≅ 0</td></tr>
<tr><td colspan="2">Temperature class</td><td>T5</td><td colspan="4">T6</td><td colspan="6">–</td></tr>
<tr><td colspan="2">Surface temperature (ambient temp. +60°C)</td><td>≤ 100°C</td><td colspan="4">≤ 85°C</td><td colspan="6">≤ 150°C</td></tr>
<tr><td colspan="2">Ambient temperature</td><td colspan="5">-20 ÷ +60°C -40 ÷ +60°C (2)</td><td colspan="6">-20 ÷ +60°C</td></tr>
<tr><td colspan="2">Applicable standards</td><td colspan="4">EN 60079-0
EN 60079-11
EN 60079-26</td><td colspan="7">IEC 60079-0
IEC 60079-11
IEC 60079-26</td></tr>
</table>

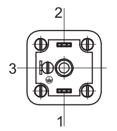
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

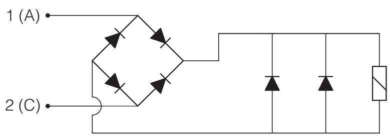
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650



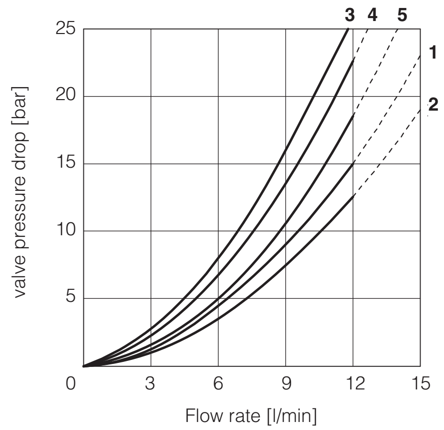


9 Q/Δp DIAGRAMS based on mineral oil ISO VG 46 at 50°C

configuration / Flow direction	2A	2C	3A	3C
P→A / P→B (1)	1	2	4	3
A→T / B→T	-	-	5	4

(1) For two-way valves pressure drop refers to P→T

DLWH

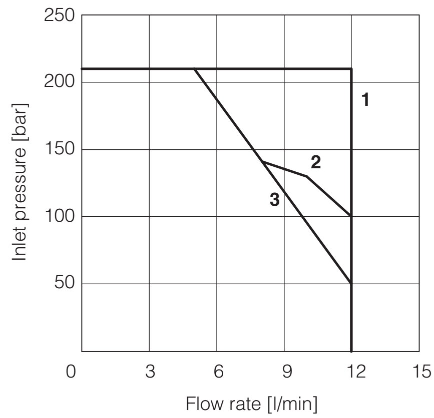


10 OPERATING LIMITS based on mineral oil ISO VG 46 at 50°C

The diagrams refer to warm solenoids and power supply provided by the Atos barrier type **Y-BXNE-412**.
In case of asymmetric flow the operating limits must be reduced.

configuration	2A	2C	3A	3C
Diagram	1	1	2	3

DLWH



11 INTERNAL LEAKAGES

DLWH internal leakages based on mineral oil ISO VG 46 at 50°C
less than 5 drops/min (0,36 cm^3/min) at max pressure.

12 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

The electric supply to these valves must be done through intrinsically safe barriers situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of specific break-down situations. The intrinsically safe barriers must be approved and certified according to the Ex ia protection mode.

To select the proper intrinsically safe barriers following data must be considered:

1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 10 .

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00 | *****

Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

13 INSTALLATION DIMENSIONS [mm]

DLWH-2A, DLWH-2C

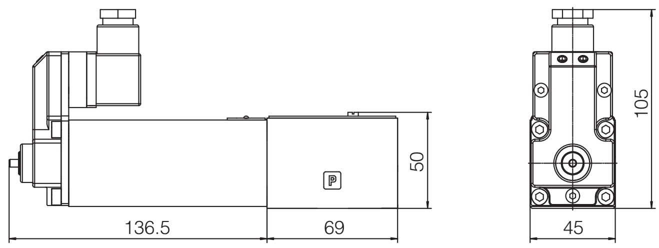
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Fastening bolts:
4 socket head screws M5x50 class 12.9

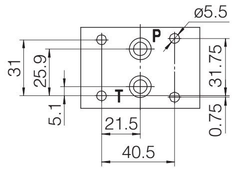
Tightening torque = 8 Nm

Seals: 2 OR 108

Diameter of ports P, T: Ø 7,5 mm (max)



Valve's bottom view



P = PRESSURE PORT
T = USE PORT

DLWH-3A, DLWH-3C

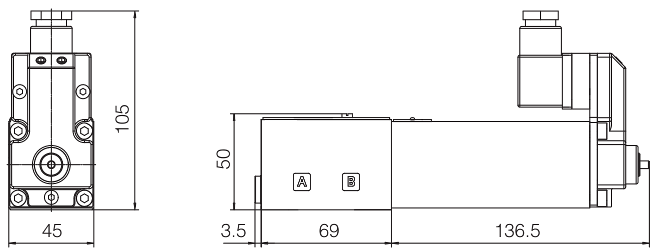
ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)

Fastening bolts:
4 socket head screws M5x50 class 12.9

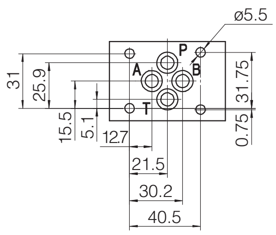
Tightening torque = 8 Nm

Seals: 4 OR 108

Diameter of ports P, A, B, T: Ø 7,5 mm (max)



Valve's bottom view



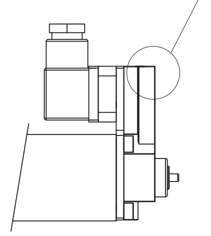
P = PRESSURE PORT

A = USE PORT
(not used for DLAH-3C version)

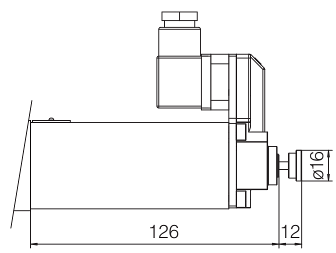
B = USE PORT
(not used for DLAH-3A version)

T = TANK PORT

DLWH/M
(different cover shape)



Option **/WP**



Mass [kg]	
DLWH-02	2,3
DLWH-03	2,3

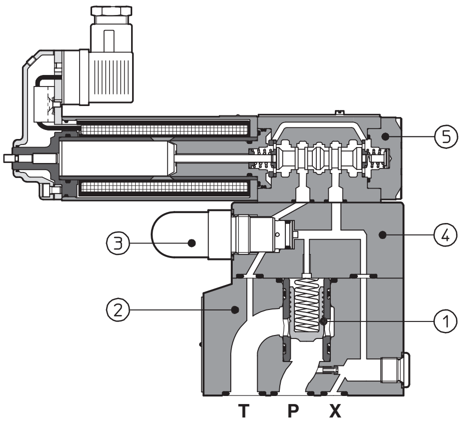
Note: the connector is supplied with the valve

14 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe pressure relief valves

piloted, subplate or in line mounting - **ATEX** or **IECEx certification**



① main poppet
② valve main body
③ mechanical pressure limiter
④ cover
⑤ intrinsically safe pilot valve

AGAM-10/10/-WO**

AGAM, ARAM

Intrinsically safe pressure relief valves equipped with solenoid pilot valve for venting or multiple pressure selection, certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 10.

AGAM: pressure relief, subplate mounting
Size: **10, 20** and **32** - ISO 6264
Max flow: **200, 400** and **600 l/min**

ARAM: pressure relief, threaded connections
Size: **G 3/4"** and **G 1 1/4"**
Max flow: **350** and **500 l/min**

Max pressure: **350 bar**

1 MODEL CODE

AGAM	/	*	-	20	/	20	/	210/100/100	-	WO	/	*	/	6	*	/	*

AGAM: Intrinsically safe pressure relief valves, piloted
AGAM subplate mounting
ARAM threated connections

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Valve size:
10 = AGAM (ISO 6264)
20 = AGAM (ISO 6264)
32 = AGAM (ISO 6264)
20 = ARAM G 3/4"
32 = ARAM G 1 1/4"

Configuration, see section 2 :

10	**20**	**22**
11	**21**	**32**

Max regulated pressure
of first (second / third) setting, see section 4 :

50 = 50 bar	**100** = 100 bar
210 = 210 bar	**350** = 350 bar

WO = intrinsically safe solenoid

Options (2):
E = external pilot
V = regulating handweel for pressure adjustment
WP = ⚠ manual override
Y = external drain

Connector type:
6 = DIN 43650 (standard)

Series number

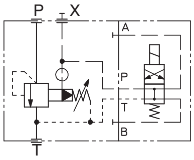
Seals material, see section 6 :
- = NBR
PE = FKM
BT = HNBR **(1)**

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

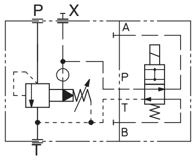
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 CONFIGURATIONS AND HYDRAULIC SYMBOLS

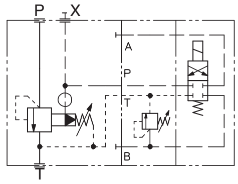
AGAM-/10**
ARAM-/10**
one setting pressure
+ venting with
de-energized solenoid



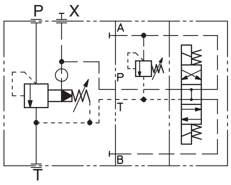
ARAM-/11**
AGAM-/11**
one setting pressure
+ venting with
energized solenoid



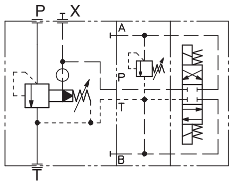
AGAM-/22**
ARAM-/22**
two setting pressure
without venting



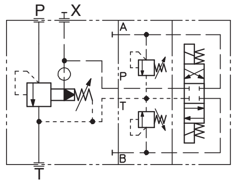
AGAM-/20**
ARAM-/20**
two setting pressure
+ venting with
de-energized solenoid



AGAM-/21**
ARAM-/21**
two setting pressure
+ venting with
energized solenoid



AGAM-/32**
ARAM-/32**
three setting pressure
without venting



3 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
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 ÷ +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 - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection “Ex ia”, see section 7 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

4 HYDRAULIC CHARACTERISTICS

Valve size		**10**	**20**	**32**
Max operating pressure	[bar]	port P = **350** port T, Y = **210**		
Max regulated pressure	[bar]	**50** **100** **210** **350**		
Pressure range	[bar]	4÷50; 6÷100; 7÷210; 8÷350		
Max flow **AGAM (1)**	[l/min]	200	400	600
Max flow **ARAM (1)**	[l/min]	-	350	500

(1) see Q/Δp diagrams at section 11 and 12

5 ELECTRICAL CHARACTERISTICS - see also section 7

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

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 ÷ +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	ISO 4406 class 20/18/15 NAS 1638 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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

7 CERTIFICATION DATA

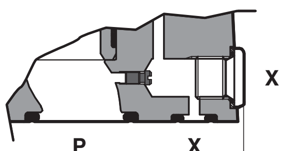
Valve type		AGAM ARAM		AGAM**/IE** ARAM**/IE**			AGAM**/M** ARAM**/M**			AGAM**/IEM** ARAM**/IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26					IEC 60079-0 IEC 60079-11 IEC 60079-26					

(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

8 OPTIONS

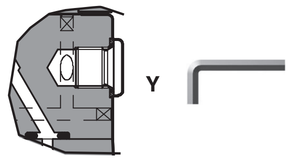
E = External pilot option to be selected when the pilot pressure is supplied from a different line respect to the P main line.
With option E the internal connection between port P and X of the valve is plugged.
The pilot pressure must be connected to the X port available on the valve's mounting surface or on main body (threaded pipe connection G ¼").



V = Regulating handweel for pressure adjustment

WP = Manual override protect by metallic cap

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 ¼" available on the pilot stage body.

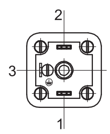


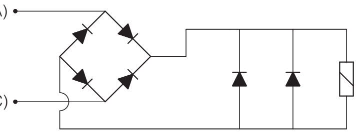
11.1 Possible combined options: all combinations are available

9 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650





10 INTRINSICALLY SAFE BARRIERS - see tech. table **GX010**

Intrinsically safe valves must be powered through safety barriers certified according to Ex-ie protection mode, limiting the energy to the solenoid.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 7 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 4.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

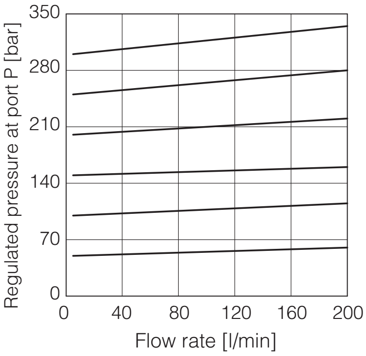
MODEL CODE OF I.S. BARRIER

Y-BXNE 412 00 | *****

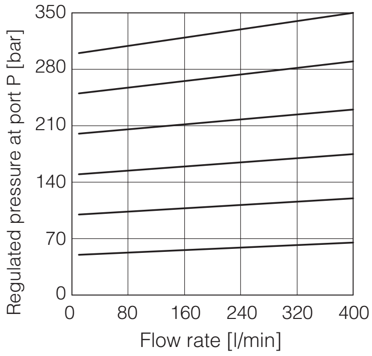
Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

11 REGULATED PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

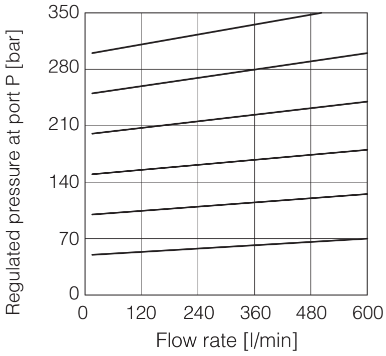
AGAM-10



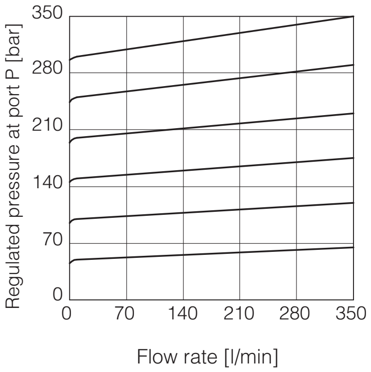
AGAM-20



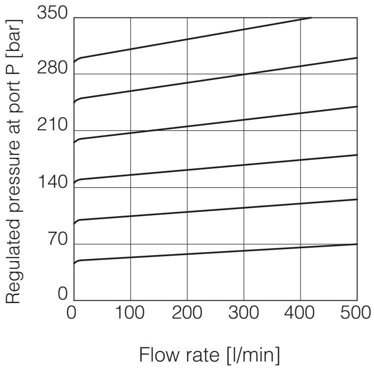
AGAM-32



ARAM-20

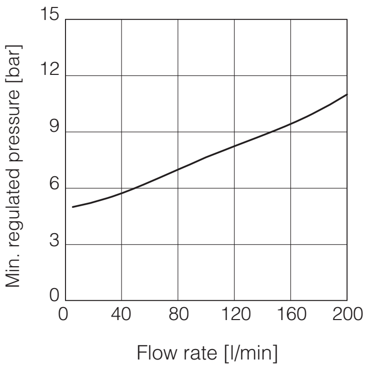


ARAM-32

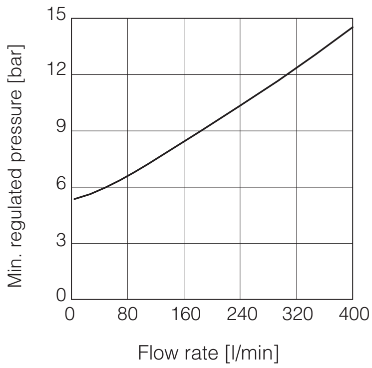


12 MINIMUM PRESSURE VERSUS FLOW DIAGRAMS based on mineral oil ISO VG 46 at 50°C

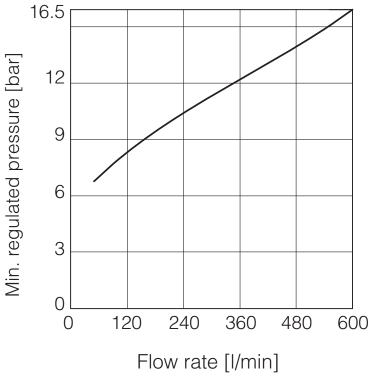
AGAM-10



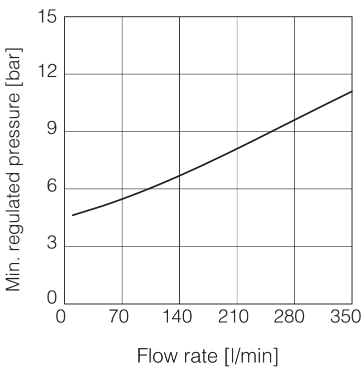
AGAM-20



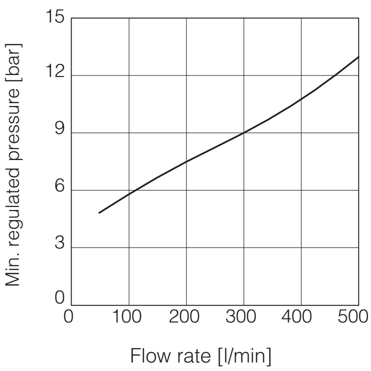
AGAM-32



ARAM-20



ARAM-32



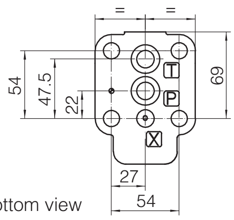
13 INSTALLATION DIMENSIONS FOR AGAM-*-WO [mm]

AGAM-10

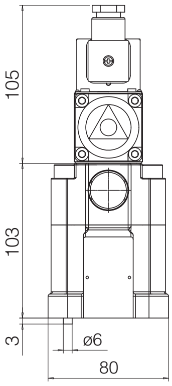
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-06-09-1-97
Fastening bolts:
4 socket head screws M12x35 class 12.9
Tightening torque = 125 Nm
Seals: 2 OR 123; 1 OR 109/70
Ports P, T: Ø = 14,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

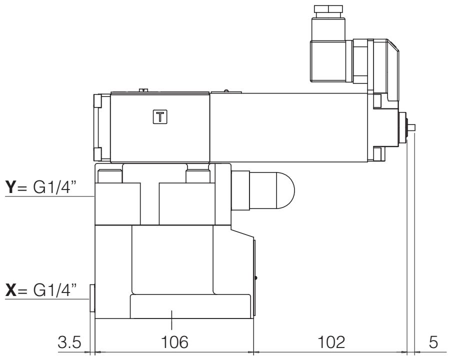
Mass [kg]	
AGAM-10/10 10/11	6,45
AGAM-10/20 10/21	7,55
AGAM-10/22 10/32	7,25 9



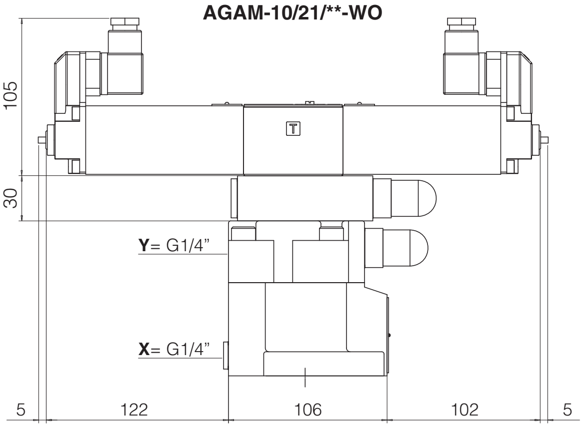
Valve's bottom view



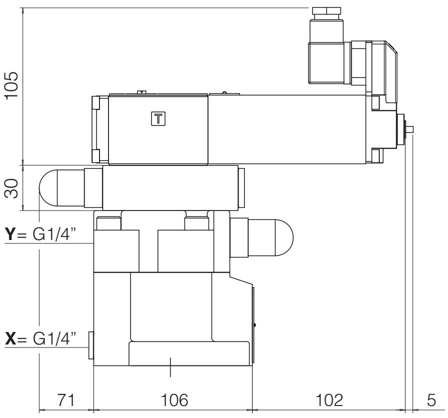
AGAM-10/10/-WO**
AGAM-10/11/-WO**



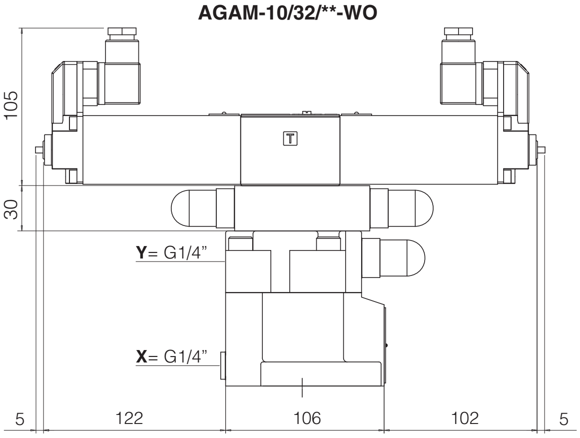
AGAM-10/20/-WO**
AGAM-10/21/-WO**



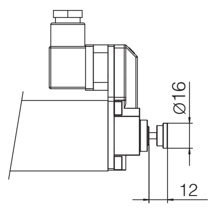
AGAM-10/22/-WO**



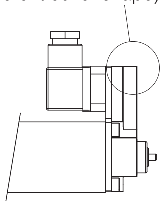
AGAM-10/32/-WO**



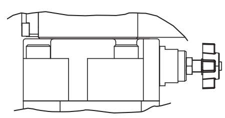
Option /WP



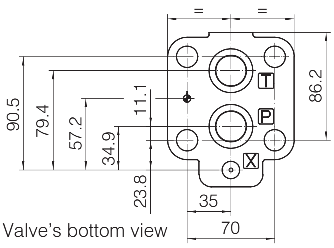
Mining version /M and /IEM
(different cover shape)



Option /V



AGAM-20



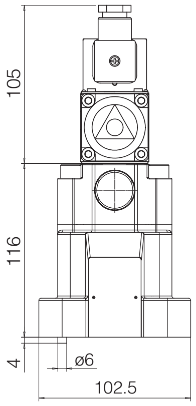
Valve's bottom view

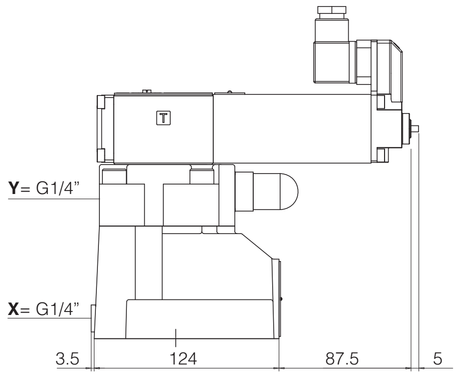
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-08-11-1-97
Fastening bolts:
4 socket head screws M16x50 class 12.9
Tightening torque = 300 Nm
Seals: 2 OR 4112; 1 OR 109/70
Ports P, T: Ø = 24 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

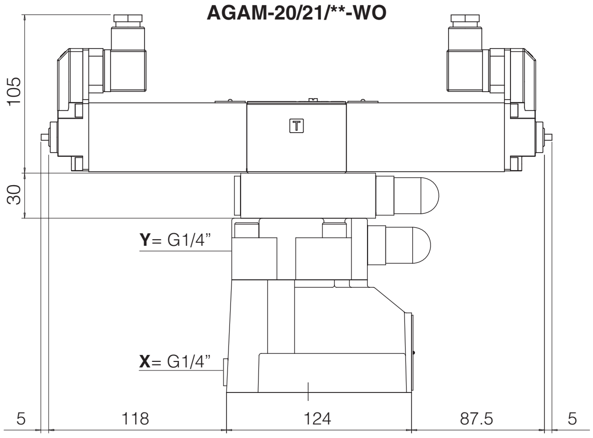
Mass [kg]	
AGAM-20/10 20/11	7,65
AGAM-20/20 20/21	8,75
AGAM-20/22 20/32	8,45 10,2

AGAM-20/10/-WO**
AGAM-20/11/-WO**

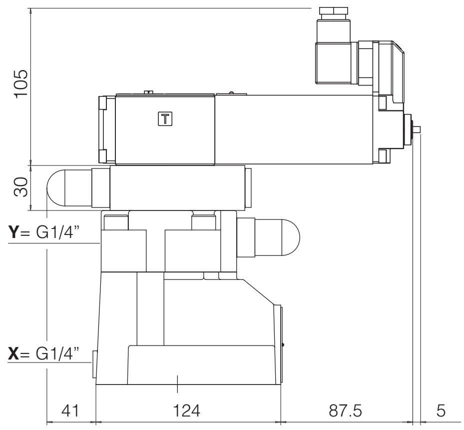




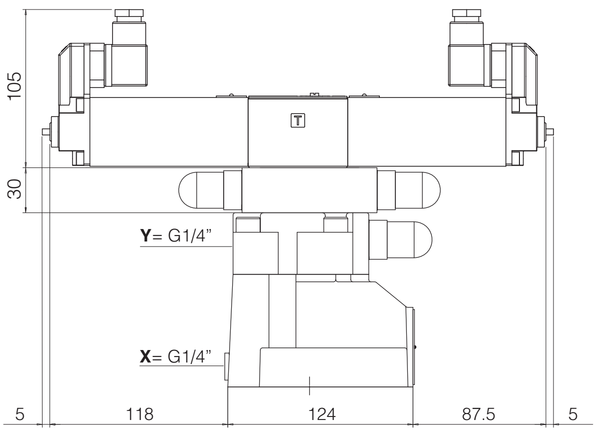
AGAM-20/20/-WO**
AGAM-20/21/-WO**



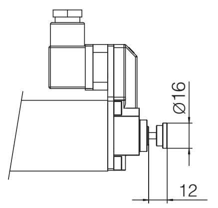
AGAM-20/22/-WO**



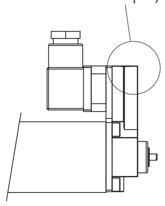
AGAM-20/32/-WO**



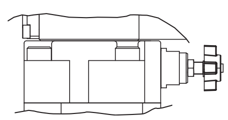
Option /WP



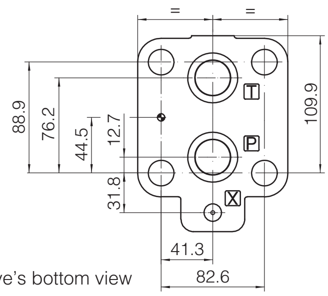
Mining version /M and /IEM
(different cover shape)



Option /V



AGAM-32

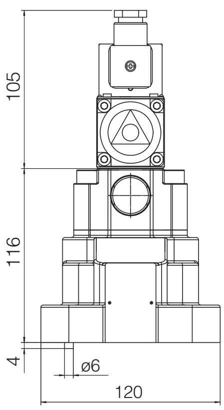


Valve's bottom view

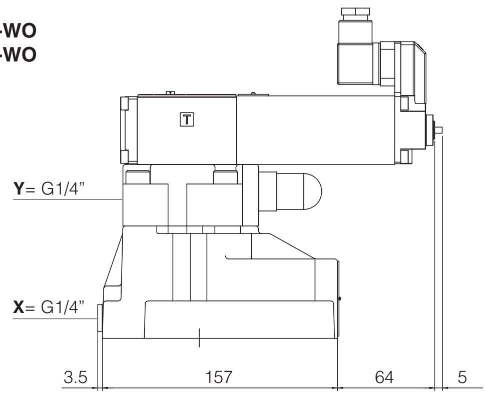
ISO 6264: 2007 (see table P005)
Mounting surface: 6264-10-17-1-97
(with M20 fixing holes instead of standard M18)
Fastening bolts:
4 socket head screws M20x60 class 12.9
Tightening torque = 600 Nm
Seals: 2 OR 4131; 1 OR 109/70
Ports P, T: Ø = 28,5 mm
Ports X: Ø = 3,2 mm

X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

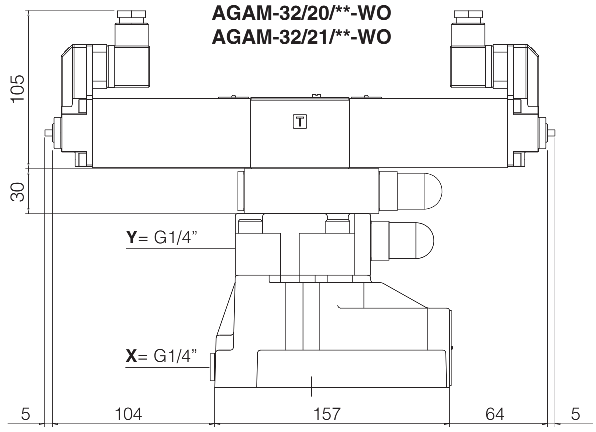
Mass [kg]	
AGAM-32/10 32/11	9,05
AGAM-32/20 32/21	10,05
AGAM-32/22 32/32	9,85 11,6



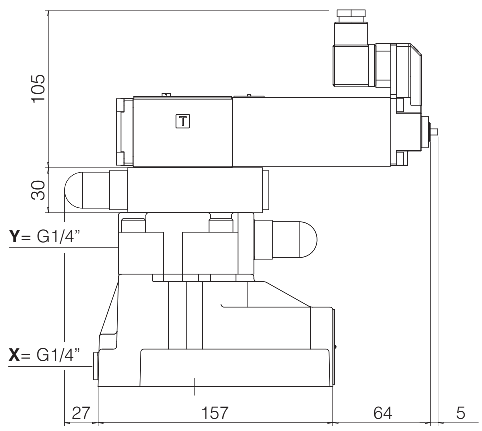
AGAM-32/10/-WO**
AGAM-32/11/-WO**



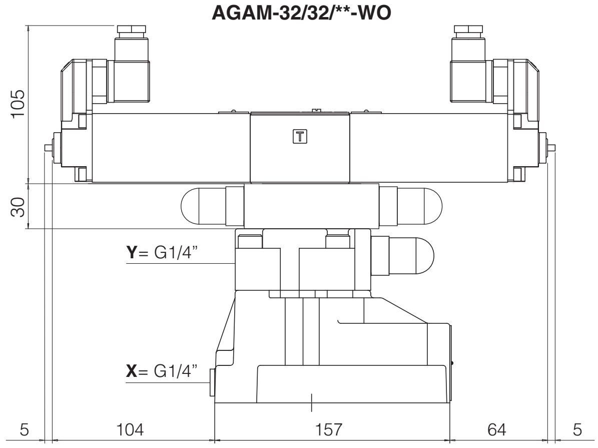
AGAM-32/20/-WO**
AGAM-32/21/-WO**



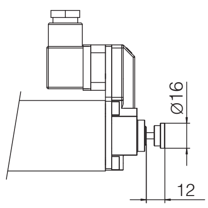
AGAM-32/22/-WO**



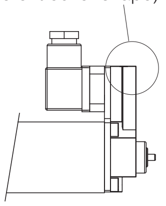
AGAM-32/32/-WO**



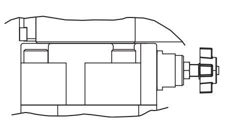
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

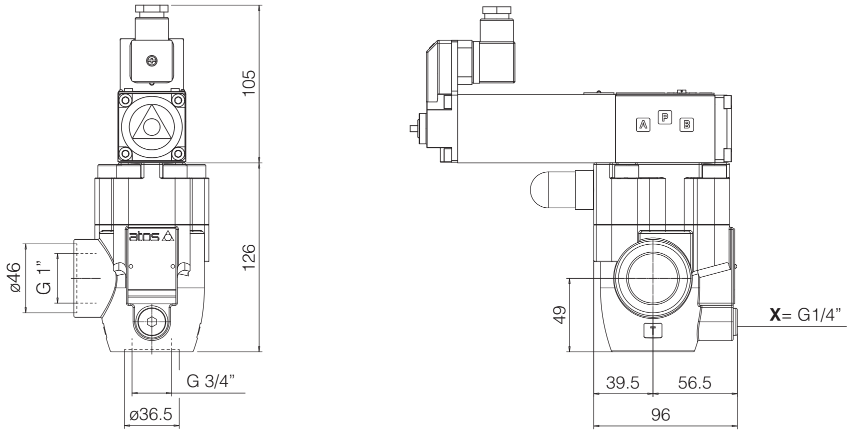


ARAM-20

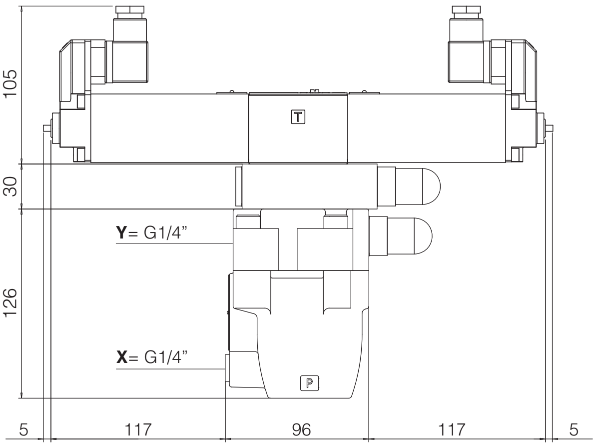
X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

Mass [kg]	
ARAM-20/10 20/11	6,75
ARAM-20/20 20/21	8,45
ARAM-20/22 20/32	8,15 10,1

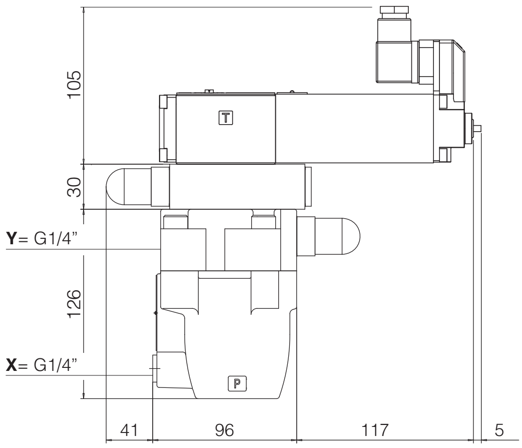
ARAM-20/10/-WO**
ARAM-20/11/-WO**



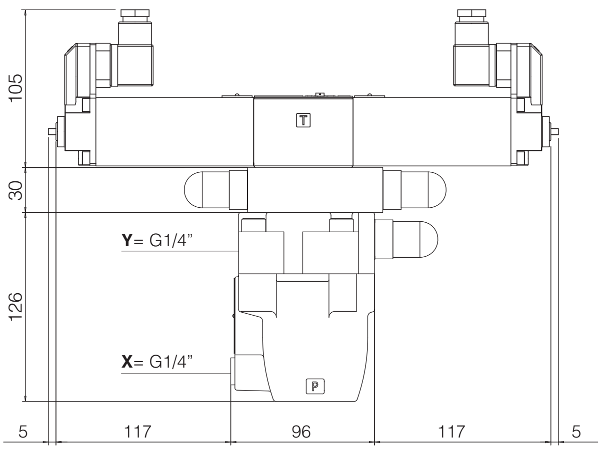
ARAM-20/20/-WO**
ARAM-20/21/-WO**



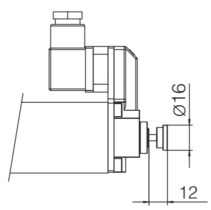
ARAM-20/22/-WO**



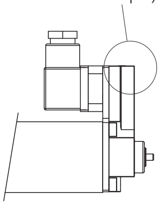
ARAM-20/32/-WO**



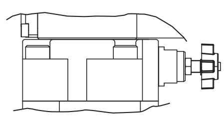
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

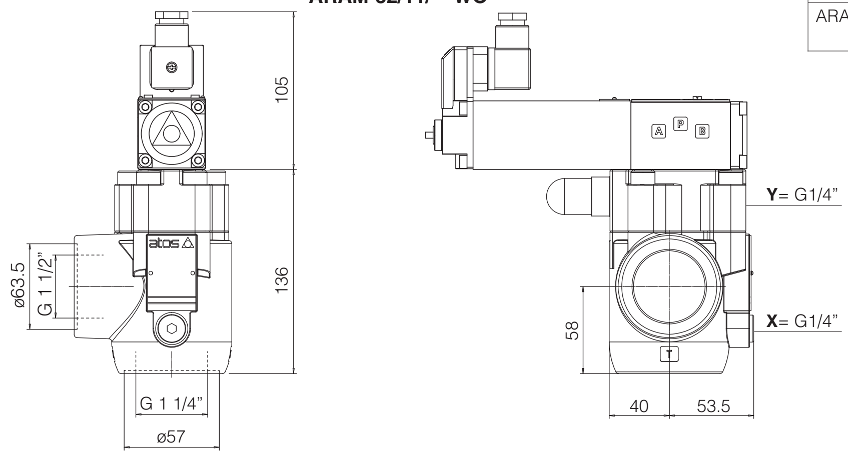


ARAM-32

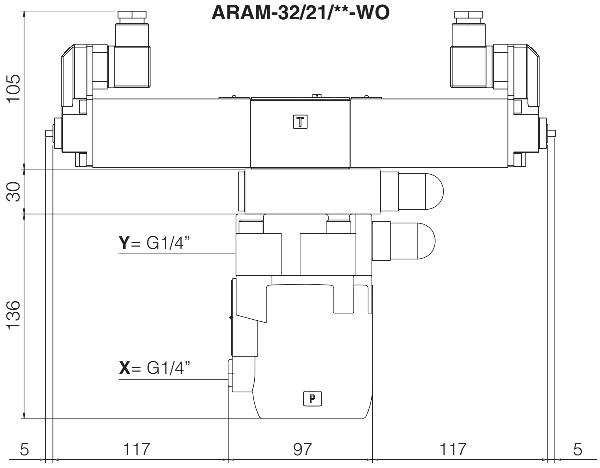
X = port connection for external pilot (option /E)
Y = port connection for external drain (option /Y)

Mass [kg]	
ARAM-32/10 32/11	7,05
ARAM-32/20 32/21	9,05
ARAM-32/22 32/32	8,55 10,7

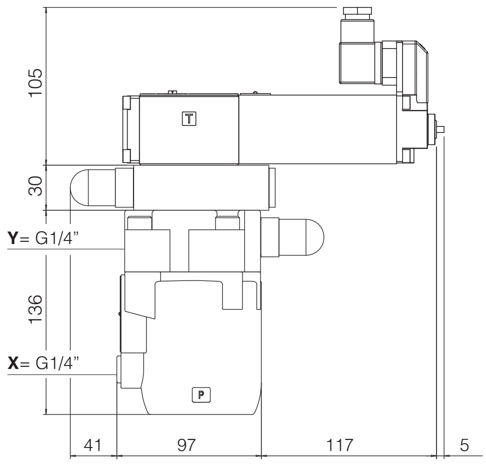
ARAM-32/10/-WO**
ARAM-32/11/-WO**



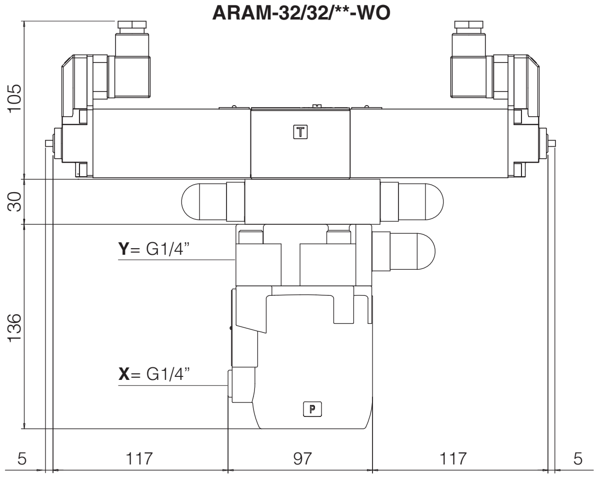
ARAM-32/20/-WO**
ARAM-32/21/-WO**



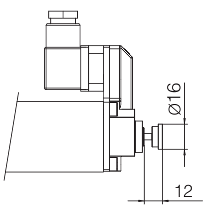
ARAM-32/22/-WO**



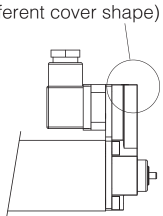
ARAM-32/32/-WO**



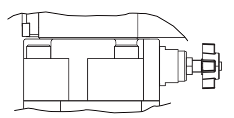
Option /WP



Mining version /M and /IEM
(different cover shape)



Option /V

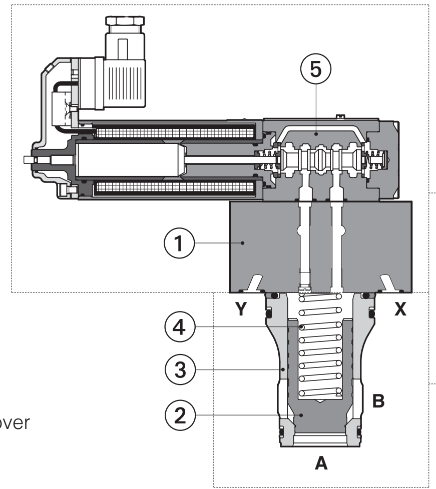


15 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P005	Mounting surfaces for electrohydraulic valves

Intrinsically safe ISO cartridge valves

on-off directional control, ISO 7368 - **ATEX** or **IECEx**



① functional cover
② poppet
③ sleeve
④ spring
⑤ intrinsically safe solenoid pilot valve

LIDEW, LIDBH, SC LI

On-off ISO directional cartridges equipped with intrinsically safe solenoid pilot valve for poppet control, certified for safe operation in hazardous environment with potentially explosive atmosphere.

Certifications:

- **ATEX** or **IECEx**:
  II 1G Ex ia IIC, IIB, IIA
  surface plants zone 0, 1 and 2
- **ATEX** or **IECEx**:
  IM2 Ex ia IMb, Ex ib IMb
  surface, tunnels or mining plants

See section 11 for certification data

The valves must be electrically powered through specific "safety barriers" limiting the max current to the solenoid, see section 13

LIDEW: directional control with ex-proof solenoid valve for oppet control

LIDBH: directional control with solenoid valve and shuttle valve for pilot line selection

Size: **16 ÷ 63**
Flow: **240 ÷ 4000 l/min** at Δp 5 bar
Max pressure: **350 bar**

1 MODEL CODE OF COVERS - to be coupled with cartridge in section 5

LI	D	EW	/	*	-	1	-	1	/	*	-	WO	/	6	*	/	*	*

LI – Cover according to ISO 7368

D = directional function

EW = with pilot solenoid valve
BH = as EW plus shuttle valve for pilot selection

Certification type:
- = Omit for Atex Group II
M = Atex Group I (mining)
IE = IECEx Group II
IEM = IECEx Group I (mining)

Cover configuration see section 2 :
LIDEW: **-**, **1**, **2**, **4**, **5**, **6**
LIDBH: **1A**, **1C**, **2A**, **2C**

Valve size (ISO 7368):

1 = 16	**3** = 32	**5** = 50
2 = 25	**4** = 40	**6** = 63

Options (2):
B = cartridge piloted via port "B" of solenoid pilot valve
E = external attachments X (1/4" GAS) and underneath port X supplied plugged (only for sizes 40...63)
WP = ⚠ manual override

WO = Intrinsically safe slenoid

Connector type:
6 = DIN 43650 (standard)

Series number

Seals material, see section 10 :
- = NBR
PE = FKM
BT = HNBR **(1)**

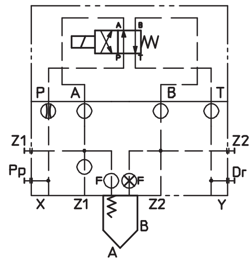
Optional different setting of the calibrated plugs in the pilot channels see section 3

(1) Not for certification **M** and **IEM**, Group I (mining)
(2) Possible combined options: all combinations are available

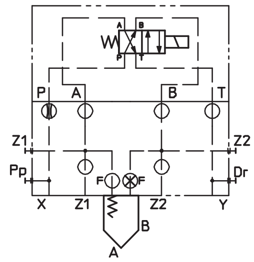
⚠ The pressure at T port makes difficult the manual override operation that can be possible only if its value is lower than 50 bar

2 VALVES CONFIGURATIONS AND HYDRAULIC SYMBOLS

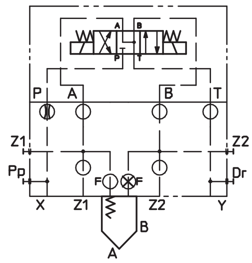
LIDEW



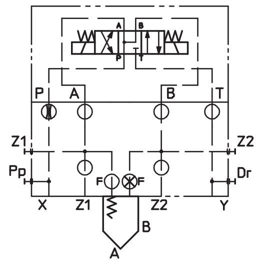
LIDEW1-*



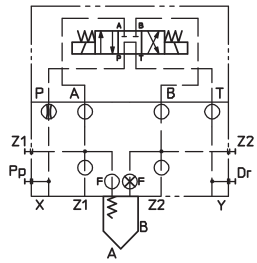
LIDEW2-*



LIDEW4-*

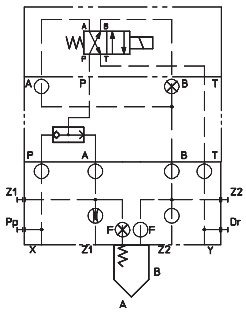


LIDEW5-*

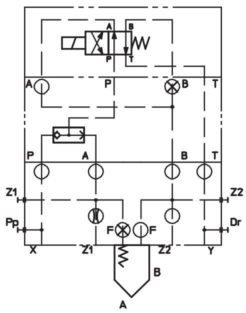


LIDEW6-*

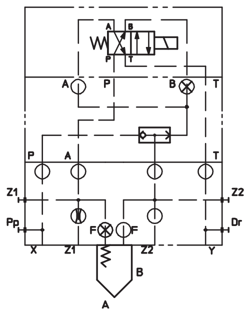
LIDBH



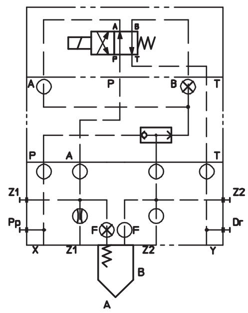
LIDBH1A-*



LIDBH1C-*



LIDBH2A-*



LIDBH2C-*

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 for solenoid pilot valve.

***** = Calibrated plugs different from standard ones reported in section 4. The restrictors configuration (if different from the standard) must be indicated at the end of the model code:

LIDEW2	-	1	/*	-	WO	/6	**	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 teths 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

Port \ 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
Z1 (only for LIDBH*-*)	M4 12A	M4 12A	M6 15A	M6 17A	M6 20A	M6 20A
P	M6 12A	M6 12A	M6 15A	M6 17A	M6 20A	M6 20A

M4 ÷ M8 = screw size; **12A ÷ 20A** = calibrated orifices diameter in tenths of mm; **A** = short calibrated hole

5 MODEL CODE OF SLIP-IN CARTRIDGES, to be coupled with covers in section 1

SC LI	-	16	43	1	40	/*

SC LI = Cartridge valve

Size (ISO 7368):
16 25 32 40 50 63

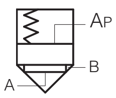
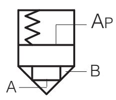
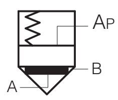
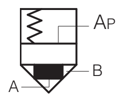
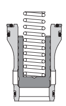
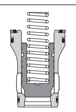
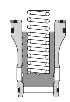
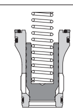
Type of poppet, see section 6 for maximum flow
32, 33
42 = as 32 but with dumping nose
43 = as 33 but with dumping nose

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

High flow:
40 = all sizes

Seals material:
- = NBR
PE = FKM
BT = HNBR

6 TYPE OF POPPET

Type of poppet		**32**	**33**	**42**	**43**
Functional sketch (Hydraulic symbol)					
Operating pressure		**420 bar max** (only SCLI cartridge)			
Nominal flow at Δp 5bar (l/min) see diagrams Q/Δp at section 9	Size **16**	270	270	240	240
	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
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	3 bar	3 bar	3 bar
	6	5,5 bar	5,5 bar	5,5 bar	5,5 bar
Cracking pressure B→A	Spring **1**	3 bar	1,2 bar	3 bar	1,2 bar
	2	12,8 bar	-	12,8 bar	-
	3	32,5 bar	6 bar	32,5 bar	6 bar
	6	54,5 bar	11 bar	54,5 bar	11 bar

7 GENERAL CHARACTERISTICS

Assembly position / location	Horizontal position only
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 ÷ +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 - salt spray test (EN ISO 9227) > 200h
Compliance	Intrinsically safe protection "Ex ia", see section 11 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

8 HYDRAULIC CHARACTERISTICS

Functional cover operating pressure	port A, B, X, Z1, Z2 = **350**; port Y = **160**
Rated flow	see section 6

9 ELECTRICAL CHARACTERISTICS - see also section 11

Nominal resistance at 20°C	150 Ω
Coil insulation	Class H
Working voltage	12 ÷ 26 V
Minimum supply current	65mA, from I.S. barriers
Protection degree	IP66
Duty factor	100%
Electrical connector	DIN 43650 2 pin+GND

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	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	

⚠ The ignition temperature of the hydraulic fluid must be 50°C higher than the max solenoid surface temperature

(1) Performance limitations in case of flame resistant fluids with water:
-max operating pressure = 210 bar
-max fluid temperature = 50°C

11 CERTIFICATION DATA

Valve type		LIDEW LIDBH		LIDEW**/IE** LIDBH**/IE**			LIDEW**/M** LIDBH**/M**			LIDEW**/IEM** LIDBH**/IEM**		
Certification		**ATEX** (Group II)		**IECEx** (Group II)			**ATEX (mining)** (Group I)			**IECEx (mining)** (Group I)		
Solenoid code		**OW-18/6**		**OWI-18/6**			**OWM-18/6**			**OWIM-18/6**		
Type examination certificate **(1)**		CESI 02 ATEX 013		IECEx CES 12.0017			CESI 02 ATEX 013			IECEx CES 12.0017		
Method of protection		**Ex II 1G Ex ia**					**Ex I M2 Ex ia I Mb Ex ib I Mb**					
		IIA T5 Ga	**IIB T6 Ga**	**IIC T6 Ga**								
Electrical characteristics (max values)	Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
	Ii [mA]	396	250	130	360	360	396	250	130	360	360	2200
	Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
	Ci , Li	≅ 0	≅ 0				≅ 0					
Temperature class		**T5**	**T6**				–					
Surface temperature (ambient temp. +60°C)		≤ 100°C	≤ 85°C				≤ 150°C					
Ambient temperature		-20 ÷ +60°C -40 ÷ +60°C **(2)**					-20 ÷ +60°C					
Applicable standards		EN 60079-0 EN 60079-11 EN 60079-26					IEC 60079-0 IEC 60079-11 IEC 60079-26					

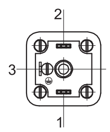
(1) The type examinator certificates can be downloaded from www.atos.com
(2) Only for **/BT** option

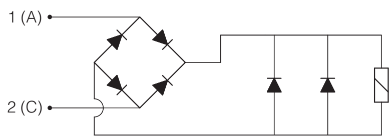
⚠ **WARNING: service work performed on the valve by the end users or not qualified personnel invalidates the certification**

12 SOLENOIDS WIRING

Connector wiring	
/6	Connections
1	Coil
2	Coil
3	GND

DIN 43650





13 **INTRINSICALLY SAFE BARRIERS** - see tech. table **GX010**

The electric supply to these valves must be done through intrinsically safe barriers situated out of potentially flammable environment (i.e. in safe zone), which limit the electric current to the intrinsically safe solenoid. The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of specific break-down situations. The intrinsically safe barriers must be approved and certified according to the Ex ia protection mode.

To select the proper intrinsically safe barriers following data must be considered:
1) Vmax and Imax of the solenoid as specified in section 11 must not be exceeded also in fault conditions;
2) the resistance of the solenoid is 150 Ω and the current supplied by the barrier, in normal operation condition, must be over the min. limit (65 mA) to ensure the valve correct operation (over 70 mA for max performances).

The barriers type **Y-BXNE 412** are galvanically isolated electronic devices, complying with European Norms EN60079-0/06, EN60079-11/07 and ATEX certified according to protection mode Ex ia IIC.
These barriers ensure the optimized functioning of the Atos valves up to the max operating limits specified in section 8.

The barriers Y-BXNE-412 are double channel type, suitable to operate valves with double or single solenoid. Two single solenoid valves can be connected to the barrier (one to each channel) but they cannot be contemporary operated.

MODEL CODE OF I.S. BARRIER

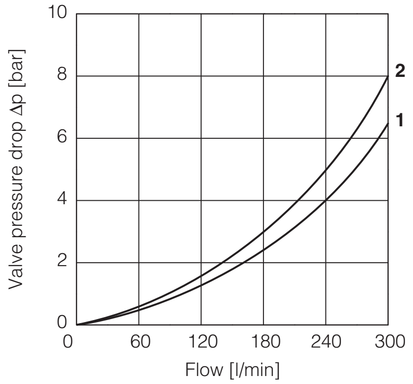
Y-BXNE 412 00	*****

Supply voltage
E = 110/230 VAC
2 = 24÷48 VDC

14 **Q/Δp DIAGRAMS** based on mineral oil ISO VG 46 at 50 °C

SC LI High flow - series 40
1 = poppet type 32 and 33 **2** = poppet type 42 and 43

size 16



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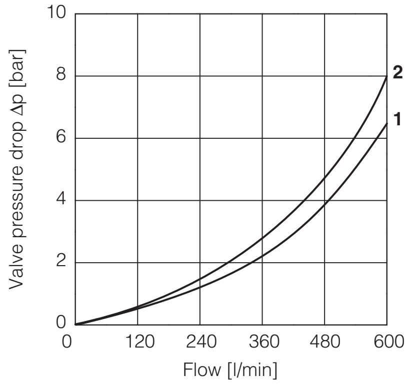

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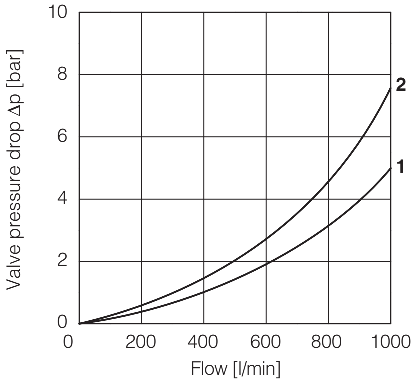

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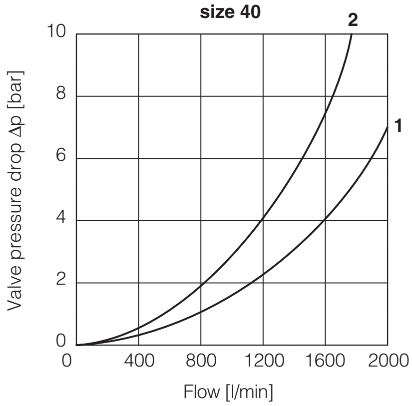

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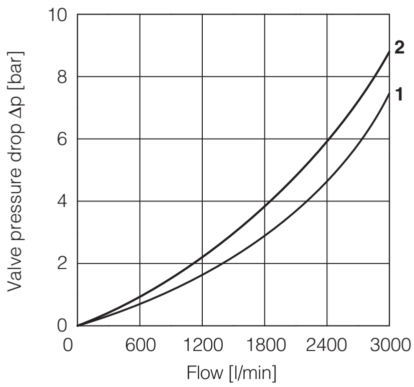
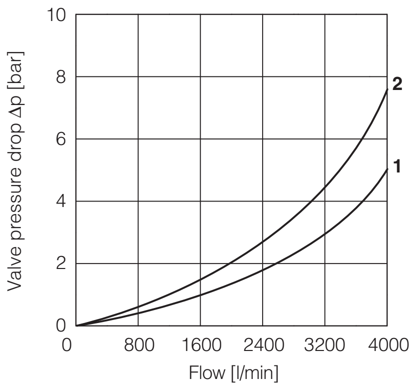
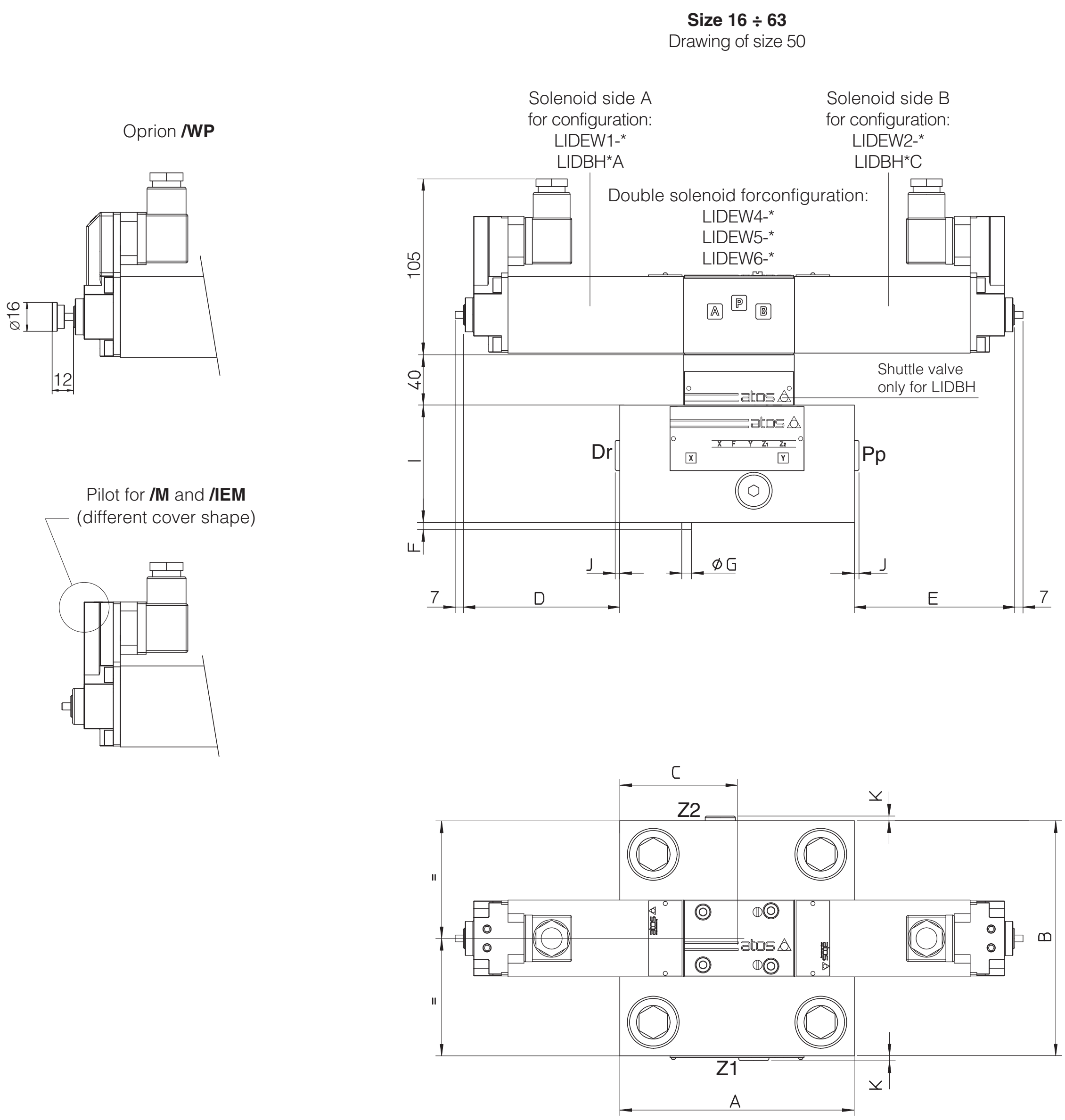


size 63



15 COVER INSTALLATION DIMENSIONS [mm] - for cartridge cavity dimensions see tech. table P006



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

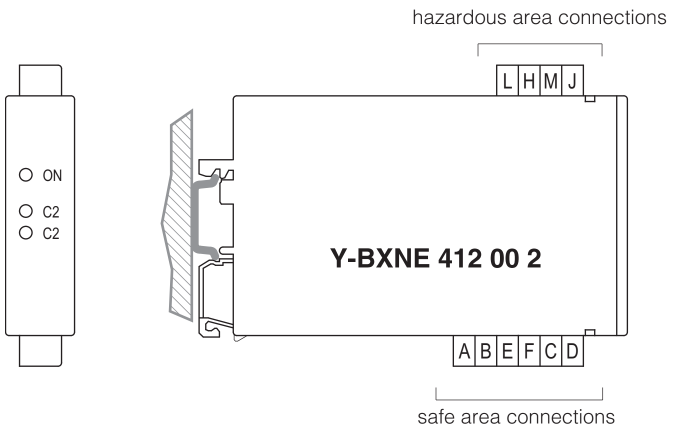
Size (1)	A	B	C	D max	E max	F	G	I	J	K	Ports Pp-Dr	Ports Z_1-Z_2	Seals	Fastening bolts (3)	Tightening torque [Nm]	Mass [Kg]
16	70	65	41	135	123	4	3	40	-	-	-	-	4 OR-108	Nr. 4 M8x45	35	3,95 ÷ 5,7
25	85	85	42,5	123	123	6	5	40	-	-	-	-	4 OR-108	Nr. 4 M12x45	125	4,35 ÷ 6,1
32	100	100	50	115	115	6	5	50	-	-	-	-	4 OR-2043	Nr. 4 M16x55	300	4,85 ÷ 6,7
40	125	125	62,5	102	102	6	5	60	3,5	-	G 1/4	-	4 OR-3043	Nr. 4 M20x70	600	7,75 ÷ 9,6
50	140	140	70	95	95	4	6	70	3,5	3,5	G 1/4	G 1/4	4 OR-3043	Nr. 4 M20x80	600	10,85 ÷ 12,7
63	180	180	90	75	75	4	6	80	3,5	3,5	G 3/8	G 3/8	4 OR-3050	Nr. 4 M30x90	2100	18,65 ÷ 20,4

16 RELATED DOCUMENTATION

X010	Basics for electrohydraulics in hazardous environments
X050	Summary of Atos intrinsically safe components certified to ATEX, IECEx
EX950	Operating and maintenance information for intrinsically safe valves
P006	Mounting surfaces and cavities for cartridge valves

Safety barriers for on-off intrinsically safe valves

DIN-rail panel format - **ATEX** and **IECEx**



Y-BXNE

Safety barriers are designed to electrically supply Atos intrinsically safe valves.

In intrinsically safe systems, the safety barrier is installed between the “safe area” and the “hazardous area” with potential presence of explosive gases and vapors, so that any fault that generates a high energy level, would not get carried over to the hazardous area.

Y-BXNE safety barriers are ATEX and IECEx certified according to the Ex ia protection mode

1 MODEL CODE OF I.S. BARRIER

Y-BXNE	412	00	*
Intrinsically safe barrier			**Power supply**: **E** = 110 / 230 VAC **2** = 24 / 48 VDC
Model: **412** = output voltage 19,5 V output current 170 mA 2 channels		**00** = no options	

The above barrier can be used both for double or for single solenoid valves.
With one barrier, two single solenoid valves can be operated but not contemporary

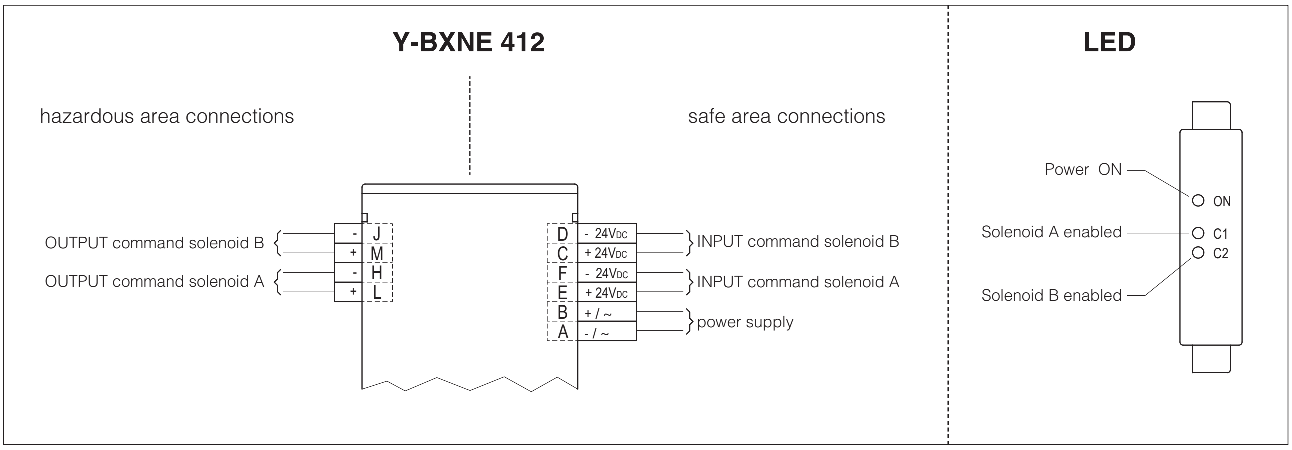
2 TECHNICAL CHARACTERISTICS

Power supply	21,6 ÷ 53 VDC or 110÷230 VAC ±10% (50/60 HZ)
Power consumption	< 3W
Output voltage Uo	19,5 V
Output current Io	170 mA
Output power Po	1,64 W
N° output channels	2
Galvanic insulation supply/output	2500 VAC / 50 Hz
Storage temperature	-25 °C ÷ +70 °C
Working temperature	-10 °C ÷ +60 °C
Format	Plastic box ; IP20 protection degree ; DIN-rail mounting as per EN50022
Electrical connections	screw terminals
Max conductor size	2,5 mm^2 max
Mass	200 gr

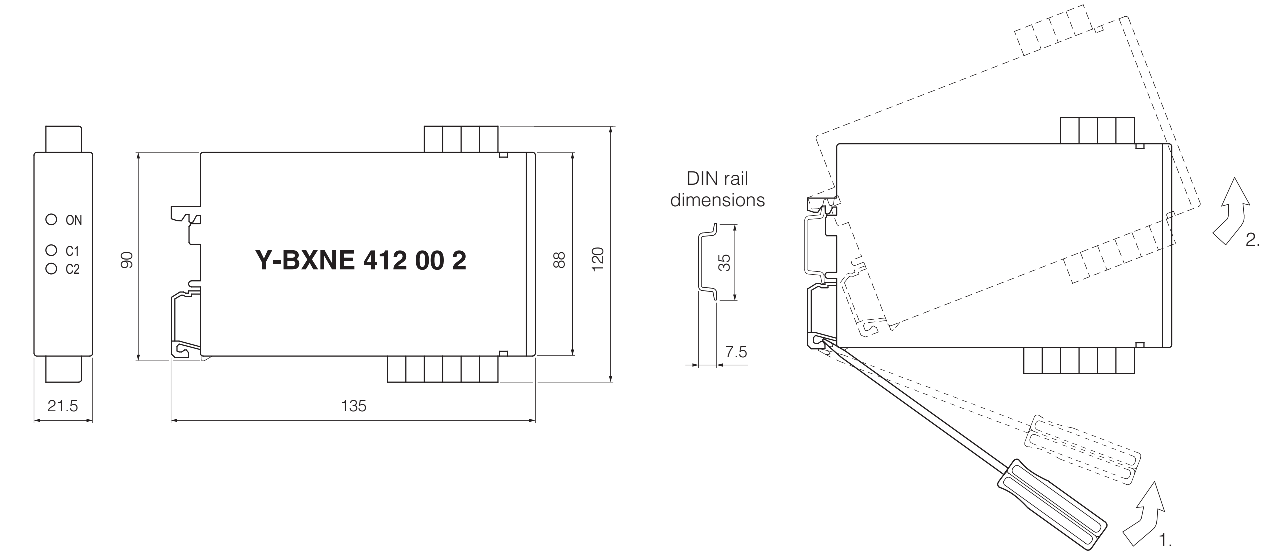
2.1 CERTIFICATION DATA

Certification	ATEX	IECEx
Type examination certificate	LCIE 02 ATEX 6104 X	LCI 09.0013 X
Method of protection	Ex II 1 G , Ex ia II C , Ex II 1 D , Ex ia D II C	
Applicabile standards	EN 60079 - 0 EN 60079 - 11 EN 61241 - 0 EN 61241 - 11	IEC 60079 - 0 IEC 60079 - 11 IEC 61241 - 0 IEC 61241 - 11

3 ELECTRIC CONNECTIONS AND LED

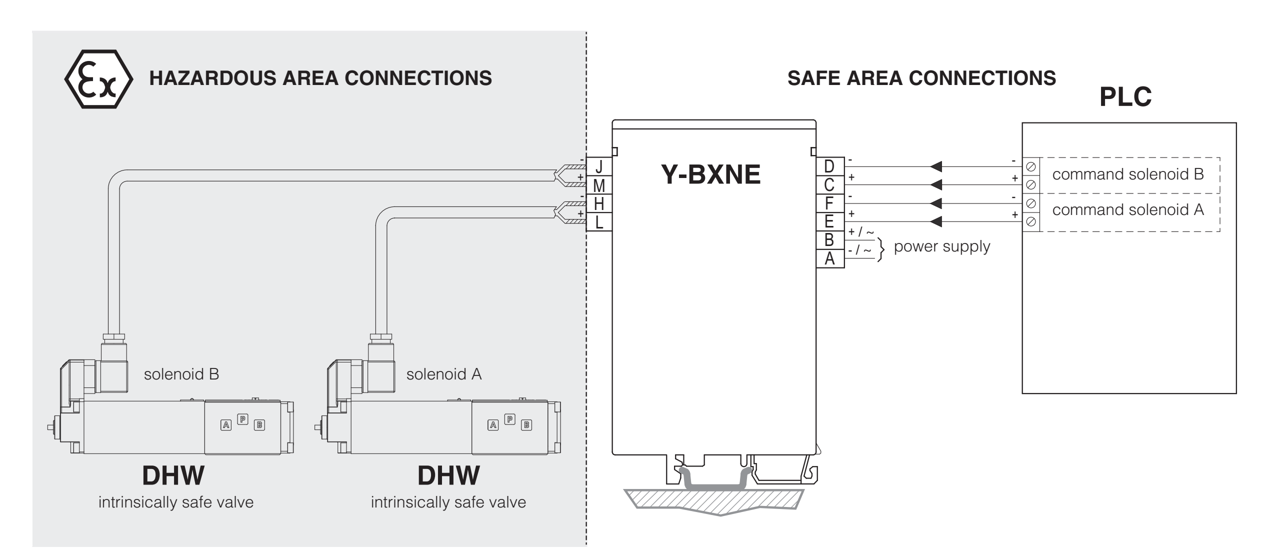


4 OVERALL DIMENSION



To unlock the safety barrier from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the safety barrier

5 INSTALLATION EXAMPLE



Example of two single solenoid valves connection - the valves cannot be contemporaly operated

4 CYLINDERS & PUMPS

INDEX

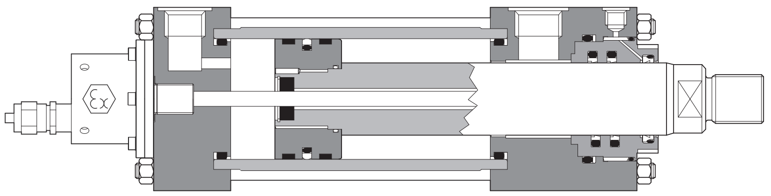
CYLINDERS & PUMPS

Ex-h

Supplementary components range available on **www.atos.com**

Hydraulic cylinders type CKA - for potentially explosive atmospheres

ATEX - ISO 6020-2 - nominal pressure 16 MPa (160 bar) - max 25 MPa (250 bar)



CKA cylinders are derived from standard CK (tab.B137) with certification according to ATEX 2014/34/EU. They are designed to limit the external surface temperature, according to the certified class, to avoid the self-ignition of the explosive mixtures potentially present in the environment. CKAM servocylinders are equipped with ex-proof built-in digital magnetostrictive position transducer, ATEX certified.

- Optional ex-proof proximity sensors, ATEX certified
- Bore sizes from **25** to **200** mm
- Up to **3** rod diameters per bore
- Strokes up to **5000** mm
- Single or double rod
- **15** standard mounting styles
- **5** seals options
- Attachments for rods and mounting styles, **see tab. B800**

For cylinder's dimensions and options **see tab B.137**

For cylinder's choice and sizing criteria **see tab. B015**

1 ATEX CERTIFICATION

Cylinder type	Group	Equipment category	Gas/dust group	Temperature class (1)	Zone
CKA	II	2 GD	II C/III C	T85°C(T6) / T135 °C(T4)	1,2,21,22
CKA + ex-proof rod position transducer (2)	II	2 G	II B	T6/T5	1,2
	II	2 D	III C	T85°C/T100°C	21,22
CKA + ex-proof proximity sensors	II	3 G	II	T4	2

(1) Temperature class depends to the max fluid temperature and sealing system
(2) The rod position transducer is certified to work with explosive gas (cat. 2G) and dust (cat. 2D)

2 MODEL CODE

CKA M / 10 - 50 / 22 / 22 * 0500 - S 3 0 1 - A - B1E3X1Z3 **

Cylinder series
CKA to ATEX 2014/34/EU dimensions to ISO 6020 - 2

Ex-proof position transducer
See section 5
- = omit if not requested
M = Digital magnetostrictive

Incorporated subplate (1)
- = omit if subplate is not requested
10 = size 06
20 = size 10
30 = size 16
40 = size 25

Bore size (1)
from **25** to **200** mm

Rod diameter (1)
from **12** to **140** mm

Second rod diameter for double rod **(1)**
from **12** to **140** mm, omit for single rod

Stroke (1)
up to **5000** mm (**4000** mm for **CKAM**)

Mounting style (1)		**REF. ISO**
C =	fixed clevis	MP1 **(4)**
D =	fixed eye	MP3 **(4)**
E =	feet	MS2
G =	front trunnion	MT1
H =	rear trunnion	MT2 **(4)**
L =	intermediate trunnion	MT4 **(5)**
N =	front flange	ME5
P =	rear flange	ME6 **(4)**
S =	fixed eye + spherical bearing	MP5 **(4)**
T =	threaded hole+tie rods extended	MX7
V =	rear tie rods extended	MX2
W =	both end tie rods extended	MX1
X =	basic execution	-
Y =	front tie rods extended	MX3
Z =	front threaded holes	MX5

Series number **(2)**

Heads' configuration (1)(3)
Oil ports positions
B* = front head
X* = rear head
Cushioning adjustments positions, to be entered only if adjustable cushioning are selected
E* = front head
Z* = rear head
* = selected position (1, 2, 3 or 4)

Options (1)(3):
Rod end
F = female thread
G = light female thread
H = light male thread
Oversized oil ports
D = front oversized oil port
Y = rear oversized oil port
Ex-proof proximity sensors, see section 8
R = front sensor
S = rear sensor
Rod treatment
K = nickel and chrome plating
T = induction surface hardening and chrome plating
Air bleeds
A = front air bleed
W = rear air bleed
Draining
L = rod side draining

Sealing system, see section 7
1 = (NBR + POLYURETHANE) high static and dynamic sealing
2 = (FKM + PTFE) very low friction and high temperatures
4 = (NBR + PTFE) very low friction and high speeds
6 = (NBR + PTFE) very low friction, single acting - pushing
7 = (NBR + PTFE) very low friction, single acting - pulling

Spacer (1)
0 = none **2** = 50 mm **4** = 100 mm **6** = 150 mm **8** = 200 mm

Cushioning (1)
0 = none

Fast adjustable	**Slow adjustable**	**Fast fixed**
1 = rear only	**4** = rear only	**7** = rear only
2 = front only	**5** = front only	**8** = front only
3 = front and rear	**6** = front and rear	**9** = front and rear

(1) For details see table **B137**
(2) For spare parts request indicate the series number printed on the nameplate only for series < 30
(3) To be entered in alphabetical order
(4) Not available for double rod
(5) XV dimension must be indicated in the model code

3 CERTIFICATION

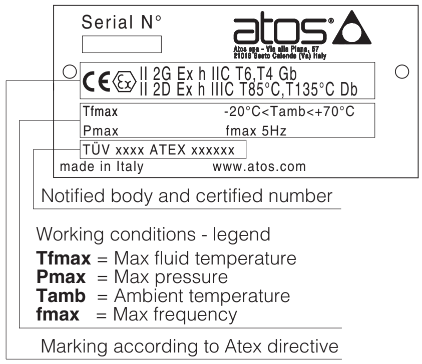
In the following are resumed the cylinders marking according to Atex certification.
Reference norm ISO 80079-36, ISO 80079-37.

II 2G Ex h IIC T6, T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust, see section 6
T6/T4 = Surface temperature class for gas, see section 6
Gb/Db = EPL Equipment group

Compliance RoHS Directive 2011/65/EU as last update by 2015/65/EU (only CKAM)
REACH Regulation (EC) no.1907/2006



4 INSTALLATION NOTES

Before installation and start-up refer to tab. BX900

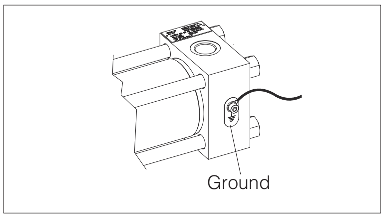
- The max surface temperature indicated in the nameplate must be lower than the following values:

GAS - **80% of gas ignition temperature**

DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**

- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine

GROUNDING



5 EX-PROOF ROD POSITION TRANSDUCER

CODE: **M**

CKA cylinders are available with "Balluff" Ex-proof rod position transducer, ATEX certified to **II 1/2 G Ex d IIC T6/T5 Ga/Gb** for gas and **II 2D Ex tb IIIC T85°C/T100°C Db IP 67 -40°C Ta +65°C (T6) -40°C Ta +80°C (T5)** for dust. Ex-proof transducers meet the requirements of the following european standard documentations:

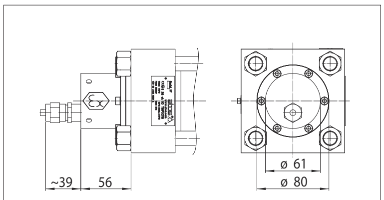
II 1/2 G Ex d IIC T6/T5 Ga/Gb
EN 60079-0
EN 60079-1
EN 60079-26

II 2D Ex tb IIIC T85°C/T100°C Db IP 67
EN 61241-0
EN 61241-0/AA
EN 61241-1

The transducer housing is made in AISI 303.
For dimensions and details, contact our technical office.

For certification and start-up refer to the user's guide included in the supply
The transducer is available with SIL certified on request

CKAM WITH ROD POSITION TRANSDUCER



cable connection with protection degree IP 67

6 MAIN CHARACTERISTICS AND FLUID REQUIREMENTS

Ambient temperature	-20÷+70°C; -40 ÷ +65°C for **CKAM**
Fluid temperature	-20÷+70°C (**T6**); -20÷+120°C (**T4**) for seals type **2** (*)
Max surface temperature	≤ +85 °C (**T6**); ≤ +135 °C (**T4**) for seals type **2** (*)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed (see section 7)	1 m/s (seals type 2, 4, 6, 7); 0,5 m/s (seals type 1)
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Note: (*) Cylinders with seals type **2** may also be certified **T6** limiting the max fluid temperature to 70°C

CKA cylinders are suitable for operation with mineral oils with or without additives (**HH, HL, HLP, HLP-D, HM, HV**), fire resistant fluids (**HFA** oil in water emulsion, 90-95% water and 5-10% oil; **HFB** water in oil emulsion, 40% water; **HFC** water glycol, max 45% water) and synthetic fluids (**HFD-U** organic esters, **HFD-R** phosphate esters) depending to the sealing system.

7 SEALING SYSTEM FEATURES

The sealing system must be choosen according to the working conditions of the system: speed, operating frequencies, fluid type and temperature. Additional verifications about minimum in/out rod speed ratio, static and dynamic sealing friction are warmly suggested, see **tab. B015**
When single acting seals are selected (types **6** and **7**), the not pressurized cylinder's chamber must be connected to the tank. Contact our technical office for the compatibility with other fluids not mentioned below and specify type and composition.

Sealing system	Material	Features	Max speed [m/s]	Fluid temperature range	Fluids compatibility	ISO Standards for seals	
						Piston	Rod
1	NBR + POLYURETHANE	**high static and dynamic sealing**	0.5	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV	ISO 7425/1	ISO 5597/1
2	FKM + PTFE	**very low friction and high temperatures**	1	-20°C to 120°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFB, HFD-U,HFD-R	ISO 7425/1	ISO 7425/2
4	NBR + PTFE	**very low friction and high speeds**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, MIL-H-5606 fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2
6 - 7	NBR + PTFE	**very low friction single acting - pushing/pulling**	1	-20°C to 70°C	Mineral oils HH, HL, HLP, HLP-D, HM, HV, fire resistance fluids HFA, HFC (water max 45%), HFD-U	ISO 7425/1	ISO 7425/2

8 EX-PROOF PROXIMITY SENSORS

CODES: **R** = front sensor; **S** = rear sensor
CKA cylinders are available with ex-proof proximity sensors, ATEX certified to **Ex II 3G Ex nA II T4 -25≤Ta≤80°C**. They meet the requirements of the following european standard documentations: EN 60079-0, EN 60079-15.
Their functioning is based on the variation of the magnetic field, generated by the sensor itself, when the cushioning piston enters on its influence area, causing a change of state (on/off) of the sensors. The sensor housing is made in stainless steel.
For dimensions and details, contact our technical office.

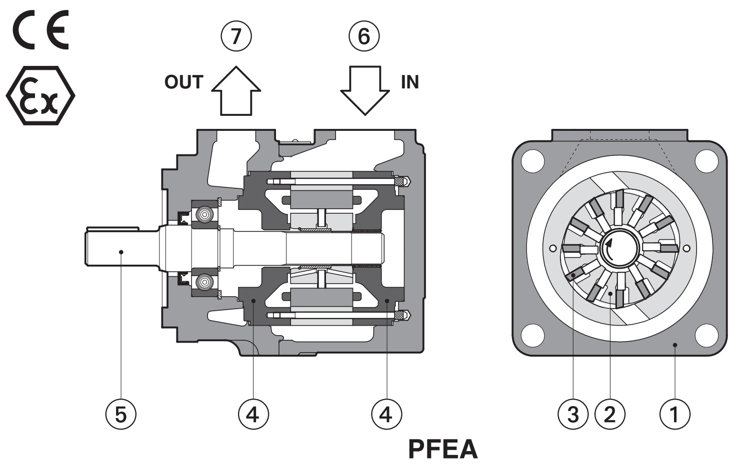
For certification and start-up refer to the user's guide included in the supply

SENSORS TECHNICAL DATA

Ambient temperature	-25 ÷ +80°C
Nominal voltage	24 VDC
Operating voltage	10 ÷ 30 VDC
Max load	200 mA
Repeatability	<5%
Protection degree	IP 68
Max frequency	1000 Hz
Max pressure	25 MPa

Ex-proof vane pumps type PFEA

fixed displacement - for potentialy explosive atmospheres - **ATEX**



① body
② and ③ rotor with vanes
④ balanced plates
⑤ shaft
⑥ inlet port
⑦ outlet port

PFEA are fixed displacement-twelve-vane pumps available in threebody sizes and two different executions.
They are certified for application in potentially explosive atmospheres according to ATEX 2014/34/EU, protection mode
Ex II 2/2G Ex h IIC T5, T4 Gb, and
Ex II 2/2D Ex h IIIC T100°C, T135°C Db
(group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).

The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

PFEA are available in two executions:

PFEA-*1 max pressure **210** bar

PFEA-*2 max pressure **300** bar

Displacements up to **150** cm^3/rev.

1 MODEL CODE

PFEA	XA	-	31	036	/	1	D	T	/	7	*	/	*

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM **(2)**

Series number

Option:
7 = for ambient temperature up to 70°C **(2)**

Port orientation, see section 8:
T = standard
U, V, W = on request

Direction of rotation (viewed from the shaft end):
D = clockwise
S = counterclockwise
Note: PFEA* are not reversible

Fixed displacement vane pump with ex-proof certification

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:
XA = for coupling with PFEA-31
XB = for coupling with PFEA-41 (only for PFEA-41, 42 and PFEA-51, 52)
XC = for coupling with PFEA-51 (only for PFEA-51 and 52)
XO = with through shaft, without rear flange

Size:
31, 41, 51 (standard)
32, 42, 52 (high pressure and low noise)

Drive shaft:
cylindrical, keyed (not for PFEA rear pumps to be coupled with PFEAX*)
1 = standard (only for PFEA 31, 41, 51)
2 = long version (only for PFEA-41 and PFEA-51)
3 = for high torque applications

splined
5 = for signal and through-shift pumps (1)
6 = for signal and through-shift pumps (only first position) — only PFEA-31,42
7 = for signal and through-shift pumps (only second and third position) — PFEA-32,42

Displacement of **PFEA-31, 41, 51** [cm^3/rev]
for PFEA-31: **010, 016, 022, 028, 036, 044**
for PFEA-41: **029, 037, 045, 056, 070, 085**
for PFEA-51: **090, 110, 129, 150**

Displacement of **PFEA-32, 42, 52** [cm^3/rev]
for PFEA-32: **016, 022, 028, 036**
for PFEA-42: **045, 056, 070, 085**
for PFEA-52: **090, 110, 129, 150**

(1) Shaft type 5 has to be selected for PFEA rear pumps to be coupled with PFEAX* first pumps
(2) Pumps with option **/7** are always equipped with seals FKM

2 GENERAL CHARACTERISTICS

Assembly 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 range	-20°C to +70°C
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	Explosion proof protection “Ex h”, see section 6 RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

3 OPERATING CHARACTERISTICS of PFEA - 31,41,51 at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3) l/min	7 bar (3) kW	140 bar (3) l/min	140 bar (3) kW	210 bar (3) l/min	210 bar (3) kW
PFEA-31010	10,5	160	800-2400	15	0,2	12	5	-	-
PFEA-31016	16,5	210 bar	800-2800	23	0,5	19	5	16	8,3
PFEA-31022	21,6			30	0,6	26	7	23	10,8
PFEA-31028	28,1			40	0,8	36	10	33	14
PFEA-31036	35,6			51	1	46	12,5	43	17,8
PFEA-31044	43,7		800-2500	63	1,3	58	15,5	55	22
PFEA-41029	29,3			41	0,8	37	10	34	14,7
PFEA-41037	36,6			52	1	48	12,5	45	18,3
PFEA-41045	45,0			64	1,3	60	16	57	22,6
PFEA-41056	55,8			80	1,6	75	21	72	28
PFEA-41070	69,9			101	2	95	26	91	35
PFEA-41085	85,3		800-2000	124	2,4	118	32	114	43
PFEA-51090	90,0		800-2200	128	2,7	119	33	114	45
PFEA-51110	109,6			157	3,2	147	40	141	55
PFEA-51129	129,2			186	3,7	174	47	168	65
PFEA-51150	150,2		800-1800	215	4,2	204	55	197	75

(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

4 OPERATING CHARACTERISTICS of PFEA - 32, 42, 52 at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

Model	Displacement cm³/rev	Max pressure (1)	Speed range rpm (2)	7 bar (3) l/min	7 bar (3) kW	140 bar (3) l/min	140 bar (3) kW	at max. pressure (3) l/min	at max. pressure (3) kW
PFEA-32016	16,5	210 bar	1000-2500	23	0,35	20	6	16	10
PFEA-32022	21,6	300 bar	1200-2500	30	0,6	26	7	20	16
PFEA-32028	28,1			40	0,8	36	10	30	20
PFEA-32036	35,6			51	1	46	12,5	40	26
PFEA-42045	45	280 bar	1000-2200	64	1,3	60	16	56	31
PFEA-42056	55,8			80	1,6	75	21	70	40
PFEA-42070	69,9	250 bar		101	2	95	26	90	42
PFEA-42085	85,3	210 bar	800-2000	124	2,4	118	32	114	43
PFEA-52090	90	250 bar	1000-2000	128	2,7	119	33	111	54
PFEA-52110	109,6			157	3,2	147	40	138	66
PFEA-52129	129,2			186	3,7	174	47	163	78
PFEA-52150	150,2	210 bar	800-1800	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

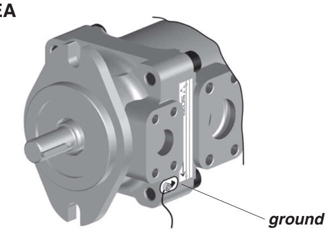
5 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max start-up viscosity = 1000 mm²/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
Max fluid contamination level — longer life	ISO4406 class 19/17/14 NAS1638 class 8		
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 CERTIFICATION MAIN DATA

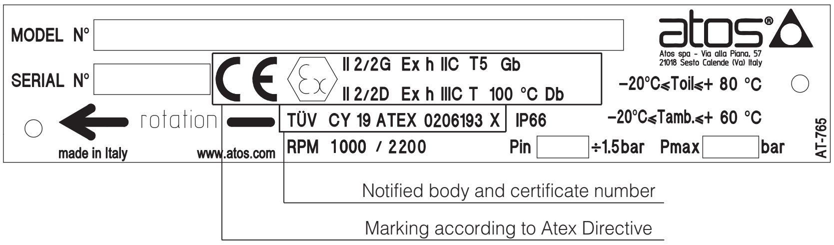
Certification	ATEX	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T6	T5
Surface temperature	≤ 85 °C	≤ 100 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	

PFEA



6.1 EXAMPLE OF PFEA NAMEPLATE MARKING

At side are resumed the pumps marking according to Atex certification



Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection (“c”, “b”, “k”)
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5)
T°C** = Max surface temperature (85, 100)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

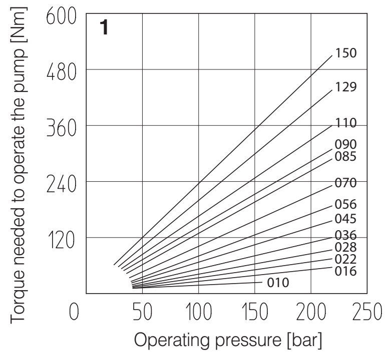
6.2 Related documentation

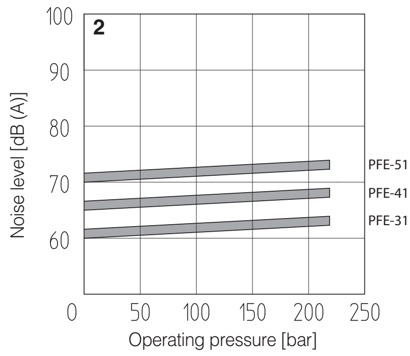
X010 Basics for electrohydraulics in hazardous environments
X020 Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900 Operating and maintenance information for ex-proof pumps

7 **DIAGRAMS** for PFEA -31, 41, 51 (Fbased 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.

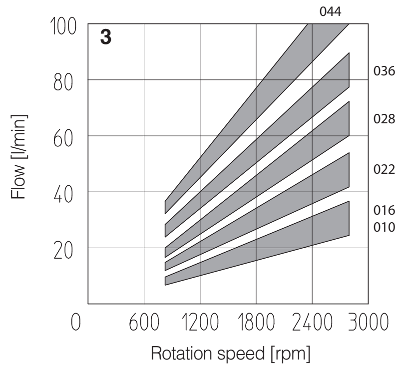


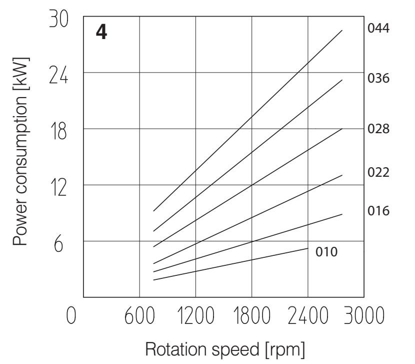


PFE-31:

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.

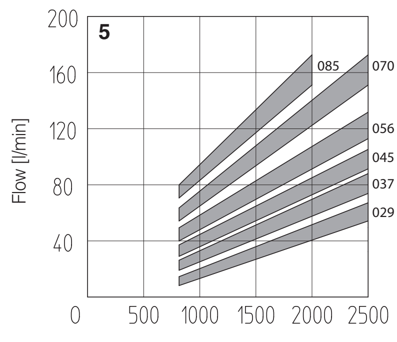


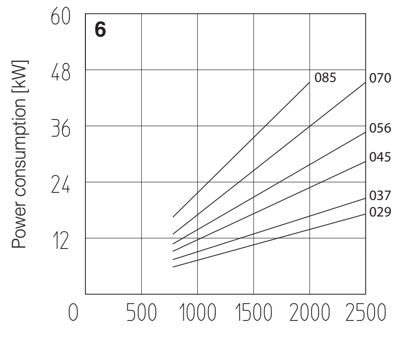


PFE-41:

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.





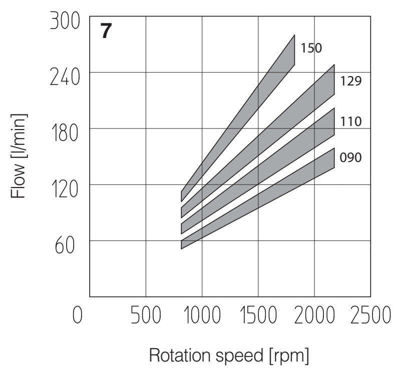
Rotation speed [rpm]

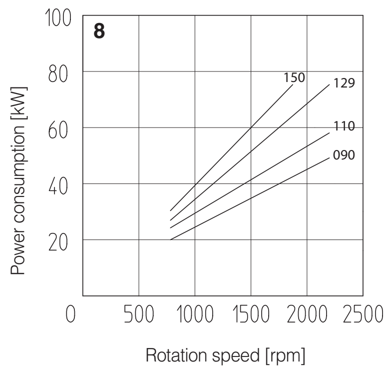
Rotation speed [rpm]

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.

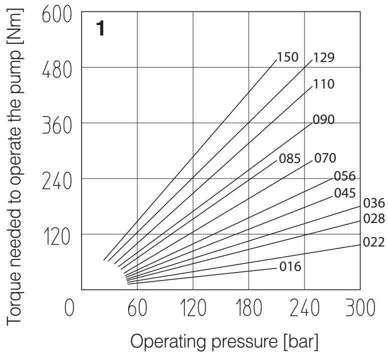


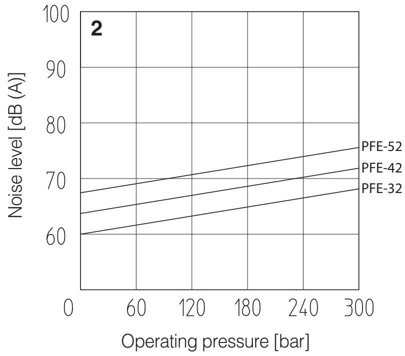


8 **DIAGRAMS** for PFEA -32, 42, 52 (based on mineral oil ISO VG 46 at 50°C)

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.

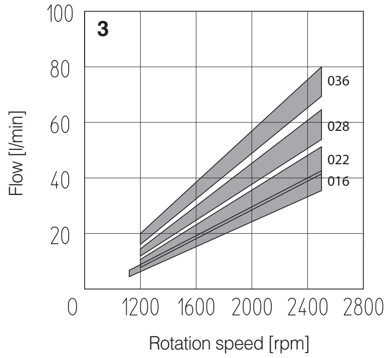


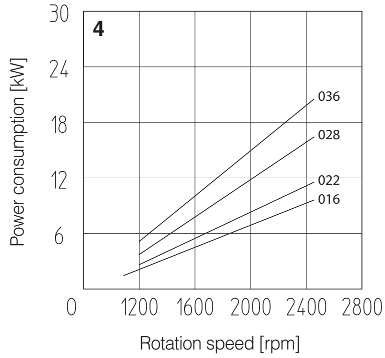


PFE-32:

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.

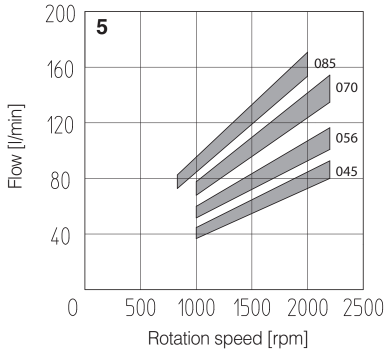


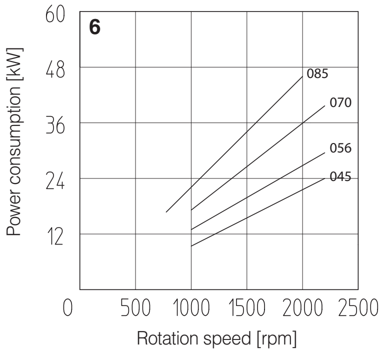


PFE-42:

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.

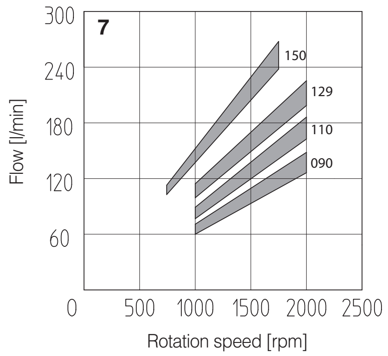


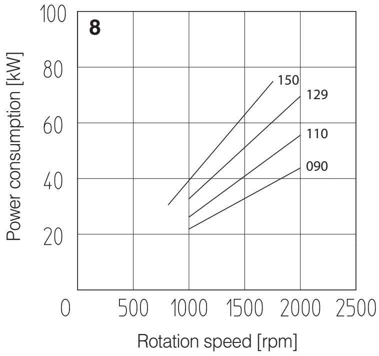


PFE-52:

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.



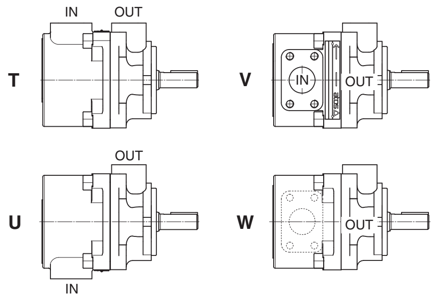


9 PORT ORIENTATION

Single pumps can be supplied with oil ports oriented in different configuration in relation to the drive shaft, as follows (wiewed from the shaft end);

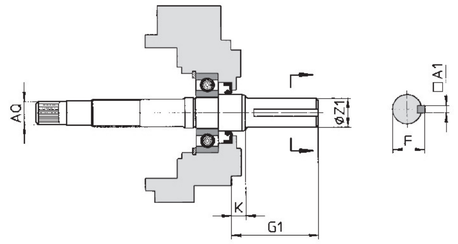
T = inlet and outlet ports on the same axis (standard)
U = outlet orientated 180° with respect to the inlet
V = outlet oriented 90° with respect to the inlet
W = outlet oriented 270° with respect to the inlet

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.



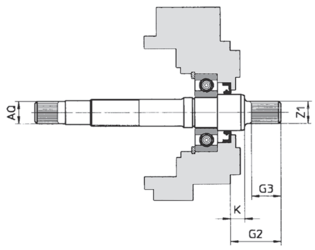
10 DRIVE SHAFT

CYLINDRICAL SHAFT KEYED



PFEA Model	PFEA - 31,41,51						PFEA - 41,51						ALL VERSIONS					
	Keyed shaft type 1 (only PFEA - 31,41,51)						Keyed shaft type 2 (only PFEA - 41,51)						Keyed shaft type 3					
						Only for through shaft execution						Only for through shaft execution						Only for through shaft execution
	A1	F	G1	K	ØZ1	Ø AQ	A1	F	G1	K	ØZ1	Ø AQ	A1	F	G1	K	ØZ1	Ø AQ
31,32	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	
41,42	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	
51,52	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



PFEA Model	Splined shaft type 5					Splined shaft type 6					Splined shaft type 7				
					Only for through shaft execution					Only for through shaft execution					Only for through shaft execution
	G2	G3	K	Z1	Ø AQ	G2	G3	K	Z1	Ø AQ	G2	G3	K	Z1	Ø AQ
31,32	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
41,42	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
51,52	56,00	42	8,10	SAE 12/24-14T	SAE 16/32-13T	–	–	–	–	–	–	–	–	–	–

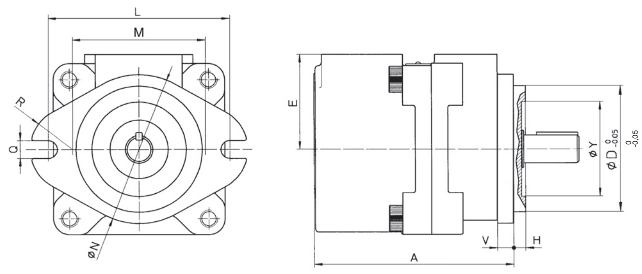
11 LIMITS OF SHAFT TORQUE

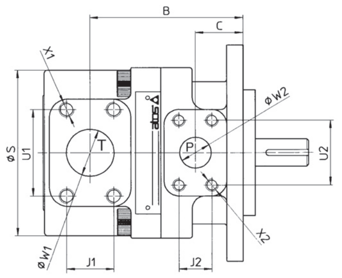
PFEA Model	Maximum driving torque [Nm]						Maximum torque available at the end of the through shaft [Nm]
	Shaft type 1	Shaft type 2	Shaft type 3	Shaft type 5	Shaft type 6	Shaft type 7	Any type of shaft
31,32	160	–	240	110	240	240	130
41,42	250	250	400	200	400	400	250
-51,52	500	500	850	450	–	–	400

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.

12 DIMENSIONS OF PFEA - 31, 41, 51 SINGLE PUMPS [mm]

T = inlet port
P = outlet port





SAE FLANGES
PFEA-31: port **T = 1 1/4"**; port **P = 3/4"**
PFEA-41: port **T = 1 1/2"**; port **P = 1"**
PFEA-51: port **T = 2**; port **P = 1 1/4"**

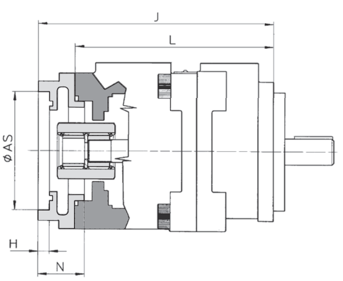
Mass:
PFE-31 = 9 kg
PFE-41 = 14 kg
PFE-51 = 25,5 kg

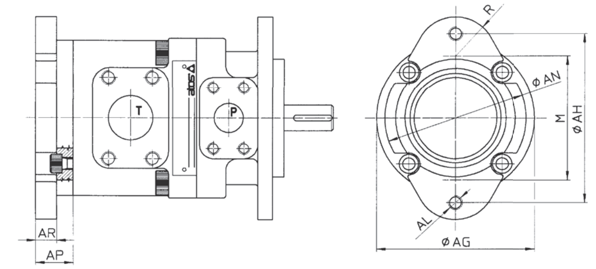
SAE flanges can be supplied with the pump

Model	A	B	C	ØD	E	H	L	M	ØN	Q	R
PFEA-31	136	100	28	82,55	70	6,4	106	73	95	11,1	28,5
PFEA-41	160	120	38	101,6	76,2	9,7	146	107	120	14,3	34
PFEA-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**
PFEA-31	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-41	134	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-51	160	77,8	58	15	51	32	42,9	30,2	M12X20	M10X20	76

13 DIMENSIONS OF PFEA-31, 41, 51 WITH THROUGH-SHAFT [mm]

T = inlet port
P = outlet port





SAE FLANGES
PFEAX-31: port **T = 1 1/4"**; port **P = 3/4"**
PFEAX-41: port **T = 1 1/2"**; port **P = 1"**
PFEAX-51: port **T = 2**; port **P = 1 1/4"**

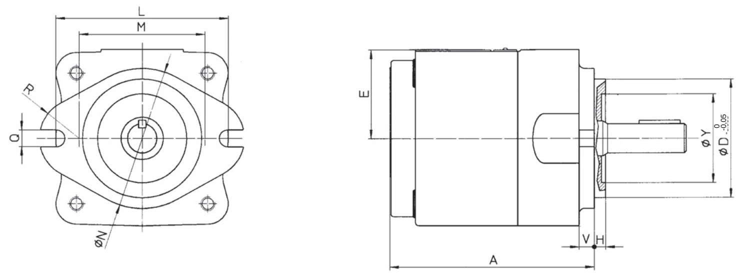
For other dimensions, see section 8

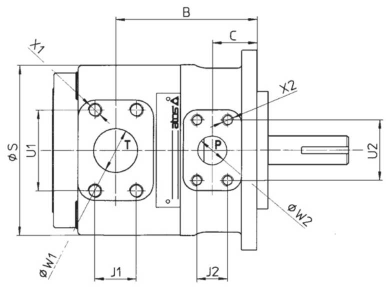
Model	Ø AG	Ø AH	AL	Tightening torque (Nm)(1)	Ø AN	AP	AR	Ø AS	H	J	L	M	N	R
PFEXA-31	114	106	M10X17	70	95	33	25	82,57 82,63	6,42 6,47	165,5	132,5	79	32	28,5
PFEXA-41	134	106	M10X17	70	95	23	11	82,57 82,63	6,42 6,47	194	171	73	32	28,5
PFEXB-41	134	146	M12	125	120	32	18	101,62 101,68	9,73 9,78	203	171	107	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

14 DIMENSIONS OF PFEA -32, 42, 52 SINGLE PUMPS [mm]

T = inlet port
P = outlet port





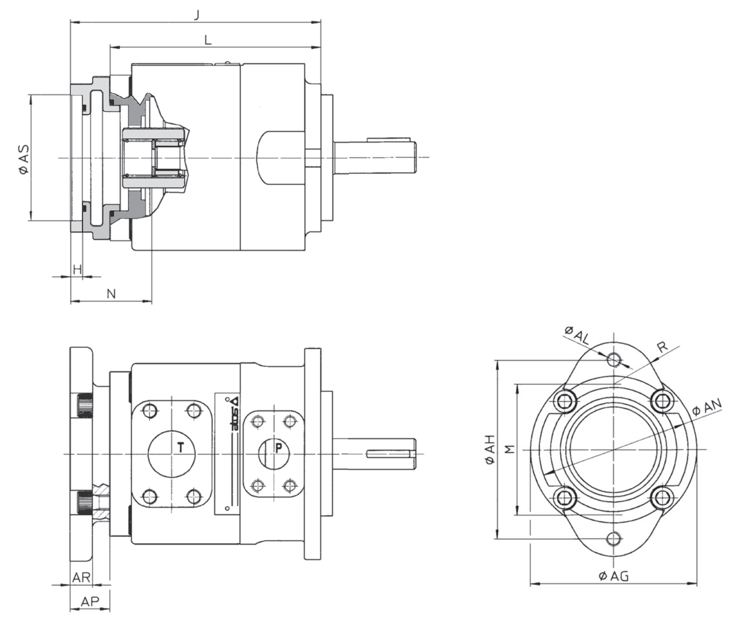
SAE FLANGES
PFEA-32: port **T = 1 1/4”**; port **P = 3/4”**
PFEA-42: port **T = 1 1/2”**; port **P = 1”**
PFEA-52: port **T = 2**; port **P = 1 1/4”**

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
PFEA-32	136	100	28	82,5	70	6,4	106	73	95	11	28,5
PFEA-42	175,5	121	38	101,6	78	9,7	146	107	121	14,3	34
PFEA-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**
PFEA-32	114	58,7	47,6	10	32	19	30,2	22,2	M10X20	M10X17	47
PFEA-42	148	70	52,4	13	38	25	35,7	26,2	M12X20	M10X17	76
PFEA-52	174	77,8	58,7	16,3	50	50	42,9	30,2	M12X20	M10X20	76

15 DIMENSIONS OF PFEA - 32, 42, 52 WITH THROUGH-SHAFT [mm]

T = inlet port
P = outlet port



SAE FLANGES
PFEAX-32: port **T = 1 1/4”**; port **P = 3/4”**
PFEAX-42: port **T = 1 1/2”**; port **P = 1”**
PFEAX-52: port **T = 2**; port **P = 1 1/4”**

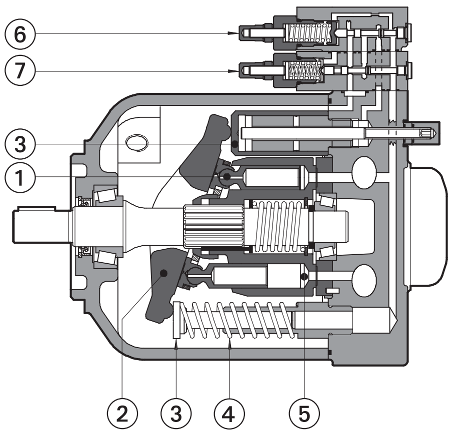
For other dimensions, see section 8

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

Ex-proof axial piston pumps type PVPCA

for potentially explosive atmospheres - **ATEX**



① pumping piston
② swashing plate
③ servo piston
④ spring
⑤ rotation barrel
⑥ pressure compensator
⑦ flow regulator

PVPCA-L-4046

PVPCA are variable displacement axial piston pumps for high pressure operation, and low noise level, available in a wide range of hydraulic and proportional controls.
They are certified for application in potentially explosive atmospheres according to ATEX 2014/34/EU, protection mode Ex II 2/2G Ex h IIC T5, T4 Gb, and Ex II 2/2D Ex h IIIC T100°C, T135°C Db (group II for surface plants with gas, vapours and dust environment, category 2, zone 1, 2, 21 and 22).
The external surface temperature of the pump is in accordance with the certified class, to avoid the self ignition of the explosive mixture present in the environment.

Displacement: **29**-**46**-**73**-**88** cm^3/rev.
Pressure: **280 bar working**
350 bar peak

1 MODEL CODE

PVPCA	XA	-	C	-	4	046	/	31044	/	1	D	-	GK	/	7	24DC	*	/	*

Variable displacement vane pump with ex-proof certification

Additional suffix for pumps with through shaft, for coupling with 2nd pump type PFEA:
XA =for coupling with PFEA-3* (only for PVPCA*-3*)
XB =for coupling with PFEA-4* (only for PVPCA*-4*)
XC =for coupling with PFEA-5* (only for PVPCA*-5*)

Type of control **(1)**:
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 proportional controls see note (2)

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

Type of PVPCA (for double pumps), see tech table A160

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)

Direction of rotation (viewed at the shaft end):
D = clockwise
S = counterclockwise

Solenoid threaded connection (only for CH control):
GK = GK-1/2" ISO/UNI-6125 (tapered)
NPT= 1/2" NPT ANSI B2.1 (tapered)
M = M20x1,5 UNI-4535

Option:
7 = for ambient temperature up to 70°C **(3)**
Only for CH control:
O = horizontal cable entrance
WP = prolongued manual override protected by metallic cap

Voltage code, only for CH: see tech table EX010

Series number

Seals material:
omit for NBR (mineral oil & water glycol)
PE = FKM **(3)**

(1) Pumps CH, CZ, LQZ, PES and PERS are supplied with two certificates, one for the pump, and one for control valve

(2) Pumps with proportional controls type: CZ, LQZ, PES and PERS are available on request.
For the technical characteristics of PVPCA pumps with proportional controls, see tech table AS170

(3) Pumps with option **/7** are always equipped with seals FKM

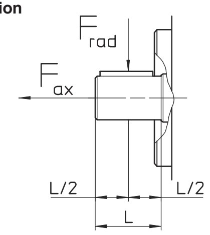
2 GENERAL CHARACTERISTICS

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 lenght is 3 m.
Ambient temperature range	-20°C to +70°C
Compliance	Explosion proof protection “Ex h”, see section 6 RoHs Directive 2011/65/EU as last update by 2015/65/EU (only PVPCA-CH) REACH Regulation (EC) n°1907/2006

3 OPERATING CHARACTERISTICS

Pump model	**PVPCA*-3029**	**PVPCA*-4046**	**PVPCA*-5073**	**PVPCA*-5090**
Displacement [cm³/rev]	29	46	73	88
Theoretical max flow at 1450 rpm [l/min]	42	66,7	105,8	127,6
Max working pressure / Peak pressure [bar]	280/350	280/350	280/350	250/315
Min/Max inlet pressure [bar abs.]	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
Power consumption at 1450 rpm and at maximum pressure and displacement [kW]	19,9	31,6	50,1	54,1
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
Max permissible load on drive shaft [N] Fax	1000	1500	2000	2000
Max permissible load on drive shaft [N] Frad	1500	1500	3000	3000
Speed rating [rpm]	500 ÷ 3000	500 ÷ 2600	500 ÷ 2600	500 ÷ 2200

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 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.

4 ELECTRICAL CHARACTERISTICS FOR VERSION CH

Valve type	DHA
Voltage code **(1)** VDC ±10%	**12DC, 24DC, 28DC, 48DC, 110DC, 125DC, 220DC**
Voltage code **(1)** VAC 50/60 Hz ±10%	**12AC, 24AC, 110AC, 230AC**
Power consumption at 20°C	8W
Coil insulation	class H
Protection degree with relevant cable gland	IP66/67 to DIN EN60529
Duty factor	100%

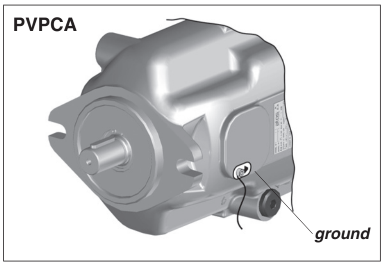
(1) For alternating current supply a rectifier bridge is provided built-in the solenoid
For power supply frequency 60 Hz, the nominal supply voltage of solenoids 110AC and 230AC must be 115/60 and 240/60 respectively

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 ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity	15÷100 mm²/s - max start-up viscosity = 1000 mm²/s		
Max fluid contamination level – normal operation	ISO4406 class 20/18/15 NAS1638 class 9		see also filter section at www.atos.com or KTF catalog
Max fluid contamination level – longer life	ISO4406 class 18/16/13 NAS1638 class 7		
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	ISO 12922

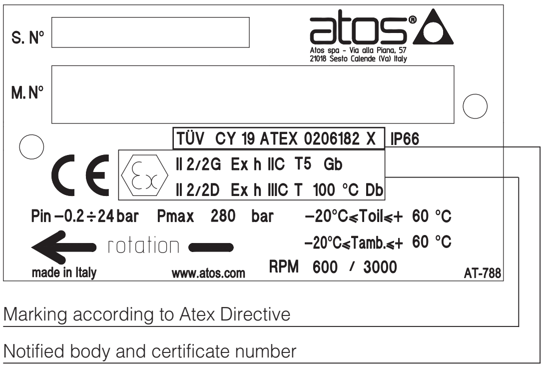
6 CERTIFICATION DATA

Certification	ATEX	
Protection mode	Ex II 2/2G Ex h IIC T5, T4 Gb, Ex II 2/2D Ex h IIIC T100°C, T135°C Db	
Type examination certificate	TUV CY 19 ATEX 026182X	
Pump version	(**std** and **/PE**)	**/7 /PE**
Temperature class	T5	T4
Surface temperature	≤ 100 °C	≤ 135 °C
Ambient temperature	-20 ÷ +60 °C	-20 ÷ +70 °C
Max inlet fluid temperature	+60 °C	+80 °C
Protection degree	IP 66	



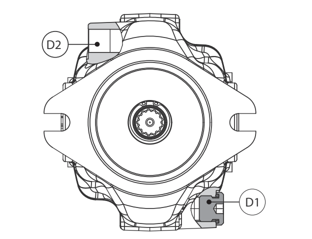
6.1 EXAMPLE OF PVPCA NAMEPLATE MARKING

At side are resumed the pumps marking according to Atex certification



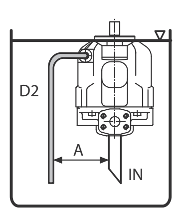
Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G = For gas and vapours
D = For dust
h = Marking includes one on more of the following types of protection (“c”, “b”, “k”)
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)
Zone 1 (gas) **and 21** (dust) = Possibility of explosive atmosphere during normal functioning
Zone 2 (gas) **and 22** (dust) = Low probability of explosive atmosphere

7 INSTALLATION POSITION

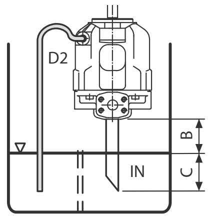


The pump is supplyed whit drain D2 open, and D1 plugged.
Before installation fill the pump with hydraulic oil for at least 3/4 of its volume, keeping it in horizontal position.
With exception of pump mounted below the oil level, we recomend to interpose a baffle plate between inlet and drain line.

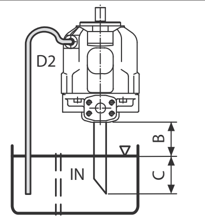
VERTICAL INSTALLATION



INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm

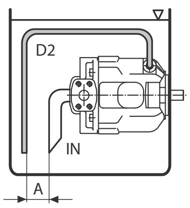


INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

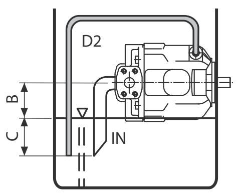


OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar absolute
B ≤ 800mm, C= 200mm

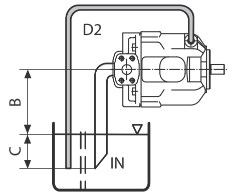
HORIZONTAL INSTALLATION



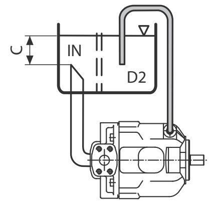
INSIDE THE TANK
Minimum oil level equal or above the pump mounting surface.
A ≥ 200mm



INSIDE THE TANK
Minimum oil level below the pump mounting surface.
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK, above oil level
Minimum inlet pressure = 0,8 bar (absolute)
B ≤ 800mm, C= 200mm



OUTSIDE THE TANK, below oil level
C= 200mm

IN: inlet line - **D1:** drain line - **A:** minimum distance between inlet and drain line - **B+C:** permissible suction height - **C:** inlet line immersion dept

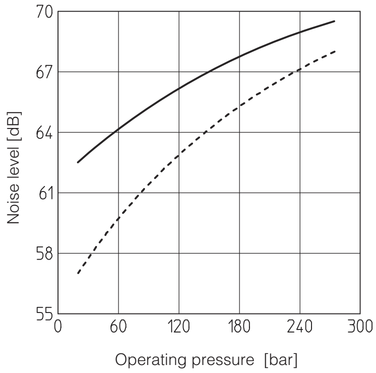
8 DIAGRAMS at 1450 rpm (based on mineral oil ISO VG 46 at 50°C)

8.1 Noise level curves

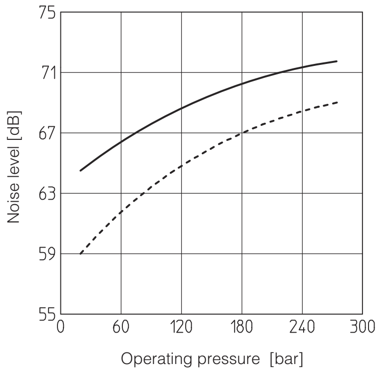
Ambient noise levels measured in compliance with ISO 4412-1 oleohydraulics -Test procedure to define the ambient noise level - Pumps
Shaft speed: 1450 rpm.

—— = Qmax ------ = Qmin

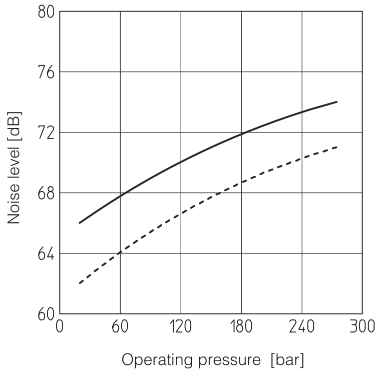
PVPCA-*-3029



PVPCA-*-4046



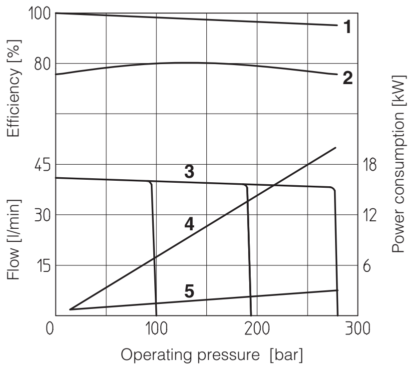
PVPCA-*-5073 and PVPCA-*-5090



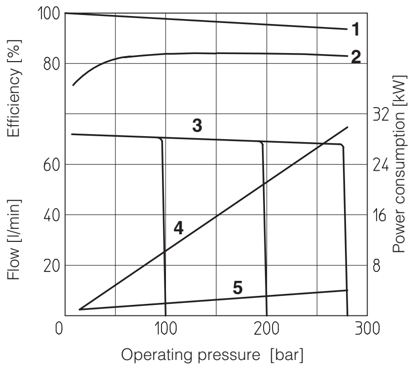
8.2 Operating limits

1 = Volumetric efficiency
2 = Overall efficiency
3 = Flow versus pressure curve
4 = Power consumption with full flow
5 = Power consumption at pressure compensation

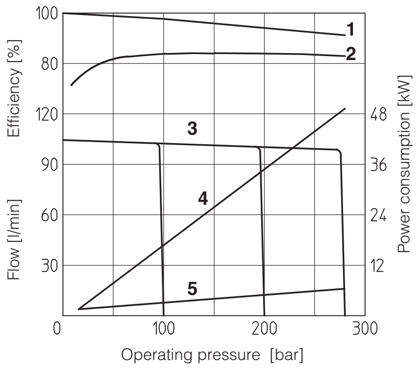
PVPCA-*-3029



PVPCA-*-4046



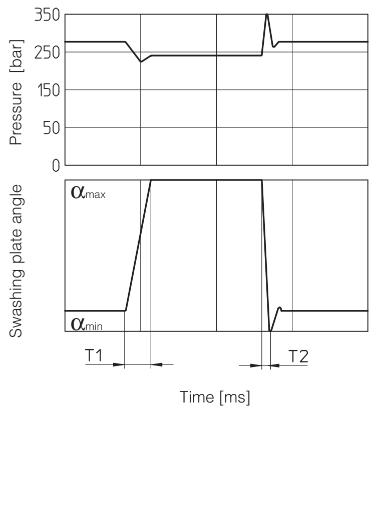
PVPCA-*-5073



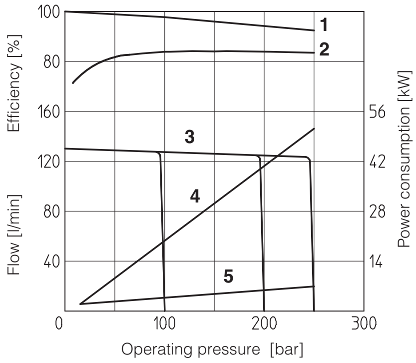
8.3 Response times

8.3.1 Response times and pressure peack due to variation 0% → 100% → 0% of the pump displacement, obtained with an istantaneously opening and shut-off of the delivery line.

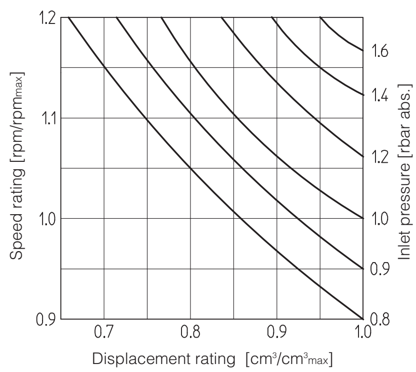
Pump type	**T1** (ms)	**T2** (ms)
PVPCA-*-3029	31	19
PVPCA-*-4046	44	20
PVPCA-*-5073	50	25
PVPCA-*-5090	53	28

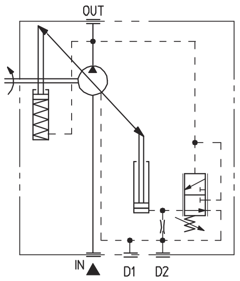


PVPCA-*-5090



8.3.2 Variation of inlet pressure and reduction of displacement with increasing speed rating

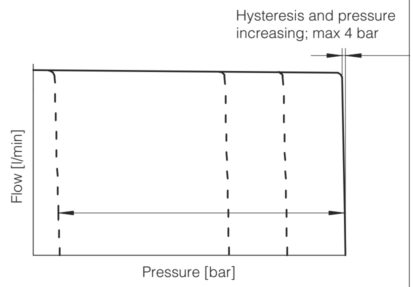


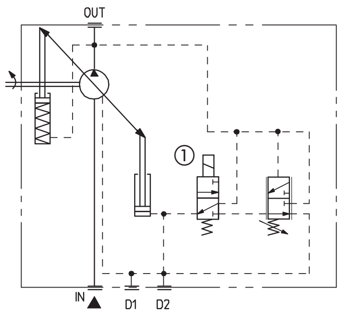


C

Manual pressure compensator

The pump displacement decreases when the line pressure approaches the setting pressure of the compensator. The pump supplies only the fluid required by the system. Pressure may be steplessly adjusted at the pilot valve.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)



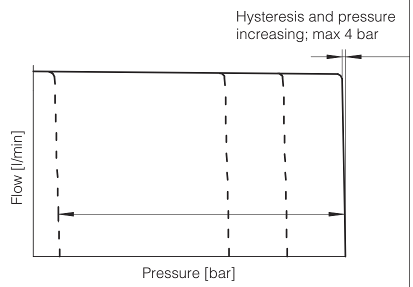


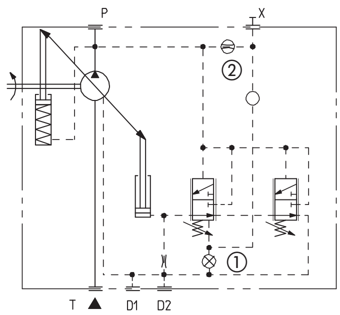
① solenoid venting valve

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 5
Venting valve OFF = null displacement
Venting valve ON = max displacement
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

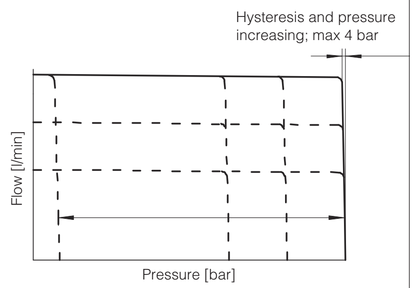


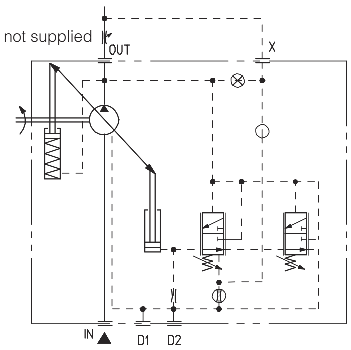


R

Remote pressure compensator

As C, but with remote setting of the compensator by means of a pressure relief valve on the piloting line X.
This version can be obtained from version L using a blind plug UNI 5923 M4x12 in pos. ① and a restrictor M4 drilled ø 0,75 mm in pos. ②.
Compensator setting range: 20 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)

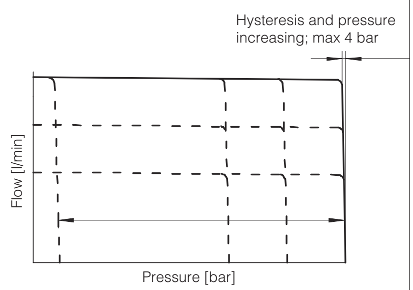


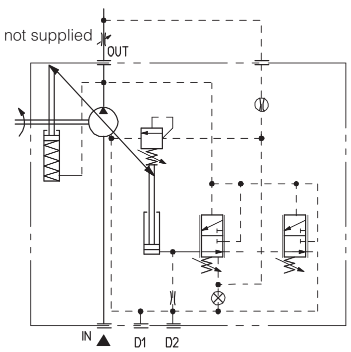


L

Load sensing

The pump displacement is automatically adjusted to maintain a constant (load indipendent) 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 ÷ 350 bar (315 bar for 090)
Compensator standard setting: 280 bar (250 bar for 090)
Differential pressure setting range: 10 ÷ 40 bar
Differential pressure standard setting: 14 bar

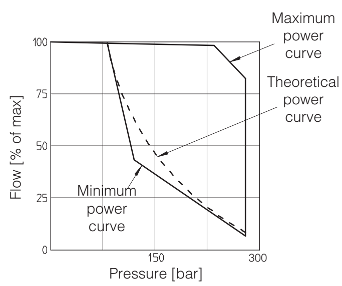




LW

Constant power

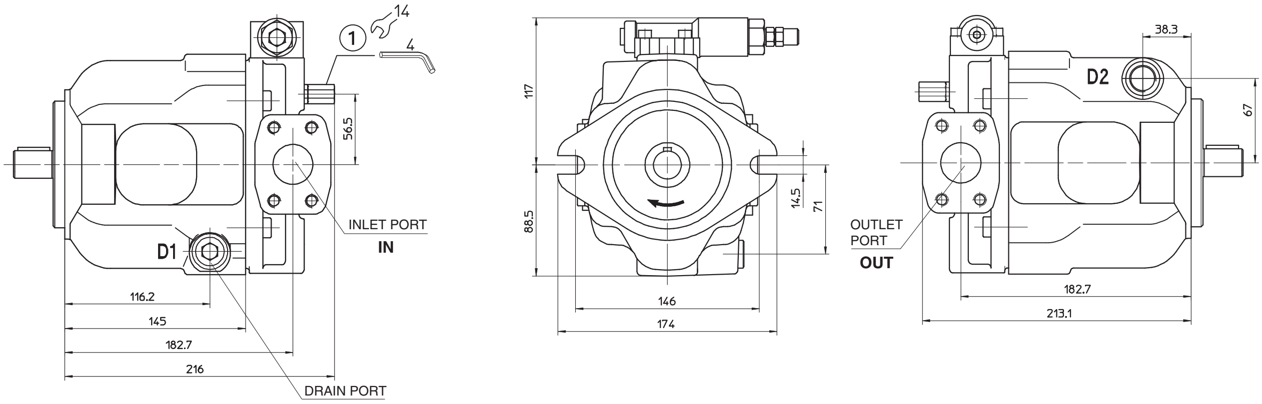
In order to achieve a constant drive torque with varying operating pressure. The swashing angle and therefore the outlet flow is varied so that the product of flow and pressure remains constant.
For the best regulation, minimum working pressure is 80 bar.
While selecting LW control, the required value of power must be communicated with the order (ex. 10 kW at 1450 rpm).

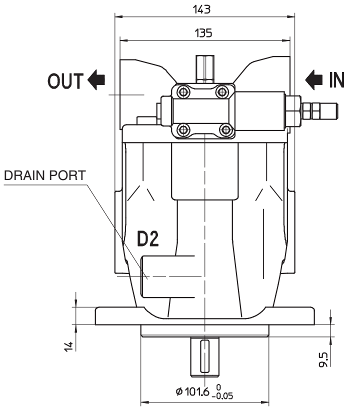


10 DIMENSIONS OF PVPCA-*-3029: BASIC VERSION “C” CONTROL

PORTS DIMENSION

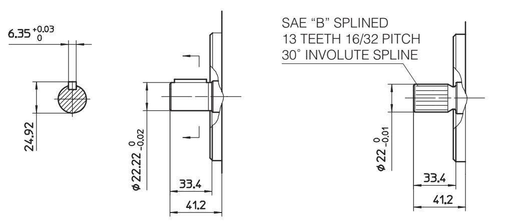
IN = Flange SAE 3000 1 1/4”
OUT = Flange SAE 6000 3/4”
D1, D2 = 1/2” BSPP
① = Regulation screw for max displacement 1,5 cm³/rev per turn. Adjustable range 20 to 29 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.



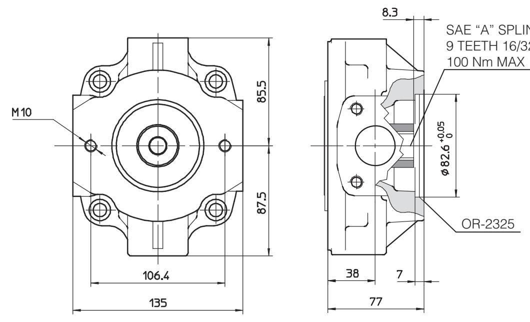


Mass: 18 kg

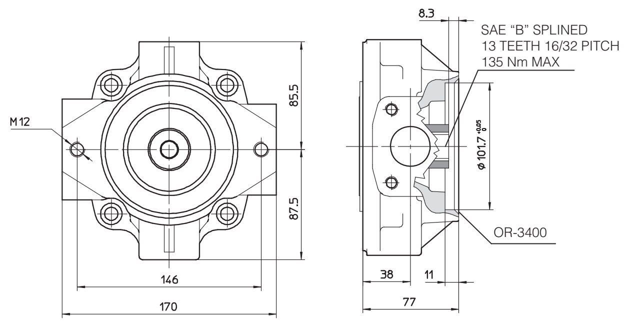
SHAFT TYPE “1” **SHAFT TYPE “5”**



INTERMEDIATE FLANGE SAE “A” FOR PFEA-31



INTERMEDIATE FLANGE SAE “B” FOR PFEA-41

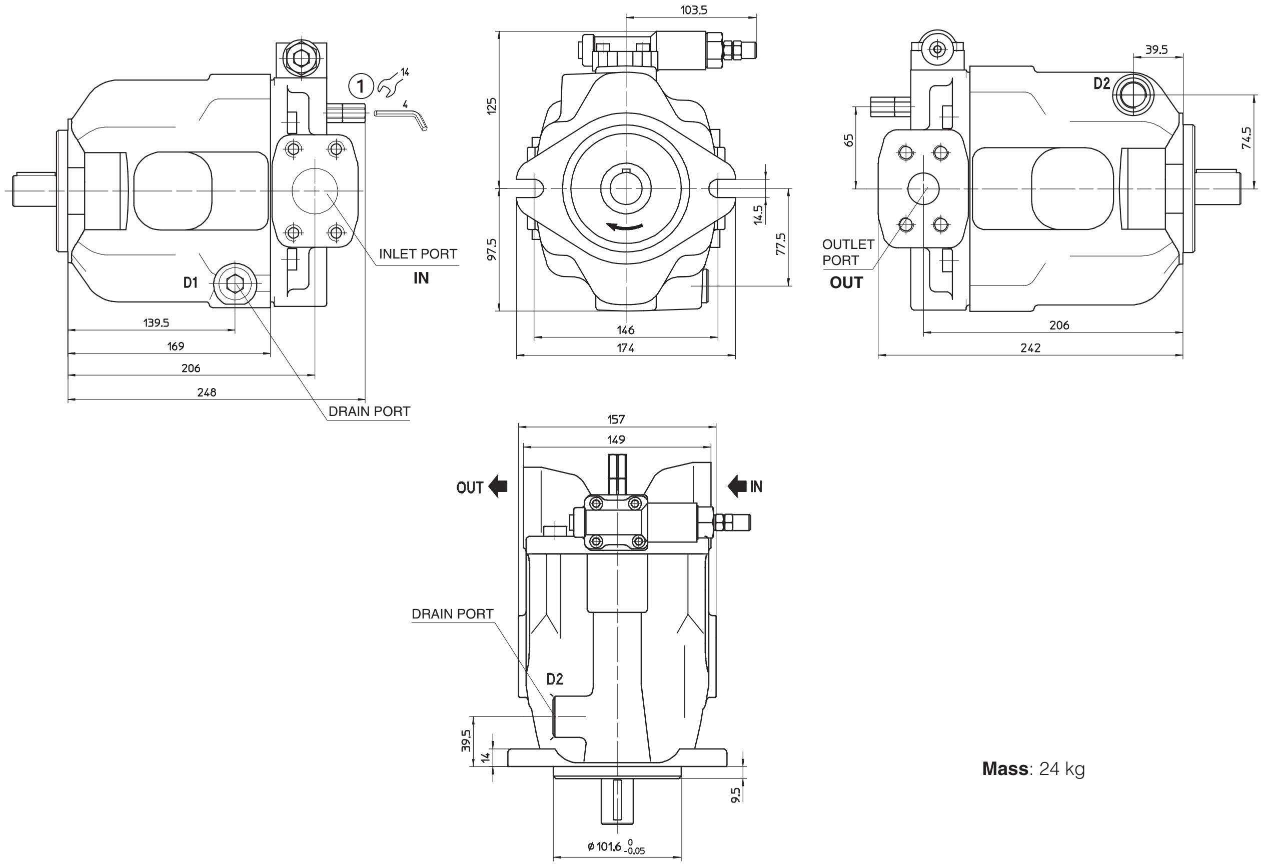


Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

11 DIMENSIONS OF PVPCA-*-4046: BASIC VERSION “C” CONTROL

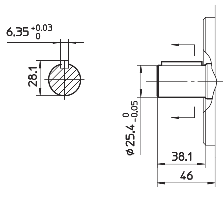
PORTS DIMENSION

IN = Flange SAE 3000 1 1/2”
OUT = Flange SAE 6000 1”
D1, D2 = 1/2” BSPP
① = Regulation screw for max displacement 2,2 cm^3/rev per turn. Adjustable range 31,8 to 46 cm^3/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

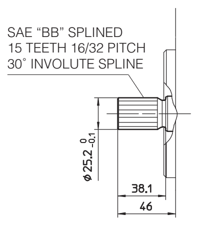


Mass: 24 kg

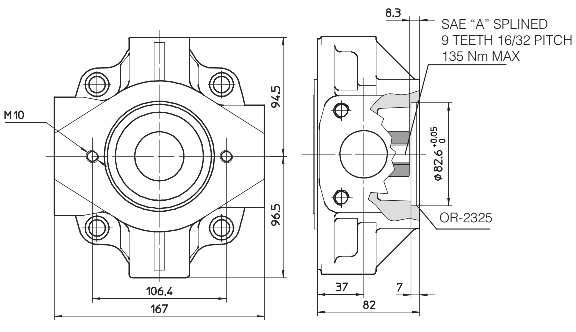
SHAFT TYPE “1”



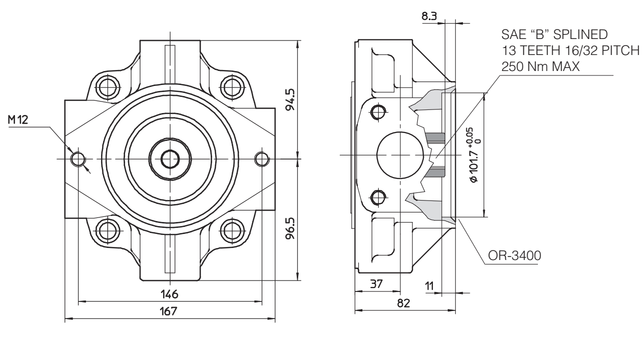
SHAFT TYPE “5”



INTERMEDIATE FLANGE SAE “A” FOR PFEA-31

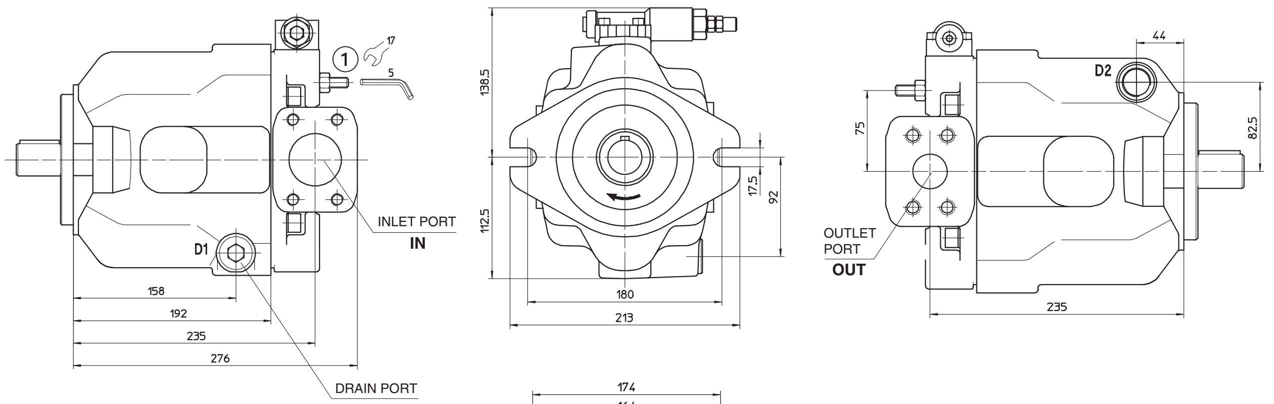


INTERMEDIATE FLANGE SAE “B” FOR PFEA-41



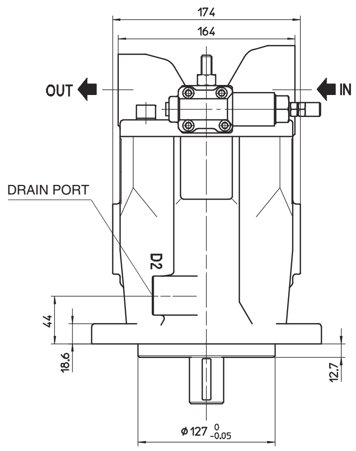
Drawing shows pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

12 DIMENSIONS OF PVPCA-*-5073 and PVPC-*-5090: BASIC VERSION "C" CONTROL



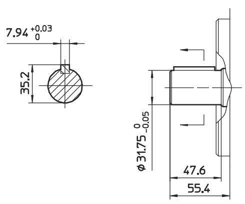
PORTS DIMENSION

IN = Flange SAE 3000 2"
OUT = Flange SAE 6000 1 1/4"
D1, D2 = 3/4" BSPP
① = Regulation screw for max displacement
3,2 cm³/rev per turn.
Adjustable range :
PVPC-5073 = 36,8 to 46 cm³/rev
PVPC-5073 = 44 to 88 cm³/rev.
In case of double pump the regulation screw is not always available, please contact our technical office.

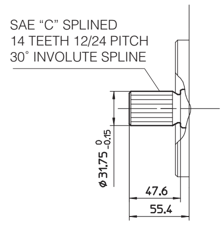


Mass: 33 kg

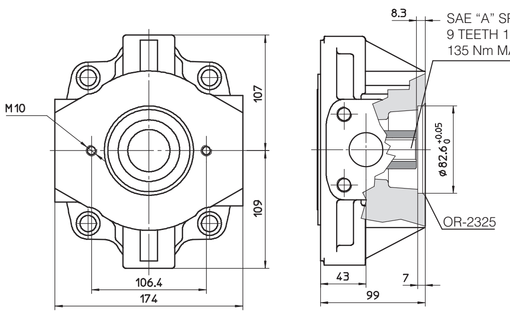
SHAFT TYPE "1"



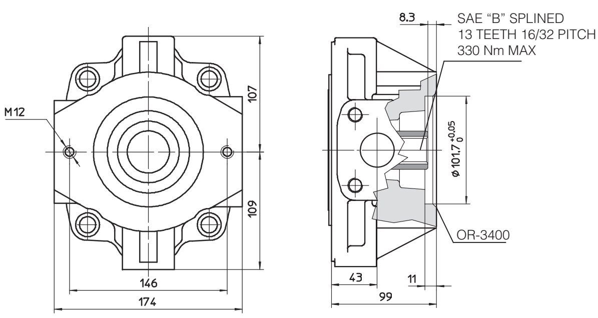
SHAFT TYPE "5"



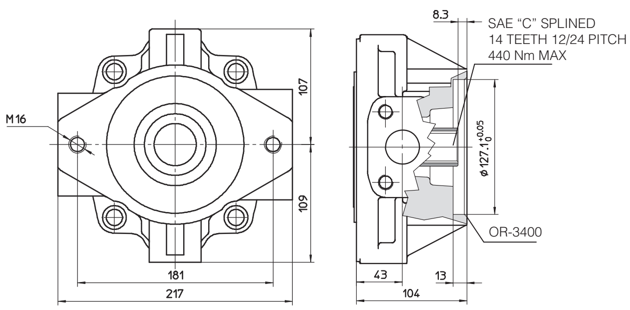
INTERMEDIATE FLANGE SAE "A" FOR PFEA-31



INTERMEDIATE FLANGE SAE "B" FOR PFEA-41



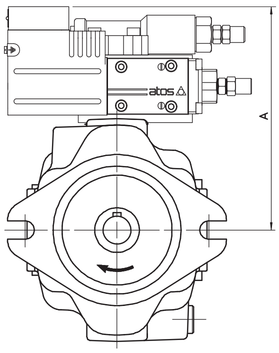
INTERMEDIATE FLANGE SAE "C" FOR PFEA-51



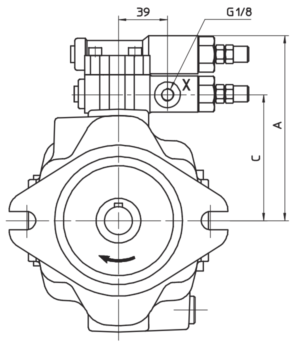
Drawing show pumps with clockwise rotation (option D): pumps with counterclockwise rotation (option S) will have inlet and outlet ports inverted

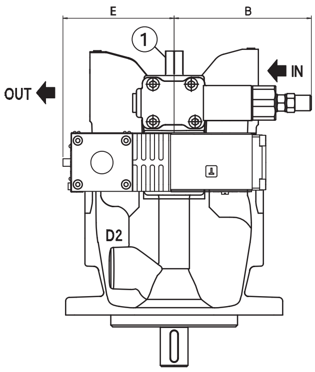
13 DIMENSIONS OF PVPCA: OTHER CONTROLS

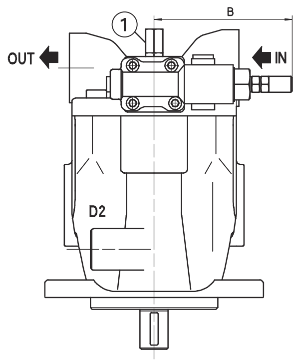
VERSION CH



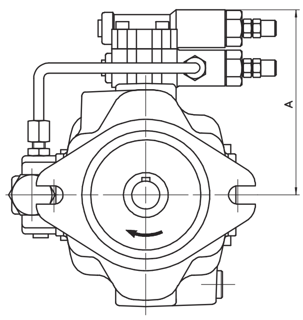
VERSIONS L, R



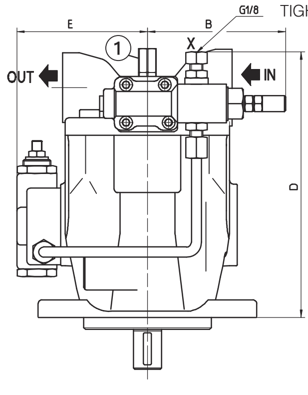




VERSION LW



TIGHTENING TORQUE = 15 Nm max



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)
PVPCA-*-3029	**CH**	144	111	-	-	92	22
	L -R	144	111	100	-	-	19,2
	LW	144	111	-	211	104	20
PVPCA-*-4046	**CH**	153	111	-	-	92	28
	L -R	153	111	109	-	-	25,2
	LW	153	111	-	235	111	26
PVPCA-*-5073 PVPCA-*-5090	**CH**	166	111	-	-	92	36,9
	L -R	166	111	122	-	-	34,2
	LW	166	111	-	258	120	35

14 RELATED DOCUMENTATION

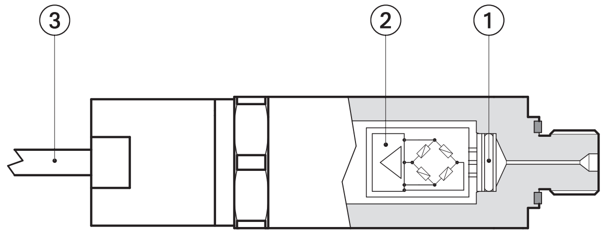
X010	Basics for electrohydraulics in hazardous environments
X020	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO
AX900	Operating and maintenance information for ex-proof pumps

5 ACCESSORIES

INDEX
ACCESSORIES

Ex-proof pressure transducers type E-ATRA-7

analog, for open and closed loop systems - **ATEX** and **IECEx**



E-ATRA-7 / 400 / I

Ex-proof E-ATRA-7 are pressure transducers used to measure the static and dynamic pressure.

The sensor is composed by a thin-film circuit a, with high resistance to overloads and pressure peaks.

The integrated electronic circuit b supplies an amplified voltage or current output signal, proportional to the hydraulic pressure, with thermal drift compensation.

The transducer housing and electronics housing are designed to contain the possible explosion which could be caused by the presence of the gas mixture inside the housing, thus avoiding dangerous propagation in the external environment.

E-ATRA-7 equip ex-proof proportional pressure control valves, RES execution.

They are also used in association with directional proportionals with option SP, SF to perform closed loop pressure controls:

Features:
- Factory preset and calibrated
- 5 m cable connection c
- 1/4" GAS - DIN 3852 hydraulic connection (pressure port orifice Ø 0,6 mm)
- IP67 protection degree
- CE mark according to EMC directive

1 MODEL CODE

E-ATRA-7	/	400	/	I	*

Pressure transducer amplified type for ex-proof applications

Pressure measuring range:
60 = 0 ÷ 60 bar
160 = 0 ÷ 160 bar
250 = 0 ÷ 250 bar
400 = 0 ÷ 400 bar

I = current output signal 4 ÷ 20 mA **(1)**

Series number

(1) Available only with current output signal 4 ÷ 20 mA

2 EXPLOSION PROOF CERTIFICATION MAIN DATA

ATEX certification **IECEx certification**	**II 2G Ex db IIC T6...T1 Gb** **Ex db IIC T6...T1 Gb**		
Temperature class (only for Group II)	**T6**	**T5**	**T4**
Surface temperature	≤ 85 °C	≤ 100 °C	≤ 135 °C
Ambient temperature	-40 ÷ +60 °C	-40 ÷ +75 °C	-40 ÷ +102 °C
Mechanical construction	Flame proof housing classified Ex d, according to EN 60079-0: EN 60079-1		
Electrical connection	Type: 5 m cable 2 wires + shield		
Special features	Available on request with FM, CSA, EAC, INMETRO and KAZINMETR certification For further details, please contact Atos technical department		

3 MAIN CHARACTERISTICS OF EX-PROOF PRESSURE TRANSDUCER

Pressure measuring range	0 ÷ 60/160/250/400 bar; other values availables 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	≤ 1 ms
Temperature compensated	0 ÷ +80 °C
Thermal drift	@ zero: ≤ ±0,025 % FS/°C max; @ FS: ≤ ±0,025 % FS/°C max
Accuracy	≤ ±0,5 % FS
Non-Linearity	≤ ±0,2 % of FS (BFSL) as per IEC 61298-2
Fluid Compatibility	Hydraulic oil as per DIN51524...535 for other fluid please contact Atos technical department
Power supply	24 VDC nominal; maximum range 10 ÷ 30 V_{DC}
Output signal	Current output signal 4 ÷ 20 mA (2 wire); for max load see section 5
Wiring protections	Against reverse polarity on power supply and short-circuit on output signal
Materials	Wetted parts: stainless steel and Elgiloy®; seals: FPM
Mass	Approx. 240 g
Electromagnetic compatibility (EMC)	EN 61326 emission (group 1, class B) and immunity (industrial application)
Vibration resistance	20 g according to DIN EN 60068-2-6
Shock resistance	1000 g according to DIN EN 60068-2-27
Protection class	IP67

Notes: FS = Full Scale; **BFSL** = Best Fit Straight Line

4 INSTALLATION AND COMMISSIONING

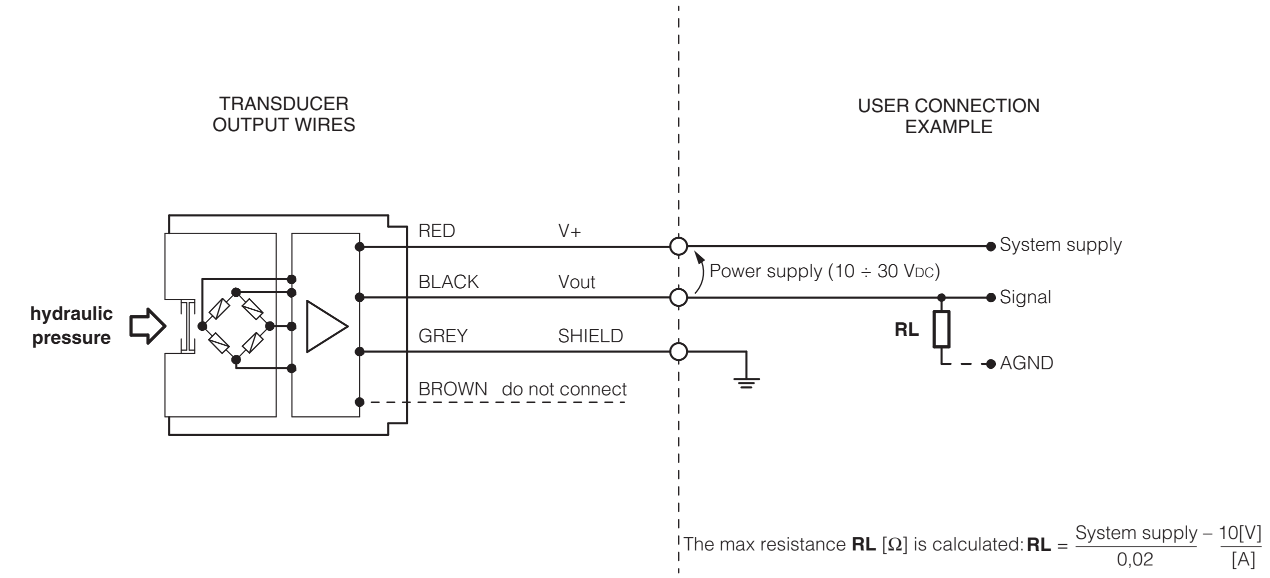
4.1 Warning

E-ATRA-7 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.

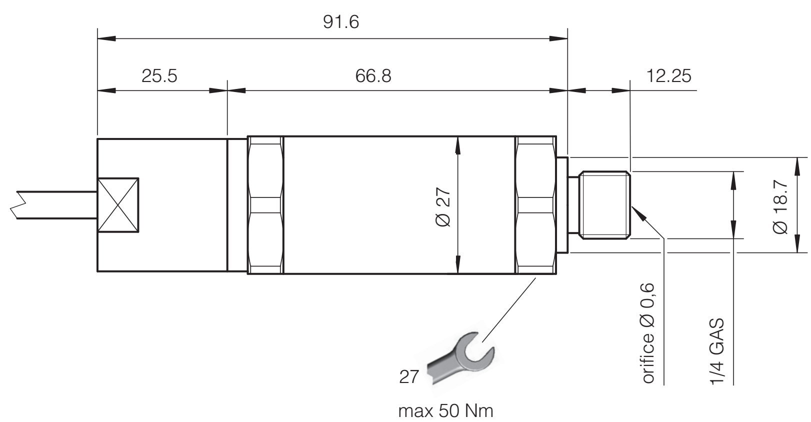
4.2 Commissioning

Install the transducer in the hydraulic circuit.
Switch-off the power supply before connecting and disconnecting the transducer cable as shown in scheme 5 .

5 ELECTRONIC CONNECTIONS



6 OVERALL DIMENSIONS [mm]



Mounting subplates type BA

single, for ISO valves size 06 to 32

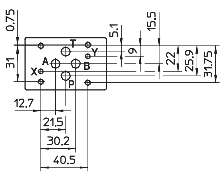
BA-* are single subplates with ISO mounting surface for installation of Atos valves and they are provided with threaded ports for connectios to pressure, tank and users lines. They are characterized by low pressure drops and they are specific for directional, flow and pressure control valves ISO size 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 the technical table of the valves to be assembled
Ambient temperature	From -20°C to +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
Fluid contamination class	See the technical table of the valves to be assembled
Fluid temperature	See the technical table of the valves to be assembled

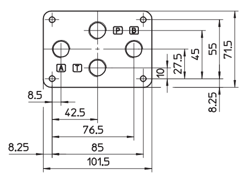
2 SINGLE STATION SUBPLATES FOR VALVES SIZE 06

ISO 4401:2005
Mounting surface: 4401-03-03-0-05

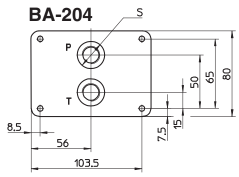


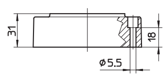
Matching valves	Set of screw (to be ordered separately)
DH-00	SET SC-DHZ
DH-01	SET SC-DHZ
DH-02	SET SC-DHZ
DH-04	SET SC-DHZ
DH-05	SET SC-DHZ
DH-08	SET SC-DHZ
DH-09	SET SC-DHZ
DHI, DHE	SET SC-DHZ
DHA, DHW	SET SC-DHZ
DHQ	SET SC-DHZ
DLEH, DLEHM	SET SC-DHZ
DLAH, DLAHM	SET SC-DHZ
DLWH	SET SC-DHZ
QV-06	SET SC-QV
RZMO, RZMA	SET SC-DHZ
RZGO, RZGA	SET SC-DHZ
DHZO, DHZA	SET SC-DHZ
DLHZO, DLHZA	SET SC-DHZ
QVHZO-*-06	SET SC-DHZ
QVHZA	SET SC-DHZ

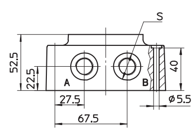
BA-202



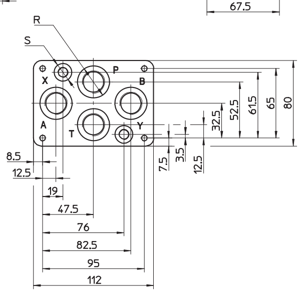
BA-204

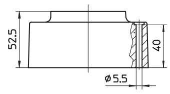






BA-302/Y





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.

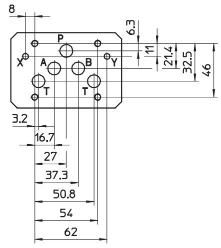
BA-*/N**: versions identical to the corresponding basic versions, but supplied without fixing bolts for type QVZO-*-06 valves (already equipped with fixing bolts).

X and Y ports are only present in the /Y versions.

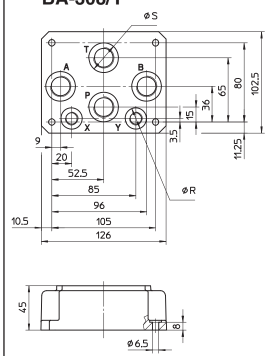
Code	Ports (GAS) A,B,P,T	Ports (GAS) (X-Y)	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-202	3/8"	–	–	–	1,2
BA-204	3/8"	–	25,5	16,5	1,8
BA-302 (/Y)	1/2"	(1/8")	30	16,5	1,8

3 SINGLE STATION SUBPLATES FOR VALVES SIZE 10

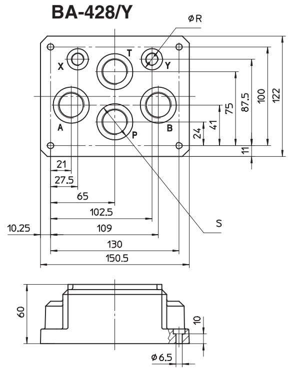
ISO 4401:2005
Mounting surface: 4401-05-05-0-05



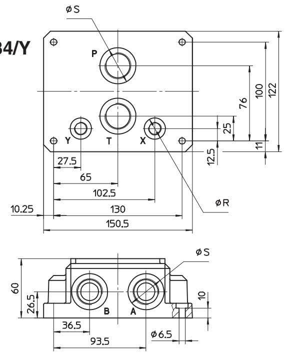
BA-308/Y



BA-428/Y



BA-434/Y



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

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.

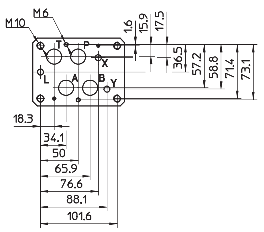
BA-*/Y**: versions dimensionally analogous to the corresponding basic versions with the addition of X and Y ports (1/4") on the base (see figure on the left).
The /Y versions are always used for valves type DKZOR, DLKZO, when drainage from port Y is required.

X and Y ports are only present in the /Y versions.

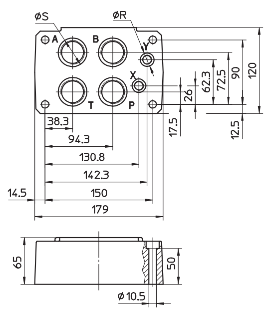
Code	Ports (GAS) A,B,P,T	Ports (GAS) (X-Y)	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA- 308 (/Y)	1/2"	(1/4")	30	21,5	2,5
BA- 428 (/Y)	3/4"	(1/4")	36,5	21,5	5,5
BA- 434 (/Y)	3/4"	(1/4")	36,5	21,5	8,5

4 SINGLE STATION SUBPLATES FOR VALVES SIZE 16

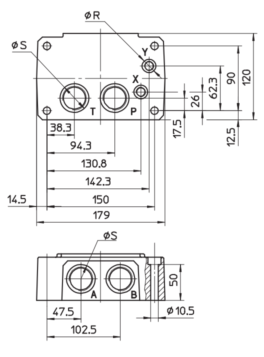
ISO 4401:2005
Mounting surface: 4401-07-07-0-05



BA-518



BA-519



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

VERSIONS

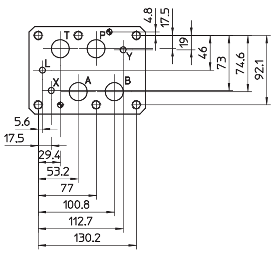
BA-518: basic version with ports P, A, B, T (1") and X, Y (1/4") on the base.

BA-519: basic version with ports P, T (1") and X, Y (1/4") on the base; ports A, B (1") on the side.

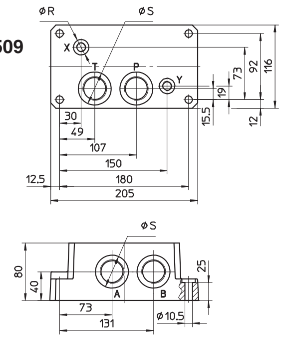
Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-518	1"	1/4"	46	21,5	8
BA-519	1"	1/4"	46	21,5	8

5 SINGLE STATION SUBPLATES FOR VALVES SIZE 25

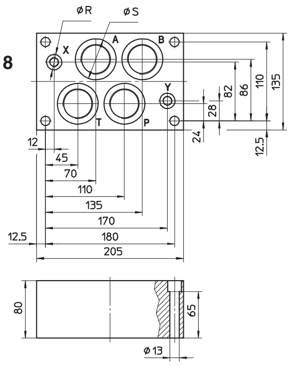
ISO 4401:2005
Mounting surface: 4401-08-08-0-05



BA-509



BA-618



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

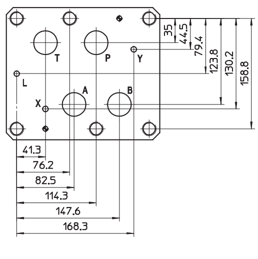
BA-509: basic version with ports P, T (1") and X, Y (1/4") on the base, ports A, B (1") on the side.

BA-618: basic version with ports P, A, B, T (1 1/4") and X, Y (1/4") on the base.

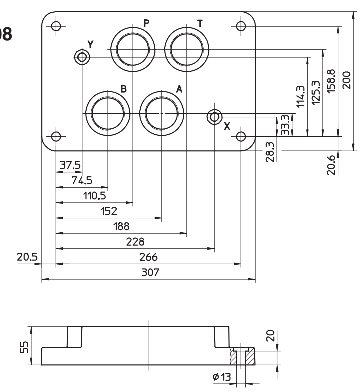
Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
BA-509	1"	1/4"	46	21,5	12,5
BA-618	1 1/4"	1/4"	57	21,5	13,5

6 SINGLE STATION SUBPLATES FOR VALVES SIZE 32

ISO 4401:2005
Mounting surface: 4401-10-09-0-05



BA-708



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

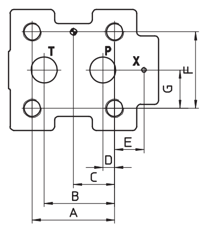
VERSIONS

BA-708: basic version with ports P, A, B, T
(1 1/2") and X, Y (1/4") on the base.

Code	Ports (GAS) A,B,P,T	Ports (GAS) X-Y	Ø Counterbore S [mm]	Ø Counterbore R [mm]	Mass [Kg]
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



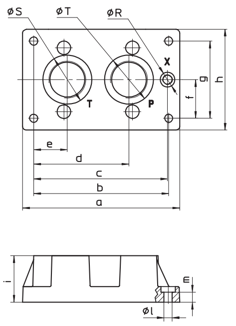
Matching valves	**Set of screw** to be ordered separately
AGAM-10	SET SC-AGA-10
AGMZO-10	SET SC-AGA-10
AGMZA-10	SET SC-AGA-10
AGAM-20	SET SC-AGA-20
AGMZO-20	SET SC-AGA-20
AGMZA-20	SET SC-AGA-20
AGAM-32	SET SC-AGA-32
AGMZO-32	SET SC-AGA-32
AGMZA-32	SET SC-AGA-32

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

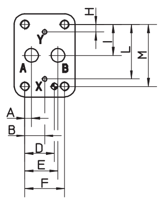
Code	a	b	c	d	e	f	g	h	i	l	m	Ø Blade S	Ø Blade R	Ø Blade T
BA - 306	130	104	97	64,5	19,5	27	54	80	40	8,4	15	36,5	21,5	30
BA - 506	180	150	133,25	92,25	37,25	37,5	75	105	50	10,5	13	46	21,5	46
BA - 706	204	175	173,5	123,5	43,5	50	100	130,5	60	10,5	13	63,5	21,5	63,5

VERSIONS

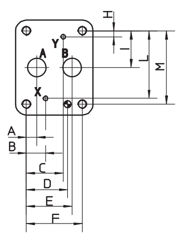
BA-306, BA-506, BA-706: basic version, see figure on left and dimensional tables.

Code	size	Ports (GAS) P	T	X	Mass [Kg]
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

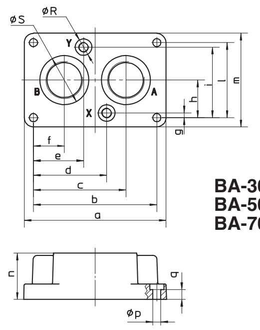
Mounting surface
ISO 5781: 2000



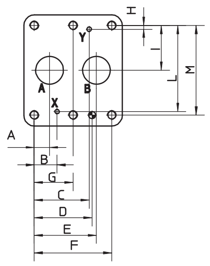
Mounting surface
ISO 5781-06-07-0-00
matching valves:
AGI*-10
AGRL-10
AGRLE-10
AGRZO-*-10



Mounting surface
ISO 5781-08-10-0-00
matching valves:
AGI*-20
AGRL-20
AGRLE-20
AGRZO-*-20



BA-305
BA-505
BA-705



Mounting surface
ISO 5781-10-13-0-00
matching valves:
AGI*-32
AGRL-32
AGRLE-32

VERSIONS

BA-305, BA-506 and **BA-705**:see figure on left and dimensional tables.

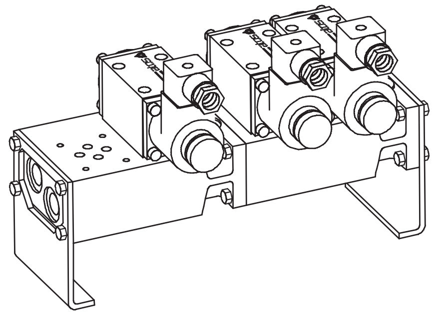
Matching valves	**Set of screw** to be ordered separately
AGI*-10(20)	SET SC-AGI
AGRL(E)-10(20)	SET SC-AGI
AGRCZO-10(20)	SET SC-AGI
AGRCZA-10(20)	SET SC-AGI
AGI*-32	SET SC-AGI-32
AGRL(E)-32	SET SC-AGRL-32

Code	a	b	c	d	e	f	g	h	i	l	m	n	p	q	Ø Blade S	Ø Blade 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

Code	size	Ports (GAS) A	B	X-Y	Mass [Kg]
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



example of **BA-244/2 + BA-244/2** modular assembling

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 **multistaion subplates** with 1 to 10 stations for valves ISO size 06.

BA-314 are **multistaion 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

Number of stations (see section 4 5 6):
1 = one station
2 = two stations
3 = three stations
4 = four stations
5 = five stations
6 = six stations
7 = seven stations (only for BA-214)
8 = eight stations (only for BA-214)
9 = nine stations (only for BA-214)
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**)

Series number

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
2 = two stations
3 = three stations
4 = four stations

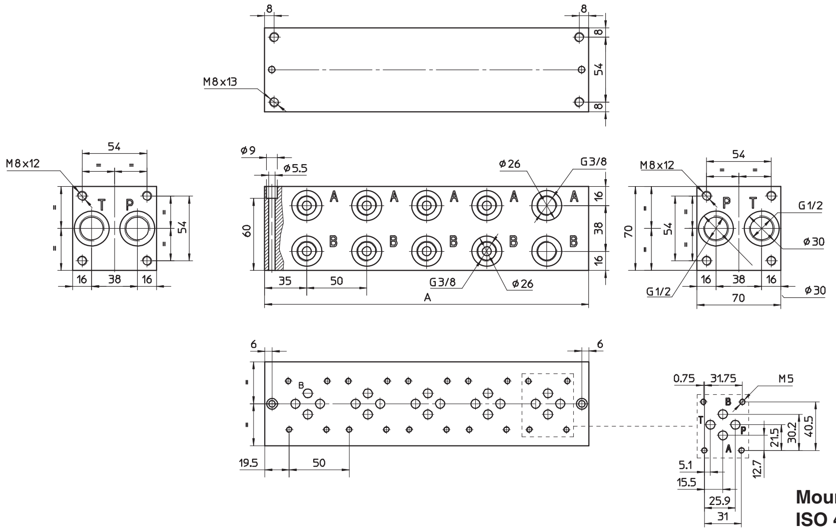
Series number

3 TECHNICAL CHARACTERISTICS

Installation positions	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 the technical table of the valves to be assembled
Ambient temperature	From -20°C to +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
Fluid contamination class	See the technical table of the valves to be assembled
Fluid temperature	See the technical table of the valves to be assembled

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



Mounting surface
ISO 4401-03-02-0-05

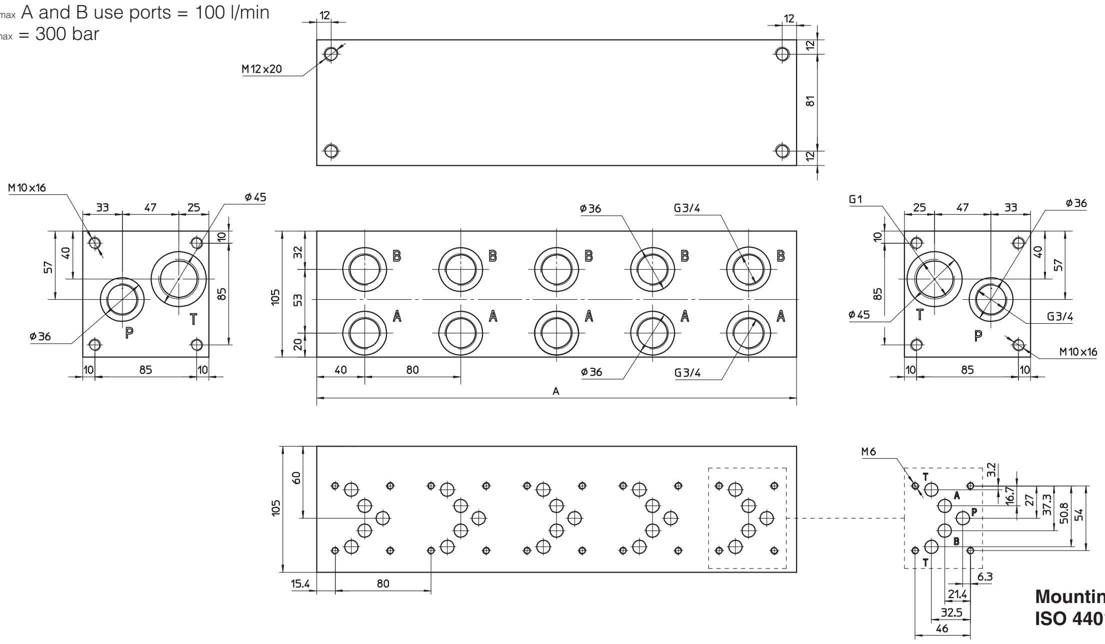
The lenght of the subplate depends to the number of stations as shown in the table below

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



Mounting surface
ISO 4401-05-04-0-05

The lenght of the subplate depends to the number of stations as shown in the table below

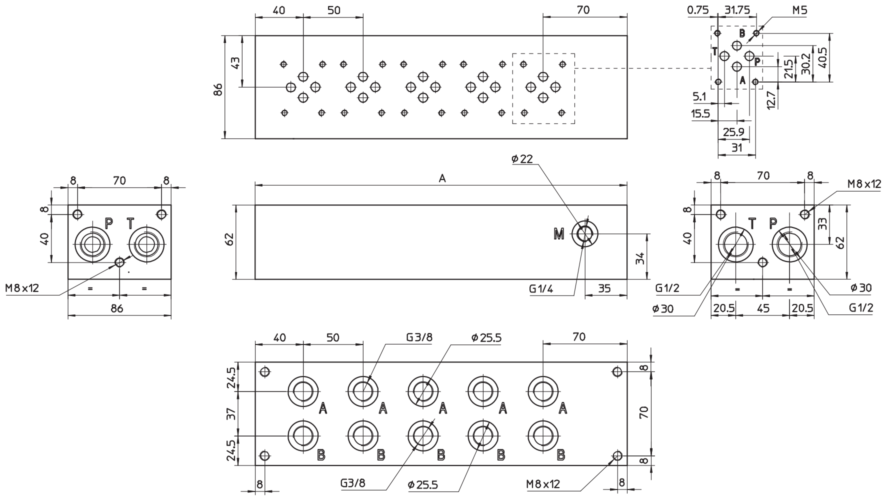
Stations	1	2	3	4	5	6
Dimension A	80	160	240	320	400	480
Mass [Kg]	4	8,5	13	17,5	22	26,5

The 5-station version is shown in the drawing

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/P [mm]

Ports P and T = G 1/2”
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

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

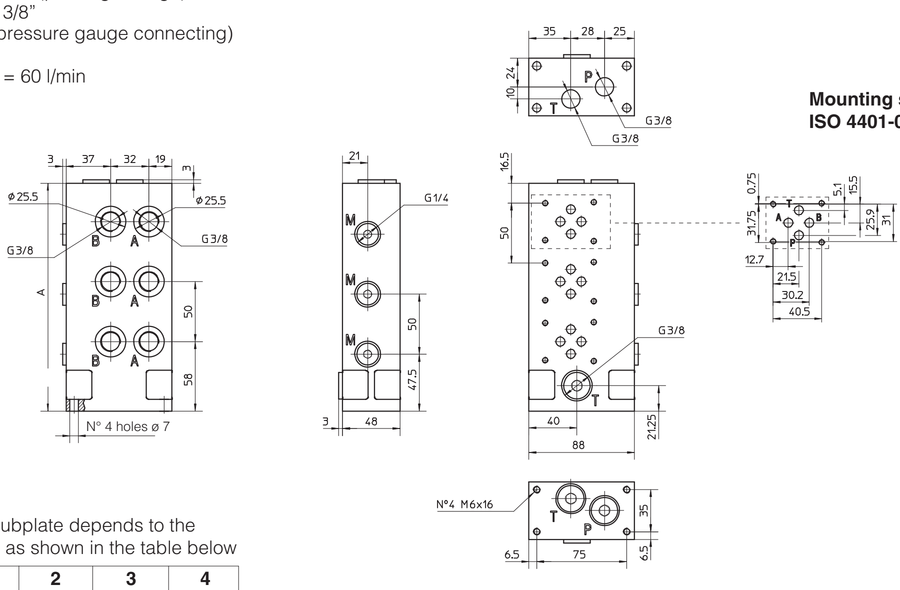
Stations	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Dimension A	160	210	260	310	360	410	460	510	560
Mass [Kg]	5,4	7	8,7	10,4	12,1	13,8	15,5	17,2	18,9

The 5-station version is shown in the drawing

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-244 [mm]

Ports P and T = G 3/8” (passing through)
Ports A and B = G 3/8”
Ports M = G 1/4” (pressure gauge connecting)
Q_{max} = 35 l/min
Q_{max} A and B ports = 60 l/min
P_{max} = 250 bar

Mounting surface
ISO 4401-03-02-0-05



The lenght of the subplate depends to the number of stations as shown in the table below

Stations	**1**	**2**	**3**	**4**
Dimension A	90	140	190	240
Mass [Kg]	2,5	3,5	5,2	7

The 3-station version is shown in the drawing

Fastening bolts: 4 exagonal head screws M6x20 class 12.9 included in the supply
Tightening torque = 15 Nm
Seals: 2 OR-3081 included in the supply

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; Pmax = 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 *

Type of subplate:
BA-214 = for valves ISO size 06
On request, available with rear ports A and B

Number of stations:

- **1** = one station
- **2** = two stations
- **3** = three stations
- **4** = four stations
- **5** = five stations
- **6** = six stations
- **7** = seven stations
- **8** = eight stations
- **9** = nine stations
- **10** = ten stations

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

Pressure range of pressure relief valve, for versions /M and /MH:
100 = 100 bar
210 = 210 bar
250 = 250 bar

AL = in aluminium
On request, available with anodizing

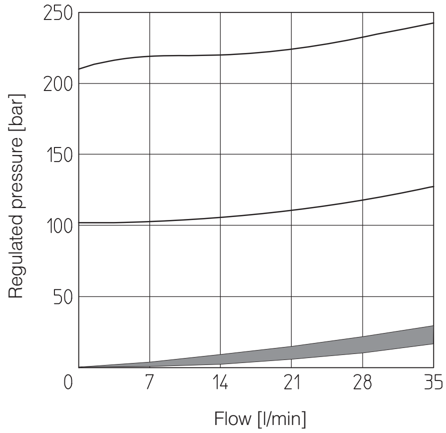
Series number

2 TECHNICAL CHARACTERISTICS

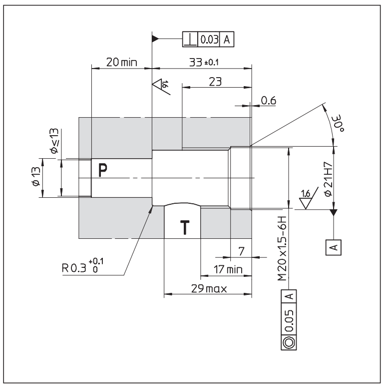
Installation position	Horizontal or vertical position
Ambient temperature	From - 20°C to + 70°C
Fluid	Hydraulic oil as per DIN 51524 ... 535, for other fluids contact our technical office
Recommended viscosity	15 ÷ 100 mm 2 /s at 40°C (ISO VG 15 ÷ 100)
Fluid contamination class	ISO 19/16 achieved with in line filters at 25µm and $ß_{25}$ 75 (recommended only for versions /M and /MH)
Fluid temperature	-20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals)

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	

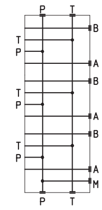


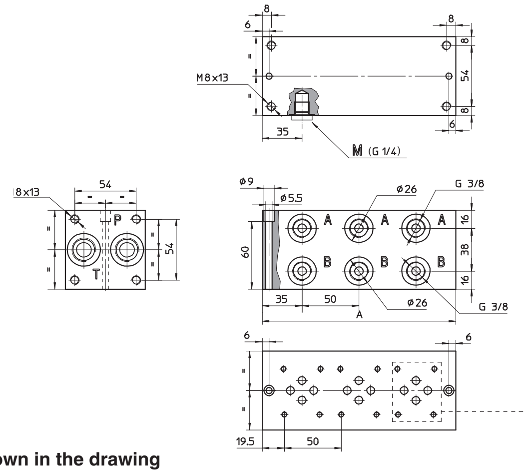
4 INSTALLATION DIMENSIONS OF CART M-5/***

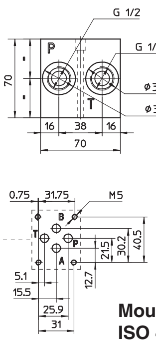


5 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*-AL [mm]

Hydraulic scheme







Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 80 l/min
Q_{max} use ports = 60 l/min
P_{max} = 210 bar

Mounting surface ISO 4401-03-02-0-05

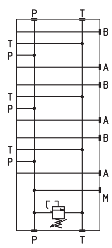
The 3-stations subplate is shown in the drawing

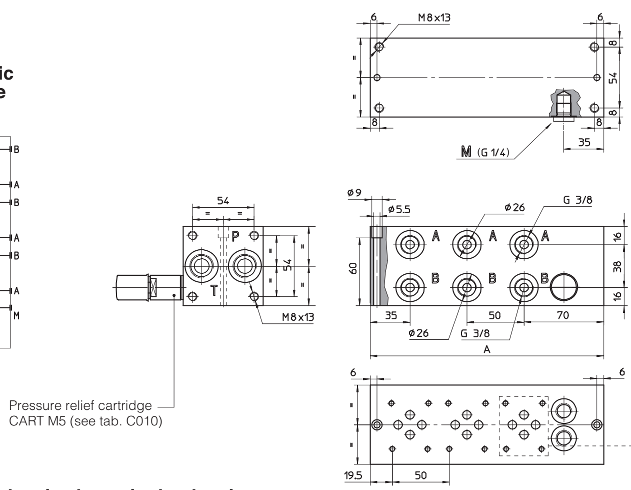
The lenght of the subplate varies with the number of stations as shown in the table below

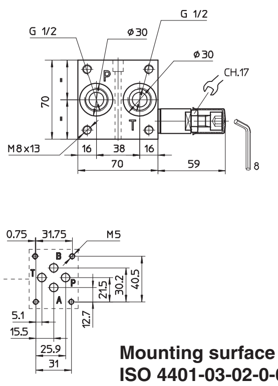
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	70	120	170	220	270	320	370	420	470	520
Mass [Kg]	1	1,4	2	2,6	3,2	3,8	4,4	5	5,6	6,2

6 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/M/*-AL [mm]

Hydraulic scheme







Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

Mounting surface ISO 4401-03-02-0-05

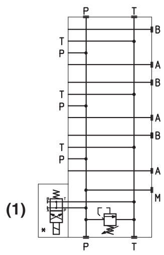
The 3-stations subplate is shown in the drawing

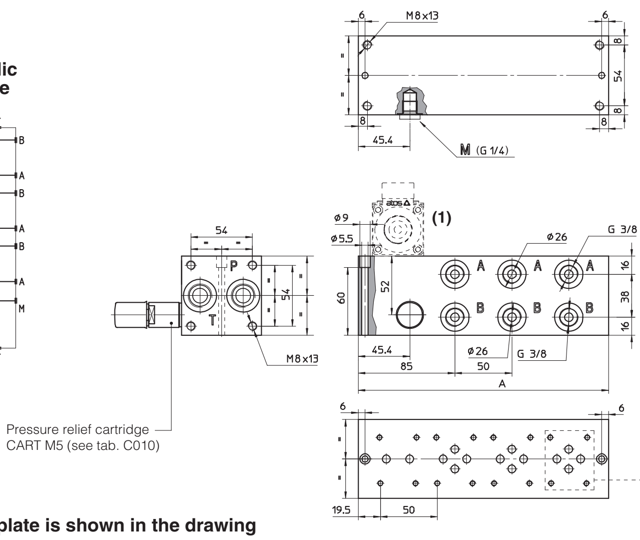
The lenght of the subplate varies with the number of stations as shown in the table below

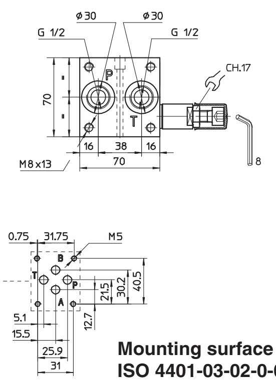
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	105	155	205	255	305	355	405	455	505	555
Mass [Kg]	1,1	1,5	2,1	2,7	3,3	3,9	4,5	5,1	5,7	6,3

7 OVERALL DIMENSIONS OF SUBPLATES TYPE BA-214/*/MH/*-AL [mm]

Hydraulic scheme







Ports P and T = G 1/2
Use ports A and B = G 3/8
Pressure gauge port M = G1/4 (plugged)
Q_{max} = 35 l/min
Q_{max} use ports = 35 l/min
P_{max} = 210 bar

Mounting surface ISO 4401-03-02-0-05

The 3-stations subplate is shown in the drawing

The lenght of the subplate varies with the number of stations as shown in the table below

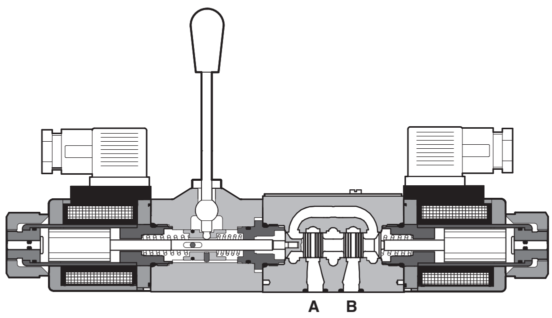
Stations	1	2	3	4	5	6	7	8	9	10
Dimension A	120	170	220	270	320	370	420	470	520	570
Mass [Kg]	1,2	1,6	2,2	2,8	3,4	4	4,6	5,2	5,8	6,4

(1) The venting directional valve in the dashing line must be ordered separately

Table **E138-7/E**

Auxiliary hand levers for solenoid valves

direct operated on-off and proportional, ISO 4401 size 06



DHE-0711/MV

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

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

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

Voltage code: see relevant tech. table

Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

(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

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**

Spool size (for DHZ*): **S3 - S5 - D3 - D5 - L3 - L5**
Max regulated flow (for QVHZO): **3-12-18-36-45** l/min

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)

Coil option: see relevant tech. table

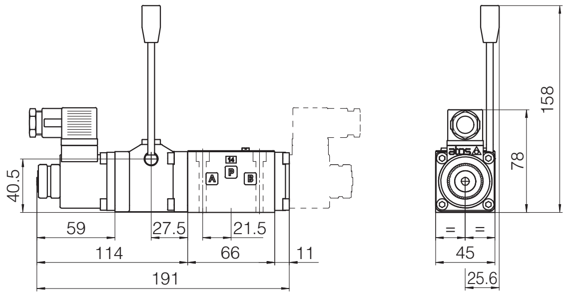
Series number

Seals material:
- = NBR
PE = FKM
BT = HNBR

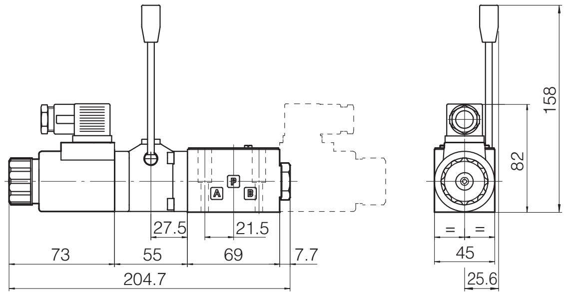
3 LEVER CHARACTERISTICS

Total angle stroke	[°deg]	± 28°	Lever actuating force	[N]	1 ÷ 8
Working angle stroke	[°deg]	± 15°	Lever device weight	[g]	880

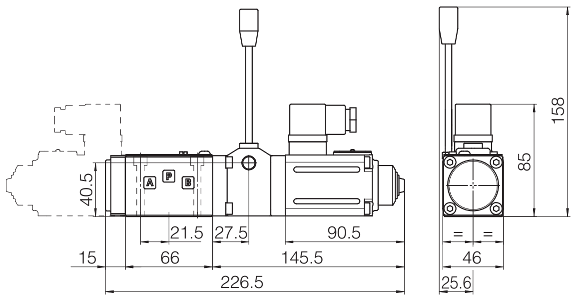
4 INSTALLATION DIMENSIONS [mm]



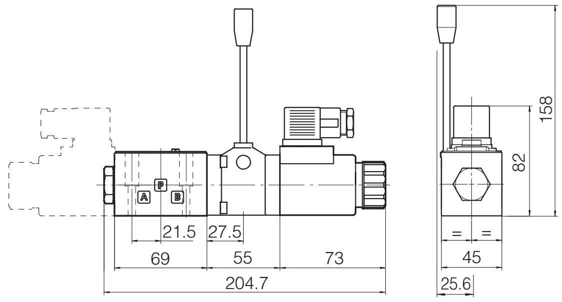
DHI-06*/MV Mass: 2,4 kg (single solenoid)
DHI-07*/MV (dotted line) Mass: 2,7 kg (double solenoid)



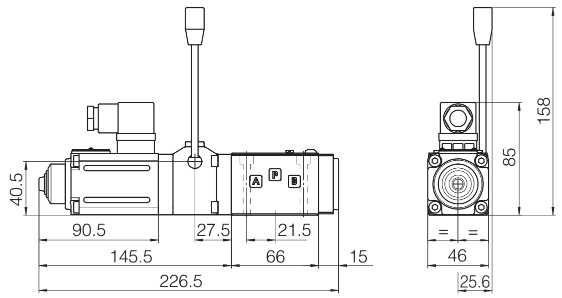
DHE-06*/MV Mass: 2,7 kg (single solenoid)
DHE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



DHZO-A-05*/MV Mass: 2,8 kg (single solenoid)
DHZO-A-07*/MV (dotted line) Mass: 3,5 kg (double solenoid)

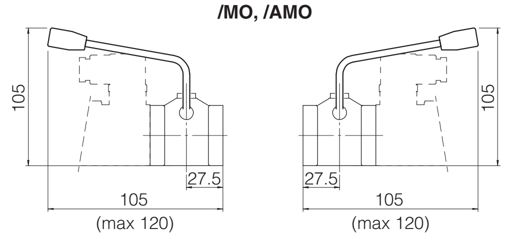


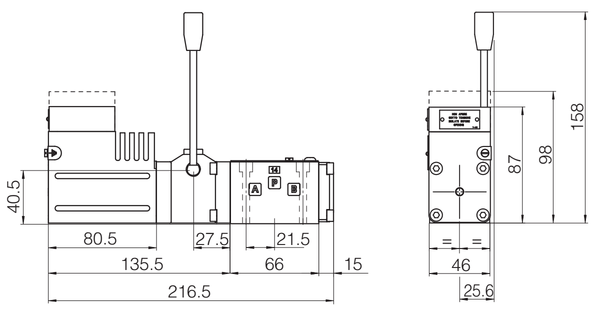
DHZE-05*/MV Mass: 2,7 kg (single solenoid)
DHZE-07*/MV (dotted line) Mass: 3,0 kg (double solenoid)



QVHZO-A-06*/MV Mass: 3,2 kg

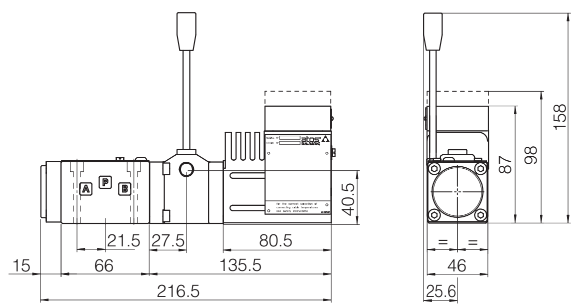
Horizontal hand lever device
/MO, /AMO





DHA/*-06*/MV Mass: 3,4 kg
DHA/UL-*-06*/MV (dotted line)

Note: see tech. table FX010 for DHA/MV models



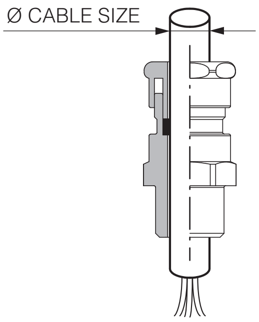
DHZA/*-06*/MV Mass: 3,4 kg
DHZA/UL-*-06*/MV (dotted line)

Note: see tech. table FX100 for DHZA/MV models

Cable glands and plugs for ex-proof valves

Multicertified ATEX, IECEx, EAC

1 MULTICERTIFIED CABLE GLAND FOR NON-ARMOURED CABLES - Group II (surface plants)

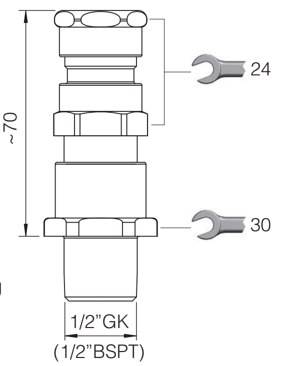
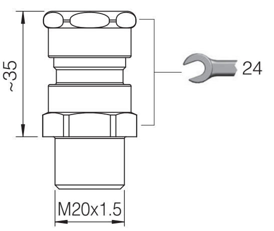
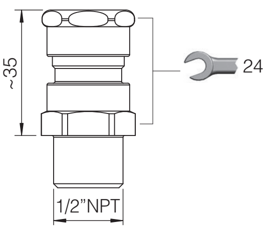
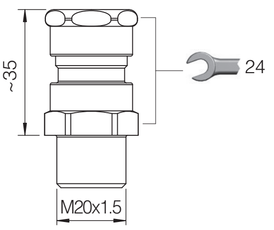


Cable glands for use with non-armoured plastic insulated cables
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb** and Dust **Extb IIIC Db II 2 GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN60079-1, IEC/EN 60079-7 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01
Operating Temperature Range: -60 °C to +100 °C

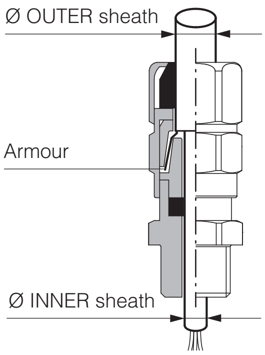
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the "safety instructions" delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-421 **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2" ISO/UNI-6125 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "GK" threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "M" threaded connection (solenoid, LVDT transducer and on-board driver)
PAMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2" NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** 6,5 to 11,9 mm	On-off and proportional ex-proof valves with "NPT" threaded connection (solenoid and LVDT transducer)
PAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** 6,5 to 11,9 mm	On-off ex-proof stainless steel valves type "X" and "XS"

2 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group II (surface plants)

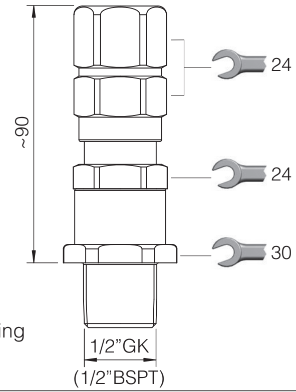
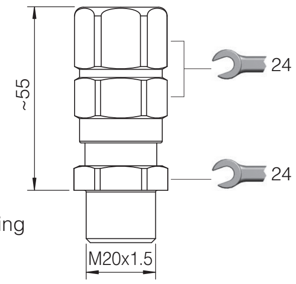
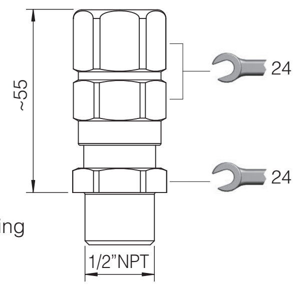
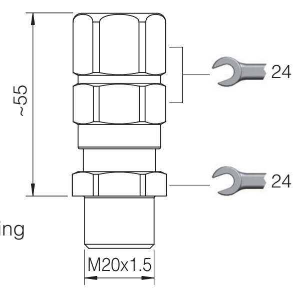


Cable glands for use with single wire armour ‘W’, wire braid ‘X’, steel tape armour ‘Z’, plastic insulated cables.
Flameproof **Exd IIC Gb**, Increased Safety **Exe IIC Gb**, Dust **Extb IIIC Db** and **ExnR IIC Gc II 2 / 3GD**, suitable for use in Zone 1, Zone 2, Zone 21, Zone 22.
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1, IEC/EN 60079-7, IEC/EN 60079-15 and IEC/EN 60079-31.
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529 and NEMA 4X
Deluge Protection to DTS01.
Operating Temperature Range: -60 °C to +80 °C

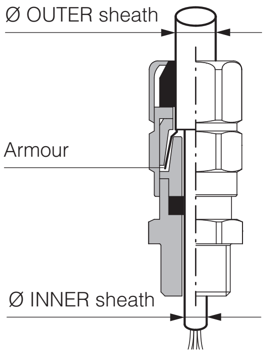
Seal on the cable inner sheath
Outer deluge seal to prevent moisture ingress to the cable armour / braid
Cable retention, low smoke
Material: Nickel Plated Brass or AISI 316
Cable glands are marked ATEX, IECEx and EAC

The electric cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 06 ATEX0056X - IECEx BAS 06.0013X Item type: 501-453RAC	**Material:** Nickel plated brass **Threaded connection:** GK-1/2” ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “GK” threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMC/M  Tightening torque: **20 Nm**	**ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “M” threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMC/NPT  Tightening torque: **20 Nm**	**EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** 1/2” NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “NPT” threaded connection (solenoid and LVDT transducer)
PAAXMC/M  Tightening torque: **20 Nm**		**Material:** Stainless steel AISI 316 **Threaded connection:** M20x1,5 UNI-4535 (6H/6g) **Cable size:** INNER sheath size 3,2 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off ex-proof stainless steel valves type “X” and “XS”

3 MULTICERTIFIED CABLE GLAND FOR ARMOURED CABLES - Group I (Mining)

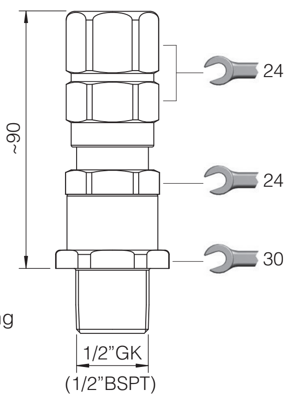
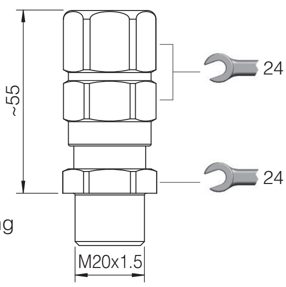
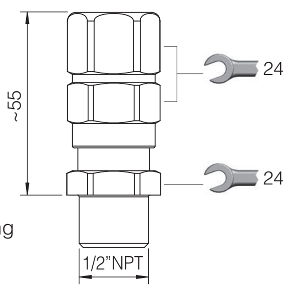


Cable glands for use with single wire armour ‘W’, wire braid ‘X’, steel tape armour ‘Z’, plastic insulated cables.
Flameproof **Exd I M2** and Increased Safety **Exe I M2**, suitable for use in Mines
Construction and Test Standards: IEC/EN 60079-0, IEC/EN 60079-1 and IEC/EN 60079-7
Ingress Protection: IP66, IP67 and IP 68 (30 meters for 7 days) to IEC/EN 60529
Operating Temperature Range: -60 °C to +80 °C

Seal on the cables inner sheath
Cable retention, low smoke
Material: Nickel Plated Brass
Cable glands are marked ATEX, IECEx and EAC

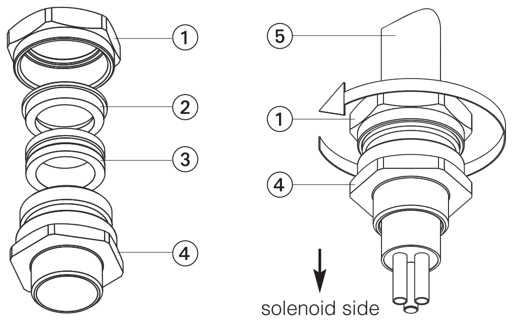
The electric cable must be suitable for the working temperature as specified in the “safety instructions” delivered with the first supply of Atos ex-proof valves.

See section 4 for cable gland assembly.

CABLE GLAND CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
PAAMMC/GK  Tightening torque: **20 Nm**	Referred to certificates: - Baseefa 08 ATEX0331X - IECEx BAS 08.0112X Item type: 453RAC **ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** GK-1/2” ISO/UNI-6125 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “GK” threaded connection (solenoid and LVDT transducer) **Approved only for the Italian market**
PAAMMC/M  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535 **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “M” threaded connection (solenoid, LVDT transducer and on-board driver)
PAAMMC/NPT  Tightening torque: **20 Nm**		**Material:** Nickel plated brass **Threaded connection:** 1/2” NPT ANSI/ASME B1.20.1 (tapered) **Cable size:** INNER sheath size 3 to 8 mm OUTER sheath size 5,5 to 12 mm	On-off and proportional ex-proof valves with “NPT” threaded connection (solenoid and LVDT transducer)

4 CABLE GLAND ASSEMBLY

Cable glands PAMC/* and PAXMC/M for non-armoured cables



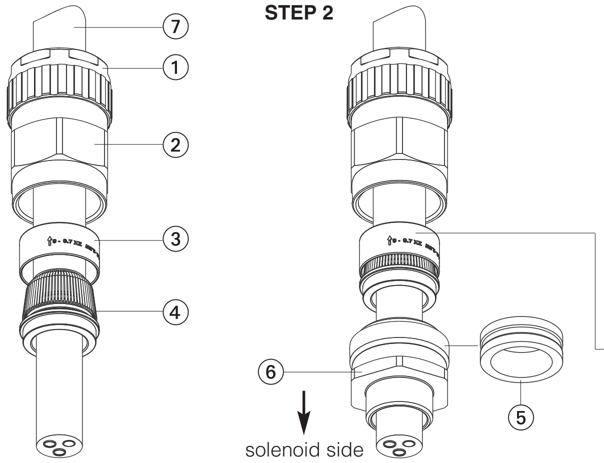
Assembling procedure

Unscrew the Back-nut ① from Entry ④
Push the electric cable ⑤ though the cable gland
Connect the cable wires to the solenoid terminal board
Screw-in the Entry ④ into the solenoid cable entrance lock it at relevant tightening torque specified in section 1
Lock the Back-nut ① using a wrench until a resistance is felt between internal seal ③ and the cable
Turn the Back-nut ① through a further half turn to ensure the complete inner sealing

① Back-nut
② Compression Spigot
③ Seal
④ Entry
⑤ Electric cable (non-armoured)

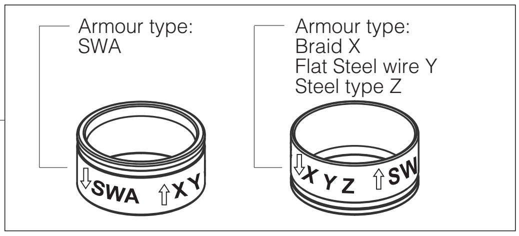
Cable glands PAAMC/*, PAAXMC/M and PAAMMC/* for armoured cables

STEP 1 **STEP 2**



① Back-nut
② Middle-nut
③ Reversible Armour Clamping Ring (RAC)
④ Armour Spigot
⑤ Inner Seal
⑥ Entry (with captive deluge seal), if required
⑦ Electric cable (armour type SWA, Braid X, Flat Steel wire Y, Steel type Z)

Reversible Armour Clamping ring (RAC) orientation



Note: the arrow corresponding to the correct armour type (SWA or X, Y, Z) must be orinted towards the ex-proof solenoid

Assembling procedure

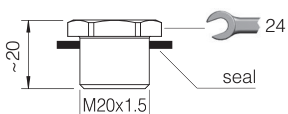
STEP 1

Unscrew Back-nut ① from Middle-nut ② and Entry ⑥ , push the cable through the Armour Spigot ④
Spread the armour over the Armour spigot ④ until the end of the armour is up against the shoulder of the armour cone
Position the Armour clamping ring ③ paying attention to its correct orientation depending to the armour type (see above)
Remove the Inner seal ⑤ from the Entry ⑥ , place the Entry ⑥ over the Armour Spigot ④
Move the sub-assembly ① + ② to meet the Entry ⑥ , connect the cable wires to the solenoid terminal board
Screw-in the Entry ⑥ into the solenoid cable entrance and lock it at relevant tightening torque specified in section 2 and 3
Hand tighten the Middle-nut ② to the Entry ⑥ and turn a further half turn with a wrench
Unscrew the Middle-nut ② and visually inspect that the armour has been successfully clamped between the armour spigot ④ and the armour clamping ring ③. If the armour is not correctly clamped, repeat the assembly

STEP 2

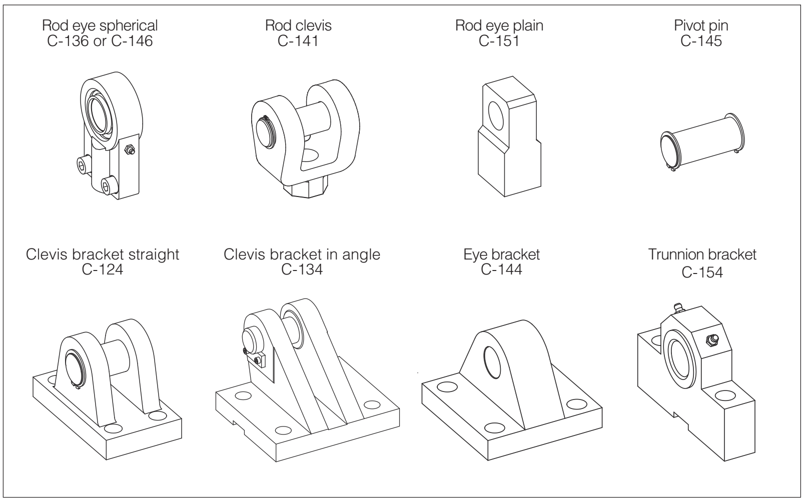
Re-assemble Middle-nut ② onto the components ③ + ④ + ⑤ + ⑥ paying attention to the correct orientation of the reversible armour Clamping ring ③ , tighten up the Middle-nut ② by hand first and then using a wrench a further 1 to 2 turns until fully tight
Hand tighten the Back-nut ① then tighten a further full turn using a wrench
Ensure that the Middle-nut ② does not rotate when tightening the Back-nut ①
Ensure that the deluge seal is compressed into correct position

5 THREADED PLUG

THREADED PLUG CODE AND DIMENSIONS	MULTICERTIFICATION	CHARACTERISTICS	VALVE TYPE
ZMX-T  Tightening torque: **20 Nm**	**ATEX:** EN 60079-0, EN 60079-1, EN 60079-7 and EN 60079-31 **IECEx:** IEC 60079-0, IEC 60079-1, IEC 60079-7 and IEC 60079-31 **EAC:** EN60079-0 and EN60079-1	**Material:** Nickel plated brass **Threaded connection:** M20x1,5 UNI-4535	Proportional ex-proof valves with on-board driver

Attachments for hydraulic cylinders

to ISO 6982, ISO 8132 and ISO 8133



SWC Cylinders Designer

Software for assisted selection of Atos cylinders & servocylinders codes, including cylinder's sizing, full technical information, 2D & 3D drawings in several CAD formats.

Available for download at www.atos.com

The table at side shows the Atos range of standard rod attachments and brackets: they are available for each cylinder bore. See section 2 for possible combinations. Stainless steel attachments are available on request.

1 MODEL CODE

C - **141** **12** - **V**

C: Standard attachment

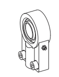
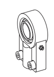
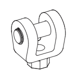
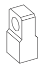
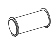
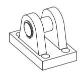
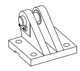
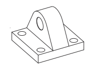
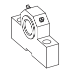
141: **Rod attachments**:
136= Rod eye spherical
146= Rod eye spherical
141= Rod clevis
151= Rod eye plain
145= Pivot pin

Brackets:
124 = Clevis bracket straight
134 = Clevis bracket in angle
144= Eye bracket
154= Trunnion bracket

12: **Bore** size/rod diameter [mm]

V: **Painting** see sect. 5

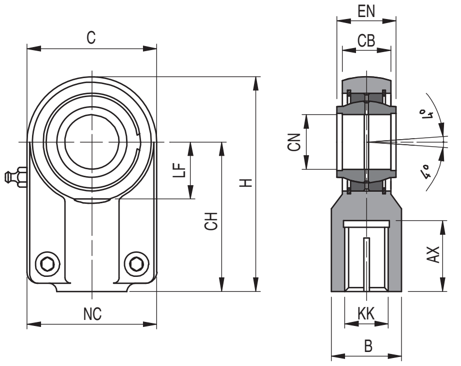
2 POSSIBLE COMBINATIONS

Ø Rod	Rod attachments codes					Ø Bore	Brackets codes			
	 (b)									
12 **18** opt.**H**(a)	NA	C-14612	C-14112	C-15112	C-14512	**25**	NA	C-13425	C-14425	C-15425
14 **22** opt.**H**(a)	C-13616	C-14614	C-14114	C-15114	C-14514	**32**	NA	C-13432	C-14432	C-15432
18 **22** opt.**H**(a) **28** opt.**H**	C-13618	C-14618	C-14118	C-15118	C-14518	**40**	C-12422 (c)	C-13440	C-14440	C-15440
22 **28** opt.**H**(a) **36** opt.**H**	C-13622	C-14622	C-14122	C-15122	C-14522	**50**	C-12428 (c) C-12436 (d)	C-13450	C-14450	C-15450
28 **36** opt.**H**(a) **45** opt.**H**	C-13628	C-14628	C-14128	C-15128	C-14522	**63**	C-12436 (c) C-12445 (d)	C-13463	C-14463	C-15463
36 **45** opt.**H**(a) **56** opt.**H**	C-13636	C-14636	C-14136	C-15136	C-14536	**80**	C-12445 (c) C-12456 (d)	C-13480	C-14480	C-15480
45 **56** opt.**H**(a) **70** opt.**H**	C-13645	C-14645	C-14145	C-15145	C-14545	**100**	C-12456 (c) C-12470 (d)	C-134100	C-144100	C-154100
56 **70** opt.**H**(a) **90** opt.**H**	C-13656	C-14656	C-14156	C-15156	C-14556	**125**	C-12470 (c) C-12490 (d)	C-134125	C-144125	C-154125
70 **90** opt.**H**(a) **110** opt.**H**	C-13670	C-14670	C-14170	C-15170	C-14570	**160**	C-12490 (c) C-124100 (d)	C-134160	C-144160	C-154160
90 **110** opt.**H**(a) **140** opt.**H**	C-13690	C-14690	C-14190	C-15190	C-14590	**200**	C-124100 (c)	C-134200	C-144200	C-154200

Notes:
(**a**) Option **H** : light male thread, for details see table B137 or B140
(**b**) C-136 is also available for rods 110, 140, 180 and 220. See section 3
(**c**) For S mounting styles in CN cylinder
(**d**) For S mounting styles in CC cylinder

3 DIMENSIONS [mm]

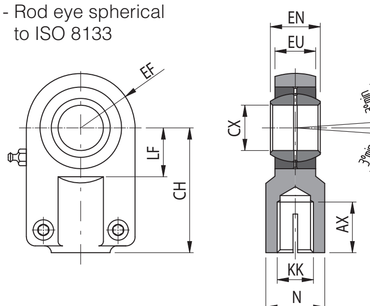
C-136 - Rod eye spherical
to ISO 6982 and 8132



Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Attachment not compliant with ISO standard

Code	KK	AX min	B max	C max	CB max	CH js13	CN H7	EN h12	H	LF min	NC	Mass [kg]	Max load [kN] (2) Dynamic	Max load [kN] (2) Static	Screws torque
C-13616 (1)	M12x1,25	17	19	33	11	38	12	12	54	13	32	0,11	10,8	24,5	6 Nm
C-13618	M14x1,5	19	22	41	14	44	16	16	64	16,5	40	0,2	17,6	36,5	10 Nm
C-13622	M16x1,5	23	28	50	17,5	52	20	20	75	20,5	47	0,35	30	48	25 Nm
C-13628	M20x1,5	29	31	64	22	65	25	25	96	25,5	54	0,62	48	78	25 Nm
C-13636	M27x2	37	38	80	28	80	32	32	118	30	66	1,15	67	114	49 Nm
C-13645	M33x2	46	47	100	34	97	40	40	146	39	80	2,18	100	204	49 Nm
C-13656	M42x2	57	58	126	42	120	50	50	179	47	96	3,96	156	310	86 Nm
C-13670	M48x2	64	70	145	53,5	140	63	63	211	58	114	6,8	255	430	210 Nm
C-13690	M64x3	86	91	184	68	180	80	80	270	74	148	13	400	695	410 Nm
C-13690A (3)	M72x3	91	100	185	72	195	90	90	296	91	160	19,1	490	750	410 Nm
C-136110	M80x3	96	110	228	85,5	210	100	100	322	94	178	25	610	1.060	710 Nm
C-136110A (3)	M90x3	106	125	235	88	235	110	110	364	106	190	32	655	1.200	710 Nm
C-136140	M100x3	113	135	320	105	260	125	125	405	116	200	46	950	1.430	710 Nm
C-136180	M125x4	126	165	400	133	310	160	160	488	145	250	82,5	1.370	2.200	710 Nm
C-136220	M160x4	161	215	500	165	390	200	200	620	190	320	168	2.120	3.650	1500Nm

C-146 - Rod eye spherical
to ISO 8133

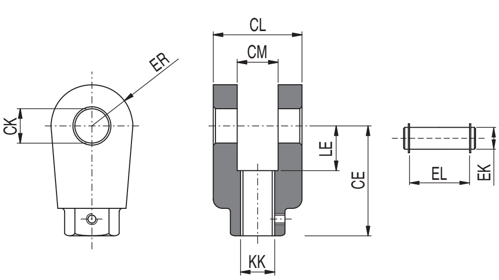


Notes:
(1) This attachment does not include the greaser because it is selflubricated
(2) Dynamic loads has to be considered when the cylinders work with oscillatory motions or push-pull loads in high frequencies
(3) Not compliant with ISO 8133

Code	KK	AX min	CH js13	CX	EF max	EN	EU max	LF min	N max	Mass [kg]	Max load [kN] (2) Dynamic	Max load [kN] (2) Static	Screws torque
C-14612 (1)	M10x1,25	15	42	$12^{0}_{-0,008}$	18	$10^{0}_{-0,12}$ (3)	8,5	16	19	0,12	10,8	17	10 Nm
C-14614 (1)	M12x1,25	17	48	$16^{0}_{-0,008}$	23	$14^{0}_{-0,12}$ (3)	11,5	20	22	0,22	21,1	28,5	10 Nm
C-14618 (1)	M14x1,5	19	58	$20^{0}_{-0,01}$	28	$16^{0}_{-0,12}$ (3)	13,5	25	28	0,43	30	42,5	25 Nm
C-14622	M16x1,5	23	68	$25^{0}_{-0,01}$	33	$20^{0}_{-0,12}$ (3)	18	30	31	0,67	48	67	25 Nm
C-14628	M20x1,5	29	85	$30^{0}_{-0,01}$	41	$22^{0}_{-0,12}$ (3)	20	35	37	1,25	62	108	49 Nm
C-14636	M27x2	37	105	$40^{0}_{-0,012}$	51	$28^{0}_{-0,12}$ (3)	24	45	47	2,16	100	156	49 Nm
C-14645	M33x2	46	130	$50^{0}_{-0,012}$	61	$35^{0}_{-0,12}$ (3)	31	58	57	3,9	156	245	86 Nm
C-14656	M42x2	57	150	$60^{0}_{-0,015}$	80	$44^{0}_{-0,15}$	39	68	69	7,15	245	380	210 Nm
C-14670	M48x2	64	185	$80^{0}_{-0,015}$	102,5	$55^{0}_{-0,15}$	48	92	91	15	400	585	410 Nm
C-14690	M64x3	86	240	$100^{0}_{-0,02}$	120	$70^{0}_{-0,20}$	57	116	110	27,3	610	865	710 Nm

C-141 - Rod clevis
to ISO 8133

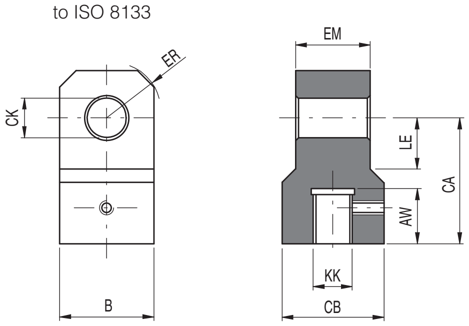
C-145 - Pivot pin



Note: Pivot pin C-145* is included in the supply

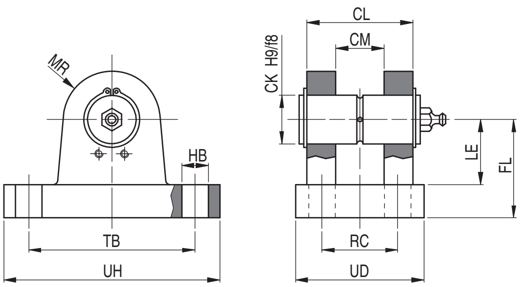
Code	KK	CE JS13	CK H9	CL max	CM A13	EK f8	EL min	ER max	LE min	Mass [kg]	Max load static [kN]
C-14112 C-14512	M10x1,25	32	10	26	12	10	29	12	13	0,1	8
C-14112 C-14512	M12x1,25	36	12	34	16	12	37	17	19	0,18	12,5
C-14118 C-14518	M14x1,5	38	14	42	20	14	45	17	19	0,23	20
C-14122 C-14522	M16x1,5	54	20	62	30	20	66	29	32	0,9	32
C-14128 C-14522	M20x1,5	60	20	62	30	20	66	29	32	0,91	50
C-14136 C-14536	M27x2	75	28	83	40	28	87	34	39	1,92	80
C-14145 C-14545	M33x2	99	36	103	50	36	107	50	54	4,92	125
C-14156 C-14556	M42x2	113	45	123	60	45	129	53	57	6,53	200
C-14170 C-14570	M48x2	126	56	143	70	56	149	59	63	10,11	320
C-14190 C-14590	M64x3	168	70	163	80	70	169	78	83	19,2	500

C-151 - Rod eye plain
to ISO 8133



Code	KK	AW min	B	CA JS13	CB max	CK H9	EM h13	ER max	LE min	Mass [kg]	Max load static [kN]
C-15112	M10x1,25	14	18	32	18	10	12	12	13	0,08	8
C-15114	M12x1,25	16	22	36	22	12	16	17	19	0,15	12,5
C-15118	M14x1,5	18	25	38	20	14	20	17	19	0,22	20
C-15122	M16x1,5	22	35	54	30	20	30	29	32	0,5	32
C-15128	M20x1,5	28	40	60	30	20	30	29	32	1,1	50
C-15136	M27x2	36	50	75	40	28	40	34	39	1,5	80
C-15145	M33x2	45	70	99	50	36	50	50	54	2,5	125
C-15156	M42x2	56	100	113	65	45	60	53	57	4,2	200
C-15170	M48x2	63	116	126	90	56	70	59	63	11,8	320
C-15190	M64x3	85	160	168	110	70	80	78	83	17	500

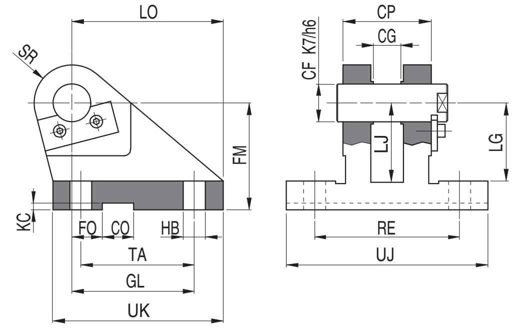
C-124 - Clevis bracket straight
to ISO 8132



Note: Pivot pin and seeger are included in the supply
Supplied with threaded holes for pivot pin locking plate (not included)

Code	CK H9	CL h16	CM A13	FL JS12	HB H13	LE min	MR max	RC JS14	TB JS14	UD max	UH max	Mass [kg]	Max load static [kN]
C-12414	12	28	12	34	9	22	12	20	50	40	70	0,31	8
C-12418	16	36	16	40	11	27	16	26	65	50	90	0,59	12,5
C-12422	20	45	20	45	11	30	20	32	75	58	98	0,9	20
C-12428	25	56	25	55	13,5	37	25	40	85	70	113	1,6	32
C-12436	32	70	32	65	17,5	43	32	50	110	85	143	2,8	50
C-12445	40	90	40	76	22	52	40	65	130	108	170	5	80
C-12456	50	110	50	95	26	65	50	80	170	130	220	10,1	125
C-12470	63	140	63	112	33	75	63	100	210	160	270	15,4	200
C-12490	80	170	80	140	39	95	80	125	250	210	320	30	320
C-124100	100	210	100	180	45	120	100	160	315	260	400	60,2	500

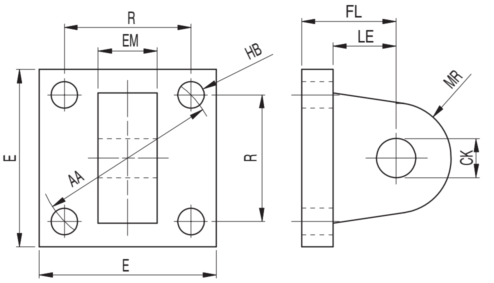
C-134 - Clevis bracket in angle
to DIN 24556 or ISO 8133 with additional machining for dimension CO



Notes:
Pivot pin with locking plate is included in the supply
(1) Not compliant with ISO 8133

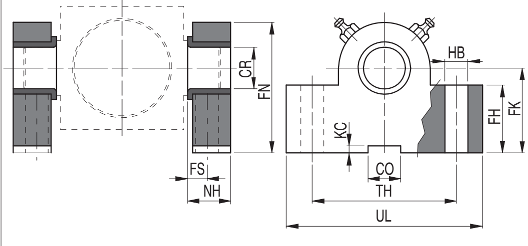
Code	CF H9 (1)	CG +0,1/+0,3	CO H9	CP h14	FM js13	FO	GL JS13	HB H13	KC	LG	LJ min	LO max	RE js13	SR max	TA js13	UJ max	UK max	Mass [kg]	Max load static [kN]
C-13425	12	10	10	30	40	16	46	9	3,3	28	29	56	55	12	40	75	60	0,52	8
C-13432	16	14	16	40	50	18	61	11	4,3	37	38	74	70	16	55	95	80	1,05	12,5
C-13440	20	16	16	50	55	20	64	13,5 (1)	4,3	39	40	80	85	20	58	120	90	1,72	20
C-13450	25	20	25	60	65	22	78	15,5 (1)	5,4	48	49	98	100	25	70	140	110	2,72	32
C-13463	30	22	25	70	85	24	97	17,5 (1)	5,4	62	63	120	115	30	90	160	135	5,15	50
C-13480	40	28	36	80	100	24	123	22	8,4	72	73	148	135	40	120	190	170	9,3	80
C-134100	50	35	36	100	125	35	155	30	8,4	90	92	190	170	50	145	240	215	18,3	125
C-134125	60	44	50	120	150	35	187	39	11,4	108	110	225	200	60	185	270	260	35	200
C-134160	80	55	50	160	190	35	255	45	11,4	140	142	295	240	80	260	320	340	63	320
C-134200	100	70	63	200	210	35	285	48	12,4	150	152	335	300	100	300	400	400	109	500

C-144 - Eye bracket
to ISO 8133



Code	CK H9	AA	E max	EM h13	FL js13	HB H13	LE min	MR max	R js13	Mass [kg]	Max load static [kN]
C-14425	10	40	40	12	23	5,5	13	12	28,3	0,3	8
C-14432	12	47	46	16	29	6,6	19	17	33,2	0,45	12
C-14440	14	59	65	20	29	9	19	17	41,7	0,9	20
C-14450	20	74	79	30	48	13,5	32	29	52,3	1,3	32
C-14463	20	91	91	30	48	13,5	32	29	64,3	1,9	50
C-14480	28	117	118	40	59	17,5	39	34	82,7	4	80
C-144100	36	137	132	50	79	17,5	54	50	96,9	6,25	125
C-144125	45	178	174	60	87	24	57	53	125,9	11,4	200
C-144160	56	219	215	70	103	30	63	59	154,9	20,8	320
C-144200	70	269	256	80	132	33	82	78	190,2	38,8	500

C-154 - Trunnion bracket
(for cylinders whit mounting styles G,H and L)
to ISO 8132

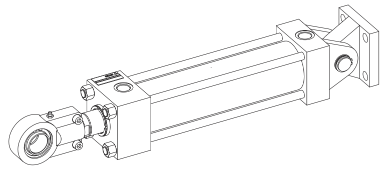


Note: The code includes two trunnion brackets
(1) To ISO 8133

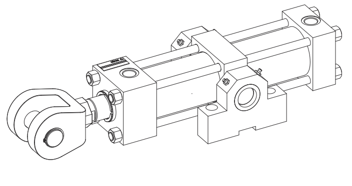
Code	CR H7	CO N9	FH max	FK JS12	FN max	FS js13	HB H13	KC 0/+0,3	NH max	TH js13	UL max	Mass [kg]	Max load static [kN]
C-15425	12	10	25	34	50	8	9	3,3	17	40	63	0,46	8
C-15432	16	16	30	40	60	10	11	4,3	21	50	80	0,83	12,5
C-15440	20	16	38	45	70	10	11	4,3	21	60	90	1,21	20
C-15450	25	25	45	55	80	12	13,5	5,4	26	80	110	2,15	32
C-15463	32	25	52	65	100	15	17,5	5,4	33	110	150	4,63	50
C-15480	40	36	60	76	120	16	22	8,4	41	125	170	7,78	80
C-154100	50	36	75	95	140	20	26	8,4	51	160	210	14,3	125
C-154125	63	50	85	112	180	25	33	11,4	61	200	265	23,4	200
C-154160	80	50	112	140	220	31	39	11,4	81	250	325	53,1	320
C-154200 (1)	100	63	150	200	300	42	52	12,4	101	320	410	112	500

4 EXAMPLES OF ATTACHMENTS

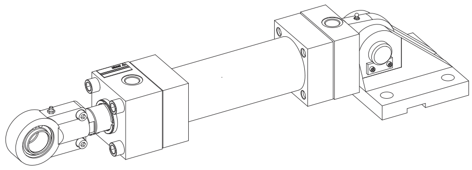
CK - mounting style **C** with rod eye **C-136** and bracket **C-144**



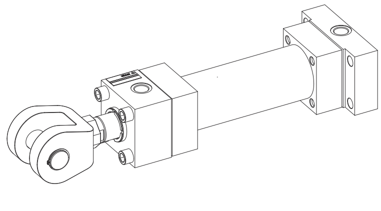
CK - mounting style **L** with rod clevis **C-141** and bracket **C-154**



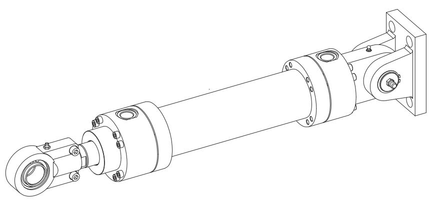
CH - mounting style **S** with rod eye **C-136** and bracket **C-134**



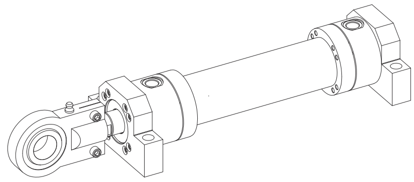
CH - mounting style **P** with rod clevis **C-141**



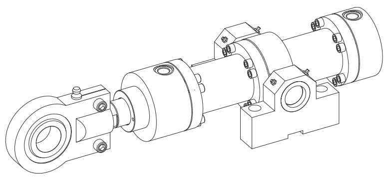
CN - mounting style **S** with rod eye **C-136** and bracket **C-124**



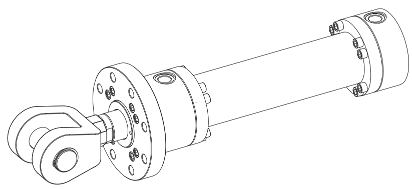
CN - mounting style **E** with rod eye **C-146**



CC - mounting style **L** with rod eye **C-146** and bracket **C-154**

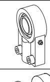
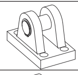
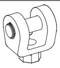
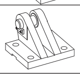
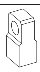
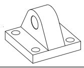
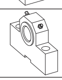


CC - mounting style **A** with rod clevis **C-141**



5 SURFACE TREATMENT

Some attachments are provided with additional surface treatment to increase the corrosion resistance (24h in neutral salt spray), see table below for details. All the attachments, except pivot pin C-145, can be supplied with standard painting RAL 9007 (200h in neutral salt spray) selecting option **-V**, special painting are available on request.

Code	Surface treatment	Code	Surface treatment
 C-136 or C-146	No treatment	 C-124	No treatment
 C-141	No treatment	 C-134	No treatment
 C-151	Black phosphate	 C-144	Black phosphate
 C-145	Black phosphate	 C-154	No treatment

6 GENERAL INFORMATION

INDEX

GENERAL INFORMATION

Basics for electrohydraulics in hazardous environments

1 HAZARDOUS ENVIRONMENTS

"Hazardous Environments" are areas where flammable liquids, gases, vapors or combustible dust exist in sufficient quantities to produce explosions or fire.

Oil & gas, chemical, mining and power plants are highly-sensitive environments where the presence of a potentially explosive atmosphere can accidentally or permanently occur.
In these environments an accidental failure or a wrong operation could cause the ignition of the surrounding explosive atmosphere with fatal consequences for human and goods safety, therefore all electrohydraulic equipment operating in these areas must be suitable for hazardous environments and must be certified according to international standards.

The purpose of this document is to provide general information about worldwide certifications for hazardous environments and relevant classifications

Typical hazardous environments can be found in the following sectors:

Presence of Gas and Vapors		**Presence of Combustible Dust**	
	Oil & Gas Offshore drilling		Feed industry Grain handling and storage
	Oil refineries Chemical plants Power plants LNG plants		Chemical & fertilizers Pharmaceutical
	Petroleum & LNG vessels		Wood & paper
	Aerospace industry		Metal processing
	Coal mines		Recycling operations

2 CERTIFICATIONS

Equipment with electrical parts designed for hazardous environments must be certified by third parties (notified bodies) in compliance with international standards for explosion protection.

There are several certifications concerning explosive environments and they are governed by local laws of the countries where they are applied.

In all certifications the basic principles for explosion protection are strictly regulated by severe international standards for explosion protection, as European norms EN60079 or North American NEC500 and 505.
These norms impose specific construction criteria and protection methods for the machinery and components to be used in potentially explosive areas.

ATOS CERTIFICATIONS
see section 3 for details

ATEX Europe
IECEx international
Russia
North America
PESO India
China
Canada
Brazil
Korea

WORLDWIDE CERTIFICATIONS

The following map shows the main certifications with the relative countries where they are most widely applied.
International certification IECEx is recognized worldwide even in countries where local certifications exist.

3 CERTIFICATIONS FOR ATOS EX PROOF AND INTRINSICALLY SAFE COMPONENTS

Atos ex-proof and Intrinsically safe components are certified with major international certifications, as listed in the following.

Note: see technical table of each specific Atos component to verifiy the available certifications

MULTICERTIFICATION

Multicertifications is a great plus offered by Atos, where the same component is provided with the following certifications:

ATEX Directive 2014/34/EU, equipment and protective system intended for use in potentially explosive atmosphere
It defines the manufacturing criteria and the safety requirements of the equipment used in potentially explosive environments for presence of gas or flammable dusts, within the European Union.
The Directive provides the classification and marking of components to EN 60079 harmonized norms.

IECEx International Electrotechnical Commission Explosive
International program for the safety of the equipment installed in a potentially explosive atmosphere, required to access international markets. IECEx provides certification of conformity for electrical equipment and machinery to be used in potential explosive environments and it is based on IEC 60079 standards. The objective of the IECEx is to facilitate international trade of equipment for use in explosive atmospheres.

EAC Eurasian Certification
It is applicable to the Customs Union Territory Including Russia, Kazakhstan, Belarus, Armenia and Kyrgyzstan
It indicates the compliance with the Customs Union Technical Regulation TP TC 012/2011 “safety of equipment intended for use in explosive atmospheres” and it acknowledges the whole ATEX Directive 2014/34/EU.

PESO Petroleum and Explosive Safety Organization (earlier known as CCoE)
It approves products distributed within Indian territory for suitability in usage at petroleum or in any place with potentially explosive atmosphere. It is based on harmonized norms and international standards under ATEX and IECEx.
Atos multicertified ex-proof valves for gas group II are also certified Peso.

cULus North American Certification
It is a widely recognized certification across North America (US and Canada).
It provides certification of conformity for equipment and machinery installed in locations where explosion or fire hazards exist due to the presence of flammable gases, combustible dust, or ignitable fibers. It is based on NEC standards

MA safety certificate of approval for mining products
Chinese authority for certification of components operating in chinese coal mines.
It acknowledges the harmonized norms and international standards under ATEX and IECEx.

The following sections describe the various classifications related to hazardous environments according to certifications available for Atos components.
The classification is marked on the nameplate of each certified component to state its conformity to the specific hazardous environment and explosive atmosphere.

See section 4 for classifications to **ATEX, IECEx, EAC, PESO**

See section 5 for classifications to **cULus**

4 CLASSIFICATIONS TO ATEX, IECEx, EAC, PESO

The classifications reported in the following sections are those established by the EN and IEC standards related to ATEX and IECEx.
EAC and PESO certifications acknowledge the same classification system of ATEX and IECEx.
An example of classification present on the component nameplate iso shown in the following:

environment				atmosphere		environment
II	**2 G**	**Ex**	**d**	**IIC**	**T6/T5/T4**	**Gb**
Group see sect. 4.1	**Category** see sect. 4.3	**Mark of Explosion Proof**	**Protection Method** see sect. 4.7	**Gas Group** see sect. 4.4	**Temperature Class** see sect. 4.6	**Equipment Protection Level (EPL)** see sect. 4.3

Once the user has classified the area in which the component is intended to be placed, he will be able to define the level of protection of the component.

The evaluation of the risk and consequentially the level of protection required by the equipment passes through two main classifications:

A- Environment: the classification is referred to the location in which the product is intended to be placed
Environment is further classified in **Group** and **Zone**.

B- Atmosphere: the classification is referred to the type of explosive substance present in the atmosphere
Atmosphere is further classified in **Gas Group**, **Dust Group** and **Temperature**.

A- ENVIRONMENT

4.1 Group classification

Explosive environments are classified into **Group I** for underground mines, and **Group II** for surface areas

4.2 Zone classification - The Zone classification is not reported on the component nameplate
Explosive environments are classified into **Zone**, identified **0, 1, 2** for **Gas**, and **20, 21, 22** for **Dust**, depending on the time and frequency the explosive substance is present: Zone 2 and 22 are less dangerous than 0, 1 or 20, 21.
Components certified for Zone 0 (or 20) may also be used in Zone 1, 2 (or 21, 22).

4.3 Safety level required: Category and EPL

The Zone is directly linked with the safety level required; a zone with higher risk requires a higher safety level. There are two different classifications: **Category** and **EPL**

Category: ATEX classifies the safety required level into **Category 1, 2, 3** accompanied with letter **G** for gas and letter **D** for Dust: Category 1G (or 1D) are safer than 2G, 3G (or 2D, 3D).
Components certified for Category 1 may also be used where Category 2 or 3 is needed.
For Group I the classification is **Category M1** or **M2** with M1 safer than M2.

EPL: IECEx classifies the safety level required into **Equipment Protection Level (EPL) a, b, c** anticipated by letter **G** for gas and **D** for dust depending on the safety level required: Category Ga (or Da) are safer than Gb, Gc (or Db, Dc).

Components certified for EPL Ga (or Da) may also be used where EPL Gb, Gc (or Db, Dc) is needed.

Environment classification

Explosive Atmosphere	**Group** see 4.1	**Zone** see 4.2	**Safety level required** see 4.3		**Atos component**	
			Category	**EPL**		
Gas (mining)	I	-	M1	-		HIGHER PROTECTION
	I	-	M2		① ③	
Gas (surface)	II	0	1G	Ga	④	HIGHER PROTECTION
		1	2G	Gb	② ⑤	
		2	3G	Gc	② ⑤	
Dust	II	20	1D	Da		HIGHER PROTECTION
	II	21	2D	Db	② ⑤	
		22	3D	Dc	② ⑤	

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders

B- ATMOSPHERE

4.4 Gas Group classification

The classification is based on the minimum ignition energy of the explosive atmosphere in which a component may be installed.
The **Gas Groups** are identified **IIA, IIB, IIC** depending on the dangerousness of the substances: group IIA is less dangerous than group IIB and IIC. Components certified for Gas Group IIC may also be used in less dangerous Groups IIB and IIA

4.5 Dust group classification

The classification is based on nominal dimensions and electrical resistivity of particles.
The **Dust Groups** are identified **IIIA, IIIB** and **IIIC**, depending on the dangerousness of the substances: group IIIC contains smaller and less electrically resistive substances than group IIIB and IIIA. Components certified for Dust Group IIIC may also be used in less dangerous Groups IIIB and IIIA.

4.6 Temperature class

Based on their maximum surface temperature, the components are classified into **Temperature Classes T1** to **T6** for Gas, whereas for Dust the max surface temperature is directly reported in **°C**. The maximum surface temperature of the component must be lower than the ignition temperature of the surrounding explosive atmosphere.
Components certified with Temperature Class T6 may also be used in lower Classes T5 to T1

Atmosphere and Temperature class

Gas Group	Gas type					
IIC	Hydrogen	Acetylene				Carbon disulphide
IIB	City gas Acrylic Nitrile	Ethylene	Ethyl glycol Carbon hydrogen	Ethyl ether		
IIA	Ammonia Methane Ethane Propane	Ethanol n-Butane	Petrol Diesel fuel Fuel oil n-Hexane	Acetal-dehyde		
Temperature class	**T1** < 450°C	**T2** < 300°C	**T3** < 200°C	**T4** < 135°C	**T5** < 100°C	**T6** < 85°C

HIGHER PROTECTION

HIGHER PROTECTION

Note: the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two or three different T are reported on the components nameplate (i.e. T6/T5/T4). See technical table of each specific Atos component for Temperature class.

Dust Group	Dust type
IIIC	Conductive dust
IIIB	Non conductive dust
IIIA	Flammable fibers

HIGHER PROTECTION

For dust explosion proof, the max surface temperature is directly shown (e.g. T85°C)

4.7 Protection method

The ignition of the surrounding explosive atmosphere can be prevented adopting for the component a proper protection method.
The protection method is directly linked to the design and manufacturing characteristics of the component.
The table below reports the **Code** related to the protection method adopted along with the relative **Zone** of application.

HIGHER PROTECTION HIGHER PROTECTION

Protection principle	Protection method	Code		Zone						Atos component
				Gas			Dust			
				0	1	2	20	21	22	
Prevents transmission of the explosion outside	Flameproof enclosure	Ex d	da	X	X	X	X	X	X	
			db		X	X				① ②
			dc			X				
Dust explosion proof	Protection by enclosure	Ex t	ta				X	X	X	
			tb					X	X	②
			tc						X	
Low current / voltage supply	Intrinsically safe	Ex i	ia	X	X	X				③ ④
			ib		X	X				
			tc			X				
Non-electrical	Construction safety Control of igniction sources Protection by liquid immersion	Ex h	c b k		X	X		X	X	⑤

① Atos ex-proof (mining) ② Atos ex-proof (gas & dust) ③ Atos intrinsically safe (mining) ④ Atos intrinsically safe (gas)

⑤ Pumps and cylinders

4.8 Painting

According to EN60079-0 the valves can be coated with a non-metallic material (i.e. painting), observing the maximum thickness:

Group IIC < 0,2 mm max
Group IIB < 0,3 mm max
Group IIA < 0,3 mm max

5 CLASSIFICATIONS TO cULus

The classification of explosive environments in cULus certification is regulated by NEC Standards (National Electric Code) and it is based on NEC 500 and NEC 505 articles.

NEC 500 covers the requirements for the classification system in Classes I, II, II and Divisions 1 and 2.

NEC 505 covers the requirements for the classification system in Zones (Zone 0, 1, and 2) as alternative to the NEC 500.

An example of classification present on the component nameplate is shown in the following:

NEC 500

Class I	Division I	Groups C & D	T6/T5
		Gas Groups	**Temperature Class**
see sect. 5.1	see sect. 5.3	see sect. 5.2	see sect. 5.5

NEC 505

Class I	Zone I	Groups IIA & IIB	T6/T5
		Gas Groups	**Temperature Class**
see sect. 5.1	see sect. 5.4	see sect. 5.2	see sect. 5.5

5.1 Class classification - NEC 500 and NEC 505

Location where explosive substances are present in the atmosphere are classified as:
Class I where flammable vapors and gases may be present
Class II and **Class III** where combustible dust and easily ignitable fibers may be present

5.2 Group classification

NEC 500: based on the ignition temperatures and explosion pressure, NEC 500 classifies gases and dust into Groups, identifying **Group A, B, C, D** for **Gases** and **Group E, F, G** for **Dusts**. Group D (or G) is less dangerous than Groups A, B, C (or E, F).
Components certified with Group A (or E) may also be used in lower Group B to D (or F to G).

NEC 505: the Gas Groups have the same classifications as per IECEx, as reported in the following table for comparison with NEC 500.

Explosive atmosphere	Typical hazard material	Class	Group		Atos component
			NEC 500	NEC 505	
Gases, vapors and liquids	Acetylene	Class I	A	IIC	
	Hydrogen, Butadiene, Ethylene Oxide, Propylene Oxide	Class I	B	IIC or IIB+H2	
	Ethylene, Formaldehyde, Cyclopropane, Ethyl Ether, etc	Class I	C	IIB	①
	Methane, Butane, Petrol, Natural gas, Propane, Gasoline	Class I	D	IIA	
Dusts	Metallic dusts (conductive and explosive)	Class II	E	IIIC	
	Coal dusts (some are conductive and all are explosive)	Class II	F	IIIC	
	Grain dust	Class II	G	IIIB	
Solid combustible, fibres and particles	Textile products, wood, paper, cotton processing (easily flammable, but does not risk to be explosive)	Class III	-	IIIA	

HIGHER PROTECTION

① Atos ex-proof

5.3 Division classification – only for NEC 500 Standard

Each of the three Classes described in section 5.1 is further subdivided into two Divisions:

Division 1 includes explosive substances that are continuously, intermittently or periodically present in the atmosphere.
The ignitable concentrations of above substances exist under normal conditions or it is caused by frequent maintenance or by equipment failure.

Division 2 includes explosive substances present under "unusual" circumstances.
Above substances are normally contained into sealed containers or into closed systems from which they can only escape through accidental rupture or breakdowns of such containers.

The installation and requirements for **Division 1** are more restrictive than for **Division 2**.
Components certified with Division 1 may also be used when Division 2 is required.

5.4 Zone classification – only for NEC 505 Standard

NEC 505 Standard introduces the Zone classification:

Zone 0 defines locations in which an explosive gas is present continuously or for long periods during normal operation.

Zone 1 defines locations in which ignitable concentrations of gas exist under normal operation or it is caused by frequent maintenance or equipment failure.

Zone 2 defines the area in which an explosive gas is not likely to occur or it will exist only for a short time

Component certified with Zone 0 may be used when Zone 1 is required.

The following table reports a comparison between Division classification to NEC 500 and Zone classification to NEC 505 Standards.

	Continuous Hazard	**Intermittent hazard**	**Hazard under abnormal conditions**
NEC 500	Division 1 ①		Division 2
NEC 505	Zone 0 (Zone 20 dust)	Zone 1 (Zone 21 dust) ①	Zone 2 (Zone 22 dust)

① Atos ex-proof /UL

5.5 Temperature classes

The temperature classes designate the maximum operating temperatures of the equipment surface which must not exceed the ignition temperature of the surrounding atmosphere.
The temperature class is marked on the component nameplate.

Products certified with temperature class T6 may also be used in lower classes T5 to T1

Code	**Max surface Temperature**		**Atos component**
	[°C]	**[°F]**	
T6	85	185	①
T5	100	212	②
T4A	120	248	
T4	135	275	③
T3C	160	320	
T3B	165	329	
T3A	180	356	
T3	200	392	④
T2D	215	419	
T2C	230	446	
T2B	260	500	
T2A	280	536	
T2	300	572	
T1	450	842	

HIGHER PROTECTION

Note:
the Temperature class may change depending on the max ambient temperature where the component is installed. In this case two different T are reported on the components nameplate (i.e. T6/T5).
See technical table of each specific Atos component for Temperature Class.

① Atos ex-proof ON-OFF - Tamb up to +55°C

② Atos ex-proof ON-OFF - Tamb from +55°C to +70°C

③ Atos ex-proof proportionals - Tamb up to +55°C

④ Atos ex-proof proportionals - Tamb from +55°C to +70°C

6 ATEX vs. cULus (NEC)

The following tables report a comparison between ATEX and cULus (NEC) classification systems.

Note: due to the different nature Atex and cULus systems, the direct comparison is not fully applicable.
The comparison is just to be used as a general reference for transition from one system to the other.

6.1 Comparison concerning the classification of hazardous environments due to the presence of Gas or Dust

Gas

ATEX	Zone 0	Zone 1	Zone 2
cULus (NEC 505)	Zone 0	Zone 1	Zone 2
cULus (NEC 500)	Class I, Division I		Class I, Division 2

Dust

ATEX	Zone 20	Zone 21	Zone 22
cULus (NEC 505)	Zone 20	Zone 21	Zone 22
cULus (NEC 500)	Class II, Division I		Class II, Division 2

6.2 Comparison concerning the classification of Gas Groups

	Gas type			
	Propane	**Ethylene**	**Hydrogen**	**Acetylene**
ATEX	IIA	IIB	IIC	IIC
cULus (NEC 505)	IIA	IIB	IIC	IIC
cULus (NEC 500)	D	C	B	A

Note: the direct comparison concerning Dust Group is not possible since the classification criteria between ATEX and cULus are consistently different

6.3 Comparison concerning the Temperature Classes for Gas Group II

ATEX	cULus (NEC 505)	cULus (NEC 500)	Max surface temperature [°C]	Max surface temperature [°F]
T6	T6	T6	85	185
T5	T5	T5	100	212
		T4A	120	248
T4	T4	T4	135	275
		T3C	160	320
		T3B	165	329
		T3A	180	356
T3	T3	T3	200	392
		T2D	215	419
		T2C	230	446
		T2B	260	500
		T2A	280	536
T2	T2	T2	300	572
T1	T1	T1	450	842

7 ATOS COMPONENTS EXEMPTED FROM CERTIFICATION AND MARKING

Atos hydraulic components made only by mechanical parts and not equipped with electrical functions are exempted from certification because their functioning does not generate dangerous conditions for the explosive environment.

The safe application of these components in hazardous environments is justified by following analysis:

- All the internal parts of the components are separated and insulated from the external environment by means of pressure-proof seals. The internal volumes are filled by the hydraulic fluid, thus there are no volumes which can be saturated by the external explosive atmosphere.
- The operation of mechanical parts does not produce potential sources of ignition of the explosive gas mixture.
- The functioning of the mechanical parts does not create conditions as overheating which may cause the explosion of the surrounding atmosphere.

The following components are included in this range:

- On-off pressure control valves (without solenoid pilot) type CART-*, ARE, ARAM, AGAM, AGIR, AGIS, AGIU, REM
- Flow control valves type QV, AQFR
- Check valves type DB, DR, ADR, ADRL, AGRL, AGRLE
- Modular valves type HMP, HM, KM, HS, KS, HG, KG, JPG, HC, KC, JPC, HQ, KQ,JPQ,HR, KR, JPR
  (modular fast/slow valves type DHQ and pressure switch type MAP, cannot be used in potentially explosive atmosphere)
- On off Mechanical, Hydraulic, Pneumatic operated valves
- On-off ISO cartridges, type SC LI and ISO functional covers without solenoid pilot valve.

8 INGRESS PROTECTION (IP)

The "Ingress Protection" identifies the environmental protection of a device defined in IEC Standard 60529.
The IP classification system designates, by means of two digits, the degree of protection provided by a device against ingress of dust and water.

FIRST	DEGREE OF PROTECTION AGAINST SOLID OBJECTS	SECOND	DEGREE OF PROTECTION AGAINST WATER	Atos component
0	Non-protected	0	Non-protected	
1	Protected against a solid object with diameter greater than 50 mm	1	Protected against water dripping vertically, such as condensation	
2	Protected against a solid object with diameter greater than 12 mm	2	Protected against dripping water when tilted up to 15°	
3	Protected against a solid object with diameter greater than 2.5 mm	3	Protected against water spraying at an angle of up to 60°	
4	Protected against a solid object with diameter greater than 1.0 mm	4	Protected against water splashing from any direction	
5	Dust-protected. Prevents ingress of dust sufficient to cause harm	5	Protected against jets of water from any direction	
6	Dust tight. No dust ingress	6	Protection against heavy seas or powerful jets of water	① ②
		7	Protected against harmful ingress of water when immersed between a depth of 150 mm to 1 meter	①
		8	Protected against submersion. Suitable for continuous immersion in water	

① Atos ex-proof multicertification (mining / surface) = IP66/67 ② Atos intrinsically safe = IP66

The ingress protection of cULus certified components is "Raintight enclosure, UL approved"

8.1 Comparison between IEC and NEMA standards

An equivalent classification of the enclosures degrees of protection, for the USA market, is defined according to NEMA Standard.
Note: the direct comparison is not possible since the classification criteria are consistently different between IEC and NEMA.
The comparison is just to be used as a general reference for transition from one system to another.

<table>
<tr><th>NEMA</th><td>1</td><td>2</td><td>3</td><td>3X</td><td>3R</td><td>3RX</td><td>3S</td><td>3SX</td><td>4</td><td>4X</td><td>5</td><td>6</td><td>6P</td><td>12</td><td>12K</td><td>13</td></tr>
<tr><th>IEC (IP)</th><td>20</td><td>22</td><td colspan="2">55</td><td colspan="2">24</td><td colspan="2">55</td><td colspan="2">66</td><td>53</td><td>67</td><td>68</td><td colspan="3">54</td></tr>
</table>

Summary of Atos ex-proof components
multicertified to **ATEX, IECEx, EAC, PESO**

Atos ex-proof components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments in presence of flammable liquids, gases, vapors or combustible dust.

They are certified by independent notified bodies in conformity to **ATEX, IECEx, EAC** and **PESO** standards.

1 PRODUCTS RANGE

1.1 PROPORTIONAL and ON-OFF VALVES

The certification for proportional and on-off valves is relevant to solenoids, on-board electronic drivers and transducers.
These components are engineered and manufactured according to protection method **Ex-d** (code **Ex-t** for dust environements), where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Driver	Environment	Multicertification				Marking
				ATEX	IECEx	EAC	PESO	
Proportional valves	Servoproportional directionals High preformance directionals Directional valves High performance pressure valves Pressure valves Flow valves	on-board	Gas & Dust	X	X			see sect. 4
		off-board	Gas & Dust	X	X	X	X (only Gas)	see sect. 5
			Mining	X	X			see sect. 7
Axis controls	Servoproportional directionals	on-board	Gas & Dust	X	X			see sect. 4
On-off valves	Directional valves Pressure relief valves	-	Gas & Dust	X	X	X	X (only Gas)	see sect. 6
			Mining	X	X			see sect. 8

1.2 PUMPS and CYLINDERS

Hydraulic components without electrical parts are also subject to the requirements of ATEX Directive 2014/34/EU, but the certification is not mandatory (it can be performed on voluntary basis).

PVPCA variable displacement axial piston pumps, PFEA fixed displacement vane pumps and CKA hydraulic cylinders, are ATEX certified to **Ex-h** protection.The protection method Ex-h combines the characteristics of construction safety (Ex-c), control of ignition source (Ex-b) and protection by liquid immersion (Ex-k)

Product Category	Component	Environment	Certification	Marking
Pumps	PVPCA - variable displacement piston pumps PFEA - fixed displacement vane pumps	Gas & Dust	ATEX	see sect. 9
Cylinder	CKA - hydraulic cylinders CKAM - hydraulic servocylinders	Gas & Dust	ATEX	see sect. 10

2 FLAMEPROOF ENCLOSURE - Ex-d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid and driver power, in order to limit the surface temperature within certified classes (T6, T5, etc), to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure, combined with IP66/67 ingress protection, makes the ex-proof valves suited for application in harsh environments.

Electrical wiring
The electrical wiring to the terminal board of ex-proof solenoids, on-board digital drivers and transducers must be performed using ex-proof certified cable glands, see tech. table KX600.
Electric cables must be approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

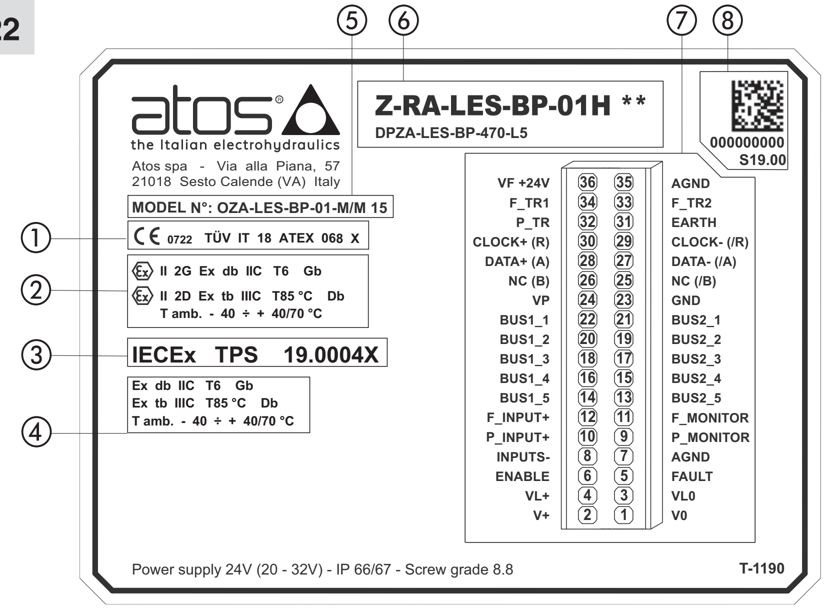
3 NAMEPLATE MARKING

The ex-proof certified components are provided with a specific nameplate reporting the certificate number, the notified body and the classification according to the relevant certification.
The classification identifies the protection method and the compatibility of the ex-proof component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for component categories.

Driver nameplate marking to ATEX and IECEx

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Code of solenoid
6. Code of on-board driver and related proportional valve
7. Electronic connections
8. Qr code and driver serial number



ATEX / IECEX classification - for Gas group II

II 2 G	Ex	d	IIC	T6/T5/T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEX classification - for Dust

II 2 D	Ex	tb	IIIC	T85/T100/T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T100** ≤ 100°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX150 DLHZA-TES, DLKZA-TES - direct, sleeve execution
FX135 DHZA-TES, DKZA-TES - direct
FX235 DPZA-LES, piloted
FX380 LIQZA-LES, 3-way cartridge

High performance directional - positive overlap with LVDT transducer

FX130 DHZA-TES, DKZA-TES - direct
FX230 DPZA-LES - piloted
FX360 LIQZA-LES, 2-way cartridge

Directional valves - positive overlap without transducer

FX110 DHZA-AES, DKZA-AES - direct
FX210 DPZA-AES - piloted

High performance pressure valves - with pressure transducer

FX030 RZMA-RES, AGMZA-RES - relieft
FX060 RZGA-RES, AGRCZA-RES - reducing
FX320 LIMZA-RES, LIRZA-RES, LICZA-RES - relief, reducing, compensator

Pressure valves - without transducer

FX020 RZMA-AES, AGMZA-AES - relief
FX050 RZGA-AES, AGRCZA-AES - reducing
FX080 DHRZA-AES - reducing
FX310 LIMZA-AES - relief
LIRZA-AES - reducing
LICZA-AES - compensator

Flow valves, pressure compensated

FX430 QVHZA-TES, QVKZA-TES - with LVDT transducer
FX410 QVHZA-AES, QVKZA-AES - without transducer

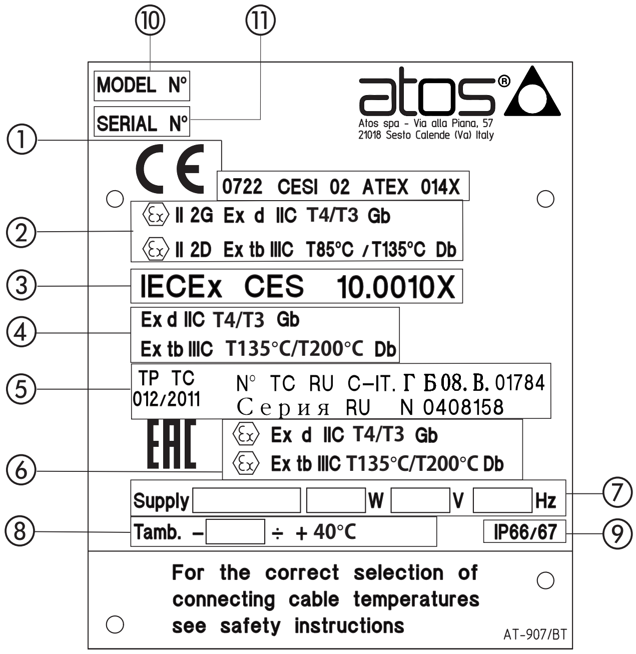
Servoproportional valves with on-board axis controller

FX610 DLHZA-TEZ, DLKZA-TEZ – direct, sleeve execution
FX620 DHZA-TEZ, DKZA-TEZ - direct
FX630 DPZA-LEZ - piloted

Solenoid nameplate marking to ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. EAC notified body and certificate number
6. Marking according to EAC
7. Power supply characteristics
8. Ambient temperature
9. Ingress protection:
   -IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   -IP67 = no dust ingress, protection to water immersion
10. Solenoid model code
11. Solenoid serial number



Note: PESO certificate number is not reported on the component nameplate, it is reported in the components technical table.
The certificate can be downloaded from www.atos.com

ATEX / IECEX / EAC / PESO classification - for Gas group II

II 2 G	Ex	d	IIC	T4 / T3	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEx / EAC classification - for Dust

II 2 D	Ex	tb	IIIC	T135 / T200	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 135°C **T135** ≤ 200°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX140 DLHZA-T DLKZA-T - direct, sleeve execution
FX370 LIQZA-L, 3-way cartridge

High performance directional - positive overlap with LVDT transducer

FX120 DHZA-T, DKZA-T - direct
FX220 DPZA-T - piloted
FX350 LIQZA-L, 2-way cartridge

Directional valves - positive overlap without transducer

FX100 DHZA-A, DKZA-A - direct
FX200 DPZA-A - piloted

Pressure valves - without pressure transducer

FX010 RZMA-A, HZMA-A, AGMZA-A - relief
FX040 RZGA-A, AGRCZA-A, HZGA-A, KZGA-A - reducing
FX070 DHRZA-A - reducing
FX300 LIMZA-A - relief
LIRZA-A - reducing
LICZA-A - compensator

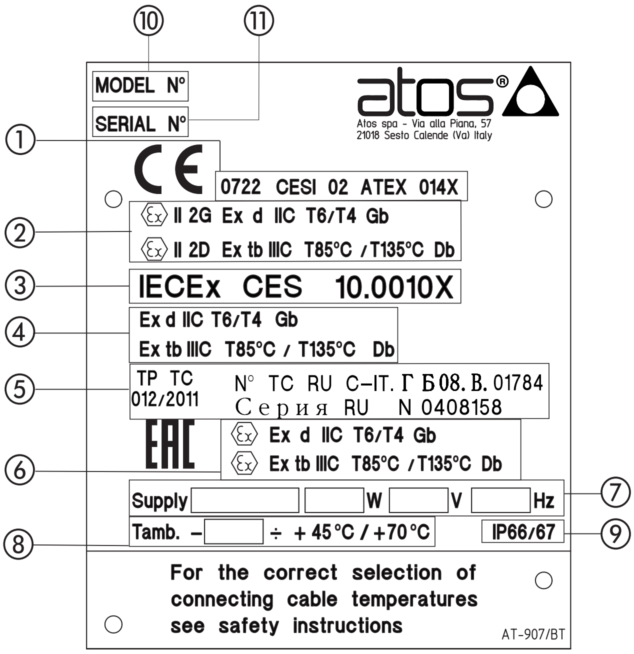
Flow valves, pressure compensated

FX420 QVHZA-T, QVKZA-T - with LVDT transducer
FX400 QVHZA-A, QVKZA-A - without transducer

Nameplate marking to ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. EAC notified body and certificate number
6. Marking according to EAC
7. Power supply characteristics
8. Ambient temperature
9. Ingress protection:
   -IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   -IP67 = no dust ingress, protection to water immersion
10. Solenoid model code
11. Solenoid serial number



Note: PESO certificate number is not reported on the component nameplate, it is reported in the components technical table.
The certificate can be downloaded from www.atos.com

ATEX / IECEX / EAC / PESO classification - for Gas group II

II 2 G	Ex	d	IIC	T6 / T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone1)

ATEX / IECEx / EAC classification - for Dust

II 2 D	Ex	tb	IIIC	T85 / T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High Protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **tb** Protection by enclosure	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone21)

RELATED DOCUMENTATION

Directional valves

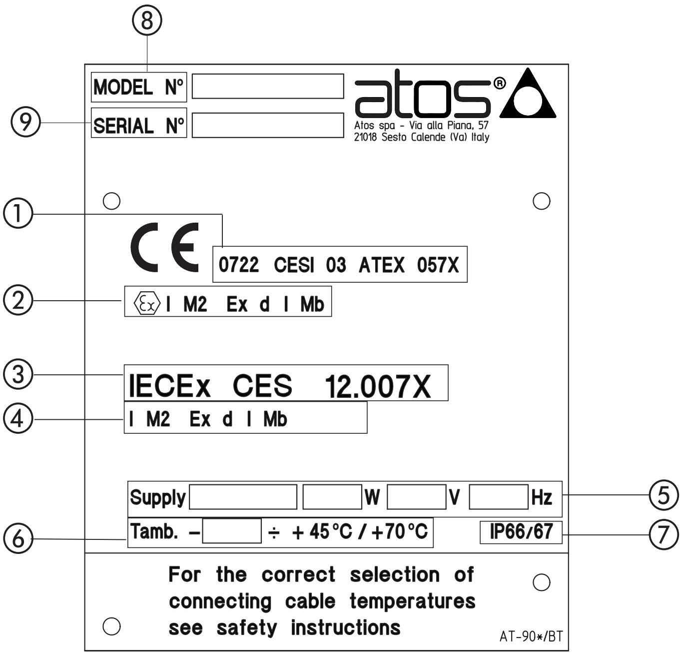
EX010 DHA - direct, spool type
EX020 DLAH, DLAHM - direct, poppet type
CART-LAH, CART-LAHM - cartridge screw-in, direct, poppet type
EX030 DPHA – piloted, spool type
EX050 LIDEW-AO, LIDBH-AO - piloted ISO cartridges and functional covers

Pressure relief valves

CX070 AGAM-AO, ARAM-AO - piloted, with solenoid valve for venting

Nameplate marking to ATEX and IECEx

Gas - group I M2 - Mining



1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Power supply characteristics
6. Ambient temperature
7. Ingress protection:
   - -IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   - -IP67 = no dust ingress, protection to water immersion
8. Solenoid model code
9. Solenoid serial number

ATEX, IECEx classification - for Gas group I - Mining

I M2	Ex	d	I	Mb
Equipment Group **I** mines **Equipment Category** **M2** High Protection	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX140 DLHZA/M-T DLKZA/M-T – direct, sleeve execution

High performance directional - positive overlap with LVDT transducer

FX120 DHZA/M-T, DKZA/M-T – direct

Directional valves - positive overlap without transducer

FX100 DHZA/M-A, DKZA/M-A - direct
FX200 DPZA/M-A - piloted

Pressure valves - without pressure transducer

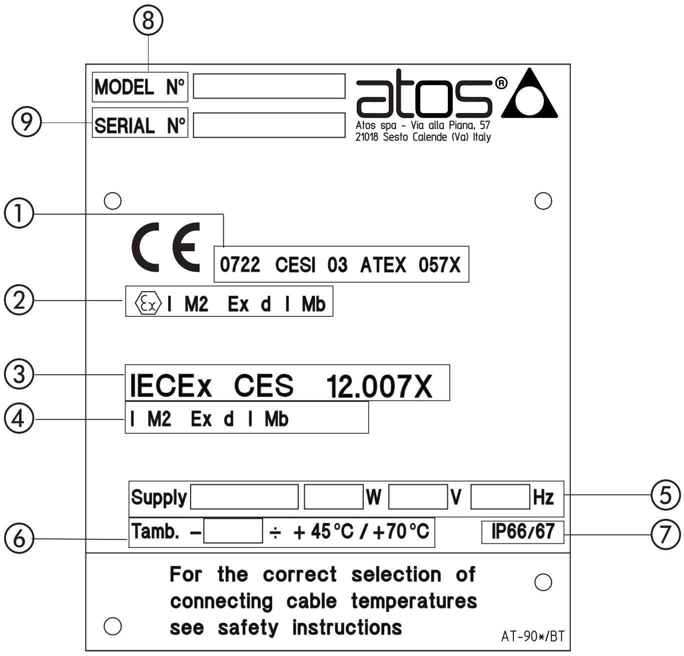
FX010 RZMA/M-A, HZMA/M-A, AGMZA/M-A - relief
FX040 RZGA/M-A, AGRCZA/M-A, HZGA/M-A, KZGA/M-A - reducing
FX070 DHRZA/M-A - reducing
FX300 LIMZA/M-A - relief
LIRZA/M-A - reducing
LICZA/M-A - compensator

Flow valves, pressure compensated

FX420 QVHZA/M-T, QVKZA/M-T - with LVDT transducer
FX400 QVHZA/M-A, QVKZA/M-A - without transducer

Nameplate marking to ATEX and IECEx

Gas - group I M2 - Mining



1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Power supply characteristics
6. Ambient temperature
7. Ingress protection:
   -IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   -IP67 = no dust ingress, protection to water immersion
8. Solenoid model code
9. Solenoid serial number

ATEX, IECEx classification - for Gas group I - Mining

I M2	Ex	d	I	Mb
Equipment Group **I** mines **Equipment Category** **M2** High Protection	**Mark of Explosion Proof**	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX010 DHA/M - direct, spool type
EX020 DLAH/M, DLAHM/M - direct, poppet type
CART-LAH/M, CART-LAHM/M - cartridge screw-in, direct, poppet type
EX030 DPHA/M - piloted, spool type
EX050 LIDEW-AO/M, LIDBH-AO/M - piloted ISO cartridges and functional covers

Pressure relief valves

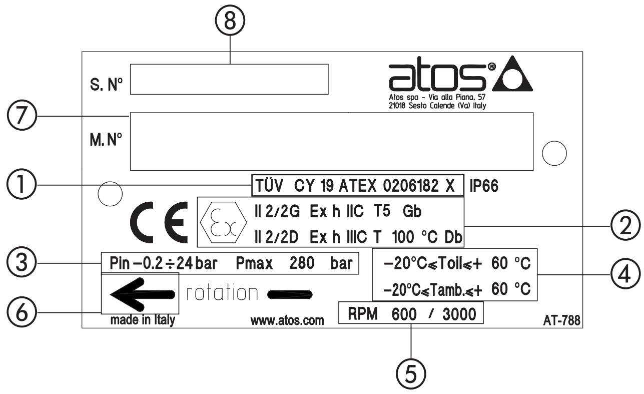
CX070 AGAM-AO/M, ARAM-AO/M - piloted, with solenoid valve for venting

Nameplate marking to ATEX and IECEx

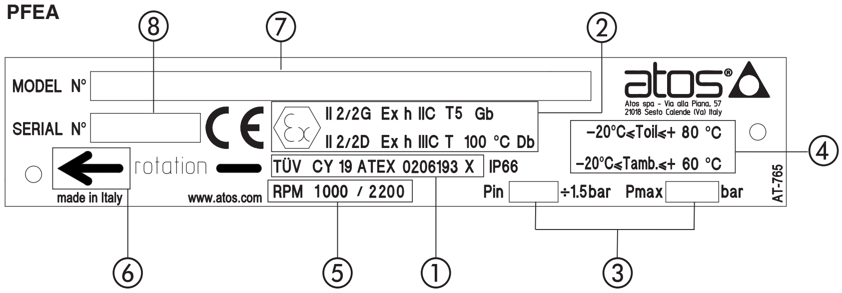
Gas - group II 2/2G - Zone 1, 2
Dust - group II 2/2D - Zone 21, 22

PVPCA

1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. Inlet pressure and max delivery pressure
4. Oil and Ambient temperature range
5. Rotation speed referred to function with mineral oil for other fluid consult Atos technical office
6. Direction of rotation
7. Pump model code
8. Pump serial number



PFEA



ATEX classification - for Gas group II

II 2/2 G	Ex	h	IIC	T5	Gb
Equipment Group **II** industrial **Equipment Category** **2/2** (1) **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T5** ≤ 100°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone 1)

ATEX classification - for Dust

II 2/2 D	Ex	h	IIIC	T100	Db
Equipment Group **II** industrial **Equipment Category** **2/2** (1) **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T100** ≤ 100°C	**Equipment Protection Level** **Db** High protection (Dust, Zone 21)

(1) Equipment of category 2 to be associated with a device (electric motor) of category 2

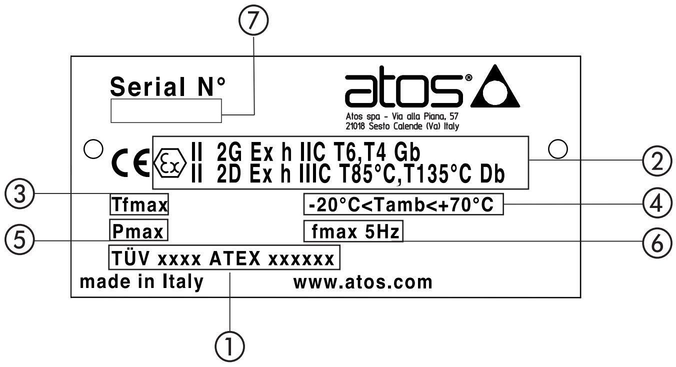
RELATED DOCUMENTATION

AX010 PVPCA - variable displacement axial piston pumps
PFEA - fixed displacement vane pumps

Nameplate marking to ATEX and IECEx

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22

1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. Max fluid temperature
4. Ambient temperature range
5. Max working pressure
6. Max working frequency
7. Cylinder serial number



ATEX - for Gas group II

II 2 G	Ex	h	IIC	T6 / T4	Gb
Equipment Group **II** industrial **Equipment Category** **2** High protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Gas Group** **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T4** ≤ 135°C	**Equipment Protection Level** **Gb** High protection (Gas, Zone 1)

ATEX - for Dust

II 2 D	Ex	h	IIIC	T85 / T135	Db
Equipment Group **II** industrial **Equipment Category** **2** High protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **h** Protection including c=constructional safety b=control of ignition source k=protection by liquid immersion	**Dust Group** **IIIC** Conductive Dust	**Temperature Class** **T85** ≤ 85°C **T135** ≤ 135°C	**Equipment Protection Level** **Db** High protection (Dust, Zone 21)

RELATED DOCUMENTATION

BX500	CKA - cylinders CKAM - servocylinders with ex-proof digital position transducer

Summary of Atos ex-proof components certified to cULus

c UL us LISTED

Atos cULus ex-proof components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments in presence of flammable liquids, gases, vapors or combustible dust.

They are certified by **UL** Underwriters Laboratories in conformity to **UL 1203, UL429, CSA C22.2** and relevant **NEC** standards.

1 PRODUCTS RANGE

Atos cULus certified ex-proof components range includes proportional valves and on-off valves.
The **UL** certification covers all electrical parts of solenoids and LVDT transducers.
These components are engineered and manufactured according to protection method **Ex d**, where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Driver	Environment	cULus certification		Marking
				NEC 500	NEC 505	
Proportional valves	Servoproportional directionals High preformance directionals Directional valves High performance pressure valves Pressure valves Flow valves	off-board	Gas	Class I Division I Groups C & D	Class I Zone 1 Groups IIA & IIB	see sect. 4
On-off valves	Directional valves Pressure relief valves	-	Gas			see sect. 5

2 FLAMEPROOF ENCLOSURE - Ex d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid in order to limit the surface temperature within certified classes (T6, T5, etc), to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure makes the ex-proof valves suited for application in harsh environments.

Electrical wiring

The electrical wiring to the terminal board of ex-proof solenoids and LVDT transducers must be performed using **UL** certified cable glands, or conduit pipe.
Electric cables must be **UL** approved for the specific temperature class reported on the ex-proof component's nameplate, refer to specific tech. table of ex-proof valves for cable temperature.

3 NAMEPLATE MARKING

Atos cULus certified ex-proof components are provided with a specific nameplate reporting the **UL** certificate number and the classification according to the relevant **NEC 500** and **NEC 505** standards.
The classification identifies the compatibility of the ex-proof component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for proportional and on-off valves.

3.1 cULus Listed logo

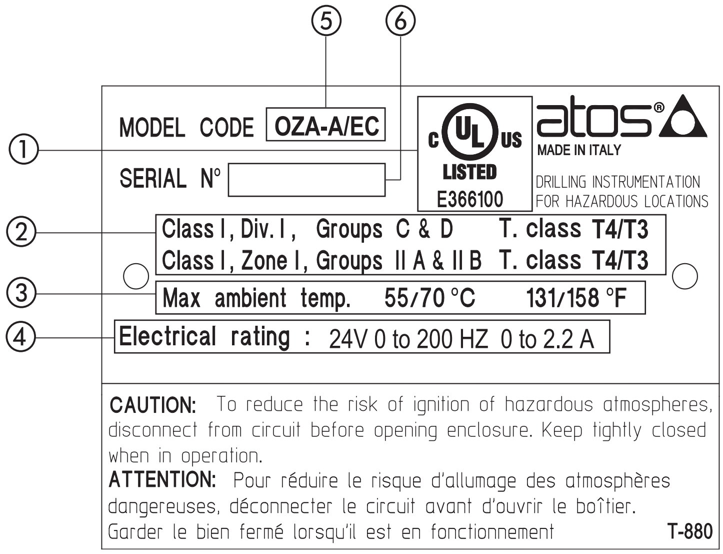
c UL us LISTED

This type of UL logo indicates compliance with both Canadian and U.S. requirements.
Atos ex-proof components are marked with **cULus Listed** logo stating that they have been investigated by UL Underwriters laboratory in accordance with following standards:

-**UL 1203** Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
-**UL 429** Standard for Electrically Operated valves
-**CSA C22.2 No. 139-13** Electrically Operated Valves

Solenoid nameplate marking to NEC 500 and NEC 505

Class I, Division I, Groups C & D
Class I, Zone 1, Groups IIA & IIB



1. cULus marking and certificate number
2. Marking according to NEC 500 and NEC 505 standards
3. Ambient temperature
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number

NEC 500 classification

Class I	Division I	Groups C & D	T4/T3
Class I Equipment for flamable Gas and Vapors	**Division I** Explosive substances continuosly or intermittently present in the atmosphere	**Gas Group** **C** Methane, Butane, Petrol, etc. **D** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C

NEC 505 classification

Class I	Zone 1	Groups IIA & IIB	T4/T3
Class I Equipment for flamable Gas and Vapors	**Zone 1** Location where explosive substance are continuosly present	**Gas Group** **IIA** Methane, Butane, Petrol, etc. **IIB** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T4** ≤ 135°C **T3** ≤ 200°C

RELATED DOCUMENTATION

Servoproportional directional - zero overlap with LVDT transducer

FX140 DLHZA/UL-T DLKZA/UL-T - direct, sleeve execution

High performance directional - positive overlap with LVDT transducer

FX120 DHZA/UL-T, DKZA/UL-T - direct

Directional valves - positive overlap without transducer

FX100 DHZA/UL-A, DKZA/UL-A - direct
FX200 DPZA/UL-A - piloted

Pressure valves - without pressure transducer

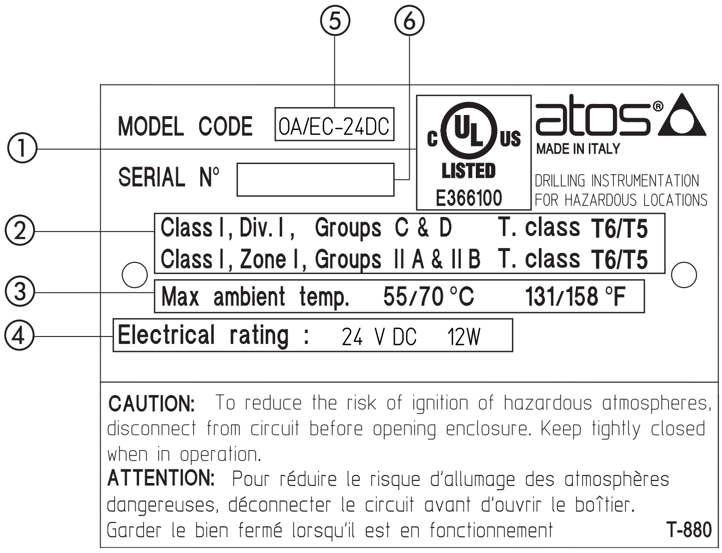
FX010 RZMA/UL-A, HZMA/UL-A, AGMZA/UL-A - relief
FX040 RZGA/UL-A, AGRCZA/UL-A, HZGA/UL-A, KZGA/UL-A - reducing
FX070 DHRZA/UL-A - reducing
FX300 LIMZA/UL-A - relief
LIRZA/UL-A - reducing
LICZA/UL-A - compensator

Flow valves, pressure compensated

FX420 QVHZA/UL-T, QVKZA/UL-T - with LVDT transducer
FX400 QVHZA/UL-A, QVKZA/UL-A - without transducer

Solenoid nameplate marking to NEC 500 and NEC 505

Class I, Division I, Groups C & D
Class I, Zone 1, Groups IIA & IIB



1. cULus marking and certificate number
2. Marking according to NEC 500 and NEC 505 standards
3. Ambient temperature
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number

NEC 500 classification

Class I	Division I	Groups C & D	T6/T5
Class I Equipment for flamable Gas and Vapors	**Division I** Explosive substances continuosly or intermittently present in the atmosphere	**Gas Group** **C** Methane, Butane, Petrol, etc. **D** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

NEC 505 classification

Class I	Zone 1	Groups IIA & IIB	T6/T5
Class I Equipment for flamable Gas and Vapors	**Zone 1** Location where explosive substance are continuosly present	**Gas Group** **IIA** Methane, Butane, Petrol, etc. **IIB** Ethylene, Formaldehyde, Cloruprophane, etc.	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C

RELATED DOCUMENTATION

Directional valves

EX010 DHA/UL - direct, spool type
EX020 DLAH/UL, DLAHM/UL - direct, poppet type
CART-LAH/UL, CART-LAHM/UL - cartridge screw-in, direct, poppet type
EX030 DPHA/UL – piloted, spool type
EX050 LIDEW-AO/UL, LIDBH-AO/UL - piloted ISO cartridges and functional covers

Pressure relief valves

CX010 AGAM-AO/UL, ARAM-AO/UL - piloted, with solenoid valve for venting

Summary of Atos ex-proof components certified to MA

Atos MA certified ex-proof components are electrohydraulic equipment designed to operate in hazardous environments of chinese underground mines with presence of methane-air atmosphere or coal dust.

They are certified by an independent notified body in conformity to Chinese Mining Products Safety Approval and Certification Center - **MA Center**.

Official notification by MA Center states that the product under consideration meets the applicable Regulations for the Implementation of the Law of the People's Republic of China on Safety in Mines.

1 PRODUCTS RANGE

Atos MA certified ex-prof range includes on-off solenoid directional valves, direct type.
Atos Sh extended range includes on-off solenoid directional valves, direct & piloted type, plus pressure relief with solenoid pilot.

The MA certification is relevant to the on-off solenoids.
They are engineered and manufactured according to protection method **Ex d**, where internal parts are sealed inside a ruggedized **flameproof enclosure**, granting high protection to the risk of explosion, see section 2 .

The mechanical parts likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Environment	MA Certification		Marking
On-off valves	Directional valves, direct & piloted Pressure relief valves	Gas	Ex d I Mb		see sect. 4

2 FLAMEPROOF ENCLOSURE - Ex d

Technical characteristics

It is characterized by a strong mechanical construction, capable of withstanding the overpressure caused by a potential internal explosion and preventing the spread of flames to the external environment. It permits to dissipate the heat generated by the solenoid and driver power, in order to limit the surface temperature, to avoid the self-ignition of the surrounding flammable atmosphere.
The rugged design of the flameproof enclosure, makes the ex-proof valves suited for application in harsh environments.

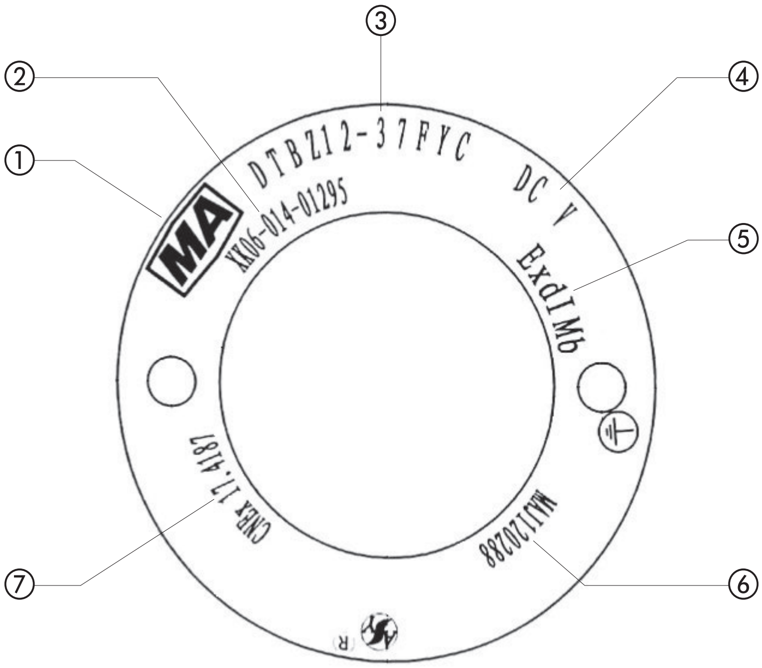
Electrical wiring
The MA certified ex-proof solenoids are provided with a built-in cable gland for the electrical wiring to the terminal board.

3 NAMEPLATE MARKING

Atos MA certified ex-proof components are provided with a specific nameplate reporting the MA certificate number, the notified body and the classification according to the MA certification.
The classification identifies the protection method and the compatibility of the ex-proof component for mining hazardous environment.
The following section provides a detailed description of the nameplate marking.

Nameplate marking to MA

Gas - group I Mb - Mining



1. MA logo
2. License
3. Solenoid model code
4. Power supply characteristics
5. MA classification for Mining
6. MA certificate number
7. Notified body and certificate number

MA classification - for Gas group I - Mining

Ex	d	I	Mb
Mark of Explosion Proof	**Protection Method** **d** Flameproof enclosure	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection

RELATED DOCUMENTATION

Directional valves

EX015 DHA/MA - DKA/MA direct, spool type

Directional valves (1)

SHX121 SDHA/MA, SDKA/MA - direct, spool type
SHX121 DPHA/MA - piloted, spool type

Pressure relief valves (1)

SHX121 SAGAM/MA - piloted, with solenoid valve for venting

(1) Atos Sh products range, see www.atos.com

Summary of Atos intrinsically safe components

certified to **ATEX** or **IECEx**

Atos intrinsically safe components are electrohydraulic equipment for industrial and mobile applications, designed to operate in hazardous environments of surface plants or underground mining with presence of flammable liquids, gases, or vapors.

They are designed to grant a very high protection, superior to ex-proof components, and suitable for hazardous environments classified **Zone 0** with high risk of explosion.

They are certified by independent notified bodies in conformity to **ATEX** or **IECEx** standards.

1 PRODUCTS RANGE

Atos intrinsically safe range includes on-off directional valves, pressure relief with solenoid pilot valve and power supply barriers.

1.1 On-off valves

The core of intrinsically safe valves is represented by the intrinsically safe solenoid.
It is engineered, manufactured and certified according to the intrinsically safe protection method **Ex i**, based on the principle of limiting the energy in the electric circuits.
The "intrinsically safe" circuit is virtually unable to produce electrical surges or thermic effects able to cause explosion in hazardous environments also in presence of break-down situations.
The Intrinsically safe equipment cannot release a sufficient electrical or thermal energy under normal or abnormal conditions to cause ignition of a specific hazardous mixture".
The intrinsically safe solenoids are designed to operate with a very low current and they must be powered by certified intrinsically safe power supply barriers.

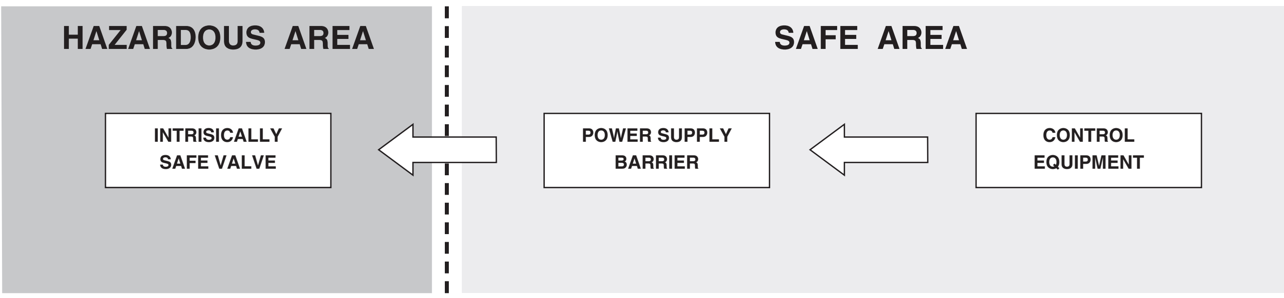
The mechanical parts of the valve likes body, spools, etc, are strictly derived from highly engineered standard components.
They are not involved in the certification since their functioning does not represent a potential risk for the explosive environment.

Product Category	Component	Environment	Certification				Marking
			ATEX Group II	IECEx Group II	ATEX Group I	IECEx Group I	
On-off valves	Directional valves Pressure relief valves	Gas	X				see sect. 3
				X			see sect. 4
		Mining			X		see sect. 5
						X	see sect. 6
Electronics	Power supply bariers	Gas & Dust	X	X			see sect. 7

1.2 Power supply barriers

The electric power supply to the intrinsically safe valves must be operated through electronic devices, to be located outside the hazardous environment.
These devices are usually called "safety barriers" because they limit the electric current to the intrinsically safe solenoid within the classified range, also in case of short circuit.

Atos barriers type Y-BXNE 412 are galvanic isolated electronic devices, designed in compliance with European Norms EN60079-0, EN60079-11 and ATEX certified with **Ex i** protection method – see tech table **GX010**
They ensure the optimized functioning of the Atos intrinsically safe valves up to the max operating limits.



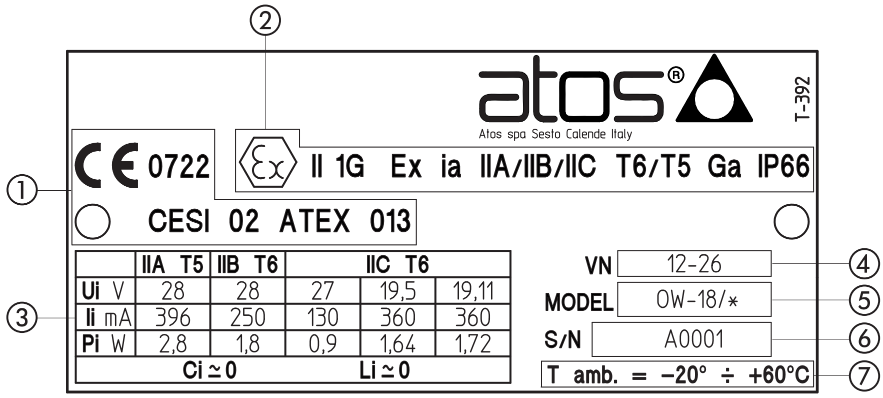
2 NAMEPLATE MARKING

Atos intrinsically safe components are provided with a specific nameplate reporting the ATEX or IECEx certificate number, the notified body and the classification according to the ATEX or IECEx certifications.
The classification identifies the protection method and the compatibility of the intrinsically safe component for a specific hazardous environment.
The following sections provide a detailed description of the nameplate marking for the intrinsically safe valves.

Nameplate marking to ATEX

Gas - group II 1G - Zone 0, 1, 2

1. ATEX notified body and certificate nember
2. Marking according to ATEX directive
3. Electric characteristics
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number
7. Ambient temperature



ATEX classification - for Gas group II

II 1G	Ex	ia	IIA / IIB / IIC	T6 / T5	Ga
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIA** Ammonia, Methane, Ethane, Propane, etc. **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C	**Equipment Protection Level** **Ga** Very high protection (Gas Zone 0)

RELATED DOCUMENTATION

Directional valves

EX100 DHW - direct, spool type
EX120 DLWH - direct, poppet type
EX130 DPHW - piloted, spool type
EX150 LIDEW-WO, LIDBH-WO - piloted ISO cartridges and functional covers

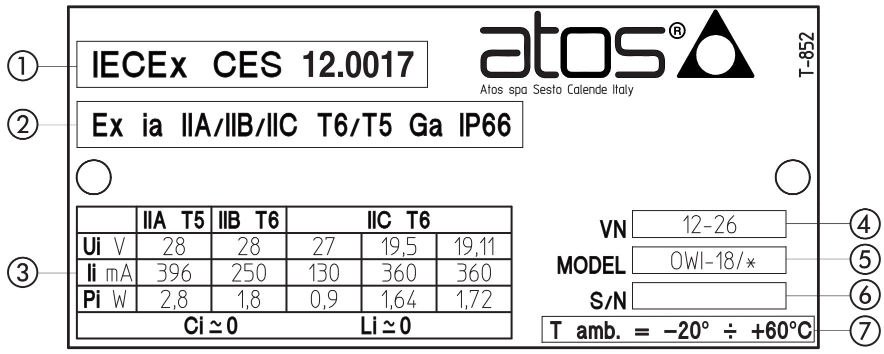
Pressure relief valves

CX030 AGAM-WO, ARAM-WO - piloted, with solenoid valve for venting

Nameplate marking to IECEx

Gas - group II 1G - Zone 0, 1, 2

1. IECEx notified body and certificate nember
2. Marking according to IECEx scheme
3. Electric characteristics
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number
7. Ambient temperature



IECEx classification - for Gas group II

Ex	ia	IIA / IIB / IIC	T6 / T5	Ga
Mark of Explosion Proof	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIA** Ammonia, Methane, Ethane, Propane, etc. **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene	**Temperature Class** **T6** ≤ 85°C **T5** ≤ 100°C	**Equipment Protection Level** **Ga** Very high protection (Gas Zone 0)

RELATED DOCUMENTATION

Directional valves

EX100 DHW/IE - direct, spool type
EX120 DLWH/IE - direct, poppet type
EX130 DPHW/IE - piloted, spool type
EX150 LIDEW/IE-WO, LIDBH/IE-WO - piloted ISO cartridges and functional covers

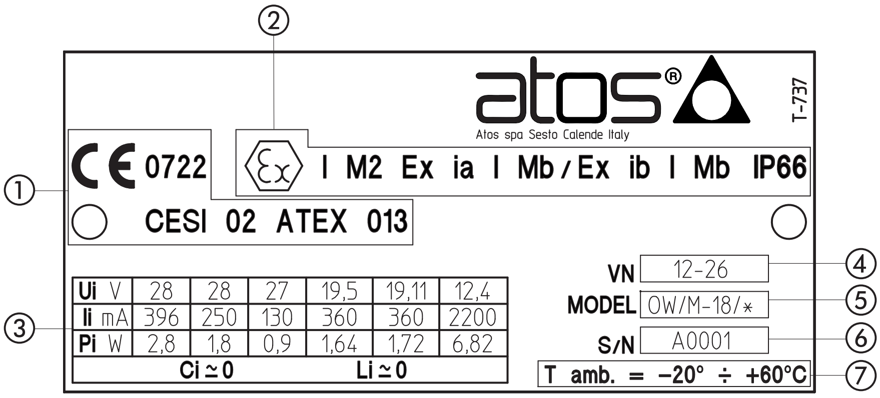
Pressure relief valves

CX030 AGAM/IE-WO, ARAM/IE-WO - piloted, with solenoid valve for venting

Nameplate marking to ATEX

Gas - group I M2 - Mining

1. ATEX notified body and certificate nember
2. Marking according to ATEX directive
3. Electric characteristics
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number
7. Ambient temperature



ATEX classification - for Gas group I - Mining

I M2	Ex	ia, ib	I	Mb
Equipment Group **I** Mines **Equipment Category** **M2** High protection	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0) **ib** Intrinsicaly safe (Gas Zone 1 and 2)	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX100 DHW/M - direct, spool type
EX120 DLWH/M - direct, poppet type
EX130 DPHW/M - piloted, spool type
EX150 LIDEW/M-WO, LIDBH/M-WO - piloted ISO cartridges and functional covers

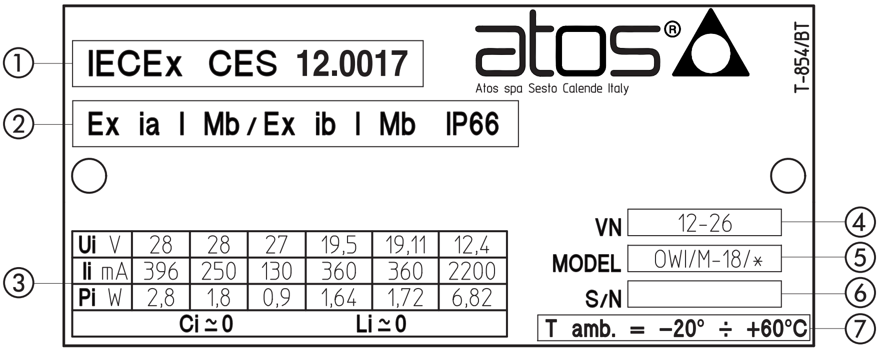
Pressure relief valves

EX030 AGAM/M-WO, ARAM/M-WO - piloted, with solenoid valve for venting

Nameplate marking to IECEx

Gas - group I Mb - Mining

① IECEx notified body and certificate nember
② Marking according to IECEx scheme
③ Electric characteristics
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number
⑦ Ambient temperature



IECEx classification - for Gas group I - Mining

Ex	ia, ib	I	Mb
Mark of Explosion Proof	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0) **ib** Intrinsicaly safe (Gas Zone 1 and 2)	**Gas Group** **I** Methane	**Equipment Protection Level** **Mb** High protection (de-energized with gas presence)

RELATED DOCUMENTATION

Directional valves

EX100 DHW//IEM - direct, spool type
EX120 DLWH/IEM - direct, poppet type
EX130 DPHW/IEM - piloted, spool type
EX150 LIDEW/IEM-WO, LIDBH/IEM-WO - piloted ISO cartridges and functional covers

Pressure relief valves

EX030 AGAM/IEM-WO, ARAM/IEM-WO - piloted, with solenoid valve for venting

Gas - group II 1G - Zone 0, 1, 2
Dust - group II 1D - Zone 20, 21, 22

ATEX and IECEx classification - for Gas group II

II 1G	Ex	ia	IIB / IIC
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **G** Gas	**Mark of Explosion Proof**	**Protection Method** **ia** Intrinsicaly safe (Gas Zone 0)	**Gas Group** **IIB** Citygas, Ethylene, Ethyl glycol, etc. **IIC** Hydrogen & Acetylene

ATEX and IECEx classification - for Dust group II

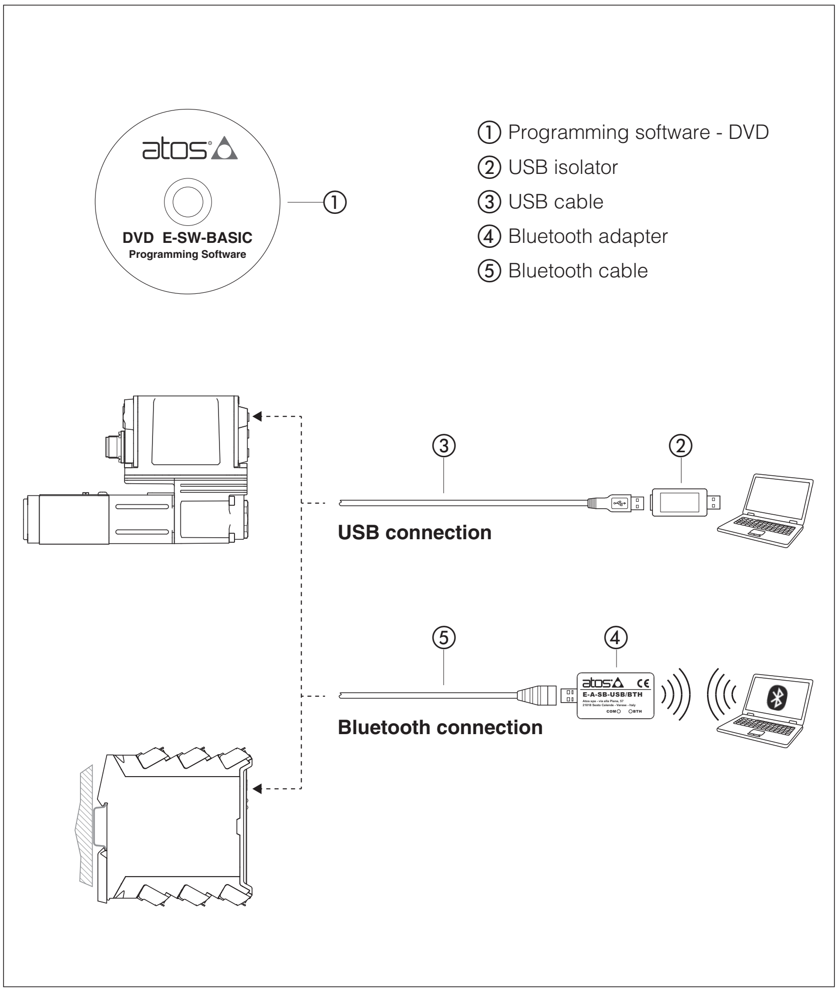
II 1D	Ex	ia D
Equipment Group **II** Industrial **Equipment Category** **1** Very high protection **Suitable for use** **D** Dust	**Mark of Explosion Proof**	**Protection Method** **ia D** Intrinsicaly safe (Dust Zone 20)

RELATED DOCUMENTATION

GX010 Y-BXNE Power supply barrier

Programming tools for digital electronics

Atos PC software, USB adapters, cables and terminators



The E-SW and Z-SW programming software are supplied in DVD format and can be easily installed on a desktop or a notebook computer. The intuitive graphic interface allows:
- set up valve's functional parameters
- verify the actual working conditions
- identify and quickly solve fault conditions
- adapt the factory preset parameters to the application requirements
- store the customized setting into the valve
- archive the customized setting into the PC

The graphic interface is organized in pages related to different specific groups of functions and parameters.

The software automatically recognizes the connected valve model and adapts the displayed parameter groups, according to the selected access level.

The software is available in different versions according to the driver and controller communication interfacing.

Fieldbus communication software includes also dedicated manuals and configuration files for user self management of the Atos electronics, using a fieldbus master.

Features:
- automatic valve recognition
- multilevel graphic interface
- numeric parameters settings (scale, bias, ramp, linearization, dither, etc.)
- real-time parameters modification
- diagnostic and monitor signals
- preset data storing into the digital driver and controller
- internal oscilloscope function
- internal database of customized preset

DVD contents:
- software installer
- user and fieldbus communication manuals
- fieldbus configuration files

1 PROGRAMMING SOFTWARE

Valve functional parameters can be easily set up with Atos E-SW / Z-SW programming software using proper connection to the digital driver/controller.

E - SW	-	BASIC	/	*	-	*

E-SW = for valve drivers

Supported valve drivers communication:

BASIC	= NP (USB)	PS (Serial)	IR (Infrared)
FIELDBUS	= BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Option:
PQ = for valve drivers with alternated P/Q controls SP, SF, SL

Supplies:
- = first supply
N = next supply

Note: E-SW-*/PQ software supports also valve drivers without P/Q control

Z - SW	-	FULL	-	*

Z-SW = for axis controllers

Supported axis controllers communication:

FULL	= NP (USB)	PS (Serial)	
	BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)
	EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)

Supplies:
- = first supply
N = next supply

1.1 Programming software versions

Different software versions are available according to the valve drivers / axis controllers type to be connected and communication interface.

Note: E-SW / 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 **E-SW-BASIC/PQ** **E-SW-FIELDBUS** **E-SW-FIELDBUS/PQ** **Z-SW-FULL**	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 personal 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 next supplies of programming software, to be ordered separately:

E-SW-BASIC-N **E-SW-BASIC/PQ-N** **E-SW-FIELDBUS-N** **E-SW-FIELDBUS/PQ-N** **Z-SW-FULL-N**	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.

Notes: the software BASIC, FIELDBUS and FULL are NOT interchangeable and must 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/controllers

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

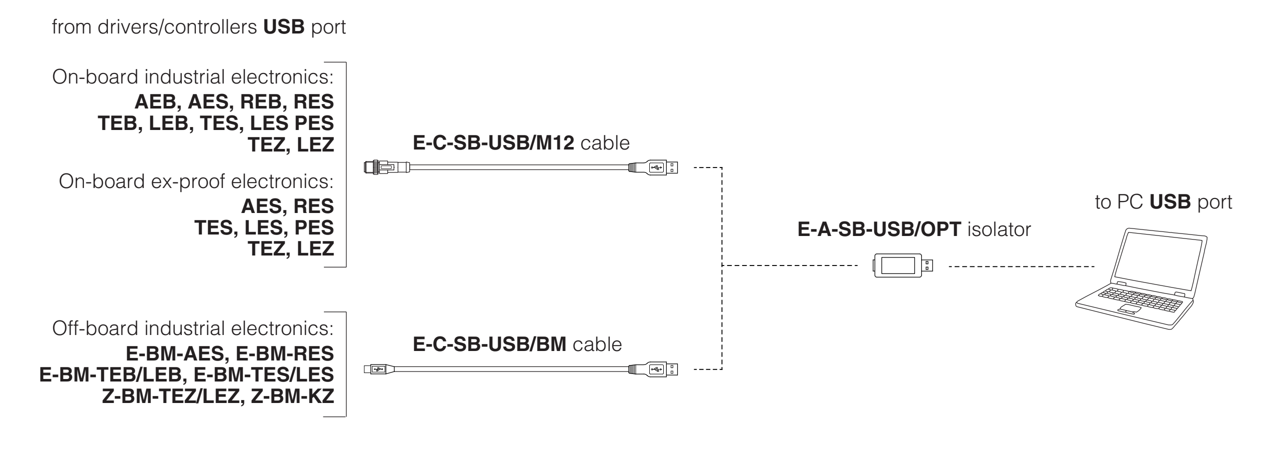
Personal Computer	Pentium® processor 1GHz or equivalent	**Memory**	512 MB RAM + Hard Disk with 250MB free space
Operating System	Windows XP SP3	**Device**	DVD reader
Monitor Resolution	1024 x 768	**Interface**	Serial RS232 port (only for PS) or USB port

2 USB connection - ISOLATOR AND CABLE

E-SW / Z-SW software permit valve's parameterization through USB port.

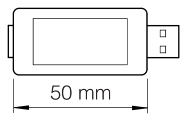
2.1 Connection tools by driver/controller type

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/controllers 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/controllers.

2.2 E-A-SB-USB/OPT - isolator adapter

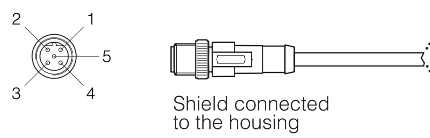


- USB 2.0 Full speed (12 MBps)
- electrical isolation 1 kV
- temperature range, -40° ÷ +50° (relative humidity 25% ÷ 75%)
- external power supply not required (power 400 mA output, 5 V ±10%)
- MTBF >1,2 million hours (MIL standard)

2.3 E-C-SB-USB/M12 - 4 m cable - only for on-board industrial and ex-proof electronics

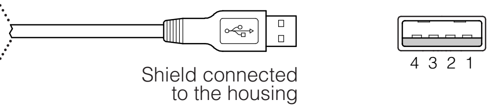
Connector to on-board driver/controller side
M12 - 5poles - male

Connector to PC side
USB type A - male



1	+5V_USB **(1)**		
2	ID **(1)**		
3	GND_USB	GND_USB	4
4	D -	D -	2
5	D+	D+	3

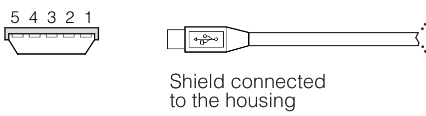
(1) do not connect



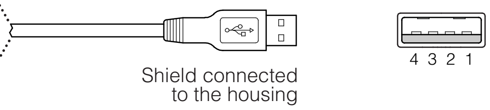
2.4 E-C-SB-USB/BM - 3 m cable - only for off-board industrial electronics

Connector to off-board driver/controller side
Mini USB type B - male

Connector to PC side
USB type A - male



1	+5V_USB	+5V_USB	1
2	D -	D -	2
3	D+	D+	3
4	ID		
5	GND_USB	GND_USB	4

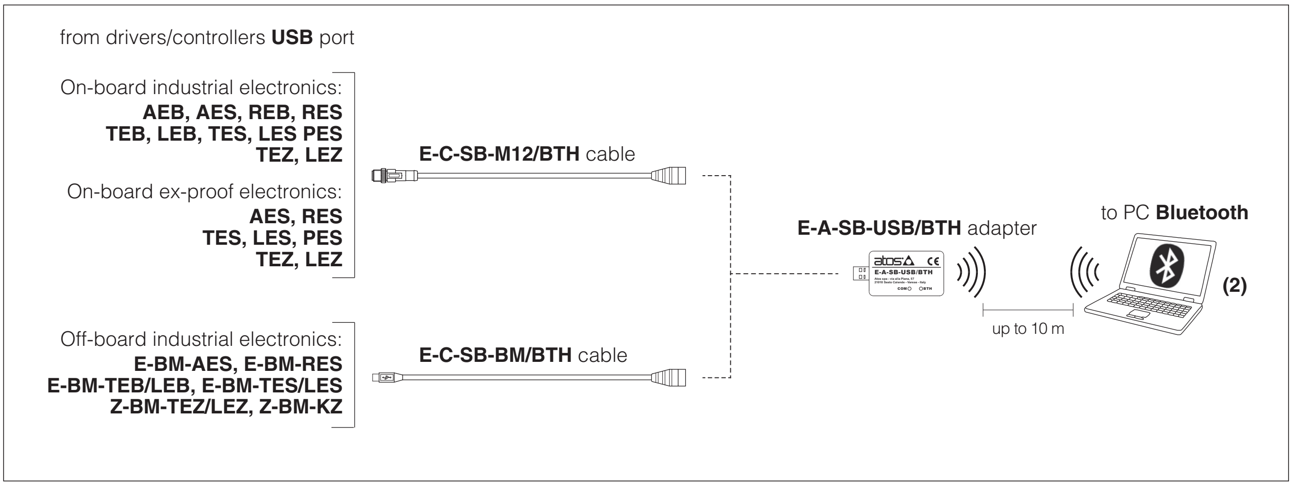


3 BLUETOOTH connection - ADAPTER AND CABLE

E-SW / Z-SW software permit valve's parameterization through Bluetooth **(1)**.

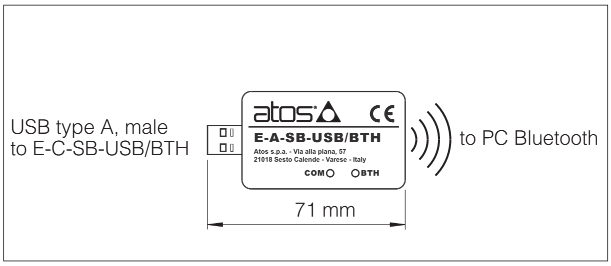
3.1 Connection tools by driver/controller type

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



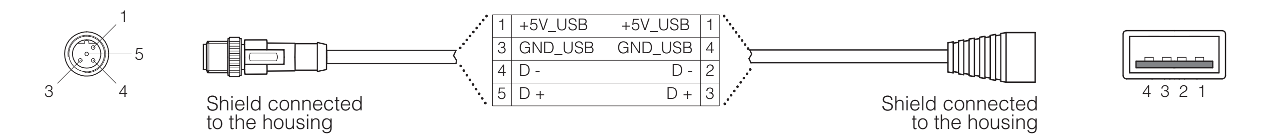
- USB male connector, type A
- type of radio interface: Bluetooth Class 2
- temperature range, -20 ÷ +70 °C (storage -40 ÷ +70 °C)
- external power supply not required (from Atos drivers/controllers only)
- protocol: Bluetooth Classic Version 2.x , 3.x supporting Serial Port Profile (SPP Profile)
- max 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 European, USA and Canadian markets!
Bluetooth adapter is certified according to RED (Europe), FCC (USA) and ISED (Canada) directives

3.3 E-C-SB-M12/BTH - 0,4 m cable - only for on-board industrial and ex-proof electronics

Connector to on-board driver/controller side
M12 - 4poles - male

Connector to Bluetooth adapter side
USB type A - female

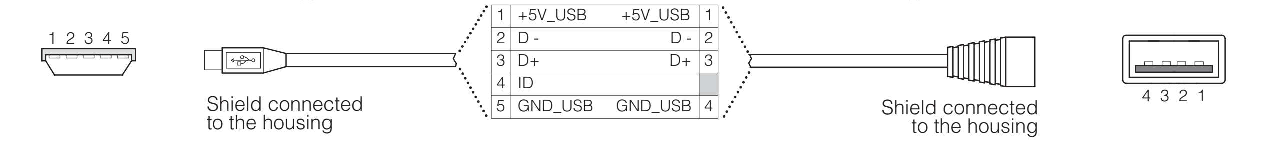


1	+5V_USB	+5V_USB	1
3	GND_USB	GND_USB	4
4	D -	D -	2
5	D +	D +	3

3.4 E-C-SB-BM/BTH - 0,2 m cable OTG - only for off-board industrial electronics

Connector to off-board driver/controller side
Mini USB type B - male

Connector to Bluetooth adapter side
USB type A - female

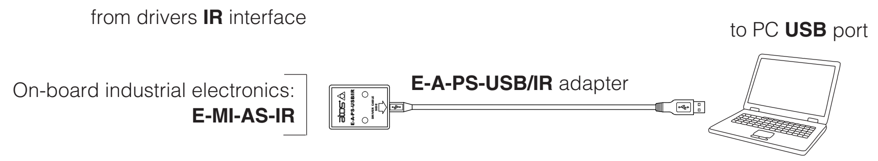


1	+5V_USB	+5V_USB	1
2	D -	D -	2
3	D+	D+	3
4	ID		
5	GND_USB	GND_USB	4

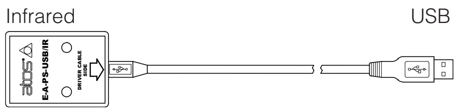
4 IR infrared - USB COMMUNICATION ADAPTER - only for **E-MI-AS-IR** drivers

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 by driver type



4.2 E-A-PS-USB/IR - 3 m adapter

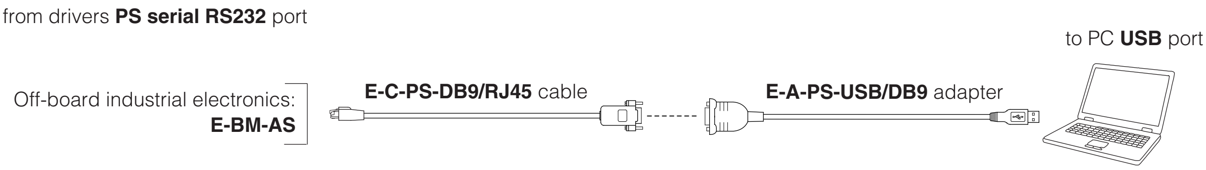


- direct infrared communication with the driver
- USB male connector, type A
- plug-in format for direct infrared connection on the driver
- transmission rate 9,6 kbit/s
- external power supply not required (USB supply)

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 by driver type



Note: the adapter is not required if PC is already equipped with a serial RS232 communication port

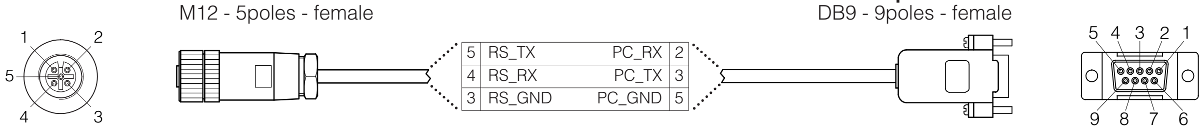
5.2 E-A-PS-USB/DB9 - 0,45 m adapter

- 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/M12 - 4 m cable

Connector to driver side
M12 - 5poles - female

Connector to adapter/PC side
DB9 - 9poles - female



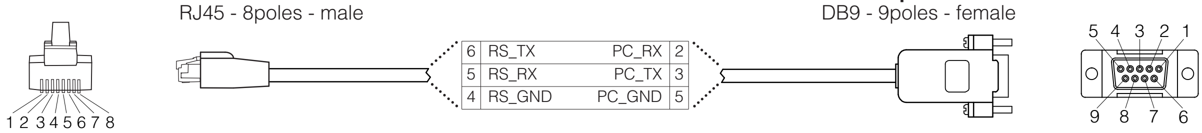
5	RS_TX	PC_RX	2
4	RS_RX	PC_TX	3
3	RS_GND	PC_GND	5

Connect the cable shield to the metallic housing of DB9 connector

5.4 E-C-PS-DB9/RJ45 - 2,5 m cable

Connector to driver side
RJ45 - 8poles - male

Connector to adapter/PC side
DB9 - 9poles - female



6	RS_TX	PC_RX	2
5	RS_RX	PC_TX	3
4	RS_GND	PC_GND	5

Connect the cable shield to the metallic housing of DB9 connector

6 ETHERNET CABLE WIRING DIAGRAM - only for EH, EW, EI and EP

Typical ethernet cable wiring diagram from industrial M12 connectors to standard RJ45 ethernet connectors.

Connect the cable shield to the metallic housing of M12 connector

7 FIELDBUS TERMINATORS - only for BC and BP

For TES, LES, PES, TEZ, LEZ series 40 or higher in BC and BP executions, the fieldbus terminator has to be used.

Note: fieldbus terminators not available for ex-proof electronics

E - TRM - **BC** - **M12** / **5PM**

Terminator

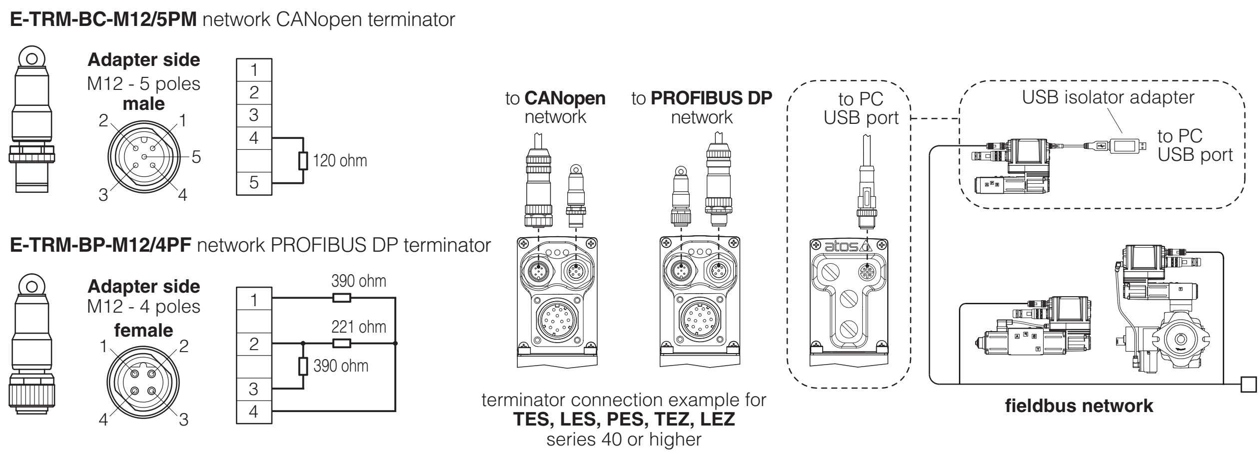
Fieldbus interfaces:
BC = CANopen
BP = PROFIBUS DP

Connector:
M12 = from M12 output fieldbus connector, drivers/controllers

Connector:
5PM = to BC executions, drivers/controllers
4PF = to BP executions, drivers/controllers

7.1 M12 - terminators for fieldbus network

The fieldbus terminators are required when output fieldbus connector has to be used as network end point.



8 FIRMWARE UPDATE

It is possible to update the firmware of the following digital drivers and controllers, 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-BM-AES s10 E-BM-RES s10	E-RI-TEB s10 E-RI-LEB s10	E-BM-TEB s10 E-BM-LEB s10	E-RI-TES s40 E-RI-LES s40	E-BM-TES s10 E-BM-LES s10	E-RI-TES-S s40 E-RI-LES-S s40	E-BM-TES-S s10 E-BM-LES-S s10	E-RI-PES-S s40
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		

9 RECCOMENDED TOOLS SELECTION

9.1 Industrial and ex-proof electronics

	Model Code	Series	Software	Cable	USB Adapter	Terminator
IR	E-MI-AS-IR	11	E-SW-BASIC		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-C-SB-USB/BM	E-A-SB-USB/OPT	
	E-BM-TEB, E-BM-LEB, E-BM-TES, E-BM-LES **(1)**	10 or higher				
	AEB, REB **(1)**	10 or higher		E-C-SB-USB/M12		
	TEB, LEB **(1)**	10 or higher				
	TES, LES **(1)**	40 or higher				
	TES, LES, PES with SP, SF, SL options **(1)**	40 or higher	E-SW-BASIC/PQ			
	E-BM-TES, E-BM-LES with SP, SF, SL options **(1)**	10 or higher		E-C-SB-USB/BM		
	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-TES, 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-TES, 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/controllers compatible with Bluetooth adapter E-A-SB-USB/BTH (see 3.1)

9.2 Phase out 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		E-C-PS-DB9/DB9		
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/M12		E-TRM-BP-DB9/DB9
	TES, LES, PES with SP, SF, SL options	31	E-SW-FIELDBUS/PQ			
	TEZ, LEZ	10	Z-SW-FULL		E-A-PS-USB/DB9	
	Z-ME-KZ-PS/BP	10 or higher		E-C-PS-DB9/DB9	E-A-PS-USB/DB9	
BC	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M12	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/M12	E-A-BC-USB/DB9	E-TRM-BC-DB9/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	

9.3 Phase out ex-proof electronics

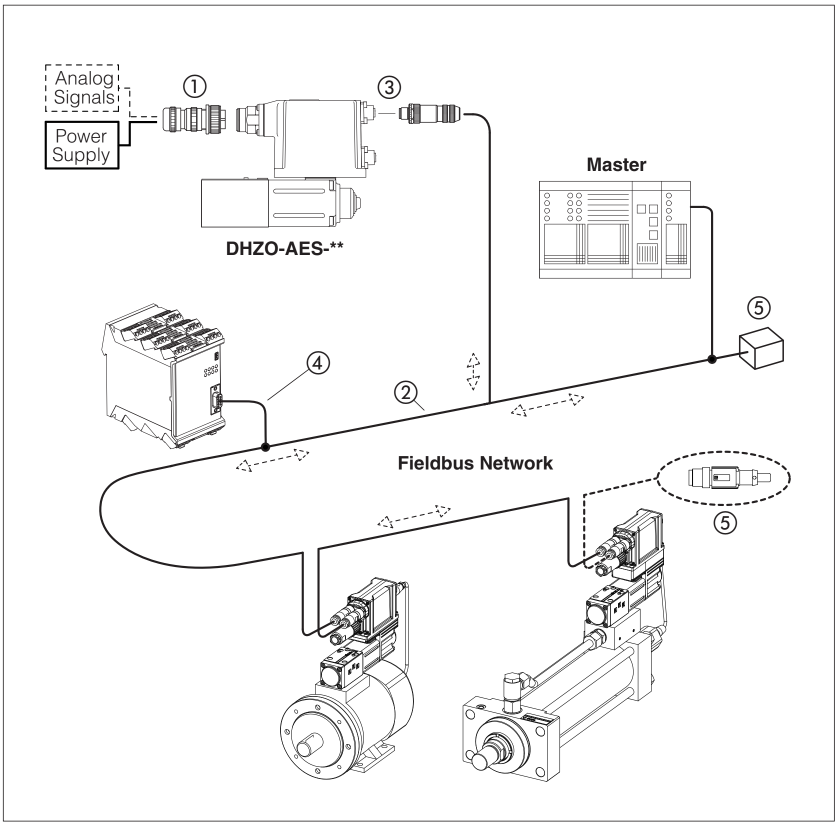
	Model Code	Series	Software	Cable	USB Adapter	Terminator
PS	AES	30	E-SW-BASIC	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31				
BP	AES	30	E-SW-FIELDBUS	E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BP-DB9/RA	E-A-BP-USB/DB9	E-TRM-BP-DB9/DB9
BC	AES	30		E-C-PS-DB9/M8	E-A-PS-USB/DB9	
	AERS, TERS, TES, LES	31		E-C-BC-DB9/RA	E-A-BC-USB/DB9	E-TRM-BC-DB9/DB9

atos

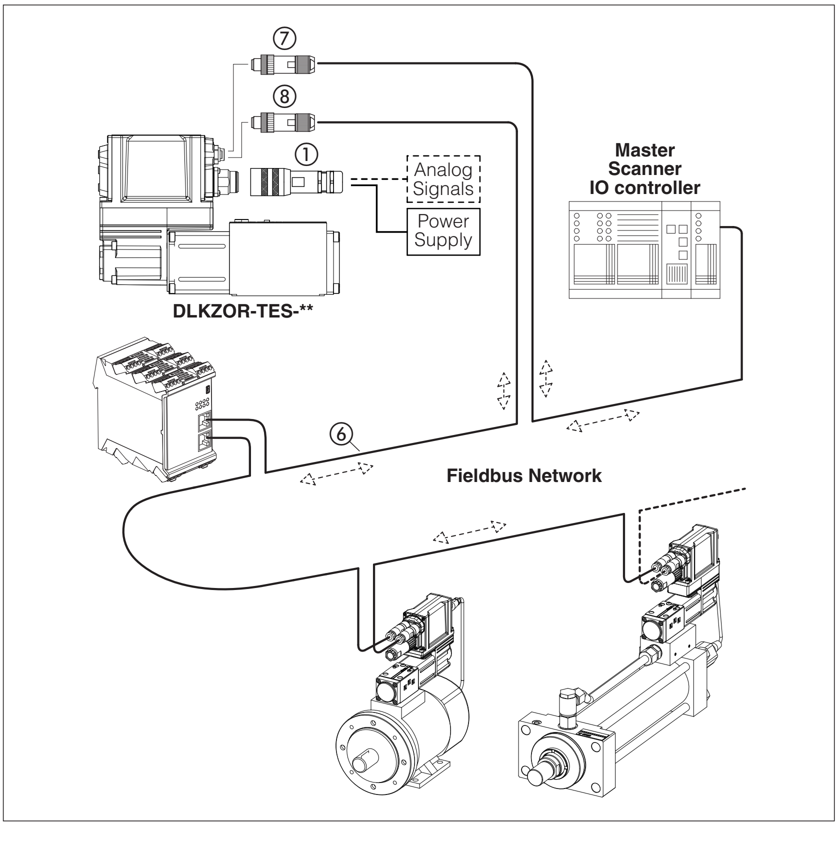
Fieldbus features

BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT), EW (POWERLINK), EI (EtherNet/IP), EP (PROFINET RT/IRT)

Typical CANopen or PROFIBUS DP fieldbus network



Typical EtherCAT, POWERLINK, EtherNet/IP or PROFINET RT/IRT 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.

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-TES, 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-TES, 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/adapter (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

Real-time communication

PZD: Process data area of PPO telegram by Data Exchange, default SAP:
cyclic transmission of standard Profibus frame

Standard electronics - drivers

PPO type 3, 113, 213, 230 for:
AES, BM-AES, TES, BM-TES, LES, BM-LES, RES, BM-RES

PPO type 5, 115, 214, 240 for:
TES, BM-TES, 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

Non real-time communication

PKW: Parameter data area of PPO telegram by Data Exchange, default SAP:
acyclic transmission of standard Profibus frame

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

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)

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/adapter (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

Physical

Serial input format	Industrial fieldbus type Fast Ethernet galvanically insulated IEC 61158-2
Transmission rate	2 x 100 Mbit/s (Fast Ethernet, Half-Duplex)
Max node	239 slaves
Ethernet Standard	ISO/IEC 8802-3 frame format
EtherType	0x88AB according to IEEE 802.3
Integrated Hub	
Cable length	0,2 - 100m (between two slave devices)
Cable type	CAT5 (4 wire twisted pair) according with T568B
Network topology	Line, tree, star, daisy chain, ring structure or any combination of these topologies
Ethernet Hub	Integrated with 2 ports: - one led for Link/Activity indicator (on each port) - one bicolor led Status/Error indicator

Communication Protocol

Data Link Layer	POWERLINK use Standard Ethernet Frames: ISO/IEC 8802-3 + IEC 61784-2
Comm. Profile	EPSG DS 301 v1.2
Device Profile	CANopen over Ethernet based on DS408 - Fluid Power Technology
Device type	Slave - supported features: - Ethernet POWERLINK v2.0 - Ring Redundancy - Support PollRsponse Chaining - Support Multiplexing - Cycle time min 200 μsec - SDO Multiple Parameter Read/Write

Startup and configuration (as per EPSG DS301 + EPSG DS 302-A/B/C/D/E)

Node setting	E-SW-FIELDBUS and Z-SW-FULL programming software
Baudrate	100 Mbit/s (Automatic)

Fieldbus communication diagnostic

Custom parameters mappable on TPDO for emergency diagnosis

Real-time communication (as per EPSG DS301 + DS408)

RPDO	1 PDO message to the driver (max number of of mapping parameters is Device specific)
TPDO	1 PDO message from the driver (max number of of mapping parameters is Device specific)

Standard references

EPSG DS301
Ethernet POWERKLINK
Communication Profile Specification v 1.2

EPSG DS302-A/B/C/D/E
Ethernet POWERKLINK
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

EPSG DS311
Ethernet POWERKLINK
XML Device Description v 1.0

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

IEC 61784-3
Industrial communication networks
- Profiles -
Part 3: Functional safety fieldbuses - General rules and profile definitions

IEC 61158-300/400/500/600
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

ISO 15745-1
Industrial automation systems and integration - Open systems application integration framework -
Part 1: Generic reference description

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

5 EtherNet/IP features for digital drivers and controllers in EI execution

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/adapter (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

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

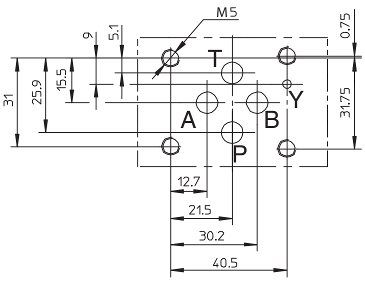
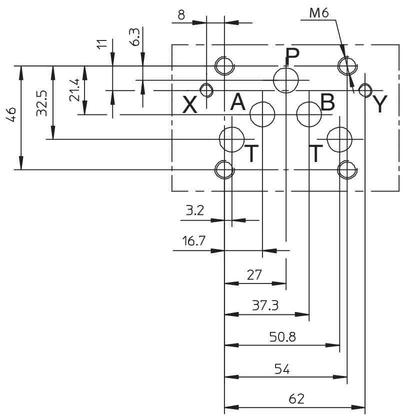
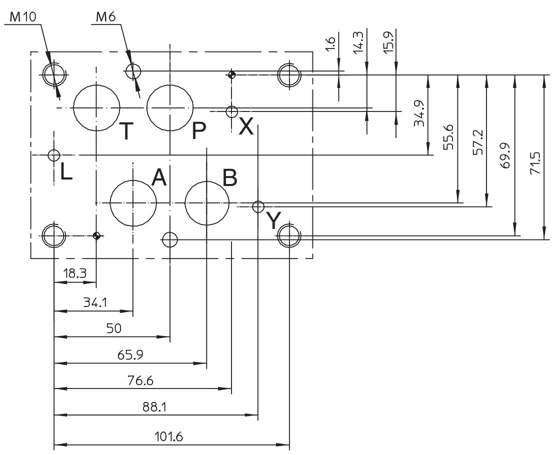
Manuals

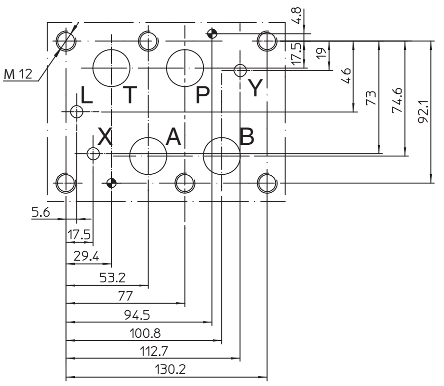
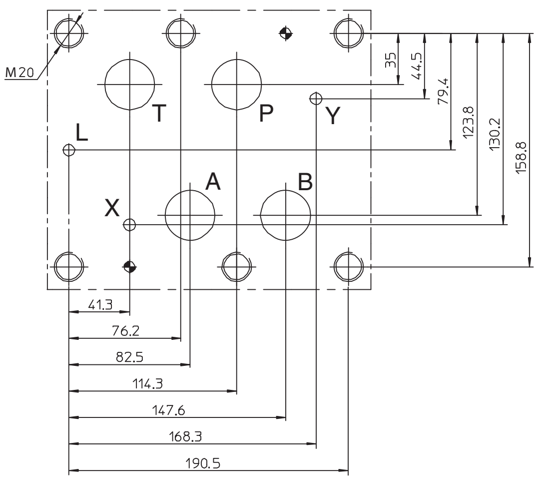
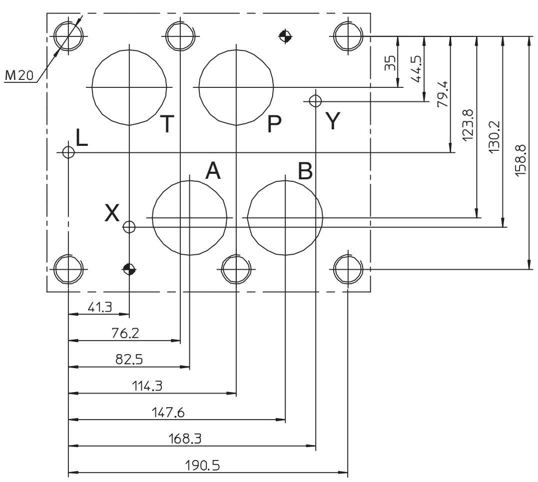
E-MAN-S-EP and STARTUP-FIELDBUS, enclosed in programming software DVD E-SW-FIELDBUS
Z-MAN-S-EP and STARTUP-FULL, enclosed in programming software DVD Z-SW-FULL

Mounting surfaces for electrohydraulic valves

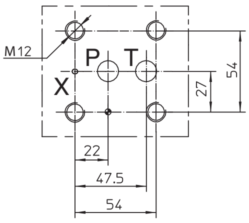
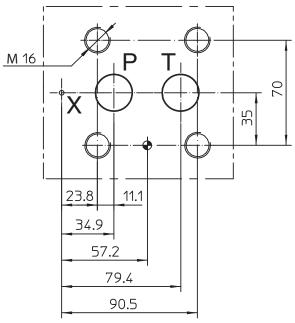
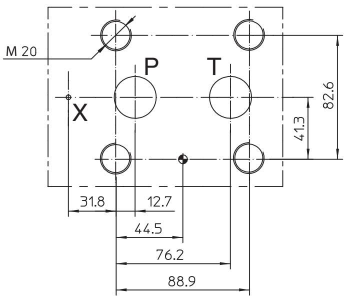
ISO standard, for directional, pressure and flow control valves plus pressure switches

1 ISO 4401: 2005 - for directional, pressure and flow control valves

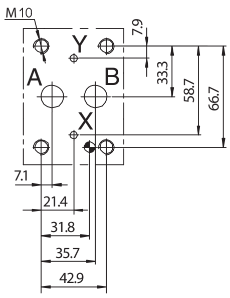
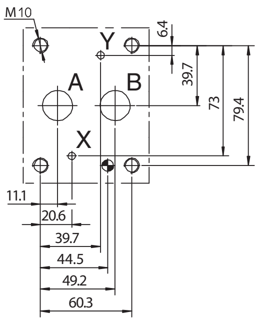
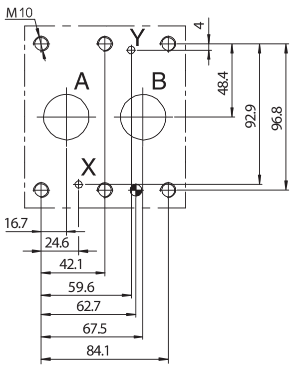
Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	**ex-proof**
	**4401-03-02-0-05** P, A, B, T = Ø 7,5 max without Y port	DH* DLOH / DLOK DLEH / DLEHM QV-06 RZMO RZGO DHZE / DHZO DLHZO QVH* H* (modular)	DHA / DHW DLAH / DLWH RZMA RZGA DHZA DLHZA QVHZA
Y port only for 4401-03-03-0-05	**4401-03-03-0-05** P, A, B, T = Ø 7,5 max Y = Ø 3,3 max	DHZO / Y DLHZO / Y	DHZA / Y DLHZA / Y
	**4401-05-04-0-05** P, A, B, T = Ø 11,2 max without X and Y port	DKE DKZOR DLKZOR QVKZOR K* (modular)	DKZA DLKZA QVKZA
X and Y port only for 4401-05-05-0-05	**4401-05-05-0-05** P, A, B, T = Ø 11,2 max X, Y = Ø 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 = Ø 17,5 max Y = Ø 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
	**4401-08-08-0-05** P, A, B, T = Ø 25 max X, Y, L = Ø 11,2 max	DP-4* DPH*-4* DPZO-*-4* JP*-3* (modular)	DPHA-4 / DPHW-2 DPZA-*-4
	**4401-10-09-0-05** P, A, B, T = Ø 32 max X, Y, L = Ø 11,2 max	DP-6* DPH*-6* DPZO-*-6*	DPHA-6 DPZA-*-6
	**4401-10-09-0-05** P, A, B, T = Ø 50 max X, Y, L = Ø 11,2 max	DPZO-*-8*	-

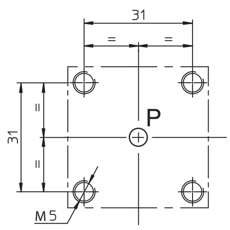
2 ISO 6264: 2007 - for pressure relief valves

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type	
		industrial	ex-proof
	**6264-06-09-1-97** P, T = Ø 14,7 max X = Ø 4,8 max	AGAM-10 AGMZO-*-10	AGAM-10 / AO AGAM-10 / WO AGMZA-*-10
	**6264-08-11-1-97** P, T = Ø 23,4 max X = Ø 6,3 max	AGAM-20 AGMZO-*-20	AGAM -20 / AO AGAM-20 / WO AGMZA-*-20
	**6264-10-17-1-97** P, T = Ø 32 max X = Ø 6,3 max	AGAM-32 AGMZO-*-32	AGAM-32 / AO AGAM-32 / WO AGMZA-*-32

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**
	**5781-06-07-0-00** A, B = Ø 14,7 max X, Y = Ø 4,8 max	AGIS-10 AGIR-10 AGIU-10 AGRL*-10 AGRCZO-*-10	AGRCZA-*-10
	**5781-08-10-0-00** A, B = Ø 23,4 max X, Y = Ø 4,8 max	AGIS-20 AGIR-20 AGIU-20 AGRL*-20 AGRCZO-*-20	AGRZA-*-20
	**5781-10-13-0-00** A, B = Ø 32 max X, Y = Ø 4,8 max	AGIS-32 AGIR-32 AGIU-32 AGRL*-32	-

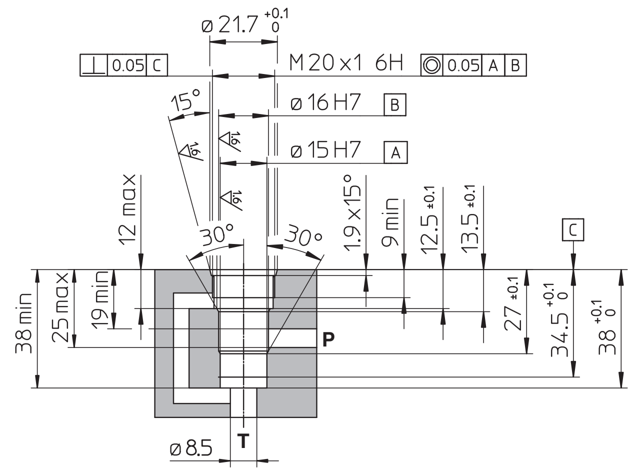
4 **ISO 16873: 2002 - for pressure switches**

Mounting surfaces dimensions [mm]	ISO code / ports size [mm]	Valve type
	**16873-01-01-0-02** P = Ø 4 max	MAP

Mounting surfaces and cavities for cartridge valves

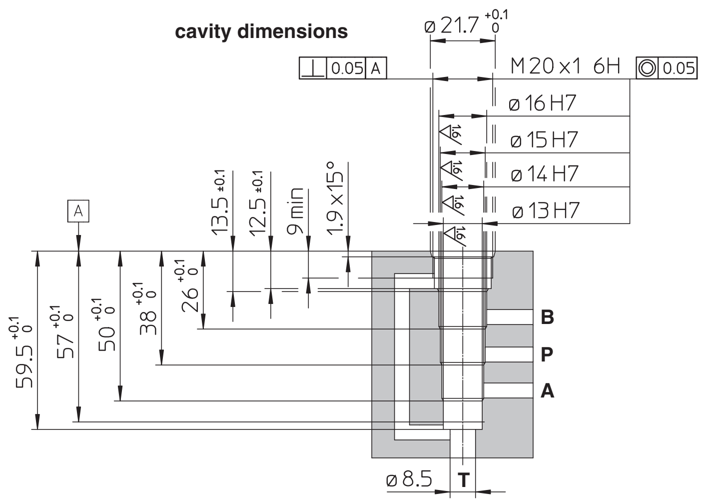
1 CAVITIES DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES type CART-LEH, CART-LEHM [mm]

CAVITY for CART-LEH 2 way

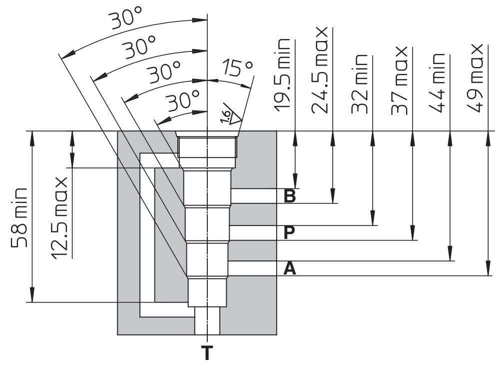


CAVITY for CART-LEH 3 way

cavity dimensions

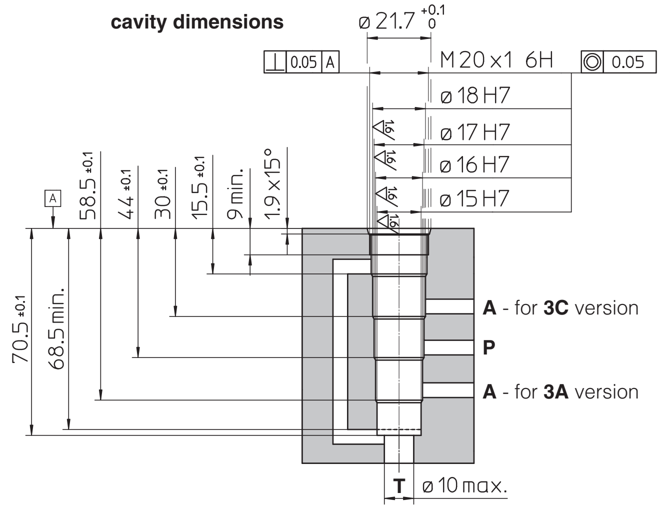


cavity edges and P, A, B, T connections

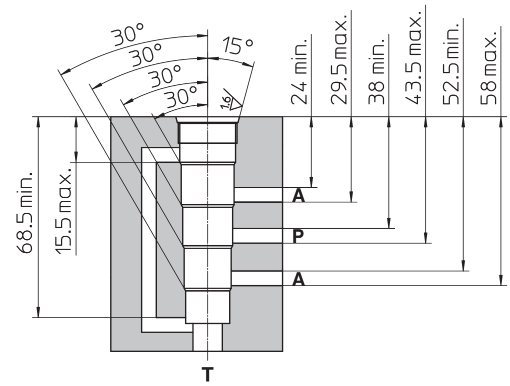


CART-LEHM 3 way

cavity dimensions

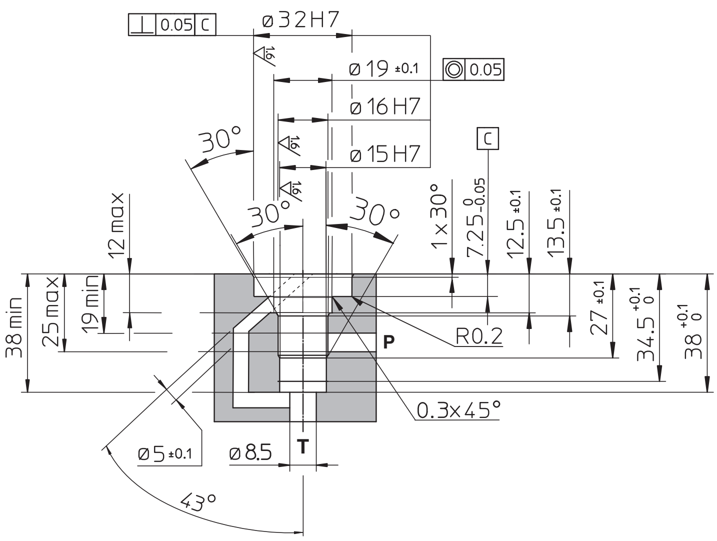


cavity edges and P, A, T connections



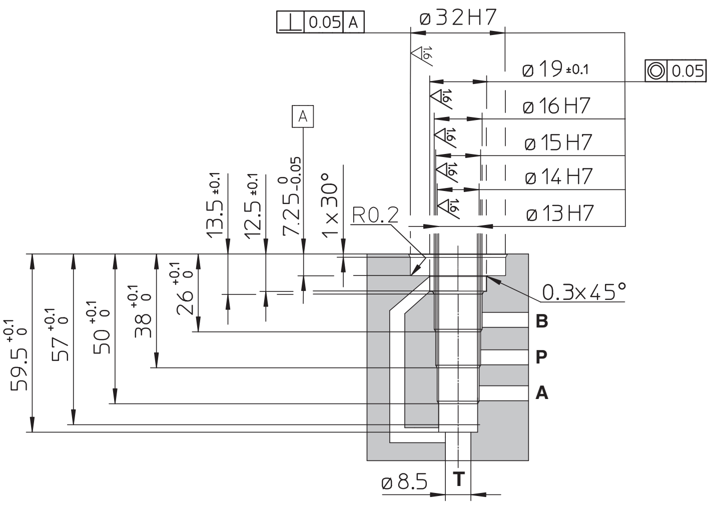
2 **CAVITIES DIMENSIONS for 2 WAY and 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAH [mm]**

CAVITY for CART-LAH 2 way

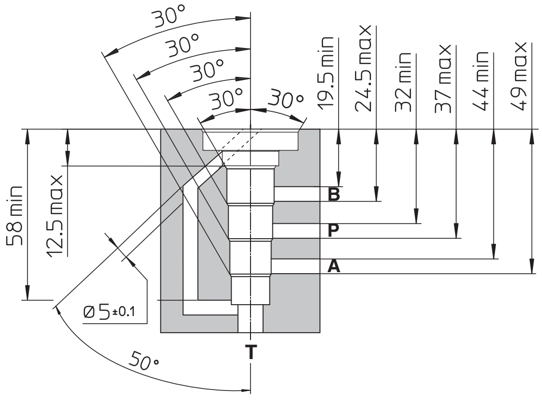


CAVITY for CART-LAH 3 way

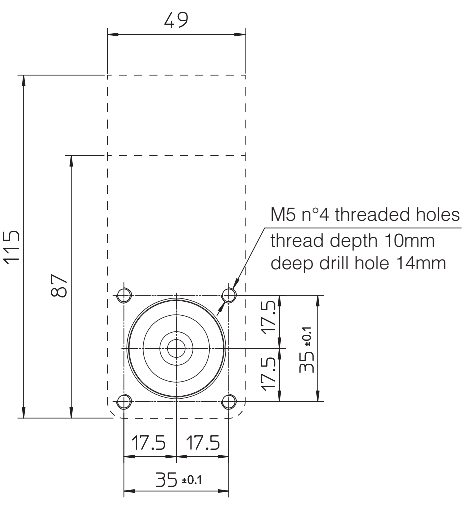
cavity dimensions



cavity edges and P, A, B, T connections



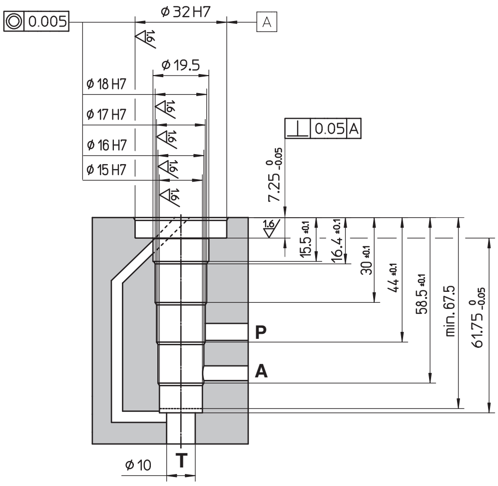
MOUNTING SURFACE for CART-LAH 2 and 3 way



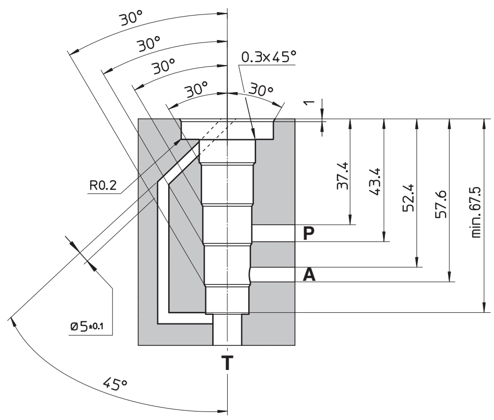
3 CAVITIES DIMENSIONS for 3 WAY EX-PROOF CARTRIDGE VALVES type CART-LAHM [mm]

CAVITY for CART-LAHM-3A

cavity dimensions

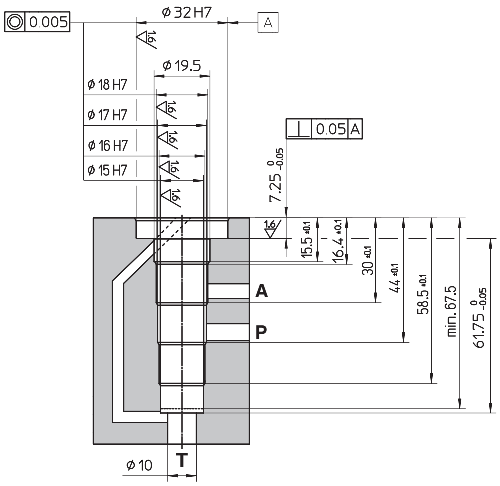


cavity edges and P, A, T connections

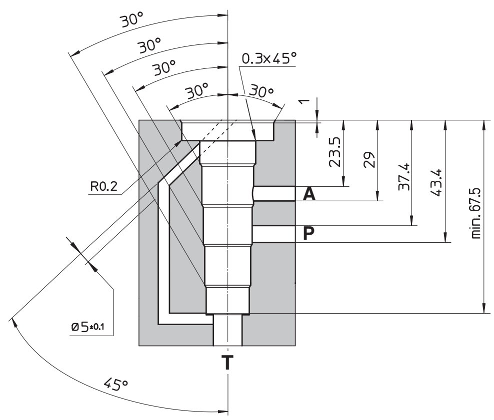


CAVITY for CART-LAHM-3C

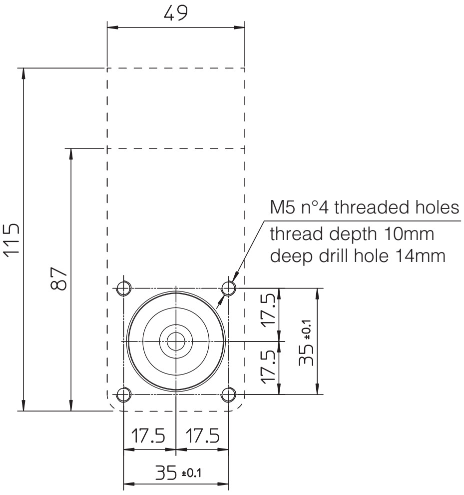
cavity dimensions



cavity edges and P, A, T connections

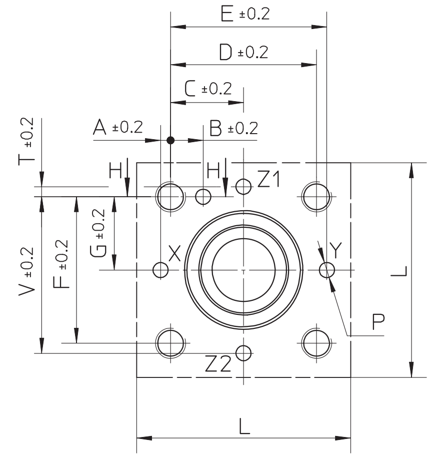


MOUNTING SURFACE for CART-LAHM 3 way



4 ISO 7368 COVER INTERFACE DIMENSIONS for 2 WAY and 3 WAY CARTRIDGE VALVES [mm]

Size from 16 to 63



VALVE TYPE

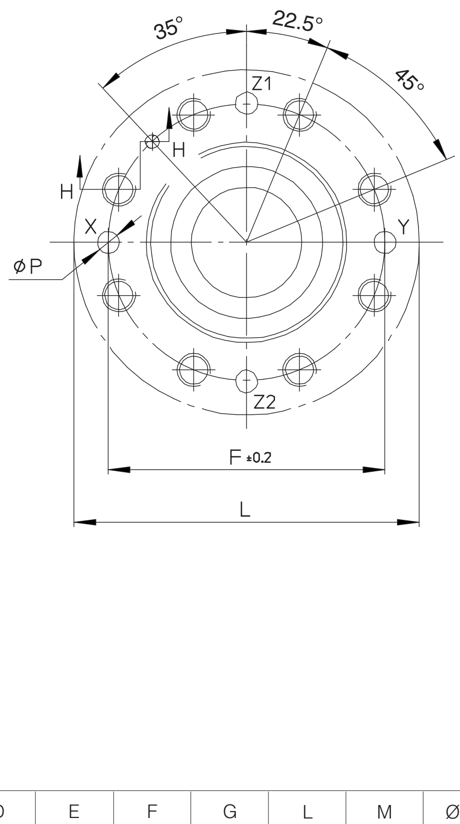
on off

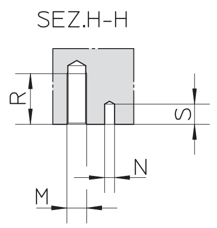
LIM
LIR
LIC
LIQV
LIDD
LIDEW
LIDBH
LIDO
LIDB
LIDR
LIDAS

proportional

LIQZO-T*
LIQZO-L* 2 way
LIQZO-L* 3 way
LIQZP-L* 2 way
LIQZP-L* 3 way

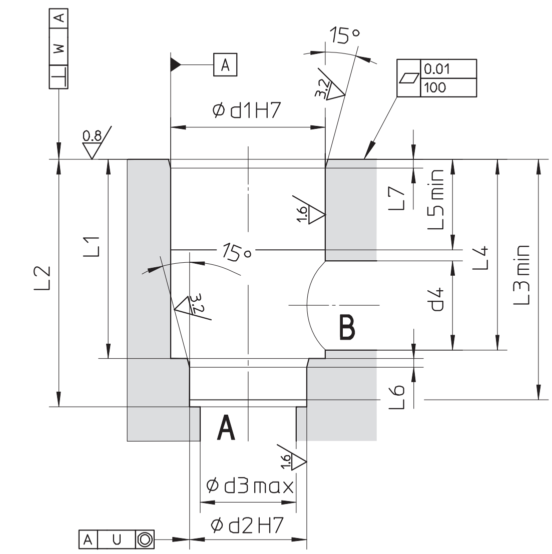
Size 80 and 100





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

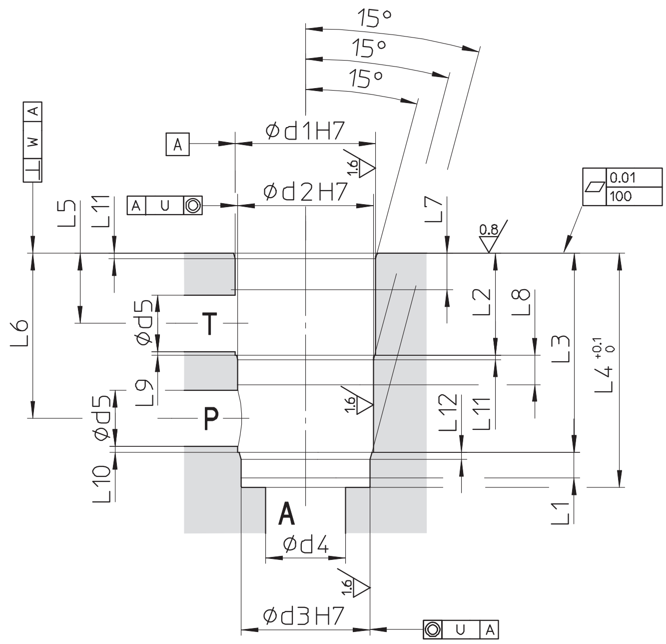
SC LI-*
LIDAS

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

4 CAVITIES DIMENSIONS for 3 WAY CARTRIDGE VALVES [mm]



VALVE TYPE

proportional

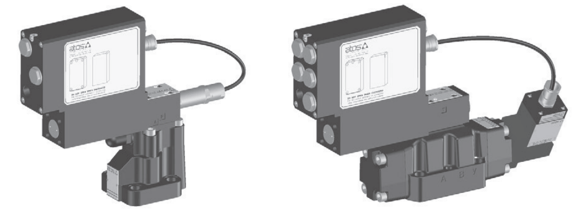
LIQZO-L* 3 way
LIQZP-L* 3 way

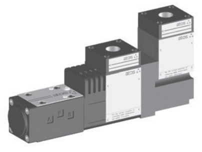
Size	ød1	ød2	ød3	ød4	ød5	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	U	W
25	45	43	34	20	20	11,5	56	89	103	45	78	25	15	1	1	2,5	2,5	0,03	0,05
32	60	58	55	32	24	13	43,5	85	100	30	70,5	18	15	1,5	2,5	2,5	2,5	0,03	0,05
40	75	73	55	40	30	15	54	105	125	36	87	21	18	3	3	3	3	0,03	0,05
50	90	87	68	50	35	17	87	143	165	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 ex-proof proportional valves

This operating and maintenance information apply to Atos ex-proof proportional valves and is intended to provide useful guidelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.





1 SYMBOL CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of proportional directional, flow and pressure control valves equipped with ex-proof proportional solenoid and on-board driver type OZA-* and MZA-* for application in explosive hazardous environments.

2.1 Warranty

All the ex-proof proportional valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic operations
- the ex-proof proportional valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

⚠ **Service work performed on the valve by the end users or not qualified personnel invalidates the certification**

3 CERTIFICATIONS AND PROTECTION MODE

3.1 Valves with on-board driver/axis controller

The ex-proof proportional valves subject of this operating and maintenance information are certified ATEX or IECEx.
They are in compliance with following protection mode:

- **II 2 G Ex d IIC T6, T5, T4 Gb**
- **II 2 D Ex tb IIIC T85°C, T100°C, T135°C Db**

3.2 Valves with off-board driver/axis controller

The ex-proof solenoids subject of this operating and maintenance information are multicertified ATEX, IECEx, EAC, PESO or cULus
They are in compliance with following protection mode:

Multicertification Group II – ATEX, IECEx, EAC, PESO

- **II 2 G Ex d IIC T6, T4, T3 Gb**
- **II 2 D Ex tb IIIC T85°C, T135°C, T200°C Db**

Multicertification Group I (mining) – ATEX, IECEx

- **I M2 Ex d I Mb**

cULus Noth American certification

Class I, Div. I, Groups C & D	**T. class T4/T3**
Class I, Zone I, Groups II A & II B	**T. class T4/T3**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0 Explosive atmospheres - Equipment: General requirements
EN 60079-1 Explosive atmospheres - Equipment protection by flameproof enclosures “d”
EN 60079-31 Explosive atmospheres - Equipment dust ignition protection by enclosures “t”

IECEx

IEC 60079-0 Explosive atmospheres - Part 0: General requirements
IEC 60079-1 Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-31 Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosures “t”

5 GENERAL CHARACTERISTICS

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU (not for valves type T) REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

7 ELECTRICAL CHARACTERISTICS

7.1 Valves with on-board driver/axis controller

Characteristics:

The power limitation is obtained by feeding the solenoid with current of 2,75 A, controlled by the on-board electronic driver/axis controller:

- Power supply: 24 V_{DC} ±10 % stabilized - Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})
- Current supply: I_{MAX} = 2,75 A PWM square wave type
- Max power consumption: 35 W
- Output protection: against short circuit

Note: 2,5 A external fuse type RVT (fast) must be provided on the power supply line

For details see technical tables relevant to the specific components, listed in section 12

7.2 Valves with off-board driver/axis controller

Solenoid characteristics:

- Max power consumption: 35 W
- Coil resistance R at 20°C: 3,2 Ω; 17,6 Ω (option /24)
- Max solenoid current: 2,5 A; 1,1 A (option /24)

For details see technical tables relevant to the specific components, listed in section 12

Off-board driver/axis controller characteristics:

The power limitation is obtained by feeding the solenoid with current of 2,5 A, controlled by following off-board driver/axis controller:

- Power supply: 24 V_{DC} ±10 % stabilized - Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})
- Current supply: I_{MAX} = 2,5 A PWM square wave type
- Output protection: against short circuit

Note: 2,5 A external fuse type RVT (fast) must be provided on the power supply line

For valves without transducer:

E-BM-AS-*/A see tech table G030
E-BM-AES-*/A see tech table GS050

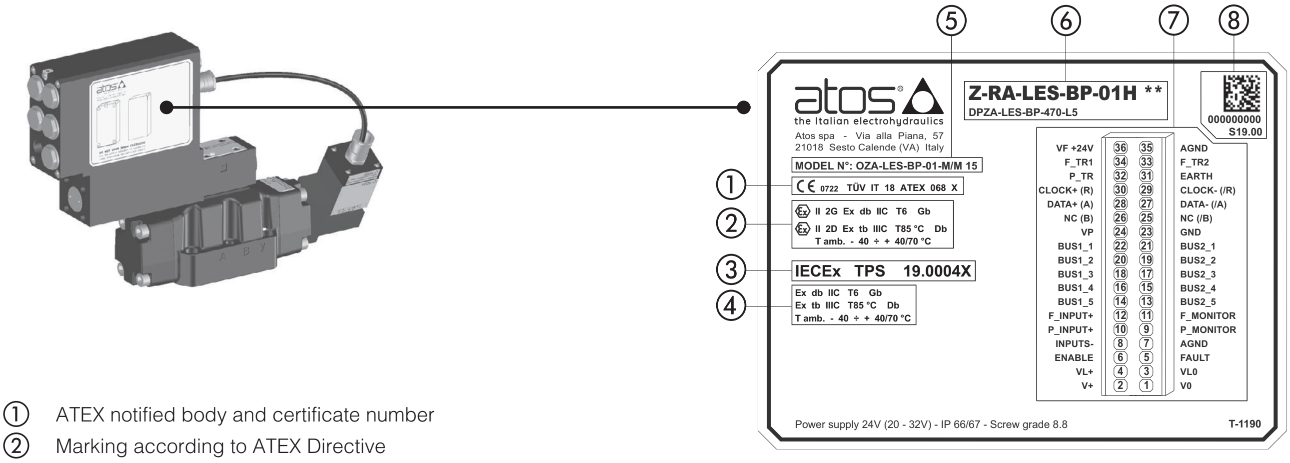
For valves with LVDT transducer:

E-BM-TEB/LEB-*/A see tech table GS230
E-BM-TES/LES-*/A see tech table GS240
Z-BM-TEZ/LEZ-*/A see tech table GS330

8 NAMEPLATES

8.1 Valve with on-board driver/axis controller - ATEX and IECEx certification

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22



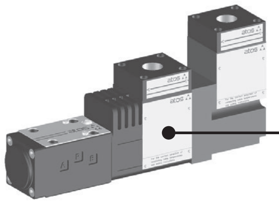
1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Code of solenoid
6. Code of on-board driver and related proportional valve
7. Electronic connections
8. Qr code and driver serial number

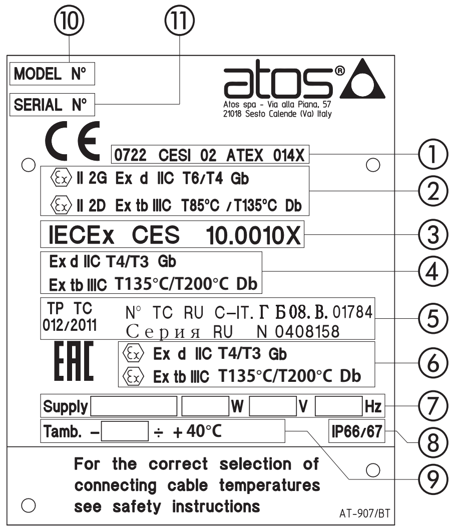
CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2
Ex db	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T6	Equipment temperature class (maximum surface temperature)
Gb	Equipment protection level, very high level protection for explosive Gas atmospheres
II 2 D	Transducer for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
III C	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
TUV IT 18 ATEX 068 X	Name of the laboratory responsible for the CE certification: 18 year of the certification release; 068 X certification number
0948	Number of the Certified Body authorized for the production quality system certification
IECEx TPS 19.0004X	Certificate number: TPS laboratory name responsible for the IECEx certification scheme: 19 year of the certification release; 0004X number of certification
T amb.	Ambient temperature range

Notes:
The group IIC solenoids are suitable for IIA and IIB environments.
The T6 temperature class solenoids are suitable for all the substances having higher temperature class (T5, T4, T3, T2, T1).
The T5 temperature class solenoids are suitable also for all the substances having higher temperature class (T4, T3, T2, T1).

8.2 Valve with off-board driver/axis controller - ATEX, IECEx, EAC and PESO

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22





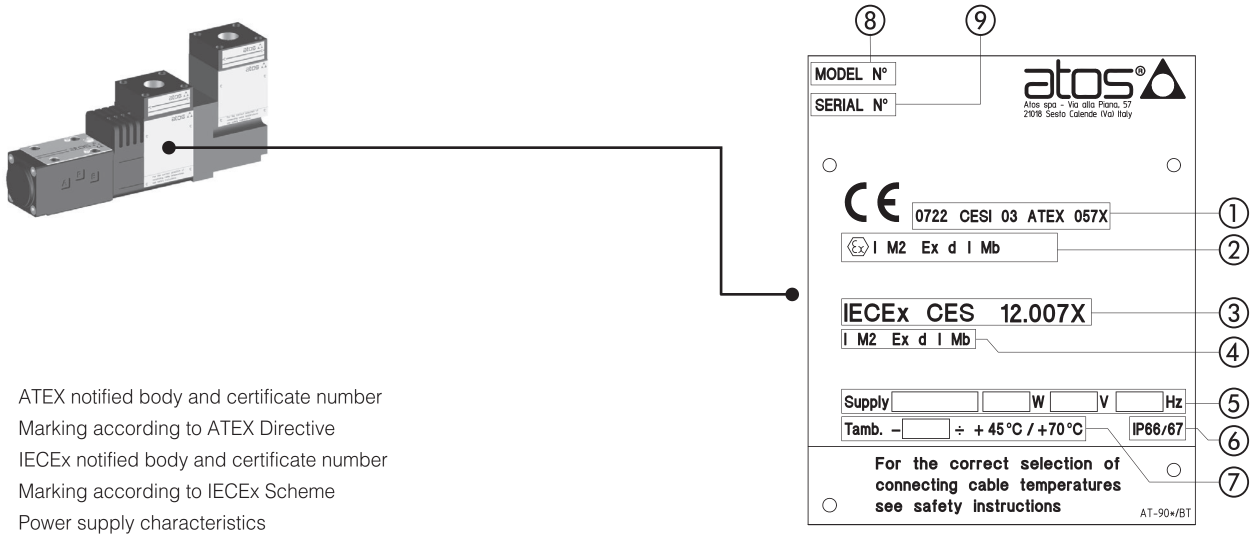
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ EAC notified body and certificate number
⑥ Marking according to EAC
⑦ Power supply characteristics
⑧ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

⑨ Ambient temperature
⑩ Solenoid model code
⑪ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas and vapors environment, category 2, suitable for zone 1 and zone 2
Ex d	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T4, T3	Solenoid temperature class (maximum surface temperature)
Gb	Equipment protection level, very high level protection for explosive Gas atmospheres
II 2 D	Equipment for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
III C	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C, T135°C, T200°C	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
CESI 02 ATEX 014 X	Name of the laboratory responsible for the CE certification: 02 year of the certification release; 014 X certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 10.0010X	Certificate number: CES laboratory name responsible for the IECEx certification scheme: 10 year of the certification release; 0010X number of certification
T amb.	Ambient temperature range

8.3 Valve with off-board driver/axis controller - ATEX and IECEx

Gas - group I M2 - Mining



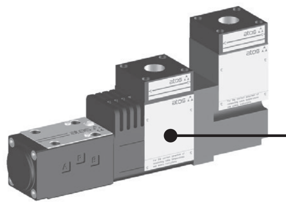
① ATEX notified body and certificate number
② Marking according to ATEX Directive
③ IECEx notified body and certificate number
④ Marking according to IECEx Scheme
⑤ Power supply characteristics
⑥ Ingress protection:
- IP66 = no dust ingress, protection against heaving seas or powerful jets of water
- IP67 = no dust ingress, protection to water immersion

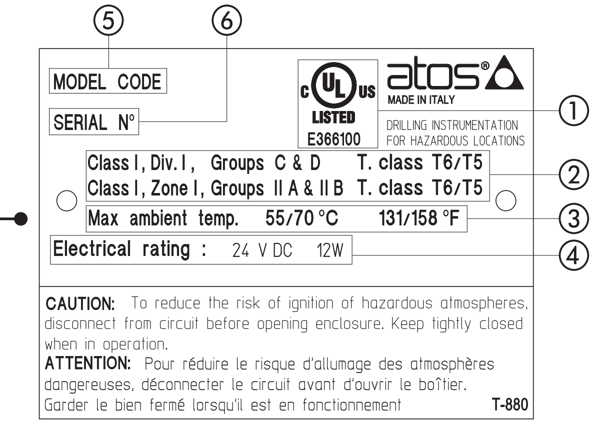
⑦ Ambient temperature
⑧ Solenoid model code
⑨ Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the technical norms
I M2	Equipment for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. The power supply of these equipment has to be switched off in case of explosive atmosphere.
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 03 ATEX 057 X	Name of the laboratory responsible for the CE certification: 03 year of the certification release; 057 certification number X= reduced risk of mechanical shock (the equipment has to be protected from mechanical shocks)
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.007X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 007X number of certification
T amb.	Ambient temperature range

8.4 Valve with off-board driver/axis controller - cULus certification

Class I, Division I, Groups C and D
Class I, Zone I, Groups IIA and IIB





① cULus marking and certificate number
② Marking according to NEC 500 and NEC 505 standards
③ Ambient temperature
④ Power supply characteristics
⑤ Solenoid model code
⑥ Solenoid serial number

c UL us LISTED E366100	cULus mark and certificate number
Class I	Equipment for flammable gas and vapours
Division I	Explosive substances continuously or intermittently present in the atmosphere
Groups C & D	Gas group C (Methane, Buthane, Petrol, etc) and D (Etylene, Formaldeyde, Cloruprophane, etc)
Zone I	Location where explosive substances are continuously present
Groups IIA & IIB	Equipment of group IIA and IIB suitable for gas of group IIA and IIB
Class T6/T5	Solenoid temperature class (maximum surface temperature)
Max ambient temp.	Max ambient temperature range in °C and °F

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of the specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

⚠ The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

⚠ Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid/driver.
This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

9.3 Electrical connection - valve with on-board driver/axis controller

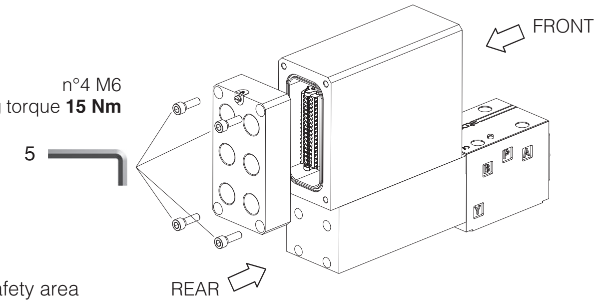
Electrical connections to the external circuits are achieved through 36 poles terminal block installed on a PCB fixed inside driver housing. The threaded cable entrance is provided with a cylindrical thread M20x1,5 UNI 4535.

The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

The electrical cables must be suitable for the working temperatures as shown in the section 9.4

Remove the 4 screws of driver's rear cover to access terminal board and fieldbus terminator



⚠ **WARNING:** the above operation must be performed in a safety area

9.4 Cable specification and temperature - Valve with on-board driver/axis controller

Power supply and signals: section of wire = 1,0 mm²   **Grounding:** section of external ground wire = 4 mm²

Cable temperature

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
40 °C	T6	85 °C	80 °C
55 °C	T5	100 °C	90 °C
70 °C	T4	135 °C	110 °C

9.5 Electrical connection - valve off-board driver/axis controller

The connection to the external circuit is made with a screw clamps 2 poles + ground, installed inside the solenoid and transducer housing. The eventual requirement of the additional ground connection on the solenoid housing must be made on the relative screw (M3x6 UNI-6107).

The threaded cable entrance is provided with one of following optional connections:
- conical thread 1/2" NPT ANSI B2.1
- conical thread GK-1/2" "(Annex 1 CEI EN 60079-1 2008-11) only for the Italian market
- cylindrical thread M20x1,5 UNI 4535

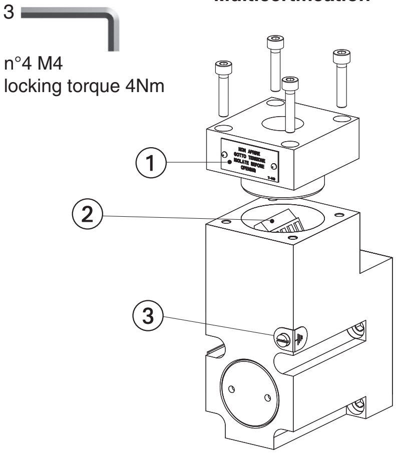
The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

Note: a Loctite sealant type 545, should be used on the cable gland entry threads

The electrical cables must be suitable for the working temperatures as shown in the section 9.6

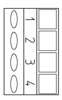
LVDT main stage transducer - only for DPZA-T

Multicertification



① cover with threaded connection for vertical cable gland fitting
② terminal board for cables wiring
③ screw terminal for additional equipotential grounding

Position transducer wiring

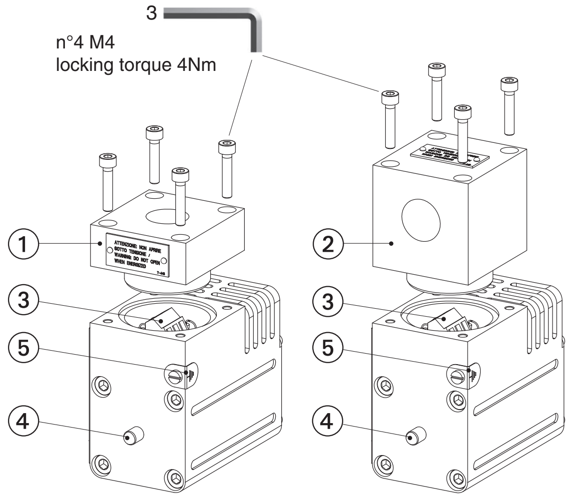


1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

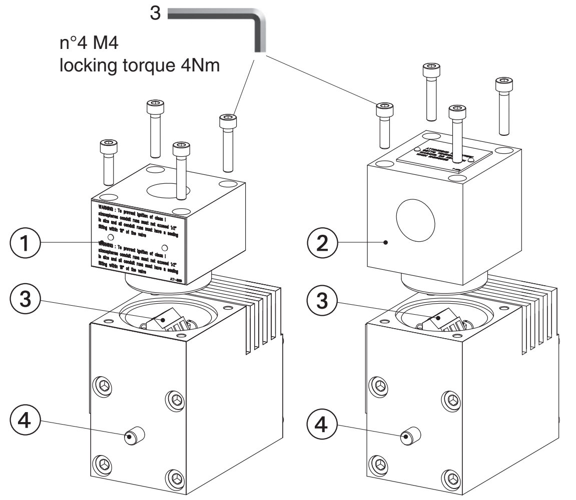
Valve without LVDT transducer

Multicertification



Standard version | Option /O

cULus certification



Standard version | Option /O

① cover with threaded connection for vertical cable gland fitting
② cover with threaded connection for horizontal cable gland fitting
③ terminal board for cables wiring
④ standard manual override
⑤ screw terminal for additional equipotential grounding

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm^2 (max AWG14)

⚠ **Pay attention to coil polarity**

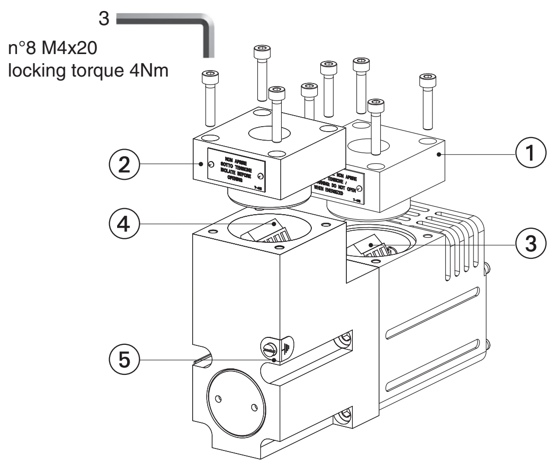
1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm^2 (max AWG16)

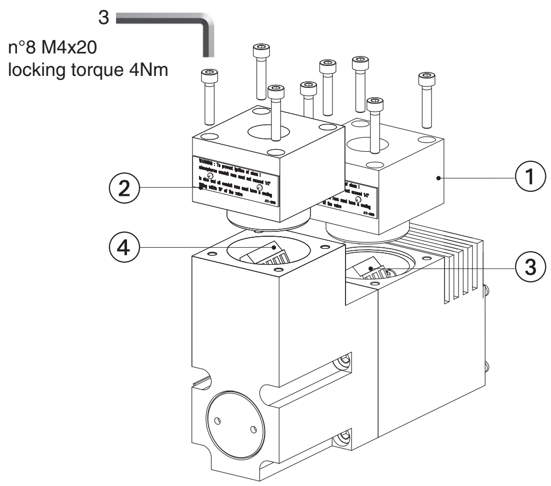
alternative GND screw terminal connected to solenoid housing

Valve with LVDT transducer

Multicertification



cULus certification



① solenoid cover with threaded connection for cable gland fitting
② transducer cover with threaded connection for cable gland fitting
③ solenoid terminal board for cables wiring
④ transducer terminal board for cables wiring
⑤ screw terminal for additional equipotential grounding

Solenoid wiring

1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm^2 (max AWG14)

Solenoid wiring

⚠ **Pay attention to respect the polarity**

1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm^2 (max AWG16), see section 9.6 note 1

alternative GND screw terminal connected to solenoid housing

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

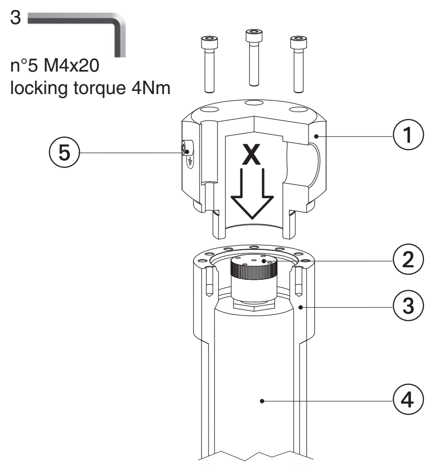
PCB 4 poles terminal board suitable for wires cross sections up to 2,5 mm^2 (max AWG14)

Position transducer wiring

1 = Output signal
2 = Supply -15 V
3 = Supply +15 V
4 = GND

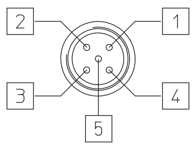
PCB 4 poles terminal board suggested cable section up to 1,5 mm^2 (max AWG16), see section 9.6 note 1

LVDT main stage transducer - only for LIQZA-L



① transducer cover with threaded connection for cable gland fitting
② transducer terminal board for cables wiring
③ ex-proof protection for LVDT transducer
④ LVDT transducer
⑤ screw terminal for additional equipotential grounding

Transducer wiring - view from **X**



1 = Do not connect
2 = Supply -15 V
3 = GND
4 = Output signal
5 = Supply +15 V

9.6 Cable specification and temperature - Valve with off-board driver/axis controller

Cable specification - Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm²	**Grounding:** section of internal ground wire = 2,5 mm² section of external ground wire = 4 mm²

Cable temperature - Multicertification Group I and Group II

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]	
	Goup I	Goup II	Goup I	Goup II	Goup I	Goup II
40 °C	-	T4	150 °C	-	90 °C	-
45 °C	-	T4	150 °C	135 °C	-	90 °C
55 °C	-	T3	150 °C	200 °C	-	110 °C
60 °C	-	-	150 °C	-	110 °C	-
70 °C	N.A.	T3	N.A.	200 °C	N.A.	120 °C

Cable specification - cULus certification

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm² (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: for Class I wiring the 3C 1,5 mm² AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring

Cable temperature - cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
55 °C	T4	135 °C	100 °C
70 °C	T3	200 °C	100 °C

9.7 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.
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: 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s

9.8 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, 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

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- 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 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

10.2 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 and invalidates the certification tools for repairing.

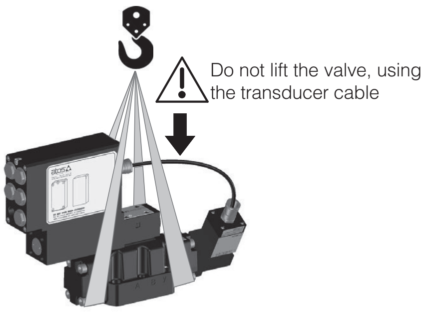
The intrinsically safe solenoids must not be opened.
Any tampering invalidates the certification and it may cause serious dangerous.

11 TRANSPORT AND STORAGE

11.1 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



Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment, such as: gloves, working shoes, safety goggles, working clothes, etc.

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

12.1 Valve with on-board driver/axis controller

Servoproportional directional - zero overlap with LVDT transducer
FX150 DLHZA-TES, DLKZA-TES - direct, sleeve execution
FX135 DHZA-TES, DKZA-TES - direct
FX235 DPZA-LES, piloted
FX380 LIQZA-LES, 3-way cartridge

High performance directional - positive overlap with LVDT transducer
FX130 DHZA-TES, DKZA-TES - direct
FX230 DPZA-LES - piloted
FX360 LIQZA-LES, 2-way cartridge

Directional valves - positive overlap without transducer
FX110 DHZA-AES, DKZA-AES - direct
FX210 DPZA-AES - piloted

High performance pressure valves - with pressure transducer
FX030 RZMA-RES, AGMZA-RES - relieft
FX060 RZGA-RES, AGRCZA-RES - reducing
FX320 LIMZA-RES, LIRZA-RES, LICZA-RES - relief, reducing, compensator

Pressure valves - without transducer
FX020 RZMA-AES, AGMZA-AES - relief
FX050 RZGA-AES, AGRCZA-AES - reducing
FX080 DHRZA-AES - reducing
FX310 LIMZA-AES - relief
LIRZA-AES - reducing
LICZA-AES - compensator

Flow valves, pressure compensated
FX430 QVHZA-TES, QVKZA-TES - with LVDT transducer
FX410 QVHZA-AES, QVKZA-AES - without transducer

Servoproportional valves with on-board axis controller
FX610 DLHZA-TEZ, DLKZA-TEZ – direct, sleeve execution
FX620 DHZA-TEZ, DKZA-TEZ - direct
FX630 DPZA-LEZ - piloted

12.2 Valve with off-board driver/axis controller

Servoproportional directional - zero overlap with LVDT transducer
FX140 DLHZA-T DLKZA-T - direct, sleeve execution
FX370 LIQZA-L, 3-way cartridge

High performance directional - positive overlap with LVDT transducer
FX120 DHZA-T, DKZA-T - direct
FX220 DPZA-T - piloted
FX350 LIQZA-L, 2-way cartridge

Directional valves - positive overlap without transducer
FX100 DHZA-A, DKZA-A - direct
FX200 DPZA-A - piloted

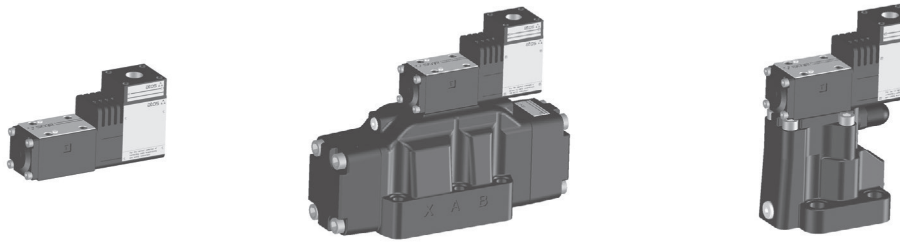
Pressure valves - without pressure transducer
FX010 RZMA-A, HZMA-A, AGMZA-A - relief
FX040 RZGA-A, AGRCZA-A, HZGA-A, KZGA-A - reducing
FX070 DHRZA-A - reducing
FX300 LIMZA-A - relief
LIRZA-A - reducing
LICZA-A - compensator

Flow valves, pressure compensated
FX420 QVHZA-T, QVKZA-T - with LVDT transducer
FX400 QVHZA-A, QVKZA-A - without transducer

Operating and maintenance information

for ex-proof on-off valves

This operating and maintenance information apply to Atos ex-proof on-off valves and is intended to provide useful guidelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.



1 SYMBOL CONVENTIONS

This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of on-off directional, flow and pressure control valves equipped with ex-proof solenoids type OA-* for application in explosive hazardous environments.

2.1 Warranty

All the ex-proof on-off valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic interventions
- the ex-proof on-off valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS AND PROTECTION MODE

The ex-proof on-off solenoids subject of this operating and maintenance information are multicertified ATEX, IECEx, EAC or cULus
They are in compliance with following protection mode:

Multicertification Group II – ATEX, IECEx, EAC, PESO

II 2 G Ex d IIC T6, T4, T3 Gb

II 2 D Ex tb IIIC T85°C, T135°C, T200°C Db

Multicertification Group I (mining) – ATEX, IECEx

I M2 Ex d I Mb

MA chinese mining certification

d I Mb

cULus Noth American certification

Class I, Div. I, Groups C & D **T. class T4/T3**

Class I, Zone I, Groups II A & II B **T. class T4/T3**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0	Explosive atmospheres - Equipment: General requirements
EN 60079-1	Explosive atmospheres - Equipment protection by flameproof enclosures “d”
EN 60079-31	Explosive atmospheres - Equipment dust ignition protection by enclosures “t”

IECEx

IEC 60079-0	Explosive atmospheres - Part 0: General requirements
IEC 60079-1	Explosive atmospheres - Part 1: Equipment protection by flameproof enclosures “d”
IEC 60079-31	Explosive atmospheres - Part 31: Equipment dust ignition protection by enclosures “t”

cULus

UL 1203	Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for use in Hazardous (classified) locations
UL 429	Standard for Electrically Operated valves
CSA C22.2	No.139-13 Electrically Operated Valves

5 GENERAL CHARACTERISTICS

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 - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection -Flame proof enclosure “Ex d” -Dust ignition protection by enclosure “Ex t” RoHs Directive 2011/65/EU as last update by 2015/65/EU (not for valves type T) REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

7 ELECTRIC CHARACTERISTICS

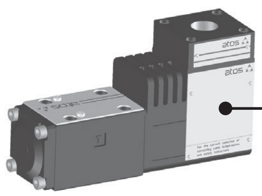
Harmonized standard	Multicertification	cULus
Power consumption at 20°C	8W	12W

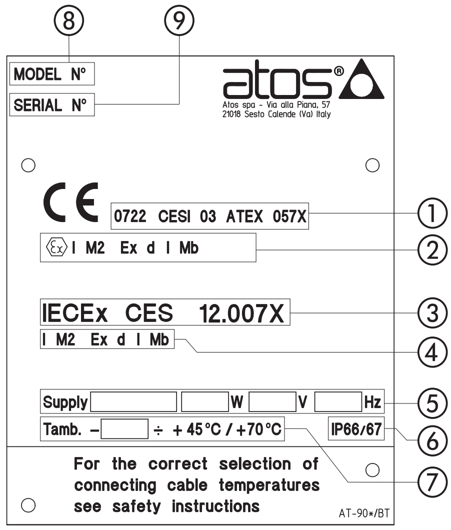
See technical tables relevant to the specific components, listed in section 12

8 NAMEPLATES

8.1 ATEX and IECEx multicertification

Gas - group I M2 - Mining



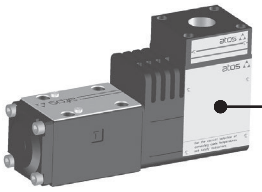


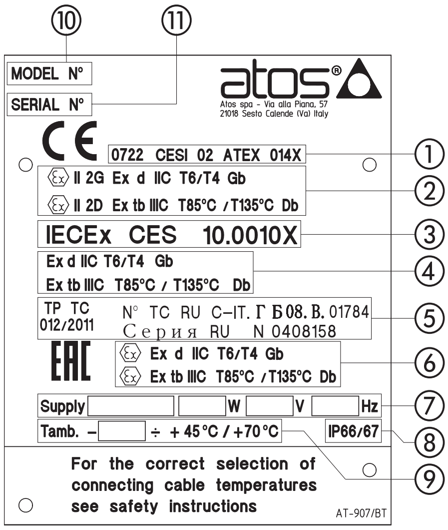
1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. Power supply characteristics
6. Ingress protection:
   - IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   - IP67 = no dust ingress, protection to water immersion
7. Ambient temperature
8. Solenoid model code
9. Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the relevant technical norms
I M2	Equipment for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. The power supply of these equipment have to be switched off in case of explosive atmosphere.
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 03 ATEX 057 X	Name of the laboratory responsible for the CE certification: 03 year of the certification release; 057 certification number X= reduced risk of mechanical shock (the equipment has to be protected from mechanical shocks)
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.007X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 007X number of certification
T amb.	Ambient temperature range

8.2 ATEX, IECEx, EAC and PESO multicertification

Gas - group II 2G - Zone 1, 2
Dust - group II 2D - Zone 21, 22



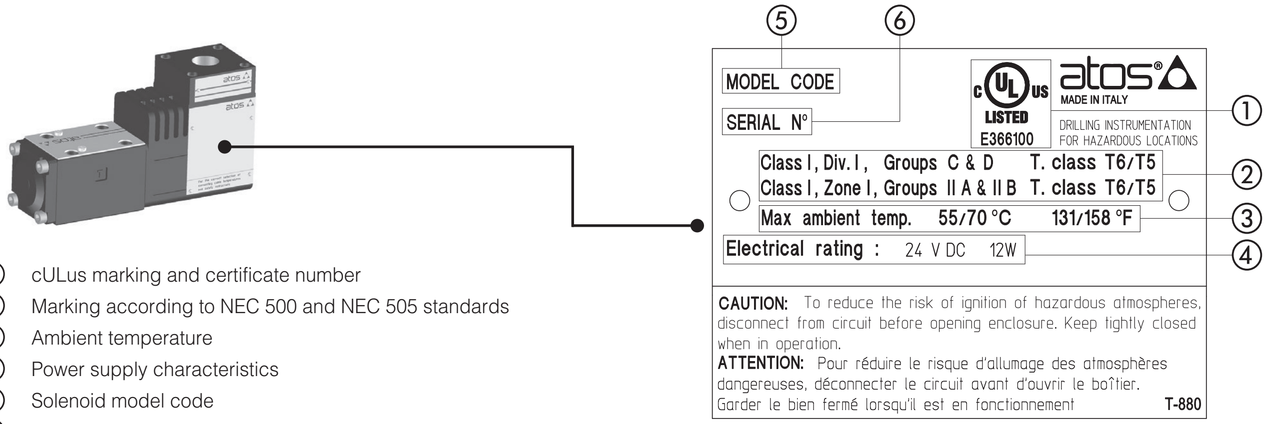


1. ATEX notified body and certificate number
2. Marking according to ATEX Directive
3. IECEx notified body and certificate number
4. Marking according to IECEx Scheme
5. EAC notified body and certificate number
6. Marking according to EAC
7. Power supply characteristics
8. Ingress protection:
   - IP66 = no dust ingress, protection against heaving seas or powerful jets of water
   - IP67 = no dust ingress, protection to water immersion
9. Ambient temperature
10. Solenoid model code
11. Solenoid serial number

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/UE directive and to the relevant technical norms
II 2 G	Equipment for surface plants with gas or vapors environment, category 2, suitable for zone 1 and 2
Ex d	Explosion-proof equipment
II C	Group II C equipment suitable for substances (gas) for group II C
T6, T4, T3	Equipment temperature class (maximum surface temperature)
Gb	Equipment protection level, high level protection for explosive Gas atmospheres
II 2 D	Equipment for surface plants with dust environment, category 2, suitable for zone 21 and zone 22
Ex tb	Equipment protection by enclosure"tb"
IIIC	Suitable for conductive dust (applicable also IIIB and/or IIIA)
IP66/67	Protection degree
T85°C, T135°C, T200°C,	Maximum surface temperature (Dust)
Db	Equipment protection level, high level protection for explosive Dust atmospheres
CESI 02 ATEX 014 X	Name of the laboratory responsible for the CE certification: 02 year of the certification release; 014 X certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 10.0010X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 10 year of the certification release; 0010X number of certification
T amb.	Ambient temperature range

8.3 cULus certification

Class I, Division 1
Class I, Zone 1

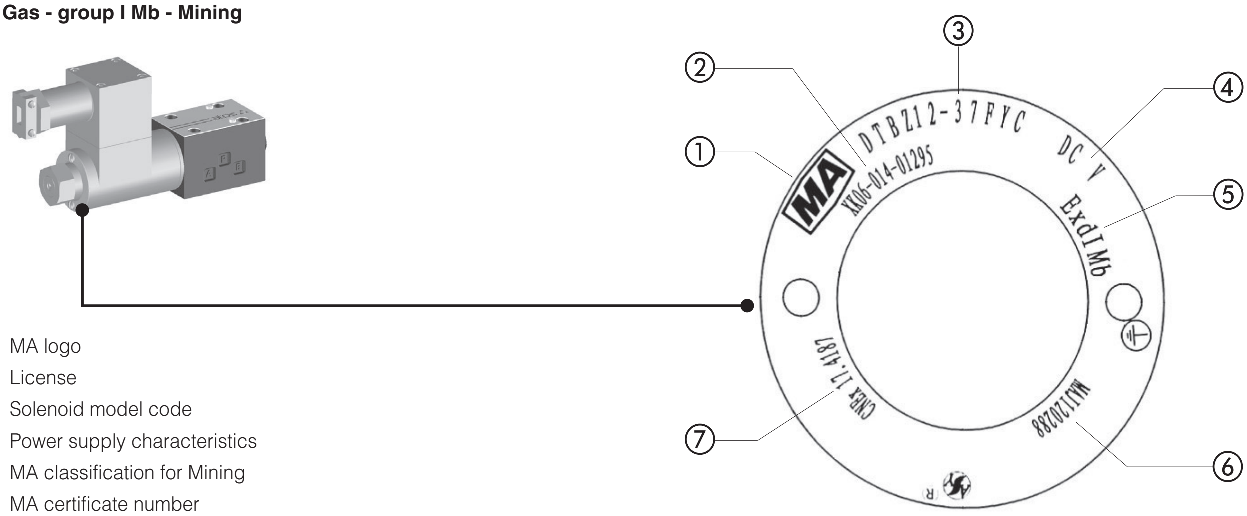


1. cULus marking and certificate number
2. Marking according to NEC 500 and NEC 505 standards
3. Ambient temperature
4. Power supply characteristics
5. Solenoid model code
6. Solenoid serial number

c UL us LISTED E366100	cULus mark and certificate number
Class I	Equipment for flammable gas and vapours
Division I	Explosive substances continuously or intermittently present in the atmosphere
Groups C & D	Gas group C (Methane, Buthane, Petrol, etc) and D (Etylene, Formaldeyde, Cloruprophane, etc)
Zone I	Location where explosive substances are continuously present
Groups IIA & IIB	Equipment of group IIA and IIB suitable for gas of group IIA and IIB
Class T6/T5	Solenoid temperature class (maximum surface temperature)
Max ambient temp.	Max ambient temperature range in °C and °F

8.4 MA certification

Gas - group I Mb - Mining



1. MA logo
2. License
3. Solenoid model code
4. Power supply characteristics
5. MA classification for Mining
6. MA certificate number
7. Notified body and certificate number

MA	MA Center mark
Ex d	Explosion-proof equipment
I	Group I equipment suitable for substances (gas) for group I
Mb	Equipment protection level, high level protection for explosive atmospheres

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

⚠ The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

⚠ Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid.
This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

9.3 Electrical connection - valve off-board driver/axis controller

The connection to the external circuit is made with a screw clamps 2 poles + ground, installed inside the solenoid and transducer housing.
The eventual requirement of the additional ground connection on the solenoid housing must be made on the relative screw (M3x6 UNI-6107).

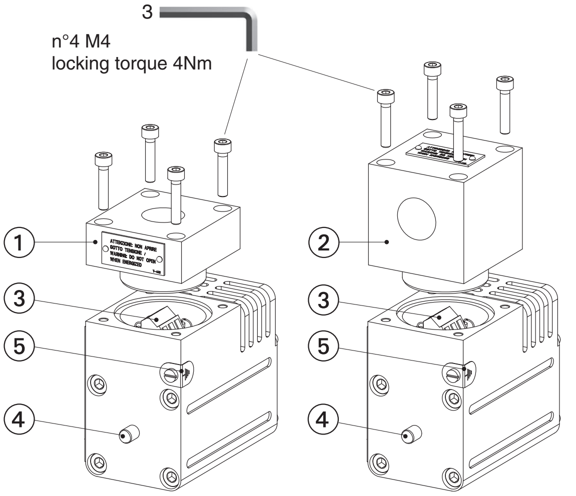
The threaded cable entrance is provided with one of following optional connections:
- conical thread 1/2" NPT ANSI B2.1
- conical thread GK-1/2" "(Annex 1 CEI EN 60079-1 2008-11) only for the Italian market
- cylindrical thread M20x1,5 UNI 4535

The cable glands used for the cable entrance must be certified for the specific hazardous environment – see tech. table **KX800** for Atos ex-proof cable glands.

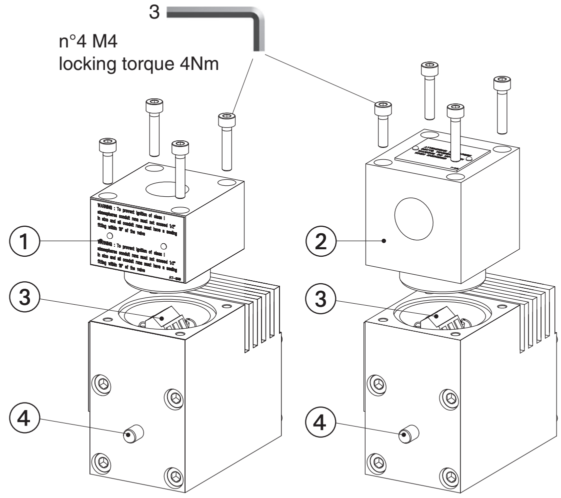
Note: a Loctite sealant type 545, should be used on the cable gland entry threads

The electrical cables must be suitable for the working temperatures as shown in the section 9.6

Multicertification | **cULus certification**

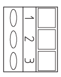


Standard version **Option /O**



Standard version **Option /O**

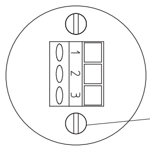
1 cover with threaded connection for vertical cable gland fitting
2 cover with threaded connection for horizontal cable gland fitting
3 terminal board for cables wiring
4 standard manual override
5 screw terminal for additional equipotential grounding



1 = Coil
2 = GND
3 = Coil

PCB 3 poles terminal board suitable for wires cross sections up to 2,5 mm² (max AWG14)

Pay attention to coil polarity

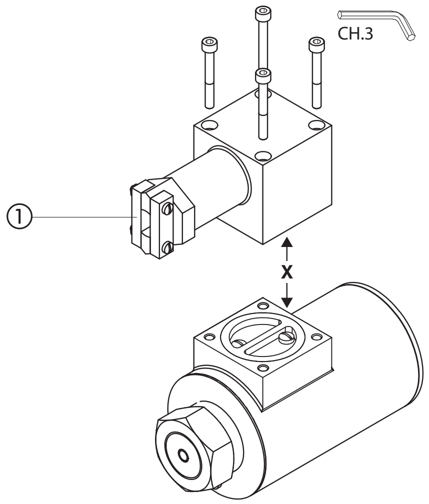


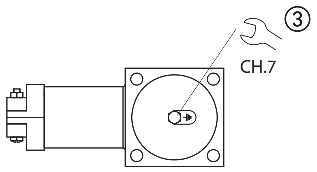
1 = Coil **+**
2 = GND
3 = Coil **-**

PCB 3 poles terminal board suggested cable section up to 1,5 mm² (max AWG16)

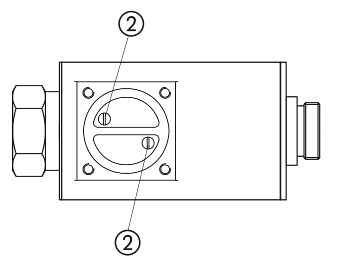
alternative GND screw terminal connected to solenoid housing

MA chinese mining certification





view from **X**



1 cable entrance = ø 10,5 mm
2 terminal board for power supply coil connection
3 screw terminal for ground connection

9.4 Cable specification and temperature

Cable specification - Multicertification Group I and Group II

Power supply: section of coil connection wires = 2,5 mm^2	**Grounding:** section of internal ground wire = 2,5 mm^2 section of external ground wire = 4 mm^2

Cable temperature - Multicertification Group I and Group II

Max ambient temperature [°C]	Temperature class		Max surface temperature [°C]		Min. cable temperature [°C]
	Goup I	Goup II	Goup I	Goup II	
40 °C	-	T6	150 °C	85 °C	not prescribed
70 °C	-	T4	150 °C	135 °C	90 °C

Cable specification - cULus certification

- Suitable for use in Class I Division 1, Gas Groups C
- Armored Marine Shipboard Cable which meets UL 1309
- Tinned Stranded Copper Conductors
- Bronze braided armor
- Overall impervious sheath over the armor

Any Listed (UBVZ/ UBVZ7) Marine Shipboard Cable rated 300 V min, 15A min. 3C 2,5 mm^2 (14 AWG) having a suitable service temperature range of at least -25°C to +110°C ("/BT" Models require a temperature range from -40°C to +110°C)

Note 1: For Class I wiring the 3C 1,5 mm^2 AWG 16 cable size is admitted only if a fuse lower than 10 A is connected to the load side of the solenoid wiring.

Cable temperature - cULus certification

Max ambient temperature [°C]	Temperature class	Max surface temperature [°C]	Min. cable temperature [°C]
55 °C	T6	85 °C	100 °C
70 °C	T5	100 °C	100 °C

9.5 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 mm^2/s - max allowed range 2,8 ÷ 500 mm^2/s

9.6 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

10 MAINTENANCE

Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics

10.1 Ordinary maintenance

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- 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 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

10.2 Repairing

In case of incorrect functioning or beak-down it is recommended to send the valve back to Atos which will provide for the reparation.
If the reparations are not made by the manufacturer, they must be performed in accordance to the criteria of IEC 60079-19 standard for IECEx and EN 60079-19 for ATEX, and by facilities having the technical know-how about the protection modes and equipped with suitable tools for repairing and controls.

Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

Before beginning any repairing activity, the following guidelines must be observed:

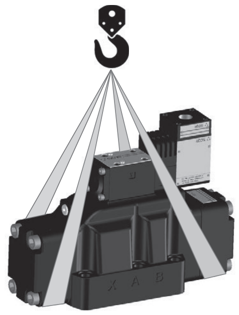
- Unauthorized opening of the valves during the warranty period invalidates the warranty and invalidates the certification
- Be sure to use only original spare parts manufactured or supplied by Atos factory
- Provide all the required tools to make the repair operations safely and to don't damage the components
- Read and follow all the safety notes given in section

11 TRANSPORT AND STORAGE

11.1 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



Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment
  (such as gloves, working shoes, safety goggles, working clothes, etc.)

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

Directional valves

EX010 DHA - direct, spool type
EX015 DHA, DKA - direct, spool type
EX020 DLAH , DLAHM - direct, poppet type
EX030 DPHA - piloted
EX050 LIDEW-AO, LIDBH-AO - piloted ISO cartridges and functional covers

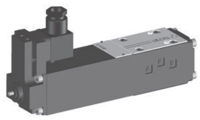
Pressure relief valves

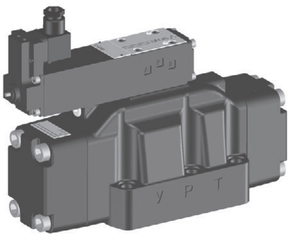
CX010 AGAM-AO, ARAM-AO - piloted, with solenoid valve for venting

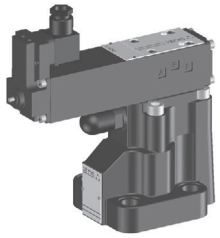
Operating and maintenance information

for intrinsically safe on-off valves

This operating and maintenance information apply to Atos intrinsically safe on-off valves and is intended to provide useful giudelines to avoid risks when the valves are installed in a system operating in hazardous areas with explosive or flammable environement.
The prescriptions included in this document must be strictly observed to avoid damages and injury. The respect of this operating and maintenance information grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the valves are also provided.







1 SYMBOL CONVENTIONS

This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information is part of the operating instructions for the complete machine but it cannot replace them.

This document is relevant to the installation, use and maintenance of on-off directional and pressure control valves equipped with intrinsically safe solenoids type OW-* for application in explosive hazardous environments.

Due to the low power consumption, the intrinsically safe circuit is virtually protected against electrical sparks or thermal effects that could cause the ignition of the explosive atmosphere, also in case of failure. The protection is ensured only if the whole system is in compliance with the requirements of IEC/EN 60079-25 (Ex-i systems).

2.1 Warranty

All the intrinsically safe valves have 1 year warranty; the expiration of warranty results from the following operations:
- unauthorized mechanical or electronic interventions
- the intrinsically safe valves are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

Service work performed on the valve by the end users or not qualified personnel invalidates the certification

3 CERTIFICATIONS AND PROTECTION MODE

The intrinsically safe solenoids subject of this operating and maintenance information are certified ATEX or IECEx.
They are in compliance with following protection mode:

Group II

II 1G Ex ia IIC T6 Ga

II 1G Ex ia IIB T6 Ga

II 1G Ex ia IIA T5 Ga

Group I (mining)

I M2 Ex ia I Mb / Ex ib I Mb

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

ATEX

EN 60079-0 Electrical apparatus for explosive atmospheres - Part 0: general requirements
EN 60079-11 Equipment protection by intrinsic safety 'i'
EN 60079-26 Equipment with equipment protection level (EPL) Ga

IECEx

IEC 60079-0 Electrical apparatus for explosive atmospheres - Part 0: general requirements
IEC 60079-11 Equipment protection by intrinsic safety 'i'
IEC 60079-26 Equipment with equipment protection level (EPL) Ga

5 GENERAL CHARACTERISTICS

Ambient temperature	**Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C
Storage temperature range	**Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°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
Surface protection	Zinc coating with black passivation
Compliance	Intrinsically safe protection “Ex ia” RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

6 HYDRAULIC CHARACTERISTICS

See technical tables relevant to the specific components, listed in section 12

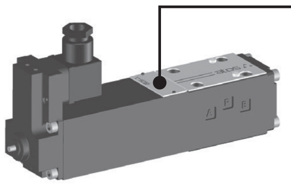
7 CERTIFIED ELECTRICAL CHARACTERISTICS

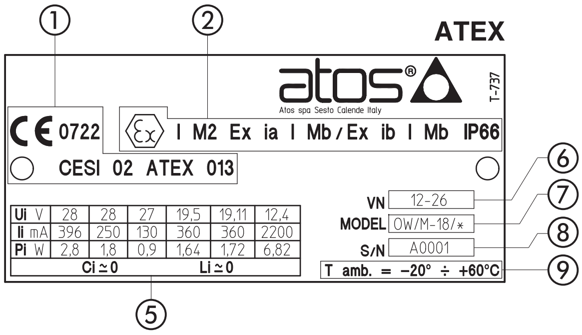
Electrical characteristics (max values)	Metod of protection										
	Group II					Group I (Mining)					
	Ex II 1G Ex ia					Ex I M2		Ex ia I Mb		Ex ib I Mb	
	IIA T5 Ga	IIB T6 Ga	IIC T6 Ga								
Ui [V]	28	28	27	19,5	19,11	28	28	27	19,5	19,11	12,4
Ii [mA]	396	250	160	360	360	396	250	160	360	360	2200
Pi [W]	2,8	1,8	0,9	1,64	1,72	2,8	1,8	0,9	1,64	1,72	6,82
Ci , Li	≅ 0										
VN	12 ÷ 26 V										

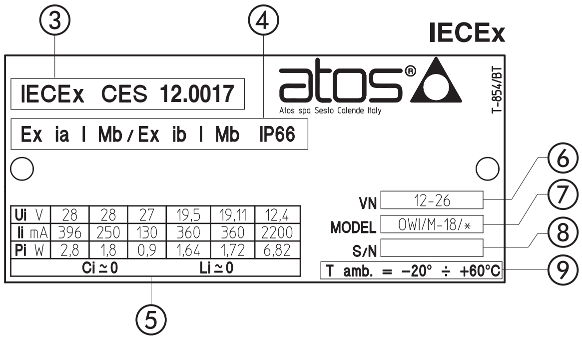
8 NAMEPLATES

8.1 ATEX and IECEx certification

Gas - group I M2 - Mining





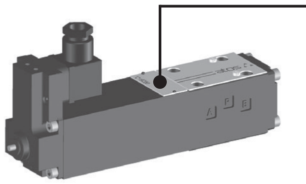


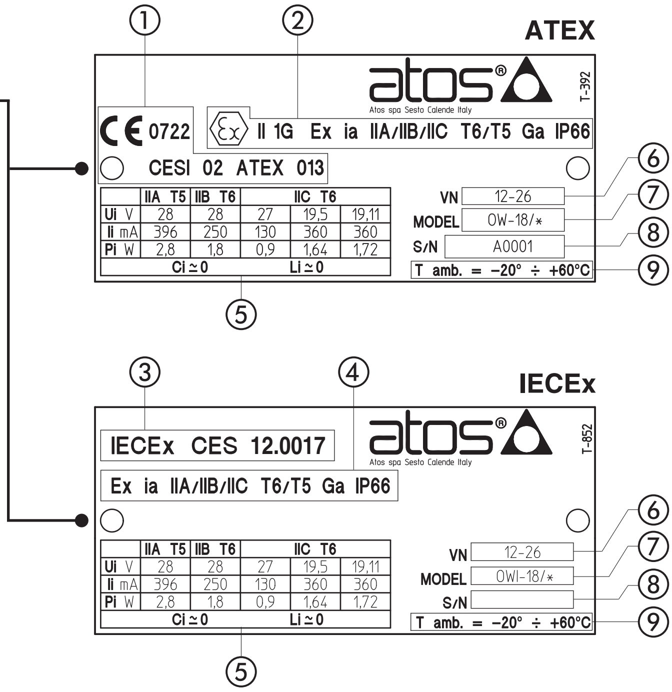
1. ATEX notified body and certificate nember
2. Marking according to ATEX directive
3. IECEx notified body and certificate nember
4. Marking according to IECEx scheme
5. Electric characteristics
6. Power supply characteristics
7. Solenoid model code
8. Solenoid serial number
9. Ambient temperature

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the relevant technical norms
I M2	Solenoid for mining (or relevant surface plants) which could be exposed to gas and / or flammable dust. Category M2: power supply of these equipments has to be switched off in case of explosive atmosphere.
Ex ia / Ex ib	Intrinsically safe solenoid, category “ia“ or “ib”
I	Equipment of group I
Mb	Equipment protection level, high level protection for explosive atmospheres
CESI 02 ATEX 013	Name of the laboratory responsible for the CE certification: 02= year of the certification release; 013 certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.0017X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 0017X number of certification
Ui, Ii, Pi, Ci, Li	Max input parameters of the equipment (relevant to the intrinsically safe)
T amb.	Ambient temperature range (min. -20°C max. +60°C)

8.2 ATEX and IECEx certification

Gas - group II 1G - Zone 0, 1, 2





1. ATEX notified body and certificate nember
2. Marking according to ATEX directive
3. IECEx notified body and certificate nember
4. Marking according to IECEx scheme
5. Electric characteristics
6. Power supply characteristics
7. Solenoid model code
8. Solenoid serial number
9. Ambient temperature

CE	Mark of conformity to the applicable European directives
Ex	Mark of conformity to the 2014/34/EU directive and to the technical norms
II 1 G	Solenoid for surface plants with gas or vapours environment, category 1, suitable for zone 0 and with redundancy for zone 1 and 2
Ex ia	Intrinsically safe solenoid, category “ia“
II C	Group II C equipment suitable for substances (gas) for group II C
II B	Group II B equipment suitable for substances (gas) for group II B
II A	Group II A equipment suitable for substances (gas) for group II A
T6 / T5	Solenoid temperature class (maximum surface temperature)
Ga	Equipment protection level, very high level protection for explosive Gas atmospheres
CESI 02 ATEX 013	Name of the laboratory responsible for the CE certification: 02= year of the certification release; 013 certification number
0722	Number of the Certified Body authorized for the production quality system certification: 0722 = CESI
IECEx CES 12.0017X	Certificate number: CES laboratory name responsible for the IEC Ex certification scheme: 12 year of the certification release; 0017X number of certification
Ui, Ii, Pi, Ci, Li	Max input parameters of the equipment (relevant to the intrinsically safe)
T amb.	Ambient temperature range (min. -20°C and -40°C for /BT option, max. +60°C)

Notes:

The group IIC solenoids are suitable for IIA and IIB environments.

The T6 temperature class solenoids are suitable for all the substances having higher temperature class (T5, T4, T3, T2, T1).

The T5 temperature class solenoids are suitable also for all the substances having higher temperature class (T4, T3, T2, T1).

9 SAFETY NOTES

9.1 Improper use

Any improper use of the components is not admissible.

Improper use of the product includes:
- Wrong installation / installation in areas not approved for the specific component
- Incorrect cleanliness during storage and assembly
- Use of inappropriate or non-admissible hydraulic fluids
- Use outside of the specified performance limits
- Use of inappropriate electrical power supply
- Incorrect transport

9.2 Installation

⚠ The installation or use of inappropriate components in explosive hazardous environments could cause personal injuries and damage to property.

For the application in explosion hazardous environments, the compliance of the solenoid with the zone classification and with the flammable substances present in the system must be verified.
The main safety requirements against the explosion risks in the classified areas are established by the European Directives 2014/34/UE (for the components) and 99/92/CE (for the plants and safety of the workers against the risk of explosion).

The classification criteria of the area against the explosion risks are established by the norm EN60079-10.
The technical requirements of the electrical systems are established by the norm EN60079-14 (group II).

Note: the max fluid temperature controlled by the valve must not exceed + 60°C

⚠ Ensure that no explosive atmosphere may occur during the valve installation.
Only use the valve in the intended explosion protection area.
The ignition temperature of the hydraulic fluid used must be 50°C higher than the maximum surface temperature of the valve.

Use of the valve outside the approved temperature ranges may lead to functional failures like e.g. overheating of the valve solenoid.
This means that the explosion protection is no longer ensured.
Only use the valve within the fluid temperature range.
During operation, touch the valve solenoid only by using protective gloves.
Unload the system pressure before working on the valve.
Danger of serious injury can be caused by a powerful leaking of hydraulic fluid jet.
Before working on the valve, ensure that the hydraulic system is depressurized and the electrical control is de-energized.

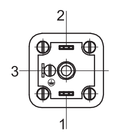
9.3 Electrical connection

For the solenoid application in classified area, specific equipment (safety barriers), certified in conformity to EN60079-11 norms, must be used.
Their electrical output characteristics must be in accordance to the solenoid max input parameters, printed on the solenoid nameplate.
See tech. table GX010 for Atos safety barriers.
The analysis of the system composed by the electrical equipment, the solenoid and the connection cables has to be performed by trained personnel and it must be in accordance to the requirements of EN 60079-25 (Ex-i systems) concerning to the intrinsically safety systems.

Connector wiring

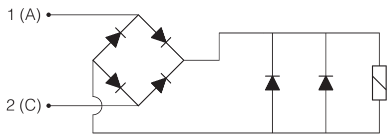
/6	Connections
1	Coil
2	Coil
3	GND

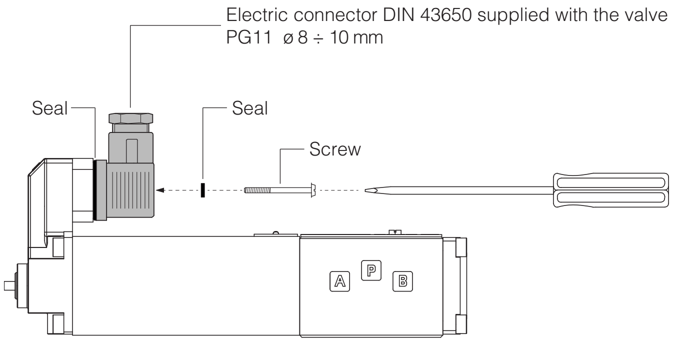
Connector interface



DIN 43650

Electric circuit





⚠ In case of humid or wet environments, water or humidity may penetrate into the electrical connections.
This case may lead to malfunctions at the valve and to unexpected movements of the controlled hydraulic actuator which may result in personal injury and damage to property.
Only use the valve within the intended IP protection class.
Before the assembly ensure that the connector seals are in good condition.
The electric connector must be fully tightened with the relevant screw.

9.4 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 mm^2/s - max allowed range 2,8 ÷ 500 mm^2/s

9.5 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

10 MAINTENANCE

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

10.1 Ordinary maintenance

⚠ Service work perfomed on the valve by end user or not qualified personnel invalidates the certification

- 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 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

10.2 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 and invalidates the certification tools for repairing.

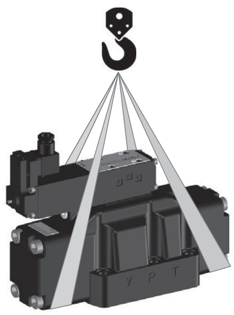
⚠ **The intrinsically safe solenoids must not be opened.**
Any tampering invalidates the certification and it may cause serious dangerous.

11 TRANSPORT AND STORAGE

11.1 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



⚠ Danger of damage to property and personal injuries!
The valve may fall down and cause damage and injuries, if transported improperly:
- Use the original packaging for transport
- Use personal protective equipment
(such as gloves, working shoes, safety goggles, working clothes, etc.)

11.2 Storage

Valve's corrosion protection is achieved with zinc coating: this treatment protect the valve to grant a storage period up to 12 months.
Additionally all valves are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.
In case of storage period longer than 12 months please contact our technical office.
Ensure that valves are well protected against water and humidity in case of storage in open air.

12 RELATED DOCUMENTATION

Directional valves

EX100 DHW - direct, spool type
EX120 DLWH - direct, poppet type
EX130 DPHW - piloted, spool type
EX150 LIDEW-WO, LIDBH-WO - piloted ISO cartridges and functional covers

Pressure relief valves

CX030 AGAM-WO, ARAM-WO - piloted, with solenoid valve for venting

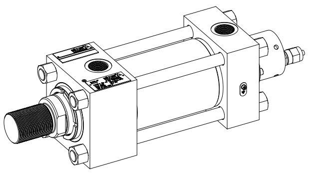
Safety barriers

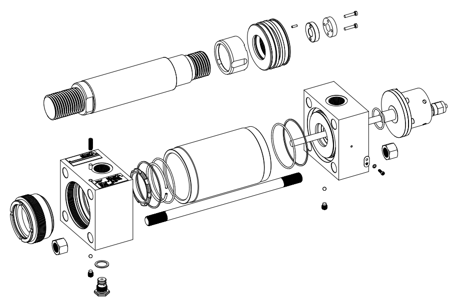
GX010 Y-BXNE Power supply barrier

Operating and maintenance information

for ex-proof cylinders & servocylinders

These operating and maintenance information are valid only for Atos ex-proof cylinders & servocylinders; they are intended to provide useful guidelines to avoid risks when hydraulic cylinders are installed in a machine or a system. Information and notes about transportation and storage of hydraulic cylinders are also provided.
These norms must be strictly observed to avoid damages and ensure trouble-free operation. The respect of these operating and maintenance information ensures an increased working life and thus reduced repairing cost of the hydraulic cylinders and system.





1 SYMBOLS CONVENTIONS

⚠ This symbol refers to possible danger which can cause serious injuries

2 GENERAL NOTES

The cylinder operating and maintenance information are part of the operating instructions for the complete machine but they cannot replace them

Atos is not liable for damages resulting from an incorrect observance of these instructions.
All the hydraulic cylinders have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorised mechanical or electronic interventions
- The hydraulic cylinders are not used exclusively for their intended purpose as defined in these operating and maintenance instructions

3 HARMONIZED STANDARDS

CKA cylinders meet the requirements laid down in the Explosion protection directive 2014/34/EU with reference to European standards documentations:

ISO 80079-36 "Non electrical equipment for potentially explosive atmospheres - Basic method and requirements"
ISO 80079-37 "Non electrical equipment for explosive atmospheres - Protection constructional safety 'c', liquid immersion 'k'"

The hydraulic cylinder must be exclusively used in areas and zones assigned to the equipment group and category. Also observe the other details about explosion protection given as follow. See section 6 for zones in relation to equipment groups and category.

⚠ **Check the code in the nameplate to ensure that the hydraulic cylinder is suitable for the installation area**

4 WORKING CONDITIONS

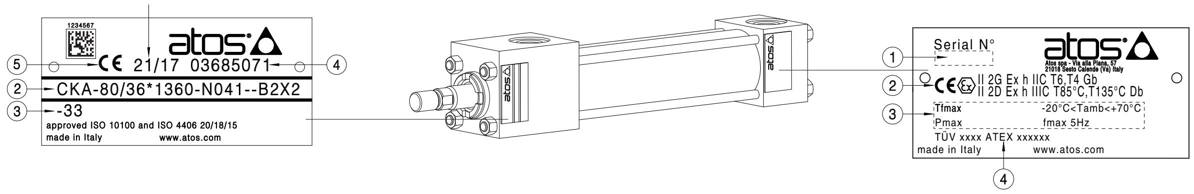
⚠ **The operation of hydraulic cylinders is not permitted at different operating and environmental conditions than those specified below**

Description	**CKA, CKAM**
Ambient temperature	-20 ÷ +70°C -40 ÷ +65°C for **CKAM**
Fluid temperature	-20 ÷ +70°C (**T6**) -20 ÷ +120°C (**T4**) for seals type **G2** (1)
Max surface temperature	≤ +85 °C (**T6**) ≤ +135 °C (**T4**) for seals type **G2** (1)
Max working pressure	16 MPa (160 bar)
Max pressure	25 MPa (250 bar)
Max frequency	5 Hz
Max speed	1 m/s 0,5 m/s for seals type **G1**
Recommended viscosity	15 ÷ 100 mm²/s
Max fluid contamination level	ISO4406 20/18/15 NAS1638 class 9, see also filter section at www.atos.com or KTF catalog

Note: (1) Cylinders with seals type **G2** may also be certified **T6** limiting the max fluid temperature to 70°C

5 NAMEPLATES

Nameplate 1 - Standard **Nameplate 2 - ATEX**



Nameplate 1 - Standard (2)

Pos.	Description
①	Delivery date
②	Cylinder code
③	Series number
④	Customer code (only if requested)
⑤	CE mark

Nameplate 2 - ATEX (1)(2)

Pos.	Description
①	Cylinder serial number
②	Marking according to ATEX directive
③	Working limit conditions
④	Notified body and certified number

Working conditions - legend

Sym.	Meaning
Tfmax	Max fluid temperature
Pmax	Max pressure
Tamb	Ambient temperature
fmax	Max frequency

Notes: (1) ATEX cylinders are supplied with 2 nameplates: standard and ATEX
(2) The position of the nameplate on the rear or front heads can change due to the cylinder overall dimensions

6 ATEX CERTIFICATION

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive EN 60079-10-1/2. The table below shows the available installation zones related to the equipment group and category.

EN 60079-0		Directive 2014/34/EU		Application, properties (exerpt from Directives)	Zones EN 60079-10-1/2
EPL	**Group**	**Equipment group**	**Category**		
Gb	II	II	2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
Gc		II	3G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur for short periods. **Normal level of protection**	2
Db	III	II	2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21,22
Dc		II	3D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur rarely or for short periods. **Normal level of protection**	22

⚠ **The cylinder group and category may change when rod position transducers or proximity sensors are provided, see table below and tab. BX500. For details about certification and safety notes consult the user's guides included in the supply**

Cylinder type		Group	Equipment category	Gas/dust group	Temperature class	Zone
CKA		II	2 GD	II C/III C	T85°C(T6) / T135°C(T4)	1,2,21,22
CKA with ex-proof rod position transducer	**GAS**	II	2 G	II B	T6/T5	1,2
	DUST	II	2 D	IIIC	T85°C/T100°C	21,22
CKA with ex-proof proximity sensors		II	3 G	II	T4	2

II 2G Ex h IIC T6,T4 Gb (gas) **II 2D Ex h IIIC T85°C, T135°C Db (dust)**

GROUP II, Atex

II = Group II for surface plants
2 = High protection (equipment category)
G = For gas, vapours
D = For dust
Ex = Equipment for explosive atmospheres
IIC = Gas group
IIIC = Dust group
T85°C/T135°C = Surface temperature class for dust
T6/T4 = Surface temperature class for gas
Gb/Db = EPL Equipment group

7 SAFETY NOTES

7.1 General

- The presence of cushioning can lead to a peak of pressure that can reduce the cylinder working life, ensure that the dissipated energy is less than the max value reported in **tab. B015**
- Make sure that the maximum working conditions, shown in section 4, are not exceeded
- Ensure to use hydraulic fluids compatible with the selected sealing system, see **tab. BX500**
- The rod must be handled with care to prevent damages on the surface coating which can deteriorate the sealing system and lead to the corrosion of the basic material
- The mounting screws must be free from shearing stress
- Transverse forces on the rods must always be avoided
- When the cylinder has to drive a rotating structure or where little alignment errors are expected, mounting style with spherical bearing should be used
- Contact surfaces, support elements in tolerance, elastic materials and labels must be covered before painting the cylinder

7.2 Proximity sensors

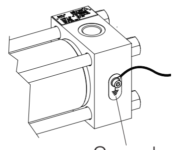
- Proximity sensors are supplied already adjusted, if other regulations are necessary see **tab. BX500** or contact our technical office
- Ensure not to remove the sensor while the cylinder is under pressure
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.3 Position measuring system

- Position transducers must never be removed, if not otherwise specified in **tab. BX500**, while the cylinder is under pressure
- Observe the information provided in **tab. BX500** for the electronic connections
- The connectors must never be plugged or unplugged when the power supply is switched-on

7.4 Installation

- Consult **tab. P002** for installation, commissioning and maintenance of electrohydraulic system
- The piping have to be dimensioned according to the max pressure and max flow rate required
- All pipes and surfaces must be cleaned from dirt before mounting
- Remove all plug screws and covers before mounting
- Make sure that connections are sealed before giving pressure to the system
- Ensure to not exchange the pipe ports when connecting the cylinders
- Bleed-off the system or the hydraulic cylinder using the proper device, see the technical data sheet for details
- Ensure that the cylinder mounting allow easy of acces for the purpose of maintenance and the adjustment of cushioning
- The max surface temperature indicated in the nameplate must be lower than the following values:
  GAS - **80% of gas ignition temperature**
  DUST - max value between **dust ignition temperature - 75°C** and **2/3 of dust ignition temperature**
- The ignition temperature of the fluid must be 50°C greater than the maximum surface temperature indicated in the nameplate
- The cylinder must be grounded using the threaded hole on the rear head, evidenced by the nameplate with ground symbol. The hydraulic cylinder must be put at the same electric potential of the machine



⚠ **For details about ex-proof proximity sensors or position transducer refer to the user's guide included in the supply**

8 MAINTENANCE

- Ordinary maintenance of the cylinder consist of cleaning of the external surfaces using a wet cloth to avoid accumulation of dust layer > 5 mm
- Do not use compressed air for cleaning to avoid any dangerous dust dispersion on the surrounding atmosphere
- Any sudden increment in temperature requires immediate stop of the system and inspection of the relevant components

⚠ **Maintenance must be carried out only by qualified personnel with a specific knowledge of hydraulics and electrohydraulics**

8.1 Preliminary check and ordinary maintenance

Atos hydraulic cylinders don't require any maintenance after commissioning. Anyway it is recommended to take into account the following remarks:

- Results of maintenance and inspection must be planned and documented
- Check oil escaping from oil ports or leakages at the cylinder heads
- Check for damages of the chromeplated surface of the rod: damages may indicate oil contamination or the presence of excessive transverse load
- Determine lubricating intervals for spherical clevises, trunnion and all parts not self-lubricated
- The rod should always be retracted during long stop of the machine or system

⚠ **Any repairing must be performed only by experienced personnel, authorized by Atos**

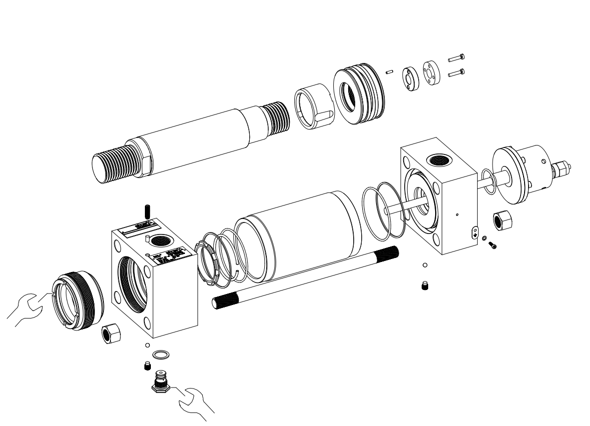
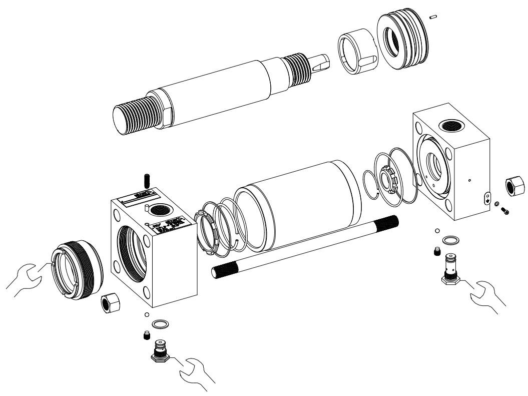
- Remove any salt, machining residuals or other dirt cumulated on the rod surface
- Follow the maintenance instructions of the fluid manufacturer

8.2 Repairing

Before beginning any repairing observe the following guidelines:

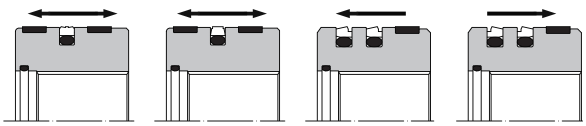
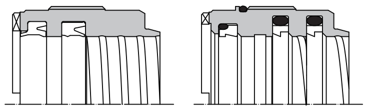
- Unauthorized opening of the cylinder during the warranty period results in the warranty expiration
- Be sure to use only original spare parts manufactured or supplied by Atos
- Provide all the required tools to make the repair operations safely and not damage the components
- Read and follow all the safety notes given in section 7
- Ensure that the cylinder is well locked before beginning any operation
- Disassembly or assembly the cylinder with the right order as indicated in section **8.3**
- When mounting rod or piston guides and seals observe the correct position as indicated in section **8.4**. Any bad positioning can result in oil leakages
- It is strongly recommended the use of expanding sleeves to insert the seals in the proper groove
- Tighten all the screws or nuts as follow: lubricates the threads, insert the screw or the nut by hand for some turns, tighten the screw crosswise with the tightening torque specified in the technical table (a pneumatic screw driver may be used)
- Rod bearing and piston must be locked respectively to the front head and to the rod by means of special pin to avoid unscrewing
- The replacement of wear parts such as seals, rod bearing and guide rings depends on the operating conditions, temperature and quality of the fluid

8.3 Cylinders exploded views

CKAM servocylinder - For spare parts contact our technical office	**CKA -** For spare parts contact our technical office
	

Note: this symbol means that a particular equipment is required for mounting, contact our technical office

8.4 Sealing system mounting

PISTON	ROD BEARING
	
G1 · G2-G4 · G6 Single effect pushing · G7 Single effect pulling	G1 · G2-G4-G6-G7

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transport of hydraulic cylinders:

- Cylinders have to be transported using a forklift truck or a lifting gear always ensuring a stable position of the cylinder
- Cylinders have to be transported in horizontal position in their original packaging
- Use soft lifting belts to move or lift the cylinders in order to avoid damages
- Before any movement check the cylinders weight (due to tolerances, the weight may be 10% greater than the values specified in the technical table)

⚠ **Additional parts such as pipes, subplates and transducers must never be used for lifting**

9.2 Storage

Corrosion protection is achieved with alkyd primer painting RAL 9007: the primer grants a storage period up to 12 months. Additionally all cylinders are tested with mineral oil OSO 46; the oil film, presents in the cylinder chambers after testing, ensures the internal corrosion protection.

Anyway be care to observe the following remarks:

- When a storage in the open air is foreseen ensure that cylinders are well protected against water
- The cylinders must be inspected at least once a year and rotated through 90° every six months to preserve the seals

⚠ **In case of storage period longer than 12 months, contact our technical office**

10 CYLINDERS TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Oil leakage	High lateral loads involve a premature wear of the bronze bushing, seals and wear rings	a) Improve the precision of the machine alignment b) Decrease lateral loads c) Install a pivoted mounting style **C**-**D**-**G**-**H**-**S**-**L**
	Fluid contaminants produce scratch and score marks on the seals	Check the fluid contamination class is < 20/18/15
	Chemical attack cause the deterioration of seals compound	Check seals compatibility with operating fluid
	High temperatures (fluid/ambient) the seals dark and flaked	a) Decrease the fluid temperature b) Install **G2** sealings for high temperatures
	Low temperature (ambient) make the seals brittle	a) Move the cylinder in a higher temperature zone b) Install **G9** seals for low temperatures
	High rod speed reduce the lubricant capacity of the seals	For rod speed > 0,5 m/s Install **G2** – **G4** seals
	High frequency reduce the lubricant capacity of the seals	For rod frequency > 5 hz Install **G0** seals
	Output rod speed higher than the input one	Check the rod speed ratio in/out complies with the minimum R_{min} value, see tech.table **B015**
	The pressurization of the mixture air/mineral oil may involve self combustion dangerous for the seals (Diesel effect)	Bleed off completely the air inside the hydraulic circuit
Wiper or seal extrusion	Overpressure	a) Limit the pressure of the system b) Install **G2**-**G4**-**G8** seals if overpressure cannot be reduced
	Rod seals leakages may involve overpressures among wiper and rod seal, causing their extrusion	a) See possible causes and solutions for oil leakage troubles b) Install draining option **L**
Lose of cushioning effect	Rod speed too low at end stroke	a) Check the cushioning adjustment is not fully open, regulate it if necessary b) Replace "fast" cushioning **1**-**2**-**3**, with "slow" cushioning **4**-**5**-**6** if the cushioning is not effective with cushioning adjustment fully closed
	Cushioning adjustment cartridge with improper regulation	Close the cushioning adjustment screw till restoring the cushioning effect
	Fluid contaminants produce scratch and score marks on the cushioning piston	Check the fluid contamination class is < 20/18/15
Rod locked or impossible to move	Overpressure in the cushioning chamber could involve the cushioning piston locking	a) Replace "fixed" cushioning **7**-**9** with "adjustable" cushioning **1**-**3** b) For adjustable cushioning, open the cushioning adjustment to decrease the max pressure inside the cushioning chamber c) Check the energy dissipated by the cushioning is lower than max energy dissipable, see tech.table **B015**
	Fluid contaminants may lock the piston because of its tight tolerances	Check the fluid contamination class is < 20/18/15
Rod failure	Overload/overpressure involves ductile rod failure	a) Check the overpressure inside the cylinder and decrease it b) Check the compliance with the admitted operating pressure according to the cylinder series
	High load/pressure coupled to high frequencies or long life expectation involves fatigue rod failure	a) Check the expected rod fatigue working life proposed in tech. table **B015** b) Decrease the operating pressure
Rod vibration	Seals with excessive friction could involve rod vibration and noise	Install low friction PTFE seals **G2**-**G4**, see tech.table **B015**
	Air in the circuit may involve a jerky motion of the rod	Bleed off completely the air inside the hydraulic circuit
Rod motion without oil pressure	Variations in the fluid temperature involve the fluid expansion / compression thus the rod moving	a) Decrease the temperature variations in the oil b) Change the fluid type to decrease the coefficient of thermal expansion
	Excessive oil leakage from the piston or rod seals	See likely causes and solutions for oil leakage troubles
Noisy cylinder	Impact of the piston with the heads caused by high speed (>0,05 m/s)	a) Decrease the rod speed b) Install external or internal cushioning system **1**-**9**, see tech.table **B015** for the max energy that can be dissipated
	Fluid contaminants, foreign particles inside the cylinder may generate unusual noise	Check the fluid contamination class is < 20/18/15
	High oil flow speed > 6 m/s	a) Increase the piping diameters to reduce the oil flow speed b) Install oversized oil ports, options **D**-**Y**

11 SERVOCYLINDERS TROUBLESHOOTING

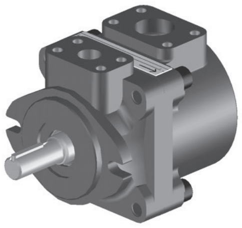
TROUBLE	POSSIBLE CAUSES	SOLUTIONS
Transducer malfunctioning / failure	Improper electronic connections may involve the transducer malfunctioning	Check the electronic connections scheme in tech table **B310**
	Not stabilized power supply may involve dangerous peak of voltage	Install a voltage stabilizer
	Uncontrolled disconnection and connection of plug-in connectors may damage the transducer	Be carefull to switch off the power supply before connecting the position transducer

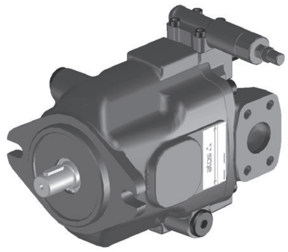
Note: for cylinders troubleshooting refer to section 10

Operating and maintenance information

for ex-proof pumps

This operating and maintenance information apply to ATOS ex-proof pumps and is intended to provide useful guidelines to avoid risks when the pumps are installed in a system.
These norms must be strictly observed to avoid damages and to ensure trouble-free operation. The respect of these operating and maintenance norms grant an increased working life, trouble-free operation and thus reduced repairing costs.
Information and notes on the transport and storage of the pumps are also provided.





1 SYMBOLS CONVENTIONS

This symbol refers to possible dangers which can cause serious injuries

2 GENERAL NOTES

The operating and maintenance information are part of the operating instructions for the complete machine but thay cannot replace them

This document is relevant to the installation, use and maintenance of ex-proof fixed displacement vane pumps and ex-proof variable displacement piston pumps for application in explosive hazardous environments.

2.1 Warranty

All the hydraulic pumps have 1 year warranty; the expiration of warranty results from the following operations:
- Unauthorized mechanical interventions
- The hydraulic pumps are not used exclusively for their intended porpose as defined in these operating and maintenance information
- Respect the working limits indicated on nameplate and on technical tables: AX010 for PFEA and AX050 for PVPCA

3 CERTIFICATIONS AND PROTECTION MODE

The ex-proof pumps subject of this operating and maintenance information are certified ATEX
They are in compliance with following protection mode:

II 2/2 G Ex h IIC T5 Gb **II 2/2 D Ex h IIIC T100°C Db**

4 HARMONIZED STANDARDS

The Essential Health and Safety Requirements are assured by compliance to the following standards:

EN ISO 80079-36 Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements
EN ISO 80079-37 Explosive atmospheres – Part 37: Non-electrical equipment for explosive atmospheres – Non electrical type of protection constructional safety “c”, control of ignition source “b”, liquid immersion “k”

The pumps may exclusively be used in areas and zones assigned to the equipments group and category. See section 6 for zones in relation to equipment groups and category.

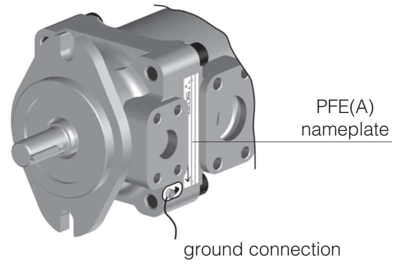
Check the code in the nameplate to ensure that the pump is suitable for the installation area.

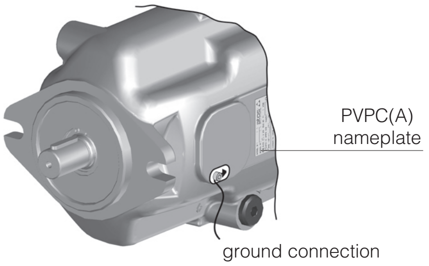
5 WORKING CONDITIONS

Pumps type	**PFEA**		**PVPCA**	
Pumps version	**STD, /PE**	**/7 /PE**	**STD, /PE**	**/7 /PE**
Ambient temperature [°C]	-20 ÷ +60	-20÷+70	-20 ÷ +60	-20÷+70
Max inlet fluid temperature [°C]	+60	+80	+60	+80
Protection degree	IP 66			
Max working pressure (1)	**PFEA*-*1**: from 160 to 210 bar, **PFEA*-*2**: from 210 to 300 bar		280 bar for size 29, 46, 73 250 bar for size 90	
Recommended pressure at inlet port	**PFEA*-*1**: from -0,15 to +1,5 bar for speed up to 1800 rpm; from 0 to +1,5 bar for speed over 1800 rpm **PFEA*-*2**: from 0 to +1,5 bar		from -0,2 to +24 bar	
Speed range (1) [rpm]	from 800 to 2800 rpm, depending to the size		from 600 to 3000 rpm, depending to the size	

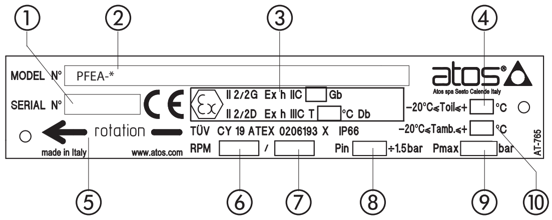
(1) Max working pressure and speed range must be reduced for /PE versions and for water glycol fluids, see tab. **AX10** for PFEA and **AX050** for PVPCA-*

5 NAMEPLATES

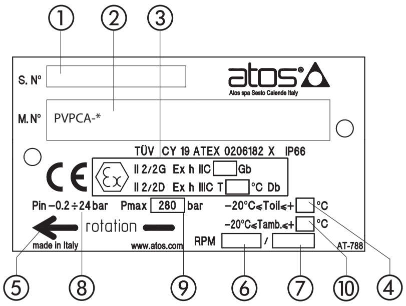




Nameplate for PFEA



Nameplate for PVPCA



Description

① Serial number
② Pump code
③ Marking according to ATEX
④ Maximum inlet fluid temperature
⑤ Pump shaft rotation direction: clockwise or counterclockwise
⑥ Minimum pump rotation speed in RPM = revolution/min
⑦ Maximum pump rotation speed in RPM = revolution/min
⑧ Mimimun inlet pressure (PFEA), range inlet pressure (PVPCA)
⑨ Maximum working pressure
⑩ Maximum ambient temperature
⑪ Delivery date

Ex II 2/2G Ex h IIC T(*) Gb or **Ex II 2/2D Ex h IIIC T(**)°C Db**

Ex = Equipment for explosive atmospheres
II = Group II for surfaces plants
2/2 = Pump category
G or **D** = **G** for gas and vapours, **D** for dust
h = Marking includes one on more of the following types of protection (“c”, “b”, “k”)
IIC = Gas group (acetylene, hydrogen)
IIIC = Conduictive dust
T* = Temperature class (T6, T5, T4)
T°C** = Max surface temperature (85, 100, 135)

6 EQUIPEMENT GROUP, CATEGORY AND INSTALLATION ZONE

The user must define the overall areas of the system into different explosive atmospheres zones in accordance with directive 99/92/CE.
The table below shows the available installation zones related to the equipment group and category.

Equipment group	Category	Application, properties	Zone
II	2/2G	Potentially explosive atmospheres, in which explosive gases, mists or vapors are likely to occur occasionally. **High level of protection**	1, 2
II	2/2D	Potentially explosive atmospheres, in which explosive dust/air mixtures are likely to occur occasionally. **High level of protection**	21, 22

PUMP VERSION	Equipment group	Category	Gas and Dust group	Temperature class	Zone
PFEA and PVPCA	II	2/2G and 2/2D	IIC and IIIC	PFEA T6 (T85°C), PVPCA T5 (T100°C)	1, 2, 21, 22
PFEA* /7 /PE and PVPCA* /7 /PE	II	2/2G and 2/2D	IIC and IIIC	PFEA* T5 (T100°C), PVPCA* T4 (T135°C)	1, 2, 21, 22

7 **SAFETY NOTES**

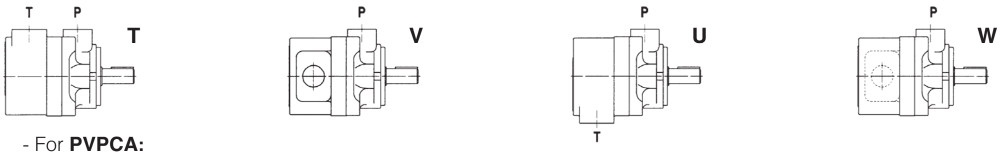
- General:

- Before start up make sure that the pump is always filled with the working fluid. See section 7.4.
- The pump must not be used 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 section 5 are not exceeded

7.1 Installation position and port orientation

The installation must ensure that the pump remains always filled with the working fluid.

- For **PFEA:** the pump can operate in any position, the available orientation of the oil ports is according to the below picture. In the ordering code must be specified the selected orientation.



- For **PVPCA:**
  - 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 realized by means of proper elastic coupling.

7.2 Shaft loads

PFEA: axial and radial loads acting on shaft are not permitted.
PVPCA: axial and radial loads acting on shaft are permitted, max permissible loads are indicated in the table AX050, 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

7.3 Shaft rotation

The direction of shaft rotation (D = clockwise, S = counterclockwaise, viewed from the shaft end) must be the same of the arrow on the nameplate.

7.4 Oil level and temperature

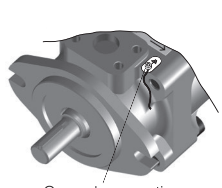
Make sure that the pump is always filled with flui. The installer / end user has to provide a level meter to verify the presence of fluid inside the tank.

The monitoring of the inlet fluid temperature it is required only when it can reach critical values.

This monitoring should be performed on the surface of the fluid inlet pipe, near the pump’s suction flange.
The monitoring system must operating with a tolerance of -5 °C of the maximum declared value.
For example, if the maximum inlet fluid temperature is 60 °C, the control system must be operating between + 55 °C and + 60 °C.
The sensor used for monitoring the fluid level and the temperature must be ATEX certified and conform to the installation area:
the control unit (PLC) must be certified IPL1 or SIL 1 also.

7.5 Important notes

- A pressure relief valve must be installed on the pressure line near the pump outlet port.
- The electric motor to be used for the pump operation must be also certified in compliance with installation zone. The compliance with applicable norms is extended to all electrical components connected with the installed pump.
- The piping have to be dimensioned 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 pipe ports when connecting the system
- Ensure that the pump installation allows an easy acces for maintenance purpose
- According to EN 1127-1:2008, the maximum surface temperature indicated in the nameplate must be lower than the following Tmax values:
  Gas - Tmax= max value (80% of gas ignition temperature) **Dust** - Tmax = dust ignition tempeature - 75°C
- Make sure that the pump is suitable for the use in the designated installation area, on the base of the zone classification according to the Directive 99/92/CE and to the type of flammable atmosphere (gas, vapor, dust)
- The fluid ignition temperature must be 50K greater than the maximum surface temperature indicated in the nameplate
- The maximum operating pressure and minimum inlet pressure are indicated on pump’s nameplate
- The pump must be connected to ground using the ground facility (screw M3x5) provided on the pump body and evidenced with grounding nameplate
- The pump’s body and the electric motor, or other devices used to drive the pump, must be connected at the same electric equipotential level
- Pumps PVPCA with control devices type CH are equipped with Explosion-proof solenoid valves (assembled to the pump body and certified according to ATEX 2014/34/EU
- Pumps PVPCA with control devices type LW are equipped with a device to achieve a constant power, factory set at a specific power value required by customer



Ground connection

Grounding nameplate

7.6 Hydraulic fluids and operating viscosity range

Recommended mineral oils type HLP having high viscosity index. Ensure to use hydraulic fluids 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 PVPCA 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 limits:

- 10 mm^2/s for short periods at max fluid temperature on drain line
- 24 to 100 mm^2/sduring normal operation
- 1000 mm^2/s for short period at cold start-up (800 mm^2/sec for PVPCA)

7.7 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: **PFEA** = ISO4406 class 21/19/16 NAS1638 class 10; **PVPCA** = ISO4406 class 20/18/15 NAS1638 class 9
- longer life: **PFEA** = ISO4406 class 19/17/14 NAS1638 class 8; **PVPCA** = ISO4406 class 18/16/13 NAS1638 class 7

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

- Service work perfomed 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 bearing and front shaft seal, according to the following schedule:
  PFEA must be replaced after reaching **20000 working hours**
  PVPCA without radial loads must be replaced after reaching **20000 working hours**

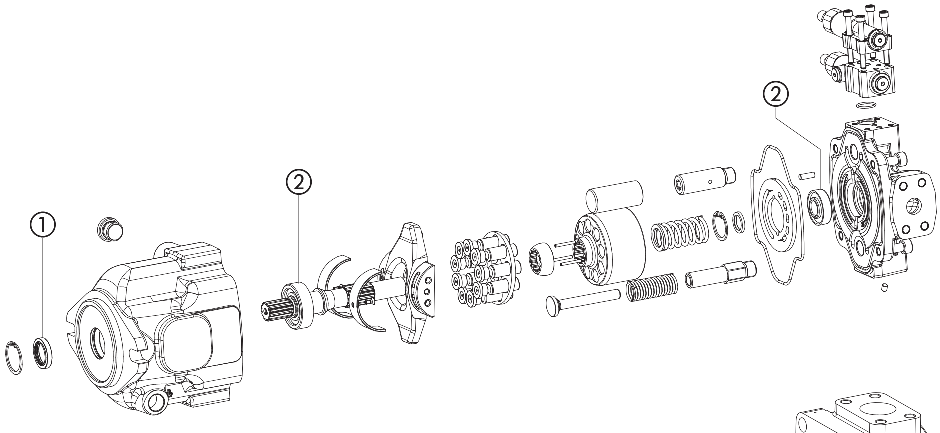
In presence of radial loads (permitted only for PVPCA) the following maintenance schedule must be considerated:

PVPCA-3029 must be replaced after reaching **1550 working hours**
PVPCA-4046 must be replaced after reaching **2600 working hours**
PVPCA-5073 must be replaced after reaching **5000 working hours**
PVPCA-5090 must be replaced after reaching **5000 working hours**

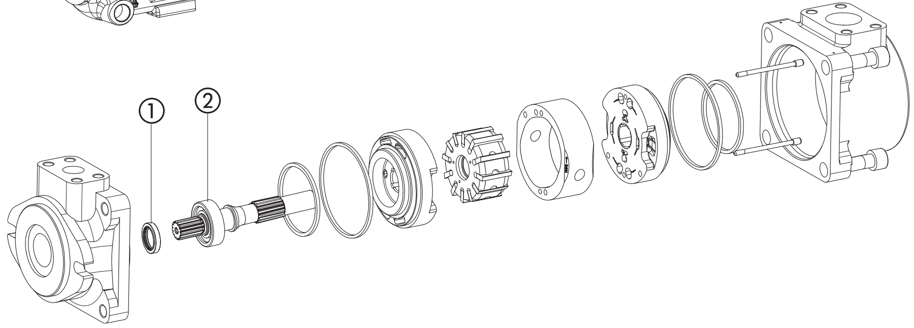
- When mounting bearings and front seal, observe the correct position as indicated in the drawing below: any incorrect positioning can result in oil leakages
- Results of maintenance and inspection must be planned and documented
- Follow the maintenance instructions of the fluid manufacturer

① Front seal
② Bearings

PVPCA



PFEA



8.2 Repairing

Before beginning any repairing activity, the following guidelines must be observed:

- Unauthorized opening of the pump during the warranty period invalidates the warranty
- Be sure to use only original spare parts manufactured or supplied by ATOS factory
- Provide all the required tools to make the repair operations safely and to don't damage the components

9 TRANSPORT AND STORAGE

9.1 Transport

Observe the following guidelines for transportation of pumps:

- Hydraulic 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 rilevant technical tables AX010 and AX050

9.2 Storage

PFEA corrosion protection is achieved with zinc phosphating: this treatment protect the pump to grant a storage period up to 12 months.

PVPCA corrosion protection is achieved with trasparent oil film.

Additionally all pumps are tested with mineral oil OSO 46; the oil film left after testing ensure the internal corrosion protection.

In case of storage period longer than 12 months please contact our technical office.

Ensure that pumps are well protected against water and humidity in case of a storage in the open air.

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