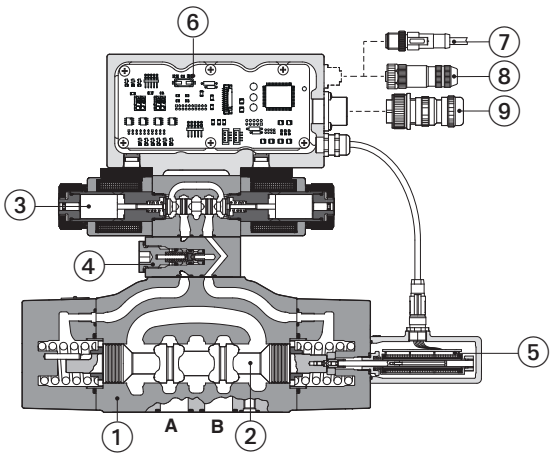
Digital proportional directional valves high performance

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



DPZE-TID-*-271

① Valve body
② Main stage Spool
③ Pilot valve
④ Pilot pressure reducing (standard)
⑤ Main stage LVDT transducer
⑥ On-board digital driver
⑦ USB connector - only for TID-NP
⑧ CANopen connector - only for TID-BC
⑨ Main connector

DPZE-TID

Digital high performances proportional directional valves, piloted, with LVDT position transducer (main stage) and positive spool overlap for directional controls and not compensated flow regulations.

TID on-board digital driver performs the valve's hydraulic regulation according to the reference signal, analog for TID-NP or CANopen for TID-BC.
The software setting of functional parameters can be performed via USB port for TID-NP, or via CANopen interface for TID-BC.

The LVDT transducer grants high regulation accuracy and response sensitivity.
With de-energized proportional solenoids, the mechanical central position of the spool is performed by centering springs.

Size: **16** ÷ **32** - ISO 4401
4/3 and 4/2 way with standard spools
4/4 way with regenerative spools
Max flow: **400** ÷ **1600 l/min**
Max pressure: **350 bar**

1 MODEL CODE OF STANDARD SPOOLS

DPZE	-	TID	-	NP	-	2	71	-	L	5	/	*	*	/	*

DPZE: Proportional directional valve, piloted

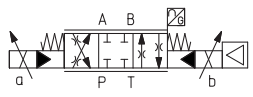
TID = on-board digital driver and LVDT transducer

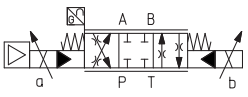
Fieldbus interfaces:
NP = Not present (USB port available)
BC = CANopen (USB port not available) **(1)**

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

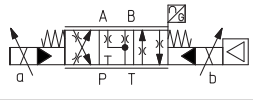
Configuration: **Standard** Option **/B**

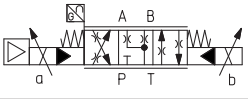
71 =





73 =





Series number

Seals material, see sect. 8:
- = NBR
PE = FKM

Hydraulic options (2) (3):
B = on-board digital driver, connectors and LVDT position transducer at side of port A of the main stage (side B of pilot valve)
D = internal drain
E = external pilot pressure

Electronic options, only for **TID-NP (2)**:
I = current reference input and monitor 4÷20mA
J = current reference input 4÷20mA and voltage monitor ±10 VDC

Spool size:		**3** (L,S,D)	**5** (L,DL,S,D)	**5** (L,S,D)
DPZE-2	=	160	250	-
DPZE-4	=	-	480	-
DPZE-6	=	-	-	640

Nominal flow (l/min) at Δp 10 bar P-T

Spool type, regulating characteristics **(4)**:

L linear

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

S progressive

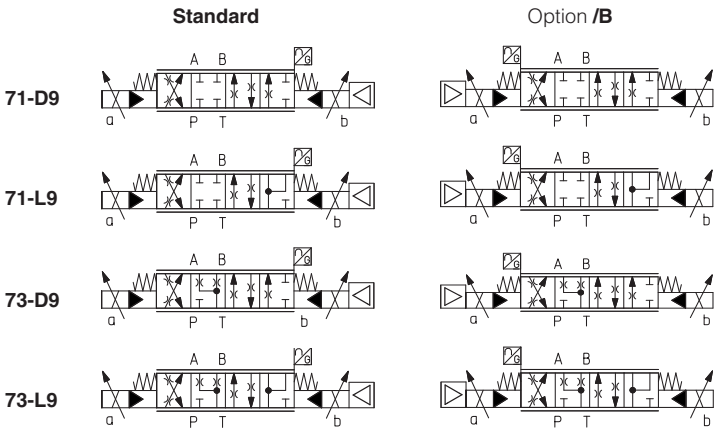
D differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

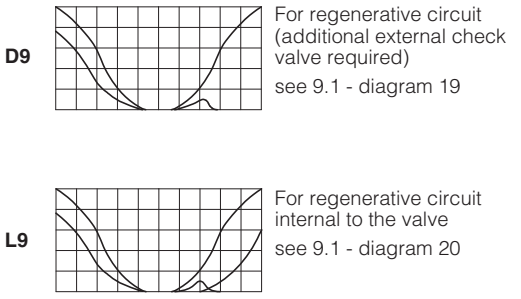
(1) Reference and monitor signals only via CANopen (analog signals not available)
(2) For possible combined options, see section 12
(3) Pilot and Drain configuration: standard configuration is internal pilot and external drain, other configurations on request
(4) For regenerative circuit select configuration 71 or 73 with specific spools D9 or L9, see section 2

2 SPOOLS SPECIFIC FOR REGENERATIVE CIRCUIT - for valve model code and options, see section 1

DPZE	-	TID	-	NP	-	2	71 - L9	/	*	*	/	*

Configuration and spool:





Spool size:		**D9**	**L9**
DPZO-2	=	250	250
DPZO-4	=	480	-
DPZO-6	=	-	-

Nominal flow (l/min) at Δp 10 bar P-T

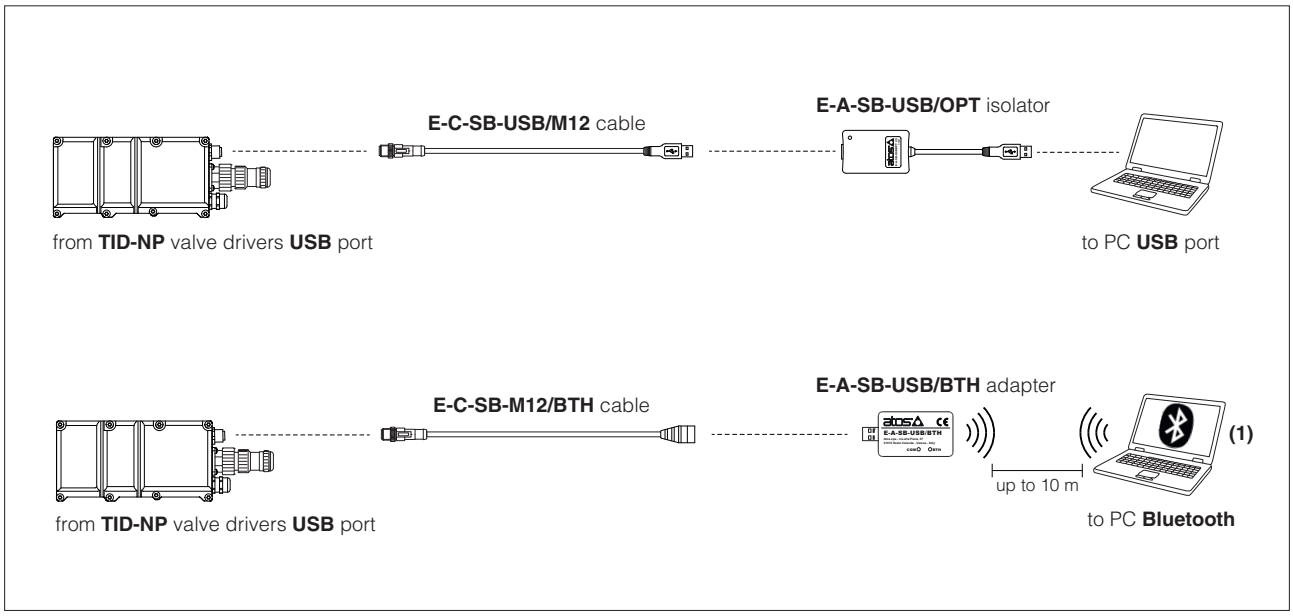
3 GENERAL NOTES

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

4 VALVE SETTINGS AND PROGRAMMING TOOLS

4.1 TID-NP

Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW-BASIC programming software connected via USB/bluetooth to the digital driver, see tech. table **GS500**.



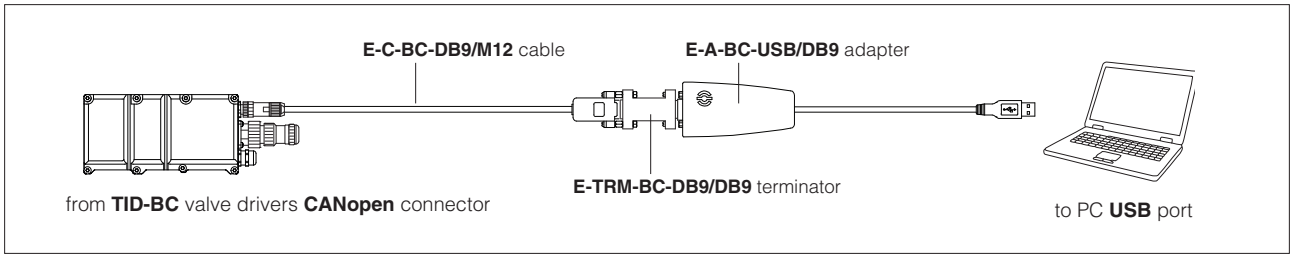
(1) If PC has not built-in Bluetooth, use standard USB to Bluetooth dongle compatible with E-A-SB-USB/BTH specification (please refer to STARTUP-BLUETOOTH guide)

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

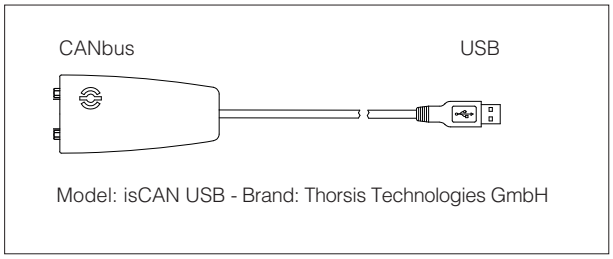
WARNING: see tech table **GS500** for the list of countries where the Bluetooth adapter has been approved

4.2 TID-BC

Valve's functional parameters and configurations can be easily set and optimized using Atos E-SW-FIELDBUS programming software connected via CANopen connector to the digital driver using an adapter from PC USB port to valve CANopen connector, see tech. table **GS500**.

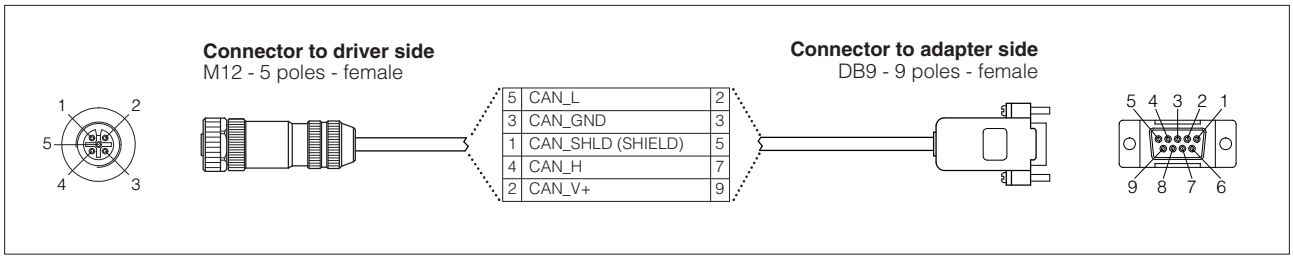


E-A-BC-USB/DB9 adapter - 2 m length



- DB9 male connector according to the CiA specification DR303-1
- USB male connector, type A
- transmission rate from 10 kbit/s to 1 Mbit/s
- external power supply not required (USB supply)
- LEDs indicate the actual working condition

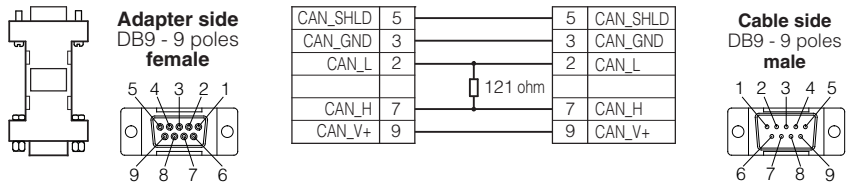
E-C-BC-DB9/M12 cable - 2 m length



DB9 - terminators for USB adapter connection

The fieldbus terminators are required when USB adapter has to be connected directly to the digital driver.

E-TRM-BC-DB9/DB9 CANopen terminator for E-A-BC-USB/DB9 USB adapter



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
Storage temperature range	**Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C
Surface protection	Zinc coating with black passivation (body), tin plating (driver housing)
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h
Compliance	CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3) RoHS Directive 2011/65/EU as last update by 2015/863/EU REACH Regulation (EC) n°1907/2006

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

Valve model			DPZE-*-2		DPZE-*-4	DPZE-*-6
Pressure limits		[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;			
Spool type **(1)**		standard	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
		regenerative		**D9, L9**	**D9**	
Nominal flow Δp P-T **(2)**		[l/min]				
	Δp= 10 bar		160	250	480	640
	Δp= 30 bar		270	430	830	1100
	Max permissible flow		400	550	1000	1600
Piloting pressure		[bar]	min. = 25; max = 350			
Piloting volume		[cm³]	3,7		9,0	21,6
Piloting flow **(3)**		[l/min]	3,7		6,8	14,4
Leakage **(4)**	Pilot	[cm³]	100 / 300		200 / 500	900 / 2800
	Main stage	[l/min]	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(5)**		[ms]	≤ 75		≤ 90	≤ 120
Hysteresis			≤ 1 [% of max regulation]			
Repeatability			± 0,5 [% of max regulation]			
Thermal drift			zero point displacement < 1% at ΔT = 40°C			

(1) For spool type **D** and **DL** the flow value is referred to single path P-A (A-T) at Δp/2 per control edge. The flow P-B (B-T) is 50% of P-A (A-T)

(2) For different Δp, the max flow is in accordance to the diagrams in section 9.2

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

(4) At p = 100/350 bar

(5) 0-100% step signal see detailed diagrams in section 9.3

7 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	
Max power consumption	50 W	
Max. solenoid current	2,6 A	
Coil resistance R at 20°C	3,1 Ω	
Analog input signals **(1)**	Voltage: range ±10 VDC (24 VMAX tolerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω	
Monitor outputs **(1)**	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance	
Alarms	Solenoid not connected/short circuit, cable break with current reference signal **(1)**, over/under temperature, valve spool transducer malfunctions, alarms history storage function	
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors	
Duty factor	Continuous rating (ED=100%)	
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply	
Communication interface	USB - Atos ASCII coding	CANopen - EN50325-4 + DS408
Communication physical layer	not insulated - USB 2.0 + USB OTG	optical insulated - CAN ISO11898
Recommended wiring cable	LiYCY shielded cables, see section 15	

(1) Available only for TID-NP

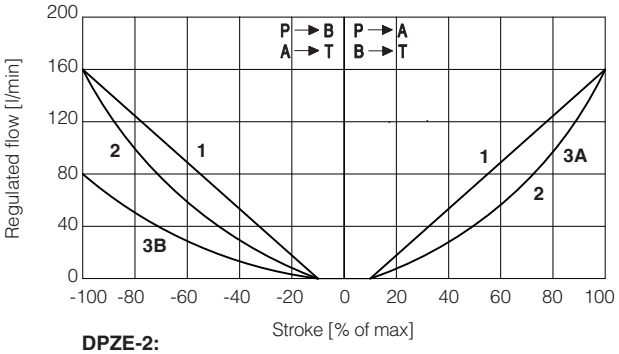
Note: a maximum time of 500 ms (depending on communication type) has to be considered between the driver energizing with the 24 VDC power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

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

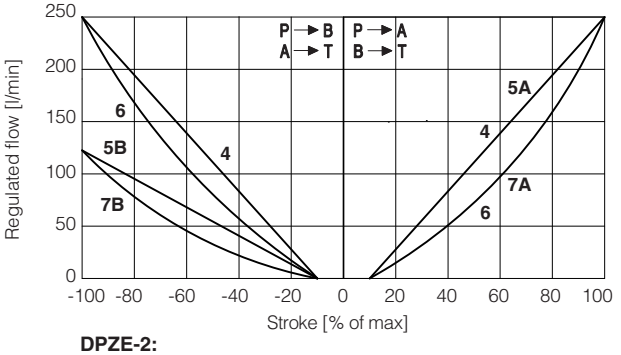
Seals, recommended fluid temperature		NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C		
Recommended viscosity		20÷100 mm²/s - max allowed range 15 ÷ 380 mm²/s		
Max fluid contamination level	normal operation	ISO4406 class 18/16/13 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	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water		FKM	HFDU, HFDR	ISO 12922
Flame resistant with water		NBR	HFC	

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

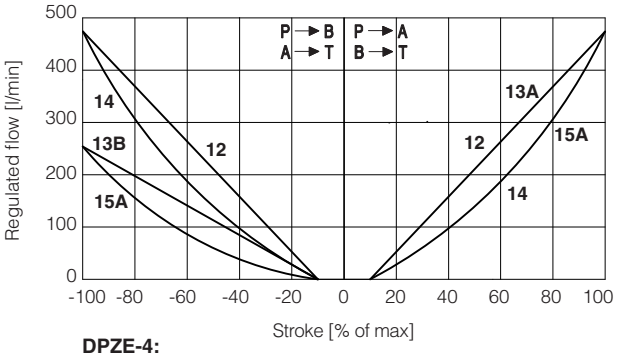
9.1 Regulation diagrams (values measure at p 10 bar P-T)



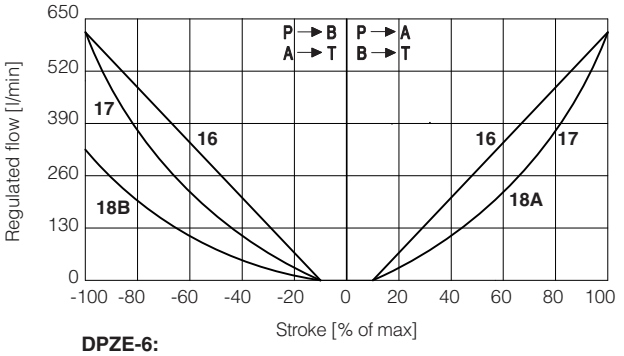
DPZE-2:
1 = L3 **3A** = D3 (P → A, A → T)
2 = S3 **3B** = D3 (P → B, B → T)



DPZE-2:
4 = L5 **5A** = DL5 (P → A, A → T) **7A** = D5 (P → A, A → T)
6 = S5 **5B** = DL5 (P → B, B → T) **7B** = D5 (P → B, B → T)



DPZE-4:
12=L5 **13A**=DL5 (P → A, A → T) **15A**=D5 (P → A, A → T)
14=S5 **13B**=DL5 (P → B, B → T) **15B**=D5 (P → B, B → T)



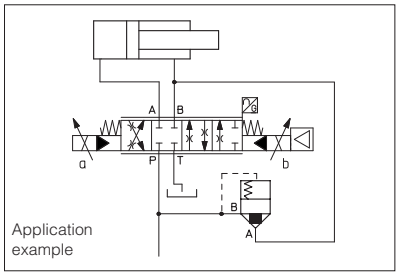
DPZE-6:
16 = L5 **18A** = D5 (P → A, A → T)
17 = S5 **18B** = D5 (P → B, B → T)

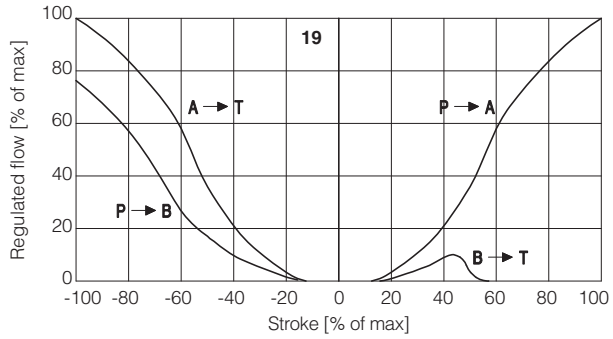
Note:
Hydraulic configuration vs. reference signal (standard and option /B)

TID-NP		**TID-BC**	
Reference signal 0 ÷ +10 V / 12 ÷ 20 mA	P → A / B → T	Positive reference signal	P → A / B → T
Reference signal 0 ÷ -10 V / 12 ÷ 4 mA	P → B / A → T	Negative reference signal	P → B / A → T

19 = differential - regenerative spool **D9**
(not available for valve size 32)

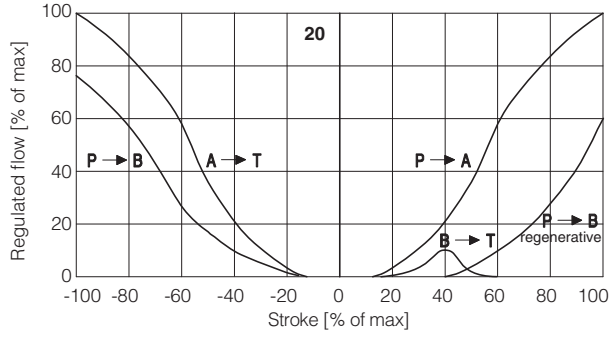
D9 spool type with a fourth position specific to regenerative circuit, performed by means of an additional external check valve.





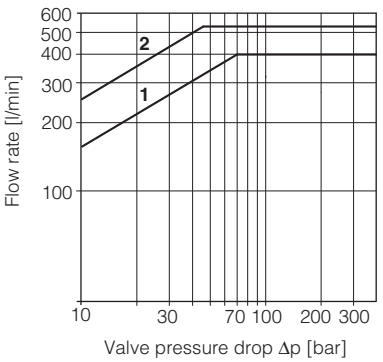
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.

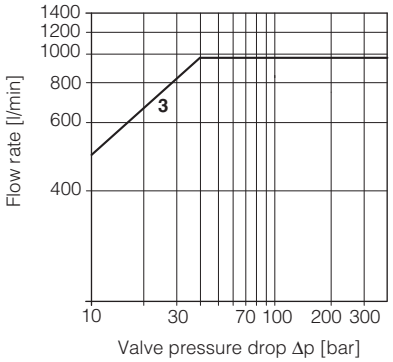


9.2 Operating diagrams

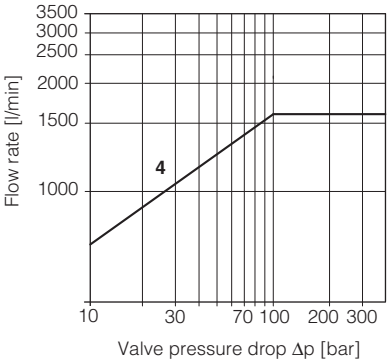
Flow /Δp diagram stated at 100% of spool stroke



DPZE-2:
1 = spools L3, S3, D3
2 = spools L5, S5, D5, DL5, D9, L9



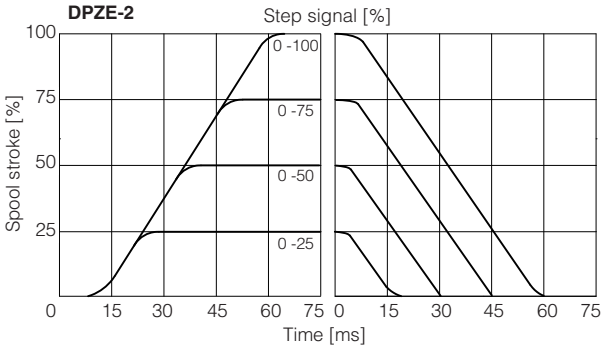
DPZE-4:
3 = spools L5, S5, D5, DL5, D9

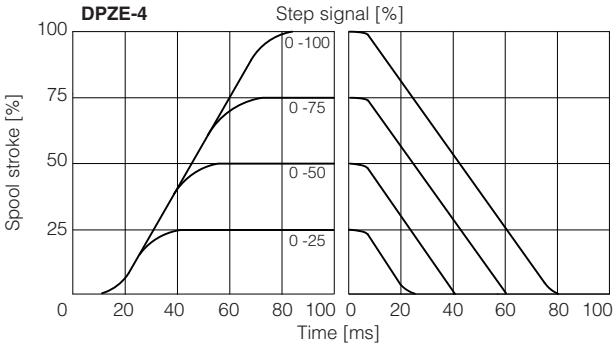


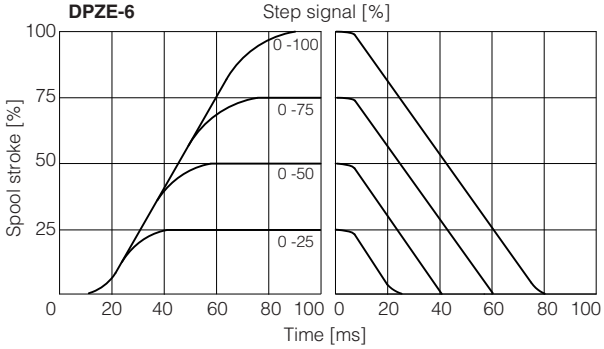
DPZE-6:
4 = L5, S5, D5

9.3 Response time

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







10 HYDRAULIC OPTIONS

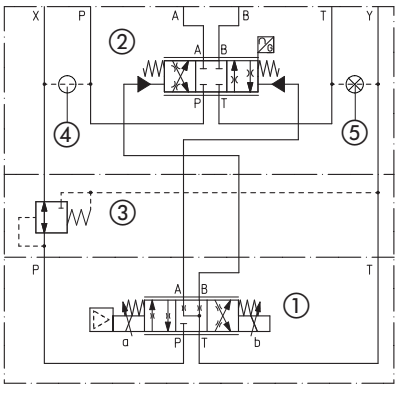
B = Configurations 71, 73: on-board digital driver connectors and LVDT transducer at side of port A of the main stage (side B of pilot valve).
For hydraulic configuration vs reference signal, see 9.1

D = Internal drain.
Pilot and drain configuration can be modified as shown in section 16.
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in section 16.
The valve's standard configuration provides internal pilot and external drain.

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

Functional Scheme - example of configuration 71



11 ELECTRONIC OPTIONS - only for **TID-NP**

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 VDC.
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.

J = This option provides 4 ÷ 20 mA current reference and ±10 VDC voltage monitor signals.
The valve functioning is disabled in case of reference signal cable breakage.

12 POSSIBLE COMBINED OPTIONS

for **TID-NP**: /BD, /BE, /BI, /BJ, /BDE, /BDI, /BDJ, /BEI, /BEJ, /BDEI, /BDEJ, /DE, /DI, /DJ, /DEI, /DEJ, /EI, /EJ
for **TID-BC**: /BD, /BE, /DE, BDE,

13 POWER SUPPLY AND SIGNALS SPECIFICATIONS

13.1 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 the power supply: 2,5 A time lag fuse.

13.2 Flow reference input signal (Q_INPUT+) - only for **TID-NP**

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Standard (voltage reference input): default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Options /I and /J (current reference input): default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

13.3 Flow monitor output signal (Q_MONITOR) - only for **TID-NP**

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.
Standard and option /J (voltage monitor output): default is ±10 VDC and can be reconfigured via software, within a maximum range of ±10 VDC.
Options /I and /J (current monitor output): default is 4 ÷ 20 mA and can be reconfigured via software, within a maximum range of ± 20 mA.

Note:

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

14 ELECTRONIC CONNECTIONS

14.1 Main connector signals - 7 pin (A1) (A2)

PIN	TID-NP	TID-BC	TECHNICAL SPECIFICATIONS	NOTES
A	**V+**		Power supply 24 VDC	Input - power supply
B	**V0**		Power supply 0 VDC	Gnd - power supply
C	**AGND**	**(1)**	Analog ground	Gnd - analog signal
D	**Q_INPUT+**	**(1)**	Flow reference input signal: ±10 VDC for standard, 4 ÷ 20 mA for /I and /J options	Input - analog signal
E	**INPUT-**	**(1)**	Negative reference input signal for Q_INPUT+	Input - analog signal
F	**Q_MONITOR**	**(1)**	Flow monitor output signal: ±10 VDC for standard and /J option, 4 ÷ 20 mA for /I option, referred to AGND	Output - analog signal
G	**EARTH**		Internally connected to driver housing	

(1) Do not connect for TID-BC

14.2 USB connector - M12 5 pin (B) - only for **TID-NP**

PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**+5V_USB**	Power supply
2	**ID**	Identification
3	**GND_USB**	Signal zero data line
4	**D-**	Data line -
5	**D+**	Data line +

(1) Shield connection on connector housing is recommended

14.3 CANopen connector - M12 - 5 pin (C) - only for **TID-BC**

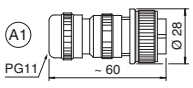
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	**CAN_SHLD**	Shield
2	**not used**	-
3	**CAN_GND**	Signal zero data line
4	**CAN_H**	Bus line (high)
5	**CAN_L**	Bus line (low)

(1) Shield connection on connector housing is recommended

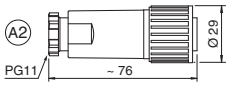
14.4 Connections layout

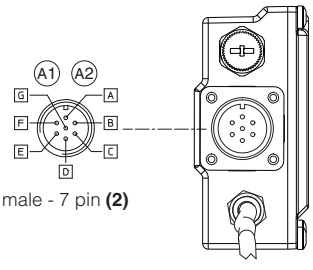
MAIN CONNECTORS

ZM-7P - 7 pin - metallic **(1)**



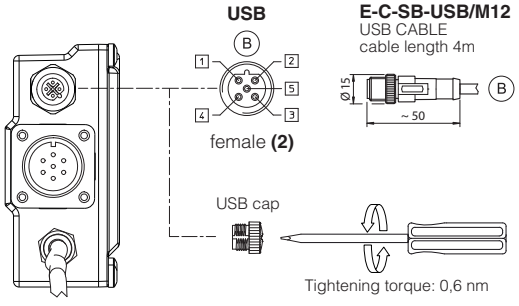
ZH-7P - 7 pin - plastic



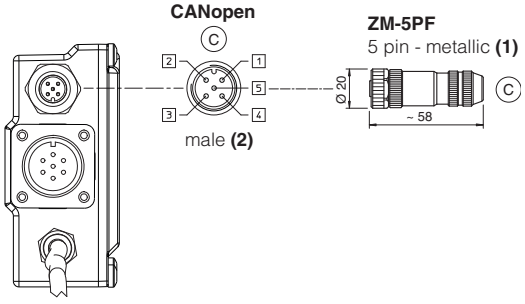


male - 7 pin **(2)**

USB CONNECTOR - only for **TID-NP**



FIELDBUS CONNECTOR - only for **TID-BC**



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

15 CONNECTORS CHARACTERISTICS - to be ordered separately

15.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A2) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)	LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply)
Conductor size	up to 1 mm² - available for 7 wires	up to 1 mm² - available for 7 wires
Connection type	to solder	to solder
Protection (EN 60529)	IP 67	IP 67

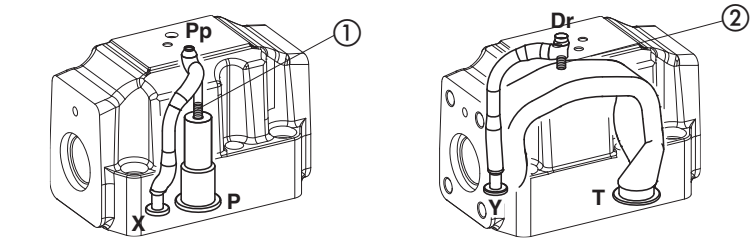
15.2 Fieldbus communication connector - only for **TID-BC**

CONNECTOR TYPE	CANopen
CODE	(C) ZM-5PF
Type	5 pin female straight circular
Standard	M12 coding A – IEC 61076-2-101
Material	Metallic
Cable gland	Pressure nut - cable diameter 6÷8 mm
Cable	CANbus Standard (DR 303-1)
Connection type	screw terminal
Protection (EN 60529)	IP67

16 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

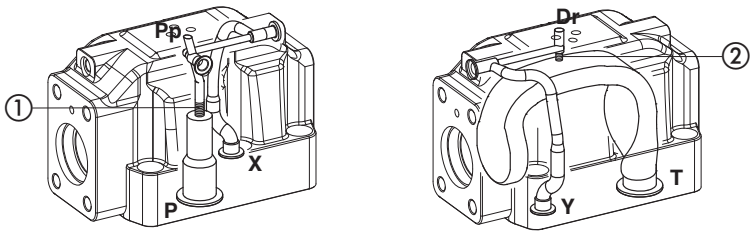
Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external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

DPZE-2 **Pilot channels** **Drain channels**



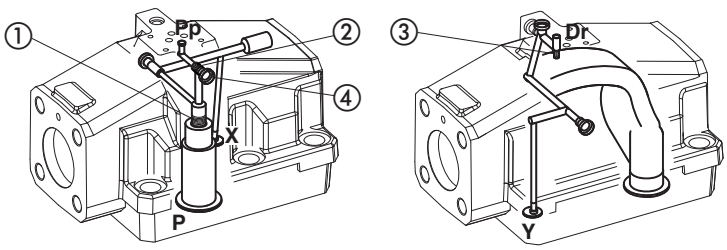
Internal piloting: Without blinded plug SP-X300F ①;
External piloting: Add blinded plug SP-X300F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZE-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.

DPZE-6 **Pilot channels** **Drain channels**

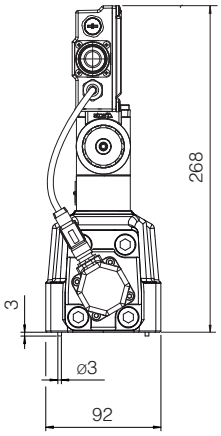


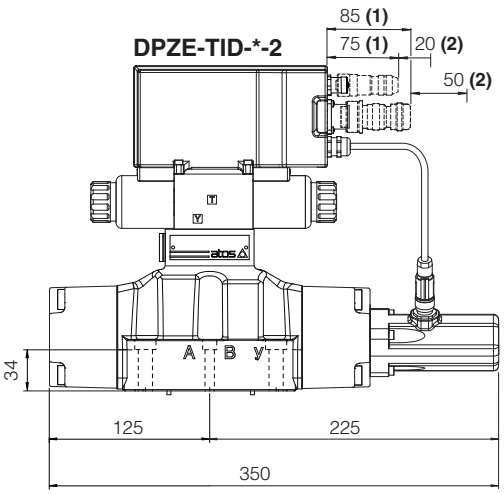
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
External drain: Add blinded plug SP-X300F ③.

DPZE-TID-*-2

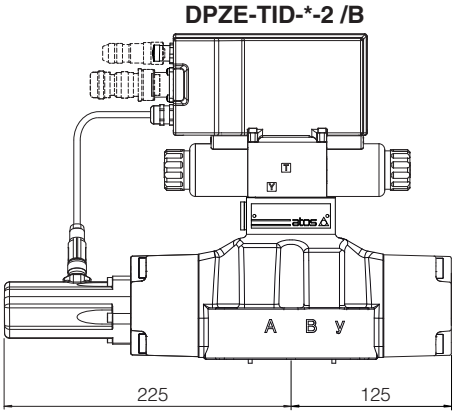
ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)

DPZE-*-2	Mass [kg]
all versions	14,8





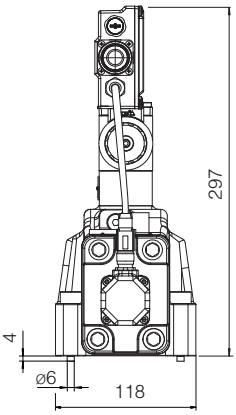
(1) The indicated dimension refers to the longer connectors.
For dimensions of all connectors, see section 14.4
(2) Space required for connection cable and for connector removal

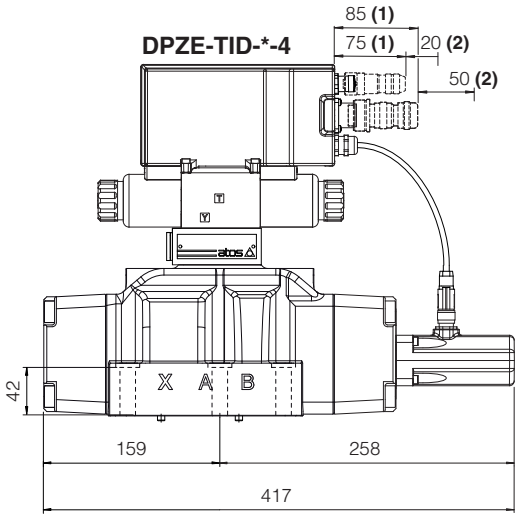


DPZE-TID-*-4

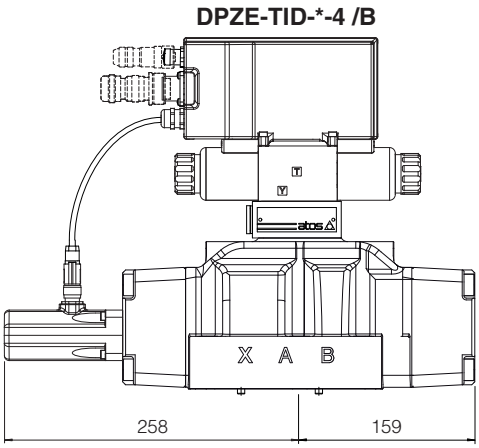
ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)

DPZE-*-4	Mass [kg]
all versions	19,3



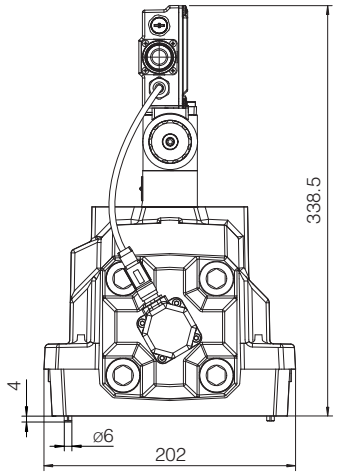


(1) The indicated dimension refers to the longer connectors.
For dimensions of all connectors, see section 14.4
(2) Space required for connection cable and for connector removal

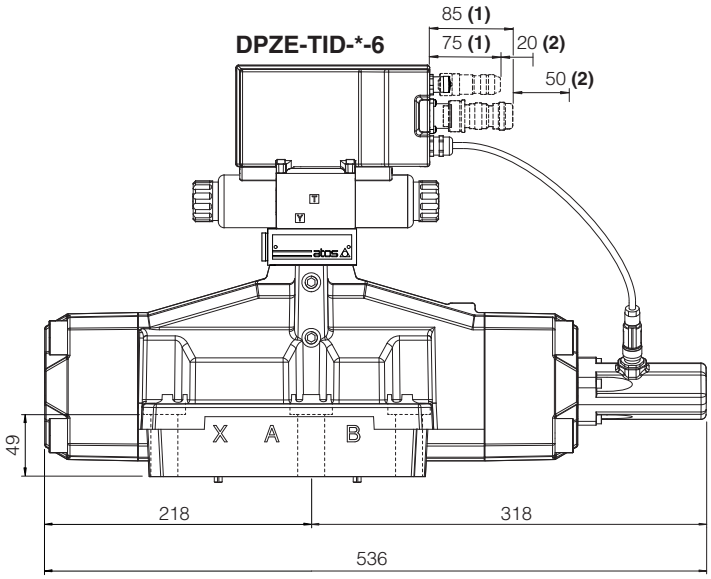


DPZE-TID-*-6

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



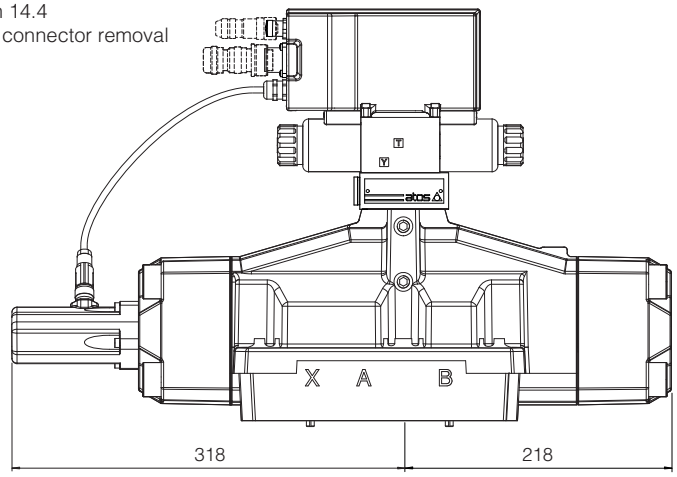
DPZE-TID-*-6



DPZE-*-6	Mass [kg]
all versions	43,3

(1) The indicated dimension refers to the longer connectors.
For dimensions of all connectors, see section 14.4
(2) Space required for connection cable and for connector removal

DPZE-TID-*-6 /B



18 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
DPZE	**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 M20x80 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)

19 RELATED DOCUMENTATION

FS001 Basics for digital electrohydraulics
FS900 Operating and maintenance information for proportional valves
GS500 Programming tools
GS510 Fieldbus
K800 Electric and electronic connectors
P005 Mounting surfaces for electrohydraulic valves
QD320 Quickstart for TID valves commissioning
E-MAN-RI-TID TID user manual