Digital proportional directional valves

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

DPZO-TES-SN-BP-251

① Valve body
② Main stage Spool
③ Pilot valve
④ Main stage LVDT transducer
⑤ On-board digital driver
⑥ USB connector
⑦ Fieldbus connectors
⑧ Main connector

DPZO-TEB, DPZO-TES

Digital proportional directional valves, piloted, specifically designed for directional and speed controls.

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

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

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

Size: **10 ÷ 32** - ISO 4401
Max flow: **180 ÷ 1600 l/min**
Max pressure: **350 bar**

---

1 **MODEL CODE OF STANDARD SPOOLS**

DPZO	-	TES	-	SN	-	NP	-	2	71	-	L	5	/	*	*	/	*

Proportional directional valve, piloted

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

Alternated P/Q controls:
SN = none

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

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

Configuration:

	Standard	Option **/B**
51 =		
53 =		
71 =		
73 =		

Series number

Seals material, see sect. **10** :
- = NBR
PE = FKM
BT = HNBR

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

Electronics options (2):
F = fault signal
I = current reference input and monitor 4÷20mA (omit for std voltage ±10VDC)
Q = enable signal
Z = double power supply, enable, fault and monitor signals - 12 pin connector **(3)**

Safety options TÜV certified - only **TES (2)**:
U = safe double power supply
K = safe on/off signals
See section **6**

SAFETY CERTIFIED

Spool size:	3 (L,S,D)	5 (L,DL,S,D)	5 (L,S,D)
DPZO-1 =	-	100	-
DPZO-2 =	160	250	-
DPZO-4 =	-	480	-
DPZO-6 =	-	-	640
Nominal flow (l/min) at Δp 10 bar P-T			

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) Only in version **SN-NP**
(2) For possible combined options, see section **14**
(3) Double power supply only for **TES**
(4) Spools for regenerative circuit , see section **2**

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

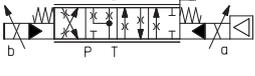| DPZO | - | TES | - | SN | - | NP | - | 2 | 71 - L9 | / | * | * | / | * |

Configuration and spool:
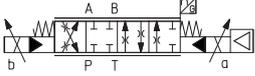
71-D9
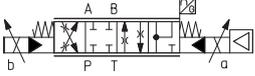
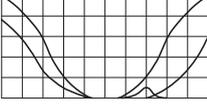**71-L9**

73-D9
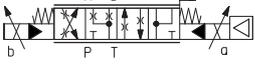
73-L9

Spool size:	D9	L9
DPZO-1 =	100	-
DPZO-2 =	250	250
DPZO-4 =	480	-

Nominal flow (l/min) at Δp 10bar P-T
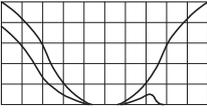
D9
For regenerative circuit (additional external check valve required)
see 11.1 - diagram 19

L9
For regenerative circuit internal to the valve
see 11.1 - diagram 20

3 GENERAL NOTES

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

4 VALVE SETTINGS AND PROGRAMMING TOOLS

USB or Bluetooth connection

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

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

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

TES
E-C-SB-USB/M12 cable
E-A-SB-USB/OPT isolator
TEB
E-C-SB-M12/BTH cable
E-A-SB-USB/BTH adapter

⚠️ **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

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

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

6 SAFETY OPTIONS - only for TES

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

SAFETY CERTIFIED

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

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

7 GENERAL CHARACTERISTICS

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

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

Valve model		**DPZO-*-1**	**DPZO-*-2**		**DPZO-*-4**	**DPZO-*-6**
Pressure limits	[bar]	ports **P, A, B, X** = 350; **T** = 250 (10 for option /D); **Y** = 10;				
Spool type	standard	**L5, DL5, S5, D5**	**L3, S3, D3**	**L5, DL5, S5, D5**		**L5, S5, D5**
	regenerative	**D9**		**D9, L9**	**D9**	
Nominal flow Δp P-T [l/min] **(1)**						
	Δp= 10 bar	100	160	250	480	640
	Δp= 30 bar	160	270	430	830	1100
	Max permissible flow	180	400	550	1000	1600
Piloting pressure	[bar]	min. = 25; max = 350				
Piloting volume	[cm³]	1,4	3,7		9,0	21,6
Piloting flow **(2)**	[l/min]	1,7	3,7		6,8	14,4
Leakage **(3)**	Pilot [cm³]	100 / 300	100 / 300		200 / 500	900 / 2800
	Main stage [l/min]	0,15 / 0,5	0,2 / 0,6		0,3 / 1,0	1,0 / 3,0
Response time **(4)**	[ms]	≤ 60	≤ 75		≤ 90	≤ 120
Hysteresis		≤ 1 [% of max regulation]				
Repeatability		± 0,5 [% of max regulation]				
Thermal drift		zero point displacement < 1% at ΔT = 40°C				

(1) For different Δp, the max flow is in accordance to the diagrams in section 11.2   **(3)** At p = 100/350 bar
(2) With step reference input signal 0 ÷100 %   **(4)** 0-100% step signal see detailed diagrams in section 11.3

9 **ELECTRICAL CHARACTERISTICS**

|	
Power supplies	Nominal : +24 V_{DC} Rectified and filtered : V_{RMS} = 20 ÷ 32 V_{MAX} (ripple max 10 % V_{PP})
Max power consumption	50 W
Max. solenoid current	2,6 A
Coil resistance R at 20°C	3 ÷ 3,3 Ω
Analog input signals	Voltage: range ±10 V_{DC} (24 V_{MAX} tollerant) Input impedance: R_i > 50 kΩ Current: range ±20 mA Input impedance: R_i = 500 Ω
Monitor outputs	Output range: voltage ±10 V_{DC} @ max 5 mA current ±20 mA @ max 500 Ω load resistance
Enable input	Range: 0 ÷ 5 V_{DC} (OFF state), 9 ÷ 24 V_{DC} (ON state), 5 ÷ 9 V_{DC} (not accepted); Input impedance: R_i > 10 kΩ
Fault output	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
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors
Duty factor	Continuous rating (ED=100%)
Tropicalization	Tropical coating on electronics PCB
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section **18**			

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.

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
longer life	ISO4406 class 16/14/11 NAS1638 class 5 www.atos.com or KTF catalog

Hydraulic fluid	**Suitable seals type**	**Classification**	**Ref. Standard**
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

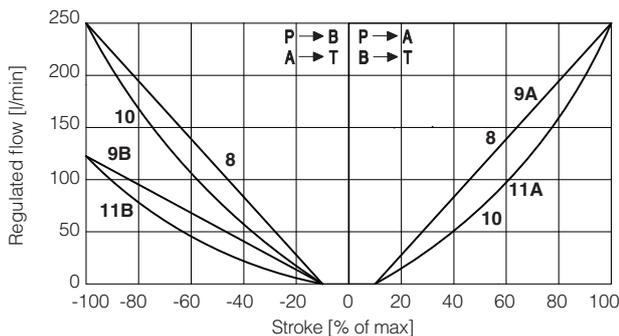**11** **DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

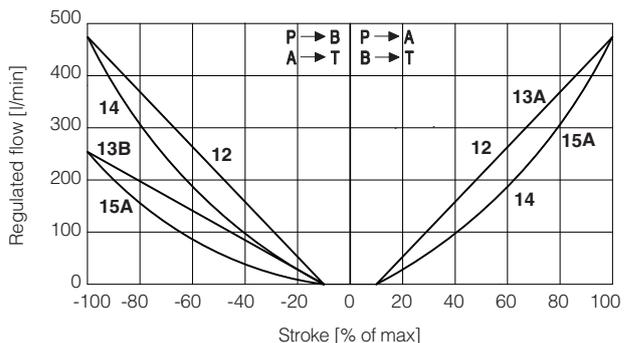**11.1 Regulation diagrams** (values measure at p 10 bar P-T)
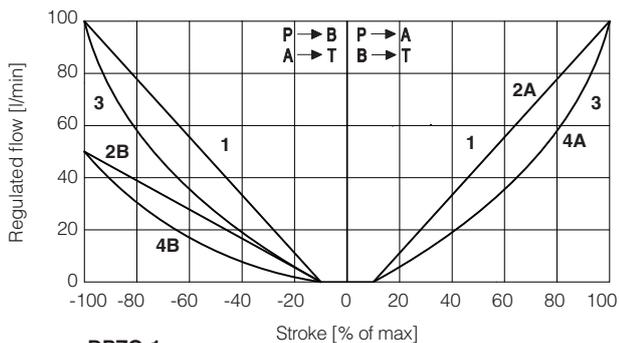
DPZO-1:
1 = L5   **2A** = DL5 (P → A, A → T)   **4A** = D5 (P → A, A → T)
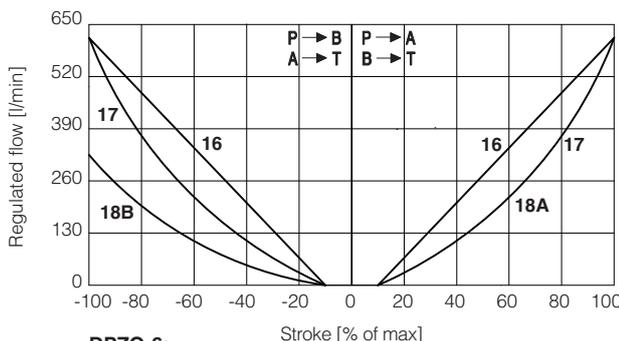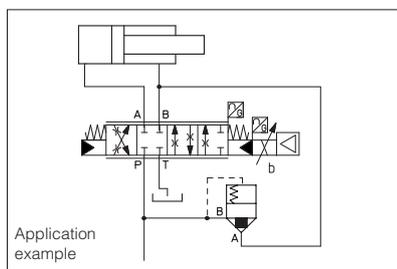**3** = S5   **2B** = DL5 (P → B, B → T)   **4B** = D5 (P → B, B → T)
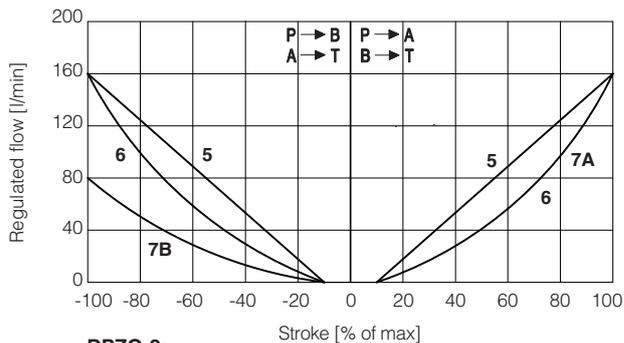
DPZO-2:
5 = L3   **7A** = D3 (P → A, A → T)
6 = S3   **7B** = D3 (P → B, B → T)

DPZO-2:
8 = L5   **9A** = DL5 (P → A, A → T)   **11A** = D5 (P → A, A → T)
10 = S5   **9B** = DL5 (P → B, B → T)   **11B** = D5 (P → B, B → T)

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

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

Note:

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

Reference signal $\left.\begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix}\right\}$ 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

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.

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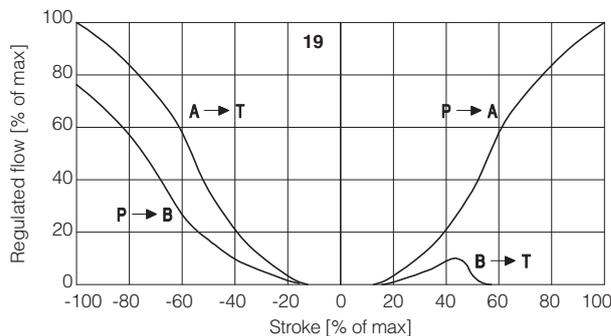
20 = linear - internal regenerative spool **L9**
(available only for valve size 16)

L9 spool type with a fourth position specific to perform a regenerative circuit internal to the valve.
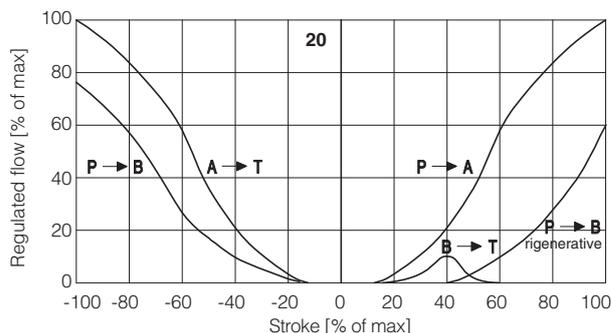
11.2 Operating diagrams
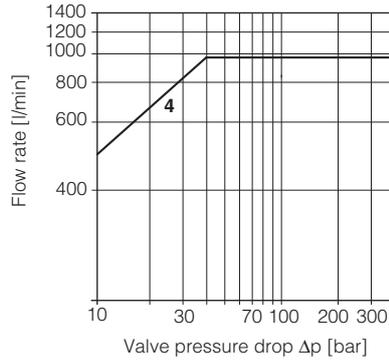
Flow /∆p diagram stated at 100% of spool stroke
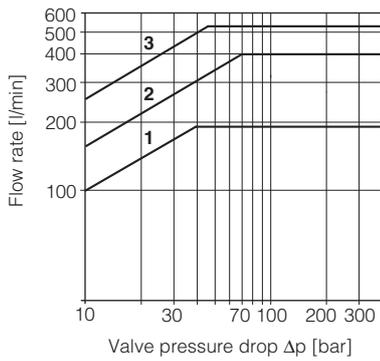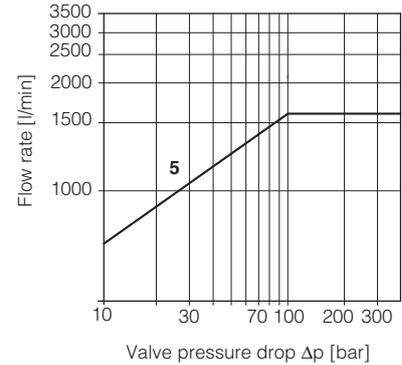

DPZO-1:
1 = spools L5, S5, D5, DL5, D9
DPZO-2:
2 = spools L3, S3, D3
3 = spools L5, S5, D5, DL5, D9, L9

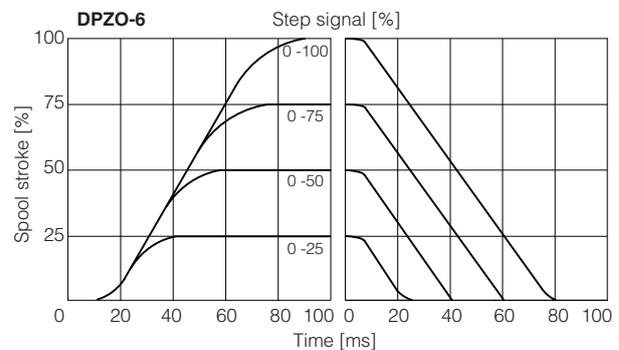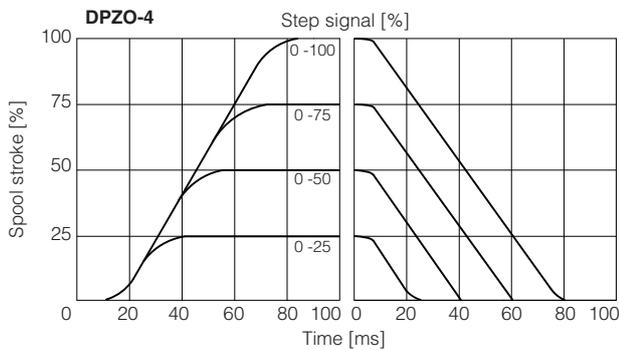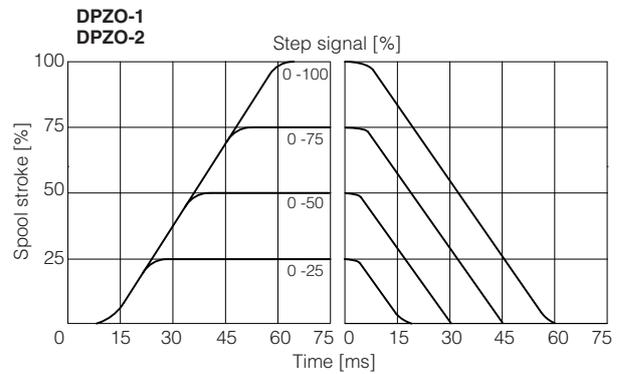**DPZO-4:**
4 = spools L5, S5, D5, DL5, D9

DPZO-6:
6 = L5, S5, D5

11.3 Response time

The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values.

For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

DPZO-1
DPZO-2

DPZO-4

DPZO-6

11.4 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar
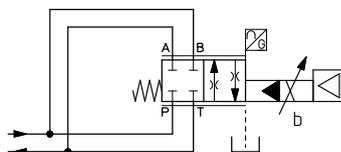
| DPZO-*-	151-L5	251-L5	451-L5	651-L5
Max flow [l/min] ∆p = 15 bar	320	860	1600	2200

12 **HYDRAULIC OPTIONS**

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

D = Internal drain (through port T).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section **19**
The valve's standard configuration provides internal pilot and external drain.

E = External pilot (through port X).
Pilot and drain configuration can be modified as shown in the functional scheme here aside. For detailed view of plugs position, see section **19**
The valve's standard configuration provides internal pilot and external drain.

① Pilot valve
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
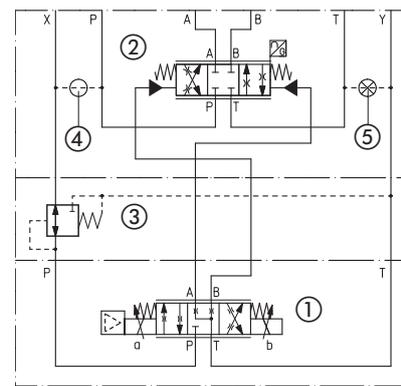
13 **ELECTRONICS OPTIONS**

F = This option permits to monitor the eventual fault condition of the driver, as for example the solenoid short circuit/not connected, reference signal cable broken for option /I, spool position transducer broken, etc. - see 15.9 for signal specifications.

I = This option provides 4 ÷ 20 mA current reference and monitor signals, instead of the standard ±10 V_{DC}.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 V_{DC} or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

Q = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 15.7 for signal specifications.

Z = This option provides, on the 12 pin main connector, the following additional features:
Fault output signal - see above option **/F**
Enable input signal - see above option **/Q**
Repeat enable output signal - only for **TEB** (see 15.8)
Power supply for driver's logics and communication - only for **TES** (see 15.2)

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

14 **POSSIBLE COMBINED OPTIONS**

Hydraulic options:
all combination possible

Electronics options - Standard versions:
TEB-SN, **TES-SN**
/FI, /IQ, /IZ

Electronics options - Safety certified versions:
TES-SN
/IU, /IK

15 **POWER SUPPLY AND SIGNALS SPECIFICATIONS**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).
For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

15.1 **Power supply (V+ and V0)**
The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers. In case of separate power supply see 15.2.

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

15.2 **Power supply for driver's logic and communication (VL+ and VL0)** - only for **TES** with **/Z** option
The power supply for driver's logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
The separate power supply for driver's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

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

15.3 Flow reference input signal (Q_INPUT+)

The driver controls in closed loop the valve spool position proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 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) - not for /F

The driver generates an analog output signal proportional to the actual spool position of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, pilot spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

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

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

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

Repeat enable is used as output repeater signal of enable input signal (see 15.5).

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

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

16 ELECTRONIC CONNECTIONS AND LEDS

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

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

16.2 Main connector signals - 12 pin (A2) /Z option

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

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

16.3 Communications connectors (B) - (C)

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

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

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

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

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

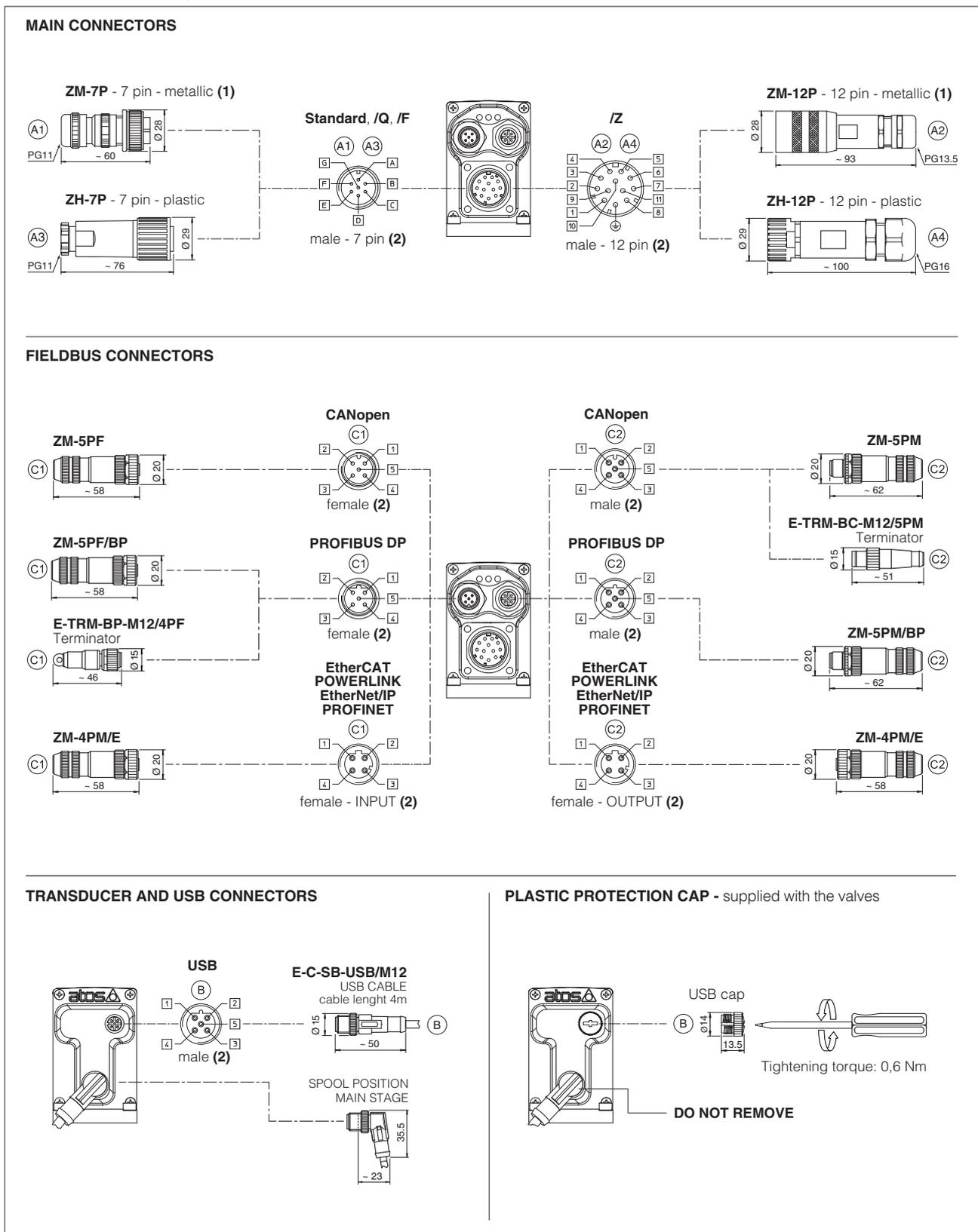**(2)** Pin 2 can be fed with external +5V supply of CAN interface

16.4   TEB connections layout
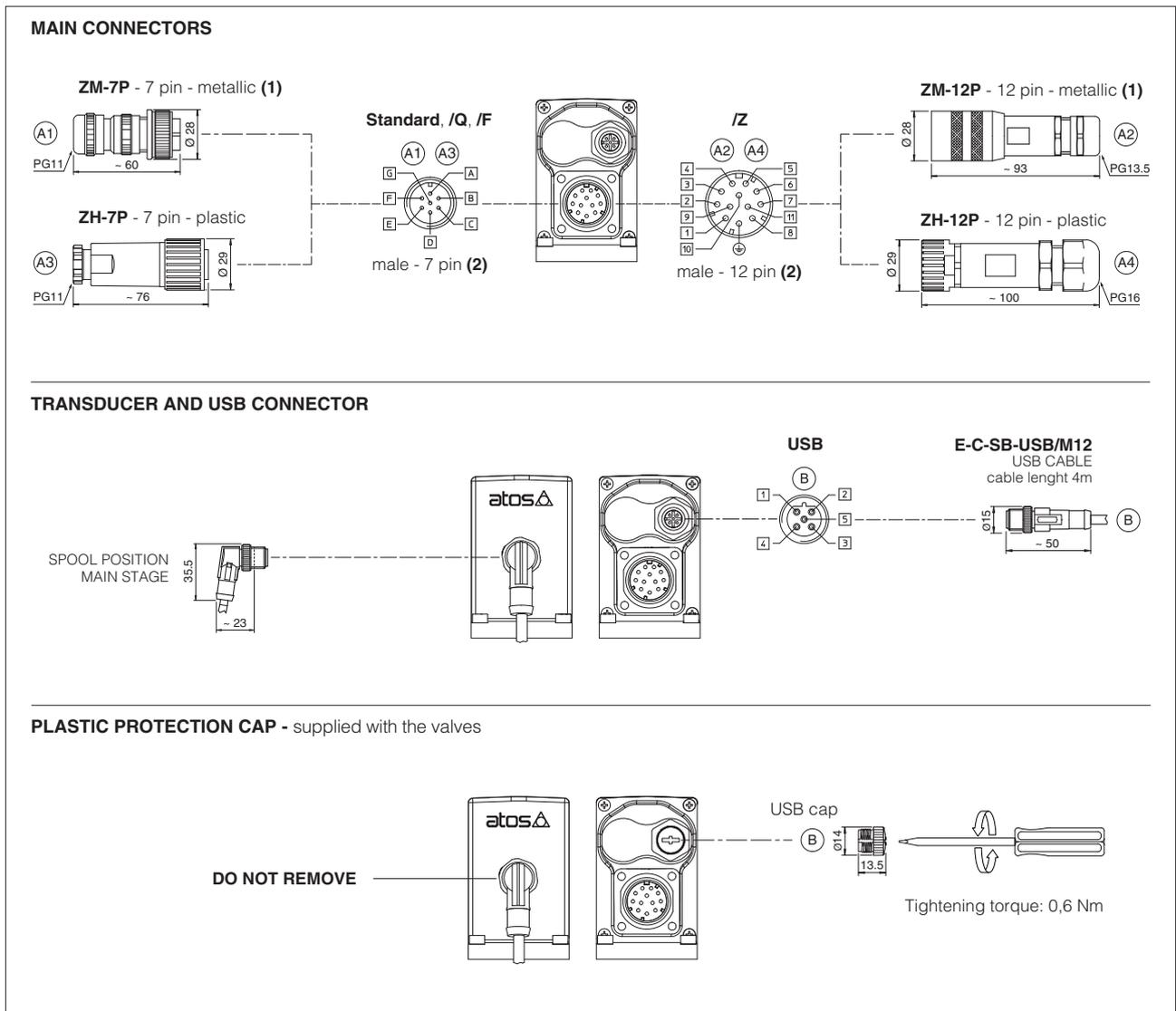
MAIN CONNECTORS

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

ZH-7P - 7 pin - plastic

Standard, /Q, /F

male - 7 pin **(2)**

/Z

male - 12 pin **(2)**

ZM-12P - 12 pin - metallic **(1)**

ZH-12P - 12 pin - plastic

TRANSDUCER AND USB CONNECTOR

SPOOL POSITION MAIN STAGE

USB

E-C-SB-USB/M12
USB CABLE
cable lenght 4m

PLASTIC PROTECTION CAP - supplied with the valves

DO NOT REMOVE

USB cap

Tightening torque: 0,6 Nm

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

16.5   TES connections layout

MAIN CONNECTORS

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

A1 PG11 Ø 28 ~ 60

Standard, **/Q**, **/F**

A1 A3

G — A
F — B
E — C
D

male - 7 pin **(2)**

/Z

A2 A4

4 — 5
3 — 6
2 — 7
9 — 11
1 — 8
10

male - 12 pin **(2)**

ZM-12P - 12 pin - metallic **(1)**

Ø 28 ~ 93 A2 PG13.5

ZH-7P - 7 pin - plastic

A3 PG11 Ø 29 ~ 76

ZH-12P - 12 pin - plastic

Ø 29 ~ 100 A4 PG16

FIELDBUS CONNECTORS

ZM-5PF

C1 Ø 20 ~ 58

CANopen

C1

2 — 1
5
3 — 4

female **(2)**

CANopen

C2

1 — 2
5
4 — 3

male **(2)**

ZM-5PM

Ø 20 ~ 62 C2

ZM-5PF/BP

C1 Ø 20 ~ 58

PROFIBUS DP

C1

2 — 1
5
3 — 4

female **(2)**

PROFIBUS DP

C2

1 — 2
5
4 — 3

male **(2)**

E-TRM-BC-M12/5PM
Terminator

Ø 15 ~ 51 C2

E-TRM-BP-M12/4PF
Terminator

C1 Ø 15 ~ 46

EtherCAT
POWERLINK
EtherNet/IP
PROFINET

C1

1 — 2
4 — 3

female - INPUT **(2)**

EtherCAT
POWERLINK
EtherNet/IP
PROFINET

C2

1 — 2
4 — 3

female - OUTPUT **(2)**

ZM-5PM/BP

Ø 20 ~ 62 C2

ZM-4PM/E

C1 Ø 20 ~ 58

ZM-4PM/E

Ø 20 ~ 58 C2

TRANSDUCER AND USB CONNECTORS

USB

B

1 — 2
5
4 — 3

male **(2)**

E-C-SB-USB/M12
USB CABLE
cable lenght 4m

Ø 15 ~ 50 B

SPOOL POSITION
MAIN STAGE

35.5 ~ 23

PLASTIC PROTECTION CAP - supplied with the valves

USB cap

B Ø14 13.5

Tightening torque: 0,6 Nm

DO NOT REMOVE

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

16.6 Diagnostic LEDs - only for **TES**

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

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

17 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

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

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

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

BC and BP pass-through connection
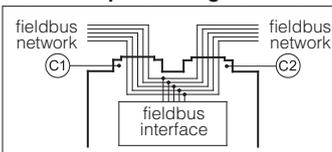
18 CONNECTORS CHARACTERISTICS - to be ordered separately

18.1 Main connectors - 7 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-7P	(A3) ZH-7P
Type	7pin female straight circular	7pin female straight circular
Standard	According to MIL-C-5015	According to MIL-C-5015
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG11	PG11
Recommended cable	LiYCY 7 x 0,75 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

18.2 Main connectors - 12 pin

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A2) ZM-12P	(A4) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

18.3 Fieldbus communication connectors

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

(1) E-TRM-** terminators can be ordered separately - see tech table **GS500**   **(2)** Internally terminated

19 PLUGS LOCATION FOR PILOT/DRAIN CHANNELS

Depending on the position of internal plugs, different pilot/drain configurations can be obtained as shown below.
To modify the pilot/drain configuration, proper plugs must only be interchanged. The plugs have to be sealed using loctite 270.
Standard valves configuration provides internal pilot and external drain
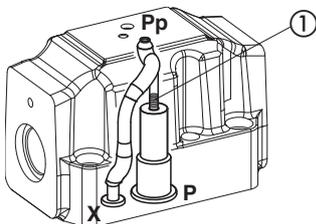
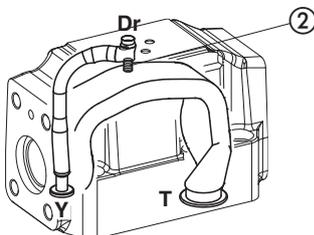**DPZO-1**   Pilot channels   Drain channels
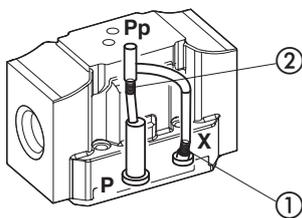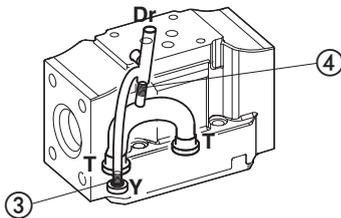
Internal piloting: blinded plug SP-X300F ① in X;
External piloting: blinded plug SP-X300F ② in Pp;
Internal drain: blinded plug SP-X300F ③ in Y;
External drain: blinded plug SP-X300F ④ in Dr.

DPZO-2   Pilot channels   Drain channels

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

DPZO-4   Pilot channels   Drain channels
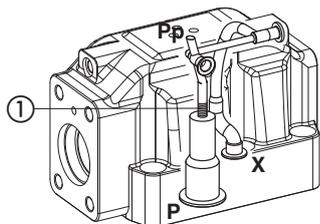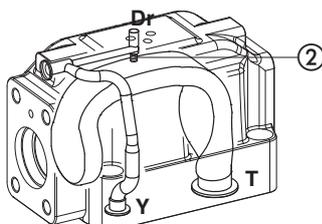
Internal piloting: Without blinded plug SP-X500F ①;
External piloting: Add blinded plug SP-X500F ①;
Internal drain: Without blinded plug SP-X300F ②;
External drain: Add blinded plug SP-X300F ②.

DPZO-6   Pilot channels   Drain channels
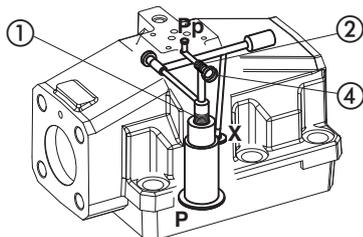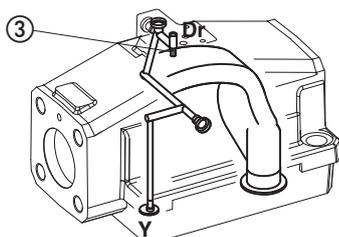
Internal piloting: Without plug ①;
External piloting: Add DIN-908 M16x1,5 in pos ①;
Internal drain: Without blinded plug SP-X300F ③;
**External drain:**   Add blinded plug SP-X300F ③.

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

21 INSTALLATION DIMENSIONS [mm]
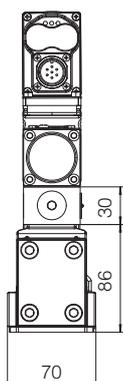
DPZO-TEB-*-15*
DPZO-TES-*-15*
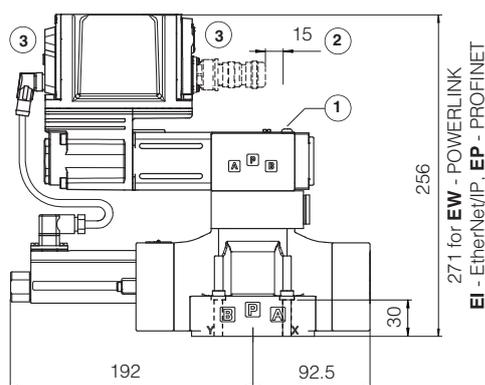
DPZO-TEB-*-17*
DPZO-TES-*-17*
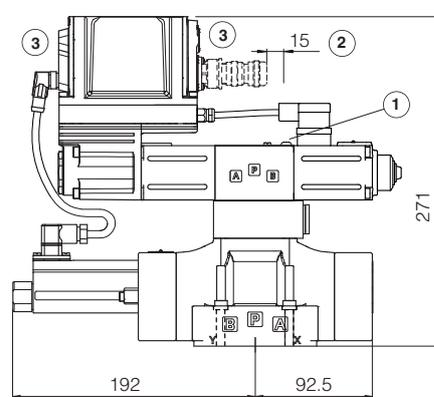
ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)

Mass [kg]	
DPZO-*-15	9
DPZO-*-17	9,8

① = Air bleeding

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage
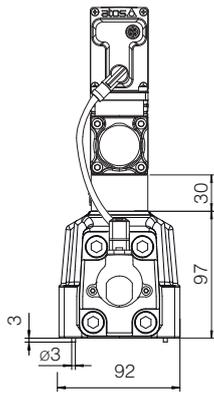
DPZO-TEB-*-25*
DPZO-TES-*-25*

30
97
3
ø3
92

267
282 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

2   15   3   3
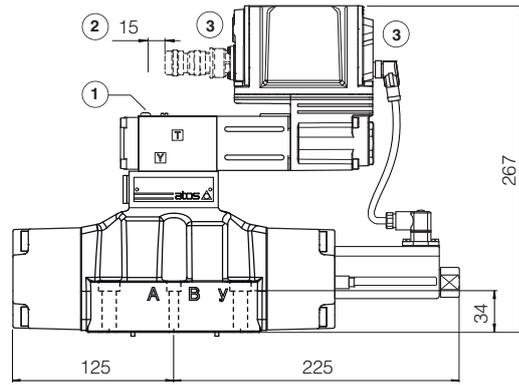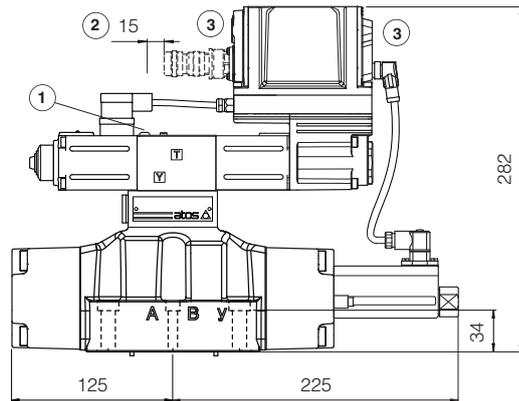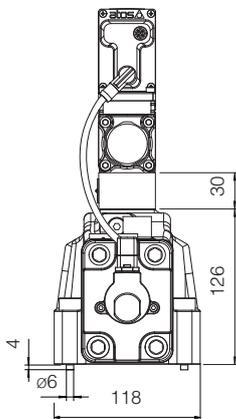1
T
Y
A   B   y
34
125   225

DPZO-TEB-*-27*
DPZO-TES-*-27*

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

Mass [kg]	
DPZO-*-25	14
DPZO-*-27	14,8

2   15   3   3
1
T
Y
A   B   y
282
34
125   225

DPZO-TEB-*-45*
DPZO-TES-*-45*

30
126
4
ø6
118

2 15   3   3
1
T
Y
X   A   B
296
311 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET
42
159   258
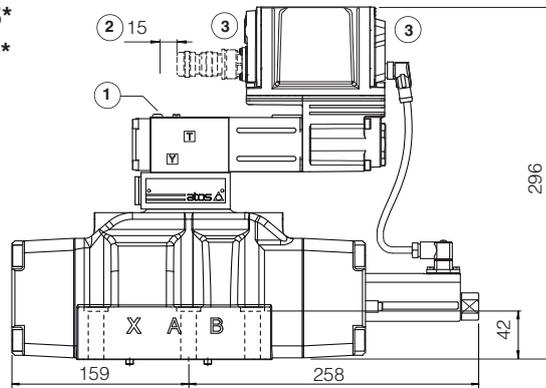
DPZO-TEB-*-47*
DPZO-TES-*-47*

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

Mass [kg]	
DPZO-*-45	18,5
DPZO-*-47	19,3

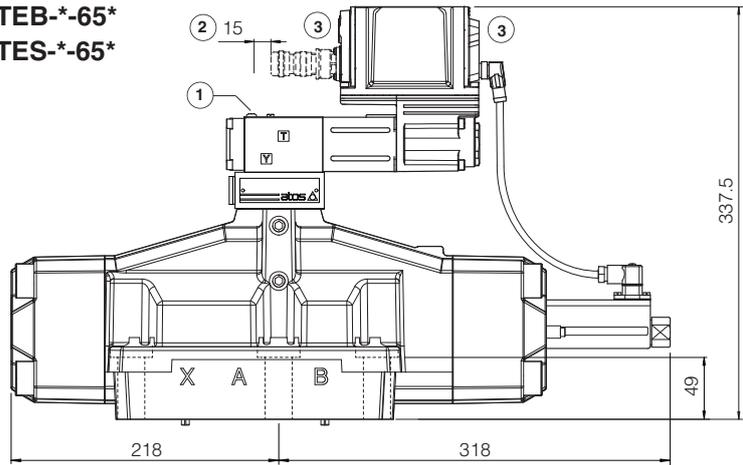2   15   3   3
1
T
Y
X   A   B
311
159   258

1 = Air bleeding   ⌐ 3

2 = Space to remove the connectors

3 = The dimensions of all connectors must be considered, see section 16.4 and 16.5

Note: for option /B the proportional solenoid, the LVDT transducer and the on-board digital driver are at side of port A of the main stage
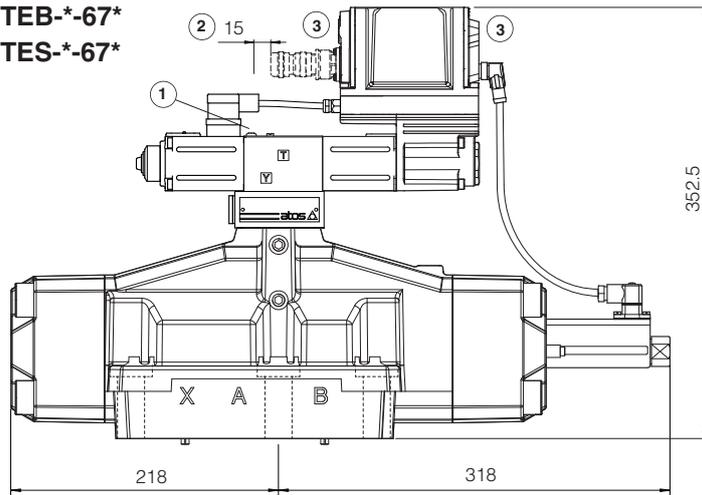
DPZO-TEB-*-65*
DPZO-TES-*-65*

337.5

352.5 for **EW** - POWERLINK
EI - EtherNet/IP, **EP** - PROFINET

② 15   ③   ③

①

30

167.5

4

ø6

202

218   318

49

DPZO-TEB-*-67*
DPZO-TES-*-67*

② 15   ③   ③

①

352.5

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

Mass [kg]	
DPZO-*-65	42,5
DPZO-*-67	43,3

218   318

① = Air bleeding   3

② = Space to remove the connectors

③ = The dimensions of all connectors must be considered, see section 16.4 and 16.5

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

22 **RELATED DOCUMENTATION**

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