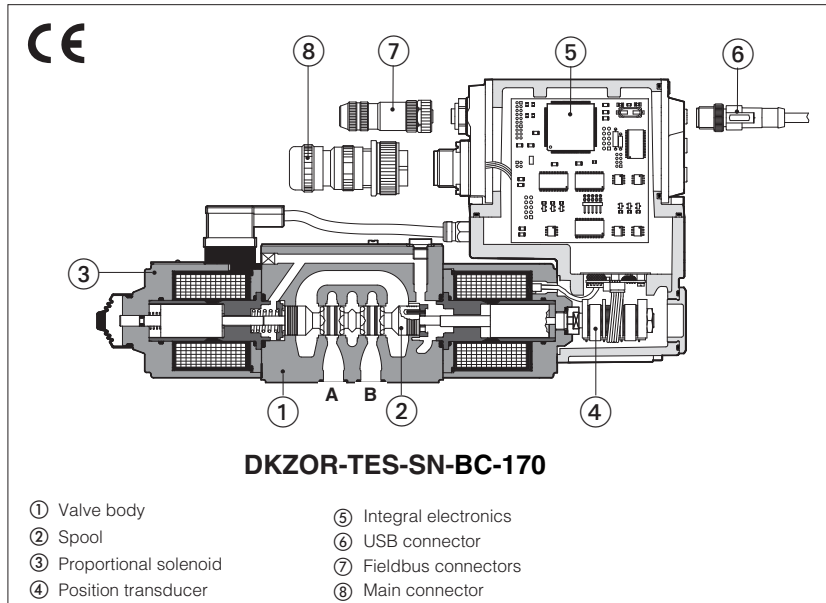


Servoproportional directional valves

rugged digital, direct operated, with position transducer and **zero spool overlap**



DHZO-TEB, DHZO-TES

DKZOR-TEB, DKZOR-TES

Servoproportional direct operated digital proportional valves with LVDT position transducer and zero spool overlap for position closed loop controls. The double solenoid construction involves larger flows and central safety rest position.

The integral digital electronic driver performs the valve's hydraulic regulation according to the reference signal and assures valve-to-valve interchangeability thanks to the factory presetting.

Servoproportional valves are available in TEB basic execution with analog reference signals and USB port for software functional parameters setting or in 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: **06** and **10**

Max flow: up to **75** and **170 l/min**

Max pressure: **350 bar** (DHZO)

315 bar (DKZOR)

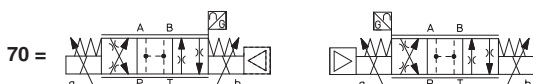
1 MODEL CODE

DHZO	-	T	ES	-	SN	-	NP	-	0	70	-	L	5	/	*	*	/	*															
DHZO = size 06 DKZOR = size 10		T = closed-loop one LVDT transducer		ES = basic (1) ES = full		SN = none (1) SP = pressure control (1 pressure transducer) SF = force control (2 pressure transducers) SL = force control (1 load cell)		NP = Not present (1) BP = PROFIBUS DP BC = CANopen EH = EtherCAT		Valve size ISO 4401: 0 = 06 1 = 10		Seals material , see sections 6, 7: - = NBR PE = FKM BT = HNBR (2)		Series number		Hydraulic options , see section 11 : B = solenoid, integral electronics and position transducer at side of port A Y = external drain Electronic options , see section 12 : I = current reference input and monitor 4÷20 mA (omit for standard voltage reference input and monitor ±10 V) Only for SN (3) : F = fault signal Q = enable signal Z = double power supply, enable, fault and monitor signals - 12 pin connector (4) Only for SP, SF, SL C = current feedback for remote transducer(s)																	
Fieldbus interfaces , USB port always present:																																	
NP = Not present (1) BP = PROFIBUS DP BC = CANopen EH = EtherCAT																																	
Spool size: 3 (L) 5 (L,D) DHZO = 17 28 DKZOR = 45 75																																	

Configuration:

Standard

Option /B



(1) TEB basic execution is available only in version SN-NP
(3) F, Q, Z options are standard for SP, SF, SL

(2) Only for TES and TEZ
(4) double power supply only for TES

2 GENERAL NOTES

DHZO-TES, TEB and DKZOR-TES, TEB proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components. The electrical signals of the valve (e.g. 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).

3 AXIS CONTROLLER

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

For detailed information about integral axis controller see tech table **FS230**.

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

4 ALTERNATED P/Q CONTROLS - only for TES

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

For detailed information and connector wiring of options SP, SF, SL see tech table **GS212**.

5 FIELDBUS - only for TES

Fieldbus allows the direct communication of the proportional valve with machine control unit for digital reference signal, diagnostics and settings of functional parameters. Analog reference signal remain available on the main connector for quick commissioning and maintenance.

For detailed information about fieldbus features and specification see tech table **GS510**.

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

Assembly position	Any position			
Subplate surface finishing	Roughness index, Ra 0,4 flatness ratio 0,01/100 (ISO 1101)			
MTTFd valves according to EN ISO 13849	150 years, see technical table P007			
Ambient temperature range	standard execution = -20°C ÷ +60°C /BT option = -40°C ÷ +60°C			
Storage temperature range	Standard execution = -20°C ÷ +70°C /BT option = -40°C ÷ +70°C			
Coil resistance R at 20°C	DHZO = 3 ÷ 3,3 Ω		DKZOR = 3,8 ÷ 4,1 Ω	
Max. solenoid current	DHZO = 2,6 A		DKZOR = 3 A	
Max. power	50 Watt			
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	IP66/67			
Tropicalization	Tropical coating on electronics PCB			
Duty factor	Continuous rating (ED=100%)			
EMC, climate and mechanical load	See technical table G004			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX

Valve model		DHZO			DKZOR		
Pressure limits [bar]		ports P, A, B = 350; T = 210 (250 with external drain /Y); Y = 10			ports P, A, B = 315; T = 210 (250 with external drain /Y); Y = 10		
Spool type		L3	L5	D5	L3	L5	D5
Nominal flow [l/min]							
(1)	Δp= 10 bar	17	28	28	45	75	75
Δp P-T	Δp= 30 bar	30	50	50	80	130	130
max	Δp= 70 bar	45	75	75	120	170	170
permissible flow (2)		50	80	80	130	180	180
Response time [ms] (0-100% step signal) (3)		< 15			< 20		
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					

Notes:

above performance data refer to valves coupled with Atos electronic drivers, see section 8.

(1) for different Δp, the max flow is in accordance to the diagrams in section 9.2

(2) see detailed diagrams in section 9.3

(3) see detailed diagrams in section 9.4

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

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +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		
Fluid contamination class	ISO 4406 class 20/18/15 NAS 1638 class 9, in line filters of 10 µm (β10 ≥75 recommended)		
Hydraulic fluid	Suitable seals type	Classification	Ref. Standard
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water	NBR, HNBR	HFC	

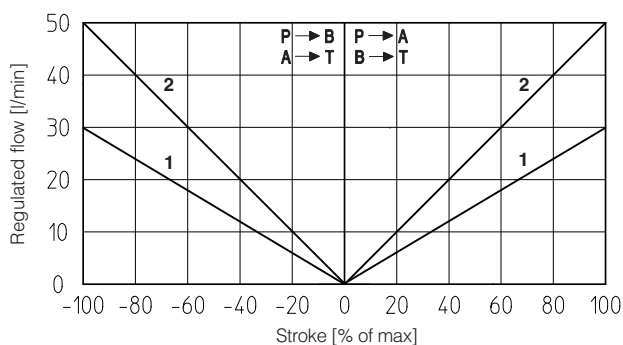
8 ELECTRONIC DRIVERS

Valve model	TEB	TES	TES-SP, SF, SL	TEZ
Drivers model	E-RI-TEB-N	E-RI-TES-N	E-RI-TES-S	E-RI-TEZ
Type	Digital			
Format	Integral to valve			
Data sheet	GS208	GS210	GS212	FS230

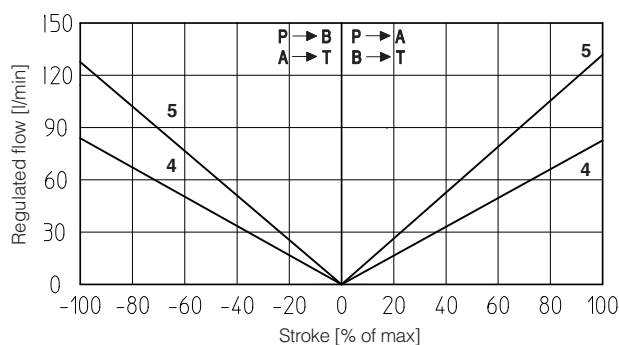
Note: For main and communication connector see sections 12 , 13

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

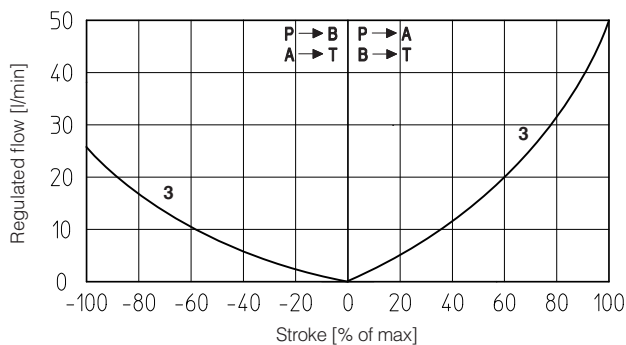
9.1 Regulation diagrams (values measure at Δp 30 bar P-T)



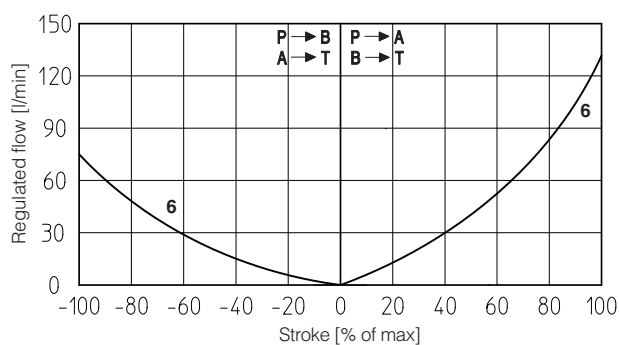
DHZO
1 = L3 2 = L5



DKZOR
4 = L3 5 = L5



DHZO
3 = D5



DKZOR
6 = D5

Note:

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

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

9.2 Flow / Δp diagrams

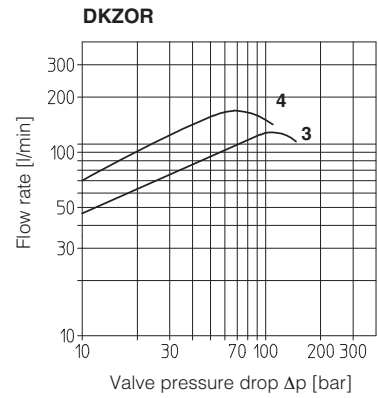
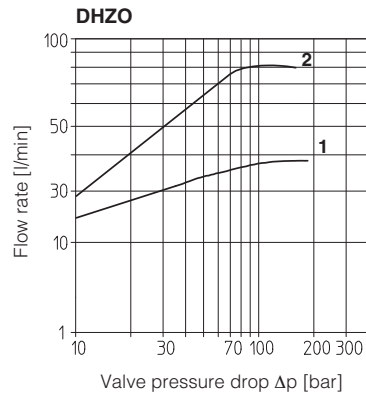
stated at 100% of valve stroke

DHZO

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

DKZOR

- 3 = spool L3
4 = spool L5, D5



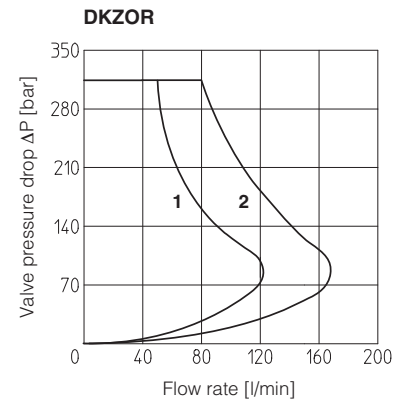
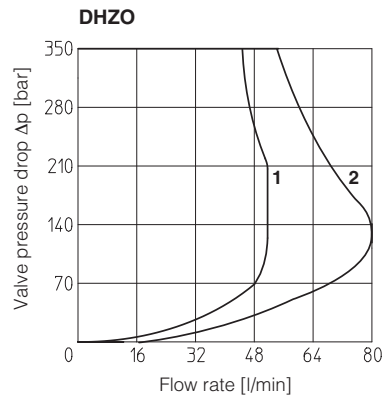
9.3 Operating limits

DHZO

- 1 = spool L3
2 = spool L5, D5

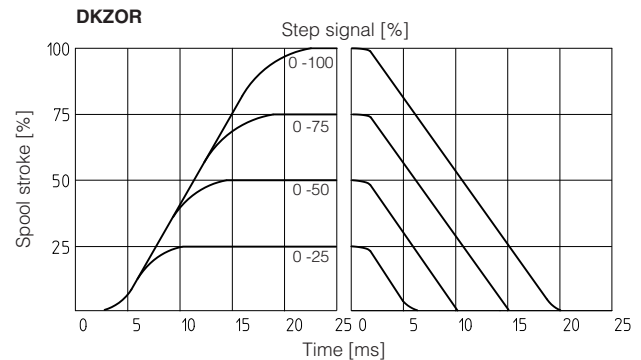
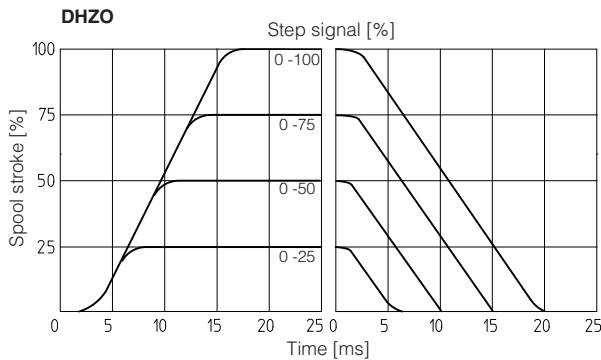
DKZOR

- 3 = spool L3
4 = spool L5, D5



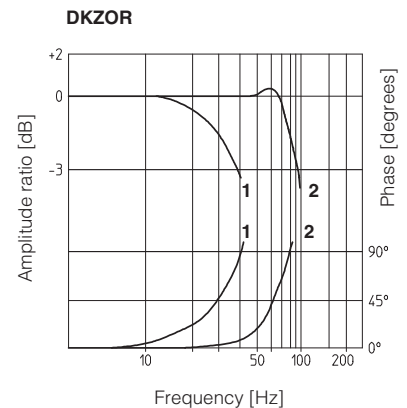
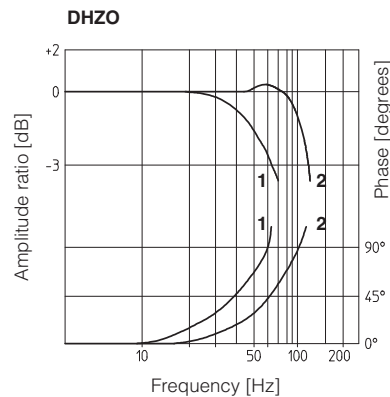
9.4 Response time

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



9.5 Bode diagrams

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



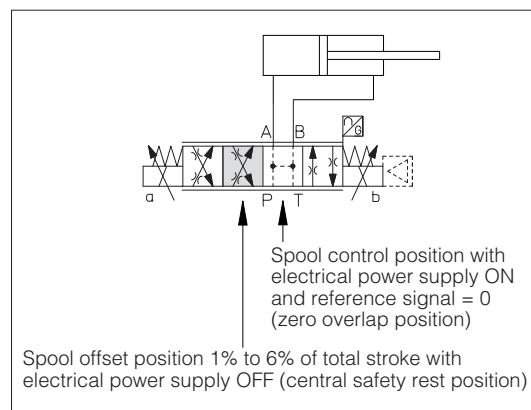
10 CENTRAL SAFETY REST POSITION OF ZERO SPOOL OVERLAP - configuration 70

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



11 HYDRAULIC OPTIONS

11.1 Option /B

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

For hydraulic configuration vs reference signal, see section 9.1

11.2 Option /Y

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

12 ELECTRONIC OPTIONS

Standard driver execution provides on the 7 pin main connector:

Power supply - 24 Vdc must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply. Apply at least a 10000 μ F/40 V capacitance to single phase rectifiers or a 4700 μ F/40 V capacitance to three phase rectifiers

Reference input signal - analog differential input with ± 10 Vdc nominal range (pin D, E), proportional to desired valve spool position

Monitor output signal - analog output signal proportional to the actual valve's spool position with ± 10 Vdc nominal range

A minimum time of 300 to 500 ms have be considered between the driver energizing with the 24 Vdc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

12.1 Option /F

It provides a Fault output signal in place of the Monitor output signal, to indicate fault conditions of the driver (cable interruption of spool transducers or reference signal - for /I option): Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc

12.2 Option /I

It provides 4 $\div$ 20 mA current reference and monitor signals, instead of the standard ± 10 V.

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

12.3 Option /Q

It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24 Vdc on the enable input signal.

12.4 Option /Z

It provides, on the 12 pin main connector, the following additional features:

Enable Input Signal

To enable the driver, supply 24 Vdc on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active.

Fault Output Signal

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4 $\div$ 20mA input, etc.). Fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

Power supply for driver's logics and communication - only for TES

Separated power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).

Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition aids to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

12.5 Options /C - only for SP, SF, SL

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

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

12.6 Possible combined options

For **SN**: /FI, /IQ and /IZ

For **SP, SF, SL**: /CI

13 ELECTRONIC CONNECTIONS AND LEDS

13.1 Main connector signal - 7 pin - standard, /F and /Q options (A1)

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

13.2 Main connector signal - 12 pin - /Z option and SP, SF, SL (A2)

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

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

13.4 Communications connectors (B) - (C)

(B) USB connector - M12 - 5 pin always present		
PIN	SIGNAL	TECHNICAL SPECIFICATION (1)
1	+5V_USB	Supply for external USB Flash Drive
2	ID	USB Flash Drive identification
3	GND_USB	Signal zero data line
4	D-	Data line -
5	D+	Data line +

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

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

(C1) (C2) EH 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	

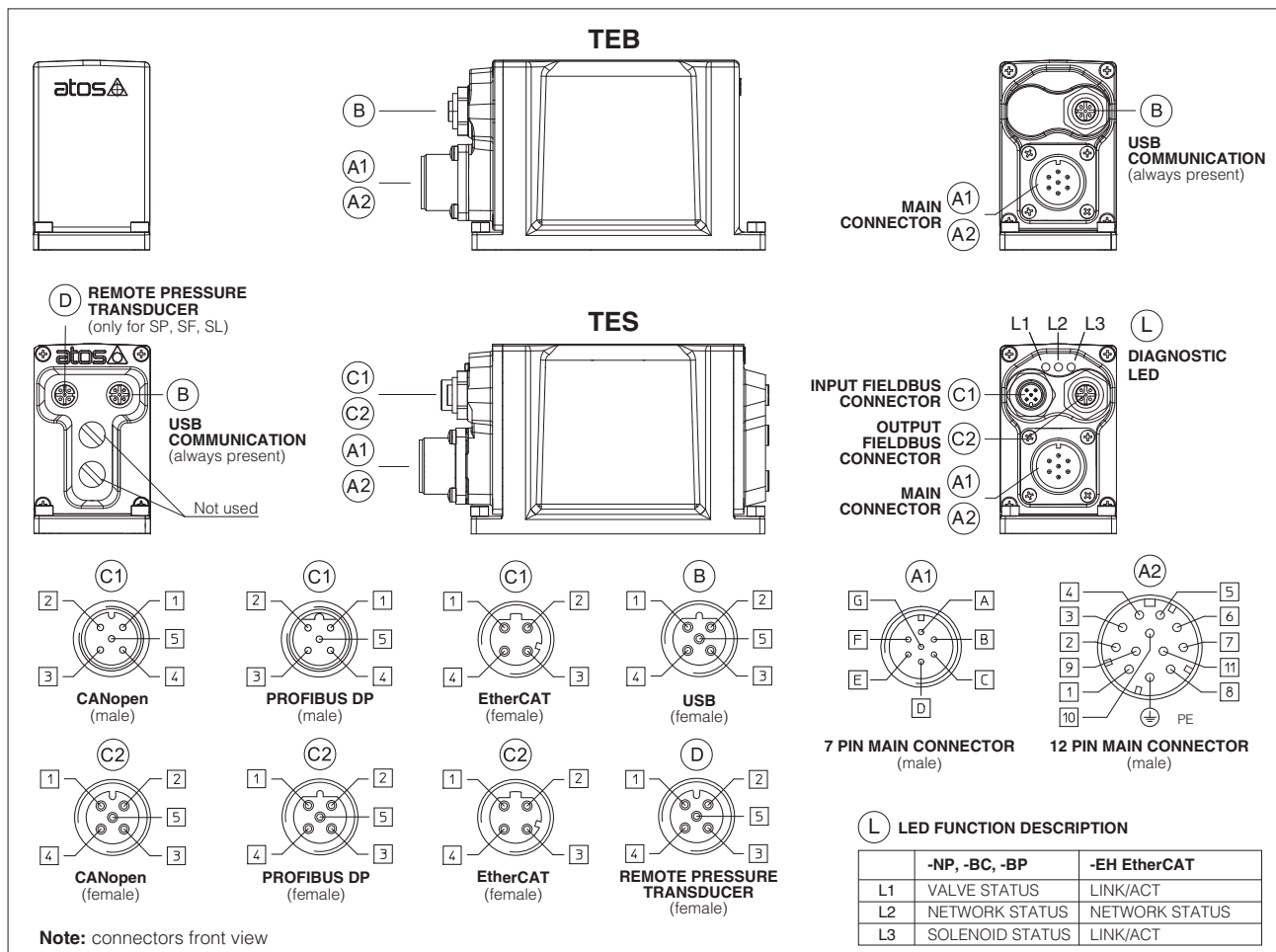
Note (1) shield connection on connector's housing is recommended

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

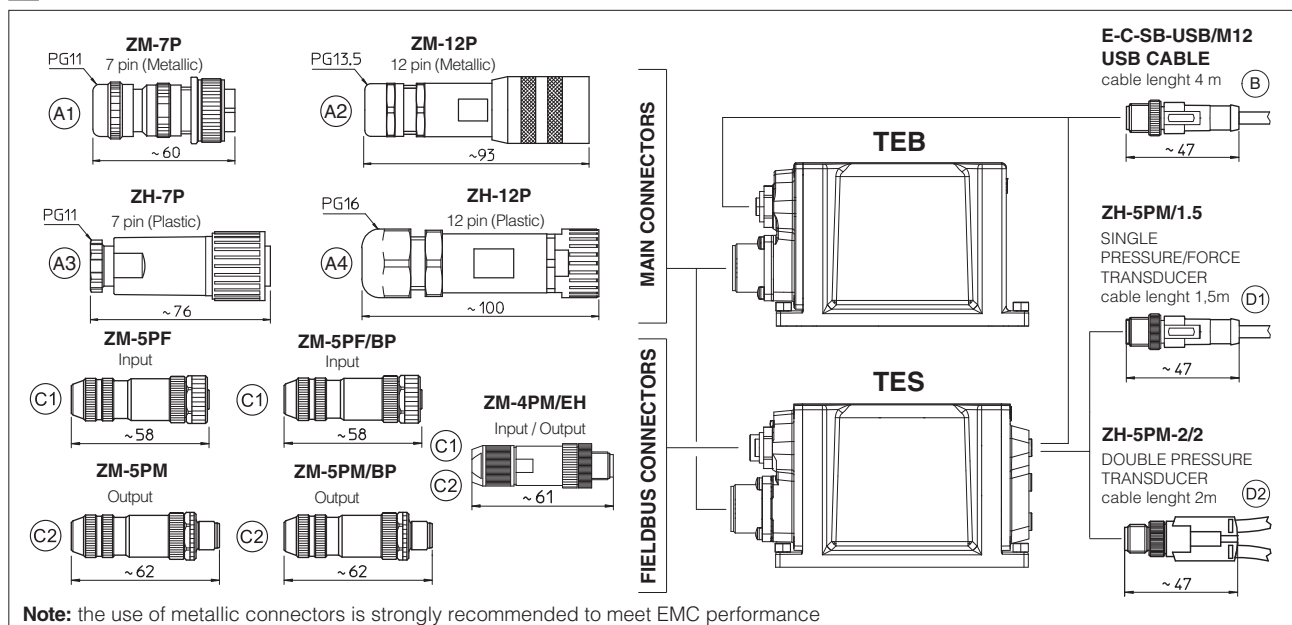
PIN	SIGNAL	TECHNICAL SPECIFICATION	Single transducer (1)	Double transducers (1)
1	VF +24V	Power supply +24Vdc	Connect	Connect
2	TR1	1st signal transducer: ± 10 Vdc / ± 20 mA maximum range, software selectable Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /C option	Connect	Connect
3	AGND	Common GND for transducer power and signals	Connect	Connect
4	TR2	2nd signal transducer: ± 10 Vdc / ± 20 mA maximum range, software selectable Defaults are ± 10 Vdc for standard and $4 \div 20$ mA for /C option	/	Connect
5	NC	Not connect	/	/

Note (1) single/double transducer configuration and analog input range are software selectable

13.5 Connections layout



14 CONNECTORS



15 MODEL CODES OF MAIN CONNECTORS AND COMMUNICATION CONNECTORS - to be ordered separately

VALVE VERSION	TEB TES	TEB / Z TES / Z	CANopen (-BC)	PROFIBUS DP (-BP)	EtherCat (-EH)	P/Q controls SP, SL, SF
CONNECTOR CODE	ZM-7P (A1)	ZM-12P (A2)	ZM-5PF (C1)	ZM-5PF/BP (C1)	ZM-4PM/EH (C1)	ZH-5PM/1.5 (1) (D1)
	ZH-7P (A3)	ZH-12P (A4)	ZM-5PM (C2)	ZM-5PM/BP (C2)	ZM-4PM/EH (C2)	ZH-5PM-2/2 (2) (D2)
PROTECTION DEGREE	IP67					
DATA SHEET	GS208, GS210, GS212, K500					

only for TES

(1) only for SP or SL

(2) only for SF

15 PROGRAMMING TOOLS - see table GS500



Valve's functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB communication port to the digital driver. E-SW software is available in different versions according to the driver's fieldbus interface:

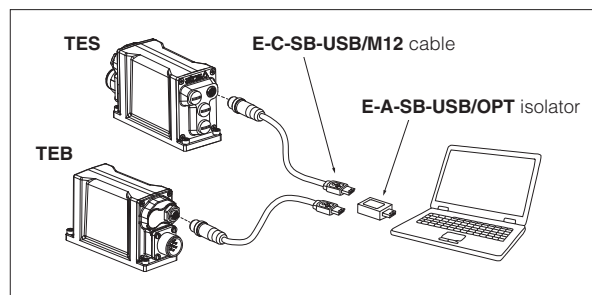
NP (not present) E-SW-PS, BC (CANopen) E-SW-BC, BP (PROFIBUS DP) E-SW-BP and EH (EtherCAT) E-SW-EH.

For fieldbus versions, E-SW software permits valve's parameterization through USB communication port also if the driver is connected to the central machine unit via fieldbus.

WARNING: drivers USB port is not isolated!

Use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection.

USB connection



17 INSTALLATION DIMENSIONS [mm]

DHZO-TEB, DHZO-TES

ISO 4401: 2000

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

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

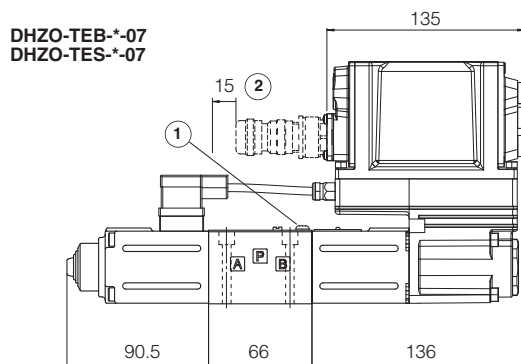
Fastening bolts: 4 socket head screws M5x50 class 12.9

Tightening torque = 8 Nm

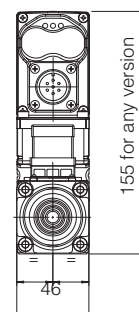
Seals: 4 OR 108; 1 OR 2025

Diameter of ports A, B, P, T: $\varnothing$ 7,5 mm (max)

Diameter of port Y: $\varnothing$ = 3,2 mm (only for /Y option)



Mass: 3,1 kg



DKZOR-TEB, DKZOR-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)

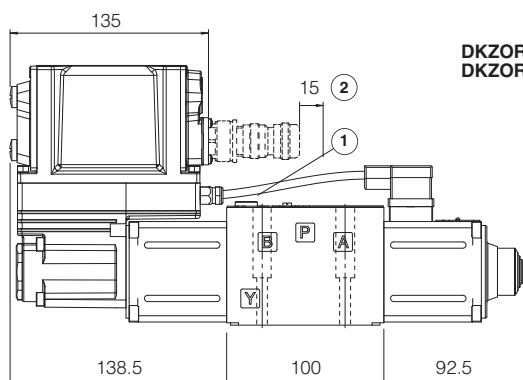
Fastening bolts: 4 socket head screws M6x40 class 12.9

Tightening torque = 15 Nm

Seals: 5 OR 2050; 1 OR 108

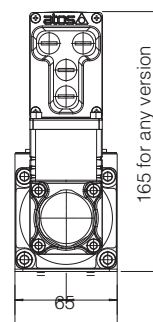
Diameter of ports A, B, P, T: $\varnothing$ 11,2 mm (max)

Diameter of port Y: $\varnothing$ = 5 mm (only for /Y option)



DKZOR-TEB*-17
DKZOR-TES*-17

Mass: 5,0 kg



① = Air bleed off

② = Space to remove 7 or 12 pin the main connector - for main and communication connectors see section 14, 15

Note: for option /B the solenoid, the position transducer and the integral electronics are at side of port A