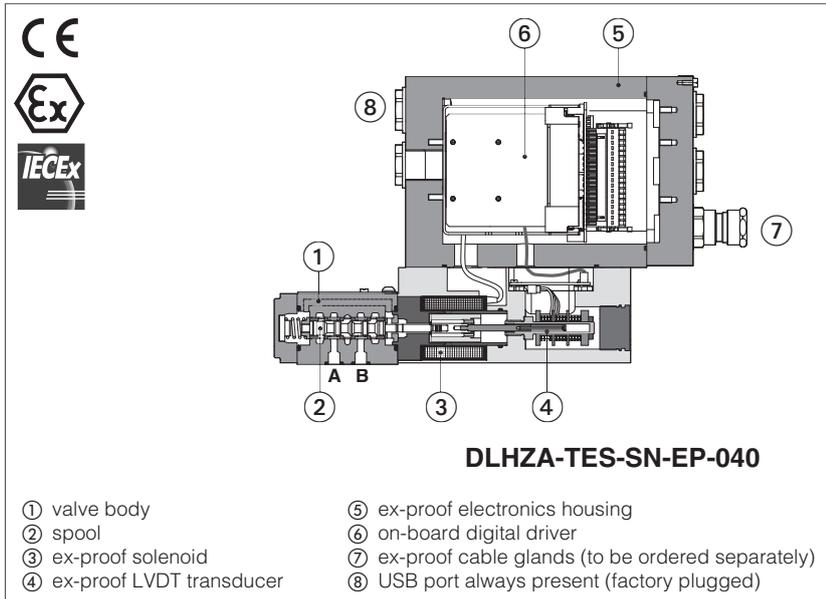




Table FX150-2/E

# Ex-proof digital servoproportional directional valves sleeve execution

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



### DLHZA-TES, DLKZA-TES

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

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

● **Multicertification ATEX and IECEx**

for gas group **II 2G** and dust category **II 2D**

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

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

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

## 1 MODEL CODE

<b>DLHZA</b>	-	<b>TES</b>	-	<b>SN</b>	-	<b>NP</b>	-	<b>0</b>	-	<b>40</b>	-	<b>L</b>	-	<b>7</b>	/	<b>3</b>	/	<b>M</b>	/	<b>*</b>	/	<b>*</b>																											
<p>Ex-proof proportional directional valves, direct  <b>DLHZA</b> = size 06  <b>DLKZA</b> = size 10</p> <p><b>TES</b> = on-board driver and LVDT transducer</p> <p><b>Alternated P/Q controls</b>, see section 5:  <b>SN</b> = none  <b>SP</b> = pressure control (1 pressure transducer)  <b>SF</b> = force control (2 pressure transducers)  <b>SL</b> = force control (1 load cell)</p> <p><b>Fieldbus interface</b>, USB port always present:  <b>NP</b> = Not Present      <b>EW</b> = POWERLINK  <b>BC</b> = CANopen        <b>EI</b> = EtherNet/IP  <b>BP</b> = PROFIBUS DP    <b>EP</b> = PROFINET RT/IRT  <b>EH</b> = EtherCAT</p> <p><b>Valve size ISO 4401:</b>    <b>0</b> = 06    <b>1</b> = 10</p> <p><b>Configuration: Standard</b>       <b>Option /B</b> </p> <p><b>40</b> =  with fail safe configuration 1 or 3</p> <p><b>60</b> =  without fail safe</p> <p><b>Spool type</b>, regulating characteristics:  <b>L</b> = linear       <b>V</b> = progressive       <b>T</b> = not linear (1)</p> <p> <b>D</b> = differential-linear (1)       <b>DT</b> = differential-not linear (1)  P-A = Q, B-T = Q/2      P-A = Q, B-T = Q/2  P-B = Q/2, A-T = Q      P-B = Q/2, A-T = Q</p>																																																	
<p><b>Seals material</b>, see section 10:  - = NBR  <b>PE</b> = FKM  <b>BT</b> = HNBR</p> <p>Series number</p> <p><b>Hydraulic options (2):</b>  <b>B</b> = solenoid with integral electronics and position transducer at side of port A (3)  <b>Y</b> = external drain</p> <p><b>Electronic options (2):</b>  <b>C</b> = current feedback for pressure transducer  4 ÷ 20 mA, only for <b>SP, SF, SL</b>  (omit for std voltage ±10 VDC)  <b>I</b> = current reference input and monitor  4 ÷ 20 mA (omit for std voltage ±10 VDC)</p> <p><b>Cable entrance threaded connection:</b>  <b>M</b> = M20x1,5</p> <p><b>Fail safe configuration</b>, see section 18:  <b>1</b> =       <b>3</b> = </p> <p><b>Note:</b> select <b>1</b> for configuration <b>60</b> even without fail safe</p>																																																	
<table border="0" style="width: 100%;"> <tr> <td><b>Spool size:</b></td> <td><b>0(L)</b></td> <td><b>1(L)</b></td> <td><b>1(V)</b></td> <td><b>3(L)</b></td> <td><b>3(T)</b></td> <td><b>3(V)</b></td> <td><b>5(L,T)</b></td> <td><b>7(L,T,V,D,DT)</b></td> </tr> <tr> <td>DLHZA =</td> <td>4</td> <td>7</td> <td>8</td> <td>14</td> <td>-</td> <td>20</td> <td>28</td> <td>40</td> </tr> <tr> <td>DLKZA =</td> <td>-</td> <td>-</td> <td>-</td> <td>60</td> <td>60</td> <td>-</td> <td>-</td> <td>100</td> </tr> </table> <p>Nominal flow (l/min) at Δp 70bar P-T</p>																							<b>Spool size:</b>	<b>0(L)</b>	<b>1(L)</b>	<b>1(V)</b>	<b>3(L)</b>	<b>3(T)</b>	<b>3(V)</b>	<b>5(L,T)</b>	<b>7(L,T,V,D,DT)</b>	DLHZA =	4	7	8	14	-	20	28	40	DLKZA =	-	-	-	60	60	-	-	100
<b>Spool size:</b>	<b>0(L)</b>	<b>1(L)</b>	<b>1(V)</b>	<b>3(L)</b>	<b>3(T)</b>	<b>3(V)</b>	<b>5(L,T)</b>	<b>7(L,T,V,D,DT)</b>																																									
DLHZA =	4	7	8	14	-	20	28	40																																									
DLKZA =	-	-	-	60	60	-	-	100																																									

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

**2 GENERAL NOTES**

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-\* programming software.

**3 VALVE SETTINGS AND PROGRAMMING TOOLS**

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

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

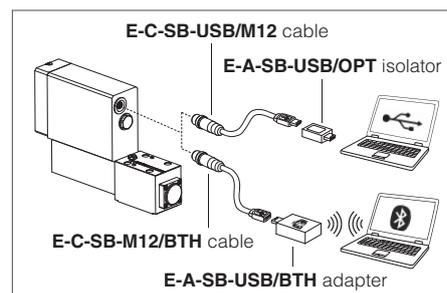
The software is available in different versions according to the driver's options (see table **GS500**):

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

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

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

**USB or Bluetooth connection**



**4 FIELDBUS** - see tech. table **GS510**

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

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

**S\*** options add the closed loop control of pressure (**SP**) or force (**SF** and **SL**) to the basic functions of proportional directional valves flow regulation. A dedicated algorithm alternates pressure (force) depending on the actual hydraulic system conditions. An additional connector is available for transducers to be interfaced to the valve's driver (1 pressure transducer for SP, 2 pressure transducers for SF or 1 load cell for SL). The alternated pressure control (SP) is possible only for specific installation conditions.

**6 AXIS CONTROLLER** - see tech. table **FX610**

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. Alternated pressure or force closed loop control can be set by software additionally to the position control. Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested. For more information consult Atos Technical Office.

**7 GENERAL CHARACTERISTICS**

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	<b>Standard</b> = -20°C ÷ +60°C <b>/PE option</b> = -20°C ÷ +60°C <b>/BT option</b> = -40°C ÷ +60°C
Storage temperature range	<b>Standard</b> = -20°C ÷ +70°C <b>/PE option</b> = -20°C ÷ +70°C <b>/BT option</b> = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (ISO 9227) > 200 h
Compliance	Explosion proof protection, see section <b>11</b> -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t"  RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

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

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

(1) referred to spool in neutral position and 50°C oil temperature

(2) 0-100% step signal

**9 ELECTRICAL CHARACTERISTICS**

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)	
Max power consumption	35 W	
Analog input signals	Voltage: range ±10 VDC (24 VMAX tollerant) Current: range ±20 mA	Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account	
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance	
Enable input	Range: 0 ÷ 5 Vdc (OFF state), 9 ÷ 24 Vdc (ON state), 5 ÷ 9 Vdc (not accepted); Input impedance: Ri > 10 kΩ	
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)	
Pressure transducer power supply	+24Vdc @ max 100 mA (E-ATRA-7 see tech table <b>GX800</b> )	
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions	
Protection degree to DIN EN60529	IP66/67 with relevant cable gland	
Duty factor	Continuous rating (ED=100%)	
Tropicalization	Tropical coating on electronics PCB	
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply	
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)	
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898
		PROFIBUS DP EN50170-2/IEC61158
		optical insulated RS485
		EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
		Fast Ethernet, insulated 100 Base TX

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

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

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm <sup>2</sup> /s - max allowed range 15 ÷ 380 mm <sup>2</sup> /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
<b>Hydraulic fluid</b>	<b>Suitable seals type</b>	<b>Classification</b>	<b>Ref. Standard</b>
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLPD	DIN 51524
Flame resistant without water	FKM	HFDU, HFDR	ISO 12922
Flame resistant with water (1)	NBR, HNBR	HFC	

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

**(1) Performance limitations in case of flame resistant fluids with water:**

- max operating pressure = 210 bar
- max fluid temperature = 50°C

**11 CERTIFICATION DATA**

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

(1) The type examiner certificates can be downloaded from [www.atos.com](http://www.atos.com)

(2) The driver and solenoids are certified for minimum ambient temperature -40°C.

In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

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

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

<b>Power supply and signals:</b> section of wire = 1,0 mm <sup>2</sup>	<b>Grounding:</b> section of external ground wire = 4 mm <sup>2</sup>
--	---

**12.1 Cable temperature**

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

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

**13 CABLE GLANDS**

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

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

**14 HYDRAULIC OPTIONS**

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

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

**15 ELECTRONIC OPTIONS**

**I** = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 Vdc.

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

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

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

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

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

**16 POSSIBLE COMBINED OPTIONS**

**For SN:** /BI, /BY, /IY

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

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

**17.1 Regulation diagrams**

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

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

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

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

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

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

**Note**

Hydraulic configuration vs. reference signal:

**Standard**

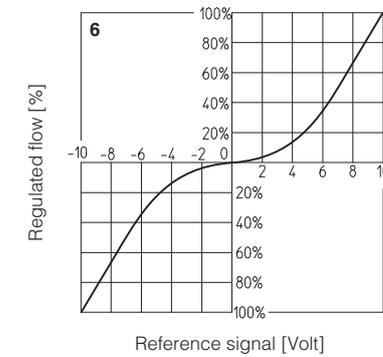
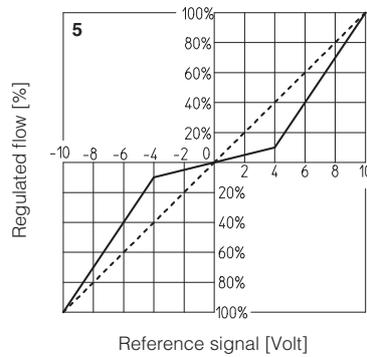
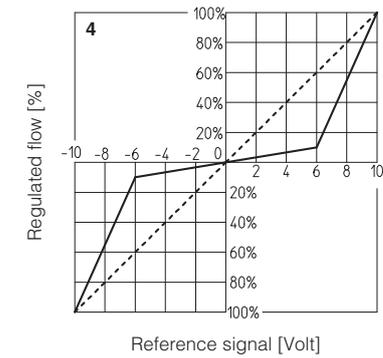
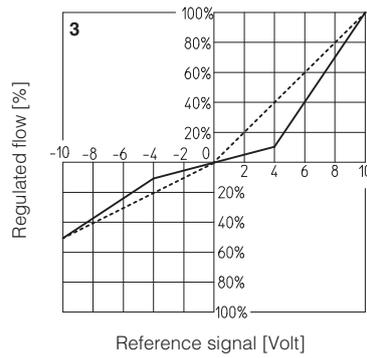
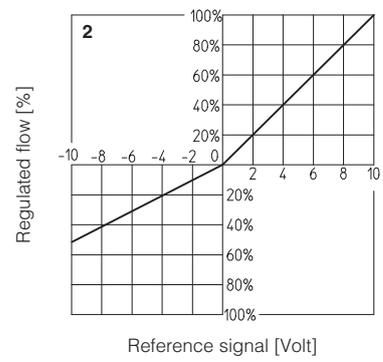
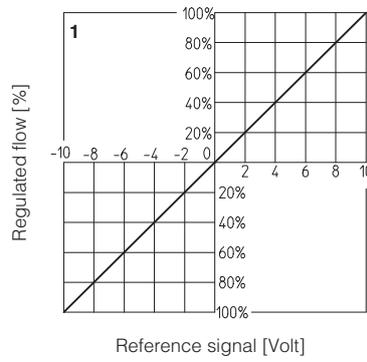
Reference signal  $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$

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

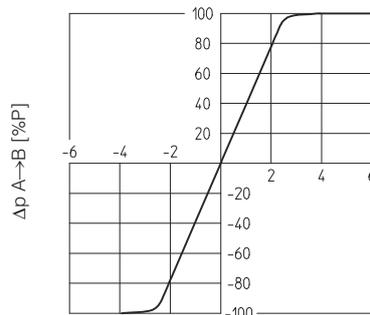
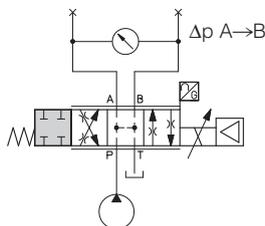
**option /B**

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

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



**17.2 Pressure gain**



**17.3 Bode diagrams**

Stated at nominal hydraulic conditions

DLHZA:

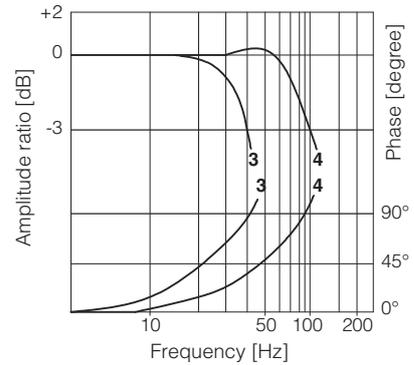
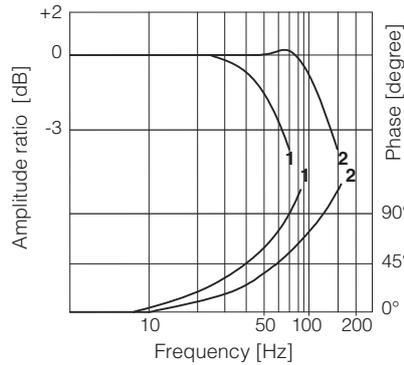
**1** = ± 100% nominal stroke

**2** = ± 5% nominal stroke

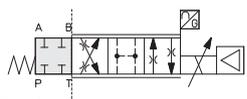
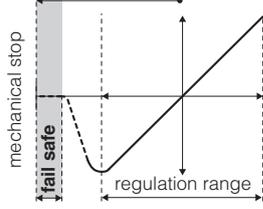
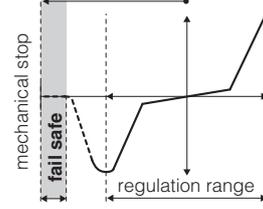
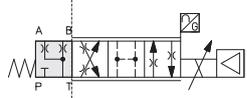
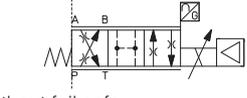
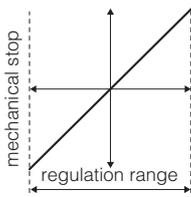
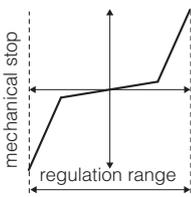
DLKZA:

**3** = ± 100% nominal stroke

**4** = ± 5% nominal stroke



**18 FAIL SAFE POSITION**

CONFIGURATION	LINEAR	NOT LINEAR
 fail safe <b>1</b>	 $t = 7-10$ ms (DLHZA) $t = 15-20$ ms (DLKZA)	 $t = 7-10$ ms (DLHZA) $t = 15-20$ ms (DLKZA)
 fail safe <b>3</b>		
 without fail safe		

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

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

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

**(2)** Referred to spool in fail safe position at Δp = 35 bar per edge

**19 POWER SUPPLY AND SIGNALS SPECIFICATIONS**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

**19.1 Power supply (V+ and V0)**

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

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

**19.2 Power supply for driver's logic and communication (VL+ and VLO)**

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

The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

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

**19.3 Flow reference input signal (Q\_INPUT+)**

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

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

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

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

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

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

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

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

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

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

**19.5 Flow monitor output signal (Q\_MONITOR)**

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

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

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

**19.6 Pressure or force monitor output signal (F\_MONITOR) - only for SP, SF, SL**

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

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

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

**19.7 Enable input signal (ENABLE)**

To enable the driver, supply a 24 Vdc on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

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

**19.8 Fault output signal (FAULT)**

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

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

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

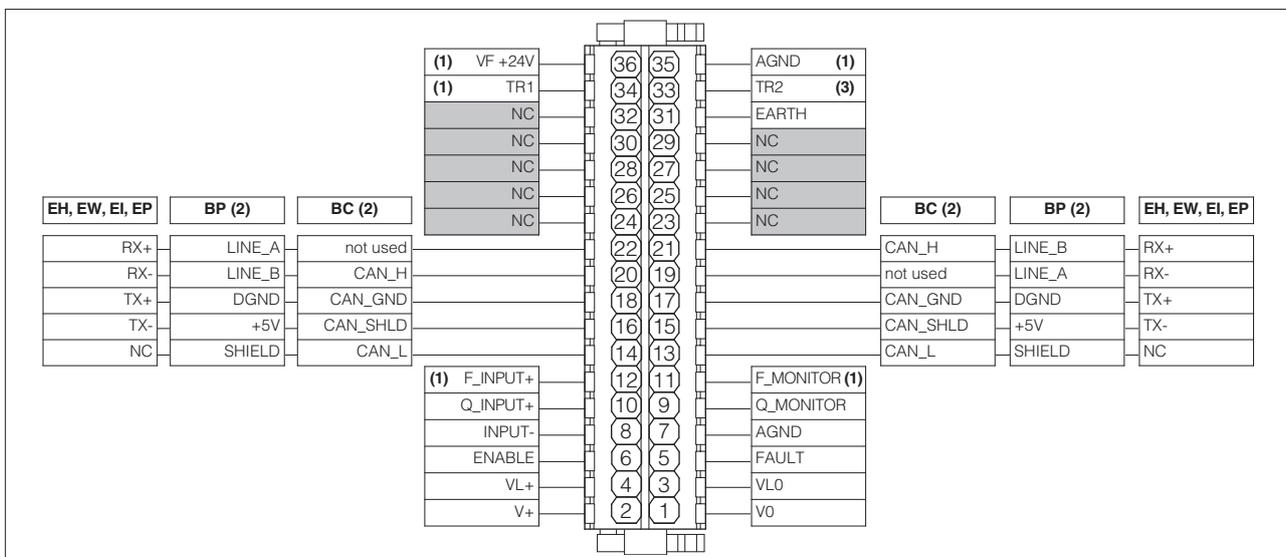
Analog remote pressure transducers or load cell can be directly connected to the driver.

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

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

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

**20 TERMINAL BOARD OVERVIEW**



(1) connections available only SP, SF, SL

(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

(3) connection available only SF

21 ELECTRONIC CONNECTIONS

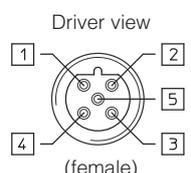
21.1 Main connections signals

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

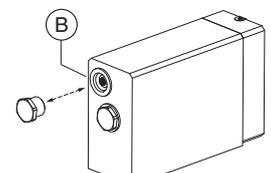
(1) Available only for SP, SF, SL

21.2 USB connector - M12 - 5 pin always present

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



Driver view  
(female)



21.3 BC fieldbus execution connections

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

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

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

21.4 BP fieldbus execution connections

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

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

21.5 EH, EW, EI, EP fieldbus execution connections

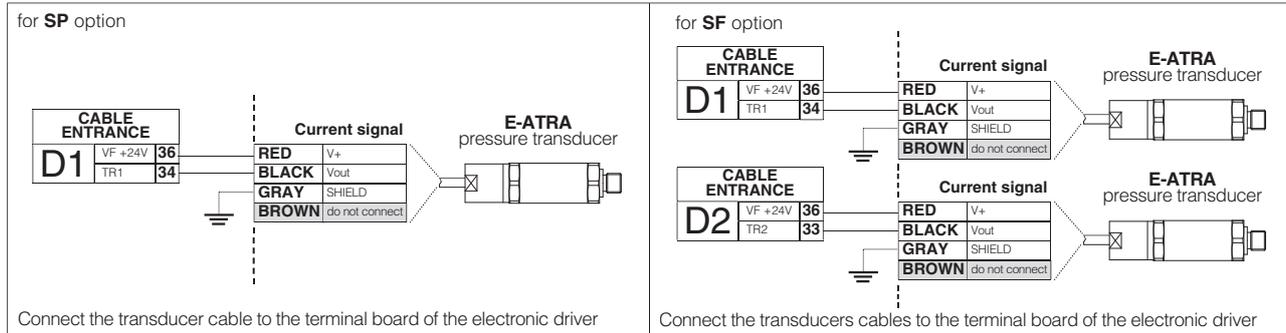
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
<b>C1</b> (input)	14	<b>NC</b>	do not connect
	16	<b>TX-</b>	Transmitter
	18	<b>TX+</b>	Transmitter
	20	<b>RX-</b>	Receiver
	22	<b>RX+</b>	Receiver

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

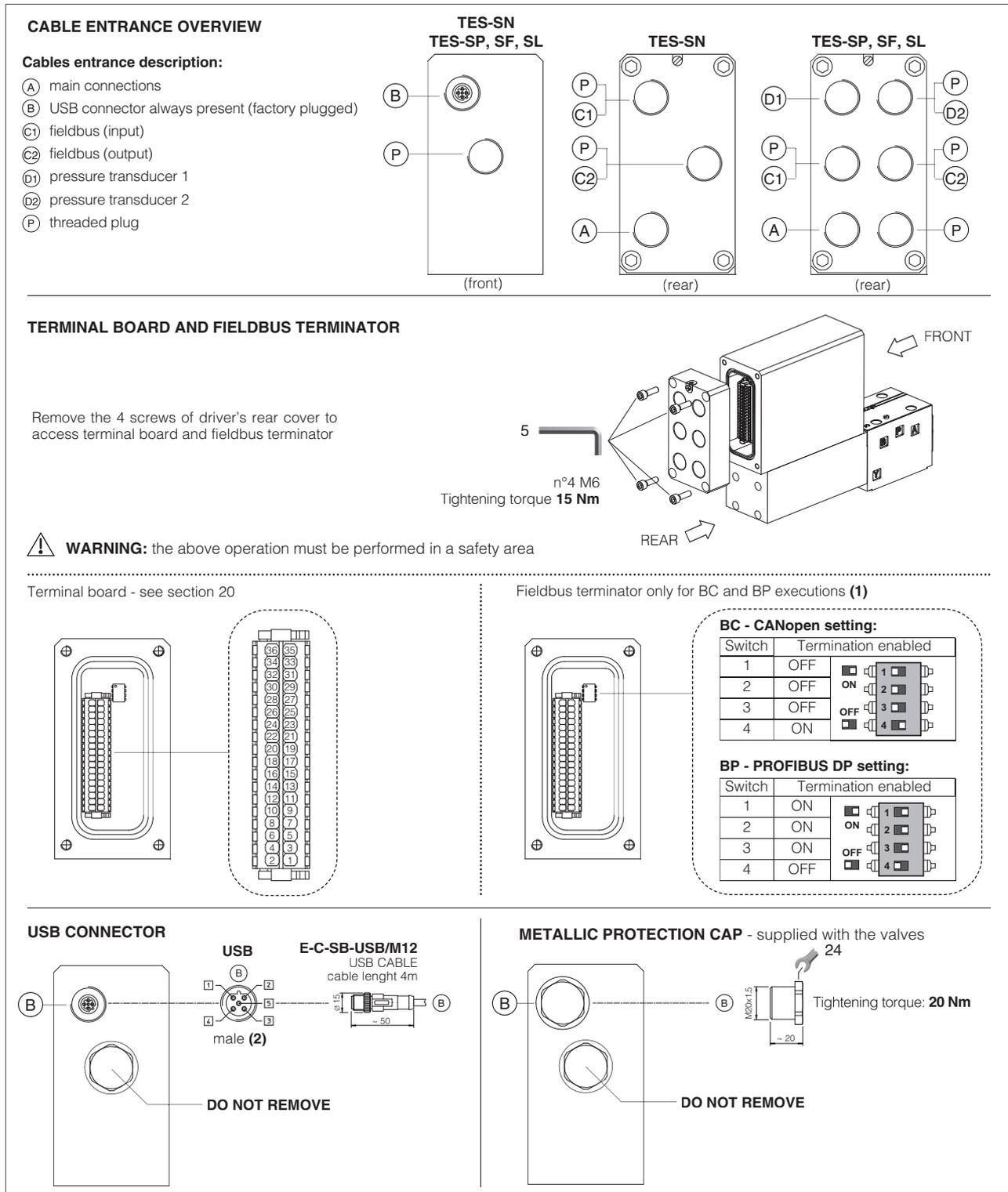
21.6 Remote pressure transducer connector - only for SP, SF, SL

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

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

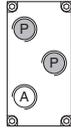
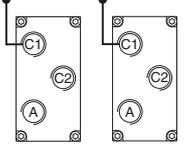
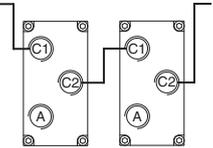


**22 CONNECTIONS LAYOUT**

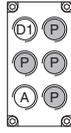
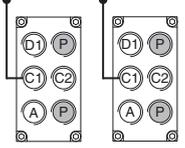
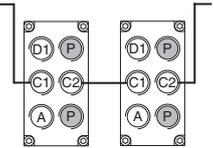


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF  
 (2) Pin layout always referred to driver's view

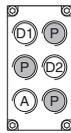
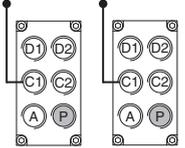
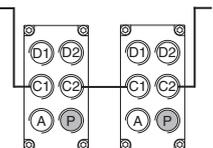
**22.1 Cable glands and threaded plug for TES-SN - see tech table KX800**

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

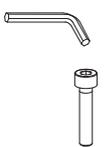
**22.2 Cable glands and threaded plug for TES-SP, SL - see tech table KX800**

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

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

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

23 FASTENING BOLTS AND SEALS

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

24 INSTALLATION DIMENSIONS [mm]

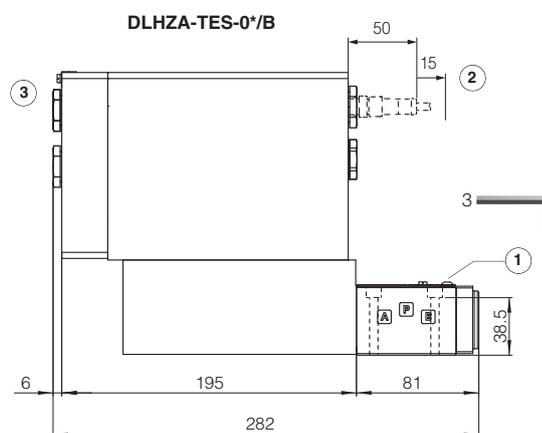
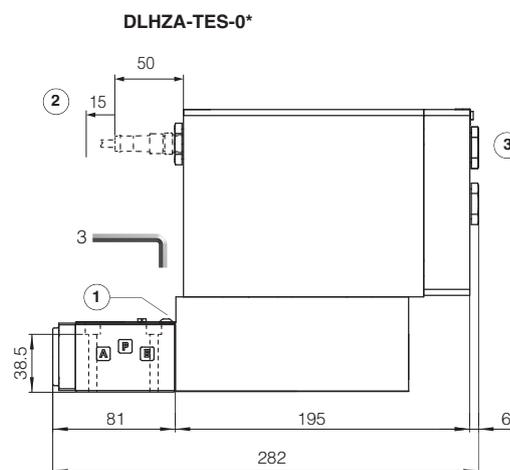
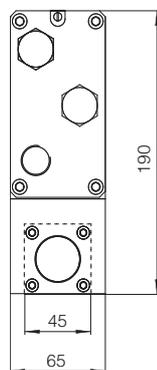
**DLHZA-TES**

ISO 4401: 2005

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

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

Mass [kg]	
DLHZA-TES	7,2



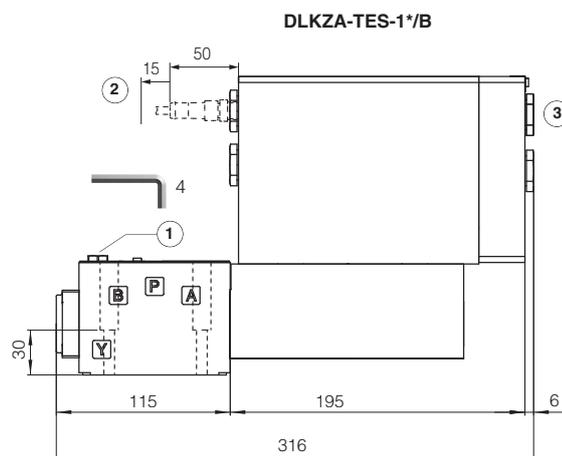
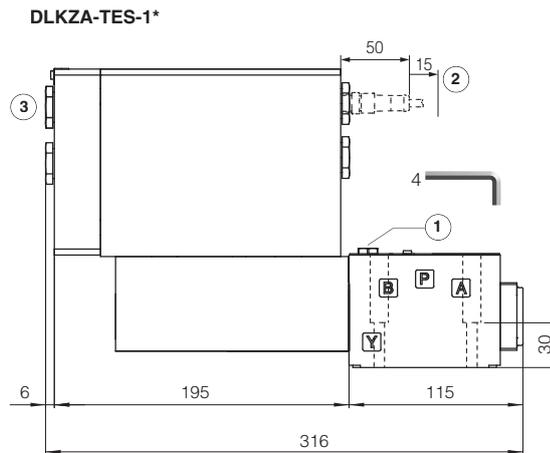
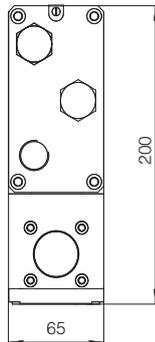
- ① = Air bleed off
- ② = Space to remove the USB connector
- ③ = The dimensions of cable glands must be considered (see tech table **KX800**)

## DLKZA-TES

ISO 4401: 2000

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

Mass [kg]	
DLKZA-TES	9



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

### 25 RELATED DOCUMENTATION

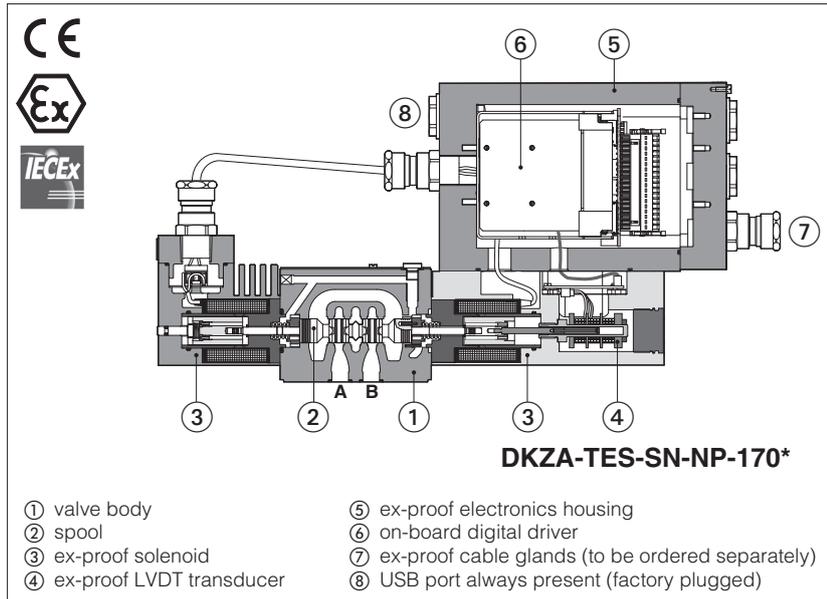
<b>X010</b>	Basics for electrohydraulics in hazardous environments	<b>GS500</b>	Programming tools
<b>X020</b>	Summary of Atos ex-proof components certified to ATEX, IECEx, EAC, PESO	<b>GS510</b>	Fieldbus
<b>FX500</b>	Ex-proof digital proportionals with P/Q control	<b>GX800</b>	Ex-proof pressure transducer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



Table **FX135-2/E**

## Ex-proof digital servoproportional directional valves

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



### DHZA-TES, DKZA-TES

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

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

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

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

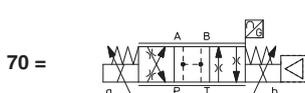
TEZ execution includes valve driver plus axis card to perform position control (see section 6).

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

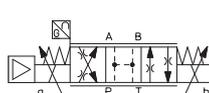
### 1 MODEL CODE

<b>DHZA</b>	-	<b>TES</b>	-	<b>SN</b>	-	<b>NP</b>	-	<b>0</b>	<b>70</b>	-	<b>L</b>	<b>5</b>	/	<b>M</b>	/	<b>*</b>	/	<b>*</b>							
<p>Ex-proof proportional directional valves, direct</p> <p><b>DHZA</b> = size 06 <b>DKZA</b> = size 10</p> <p><b>TES</b> = on-board driver and LVDT transducer</p> <p><b>Alternated P/Q controls</b>, see section 5:</p> <p><b>SN</b> = none <b>SP</b> = pressure control (1 pressure transducer) <b>SF</b> = force control (2 pressure transducers) <b>SL</b> = force control (1 load cell)</p> <p><b>Fieldbus interface</b>, USB port always present:</p> <table border="0" style="width: 100%;"> <tr> <td><b>NP</b> = Not Present</td> <td><b>EW</b> = POWERLINK</td> </tr> <tr> <td><b>BC</b> = CANopen</td> <td><b>EI</b> = EtherNet/IP</td> </tr> <tr> <td><b>BP</b> = PROFIBUS DP</td> <td><b>EP</b> = PROFINET RT/IRT</td> </tr> <tr> <td><b>EH</b> = EtherCAT</td> <td></td> </tr> </table> <p><b>Valve size ISO 4401:</b> <b>0</b> = 06    <b>1</b> = 10</p>																		<b>NP</b> = Not Present	<b>EW</b> = POWERLINK	<b>BC</b> = CANopen	<b>EI</b> = EtherNet/IP	<b>BP</b> = PROFIBUS DP	<b>EP</b> = PROFINET RT/IRT	<b>EH</b> = EtherCAT	
<b>NP</b> = Not Present	<b>EW</b> = POWERLINK																								
<b>BC</b> = CANopen	<b>EI</b> = EtherNet/IP																								
<b>BP</b> = PROFIBUS DP	<b>EP</b> = PROFINET RT/IRT																								
<b>EH</b> = EtherCAT																									
<p style="text-align: right;"><b>Seals material</b>, see section 10:</p> <p>- = NBR <b>PE</b> = FKM <b>BT</b> = HNBR</p> <p style="text-align: right;">Series number</p>																									
<p><b>Hydraulic options (1):</b></p> <p><b>B</b> = solenoid with integral digital electronics at side of port A (2) <b>Y</b> = external drain</p> <p><b>Electronic options (1):</b></p> <p><b>C</b> = current feedback for pressure transducer 4 ÷ 20 mA, only for <b>SP, SF, SL</b> (omit for std voltage ±10 Vdc) <b>I</b> = current reference input and monitor 4 ÷ 20 mA (omit for std voltage ±10 Vdc)</p>																									
<p><b>Cable entrance threaded connection:</b></p> <p><b>M</b> = M20x1,5</p>																									
<p><b>Spool size:</b>    <b>3</b> (L)    <b>5</b> (L,D)</p> <p>DHZA =        18        28</p> <p>DKZA =        45        75</p> <p>Nominal flow (l/min) at Δp 10 bar P-T</p>																									

### Configuration: Standard



### Option /B



### Spool type, regulating characteristics:

**L** = linear



**D** = differential-progressive



P-A = Q,    B-T = Q/2

P-B = Q/2,    A-T = Q

(1) For possible combined options, see section 16

(2) In standard configuration the solenoid with on-board digital driver and position transducer are at side port B

**2 GENERAL NOTES**

Atos digital proportionals valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **FX900** and in the user manuals included in the E-SW-\* programming software.

**3 VALVE SETTINGS AND PROGRAMMING TOOLS**



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

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

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

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

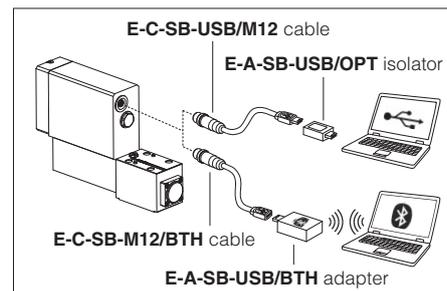


**WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection



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

**USB or Bluetooth connection**



**4 FIELDBUS** - see tech. table **GS510**

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

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

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

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

**6 AXIS CONTROLLER** - see tech. table **FX620**

Digital servoproportional with integral electronics **TEZ** include valve's driver plus axis controller, performing position closed loop of any hydraulic actuator equipped with analog, encoder or SSI position transducer. Alternated pressure or force closed loop control can be set by software additionally to the position control.

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

**7 GENERAL CHARACTERISTICS**

Assembly position	Any position
Subplate surface finishing to ISO 4401	Acceptable roughness index, Ra ≤0,8 recommended Ra 0,4 - flatness ratio 0,01/100
MTTFd valves according to EN ISO 13849	150 years, see technical table P007
Ambient temperature range	<b>Standard</b> = -20°C ÷ +60°C <b>/PE option</b> = -20°C ÷ +60°C <b>/BT option</b> = -40°C ÷ +60°C
Storage temperature range	<b>Standard</b> = -20°C ÷ +70°C <b>/PE option</b> = -20°C ÷ +70°C <b>/BT option</b> = -40°C ÷ +70°C
Surface protection	Zinc coating with black passivation - salt spray test (EN ISO 9227) > 200 h
Compliance	Explosion proof protection, see section <b>11</b> -Flame proof enclosure "Ex d" -Dust ignition protection by enclosure "Ex t"  RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006

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

Valve model	DHZA			DKZA		
Pressure limits [bar]	ports <b>P, A, B</b> = 350; <b>T</b> = 210 (250 with external drain /Y); <b>Y</b> = 10			ports <b>P, A, B</b> = 315; <b>T</b> = 210 (250 with external drain /Y); <b>Y</b> = 10		
Spool type	<b>L3</b>	<b>L5</b>	<b>D5</b>	<b>L3</b>	<b>L5</b>	<b>D5</b>
Nominal flow						
[l/min] at $\Delta p = 10$ bar	18	28	28	45	75	75
$\Delta p$ P-T at $\Delta p = 30$ bar	30	50	50	80	130	130
max permissible flow	40	60	60	90	150	150
$\Delta p$ max P-T [bar]	70	50	50	40	40	40
Response time [ms] <b>(1)</b>	≤ 18			≤ 25		
Leakage [cm <sup>3</sup> ]	<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 $\Delta T = 40^\circ C$					

**(1)** 0-100% step signal**9 ELECTRICAL CHARACTERISTICS**

Power supplies	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	35 W			
Analog input signals	Voltage: range ±10 Vdc (24 VMAX tolerant) Current: range ±20 mA		Input impedance: Ri > 50 kΩ Input impedance: Ri = 500 Ω	
Insulation class	H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Monitor outputs	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input	Range: 0 ÷ 5 Vdc (OFF state), 9 ÷ 24 Vdc (ON state), 5 ÷ 9 Vdc (not accepted); Input impedance: Ri > 10 kΩ			
Fault output	Output range: 0 ÷ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V ) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Pressure transducer power supply	+24VDC @ max 100 mA (E-ATRA-7 see tech table <b>GX800</b> )			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Protection degree to DIN EN60529	IP66/67 with relevant cable gland			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid current supply; spool position control (SN) or pressure/force control (SP, SF, SL) by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB Atos ASCII coding not insulated	CANopen EN50325-4 + DS408 optical insulated	PROFIBUS DP EN50170-2/IEC61158 optical insulated	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158 Fast Ethernet, insulated
Communication physical layer	USB 2.0 + USB OTG	CAN ISO11898	RS485	100 Base TX

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

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

Seals, recommended fluid temperature	NBR seals (standard) = -20°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C FKM seals (/PE option) = -20°C ÷ +80°C HNBR seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -40°C ÷ +50°C		
Recommended viscosity	20 ÷ 100 mm <sup>2</sup> /s - max allowed range 15 ÷ 380 mm <sup>2</sup> /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
<b>Hydraulic fluid</b>	<b>Suitable seals type</b>	<b>Classification</b>	<b>Ref. Standard</b>
Mineral oils	NBR, FKM, HNBR	HL, HLP, HLPD, HVLP, HVLDPD	DIN 51524
Flame resistant without water	FKM	HF DU, HF DR	ISO 12922
Flame resistant with water <b>(1)</b>	NBR, HNBR	HFC	

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

**(1) Performance limitations in case of flame resistant fluids with water:**

- max operating pressure = 210 bar
- max fluid temperature = 50°C

**11 CERTIFICATION DATA**

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

(1) The type examiner certificates can be downloaded from [www.atos.com](http://www.atos.com)

(2) The driver and solenoids are certified for minimum ambient temperature -40°C.

In case the complete valve must withstand with minimum ambient temperature -40°C, select **/BT** in the model code.

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

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

<b>Power supply and signals:</b> section of wire = 1,0 mm <sup>2</sup>	<b>Grounding:</b> section of external ground wire = 4 mm <sup>2</sup>
--	---

**12.1 Cable temperature**

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

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

**13 CABLE GLANDS**

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

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

**14 HYDRAULIC OPTIONS**

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

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

**15 ELECTRONIC OPTIONS**

**I** = It provides 4 ÷ 20 mA current reference signal, instead of the standard ±10 VDC.

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

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

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

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

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

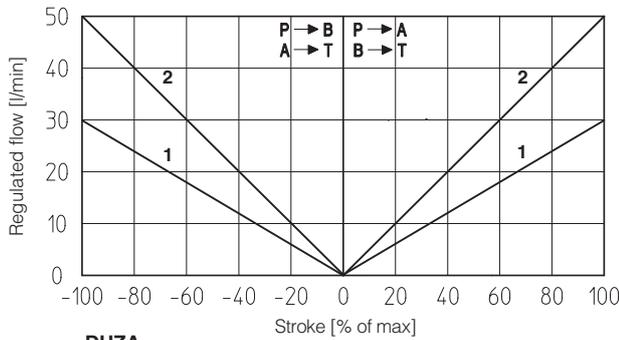
**16 POSSIBLE COMBINED OPTIONS**

**For SN:** /BI, /BY, /IY

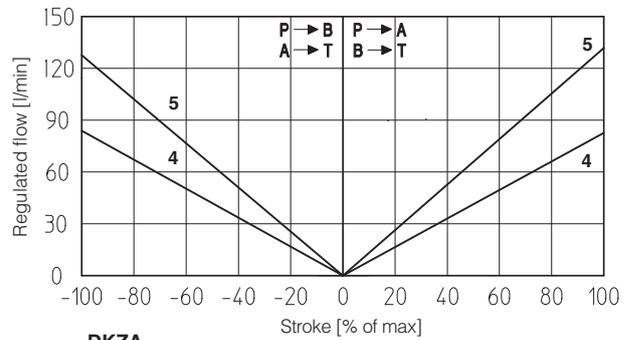
**For SP, SF, SL:** /BI, /BY, /IY, /CI, /BCI, CIY, BCIY

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

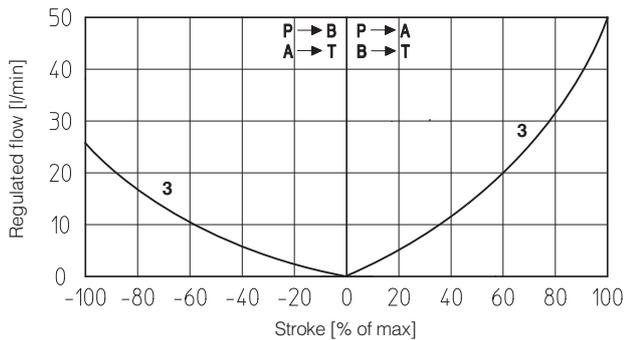
17.1 Regulation diagrams (values measure at Δp 30 bar P-T)



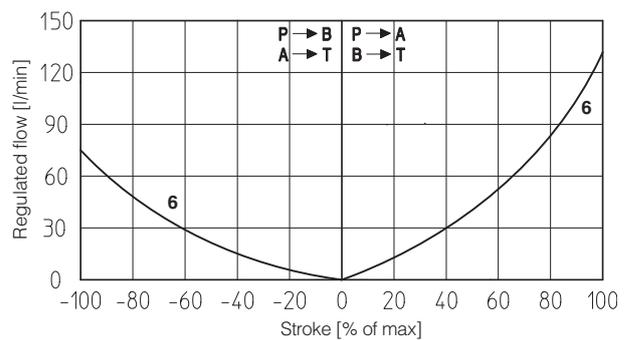
DHZA  
1 = L3 2 = L5



DKZA  
4 = L3 5 = L5



DHZA  
3 = D5



DKZA  
6 = D5

Note:

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

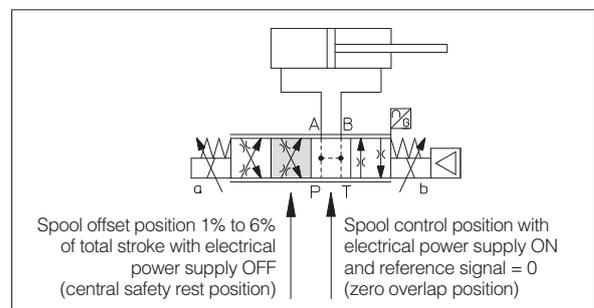
Reference signal  $\left. \begin{matrix} 0 \div +10 \text{ V} \\ 12 \div 20 \text{ mA} \end{matrix} \right\} P \rightarrow A / B \rightarrow T$       Reference signal  $\left. \begin{matrix} 0 \div -10 \text{ V} \\ 12 \div 4 \text{ mA} \end{matrix} \right\} P \rightarrow B / A \rightarrow T$

17.2 Spool safety rest position

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

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

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



**18 POWER SUPPLY AND SIGNALS SPECIFICATIONS**

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

**18.1 Power supply (V+ and V0)**

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

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

**18.2 Power supply for driver's logic and communication (VL+ and VL0)**

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

The separate power supply for driver's logic on pin 3 and 4, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

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

**18.3 Flow reference input signal (Q\_INPUT+)**

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

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

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

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

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

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

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

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

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

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

**18.5 Flow monitor output signal (Q\_MONITOR)**

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

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

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

**18.6 Pressure or force monitor output signal (F\_MONITOR) - only for SP, SF, SL**

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

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

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

**18.7 Enable input signal (ENABLE)**

To enable the driver, supply a 24 VDC on pin 6: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver; it is used to active the communication and the other driver functions when the valve must be disabled for safety reasons. This condition **does not comply** with norms IEC 61508 and ISO 13849.

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

**18.8 Fault output signal (FAULT)**

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

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

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

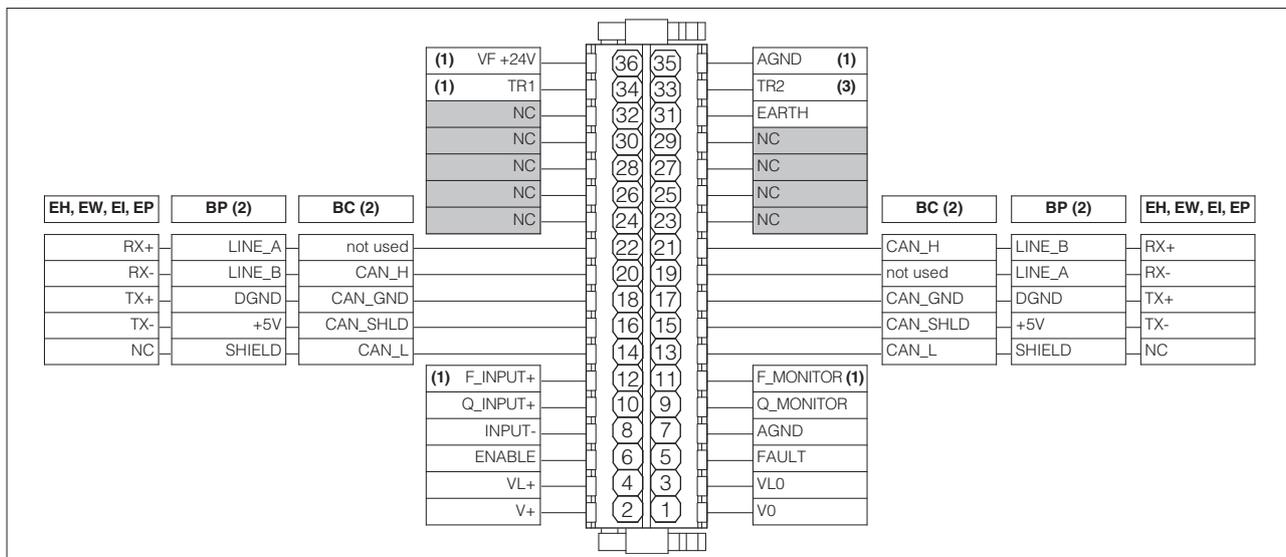
Analog remote pressure transducers or load cell can be directly connected to the driver.

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

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

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see table FX500).

**19 TERMINAL BOARD OVERVIEW**



(1) connections available only SP, SF, SL

(2) For BC and BP executions the fieldbus connections have an internal pass-through connection

(3) connection available only SF

20 ELECTRONIC CONNECTIONS

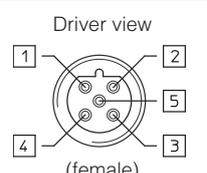
20.1 Main connections signals

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

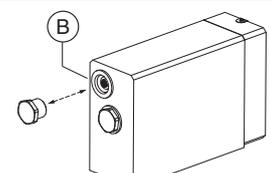
(1) Available only for SP, SF, SL

20.2 USB connector - M12 - 5 pin always present

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



Driver view  
(female)



20.3 BC fieldbus execution connections

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

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

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

20.4 BP fieldbus execution connections

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

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

20.5 EH, EW, EI, EP fieldbus execution connections

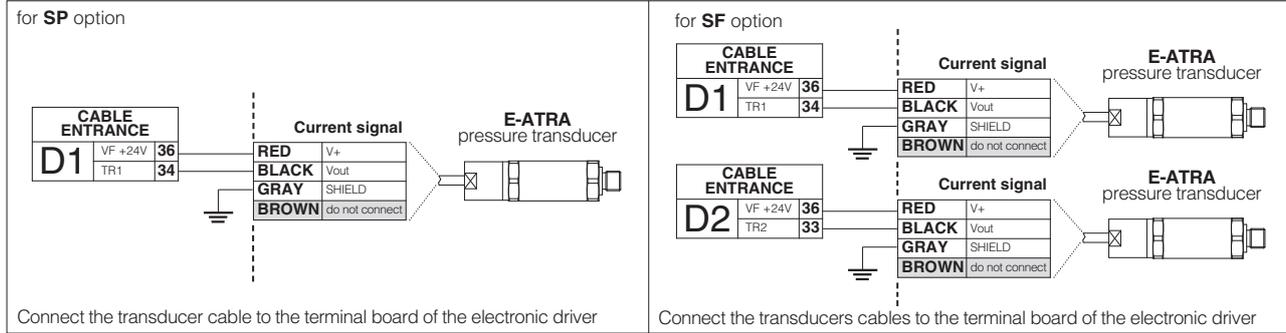
CABLE ENTRANCE	PIN	SIGNAL	TECHNICAL SPECIFICATIONS
<b>C1</b> (input)	14	<b>NC</b>	do not connect
	16	<b>TX-</b>	Transmitter
	18	<b>TX+</b>	Transmitter
	20	<b>RX-</b>	Receiver
	22	<b>RX+</b>	Receiver

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

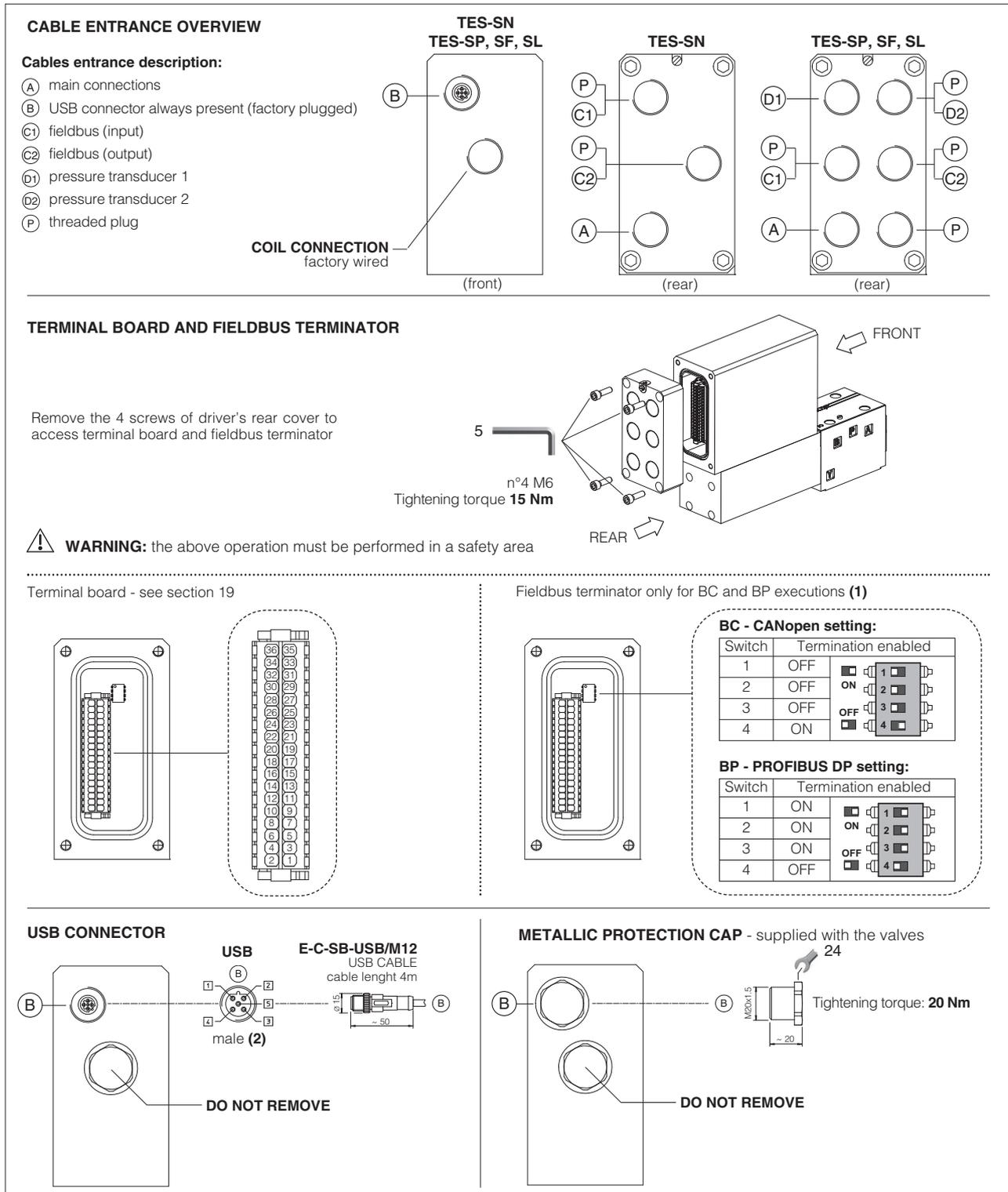
20.6 Remote pressure transducer connector - only for SP, SF, SL

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

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

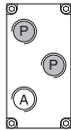
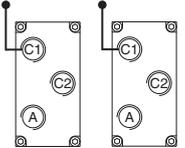
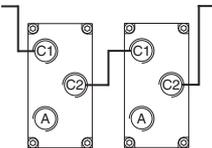


**21 CONNECTIONS LAYOUT**

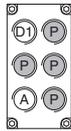
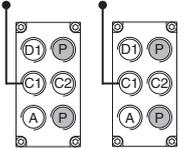
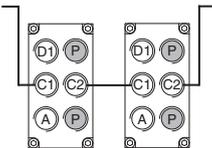


(1) Drivers with BC and BP fieldbus interface are delivered by default 'Not Terminated'. All switches are set OFF  
 (2) Pin layout always referred to driver's view

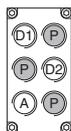
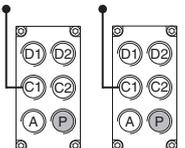
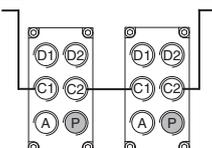
**21.1 Cable glands and threaded plug for TES-SN - see tech table KX800**

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

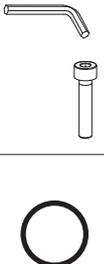
**21.2 Cable glands and threaded plug for TES-SP, SL - see tech table KX800**

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

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

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

22 FASTENING BOLTS AND SEALS

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

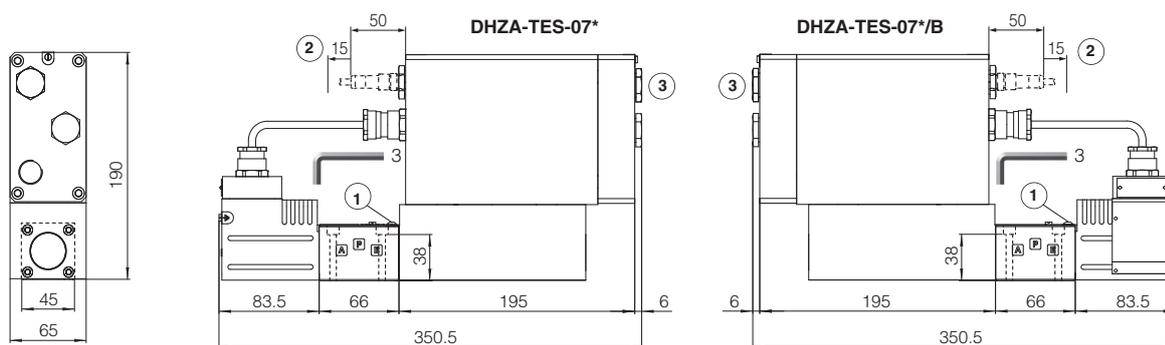
23 INSTALLATION DIMENSIONS [mm]

**DHZA-TES**

ISO 4401: 2005

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

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

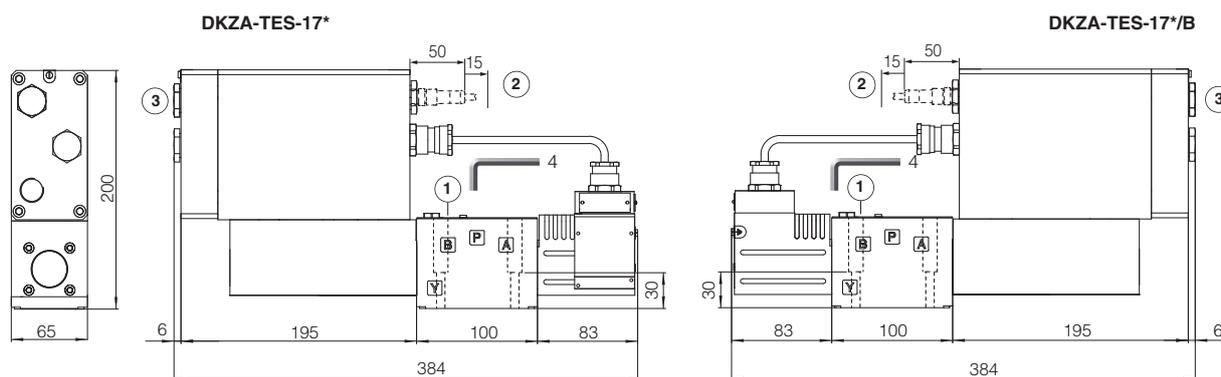


**DKZA-TES**

ISO 4401: 2005

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

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



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

24 RELATED DOCUMENTATION

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