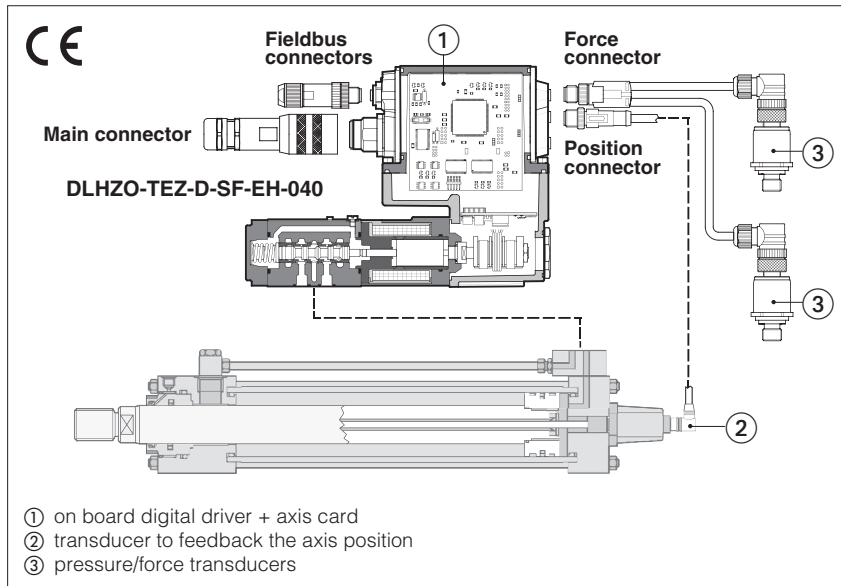


# Digital servoproportionals with on-board axis control

digital, direct and pilot operated directional valves with LVDT transducer - zero overlap spool



- ① on board digital driver + axis card
- ② transducer to feedback the axis position
- ③ pressure/force transducers

## DLHZO-TEZ, DLKZOR-TEZ DHZO-TEZ, DKZOR-TEZ, DPZO-LEZ

Digital servoproportionals direct or pilot operated include valve's driver + axis card to perform the position closed loop of any linear or rotative hydraulic actuator.

The controlled actuator has to be equipped with integral or external transducer (analog, potentiometer, SSI or Encoder) to feedback the axis position.

Directional servoproportionals are operated by an external or internally generated reference position signal, see [2].

**Alternated P/Q control option**, see [3]:  
**SP, SF, SL** = alternated pressure/force control to the basic position one

**Safety options** TÜV certified, see [8]:

**U** = safe double power supply

**K** = safe on/off acknowledge signals

Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested.

### 1 MODEL CODE

<b>DLHZO</b>	-	<b>TEZ</b>	-	<b>D</b>	-	<b>SF</b>	-	<b>EH</b>	-	<b>0</b>	<b>4</b>	<b>0</b>	-	<b>L5</b>	/	<b>*</b>	Safety option, TÜV certified, see section [8] Hydraulic and electronics options, see tech table <b>FS180</b>
<p>Direct operated servoproportional sleeve execution:  <b>DLHZO</b> = size 06  <b>DLKZOR</b> = size 10</p> <p><b>TEZ</b> = on-board digital driver + axis card, one LVDT transducer</p> <p><b>Fail safe type</b>, only for configuration 4:  <b>1</b> = A, B, P, T with positive overlapping (20% of spool stroke)  <b>3</b> = P positive (20% of spool stroke); A, B, T negative overlapping</p> <p><b>Spool type</b>:  <b>L0, L1, L3, L5, L7</b> = linear (<b>L0, L1, L5</b>, only for valve size 06)  <b>D7</b> = differential-linear (as <b>L</b>, but with P-A = Q, P-B = Q/2)  <b>DT7</b> = as <b>D</b>, but with non linear regulation  <b>T5, T7</b> = not linear regulation (<b>T5</b> only for valve size 10)</p> <p><b>Spool overlapping in central position: 0 = zero</b></p> <p><b>Configuration: 4</b> = with fail safe    <b>6</b> = without fail safe</p> <p><b>Valve size ISO 4401: 0</b> = 06    <b>1</b> = 10</p>																	

<b>DHZO</b>	-	<b>TEZ</b>	-	<b>D</b>	-	<b>SF</b>	-	<b>EH</b>	-	<b>0</b>	<b>7</b>	<b>0</b>	-	<b>L5</b>	/	<b>*</b>	Safety option, TÜV certified, see section [8] Hydraulic and electronics options, see tech table <b>FS168</b>
<p>Direct operated servoproportional:  <b>DHZO</b> = size 06  <b>DKZOR</b> = size 10</p> <p><b>TEZ</b> = on-board digital driver + axis card, one LVDT transducer</p> <p><b>Spool type</b>:  <b>L3, L5</b> = linear  <b>D5</b> = differential-progressive (P-A = Q, P-B = Q/2)</p> <p><b>Spool overlapping in central position: 0 = zero</b></p> <p><b>Configuration: 7</b> = 3 position, spring centered</p> <p><b>Valve size ISO 4401: 0</b> = 06    <b>1</b> = 10</p>																	

<b>DPZO</b>	-	<b>LEZ</b>	-	<b>D</b>	-	<b>SF</b>	-	<b>EH</b>	-	<b>1</b>	<b>6</b>	<b>0</b>	-	<b>L5</b>	/	<b>*</b>	Safety option, TÜV certified, see section [8] Hydraulic and electronics options, see tech table <b>FS178</b>
<p>Pilot operated servoproportional:  <b>DPZO</b></p> <p><b>LEZ</b> = on-board digital driver + axis card, two LVDT transducers</p> <p><b>Position transducer type</b>:  <b>A</b> = Analog (standard, potentiometer)  <b>D</b> = Digital (SSI, Encoder)</p> <p><b>Alternated P/Q control</b>, see section [3]:  <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 (load cell)</p> <p><b>Spool type</b>:  <b>L3, L5</b> = linear (<b>L3</b>, only for valve size 16)  <b>DL5</b> = differential-linear (as <b>L</b>, but with P-A = Q, P-B = Q/2)  <b>T5</b> = not linear regulation (only for valve size 16)</p> <p><b>Spool overlapping in central position: 0 = zero</b></p> <p><b>Configuration</b>:  <b>6</b> = spring offset (only for spool <b>L, DL</b>)    <b>7</b> = 3 position, spring centered</p> <p><b>Valve size ISO 4401: 1</b> = 10    <b>2</b> = 16    <b>4</b> = 25    <b>4M</b> = 27    <b>6</b> = 32    <b>8</b> = 35</p>																	

Fieldbus interfaces, USB port always present:

- NP = Not present
- BC = CANopen
- EH = EtherCAT
- EW = POWERLINK
- BP = PROFIBUS DP
- EI = EtherNet/IP
- EP = PROFINET RT/IRT

## 2 POSITION REFERENCE MODE

### 2.1 External reference generation

Axis controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer.

The external reference signal can be software selected among:

**Analog reference (a)** - the controller receives in real time the reference signal from the machine electronic central unit by means analog input on the main connector.

**Fieldbus reference (b)** - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication.

For fieldbus communication details, please refer to the controller user manual.

### 2.2 Internal reference generation

Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

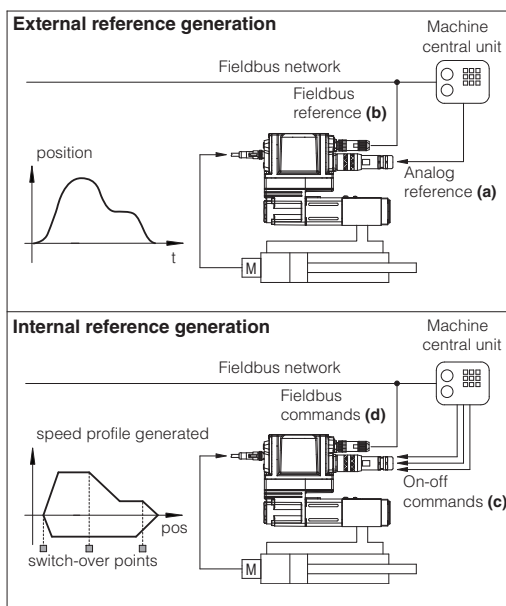
The internal reference signal is generated by a pre-programmed cycle; only start, stop and switch-over commands are required from the machine electronic central unit by means :

- on-off commands (c)

- fieldbus commands (d)

Atos PC software allows to design a customized sequence of motion phases adapted to the specific application requirements: a range of predefined standard sequences are available in the Z-SW software.

Start/stop/switch-over commands and reference generation type can be set for each phase in order to realize an automatic cycle according to the application requests. Refer to the controller user manual for further details on commands and reference generation type.



### Start / stop / switch-over commands examples

**External digital input** on-off commands, on main connector, are used to start/stop the cycle generation or to change the motion phase

**External fieldbus input** on-off commands, by fieldbus communication, are used to start/stop the cycle generation or to change the motion phase

**Switch by position** switch-over from actual to following motion phase occurs when the actual position reaches a programmed value

**Switch by time** switch-over from actual to following motion phase occurs after a fixed time, starting from the actual phase activation

### Reference generation types examples

**Absolute** a target position reference signal is internally generated for each motion phase; maximum speed and acceleration can be set to obtain a smooth and precise position control

**Relative** as 'Absolute' but the target position corresponds to the actuator position plus a fixed quote internally set by software

**Time** as 'Absolute' type but the controller automatically determines the speed and acceleration in order to reach the target absolute position in the fixed time internally set by software

## 3 ALTERNATED POSITION / FORCE CONTROL

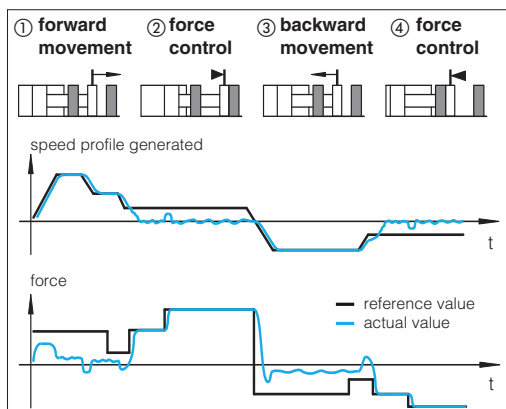
**SP, SF, SL** options allow to add the alternated force closed loop control to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

The position/force controls are operated according to two separate reference signals and a dedicated algorithm automatically selects which control is active time by time.

The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

Position control is active (see phase ① and ③ at side) when the actuator force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation.

Force control is active (see phase ② and ④ at side) when the actuator actual force, measured by remote transducers, grows up to the relevant reference signal - the controller reduces the valve's regulation in order to limit the actuator force; if the force tends to decrease under its reference signal, the position control returns active.



### Alternated control configurations

SP	SF	SL	
one remote pressure transducer has to be installed on the actuator's port to be controlled	two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)	one load cell transducer has to be installed between the actuator and the controlled load	
<b>T</b> valve's spool transducer	<b>M</b> actuator's position transducer	<b>P</b> pressure transducer	<b>L</b> load cell

### SP – position/pressure control

Adds pressure control to standard position control and permits to limit the max force in one direction controlling in closed loop the pressure acting on one side of the hydraulic actuator. A single pressure transducer has to be installed on hydraulic line to be controlled.

### SF – position/force control

Adds force control to standard position control and permits to limit the max force in two directions controlling in closed loop the delta pressure acting on both sides of the hydraulic actuator. Two pressure transducers have to be installed on both hydraulic line.

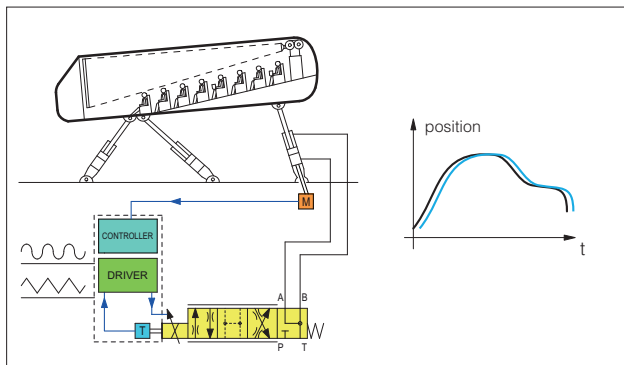
### SL – position/force control

Adds force control to standard position control and permits to limit the max force in one or two directions controlling in closed loop the force performed by the hydraulic actuator. A load cell has to be installed on hydraulic actuator.

#### General Notes:

- servoproportional type DLHZO, DLKZOR and DPZO-L are strongly recommended for high accuracy applications  
see tech tables **FS180, FS178**
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault,  
see tech table **EY100**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS002**
- Atos technical service is available for additional evaluations related to specific applications usage

## 4 APPLICATION EXAMPLES



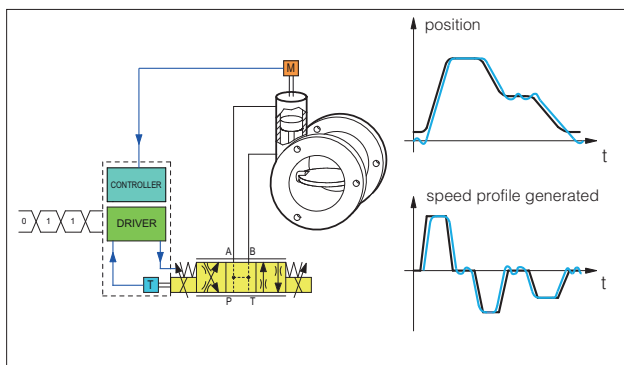
### Multiaxis simulators

To obtain the desired simulation effects, the machine central electronic unit of multiaxis simulators generates the time-dependent motion profiles and synchronizes all the controlled axis.

DLHZO-T high performance servoproportional valve in steel sleeve execution allows to obtain fast, accurate and reliable movements of the system.

Axis controller allows high performance position control and easy optimization of the system architecture thanks to:

- analog position reference mode for real time motion profile synchronization
- analog position transducer for reliable and compact solution
- complete diagnostic functionalities for advanced system monitoring



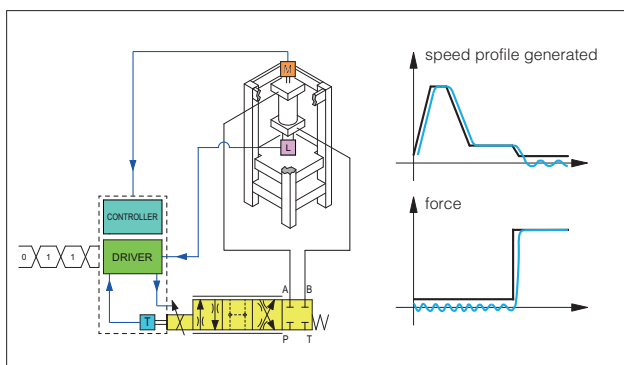
### Process valves

Process valves motion regulation requires smooth and remote controls due to wide distributed applications.

DHZO-T proportional valve with spool position transducer allows smooth regulations and accurate movements.

Axis controller allows remote control thanks to:

- internal reference generation with maximum speed and acceleration settings for standing alone axis control
- potentiometer position transducer for compact and cost effective solution
- fieldbus connection for easy parameterization and remote commands



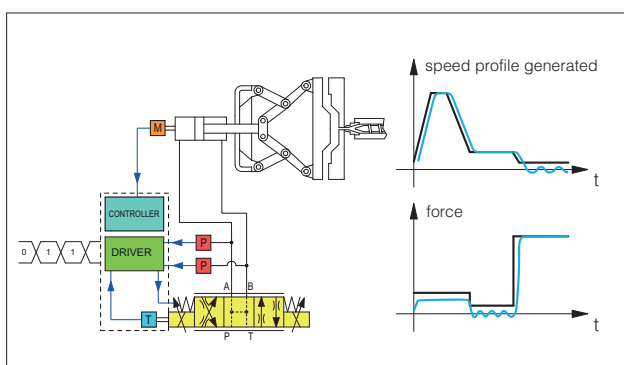
### Hydraulic presses

Hydraulic presses perform shaft assembly with and accurate force and position control. Several set of motion parameters can be internally stored and selected by machine electronic control unit to adapt the presses performances to the specific production.

DLHZO-T high performance servoproportional valve in steel sleeve execution allows to obtain accurate position and force controls in a single device.

Axis controller with force control (SL control) performs position/force control thanks to:

- fieldbus reference mode for remote control
- encoder position transducer for accurate position control loop
- one load cell for alternated force control
- complete diagnostic functionalities for advanced system monitoring



### Clamp control on plastic machines

Clamp movements involve fast/slow motion with accurate alternated position/force controls for the mould safety functions.

DKZOR-T proportional valve allows to obtain quick and accurate regulations in the different working/control phases of the machine.

Axis controller with force control (SF control) simplifies the hydraulic + electronic system architecture and combines position/force regulation in a single device thanks to:

- internal reference generation for standing alone axis control
- SSI digital position transducer for high performance solution
- two pressure transducers for alternated force control
- fieldbus connection for machine remote control and advanced diagnostics

## 5 GENERAL NOTES

Atos digital proportional valves are CE marked according to the applicable directives (e.g. Immunity and Emission EMC Directive). Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in tech table **F003** and in the user manuals included in the Z-SW-\* programming software.

## 6 VALVE SETTINGS AND PROGRAMMING TOOLS

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

**Z-SW-FULL** support:

NP (USB)	PS (Serial)		
BC (CANopen)	BP (PROFIBUS DP)	EH (EtherCAT)	
EW (POWERLINK)	EI (EtherNet/IP)	EP (PROFINET)	

**Note:** Z-SW programming software supports valves with option SP, SF, SL for alternated control

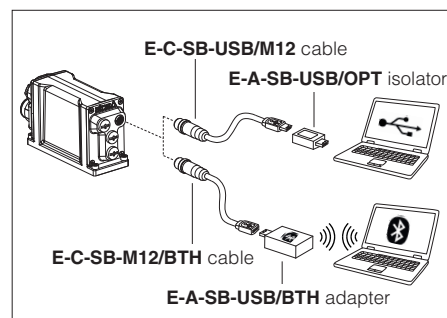


**WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of isolator adapter is highly recommended for PC protection (see tech table **GS500**)



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

### USB or Bluetooth connection



## 7 FIELDBUS - see tech. table **GS510**

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

## 8 SAFETY OPTIONS

Atos range of proportional directional valves, provides functional safety options **/U** and **/K**, designed to accomplish a safety function, intended to reduce the risk in process control systems.

They are **TÜV certified** in compliance to **IEC 61508 up to SIL 3 and ISO 13849 up to category 4, PL e**



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

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

## 9 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	<b>DLHZO, DLKZOR, DHZO, DKZOR</b> 150 years, see technical table P007	<b>DPZO</b> 75 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 (body) galvanic treatment (controller housing)	
Corrosion resistance	Salt spray test (EN ISO 9227) > 200 h	
Conformity	RoHs Directive 2011/65/EU as last update by 2015/65/EU REACH Regulation (EC) n°1907/2006	

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

For hydraulic characteristics and performance diagrams, see tech tables of specific components:

**DLHZO, DLKZOR** = direct operated servoproportional sleeve execution, tech table **FS180**

**DHZO, DKZOR** = direct operated servoproportional, tech table **FS168**

**DPZO** = pilot operated servoproportional, tech table **FS178**

## 11 ELECTRICAL CHARACTERISTICS

Power supplies	Nominal : +24 VDC Rectified and filtered : $V_{RMS} = 20 \div 32 V_{MAX}$ (ripple max 10 % VPP)			
Max power consumption	50 W			
Max. solenoid current	<b>DLHZO, DHZO, DPZO</b> = 2,6 A <b>DLKZOR, DKZOR</b> = 3 A			
Coil resistance R at 20°C	<b>DLHZO, DHZO, DPZO</b> = $3 \div 3,3 \Omega$ <b>DLKZOR, DKZOR</b> = $3,8 \div 4,1 \Omega$			
Analog input signals	Voltage: range $\pm 10$ VDC (24 VMAX tollerant) Current: range $\pm 20$ mA		Input impedance: $R_i > 50 k\Omega$ Input impedance: $R_i = 500 \Omega$	
Monitor outputs	Output range: voltage $\pm 10$ VDC @ max 5 mA current $\pm 20$ mA @ max 500 $\Omega$ load resistance			
Enable input	Range: 0 $\div$ 5 Vdc (OFF state), 9 $\div$ 24 Vdc (ON state), 5 $\div$ 9 Vdc (not accepted); Input impedance: $R_i > 10 k\Omega$			
Fault output	Output range: 0 $\div$ 24 Vdc (ON state > [power supply - 2 V] ; OFF state < 1 V ) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)			
Position transducers power supply	+24 Vdc @ max 100 mA and +5 Vdc @ max 100 mA are software selectable; $\pm 10$ Vdc @ max 14 mA minimum load resistance 700 $\Omega$			
Pressure/Force transducer power supply (only for SP, SF, SL)	+24Vdc @ max 100 mA (E-ATR-8 see tech table <b>GS465</b> )			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function			
Insulation class	H (180°) Due to the occuring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account			
Protection degree to DIN EN60529	IP66 / IP67 with mating connectors			
Duty factor	Continuous rating (ED=100%)			
Tropicalization	Tropical coating on electronics PCB			
Additional characteristics	Short circuit protection of solenoid's current supply; 3 leds for diagnostic; spool position control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply			
Electromagnetic compatibility (EMC)	According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)			
Communication interface	USB	CANopen	PROFIBUS DP	EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EC 61158
	Atos ASCII coding	EN50325-4 + DS408	EN50170-2/IEC61158	
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable	LiYCY shielded cables, see section <a href="#">17</a>			

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

## 12 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 $\div$ +60°C, with HFC hydraulic fluids = -20°C $\div$ +50°C FKM seals (/PE option) = -20°C $\div$ +80°C HNBR seals (/BT option) = -40°C $\div$ +60°C, with HFC hydraulic fluids = -40°C $\div$ +50°C		
Recommended viscosity	20 $\div$ 100 mm <sup>2</sup> /s - max allowed range 15 $\div$ 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 <a href="http://www.atos.com">www.atos.com</a> or KTF catalog
	longer life	ISO4406 class 16/14/11 NAS1638 class 5	
<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	NBR, HNBR	HFC	


## 13 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).

For certified safety options: **/U** see tech. table **FY100** and **/K** see tech. table **FY200**

### 13.1 Power supply (V+ and V0)


The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000  $\mu$ F/40 V capacitance to single phase rectifiers or a 4700  $\mu$ F/40 V capacitance to three phase rectifiers. In case of separate power supply see 13.2.

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

### 13.2 Power supply for driver's logic and communication (VL+ and VL0)

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

The separate power supply for controller's logic on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 maintaining active the diagnostics, USB and fieldbus communications.

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

### 13.3 Position reference input signal (P\_INPUT+)

Functionality of P\_INPUT+ signal (pin 4), depends on controller's reference mode, see section 2 :

*External analog reference generation* (see 2.1): input is used as reference for the controller axis position closed loop.

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

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

*Fieldbus/internal reference generation* (see 2.2): analog reference input signal can be used as on-off commands with input range  $0 \div 24$ VDC.

### 13.4 Pressure or force reference input signal (F\_INPUT+) - only for SP, SF, SL

Functionality of F\_INPUT+ signal (pin 7), depends on selected controllers' reference mode and alternated control options, see section 3 :

*SP, SL, SF controls and external analog reference selected* : input is used as reference for the controller pressure/force closed loop.

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

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

*SN control or fieldbus/internal reference selected*: analog reference input signal can be used as on-off commands with input range  $0 \div 24$ VDC.

### 13.5 Position monitor output signal (P\_MONITOR)

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

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

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

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

The controller generates an analog output signal according to alternated pressure/force control option:

*SN control*: output signal is proportional to the actual valve spool position

*SP, SL, SF controls*: output signal is proportional to the actual pressure/force applied to the cylinder's rod end

Monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).

The output range and polarity are software selectable within the maximum range  $\pm 10$  VDC or  $\pm 20$  mA.

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

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

### 13.7 Enable input signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin 3.

When the Enable signal is set to zero the controller can be software set to perform one of the following actions:

- maintain the actuator actual position in close loop control
- move towards a predefined position in closed loop control and maintains the reached position (hold position)
- move forward or backward in open loop (only the valve's closed loop remain active)

### 13.8 Fault output signal (FAULT)

Fault output signal indicates fault conditions of the controller (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 Vdc.

Fault status is not affected by the Enable input signal.

Fault output signal can be used as digital output by software selection.

### 13.9 Position transducer input signal

A position transducer must be always directly connected to the controller. Select the correct controller execution depending on the desired transducer interface: digital SSI or Encoder (D execution), potentiometer or a generic transducer with analog interface (A execution).

Position digital input signal is factory preset to binary SSI, it can be reconfigured via software selecting between binary/gray SSI and Encoder.

Position analog input signal is factory preset according to selected valve code, defaults are  $\pm 10$  VDC for standard and  $4 \div 20$  mA for /C option.

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

Refer to position transducer characteristics to select the transducer type according to specific application requirements (see 14.1).

### 13.10 Remote pressure/force transducer input signals - only for SP, SF, SL

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

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

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

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see 14.2).

### 13.11 Possible combined electronic options

#### Standard versions

For **A-SN, A-SP, A-SF, A-SL**: /I, /C, /CI

For **D-SN**: /I

For **D-SP, D-SF, D-SL**: /I, /C, /CI

#### Safety certified versions:

For **A-SN, A-SP, A-SF, A-SL**: /IU, /CU, /CIU, /IK, /CK, /CIK

For **D-SN**: /IU, /IK

For **D-SP, D-SF, D-SL**: /IU, /CU, /CIU, /IK, /CK, /CIK

## 14 ACTUATOR'S TRANSDUCER CHARACTERISTICS

### 14.1 Position transducers

The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controllers, depending to the system requirements: potentiometer or analog signal (A execution), SSI or Encoder (D execution). Transducers with digital interface allow high resolution and accurate measures, that combined with fieldbus communication grants highest performances. Transducers with analog interface grant simple and cost effective solutions.

### 14.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer, see section [3]. Alternated pressure/force controls require to install pressure transducers or load cell to measure the actual pressure/force values. Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure and position/force controls (see tech table **GS465** for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control. The characteristics of the remote pressure/force transducers must be always selected to match the application requirements and to obtain the best performances: transducer nominal range should be at least 115%÷120% of the maximum regulated pressure/force.

### 14.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer's datasheet

Execution	Position				Pressure/Force
	A		D		SP, SF, SL
Input type	Potentiometer	Analog	SSI (3)	Incremental Encoder	Analog
Power supply (1)	±10 Vdc	+24 Vdc	+5 Vdc / +24 Vdc	+5 Vdc / +24 Vdc	+24 Vdc
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA	Serial SSI binary/gray	TTL 5Vpp - 150 KHz	±10 Vdc 4 ÷ 20 mA
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	1 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (2)	± 0.1% FS	< ±0.03% FS	< ± 0.01 % FS	< ± 0.001 % FS	< ±0.25% FS
Repeatability (2)	± 0.05% FS	< ± 0.005% FS	< ± 0.001 % FS	< ± 0.001 % FS	< ±0.1% FS

(1) Power supply provided by Atos controller (2) Percentage of total stroke (3) For Balluff BTL7 with SSI interface only special code SA433 is supported

## 15 ELECTRONIC CONNECTIONS

### 15.1 Main connector - 12 pin (A)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	V+	Power supply 24 Vdc	Input - power supply
2	V0	Power supply 0 Vdc	Gnd - power supply
3	ENABLE	Enable (24 Vdc) or disable (0 Vdc) the controller, referred to VL0	Input - on/off signal
4	P_INPUT+	Position reference input signal: ±10 Vdc / ±20 mA maximum range	Input - analog signal <b>Software selectable</b>
5	INPUT-	Negative reference input signal for P_INPUT+ and F_INPUT+	Gnd - analog signal
6	P_MONITOR	Position monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to VL0	Output - analog signal <b>Software selectable</b>
7	F_INPUT+	Pressure/Force reference input signal (SP, SF, SL controls): ±10 Vdc / ±20 mA maximum range	Input - analog signal <b>Software selectable</b>
8	F_MONITOR	Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 Vdc / ±20mA maximum range, referred to VL0	Output - analog signal <b>Software selectable</b>
9	VL+	Power supply 24 Vdc for controller's logic and communication	Input - power supply
10	VL0 (1)	Power supply 0 Vdc for controller's logic and communication	Gnd - power supply
11	FAULT	Fault (0 Vdc) or normal working (24 Vdc), referred to VL0	Output - on/off signal
PE	EARTH	Internally connected to controller housing	

(1) Do not disconnect VL0 before VL+ when the controller is connected to PC USB port

### 15.2 Communication connectors (B) - (C)

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

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

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

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

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

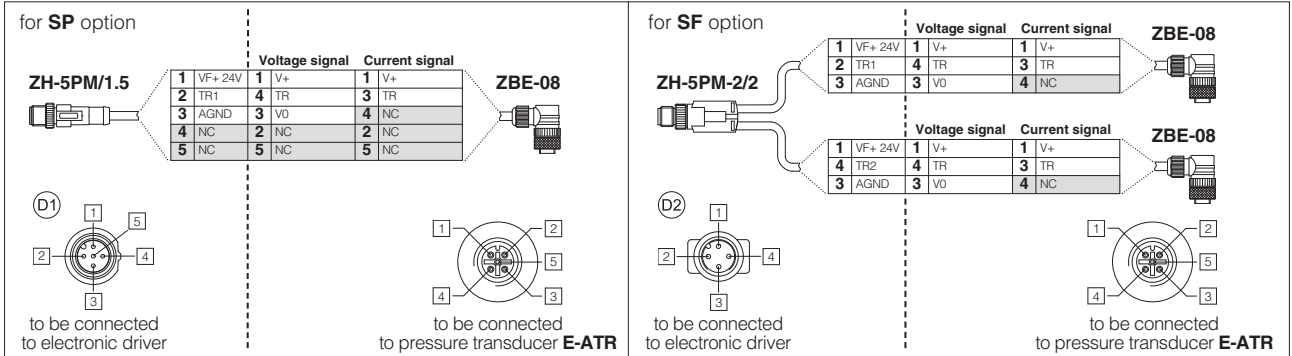
(2) Pin 2 can be fed with external +5V supply of CAN interface

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

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	(D1) SP, SL - Single transducer (1)		(D2) SF - Double transducers (1)	
				Voltage	Current	Voltage	Current
1	VF +24V	Power supply +24Vdc	Output - power supply	Connect	Connect	Connect	Connect
2	TR1	1st signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal <b>Software selectable</b>	Connect	Connect	Connect	Connect
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	/	Connect	/
4	TR2	2nd signal transducer: ±10 Vdc / ±20 mA maximum range	Input - analog signal <b>Software selectable</b>	/	/	Connect	Connect
5	NC	Not connect		/	/	/	/

(1) Single/double transducer configuration is software selectable

Remote pressure transducers connection - example



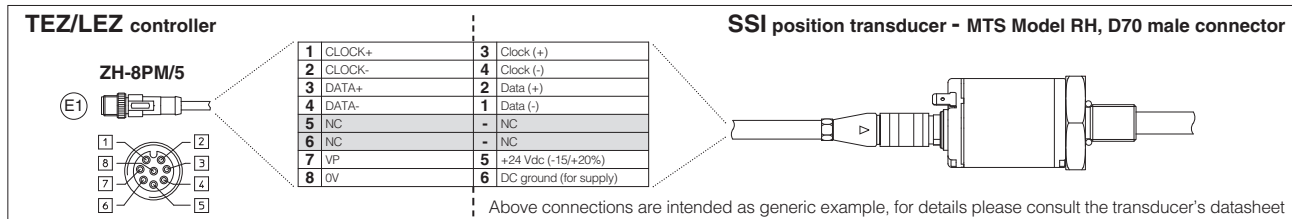
Note: pin layout always referred to driver's view

15.4 D execution - Digital position transducers connector - M12 - 8 pin (E1)

SSI - default transducer (1)				Encoder (1)		
PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	SIGNAL	TECHNICAL SPECIFICATION	NOTES
1	CLOCK+	Serial synchronous clock (+)	Input - digital signal	R	Input channel R	Input - digital signal
2	CLOCK-	Serial synchronous clock (-)		/R	Input channel /R	
3	DATA+	Serial position data (+)		A	Input channel A	
4	DATA-	Serial position data (-)		/A	Input channel /A	
5	NC	Not connect	B	Input channel B		
6	NC		/B	Input channel /B		
7	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply <b>Software selectable</b>	VP	Power supply: +24Vdc, +5Vdc or OFF (default OFF)	Output - power supply <b>Software selectable</b>
8	0V	Common gnd for transducer power and signals	Common gnd	0V	Common gnd for transducer power and signals	Common gnd

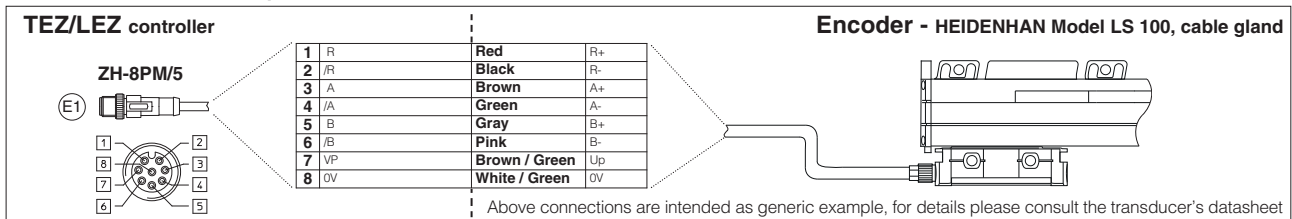
(1) Digital position transducer type is software selectable: Encoder or SSI, see 13.9

SSI connection - example



Note: pin layout referred to controller's view

Encoder connection - example



Note: pin layout referred to controller's view

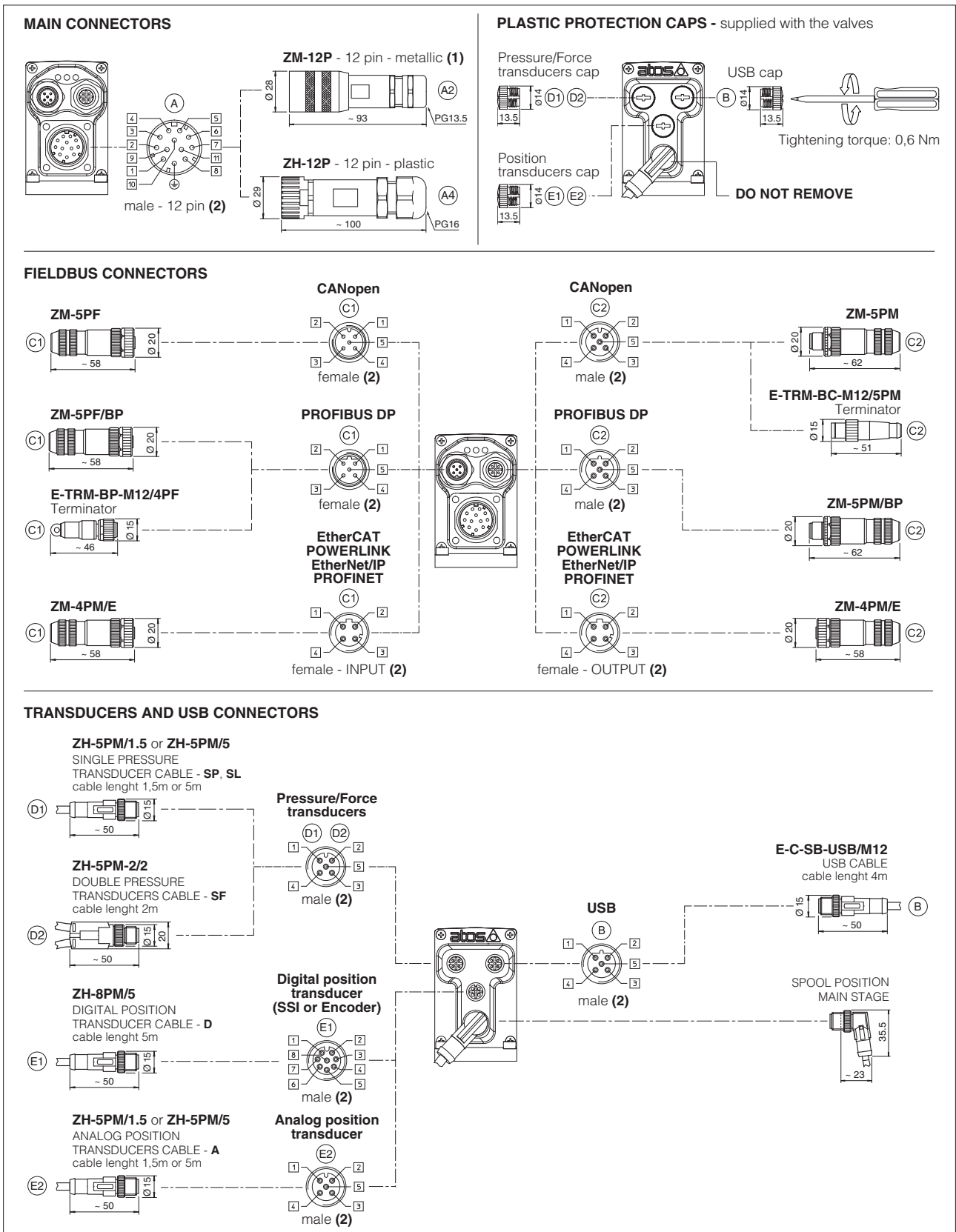
15.5 A execution - Analog position transducers connector - M12 - 5 pin (E2)

PIN	SIGNAL	TECHNICAL SPECIFICATION	NOTES	Potentiometer	Analog
1	VP +24V	Power supply: +24Vdc or OFF (default OFF)	Output - power supply <b>Software selectable</b>	/	Connect
2	VP +10V	Power supply reference +10Vdc (always present)	Output - power supply	Connect	/
3	AGND	Common gnd for transducer power and signals	Common gnd	Connect	Connect
4	TR	Signal transducer	Input - analog signal	Connect	Connect
5	VP -10V	Power supply reference -10Vdc (always present)	Output - power supply	Connect	/

Note: analog input range is software selectable, see 13.9



## 15.6 TEZ/LEZ connections layout



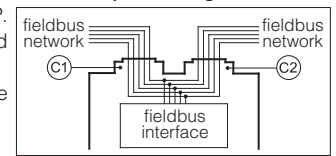
## 16 IN / OUT FIELDBUS COMMUNICATION CONNECTORS

Two fieldbus communication connectors are always available for digital controllers executions BC, BP, EH, EW, EI, EP. This feature allows considerable technical advantages in terms of installation simplicity, wiring reduction and also avoids the use of expensive T-connectors.

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

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

### BC and BP pass-through connection



## 17 CONNECTORS CHARACTERISTICS - to be ordered separately

### 17.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
<b>CODE</b>	(A1) <b>ZM-12P</b>	(A2) <b>ZH-12P</b>
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm <sup>2</sup> max 20 m (logic and power supply)	LiYCY 10 x 0,14mm <sup>2</sup> max 40 m (logic) LiYY 3 x 1mm <sup>2</sup> max 40 m (power supply)
Conductor size	0,5 mm <sup>2</sup> to 1,5 mm <sup>2</sup> - available for 12 wires	0,14 mm <sup>2</sup> to 0,5 mm <sup>2</sup> - available for 9 wires 0,5 mm <sup>2</sup> to 1,5 mm <sup>2</sup> - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

### 17.2 Fieldbus communication connectors

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

(1) E-TRM-\*\* terminators can be ordered separately, see tech table **GS500**

(2) Internally terminated

### 17.3 Pressure/Force transducer connectors - only for SP, SF, SL

CONNECTOR TYPE	SP, SL - Single transducer		SF - Double transducers
<b>CODE</b>	(D1) <b>ZH-5PM/1.5</b>	(D1) <b>ZH-5PM/5</b>	(D2) <b>ZH-5PM-2/2</b>
Type	5 pin male straight circular		4 pin male straight circular
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101
Material	Plastic		Plastic
Cable gland	Connector moulded on cables 1,5 m length   5 m length		Connector moulded on cables 2 m length
Cable	5 x 0,25 mm <sup>2</sup>		3 x 0,25 mm <sup>2</sup> (both cables)
Connection type	molded cable		splitting cable
Protection (EN 60529)	IP 67		IP 67

### 17.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 14.4		ANALOG POSITION TRANSDUCER A execution - see 14.5	
<b>CODE</b>	(E1) <b>ZH-8PM/5</b>		(E2) <b>ZH-5PM/1.5</b>	(E2) <b>ZH-5PM/5</b>
Type	8 pin male straight circular		5 pin male straight circular	
Standard	M12 coding A – IEC 61076-2-101		M12 coding A – IEC 61076-2-101	
Material	Plastic		Plastic	
Cable gland	Connector moulded on cables 5 m length		Connector moulded on cables 1,5 m length   5 m length	
Cable	8 x 0,25 mm <sup>2</sup>		5 x 0,25 mm <sup>2</sup>	
Connection type	molded cable		molded cable	
Protection (EN 60529)	IP 67		IP 67	

## 18 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the user manuals included in the Z-SW programming software:

**Z-MAN-RI-LEZ** - user manual for **TEZ** and **LEZ** with **SN**

**Z-MAN-RI-LEZ-S** - user manual for **TEZ** and **LEZ** with **SP, SF, SL**

### 18.1 External reference and transducer parameters

Allow to configure the controller reference and transducer inputs, analog or digital, to match the specific application requirements:

- *Scaling parameters* define the correspondence of these signals with the specific actuator stroke or force to be controlled
- *Limit parameters* define maximum/minimum stroke and force to detect possible alarm conditions
- *Homing parameters* define the startup procedure to initialize incremental transducer (e.g. Encoder)

### 18.2 PID control dynamics parameters

Allow to optimize and adapt the controller closed loop to the wide range of hydraulic system characteristics:

- *PID parameters* each part of the closed loop algorithm (proportional, integral, derivative, feed forward, fine positioning, etc) can be modified to match the application requirements

### 18.3 Monitoring parameters

Allow to configure the controller monitoring function of the positioning error (difference between actual reference and feedback) and detects anomalous conditions:

- *Monitoring parameters* maximum allowed errors can be set for both static and dynamic positioning phases, and dedicated waiting times can be set to delay the activation of the alarm condition and relevant reaction (see 18.4)

### 18.4 Fault parameters

Allow to configure how the controller detect and react to alarm conditions:

- *Diagnostics parameters* define different conditions, threshold and delay time to detect alarm conditions
- *Reaction parameters* define different actions to be performed in case of alarm presence (stop at actual or preprogrammed position, emergency forward/backward, controller disabling, etc.)

### 18.5 Valve characteristics compensation

Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

- *Valve parameters* modify the standard valve regulation by means of deadband compensation, curve linearization and differentiated gain for positive and negative regulation

### 18.6 Motion phases parameters

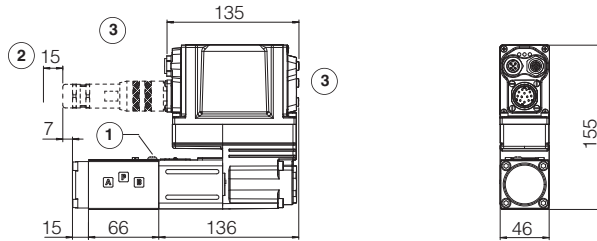
When the internal reference generation is active a pre-programmed cycle can be generated; start/stop/switch-over commands and reference generation types parameters can be set to design a customized sequence of motion phases adapted to the specific application requirements (see 2.2).

## 19 FASTENING BOLTS AND SEALS

Type	Size	Fastening bolts	Seals
<b>DLHZO</b>	<b>06</b>	4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	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)
<b>DLKZOR</b>	<b>10</b>	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	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)
<b>DHZO</b>	<b>06</b>	4 socket head screws M5x50 class 12.9 Tightening torque = 8 Nm	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)
<b>DKZOR</b>	<b>10</b>	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	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)
<b>DPZO</b>	<b>1 = 10</b>	4 socket head screws M6x40 class 12.9 Tightening torque = 15 Nm	5 OR 2050; Diameter of ports A, B, P, T: Ø 11 mm (max) 2 OR 108 Diameter of ports X, Y: Ø = 5 mm (max)
	<b>2 = 16</b>	4 socket head screws M10x50 class 12.9 Tightening torque = 70 Nm 2 socket head screws M6x45 class 12.9 Tightening torque = 15 Nm	4 OR 130; Diameter of ports A, B, P, T: Ø 20 mm (max) 3 OR 109/70 Diameter of ports X, Y: Ø = 7 mm (max)
	<b>4 = 25</b>	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 4112; Diameter of ports A, B, P, T: Ø 24 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	<b>4M = 27</b>	6 socket head screws M12x60 class 12.9 Tightening torque = 125 Nm	4 OR 41301; Diameter of ports A, B, P, T: Ø 32 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	<b>6 = 32</b>	6 socket head screws M20x90 class 12.9 Tightening torque = 600 Nm	4 OR 144; Diameter of ports A, B, P, T: Ø 34 mm (max) 3 OR 3056 Diameter of ports X, Y: Ø = 7 mm (max)
	<b>8 = 35</b>	6 socket head screws M20x100 class 12.9 Tightening torque = 600 Nm	4 OR 156; Diameter of ports A, B, P, T: Ø 50 mm (max) 2 OR 3056 Diameter of ports X, Y: Ø = 9 mm (max)

**20** INSTALLATION DIMENSIONS FOR DLHZO and DLKZOR [mm]

**DLHZO-TEZ-\***

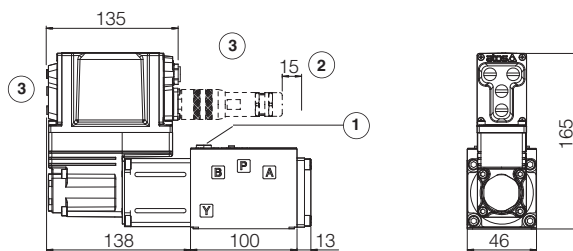


**ISO 4401: 2005**  
**Mounting surface: 4401-03-02-0-05**  
 (see table P005)

Mass [kg]	
DLHZO	2,3

- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

**DLKZOR-TEZ-\***



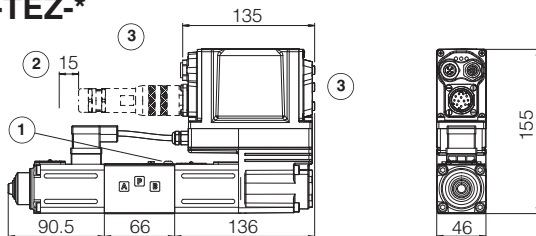
**ISO 4401: 2005**  
**Mounting surface: 4401-05-04-0-05**  
 (see table P005)

Mass [kg]	
DLKZOR	4,3

- ① = Air bleeding 4 13
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

**21** INSTALLATION DIMENSIONS FOR DHZO and DKZOR [mm]

**DHZO-TEZ-\***

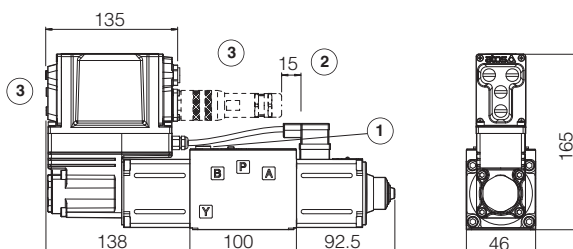


**ISO 4401: 2005**  
**Mounting surface: 4401-03-02-0-05**  
 (see table P005)

Mass [kg]	
DHZO	3,1

- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

**DKZOR-TEZ-\***

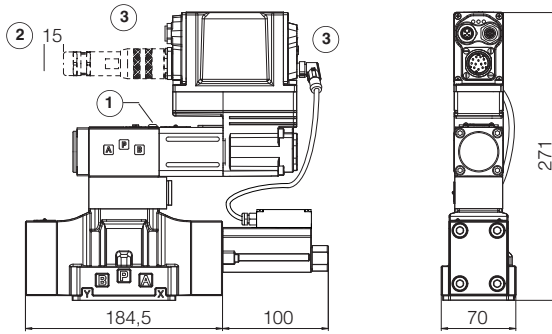


**ISO 4401: 2005**  
**Mounting surface: 4401-05-04-0-05**  
 (see table P005)

Mass [kg]	
DKZOR	5,0

- ① = Air bleeding 4 13
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

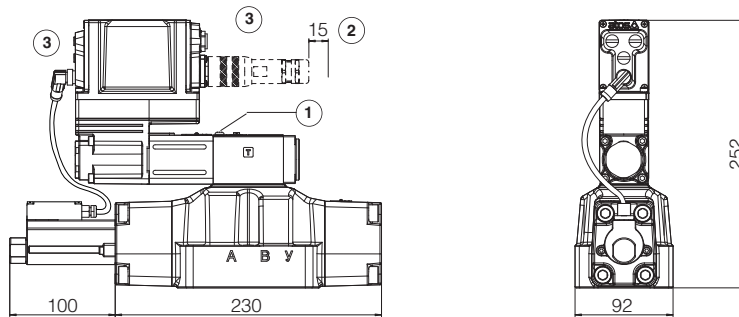
**DPZO-LEZ-1\***



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

Mass [kg]	
DPZO-*-1	9,5

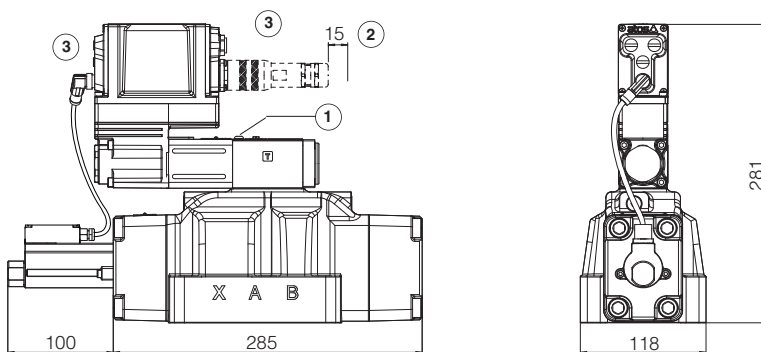
**DPZO-LEZ-2\***



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

Mass [kg]	
DPZO-*-2	14

**DPZO-LEZ-4\***



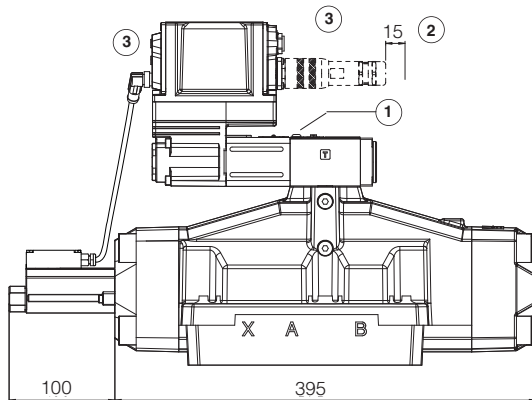
ISO 4401: 2005  
**Mounting surface: 4401-08-08-0-05**  
 (see table P005)

Mass [kg]	
DPZO-*-4	19

Mass: kg 19

- ① = Air bleeding 3
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

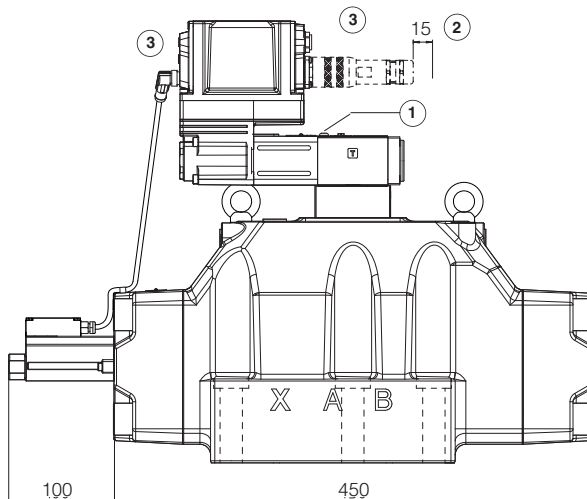
## DPZO-LEZ-6\*



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


Mass [kg]	
DPZO-*-6	43

## DPZO-LEZ-8\*



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

Mass [kg]	
DPZO-*-6	80

- ① = Air bleeding 
- ② = Space to remove the connectors
- ③ = The dimensions of all connectors must be considered, see section 15.6

### 23 RELATED DOCUMENTATION

<b>F002</b>	Basics for digital electrohydraulics	<b>GS005</b>	Digital axis motion controller
<b>F003</b>	Commissioning and troubleshooting	<b>GS500</b>	Programming tools
<b>FS168</b>	Servoproportional directional valves	<b>GS510</b>	Fieldbus
<b>FS178</b>	Two stage servoproportional directional valves	<b>K500</b>	Electric and electronic connectors
<b>FS180</b>	Servoproportional directional valves in sleeve execution	<b>P005</b>	Mounting surfaces for electrohydraulic valves
<b>FY100</b>	Safety proportional valves - option /U	<b>QF300</b>	Quickstart for TES valves commissioning
<b>FY200</b>	Safety proportional valves - option /K	<b>QF320</b>	Quickstart for LES valves commissioning
<b>GS001</b>	Basics for digital proportionals		
<b>GS002</b>	Basics for digital proportionals with P/Q control		
<b>GS003</b>	Settings for digital proportionals		