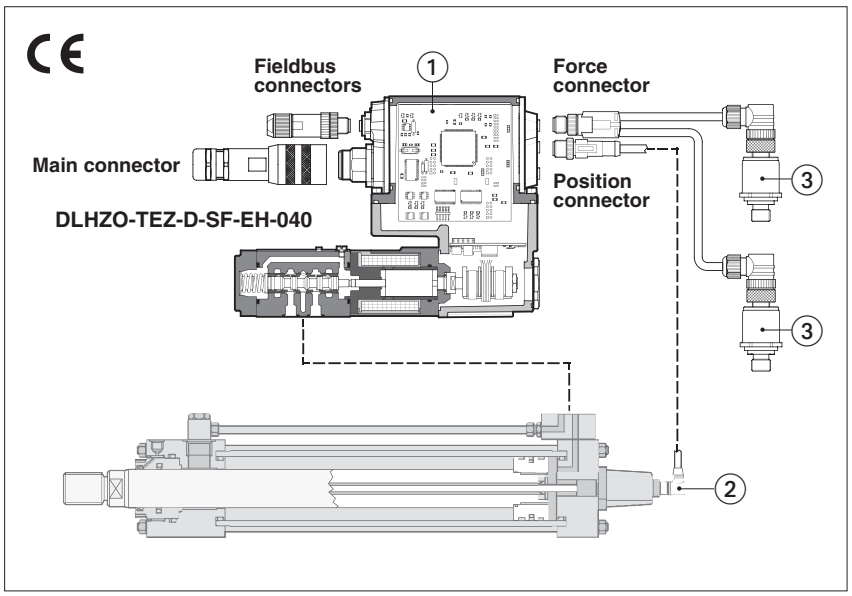
Digital servoproportionals with integral axis controller

direct and pilot operated directional valves with position transducer - zero overlap spool



Digital servoproportionals direct or pilot operated include valve's driver + axis controller ① 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 ② (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).
S option adds alternated pressure/force control to the basic position one (see 3); 1 or 2 pressure/force transducers ③ and a second pressure/force reference signal are required.
Atos PC software allows to customize the controller configuration to the specific application requirements.
Atos also supplies complete servoactuators integrating servocylinder, digital servoproportional valve and axis controller, fully assembled and tested.

1 MODEL CODE

DLHZO	-	T	EZ	-	D	-	SF	-	EH	-	0	4	0	-	L5	1	/	*
DHZO	-	T	EZ	-	D	-	SF	-	EH	-	0	7	0	-	L5		/	*
DPZO	-	L	EZ	-	D	-	SF	-	EH	-	1	6	0	-	L5		/	*

Hydraulic options see tech table **FS180**
Electronic options, see section 7

Fail safe type, only for configuration 4**:**
1 = A, B, P, T with positive overlapping (20% of spool stroke)
3 = P positive (20% of spool stroke); A, B, T negative overlapping

Spool type:
L0, L1, L3, L5, L7 = linear (**L0, L1, L5,** only for valve size 06)
D7 = differential-linear (as **L**, but with P-A = Q, P-B = Q/2)
DT7 = as **D**, but with non linear regulation
T5, T7 = not linear regulation (**T5** only for valve size 10)

Spool overlapping in central position: 0 = **zero**

Configuration: 4 = with fail safe **6** = without fail safe

Valve size, ISO 4401**: 0** = 06 **1** = 10

Hydraulic options see tech table **FS168**
Electronic options, see section 7

Spool type:
L3, L5 = linear
D5 = differential-linear (as **L**, but with P-A = Q, P-B = Q/2)

Spool overlapping in central position: 0 = **zero**

Configuration: 7 = 3 position, spring centered

Valve size, ISO 4401**: 0** = 06 **1** = 10

Hydraulic options see tech table **FS178**
Electronic options, see section 7

Spool type:
L5 = linear
DL5 = differential-linear (as **L**, but with P-A = Q, P-B = Q/2)
T5 = not linear regulation (only for valve size 16)

Spool overlapping in central position: 0 = **zero**

Configuration: 6 = spring offset (only for spool L) **7** = 3 position, spring centered

Valve size, ISO 4401**: 1** = 10 **2** = 16 **4** = 25 **4M** = 27 **6** = 32 **8** = 35

Direct operated servoproportional sleeve execution:
DLHZO = size 06
DLKZOR = size 10

Direct operated servoproportional:
DHZO = size 06
DKZOR = size 10

Pilot operated servoproportional:
DPZO

T = closed loop 1 LVDT transducer

L = closed loop 2 LVDT transducers

EZ = integral digital driver + axis controller

Position transducer type:
A = Analog (standard, potentiometer)
D = Digital (SSI, Encoder)

Alternated P/Q control, see section 3 **:**
SN = none
SP = pressure control (1 pressure transducer)
SF = force control (2 pressure transducers)
SL = force control (load cell)

Fieldbus interface, USB port always present:
NP = Not Present **BP** = PROFIBUS DP
BC = CANopen **EH** = EtherCAT

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 BC, BP or EH fieldbus communication details, please refer to the controller user manual.

2.2 Internal reference generation

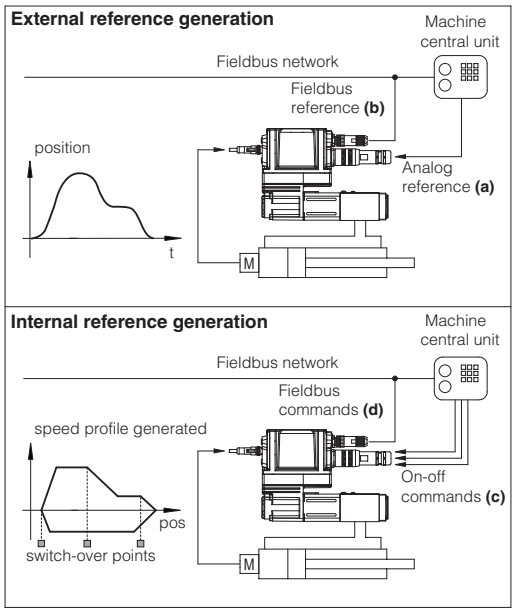
Axis controller regulates in closed loop the actuator position according to an internally generated reference position signal and to the position feedback from the actuator transducer.

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

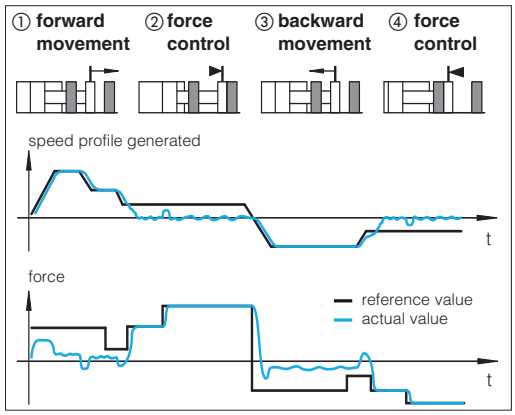
S option allows to add the alternated force closed loop control to the actuator's standard position control, requiring one or two remote transducers (pressure or force) that have to be installed on the actuator, see below functional schemes.

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.

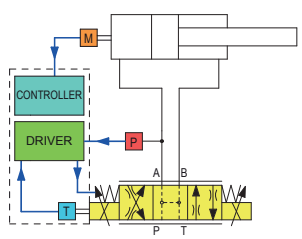
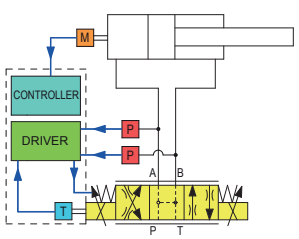
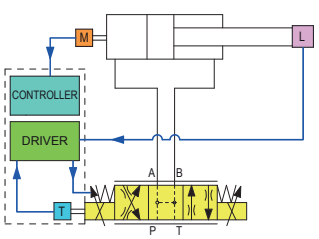
The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability and vibrations.

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

T valve's spool transducer	M actuator's position transducer	P pressure transducer	L 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.

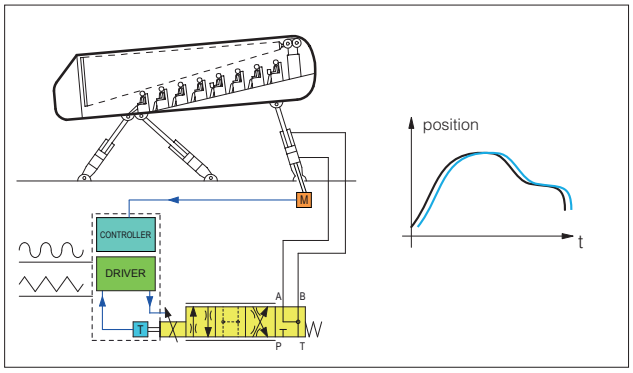
SL – position/force control

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 **E115**
- for additional information about alternated P/Q controls configuration please refer to tech table **GS212**
- Atos technical service is available for additional evaluations related to specific applications usage

4 APPLICATION EXAMPLES



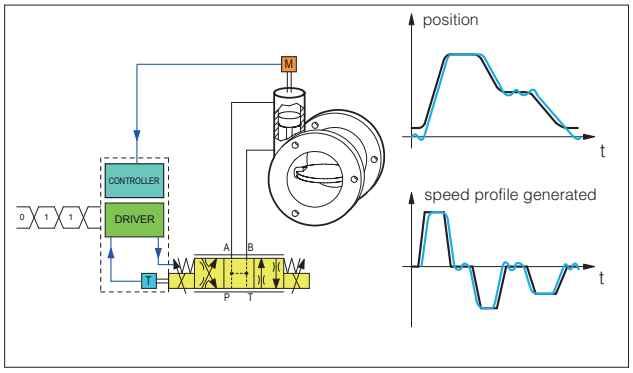
Multiaxis simulators

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



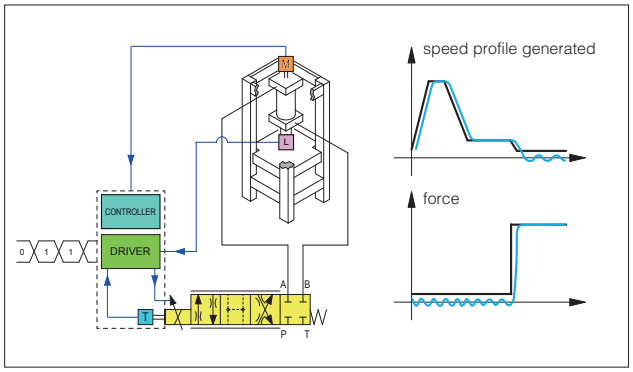
Process valves

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



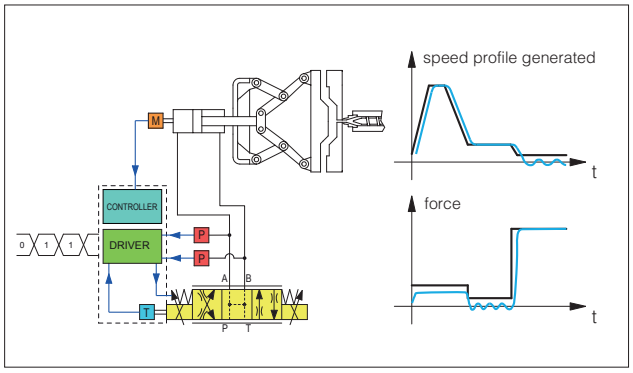
Hydraulic presses

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:

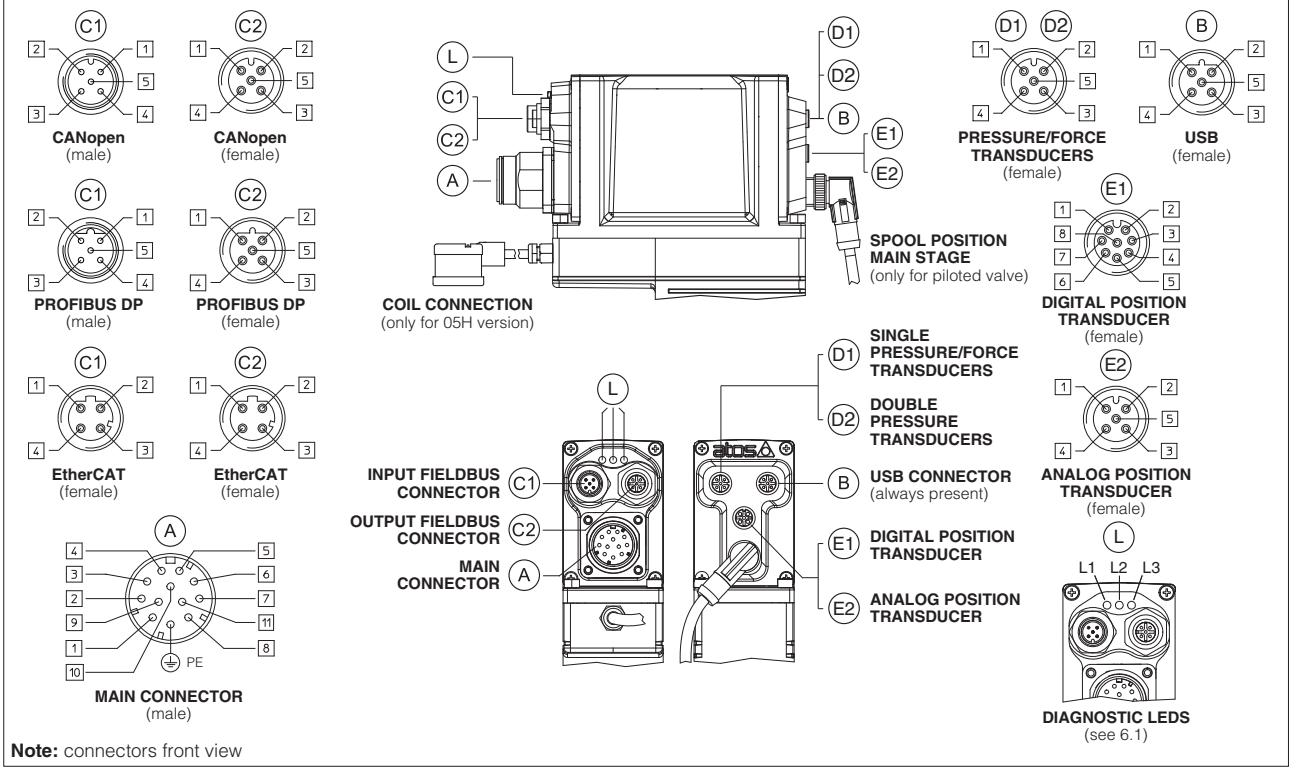
- internal reference generation for standing alone axis control
- SSI digital position transducer for high performance solution
- two pressure transducers for alternated force control
- fieldbus connection for machine remote control and advanced diagnostics

5 MAIN CHARACTERISTICS

Power supplies (see 7.1, 7.6)	Nominal : +24 VDC Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP)			
Max power consumption	50 W			
Reference input signals (see 7.2, 7.3)	Voltage: range ±10 VDC (24 VMAX tollerant) Input impedance: Ri > 50 kΩ Current: range ±20 mA Input impedance: Ri = 500 Ω			
Monitor outputs (see 7.4, 7.5)	Output range: voltage ±10 VDC @ max 5 mA current ±20 mA @ max 500 Ω load resistance			
Enable input (see 7.8)	Range: 0 ÷ 5 VDC (OFF state), 9 ÷ 24 VDC (ON state), 5 ÷ 9 VDC (not accepted); Input impedance: Ri > 10 kΩ			
Fault output (see 7.7)	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)			
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions			
Position transducers power supply	+24 VDC @ max 100 mA and +5 VDC@ max 100 mA are software selectable; ±10 VDC @ max 14 mA minimum load resistance 700 Ω			
Pressure/Force transducers power supply	+24 VDC @ max 100 mA			
Format	Sealed box on the valve; IP66 / IP67 protection degree			
Tropicalization	Tropical coating on electronic PCB			
Operating temperature	-40 ÷ +60 °C (storage -40 ÷ +70 °C)			
Mass	Approx. 510 g			
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 2004/108/CE (Immunity: EN 61000-2; Emission: EN 61000-3)			
Communication interface	USB Atos ASCII coding	CANopen EN50325-4 + DS408	PROFIBUS DP EN50170-2/IEC61158	EtherCAT IEC 61158
Communication physical layer	not insulated USB 2.0 + USB OTG	optical insulated CAN ISO11898	optical insulated RS485	Fast Ethernet, insulated 100 Base TX
Recommended wiring cable (see 13)	LiYCY shielded cables			

Note: a minimum time of 300 to 500 ms 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

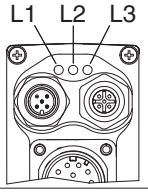
6 CONNECTIONS AND LEDS



Note: connectors front view

6.1 Diagnostic LEDs (L)

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

FIELDBUS / LEDS	NP Not Present	BC CANopen	BP PROFIBUS DP	EH EtherCAT	L1 L2 L3
L1	VALVE STATUS			LINK/ACT	
L2	NETWORK STATUS			NETWORK STATUS	
L3	SOLENOID STATUS			LINK/ACT	

6.2 Main connector - 12 pin (A) - see 13.1

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES
1	**V+**	Power supply 24 VDC (see 71)	Input - power supply
2	**V0**	Power supply 0 VDC (see 7.1)	Gnd - power supply
3	**ENABLE**	Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.8)	Input - on/off signal
4	**P_INPUT+**	Position reference input signal: ±10 VDC / ±20 mA maximum range (see 7.2)	Input - analog signal **Software selectable**
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 (see 7.4)	Output - analog signal **Software selectable**
7	**F_INPUT+**	Pressure/Force reference input signal (SP, SF, SL controls): ±10 VDC / ±20 mA maximum range (see 7.3)	Input - analog signal **Software selectable**
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 (see 7.5)	Output - analog signal **Software selectable**
9	**VL+**	Power supply 24 VDC for controller's logic and communication (see 7.6)	Input - power supply
10	**VL0** (1)	Power supply 0 VDC for controller's logic and communication (see 7.6)	Gnd - power supply
11	**FAULT**	Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.7)	Output - on/off signal
PE	**EARTH**	Internally connected to controller housing	

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

6.3 Communication connectors (B) - (C) - see 13.2

(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 fieldbus execution, connector - M12 - 5 pin**		
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION** (1)
1	**TX+**	Transmitter
2	**RX+**	Receiver
3	**TX-**	Transmitter
4	**RX-**	Receiver
Housing	**SHIELD**	

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

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

6.4 Remote pressure/force transducer connector - M12 - 5 pin (D) - see 13.3

PIN	SIGNAL	TECHNICAL SPECIFICATION	(D1) **SP, SL - Single transducer** (1)		(D2) **SF - Double transducers** (1)	
			Voltage	**Current**	**Voltage**	**Current**
1	**VF +24V**	Power supply +24VDC	Connect	Connect	Connect	Connect
2	**TR1**	1st signal transducer: ±10 VDC / ±20 mA maximum range, software selectable	Connect	Connect	Connect	Connect
3	**AGND**	Common GND for transducer power and signals	Connect	/	Connect	/
4	**TR2**	2nd signal transducer: ±10 VDC / ±20 mA maximum range, software selectable	/	/	Connect	Connect
5	**NC**	Not connect	/	/	/	/

Note: (1) single/double transducer configuration is software selectable - see 7.10

6.5 D execution - Digital position transducers connector - M12 - 8 pin (E1) - see 13.4

SSI - default transducer (1)			**Encoder** (1)	
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	**CLOCK+**	Serial syncronous clock (+)	**R**	Input channel R
2	**CLOCK-**	Serial syncronous 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**	Do not connect	**B**	Input channel B
6	**NC**	Do not connect	**/B**	Input channel /B
7	**VP**	Power supply, software selectable between: +24VDC , +5VDC or OFF (default OFF)	**VP**	Power supply, software selectable between: +24VDC , +5VDC or OFF (default OFF)
8	**0 V**	Common GND for transducer power and signals	**0 V**	Common GND for transducer power and signals

Note: (1) digital position transducer type is software selectable: Encoder or SSI - see 7.9

6.6 A execution - Analog position transducers connector - M12 - 5 pin (E2) - see 13.4

PIN	SIGNAL	TECHNICAL SPECIFICATION	Potentiometer	Analog
1	**VP +24V**	Power supply, software selectable between: +24VDC or OFF (default OFF)	/	Connect
2	**VP +10V**	Power supply reference +10VDC (always present)	Connect	/
3	**AGND**	Common GND for transducer power and signals	Connect	Connect
4	**TR**	Signal transducer	Connect	Connect
5	**VP -10V**	Power supply reference -10VDC (always present)	Connect	/

Note: analog input range is software selectable - see 7.9

7 SIGNAL SPECIFICATIONS

Atos digital controllers are CE marked according to the applicable directives (e.g. Immunity/Emission EMC Directive).
Installation, wirings and start-up procedures must be performed according to the prescriptions shown in tech table **F003** and in the user manuals included in the Z-SW programming software.
The electrical signals of the controller (e.g. monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards.

7.1 Power supply (V+ and V0)

The power supply to the solenoids 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 controller power supply: 2,5 A fuse.

7.2 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin 4), depends on controllers' 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 ±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.

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

7.3 Pressure or force reference input signal (F_INPUT+)

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 ±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.

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

7.4 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 ±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.

7.5 Pressure or force monitor output signal (F_MONITOR)

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/forcel 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 ±10 VDC or ±20 mA.
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.

7.6 Power supply for controller's logic and communication (VL+ and VL0)

The power supply to the solenoids 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.
Separate power supply (pin 9,10) allow to cut solenoid power supply (pin 1,2) while maintaining active diagnostics, USB and fieldbus communication.
A safety fuse is required in series to each controller power supply: 500 mA fast fuse.

7.7 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 status of the Enable input signal.
Fault output signal can be used as digital output by software selection.

7.8 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)
- disable the valve functioning (current output stage is switched off and the valve goes in fail safe/central position)

7.9 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 ±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 position transducer characteristics to select the transducer type according to specific application requirements (see 9.1).

7.10 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 ±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 9.2).

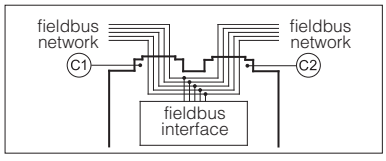
7.11 Possible combined electronic options:

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

8 IN / OUT FIELDBUS COMMUNICATION CONNECTOR

Two fieldbus communication connectors are always available for digital drivers executions BC, BP and EH.
This features allows considerable technical advantages in terms of installation simplicity, wirings reduction and also avoid the usage expensive T-connectors.
For BC and BP executions the fieldbus connectors have an internal pass-through connection (see 8.1) and can be used like end point of the fieldbus network, using an external terminator (see tech table **GS500**).
For EH execution the external terminators are not required: each connector is internally terminated.

8.1 - BC and BP pass-through connection



9 ACTUATOR'S TRANSDUCER CHARACTERISTICS

9.1 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.

9.2 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 **G465** 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.

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

	Position				**Pressure/Force**
Execution	**A**		**D**		**SP, SF, SL**
Input type	Potentiometer	Analog	SSI	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

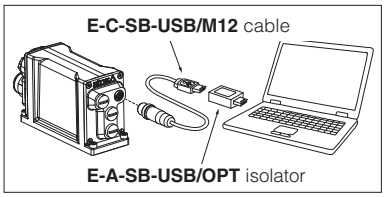
Notes: **(1)** power supply provided by digital controller - see 6.5 and 6.6 **(2)** percentage of total stroke

10 PROGRAMMING TOOLS - see tech table **GS500**

Valve's functional parameters and configurations, can be easily set and optimized using Atos Z-SW programming software connected via USB communication port to the digital controller (see 10.1). Z-SW software is available in different versions according to the controllers's fieldbus interface: NP (Not Present) Z-SW-PS, BC (CANopen) Z-SW-BC, BP (PROFIBUS DP) Z-SW-BP and EH (EtherCAT) Z-SW-EH.
For fieldbus versions, Z-SW software permits valve's parameterization through USB communication port also if the controller is connected to the central machine unit via fieldbus.

WARNING: controllers USB port is not isolated!
Use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection.

10.1 - USB connection



Full programming software, to be ordered separately :

Z-SW-* DVD first supply = software has to be activated via web registration at www.download.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access personal Atos Download Area.
The software remains active for 10 days from the installation date and then it stops until the user inputs the Activation Code.

Z-SW-*-N DVD next supplies = only for supplies after the first; service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply web registration

Atos Download Area: direct access to latest releases of Z-SW software, manuals, USB drivers and fieldbus configuration files at www.download.atos.com

USB Adapters, Cables and Terminators, can be ordered separately

11 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-* DVD 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**

11.1 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)

11.2 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

11.3 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 11.4)

11.4 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.)

11.5 Valve characteristics compensation

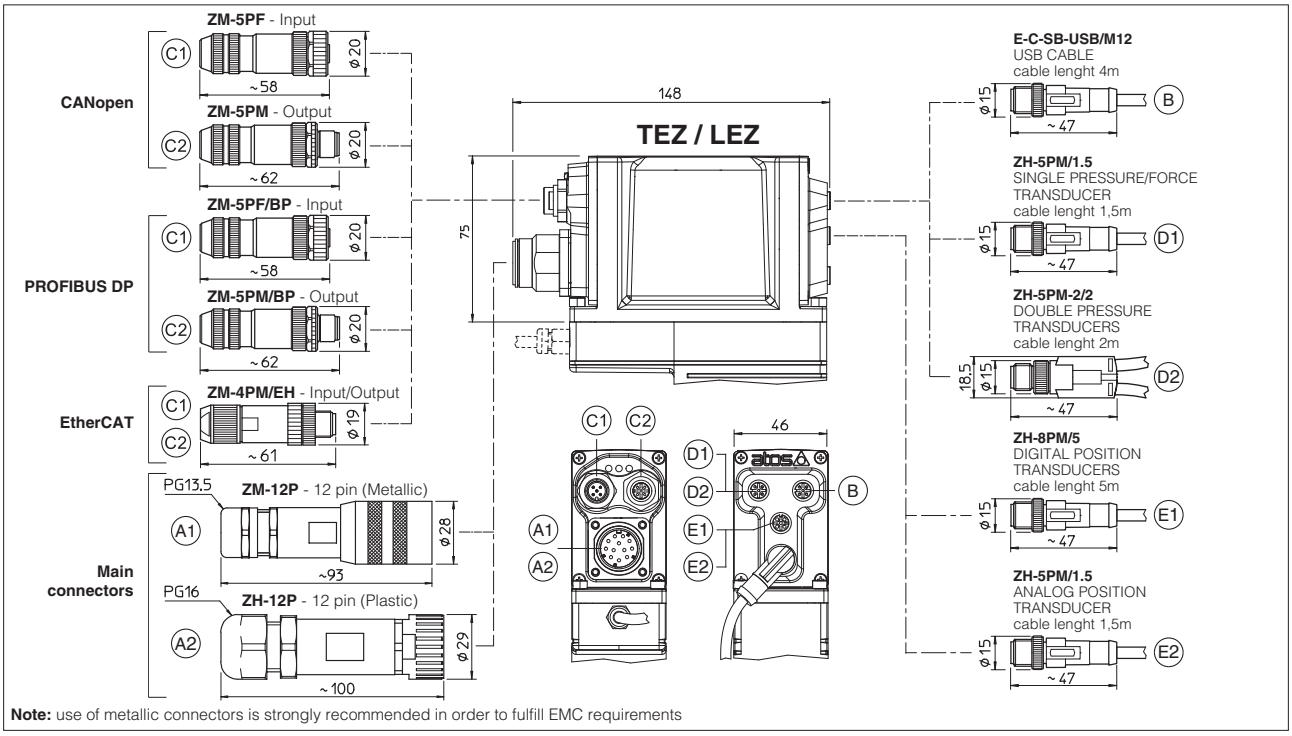
Allow to modify the valve regulation to match the actuator/system characteristics and to obtain the best overall performances:

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

11.6 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).

12 OVERALL DIMENSIONS [mm]



Note: use of metallic connectors is strongly recommended in order to fulfill EMC requirements

13 CONNECTORS CHARACTERISTICS - to be ordered separately

13.1 Main connectors

CONNECTOR TYPE	POWER SUPPLY	POWER SUPPLY
CODE	(A1) ZM-12P	(A2) ZH-12P
Type	12pin female straight circular	12pin female straight circular
Standard	DIN 43651	DIN 43651
Material	Metallic	Plastic reinforced with fiber glass
Cable gland	PG13,5	PG16
Recommended cable	LiYCY 12 x 0,75 mm² max 20 m (logic and power supply)	LiYCY 10 x 0,14mm² max 40 m (logic) LiYY 3 x 1mm² max 40 m (power supply)
Conductor size	0,5 mm² to 1,5 mm² - available for 12 wires	0,14 mm² to 0,5 mm² - available for 9 wires 0,5 mm² to 1,5 mm² - available for 3 wires
Connection type	to crimp	to crimp
Protection (EN 60529)	IP 67	IP 67

13.2 Fieldbus communication connectors

CONNECTOR TYPE	BC CANopen (1)		BP PROFIBUS DP (1)		EH EtherCAT (2)
CODE	(C1) ZM-5PF	(C2) ZM-5PM	(C1) ZM-5PF/BP	(C2) ZM-5PM/BP	(C1) (C2) ZM-4PM/EH
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 60947-5-2		M12 coding B – IEC 60947-5-2		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)	IP 67		IP 67		IP 67

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

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

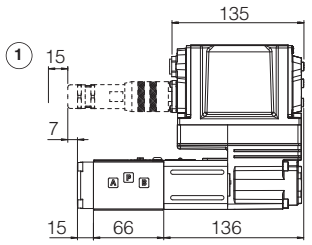
CONNECTOR TYPE	SP, SL - Single transducer	SF - Double transducers
CODE	(D1) ZH-5PM/1.5	(D2) ZH-5PM-2/2
Type	5 pin male straight circular	4 pin male straight circular
Standard	M12 coding A – IEC 60947-5-2	M12 coding A – IEC 60947-5-2
Material	Plastic	Plastic
Cable gland	Connector moulded on cables 1,5 m lenght	Connector moulded on cables 2 m lenght
Cable	3 x 0,25 mm²	3 x 0,25 mm² (both cables)
Connection type	molded cable	splitting cable
Protection (EN 60529)	IP 67	IP 67

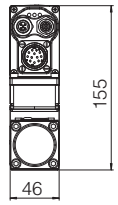
13.4 Position transducer connectors

CONNECTOR TYPE	DIGITAL POSITION TRANSDUCER D execution - see 6.5	ANALOG POSITION TRANSDUCER A execution - see 6.6
CODE	(E1) ZH-8PM/5	(E2) ZH-5PM/1.5
Type	8 pin male straight circular	5 pin male straight circular
Standard	M12 coding A – IEC 60947-5-2	M12 coding A – IEC 60947-5-2
Material	Plastic	Plastic
Cable gland	Connector moulded on cables 5 m lenght	Connector moulded on cables 1,5 m lenght
Cable	8 x 0,25 mm²	4 x 0,25 mm²
Connection type	molded cable	molded cable
Protection (EN 60529)	IP 67	IP 67

14 **INSTALLATION DIMENSIONS DLHZO and DLKZOR [mm]**

DLHZO-TEZ-*

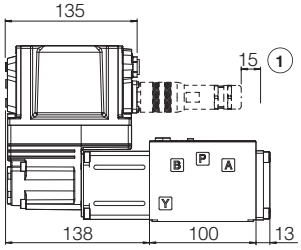


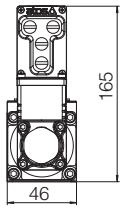


Mass: 2,3 kg

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)

DLKZOR-TEZ-*





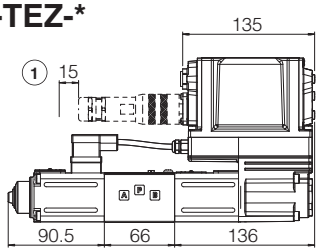
Mass: 4,3 kg

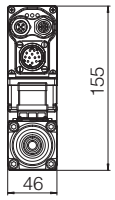
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
(see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)

(1) = Space to remove main connector. For main and communication connectors see section 12, 13

15 **INSTALLATION DIMENSIONS DHZO and DKZOR [mm]**

DHZO-TEZ-*

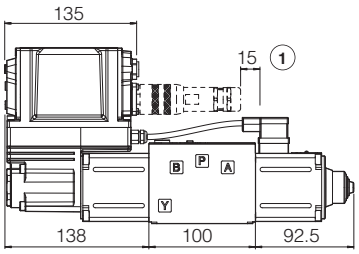


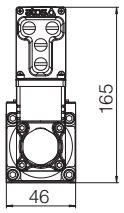


Mass: 3,1 kg

ISO 4401: 2005
Mounting surface: 4401-03-02-0-05
(see table P005)
Fastening bolts:
4 socket head screws M5x50 class 12.9
Tightening torque = 8 Nm
Seals: 4 OR 108; 1 OR 2025
Diameter of ports A, B, P, T: Ø 7,5 mm (max)

DKZOR-TEZ-*





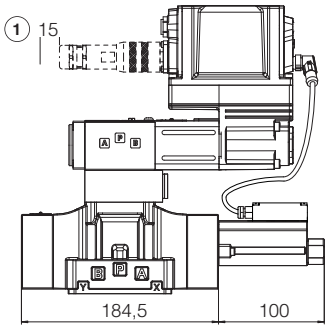
Mass: 5 kg

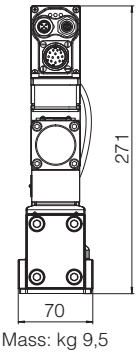
ISO 4401: 2005
Mounting surface: 4401-05-04-0-05
(see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 1 OR 108
Diameter of ports A, B, P, T: Ø 11,2 mm (max)

(1) = Space to remove main connector. For main and communication connectors see section 12, 13

16 **INSTALLATION DIMENSIONS DPZO [mm]**

DPZO-LEZ-1*



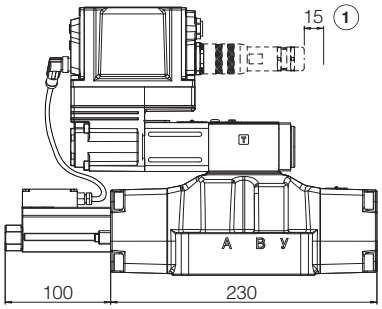


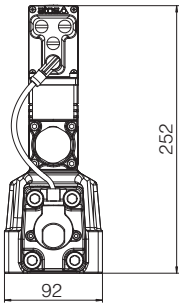
Mass: kg 9,5

ISO 4401: 2005
Mounting surface: 4401-05-05-0-05
(see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050, 2 OR 108
Diameter of ports A,B, P, T: Ø = 11 mm
Diameter of ports X, Y: Ø = 5 mm

(1) = Space to remove main connector. For main and communication connectors see section 12, 13

DPZO-LEZ-2*

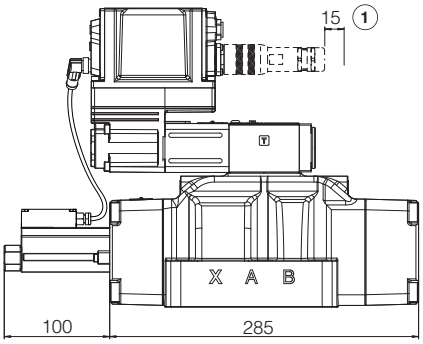


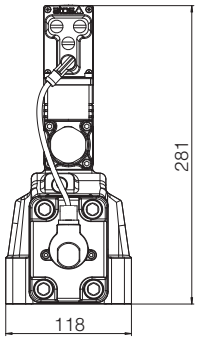


Mass: kg 14

ISO 4401: 2005
Mounting surface: 4401-07-07-0-05
(see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x45 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130, 2 OR 2043
Diameter of ports A, B, P, T: Ø = 20 mm
Diameter of ports X, Y: Ø = 7 mm

DPZO-LEZ-4*



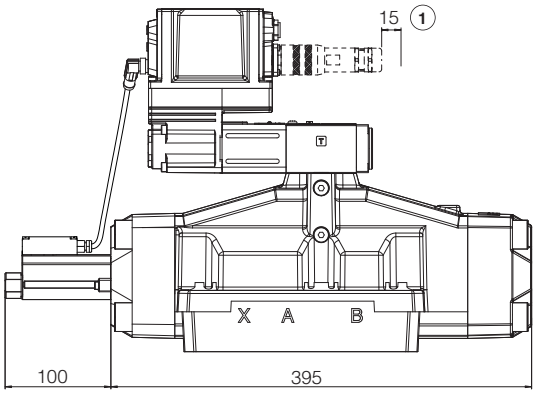


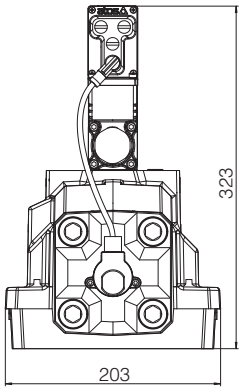
Mass: kg 19

ISO 4401: 2005
Mounting surface: 4401-08-08-0-05
(see table P005)
Fastening bolts:
6 socket head screws M12x60 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm
Diameter of ports X, Y, L: Ø = 7 mm

DPZO-4M
Seals: 4 OR 4131; 2 OR 3056
Diameter of ports A, B, P, T: Ø = 32 mm
Diameter of ports X, Y: Ø = 7 mm
Detail of A, B, P, T ports

DPZO-LEZ-6*

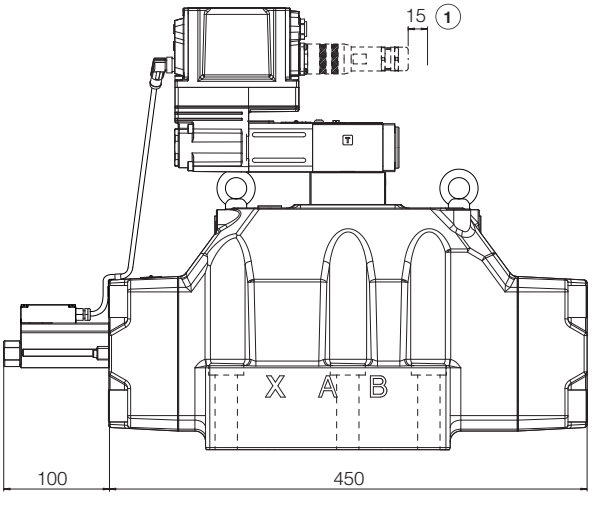


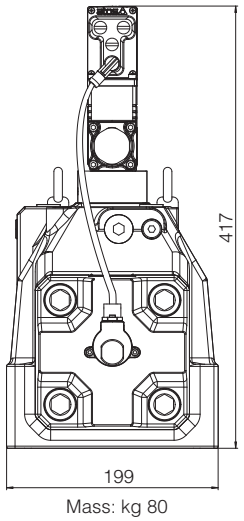


Mass: kg 43

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(see table P005)
Fastening bolts:
6 socket head screws M20x90 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 34 mm
Diameter of ports X, Y: Ø = 7 mm
Seals: 4 OR 144, 2 OR 3056

DPZO-LEZ-8*





Mass: kg 80

ISO 4401: 2005
Mounting surface: 4401-10-09-0-05
(see table P005)
Fastening bolts:
6 socket head screws M20x100 class 12.9
Tightening torque = 600 Nm
Diameter of ports A, B, P, T: Ø = 50 mm
Diameter of ports X, Y: Ø = 9 mm
Seals: 4 OR 156, 2 OR 3056

(1) = Space to remove main connector. For main and communication connectors see section 12, 13