Digital position controllers type **Z-RI-TEZ, Z-RI-LEZ**
integral-to-valve format for directional proportionals with position transducer

DLHZO-TEZ-MSF-PS-040

Position control	
Alternated control	**P/Q**
Real-time Fieldbus Reference	
Enhanced Diagnostic	

Z-SW programming software

Z-RI integral digital controllers ① perform the basic driver functions for proportional valves plus the position closed loop control of the linear or rotary actuator to which the proportional valve is connected.

Z-RI-TEZ execution operates direct and pilot operated directional valves with one integral spool position transducer ②.

Z-RI-LEZ execution operates directional pilot operated valves with two integral spool position transducers.

The controlled actuator has to be equipped with integral or external transducer ③ (analog, encoder or SSI) to feedback its position to the controller for closed loop functions.

The controller is operated in real time by external or internally generated reference position signal (see section **3**).

With external reference the actuator's motion cycle is managed by analog input signal or by fieldbus.

With internally generated reference the actuator's motion cycle is managed by external on/off commands or by fieldbus.

Options /SP /SF /SL allow to add an alternated pressure/force control to the basic position control functions (see section **4**).

Remote pressure/force transducers ④ have to be assembled on the actuator and connected to the controller: an additional reference pressure/force signal is required.

On request, Atos supply complete servoactuators assembled & tested, thus ready to use after hydraulic piping to the hydraulic source and wiring to the electronic system.

They are smart machine units integrating servocylinder, proportional valve plus digital controller and optional pressure/force transducers.

Electrical features:
- IP67 protection degree
- CE mark to EMC directive

Software features:
- Internal generation of motion profile sequence
- Setting of axis's dynamic response (PID) to optimize the application performances
- Enhanced diagnostics of the axis status
- Intuitive graphic interface

1   MODEL CODE

Z - RI - TEZ - M SF - PS - 01H /* ** / *

Integral electronic position controller

for proportional directional valves with
TEZ = one spool position transducer
LEZ = two spool position transducers

Position tranducer type:
P = potentiometer
F = analog
M = SSI
E = Encoder

Alternate pressure/force control:
SN = none
SP = closed loop pressure control with 1 remote pressure transducer
SF = closed loop force control with 2 remote pressure transducers
SL = closed loop force control with 1 remote load cell

Set code (see note)

Series number

Options:
- **-** = standard with voltage reference and feedback signals
- **C** = current feedback input for transducer signal(s)
- **I** = current reference input and monitor (4÷20 mA) output signals

01H = for proportional single solenoid valve
05H = for proportional double solenoid valves

PS = Serial communication interface
BC = CANopen communication interface
BP = PROFIBUS DP communication interface

Note: the set code identifies the correspondence between the digital integral controller and the relevant valve; it is assigned by Atos when the driver is ordered as a spare part.

2   VALVE CODE EXAMPLE

DLHZO - TEZ - M SF - PS - 0 4 0 - L 7 3 /* / /***

Proportional Valve [1]
DHZO, DKZOR - see F165
DLHZO, DLKZOR - see F180
DPZO - see F175

for proportional directional valves with
TEZ = one spool position transducer
LEZ = two spool position transducers

Position tranducer type (P ,F, M, E)

Alternate pressure/force control (SN, SP, SL, SF)

Communication interfaces (PS, BC, BP)

Valve size [1] (0, 1, 2, 3)

Configuration [1] (4, 5, 6, 7)

Spool overlapping in central position [1] (0, 1, 2, 3)

Spool type [1] (L, S, D, T)

Spool size [1] (14, 1, 3, 5, 7)

Fail safe configuration [1] (1, 3)

Valve [1] and **controller options**

Design number

Synthetic fluids (WG, PE)

Note: (1) for the valve code and relevant options, see the specific valve technical table; **bolded indications are referred to specific valve code with integral controller**

3.1 External reference generation

Z-RI 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 of the analog input on the main connector (see 6.1).

Fieldbus reference (b)

The controller receives in real time the reference signal from the machine electronic central unit by means of the digital fieldbus communication (-BC and -BP executions).

For fieldbus communication details, please refer to the controller user manual (see section 10).

3.2 Internal reference generation

Z-RI 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 of:

- on-off commands **(c)**

- fieldbus commands **(d)**

External reference generation

Internal reference generation

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 the available selection of start/stop/switch-over 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
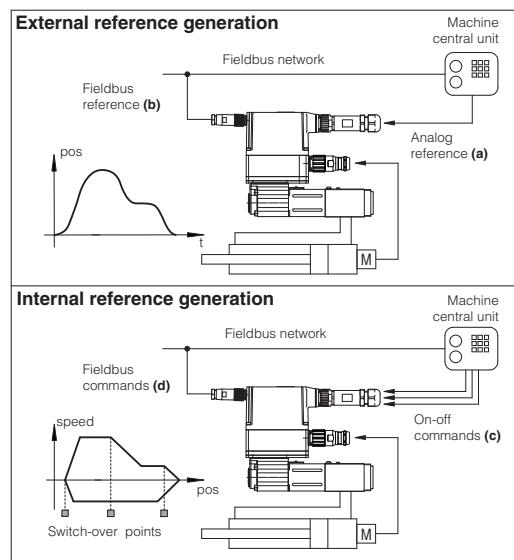
4 POSITION / PRESSURE OR FORCE CONTROL

SP/SF/SL options add an alternated pressure or force control to the actuator's standard position control (see below functional schemes).

Remote transducers (pressure or force) have to be installed on the actuator.

The position/pressure (or 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 pressure or force is lower than the relevant reference signal - the valve controls the actuator position by closed-loop regulation of the valve spool/poppet.

Pressure or force control is active (see phase ② and ④ at side) when the actuator pressure or 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 pressure or force; if the pressure or force tends to decrease under its reference signal, the position control returns active.

① **forward movement** ② **force control** ③ **backward movement** ④ **force control**

speed

force

— reference value
···· actual value

/SP option

Alternated Position/Pressure Control

one remote pressure transducer has to be installed on the actuator's port to be controlled

/SL option

Alternated Position/Force Control

one load cell transducer has to be installed between the actuator and the controlled load

/SF option

Alternated Position/Force Control

two remote pressure transducers have to be installed on the actuator's ports; the actuator force is calculated by the pressure feedbacks (Pa - Pb)

| T | valve's spool transducer | M | actuator's position transducer | P | pressure transducer | L | load cell |

5 APPLICATION EXAMPLES
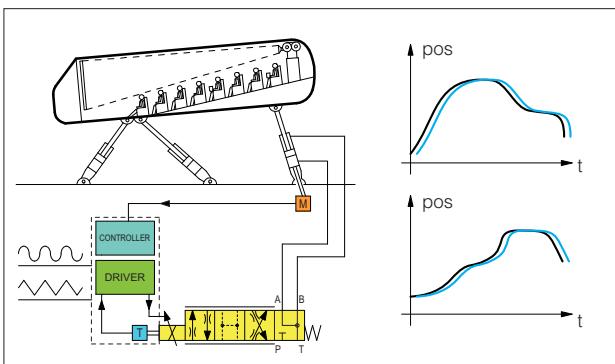
Multiaxis simulators

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-TE high performance servoproportional valves in steel sleeve execution allow to obtain fast, accurate and reliable movements of the system.

Z-RI-TEZ controllers allow 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
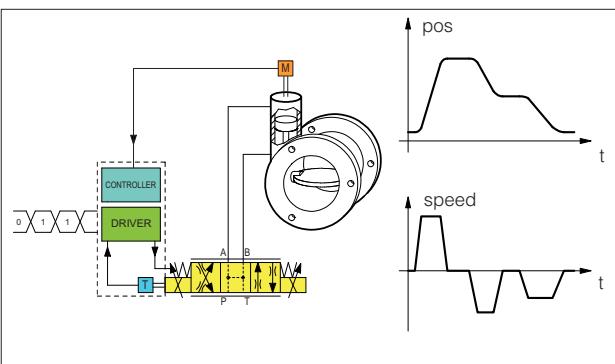
Process valves

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

DHZO-TE proportional valves with spool position transducer allow smooth regulations and accurate movements.

Z-RI-TEZ controllers allow 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

Also available in Ex-proof execution, see tables B400 and F600.
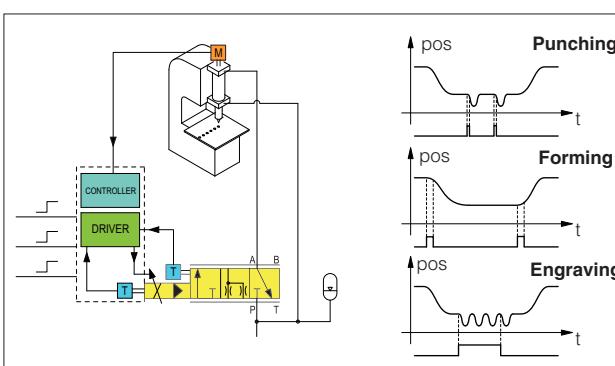
Steel sheet machinery

Steel sheet machinery demand for fast and precise positioning of axis' tool and its synchronization with the electromechanic sheet positioning.

DPZO-LE pilot operated proportional valves with 2 spool position transducers allow high flow-rate and high performance for position control.

Z-RI-LEZ controllers allow to easily adapt the machine working cycle to different working process (e.g. punching, forming or engraving) thanks to:
- internal reference generation to define accurate and precise movements
- SSI digital position transducer for high performance solution
- external digital commands for fast selection of the predefined working cycle
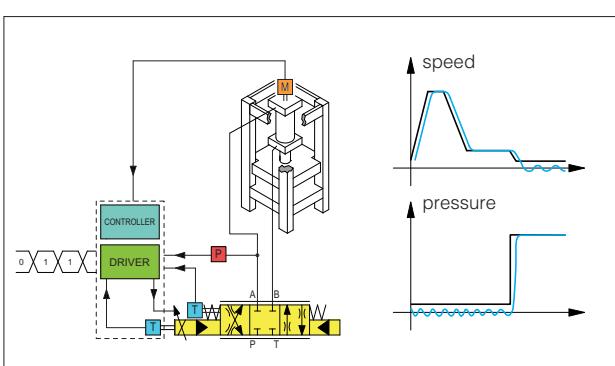
Hydraulic presses

Hydraulic presses perform high structural strength, precise and accurate pressure 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.

DPZO-LE pilot operated proportional valves with 2 spool position transducers allow high flow-rate and alternated pressure controls in a single device.

Z-RI-LEZ controllers with additional pressure control (SP option) perform remote and accurate position/pressure control thanks to:
- fieldbus reference mode for remote control
- encoder position transducer for accurate position control loop
- one pressure transducer for alternated pressure control
- complete diagnostic functionalities for advanced system monitoring
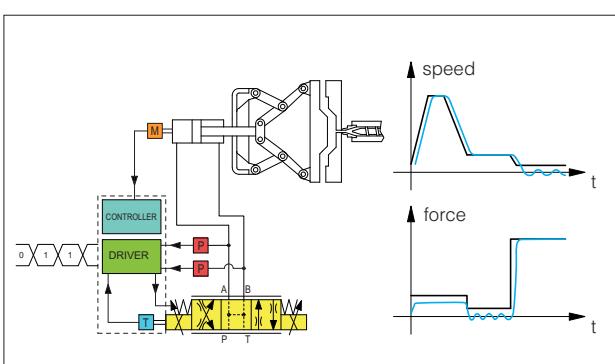
Clamp control on plastic machines

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

DKZOR-TE proportional valves allow to obtain quick and accurate regulations in the different working/control phases of the machine.

Z-RI-TEZ controllers with additional force control (SF option) simplify the hydraulic + electronic system architecture and combine 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

6 ELECTRONIC CONNECTIONS

MAIN CONNECTOR (*) Ⓐ

COIL CONNECTION (only for 05H version)

POSITION TRANSDUCER CONNECTOR (*) Ⓒ

COMMUNICATION CONNECTOR (*) Ⓑ

SPOOL POSITION TRANSDUCER CONNECTOR (only for LEZ version)

PRESSURE / FORCE TRANSDUCER(S) CONNECTOR(*) Ⓓ

Ⓑ1

Ⓑ2

Ⓒ1 **DIGITAL TRANSDUCER (*)**

Ⓒ2 **ANALOG TRANSDUCER (*)**

Ⓓ1 Ⓓ2
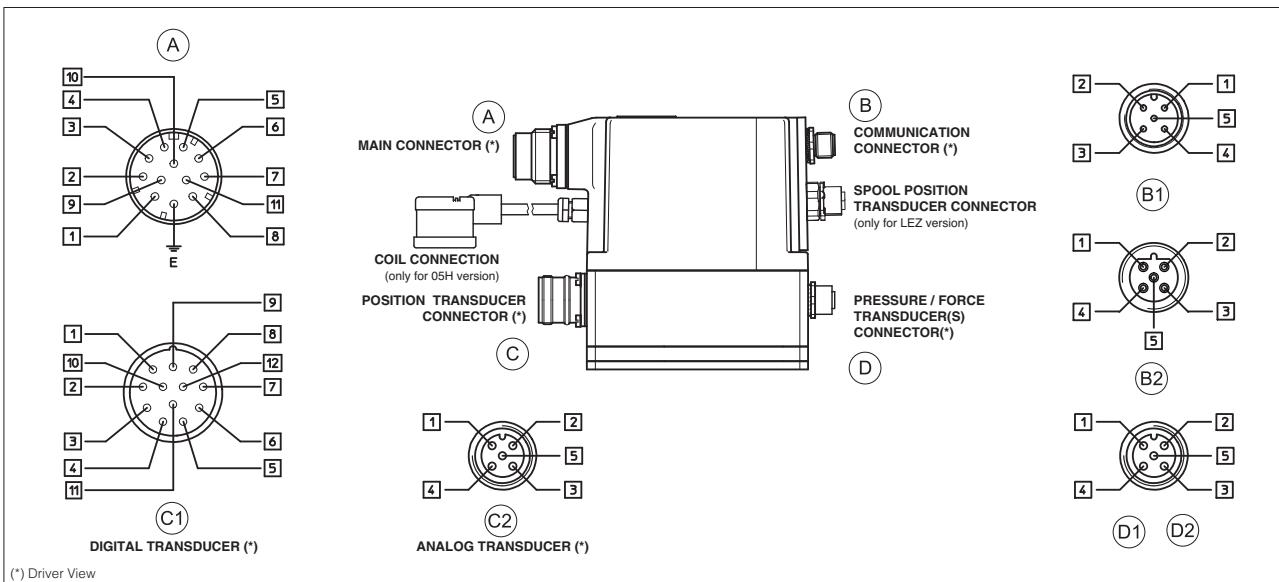
(*) Driver View

6.1 MAIN CONNECTOR - 12 PIN Ⓐ

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	
1	V+	Power supply 24 V_{DC} for solenoid power stage - see 9.1	Input	- power supply
2	V0	Power supply 0 V_{DC} for solenoid power stage - see 9.1	Gnd	- power supply
3	ENABLE	Enable (24 V_{DC}) or disable (0 V_{DC}) the driver - see 9.7	Input	- on/off signal
4	P_INPUT+	Position reference: ±10 V_{DC} (4 ÷ 20 mA for /I option) - see 9.2	Input	- analog signal
5	AGND	Ground: signal zero for reference inputs	Gnd	- analog signal
6	P_MONITOR	Position monitor: ±10 V_{DC} maximum range (4 ÷ 20 mA for /I option) - see 9.4	Output	- analog signal
7				
8		Other connections - see 6.1.1, 6.1.2, 6.1.3		
9				
10				
11	FAULT	Driver status: Fault (0 V_{DC}) or normal working (24 V_{DC}) - see 9.8	Output	- on/off signal
E	Earth	Connect only when the power supply is not conform to VDE 0551 (CEI 14/6)		

6.1.1 -PS serial execution without alternate position/pressure (or position/force) control

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	
7	DI3	Digital Input 3 - see 9.9	Input	- on/off signal
8	DI2	Digital Input 2 - see 9.9	Input	- on/off signal
9	DI1	Digital Input 1 - see 9.9	Input	- on/off signal
10	DO1	Digital Output 1 - see 9.10	Output	- on/off signal

6.1.2 -PS serial execution with alternate position/pressure (or position/force) control (options SP/SF/SL)

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	
7	F_INPUT+	Pressure / Force reference: ±10 V_{DC} (4 ÷ 20 mA for /I option) - see 9.3	Input	- analog signal
8	F_MONITOR	Pressure / Force monitor: ±10 V_{DC} maximum range (4 ÷ 20 mA for /I option) - see 9.5	Output	- analog signal
9	DI1	Digital Input 1 - see 9.9	Input	- on/off signal
10	DO1	Digital Output 1 - see 9.9	Output	- on/off signal

6.1.3 -BC/-BP fieldbus execution

PIN	SIGNAL	TECHNICAL SPECIFICATIONS	NOTES	
7	F_INPUT+	Pressure/Force reference: ±10 V_{DC} (4 ÷ 20 mA for /I option) - see 9.3 (NC for SN execution)	Input	- analog signal
8	F_MONITOR	Pressure/Force monitor: ±10 V_{DC} (4 ÷ 20 mA for /I option) - see 9.5 (NC for SN execution)	Output	- analog signal
9	VL+	Separate power supply 24 V_{DC} for controller's logic - see 9.6	Input	- power supply
10	VL0	Separate power supply 0 V_{DC} for controller's logic - see 9.6	Gnd	- power supply

6.2 COMMUNICATION CONNECTOR - M12 - 5 PIN Ⓑ

	Ⓑ1	-PS Serial	Ⓑ1	-BC CANopen	Ⓑ2	-BP PROFIBUS DP
PIN	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION	SIGNAL	TECHNICAL SPECIFICATION
1	NC	do not connect	CAN_SHLD	Shield	+5V	for termination
2	NC	do not connect	NC	do not connect	LINE-A	Bus line (high)
3	RS_GND	Signal zero data line	CAN_GND	Signal zero data line	DGND	data line and termination Signal zero
4	RS_RX	Valves receiving data line	CAN_H	Bus line (high)	LINE-B	Bus line (low)
5	RS_TX	Valves transmitting data line	CAN_L	Bus line (low)	SHIELD	

6.3 POSITION TRANSDUCER CONNECTOR Ⓒ

6.3.1 Digital position transducers - M23 - 12 pin Ⓒ1 - see 9.11

		ENCODER -E execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	$\overline{B}$	Signal input channel $\overline{B}$
2	NC	do not connect
3	R	Signal input channel R
4	$\overline{R}$	Signal input channel $\overline{R}$
5	A	Signal input channel A
6	$\overline{A}$	Signal input channel $\overline{A}$
7	NC	do not connect
8	B	Signal input channel B
9	NC	do not connect
10	0 V	Common GND for transducer power and signals
11	NC	do not connect
12	VT	Power supply +5V$_{DC}$

		SSI -M execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	0 V	Common GND for transducer power and signals
2	DATA+	Serial positon data (+)
3	CLOCK+	Serial syncronous clock (-)
4	NC	do not connect
5	NC	do not connect
6	NC	do not connect
7	NC	do not connect
8	NC	do not connect
9	VT	Power supply +24V$_{DC}$
10	DATA-	Serial positon data (-)
11	CLOCK-	Serial syncronous clock (-)
12	NC	do not connect

6.3.2 Analog position transducers - M12 - 5 pin Ⓒ2 - see 9.11

		ANALOG -P execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	VT+	Power supply reference +10V$_{DC}$
2	VT-	Power supply reference -10V$_{DC}$
3	AGND	Common GND for transducer power and signals
4	TR	Signal transducer
5	SHIELD	Cable shield

		ANALOG -F execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	VT	Power supply +24V$_{DC}$
2	NC	do not connect
3	AGND	Common GND for transducer power and signals
4	TR	Signal transducer
5	SHIELD	Cable shield

6.4 PRESSURE/FORCE TRANSDUCER CONNECTOR - M12 - 5 PIN Ⓓ - see 9.12

Ⓓ1		SP and SL execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	VT	Power supply +24V$_{DC}$
2	TR	Signal transducer
3	AGND	Common GND for transducer power and signals
4	NC	do not connect
5	SHIELD	Cable shield

Ⓓ2		SF execution
PIN	**SIGNAL**	**TECHNICAL SPECIFICATION**
1	VT	Power supply +24V$_{DC}$
2	TR1	Signal transducer
3	AGND	Common GND for transducer power and signals
4	TR2	2nd signal transducer
5	SHIELD	Cable shield

7 CONTROLLER CHARACTERISTICS

Power supply (*) (see 9.1, 9.6)	Nominal: +24 V$_{DC}$ Rectified and filtered: Vrms = 20 ÷ 32 V$_{MAX}$ (ripple max 10 % V$_{PP}$)
Max power consumption	50 W
Reference input signals (see 9.2, 9.3)	Voltage: range ±10 V$_{DC}$ Input impedance: Ri > 50 kΩ Current: range 4 ÷ 20 mA Input impedance: Ri = 316 Ω
Monitor outputs (see 9.4, 9.5)	Output range : voltage ±10 V$_{DC}$ @ max 5mA current 4 ÷ 20 mA @ max 500 Ω load resistance
Enable input (see 9.7) Logic input (see 9.9)	Range: 0 ÷ 5 V$_{DC}$ (OFF state), 9 ÷ 24 V$_{DC}$ (ON state), 5 ÷ 9 V$_{DC}$ (not accepted); Input impedance: Ri > 10 kΩ
Fault output (see 9.8) Logic output (see 9.10)	Output range: 0 ÷ 24 V$_{DC}$ (ON state > [power supply] - 2V; OFF state < 1V) @ max 50mA
Alarms	Solenoid not connected/short circuit, cable break with current reference signal, over temperature, under temperature, valve spool trasducer cable break
Format	Sealed box on the valve; IP67 protection degree
Operating temperature	-20 ÷ 60 °C (storage -20 ÷ 70 °C)
Mass	approx. 475g
Additional characteristics	Short circuit protection of solenoid's current supply; spool position control by P.I.D. with rapid solenoid switching
Electromagnetic compatibility (EMC)	According to Directive 2004/108/CE (Immunity: EN 50082-2; Emission: EN 50081-2)

Communication interface
  Physical Layer
  Protocol
	-PS Serial	-BC CANopen - see tab. G510	-BP PROFIBUS - see tab. G510

	serial RS232 Atos ASCII coding	optical insulated CAN ISO11898 CANopen EN50325-4 + DS408	optical insulated RS485 PROFIBUS DP EN50170-2/IEC61158
Recommended wiring cable	LiYCY shielded cables: 0,5 mm^2 for length up to 40m [1,5 mm^2 for power supply and solenoid]		

(*) Note: Nominal data for solenoid power stage and driver logic.
Note: A minimum time of 270 to 340 ms have be considered between the driver energizing with the 24 V$_{DC}$ power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

8 TRANSDUCER CHARACTERISTICS

8.1 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 (option /P), analog signal (option /F), SSI (option /M), and encoder (option /E), see 8.3.
Transducers with digital interface (options /M and /E) allow the user to get high resolution and accurate measures. Transducers with analog interface (options /P and /F) grant simple and cost effective solutions.

8.2 Pressure/force transducers

The accuracy of the pressure/force control is strongly dependent to the selected pressure/force transducer (see section 4). Alternated pressure/force controls require to install pressure transducers (options /SP and /SF) or load cell (option /SL) to measure the actual pressure/force values.
Pressure transducers allow easy system integration and cost effective solution for both alternated position/pressure (option /SP) and position/force (option /SF) controls (see G465 for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force control (option /SL).
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.

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

	Position				Pressure/force
Options	/P	/F	/M	/E	/SP, /SF, /SL
Input type	Potentiometer, analog	Analog	SSI, digital	Incremental Encoder, digital	Analog
Controller Interface	±10V	0 ÷ 10V 4 ÷ 20 mA (option /C)	Serial SSI	TTL 5Vpp - 150 KHz	±10 V$_{DC}$ 4 ÷ 20 mA (option /C)
Max speed	0,5 m/s	1 m/s	2 m/s	2 m/s	-
Max Resolution	< 0.4 % FS	< 0.2 % FS	5 µm	1 µm (@ 0.15 m/s)	< 0.4 % FS
Linearity error (1)	± 0.1%	< ±0.03%	< ± 0.01 %	< ± 0.001 %	< ±0.25%
Repeatability (1)	± 0.05%	< ± 0.005%	< ± 0.001 %	< ± 0.001 %	< ±0.1%
Power supply (2)	±10 V$_{DC}$	+24 V$_{DC}$	+24 V$_{DC}$	+5 V$_{DC}$	+24 V$_{DC}$

Notes: (1) percentage of the total stroke; (2) provided by Z-RI controller; for additional details consult Atos technical office.

9 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 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.

9.1 Power supply and wirings (V+ and V0)

The power supply must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
A safety fuse is required in series to each controller power supply: 2,5 A fuse
Note: pin 2 and 10 (zero Volt) are connected together inside the electronics.

9.2 Position reference input signal (P_INPUT+)

The controller allows to regulate the axis position in closed loop according to an external voltage (standard) or current (option /I) reference input signal (P_INPUT+), referred to the common mode signal zero (AGND), see 3.1.
The input range and polarity are software selectable within the ±10 V$_{DC}$ maximum range; default setting is 0 ÷ 10 V$_{DC}$.
Controller with fieldbus interface (-BC or -BP) can be software set to receive reference value directly by the machine electronic control unit (fieldbus master); in this case the analog reference input signal can be used for start-up and maintenance operations
Option /I
The maximum signals range is software selectable among 4 ÷ 20mA (default with cable break detection), ±10mA, ±20mA or 0 ÷ 20mA

9.3 Pressure or force reference input signals (F_INPUT+)

With SP/SF/SL executions the controller is designed to receive a second analog voltage (standard) or current (option /I) reference input signal (F_INPUT+), referred to the common mode signal zero (AGND), dedicated to the pressure or force closed loop control (see section 4).
The input range and polarity are software selectable within the ±10 V$_{DC}$ maximum range; default setting is 0 ÷ 10 V$_{DC}$.
Controller with fieldbus interface (-BC or -BP) can be software set to receive reference value directly by the machine electronic control unit (fieldbus master); in this case the analog reference input signals can be used for start-up and maintenance operations
Option /I
The maximum signals range is software selectable among 4 ÷ 20mA (default with cable break detection), ±10mA, ±20mA or 0 ÷ 20mA

9.4 Position monitor output signal (P_MONITOR+)

The controller generates an analog voltage (standard) or current (option /I) 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).
The output polarity is software selectable within ±10 V$_{DC}$ maximum range; default setting is 0 ÷ 10 V$_{DC}$
Option /I
The maximum signals range is 4 ÷ 20 mA

9.5 Pressure or force monitor output signal (F_MONITOR+)

With SP/SF/SL executions the controller generates a second analog voltage (standard) or current (option /I) output signal proportional to the actual pressure or force applied to the cylinder's rod end; the monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force monitor).
The output polarity is software selectable within ±10 V$_{DC}$ maximum range; default settings are 0 ÷ 10 V$_{DC}$
Option /I
The maximum signals range is 4 ÷ 20 mA

9.6 Logic power supply (VL+ and VL0) - only for -BC and BP execution

Separate power supply for the solenoid and for the digital electronic circuits (pin 9,10).
Cutting solenoid power supply (pin 1,2) allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller
A safety fuse is required in series to each controller power supply: 500 mA fast fuse
Note: pin 2 and 10 (zero Volt) are connected together inside the electronics

9.7 Enable Input Signal (ENABLE)

To enable the controller, a 24V$_{DC}$ voltage has to be applied on pin 3 referred to pin 2.
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)

9.8 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 (pin 11 referred to pin2).
Fault status is not affected by the status of the Enable input signal

9.9 Logic input signals (DI1, DI2, DI3 / only for -PS)

3 logic on-off input signals can be used to start, stop or synchronize the controller positioning sequence with the machine working cycle (see 3.2).
Logic inputs function and controller positioning sequence can be set using Atos PC software or by fieldbus.
In case of SP/SF/SL executions only 1 logic input is available (see 6.1)

9.10 Logic output signal (DO1 / only for -PS)

The controller generates a digital output on-off signal to identify a specific working condition, software selectable: target position reached, pressure or force control active, positioning direction, etc.
This output signal can be used also to synchronize the machine cycle with actuator positioning process (see 3.2)

9.11 Position transducer input signal

A position transducer must be always directly connected to the controller.
Select the correct controller execution (P, F, M or E) depending on the desired transducer interface (Potentiometer, Analog, SSI or Encoder).
Refer to position transducer characteristics to select the transducer type that mach the specific application requirements (see 8.1)
Option /C (*only for analog F execution*)
The maximum signals range is software selectable among 4 ÷ 20 mA (default with cable break detection) or 0 ÷ 20 mA

9.12 Pressure/force transducer input signal (only for SP, SF, SL)

Analog remote pressure transducers or load cell with maximum ±10 VDC signal range must be directly connected to the controller.
Refer to pressure/force transducer characteristics to select the transducer type that mach the specific application requirements (see 8.2)
Option /C
The maximum signals range is software selectable among 4 ÷ 20 mA (default with cable break detection) or 0 ÷ 20 mA

10 PROGRAMMING DEVICES

The functional parameters of digital controllers, like internal reference generation or controller dynamics, can be easily set and optimized with the Atos Z-SW programming software, available in three different versions according to the driver's communication interface: Z-SW-PS (Serial), Z-SW-BC (CANopen) and Z-SW-BP (PROFIBUS DP).
A proper connection is required between the PC and the electronic controller communication port: for a more detailed description of software interface, PC requirements, adapters, cables and terminators, please refer to technical table G500.
Digital controllers with fieldbus communication interface (-BC and -BP) can be directly managed by the machine control unit; it is required to implement in the machine control the standard communication as described in the user manuals supplied with the relevant programming software; please contact Atos technical office for assistance.

Programming software, must be ordered separately:

Z-SW-*   (mandatory - first supply) = Dvd including Z-SW-* software installer and operator manuals; it allows the registration to Atos digital service
Z-SW-*-N   (optional - next supplies)   = as above but not including the registration form for Atos digitals service
On first supply of the Z-SW-* software, it is required to apply for the registration in the Atos download area: www.download.atos.com .
Once the registration is completed, the password will be sent by email.
The software remains active for 10 days from the installation date and then it stops until the user inputs his password.
With the password it is also possible to download the latest releases of the Atos software, manuals, drivers and configuration files.

USB Adapters, Cables and Terminators, can be ordered separately (see tab. G500)

11 MAIN SOFTWARE PARAMETER SETTINGS

For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the programming manuals included in the Z-SW programming software (see section 10)

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 3.2)

12 OVERALL DIMENSIONS [mm]

Ⓐ Main connector	Ⓑ1 Communication connector (-PS or -BC)
Ⓒ1 Digital position transducers connector (-M, -E)	Ⓑ2 Communication connector (-BP)
Ⓒ2 Analog position transducers connector (-P, -F)	Ⓓ1 Pressure/force transducers connector (-SP or -SL)
	Ⓓ2 Pressure transducers connector (-SF)
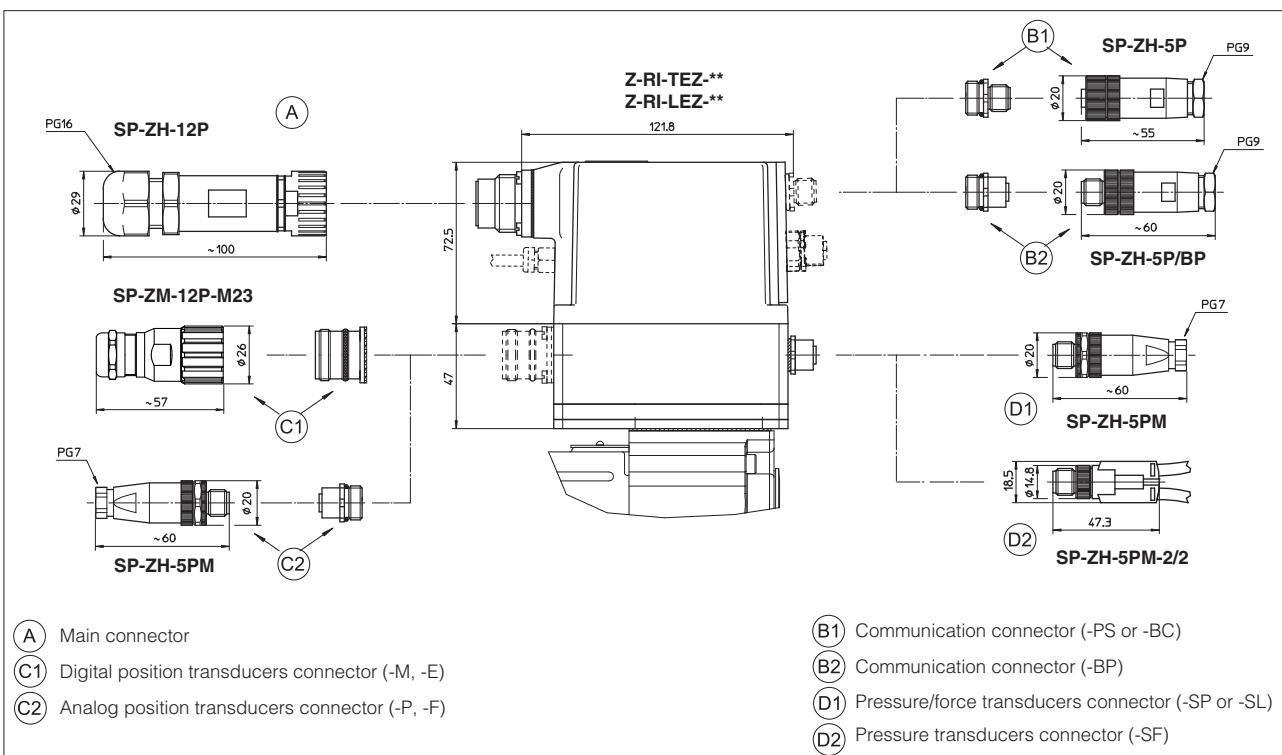
13 CHARACTERISTICS OF CONNECTORS (to be ordered separately)

13.1 Main and position transducer connectors

CONNECTOR TYPE	POWER SUPPLY CONNECTOR	POSITION TRANSDUCER CONNECTOR (M and E executions)	POSITION TRANSDUCER CONNECTOR (F and P executions)
CODE	SP-ZH-12P	SP-ZM-12P-M23	SP-ZH-5PM
Type	Female straight circular socket plug 12 pin	Male straight circular socket plug 12 pin	Male straight circular socket plug 5 pin
Standard	DIN 43651	- -	M12 – IEC 60947-5-2
Material	Plastic reinforced with fiber glass	Metallic	Plastic
Cable gland	PG16	- -	PG7
Cable	LiCY 10 x 0,14 mm² (signal) LiYY 3 x 1 mm² (alimentation)	diameter 3 ÷ 7 mm	4x 0,25 mm²
Connection type	to crimp	to solder	screw terminal
Protection (DIN 40050)	IP 67	IP 67	IP 67

13.2 Pressure transducer connectors

CONNECTOR TYPE	SINGLE TRANSDUCER CONNECTOR (SP and SL executions)	DOUBLE TRANSDUCER CONNECTOR (SF execution)
CODE	SP-ZH-5PM	SP-ZH-5PM-2/2
Type	Male straight circular socket plug 5 pin	Male straight circular socket plug 4 pin
Standard	M12 – IEC 60947-5-2	M12 – IEC 60947-5-2
Material	Plastic	Plastic
Cable gland	PG7	Connector moulded on cables 2 m lenght
Cable	diameter 4 ÷ 6 mm	3x 0,25 mm² (both cables)
Connection type	screw terminal	splitting cable
Protection (DIN 40050)	IP 67	IP 67

13.3 Communication connectors

CONNECTOR TYPE	-PS Serial Connector	-BC CANopen Connector	-BP PROFIBUS DP Connector
CODE	SP-ZH-5P	SP-ZH-5P	SP-ZH-5P/BP
Type	Female straight circular socket plug 5 pin	Female straight circular socket plug 5 pin	Male straight circular socket plug 5 pin
Standard	M12 – IEC 60947-5-2	M12 – IEC 60947-5-2	M12 – IEC 60947-5-2
Material	Plastic	Plastic	Plastic
Cable gland	PG9	PG9	PG9
Cable	LiYCY 5x0,25 mm² shielded	CANBus Standard (301 DSP)	PROFIBUS DP Standard
Connection type	screw terminal	screw terminal	screw terminal
Protection (DIN 40050)	IP 67	IP 67	IP 67