Digital Z-BM-TEZ/LEZ position controllers with driver functionality

DIN-rail panel format, for electrohydraulic closed loop controls

Z-BM-TEZ/LEZ

Digital axis controllers perform the driver functions for proportional valves plus the position closed loop control of the linear or rotative actuator to which the proportional valve is connected.

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

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

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

The controller is operated by an external or internally generated reference position signal (see section 4).

A pressure/force alternated control may be set by software additionally to the position control: a pressure/force transducer has to be assembled into the actuator and connected to the controller; a second pressure/force reference signal is required.

Atos PC software allows to customize the controller configuration to the specific application requirements.

Electrical Features:
- up to 11 fast plug-in connectors
- USB port always present - Mini USB type B
- DB9 fieldbus communication connector for CANopen and PROFIBUS DP
- RJ45 ethernet communication connectors input and output for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics (see 8.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:
- Intuitive graphic interface
- Internal generation of motion cycle
- Setting of axis’s dynamic response (PID) to optimize the application performances
- Setting of valve’s functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Complete diagnostics of axis status
- Internal oscilloscope function
- In field firmware update through USB port

MODEL CODE

<table>
<thead>
<tr>
<th>Z-BM</th>
<th>TEZ</th>
<th>NP</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-board electronic axis controller in DIN rail panel format</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| TEZ = digital full driver + axis card, for valves with one LVDT transducer |
| LEZ = digital full driver + axis card, for valves with two LVDT transducers |

Fieldbus interface, USB port always present:
- NP = Not Present
- BC = CANopen
- BP = PROFIBUS DP
- EH = EtherCAT
- EW = POWERLINK
- EI = EtherNet/IP
- EP = PROFINET RT/IRT

Options, see section 7:
- A = max current limitation for Ex-proof valves
- C = current feedback 4 ÷ 20 mA for LVDT transducers, only in combination with option A

01H = for single solenoid proportional valves
05H = for double solenoid proportional valves (only for TEZ)
4 POSITION REFERENCE MODE

4.1 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 (see 8.2) limiting speed, acceleration and deceleration values.
- Fieldbus reference (b) - the controller receives in real time the reference signal from the machine electronic central unit by means digital fieldbus communication limiting speed, acceleration and deceleration values.

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

4.2 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 of:
- on-off commands (c)
- fieldbus commands (d)

Atos PC software allows to design a customized sequence of motion phases through a range of pre-defined standard commands.

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 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
- **Switch by internal status**
  - switch-over from internal status are used to start/stop the cycle generation or to change the motion phase

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

Note: block diagram example for alternated position/force control, with fieldbus interface

3 VALVES RANGE

<table>
<thead>
<tr>
<th>Valves</th>
<th>Directional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>DHZO-T, DKZOR-T</td>
</tr>
<tr>
<td>Data sheet</td>
<td>F165</td>
</tr>
<tr>
<td>Ex-proof</td>
<td>DLHZO-T, DLKZOR-T</td>
</tr>
<tr>
<td>Data sheet</td>
<td>F180</td>
</tr>
<tr>
<td>Controller model</td>
<td>DPZO-L</td>
</tr>
<tr>
<td>Z-BM-TEZ</td>
<td>DLHZA-T, DLKZ-T</td>
</tr>
<tr>
<td>Z-BM-LEZ</td>
<td>FX140</td>
</tr>
</tbody>
</table>

2 BLOCK DIAGRAM EXAMPLE
5 ALTERNATED POSITION / FORCE CONTROL

Alternated pressure or force closed loop control can be added 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 - software selectable

<table>
<thead>
<tr>
<th>SP</th>
<th>SF</th>
<th>SL</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Functional Scheme SP" /></td>
<td><img src="image2" alt="Functional Scheme SF" /></td>
<td><img src="image3" alt="Functional Scheme SL" /></td>
</tr>
</tbody>
</table>

- 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

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
- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault, see tech table EY105
- 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

6 APPLICATION EXAMPLES

Hydraulic steering wheel in marine applications

Rudder controls on motor yachts and sail boats requires smooth control for precise and reliable operations.

Z-BM-TEZ/LEZ controllers perform the rudder position control system, ensuring accurate and repetitive regulations for a comfortable ride, thanks to:

- analog position reference mode for real time controls
- analog position transducer for simple and compact solution
- position PID control parameters to optimize the system response
- complete diagnostic information for advanced system monitoring
### Wind turbines

The pitch control of the rotor blades is required to maximize the energy production. Accurate positioning, decentralized intelligence as well as long service life and reliability are required.

Z-BM-TEZ/LEZ controllers perform high quality regulation of the blade pitch simplifying the system architecture, thanks to:
- SSI digital position transducer for high precision control
- complete remote system management with fieldbus interface
- position PID selection to adapt the position control to the different wind conditions

### Process valves

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

Z-BM-TEZ/LEZ 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

### Wood machinery

Hydraulic wood machines require configurable and repetitive motion profiles, accurate position controls, and digital signals for synchronization purpose.

Z-BM-TEZ/LEZ controllers allow remote control, thanks to:
- internal reference generation with maximum speed and acceleration settings for simple and reliable solution
- pressure transducer for alternate pressure control
- fieldbus connection for easy parameterization, commands, and controller state indication

### Bending Machines

Machine tools for cold-forming flat sheets require complete, automatic, programmable and flexible machine control to produce sheet metal panels from punched blank.

Z-BM-TEZ/LEZ controller combine high level position regulation with accurate force control to provide in a single device a complete and dedicated solution, thanks to:
- internal reference generation to simplify the machine control cycle
- digital position sensor for high resolution measurement system
- two pressure transducers for alternate force control
- fieldbus interface for easy machine control integration
- auxiliary digital outputs for system status indication (target reached, force control active)

### Die-casting machinery

Clamp movements in die-casting phases involve fast/slow motion cycle with accurate and repetitive alternated position/force controls for the mould safety functions.

Z-BM-TEZ/LEZ controllers, with alternated position/force control, simplify the hydraulic + electronic system architecture, thanks to:
- internal reference generation for repetitive working cycles
- SSI digital position transducer for accurate axis control
- two pressure transducers for alternate force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics
7 MAIN CHARACTERISTICS

Power supplies (see 10.1, 10.2) Nominal: +24 Vcc Rectified and filtered: \( V_{\text{b}} \) = \( V_{\text{max}} = 20 \div 32 \) \( V_{\text{max}} \) (ripple max 10 % \( V_{\text{max}} \))

Max power consumption 50 W

Current supplied to solenoids \( \text{MAX} = 3.0 \ A \) for standard driver \( \text{MAX} = 2.5 \ A \) for ex-proof driver (\( \text{IA option} \))

Analog input signals (see 10.3, 10.4) Voltage range: \( \pm 10 \ V_{\text{cc}} \) (24 \( V_{\text{max}} \) tolerant) Input impedance: \( R_{\text{i}} > 50 \ Omega \)

Monitor outputs (see 10.5, 10.6) Output range: voltage \( \pm 10 \ V_{\text{cc}} \) current \( \pm 20 \ mA \) @ max 500 \( \Omega \) load resistance

Enable input (see 10.7) Range: 0 \( \div \) 5 \( V_{\text{cc}} \) (OFF state), 9 \( \div \) 24 \( V_{\text{cc}} \) (ON state), 5 \( \div \) 9 \( V_{\text{cc}} \) (not accepted); Input impedance: \( R_{\text{i}} > 10 \ K\Omega \)

Fault output (see 10.8) Output range: 0 \( \div \) 24 \( V_{\text{cc}} \) (ON state \( \geq \) [power supply - 2 V]) ; OFF state \(< 1 \ V \) @ max 50 mA; Alarms: Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, position control monitoring, valve spool transducer malfunctions, alarms history storage function

Position transducers power supply +24 \( V_{\text{cc}} \) \( \times \) max 100 mA or +5 \( V_{\text{cc}} \) \( \times \) max 100 mA are software selectable

Pressure/Force transducers power supply +24 \( V_{\text{cc}} \) \( \times \) max 100 mA

Communication interface
- USB
- Atos ASCII coding
- CANopen
- PROFIBUS DP
- EtherCAT
- POWERLINK
- PROFINET
- EtherNet/IP
- CANopen
- PROFIBUS DP
- EtherCAT
- POWERLINK
- PROFINET

Recommended wiring cable
- LYCY shielded cables: 0.5 \( \text{mm}^2 \) max 50 m for logic - 1.5 \( \text{mm}^2 \) max 50 m for power supply

Max conductor size (see 13) 2.5 \( \text{mm}^2 \)

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

8 CONNECTIONS AND LEDS

A,B,C,D,E,F,G,H,I,J,K connectors included

(1) D connector is available only for Z-BM-LEZ-**-01H

(2) To interface with Siemens 6ES7972-0BA12-0XA connector, it is mandatory to use also one of the following adapters to avoid interference with the USB connector: DG909MF1 - the connector will be oriented upwards; DG909MF3 - the connector will be oriented downwards

8.1 Diagnostic LEDs

Eight leds show controller operative conditions for immediate basic diagnostics. Please refer to the controller user manual for detailed information.
8.2 Connectors - 4 pin

<table>
<thead>
<tr>
<th>CONNECTOR PIN</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATIONS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>V+</td>
<td>Power supply 24 VDC (see 10.1)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td>A2</td>
<td>V0</td>
<td>Power supply 0 VDC (see 10.1)</td>
<td>Gnd - power supply</td>
</tr>
<tr>
<td>A3</td>
<td>VL+</td>
<td>Power supply 24 VDC for driver's logic and communication (see 10.2)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td>A4</td>
<td>VL0</td>
<td>Power supply 0 VDC for driver's logic and communication (see 10.2)</td>
<td>Gnd - power supply</td>
</tr>
<tr>
<td>B1</td>
<td>P_INPUT+</td>
<td>Position reference input signal ±10 VDC / ±20 mA maximum range,</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>default is ±10 VDC (see 10.3)</td>
<td>Software selectable</td>
</tr>
<tr>
<td>B2</td>
<td>INPUT-</td>
<td>Negative reference input signal for P_INPUT+ and F_INPUT+</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td>B3</td>
<td>F_INPUT+</td>
<td>Pressure/Force reference input signal (SP, SF, SL controls):</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>±10 VDC / ±20 mA maximum range, default is ±10 VDC (see 10.4)</td>
<td>Software selectable</td>
</tr>
<tr>
<td>B4</td>
<td>EARTH</td>
<td>Connect to system ground</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>P_MONITOR</td>
<td>Position monitor output signal ±10 VDC / ±20 mA maximum range,</td>
<td>Output - analog signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>referred to AGND, default is ±10 VDC (see 10.5)</td>
<td>Software selectable</td>
</tr>
<tr>
<td>C2</td>
<td>ENABLE</td>
<td>Enable (24 VDC) or disable (0 VDC) the controller, referred to VLO</td>
<td>Input - on/off signal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(see 10.7)</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>F_MONITOR</td>
<td>Pressure/Force (SP, SF, SL controls) or valve spool position (SN control) monitor output signal: ±10 VDC / ±20 mA maximum range, referred to AGND, default is ±10 VDC (see 10.6)</td>
<td>Output - analog signal Software selectable</td>
</tr>
<tr>
<td>C4</td>
<td>FAULT</td>
<td>Fault (0 VDC) or normal working (24 VDC), referred to VLO (see 10.8)</td>
<td>Output - on/off signal</td>
</tr>
<tr>
<td>D1</td>
<td>LVDT_L</td>
<td>Main stage valve position transducer signal (see 10.11)</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td>D2</td>
<td>-15V</td>
<td>Main stage valve position transducer power supply -15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td>D3</td>
<td>+15V</td>
<td>Main stage valve position transducer power supply +15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td>D4</td>
<td>AGND</td>
<td>Common gnd for transducer power and monitor outputs</td>
<td>Common gnd</td>
</tr>
<tr>
<td>E1</td>
<td>LVDT_T</td>
<td>Direct valve or pilot valve position transducer signal (see 10.11)</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td>E2</td>
<td>-15V</td>
<td>Direct valve or pilot valve position transducer power supply -15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td>E3</td>
<td>+15V</td>
<td>Direct valve or pilot valve position transducer power supply +15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td>E4</td>
<td>AGND</td>
<td>Common gnd for transducer power and monitor outputs</td>
<td>Common gnd</td>
</tr>
<tr>
<td>F1</td>
<td>SOL_S1-</td>
<td>Negative current to solenoid S1</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td>F2</td>
<td>SOL_S1+</td>
<td>Positive current to solenoid S1</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td>F3</td>
<td>SOL_S2-</td>
<td>Negative current to solenoid S2</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td>F4</td>
<td>SOL_S2+</td>
<td>Positive current to solenoid S2</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td>G1</td>
<td></td>
<td>Digital position transducer SSI or Encoder is software selectable:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- SSI connections see 8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Encoder connections see 8.4</td>
<td></td>
</tr>
<tr>
<td>H1</td>
<td></td>
<td>Digital position transducer SSI or Encoder is software selectable:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- SSI connections see 8.3</td>
<td></td>
</tr>
<tr>
<td>H2</td>
<td></td>
<td>- Encoder connections see 8.4</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td></td>
<td>Digital position transducer SSI or Encoder is software selectable:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- SSI connections see 8.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Encoder connections see 8.4</td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>VP</td>
<td>Power supply: +24Vcc, +5Vcc or OFF (default OFF)</td>
<td>Output - power supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Software selectable</td>
</tr>
<tr>
<td>I2</td>
<td>P_TR1</td>
<td>Analog position transducer input signal ±10 VDC / ±20 mA maximum range, default is ±10 VDC (see 10.9)</td>
<td>Input - analog signal Software selectable</td>
</tr>
<tr>
<td>I3</td>
<td>AGND</td>
<td>Common gnd for transducer power and signals</td>
<td>Common gnd</td>
</tr>
<tr>
<td>I4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
</tr>
<tr>
<td>J1</td>
<td>VF +24V</td>
<td>Power supply: +24Vcc or OFF (default OFF)</td>
<td>Output - power supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Software selectable</td>
</tr>
<tr>
<td>J2</td>
<td>F_TR1</td>
<td>1st signal pressure/force transducer: ±10 VDC / ±20 mA maximum range, default is ±10 VDC (see 10.10)</td>
<td>Input - analog signal Software selectable</td>
</tr>
<tr>
<td>J3</td>
<td>AGND</td>
<td>Common gnd for transducer power and signals</td>
<td>Common gnd</td>
</tr>
<tr>
<td>J4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
</tr>
<tr>
<td>K1</td>
<td>VF +24V</td>
<td>Power supply: +24Vcc or OFF (default OFF)</td>
<td>Output - power supply</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Software selectable</td>
</tr>
<tr>
<td>K2</td>
<td>F_TR2</td>
<td>2nd signal pressure transducer (only for SF): ±10 VDC / ±20 mA maximum range, default is ±10 VDC (see 10.10)</td>
<td>Input - analog signal Software selectable</td>
</tr>
<tr>
<td>K3</td>
<td>AGND</td>
<td>Common gnd for transducer power and signals</td>
<td>Common gnd</td>
</tr>
<tr>
<td>K4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
</tr>
</tbody>
</table>

(1) D connector is available only for Z-BM-LEZ-**-01H
8.3 SSI connectors signals - 4 pin

**G**
- G1: CLOCK+
- G2: CLOCK-
- G3: VP
- G4: 0V

**H**
- H1: DATA+
- H2: DATA-
- H3: NC
- H4: NC

Note: for Balluff BTL7 with SSI interface only special code SA433 is supported

SSI connection - example

**Z-BM-TEZ/LEZ controller**

**SSI position transducer - MTS Model RH, D70 male connector**

Above connections are intended as generic example, for details please consult the transducer’s datasheet

8.4 Encoder connectors signals - 4 pin

**G**
- G1: R
- G2: /R
- G3: VP
- G4: 0V

**H**
- H1: A
- H2: /A
- H3: B
- H4: /B

Encoder connection - example

**Z-BM-TEZ/LEZ controller**

**Encoder - HEIDENHAN Model LS 100, cable gland**

Above connections are intended as generic example, for details please consult the transducer’s datasheet

8.5 Pressure/force transducers connection - example

**Voltage**

**Current**

8.6 Communication connectors ③ - ④ - ⑤ - ⑥ - ⑦

**USB connector - Mini USB type B**
- Always present

**BP fieldbus execution, connector - DB9 - 9 pin**

**BC fieldbus execution, connector - DB9 - 9 pin**

**EH, EW, EL EP fieldbus execution, connector - RJ45 - 8 pin**

(1) shield connection on connector’s housing is recommended

GS330
9 SET CODE

The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of controller’s model code (see section 11). For correct set code selection, please include in the controller order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

10 SIGNALS SPECIFICATIONS

Atos digital drivers 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.

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, ISO 4419).

10.1 Power supply (V+ and V0)

The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

⚠️ A safety fuse is required in series to each power supply: 2.5 A time lag fuse.

10.2 Power supply for driver’s logic and communication (VL+ and VLO)

The power supply (pin A3 and A4) for driver’s logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.

The separate power supply for driver’s logic, allow to remove solenoid power supply from pin A1 and A2 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.

10.3 Position reference input signal (P_INPUT+)

Functionality of P_INPUT+ signal (pin B1), depends on controllers’ reference mode, see section 11. external analog reference generation (see 4.1): input is used as reference for the controller position closed loop.

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

fieldbus/internal reference generation (see 4.2): analog reference input signal can be used as on-off commands with input range 0 – 24VDC.

10.4 Pressure or force reference input signal (F_INPUT+)

Functionality of F_INPUT+ signal (pin B3), depends on selected controllers’ reference mode and alternated control options, see section 11.

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

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

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

10.5 Position monitor output signal (P_MONITOR)

The controller generates an analog output signal (pin C1) 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 range and polarity are software selectable within the maximum range ±10 VDC or ±20 mA; default is ±10 V DC.

10.6 Pressure or force monitor output signal (F_MONITOR)

The controller generates an analog output signal (pin C3) according to alternated pressure/force control option:

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

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

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; default is ±10 VDC.

10.7 Enable Input Signal (ENABLE)

To enable the controller, a 24VDC voltage has to be applied on pin C2.

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)

10.8 Fault output signal (FAULT)

Fault output signal (pin C4) 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.

10.9 Position transducer input signals

A position transducer must be always directly connected to the controller. Position digital input signals are factory preset to binary SSI. They can be reconfigured via software selecting between binary/gray SSI, Encoder or generic transducer with analog interface.

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

Refer to position transducer characteristics to select the transducer type according to specific application requirements, see section 11.

10.10 Remote pressure/force transducer input signals (F_TR1 and F_TR2) - SP, SF, SL controls

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

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

Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements, see section 11.

10.11 Main stage and direct or pilot position transducer input signals (LVDT_L and LVDT_T)

Main stage (LVDT_L pin D1) and direct or pilot (LVDT_T pin E1) position transducer integrated to the valve have to be directly connected to the controller using ±15 VDC supply output available at pin D2, D3 and pin E2, E3.

Note: Transducer input signals working range is ±10 VDC for standard or 4 – 20 mA for /C option and cannot be reconfigured via software (input signals setting depends to the driver set code).

10.12 Possible combined options: /AC
11. ACTUATOR’S TRANSDUCER CHARACTERISTICS

11.1 Position transducers
The accuracy of the position control is strongly dependent on the selected position transducer. Four different transducer interfaces are available on the controllers, depending on the system requirements: analog signal (analog), SSI or Encoder (digital).
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.

11.2 Pressure/force transducers
The accuracy of the pressure/force control is strongly dependent on the selected pressure/force transducer (see section 3). Alternate 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.

11.3 Transducers characteristics & interfaces - following values are just for reference, for details please consult the transducer’s datasheet:

<table>
<thead>
<tr>
<th>Transducer Type</th>
<th>Position</th>
<th>Pressure/Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input type</td>
<td>Analog</td>
<td>Analog</td>
</tr>
<tr>
<td>Power supply (1)</td>
<td>+24 Vdc</td>
<td>+24 Vcc</td>
</tr>
<tr>
<td>Controller Interface</td>
<td>0 ÷ 10V or 4 ÷ 20 mA</td>
<td>0 ÷ 10V or 4 ÷ 20 mA</td>
</tr>
<tr>
<td>Max speed</td>
<td>1 m/s</td>
<td>1 m/s</td>
</tr>
<tr>
<td>Max Resolution</td>
<td>&lt; 0.2% FS</td>
<td>1 μm</td>
</tr>
<tr>
<td>Linearity error</td>
<td>&lt; ±0.03% FS</td>
<td>&lt; ±0.01% FS</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; ±0.005% FS</td>
<td>&lt; ±0.001% FS</td>
</tr>
</tbody>
</table>

(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.

12. 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.
The software is available in different versions according to the driver’s options (see table GS500):
Z-SW-FULL: support: NP (USB), PG (Serial), IR (Infrared), BC (CANopen), BP (PROFIBUS DP), EH (EtherCAT), EW (POWERLINK), Ei (EtherNet/IP), EP (PROFINET)

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

DVs programming software, to be ordered separately:
Z-SW-FULL: DVD first supply = software has to be activated via web registration at www.atos.com; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area
Z-SW-FULL-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.atos.com
USB Adapters, Cables and Terminators, can be ordered separately

13. MAIN SOFTWARE PARAMETER SETTINGS
For a detailed descriptions of the available settings, wiring to the user manuals included in the Z-SW programming software:
Z-MAN-BM-LEZ: user manual for Z-BM-LEZ and Z-BM-TEZ

13.1 External reference and transducer parameters
- 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)

13.2 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, feedback, fine positioning, etc.) can be modified to match the application requirements

13.3 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 13.4)

13.4 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.)

13.5 Valve characteristics compensation
- Allow to modify the valve regulation to match to 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

13.6 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 4.2).
**OVERALL DIMENSIONS [mm]**

To extract the connectors:
1. push lever
2. pull connector

To insert the connectors:
1. push the connector in its slot

*Note:* all connectors are supplied with a mechanical coding. This feature ensures a unique insertion of each connector in the own slot. (eg. connector A can not be inserted into connector slot of B,C,D,E,F,G,H,I,J,K)

To wire cables in the connectors:
1. insert cable into the termination
2. turn screw with a screwdriver

*Note:* max conductor size: 2,5 mm²
tightening torque: 0,4 ÷ 0,6 Nm

To unlock the controller from the DIN rail:
1. pull down the locking slide with a screwdriver
2. rotate up the controller

*Note:* D connector is available only for Z-BM-LEZ-**-01H
16.1 Position control - analog reference - analog position transducer

16.2 Alternated position/force control - CANopen reference - SSI position transducer - 2 analog pressure transducers

16.3 Alternated position/force control - EtherNet/IP reference - Encoder position transducer - analog load cell