Hydraulika proporcjonalna
Proportional electrohydraulics

atomy®

2014
**Electronic drivers type E-MI-AC**

analog, DIN 43650 plug-in format, for proportional valves without transducer

E-MI-AC drivers control the current to the solenoid of Atos proportional valves without pressure or position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

**Features:**

- bias and scale regulations by potentiometers;
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator;
- factory pre-setted
- aluminium box with IP65 protection degree
- electronic filters on input and output lines;
- CE marking grating the conformity to the EMC Directive (Electromagnetic compatibility).

**Applications:**

Pressure, flow, position open or closed-loop systems, according to the block diagram.

---

1. **MODEL CODE**

   **E-MI** – **AC** – **01F** – **/*

   E-MI = electronic driver plug format as per DIN 43650
   
   AC = for proportional valve without transducer
   
   01F = for single solenoid proportional valve
   
   Options:
   - standard symmetrical ramps
   - RR = adjustable dissymmetrical ramps, adjustable dither, suitable also for current signal 0÷20 mA
   
   **/* = set code (see 4.4)

   Series number

2. **BLOCK DIAGRAM**
### MAIN CHARACTERISTICS OF E-MI-AC-01F ELECTRONIC DRIVERS

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (nominal)</td>
<td>Nominal power supply: 24V DC</td>
</tr>
<tr>
<td>Current supplied to solenoid</td>
<td>$I_{\text{max}} = 2.7A$ type PWM square wave (with solenoid type ZO(R)-A with resistance 3.2 $\Omega$)</td>
</tr>
<tr>
<td>Nominal reference signal (factory pre-set)</td>
<td>$0 \div 10$ VDC</td>
</tr>
<tr>
<td>Reference signal variation range</td>
<td>$0 \div 10$ VDC / $0 \div 5$ VDC</td>
</tr>
<tr>
<td>Input signal impedance</td>
<td>Voltage signal $R_I &gt; 50$ K$\Omega$</td>
</tr>
<tr>
<td>Potentiometers supply</td>
<td>$+5V/10$ mA at contact 3</td>
</tr>
<tr>
<td>Ramp time</td>
<td>$10$ sec. max for $0 \div 10V$ reference signal</td>
</tr>
<tr>
<td>Electrical wirings (customer care)</td>
<td>Shielded cable 5 pins + shield; section $0.5$ to $1.0$ mm$^2$ (20 AWG - 18 AWG)</td>
</tr>
<tr>
<td>Box format</td>
<td>Box equipped with DIN 43650-IP65 plug; VDE 0110 wired on solenoid</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$0 \div 50$ °C (storage $-20 \div +70$ °C)</td>
</tr>
<tr>
<td>Weight</td>
<td>190 g</td>
</tr>
<tr>
<td>Features</td>
<td>Outputs to solenoids protected against accidental short circuits</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

#### 4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 $\mu$F/40V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 $\mu$F capacitor. Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC), connecting the shield to noiseless earth (TE). It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

The 12 VDC electric voltage supply is allowed only after evaluation of the performances required from the proportional valves, and however after check with our technical office.

#### 4.2 Reference signal

The electronic driver is designed to receive a voltage reference signal according to the following options:
- Potentiometers mounted externally and wired according to the application diagrams.
- External reference signals generated by PLC.
- Voltage from 0 to 10V.
- Current from 0 to 20 mA (only with option /RR).

#### 4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test point M and pin 2. Reading scale is 1 mV = 10 mA. To visualize the signals use voltmeters with impedance $>10$ K$\Omega$.

#### 4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:
- 1 = RZGO (KZGO)
- 2 = RZMO, AG*ZO, LI*ZO
- 3 = DHZO, DKZOR
- 4 = DPZO-A-*5
- 6 = QV*ZO(R), LEQZO

#### 4.5 Calibrations available to the user

- **Scale**
  - The relation between driving current and reference signal can be regulated with the Scale adjustment.
- **Bias** (dead band)
  - Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to the corresponding electrical zero. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). An output current is obtained when the input voltage is 100 mV or greater.
- **Ramps**
  - The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current). The rise/fall time of the current is set via internal potentiometer P1 up to a max. time of 10 sec. for 0-10V of reference signal. The option /RR provides dissymmetrical ramps, ramp up is set via P1 potentiometer and ramp down is set via P2.
- **Dither**
  - With the /RR option the dither frequency adjust is allowed from 100 Hz to 500 Hz.

### EXTERNAL REFERENCE SIGNALS

#### External Generator Voltage Signal

- $0 \div 10$ VDC

#### External Potentiometer Connection

- **Potentiometer**

#### External Generator Current Signal (Option /RR)

- $0 \div 20$ mA

#### Connection for Two Solenoids Proportional Valve (Option /7)

- **Solenoids**

- **Power Supply**

- **Two Solenoids Proportional Valve**

- **EMI-AC-01F7**
6 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below:

6.1 Warning
- Never insert or remove the driver while the electronic system is powered on.
- Protect the regulator on power line with an external 2A fuse.
- Refer to to identify components mentioned in calibration procedures.
- The E-MI-AC electronic drivers are designed to work in open loop system, where the coupled proportional valve is not required to work at its limits.

6.2 Start-up
Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and Ramps potentiometers, in sequence.
- Remove the cover and connect the electronic driver according to the desired connection diagram, see .
For double solenoid valves two electronic drivers type E-MI-AC-01F/7 must be used connected as shown in .
Start-up instructions are the same for each driver.
On the first driver two cable clamps must be mounted, one for the external wirings and one to give power and signal to the second driver which is equipped with one cable clamp and one blind plug.
A differential voltage signal -10 V = +10 V must be supplied to the first driver.
Note that the first driver will work with signal from 0 to 10V while the second driver will work with signal from 0 to -10 V.
- The current supplied to the coil can be measured by a voltmeter connected between pins M and 2 of the screw terminal. The reading range will be: \( I = 10 \times V \) (for example reading 70 mV the current in the coil will be 700 mA).

Bias adjustment (dead band compensation) see .
- Supply electrical power to the driver; supply a reference signal voltage = 0.1 V. Gradually turn the P4 bias potentiometer until a movement of the controlled actuator is obtained.
- Turn in the opposite direction until the actuator is stopped.

Scale adjustment, see .
Supply max. current reference signal; check if the current in the coil reaches the max. value desired, turning P3 clockwise (see the regulation curve of the employed valve used).

Ramps see .
Turning the ramp potentiometer clockwise, acceleration and deceleration time can be increased to obtain the optimization of the complete system.

7 RAMPS

8 E-MI-AC ADJUSTMENT

9 E-MI-AC-01F TOPOGRAPHICAL VIEW OF REGULATIONS
**ELECTROMAGNETIC COMPATIBILITY**

Atos electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

**SAFETY**

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be paid to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

**WIRING BLOCK DIAGRAM**

**DIMENSIONS [mm]**

**EARTH CONNECTIONS**

**IMPORTANT INSTRUCTIONS**
Electronic drivers type E-BM-AC
analog, DIN 43700 UNDECAL fast plug-in, for proportional valves without transducer

E-BM-AC drivers control the current to the solenoid of Atos proportional valves without pressure or position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:
- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-setted
- alluminium box (DIN 43700 modular unit)
- can be mounted on back panel DIN guide or on front panel
- power supply 24 Vdc or 12 Vdc (/12 option)
- electronic filters on input and output lines
- CE marking granting the conformity to the EMC Directive (Electromagnetic Compatibility)

Applications:
Pressure, flow, position open or closed-loop regulation systems, according to the block diagram.

Options:
- = standard symmetrical ramp
/RR = with adjustable dissymmetrical ramps

** Model Code **

<table>
<thead>
<tr>
<th>E-BM</th>
<th>AC</th>
<th>01F</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-BM = electronic driver</td>
<td>Fast plug-in format</td>
<td>AC = for proportional valves without transducer</td>
</tr>
</tbody>
</table>

Options:
- /12 = 12 Vdc power supply (see 4.1)
- 24 Vdc power supply

Notes:
- the reference R2 must be supplied only for E-BM-AC-011F
- with the version 011F it is possible to regulate two-single solenoid proportional valves also contemporary
4 GENERAL SPECIFICATIONS

4.1 Power supply and wiring

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier use a 10000 µF/400V capacitor or pulse voltage is generated by a three phase rectifier, connect a 4700 µF/400V capacitor (see 4.5). Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC).

It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.). Wire the earth connection as shown in 4.3, according to CEI EN 60204-1 standards. Connect the shield of the driver to the noiseless earth terminal (TE).

The driver is designed to correctly work with 24 Vdc (±20%) or 12 Vdc (±20%) nominal voltage supply coupled with coils having a resistance from 2.0 Ω to 13.4 Ω, as shown in the side table.

4.2 Reference signal

The electronic driver is designed to receive a voltage reference signal according to the following options:

- Potentiometers mounted externally and wired according to the application diagrams, see 4.3.
- External reference signals generated by PLC, see 4.3.

4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter on the front panel test points (see 4.1). Reading scale is 1 mV = 1 mA. To visualize the signals use voltmeters with impedance >10 kΩ.

4.4 Set code

Basic calibration of the electronic driver is factory pre-set, according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

1 = RZGO, KZGO
2 = RZMO, AG*ZO, LI*ZO
3B = DHZO-A-06, DKZOR-A-16
4B = DPZO-A-*7
6 = QV*ZO(R), LIQZO

For ex-proof valves, insert an “A” before the code of adjustment. For example, the code of adjustment for RZGA is A1 (see table E120).

The calibrations 3B and 4B allow the coupling with single solenoid valves with two external positions. For single solenoid valves with two external operating positions, the reference signal is ±5V (calibration codes 3B and 4B).

Separate Scale potentiometers P3 and P4 for solenoids S1 and S2 enable the electronic card to be set for different output currents, obtaining differential hydraulic operations.

4.5 Calibrations available to the user, see 4.4

Scale

The relation between driving current and reference signal can be regulated with the Scale adjustment. For single solenoid valves with two external operating positions, the reference signal is ±5V (calibration codes 3B and 4B).

Bias (dead band)

Regulation of dead band adjusts the hydraulic zero of the valve (starting position adjustment) to a minimum signal of 200 mV. The electronic card is factory pre-set for the valve it is coupled with, according to the set code (see section 4.4). E-BM-AC-05F* driver for double solenoid is equipped with an internal channel selector enabling the relevant channel with input reference voltage signal greater than ±200 mV and supplying the bias current set by front panel Bias potentiometers P1 and P2 for each solenoid.

For drivers type E-BM-AC-01F with calibration codes 3B and 4B there is not threshold and the bias is used for the adjustment of the central position of the valve.

Ramps see 4.3

The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current). The rise/fall time of the current is set via potentiometers on front panel up to a max. time of 10 sec. for 0-100% of reference signal. The option /RR allows up and down dissymmetrical ramps for each solenoid.
It is advisable to perform calibration procedures in the order given below.

6.1 Warning
- Never insert or remove the driver while the electronic system is powered on.
- Protect the regulator on power line with an external fuse (2,5A RTV for version E-BM-AC-01F and E-BM-AC-05F; 5A RTV for E-BM-AC-011F).
- Refer to section [2] to identify components mentioned in calibration procedures.
- It is possible to install the E-BM-AC driver on front panel (drilling plane 33,5x68,5 mm) or on back panel DIN guide (see fig. [3]).

The electrical connection is made on the clamps of the proper UNDECAL type E-K-11B socket, equipped with antivibrating spring.

6.2 Start-up
Factory pre-set adjustments might not meet the requirements desired for the specific application. Performances can be optimized by on-site re-adjustments of Bias, Scale and ramps potentiometers, in sequence.
- Connect the electronic driver according to the desired connection diagram, (see fig. [4]).
- The current supplied to the coil can be measured by a voltmeter connected between the test points on the front panel.
- The reading range will be: \([\text{mA}] = \frac{\text{V}[\text{mV}]}{R}\).

Bias adjustment (dead band compensation), see fig. [5] and [6].

For E-BM-AC-01F and E-BM-AC-11F:
- supply a reference signal voltage \(R_1 = +0,2 \text{ VDC}\);
- turn clockwise the potentiometer \(P_1\) for solenoid \(S_1\) until the movement of the controlled actuator is obtained.
- turn the potentiometer \(P_1\) in the opposite direction until the actuator is stopped.
- repeat the operation and supply a reference signal voltage \(R_2 = +0,2 \text{ VDC}\) by the potentiometer \(P_2\).

For E-BM-AC-05F:
- supply a reference voltage \(R_1 = +0,2 \text{ VDC}\);
- turn clockwise the potentiometer \(P_1\) for solenoid \(S_1\) until the movement of the controlled actuator is obtained.
- turn the potentiometer \(P_1\) in the opposite direction until the actuator is stopped.
- repeat the operation and supply a reference signal voltage \(R_1 = -0,2 \text{ VDC}\) by the potentiometer \(P_2\).

Scale adjustment (see fig. [5] and [6]).

Supply max. reference signal voltage \(R_1\) (for E-BM-AC-05F driver repeat for max. negative reference signal voltage \(R_1\)) in the specified range and turn scale potentiometer \(P_3\) (\(P_4\) for negative reference signal) until the actuator speed reaches the desired value.
- For version E-BM-AC-011F repeat the operation and supply the max positive reference signal \(R_2\) by the potentiometer \(P_4\).

Ramps, see fig. [5] and [6].

Turning the ramp potentiometer(s) clockwise, acceleration(s) and deceleration(s) can be reduced to obtain the optimization of the complete system.
**ELETTROMAGNETIC COMPATIBILITY**

Also electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of european directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

**E-BM-AC-0*F WIRING BLOCK DIAGRAM**

**E-BM-AC-01F and E-BM-AC-011F GENERAL CONNECTIONS**

**E-BM-AC-05F and E-BM-AC-01F/*B GENERAL CONNECTIONS**

**EARTH CONNECTIONS**
Electronic drivers type E-ME-AC
analog, Eurocard format, for proportional valves without transducer

E-ME-AC drivers control the current to the solenoid of Atos proportional valves without pressure or position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:
- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR and /RR-4 options) rising and falling ramp generator
- factory pre-setted
- Eurocard format (DIN 41494 modular unit)
- 4 internally generated reference signals, selectables by external ON-OFF signals (-4, /RR-4, /4R-4 options)
- electronic filters on input and output lines
- CE marking granting the conformity to the EMC Directive (Electromagnetic Compatibility)
- both sides of the card with shielded cover with E faston connector

Applications:
Pressure, flow, position open or closed-loop regulation systems, according to the block diagram.

MODEL CODE

E-ME-AC-01F (*)

CLOSE LOOP CONTROL (AXES CARD)

EXTERNAL GENERATOR

REFERENCE

CLOSE LOOP CONTROL (AXES CARD)

TRANSDUCER

ACTUATOR FEEDBACK

FLOW

PRESSURE

ACCELERATION

SPEED

POSITION

FORCE

DRIVING CURRENT

CURRENT AMPLIFIER

SCALE

DEAD BAND

RAMP

PROPORTIONAL VALVE

DRIVING CURRENT

ELECTRONIC DRIVER E-ME-AC-01F (*)

(*) dotted line for E-ME-AC-05F

OPTIONS:
- standard symmetrical ramp
- /RR = with adjustable dissymmetrical ramps
- /4 = with 4 reference potentiometers
- /RR-4 = with rising and falling ramps and 4 reference potentiometers
- /4R-4 = with 4 ramps and 4 reference potentiometers
- / = suitable to receive current reference signal 4-20 mA (not suitable with -4, /RR-4, /4R-4 options)

Table G035-11/E
4 GENERAL SPECIFICATIONS

4.1 Power supply and wirings
The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier, use a 10000 μF/400V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700 μF/400V capacitor (see ).

4.2 Reference signal
The electronic driver is designed to receive voltage or current reference signals according to the following options:

- internal potentiometers mounted on board, see ;
- external reference signals, see .

4.3 Monitor signal
This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter on the front panel test points (see ). Reading scale is 1 mV = 1 mA.

4.4 Set code
Basic calibration of the electronic driver is factory preset according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

- = RZGO, KZGO
- = DHZO, DKZOR
- = DPZO-A=*5, DPZO-A=*7
- = QV*ZO(R), LIQZO

For ex-proof valves, insert an “A” before the code of adjustment. For example, the code of adjustment for RZGA is A1 (see table E120).

4.5 Calibrations/settings available to the user
The Scale regulation, available on the front panel, permit to modify the relation between the reference signal and the regulated current to the solenoid. Modifying this regulation (see ) it is possible to fit the valve hydraulic behaviour to the effective system conditions; in addition, the two regulations available for double solenoid valves (driver E-ME-AC-05F) permit to set different hydraulic adjustments for positive and negative movements. The Scale regulation is factory set at standard values depending to the proportional valve to be controlled and it is identified by the driver set code (see 4.4).

Bias
The bias regulations, available on the front panel, permit to set the correspondence between the electrical zero of the reference signal with the beginning of the valve’s hydraulic regulation, compensating the dead band and the component’s mechanical tolerances. Modifying this regulation (see ) it is possible to fit the valve hydraulic behaviour to the effective system conditions; in case of drivers for double solenoid valves (E-ME-AC-05F) the bias are active only when the reference signal is over the threshold value of a ± 100 mV.

5 EXTERNAL REFERENCE SIGNALS
The available ramp regulations depend on the driver version:
- in the standard version it is available a single regulation for rise/fall ramp (P7)
- in the /RR version it is possible to separately regulate the rise ramp and the fall ramp (P7 and P17)
In the version -4R-4 it is possible to separately regulate the ramp for each of the internal reference signals (P11-P12-P13-P14).

External ramps, see [Diagram]
This feature allows to regulate the ramp time by means of external potentiometers. In order to use this capability:
- set switch SW1 in position 2
- connect one or more external potentiometers as shown (use only 2,5 MΩ potentiometers).

Internal reference signals
In the version -4, /RR-4 and /4R-4 the driver can self generate 4 different internal reference signals, selectable by means of 4 relevant on-off commands 24 VDC, to be supplied to the contacts 22c, 24c, 24a, 22a (see scheme [Diagram] each internal reference signal can be adjusted by means of a relevant potentiometer available on the front panel.

7 INSTALLATION AND START-UP
It is advisable to perform calibration procedures in the order given below.

7.1 Warning
- Never insert or remove the driver while the electronic system is powered on.
- Voltages must always be measured with reference to GND (connector contact 8a or front panel test point)
- Refer to [Diagram] to identify components mentioned in calibration procedures.

7.2 Start-up
Factory pre-set adjustments might not meet the desired requirements for the specific application and performances can be optimized by on-site re-adjustments of Bias, scale and ramps potentiometers, in sequence.
- Connect the electronic driver according to the desired connection diagram, [Diagram]
The current supplied to the coil can be measured by a voltmeter connected between the test points on the front panel.
For E-ME-AC-05F the channel enabled led (LS or L6) shows the supplied coil.

Enabling signal, see [Diagram]
The electronic driver operate when the contact 18a is supplied with an enabling signal (usually 24VDC). It could be useful in emergency conditions to inhibit the driver by zeroing this signal.

Bias adjustment (Dead band compensation), see [Diagram]
- Supply a reference signal voltage (0V DC for E-ME-AC-01F and ± 0,1VDC for E-ME-AC-05F).
- Gradually turn bias potentiometer(s) until a movement of the controlled actuator is obtained
- Turn in the opposite direction until the actuator is stopped.

Scale adjustment, see [Diagram]
Supply max reference voltage signal (for E-ME-AC-05F driver repeat for max negative voltage) in the specified range and turn scale potentiometer(s) until the actuator speed reaches the desired value.

Ramps, see [Diagram]
Turning the ramp potentiometer(s) clockwise, acceleration(s) and deceleration(s) can be reduced to obtain optimization of the complete system.

9 E-ME-AC-05F TOPOGRAPHICAL VIEW OF REGULATIONS

10 E-ME-AC-01F ADJUSTMENT

11 E-ME-AC-05F ADJUSTMENT
ELETTRONIC COMPUTER 

**ELETTROMAGNETIC COMPATIBILITY**

Atos electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

**SAFETY**

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be paid to switch-on/s Northwest of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

**IMPORTANT INSTRUCTIONS**

1. **Connectors Type**
   - SP-666 (see K500 table)

2. **Driving Current**
   - 24 Vcc
   - +5 Vcc: 50 mA
   - +15 Vcc: 25 mA
   - -5 Vcc: 50 mA
   - -15 Vcc: 20 mA

3. **Reference Input (+24 Vcc)**
   - REF. 1
   - REF. 2
   - REF. 3
   - REF. 4

4. **Enable (+24 Vcc)**
   - REF. 1
   - REF. 2
   - REF. 3
   - REF. 4

5. **Coil S1**
   - Coil S1
   - Coil S2

6. **Note:** S1 and S2 solenoids are referred respectively to B port side and A port side.

**WIRING BLOCK DIAGRAM**

**GENERAL CONNECTIONS**

**EARTH CONNECTIONS**

**NOTE:** only for E-ME-AC-05F
Electronic drivers type E-ME-T
analog, Eurocard format, for proportional valves with transducer

E-ME-T drivers control the current to the solenoid of Atos proportional valves with position transducer, regulating the spool position or the flow according to the electronic reference signal, adjusted by transducer’s feedback.

Features:
- bias regulation
- scale and dissymmetrical ramps regulation
- voltage (standard) or current (/I option) reference signal
- voltage (standard) or current (/C option) feedback signal
- test point for reference and feedback control on front panel
- factory pre-setted
- Eurocard format (DIN 41494 - plug-in unit)
- electronic filters on input and output lines
- CE marking granting the conformity to the EMC Directive (Electromagnetic compatibility)
- both sides of the card with shielded cover with E faston connector

Applications:
Position or flow open or closed-loop regulation systems, according to the block diagram 2

MODEL CODE
E-ME - T - 01H

E-ME = electronic driver in Eurocard format
T = driver for -T proportional valve with transducer
01H = for single solenoid proportional valves
05H = for double solenoid proportional valves

Set code (see 4.4)
Series number

Options:
- = standard with rising and falling ramps
/I = suitable to receive current feedback signals 4 ÷ 20 mA (available only for ex-proof and armoured valves)
/C = suitable to receive current reference signal 4 ÷ 20 mA.

Table G140-15/E
G140
## MAIN CHARACTERISTICS OF E-ME-T ELECTRONIC DRIVERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power supply</strong></td>
<td>Stabilized : 24 VDC</td>
</tr>
<tr>
<td>(positive at contacts 2a, 2c)</td>
<td>Rectified and filtered : Vrms = 21 + 33 VDC (max ripple 2 Vpp)</td>
</tr>
<tr>
<td><strong>Max power consumption</strong></td>
<td>50 W</td>
</tr>
<tr>
<td><strong>Current supplied to solenoids</strong></td>
<td>Imax = 3.3 A square wave PWM type (for ex-proof valves Imax = 2.5 A)</td>
</tr>
<tr>
<td><strong>Nominal reference signal, factory preset</strong></td>
<td>E-ME-T-01H : 0 ÷ 10 V at contact 12c (GND on 8a) (a 10 V option, see 4.4)</td>
</tr>
<tr>
<td></td>
<td>E-ME-T-05H : ±10 V at contact 12c (GND on 8a or 16c) for option f</td>
</tr>
<tr>
<td><strong>Reference signal variation range</strong></td>
<td>±10V (SW pos. 1) and ±5V (SW pos. 2)</td>
</tr>
<tr>
<td>(internal scale adjust option)</td>
<td></td>
</tr>
<tr>
<td><strong>Input signal impedance</strong></td>
<td>Voltage RSH = 50 kΩ - (0 option RSH = 316 kΩ)</td>
</tr>
<tr>
<td><strong>Potentiometer supply</strong></td>
<td>+10 V / 10 mA at contact 10c and -10 V / 10 mA at contact 14c</td>
</tr>
<tr>
<td><strong>Ramp time</strong></td>
<td>14 sec. max. (0 = 100% of reference signal)</td>
</tr>
<tr>
<td><strong>Enabling signal</strong></td>
<td>V = 5 ÷ 24 VDC on contact 8c with led indicator on panel</td>
</tr>
<tr>
<td><strong>Electrical wiring</strong></td>
<td>Coil : 2 x 1 mm² to 20 m, Transducer : 4 x 0.25 mm² to 20 m, 2 x 1.5 mm² shielded to 40 m</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>0 = 50 °C (storage -20 = +70 °C)</td>
</tr>
<tr>
<td><strong>Front panel dimensions</strong></td>
<td>128 x 4 x 35.3 mm</td>
</tr>
<tr>
<td><strong>Weights</strong></td>
<td>500 g</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td>Position control by PID action - Fast solenoid excitation and switching off. Outputs to solenoids protected against accidental short circuits. Feedback cable break produces an inhibition of the driver, zeroing the current and creating a fail-safe position in the valve. Only for set codes TH* or TK*: circuit to make linear the regulation characteristic of the valve.</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

#### 4.1 Power supply and wirings

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier, use a 100000µF/40V capacitor; if pulse voltage is generated by a three phase rectifier connect a 4700µF/40V capacitor (see 7).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC). It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.). Wire the earth connection as shown in 14 according to CEI EN 60204-1 standards. Connect the shield of the driver to the noiseless earth terminal (TE) 14.

#### 4.2 Reference signal

The electronic driver is designed to receive external voltage or current reference signals according to .

Note that drivers suitable to receive current reference (option f) have reference signal values in the range 4 = 20 mA 7.

#### 4.3 Enabling signal

The digital signal on contact 8c allows to enable (24 V DC) or disable (0 V) the driver without switching off the power supply; use this signal to cyclically inhibit the driver or in emergency conditions 7.

#### 4.4 Set code

Basic calibration of the electronic driver is factory preset according to the proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows.

- DHZO-T-05* = DH05SA
- DPZO-T-17* = DP17SD
- DLHZO-T-0°-T7 = TH04SA
- DHZO-T-30°-B = DH05SA
- DPZO-T-17°-B = DP17BD
- DLKZOR-T-11* = TK14SC
- DLKZOR-T-17°-B = DK16SA
- DPZO-T-17°-B = DP17SC
- DLKZOR-T-17° = DK16SA
- DLKZOR-T-17°-T = TK14SC
- DHZO-T-07* = DH07SA
- DPZO-T-67* = DP67SA
- LKZOR-T-10° = TH06SA
- DHZO-T-07°-B = DH07BA
- DPZO-T-67° = DP67BA
- LKZOR-T-10°-T = TH06SA
- DLKZOR-T-17°-T = DK17SA
- DPZO-T-17°-T = DP17TD
- DLKZOR-T-17°-T = DK17SD
- DLKZOR-T-17°-T7 = TK14SC
- DLKZOR-T-17°-T7 = TK14SC

For ex-proof valves, insert an "A" in the fifth digit of the code adjustment; for example, the code adjustment for DLHZA-T is DH04AA (see table E120).

#### 4.5 Calibration/setting available to the user

- **Scale**
  - The Scale regulation, available on the card side, permits to modify the relation between the reference signal and the position or the regulated flow.
  - Modifying this regulation it is possible to fit the valve hydraulic behaviour to the effective system conditions; in addition the two regulations available for double solenoid valves (driver E-ME-T-05H) permit to set different hydraulic adjustments for positive and negative movements.
  - The Scale regulation is factory set in order to control the max valve opening with 100% of the reference signal (10 V)

- **Bias** (dead band compensation)
  - The bias regulations, available on the front panel (P1, P2), permit to set the correspondence between the electrical zero of the reference signal with the beginning of the valve’s hydraulic regulation, compensating the dead band and the component’s mechanical tolerances.
  - Modifying this regulation (see 4.4) it is possible to fit the valve hydraulic behaviour to the effective system conditions; in case of drivers for double solenoid valves (E-ME-T-05H) the bias are active only when the reference signal is over the threshold value = ±200 mV. This regulation is factory set at the standard values depending to the proportional valve to be controlled and it is identified by the driver set code (see 4.4).

- **Ramps**
  - The ramp regulation, available on the front panel, permit to modify the time in which the valve reaches the set opening value in front of a step change of the reference signal.
  - The ramp regulation is factory set at value close to zero and it can be increased up to 14 sec max for a step change of the reference signal from 0% to 100%.

---

### 5 EXTERNAL REFERENCE SIGNALS

#### EXTERNAL CONNECTIONS

Solenoids S1 reference

**10 KΩ**

<table>
<thead>
<tr>
<th>Solenoid S2 reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

Potentiometers

Solenoids S1 and S2 reference

Differential external reference

**10 KΩ**

<table>
<thead>
<tr>
<th>Potentiometer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 KΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>10 KΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

### CONNECTIONS

**10 KΩ**

<table>
<thead>
<tr>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

**10 KΩ**

<table>
<thead>
<tr>
<th>Option 4 + 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>

**10 KΩ**

<table>
<thead>
<tr>
<th>Option 4 + 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 KΩ</strong></td>
</tr>
</tbody>
</table>
6 INSTALLATION AND START-UP

6.1 Warning:
- Do not insert or remove the driver while the electronic system is energized.
- Connect the electronic driver according to the desired connection scheme (see , ).
- The voltages must be always measured in reference to the GND (pin 8a of the connector).
- Refer to to identify the components mentioned in the setting procedure.
- To check the reference signal and the regulated valve opening, use the test points T1 and T2 on the front panel.
- To check the correct solenoid command for positive and negative regulations, use the two led S1 and S2 (only for drivers E-ME-T-05H).

6.2 Start-up
It is possible that the factory settings do not match the required performances for the specific application. The system can be optimized on field, by setting in sequence the bias, scale and ramp potentiometers.

It is advisable to perform calibration procedures in the order given below.

Bias adjustment (dead band compensation), see , , .
- Supply a reference signal voltage (0 VDC for E-ME-T-01H and ±0.2 VDC for E-ME-T-05H;
- Gradually turn potentiometer(s) (P1 for coil S1 and P2 for coil S2) until a movement of the control-actuator is obtained.
- Turn slowly in the opposite sense until stop is obtained.

Scale adjustment, see , , .
Set the switch A (see….) depending to the selected range of the reference signal.
In case it is required the regulation of the valve max opening, proceed as follow:
- Supply max reference signal (for E-ME-T-05H driver repeat for max negative voltage) in the specified range and turn counterclockwise internal scale potentiometers P5 and P6 (factory preset to 100%) to reduce valve opening (see -C).

Gain see , (only for adjustments TH* and TK*).
Front panel potentiometer P7 could be rotated to increase sensitivity and positioning accuracy of the axis (clockwise rotation = increase in sensitivity). Factory preset completely counterclockwise.

Ramps (see , ).
If the card is being used in an open loop system push the switch from position ramp off (standard) to position ramp on, (see -B). Calibrate the ramp settings only if dynamic impacts and tendencies towards instability persist after optimizations of the whole system. Adjust the ramp settings using the ramp potentiometers (P3 and P4) until the phenomenon has been eliminated (Clockwise rotation = increase in ramp time).

The two available regulations P3 and P4 permit to respectively regulate the ramp times for positive and negative variations of the reference signal. In case of application of the driver in closed loop systems, it is advisable to disable the ramp function: it is possible to permanently disable this function by means of a switch on the card side ( ) or temporarily, connecting the pin 6c and 8a ( ).

Gain, see (only for adjustments TH* and TK*). Pressure gain adjustment around “zero” increases sensitivity and positioning accuracy of the axis and optimize the valve operation according to the stiffness of the system by increasing the hydraulic gain of the valve around the hydraulic zero.

7 RAMPS AND SETTINGS

8 E-ME-T-05H TOPOGRAPHICAL VIEW OF REGULATIONS

9 E-ME-T-01H DIAGRAM

10 E-ME-T-05H DIAGRAM
**ELECTROMAGNETIC COMPATIBILITY**

Atos electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

**SAFETY**

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of European directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

### Wiring Block Diagram

Below is a wiring block diagram showing the connections for the electronic drivers and proportional valves. The diagram includes various components such as power supply, signal ground, reference, current feedback, and various other inputs and outputs. The connections are labeled with their respective voltages and currents.

### General Connections

The general connections section includes diagrams for different types of connections, such as enable, ramp exclusion, and fault. These connections are crucial for the proper operation of the electronic drivers and proportional valves.

### Earth Connections

The earth connections section shows the connections for protective earth and noiseless earth. This is important for ensuring the safety and compatibility of the electronic devices with the electrical system.
Electronic drivers type E-ME-L
analog, Eurocard format, for proportional valves with two transducers

E-ME-L drivers control the current to the solenoid of Atos proportional valves with position transducer, regulating the spool position or the flow according to the electronic reference signal, adjusted by transducers’s feedbacks.

Features:
- bias regulation
- scale and dissymmetrical ramps regulation
- voltage (standard) or current (/I option) reference signal
- voltage (standard) or current (/C option) feedback signal
- test point for reference and feedback control on front panel
- factory pre-setted
- Eurocard format (DIN 41494 - plug-in unit)
- electronic filters on input and output lines
- CE marking granting the conformity to the EMC Directive (Electromagnetic compatibility)
- both sides of the card with shielded cover with E faston connector

Applications:
Position or flow open or closed-loop regulation systems, according to the block diagram.

**MODEL CODE**

E-ME = electronic driver in Eurocard format

L = driver for -L proportional valve with two transducers

01H = for single solenoid proportional valves

**BLOCK DIAGRAM**
### 3 MAIN CHARACTERISTICS OF E-ME-L ELECTRONIC DRIVERS

| Power supply (positive at contacts 2a, 2c) | Rectified & filtered | Nominal \( V_{dc} = 24 \) \(|\pm 3 \times 10^{-3}| (max ripple = 2Vpp)\) |
|-------------------------------------------|----------------------|-------------------------------------------------|
| Max power consumption                      | 50 W                 |                                                  |
| Current supplied to solenoid              | \( I_{max} = 3,3A \) | FPGA type                                        |
| Nominal reference signal, factory preset   | E-ME-L-01H           | \( 0 \div 10 V \) at contact 12c (GND on 16ac) (\( \pm 10 V \) option see 4.2) |
| Ramping signal                            | 4 \times 20 mA at contact 12c (+) and 8a (-) |
| Input signal variation range, (internal scale adjust option) | \( \pm 10 V \) (SW pos. 1) and \( \pm 5 V \) (SW pos.2) | \( 0 \div 10 V \) (SW pos. 1) and \( 0 \div 5 V \) for valves with one external position (DPZO-L-*5, LIQZO-L-*2) |
| Input signal impedance                    | Voltage Ri > 50 KOhm - (If option Ri = 318 Ohm) |
| Potentiometers supply                     | +10 V / 10 mA at contact 10c and -10 V / 10 mA at contact 14c |
| Ramp time                                 | 14 sec. max          | (0 \( \div 100\% \) of reference signal) |
| Enabling signal                           | V = 5 \( \div 24 V \) on contact 8c with led indicator on panel; Ri \( \geq 30 k\Omega \) (max 3 mA) |
| Electrical wiring                         | Coil: \( 2 \times 1 \) mm² to 20 m; Transducer: \( 4 \times 0,25 \) mm² to 20 m; \( 4 \times 0,5 \) mm² shielded to 40 m |
| Card connector                            | Male DIN 41612 (D)   |                                                  |
| Connector elements available              | Type E-K-32M frame snap connector (see table G800) to be ordered separately |
| Front panel dimensions                    | 128,4 x 35,3 mm      |                                                  |
| Weight                                     | 520 gr.              |                                                  |
| Features                                   | Position control by PID action - Rapid solenoid excitation and switching off - Outputs to solenoids protected against accidental short circuits - Feedback cable break produces an inhibit of the driver, zeroing the current and creating a fail-safe position in the valve. |

### 4 GENERAL SPECIFICATIONS

#### 4.1 Power supply and wirings

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier, use a 10000µF/40V capacitor; if pulse voltage is generated by a three phase rectifier connect a 4700µF/40V capacitor (see diagram for connection type B).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC).

It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.).

Wire the earth connection as shown in diagram, according to CEI EN 60204-1 standards. Connect the shield of the driver to the noiseless earth terminal (TE) and take care that the earth connection cable is protected against accidental short circuits - Feedback cable break produces an inhibit of the driver, zeroing the current and creating a fail-safe position in the valve.

#### 4.2 Reference signal

The electronic driver is designed to receive external voltage or current reference signals according to diagram. Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC).

#### 4.3 Enabling signal

The enabling signal on contact 8c allows to enable (24 Vcc) or disable (0 V) the driver without switching off the power supply. Use this signal to cyclically inhibit the driver or in emergency conditions.

#### 4.4 Set code

Basic calibration of the electronic driver is factory preset according to proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follow:

- **DPZO-L-15** = DL15AA
- **DPZO-L-15/B** = DL15SB
- **DPZO-L-16** = DL16AA
- **DPZO-L-16/B** = DL16SB
- **DPZO-L-17** = DL17AA
- **DPZO-L-17/B** = DL17SB
- **DPZO-L-25** = DL25AA
- **DPZO-L-25/B** = DL25SB
- **DPZO-L-25/16** = DL25SB
- **DPZO-L-25/33** = DL25SB
- **DPZO-L-27** = DL27AA
- **DPZO-L-27/B** = DL27SB
- **DPZO-L-27/16** = DL27SB
- **DPZO-L-32** = DL32AA
- **DPZO-L-32/B** = DL32SB
- **DPZO-L-32/16** = DL32SB
- **DPZO-L-37** = DL37AA
- **DPZO-L-37/B** = DL37SB
- **DPZO-L-37/16** = DL37SB
- **DPZO-L-37/33** = DL37SB
- **DPZO-L-50** = DL50AA
- **DPZO-L-50/B** = DL50SB
- **DPZO-L-50/16** = DL50SB
- **DPZO-L-50/33** = DL50SB
- **DPZO-L-63** = DL63AA
- **DPZO-L-63/B** = DL63SB
- **DPZO-L-63/16** = DL63SB
- **DPZO-L-63/33** = DL63SB
- **DPZO-L-80** = DL80AA
- **DPZO-L-80/B** = DL80SB
- **DPZO-L-80/16** = DL80SB
- **DPZO-L-80/33** = DL80SB
- **DPZO-L-100** = DL100AA
- **DPZO-L-100/B** = DL100SB
- **DPZO-L-100/16** = DL100SB
- **DPZO-L-100/33** = DL100SB

(*) These codes have the main stage transducer connection different from standard (see diagram - connection type B) For ex-proof valves, insert an ‘A’ in the fifth digit of the code adjustment: for example, the code adjustment for DPZA-L-*5 is DL15AA (see table E120).

#### 4.5 Calibrations/settings available to the user

**Scale**, see diagram

The Scale regulation, available on the card side, permits to modify the relation between the reference signal and the position or the regulated flow. Modifying this regulation it is possible to fit the valve hydraulic behaviour to the effective system conditions; in addition the two regulations available for positive and negative reference signals permit to set different hydraulic adjustments for positive and negative movements.

The Scale regulation is factory set in order to control the max valve opening with 100% of the reference signal (10 V).
Installation and Start-up

6.1 Warning
- Do not insert or remove the driver while the electronic system is energized.
- Connect the electronic driver according to the desired connection diagram (see , ).
- The voltages must be always measured in reference to the GND (pin 16a of the connector).
- Refer to to identify components mentioned in the setting procedure.
- To check the reference signal and the regulated valve opening, use the test points T1 and T2 on the front panel.

6.2 Start-up
Factory preset adjustments may not meet the desired requirements for the specific application and performances can be optimized by on-site re-adjustments of bias, scale and ramps potentiometers, in sequence. It is advisable to perform calibration procedures in the order given below.

Bias adjustment (dead band compensation), see , .
- Supply a reference signal voltage = 0VDC.
- Gradually turn bias potentiometer P1 until a movement of the controlled actuator is obtained.
- Turn slowly in the opposite sense, until stop is obtained.

Scale adjustment
Factory preset reference signal is ± 10V (selector in position 1). If a 0 ÷ 5V (± 5V) reference signal is available, set selector in position 2 ( see -A).
- Only in particular cases when a non standard reference signal is available it is possible to adjust maximum valve opening with scale regulation proceeding as follow:
  - supply max reference signal voltage (repeat for max negative voltage) in the specified range and turn counterclockwise internal scale potentiometers P5 and P6 (factory preset to 100%) to reduce valve opening (see -C).

Ramps, see , .
The ramp regulation, available on the front panel, permit to modify the time in which the valve reaches the set opening value in front of a step change of the reference signal.
The ramp regulation is factory set at value close to zero and it can be increased up to 14 sec max for a step change of the reference signal from 0% to 100%.
The two available regulations P3 and P4 permit to respectively regulate the ramp times for positive and negative variations of the reference signal. In case of application of the driver in closed loop systems, it is advisable to disable the ramp function: it is possible to permanently disable this function by means of a switch on the card side ( ) or temporarily, connecting the pin 6c and 6a ( ).
**ELETTROMAGNETIC COMPATIBILITY**

Atos electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table.

The device must be verified on the machine because the magnetic field may be different from the test conditions.

**SAFETY**

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of european directives (Safety requirements of fluid technology systems and components—hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

**WIRING BLOCK DIAGRAM**

**GENERAL CONNECTIONS**

**EARTH CONNECTIONS**
Electronic drivers type E-RP-AC
analog, sealed and rugged box, for proportional valves without transducer

E-RP-AC drivers control the current to the solenoid of Atos proportional valves without pressure or position transducer, regulating the spool position, the flow or the pressure according to the electronic reference signal.

Features:
- bias and scale regulations by potentiometers
- symmetrical (standard) or dissymmetrical (/RR option) rising and falling ramp generator
- factory pre-setted
- alluminium box with IP65 protection degree
- power supply 24 Vdc or 12 Vdc (/12 option)
- electronic filters on input and output lines
- CE marking granting the conformity to the EMC Directive (Electromagnetic compatibility)

Applications:
Pressure, flow, position open or closed-loop regulation systems, according to the block diagram.

1 MODEL CODE

E-RP – AC – 01F – ** /**

E-RP = Electronic driver in sealed box
AC = for proportional valves without transducer
01F = for single solenoid proportional valves
05F = for double solenoid proportional valves

Options:
- = standard symmetrical ramp
/RR = with adjustable dissymmetrical ramps
/RRE = with external ramp setting
= suitable to receive current reference signal 4 ÷ 20 mA

Set code (see 4.4)
Series number

Options:
= 24 Vdc power supply
/12 = 12 Vdc power supply (see 4.1)

2 BLOCK DIAGRAM

ELECTRONIC DRIVER E-RP-AC-01F (*)

* dotted line for E-RP-AC-05F
### MAIN CHARACTERISTICS OF E-RP-AC ELECTRONIC DRIVERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (positive at contacts 1)</td>
<td>Rectified &amp; filtered: V_{AC} = 21 ± 33 (max ripple = 2Vpp)</td>
</tr>
<tr>
<td>Max power consumption</td>
<td>50 W</td>
</tr>
<tr>
<td>Current supplied to solenoid</td>
<td>I_{max} = 3.3A square wave PWM type; (for ex-proof valves I_{max} = 2.5A)</td>
</tr>
<tr>
<td>Nominal reference signal, factory preset</td>
<td>E-RP-AC-OF5: +0.5V at contact 10 (GND on 11)</td>
</tr>
<tr>
<td>Reference signal variation range</td>
<td>± 10V max ± 2.5 V min</td>
</tr>
<tr>
<td>Input signal impedance</td>
<td>Voltage R &gt; 50 KOhm; - (option R = 316 Ohm)</td>
</tr>
<tr>
<td>Potentiometers supply</td>
<td>+5V / 50 mA at contact 8 and -5V / 10mA at contact 9</td>
</tr>
<tr>
<td>Ramp time</td>
<td>5 or 90 sec. max (0 -100% of reference signal) see</td>
</tr>
<tr>
<td>Enabling signal</td>
<td>V = 5 ÷ 24V on contact 7</td>
</tr>
<tr>
<td>Card format</td>
<td>Sealed box IP 65</td>
</tr>
<tr>
<td>Connections</td>
<td>14 contacts - terminal strip</td>
</tr>
<tr>
<td>Cable Clamp</td>
<td>Dimension PG7 - water proof - Cable Ø 5 = 6.5</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 ÷ 50 °C (storage -20 ÷ +70 °C)</td>
</tr>
<tr>
<td>Box dimensions</td>
<td>175 x 80 x 57 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>940 gr.</td>
</tr>
<tr>
<td>Features</td>
<td>Rapid solenoid excitation and switching off</td>
</tr>
<tr>
<td></td>
<td>Outputs to solenoids protected against accidental short circuits.</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

#### 4.1 Power supply and wirings

The power supply must be appropriately stabilized or rectified and filtered. If the power supply is generated by a single phase rectifier, use a 1000µF/40V capacitor; if pulse voltage is generated by a three phase rectifier, connect a 4700µF/40V capacitor (see table 4).

Connect the reference signal to the main electronic control by means of shielded and twisted cables. Pay attention: the negative and the positive poles must not be exchanged each other. Shield the wirings to avoid electromagnetic noise (EMC).

It is suitable to keep the driver and its cables far from any electromagnetic radiation source (like cables where high currents flow, electric motors, transformers, relays, solenoids, portable radio-transmitter, etc.). Wire the earth connection as shown in , according to CEI EN 60204-1 standards.

Connect the shield of the driver to the noiseless earth terminal (TE). The driver is designed to correctly work with 24 V (±20%) or 12 V (±20%) nominal voltage supply coupled with coils having a resistance from 2.0 Ω to 13.4 Ω, as shown in the side table.

#### 4.2 Reference signal

The electronic driver is designed to receive voltage or current reference signals, see table 5.

Note that drivers suitable to receive current reference (option I) have signal values in the range 4 to 20mA.

It is possible to use current option also for double channels drivers type E-RP-AC-OSF using the reference inversion signal on contact 12.

#### 4.3 Monitor signal

This voltage output signal allows to measure the current supplied to the coil, read by a voltmeter between the test points on the card (see ).

Reading scale is 1 mV = 1 mA. To visualize the signals use voltmeters with impedance >10 KΩ.

#### 4.4 Set code

Basic calibration of the electronic driver is factory pre-set according to proportional valve it has to be coupled with. These pre-calibrations are identified by a standard number in the model code as follows:

1 = RZGO, KZGO
2 = RZMO, AG*ZO, L*ZO
3 = DHZQ, DZKOR
4 = DPZO-A-*5, DPZO-A-*7
6 = VZG*20(R), LQZGO

For ex-proof valves, insert an “A” before the code of adjustment.

For example, the code of adjustment for RZQA is A1 (see table E120).

#### 4.5 Calibrations accessible to the user, see

The relation between driving current and reference signal can be regulated with the Scale adjustment. For single solenoid valves with two external operating positions, the reference signal is the same as the double solenoid driver. Separate Scale potentiometer for solenoid S1 and S2 enable the electronic driver to be set for different output currents, obtaining differential hydraulic operations.

**Bias (dead band)**

Regulation of dead band adjusts the hydraulic zero of the valve (adjustment of starting position) to the corresponding electrical zero. The electronic driver is factory preset for the valve it is coupled according to the set code (see section 4.4).

For double solenoid driver E-RP-AC-OSF a step function generator becomes active at an input reference voltage signal greater than ± 100 mV enabling start current set by Bias potentiometers S1 and S2 for independent solenoid Dead Band regulation.

---

### EXTERNAL REFERENCE SIGNALS

#### EXTERNAL POTENTIOMETERS

<table>
<thead>
<tr>
<th>SOLENOID S1 REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOLENOID S2 REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOLENOIDS S1 AND S2 REFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>10kΩ</td>
</tr>
</tbody>
</table>

#### EXTERNAL REFERENCE GENERATOR AND /I OPTION

#### EXAMPLE WITH THREE EXTERNAL RAMPS

<table>
<thead>
<tr>
<th>Ramp 1</th>
<th>Ramp 2</th>
<th>Ramp 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5Ω</td>
<td>2.5Ω</td>
<td>2.5Ω</td>
</tr>
</tbody>
</table>

#### EXTERNAL RAMPS - /RRE option

---

### EXTERNAL RAMP - /RRE option
7 INSTALLATION AND START-UP

It is advisable to perform calibration procedures in the order given below.

7.1 Warning
- Never insert or remove the driver connector while the electronic system is powered on.
- Voltages must always be measured with reference to GND (connector contact 11) or test point.
- Refer to the diagram to identify components mentioned in calibration procedures.

7.2 Start-up

Factory preset adjustments may not meet the desired requirements for the specific application and performances can be optimized by on-site re-adjustments of bias, scale and ramps potentiometers, in sequence.

- Connect the electronic driver according to the desired connection diagram (see diagram).
- The current supplied to the coil can be measured by a voltmeter connected between test point (current monitor and GND).

For E-RP-AC-05F the drive enabled led (S1 or S2) shows the supplied coil.

Enabling signal, see diagram.
The electronic driver operate when the contact 7 is supplied with an enabling signal (usually 24 VDC).

It could be useful in emergency conditions to inhibit the driver by zeroing this signal

Bias adjustment (Dead band compensation), see diagram.
- Supply a reference signal voltage (0V for E-RP-AC-01F and ±0,1 V for E-RP-AC-05F).
- Gradually turn bias potentiometer(s) until a movement of the controlled actuator is obtained.
- Turn in the opposite direction, until the actuator is stopped.

Scale adjustment, see diagram.
Supply max reference signal voltage (for E-RP-AC-05F driver repeat for max negative voltage) in the specificated range and turn scale potentiometer(s) until the actuator speed reaches the desired value.

Ramps, see diagram.
- Turning ramp potentiometer(s) clockwise acceleration(s) and deceleration(s) can be reduced to obtain optimization of the complete system.

9 E-RP-AC-05F TOPOGRAPHICAL VIEW OF REGULATIONS AND DIMENSIONS [mm]

The internal ramp generator circuit converts a step input signal into a slowly increasing output signal (solenoid current).

The rise/fall time of the current is set via potentiometer P1, to a maximum time of 5 or 90 sec (switch SW1) for 0 - 100% of reference signal.

The option /RR provides dissymetrical ramps, (P2) /RRE allows external ramp setting as shown in table

To switch off the ramp circuit connect contacts 13 and 14 on the electric connector.
**ELECTROMAGNETIC COMPATIBILITY**

Alto electronic drivers and proportional valves are designed according to the 2004/108/CE Directive (Electromagnetic Compatibility) and according to EN 50081-2 (Emission) and EN 50082-2 (Immunity) standards. The electromagnetic compatibility of electronic drivers is valid only for wirings realized according to the typical electric connections shown in this technical table. The device must be verified on the machine because the magnetic field may be different from the test conditions.

**SAFETY**

The electrical signals (for example reference signals, feedback and enable signal) of electronic drivers must not be used to realize safety conditions of the machine. This is in accordance with the provisions of european directives (Safety requirements of fluid technology systems and components-hydraulics, EN 982). Special attention must be payed to switch-on/switch-off of electronic drivers because they could produce uncontrolled movements of actuators operated by the proportional valves.

**WIRING BLOCK DIAGRAM**

NOTE: S1 and S2 solenoids are referred respectively to B port side and A port side.

**GENERAL CONNECTIONS**

**EARTH CONNECTIONS**
Digital electronic drivers type E-MI-AS-IR
DIN 43650 plug-in format, for proportional valves without transducer

E-MI-AS digital drivers are designed for mounting on the solenoid’s DIN connector of proportional valves without transducer. They supply and control the current to the solenoid according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the valve’s hydraulic regulation. E-MI-AS drivers can drive single or double solenoid proportional valve.

**Electrical Features:**
- Standard 5m cable connection (I) or M12 connector (M12 option)
- Infrared communication interface (IR to program the driver with Atos PC software
- 2 leds for diagnostics: driver status and solenoid status
- +5 Vcc output supply for external reference potentiometer (not available for /M12 option)
- Current reference input (I option)
- Plastic box with IP65 protection degree and standard DIN43650 plug-in format with double earth connection to allow double-side orientation
- CE mark according to EMC directive

**Software Features:**
- Setting of valve’s functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- Max power limitation (/W option)
- Selectable range of electronic reference analog input: voltage or current (I option)
- Complete diagnostics of driver status, solenoid and driver fault conditions
- Intuitive graphic interface

---

**Options, see section 4**
- standard version (with 5 m cable)
- current reference input
- with 5 poles M12 connector (*)
- power limitation function (see 6.7)

---

**Table: G020-7/E**

**MODEL CODE**

<table>
<thead>
<tr>
<th>Electronic driver plug-in format DIN 43650</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = driver for valves without transducer</td>
</tr>
<tr>
<td>S = digital execution</td>
</tr>
<tr>
<td>IR = Serial infrared communication interface</td>
</tr>
</tbody>
</table>

**Options, see section 4**
- standard version (with 5 m cable)
- current reference input
- with 5 poles M12 connector (*)
- power limitation function (see 6.7)

---

**BLOCK DIAGRAM**

---

(*) Note: ZH-5P female connector must be ordered separately.

---

(*) +5 Vcc / 5 mA output supply for external potentiometer not available for /M12 option
3 MAIN CHARACTERISTICS OF E-MI-AS-IR ELECTRONIC DRIVERS

| Nominal: +24 VDC Rectified and filtered: Vrms = 20 ÷ 27 VMAX (ripple max 10 % VPP) | Nominal: +12 VDC Rectified and filtered: Vrms = 10 ÷ 14 VMAX (ripple max 10 % VPP) |
| Max power consumption: 50 W |
| Current supplied to solenoids: IMAX = 2.7 A with +24 VDC power supply to drive standard proportional valves (3,2 Ω solenoid) IMAX = 3.3 A with +12 VDC power supply to drive proportional valves with /6 option (2,1 Ω solenoid) |
| Reference input signal (*) (CMD1 - see 4.2) Standard (voltage) /I option (current) Input range: 0 ÷ 10 Voc Input impedance: Ri > 50 kΩ Input range: 4 ÷ 20 mA / 0 ÷ 20 mA Input impedance: Ri = 500 Ω |
| Enable Input Signal (CMD2 - see 4.5) ON/OFF Input Signal (CMD1,CMD2 - see 4.6) Input range: 0 ÷ 24 Voc (OFF state: 0 ÷ 5 Voc; ON state: 9 ÷ 24 Voc) Input impedance: Ri > 10 kΩ |
| Pressure transducer input (CMD2 - see 4.3) +5 V @ max 5 mA: output supply for external potentiometer (not available for /M12 option) |
| Output supply (see 4.4) Solenoid coil not connected, short circuit and cable break with current reference signal (I option) |
| Alarms Short circuit protection of current output to solenoid |
| Format Plastic box; IP65 protection degree (when fixed on solenoid); DIN43650 format |
| Operating temperature -20 ÷ +50 °C (storage -25 ÷ +85 °C) |
| Mass Standard version: 450 g; /M12 option: 70 g |
| Additional characteristics Short circuit protection of current output to solenoid |
| Communication interface Infrared, Atos protocol with ASCII coding; E-A-PS-USB/IR adapter is required (see section 3) |
| Wiring cable characteristics 2 poles x 0,5 mm² plus 4 poles x 0,35 mm², external diameter 7,4 mm |

(*) Note: Negative reference input signal not allowed.

4 SIGNALS SPECIFICATIONS

4.1 Power supply and wirings

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 driver power supply: 2.5 A fuse (4 A fuse when 12Voc power supply is applied) |

4.2 Reference Input Signal (CMD1: yellow/pin 4, referred to AGND: white/pin 3)

The driver proportionally transforms the external reference signal input into the current supplied to the solenoid.

The driver is designed to receive one analog reference input (CMD1 on yellow/pin 4) referred to the analog electric ground (AGND on white/pin3) and with a maximum range of 0 ÷ 10 V. Internal reference generation is software selectable (see 6.6).

Option /I (current reference input)

The reference input signal maximum range is software selectable among current 4 ÷ 20 mA (with cable break detection) or 0 ÷ 20 mA.

4.3 Pressure Input Signal (CMD2: blue/pin 5, /W option)

When hydraulic power limitation is active (see 6.7), enable input (CMD2) is managed as an analog input and has to be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 ÷ 10 Voc.

4.4 Output supply for external potentiometer - (OUTPUT SUPPLY: green, referred to AGND: white) not available for /M12 option

The reference analog signal can be generated by an external potentiometer directly connected to the driver, using the +5Voc supply output available at green wire thus generating the desired reference signal.

4.5 Enable Input Signal (CMD2: blue/pin 5, referred to AGND: white/pin 3)

Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the driver, it is used to maintain active the infrared connection and the other driver functions when the valve must be deactivated for safety reasons.

Enable the driver, supply a 24Voc on CMD2 (blue/pin 5, referred to white/pin 3). The polarity of the enable input can be customized and the enable function can be deactivated, see table at side.

4.6 ON/OFF Input Signals (CMD1: yellow/pin 4, CMD2: blue/pin 5)

When the driver is configured in internal reference generation mode (see 6.6), both reference input (CMD1) and enable input (CMD2) are managed as ON/OFF input signals. In this mode they are used to select the active reference signal, among the available stored values.

4.7 Possible combined options: /M12, /IM12W, /IW and /M12W.

5 SOFTWARE TOOLS

The driver configuration and parameters can be easily set with the E-SW-PS programming software.

The E-A-PS-USB/IR (dedicated adapter (usb to infrared)) is required between the PC and the electronic driver.

For a more detailed description of software interface, PC requirements and adapter characteristics please refer to tab. G500.

Programming software, must be ordered separately:

E-SW-PS (mandatory - first supply) = Dvd including E-SW-PS software installer and operator manuals; It allows the registration to Atos digital service E-SW-PS-N (optional - next supplies) = as above but not allowing the registration to Atos digital service

On first supply of the E-SW-PS software, it is required to apply for the registration in the Atos download area : www.downloadatos.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 you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

Adapter, must be ordered separately

E-A-PS-USB/IR = adapter from USB connector (PC communication port) to driver infrared communication interface: plug the adapter on the driver to establish the infrared communication
# MAIN SOFTWARE PARAMETER SETTINGS

The following is a brief description of the main settings and features of E-MI-AS drivers.

For a detailed description of all available settings, wirings and installation procedures, please refer to the programming manuals E-MAN-MI-AS included in the E-SW-PS Dvd (see section 5).

## 6.1 Scale

Scale function allows to set the maximum current supplied to the solenoid, corresponding to the max valve regulation, at maximum reference signal value. This regulation allows to adapt the maximum current supplied from the driver to the specific nominal current of the proportional valves to which the driver is coupled. It is also useful to reduce the maximum valve regulation in front of maximum reference signal.

## 6.2 Bias and Threshold

Proportional valves may be provided with a dead band in the hydraulic regulation corresponding to their switch-off status. This dead band discontinuity in the valve’s regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

The Bias function is activated when the reference signal overcome the Threshold value, preset into the driver.

The Bias setting allows to calibrate the Bias current supplied to the solenoid of the specific proportional valve to which the driver is coupled.

The Threshold setting is useful to avoid undesired valve regulation at zero reference signal when electric noise is present on the analog input signal: smaller threshold reduces the reference signal dead band, greater values are less affected by electric noise presence.

If internal reference generation is active (see 6.6), threshold should be set to 0.

## 6.3 Ramps

The ramp generator allows to convert sudden change of electronic reference signal into smooth time-dependent increasing/decreasing of the current supplied to the solenoid.

Different ramp mode can be set:
- single ramp for any reference variation
- two ramps for increasing and for decreasing reference variations

Ramp generator is useful for application where smooth hydraulic actuation is necessary to avoid machine vibration and shocks.

If the proportional valve is driven by a closed loop controller, the ramps can lead to unstable behaviour, for these applications ramp function can be software disabled (default setting).

## 6.4 Dither

The dither is an high frequency modulation of the current supplied to the solenoid, to reduce the hysteresis of the valve’s regulation: a small vibration in the valve’s regulating parts considerably reduces static friction effects.

Dither frequency can be set in a range from 80 to 500 Hz (default value is 200Hz).

Lower dither setting reduces the hysteresis but also reduces the regulation stability. In some applications this can lead to vibration and noise: right setting usually depends on system setup.

Default dither is a valid setting for a wide range of hydraulic applications.

## 6.5 Linearization

Linearization function allows to set the relation between the reference input signal and the current supplied to the solenoid.

Linearization is useful for applications where it is required to linearize the valve’s regulation in a defined working condition (e.g. maximum pressure control at defined working flow).

## 6.6 Internal Reference Generation

Internal reference generation is software selectable. In this mode the 2 driver inputs (see 4.6) allow to select the desired solenoid current reference signal, among the different internal stored values: external control unit can thus manage complex machine profile by simple switching of the reference signal, by 2 digital inputs (see 4.6).

Each digital input combination corresponds to a different reference value; up to 4 different internal values are available:

<table>
<thead>
<tr>
<th>Internal generated references</th>
<th>CMD1</th>
<th>CMD2</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF1</td>
<td>0</td>
<td>24 Vdc</td>
</tr>
<tr>
<td>REF2</td>
<td>24 Vdc</td>
<td>0</td>
</tr>
<tr>
<td>REF3</td>
<td>0</td>
<td>24 Vdc</td>
</tr>
<tr>
<td>REF4</td>
<td>24 Vdc</td>
<td>0</td>
</tr>
</tbody>
</table>

A different ramp time value can be set by software for each available stored reference value.

## 6.7 Hydraulic Power Limitation (option /W)

E-MI-AS drivers with /W option electronically perform hydraulic power limitation on single solenoid valves:
- flow control valves (direct and pilot operated)
- directional control valves (direct and pilot operated) + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-“LQZ, tab. A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) and a pressure transducer, installed in the hydraulic system, has to be connected to the driver’s analog input CMD2 (see 4.3).

When the actual requested hydraulic power \(p \times Q\) (CMD2xCMD1) reaches the max power limit \((p1 \times Q1)\), internally set by software, the driver automatically reduces the flow regulation of the valve.

The higher is the pressure transducer feedback the lower is the valve’s regulated flow:

\[
\text{Flow regulation} = \min \left( \frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}, \frac{\text{Flow Reference [CMD1]}}{} \right)
\]

<table>
<thead>
<tr>
<th>reference signal for valve regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(p) (x) (Q)</td>
</tr>
<tr>
<td>pressure feedback</td>
</tr>
</tbody>
</table>

Regulation curve 1 with and without power limitation, \(p1 \times Q1 = \text{max power limit}\).


## DRIVER CONNECTIONS

<table>
<thead>
<tr>
<th>Standard cable wire color</th>
<th>M12 option pin</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATIONS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RED</td>
<td>1</td>
<td>V+</td>
<td>Power supply +24 V or +12 V (see 4.1)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td>BLACK</td>
<td>2</td>
<td>V0</td>
<td>Power supply 0 V</td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>3</td>
<td>AGND (Signal zero)</td>
<td>Ground for CMD1, CMD2 and OUTPUT SUPPLY</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td>GREEN</td>
<td>N.A.</td>
<td>OUTPUT SUPPLY</td>
<td>+5 V @ 5 mA; output supply for external potentiometer (not available for option /M12) (see 4.4)</td>
<td>Output - analog signal</td>
</tr>
</tbody>
</table>

The two input signals CMD1 and CMD2 can be managed as analog input or ON/OFF signals, their function depends on the selected software setting:

<table>
<thead>
<tr>
<th>Standard cable wire color</th>
<th>M12 option pin</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATIONS (software setting dependent)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>YELLOW</td>
<td>4</td>
<td>CMD 1</td>
<td>Reference analog input: 0 ÷ 10 V (4 ÷ 20 mA; 0 ÷ 20 mA for /I option)</td>
<td>Input - analog or digital</td>
</tr>
<tr>
<td>BLUE</td>
<td>5</td>
<td>CMD 2</td>
<td>Enable/disable the driver: 24 V/O (0 V/O)</td>
<td></td>
</tr>
</tbody>
</table>

8 DOUBLE SOLENOID VALVES OPERATION

It is possible to use two E-MI-AS drivers to operate one double solenoid proportional valve supplying the same analog signal to both CMD1 inputs reference. The enable input signal is used to select which driver/solenoid has to be active.

To operate double solenoid valves it is required to:
- parallel wire the two drivers (see following scheme).
- select opposite polarity (default and reverse) for the two enable signals (see 4.5)
- manage from PLC or machine unit: 1 analog reference signal corresponding to desired valve’s regulation and 1 ON/OFF signal to select the active solenoid.

### Dual Solenoid Connection Diagram

- **CMD 1**: reference input signal 0 ÷ 10 V
- **CMD 2**: S1/S2 solenoid enable 0 or +24 V
- **AGND**: signal zero
- **V+**: power supply +24 V
- **V0**: power supply 0 V

Numbers inside brackets are referred to 5 poles connector (option /M12)

### Diagnostic LEDs

It is possible to verify the actual status of solenoid command (yellow LED) and the driver status (green LED).

The following table details the possible displayed conditions:

- **Coil (Yellow LED)**
  - Light signal displayed: Coil status
  - Light Off: PWM command OFF
  - Light On: PWM command ON
  - Slow blinking: Solenoid not connected
  - Fast blinking: Short circuit on the solenoid

- **Status (Green LED)**
  - Light signal displayed: Driver status
  - Light Off: Absence of power supply
  - Light On: Malfunctioning
  - Slow blinking: Driver disabled or Alarm present
  - Fast blinking: Driver enabled

10 DIMENSIONS [mm] AND INSTALLATION

![Dimensions Diagram](image)
Digital electronic drivers type E-BM-AS
DIN-rail panel format, for proportional valves without transducer

E-BM-AS digital drivers supply and control the current to the solenoid of Atos proportional valves without transducer, according to the electronic reference input signal. The solenoid proportionally transforms the current into a force, acting on the valve spool or poppet, against a reacting spring, thus providing the hydraulic regulation.

E-BM-AS can drive up to two single or one double solenoid proportional valves.

**Electrical Features:**
- 4 fast plug-in connectors
- RJ45 connector for RS232 Serial communication to program the driver with the Atos PC software
- 4 leds for diagnostics: power supply presence, driver status, solenoid status (S1 and S2)
- ±5 VDC output supply for external reference potentiometers (P option)
- Electrical protection against reverse polarity of power supply
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

**Software Features:**
- Setting of valve’s functional parameters: bias, scale, ramps, dither
- Linearization function for the hydraulic regulation
- 2 selectable modes for electronic reference signal: external analog input or internal generation
- Max power limitation (W option)
- Selectable range of electronic reference analog inputs: voltage or current
- Complete diagnostics of driver status, solenoid and driver fault conditions
- Intuitive graphic interface

---

**Table G030-4/E**

<table>
<thead>
<tr>
<th>MODEL CODE</th>
<th><strong>E - BM</strong> - A S - PS - 01H / **</th>
</tr>
</thead>
<tbody>
<tr>
<td>Options see section 6</td>
<td></td>
</tr>
<tr>
<td>12 = 12 Vdc power supply</td>
<td></td>
</tr>
<tr>
<td>A = max current limitation for ex-proof valves</td>
<td></td>
</tr>
<tr>
<td>P = electrical supply for external potentiometers to generate reference signal</td>
<td></td>
</tr>
<tr>
<td>W = power limitation function (see 6.7)</td>
<td></td>
</tr>
<tr>
<td>01H = for single solenoid proportional valve</td>
<td></td>
</tr>
<tr>
<td>05H = for double solenoid or two single solenoid proportional valves</td>
<td></td>
</tr>
</tbody>
</table>

**GROUP CODE**

 only for 05H version
3 MAIN CHARACTERISTICS OF E-BM-AS ELECTRONIC DRIVERS

Power supply (see 4.1) Nominal: +24 Vdc Rectified and filtered: Vmin = 20 +/− 32 Vdc (ripple max 10 % Vpp)
Standard option /12 Nominal: +12 Vdc Rectified and filtered: Vmin = 10 +/− 14 Vdc (ripple max 10 % Vpp)
Max power consumption 50 W for 01H version; 100 W for 05H version
Current supplied to solenoids Imax = 2.7 A with +24 Vdc power supply to drive standard proportional valves (3.2 I2 solenoid)
Imax = 3.3 A with +12 Vdc power supply to drive proportional valves with /6 option (2.1 I2 solenoid)
Imax = 2.5 A with +24 Vdc power supply to drive ex-proof proportional valves (3.2 I2 solenoid) for /A option
Reference input signal (see 4.2) Voltage: range ±10 Vdc Current range ±20 mA
Input impedance: R1 > 50 kΩ Input impedance: R1 = 500 Ω
Enable and ON/OFF inputs (see 4.5, 4.7) Range: 0 +/− 24 Vdc (OFF state: 0 +/− 5 Vdc; ON state: 9 +/− 24 Vdc)
Input impedance: R1 > 10 kΩ
Output supply (see 4.4) ±5 Vdc @ max 10 mA: output supply for external potentiometers (only for /P option)
Status output (see 4.6) Output range: 0 +/− 24 Vdc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 1.4 A
Alarms Solenoid not connected, short circuit and cable break with current reference signal
Format Plastic box; IP20 protection degree; L 35 - H 7,5 mm rail mounting as per EN60715
Operating temperature -20 ÷ 20 °C (-20 ÷ 40 °C on 05H version for two single solenoid proportional valves; storage -25 ÷ 85 °C)
Mass 130 g
Additional characteristics Short circuit protection of current output to solenoids; protection against reverse polarity of power supply
Communication interface RS232 serial connection (not insulated), Atos protocol with ASCII coding (see section 8)
Recommended wiring cable LYYCY shielded cables: 0.5 mm² for length up to 40 m [1.5 mm² for power supply and solenoids]

4 SIGNALS SPECIFICATIONS
4.1 Power supply and wirings
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 driver power supply: 2.5 A fuse for 01H version and 5 A fuse for 06H version.

Option /12: This driver execution is designed to receive a 12 Vdc power supply and it is commonly used in mobile applications.

4.2 Reference Input Signals (pin B1 and B3, both referred to pin B2)
The driver proportionally transforms the external reference input signal into the current supplied to the solenoid.
The driver is designed to receive one (01H) or two (09H) analog reference inputs (CMD1 on pin B1, CMD2 on pin B3); both signals are referred to a common electric ground (CM- on pin B2).
The input range is software selectable among voltage (0 +/− 10 Vdc) or current (4 +/− 20 mA with cable break detection or 0 +/− 20 mA).
Default settings: 0 = 10 Vdc for two position valves; 0 = 10 Vdc for three position valves (see valve’s tech. table). Other ranges can be set by software. Internal reference selection is software selectable (see 6.6).
Note: software selection of analog input range (voltage or current) is applied to both signals CMD1 and CMD2.

4.3 Pressure Input Signal (pin B3 referred to pin B2, /W option)
When hydraulic power limitation is active (see 6.7), input signal CMD2 must be connected to an external pressure transducer installed on the hydraulic system; maximum input range 0 +/− 10 Vdc.

4.4 Output supply Signal for external reference potentiometers (P option)
The reference analog signals can be generated by one (01H) or two (09H) external potentiometers directly connected to the driver, using the ±5 Vdc supply output available at pin C3 and C4.

4.5 Enable Input Signal (pin D3 referred to pin D2)
Enable input signal allows to enable/disable the current supply to the solenoids, without removing the electrical power supply to the driver; it is used to maintain active the serial connection and the other driver functions when the valve must be disabled for safety reasons.
To enable the driver, supply a 24Vdc on pin D3 referred to pin D2.

4.6 Status Output Signal (pin D4 referred to pin D2)
Status output signal indicates fault conditions of the driver (short circuits, solenoids not connected, cable broken for 4 +/− 20mA input) and is not affected by Enable input signal status: fault presence corresponds to 0 Vdc, normal working corresponds to 24 Vdc.
When hydraulic power limitation function is active (see 6.7), status output signal can be software configured to indicate power limitation status: not active (0 Vdc) or active (24 Vdc).

4.7 ON/OFF Input Signals (pin C1...C4 referred to DGND pin B4)
When the driver is configured in internal reference generation mode (see 6.6), the 4 ON/OFF input signals (DI) are used to select the active reference signal, among the available stored values. If the 4 ON/OFF input signals (DI) are not active, the driver can be commanded by external analog reference. The polarity of the digital inputs can be customized: active status = +24 Vdc is the default setting.

Note: with /P option two ON/OFF signals are available as digital inputs (DI).

4.8 Possible combined options: /12W, /12PW, /AW, /PW and /AP (only for 05H); /12P and /AP (for 01H and 09H).

5 SOFTWARE TOOLS
The driver configuration and parameters can be easily set with the Atos E-SW-PS programming software.
A serial RS232 connection is required between the PC and the electronic driver.
For a more detailed description of software interface, PC requirements and cable/adapter characteristics please refer to technical tab. G500.

Programming software, must be ordered separately:
E-SW-PS (mandatory - first supply) = Dvd including E-SW-PS software installer and operator manuals; it allows the registration to Atos digital service
E-SW-PS-N (optional - next supplies) = as above but not allowing the registration to Atos digital service
On first supply of the E-SW-PS 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 you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

Cable and adapter, can be ordered separately:
E-C-PS-DB9/RJ45 = cross cable from DB9 connector (PC communication port) to RJ45 connector (driver communication port)
E-A-PS-USB/DB9 = adapter from DB9 to USB connector (PC communication port); required if the DB9 communication port is not available on the PC
6.6 Internal Reference Generation

Internal generation of reference values is software selectable. In this mode the 4 digital inputs of the driver (DI1..DI4) allow to activate the desired internal reference signal, among the different driver’s stored values: external control unit can thus manage complex machine profile by simple switching the reference signal, by 4 digital inputs (see 4.7).

The digital inputs are software configurable in 2 different reference selection mode:

- **Standard mode**
  - each digital input corresponds to a different value; up to 4 different internal values are available (2+2 with E-BM-AS-PS-05H driving two single solenoid valves)
  - Binary mode
  - each digital input combination corresponds to a different value; up to 15 different internal values are available (3+3 with E-BM-AS-PS-05H driving two single solenoid valves)

A dead band discontinuity in the valve’s regulation can be compensated by activating the Bias function, which adds a fixed preset Bias value to the reference signal (external input or internally generated).

6.7 Hydraulic Power Limitation (*W* option, only for drivers E-BM-AS-PS-05H)

E-BM-AS drivers with *W* option electronically perform hydraulic power limitation on:

- direct and pilot operated flow control valves
- direct and pilot operated directional control valves + mechanical pressure compensator
- variable displacement pumps with proportional flow regulator (e.g. PVPC-***LQZ***, tech.tab. A170)

The driver receives the flow reference signal by the analog external input CMD1 (see 4.2) or by the internal generator (see 6.6). A pressure transducer, installed in the hydraulic system, has to be connected to the driver’s analog input CMD2.

When the actual requested hydraulic power \( p_1 \times Q_1 \) (CMD2xCMD1) reaches the max power limit \( p_1 \times Q_1 \) set into the driver, the software automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve’s regulated flow:

\[
\text{Flow regulation} = \min \left( \frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [CMD2]}}, \frac{\text{Flow Reference [CMD1]}}{\text{Transducer Pressure [CMD2]}} \right)
\]

**6.7.1 - Ramp generator selection (standard mode)**

<table>
<thead>
<tr>
<th>DI1</th>
<th>DI2</th>
<th>DI3</th>
<th>DI4</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
<td>External</td>
</tr>
<tr>
<td>1/1</td>
<td>OFF</td>
<td>OFF</td>
<td>Generation 1</td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>OFF</td>
<td>OFF</td>
<td>Generation 2</td>
<td></td>
</tr>
<tr>
<td>2/1</td>
<td>OFF</td>
<td>OFF</td>
<td>Generation 3</td>
<td></td>
</tr>
<tr>
<td>2/2</td>
<td>OFF</td>
<td>OFF</td>
<td>Generation 4</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Don’t care*
The 4 fast plug-in connectors (A, B, C, D), included in the supply, provide simple wirings, easy driver’s replacement and the possibility to test the signals directly on the connectors.

<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>SOL S1</td>
<td>Current to solenoid S1</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td>A2</td>
<td>SOL S2 (*)</td>
<td>Current to solenoid S2</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>CMD1</td>
<td>Reference analog input: ±10 Vcc / ± 20 mA maximum range software selectable (see 4.2)</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>CMD-</td>
<td>Zero signal, ground for reference signals</td>
<td>Reference for ±5 Vcc output (AGND)</td>
</tr>
<tr>
<td>B3</td>
<td>CMD2 (*)</td>
<td>Reference analog input: ±10 Vcc / ± 20 mA maximum range software selectable (see 4.2)</td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>DGND</td>
<td>Optical insulated ground for on/off inputs (D11 = D14)</td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>Di1</td>
<td>Optical insulated on/off input 0 ÷ 24 Vcc referred to pin B4 (DGND) (see 4.7)</td>
<td>as standard</td>
</tr>
<tr>
<td>C2</td>
<td>Di2</td>
<td></td>
<td>as standard</td>
</tr>
<tr>
<td>C3</td>
<td>Di3</td>
<td></td>
<td>+5 Vcc @ 10 mA output supply to pin B2 (AGND)</td>
</tr>
<tr>
<td>C4</td>
<td>Di4</td>
<td></td>
<td>-5 Vcc @ 10 mA output supply to pin B2 (AGND)</td>
</tr>
<tr>
<td>D1</td>
<td>V+</td>
<td>Power supply 24 Vcc (see 4.1)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td>D2</td>
<td>V0</td>
<td>Power supply 0 Vcc</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>ENABLE</td>
<td>Enable (24 Vcc) or disable (0 Vcc) the driver (see 4.5)</td>
<td>Input - on/off signal</td>
</tr>
<tr>
<td>D4</td>
<td>STATUS</td>
<td>Fault (default) or software selected output (see 4.6)</td>
<td>Output - on/off signal</td>
</tr>
</tbody>
</table>

(*) Note: Only for double or two single solenoid driver (version 05H).

**2 FRONT PANNEL CONNECTOR AND LEDS**

**DIAGNOSTIC LEDS**

<table>
<thead>
<tr>
<th>POWER (GREEN LED)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light signal displayed</td>
<td>Power supply status</td>
</tr>
<tr>
<td>Light Off</td>
<td>Power OFF</td>
</tr>
<tr>
<td>Light On</td>
<td>Power ON</td>
</tr>
</tbody>
</table>

**STATUS (GREEN LED)**

<table>
<thead>
<tr>
<th>Light signal displayed</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver status</td>
<td>Light signal displayed</td>
</tr>
<tr>
<td>Fault conditions</td>
<td>Light Off or Light On</td>
</tr>
<tr>
<td>Driver disabled</td>
<td>Slow blinking</td>
</tr>
<tr>
<td>Driver enabled</td>
<td>Fast blinking</td>
</tr>
</tbody>
</table>

**S1 & S2 (YELLOW LEDS)**

<table>
<thead>
<tr>
<th>Light signal displayed</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coil status</td>
<td>Light signal displayed</td>
</tr>
<tr>
<td>PWM command OFF</td>
<td>Light Off</td>
</tr>
<tr>
<td>PWM command ON</td>
<td>Light On</td>
</tr>
<tr>
<td>Coil not connected</td>
<td>Slow blinking</td>
</tr>
<tr>
<td>Short circuit on the solenoid</td>
<td>Fast blinking</td>
</tr>
</tbody>
</table>

**REAR CONNECTIONS**

**CONNECTOR PIN | SIGNAL | TECHNICAL SPECIFICATIONS | NOTES**

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>/</td>
<td>Not connected</td>
</tr>
<tr>
<td>2</td>
<td>/</td>
<td>Not connected</td>
</tr>
<tr>
<td>3</td>
<td>/</td>
<td>Not connected</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Signal zero data line</td>
</tr>
<tr>
<td>5</td>
<td>RX</td>
<td>Driver receiving data line</td>
</tr>
<tr>
<td>6</td>
<td>TX</td>
<td>Driver transmitting data line</td>
</tr>
<tr>
<td>7</td>
<td>/</td>
<td>Not connected</td>
</tr>
<tr>
<td>8</td>
<td>/</td>
<td>Not connected</td>
</tr>
</tbody>
</table>

**DIMENSIONS [mm] AND INSTALLATION**

A, B, C, D connectors are included in the supply.
Digital position controllers type Z-ME-KZ
Eurocard format, for electrohydraulic closed loop controls

Z-ME-KZ digital axis controllers perform the position closed loop of linear or rotative hydraulic axes. The controller receives a position feedback from the axis transducer and it generates a reference signal to the proportional valve which regulates the hydraulic flow to the actuator.

The position feedback interfaces are SSI, incremental encoder, potentiometer or standard analog inputs (voltage or current) software selectable.

A front panel serial port is always present for configuration and monitoring of the controller. The controller can be operated in real time by external or internally generated reference signal. With external reference signal the actuator’s motion cycle can be managed by either analog or fieldbus reference input. With internally generated reference signal the actuator’s motion cycle can be managed by external or fieldbus on/off commands.

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 reference pressure/force signal is required.

Several auxiliary digital inputs/outputs are available and they can be used to synchronize other machine functions and to transmit information on the controller state.

**Electrical Features:**
- 4 digits front panel display to check and change parameters as well as for diagnostics
- Front panel DB9 connector for serial programming interface
- Front panel test points for debug and maintenance
- Eurocard format (DIN 41494 - Plug-in-units)
- CE mark according to EMC directive

**Software Features:**
- Internal generation of motion cycle
- Setting of axis’s dynamic response (PID) to optimize the application performances
- Software selectable range of electronic reference analog inputs: voltage or current
- Enhanced diagnostics of the axis status
- Intuitive graphic interface
- In field firmware update through standard serial communication
- Internal oscilloscope function
3 POSITION REFERENCE MODE

3.1 External reference generation

Z-ME-KZ controller regulates in closed loop the actuator position according to an external reference position signal and to the position feedback from the actuator transducer. It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

The external reference signal can be software selected among:

- Analog reference (a)
- Fieldbus reference (b)

The controller receives in real time the reference signal from the machine electronic central unit by means of the analog input (see section 2) or from the remote transducers that measure pressure or force; if the pressure or force tends to decrease under its reference signal, the position feedback from the actuator transducer is increased until the relevant reference value is achieved.

Fieldbus reference (b)

For fieldbus communication details, please refer to the controller user manual (see section 3).

3.2 Internal reference generation

Z-ME-KZ 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. It generates a reference signal for the proportional valve which regulates the hydraulic flow to the actuator.

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

Internal reference generation types examples

- Absolute a target position reference signal is internally generated for each motion phase; maximum speed, acceleration and deceleration 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
- Hold the controller holds the actual position

4 PRESSURE / FORCE CONTROL

Alternated pressure or force control can be added 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 at each 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 actual pressure or force is lower than the relevant reference signal.

Pressure or force control is active (see phase 2 and 4 at side) when the actuator actual pressure or force is higher than 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.
Hydraulic steering wheel in marine applications

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

Z-ME-KZ 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
- potentiometer 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-ME-KZ 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

Wood machinery

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

Z-ME-KZ controllers allow remote control, thanks to:
- internal reference generation with maximum speed and acceleration settings
- analog position transducer for simple and reliable solution
- pressure transducer for alternated pressure control
- fieldbus connection for remote 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-ME-KZ 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 alternated 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-ME-KZ 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 alternated force control
- auxiliary digital inputs/output to synchronize the machine functions
- fieldbus connection for machine remote control and advanced diagnostics
6 CONTROLLER CHARACTERISTICS

Power supply (see 11.1) Nominal: +24 Vdc Rectified and filtered: Vrms = 20 ÷ 32 Vmax (ripple max 10 % Vpp)
Max power consumption 10 W
Position transducer SSI, incremental encoder, potentiometer, analog
Analog Inputs Input range: voltage ±10 Vdc current 0 ÷ 20 mA Input impedance: Ri > 100 kΩ
Analog Outputs Output range: voltage ±10 Vdc @ max 10 mA current 0 ÷ 20 mA @ max 500 Ω load resistance
Digital Inputs Input range: 0 ÷ ±5 Vdc (OFF state), 16 ÷ 24 Vdc (ON state), 5 ÷ 16 Vdc (not accepted), Input impedance: Ri > 10 kΩ
Digital Outputs (*) Output range: 0 ÷ +24 Vdc (ON state > [power supply - 2 V]; OFF state < 1 V) @ max 30 mA
Enable input Range: 0 ÷ 5 Vdc (OFF state), 16 ÷ 24 Vdc (ON state), 5 ÷ 16 Vdc (not accepted); Input impedance: Ri > 10 kΩ
Fault output (*) Output range: 0 ÷ +24 Vdc (no fault state > [power supply - 2 V]; fault state < 1 V) @ max 50 mA
Analog reference outputs ±10 Vdc @ max 30 mA
Incremental encoder power supply +5 Vdc @ max 100 mA
Alarms Position transducer out of range, analog input out of range
Card format Eurocard 100x160 mm (Plug-in unit DIN 41494)
Card rear connector Male DIN 41612/D. Available frame snap connector type E-K-64M (see table G800) To be ordered separately
Operating temperature 0 ÷ 50 °C (storage -20 ÷ 70 °C)
Front panel dimensions 128,4 x 40 mm
Mass Approx. 250 g
Electromagnetic compatibility (EMC) According to Directive 2004/108/CE (Immunity: EN 50082-2; Emission: EN 50081-2)
Communication interface Serial -BC CANopen - see tab. G510 -BP PROFIBUS - see tab. G510
Communication physical layer serial RS232 (not insulated) CAN ISO11898 (optical insulated) RS485 (optical insulated)
Communication protocol Atos ASCII coding CANopen EN50325-4 + DS408 PROFIBUS DP ENS0170-2/EC61158

(*) Note: External negative voltage not allowed (e.g. due to inductive loads).

7 TRANSDUCER CHARACTERISTICS

7.1 Position transducers
The accuracy of the position control is strongly dependent to the selected position transducer. Four different transducer interfaces are available on the controller, depending to the system requirements: potentiometer, analog signal, SSI, and encoder, see 7.3. Transducers with digital interface (SSI and encoder) allow the user to get high resolution and accurate measures. Transducers with analog interface (potentiometer and analog signal) grant simple and cost effective solutions.

7.2 Pressure/force transducers
The accuracy of the pressure/force controls is strongly dependent to the selected pressure/force transducers (see section 7.3). 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 G465 for pressure transducers details). Load cell transducers allow the user to get high accuracy and precise regulations for alternated position/force controls. 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.

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

<table>
<thead>
<tr>
<th>Input type</th>
<th>Position</th>
<th>Pressure/force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller Interface</td>
<td>±10 V dc</td>
<td>±10 V dc - 4 ÷ 20 mA</td>
</tr>
<tr>
<td>Analog (3)</td>
<td>+10 V dc</td>
<td>+10 V dc - 4 ÷ 20 mA</td>
</tr>
<tr>
<td>SSI, digital (3)</td>
<td>+10 V dc</td>
<td>+10 V dc - 4 ÷ 20 mA</td>
</tr>
<tr>
<td>Incremental Encoder, digital</td>
<td>+10 V dc</td>
<td>+10 V dc - 4 ÷ 20 mA</td>
</tr>
</tbody>
</table>

Notes: (1) percentage of the total stroke; (2) provided by Z-ME-KZ controller; (3) magnetosonic transducer; for additional details contact Atos technical support.
8 FRONT PANEL DESCRIPTION

8.1 Keyboard and display
On the Z-ME-KZ front panel are available 4 function keys (ESC, ENT, UP, DWN), and a numeric display (4 digits plus sign) to allow the user to view and change the controller’s parameters as well as to display diagnostic messages. The following parameters can be accessed (viewed or changed) via corresponding menu structure:
- command and actual values
- analog input / output values
- digital input / output status
- position sensor indication
- force / pressure sensor indication
Parameter’s changes of the configuration, control gains, trigger conditions, internal cycle, fault monitoring are not allowed via front panel operations.

8.2 LED indication
The led indications are used to display the internal status (Active, OK) of the controller or the status of the digital IO of the Z-ME-KZ. There are 22 led divided in four different types:
- internal controller’s status (Active - OK)
- digital input status (I1 ÷ I8)
- digital output status (O1 ÷ O7)
- software programmable led (A1 ÷ A5) for specific functions

8.3 Test points
The test points present on the controller front panel can be used to monitor the actual position (X1) and the force / pressure (X2) value measured by the relevant transducers. Both signals are referred to the analog ground (┴) pin. The two signals are respectively connected to P_MONITOR+ (X1) and F_MONITOR+ (X2) analog output present on the rear connector of the controller card. These signals can be software set to show other signals available in the controller (see 11.8 and 11.9).

8.4 Communication ports
On the front panel of the Z-ME-KZ is always present a serial RS232 port to program the controller by the Atos Z-SW software (see section ). All the functional parameters of digital controller, like internal reference generation, controller dynamics, IO configurations, can be easily set and optimized by the user.
For -BP or -BC options a second communication port dedicated to the selected fieldbus connection is present on the controller. For -BP option the PROFIBUS-DP port is located on the front panel of the Z-ME-KZ controller. For -BC option the CANopen connection is located on the rear connector of the Z-ME-KZ controller.
Through the fieldbus communication only the real-time parameters may be exchanged:
- position, velocity and force / pressure reference
- position, velocity and force / pressure feedback
- controller commands and status
- diagnostic / error messages
For more information about the front panel settings and fieldbus communication, please refer to the controller user manual.

10 ELECTRONIC CONNECTIONS - 64 PIN REAR CONNECTOR

<table>
<thead>
<tr>
<th>pin</th>
<th>f</th>
<th>d</th>
<th>b</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>DO 7</td>
<td>(O)</td>
<td>DI 1</td>
<td>(I)</td>
</tr>
<tr>
<td>4</td>
<td>SSI clock +</td>
<td>(D)</td>
<td>DI 2</td>
<td>(I)</td>
</tr>
<tr>
<td>6</td>
<td>SSI clock -</td>
<td>(D)</td>
<td>DI 3</td>
<td>(I)</td>
</tr>
<tr>
<td>8</td>
<td>SSI data + / Inc Ua1 (D)</td>
<td>DI 4</td>
<td>(I)</td>
<td>F_INPUT -</td>
</tr>
<tr>
<td>10</td>
<td>SSI data - / Inc Ua1 (D)</td>
<td>DI 5</td>
<td>(I)</td>
<td>P_INPUT +</td>
</tr>
<tr>
<td>12</td>
<td>Inc Ua2 (D)</td>
<td>DI 6</td>
<td>(I)</td>
<td>P_INPUT -</td>
</tr>
<tr>
<td>14</td>
<td>Inc /Ua2 (D)</td>
<td>DI 7</td>
<td>(I)</td>
<td>F_TR1 +</td>
</tr>
<tr>
<td>16</td>
<td>Inc Ua0 (D)</td>
<td>DI 8</td>
<td>(I)</td>
<td>F_TR1 -</td>
</tr>
<tr>
<td>18</td>
<td>Inc /Ua0 (D)</td>
<td>ENABLE</td>
<td>(I)</td>
<td>P_TR +</td>
</tr>
<tr>
<td>20</td>
<td>Inc +5Vdc</td>
<td>(O)</td>
<td>DO 1</td>
<td>(O)</td>
</tr>
<tr>
<td>22</td>
<td>nc</td>
<td>FAULT</td>
<td>(O)</td>
<td>VALVE_MONITOR+</td>
</tr>
<tr>
<td>24</td>
<td>nc</td>
<td>nc</td>
<td>VALVE_MONITOR-</td>
<td>(I)</td>
</tr>
<tr>
<td>26</td>
<td>nc</td>
<td>DO 2</td>
<td>(O)</td>
<td>P_MONITOR+</td>
</tr>
<tr>
<td>28</td>
<td>CAN_GND</td>
<td>(F)</td>
<td>nc</td>
<td>AGND</td>
</tr>
<tr>
<td>30</td>
<td>CAN_L</td>
<td>(F)</td>
<td>CONTROL_OUTPUT+</td>
<td>(O)</td>
</tr>
<tr>
<td>32</td>
<td>CAN_H</td>
<td>(F)</td>
<td>F_MONITOR+</td>
<td>(O)</td>
</tr>
</tbody>
</table>

(1) Input - (O) Output - (D) Digital transducers - (PS) Power supply - (F) Fieldbus interface, only for -BC option
11 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.

11.1 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.
The controller is protected against overloads by a internal safety fuse: 3,15 A fuse.

11.2 Position reference input signal (P_INPUT+, P_INPUT-)
The controller allows to regulate the axis position in closed loop according to an external voltage or current reference input signal (P_INPUT+ and P_INPUT-), see 3.1. The analog input is a differential input type.
The input range and polarity are software selectable within the maximum range ±10 Vcc for voltage or 0 ÷ 20 mA for current; default setting is 0 ÷ 10 Vcc.
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.

11.3 Pressure or force reference input signals (F_INPUT+, F_INPUT-)
For alternated position/force (or position/pressure) control the Z-ME-KZ receives a second analog voltage or current reference input signal (F_INPUT+ and F_INPUT-) dedicated to the force (or pressure) closed loop control (see section 11.5). The analog input is a differential input type.
The input range and polarity are software selectable within the maximum range ±10 Vcc for voltage or 0 ÷ 20 mA for current; default setting is 0 ÷ 10 Vcc.
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.

11.4 Position transducer input signal
A position transducer must be always directly connected to the controller: digital SSI (SSI clock+, SSI clock-, SSI data+, SSI data-), digital Encoder (Inc Ua1, Inc Ua1, Inc Ua2, Inc /Ua2,Inc Ua0, Inc /Ua0), potentiometer or a generic transducer with analog interface (P_TR+,-P_TR-) can be used.
For transducers with analog interface the input range and polarity are software selectable within the maximum range ±10 Vcc for voltage or 0 ÷ 20 mA for current; default setting is 0 ÷ 10 Vcc.
Refer to position transducer characteristics to select the transducer type that matches the specific application requirements (see 7.1).

11.5 Force / pressure transducer input signal (F_TR1+, F_TR1-, F_TR2+, F_TR2-)
Analog remote pressure transducers or load cell with maximum ±10 Vcc signal range must be directly connected to the controller in case of alternated position/force (or position/pressure) control.
Refer to pressure/force transducer characteristics to select the transducer type that matches the specific application requirements (see 7.2).
The input range and polarity are software selectable within the maximum range ±10 Vcc for voltage or 0 ÷ 20 mA for current; default setting is 0 ÷ 10 Vcc.

11.6 Analog valve monitor input signal (VALVE_MONITOR+ , VALVE_MONITOR-)
The controller allows to monitor the regulation of the proportional valve which operates the hydraulic flow to the actuator (VALVE_MON+, VALVE_MON-).
The analog input is a differential input type.
The input range and polarity are software selectable within the maximum range ±10 Vcc for voltage or 0 ÷ 20 mA for current; default setting is 0 ÷ 10 Vcc.

11.7 Control output signal (CONTROL_OUTPUT+)
The error signal processed by the control algorithms generates the control output signal (CONTROL_OUTPUT+) for the external driver of the proportional valve which operates the hydraulic flow to the actuator.
The output range and polarity are software selectable within ±10 Vcc (for voltage) or 0 ÷ 20 mA (for current) maximum range referred to the analog ground (AGND); default setting is ±10 Vcc.

11.8 Position monitor output signal (P_MONITOR+)
The controller generates an analog voltage 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 Vcc maximum range referred to the analog ground (AGND); default setting is ±10 Vcc.
The P_MONITOR signal is also present on the front panel at test point X1.

11.9 Pressure or force monitor output signal (F_MONITOR+)
For alternated position/force (or position/pressure) control, the Z-ME-KZ generates an analog voltage output signal proportional to the actual pressure or force applied to the actuator end; the monitor output signals can be software set to show other signals available in the controller (e.g. analog reference, force reference).
The output polarity is software selectable within ±10 Vcc maximum range referred to the analog ground (AGND); default setting is ±10 Vcc.
The F_MONITOR signal is also present on the front panel at test point X2.

11.10 Enable Input Signal (ENABLE)
To enable the controller, a 24Vcc voltage has to be applied on pin d18 referred to pin b28.
When the Enable signal is set to zero the controller can be software set to perform one of the following actions:
- move forward or backward in open loop - default setting
- move forward and maintain in closed loop a predefined actuator’s position (hold position)
- maintain the actuator actual position in close loop control
- disable the controller functioning (control output set to zero)

11.11 Fault output signal (FAULT)
Fault output signal indicates fault conditions of the controller (alarm active, reference or transducer signal cable broken, max error exceeded, etc.).
Fault presence corresponds to 0 Vcc, normal working corresponds to 24 Vcc (pin d22 referred to pin b28).

11.12 Power supply signal for potentiometer position transducer (VREF -10Vcc, VREF +10Vcc)
Power supply for potentiometer position transducer may be generated from the controller card using the VREF -10Vcc and VREF +10Vcc signal max 30 mA.

11.13 Power supply for incremental encoder position transducer (Inc +5Vcc, GND)
Power supply for incremental encoder position transducer may be generated from the controller card using the +5Vcc max 100 mA.
11.14 Digital input signals (DI1 - DI8)
The 8 digital inputs can be used to trigger a command or to read a system state. For each input by the Z-SW software, it is possible to set the polarity and to match a proper condition within the following:
- start/stop/switch-over command in case of internal reference generation (see 3.2)
- specific operative command for hydraulic axis mode (referencing mode, jog mode, automatic mode)
- jog command
- disable pressure / force alternated control

11.15 Digital output signals (DO1 - DO7)
The 7 digital outputs can be used to generate digital signals useful to the system synchronization and for monitoring purpose. The digital outputs can be configured in polarity and all the channels can be independently programmed by the Z-SW software.
Typically the digital outputs are used to:
- set alarm condition related with the hydraulic axis working phase
- identify a particular working condition to synchronize other machine functionalities
- signal target position reached
- signal pressure / force control active
- signal tracking error

11.16 CANopen communication signals (only for /BC option)
For controllers with CANopen communication interface (only for /BC option), the connections are located on the rear connector: pin f28 (CAN_GND), pin f30 (CAN_L) and pin f32 (CAN_H).

12 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 managed in real-time 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 digital 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)

13 MAIN SOFTWARE PARAMETER SETTINGS
For a detailed descriptions of the available settings, wirings and installation procedures, please refer to the programming manual Z-MAN-ME-KZ included in the Z-SW-* Dvd programming software (see section 12).

13.1 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)

13.2 Position PID control dynamics parameters
Allow to optimize and adapt the position controller closed loop to the wide range of hydraulic system characteristics:
- PID (position) each part of the position controller closed loop algorithm (proportional, fine positioning advanced integral, derivative, feed forward, etc.) can be modified in order to match the application requirements.

13.3 Multiple pressure/force PID control dynamics parameters
Allow to optimize and adapt the pressure/force controller closed loop to the wide range of hydraulic system characteristics:
- PID (pressure/force) each part of the pressure/force controller closed loop algorithm (proportional, integral, derivative, feed forward, etc) can be modified in order to match the application requirements. Through Atos software or using dedicated digital inputs it is possible to select up to four different pressure/force PID parameters setting, stored into the controller. Switching the active setting of pressure/force PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.).

13.4 Control output signal parameters
Allow to configure the controller command for the proportional valve which regulates the hydraulic flow to the actuator:
- Scaling parameters define the correspondence of the command signal to the specific valve reference signal range
- Limit parameters define maximum/minimum range to detect possible alarm conditions

13.5 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 13.6)

13.6 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.)

13.7 Digital IO configuration
Allow to configure the controller’s digital inputs/outputs to trigger/generate signals from/to the external machine central unit:
- Polarity define the signal active state
- Trigger condition define the input state to run a predefined internal command (see 11.14)
- Output state define the digital output based on the internal controller state (see 11.15)

13.8 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).
14 WIRING BLOCK EXAMPLES

14.1 Position control - external analog reference - potentiometer actuator transducer

14.2 Alternated position/force control - external reference - SSI actuator transducer - 2 pressure transducers - CANopen

14.3 Alternated position/force control - internal reference generation - encoder actuator transducer - load cell - PROFIBUS-DP
Dział Handlowy i Produkcja
Bielsko-Biała, ul. Strażacka 60
Sekretariat Spółki

Marketing:
- produkcja zasilaczy, układów hydraulicznych
  tel. +48 33 829 56 60
  fax. +48 33 829 56 69
- elektrozawory, chłodnice, zawory nabojoowe, bloki zaworowe
  tel. +48 33 829 56 63
  tel. +48 33 829 56 79
- produkcja cylindrów
  tel. +48 33 829 56 65
- elementy cylindrów: rury, tłoczyska, dławnice, tłoki, końcówki
  tel. +48 33 829 56 62
  tel. +48 33 829 56 72
- Dział Konstrukcyjny
  tel. +48 33 829 56 65
  tel. +48 33 829 56 78
  tel. +48 33 829 56 68
  tel. +48 33 829 56 67
  tel. +48 33 829 56 97

Sprzedaż:
  - komponenty (elektrozawory, chłodnice, zawory nabojoowe, bloki zaworowe, dławnice, tłoki)
    tel. +48 33 829 56 78
  - cylindry, zasilacze, agregaty filtracyjne
    tel. +48 33 829 56 68
  - rury i tłoczyska *
    tel. +48 33 829 56 78
  *ul. Strażacka 41

Oddział Handlowy
Bielsko-Biała, ul. Strażacka 41

Sekretariat Oddziału

Marketing:
- dostawy do klientów OEM
  tel. +48 33 829 56 87
  fax. +48 33 815 88 68
- produkcja przewodów hydr., węże i końcówki
  tel. +48 33 829 56 80
  tel. +48 33 829 87 34
- filtry, pompę zębate, rozdzielacze, elementy zasilaczy
  tel. +48 33 829 56 60
  tel. +48 33 829 87 95
- pompę zębate, rozdzielacze, zawory, dzielniki strumienia*
  tel. +48 33 829 56 84
  tel. +48 33 829 87 36
- urządzenia do produkcji przewodów hydr.
  tel. +48 33 829 56 85
  tel. +48 33 829 87 30
- uszczelnienia do cylindrów*
  tel. +48 33 829 56 98
  tel. +48 33 829 56 99
- eksport
  export@hydro.com.pl

Sprzedaż:
- filtry, elementy zasilaczy*
  tel. +48 33 829 87 38
- elementy złączne, złącza pomiarowe, zawory*
  tel. +48 33 829 87 33
- uszczelnienia, manometry*
  tel. +48 33 829 87 40
- szybkociągca, przewody hydr*
  tel. +48 33 829 56 94
- eksport*
  tel. +48 33 829 87 32
- Spedycja Oddziału Handlowego*
  tel. +48 33 829 56 93
  *ul. Swit 37

Punkt Handlowy
Czeladź, ul. Wojkowicka 14a

biuro@hydro.com.pl

tel. +48 33 829 56 87
fax. +48 33 829 87 34

www.hydro.com.pl