Digital E-BM-TES/LES drivers
DIN-rail panel format, for proportional valves with one or two spool position transducers

E-BM-TES/LES
Digital drivers 1 supply and control, in closed loop, the position of the spool or poppet of direct and pilot operated proportional valves according to the electronic reference input signal.
TES execution operates direct operated directional/flow control valves with one integral spool position transducer.
LES execution operates pilot operated directional valves with two integral spool position transducers.
Option S adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation (see section 4).
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:
- up to 9 fast plug-in connectors 2
- USB port 3 always present - Mini USB type B
- DB9 fieldbus communication connector 4 for CANopen and 5 PROFIBUS DP
- RJ45 ethernet communication connectors 6 output and 7 input for EtherCAT, POWERLINK, EtherNet/IP, PROFINET
- 8 leds for diagnostics 8 (see 6.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +50 °C
- Plastic box with IP20 protection degree and standard DIN-rail mounting
- CE mark according to EMC directive

Software Features:
- Intuitive graphic interface
- Setting of valve’s functional parameters: bias, scale, ramps, dither
- Linearization function for hydraulic regulation
- Setting of PID gains
- Selection of analog IN / OUT range
- Complete diagnostic of driver status
- Internal oscilloscope function
- In field firmware update through USB port

1 MODEL CODE

<table>
<thead>
<tr>
<th>E-BM</th>
<th>T</th>
<th>ES</th>
<th>N</th>
<th>NP</th>
<th>01H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic driver in DIN rail panel format</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T = closed-loop one LVDT transducer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L = closed-loop two LVDT transducers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES = full</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternated P/Q control:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N = none</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S = closed loop pressure/force (see tech table GS002)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fieldbus interface, USB port always present:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NP = Not Present</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BC = CANopen</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>BP = PROFIBUS DP</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>EH = EtherCAT</td>
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<td></td>
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<tr>
<td>EW = POWERLINK</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EI = EtherNet/IP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP = PROFINET RT/IRT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Options, see section 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A = max current limitation for Ex-proof valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C = current feedback 4 ÷ 20 mA for remote transducers (only for option S)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l = current reference input and monitor 4 ÷ 20 mA (omit for voltage reference and monitor input ±10 Vdc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>= omit for direct valves and for pilot operated valves with two LVDT transducers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P = for pilot operated valves with one LVDT transducer (only for TES-N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01H = for single solenoid proportional valves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05H = for double solenoid proportional valves (only for TES)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

GS240
2 BLOCK DIAGRAM EXAMPLE

Fieldbus network

E-SW software

LVDT, T transducer

Solenoid power PWM

Pressure/force feedback - only for S option

Proportional valve

Hydraulic actuator

3 VALVES RANGE

<table>
<thead>
<tr>
<th>Valves</th>
<th>Directional</th>
<th>Flow</th>
<th>Directional</th>
<th>Cartridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Data</td>
<td>DHZO-T, DKLZO-T</td>
<td>DLHZO-T, DKLZO-T</td>
<td>DPZO-T, QVHZO-T, QVKZOR-T</td>
<td>DPZO-L, QVHZOR-T</td>
</tr>
<tr>
<td>Sheet</td>
<td>F165</td>
<td>F190</td>
<td>F172</td>
<td>F1412</td>
</tr>
<tr>
<td>Ex-proof Data</td>
<td>DHZA-T, DKZA-T</td>
<td>DLHZA-T, DKLKA-T</td>
<td>DPZA-T, QVLZA-T</td>
<td>-</td>
</tr>
<tr>
<td>Sheet</td>
<td>FX120</td>
<td>FX140</td>
<td>FX220</td>
<td>FX420</td>
</tr>
<tr>
<td>Driver model</td>
<td>E-BM-TEB</td>
<td>E-BM-TEB</td>
<td>E-BM-TEB</td>
<td>E-BM-TEB</td>
</tr>
</tbody>
</table>

4 ALTERNATED P/Q CONTROL - only for S option

S option on digital drivers adds the closed loop control of pressure (SP) or force (SF and SL) to the basic functions of proportional directional valves flow regulation. The alternated P/Q control operates according to the two electronic reference signals by a dedicated algorithm that automatically selects which control will be active time by time. The dynamics of the switching between the two controls can be regulated thanks to specific software setting, in order to avoid instability or vibrations.

Flow regulation is active when the actual system pressure/force is lower than the relevant input reference signal - the valve works normally to regulate the flow by controlling in closed-loop the spool/poppet position through the integral LVDT transducer.

Pressure/force control is activated when the actual system pressure/force, measured by remote transducers, grows up to the relevant input reference signal - the driver reduces the valve’s flow regulation in order to keep steady the system pressure/force. If the pressure/force tends to decrease under its input reference signal, the flow control returns active.

The dynamic response of pressure/force control can be adapted to different system’s characteristics, by setting the internal PID parameters using Atos PC software.

Up to 4 different PIDs are selectable to optimize the system dynamic response according to different hydraulic working conditions.

Alternated control configurations - software selectable

SP – flow/pressure control

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

SF – flow/force control

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

SL – flow/force control

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

General Notes:

- auxiliary check valves are recommended in case of specific hydraulic configuration requirements in absence of power supply or fault - see tech table EY105
- for additional information about alternated P/Q controls configuration please refer to tech table GS002
- Atos technical service is available for additional evaluations related to specific applications usage
**5 MAIN CHARACTERISTICS**

- **Power supplies** (see 8.1, 8.2) Nominal: +24 Vcc Rectified and filtered: -24 Vcc = 32 Vmax (ripple max 10 % Vcc)
- **Max power consumption** 50 W
- **Current supplied to solenoids** max = 3.0 A for standard driver max = 2.5 A for ex-proof driver (IA option)
- **Analog input signals** (see 8.3, 8.4) Voltage: range -10 Vcc (24 Vmax tolerant) Input impedance: R_i > 10 kΩ
- **Current**: range ±20 mA Input impedance: R_i = 500 Ω
- **Monitor outputs** (see 8.5, 8.6) Output range: voltage ±10 V @ max 5 mA current ±20 mA @ max 500 Ω load resistance
- **Enable input** Digital inputs (see 8.7) Range: 0 = 5 Vcc (OFF state), 9 = 24 Vcc (ON state), 5 = 9 Vcc (not accepted). Input impedance: R_i > 10 kΩ
- **Fault output** (see 8.8) Output range: 0 = 24 Vcc (ON state) > [power supply - 2 V] OFF state < 1 V @ max 50 mA, external negative voltage not allowed (e.g. due to inductive loads)
- **Alarms** Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
- **Pressure/Force transducers power supply** (only for S option) +24 Vcc @ max 100 mA (E-ATR-8 see tech table GS465)
- **Format** Plastic box; IP20 protection degree; L 35 - H 7.5 mm; DIN-rail mounting as per EN60715
- **Operating temperature** -20 +50 °C (storage -25 +85 °C)
- **Mass** Approx. 400 g
- **Electromagnetic compatibility (EMC)** According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)
- **Communication interface** USB CANopen PROFIBUS DP EtherCAT, POWERLINK, EtherNet/IP, PROFINET IO RT / IRT EN50170-2/IEC61158
- **Communication physical layer** not insulated optical insulated CAN ISO11898 optical insulated RS485 Fast Ethernet, insulated 100 Base TX
- **Recommended wiring cable** LIYCY shielded cables: 0.5 mm² max 50 m for logic - 1.5 mm² max 50 m for power supply Note: for transducers wiring cable please consult the transducers datasheet
- **Max conductor size** (see 12) 2.5 mm²

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

---

**6 CONNECTIONS AND LEDS**

- D connector is available only for TES-N versions 01HP / 05HP and LES-∗
- E connector is available only for TES-∗ versions 01H / 05H and LES-∗
- I, J and K connectors are available only for TES-S and LES-S

---

**6.1 Diagnostic LEDs**

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

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>PIN</th>
<th>ALTERNATED PIQ CONTROL</th>
<th>TECHNICAL SPECIFICATIONS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>V+</td>
<td>Power supply 24 Vdc</td>
<td>(see 8.1)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td>A2</td>
<td>V0</td>
<td>Power supply 0 Vdc</td>
<td>(see 8.1)</td>
<td>Gnd - power supply</td>
</tr>
<tr>
<td>A3</td>
<td>VL+</td>
<td>Power supply 24 Vdc for driver’s logic and communication (see 8.2)</td>
<td>Input - power supply</td>
<td></td>
</tr>
<tr>
<td>A4</td>
<td>VL0</td>
<td>Power supply 0 Vdc for driver’s logic and communication (see 8.2)</td>
<td>Gnd - power supply</td>
<td></td>
</tr>
<tr>
<td>B1</td>
<td>Q_INPUT+</td>
<td>Flow reference input signal: ±10 Vdc / ±20 mA maximum range Default are ±10 Vdc for standard and 4 × 20 mA for /I option (see 8.3)</td>
<td>Input - analog signal Software selectable</td>
<td></td>
</tr>
<tr>
<td>B2</td>
<td>INPUT-</td>
<td>Negative reference input signal for Q_INPUT+ and F_INPUT+</td>
<td>Input - analog signal</td>
<td></td>
</tr>
<tr>
<td>B3</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B4</td>
<td>EARTH</td>
<td>Connect to system ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1</td>
<td>Q_MONITOR</td>
<td>Flow monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to AGND. Default are ±10 Vdc for standard and 4 × 20 mA for /I option (see 8.7)</td>
<td>Output - analog signal Software selectable</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>ENABLE</td>
<td>Enable (24 Vcc) or disable (0 Vcc) the controller, referred to VL0 (see 8.7)</td>
<td>Input - on/off signal</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>FAULT</td>
<td>Fault (0 Vcc) or normal working (24 Vcc), referred to VL0 (see 8.8)</td>
<td>Output - on/off signal</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>LVDT_L</td>
<td>Main stage valve position transducer signal (see 8.9)</td>
<td>Input - analog signal</td>
<td></td>
</tr>
<tr>
<td>D2</td>
<td>-15V</td>
<td>Main stage valve position transducer power supply -15V</td>
<td>Output power supply</td>
<td></td>
</tr>
<tr>
<td>D3</td>
<td>+15V</td>
<td>Main stage valve position transducer power supply +15V</td>
<td>Output power supply</td>
<td></td>
</tr>
<tr>
<td>D4</td>
<td>AGND</td>
<td>Common gnd for transducer power and monitor outputs</td>
<td>Common gnd</td>
<td></td>
</tr>
<tr>
<td>E1</td>
<td>LVDT_T</td>
<td>Direct valve or pilot valve position transducer signal (see 8.9)</td>
<td>Input - analog signal</td>
<td></td>
</tr>
<tr>
<td>E2</td>
<td>-15V</td>
<td>Direct valve or pilot valve position transducer power supply -15V</td>
<td>Output power supply</td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>+15V</td>
<td>Direct valve or pilot valve position transducer power supply +15V</td>
<td>Output power supply</td>
<td></td>
</tr>
<tr>
<td>E4</td>
<td>AGND</td>
<td>Common gnd for transducer power and monitor outputs</td>
<td>Common gnd</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>SOL_S1-</td>
<td>Negative current to solenoid S1</td>
<td>Output - power PWM</td>
<td></td>
</tr>
<tr>
<td>F2</td>
<td>SOL_S1+</td>
<td>Positive current to solenoid S1</td>
<td>Output - power PWM</td>
<td></td>
</tr>
<tr>
<td>F3</td>
<td>SOL_S2-</td>
<td>Negative current to solenoid S2</td>
<td>Output - power PWM</td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td>SOL_S2+</td>
<td>Positive current to solenoid S2</td>
<td>Output - power PWM</td>
<td></td>
</tr>
<tr>
<td>I1</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I2</td>
<td>D_IN0</td>
<td>NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11) Fieldbus execution: general purpose digital input 0 × 24Vcc, referred to VL0 (see 8.11)</td>
<td>Input - on/off signal</td>
<td></td>
</tr>
<tr>
<td>I3</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J1</td>
<td>VF +24V</td>
<td>Power supply: +24Vcc or OFF (default OFF)</td>
<td>Output - power supply Software selectable</td>
<td></td>
</tr>
<tr>
<td>J2</td>
<td>F_TR1</td>
<td>1st signal pressure/force transducer: ±10 Vcc / ±20 mA maximum range Default are ±10 Vcc for standard and 4 × 20 mA for /C option (see 8.10)</td>
<td>Input - analog signal Software selectable</td>
<td></td>
</tr>
<tr>
<td>J3</td>
<td>AGND</td>
<td>Common gnd for transducer power and signals</td>
<td>Common gnd</td>
<td></td>
</tr>
<tr>
<td>J4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K1</td>
<td>VF +24V</td>
<td>Power supply: +24Vcc or OFF (default OFF)</td>
<td>Output - power supply Software selectable</td>
<td></td>
</tr>
<tr>
<td>K2</td>
<td>F_TR2</td>
<td>2nd signal pressure/force transducer (only for 3P): ±10 Vcc / ±20 mA maximum range Default are ±10 Vcc for standard and 4 × 20 mA for /C option (see 8.10)</td>
<td>Input - analog signal Software selectable</td>
<td></td>
</tr>
<tr>
<td>K3</td>
<td>AGND</td>
<td>Common gnd for transducer power and signals</td>
<td>Common gnd</td>
<td></td>
</tr>
<tr>
<td>K4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*

---

**Notes:***

- **A1** V+: Power supply 24 Vdc (see 8.1).
- **A2** V0: Power supply 0 Vdc (see 8.1).
- **A3** VL+: Power supply 24 Vdc for driver’s logic and communication (see 8.2).
- **A4** VL0: Power supply 0 Vdc for driver’s logic and communication (see 8.2).
- **B1** Q_INPUT+: Flow reference input signal: ±10 Vdc / ±20 mA maximum range. Default are ±10 Vdc for standard and 4 × 20 mA for /I option (see 8.3).
- **B2** INPUT-: Negative reference input signal for Q_INPUT+ and F_INPUT+.
- **B3** NC: Do not connect.
- **B4** EARTH: Connect to system ground.
- **C1** Q_MONITOR: Flow monitor output signal: ±10 Vdc / ±20 mA maximum range, referred to AGND. Default are ±10 Vdc for standard and 4 × 20 mA for /I option (see 8.7).
- **C2** ENABLE: Enable (24 Vcc) or disable (0 Vcc) the controller, referred to VL0 (see 8.7).
- **C3** NC: Do not connect.
- **C4** FAULT: Fault (0 Vcc) or normal working (24 Vcc), referred to VL0 (see 8.8).
- **D1** LVDT_L: Main stage valve position transducer signal (see 8.9).
- **D2** -15V: Main stage valve position transducer power supply -15V.
- **D3** +15V: Main stage valve position transducer power supply +15V.
- **D4** AGND: Common gnd for transducer power and monitor outputs.
- **E1** LVDT_T: Direct valve or pilot valve position transducer signal (see 8.9).
- **E2** -15V: Direct valve or pilot valve position transducer power supply -15V.
- **E3** +15V: Direct valve or pilot valve position transducer power supply +15V.
- **E4** AGND: Common gnd for transducer power and monitor outputs.
- **F1** SOL_S1-: Negative current to solenoid S1.
- **F2** SOL_S1+: Positive current to solenoid S1.
- **F3** SOL_S2-: Negative current to solenoid S2.
- **F4** SOL_S2+: Positive current to solenoid S2.
- **I1** NC: Do not connect.
- **I2** D_IN0: NP execution: multiple pressure/force PID selection, referred to VL0 (see 8.11). Fieldbus execution: general purpose digital input 0 × 24Vcc, referred to VL0 (see 8.11).
- **I3** NC: Do not connect.
- **I4** NC: Do not connect.
- **J1** VF +24V: Power supply: +24Vcc or OFF (default OFF).
- **J2** F_TR1: 1st signal pressure/force transducer: ±10 Vcc / ±20 mA maximum range. Default are ±10 Vcc for standard and 4 × 20 mA for /C option (see 8.10).
- **J3** AGND: Common gnd for transducer power and signals.
- **J4** NC: Do not connect.
- **K1** VF +24V: Power supply: +24Vcc or OFF (default OFF).
- **K2** F_TR2: 2nd signal pressure/force transducer (only for 3P): ±10 Vcc / ±20 mA maximum range. Default are ±10 Vcc for standard and 4 × 20 mA for /C option (see 8.10).
- **K3** AGND: Common gnd for transducer power and signals.
- **K4** NC: Do not connect.
6.3 Pressure/force transducers connection - only for S option

6.4 Communication connectors

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

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5V_USB</td>
<td>Power supply</td>
</tr>
<tr>
<td>2</td>
<td>D-</td>
<td>Data line -</td>
</tr>
<tr>
<td>3</td>
<td>D+</td>
<td>Data line +</td>
</tr>
<tr>
<td>4</td>
<td>ID</td>
<td>Identification</td>
</tr>
<tr>
<td>5</td>
<td>GND_USB</td>
<td>Signal zero data line</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SHIELD</td>
<td>Bus line (low)</td>
</tr>
<tr>
<td>3</td>
<td>DGND</td>
<td>Data line and termination signal zero</td>
</tr>
<tr>
<td>6</td>
<td>+5V</td>
<td>Termination supply signal</td>
</tr>
<tr>
<td>8</td>
<td>LINE-A</td>
<td>Bus line (high)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>CAN_L</td>
<td>Bus line (low)</td>
</tr>
<tr>
<td>3</td>
<td>CAN_GND</td>
<td>Signal zero data line</td>
</tr>
<tr>
<td>5</td>
<td>CAN_SHLD</td>
<td>Shield</td>
</tr>
<tr>
<td>7</td>
<td>CAN_H</td>
<td>Bus line (high)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>PIN</th>
<th>SIGNAL</th>
<th>TECHNICAL SPECIFICATION (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
<td>Transmitter - white/orange</td>
</tr>
<tr>
<td>2</td>
<td>RX+</td>
<td>Receiver - white/green</td>
</tr>
<tr>
<td>3</td>
<td>TX-</td>
<td>Transmitter - orange</td>
</tr>
<tr>
<td>6</td>
<td>RX-</td>
<td>Receiver - green</td>
</tr>
</tbody>
</table>

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

7 SET CODE
The basic calibration of electronic driver is factory preset, according to the proportional valve to be coupled. These pre-calibrations are identified by the set code at the end of driver’s model code (see section [3]). For correct set code selection, please include in the driver order also the complete code of the coupled proportional valve. For further information about set code, please contact Atos technical office.

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

Generic electrical output signals of the valve (e.g. fault or monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine’s safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, ISO 4413).

8.1 Power supply (V+ and V0)
The power supply (pin A1 and A2) must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

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

8.2 Power supply for driver’s logic and communication (VL+ and VL0)
The power supply (pin A3 and A4) for driver’s logic and communication must be appropriately stabilized or rectified and filtered: apply at least a 10000 μF/40 V capacitance to single phase rectifiers or a 4700 μF/40 V capacitance to three phase rectifiers.

The separate power supply for driver’s logic, allow to remove solenoid power supply from pin A1 and A2 maintaining active the diagnostics, USB and fieldbus communications.

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

8.3 Flow reference input signals (Q_INPUT+)
The driver is designed to receive an analog reference input signal (pin B1) for the valve’s spool position.

Reference input signal is factory preset according to selected valve code, defaults are ±10 Vcc for standard and 4 ÷ 20 mA for S option.

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

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus interface).

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

8.4 Pressure or force reference input signal (F_INPUT+) - only for S option
Functionality of pressure or force input reference signal (pin B3), is used as reference for the driver’s pressure/force closed loop, see section [3].

Reference input signal is factory preset according to selected valve code, defaults are ±10 Vcc for standard and 4 ÷ 20 mA for S option.

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

Drivers with fieldbus interface can be software set to receive reference signal directly from the machine control unit (fieldbus interface).

⚠️ A safety fuse is required in series to each driver’s logic and communication power supply: 500 mA fast fuse.
8.5 Flow monitor output signal (Q. MONITOR)
The driver generates an analog output signal (pin C1) proportional to the actual spool position; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference, valve spool position).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ± 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

8.6 Pressure or force monitor output signal (F. MONITOR) - only for S option
The driver generates an analog output signal (C3) proportional to actuator force/pressure control; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, force reference).
Monitor output signal is factory preset according to selected valve code, defaults are ±10 VDC for standard and 4 ± 20 mA for /I option.
Output signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.

8.7 Enable input signal (ENABLE)
To enable the driver, supply 24 VDC on pin C2: Enable input signal allows to enable/disable the current supply to the solenoid, without removing the electrical power supply to the digital driver; it is used to activate the communication and the other driver functions when the valve must be disabled for safety reasons. This condition does not comply with norms IEC 61508 and ISO 13849.
Enable input signal can be used as digital input by software selection.

8.8 Fault output signal (FAULT)
Fault output signal (pin C4) indicates fault conditions of the driver (solenoid short circuits/not connected, reference or transducer signal cable broken, maximum error exceeded, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the status of the Enable input signal.
Fault output signal can be used as output signal by software selection.

8.9 Main stage and direct or pilot position transducer input signals (LVD_T, LVD_T)
Main stage (LVD_T pin D1) and direct or pilot (LVD_T pin E1) position transducer integrated to the valve have to be directly connected to the driver, using a 15 VDC supply output available at pin D2, D3 and pin E2, E3.
Note: transducer input signals working range is ±10 VDC for standard or ± 20 mA for /C option and cannot be reconfigured via software (input signals setting depends on the driver set code).

8.10 Remote pressure/force transducer input signals (F TR1 and F TR2) - only for S option
Analog remote pressure transducers or load cell can be directly connected to the driver.
Analog input signals are factory preset according to selected driver code, defaults are ±10 VDC for standard and 4 ± 20 mA for /C option.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ± 20 mA.
Refer to pressure/force transducer characteristics to select the transducer type according to specific application requirements (see tech table GS002).

8.11 Multiple PID selection or digital input signals (DIN0 and DIN1) - only for S option
Two on-off input signals are available on the connectors I and K.
For NP executions pin I2 and/or pin K2 are used to select one of the four pressure (force) PID parameters setting, stored into the driver. Switching the active setting of pressure PID during the machine cycle allows to optimize the system dynamic response in different hydraulic working conditions (volume, flow, etc.). Supply a 24 VDC or a 0 VDC on pin I2 and/or pin K2, to select one of the four PID settings as indicated by binary code table at side. Gray code can be selected by software. For fieldbus executions pin I2 and/or K2 can be used as generic purpose on-off input signals.

8.12 Possible combined options: /AC, /AI, /ACI, /CI - combined options /CI is available only for E-BM-TES/LES-S.

9 VALVE SETTINGS AND PROGRAMMING TOOLS
Valve’s functional parameters and configurations, can be easily set and optimized using Atos E-SW programming software connected via USB port to the digital driver (see table GS003).
For fieldbus versions, the software permits valve’s parameterization through USB port also if the driver is connected to the central machine unit via fieldbus.

The software is available in different versions according to the driver’s options (see table GS500).
E-SW-BASIC support: NP (USB) PS (Serial) IR (Infrared)
E-SW-FIELDBUS support: BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT)
EW (POWERLINK) EI (EtherNet/IP) EP (PROFINET)
E-SW-/PQ support: valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)

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

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

Free programming software, web download:
E-SW-BASIC web download = software can be downloaded upon web registration at www.atos.com ; service and DVD not included
Upon web registration user receive via email the Activation Code (software free license) and login data to access Atos Download Area
DVD programming software, to be ordered separately:
E-SW-/PQ DVD first supply = software has to be activated via web registration at www.atos.com ; 1 year service included
Upon web registration user receive via email the Activation Code (software license) and login data to access Atos Download Area
E-SW-*/PQ DVD next supplies = only for supplies after the first, service not included, web registration not allowed
Software has to be activated with Activation Code received upon first supply by web registration
Atos Download Area: direct access to latest releases of E-SW software, manuals, USB drivers and fieldbus configuration files at www.atos.com
USB Adapters, Cables and Terminators, can be ordered separately

10 MAIN SOFTWARE PARAMETER SETTINGs
For basic information about main setting parameters by E-SW programming software, see tech table GS003
For detailed descriptions of settings, wirings and installation procedures, please refer to the user manual included in the E-SW programming software:
**OVERALL DIMENSIONS [mm]**

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

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

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

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

Note: max conductor size: 2.5 mm²
tightening torque: 0.4 ÷ 0.6 Nm

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

(1) D connector is available only for TES-N versions 01HP / 05HP and LES-*
(2) E connector is available only for TES-* versions 01H / 05H and LES-*
(3) I, J and K connectors are available only for TES-S and LES-S