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

E-BM-TEB/LEB
Digital drivers 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.

TEB execution operates direct operated directional/flow control valves with one integral spool position transducer.
LEB execution operates pilot operated directional valves with two integral spool position transducers.
Atos PC software allows to customize the driver configuration to the specific application requirements.

Electrical Features:
- 6 fast plug-in connectors
- USB port always present - Mini USB type B
- 2 leds for diagnostics (see 5.1)
- Electrical protection against reverse polarity of power supply
- Operating temperature range: -20 ÷ +60 °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

MODEL CODE

<table>
<thead>
<tr>
<th>E-BM</th>
<th>-</th>
<th>TEB</th>
<th>-</th>
<th>N</th>
<th>-</th>
<th>NP</th>
<th>-</th>
<th>01H</th>
</tr>
</thead>
</table>

Off-board electronic driver in DIN rail panel format

TEB = digital basic driver, for valves with one LVDT transducer
LEB = digital basic driver, for valves with two LVDT transducers

Alternated P/Q control:
N = none

Fieldbus interface, USB port always present:
NP = Not Present
### 2 BLOCK DIAGRAM EXAMPLE

![Block Diagram Example]

- E-SW software
- LVDT_T transducer
- Solenoid S1 power PWM
- Solenoid S2 power PWM

### 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 sheet</td>
<td>DHZO-T, D0ZOR-T</td>
<td>F165</td>
<td>DPZO-T, QVHZO-T, QVKZOR-T</td>
<td>F170</td>
</tr>
<tr>
<td>Ex-proof Data sheet</td>
<td>DHZA-T, D0ZKA-T</td>
<td>FX120</td>
<td>DPZ-A, QVHZ-A, QVKZ-A</td>
<td>FX140</td>
</tr>
<tr>
<td>Driver model</td>
<td>E-BM-TEB</td>
<td></td>
<td>E-BM-LEB</td>
<td></td>
</tr>
</tbody>
</table>

### 4 MAIN CHARACTERISTICS

- **Power supply** *(see 7.1)*
  - Nominal: +24 Vcc
  - Rectified and filtered: \( V_{\text{RMS}} = 20 \div 32 \text{ Vmax} \) (ripple max 10 % Vpp)
- **Max power consumption** 50 W
- **Current supplied to solenoids** \( I_{\text{max}} = 3.0 \text{ A for standard driver} \)
  \( I_{\text{max}} = 2.5 \text{ A for ex-proof driver (IA option)} \)
- **Analog input signal** *(see 7.2)*
  - Voltage: range \( \pm 10 \text{ Vcc} \) (24 Vmax tolerant)
  - Current: range \( \pm 20 \text{ mA} \)
  - Input impedance: \( R_i > 50 \text{ k} \Omega \)
- **Monitor output** *(see 7.3)*
  - Voltage range: \( \pm 10 \text{ Vcc} @ \text{max 5 mA} \)
  - Current range: \( \pm 20 \text{ mA} @ \text{max 500 k} \Omega \) load resistance
- **Enable input** *(see 7.4)*
  - Range: \( 0 \div 5 \text{ Vcc} \) (OFF state), \( 9 \div 24 \text{ Vcc} \) (ON state), \( 5 \div 9 \text{ Vcc} \) (not accepted)
  - Input impedance: \( R_i > 10 \text{ k} \Omega \)
- **Repeat enable output** *(see 7.5)*
  - Range: \( 0 \div 24 \text{ Vcc} \) (ON state > \[power supply - 2 \text{ Vcc}\] ; OFF state < 1 V)
  - @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads)
- **Fault output** *(see 7.6)*
  - Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, valve spool transducer malfunctions, alarms history storage function
- **Format**
  - Plastic box: IP20 protection degree; L 35 - H 7.5 mm; DIN-rail mounting as per EN60715
- **Operating temperature** -20 ÷ +60 °C (storage -25 ÷ +85 °C)
- **Mass** Approx. 400 g
- **Additional characteristics**
  - 2 leds for diagnostic; protection against reverse polarity of power supply
- **Electromagnetic compatibility (EMC)** According to Directive 2014/30/UE (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)
- **Communication interface**
  - USB Atos ASCII coding
- **Communication physical layer**
  - USB 2.0 + USB OTG not insulated
- **Recommended wiring cable**
  - LYCY 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 11)* 2.5 mm²

**Note:** A maximum time of 400 ms have be considered between the driver energizing with the 24 Vcc power supply and when the valve is ready to operate. During this time the current to the valve coils is switched to zero.

### 5 CONNECTIONS AND LEDS

- **USB CONNECTOR** always present (female)
- **DIAGNOSTIC LEDS** *(see 5.1)*

A, B, C, D, E, F connectors included

(1) D connector is available only for TEB-N versions 01HP / 05HP and LEB-N
(2) E connector is available only for TEB-N versions 01H / 09H and LEB-N
5.1 Diagnostic LEDs

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

<table>
<thead>
<tr>
<th>LEDS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PW</td>
<td>OFF = Power supply OFF ON = Power supply ON</td>
</tr>
<tr>
<td>ST</td>
<td>OFF = Fault present ON = No fault</td>
</tr>
</tbody>
</table>

5.2 Connectors - 4 pin

<table>
<thead>
<tr>
<th>CONNECTOR</th>
<th>PIN</th>
<th>SIGNALS</th>
<th>TECHNICAL SPECIFICATIONS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A1</td>
<td>V+</td>
<td>Power supply 24 VDC (see 7.1)</td>
<td>Input - power supply</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>V0</td>
<td>Power supply 0 VDC (see 7.1)</td>
<td>Gnd - power supply</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A4</td>
<td>NC</td>
<td>Do not connect</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>B1</td>
<td>Q_INPUT+</td>
<td>Flow reference input signal: $\pm 10$ VDC / $\pm 20$ mA maximum range Default are $\pm 10$ VDC for standard and $4 \div 20$ mA for /I option (see 7.2)</td>
<td>Input - analog signal Software selectable</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>INPUT-</td>
<td>Negative reference input signal for Q_INPUT+</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td>AGND</td>
<td>Common gnd for monitor output</td>
<td>Common gnd</td>
</tr>
<tr>
<td></td>
<td>B4</td>
<td>EARTH</td>
<td>Connect to system ground</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>C1</td>
<td>Q_MONITOR</td>
<td>Flow monitor output signal: $\pm 10$ VDC / $\pm 20$ mA maximum range, referred to AGND Default are $\pm 10$ VDC for standard and $4 \div 20$ mA for /I option (see 7.3)</td>
<td>Output - analog signal Software selectable</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>ENABLE</td>
<td>Enable (24 VDC) or disable (0 VDC) the controller, referred to V0 (see 7.4)</td>
<td>Input - on/off signal</td>
</tr>
<tr>
<td></td>
<td>C3</td>
<td>R_ENABLE</td>
<td>Repeat enable, output repeater signal of enable input, referred to V0 (see 7.5)</td>
<td>Output - on/off signal</td>
</tr>
<tr>
<td></td>
<td>C4</td>
<td>FAULT</td>
<td>Fault (0 VDC) or normal working (24 VDC), referred to V0 (see 7.6)</td>
<td>Output - on/off signal</td>
</tr>
<tr>
<td>D (1)</td>
<td>D1</td>
<td>LVDT_L</td>
<td>Main stage valve position transducer signal (see 7.7)</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td></td>
<td>D2</td>
<td>-15V</td>
<td>Main stage valve position transducer power supply -15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td></td>
<td>D3</td>
<td>+15V</td>
<td>Main stage valve position transducer power supply +15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td></td>
<td>D4</td>
<td>AGND</td>
<td>Common gnd for transducer power</td>
<td>Common gnd</td>
</tr>
<tr>
<td>E (2)</td>
<td>E1</td>
<td>LVDT_T</td>
<td>Direct valve or pilot valve position transducer signal (see 7.7)</td>
<td>Input - analog signal</td>
</tr>
<tr>
<td></td>
<td>E2</td>
<td>-15V</td>
<td>Direct valve or pilot valve stage position transducer power supply -15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td></td>
<td>E3</td>
<td>+15V</td>
<td>Direct valve or pilot valve stage position transducer power supply +15V</td>
<td>Output power supply</td>
</tr>
<tr>
<td></td>
<td>E4</td>
<td>AGND</td>
<td>Common gnd for transducer power</td>
<td>Common gnd</td>
</tr>
<tr>
<td>F</td>
<td>F1</td>
<td>SOL_S1-</td>
<td>Negative current to solenoid S1</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td></td>
<td>F2</td>
<td>SOL_S1+</td>
<td>Positive current to solenoid S1</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td></td>
<td>F3</td>
<td>SOL_S2-</td>
<td>Negative current to solenoid S2</td>
<td>Output - power PWM</td>
</tr>
<tr>
<td></td>
<td>F4</td>
<td>SOL_S2+</td>
<td>Positive current to solenoid S2</td>
<td>Output - power PWM</td>
</tr>
</tbody>
</table>

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

6 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 6). 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.
7 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).

7.1 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.

7.2 Flow reference input signal (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 /I option. Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 Vcc or ± 20 mA.

7.3 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, valve spool position). Monitor output signal is factory preset according to selected valve code, defaults are ±10 Vcc 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 Vcc or ± 20 mA.

7.4 Enable input signal (ENABLE)

To enable the driver, supply 24 Vcc on pin C2: 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 active 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.

7.5 Repeat enable output signal (R_ENABLE)

Repeat enable (pin C3) is used as output repeater signal of enable input signal (see 7.4).

7.6 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 Vcc, normal working corresponds to 24 Vcc. Fault status is not affected by the status of the Enable input signal.

7.7 Main stage and direct or pilot position transducer input signals (LVDT L and LVDT T)

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

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

7.8 Possible combined options: /AC, /AI /ACI

8 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 GS500).

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):

<table>
<thead>
<tr>
<th>Version</th>
<th>Functions Supported</th>
<th>USB Isolated</th>
<th>Bluetooth Isolated</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-SW-BASIC</td>
<td>NS (USB) PS (Serial) IR (Infrared)</td>
<td>true</td>
<td>false</td>
</tr>
<tr>
<td>E-SW-FIELDBUS</td>
<td>BC (CANopen) BP (PROFIBUS DP) EH (EtherCAT) EW (POWERLINK) Ei (EtherNet/IP) EP (PROFINET)</td>
<td>true</td>
<td>false</td>
</tr>
<tr>
<td>E-SW-/PQ</td>
<td>valves with SP, SF, SL alternated control (e.g. E-SW-BASIC/PQ)</td>
<td>true</td>
<td>false</td>
</tr>
</tbody>
</table>

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: see tech table GS500 for the list of countries where the Bluetooth adapter has been approved.

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-+/N/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 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

9 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:

E-MAN-BM-LEB - user manual for E-BM-TEB and E-BM-LEB digital drivers
OVERALL DIMENSIONS [mm]

A, B, C, D, E, F connectors included

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INSTALLATION

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

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

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

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

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

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

---

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