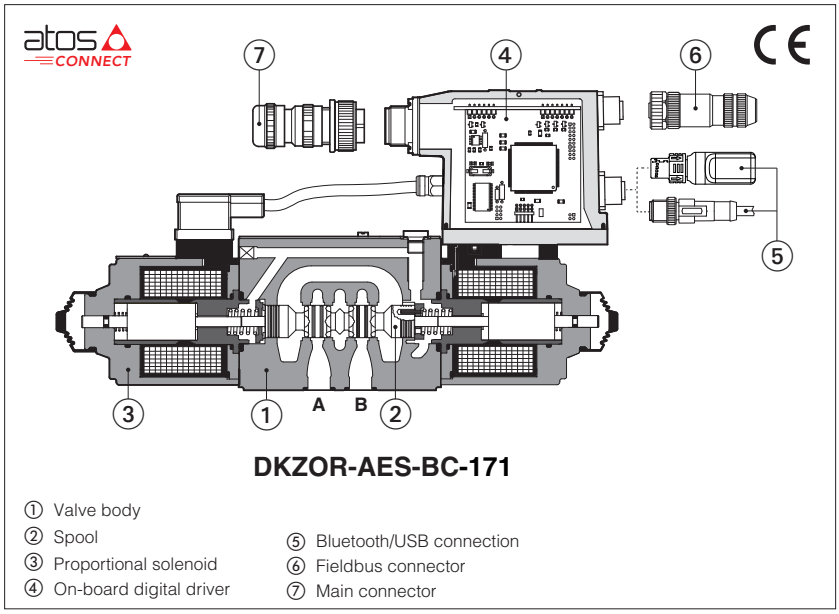
# Digital proportional directional valves

direct, without transducer, with positive spool overlap




**DKZOR-AES-BC-171**

① Valve body
② Spool
③ Proportional solenoid
④ On-board digital driver
⑤ Bluetooth/USB connection
⑥ Fieldbus connector
⑦ Main connector

## DHZO-A, DHZO-AEB, DHZO-AES
## DKZOR-A, DKZOR-AEB, DKZOR-AES

Digital proportional valves without position transducer and with positive spool overlap, for open loop directional controls and not compensated flow regulations.

**A** to be coupled with off-board drivers.

**AEB** basic execution, with on-board digital driver, with analog reference signal or IO-Link interface for digital reference signal, valve settings, and real-time diagnostics.

**AES** full execution, with on-board digital driver which includes also fieldbus interfaces for digital reference signal, valve settings, and real-time diagnostics.

For **AEB** and **AES**, Bluetooth/USB connection is always present for valve settings via mobile App and Atos PC software.

| **DHZO**: | **DKZOR**: |
|---|---|
| Size: **06** - ISO 4401 | Size: **10** - ISO 4401 |
| Max flow: **70 l/min** | Max flow: **160 l/min** |
| Max pressure: **350 bar** | Max pressure: **315 bar** |

## 1 MODEL CODE for STANDARD SPOOLS

| DHZO | - | AES | - | BP | - | 0 | 71 | - | L | 5 | / | * | / | * | / | * | * | / | * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

**DHZO** = size 06
**DKZOR** = size 10

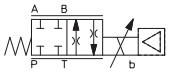
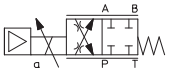
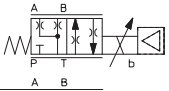
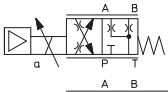
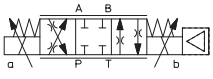
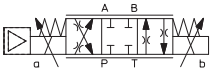
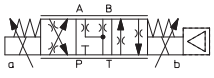
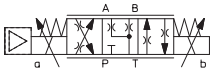
**A** = off-board driver, see section 2
**AEB** = basic on-board digital driver
**AES** = full on-board digital driver

**IO-Link interface**, only for AEB, see section 6:
**NP** = Not present **IL** = IO-Link

**Fieldbus interfaces**, only for AES, see section 7:
**BC** = CANopen **EH** = EtherCAT
**BP** = PROFIBUS DP

**Valve size** ISO 4401:
**0** = 06 **1** = 10

**Configuration (1)**:

| | Standard | Option **/B** |
|---|---|---|
| **51 =** |  |  |
| **53 =** |  |  |
| **71 =** |  |  |
| **73 =** |  |  |

**Spool type**, regulating characteristics, see section 12:
**L** = linear **S** = progressive **D** = differential-progressive
P-A = Q, B-T = Q/2
P-B = Q/2, A-T = Q

**(1)** Hydraulic symbols are represented with on-board digital driver

Series number

**Seals material,** see section 11:
**-** = NBR
**PE** = FKM
**BT** = NBR low temp.

**Coil voltage,** only for **A** - see section 16:
**-** = standard coil for 24 VDC Atos drivers
**6** = optional coil for 12 VDC Atos drivers
**18** = optional coil for low current drivers

**Bluetooth option,** only for **AEB** and **AES (1)**, see section 5:
**T** = Bluetooth adapter supplied with the valve

**Hydraulic options (2)**:
**B** = solenoid and on-board digital driver at side of port A
**Y** = external drain

**Hand lever options,** only for **A**:
**MO** = horizontal hand lever
**MV** = vertical hand lever
**BMO** = horizontal hand lever installed at side of port A
**BMV** = vertical hand lever installed at side of port A

**Electronic options,** only for **AEB** and **AES (2) (3)**:
**C** = current feedback for pressure transducer 4 ÷ 20 mA (only for **W**)
**I** = current reference input 4 ÷ 20 mA
**Q** = enable signal
**Z** = double power supply, enable, fault and monitor signals - 12 pin connector
**W** = power limitation function

| **Spool size**: | **14** (L) | **1** (L) | **2** (S) | **3** (L,S,D) | **5** (L,S,D) |
|---|---|---|---|---|---|
| DHZO = | 1 | 4,5 | 8 | 18 | 28 |
| DKZOR = | - | - | - | 45 | 60 |

Nominal flow (l/min) at Δp 10bar P-T (see section 9)

**(2)** For possible combined options, see section 15
**(3)** /I, /Q, /Z options not available for AEB-IL

## 2 OFF-BOARD ELECTRONIC DRIVERS - only for **A**

| Drivers model | E-MI-AC-01F | | E-MI-AS-IR | | E-BM-AS-PS | | E-BM-AES |
|---|---|---|---|---|---|---|---|
| Type | Analog | | Digital | | | | |
| Voltage supply (VDC) | 12 | 24 | 12 | 24 | 12 | 24 | 24 |
| Valve coil option | /6 | std | /6 | std | /6 | std | std |
| Format | plug-in to solenoid | | | | DIN-rail panel | | |
| Tech table | G010 | | G020 | | G030 | | GS050 |

## 3 GENERAL NOTES

Atos digital proportionals valves 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 **FS900** and in the user manuals included in the E-SW-SETUP programming software.

## 4 VALVE SETTINGS AND PROGRAMMING TOOLS - see tech. table **GS500**

### 4.1 Atos CONNECT mobile App

Free downloadable App for smartphones and tablets which allows quick access to valve main functional parameters and basic diagnostic information via Bluetooth, thus avoiding physical cable connection and significantly reducing commissioning time.
Atos CONNECT supports Atos digital valve drivers equipped with E-A-BTH adapter or with built-in Bluetooth. It does not support valves with p/Q control or axis controls.

Download on the App Store

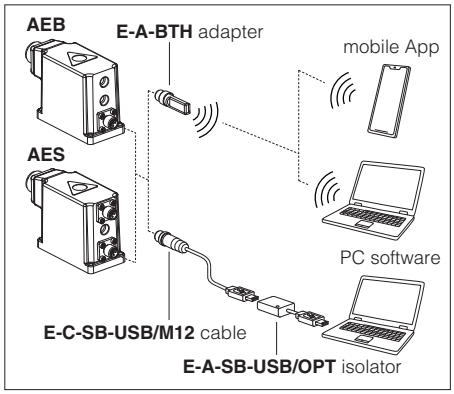
GET IT ON Google Play

### 4.2 E-SW-SETUP PC software

Free downloadable software for PC allows to set all valve functional parameters and to access complete diagnostic information of digital valve drivers via Bluetooth/USB service port.
Atos E-SW-SETUP PC software supports all Atos digital valve drivers and it is available at www.atos.com in MyAtos area.

**WARNING: drivers USB port is not isolated!** For E-C-SB-USB/M12 cable, the use of E-A-SB-USB/OPT isolator adapter is highly recommended for PC protection

**Bluetooth or USB connection**




## 5 BLUETOOTH OPTION - see tech. table **GS500**

**T** option adds Bluetooth® connectivity to Atos valve drivers thanks to E-A-BTH adapter, which can be left permanently installed on-board, to allow the Bluetooth connection with the valve drivers at any time. E-A-BTH adapter can also be purchased separately and used to connect with any supported Atos digital product.
Bluetooth connection to the valve can be protected against unauthorised access by setting a personal password. The adapter leds visually indicates the status of valve driver and Bluetooth connection.

**WARNING:** for the list of countries where the Bluetooth adapter has been approved, see tech. table **GS500**
T option is not available for the Indian market, so the Bluetooth adapter must be ordered separately.

## 6 IO-LINK - only for **AEB**, see tech. table **GS520**

IO-Link allows low cost digital communication between the valve and machine central unit. The valve is directly connected to a port of an IO-Link master (point-to-point connection) via low-cost unshielded cables for digital reference, diagnostic and settings. The IO-Link master works as a hub exchanging this information with the machine central unit via fieldbus.

## 7 FIELDBUS - only for **AES**, see tech. table **GS510**

Fieldbus allows valve direct communication with machine control unit for digital reference, valve diagnostics and settings. These execution allow to operate the valves through fieldbus or analog signals available on the main connector.

## 8 GENERAL CHARACTERISTICS

| | |
|---|---|
| Assembly position | Any position |
| Subplate surface finishing to ISO 4401 | Acceptable roughness index: Ra ≤ 0,8, recommended Ra 0,4 – Flatness ratio 0,01/100 |
| MTTFd valves according to EN ISO 13849 | 150 years, for further details see technical table P007 |
| Ambient temperature range | **A:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +60°C<br>**AEB, AES:** **Standard** = -20°C ÷ +60°C **/PE** option = -20°C ÷ +60°C **/BT** option = -40°C ÷ +60°C |
| Storage temperature range | **A:** **Standard** = -20°C ÷ +80°C **/PE** option = -20°C ÷ +80°C **/BT** option = -40°C ÷ +70°C<br>**AEB, AES:** **Standard** = -20°C ÷ +70°C **/PE** option = -20°C ÷ +70°C **/BT** option = -40°C ÷ +70°C |
| Surface protection | Zinc coating with black passivation, galvanic treatment (driver housing for AEB and AES) |
| Corrosion resistance | Salt spray test (EN ISO 9227) > 200 h |
| Vibration resistance | See technical table G004 (for AEB and AES) |
| Compliance | CE according to EMC directive 2014/30/EU (Immunity: EN 61000-6-2; Emission: EN 61000-6-3)<br>RoHS Directive 2011/65/EU as last update by 2015/863/EU<br>REACH Regulation (EC) n°1907/2006 |

## 9 HYDRAULIC CHARACTERISTICS - based on mineral oil ISO VG 46 at 50 °C

| Valve model | | DHZO | | | | | DKZOR | |
|---|---|---|---|---|---|---|---|---|
| Pressure limits [bar] | | ports **P**, **A**, **B** = 350; **T** = 210 (250 with external drain /Y) **Y** = 10 | | | | | ports **P**, **A**, **B** = 315; **T** = 210 (250 with external drain /Y) **Y** = 10 | |
| Spool type and size | | **L14** | **L1** | **S2** | **L3, S3, D3** | **L5, S5, D5** | **L3, S3, D3** | **L5, S5, D5** |
| Nominal flow Δp P-T [l/min] **(1)** | Δp= 10 bar | 1 | 4,5 | 8 | 18 | 28 | 45 | 60 |
| | Δp= 30 bar | 1,7 | 8 | 14 | 30 | 50 | 80 | 105 |
| | Δp= 70 bar | 2,6 | 12 | 21 | 45 | 70 | 120 | 160 |
| Max permissible flow **(2)** | | 4 | 18 | 30 | 50 | 70 | 120 | 160 |
| Leakage [cm³/min] | | <30 (at p = 100 bar); <135 (at p = 350 bar) | | | | | <80 (at p = 100 bar); <600 (at p = 315 bar) | |
| Response time **(3)** [ms] | | ≤ 30 | | | | | ≤ 40 | |
| Hysteresis | | ≤ 5 [% of max regulation] | | | | | | |
| Repeatibility | | ± 1 [% of max regulation] | | | | | | |

**Note:** above performance data refer to valves coupled with Atos electronic drivers, see section 2

**(1)** For different Δp, the max flow is in accordance to the diagrams in section 12.2
**(2)** See detailed diagrams in section 12.3
**(3)** 0-100% step signal, see detailed diagrams in section 12.4

## 10 ELECTRICAL CHARACTERISTICS

| Power supplies | Nominal : +24 VDC<br>Rectified and filtered : VRMS = 20 ÷ 32 VMAX (ripple max 10 % VPP) | | | | | |
|---|---|---|---|---|---|---|
| Max power consumption | **DHZO** | | | **DKZOR** | | |
| | **A** = 30 W | **AEB**, **AES** = 50 W | | **A** = 35 W | **AEB**, **AES** = 50 W | |
| Coil voltage code | standard | option /6 | option /18 | standard | option /6 | option /18 |
| Max. solenoid current | 2,2 A | 2,75 A | 1 A | 2,6 A | 3,25 A | 1,2 A |
| Coil resistance R at 20°C | 3 ÷ 3,3 Ω | 2 ÷ 2,2 Ω | 13 ÷ 13,4 Ω | 3,8 ÷ 4,1 Ω | 2,2 ÷ 2,4 Ω | 12 ÷ 12,5 Ω |
| Analog input signals | Voltage: range ±10 VDC (24 VMAX tolerant) Input impedance: Ri > 50 kΩ<br>Current: range ±20 mA Input impedance: Ri = 500 Ω | | | | | |
| Monitor output | Output range: voltage ±5 VDC @ max 5 mA | | | | | |
| Enable input | Range: 0 ÷ 9 VDC (OFF state), 15 ÷ 24 VDC (ON state), 9 ÷ 15 VDC (not accepted); Input impedance: Ri > 87 kΩ | | | | | |
| Fault output | Output range : 0 ÷ 24 VDC (ON state ≅ VL+ [logic power supply] ; OFF state ≅ 0 V) @ max 50 mA; external negative voltage not allowed (e.g. due to inductive loads) | | | | | |
| Pressure transducer power supply (only for /W option) | +24VDC @ max 100 mA (E-ATR-8 see tech table **GS465**) | | | | | |
| Alarms | Solenoid not connected/short circuit, cable break with current reference signal, over/under temperature, current control monitoring, power supplies level, pressure transducer failure (/W option) | | | | | |
| Insulation class | H (180°) Due to the occurring surface temperatures of the solenoid coils, the European standards ISO 13732-1 and EN982 must be taken into account | | | | | |
| Protection degree to DIN EN60529 | **A** = IP65; **AEB**, **AES** = IP66 / IP67 with mating connectors | | | | | |
| Duty factor | Continuous rating (ED=100%) | | | | | |
| Tropicalization | Tropical coating on electronics PCB | | | | | |
| Additional characteristics | Short circuit protection of solenoid's current supply; current control by P.I.D. with rapid solenoid switching; protection against reverse polarity of power supply | | | | | |
| Communication interface | USB<br>Atos ASCII coding | IO-Link<br>Interface and System Specification 1.1.3 | CANopen<br>EN50325-4 + DS408 | PROFIBUS DP<br>EN50170-2/IEC61158 | EtherCAT<br>IEC 61158 | |
| Communication physical layer | not insulated<br>USB 2.0+USB OTG | SDCI<br>class port B | optical insulated<br>CAN ISO11898 | optical insulated<br>RS485 | Fast Ethernet, insulated<br>100 Base TX | |
| Recommended wiring cable | LiYCY shielded cables, see section 20 | | | | | |

**Note:** a maximum time of 500 ms (depending on communication type) has to 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.

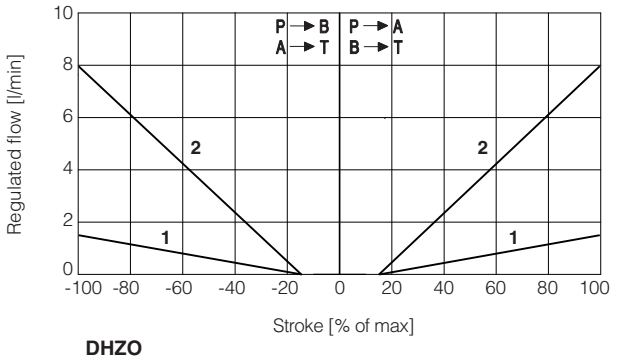
## 11 SEALS AND HYDRAULIC FLUIDS - for other fluids not included in below table, consult our technical office

| Seals, recommended fluid temperature | | NBR seals (standard) = -20°C ÷ +60°C (+80°C for **A**), with HFC hydraulic fluids = -20°C ÷ +50°C<br>FKM seals (/PE option) = -20°C ÷ +80°C<br>NBR low temp. seals (/BT option) = -40°C ÷ +60°C, with HFC hydraulic fluids = -20°C ÷ +50°C | |
|---|---|---|---|
| Recommended viscosity | | 20 ÷ 100 mm²/s - max allowed range 15 ÷ 380 mm²/s | |
| Max fluid contamination level | normal operation | ISO4406 class 18/16/13 NAS1638 class 7 | see also filter section at www.atos.com or KTF catalog |
| | longer life | ISO4406 class 16/14/11 NAS1638 class 5 | |

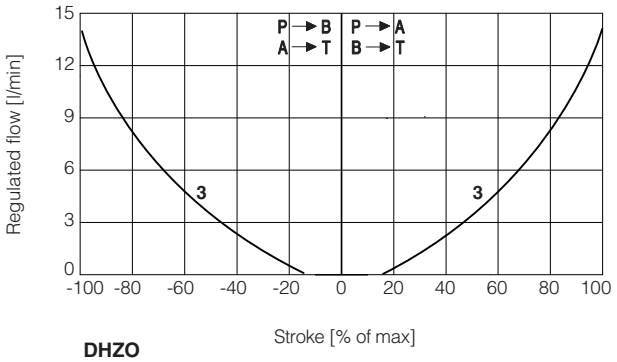
| **Hydraulic fluid** | **Suitable seals type** | **Classification** | **Ref. Standard** |
|---|---|---|---|
| Mineral oils | NBR, FKM, NBR low temp. | HL, HLP, HLPD, HVLP, HVLPD | DIN 51524 |
| Flame resistant without water | FKM | HFDU, HFDR | ISO 12922 |
| Flame resistant with water | NBR, NBR low temp. | HFC | |

## 12 **DIAGRAMS** - based on mineral oil ISO VG 46 at 50 °C

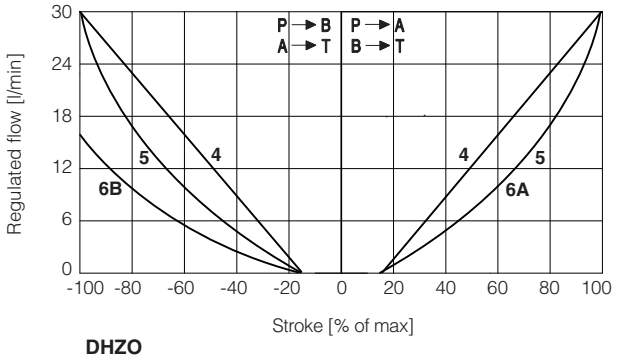
### 12.1 **Regulation diagrams** - values measure at Δp 30 bar P-T



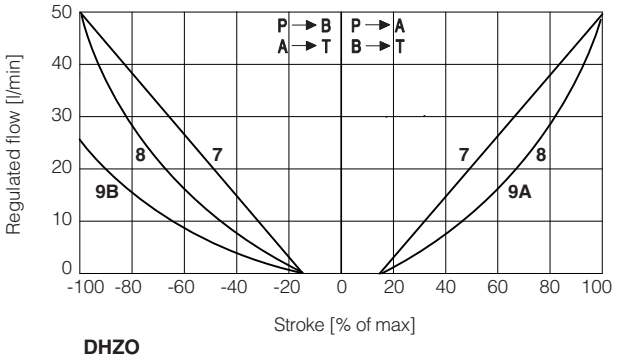

**DHZO**
**1** = L14 **2** = L1



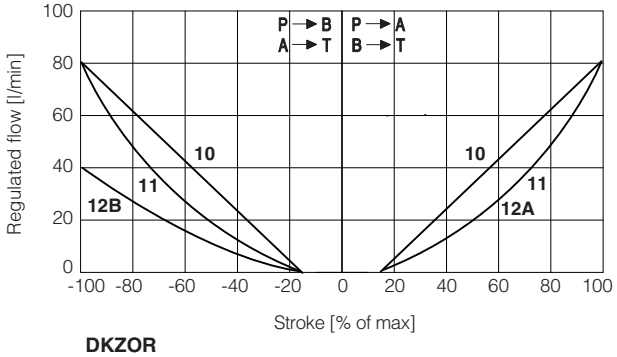

**DHZO**
**3** = S2



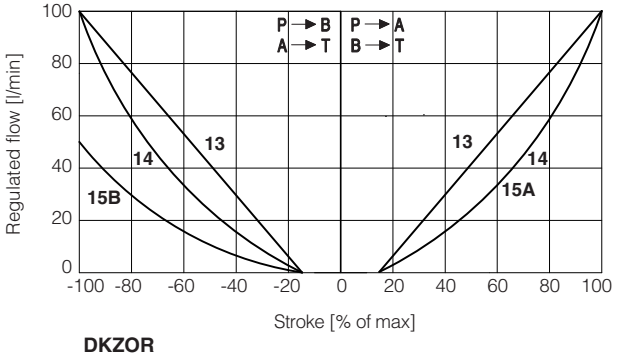

**DHZO**
**4** = L3 **5** = S3 **6A** = D3 (P → A, A → T)
**6B** = D3 (P → B, B → T)




**DHZO**
**7** = L5 **8** = S5 **9A** = D5 (P → A, A → T)
**9B** = D5 (P → B, B → T)




**DKZOR**
**10** = L3 **11** = S3 **12A** = D3 (P → A, A → T)
**12B** = D3 (P → B, B → T)




**DKZOR**
**13** = L5 **14** = S5 **15A** = D5 (P → A, A → T)
**15B** = D5 (P → B, B → T)

**Note**: Hydraulic configuration vs. reference signal for configuration 71 and 73 (standard and option /B)

Reference signal $\begin{matrix} 0 \div +10\ V \\ 12 \div 20\ mA \end{matrix}$ } P → A / B → T

Reference signal $\begin{matrix} 0 \div -10\ V \\ 12 \div 4\ mA \end{matrix}$ } P → B / A → T

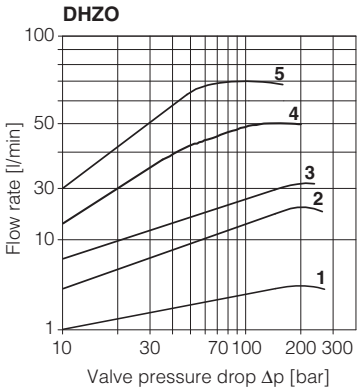
### 12.2 Flow /Δp diagrams - stated at 100% of valve stroke

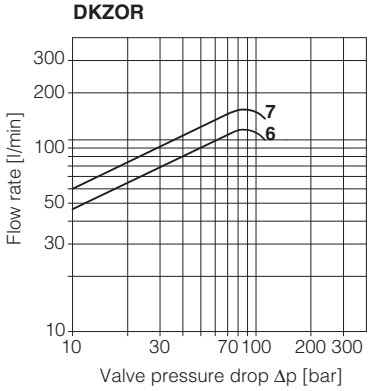
**DHZO**

**1** = spool L14
**2** = spool L1
**3** = spool S2
**4** = spool L3, S3, D3
**5** = spool L5, S5, D5

**DKZOR**

**6** = spool S3, L3, D3
**7** = spool S5, L5, D5



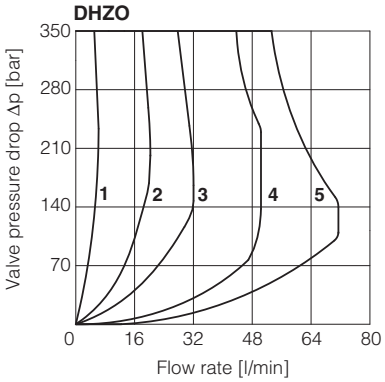

### 12.3 Operating limits

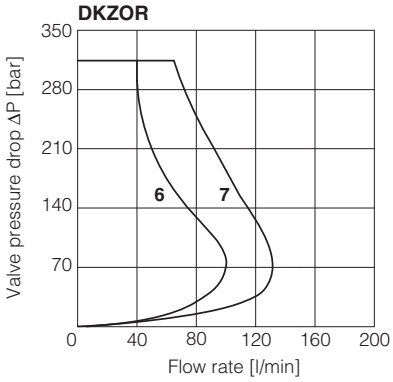
**DHZO**

**1** = spool L14
**2** = spool L1
**3** = spool S2
**4** = spool L3, S3, D3
**5** = spool L5, S5, D5

**DKZOR**

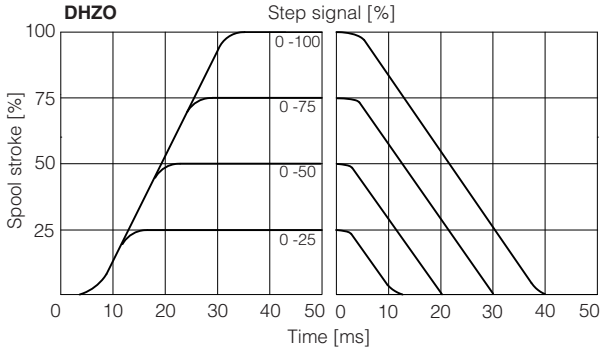
**6** = spool S3, L3, D3
**7** = spool S5, L5, D5

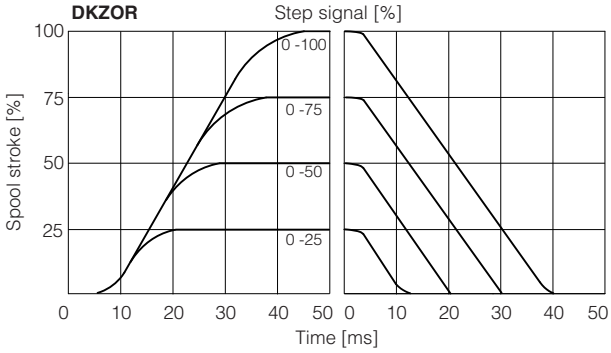



### 12.4 Response time

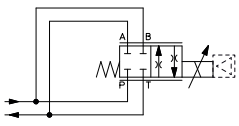
The response times in below diagrams are measured at different steps of the reference input signal. They have to be considered as average values. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.




### 12.5 Operation as throttle valve

Single solenoid valves configuration 51 and 53 can be used as simple throttle valves:
Pmax = 250 bar (option /Y advisable)




| Max flow Δp= 15 bar [l/min] | Spool type and size | | | | |
|---|---|---|---|---|---|
| | **L14** | **L1** | **S2** | **L3 S3** | **L5 S5** |
| **DHZO** | 4 | 16 | 28 | 60 | 100 |
| **DKZOR** | - | - | - | 160 | 200 |

## 13 HYDRAULIC OPTIONS

**B** = DHZO-05 and DKZOR-15 = solenoid and on-board digital driver at side of port A.
DHZO-07 and DKZOR-17 = on-board digital driver at side of port A.

**Y** = External drain advisable when the valve is used in double flow path, see section 12.5.
This option is mandatory if the pressure in port T exceeds 210 bar.

**Hand lever option** - only for **DHZO-A** with spool type S3, S5, D3, D5, L3, L5.

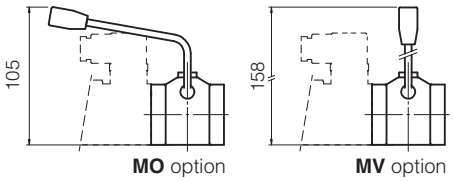
It allows to operate the valve in absence of electrical power supply.
For detailed description of DHZO-A with hand lever option see tech. table **E138**.

**MO** = Horizontal hand lever

**BMO** = Horizontal hand lever installed at side of port A

**MV** = Vertical hand lever

**BMV** = Vertical hand lever installed at side of port A

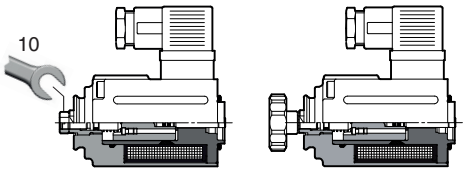


**MO** option **MV** option

The following supplementary options allow to operate **DHZO-A** and **DKZOR-A** in absence of electrical power supply by means of a micrometric screw replacing the standard solenoid manual override, see tech. table **TK150**

**N** = Manual micrometric adjustment

**NV** = As option /N plus handwheel



**N** option **NV** option

## 14 ELECTRONIC OPTIONS - only for **AEB** and **AES**

**I** = This option provides 4 ÷ 20 mA current reference, instead of the standard ±10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.
Note: **/I** option not available for **AEB-IL**

**Q** = This option permits to inhibit the valve function without removing the power supply to the driver. Upon disable command the current to the solenoid is zeroed and the valve's spool moves to rest position.
The option /Q is suggested for all cases where the valve has to be frequently inhibited during the machine cycle – see 17.5 for signal specifications.
Note: **/Q** option not available for **AEB-IL**

**Z** = This option provides, on the 12 pin main connector, the following additional features:
**Fault output signal** - see 17.6
**Enable input signal** - see above option /Q
**Power supply for driver's logics and communication** - see 17.2
Note: **/Z** option not available for **AEB-IL**

**C** = Only in combination with option **/W**
This option is available to connect pressure transducers with 4 ÷ 20 mA current output signal, instead of the standard 0 ÷ 10 VDC.
Input signal can be reconfigured via software selecting between voltage and current, within a maximum range of ±10 VDC or ±20 mA.

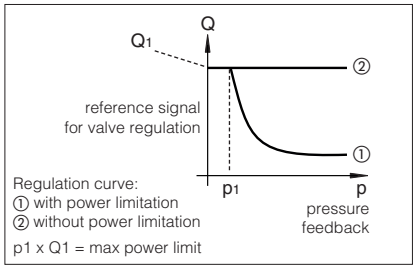
**W** = Only for valves coupled with pressure compensator, see tech table **D150**.

It provides the hydraulic power limitation function. The driver receives the flow reference signal by the analog input INPUT+ and a pressure transducer, installed in the hydraulic system, has to be connected to the driver's analog input TR.
When the actual requested hydraulic power **p**x**Q** (TR x INPUT+) reaches the max power limit (p1xQ1), internally set by software, the driver automatically reduces the flow regulation of the valve. The higher is the pressure feedback the lower is the valve's regulated flow:

$$\text{Flow regulation} = \text{Min}\left( \frac{\text{PowerLimit [sw setting]}}{\text{Transducer Pressure [TR]}} \; ; \; \text{Flow Reference [INPUT+]} \right)$$

Notes: for **AEB-IL** the drive receives the flow reference signal directly by IO-Link interface
for **AES** the drive can receive the flow reference signal directly by fieldbus interface

**Hydraulic Power Limitation** - only for option **/W**




## 15 POSSIBLE COMBINED OPTIONS

For **AEB-NP** and **AES**

**Hydraulic options**: /BY

**Electronic options**: /IQ, /IZ, /IW, /CW, /CWI

For **AEB-IL**

**Hydraulic options**: /BY

**Electronic options**: /CW

**Note**: **/T** Bluetooth adapter option can be combined with all other options

## 16 COIL VOLTAGE OPTIONS - only for **A**

**6** = Optional coil to be used with Atos drivers with power supply 12 VDC.

**18** = Optional coil to be used with electronic drivers not supplied by Atos, with power supply 24 VDC and with max current limited to 1A.

## 17 POWER SUPPLY AND SIGNALS SPECIFICATIONS - only for **AEB** and **AES**

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).

For **AEB-IL** see section 18 for IO-Link signals specifications and see 17.7 for presssure trasducer signal for **/W** option.

### 17.1 Power supply (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. In case of separate power supply see 17.2.

⚠ A safety fuse is required in series to each power supply: 2,5 A time lag fuse.

### 17.2 Power supply for driver's logic and communication (VL+ and VL0) - only for **/Z** and **/W** options

The power supply 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 on pin 9 and 10, allow to remove solenoid power supply from pin 1 and 2 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.

### 17.3 Reference input signal (INPUT+)

The driver controls in closed loop the current to the valve proportionally to the external reference input signal.
Reference input signal is factory preset according to selected valve code, defaults are ±10 VDC 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 VDC or ± 20 mA.
Drivers with fieldbus interface (BC, BP, EH) can be software set to receive reference signal directly from the machine control unit (fieldbus reference). Analog reference input signal can be used as on-off commands with input range 0 ÷ 24VDC.

### 17.4 Monitor output signals (MONITOR and MONITOR2)

The driver generates an analog output signal (MONITOR) proportional to the actual coil current of the valve; the monitor output signal can be software set to show other signals available in the driver (e.g. analog reference, fieldbus reference).
Monitor output signal is factory preset according to selected valve code, default settings is ±5 VDC (1V = 1A).
Output signal can be reconfigured via software, within a maximum range of ±5 VDC.

*Option /W*
The driver generates a second analog output signal (MONITOR2) proportional to the actual system pressure.
The output maximum range is ±5 VDC; default setting is 0 ÷ 5 VDC.

### 17.5 Enable input signal (ENABLE) - not for standard

To enable the driver, supply a 24 VDC on pin 3 (pin C): 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.
Enable input signal can be used as generic digital input by software selection.

### 17.6 Fault output signal (FAULT) - only for **/Z** and **/W** options

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal broken for 4 ÷ 20 mA input, etc.).
Fault presence corresponds to 0 VDC, normal working corresponds to 24 VDC.
Fault status is not affected by the Enable input signal.

### 17.7 Remote pressure transducer input signal (TR) - only for **/W** option

Analog pressure transducers can be directly connected to the driver (see 19.5).
Analog input signal is factory preset according to selected driver code, defaults are 0 ÷ 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.
Note: transducer feedback can be read as a digital information through fieldbus and IO-Link communication - software selectable.

## 18 IO-LINK SIGNALS SPECIFICATIONS - only for **AEB-IL**

### 18.1 Power supply for IO-Link communication (L+ and L-)

The IO-Link master provides dedicated 24 VDC power supply for IO-Link communication.
Maximum power consumption: 2 W
Internal electrical isolation of power L+, L- from P24, N24

### 18.2 Power supply for driver's logic and valve regulation (P24 and N24)

The IO-Link master provides dedicated 24 VDC power supply for valve regulation, logics and diagnostics.
Maximum power consumption: 50 W
Internal electrical isolation of power P24, N24 from L+, L-

### 18.3 IO-Link data line (C/Q)

C/Q signal is used to establish communication between IO-Link master and valve.

## 19 ELECTRONIC CONNECTIONS

### 19.1 Main connector signals - 7 pin (A1) Standard and /Q option - for AEB-NP and AES

| PIN | Standard | /Q | TECHNICAL SPECIFICATIONS | NOTES |
|---|---|---|---|---|
| A | **V+** | | Power supply 24 VDC | Input - power supply |
| B | **V0** | | Power supply 0 VDC | Gnd - power supply |
| C | **AGND** | | Analog ground | Gnd - analog signal |
| | | **ENABLE** | Enable (24 VDC) or disable (0 VDC) the driver, referred to V0 | Input - on/off signal |
| D | **INPUT+** | | Reference input signal: ±10 VDC / ±20 mA maximum range<br>Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option | Input - analog signal<br>**Software selectable** |
| E | **INPUT-** | | Negative reference input signal for INPUT+ | Input - analog signal |
| F | **MONITOR** referred to:<br>AGND / V0 | | Monitor output signal: ±5 VDC maximum range<br>Default is ± 5 VDC (1V = 1A) | Output - analog signal<br>**Software selectable** |
| G | **EARTH** | | Internally connected to driver housing | |

### 19.2 Main connector signals - 12 pin (A2) /Z and /W options - for AEB-NP and AES

| PIN | /Z | /W | TECHNICAL SPECIFICATIONS | NOTES |
|---|---|---|---|---|
| 1 | **V+** | | Power supply 24 VDC | Input - power supply |
| 2 | **V0** | | Power supply 0 VDC | Gnd - power supply |
| 3 | **ENABLE** | | Enable (24 VDC) or disable (0 VDC) the driver, referred to VL0 | Input - on/off signal |
| 4 | **INPUT+** | | Reference input signal: ±10 VDC / ±20 mA maximum range<br>Defaults are ±10 VDC for standard and 4 ÷ 20 mA for /I option | Input - analog signal<br>**Software selectable** |
| 5 | **INPUT-** | | Negative reference input signal for INPUT+ | Input - analog signal |
| 6 | **MONITOR** | | Monitor output signal: ±5 VDC maximum range, referred to VL0<br>Default is ± 5 VDC (1V = 1A) | Output - analog signal<br>**Software selectable** |
| 7 | **NC** | | Do not connect | |
| 8 | **NC** | | Do not connect | |
| | | **MONITOR2** | 2nd monitor output signal: ±5 VDC maximum range, referred to VL0. Default is 0 ÷ 5 VDC | Output - analog signal |
| 9 | **VL+** | | Power supply 24 VDC for driver's logic and communication | Input - power supply |
| 10 | **VL0** | | Power supply 0 VDC for driver's logic and communication | Gnd - power supply |
| 11 | **FAULT** | | Fault (0 VDC) or normal working (24 VDC), referred to VL0 | Output - on/off signal |
| PE | **EARTH** | | Internally connected to driver housing | |

**Note:** do not disconnect VL0 before VL+ when the driver is connected to PC USB port

### 19.3 IO-Link connector signals - M12 - 5 pin - Coding A, port class B (A) only for AEB-IL

| PIN | SIGNAL | TECHNICAL SPECIFICATIONS | NOTES |
|---|---|---|---|
| 1 | **L+** | Power supply 24 VDC for IO-Link communication | Input - power supply |
| 2 | **P24** | Power supply 24 VDC for valve regulation, logics and diagnostics | Input - power supply |
| 3 | **L-** | Power supply 0 VDC for IO-Link communication | Gnd - power supply |
| 4 | **C/Q** | IO-Link data line | Input / Output - signal |
| 5 | **N24** | Power supply 0 VDC for valve regulation, logics and diagnostics | Gnd - power supply |

**Note:** L+, L- and P24, N24 are electrically isolated

### 19.4 Communication connectors - for AEB (B) and AES (B) - (C)

| (B) USB connector - M12 - 5 pin always present | | |
|---|---|---|
| **PIN** | **SIGNAL** | **TECHNICAL SPECIFICATION (1)** |
| 1 | **+5V_USB** | Power supply |
| 2 | **ID** | Identification |
| 3 | **GND_USB** | Signal zero data line |
| 4 | **D-** | Data line - |
| 5 | **D+** | Data line + |

| (C1) BC fieldbus execution, connector - M12 - 5 pin (2) | | |
|---|---|---|
| **PIN** | **SIGNAL** | **TECHNICAL SPECIFICATION (1)** |
| 1 | **CAN_SHLD** | Shield |
| 2 | **NC** | do not connect |
| 3 | **CAN_GND** | Signal zero data line |
| 4 | **CAN_H** | Bus line (high) |
| 5 | **CAN_L** | Bus line (low) |

| (C2) BP fieldbus execution, connector - M12 - 5 pin (2) | | |
|---|---|---|
| **PIN** | **SIGNAL** | **TECHNICAL SPECIFICATION (1)** |
| 1 | **+5V** | Termination supply signal |
| 2 | **LINE-A** | Bus line (high) |
| 3 | **DGND** | Data line and termination signal zero |
| 4 | **LINE-B** | Bus line (low) |
| 5 | **SHIELD** | |

| (C3) (C4) EH fieldbus execution, connector - M12 - 4 pin (2) | | |
|---|---|---|
| **PIN** | **SIGNAL** | **TECHNICAL SPECIFICATION (1)** |
| 1 | **TX+** | Transmitter |
| 2 | **RX+** | Receiver |
| 3 | **TX-** | Transmitter |
| 4 | **RX-** | Receiver |
| Housing | **SHIELD** | |

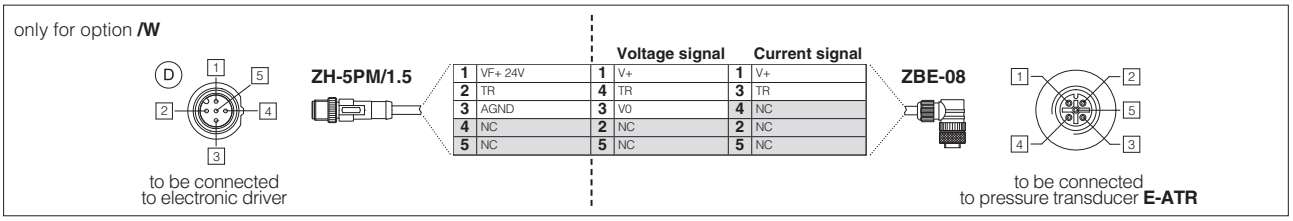
**(1)** Shield connection on connector's housing is recommended

**(2)** Only for **AES** execution

**19.5 Remote pressure transducer connector - M12 - 5 pin** - only for **/W** option - for **AEB** and **AES** (D)

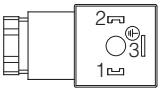
| PIN | SIGNAL | TECHNICAL SPECIFICATION | Voltage | Current |
|---|---|---|---|---|
| 1 | **VF +24V** | Power supply +24VDC | Connect | Connect |
| 2 | **TR** | Signal transducer maximum range ±10 VDC / ±20 mA, software selectable<br>Defaults are 0 ÷ 10 VDC for standard and 4 ÷ 20 mA for /C option | Connect | Connect |
| 3 | **AGND** | Common GND for transducer power and signals | Connect | / |
| 4 | **NC** | Not Connect | / | / |
| 5 | **NC** | Not Connect | / | / |

**Remote pressure transducer connection - example**



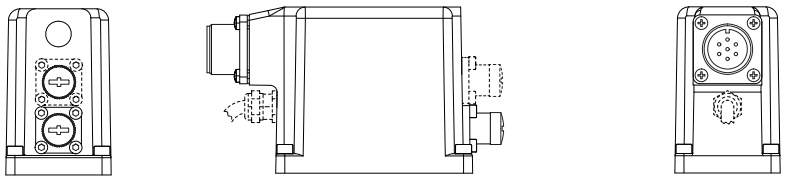

**Note:** connectors front view

**19.6 Solenoid connection** - only for **A**

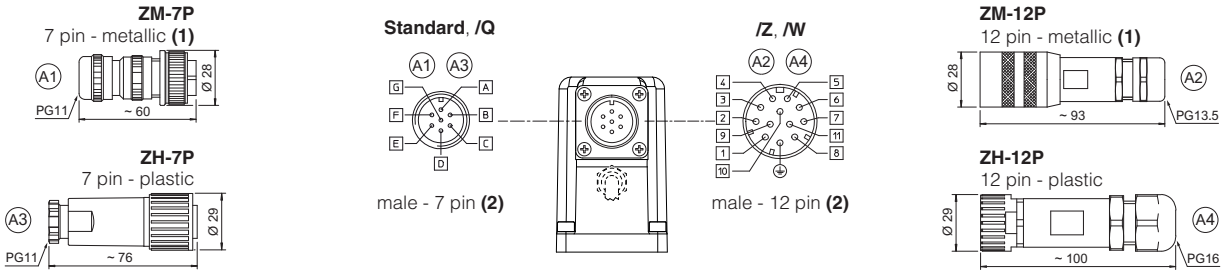
| PIN | SIGNAL | TECHNICAL SPECIFICATION | Connector code 666 |
|---|---|---|---|
| 1 | **COIL** | Power supply |  |
| 2 | **COIL** | Power supply | |
| 3 | **GND** | Ground | |

### 19.7 AEB-NP connections layout

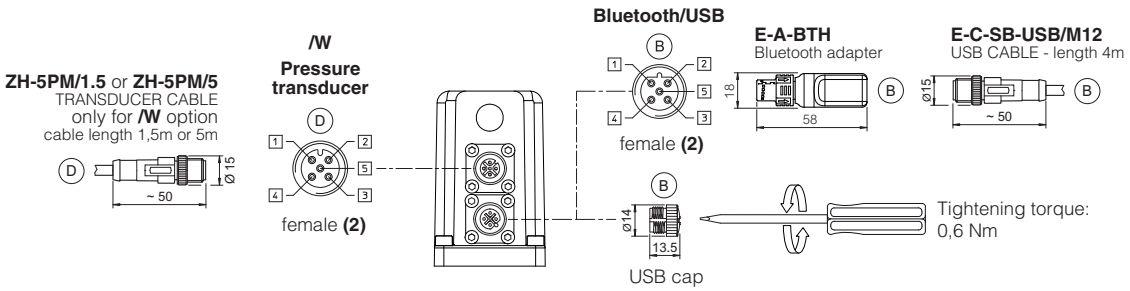
**DRIVER OVERVIEW**



**MAIN CONNECTORS**



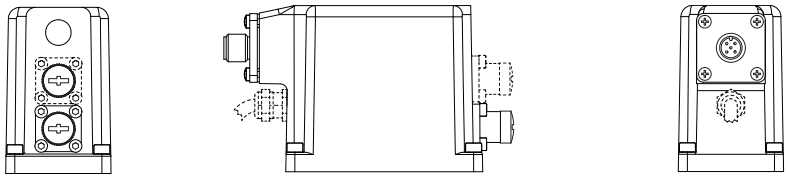

**TRANSDUCER CONNECTOR - BLUETOOTH ADAPTER AND USB CONNECTOR**



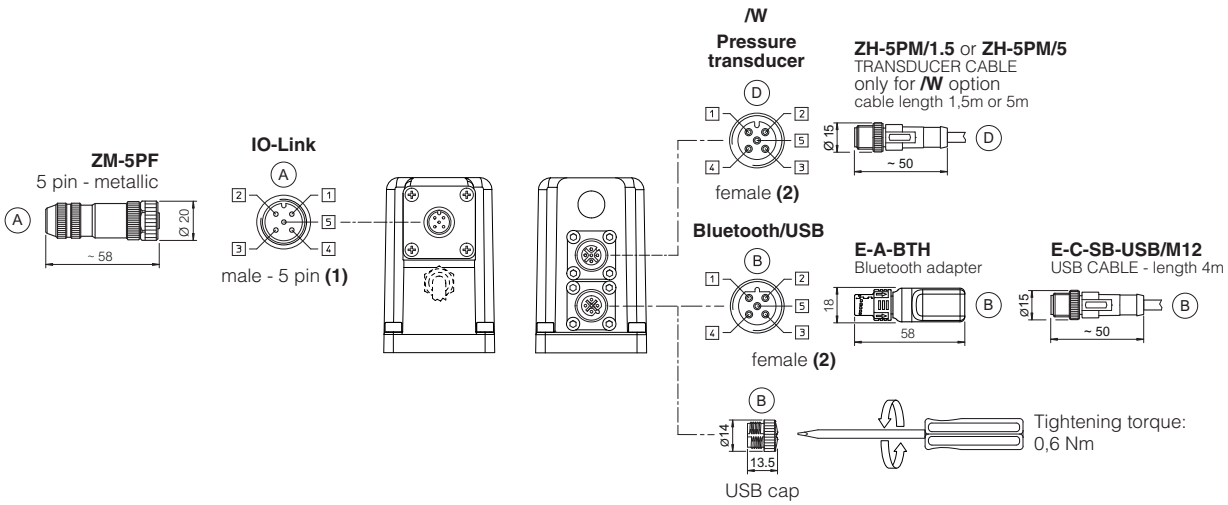

**(1)** Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

### 19.8 AEB-IL connections layout

**DRIVER OVERVIEW**



**IO-Link AND TRANSDUCER CONNECTORS - BLUETOOTH ADAPTER AND USB CONNECTOR**

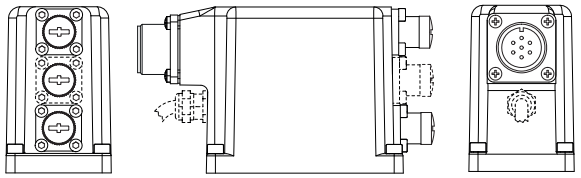



**(1)** Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

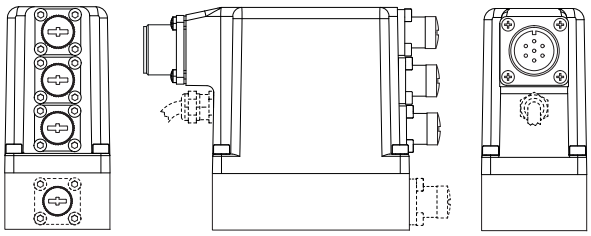
### 19.9 AES connections layout

**DRIVER OVERVIEW**

**BC** , **BP**

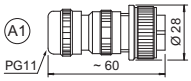


**EH**

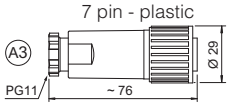


**MAIN CONNECTORS**

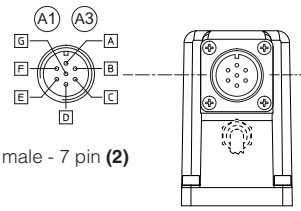
**ZM-7P**
7 pin - metallic **(1)**




**ZH-7P**
7 pin - plastic

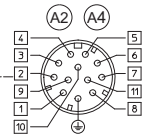



**Standard**, **/Q**



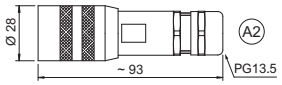

male - 7 pin **(2)**

**/Z**, **/W**

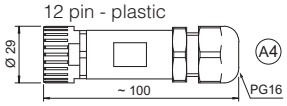



male - 12 pin **(2)**

**ZM-12P**
12 pin - metallic **(1)**

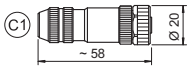



**ZH-12P**
12 pin - plastic

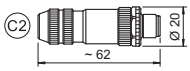



**FIELDBUS CONNECTORS**

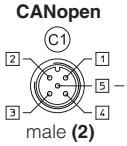
**ZM-5PF**




**ZM-5PM/BP**

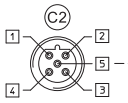



**CANopen**



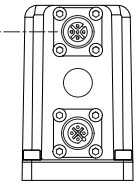

male **(2)**

**PROFIBUS DP**

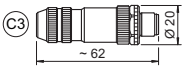



female **(2)**

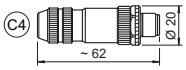
**BC - BP**



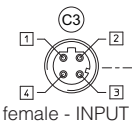
**ZM-4PM/E**




**ZM-4PM/E**

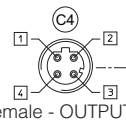



**EtherCAT**



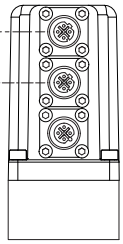

female - INPUT **(2)**

**EtherCAT**



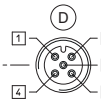

female - OUTPUT **(2)**

**EH**



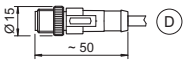
**TRANSDUCER CONNECTOR - BLUETOOTH ADAPTER AND USB CONNECTOR**

**/W**
**Pressure transducer**

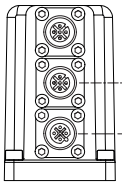



female **(2)**

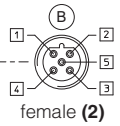
**ZH-5PM/1.5** or **ZH-5PM/5**
TRANSDUCER CABLE
only for **/W** option
cable length 1,5m or 5m




**BC** , **BP**

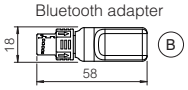


**Bluetooth/USB**

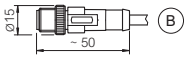


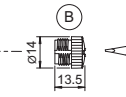

female **(2)**

**E-A-BTH**
Bluetooth adapter




**E-C-SB-USB/M12**
USB CABLE
cable length 4m

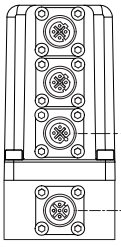


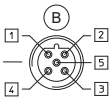

USB cap

Tightening torque:
0,6 Nm

**EH**

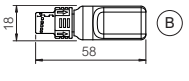


**Bluetooth/USB**

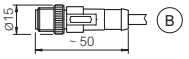


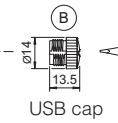

female **(2)**

**E-A-BTH**
Bluetooth adapter




**E-C-SB-USB/M12**
USB CABLE
cable length 4m

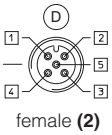



USB cap

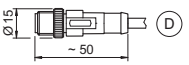
Tightening torque:
0,6 Nm

**/W**
**Pressure transducer**




female **(2)**

**ZH-5PM/1.5** or **ZH-5PM/5**
TRANSDUCER CABLE
only for **/W** option
cable length 1,5m or 5m




**(1)** Use of metallic connectors is strongly recommended in order to fulfill EMC requirements **(2)** Pin layout always referred to driver's view

## 20 CONNECTORS CHARACTERISTICS - to be ordered separately

### 20.1 Main connectors - 7 pin - for **AEB-NP** and **AES**

| CONNECTOR TYPE | POWER SUPPLY AND SIGNALS | POWER SUPPLY AND SIGNALS |
|---|---|---|
| CODE | (A1) ZM-7P | (A3) ZH-7P |
| Type | 7pin female straight circular | 7pin female straight circular |
| Standard | According to MIL-C-5015 | According to MIL-C-5015 |
| Material | Metallic | Plastic reinforced with fiber glass |
| Cable gland | PG11 | PG11 |
| Recommended cable | LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply) | LiYCY 7 x 0,75 mm² max 20 m (logic and power supply) or LiYCY 7 x 1 mm² max 40 m (logic and power supply) |
| Conductor size | up to 1 mm² - available for 7 wires | up to 1 mm² - available for 7 wires |
| Connection type | to solder | to solder |
| Protection (EN 60529) | IP 67 | IP 67 |

### 20.2 Main connectors - 12 pin - for **AEB-NP** and **AES**

| CONNECTOR TYPE | POWER SUPPLY AND SIGNALS | POWER SUPPLY AND SIGNALS |
|---|---|---|
| CODE | (A2) ZM-12P | (A4) ZH-12P |
| Type | 12pin female straight circular | 12pin female straight circular |
| Standard | DIN 43651 | DIN 43651 |
| Material | Metallic | Plastic reinforced with fiber glass |
| Cable gland | PG13,5 | PG16 |
| Recommended cable | LiYCY 12 x 0,75 mm² max 20 m (logic and power supply) | LiYCY 10 x 0,14mm² max 40 m (logic)<br>LiYY 3 x 1mm² max 40 m (power supply) |
| Conductor size | 0,5 mm² to 1,5 mm² - available for 12 wires | 0,14 mm² to 0,5 mm² - available for 9 wires<br>0,5 mm² to 1,5 mm² - available for 3 wires |
| Connection type | to crimp | to crimp |
| Protection (EN 60529) | IP 67 | IP 67 |

### 20.3 IO-Link connector - only for **AEB-IL**

| CONNECTOR TYPE | IL IO-Link |
|---|---|
| CODE | (A) ZM-5PF |
| Type | 5pin female straight circular |
| Standard | M12 coding A – IEC 61076-2-101 |
| Material | Metallic |
| Cable gland | Pressure nut - cable diameter 6÷8 mm |
| Recommended cable | 5 x 0,75 mm² max 20 m |
| Connection type | screw terminal |
| Protection (EN 60529) | IP 67 |

### 20.4 Fieldbus communication connectors - only for **AES**

| CONNECTOR TYPE | BC CANopen (1) | | BP PROFIBUS DP (1) | | EH EtherCAT (2) |
|---|---|---|---|---|---|
| CODE | (C1) ZM-5PF | (C2) ZM-5PM | (C1) ZM-5PF/BP | (C2) ZM-5PM/BP | (C1) (C2) ZM-4PM/E |
| Type | 5 pin female straight circular | 5 pin male straight circular | 5 pin female straight circular | 5 pin male straight circular | 4 pin male straight circular |
| Standard | M12 coding A – IEC 61076-2-101 | | M12 coding B – IEC 61076-2-101 | | M12 coding D – IEC 61076-2-101 |
| Material | Metallic | | Metallic | | Metallic |
| Cable gland | Pressure nut - cable diameter 6÷8 mm | | Pressure nut - cable diameter 6÷8 mm | | Pressure nut - cable diameter 4÷8 mm |
| Cable | CANbus Standard (DR 303-1) | | PROFIBUS DP Standard | | Ethernet standard CAT-5 |
| Connection type | screw terminal | | screw terminal | | terminal block |
| Protection (EN 60529) | IP67 | | IP 67 | | IP 67 |

**(1)** E-TRM-** terminators can be ordered separately - see tech table **GS500**

**(2)** Internally terminated

### 20.5 Remote pressure transducer connectors - only for **/W** option

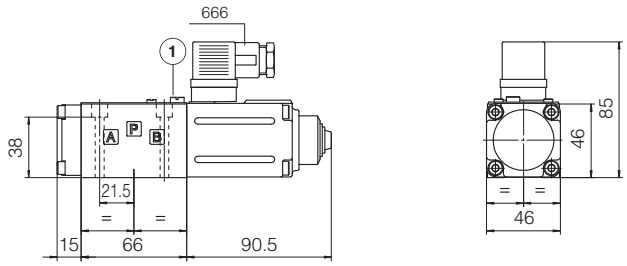
| CONNECTOR TYPE | TRANSDUCER | |
|---|---|---|
| CODE | (D1) ZH-5PM/1.5 | (D1) ZH-5PM/5 |
| Type | 5 pin male straight circular | |
| Standard | M12 coding A – IEC 61076-2-101 | |
| Material | Plastic | |
| Cable gland | Connector moulded on cables<br>1,5 m length | 5 m length |
| Cable | 5 x 0,25 mm² | |
| Connection type | molded cable | |
| Protection (EN 60529) | IP 67 | |

## 21 INSTALLATION DIMENSIONS FOR DHZO [mm]

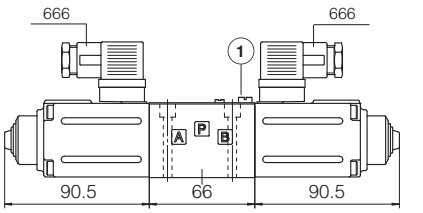
**ISO 4401: 2005**
**Mounting surface: 4401-03-02-0-05** (see table P005)
**(for /Y version, surface 4401-03-03-0-05 without X port)**

| | Mass [kg] | | |
|---|---|---|---|
| | **A** | **AEB, AES** | **AES-EH** |
| DHZO-*-05 | 1,9 | 2,3 | 2,4 |
| DHZO-*-07 | 2,6 | 3,1 | 3,2 |

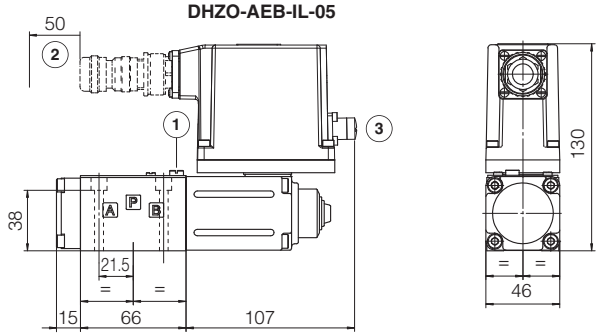
**DHZO-A-05**



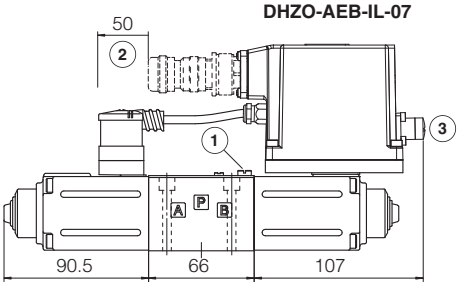

**DHZO-A-07**



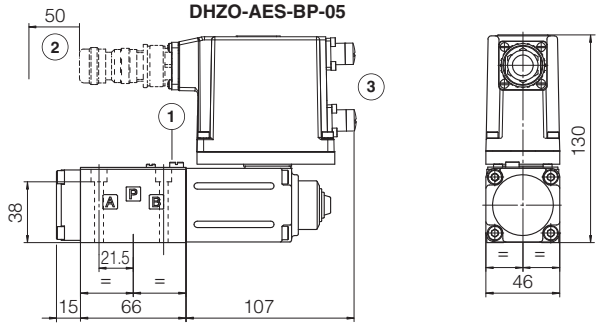

**DHZO-AEB-NP-05**
**DHZO-AEB-IL-05**



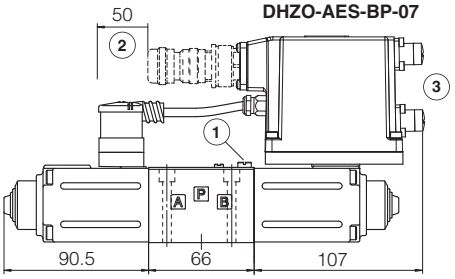

**DHZO-AEB-NP-07**
**DHZO-AEB-IL-07**



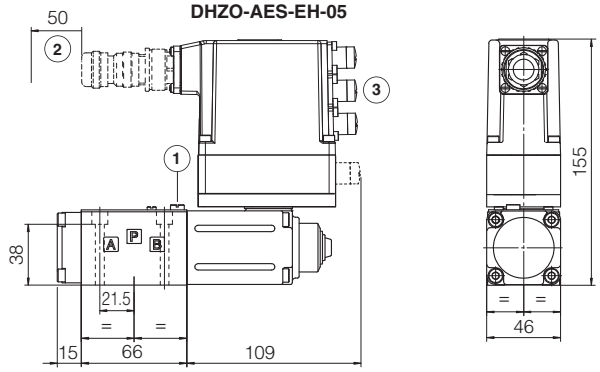

**DHZO-AES-BC-05**
**DHZO-AES-BP-05**



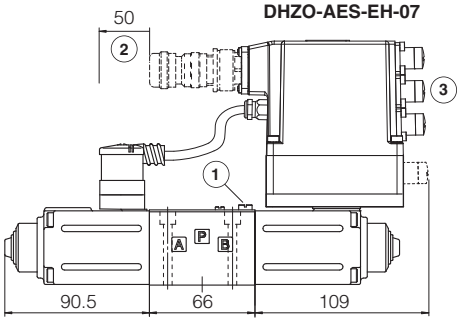

**DHZO-AES-BC-07**
**DHZO-AES-BP-07**




**DHZO-AES-EH-05**




**DHZO-AES-EH-07**




(1) = Air bleeding 3

(2) = Space required for connection cable and for connector removal

(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

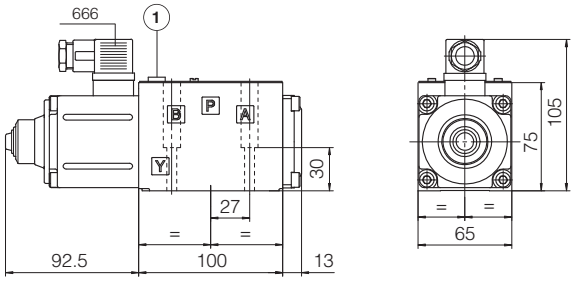
**Note:** for /B option the solenoid and the on-board digital driver are at side of port A

## 22 INSTALLATION DIMENSIONS FOR DKZOR [mm]

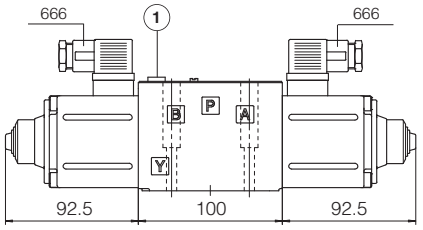
**ISO 4401: 2005**
**Mounting surface: 4401-05-04-0-05** (see table P005)
**(for /Y version, surface 4401-05-05-0-05 without X port)**

| | Mass [kg] | | |
|---|---|---|---|
| | **A** | **AEB, AES** | **AES-EH** |
| DKZOR-*-15 | 3,8 | 4,3 | 4,4 |
| DKZOR-*-17 | 4,5 | 5,0 | 5,1 |

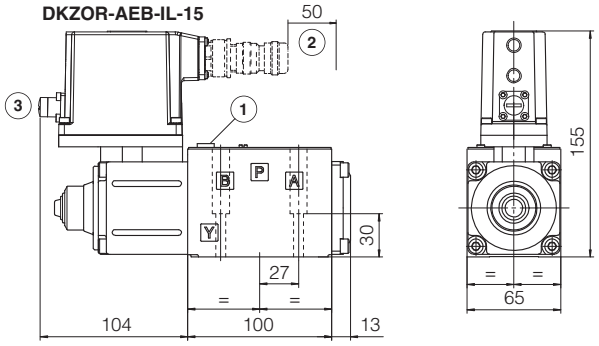
**DKZOR-A-15**



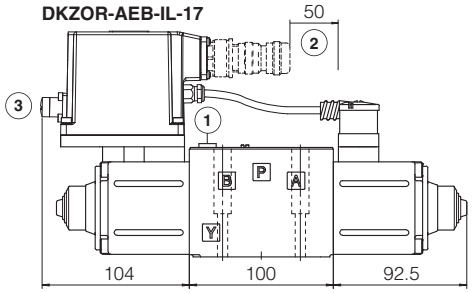

**DKZOR-A-17**



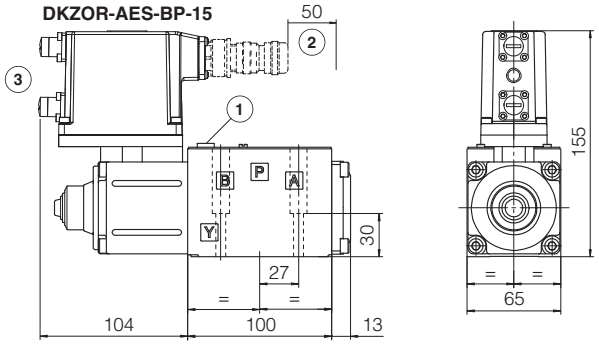

**DKZOR-AEB-NP-15**
**DKZOR-AEB-IL-15**



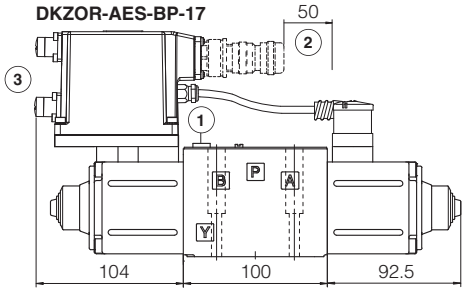

**DKZOR-AEB-NP-17**
**DKZOR-AEB-IL-17**



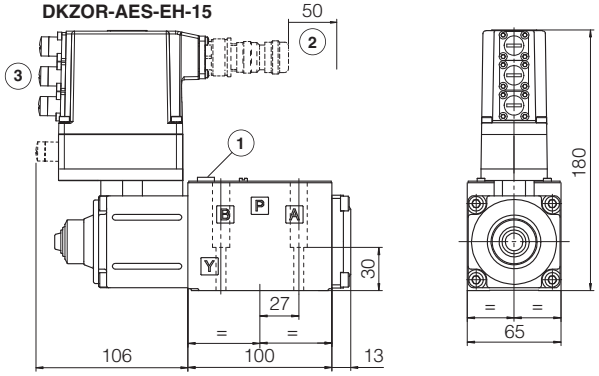

**DKZOR-AES-BC-15**
**DKZOR-AES-BP-15**



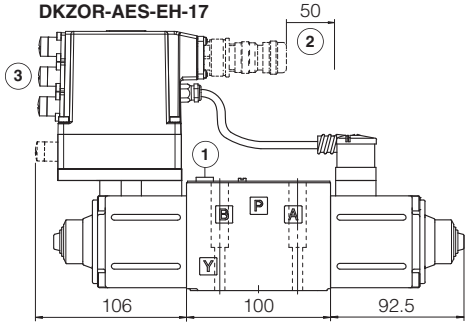

**DKZOR-AES-BC-17**
**DKZOR-AES-BP-17**




**DKZOR-AES-EH-15**




**DKZOR-AES-EH-17**



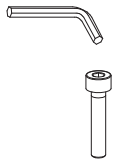

(1) = Air bleeding 3

(2) = Space required for connection cable and for connector removal

(3) = The dimensions of connectors and Bluetooth adapter must be considered, see section 19.7, 19.8 and 19.9

**Note:** for /B option the solenoid and the on-board digital driver are at side of port A

## 23 FASTENING BOLTS AND SEALS

| | DHZO | DKZOR |
|---|---|---|
|  | **Fastening bolts:**<br>4 socket head screws M5x50 class 12.9<br>Tightening torque = 8 Nm | **Fastening bolts:**<br>4 socket head screws M6x40 class 12.9<br>Tightening torque = 15 Nm |
|  | **Seals:**<br>4 OR 108<br>Diameter of ports A, B, P, T: Ø 7,5 mm (max)<br>1 OR 2025<br>Diameter of port Y: Ø 3,2 mm (only for /Y option) | **Seals:**<br>5 OR 2050<br>Diameter of ports A, B, P, T: Ø 11,2 mm (max)<br>1 OR 108<br>Diameter of port Y: Ø 5 mm (only for /Y option) |

## 24 RELATED DOCUMENTATION

| | |
|---|---|
| **FS001** | Basics for digital electrohydraulics |
| **FS900** | Operating and maintenance information for proportional valves |
| **G010** | E-MI-AC analog driver |
| **G020** | E-MI-AS-IR digital driver |
| **G030** | E-BM-AS digital driver |
| **GS050** | E-BM-AES digital driver |
| **GS500** | Programming tools |
| **GS510** | Fieldbus |
| **GS520** | IO-Link interface |
| **K800** | Electric and electronic connectors |
| **P005** | Mounting surfaces for electrohydraulic valves |
| **QB100** | Quickstart for AEB valves commissioning |
| **QF100** | Quickstart for AES valves commissioning |
| **E-MAN-MI-AS** | E-MI-AS-IR user manual (off-board) |
| **E-MAN-BM-AS** | E-BM-AS user manual (off-board) |
| **E-MAN-BM-AES** | E-BM-AES user manual (off-board) |
| **E-MAN-RI-AEB** | AEB user manual |
| **E-MAN-RI-AES** | AES user manual |