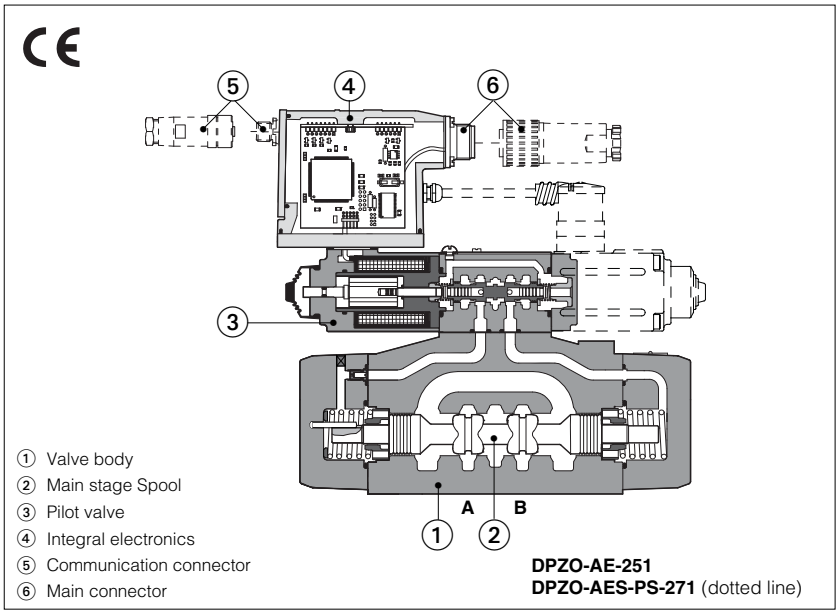
# Proportional directional valves type DPZO-A*

two stage without position transducer, ISO 4401 sizes 10, 16 and 25




① Valve body
② Main stage Spool
③ Pilot valve
④ Integral electronics
⑤ Communication connector
⑥ Main connector

**DPZO-AE-251**
**DPZO-AES-PS-271** (dotted line)

DPZO-A* are two stage proportional valves without position transducer, which provide both directional and non compensated flow control according to the electronic reference signal.

They operate in association with electronic drivers, see section [2], which supply the proportional valves with correct current signal to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:
- -A, without position transducer;
- -AE, -AES as -A plus analogue (AE) or digital (AES) integral electronics ④.
- -AEG, as A plus integral digital cycle generator (see table G120).

The 4-way spool ②, sliding into a 5-chambers body ①, is piloted in open loop by the proportional pressure reducing valve ③ type DHRZO.

The integral electronics ④ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.
The electronic main connector ⑥ is fully interchangeable for –AE and –AES executions.
Standard 7 pin main connector is used for power supply, analog input reference and monitor signals.
12 pin connector is used for AEG version and for option /Z (AES).

Following communication interfaces ⑤ are available for the digital -AES and -AEG executions:
- -PS, RS232 serial communication interface. The valve reference signal is provided with analogue commands via the 7 (or 12) pins connector ⑥.
- -BC, CANopen interface (only for -AES)
- -BP, PROFIBUS DP interface (only for -AES)

The valves with -BC and -BP interfaces can be integrated into a fieldbus communication network and thus digitally operated by the machine control unit.
The coils are fully plastic encapsulated (insulation class H) and valves have anti-vibration, antishock and weather-proof features.

Surface mounting: ISO 4401 size 10, 16 and 25.

Max flow respectively up to 160 l/min, 340 l/min and 680 l/min with valve differential pressure Δp = 30 bar, see section [3].

Max pressure: 350 bar.

## 1 MODEL CODE

**DPZO - AES - PS - 2 7 1 - D 5 / * * * /***

Piloted proportional directional valve

**A** = without position transducer
**AE** = as A plus integral electronics
**AES** = as A plus integral digital electronics
**AEG** = as A plus integral digital cycle generator (1)

Communication interfaces (only for AES and AEG)
**PS** = Serial
**BC** = CANopen (only for AES)
**BP** = PROFIBUS DP (only for AES)

Valve size:
**1** = 10 **2** = 16 **3** = 25

Configuration, see section [3]:
**5** = external plus central position, spring centered
**7** = 3 positions; spring centered

Spool overlapping in central position, see section [3]:
**1** = P, A, B, T positive overlapping (2)
**3** = P positive overlapping (2); A, B, T negative overlapping

Spool type
**L** = linear
**S** = progressive
**D** = as **S**, but with P-A = Q, P-B = Q/2

Spool size: **3, 5** and **9** = see section [3]

**Hydraulic options,** see section [4]:
**B** = solenoid and integral electronics at side of port B of the main stage;
**D** = internal drain
**E** = external pilot
**G** = pressure reducing valve for piloting

**Electronics options for -AE execution,** see section [8]:
**I** = current reference input (4÷20 mA)
**Q** = enable signal

**Electronics options for -AES execution,** see section [10]:
**I** = current reference input (4÷20 mA)
**Z** = double power supply, enable and fault (12 pins connector)

**Coils voltage (only for -A execution):** see section [6]:
**-** = standard 12 $V_{DC}$ coil
**6** = with 6 $V_{DC}$ coil
**18** = with 18 $V_{DC}$

Series number

Synthetic fluids:
**WG** = water-glycol
**PE** = phosph. ester

**Note:**
(1) For detailed description of AEG integral cycle generator, see table G120
(2) Overlapping = 20% of spool stroke for type **S** and **D**, 10% of spool stroke for type **L**

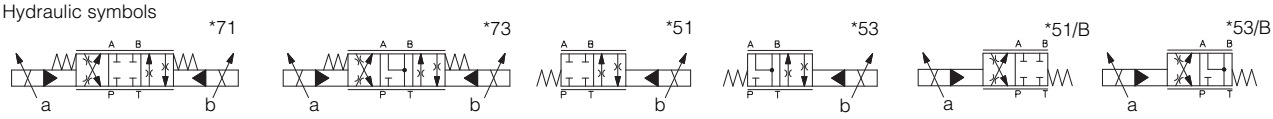
## 2 ELECTRONIC DRIVERS FOR DPZO-A*

| Valve model | -A | | | | | | -AE | -AES | -AEG |
|---|---|---|---|---|---|---|---|---|---|
| Drivers model | E-MI-AC-0*F | E-MI-AS-IR | E-BM-AC-0*F | E-BM-AS-PS | E-ME-AC-0*F | E-RP-AC-0*F | E-RI-AE | E-RI-AES | E-RI-AEG |
| Data sheet | G010 | G020 | G025 | G030 | G035 | G100 | G110 | G115 | G120 |

**Note:** For power supply and communication connector see section [17]

## 3 HYDRAULIC CHARACTERISTICS (based on mineral oil ISO VG 46 at 50 °C)

Hydraulic symbols




| Valve model | DPZO-1 | | | DPZO-2 | | | | | DPZO-3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Spool overlapping | 1, 3 | | | 1, 3 | | | | | 1, 3 | | |
| Spool type and size | L5 | S5 | D5 | S3 | D3 | L5 | S5 | D5 | L5 | S5 | D5 |
| Max flow (1) [l/min] | | | | | | | | | | | |
| at Δp = 10 bar | 100 | 100 | 100 : 60 | 130 | 130 : 80 | 200 | 180 | 180 : 130 | 390 | 360 | 360 : 220 |
| at Δp = 30 bar | 160 | 160 | 160 : 100 | 225 | 225 : 135 | 340 | 310 | 310 : 225 | 680 | 620 | 620 : 380 |
| max permissible flow | 180 | 180 | 180 : 110 | 500 | 500 : 300 | 710 | 640 | 640 : 460 | 1350 | 1250 | 1250 : 760 |
| Pressure limits [bar] | ports P, A, B, X = 350; T = 250 (5 for option /D); Y = 5 | | | | | | | | | | |
| Response time [ms] | < 80 | | | < 100 | | | | | < 120 | | |
| Hysteresis [%] | ≤ 5% | | | | | | | | | | |
| Repeatability | ± 1% | | | | | | | | | | |

**Notes:**
- Above performance data refer to valves coupled with Atos electronic drivers, see section 2.
- In case of long time shutdown of the hydraulic supply to the pilot valve, the driver has to be switched off to avoid its overheating.
- The flow regulated by the directional proportional valves is not pressure compensated, thus it is affected by the load variations.To keep costant the regulated flow under different load conditions, modular pressure compensators are available (see tab. D150).

(1) For different Δp, the max flow is in accordance to the diagrams in section 14.2

## 4 HYDRAULIC OPTIONS

**4.1 Option /B** Solenoid (for valve configuration *5*) and integral electronics at side of port A.

**4.2 Pilot and drain configuration** -The pilot / drain configuration can be modified as shown in the table E080 section 12.

The valve's standard configuration provides internal pilot and external drain. For different pilot / drain configuration select:

**Option /E** External pilot (through port X). **Option /D** Internal drain.

**Option /G** Pressure reducing valve with fixed setting (= 40 bar for DPZO-1 and -2; 100 bar for DPZO-3) installed between pilot valve and main body. It is advisable for valves with internal pilot in case of system pressure higher than 200 bar. This option is standard for DPZO-L*-1.

## 5 GENERAL NOTES

DPZO-A* proportional valves are CE marked according to the applicable Directives (e.g. Immunity/Emission EMC Directive and Low Voltage Directive).

Installation, wirings and start-up procedures must be performed according to the general prescriptions shown in table F003 and in the installation notes supplied with relevant components.

The electrical signals of the valve (e.g. monitor signals) must not be directly used to activate safety functions, like to switch-ON/OFF the machine's safety components, as prescribed by the European standards (Safety requirements of fluid technology systems and components-hydraulics, EN-982).

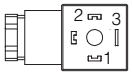
## 6 OPTIONS FOR -A EXECUTION

**6.1 Option /6** 6 VDC coil instead of standard 12 VDC, to be used in case of power supply 12 VDC

**6.2 Option /18** 18 VDC coil instead of standard 12 VDC, to be used with electronic drivers not supplied by Atos

## 7 CONNECTIONS FOR -A EXECUTION

| SOLENOID POWER SUPPLY CONNECTOR | |
|---|---|
| PIN | Signal description |
| 1 | SUPPLY |
| 2 | SUPPLY |
| 3 | GND |




## 8 ANALOG INTEGRAL DRIVERS -AE - OPTIONS

Standard driver execution provides on the 7 pin main connector:

*Power supply* - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to the driver power supply. Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers

*Reference input signal* - analog differential input with ±10 VDC nominal range (pin D,E), proportional to desired coil current.

*Monitor output signal* - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

**8.1 Option /I**

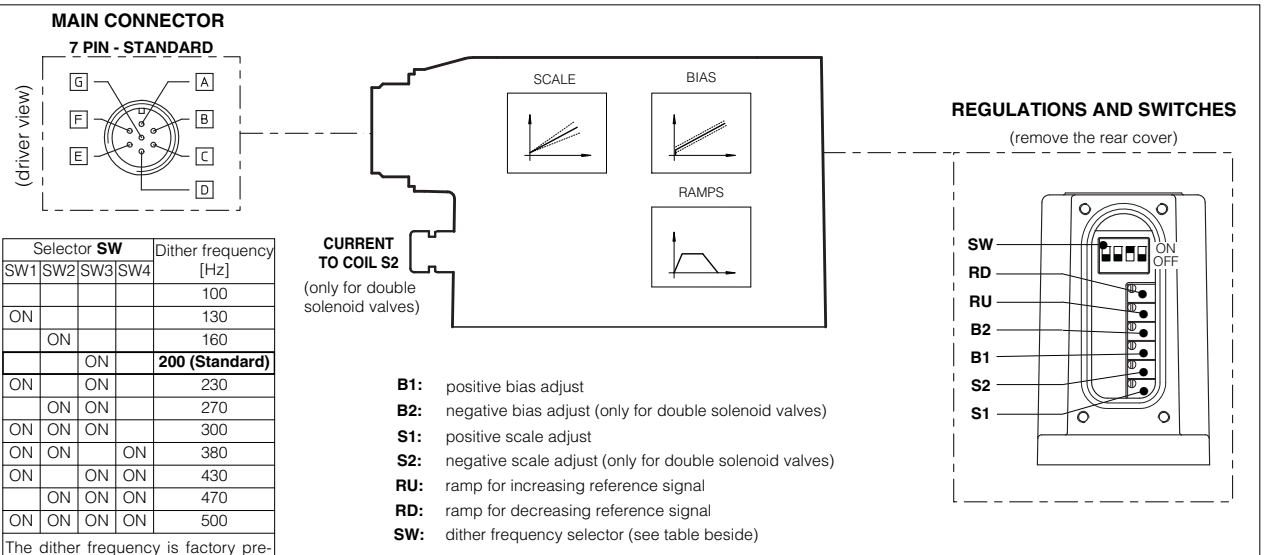
It provides the 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard ±10 VDC.
It is normally used in case of long distance between the machine control unit and the valve or where the reference signal can be affected by electrical noise; the valve functioning is disabled in case of reference signal cable breakage.

**8.2 Option /Q**

It provides the possibility to enable or disable the valve functioning without cutting the power supply (the valve functioning is disabled but the driver current output stage is still active). To enable the driver supply a 24VDC on the enable input signal.

**8.3 Possible combined options:** /IQ

## 9 ANALOG INTEGRAL DRIVERS -AE - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS




| Selector **SW** | | | | Dither frequency |
|---|---|---|---|---|
| SW1 | SW2 | SW3 | SW4 | [Hz] |
| | | | | 100 |
| ON | | | | 130 |
| | ON | | | 160 |
| | | ON | | **200 (Standard)** |
| ON | | ON | | 230 |
| | ON | ON | | 270 |
| ON | ON | ON | | 300 |
| ON | ON | | ON | 380 |
| ON | | ON | ON | 430 |
| | ON | ON | ON | 470 |
| ON | ON | ON | ON | 500 |

The dither frequency is factory pre-set at 200 Hz and its regulation may be adjusted after contact with Atos technical department

**B1:** positive bias adjust
**B2:** negative bias adjust (only for double solenoid valves)
**S1:** positive scale adjust
**S2:** negative scale adjust (only for double solenoid valves)
**RU:** ramp for increasing reference signal
**RD:** ramp for decreasing reference signal
**SW:** dither frequency selector (see table beside)

### 9.1 ELECTRONIC CONNECTIONS - 7 PIN MAIN CONNECTORS

| PIN | SIGNAL | TECHNICAL SPECIFICATIONS | | NOTES |
|---|---|---|---|---|
| A | V+ | Power supply 24 VDC for solenoid power stage and driver logic | | Input - power supply |
| B | V0 | Power supply 0 VDC for solenoid power stage and driver logic | | Gnd - power supply |
| C (1) | AGND | Ground - signal zero for MONITOR signal | | Gnd - analog signal |
| | ENABLE | Enable (24 VDC) or disable (0 VDC) the driver | (for /Q option) | Input - on/off signal |
| D | INPUT+ | Reference analog differential input: ±10 VDC maximum range<br>For single solenoid valves the reference input is 0÷+10 VDC | (4 ÷ 20 mA for /I option)<br>(4 ÷ 20 mA for /I option) | Input - analog signal |
| E | INPUT - | For double solenoid valves the reference input is ±10 VDC | (4 ÷ 20 mA for /I option) | |
| F | MONITOR | Monitor analog output: ±10 VDC maximum range | | Output - analog signal |
| G | EARTH | Internally connected to the driver housing | | |

**Note:** (1) with /Q option ENABLE signal replaces AGND on pin C; MONITOR signal is reffered to pin B.
A minimum time of 60ms to 160ms 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

## 10 DIGITAL INTEGRAL DRIVERS -AES - OPTIONS

Standard driver execution provides on the 7 pin main connector:

*Power supply* - 24VDC must be appropriately stabilized or rectified and filtered; a 2,5 A safety fuse is required in series to each driver power supply Apply at least a 10000 µF/40 V capacitance to single phase rectifiers or a 4700 µF/40 V capacitance to three phase rectifiers.
*Reference input signal* - analog differential input with ±10VDC nominal range (pin D,E), proportional to desired coil current.
*Monitor output signal* - analog output signal proportional to the actual valve's coil current (1V monitor = 1A coil current)

Following options are available to adapt standard execution to special application requirements:

### 10.1 Option /I

It provides 4÷20 mA current reference signal instead of the standard ±10 VDC. Monitor output signal is still the standard 0÷10 VDC.
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.

### 10.2 Option /Z

It provides on a 12 pin main connector the above standard features plus:

**Logic power supply**

Option /Z provides separate power supply for the solenoid (pin 1, 2) and for the digital electronic circuits (pin 9, 10).
Cutting solenoid power supply allows to interrupt the valve functioning but keeping energized the digital electronics thus avoiding fault conditions of the machine fieldbus controller. This condition allows to realize safety systems in compliance with European Norms EN13849-1 (ex EN954-1).

**Enable Input Signal**

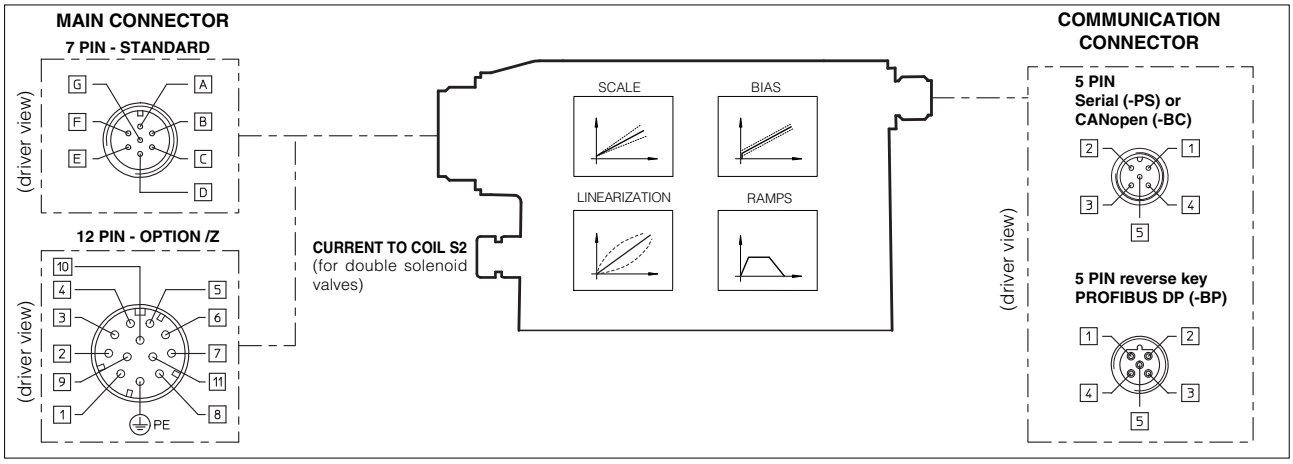
To enable the driver, supply a 24VDC on pin 3 referred to pin 2: when the Enable signal is set to zero the valve functioning is disabled (zero current to the solenoid) but the driver current output stage is still active. This condition does not comply with European Norms EN13849-1 (ex EN954-1).

**Fault Output Signal**

Fault output signal indicates fault conditions of the driver (solenoid short circuits/not connected, reference signal cable broken for 4÷20mA input, etc.). Fault presence corresponds to 0 VDC, normal working corresponds to 24VDC (pin 11 referred to pin 2): Fault status is not affected by the Enable input signal

### 10.3 Possible combined options: /IZ

## 11 DIGITAL INTEGRAL DRIVERS -AES - MAIN FUNCTIONS AND ELECTRONIC CONNECTIONS




### 11.1 ELECTRONIC CONNECTIONS - 7 & 12 PIN MAIN CONNECTORS

| Standard 7pin | /Z option 12pin | SIGNAL | TECHNICAL SPECIFICATIONS | NOTES |
|---|---|---|---|---|
| A | 1 | V+ | Power supply 24 VDC for solenoid power stage (and for driver logic on 7 pin connection) | Input - power supply |
| B | 2 | V0 | Power supply 0 VDC for solenoid power stage (and for driver logic on 7 pin connection) | Gnd - power supply |
| - | 3 | ENABLE | Enable (24 VDC) or disable (0 VDC) the driver | Input - on/off signal |
| D | 4 | INPUT+ | Reference analog input: ±10 VDC maximum range (4 ÷ 20 mA for /I option)<br>For single solenoid valves the reference input is 0÷+10 VDC (4 ÷ 20 mA for /I option)<br>For double solenoid valves the reference input is ±10 VDC (4 ÷ 20 mA for /I option)<br>standard: differential input; /Z option: common mode INPUT+ referred to AGND | Input - analog signal |
| E | - | INPUT - | | |
| C | 5 | AGND | Ground - signal zero for MONITOR signal<br>signal zero for INPUT+ signal (only for /Z option) | Gnd - analog signal |
| F | 6 | MONITOR | Monitor analog output: ±10 VDC maximum range | Output - analog signal |
| - | 7 | NC | do not connect | |
| - | 8 | NC | do not connect | |
| - | 9 | VL+ | Power supply 24 VDC for driver logic | Input - power supply |
| - | 10 | VL0 | Power supply 0 VDC for driver logic | Gnd - power supply |
| - | 11 | FAULT | Fault (0 VDC) or normal working (24 VDC) | Output - on/off signal |
| G | PE | EARTH | Internally connected to the driver housing | |

**Note:** A minimum time of 270 to 340 ms 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.

### 11.2 ELECTRONIC CONNECTIONS - 5 PIN COMMUNICATION CONNECTORS

| | -PS Serial | | -BC CANopen | | -BP PROFIBUS DP | |
|---|---|---|---|---|---|---|
| PIN | SIGNAL | TECHNICAL SPECIFICATION | SIGNAL | TECHNICAL SPECIFICATION | SIGNAL | TECHNICAL SPECIFICATION |
| 1 | NC | do not connect | CAN_SHLD | Shield | +5V | for termination |
| 2 | NC | do not connect | NC | do not connect | LINE-A | Bus line (high) |
| 3 | RS_GND | Signal zero data line | CAN_GND | Signal zero data line | DGND | data line and termination Signal zero |
| 4 | RS_RX | Valves receiving data line | CAN_H | Bus line (high) | LINE-B | Bus line (low) |
| 5 | RS_TX | Valves transmitting data line | CAN_L | Bus line (low) | SHIELD | |

## 12 SOFTWARE TOOLS

The functional parameters of digital valves, as the bias, scale ramp and linearization of the regulation characteristic, can be easily set and optimized with the Atos E-SW programming software, available in three different versions according to the driver's communication interfacing: E-SW-PS (Serial), E-SW-BC (CANopen) and E-SW-BP (PROFIBUS DP).
A proper connection is required between the PC and the electronic driver communication port: for a more detailed description of software interface, PC requirements, adapters, cables and terminators, please **see table G500.**
Proportional valves with fieldbus communication interface (-BC and -BP) can be directly managed by the machine control unit; it is required to implement in the machine control the standard communication as described in the user manuals supplied with the relevant programming software. For detailed description of available fieldbus feature, **see table G510.**

On first supply of the E-SW software, it is required to apply for the registration in the Atos download area: **www.download.atos.com**
Once the registration is completed, the password will be sent by email.
The software remains active for 10 days from the installation date and then it stops until the user inputs his password.
With the password you can also download, in your personal area, the latest releases of the Atos software, manuals, drivers and configuration files.

## 13 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES TYPE DPZO-A*

| | | | |
|---|---|---|---|
| Assembly position | Any position | | |
| Subplate surface finishing | Roughness index, $\sqrt{}^{0.4}$ flatness ratio 0,01/100 (ISO 1101) | | |
| Ambient temperature | -20°C ÷ +70°C for -A execution; -20°C ÷ +60°C for -AE and -AES executions | | |
| Fluid | Hydraulic oil as per DIN 51524 ... 535 for other fluids see section 1 | | |
| Recommended viscosity | 15 ÷100 mm²/s at 40°C (ISO VG 15÷100) | | |
| Fluid contamination class | ISO 18/15 achieved with in line filters of 10 µm and $\beta_{10} \geq 75$ (recommended) | | |
| Fluid temperature | -20°C +60°C (standard and /WG seals) -20°C +80°C (/PE seals) | | |
| Coil voltage | 12 VDC coil | 6 VDC coil | 18 VDC coil |
| Coil resistance R at 20°C | 3 ÷ 3,3 Ω | 2 ÷ 2,2 Ω | 13 ÷ 13,4 Ω |
| Max. solenoid current | 1,9 A | 2,35 A | 0,9 A |
| Max. power | 30 Watt | | |
| Protection degree (CEI EN-60529) | IP65 for -A execution; IP65÷67 for -AE and -AES executions, depending to the connector type, see sect. 17 | | |
| Relative duty factor | Continuous rating (ED=100%) | | |

## 14 DIAGRAMS (based on mineral oil ISO VG 46 at 50 °C)

### 14.1 Regulation diagrams

DPZO-1:
**1** = linear spool L5
**2** = differential spool S5, D5

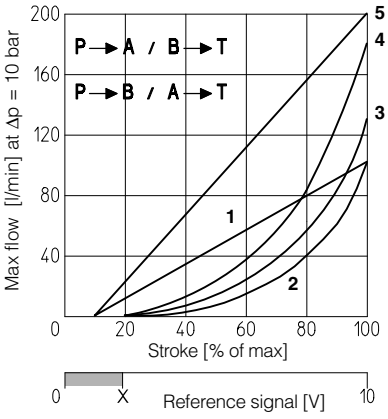
DPZO-2:
**3** = progressive spool S3, D3
**4** = progressive spool S5, D5
**5** = linear spool L5

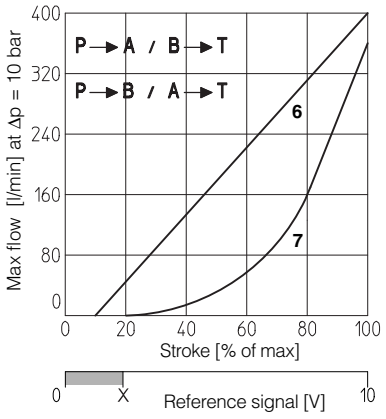
DPZO-3:
**6** = linear spool L5
**7** = progressive spool S5, D5

**Note**:
1) Hydraulic configuration vs. reference signal:
for double solenoid valves (also for option /B)

Reference signal 0 ÷+10 V / 12÷20 mA P → A / B → T

Reference signal 0 ÷-10 V / 4÷12 mA P → B / A → T




**X** = Threshold for bias activation depending to the valve type and amplifier type

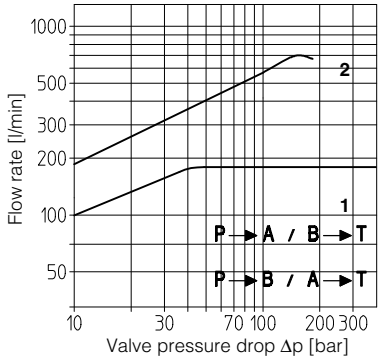
### 14.2 Flow /Δp diagram

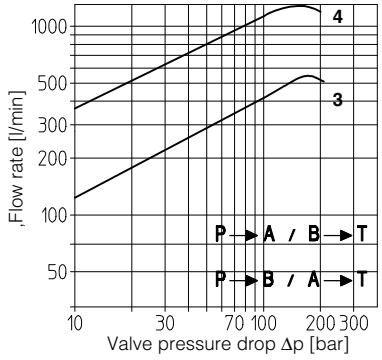
Stated at 100% of valve stroke

DPZO-1:
**1** = spool L5, S5, D5

DPZO-2:
**2** = spool L5, S5, D5
**3** = spool S3, D3

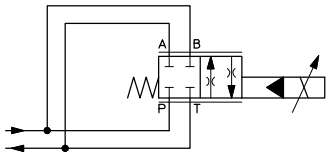
DPZO-3:
**4** = spool L5, S5, D5




### 14.3 Operation as throttle valve

Single solenoid valves (*51) can be used as simple throttle valves:
Pmax = 250 bar
For this application, the use of valve -T, -TE or -TES (see tab. F172 and F175) is advisable (consult our technical office)

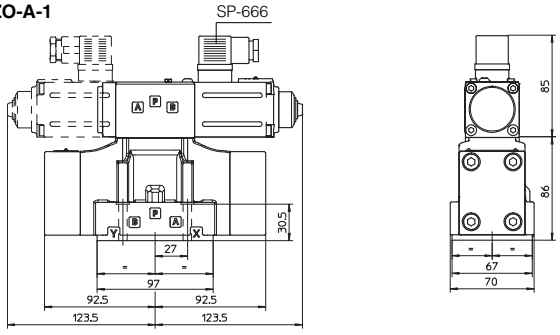



| DPZO-*- | | 151-L5 | 251-L5 | 351-L5 |
|---|---|---|---|---|
| Max flow | [l/min] | 320 | 650 | 1300 |
| Δp | [bar] | 30 | 30 | 30 |

**15 INSTALLATION DIMENSIONS FOR DPZO-1 AND DPZO-2 [mm]**

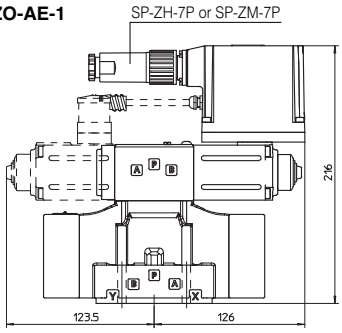
## DPZO-A(*)-1 (dotted line = double solenoid version)

**DPZO-A-1**

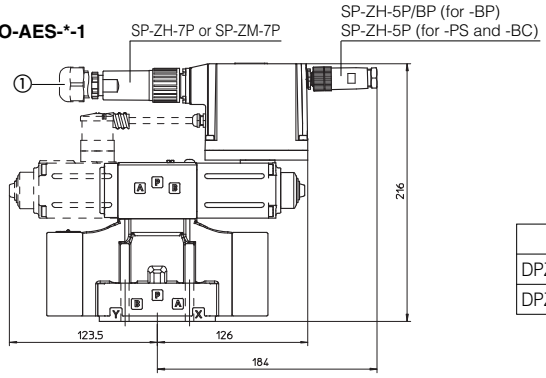



**ISO 4401: 2005**
**Mounting surface: 4401-05-05-0-05** (see table P005)
Fastening bolts:
4 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 5 OR 2050; 2 OR 108
Diameter of ports A, B, P, T: Ø = 11 mm;
Diameter of ports X, Y: Ø = 5 mm;

**DPZO-AE-1**




**DPZO-AES-*-1**




**Mass [kg]**

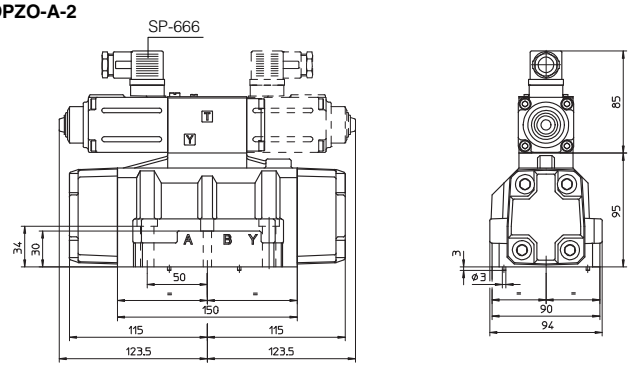
| | A | AE, AES |
|---|---|---|
| DPZO-*-15* | 7,7 | 8,1 |
| DPZO-*-17* | 8,6 | 9 |

**-AES EXECUTION**
① = 12 pin connector SP-ZH-12P for option /Z

**NOTE:**
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

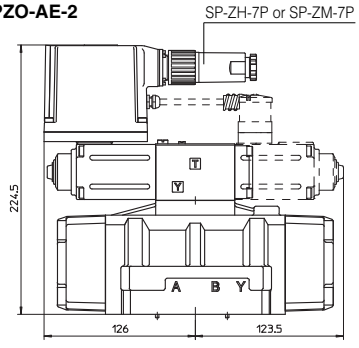
## DPZO-A(*)-2 (dotted line = double solenoid version)

**DPZO-A-2**

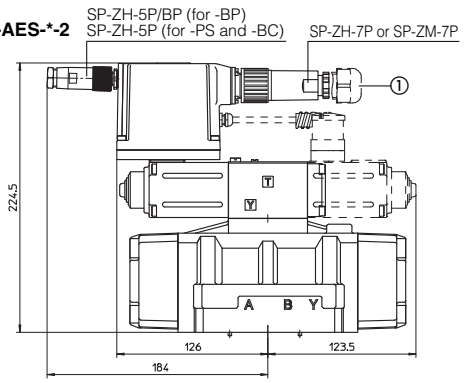



**ISO 4401: 2005**
**Mounting surface: 4401-07-07-0-05** (see table P005)
Fastening bolts:
4 socket head screws M10x50 class 12.9
Tightening torque = 70 Nm
2 socket head screws M6x40 class 12.9
Tightening torque = 15 Nm
Seals: 4 OR 130; 3 OR 109/70
Diameter of ports A, B, P, T: Ø = 20 mm;
Diameter of ports X, Y: Ø = 7 mm;

**DPZO-AE-2**




**DPZO-AES-*-2**




**Mass [kg]**

| | A | AE, AES |
|---|---|---|
| DPZO-*-25* | 11,9 | 12,3 |
| DPZO-*-27* | 12,8 | 13,2 |

**-AES EXECUTION**
① = 12 pin connector SP-ZH-12P for option /Z

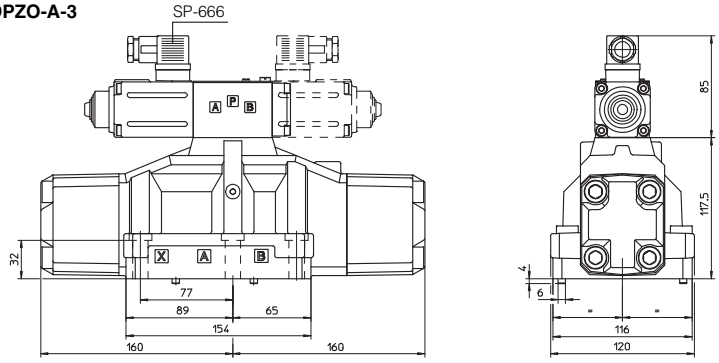
**NOTE:**
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

## 16 INSTALLATION DIMENSIONS FOR DPZO-3 [mm]

# DPZO-A(*)-3 (dotted line = double solenoid version)

**ISO 4401: 2005**
**Mounting surface: 4401-08-08-0-05** (see table P005)
Fastening bolts:
6 socket head screws M12x50 class 12.9
Tightening torque = 125 Nm
Seals: 4 OR 4112; 3 OR 3056
Diameter of ports A, B, P, T: Ø = 24 mm;
Diameter of ports X, Y: Ø = 7 mm;

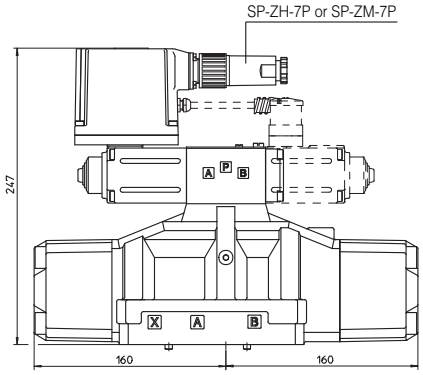
**DPZO-A-3**



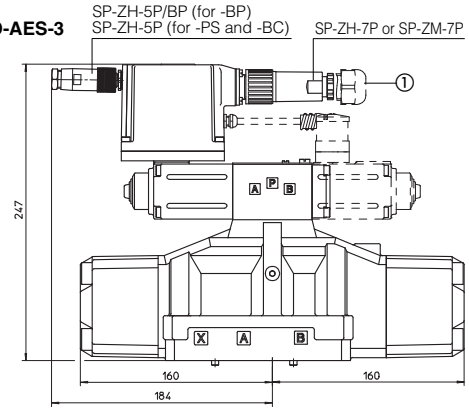

**Mass [kg]**

| | A | AE, AES |
|---|---|---|
| DPZO-*-35* | 17,1 | 17,5 |
| DPZO-*-37* | 18 | 18,4 |

**DPZO-AE-3**




**DPZO-AES-3**




**-AES EXECUTION**
① = 12 pin connector SP-ZH-12P for option /Z

**NOTE:**
For option /B the proportional solenoid and the electronics (in case of execution -AE and -AES) are at side of port B of the main stage.

## 17 MODEL CODES OF POWER SUPPLY AND COMMUNICATION CONNECTORS (to be ordered separately)

| VALVE VERSION | -A | -AE, -AES | | -AES/Z -AEG | -Serial (-PS) or CANopen (-BC) | PROFIBUS DP (-BP) |
|---|---|---|---|---|---|---|
| CONNECTOR CODE | SP-666 | SP-ZH-7P | SP-ZM-7P | SP-ZH-12P | SP-ZH-5P | SP-ZH-5P/BP |
| PROTECTION DEGREE | IP65 | IP67 | IP67 | IP65 | IP67 | IP67 |
| DATA SHEET | K500 | G110, G115, K500 | | | G115, K500 | |

connectors supplyed with the valve