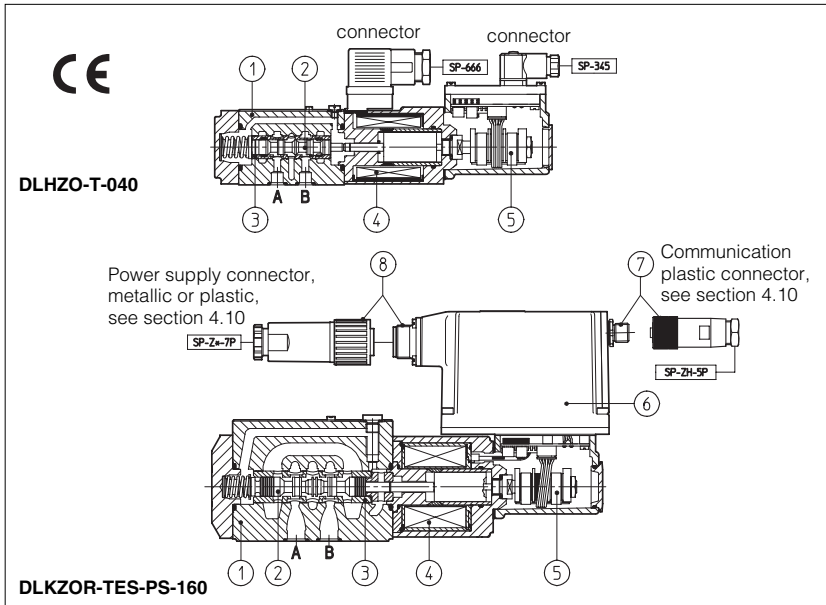


# Proportional directional valves type DLHZO and DLKZOR

sleeve execution, direct operated, ISO 4401 size 06 and 10



DLHZO and DLKZOR are high performance proportional valves, direct operated, with sleeve execution and LVDT position transducer, which provide both directional control and non compensated flow control according to the electronic reference signal.

They operate in association with electronic drivers, see section 8, which supply the proportional valves with proper current signal to align valve regulation to the reference signal supplied to the electronic driver.

They are available in different executions:

- -T, with position transducer ⑧;
- -TE, -TES as -T plus analogue (TE) or digital (TES) integral electronics.

The 4-way spool ② sliding into a precision - machined and hardened sleeve ③ for maximum overlapping accuracy. The sleeve ③ is mechanically forced into a 5-chamber body ①. The spool is directly operated by a proportional solenoid ④ and it is controlled in close loop position by means of the LVDT position transducer ⑤.

The integral electronics ⑥ ensures factory presetting, fine functionality plus valve-to-valve interchangeability and simplified wiring and installation.

Following communication interfaces ⑦ are available for the digital -TES execution:

- -PS, RS232 serial communication interface. The valve reference signal is provided with analogue commands via the 7 (or 12) pins connector ⑧.
- -BC, CANbus interface
- -BP, PROFIBUS-DP interface

In the -BC and -BP interfaces the valve reference signal is provided via fieldbus; during start up or maintenance, the valves can be operated with analogue signals via the 7 (or 12) pins connector ⑧.

Thanks to the optimisation of the integral electrohydraulic system, static and dynamic performances compare with good servovalves whilst maintaining the typical benefits of proportional hydraulics: less sensitivity, coarser filtration requirements, intrinsic stability, easier servicing and consequently improved reliability.

The coils are fully plastic encapsulated (insulation class H) and valves have antivibration, antishock and weather-proof features.

Surface mounting; ISO 4401 size 06 and 10. Maximum flow respectively up to 40 l/min and 100 l/min with differential pressure  $\Delta p = 70$  bar, see table 2. Max pressure = 350 bar

## 1 MODEL CODE

**DLHZO -TES-PS-0 4 0-L 7 3 / \* \*\* / \***

DLHZO = size 06  
DLKZOR = size 10

T = with position transducer  
TE = as T plus integral electronics  
TES = as T plus integral digital electronics

Communication interfaces (only for TES)

PS = RS232 serial  
BC = CANbus  
BP = PROFIBUS-DP

Valve size, see section 2  
0 = ISO 4401 size 06 1 = ISO 4401 size 10

Valve configuration, see section 2  
4 = 2 external position, spring offset, fail safe  
6 = 2 external position, spring offset

0 = zero overlapping

L = linear regulation; T = not linear regulation;

1, 3, 5, 7 = spool size, see section 2

Fail safe configuration:

1 = A, B, P, T with positive overlapping 3 = P positive overlapping; A, B, T negative

Option /C for current feedback signal (4 + 20 mA) is available on request for applications with long distance between valve and driver producing possible electrical "noise" problems.

Synthetic fluids  
WG = water-glycol  
PE = phosphate ester  
Design number

Options, see section 4:

Y = external drain  
B = solenoid, integral electronics and position transducer at side of port A

for -TE execution:

I = current reference (4+20 mA)  
F = fault signal  
Q = enable signal  
S = with logic state signals (12 poles connector)  
Z = enable, fault and monitor signals (12 poles connector)

for -TES execution (12 poles connector):

Z = double power supply, enable and fault  
SP = additional closed loop pressure control with multiple PID parameters set - only for -PS  
ZP = as SP but with double power supply, enable and fault - only for -BC and -BP  
C = remote pressure transducer with current feedback 4+20 mA - only for -TES/SP and -TES/ZP

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

Hydraulic symbols	DLHZO						DLKZOR		
	*40-L*3 *40-T*3		*40-L*1 *40-T*1		*60				
Valve model	DLHZO						DLKZOR		
Pressure limits [bar]	ports P, A, B = 350; T = 160 (250 with external drain /Y)						ports P, A, B = 315; T = 160 (250 with external drain /Y)		
Spool	-T -TE						-T -TE		
	L1	L3	L5	T5	L7	T7	L3	L7	T7
Max flow (1) [l/min]									
at $\Delta p = 30$ bar	4,5	9	18		27		40	60	
at $\Delta p = 70$ bar	7	14	28		40		60	100	
at $\Delta p_{max} = (\dots)$ bar	18 (350)	32 (350)	50 (250)		70 (200)		90 (200)	160 (160)	
Leakage [cm <sup>3</sup> /min] at P = 100 bar (2)	< 200	< 300	< 500	< 200	< 900	< 200	< 1000	< 1500	< 400
Response time (3) [ms]	≤ 10						≤ 15		
Hysteresis [%]	≤ 0,1%						≤ 0,1%		

Above performance data refer to valves coupled with Atos electronic drivers, see section 8.

(1) For different  $\Delta p$ , the max flow is in accordance to the diagrams in section 6.2.

(2) Referred to spool in center position and 50°C oil temperature.

(3) Reponse times at step signal (0%→100%) are measured from 10% to 90% of step value and are strictly referred to valve regulation.

### 3 MAIN CHARACTERISTICS OF PROPORTIONAL DIRECTIONAL VALVES TYPE DLHZO-T\* AND DLKZOR-T\*

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 -T execution; -20°C ÷ +60°C for -TE and -TES executions
Fluid	Hydraulic oil as per DIN 51524 ... 535 for other fluids see section I
Recommended viscosity	15 ÷ 100 mm <sup>2</sup> /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)

#### 3.1 Coils characteristics

Valve model	DLHZO-T*	DLKZOR-T*
Coil resistance R at 20°C	3 ÷ 3,3	2,2 ÷ 3,4 Ω
Max. solenoid current	2,6 A	3,3 A
Max. power	35 Watt	40 Watt
Protection degree (CEI EN-60529)	IP65 for -T execution; IP65÷67 for -TE and -TES executions, depending to the connector type (see sect. 4.10)	
Duty factor	Continuous rating (ED=100%)	

### 4 INTEGRAL ELECTRONICS OPTIONS AND WIRING

- 4.1 Option /I** It provides the 4±20 mA current reference signal and the current feedback signals instead of the standard ± 10V. 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. In case of breakage of the reference signal cable, the valve functioning is disabled.
- 4.2 Option /F** Safety option providing an output signal which switches to zero in case of interruption of the transducer feedback cable. In this condition the valve functioning is disabled.
- 4.3 Option /Q** Safety option providing the possibility to enable or disable the valve functioning without cutting the power supply.
- 4.4 Option /S** Option for diagnostic controls, providing three on-off output signals for the real time monitor of the valve's spool position (central, P→A or P→B). For the electrical wiring of -TE electronics with option /S (12 poles connector), see tab. G200.
- 4.5 Option /Z** For -TE execution: option providing the same characteristics of /F and /Q plus the monitor signal of the spool position. For -TES execution: safety option, specifically introduced for -BC and -BP fieldbus interfaces, provides two separated power supplies for the digital electronic circuits and for the solenoid power supply stage. The Enable and Fault signals are also available. The option /Z allows to interrupt the valve functioning by cutting the solenoid power supply (e.g. for emergency, as provided by the European Norms EN954-1 for components with safety class 2), but keeping energized the digital electronic circuits, thus avoiding fault conditions of the machine bus controller. For the electrical wiring of -TE and -TES electronics with option /Z (12 poles connector), see tab. G200 and G210.
- 4.6 Option /SP** Option providing in addition to the standard valve functions, a closed loop control of the max pressure, thus realizing a P/Q regulation. A remote pressure transducer must be installed on the system and its feedback has to be interfaced to the valve. If the real value of the pressure in the system remains below the relevant reference signal, the driver regulates in closed loop the valve's spool position, according to the flow reference signal. When the real pressure become close to the relevant reference signal, the driver automatically performs the closed loop control of the pressure. This option permits to realize accurate dynamic pressure profiles. Up to 4 set of PID pressure parameters can be real time selected during the axis motion via on-off signals to the 12 poles connector to optimize the control performances in the different phases of the machine cycle. For additional information and for the electrical wiring, see tab. G210.
- 4.7 Option /ZP** Integral digital P/Q controller providing the same characteristics of option /SP plus additional double power supply, enable and fault, like -TES/Z. In this option the multiple set of PID pressure parameters can be real time selected during the axis motion through the -BC or -BP interfaces. For additional information and for the electrical wiring, see tab. G210.
- 4.8 Option /C** (compatible only with options /SP and /ZP) The valve electronics is set to receive 4±20 mA signal from the remote pressure transducer instead of standard 0÷10 V. In case of breakage of the transducer feedback cable the driver functioning is disabled. For additional information and for the electrical wiring, see tab. G210.
- 4.9 Integral electronics wiring**

For the electric wiring shielded cables must be provided: the shield must be connected to the power supply zero on the generator side, see tab. F003

#### POWER SUPPLY CONNECTOR

PIN	SIGNAL DESCRIPTION	-TE, -TES	-TE/I	-TE/F	-TE/Q
A	Power supply 24 V <sub>dc</sub>	Stabilized:	+24V <sub>dc</sub>		
B	Power supply zero	Filtered and rectified:	V <sub>rms</sub> = 21 ÷ 33 (ripple max 2V <sub>pp</sub> )		
C	Signal zero	Reference 0 V <sub>dc</sub>	Reference 0 V <sub>dc</sub>	Reference 0 V <sub>dc</sub>	Enabling input normal working 9 ÷ 24 V <sub>dc</sub>
D	Input signal +	±10 V <sub>dc</sub>	4 ÷ 20 V <sub>dc</sub>	±10 V <sub>dc</sub>	±10 V <sub>dc</sub>
E	Input signal -				
F	Monitor Spool position	±10 V referred to pin C (signal 0 V <sub>dc</sub> ) 1 V = 10% of spool position	4 ÷ 20 mA referred to pin C (signal 0 V <sub>dc</sub> ) 4 ÷ 20 mA = 0÷100% of spool position	Fault signal alarm = 0 V <sub>dc</sub> Normal working = +24 V <sub>dc</sub>	±10 V referred to pin B (signal 0 V <sub>dc</sub> ) 1 V = 10% of spool position
G	Earth	Connect only when the power supply is not conform to VDE 0551 (CEI 14/6)			

#### COMMUNICATION CONNECTORS (for -TES)

Communication options	-PS (RS232) male connector	-BC (CAN Bus) male connector	-BP (PROFIBUS-DP) female connector (reverse key)
Pin number Signal description	1 NC Not Connected	CAN_SHLD Shield	+5V Termination voltage
	2 NC Not Connected	NC Not Connected	LINE -A Bus line (high)
	3 RS_GND Signal zero data line	CAN_GND Signal zero data line	DGND Signal zero data line /termination voltage
	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 Shield

#### POSITION TRANSDUCER CONNECTOR (-T)

PIN	Signal description
1	OUTPUT SIGNAL
2	SUPPLY -15 V <sub>dc</sub>
3	SUPPLY +15 V <sub>dc</sub>
4	GND

#### Note:

- electrical signals (e.g. actual - feedback signals) acquired via valve electronics must not be used to switch off the machine safety functions. This is in accordance with the European standards (Safety requirements of fluid technology systems and components - hydraulics, EN-892).
- installation notes with basic information for commissioning and start-up, are always supplied with relevant components, together with the specific technical tables.

#### 4.10 Model codes of power supply and communication connectors

VALVE VERSION	-T		-TE, -TES		-TE/S, -TE/Z -TES/Z, /S, /ZP	-RS232 (-PS) OR CANBUS (-BC)	PROFIBUS (-BP)	PRESSURE TRANSDUCER only for TES/SP, /ZP
	Power supply	Transducer						
CONNECTOR CODE	SP-666	SP-345	SP-ZH-7P (1)	SP-ZM-7P (1)	SP-ZH-12P (1)	SP-ZH-5P (1)	SP-ZH-5P/BP (1)	SP-ZH-4P-M8/5 (1)(2)
CONNECTOR CODE	IP65	IP65	IP67	IP66	IP65	IP67	IP67	IP67

(1) to be ordered separately (2) M8 connector moulded on cable 5 mt length

### 5 PROGRAMMING DEVICES

The functional parameters of the digital valves, as the bias, scale, ramp and linearization of the regulation characteristic, can be easily set and optimized with graphic interface by using the following software programming devices suitable for standard PC:

**KIT-E-SW-PS** for electronics with RS232 interface (option -PS)

**KIT-E-SW-BC** for electronics with CANbus interface (option -BC)

**KIT-E-SW-BP** for electronics with PROFIBUS-DP interface (option -BP)

see tab. G500 for complete information about the programming device kits and for the PC minimum requirements.

Only for the -BC and -BP communication options, the functional parameters can be alternatively set via fieldbus through the machine control unit, using the standard communication protocol implemented by Atos.

The protocol operating instructions to be implemented in the standard protocols (DS301V4.02, DSP408 for CANbus and DPVO for PROFIBUS-DP) are described in the user manuals MAN-S-BC (for -BC option) and MAN-S-BP (for -BP option) supplied with the relevant programming device kits.

**The above programming devices have to be ordered separately.**

**6 DIAGRAMS** (based on mineral oil ISO VG 46 at 50 °C)

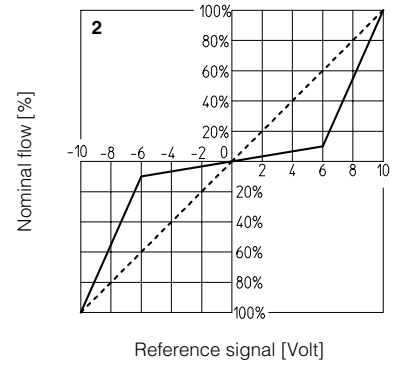
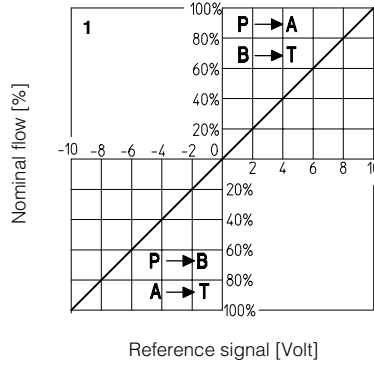
**6.1 Operating diagrams**

Stated for DLHZO and DLKZOR valves

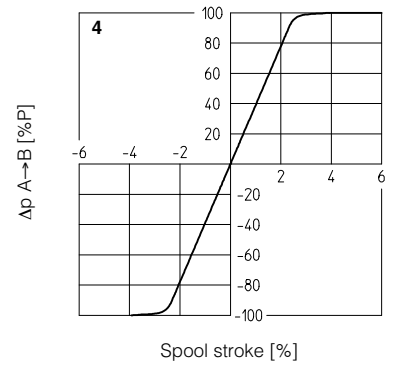
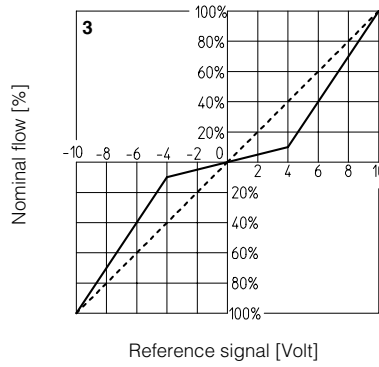
- 1 = Linear spools L
- 2 = Linear spool T5 (only for DLHZO)

**Note:**

- 1) For the valves with digital electronics -TES, the regulation characteristic can be modified by setting the internal software parameters, see tab. G500.
- 2) Hydraulic configuration vs. reference signal: (for double solenoid valves)  
 Reference signal 0 ÷ +10 V P → A / B → T (also for option /B)  
 12 ÷ 20 mA  
 Reference signal 0 ÷ -10 V P → B / A → T (also for option /B)  
 4 ÷ 12 mA



- 3 = Not linear spool T7
- 4 = Pressure gain



**6.2 Flow /Δp diagrams**

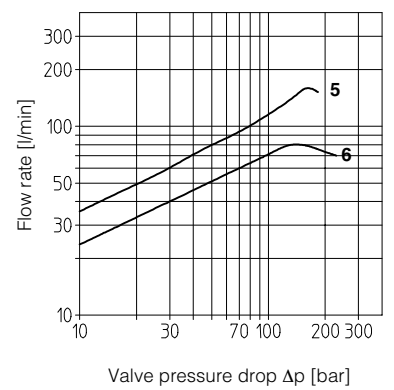
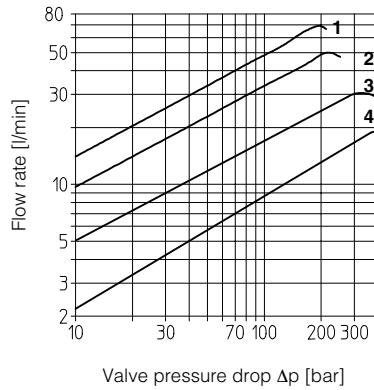
Stated at 100% of spool stroke

DLHZO:

- 1 = spool L7, T7
- 2 = spool L5, T5
- 3 = spool L3
- 4 = spool L1

DLKZOR:

- 5 = spool L7, T7
- 6 = spool L3



**6.3 Bode diagrams**

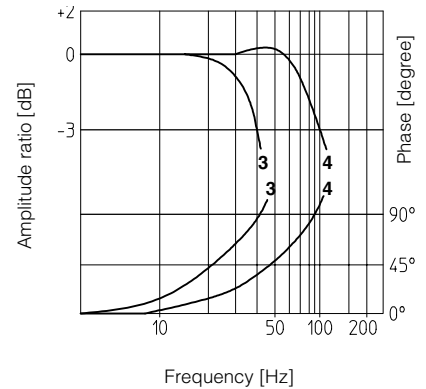
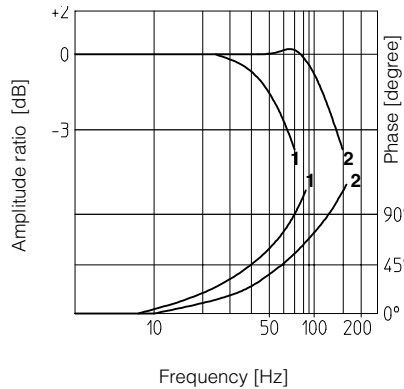
Stated at nominal hydraulic conditions

DLHZO:

- 1 = ± 100% nominal stroke
- 2 = ± 5% nominal stroke

DLKZOR:

- 3 = ± 100% nominal stroke
- 4 = ± 5% nominal stroke



**6.4 Dynamic response**

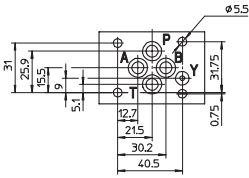
The response times in section 2 have to be considered as average valves. For the valves with digital electronics the dynamics performances can be optimized by setting the internal software parameters.

**7 INSTALLATION DIMENSIONS [mm]**

**DLHZO**

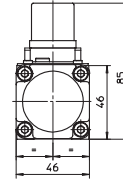
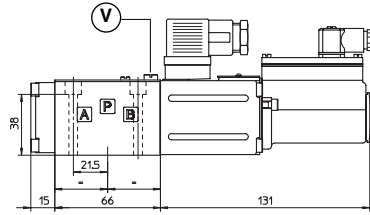
**Mounting surface**  
**ISO 4401-AB-03-4 size 06**

Fastening bolts: 4 socket head screws M5 x 50  
 Seals: 4 OR 108; 1 OR 2025  
 Diameter of ports A, B, P, T: Ø 7,5 mm (max)  
 Diameter of port Y: Ø 3,2 mm (only for /Y option)



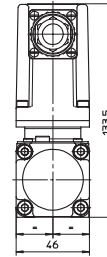
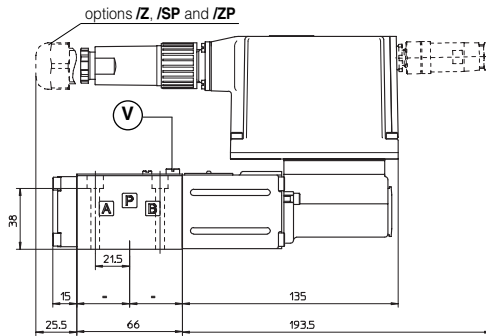
- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- Y** = DRAIN PORT (see note)
- V** = AIR BLEED-OFF

**NOTE:** for option /B the solenoid, the position transducer and the electronics are at side of port A



**DLHZO-T**

Mass: 2,3 kg



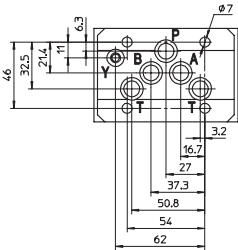
**DLHZO-TE**  
**DLHZO-TES** (dotted line)

Mass: 2,8 kg

**DLKZOR**

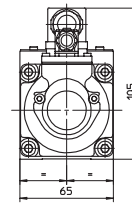
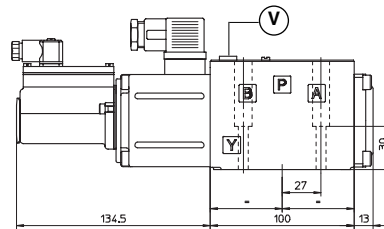
**Mounting surface**  
**ISO 4401-AC-05-4 size 10**

Fastening bolts: 4 socket head screws M6 x 40  
 Seals: 4 OR 108; 1 OR 2025  
 Diameter of ports A, B, P, T: Ø 11,2 mm (max)  
 Diameter of port Y: Ø 5 mm (only for /Y option)



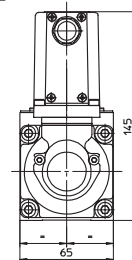
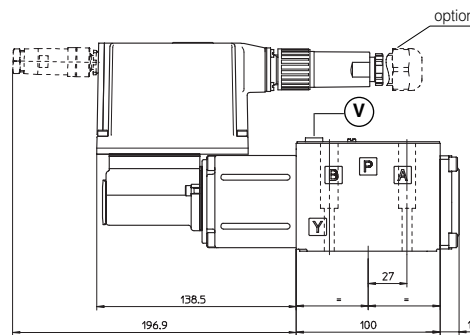
- P** = PRESSURE PORT
- A, B** = USE PORT
- T** = TANK PORT
- Y** = DRAIN PORT (see note)
- V** = AIR BLEED-OFF

**NOTE:** for option /B the solenoid, the position transducer and the electronics are at side of port A



**DLKZOR-T**

Mass: 4,2 kg



**DLKZOR-TE**  
**DLKZOR-TES** (dotted line)

Mass: 4,7 kg

**8 ELECTRONIC DRIVERS FOR DLHZO AND DLKZOR-T\***

Valve model	<b>-T</b>	<b>-TE</b>	<b>-TES</b>
Drivers model	E-ME-T	E-RI-TE	E-RI-TES
Data sheet	G140	G200	G210

For complete information about the drivers characteristics and relevant options, see the technical data sheet specified in the table.

**9 MOUNTING PLATES** (select /Y in the plate model code for valve with option /Y)

Size	Model	Ports location	Gas ports A, B, P, T (X, Y)	Ø Counterbore [mm] A, B, P, T (X, Y)	Mass [kg]
03	BA-202	Ports A, B, P, T underneath	3/8"	—	1,2
	BA-204 (Y)	Ports P, T (X, Y) underneath; ports A, B on lateral side	3/8" (1/8")	25,5 (16,5)	1,8
	BA-302 (Y)	Ports A, B, P, T (X, Y) underneath	1/2" (1/8")	30 (16,5)	1,8
05	BA-308 (Y)	Ports A, B, P, T (X, Y) underneath	1/2" (1/4")	30 (21,5)	2,5
	BA-428 (Y)	Ports A, B, P, T (X, Y) underneath	3/4" (1/4")	36,5 (21,5)	5,5
10	BA-434 (Y)	Ports P, T (X, Y) underneath; A, B on lateral side	3/4" (1/4")	36,5 (21,5)	8,5