Proportional pressure reducing valve, pilot-operated

Type Z3DRE and Z3DREE

RE 29282
Edition: 2019-02
Replaces: 2018-11

H8127

- Size 10
- Component series 1X
- Maximum operating pressure 350 bar
- Maximum flow 120 l/min

Features

- Operation by rotatable proportional solenoid
- Sandwich plate design
- Porting pattern according to ISO 4401-05-05-0-05
- 4 pressure ratings
- Valve and control electronics from a single source
- External control electronics for type Z3DRE
- Linear command value pressure characteristic curve
- Integrated electronics (OBE) with type Z3DREE with little manufacturing tolerance of the command value pressure characteristic curve

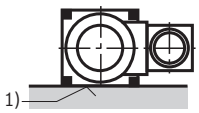
Contents

Ordering code

01	02	03	04	05	06	07	08		09		10	11	12	13	14	15	16	17
Z	**3**	**DRE**		**10**	**V**	**P**	**2**	**–**	**1X**	**/**				**G24**				*****

01	Sandwich plate valve	**Z**
02	3-way version	**3**
03	Proportional pressure reducing valve	**DRE**
04	External control electronics	**no code**
	Integrated electronics (OBE)	**E**
05	Size 10	**10**
06	Pilot-operated	**V**
07	Pressure reduction in channel P①	**P**

Preferred position of the proportional solenoid

08	 1) The mating connector can be brought to the desired position when the nut was loosened, see "Dimensions" page 14 and 15	**2**
09	Component series 10 ... 19 (10 ... 19: unchanged installation and connection dimensions)	**1X**

Pressure rating

10	Set pressure up to 50 bar	**50**
	Set pressure up to 100 bar	**100**
	Set pressure up to 200 bar	**200**
	Set pressure up to 315 bar	**315**

Pilot oil flow

11	Pilot oil supply for the directional valve from port P②, pilot oil return external for directional valve and Z3DRE(E)	**Y**
	Pilot oil supply external for directional valve, pilot oil return external for directional valve and Z3DRE(E)	**XY**
	Pilot oil supply for the directional valve from port P②, pilot oil return internal for directional valve and external for Z3DRE(E)	**L**
	Pilot oil supply external for directional valve, pilot oil return internal for directional valve and external for Z3DRE(E); Directional valve without pilot oil supply	**XL**
	Further information see page 6	

Pressure measuring port G1/4

12	Without pressure measuring port	**no code**
	With pressure measuring port (secondary pressure)	**MS**
13	Direct voltage 24 V	**G24**

Electrical connection

14	**External** control electronics: connector DIN EN 175301-803	**K4** 2)
	Integrated electronics: connector DIN EN 175301-804	**K31** 2)

Control electronics interface

15	**External** control electronics	**no code**
	– Integrated electronics	
	Command value input 0 ... 10 V	**A1**
	Command value input 4 ... 20 mA	**F1**

1) Valve contact surface (seal ring recess in the housing)

2) Mating connectors, separate order, see page 16 and data sheet 08006.

Ordering code

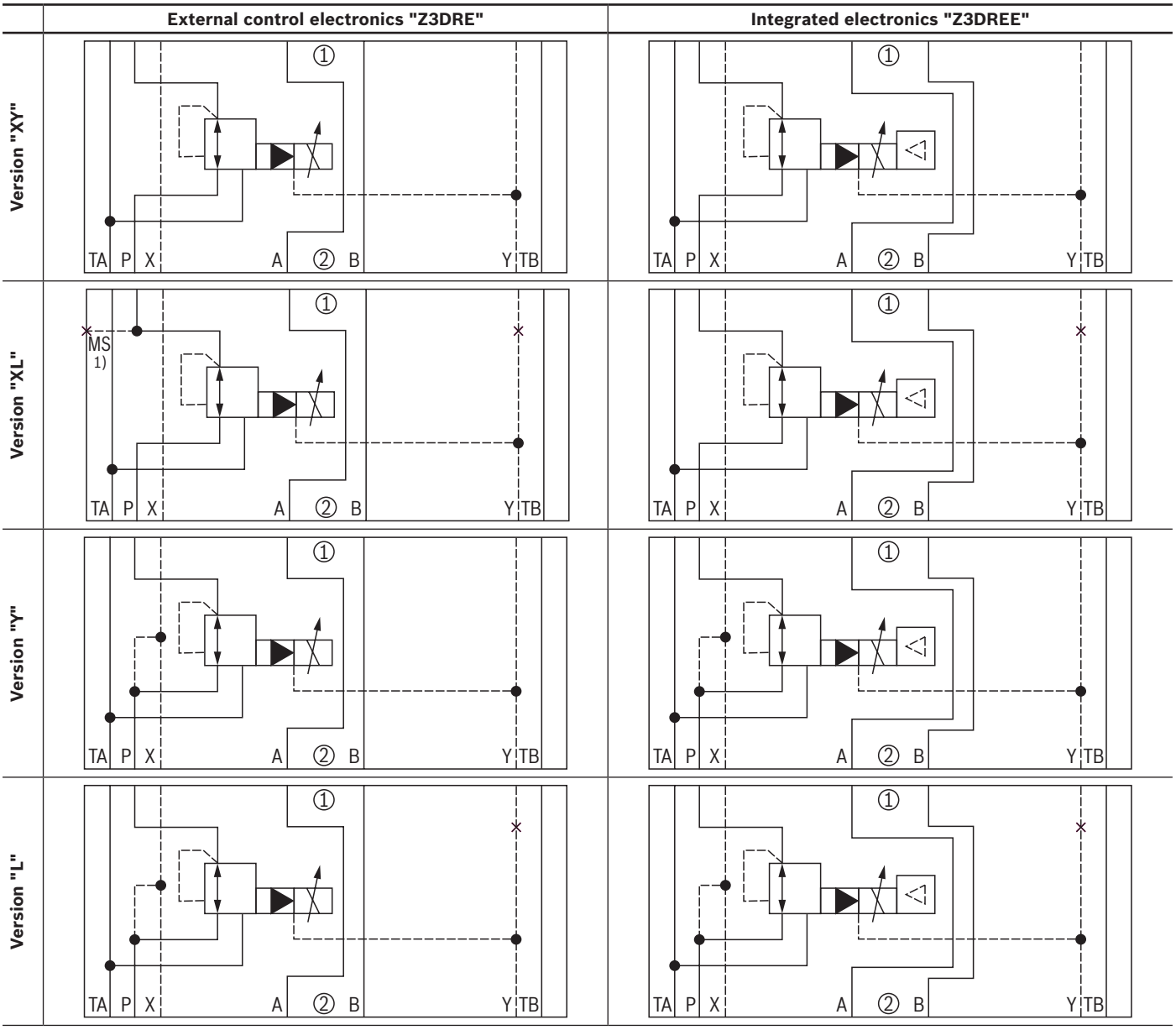
01	02	03	04	05	06	07	08		09		10	11	12	13	14	15	16	17
Z	**3**	**DRE**		**10**	**V**	**P**	**2**	**–**	**1X**	**/**				**G24**				*****

Seal material (observe compatibility of seals with hydraulic fluid used, see page 8)

16	NBR seals	**M**
	FKM seals	**V**

17	Further details in the plain text	

Symbols (① = component side, ② = plate side)



1) Pressure measuring port "MS" as example for all types

Notes:

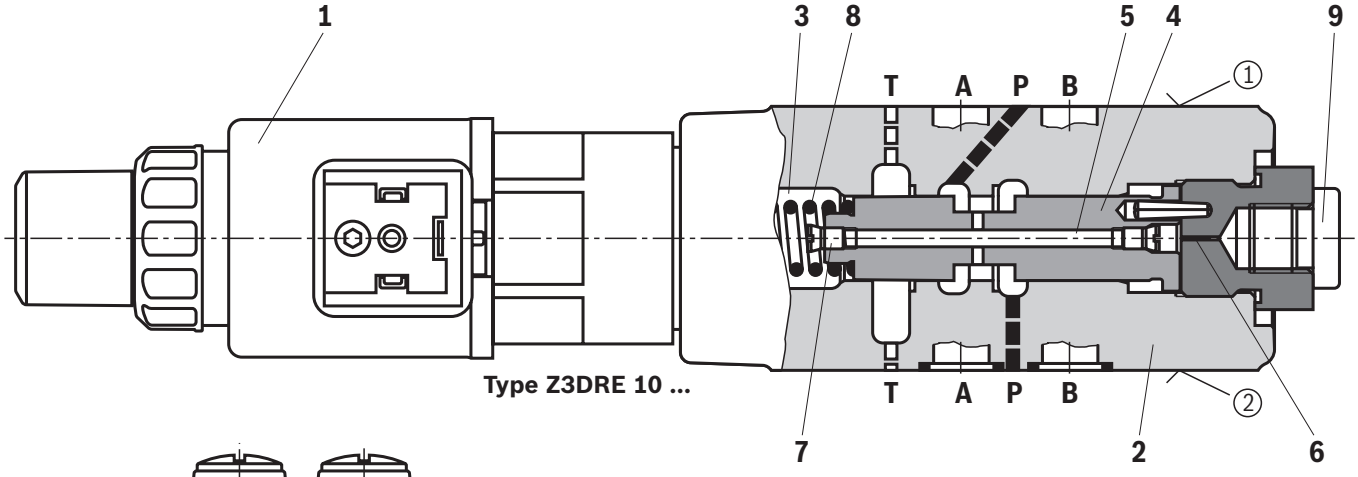
- Representation according to DIN ISO 1219-1.
- Deviating from ISO 4401, port T is in this data sheet called TA, port T1 is called TB.

Function, section

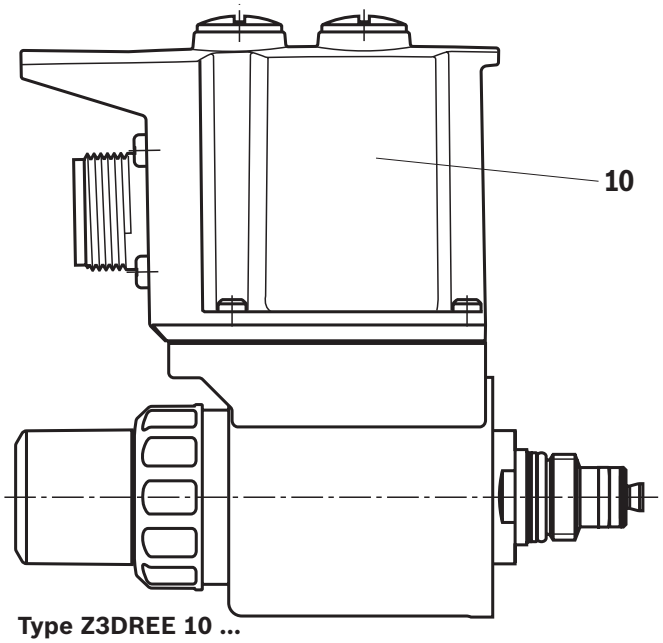
Valves of type Z3DRE... are pilot-operated pressure reducing valves in sandwich plate design and 3-way version, i. e. with pressure limitation of the actuator pressure.
They are used for reducing a system pressure.
The valves basically consist of a proportional pilot control valve (1), main valve (2) and control spool (4).
The pressure in channel P① is set in a command value-dependent form via the pilot control valve (1).

External control electronics "Z3DRE"
In rest position, i. e. without pressure in channel P②, the control spool (4) opens the connection from channel P② to P①.
The pressure in channel P① acts on the spool face (6) via the bore (5). The pilot oil for the pilot control valve (1) is taken from channel P① and flows via the bore (5) and the nozzle (7) into the spring chamber (3).
The pressure required in channel P① is preset at the related amplifier. The proportional pilot control valve (1) increases the pressure in the spring chamber (3).

In this way, the two chambers (6) and (3) are pressure-compensated and the compression spring (8) moves the control spool (4) to the right in opening direction P② to P①. As soon as the actuator pressure P① has increased to the value set at the pilot control valve (1), the valve poppet (11) opens and limits the pressure in the spring chamber (3). The control spool (4) now moves to the left into control position. If the actuator pressure P① exceeds the value set at the pilot control valve (1), the control spool (4) is moved further to the left. It blocks the flow from P② to P① and opens the connection from P① to the tank until the pressure has dropped again to the set value.
Version "MS" enables measurement and monitoring of the set secondary pressure via a pressure load cell at the measuring port (9).



Type Z3DRE 10 ...

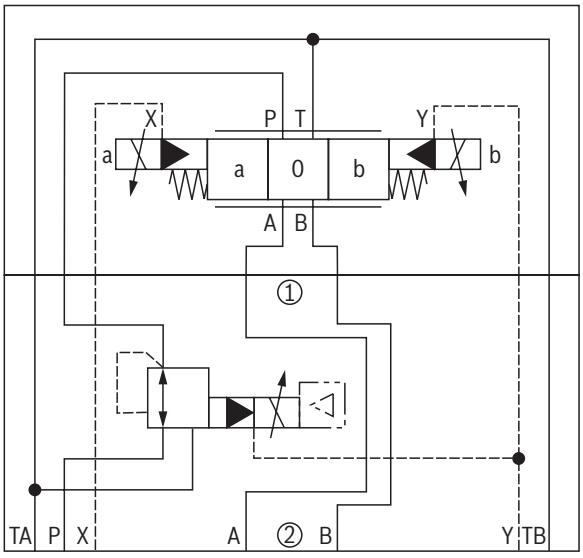


Type Z3DREE 10 ...

Integrated electronics "Z3DREE"
With regard to function and set-up, these valves correspond to type Z3DRE - except for the integrated electronics (OBE). The electronics (OBE) in the housing (10) maintain the supply and command value voltage via the mating connector.
At the factory, the command value pressure characteristic curve is adjusted with little manufacturing tolerance.
For further details on the integrated electronics (OBE) refer to page 9 and 10.

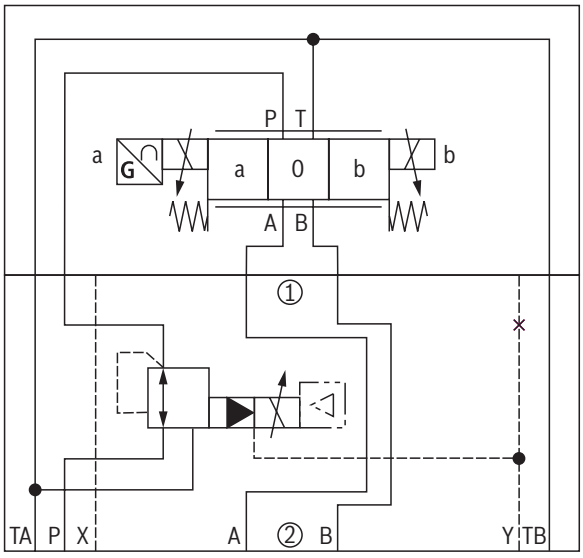
Pilot oil supply (for the attached directional valve)

Version "XY"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



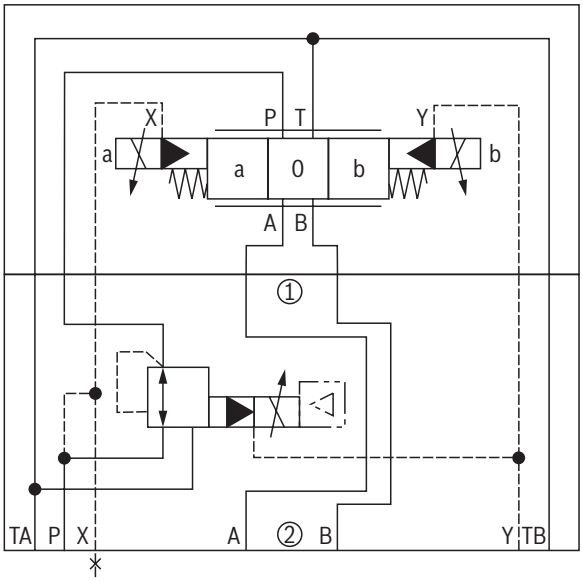
No connection between P② and X

Version "XL"
(e.g. with proportional directional valve, direct operated, type 4WRE)



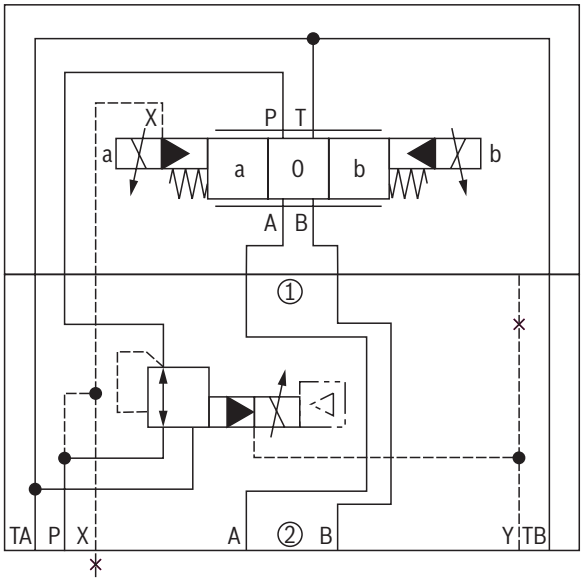
No connection between P② and X

Version "Y"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



Port X in the subplate must be closed

Version "L"
(e.g. with proportional directional valve, pilot-operated, type 4WRZ)



Port X in the subplate must be closed

Notes:
- With **direct operated** directional valves, the seals for ports X and Y are missing in the connection surface of the housing. To ensure that no hydraulic fluid leaks, the pilot oil supply from P② to X and the pilot oil return between directional valve and Z3DRE(E) has to be closed (version "XL").
- A **pilot-operated** proportional directional valve in connection with Z3DRE(E) has to have an **external pilot oil supply**.

Notes:
- Representation according to DIN ISO 1219-1.
- Deviating from ISO 4401, port T is in this data sheet called TA, port T1 is called TB.

Technical data
(for applications outside these values, please consult us!)

general			
Weight	▶ "Z3DRE"	kg	3.3
	▶ "Z3DREE"	kg	3.4
Installation position			preferred position of the proportional solenoid downward or horizontal
Storage temperature range		°C	–20 ... +80
Ambient temperature range	▶ "Z3DRE"	°C	–20 ... +70
	▶ "Z3DREE"	°C	–20 ... +50
Sine test according to DIN EN 60068-2-6			10 ... 2000 ... 10 Hz / maximum 10 g / 10 cycles
Noise test according to DIN EN 60068-2-64			20 ... 2000 Hz / 10 g_{RMS} / 24 h
Transport shock according to DIN EN 60068-2-27			15 g / 11 ms
$MTTF_D$ values according to EN ISO 13849		Years	150 [1] (for more information see data sheet 08012)

hydraulic			
Maximum operating pressure [2]	▶ Port P①	bar	350
	▶ Ports P②, A, B, X	bar	350
	▶ Port T	bar	250
	▶ Port Y, L		Line separate and to the tank at zero pressure
Maximum set pressure at port P①	▶ Pressure rating 50 bar	bar	50
	▶ Pressure rating 100 bar	bar	100
	▶ Pressure rating 200 bar	bar	200
	▶ Pressure rating 315 bar	bar	315
Minimum set pressure in channel P① with command value zero		bar	12
Maximum flow		l/min	120
Pilot flow		l/min	0.4 ... 0.9
Hydraulic fluid			see table page 8
Hydraulic fluid temperature range		°C	–20 ... +80
Viscosity range		mm^2/s	15 ... 380
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3]
Hysteresis		%	< 6 of the maximum set pressure
Repetition accuracy		%	< ±2 of the maximum set pressure
Linearity		%	±3.5 of the maximum set pressure
Manufacturing tolerance of the command value pressure characteristic curve, related to the hysteresis characteristic curve	▶ "Z3DRE" [4]	%	±5 of the maximum set pressure
	▶ "Z3DREE" [5]	%	±1.5 of the maximum set pressure
Step response $T_u + T_g$ [6]	▶ 10 ... 90%	msec	~140
	▶ 90 ... 10%	msec	~140

1) Switch off "OBE" voltage supply.

2) The pressure at port P② must be approx. 20 bar higher than the required set pressure that is to be achieved at port P①.

3) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and simultaneously increases the life cycle of the components.
Available filters can be found at www.boschrexroth.com/filter.

4) Details see page 11

5) Comparison at the factory

6) Measured with 5 liters standing hydraulic fluid column at port P①

Technical data
(for applications outside these values, please consult us!)

Hydraulic fluid		Classification	Suitable Sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**
- ▶ For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us.
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.).
- ▶ The ignition temperature of the hydraulic fluid used must be 50 K higher than the maximum surface temperature.
- ▶ **Bio-degradable and flame-resistant – containing water:** If components with galvanic zinc coating (e.g. version "J3" or "J5") or parts containing zinc are used, small amounts of dissolved zinc may get into the hydraulic system and cause accelerated aging of the hydraulic fluid. Zinc soap may form as a chemical reaction product, which may clog filters, nozzles and solenoid valves - particularly in connection with local heat input.
- ▶ **Flame-resistant – containing water:**
  - – Due to increased cavitation tendency with HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to the use with mineral oil HLP. In order to reduce the cavitation effect, it is recommended - if possible specific to the installation - to back up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - – Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

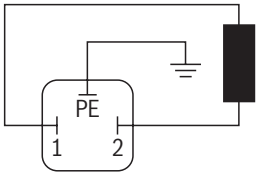
electric			
Minimum solenoid current		mA	100
Maximum solenoid current		mA	1600 ±10%
Solenoid coil resistance	▶ Cold value at 20 °C	Ω	5.5
	▶ Maximum hot value	Ω	8.05
Duty cycle		%	100

electrical, integrated electronics (OBE)			
Supply voltage	▶ Nominal voltage	VDC	24
	▶ Lower limit value	VDC	21
	▶ Upper limit value	VDC	35
Current consumption		A	≤ 1.5
Fuse protection		A	2 (time-lag)
Inputs	▶ Voltage	V	0 ... 10
	▶ Current	mA	4 ... 20
Output	▶ Actual current value	mV	1 mV corresponds to 1 mA
Protection class of the valve according to EN 60529			IP 65 (with mating connector mounted and locked)

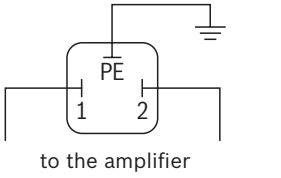
External control electronics	
Modular design	Type VT-MSPA1-2X according to data sheet 30232

Electrical connection: External control electronics "Z3DRE"

Connection at connector



Connection at mating connector



☞ **Notice:**
Mating connectors, separate order, see page 16 and data sheet 08006.

Electrical connection: Integrated electronics "Z3DREE"

Connector pin assignment

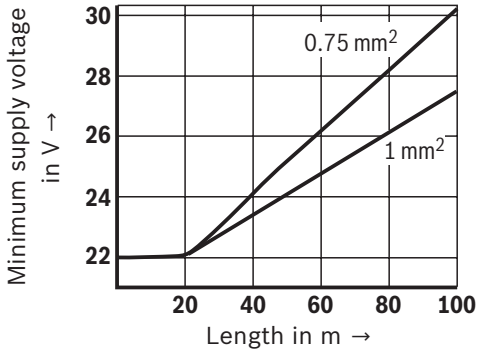
Pin	Signal	Assignment interface A1	Assignment interface F1
A	Supply voltage	24 VDC (u(t) = 21 V ... 35 V); I_{max}≤ 1.5 A	
B		0 V	
C	Reference potential actual value	Reference potential actual value - pin F; 0 V	
D	Differential amplifier input	0 ... 10 V; R_E = 100 kΩ	4 ... 20 mA; R_E = 100 Ω
E		Reference potential command value	
F	Measuring output (actual value)	0 ... 1.6 V actual value (1 mV corresponds to 1 mA); load resistance > 10 kΩ	
PE		Functional ground (directly connected to solenoid and valve housing)	

☞ **Notice:**
Mating connectors, separate order, see page 16 and data sheet 08006.

Connection cable (recommendation)**:**

- Recommendation 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
- Only connect the screening to PE on the supply side.
- Maximum length 100 m

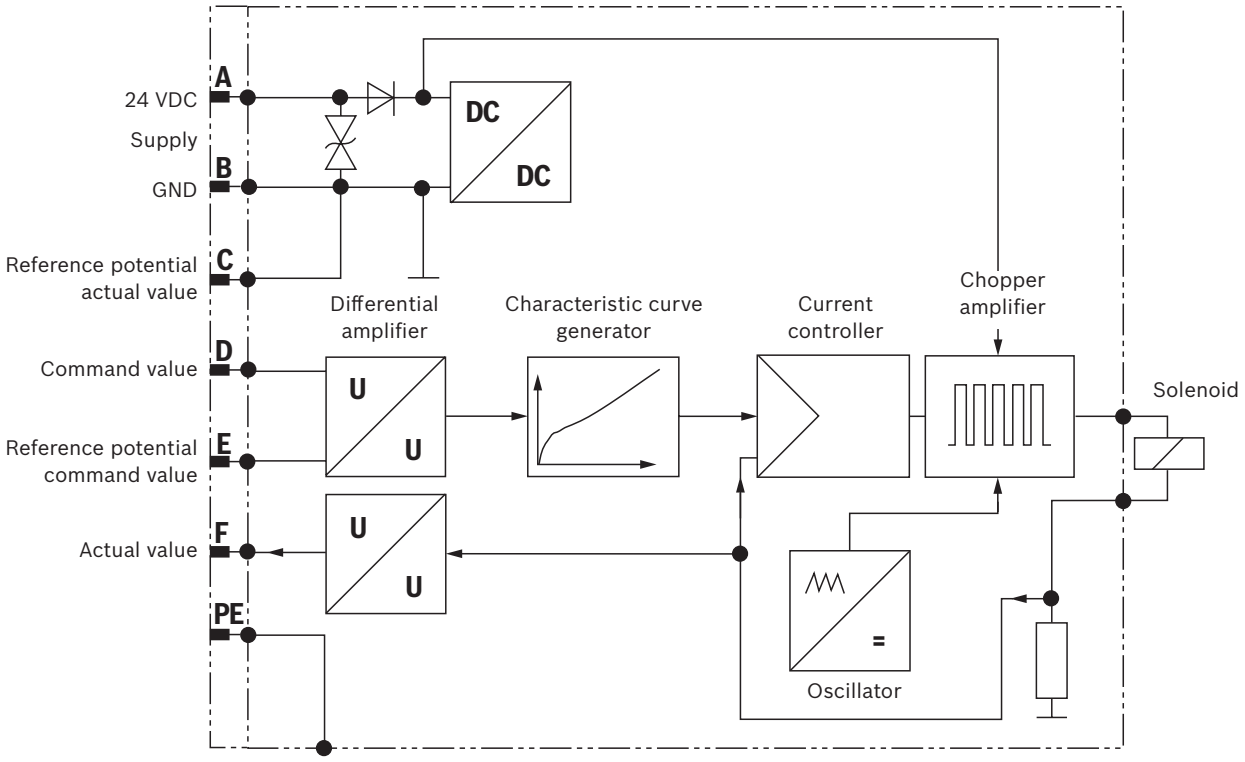
The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



Block diagram/controller function block: Integrated electronics "Z3DREE"

The electronics are supplied with voltage via ports A and B. The command value is applied to the differential amplifier ports D and E.
Via the characteristic curve generator, the command value solenoid current characteristic curve is adjusted to the valve so that non-linearities in the hydraulic system are compensated and thus, a linear command value pressure characteristic curve is created.
The current controller controls the solenoid current independently of the solenoid coil resistance.

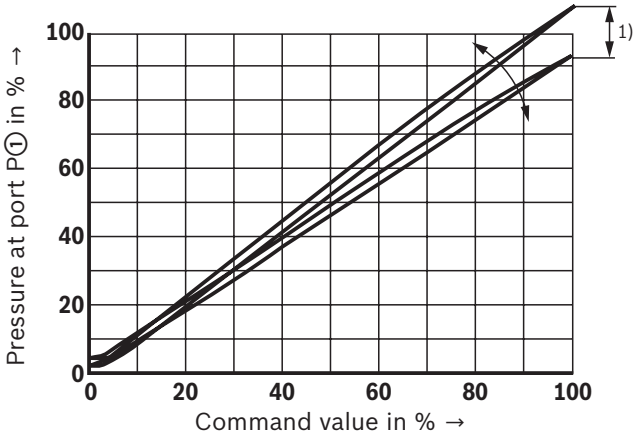
The power stage of the electronics for controlling the proportional solenoid is a chopper amplifier with a clock frequency of approx. 180 Hz to 400 Hz. The output signal is pulse-width modulated (PWM).
For checking the solenoid current, a voltage can be measured at the connector between pin F(+) and pin C(–) that is proportional to the solenoid current. **1 mV** corresponds to **1 mA** solenoid current.



Characteristic curves

(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

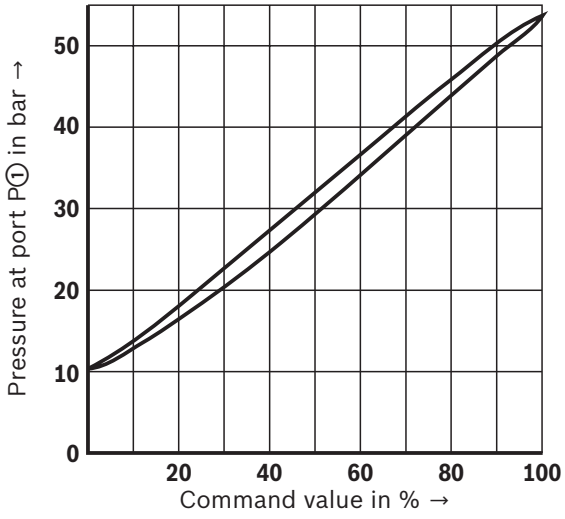
Reduced pressure at port P① dependent on the command value (manufacturing tolerance)



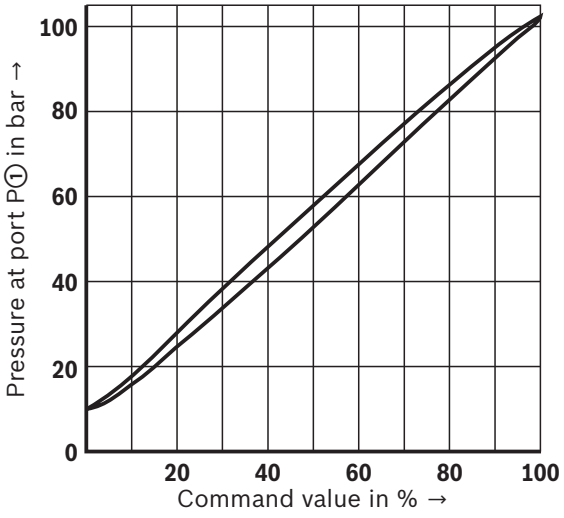
1) In order to be able to adjust several valves to the same characteristic curve, the manufacturing tolerance can - with version "Z3DRE" - be changed at the **external amplifier** (type and data sheet see page 8) using the command value attenuator "**G**". In this connection, do not set the pressure higher than the maximum set pressure of the pressure rating with command value 100%.

Pressure at port P① dependent on the command value (with a flow of 0 l/min)

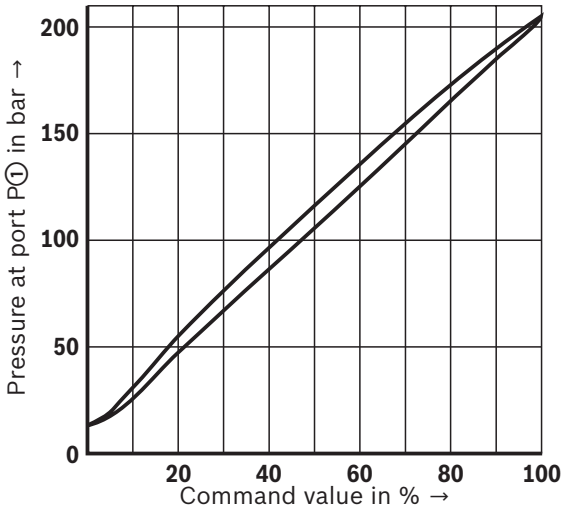
Pressure rating 50 bar



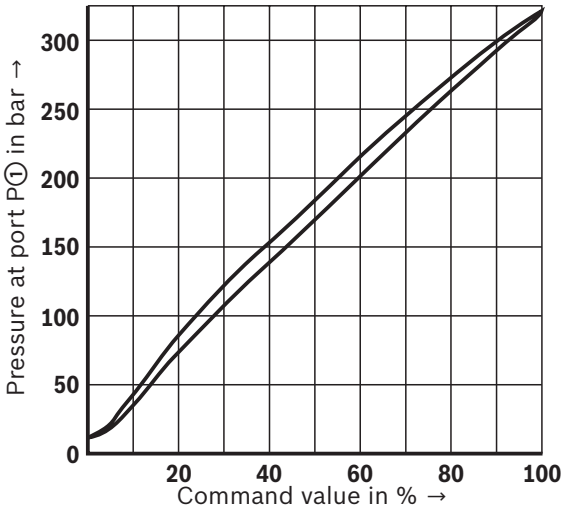
Pressure rating 100 bar



Pressure rating 200 bar



Pressure rating 315 bar

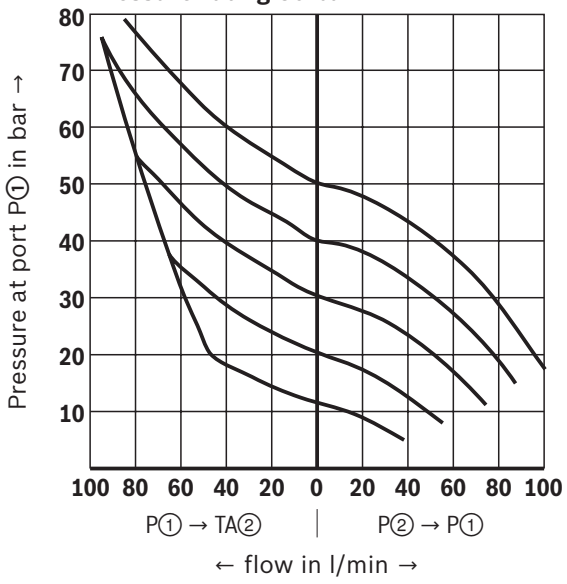


Characteristic curves

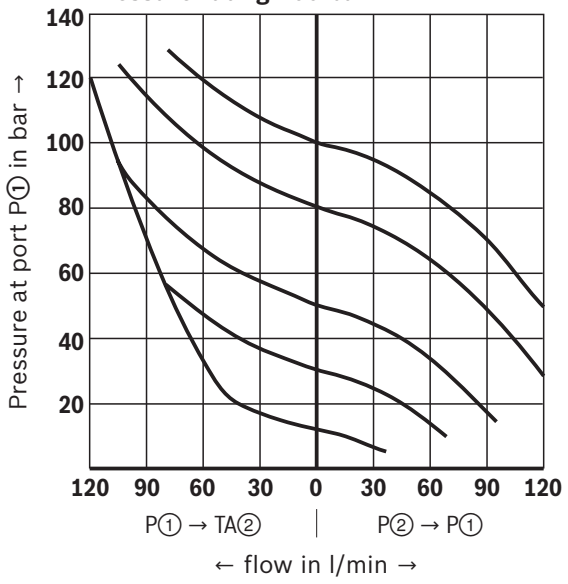
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure at port P① dependent on the flow

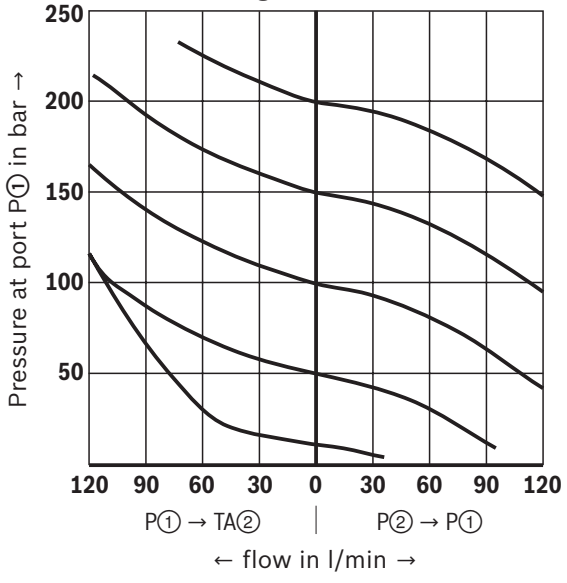
Pressure rating 50 bar



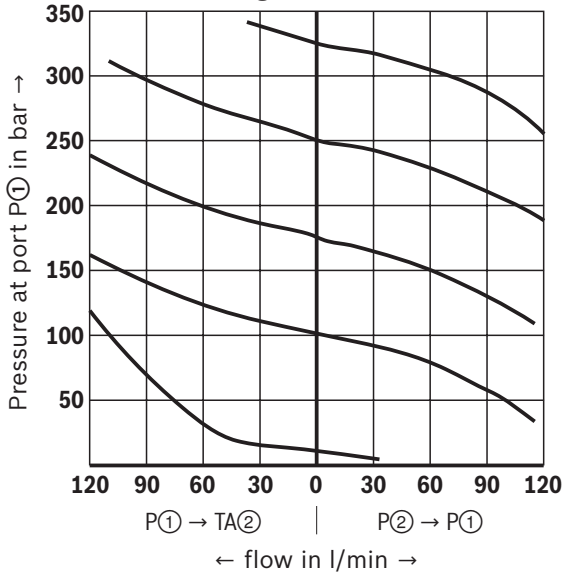
Pressure rating 100 bar



Pressure rating 200 bar



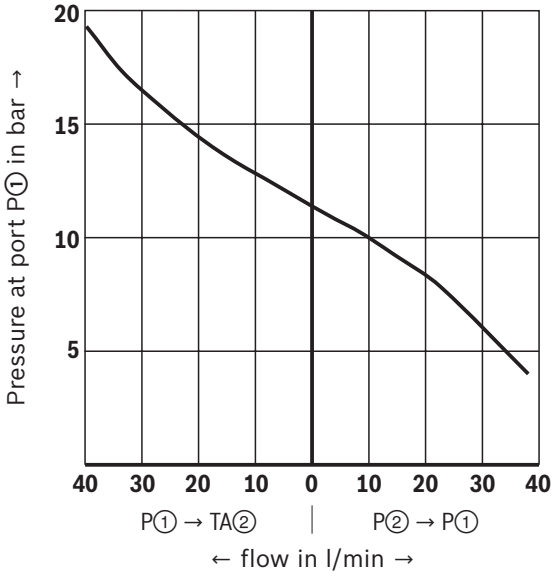
Pressure rating 315 bar



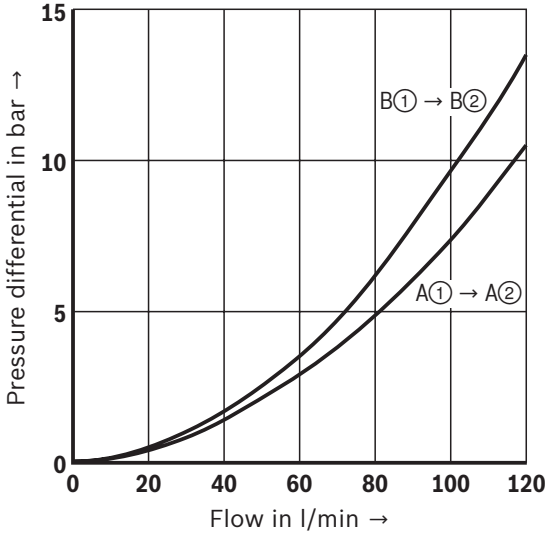
Characteristic curves

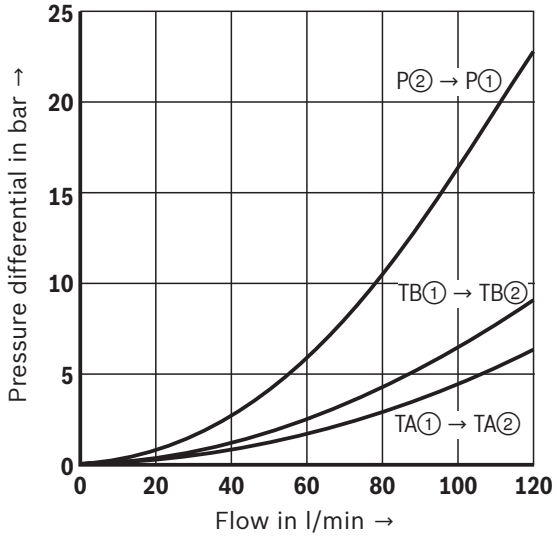
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Minimum set pressure dependent on the flow with command value zero

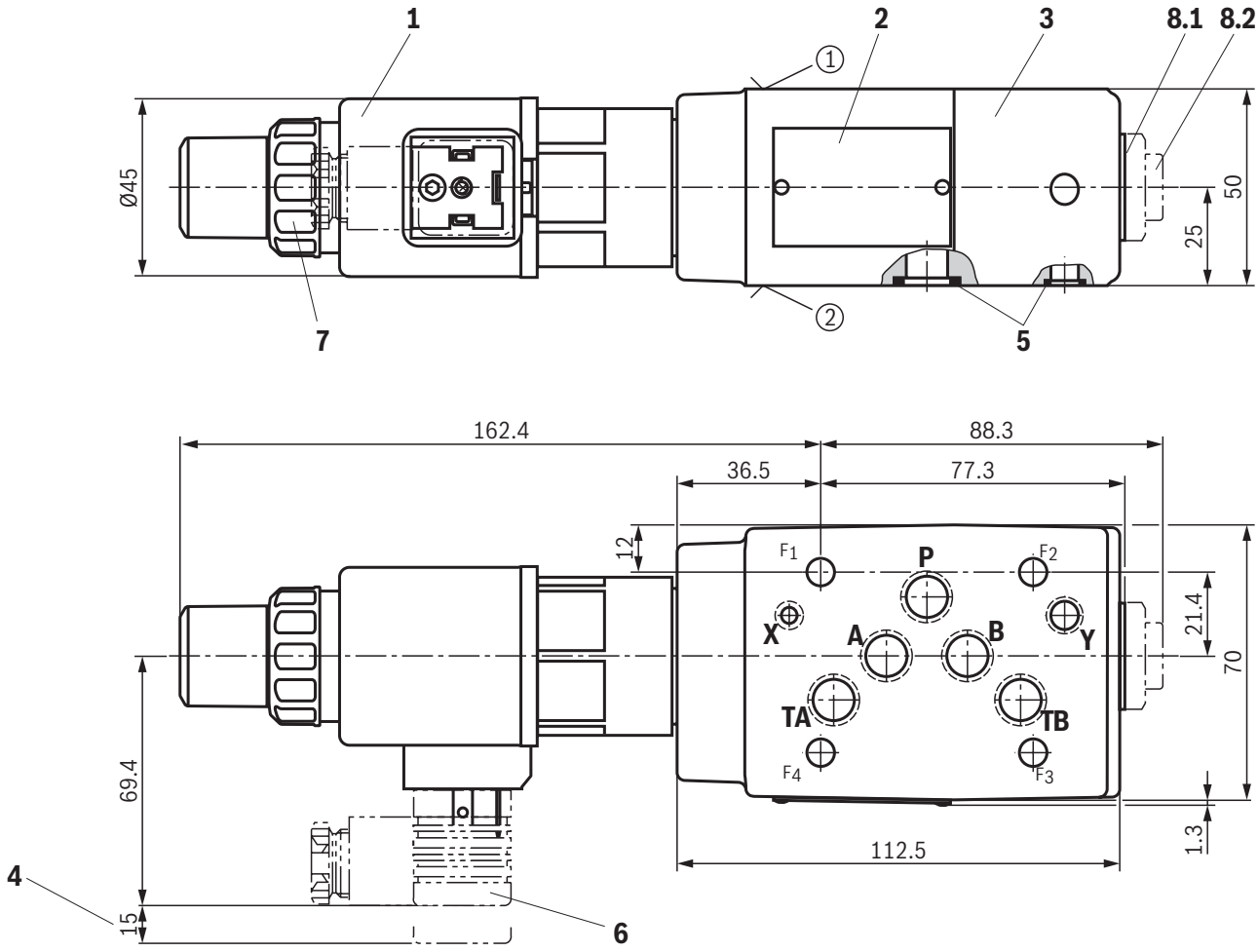


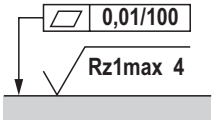
Pressure differential dependent on the flow





Dimensions: External control electronics "Z3DRE" (dimensions in mm)





Required surface quality of the valve contact surface

① component side – porting pattern according to ISO 4401-05-05-0-05

② plate side – porting pattern according to ISO 4401-05-05-0-05

1 Solenoid coil

2 Name plate

3 Valve housing

4 Space required for removing the mating connector

5 Identical seal rings for ports A, B, P, T (plate side)
Identical seal rings for ports X and Y (plate side)

6 Mating connector, separate order, see page 16

7 O-ring and plastic nut SW32 for coil fixation.
The nut can be loosened by rotating it counterclockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut (tightening torque 4^{+1} Nm)

8.1 Without pressure measuring port (standard)

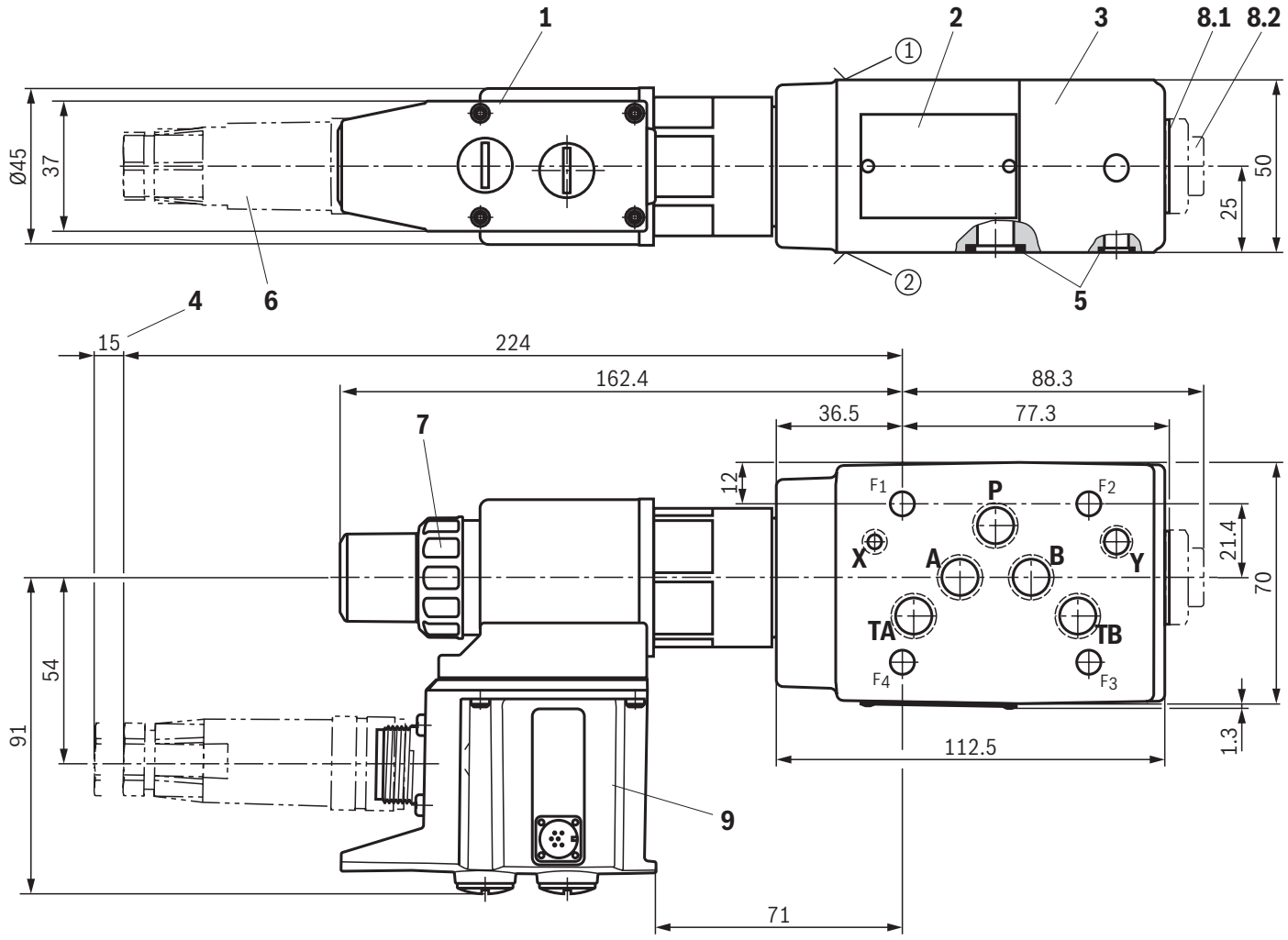
8.2 Pressure measuring port (version "MS"); when loosening the plug screw (internal hexagon SW6, tightening torque M_A = 20 Nm ±10%), hold the reducing piece SW24

Valve mounting screws (separate order)
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

☞ **Notes:**

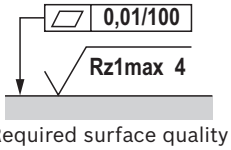
- Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Dimensions: Integrated electronics "Z3DREE"
(dimensions in mm)



① component side – porting pattern according to ISO 401-05-05-0-05

② plate side – porting pattern according to ISO 4401-05-05-0-05



Required surface quality
of the valve contact surface

1 Solenoid coil

2 Name plate

3 Valve housing

4 Space required for removing the mating connector

5 Identical seal rings for ports A, B, P, T (plate side)
Identical seal rings for ports X and Y (plate side)

6 Mating connector, separate order, see page 16

7 O-ring and plastic nut SW32 for coil fixation.
The nut can be loosened by rotating it counterclockwise (1 turn). The solenoid coil can then be rotated to the required position before fixing it again by tightening the nut (tightening torque 4^{+1} Nm)

8.1 Without pressure measuring port (standard)

8.2 Pressure measuring port (version "MS"); when loosening the plug screw (internal hexagon SW6, tightening torque M_A = 20 Nm ±10%), hold the reducing piece SW24

9 Integrated electronics with connector

Valve mounting screws (separate order)
4 hexagon socket head cap screws ISO 4762 - M6 - 10.9

☞ **Notes:**

- Length and tightening torque of the valve mounting screws must be calculated according to the components mounted under and over the sandwich plate valve.
- Deviating from ISO 4401, port T is called TA and port T1 is called TB in this data sheet.
- The dimensions are nominal dimensions which are subject to tolerances.

Accessories (separate order)

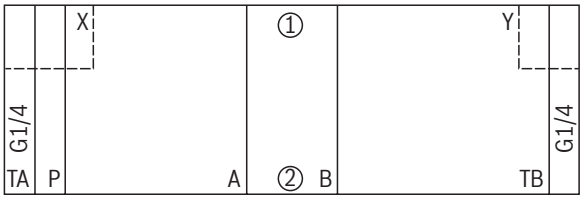
Valves with external control electronics

Mating connectors 2-pole + PE	Design	Material number	Data sheet
For valves with "K4" connector, 2+PE, design A (large cubic connector) 12 ... 240 V, 16 A, black, M16 x 1.5	Plastic	**R901017011**	08006

Valves with integrated electronics

Mating connectors 6-pole + PE	Structural shape	Design	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	straight	Metal	**R900223890**	08006
	straight	Plastic	**R900021267**	08006

Sandwich plate type HSZ



Sandwich plate type HSZ 10 B097-3X/M01

Dimensions (length x width x height)	100 x 70 x 30 mm
Weight	2.5 kg
Size of ports X and Y	G1/4
Material no.	**R900320785**
Data sheet	48052

Subplates (separate order) with porting pattern according to ISO 4401-05-05-0-05, see data sheet 45100.

Further information

- Valve amplifier for proportional valves without electrical position feedback — Data sheet 30232
- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Flame-resistant, water-free hydraulic fluids — Data sheet 90222
- Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC) — Data sheet 90223
- Reliability characteristics according to EN ISO 13849 — Data sheet 08012
- Mating connectors and cable sets for valves and sensors — Data sheet 08006
- Hydraulic valves for industrial applications — Operating instructions 07600-B
- Selection of filters — www.boschrexroth.com/filter
- Information on available spare parts — www.boschrexroth.com/spc

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