

Proportional pressure relief valves, pressure-controlled, direct operated, with integrated electronics (OBE)

Type DBETA



- ▶ Size 6
- ▶ Component series 6X
- ▶ Maximum operating pressure 500 bar
- ▶ Maximum flow 5 l/min



Features

- ▶ For the limitation of system pressure (pilot control valve)
- ▶ Subplate mounting
- ▶ Porting pattern according to ISO 4401-03-02-0-05
- ▶ Integrated pressure sensor
- ▶ Actual pressure value can be read via analog output
- ▶ Pressure controller adjustable for various applications (simple adjustment via DIL switch)
- ▶ Linear command value pressure characteristic curve
- ▶ Virtually flow-independent pressure control
- ▶ CE conformity according to EMC Directive 2014/30/EU

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Ordering code

01	02	03	04	05	06	07	08	09
DBETA	-	6X	/	P	G24	K31		*

01	Proportional pressure relief valve, pressure-controlled with integrated electronics (OBE)	DBETA
02	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	6X
03	Pressure measurement in channel P	P

Pressure rating

04	50 bar	50
	100 bar	100
	200 bar	200 ◇
	350 bar	350 ◇
	500 bar (only version "M")	500

Supply voltage

05	Direct voltage 24 V	G24
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Electrical connection

06	Connector, 7-pole (6 + PE) according to EN 175201-804	K31
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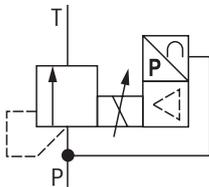
Electronics interface

07	Command value input 0 ... 10 V; actual value output 0 ... 10 V	A1 ◇
	Command value input 4 ... 20 mA; actual value output 4 ... 20 mA	F1

Seal material (observe compatibility of seals with hydraulic fluid used, see page 5)

08	NBR seals	M ◇
	FKM seals	V
09	Further details in the plain text	*

 **Notice:** ◇ = Preferred type

Symbol

Function, section

General

DBETA valves are direct operated proportional pressure relief valves. They are used for the system pressure limitation in hydraulic systems.

The pressure is regulated by the pressure sensor and the valve electronics. Dependent on the electric command value, these valves can be used to steplessly set and adjust the system pressure to be limited.

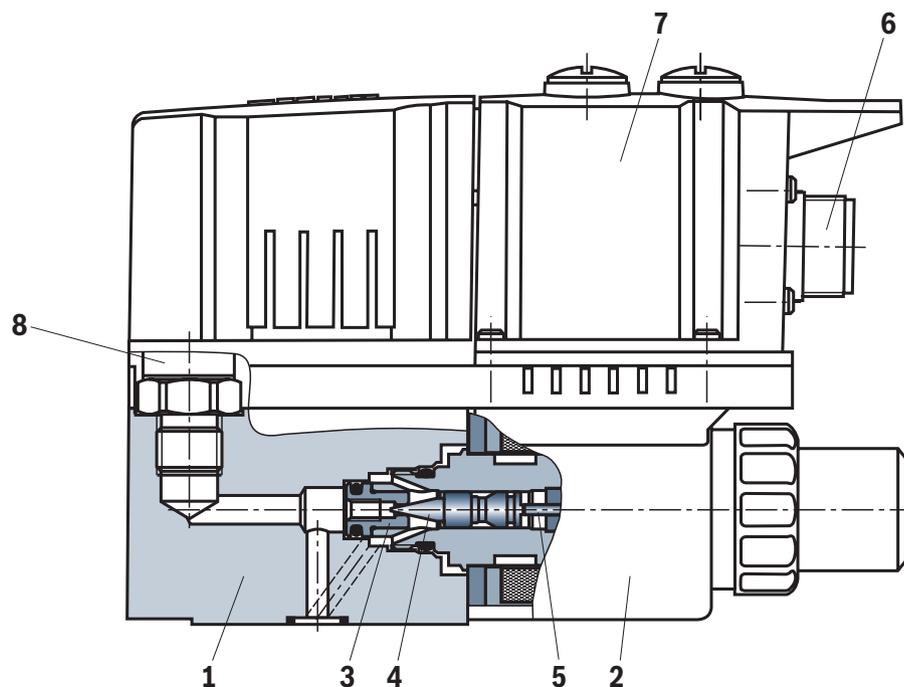
The valves mainly consist of the housing (1), the valve seat (3), the valve poppet (4), the proportional solenoid (2), the integrated electronics (OBE) (7) and the pressure sensor (8).

The pressure in channel P is regulated by a pressure sensor (8) and controlled independently of the volume flow via the integrated electronics (OBE) (7). The pressure in channel P is made available via connectors (6) as an analog actual value. At a command value of zero, the integrated electronics (OBE) only supply the proportional solenoid (2) with the minimum control current and the minimum set pressure is set. The integrated pressure controller can be adapted for different applications using the DIL switch (9) (see table on page 7).

Basic principle

The supply voltage and the command value are applied to the connector (6). Dependent on the command value, the electronics convert the input signal into current.

The proportional solenoid converts the electric current into mechanical force that acts on the valve poppet (4) via the armature plunger (5). The valve poppet (4) counteracts the hydraulic force in channel P. When the hydraulic force at the valve poppet (4) equals the solenoid force, the set pressure is reached. The pressure is maintained at the set value by increasing/decreasing the cross-section P→T.



Type DBETA.P..

Technical data

(For applications outside these values, please consult us!)

General	
Type of connection	Subplate mounting
Porting pattern	ISO 4401-03-02-0-05
Weight	kg 1.9
Installation position	Any
Ambient temperature range	°C -20 ... +60 (FKM seals) -15 ... +60 (NBR seals)
Maximum storage time	Years 1 (if the storage conditions are observed, refer to the operating instructions 07600-B)
Maximum relative humidity (no condensation)	% 97
Protection class according to EN 60529	IP65 (if suitable and correctly mounted mating connectors are used)
MTTF _D value according to EN ISO 13849	Years 150 (for further details see data sheet 08012) ¹⁾
Sine test according to EN 60068-2-6	10 ... 2000 ... 10 Hz / maximum 10 g / 10 cycles
Noise test according to EN 60068-2-64	20 ... 2000 Hz / 10 g _{RMS} / 30 g peak / 24 h
Transport shock according to EN 60068-2-27	15 g / 11 ms
Conformity	<ul style="list-style-type: none"> ▶ CE according to EMC Directive 2014/30/EU, tested according to ▶ UKCA according to Electromagnetic Compatibility Regulations SI 2016/1091, tested according to ▶ RoHS Directive
	EN 61000-6-2 and EN 61000-6-3
	EN 61000-6-2 and EN 61000-6-3
	2011/65/EU ²⁾

Hydraulic	
Maximum operating pressure	<ul style="list-style-type: none"> ▶ Port A, P <ul style="list-style-type: none"> - Pressure rating "200", "350", "500" bar 500 ³⁾ ▶ Port P <ul style="list-style-type: none"> - Pressure rating "100" bar 300 ³⁾ - Pressure rating "50" bar 125 ³⁾ ▶ Port T bar Depressurized to the tank ⁴⁾
Hydraulic fluid	See table on page 5
Hydraulic fluid temperature range (flowed-through)	°C -15 ... +80 (FKM seals) -20 ... +80 (NBR seals)
Viscosity range	<ul style="list-style-type: none"> ▶ Recommended mm²/s 30 ... 46 ▶ Maximum admissible mm²/s 20 ... 380
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)	Class 20/18/15 ⁵⁾
Maximum flow ⁶⁾	l/min 5
Maximum set pressure	bar 50; 100; 200; 350; 500
Minimum set pressure	bar See characteristic curves on page 9
Minimum line volume	ml 20

1) Voltage supply "OBE" switched off.

2) The product fulfills the substance requirements of the RoHS Directive 2011/65/EU.

3) The summated pressure of all ports must not exceed 1030 bar, e.g. port P 500 bar + port B 500 bar + port T 30 bar + port A 0 bar = 1030 bar.

4) Tank preloading of 30 bar in addition.

- ▶ Tank preloading adds up to the minimum set pressure.
- ▶ A short-time, static pressure of 300 bar is admissible.

5) The cleanliness classes specified for the components must be adhered to in hydraulic systems. Effective filtration prevents faults and at the same time increases the life cycle of the components.

6) Recommended operating range >0.5 l/min.

Technical data

(For applications outside these values, please consult us!)

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP, HLPD, HVLP, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ insoluble in water	HETG	ISO 15380	90221
		HEES		
	▶ soluble in water	HEPG	ISO 15380	
Flame-resistant	▶ water-free	HFDU (glycol base)	ISO 12922	90222
		HFDU (ester base)		
		HFDR		
	▶ containing water	HFC (Fuchs: Hydrotherm 46M, Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	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 restrictions on the technical 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 an increased cavitation tendency with the use of HFC hydraulic fluids, the life cycle of the component may be reduced by up to 30% as compared to use with HLP mineral oil. In order to reduce the cavitation effect, it is recommended – if possible specific to the installation – backing 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.

Static/dynamic			
Hysteresis ⁷⁾	%	<1	
Range of inversion ⁷⁾	%	<0.25	
Response sensitivity ⁷⁾	%	<0.25	
Linearity ⁷⁾	%	±1	
Step response $T_u + T_g$ ⁸⁾	▶ 10% → 90%	ms	165 (system dependent)
	▶ 90% → 10%	ms	88 (system dependent)

⁵⁾ From the maximum set pressure ($q_v > 0.2$ l/min; command value >10%)

⁶⁾ Line volume <20 cm³, $q_v = 0.8$ l/min

Technical data

(For applications outside these values, please consult us!)

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

Electrical, integrated electronics (OBE) – interface "A1"				
Supply voltage	▶ Nominal value	VDC	24	
	▶ Minimum	VDC	18	
	▶ Maximum	VDC	36	
	▶ Maximum residual ripple	V _{pp}	2.5	
	▶ Maximum power consumption	VA	40	
	▶ Current consumption during operation ⁷⁾	Rated current	A _{eff}	≤1.5
		Impulse current	A	<3.2
▶ Fuse protection, external	A _T	2 (time-lag)		
Charging capacity (externally effective)		μF	<60	
Relative duty cycle time according to VDE 0580	S1 (continuous operation)			
Functional ground and screening	See pin assignment, page 8			
Command value (differential amplifier)	▶ Measurement range	V	0 ... 10	
	▶ Input resistance	kΩ	>100	
Actual value (test signal)	▶ Output range	V	0 ... 10	
	▶ Minimum load impedance	kΩ	>2	

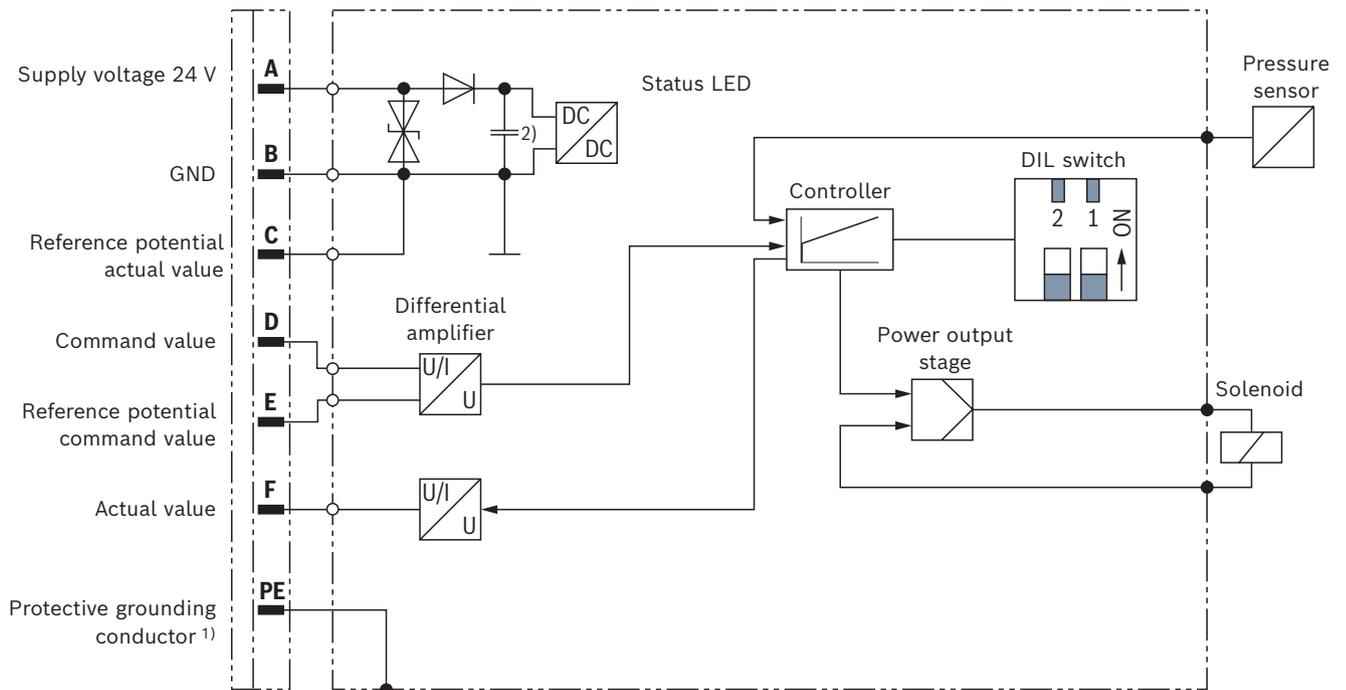
Electrical, integrated electronics (OBE) – interface "F1"				
Supply voltage	▶ Nominal value	VDC	24	
	▶ Minimum	VDC	18	
	▶ Maximum	VDC	36	
	▶ Maximum residual ripple	V _{pp}	2.5	
	▶ Maximum power consumption	VA	40	
	▶ Current consumption during operation ⁷⁾	Rated current	A _{eff}	≤1.5
		Impulse current	A	<3.2
▶ Fuse protection, external	A _T	2 (time-lag)		
Charging capacity (externally effective)		μF	<60	
Relative duty cycle time according to VDE 0580	S1 (continuous operation)			
Functional ground and screening	See pin assignment, page 8			
Command value	▶ Input current range	mA	4 ... 20	
	▶ Input resistance	Ω	100 (+2 V diode path)	
Actual value (test signal)	▶ Output range	mA	4 ... 20	
	▶ Maximum load	Ω	475	

⁷⁾ The making current peak is usually higher (depending on power supply unit, supply line and capacities).

**Notice:**

EMC Directive conditions see page 11.

Block diagram/pin assignment



- 1) The protective grounding conductor (PE) is connected to the valve housing.
- 2) The charging of the capacitor (60 μF) upon connection of the supply voltage results in a current peak (dependence from the power supply).

Notice:

- ▶ If the pressure sensor fails, the valve switches to controlled operation. Pin F outputs 0 V or 4 mA.
- ▶ If the flow changes, the pressure controller is automatically adjusted to these operating conditions. In the first cycles, this may lead to changes in the transition behavior.
- ▶ The controller properties can be adapted to specific applications using the DIL switch (see table below).

DIL switch position

Switch position		Function	Examples of application
2	1		
OFF	OFF	Controlled operation, no pressure control	Commissioning / system analysis
OFF	ON	Smallest dead volume (from 20 cm ³)	Systems with little damping
ON	OFF	Pilot-operated, large dead volume	Logic pilot control valve e.g. LC40
ON	ON	Pilot-operated, small dead volume	Logic pilot control valve e.g. LC16, LC25 Remote pump control (DRG control)

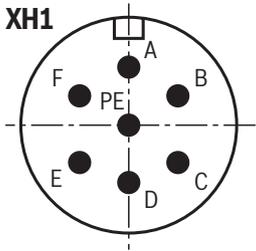
Notice:

- ▶ Adjust the switch position of the application before commissioning.
- ▶ Default setting: both switches to ON (pilot-operated, small dead volume).
- ▶ After adjusting the switch position, switch the supply voltage off and back on to activate the change.

Electrical connections and assignment

Connector pin assignment "XH1", 6-pole + PE according to DIN 43563

Pin	Interface assignment	
	"A1"	"F1"
A	Supply voltage	Supply voltage
B	GND	GND
C	Reference potential actual value (connect with GND on control side)	Reference potential actual value (connect with GND on control side; current loop I_{F-C} feedback)
D	Command value	Command value
E	Reference potential command value (connect with GND on control side)	Reference potential command value (connect with GND on control side; current loop I_{D-E} feedback)
F	Actual value	Actual value
PE	Functional ground (directly connected to the valve housing)	



	Command value
"A1"	0 ... +10 V
"F1"	4 ... 20 mA

Connection cable:

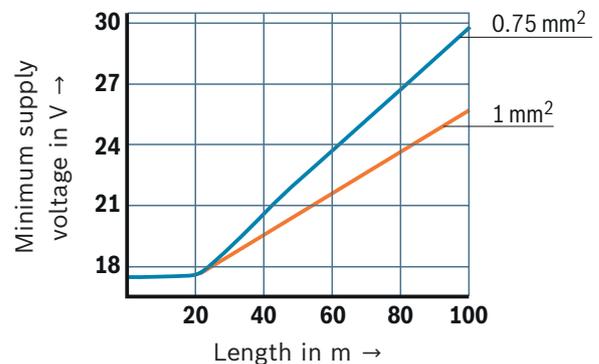
- ▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
- ▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
- ▶ EMC-compatible installation, see page 11.

Notice:

Mating connectors, separate order, see page 11 and data sheet 08006.

Connection cable (recommendation):

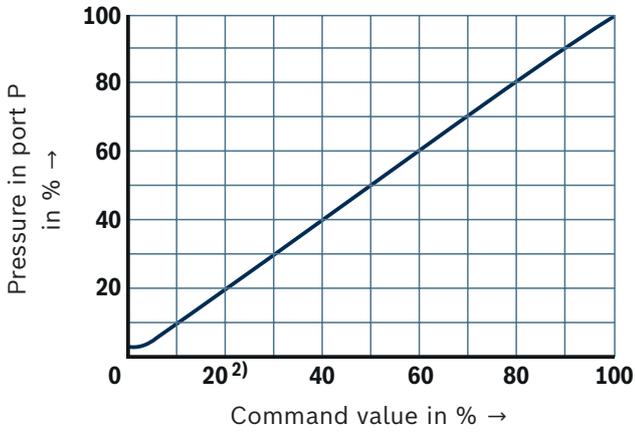
- ▶ 6-wire, 0.75 or 1 mm² plus protective grounding conductor and screening
 - ▶ Only connect the screening to PE on the supply side
 - ▶ Maximum admissible length = 100 m
- The minimum supply voltage at the power supply unit depends on the length of the supply line (see diagram).



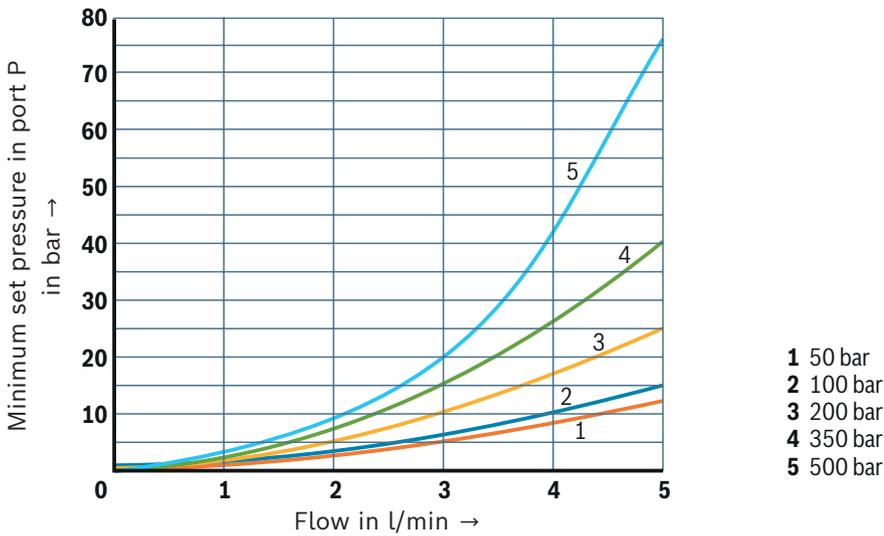
Characteristic curves

(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$)

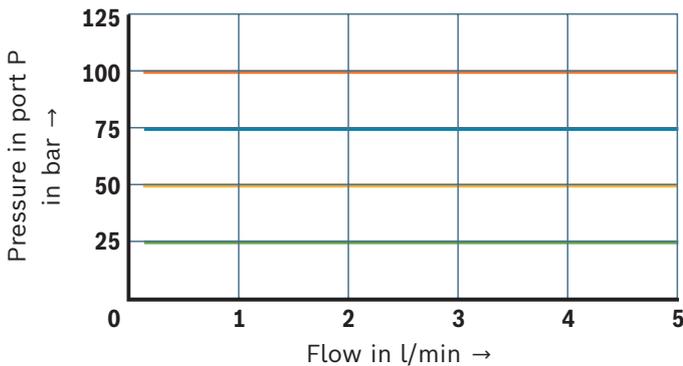
Pressure in port P dependent on the command value (flow = 0.8 l/min)



Minimum set pressure in port P dependent on the flow (command value 0 V or 4 mA)



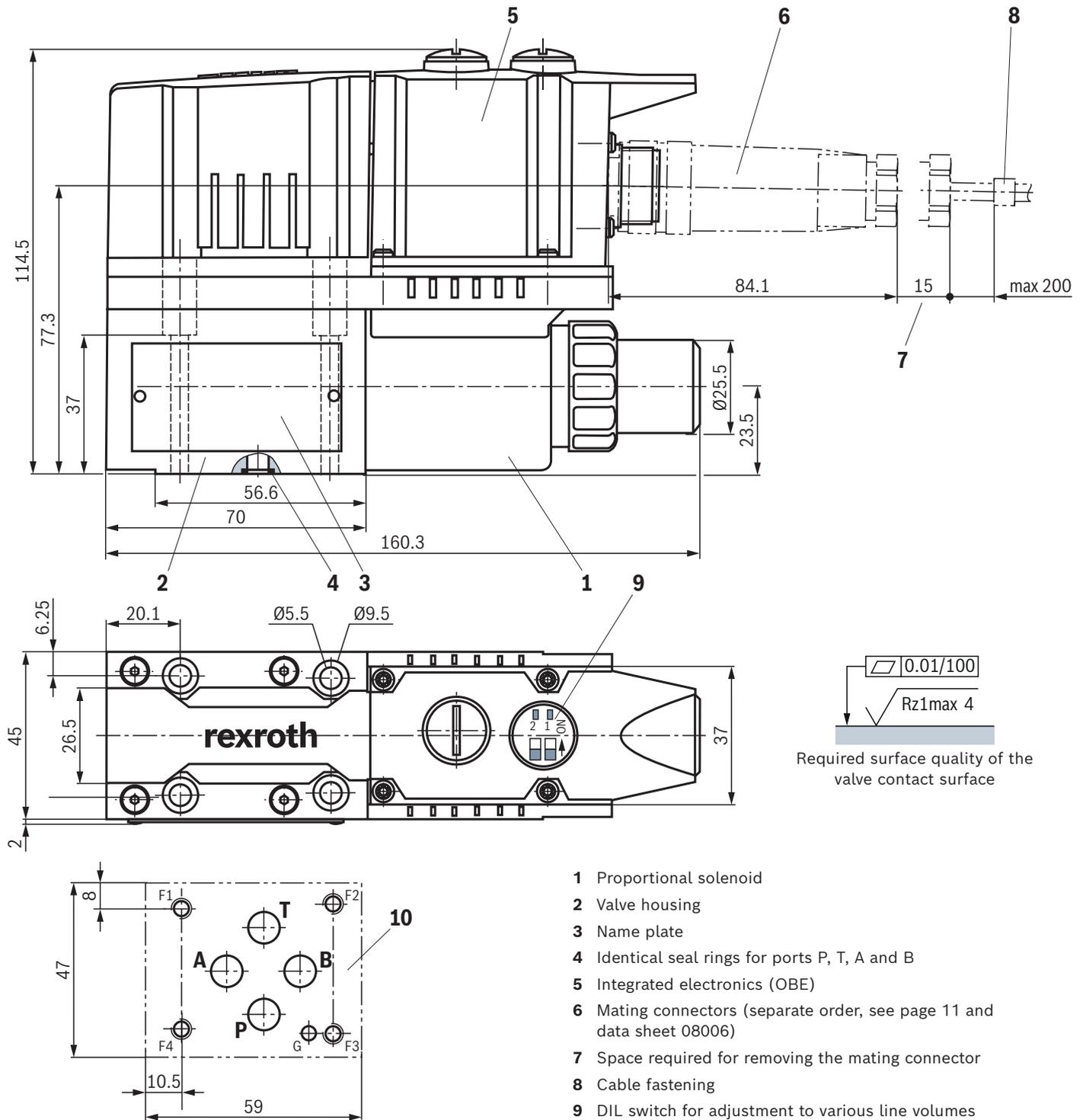
Pressure in port P depending on the flow (applies to all pressure ratings)



Notice:
Typical characteristic curves which are subject to tolerance variations.

Dimensions

(dimensions in mm)



Required surface quality of the valve contact surface

- 1 Proportional solenoid
- 2 Valve housing
- 3 Name plate
- 4 Identical seal rings for ports P, T, A and B
- 5 Integrated electronics (OBE)
- 6 Mating connectors (separate order, see page 11 and data sheet 08006)
- 7 Space required for removing the mating connector
- 8 Cable fastening
- 9 DIL switch for adjustment to various line volumes (see page 7)
- 10 Machined valve contact surface; porting pattern according to ISO 4401-03-02-0-05
 Deviating from the standard:
 - ▶ Channel A not drilled, blind counterbore with sealing
 - ▶ Channel B not drilled, blind counterbore with sealing
 - ▶ Locating pin not included in the scope of delivery

Valve mounting screws and subplates, see page 11.

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
6	4	ISO 4762 - M5 x 45 - 10.9-ISO4042-ZnNi-5-Cn-T0 Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$; tightening torque $M_A = 7 \text{ Nm} \pm 10\%$	R913048087



Notice:

The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Subplates (separate order) with porting pattern according to ISO 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

Mating connectors and cable sets

Item ¹⁾	Designation	Version	Short designation	Material number	Data sheet
6	Mating connector; for valves with round connector, 6-pole + PE	Straight, metal	7PZ31...M	R900223890	08006

¹⁾ See dimensions on page 10.

EMC Directive requirements

- ▶ Shielded connection cables must be used for the electrical connection. The shielding must be placed on both sides.
- ▶ A metal mating connector must be used to make contact between the cable shielding and the valve.
- ▶ A separate EMC-approved power supply unit must be provided for each valve, e.g. one that is CE-compliant.
- ▶ The production of a low impedance connection is established via the professional installation of the valve on a grounded metal manifold block in the system.
- ▶ For electric supply lines over 30 m, overvoltage protection must be provided in the control cabinet.
- ▶ In a strong electro-magnetic environment, further EMC measures may be required, such as shielding of the complete device via metal housings or the use of ferrites on supply and signal lines.

Further information

▶ Subplates	Data sheet 45100
▶ Hydraulic fluids based on mineral oils	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	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
▶ Information on available spare parts	www.boschrexroth.com/spc

Bosch Rexroth AG
Industrial Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52/ 40 30 20
my.support@boschrexroth.com
www.boschrexroth.com

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