

Directional control valve, pilot-operated,
with electrical position feedback and
integrated electronics (OBE)

Type 4WRDE

RE 29097

Edition: 2018-11

Replaces: 2018-10



H8092

- ▶ Size 10 ... 27
- ▶ Component series 6X
- ▶ Maximum operating pressure 350 bar
- ▶ Rated flow 25 ... 500 ml/min

Features

- ▶ Precise – High response sensitivity and little hysteresis
- ▶ High-quality – Pilot control valve type 4WS2EM6-2X with control spool and sleeve
- ▶ Flexible – Suitable for position, velocity, force and pressure control in very exact and dynamic applications
- ▶ Reliable – Proven and robust design

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
4	WRD	E						— 6X	/			/	24	*

01	4 main ports	4
02	Directional control valve	WRD
03	With integrated electronics (OBE)	E
04	Size 10	10
	Size 16	16
	Size 25	25
	Size 27	27
05	Symbols e.g. E, E1, W etc.; possible version see page 3	

Control spool position in de-energized state

06	Not defined	no code
	100% P → A / B → T	P
	100% P → B / A → T	N

Rated flow at 10 bar pressure differential (5 bar per control edge)

07	– Size 10	
	25 l/min (only symbol E, W6-, W8- and V with version "L")	25
	50 l/min	50
	90 l/min	100
	– Size 16	
	150 l/min (only symbol V1 with version "L")	150
	220 l/min	220
	– Size 25	
	220 l/min	220
	350 l/min	350
	– Size 27	
	500 l/min	500

Flow characteristic

08	Linear	L
	Linear with fine control range	P
09	Component series 60 ... 69 (60 ... 69: unchanged installation and connection dimensions)	6X

Seal material

10	NBR seals	M
	FKM seals	V
	Observe compatibility of seals with hydraulic fluid used.	

Pilot oil flow

11	External pilot oil supply, external pilot oil return	XY
	Internal pilot oil supply, external pilot oil return	PY
	Internal pilot oil supply, internal pilot oil return	PT
	External pilot oil supply, internal pilot oil return	XT
12	Without sandwich plate shut-off valve	no code
	With sandwich plate shut-off valve, 24 V	WG
13	Supply voltage 24 V	24

Ordering code

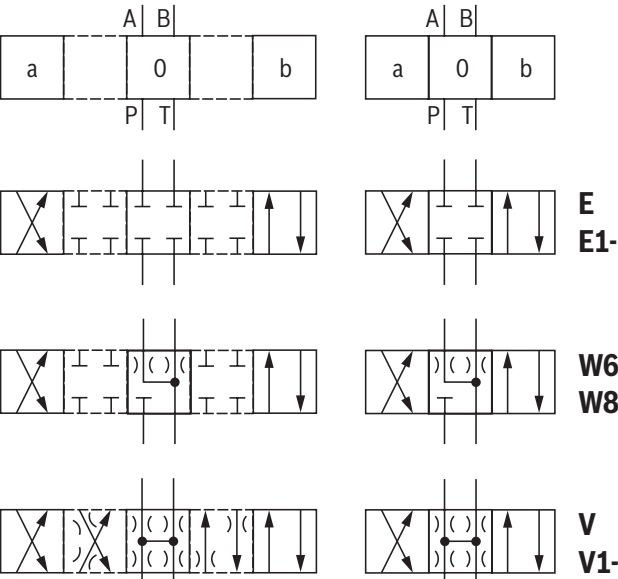
01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
4	WRD	E						— 6X	/			/	24	*

Electrical interface

14	Command value ±10 VDC, actual value ±10 VDC (connector 6+PE)	A1 ¹⁾
	Command value 4 ... 20 mA, actual value 4 ... 20 mA (connector 6+PE)	F1
	Command value ±10 mA, actual value 4 ... 20 ma (connector 6+PE), only in connection with version "P" and "N" (de-energized control spool position)	C6-972
15	For further information, see the plain text	

1) When replacing the component series 5X by the functionally compatible component series 6X, the electronics interface is to be defined with "A5" (as version "A1", however additionally with enable input +24V at pin C)

Symbols



With symbol E1-, W8 and V1-:

P → A: $q_{V \max}$ B → T: $q_V/2$
P → B: $q_V/2$ A → T: $q_{V \max}$

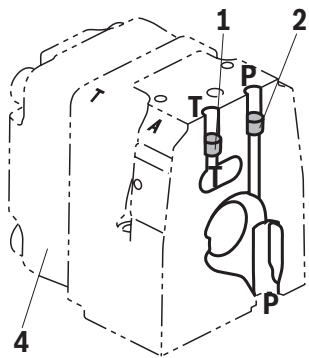
- Notes:**
- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
 - With symbols W6 and W8 there is a connection from A to T and B to T with approx. 3% of the relevant nominal cross-section in zero position.

Symbols

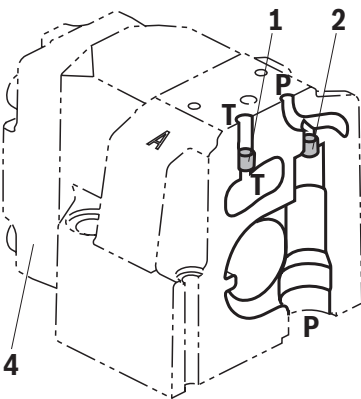
Design	simple	detailed
"XY"		
"PY"		
"PT"		
"XT"		

Pilot oil supply (schematic illustration)

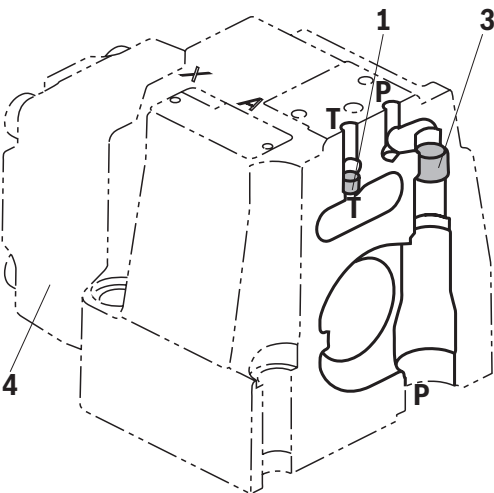
NG10



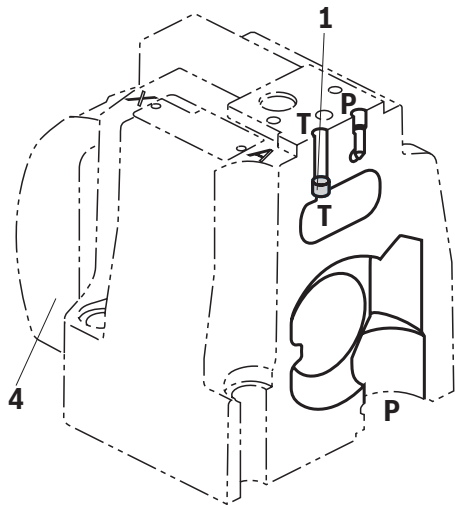
NG16



NG25



NG27



- 1 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil return
- 2 Plug screw M6 according to DIN 906, wrench size 3
– pilot oil supply
- 3 Plug screw M12 x 1.5 according DIN 906, wrench size 6
– pilot oil supply
- 4 Main stage housing cover (opposite the OBE)

Pilot oil supply		Pilot oil return	
external	internal	external	internal
2, 3	2, 3	1	1
closed	open	closed	open

Further explanations on page 7.

Pilot oil supply

Version "XY"

External pilot oil supply

external pilot oil return

With this version, the pilot oil is supplied from a separate pilot oil circuit (external).

The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).

Version "PY"

Internal pilot oil supply

external pilot oil return

With this version, the pilot oil is supplied from channel P of the main valve (internal).

The pilot oil return is not directed into channel T of the main valve, but is separately directed to the tank via port Y (external).

In the subplate, port X is to be closed.

Version "PT"

Internal pilot oil supply

internal pilot oil return

With this version, the pilot oil is supplied from channel P of the main valve (internal).

The pilot oil is directly returned to channel T of the main valve (internal).

In the subplate, ports X and Y are to be closed.

Version "XT"

External pilot oil supply

internal pilot oil return

With this version, the pilot oil is supplied from a separate pilot oil circuit (external).

The pilot oil is directly returned to channel T of the main valve (internal).

In the subplate, port Y is to be closed.

Technical data

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

general					
Size	NG	10	16	25	27
Weight	kg	7.5	10.5	17.5	19.5
Installation position		any (preferably horizontal)			
Ambient temperature range		°C	−20 ... +60		
Maximum storage time		Years	1 (if the storage conditions are observed; refer to the operating instructions 07600-B)		
Vibration resistance	▶ Sine test according to DIN EN 60068-2-6	10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes			
	▶ Noise test according to DIN EN 60068-2-64	20 ... 2000 Hz / 10 g _{RMS} / 30 g peak / 30 min. / 3 axes			
	▶ Transport shock according to DIN EN 60068-2-27	15 g / 11 ms / 3 axes			
Maximum relative humidity (no condensation)		%	95		
hydraulic					
Maximum operating pressure	▶ Port A, B, P				
	– Pilot oil supply external ¹⁾	bar	350	350	350
	– Internal pilot oil supply	bar	25 ... 250		
	▶ Port X	bar	25 ... 250		
Maximum return flow pressure	▶ Port T				
	– External pilot oil return	bar	315	250	250
	– Pilot oil return internal	bar	Pressure peaks < 100 static < 10 admissible		
	▶ Port Y	bar	Pressure peaks < 100 static < 10 admissible		
Rated flow (Δp = 5 bar per control edge) ²⁾		l/min	25	–	–
			50	150	220
			90	220	350
Maximum flow		l/min	170	460	870
Maximum pilot oil flow at stepped input signal (0 → 100%, pilot pressure 250 bar)		l/min	8.3	15.6	8.6
Pilot oil volume 0 ... 100%		cm ³	1.1	2.9	2.3
Zero flow pilot control valve (pilot pressure 100 bar)		l/min	0.7	0.8	0.8
Maximum zero flow	▶ Symbol V, V1-		see characteristic curves page 14		
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-				
	– Main valve	l/min	0.1	0.2	0.3
	– Main + pilot control valve	l/min	0.8	1	1.1
	▶ Symbol W6-, W8-				
	– Main valve	l/min	0.2	0.4	0.5
	– Main + pilot control valve	l/min	0.9	1.2	1.4
Hydraulic fluid			see table page 9		
Hydraulic fluid temperature range (flown-through)		°C	−20 ... +80		
Viscosity range	▶ Maximum	mm ² /s	20 ... 380		
	▶ Recommended	mm ² /s	30 ... 45		
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Pilot control valve: Class 18/16/13 ³⁾ Main stage: Class 20/18/15 ³⁾		

¹⁾ For perfect system behavior, an external pilot oil supply is recommended for pressures above 210 bar.

²⁾ Flow for deviating Δp :

$$q_x = q_{Vnom} \times \sqrt{\frac{\Delta p_x}{5}}$$

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.

Technical data

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

Hydraulic fluid	Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils	HL, HLP, HLPD, HVLP, HVLDP	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, Fuchs Renosafe 500, Petrofer Ultra Safe 620, Houghton Houghto 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 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.

▶ 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.

static /dynamic			
Hysteresis	%	< 0.2	
Response sensitivity	%	< 0.1	
Range of inversion	%	< 0.1	
Manufacturing tolerance q_{Vmax}	%	10	
Zero shift upon change of	▶ Hydraulic fluid temperature	%/10 K	< 0.2
	▶ Ambient temperature	%/10 K	< 0.2
	▶ Operating pressure	%/100 bar	< 0.5
	▶ Return flow pressure 0 ... 10% of p	%/100 bar	< 0.2
Zero compensation ⁴⁾			Ex plant ±1%

electrical, integrated electronics (OBE)			
Protection class according to EN 60529		IP 65 with mating connector mounted and locked	
Supply voltage	▶ Nominal voltage	VDC	24 (full bridge rectification with smoothing capacitor 2200 µF, $I_{max} = 230$ mA)
	▶ Lower limit value	VDC	18
	▶ Upper limit value	VDC	36
Maximum current consumption		mA	< 200
Functional ground and screening	see page 10 (CE-compliant installation)		
Adjustment	Calibrated in the plant, see valve characteristic curves page 14 ... 20		

⁴⁾ Related to the pressure-signal characteristic curve (symbol V)

Electrical connections, assignment

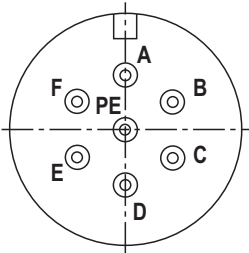
Contact	Interface assignment		
	"A1" (6 + PE)	"F1" (6 + PE)	"C6-972" (6 + PE)
A	24 VDC supply voltage		
B	GND		
C	n.c.	n.c. (not to be connected)	Enable input 24 VDC (high ≥ 8.5 V; low ≤ 6.5 V) ¹⁾
D	Command value ±10 V ²⁾ (<i>Re</i> > 100 kΩ)	Command value 4 ... 20 mA ³⁾ (<i>Re</i> = 100 Ω)	Command value ±10 mA ²⁾ (<i>Re</i> = 200 Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ±10 V (<i>Ri</i> ≈ 1 kΩ)	Actual value 4 ... 20 mA (load max. 500 Ω)	Actual value 4 ... 20 mA (load max. 500 Ω)
PE	Functional ground (directly connected to the valve housing)		

- 1)

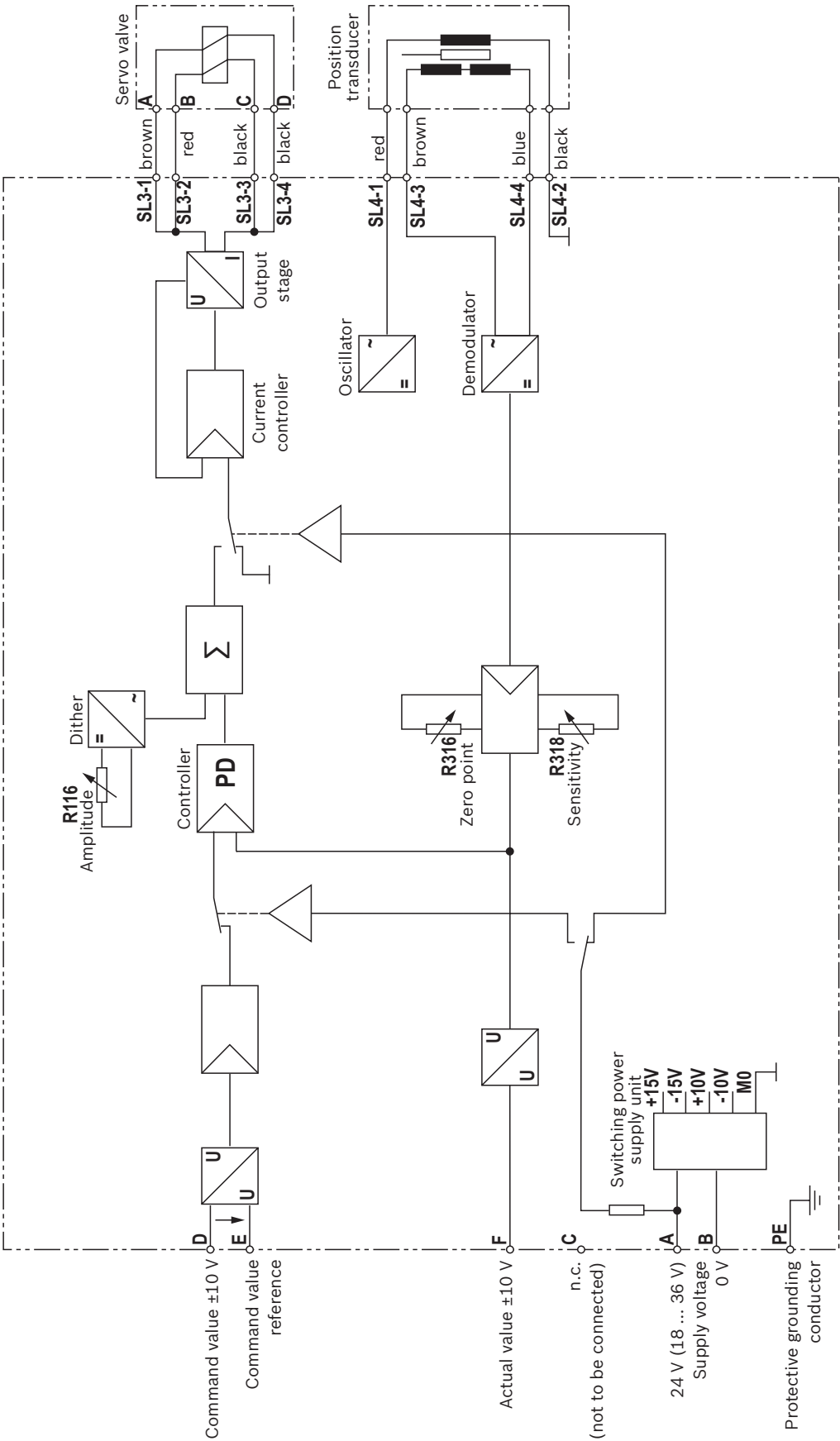
At active hydraulic pressure and "low" enable signal, the control spool of the main stage is in a regulated central position (preferred direction adjustable by ±10% by means of potentiometer R161).
If a directional sandwich plate valve (version "WG") is used between pilot control valve and main stage, the control chambers are unloaded from the pilot control valve to the main stage control spool. With symbols E, E1-, W6- and W8-, the centering springs set the main stage control spool in central position, symbols V- and V1 are switched to preferred direction P → B and A → T in a tolerance range of 1% to 11% of the control spool stroke. As a consequence, the cylinder axis leaves its position at minimum velocity.
- 2)

Differential command value input: Positive command value at D compared to E results in flow from P → A and B → T at the main stage.
- 3)

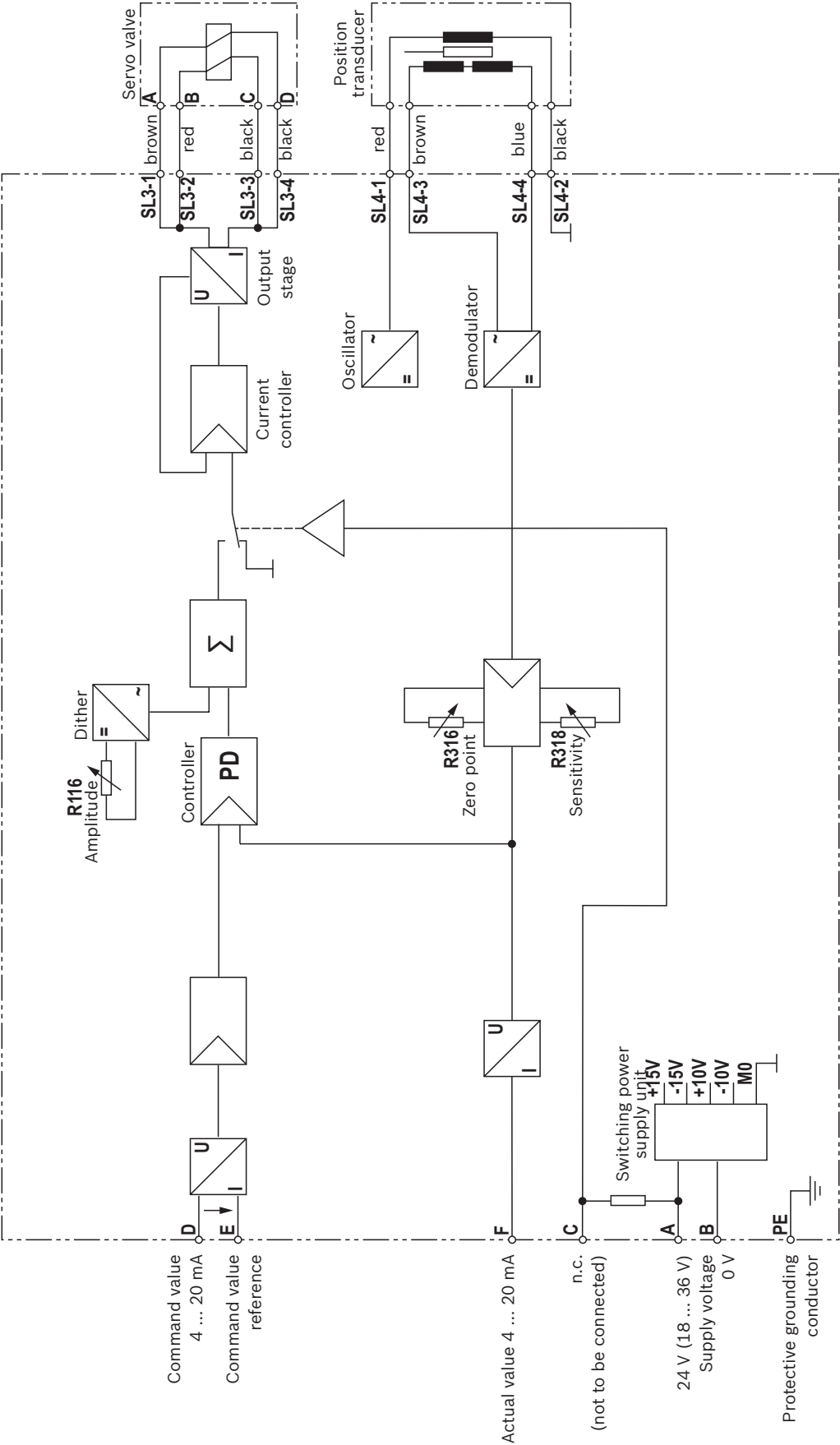
Differential command value input: Command value of 12 ... 20 mA at D compared to E results in flow from P → A and B → T at the main stage.



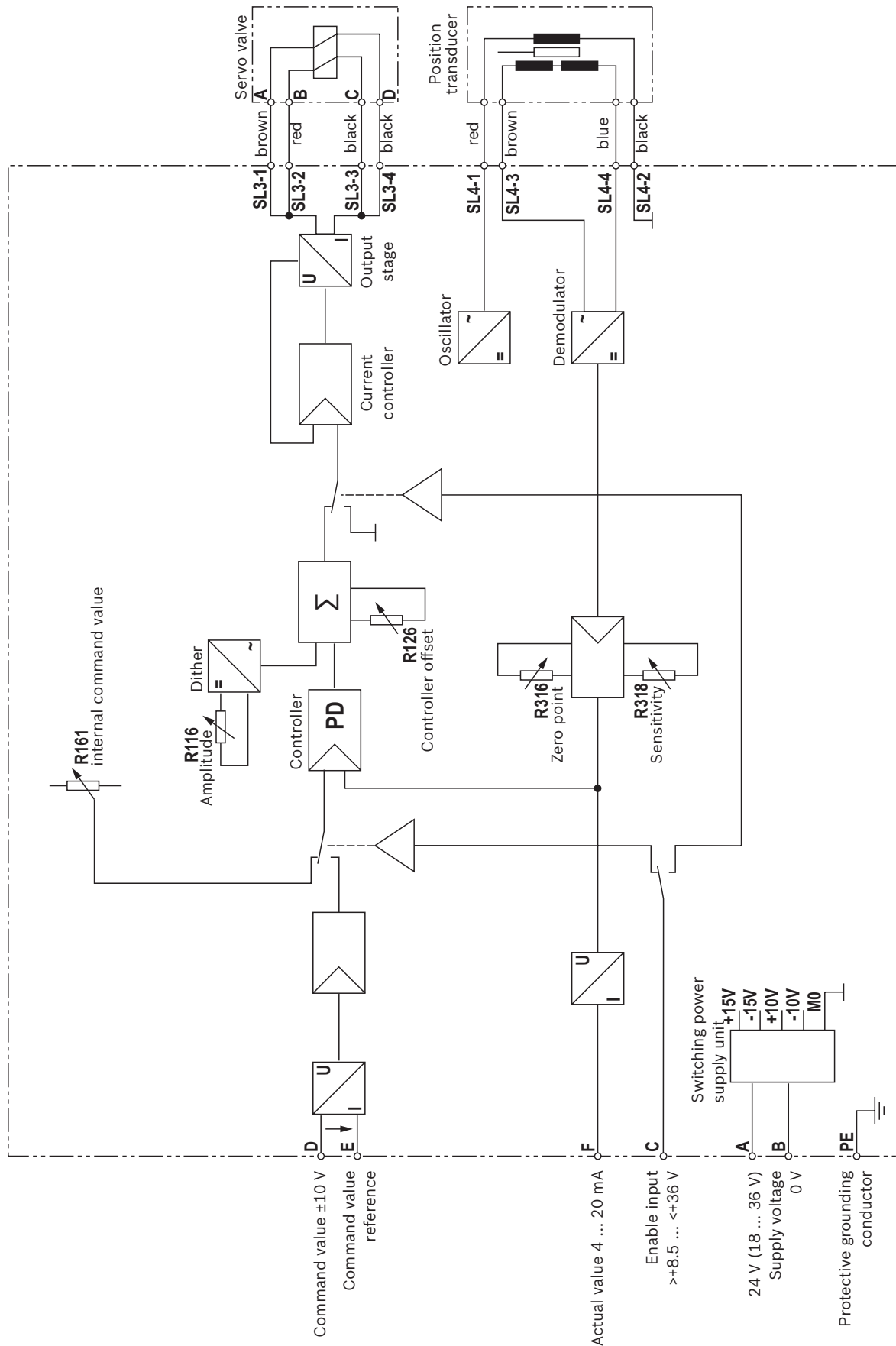
Block diagram/controller function block: Version "A1"



Block diagram/controller function block: Version "F1"



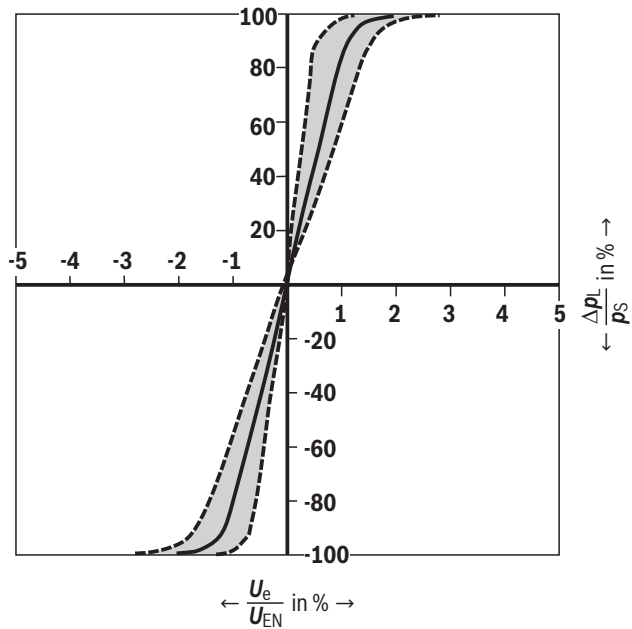
Block diagram/controller function block: Version "C6-972"



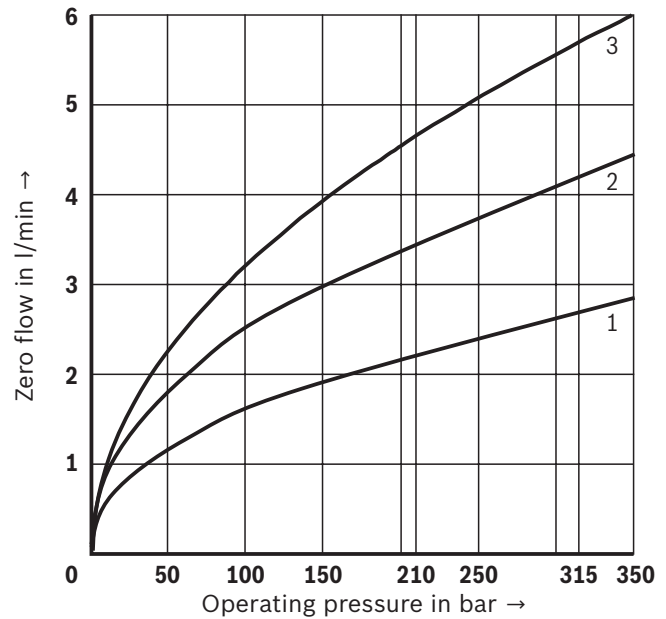
Characteristic curves

(measured with HLP46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ and $p = 100\text{ bar}$)

Pressure-signal characteristic curve (symbol V)



Zero flow of the main stage (symbol V), without pilot control valve

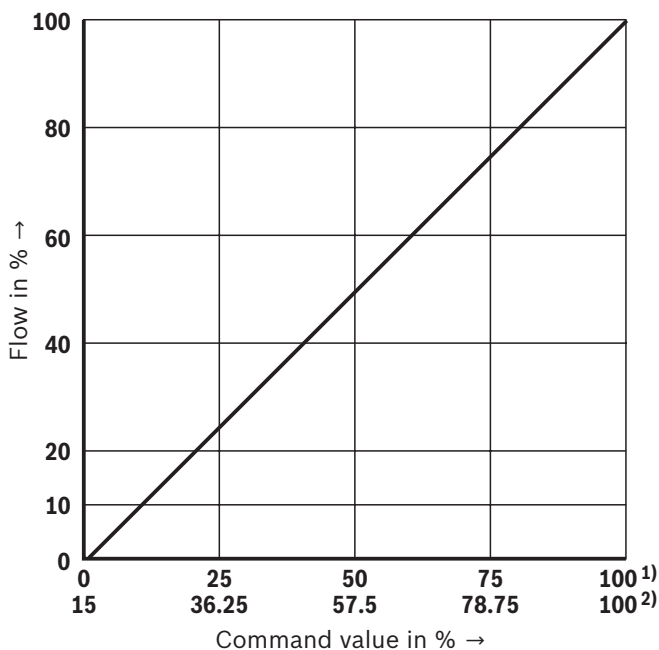


- 1 Size 10
- 2 Size 16
- 3 Size 25 and 27

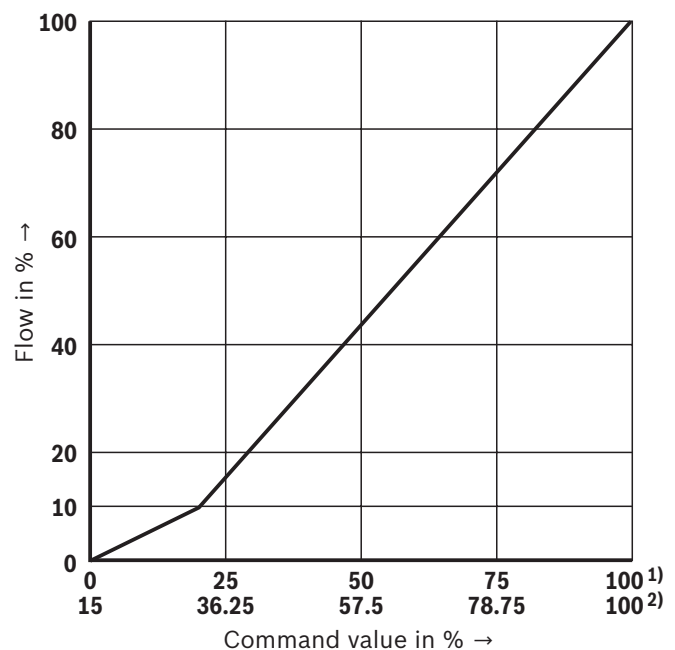
Flow command value function

(at e.g. P → A / B → T and 10 bar pressure differential or P → A or A → T and 5 bar per control edge)

Version "L" (symbols E, W and V)



Version "P" (symbols E, W and V)

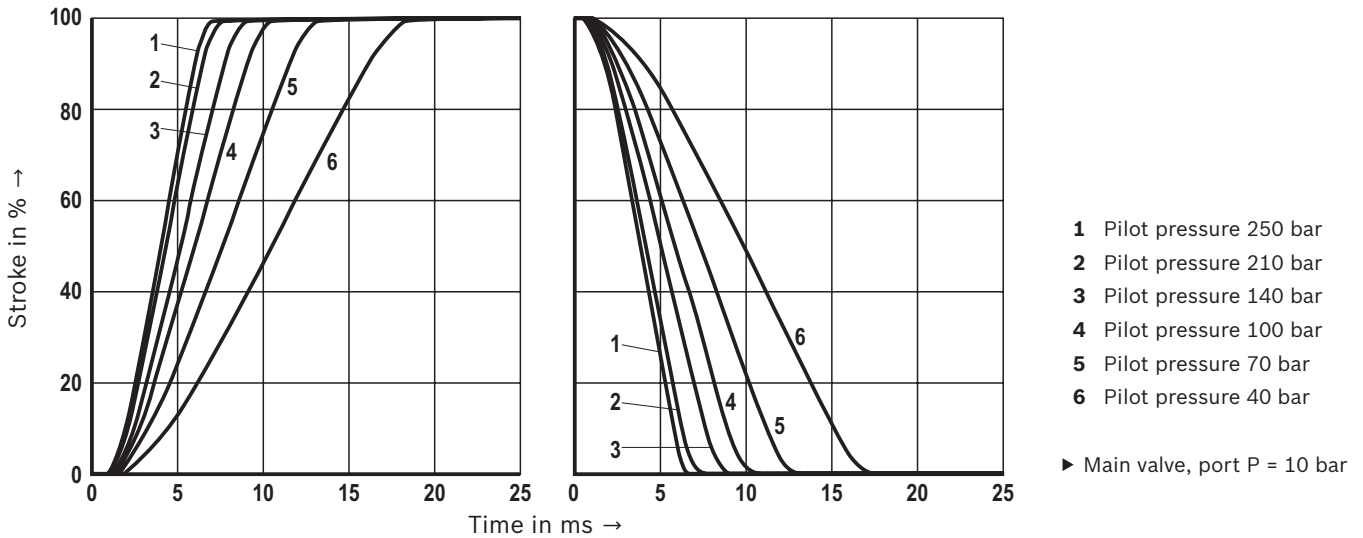


1) Positive overlap 0 ... 0.5% at symbol V

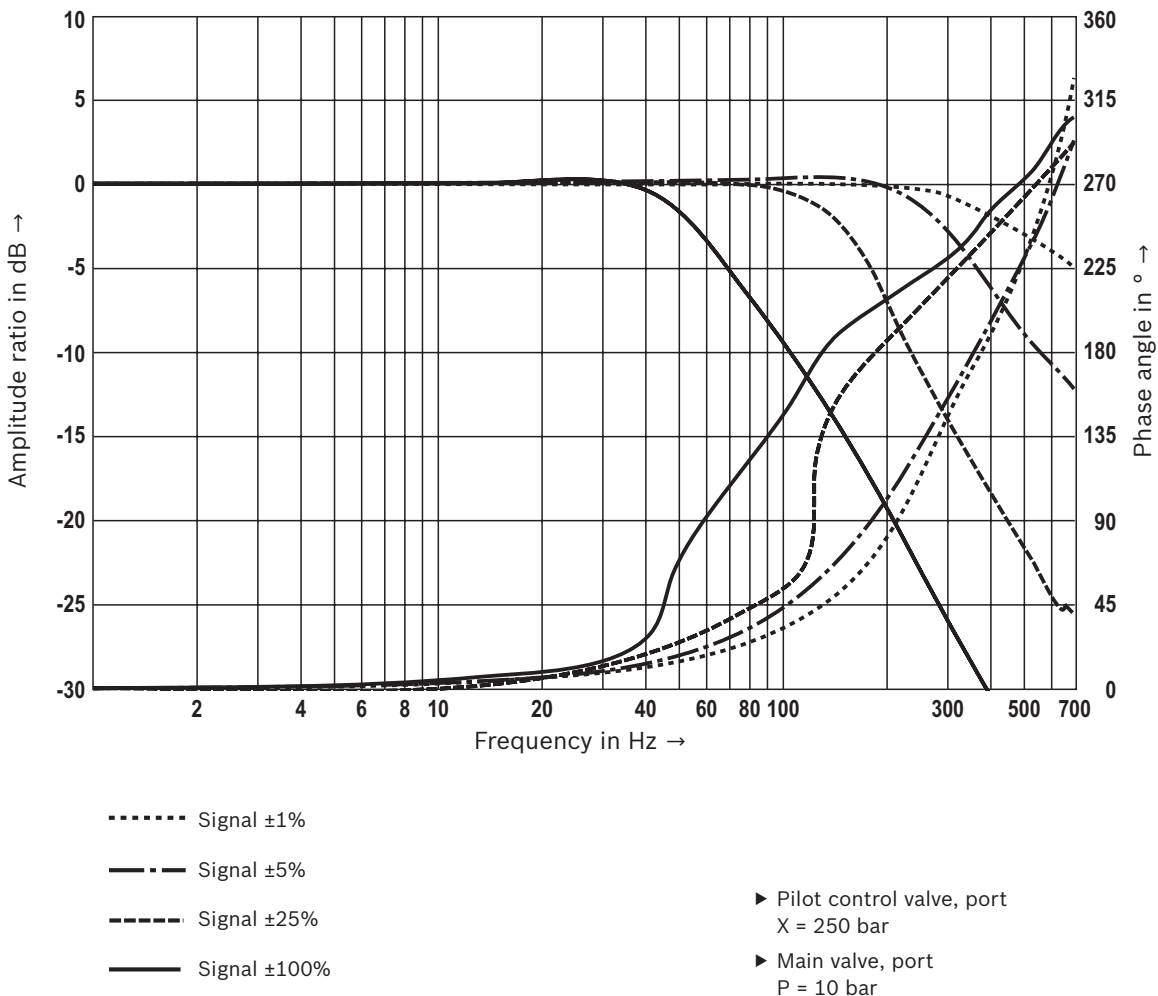
2) Positive overlap 15% at symbols E and W

Characteristic curves: Size 10
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

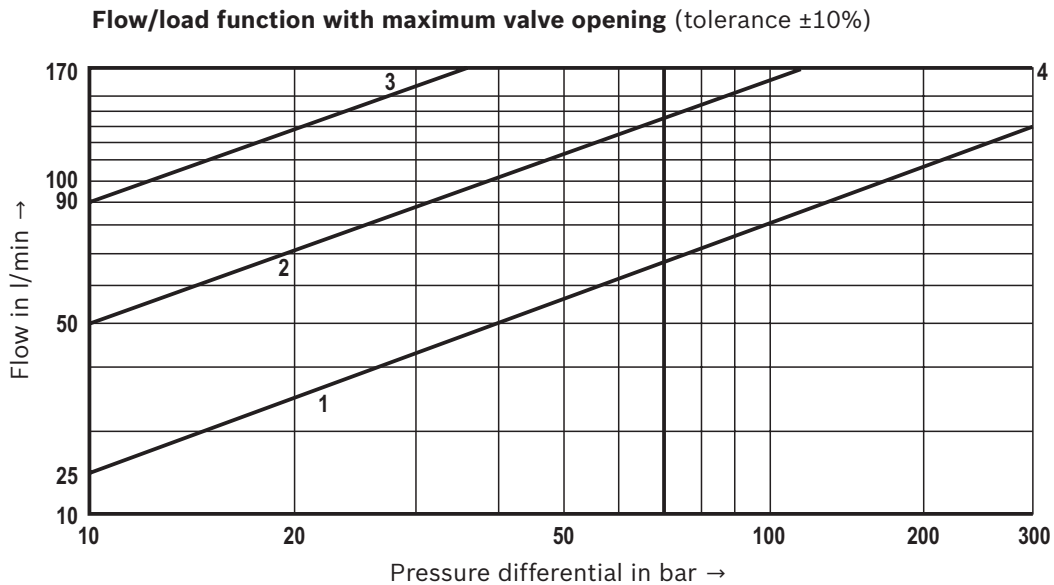
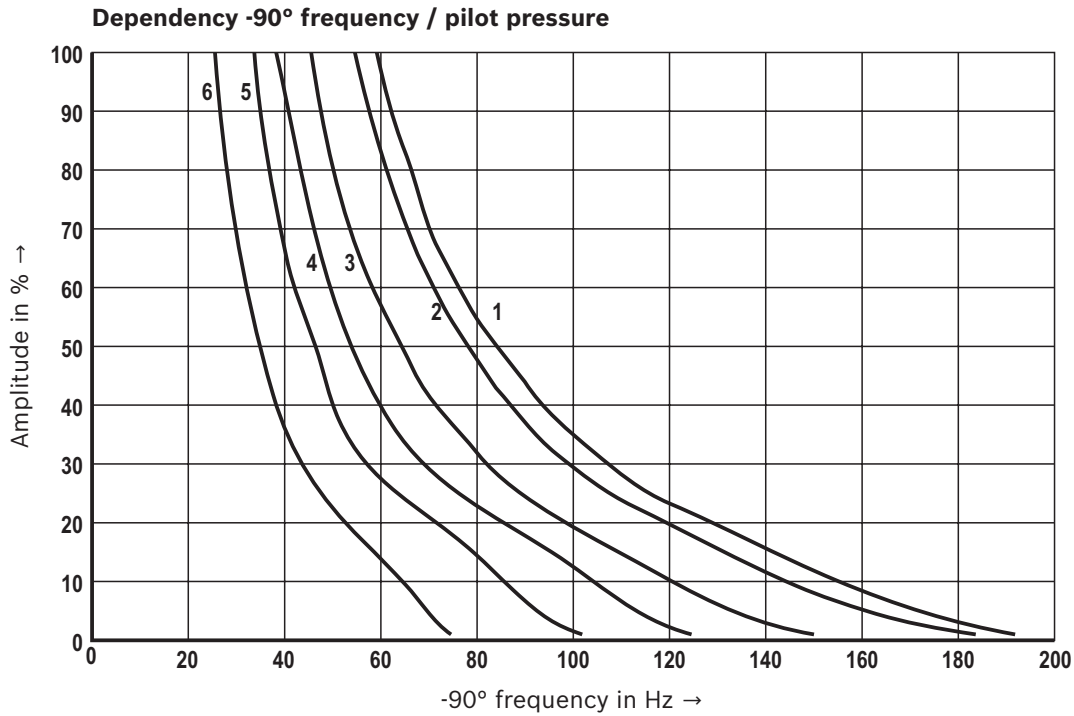
Transition function with stepped electric input signals



Frequency response characteristic curves



Characteristic curves: Size 10
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)



$$\Delta p = p_P - p_L - p_T$$

Δp Pressure differential

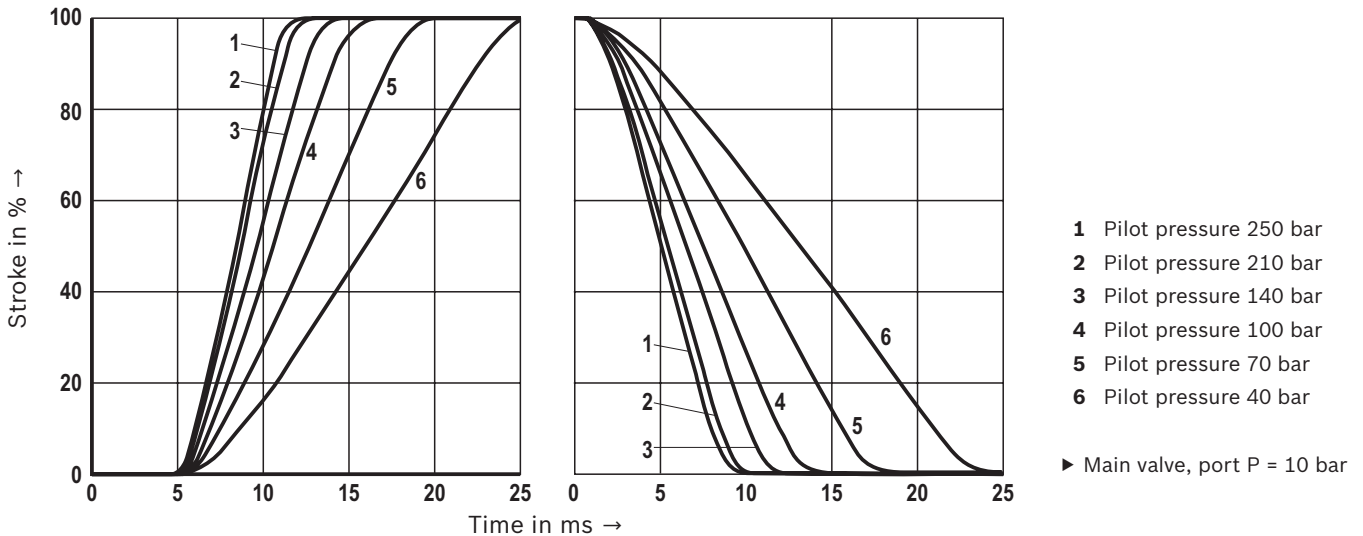
p_P Inlet pressure

p_L Load pressure

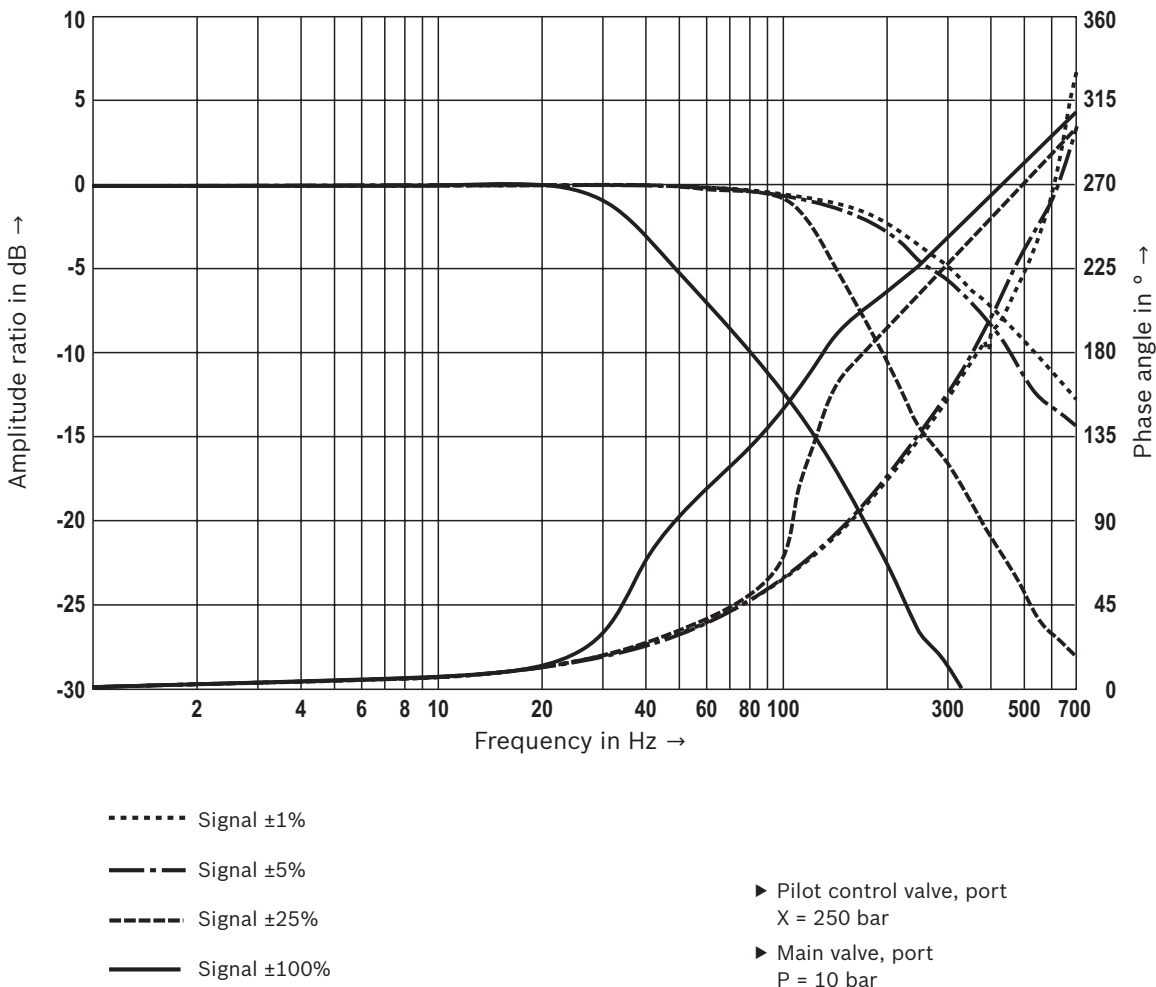
p_T Return flow pressure

Characteristic curves: Size 16
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

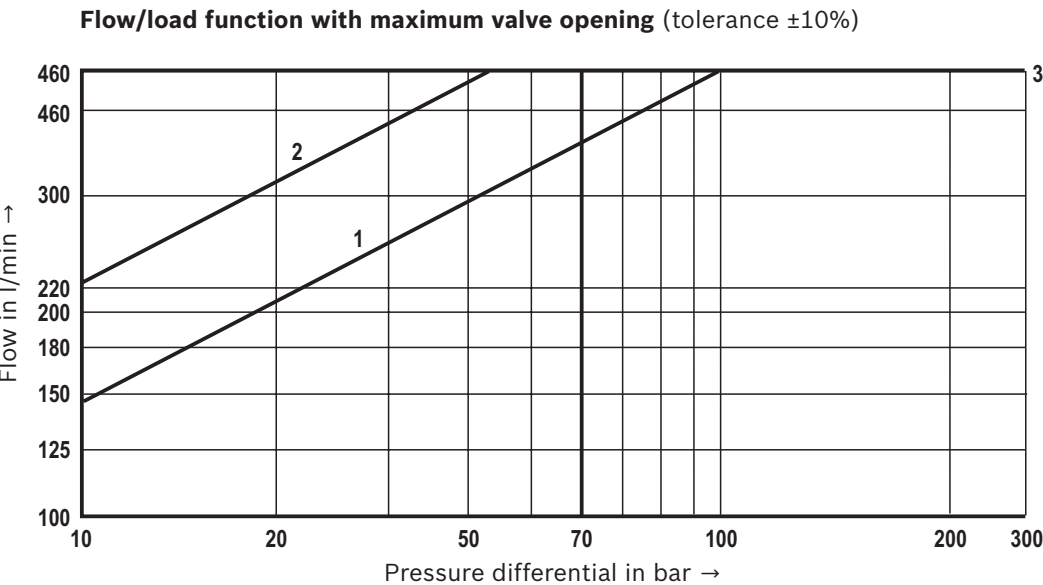
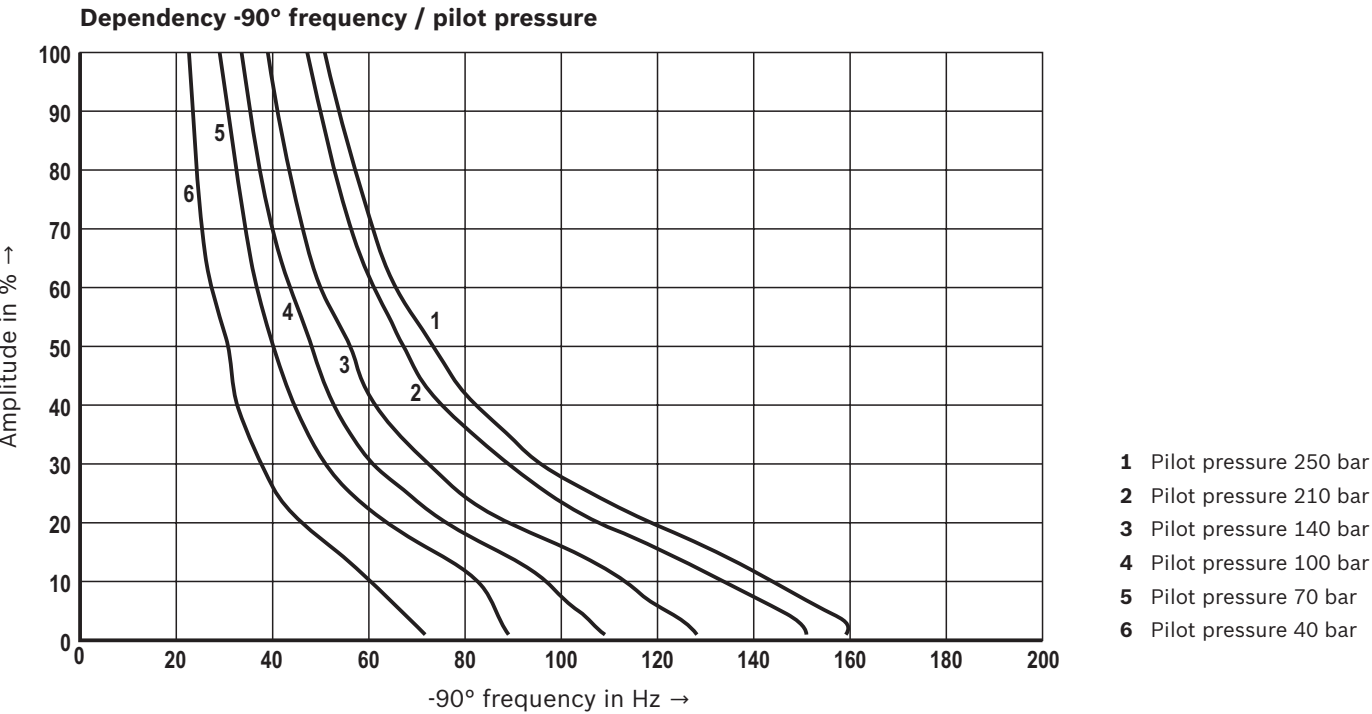
Transition function with stepped electric input signals



Frequency response characteristic curves



Characteristic curves: Size 16
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

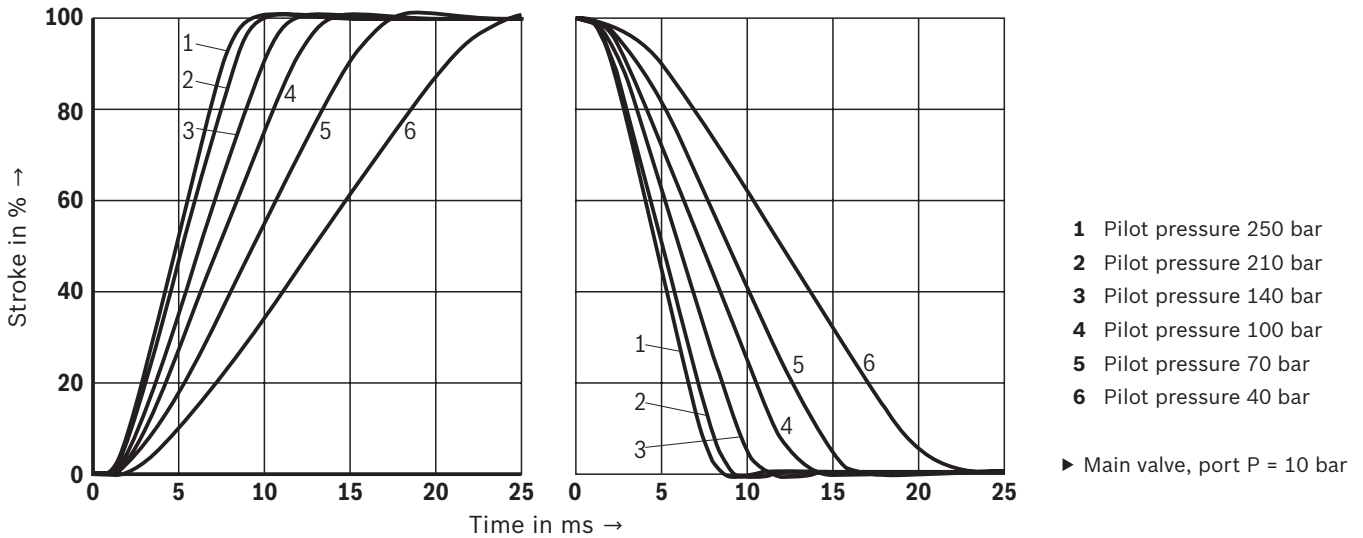


$\Delta p = p_P - p_L - p_T$

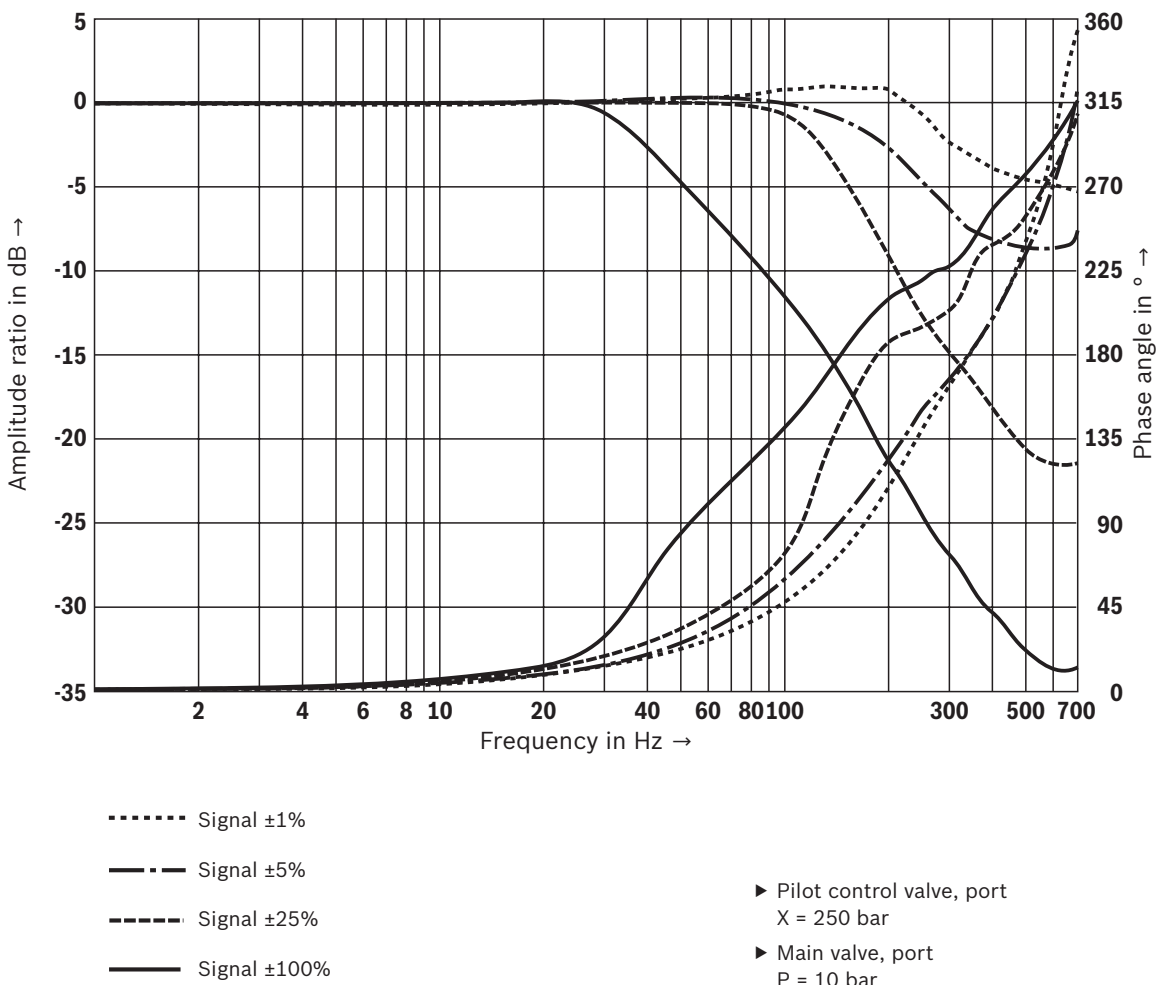
- Δp Pressure differential
- p_P Inlet pressure
- p_L Load pressure
- p_T Return flow pressure

Characteristic curves: Size 25 and 27
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

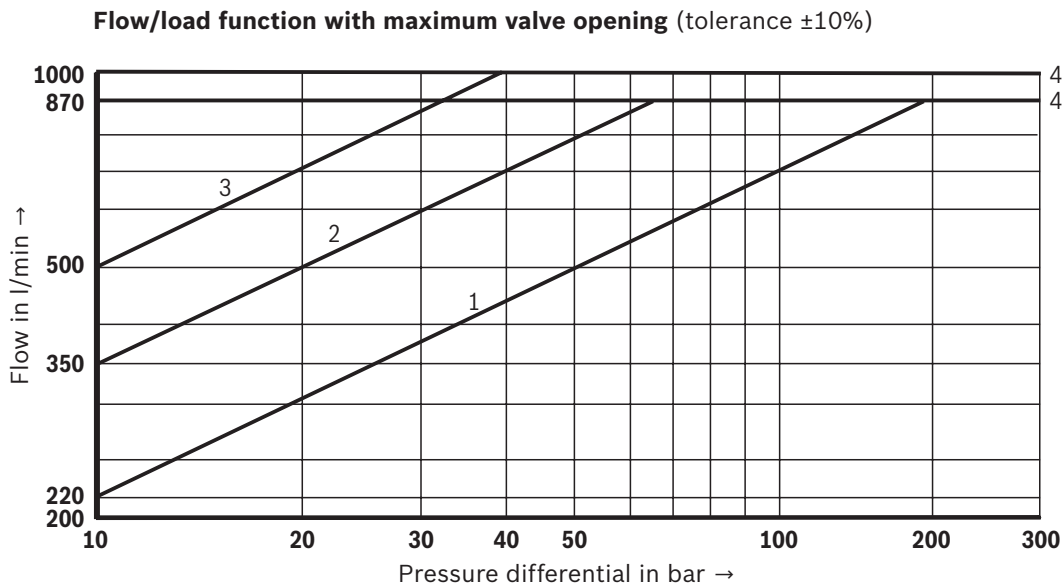
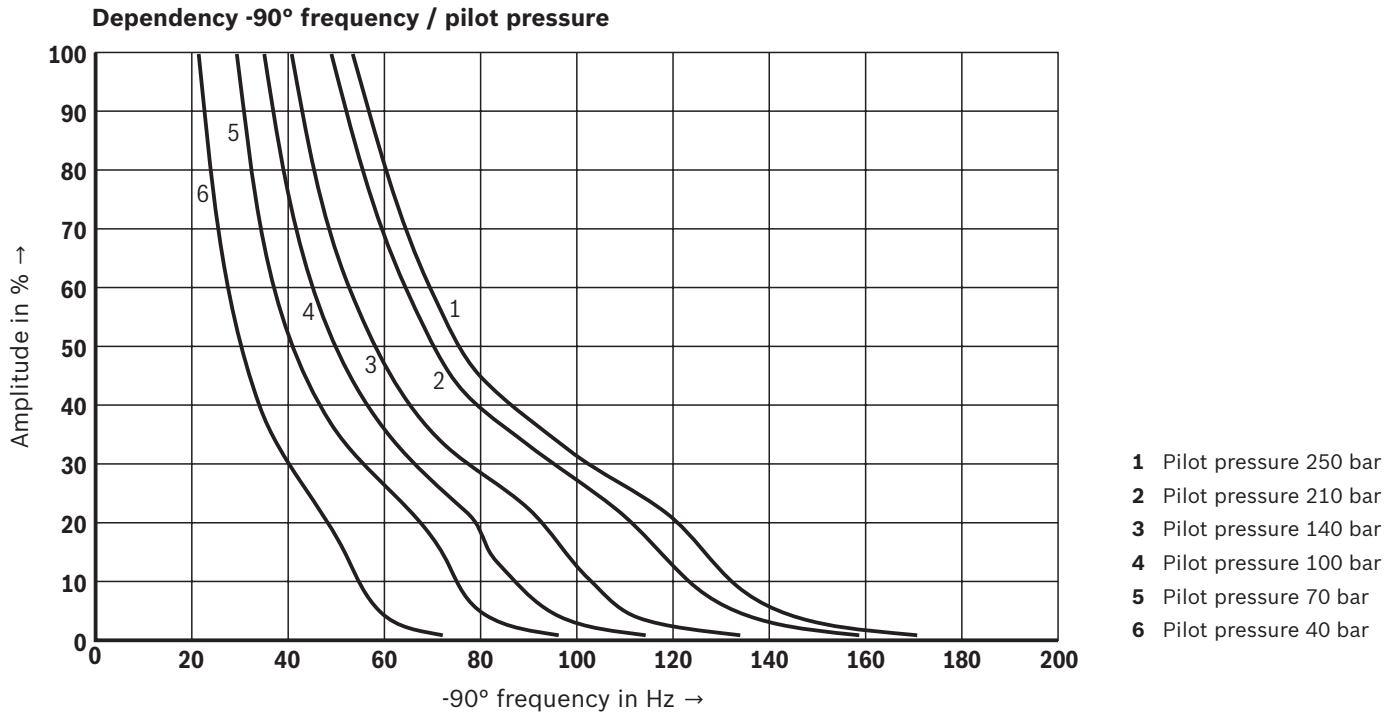
Transition function with stepped electric input signals



Frequency response characteristic curves



Characteristic curves: Size 25 and 27
(measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^{\circ}\text{C}$)

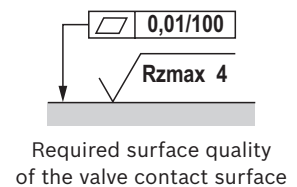
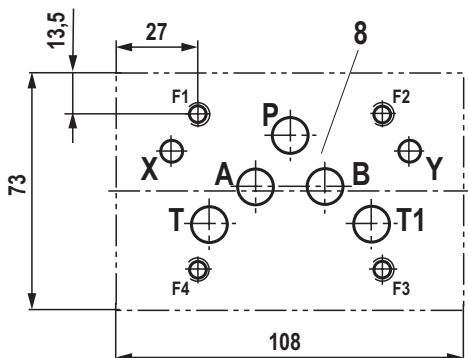
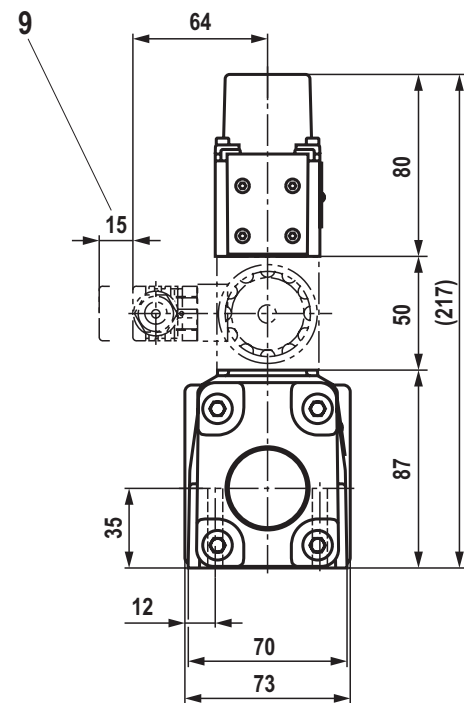
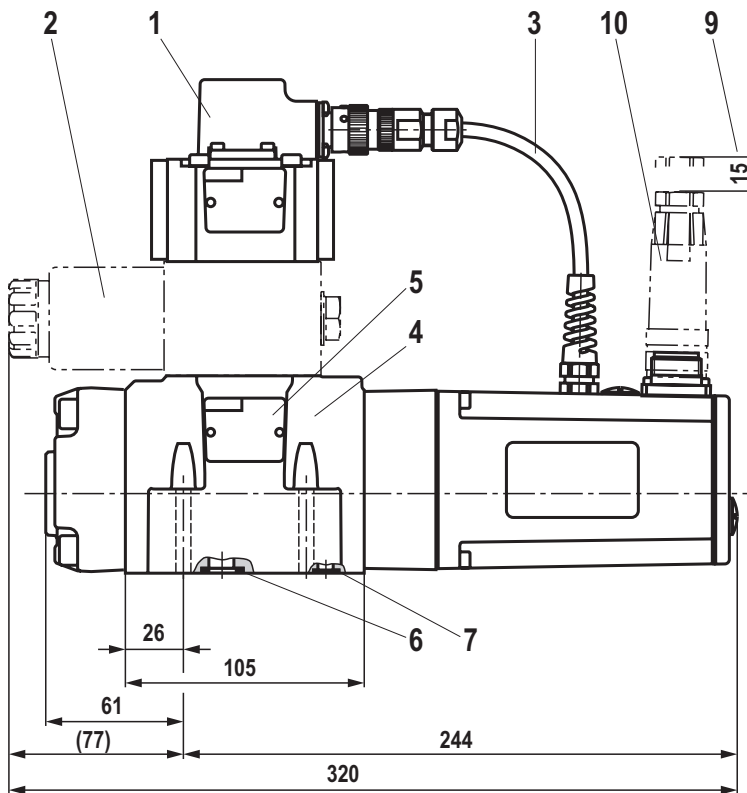


- 1 Rated flow 220 l/min
- 2 Rated flow 350 l/min
- 3 Rated flow 500 l/min
- 4 Recommended flow limitation (flow velocity 30 m/s)

$$\Delta p = p_P - p_L - p_T$$

Δp Pressure differential
 p_P Inlet pressure
 p_L Load pressure
 p_T Return flow pressure

Dimensions: Size 10
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T and T1
- 7 Identical seal rings for ports X and Y
- 8 Machined valve contact surface; porting pattern according to ISO 4401-05-05-0-05 (ports X and Y as required)
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 26

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

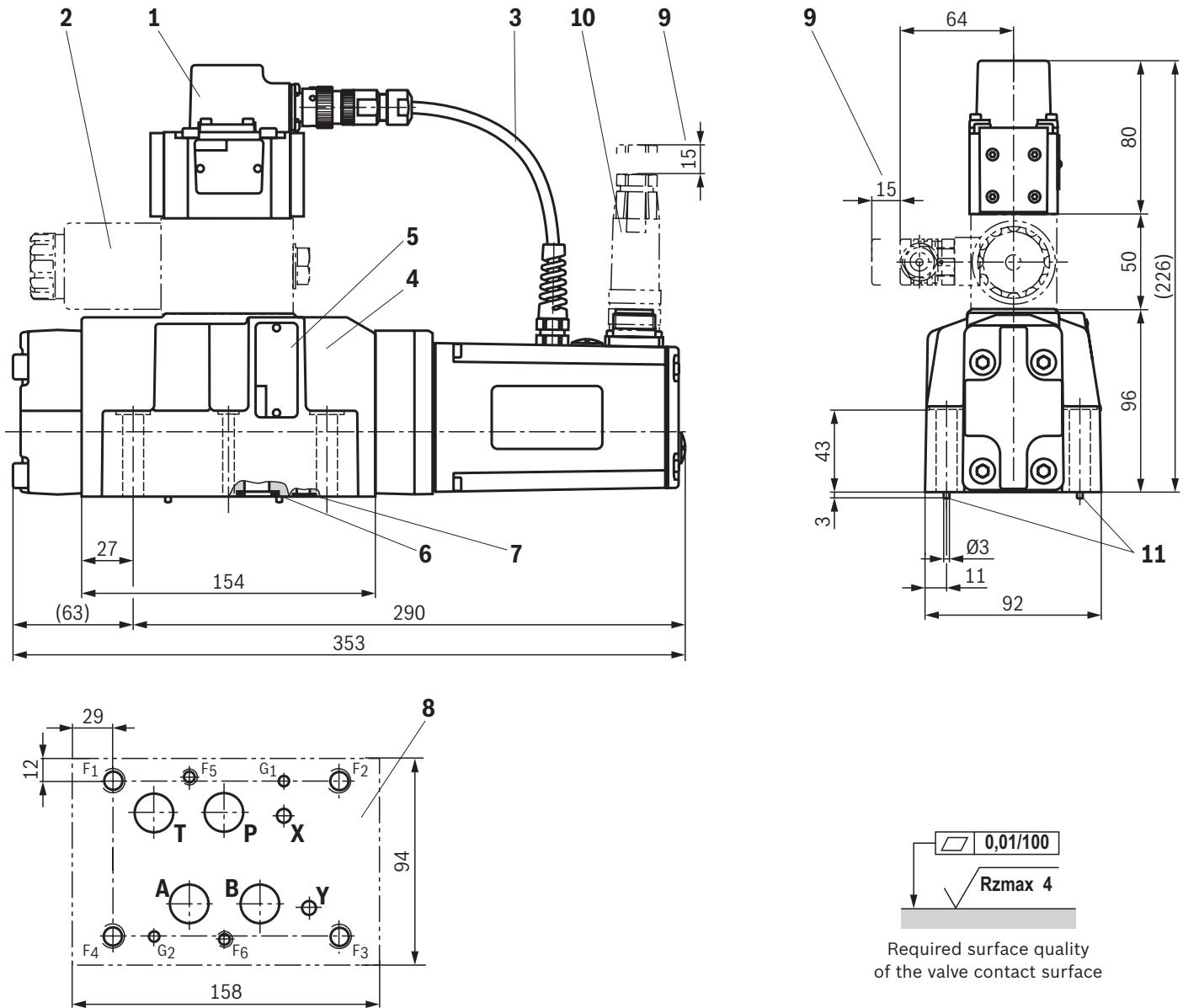


Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 25.

Dimensions: Size 16 (dimensions in mm)



Required surface quality
of the valve contact surface

- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y
- 8 Machined valve contact surface; porting pattern according to ISO 4401-07-07-0-05 (ports X and Y as required)
Deviating from the standard: ports A, B, P, T – Ø20 mm
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 26
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-07-07-0-05 see data sheet 45100.

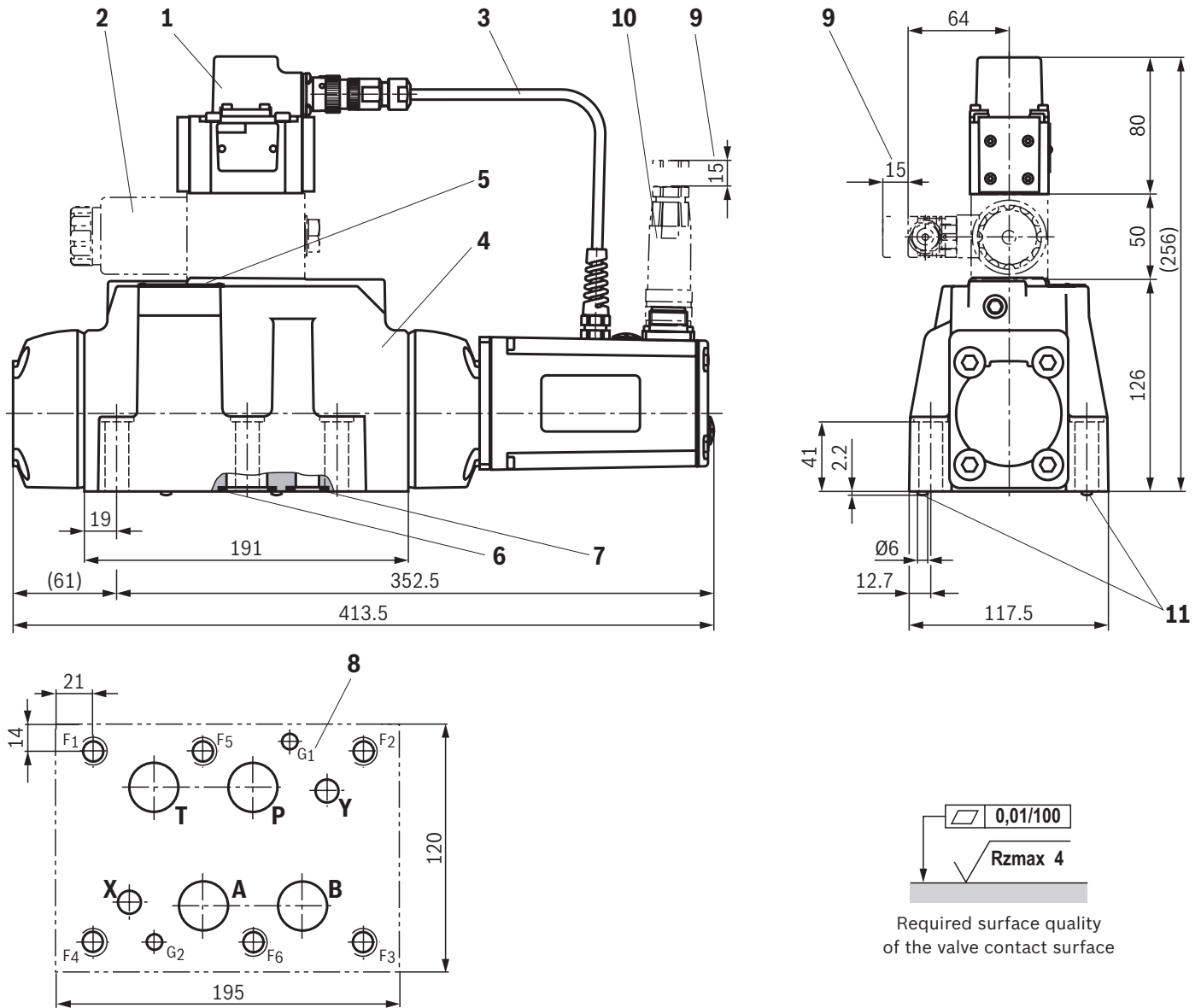


Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 25.

Dimensions: Size 25
(dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y
- 8 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 26
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.

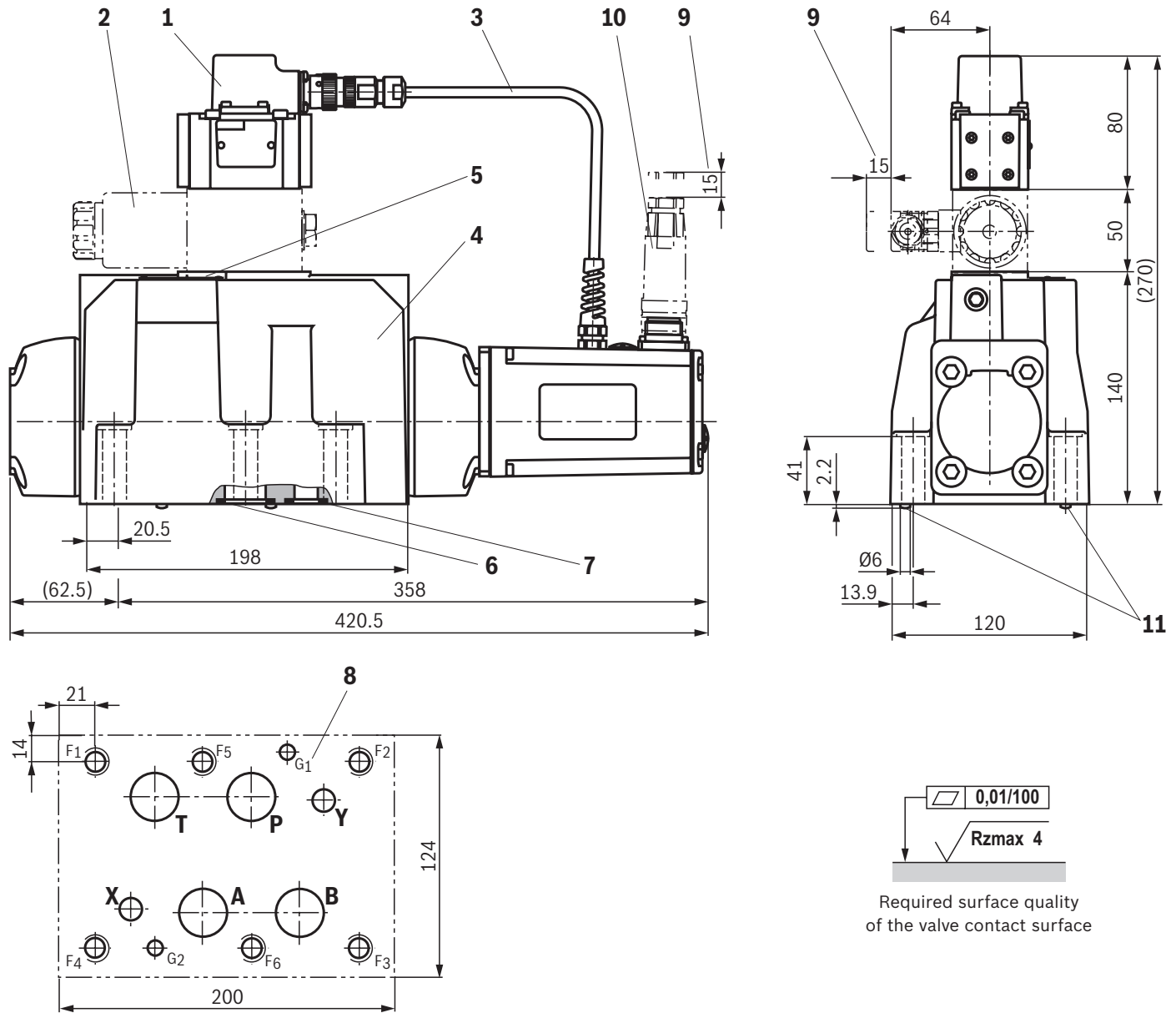


Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 25.

Dimensions: Size 27 (dimensions in mm)



- 1 Pilot control valve
- 2 Directional sandwich plate valve (only included with version "WG")
- 3 Cabling
- 4 Main stage
- 5 Name plate
- 6 Identical seal rings for ports A, B, P, T
- 7 Identical seal rings for ports X, Y
- 8 Machined valve contact surface; porting pattern according to ISO 4401-08-08-0-05 (ports X, Y as required)
Deviating from the standard: ports A, B, P, T – $\varnothing 32$ mm
- 9 Space required to remove the mating connectors
- 10 Mating connector, separate order, see page 26
- 11 Locking pin

Subplates (separate order) with porting pattern according to ISO 4401-08-08-0-05 see data sheet 45100.



Notice:

The dimensions are nominal dimensions which are subject to tolerances.

Valve mounting screws see page 25.

Dimensions

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	ISO 4762 - M6 x 45 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque M_A = 13.5 Nm ±10%	R913043777
	or		
	4	ISO 4762 - M6 x 45 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	or		
16	4	ASME B18.3 - 1/4-20 UNC x 1 3/4" - ASTM-A574 Tightening torque M_A = 15 Nm [11 ft-lbs] ±10%	Not included in the Rexroth delivery range
	2	ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque M_A = 12.2 Nm ±10%	R913043410
	4	ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C Tightening torque M_A = 58 Nm ±20%	R913014770
	or		
	2	ISO 4762 - M6 x 60 - 10.9 Tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	ISO 4762 - M10 x 60 - 10.9 Tightening torque M_A = 75 Nm ±20%	
	or		
	2	ASME B18.3 - 1/4-20 UNC x 2 1/4" - ASTM-A574 Tightening torque M_A = 15 Nm [11 ft-lbs] ±10%	Not included in the Rexroth delivery range
4	ASME B18.3 - 3/8-16 UNC x 2 1/4" - ASTM-A574 Tightening torque M_A = 60 Nm [44 ft-lbs] ±10%		
25, 27	6	ISO 4762 - M12 x 60 - 10.9-flZn/nc/480h/C Tightening torque M_A = 100 Nm ±20%	R913015613
	or		
	6	ISO 4762 - M12 x 60 Tightening torque M_A = 130 Nm ±20%	Not included in the Rexroth delivery range
	or		
	6	ASME B18.3 - 1/2-13 UNC x 2 1/4" - ASTM-A574 Tightening torque M_A = 110 Nm [81 ft-lbs] ±10%	Not included in the Rexroth delivery range



Notice:

For reasons of stability, exclusively these valve mounting screws may be used. The tightening torque of the hexagon socket head cap screws refers to the maximum operating pressure.

Accessories (separate order)**Directional control valve**

Mating connectors 6-pole + PE	Design	Design	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm ²	straight	Metal	R900223890	08006
	straight	Plastic	R900021267	

Cable sets 6-pole + PE	Length in m	Material number	Data sheet
For the connection of valves with integrated electronics, round connector 6+PE, straight connector, shielded, potted-in mating connector, line cross-section 0.75 mm ²	3.0	R901420483	08006
	5.0	R901420491	
	10.0	R901420496	
	20.0	R901448068	–

Sandwich plate valve

Mating connectors	Material number	Data sheet
Mating connector according to DIN EN 175301-803, ISO 4400	e.g. R901017011 (plastic)	08006

Miscellaneous

	Material number
Filter element and seal	R961001949

Further information

► Hydraulic valves for industrial applications	Data sheet 07600-B
► Directional servo valve with mechanical position feedback	Data sheet 29564
► Subplates	Data sheet 45100
► Hydraulic fluids on mineral oil basis	Data sheet 90220
► Flame-resistant hydraulic fluids - containing water (HFAE, HFAS, HFB, HFC)	Data sheet 90223
► Reliability characteristics according to EN ISO 13849	Data sheet 08012
► Hexagon socket head cap screw, metric/UNC	Data sheet 08936
► General product information on hydraulic products	Data sheet 07008
► Installation, commissioning and maintenance of servo valves and high-response valves	Data sheet 07700
► Assembly, commissioning and maintenance of hydraulic systems	Data sheet 07900
► Selection of filters	www.boschrexroth.com/filter
► Information on available spare parts	www.boschrexroth.com/spc

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