RE 29564-XL
Edition: 2020-11
Replaces: 2018-09
RA87651324_AA

rexroth
A Bosch Company

Directional servo valve with mechanical position feedback

Type 4WS2EM ...XL

H8123

- Size 6
- Component series 2X
- Maximum operating pressure 315 bar
- Maximum flow 48 l/min

CE

ATEX units
For potentially explosive atmospheres

Information on explosion protection:
- Area of application in accordance with the Explosion Protection Directive 2014/34/EU: **II 3G**
- Type of protection:
  Ex ic IIC T4 Gc according to EN IEC 60079-0 / EN 60079-11 and IEC 60079-0 / IEC 60079-11

Features

- 4 or 3-way version
- For intended use in potentially explosive atmosphere
- Valve for position, force, pressure or velocity control
- For subplate mounting
- Porting pattern according to ISO 4401-03-02-0-05 (however, without locating hole)
- Dry control motor, no contamination of the solenoid gaps by the hydraulic fluid
- Can also be used as 3-way version
- Wear-free control spool return element
- Pressure chambers at the control sleeve with gap seal, therefore no wear of seal ring

Contents

☞ **Notice:** The documentation version with which the product was supplied is valid.

Ordering code

01	02		03		04	05	06	07	08	09	10	11	12	13
4WS2EM	**6**	**–**	**2X**	**/**		**B**	**11**	**XL**	**ET**		**K17**		**V**	

01	Directional servo valve, 4-way version, 2-stage, with mechanical feedback, for **external** control electronics, electrically operated	**4WS2EM**
02	Size 6	**6**
03	Component series 20 ... 29 (20 ... 29: unchanged installation and connection dimensions)	**2X**

Nominal flow

04	2 l/min	**2**
	5 l/min	**5**
	10 l/min	**10**
	15 l/min	**15**
	20 l/min	**20**
	25 l/min	**25**
	Characteristic curves, see page 11 (observe tolerance field of the flow/signal function)	
05	Control sleeve exchangeable	**B**
06	Valve for **external** control electronics; coil no. 11 (30 mA/85 Ω per coil)	**11**

Explosion protection

07	"Type of protection ic"	**XL**
	For details, see information on explosion protection, page 6	
08	Pilot oil supply and return internal	**ET**

Inlet pressure range

09	10 ... 210 bar	**210**
	10 ... 315 bar	**315**

Electrical connection

10	**Without** mating connector; connector	**K17**

Control spool overlap (in % of the nominal stroke)

11	0 ... 0.5% negative	**E**
	0 ... 0.5% positive	**D**
	3 ... 5% positive	**C**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 6)

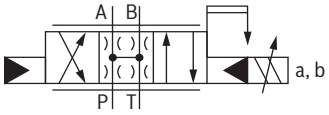
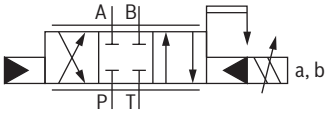
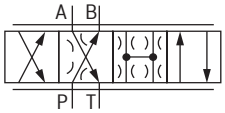
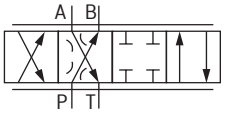
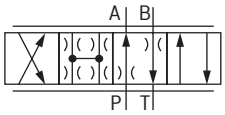
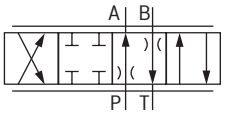
12	FKM seals	**V**

Special versions

13	Standard version	**no code**
	The channels P → B and A → T are open 10% of the nominal quantity without control (de-energized state).	**-100**
	The channels P → A and B → T are open 10% of the nominal quantity without control (de-energized state).	**-102**

Bosch Rexroth AG, RE 29564-XL, edition: 2020-11

Symbols

	Control spool overlap "E"	Control spool overlap "C" and "D"
Standard		
Special version "-100"		
Special version "-102"		

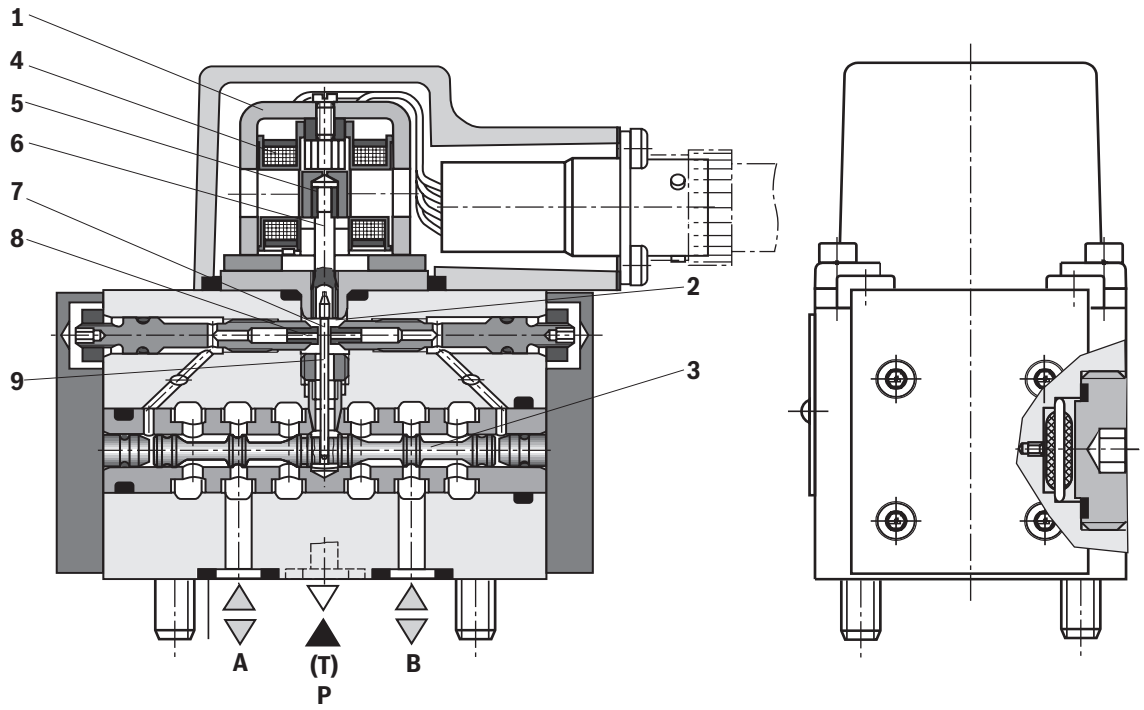
☞ **Notice:**
Representation according to DIN ISO 1219-1.

Function, section, symbol

Valves of type 4WS2EM ...XL are electrically operated, 2-stage directional servo valves. They are mainly used to control position, force, pressure or velocity.
The valves are made of an electro-mechanical converter (torque motor) (1), a hydraulic amplifier (nozzle flapper plate system) (2) and a control spool (3) in a sleeve (2nd stage) which is connected with the torque motor via a mechanical feedback.
An electrical input signal at the coils (4) of the torque motor generates a force by means of a permanent magnet which acts on the armature (5), and in connection with a torque tube (6) results in a torque. This causes the flapper plate (7) which is connected to the torque tube (6) via a bolt to move from the central position between the two control nozzles (8), and a pressure differential is created across the front sides of the control spool (3). The pressure differential results in the control spool changing its position, which results in the pressure port being connected to one actuator port and, at the same time, the other actuator port being connected to the return flow port.

The control spool (3) is connected to the flapper plate or the torque motor by means of a bending spring (mechanical feedback) (9). The position of the control spool (3) is changed until the feedback torque across the bending spring and the electro-magnetic torque of the torque motor are balanced and the pressure differential at the nozzle flapper plate system becomes zero.
The stroke of the control spool (3) and consequently the flow of the servo valve are controlled proportionally to the electrical input signal. It must be noted that the flow depends on the valve pressure drop.

External control electronics (separate order)
External control electronics (servo amplifier) serve the actuation of the valve, amplifying an analog input signal (command value) so that with the output signal, the servo valve is actuated in a flow-controlled form.
For the limitation of the electric data, a safety barrier is to be connected between valve and amplifier (see page 7).



Type 4WS2EM 6 ...XL...

Technical data

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

General			
Installation position			Any - ensure that during start-up of the system, the valve is supplied with sufficient pressure (≥ 10 bar)
Surface protection	▶ Valve body, cover, filter screw		Nitro-carburated
	▶ Cap		Anodized
Storage temperature range		°C	+5 ... +40
Maximum storage time		Years	1
Ambient temperature range		°C	–30 ... +80
Weight		kg	1.1

Hydraulic			
Operating pressure	▶ Ports P, A, B	bar	10 ... 210 or 10 ... 315
Return flow pressure	▶ Port T	bar	Pressure peaks < 100 static < 10
Hydraulic fluid			See table page 6
Hydraulic fluid temperature range		°C	–15 ... +80; preferably +40 ... +50
Viscosity range		mm^2/s	15 ... 380; preferably 30 ... 45
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)			Class 18/16/13 [1]
Zero flow $q_{V,L}$		l/min	see characteristic curve on page 10
Rated flows $q_{V\,nom}$ (tolerance ±10% with valve pressure differential Δp = 70 bar		l/min	2; 5; 10; 15; 20; 25
Maximum control spool stroke with mechanical end position (in case of error) related to nominal stroke		%	120 ... 170
Feedback system			mechanical
Hysteresis (dither-optimized)		%	≤ 1.5
Range of inversion (dither-optimized)		%	≤ 0.2
Response sensitivity (dither-optimized)		%	≤ 0.2
Pressure amplification with 1% control spool stroke change (from the hydraulic zero point)		% of p_P	≥ 50
Zero adjustment flow across the entire operating pressure range		%	≤ 3, long-term ≤ 5
Zero shift upon change of:			
▶ Hydraulic fluid temperature		% / 20 °C	≤ 1
▶ Ambient temperature		% / 20 °C	≤ 1
▶ Operating pressure 80 ... 120% of p_P		% / 100 bar	≤ 2
▶ Return flow pressure 0 ... 10% of p_P		% / bar	≤ 1

[1] 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.

$q_{V,L}$ = zero flow in l/min
$q_{V\,nom}$ = nominal flow in l/min
p_P = operating pressure in bar

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	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	

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 at least 150 °C.

Electric		
Protection class according to EN 60529		IP 65 with mating connector correctly mounted and locked
Type of signal		analog
Nominal flow per coil (command value 100%)	mA	30
Resistance per coil	Ω	85

Notice:
In case of control using non-Rexroth amplifiers, we recommend a superimposed dither signal.

Information on explosion protection	
Area of application according to Directive 2014/34/EU	II 3G
Type of protection according to EN IEC 60079-0 / EN 60079-11	Ex ic IIC T4 Gc
"IECEx Certificate of Conformity"	IECEx BVS 18.0045X
Power supply of the valve only from intrinsically safe electric circuits	Maximum values see page 7
Special application conditions for safe application	see ambient and hydraulic fluid temperature range page 5

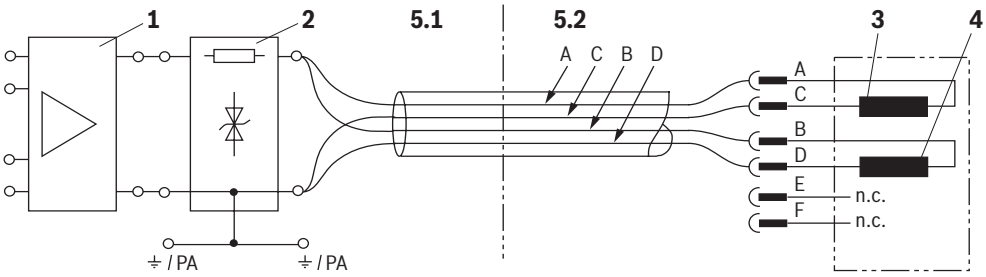
External control electronics		
Recommended safety barrier		see page 7
Servo amplifier in modular design	analog	Type VT 11021 according to data sheet 29743

Important notice:
The external servo amplifier and the safety barrier must be operated outside the potentially explosive atmospheres.

Electrical connection

The coils can be connected in **parallel connection** or individual control.

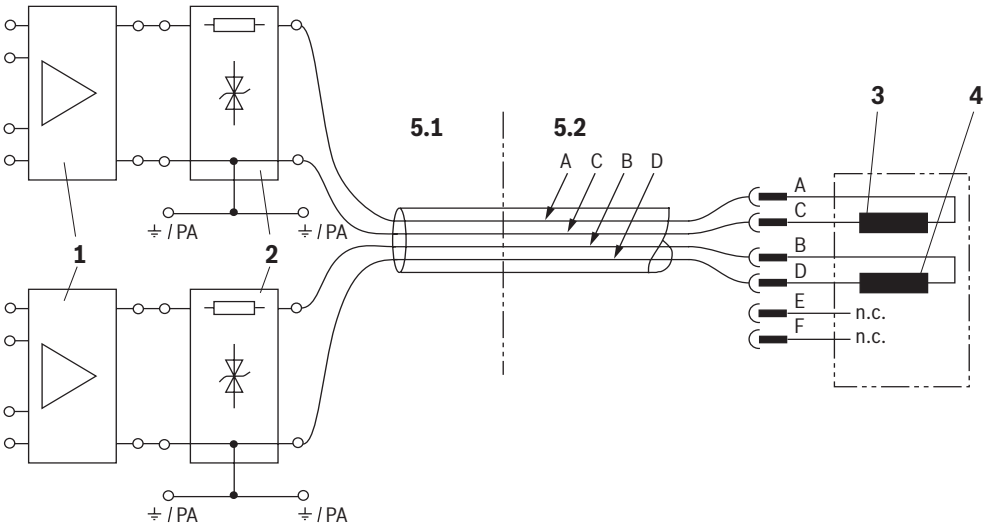
▶ Parallel connection



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	15
	▶ I_{max}	mA	153
	▶ P_{max}	mW	570
Recommended safety barrier			Type 9001/02-133-150-101 (company Stahl) or Z915 (company Pepperl+Fuchs)

▶ Individual control



1 Servo amplifier
2 Safety barrier
3 Valve, coil A
4 Valve, coil B
5.1 Non-explosive area
5.2 Explosive area

Power supply of the valve only from intrinsically safe electric circuits with the following maximum values	▶ U_{max}	V	9.3	12.5
	▶ I_{max}	mA	205	90
	▶ P_{max}	mW	476	282
Recommended safety barrier			9002/77-093-300-001 (company Stahl)	Z966 (company Pepperl+Fuchs)

☞ **Notice:**
Only use approved cables and lines for intrinsically safe electric circuits.

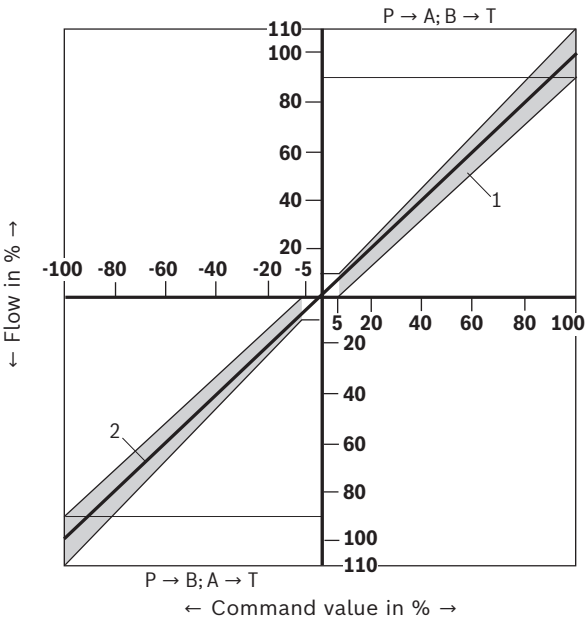
The electric control with plus (+) at A and B and minus (–) at C and D results in direction of flow P → A and B → T.
Inverted electric control results in direction of flow P → B and A → T.
Pins E and F at the connector are not connected.

Characteristic curves

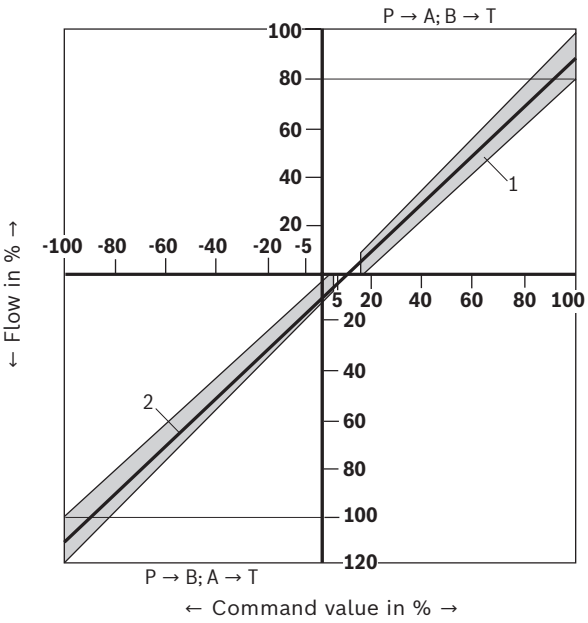
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Tolerance field of the flow/signal function at constant valve pressure differential ***Δp***

Standard



Special version "-100"



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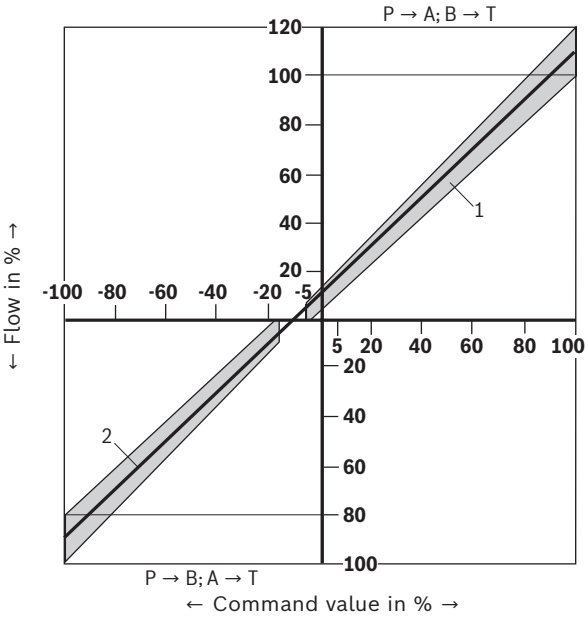


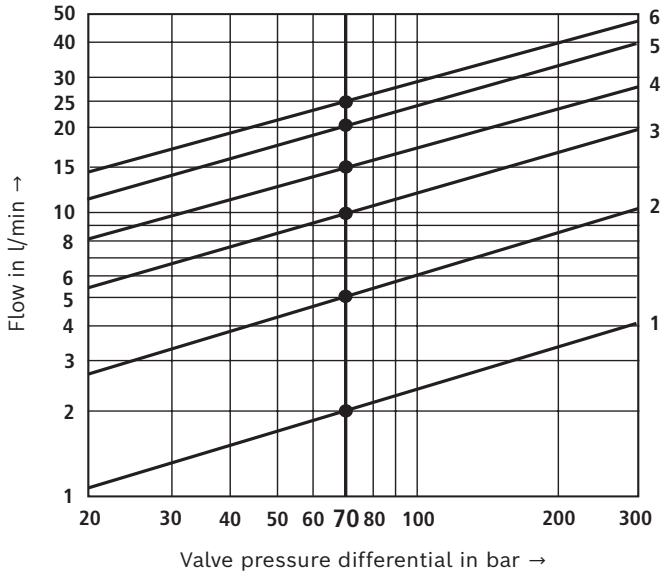
1 Tolerance field
2 Typical flow curve

Characteristic curves

(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Flow/load function

(tolerance ±10%) with 100% command value signal



Nominal flow

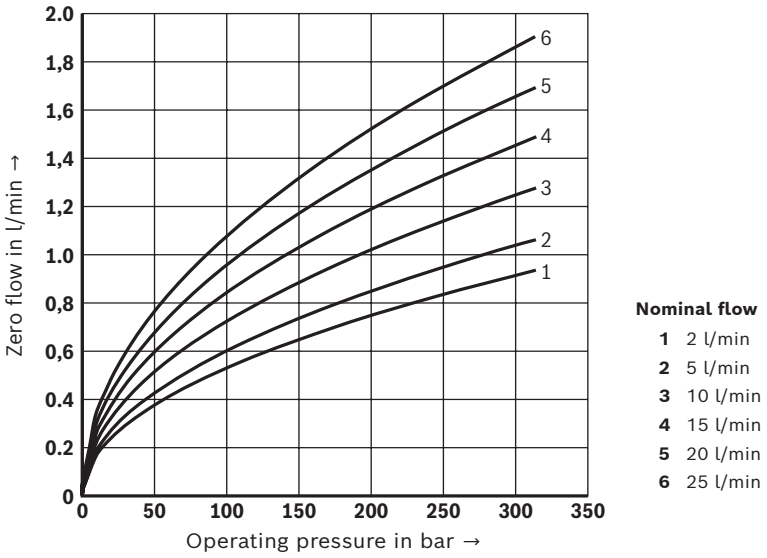
- **1** 2 l/min
- **2** 5 l/min
- **3** 10 l/min
- **4** 15 l/min
- **5** 20 l/min
- **6** 25 l/min

Notes:

- Flow values in the maximum command value range (see tolerance field of the flow/signal function)
- $\Delta p = p_P - p_L - p_T$
  Δp valve pressure differential
  p_P inlet pressure
  p_L load pressure
  p_T return flow pressure

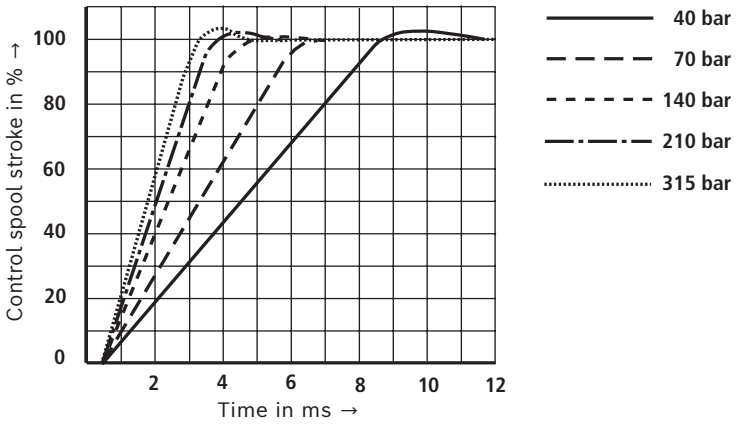
Characteristic curves
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Zero flow (with control spool overlap "E", measured without dither signal)



Nominal flow
- **1** 2 l/min
- **2** 5 l/min
- **3** 10 l/min
- **4** 15 l/min
- **5** 20 l/min
- **6** 25 l/min

Transition function with pressure rating 315 bar, step response without flow



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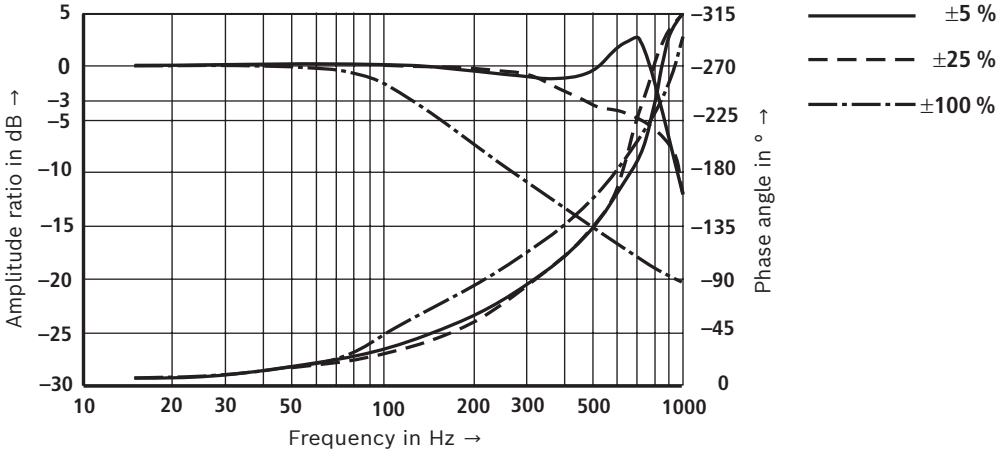
Characteristic curves

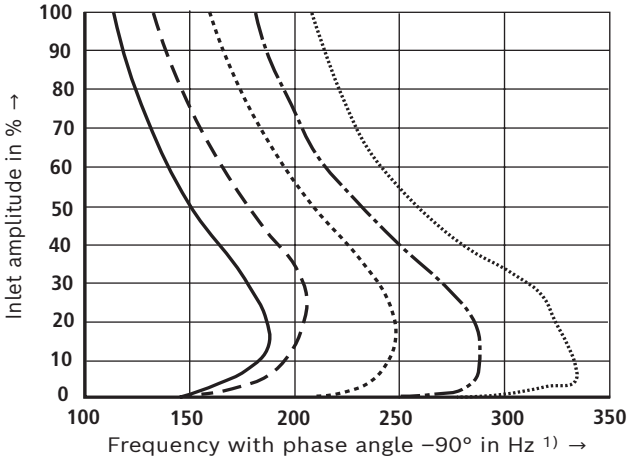
(measured with HLP 32, ϑ_{oil} = 40 °C ± 5 °C)

Frequency response with pressure rating 315 bar, stroke frequency without flow

(measured with pilot pressure p_{St} = 315 bar)



Dependency of the frequency *f* at −90° on the operating pressure *p* and the inlet amplitude

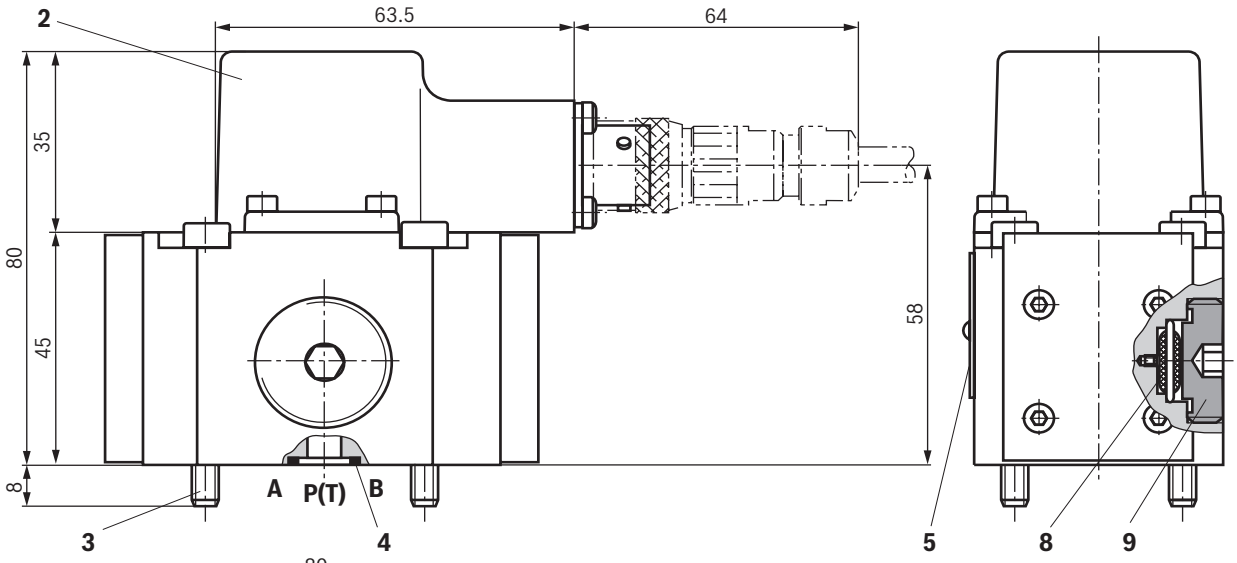


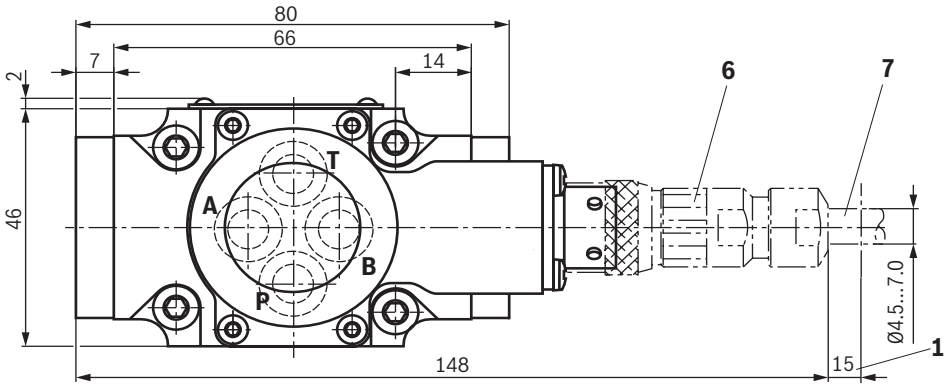
☞ **Notice:**
The output signal corresponds to the control spool stroke with flow without load pressure

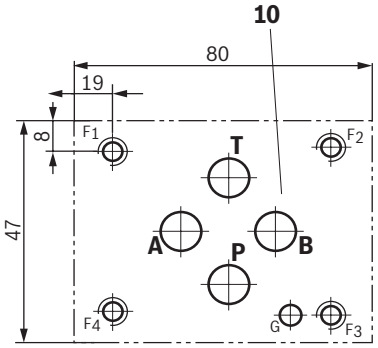
1) Correction factors with $q_{V\ nom}$:

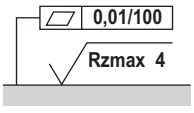
25 l/min	1.00
20 l/min	1.00
15 l/min	0.95
10 l/min	0.90
5 l/min	0.85
2 l/min	0.80

Dimensions
(dimensions in mm)









Required surface quality
of the valve contact surface

For item explanations, valve mounting screws and **subplates,** see page 13.

Notes:
The dimensions are nominal dimensions which are subject to tolerances.

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Dimensions

1 Space required for removing the mating connector, additionally observe the bending radius of the connection line
2 Cap
3 **Valve mounting screws** (included in the scope of delivery)
Only use valve mounting screws with the subsequently listed thread diameters and strength properties. Observe the screw-in depth.
4 hexagon socket head cap screws ISO 4762 - M5 x 50 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%
4 Identical seal rings for ports P, A, B and T
5 Name plate
6 Mating connector (separate order, see page 14)
7 Connection line, further information on page 7
8 Filter
9 Plug screw
10 Machined valve contact surface;
Porting pattern according to ISO 4401-03-02-0-05
(however, without locating hole)

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

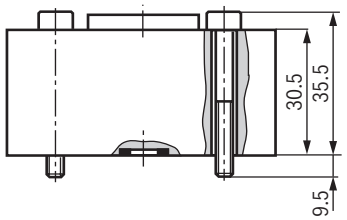
☞ **Notice:**
Subplates are no components in the sense of Directive 2014/34/EU and can be used after the manufacturer of the overall system has conducted an assessment of the risk of ignition. The "G...J3" versions are free from aluminum and/or magnesium and galvanized.

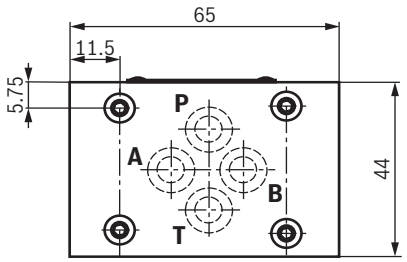
Flushing plate with porting pattern according to ISO 4401-03-02-0-05 (dimensions in mm)

Symbol

Ordering code and further information
- Material number **R901541300**
- Weight 0.6 kg
- Identical seal rings for ports P, A, B and T
- Mounting screws (included in the scope of delivery)
For reasons of stability, exclusively the following mounting screws are to be used:
4 hexagon socket head cap screws ISO 4762 - M5 x 40 - 10.9
(Friction coefficient μ_{total} = 0.09 ... 0.14)
Tightening torque M_A = 7 Nm ±10%

☞ **Notice:**
Before assembly and operation, observe the information in the operating instructions 29564-XL-B.





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	straight, metal	6P KPTC6	**R901043330**	08006

[1] See dimensions on page 12.

Further information

- Subplates — Data sheet 45100
- Hydraulic fluids on mineral oil basis — Data sheet 90220
- Environmentally compatible hydraulic fluids — Data sheet 90221
- Mating connectors and cable sets for valves and sensors — Data sheet 08006
- Analog amplifier module type VT 11021 — Data sheet 29743
- Use of non-electrical hydraulic components in an explosive environment (ATEX) — Data sheet 07011
- Selection of filters
- Information on available spare parts

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