

Directional control valves, direct operated with electrical position feedback and integrated electronics (OBE)

Type 4WRPEH



- ▶ Size 10
- ▶ Component series 3X
- ▶ Maximum operating pressure 350 bar
- ▶ Rated flow 50 ... 100 ml/min
- ▶ Digital interface, IO link for I4.0



Features

- ▶ Reliable - proven and robust design
- ▶ Safe - fail-safe position of the control spool in switched-off condition
- ▶ Energy-efficient - no pilot oil demand
- ▶ High quality - control spool and sleeve in servo quality
- ▶ Flexible - suitable for position, velocity and pressure control
- ▶ Precise - high response sensitivity and little hysteresis
- ▶ IO-Link interface, optional

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Ordering code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
4	WRP	E	H	10		B			-	3X	/		/		24	*

01	4 main ports	4
02	Directional control valve, direct operated	WRP
03	With integrated electronics	E
04	Control spool/sleeve	H
05	Size 10	10
06	Symbols e.g. C, C1, C5 etc.; for possible design, see page 3	
07	Installation side of the inductive position transducer	B

Rated flow ($\Delta p = 35$ bar/control edge)

08	50 l/min	50
	100 l/min	100

Flow characteristic

09	Linear	L
	Inflected characteristic curve, linear	P
10	Component series 30 ... 39 (30 ... 39: unchanged installation and connection dimensions)	3X

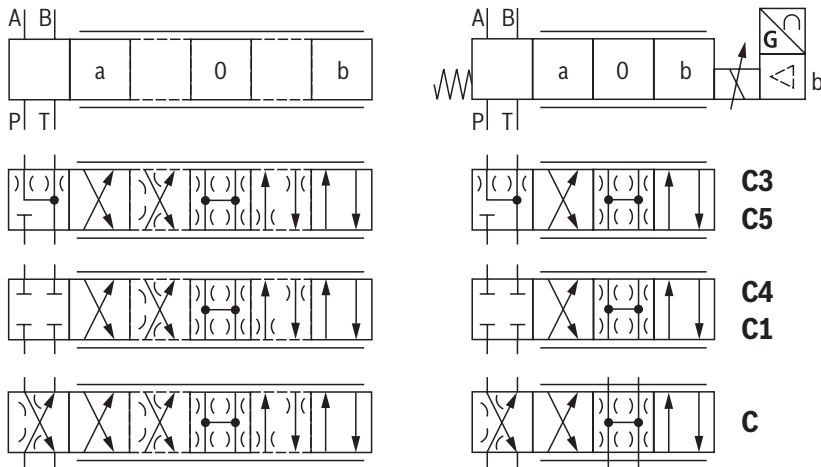
Seal material(observe compatibility of seals with hydraulic fluid used, see page 6)

11	NBR seals	M
	FKM seals	V
12	Without damping plate	no code
	With damping plate	D
13	Supply voltage of the integrated electronics 24 VDC	24

Interfaces of the control electronics

14	Command value input ± 10 V	A1
	Command value input 4 ... 20 mA	F1
	IO-Link interface	L1
	Command value ± 10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	C6
15	Without electronics protection membrane	no code
	With electronics protection membrane	-967
16	Further details in the plain text	

Symbols



With symbols C5 and C1:
 P → A: $q_{V \text{ nom}}$ B → T: $q_{V \text{ nom}}/2$
 P → B: $q_{V \text{ nom}}/2$ A → T: $q_{V \text{ nom}}$

Notice:
 Representation according to DIN ISO 1219-1.
 Hydraulic interim positions are shown by dashes.

Flow characteristic

Symbol	Linear characteristic curve (model "L")	Inflected characteristic curve (version "P") Inflection 40%
C3, C5		
C4, C1		
C		

Function, section

Valves of type 4WRPEH are direct operated directional control valves with electrical position feedback and integrated electronics (OBE).

Set-up

The 4WRPEH high-response valve mainly consists of:

- ▶ Valve housing with control spool and sleeve in servo quality (1)
- ▶ Control solenoid with position transducer (2) (optionally with electronics protection membrane (6))
- ▶ On-board electronics (OBE) (3) with analog or IO-Link interface (4) (optionally with damping plate (5))

- ▶ Falling below the minimum supply voltage
- ▶ Only at interface "F1":
 - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop))
- ▶ Only at interface "L1":
 - Enable inactive, communication interruption (watchdog)
 - In case of internal IO-Link error
- ▶ Only at interface "C6":
 - Additionally, release inactive

Function

The integrated electronics (OBE) compares the specified command value to the position actual value. In case of control deviations, the stroke solenoid will be activated. Due to the changed solenoid force, the control spool is adjusted against the spring. Stroke/control spool cross-section is controlled proportionally to the command value. In case of a command value presetting of 0, the electronics adjusts the control spool against the spring to central position. In deactivated condition, the spring is untensioned to a maximum and the valve is in fail-safe position.

Damping plate "D"

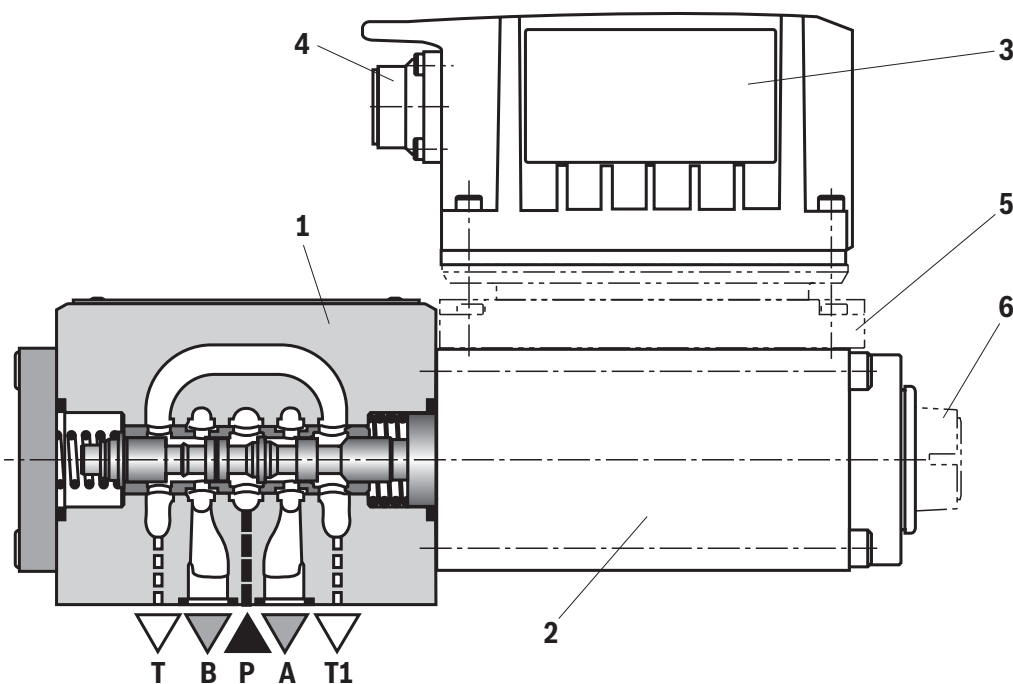
The damping plate (5) reduces the acceleration amplitudes on the on-board electronics (frequencies >300 Hz).

Notice:

Using the damping plate is not recommended for applications with mainly low-frequency excitation <300 Hz.

Electronics protection membrane "-967"

- To prevent condensate formation in the housing of the integrated electronics (OBE), an electronics protection membrane (6) can be used. Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



Type 4WRPEH 10 CB..-3X...

Technical data

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

General	
Type of connection	Subplate mounting, porting pattern according to ISO 4401-05-04-0-05
Installation position	Any
Ambient temperature range	°C -20 ... +60
Transport temperature	°C -30 ... +80
Maximum storage time	years 1 (if the storage conditions are observed; refer to the operating instructions 07600-B)
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 shocks / 3 axes
Shock according to DIN EN 60068-2-27	35 g / 6 ms / 1000 shocks / 3 axes
Weight	kg 7.1
Maximum relative humidity (no condensation)	% 95
Maximum solenoid surface temperature	°C 150
MTTF _d value according to EN ISO 13849	years 150 (for further details see data sheet 08012)
Conformity	<ul style="list-style-type: none"> ▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2011/65/EU ▶ REACH ordinance (EC) no. 1907/2006

Hydraulic				
Maximum operating pressure	▶ Ports A, B, P	bar	350	
	▶ Port T	bar	250	
Rated flow at $\Delta p = 35$ bar/control edge ¹⁾		l/min	50	100
Hydraulic fluid	See table page 6			
Viscosity range	▶ Recommended	mm ² /s	20 ... 100	
	▶ Maximum	mm ² /s	10 ... 800	
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70	
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)	Class 18/16/13 ²⁾			
Limitation of use (Δp) with regard to the transition to failsafe (values apply to summated edge)	▶ Symbols C3, C5, C	bar	350	140
	▶ Symbols C1, C4	bar	250	100
Leakage flow at 100 bar	▶ Linear characteristic curve "L"	cm ³ /min	< 1200	< 1500 (1:1) < 1000 (2:1)
	▶ Inflected characteristic curve "P"	cm ³ /min	< 600 (1:1) < 500 (2:1)	< 600

¹⁾ Flow for deviating Δp (control edge):

$$q_x = q_{Vnom} \cdot \sqrt{\frac{\Delta p_x}{35}}$$

²⁾ 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 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)	NBR	ISO 12922

**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.

Static/dynamic

Hysteresis	%	≤ 0.2
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)		Zero shift < 1% with $\Delta\theta = 40^\circ\text{C}$
Command value step	ms	see characteristic curves page 15
Zero compensation		ex plant ±1%

Technical data

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

electrical, integrated electronics (OBE) – Interface "A1" and "F1"			
Relative duty cycle	%		100 (continuous operation)
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage	VDC		24
▶ Terminal A	VDC		min. 19 / max. 36
▶ Terminal B	VDC		0
Maximum admissible residual ripple	Vpp		2.5
Maximum power consumption	VA		60
Fuse protection, external	A _T		3.15 (time-lag)
Input, version "A1"			Differential amplifier, R _i = 100 kΩ
▶ Terminal D (U _E)	VDC		0 ... ±10
▶ Terminal E	VDC		0
Input, version "F1"			Load, R _{sh} = 200 Ω
▶ Terminal D (I _{D-E})	mA		4 ... 20
▶ Terminal E (I _{D-E})			Current loop I _{D-E} feedback
Maximum voltage of the differential inputs against 0 V			D → B; E → B (max. 18 V)
Test signal, version "A1"			LVDT
▶ Terminal F (U _{Test})	VDC		0 ... ±10
▶ Terminal C			Reference 0 V
Test signal, version "F1"	mA		LVDT signal 4 ... 20 at external load 200 ... 500 Ω maximum
▶ Terminal F (I _{F-C})	mA		4 ... 20 output
▶ Terminal C (I _{F-C})			Current loop I _{F-C} feedback
Functional ground and screening			see pin assignment on page 10 (CE-compliant installation)
Adjustment			Calibrated in the plant, see valve characteristic curves page 11 ... 16
electrical, integrated electronics (OBE) – Interface "L1"			
Relative duty cycle	%		100 (continuous operation)
Protection class according to EN 60529			IP65 (If suitable and correctly mounted mating connectors are used)
Supply voltage	VDC		24
▶ Valve amplifier	VDC		min. 18 / max. 30
– Pin 2	VDC		min. 18 / max. 30
– Pin 5	VDC		0
▶ IO-Link interface	VDC		24
– Pin 1	VDC		min. 18 / max. 30
– Pin 3	VDC		0
Maximum current consumption	A		3
▶ Valve amplifier	A		3
▶ IO-Link interface	mA		50
Maximum residual ripple	Vpp		1.3
Maximum current consumption	mA		50
Minimum process cycle time	ms		0.6
Bit rate COM3	kBaud (kbit/s)		230.4
Required master port class			Class B
Resolution	bit		12 (110% valve opening)
▶ A/D transformer	bit		12 (110% valve opening)
▶ D/A transformer	bit		12 (110% valve opening)
Functional ground			Provide via valve block
Adjustment			Calibrated in the plant
Directive			IO-Link Interface and System Specification Version 1.1.2, July 2013

Technical data

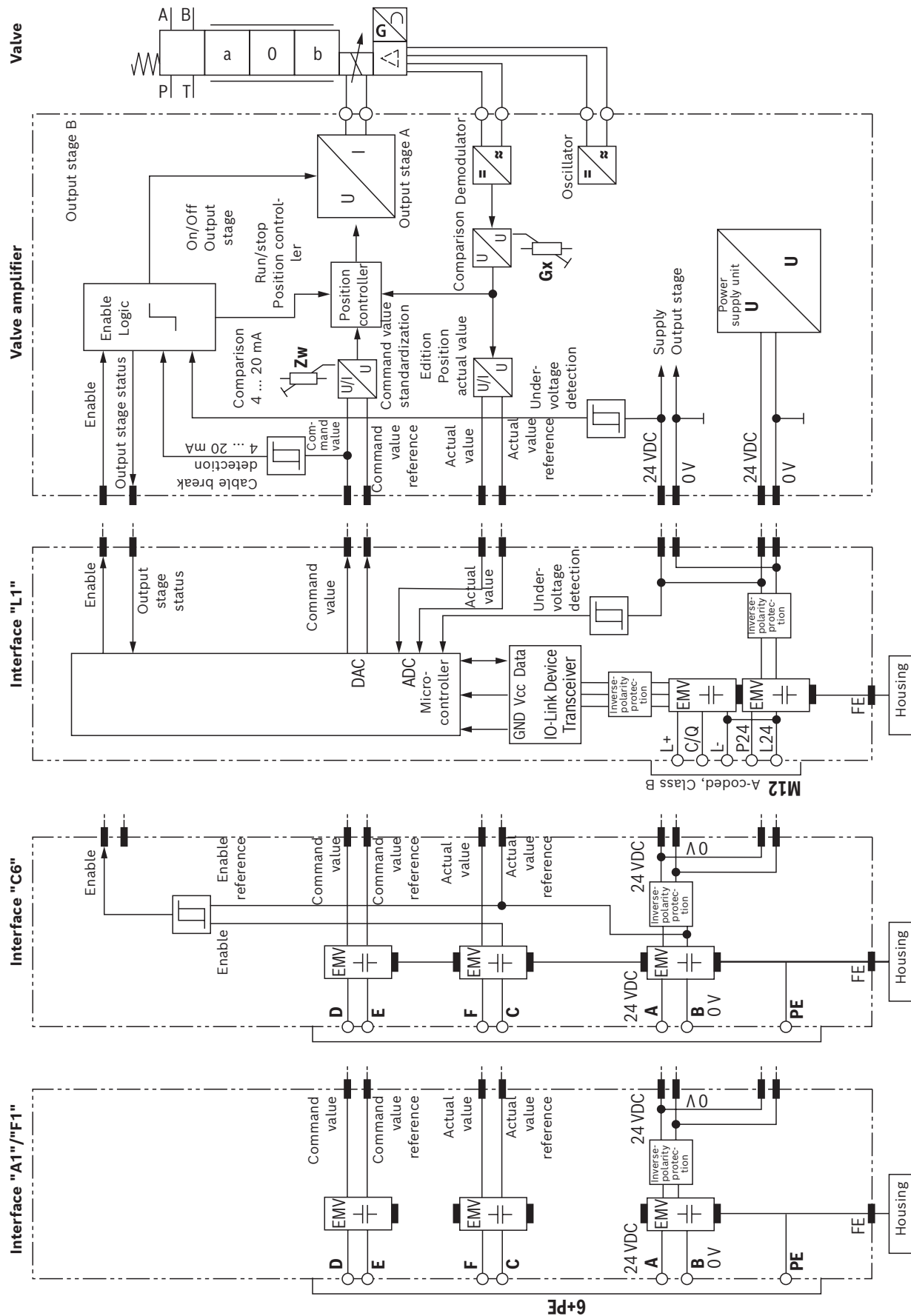
(For applications outside these values, please consult us!)

Electrical, integrated control electronics (OBE) – Interface "C6"			
Relative duty cycle	%	100 (continuous operation)	
Protection class according to EN 60529		IP65 (If suitable and correctly mounted mating connectors are used)	
Supply voltage	VDC	24	
▶ Terminal A	VDC	min. 19 / max. 36	
▶ Terminal B	VDC	0	
Maximum admissible residual ripple	Vpp	2.5	
Maximum power consumption	VA	60	
Fuse protection, external	A _T	3.15 (time-lag)	
Input		Load, R_{sh} = 200 Ω	
▶ Terminal D (I_{D-E})	mA	0 ... ±10	
▶ Terminal E (I_{D-E})		Current loop I_{D-E} feedback	
Test signal		LVDT signal 4 ... 20 mA on external load 200 ... 500 Ω maximum	
▶ Terminal F (I_{F-C})	mA	4 ... 20	
▶ Terminal B (I_{F-C})		Current loop I_{F-C} feedback	
Functional ground and screening		See page 10 (EMC-compliant installation)	
Adjustment		Calibrated in the plant, see characteristic curves page 11 ... 16	

Fail-safe position: Flow/leakage flow

		Rated flow at $\Delta p = 35$ bar/control edge		l/min	50	100	
C		Flow at $\Delta p = 35$ bar/control edge		l/min	50	100	
C3, C5		Leakage flow at 100 bar	P→A	cm ³ /min	50		
			P→B	cm ³ /min	70		
C4, C1		Flow at $\Delta p = 35$ bar	A→T	l/min	10 ... 100		
			B→T	l/min	10 ... 25		
			Leakage flow at 100 bar	P→A	cm ³ /min	50	
				P→B	cm ³ /min	70	
			A→T	cm ³ /min	70		
			B→T	cm ³ /min	50		
	Fail-safe	$p = 0$ bar \Rightarrow 13 ms	Internal shut-off in case of the following errors:				
		$p = 100$ bar \Rightarrow 17 ms	<ul style="list-style-type: none"> ▶ Drop of supply voltage $U_B \leq 15$ V and restarting at $U_B \geq 17.5$ V. ▶ Only at interface "F1": <ul style="list-style-type: none"> - Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)) ▶ Only at interface "L1": <ul style="list-style-type: none"> - Enable inactive, communication interruption (watchdog) - In case of internal IO-Link error 				

Block diagram/controller function block



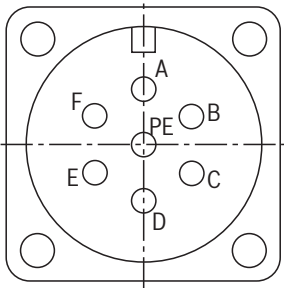
Notice:

▶ Electrical signals provided via control electronics (e.g. actual value) must not be used for switching off safety-relevant machine functions.

▶ The setting of the potentiometer at the factory must not be changed.

Electrical connections and assignment

Contact	Interface assignment		
	"A1" (6 + PE)	"F1" (6 + PE)	"C6" (6 + PE)
A	24 VDC supply voltage		
B	GND		GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input 24 VDC (high ≥ 11 V, low ≤ 5 V)
D	Command value ± 10 V ($R_e > 100$ k Ω)	Command value 4 ... 20 mA ($R_e = 200$ Ω)	Command value ± 10 mA ($R_e = 200$ Ω)
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value ± 10 V ($R_i \approx 1$ k Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)	Actual value 4 ... 20 mA (Load max. 500 Ω)
FE	Functional ground (directly connected to the valve housing)		

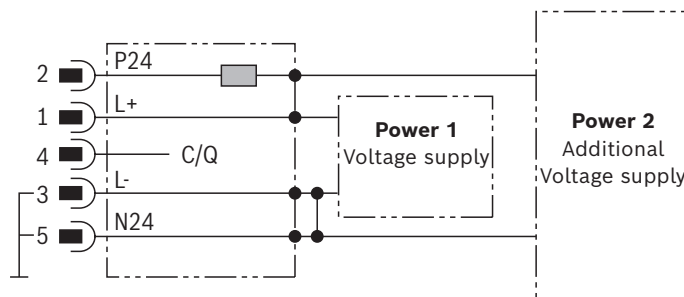
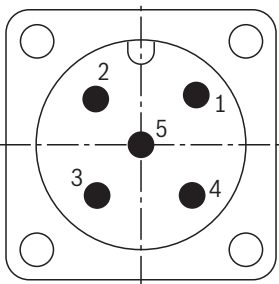


Command value:	<ul style="list-style-type: none"> ▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T. ▶ Negative command value (0 ... -10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable:	<ul style="list-style-type: none"> ▶ 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-compliant installation: <ul style="list-style-type: none"> - Apply screening to both line ends - Use metal mating connector (see page 18) ▶ Alternatively up to 30 m cable length admissible <ul style="list-style-type: none"> - Apply screening on supply side - Plastic mating connector (see page 18) can be used

Notice:

Mating connectors, separate order, see page 18 and data sheet 08006.

Connector pin assignment "L1" (M12-5, A-coded, class B)



Notice:

- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 18 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA
- ▶ With a wire cross-section of 0.34 mm² (standard line), a maximum cable length of 10 m is possible. For a maximum cable length of 20 m, the cross-section must be doubled.

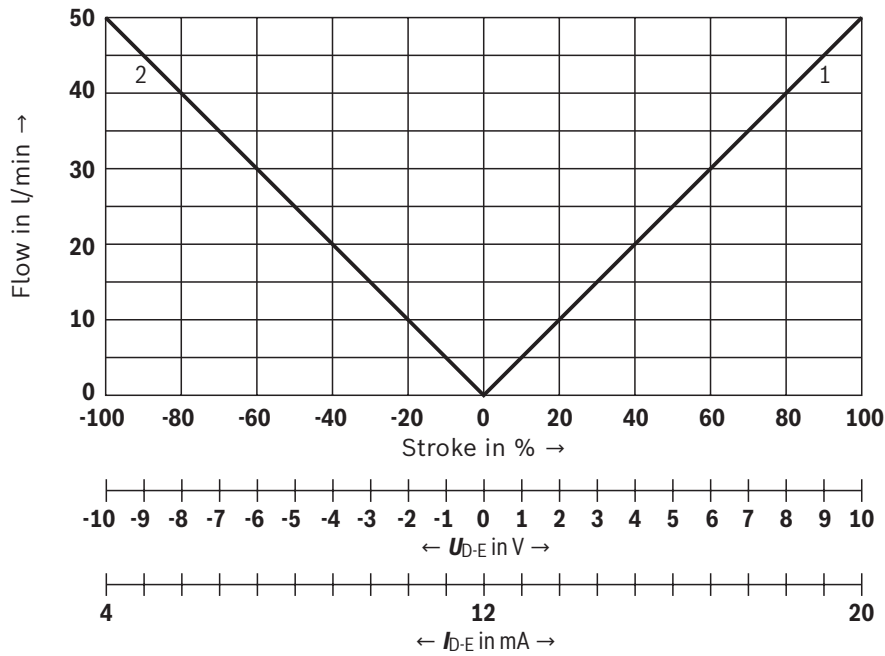
Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 3 A)
3	L-	Reference potential pin 1 ¹⁾
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 ¹⁾

¹⁾ Pin 3 and 5 are linked with each other in the valve electronics. The reference potentials L- and N24 of the two supply voltages must also be linked with each other on the power supply unit side.

Characteristic curves: Flow characteristic "L"
 (measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$; $\Delta p = 35 \text{ bar/control edge}$)

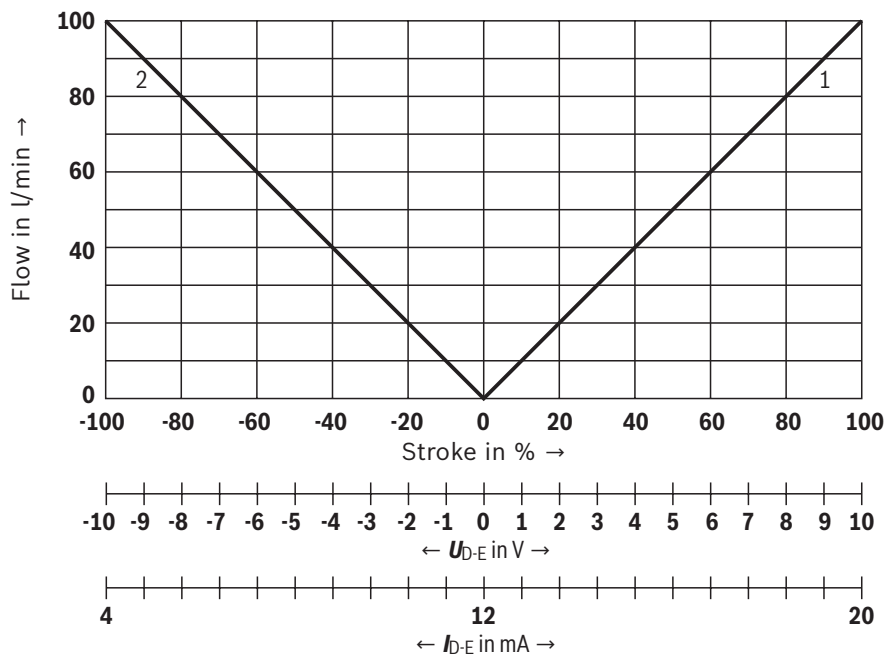
Flow/signal function

Symbol C, C3 and C4 – Version "50"



- 1 P-A; B-T
- 2 P-B; A-T

Symbol C, C3 and C4 – Version "100"

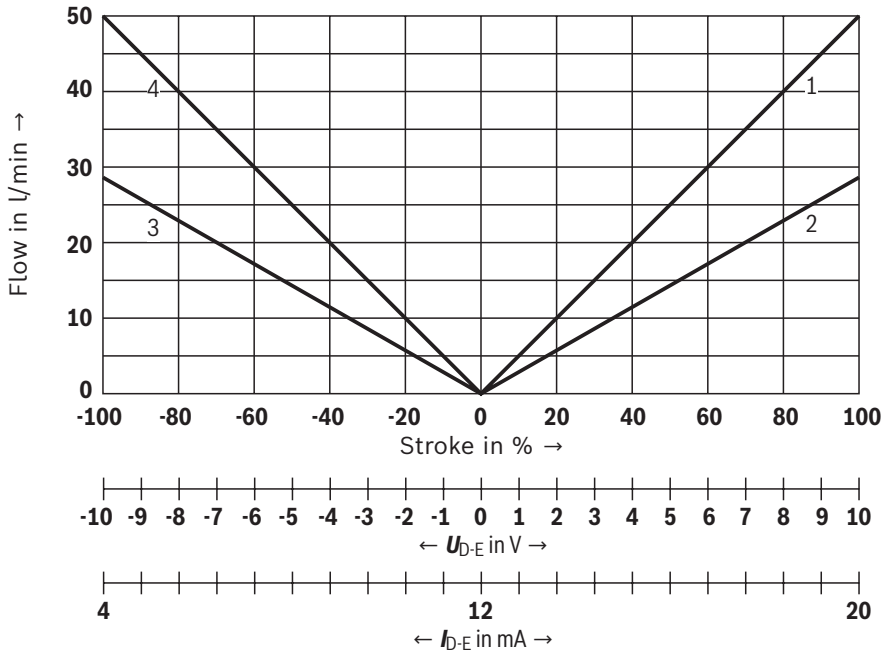


- 1 P-A; B-T
- 2 P-B; A-T

Characteristic curves: Flow characteristic "L"
 (measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$; $\Delta p = 35 \text{ bar/control edge}$)

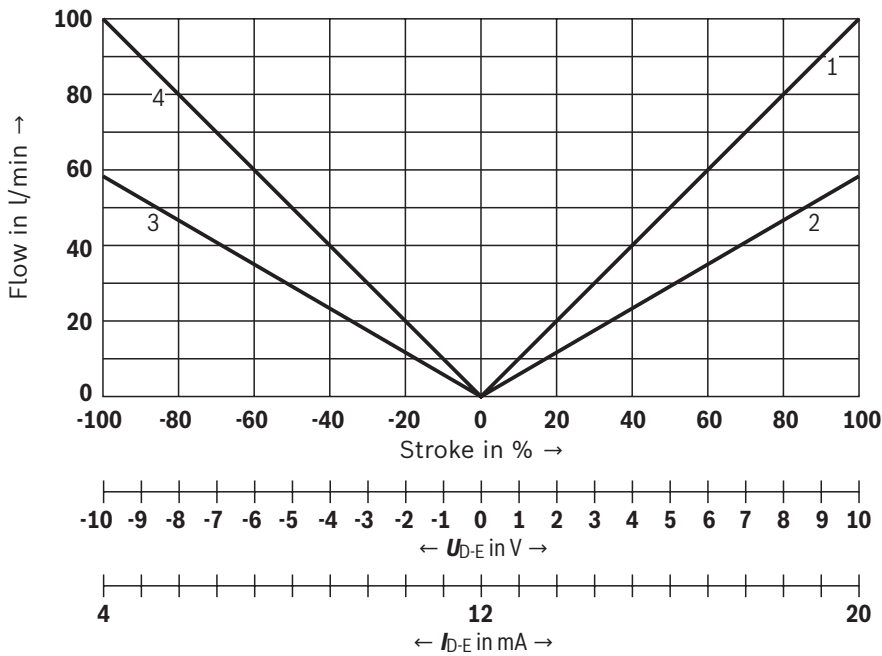
Flow/signal function

Symbol C1 and C5 – Version "50"



- 1 P-A
- 2 B-T
- 3 P-B
- 4 A-T

Symbol C1 and C5 – Version "100"

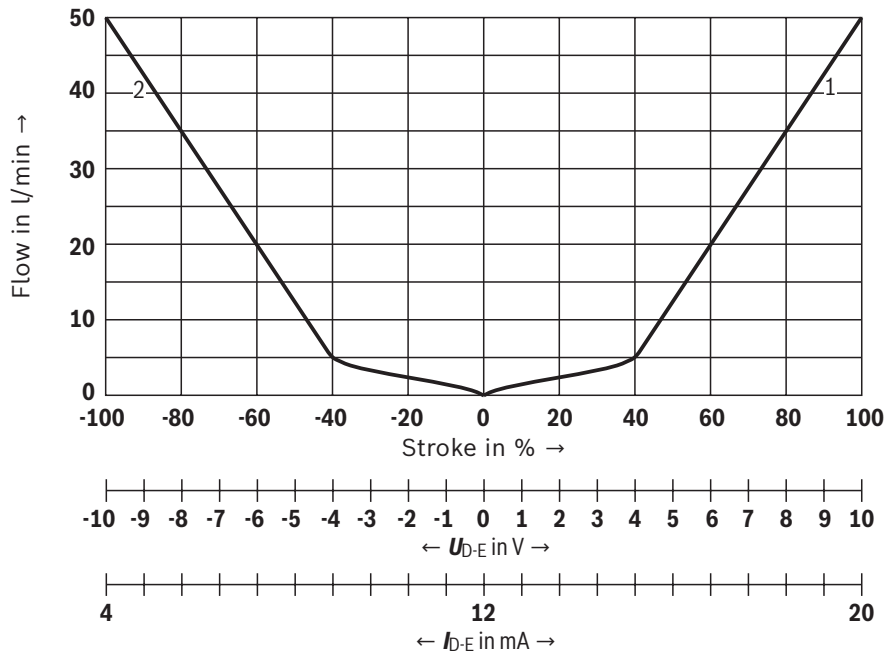


- 1 P-A
- 2 B-T
- 3 P-B
- 4 A-T

Characteristic curves: Flow characteristic "P"
 (measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ }^\circ\text{C}$; $\Delta p = 35 \text{ bar/control edge}$)

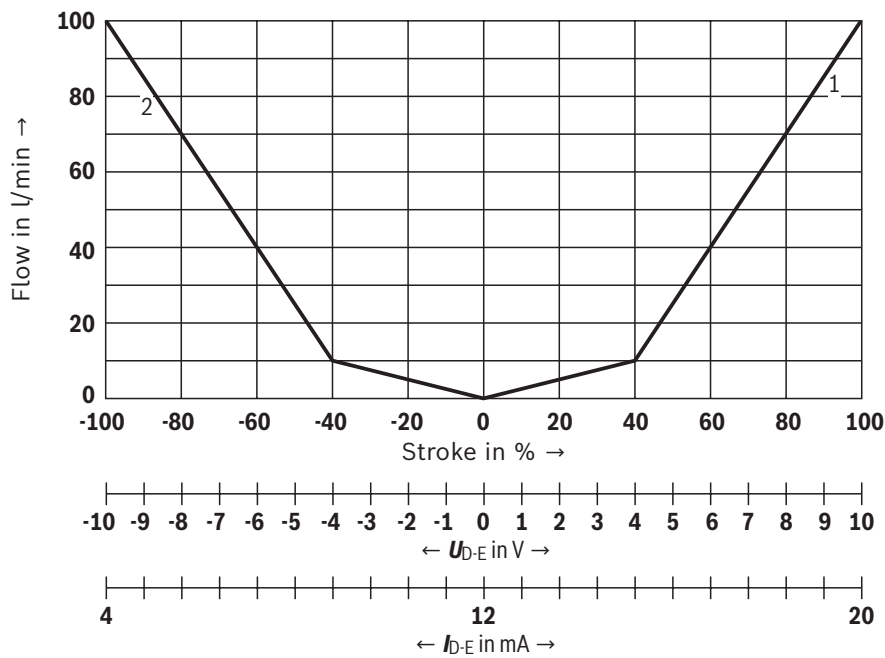
Flow/signal function

Symbol C, C3 and C4 – Version "50"



- 1 P-A; B-T
- 2 P-B; A-T

Symbol C, C3 and C4 – Version "100"

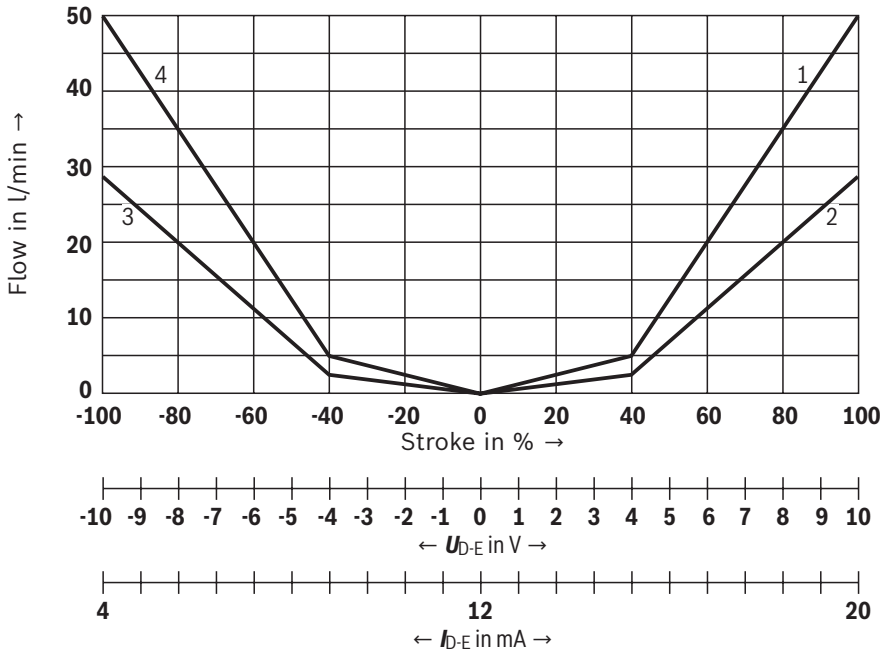


- 1 P-A; B-T
- 2 P-B; A-T

Characteristic curves: Flow characteristic "P"
 (measured with HLP46, $\vartheta_{oil} = 40 \pm 5 \text{ } ^\circ\text{C}$; $\Delta p = 35 \text{ bar/control edge}$)

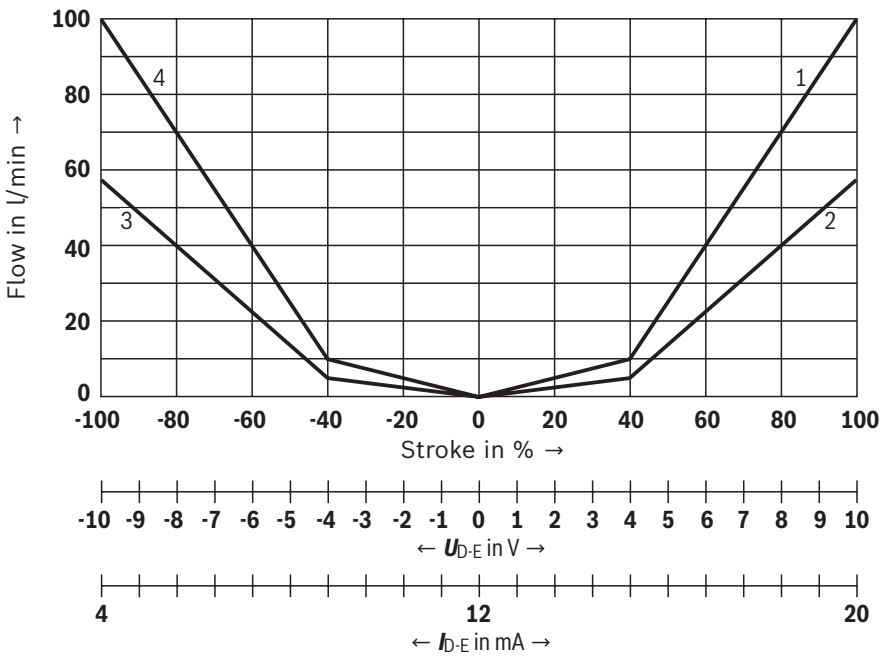
Flow/signal function

Symbol C1 and C5 – Version "50"



- 1 P-A
- 2 B-T
- 3 P-B
- 4 A-T

Symbol C1 and C5 – Version "100"

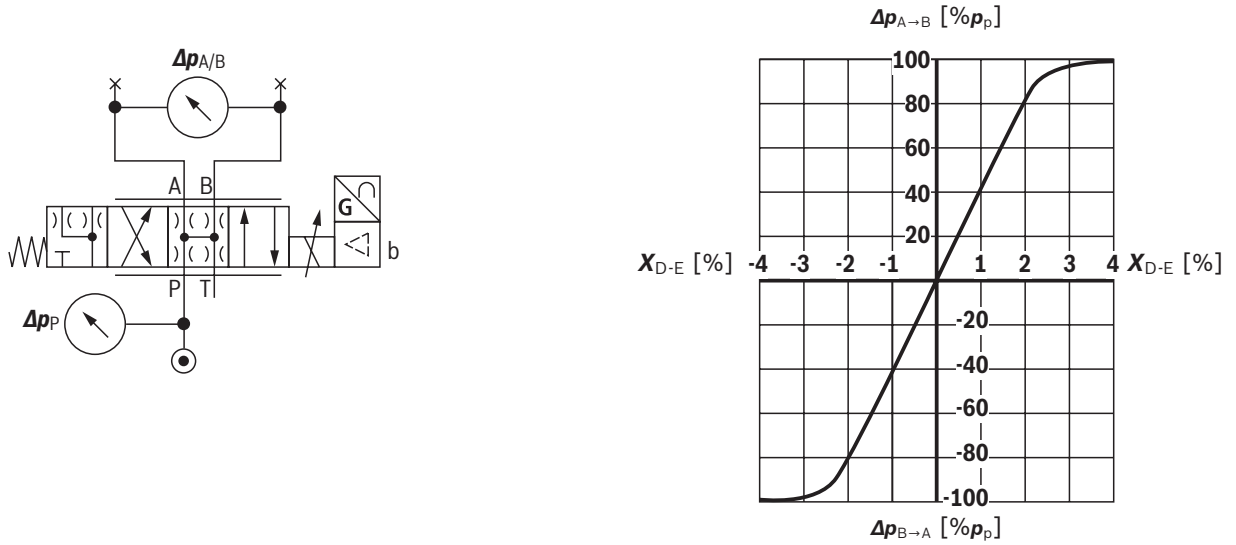


- 1 P-A
- 2 B-T
- 3 P-B
- 4 A-T

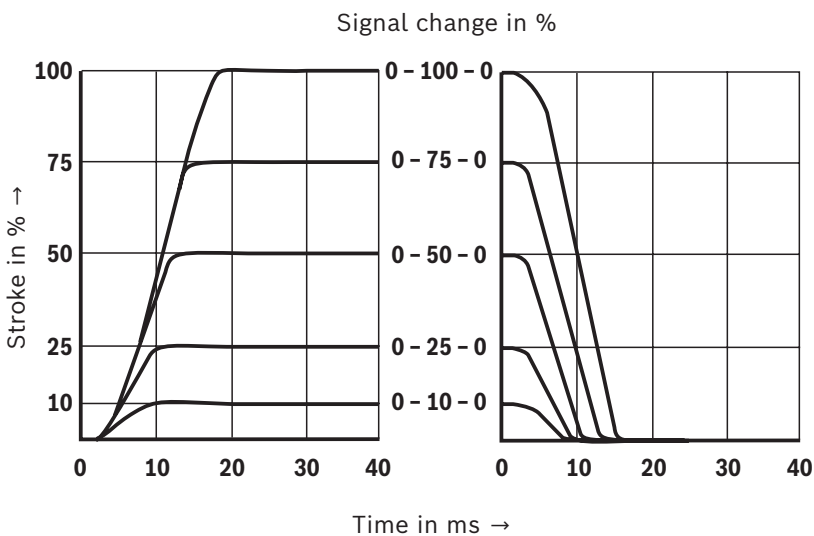
Characteristic curves

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

Pressure/signal characteristic curve

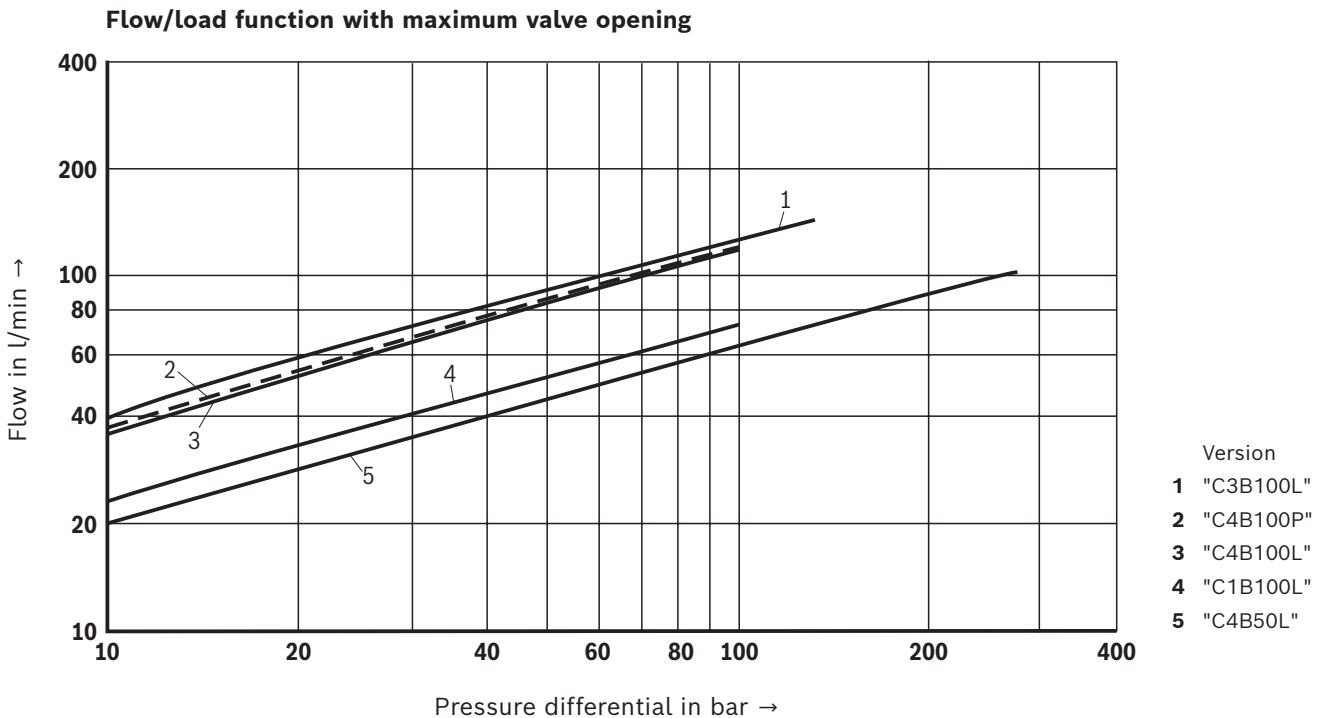
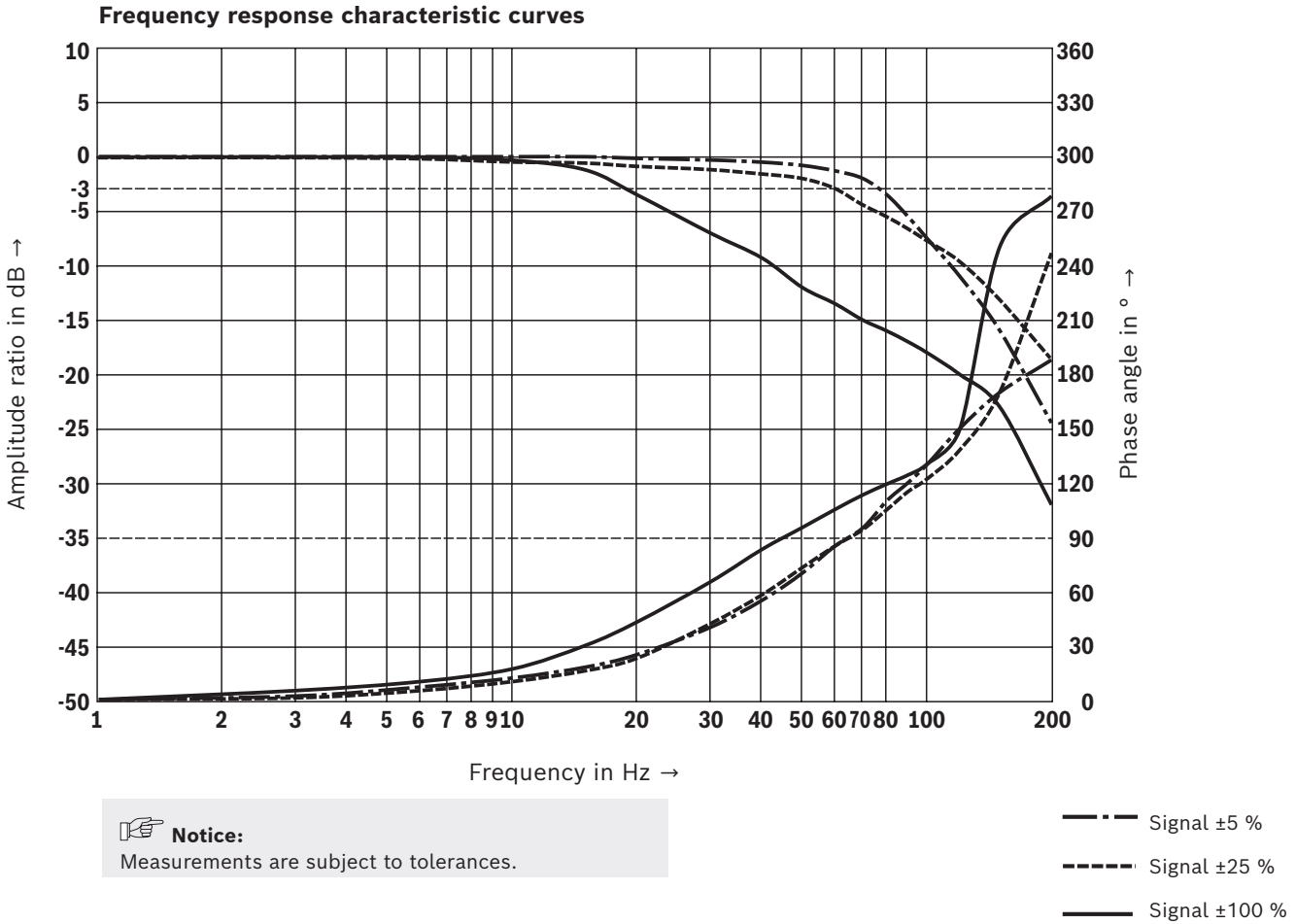


Transition function with stepped electric input signals

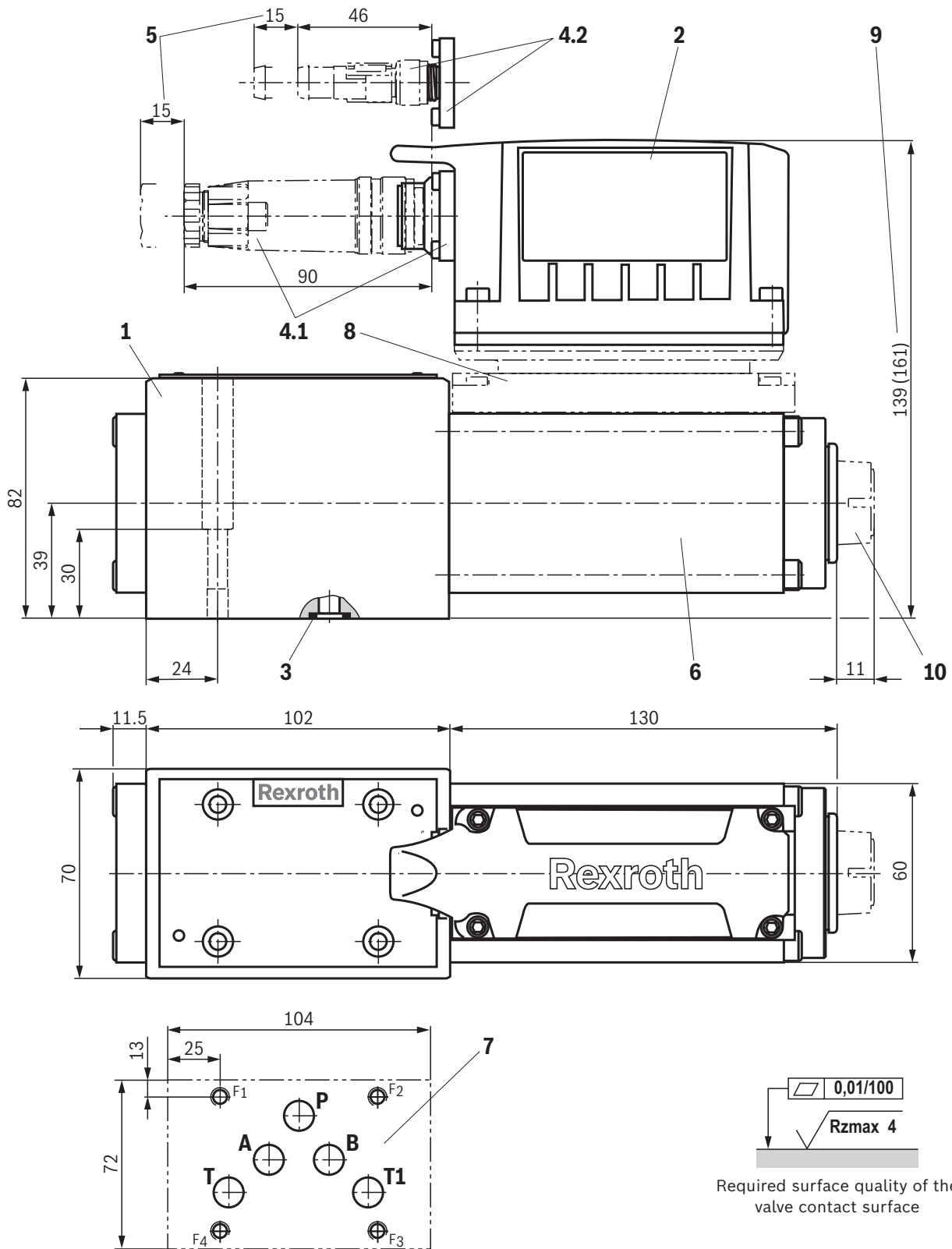


Characteristic curves

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



Dimensions
(dimensions in mm)



0,01/100
Rzmax 4

Required surface quality of the valve contact surface

Notice:

The dimensions are nominal dimensions which are subject to tolerances.

For item explanations, valve mounting screws and subplates, see page 18.

Dimensions

- 1 Valve housing
- 2 Integrated electronics
- 3 Identical seal rings for ports P, A, B, T, T1
- 4.1 Mating connectors with version "A1" and "F1", separate order, see page 18 data sheet 08006
- 4.2 Mating connectors with version "L1", separate order, see page 18 data sheet 08006
- 5 Space required to remove the mating connector
- 6 Control solenoid with position transducer
- 7 Machined valve contact surface, porting pattern according to ISO 4401-05-04-0-05
Deviating from the standard:
Ports P, A, B, T, T1 $\varnothing 10.5$ mm
- 8 Damping plate "D"
- 9 Dimension in () for version with damping plate "D"
- 10 Electronics protection membrane "-967"

Valve mounting screws (separate order)

Size	Quantity	Hexagon socket head cap screws	Material number
10	4	ISO 4762 - M6 x 40 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B (Friction coefficient $\mu_{\text{total}} = 0.09 \dots 0.14$) Tightening torque $M_A = 12.5$ Nm $\pm 10\%$	R913051533
	or		
	4	ISO 4762 - M6 x 40 - 10.9 Tightening torque $M_A = 15.5$ Nm $\pm 10\%$	Not included in the Rexroth delivery range
or			
	4	ASME B18.3 - 1/4-20 UNC x 1 3/4" - ASTM-A574 Tightening torque $M_A = 15$ Nm [<i>11 ft-lbs</i>] $\pm 10\%$	Not included in the Rexroth delivery range

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 4401-05-04-0-05 see data sheet 45100.

Accessories (separate order)

Valves with integrated electronics

Mating connectors 6-pole + PE	Design	Version	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	08006
	Angled	Plastic	R900217845	-

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	08006
	10.0	R901420496	08006
	20.0	R901448068	-

Test and service devices

	Material number	Data sheet
Service case with test device for proportional servo valves with integrated electronics (OBE)	R901049737	29685
Measuring adapter (6P+PE)	-	30068

Further information

- ▶ Hydraulic valves for industrial applications Data sheet 07600-B
- ▶ 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
- ▶ Hexagon socket head cap screw, metric/UNC Data sheet 08936
- ▶ Installation, commissioning and maintenance of servo valves and high-response valves Data sheet 07700
- ▶ Assembly, commissioning and maintenance of hydraulic systems Data sheet 07900
- ▶ General product information on hydraulic products Data sheet 07008
- ▶ Directional control valves, direct operated, with electrical position feedback and IO link interface Data sheet 29400-PA
- ▶ Selection of filters www.boschrexroth.com/filter
- ▶ Information on available spare parts www.boschrexroth.com/spc
- ▶ Link hydraulics via IO-Link www.boschrexroth.com/io-link

Notes

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