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

Type 4WRPEH

RE 29121
Edition: 2018-01
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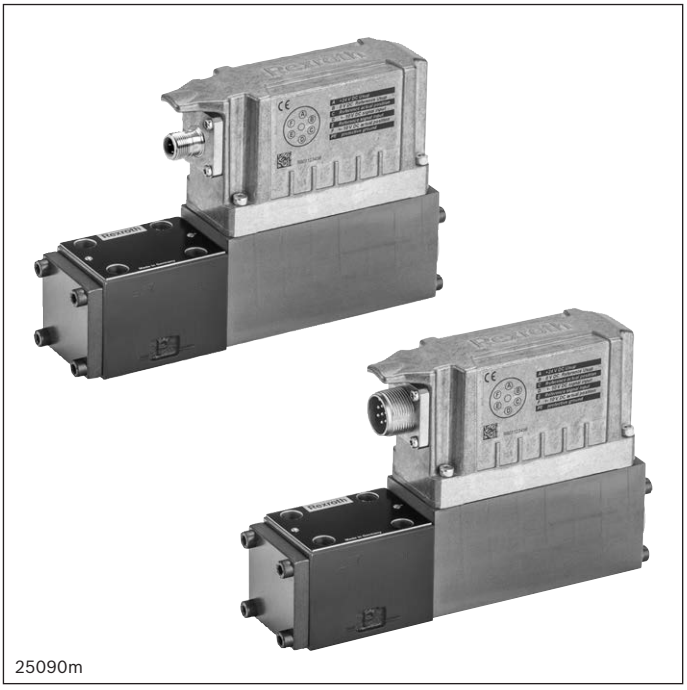


25090m

- Size 6
- Component series 3X
- Maximum operating pressure 350 bar
- Rated flow 4 ... 40 l/min

CE

IO-Link

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

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10		11		12	13	14	15	16
4	**WRP**	**E**	**H**	**6**		**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 6	**6**
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 (***Δp*** = 35 bar/control edge)

08		Flow characteristic		
		"L"	**"P"**	
	4 l/min	✓	✓ (Inflection at 20%)	**04**
	12 l/min	✓	–	**12**
	15 l/min	–	✓ (Inflection at 60%)	**15**
	24 l/min	✓	–	**24**
	25 l/min	–	✓ (Inflection at 60%)	**25**
	40 l/min	✓	✓ (Inflection at 40%)	**40**

Flow characteristic

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

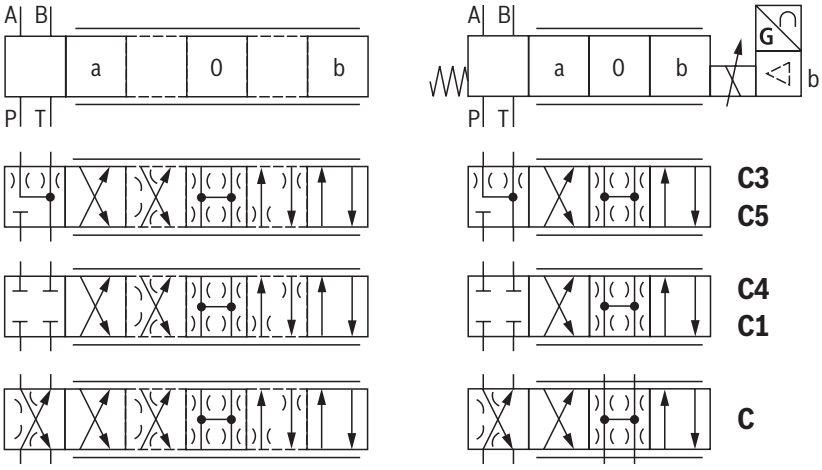
Seal material

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

Interfaces of the control electronics

14	Command value input ±10 V	**A1**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1**
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: [1)]

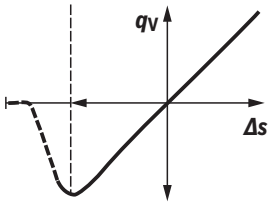
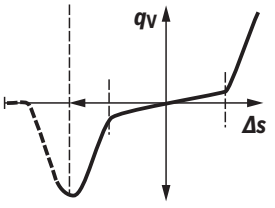
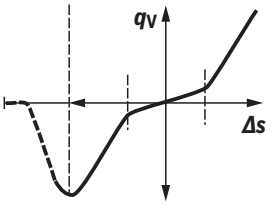
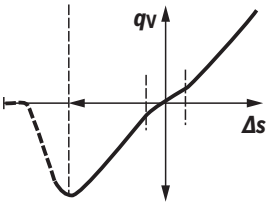
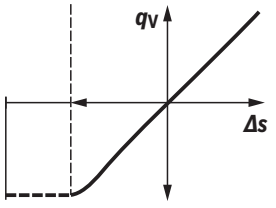
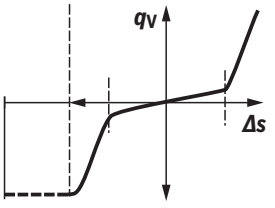
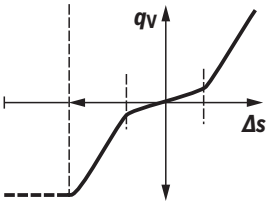
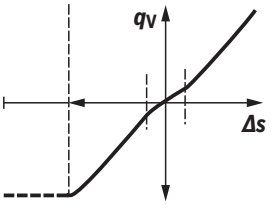
P → A: $q_{V\,nom}$ B → T: $q_{V\,nom}/2$

P → B: $q_{V\,nom}/2$ A → T: $q_{V\,nom}$

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

1) $q_{V\,nom}$ 2:1 in connection with flow characteristics "P" for rated flow 40 l/min only (version "40")

Flow characteristic

Symbol	Linear characteristic curve (version "L")	Inflected characteristic curve (version "P")		
		Inflection 60% ($q_{V\,nom}$ = 15.25 l/min)	Inflection 40%	Inflection 20%
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 (5))
- On-board electronics (OBE) (3) with analog or IO-Link interface (4) (optionally with damping plate (6))

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.

Control solenoid shut-off

In case of the following errors, the control solenoid is de-energized by the integrated electronics (OBE) and the control spool is set to fail-safe position:

- 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

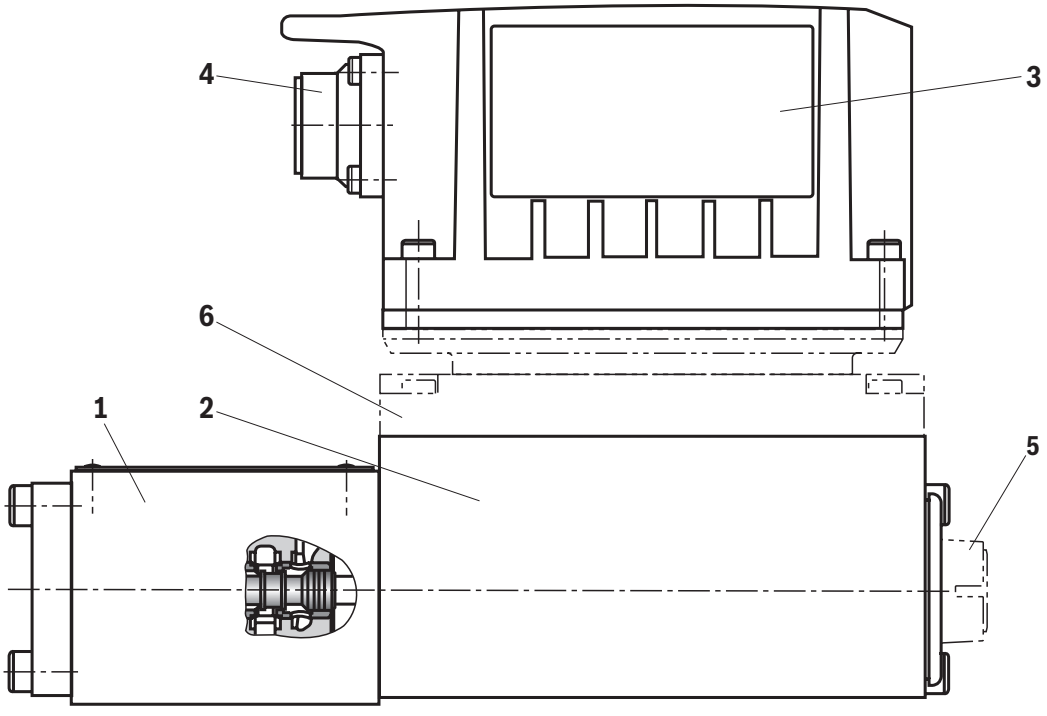
Damping plate "D"

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

☞ **Notice:**
Use of 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 (5) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).



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

general			
Design			Spool valve, direct operated, with steel sleeve
Actuation			Proportional solenoid with position control, OBE
Type of connection			Subplate mounting, porting pattern according to ISO 4401
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	▶ Without damping plate		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
	▶ With damping plate [1]		10 ... 2000 Hz / maximum of 10 g / 10 cycles / 3 axes
Noise test according to DIN EN 60068-2-64	▶ Without damping plate		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 30 min. / 3 axes
	▶ With damping plate [1]		20 ... 2000 Hz / 10 g_{RMS} / 30 g peak / 24 h / 3 axes
Transport shock according to DIN EN 60068-2-27	▶ Without damping plate		15 g / 11 ms / 3 shocks / 3 axes
	▶ With damping plate [1]		15 g / 11 ms / 3 shocks / 3 axes
Shock according to DIN EN 60068-2-27	▶ With damping plate [1]		35 g / 6 ms / 1000 shocks / 3 axes
Weight		kg	2.9
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			▶ CE according to EMC directive 2014/30/EU, tested according to EN 61000-6-2 and EN 61000-6-3 ▶ RoHS directive 2015/65/EU ▶ REACH ordinance (EC) no. 1907/2006

hydraulic							
Maximum operating pressure	▶ Port A, B, P	bar	350				
	▶ Port T	bar	250				
Rated flow at Δp = 35 bar/control edge [2]		l/min	4	12	15	24/25	40
Hydraulic fluid			see table page 6				
Viscosity range	▶ Recommended	mm^2/s	20 ... 100				
	▶ Maximum admissible	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 [3]				
Limitation of use (Δp) with regard to the transition to failsafe (values apply to summated edge)	▶ Symbols C3, C5, C	bar	350	350	350	350	160
	▶ Symbols C1, C4	bar	350	350	280	250	100
Leakage flow at 100 bar	▶ Linear characteristic curve "L"	cm^3/min	< 180	< 300	–	< 500	< 900
	▶ Inflected characteristic curve "P"	cm^3/min	< 150	–	< 180	< 300	< 450

[1] Not recommended for applications with mainly low-frequency excitation < 300 Hz

[2] Flow for deviating Δp (control edge):

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

[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.
For the selection of filters, see 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, HVLPD	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	NBR, FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU, HFDR	FKM	ISO 12922	90222
	▶ Containing water	HFC (Fuchs Hydrotherm 46M, Petrofer Ultra Safe 620)	NBR	ISO 12922	90223

☞ **Important information on hydraulic fluids:**
- ▶ For further information and data on the use of other hydraulic fluids, please refer to the data sheets above or contact us!
- ▶ There may be limitations regarding the technical valve data (temperature, pressure range, life cycle, maintenance intervals, etc.)!
- ▶ The ignition temperature of the hydraulic fluid used must be 40 K higher than the maximum solenoid surface temperature.
- ▶ **Flame-resistant – containing water**:
  - – Maximum operating pressure 210 bar
  - – Maximum pressure differential per control edge 175 bar
  - – Pressure pre-loading at the tank port >20% of the pressure differential, otherwise increased cavitation erosion
  - – Life cycle as compared to operation with mineral oil HL, HLP 50 ... 100%
  - – Maximum hydraulic fluid temperature 50 °C

static / dynamic		
Hysteresis	%	< 0.1
Range of inversion	%	< 0.05
Response sensitivity	%	< 0.05
Manufacturing tolerance q_{Vmax}	%	< 10
Temperature drift (temperature range 20 °C ... 80 °C)		Zero shift < 0.25% with $\Delta\vartheta$ = 10 K
Pressure drift	%/100 bar	Zero shift < 0.15
Zero compensation		Ex plant ±1%

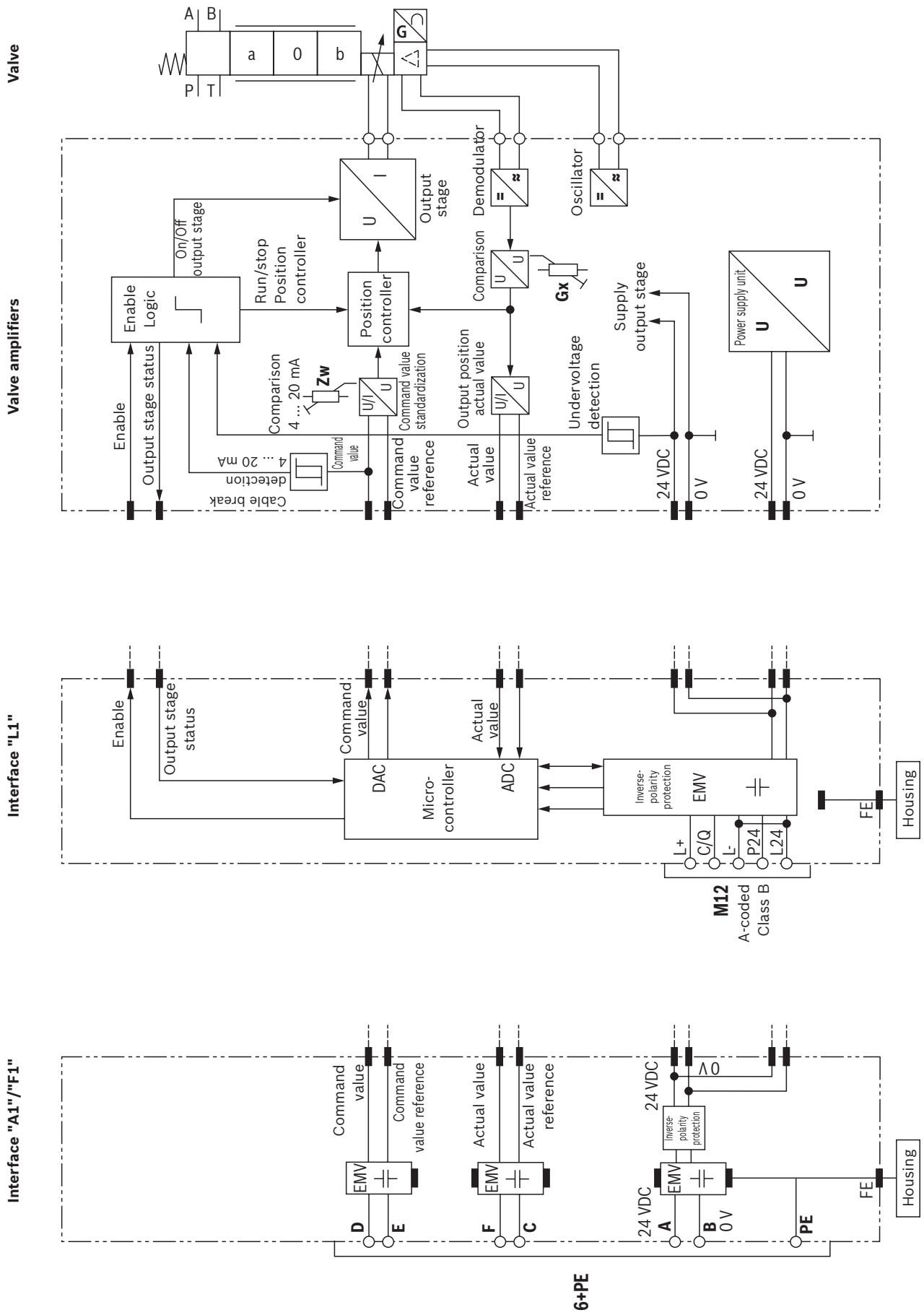
electrical, integrated electronics (OBE) – Interface "A1" and "F1"		
Relative duty cycle	%	100 (continuous operation)
Protection class according to EN 60529		IP 65 with mounted and locked plug-in connectors
Supply voltage	VDC	24
▶ Terminal A	VDC	min. 19 / max. 36
▶ Terminal B	VDC	0
Maximum admissible residual ripple	Vpp	2.5
Maximum power consumption	VA	40
Fuse protection, external	A_T	2.5 (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 9 (CE-compliant installation)
Adjustment		Calibrated in the plant, see valve characteristic curves page 10 ... 18

Technical data

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

electrical, integrated electronics (OBE) – Interface "L1"			
Relative duty cycle		%	100 (continuous operation)
Protection class according to EN 60529			IP 65 with mounted and locked plug-in connectors
Supply voltage	▶ Valve amplifier	VDC	24
	– 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	▶ Valve amplifier	A	2
	▶ 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	▶ 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

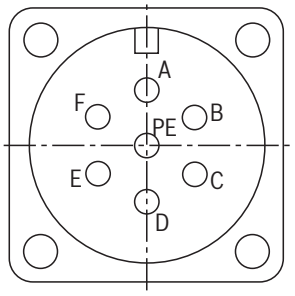
Block diagram/controller function block



Electrical connections and assignment

Connector pin assignment "A1" and "F1"

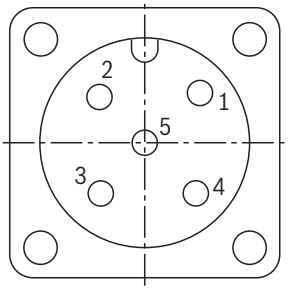
Pin	Signal	Assignment interface "A1"	Assignment interface "F1"
A	Supply voltage	24 VDC	
B		0 V	
C	Reference potential actual value	Reference potential actual value - pin F	
D	Differential amplifier input	Command value ±10 V	Command value 4 ... 20 mA
E		Reference potential command value - pin D	
F	Measuring output (actual value)	Actual value ±10 V	Actual value 4 ... 20 mA
PE		Functional ground (directly connected to the valve housing)	

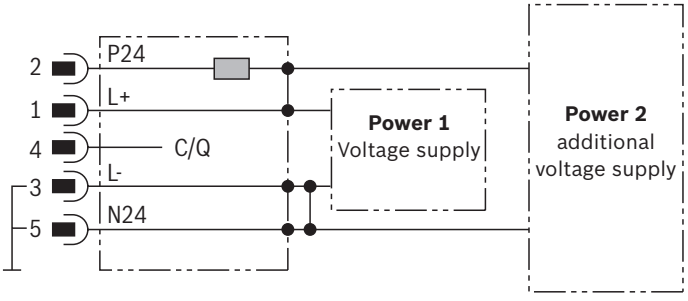


Command value	▶ Positive command value (0 ... 10 V or 12 ... 20 mA) at D and reference potential at E cause flow from P → A and B → T.
	▶ Negative command value (0 ... –10 V or 12 ... 4 mA) at D and reference potential at E cause flow from P → B and A → T.
Connection cable	▶ Up to 20 m cable length type LiYCY 7 x 0.75 mm²
	▶ Up to 40 m cable length type LiYCY 7 x 1.0 mm²
	▶ EMC compliant installation: – Apply screening to both line ends – Use metal mating connector (see page 20) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 20) can be used

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

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





☞ **Notes:**
- ▶ 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 20 and data sheet 08006.
- ▶ Communication and parameter description see data sheet 29400-PA

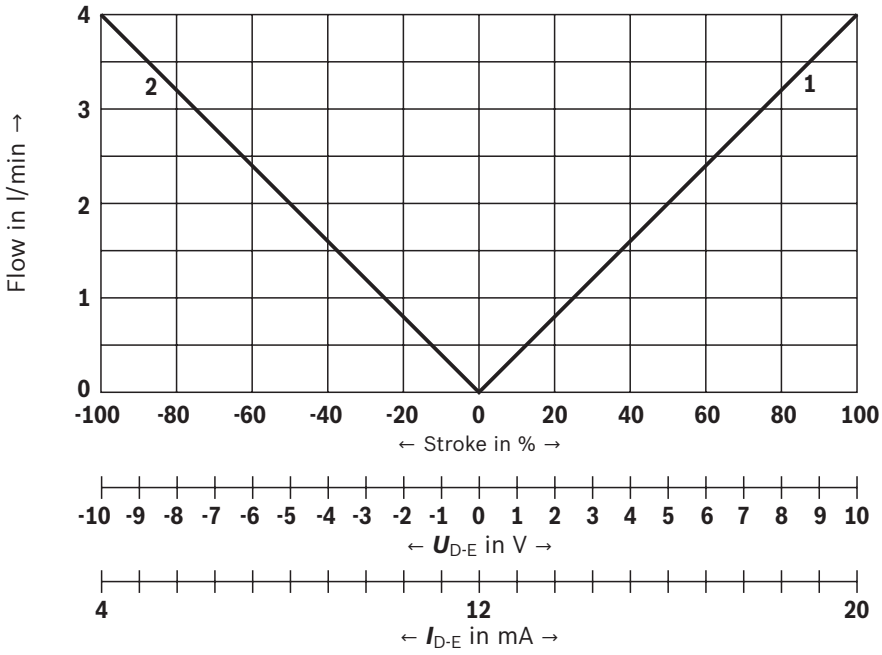
Pin	Signal	Allocation interface L1
1	L+	Voltage supply IO-Link
2	P24	Voltage supply valve electronics and power part (current consumption 2 A)
3	L-	Reference potential pin 1 [1)]
4	C/Q	Data line IO-Link (SDCI)
5	N24	Reference potential pin 2 [1)]

[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, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

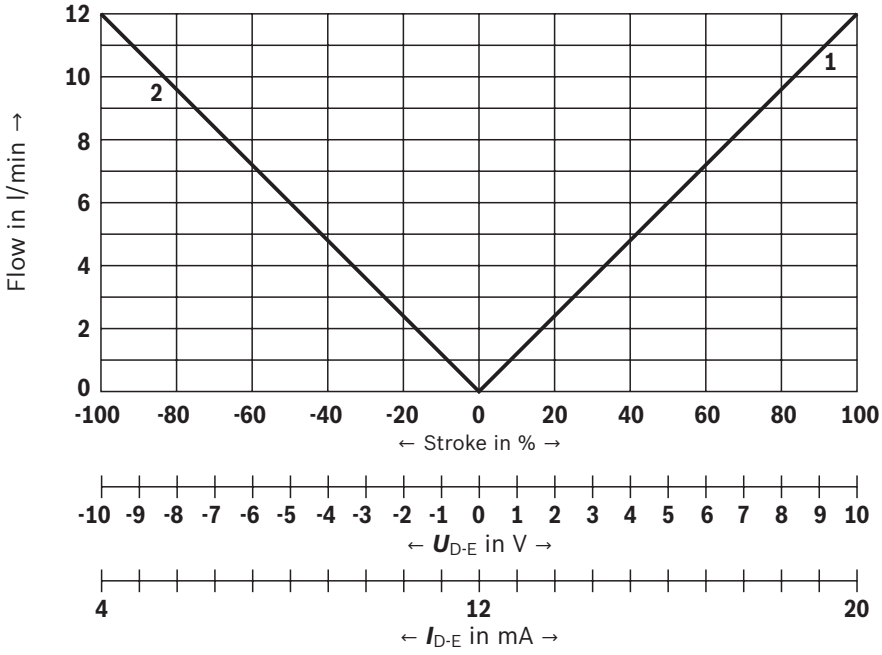
Flow/signal function

Symbol C, C3 and C4 – Version "04"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "12"

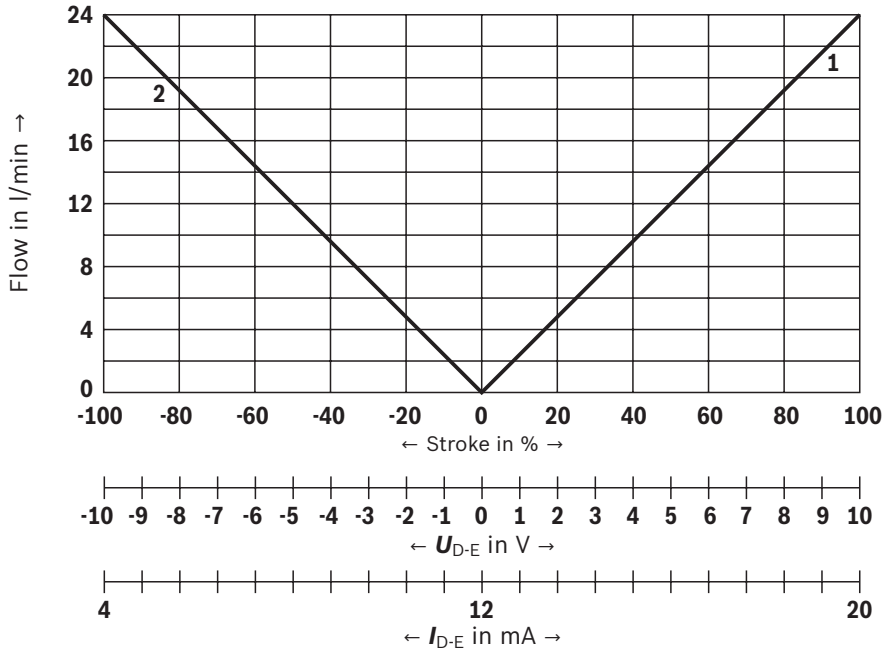


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

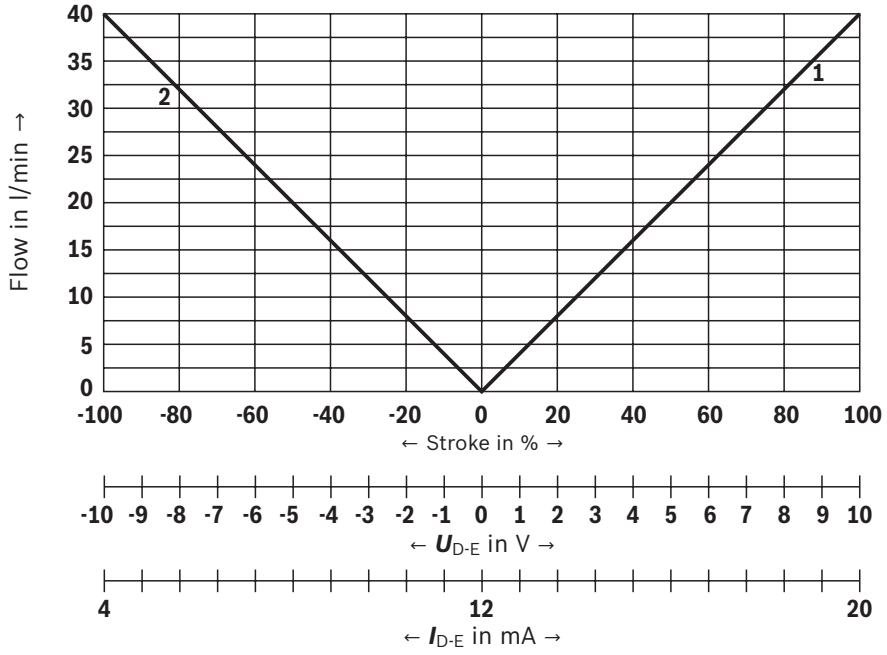
Flow/signal function

Symbol C, C3 and C4 – Version "24"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "40"

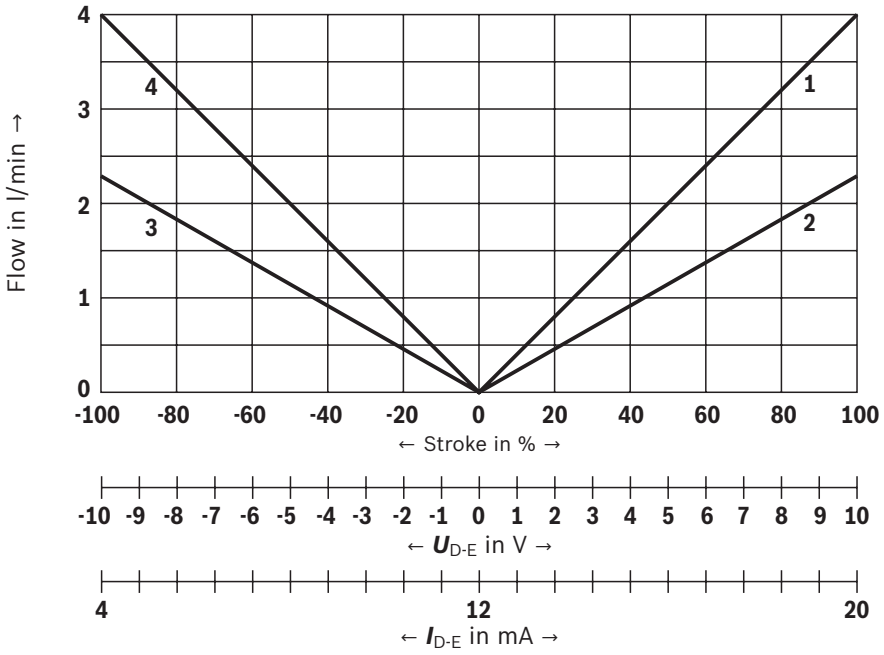


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

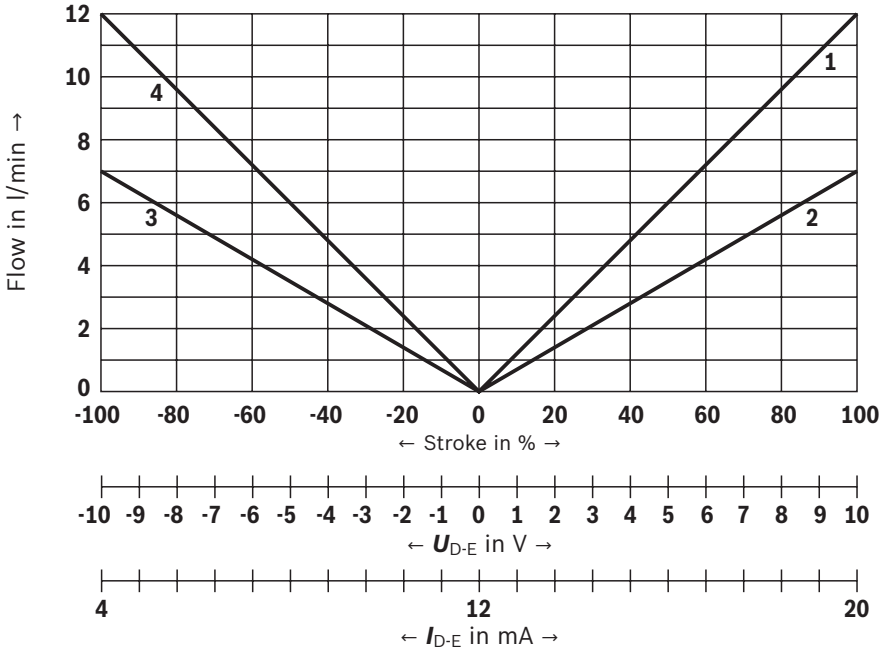
Flow/signal function

Symbol C1 and C5 – Version "04"



1 P–A
2 B–T
3 P–B
4 A–T

Symbol C1 and C5 – Version "12"

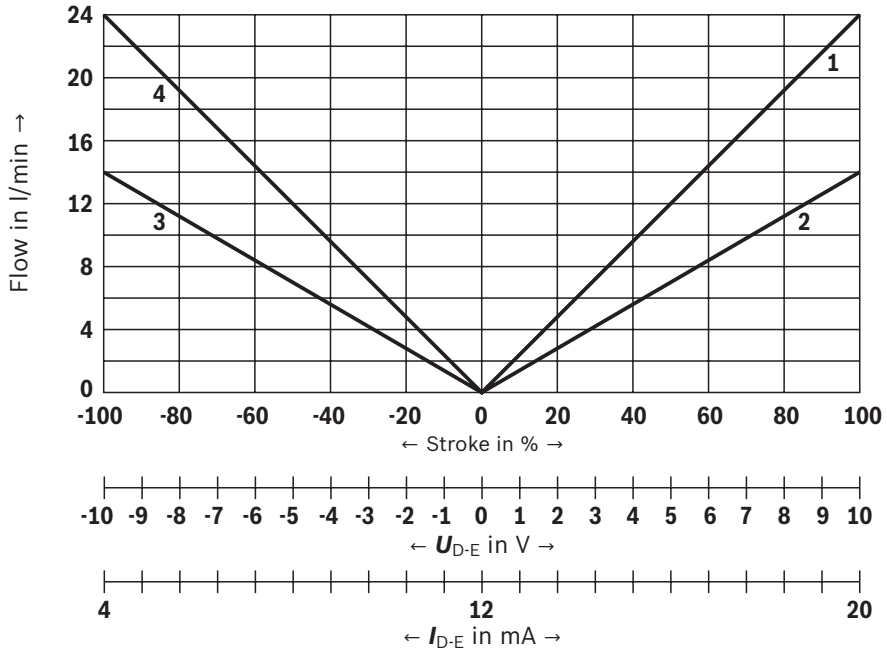


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic "L"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

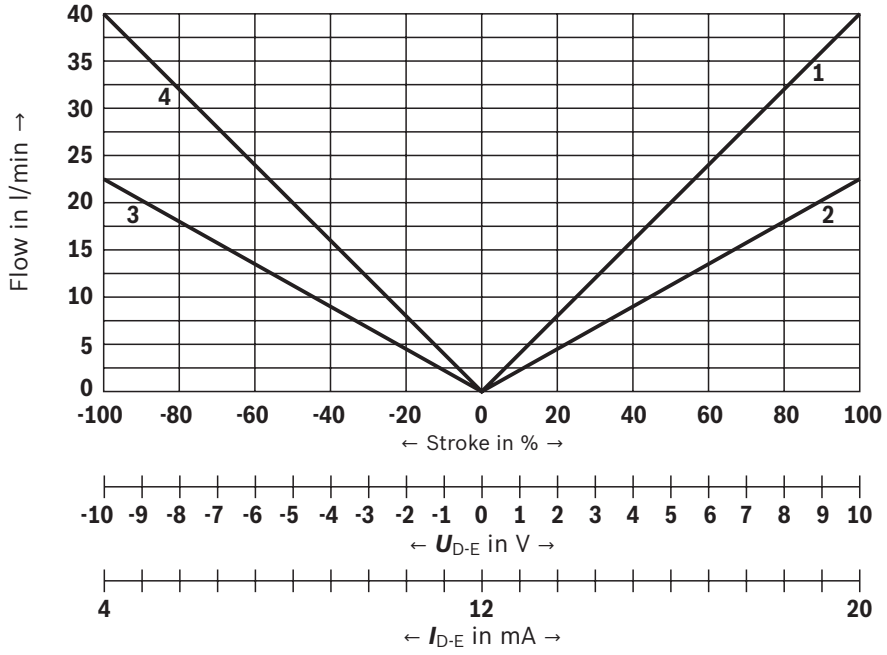
Flow/signal function

Symbol C1 and C5 – Version "24"



1 P–A
2 B–T
3 P–B
4 A–T

Symbol C1 and C5 – Version "40"

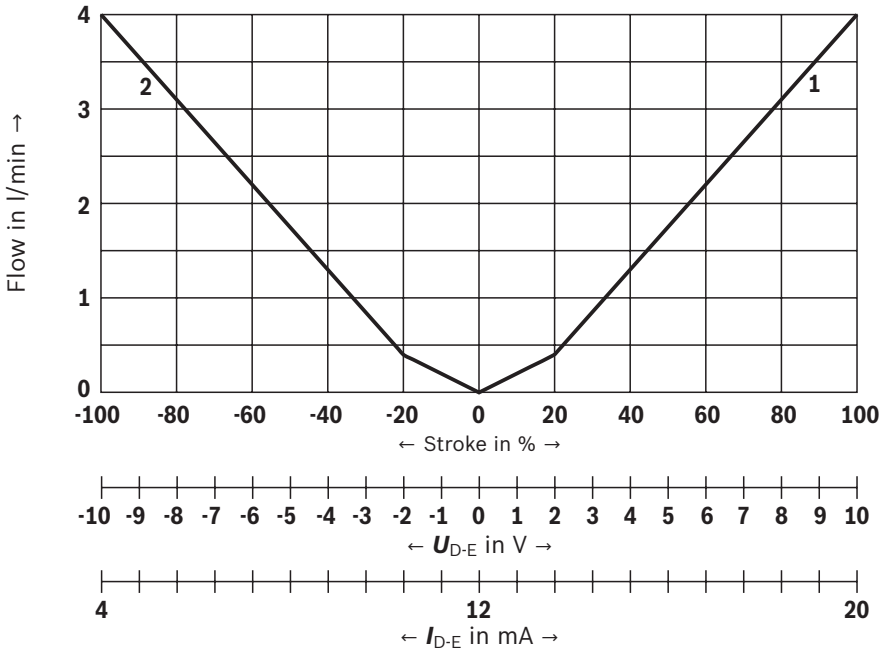


1 P–A
2 B–T
3 P–B
4 A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

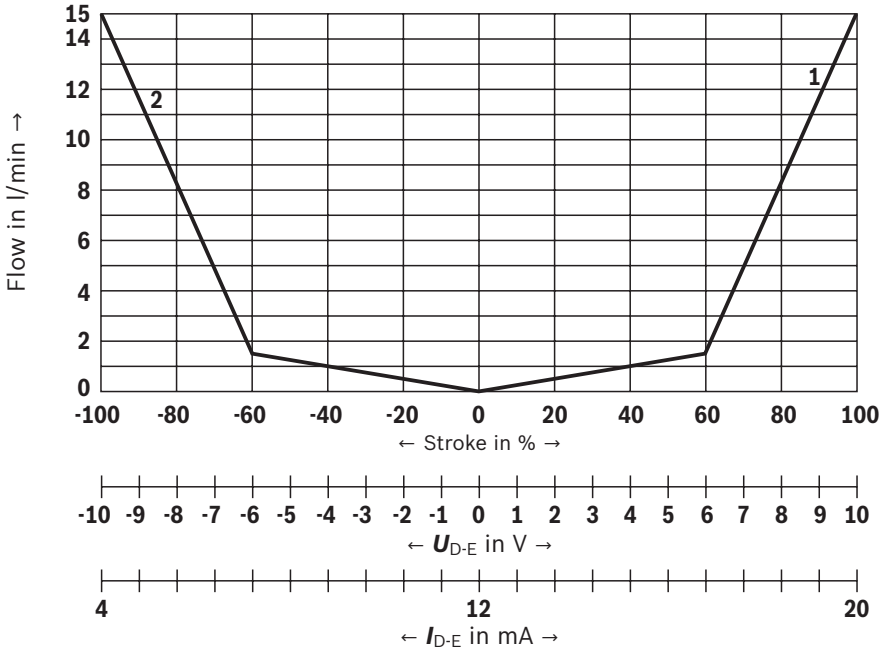
Flow/signal function

Symbol C, C3 and C4 – Version "04"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "15"

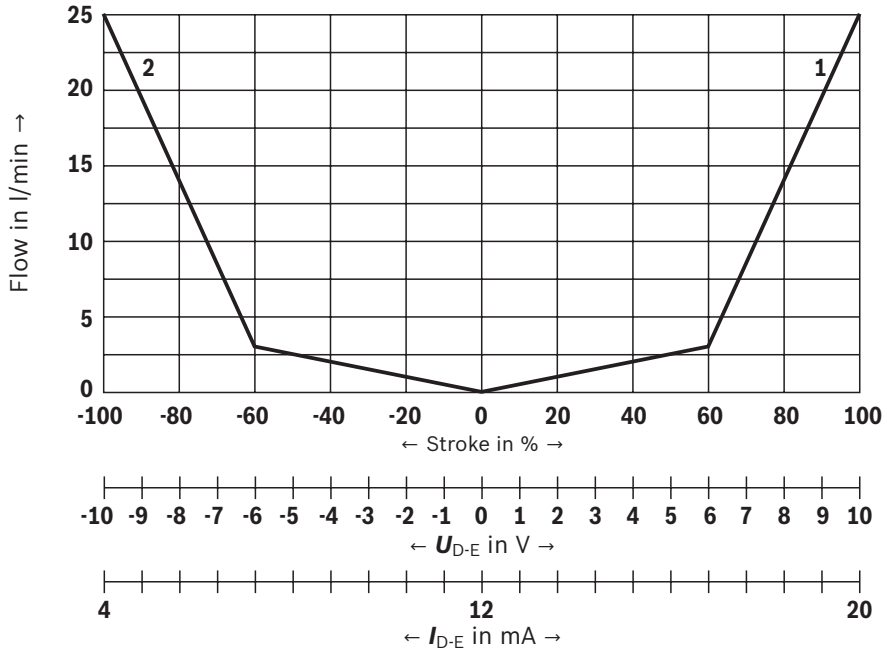


1 P–A; B–T
2 P–B; A–T

Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

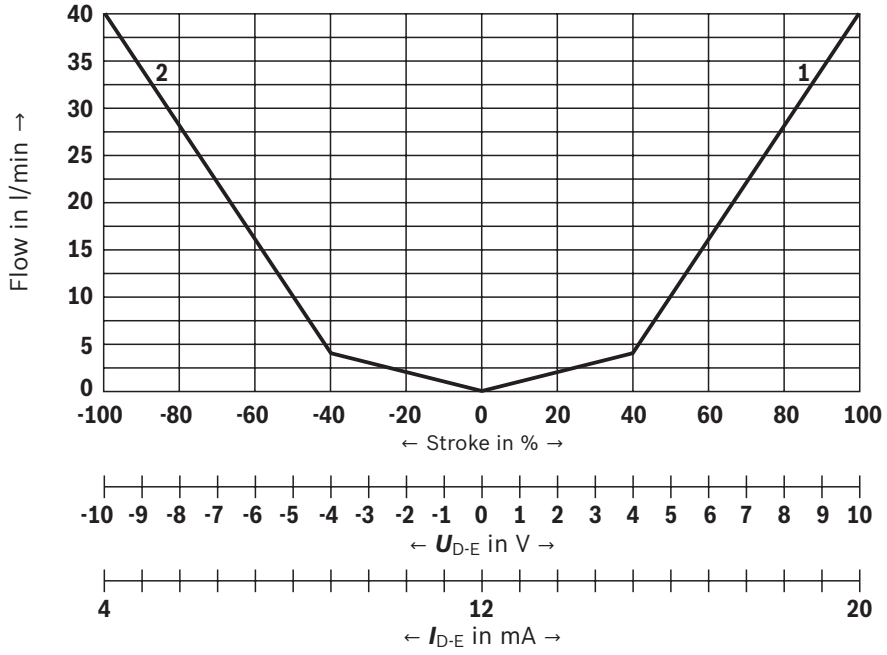
Flow/signal function

Symbol C, C3 and C4 – Version "25"



1 P–A; B–T
2 P–B; A–T

Symbol C, C3 and C4 – Version "40"

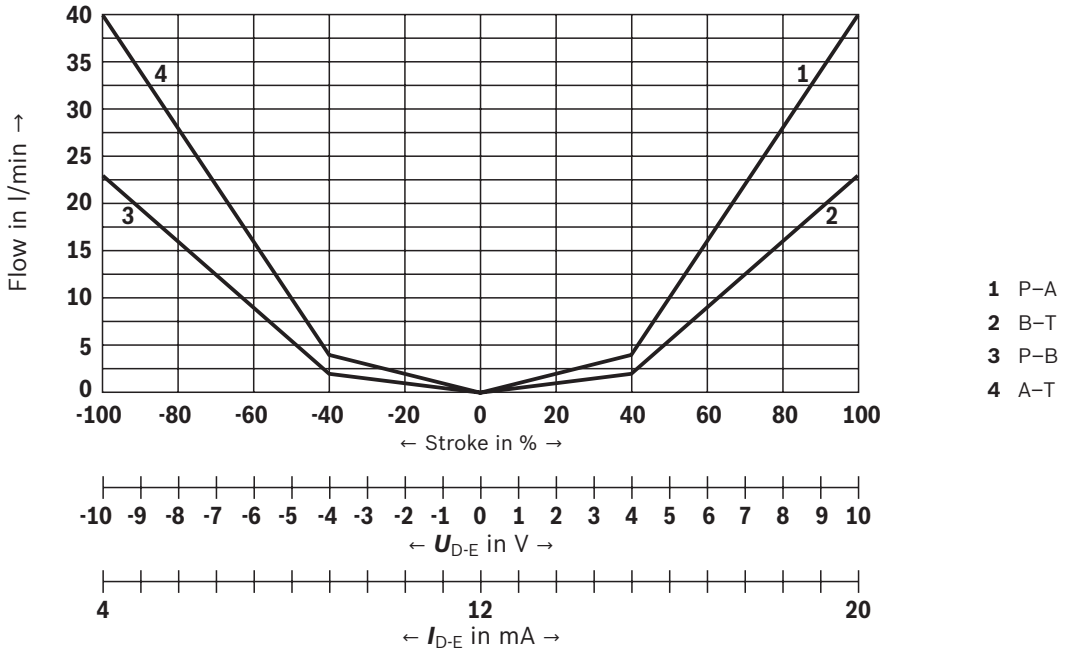


1 P–A; B–T
2 P–B; A–T

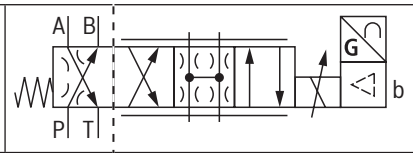
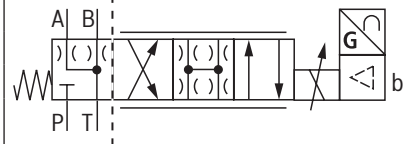
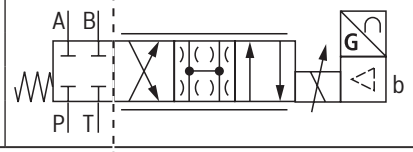
Characteristic curves: Flow characteristic "P"
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C; Δp = 35 bar/control edge)

Flow/signal function

Symbol C1 and C5 – Version "40"



Fail-safe position: Flow/leakage flow

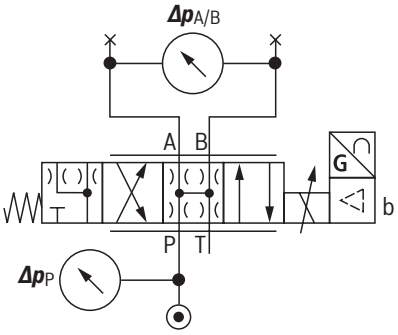
	Fail-safe position	Rated flow at Δp = 35 bar/control edge		l/min	4	12	15	24/25	40
C		Flow at Δp = 35 bar/control edge		l/min	4	10	13	18	20
C3, C5		Leakage flow at 100 bar	P→A	cm³/min	50				
			P→B	cm³/min	70				
		Flow at Δp = 35 bar	A→T	l/min	10 ... 20				
			B→T	l/min	7 ... 20				
C4, C1		Leakage flow at 100 bar	P→A	cm³/min	50				
			P→B	cm³/min	70				
			A→T	cm³/min	70				
			B→T	cm³/min	50				

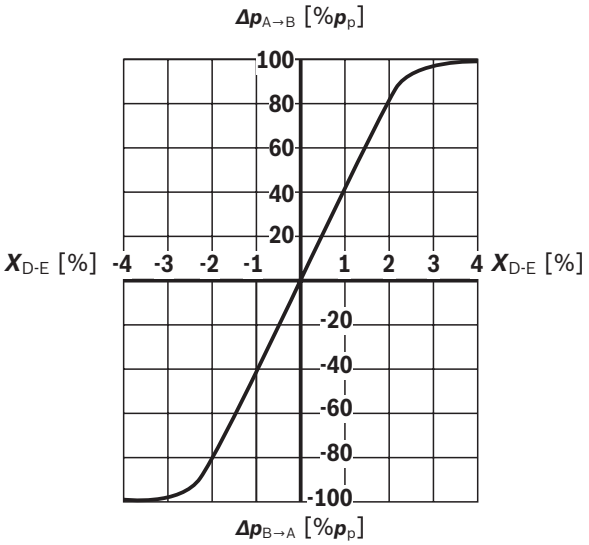
Fail-safe	p = 0 bar ⇒ 7 ms	Internal shut-off in case of the following errors: ▶ Drop of supply voltage U_B ≤15 V and restarting at U_B ≥17.5 V. ▶ Only at interface "F1": – Falling below the minimum current command value of 2 mA (includes cable break of the command value line (current loop)) ▶ Only at interface "L1": – Enable inactive, communication interruption (watchdog) – In case of internal IO-Link error
	p = 100 bar ⇒ 10 ms	

Characteristic curves

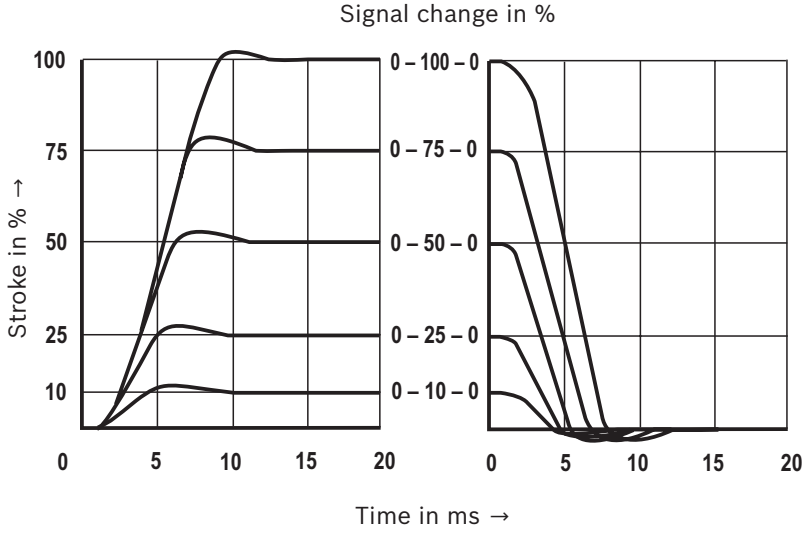
(measured with HLP46, ϑ_{Oil} = 40 ±5 °C)

Pressure/signal characteristic curve





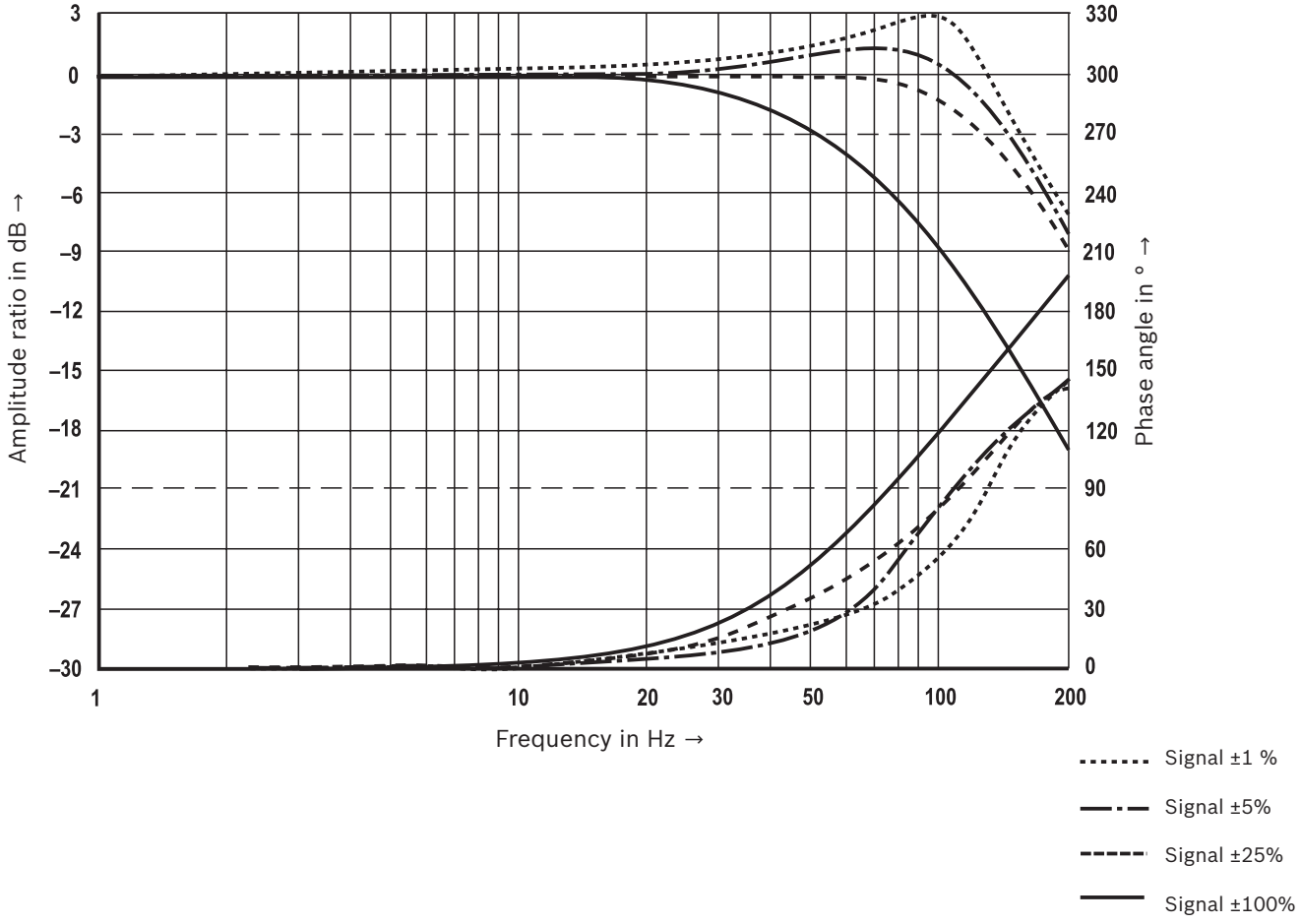
Transition function with stepped electric input signals



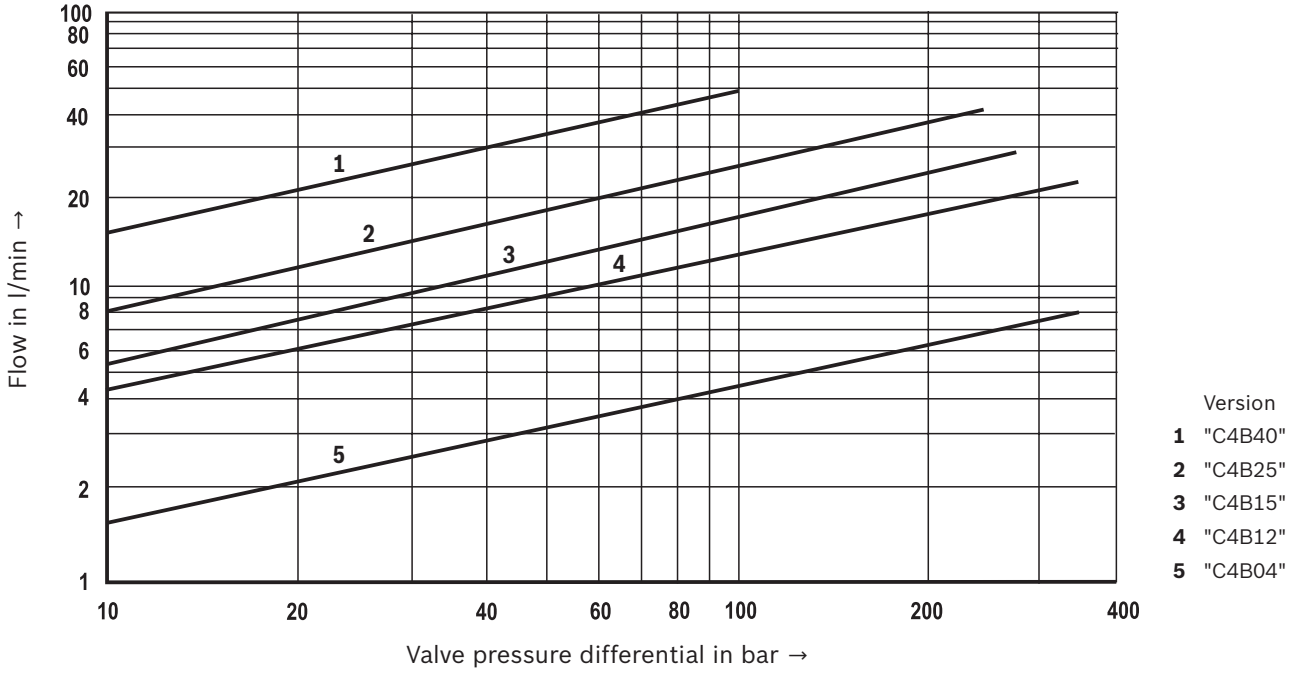
Characteristic curves

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

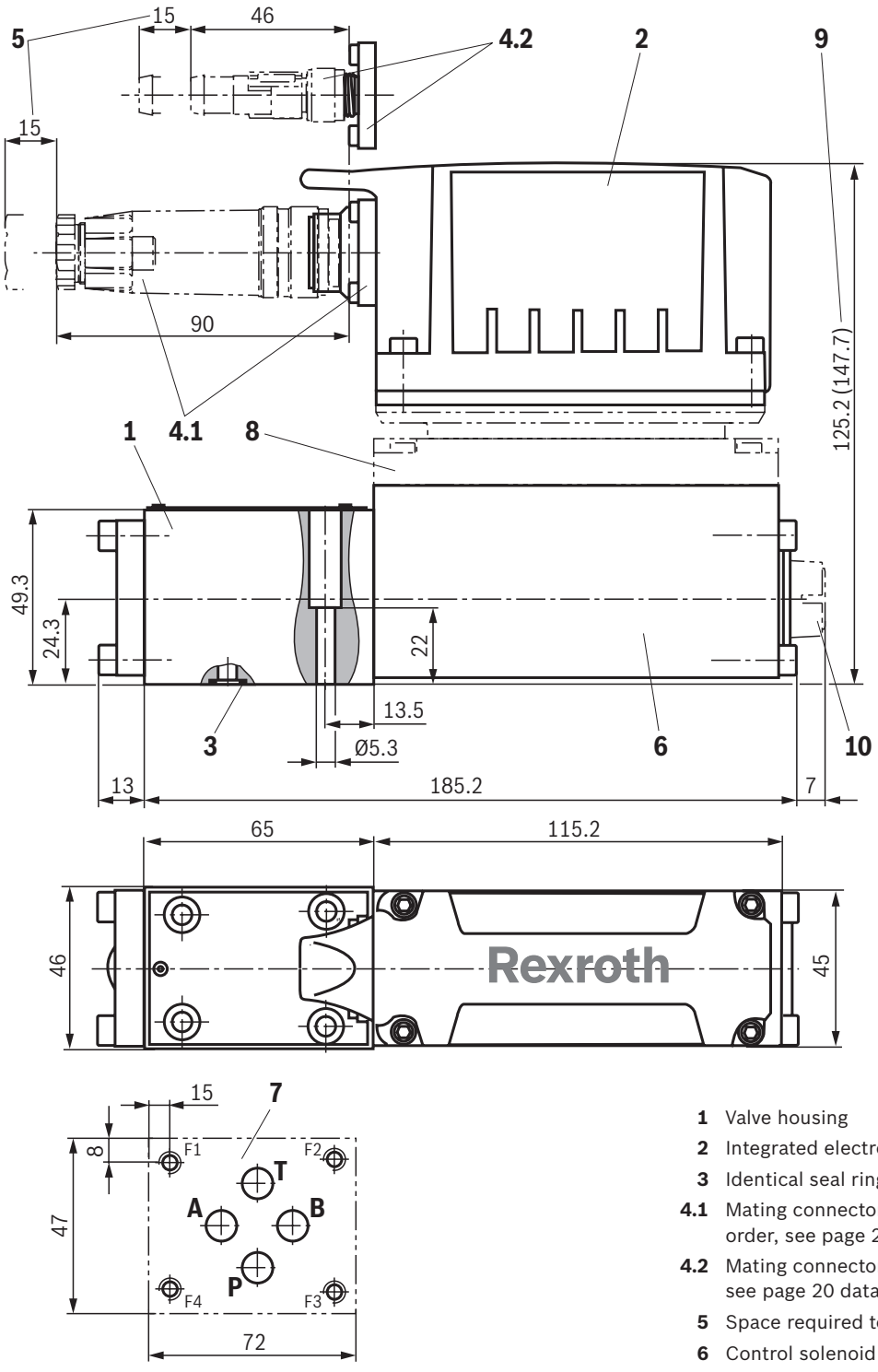
Frequency response characteristic curves

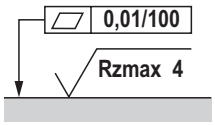


Flow/load function with maximum valve opening



Dimensions
(dimensions in mm)





Required surface quality of the valve contact surface

1 Valve housing
2 Integrated electronics
3 Identical seal rings for ports P, A, B, T
4.1 Mating connectors with version "A1" and "F1", separate order, see page 20 data sheet 08006
4.2 Mating connectors with version "L1", separate order, see page 20 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 4401-03-02-0-05
Deviating from the standard: Ports P, A, B, T Ø8 mm
Minimum screw-in depth:
- Ferrous metal 1.5 x Ø
- Non-ferrous 2 x Ø

8 Damping plate "D"
9 Dimension in () for version with damping plate "D"
10 Electronics protection membrane "-967"

☞ **Notice:**
The dimensions are nominal dimensions which are subject to tolerances.

Dimensions

Valve mounting screws (separate order)

4 hexagon socket head cap screws	Material number
ISO 4762 - M5 x 30 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B Tightening torque M_A = 7 Nm ±10 %	**R913048086**
or	
ISO 4762 - M5 x 30 - 10.9 Tightening torque M_A = 8.9 Nm ±10 %	Not included in the Rexroth delivery range
or	
ASME B18.3 - 10-24 UNC x 1 1/4" - ASTM-A574 Tightening torque M_A = 8.0 Nm *[5.9 ft-lbs]* ±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 4401-03-02-0-05 see data sheet 45100.

Accessories (separate order)

Valve with integrated electronics

Interface	Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
"A1", "F1"	For the connection of valves with integrated electronics, round connector 6+PE, line cross-section 0.5 ... 1.5 mm²	straight	Metal	**R900223890**	08006
		straight	Plastic	**R900021267**	08006
		angled	Plastic	**R900217845**	–
"L1"					

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 mm²	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)		29685

IO-Link gateways

Designation	Description	Material number
S67E-PN-IOL8-DI4-M12-6P	IndraControl S67E PROFINET device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174436**
S67E-S3-IOL8-DI4-M12-6P	IndraControl S67E Sercos device in the plastic housing 8 IO-Link ports (4 x class A and 4 x class B), 4 digital inputs, 24 VDC, M12 quick connection technology	**R911174437**

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
▶ Selection of filters	www.boschrexroth.com/filter
▶ Information on available spare parts	www.boschrexroth.com/spc

Notes

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Notes

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