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rexroth
A Bosch Company

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

Type 4WRLE



- Size 10 ... 35
- Component series 4X
- Maximum operating pressure 350 bar
- Rated flow 60 ... 1500 l/min
- Digital interface, IO-Link for I4.0

CE

IO-Link

Features

- Reliable – proven and robust design
- Safe
  - The control spool of the pilot control valve is in the "fail safe" position when the unit is switched off
  - The control spool of the main valve is in the spring-centered central position and/or in the offset position
- High quality – control spool and sleeve of the pilot control valve in servo quality
- Flexible – suitable for position, velocity and pressure control
- Precise – high response sensitivity and little hysteresis
- IO-Link interface, optional. Use of the valve with IO-Link as a shut-off element up to category 3, PL d according to EN 13849-1.

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Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	WRL	E						–	4X	/			/		24			*

01	4 main ports	**4**
02	Directional control valve, pilot-operated	**WRL**
03	With integrated electronics (OBE)	**E**
04	Size 10	**10**
	Size 16	**16**
	Size 25	**25**
	Size 27	**27**
	Size 35	**35**
05	Symbols e.g. E, E1-, W6- etc.; possible version see page 4	

Rated flow (***Δp*** = 5 bar/control edge)

06	**– Size 10**	
	60 l/min (only symbol E, E1-, W6-, W8-, V, V1-)	**60**
	100 l/min	**100 ◊**
	– Size 16	
	200 l/min (only symbol W6- and W8-)	**200 ◊**
	250 l/min (only symbol E, E1-, V, V1- and Q3-)	**250 ◊**
	– Size 25	
	350 l/min (only symbol W6- and W8-)	**350 ◊**
	400 l/min (only symbol E, E1-, V, V1- and Q3-)	**400 ◊**
	– Size 27	
	430 l/min (only symbol W6- and W8-)	**430 ◊**
	600 l/min (only symbol E, E1-, V, V1- and Q3-)	**600 ◊**
	– Size 35	
	1000 l/min (only symbol E, E1-, V, V1-)	**1000**
	1200 l/min (only symbol W6- and W8-)	**1200 ◊**
	1500 l/min (only symbol E, E1-, V, V1- and Q3-)	**1500 ◊**

Flow characteristic

07	Linear	**L ◊**
	Linear with fine control range	**P**
	Progressive with linear fine control (only symbol Q3-)	**M**
08	Without overlap jump (only symbols V, V1- and Q3-)	**no code**
	With overlap jump (opening point 5% with covered valve; only symbols E, E1-, W6-, W8-)	**J**
09	Component series 40 ... 49 (40 ... 49: Unchanged installation and mounting dimensions)	**4X**

Seal material (observe compatibility of seals with hydraulic fluid used, see page 12)

10	NBR seals	**M ◊**
	FKM seals	**V**

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**

Ordering code

01	02	03	04	05	06	07	08		09		10	11		12	13	14	15	16
4	**WRL**	**E**						**–**	**4X**	**/**			**/**		**24**			*****

12	**Without** damping plate	**no code ◊**
	With damping plate	**D**

13	Supply voltage 24 V	**24**

Interfaces of the control electronics

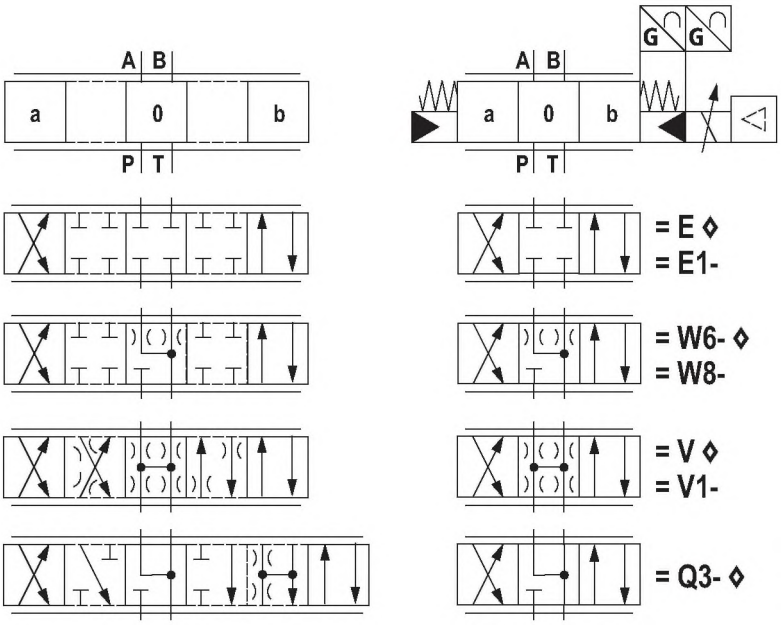
14	Command value input ±10 V	**A1 ◊**
	Command value input 4 ... 20 mA	**F1**
	IO-Link interface	**L1 ◊**
	Command value ±10 mA, actual value 4 ... 20 mA, release (connector 6+PE)	**C6**

15	**Without** electronics protection membrane	**no code ◊**
	With electronics protection membrane	**-967**

16	Further details in the plain text	*

☞ **Notice: ◊** = Preferred type

Symbols

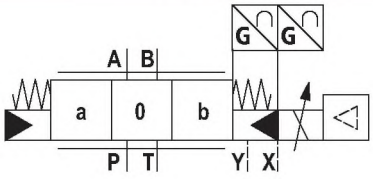
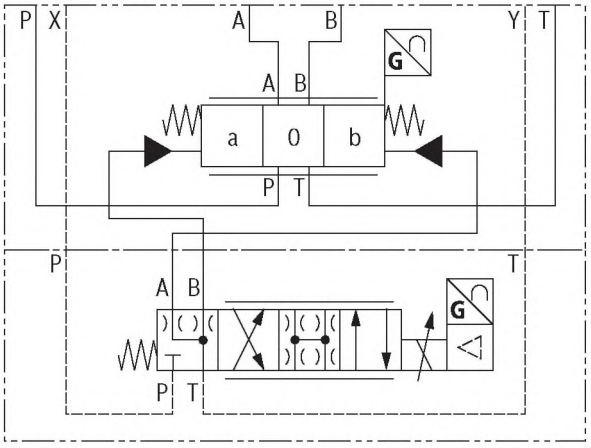
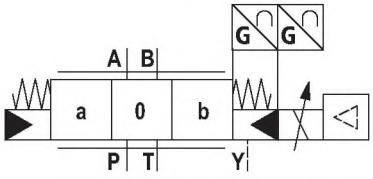
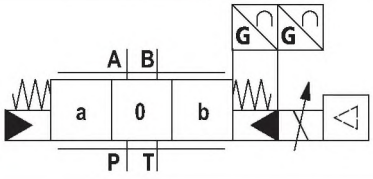
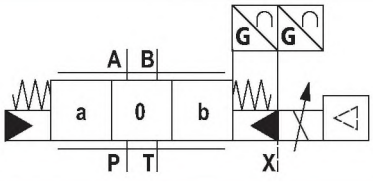


With symbol E1–, V1– and W8–:

P→A: $q_{V\,max}$ B→T: $q_V/2$

P→B: $q_V/2$ A→T: $q_{V\,max}$

☞ **Notice:** ◊ = Preferred type

Version	Simple	Detailed
"XY"		
"PY"		
"PT"		
"XT"		

☞ **Notice:**

- Representation according to DIN ISO 1219-1. Hydraulic interim positions are shown by dashes.
- For information on the "switch-off behavior", refer to Technical data on page 12.

Function, section: Symbol E. and W.

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:

- Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- Main valve (2) with centering spring and position feedback
- On-board electronics (OBE) (3) with analog (6) or IO-Link interface

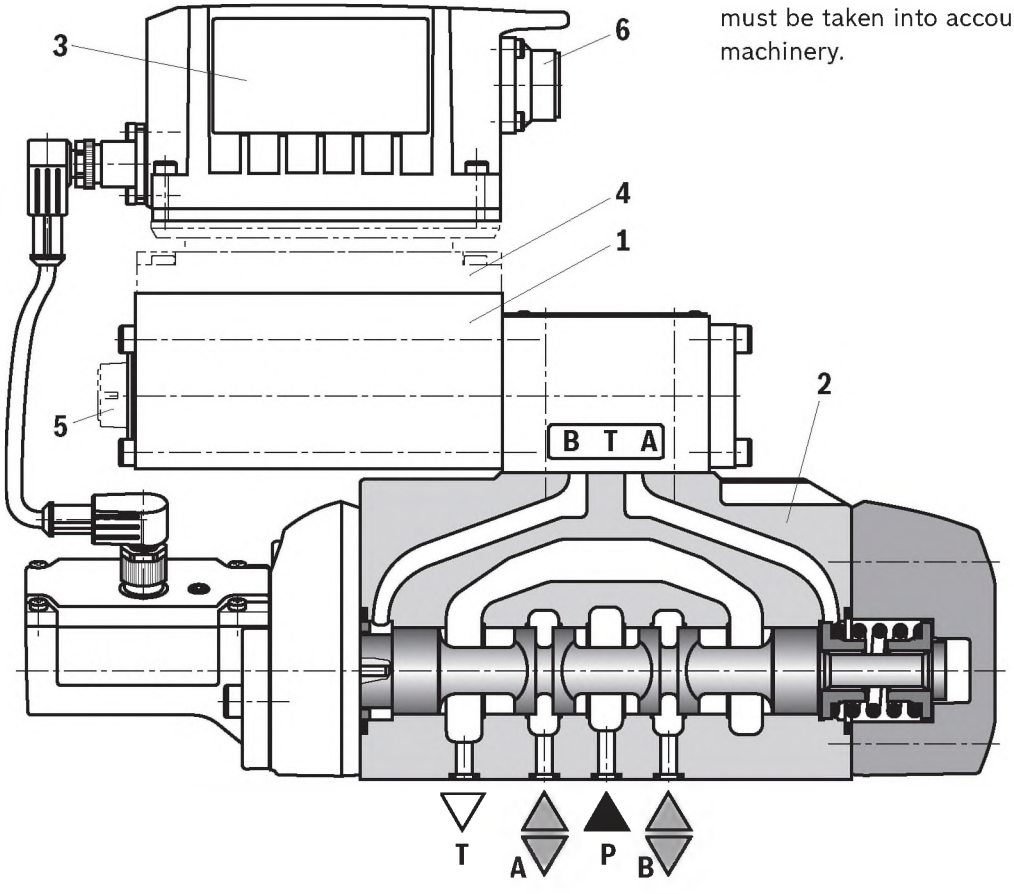
Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the "fail-safe" position.
The control spool of the main valve is in its spring-centered central position.

The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the pilot control spool is adjusted against the spring.
The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X.
The feedback can be internal via port T or external via port Y to the tank.

Safety function (IO-Link shut-off)

By shutting off the supply voltage at the IO-Link master (Class B-Port), pins 2 and 5, the IO-Link valve can be safely switched off. After shut-off of the supply voltage, the main valve control spool is set to spring-centered central position. In order to also guarantee the hydraulic prerequisite for the safety shut-down, the overlap of control spool must also be considered.
Observe $MTTF_D$ values (data sheet 08012) and operating instructions 29118-B.
The safe shut-off is not part of the IO-Link valve and must be taken into account for the safe design of the machinery.



Function, section: Symbol E. and W.

Control solenoid shut-off
In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE), the pilot control spool is set to its "fail-safe" position and unloads the pilot oil chambers of the main valve. Operated by the spring, the main valve control spool will move to the central position.

- Falling below the minimum supply voltage ≤15 V (restarting ≥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
- Only at interface "C6":
  - Additionally, release inactive

Damping plate "D"
The damping plate (4) 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 (5) can be used.
Recommended for use outside industry-standard conditions with high ambient air humidity and significant cyclic temperature changes (e.g. outdoors).

☞ **Notice:**

- Pilot-operated 4/3 directional control valves with positive overlap are functional in controlled or regulated axes. The overlap in the de-energized state is approx. 20% of the control spool stroke.
- 4/3 directional control valves do not have a leakage-free basic locking when deactivated. Leakage must be considered when designing the drive.
- When using the valve with IO-Link interface in compliance with category 3 according to EN 13849-1, adequate cyclic diagnosis or monitoring of the valve function outside of the valve by the control system must be implemented by the machine integrator. Without suitable diagnostic measures, only category B or 1 according to EN 13849-1 can be achieved.

For sectional drawing see page 5.

Function, section: Symbol V and V1-

The valve type 4WRLE is a pilot-operated directional control valve with electrical position feedback and integrated electronics (OBE).

Set-up

The valve basically consists of 3 main assemblies:

- Pilot control valve (1) with control spool and sleeve, return spring, control solenoid and inductive position transducer (optionally with electronics protection membrane (5) and damping plate (4))
- Main valve (2) with centering spring and position feedback
- On-board electronics (OBE) (3) with analog (6) or IO-Link interface

Function

When the integrated electronics (OBE) are switched off or inactive, the control spool of the pilot control valve is spring-operated in the "fail-safe" position.
The control spool of the main valve is in its spring-centered offset position at approx. 6% of the stroke in direction P→B, A→T.
The integrated electronics (OBE) compare the specified command value to the position actual value of the main valve control spool. In case of control deviations, the control solenoid will be activated. Due to the changed magnetic force, the pilot control spool is adjusted against the spring.
The flow, which is activated via the control cross-sections, leads to an adjustment of the main control spool. The stroke/control cross-section of the main control spool is regulated proportionally to the command value. In case of a command value presetting of 0 V, the electronics adjust the control spool of the main valve to central position.
The pilot oil supply in the pilot control valve is either internal via port P or external via port X.
The feedback can be internal via port T or external via port Y to the tank.

Control solenoid shut-off

In case of the following errors, the control solenoids are de-energized by the integrated electronics (OBE), the pilot control spool is set to its "fail-safe" position and unloads the pilot oil chambers of the main valve.
Operated by the spring, the main valve control spool will move to the offset position (approx. 6% P→B, A→T).

- Falling below the minimum supply voltage ≤15 V (restarting ≥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
- Only at interface "C6":
  - Additionally, release inactive

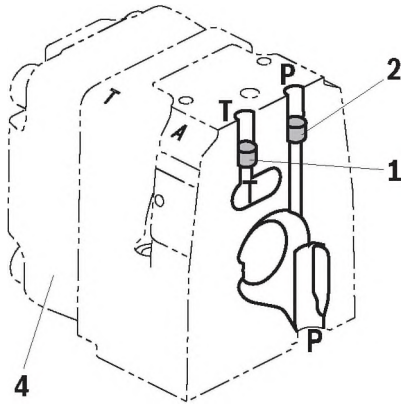
Damping plate "D" and **electronics protection membrane "-967"** see page 6.

☞ **Notice:**
Pilot-operated 4/3 directional control valves with zero overlap are only functional in the active control loop and do not have a locking basic position when deactivated. Consequently "external isolation valves" are required in many applications and must be taken into account regarding the switch-on/switch-off order. While the electrical supply voltage is switching off, the drive may be accelerated for a short time in functional direction P to B.

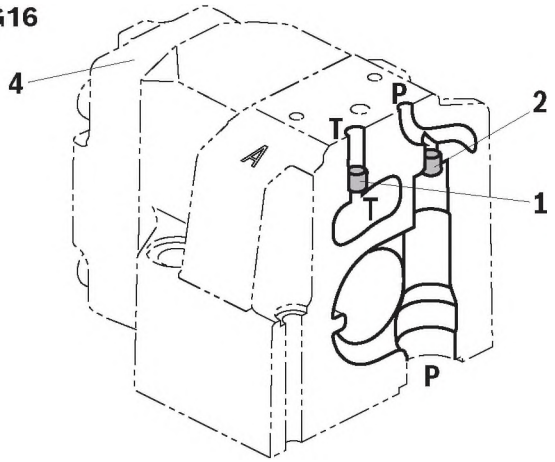
For sectional drawing see page 5.

Pilot oil supply (schematic illustration)

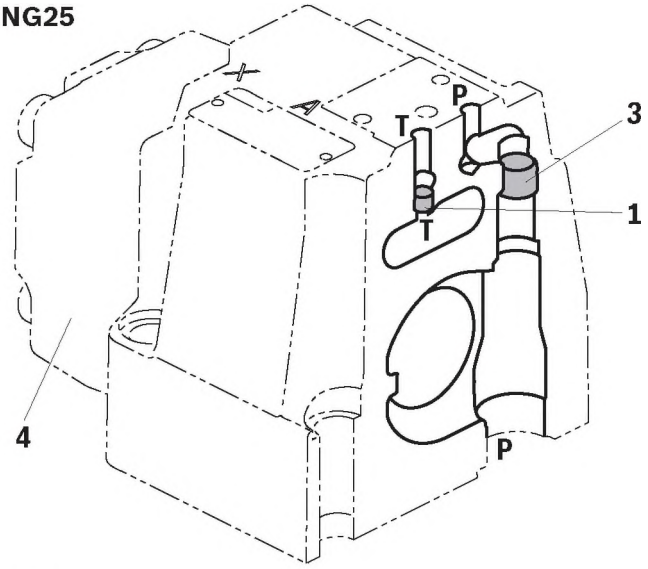
NG10



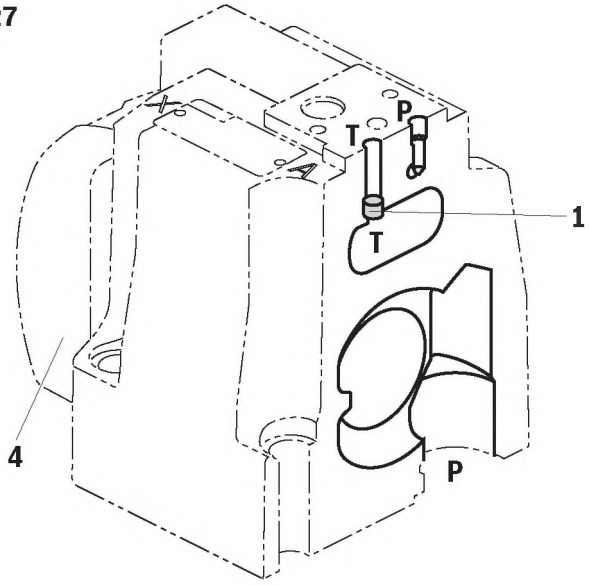
NG16



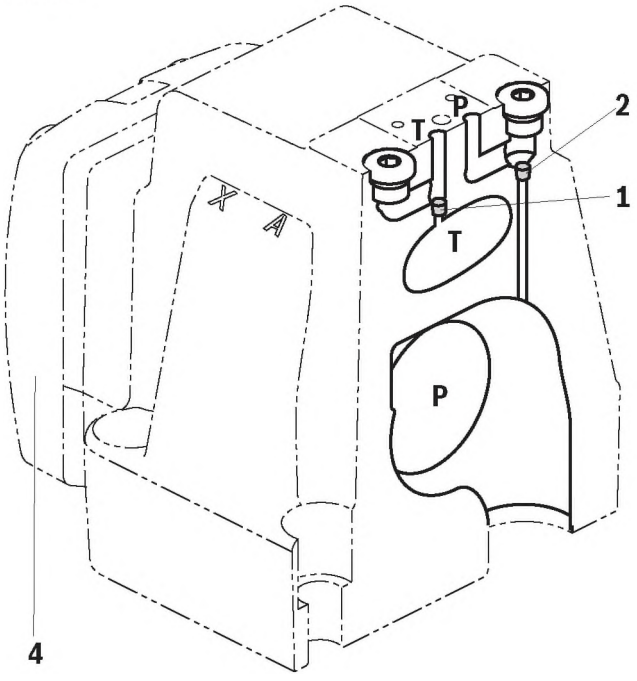
NG25



NG27



NG35



1 Plug screw M6 according to DIN 906, SW3 – pilot oil return

2 Plug screw M6 according to DIN 906, SW3 – pilot oil supply

3 Plug screw M12 x 1.5 according to DIN 906, SW6 – pilot oil supply

4 Housing cover main stage (position transducer side)

Pilot oil supply
external: **2, 3** closed
internal: **2, 3** open

Pilot oil return
external: **1** closed
internal: **1** open

Further explanations on page 9.

Pilot oil supply

Version "XY"
External pilot oil supply
External pilot oil return
In this version, the pilot oil is supplied from a separate control 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
In this version, the pilot oil is supplied from a separate control 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.

☞ **Notice:**
The modification of the pilot oil supply may only be performed by authorized specialists or at the factory. The maximum admissible operating parameters must be observed, see page 11.

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

General							
Size	NG	10	16	25	27	35	
Type of connection		Subplate mounting					
Porting pattern		ISO 4401					
Weight	kg	9	12	19	21	80	
Installation position		Any					
Ambient temperature range	°C	–20 ... +60					
Storage temperature range	°C	+5 ... +40					
Maximum storage time	Years	1 (if the storage conditions are observed, refer to the operating instructions 07600-B)					
Maximum relative humidity (no condensation)	%	95					
Protection class according to EN 60529		IP65 (if suitable and correctly mounted mating connectors are used)					
Maximum surface temperature	°C	120 (individual operation)					
$MTTF_D$ value according to EN ISO 13849	Years	75 (for further details see data sheet 08012)					
Can be used up to category according to EN ISO 13849	▶ Version "A1", "F1"	1 (up to PL c); as switch-off element					
	▶ Version "L1"	3 (up to PL d); as switch-off element					
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					
Conformity	▶ 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 [2]					

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

[2] The product fulfills the substance requirements of the RoHS directive 2011/65/EU.

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

Hydraulic							
Size		NG	10	16	25	27	35
Maximum operating pressure	▶ Ports A, B, P						
	– External pilot oil supply	bar		350		270	350
	– Internal pilot oil supply	bar		280		270	280
	▶ Port X	bar		280		270	280
	▶ Port T [3]						
	– External pilot oil return	bar		250		210	350
	– Internal pilot oil return	bar		250		210	250
	▶ Port Y	bar		250		210	250
Hydraulic fluid			See table page 12				
Hydraulic fluid temperature range (flown-through)		°C	-20 ... +70				
Viscosity range	▶ Recommended	mm²/s	20 ... 100				
	▶ Maximum	mm²/s	10 ... 800				
Maximum admissible degree of contamination of the hydraulic fluid; cleanliness class according to ISO 4406 (c)			Class 18/16/13 [4]				
Rated flow (***Δp*** = 5 bar/control edge) [5]		l/min	60/100	200/250	350/400	430/600	1000/1200/1500
Maximum flow		l/min	300	800	1250	1850	4700
Maximum leakage flow (inlet pressure 100 bar)	▶ Symbol E, E1-						
	– Main valve	l/min	0.10	0.17	0.19		0.83
	– Main valve + pilot control valve	l/min	0.16	0.28	0.36		1.11
	▶ Symbol W6-, W8-						
	– Main valve	l/min	0.21	0.35	0.38		1.67
	– Main valve + pilot control valve	l/min	0.26	0.45	0.56		1.95
Maximum zero flow (inlet pressure 100 bar)	▶ Symbol V, V1-						
	– Main valve	l/min	1.7	2.3	2.8	3.3	7.2
	– Main valve + pilot control valve	l/min	1.85	2.6	3.2	3.7	7.65
	▶ Symbol Q3-						
	– Main valve	l/min	0.4	1.6	1.8	2.2	1.6
	– Main valve + pilot control valve	l/min	0.55	1.9	2.2	2.6	2.05
Minimum pilot pressure (pilot control valve)		bar	10				
Pilot flow [6]	▶ Symbol E, W	l/min	3	4	10		26
	▶ Symbol V, Q3-	l/min	4	11	19		29

[3] Observe project planning information, see page 42.

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

[5] Flow for deviating ***Δp*** (per control edge):

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

[6] At port X and Y with stepped input signal from 0 ... 100% (pilot pressure 100 bar)

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

Hydraulic fluid		Classification	Suitable sealing materials	Standards	Data sheet
Mineral oils		HL, HLP	NBR, FKM	DIN 51524	90220
Bio-degradable	▶ Insoluble in water	HETG	FKM	ISO 15380	90221
		HEES	FKM		
	▶ Soluble in water	HEPG	FKM	ISO 15380	
Flame-resistant	▶ Water-free	HFDU (glycol base)	FKM	ISO 12922	90222
		HFDU (ester base)	FKM		
		HFDR	FKM		
	▶ Containing water	HFC (Fuchs: Hydrotherm 46M, Fuchs Renosafe 500; Petrofer: Ultra Safe 620; Houghton: Safe 620; Union: Carbide HP5046)	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 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 the 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 – backing up the return flow pressure in ports T to approx. 20% of the pressure differential at the component.
  - Dependent on the hydraulic fluid used, the maximum ambient and hydraulic fluid temperature must not exceed 50 °C. In order to reduce the heat input into the component, the command value profile is to be adjusted for proportional and high-response valves.

Static/dynamic							
Size		NG	10	16	25	27	35
Hysteresis		%	<0.1				
Range of inversion		%	<0.08				
Response sensitivity		%	<0.05				
Manufacturing tolerance q_{Vmax}		%	≤10				
Temperature drift (temperature range 20 ... 80 °C)		%/10 °C	Zero shift < 0.25				
Zero point calibration		%	±1 (ex works)				
Step response time for 0 ... 100% at X = 210 bar)	▶ Symbols E, E1-, W6-, W8-	ms	25	37	36	36	55
Switch-off behavior (after electrical shut-off)	▶ Symbol E, E1-		Pilot control valve in fail-safe position, main valve moves to overlapped spring-centered central position				
	▶ Symbol W6-, W8-		Pilot control valve in "fail-safe" position, main valve moves to spring-centered central position (P blocked, A/B to port T open).				
	▶ Symbol V, V1-		Pilot control valve in fail-safe position, main valve moves to spring-centered "offset position" (approx. 6%, P→B/A→T)				
	▶ Symbol Q3		Pilot control valve in "fail-safe" position, main valve moves to spring-centered "offset position" (P blocked, A/B to port T open)				

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

Electrical, integrated electronics (OBE) – Interface "A1"			
Supply voltage	▶ Nominal value	VDC	24
	▶ Minimum	VDC	19
	▶ Maximum	VDC	36
	▶ Maximum residual ripple	Vpp	2.5
	▶ Maximum power consumption	VA	40
	▶ Fuse protection, external	A_T	2.5 (time-lag)
Relative duty cycle time according to VDE 0580		%	S1 (continuous operation)
Functional ground and screening			See page 15 (EMC-compliant installation)
Maximum voltage of the differential inputs against 0 V			D→B; E→B (max. 18 V)
Command value (differential amplifier)	▶ Measurement range	V	±10
	▶ Input resistance	kΩ	>100
Actual value (test signal)	▶ Output range	V	±10
	▶ Minimum load impedance	kΩ	>1

Electrical, integrated electronics (OBE) – Interface "F1"			
Supply voltage	▶ Nominal value	VDC	24
	▶ Minimum	VDC	19
	▶ Maximum	VDC	36
	▶ Maximum residual ripple	Vpp	2.5
	▶ Maximum power consumption	VA	40
	▶ Fuse protection, external	A_T	2.5 (time-lag)
Relative duty cycle time according to VDE 0580		%	S1 (continuous operation)
Functional ground and screening			See page 15 (EMC-compliant installation)
Maximum voltage of the differential inputs against 0 V			D→B; E →B (max. 18 V)
Command value	▶ Input current range	mA	4 ... 20
	▶ Input resistance	Ω	200
Actual value (test signal)	▶ Output range	mA	4 ... 20
	▶ Maximum load	Ω	500

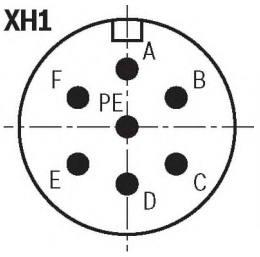
Electrical, integrated electronics (OBE) – Interface "C6"			
Supply voltage (U_B)	▶ Nominal value	VDC	24
	▶ Minimum	VDC	19
	▶ Maximum	VDC	36
	▶ Maximum residual ripple	Vpp	2.5
	▶ Maximum power consumption	VA	40
	▶ Fuse protection, external	A_T	2.5 (time-lag)
Relative duty cycle time according to VDE 0580		%	S1 (continuous operation)
Functional ground and screening			See page 15 (EMC-compliant installation)
Command value	▶ Input current range	mA	±10
	▶ Input resistance	Ω	200
Actual value (test signal)	▶ Output range	mA	4 ... 20
	▶ Maximum load	Ω	500
Enable	▶ Low level range	V	−3 ... 5
	▶ High level range	V	11 ... U_B
	▶ Maximum current consumption at high level	mA	7.25 (U_B = 24 V); 11 ($U_{B\,max}$)

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

Electrical, integrated electronics (OBE) – Interface "L1"			
Supply voltage	▶ Valve amplifiers		
	– Nominal value	VDC	24
	– Minimum	VDC	18
	– Maximum	VDC	30
	– Maximum residual ripple	Vpp	1.3
	– Maximum power consumption	VA	40
	▶ IO-Link interface		
	– Nominal value	VDC	24
	– Minimum	VDC	18
	– Maximum	VDC	30
	– Maximum residual ripple	Vpp	1.3
	– Maximum power consumption	VA	1.2
Relative duty cycle time according to VDE 0580		%	S1 (continuous operation)
Functional ground and screening			Provide via valve block
Bit rate COM3		kBaud (kbit/s)	230.4
Required master port class			Class B
Directive			IO-Link Interface and System Specification Version 1.1.2

Electrical connections and assignment

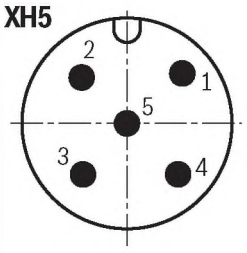
Contact	Interface assignment		
	"A1" (6 + PE)	**"F1"** (6 + PE)	**"C6"** (6 + PE)
A	Supply voltage	Supply voltage	Supply voltage
B	GND	GND	GND, reference potential actual value/enable
C	Reference potential actual value	Reference potential actual value	Enable input
D	Command value	Command value	Command value
E	Reference potential command value	Reference potential command value	Reference potential command value
F	Actual value	Actual value	Actual value
FE	Functional ground (directly connected to the valve housing)		

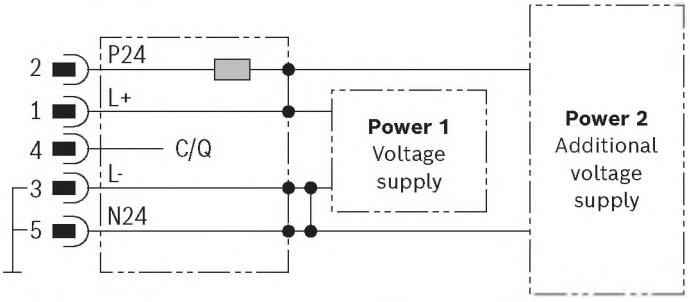


Command value	▶ Command value 0 ... +10 V or 12 ... 20 mA at D and reference potential at E: Flow from P→A and B→T.
	▶ Command value 0 ... −10 V or 12 ... 4 mA at D and reference potential at E: Flow from P→B and A→T.
Actual value	▶ Actual value 0 ... +10 V or 12 ... 20 mA at F and reference potential at C: Flow from P→A and B→T.
	▶ Actual value 0 ... −10 V or 12 ... 4 mA at F and reference potential at C: 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 41) ▶ Alternatively up to 30 m cable length admissible – Apply screening on supply side – Plastic mating connector (see page 41) can be used

☞ **Notice:**
Mating connectors, separate order, see page 41 and data sheet 08006.

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

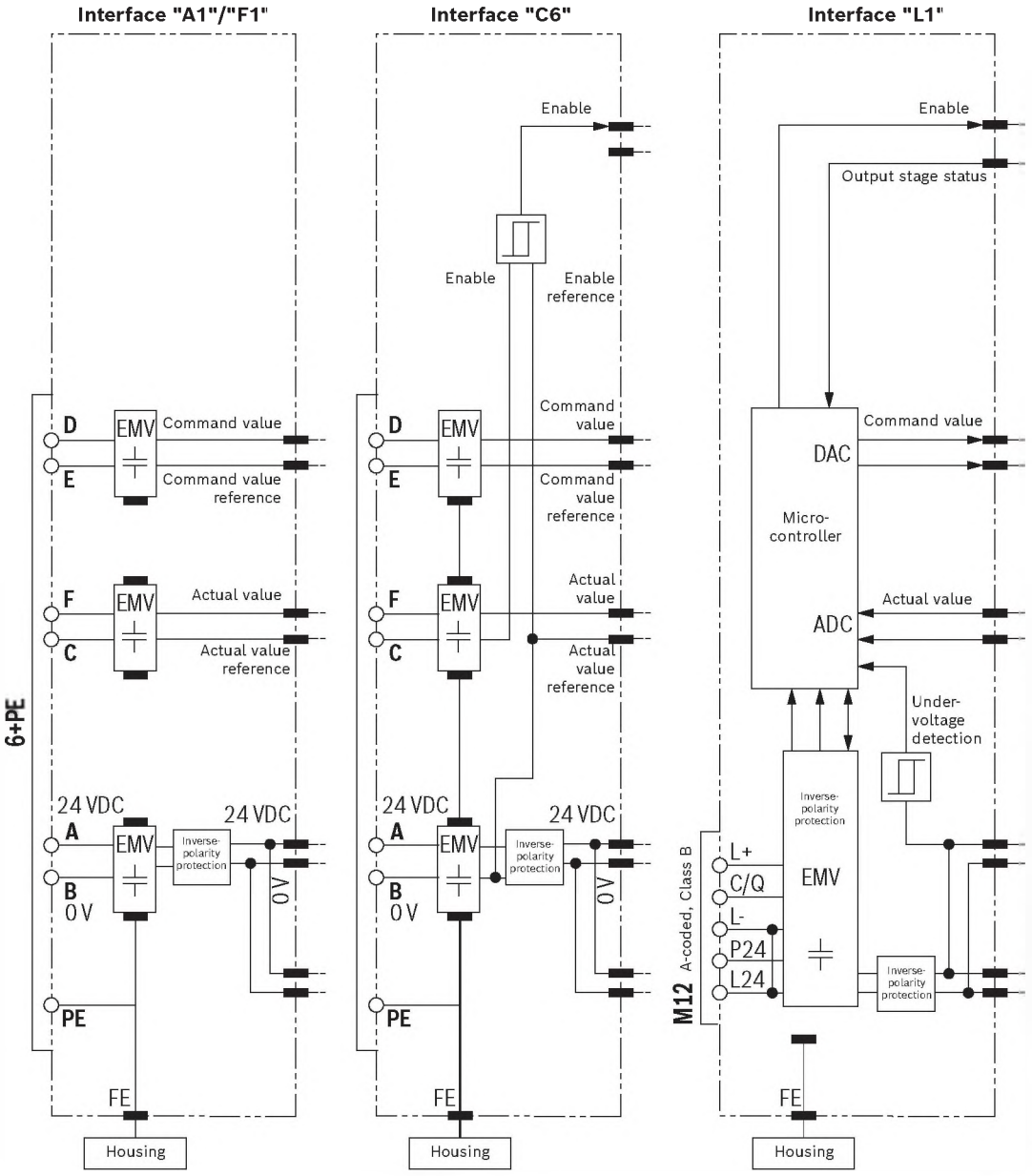




☞ **Notice:**
- ▶ M12 sensor/actuator connection line, 5-pole; M12 connector/bush, A-coded, without shield, maximum cable length 20 m. Observe the voltage drop over the cable. Wire cross-section at least 0.34 mm².
- ▶ Mating connectors, separate order, see page 41 and data sheet 08006.
- ▶ For the communication 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.

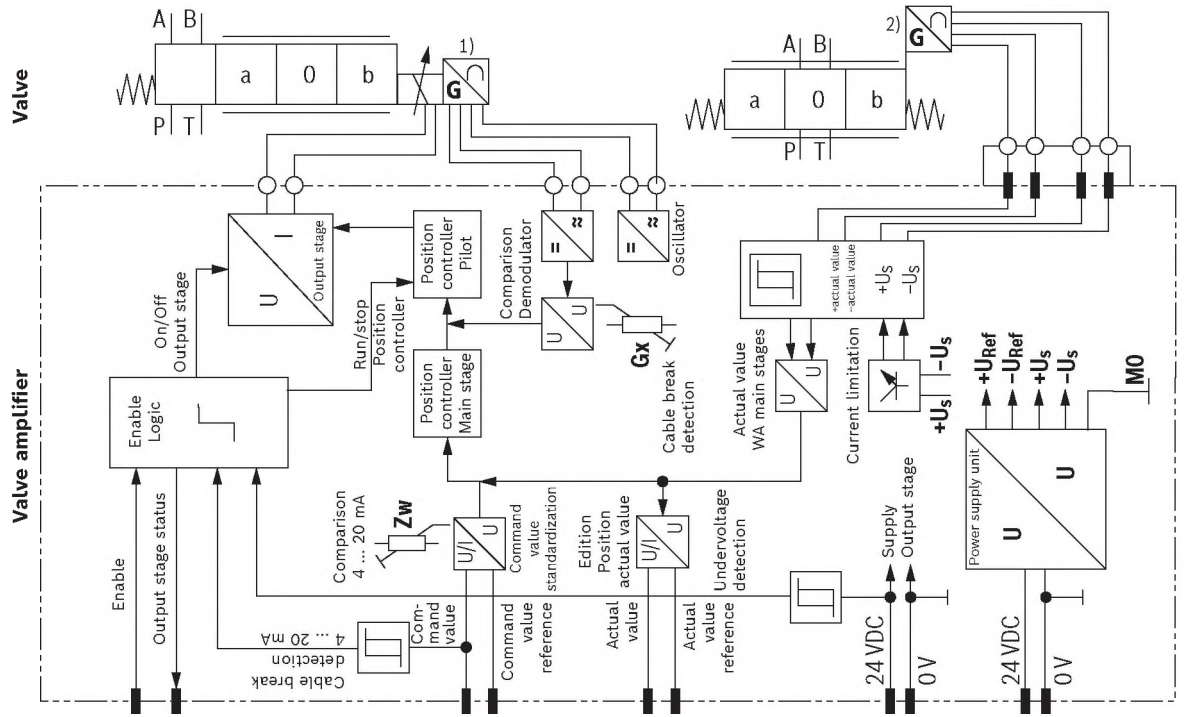


1) Position transducer, pilot control valve
2) Position transducer, main valve

Notice:

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

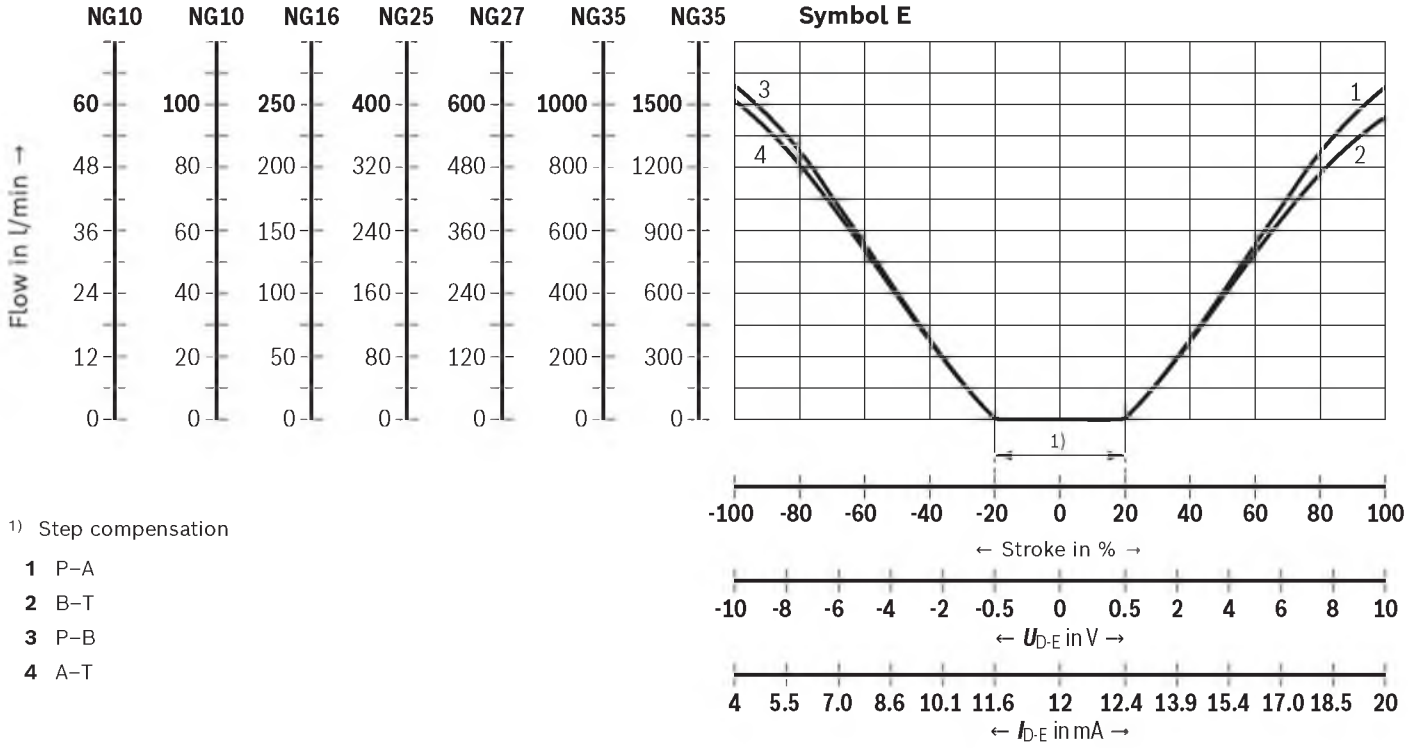
Block diagram/controller function block



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

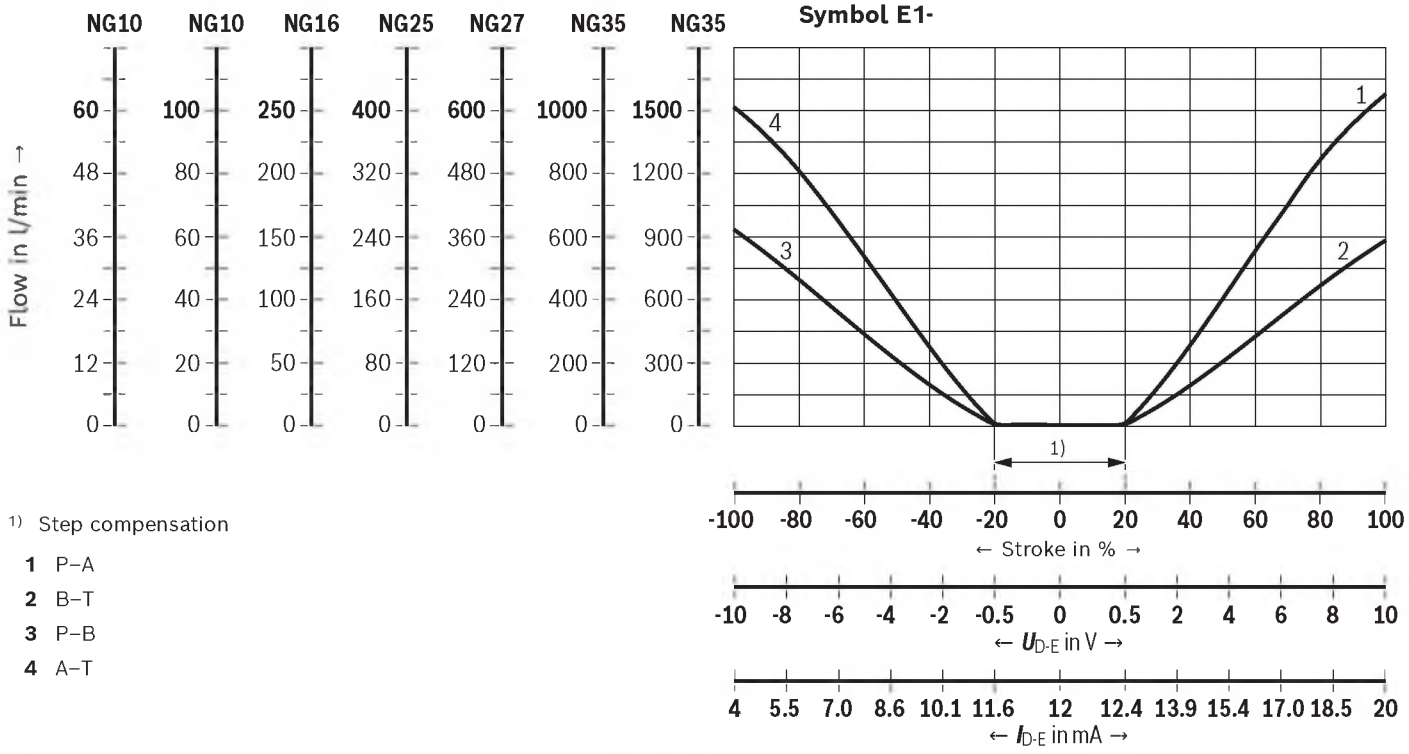
Characteristic curves: Flow characteristic "L"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T



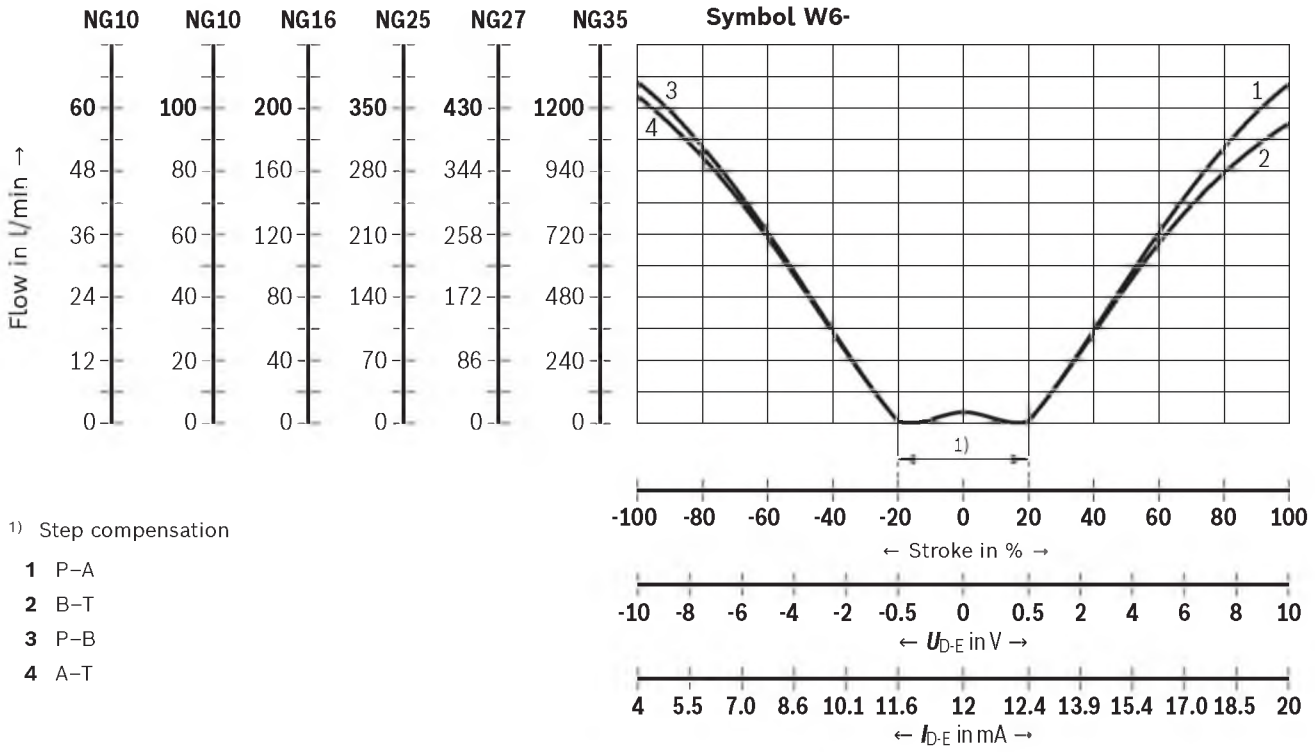
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

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

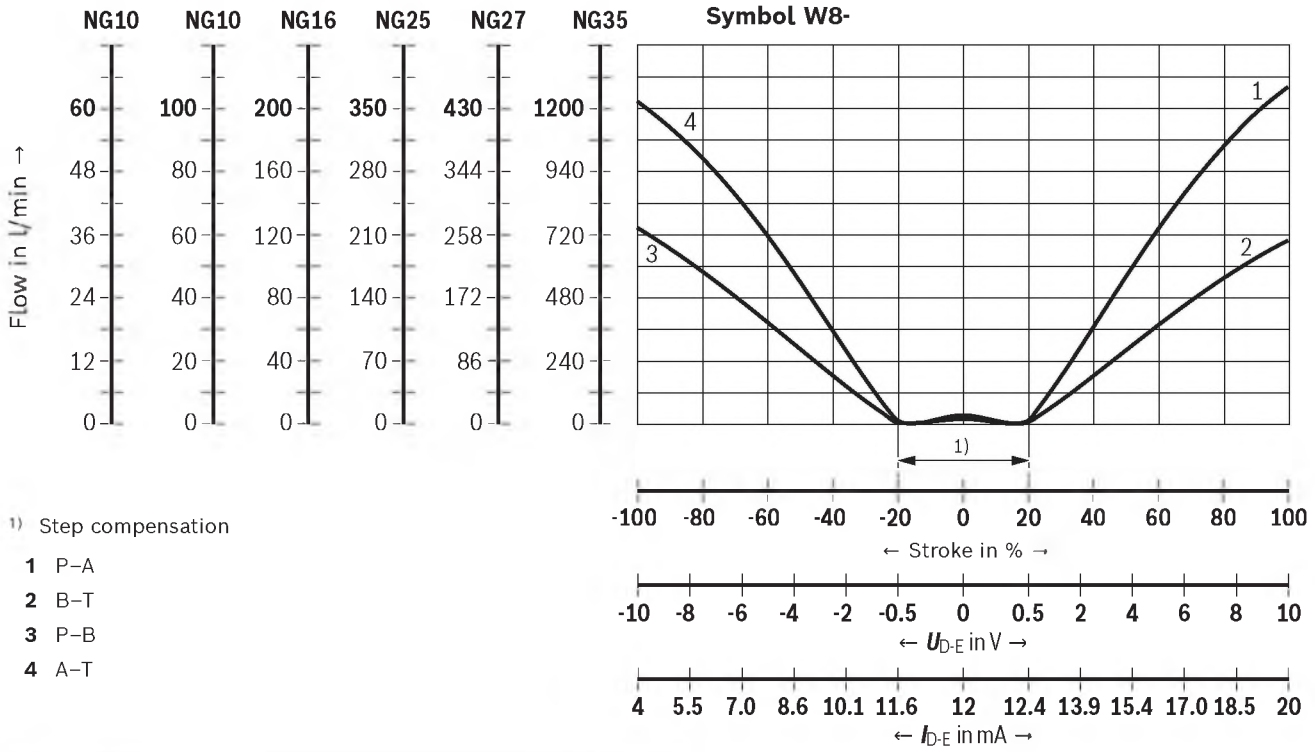
Characteristic curves: Flow characteristic "L"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T



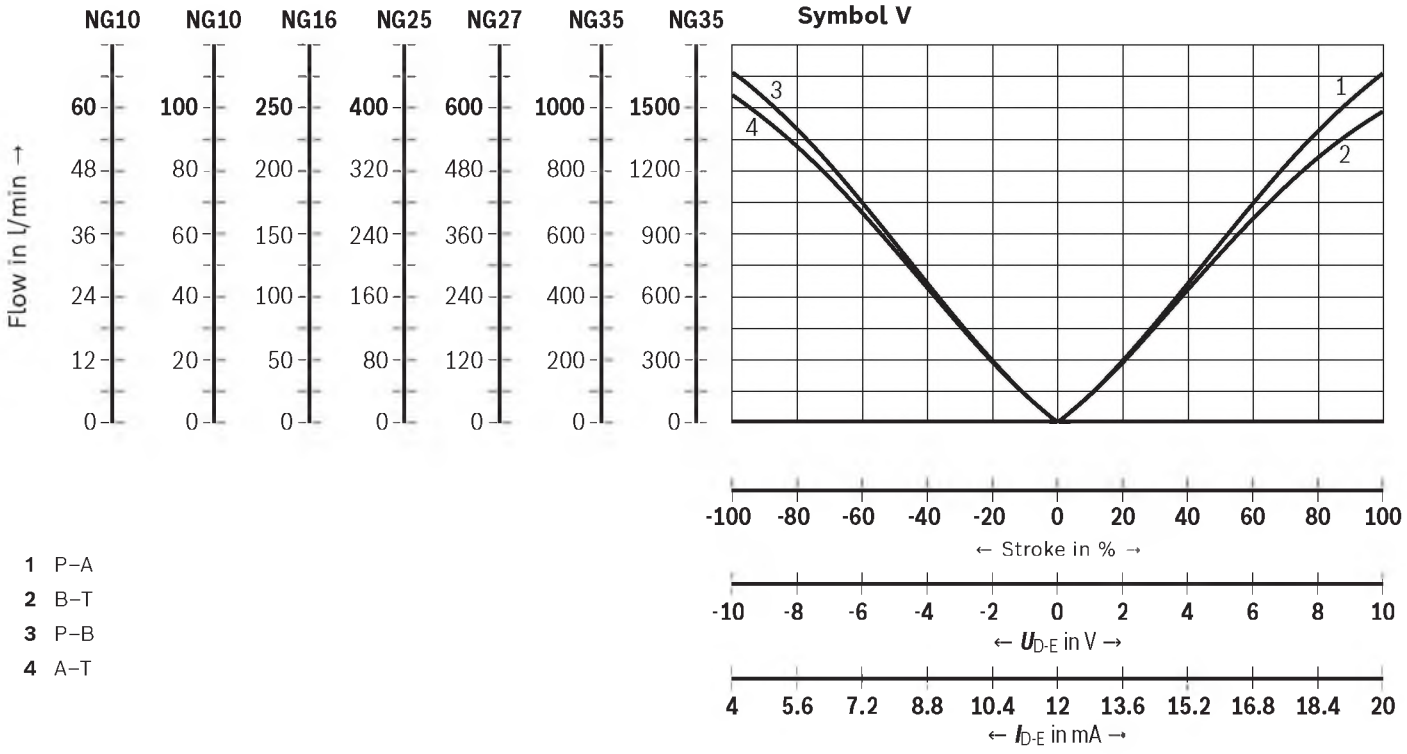
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

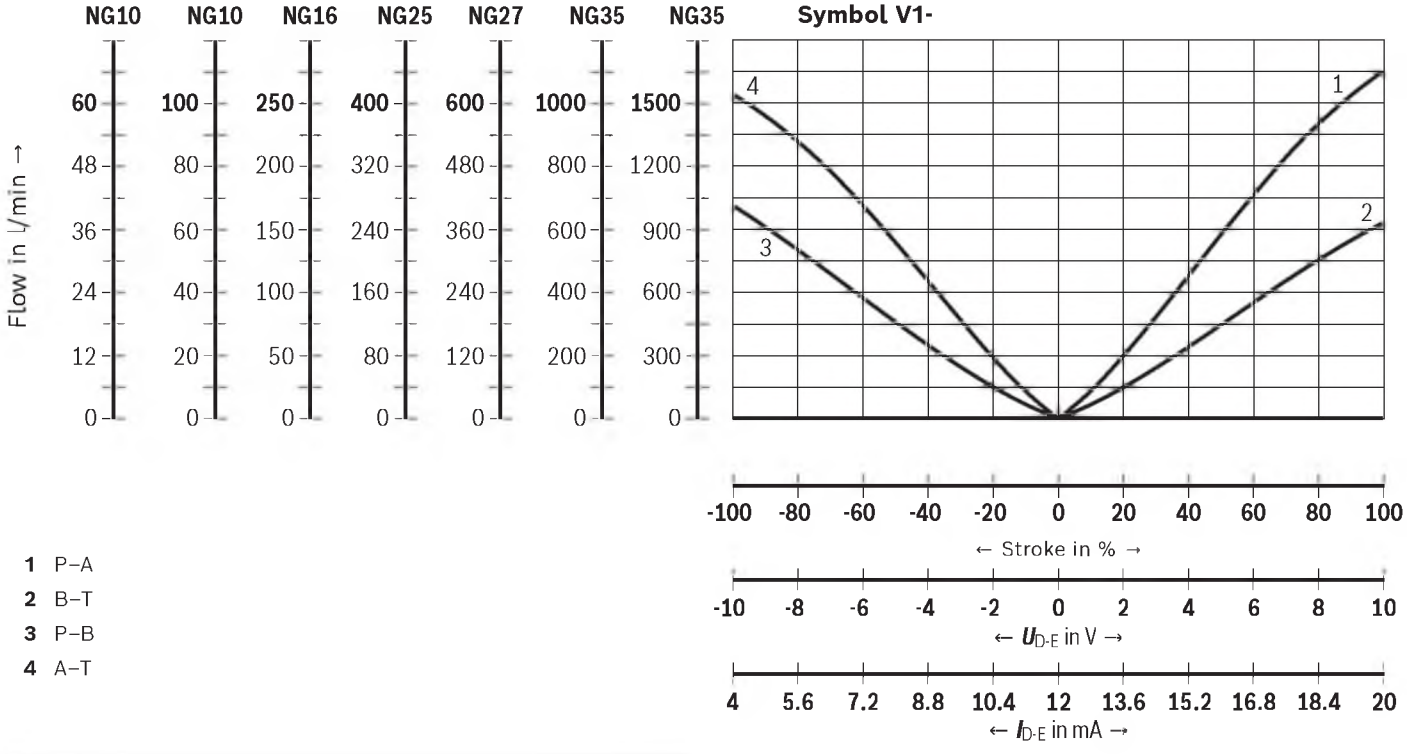
Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Flow characteristic "L"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1 P–A
2 B–T
3 P–B
4 A–T

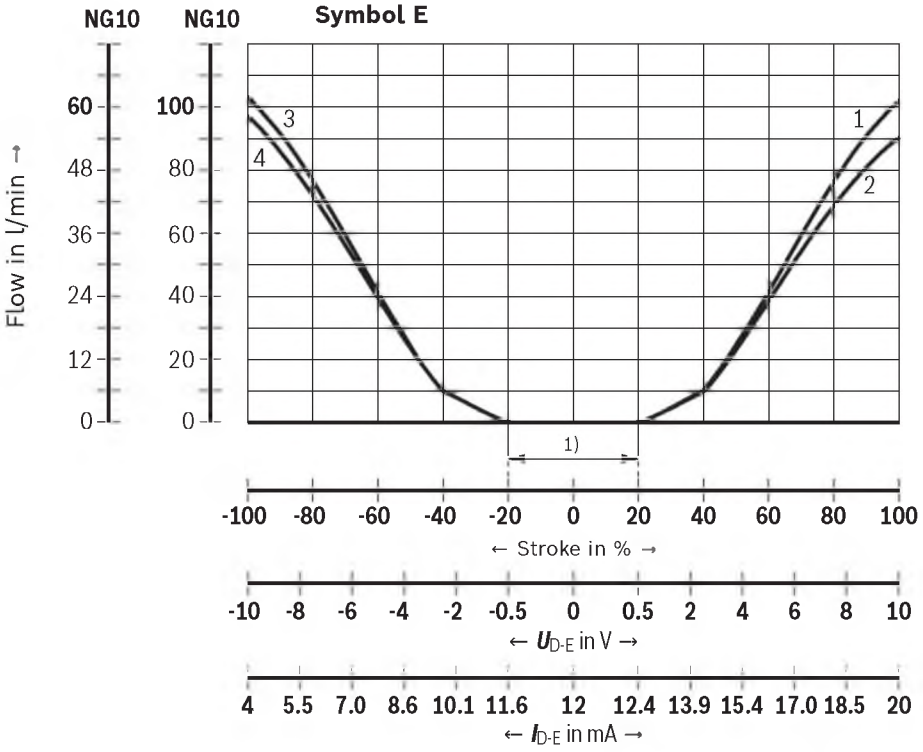


1 P–A
2 B–T
3 P–B
4 A–T

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

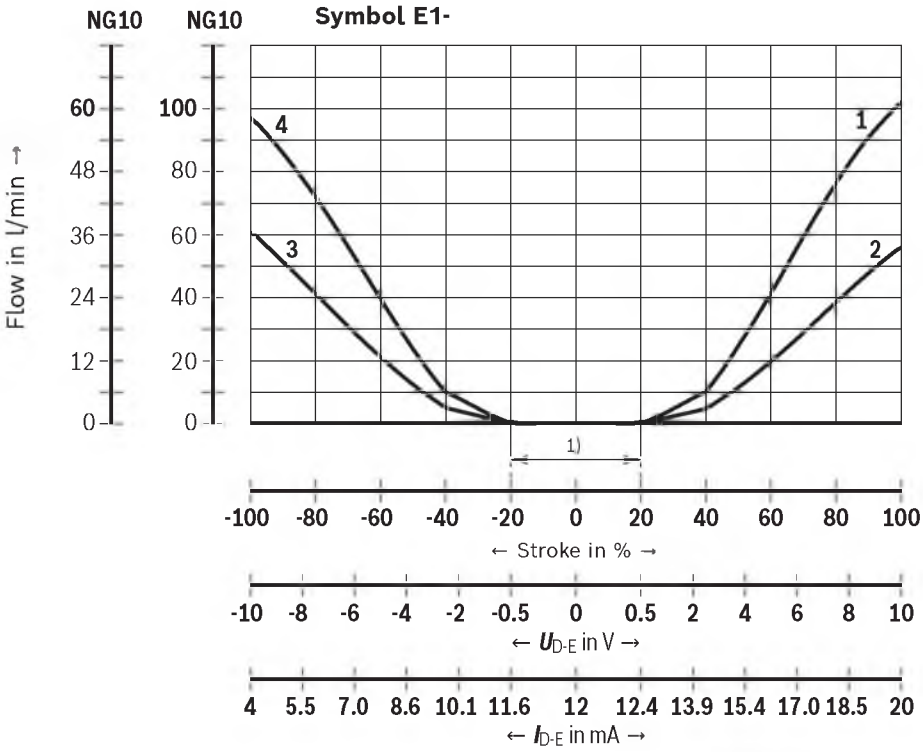
Characteristic curves: Flow characteristic "P"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T



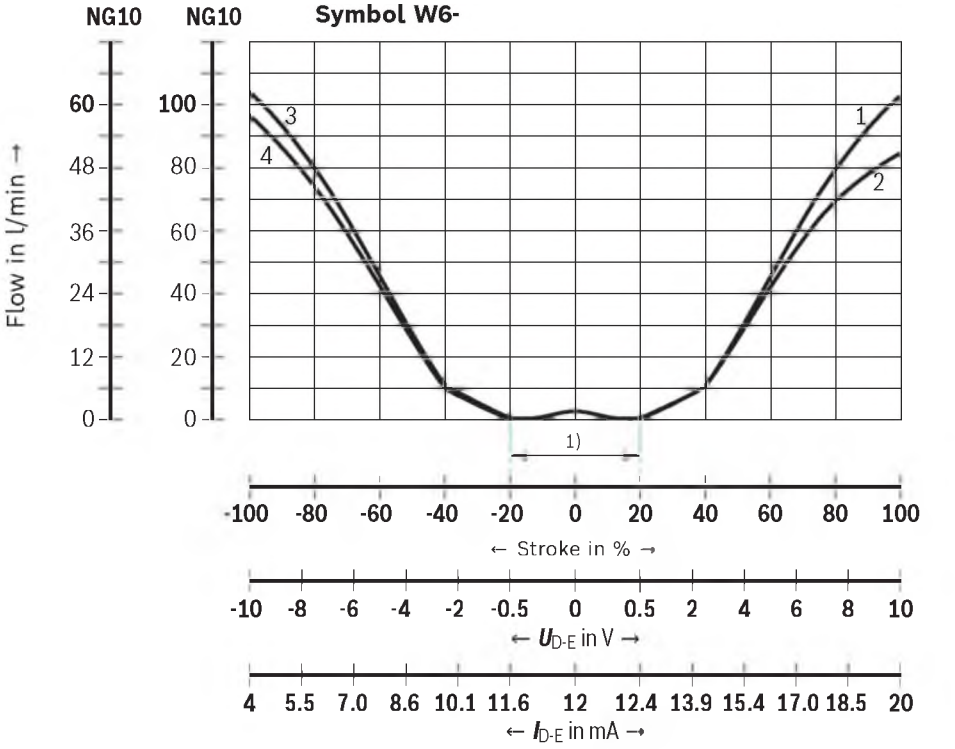
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

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

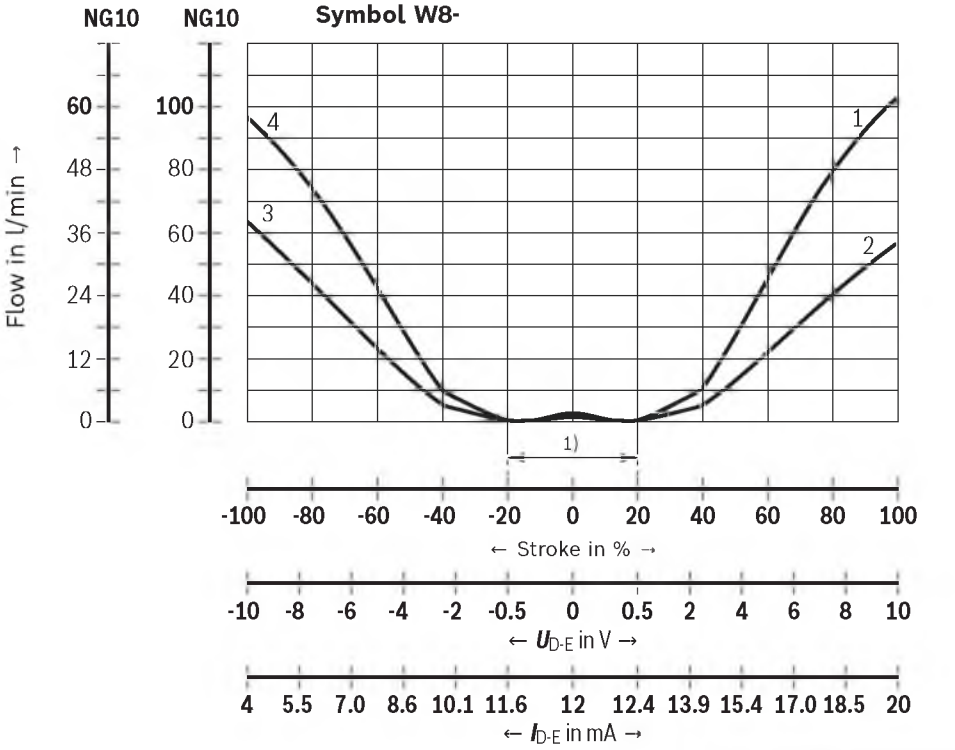
Characteristic curves: Flow characteristic "P"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T



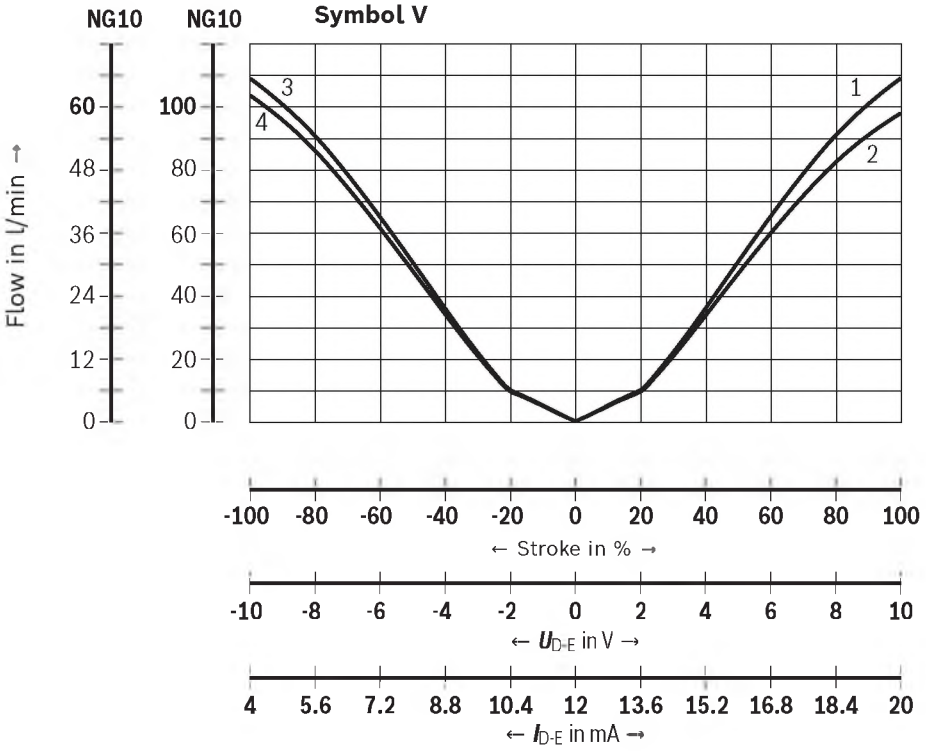
1) Step compensation

1 P–A
2 B–T
3 P–B
4 A–T

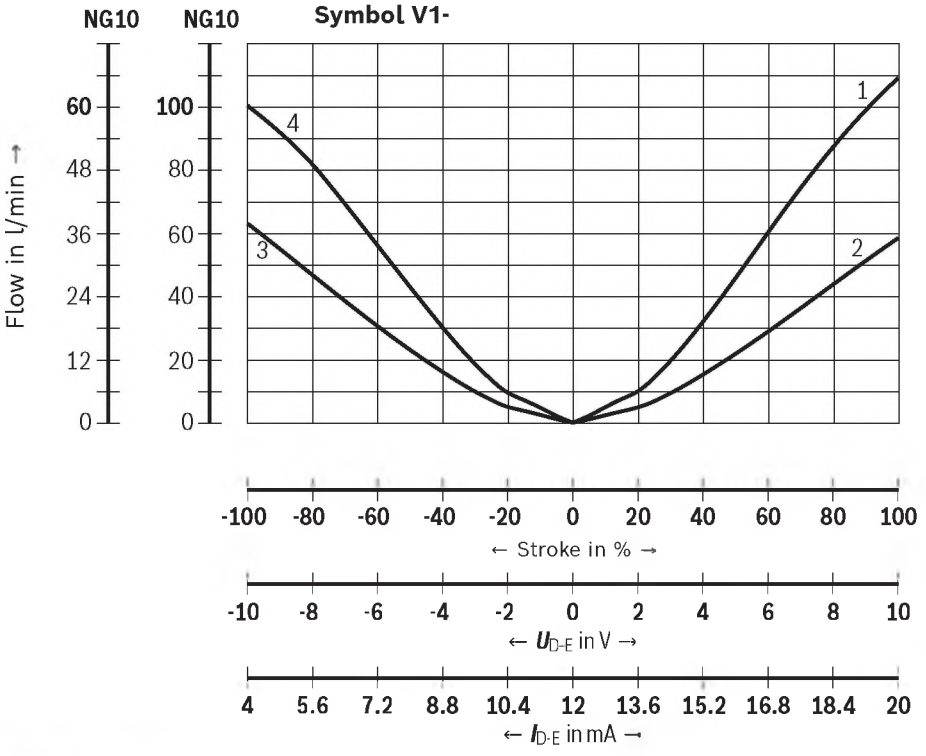
Notice:
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Flow characteristic "P"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function



1 P–A
2 B–T
3 P–B
4 A–T



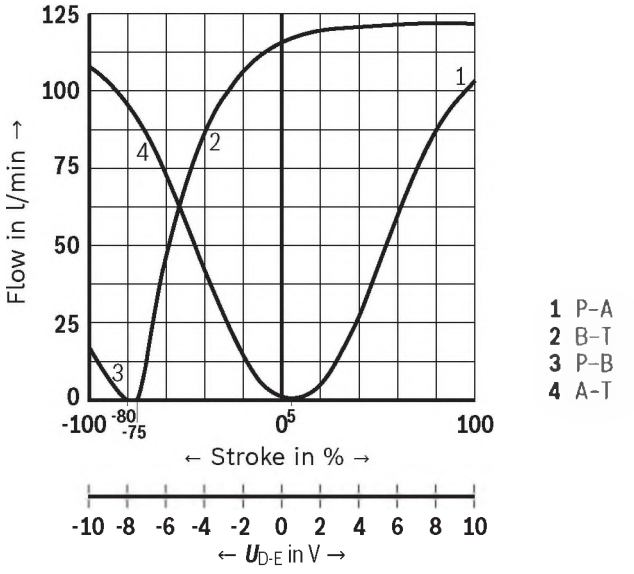
1 P–A
2 B–T
3 P–B
4 A–T

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

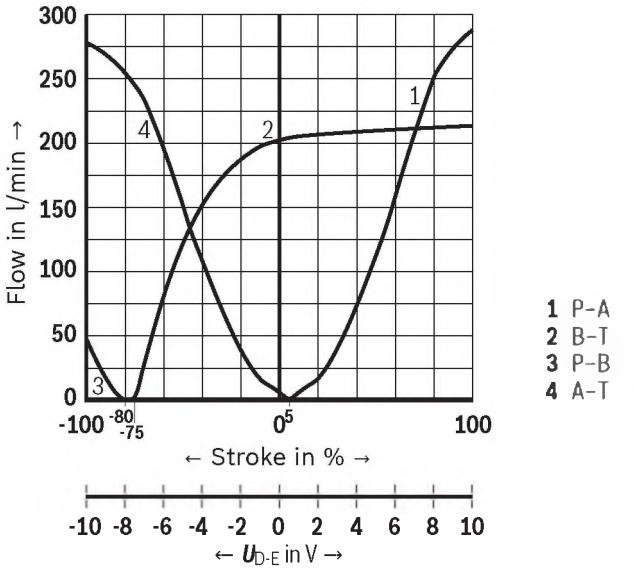
Characteristic curves: Flow characteristic "M"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function

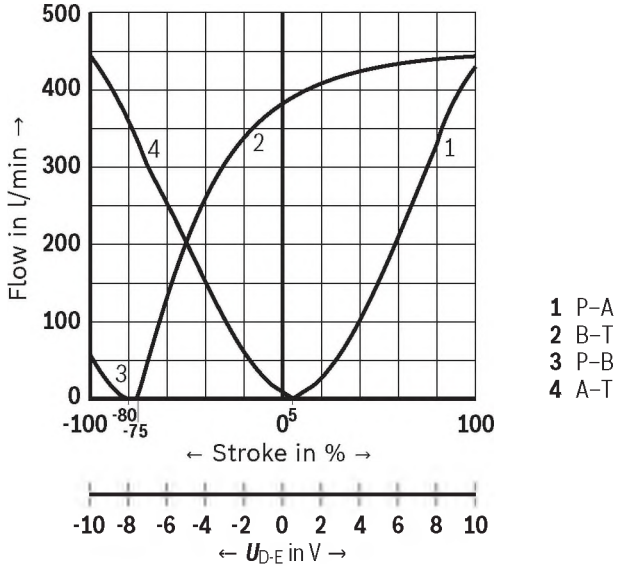
Symbol Q3, version "100"



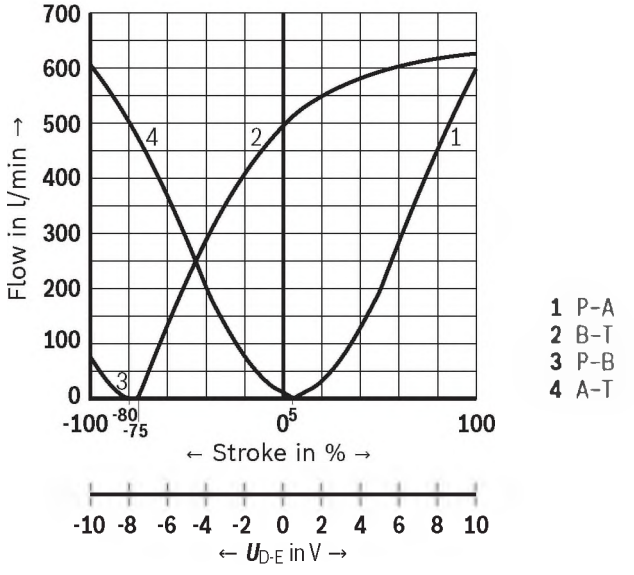
Symbol Q3, version "250"



Symbol Q3, version "400"



Symbol Q3, version "600"

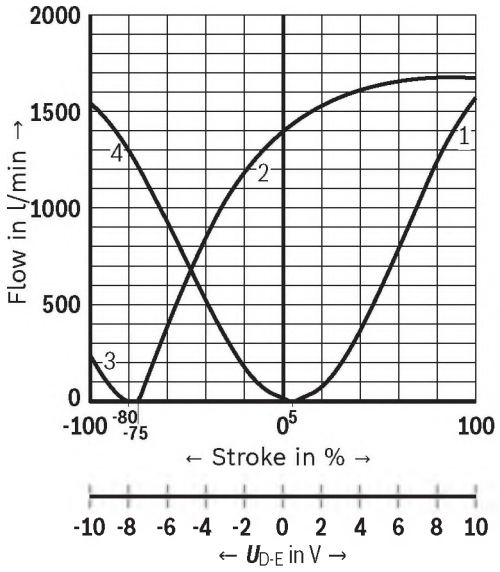


☞ **Notice:**
Typical characteristic curves which are subject to tolerance variations.

Characteristic curves: Flow characteristic "M"
(valid for HLP46, ϑ_{oil} = 40 ±5 °C; Δp = 5 bar/control edge)

Flow/signal function

Symbol Q3, version "1500"

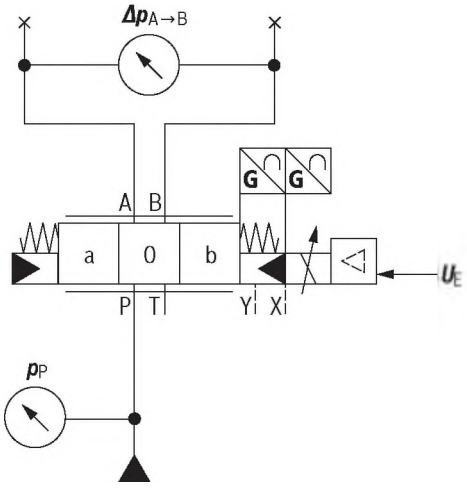


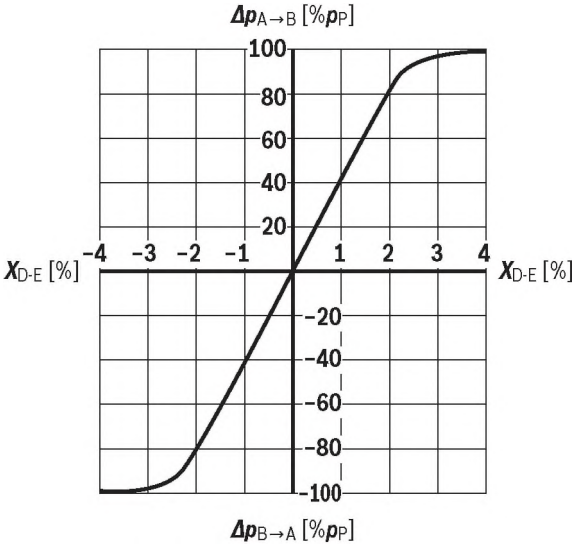
1 P–A
2 B–T
3 P–B
4 A–T

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

Characteristic curves
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

Pressure/signal characteristic curve

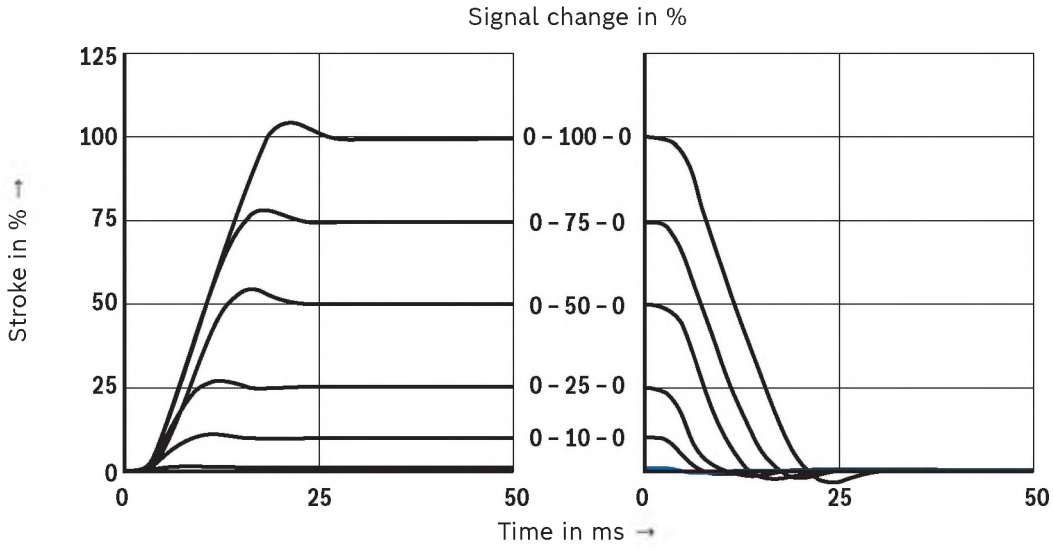




Characteristic curves: Size 10
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

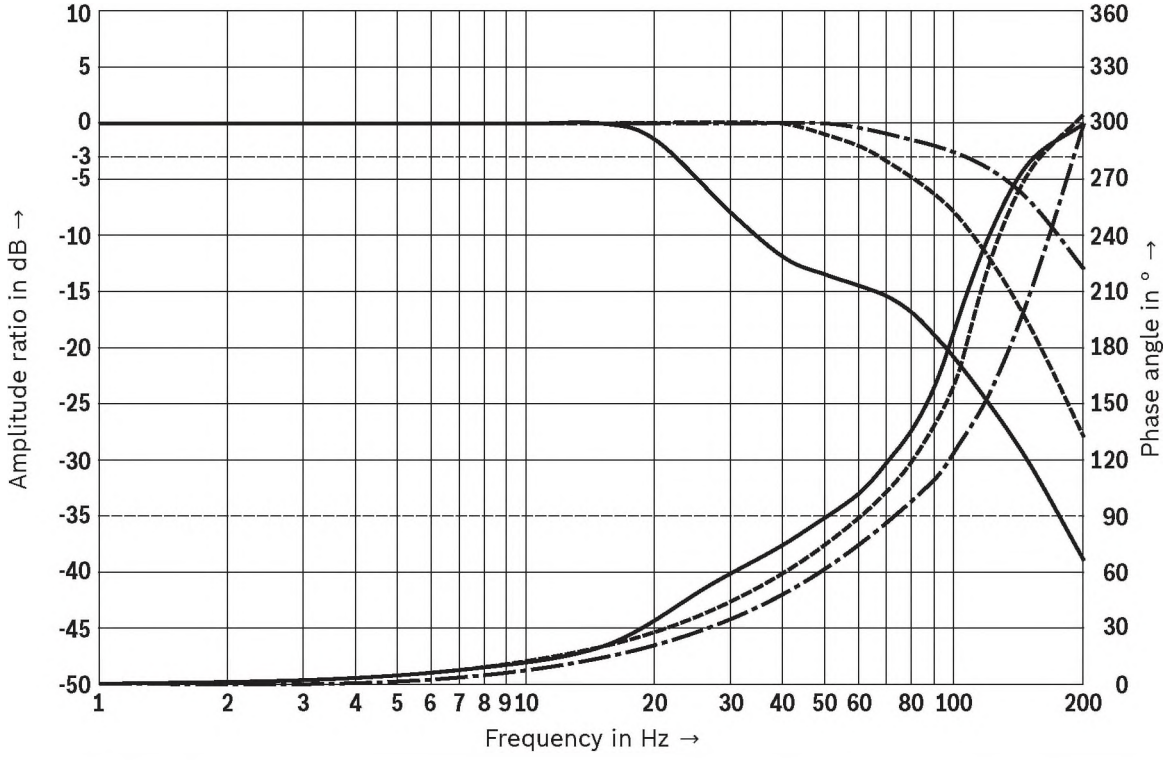
Transition function with stepped electric input signals

Symbols V and Q3-



Frequency response

Symbols V and Q3-



Signal ±5%

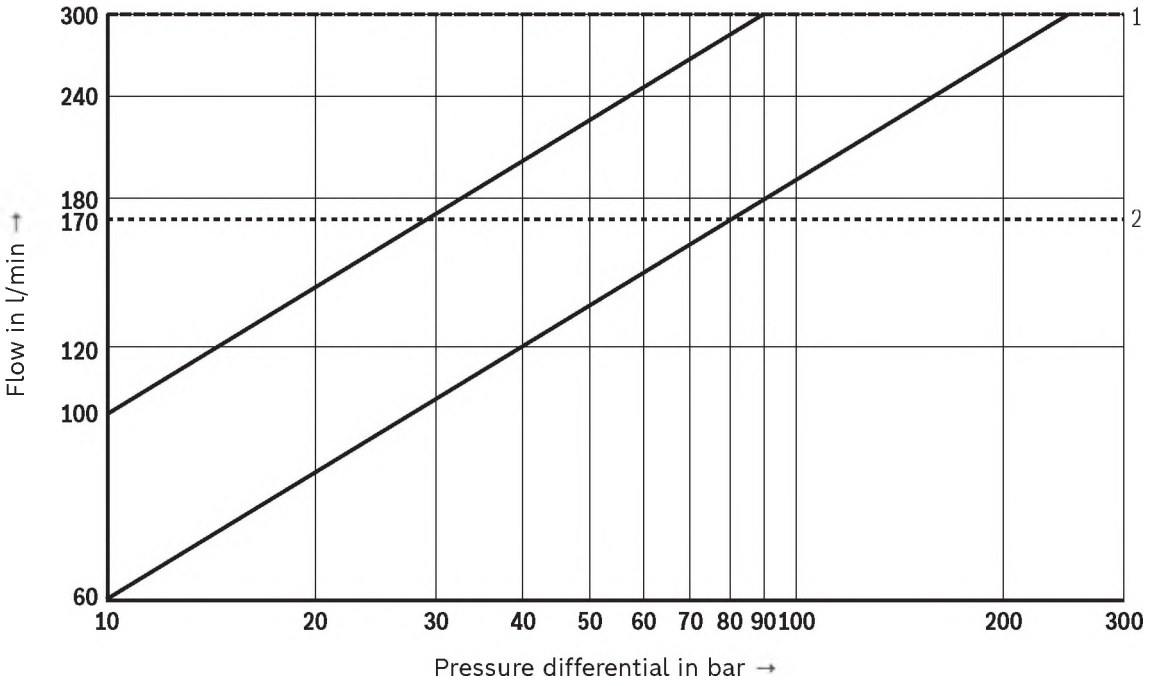
Signal ±25%

Signal ±100%

Notice:
- Typical characteristic curves which are subject to tolerance variations.
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Characteristic curves: Size 10
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



1 Maximum admissible flow

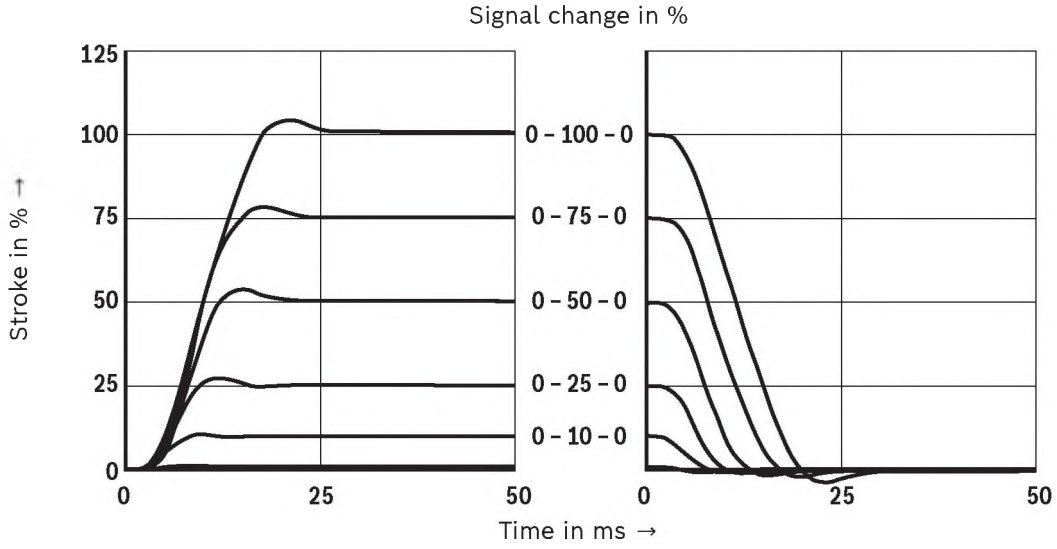
2 Recommended flow
(flow velocity 30 m/s)

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

Characteristic curves: Size 16
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

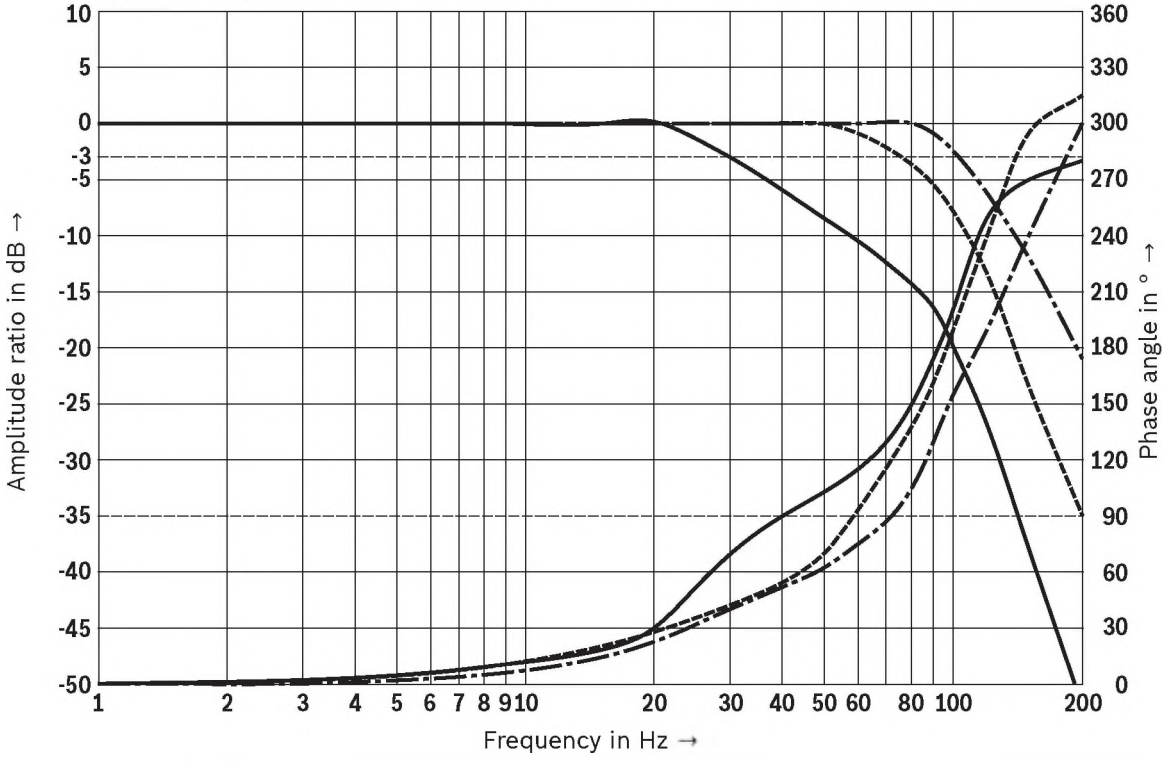
Transition function with stepped electric input signals

Symbols V and Q3-



Frequency response

Symbols V and Q3-



Signal ±5%

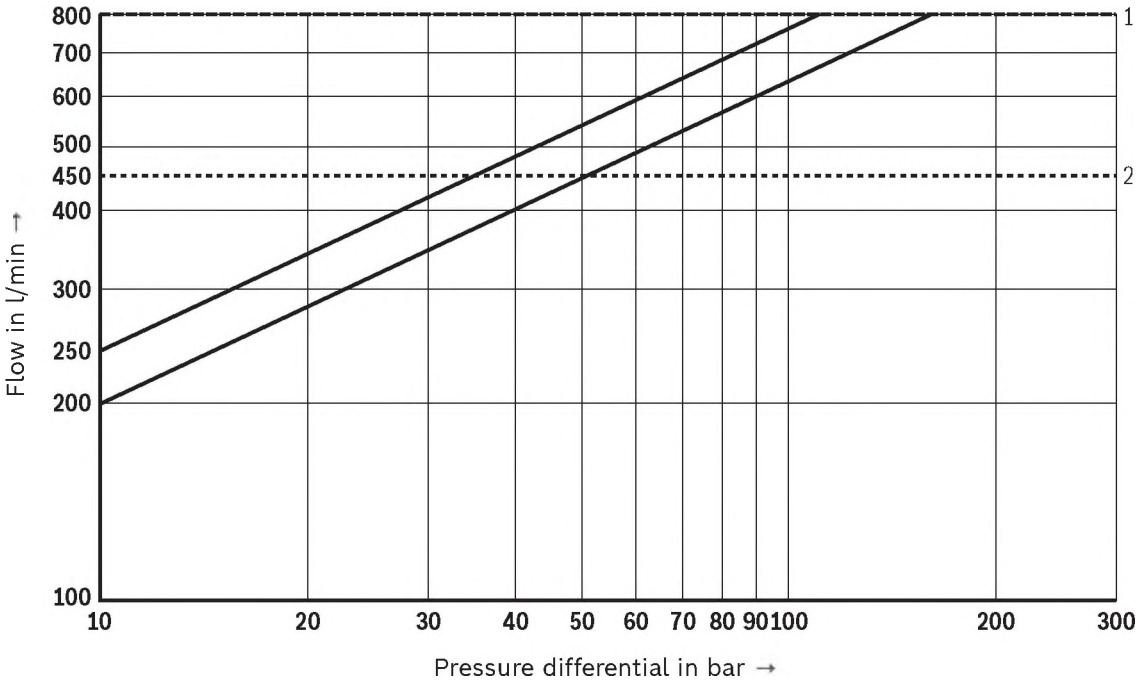
Signal ±25%

Signal ±100%

Notice:
- Typical characteristic curves which are subject to tolerance variations.
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Characteristic curves: Size 16
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



1 Maximum admissible flow

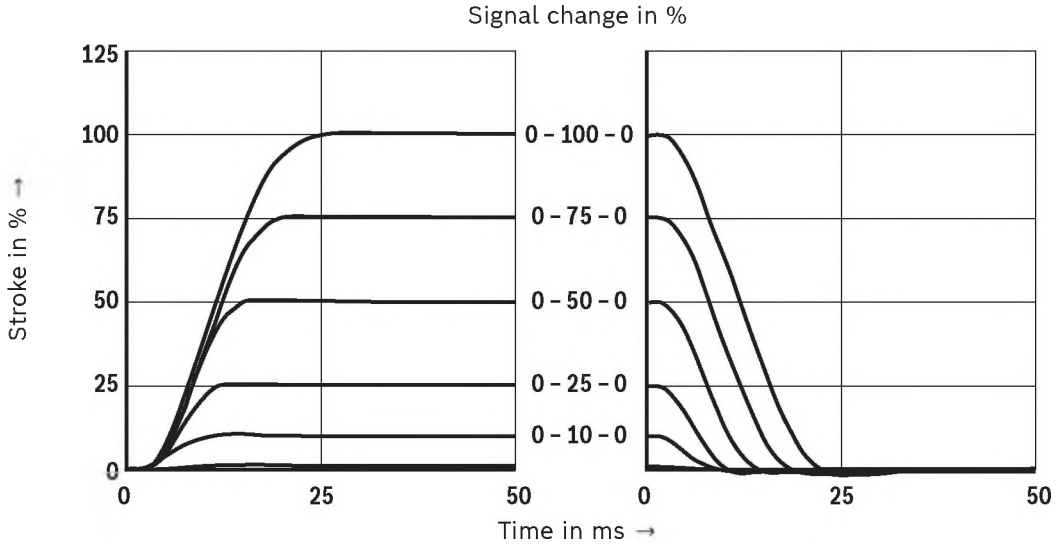
2 Recommended flow
(flow velocity 30 m/s)

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

Characteristic curves: Size 25
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

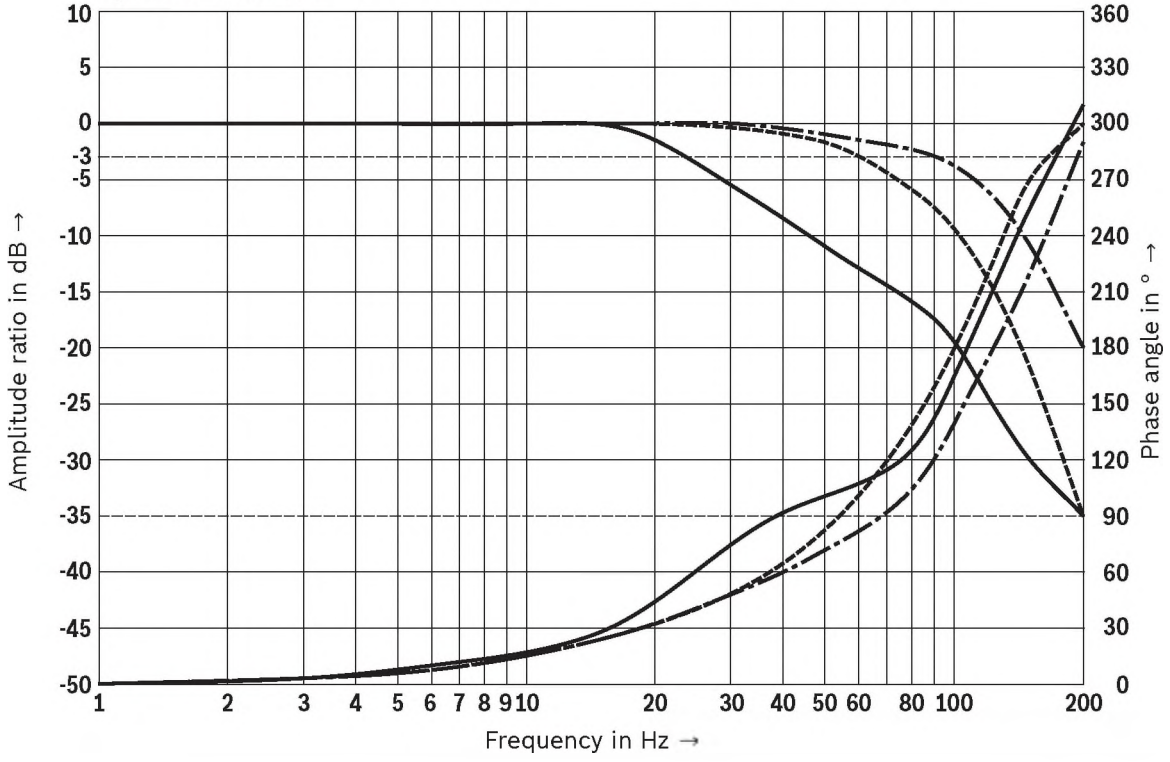
Transition function with stepped electric input signals

Symbols V and Q3-



Frequency response

Symbols V and Q3-



Signal ±5%

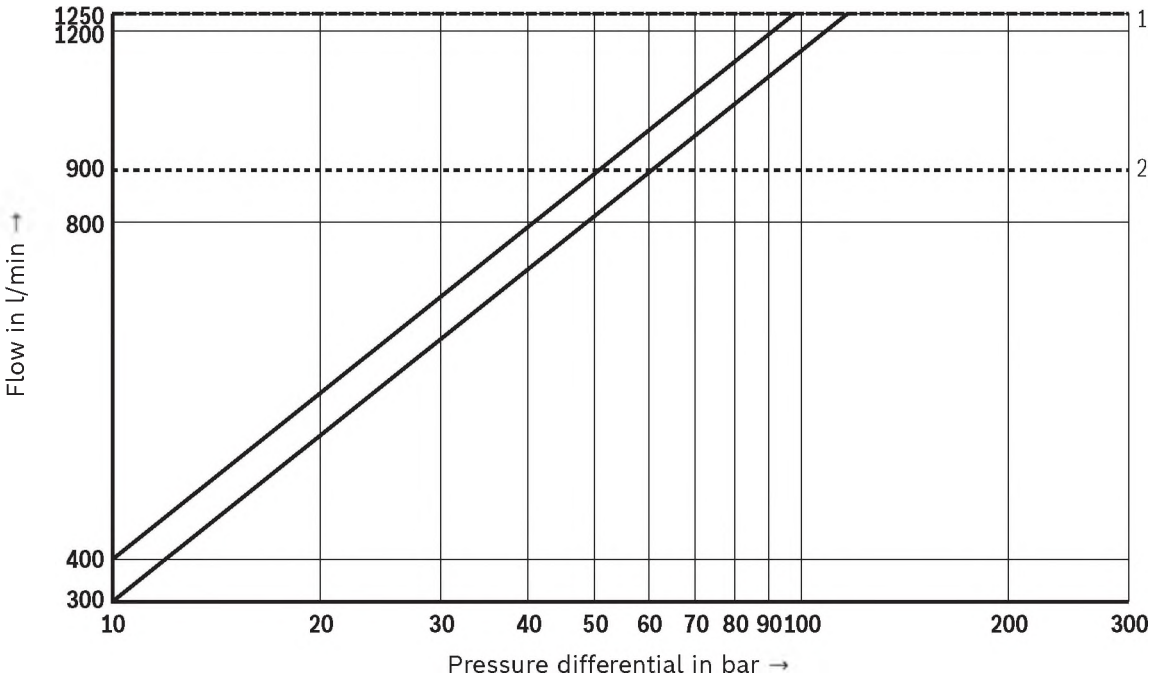
Signal ±25%

Signal ±100%

Notice:
- Typical characteristic curves which are subject to tolerance variations.
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Characteristic curves: Size 25
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



1 Maximum admissible flow

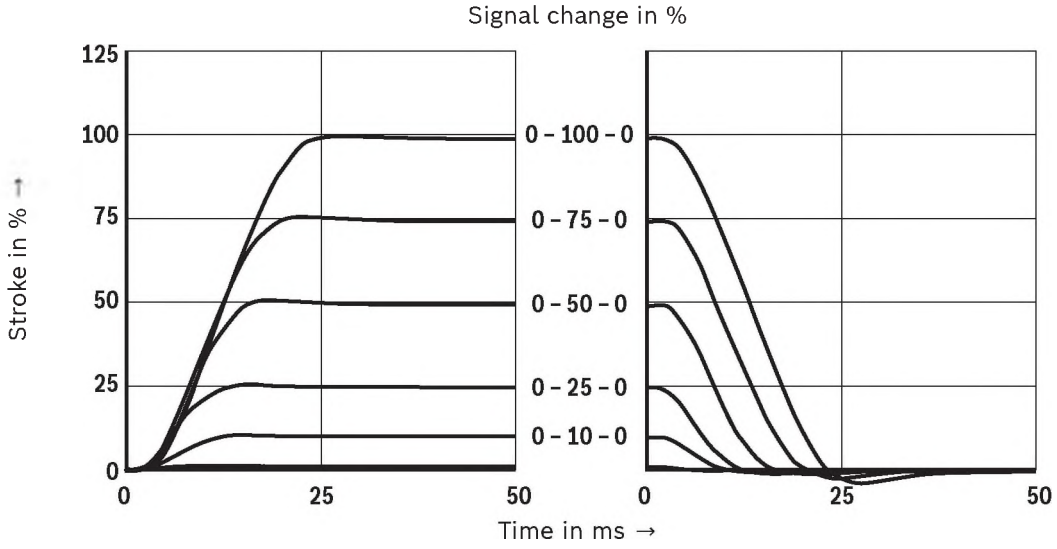
2 Recommended flow
(flow velocity 30 m/s)

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

Characteristic curves: Size 27
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

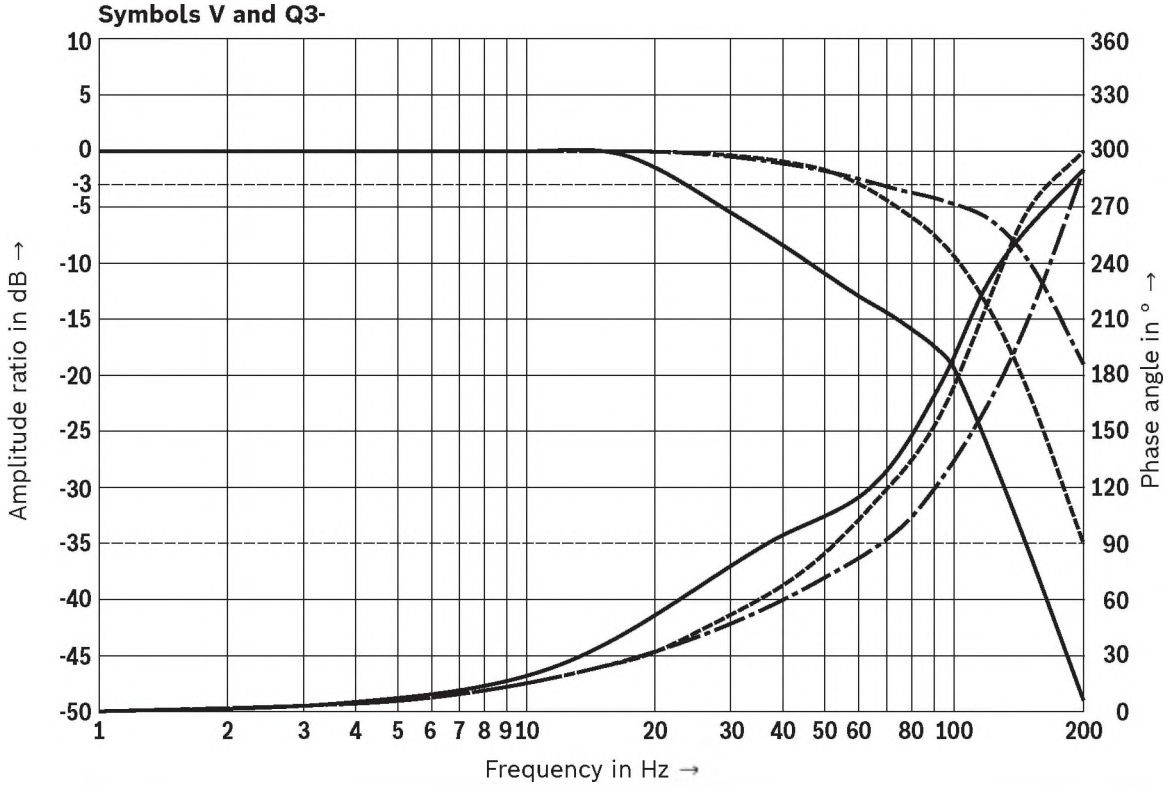
Transition function with stepped electric input signals

Symbols V and Q3-



Frequency response

Symbols V and Q3-



Signal ±5%

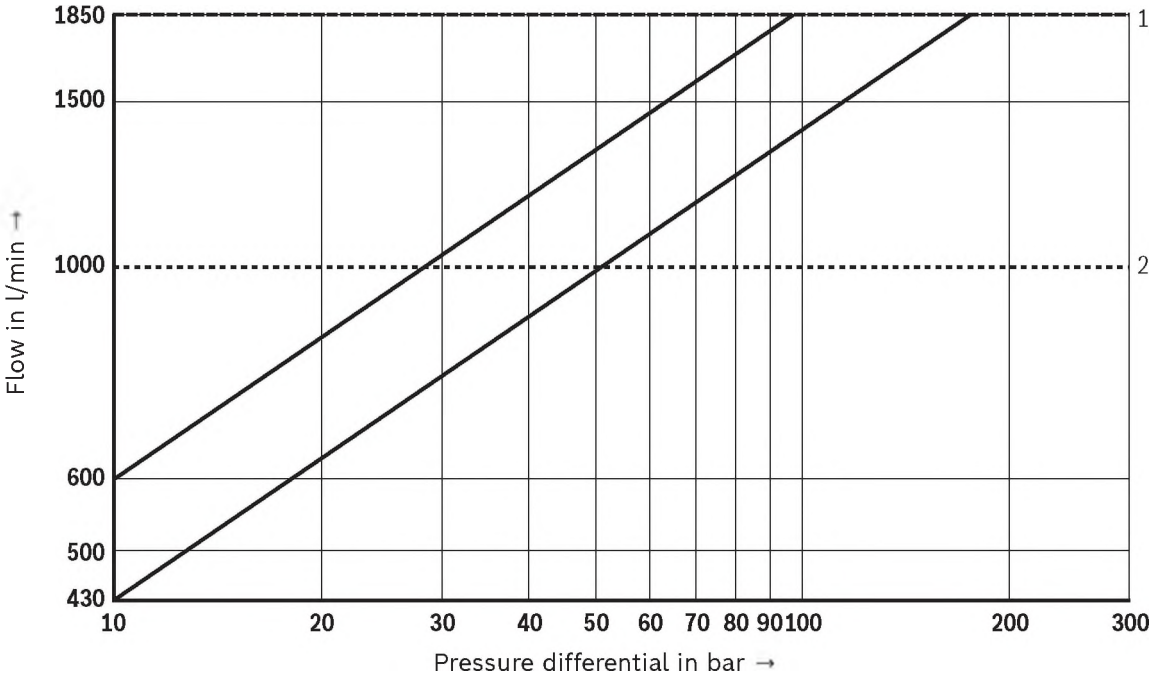
Signal ±25%

Signal ±100%

Notice:
- Typical characteristic curves which are subject to tolerance variations.
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Characteristic curves: Size 27
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)



1 Maximum admissible flow

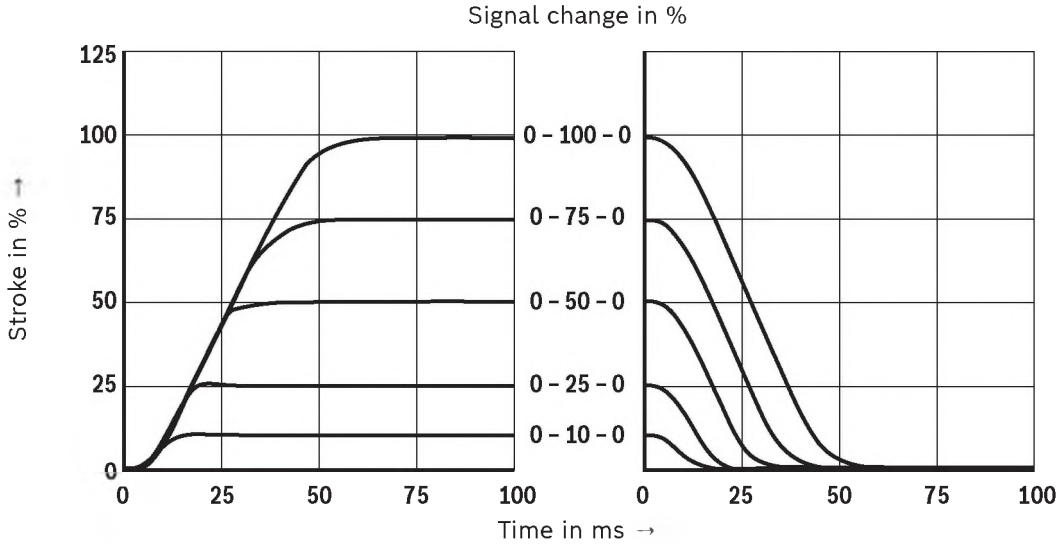
2 Recommended flow
(flow velocity 30 m/s)

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

Characteristic curves: Size 35
(measured with HLP46, ϑ_{oil} = 40 ±5 °C)

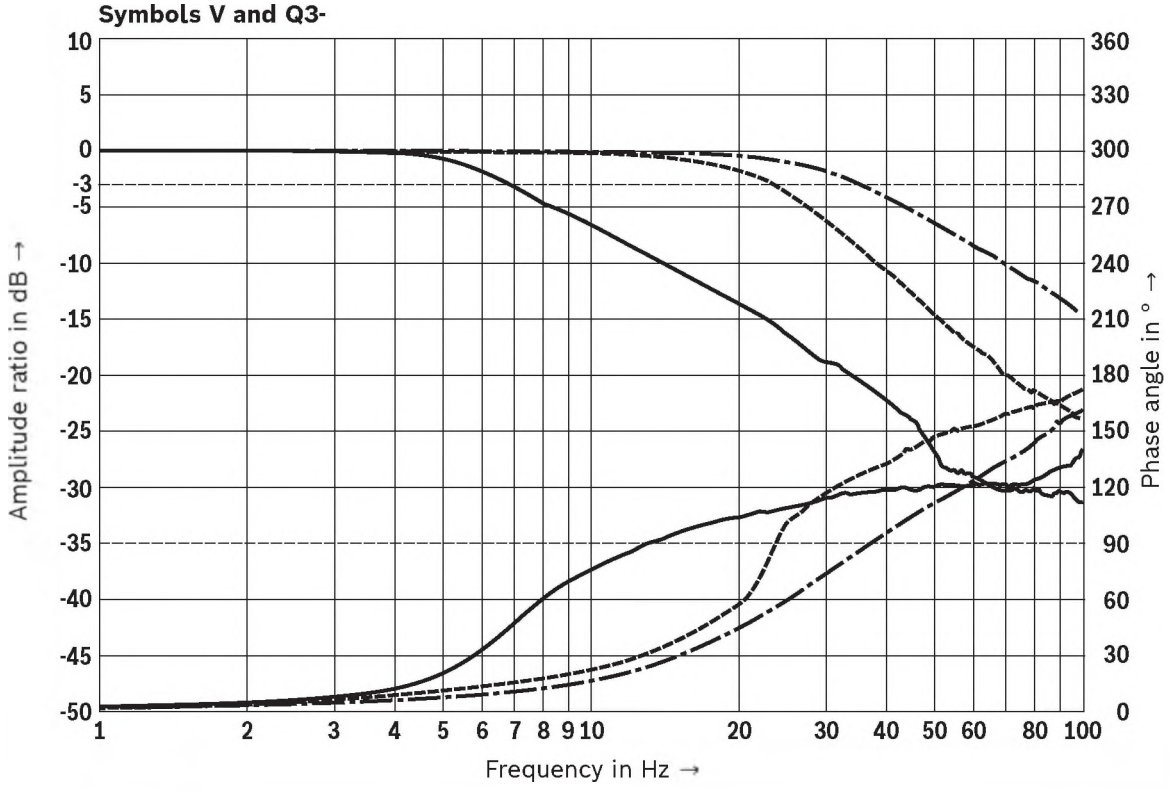
Transition function with stepped electric input signals

Symbols V and Q3-



Frequency response

Symbols V and Q3-



Signal ±5%

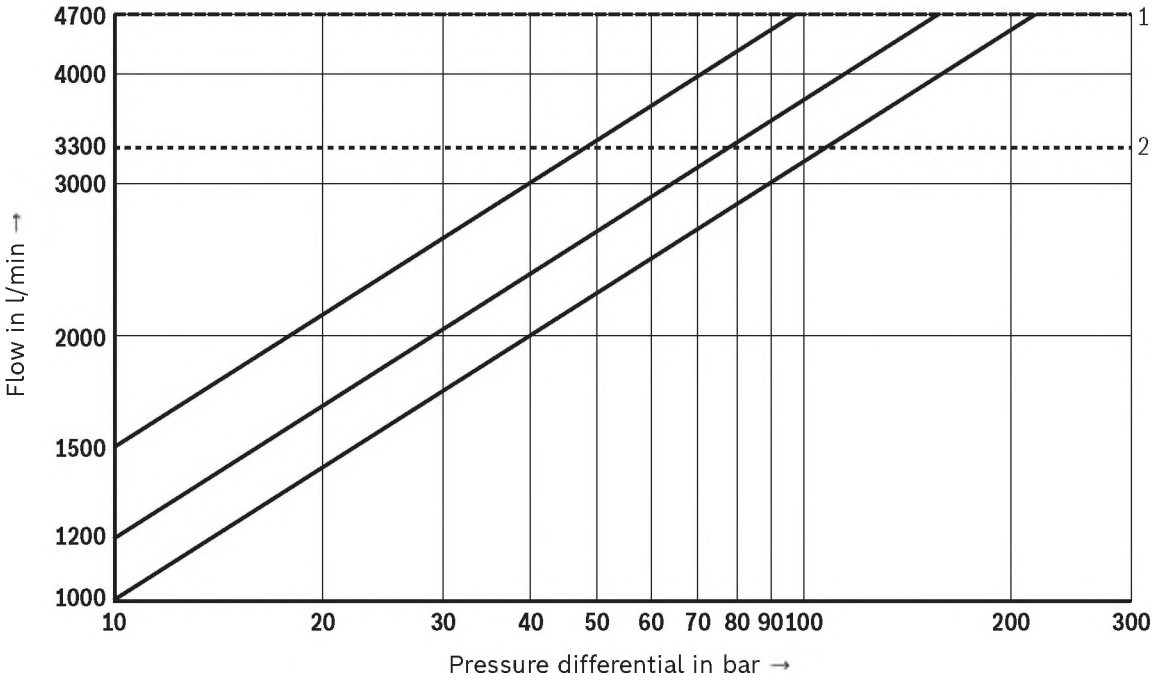
Signal ±25%

Signal ±100%

Notice:
- Typical characteristic curves which are subject to tolerance variations.
- Main valve, port P = 10 bar
- Pilot control valve, port X = 210 bar

Characteristic curves: Size 35
(valid for HLP46, ϑ_{oil} = 40 ±5 °C)

Flow/load function (with maximum valve opening; tolerance ±10%)

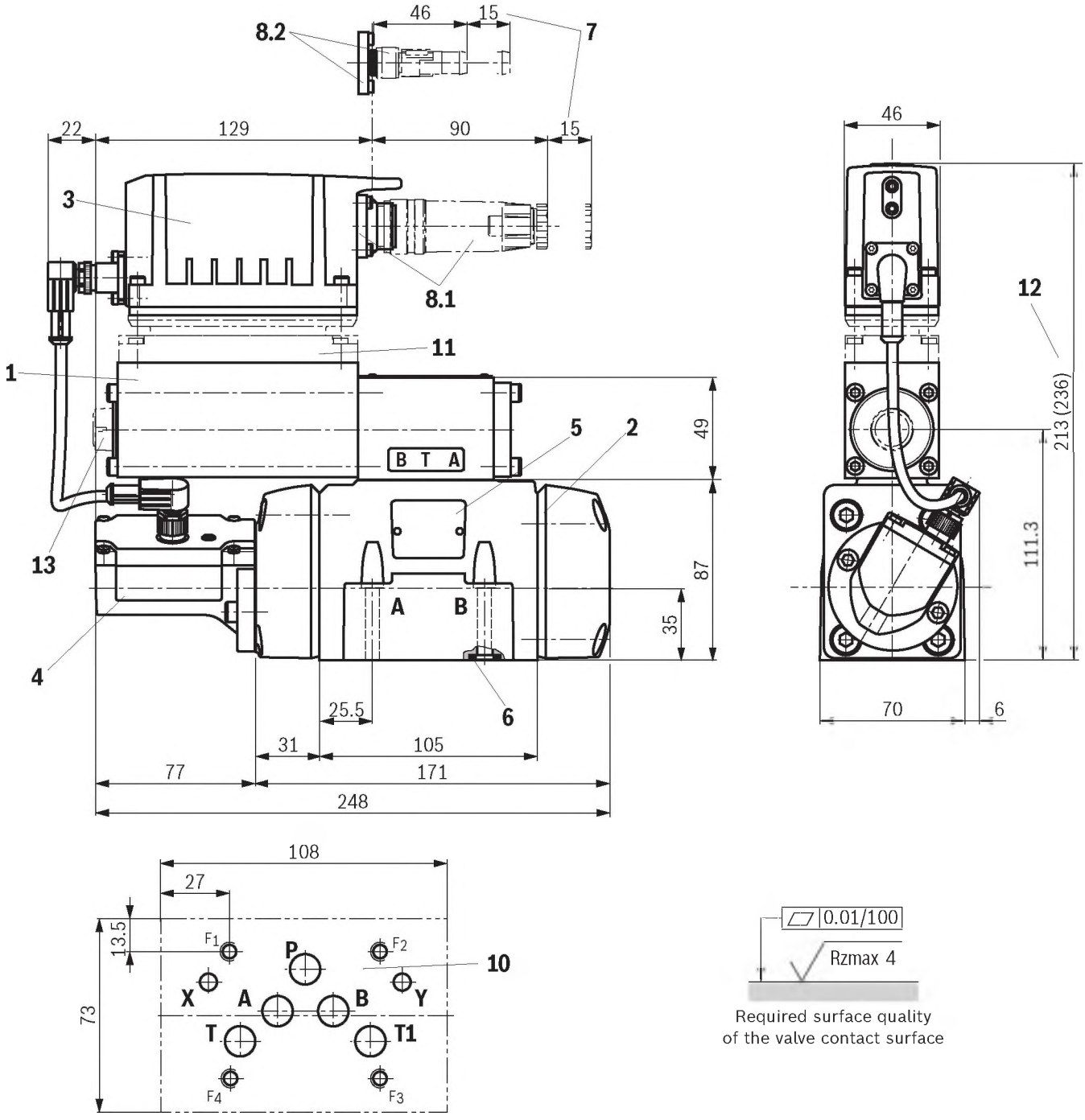


1 Maximum admissible flow

2 Recommended flow
(flow velocity 30 m/s)

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

Dimensions: Size 10
(dimensions in mm)

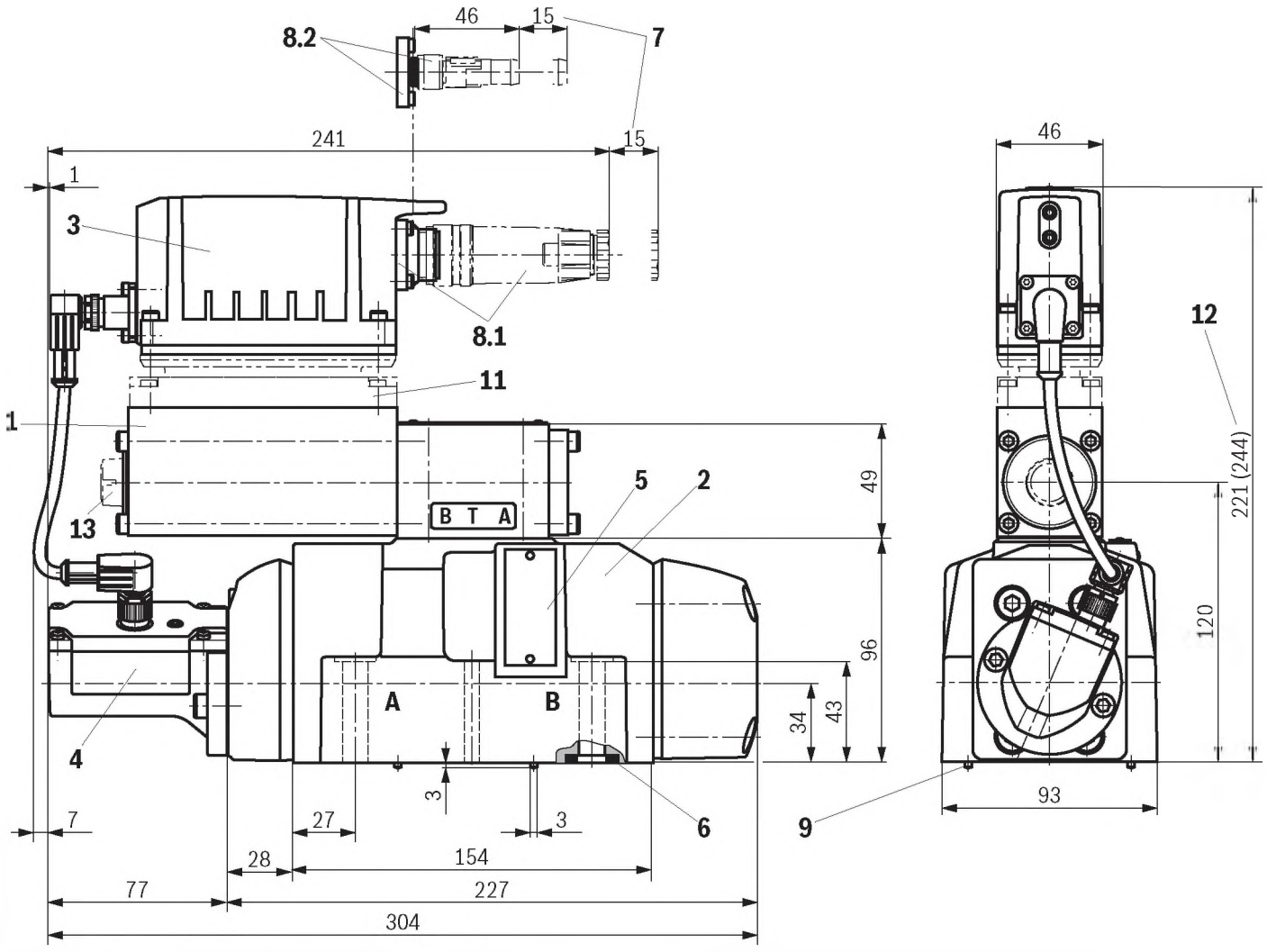


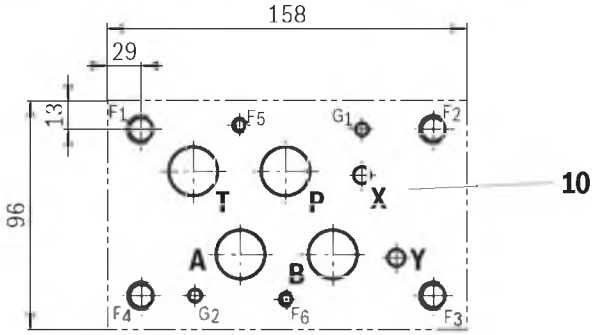
Required surface quality
of the valve contact surface

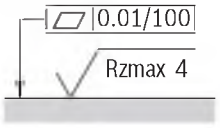
Item explanations, see page 39. **Valve mounting screws** and **subplates**, see page 40.

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

Dimensions: Size 16
(dimensions in mm)





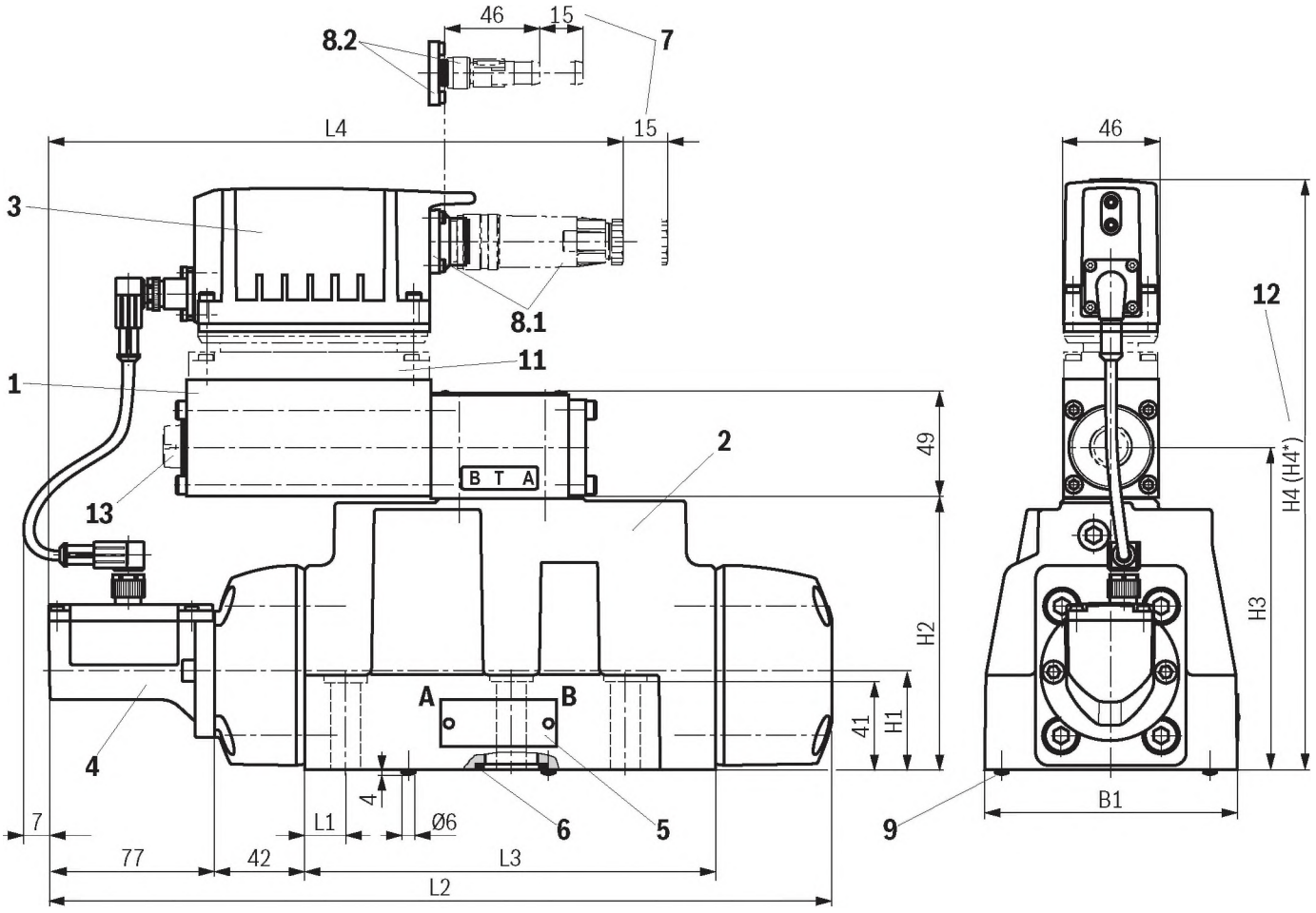


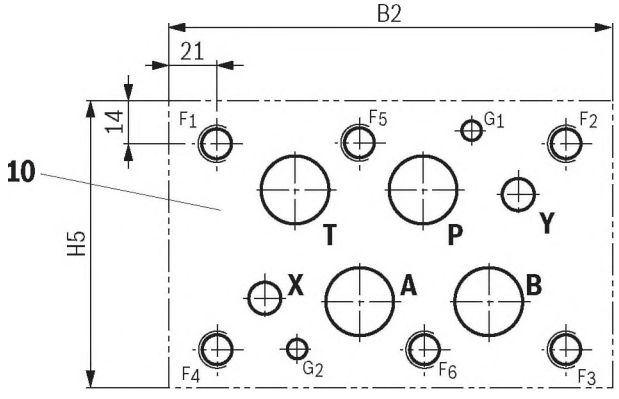
Required surface quality
of the valve contact surface

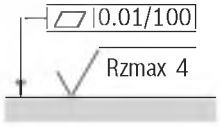
Item explanations, see page 39. **Valve mounting screws** and **subplates**, see page 40.

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

Dimensions: Sizes 25 and 27
(dimensions in mm)







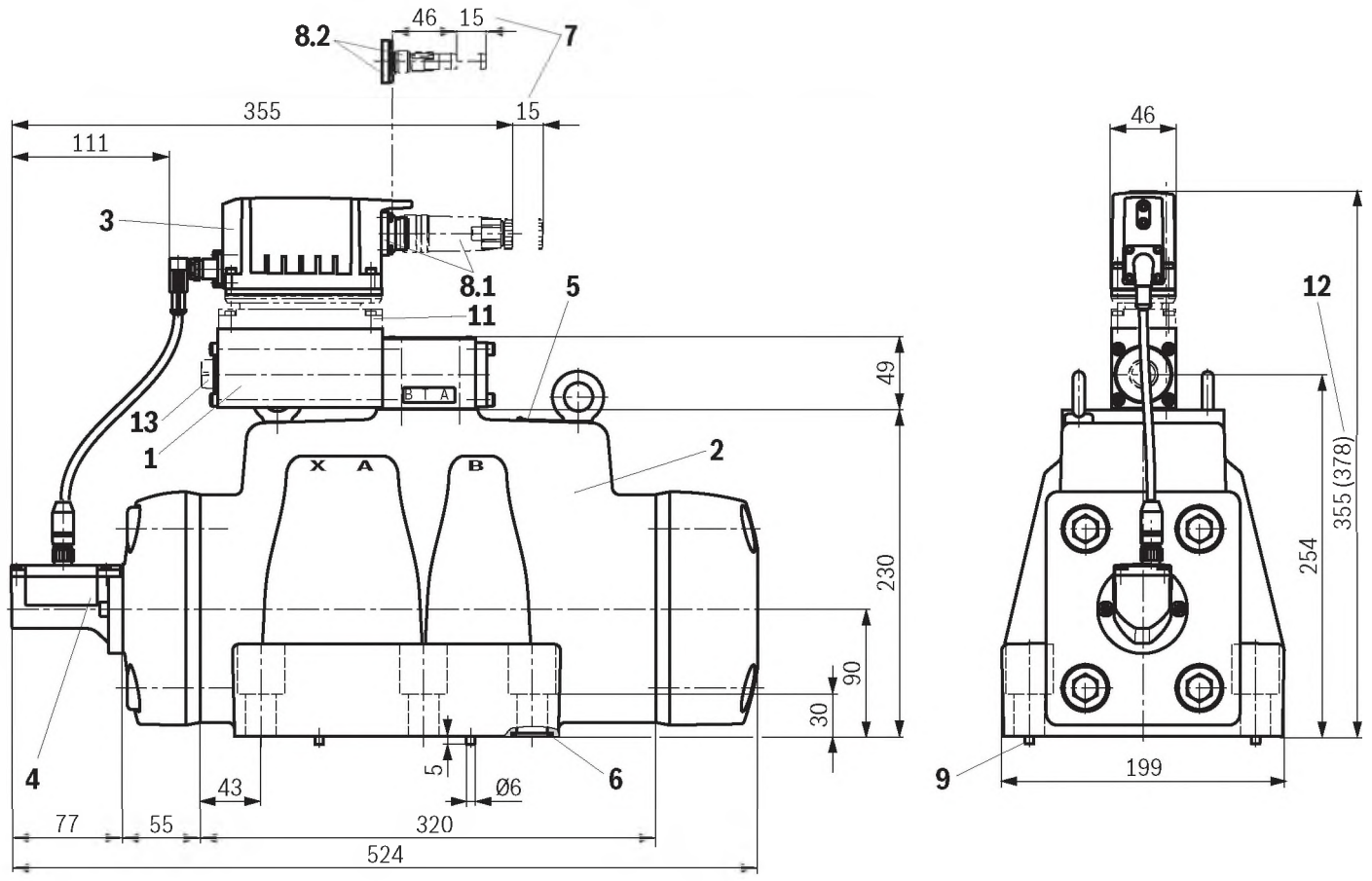
Required surface quality
of the valve contact surface

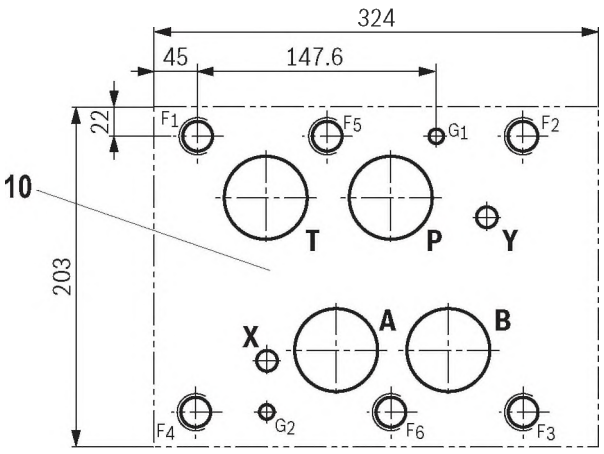
NG	L1	L2	L3	L4	H1	H2	H3	H4	H4*	H5	B1	B2
25	19	364	191	274	46	126	150	251	274	120	118	195
27	20.5	371	198	277	50	140	164	265	288	124	120	200

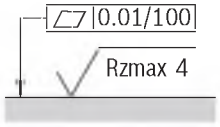
Item explanations, see page 39. **Valve mounting screws** and **subplates**, see page 40.

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

Dimensions: Size 35
(dimensions in mm)







Required surface quality of the valve contact surface

Item explanations, see page 39. **Valve mounting screws** and **subplates**, see page 40.

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

Dimensions

1 Pilot control valve
2 Main valve
3 Integrated electronics (OBE)
4 Inductive position transducer (main valve)
5 Name plate
6 Identical seal rings for ports P, A, B, T
Identical seal rings for ports X, Y
7 Space required for removing the mating connector
8.1 Mating connectors for version "A1", "F1" and "C6", separate order, see page 41 and data sheet 08006.
8.2 Mating connectors for version "L1", separate order, see page 41 and data sheet 08006.
9 Positioning pin
10 Machined valve contact surface
- Size 10:
  Porting pattern according to ISO 4401-05-05-0-05
- Size 16:
  Porting pattern according to ISO 4401-07-07-0-05
  Deviating from the standard:
  Ports P, A, B, T – Ø20 mm
- Size 25 and 27:
  Porting pattern according to ISO 4401-08-08-0-05
  Deviating from the standard:
  NG27: Ports P, A, B, T – Ø32 mm
- Size 35:
  Porting pattern according to ISO 4401-10-09-0-05
  Deviating from the standard:
  Ports P, A, B, T – Ø50 mm

[1)]Position G1 according to DIN 24340 Form A

11 Damping plate "D"
12 Dimension in () for version with damping plate "D"
13 Electronics protection membrane "-967"

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** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 13.5 Nm ±10%	**R913043777**
	or		
	4	**ISO 4762 - M6 x 45 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 15.5 Nm ±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 *[11 ft-lbs]* ±10%	Not included in the Rexroth delivery range
16	2	**ISO 4762 - M6 x 60 - 10.9-CM-Fe-ZnNi-5-Cn-T0-H-B** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 12.2 Nm ±10%	**R913043410**
	4	**ISO 4762 - M10 x 60 - 10.9-flZn/nc/480h/C** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 58 Nm ±20%	**R913014770**
	or		
	2	**ISO 4762 - M6 x 60 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 15.5 Nm ±10%	Not included in the Rexroth delivery range
	4	**ISO 4762 - M10 x 60 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 75 Nm ±10%	
	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** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 100 Nm ±20%	**R913015613**
	or		
	6	**ISO 4762 - M12 x 60** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 100 Nm ±10%	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
35	6	**ISO 4762 - M20 x 60 - 10.9-flZn/nc/480h/C** Friction coefficient μ_{total} = 0.09 ... 0.14; tightening torque M_A = 465 Nm ±20%	**R913014726**
	or		
	6	**ISO 4762 - M20 x 60 - 10.9** Friction coefficient μ_{total} = 0.12 ... 0.17; tightening torque M_A = 610 Nm ±10%	Not included in the Rexroth delivery range
	or		
	6	**ASME B18.3 - 3/4-10 UNC x 2 1/4" - ASTM-A574** Tightening torque M_A = 395 Nm *[291 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.
- Only the valve mounting screws listed here may be used (for size 16, a minimum screw length of 55 mm is admissible, as well).
- Prior to assembly, check the existing mounting bore on the block for sufficient screw-in depth.

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

Accessories (separate order)

Valves with integrated electronics

Interface	Mating connectors 6-pole + PE	Design	Version	Material number	Data sheet
"A1", "F1", "C6"	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**	–

Interface	Cable sets 6-pole + PE	**Length** in m	Material number	Data sheet
"A1", "F1", "C6"	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 continuous control valves with integrated electronics (OBE)	**R901049737**	29685

Valves with integrated electronics and IO-Link interface

Cable sets for IO-Link	**Length** in m	Material number	Data sheet
For the connection of valves with IO-Link interface, M12-5, A-coded, unshielded, line cross-section 5 x 0.34 mm²	1.5	**R901508849**	–
	3.0	**R901554223**	–
	5.0	**R901415747**	–

Project planning information

- The use of the valves with IO-Link as a shut-off element up to category 3, PL d according to EN 13849-1 is possible from component series 43 (4WRLE . E...-43/...L1). For additional application notes regarding safe shut-off, see operating instructions 29118-B.
  For component series ≤42, the valve must not be used for safe shut-off.
- The maximum operating pressure of 350 bar at port T is possible with size 35 from component series 43.
  For component series ≤42, the valve may be operated up to a maximum of 250 bar.
- Maximum operating pressure of 350 bar at port T only with double flow (supply via ports P and T, discharge via ports A and B; the supply pressure must be kept constant, load pressure in the discharge can be pulsating) without changing the direction of flow.
- Can be used without restriction up to a maximum operating pressure of 250 bar at port T.

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
▶ Directional control valves, direct operated, with electrical position feedback and IO-Link interface	Data sheet 29400-PA
▶ Information on available spares	www.boschrexroth.com/spc
▶ Connecting hydraulic systems via IO-Link	www.boschrexroth.com/io-link

Notes

Notes

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