Proportional flow control valve, with on-board electronics (OBE) and inductive position transducer

Type 3FREEZ

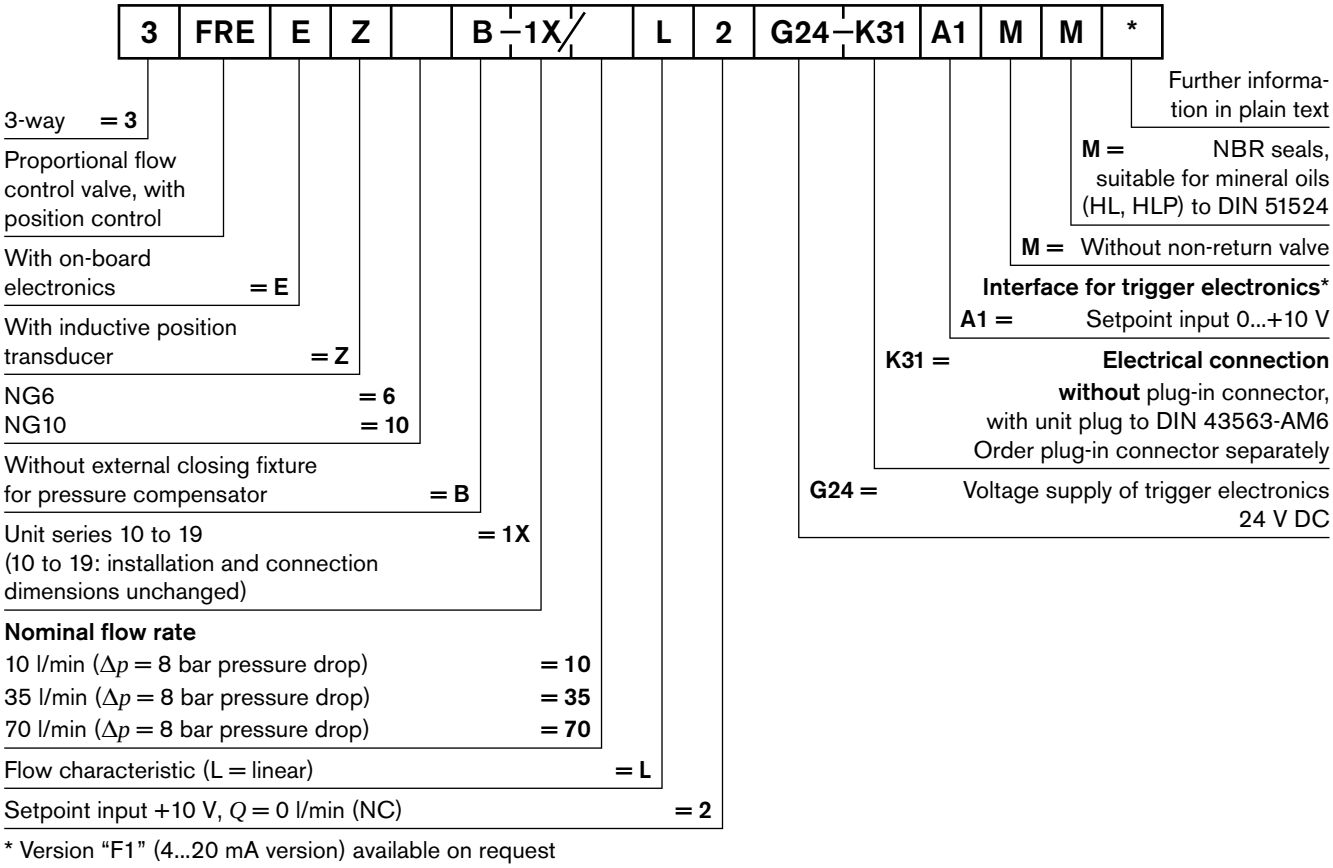
Nominal size 6, 10
Unit series 1X
Maximum working pressure 250 bar
Nominal flow rate Q_{nom} 10...70 l/min

Overview of Contents

Features

- Directly controlled flow control valves NG6 and NG10 with on-board electronics and inductive position transducer
- With position control, minimal hysteresis < 1 %, see Technical Data
- The 3-way function is determined by how the hydraulic ports are assigned (residual flow runs through port P, 3rd way)
- Adjustable by means of the controlled solenoid position, the position transducer and the on-board electronics
- For subplate attachment, mounting hole configuration NG6 to ISO 4401-03-02-0-94, NG10 to ISO 4401-05-04-0-94
- Subplates as per catalog sheet, RE 45053 for NG6, RE 45055 for NG10 (order separately)
- Plug-in connector to DIN 43563-AM6, see catalog sheet RE 08008 (order separately)
- Data for the on-board trigger electronics
  - Complies with CE, EMC directives EN 61000-6-2: 2002-08 and EN 61000-6-3: 2002-08
  - $U_B = 24\ V_{nom}$ DC
  - Electrical connection 6P+PE
  - Signal actuation
    - Standard 0...+10 V (A1)
  - Valve curve calibrated at the factory

Ordering data



* Version “F1” (4...20 mA version) available on request

Preferred types

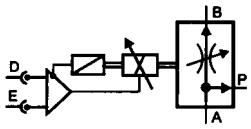
NG6		NG10	
Type		**Type**	
3FREEZ6B–1X/10L2G24–K31A1MM		3FREEZ10B–1X/70L2G24–K31A1MM	
3FREEZ6B–1X/35L2G24–K31A1MM			

Symbols

For on-board electronics

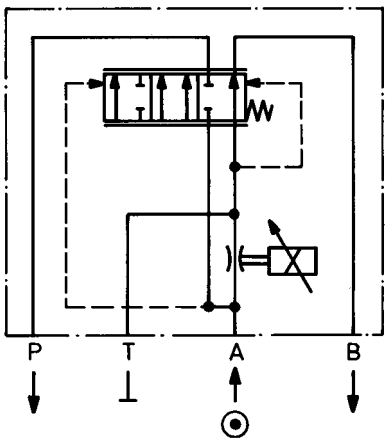
3-way, normally closed

NC



General
Flow control valves are directly actuated throttle valves with integrated pressure compensator.

3-way flow control valve
A: Supply
B: Discharge
P: Residual flow, capacity up to 250 bar, or tank
T: Closed



Function, sectional diagram

General

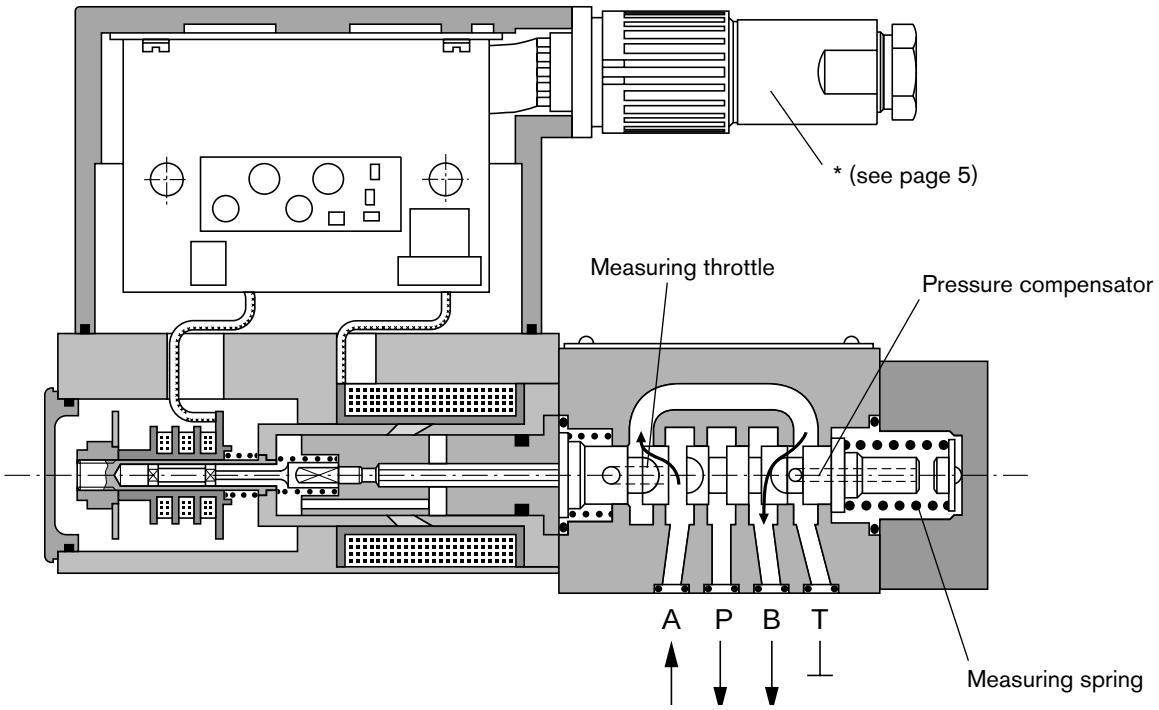
Type 3FREEZ proportional flow control valves with position control and on-board electronics are available in nominal sizes 6 and 10. They are actuated by means of a proportional solenoid with inductive position transducer. Hysteresis is < 1 %. The on-board electronics are calibrated at the factory and enable rapid response times. The design of the valve body is such that the residual flow runs through port P.

Basic principle

To adjust the oil flow rate from B, a setpoint is set in the trigger electronics. Based on this setpoint, the electronics control the solenoid coil as a function of the signal from the position transducer. The position control ensures very low hysteresis. The valve opening is determined by the metering edges on the spool, and the integrated pressure compensator compares the pressure drop by means of an 8-bar measuring spring. The pressure compensator with measuring spring regulates the pressure before the throttling edge according to the simplified formula: “Load pressure plus force of measuring spring”. In this way, the pressure drop over the metering edge is maintained at a constant level.

NG6

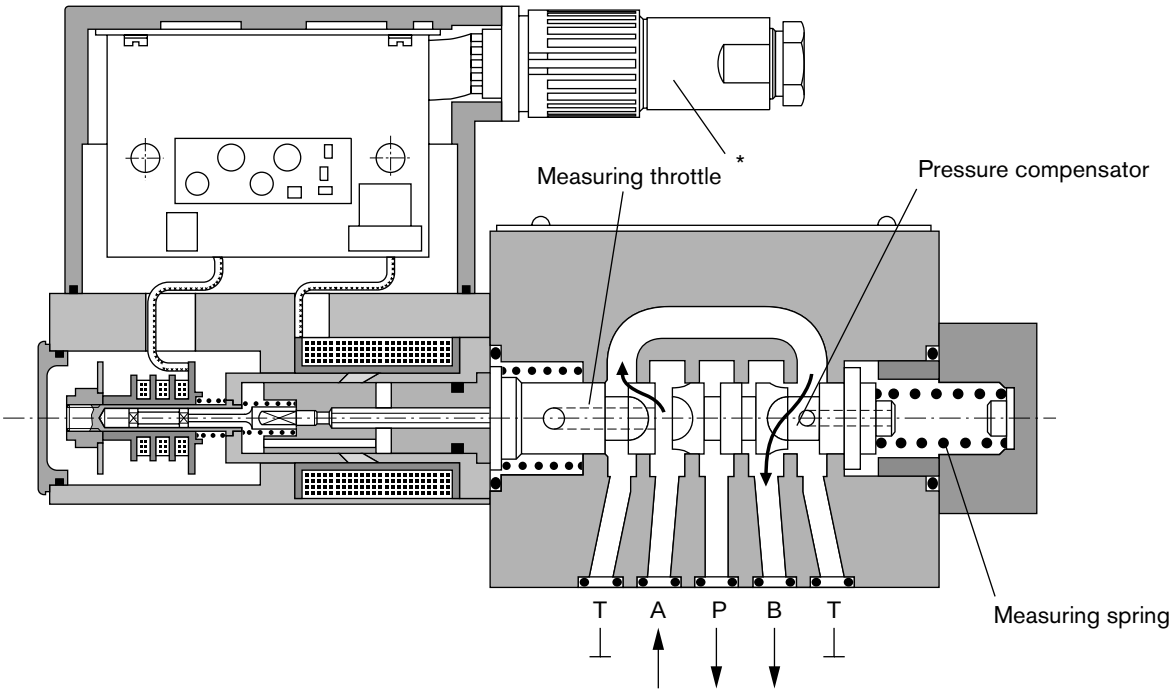
CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Function, sectional diagram

NG10

CE EN 61000-6-2: 2002-08
EN 61000-6-3: 2002-08



Accessories

Type			Material Number
(4x) ISO 4762-M5x30-10.9	Cheese-head bolts NG6		2 910 151 166
(4x) ISO 4762-M6x35-10.9	Cheese-head bolts NG10		2 910 151 207
* 	Plug-in connectors 6P+PE, see also RE 08008	KS	1 834 482 022
		KS	1 834 482 026
		MS	1 834 482 023
		MS	1 834 482 024
		KS 90°	1 834 484 252

Testing and service equipment

Test box type VT-PE-TB3, see RE 30065
Measuring adapter 6P+PE type VT-PA-2, see RE 30068

Technical data

General

Construction			Spool-type valve with integrated pressure compensator
Actuation			Proportional solenoid with position control and on-board electronics OBE
Connection type			Subplate, mounting hole configuration NG6 (ISO 4401-03-02-0-94), NG10 (ISO 4401-05-04-0-94)
Mounting position			Optional
Ambient temperature range		°C	–20...+50
Weight	NG6	kg	3.1
	NG10	kg	6.9
Vibration resistance, test condition			Max. 25 g, shaken in 3 dimensions (24 h)

Hydraulic (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Pressure fluid			Hydraulic oil to DIN 51524...535, other fluids after prior consultation		
Viscosity range,	recommended	mm^2/s	20...100		
	max. permitted	mm^2/s	10...800		
Pressure fluid temperature range		°C	–20...+70		
Maximum permitted degree of contamination of pressure fluid Purity class to ISO 4406 (c)			Class 18/16/13 [1]		
Direction of flow, see symbol			**NG6**		**NG10**
Nominal flow rate Q_B with closed-loop control		l/min	10	35	70
Pressure drop Δp		bar	8	8	8
Supply flow rate $Q_{A\,max}$		l/min	50	50	100
Minimum pressure drop $p_A > p_B$		bar	14	14	14
Max. working pressure		bar	Port A, B: 250 Port T: Closed Port P: Closed or residual flow 250 bar		

Static/Dynamic

Hysteresis	%	≤ 1	≤ 1
Range of inversion	%	≤ 0.5	≤ 0.5
Manufacturing tolerance	%	≤ 5	≤ 5
Resp. time 100 %/signal change 10 %	ms	25/25	35/25
Correction time on max. load change (pressure compensator)	ms	≤ 30	≤ 45
Conformity		CE EN 61000-6-2: 2002-08 EN 61000-6-3: 2002-08	

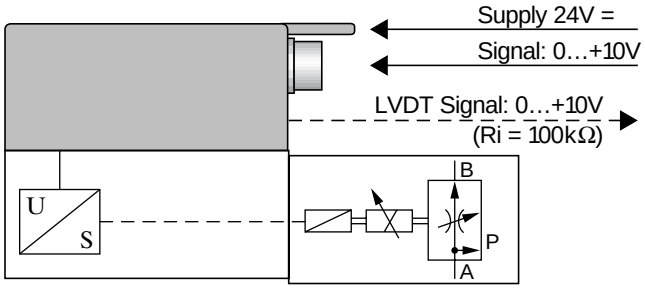
[1] The purity classes stated for the components must be complied with in hydraulic systems.
Effective filtration prevents problems and also extends the service life of components.
For a selection of filters, see catalog sheets RE 50070, RE 50076 and RE 50081 .

Technical data

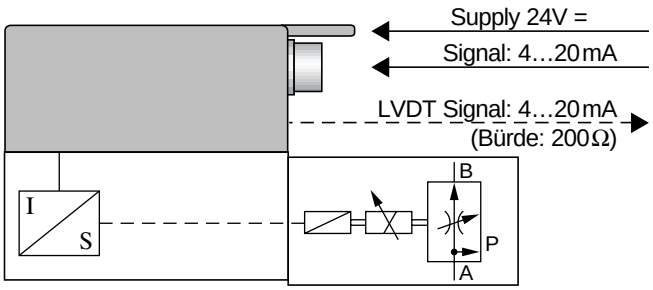
Electrical, trigger electronics integrated in valve		
Cyclic duration factor	%	100
Degree of protection		IP 65 to DIN 40050 and IEC 14434/5
Connection		Plug-in connector 6P+PE, DIN 43563
Supply voltage Terminal A: Terminal B: 0 V		24 V DC_{nom} Min. 21 V DC/max. 40 V DC Ripple max. 2 V DC
Power consumption		Solenoid ⍁ 45 mm = 40 VA max.
External fuse		2.5 A_F
Input, “standard” version Terminal D: U_E Terminal E:	A1	Differential amplifier, R_i = 100 kΩ 0...+10 V 0 V
Input, “mA signal” version Terminal D: I_{D-E} Terminal E: I_{D-E}	F1*	Burden, R_{sh} = 200 Ω 4...20 mA Current loop I_{D-E} feedback
Max. voltage to differential inputs over 0 V		D → B E → B } max. 18 V DC
Test signal, “standard” version Terminal F: U_{Test} Terminal C:	A1	LVDT 0...+10 V Reference 0 V
Test signal, “mA signal” version Terminal F: I_{F-C} Terminal C: I_{F-C}	F1*	LVDT signal 4...20 mA at external load 200...500 Ω max. 4...20 mA output Current loop I_{F-C} feedback
Safety earth conductor and shield		See pin assignment (installation in conformity with CE)
Recommended cable		See pin assignment up to 20 m 7 x 0.75 mm^2 up to 40 m 7 x 1 mm^2
Calibration		Calibrated at the factory, see valve curve

* Version “F1” (4...20 mA version) available on request

Version A1: Standard

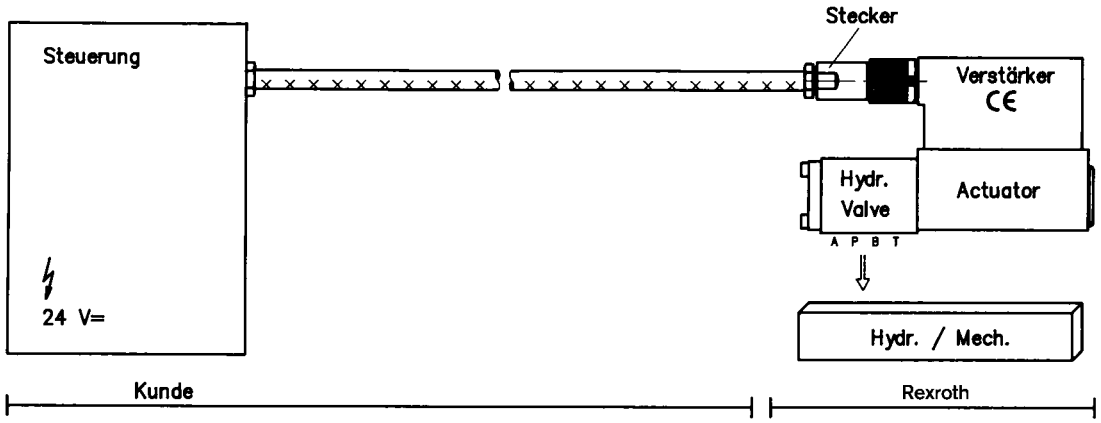


* Version F1: mA Signal



Connection

For electrical data, see page 7 and
Operating Instructions **1 819 929 083**



Technical notes for the cable

Design:
- Multi-wire cable
- Extra-finely stranded wire to VDE 0295, Class 6
- Safety earth conductor, green/yellow
- Cu braided shield

Type:
- e.g. Ölflex-FD 855 CP (from Lappkabel company)

No. of wires:
- Determined by type of valve, plug type and signal assignment

Cable Ø:
- 0.75 mm^2 up to 20 m long
- 1.0 mm^2 up to 40 m long

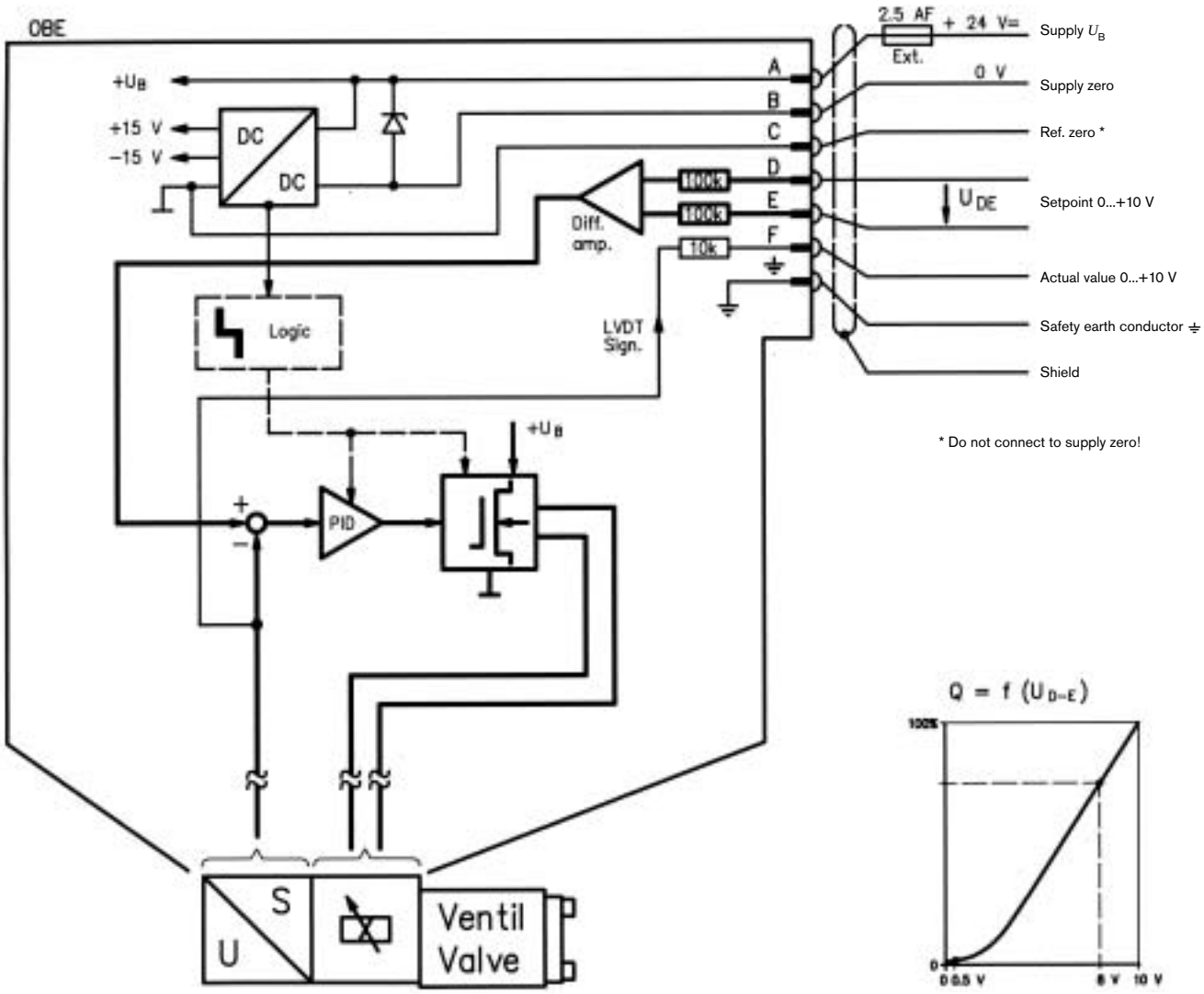
Outside Ø:
- 9.4...11.8 mm – Pg 11
- 12.7...13.5 mm – Pg 16

Important

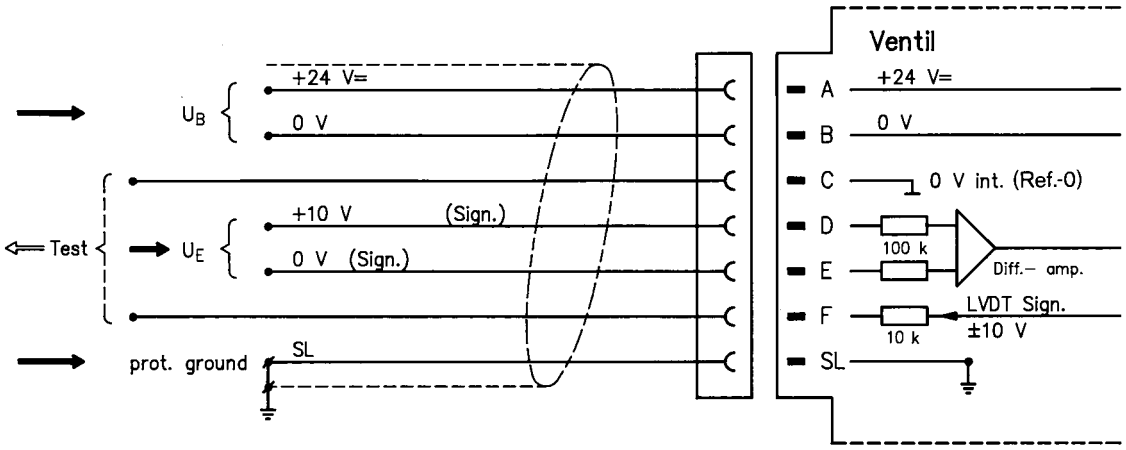
Power supply 24 V DC nom.,
if voltage drops below 18 V DC, rapid shutdown resembling "Enable OFF" takes place internally.
In addition, with the "mA signal" version:
$I_{D\text{-}E} \geqq 3$ mA – valve is active
$I_{D\text{-}E} \leqq 2$ mA – valve is deactivated.
Electrical signals (e.g. actual values) emitted via the trigger electronics must not be used to shut down safety-relevant machine functions!
(Also see European Standard, "Technical Safety Requirements for Fluid-Powered Systems and Components – Hydraulics", EN 982).

On-board trigger electronics

Circuit diagram/pin assignment
Version A1: $U_{D\text{-}E}$ 0...+10 V

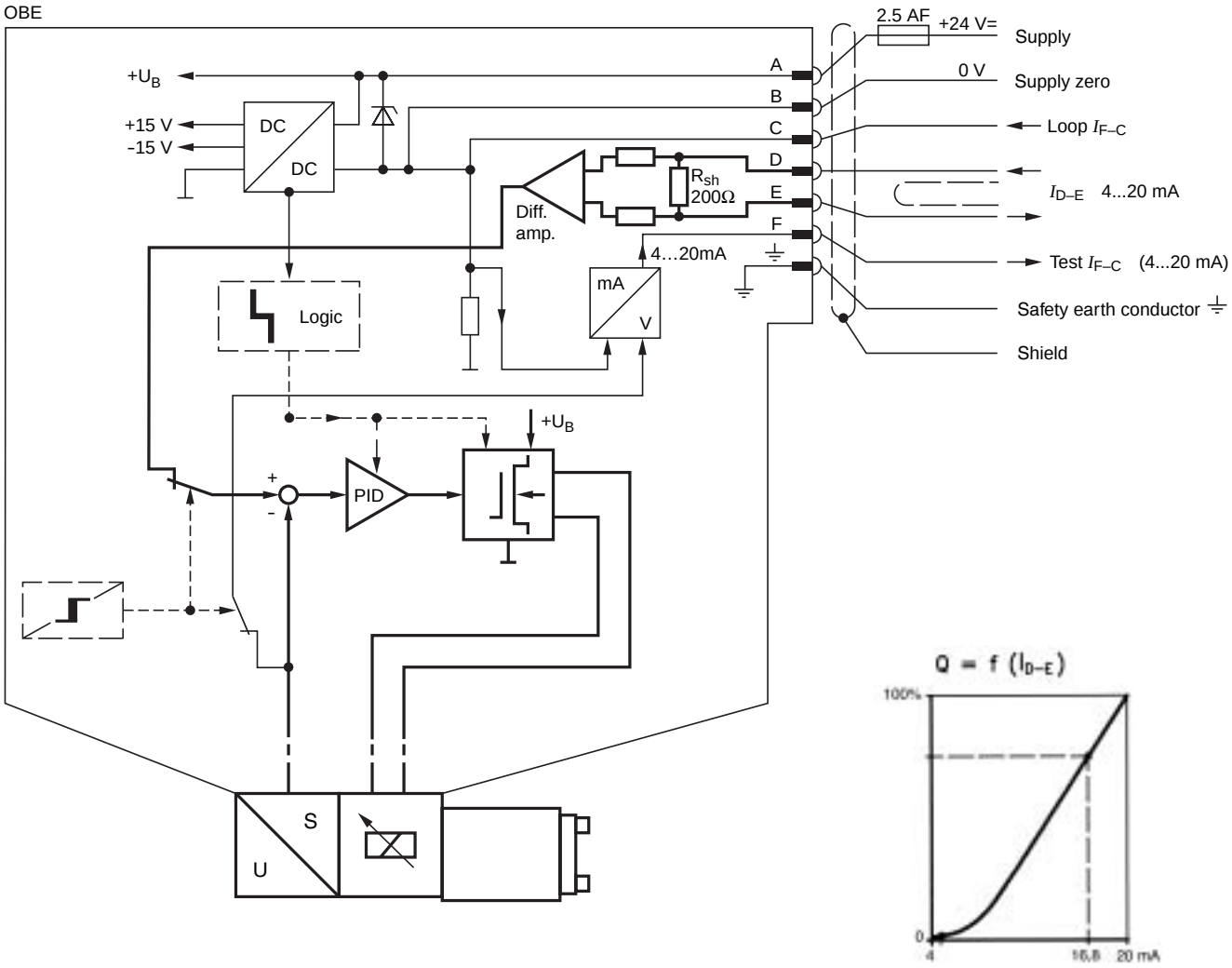


Pin assignment
Version A1: $U_{D\text{-}E}$ 0...+10 V
(R_i = 100 kΩ)

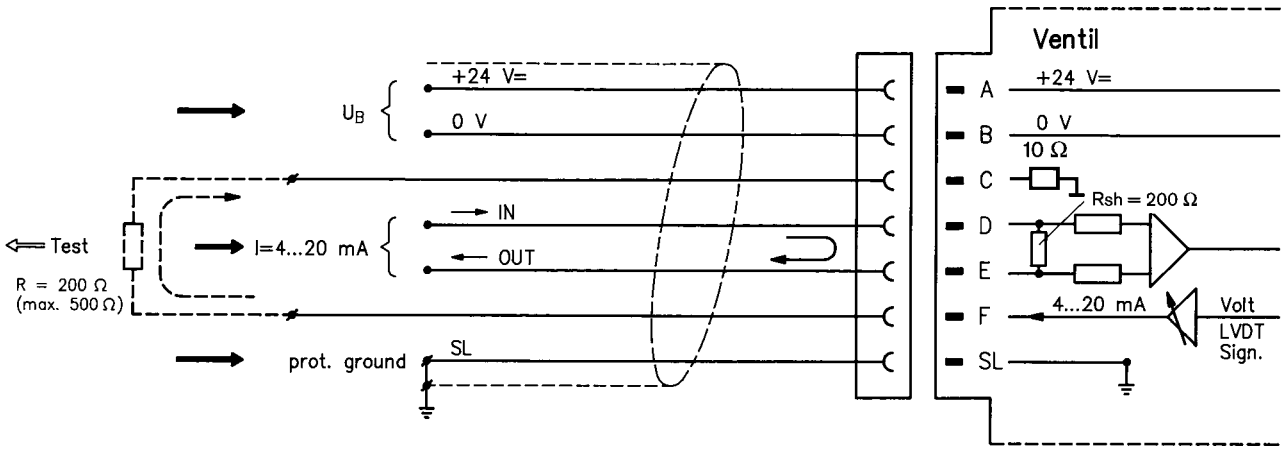


On-board trigger electronics

Circuit diagram/pin assignment
Version F1: $I_{D\text{-}E}$ 4...20 mA



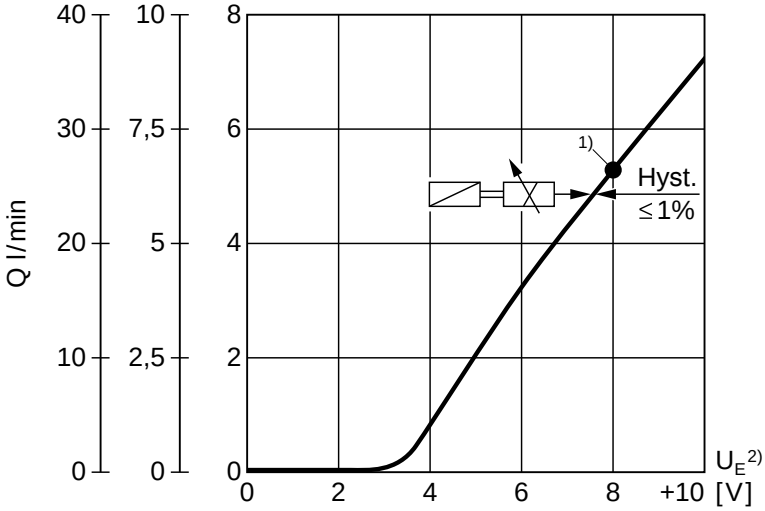
Pin assignment 6P+PE
Version F1: $I_{D\text{-}E}$ 4...20 mA
(R_{sh} = 200 kΩ)



Characteristic curves NG6 (measured with HLP 46, $\vartheta_{oil} = 40\,°C \pm 5\,°C$)

Q_{nom} = 10/35 l/min

Basic position closed “NC”

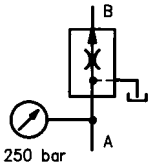


Valve amplifier

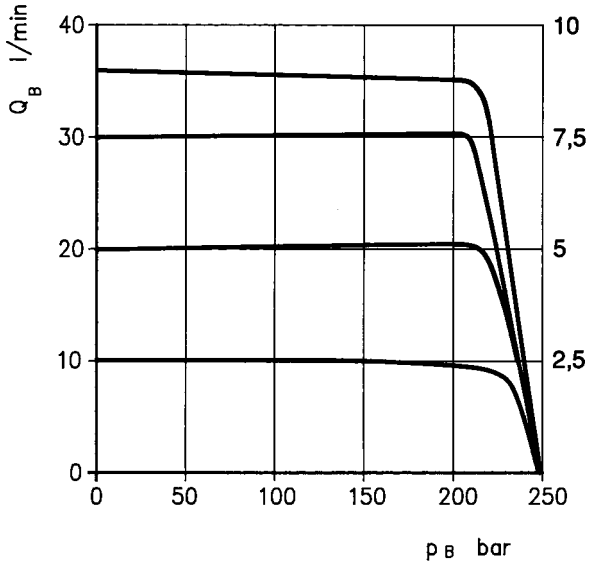
1) Factory setting – OBE
±5% manufacturing tolerance

2) Version: $U_E = 0...+10$ V

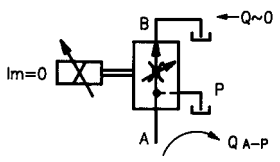
3-way version

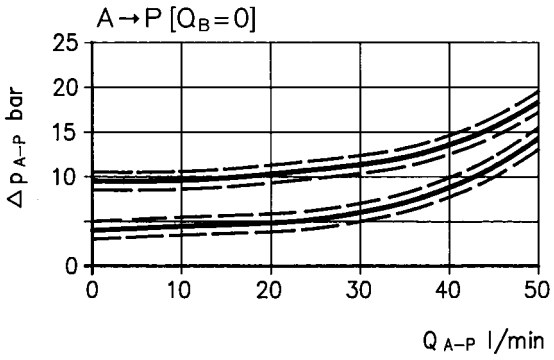


Q_{nom} = 10/35 l/min



Residual flow “A–P”
(pressure drop)

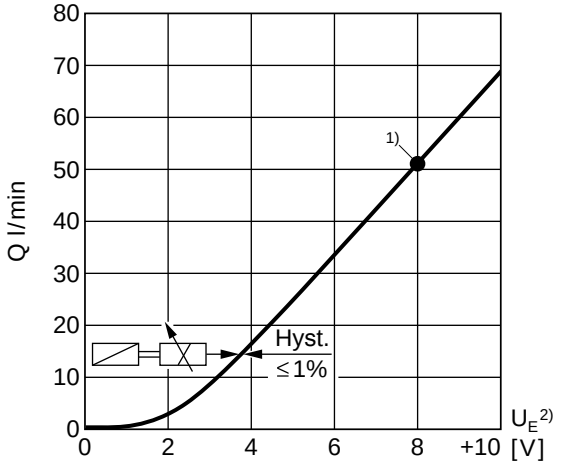




Characteristic curves NG10 (measured with HLP 46, $\vartheta_{oil} = 40°C \pm 5°C$)

$Q_{nom.} = 70$ l/min

Basic position closed “NC”

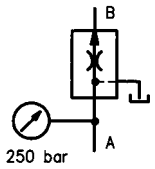


Valve amplifier

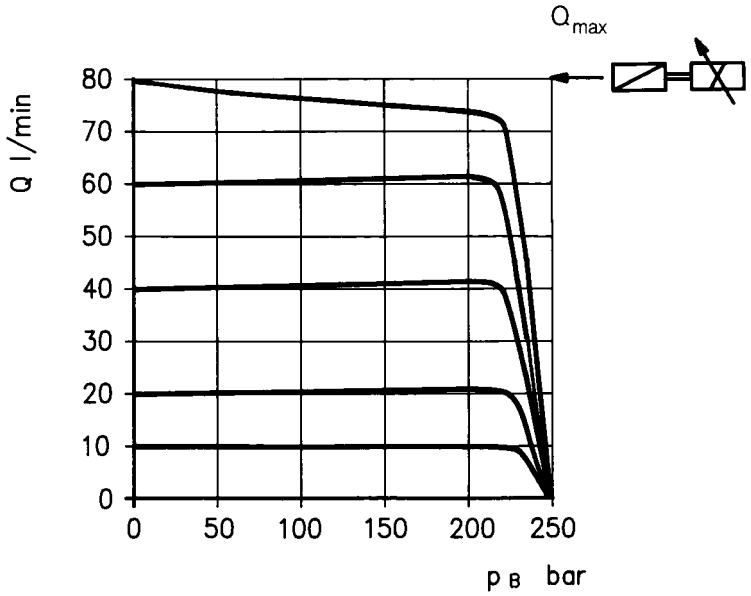
1) Factory setting – OBE
±5% manufacturing tolerance

2) Version: $U_E = 0...+10$ V

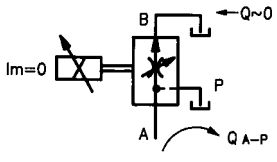
3-way version

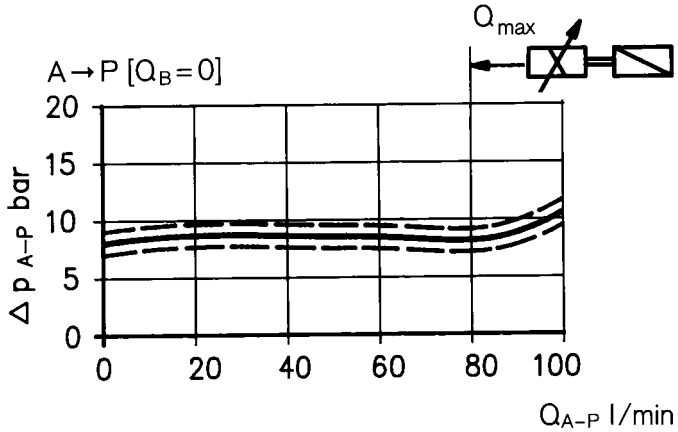


$Q_{nom} = 70$ l/min

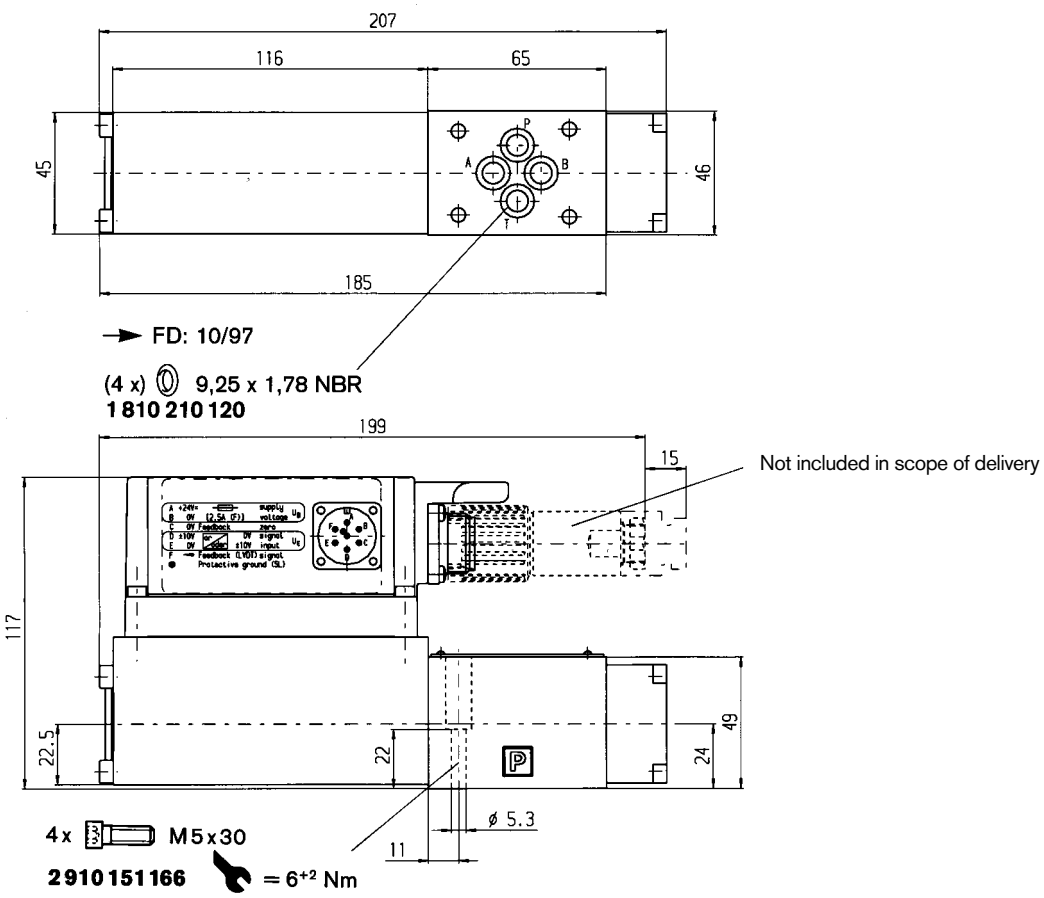


Residual flow “A-P”
(pressure drop)

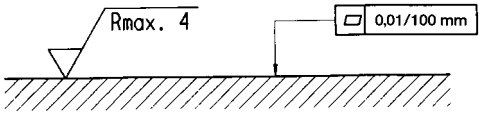




Unit dimensions NG6 (nominal dimensions in mm)

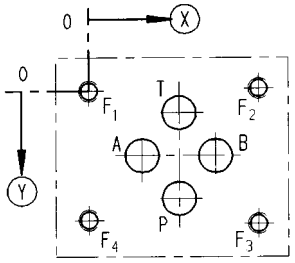


Required surface quality of mating component



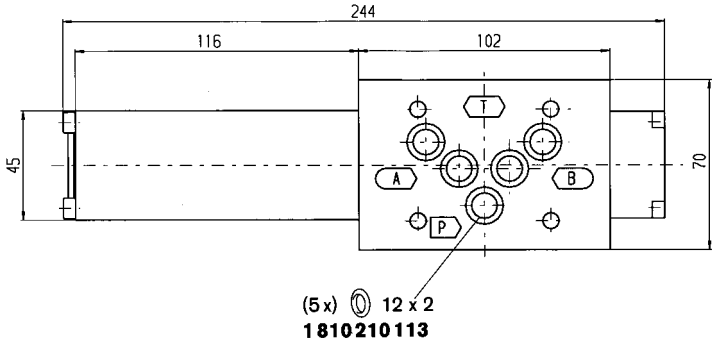
Mounting hole configuration: NG6 (ISO 4401-03-02-0-94)
For subplates see catalog sheet RE 45053

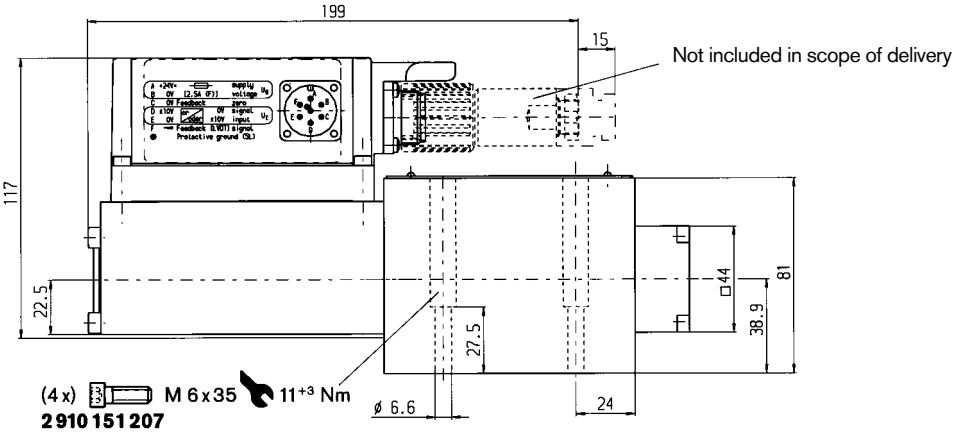
[1] Deviates from standard
[2] Thread depth:
Ferrous metal 1.5 x Ø
Non-ferrous 2 x Ø



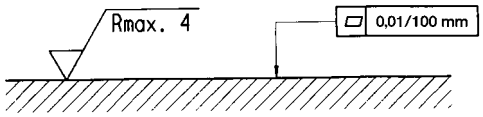
	P	A	T	B	F_1	F_2	F_3	F_4
Ⓧ	21.5	12.5	21.5	30.2	0	40.5	40.5	0
Ⓨ	25.9	15.5	5.1	15.5	0	–0.75	31.75	31
∅	8 [1]	8 [1]	8 [1]	8 [1]	M5 [2]	M5 [2]	M5 [2]	M5 [2]

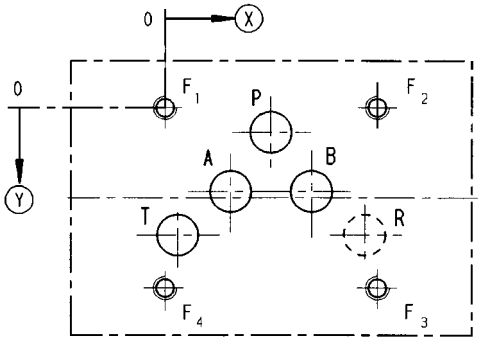
Unit dimensions NG10 (nominal dimensions in mm)





Required surface quality of mating component





Mounting hole configuration: NG10 (ISO 4401-05-04-0-94)
For subplates see catalog sheet RE 45055

1) Deviates from standard
2) Thread depth:
Ferrous metal 1.5 x Ø*
Non-ferrous 2 x Ø
* NG10 min. 10.5 mm

	P	A	T	B	F_1	F_2	F_3	F_4	R
Ⓧ	27	16.7	3.2	37.3	0	54	54	0	50.8
Ⓨ	6.3	21.4	32.5	21.4	0	0	46	46	32.5
⌀	10.5 1)	10.5 1)	10.5 1)	10.5 1)	M6 2)	M6 2)	M6 2)	M6 2)	10.5 1)

Notes

Notes