

**RE 29 190/05.02**

Replaces: 12.98

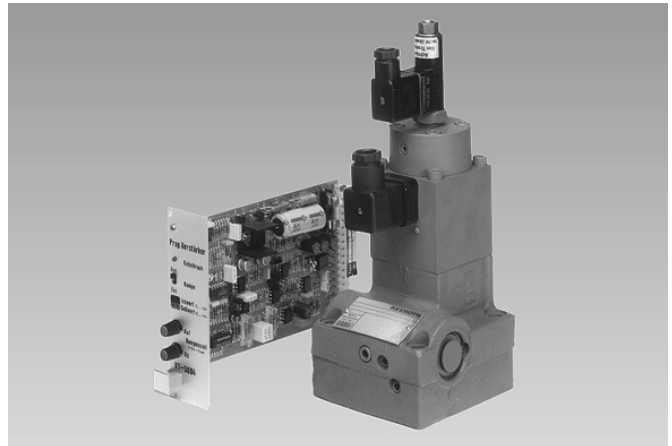
**Proportional flow control valve  
2-way version  
Type 2FRE**

Nominal sizes 10 and 16

Series 4X

Maximum operating pressure 315 bar

Maximum flow 160 L/min



Type 2FRE .-4X/...K4 with plug-in connector and associated control electronics (separate order)

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**Features**

- Valve with a pressure compensator for pressure compensated control of a flow
- Actuation via a proportional solenoid
- For subplate mounting:  
Porting pattern to DIN 24 340 form G, subplates to catalogue sheet RE 45 066 (separate order), see page 10
- With electrical position feedback of the control orifice
- The position transducer coil can be axially moved making the zero point adjustment of the control orifice easy, without having to touch the electronics (electrical-hydraulic)
- Minimum sample variation of valve and electrical amplifier VT 5004, VT-VRPD-1 and VT 11034 (separate order), see page 5
- Flow control is possible in both directions by using a rectifier sandwich plate



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## Ordering details

### Proportional flow control valve

	<b>2FRE</b>	<b>-4X/</b>	<b>B</b>	<b>K4</b>	<b>*</b>	
Nominal size 10	= <b>10</b>					Further details in clear text NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524
Nominal size 16	= <b>16</b>					
Series 40 to 49 (40 to 49: unchanged installation and connection dimensions)	= <b>4X</b>					FKM seals
						<b>Electrical connections</b>
						<b>K4 =</b> With component plug to DIN 43 650-AM2 for proportional solenoid and GSA20 manufacturer Hirschmann for the position transducer <b>Without</b> plug-in connector plug-in connector – separate order, see page 6
						<b>B =</b> With pressure compensator stroke limiter

Flow control range A → B			
Nominal size 10		Nominal size 16	
Linear	Progressive with fast feed (fine control range)	Linear	
Up to 10 L/min = <b>10L</b>	Up to 5 L/min = <b>5QE</b>	Up to 80 L/min = <b>80L</b>	
Up to 16 L/min = <b>16L</b>		Up to 100 L/min = <b>100L</b>	
Up to 25 L/min = <b>25L</b>		Up to 125 L/min = <b>125L</b>	
Up to 50 L/min = <b>50L</b>		Up to 160 L/min = <b>160L</b>	
Up to 60 L/min = <b>60L</b>			

### Rectifier sandwich plate

	<b>Z4S</b>	<b>-2X/</b>	<b>*</b>	
Nominal size 10	= <b>10</b>			Further details in clear text NBR seals, suitable for mineral oil (HL, HLP) to DIN 51 524
Nominal size 16	= <b>16</b>			
Series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	= <b>2X</b>			FKM seals
				<b>No code =</b>
				<b>V =</b>

### Preferred types

#### NS 10

Material No.	Type
00915817	2FRE 10-4X/10LBK4M
00915825	2FRE 10-4X/16LBK4M
00915820	2FRE 10-4X/25LBK4M
00915815	2FRE 10-4X/50LBK4M

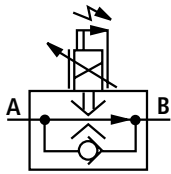
#### NS 16

Material No.	Type
00915819	2FRE 16-4X/100LBK4M
00915814	2FRE 16-4X/160LBK4M

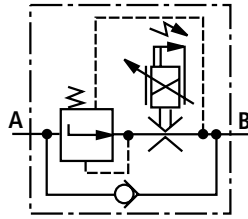
## Symbols

### Proportional flow control valve

Simplified

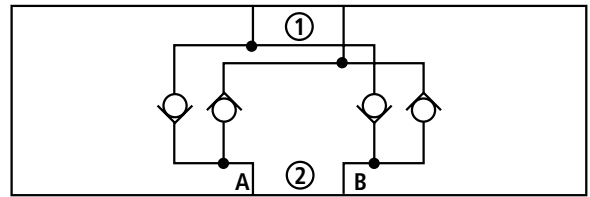


Detailed



### Rectifier sandwich plate

1 = component side, 2 = subplate side



## Function, section

The type 2FRE... proportional flow control valves have a 2-way function. They can, from an applied electrical command value, regulate a flow which is pressure and to a great extent temperature compensated.

They basically comprise of the housing (1), proportional solenoid with inductive position transducer (2), measuring orifice (3), pressure compensator (4), stroke limiter (5), as well as a check valve (6).

The setting of the flow is determined (0 to 100 %) at the command value potentiometer. The applied command value causes, via the amplifier as well as the proportional solenoid, the adjustment of measurement orifice (3). The position of the measurement orifice (3) is obtained by the position transducer. Any deviations from the command value are compensated for by the position feedback control.

The pressure transducer compensator (4) holds the pressure drop at the measurement orifice (3) at a constant value. The flow is, therefore pressure compensated.

The small temperature drift is achieved due to the design of the measurement orifice.

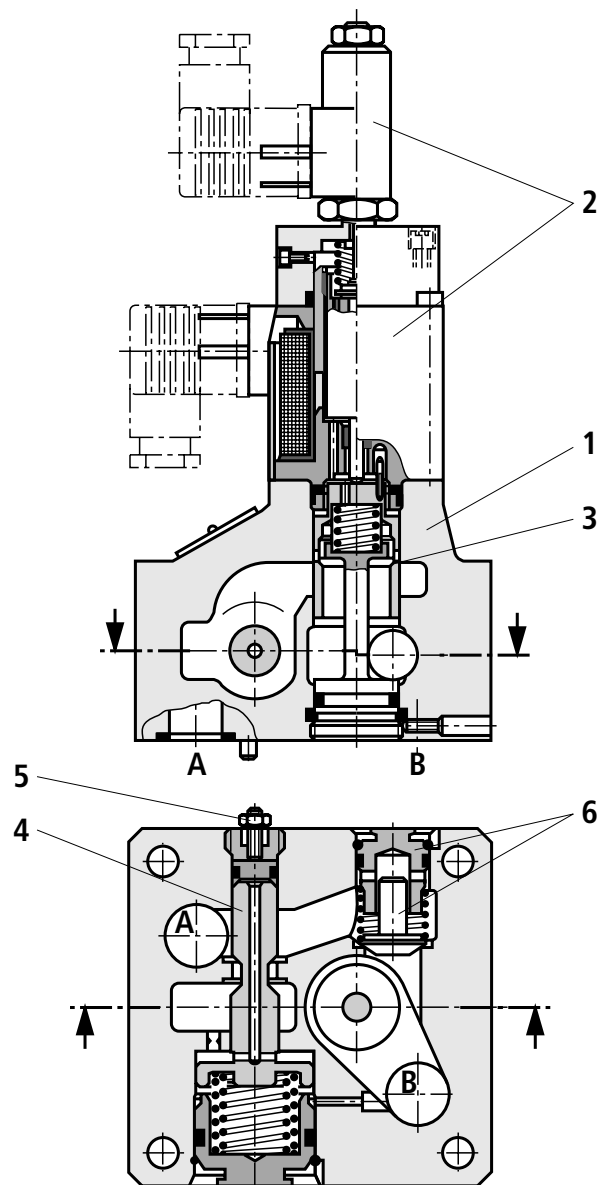
At a 0 % command value the measurement orifice is closed.

In the case of a loss of power or a cable break at the position transducer the measurement orifice closes.

From a 0 % command value a jump free start is possible. Via two ramps within the electrical amplifier it is possible to delay the opening and closing of the measurement orifice.

Via the check valve (6) free-flow is possible from B to A.

With an additional rectifier sandwich plate type Z4S..., which is fitted under the proportional flow control valve, it is possible to control the flow too and from the actuator.



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

**General**

Nominal size	NS	<b>10</b>	<b>16</b>	
Installation		Optional		
Storage temperature range	°C	-20 to +80		
Ambient temperature range	°C	-20 to +70		
Weight	Proportional flow control valve	kg	6.1	8.5
	Rectifier sandwich plate	kg	3.2	9.3

**Hydraulic**, proportional flow control valve (measured with HLP 46 and at  $\vartheta_{oil} = 40^{\circ}\text{C} \pm 5^{\circ}\text{C}$ )

Max. perm. operating pressure	Port A	bar	Up to 315								
Flow $q_{Vmax}$	Nominal size	NS	<b>10</b>					<b>16</b>			
	Linear	L/min	10	16	25	50	60	80	100	125	160
	Progressive with fast feed	L/min	40					-			
Minimum pressure differential		bar	3 to 8					6 to 10			
$\Delta p$ free return flow B → A		bar	See diagram on page 9								
Flow control temperature drift	Hydraulic + electrical $\Delta q_V / ^{\circ}\text{C}$	%	0.1 at $q_{Vmax}$								
	Pressure compensated (up to $\Delta p = 315$ bar)	%	$\pm 2$ at $q_{Vmax}$								
Pressure fluid			Mineral oil (HL, HLP) to DIN 51 524 further pressure fluids on request!								
Pressure fluid temperature range		°C	- 20 to + 80								
Viscosity range		mm <sup>2</sup> /s	15 to 380								
Degree of contamination			Max. permissible degree of contamination of the pressure fluid is to NAS 1638					Recommended is a filter with a minimum retention rate of $\beta_x \geq 75$			
			Class 9					x = 10			
Hysteresis		%	$< \pm 1$ at $q_{Vmax}$								
Repeatability		%	$< 1$ at $q_{Vmax}$								
Sample spread	Valve 2FRE...	%	$\leq \pm 2$ with a command value of 33 % $\leq \pm 5$ with a command value of 100 %								
	Amplifier VT 5004	%	$< 0.5$								
	Amplifier VT 11034	%	$< \pm 2$								

**Hydraulic**, rectifier sandwich plate

Operating pressure		bar	Up to 315			
Opening pressure		bar	1.5			
Nominal flow	Nominal size	NS	<b>10</b>		<b>16</b>	
		L/min	60		160	

**Technical data** (for applications outside these parameters, please consult us!)**Electrical, proportional solenoid**

Voltage type			DC
Coil resistance	Cold value at 20 °C	Ω	10
	Max. warm value	Ω	13.9
Duty		%	100
Max. current per solenoid		A	1.51
Electrical connection	With component plug to DIN 43 650-AM2		
	Plug-in connector to DIN 43 650-AF2/Pg11 <sup>1)</sup>		
Protection to DIN 40 050	IP 65 <sup>2)</sup>		

**Electrical, inductive position transducer**

Coil resistance at 20 °C (also see page 6)	Total coil resistance between	Ω	1 and 2	2 and $\frac{1}{2}$	$\frac{1}{2}$ and 1
			31.5	45.5	31.5
Electrical connection	With component plug GSA, manufacturer Hirschmann				
	Plug-in connector GM209N (Pg9), manufacturer Hirschmann <sup>1)</sup>				
Inductivity		mH	6 to 8		
Oscillator frequency		kHz	2.5		
Electrical position measuring system	Differential throttle				
Nominal stroke		mm	4		
Protection to DIN 40 050	IP 65 <sup>2)</sup>				

**Control electronics** (separate order)

Associated amplifier in Eurocard format	Type VT 5004 to catalogue sheet RE 29 945
	Type VT-VRPD-1 to catalogue sheet RE 30 125
Associated amplifier module	Type VT 11034 to catalogue sheet RE 29 774

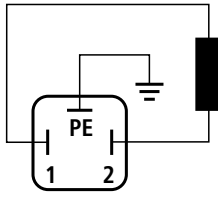
<sup>1)</sup> Separate order, see page 6

<sup>2)</sup> Due to the occurring surface temperature of the solenoid coils, the European Standards EN563 and EN982 must be taken into account!

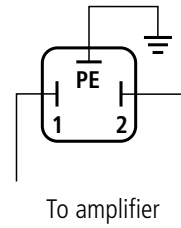
## Electrical connections

### Proportional solenoid

Connections on component plug



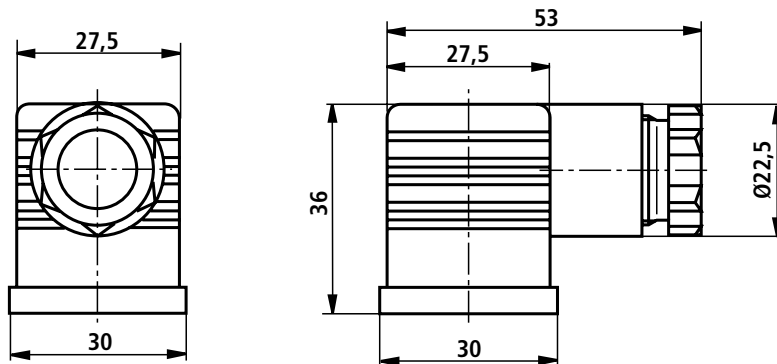
Connections on plug-in connector



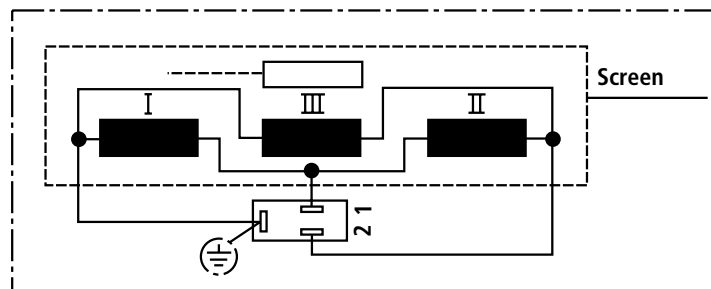
Plug-in connector to DIN 43 650-AF2/Pg11

Separate order under Material No. **00074684**

(plastic version)



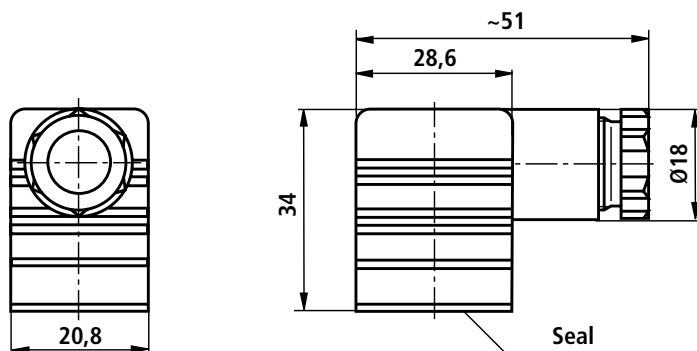
### Inductive position transducer



Plug-in connector GM209N, manufacturer Hirschmann

Separate order under Material No. **00013674**

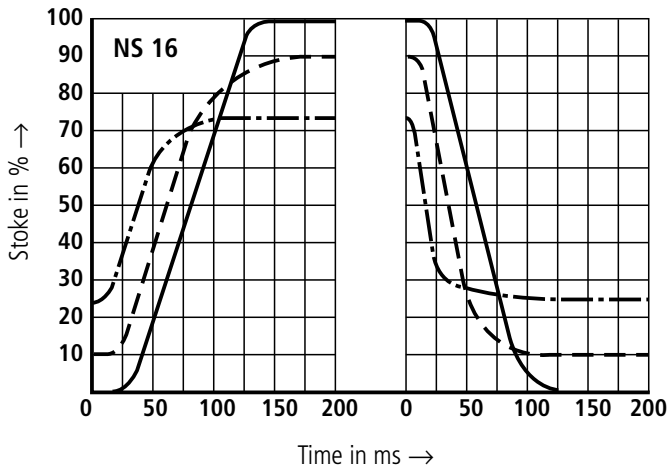
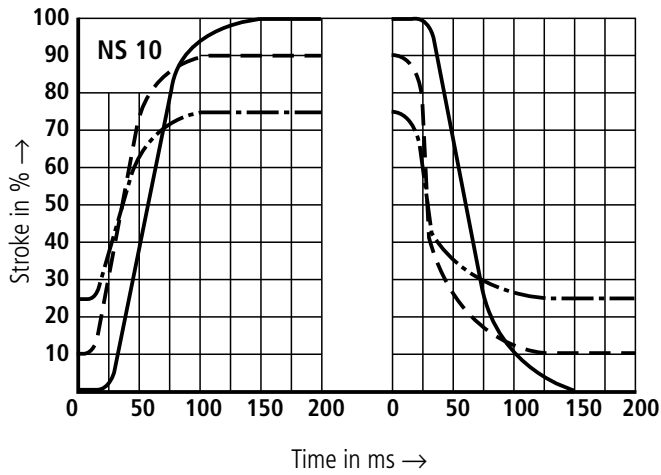
(plastic version)



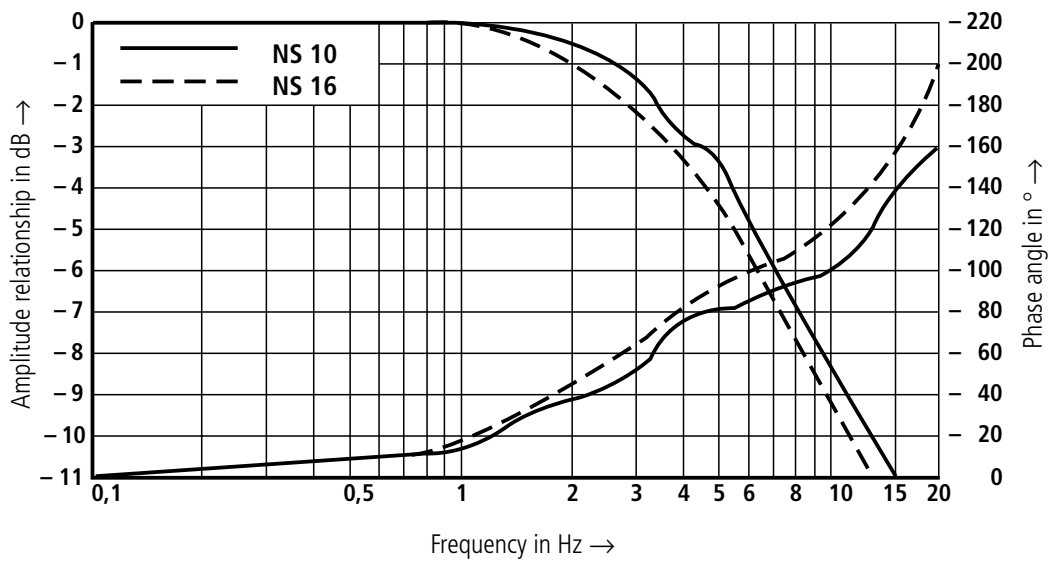
## Characteristic curves

(measured at  $v = 41 \text{ mm}^2/\text{s}$  and  $\vartheta = 50 \text{ }^\circ\text{C}$ ;  $p_{\text{nom}} = 50 \text{ bar}$ ; amplitude  $0 \rightarrow 100 \%$ ; NS 10 type 60L / NS 16 type 160L)

### Transient function with a stepped form of command value change

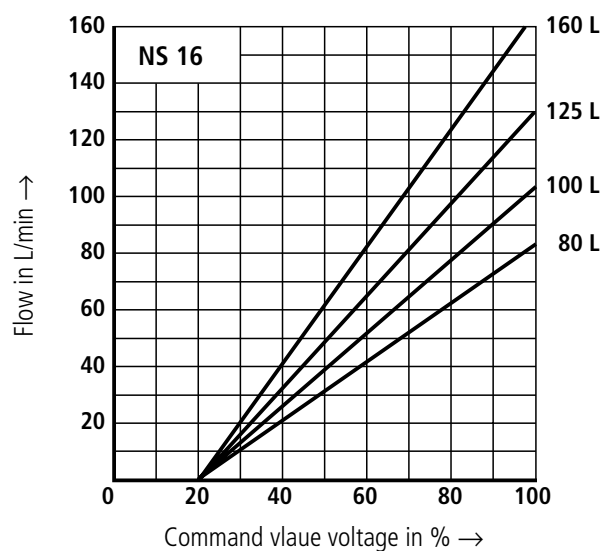
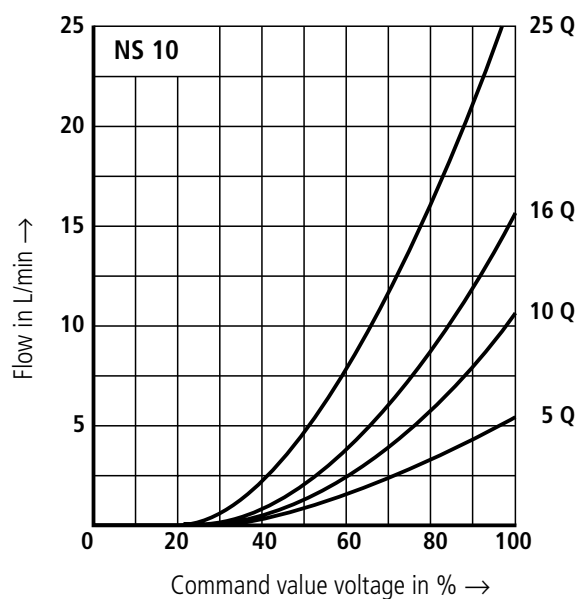
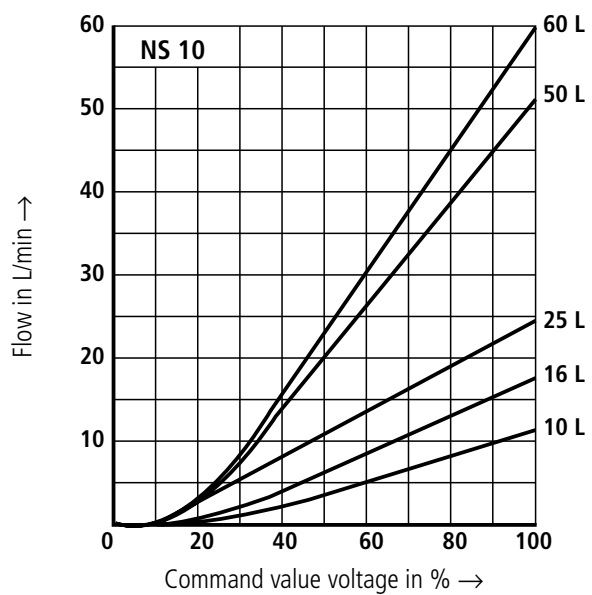


### Frequency response characteristic curves



**Characteristic curves** (measured at  $v = 41 \text{ mm}^2/\text{s}$  and  $\vartheta = 50 \text{ }^\circ\text{C}$ )

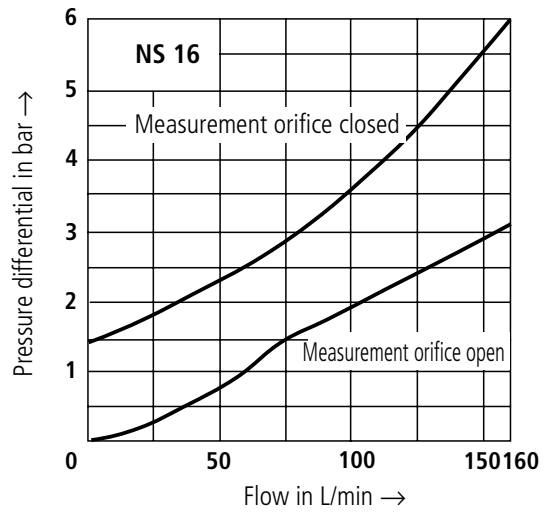
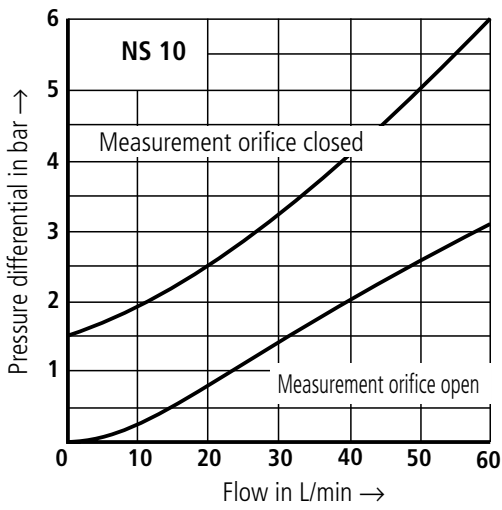
Relationship of the flow to the command value voltage (flow control from A  $\rightarrow$  B)



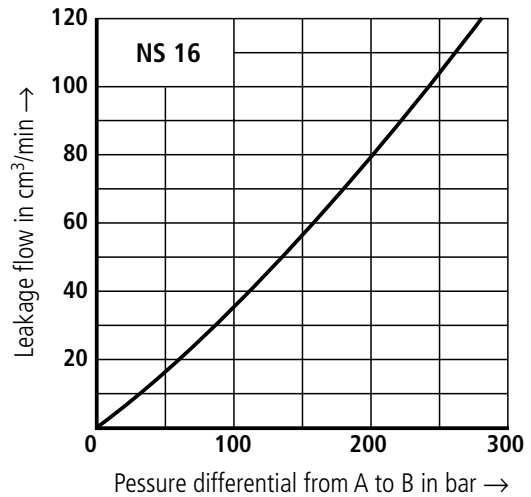
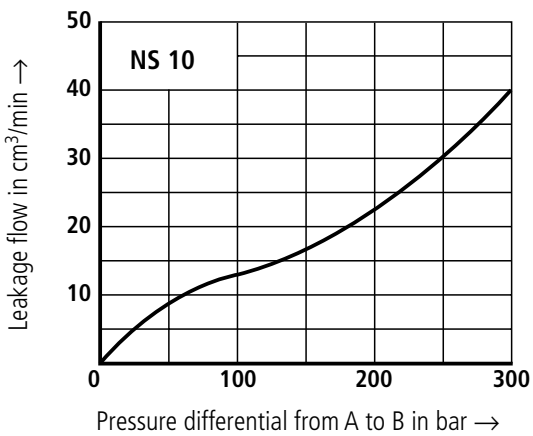


**Characteristic curves** (measured at  $v = 41 \text{ mm}^2/\text{s}$  and  $\vartheta = 50 \text{ }^\circ\text{C}$ )

**Pressure differential over the check valve B → A**

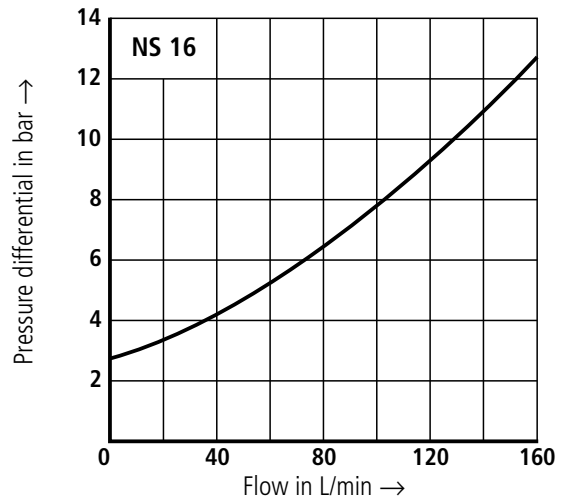
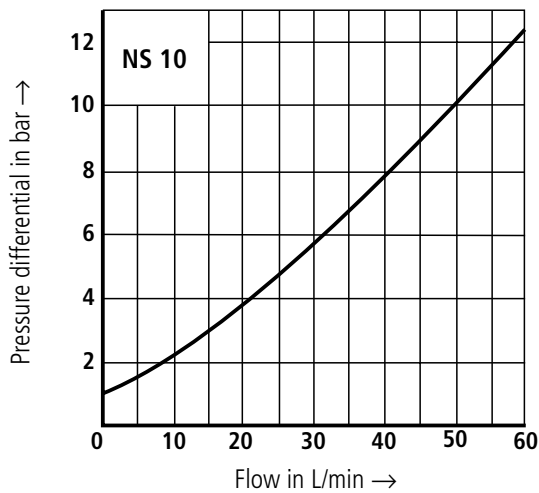


**Leakage flow from A → B**



**Rectifier sandwich plate**

**Pressure differential with the same flow in both directions**  
Flow from A → B (B → A)

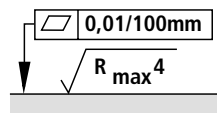


## Unit dimensions

(dimensions in mm)

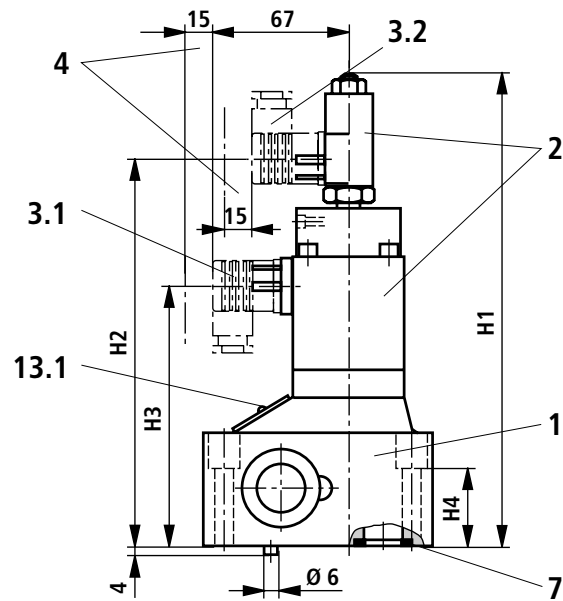
- 1 Valve housing
- 2 Proportional solenoid with inductive position transducer
- 3.1 Plug-in connector to DIN 43 650-AF2/Pg11  
separate order, see page 6
- 3.2 Plug-in connection GM209 (Pg9), manufacturer Hirschmann;  
separate order, see page 6
- 4 Space required to remove the plug-in connector
- 5 Pressure compensator stroke limiter grub screw, internal  
hexagon 3A/F, locknut 10A/F
- 6 Valve fixing screws (separate order)
  - **Without** rectifier sandwich plate  
**NS 10:** 4 off M8 x 60 DIN 912-10.9;  $M_A = 37$  Nm  
**NS 16:** 4 off M10 x 70 DIN 912-10.9;  $M_A = 75$  Nm
  - **With** rectifier sandwich plate  
**NS 10:** 4 off M8 x 120 DIN 912-10.9;  $M_A = 37$  Nm  
**NS 16:** 4 off M10 x 160 DIN 912-10.9;  $M_A = 75$  Nm
- 7 R-ring for ports A, B  
**NG 10:** R-Ring 18,64 x 3,53 x 3,53  
**NG 16:** R-Ring 26,57 x 3,53 x 3,53
- 8 Port A
- 9 Port B
- 10.1 Locating pin (NS 10 and 16)
- 10.2 Locating pin (NS 16)
- 11.1 Drilling for locating pin (NS 10 and 16)
- 11.2 Drilling for locating pin (NS 16)
- 12 Rectifier sandwich plate
- 13.1 Name plate (proportional flow control valve)
- 13.2 Name plate (rectifier sandwich plate NS 10)
- 13.3 Name plate (rectifier sandwich plate NS 16)
- 14 Subplates to catalogue sheet RE 45 066  
(separate order)

NS	10	16	NS	10	16
B1	95	123.5	L1	102.5	123.5
B2	76	101.5	L2	82.5	101.5
B3	9.5	11	L3	10	11
B4	79.4	102.4	L4	68.5	81.5
ØD1	9	11	L5	30	40
ØD2	15	18	L6	23.8	28.6
H1	245	255.5			
H2	200	210			
H3	210	140			
H4	48	51			
H5	60	85			
H6	30	40			

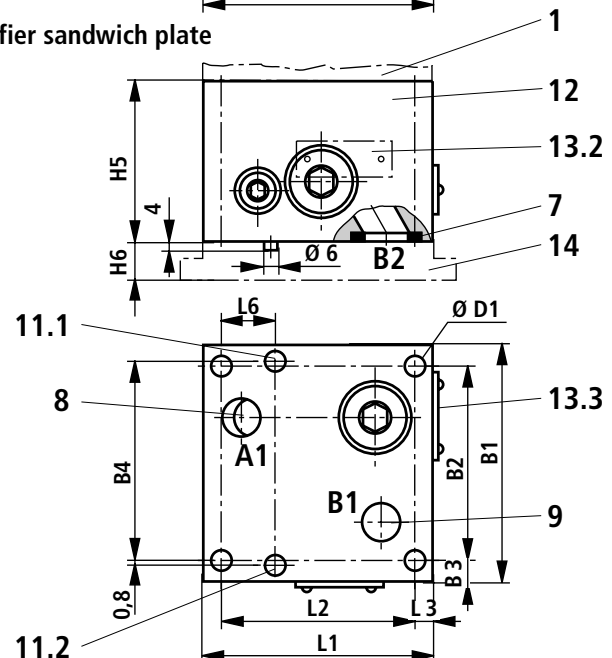


Required surface finish of mating piece

### Proportional flow control valve



### Rectifier sandwich plate



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