

2-way flow control valve

RA 28389/07.04
Replaces: 06.98

1/12

Models 2FRM..., 2FRH... and 2FRW...

Nominal sizes 10 and 16
 Series 3X
 Maximum operating pressure 315 bar (4600 PSI)
 Maximum flow 160 L/min (42.5 GPM)

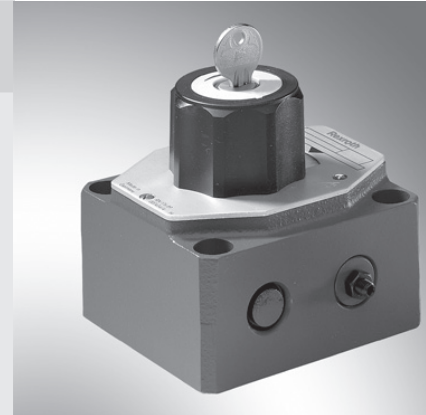


Table of contents

Contents	Page
Features	1
Ordering details	2
Symbols	2, 3
Standard types	4
Functional description, cross-section	4, 5
Technical data	6 and 7
Characteristic curves	8
Unit dimensions	9 to 11
Plug-in connector ordering details	12

Features

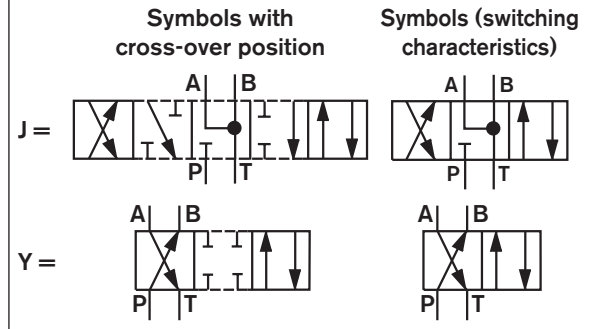
- For subplate mounting,
Mounts on standard ISO 6263-06-2, 07-2; NFPA T3.5.1M
R1 **2 FO 6**, **2 FO 7** interface
For subplates see catalog sheet RE 45066
(separate order)
 - Mechanical operation (type 2FRM..)
 - Hydraulic operation (type 2FRH..)
 - Electro-hydraulic operation (type 2FRW..)
 - Pressure compensator stroke limiter, optional
 - Start-up jump reduction
 - Adjustable stroke limiter for the rack and
pinion actuator (types 2FRH.. and 2FRW..)
 - Flow control in both directions using a
rectifier sandwich plate
- For further information see:
- Pilot valves
 - High performance directional valves RE 23178
 - Subplates RE 45066

Ordering details: 2-way flow control valve

2FR		-3X/			1)	1)	1)	1)	1)		*
-----	--	------	--	--	----	----	----	----	----	--	---

2-way flow control valve		Further details in clear text
Mechanical operation	= M	No code = NBR seals V = FKM seals (other seals on request) ⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Hydraulic operation	= H	
Electro-hydraulic operation	= W	
Nominal size 10	= 10	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Nominal size 16	= 16	
Series 30 to 39 (30 to 39: unchanged installation and connection dimensions)	= 3X	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Flow range A to B		
NS 10, linear		⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Up to 110 L/min	= 10L	
Up to 116 L/min	= 16L	
Up to 125 L/min	= 25L	
Up to 150 L/min	= 50L	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
NS 16, linear		
Up to 60 L/min	= 60L	
Up to 100 L/min	= 100L	
Up to 160 L/min	= 160L	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Without pressure compensator stroke limiter	= No code	
With pressure compensator stroke limiter	= B	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Without actual value potentiometer	= No code	
With actual value potentiometer (not available for type 2FRM)	= P	⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account! Electrical connections K4 ²⁾ = Without plug-in connector with component plug DIN EN 175 301-803 No code = Without hand override N9 = With protected hand override N = With hand override G24 = 24 DC W230 = 230 V AC 50 Hz (for other voltages and frequencies see RE 23178)
Directional valve NS 6 with wet pin solenoid	= 6E	

- ¹⁾ These ordering details **only** have to be entered for the electro-hydraulic operation type 2FRW!
- ²⁾ Plug-in connectors must be ordered separately (see page 12)



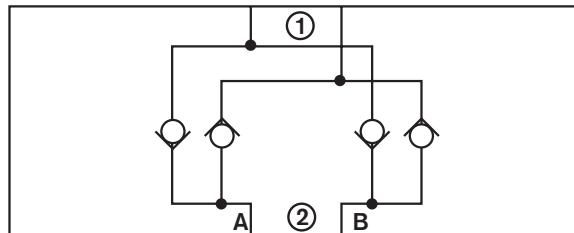
Ordering details: rectifier sandwich plate

Z4S		/	*
-----	--	---	---

Nominal size 10	= 10	Further details in clear text
Nominal size 16	= 16	
Series 30 to 39 (NS 10) (30 to 39: unchanged installation and connection dimensions)	= 3X	No code = NBR seals V = FKM seals (other seals on request) ⚠ Attention! The compatibility of the seals and pressure fluid has to be taken into account!
Series 20 to 29 (NS 16) (20 to 29: unchanged installation and connection dimensions)	= 2X	

Further details in clear text	
No code =	NBR seals
V =	FKM seals
(other seals on request)	
⚠ Attention!	
The compatibility of the seals and pressure fluid has to be taken into account!	

Symbol: rectifier sandwich plate (1) = component side, (2) = subplate side



Symbols: 2-way flow control valve

	Simplified	Detailed
Type 2FRM		
Type 2FRM		
Type 2FRM		
Type 2FRM		<p>Solenoid "a" energized flow controller $q_{V\ min}$</p> <p>Solenoid "b" energized flow controller $q_{V\ max}$</p> <p>Symbol J</p> <p>Symbol Y optional</p>
Type 2FRM		<p>Solenoid "a" energized flow controller $q_{V\ min}$</p> <p>Solenoid "b" energized flow controller $q_{V\ max}$</p> <p>Symbol J</p> <p>Symbol Y optional</p>

Standard types

Type	Material No.
2FRM 10-3X/10L	R900424887
2FRM 10-3X/10LB	R900423250
2FRM 10-3X/16L	R900423251
2FRM 10-3X/16LB	R900423252
2FRM 10-3X/25L	R900423255
2FRM 10-3X/25LB	R900423256
2FRM 10-3X/50L	R900420286
2FRM 10-3X/50LB	R900423261

Type	Material No.
2FRM 16-3X/100L	R900424905
2FRM 16-3X/100LB	R900420287
2FRM 16-3X/160L	R900424906
2FRM 16-3X/160LB	R900424902
2FRM 16-3X/160LV	R900427777
2FRM 16-3X/60L	R900423271
2FRM 16-3X/60LB	R900424903

Functional description, cross-section

Flow control valves of types 2FRM..., 2FRH... and 2FRW... are 2-way flow control valves. They are used to maintain a flow constant virtually independent of pressure and temperature.

The valves basically consist of the housing (1), orifice bush (2), pressure compensator (3) with optional stroke limiter (3.1), check valve (4), adjustment element (5) for type 2FRM... as well as a rack and pinion actuator (6), directional valve (7) and actual value potentiometer (8) for types 2FRH... and 2FRW...

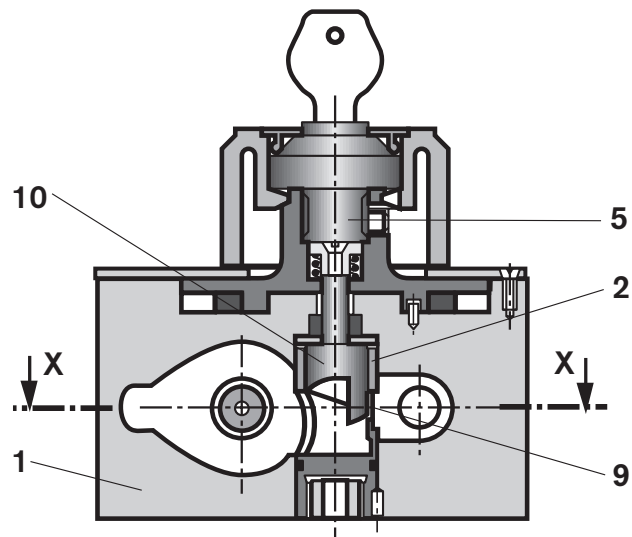
The flow from port A to port B is throttled at the orifice (9). On type 2FRM... the throttling area is adjusted by rotating the curved pin (10) mechanically by means of the adjustment element (5), for types 2FRH... and 2FRW... hydraulically via a rack and pinion actuator (6), which is controlled by a built-on electrically operated directional valve (7). The control speed can be set by means of throttle check valves (6.3 and 6.4). In order to limit the required actuating range, the rack and pinion actuator (6) is fitted with adjustable stroke limiters on both ends (6.1 and 6.2). In order to maintain the flow across the orifice (9) constant, a pressure compensator is connected upstream of the orifice (3).

The flow is maintained largely independent of temperature due to the orifice design.

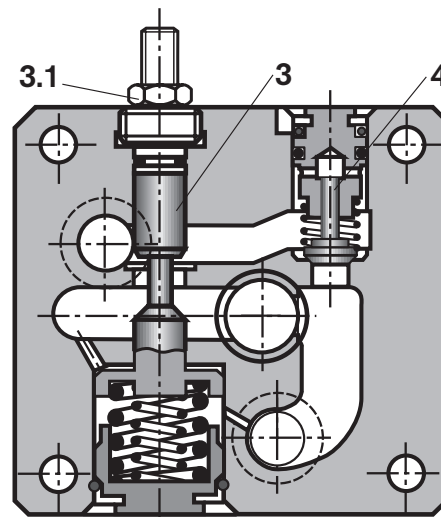
Free return flow from port B to port A is via the check valve (4).

In order to permit the orifice position in valve types 2FRH... and 2FRW... to be continuously monitored, an actual value potentiometer (8) can be fitted. Suitable electrical control components are available for electrical command value pre-selection.

The flow is only controlled from A to B. In order to control the flow in both directions a rectifier sandwich plate type Z4S (supply and return) can be installed under the flow control valve.

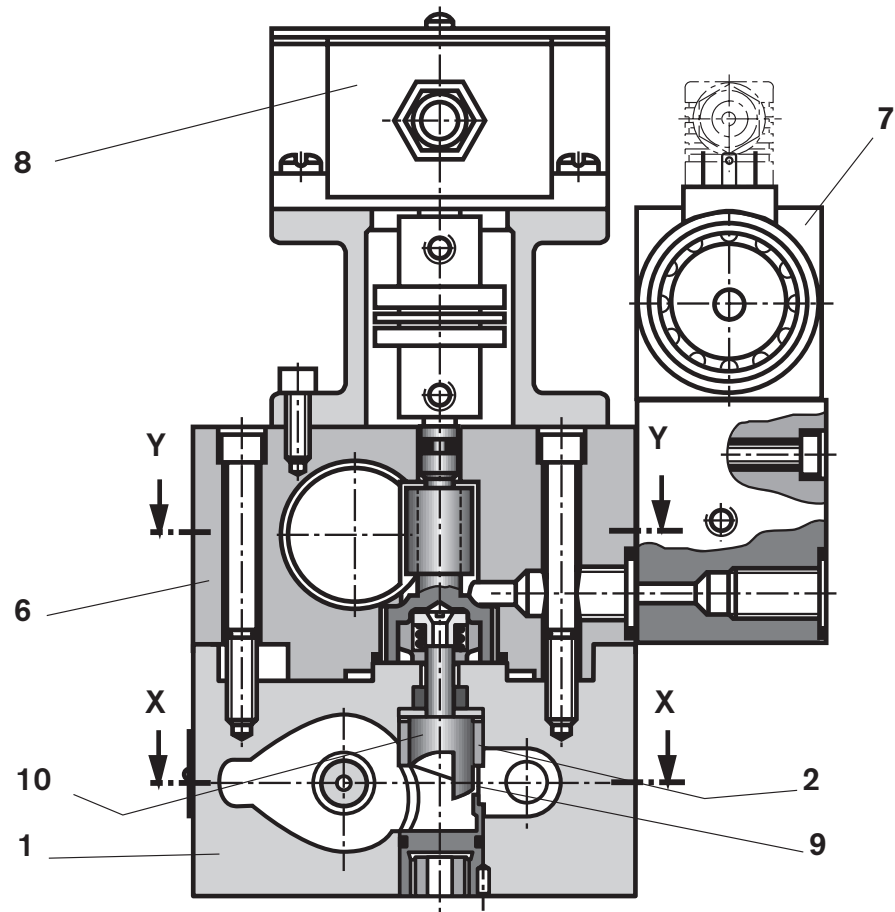


Type 2 FRM...

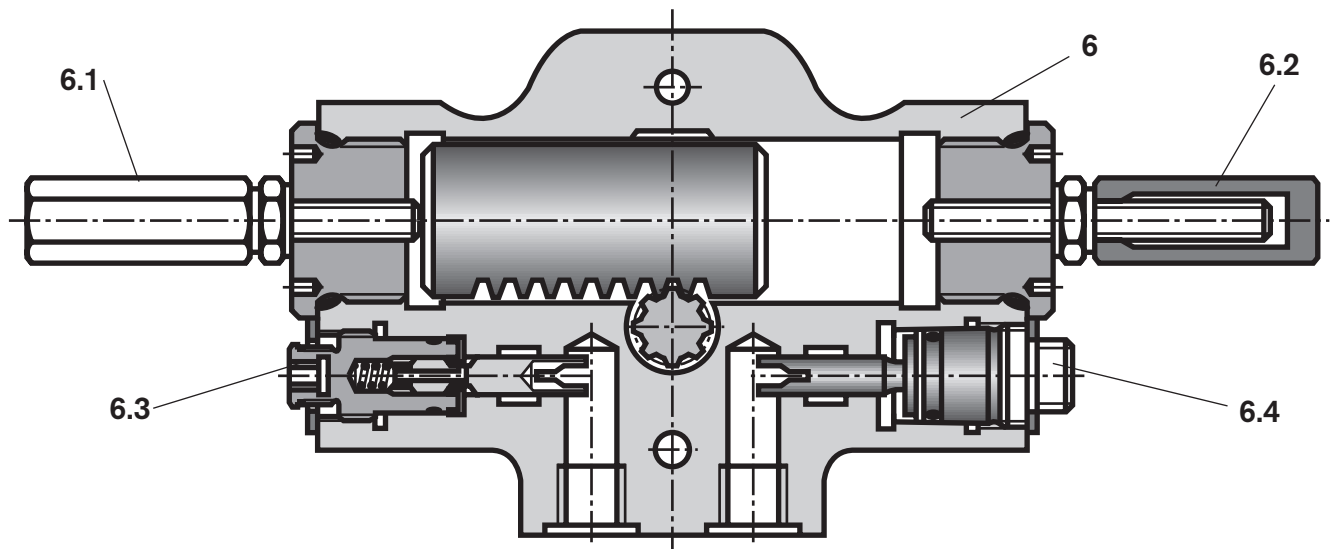


Section X-X

Functional description, cross-section



Type 2FRW...P...



Section Y-Y (rotated through 90°)

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

Weight			NS 10	NS 16
	Type 2FRM	kg (lbs)	5.6 (12.3)	11.3 (24.9)
	Type 2FRH	kg (lbs)	9.2 (20.3)	14.9 (32.8)
	Type 2FRH..P	kg (lbs)	10.3 (22.7)	16 (35.3)
	Type 2FRW	kg (lbs)	11.3 (24.9)	17 (37)
	Type 2FRW..P	kg (lbs)	12.4 (27.3)	18.1 (39.8)
	Rectifier sandwich plate	kg (lbs)	3.0 (6.6)	8.1 (17.8)
Installation		Type 2FRM	Installation	
		Types 2FRH and 2FRW	Actuator horizontal (rack and pinion)	
Pressure fluid		Mineral oil (HL, HLP) to DIN 51 524 1); Fast bio-degradable pressure fluids to VDMA 24 568 (also see RE 90221); HETG (rape seed oil) 1); HEPG (polyglycole) 2); HEES (Synthetic ester) 2); other pressure fluids on request		
Ambient temperature range	NBR seals	°C (°F)	-30 to 80 (-22 to 176) [-30 to 50 (-22 to 122) for type 2FRW]	
	FKM seals	°C (°F)	-20 to 80 (-4 to 176) [-20 to 50 (-4 to 122) for type 2FRW]	
Pressure fluid temperature range	NBR seals	°C (°F)	-30 to +80 (-22 to 176)	
	FKM seals	°C (°F)	-20 to +80 (-4 to 176)	
Viscosity range		mm ² /s (SUS)	10 to 800 (60 to 3710)	
ISO code cleanliness class		Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 (C) class 20/18/15 3)		

¹⁾ Suitable for NBR **and** FKM seals

²⁾ **Only** suitable for FKM seals

³⁾ The cleanliness class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.

For the selection of filters see catalogue sheets RE 50070, RE 50076 and RE 50081.

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

2-way flow control valves types 2FRM..., 2FRH... and 2FRW...

		NS 10				NS 16		
Maximum flow	L/min (GPM)	10 (2.64)	16 (4.23)	25 (6.60)	50 (13.21)	60 (15.85)	100 (26.41)	160 (42.27)
Pressure differential with free-flow from B to A, qV dependent	bar (PSI)	2 (29.0)	2.5 (36.3)	3.5 (50.8)	6 (87.0)	2.8 (40.6)	4.3 (62.4)	7.3 (105.9)
Minimum pressure differential	bar (PSI)	3 to 7 (43 to 101)				5 to 12 (72 to 174)		
Flow control	<ul style="list-style-type: none"> • Temperature, stable, -20 to +80 °C (-4 to +176 °F) • Pressure, stable, up to Dp = 315 bar (4568 PSI) 	± 2 % (qV max)				± 2 % (qV max)		
		± 2 % (qV max)				< ± 5 % (qV max)		
Maximum operating pressure, port A	bar (PSI)	315 (4600)						

2-way flow control valves types 2FRH... and 2FRW...

Pilot volume for the max. adjustment range	cm ³ (in ³)	22 (1.34) at 300°	
Pilot pressure range	bar (PSI)	10 to 100 (145 to 1450) (max. value must not be exceeded!)	
Adjustment speed (dependent on the pilot pressure)		Without potentiometer	With potentiometer
(Dependent on the pilot pressure)		5 to 2000°/s	5 to 300°/s
Maximum flow (directional valve)	L/min (GPM)	10 (2.64)	See RE 23178
Maximum operating pressure (directional valve)	bar (PSI)	Up to 315 (4600)	See RE 23178

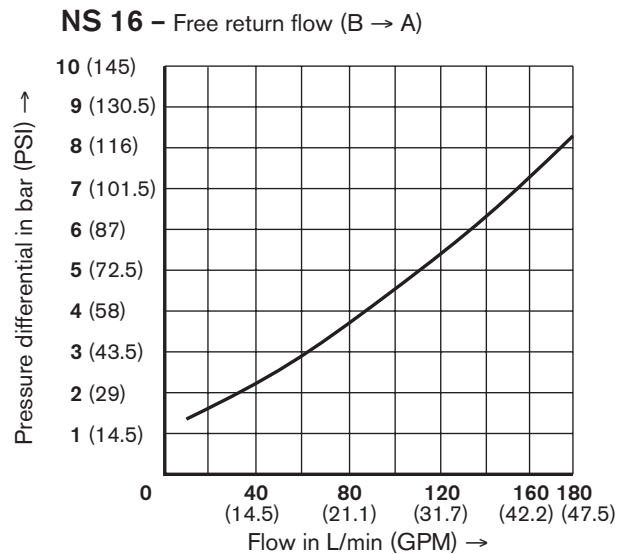
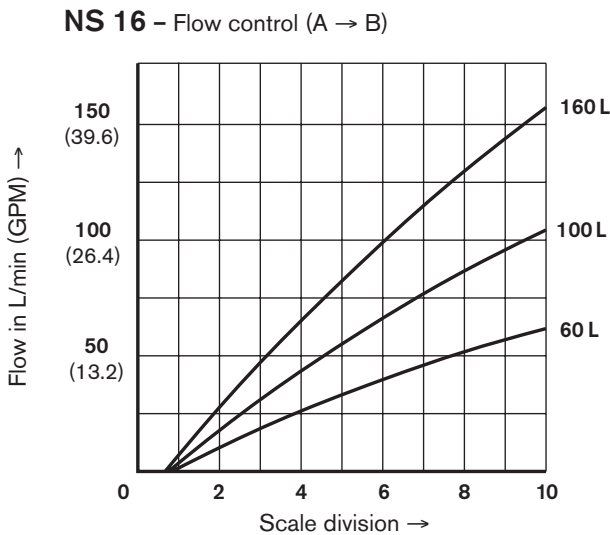
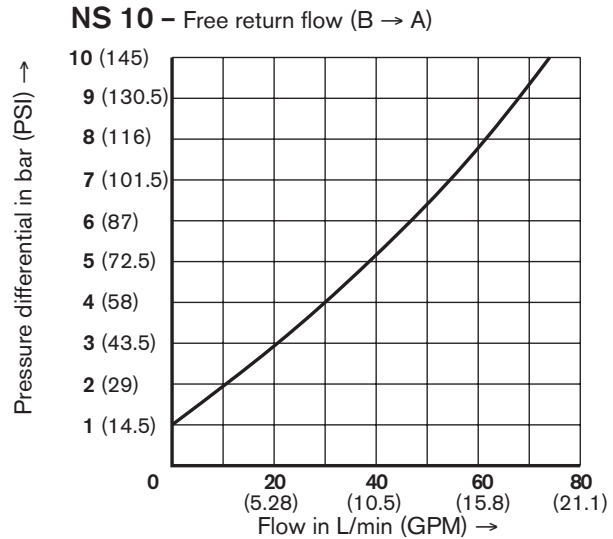
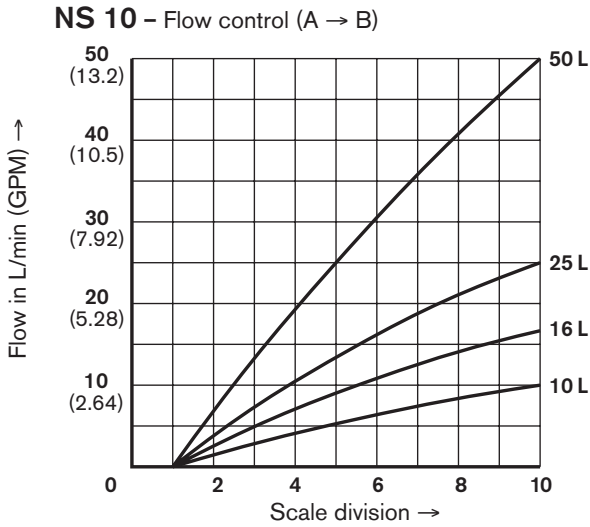
Potentiometer

		Actual value potentiometer
Resistance	Ω	1000
Loadability	W	5
Maximum wiper current	A	0.12
Protection to DIN 40 050		IP 65
Adjustment end position error (dependent on the adjustment speed)		±1.5° at 10°/s

Rectifier sandwich plate Z4S...

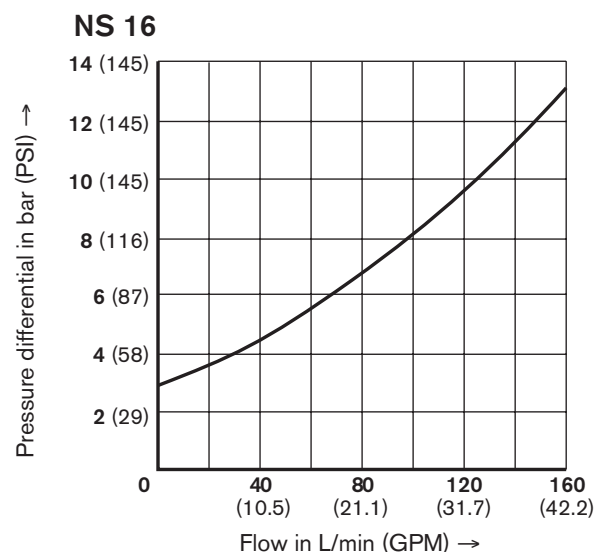
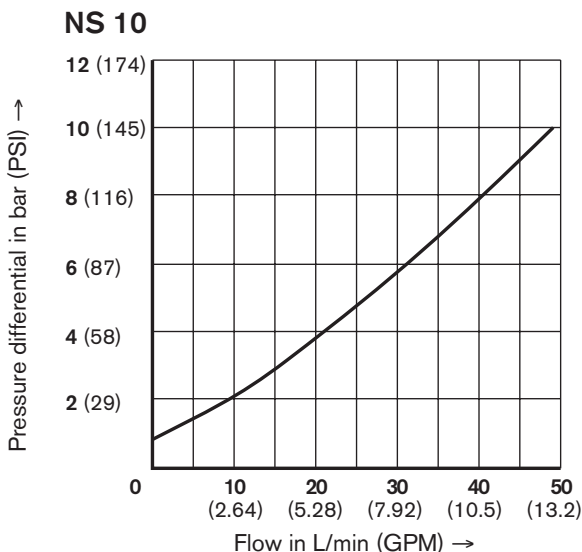
Flow, max.	L/min (GPM)	50 (13.2)	160 (42.27)
Operating pressure, max.	bar (PSI)	315 (4600)	
Opening pressure	bar (PSI)	1.5 (22)	

Characteristic curves – measured with HLP46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ ($104\text{ °F} \pm 41\text{ °F}$)



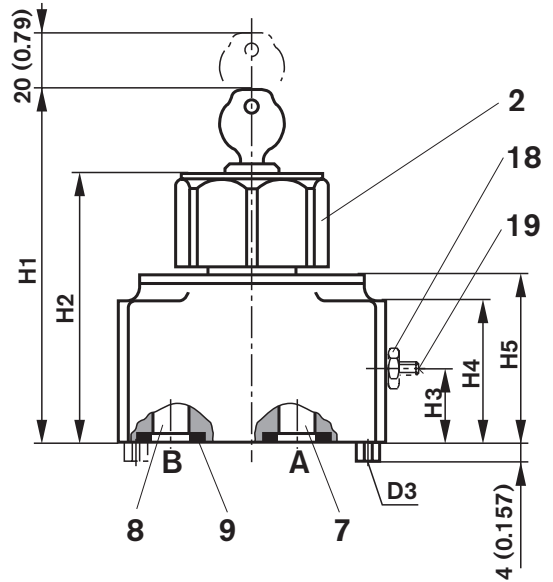
Characteristic curves: rectifier sandwich plate – measured with HLP46, $\vartheta_{oil} = 40\text{ °C} \pm 5\text{ °C}$ ($104\text{ °F} \pm 41\text{ °F}$)

Pressure differential Δp is the same for both directions of flow q_v from A to B (B to A)



Unit dimensions: 2-way flow control valve type 2FRM – dimensions in millimeters (inches)

- 1 Pressure compenstor stroke limiter, optional
- 2 Adjustment element, lockable rotary knob
(may be locked in any position)
Turning range 300° = 10 scale divisions
 $M_d \approx 0.7 \text{ Nm (6.2 lb-in)}$
- 6 Name plate
- 7 Input "A"
- 8 Output "B"
- 9 Seal ring
- 10.1 Locating pin (NS 10 and 16)
- 10.2 Locating pin (NS 16)
- 18 Hexagon 10A/F
- 19 Internal hexagon 3A/F



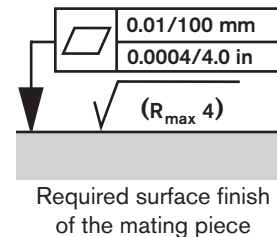
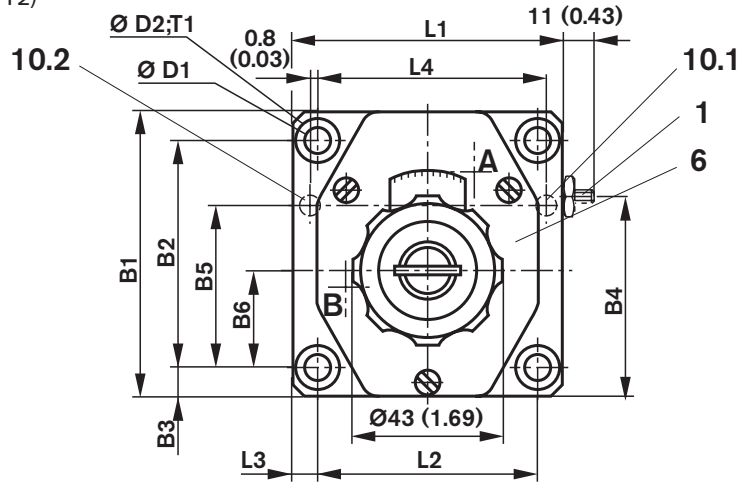
Subplates for:

	BSP	SAE Ports
Nominal size 10:	G 279 (G 1/2)	(SAE-8; 3/4"-16)
	G 280 (G 3/4)	(SAE-12; 1 1/16"-12)
Nominal size 16:	G 281 (G 1)	(SAE-16; 1 5/16"-12)
	G 282 (G 1 1/4)	(SAE-20; 5/8"-12)

to catalogue sheet RE 45066 and

Valve fixing screws

- Nominal size 10
M8 x 50 DIN 912-10.9 (5/16-18 UNC x 2");
 $M_A = 37 \text{ Nm (27.3 lb-ft)}$
 - Nominal size 16
M10 x 80 DIN 912-10.9 (3/8-16 UNC x 3");
 $M_A = 75 \text{ Nm (55.3 lb-ft)}$
- Must be ordered separately.

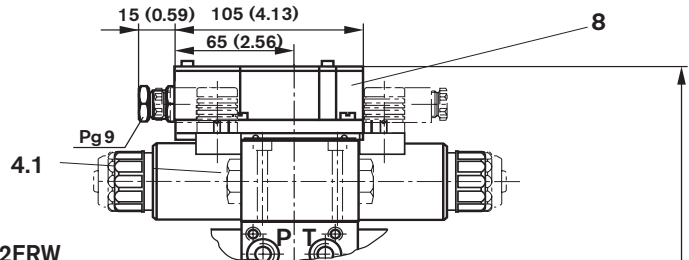


NS	B1	B2	B3	B4	B5	B6	Ø D1	Ø D2	D3	H1	H2	H3	H4	H5	L1	L2	L3	L4	T1
10	101.5 (4)	82.5 (3.24)	9.5 (0.37)	68 (2.67)	58.7 (2.31)	35.5 (1.39)	9 (0.354)	15 (0.590)	6 (.24)	125 (4.92)	95 (3.74)	26 (1.02)	51 (2.0)	60 (2.3)	95 (3.74)	76 (2.99)	9.5 (0.37)	79.4 (3.12)	13 (0.52)
16	123.5 (4.86)	101.5 (3.99)	11 (0.43)	81.5 (3.2)	72.9 (2.87)	41.5 (1.63)	11 (0.434)	18 (0.708)	6 (.24)	147 (5.79)	117 (4.61)	34 (1.33)	72 (2.8)	82 (3.2)	123.5 (4.86)	101.5 (3.99)	11 (0.43)	102.4 (4.0)	12 (0.47)

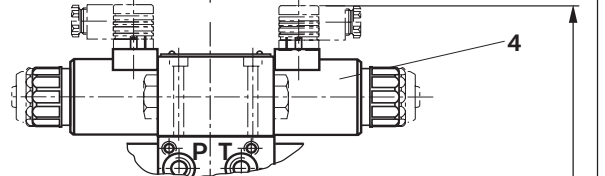
Unit dimensions: 2-way flow control valve types 2FRW, 2FRH – dimensions in mm (inches)

- 1 Pressure compensator stroke limiter, optional
- 2 Flow indicator, rotation range 300° = 10 scale divisions
- 3.1 Rack and pinion actuator stroke limiter for min. flow 1 turn = approx. 12° (of 300°)
- 3.2 Rack and pinion actuator stroke limiter for max. flow 1 turn = approx. 12° (of 300°)
- 4 Directional valve NS 6, symbols J or Y (Y de-energized = $q_{V \min}$)
For detailed dimensions of the directional valve, see RE 23178
- 4.1 Cover for valve type Y
- 5 Actual value potentiometer
- 6 Name plate
- 7 Input "A"
- 8 Output "B"
- 9 Seal ring
- 10.1 Locating pin (NS 10 and 16)
- 10.2 Locating pin (NS 16)
- 11.1 Speed adjustment throttle towards min. flow (v_0 to $v_{\max.} = 5$ turns); Internal hexagon 6A/F
- 11.2 Speed adjustment throttle towards max. flow (v_0 to $v_{\max.} = 5$ turns); Internal hexagon 6A/F
- 12.1 Pressure in X = opening of the orifice
- 12.2 Pressure in Y = closing of the orifice
- 13 Scale disc
- 18 Hexagon 10A/F
- 19 Internal hexagon 3A/F
- 20 Hexagon 13A/F

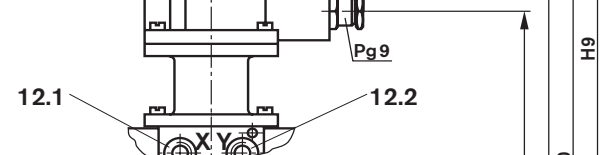
Type 2FRW..P



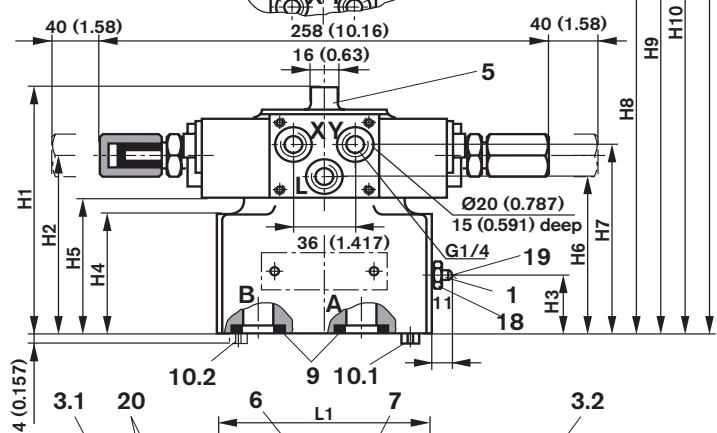
Type 2FRW



Type 2FRH..P

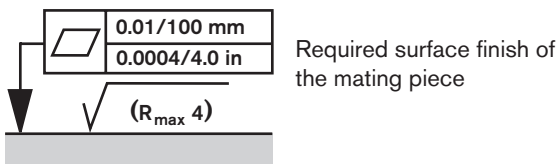


Type 2FRH



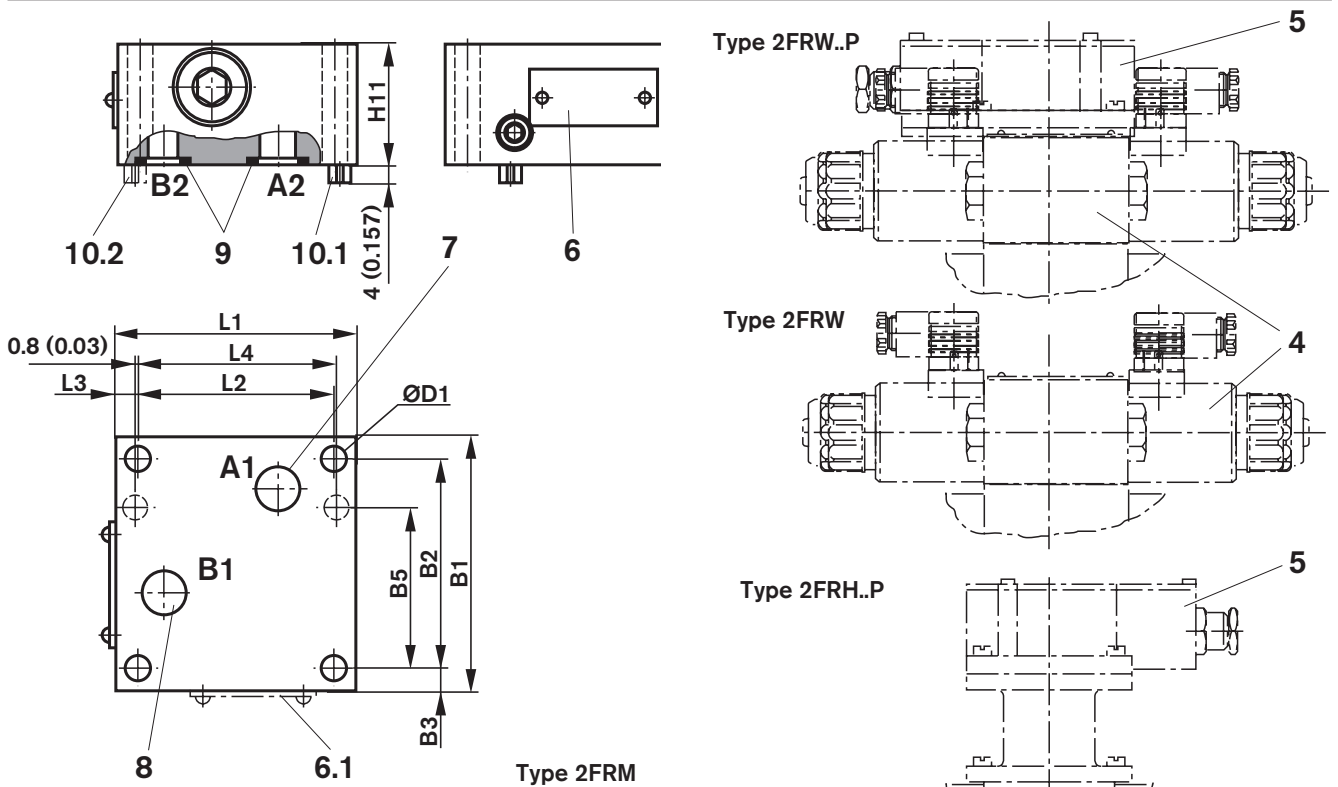
For subplates and valve fixing screws and valve connection dimensions see page 9.

- 1) Type 2FRH
- 2) Type 2FRW
- 3) Dimension with plug-in connection **without** circuitry to DIN EN 175 301–802 and ISO 4400
- 4) Dimension with plug-in connector **with** circuitry to DIN EN 175 301–802 and ISO 4400



NS	B1	B2	B3	B4	B5	B6	H1	H2	H3	H4	H5	H6	H7 ¹⁾	H7 ²⁾	H8	H9	H10 ³⁾	H10 ⁴⁾	L1
10	101.5 (4)	146 (5.74)	9.5 (0.37)	68 (2.67)	35.5 (1.38)	54.5 (2.14)	125.5 (4.94)	84 (3.3)	26 (1.02)	51 (2)	58 (2.2)	70 (2.7)	89 (3.5)	87 (3.4)	179 (7.0)	203 (7.99)	201 (7.91)	206 (8.11)	95 (3.74)
16	123.5 (4.86)	160.5 (6.3)	11 (0.43)	81.5 (3.2)	41.5 (1.63)	60.5 (2.38)	147.5 (5.81)	106 (4.17)	34 (1.33)	72 (2.8)	80 (3.1)	92 (3.6)	111 (4.37)	109 (4.29)	201 (7.9)	225 (8.86)	223 (8.7)	228 (8.98)	123.5 (0.47)

Unit dimensions: rectifier sandwich plate Z4S... – dimensions in mm (inches)



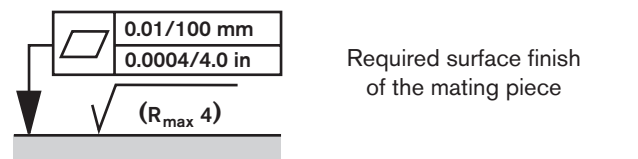
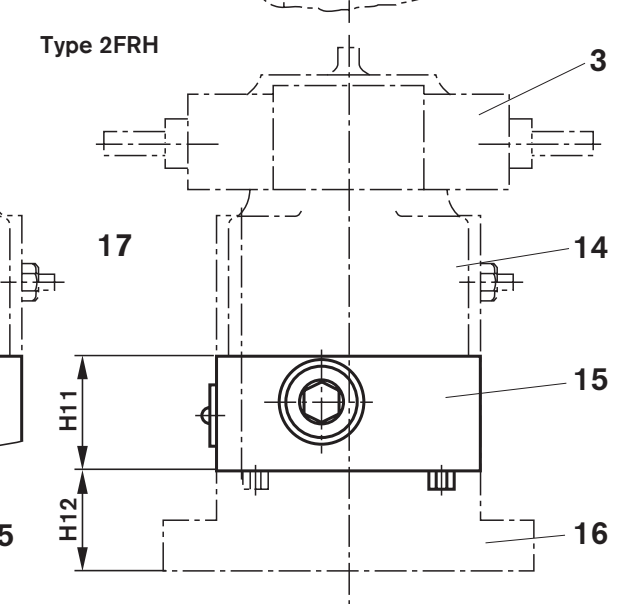
- 3 Rack and pinion actuator
- 4 Directional valve NS 6
- 5 Actual value potentiometer
- 6 Name plate (NS 10)
- 6.1 Name plate (NS 16)
- 7 Input "A"
- 8 Output "B"
- 9 Seal ring
- 10.1 Locating pin (NS 10 and 16)
- 10.2 Locating pin (NS 16)

- 14 2-way flow control valve
- 15 Rectifier sandwich plate
- 16 Subplates, see page 6
- 17 Valve fixing screws

Nominal size 10:
 M8 x 100 DIN 912-10.9 (5/16-18 UNC x 4");
 $M_A = 37 \text{ Nm (27.3 lb-ft)}$

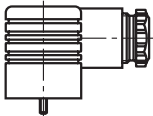
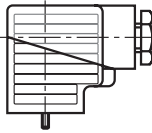
Nominal size 16:
 M10 x 160 DIN 912-10.9 (3/8-16 UNC x 6-1/4");
 $M_A = 75 \text{ Nm (55.3 lb-ft)}$

Valve fixing screws for inserting a rectifier sandwich plate between the flow control valve and subplate must be ordered separately.



NS	B1	B2	B3	B5	Ø D1	H11	H12	L1	L2	L3	L4
10	101.5 (4)	82.5 (3.248)	9.5 (0.374)	58.7 (2.31)	9 (0.354)	50 (1.97)	30 (1.18)	95 (3.74)	76 (2.992)	9.5 (0.374)	79.4 (3.12)
16	123.5 (4.86)	101.5 (3.996)	11 (0.433)	72.9 (2.81)	11 (0.433)	85 (3.35)	40 (1.57)	123.5 (4.86)	101.5 (3.996)	11 (0.433)	102.4 (4.03)

Ordering details: plug-in connectors to DIN EN 175 301-803 and ISO 4400 for component plug "K4"

For further plug-in connectors see RE 08006					
		Material No.			
Valve side	Color	Without circuitry	With indicator light 12 ... 240 V	With rectifier 12 ... 240 V	With indicator light and Z-diode protective circuitry 24 V
a	Grey	R901017010	-	-	-
b	Black	R901017011	-	-	-
a/b	Black	-	R901017022	R901017025	R901017026

Bosch Rexroth Corp.
Industrial Hydraulics
2315 City Line Road
Bethlehem, PA 18017-2131
USA
Telephone (610) 684-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

© This document, as well as the data, specifications and other information set forth in it, are the exclusive property of Bosch Rexroth Corporation. Without their consent it may not be reproduced or given to third parties.

The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.