2-Way Proportional Flow Control Valve

Model: 2FRE(E)...4X

- Size 10, 16
- Maximum working pressure 315 bar
- Maximum working flow 160 L/min

Contents

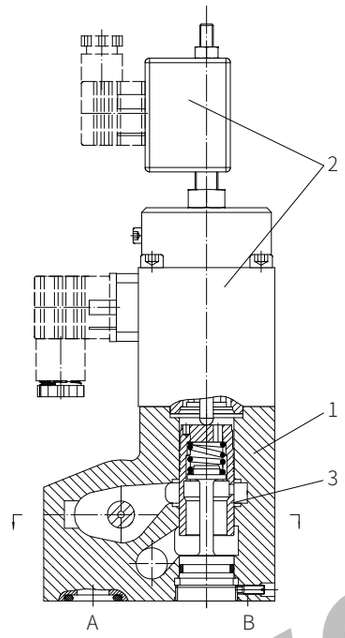
Features

- With pressure compensation for the pressure compensated control a flow
- Operation by proportional solenoid
- With electrical position feedback of control throttler
- The position transducer coil is axially adjusted to make the zero position adjustment of the throttle port easy (electrical, hydraulic) without the need to adjust the electronics
- Minimum sample variation of valve 2FRE and proportional amplifiers

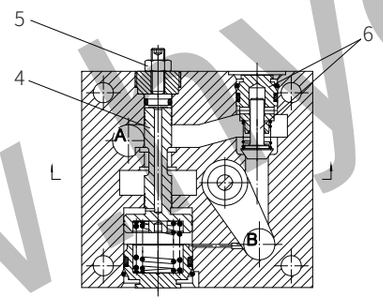
Function description, sectional drawing

The 2FRE... proportional flow control valves have a 2-way function.They can control a corresponding flow with a large degree of compensation for pressure and temperature according to the provided electrical command value. The valve basically consists of valve body (1), proportional solenoid with inductive position transducer (2), measurement orifice (3), pressure compensator (4), stroke limiter (5) and optional check valve (6).

The setting of the flow rate (0 to 100%) is determined on the command value potentiometer. The applied command value adjusts the measurement orifice (3) via the amplifier and proportional solenoid. The position of the measurement orifice (3) is measured by the inductive position transducer. Any deviation from the command value is compensated through feedback control. The pressure compensator (4) keeps the pressure drop at the measurement orifice (3) at a constant value at all times. Therefore, the flow is load compensated. The low temperature drift is achieved due to the design of the measurement orifice. With a command value of 0%, the measurement orifice is closed.



In the case of a power failure or a cable break at the inductive position transducer, the measurement orifice closes. When the command value is 0%, it is possible a start-up without overshoot. The opening and closing of the measurement orifice can be delay via two ramps in the proportional amplifier.



Via the check valve (6) a free flow from B to A is possible. By installing a rectifier sandwich plate Z4S...under the proportional flow control valve, the flow from the actuator can be controlled in both directions.

Models and specifications

Proportional flow control valve

2FRE | E | –4X | / | B | / | | *

- without integrated electronics =No code
- with integrated electronics =E
- Size 10 =10
- Size 16 =16
- 40 to 49 series =4X
- (40 to 49 series installation and connection size unchanged)
- more information in text
- sealing material
- No code= NBR seals
- V= FKM seals
- (consult for other seals)
- Interface for electronics (only for model 2FREE)
- A1= command value ±10V
- F1= command value 4 to 20mA
- electrical connection
- No code= for model 2FREE: without plug
- K31= for model 2FREE
- B=pressure compensator, with stroke limiter

Flow range A →B		
Size 10		Size 16
Linear	Increase by degrees	Linear
to 5L/min=5L	to 5L/min=5Q	to 80L/min=80L
to 10L/min=10L	to 10L/min=10Q	to 100L/min=100L
to 16L/min=16L	to 16L/min=16Q	to 125L/min=125L
to 25L/min=25L	to 25L/min=25Q	to 160L/min=160L
to 50L/min=50L		
to 60L/min=60L		

Rectifier sandwich plate

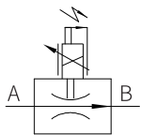
Z4S | – | 2X | / | *

- Size 10 =10
- Size 16 =16
- 20 to 29 series =2X
- (20 to 29 series installation and connection size unchanged)
- more information in text
- sealing material
- No code= NBR seals
- V= FKM seals
- (consult for other seals)

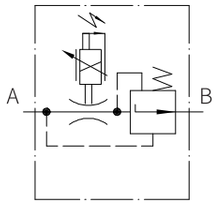
Functional symbols

Proportional flow control valve

Simplified

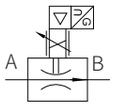


Detailed

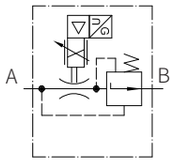


Proportional flow control valve (with integrated OBE)

Simplified

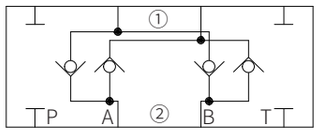


Detailed



Rectifier sandwich plate

(①= Valve side, ②= Subplate side)



Technical parameters

Overview										
Size		10					16			
Installation position		Optional								
Storage temperature range	°C	-20 to+80								
Environment 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 (Measured when using HLP46, ϑ_{oil}=40°C ± 5°C)										
Max. working pressure Port A	bar	to 315								
Flow $q_{v\,max.}$ Linear	L/min	10	16	25	50	60	80	100	125	160
Progressive	L/min	40					-			
Minimum pressure differential	bar	3 to 8					6 to 10			
Pressure differential with free return flow B → A	bar	See characteristic curve								
Flow control temperature drift	%	△q_v /°C 0.1在$q_{v\,max.}$ Hydraulic + electrical								
	%	to △p=315bar ±2 in $q_{v\,max.}$ Pressure compensator								
Fluid		Mineral oil (HL, HLP)[1] in accordance with DIN 51524; Fast living organisms degraded oil according to VDMA 24568; HETG (Rapeseed oil)[1]; HEPG(Polyethyleneglycol)[2] ; HEES (Synthetic Fats)[2]								
Oil temperature range	°C	-20 to +80								
Viscosity range	mm^2/s	15 to 380								
Cleanliness of oil[3]		The maximum allowable pollution level of oil is ISO4406 Class 20/18/15								
Hysteresis	%	＜±1 of $q_{v\,max}$								
Repeatability	%	＜1 of $q_{v\,max}$								
Manufacturingtolerance		⩽±2% with command value 33%								
model 2FRE6...		⩽±5% with command value 100%								
RT-MRPD1-150-30-CN-A1/F1	%	＜±2								
Hydraulic – Rectifier sandwich plate										
Working pressure	bar	to 315								
Cracking pressure	bar	15								
Nominal flow	L/min	60					160			

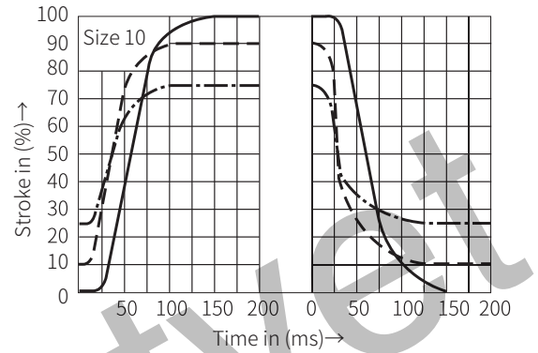
04

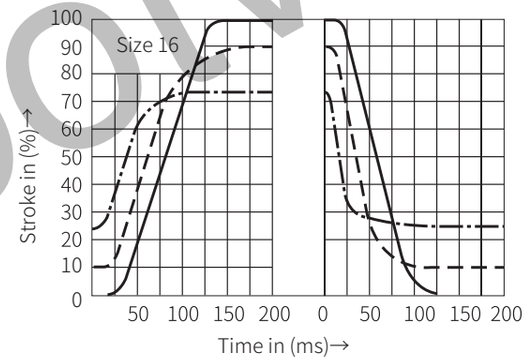
Technical parameters

Electrical (proportional solenoid)				
Protection to DIN40050		IP65		
Voltage type		DC		
Coil resistance	Cold value at 20°C Ω	10		
	Max. warm value Ω	13.9		
Duty cycle		100		
Maximum current per solenoid A		1.51		
Electrical connections		Component plug		
		Connecting plug		
Electrical (Inductive position transducer)				
Protection to DIN40050 bar		IP65		
Coil resistance	Cold value at 20°C Ω	31.5	45.5	31.5
	Between.. and Ω	1 and 2	2 and ≙	1 and ≙
Electrical connections		Component plug		
		Connecting plug		
Inductivity mH		6 to 8		
Oscillator frequency KHz		2.5		
Electrical position measurement system		Different throttle valves		
Nominal stroke mm		4		

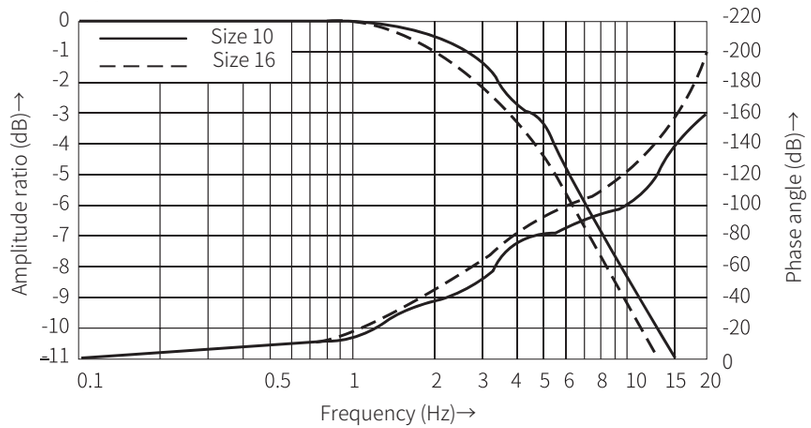
Characteristic curve

(Measured when using HLP46, ϑ_{oil}=40°C ± 5°C,
Pnom = 50 bar, Amplitude 0 → >100 %; size 10 type 60L and size 16 type 160L)
Transient function at stepped command value change





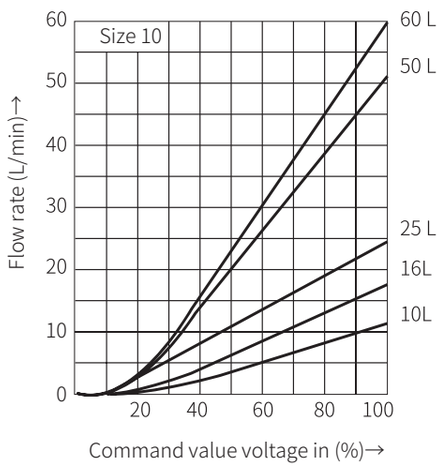
Frequency response characteristic curves

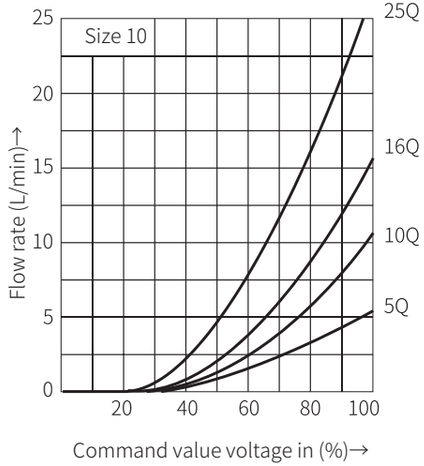


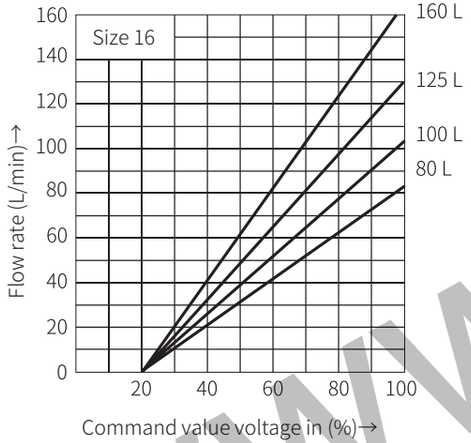
Characteristic curve

(Measured when using HLP46, ϑ_{oil}=40°C ± 5°C)

Dependence of flow on command value voltage (flow control from A → B)



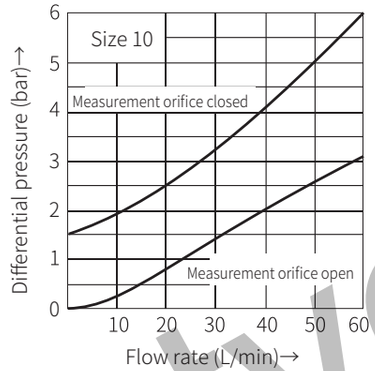


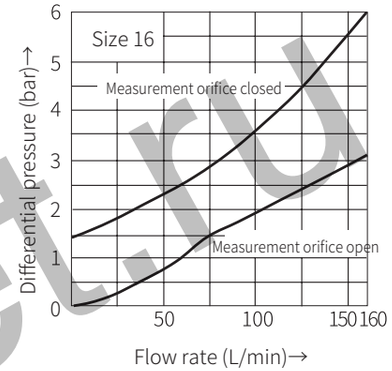


Characteristic curve

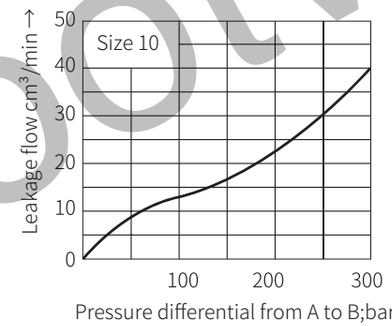
(Measured when using HLP46, ϑ_{oil}=40°C ± 5°C)

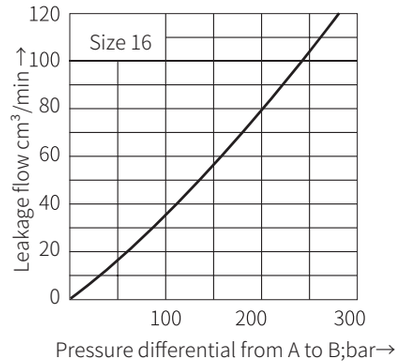
Pressure differential via check valve B → A





Leakage flow from A to B

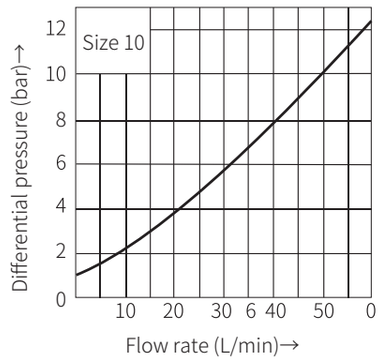


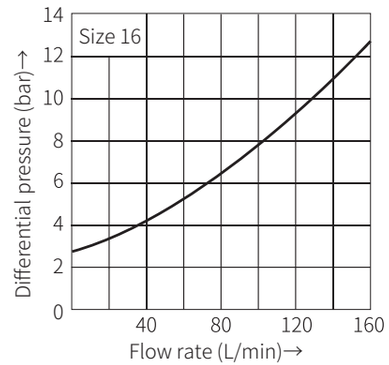


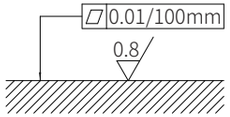
Rectifier sandwich plate

The pressure differential and flow relationship in two flow directions are the same

Flow from A → B (B → A)

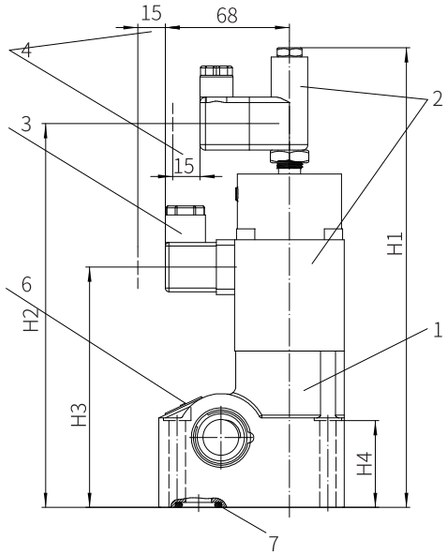




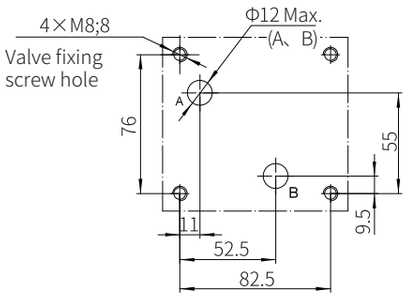


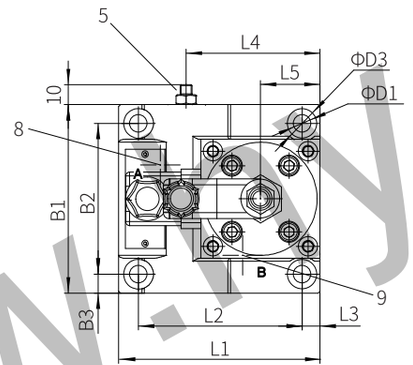
Required surface finishing of mating components

1 Valve body
2 Proportional solenoid with inductive position transducer
3 Connecting plug
4 Space required to remove the plug
5 Pressure compensator with stroke limiter
6 Name plate
7 O-ring
(NG10: 18.66x3.53; NG16: 26.58x3.53)
8 Port A
9 Port B

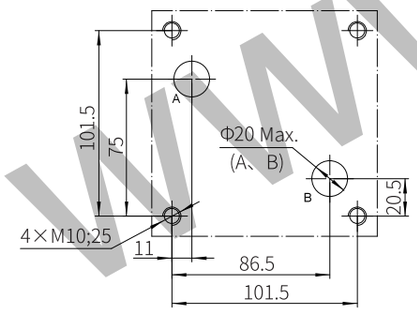


2FRM10 Installation surface size



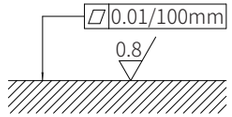


2FRM16 Installation surface size



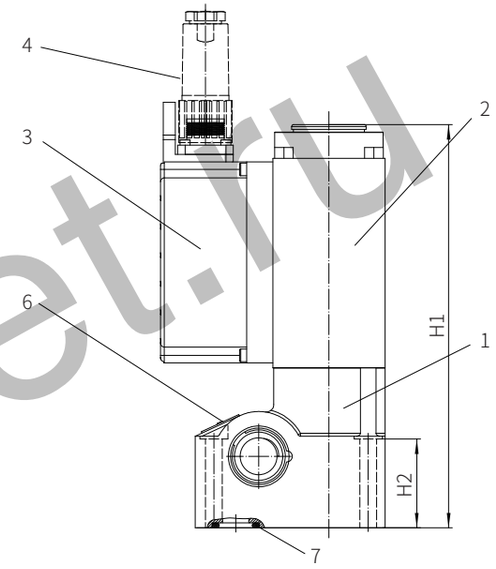
Size	B1	B2	B3	L1	L2	L3	L4
10	76	9.5	101.5	82.5	9	6	7.5
16	123.5	101.5	11	23.5	101.5	11	81.5

Size	L5	H1	H2	H3	H4	D1	D2
10	30	251.5	210	131.5	47.5	9	15
16	44	261.5	220	141.5	51	11	18

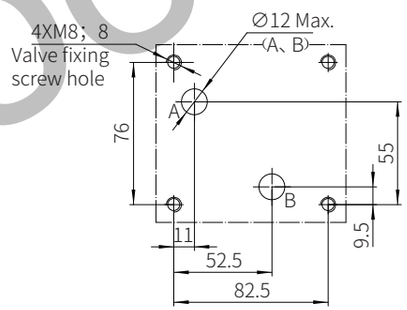


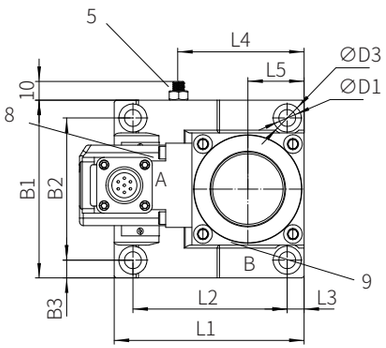
Required surface finishing of mating components

1 Valve body
2 Proportional solenoid with inductive position transducer
3 Integrated amplifier (OBE)
4 7-pin aviation plug
5 Pressure compensator with stroke limiter
6 Name plate
7 O-ring
(NG10: 18.66x3.53; NG16: 26.58x3.53)
8 Port A
9 Port B

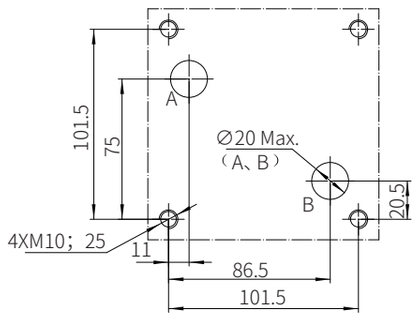


2FRM10 Installation surface size





2FRM16 Installation surface size



Size	B1	B2	B3	L1	L2	L3	L4
10	95	76	9.5	101.5	82.5	9	67.5
16	123.5	101.5	11	123.5	101.5	11	81.5

Size	L5	H1	H2	D1	D2
10	30	215.5	47.5	9	15
16	44	225.5	51	11	18