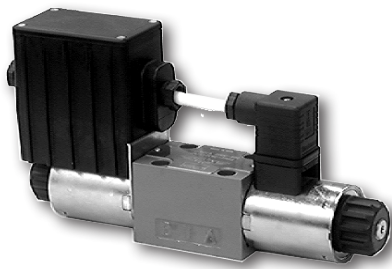


Proportional Directional Control Valve, with Analogue Control Electronics

PRM2-04

Size 04 (D02) • Q_{max} 20 l/min (5 GPM) • p_{max} 320 bar (4600 PSI)



Technical Features

- › Direct acting, proportional control valve without or with integrated analogue electronic (OBE) with subplate mounting interface acc. to ISO 4401, DIN 24340 (CETOP 02) standards
- › Used for directional and speed control of hydraulic actuators
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › The valve can be controlled directly by a current control supply unit or by means of the electronic control units to exploit valve performance to the full
- › Converter analogue card allow a fine control of the positioning of the valve spool, reducing hysteresis and response time and optimizing the performance of the valve
- › Three chamber housing design for production cost saving
- › For versions without OBE wide range of solenoid electrical terminal versions available
- › Wide range of interchangeable spools and manual overrides available
- › The coil is fastened to the core tube with a retaining nut and can be rotated by 360° to suit the available space
- › In the standard version, the valve housing is phosphated and steel parts zinc-coated for 240 h salt spray protection acc. to ISO 9227
- › Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray)

Functional Description

PRM2-04* Versions without on board electronics

The valve can be controlled directly by a current control supply unit or by means of the external electronic card directly mounted to the electrical terminal (see catalogue of EL3E card 9145 and EL6 card 9150). This control card, depending on the number of the controlled solenoids, can be mounted onto either solenoid.

PRM2-04*EK Versions with on board electronics

A control box, which comprises one or two electronic control cards, depending on the number of the controlled solenoids, can be mounted onto either solenoid. With the model with two solenoids, the solenoid mounted opposite the control box is connected with the box by means of a DIN connector, a two-cored cable and a bushing. The connection of the control box with the supply source and with the control signal is realized by means of a 4-pin connector, type M12x1. The electric control unit supplies the solenoid with current, which varies with the control signal.

The electronic control unit provides the following adjustment possibilities:

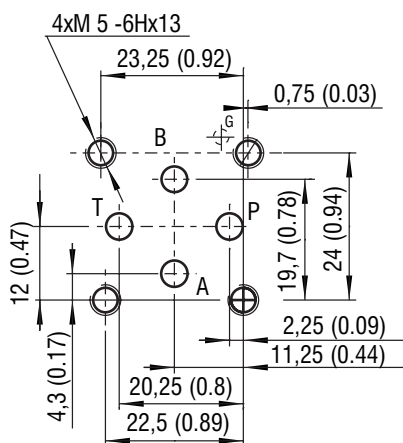
Offset, gain, rise and drop-out time of the ramp generator, frequency (2 frequencies) and amplitude of the dither signal generator. The correct function of the control unit is signaled by LED-diodes. Stabilized voltage +10V (+5V for 12V voltage) is also available for the user.

By the use of this voltage, a voltage control signal can be made by means of a potentiometer ≥ 1 kW.

The electronic control card enables voltage or current control to be used, according to the positions of the switches SW1 to SW3.

Technical Data

ISO 4401-02-01-0-05



Ports P, A, B, T - max. \varnothing 4.5 mm (0.18 in)

Nominal Size		04 (D02)	
Max. operating pressure at port P, A, B	bar (PSI)	320 (4580)	
Max. operating pressure at port T	bar (PSI)	210 (3050)	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +80 (-4 ... +176)	
Ambient temperature range	°C (°F)	-30 ... +50 (-22 ... +122)	
Hysteresis	%	≤ 6	
Nominal flow rate Q_n at $\Delta p=10$ bar (145 PSI)	l/min (GPM)	4 (1.1) 8 (2.1) 12 (3.2)	
Protection degree (for version PRM*EK)		IP65	
Mass - valve with 1 solenoid	kg (lbs)	0.9 (1.98)	
- valve with 2 solenoids		1.25 (2.76)	
Technical Data of the Proportional Solenoid			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	1.7	0.8
Mean resistance value at 20 °C (68 °F)	Ω	5	21
Technical data of the electronics		Ucc 12V DC	Ucc 24V DC
Supply voltage range	V	11.2... 14.7	20... 30
Stabilized voltage for control	V	5 DC (R > 1 k Ω)	10 DC (R > 1 k Ω)
Control signal		see table of switches configuration (page 4,5 and 6)	
Maximum output current	A	2.4 for R < 4 Ω	1.5 for R < 10 Ω
Ramp adjustment range	s	0.05... 3	
Dither frequency	Hz	90 / 60	
Dither amplitude	%	0... 30	
	Data Sheet	Type	
General information	GI_0060	products and operating conditions	
Coil types / Connectors	C_8007 / K_8008	C19B* / K*	
Mounting interface	SMT_0019	Size 04	
Spare parts	SP_8010		
Subplates	SP_0002	DP*-04	

Ordering Code

PRM2-04 [] / [] - [] [] [] [] - []

Proportional directional control valve, with analogue control electronics

Valve size

Spool symbols

see table „Spool Symbols“

Nominal flow rate at $\Delta p = 10$ bar (145 PSI)

4 l/min (1.05 GPM)	4
8 l/min (2.1 GPM)	8
12 l/min (3.2 GPM)	12

Rated supply voltage of solenoids (at the coil terminal)

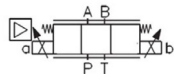
12 V DC	12
24 V DC	24

Electronics on board / Position at solenoid

connection by connector M12 x 1

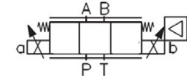
(4-pin connector, supplied with counterpart)

on board electronics (solenoid „a“)



EK

on board electronics (solenoid „b“)*



EKB

Surface treatment
 No designation standard
 A zinc-coated (ZnCr-3), ISO 9227 (240 h)
 B zinc-coated (ZnNi), ISO 9227 (520 h)

Seals
 No designation NBR
 V FPM (Viton)

Manual override
 No designation standard
 N2 protected with rubber boot

Connector
 only for version without on board electronic „EK“
 E1 EN 175301-803-A
 E2 E1 with quenching diode
 E3 AMP Junior Timer - axial direction
 E4 E3 with quenching diode
 E3A AMP Junior Timer - axial direction (2 pins; male)
 E4A E3A with quenching diode
 E8 loose conductors (two insulated wires)
 E9 E8 with quenching diode
 E12A deutsch DT04-2P - axial direction (2 pins; male)
 E13A E12A with quenching diode

*For valve versions with one solenoid the designation „B“ with OBE is not shown.

- Valves without integrated control electronics with E1, E2 coils (with connector according to EN 175301-803, form A) are delivered in the standard version with connector sockets.
- For proportional valves with two solenoids, one solenoid must be de-energized before the other solenoid can be charged.
- Mounting bolts M5 x 35 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 5 Nm (3.7 lbf.ft).
- Besides the shown, commonly used valve versions other specialmodels are available.
- Contact our technical support for their identification, feasibility and operating limits.

Spool Symbols

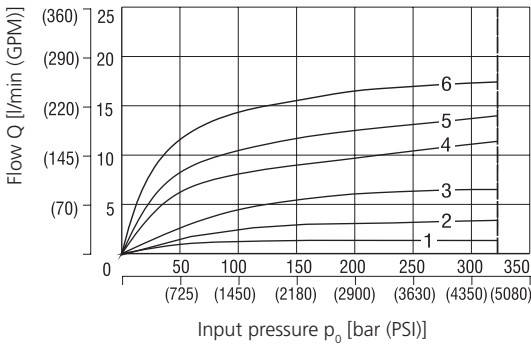
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11		3Z12	
2Y51		3Y11	
2Y11		3Y12	

*Model for cylinders with asymmetric piston area ratio 1:2

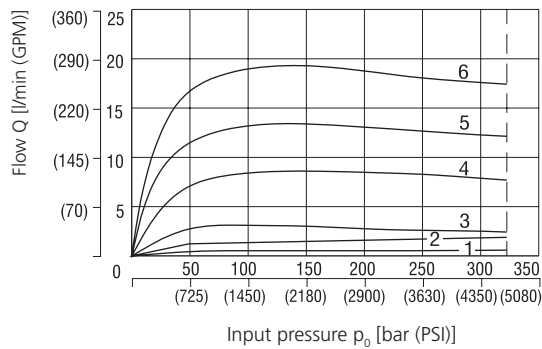
Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

Operating limits: Flow direction P → A / B → T or P → B / A → T

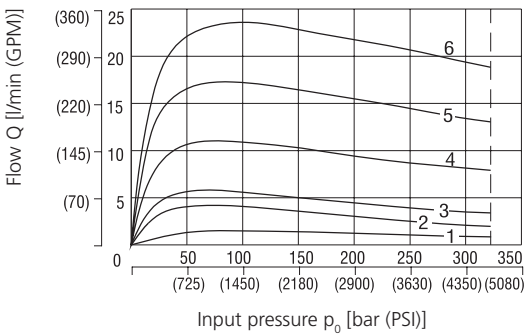
Nominal flow 4 l/min (1.1 GPM)



Nominal flow 8 l/min (2.1 GPM)



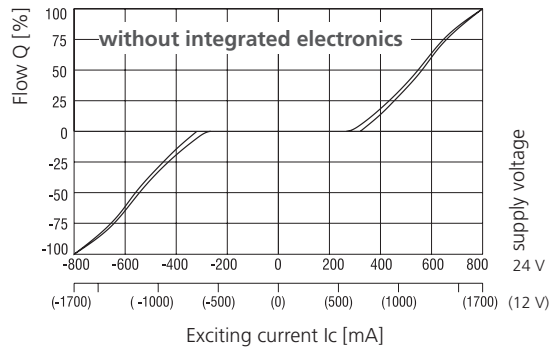
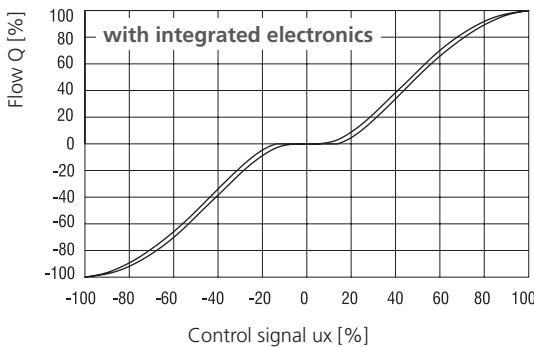
Nominal flow 12 l/min (3.2 GPM)



Solenoid current:

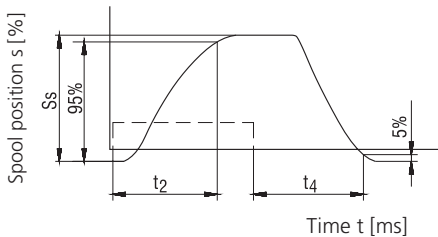
- 1 = 50 %
- 2 = 60 %
- 3 = 70 %
- 4 = 80 %
- 5 = 90 %
- 6 = 100 %

Regulated flow related to control signal $\Delta p = 10 \text{ bar}$ (145 PSI)



The coil current which initializes the flow through the proportional directional valve can differ due to the production tolerances about in a range of $\pm 6\%$ of the limit current.

Transient Characteristic measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS), $\Delta p = 10 \text{ bar}$ (145 PSI)

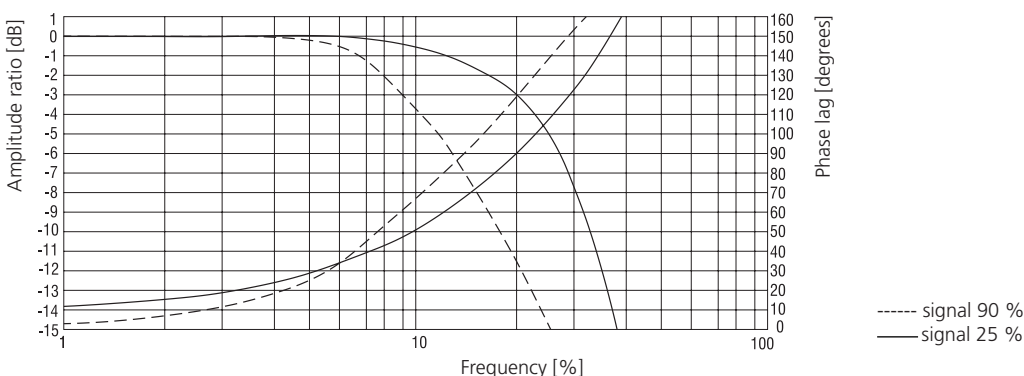


Steady Spool Position S_s [%]	t_2 [ms]	t_4 [ms]
100	85	100
75	70	85
50	55	75
25	45	55

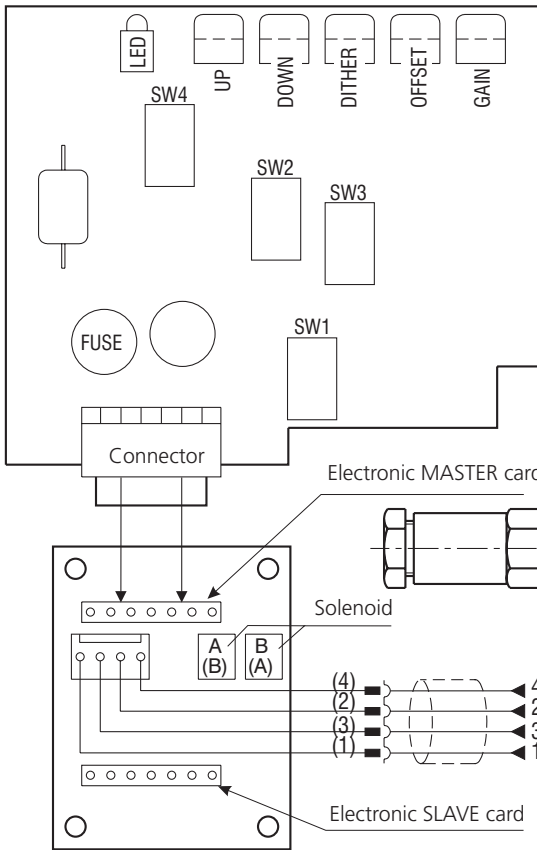
The values in table have only an informative character. The times of the transient characteristics at pressure or flow control will be in a particular hydraulic circuit always longer.

---- the control signal course of the integrated electronics

Frequency Response

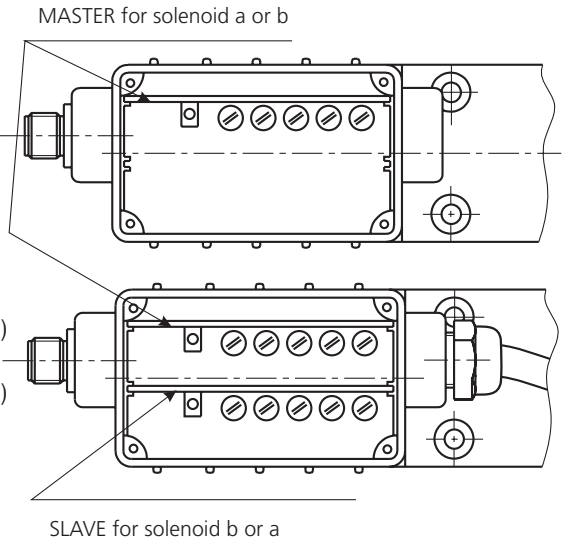


Component Arrangement on the Electronic Card



PIN	Description	Wire Colours	Connection Connector - Electronics
1	+24 V (Ucc) (+12 V)	(1) brown	
2	control	(2) white	
3	0 V	(3) blue	
4	+10 V (+5 V)	(4) black	

SW1 - control signal choice
 SW2 - control signal choice
 SW3 - control signal choice
 SW4 - dither frequency



Attention: The control signal must have the same ground potential as the supply source.

Table of the Switch Configuration for the Control Signal Choices

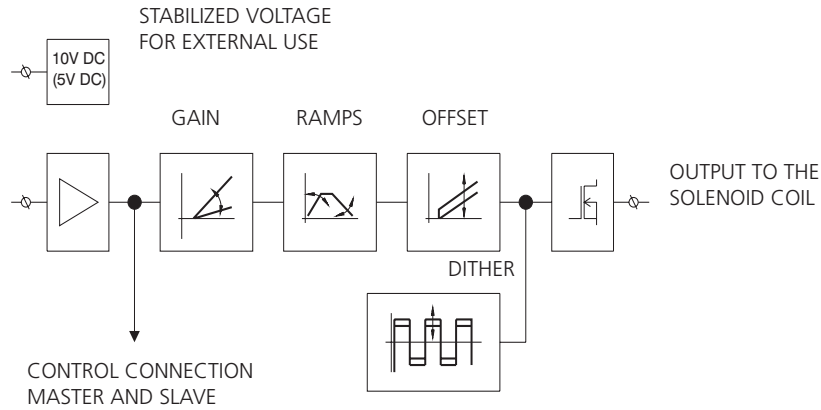
		PRM2-042				PRM2-043	
		0 ... 5 V	0 ... 10 V (0...5 V)*	0 ... 20 mA	4 ... 20 mA	Ucc/2 ± 10 V (± 5 V)*	± 10 V (± 5 V)*
MASTER M	SW1						
	SW2						
	SW3						
	SW4	90 Hz			60 Hz		
SLAVE S	SW1						
	SW2						
	SW3						
	SW4					90 Hz	60 Hz

Designation of the basic manufacture setting.

The ramp functions are adjusted on their minimum values, the dither is set to the optimal value with respect to hysteresis. Offset and gain are adjusted according to the characteristic on page 3 and 4. The manufacturer does not recommend these adjusted values to be changed.

* Input signal level for the 12 V electronic unit.

Block Diagram

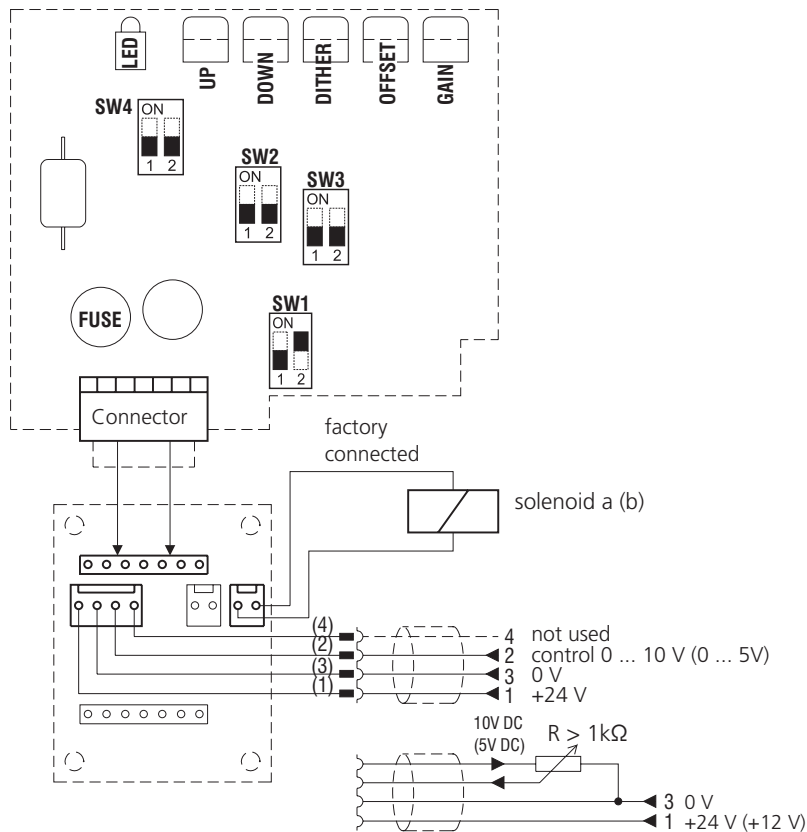


Setting of Control Electronics

Valve PRM2-042*EK (with one solenoid)

Control with external voltage source 0...10 V, 0 ... 5 V (Factory setting) or with external potentiometer $R > 1\text{ k}\Omega$

Master card for solenoid a (b)

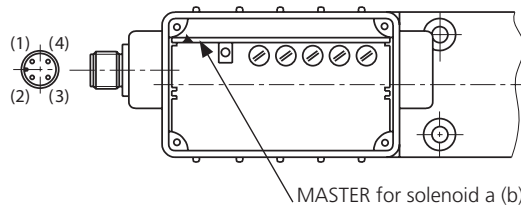
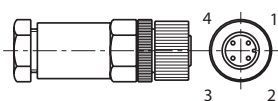


Factory set values:

- Control signal: 0 - 10 V (0 - 5 V)
- Dither: frequency 90 Hz
amplitude - optimum
- Ramps: 0.05 s
- Offset, gain: according to the characteristics on page 3



The control signal must have the same ground potential as the supply source.



Wire colours

(connection connector - electronics)

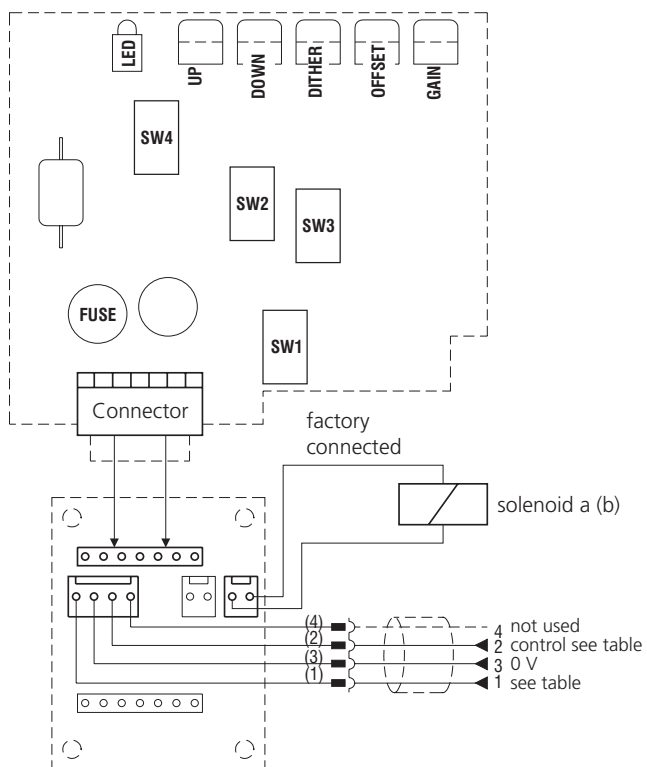
- (1) - brown
- (2) - white
- (3) - blue
- (4) - black

Setting of Control Electronics

Valve PRM2-042*EK (with one solenoid)

Control with external source 0 ... 5 V, 0 ... 20 mA, 4 ... 20 mA

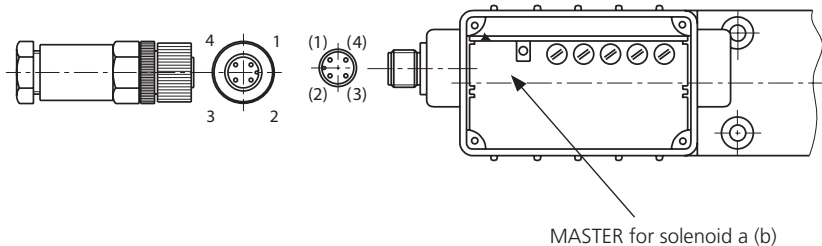
Master card for solenoid a (b)



Control with external source			
	0 ...5 V	0 ...20 mA	4 ...20 mA
SW1			
SW2			
SW3			
SW4			
PIN 1 (1)	+24 V	+24 V (+12 V)	+24 V (+12 V)
PIN 2 (2)	0 ...5 V	0 ...20 mA	4 ...20 mA

For the other than factory setting modification the following steps are required:

1. Unscrew the electronics cover
2. Carefully remove the master card
3. Flip the switch SW1 (2 or 3) in position shown in the table
4. Put in the master card and fix the electronics cover
5. Connect the voltage +24 V (+12 V) from an external supply source to terminals 1 and 3 of the connector
6. Bring the control voltage (current) from an external source to terminals 2 and 3 of the connector



**Wire colours
(connection connector - electronics)**
 (1) - brown
 (2) - white
 (3) - blue
 (4) - black

MASTER for solenoid a (b)



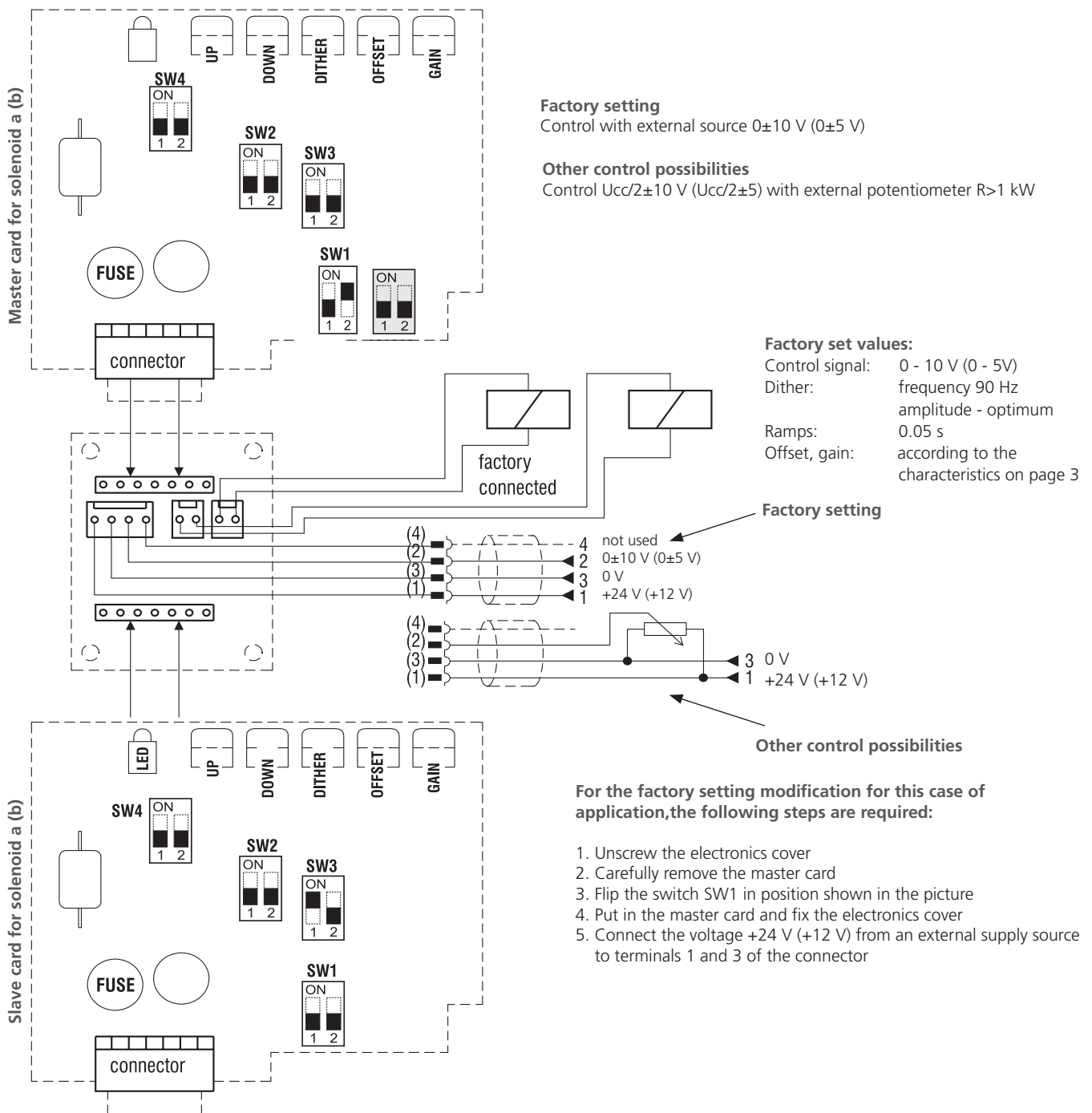
The control signal must have the same ground potential as the supply source.



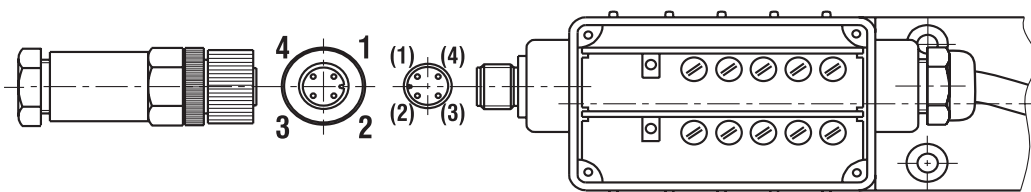
Designation of the basic factory setting.
 The ramp functions are adjusted on their minimum values.
 The dither is set to the optimal value with respect to hysteresis.
 Offset and gain are adjusted according to the characteristic on page 1 and 2.
 The manufacturer does not recommend these adjusted values to be changed.

Setting of Control Electronics

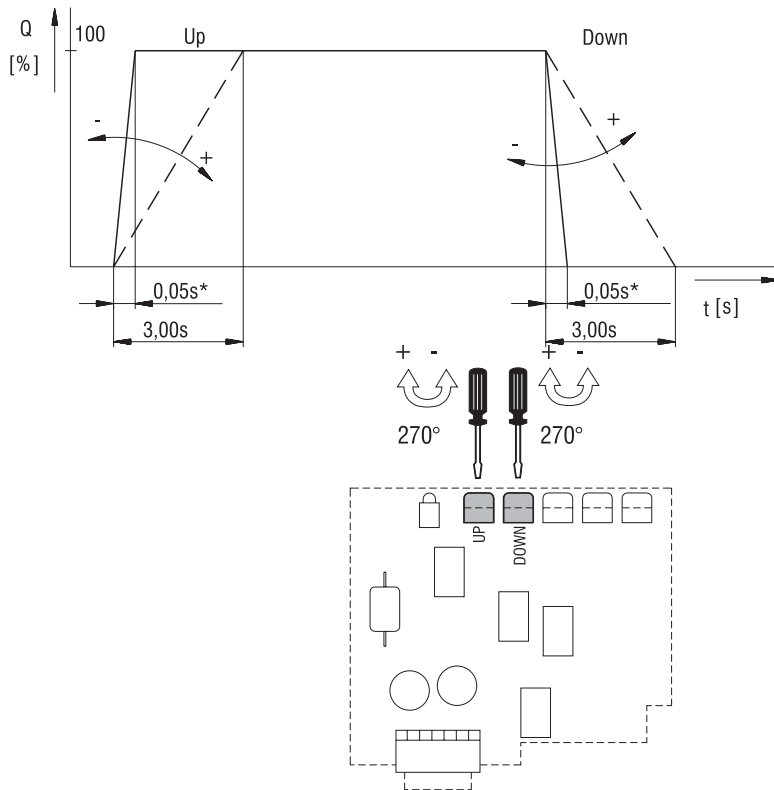
Valve PRM2-043*EK (with two solenoids), factory setting, other control possibilities



The control signal must have the same ground potential as the supply source.

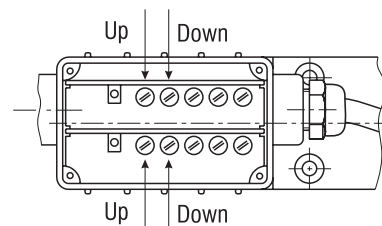


Ramp Adjustment (Up, Down)



* The value has only an informative character with respect to the particular type of the proportional directional valve (see page 3).

Ramp adjustment for slave solenoid

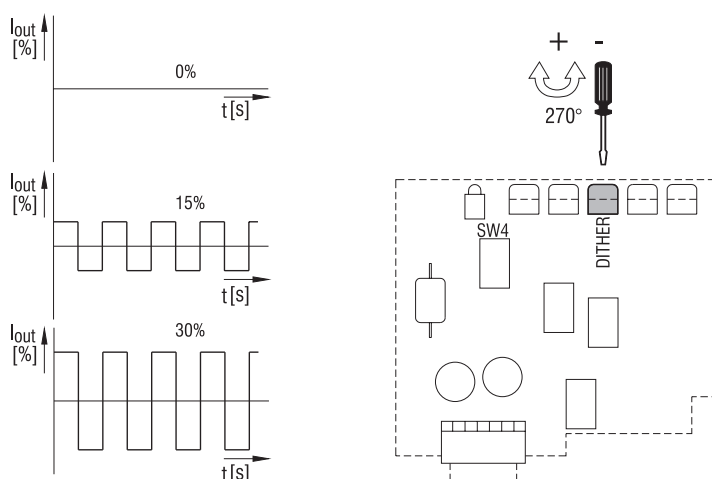


Ramp adjustment for master solenoid

i The factory setting of the ramp functions is to the minimum values.

Dither Adjustment

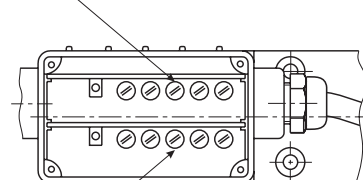
Amplitude - potentiometer (dither) (0 - 30 %)



Frequency - switch SW4



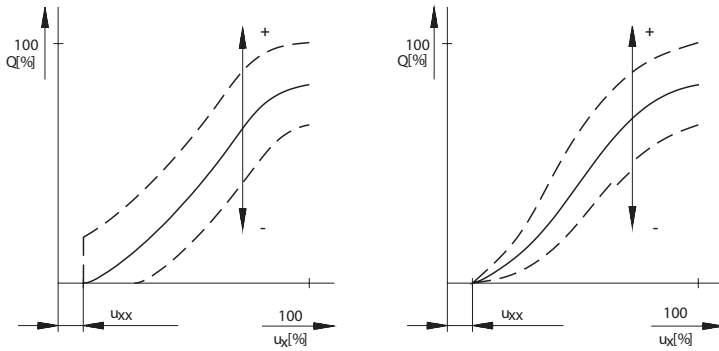
Amplitude adjustment for master solenoid



Amplitude adjustment for slave solenoid

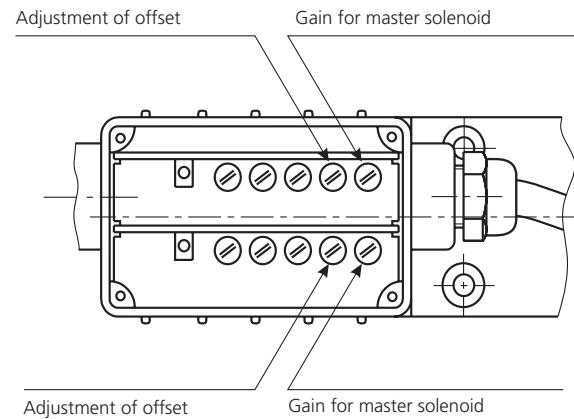
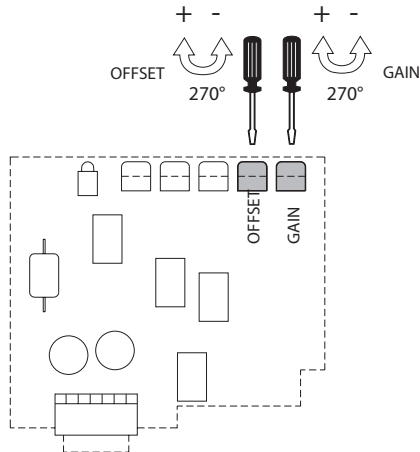
i The dither is adjusted with regard to the minimum hysteresis.

Offset, Gain Parameters Adjustment



i The factory setting of the offset and gain parameters is specific for the solenoids used. The manufacturer does not recommend this setting to be changed.

Nominal Supply Voltage of Electronics (V)	Area Insensible to Control Signal u_{xx} (%)
12	1 ... 3
24	0,5 ... 2



Solenoid Coil in millimeters (inches)

E1, E2 Protection Degree IP65	E3, E4 Protection Degree IP67	E3A, E4A Protection Degree IP65	E8, E9 Protection Degree IP65	E12A, E13A Protection Degree IP67 / 69K
			Note: A = Standard 300 mm, (11.8 in) other lengths on demand	

The indicated IP protection level is only achieved if the connector is properly mounted.

Manual Override in millimeters (inches)

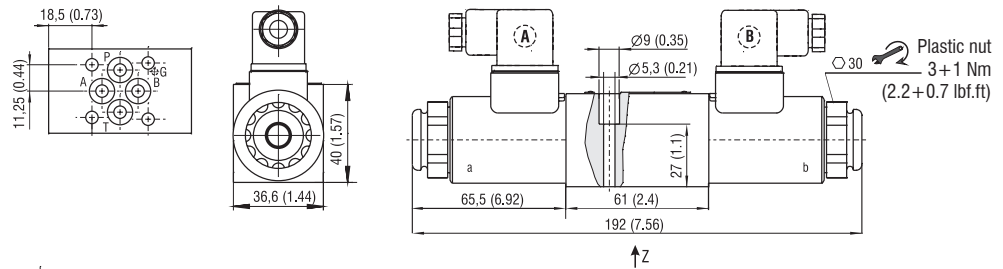
No Designation - Standard	Designation N2 - Rubber Boot Protected

In case of solenoid malfunction or power failure, the spool of the valve can be shifted by manual override as long as the pressure in port T does not exceed 25 bar (363 PSI). For alternative manual overrides contact our technical support.

Dimensions in millimeters (inches)

PRM2-043.../...E1

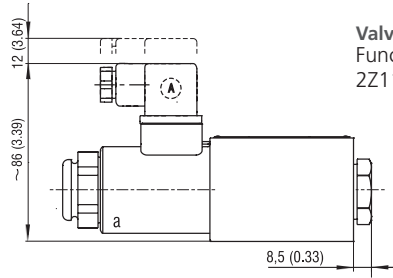
Valve with two solenoids
Example with electrical terminal
EN 175301-803-A (E1, E2)



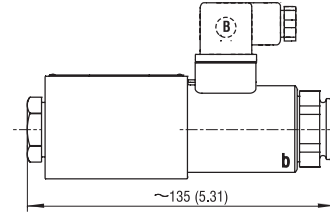
Functional symbols
3Z11, 3Z12, 3Y11, 3Y12

PRM2-042.../...E1

Valve with one solenoid „a“
Functional symbols
2Z51, 2Y51

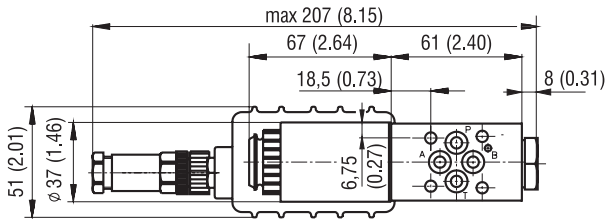


Valve with one solenoid „b“
Functional symbols
2Z11, 2Y11



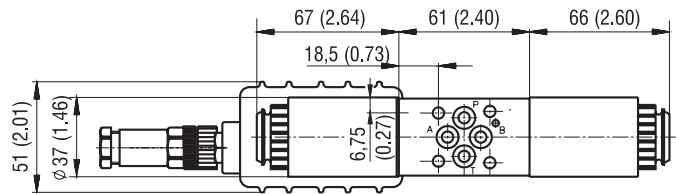
PRM2-043x/xEK*

Valve with one solenoid
OBE on side „a“ version EK



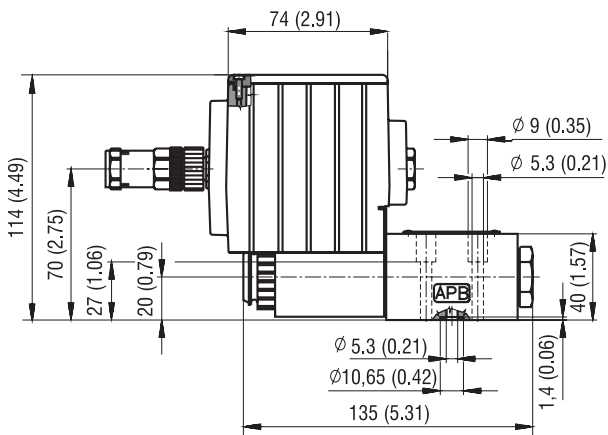
PRM2-043x/xEK*

Valve with two solenoids
OBE on side „a“ version EK



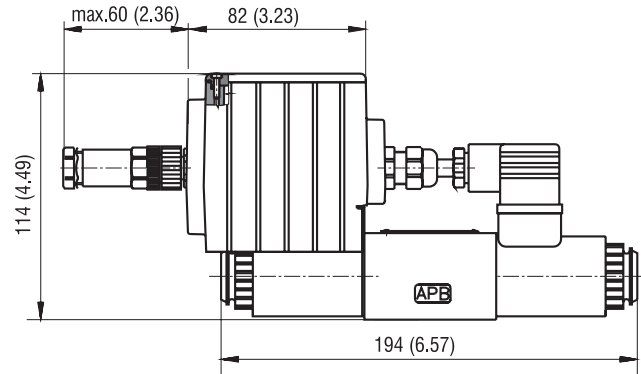
Valve with one solenoid „a“

Spool symbols 2Z51, 2Y51
OBE on side „a“ version EK



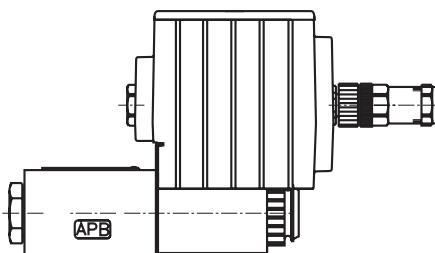
Valve with two solenoids

Spool symbols 3Z11, 3Z12, 3Y11, 3Y12
OBE on side „a“ version EK



Valve with one solenoid „b“

Spool symbols 2Z11, 2Y11
OBE on side „b“ version EK



Valve with two solenoids

OBE on side „b“ version EKB
Spool symbols 3Z11, 3Z12, 3Y11, 3Y12

