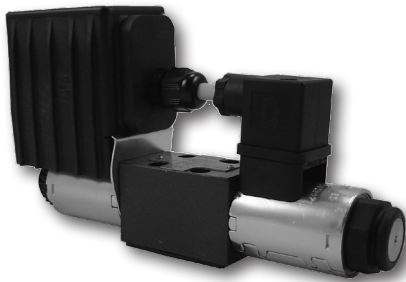


## Proportional Directional Control Valve, with Analogue Control Electronics

### 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:

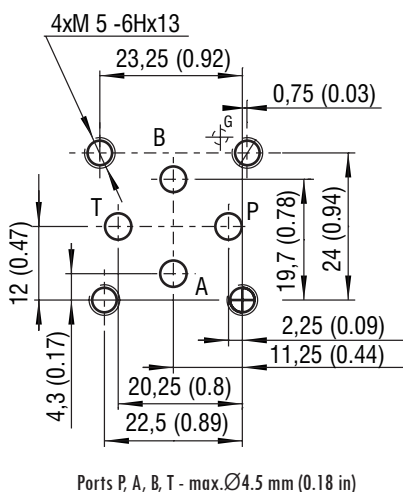
Offset, gain, rise and drop-out time of the ramp generator, frequency (2 frequencies) and amplitude of the dither signal generator. The correct function of the control unit is signaled by LED-diodes. Stabilized voltage +10V (+5V for 12V voltage) is also available for the user.

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

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



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	%	$\leq 6$
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)
<b>Technical Data of the Proportional Solenoid</b>		
Nominal supply voltage	V	12 DC 24 DC
Limit current	A	1.7 0.8
Mean resistance value at 20 °C (68 °F)	$\Omega$	5 21
<b>Technical data of the electronics</b>		
Supply voltage range	V	11.2... 14.7 20... 30
Stabilized voltage for control	V	5 DC (R > 1 k $\Omega$ ) 10 DC (R > 1 k $\Omega$ )
Control signal	see table of switches configuration (page 4,5 and 6)	
Maximum output current	A	2.4 for R < 4 $\Omega$ 1.5 for R < 10 $\Omega$
Ramp adjustment range	s	0.05... 3
Dither frequency	Hz	90 / 60
Dither amplitude	%	0... 30
<b>Data Sheet</b>		<b>Type</b>
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	DP_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)	04
8 l/min (2.1 GPM)	08
12 l/min (3.2 GPM)	12

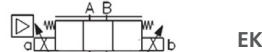
Rated supply voltage of solenoids (at the coil terminal)

12 V DC	12
24 V DC	24

Electronics on board / Position at solenoid

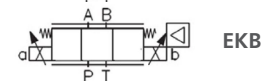
connection by connector M12 x 1 (4-pin connector, supplied with counterpart)

on board electronics (solenoid „a“)



EK

on board electronics (solenoid „b“)\*



EKB

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

Surface treatment standard

No designation  
**V**

Seals  
 NBR  
 FPM (Viton)

No designation  
**N2**

Manual override  
 standard  
 protected with rubber boot

No designation

Conector according to EN 175301-803-A

valve version with an onboard electronic control unit

**K1**

connector socket(s) according to EN 175301-803-A without rectifier for valve version without an onboard electronic control unit and with coil type E1 or E2

Connector

only for version without on board electronic „EK“

<b>E1</b>	EN 175301-803-A
<b>E2</b>	E1 with quenching diode
<b>E3</b>	AMP Junior Timer - radial directions (2 pins; male)
<b>E4</b>	E3 with quenching diode
<b>E3A</b>	AMP Junior Timer - axial direction (2 pins; male)
<b>E4A</b>	E3A with quenching diode
<b>E8</b>	loose conductors (two insulated wires)
<b>E9</b>	E8 with quenching diode
<b>E12A</b>	deutsch DT04-2P - axial direction (2 pins; male)
<b>E13A</b>	E12A with quenching diode

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

- 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

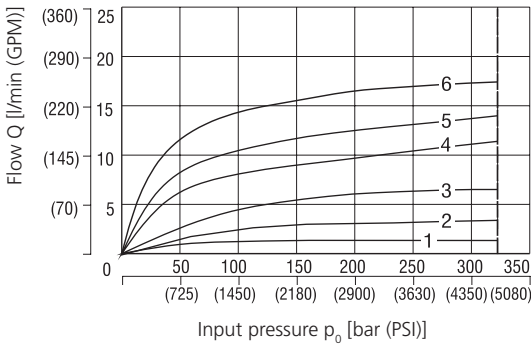
Type	Symbol	Type	Symbol
<b>2Z51</b>		<b>3Z11</b>	
<b>2Z11</b>		<b>3Z12</b>	 $\frac{q_A}{q_B} = \frac{1}{2}^*$
<b>2Y51</b>		<b>3Y11</b>	
<b>2Y11</b>		<b>3Y12</b>	 $\frac{q_A}{q_B} = \frac{1}{2}^*$

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

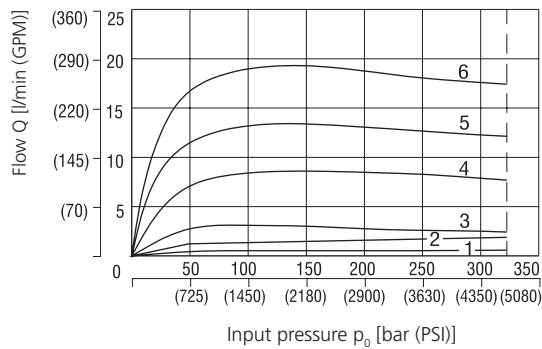
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

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

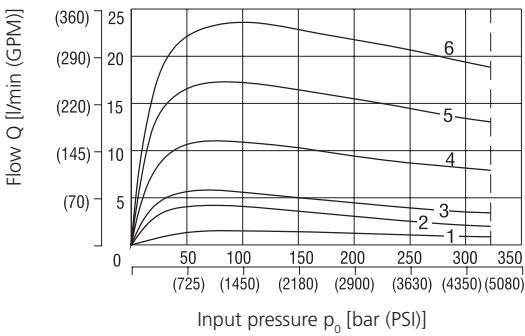
Nominal flow 4 l/min (1.1 GPM)



Nominal flow 8 l/min (2.1 GPM)



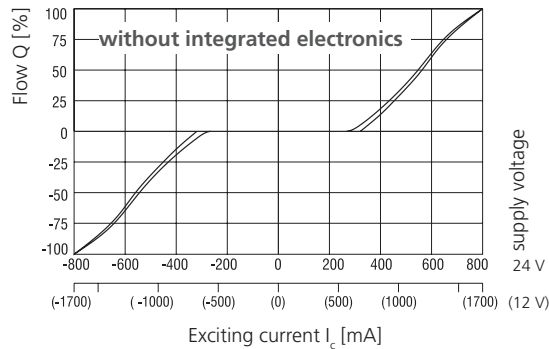
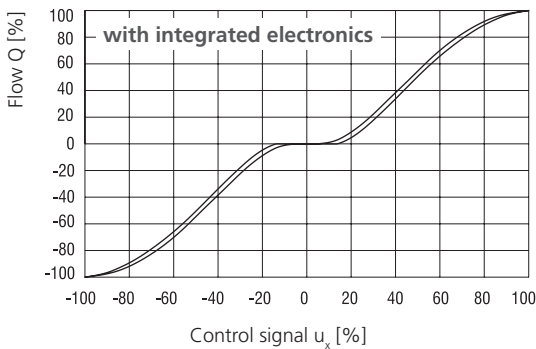
Nominal flow 12 l/min (3.2 GPM)



**Solenoid current:**

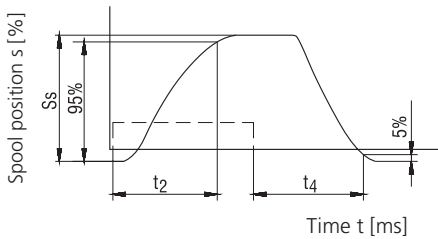
- 1 = 50 %
- 2 = 60 %
- 3 = 70 %
- 4 = 80 %
- 5 = 90 %
- 6 = 100 %

**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)

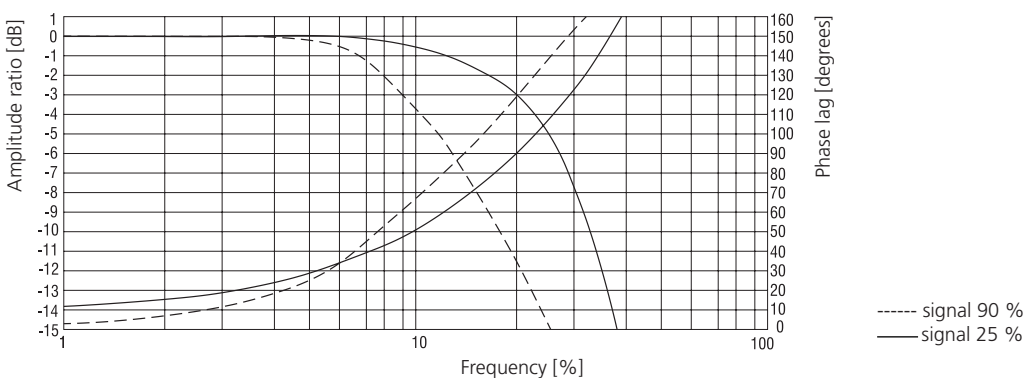


Steady Spool Position $S_s$ [%]	$t_2$ [ms]	$t_4$ [ms]
100	85	100
75	70	85
50	55	75
25	45	55

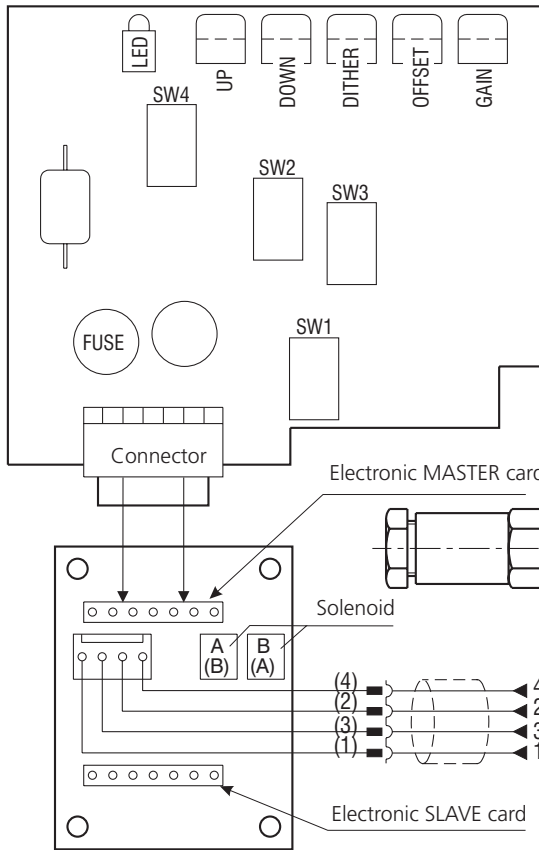
The values in table have only an informative character. The times of the transient characteristics at pressure or flow control will be in a particular hydraulic circuit always longer.

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

**Frequency Response**

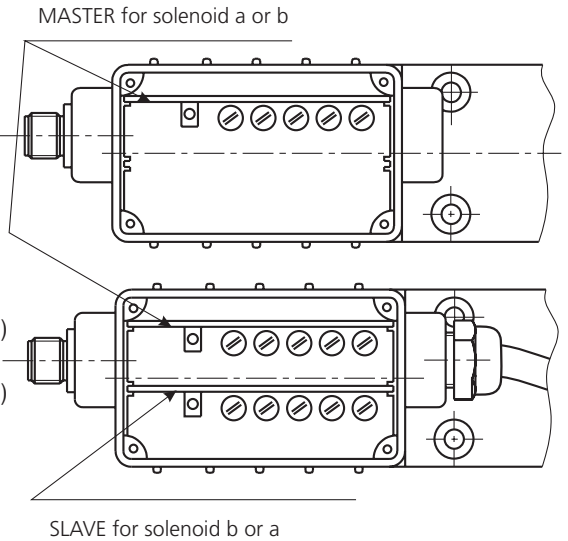


### Component Arrangement on the Electronic Card



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

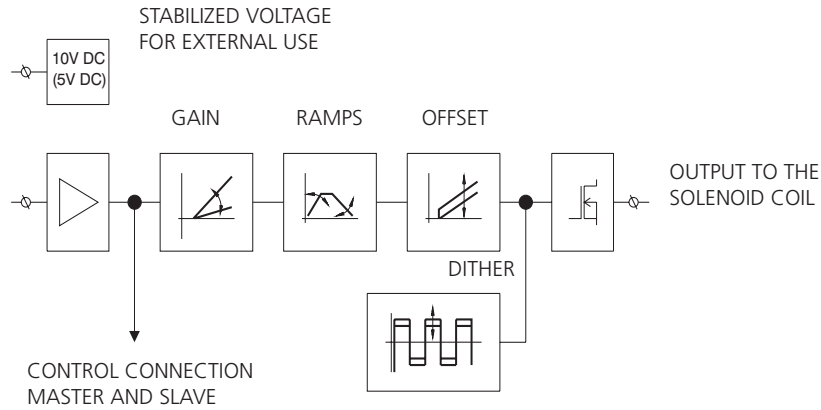
		PRM2-042				PRM2-043	
		0 ... 5 V	0 ... 10 V (0...5 V)*	0 ... 20 mA	4 ... 20 mA	Ucc/2 ± 10 V (± 5 V)*	± 10 V (± 5 V)*
MASTER M	SW1						
	SW2						
	SW3						
	SW4	90 Hz			60 Hz		
SLAVE S	SW1						
	SW2						
	SW3						
	SW4					90 Hz	60 Hz

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**

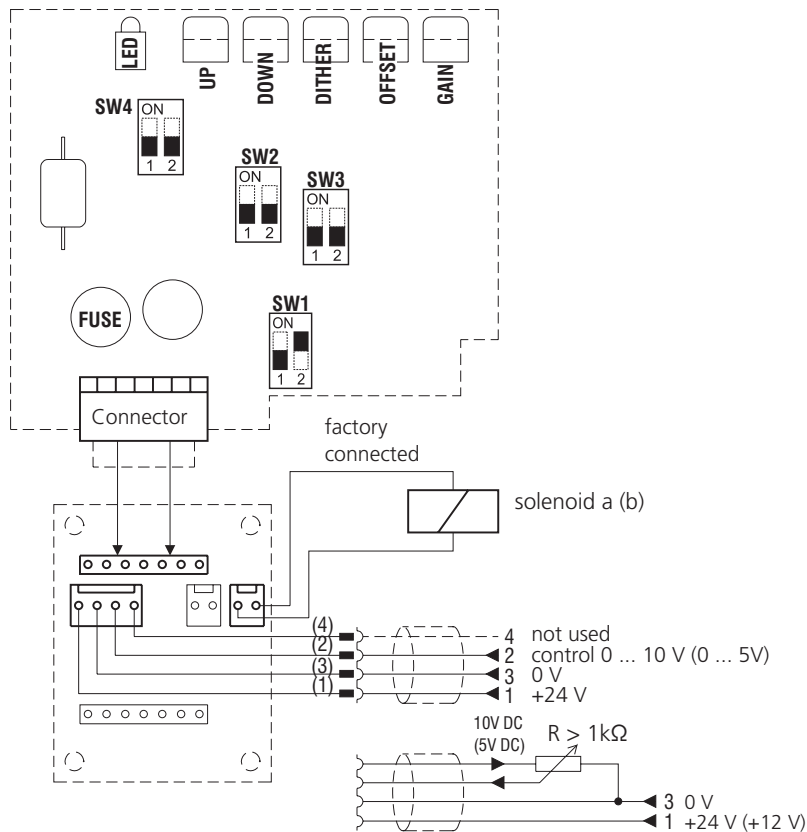


**Setting of Control Electronics**

**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)**

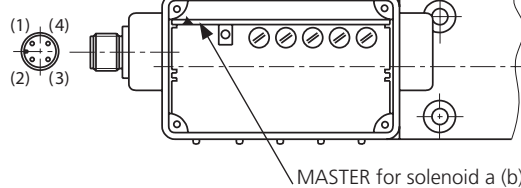
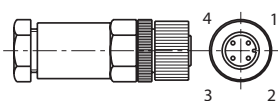


**Factory set values:**

- 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)**

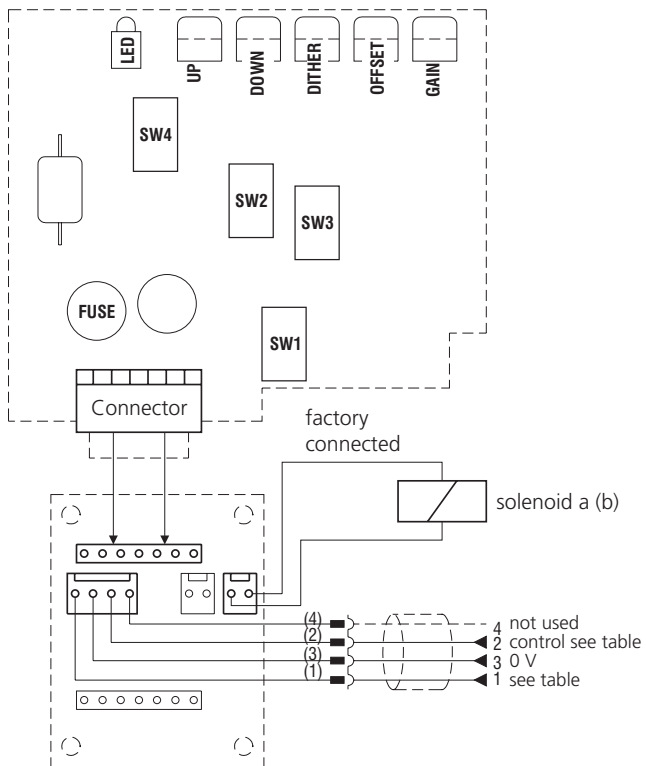
- (1) - brown
- (2) - white
- (3) - blue
- (4) - black

## Setting of Control Electronics

### Valve PRM2-042\*EK (with one solenoid)

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

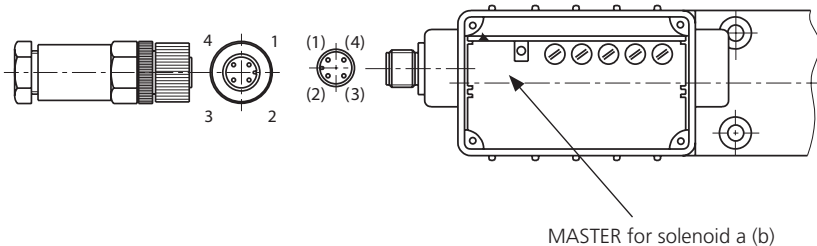
#### Master card for solenoid a (b)



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



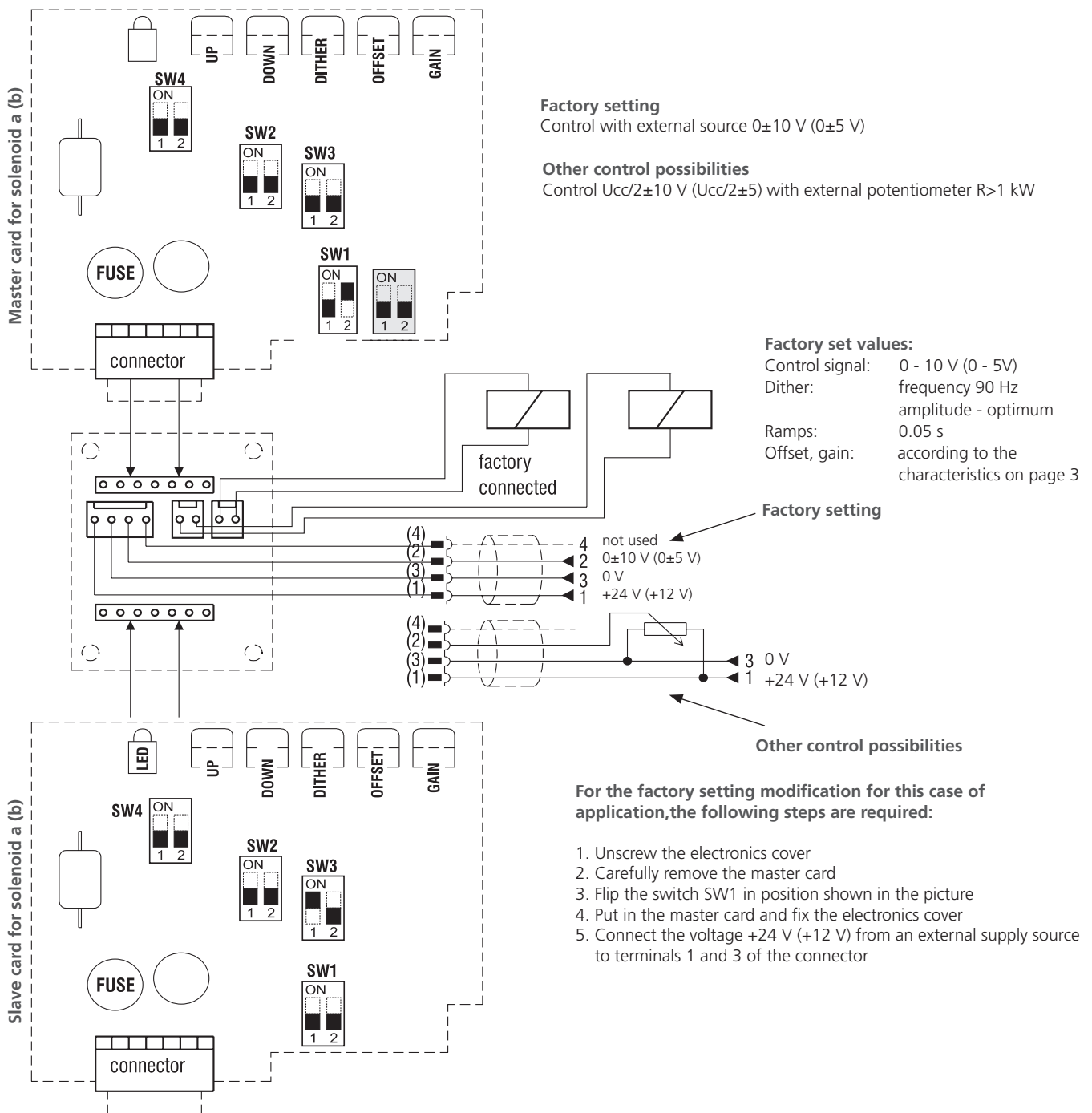
The control signal must have the same ground potential as the supply source.



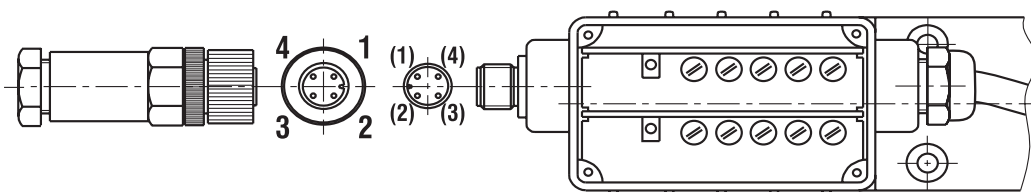
Designation of the basic factory setting.  
The ramp functions are adjusted on their minimum values.  
The dither is set to the optimal value with respect to hysteresis.  
Offset and gain are adjusted according to the characteristic on page 1 and 2.  
The manufacturer does not recommend these adjusted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

## Setting of Control Electronics

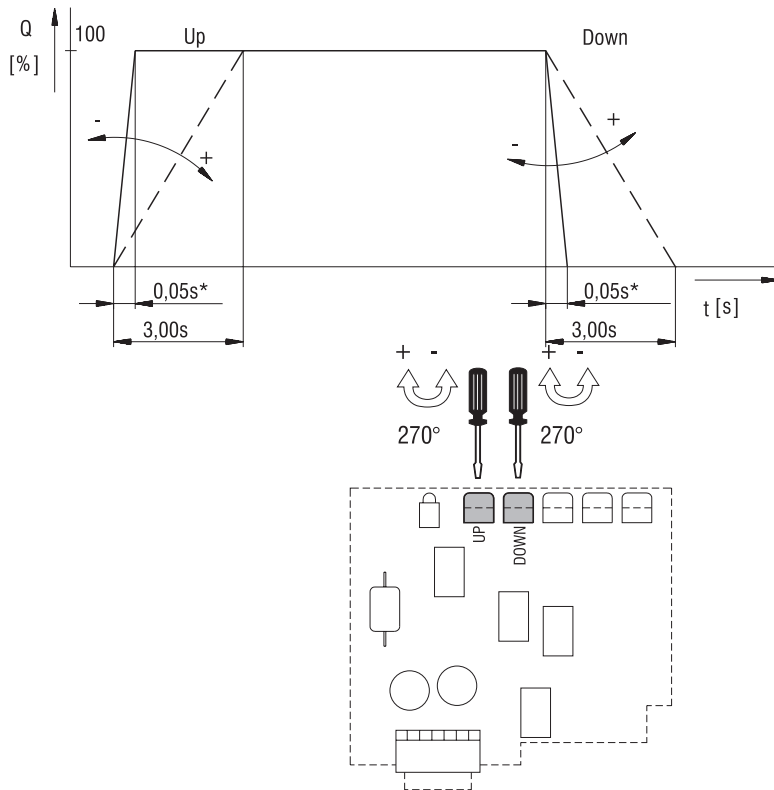
Valve PRM2-043\*EK (with two solenoids), factory setting, other control possibilities



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

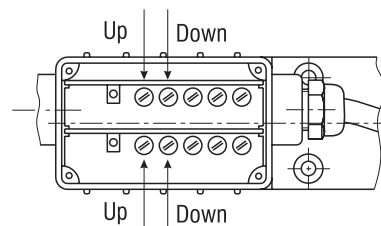


**Ramp Adjustment (Up, Down)**



\* 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

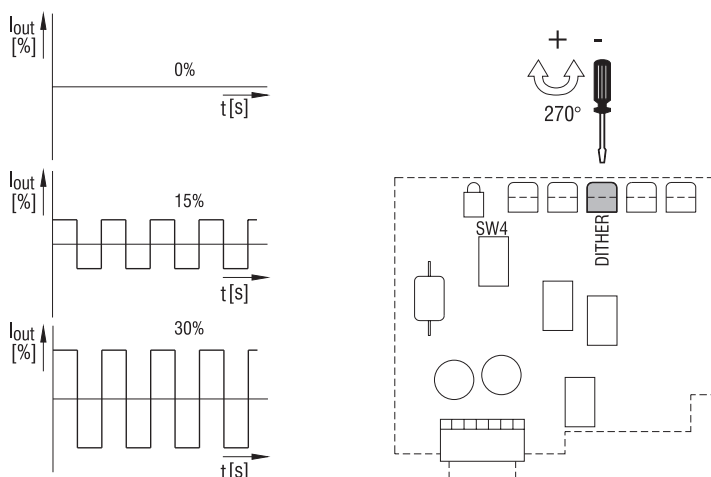


Ramp adjustment for master solenoid

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

**Dither Adjustment**

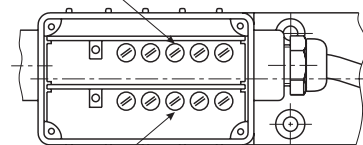
**Amplitude - potentiometer (dither) (0 - 30 %)**



**Frequency - switch SW4**



Amplitude adjustment for master solenoid

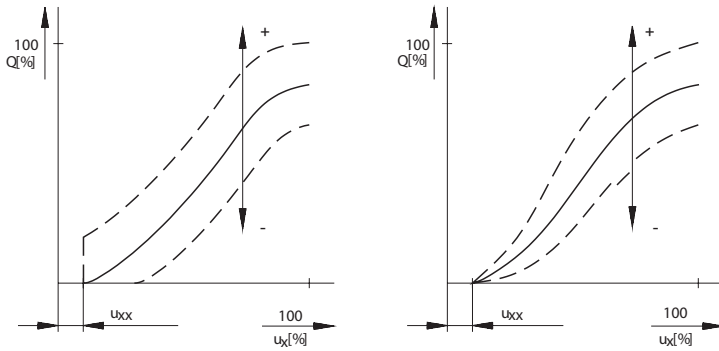


Amplitude adjustment for slave solenoid

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

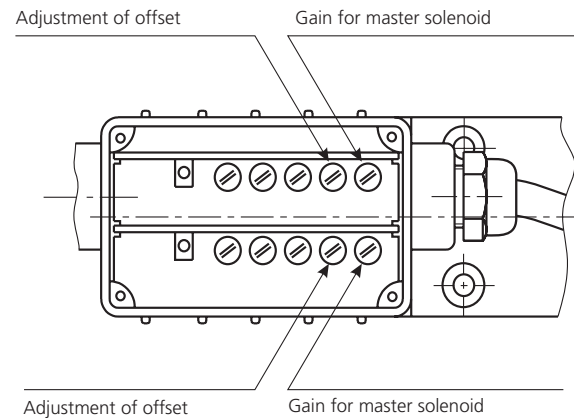
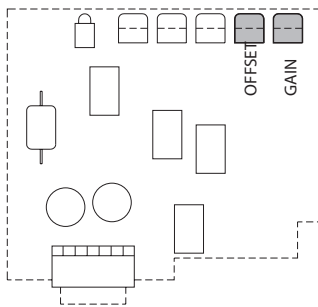
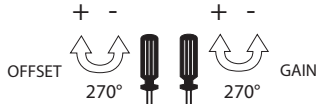


## Offset, Gain Parameters Adjustment



**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
			<p>Note: A = Standard 300 mm, (11.8 in) other lengths on demand</p>	

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

## Manual Override in millimeters (inches)

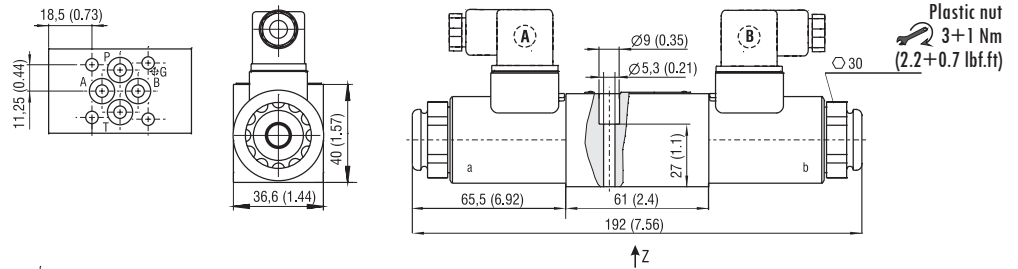
No Designation - Standard	Designation N2 - Rubber Boot Protected

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**

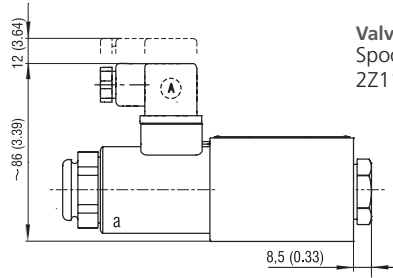
Valve with two solenoids  
Example with electrical terminal  
EN 175301-803-A (E1, E2)



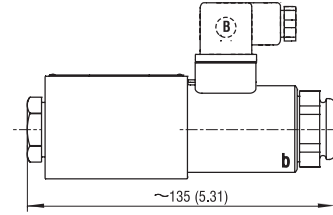
Spool symbols  
3Z11, 3Z12, 3Y11, 3Y12

**PRM2-042.../...E1**

Valve with one solenoid „a”  
Spool symbols  
2Z51, 2Y51

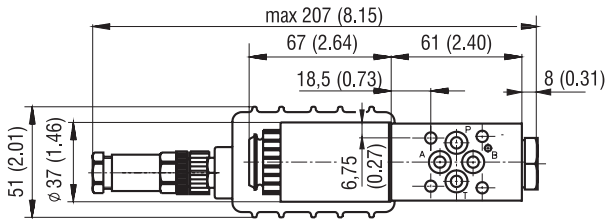


Valve with one solenoid „b”  
Spool symbols  
2Z11, 2Y11



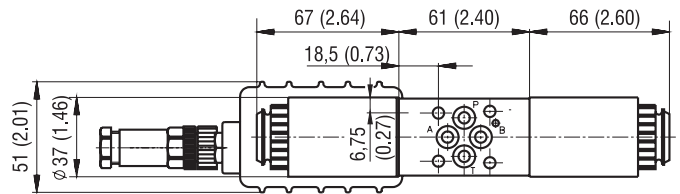
**PRM2-043x/xEK\***

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



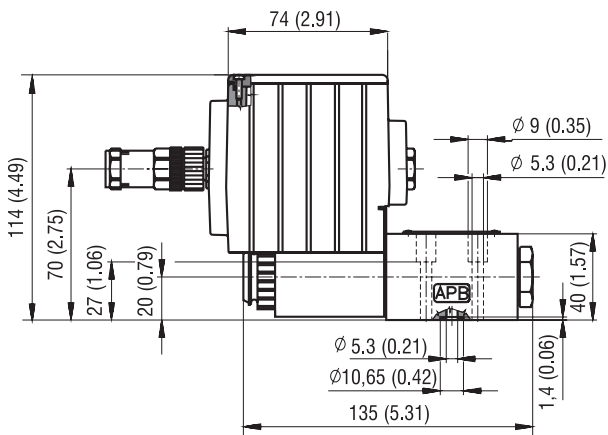
**PRM2-043x/xEK\***

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



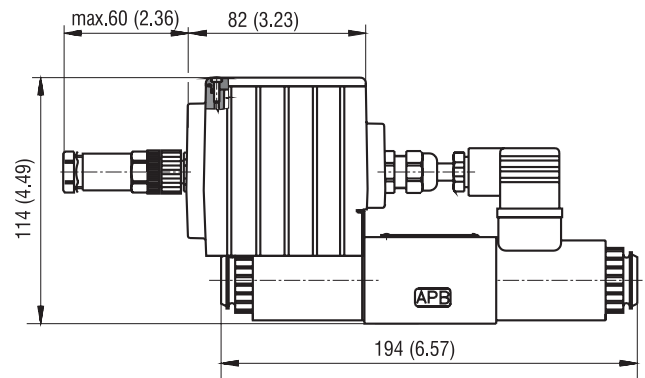
**Valve with one solenoid „a”**

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



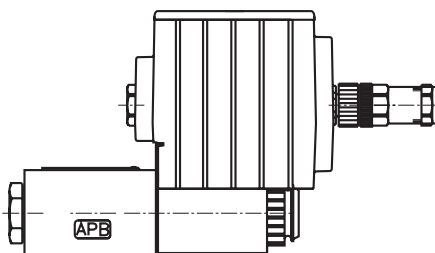
**Valve with two solenoids**

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

