

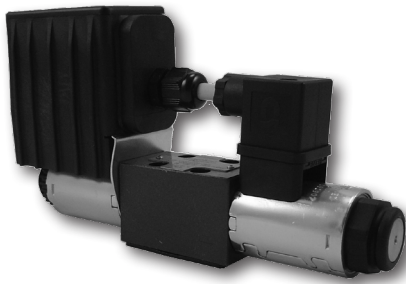
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## Proportional Directional Control Valve, with Analogue Control Electronics

### 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 onboard 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 onboard 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:

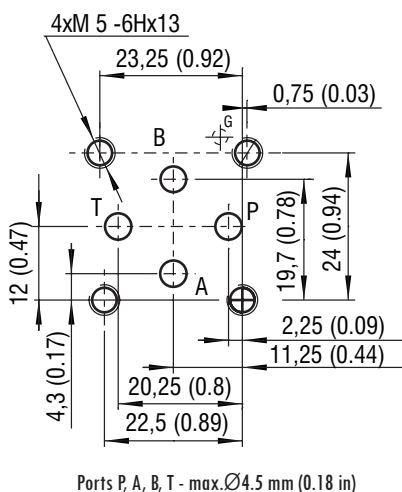
Offset, gain, rise and drop-out time of the ramp generator, frequency (2 frequencies) and amplitude of the dither signal generator. The correct function of the control unit is signaled by LED-diodes. Stabilized voltage +10V (+5V for 12V voltage) is also available for the user.

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



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)	
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)	$\Omega$	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 $\Omega$ )	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	
	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	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 Δp = 10 bar (145 PSI)**

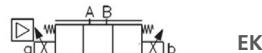
4 l/min (1.05 GPM)	04
8 l/min (2.1 GPM)	08
12 l/min (3.2 GPM)	12

**Rated supply voltage of solenoids (at the coil terminal)**

12 V DC	12
24 V DC	24

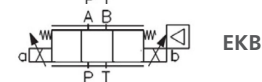
**Electronics onboard / Position at solenoid**  
connection by connector M12 x 1  
(4-pin connector, supplied with counterpart)

onboard electronics (solenoid „a“)



EK

onboard 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 according to EN 175301-803-A**  
No designation valve version with an onboard electronic control unit  
K1 valve version without an onboard electronic control unit with the coil types E3, E4, E3A, E4A, E8, E9, E12A and E13A connector plug according to EN 175301-803-A without rectifier, for valve version without an onboard electronic control unit and valve with coil type E1 or E2

**Connector**  
only for version without onboard electronic „EK“  
EN 175301-803-A  
E1 E1 with quenching diode  
E2 E2 with quenching diode  
E3 AMP Junior Timer - radial directions (2 pins; male)  
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.

- 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+1 Nm (3.7+0.7 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

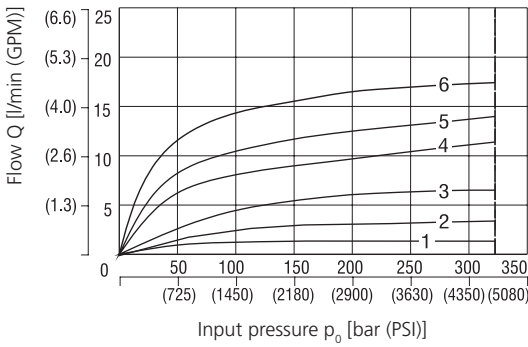
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11		3Z12	 $\frac{q_A}{q_B} = \frac{1}{2}^*$
2Y51		3Y11	
2Y11		3Y12	 $\frac{q_A}{q_B} = \frac{1}{2}^*$

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

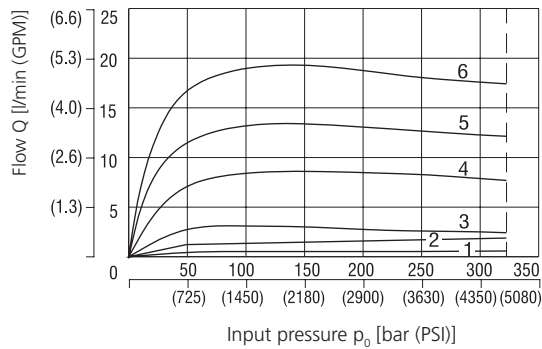
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$

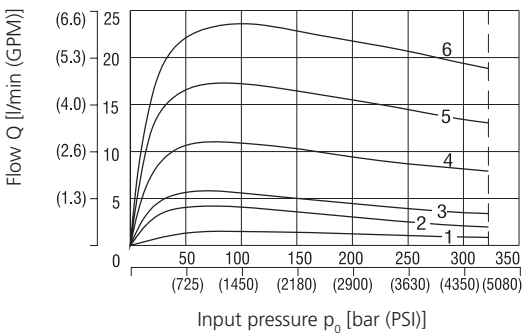
Nominal flow 4 l/min (1.1 GPM)



Nominal flow 8 l/min (2.1 GPM)



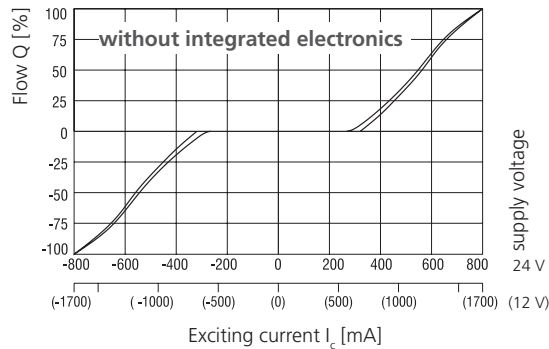
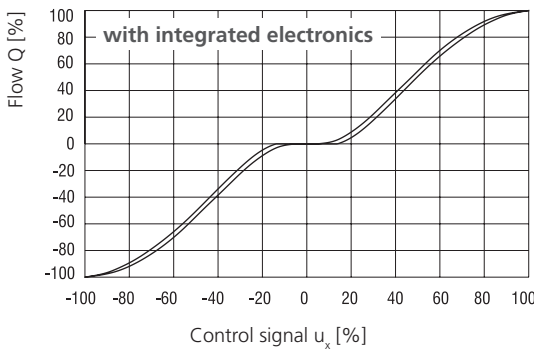
Nominal flow 12 l/min (3.2 GPM)



**Solenoid current:**

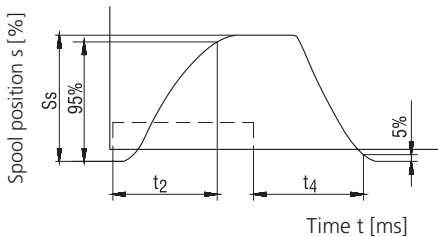
- 1 = 50 %
- 2 = 60 %
- 3 = 70 %
- 4 = 80 %
- 5 = 90 %
- 6 = 100 %

**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)

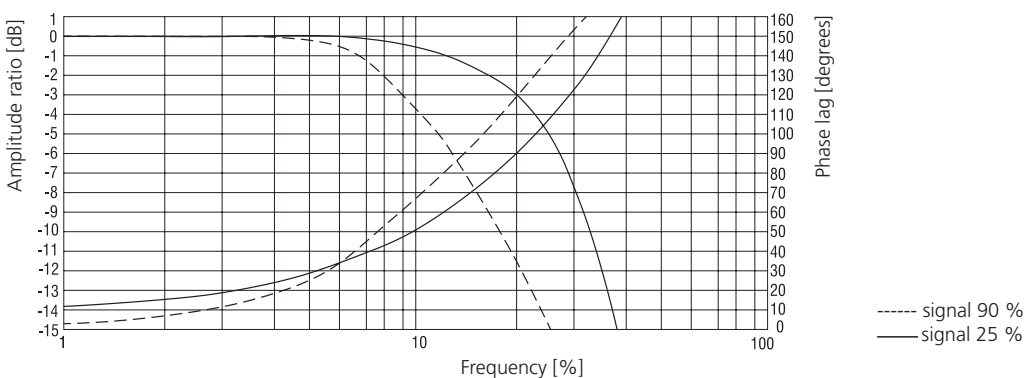


Steady Spool Position $S_s$ [%]	$t_2$ [ms]	$t_4$ [ms]
100	85	100
75	70	85
50	55	75
25	45	55

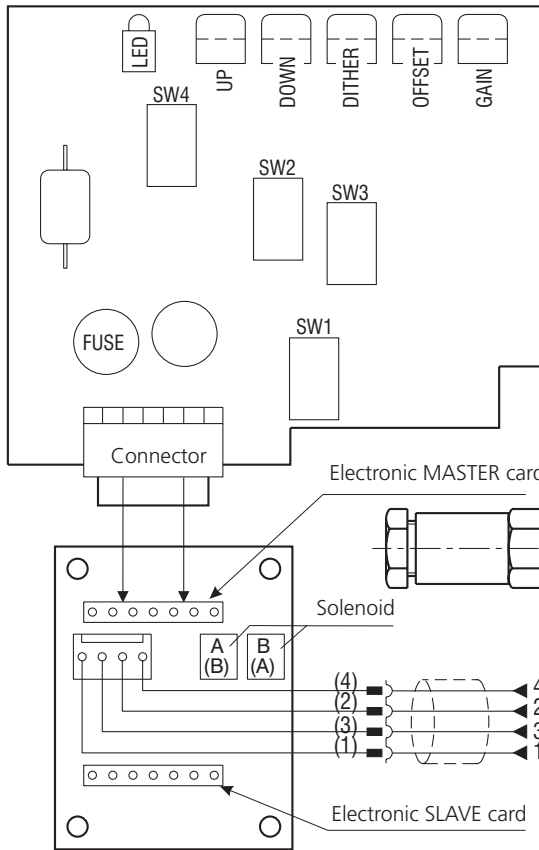
The values in table have only an informative character. The times of the transient characteristics at pressure or flow control will be in a particular hydraulic circuit always longer.

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

**Frequency Response**

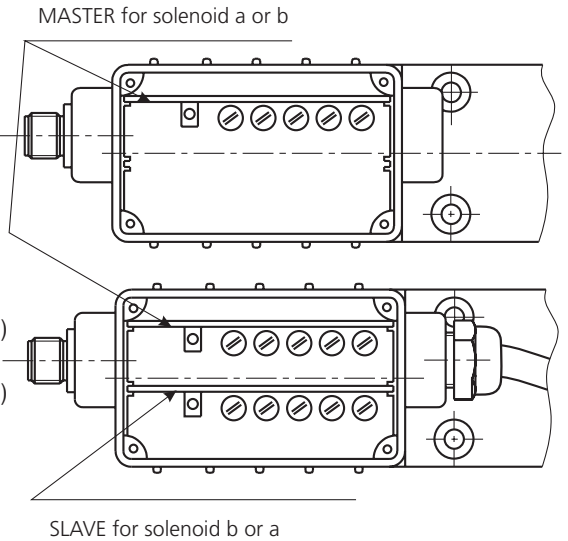


### Component Arrangement on the Electronic Card



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

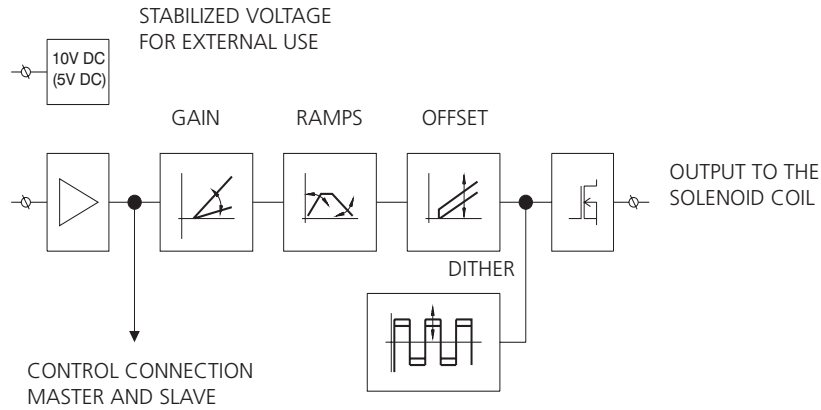
		PRM2-042				PRM2-043	
		0 ... 5 V	0 ... 10 V (0...5 V)*	0 ... 20 mA	4 ... 20 mA	Ucc/2 ± 10 V (± 5 V)*	± 10 V (± 5 V)*
MASTER M	SW1						
	SW2						
	SW3						
	SW4	90 Hz			60 Hz		
SLAVE S	SW1						
	SW2						
	SW3						
	SW4					90 Hz	60 Hz

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**

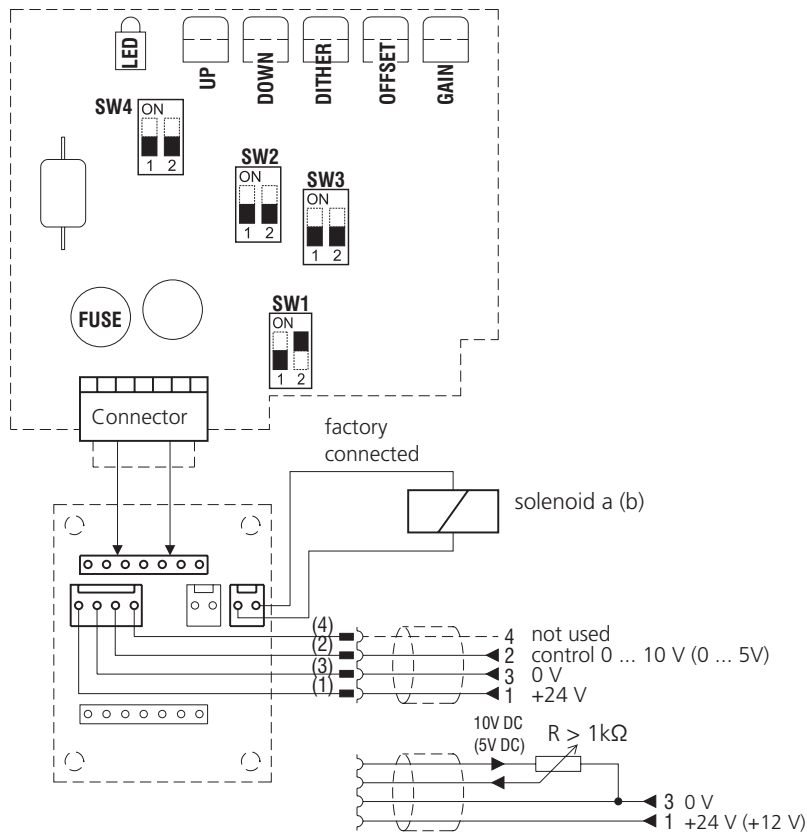


**Setting of Control Electronics**

**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)**

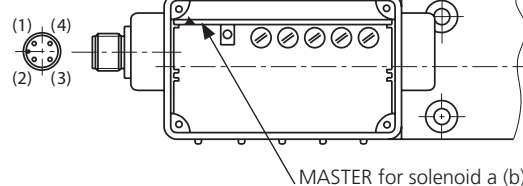
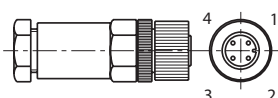


**Factory set values:**

- 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)**

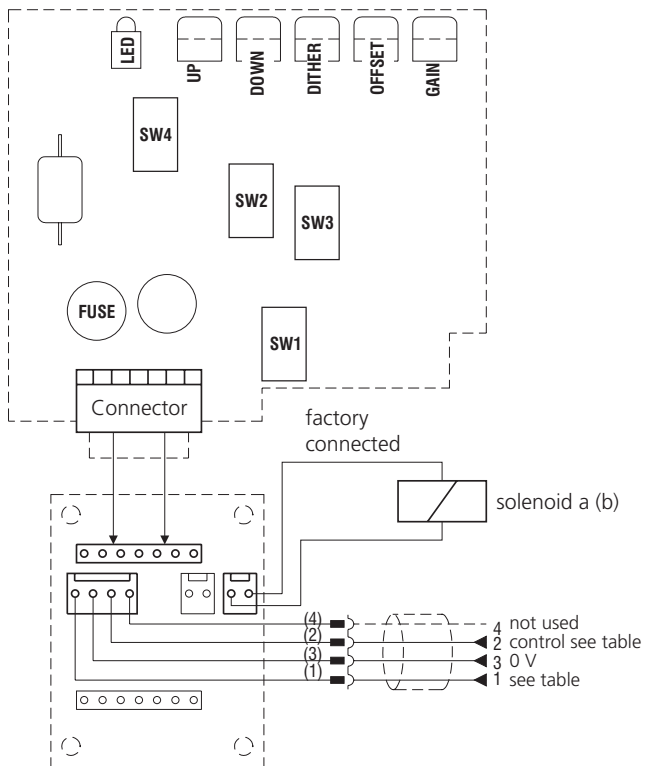
- (1) - brown
- (2) - white
- (3) - blue
- (4) - black

## Setting of Control Electronics

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

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

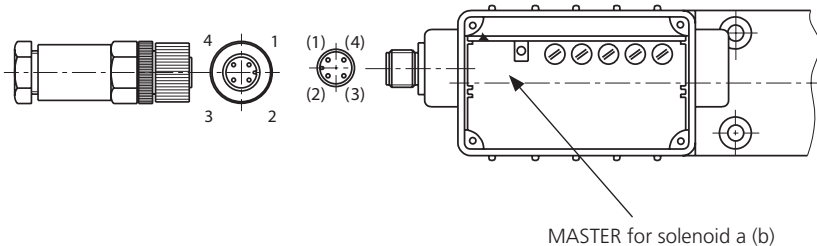
#### Master card for solenoid a (b)



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



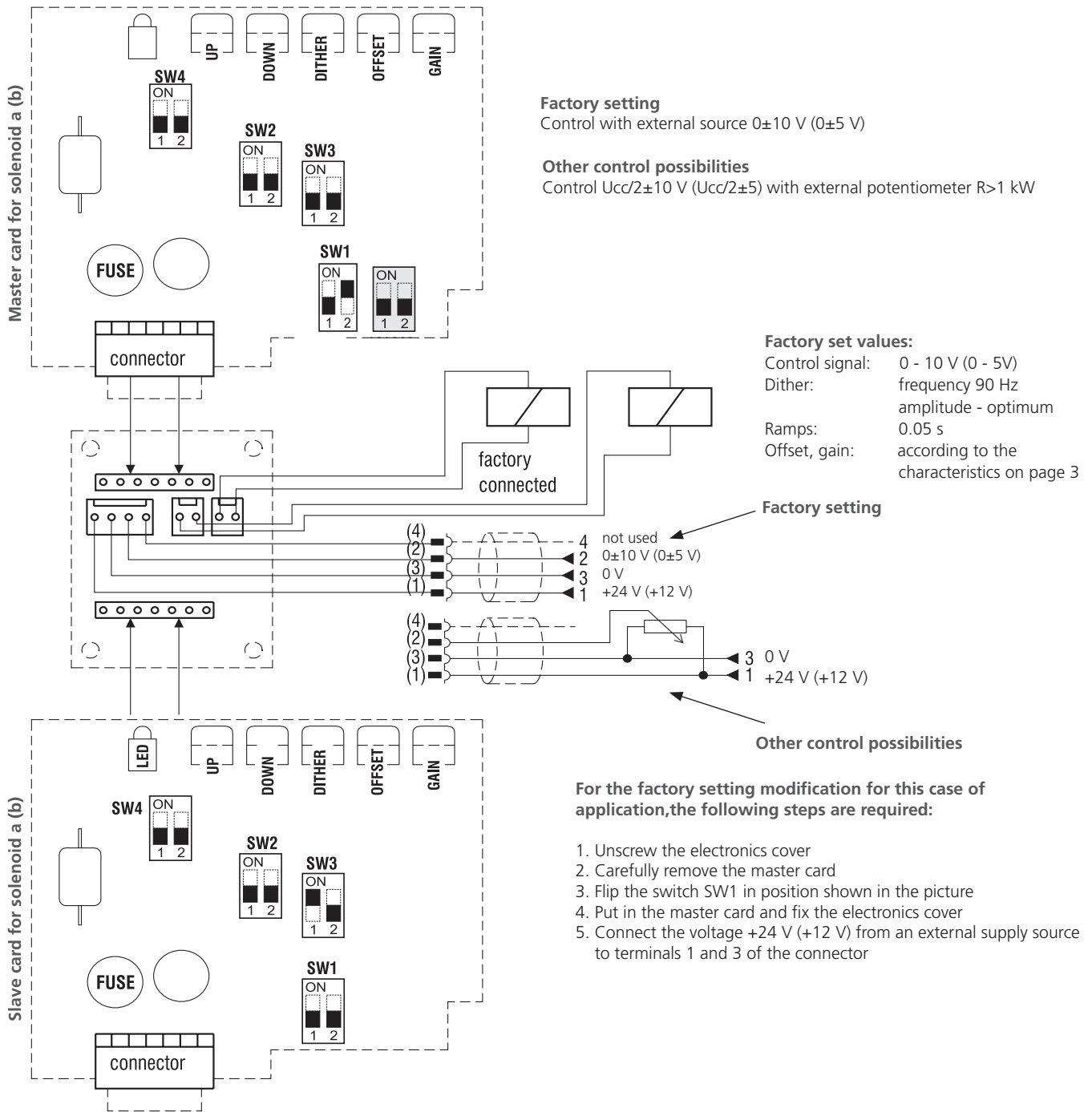
The control signal must have the same ground potential as the supply source.



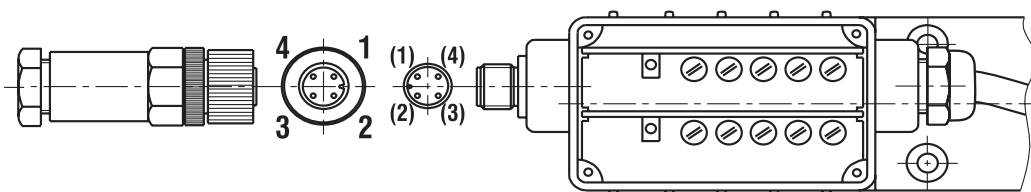
Designation of the basic factory setting.  
 The ramp functions are adjusted on their minimum values.  
 The dither is set to the optimal value with respect to hysteresis.  
 Offset and gain are adjusted according to the characteristic on page 1 and 2.  
 The manufacturer does not recommend these adjusted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

## Setting of Control Electronics

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

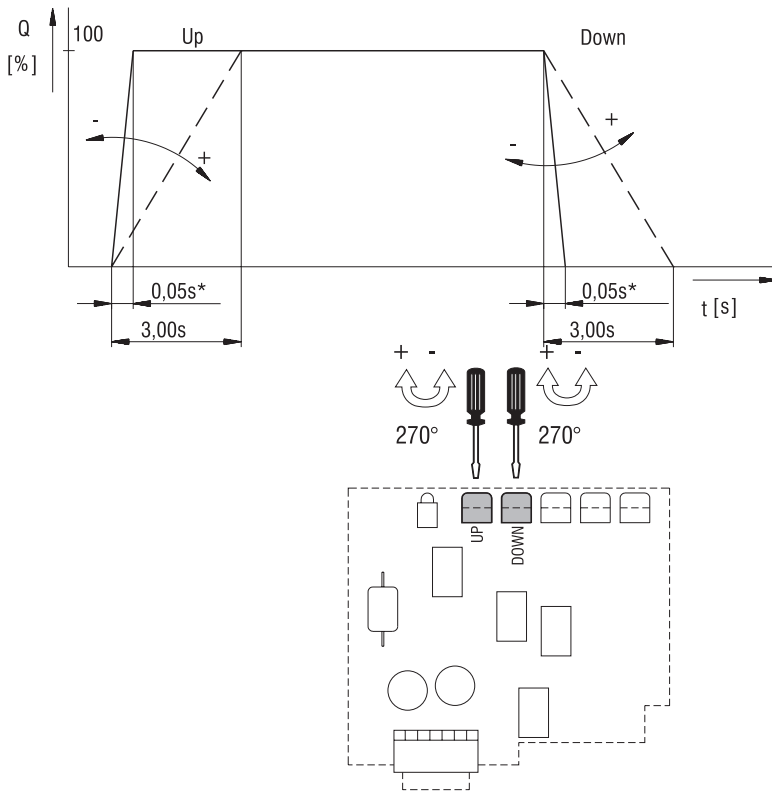


The control signal must have the same ground potential as the supply source.



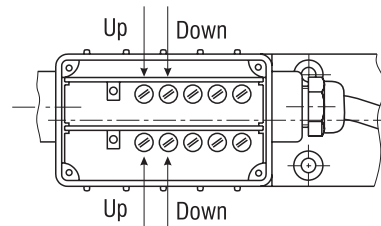


**Ramp Adjustment (Up, Down)**



\* 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

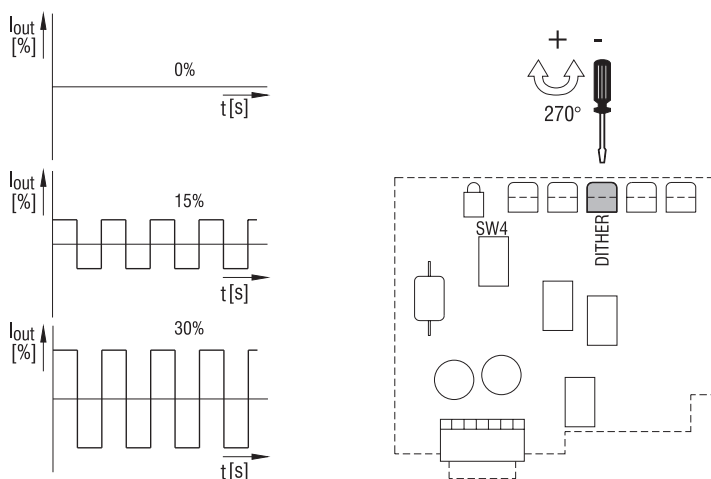


Ramp adjustment for master solenoid

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

**Dither Adjustment**

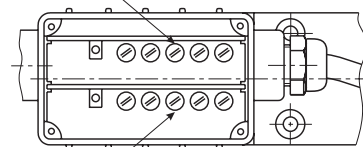
**Amplitude - potentiometer (dither) (0 - 30 %)**



**Frequency - switch SW4**



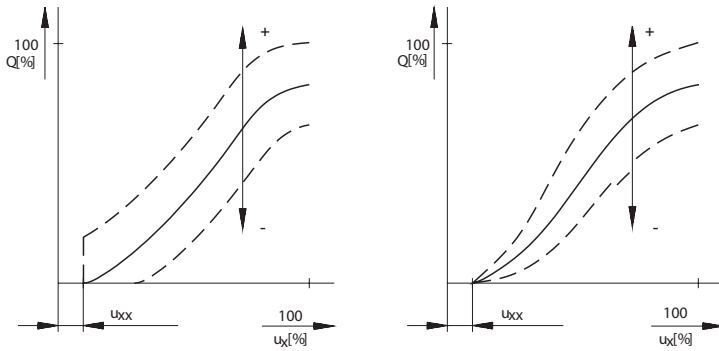
Amplitude adjustment for master solenoid



Amplitude adjustment for slave solenoid

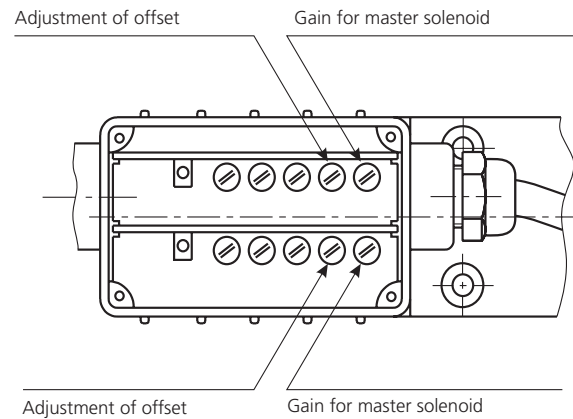
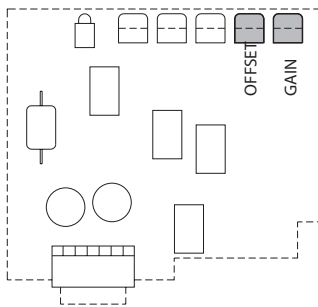
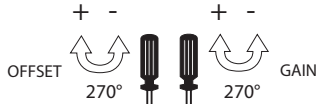
**i** The dither is adjusted with regard to the minimum hysteresis.

## 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)

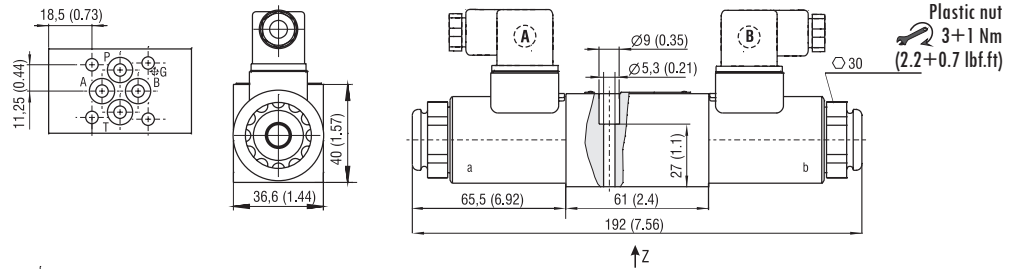
No Designation - Standard	Designation N2 - Rubber Boot Protected

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**

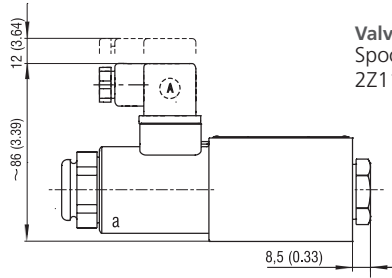
Valve with two solenoids  
Example with electrical terminal  
EN 175301-803-A (E1, E2)



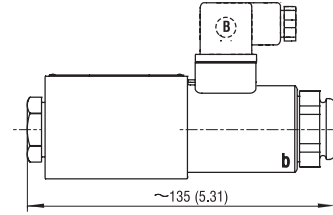
Spool symbols  
3Z11, 3Z12, 3Y11, 3Y12

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

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

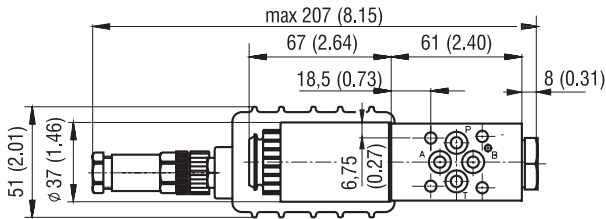


Valve with one solenoid „b”  
Spool symbols  
2Z11, 2Y11



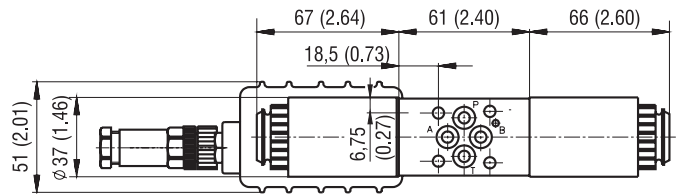
**PRM2-043x/xEK\***

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



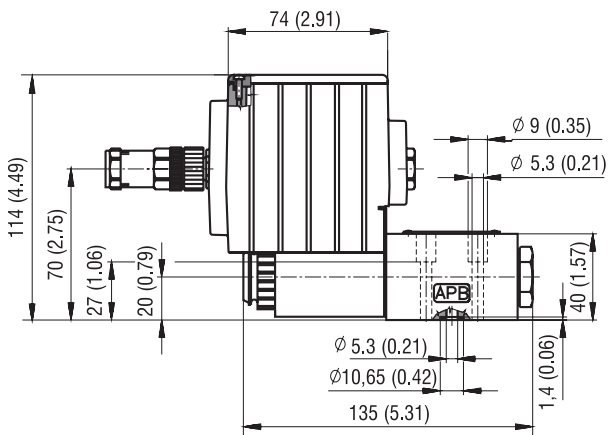
**PRM2-043x/xEK\***

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



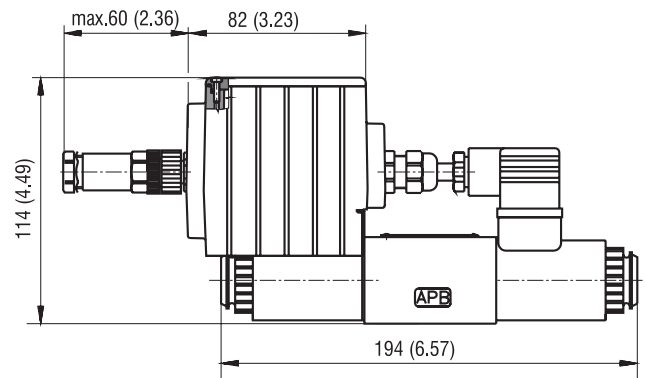
**Valve with one solenoid „a”**

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



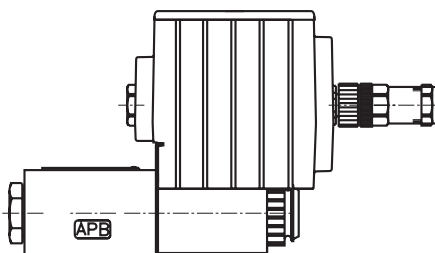
**Valve with two solenoids**

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



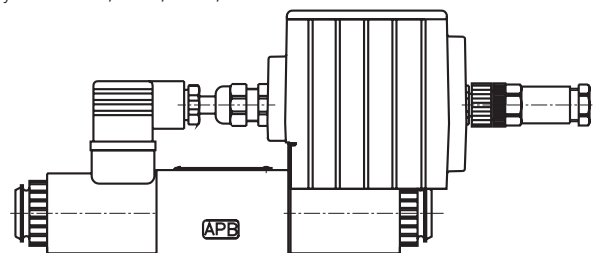
**Valve with one solenoid „b”**

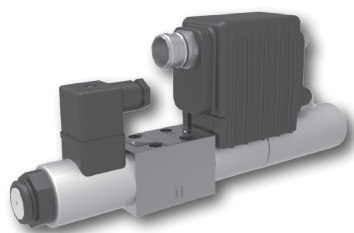
Spool symbols 2Z11, 2Y11  
OBE on side „b” version EK



**Valve with two solenoids**

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





### Technical Features

- › Direct acting, proportional control valve controlled by digital electronics, spool position feedback and process feedback (optional)
- › Control valve with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 02) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › Digital converter card allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the performance of the valve
- › Various models with or without onboard digital converter card or position sensor feedback available
- › Used for directional and speed control of hydraulic actuators
- › Wide range of interchangeable spools available
- › For versions without integrated digital electronic unit wide range of solenoid electrical terminal versions available
- › The driver directly manages digital settings. It's possible to customize the settings for special applications using the optional kit
- › In the standard version, the valve housing is phosphated and steel parts zinc-coated for 240 h protection acc. to ISO 9227
- › Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray)

### Functional Description

The proportional directional valve PRM7 consists of a cast iron housing, a special control spool, two centering springs with supporting washers, one or two proportional solenoids, a position sensor or, if desired, a control box with digital electronics. The measurement system of the position sensor consists of a differential transformer with sensor core and its electronic evaluation unit.

#### Models without integrated electronic unit

The electrical connection of the solenoids is realized by a variety of connectors. The position sensor output is connected by the G4W1F connector plug. Both connectors are supplied.

In this case the proportional valve can be used as follows:

**S01, S02** with the internal feedback from the spool position sensor.

#### Models with the integrated electronic unit

The model comprises an electronic control box that is mounted together with the position sensor on either of the solenoids. The connection of the position sensor to the control box is provided by a cable. For models with two solenoids, the solenoid mounted opposite the control box is connected to the control box by a EN 175301-803 connector.

The connection of the supply voltage, control signal, program input and external output of the position sensor is implemented in a 7-pin connector (M23). The connection of the external feedback is provided by a 5-pin connector, which also has three supply voltages +24 V, +10 V and -5 V for an external sensor available.

The solenoid coils, including the control box, can be turned in the range of  $\pm 90^\circ$ . The digital control unit enables the proportional valve to be controlled on the basis of data required from two feedback circuits. In this case the proportional valve can be used as follows:

- E01** Proportional directional valve
- E02\*S01** Only with the internal feedback from the spool position sensor.
- E03** Only with the external feedback (pressure sensor, position sensor, etc.).
- E04\*S01** With internal and external feedback.

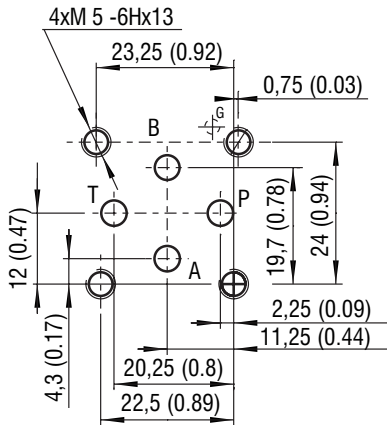
The digital control unit utilizes pulse-with-modulation (PWM) and supplies the solenoids with current proportional to the control signal.

The supply current is additionally modulated with a dither frequency. Individual functional parameters are adjusted through software by a special programmer, or by computer through the RS 232 interface. The cable kit must be ordered separately, as detailed on page 4. The correct function of the digital control unit is signaled by a green LED. The incorrect function (failure) is indicated by a red LED. As a standard, the proportional valve is delivered with factory setting.

For a model including an external feedback contact the manufacturer.

## Technical Data

ISO 4401-02-01-0-05



Ports P, A, B, T - max Ø4.5 mm (0.18 in)

Valve Size	04 (D02)		
Max. operating pressure at ports P, A, B	bar (PSI)	320 (4600)	
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 max.	°C (°F)	-30 ... +50 (-22 ... +122)	
Nominal flow at $\Delta p = 10$ bar (145 PSI)	l/min (GPM)	4 (1.1)	8 (2.1) 12 (3.2)
Hysteresis	%	< 6	
Hysteresis - closed position loop	%	< 0.5	
Protection degree EN 60529		IP 65	
Weight - valve with 1 solenoid	kg (lbs)	1.5 (3.30)	
- valve with 2 solenoids		1.8 (3.96)	
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	DP_0002	DP*-04	

## Ordering Code

PRM7-04 [ ] / [ ] - [ ] [ ] [ ] [ ] [ ] [ ] [ ] - [ ]

**Proportional Directional Control Valve Controlled by** (internal or external) **Digital Electronics**

**Valve size**

**Spool symbols**

see the table „Spool symbols“

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

flow 4 l/min (1.1 GPM)

**04**

flow 8 l/min (2.1 GPM)

**08**

flow 12 l/min (3.2 GPM)

**12**

**Nominal solenoid supply voltage**

12 V DC

**12**

24 V DC

**24**

**Model with integrated electronic**

proportional directional valve without feedback

**E01**

proportional directional valve with external feedback

**E03**

proportional directional valve with position sensor

**E02S01**

proportional directional valve

**E04S01**

with position sensor and external feedback

(model without electronic)

**(no designation)**

**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)

**Installation side of electronic unit and position sensor**

**No designation** of port A (case with two solenoids)

**Model without integrated electronic**

**S01**

position sensor with voltage outlet

**S02**

position sensor with current outlet

**Connector according to EN 175301-803-A**

**K1**

without rectifier

**Connector for models without integrated electronic**

**E1**

EN 175301-803-A

**E2**

E1 with quenching diode

- 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 special models 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	

$$\frac{q_A}{q_B} = \frac{1}{2}^*$$

$$\frac{q_A}{q_B} = \frac{1}{2}^*$$

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

### Technical Data of Position Sensor - Voltage Outlet

Operating pressure	bar (PSI)	to 320 (4640), static
Electrical connection*only for S01 model		electrical connector G4W1F Hirschmann*
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP 65
Measured distance	mm (in)	8 (0.315)
Operating voltage	V	9.6 ... 30 DC
Linearity error	%	< 1
Current consumption at load current of 2 mA	mA	< 15
Output voltage	V	0 ... 5
Output signal range used: 0 position 1 solenoid - stroke 1.8 mm (0.07 in) 2 solenoids - stroke ±1.8 mm (0.07 in)	V	2.5 1.375 ... 2.5 1.375 ... 3.625
Max. load current	mA	2
Noise voltage - at load current 0 - at load current of 2 mA	mV <sub>p-p</sub>	< 20 < 15
Additional output signal error at: - temperature change between 0 ... 80°C (32... 176 °F) - between 0... -25 °C (32 ... -13 °F) - Load change from 0 to 2 mA		typical 0.2% / 10K max. 0.5 % / 10K max. 0.5 % / 10K 0.1 %
Input voltage change from 9.6 V to 14.4 V from 14.4 V to 30 V	%	< 0.1 < 0.25
Long-term drift (30 days)	%	< 0.25
Cut-off frequency 3dB fall in amplitude Frequency 90°	Hz	> 600 > 600

### Technical Data of Position Sensor - Current Outlet

Linearity	%	< 1
Operating pressure	bar (PSI)	to 320 (4640), static
Electrical connection*only for S02 model		electrical connector G4W1F Hirschmann*
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP 65
Operating voltage	V	20 ... 30 DC
Current	mA	< 35
Output signal range	mA	4 ... 20
Output signal range used: 0 position 1 solenoid - stroke 1.8mm (0.07 in) 2 solenoids - stroke ±1.8 mm (0.07 in)	mA	12 8.4 ... 12 8.4 ... 15.6
Additional output signal error: - at temperature change from +10... 55°C (50... 131°F) - at impedance change from 50 % - at input voltage change in the operating voltage range		0.2% / 10K ≤ 0.1% ≤ 0.05%
Impedance	Ω	≤ 500
Output signal ripple	mA R.M.S.	≤ 0.02
Limit frequency at 3 dB amplitude decrease	Hz	≥ 800

### Technical Data of Proportional Solenoid

Type of coil	V	12 DC	24 DC
Limiting current	A	1.7	0.8
Resistance at 20° C (68 °F)	Ω	4.9	21

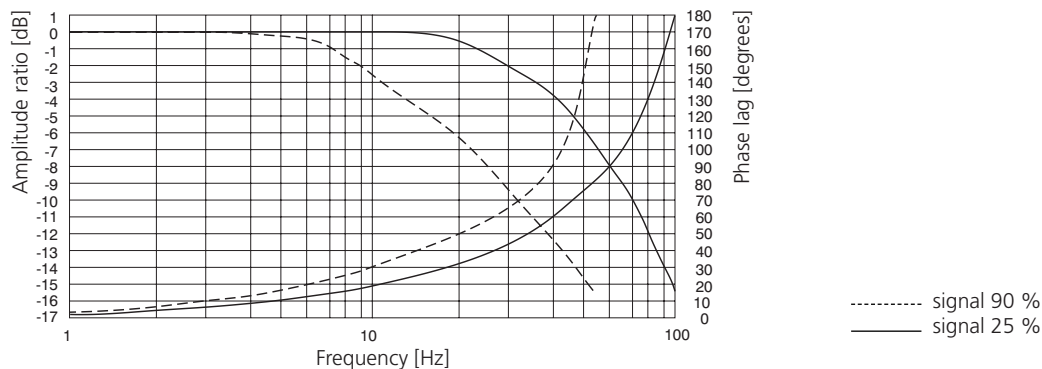
### Electronics Data

Supply voltage with polarity inversion protection	V	11.2 ... 28 V DC (residual ripple < 10 %)
Input: command signal / according to customer setting		±10 V, 0...10 V, ±10 mA, 4...20 mA, 0...20 mA, 12 mA ±8 mA
Input: spool position sensor signal		0...5 V
Input: external feedback signal		0...10 V, 4...20 mA, 0...20 mA
Resolution of the A/D converter		12 bit
Output: solenoids		two PWM output stages up to max. 3.5 A
PWM frequency	kHz	18
Adjustment of parameters	μS	170
EMC	Interference resistance	61000 - 6 - 2 : 2005
	Radiation resistance	55011 : 1998 class A
Parameter setting	Serial port RS 232 (zero modem), 19200 bauds, 8 data bits, 1 stop bit, no parity. Special software PRM7 Conf.	

## Accessories

Order number	Content
23093400	Connecting cable to PC - length 2 m (6.56 ft), CD-ROM with program PRM7 Conf and user manual
23093500	Connecting cable to PC - length 5 m (16.40 ft), CD-ROM with program PRM7 Conf and user manual
24523400	Connecting cable to PC - length 2 m (6.56 ft)
24523500	Connecting cable to PC - length 5 m (16.40 ft)

## Frequency Response closed position loop, for E02S01 model

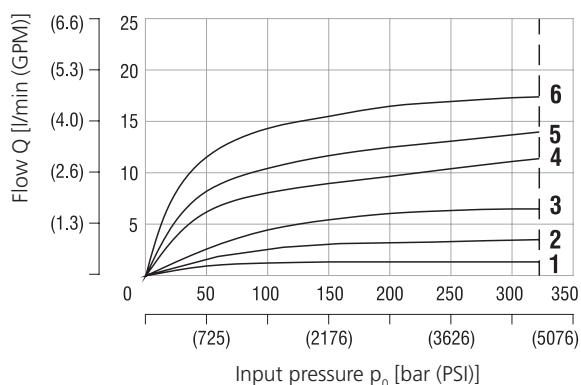


## Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

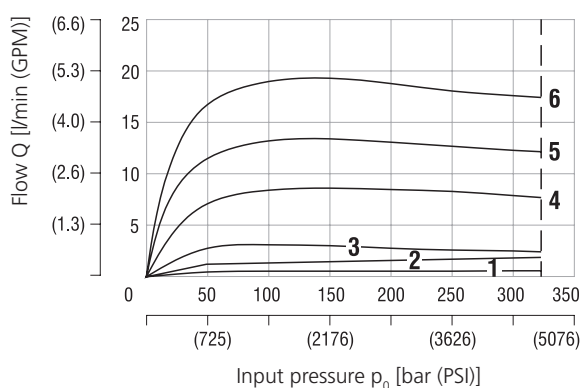
**Operating limits:** Flow direction P → A / B → T or P → B / A → T

Operating limits only for **E01 model only**

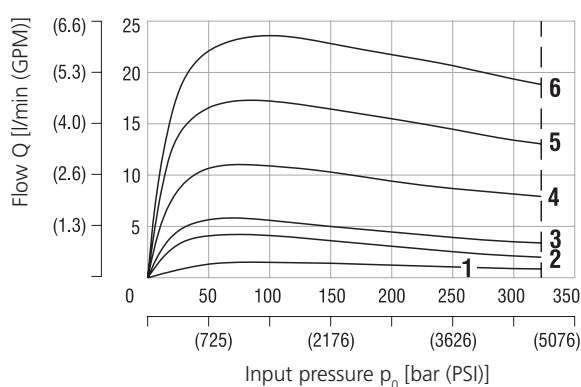
Nominal flow 4 l/min (1.1 GPM)



Nominal flow 8 l/min (2.1 GPM)



Nominal flow 12 l/min (3.2 GPM)

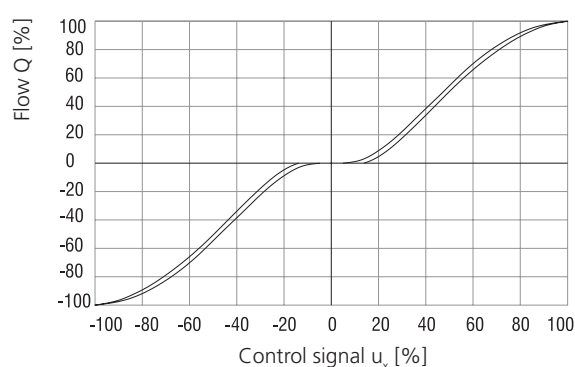


**Solenoid current:**

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

**Regulated flow related to control signal**

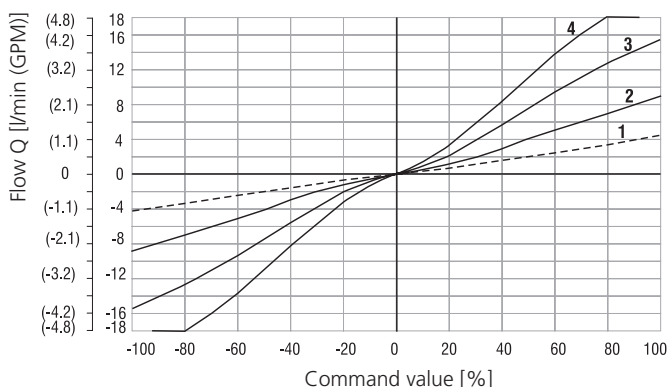
Flow characteristics (E01 model only)  $\Delta p = 10 \text{ bar}$  (145 PSI)



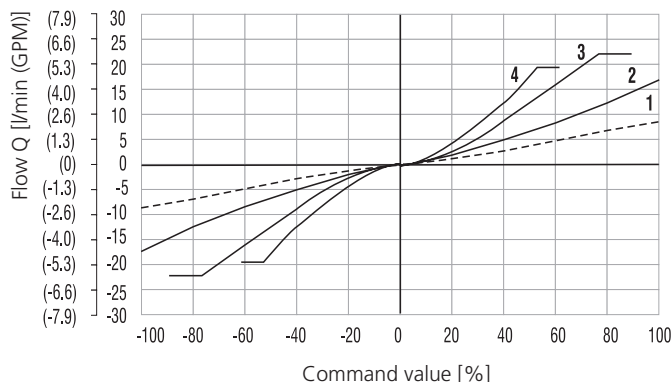
## Flow Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

### Flow characteristics (E02S01 model only)

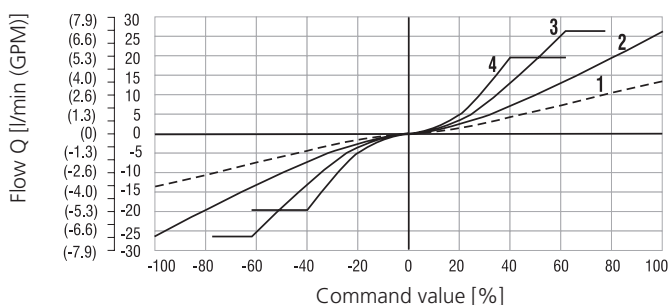
$Q_n = 4 \text{ l/min}$  (1.1 GPM) by  $\Delta p = 10 \text{ bar}$  (145 PSI)



$Q_n = 8 \text{ l/min}$  (2.1 GPM) by  $\Delta p = 10 \text{ bar}$  (145 PSI)



$Q_n = 12 \text{ l/min}$  (3.2 GPM) by  $\Delta p = 10 \text{ bar}$  (145 PSI)



$\Delta p$  = Valve pressure differential (input pressure  $p_0$  minus load pressure and return pressure  $p_r$ )

$\Delta p_n$  = Valve pressure differential (for nominal flow  $Q_n$ )

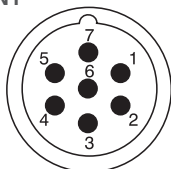
1	$\Delta p_n = 10 \text{ bar}$ (145 PSI)
2	$p_0 = 50 \text{ bar}$ (725 PSI)
3	$p_0 = 160 \text{ bar}$ (2321 PSI)
4	$p_0 = 320 \text{ bar}$ (4641 PSI)

## Factory Settings

Item	Model							
	E01	2 Magnets	E02S01	2 Magnets	E03	2 Magnets	E04S01	2 Magnets
Control signal	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets
Signal external feedback	0 ... 10 V	$\pm 10 \text{ V}$	0 ... 10 V	$\pm 10 \text{ V}$	0 ... 10 V	$\pm 10 \text{ V}$	0 ... 10 V	$\pm 10 \text{ V}$
Output spool position sensor	-	-	0 ... 5 V	-	0 ... 10 V	-	0 ... 5 V	-

## Connectors

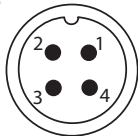
### KN1



Connector KN1 - type M23 (male)	
PIN	Technical data
1	*Power supply input
2	*Ground (power supply)
3	Control signal
4	Ground (signal)
5	Power reference signal
6	Control signal of position sensor spool
7	*Protective earth lead (PE)

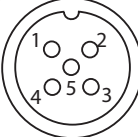
\*Recommended min. lead cross section  $0.75 \text{ mm}^2$

### KN2



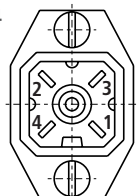
Connector KN2 - type M12x1 (male)	
PIN	Technical data
1	TxD
2	RxD
3	Ground (signal)
4	Not used

### KN3



Connector KN3 - type M12x1 (female)	
PIN	Technical data
1	Power supply output
2	Signal of external feedback
3	Ground
4	Not used
5	Not used

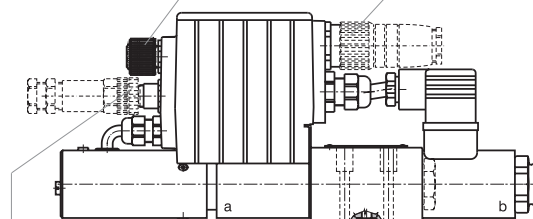
### KN4



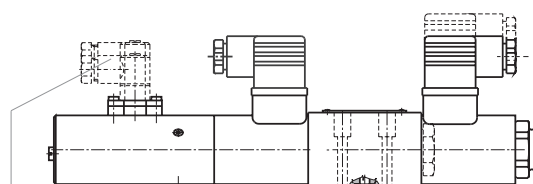
Connector KN4 - type G4A5M (male)	
PIN	Technical data
1	Power supply input
2	Power supply output
3	Ground
4	Not used

**KN1** - Main input connector M23 (7 PIN)  
Cable diameter 8 ... 12 mm (0.31 ... 0.47 in)

**KN2** - Connection RS232 M12x1 (4 PIN)  
to program the electronics



**KN3** - Connector M12x1 (5 PIN)  
Signal of external feedback  
(for configurations E03 and E04S01 only)



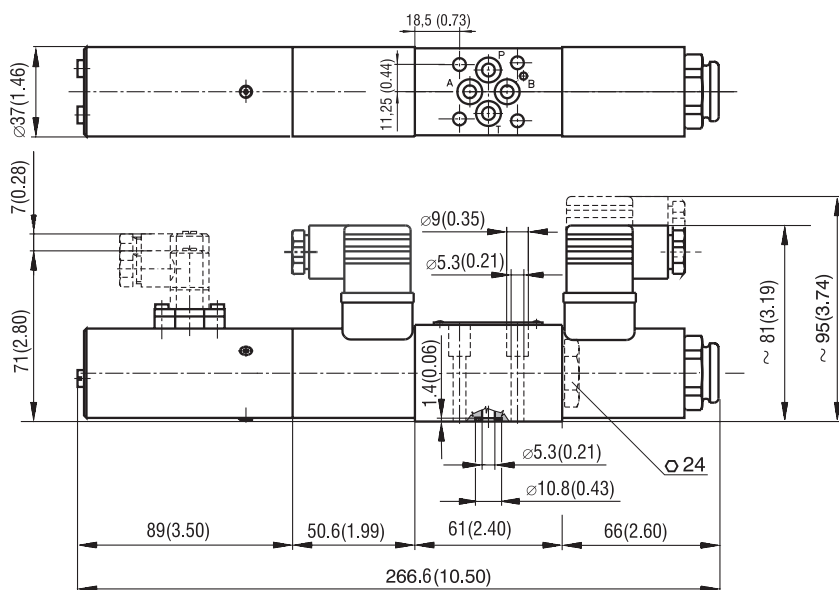
**KN4** - Connector G4A5M (4 PIN)  
Internal feedback - spool position signal  
for valve without ECU



Dimensions in millimeters (inches)

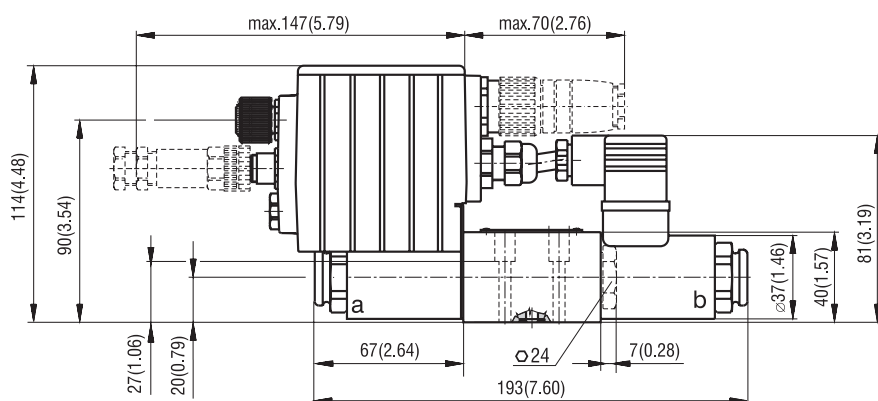
PRM7-043 ... S01

PRM7-043 ... S02



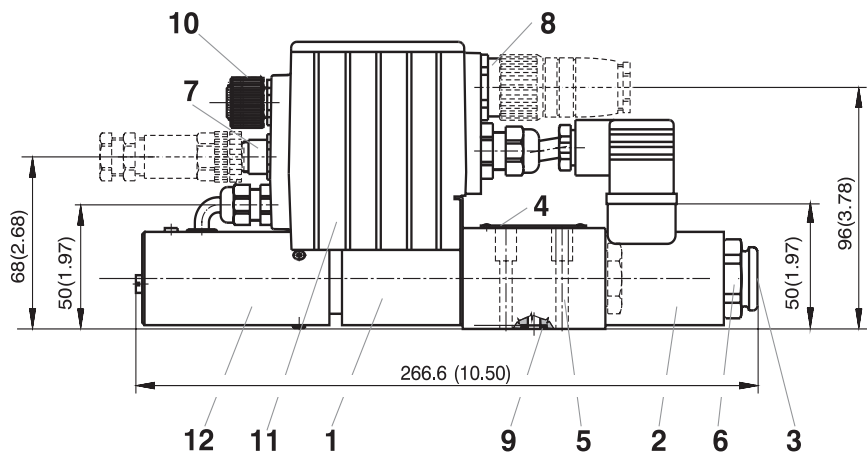
PRM7-043 ... E01 - without connector plug for spool position feedback

PRM7-043 ... E03



PRM7-043 ... E02S01 - without connector plug for spool position feedback

PRM7-043 ... E04S01

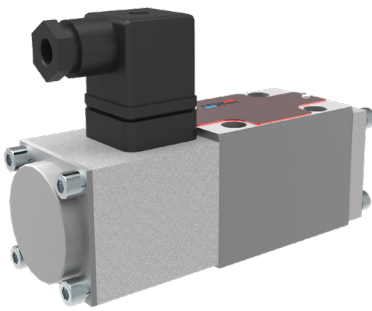


- 1 Solenoid a
- 2 Solenoid b
- 3 Manual override
- 4 Name plate
- 5 4 mounting holes
- 6 Solenoid fixing nut
- 7 Connector M12x1 for connection of external feedback
- 8 Main supply connector M23
- 9 Square ring 7.65 x 1.68 (4 pcs.), supplied in delivery packet
- 10 Cover of connector M12x1 for programming
- 11 Plastic box with integrated electronics
- 12 Position sensor

## Proportional directional valves with linear motor

# PRL1

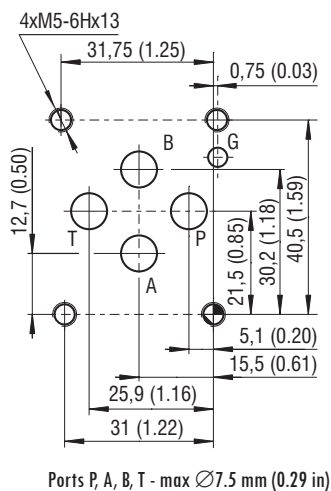
Size 06 (D03) •  $Q_{max}$  63 l/min (17 GPM) •  $p_{max}$  350 bar (5100 PSI)



### Technical Features

- › Proportional directional control valve with high response speed to a change of command signal
- › Connecting diagram size 06 according to standards ISO 4401 and DIN 24340 (CETOP 03)
- › The valve is suitable for continuous control of flow rate or pressure (as a pilot valve) depending on the command signal
- › It is designed for control of hydraulic cylinders and rotational hydraulic motors
- › High reliability of design solution
- › It is required the same cleanliness degree of the working fluid as at standard valves
- › The direct spool control improves the dynamic of valve and reduces dependence on operating pressure
- › The valve can be delivered with electronic control unit and with manual override
- › In the standard design the valve body is phosphated. Steel parts are zinc-coated with corrosion protection 240 h in NSS acc. to ISO 9227.

### ISO 4401-03-02-0-05



### Technical Data

Valve size		06 (D03)			
Max. operating pressure	bar (PSI)	350 (5080)		150 (2180)	
Rated flow at $\Delta p = 70$ bar	l/min (GPM)	3.2 (0.85)	16 (4.23)	32 (8.45)	63 (16.6)
Rated flow at $\Delta p = 10$ bar	l/min (GPM)	1.1 (0.29)	6.3 (1.66)	12.5 (3.30)	25 (6.60)
Max. current coil for 12 V	A	3			
Max. current coil for 24 V	A	2.5			
Hysteresis	%	< 7			
Threshold	%	< 2			
Fluid temperature range	°C (°F)	-30 ... +80 (-22 ... +176)			
Ambient temperature, max.	°C (°F)	-30 ... +50 (-22 ... +122)			
Weight	kg (lbs)	1.8 (3.97)			

Flow losses in l/min		Spool lap			
at input pressure 100 bar, viscosity 32 mm <sup>2</sup> /s and middle position of spool					
		0	1	2	3
PRL1-06-03--24 (12)	l/min	< 0.8	< 0.2	< 0.2	< 2.0
PRL1-06-16--24 (12)		< 1.5	< 0.2	< 0.2	-
PRL1-06-32--24 (12)		< 1.5	< 0.2	< 0.2	-
PRL1-06-63--24 (12)		< 1.5	< 0.2	< 0.2	-

	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 06
Subplates	DP-04 (06, 10)	Size 06
Spare parts	SP_8010	

### Functional Description

The PRL1 proportional directional control valve is designed for continuous remote control of rotational hydromotors and hydraulic cylinders in mobile and stationary applications. Direct spool operation by linear motor and robust design increase valve function reliability and reduce the required cleanliness of the working fluid. The hydraulic part consists of a cast-iron body with a fitted spool. The control part consists of a linear motor. The armature of the linear motor is centred by springs and the working gaps are premagnetized in opposite directions by permanent rare earth magnets. When the coil is energized, the armature with spool moves from the middle position. Spool position and volumetric flow are proportional to the control current. The moving direction of the spool and flow direction depend on current flow direction. In the event of supply voltage disconnection or cable failure the motor armature with the spool moves back to the basic middle position. The manual override allows smooth adjustment of the spool by screwing the hexagonal socket screw 4 in the flange. If the manual override is mounted on both sides of the valve, the spool may only be manually adjusted from one side to prevent the rod from deforming. On the opposite side the manual override must be released. The EL2 electronic control unit can be used for valve control. Although the PRL1 proportional directional control valve is primarily designed for control of both flow direction and volume (size), it can be used for pressure control as a pilot valve for proportional directional control valves of larger sizes. Due to their dynamic properties the PRL1 proportional directional control valves are used for control of closed loop control systems.

### Spool Symbols

Symbol	PRL1-06-...-...-...	PRL1-06-...-...-...N	PRL1-06-...-...-...NN
Z11			
Y11			
H11			

Performance Curves measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS) and  $t = 40 \text{ }^\circ\text{C}$  (104  $^\circ\text{F}$ )

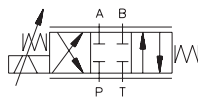
**Flow characteristic**

**Pressure characteristic**

**Flow characteristic**

**Pressure characteristic**

**Spool lap 0**

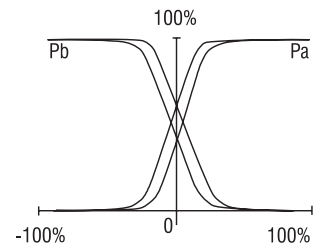
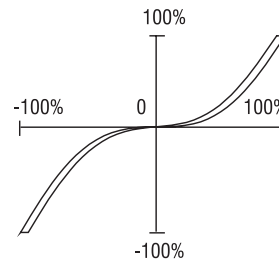
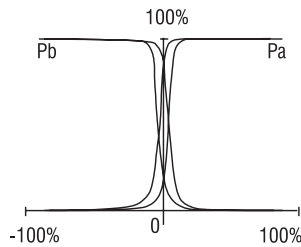
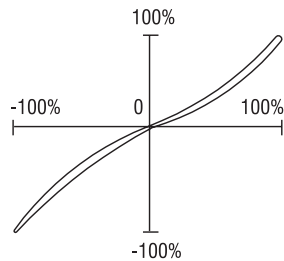


Q [l/min] / Command signal [%]

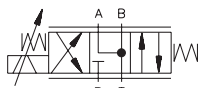
$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]

Q [l/min] / Command signal [%]

$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]



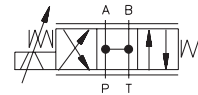
**Spool lap 2**



Q [l/min] / Command signal [%]

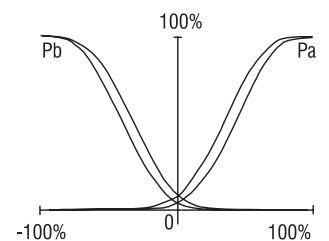
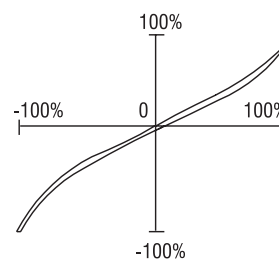
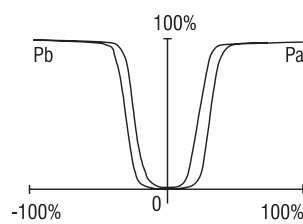
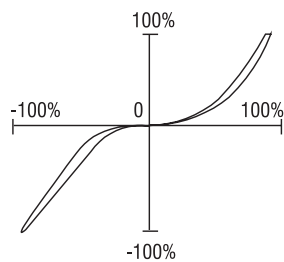
$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]

**Spool lap 3**



Q [l/min] / Command signal [%]

$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]



**Ordering Code**

PRL1-06----

Proportional directional valves with linear motor

Nominal size  
ISO 4401-03-02-0-05,  
DIN 24340 (CETOP 03), size 06

Nominal flow in l/min at the pressure difference at the valve

$\Delta p$ 70	(1015)	$\Delta p$ 10	(145)	[bar (PSI)]	
3.2	(0.8)	1.1	(0.29)	[l/min (GPM)]	<b>03</b>
16	(4.2)	6.3	(1.7)	[l/min (GPM)]	<b>16</b>
32	(8.5)	12.5	(3.3)	[l/min (GPM)]	<b>32</b>

**Spool lap**

- „Z“ zero
- „Z“ 25 % overlap
- „Y“ 25 % overlap
- „H“ pressure valve

- 0
- 1
- 2
- 3

**No designation**

- N basic
- NN manual override on the valve
- NN manual override on both the valve and linear motor

**Nominal supply voltage of the control electronic**

- 12 12 V DC (11.2 - 14.7)
- 24 24 V DC (22.4 - 27.5)

	Spool lap			
	0	1	2	3
PRL1-06-03--24 (12)	●	●	●	●
PRL1-06-16--24 (12)	●	●	●	●
PRL1-06-32--24 (12)	○	○	○	○

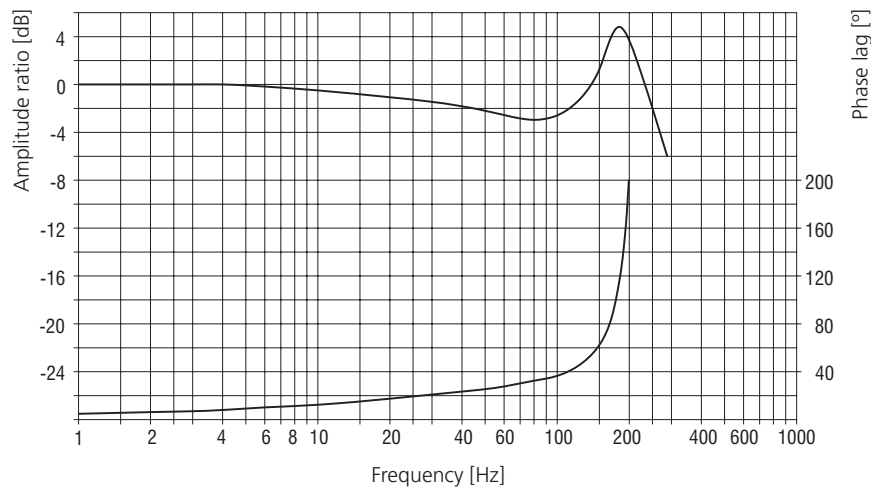
- common types
  - restricted max. parameters, consultation with the manufacturer necessary
- Additional flow rates delivered by request.

## Frequency Response

PRL1-06-16-0-24

$p_o = 100$  bar

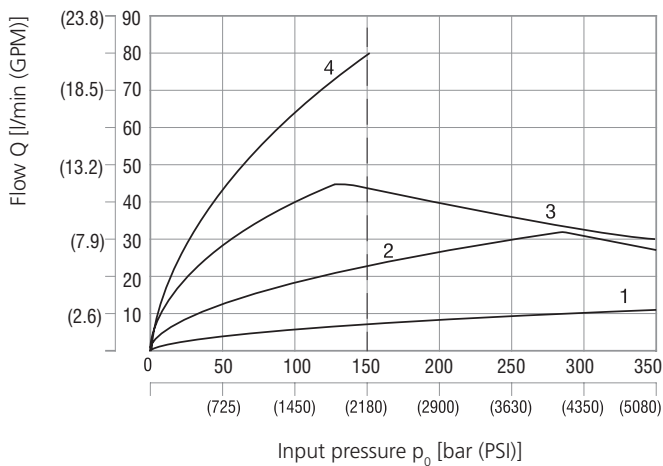
$x = 25$  %



**Characteristics** measured at  $v = 32$  mm<sup>2</sup>/s (156 SUS) and  $t = 40$  °C (104 °F)

**Power characteristics:** flow direction P → A / B → T nebo P → B / A → T

For nominal flow rates: 3.2, 16, 32, 63

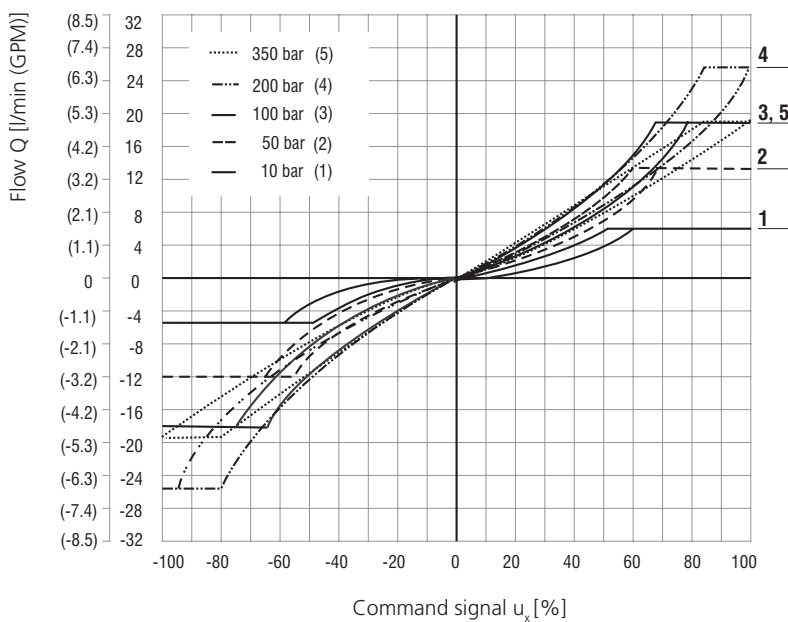


**At max current flowing through the coil 24 V (12 V), 100% command signal**

1	PRL1-06-03--24 (12)	
2	PRL1-06-16--24 (12)	max. 350 bar (5080 PSI)
3	PRL1-06-32--24 (12)	
4	PRL1-06-63--24 (12)	max. 150 bar (2180 PSI)

**Flow characteristics:** flow direction P → A / B → T or P → B / A → T

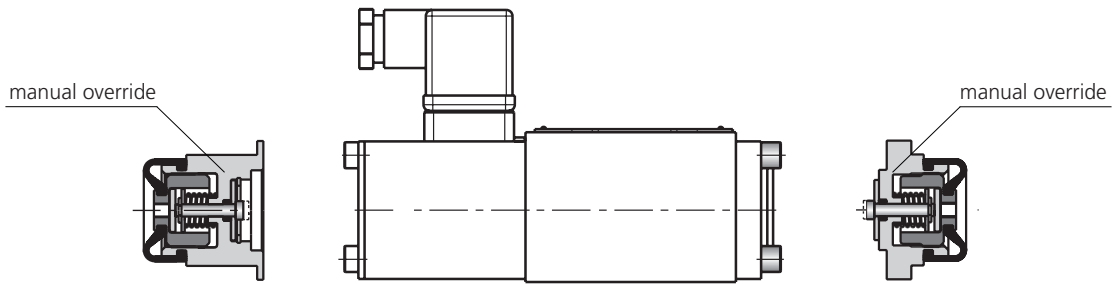
PRL1-06-16-0-24



$\Delta p$  = Valve pressure differential (inlet pressure  $p_o$  minus load pressure and return pressure  $p_r$ )

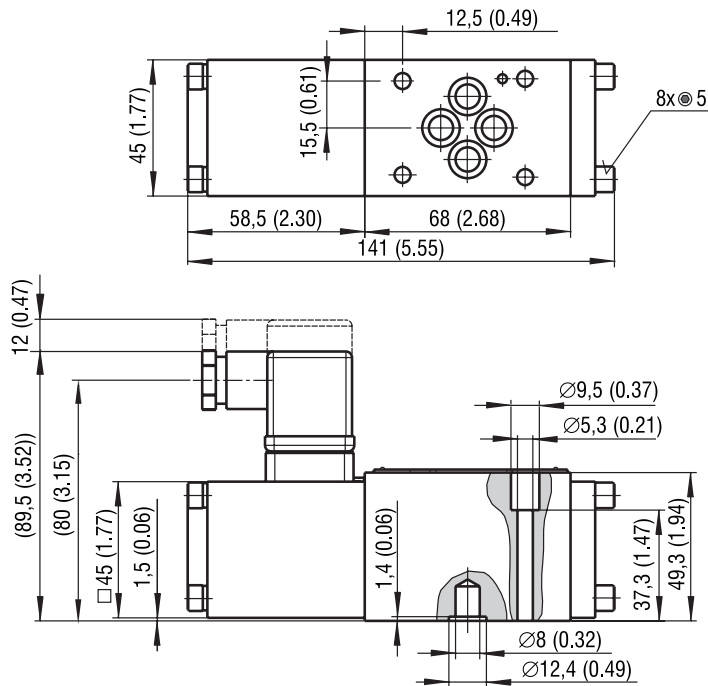
1	$\Delta p = 10$ bar (145 PSI)
2	$p_o = 50$ bar (725 PSI)
3	$p_o = 100$ bar (1450 PSI)
4	$p_o = 200$ bar (2900 PSI)
5	$p_o = 350$ bar (5076 PSI)


Manual Override in millimeters (inches)



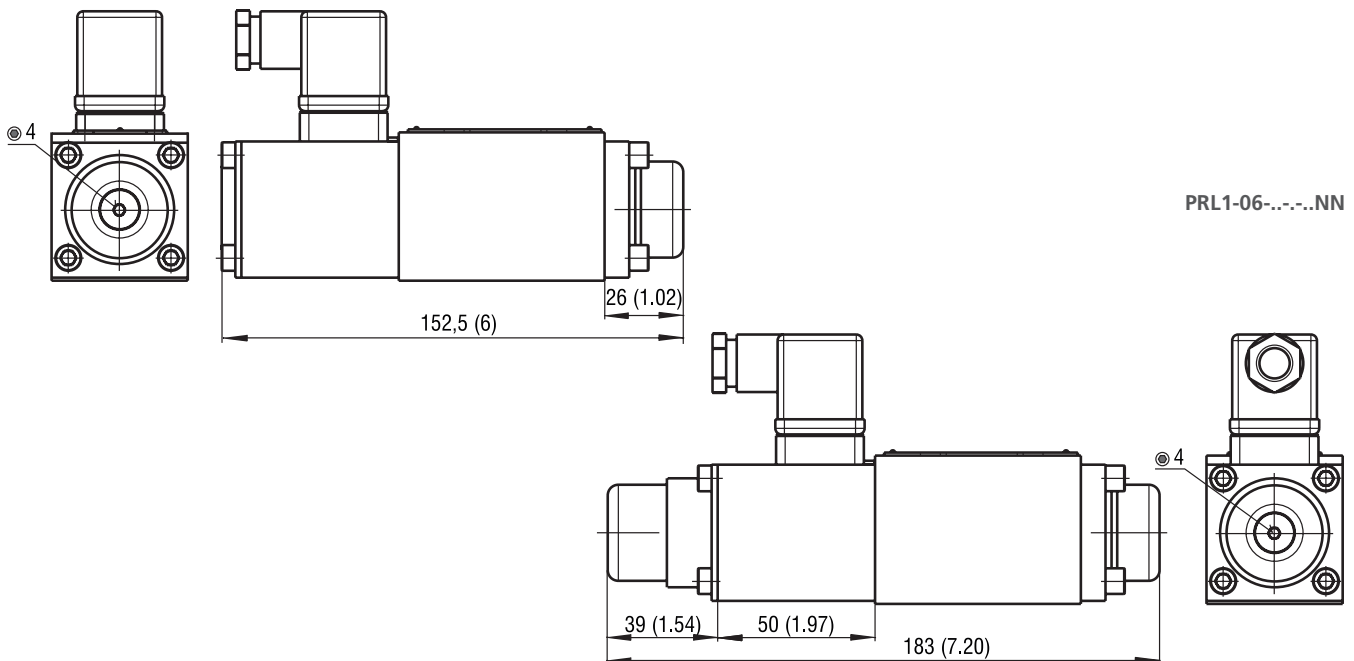
Dimensions in millimeters (inches)

PRL1-06-.....



Mounting screws  8.9+1 Nm (6.6+0.7 lbf.ft)  
M5 x 45 DIN 912-10.9

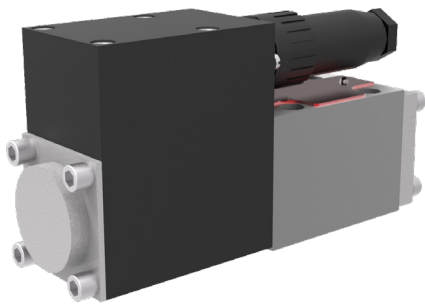
PRL1-06-.....N



Proportional directional valve with linear motor and displacement transducer

**PRL2**

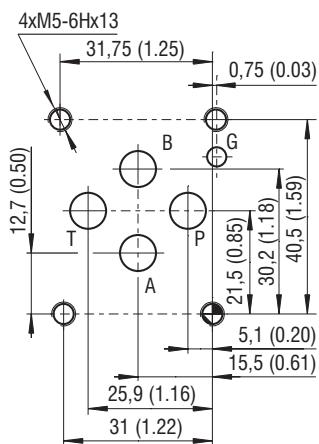
Size 06 (D03) •  $Q_{max}$  63 l/min (17 GPM) •  $p_{max}$  350 bar (5100 PSI)



**Technical Features**

- › Proportional directional control valve with high response speed to a change of command signal
- › Built-in spool position sensor reduces hysteresis below 1%
- › Connecting diagram size 06 according to standards ISO 4401 and DIN 24340 (CETOP 03)
- › The valve is suitable for continuous control of flow rate or pressure (as a pilot valve) depending on the command signal
- › It is designed for control of hydraulic cylinders and rotational hydraulic motors
- › High reliability of design solution
- › It is required the same cleanliness degree of the working fluid as at standard valves
- › The direct spool control improves the dynamic of valve and reduces dependence on operating pressure
- › The valve can be delivered with electronic control unit and with manual override
- › In the standard design the valve body is phosphated. Steel parts are zinc-coated with corrosion protection 240 h in NSS acc. to ISO 9227

ISO 4401-03-02-0-05



Ports P, A, B, T - max  $\varnothing$ 7.5 mm (0.29 in)

**Technical Data**

Valve size		06 (D03)			
Max. operating pressure	bar (PSI)	350 (5080)			
Rated flow at $\Delta p = 70$ bar	l/min (GPM)	3.2 (0.85)	16 (4.23)	32 (8.45)	63 (16.6)
Rated flow at $\Delta p = 10$ bar	l/min (GPM)	1.1 (0.29)	6.3 (1.66)	12.5 (3.30)	25 (6.60)
Max. current coil for 24 V	A	2.6			
Sensor output signal	V DC	0 - 2			
Hysteresis	%	< 1			
Threshold	%	< 0.5			
Fluid temperature range	$^{\circ}C$ ( $^{\circ}F$ )	-30 ... +80 (-22 ... +176)			
Ambient temperature, max.	$^{\circ}C$ ( $^{\circ}F$ )	-30 ... +50 -22 ... (+122)			
Weight	kg (lbs)	2.3 (5.07)			

Flow losses in l/min		Spool lap			
at input pressure 100 bar, viscosity 32 mm <sup>2</sup> /s and middle position of spool					
		0	1	2	3
PRL2-06-03--24	l/min	< 0.8	< 0.2	< 0.2	< 2.0
PRL2-06-16--24		< 1.5	< 0.2	< 0.2	-
PRL2-06-32--24		< 1.5	< 0.2	< 0.2	-
PRL2-06-63--24		< 1.5	< 0.2	< 0.2	-

	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 06
Subplates	DP-04 (06, 10)	Size 06
Spare parts	SP_8010	

**Functional Description**

The PRL2 proportional directional control valve is designed for continuous remote control of rotational hydromotors and hydraulic cylinders in mobile and stationary applications. Direct spool operation by linear motor and robust design increase valve function reliability and reduce the required cleanliness of the working fluid. The hydraulic part consists of a cast-iron body with a fitted spool. The control part consists of a linear motor. The armature of the linear motor is centred by springs and the working gaps are premagnetized in opposite directions by permanent rare earth magnets. When the coil is energized, the armature with spool moves from the middle position. Spool position and volumetric flow are proportional to the control current. The moving direction of the spool and flow direction depend on current flow direction. In the event of supply voltage disconnection or cable failure the motor armature with the spool moves back to the basic middle position. The actual spool position is sensed by the built-in inductive position sensor. The sensor signal is processed by an integrated electronic unit, which allows an adjustment of zero and amplification of the feedback signal, which is led to the controller of the EL2-24 BA electronic control unit. The closed loop regulation with feedback significantly reduces the hysteresis to below 1%. Although the PRL2 proportional directional control valve is primarily designed for control of both flow direction and volume (size), it can be used for pressure control as a pilot valve for proportional directional control valves of larger sizes. Due to their dynamic properties the PRL2 proportional directional control valves are used for control of closed loop control systems.

**Spool Symbols**

Type	Z11	Y11	H11
Symbol			

Performance Curves measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS) and  $t = 40 \text{ }^\circ\text{C}$  (104  $^\circ\text{F}$ )

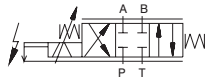
### Flow characteristic

### Pressure characteristic

### Flow characteristic

### Pressure characteristic

#### Spool lap 0

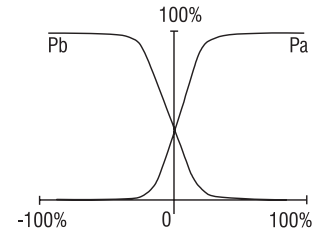
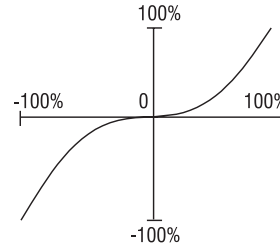
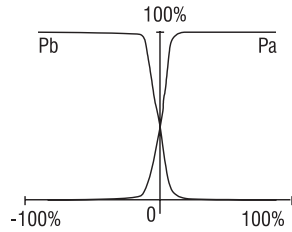
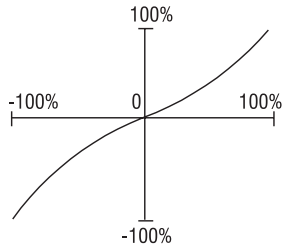


Q [l/min] / Command signal [%]

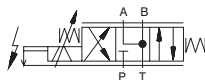
$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]

Q [l/min] / Command signal [%]

$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]



#### Spool lap 2

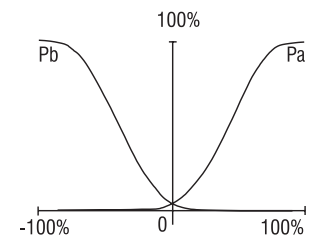
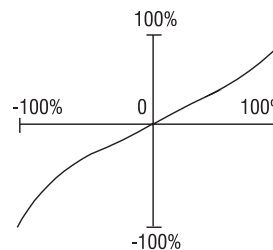
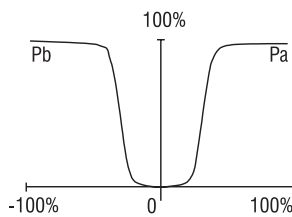
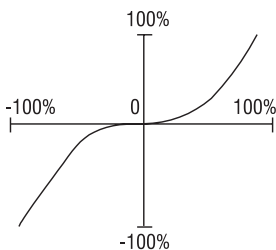


Q [l/min] / Command signal [%]

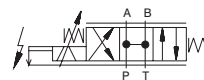
$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]

Q [l/min] / Command signal [%]

$P_{A'}$ ,  $P_B$  [bar] / Command signal [%]



#### Spool lap 3



## Ordering Code

PRL2-06----

Proportional directional valve with linear motor and displacement transducer

Nominal size  
ISO 4401-03-02-0-05,  
DIN 24340 (CETOP 03), size 06

Nominal flow in l/min at the pressure difference at the valve

$\Delta p$ 70	(1015)	$\Delta p$ 10	(145)	[bar (PSI)]	
3,2	(0.8)	1,1	(0.29)	[l/min (GPM)]	<b>03</b>
16	(4.2)	6,3	(1.7)	[l/min (GPM)]	<b>16</b>
32	(8.5)	12,5	(3.3)	[l/min (GPM)]	<b>32</b>
63	(16.6)	25,0	(6.6)	[l/min (GPM)]	<b>63</b>

#### Spool lap

„Z“ zero **0**  
 „Z“ 25 % overlap **1**  
 „Y“ 25 % overlap **2**  
 „Y“ pressure valve (only  $Q_n$  03) **3**

KA  
KM

Connector  
AMPHENOL T 3105 101  
MIL EN175201-804

Nominal supply voltage of the control electronic  
**24** 24 V DC (22.4 - 27.5)

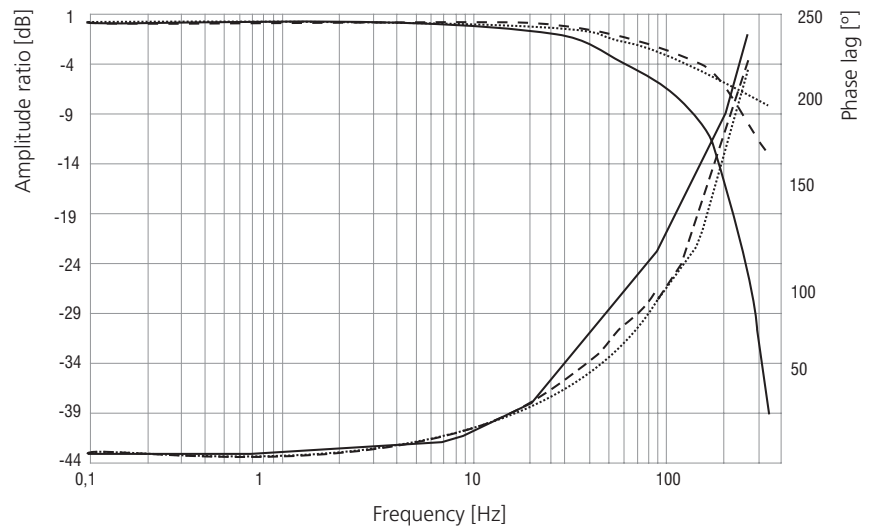
	Spool lap			
	0	1	2	3
PRL2-06-03--24	●	●	●	●
PRL2-06-16--24	●	●	●	
PRL2-06-32--24	○	○	○	
PRL2-06-63--24	○	○	○	

- common types
- restricted max. parameters, consultation with the manufacturer necessary. Additional flow rates delivered by request.

## Frequency Response

PRL2-06-16-0-24

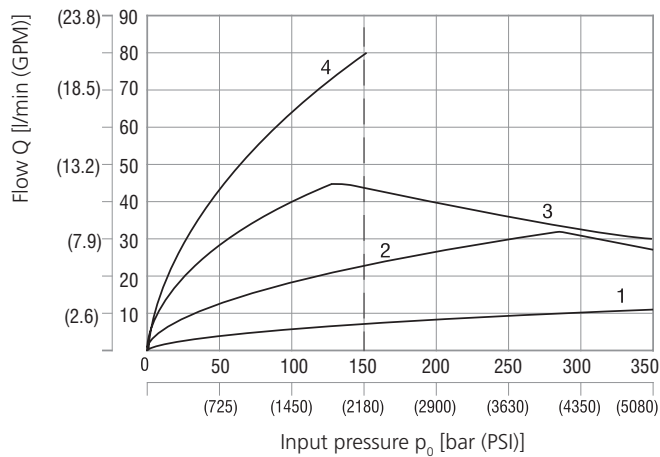
signál ±10 % .....  
 signál ±25 % - - - -  
 signál ±100 % ———



**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS) and  $t = 40 \text{ °C}$  (104 °F)

**Power characteristics:** flow direction  $P \rightarrow A / B \rightarrow T$  nebo  $P \rightarrow B / A \rightarrow T$

For nominal flow rates: 3.2, 16, 32, 63

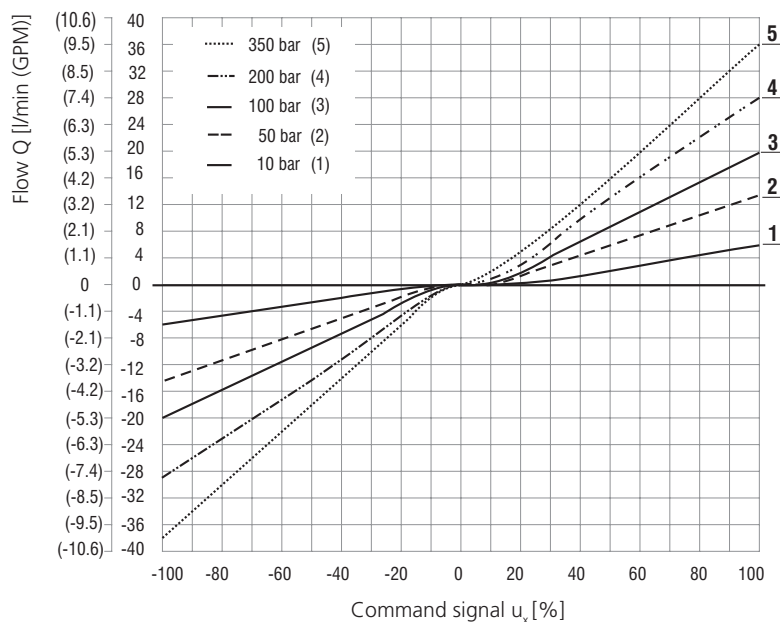


**At max current flowing through the coil 24 V (12 V), 100% command signal**

1	PRL2-06-03-.-24	max. 350 bar (5080 PSI)
2	PRL2-06-16-.-24	
3	PRL2-06-32-.-24	max. 150 bar (2180 PSI)
4	PRL2-06-63-.-24	

**Flow characteristics:** flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$

PRL2-06-16-0-24



$\Delta p$  = Valve pressure differential (inlet pressure  $p_0$  minus load pressure and return pressure  $p_r$ )

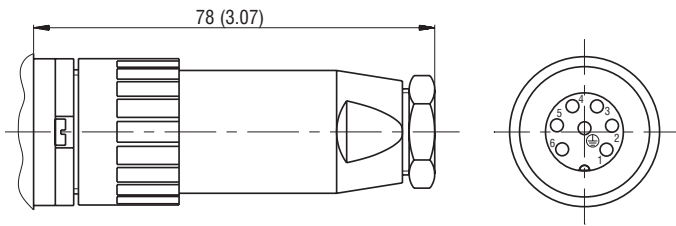
1	$\Delta p = 10 \text{ bar}$ (145 PSI)
2	$p_0 = 50 \text{ bar}$ (725 PSI)
3	$p_0 = 100 \text{ bar}$ (1450 PSI)
4	$p_0 = 200 \text{ bar}$ (2900 PSI)
5	$p_0 = 350 \text{ bar}$ (5076 PSI)



## Electric Connection

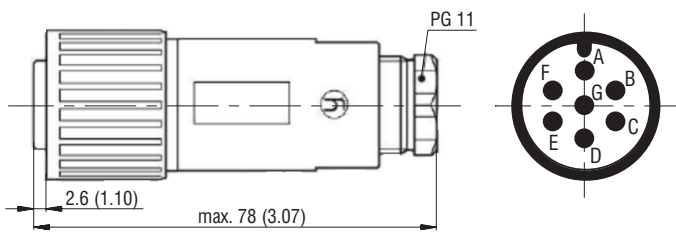
### Connector plug AMPHENOL T 3105 101 DIN 43 563-BF6-3/Pg11 6-core cable 2 x 1 + 4 x 0.15

Connector plug is to be ordered either separately or as part of the connecting cable - ordering number see the table below.



Model	Ordering number
Connector plug AMPHENOL T3105 101	16031300
Connector plug/connecting cable PRL2 - 2 m	16031400
Connector plug/connecting cable PRL2 - 3 m	16031500
Connector plug/connecting cable PRL2 - 5 m	23143300
Connector plug/connecting cable PRL2 - 10 m	23143400
Connector plug/connecting cable PRL2 - 15 m	23143600
Connector Connection	
Signal	Contact - wire colour
Inverted transducer output	1 - black
Noninverted transducer output	2 - green
Transducer supply 24 V	3 - red
Transducer supply 0 V	4 - white + screening
Input 1 of the linear motor PRL2 (+)	5 - white strong
Input 2 of the linear motor PRL2 (-)	6 - red strong

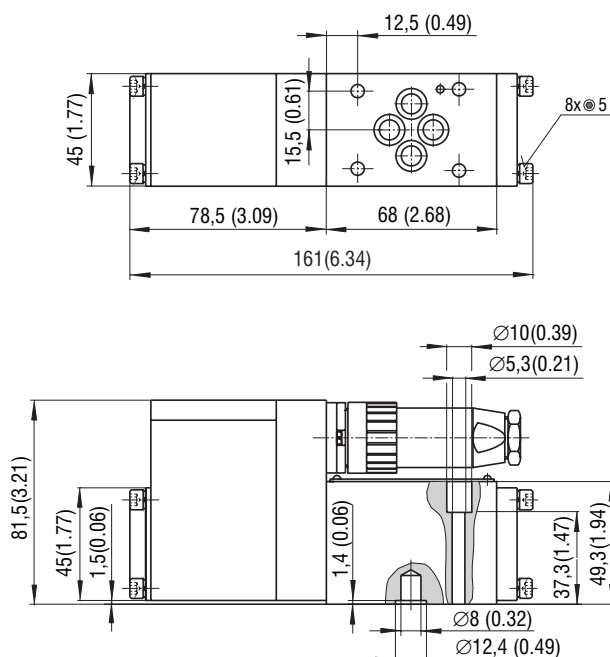
### Connector plug MIL EN 175201-804 / PG 11



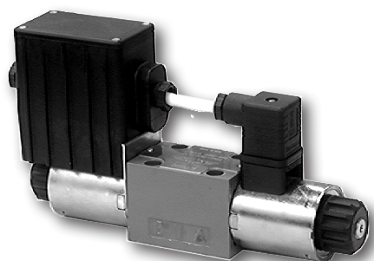
Model	Ordering number
Connector plug MIL EN 175201-804	40375000
Connector Connection	
Signal	Contact
Transducer supply 24 V	A
Transducer supply 0 V	B
Inverted transducer output	C
Input 1 of the linear motor PRL2 (+)	D
Input 2 of the linear motor PRL2 (-)	E
Noninverted transducer output	F
Not used	G

## Dimensions in millimeters (inches)

PRL2-06-...-...



Mounting screws 8.9+1 Nm (6.6+0.7 lbf.ft)  
M5 x 45 DIN 912-10.9


**Technical Features**

- › Direct acting, proportional control valve without or with integrated analog electronic (OBE) with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 03) 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 fullest
- › Analog converter card allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the valve performance
- › Five chambers housing design with reduced hydraulic power dependence on fluid viscosity
- › For versions without OBE a 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 are 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**
**PRM2-06\* Versions without on board electronics**

The valve can be controlled directly by a current control supply unit or by the external electronic card directly mounted to the electrical terminal (see catalog 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.

**PRM2-06\*EK Versions with on board electronics**

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

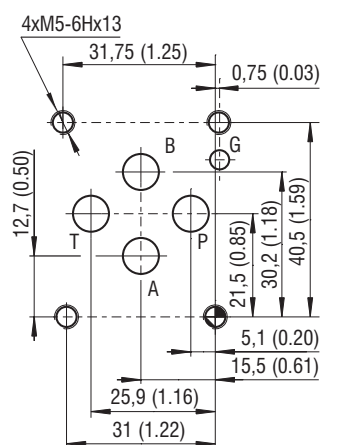
The electronic control unit provides the following adjustment possibilities:

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 LEDs. Stabilized voltage +10 V (+5 V for 12 V voltage) is also available to the user.

Using this voltage and a potentiometer  $\geq 1k\Omega$  a voltage control signal can be generated.

The electronic control card enables voltage or current control to be used, depending on the position of the switches SW1 to SW3.

**Technical Data**
**ISO 4401-03-02-0-05**

 Ports P, A, B, T - max.  $\varnothing 7.5$  mm (0.29 in)

Nominal Size		06 (D03)	
Max. operating pressure at port P, A, B	bar (PSI)	350 (5080)	
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)	5 (1.13)	8 (2.1) 15 (4.0) 30 (7.9)
Protection degree (for version PRM*EK)		IP65	
Mass	kg (lbs)	1.9 (4.2) 2.4 (5.3)	
<b>Technical Data of the Proportional Solenoid</b>			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	2.5	1.0
- with electronic		1.6	-
Mean resistance value at 20 °C (68 °F)	$\Omega$	2.3	13.4
- with electronic		5.2	-
<b>Technical Data of the Electronics</b>		V	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 $\Omega$ )	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	
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types / Connectors	C_8007 / K_8008	C22B* / K*	
Mounting interface	SMT_0019	Size 06	
Spare parts	SP_8010		
Subplates	DP_0002	DP*-06	

### Ordering Code

PRM2-06 [ ] / [ ] - [ ] [ ] [ ] [ ] [ ] - [ ]

**Proportional directional control valve, with analog control electronics**

**Valve size**

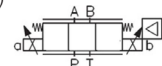
**Spool symbols**  
see table „Spool Symbols“

Nominal flow rate at $\Delta p = 10$ bar (145 PSI)	
5 l/min (1.3 GPM)	05
8 l/min (2.1 GPM)	08
15 l/min (4.0 GPM)	15
30 l/min (7.9 GPM)	30

Rated supply voltage of solenoids (at the coil terminal)	
12 V DC	12
24 V DC	24

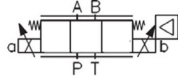
**Electronics on board / Position at solenoid**  
connection by connector M12 x 1  
(4-pin connector, supplied with counterpart)

on board electronics (solenoid „a“)



EK

on board electronics (solenoid „b“)\*



EKB

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

No designation	Seals
V	NBR
	FPM (Viton)

No designation	Manual Override
N1	standard
N2	protected with cap nut
	protected with rubber boot

No designation	Connector according to EN 175301-803-A
K1	valve version with an onboard electronic control unit
	valve version without an onboard electronic control unit
	with the coil types E3, E4, E3A, E4A, E8, E9, E12A and E13A
	connector plug according to EN 175301-803-A
	without rectifier, for valve version without an onboard electronic control unit and valve with coil type E1 or E2

	Connector
E1	only for version without on board electronic „EK“
E2	with terminal for the connector, EN 175301-803-A
E3A	E1 with quenching diode
E4A	with AMP-Junior-Timer-connector - Axial direction
E8	E3A with quenching diode
E9	loose conductors (two insulated wires)
E12A	E8 with quenching diode
E13A	with Deutsch DT04-2P
	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 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 8.9 Nm (6.56 lbf.ft)
- Besides the shown, commonly used valve versions other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

### Spool Symbols

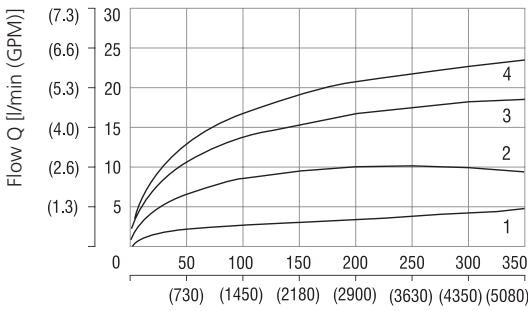
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11		3Z12	$\frac{q_A}{q_B} = \frac{1}{2}$
2Y51		3Y11	
2Y11		3Y12	$\frac{q_A}{q_B} = \frac{1}{2}$

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

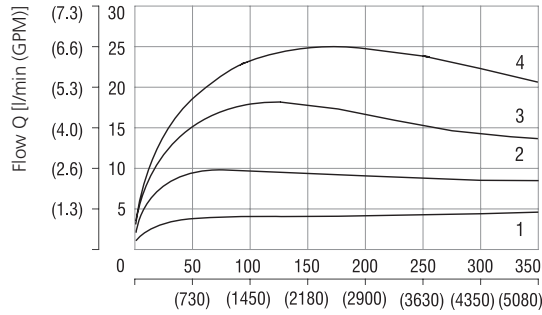
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$

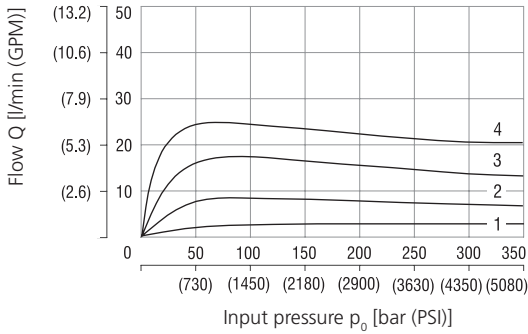
Nominal flow 5 l/min (1.3 GPM)



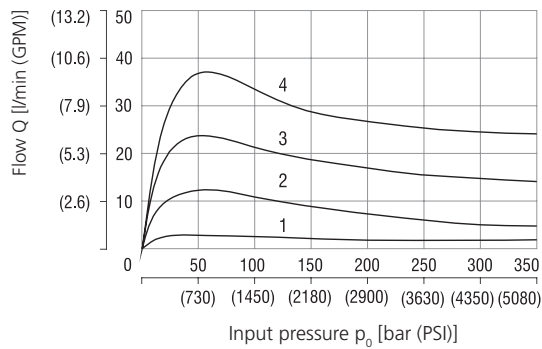
Nominal flow 8 l/min (2.1 GPM)



Nominal flow 15 l/min (4.0 GPM)



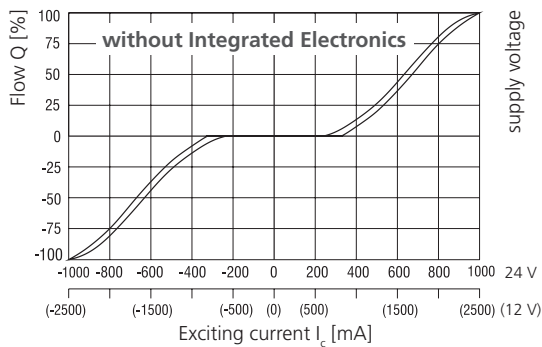
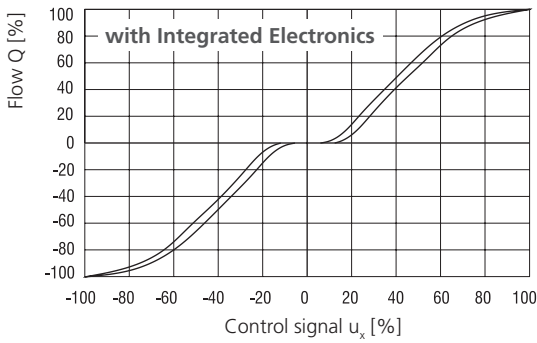
Nominal flow 30 l/min (7.9 GPM)



**Solenoid current:**  
 1 = 40 %  
 2 = 60 %  
 3 = 80 %  
 4 = 100 %

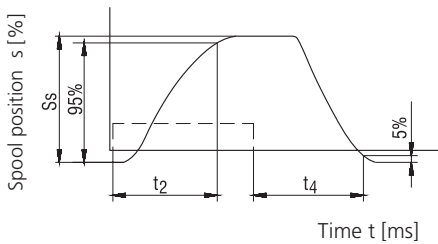
**Regulated flow related to control signal**

$\Delta p = 10 \text{ bar}$  (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)

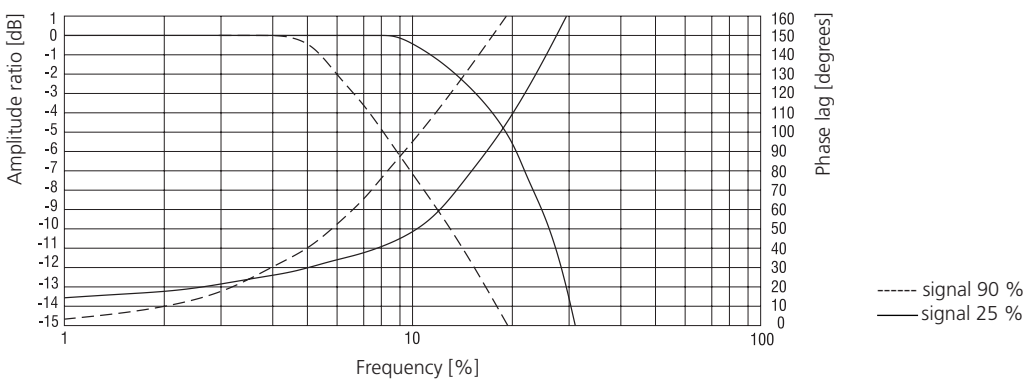


Steady Spool Position $S_s$ [%]	$t_2$ [ms]	$t_4$ [ms]
100	85	100
75	70	85
50	55	75
25	45	55

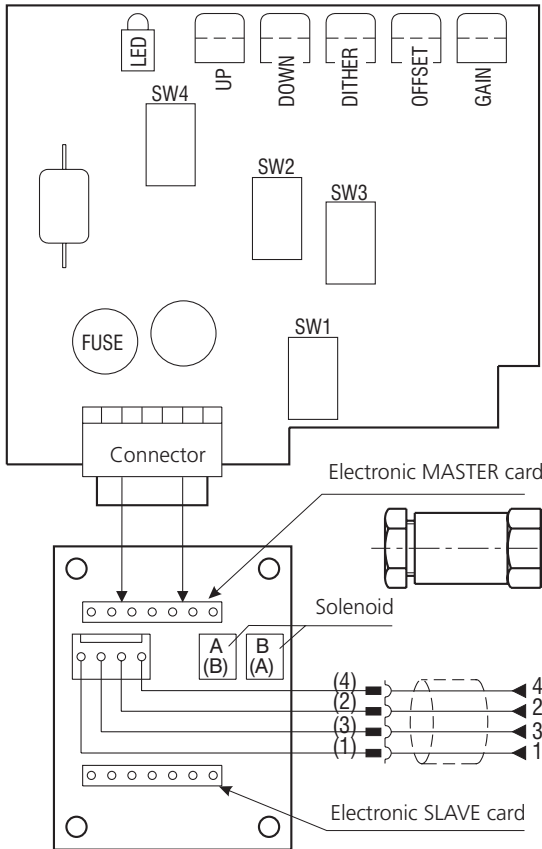
The values in table have only an informative character. The times of the transient characteristics at pressure or flow control will be in a particular hydraulic circuit always longer.

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

**Frequency Response**

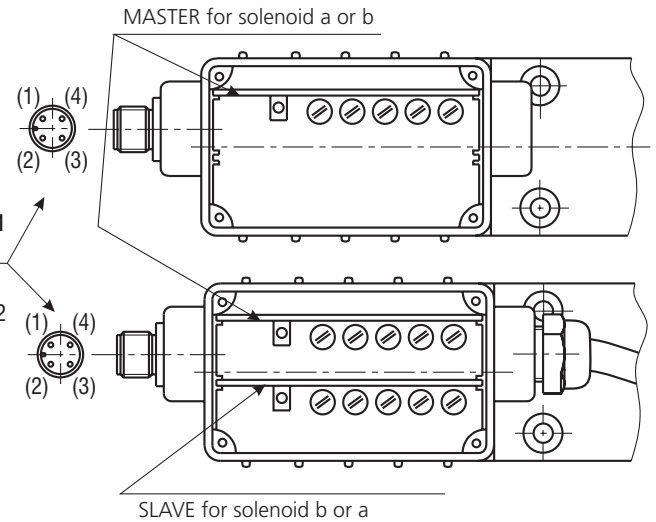


### Component Arrangement on the Electronic Card



PIN	Description	Wire Colors, 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.

### Table of the Switch Configuration for the Control Signal Choices

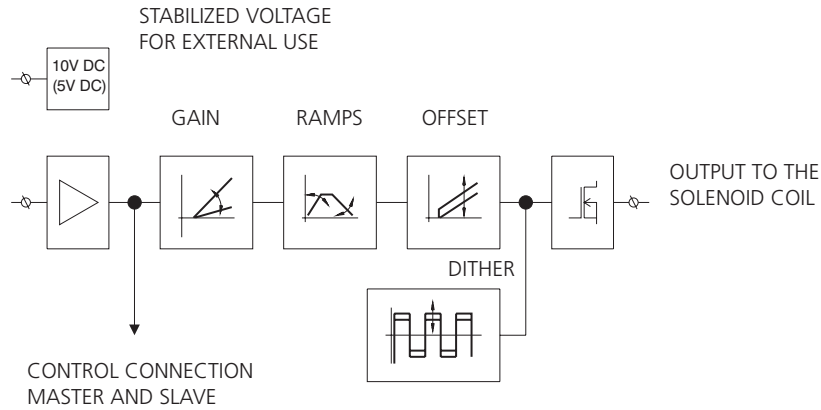
		PRM2-062				PRM2-063	
		0 ... 5 V	0 ... 10 V (0...5 V)*	0 ... 20 mA	4 ... 20 mA	Ucc/2 ± 10 V (± 5 V)*	± 10 V (± 5 V)*
MASTER M	SW1						
	SW2						
	SW3						
	SW4	90 Hz			60 Hz		
SLAVE S	SW1						
	SW2						
	SW3						
	SW4					90 Hz	60 Hz

Designation of the basic manufacture setting.

The ramp functions are adjusted to 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 to change these adjusted values.

\* Input signal level for the 12 V electronic unit.

**Block Diagram**

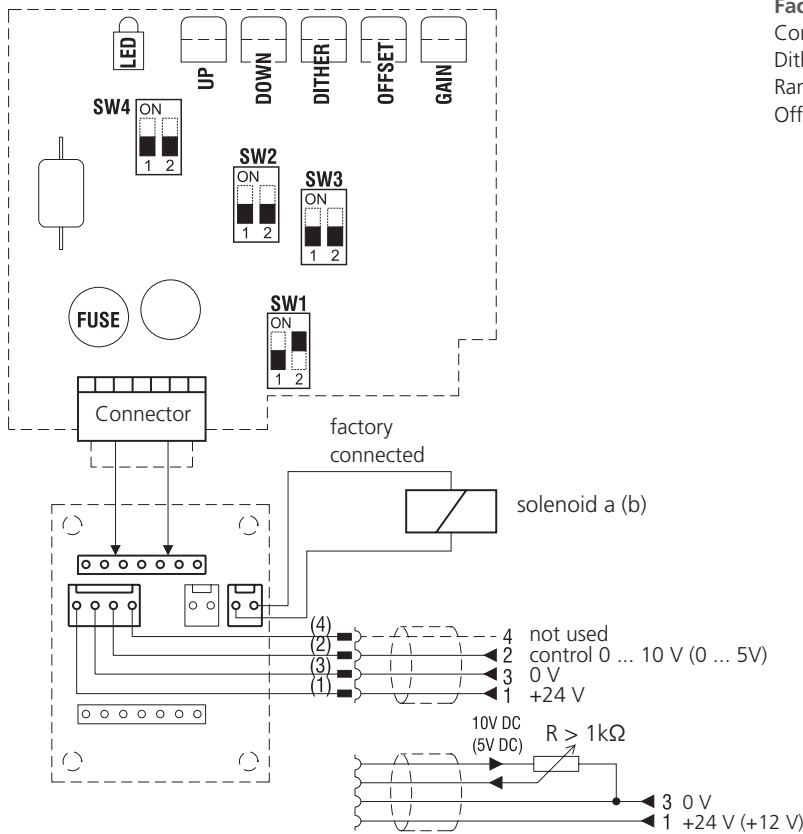


**Setting of Control Electronics**

**Valve PRM2-062\*EK (with one solenoid)**

Control with external voltage source 0...10 V, 0 ... 5 V (factory setting) or with external potentiometer R>1 kΩ

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

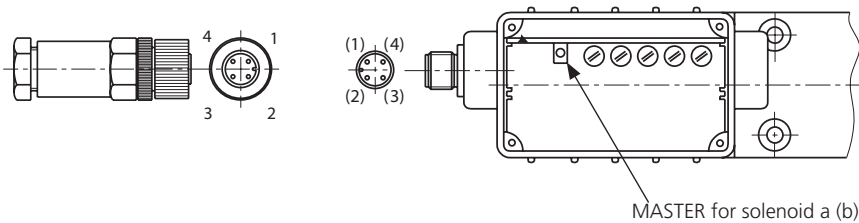


**Factory set values:**

- 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 colors**

**(connection connector - electronics)**

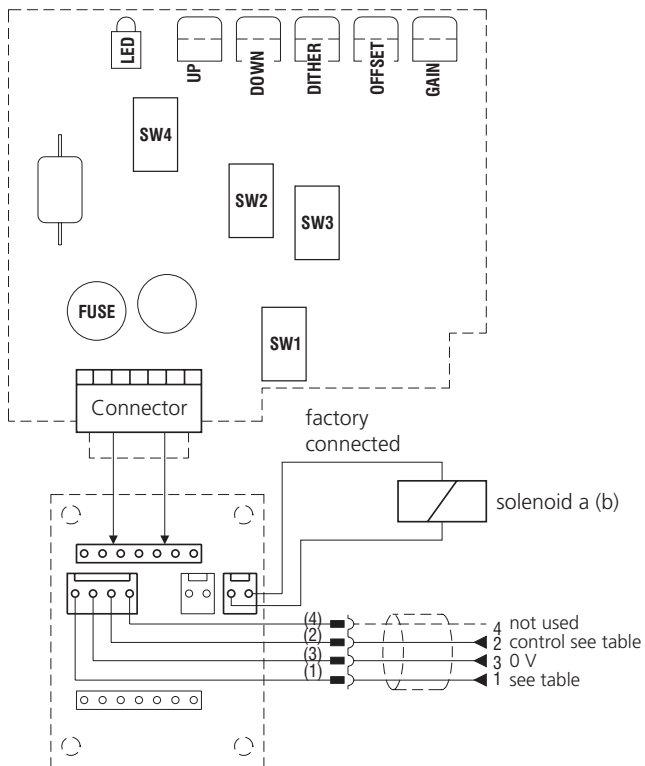
- (1) - brown
- (2) - white
- (3) - blue
- (4) - black

## Setting of Control Electronics

### Valve PRM2-062\*EK (with one solenoid)

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

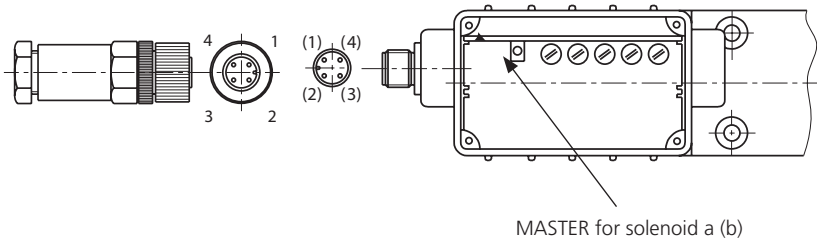
#### Master card for solenoid a (b)



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

Follow the subsequent steps to modify the factory settings:

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 colors  
(connection connector - electronics)**

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



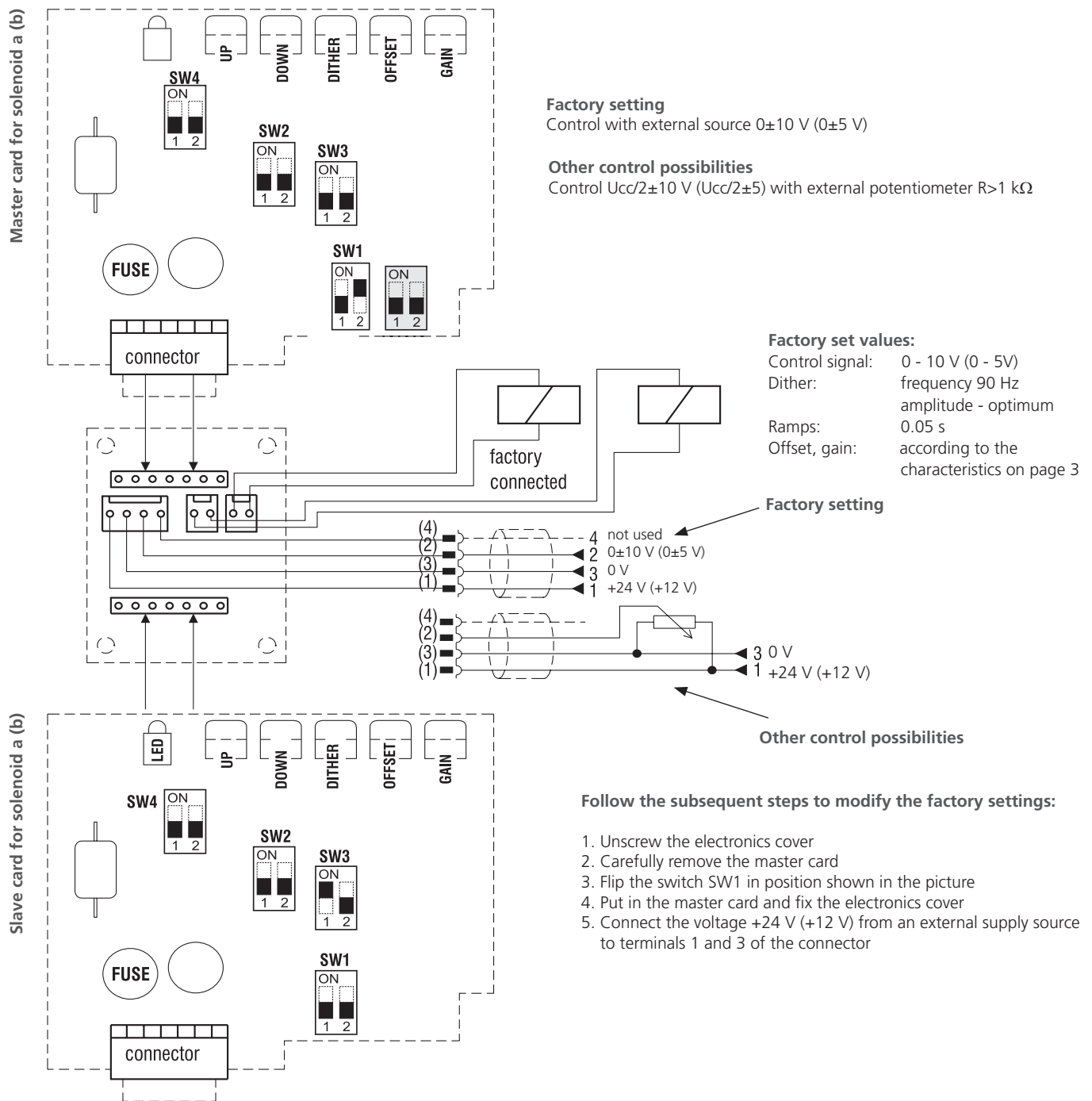
The control signal must have the same ground potential as the supply source.



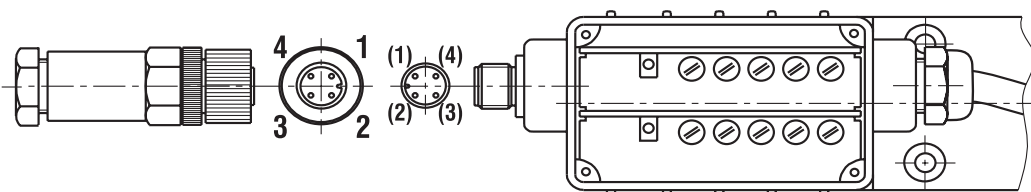
Designation of the basic factory setting.  
 The ramp functions are adjusted on their minimum values.  
 The dither is set to the optimal value with respect to hysteresis.  
 Offset and gain are adjusted according to the characteristic on page 1 and 2.  
 The manufacturer does not recommend to change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

Setting of control electronics

Valve PRM2-063\*EK (with two solenoids), factory setting, other control possibilities

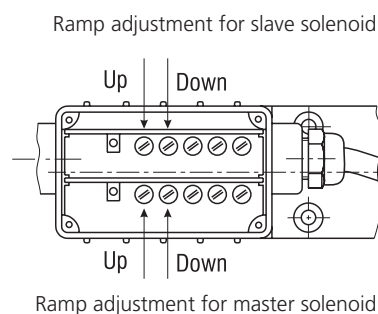
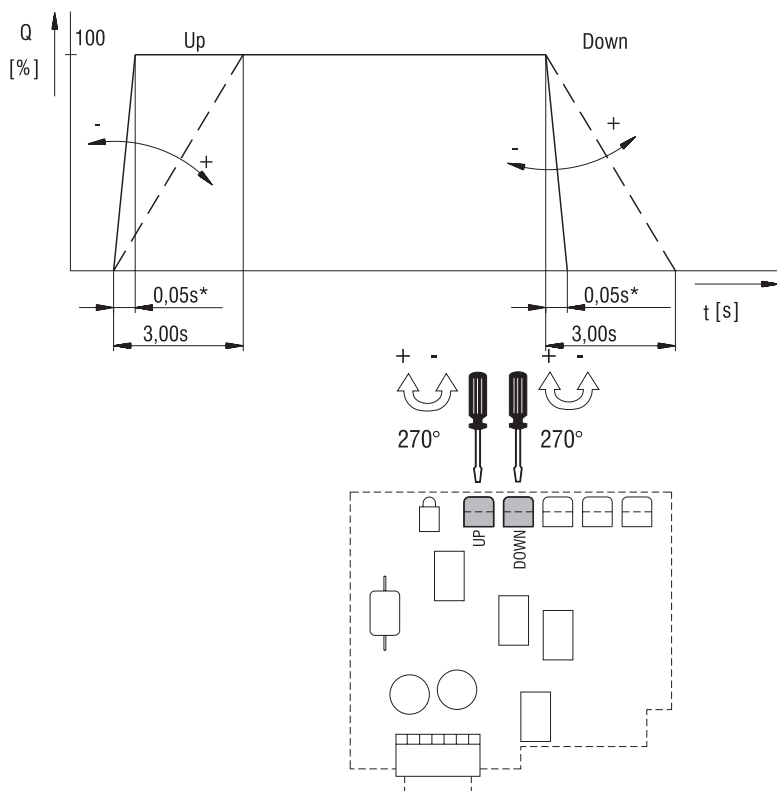


The control signal must have the same ground potential as the supply source.





**Ramp Adjustment (Up, Down)**



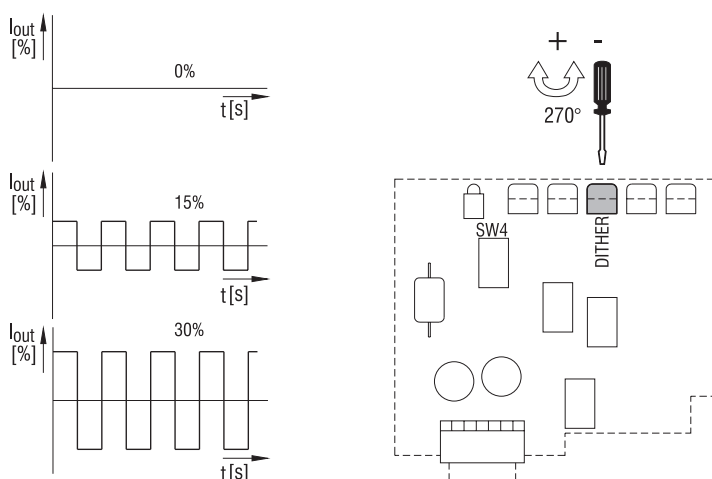
\* The value has only an informative character with respect to the particular type of the proportional directional valve (see page 3).



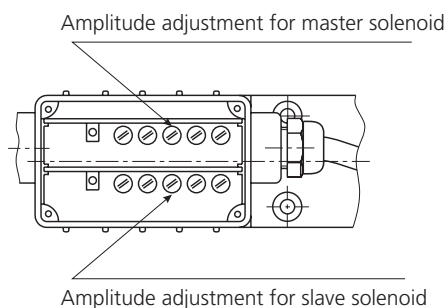
The factory setting of the ramp is at the minimum value.

**Dither Adjustment**

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

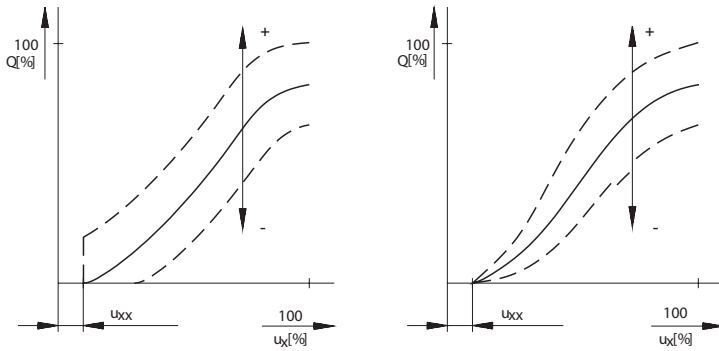


**Frequency - switch SW4**



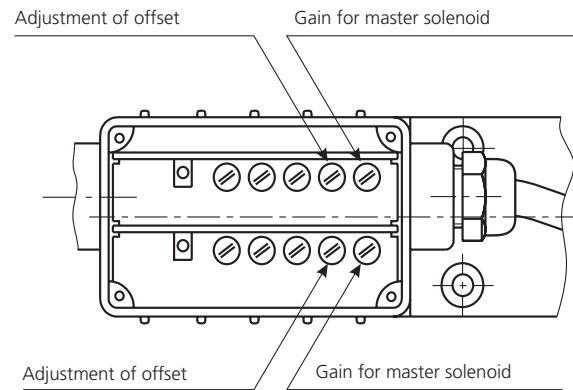
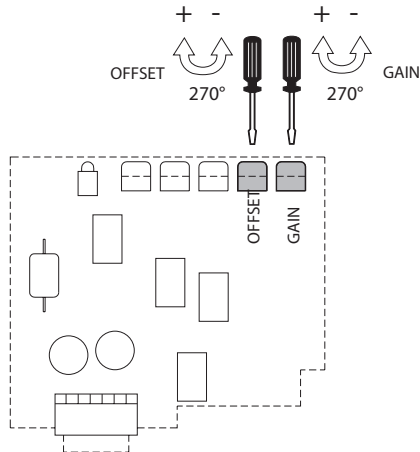
The dither is adjusted to minimize hysteresis.

## Offset, Gain Parameters Adjustment



The factory setting of the offset and gain parameters is specific for the solenoids used. The manufacturer does not recommend to change these settings.

Nominal Electronics Supply Voltage (V)	Area Insensitive to Control Signal $u_{xx}$ (%)
12	1 ... 3
24	0.5 ... 2



## Solenoid Coil in millimeters (inches)

E1, E2 Protection Degree IP65	E3A, E4A Protection Degree IP67	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)

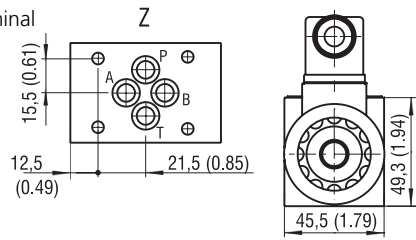
No Designation - Standard	Designation N1 - Cap Nut Covered	Designation N2 - Rubber Boot Protected

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.

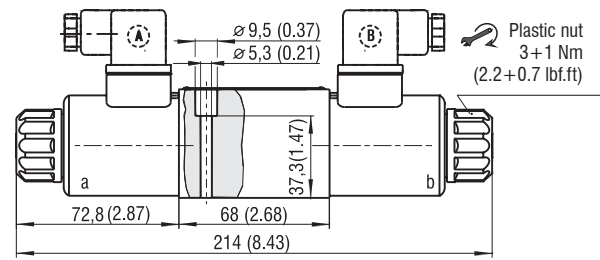
Dimensions in millimeters (inches)

**PRM2-063.../...E1**

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

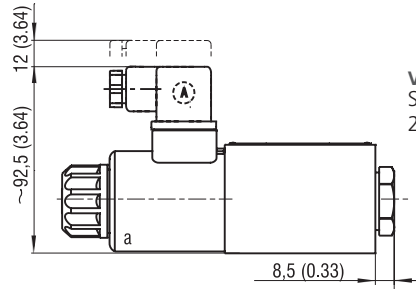


Spool symbols  
3Z11, 3Z12, 3Y11, 3Y12

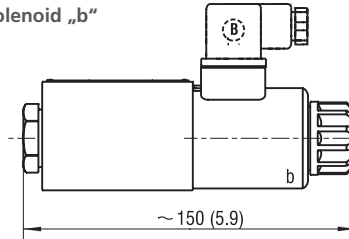


**PRM2-062.../...E1**

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

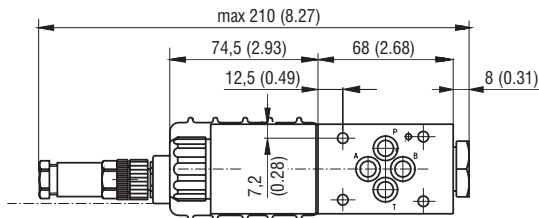


Valve with one solenoid „b”  
Spool symbols  
2Z11, 2Y11



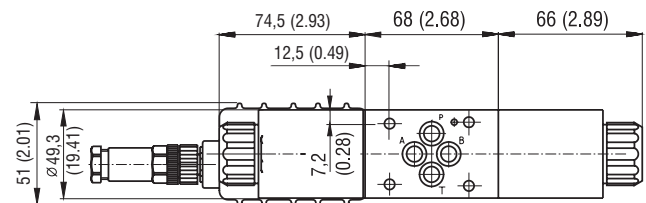
**PRM2-063x/xEK\***

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



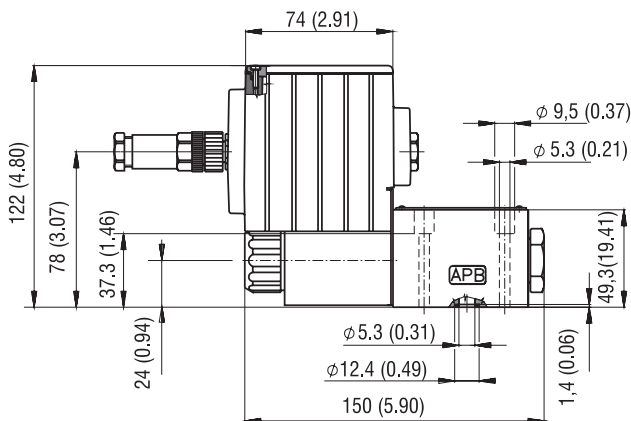
**PRM2-063x/xEK\***

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



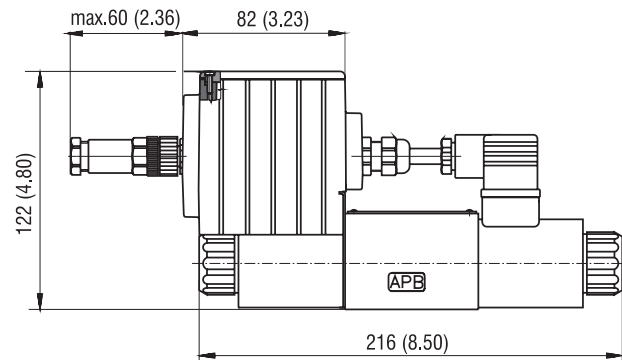
**Valve with one solenoid „a”**

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



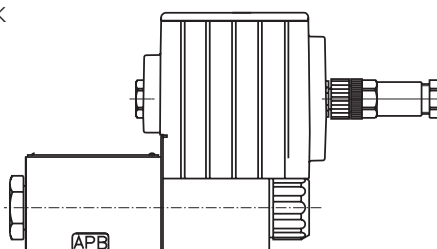
**Valve with two solenoids**

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



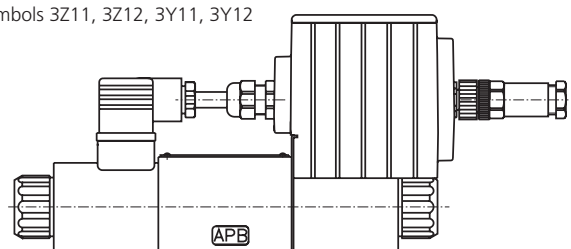
**Valve with one solenoid „b”**

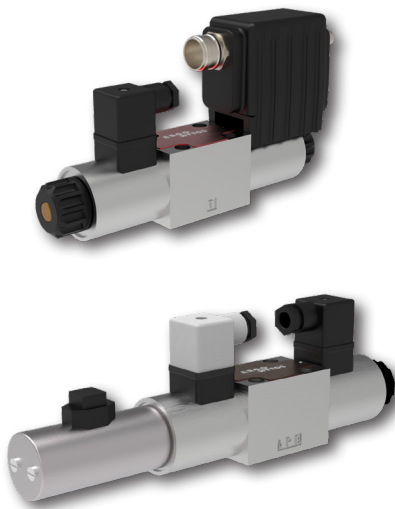
Spool symbols 2Z11, 2Y11  
OBE on side “b” version EK



**Valve with two solenoids**

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




**Technical Features**

- › Proportional control valve controlled by integrated digital electronics with the external feedback or proportional control valve controlled by external digital electronics with a spool position sensor
- › Control valve with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 03) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › Digital converter card allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the performance of the valve
- › Various models with or without onboard digital converter card or position sensor feedback available
- › Used for directional and speed control of hydraulic actuators
- › Wide range of interchangeable spools available
- › For versions without integrated digital electronic unit wide range of solenoid electrical terminal versions available
- › The driver directly manages digital settings. It's possible to customize the settings for special applications using the optional kit
- › In the standard version, the valve housing is phosphated and steel parts zinc-coated for 240 h protection acc. to ISO 9227
- › Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray)

**Functional Description**

The **PRM7-06** proportional directional control valve is designed for the smooth control of the volumetric flow rate, i.e. the movement speed of the piston rod of a hydraulic cylinder or the speed of the output shaft of a rotary hydraulic motor. A valve with two control solenoids also controls the direction of the flow of the working fluid and thus the direction of the output member of the consumer.

The hydraulic part of the valve consists of a cast iron body with subplate mounting in accordance to ISO 4401 on the bottom surface, a spool with shaped control edges and spool centering springs. Spool movement is assured by control solenoids, proportionally controlled via a signal from integrated or external digital electronic control unit (ECU). The valve can operate in an open control loop (without feedback signal) or a closed control loop via an internal or external feedback signal. Internal feedback is assured by a spool position sensor, which operates on the principle of a Linear Variable Differential Transformer (LVDT), the core of which is mechanically connected to the valve spool. External feedback is provided by a sensor connected to the hydraulic circuit which reads the actual value of the controlled parameter.

**Design without integrated electronic control unit (ECU)**

In this design, the valve is offered with a LVDT spool position sensor with a voltage (type **S01**) or a current (type **S02**) output. The valve is controlled by external ECU. It is possible to select the connector types (E1, E2) for electrical connection of control solenoids. The sensor is connected using a G4W1F connector. Connector plugs are included.

**Design with integrated electronic control unit (ECU)**

This valve is designed to be operated in an open loop without feedback (type E01) or in a closed loop using a feedback signal from an external sensor (type E02).

The plastic housing with the ECU is mounted on one of the control solenoids, the other solenoid is connected to the ECU by a cable ending with an EN 175301-803 connector plug. Communication with the external sensor is achieved via a five-pin connector which also enables supply voltages of +24 V, +10 V or -5 V. The solenoid coils including the integrated ECU can be rotated by  $\pm 90^\circ$ .

**Integrated electronic control unit (ECU)**

The ECU utilizes pulse width modulation (PWM) of the control signal to the solenoid coils, reducing loss and heating the coil as well as increasing control precision. The resulting current entering the coils is proportional to that of the control signal. Additionally, the coil input current can be modulated by a dither signal. This signal causes permanent vibration of the armature and spool, thus greatly reducing the effects of adhesive forces and reducing valve hysteresis. Basic valve parameters are set through software and by means of a special programmer, or by computer via a RS 232 interface. The PC connection set must be ordered separately as described on page 4. Correct function of the ECU is indicated by a green LED, Incorrect function is indicated by a red LED.

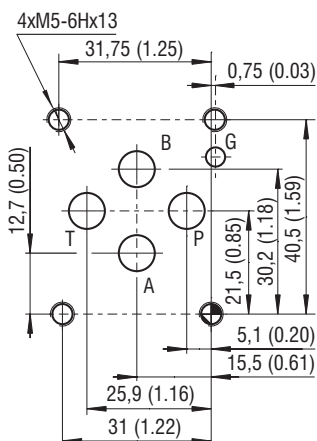
In the basic version, the valve is supplied with factory settings. Consult the manufacturer for external feedback.

**Note:**

The **PRM9-06** proportional directional control valve, equipped with integrated electronic control unit and spool position sensor (LVDT), enables closed loop control using a combination of internal and external feedback. The valve can also be connected to the CAN-Bus. (see catalogue HC 5129).

## Technical Data

ISO 4401-03-02-0-05



Ports P, A, B, T - max Ø7.5 mm (0.29 in)

Valve Size		06 (D03)
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5100)
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 max.	°C (°F)	-30 ... +50 (-22 ... +122)
Nominal flow Q <sub>N</sub> at Δp=10 bar (145 PSI)	l/min (GPM)	5 (1.3), 8 (2.1), 15 (4.0), 30 (7.9)
Hysteresis	%	< 6
Hysteresis - closed position loop	%	< 0.5
Protection degree EN 60529		IP 65
Weight - valve with 1 solenoid	kg (lbs)	2.3 (5.1)
- valve with 2 solenoids		2.8 (6.2)
	Data Sheet	Type
General information	GL_0060	Products and operating conditions
Coil types / Connectors	C_8007 / K_8008	C22A* / K*
Mounting interface	SMT_0019	Size 06
Spare parts	SP_8010	
Subplates	DP_0002	DP*-06

## Ordering Code

PRM7-06 / - - - - K1 - - - -

**Proportional Directional Control Valve Controlled by** (internal or external) **Digital Electronics**

**Valve size**

**Spool symbols**

see the table „Spool symbols“

**Nominal flow rate at Δp = 10 bar (145 PSI)**

flow 5 l/min (1.3 GPM)	<b>05</b>
flow 8 l/min (2.1 GPM)	<b>08</b>
flow 15 l/min (4.0 GPM)	<b>15</b>
flow 30 l/min (7.9 GPM)	<b>30</b>

**Nominal solenoid supply voltage**

12 V DC	<b>12</b>
24 V DC	<b>24</b>

**Model with integrated electronic**

proportional directional valve without feedback **E01**  
 proportional directional valve with external feedback **E03**

**Model without integrated electronic** no designation

**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)

**Installation side of electronic unit and position sensor**  
**No designation** of port A (case with two solenoids)

**Model without integrated electronic**  
**S01** position sensor with voltage outlet  
**S02** position sensor with current outlet

**Connector according to EN 175301-803-A**  
 without rectifier

**Connector for models without integrated electronic**  
 EN 175301-803-A  
**E1** with quenching diode  
**E2**

- 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 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 8.9+1 Nm (6.56+0.7 lbf.ft)
- Besides the shown, commonly used valve versions other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

## Spool Symbols

Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11		3Z12	 $\frac{q_A}{q_B} = \frac{1}{2}$
2Y51		3Y11	
2Y11		3Y12	 $\frac{q_A}{q_B} = \frac{1}{2}$

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

### Technical Data of Position Sensor - Voltage Outlet

Operating pressure	bar (PSI)	to 350 (5100), static
Electrical connection for S01 model		electrical connector G4W1F Hirschmann
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP 65
Measured distance	mm (in)	8 (0.315)
Operating voltage	V	9.6 ... 30 DC
Linearity error	%	< 1
Current consumption at load current of 2 mA	mA	< 15
Output voltage	V	0 ... 5
Output signal range used: 0 position 1 solenoid - stroke 2.8 mm (0.11 in) 2 solenoids - stroke $\pm 2.8$ mm (0.11 in)	V	2.5 0.75 ... 2.5 0.75 ... 4.025
Max. load current	mA	2
Noise voltage - at load current 0 - at load current of 2 mA	mV <sub>p-p</sub>	< 20 < 15
Additional output signal error at: - temperature change between 0 ... 80°C (32... 176 °F) - between 0 ... -25 °C (32 ... -13 °F) - Load change from 0 to 2 mA		typical 0.2 % / 10K max. 0.5 % / 10K max. 0.5 % / 10K 0.1 %
Input voltage change from 9.6 V to 14.4 V from 14.4 V to 30 V	%	< 0.1 < 0.25
Long-term drift (30 days)	%	< 0.25
Cut-off frequency 3dB fall in amplitude Frequency 90°	Hz	> 600 > 600

### Technical Data of Position Sensor - Current Outlet

Linearity	%	< 1
Operating pressure	bar (PSI)	to 350 (5100), static
Electrical connection for S02 model		electrical connector G4W1F Hirschmann
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP 65
Operatin voltage	V	20 ... 30 DC
Current	mA	< 35
Output signal range	mA	4 ... 20
Output signal range used: 0 position 1 solenoid - stroke 2.8 mm (0.11 in) 2 solenoids - stroke $\pm 2.8$ mm (0.11 in)	mA	12 4.4 ... 12 4.4 ... 19.6
Additional output signal error: - at temperature change from +10 ... 55 °C (50... 131 °F) - at impedance change from 50 % - at input voltage change in the operating voltage range		0.2% / 10K $\leq 0.1$ % $\leq 0.05$ %
Impedance	$\Omega$	$\leq 500$
Output signal ripple	mA R.M.S.	$\leq 0.02$
Limit frequency at 3 dB amplitude decrease	Hz	$\geq 800$

### Technical Data of Proportional Solenoid

Type of coil	V	12 DC	24 DC
Limiting current	A	2.4	1.0
Resistance at 20 °C (68 °F)	$\Omega$	2.3	13.4

### Electronics Data

Supply voltage with polarity inversion protection	V	11.2 ... 28 VDC (residual ripple < 10 %)
Input: command signal / according to customer setting		$\pm 10$ V, 0...10 V, $\pm 10$ mA, 4...20 mA, 0...20 mA, 12 mA $\pm 8$ mA
Input: spool position sensor signal		0...5 V
Input: external feedback signal		0...10V, 4...20 mA, 0...20 mA
Resolution of the A/D converter		12 bit
Output: solenoids		two PWM output stages up to max. 3.5 A
PWM frequency	kHz	18
Adjustment of parameters	$\mu$ S	170
EMC	Interference resistance	61000 - 6 - 2 : 2005
	Radiation resistance	55011 : 1998 class A
Parameter setting	Serial port RS 232 (zero modem). 19200 bauds, 8 data bits, 1 stop bit, no parity. Special software PRM7 Conf.	

## Accessories

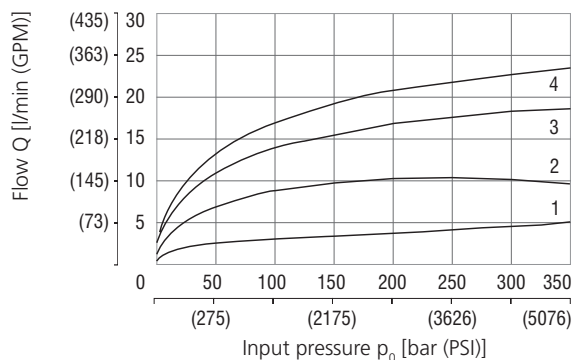
Order number	Content
23093400	Connecting cable to PC - length 2 m (6.56 ft), CD-ROM with program PRM7 Conf and user manual
23093500	Connecting cable to PC - length 5 m (16.40 ft), CD-ROM with program PRM7 Conf and user manual
24523400	Connecting cable to PC - length size 2 m (6.56 ft)
24523500	Connecting cable to PC - length size 5 m (16.40 ft)

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

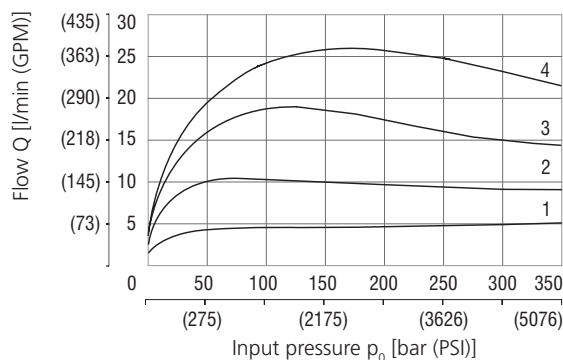
**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$

**Operating limits (E01 model only)**

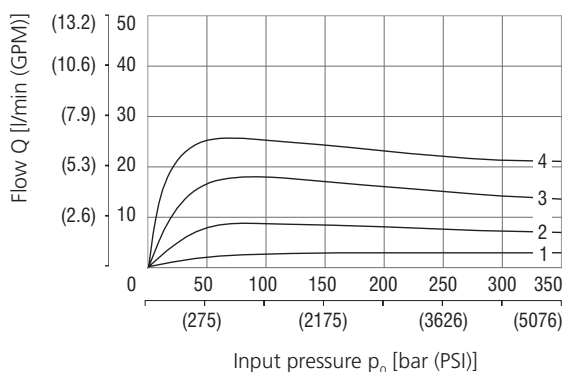
Nominal flow 5 l/min (1.3 GPM)



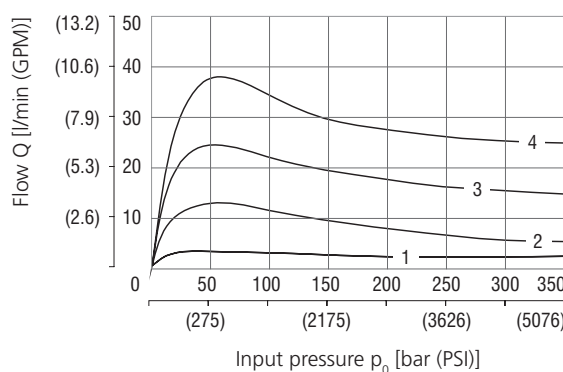
Nominal flow 8 l/min (2.1 GPM)



Nominal flow 15 l/min (4.0 GPM)



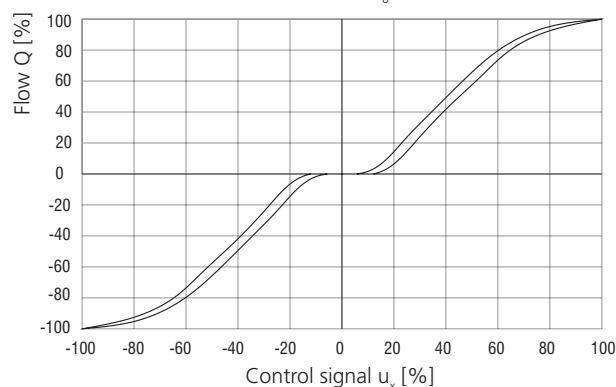
Nominal flow 30 l/min (7.9 GPM)



**Solenoid current:**  
 1 = 40 %  
 2 = 60 %  
 3 = 80 %  
 4 = 100 %

### Regulated flow related to control signal

Flow characteristics (E01 model only)  $\Delta p = 10 \text{ bar}$  (145 PSI)

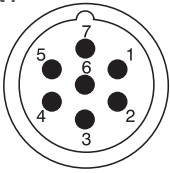


## Factory Settings

Item / Model	E01	E03
	1 Magnet	2 Magnets
Control signal	0 ... 10 V	0 ... 10 V
Signal external feedback	-	± 10 V
Output position sensor spool	-	-

## Connectors

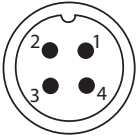
### KN1



Connector KN1 - type M23 (male)	
PIN	Technical data
1	*Power supply input
2	*Ground (power supply)
3	Control signal
4	Ground (signal)
5	Power reference signal
6	Control signal of position sensor spool
7	*Protective earth lead (PE)

\*Recommended min. lead cross section 0.75 mm<sup>2</sup>

### KN2



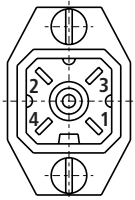
Connector KN2 - type M12x1 (male)	
PIN	Technical data
1	TxD
2	RxD
3	Ground (signal)
4	Not used

### KN3



Connector KN3 - type M12x1 (female)	
PIN	Technical data
1	Power supply output
2	Signal of external feedback
3	Ground
4	Not used
5	Not used

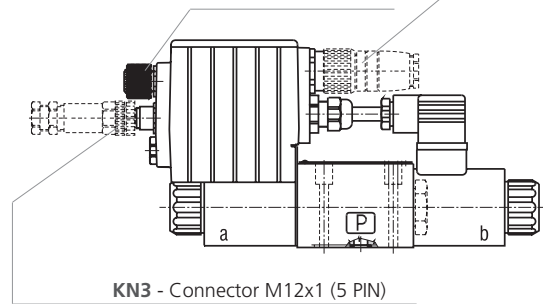
### KN4



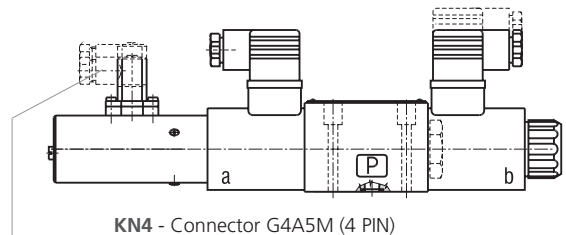
Connector KN4 - type G4A5M (male)	
PIN	Technical data
1	Power supply input
2	Power supply output
3	Ground
4	Not used

**KN1** - Main input connector M23 (7 PIN)  
Cable diameter 8 ...12 mm (0.31...0.47 in)

**KN2** - Connection RS232 M12x1 (4 PIN)  
to program the electronics



**KN3** - Connector M12x1 (5 PIN)  
Signal of external feedback  
(for configurations E03)



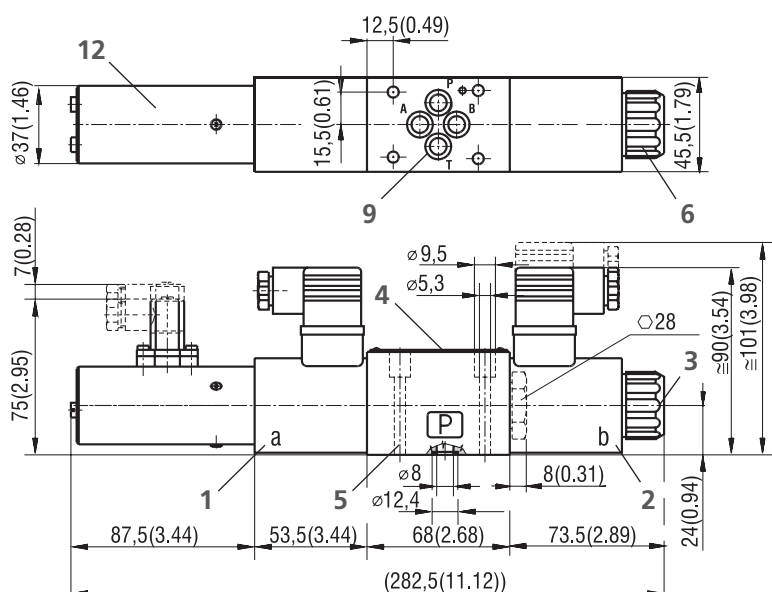
**KN4** - Connector G4A5M (4 PIN)  
Internal feedback - spool position signal  
for valve without ECU



**Dimensions** in millimeters (inches)

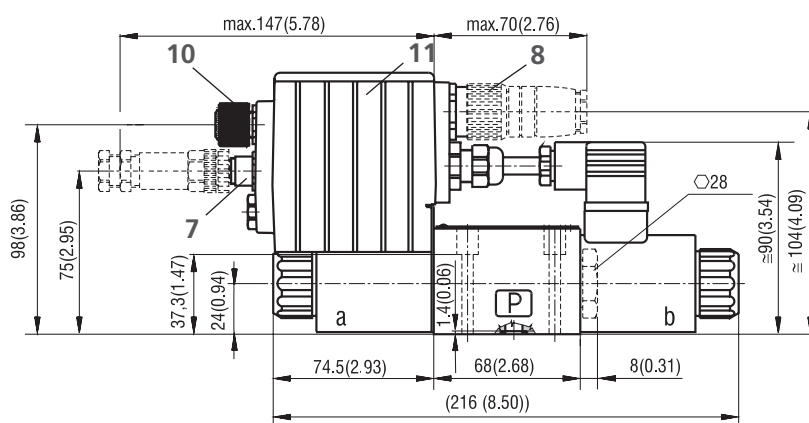
PRM7-063 ... S01

PRM7-063 ... S02



PRM7-063 ... E01 - without connector plug for spool position feedback

PRM7-063 ... E03

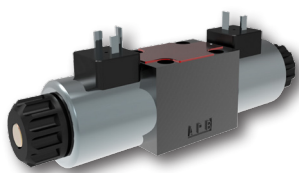


- 1 Solenoid a
- 2 Solenoid b
- 3 Manual override
- 4 Name plate
- 5 4 mounting holes
- 6 Solenoid fixing nut
- 7 Connector M12x1 for connection of external feedback
- 8 Main supply connector M23
- 9 Square ring 7.65 x 1.68 (4 pcs.), supplied in delivery packet
- 10 Cover of connector M12x1 for programming
- 11 Plastic box with integrated electronics
- 12 Position sensor

## Proportional Directional Control Valve, Pilot Operated

# PRM8-06

Size 06 (D03) •  $Q_{max}$  140 l/min (37 GPM) •  $p_{max}$  350 bar (5100 PSI)



### Technical Features

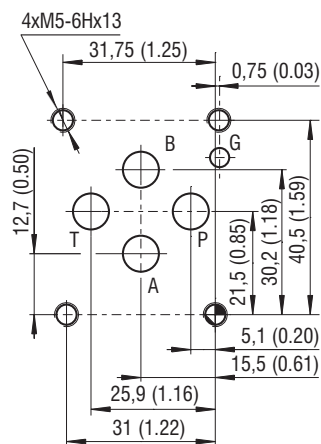
- › Pilot operated proportional control valve with exceptional hydraulic power limits
- › Subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 03) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › The valve can be controlled directly by a current control supply unit or by an electronic control unit to exploit the valve performance to the fullest
- › Analog converter card EL3E allows fine position control of the valve spool, reducing hysteresis and response time and optimizing the performance of the valve
- › Five chamber housing design with reduced hydraulic power dependence on fluid viscosity
- › Wide range of electrical terminal versions for the solenoids 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

The pilot operated main spool valve follows the control spool position, which is given by the control current to the solenoid. The solenoids are supplied from an external source, which should be provided with a current feedback. In order to achieve optimum operating parameters the external electronics should be able to generate a dither signal. The proportional valve can be used within the whole range of input pressure where the required continuity of the flow rate characteristics and minimum hysteresis is achieved.

The selected concept increases the achieved output parameters of the proportional valve in comparison to direct controlled proportional valve. 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.

### ISO 4401-03-02-0-05



Ports P, A, B, T - max.  $\varnothing$ 7.5 mm (0.29 in)

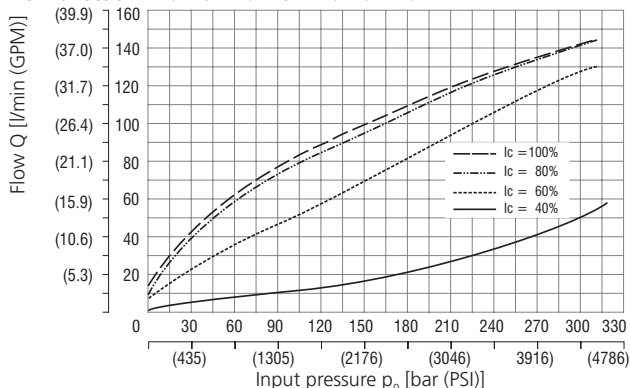
### Technical Data

Valve size		06 (D03)	
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5080)	
Maximal flow at pressure 320 bar (4640 PSI)	l/min (GPM)	140 (37)	
Maximum operating pressure at port T	bar (PSI)	210 (3050)	
Fluid temperature range (NBR / (FPM))	°C (°F)	-30 .. +80 (-22 ... +176) / -20 .. +80 (-4 .. +176)	
Ambient temperature max.	°C (°F)	-30 ... +50 (-22 ... +122)	
Nominal flow rate $Q_n$ at $\Delta p=10$ bar (145 PSI)	l/min (GPM)	25 (6.6)	
Hysteresis	%	< 6	
Mass	kg (lbs)	2.4 (5.3)	
Technical data of the proportional solenoid			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	2.5	1.0
Mean resistance value at 20 °C (68 °F)	$\Omega$	2.3	13.4
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types / Connectors	C_8007	C22B* / K*	
Mounting interface	SMT_0019	Size 06	
Spare parts	SP_8010		

### Characteristics measured at $v = 32$ mm<sup>2</sup>/s (156 SUS)

#### Operating limits:

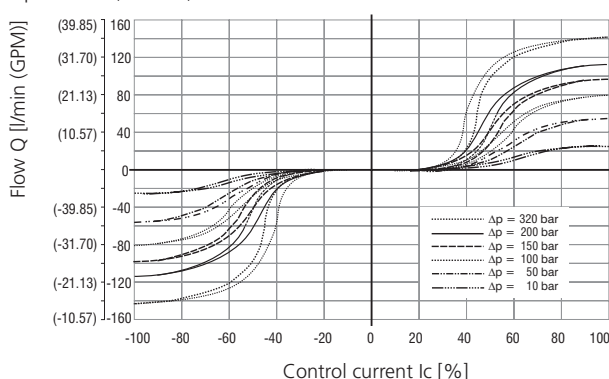
Flow direction P → A / B → T or P → B / A → T



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

#### Regulated flow related to control signal

$\Delta p=10$  bar (145 PSI)



## Ordering Code

<p><b>Proportional directional control valve</b></p> <p><b>Valve size</b></p> <p><b>Spool symbols</b></p> <p><b>Nominal flow rate at Δp = 10 bar (145 PSI)</b> 25 l/min (6.6 GPM)</p> <p><b>Rated supply voltage of solenoids (at the coil terminal)</b> 12 V DC 24 V DC</p>	<p>PRM8-06</p> <p>3Z11</p> <p>3Y11</p> <p>2Z11</p> <p>25</p> <p>12</p> <p>24</p>	<p>No designation</p> <p>No designation</p> <p>No designation</p> <p>E1</p> <p>E2</p> <p>E3A</p> <p>E4A</p> <p>E8</p> <p>E9</p> <p>E12A</p> <p>E13A</p>	<p>Surface treatment standard</p> <p>A zinc-coated (ZnCr-3), ISO 9227 (240 h)</p> <p>B zinc-coated (ZnNi), ISO 9227 (520 h)</p> <p>Clamping length for mounting screw 22mm (0.86 in)</p> <p>Seals NBR</p> <p>V FPM (Viton)</p> <p>Manual override standard</p> <p>N1 protected with retaining nut</p> <p>N2 protected with rubber boot</p> <p>Connector EN 175301-803-A</p> <p>E1 with quenching diode</p> <p>AMP Junior Timer - axial direction (2 pins; male)</p> <p>E3A with quenching diode</p> <p>Loose conductors (two insulated wires)</p> <p>E8 with quenching diode</p> <p>Deutsch DT04-2P - axial direction (2 pins; male)</p> <p>E12A with quenching diode</p>
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- For proportional valves with two solenoids, one solenoid must be de-energized before the other solenoid can be charged.
- The solenoid operated valves are delivered without connectors. For available connectors see data sheet K\_8008.
- Electronics for controlling proportional valves can be ordered separately, see catalog HA 9150.
- Mounting bolts M5 x 30 ISO 4762 or studs must be ordered separately. Tightening torque is 8.9 Nm (6.56 lbf.ft)
- Besides the shown widely used valve versions other special models are available. Contact our technical support for their identification, feasibility and operating limits.

### Solenoid Coil in millimeters (inches)

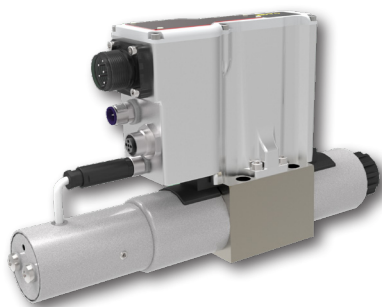
E1, E2 Protection degree IP65	E3A, E4A Protection degree IP67	E8, E9 Protection degree IP65	E12A, E13A Protection degree IP67 / 69K	
				The indicated IP protection level is only achieved if the connector is properly mounted.

### Manual Override in millimeters (inches)

No Designation - Standard	Designation N1 - Cap Nut Covered	Designation N2 - Rubber Boot Protected	
			In case of solenoid malfunction or power failure, the spool of valve can be shifted with a manual override under condition that the P channel is pressurized. The main spool is operated hydraulically after shifting the control spool with the manual override. The pressure in T port does not exceed 25 bar (363 PSI). For alternative manual overrides contact our technical support.

### Dimensions in millimeters (inches)

<p><b>Z</b></p>	<p><b>with one solenoid "b" *</b> - Spool symbols 2Z11</p>	<p><b>with two solenoids* - Spool symbols 3Z11, 3Y11</b></p> <p>Plastic nut 3 + 1 Nm (2.2 + 0.7 lbf.ft)</p>
<p>* Example with electrical terminal EN 175301-803-A (E1, E2)</p>		
<p><b>!</b> Proper function of the valve is guaranteed only if the supply pressure in the "P" channel is present and exceeds always the pressure in the "T" channel.</p>		



### Technical Features

- › Direct acting proportional control valve with integrated digital onboard electronics (OBE), proportional control, spool and process feedback
- › Control valve with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 03) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › Digital electronics allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the performance of the valve
- › Used for e.g. position and speed control of hydraulic actuators
- › Wide range of interchangeable spools available
- › The settings of electronics can individually be adjusted by a parametrization software
- › Easy to connect via USB ↔ Micro-USB ports
- › Optical feedback of valve status through three LEDs
- › The valve is zinc-coated with the enhanced surface corrosion protection 520 h in NSS acc. to ISO 9227
- › High hydraulic power limits and smooth running characteristic
- › Improved shock and vibration behavior
- › CANopen connectivity

### Functional Description

The proportional directional control valve PRM9 consists of a cast iron housing, a special control spool, two centering springs with supporting washers, one or two proportional solenoids, a position sensor and a digital onboard electronic. The measurement system of the position sensor is based on a differential transformer with a sensor core and its electronic evaluation unit.

The unit, containing the digital onboard electronics, is mounted on the valve housing. Due to this, the solenoids are able to be connected directly to the electronics without any cabling at all. The connection of the position sensor to the control unit is provided by a cable.

For main contacting of the digital electronics, the MIL-C5015 (6 + PE) connector is available for connecting the supply, the setpoint signal and monitor signal of the internal piston position. Other connection possibilities are directly related to the selected valve variant. These are, in detail, M12x1, 5-pin, for the bus connection in the standard version CANopen and also M12x1, 5-pin, for connecting an external sensor (of an external process variable).

The digital control unit utilizes pulse-width-modulation (PWM) and supplies the solenoids with current, proportionally to the control signal. The supply current is additionally modulated with a dither frequency and an amplitude.

Further / individual functional parameters like ramp, offset, deadband, max. current, etc. can be adjusted with the PRM9 parametrization software. Therefore, a standard computer can be connected with the valve by USB (USB-A (PC) ↔ μ-USB (valve)).

The factory configuration is set individually for each valve. The configuration data file as well as the parametrization software and the fieldbus data file can be downloaded from the ARGO-HYTOS website.

**The PRM9 is available with following model options:**

#### Models with standard OBE

- E02S02** internal spool position feedback
- E04S02** internal spool position and external feedback

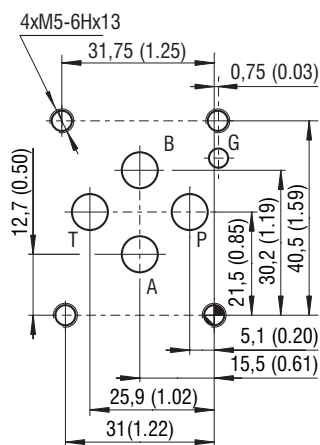
#### Models with OBE and CANopen connectivity

- E02S02-CA** internal spool position feedback, CANopen connectivity
- E04S02-CA** internal spool position and external feedback and CANopen connectivity

All models are equipped with an optical feedback (standard: 2 LEDs; with CANopen: 3 LEDs). The flash code of the LED indicates the current status of the valve (for further details see the operating manual of the valve). As a standard, the proportional valve is delivered with factory setting. For a model including an external feedback (E04), contact the manufacturer for specific data.

## Technical Data

ISO 4401-03-02-0-05



Ports P, A, B, T - max Ø7.5 mm (0.29 in)

Valve size	06 (D03)	
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5100)
Max. operating pressure at port T	bar (PSI)	210 (3046)
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)
Fluid temperature range (FPM)	°C (°F)	-20 ... +80 (-4 ... +176)
Ambient temperature max.	°C (°F)	-40 ... +50 (-40... +122)
Nominal flow rate $Q_n$ at $\Delta p=10$ bar (145 PSI)	l/min (GPM)	5 (1.3), 8 (2.1), 15 (3.9), 30 (7.9)
Hysteresis - closed position loop	%	< 0.5
Protection degree EN 60 529	IP65 & IP67	
Weight - valve with 1 solenoid	kg (lbs)	2.4 (6.4)
- valve with 2 solenoids		
Shock & vibration	Sinus 10 g, max ampl. 0.75 mm, 10-2000 Hz Shock 30 g, half sinus 11ms	
Electromagnetic compatibility (EMC)	DIN EN 61000-4-2 DIN EN 61000-4-3 DIN EN 61000-4-4 DIN EN 61000-4-5 DIN EN 61000-4-6 DIN EN 61000-4-8	
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Coil types / Connectors	C_8007 / K_8008	
Mounting interface	SMT_0019	Size 06
Spare parts	SP_8010	
Subplates	SP_0002	DP*-06

## Ordering Code

PRM9-06



**Proportional Directional Control Valve, with Digital Onboard Electronics and Internal Feedback**

**Valve size**

**Spool symbols**

see the table „Spool Symbols“

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

flow 5 l/min (1.3 GPM)

05

flow 8 l/min (2.1 GPM)

08

flow 15 l/min (4.0 GPM)

15

flow 30 l/min (7.9 GPM)

30

**Nominal solenoid supply voltage**

24V DC

24

**Surface treatment**  
zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**

NBR

FPM (Viton)

**No designation**

V

**Installation side of position transducer**

spool position transducer at side of port „A“

spool position transducer at side of port „B“

Standard installation side of position transducer acc. of Spool Symbols table, other version consult with factory for their feasibility and availability

**Model**

OBE, spool position transducer

**E02502**

OBE, spool position transducer and external feedback

**E04502**

OBE CANopen, spool position transducer

**E02502-CA**

OBE CANopen, spool position transducer and external feedback

**E04502-CA**

- For proportional valves with two solenoids, one solenoid must be de-energized before the other solenoid can be charged.
- Mounting bolts M5 x 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 8.9 Nm (6.56 lbf.ft).
- Besides the shown, commonly used valve versions other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

## Spool Symbols

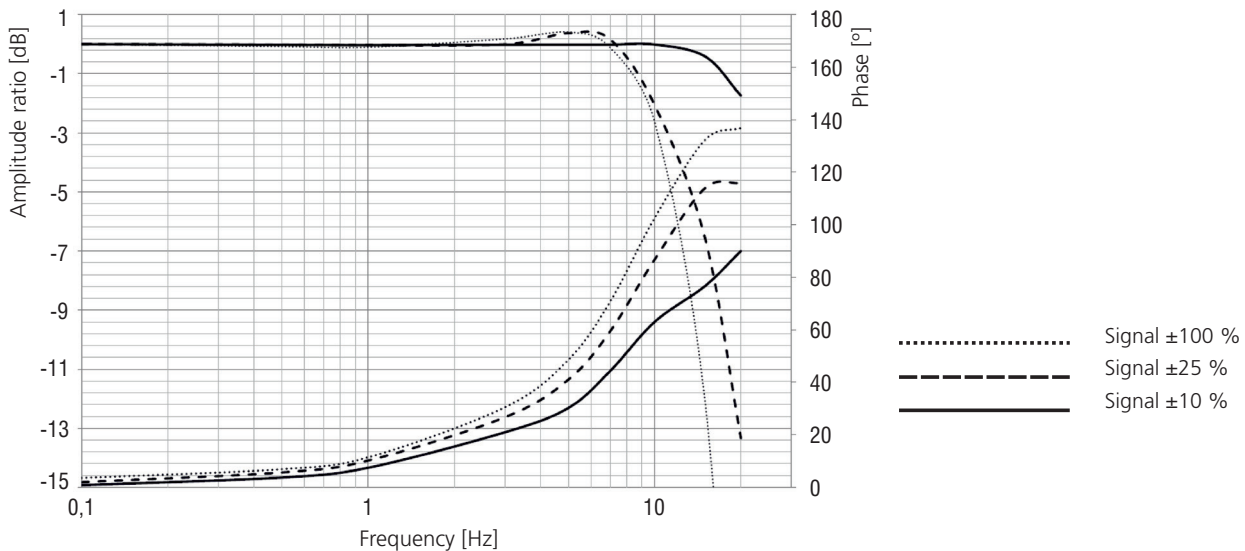
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11			
2Y51		3Y11	
2Y11			

## Technical Data of Proportional Directional Control Valve

Solenoid data		
Type of coil	V	24
Limiting current	A	2.4
Resistance at 20 °C (68 °F)	$\Omega$	3.8

Electronics Data		
Supply voltage with polarity inversion protection	V	19.2...24...28
Input		
Command signal (according to customer setting)		$\pm 10$ V; $5 \pm 5$ V; $0 \dots 10$ V; $0 \dots 24$ V; $12 \pm 12$ V; $\pm 10$ mA; $12 \pm 8$ mA; $0 \dots 20$ mA; $4 \dots 20$ mA
External feedback signal (according to customer setting)		$\pm 10$ V; $0 \dots 10$ V; $0 \dots U_{ref}$ ; $U_{ref}/2 \pm U_{ref}$ ; $\pm 10$ mA; $0 \dots 20$ mA; $4 \dots 20$ mA
Output		
Spool position of monitoring signal	V	$\pm 10$
Output current to solenoids	A	2x PWM output stages up to 4 A
Resolution of the A/D converter	bit	12
PWM frequency	kHz	18
Cycle time	$\mu s$	200
Parameter setting: By PRM9 parametrization software. Connection via USB-A to $\mu$ -USB cable		

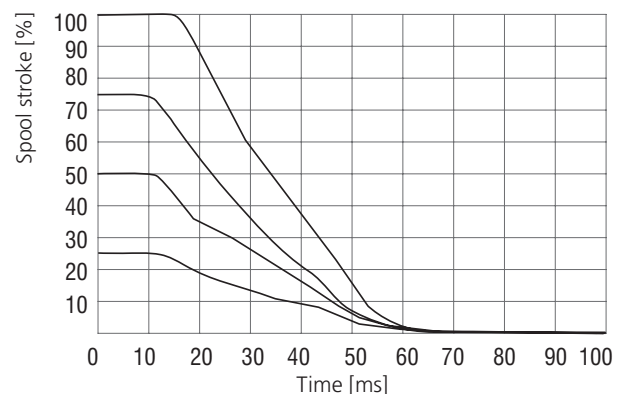
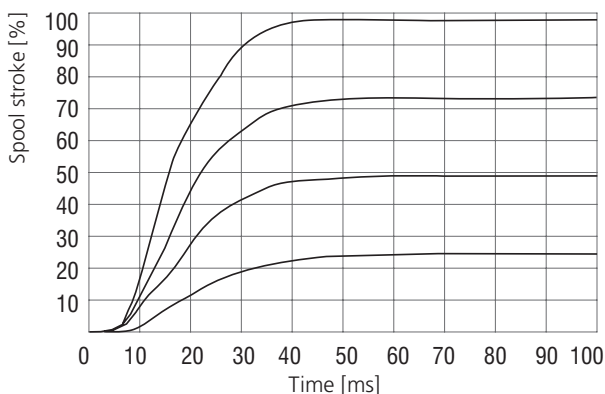
### Frequency Response closed position loop, for E02S02 model



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

#### Step response

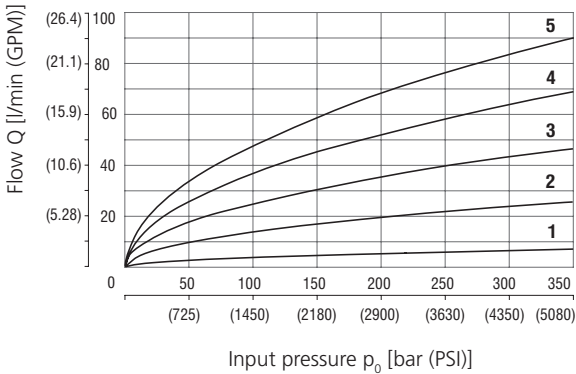
- E02S02 model only (internal position feedback)



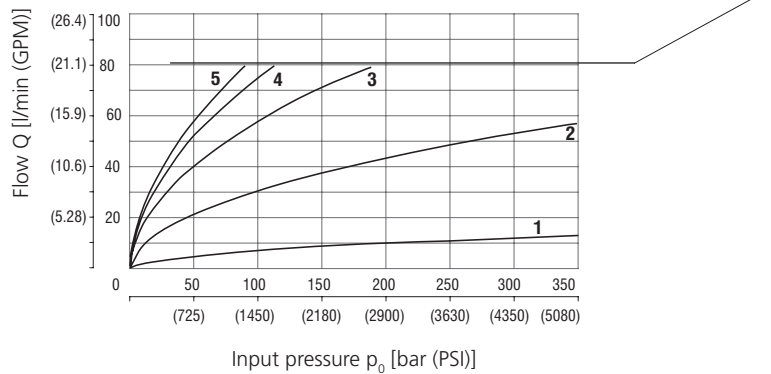
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$   
 - E02S02 model only

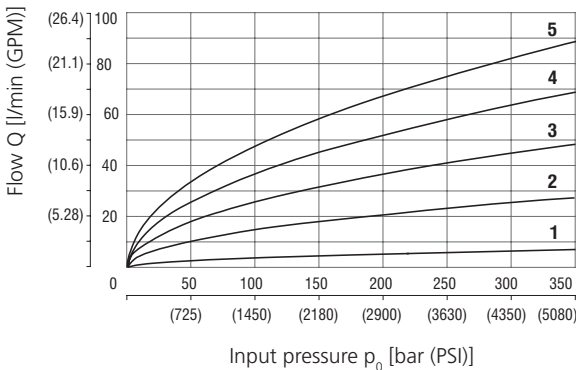
**Z11/15** Nominal flow 15 l/min (4.0 GPM)



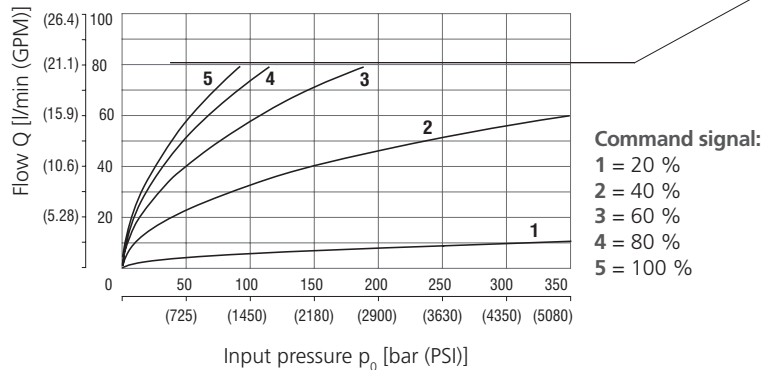
**Z11/30** Nominal flow 30 l/min (7.9 GPM)



**Y11/15** Nominal flow 15 l/min (4.0 GPM)



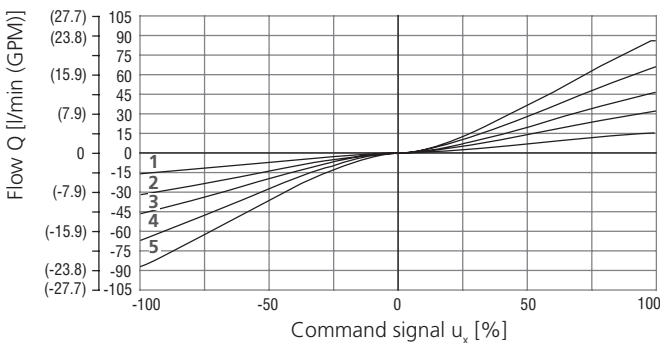
**Y11/30** Nominal flow 30 l/min (7.9 GPM)



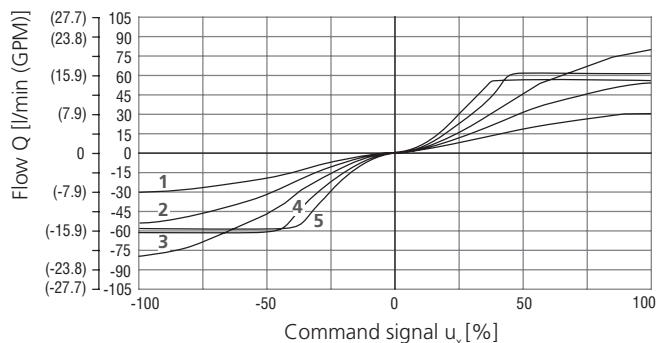
**Command signal:**  
 1 = 20 %  
 2 = 40 %  
 3 = 60 %  
 4 = 80 %  
 5 = 100 %

**Flow characteristics:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$   
 - E02S02 model only

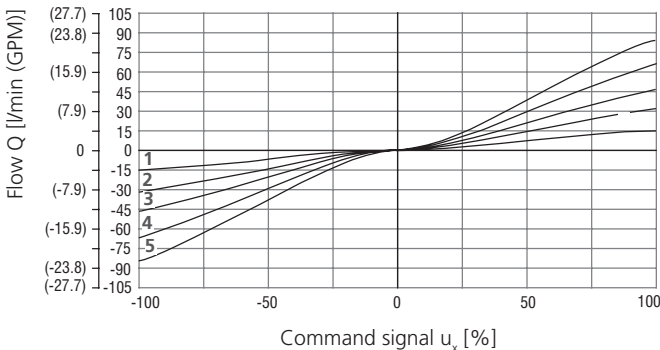
**Z11/15** Nominal flow 15 l/min (4.0 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



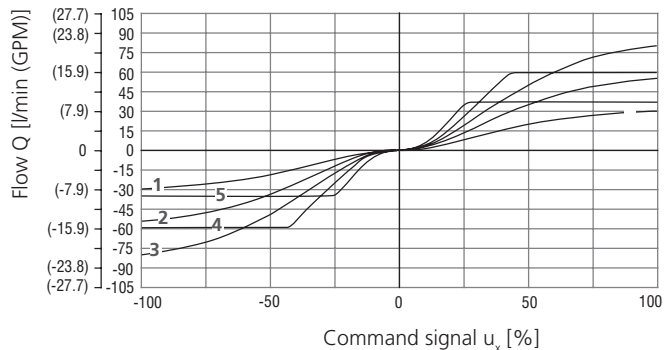
**Z11/30** Nominal flow 30 l/min (7.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



**Y11/15** Nominal flow 15 l/min (4.0 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



**Y11/30** Nominal flow 30 l/min (7.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



$\Delta p$  = Valve pressure differential  
 (input pressure  $p_0$  minus load pressure and return pressure  $p_r$ )

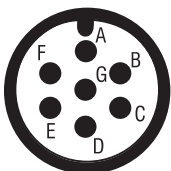
1	$\Delta p = 10 \text{ bar}$ (145 PSI)	4	$p_0 = 200 \text{ bar}$ (2900 PSI)
2	$p_0 = 50 \text{ bar}$ (725 PSI)	5	$p_0 = 350 \text{ bar}$ (5076 PSI)
3	$p_0 = 100 \text{ bar}$ (1450 PSI)		

## Factory Settings

Item	Model							
	E02S02		E04S02		E02S02-CA		E04S02-CA	
	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets
Command signal	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V
Signal external feedback	-	-	0...10 V		-	-	0...10 V	
Spool position of monitoring signal	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V

## Connectors

10



Main supply connector 6+PE MIL (EN 175201-804)

PIN	Technical data
A	Supply 24 V
B	GND (Supply)
C	GND (Monitor)
D	INPUT
E	GND (Input)
F	Monitor
G	PE

9



Connector M12x1, plug (5-pol, A-Code), CANopen (optional)

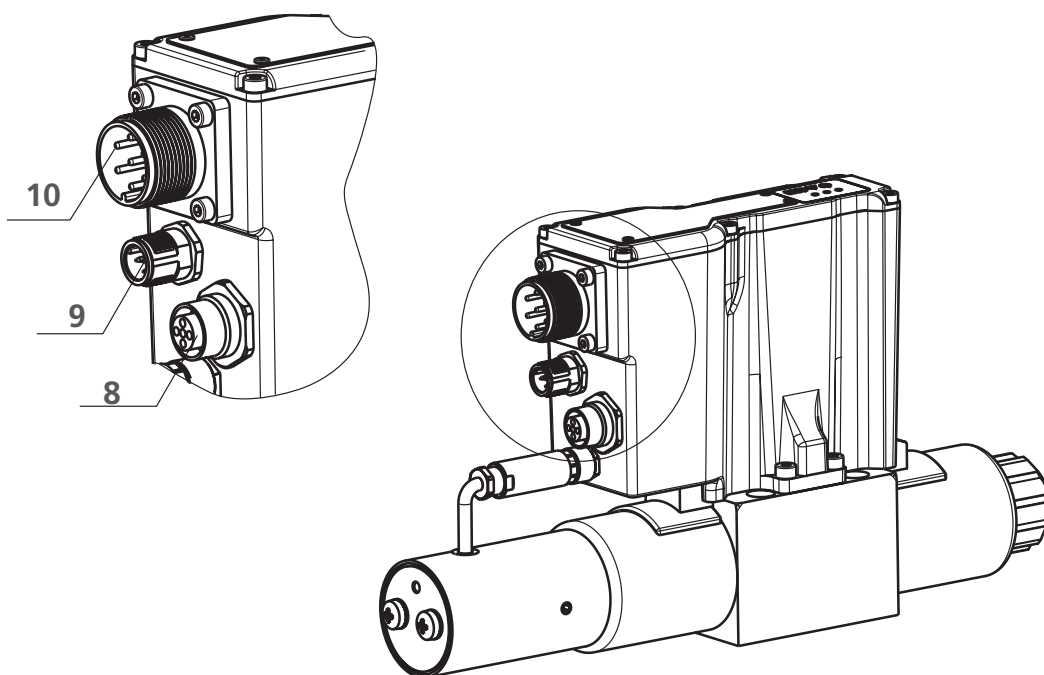
PIN	Technical data
1	n.c.
2	n.c.
3	CAN GND
4	CAN HIGH
5	CAN LOW

8

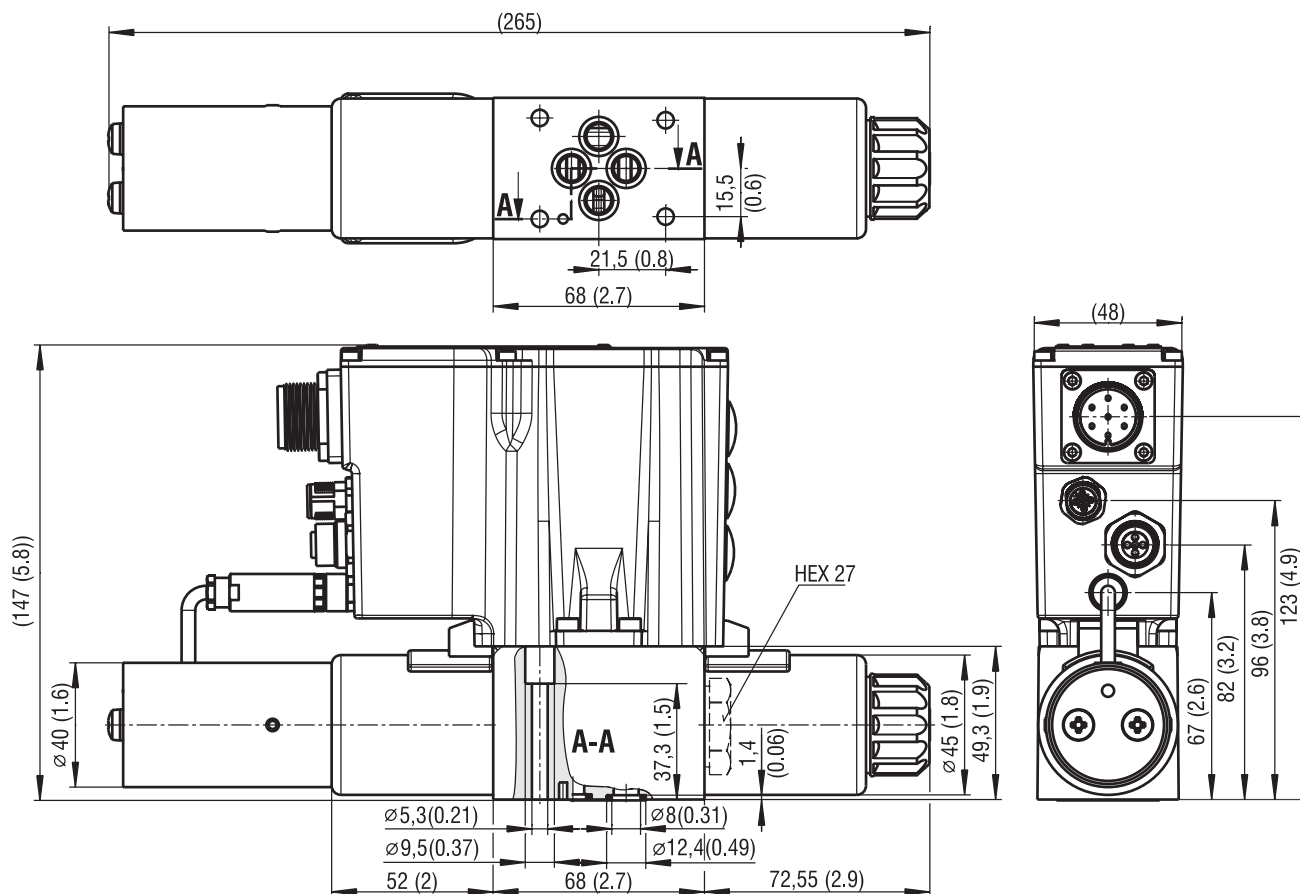


Connector M12x1, socket (5-pol, A-Code), external feedback (optional)

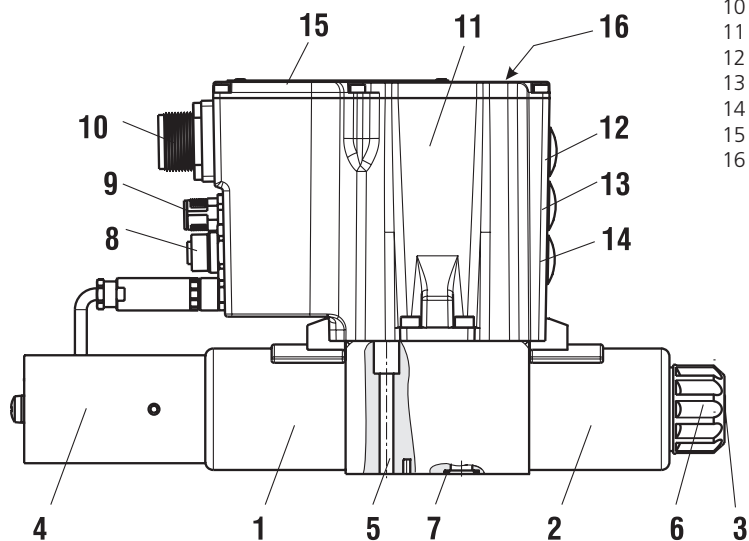
PIN	Technical data
1	Supply 24 V
2	Signal
3	GND
4	n.c.
5	n.c.



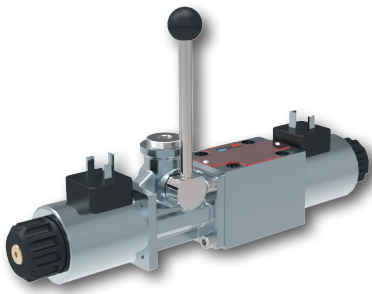




- 1 Solenoid a
- 2 Solenoid b
- 3 Manual override
- 4 Position sensor
- 5 4 mounting holes
- 6 Solenoid fixing nut
- 7 Square ring 9.25x1.68 (5. pcs.),supplied in delivery packe
- 8 Connector M12x1, socket (5-pol,A-Code), external feedback (optional)
- 9 Connector M12x1, plug (5-pol,A-Code), CANopen (optional)
- 10 Main supply connector 6+PE MIL (EN 175201-804)
- 11 Aluminium housing with integrated digital electronics
- 12  $\mu$ -USB connection
- 13 Encoder Baud Rate (optional)
- 14 Encoder Node-ID (optional)
- 15 Name plate
- 16 Status LEDs



**Proportional Directional Control Valve, with Auxiliary Lever Override**
**PRMR2-06**

 Size 06 (D03) •  $Q_{max}$  40 l/min (11 GPM) •  $p_{max}$  350 bar (5100 PSI)

**Technical Features**

- › Direct acting proportional directional control valve with subplate mounting interface acc. to standards ISO 4401, DIN 24340 (CETOP 03)
- › The valve is used for directional and speed control of hydraulic appliances
- › Auxiliary lever actuator allows emergency spool control by hand when the solenoids are deenergised, e.g. in the case of electrical failures or maintenance activities
- › The flow rate can be controlled continuously and proportionally to command signal
- › The valve can be controlled directly by a current control signal or by means of the electronic control unit to fully exploit the valve performance. The electronic control unit must be ordered separately
- › Wide range of solenoid electrical terminal versions available
- › The five chambers body design reduces the dependence of hydraulic power on fluid viscosity
- › The coil is fastened to the actuating system with a plastic nut and can be rotated by 360° to to position suitable for the space available
- › In the standard version, the valve body is phosphated and the steel parts are zinc coated for 240 h salt spray protection acc. to ISO 9227
- › Optional surface protection for mobile applications with zinc coated body for 520 h salt spray protection acc. to ISO 9227

**Functional Description**

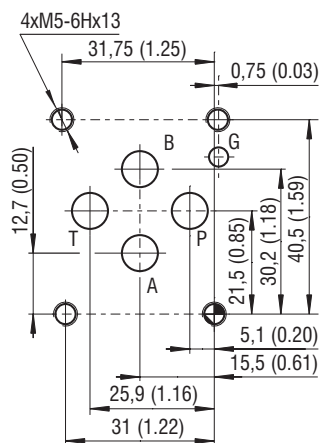
The valve is used for speed control and the valve with two solenoids also for control of movement direction of hydraulic appliances. The built-in lever actuator is intended for manual operating up to maximum pressure 100 bar in channel -T. The manual operating of the valve is usually used in an emergency situation or for service purposes. The manual actuator can be used only when the solenoids are switched off.

For effective valve control it is recommended to use one of the offered electronic control units:

External analogue control unit EL3E in a plastic box (Data sheet 9145)

External digital control unit EL4 in Eurocard format allows an operation in closed control loop with a feedback signal (Data sheet 9140)

Digital control unit EL6 in plug-in version is basically intended for one-solenoid valve. Two are needed and a coordination of their mutual functions are necessary for two-solenoid valves. (Data sheet 9150)

**Technical Data**
**ISO 4401-03-02-0-05**


Ports P, A, B, T - max.  $\varnothing$ 7.5 mm (0.29 in)

Nominal Size	06 (D03)		
Max. operating pressure at port P, A, B	bar (PSI)	350 (5080)	
Max. operating pressure at port T	bar (PSI)	100 (1450)	
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)	5 (1.13)	8 (2.1) 15 (4.0) 30 (7.9)
Weight	kg (lbs)	2.8 (6.2) 3.3 (7.3)	
<b>Technical Data of the Proportional Solenoid</b>			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	2.5	1.0
Mean resistance value at 20 °C (68 °F)	$\Omega$	2.3	13.4
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types / Connectors	C_8007 / K_8008	C22B* / K*	
Mounting interface	SMT_0019	Size 06	
Spare parts	SP_8010		
Subplates	DP_0002	DP*-06	

### Ordering Code

PRMR2-06 / - - K1 / - -

**Proportional Directional Control Valve, with Auxiliary Lever Override**

**Valve size**

**Spool symbols**

see table „Spool Symbols“

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

5 l/min (1.3 GPM)	05
8 l/min (2.1 GPM)	08
15 l/min (4.0 GPM)	15
30 l/min (7.9 GPM)	30

**Rated supply voltage of solenoids**

(at the coil terminal)

12 V DC	12
24 V DC	24

**Connector**

with terminal for the connector, EN 175301-803-A

E1 with quenching diode	E1
with AMP-Junior-Timer-connector - Axial direction	E2
E3A with quenching diode	E3A
loose conductors (two insulated wires)	E4A
E8 with quenching diode	E8
with Deutsch DT04-2P	E9
E12A with quenching diode	E12A
	E13A

**Surface treatment**  
 No designation standard  
 B zinc-coated (ZnNi), ISO 9227 (520 h)

**Lever override length**  
 No designation standard 102 mm

**Manual lever and position of override actuating section**  
 A19 standard, lever on side A, upward  
 B19 standard, lever on side B, upward

**Seals**  
 No designation NBR  
 V FPM (Viton)

**Conector according to EN 175301-803-A**  
 connector socket(s) according to EN 175301-803-A with coil type E1 or E2



- The lever actuator must not be used until all solenoids are switched off.
- For proportional valves with two solenoids, one solenoid must be de-energized before the other solenoid can be charged.

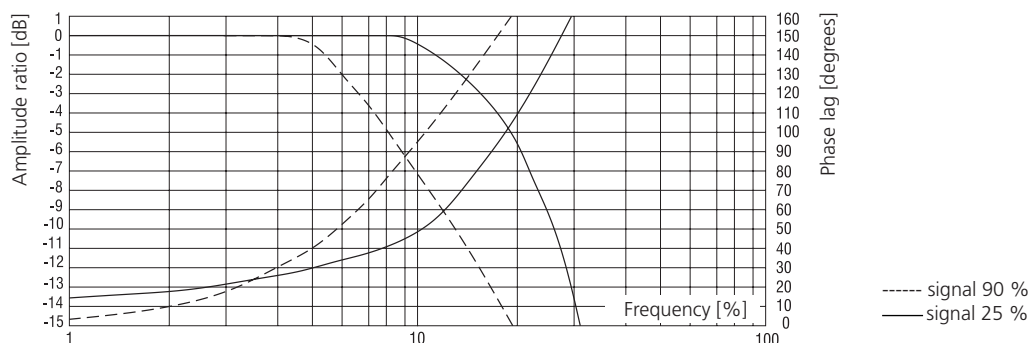
- Mounting bolts M5 x 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 8.9 Nm (6.56 lbf.ft)
- As well as the commonly used valve versions, other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

### Spool Symbols

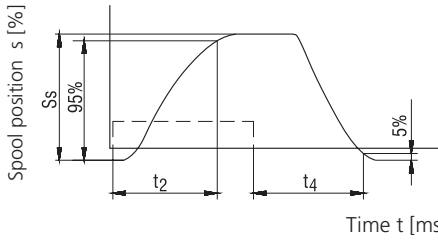
Type	Symbol	Type	Symbol	Type	Symbol
2Z51		2Y11		3Y11	
2Z11		3Z11		3Y12	$\frac{q_A}{q_B} = \frac{1}{2}^*$
2Y51		3Z12	$\frac{q_A}{q_B} = \frac{1}{2}^*$	The valve with two solenoids can be optionally ordered with the lever actuator on the left or right side acc. to ordering code	

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

### Frequency Response



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



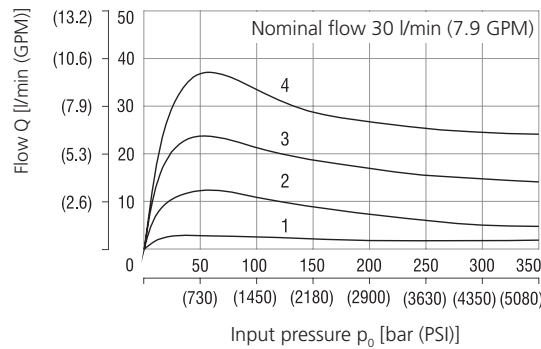
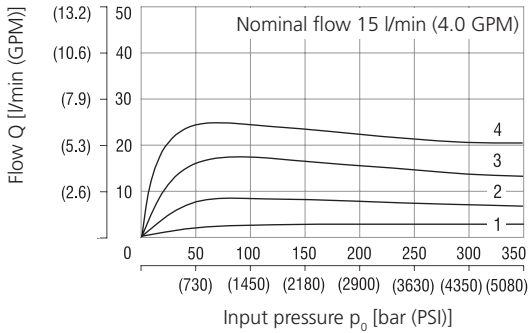
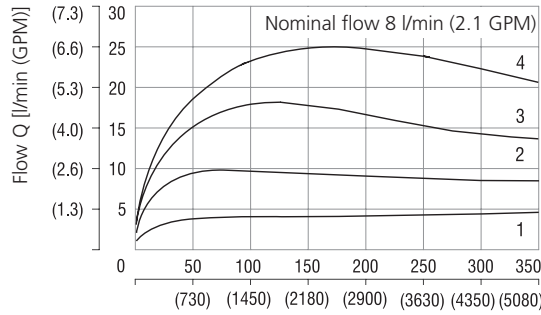
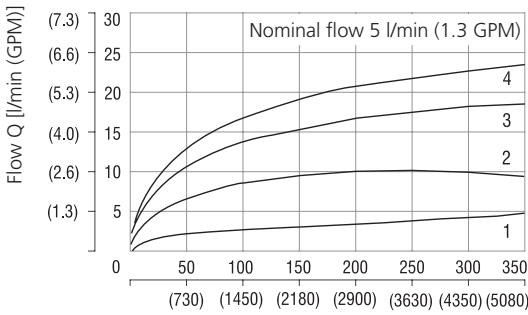
Steady Spool Position $S_s$ [%]	$t_2$ [ms]	$t_4$ [ms]
100	85	100
75	70	85
50	55	75
25	45	55

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

Time t [ms] ---- the control signal course of the integrated electronics

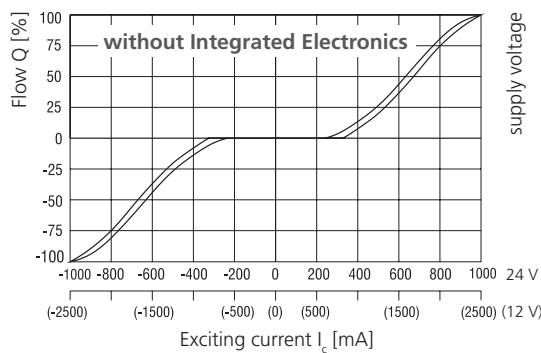
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$



**Solenoid current:**  
1 = 40 %  
2 = 60 %  
3 = 80 %  
4 = 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 in a range of  $\pm 6\%$  of the limit current.

**Solenoid Coil** in millimeters (inches)

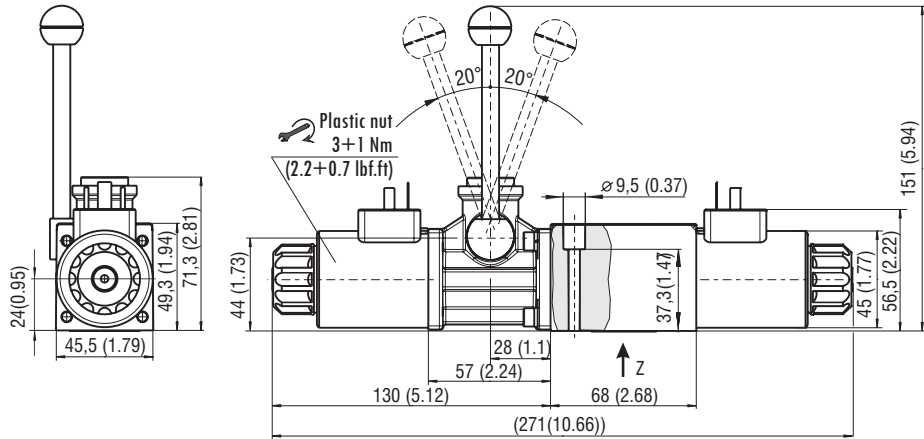
E1, E2 Protection Degree IP65	E3A, E4A Protection Degree IP67	E8, E9 Protection Degree IP65	E12A, E13A Protection Degree IP67 / 69K
		<p>Note: A = Standard 300 mm, (11.8 in) other lengths on demand</p>	

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

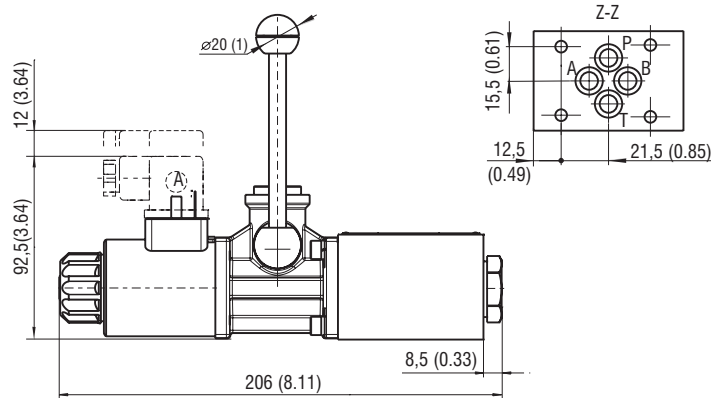
Dimensions in millimeters (inches)

**PRMR2-063 \*/ A19**

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

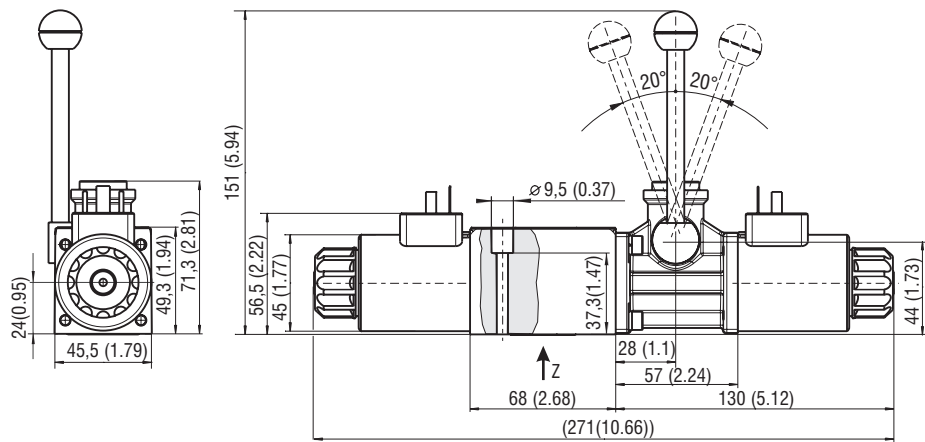


**PRMR2-062 \*/ A19**

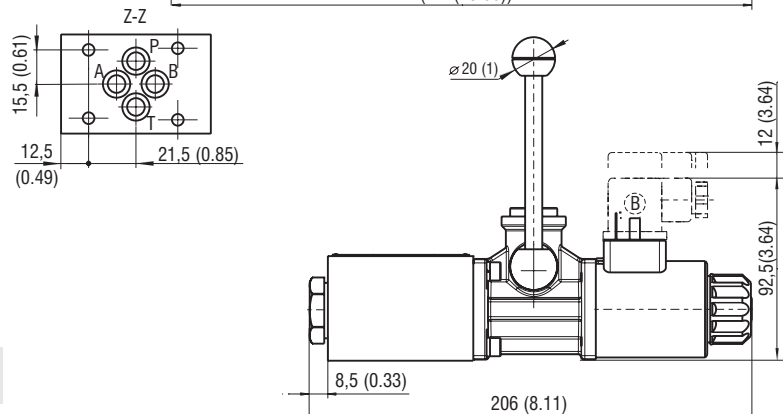


**PRMR2-063 \*/ B19**

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



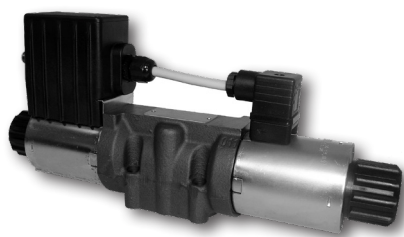
**PRMR2-062 \*/ B19**



The lever operator should never be used when any solenoid is energized.

Manual lever and actuating section is shown in the standard supplied position which is the most frequently used. Both elements can be rotated to various positions 90° apart. For other positions of lever and actuating section consult our technical department for their identification.

Mounting screws 8.9 Nm (6.56 lbf.ft)  
M5 x 45 DIN 912-10.9


**Technical Features**

- › Direct acting, proportional control valve without or with integrated analog electronic (OBE) with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 05) 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 fullest
- › Analog converter card allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the valve performance
- › Five chambers housing design with reduced hydraulic power dependence on fluid viscosity
- › For versions without OBE a 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. The steel parts are zinc coated (240 h corrosion protection in NSS acc. to ISO 9227)
- › With optional increased surface corrosion protection of the whole valve 520 h in NSS, e.g. for mobile applications

**Functional Description**
**PRM6-10\* Versions without on board electronics**

The valve can be controlled directly by a current control supply unit or by the external electronic card directly mounted to the electrical terminal (see catalog 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.

**PRM6-10\*EK Versions with on board electronics**

A control box, which comprises one or two electronic control cards, depending on the number of controlled solenoids, can be mounted onto either solenoid. For models with two solenoids, the solenoid mounted opposite the control box is connected to the box by a DIN connector, a two-lead cable and a bushing.

The connection of the control box with the supply source and with the control signal is implemented by a 4-pin connector of 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:

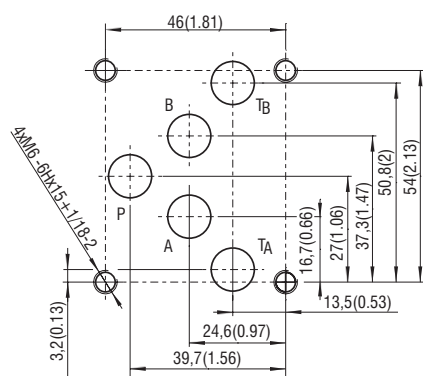
Offset, gain, rise and drop-out time of the ramp generator, frequency (2 frequencies) and amplitude of the dither signal generator.

The correct function of the control unit is signaled by LEDs.

Stabilized voltage +10 V (+5 V for 12 V voltage) is also available to the user.

Using this voltage and a potentiometer  $\geq 1k\Omega$  a voltage control signal can be generated.

The electronic control card enables voltage or current control to be used, depending on the position of the switches SW1 to SW3.

**Technical Data**
**ISO 4401-05-04-0-05**

 Ports P, A, B, T - max.  $\varnothing 11.2$  mm (0.44 in)

Valve Size	10 (D05)		
Maximal flow at pressure 320 bar (4640 PSI)	l/min (GPM)		
	80 (21)		
Max. operating pressure at ports P, A, B	bar (PSI)		
	350 (5080)		
Maximum 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 max.	°C (°F)		
	-30 ... +50 (-22 ... +122)		
Nominal flow rate $Q_n$ at $\Delta p=10$ bar (145 PSI)	l/min (GPM)		
	30 (7.9) / 60 (15.9) / 80 (21.13)		
Hysteresis	%		
	< 6		
Weight	kg (lbs)		
- valve with 1 solenoid	4.3 (9.48)		
- valve with 2 solenoids	5.8 (12.78)		
Protection degree (for version PRM*EK)	IP65		
<b>Technical Data of the Proportional Solenoid</b>			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	1.9	1.1
Mean resistance value at 20 °C (68 °F)	$\Omega$	4.7	13.9
<b>Technical Data of the Electronics</b>			
Supply voltage range	V DC	U <sub>cc</sub> 12V DC	U <sub>cc</sub> 24V DC
Stabilized voltage for control	V DC	5 (R > 1k $\Omega$ )	5 (R $\geq$ 1k $\Omega$ )
Maximum output current	A	2.4 (R < 4 $\Omega$ )	1.5 (R < 10 $\Omega$ )
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	C31* / K*	
Mounting interface	SMT_0019	Size 10	
Spare parts	SP_8010		
Subplates	DP_0002	DP*-10	

## Ordering Code

PRM6-10 [ ] / [ ] - [ ] [ ] [ ] [ ] [ ] - [ ]

**Proportional directional control valve**

**Valve size**

**Spool symbols**  
see table „Spool Symbols“

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

30 l/min (7.9 GPM)	30
60 l/min (15.85 GPM)	60
80 l/min (21 GPM)	80

**Rated supply voltage of solenoids (at the coil terminal)**

12 V DC	12
24 V DC	24

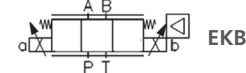
**Electronics on board / Position at solenoid**

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

on board electronics (solenoid „a“)



on board electronics (solenoid „b“)\*



**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**

**N1** protected with retaining nut  
**N2** protected with rubber boot

**Manual Override**

standard

**Connector according to EN 175301-803-A**

**No designation** valve version with an onboard electronic control unit  
**K1** valve version without an onboard electronic control unit with the coil types E3, E4, E3A, E4A, E8, E9, E12A and E13A connector plug according to EN 175301-803-A without rectifier, for valve version without an onboard electronic control unit and valve 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>E8</b>	loose conductors (two insulated wires)
<b>E9</b>	E8 with quenching diode
<b>E12A</b>	deutsch DT04-2P - axial direction
<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 M6 x 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 14+1 Nm (10.3+0.7 lbf.ft).
- Besides the shown, commonly used valve versions other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

## Spool Symbols

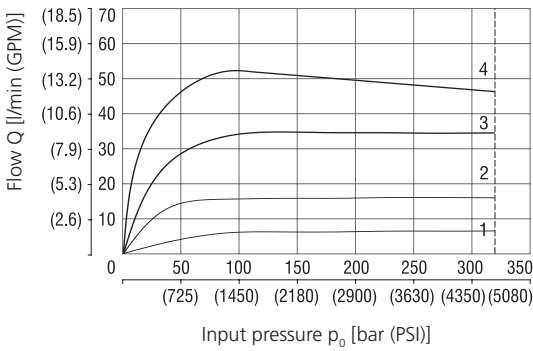
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11		3Z12	$\frac{q_A}{q_B} = \frac{1}{2}^*$
2Y51		3Y11	
2Y11		3Y12	$\frac{q_A}{q_B} = \frac{1}{2}^*$

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

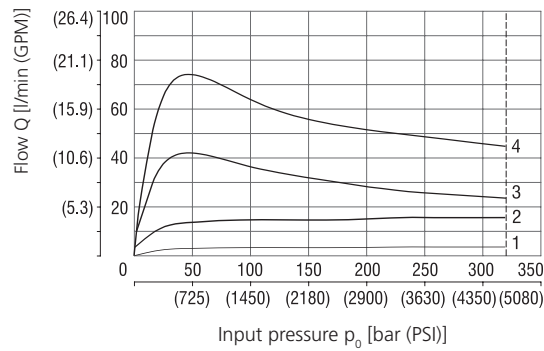
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

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

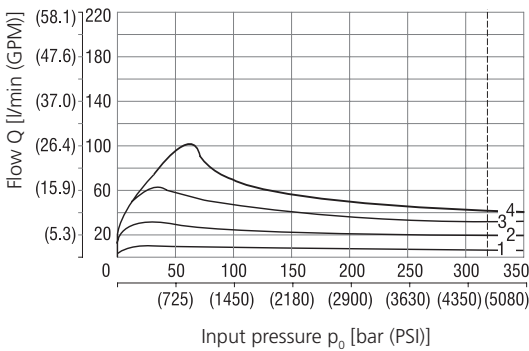
Nominal flow 30 l/min (7.95 GPM)



Nominal flow 60 l/min (15.85 GPM)



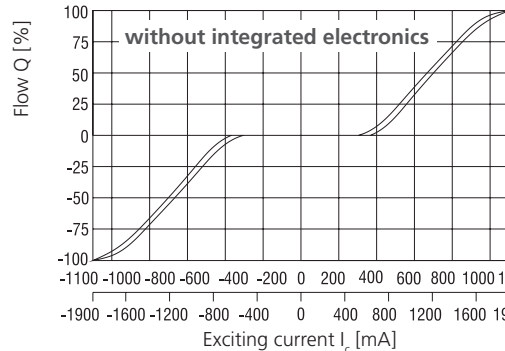
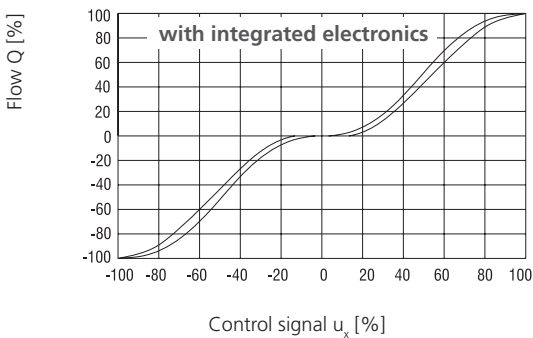
Nominal flow 80 l/min (21.13 GPM)



**Solenoid current:**

- 1 = 40 %
- 2 = 60 %
- 3 = 80 %
- 4 = 100 %

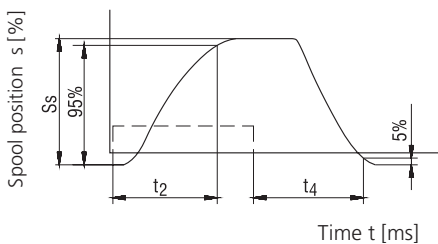
**Regulated flow related to control signal  $\Delta p = 10 \text{ bar}$  (145 PSI)**



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.

24 V / 12 V supply voltage

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

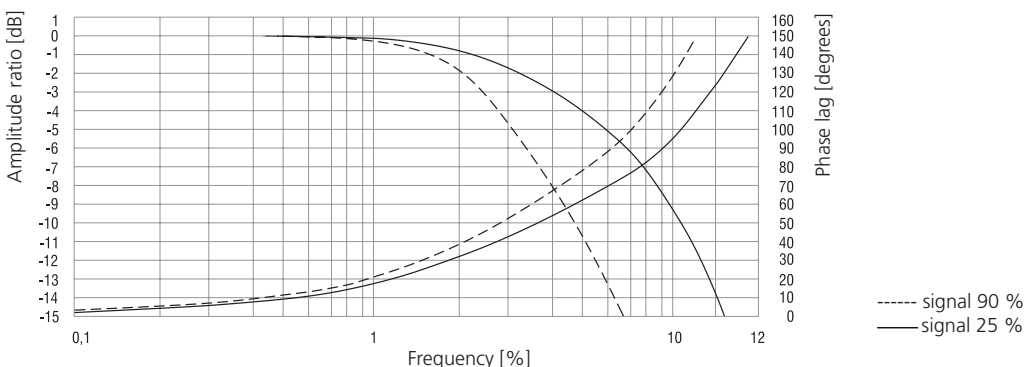


Steady Spool Position $S_s$ [%]	$t_2$ [ms]	$t_4$ [ms]
100	85	100
75	70	85
50	55	75
25	45	55

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.

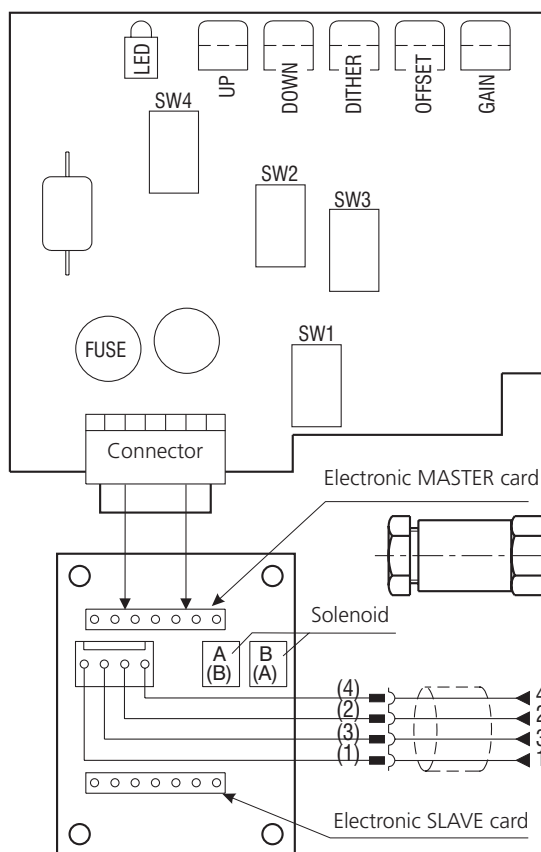
---- the control signal course of the integrated electronics

**Frequency Response**



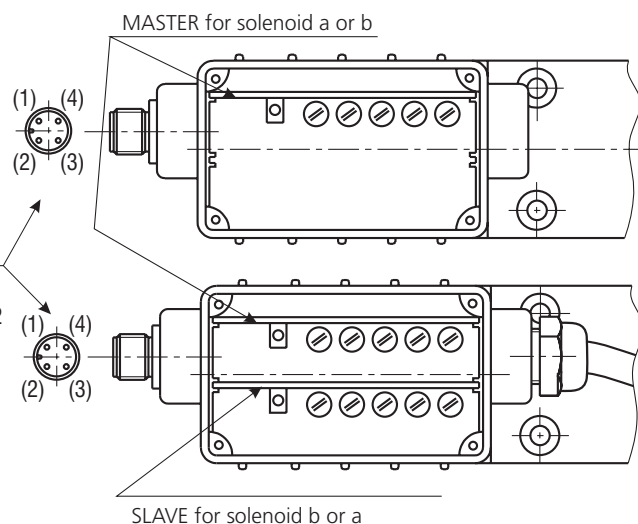


## Component Arrangement on the Electronic Card



PIN	Description	Wire Colors	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

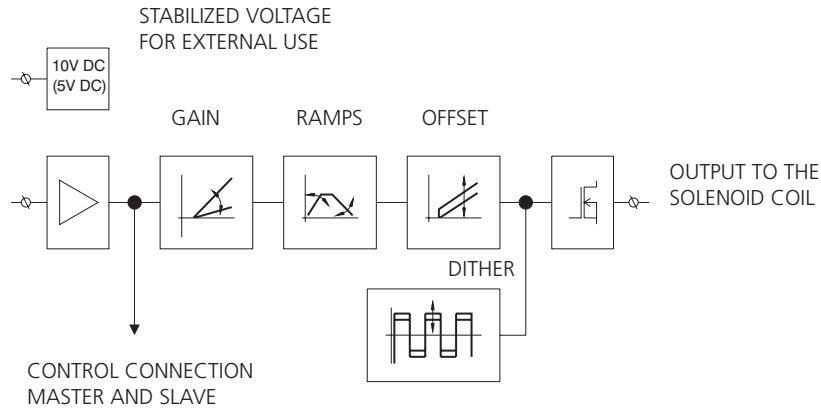
		PRM6-102				PRM6-103	
		0 ... 5 V	0 ... 10 V (0...5 V)*	0 ... 20 mA	4 ... 20 mA	Ucc/2 ±10 V (±5 V)*	±10 V (±5 V)*
MASTER M	SW1						
	SW2						
	SW3						
	SW4	90 Hz			60 Hz		
SLAVE S	SW1						
	SW2						
	SW3						
	SW4					90 Hz	60 Hz

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 to change these adjusted values.

\* Input signal level for the 12 V electronic unit.

**Block Diagram**

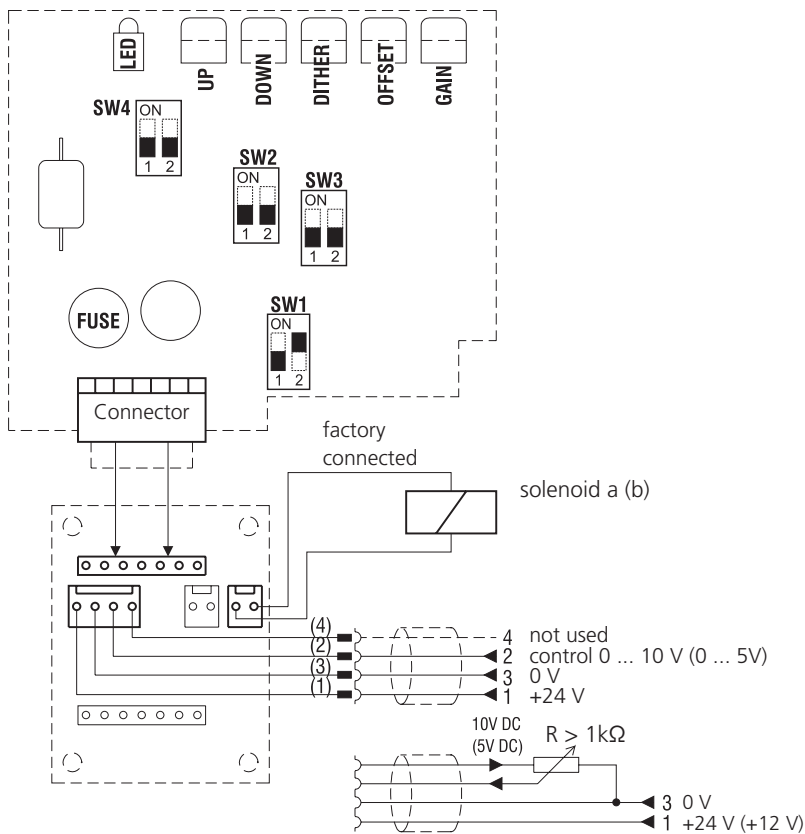


**Setting of Control Electronics**

**Valve PRM6-102\*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)**

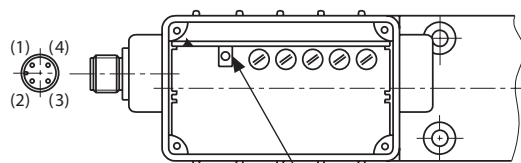
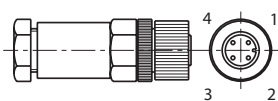


**Factory set values:**

- 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.



MASTER for solenoid a (b)

**Wire colors**

(connection connector - electronics)

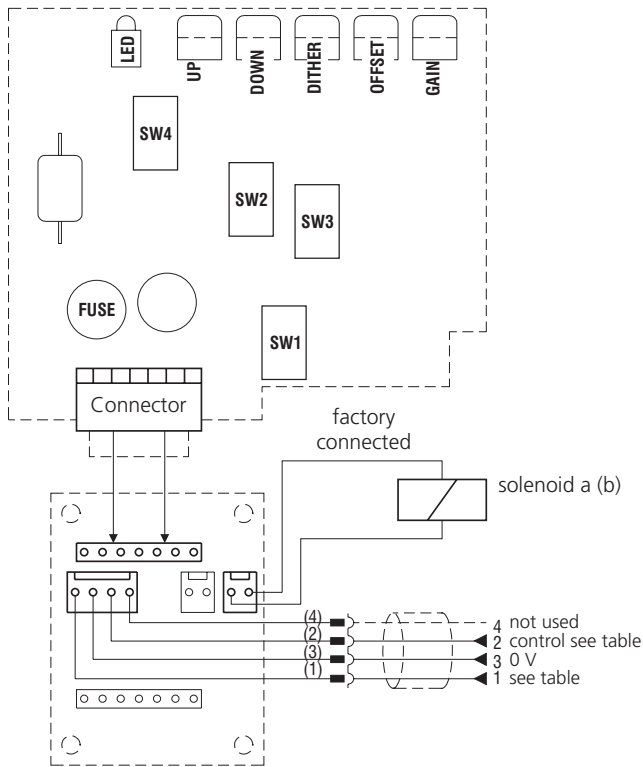
- (1) - brown
- (2) - white
- (3) - blue
- (4) - black

## Setting of Control Electronics

### Valve PRM6-102\*EK (with one solenoid)

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

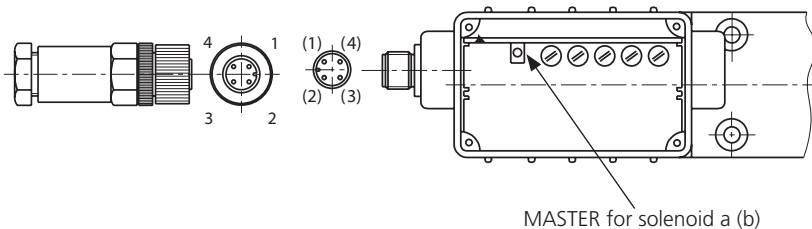
#### Master card for solenoid a (b)



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

Follow the subsequent steps to modify the factory settings:

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 colors (connection connector - electronics)

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



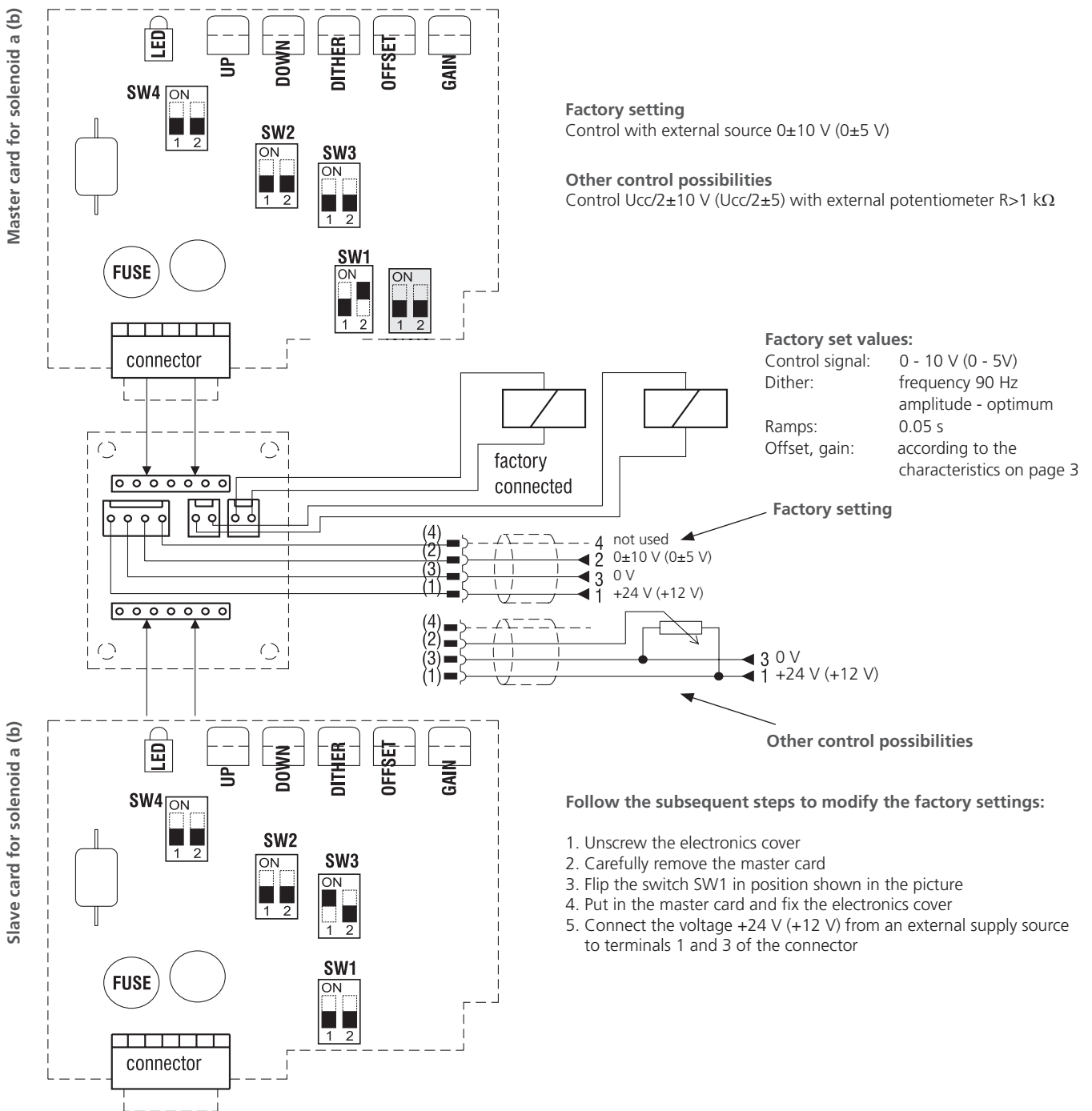
The control signal must have the same ground potential as the supply source.



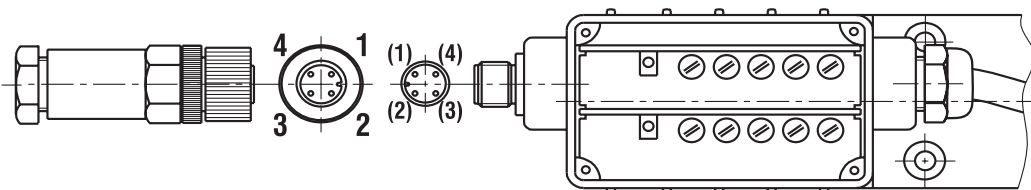
Designation of the basic factory setting.  
The ramp functions are adjusted on their minimum values.  
The dither is set to the optimal value with respect to hysteresis.  
Offset and gain are adjusted according to the characteristic on page 3.  
The manufacturer does not recommend to change these adjusted values.

## Setting of Control Electronics

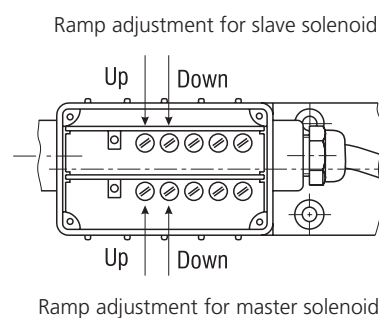
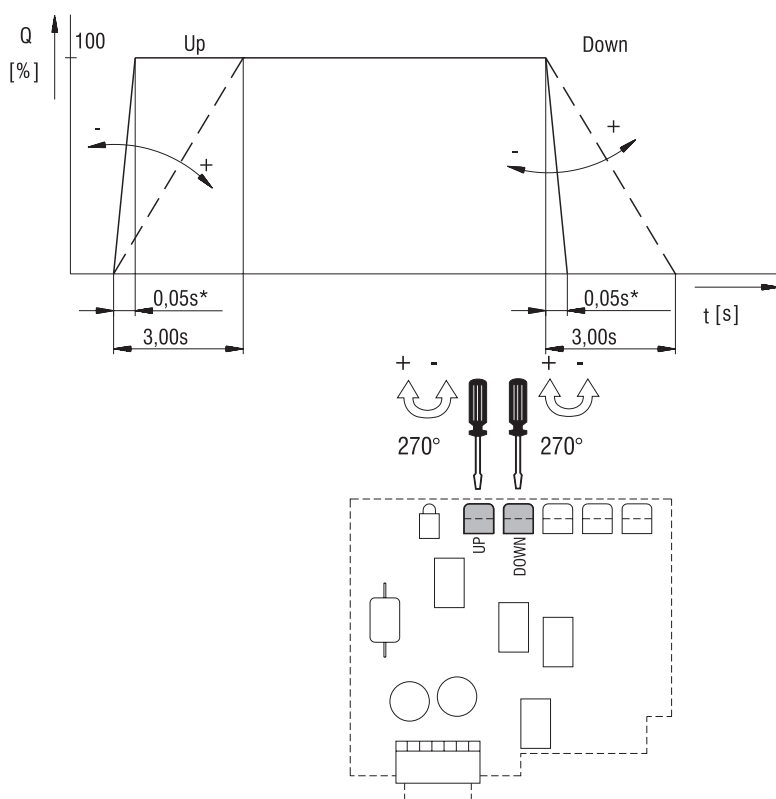
Valve PRM6-103\*EK (with two solenoids), factory setting, other control possibilities



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



**Ramp Adjustment (Up, Down)**



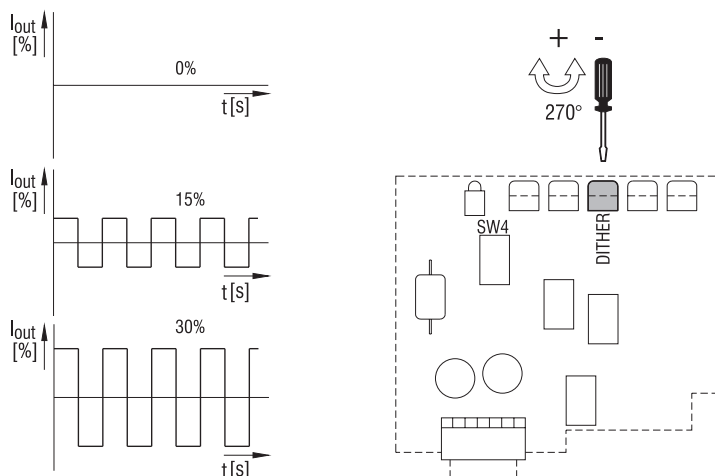
\* The value has only an informative character with respect to the particular type of the proportional directional valve (see page 3).



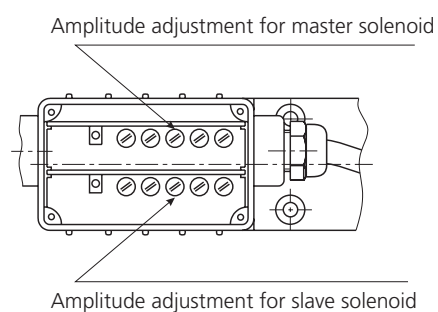
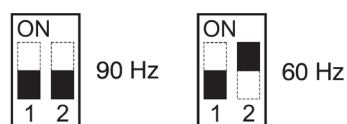
The factory setting of the ramp is at the minimum value.

**Dither Adjustment**

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

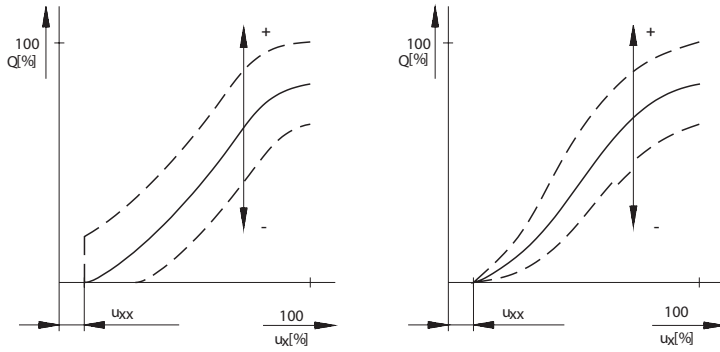


**Frequency - switch SW4**



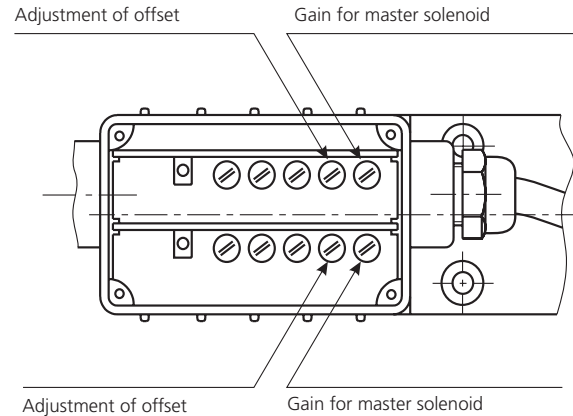
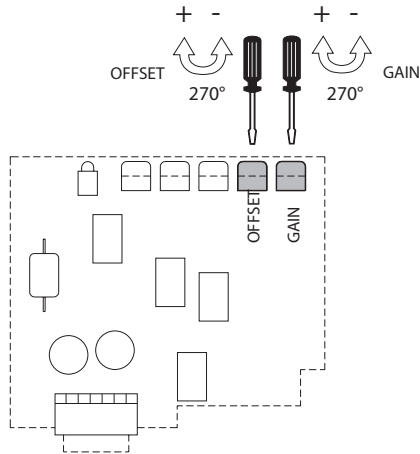
The dither is adjusted to minimize hysteresis.

### 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 to change these settings.

Nominal Electronics Supply Voltage (V)	Area Insensitive to Control Signal $u_{xx}$ (%)
12	1 ... 3
24	0.5 ... 2



### Solenoid Coil in millimeters (inches)

E1, E2 Protection Degree IP65	E3A, E4A Protection Degree IP67	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)

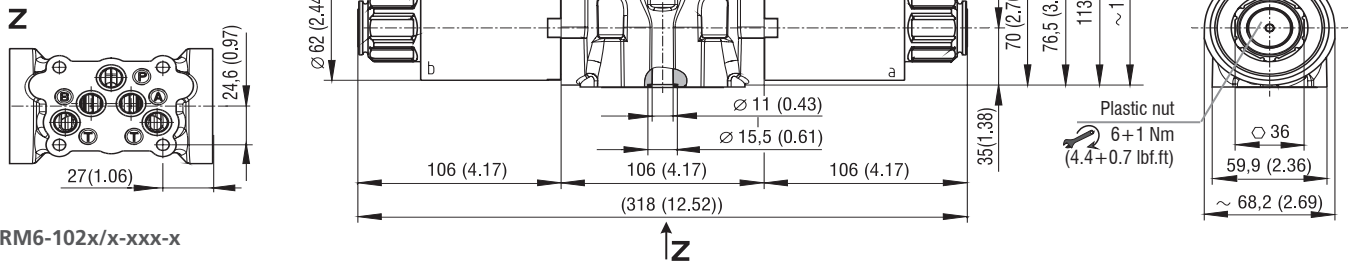
No Designation - Standard	Designation N1 - Cap Nut Covered	Designation N2 - Rubber Boot Protected

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)

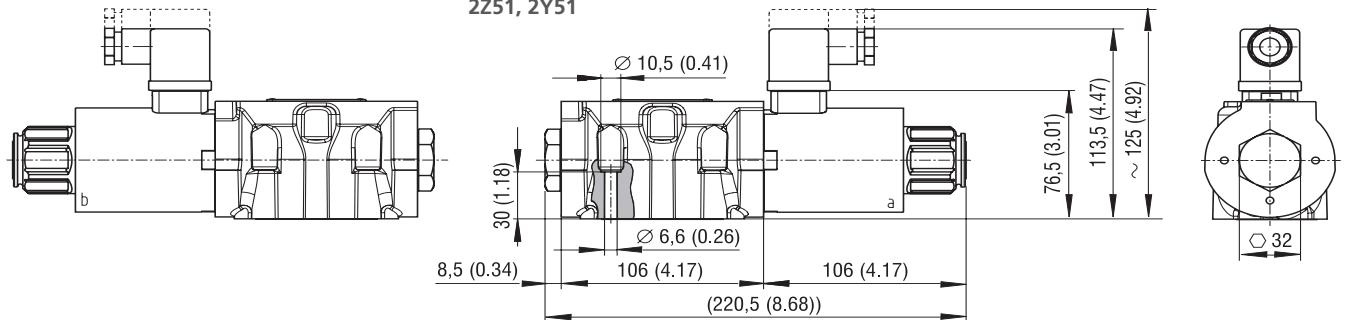
**PRM6-103x/x-xxx-x**

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



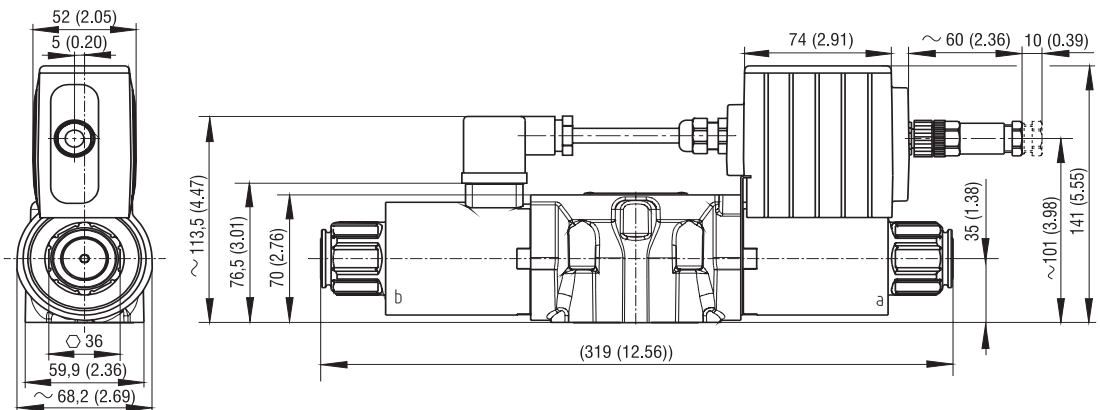
**PRM6-102x/x-xxx-x**

**Spool symbols:**  
2Z11, 2Y11



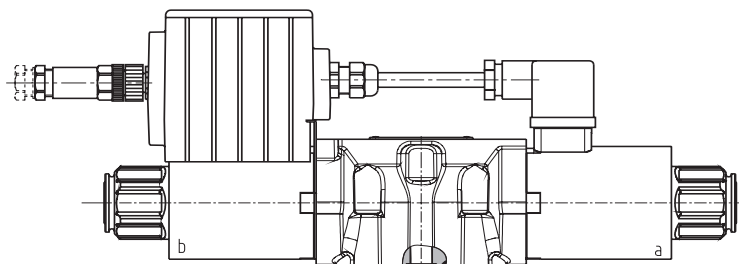
**PRM6-103x/x-xxEKx-x**

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



**PRM6-103xB/x-xxEKx-x**

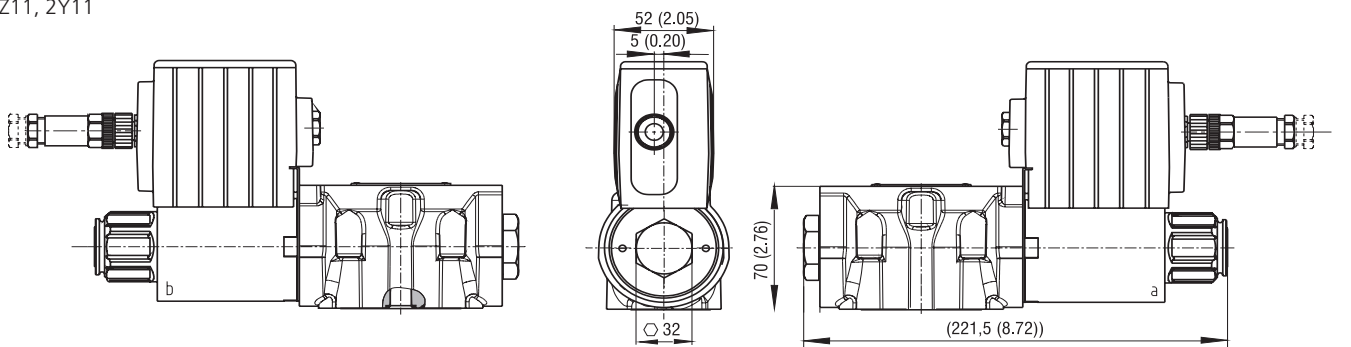
**Spool symbols:**  
3Z11B, 3Z12B, 3Y11B, 3Y12B

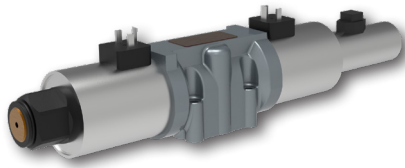


**PRM6-102x/x-xxEKx-x**

**Spool symbols:**  
2Z11, 2Y11

**Spool symbols:** 2Z51, 2Y51




**Technical Features**

- › Proportional control valve controlled by integrated digital electronics with the external feedback or proportional control valve controlled by external digital electronics with a spool position sensor
- › Control valve with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 05) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › Digital converter card allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the performance of the valve
- › Various models with or without onboard digital converter card or position sensor feedback available
- › Used for directional and speed control of hydraulic actuators
- › Wide range of interchangeable spools available
- › For versions without integrated digital electronic unit wide range of solenoid electrical terminal versions available
- › The driver directly manages digital settings. It's possible to customize the settings for special applications using the optional kit
- › In the standard version, the valve housing is phosphated and steel parts zinc-coated for 240 h protection acc. to ISO 9227
- › Enhanced surface protection for mobile sector available (ISO 9227, 520 h salt spray)

**Functional Description**

The **PRM7-10 proportional directional control** valve is designed for the smooth control of the volumetric flow rate, i.e. the movement speed of the piston rod of a hydraulic cylinder or the speed of the output shaft of a rotary hydraulic motor. A valve with two control solenoids also controls the direction of the flow of the working fluid and thus the direction of the output member of the consumer.

The hydraulic part of the valve consists of a cast iron body with subplate mounting in accordance to ISO 4401 on the bottom surface, a spool with shaped control edges and spool centering springs. Spool movement is assured by control solenoids, proportionally controlled via a signal from integrated or external digital electronic control unit (ECU). The valve can operate in an open control loop (without feedback signal) or a closed control loop via an internal or external feedback signal. Internal feedback is assured by a spool position sensor, which operates on the principle of a Linear Variable Differential Transformer (LVDT), the core of which is mechanically connected to the valve spool. External feedback is provided by a sensor connected to the hydraulic circuit which reads the actual value of the controlled parameter.

**Design without integrated electronic control unit (ECU)**

In this design, the valve is offered with a LVDT spool position sensor with a voltage (type **S01**) or a current (type **S02**) output. The valve is controlled by external ECU. It is possible to select the connector types (E1, E2) for electrical connection of control solenoids. The sensor is connected using a G4W1F connector. Connector plugs are included.

**Design with integrated electronic control unit (ECU)**

This valve is designed to be operated in an open loop without feedback (type E01) or in a closed loop using a feedback signal from an external sensor (type E02).

The plastic housing with the ECU is mounted on one of the control solenoids, the other solenoid is connected to the ECU by a cable ending with an EN 175301-803 connector plug. Communication with the external sensor is achieved via a five-pin connector which also enables supply voltages of +24 V, +10 V or -5 V. The solenoid coils including the integrated ECU can be rotated by  $\pm 90^\circ$ .

**Integrated electronic control unit (ECU)**

The ECU utilizes pulse width modulation (PWM) of the control signal to the solenoid coils, reducing loss and heating the coil as well as increasing control precision. The resulting current entering the coils is proportional to that of the control signal. Additionally, the coil input current can be modulated by a dither signal. This signal causes permanent vibration of the armature and spool, thus greatly reducing the effects of adhesive forces and reducing valve hysteresis. Basic valve parameters are set through software and by means of a special programmer, or by computer via a RS 232 interface. The PC connection set must be ordered separately as described on page 4. Correct function of the ECU is indicated by a green LED, Incorrect function is indicated by a red LED.

In the basic version, the valve is supplied with factory settings. Consult the manufacturer for external feedback.

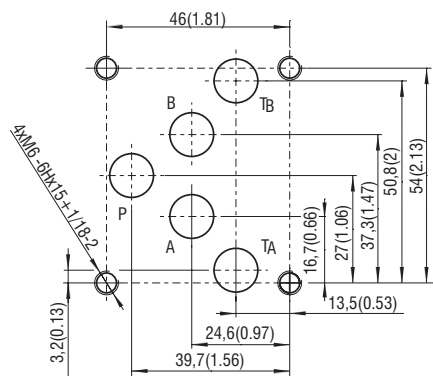
**Note:**

The **PRM9-10** proportional directional control valve, equipped with integrated electronic control unit and spool position sensor (LVDT), enables closed loop control using a combination of internal and external feedback. The valve can also be connected to the CAN-Bus. (see catalogue HC 5129).



### Technical Data

ISO 4401-05-04-0-05



Ports P, A, B, T - max Ø11.2 mm (0.44 in)

Valve size	10 (D05)	
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5100)
Max. operating pressure at port T	bar (PSI)	210 (3046)
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)
Fluid temperature range (FPM)	°C (°F)	-20 ... +80 (-4 ... +176)
Ambient temperature max.	°C (°F)	-30 ... +50 (-22... +122)
Nominal flow rate Q <sub>n</sub> at Δp=10 bar (145 PSI)	l/min (GPM)	30 (7.9) / 60 (15.9) / 80 (21.1)
Hysteresis	%	< 6
Hysteresis - closed position loop	%	< 0.5
Protection degree EN 60529	IP 65	
Weight	kg (lbs)	4.4 (9.70) 5.9 (13.01)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Coil types / Connectors	C_8007 / K_8008	
Mounting interface	SMT_0019	Size 10
Spare parts	SP_8010	
Subplates	DP_0002	DP*-10

### Ordering Code

PRM7-10 / - - - - - K1 - - - - -

**Proportional Directional Control Valve Controlled by** (internal or external) **Digital Electronics**

**Valve size**

**Spool symbols**

see the table „Spool symbols“

**Nominal flow rate at Δp = 10 bar (145 PSI)**

flow 30 l/min (7.9 GPM)	<b>30</b>
flow 60 l/min (15.6 GPM)	<b>60</b>
flow 80 l/min (21.1 GPM)	<b>80</b>

**Nominal solenoid supply voltage**

12 V DC	<b>12</b>
24 V DC	<b>24</b>

**Model with integrated electronic**

proportional directional valve without feedback **E01**  
proportional directional valve with external feedback **E03**

**Model without electronic**

**no designation**

**Surface treatment**  
standard  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
NBR  
**V** FPM (Viton)

**Installation side of electronic unit and position sensor**  
**No designation** of port A (case with two solenoids)

**Model without integrated electronic**  
S01 position sensor with voltage outlet  
S02 position sensor with current outlet

**Connector according to EN 175301-803-A**  
without rectifier

**Connector for models without integrated electronic**  
EN 175301-803-A  
E1 with quenching diode

- 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 M6 x 45 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 14 Nm (10.3 lbf.ft).
- Besides the shown, commonly used valve versions other special models 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	

$$\frac{q_A}{q_B} = \frac{1}{2}$$

$$\frac{q_A}{q_B} = \frac{1}{2}$$

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

### Technical Data of Position Sensor - Voltage Outlet

Operating pressure	bar (PSI)	to 350 (5080), static
Electrical connection for S01 model		electrical connector G4W1F Hirschmann
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP65
Measured distance	mm (in)	8 (0.315)
Operating voltage	V	9.6 ... 30 DC
Linearity error	%	< 1
Current consumption at load current of 2 mA	mA	< 15
Output voltage	V	0 ... 5
Output signal range used: 0 position 1 solenoid - stroke 1.8 mm (0.07 in) 2 solenoids - stroke ±1.8 mm (0.07 in)	V	2.5 0.125 ... 2.5 0.125 ... 4.875
Max. load current	mA	2
Noise voltage - at load current 0 - at load current of 2 mA	mV <sub>p-p</sub>	< 20 < 15
Additional output signal error at: - temperature change between 0 ... 80° C (32... 176 °F) - between 0... -25 °C (32 ... -13 °F) - Load change from 0 to 2 mA		typical 0.2% / 10K max. 0.5 % / 10K max. 0.5 % / 10K 0.1 %
Input voltage change from 9.6 V to 14.4 V from 14.4 V to 30 V	%	< 0.1 < 0.25
Long-term drift (30 days)	%	< 0.25
Cut-off frequency 3dB fall in amplitude Frequency 90°	Hz	> 600 > 600

### Technical Data of Position Sensor - Current Outlet

Linearity	%	< 1
Operating pressure	bar (PSI)	to 350 (5076), static
Electrical connection for S02 model		electrical connector G4W1F Hirschmann
Contact assignment		1 - Power supply 2 - Command signal 3 - GND 4 - not used
Enclosure protection type according to EN 60529		IP 65
Operating voltage	V	20 ... 30 DC
Current	mA	< 35
Output signal range	mA	4 ... 20
Output signal range used: 0 position 1 solenoid - stroke 1.8 mm (0.07 in) 2 solenoids - stroke ±1.8 mm (0.07 in)	mA	12 4.4 ... 12 4.4 ... 19.6
Additional output signal error: - at temperature change from +10... 55° C (50... 131° F) - at impedance change beyond 50% - at input voltage change in the operating voltage range		0.2% / 10K ≤ 0.1% ≤ 0.05%
Impedance	Ω	≤ 500
Output signal ripple	mA R.M.S.	≤ 0.02
Limit frequency at 3 dB amplitude decrease	Hz	≥ 800

### Technical Data of Proportional Solenoid

Type of coil	V	12 DC	24 DC
Limiting current	A	1.9	1.1
Resistance at 20° C (68 °F)	Ω	4.7	13.9

### Electronics Data

Supply voltage with polarity inversion protection	V	11.2 ... 28 V DC (residual ripple < 10%)
Input: command signal / according to customer setting		±10 V, 0...10 V, ±10 mA, 4...20 mA, 0...20 mA, 12 mA±8 mA
Input: spool position sensor signal		0...5 V
Input: external feedback signal		0...10 V, 4...20 mA, 0...20 mA
Resolution of the A/D converter		12 bit
Output: solenoids		two PWM output stages up to max. 3.5 A
PWM frequency	kHz	18
Adjustment of parameters	μs	170
EMC	Interference resistance	61000 - 6 - 2 : 2005
	Radiation resistance	55011 : 1998 class A
Parameter setting	Serial port RS 232 (zero modem). 19200 bauds, 8 data bits, 1 stop bit, no parity. Special software PRM7 Conf.	

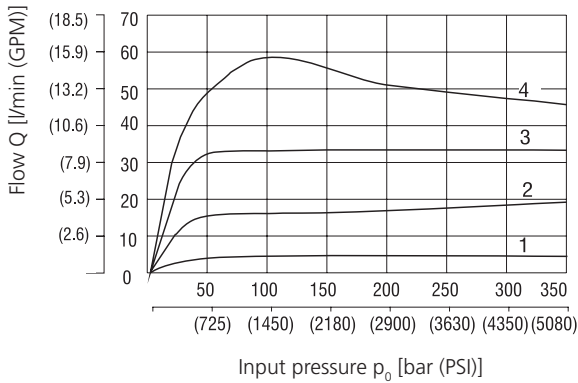
## Accessories

Order number	Content
23093400	Connecting cable to PC - length 2 m (6.56 ft), CD-ROM with program PRM7 Conf and user manual
23093500	Connecting cable to PC - length 5 m (16.40 ft), CD-ROM with program PRM7 Conf and user manual
24523400	Connecting cable to PC - length 2 m (6.56 ft)
24523500	Connecting cable to PC - length 5 m (16.40 ft)

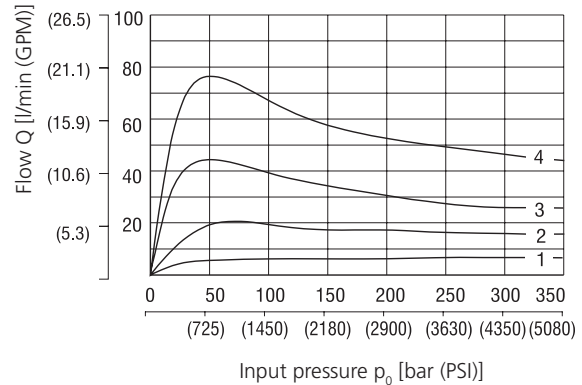
## Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$   
**Operating limits (E01 model only)**

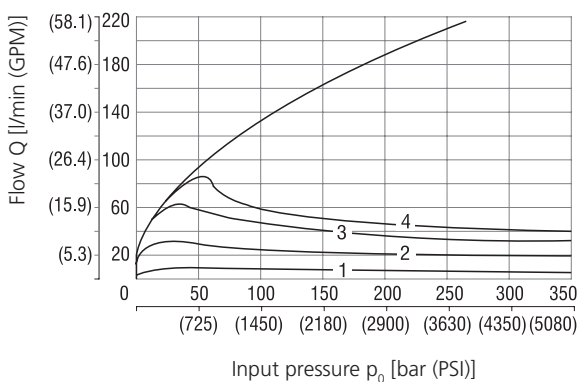
Nominal flow 30 l/min (7.9 GPM)



Nominal flow 60 l/min (15.9 GPM)



Nominal flow 80 l/min (21.1 GPM)

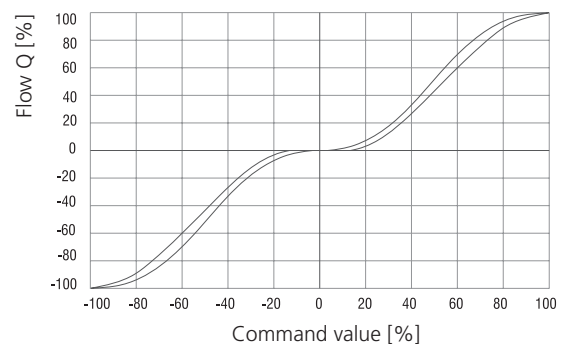


**Solenoid current:**

- 1 = 40 %
- 2 = 60 %
- 3 = 80 %
- 4 = 100 %

**Regulated flow related to control signal**

Flow characteristics (E01 model only)  $\Delta p = 10 \text{ bar}$  (145 PSI)

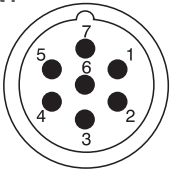


## Factory Settings

Item / Model	E01		E03	
	1 Magnet	2 Magnets	1 Magnet	2 Magnets
Control signal	0 ... 10 V	$\pm 10 \text{ V}$	0 ... 10 V	$\pm 10 \text{ V}$
Signal external feedback	-		0 ... 10 V	
Output position sensor spool	-		-	

## Connectors

### KN1



Connector KN1 - type M23 (male)	
PIN	Technical data
1	*Power supply input
2	*Ground (power supply)
3	Control signal
4	Ground (signal)
5	Power reference signal
6	Control signal of position sensor spool
7	*Protective earth lead (PE)

\*Recommended min. lead cross section 0.75 mm<sup>2</sup>

### KN2



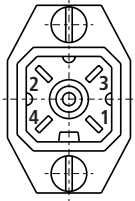
Connector KN2 - type M12x1 (male)	
PIN	Technical data
1	TxD
2	RxD
3	Ground (signal)
4	Not used

### KN3



Connector KN3 - type M12x1 (female)	
PIN	Technical data
1	Power supply output
2	Signal of external feedback
3	Ground
4	Not used
5	Not used

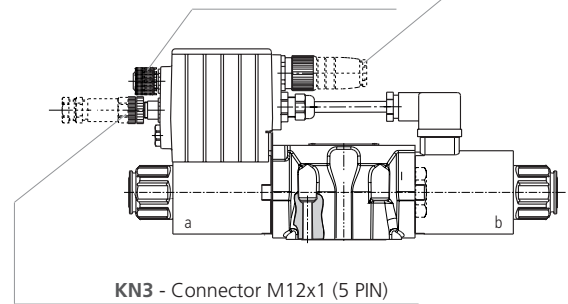
### KN4



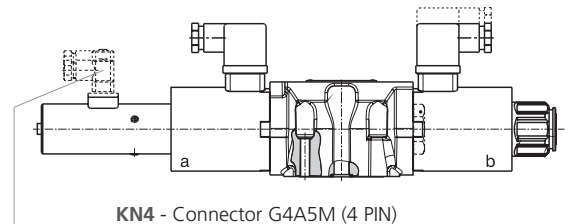
Connector KN4 - type G4A5M (male)	
PIN	Technical data
1	Power supply input
2	Power supply output
3	Ground
4	Not used

**KN1** - Main input connector M23 (7 PIN)  
Cable diameter 8 ...12 mm (0.31...0.47 in)

**KN2** - Connection RS232 M12x1 (4 PIN)  
to program the electronics



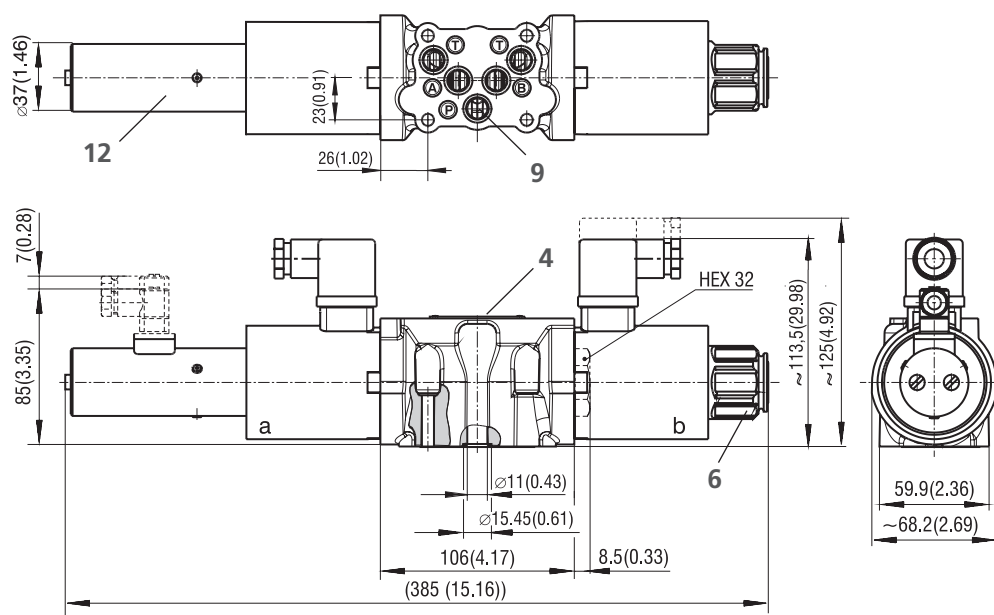
**KN3** - Connector M12x1 (5 PIN)  
Signal of external feedback  
(for configurations E03)



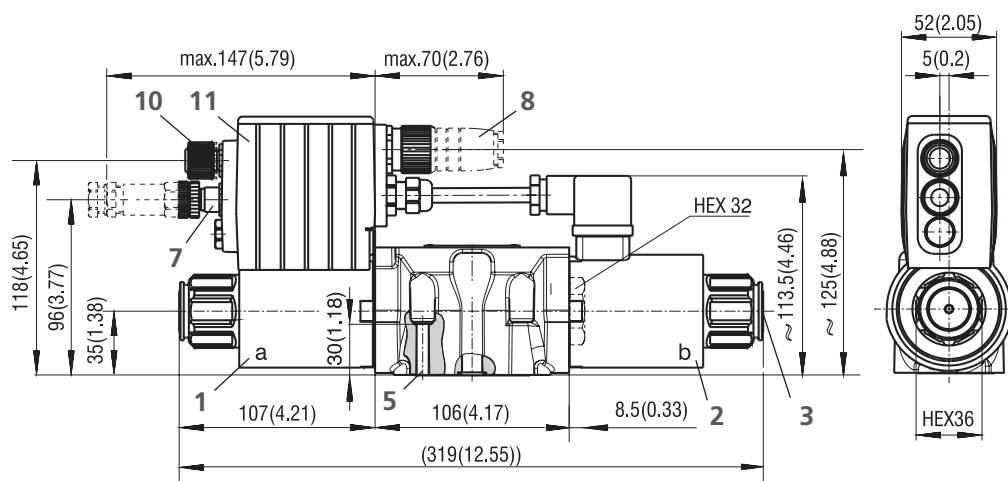
**KN4** - Connector G4A5M (4 PIN)  
Internal feedback - spool position signal  
for valve without ECU

Dimensions in millimeters (inches)

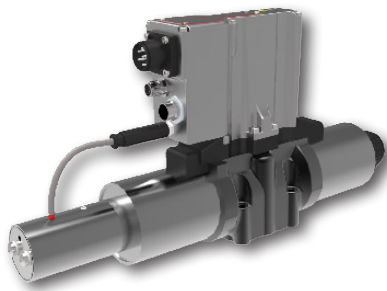
PRM7-102, 103 ... S01  
PRM7-102, 103 ... S02



PRM7-102, 103 ... E01 - without connector plug for spool position feedback  
PRM7-102, 103 ... E03



- 1 Solenoid a
- 2 Solenoid b
- 3 Manual override
- 4 Name plate
- 5 5 mounting holes
- 6 Solenoid fixing nut
- 7 Connector M12x1 for connection of external feedback
- 8 Main supply connector M23
- 9 Square ring 12.42x1.68 (5 pcs.), supplied in delivery packet
- 10 Cover of connector M12x1 for programming
- 11 Plastic box with integrated electronics
- 12 Position sensor



### Technical Features

- › Direct acting proportional control valve with integrated digital onboard electronics (OBE), proportional control, spool and process feedback
- › Control valve with subplate mounting surface acc. to ISO 4401, DIN 24340 (CETOP 05) standards
- › The valve opening and resulting flow rate can be modulated continuously in proportion to the reference signal
- › Digital electronics allows fine control of the valve spool position, reducing hysteresis and response time and optimizing the performance of the valve
- › Used for e.g. position and speed control of hydraulic actuators
- › Wide range of interchangeable spools available
- › The settings of electronics can individually be adjusted by a parametrization software
- › Easy to connect via USB ↔ Micro-USB ports
- › Optical feedback of valve status through three LEDs
- › The valve is zinc-coated with the enhanced surface corrosion protection 520 h in NSS acc. to ISO 9227
- › High hydraulic power limits and smooth running characteristic
- › Improved shock and vibration behavior
- › CANopen connectivity

### Functional Description

The proportional directional control valve PRM9 consists of a cast iron housing, a special control spool, two centering springs with supporting washers, one or two proportional solenoids, a position sensor and a digital onboard electronic. The measurement system of the position sensor is based on a differential transformer with a sensor core and its electronic evaluation unit.

The unit, containing the digital onboard electronics, is mounted on the valve housing. Due to this, the solenoids are able to be connected directly to the electronics without any cabling at all. The connection of the position sensor to the control unit is provided by a cable.

For main contacting of the digital electronics, the MIL-C5015 (6 + PE) connector is available for connecting the supply, the setpoint signal and monitor signal of the internal piston position. Other connection possibilities are directly related to the selected valve variant. These are, in detail, M12 x 1, 5-pin, for the bus connection in the standard version CANopen and also M12 x 1, 5-pin, for connecting an external sensor (of an external process variable).

The digital control unit utilizes pulse-width-modulation (PWM) and supplies the solenoids with current, proportionally to the control signal. The supply current is additionally modulated with a dither frequency and an amplitude.

Further / individual functional parameters like ramp, offset, deadband, max. current, etc. can be adjusted with the PRM9 parametrization software. Therefore, a standard computer can be connected with the valve by USB (USB-A (PC) ↔ μ-USB (valve)).

The factory configuration is set individually for each valve. The configuration data file as well as the parametrization software and the fieldbus data file can be downloaded from the ARGO-HYTOS website.

#### The PRM9 is available with following model options:

##### Models with standard OBE

- E02S02** internal spool position feedback
- E04S02** internal spool position and external feedback

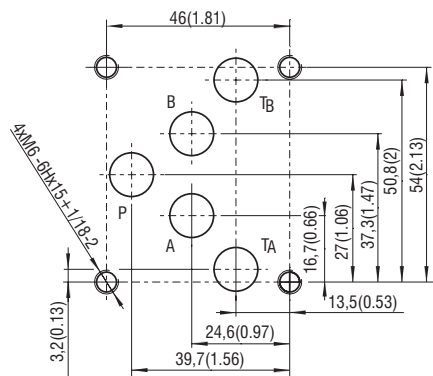
##### Models with OBE and CANopen connectivity

- E02S02-CA** internal spool position feedback, CANopen connectivity
- E04S02-CA** internal spool position and external feedback and CANopen connectivity

All models are equipped with an optical feedback (standard: 2 LEDs; with CANopen: 3 LEDs). The flash code of the LED indicates the current status of the valve (for further details see the operating manual of the valve). As a standard, the proportional valve is delivered with factory setting. For a model including an external feedback (E04), contact the manufacturer for specific data.

## Technical Data

ISO 4401-05-04-0-05



Ports P, A, B, T - max. Ø11.2 mm (0.44 in)

Valve size		10 (D05)
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5100)
Max. operating pressure at port T	bar (PSI)	210 (3046)
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)
Fluid temperature range (FPM)	°C (°F)	-20 ... +80 (-4 ... +176)
Ambient temperature max.	°C (°F)	-40 ... +50 (-40... +122)
Nominal flow rate $Q_n$ at $\Delta p=10$ bar (145 PSI)	l/min (GPM)	30 (7.9) / 60 (15.9)
Hysteresis - closed position loop	%	< 0.5
Protection degree EN 60 529		IP65 & IP67
Weight - valve with 1 solenoid - valve with 2 solenoids	kg (lbs)	5.1 (11.2) 6.6 (14.6)
Shock & vibration		Sinus 10 g, max ampl. 0.75 mm, 10-2000 Hz Shock 30 g, half sinus 11ms
Electromagnetic compatibility (EMC)		DIN EN 61000-4-2 DIN EN 61000-4-3 DIN EN 61000-4-4 DIN EN 61000-4-5 DIN EN 61000-4-6 DIN EN 61000-4-8
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Coil types / Connectors	C_8007 / K_8008	
Mounting interface	SMT_0019	Size 10
Spare parts	SP_8010	
Subplates	SP_0002	DP*-10

## Ordering Code

PRM9-10  /  -    -

Proportional Directional Control Valve, with Digital Onboard Electronics and Internal Feedback

Valve size

Spool symbols

see the table „Spool Symbols“

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

flow 30 l/min (7.9 GPM)

flow 60 l/min (15.6 GPM)

30

60

Nominal solenoid supply voltage

24V DC

24

No designation  
V

A  
B

Standard installation side of position transducer acc. of Spool Symbols table, other version consult with factory for their feasibility and availability

Surface treatment  
zinc-coated (ZnNi), ISO 9227 (520 h)

Seals  
NBR  
FPM (Viton)

Installation side of position transducer  
spool position transducer at side of port „A“  
spool position transducer at side of port „B“

E02S02

E04S02

E02S02-CA

E04S02-CA

OBE, spool position transducer  
OBE, spool position transducer and external feedback  
OBE CANopen, spool position transducer  
OBE CANopen, spool position transducer and external feedback

- For proportional valves with two solenoids, one solenoid must be de-energized before the other solenoid can be charged.
- Mounting bolts M6 x 40 DIN 912-10.9 or studs must be ordered separately. Tightening torque is 14 Nm (10.3 lbf.ft).
- Besides the shown, commonly used valve versions other special models are available.
- Contact our technical support for their identification, feasibility and operating limits.

## Spool Symbols

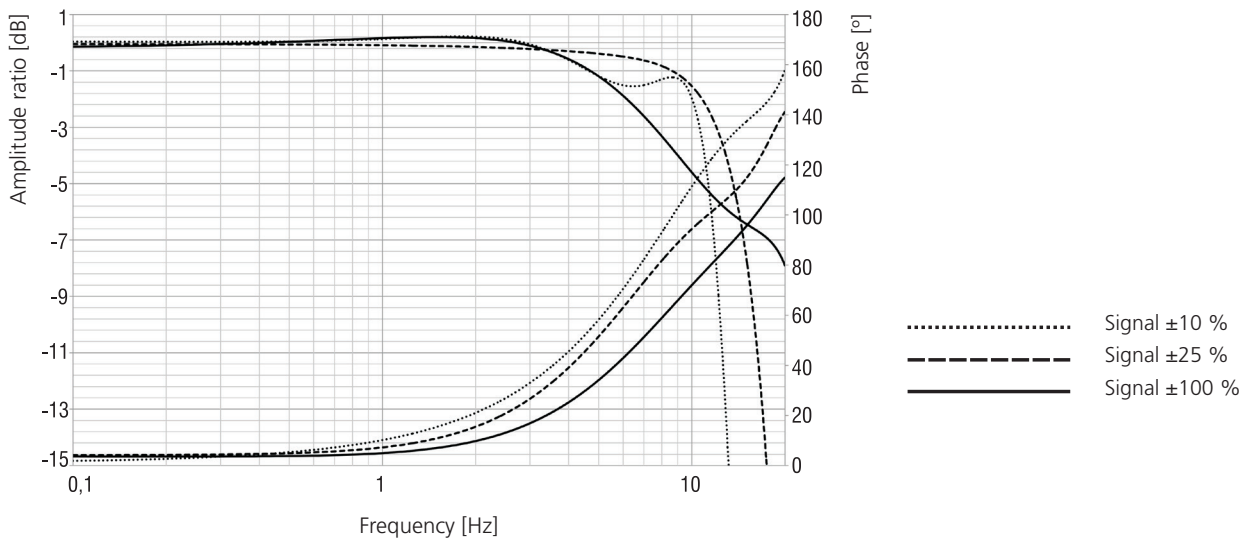
Type	Symbol	Type	Symbol
2Z51		3Z11	
2Z11			
2Y51		3Y11	
2Y11			

### Technical Data of Proportional Directional Control Valve

Solenoid data		
Type of coil	V	24
Limiting current	A	2.5
Resistance at 20 °C (68 °F)	Ω	4.73

Electronics Data		
Supply voltage with polarity inversion protection	V	19.2...24...28
Input		
Command signal (according to customer setting)		±10 V; 5±5 V; 0...10 V; 0...24 V; 12±12 V; ±10 mA; 12±8 mA; 0...20 mA; 4...20 mA
External feedback signal (according to customer setting)		±10 V; 0...10 V; 0...Uref; Uref/2 ± Uref; ±10 mA; 0...20 mA; 4...20 mA
Output		
Spool position of monitoring signal	V	±10 V
Output current to solenoids	A	2x PWM output stages up to 4 A
Resolution of the A/D converter	bit	12
PWM frequency	kHz	18
Cycle time	μs	200
Parameter setting: By PRM9 parametrization software. Connection via USB-A to μ-USB cable		

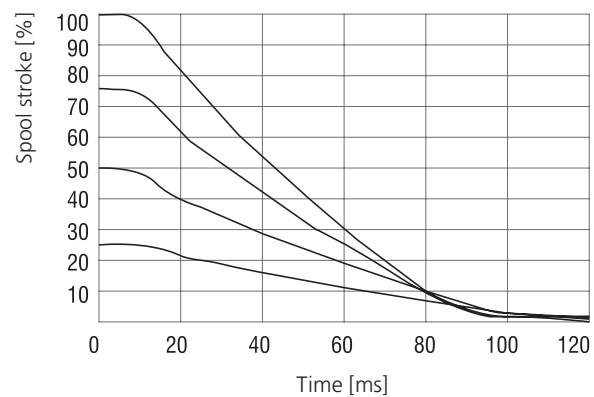
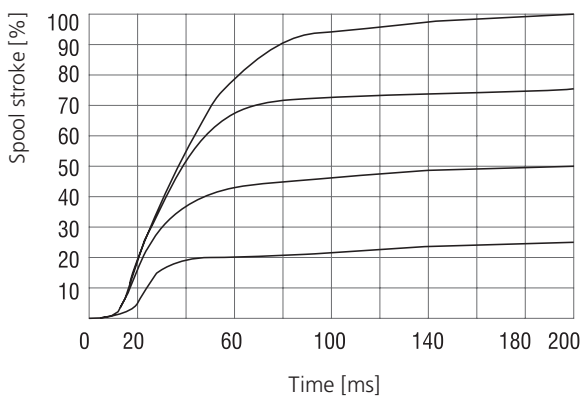
### Frequency Response closed position loop, for E02S02 model



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

#### Step response

- E02S02 model only (internal position feedback)

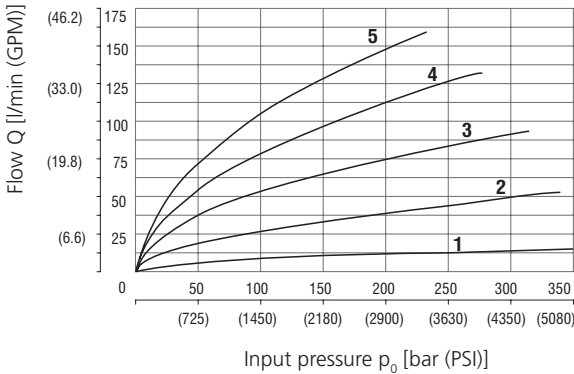




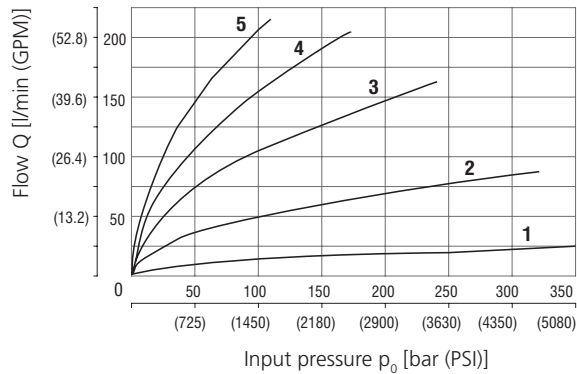
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Operating limits:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$   
 - E02S02 model only

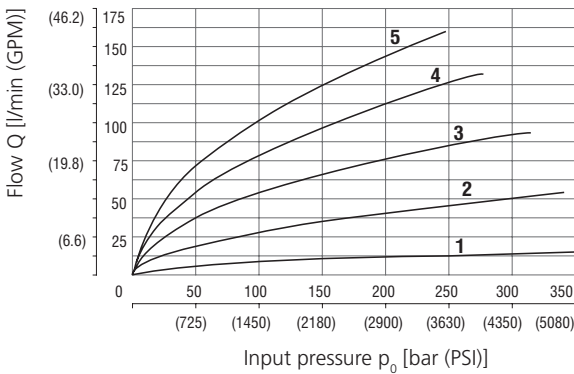
**Z11/30** Nominal flow 30 l/min (7.9 GPM)



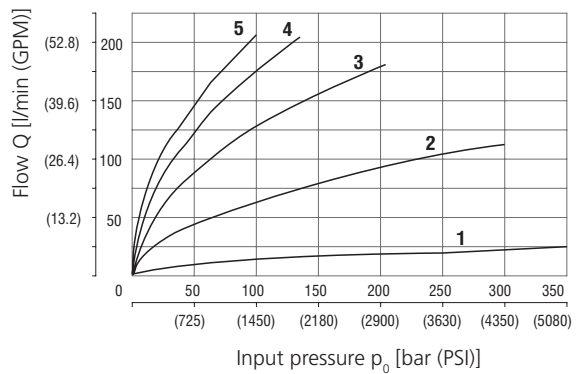
**Z11/60** Nominal flow 60 l/min (15.9 GPM)



**Y11/30** Nominal flow 30 l/min (7.9 GPM)



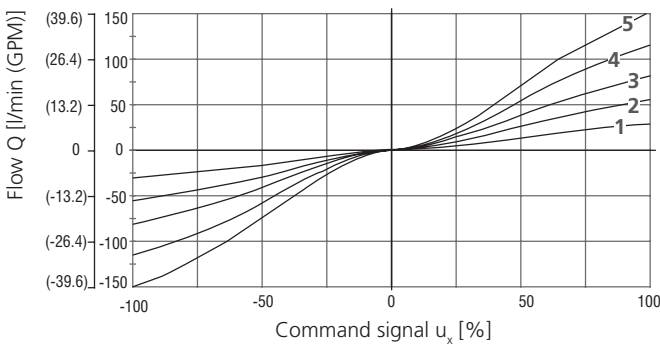
**Y11/60** Nominal flow 60 l/min (15.9 GPM)



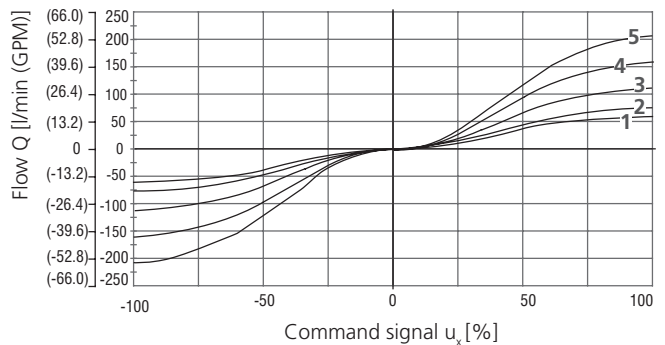
**Command signal:**  
 1 = 20 %  
 2 = 40 %  
 3 = 60 %  
 4 = 80 %  
 5 = 100 %

**Flow characteristics:** Flow direction  $P \rightarrow A / B \rightarrow T$  or  $P \rightarrow B / A \rightarrow T$   
 - E02S02 model only

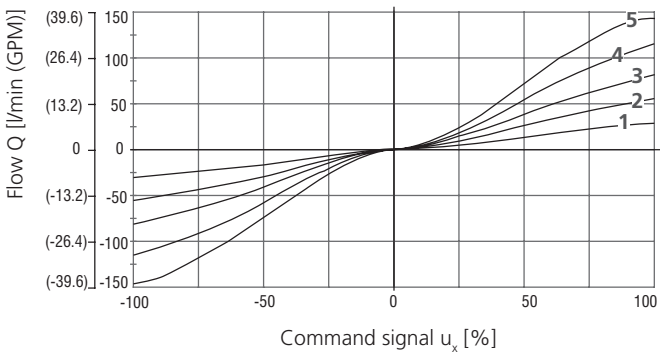
**Z11/30** Nominal flow 30 l/min (7.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



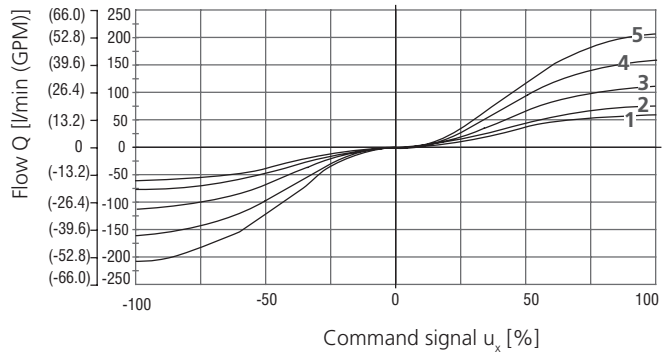
**Z11/60** Nominal flow 60 l/min (15.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



**Y11/30** Nominal flow 30 l/min (7.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



**Y11/60** Nominal flow 60 l/min (15.9 GPM) at  $\Delta p = 10 \text{ bar}$  (145 PSI)



$\Delta p$  = Valve pressure differential  
 (input pressure  $p_0$  minus load pressure and return pressure  $p_r$ )

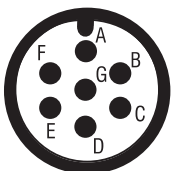
1	$\Delta p = 10 \text{ bar}$ (145 PSI)	4	$p_0 = 200 \text{ bar}$ (2900 PSI)
2	$p_0 = 50 \text{ bar}$ (725 PSI)	5	$p_0 = 350 \text{ bar}$ (5076 PSI)
3	$p_0 = 100 \text{ bar}$ (1450 PSI)		

## Factory Settings

Item	Model							
	E02S02		E04S02		E02S02-CA		E04S02-CA	
	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets	1 Magnet	2 Magnets
Command signal	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V
Signal external feedback	-	-	0...10 V		-	-	0...10 V	
Spool position of monitoring signal	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V	0...10 V	±10 V

## Connectors

10



Main supply connector 6+PE MIL (EN 175201-804)

PIN	Technical data
A	Supply 24 V
B	GND (Supply)
C	GND (Monitor)
D	INPUT
E	GND (Input)
F	Monitor
G	PE

9



Connector M12x1, plug (5-pol, A-Code), CANopen (optional)

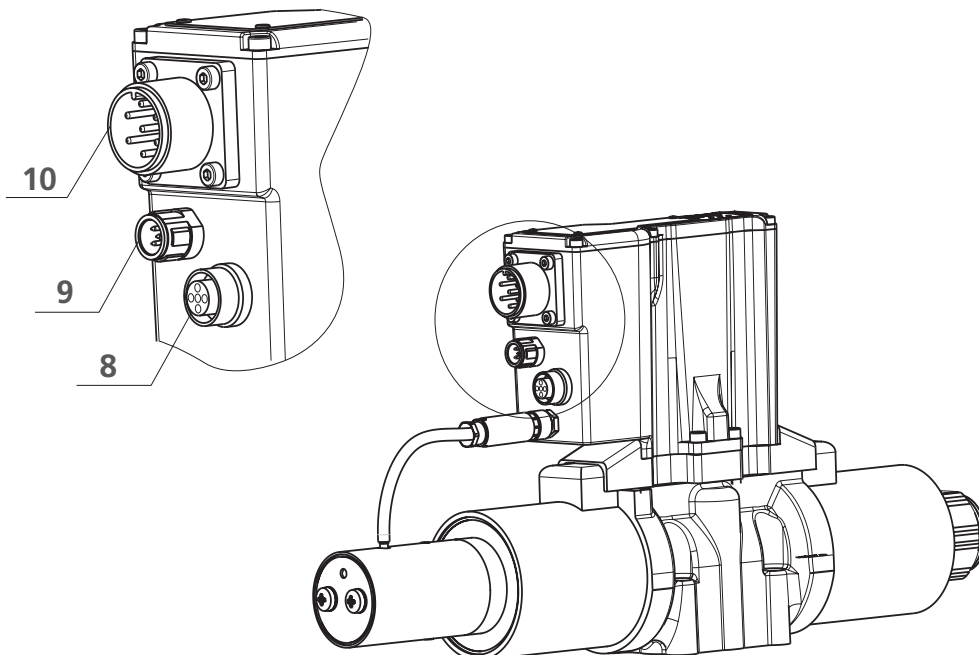
PIN	Technical data
1	n.c.
2	n.c.
3	CAN GND
4	CAN HIGH
5	CAN LOW

8

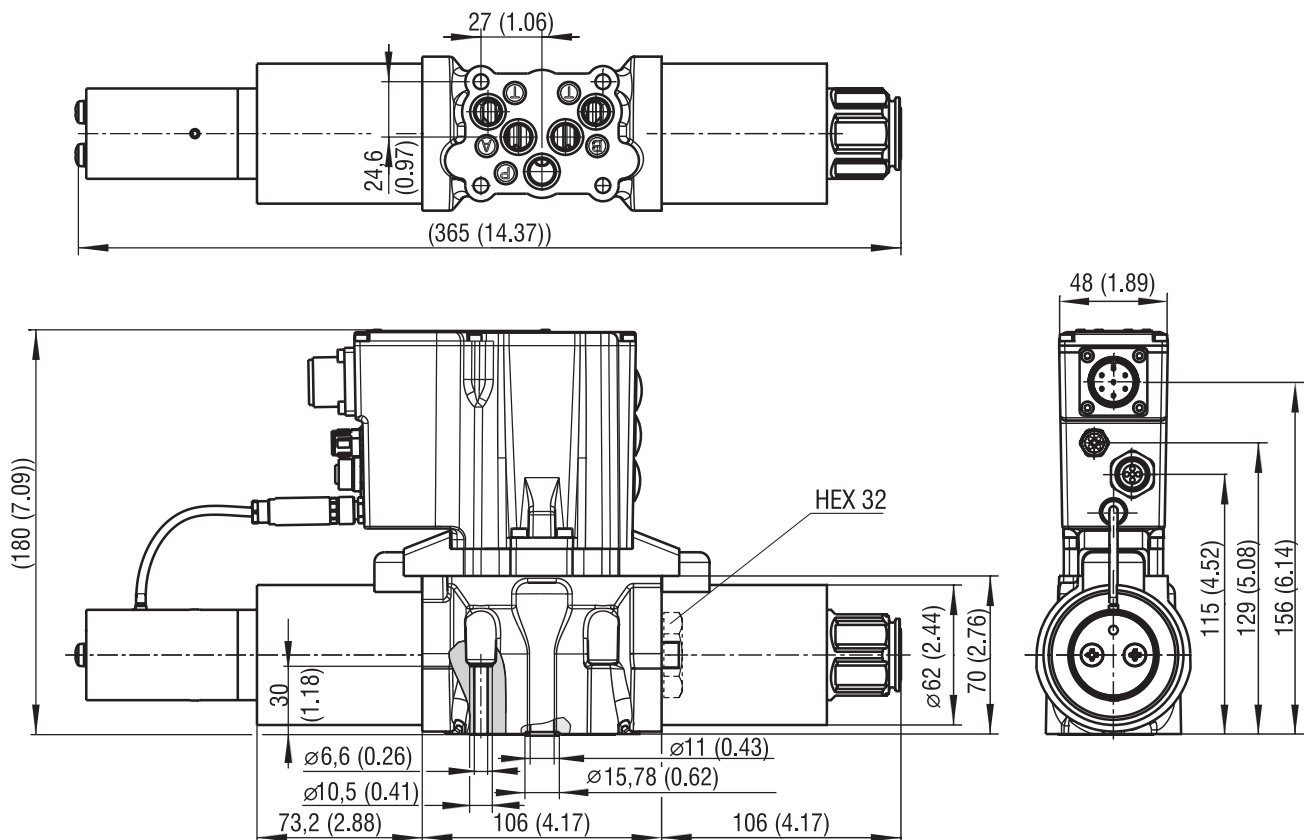


Connector M12x1, socket (5-pol, A-Code), external feedback (optional)

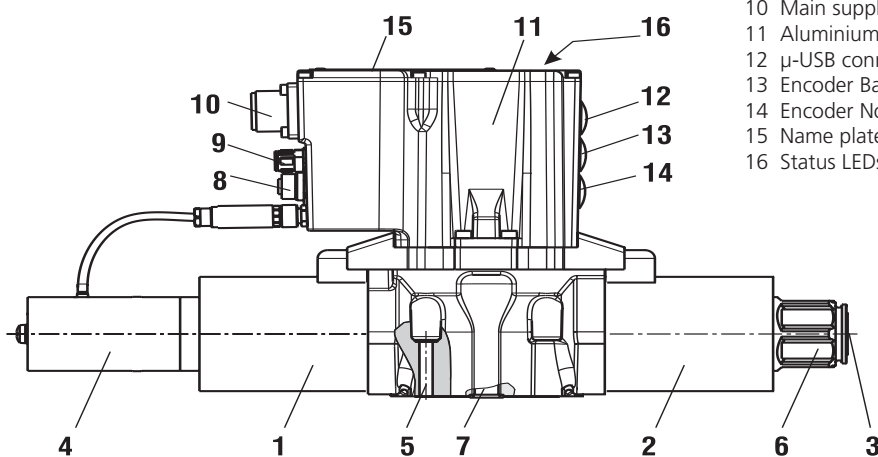
PIN	Technical data
1	Supply 24 V
2	Signal
3	GND
4	n.c.
5	n.c.



Dimensions in millimeters (inches)



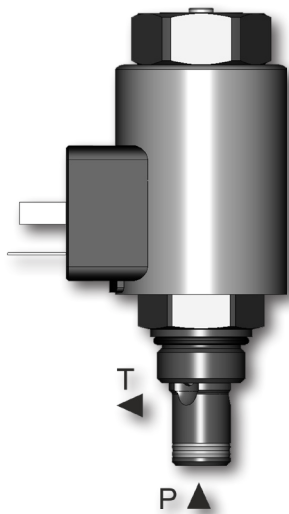
- 1 Solenoid a
- 2 Solenoid b
- 3 Manual override
- 4 Position sensor
- 5 4 mounting holes
- 6 Solenoid fixing nut
- 7 Square ring 12.42x1.68 (5. pcs.),supplied in delivery packe
- 8 Connector M12x1, socket (5-pol, A-Code), external feedback (optional)
- 9 Connector M12x1, plug (5-pol, A-Code), CANopen (optional)
- 10 Main supply connector 6+PE MIL (EN 175201-804)
- 11 Aluminium housing with integrated digital electronics
- 12  $\mu$ -USB connection
- 13 Encoder Baud Rate (optional)
- 14 Encoder Node-ID (optional)
- 15 Name plate
- 16 Status LEDs



## Proportional Pressure Relief Valve, Direct Acting

### SR1P2-A2

3/4-16 UNF •  $Q_{max}$  1.5 l/min (0.40 GPM) •  $p_{max}$  350 bar (5100 PSI)



#### Technical Features

- › Pressure in the circuit increases proportional to increasing electric command signal
- › Low hysteresis and accurate pressure control
- › Wide pressure range up to 350 bar
- › Pilot valve for valves SR4P2-B2 and SP4P2-B3 or a direct acting valve for small flow up to 1,5 l/min
- › Optional electrical terminal of solenoid: EN 175301-803-A, AMP Junior Timer or Deutsch DT04-2P
- › Coil supply voltage 12 or 24 V DC
- › In the standard version, the valve is zinc-coated for 240 h protection in NSS acc. to ISO 9227

#### Functional Description

Screw-in cartridge proportional pressure relief valve, pilot operated, with connection thread 3/4-16 UNF. The valve maintains the constant pressure in the circuit proportional to the input command signal. The valve does not have a mechanical stroke limitation and thus cannot be used as a safety valve. Air bleeding is necessary for the correct function of the valve.

Installation: When possible, the valve should be mounted below the reservoir oil level. This will maintain oil in the actuator, preventing instability caused by air in the system. If possible, to achieve the best result, mount the valve vertically above the bleed screw and ensure proper air bleeding.

Note: back pressure in T-channel automatically increases the set cracking pressure of the valve in a ratio of 1:1

#### Technical Data

Valve size / Cartridge cavity		3/4-16 UNF-2A / A2 (C-8-2)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow	l/min (GPM)	1.5 (0.40)	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... 176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... 248)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... 176)	
Hysteresis	%	< 5	
<b>Solenoid data</b>			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0.6
Rated resistance at 20 °C (68 °F)	Ω	6.5 ± 5 %	20.6 ± 5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	200	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc.to EN 60529**		IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.44 (0.97)	
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types	C_8007	C19B*	
Valve bodies	In-line mounted	SB_0018	SB-A2*
	Sandwich mounted	SB-04(06)_0028	SB-*A2*
Cavity details / Form tools	SMT_0019	SMT-A2*	
Spare Parts	SP_8010		

\*\*The indicated IP protection level is only reached with a properly mounted connector.

#### Dimensions in millimeters (inches)

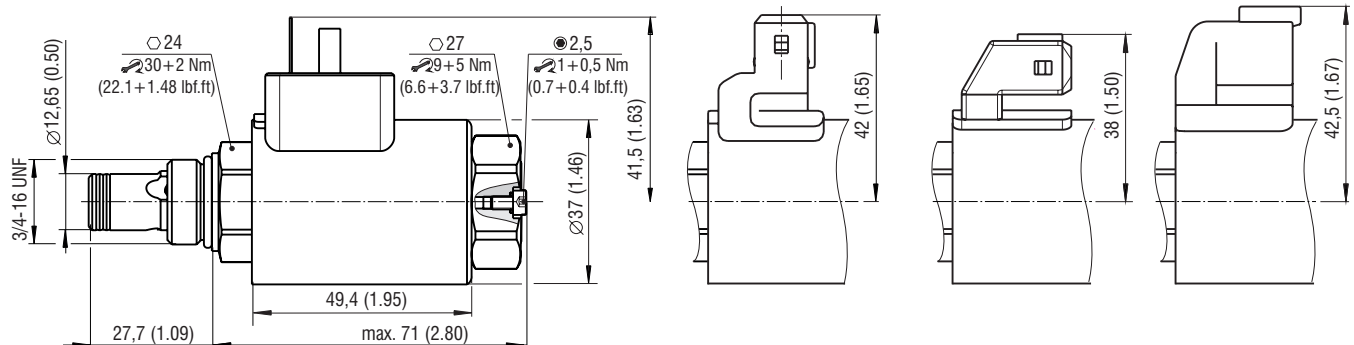
##### Connector type

E1, E2 - IP65  
EN 175301-803-A

E3, E4 - IP67  
AMP Junior Timer  
- radial

E3A, E4A - IP67  
AMP Junior Timer  
- axial

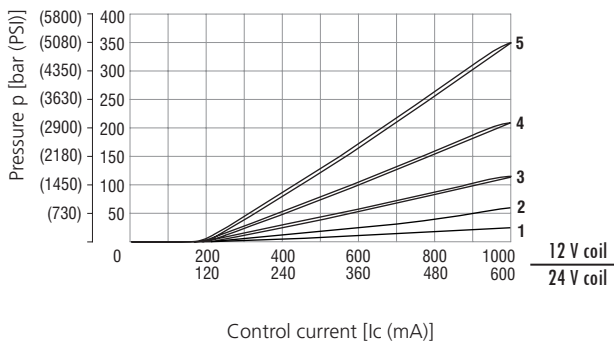
E12A, E13A  
- IP67 / IP69K  
Deutsch DT04-2P



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

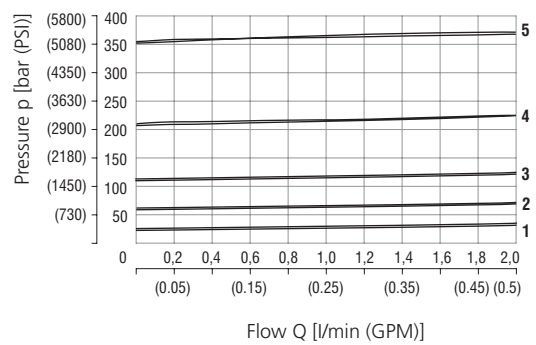
**Relief pressure related to control signal**

$Q=0.2 \text{ l/min}$  (0.05 GPM), pressure in port T=0 bar, PWM 160Hz



Pressure range	3	6	12	21	35
	1	2	3	4	5

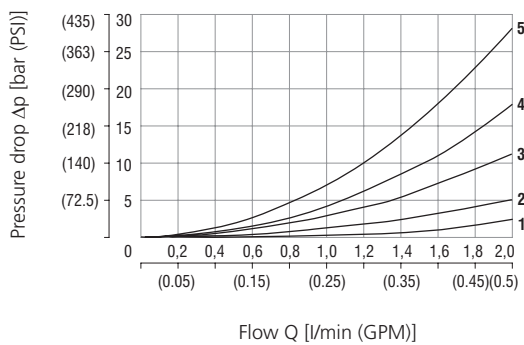
**Relief pressure related to flow rate**



Pressure range	3	6	12	21	35
	1	2	3	4	5

**Pressure drop related to flow rate**

0% of control current, P-T direction



Pressure range	3	6	12	21	35
	1	2	3	4	5



**Attention:**

The proportional pressure relief valve is not mechanically protected and it does not perform the relief valve function.

**Ordering Code**

SR1P2 - A2 / H [ ] - [ ] [ ] [ ] - [ ]

**Proportional Pressure Relief Valve, Direct Acting**

**Valve cavity**  
3/4-16 UNF (C-8-2)

**Model**  
High performance

**Max. reduced pressure**  
up to 30 bar (435 PSI) **3**  
up to 60 bar (870 PSI) **6**  
up to 120 bar (1740 PSI) **12**  
up to 210 bar (3046 PSI) **21**  
up to 350 bar (5076 PSI) **35**

**Supply voltage / max. current**  
12 V DC / 1 A **12**  
24 V DC / 0.6 A **24**

**Surface treatment**  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
**No designation** NBR  
**V** FPM (Viton)

**Connector type**  
EN 175301-803-A  
**E1** E1 with quenching diode  
**E2** AMP Junior Timer - radial direction (2 pins; male)  
**E3** E3 with quenching diode  
**E4** AMP Junior Timer - axial direction (2 pins; male)  
**E3A** E3A with quenching diode  
**E4A** E4A with quenching diode  
**E12A** Deutsch DT04-2P - axial direction  
**E13A** E12A with quenching diode

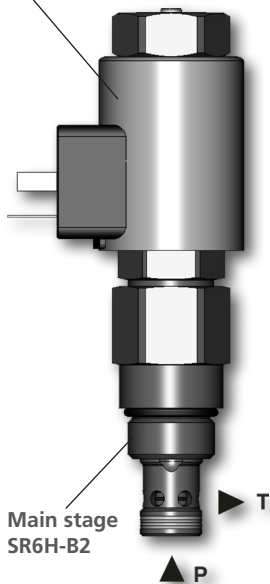
For other solenoid terminals see data sheet No. 8007

## Proportional Pressure Relief Valve, Pilot Operated

### SR4P2-B2

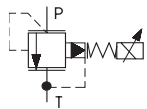
7/8-14 UNF •  $Q_{max}$  80 l/min (21 GPM) •  $p_{max}$  350 bar (5100 PSI)

Pilot stage  
SR1P2-A2



Main stage  
SR6H-B2

Symbol



### Technical Features

- › Pressure in the circuit increases proportional to increasing electric command signal
- › Low hysteresis, accurate pressure control and low pressure drop
- › Wide pressure range up to 350 bar
- › High flow capacity up to 80 l/min
- › Optional electrical terminal of solenoid: EN 175301-803-A, AMP Junior Timer or Deutsch DT04-2P
- › Coil supply voltage 12 or 24 V DC
- › In the standard version, the valve is zinc-coated for 240 h protection in NSS acc. to ISO 9227

### Functional Description

Screw-in cartridge proportional pressure relief valve, pilot operated. The complete valve consists of a pilot stage - valve SR1P2-A2 and a main stage with connection thread 7/8-14 UNF. The valve maintains the constant pressure in the circuit proportional to the input command signal. The valve does not have a mechanical stroke limitation and thus cannot be used as a safety valve. Air bleeding is necessary for the correct function of the valve.

Installation: When possible, the valve should be mounted below the reservoir oil level. This will maintain oil in the actuator, preventing instability caused by air in the system. If possible, to achieve the best result, mount the valve vertically above the bleed screw and ensure proper air bleeding.

Note: back pressure in T-channel automatically increases the set cracking pressure of the valve in a ratio of 1:1

### Technical Data

Valve size / Cartridge cavity		7/8-14 UNF-2A / B2 (C-10-2)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow	l/min (GPM)	80 (21.1)	
Fluid temperature range (NBR)	°C (°F)	-30...+80 (-22...+176)	
Fluid temperature range (FPM)	°C (°F)	-20...+120 (-4...+248)	
Ambient temperature range	°C (°F)	-30...+80 (-22...+176)	
Min. setting pressure	bar (PSI)	7 bar (101.5 PSI) for 5 l/min (1.32 GPM)	
Hysteresis	%	< 5	
Solenoid data			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0.6
Rated resistance at 20 °C (68 °F)	Ω	6.5±5 %	20.6±5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	250	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.58 (1.28)	
	Data Sheet	Type	
General information			
	GI_0060	Products and operating conditions	
Coil types	C_8007	C19B*	
Valve bodies	In-line mounted	SB_0018	SB-B2*
Cavity details / Form tools	SMT_0019	SMT-B2*	
Spare parts	SP_8010		

\*\*The indicated IP protection level is only reached with a properly mounted connector.

### Dimensions in millimeters (inches)

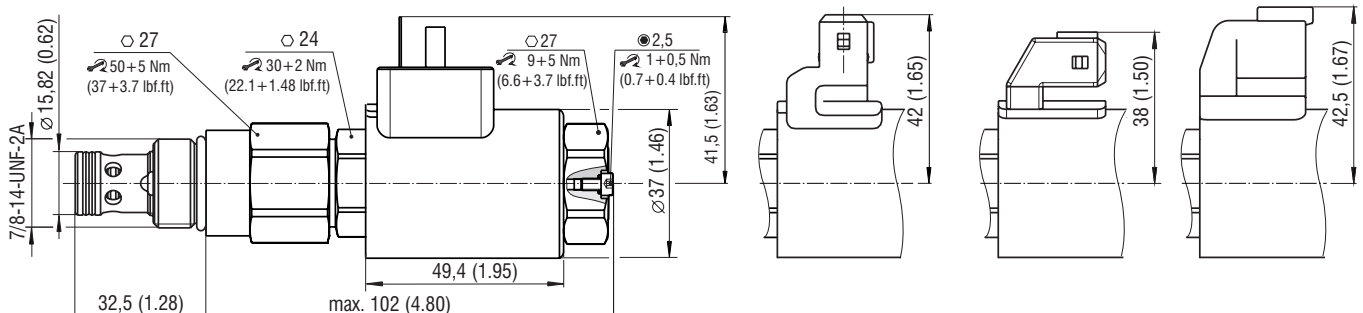
#### Connector type

E1, E2 - IP65  
EN 175301-803-A

E3, E4 - IP67  
AMP Junior  
Timer - radial

E3A, E4A - IP67  
AMP Junior  
Timer - axial

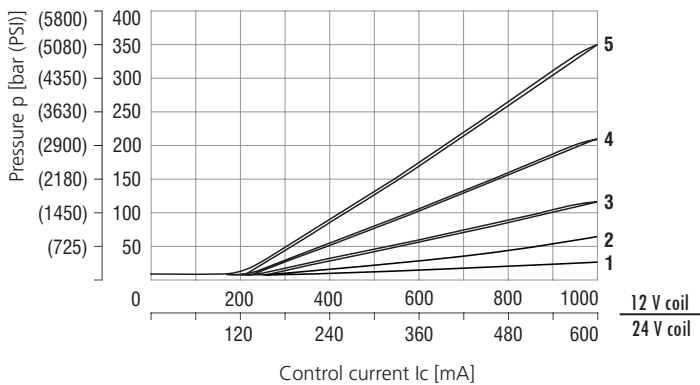
E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P



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

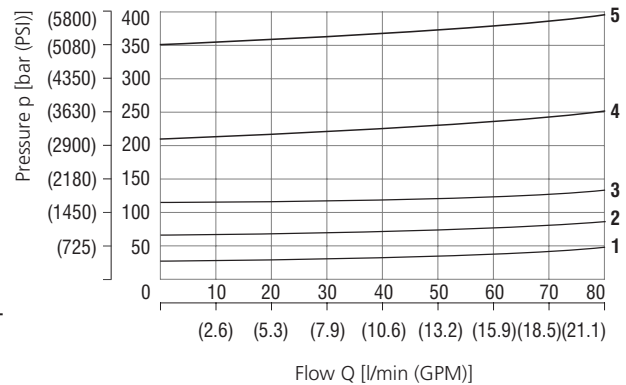
**Relief pressure related to control signal**

Q=5 l/min (1.32 GPM), pressure in port T=0 bar, PWM 160Hz



Pressure range	3	6	12	21	35
	1	2	3	4	5

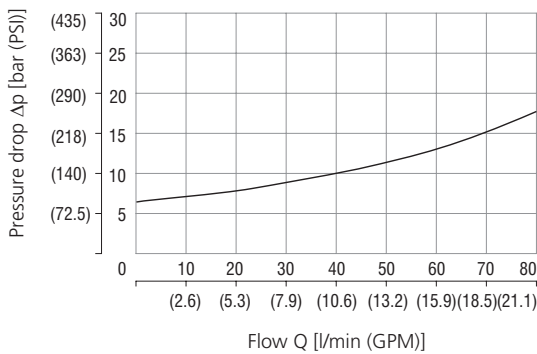
**Relief pressure related to flow rate**



Pressure range	3	6	12	21	35
	1	2	3	4	5

**Pressure drop related to flow rate**

0% of control current, P-T direction



**Attention:**

The proportional pressure relief valve is not mechanically protected and it does not perform the relief valve function.

**Ordering Code**

SR4P2 - B2 / H [ ] - [ ] [ ] - [ ]

**Proportional Pressure Relief Valve, Pilot Operated**

**Valve cavity**  
7/8-14 UNF-2A (C-10-2)

**Model**  
High performance

**Max. reduced pressure**  
up to 30 bar (435 PSI) **3**  
up to 60 bar (870 PSI) **6**  
up to 120 bar (1740 PSI) **12**  
up to 210 bar (3046 PSI) **21**  
up to 350 bar (5076 PSI) **35**

**Supply voltage / max. current**  
12 V DC / 1.0 A **12**  
24 V DC / 0.6 A **24**

**Surface treatment**  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

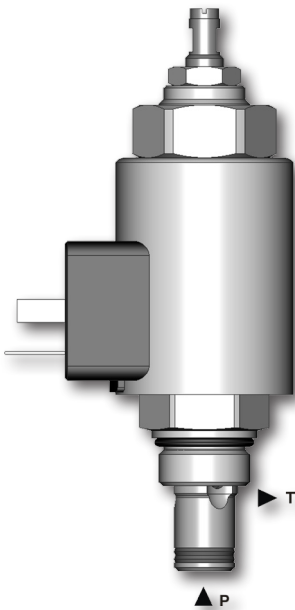
**Seals**  
**No designation** NBR  
**V** FPM (Viton)

**Connector type**  
EN 175301-803-A  
**E1** E1 with quenching diode  
**E2** AMP Junior Timer - radial direction (2 pins; male)  
**E3** E3 with quenching diode  
**E4** AMP Junior Timer - axial direction (2 pins; male)  
**E3A** E3A with quenching diode  
**E4A** AMP Junior Timer - axial direction (2 pins; male)  
**E12A** E12A with quenching diode  
**E13A** E13A with quenching diode

Main stage ordering key: SR6H-B2/HV

For other solenoid terminals see data sheet No. 8007

# SRN1P1-A2

 3/4-16 UNF •  $Q_{max}$  1.5 l/min (0.40 GPM) •  $p_{max}$  350 bar (5100 PSI)


## Technical Features

- › Decreasing pressure output proportional with increasing DC current input
- › Low hysteresis, accurate pressure control
- › Wide pressure range up to 350 bar
- › Mechanical adjustment of minimum cracking pressure
- › Solenoid electrical terminal option acc. to EN 175301-803-A, AMP Junior Timer or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › Usable as pilot stage of SRN4P1-B2 and SPN4P1-B3 proportional valves
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

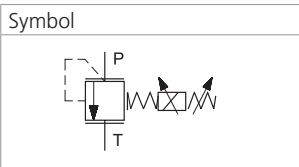
## Functional Description

A direct operated proportional poppet pressure relief valve in the form of a screw-in cartridge. The valve is designed for continuous regulation of system pressure. It is used mostly as a pilot stage. To set the minimum cracking pressure use the adjusting screw (s=5) which incorporates also the air bleed screw. Back pressure on port T becomes additive to the pressure setting of the valve. Air bleeding is necessary for the correct function of the valve. Installation: When possible, the valve should be mounted below the reservoir oil level. This will keep oil in the actuator at all times, preventing instability caused by air enclosures. If this is not possible, mount the valve for best results vertically downward with proper air bleeding.

## Technical Data

Valve size / Cartridge cavity		3/4-16 UNF-2A / A2 (C-8-2)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow	l/min (GPM)	1.5 (0.40)	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... 176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... 248)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... 176)	
Hysteresis	%	< 5	
Solenoid data			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0,6
Rated resistance at 20 °C (68 °F)	Ω	6.5 ± 5 %	20.6 ± 5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	160 - 200	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc.to EN 60529**		IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.44 (0.97)	
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types	C_8007	C19B*	
Valve bodies	In-line mounted	SB_0018	SB-A2*
	Sandwich mounted	SB-04(06)_0028	SB-*A2*
Cavity details / Form tools	SMT_0019	SMT-A2*	
Spare Parts	SP_8010		

\*\*The indicated IP protection level is reached only with a properly mounted connector.



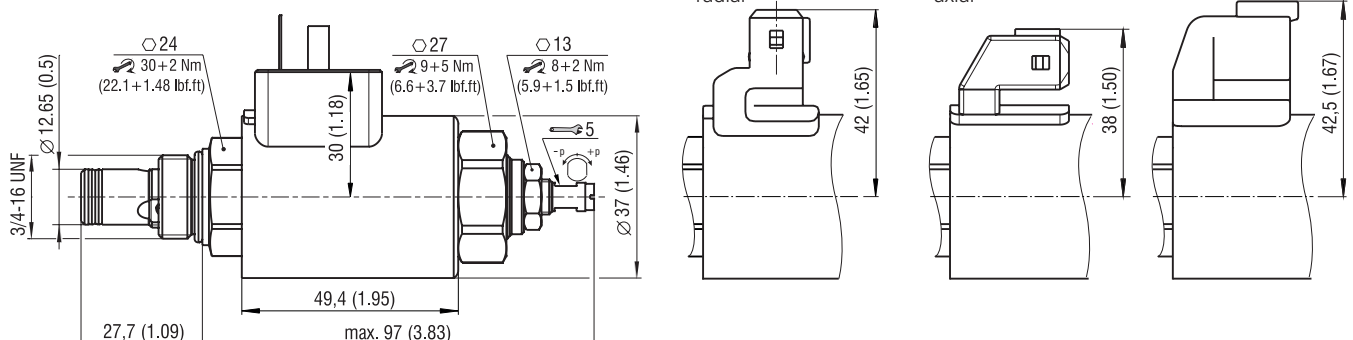
## Dimensions in millimeters (inches)

### Connector type

 E1, E2 - IP65  
 EN 175301-803-A

 E3, E4 - IP67  
 AMP Junior Timer  
 - radial

 E3A, E4A - IP67  
 AMP Junior Timer  
 - axial

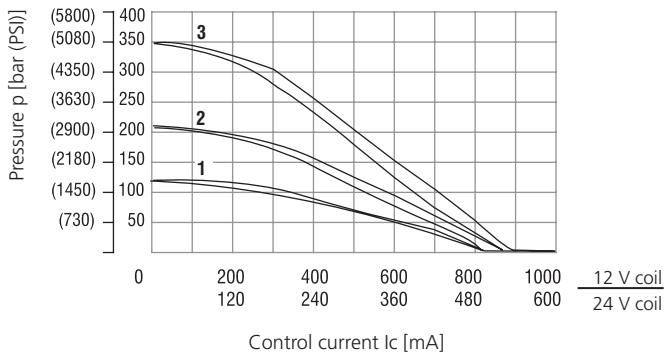
 E12A, E13A - IP67 / IP69K  
 Deutsch DT04-2P




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

**Relief pressure related to control signal**

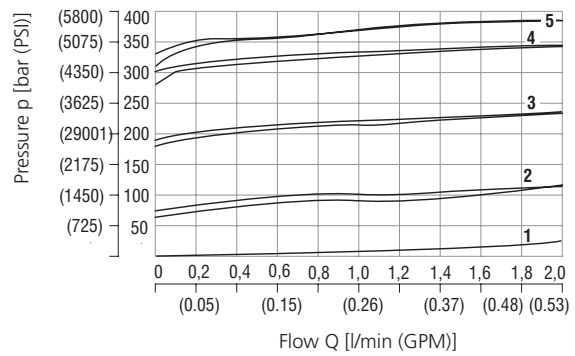
$Q=0.2 \text{ l/min}$  (0.05 GPM), pressure in port T=0 bar, PWM 160Hz



Pressure range	12	21	35
	1	2	3

**Relief pressure related to flow rate**

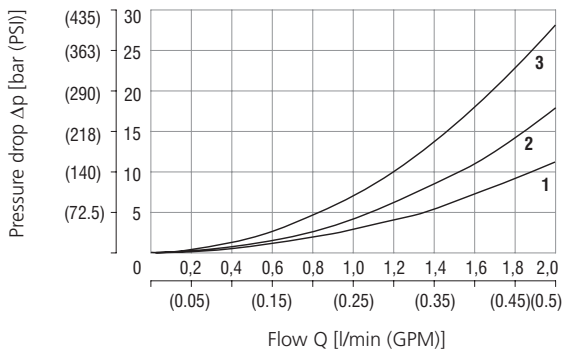
Pressure range 35, various control currents



Control current	1	2	3	4	5
	100 % $I_{max}$	75 % $I_{max}$	50 % $I_{max}$	25 % $I_{max}$	0 % $I_{max}$

**Pressure drop related to flow rate**

100% of control current, P-T direction



Pressure range	12	21	35
	1	2	3

**Ordering Code**

SRN1P1 - A2 / H - - - -

**Proportional pressure control valve, relieving, direct-acting, inverted**

**Valve cavity**  
3/4-16UNF (C-8-2)

**Model**  
High performance

**Max. regulated pressure**  
up to 120 bar (1740 PSI) **12**  
up to 210 bar (3046 PSI) **21**  
up to 350 bar (5076 PSI) **35**

**Supply voltage / max. current**  
12 V DC / 1 A **12**  
24 V DC / 0.6 A **24**

**Surface treatment**  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
**No designation** NBR  
**V** FPM (Viton)

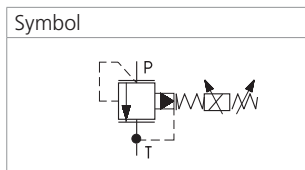
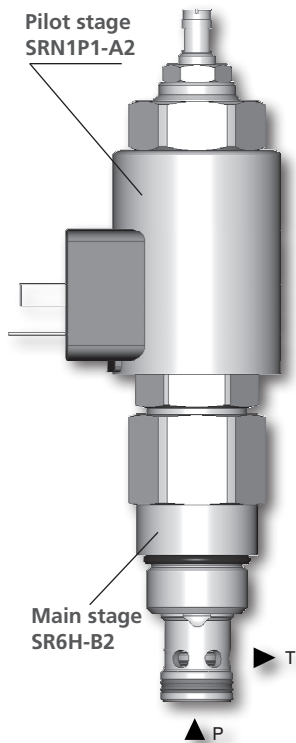
**Connector type**  
EN 175301-803-A  
**E1** E1 with quenching diode  
**E2** E2 with quenching diode  
**E3** AMP Junior Timer - radial direction (2 pins; male)  
**E4** E3 with quenching diode  
**E3A** AMP Junior Timer - axial direction (2 pins; male)  
**E4A** E3A with quenching diode  
**E12A** Deutsch DT04-2P - axial direction  
**E13A** E12A with quenching diode

For other solenoid terminals see data sheet No. 8007

Proportional Pressure Control Valve, Relieving, Pilot Operated, Inverted

**SRN4P1-B2**

7/8-14 UNF •  $Q_{max}$  80 l/min (21 GPM) •  $p_{max}$  350 bar (5100 PSI)



**Technical Features**

- › Decreasing pressure output proportional with increasing DC current input
- › Low hysteresis, accurate pressure control and low pressure drop
- › Wide pressure range up to 350 bar
- › Mechanical adjustment of minimum cracking pressure
- › High flow capacity
- › Solenoid electrical terminal option acc. to EN 175301-803-A, AMP Junior Timer, or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A pilot operated proportional pressure relief spool valve in the form of a screw-in cartridge. The valve is designed for continuous regulation of system pressure. The complete valve consist of pilot stage SRN1P1-A2 and main stage with connection 7/8-14 UNF. To set the minimum cracking pressure use the adjusting screw (s=5) which incorporates also the air bleed screw. Back pressure on port T becomes additive to the pressure setting of the valve. Air bleeding is necessary for the correct function of the valve.  
 Installation: When possible, the valve should be mounted below the reservoir oil level. This will keep oil in the actuator at all times, preventing instability caused by air enclosures. If this is not possible, mount the valve for best results vertically downward with proper air bleeding.

**Technical Data**

Valve size / Cartridge cavity		7/8-14 UNF-2A / B2 (C-10-2)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow	l/min (GPM)	80 (21.1)	
Fluid temperature range (NBR)	°C (°F)	-30...+80 (-22...+176)	
Fluid temperature range (FPM)	°C (°F)	-20...+120 (-4...+248)	
Ambient temperature range	°C (°F)	-30...+80 (-22...+176)	
Min. setting pressure	bar (PSI)	7 bar (101.5 PSI) for 5 l/min (1.32 GPM)	
Hysteresis	%	< 5	
<b>Solenoid data</b>			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0.6
Rated resistance at 20 °C (68 °F)	Ω	6.5±5 %	20.6±5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	250	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.58 (1.28)	
	Data Sheet	Type	
<b>General information</b>			
	GI_0060	Products and operating conditions	
Coil types	C_8007	C19B*	
Valve bodies	In-line mounted	SB_0018	SB-B2*
Cavity details / Form tools	SMT_0019	SMT-B2*	
Spare parts	SP_8010		

\*\*The indicated IP protection level is only reached with a properly mounted connector.

**Dimensions** in millimeters (inches)

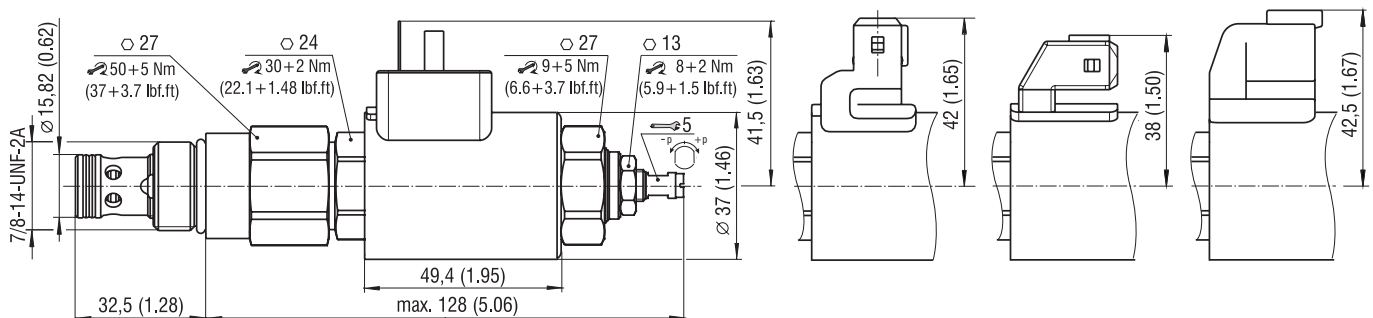
**Connector type**

E1, E2 - IP65  
EN 175301-803-A

E3, E4 - IP67  
AMP Junior Timer  
- radial

E3A, E4A - IP67  
AMP Junior Timer  
- axial

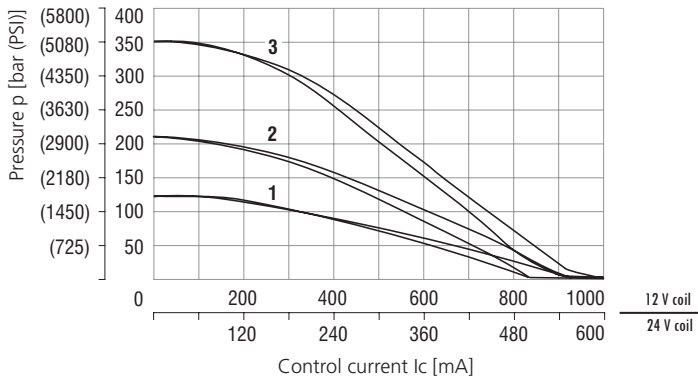
E12A, E13A  
- IP67 / IP69K  
Deutsch DT04-2P



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

**Relief pressure related to control signal**

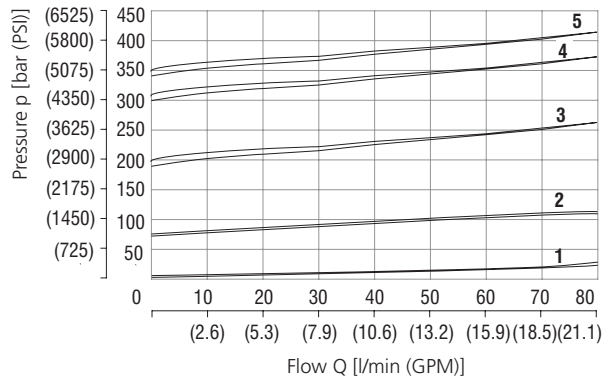
Q=5 l/min (1.32 GPM), pressure in port T=0 bar, PWM 160 Hz



Pressure range	12	21	35
	1	2	3

**Relief pressure related to flow rate**

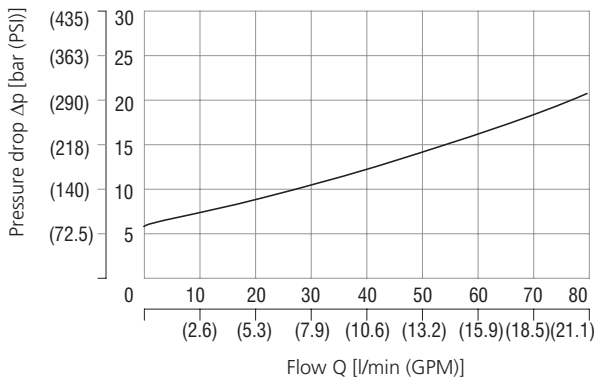
Pressure range 35, various control currents



Control current	1	2	3	4	5
	100 % I <sub>max</sub>	75 % I <sub>max</sub>	25 % I <sub>max</sub>	25 % I <sub>max</sub>	0 % I <sub>max</sub>

**Pressure drop related to flow rate**

100 % of control current, P-T direction



**Ordering Code**

SRN4P1 - B2 / H [ ] - [ ] [ ] [ ] - [ ]

**Proportional pressure control valve, relieving, pilot operated, inverted**

**Valve cavity**  
7/8-14 UNF-2A (C-10-2)

**Model**  
High performance

**Max. regulated pressure**  
up to 120 bar (1740 PSI) **12**  
up to 210 bar (3046 PSI) **21**  
up to 350 bar (5076 PSI) **35**

**Supply voltage / max. current**  
12 V DC / 1.0 A **12**  
24 V DC / 0.6 A **24**

Main stage ordering key: SR6H-B2/HV

**Surface treatment**  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
**No designation** NBR  
**V** FPM (Viton)

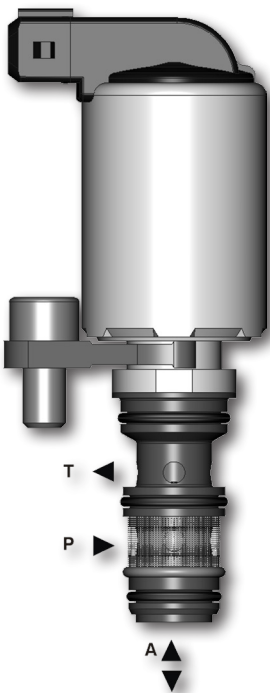
**Connector type**  
EN 175301-803-A  
**E1** E1 with quenching diode  
**E2** AMP Junior Timer - radial direction (2 pins; male)  
**E3** E3 with quenching diode  
**E4** AMP Junior Timer - axial direction (2 pins; male)  
**E3A** E3A with quenching diode  
**E4A** Deutsch DT04-2P - axial direction  
**E12A** E12A with quenching diode  
**E13A**

For other solenoid terminals see data sheet No. 8007

Proportional Pressure Control Valve, Reducing - Relieving, Direct-Acting, Slip-In Style

**PP2P1-W3**

Size D20 • Q<sub>max</sub> 20 l/min (5 GPM) • p<sub>max</sub> 50 bar (700 PSI)



**Technical Features**

- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop through CFD optimized flow paths
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal AMP Junior Timer or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › Compact design with reduced solenoid dimensions for production cost savings
- › High flow capacity and low coil power consumption
- › Optional mesh screen
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A direct-operated, spool-type hydraulic pressure reducing valve in the form of a slip-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen	with mesh screen
Symbol		

**Technical Data**

Valve size / Cartridge cavity		D20 / W3		
Max. operating pressure (port P)	bar (PSI)	50 (730)		
Max. regulated pressure (port A)	bar (PSI)	20 (290)	25 (363)	32 (460)
Max. flow rate P-A	l/min (GPM)	20 (5.3)	20 (5.3)	16 (4.2)
Fluid temperature range (NBR)	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short-time		
Fluid temperature range (FPM)	°C (°F)	-20 ...90 (-4 ...194), +100 (212) short-time		
Ambient temperature range	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short-time		
Response time at 100% signal	ms	< 50		
<b>Solenoid data</b>				
Supply voltage	V	12 DC		24 DC
Max. current	A	1		1
Rated resistance at 20 °C (68 °F)	Ω	7.2±6.5 %		11.2±6.5 %
Duty cycle	%	100		
Optimal PWM frequency	Hz	signal100		
Quenching diode		BZW06-28B	BZW06-33B	
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP 67 / IP 69K		
Weight	kg (lbs)	0.4 (0.88)		
	Data Sheet	Type		
General information		GI_0060 Products and operating conditions		
Valve bodies	In-line mounted	SB_0018 SB-W3-*		
Cavity details		SMT_0019 SB-W3-*		
Spare parts		SP_8010		

\*\*The indicated IP protection level is only reached with a properly mounted connector.

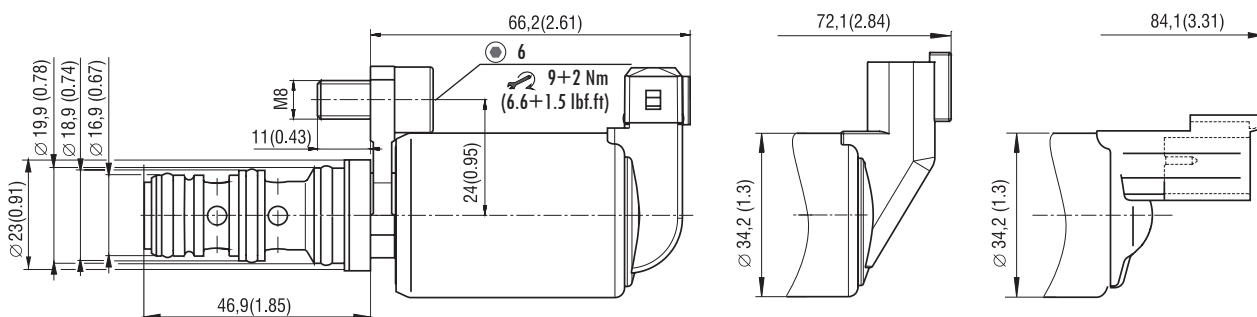
**Dimensions** in millimeters (inches)

**Connector type**

E3, E4 - IP67  
AMP Junior Timer

E12, E13 - IP67 / IP69K  
Deutsch DT04-2P

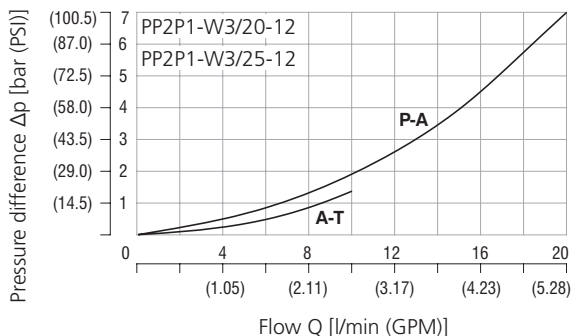
E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P



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

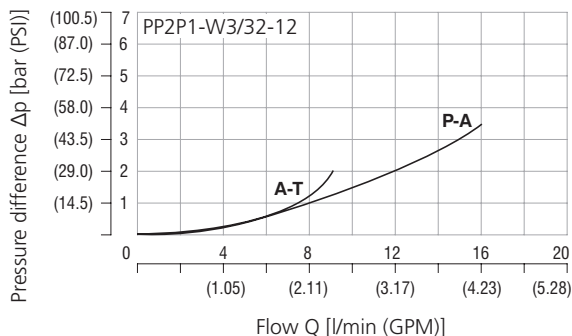
**Pressure drop related to flow rate**

A-T, Valve coil de-energized (reducing function)  
 P-A, Valve coil energized (relieving function)



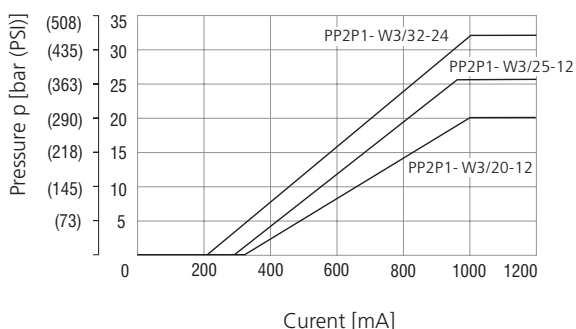
**Pressure drop related to flow rate**

A-T, Valve coil de-energized (reducing function)  
 P-A, Valve coil energized (relieving function)



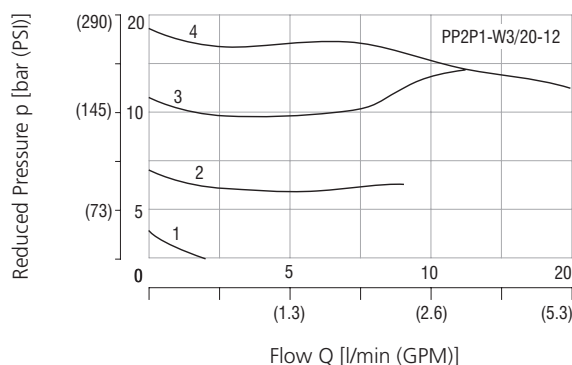
**Reduced pressure related to control signal**

Port A, range 0 - 20 bar (290 PSI)  
 Port A, range 0 - 32 bar (464 PSI)  
 Port P, Inlet pressure 50 bar (730 PSI)  
 Q = 0 lpm (GPM)



**Reducing pressure related to flow rate**

Reducing Function P - A



Control signal	
1	40 %
2	60 %
3	80 %
4	100 %

**Ordering Code**

PP2P1 - W3/ [ ] - [ ] [ ] [ ] - [ ] [ ]

Proportional pressure control valve,  
 reducing - relieving, direct-acting,  
 slip-in style

Valve cavity  
 D20 mm (0.79 in)

Max. regulated pressure  
 20 bar (290 PSI) **20**  
 25 bar (363 PSI) **25**  
 32 bar (464 PSI) **32**

Supply voltage / max. current  
 12 V DC / 1 A **12**  
 24 V DC / 1 A **24**

Mesh screen  
 No designation without mesh screen  
 SP-125 port P, 125 microns

Surface treatment  
 A zinc-coated (ZnCr-3), ISO 9227 (240 h)  
 B zinc-coated (ZnNi), ISO 9227 (520 h)

Seals  
 No designation NBR  
 V FPM (Viton)

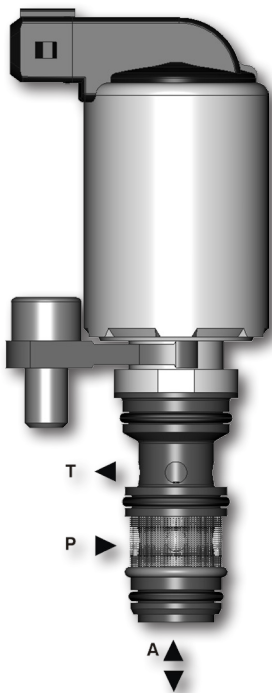
Connector  
 E3 AMP Junior Timer - radial direction (2 pins; male)  
 E4 E3 with quenching diode  
 E12 Deutsch DT04-2P - radial direction (2 pins; male)  
 E13 E12 with quenching diode  
 E12A Deutsch DT04-2P - axial direction (2 pins; male)  
 E13A E12A with quenching diode

Besides the shown, commonly used valve versions other special models are available.  
 Contact our technical support for their identification, feasibility and operating limits.

Proportional Pressure Control Valve, Reducing - Relieving, Direct-Acting, Slip-In Style

**PP2P3-W3**

Size D20 •  $Q_{max}$  30 l/min (8 GPM) •  $p_{max}$  50 bar (700 PSI)



**Technical Features**

- › Valve is primary used in clutch control application typically in mobile transmissions
- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop through CFD optimized flow paths
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal AMP Junior Timer or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › Compact design with reduced solenoid dimensions for production cost savings
- › High flow capacity and low coil power consumption
- › Optional mesh screen
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A direct-operated, spool-type hydraulic pressure reducing valve in the form of a slip-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen	with mesh screen
Symbol		

**Technical Data**

Valve size / Cartridge cavity		D20 / W3	
Max. operating pressure (port P)	bar (PSI)	50 (730)	
Max. reducing pressure (port A)	bar (PSI)	20 (290)	25 (363)
Max. flow rate P-A	l/min (GPM)	30 (7.9)	
Fluid temperature range (NBR)	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short-time	
Fluid temperature range (FPM)	°C (°F)	-20 ...90 (-4 ...194), +100 (212) short-time	
Ambient temperature range	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short-time	
Response time at 100% signal	ms	< 50	
<b>Solenoid data</b>			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	1
Rated resistance at 20 °C (68 °F)	Ω	7.2±6.5%	11.2±6.5%
Duty cycle	%	100	
Optimal PWM frequency	Hz	100	
Quenching diode		BZW06-28B	BZW06-33B
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP 67 / IP 69K	
Weight	kg (lbs)	0.4 (0.88)	
	Data Sheet	Type	
General information		GI_0060	Products and operating conditions
Valve bodies	In-line mounted	SB_0018	SB-W3-*
Cavity details		SMT_0019	SB-W3-*
Spare parts		SP_8010	

\*\*The indicated IP protection level is only reached with a properly mounted connector.

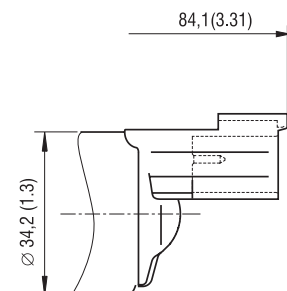
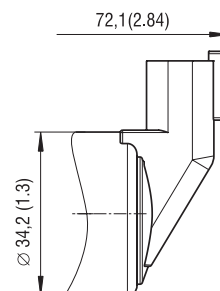
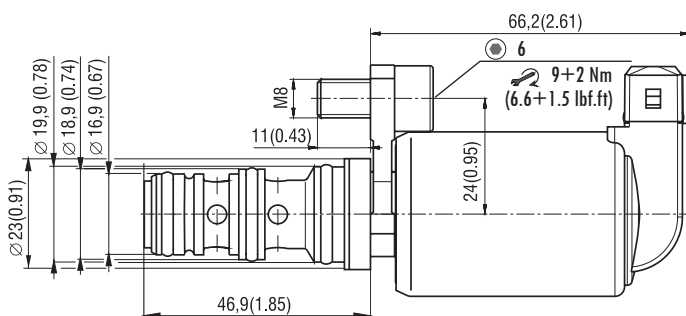
**Dimensions** in millimeters (inches)

**Connector type**

E3, E4 - IP67  
AMP Junior Timer

E12, E13 - IP67 / IP69K  
Deutsch DT04-2P

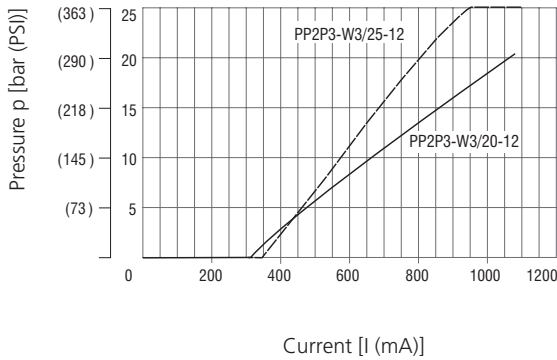
E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P



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

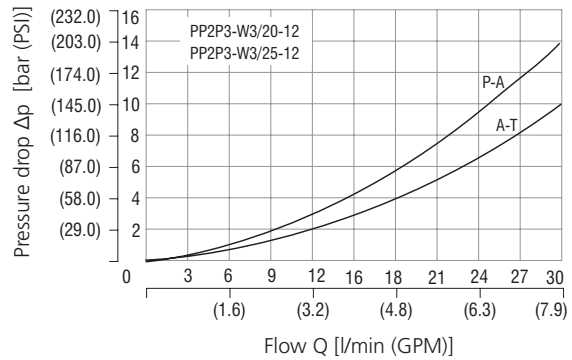
**Reduced pressure related to control signal**

Port A, range 0 - 20 bar (290 PSI)  
 Port A, range 0 - 25 bar (363 PSI)  
 Port P, Inlet pressure 50 bar (730 PSI)  
 $Q = 0 \text{ lpm}$  (GPM)

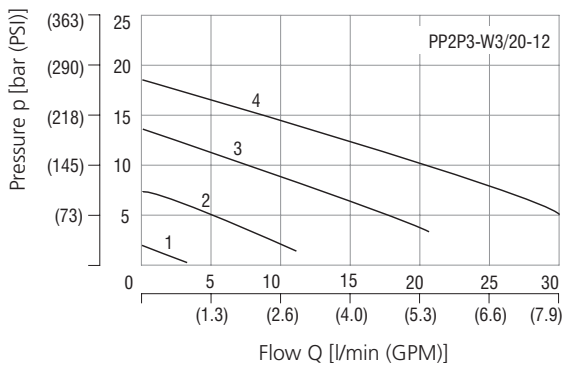


**Pressure drop related to flow rate**

A-T, Valve coil de-energized (relieving function)  
 P-A, Valve coil energized (reducing function)

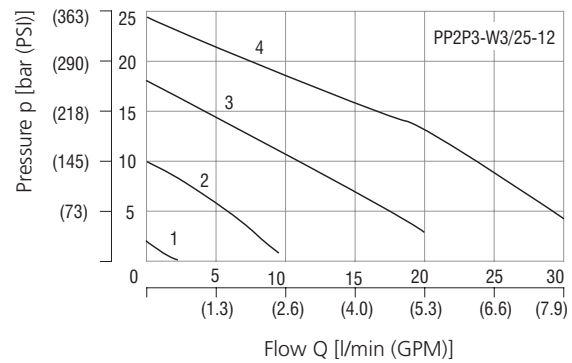


**Reducing pressure related to flow rate**



**Reducing pressure related to flow rate**

Reducing Function P - A



Control signal	
1	40 %
2	60 %
3	80 %
4	100 %

**Ordering Code**

PP2P3 - W3/ [ ] - [ ] [ ] [ ] - [ ] [ ]

Proportional pressure control valve,  
 reducing - relieving, direct-acting,  
 slip-in style

Valve cavity  
 D20 mm (0.79 in)

Max. reducing pressure  
 20 bar (290 PSI) **20**  
 25 bar (363 PSI) **25**

Supply voltage / max. current  
 12 V DC / 1 A **12**  
 24 V DC / 1 A **24**

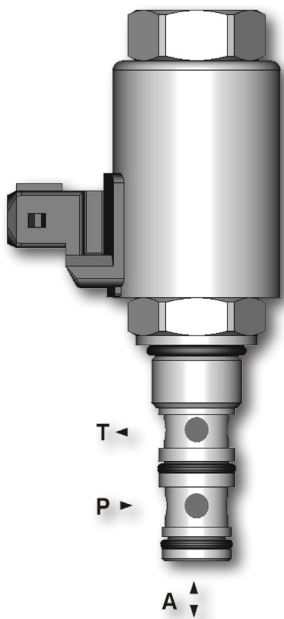
Mesh screen  
**No designation** without mesh screen  
**SP-125** port P, 125 microns

Surface treatment  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

Seals  
**No designation** NBR  
**V** FPM (Viton)

Connector  
**E3** AMP Junior Timer - radial direction (2 pins; male)  
**E4** E3 with quenching diode  
**E12** Deutsch DT04-2P - radial direction  
**E13** E12 with quenching diode  
**E12A** Deutsch DT04-2P - axial direction  
**E13A** E12A with quenching diode

Besides the shown, commonly used valve versions other special models are available.  
 Contact our technical support for their identification, feasibility and operating limits.


**Technical Features**

- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal acc. to EN 175301-803-A, AMP Junior Timer, or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › Optional mesh screen
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A direct-operated, spool-type hydraulic pressure reducing-relieving valve in the form of a screw-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen	with mesh screen
Symbol		

**Technical Data**

Valve size / Cartridge cavity		M20 x 1.5 / QE3	
Max. operating pressure (port P)	bar (PSI)	50 (730)	
Max. reduced pressure (port A)	bar (PSI)	20 (290)	32 (464)
Max. flow rate P-A	l/min (GPM)	20 (5.3)	
Fluid temperature range (NBR)	°C (°F)	-30 ... 90 (-22 ... 194), +100 (212) short-time	
Fluid temperature range (FPM)	°C (°F)	-20 ... 90 (-4 ... 194), +100 (212) short-time	
Ambient temperature range	°C (°F)	-30 ... 90 (-22 ... 194), +100 (212) short-time	
Response time at 100% signal	ms	< 50	
Solenoid data			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0,75
Rated resistance at 20 °C (68 °F)	Ω	7.1±6.5%	20.6±6.5%
Duty cycle	%	100	
Optimal PWM frequency	Hz	100	
Quenching diode		BZW06-28B	BZW06-33B
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.4 (0.88)	

	Data sheet	Type
General information	GI_0060	Products and operating conditions
Cavity details	SMT_0019	SMT-QE3*
Spare parts	SP_8010	

\*\*The indicated IP protection level is only reached with a properly mounted connector.

**Dimensions** in millimeters (inches)

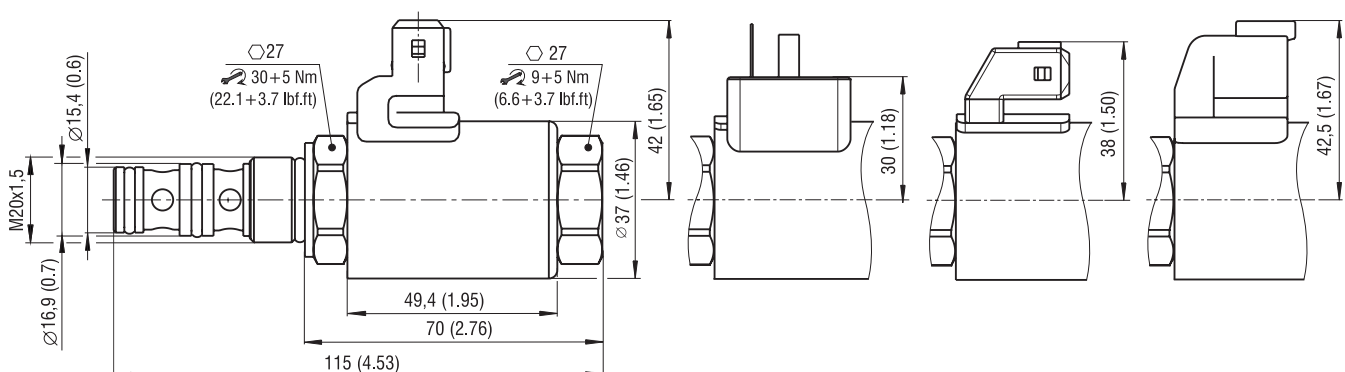
**Connector type**

E3, E4 - IP67  
 AMP Junior Timer  
 - radial

E1, E2 - IP65  
 EN 175301-803-A

E3A, E4A - IP67  
 AMP Junior Timer  
 - axial

E12A, E13A - IP67/ IP69K  
 Deutsch DT04-2P



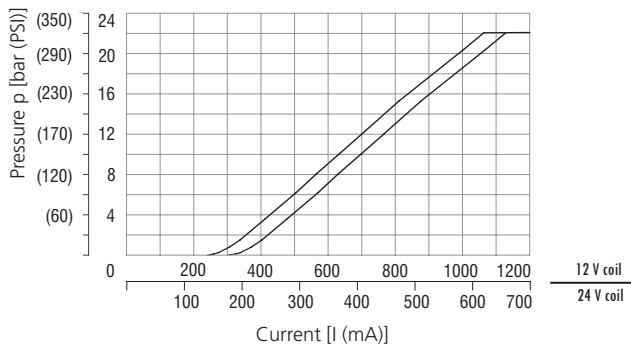


**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Reduced pressure related to control signal**

Port A, range 0 - 20 bar (290 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)

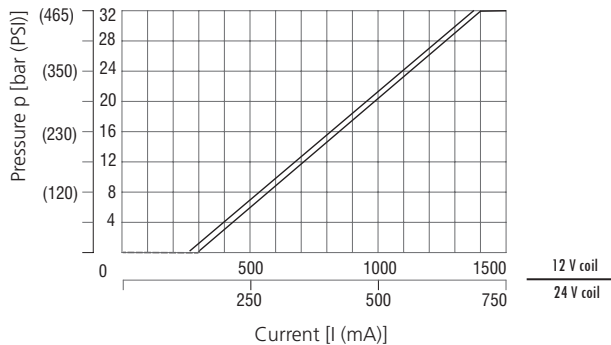
**PVRM1-063/S\*20**



**Reduced pressure related to control signal**

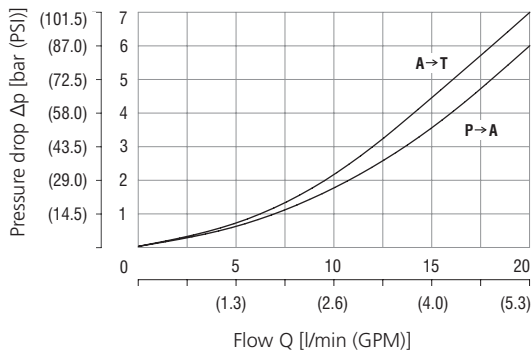
Port A, range 0 - 32 bar (464 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)

**PVRM1-063/S\*32**



**Pressure drop related to flow rate**

A-T, Valve coil de-energized (relieving function)  
 P-A, Valve coil energized (reducing function)



**Ordering Code**

**PVRM1 - 063 / S -**  -    -

**Proportional pressure control valve, reducing - relieving, direct-acting**

**Valve cavity**  
 M20 x 1.5 / QE3

**Model**  
 screw-in cartridge

**Max. reduced pressure**  
 20 bar (290 PSI) **20**  
 32 bar (464 PSI) **32**

**Supply voltage / max. current**  
 12 V DC / max. 1 A **12**  
 24 V DC / max. 0.75 A **24**

**No designation**  
**SP-125**

**Mesh screen**  
 without mesh screen  
 port P, 125 microns

**A**  
**B**

**Surface treatment**  
 zinc-coated (ZnCr-3), ISO 9227 (240 h)  
 zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

**Seals**  
 NBR  
 FPM (Viton)

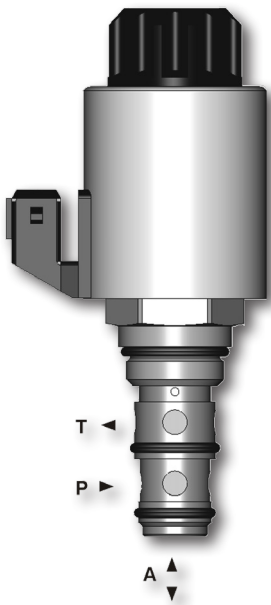
**E1**  
**E2**  
**E3**  
**E4**  
**E3A**  
**E4A**  
**E12A**  
**E13A**

**Connector**  
 EN 175301-803-A  
 E1 with quenching diode  
 AMP Junior Timer - radial direction (2 pins; male)  
 E3 with quenching diode  
 AMP Junior Timer - axial direction (2 pins; male)  
 E3A with quenching diode  
 E4A with quenching diode  
 Deutsch DT04-2P - axial direction  
 E12A with quenching diode

Proportional Pressure Control Valve, Reducing - Relieving, Direct-Acting

**PVRM3-103**

M24 x 1.5 • Q<sub>max</sub> 40 l/min (11 GPM) • p<sub>max</sub> 90 bar (1300 PSI)



**Technical Features**

- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop through CFD optimized flow paths
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal AMP Junior Timer, or Deutsch D04-2P
- › 12 or 24 V DC coils
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A direct-operated, spool-type hydraulic pressure reducing-relieving valve in the form of a screw-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen
Symbol	

**Technical Data**

Valve size / Cartridge cavity		M24 x 1.5 / QJ3			
Max. operating pressure (port P)	bar (PSI)	50 (730)		90 (1305)	
Max. reduced pressure (port A)	bar (PSI)	18 (260)	20 (290)	30 (435)	80 (1160)
Max. flow rate P-A	l/min (GPM)	40 (11)			
Fluid temperature range (NBR)	°C (°F)	-30 ... +90 (-22 ... +194), +100 (212) short-time			
Fluid temperature range (FPM)	°C (°F)	-20 ... +90 (-4 ... +194), +100 (212) short-time			
Ambient temperature range	°C (°F)	-30 ... +90 (-22 ... +194), +100 (212) short-time			
Response time at 100 % signal	ms	< 50			
Solenoid data					
Supply voltage	V	12 DC		24 DC	
Max. current	A	1.5		1	
Rated resistance at 20 °C (68 °F)	Ω	5 ± 6.5 %		13.4 ± 6.5 %	
Duty cycle	%	100			
Optimal PWM frequency	Hz	150			
Quenching diode		BZW06-28B		BZW06-33B	
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP67 / IP69K			
Weight with solenoid	kg (lbs)	0.4 (0.88)			

	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Cavity details	SMT_0019	SMT-QJ3*
Spare parts	SP_8010	

\*\*The indicated IP protection level is only reached with a properly mounted connector.

**Dimensions** in millimeters (inches)

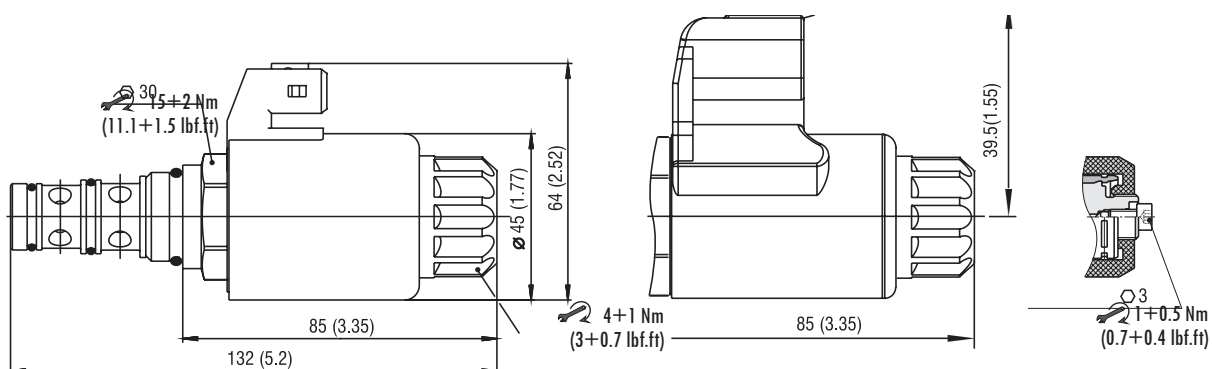
**Connector type**

E3, E4 - IP67  
AMP Junior Timer

E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P

**Ventilating screw**

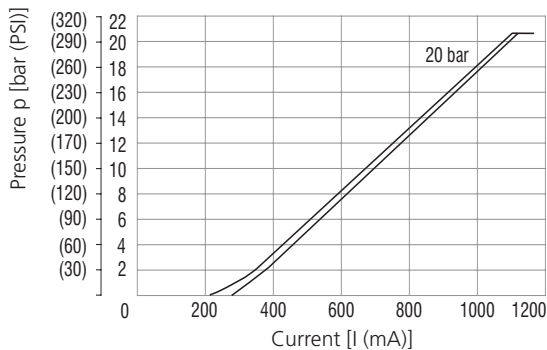
only for version with reduced pressure **80 bar**



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

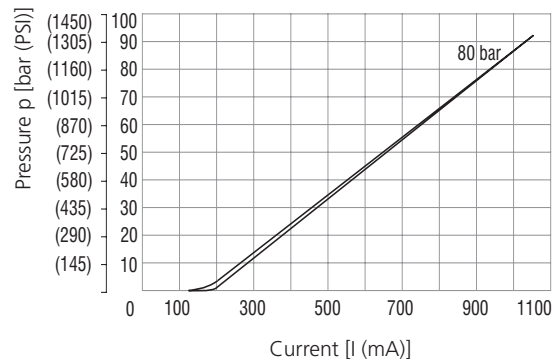
**Reduced pressure related to control signal**

Port A, range 0 - 20 bar (290 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)



**Reduced pressure related to control signal**

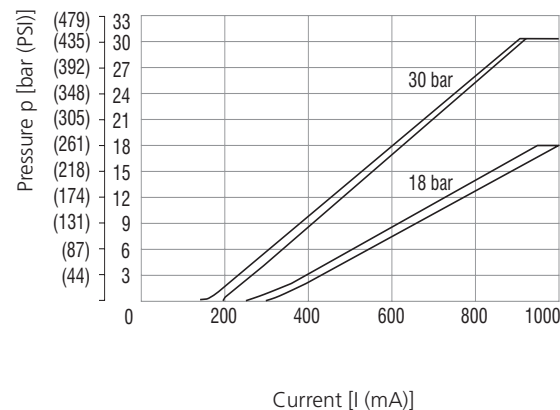
Port A, range 0 - 80 bar (1160 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 90 bar (1305 PSI)



**Reduced pressure related to control signal**

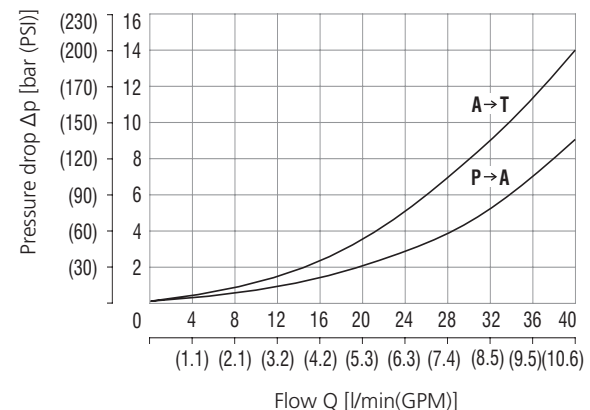
Port A, range 0 - 18 bar (260 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)

Port A, range 0 - 30 bar (435 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)



**Pressure drop related to flow rate**

A-T, Valve coil de-energized (relieving function)  
 P-A, Valve coil energized (reducing function)



**Ordering Code**

PVRM3 - 103 / S - [ ] - [ ] - [ ] - [ ]

**Proportional pressure control valve, reducing - relieving, direct-acting**

**Valve cavity**  
 M24 x 1.5 / QJ3

**Model**  
 screw-in cartridge

**Max. reduced pressure**

18 bar (260 PSI)	<b>18</b>
20 bar (290 PSI)	<b>20</b>
30 bar (435 PSI)	<b>30</b>
80 bar (1160 PSI)	<b>80</b>

**Supply voltage / max. current**

12 V DC / 1.5 A	<b>12</b>
24 V DC / 1 A	<b>24</b>

**Surface treatment**

<b>A</b>	zinc-coated (ZnCr-3), ISO 9227 (240 h)
<b>B</b>	zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

**Seals**  
 NBR  
 FPM (Viton)

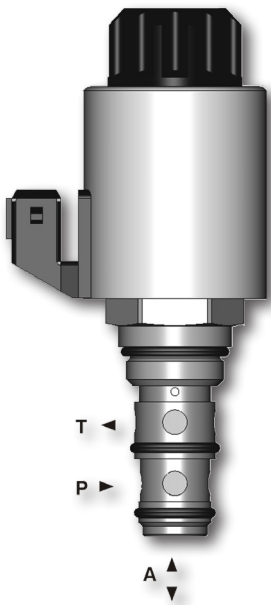
**Connector type**

<b>E3A</b>	AMP Junior Timer - axial direction (2 pins; male)
<b>E4A</b>	E3A with quenching diode
<b>E12A</b>	Deutsch DT04-2P - axial direction
<b>E13A</b>	E12A with quenching diode

Proportional Pressure Control Valve, Reducing - Relieving, Direct-Acting

**PVRM3-103**

M24 x 1.5 • Q<sub>max</sub> 40 l/min (11 GPM) • p<sub>max</sub> 90 bar (1300 PSI)



**Technical Features**

- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop through CFD optimized flow paths
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal AMP Junior Timer, or Deutsch D04-2P
- › 12 or 24 V DC coils
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A direct-operated, spool-type hydraulic pressure reducing-relieving valve in the form of a screw-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen
Symbol	

**Technical Data**

Valve size / Cartridge cavity		M24 x 1.5 / QJ3			
Max. operating pressure (port P)	bar (PSI)	50 (730)		90 (1305)	
Max. reduced pressure (port A)	bar (PSI)	18 (260)	20 (290)	30 (435)	80 (1160)
Max. flow rate P-A	l/min (GPM)	40 (11)			
Fluid temperature range (NBR)	°C (°F)	-30 ... +90 (-22 ... +194), +100 (212) short-time			
Fluid temperature range (FPM)	°C (°F)	-20 ... +90 (-4 ... +194), +100 (212) short-time			
Ambient temperature range	°C (°F)	-30 ... +90 (-22 ... +194), +100 (212) short-time			
Response time at 100 % signal	ms	< 50			
<b>Solenoid data</b>					
Supply voltage	V	12 DC		24 DC	
Max. current	A	1.5		1	
Rated resistance at 20 °C (68 °F)	Ω	5 ± 6.5 %		13.4 ± 6.5 %	
Duty cycle	%	100			
Optimal PWM frequency	Hz	150			
Quenching diode		BZW06-28B		BZW06-33B	
Enclosure type acc. to EN 60529**		(acc.to terminal type) IP67 / IP69K			
Weight with solenoid	kg (lbs)	0.4 (0.88)			

	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Cavity details	SMT_0019	SMT-QJ3*
Spare parts	SP_8010	

\*\*The indicated IP protection level is only reached with a properly mounted connector.

**Dimensions** in millimeters (inches)

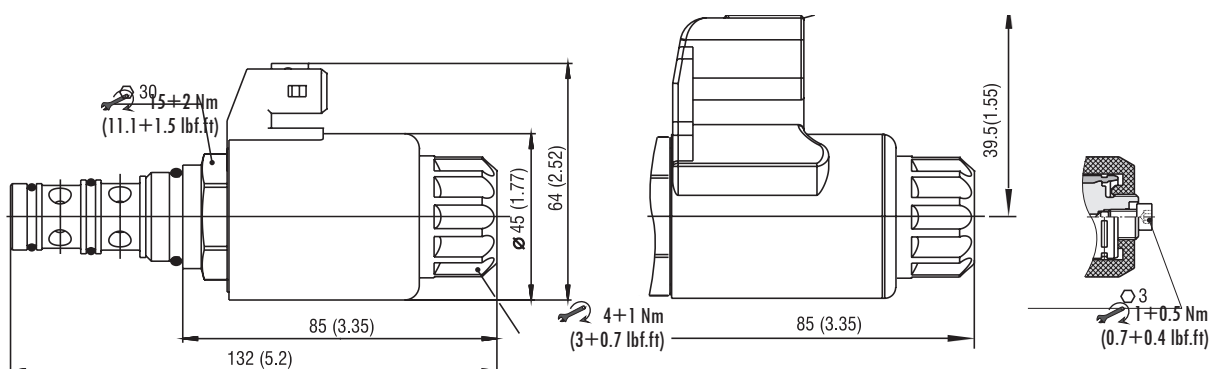
**Connector type**

E3, E4 - IP67  
AMP Junior Timer

E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P

**Ventilating screw**

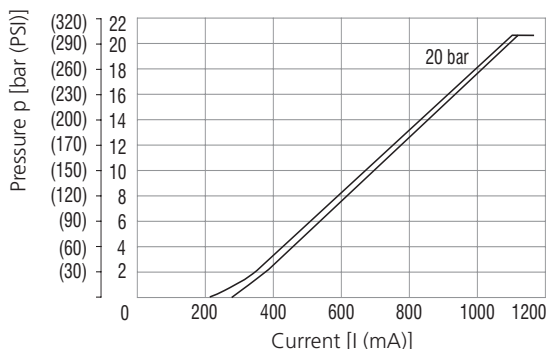
only for version with reduced pressure **80 bar**



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

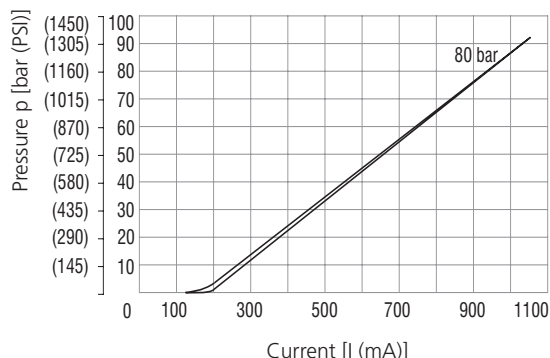
**Reduced pressure related to control signal**

Port A, range 0 - 20 bar (290 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)



**Reduced pressure related to control signal**

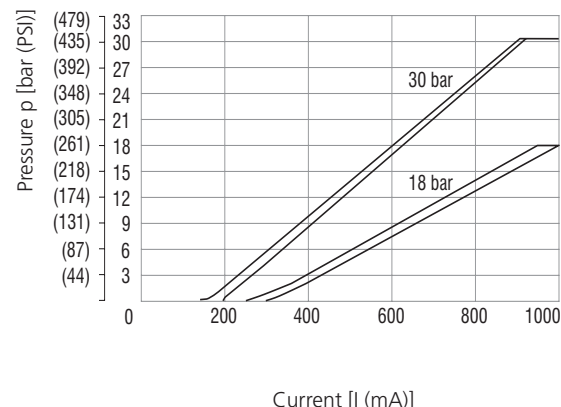
Port A, range 0 - 80 bar (1160 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 90 bar (1305 PSI)



**Reduced pressure related to control signal**

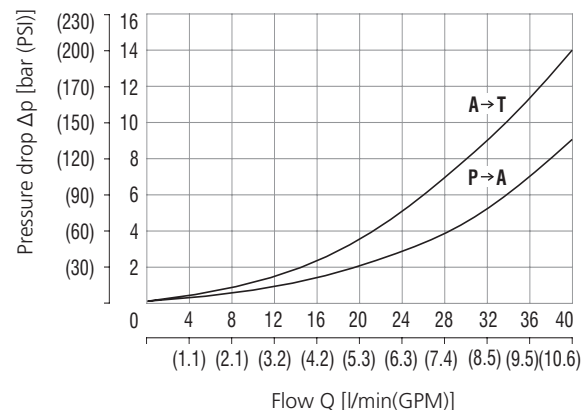
Port A, range 0 - 18 bar (260 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)

Port A, range 0 - 30 bar (435 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P, inlet pressure 50 bar (730 PSI)



**Pressure drop related to flow rate**

A-T, Valve coil de-energized (relieving function)  
 P-A, Valve coil energized (reducing function)



**Ordering Code**

PVRM3 - 103 / S - [ ] - [ ] - [ ] - [ ] - [ ]

**Proportional pressure control valve, reducing - relieving, direct-acting**

**Valve cavity**  
 M24 x 1.5 / QJ3

**Model**  
 screw-in cartridge

**Max. reduced pressure**

18 bar (260 PSI)	<b>18</b>
20 bar (290 PSI)	<b>20</b>
30 bar (435 PSI)	<b>30</b>
80 bar (1160 PSI)	<b>80</b>

**Supply voltage / max. current**

12 V DC / 1.5 A	<b>12</b>
24 V DC / 1 A	<b>24</b>

**Surface treatment**

<b>A</b>	zinc-coated (ZnCr-3), ISO 9227 (240 h)
<b>B</b>	zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

**Seals**  
 NBR  
 FPM (Viton)

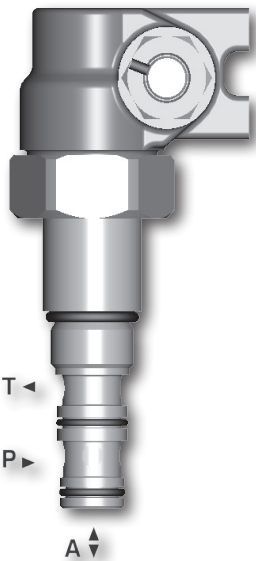
**Connector type**

<b>E3A</b>	AMP Junior Timer - axial direction (2 pins; male)
<b>E4A</b>	E3A with quenching diode
<b>E12A</b>	Deutsch DT04-2P - axial direction
<b>E13A</b>	E12A with quenching diode

Proportional Pressure Reducing - Relieving Valve, Manually Operated

**PVRR1-063**

M20x1.5 • Qmax 20 l/min (5 GPM) • pmax 30 bar (435 PSI)



**Technical Features**

- › Excellent stability throughout flow range with the rapid response to manually adjusted spool position and to dynamic operating pressure changes
- › Low hysteresis, accurate pressure control and low pressure drop
- › Integrated relief function for protection against pressure peaks
- › In the basic position of actuator the output channel A is relieved by connecting to the tank
- › Pressure range up to 10 bar
- › Hardened precision parts
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A mechanically direct-operated, spool-type pressure reducing-relieving valve in the form of a screw-in cartridge. Reduced pressure is proportional to manually adjusted stroke of the actuating system. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.



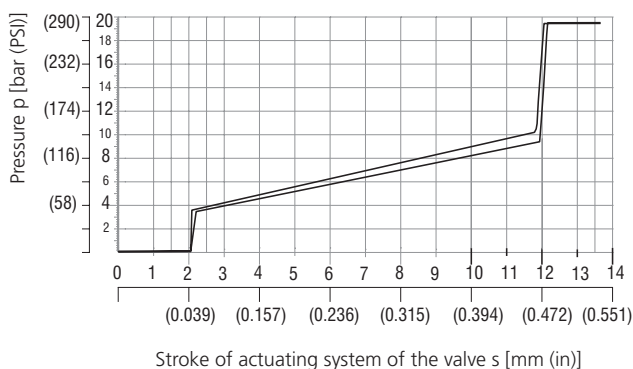
**Technical Data**

Valve size / Cartridge cavity		M20x1.5 / QE3
Max. pressure (port P)	bar (PSI)	30 (435)
Min. reduced pressure	bar (PSI)	3.5 (51)
Max. reduced pressure	bar (PSI)	10 (145)
Max. flow rate P-A	l/min (GPM)	20 (5.3)
Fluid temperature range (NBR)	°C (°F)	-30 .... +100 (-22 ... +212)
Fluid temperature range (Viton)	°C (°F)	-20 .... +120 (-4 ... +248)
Mass	kg (lbs)	0.328 (0.723)

	Data sheet	Type
General information	GI_0060	Products and operating conditions
Cavity details	SMT_0019	SMT-QE3*
Spare parts	SP_8010	

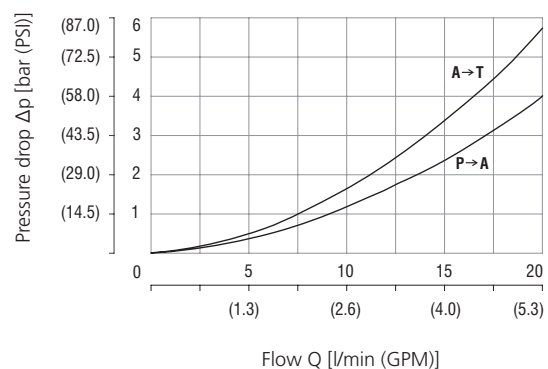
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Reduced pressure related to stroke of actuating system**

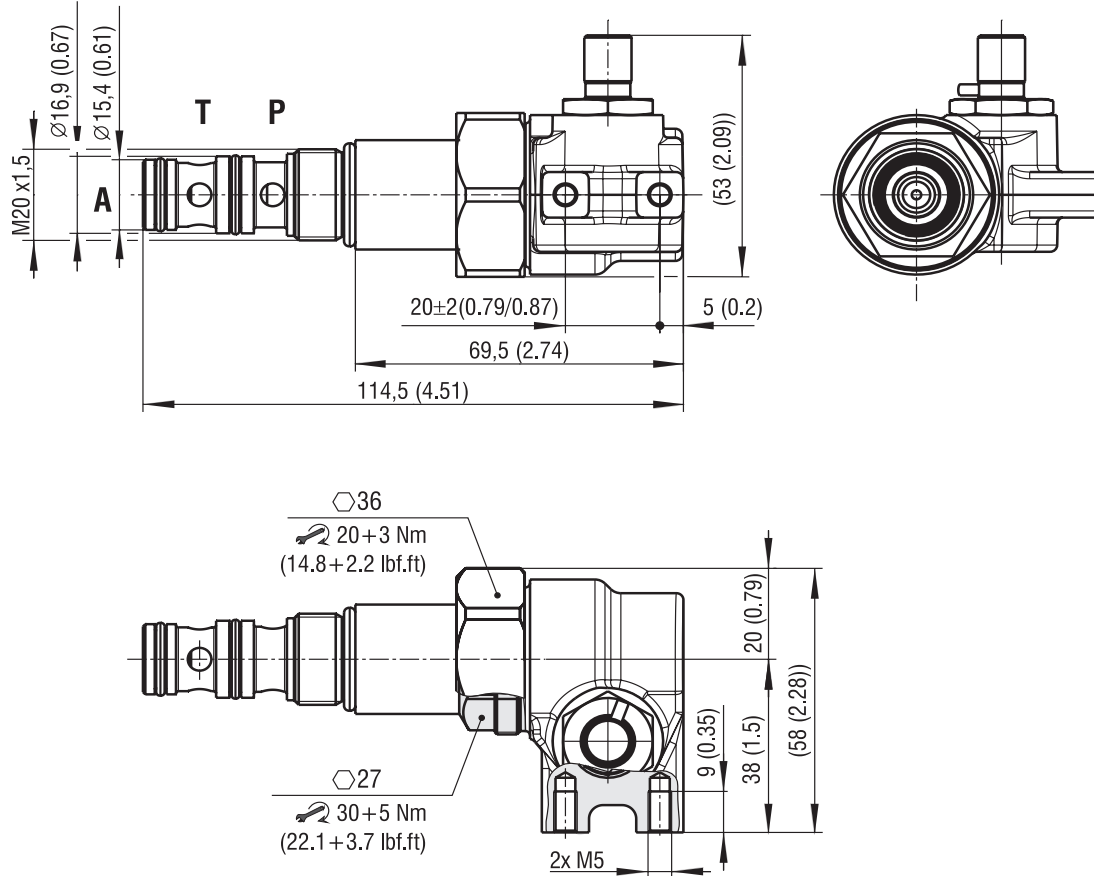


**Pressure drop related to flow rate**

A-T, relieving function  
P-A, reducing function



Dimensions in millimeters (inches)

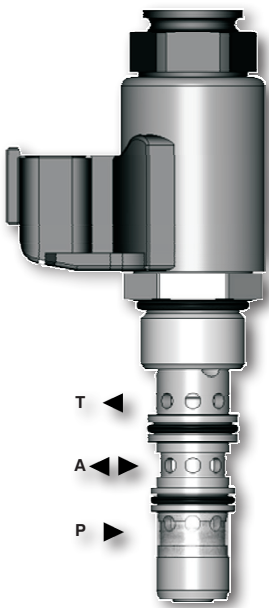


Ordering Code

<b>PVRR1 - 063 / S -</b> <input type="checkbox"/> - <input type="checkbox"/> <input type="checkbox"/> - <input type="checkbox"/>	
<p><b>Proportional Pressure Reducing - Relieving Valve, Manually Operated</b></p> <hr/> <p><b>Valve cavity</b> M20x1.5 / QE3</p> <hr/> <p><b>Model</b> screw-in cartridge</p> <hr/> <p><b>Range of regulated pressure</b> 3.5 - 10 bar (51 - 145 PSI)</p>	<p style="text-align: right;"><b>Surface treatment</b> A zinc-coated (ZnCr-3), ISO 9227 (240 h)</p> <hr/> <p style="text-align: right;"><b>Seals</b> NBR FPM (Viton)</p> <hr/> <p style="text-align: right;"><b>Actuator</b> shaft with spring pin</p>
3,5/10	1
	<p><b>No designation</b> V</p>

# SP4P1-B4

7/8-14 UNF •  $Q_{max}$  40 l/min (11 GPM) •  $p_{max}$  30 bar (435 PSI)



## Technical Features

- › Excellent stability throughout flow range with rapid response to proportional current input change
- › Low hysteresis, accurate pressure control and low pressure drop through CFD optimized flow paths
- › Precise pressure control vs current and excellent repeatability
- › Integrated relief function for protection against pressure peaks
- › Solenoid electrical terminal: AMP Junior Timer or Deutsch DT04-2P
- › 12 or 24 V DC coils
- › Compact design with reduced solenoid dimensions for production cost saving
- › High flow capacity and low coil power consumption
- › Optional mesh screen
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

## Functional Description

A pilot-operated, spool-type hydraulic pressure reducing valve in the form of a screw-in cartridge. Reduced pressure output is proportional to DC current input. This valve is intended for use as a pressure limiting device. Note: Consult factory for special OEM versions of this product.

Model Code	no mesh screen	with mesh screen
Symbol		

## Technical Data

Valve size / Cartridge cavity		7/8-14 UNF-2A / B4 (C-10-4)	
Max. operating pressure (port P)	bar (PSI)	30 (435)	
Max. reducing pressure (port A)	bar (PSI)	25 (363)	
Max. flow rate P-A	l/min (GPM)	40 (11)	
Max. control flow	l/min (GPM)	0.4 (0.12)	
Fluid temperature range (NBR)	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short time	
Fluid temperature range (FPM)	°C (°F)	-20 ...90 (-4 ...194), +100 (212) short time	
Ambient temperature range	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short time	
Response time at 100 % signal	ms	< 50	
Solenoid data			
Supply voltage	V	12 DC	24 DC
Max. current	A	0.7	0.35
Rated resistance at 20 °C (68 °F)	Ω	7.82±5 %	29.5±4.5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	200	
Quenching diode		BZW06-28B	BZW06-33B
Enclosure type acc.to EN 60529**		(acc.to terminal type) IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.3 (0.66)	
General information		Data Sheet	Type
		GI_0060	Products and operating conditions
Coil types		C_8007	
Valve bodies	In-line mounted	SB_0018	SB-B4*
	Sandwich mounted	SB-04(06)_0028	SB-*B4*
Cavity details / Form tools		SMT_0019	SMT-B4*
Spare parts		SP_8010	



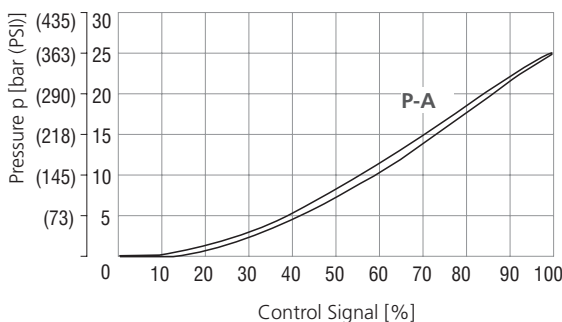
The volume flow, which is needed for control of output pressure and maintaining the adjusted value of reducing pressure, flows permanently through the pilot stage of valve.

\*\*The indicated IP protection level is only reached with a properly mounted connector.

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

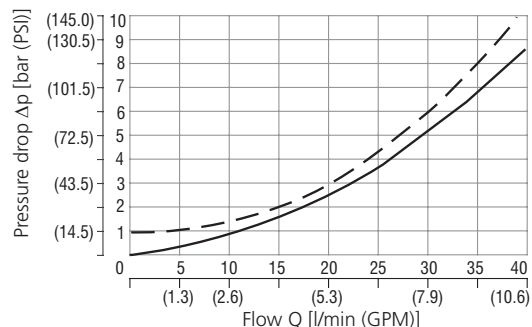
### Reduced pressure related to control signal

Port A of range 0 - 25 bar (363 PSI),  $Q = 0 \text{ lpm}$  (GPM)  
 Port P inlet pressure 30 bar (435 PSI)  
 measured without mesh screen



### Pressure drop related to flow rate

— A-T Valve coil de-energized (relieving function)  
 — P-A Valve coil energized (reducing function)  
 measured without mesh screen



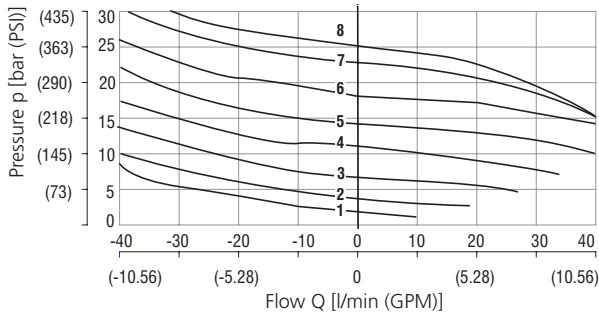


## Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

### Reducing - relieving pressure related to flow rate

Reducing pressure range 0 - 25 bar (0 - 363 PSI), input 30 bar (435 PSI)  
 various control currents  
 measured without mesh screen

relieving function A-T / reducing function P-A

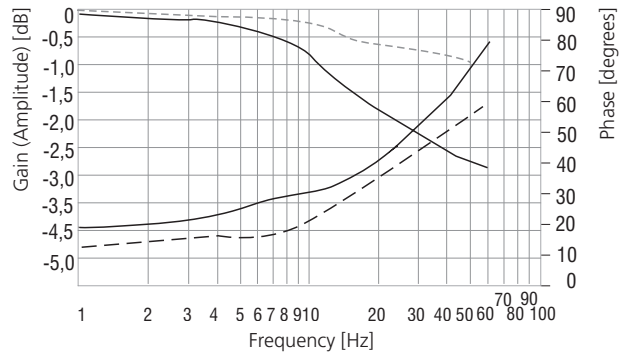


1	2	3	4	5	6	7	8
24%	35%	47%	59%	70%	82%	94%	100%

### Frequency response characteristics

Inlet pressure at port P - 30 bar (435 PSI), flow = 0 lpm (GPM)

----- signal  $70 \pm 25\%$   
 ——— signal  $55 \pm 40\%$

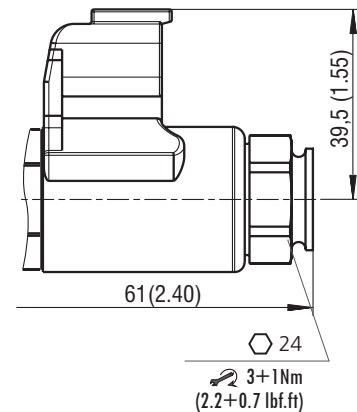
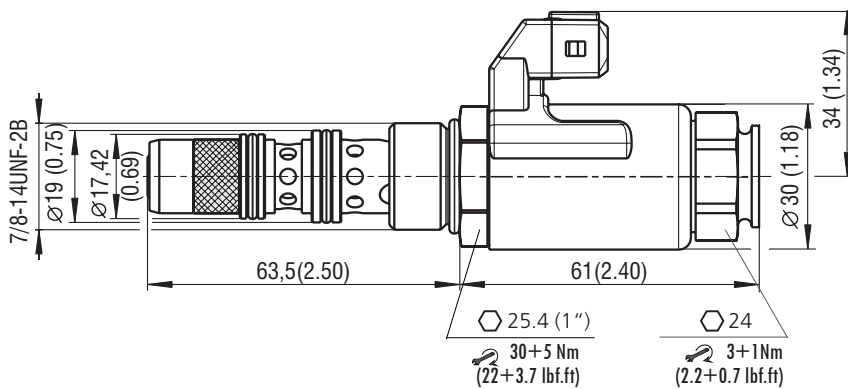


## Dimensions in millimeters (inches)

### Connector type

E3A, E4A - IP67  
 AMP Junior Timer

E12A, E13A - IP67 / IP69K  
 Deutsch DT04-2P



## Ordering Code

SP4P1-B4 /  -    -

Proportional pressure control valve,  
 reducing - relieving, pilot operated,  
 screw-in style

Valve cavity  
 7/8-14 UNF (C-10-4)

Max. reducing pressure  
 20 bar (290 PSI) **20**  
 25 bar (363 PSI) **25**

Supply voltage / max. current  
 12 V DC / 0.7 A **12**  
 24 V DC / 0.35 A **24**

No designation  
 SP-300

Mesh screen  
 without mesh screen  
 port P, 300 microns

A  
 B  
 Surface treatment  
 zinc-coated (ZnCr-3), ISO 9227 (240 h)  
 zinc-coated (ZnNi), ISO 9227 (520 h)

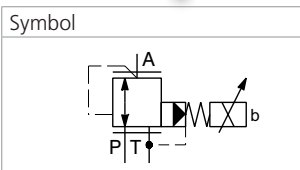
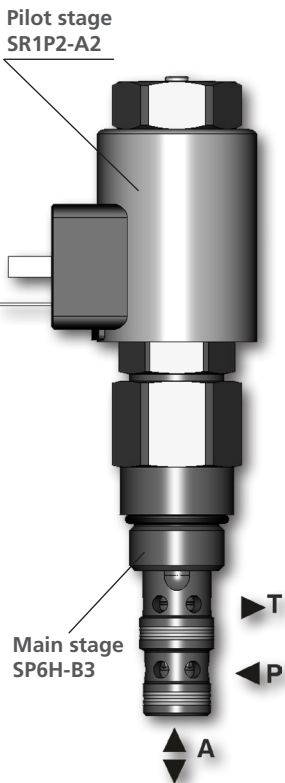
No designation  
 V

Seals  
 NBR  
 FPM (Viton)

E3A AMP Junior Timer - axial direction (2 pins; male)  
 E4A E3A with quenching diode  
 E12A Deutsch DT04-2P - axial direction  
 E13A E12A with quenching diode

**SP4P2-B3**

7/8-14 UNF •  $Q_{max}$  60 l/min (16 GPM) •  $p_{max}$  350 bar (5100 PSI)



The volume flow, which is needed for control of output pressure and maintaining the adjusted value of reducing pressure, flows permanently through the pilot stage of valve.

**Technical Features**

- › Reducing pressure increases proportional to increasing electric command signal
- › Three-way valve protects the applicator against pressure overloading
- › Low hysteresis, accurate pressure control and low pressure drop
- › Wide pressure range up to 350 bar
- › High flow capacity up to 60 l/min
- › Optional electrical terminal of solenoid: EN 175301-803-A, AMP Junior Timer or Deutsch DT04-2P
- › Coil supply voltage 12 or 24 V DC
- › In the standard version, the valve is zinc-coated for 240 h protection in NSS acc. to ISO 9227

**Functional Description**

Screw-in cartridge proportional pressure reducing valve, pilot operated. The complete valve consists of a pilot stage - valve SR1P2-A2 and a main stage with connection thread 7/8-14 UNF. The valve maintains the constant pressure in the applicator pipeline (A-port) proportional to the input command signal. When the applicator is overloaded, the circuit is connected to the tank (T-channel) and protected against pressure overloading (relieving function of the valve).

Air bleeding is necessary for the correct function of the valve. When possible, the valve should be mounted below the reservoir oil level. This will maintain oil in the actuator, preventing instability caused by air in the system. If possible, to achieve the best result, mount the valve vertically above the bleed screw.

**Technical Data**

Valve size / Cartridge cavity		7/8-14 UNF-2A / B3 (C-10-3)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow rate P-A	l/min (GPM)	60 (15.9)	
Max. control flow	l/min (GPM)	0.2 (0.05)	
Fluid temperature range (NBR)	°C (°F)	-30 ... 80 (-22 ... 176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... 120 (-4 ... 248)	
Ambient temperature range	°C (°F)	-30 ... 80 (-22 ... 176)	
Min. setting pressure	bar (PSI)	6 (87) for 0 l/min (0 GPM)	
Hysteresis	%	< 5	
<b>Solenoid data</b>			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0.6
Rated resistance at 20 °C (68 °F)	Ω	6.5±5 %	20.6±5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	250	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc.to EN 60529**		(acc.to terminal type) IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.6 (1.32)	
<b>Data Sheet</b>			
Type			
General information		GI_0060	
Products and operating conditions			
Coil types		C_8007	
Valve bodies		In-line mounted	SB_0018
Cavity details / Form tools		SMT_0019	
Spare parts		SP_8010	
		SB-B3*	
		SMT-B3*	

\*\*The indicated IP protection level is only reached with a properly mounted connector.

**Dimensions** in millimeters (inches)

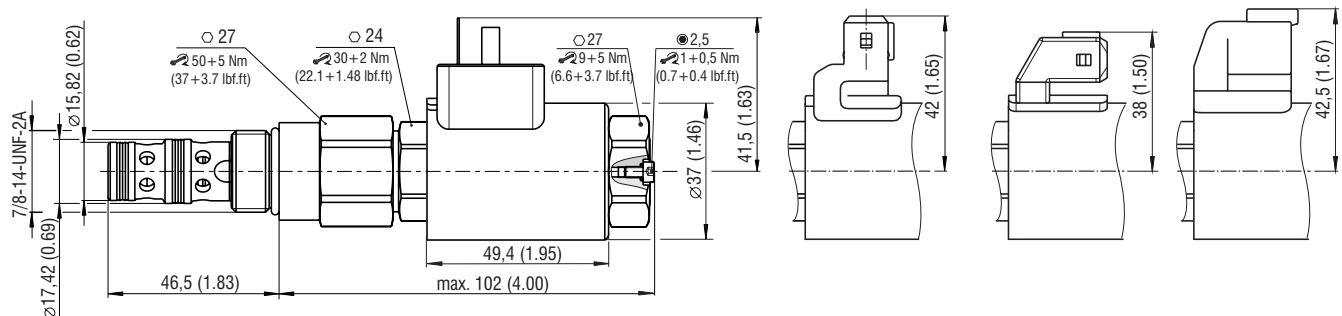
**Connector type**

E1,E2 - IP65  
EN 175301-803-A

E3, E4 - IP67  
AMP Junior  
Timer - radial

E3A, E4A - IP67  
AMP Junior  
Timer - axial

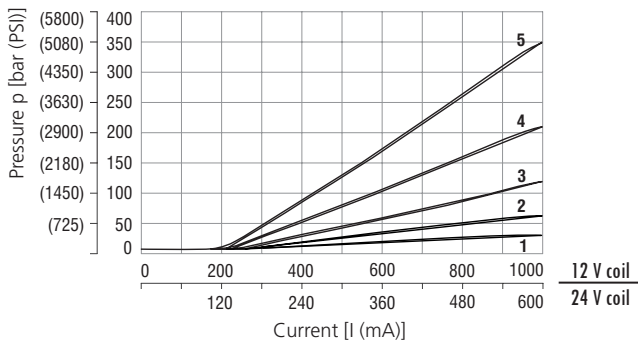
E12A, E13A - IP67 / IP69K  
Deutsch DT04-2P



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

**Reduced pressure related to control signal**

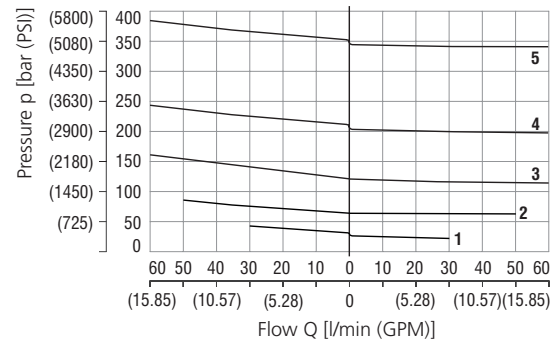
$Q = 0 \text{ l/min}$  (0 GPM), pressure in port T = 0 bar, PWM 160 Hz



Pressure range	3	6	12	21	35
	1	2	3	4	5

**Reducing - relieving pressure related to flow rate**

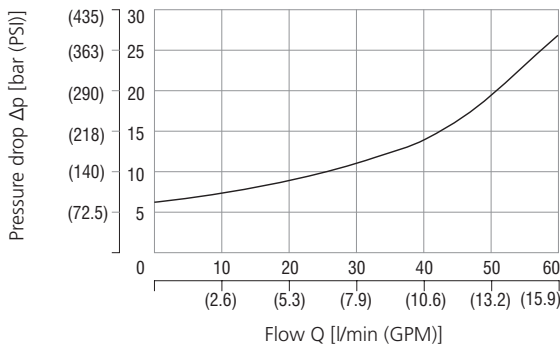
relieving function A-T / reducing function P-A



Pressure range	3	6	12	21	35
	1	2	3	4	5

**Pressure drop related to flow rate**

0% of control current, A-T direction



**Ordering Code**

**SP4P2 - B3 / H** [ ] - [ ] [ ] [ ] - [ ]

**Proportional Pressure Reducing - Relieving Valve, Pilot Operated**

**Valve cavity**  
7/8-14 UNF (C-10-3)

**Model**  
High performance

**Max. reduced pressure**

up to 30 bar (435 PSI)	<b>3</b>
up to 60 bar (870 PSI)	<b>6</b>
up to 120 bar (1740 PSI)	<b>12</b>
up to 210 bar (3046 PSI)	<b>21</b>
up to 350 bar (5076 PSI)	<b>35</b>

**Supply voltage / max. current**

12 V DC / 1.0 A	<b>12</b>
24 V DC / 0.6 A	<b>24</b>

Main stage ordering key: SP6H-B3/HV

**Surface treatment**

**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

**Seals**  
NBR  
FPM (Viton)

**Connector**  
EN 175301-803-A

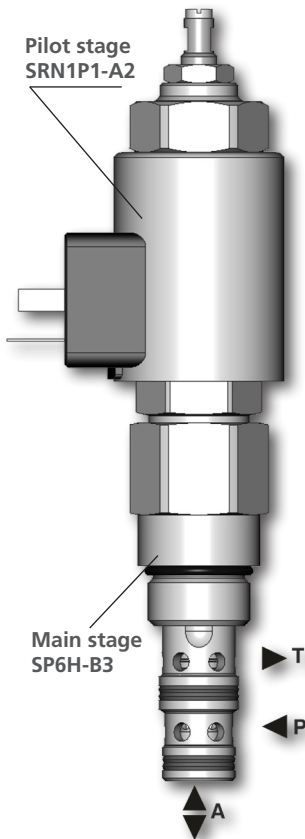
**E1** E1 with quenching diode  
**E2** AMP Junior Timer - radial direction (2 pins; male)  
**E3** E3 with quenching diode  
**E4** E3 with quenching diode  
**E3A** AMP Junior Timer - axial direction (2 pins; male)  
**E4A** E3A with quenching diode  
**E12A** Deutsch DT04-2P - axial direction  
**E13A** E12A with quenching diode

For other solenoid terminals see data sheet No. 8007

## Proportional Pressure Control Valve, Reducing - Relieving, Pilot Operated, Inverted

### SPN4P1-B3

7/8-14 UNF • Q<sub>max</sub> 60 l/min (16 GPM) • p<sub>max</sub> 350 bar (5100 PSI)



#### Technical Features

- › Decreasing pressure output proportional with increasing DC current input
- › Low hysteresis, accurate pressure control and low pressure drop
- › Wide pressure range up to 350 bar
- › Mechanical adjustment of minimum cracking pressure
- › High flow capacity
- › Solenoid electrical terminal acc. to EN 175301-803-A, AMP Junior Timer, Deutsch DT04-2P
- › 12 or 24 V DC coils
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

#### Functional Description

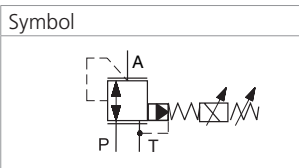
A pilot-operated proportional pressure reducing valve in the form of a screw-in cartridge. The valve is designed for continuous regulation of pressure in the consumer port. The complete valve consists of a pilot stage valve SRN1P1-A2 and a main stage with connection 7/8-14 UNF. Due to its 3-way design the valve is capable to relieve the secondary pressure to the tank port. To set the minimum cracking pressure use the adjusting screw (s=5) which incorporates also an air bleed screw. Back pressure on port T becomes additive to the pressure setting of the valve. Air bleeding is necessary for the correct function of the valve.

Installation: When possible, the valve should be mounted below the reservoir oil level. This will maintain oil in the actuator, preventing instability caused by air in the system. If this is not possible, mount the valve for best results vertically downward coil and ensure proper air bleeding.

#### Technical Data

Valve size / Cartridge cavity		7/8-14 UNF-2A / B3 (C-10-3)	
Max. operating pressure (port P)	bar (PSI)	350 (5080)	
Max. operating pressure (port T)	bar (PSI)	100 (1450)	
Max. flow	l/min (GPM)	60 (15.9)	
Max. control flow	l/min (GPM)	0.2 (0.05)	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... 176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... 248)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... 176)	
Min. setting pressure	bar (PSI)	6 (87) for 0 l/min (0 GPM)	
Hysteresis	%	< 5	
Solenoid data			
Supply voltage	V	12 DC	24 DC
Max. current	A	1	0.6
Rated resistance at 20 °C (68 °F)	Ω	6.5±5 %	20.6±5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	250	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc.to EN 60529**		(acc.to terminal type) IP65 / IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.6 (1.32)	
General information		Data Sheet	Type
		GI_0060	Products and operating conditions
Coil types		C_8007	C 19B*
Valve bodies		In-line mounted	SB_0018
			SB-B3*
Cavity details / Form tools		SMT_0019	SMT-B3*
Spare Parts		SP_8010	

\*\*The indicated IP protection level is only reached with a properly mounted connector.



**!** The volume flow, which is needed for control of output pressure and maintaining the adjusted value of reducing pressure, flows permanently through the pilot stage of valve.

#### Dimensions in millimeters (inches)

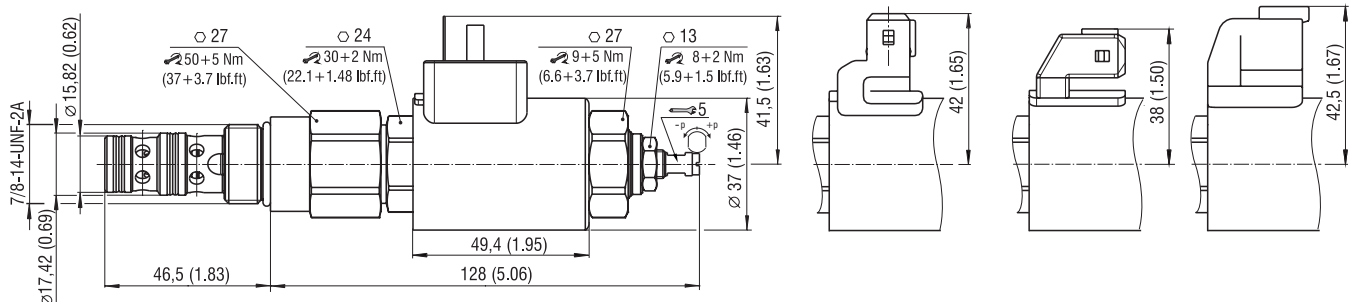
##### Connector type

E1, E2 - IP65  
EN 175301-803-A

E3, E4 - IP67  
AMP Junior Timer  
- radial

E3A, E4A - IP67  
AMP Junior Timer  
- axial

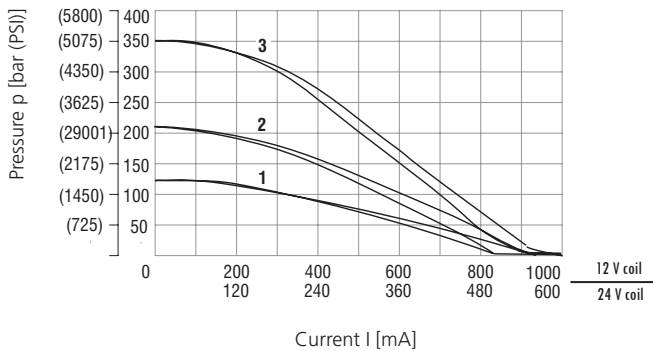
E12A, E13A  
- IP67 / IP69K  
Deutsch DT04-2P



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

### Reduced pressure related to control signal

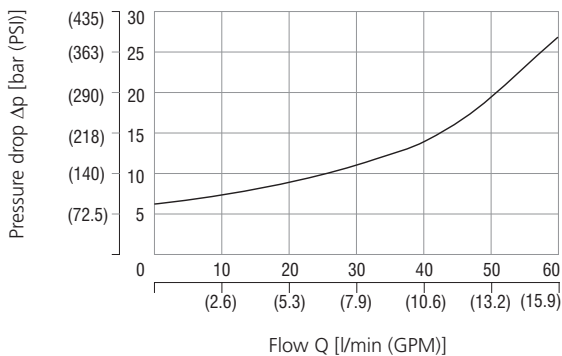
$Q = 0 \text{ l/min}$  (0 GPM), pressure in port T= 0 bar, PWM 160 Hz



Pressure range	12	21	35
	1	2	3

### Pressure drop related to flow rate

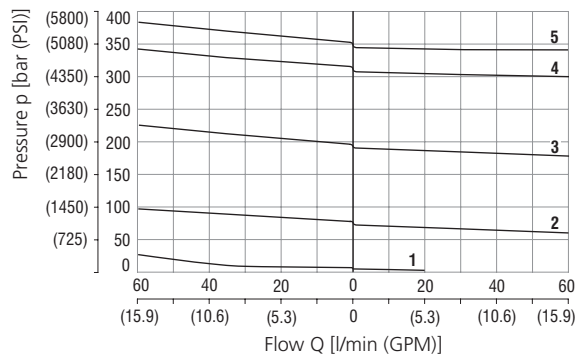
100% of control current, A-T direction



### Reducing - relieving pressure related to flow rate

Pressure range 35, Input 400 bar, various control currents

relieving function A-T / reducing function P-A



Control current	1	2	3	4	5
	100% $I_{max}$	75% $I_{max}$	50% $I_{max}$	25% $I_{max}$	0% $I_{max}$

## Ordering Code

**SPN4P1 - B3 / H**  -   -

**Proportional pressure control valve, reducing - relieving, pilot operated, inverted**

**Valve cavity**  
7/8-14 UNF (C-10-3)

**Model**  
High performance

**Max. reduced pressure**  
up to 120 bar (1740 PSI) **12**  
up to 210 bar (3046 PSI) **21**  
up to 350 bar (5076 PSI) **35**

**Supply voltage / max. current**  
12 V DC / 1.0 A **12**  
24 V DC / 0.6 A **24**

Main stage ordering key: SP6H-B3/HV

### Surface treatment

**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

### Seals

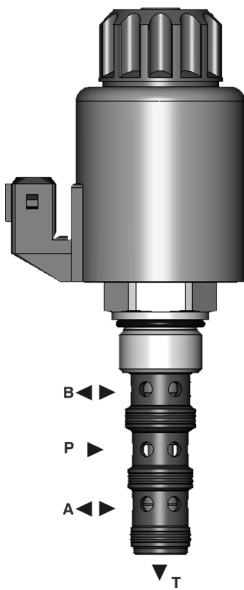
NBR  
FPM (Viton)

### Connector

**E1** EN 175301-803-A  
**E2** E1 with quenching diode  
**E3** AMP Junior Timer - radial direction (2 pins; male)  
**E4** E3 with quenching diode  
**E3A** AMP Junior Timer - axial direction (2 pins; male)  
**E4A** E3A with quenching diode  
**E12A** Deutsch DT04-2P - axial direction  
**E13A** E12A with quenching diode

For other solenoid terminals see data sheet No. 8007

**4/3 Proportional Control Valve, Screw-in Cartridge design**
**SD2P-B4**

 7/8-14 UNF •  $Q_{\max}$  25 l/min (7 GPM) •  $p_{\max}$  250 bar (3630 PSI)

**Technical Features**

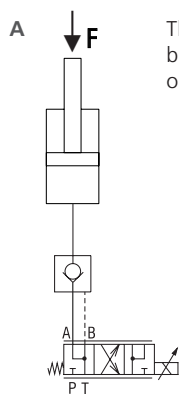
- › Proportional valve with integrated hydraulic lock control function
- › Hardened and precision working parts
- › 12 and 24 VDC standard supply voltage of coils
- › Optional type of electrical terminal EN175301-803-A, AMP Junior Timer or Deutsch DT04-2P
- › Optional Built-in quenching diode for protection of electronic control unit
- › Economical design
- › Connector positioning thanks to coil rotation around its axes 360°
- › In the standard configuration steel parts are zinc coated for 240 h protection in NSS acc. to ISO 9227

**Functional Description**

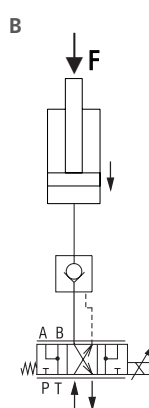
The SD2P-B4 valve can be used in any application when it comes to routing hydraulic fluid to and from the consumer. Typically, these are applications that require lifting or lowering of a load. Thanks to the proportional adjustability of the valve, the motion speed can be adjusted to the given demands.

Compared to other available proportional 4/3 directional valves, the SD2P-B4 valve is equipped with only one solenoid for both actuation directions (usually two solenoids are needed). This design provides several benefits (e.g. more compact design, fewer electric connectors);

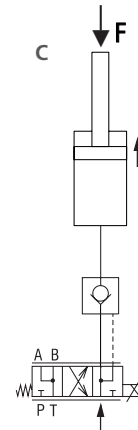
The SD2P-B4 is typically used in combination with a pilot-to-open check valve. The corresponding schematic is shown in Fig A, B and C. In such circuits, the check valve serves to decouple the consumer from the rest of the hydraulic system with zero leakage. The check valve is closed as long as the proportional valve is in center position / de-energized (Fig. A). Fig. B and C show how the energized switching positions facilitate „lowering“ and „lifting“ functions.



The piston lowering is blocked by closed pilot operated check valve.



The pilot operated check valve is opened by pressure fluid in B channel and the cylinder is relieved to the tank via A channel – the piston moves downwards by acting load F; the lowering speed can be smoothly regulated by flow throttling on the spool adage.

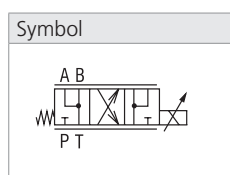


The pilot operated check valve remains open by fluid pressure in B channel. The pressure fluid is simultaneously led to the cylinder and the piston moves upwards. The lifting speed can be smoothly regulated.

**Note:**

The specific placement of the spool edge and the specific function of the Proportional directional control valve are protected by US patent 9,505,288 B2 a EP 2772373.

This original technical solution is the intellectual property of Fluid Systems Partners Holding AG and is subject to legal protection.

**Technical Data**


Valve size / Cartridge cavity		7/8-14 UNF-2A / B4	
Flow stages [ $\Delta p = 10$ bar (145 PSI)]	l/min (GPM)	4 (1.1)	20 (5.3)
Max. flow	l/min (GPM)	9 (2.4)	25 (7)
Max. operating pressure	bar (PSI)	250 (3630)	
Max. proof pressure in T channel	bar (PSI)	100 (1450) T channel should stay without pressure for the correct function	
Fluid temperature range	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short time	
Ambient temperature range	°C (°F)	-30 ...90 (-22 ...194), +100 (212) short time	
Response time at 100 % signal	ms	< 50	
<b>Solenoid data</b>			
Nominal supply voltage	V	12 DC	24 DC
Max. current	A	1.5	1
Rated resistance at 20 °C (68 °F)	$\Omega$	5	13.4
Duty cycle	%	100	
Optimal PWM frequency	Hz	200	
Enclosure type acc.to EN 60529**		(acc.to terminal type) IP67 / IP69K	
Weight with solenoid	kg (lbs)	0.67 (1.48)	
	Data Sheet	Type	
General information	GI_0060	Products and operating conditions	
Coil types	C_8007	C22B*	
Valve bodies	In-line mounted	SB_0018	SB-B4*
	Sandwich mounted	SB-04(06)_0028	SB-*B4*
Cavity details / Form tools	SMT_0019	SMT-B4*	
Spare parts	SP_8010		

\*\*The indicated IP protection level is only reached with a properly mounted connector.

## Ordering Code

**SD2P-B4 / H**  -  -     -

**4/3 proportional directional control valve with connecting thread 7/8-14 UNF**

**Valve cavity**  
7/8-14 UNF-2A

**Model**  
High performance

**Functional symbol**



**Nominal flow rate P → A at  $\Delta p = 10$  bar (1450 PSI)**  
4 l/min (1.1 GPM)  
20 l/min (5.3 GPM)

**5**  
**25**

**Surface treatment**  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
**No designation** NBR  
**V** FPM (Viton)

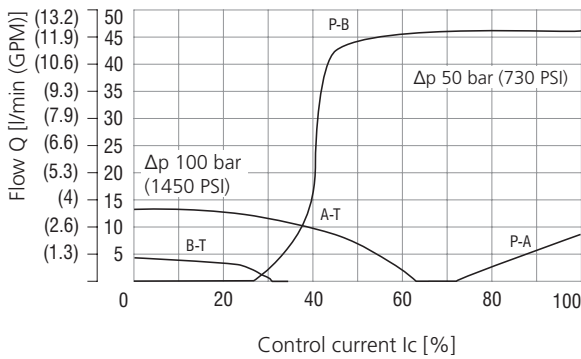
**Manual override**  
**No designation** standard

**Connector**  
**E1** EN 175301-803-A  
**E2** E1 with quenching diode  
**E3A** AMP Junior Timer - axial direction (2 pins; male)  
**E4A** E3A with quenching diode  
**E12A** Deutsch DT04-2P - axial direction (2 pins; male)  
**E13A** E12A with quenching diode

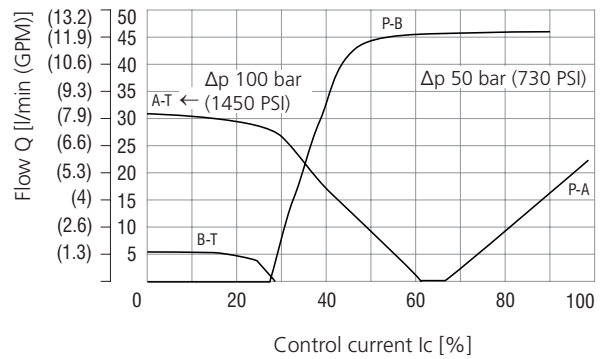
**Nominal supply voltage / max. current**  
**12** 12 V DC / 1.5 A  
**24** 24 V DC / 1.0 A

## Characteristics measured at $v = 32$ mm<sup>2</sup>/s (156 SUS)

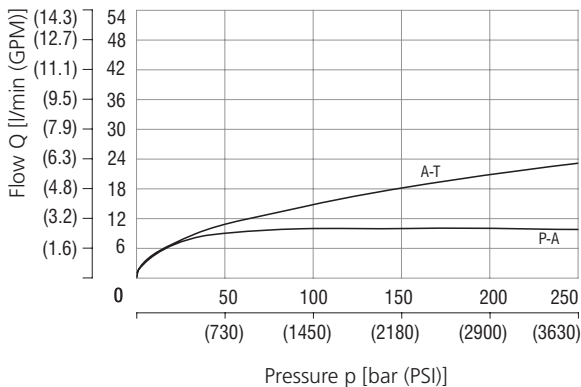
**Timing control limit SD2P-B4/H3Y13-5**



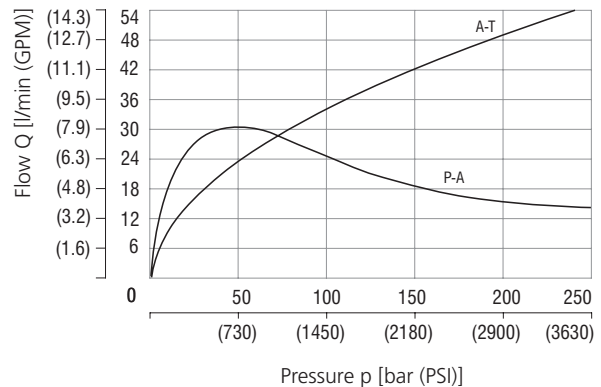
**Timing control limit SD2P-B4/H3Y13-25**



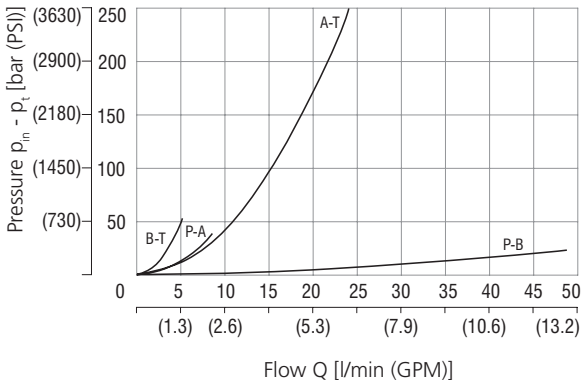
**Operating limits SD2P-B4/H3Y13-5**



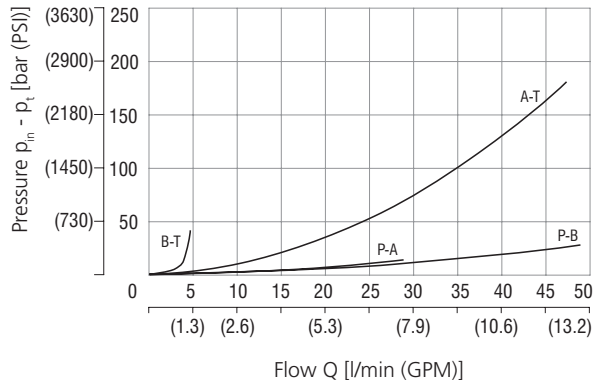
**Operating limits SD2P-B4/H3Y13-25**



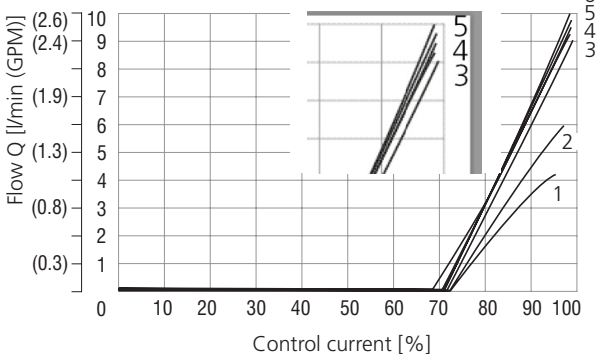
**Pressure drop SD2P-B4/H3Y13-5**



**Pressure drop SD2P-B4/H3Y13-25**

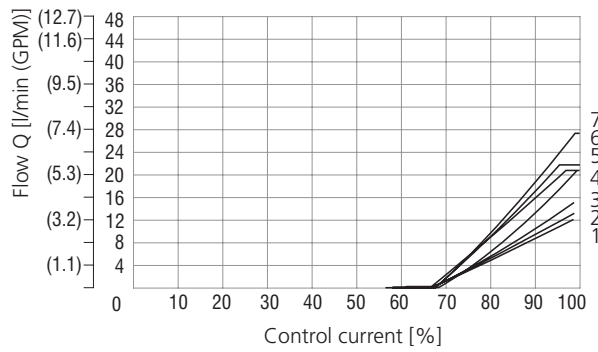


**Flow characteristic SD2P-B4/H3Y13-5  
Flow rate P - A**



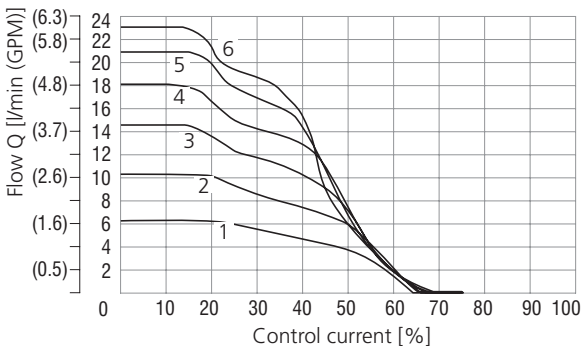
- 1 =  $\Delta p$  10 bar (145 PSI)
- 2 =  $p_m$  20 bar (290 PSI)
- 3 =  $p_m$  50 bar (725 PSI)
- 4 =  $p_m$  100 bar (1450 PSI)
- 5 =  $p_m$  150 bar (2180 PSI)
- 6 =  $p_m$  200 bar (2900 PSI)
- 7 =  $p_m$  250 bar (3630 PSI)

**Flow characteristic SD2P-B4/H3Y13-25  
Flow rate P - A**



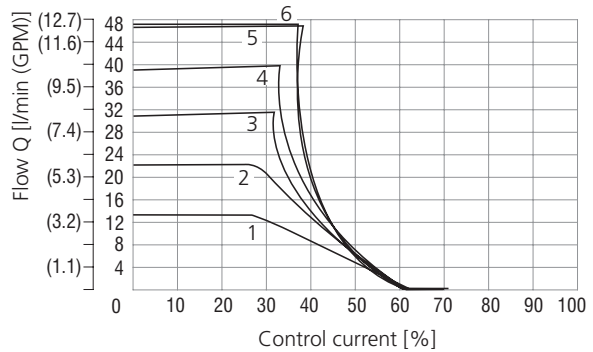
- 1 =  $p_m$  250 bar (3630 PSI)
- 2 =  $p_m$  200 bar (2900 PSI)
- 3 =  $p_m$  150 bar (2180 PSI)
- 4 =  $p_m$  100 bar (1450 PSI)
- 5 =  $\Delta p$  10 bar (145 PSI)
- 6 =  $p_m$  20 bar (290 PSI)
- 7 =  $p_m$  50 bar (725 PSI)

**Flow characteristic SD2P-B4/H3Y13-5  
Flow rate A - T**



- 1 =  $p_m$  20 bar (290 PSI)
- 2 =  $p_m$  50 bar (725 PSI)
- 3 =  $p_m$  100 bar (1450 PSI)
- 4 =  $p_m$  150 bar (2180 PSI)
- 5 =  $p_m$  200 bar (2900 PSI)
- 6 =  $p_m$  250 bar (3630 PSI)

**Flow characteristic SD2P-B4/H3Y13-25  
Flow rate A - T**



- 1 =  $p_m$  20 bar (290 PSI)
- 2 =  $p_m$  50 bar (725 PSI)
- 3 =  $p_m$  100 bar (1450 PSI)
- 4 =  $p_m$  150 bar (2180 PSI)
- 5 =  $p_m$  200 bar (2900 PSI)
- 6 =  $p_m$  250 bar (3630 PSI)



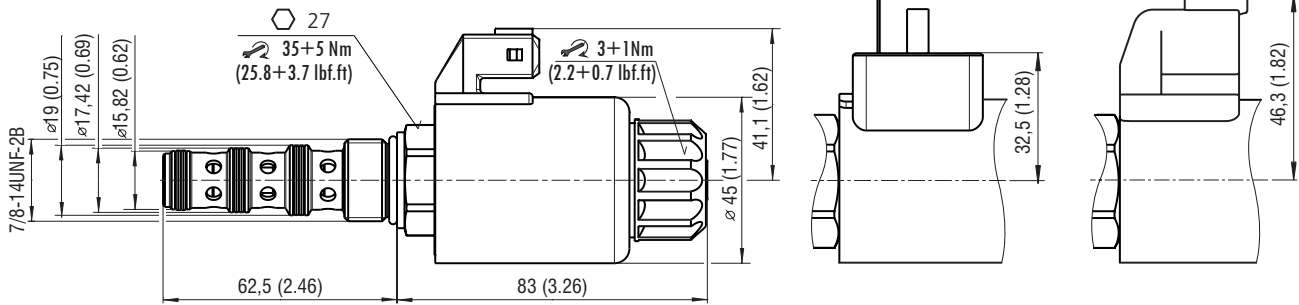
**Dimensions** in millimeters (inches)

**Connector type**

E3A, E4A - IP67 (AMP Junior Timer - axial direction)

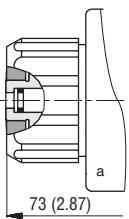
E1, E2 - IP65  
EN 175301-803-A

E12A, E13A - IP67/ IP69K  
Deutsch DT04-2P



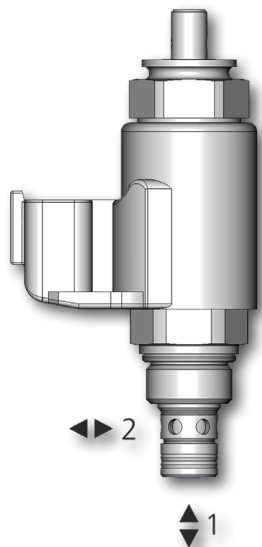
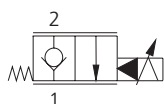
**Manual Override** in millimeters (inches)

No Designation - Standard



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.

**SD3P-A2/H**

 3/4-16 UNF •  $Q_{max}$  50 l/min (13.2 GPM) •  $p_{max}$  350 bar (5100 PSI)

**Technical Features**

- › Hardened precision parts
- › High flow capacity and leak-free closing
- › High transmitted hydraulic power, max. operating pressure 350 bar
- › Normally closed version
- › Available Manual Overrides
- › Both ports may be fully pressurized
- › Standard version zinc-coated with surface protection acc. to ISO 9227 (520 h salt spray)

**Functional Description**

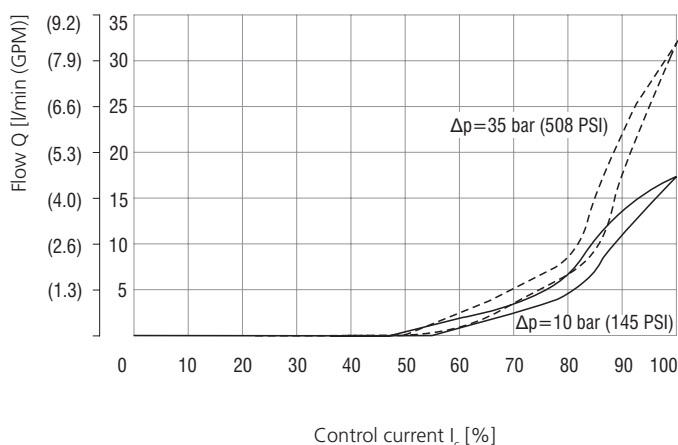
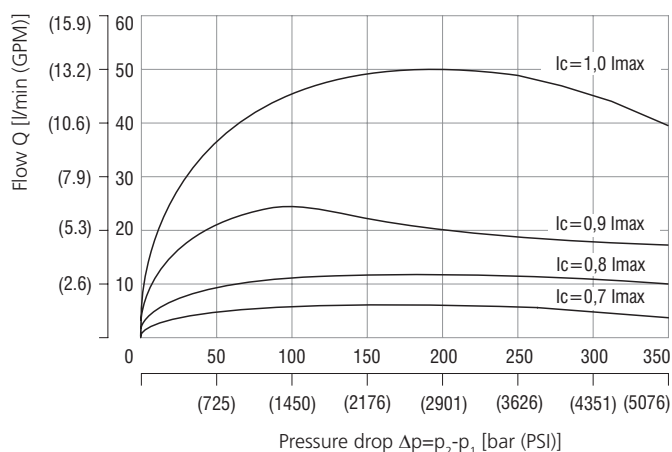
2/2 screw-in cartridge, proportional, directional, solenoid operated, piloted, poppet type valve normally closed version. When the the coil is not energized, in flow direction 1 → 2, the valve works as a non-return valve. In flow direction 2 → 1 the valve is closed with minimal volume loss.

When the coil is energized, in flow direction 2 → 1 the valve controls flow in proportion to the current. The valve is commonly used to hold a load with minimal volume loss and smooth control.

**Technical Data**

Valve size / Cartridge cavity		3/4-16 UNF-2A / A2 (C-8-2)	
Max. flow	l/min (GPM)	50 (13.2)	
Max. operating pressure	bar (PSI)	350 (5076)	
Nominal flow rate $Q_n$ at $\Delta p=35$ bar (508 PSI), direct. 2→1	l/min (GPM)	30 (7.9)	
Flow losses at $\Delta p=250$ bar (3625 PSI), direct. 2→1	ml/min	0.3	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... +176)	
Service life	cycles	10 <sup>6</sup>	
Weight - valve with solenoid	kg	0.257 (0.567)	
<b>Technical Data of the Proportional Solenoid</b>			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	0,475	0,950
Mean resistance value at 20 °C (68 °F)	Ω	6,55±0,4	16,2±1,8
Duty cycle	%	100	
Dither frequency	Hz	100	
		Datasheet	Type
General information	GI_0060	Products and operating conditions	
Coil types	C_8007	C 14B*	
Valve bodies	In-line mounted	SB_0018	SB-A2*
	Sandwich mounted	SB-04(06)_0028	SB-*A2*
Cavity details / Form tools	SMT_0019	SMT-A2*	
Spare parts	SP_8010		

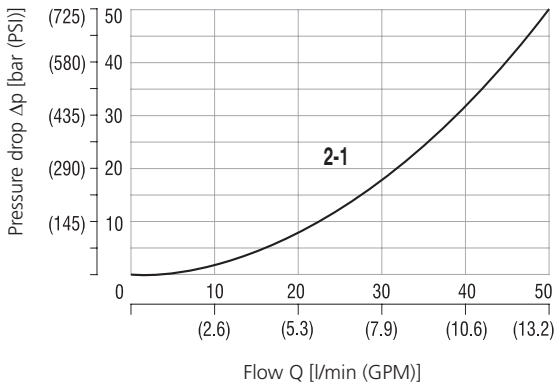
**Characteristics** measured at  $v = 32$  mm<sup>2</sup>/s (156 SUS)

**Flow characteristic - flow direction 2-1**  
at different pressure levels

**Operating limits - flow direction 2-1**  
at different current levels


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

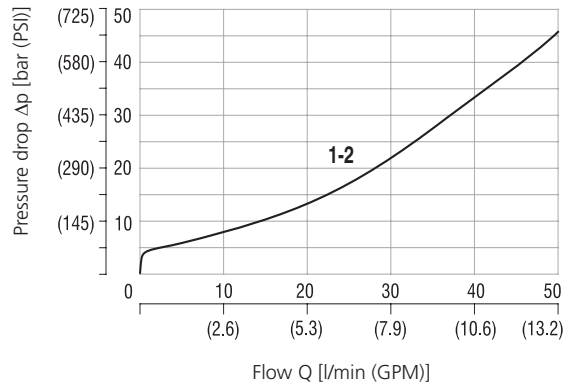
**Pressure drop related to flow rate**

Flow direction 2→1, Control current  $I_c = 1,25 \cdot I_{\text{max}}$



**Pressure drop related to flow rate**

Flow direction 1→2, Control current  $I_c = 0 \text{ mA}$



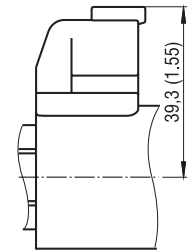
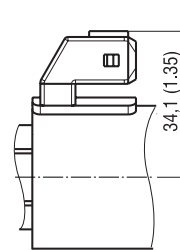
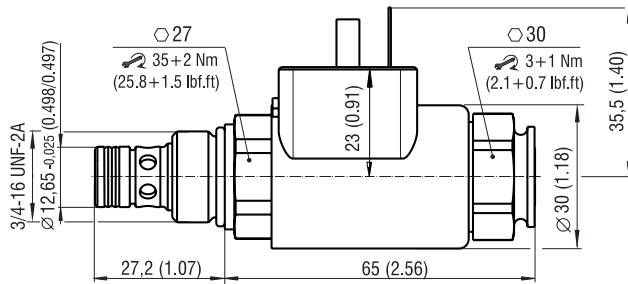
**Dimensions** in millimeters (inches)

**Connector type**

E1, E2 - IP65  
EN 175301-803-A

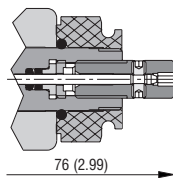
E3A, E4A - IP67  
AMP Junior Timer

E12, E13 - IP67 / IP69K  
Deutsch DT04-2P

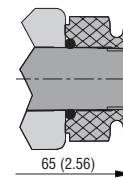


**Manual Override** dimensions in millimeters (inches)

Designation M5 - socket head screw, size 2.5



Designation M9 - without manual override



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.

**Ordering Code**

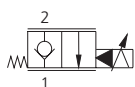
**SD3P-A2 / H 2L2 / 30 - [ ] [ ] [ ] [ ] - B**

**2/2 Proportional Directional valve, Solenoid Operated, Poppet Type, Piloted**

**Valve cavity**  
3/4-16 UNF-2A (C-8-2)

High performance

**Functional symbol**



**Nominal flow rate**  
30 l/min at 35 bar (7.9 GPM at 508 PSI)

**Rated supply voltage / max. current**  
12 V DC / 0,95 A  
24 V DC / 0,475 A

**12**  
**24**

**Surface treatment**  
zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
NBR  
FPM (Viton)

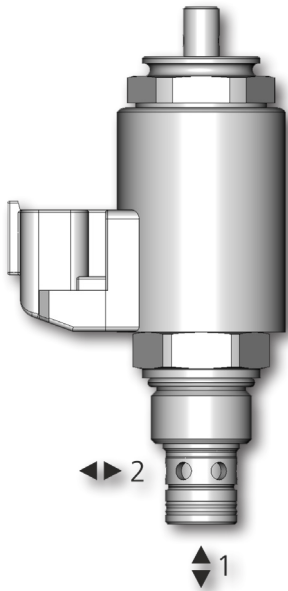
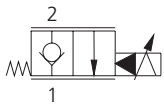
**Manual override**  
M5 socket head screw, size 2.5  
M9 without manual override

**Connector**  
E1 EN 175301-803-A  
E2 E1 with quenching diode  
E3A AMP Junior Timer - axial direction (2 pins; male)  
E4A E3A with quenching diode  
E12A Deutsch DT04-2P - axial direction  
E13A E12A with quenching diode

## 2/2 Proportional Directional valve, Solenoid Operated, Poppet Type, Piloted

### SD3P-B2/H

7/8-14 UNF •  $Q_{max}$  100 l/min (26.4 GPM) •  $p_{max}$  350 bar (5100 PSI)



#### Technical Features

- › Hardened precision parts
- › High flow capacity and leak-free closing
- › High transmitted hydraulic power up to 350 bar
- › Normally closed version
- › Available Manual Overrides
- › Both ports may be fully pressurized
- › Standard version zinc-coated with surface protection acc. to ISO 9227 (520 h salt spray)

#### Functional Description

2/2 screw-in cartridge, proportional, directional, solenoid operated, piloted, poppet type valve normally closed version. When the the coil is not energized, in flow direction 1 → 2, the valve works as a non-return valve. In flow direction 2 → 1 the valve is closed with minimal volume loss. When the coil is energized, in flow direction 2 → 1 the valve controls flow in proportion to the current.

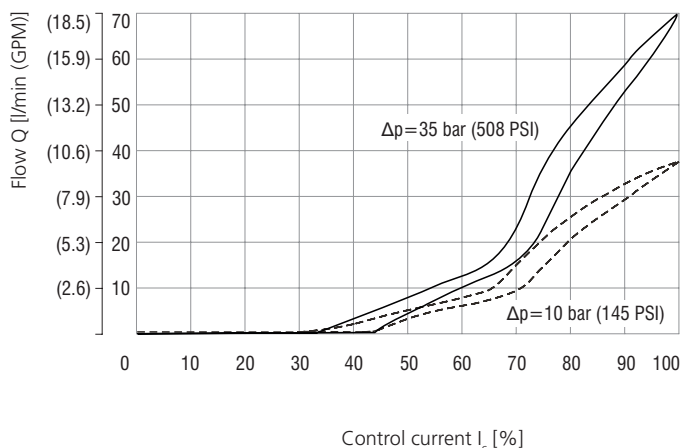
The valve is commonly used to hold a load with minimal volume loss and smooth control.

#### Technical Data

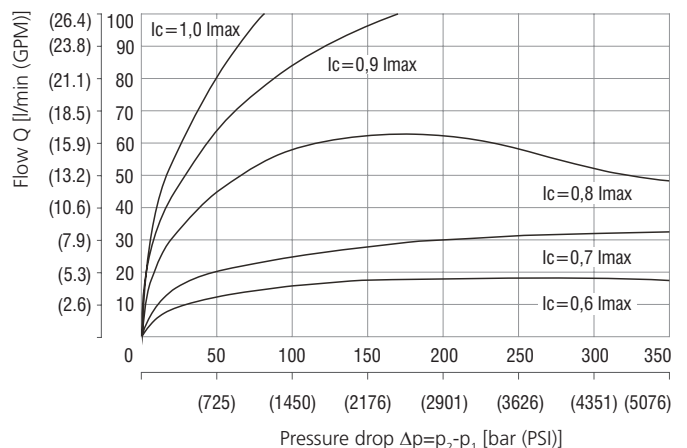
Valve size / Cartridge cavity		7/8-14 UNF-2A / B2 (C-10-2)	
Max. flow	l/min (GPM)	100 (26.4)	
Max. operating pressure	bar (PSI)	350 (5076)	
Nominal flow rate $Q_N$ at $\Delta p=35$ bar (508 PSI), direct. 2→1	l/min (GPM)	70 (18.5)	
Flow losses at $\Delta p=250$ bar (3625 PSI), direct. 2→1	ml/min	0.3	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... +176)	
Service life	cycles	10 <sup>6</sup>	
Weight - valve with solenoid	kg	0.447 (0.985)	
Technical Data of the Proportional Solenoid			
Nominal supply voltage	V	12 DC	24 DC
Limit current	A	0.475	0.950
Mean resistance value at 20 °C (68 °F)	Ω	4.9±0.22	20.8±0.8
Duty cycle	%	100	
Dither frequency	Hz	70	
		Datasheet	Type
General information		GI_0060	Products and operating conditions
Coil types		C_8007	C 19B*
Valve bodies	In-line mounted	SB_0018	SB-B2*
	Sandwich mounted	SB-04(06)_0028	SB-*B2*
Cavity details / Form tools		SMT_0019	SMT-B2*
Spare parts		SP_8010	

#### Characteristics measured at $v = 32$ mm<sup>2</sup>/s (156 SUS)

**Flow characteristic - flow direction 2-1**  
at different pressure levels



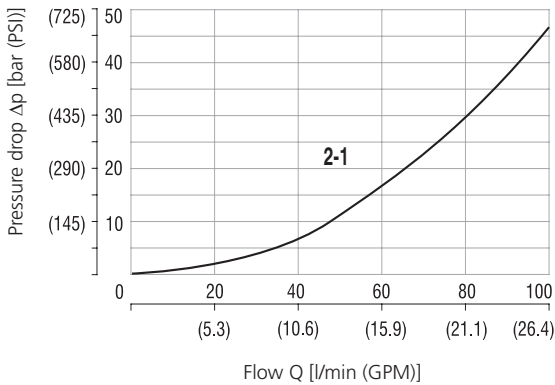
**Operating limits - flow direction 2-1**  
at different current levels



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

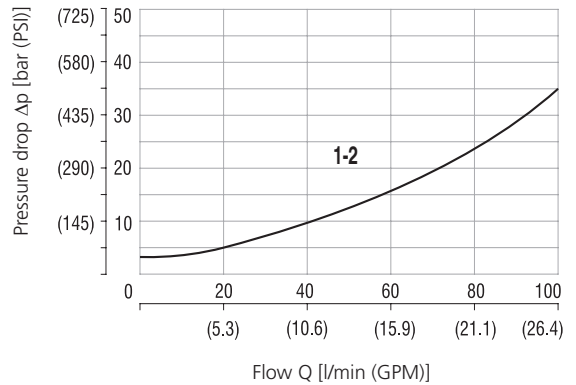
**Pressure drop related to flow rate**

Flow direction 2→1, Control current  $I_c = 1.25 \cdot I_{\text{max}}$



**Pressure drop related to flow rate**

Flow direction 1→2, Control current  $I_c = 0 \text{ mA}$



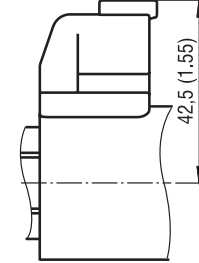
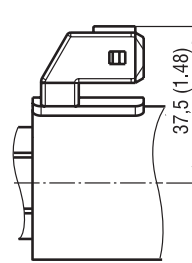
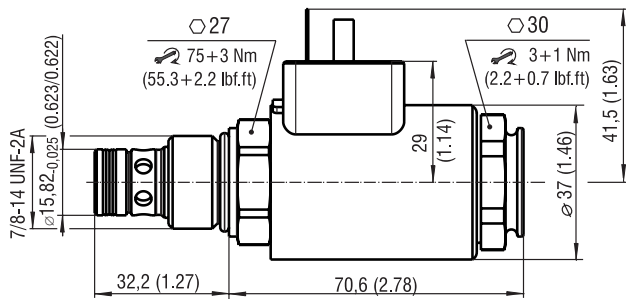
**Dimensions** in millimeters (inches)

**Connector type**

E1, E2 - IP65  
EN 175301-803-A

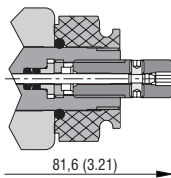
E3A, E4A - IP67  
AMP Junior Timer

E12, E13 - IP67 / IP69K  
Deutsch DT04-2P

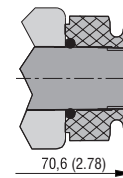


**Manual Override** dimensions in millimeters (inches)

Designation M5 - socket head screw, size 2.5



Designation M9 - without manual override



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.

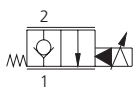
**Objednací klíč**

**2/2 Proportional Directional valve, Solenoid Operated, Poppet Type, Piloted**

**Valve cavity**  
7/8-14 UNF-2A (C-10-2)

High performance

**Functional symbol**



**Nominal flow rate**  
70 l/min při 35 bar (18.5 GPM při 508 PSI)

**Rated supply voltage / max. current**  
12 V DC / 1.2 A  
24 V DC / 0.6 A

**SD3P-B2 / H 2L2 / 70 - [ ] [ ] [ ] [ ] - B**

**Surface treatment**  
zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
No designation  
V NBR  
FPM (Viton)

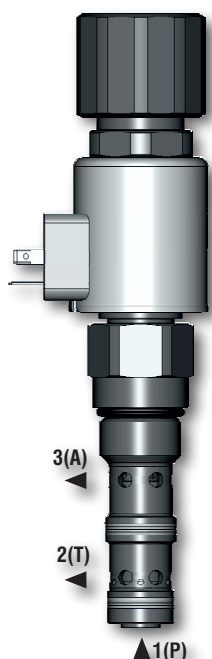
**Manual override**  
M5 socket head screw, size 2.5  
M9 without manual override

**Connector**  
E1 EN 175301-803-A  
E2 E1 with quenching diode  
E3 AMP Junior Timer (2 PIN)  
E3 with quenching diode  
E3A AMP Junior Timer - axial direction (2 PIN)  
E3A with quenching diode  
E12A Deutsch DT04-2P - axial direction (2 PIN)  
E12A with quenching diode  
E13A E12A with quenching diode

## Screw-in Cartridge Proportional Flow Control Valve

### SF32P-C3/H

1-1/16-12 UN • inlet  $Q_{max}$  100 l/min (26 GPM) / regulated  $Q_{max}$  60 l/min (16 GPM) •  $p_{max}$  350 bar (5100 PSI)



#### Technical Features

- › Proportional flow control operated by solenoid, realized by smooth regulation of flow cross section
- › Possible remote flow control by electric command signal
- › Pressure drop stabilisation with 3-way pressure compensator
- › Regulated volumetric flow independent of load change on an actuator and input pressure fluctuation
- › A and T may be fully pressurized up to 350 bar
- › The 3-way pressure compensator can be changed into 2-way compensator by closing port 2 in the block
- › Three types of connector for electric supply of coils available
- › Additional protection of electronic control unit by incorporating a quenching diode into the connector
- › Manual opening of throttle spool by manual override
- › Surface of the valve is zinc coated with corrosion protection 520 h in NSS acc. to ISO 9227

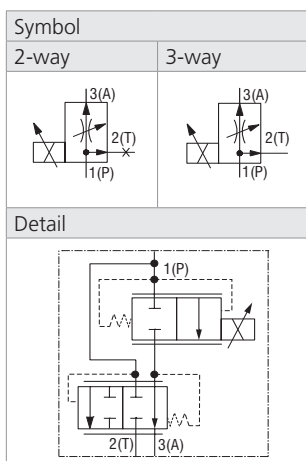
#### Functional Description

Screw-in cartridge proportional flow control valve with 3-way pressure compensator. The valve is designed to control the speed hydraulic cylinder or hydraulic motor in applications where minimal speed as load or pump supply pressures change. When port 2 is connected to tank, the valve acts as a bypass and the excess fluid is discharged through port 2 back to the tank. Proportional flow control operated by solenoid, is realized by smooth regulation of flow cross section. The flow rate smoothly increases with the increasing command signal, current flowing through the coil winding.

When the port 2 is closed, the valve changes its function into flow control valve with 2-way pressure compensator and the pressure drop is controlled by fluid flow throttling at the edge of compensator spool.

Under the condition that the bypass port (2T) is open, the maximum input flow 100 l/min (26.4 GPM) from the pump (1P) is divided into the maximum regulated flow 60 l/min (15.9 GPM) to the actuator (3A) and the flow 40 l/min (10.6 GPM) into the tank (2T).

#### Technical Data

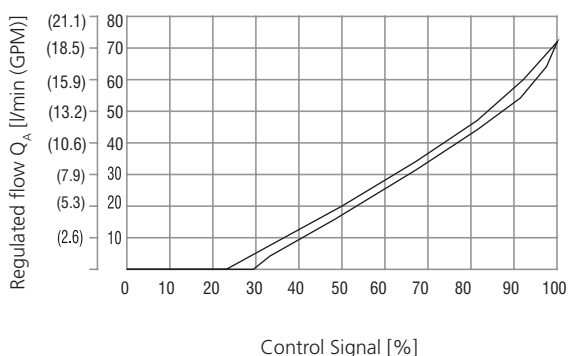


Valve size / Cartridge cavity		1-1/16-12 UN-2A / C3 (C-12-3)	
Max. inlet flow (port 1)	l/min (GPM)	100 (26.4)	
Regulated flow	l/min (GPM)	0 ... 60 (0 ... 15.9)	
Max. operating pressure in all ports	bar (PSI)	350 (5080)	
Fluid temperature range (NBR)	°C (°F)	-30 ... +80 (-22 ... +176)	
Fluid temperature range (FPM)	°C (°F)	-20 ... +80 (-4 ... +176)	
Ambient temperature range	°C (°F)	-30 ... +80 (-22 ... +176)	
Hysteresis	%	< 8	
Weight	kg (lbs)	1.17 (2.58)	
<b>Solenoid data</b>			
Supply voltage	V	12 DC	24 DC
Max. current	A	2.5	1.0
Rated resistance at 20 °C (68 °F)	Ω	2.33 ± 5 %	13.4 ± 5 %
Duty cycle	%	100	
Optimal PWM frequency	Hz	120	
Quenching diode		BZW06-19B	BZW06-33B
Enclosure type acc. to EN 60529**		IP65 / IP67 / IP69K	
	Data Sheet	Type	
General information	GI_0060	Product and operating conditions	
Coil types	C 8007	C22B	
Valve bodies	In-line mounted	SB_0018	SB-C3*
	Sandwich mounted	SB-04(06)_0028	SB-*C3* (only for size 10)
Cavity details / Form tools	SMT_0019	SMT-C3*	
Spare parts	SP_8010		

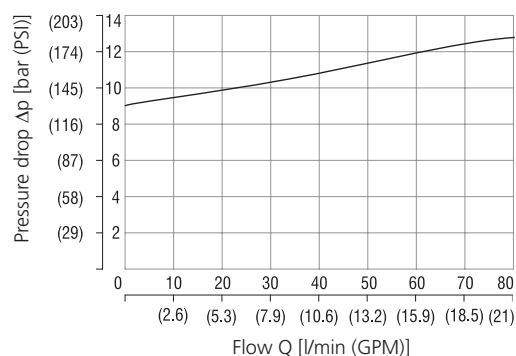
\*\*The indicated IP protection level is only reached with a properly mounted connector.

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

##### Regulated flow at port A related to control signal

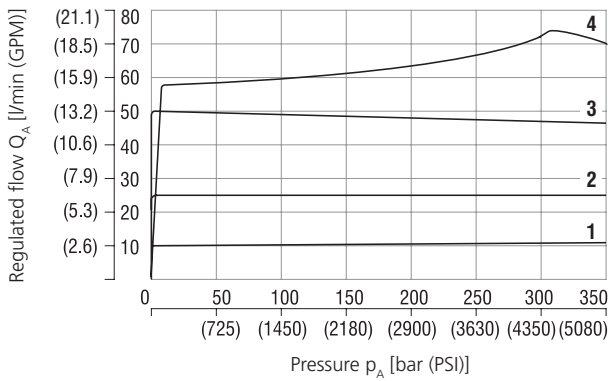


##### Pressure drop $\Delta p - P \rightarrow T$ , 0% of control current



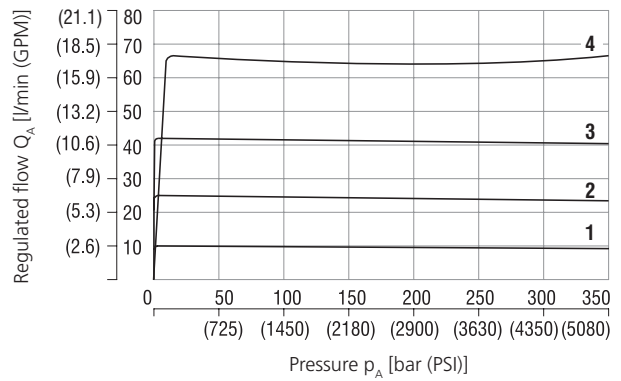
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Regulated flow at port A - related to load pressure**  
2-way pressure compensator (port T to the tank is closed)



Current control signal	1	2	3	4
	40 %	60 %	80 %	100 %

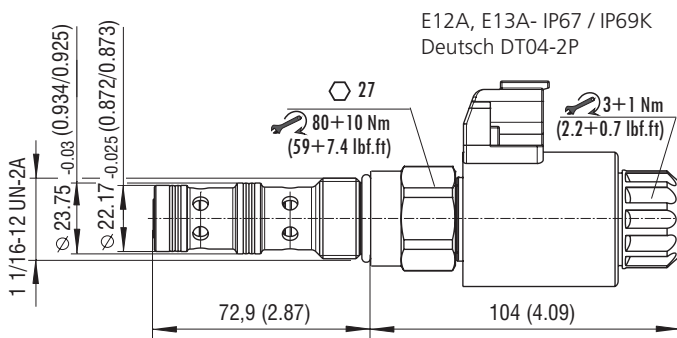
**Regulated flow at port A - related to load pressure**  
3-way pressure compensator (port T to the tank is open)



Current control signal	1	2	3	4
	40 %	60 %	80 %	100 %

**Dimensions** in millimeters (inches)

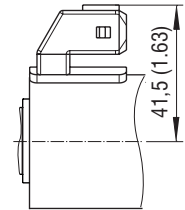
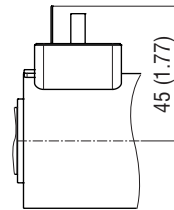
**Type of the coil connector**



E12A, E13A- IP67 / IP69K  
Deutsch DT04-2P

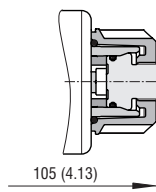
E1, E2 - IP65  
EN 175301-803-A

E3A, E4A - IP67  
AMP Junior Timer  
- axial direction

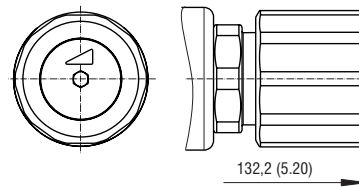


**Manual Override** in millimeters (inches)

**M9 - without manual override**



**Designation M10 - red anodized swivel handle with scale**



applicable up to max pressure 350 bar in the port P

**Ordering Code**

**SF32P-C3/HC 60 - [ ] [ ] [ ] [ ] - B**

**Screw-in Cartridge Proportional Flow Control Valve**

**Valve cavity**  
1-1/16-12 UN (C-12-3)

**Model**  
High performance

**Functional symbol**  
Normally closed

**Regulated flow**  
0 ... 60 l/min (0 ... 15.9 GPM)

**Supply voltage\* / max. current**  
12 V DC / 2.5 A **12**  
24 V DC / 1.0 A **24**

**Surface treatment**  
zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
V

**Seals**  
NBR  
FPM (Viton)

**M9**  
**M10**

**Manual override**  
without manual override  
swivel handle with the scale

**Connector**  
EN 175301-803-A  
E1 with quenching diode  
E2  
E3A AMP Junior Timer - axial direction (2 pins; male)  
E4A E3A with quenching diode  
E12A Deutsch DT04-2P - axial direction (2 pins; male)  
E13A E12A with quenching diode

\*For other supply voltages of coils see data sheet C\_8007.



Technical Features

- › 2-Way pressure compensator, spool-type, built in a modular block for vertical grouping with mounting interface acc. to ISO 4401 (size 04), DIN 24340 (CETOP 02)
- › High flow capacity
- › Meter-in design with integrated load shuttle valve
- › Meter-out design with integrated by-pass check valve
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › In the standard version, the valve body is phosphated. The steel parts are zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

Functional Description

The 2-way pressure compensator, built in a modular block, maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream and downstream from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by flow throttling on the spool control edge. In the basic position the compensator is open. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve.

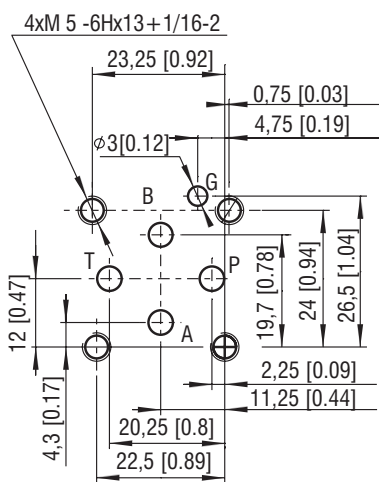
2-way pressure compensator for meter-in connection (models A, B, C)

Meter-in compensator is connected between the pump and flow control valve in the circuit. This connection can be used in the case of positive acting load on the actuator, it means in the opposite direction to the movement. The model C is equipped with an integrated load shuttle valve for pressure sensing in both actuator pipelines depending on movement direction.

2-way pressure compensator for meter-out connection (models D, E, F)

Meter-out compensator is connected between the flow control valve and actuator in one or both pipelines of actuator. This connection must be used in the case of negative acting load on the actuator, it means in the same direction to the movement, e.g. at the lowering of load. The pressure drop is stabilised in the flow direction  $A \rightarrow T$  and  $B \rightarrow T$ . In the opposite flow direction (to the actuator) the fluid flows freely through the opened integrated bypass check valve.

ISO 4401-02-01-0-05



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

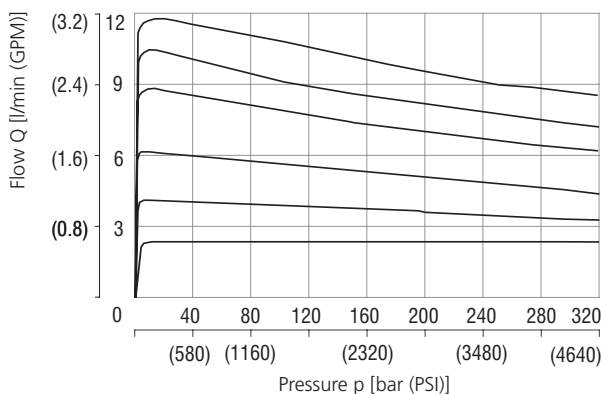
Technical Data

Valve size		04 (D02)
Max. operating pressure	bar (PSI)	320 (4640)
Max. flow	l/min (GPM)	16 (4.2)
Control pressure differential	bar (PSI)	10 (145)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight (all models)	kg (lbs)	0.6 (1.32)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 04
Spare parts	SP_8010	

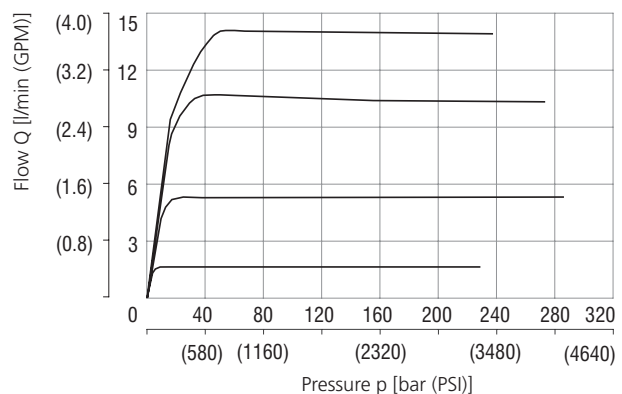
Characteristics measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

Regulated flow related to input pressure

TV2-042/MC Meter-in compensator



TV2-042/MD Meter-out compensator

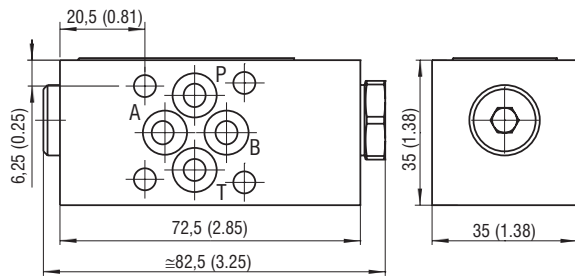


The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-043Z11/12 proportional directional valve. If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

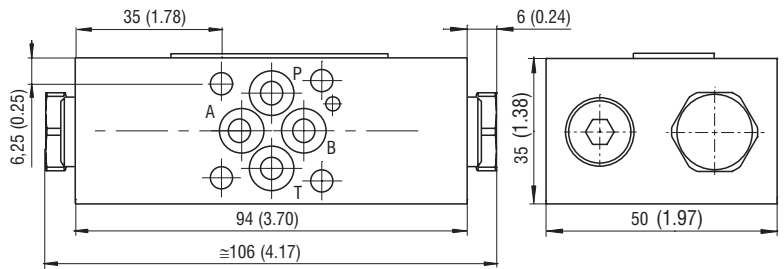


**Dimensions** in millimeters (inches)

**TV2-042/MA (B, C) Meter-in compensator**

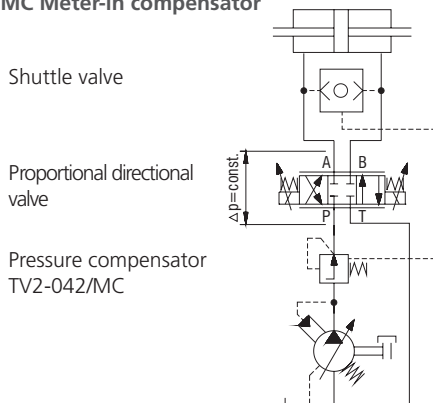


**TV2-042/MD (E, F) Meter-out compensator**

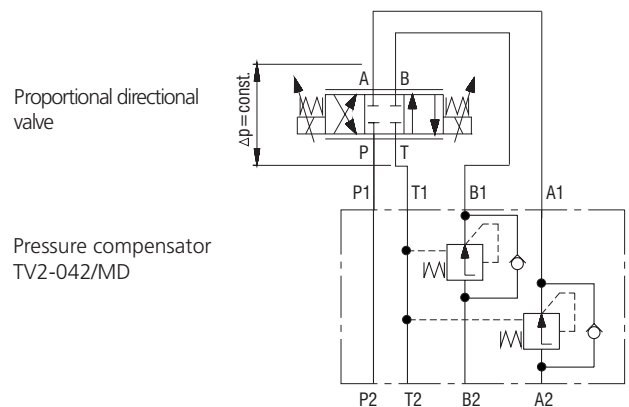


**Application Example**

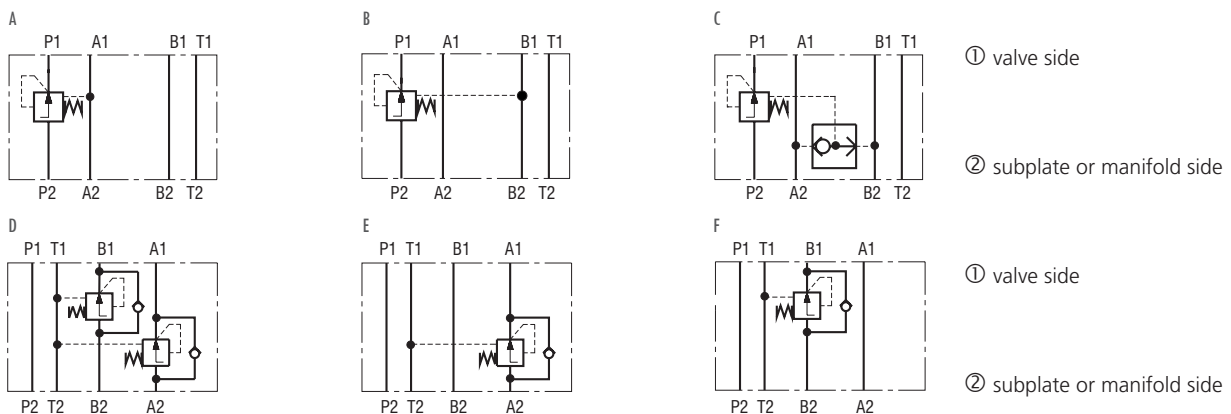
**TV2-042/MC Meter-in compensator**



**TV2-042/MD Meter-out compensator**



**Functional Symbols**



**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

**Ordering Code**

**TV2-042/M**    **1** **C**    -   

<p><b>2-Way pressure compensator, spool-type, direct-acting, modular</b></p> <p><b>Nominal size 04</b> ISO 4401-02-01-0-05, DIN 24340 (CETOP 02)</p> <p><b>2-way pressure compensator</b></p> <p><b>Sandwich plate</b></p> <p><b>Model</b> Meter-in compensator in port A Meter-in compensator in port B Meter-in compensator in port A and B Meter-out compensator in port A and B Meter-out compensator in port A Meter-out compensator in port B</p>	<p><b>A</b> <b>B</b> <b>C</b> <b>D</b> <b>E</b> <b>F</b></p>	<p><b>Surface treatment</b> <b>No designation</b> housing phosphated, steel parts zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)</p> <p><b>Seals</b> <b>No designation</b> <b>V</b> NBR FPM (Viton)</p> <p><b>Adjustment option</b> fixed setting, not adjustable</p> <p><b>Control pressure differential</b> 10 bar (145 PSI)</p>
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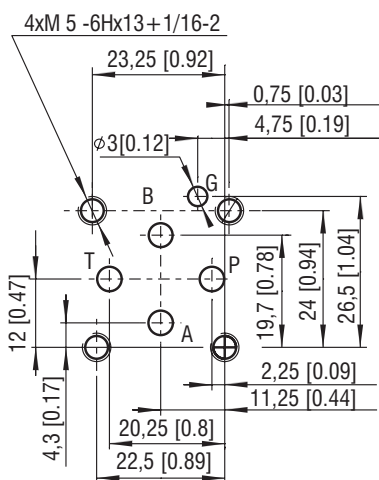

**Technical Features**

- › 3-way pressure compensator, spool-type, built in a modular block for vertical grouping with mounting interface acc. to ISO 4401 (size 04), DIN 24340 (CETOP 02)
- › High flow capacity
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Pressure sensing in the both pipelines of actuator with the help of integrated load shuttle valve (model C)
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Pressure drop setting by adjusting screw in the range from 5 to 40 bar (72.5 – 580 PSI)
- › In the standard version, the valve body is phosphated. The steel parts are zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

**Functional Description**

The 3-way pressure compensator, built in a modular block, maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream and downstream from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by releasing excess flow back to the tank. In the basic position the compensator is closed. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve or by change of the set pressure drop on the pressure compensator with the adjusting screw.

The three-way pressure compensator is connected parallel to the flow control valve. It maintains a constant pressure drop on the valve by dividing the flow from the pump. When the actuator is stopped, the pressure compensator opens and allows full fluid flow from the pump to the tank at low pressure losses. It takes over the function of unloading valve and protects the circuit against overheating. The three-way pressure compensator is very often used for system pressure regulation depending of the load (LS-regulation) in the circuits with a constant displacement pump.

**ISO 4401-02-01-0-05**

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

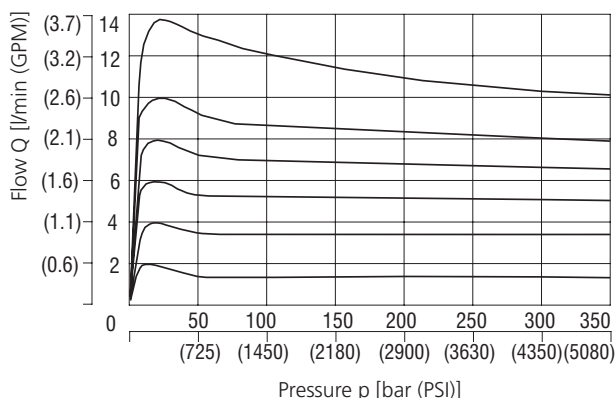
**Technical Data**

Valve size	04 (D02)	
Max. operating pressure	bar (PSI)	320 (4640)
Max. flow	l/min (GPM)	20 (4.2)
Control pressure differential	bar (PSI)	5 ... 40 (72.5 ... 580)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight (All models)	kg (lbs)	0.6 (1.32)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 04
Spare parts	SP_8010	

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

**Regulated flow related to input pressure**

TV2-043/MC Meter-in compensator

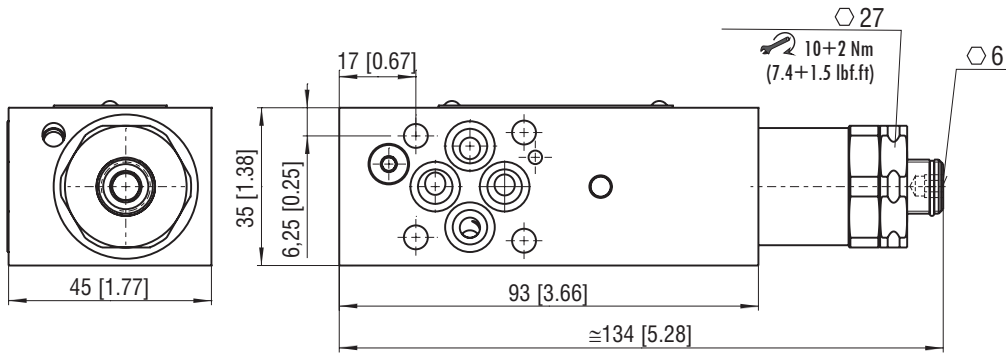


The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-043Z11/12 proportional directional valve.

If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

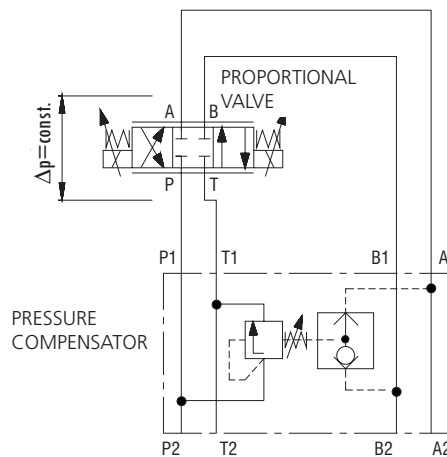
**Dimensions** in millimeters (inches)

**TV2-043/MA (B, C) - Meter-in compensator**

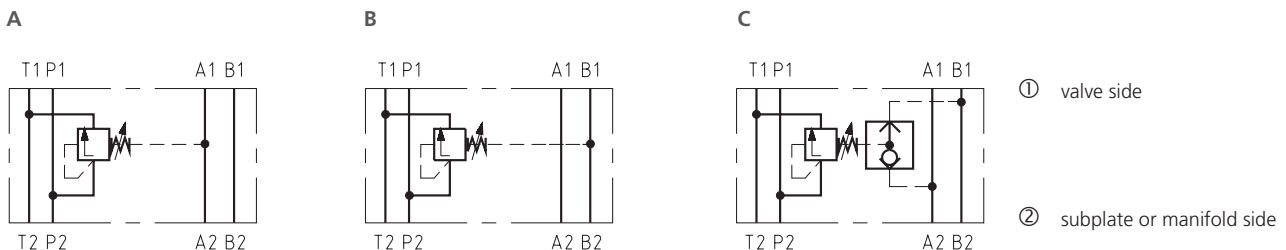


**Application Example**

**Meter-in compensator**

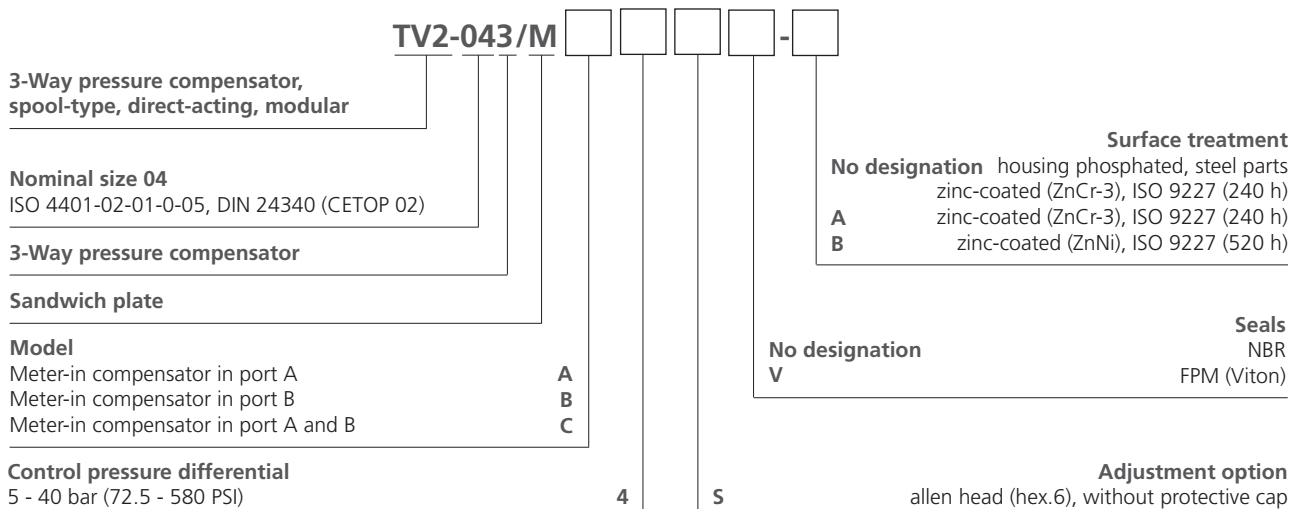


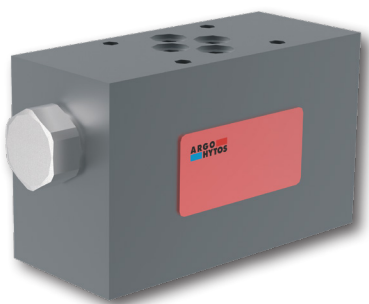
**Functional Symbols**



**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

**Ordering Code**





**Technical Features**

- › 2-Way pressure compensator, spool-type, built in a modular block for vertical grouping with mounting interface acc. to ISO 4401 (size 06), DIN 24340 (CETOP 03)
- › High flow capacity
- › Meter-in design with integrated load shuttle valve
- › Meter-out design with integrated by-pass check valve
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Possible external sensing of LS signal by means of an adapter, mounted instead of the end plug on the spring side, or by X2-channel on the connecting surface of modular block (CX version)
- › In the standard version, the valve body is phosphated. The steel parts are zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

**Functional Description**

The 2-way pressure compensator, built in a modular block, maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream and downstream from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by flow throttling on the spool control edge. In the basic position the compensator is open. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve.

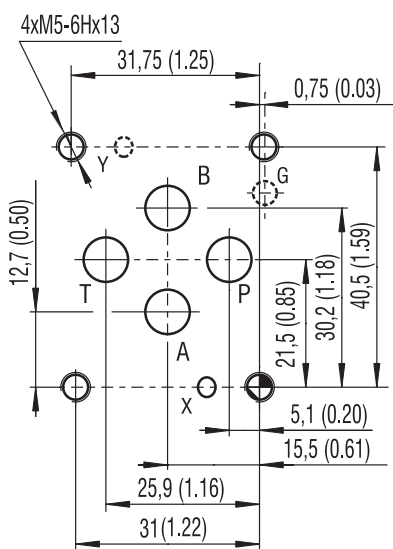
**2-way pressure compensator for meter-in connection (models A, B, C, CX)**

Meter-in compensator is connected between the pump and flow control valve in the circuit. This connection can be used in the case of positive acting load on the actuator, it means in the opposite direction to the moving. The model C is equipped with an integrated load shuttle valve for pressure sensing in both actuator pipelines depending on movement direction.

**2-way pressure compensator for meter-out connection (models D, E, F)**

Meter-out compensator is connected between the flow control valve and actuator in one or both pipelines of the actuator. This connection must be used in the case of negative acting load on the actuator, it means in the same direction as the movement, e.g. et the lowering the load. The pressure drop is stabilised in the flow direction A → T and B → T. In the opposite flow direction (to the actuator) the fluid flows freely through the opened integrated bypass check valve.

ISO 4401-03-02-0-05



Ports P, A, B, T max.  $\varnothing$ 7.5 mm (0.29)

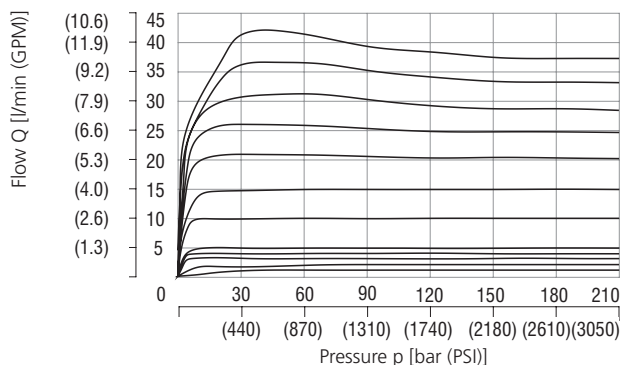
**Technical Data**

Valve size	06 (D03)	
Max. operating pressure	bar (PSI)	350 (5080)
Max. flow	l/min (GPM)	35 (9.2)
Control pressure differential	bar (PSI)	10 (145)
Fluid temperature range (NBR)	°C (°F)	-30 .... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 .... +120 (-4 ... +248)
Weight (all models)	kg (lbs)	1.0 (2.20)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 06
Spare parts	SP_8010	

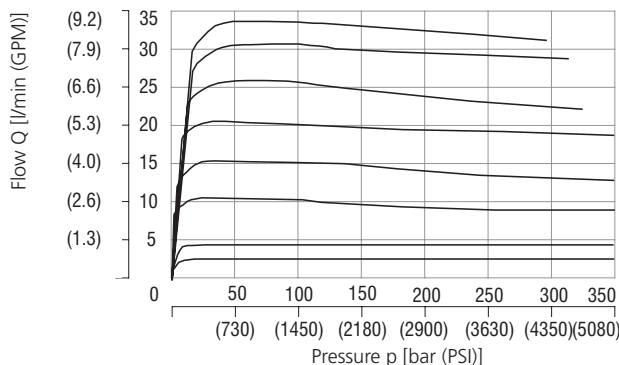
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Regulated flow related to input pressure**

TV2-062/MC Meter-in compensator



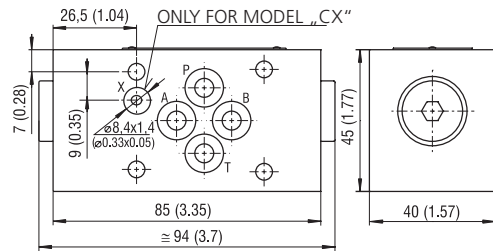
TV2-062/MD Meter-out compensator



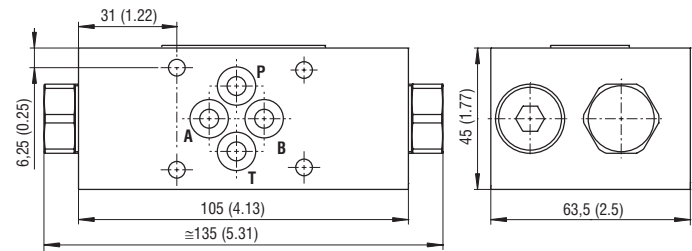
The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-063Z11/30 proportional directional valve. If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

**Dimensions** in millimeters (inches)

**TV2-062/MA (B, C, CX) Meter-in compensator**

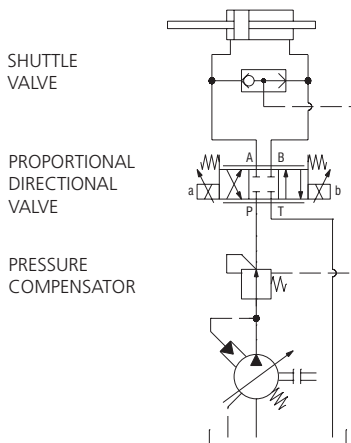


**TV2-062/MD (E, F) Meter-out compensator**

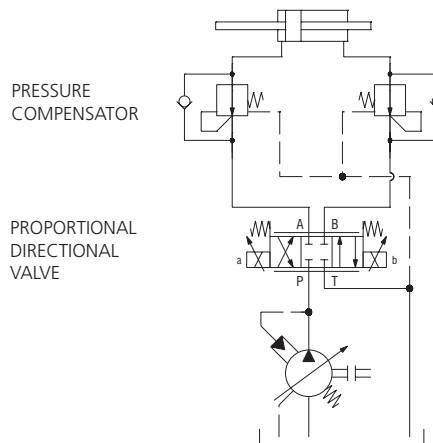


**Application Example**

**Meter-in compensator**

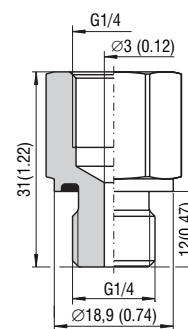


**Meter-out compensator**

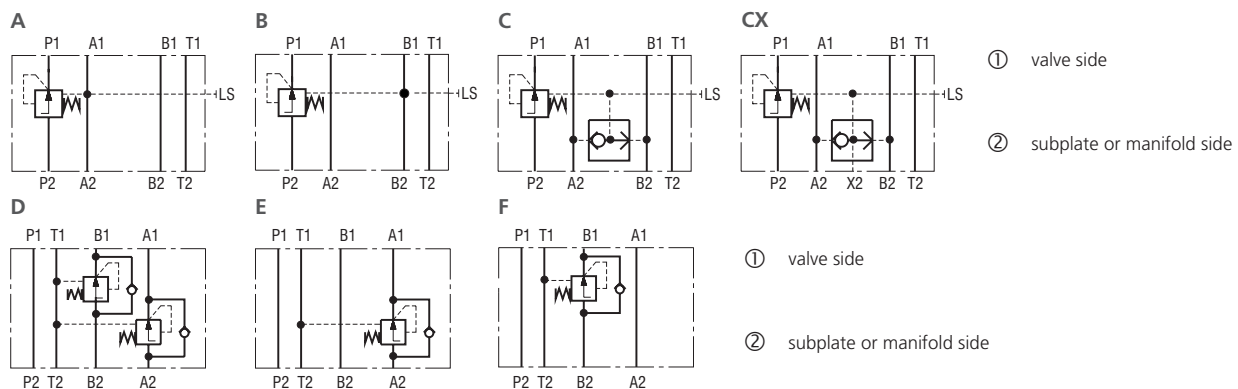


**Adapter G1/4/G1/4-ED**

addition of equipment for external LS connection  
Ordering number: 28004900



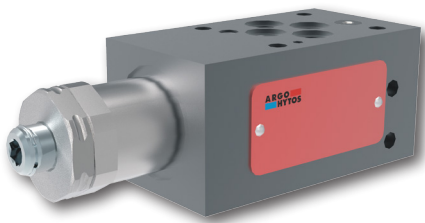
**Functional Symbols**



**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

**Ordering Code**

<p><b>2-Way pressure compensator, spool-type, direct-acting, modular</b></p> <p><b>Nominal size 06</b> ISO 4401-03-02-0-05, DIN 24340 (CETOP 03)</p> <p><b>2-Way pressure compensator</b></p> <p><b>Sandwich plate</b></p> <p><b>Model</b> Meter-in compensator in port A Meter-in compensator in port B Meter-in compensator in port A and B Meter-in compensator in port A and B with LS pattern port Meter-out compensator in port A and B Meter-out compensator in port A Meter-out compensator in port B</p>	<p><b>TV2-062/M</b> <span style="border: 1px solid black; padding: 2px;">  </span> <b>1</b> <b>C</b> <span style="border: 1px solid black; padding: 2px;">  </span> - <span style="border: 1px solid black; padding: 2px;">  </span></p>	<p><b>Surface treatment</b> No designation housing phosphated, steel parts zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)</p> <p><b>Seals</b> No designation <b>V</b> NBR FPM (Viton)</p> <p><b>Adjustment option</b> fixed setting, not adjustable</p> <p><b>Control pressure differential</b> 10 bar (145 PSI)</p>
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**Technical Features**

- › 3-Way pressure compensator, spool-type, direct-acting with subplate interface acc. to ISO 4401, DIN 24340 (CETOP 03)
- › Modular design for vertical stacking assemblies with built-in load sensing shuttle valve
- › Meter-in flow control models with load sensing from optional consumer ports
- › The valve keeps the pressure drop between the inlet and the pilot connection at a constant level
- › Used as a load sensing valve with proportional directional and flow valves to control the flow rate independently of pressure variations
- › Excellent stability throughout flow range with rapid response to dynamic pressure changes
- › Spring setting of the variable adjustment compensator can be varied from 5 to 40 bar (72.5 to 580 PSI)
- › Quiet and modulate response to load changes
- › Hardened precision parts
- › High flow capacity
- › Adjustable by allen key
- › In the standard version, the valve housing is phosphated and steel parts are zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

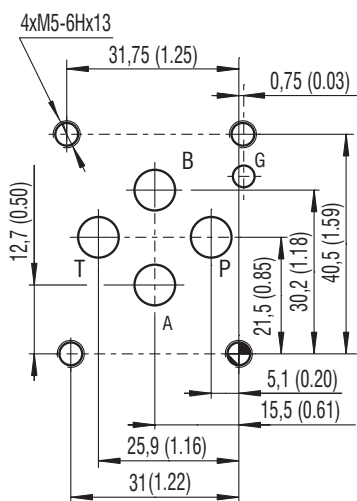
A normally closed, direct-acting, spring loaded 3-way pressure compensator valve in the form of a sandwich plate. It consists of a body, a 3-way screw-in cartridge compensator TV2-063/S and a load shuttle valve. Ports A and B are always connected through the load shuttle valve with the spring chamber of the pressure compensator cartridge valve.

Typically, 3-way pressure compensators are used as meter-in regulators in parallel with flow restrictor valves when raising or lowering variable loads at the same velocity is required. The pressure compensator valve then keeps the pressure difference between its pressure inlet and the pressure at the output port of the regulated flow valve nearly constant. When the pressure differential exceeds the pre-set value, the pressure compensator opens and releases excessive flow from the main circuit to port B. If there is no flow demand from the consumer, the compensator allows the oil to flow back to tank and therefore vents the whole system. This prevents the hydraulic system from overheating especially in load sensing circuits with a fixed displacement pump.

**Technical Data**

Valve size		06 (D03)
Max. operating pressure	bar (PSI)	320 (4640)
Max. flow	l/min (GPM)	40 (10.6)
Control pressure differential	bar (PSI)	5 ... 40 (72.5 ... 580)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Mass (Model A, B, C)	kg (lbs)	1.0 (2.20)

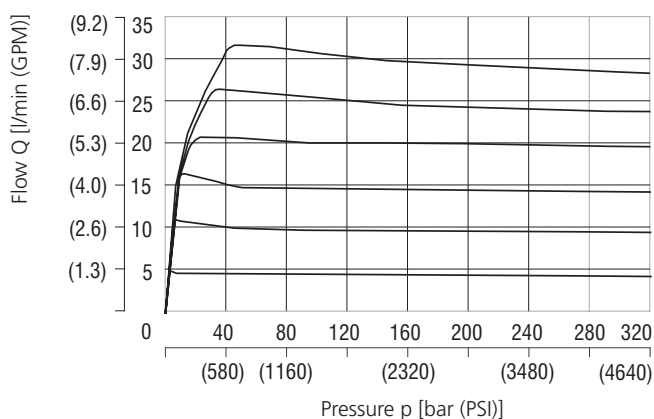
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 06
Spare parts	SP_8010	

**ISO 4401-03-02-0-05**

 Ports P, A, B, T max.  $\varnothing$  7.5 mm (0.29 in)

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

**Regulated flow related to input pressure**

TV2-063/MC Meter-in compensator

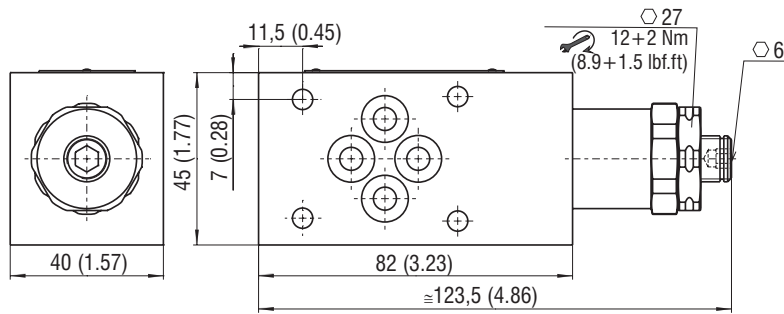


The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-063Z11/30 proportional directional valve.

If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

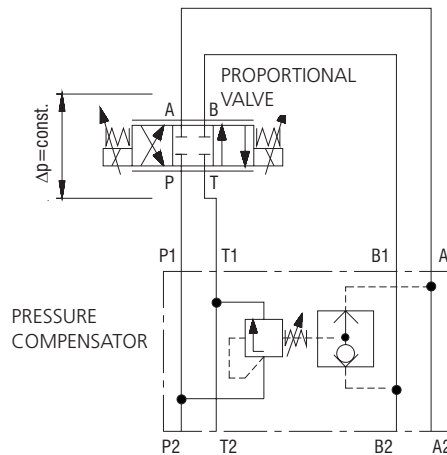
**Dimensions** in millimeters (inches)

**TV2-063/MA (B, C) - Meter-in compensator**

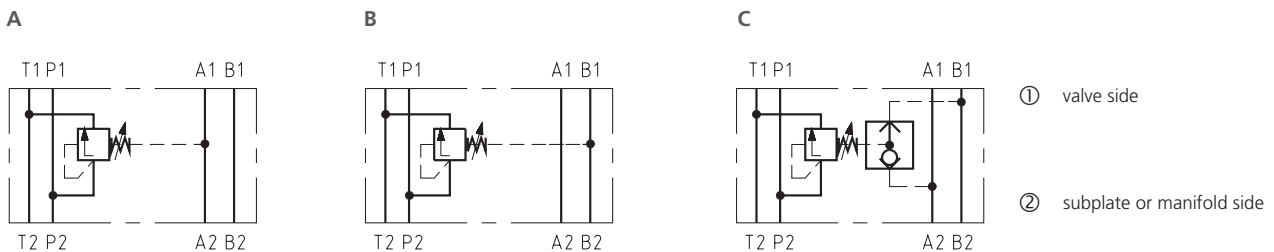


**Application Example**

**Meter-in compensator**



**Functional Symbols**

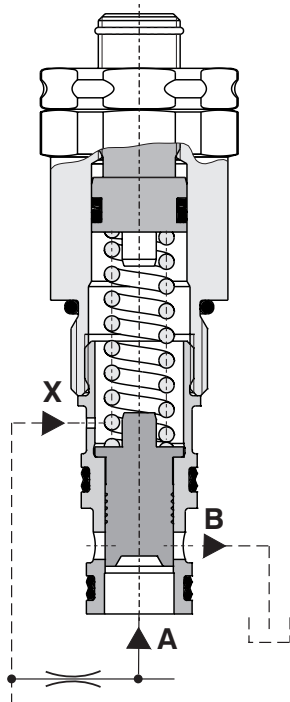
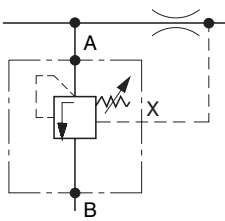


**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

**Ordering Code**

<p><b>3-Way pressure compensator, spool-type, direct-acting, modular</b></p> <p><b>Nominal size</b> ISO 4401-03-02-0-05, DIN 24340 (CETOP 03), NG 06</p> <p><b>3-Way pressure compensator</b></p> <p><b>Sandwich plate</b></p> <p><b>Model</b> Meter-in compensator in port A Meter-in compensator in port B Meter-in compensator in port A and B</p> <p><b>Control pressure differential</b> 5 - 40 bar (72.5 - 580 PSI)</p>	<p><b>TV2-063/M</b> <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span> <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span> <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span> <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span> - <span style="border: 1px solid black; display: inline-block; width: 20px; height: 20px;"></span></p>	<p><b>Surface treatment</b> <b>No designation</b> housing phosphated, steel parts zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h) <b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)</p> <p><b>Seals</b> <b>No designation</b> NBR <b>V</b> FPM (Viton)</p> <p><b>Adjustment option</b> <b>S</b> allen key (hex.6), without protective cap</p>
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**3-Way Pressure Compensator, Spool-Type, Direct-Acting**
**TV2-063/S**

M20x1.5 •  $Q_{max}$  40 l/min (11 GPM) •  $p_{max}$  350 bar (5100 PSI)

**Technical Features**

- › The valve keeps the pressure drop between the inlet and the pilot connection at a constant level
- › Used as a load sensing valve with proportional directional and flow valves to control the flow rate independently of pressure variations
- › Excellent stability throughout flow range with rapid response to dynamic pressure changes
- › Spring setting of the variable adjustment compensator can be varied from 5 to 40 bar (72.5 to 580 PSI)
- › Quiet and modulate response to load changes
- › Hardened precision parts
- › High flow capacity
- › In the standard version, the valve is zinc-coated for 240 h protection acc. to ISO 9227

**Functional Description**

A normally closed, direct-acting, spring loaded pressure compensator valve in the form of a screw-in cartridge.

From the outlet of the controlled directional or proportional flow valve a load sensing signal is taken to the spring chamber of the pressure compensator port X.

Typically, 3-way pressure compensators are used as meter-in regulators in parallel with flow restrictor valves when raising or lowering variable loads at the same velocity is required.

The pressure compensator valve then keeps the pressure difference between its pressure inlet and the pressure at the output port of the regulated flow valve nearly constant.

When the pressure differential exceeds the pre-set value, the pressure compensator opens and releases excessive flow from the main circuit to port B. If there is no flow demand from the consumer, the compensator allows the oil to flow back to tank and therefore vents the whole system. This prevents the hydraulic system from overheating especially in load sensing circuits with a fixed displacement pump.

**Technical Data**

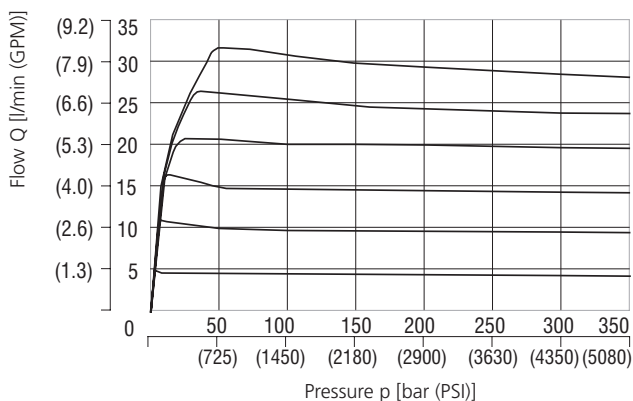
Valve size / Cartridge cavity		M20x1.5 / QE3
Max. operating pressure	bar (PSI)	350 (5080)
Max. flow	l/min (GPM)	40 (10.6)
Control pressure differential	bar (PSI)	5 ... 40 (72.5 ... 580)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Mass	kg (lbs)	0.15 (0.3)

		Data Sheet	Type
General information		GI_0060	Products and operating conditions
Valve bodies	Sandwich mounted	SB-04(06)_0028	SB-*QE3*
Cavity details		SMT_0019	SMT-QE3*
Spare parts		SP_8010	

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

**Regulated flow related to input pressure**

The characteristic of the pressure compensator corresponds with the flow rate of a PRM2-043Z11/12 and PRM2-063Z11/30 proportional directional valve.

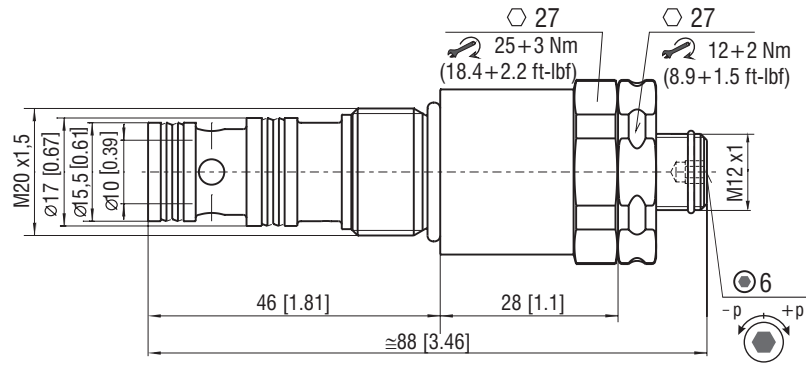


If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.



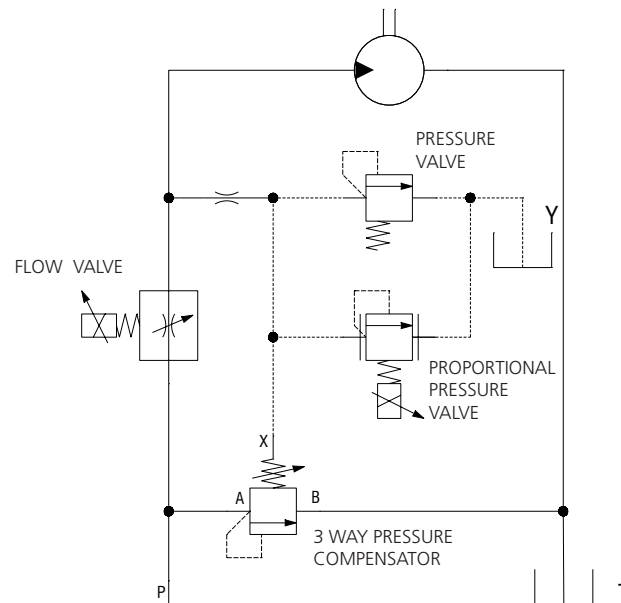
**Dimensions** in millimeters (inches)

TV2-063/S



**Application Example**

Meter-in compensator



**Ordering Code**

	<b>TV2-063/S</b> □ □ □ - □	
<b>3-Way pressure compensator, spool-type, direct-acting</b>	□	
<b>Nominal size</b> M20x1.5 / QE3	□	
<b>3-Way pressure compensator</b>	□	
<b>Cartridge design</b>	□	
<b>Pressure range</b> 5 - 40 bar (72.5 - 580 PSI)	<b>4</b>	
	<b>S</b>	<b>Surface treatment</b>
		<b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h)
		<b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)
	<b>No designation</b>	<b>Seals</b>
	<b>V</b>	<b>NBR</b>
		<b>FPM (Viton)</b>
		<b>Adjustment option</b>
		allen key (hex. 6), without protective cap



**Technical Features**

- › 2-way pressure compensator, spool-type, built in a modular block for vertical grouping with mounting interface acc. to ISO 4401 (size 10), DIN 24340 (CETOP 05)
- › High flow capacity
- › Meter-in design with integrated load shuttle valve
- › Meter-out design with integrated by-pass check valve
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Pressure drop setting by adjusting screw in the range from 4 to 14 bar (58 – 203 PSI)
- › Possible external sensing of LS signal by means of an adapter, mounted instead the end plug with adjusting screw on the spring side
- › In the standard version, the valve body is phosphated. The steel parts are zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

**Functional Description**

The 2-way pressure compensator, built in a modular block, maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream and downstream from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by flow throttling on the spool control edge. In the basic position the compensator is open. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve or by change of the set pressure drop on the pressure compensator with the adjusting screw.

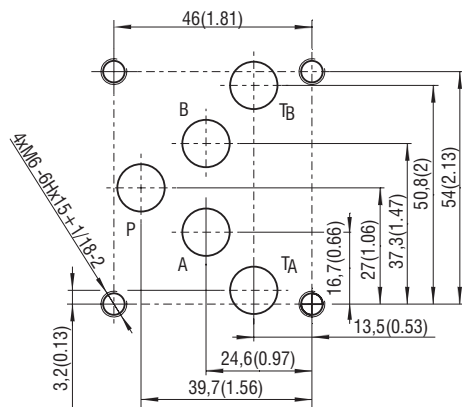
**2-way pressure compensator for meter-in connection (models A, B, C)**

Meter-in compensator is connected between the pump and flow control valve in the circuit. This connection can be used in the case of positive acting load on the actuator, it means in the opposite direction to the moving. The model C is equipped with an integrated load shuttle valve for pressure sensing in both actuator pipelines depending of moving direction.

**2-way pressure compensator for meter-out connection (models D, E, F)**

Meter-out compensator is connected between the flow control valve and actuator in one or both pipelines of actuator. This connection must be used in the case of negative acting load on the actuator, it means in the same direction to the moving, e.g. et lowering the of load. The pressure drop is stabilised in the flow direction A → T and B → T. In the opposite flow direction (to the actuator) the fluid flows freely through the opened integrated bypass check valve.

ISO 4401-05-04-0-05



Ports P, A, B, T - max.  $\varnothing$ 11.2 mm (0.44 in)

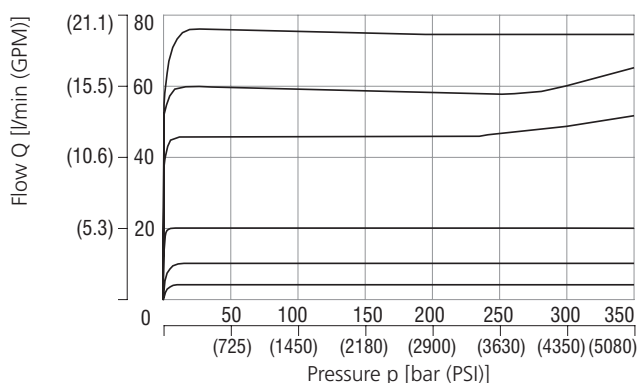
**Technical Data**

Valve size	10 (D05)	
Max. operating pressure	bar (PSI)	350 (5100)
Max. flow	l/min (GPM)	80 (21.1)
Control pressure differential	bar (PSI)	4 ... 14 (58 ... 203)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight (Models A, B, C / D, E, F)	kg (lbs)	3.7 (8.2) / 6.65 (14.7)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 10
Spare parts	SP_8010	

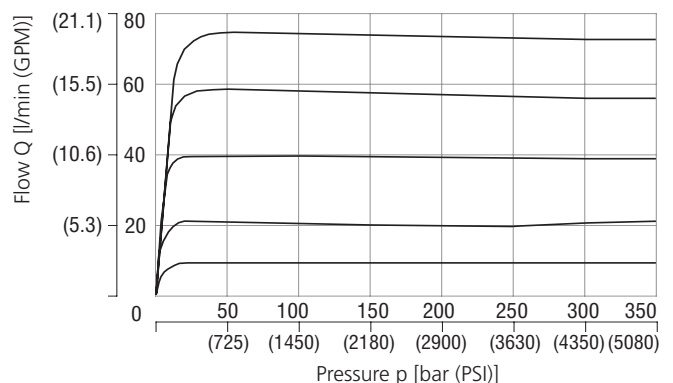
**Characteristics** measured at  $v = 32 \text{ mm}^2/\text{s}$  (156 SUS)

**Regulated flow related to input pressure**

TV2-102/MC Meter-in compensator



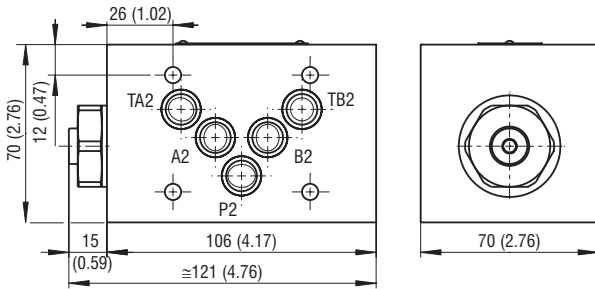
TV2-102/MD Meter-out compensator



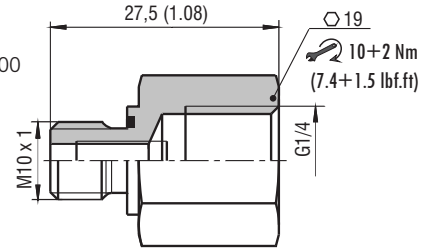
The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-103Z11/60 proportional directional valve. If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

## Dimensions in millimeters (inches)

### TV2-102/MC\*C Meter-in compensator

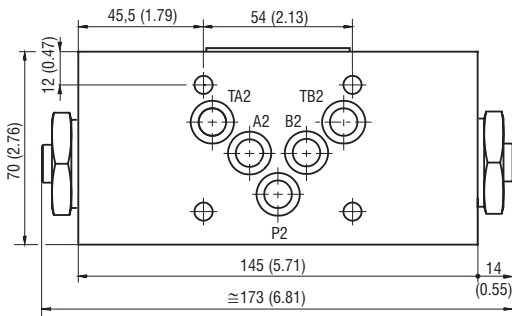


**Adapter M10x1/G1/4-ED**  
 addition of equipment  
 for external LS connection  
 Ordering number: 19860700

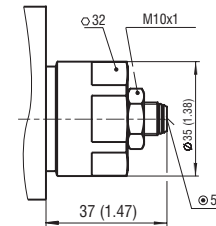


Applicable only for „TV\*C“ versions. (Fixed setting, not adjustable)

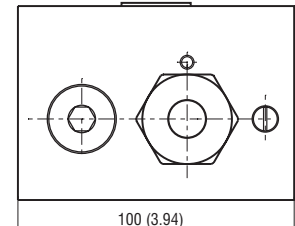
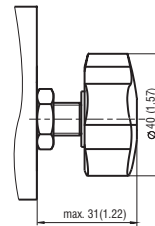
### TV2-102/MD\*C Meter-out compensator



#### Model \*S



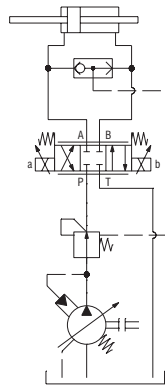
#### Model \*RP



## Application Example

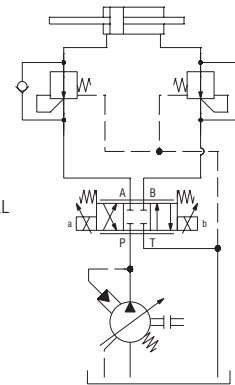
### Meter-in compensator

SHUTTLE VALVE  
 PROPORTIONAL DIRECTIONAL VALVE  
 PRESSURE COMPENSATOR

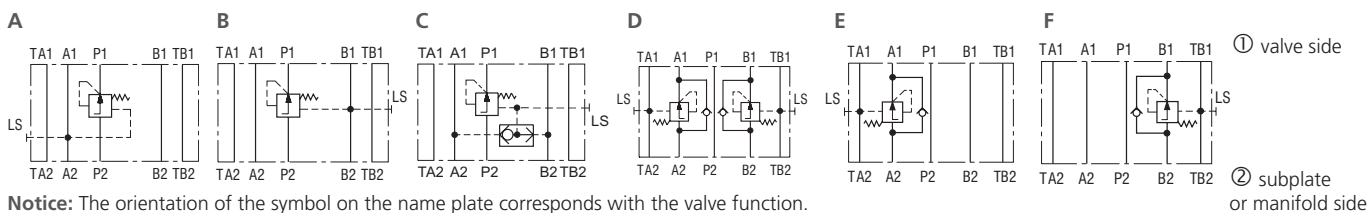


### Meter-out compensator

PRESSURE COMPENSATOR  
 PROPORTIONAL DIRECTIONAL VALVE



## Functional Symbols



**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

## Ordering Code

**2-Way pressure compensator, spool-type, direct-acting, modular**

**Nominal size 10**  
 ISO 4401-05-04-0-05, DIN 24340 (CETOP 05)

**2-Way pressure compensator**

**Sandwich plate**

### Model

- Meter-in compensator in channel A **A**
- Meter-in compensator in channel B **B**
- Meter-in compensator in channel A and B **C**
- Meter-out compensator in channel A and B **D**
- Meter-out compensator in channel A **E**
- Meter-out compensator in channel B **F**

**TV2-102/M** [ ] [ ] [ ] [ ] - [ ]

**Surface treatment**  
**No designation** housing phosphated, steel parts  
**A** zinc-coated (ZnCr-3), ISO 9227 (240 h)  
**B** zinc-coated (ZnNi), ISO 9227 (520 h)

**Seals**  
**No designation** NBR  
**V** FPM (Viton)

**Adjustment option**  
**C** fixed setting, non adjustable  
**S** allen key (hex. 5), without protective cap  
**RP** hand knob, plastic

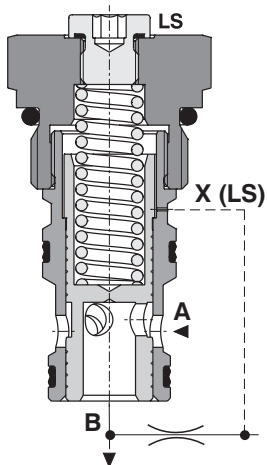
**Control pressure differential**  
**1** 4 - 12 bar (58 - 174 PSI), 10 bar (145 PSI) "C" Model  
**2** 10 - 14 bar (145 - 203 PSI), 14 bar (203 PSI) "C" Model

## 2-Way Pressure Compensator, Spool-Type, Direct-Acting, Size 10

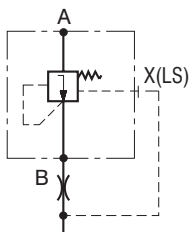
### TV2-102/S

M27x2 •  $Q_{max}$  80 l/min (21 GPM) •  $p_{max}$  350 bar (5100 PSI)

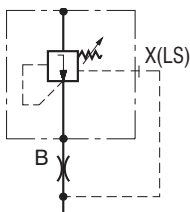
#### TV2-102/S\*C



#### TV2-102/S\*C



#### TV2-102/S\*S(RP)



#### Technical Features

- › Screw-in cartridge 2-way pressure compensator, spool-type
- › High flow capacity
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Integrated stroke limiter of compensator spool for reliable function
- › Pressure drop setting by adjusting screw in the range from 4 to 14 bar (58 – 203 PSI)
- › Possible external sensing of LS signal by means of an adapter, mounted instead of the end plug with an adjusting screw on the spring side
- › In the standard version, the valve surface is zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

#### Functional Description

The 2-way pressure compensator maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream (B) and downstream (X) from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by flow throttling (A → B) on the spool control edge. In the basic position the compensator is open. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve or by change the set pressure drop on the pressure compensator with the adjusting screw.

The pressure compensator is connected between the pump and flow control valve (meter-in connection) in the case of positive acting load on the actuator, it means in the opposite direction to the movement.

The pressure compensator is connected between the flow control valve and actuator in one or both pipelines of the actuator (meter-out connection) in the case of negative acting load on the actuator, it means in the same direction to the movement, e.g. at the lowering the load. The pressure drop is stabilised in the flow direction A → T and B → T. In the opposite flow direction (to the actuator) the fluid flows freely through the parallel connected bypass check valve. The optional adapter allows external LS signal sensing.

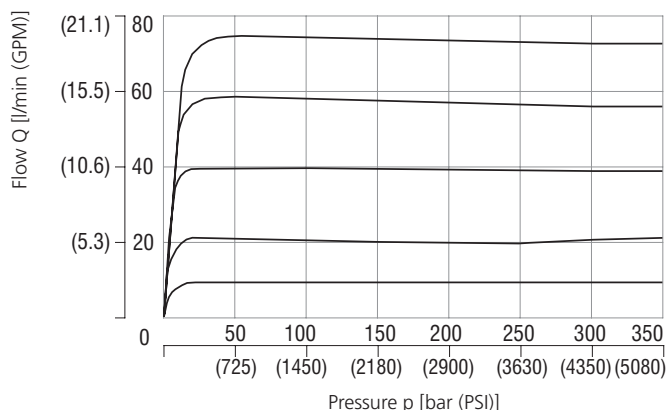
#### Technical Data

Valve size / Cartridge cavity		M27x2 / QM3
Max. operating pressure	bar (PSI)	350 (5080)
Max. flow	l/min (GPM)	80 (21.1)
Control pressure differential	bar (PSI)	4 ... 14 (58 ... 203)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight	kg (lbs)	0.15 (0.3)
Data Sheet		Type
General information		GI_0060
Valve bodies	Sandwich mounted	SB-04(06)_0028
Cavity details	SMT_0019	SMT-QM3*
Spare parts	SP_8010	

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

##### Regulated flow related to input pressure

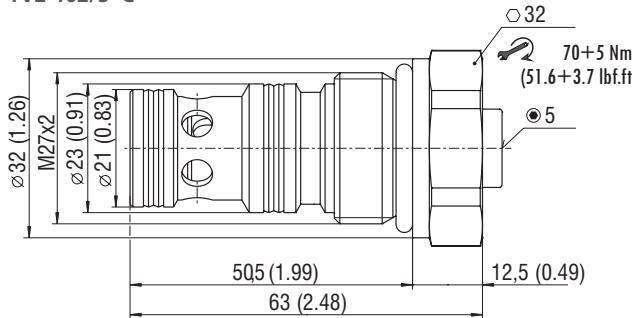
The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-103Z11/60 proportional directional valve.



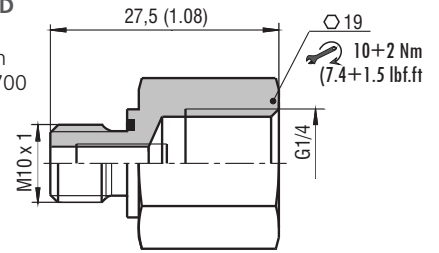
If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

## Dimensions in millimeters (inches)

### TV2-102/S\*C

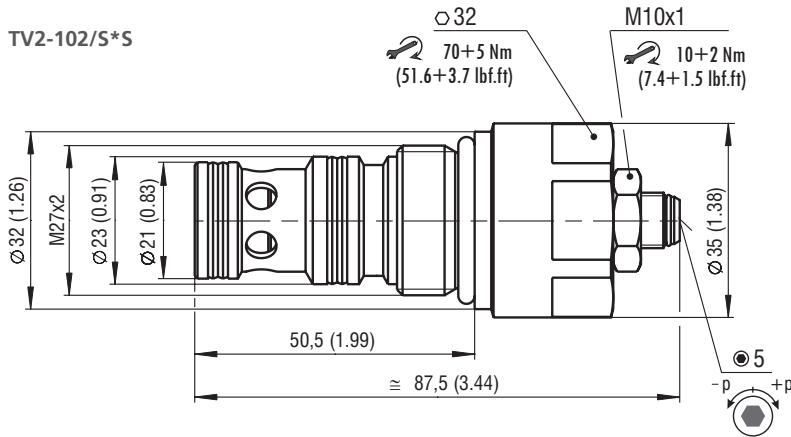


**Adapter M10x1/G1/4-ED**  
 addition of equipment  
 for external LS connection  
 Ordering number: 19860700

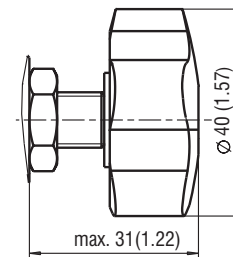


Applicable only for „TV\*C“ versions. (Fixed setting, not adjustable)

### TV2-102/S\*S

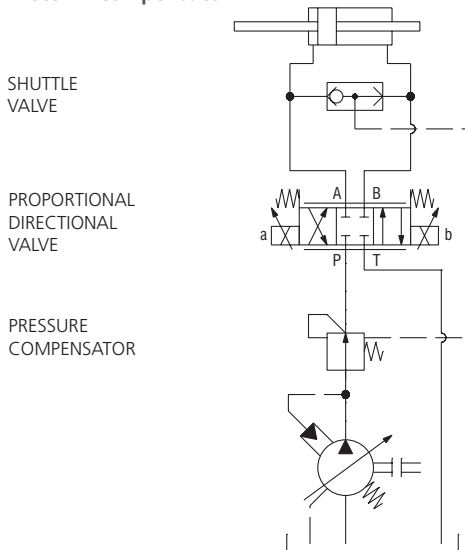


### TV2-102/S\*RP

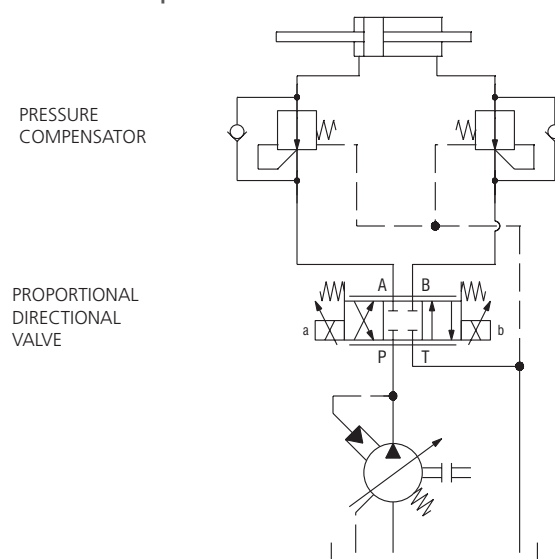


## Application Example

### Meter-in compensator



### Meter-out compensator



## Ordering Code

**2-Way pressure compensator, spool-type, direct-acting**

**Nominal size 10**  
 M27x2 / QM3

**2-way pressure compensator**

**Cartridge design**

**Control pressure differential**  
 4 - 12 bar (58 - 174 PSI), 10 bar (145 PSI) "C" Model **1**  
 10 - 14 bar (145 - 203 PSI), 14 bar (203 PSI) "C" Model **2**

**TV2-102/S**    -

**A**  
**B**

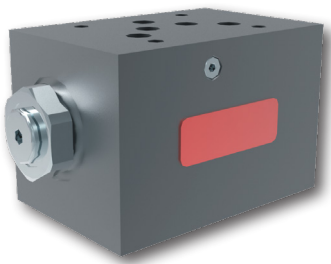
**Surface treatment**  
 zinc-coated (ZnCr-3), ISO 9227 (240 h)  
 zinc-coated (ZnNi), ISO 9227 (520 h)

**No designation**  
**V**

**Seals**  
 NBR  
 FPM (Viton)

**C**  
**S**  
**RP**

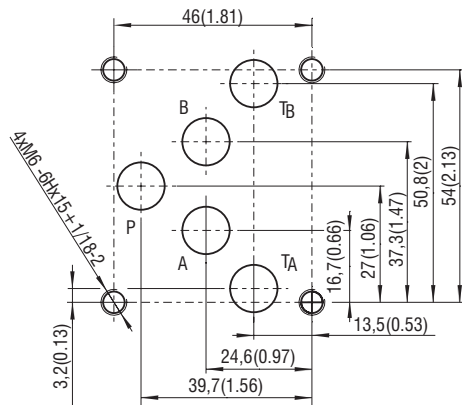
**Adjustment option**  
 fixed setting, not adjustable  
 allen key (hex. 5), without protective cap  
 hand knob, plastic


**Technical Features**

- › 3-way pressure compensator, spool-type, built in a modular block for vertical grouping with mounting interface acc. to ISO 4401 (size 10), DIN 24340 (CETOP 05)
- › High flow capacity
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Pressure sensing in the both pipelines of actuator with the help of integrated load shuttle valve (model C)
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Pressure drop setting by adjusting screw in the range from 4 to 14 bar (58 – 203 PSI)
- › Possible external sensing of LS signal by means of an adapter, mounted instead the end plug with adjusting screw on the spring side
- › In the standard version, the valve body is phosphated. The steel parts are zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

**Functional Description**

The 3-way pressure compensator, built in a modular block, maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream and downstream from the valve. The set pressure drop is defined by spring pressure acting on the spool face and is maintained by releasing excess flow back to the tank. In the basic position the compensator is closed. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve or by change of the set pressure drop on the pressure compensator with the adjusting screw. The three-way pressure compensator is connected parallel to the flow control valve. It maintains a constant pressure drop on the valve by dividing the flow from the pump. When the actuator is stopped, the pressure compensator opens and allows full fluid flow from the pump to the tank at low pressure losses. It takes over the function of unloading valve and protects the circuit against overheating. The three-way pressure compensator is very often used for system pressure regulation depending on the load (LS-regulation) in the circuits with a constant displacement pump.

**ISO 4401-05-04-0-05**

 Ports P, A, B, T - max.  $\varnothing$ 11.2 mm (0.44 in)

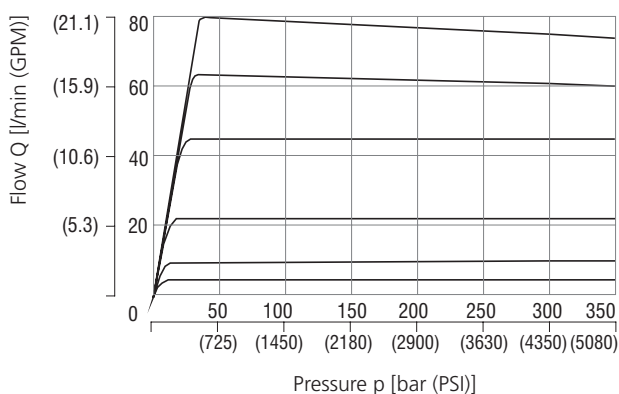
**Technical Data**

Valve size		10 (D05)
Max. operating pressure	bar (PSI)	350 (5100)
Max. flow	l/min (GPM)	80 (21.1)
Control pressure differential	bar (PSI)	4 ... 14 (58 ... 203)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight (all models)	kg (lbs)	1.0 (2.2)
	Data Sheet	Type
General information	GI_0060	Products and operating conditions
Mounting interface	SMT_0019	Size 10
Spare parts	SP_8010	

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

**Regulated flow related to input pressure**

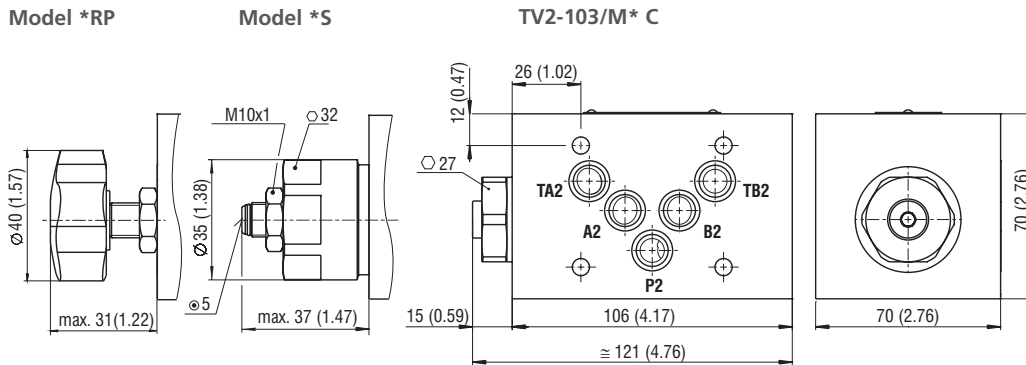
TV2-103/MC Meter-in compensator



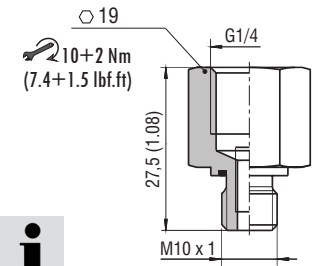
The characteristic of the pressure compensator corresponds to the flow rate of a PRM2-103Z11/60 proportional directional valve.

If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

**Dimensions** in millimeters (inches)



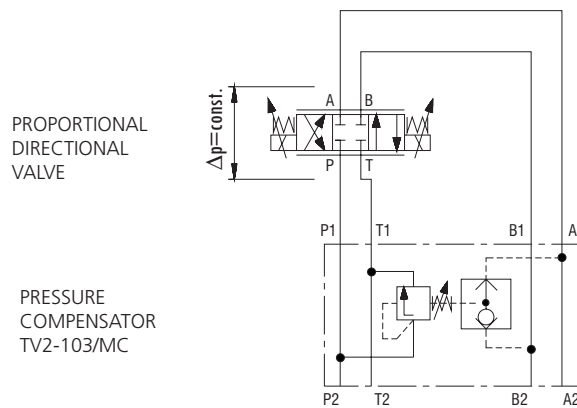
**Adapter M10x1/G1/4-ED**  
 addition of equipment  
 for external LS connection  
 Ordering number: 19860700



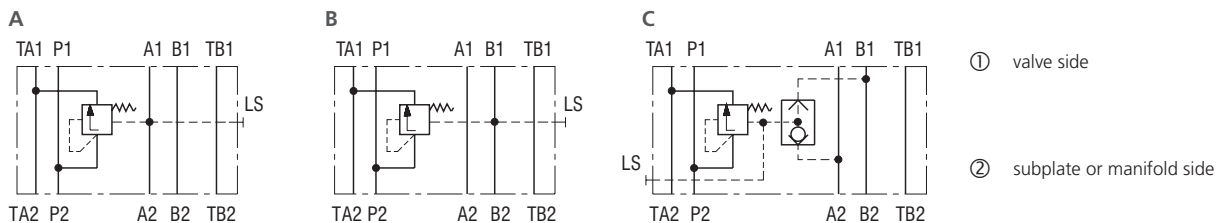
**i**  
 Applicable only for „TV\*C“ versions.  
 (Fixed setting, not adjustable)

**Application Example**

**Meter-in compensator**



**Functional Symbols**



**Notice:** The orientation of the symbol on the name plate corresponds with the valve function.

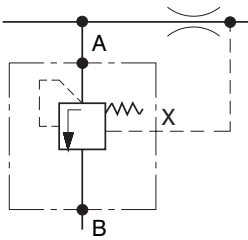
**Ordering Code**

<p><b>3-Way pressure compensator, spool-type, direct-acting, modular</b></p> <hr/> <p><b>Nominal size 10</b>          ISO 4401-05-04-0-05, DIN 24340 (CETOP 05)</p> <hr/> <p><b>3-Way pressure compensator</b></p> <hr/> <p><b>Sandwich plate</b></p> <hr/> <p><b>Model</b>          Meter-in compensator in channel A <b>A</b>          Meter-in compensator in channel B <b>B</b>          Meter-in compensator in channel A and B <b>C</b></p>	<p><b>TV2-103/M</b> <span style="border: 1px solid black; padding: 2px;"> </span> <span style="border: 1px solid black; padding: 2px;"> </span> <span style="border: 1px solid black; padding: 2px;"> </span> <span style="border: 1px solid black; padding: 2px;"> </span> - <span style="border: 1px solid black; padding: 2px;"> </span></p>	<p><b>Surface treatment</b>  <b>No designation</b> housing phosphated, steel parts zinc-coated (ZnCr-3), ISO 9227 (240 h)  <b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h)  <b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)</p> <p><b>Seals</b>  <b>No designation</b> NBR  <b>V</b> FPM (Viton)</p> <p><b>Adjustment option</b>  <b>C</b> fixed setting, not adjustable  <b>S</b> allen key (hex. 5), without protective cap  <b>RP</b> hand knob, plastic</p> <p><b>Control pressure differential</b>  <b>1</b> 4 - 12 bar (58 - 174 PSI), 10 bar (145 PSI) "C" Model  <b>2</b> 10 - 14 bar (145 - 203 PSI), 14 bar (203 PSI) "C" Model</p>
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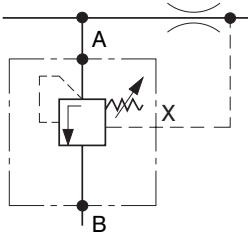
# TV2-103/S

M27x2 •  $Q_{max}$  80 l/min (21 GPM) •  $p_{max}$  350 bar (5100 PSI)

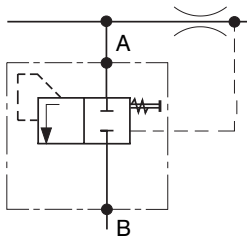
TV2-103/S\*C



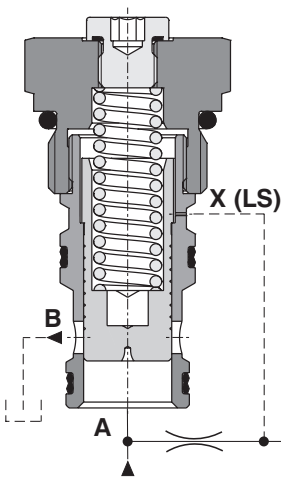
TV2-103/S\*S (RP)



TV2-103/S\*FRS



TV2-103/S\*C



## Technical Features

- › Screw-in cartridge 3-way pressure compensator, spool-type
- › High flow capacity
- › The valve maintains a constant pressure drop on a flow control valve (e.g. proportional directional control valve) and thus a constant volumetric flow independent of actuator load
- › Rapid and smooth response to load changes
- › Stable function throughout the whole flow range
- › Precisely manufactured and hardened key parts
- › Pressure drop setting by adjusting screw in the range from 4 to 14 bar (58–203 PSI)
- › Possible external sensing of LS signal by means of an adapter, mounted instead the end plug with adjusting screw on the spring side
- › In the standard version, the valve surface is zinc-coated for corrosion protection 240 h in NSS acc. to ISO 9227

## Functional Description

The 3-way pressure compensator maintains a constant pressure drop on the flow control valve and thus a constant volumetric flow independent of actuator load changes or pump power fluctuation. The spool position of the compensator is controlled by pressure drop sensed upstream (A) and downstream (X) from the valve.

The set pressure drop is defined by spring pressure acting on the spool face and is maintained by releasing of excessing flow back to the tank (B). In the basic position the compensator is closed. The volumetric flow, and thus the moving velocity of piston rod or hydraulic motor shaft can be regulated by change of flow cross section on the flow control valve or by change the set pressure drop on the pressure compensator with the adjusting screw.

The three-way pressure compensator is connected parallel to the flow control valve. It maintains a constant pressure drop on the valve by dividing the flow from the pump. When the actuator is stopped, the pressure compensator opens and allows full fluid flow from the pump to the tank at low pressure losses. It takes over the function of unloading valve and protects the circuit against overheating. The three-way pressure compensator is very often used for system pressure regulation depending of the load (LS-regulation) in the circuits with a constant displacement pump.

## Technical Data

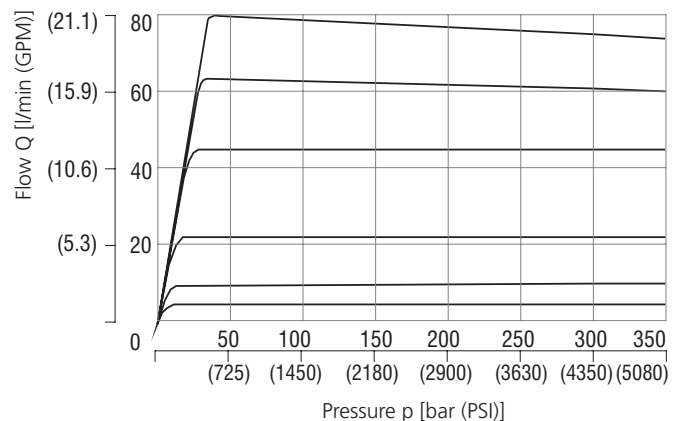
Valve size / Cartridge cavity		M27x2 / QM3
Max. operating pressure	bar (PSI)	350 (5080)
Max. flow	l/min (GPM)	80 (21.1)
Control pressure differential	bar (PSI)	4 ... 14 (58 ... 203)
Fluid temperature range (NBR)	°C (°F)	-30 ... +100 (-22 ... +212)
Fluid temperature range (FPM)	°C (°F)	-20 ... +120 (-4 ... +248)
Weight	kg (lbs)	0.15 (0.3)

		Data Sheet	Type
General information		GI_0060	Products and operating conditions
Valve bodies	Sandwich mounted	SB-04(06)_0028	SB-*QM3*
Cavity details		SMT_0019	SMT-QM3*
Spare parts		SP_8010	

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

### Regulated flow related to input pressure

The characteristic of the pressure compensator corresponds with the flow rate of a PRM2-103Z11/60 proportional valve.

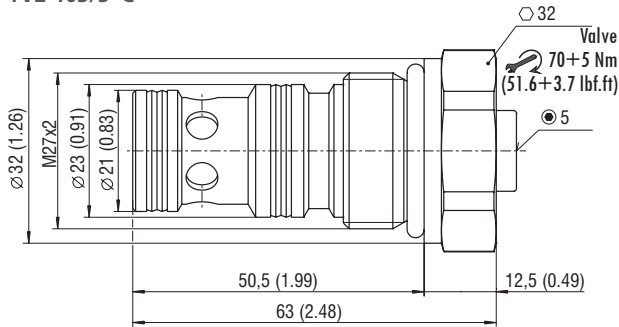


If the pressure resistance increases due to a flow rate increase, the pressure differential also has to increase in order to ensure correct regulation.

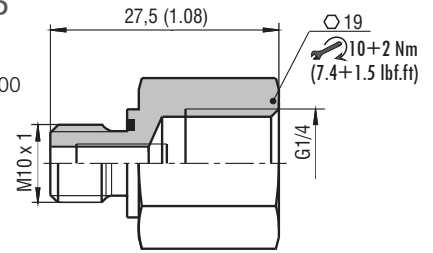


**Dimensions** in millimeters (inches)

**TV2-103/S\*C**

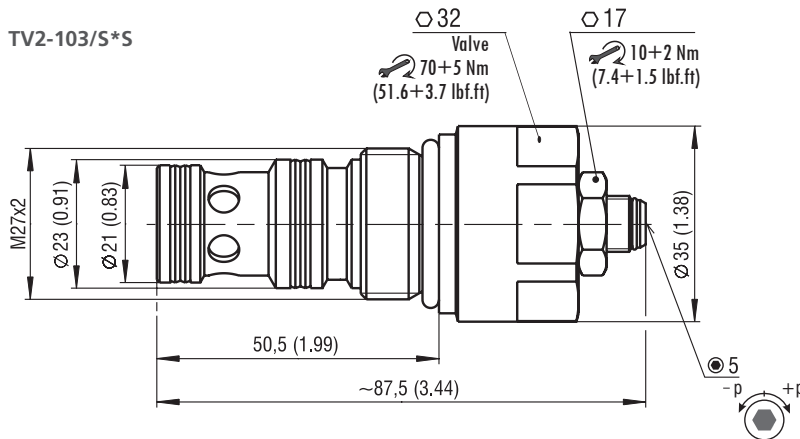


**Adapter M10x1/G1/4-ED**  
 addition of equipment  
 for external LS connection  
 Ordering number: 19860700

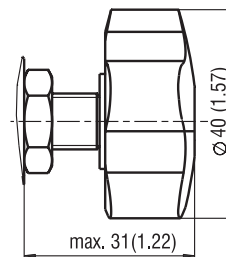


Applicable only for „TV\*C“ versions. (Fixed setting, not adjustable)

**TV2-103/S\*S**

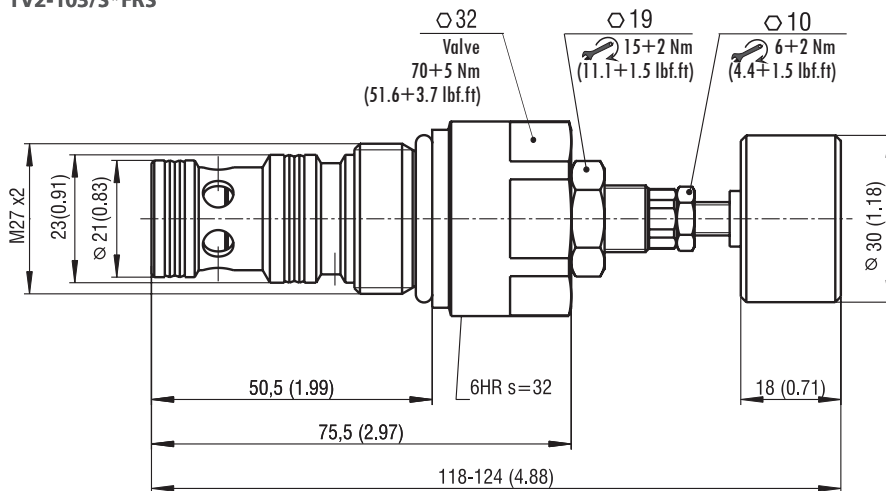


**TV2-103/S\*RP**



**Version with Blocking function**

**TV2-103/S\*FRS**



The Blocking function of Pressure compensator is intended for circuits to which can be connected either fix displacement pump or pump with load sensing regulation.

In case when Fix displacement pump is used the hand wheel of pressure compensator must be fully open.

On the other side when the load sensing pump is used the hand wheel of pressure compensator must be fully closed.

**Ordering Code**

<b>TV2-103/S</b>						
<b>3-Way pressure compensator, spool-type, direct-acting</b>						
<b>Nominal size 10</b> M27x2 / QM3						
<b>3-Way pressure compensator</b>						
<b>Cartridge design</b>						
<b>Pressure range</b>						
4 - 12 bar (58 - 174 PSI), 10 bar (145 PSI) "C" Model	<b>1</b>					
10 - 14 bar (145 - 203 PSI), 14 bar (203 PSI) "C" Model	<b>2</b>					
					<b>Surface treatment</b>	
					<b>A</b> zinc-coated (ZnCr-3), ISO 9227 (240 h)	
					<b>B</b> zinc-coated (ZnNi), ISO 9227 (520 h)	
					<b>Seals</b>	
					<b>No designation</b> NBR	
					<b>V</b> FPM (Viton)	
					<b>Adjustment option</b>	
					<b>C</b> fixed setting, not adjustable	
					<b>S</b> allen key (hex. 5), without protective cap	
					<b>RP</b> hand knob, plastic	
					<b>FRS</b> blocking function with hand knob, steel	