Proportional Directional Control Valve, with Analog Control Electronics

PRM6-10

Size 10 (D05) • Q<sub>max</sub> 80 l/min (21 GPM) • p<sub>max</sub> 350 bar (5100 PSI)

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 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 electric control unit supplies the solenoid with current, which varies with the control signal.
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 ≥1kΩ 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

<table>
<thead>
<tr>
<th>ISO 4401-05-04-0-05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve Size</td>
</tr>
<tr>
<td>Maximal flow at pressure 320 bar (4640 PSI)</td>
</tr>
<tr>
<td>Max. operating pressure at ports P, A, B</td>
</tr>
<tr>
<td>Maximum operating pressure at port T</td>
</tr>
<tr>
<td>Fluid temperature range (NBR)</td>
</tr>
<tr>
<td>Fluid temperature range (PPA)</td>
</tr>
<tr>
<td>Ambient temperature max.</td>
</tr>
<tr>
<td>Nominal flow rate Q&lt;sub&gt;n&lt;/sub&gt; at Δp=10 bar (145 PSI)</td>
</tr>
<tr>
<td>Hysteresis</td>
</tr>
<tr>
<td>Weight</td>
</tr>
<tr>
<td>- valve with 1 solenoid</td>
</tr>
<tr>
<td>- valve with 2 solenoids</td>
</tr>
<tr>
<td>Protection degree (for version PRM*EK)</td>
</tr>
</tbody>
</table>

Technical Data of the Proportional Solenoid

| Nominal supply voltage | V | 12 DC | 24 DC |
| Limit current | A | 1.9 | 1.1 |
| Mean resistance value at 20 °C (68 °F) | Ω | 4.7 | 13.9 |
| Technical Data of the Electronics | V DC | Ucc 12V DC | Ucc 24V DC |
| Supply voltage range | V DC | 11.2...14.7 | 20...30 |
| Stabilized voltage for control | V DC | 5 (R ≥ 1kΩ) | 5 (R ≥ 1kΩ) |
| Maximum output current | A | 2.4 (R < 4Ω) | 1.5 (R < 10Ω) |
| Ramp adjustment range | s | 0.05...3 |
| Dither frequency | Hz | 90 / 60 |
| Dither amplitude | % | 0...30 |
| Data Sheet Type | Gb_0060 | Products and operating conditions |
| Coil types / Connectors | C_8007 / K_8008 | C_8007 / K_8008 |
| Mounting interface | SMT_0019 | Size 10 |
| Spare parts | SP_8010 | SP_8010 |
| Subplates | DP_0002 | DP_0002 |

Subject to change · PRM6-10_5115_3en_05/2019
Proportional directional control valve

Valve size

Spool symbols
see table „Spool Symbols“

Nominal flow rate at Δp = 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“)*

*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.

Connector according to EN 175301-803-A
- only for version without on board electronic „EK“
- EN 175301-803-A
- E1 with quenching diode
- E2
- E3 with quenching diode
- AMP Junior Timer - radial directions (2 pins; male)
- E4
- E5 with quenching diode
- loose conductors (two insulated wires)
- E6
- E7 with quenching diode
- E8 with quenching diode
- E9
- E10 deutsch DT04-2P - axial direction
- E11
- E12A with quenching diode
- E13A

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

Electronics on board / Position at solenoid
- on board electronics (solenoid “a“)
- on board electronics (solenoid “b“)*

*Model for cylinders with asymmetric piston area ratio 1:2
### Characteristics measured at ν = 32 mm/s (156 SUS)

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

Nominal flow 30 l/min (7.95 GPM)

#### Flow Q [l/min (GPM)]

<table>
<thead>
<tr>
<th>Input pressure p₀ [bar (PSI)]</th>
<th>Q [l/min (GPM)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>15.85</td>
</tr>
<tr>
<td>1</td>
<td>20.05</td>
</tr>
<tr>
<td>2</td>
<td>24.20</td>
</tr>
<tr>
<td>3</td>
<td>28.35</td>
</tr>
<tr>
<td>4</td>
<td>32.50</td>
</tr>
</tbody>
</table>

Nominal flow 60 l/min (15.85 GPM)

#### Flow Q [l/min (GPM)]

<table>
<thead>
<tr>
<th>Input pressure p₀ [bar (PSI)]</th>
<th>Q [l/min (GPM)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>21.13</td>
</tr>
<tr>
<td>1</td>
<td>26.35</td>
</tr>
<tr>
<td>2</td>
<td>31.57</td>
</tr>
<tr>
<td>3</td>
<td>36.80</td>
</tr>
<tr>
<td>4</td>
<td>41.93</td>
</tr>
</tbody>
</table>

Nominal flow 80 l/min (21.13 GPM)

#### Flow Q [%]

<table>
<thead>
<tr>
<th>Spool position s [%]</th>
<th>t₁ [ms]</th>
<th>t₂ [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>85</td>
<td>100</td>
</tr>
<tr>
<td>75</td>
<td>70</td>
<td>85</td>
</tr>
<tr>
<td>50</td>
<td>55</td>
<td>75</td>
</tr>
<tr>
<td>25</td>
<td>45</td>
<td>55</td>
</tr>
</tbody>
</table>

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

Regulated flow related to control signal Δp=10 bar (145 PSI)

#### Flow Q [%]

- with integrated electronics
- without integrated electronics

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

Transient Characteristic measured at ν = 32 mm/s (156 SUS), Δp=10 bar (145 PSI)

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.

#### Frequency Response

- Amplitude ratio [dB]
- Phase lag [degrees]

----- signal 90 %
----- signal 25 %
Component Arrangement on the Electronic Card

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

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

<table>
<thead>
<tr>
<th>PIN</th>
<th>Description</th>
<th>Wire Colors Connection Connector - Electronics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24 V (Ucc) (+12 V)</td>
<td>(1) brown</td>
</tr>
<tr>
<td>2</td>
<td>control</td>
<td>(2) white</td>
</tr>
<tr>
<td>3</td>
<td>0 V</td>
<td>(3) blue</td>
</tr>
<tr>
<td>4</td>
<td>+10 V (+5 V)</td>
<td>(4) black</td>
</tr>
</tbody>
</table>

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

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**MASTER M**

<table>
<thead>
<tr>
<th>PRM6-102</th>
<th>PRM6-103</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 5 V</td>
<td>Ucc/2</td>
</tr>
<tr>
<td>0 ... 10 V (0...5 V)*</td>
<td>±10 V (±5 V)*</td>
</tr>
<tr>
<td>0 ... 20 mA</td>
<td>4 ... 20 mA</td>
</tr>
</tbody>
</table>

**SLAVE S**

<table>
<thead>
<tr>
<th>PRM6-102</th>
<th>PRM6-103</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 Hz</td>
<td>90 Hz</td>
</tr>
<tr>
<td>60 Hz</td>
<td>60 Hz</td>
</tr>
</tbody>
</table>

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**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 characteristics on page 3 and 4. The manufacturer does not recommend to change these adjusted values.

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

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

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

**Wire colors**

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

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

Select the correct control settings for the following parameters:

- **LED**: UP
- **SW1**: 1
- **SW2**: 2
- **SW3**: 3
- **SW4**: 4

Control with external source

<table>
<thead>
<tr>
<th>Control with external source</th>
<th>0 ... 5 V</th>
<th>0 ... 20 mA</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIN 1 (1)</td>
<td>+24 V</td>
<td>+24 V (+12 V)</td>
<td>+24 V (+12 V)</td>
</tr>
<tr>
<td>PIN 2 (2)</td>
<td>0 ... 5 V</td>
<td>0 ... 20 mA</td>
<td>4 ... 20 mA</td>
</tr>
</tbody>
</table>

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

Factory setting
Control with external source 0±10 V (0±5 V)

Other control possibilities
Control Ucc/2±10 V (Ucc/2±5) with external potentiometer R>1 kΩ

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

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 in position shown in the picture
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

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.

<table>
<thead>
<tr>
<th>Nominal Electronics Supply Voltage (V)</th>
<th>Area Insensitive to Control Signal uxx (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>1 ... 3</td>
</tr>
<tr>
<td>24</td>
<td>0.5 ... 2</td>
</tr>
</tbody>
</table>

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

Manual Override in millimeters (inches)

<table>
<thead>
<tr>
<th>No Designation</th>
<th>Designation N1</th>
<th>Designation N2</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Standard</td>
<td>- Cap Nut Covered</td>
<td>- Rubber Boot Protected</td>
</tr>
</tbody>
</table>

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.