
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.

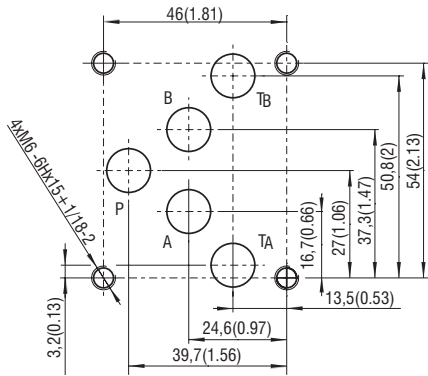
In the basic version, the valve is supplied with factory settings. Consult the manufacturer for external feedback.

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_n at $\Delta p=10$ 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	

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

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

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**

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
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 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	

*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 _{p-p}	< 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.	

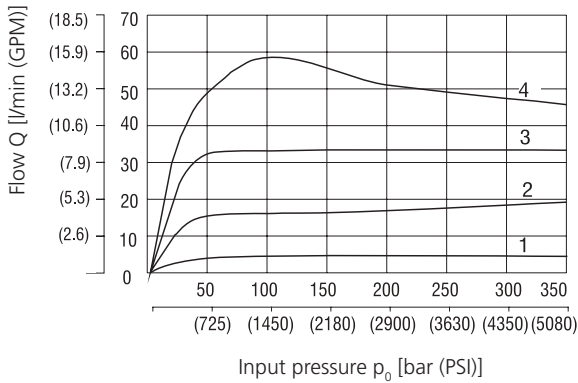
Accessories

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)

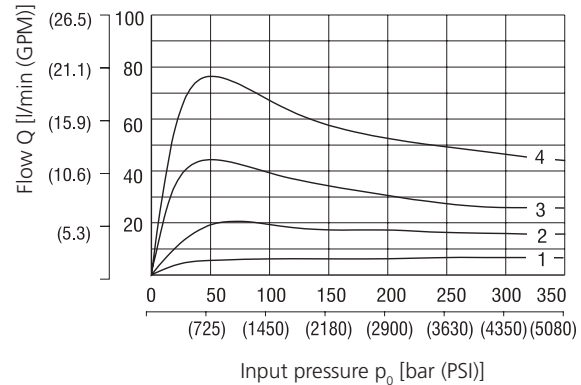
Characteristics measured at $v = 32 \text{ mm}^2/\text{s}$ (156 SUS)

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

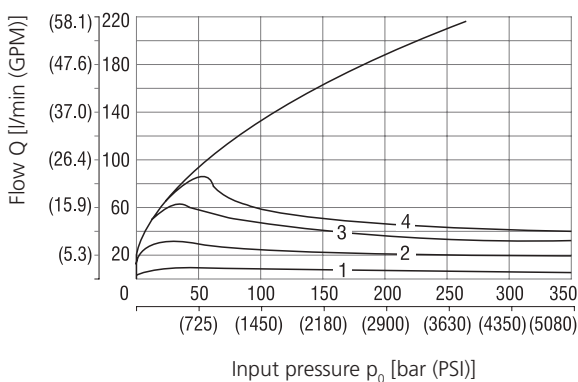
Nominal flow 30 l/min (7.9 GPM)



Nominal flow 60 l/min (15.9 GPM)



Nominal flow 80 l/min (21.1 GPM)

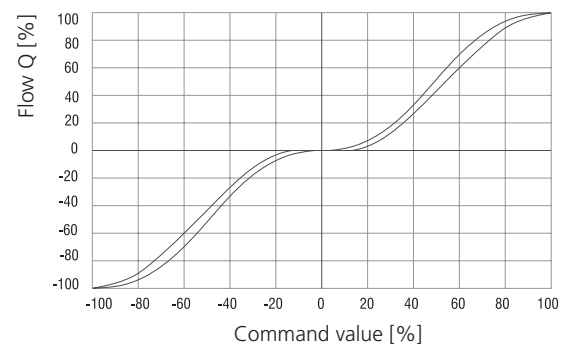


Solenoid current:

- 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)

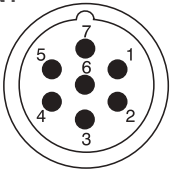


Factory Settings

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)

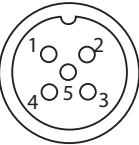
*Recommended min. lead cross section 0.75 mm²

KN2



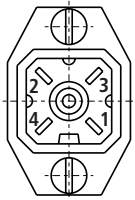
Connector KN2 - type M12x1 (male)	
PIN	Technical data
1	TxD
2	RxD
3	Ground (signal)
4	Not used

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

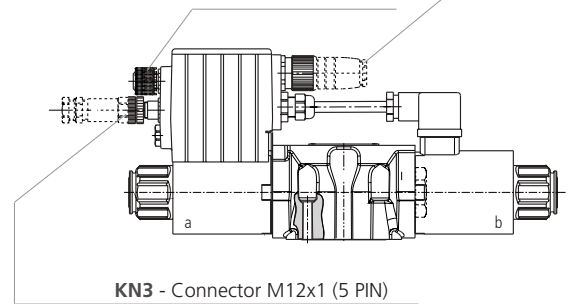
KN4



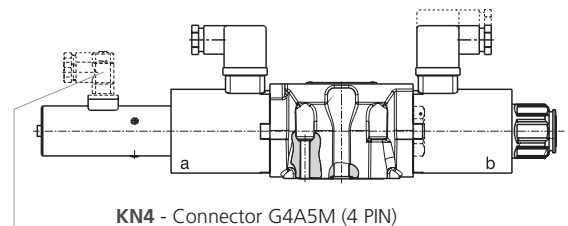
Connector KN4 - type G4A5M (male)	
PIN	Technical data
1	Power supply input
2	Power supply output
3	Ground
4	Not used

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



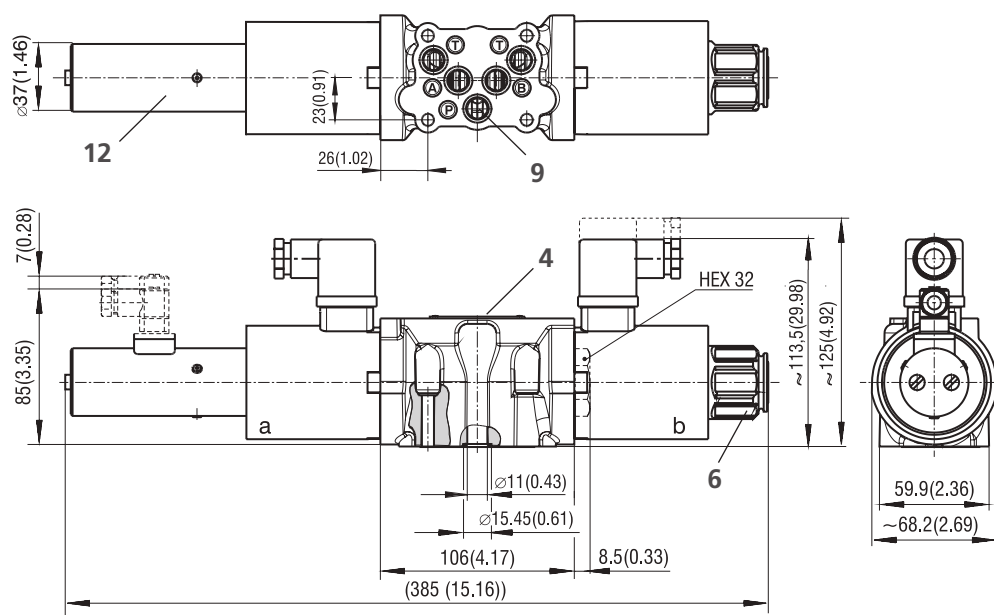
KN3 - Connector M12x1 (5 PIN)
Signal of external feedback
(for configurations E03)



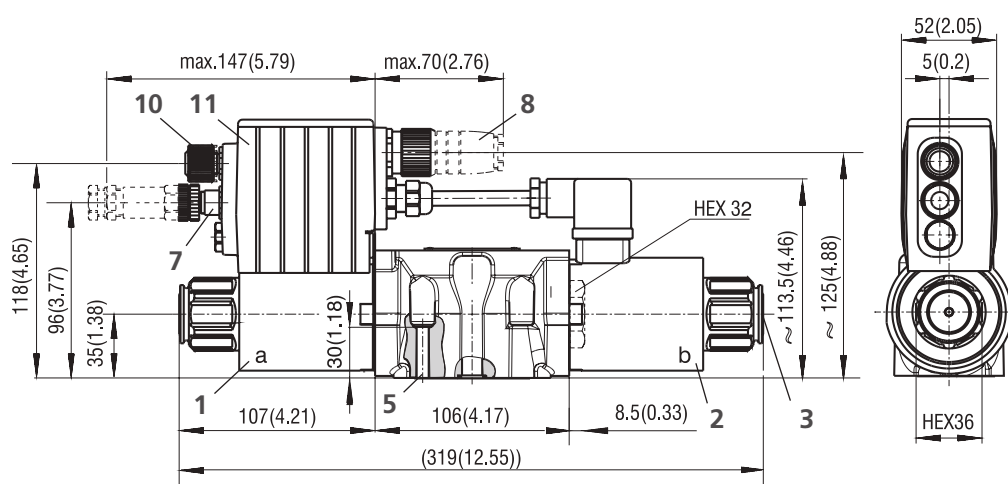
KN4 - Connector G4A5M (4 PIN)
Internal feedback - spool position signal
for valve without ECU

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