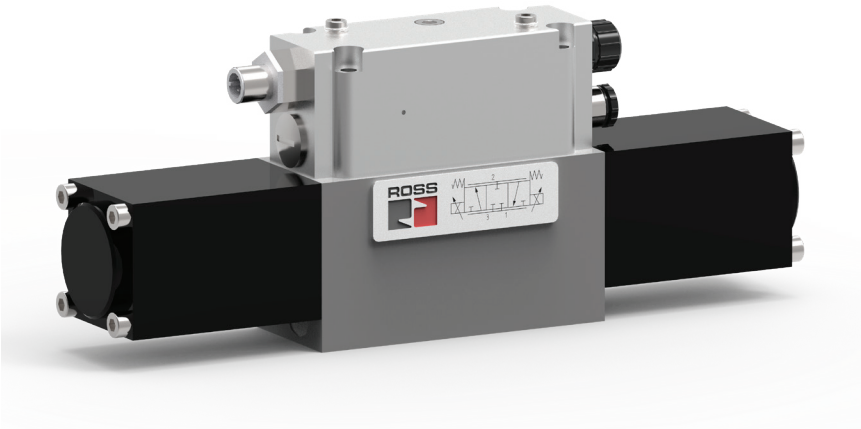
E-RE-17 06-2023

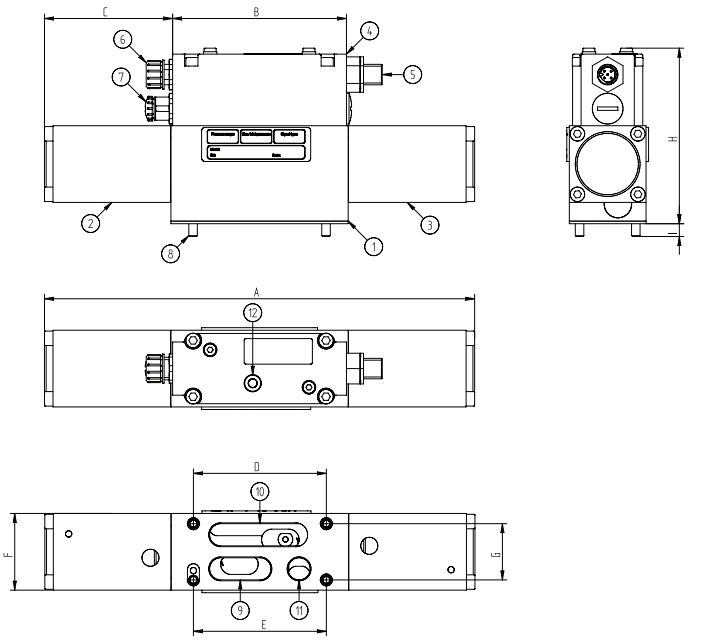
Proportional Pressure Control Valve

Operating Instructions

115P710000P **115P710002P** **115P710004P**
115P710001P **115P710003P**

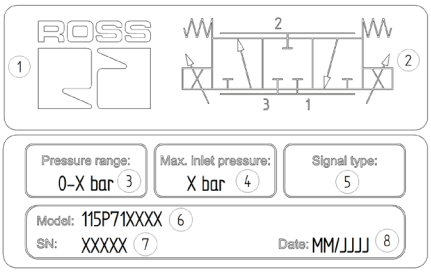


Dimensional Drawings



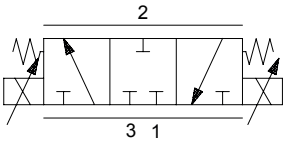
Components	
1	Valve body
2	Inlet solenoid
3	Outlet solenoid
4	Electrical housing
5	Electrical interface
6	Communication interface Input
7	Communication interface Output
8	Mounting screws (M5x100)
9	Port 1 (supply)
10	Port 2 (output)
11	Port 3 (exhaust)
12	LED (state signaling)
Dimensions mm (Zoll)	
A	252 (9.92)
B	102 (4.02)
C	75 (2.95)
D	78 (3.07)
E	78 (3.07)
F	45 (1.77)
G	33 (1.3)
H	103 (4.06)
I	7.5 (0.3)

Product Label



1	Logo
2	Pneumatic symbol
3	Operating pressure (Pressure range)
4	Max. inlet pressure
5	Electrical control (Signal type: 4-20 mA / 0-10 V)
6	Order number (Model number)
7	Serial number
8	Date of production

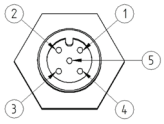
Pneumatic Symbol



3/3-Way

Electrical Connection and Pin Configuration

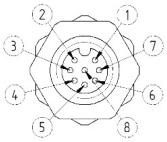
M12M5



5-pin flange connector, M12X1, A coded, positionable

Pin 1	+ 24 V
Pin 2	Set value +
Pin 3	0 V
Pin 4	Actual value +
Pin 5	PE

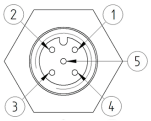
M12M8



8-pin flange connector, M12X1, A coded, positionable

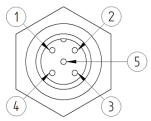
Pin 1	0 V
Pin 2	+ 24 V
Pin 3	Actual value +
Pin 4	Set value -
Pin 5	Set value +
Pin 6	NC
Pin 7	NC
Pin 8	PE

M12D5-PCAV



5-pin flange connector, M12X1, A coded, positionable

Pin 1	+ 24 V
Pin 2	NC
Pin 3	0 V
Pin 4	NC
Pin 5	NC



5-pin flange coupling, M12X1, A coded, positionable

Pin 1	NC
Pin 2	Set value +
Pin 3	Set value -
Pin 4	Actual value +
Pin 5	PE

1 About this Documentation

These instructions contain important information for the safe and appropriate mounting, commissioning and operation of the product.

▸ Read these instructions carefully und completely before using the product.

▸ Make sure to comply with all applicable local and federal laws and regulations before using this product.

1.1 Warnings in this Document

This operating manual contains warnings at section beginnings if the described actions, if executed incorrectly, may cause personal injury or material damage.

Warnings are structured as follows:

⚠ SIGNAL WORD
Type or source of hazard! Consequences ▸ Measures to avert damage

- **Warning triangle:** Indicates the risk of fatal or sever injuries.
- **Signal word:** Indicates the severity of the danger.
- **Type or source of hazard:** States the type of danger or the source of the hazard.
- **Consequences:** Describes possible consequences of ignoring the warning.
- **Measures to avert danger: I**ndicates how to avoid the danger. It is essential that the instructions to avert danger are complied with.

⚠ **WARNING**	Indicates a possible danger that could result in severe or even fatal injury if you fail to avoid it.
⚠ **CAUTION**	Indicates a danger that may result in minor to moderate injuries if you fail to avoid it.
ATTENTION	Indicates potential property damage that may be incurred by the product or its surroundings if you fail to avoid it.

2 Package Contents

Items included:

- Proportional pressure control valve
- Accessories (Screws, Seals, etc.)
- Operating instruction

3 Product Usage Prerequisites

This product has been manufactured according to accepted rules of current technology. There is risk of injury or damage if the following safety instructions and warnings are not observed.

3.1 Intended Use

Proportional Pressure Control Valves are valves, which control a certain pressure level in pneumatic systems proportional to the setpoint. The required pressure level can be only reached if the system to be filled with pressurized air is closed, i.e. it is not open to the atmosphere. The valve can compensate for a certain amount of leakage if the pressure supply is sufficient.

3.2 Operating Conditions

- The valve may only be operated in an ambient temperature range as specified Section 10.
- Air pressure quality as defined by ISO 8573-1 must be at least at the level specified in Section 10.
- The maximal inlet pressure, as defined in Section 10, must not be surpassed.
- In order to reach the required pressure level quickly, the inlet pressure must be at least 0.5 bar higher than the required working pressure.
- Supply the valve with 24 VDC and do not surpass the limits specified in Section 10. The valve operates optimally if the supply is closest to 24 VDC and is stable.

3.3 Responsibilities of the Operator

- Use the valve only for purposes described in Section 3.1!
- Use the valve only in conditions described in Section 3.2!
- Mount the valve as described in Section 4!
- Control the valve by an external signal as described in Section 5!
- Assembly, installation, commissioning, operation and decommissioning must be carried out by qualified personnel that have the expertise and experience in dealing with electrical and pneumatic systems!

4 Mounting

CAUTION

Risk of injury during installation if under pressure or energized!

Installation while pressurized or energized can result in injuries due to sudden pressure build-up or electric shock.

▸ De-energize and de-pressurize relevant system parts before installing the valve!

▸ Secure the system to prevent it from being switched on accidentally!

ATTENTION

Damaging components!

Chemical substances can damage the surface, the markings and the seals of the device.

▸ Install the valve such that it is not exposed to chemicals!

4.1 Mechanical Installation

Mount the valve only on the base plate specified in the data sheet or on a base plate having the same interface! Use only the provided screws for mounting and make sure they are tightened sufficiently!

4.2 Pneumatic Installation

If installed on the base plate, the pneumatic interface is connected. No further steps are necessary.

4.3 Electrical Installation

Connect the valve with a cable having the appropriate pin configuration. The pin configuration of the electrical interface is specified on page 3 or in the data sheet.

5 Commissioning and Operation

CAUTION

Health damage due to loud noise!

Noise levels above 70 dB(A) may cause health damage!

▸ Always wear ear protection while operating the device.

Before commissioning, the device must be installed as described in Section 4. The valve may only be operated as described in Section 3.

The main function of the valve is to control a certain pressure level at Port 2 of the device. The required pressure level is set by the setpoint signal of the device (pins “Setpoint -“ and “Setpoint +”). Depending on the valve type the setpoint signal range is 0 – 10 V or 4 – 20 mA.

If using voltage, supply 0 V to pin „Setpoint -“ and a voltage between 0 and 10 V to pin „Setpoint +“. The valve controls the pressure proportional to the setpoint signal in the valve’s pressure range. For example, if the valve has a pressure range of 0 – 4 bar, you have to provide 2.5 V at pin „Setpoint +“ to specify 1 bar pressure.

If using current, make sure a current in the range of 4 – 20 mA flows between pins „Setpoint -“ and „Setpoint +“. The valve controls the pressure proportional to the current flowing between the pins. For example, if the valve has a pressure range of 0 – 4 bar, you have to provide 8 mA of current to specify 1 bar pressure.

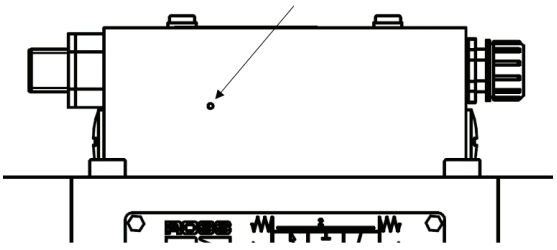
5.1 Permanent Exhaust Function

The permanent exhaust function of the valve makes sure that the valve keeps exhausting if provided with a zero setpoint (i.e. 0 V or 4 mA). The following table shows which valve types possess a permanent exhaust function.

Model	Permanent exhaust
115P710000P	yes
115P710001P	yes
115P710002P	yes
115P710003P	yes
115P710004P	no

5.2 Electronics Casing Pressure Compensation

The valve’s electronics casing has a pressure compensation membrane, which utilizes a pressure compensation port (see illustration) to hold the casing at atmospheric pressure level. The enclosure rating IP65 of the valve is maintained.



(exemplary illustration)

ATTENTION

Damage of pressure compensation membrane!

Pressurized air or steam jet may damage the pressure compensation membrane!

▸ Presssurized air or steam jet (e.g. if cleaning the valve) must not be directed at the pressure compensation port of the electronics casing in order to avoid damage to the pressure compensation membrane.

In case of a damaged pressure compensation membrane, dirt or humidity may enter the electronics casing and damage or destroy the valve's electronics.

6 State Signaling

The valve features an LED on the top of the electronics casing, signaling the valve state. Different valve states are signaled using the colors green, orange and red as well as a blink code.

ATTENTION

A warning or error signal does not always mean that the valve has a defect.

▸ Some warnings and errors indicate an external problem, e.g., insufficient supply voltage.

The LED signals green if there are no warnings or errors. Errors (E) are signaled with a red blink code, warnings (W) with an orange blink code. The valve only transmits one event (error or warning) at a time. Thus, if the valve registers several events, only the event with the highest priority is signaled. Errors have higher priority than warnings. The following table specifies all possible events of the valve, listing them with increasing priority.

Signals				
Event / Problem	**Type**	**Cipher**	**Signal color(1)**	**Blink code(2)**
Setpoint	E	1	red	. _ _ _ _
Supply voltage	E	2	red	. . _ _ _
Inlet solenoid	E	3	red	. . . _ _
Outlet solenoid	E	4	red	. . . . _
Pressure supply	E	5	red	. . . . .
Temperature	E	6	red	_ . . . .
Outlet pressure	E	7	red	_ _ . . .
Setpoint not reached	E	S	red	. . .
Overshoot	E	O	red	_ _ _
Undershoot	E	U	red	. . _
Service warning	W	R	orange	. _ .
Service error	E	R	red	. _ .
Outlet sensor	E	S1	red	. . . . _ _ _ _
Inlet sensor	E	S2	red	. . . . . _ _ _

(1) The valve is also able to store the last error event and to signal it using the same blink code in orange.

(2) The blink code is a series of short (dot ".") and long (dash "_") blinks of the LED. Codes are 3-8 blinks long. There is a 2 second pause between code signals.

Signaling past errors (as warnings) can to be explicitly activated using the "Ross Proportional Valve Diagnosis Tablet" (not included).

The following sections explain all valve signals (see table "Signals") in detail and suggest corresponding error handling options.

6.1 Setpoint

The valve monitors the allowed setpoint signal range, which may not be exceeded by more than 5% of the full scale.

Error handling: Check the control system, which supplies the valve with the setpoint signal.

6.2 Supply Voltage

The valve monitors the supply voltage, which may not deviate more than 10% from the optimal 24 VDC.

Error handling: Check the control system, which provides the supply voltage for the valve.

6.3 Inlet Solenoid

The valve monitors the current level of the inlet solenoid. The maximal current consumption of the solenoid may not be exceeded by more than 5%.

Error handling: Send the valve to the manufacturer for repair.

6.4 Outlet Solenoid

The valve monitors the current level of the outlet solenoid. The maximal current consumption of the solenoid may not be exceeded by more than 5%.

Error handling: Send the valve to the manufacturer for repair.

6.5 Pressure Supply

The valve monitors the pressure supply (inlet pressure), which may not exceed the limits defined in Section 10.

Error handling: Adjust the pressure supply level to fit the allowed range specified in Section 10.

6.6 Temperature

The valve monitors the temperature level inside the electronics casing. The temperature may not exceed the limits defined in Section 10.

Error handling: Adjust the ambient temperature level to fit the allowed range specified in Section 10.

6.7 Outlet Pressure

The valve monitors the outlet pressure (working pressure). The outlet pressure may not exceed the lower limit of the regular working pressure range (see Section 10) by more than 5% or the upper limit of the regular working pressure range (see Section 10) by more than 20% (possible overshoot).

Error handling: Contact the manufacturer to clarify the issue.

6.8 Setpoint Not Reached

The valve monitors the speed of pressure increase and decrease respectively. The target pressure must be reached in 500 ms with an accuracy of 15% of the last setpoint change. For example, if the valve controls the pressure from 1 bar to reach 2 bar (1 bar difference), the pressure must be between 1.85 bar an 2.15 bar after 500 ms at the latest.

Under usual circumstances the valve controls the pressure much faster and more precisely (see Section 10 – Performance Characteristics). Settings of this monitoring function are more tolerant in order to only indicate a serious deviation from optimal conditions (e.g. leakage, insufficient pressure supply, etc.).

Error handling: First, check the pressure supply of the valve. For certain functions, e.g. Plunger Cooling, the air consumption of the valve may be high. In such cases the inlet pressure may briefly collapse not providing sufficient air supply and the valve may reach the target pressure level too slowly or not at all.

If the pressure supply is sufficient (maintains the same level), evaluate the air consumption of the valve further. If the air consumption is too high, for example because of the mechanical setup of the system or unnecessary leakage (air flow to atmosphere) the valve cannot reach the target level.

6.9 Overshoot

The valve monitors the outlet pressure buildup for each new setpoint. The pressure may not overshoot more than 20% of the last setpoint change. For example, if the valve controls the pressure from 1 bar to reach 2 bar (1 bar difference), the pressure may not be higher than 2.2 bar.

Under usual circumstances the valve controls the pressure more precisely (see Section 10 – Performance Characteristics). The setting of this monitoring function is more tolerant in order to only indicate a serious deviation from optimal conditions (e.g. pressure supply too high).

Error handling: Check the pressure supply of the valve. The optimal inlet pressure is 0.5 bar over the highest target pressure and at least 2 bar.

6.10 Undershoot

The valve monitors the outlet pressure decrease for each new setpoint. The pressure may not undershoot more than 20% of the last setpoint change. For example, if the valve controls the pressure from 2 bar to reach 1 bar (1 bar difference), the pressure may not be lower than 0.8 bar.

Under usual circumstances the valve controls the pressure more precisely (see Section 10 – Performance Characteristics). The setting of this monitoring function is more tolerant in order to only indicate a serious deviation from optimal conditions (e.g. insufficient pressure supply).

Error handling: Check the pressure supply of the valve. The optimal inlet pressure is 0.5 bar over the highest target pressure and at least 2 bar.

6.11 Service Warning

The valve monitors the number of pressure control steps (setpoint changes). After 50 million steps the valve indicates a warning.

Warning handling: Send the valve to the manufacturer for repair.

6.12 Service Error

The valve monitors the number of pressure control steps (setpoint changes). After 65 million steps the valve indicates an error.

Error handling: Send the valve to the manufacturer for repair.

6.13 Outlet Pressure Sensor

The valve monitors the correct function of the outlet pressure sensor. If the outlet pressure sensor malfunctions, the valve cannot control the outlet pressure.

Error handling: Send the valve to the manufacturer for repair.

6.14 Inlet Pressure Sensor

The valve monitors the correct function of the inlet pressure sensor. If the inlet pressure sensor malfunctions, the valves ability to control the outlet pressure is affected.

Error handling: Send the valve to the manufacturer for repair.

7 Communication Interface

The proportional pressure control valve has a communication interface that can be used by the customer. Valves mounted on a machine can be connected to each other on a communication bus (fieldbus cables available separately) and to the Proportional Valves Diagnostics Tablet. The tablet can be used to observe and analyze the operation of the valves and, in particular, the pressure build-up process. The tablet also has a parameterizable continuous monitoring function that can record valve events and log them in a long-term log. The order number of the Diagnostics Tablet and the field bus cables can be found in the valve data sheet.

8 Disconnecting and Removal

⚠ CAUTION

Risk of injury due to disconnecting pressurized or energized parts!

▸ Disconnecting a pneumatic component while pressurized or energized may result in injury or death due to sudden pressure release, unexpected movement of parts or electric shock.

▸ Make sure to de-pressurize and de-energize the system before disconnecting the valve.

Follow these steps to disconnect the valve from the system:

- Provide a zero setpoint to the valve (0 V or 4 mA depending on the valve type)!
- Make sure the system is de-pressurized (0 bar rel. at Port 1 of the valve)!
- Disconnect the electrical supply of the valve!
- Loosen the screws and remove the valve from the system!

9 Disposal

Dispose of the valve in accordance with all applicable statutory regulations in your country.

10 Technical Specification

General		
Fluidic interface	Base mounted	
Connections size of Base	G 3/4	
Orifice size	12 mm	
Nominal flow[1]	3200 Nl/min	
Operating pressure	115P710000P	0 – 4 bar
	115P710001P	0 – 4.875 bar
	115P710002P	0 – 4 bar
	115P710003P	0 – 4 bar
	115P710004P	0 – 1.5 bar
Design	Valve elements consisting of valve seat, spring and solenoid	
Materials	Valve body	Aluminum alloy, clear anodized
	Valve internals	Stainless steel / steel (burnished)
	Reset spring	Stainless steel
	Seals	FKM
Weight	2.73 kg	
Actuator	Solenoid	Control voltage 24VDC
Electrical Characteristics		
Supply voltage	24 VDC ±10 %	
Electrical control	115P710000P	4 – 20 mA
	115P710001P	4 – 16 mA
	115P710002P	4 – 20 mA
	115P710003P	4 – 20 mA
	115P710004P	0 – 10 V
Power consumption	max. 1.8 A	
Enclosure rating	IP 65 (plugged)	
Electrical connection[2]	115P710000P	M12M5
	115P710001P	M12M5
	115P710002P	M12M8
	115P710003P	M12D5-PCAV
	115P710004P	M12M8
Operating Conditions		
Inlet pressure	max. 5 bar	
Medium	Compressed air ISO 8573-1:2010 [7:4:4]	
Ambient temperature	0 – 75°C	
Optimum Operating Conditions		
Inlet pressure	at least 2 bar and at least 0.5 bar above max. required operating pressure	
Ambient temperature	15 – 50°C	
Supply voltage	24 VDC	
Performance Characteristics[3]		
Control speed	90 % of setpoint after aprox. 100 ms 100 % of setpoint after aprox. 200 ms	
Accuracy	± 0.01 bar	
Repeatability	± 0.01 bar	

(1) at Inlet pressure = 7 bar (abs.), Outlet pressure = 6 bar (abs.), Standard conditions: 1013.25 mbar, 20°C, 0% relative humidity

(2) Please refer to section *Electrical Connection and Pin Configuration*

(3) Related to a 2.5 l volume and valid for optimum operating conditions

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