

PA 3

PNEUMATIC MONITORING UNIT



Dear Customer,

Congratulations on choosing a SCHUNK product. By choosing SCHUNK, you have opted for the highest precision, top quality and best service.

You are going to increase the process reliability of your production and achieve best machining results – to the customer's complete satisfaction.

SCHUNK products are inspiring.

Our detailed assembly and operation manual will support you.

Do you have further questions? You may contact us at any time – even after purchase. You can reach us directly at the mentioned addresses in the last chapter of these instructions.

Kindest Regards,

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1. Safety

1.1. Symbol key



You will find this symbol wherever **hazards for persons or damage to the product** are possible.



This symbol indicates **important information** on the product or its handling.

1.2. Appropriate use

The unit must only be used within the scope of its technical data. Appropriate use also includes compliance with the conditions the manufacturer has specified for commissioning, assembly, operation, environment and maintenance. Using the unit with disregard to even a minor specification will be deemed inappropriate use. The manufacturer assumes no liability for any injury or damage resulting from inappropriate use.

1.3. Safety Notes

- For application planning and operation of the equipment, please stick to the general valid rules of technology.
- Installations and maintenance work should be done by skilled personnel and with suitable tools!
- During operation, maintenance and repair works, please consider the valid rules for accident prevention and safety for electrical equipment!



- Before direct intervention, switch off the current supply first!
- Never loosen wires, cables or valves of pressurized systems.
- Make sure that the system cannot be actuated unintended and counteract any adverse effects!



- Make sure that after an interruption of the electric or pneumatic supply the process will be restarted in a defined and controlled way!
- Provide the pressure supply in a voluminous way. Otherwise you will risk a drop of pressure during switching operation!

2. Warranty

The warranty period is 24 months after delivery date from the factory, assuming use in single-shift operation and that the recommended maintenance and lubrication intervals are respected. Components that come into contact with workpieces and wearing parts are never included in the warranty. In this context, please also see our General Terms and Conditions.

3. Scope of delivery

The scope of delivery comprises:

- Pneumatic monitoring unit PA3
- Connection cable 7 x 0,25 mm² + display
- Operation manual

4. Introduction

There will be always automation tasks, where it will be difficult or impossible to monitor the status of pneumatic actuation by electronic sensors. The pneumatic monitoring unit PA 3 was designed for such a case of application, where it is impossible to detect the status of actuators in a rough industrial environment.

The PA3 monitoring electronics is attached next to the control cabinet and is connected with the control unit via an insulated cable. The pneumatic actuator with the monitoring electronics is connected via 3 pneumatic hoses. The pressure ratios of the 3 pneumatic hoses are evaluated by the monitoring electronics and are displayed via 3 signals (open, gripped and closed).

Fields of application are for example:

- Actuator monitoring inside a machining center (influence of coolant)
- Actuator monitoring close to strong magnetic fields
- Actuator monitoring in areas, where the use of electronic sensors is forbidden.

5. Design and principle of function



For monitoring the status of pneumatic actuators via pneumatic hoses, the actuators have to be designed like **double-acting cylinders**. This applies i. e. for the following actuators:

1. Grippers
2. Stroke cylinders
3. Pneumatic clamping units

The **pneumatic monitoring PA3** cannot be used for the following actuators:

4. Pneumatic motors
5. Pneumatic power screwdrivers
6. Other units, which cannot be monitored due to the PA3' principle of function.



The following contemplation exclusively refers to grippers! Other pneumatic actuators can be used in the same way! Changes in details are possible.

For determining the piston's position of the cylinder, 2 small spray holes have to be set additionally to the control connections A and B. The spray holes are connected by an AND-valve and build the C-connection (see the following picture).

The pneumatic monitoring unit PA3 is equipped with 3 pressure sensors, which will evaluate the pressure ratio of the control line.

For being able to determine the gripper positions safely, it is necessary that a time measurement is done simultaneously to the pressure measurement. This helps to determine the necessary time to close or to reopen the gripper. Hereby **the size of the gripper** and the **actuated air pressure** are considered. The measured time serves as slow-down time for recognition of the gripper' position and excludes shock pressures during the recognition of the position.

During the "gripped" position, the C-hose is de-aerated by the de-aerated piston area. Depending on the hose length it will take a certain period of time.

(see Figure 1:

Gripper in position "open",

Figure 2:

Gripper in position "gripped,

Figure 3:

Gripper in position "closed")

In addition to the slow-down time, a time factor must therefore also be set to be able to reliably determine the "gripped" status of the gripper.

Note

3 incorrect interpretations are possible per 500 gripping cycles.

The following illustrations show the pressure ratios of the various gripper positions:

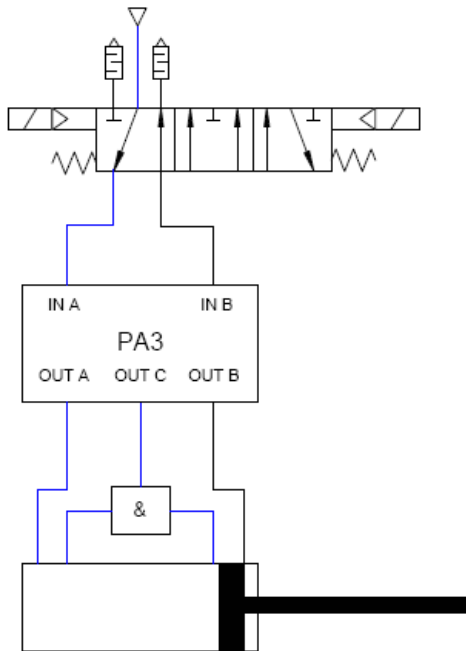


Figure 1:
Gripper in position "open"

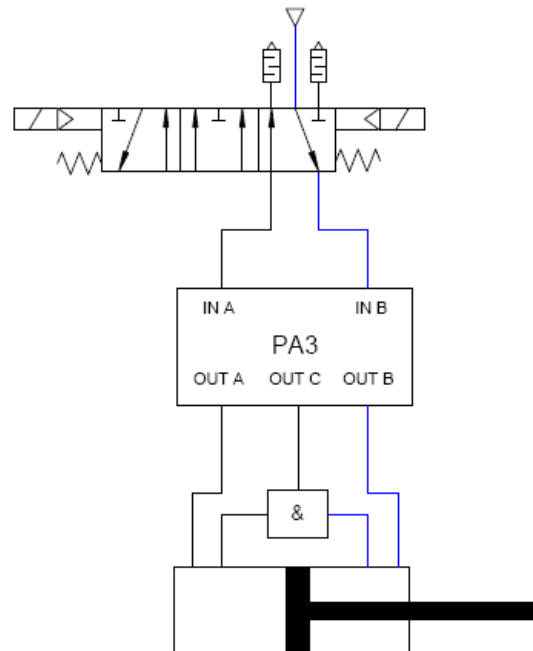


Figure 2:
Gripper in position "gripped"

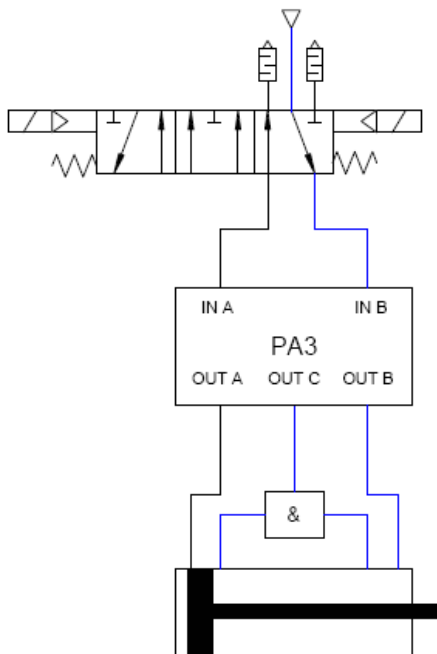


Figure 3:
Gripper in position "closed"

6. Assembly

The pneumatic monitoring unit PA 3 should be assembled next to the control cabinet.
The following bolt circle should be used for assuring an optimum fastening of the housing.

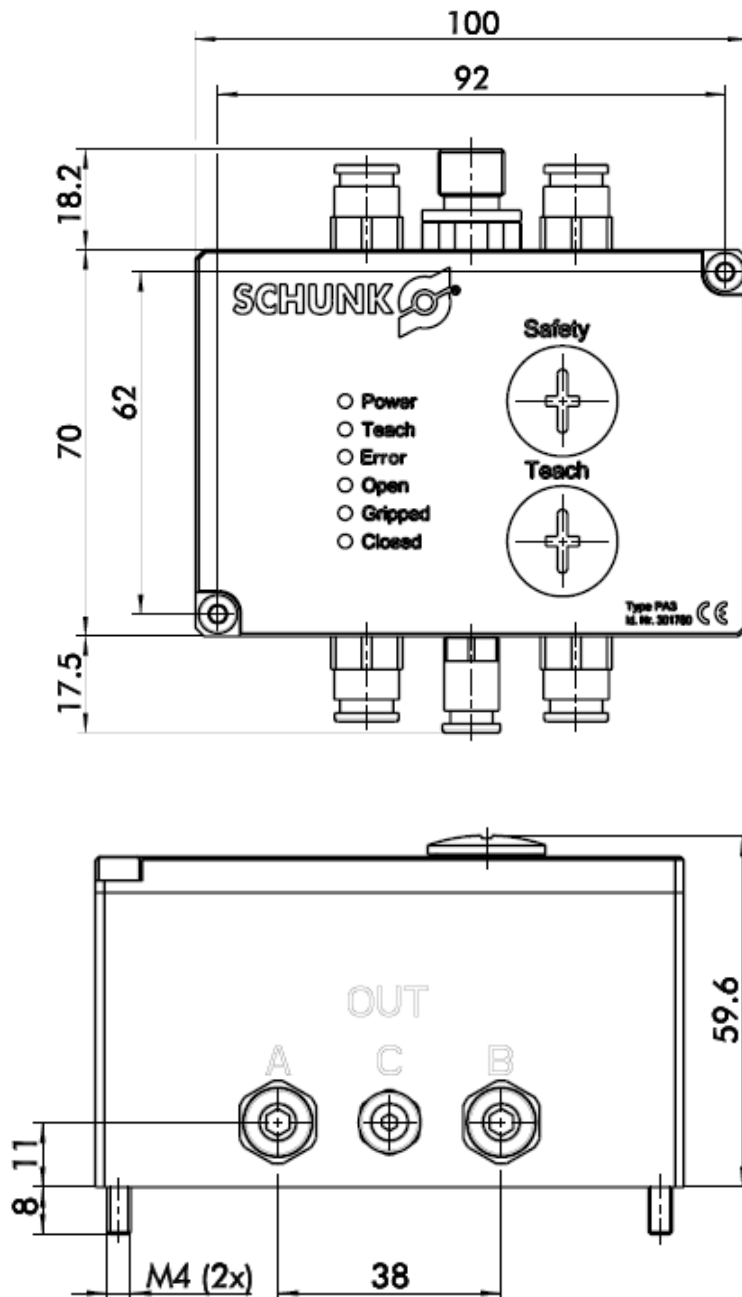


Figure 4 Bolt circle for housing fastening

6.1. Pneumatic connection



In order to assure that the electric output signals of the pneumatic monitoring unit PA3 will reproduce the correct gripper position, the gripper has to be connected as follows:

- If the pressure **IN A and OUT A** is actuated, the gripper should move into “open” direction.
- If the pressure **IN B and OUT B** is actuated, the gripper should approach the position “closed”.

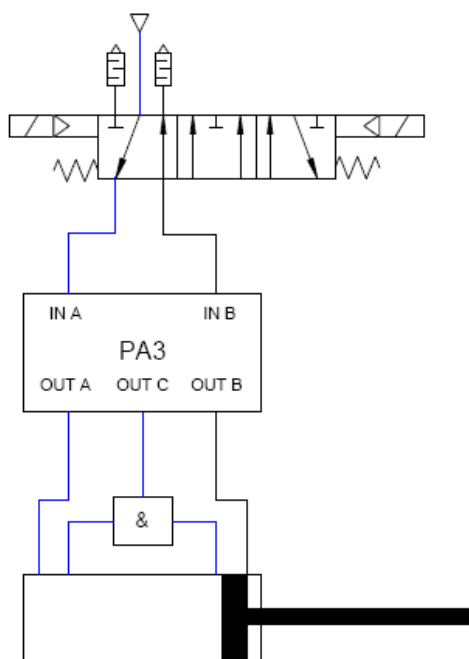


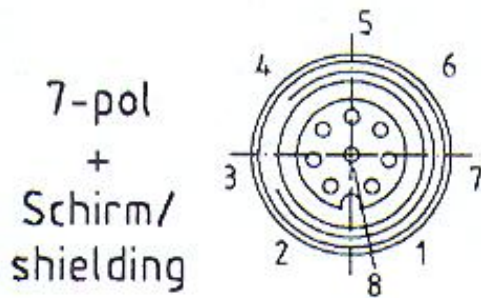
Figure 5 Suggestion of how to switch the pneumatic unit

The valves have to be chosen and approached in a way that during **normal operation always one control line** will be actuated (A **OR** B/"exclusive Or"). This is absolutely necessary for being able to evaluate the pressure edge of the control line.

If both control lines are de-aerated, the pneumatic monitoring PA 3 will show an error. An error will be also indicated, if the power supply during the switching operation will **fall below 3 bar**. The error led will flash up and for safety reasons it can be switched off only by switching off the power supply.

6.2. Electric connection

The below mentioned chart shows the cable assignment of the pneumatic monitoring



Pin- No.	Lead	Meaning
1	white	+24 V
2	brown	0 V
3	green	ERROR
4	yellow	OPEN
5	grey	GRIPPED
6	pink	CLOSED
7	blue	0 V
8	shield	shield



If there should be a pressure error during sensor operation, this will be shown with the error-LED. For safety reasons, the error LED can be switched off **only** by switching off the power supply, i. e. via a relay.

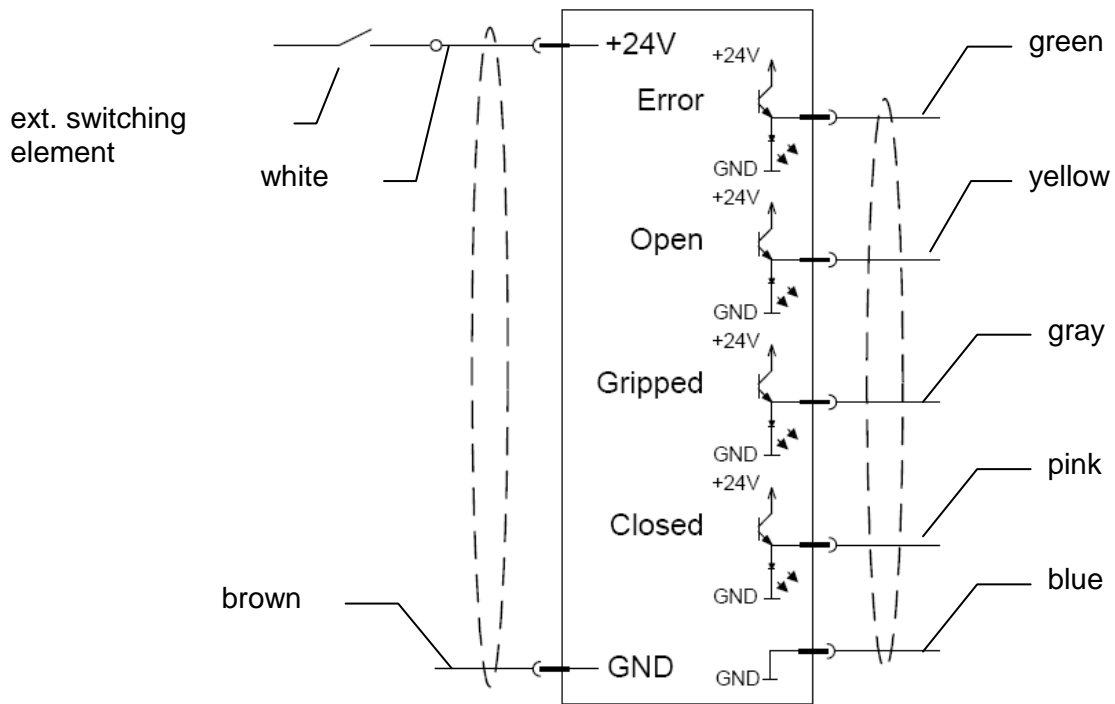


Figure 6 connection overview

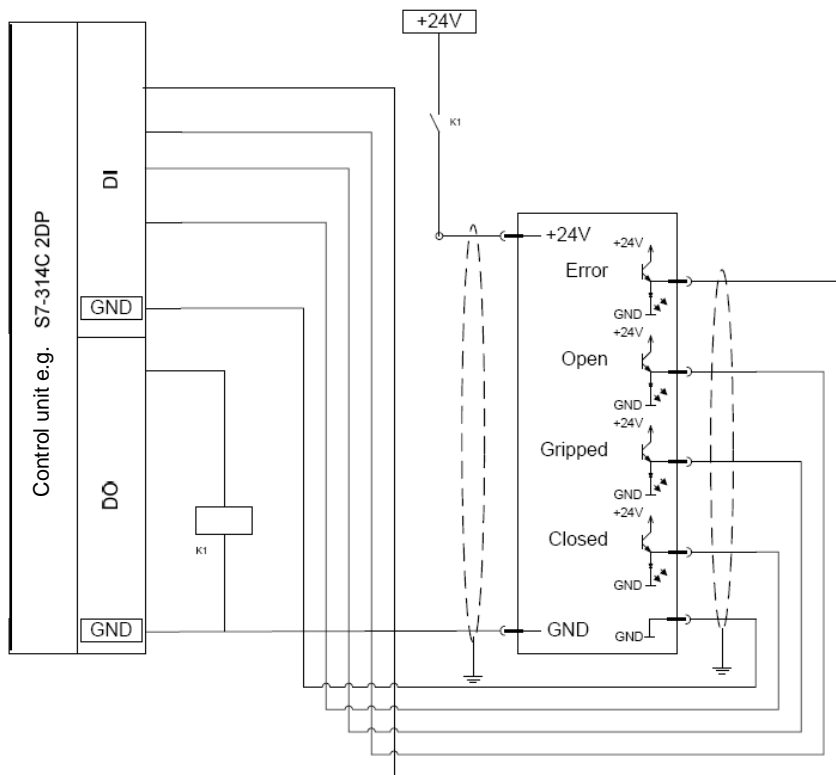


Figure 7 Suggestion of electrical connection to the control unit

7. Types of operation

In order to consider the size of the gripper during evaluation, during **teach operation** the opening and closing time is determined in relation to the air pressure. **During sensor operation** the determined parameters, actuator status, are displayed.

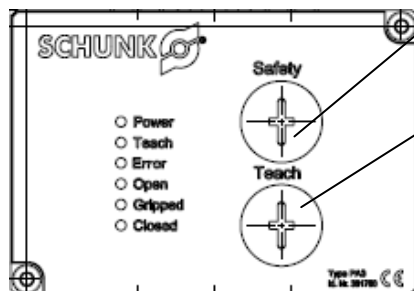
7.1. Teach operation



For being able to put the pneumatic monitoring unit PA3 in teach operation,

- the operating voltage must be connected
- the gripper valve must be open, this means connection **IN A, OUT A and C** must be actuated with pressure
- Both cover caps of the housing cover must be removed.

1. To switch over to teach-mode, the spring-loaded switch behind the cover cap **Teach** has to be pressed using a plastic screwdriver until the **Teach LED** lights up and the **Gripped LED** starts to flash.



Behind this cover cap you will find the potentiometer

Behind this cover cap you will find the spring-loaded switch

2. Use the valve to close the gripper in order to grip the workpiece. When the workpiece is gripped, the **Gripped LED** lights up permanently and the **Closed LED** starts to flash.
3. Use the valve to open the gripper. Remove the workpiece and close the gripper again. When the gripper is completely closed, the **Closed LED** lights up permanently and the **Open LED** starts to flash.
4. Use the valve to open the gripper completely. The **Open LED** lights up permanently and the **Teach LED** goes out. Teach mode is now complete. The unit automatically switches over to Sensor mode. The current gripper status is displayed.
5. You should now grip and release the workpiece several times. Position the workpiece between the gripper fingers and pneumatically open and close the gripper. While doing this, turn the "Safety" potentiometer **to the right as far as its cycle time will allow**. The further you turn the potentiometer to the right, the longer the PA3 requires to detect the gripper status. At the same time, however, the monitoring process is more resistance to external disturbance variable, such as pressure fluctuations, insufficient compressed air supply, changes in temperature or changes of the inner friction during the service life of the gripper.
6. Screw the **Teach** cover cap back in.

The pneumatic interrogation is prepared for sensor operation now.

7.2. Sensor operation

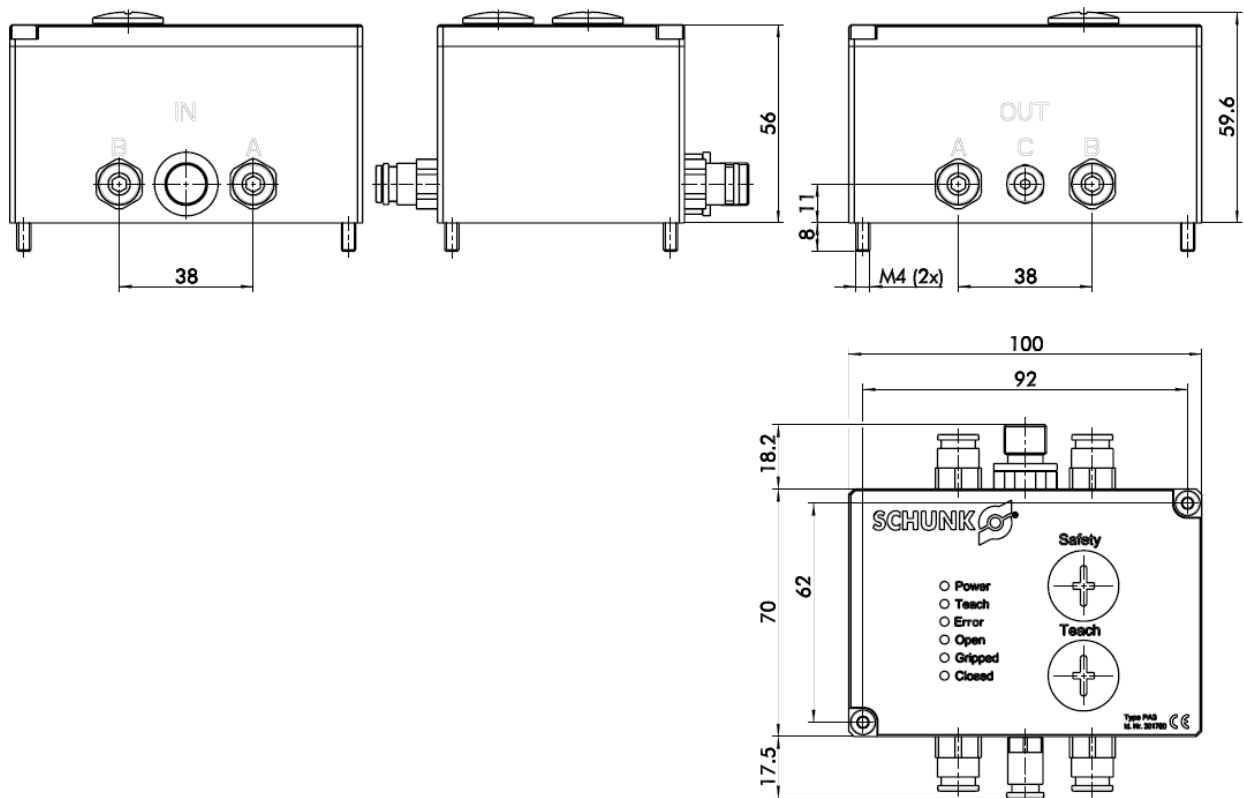
The pneumatic monitoring unit PA3 is activated in sensor operation after connection of the power supply. After activation of the power supply the run-LED illuminates. The LEDs teach, error, open, gripped and closed are illuminated for a short time and go out again. Then the actual gripper position is displayed

The pneumatic monitoring unit PA3 is ready for operation now.

If a pressure error should occur while the gripper is activated, the LEDs open, gripped and closed are switched off.

The error-LED illuminates now. For safety reasons this situation can only be changed by switching off the power supply. After re-activation of the power supply the error LED goes out again and the actual gripper position is displayed now.

8. Dimension



9. Technical Data

Parameter	value	unit
Power supply	24 ± 10%	V
min. power input	30	mA
max. power input (at $R_L \geq 1k\Omega$ / output)	130	mA
Operating temperature	0-60	°C
Switching output	4	Error, Open, Gripped, Closed
Load resistance / Output	≥ 1	k Ω
min. period of time	10	ms
max. period of time	30	s
Safety factor	1,1 ; 1,5 ; 2 ; 3	-
min. operating pressure	3	bar
max. operating pressure	10	bar
Norm flow rate	105	l/min
Cracking pressure pressure sensors	2,5 * max. operating pressure	bar

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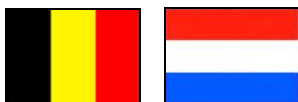
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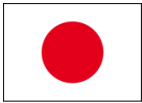
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