

Chapter 11:

Valves and Actuators with the NAMUR-interface

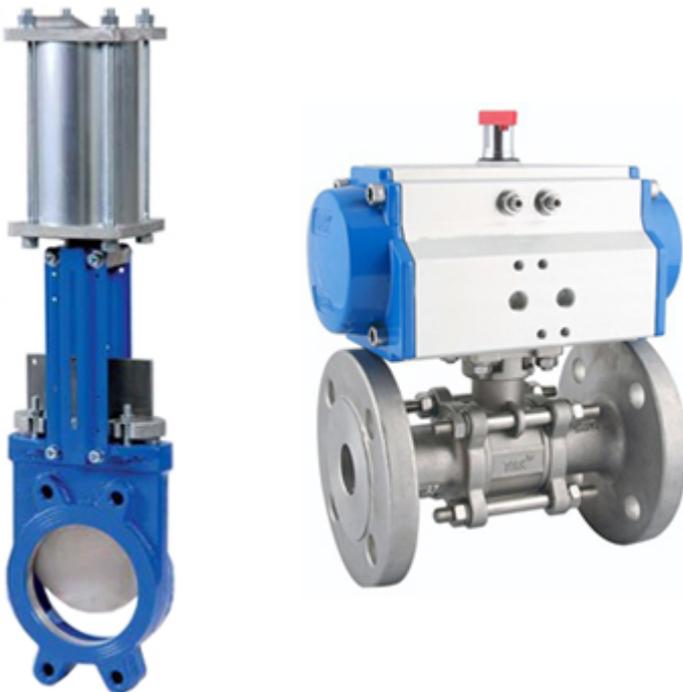


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Valves with NAMUR-interface to control process valves

1. Pneumatic actuation of process valves

Process valves can be actuated manually, electrically, pneumatically and hydraulically. **Often times pneumatic actuators** are in use when it comes to automated process valves. They are mostly either linear actuators (**pneumatic cylinders**) or **rotary actuators**.



Whether it's a linear or rotary actuator, the pneumatic automation of process valves is popular.

There are distinct advantages of pneumatic actuators in comparison to electric ones:

- High torque
- Low maintenance
- Few spare parts
- High durability
- High reliability
- Useable in explosion hazardous environments
- Inexpensive

As the field of applications and types of process valves is extremely wide, we will not cover that.

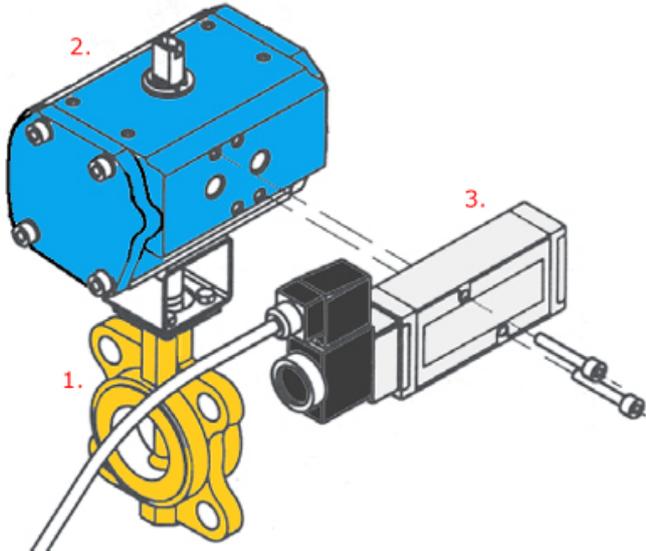
Instead we will focus on the **pneumatic actuation** and **control** of rotary actuators with **NAMUR-interface**.



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A pneumatically automated process valve has three main parts:



1. Process valve

Part of the pipe-line system, e.g. ball valve or butterfly valve.

2. Pneumatic rotary actuator

Opens and closes the process valve.

3. Pilot valve (with NAMUR-interface)

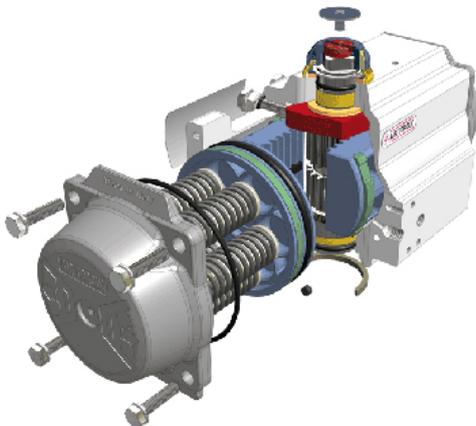
Directional control valve for control of pneumatic rotary actuators.

Further important elements can be:

- **Switch-box** to feed the position of the process valve back to a central command,
- **Manual override** – clutch for emergencies or
- **Positioner**, replacing the switch-box and mostly including the control valve.

2. Pneumatic rotary actuators

The design and dimensions of rotary actuators differ from manufacturer to manufacturer. The two most popular designs are either **Scotch-Yoke** or **Rack and Pinion** actuators. We will introduce you to the Rack and Pinion actuator with more detail.



The 2 piston rods of the 2 pistons inside the actuator are shaped like racks. Compressed air is driving them. The racks drive a pinion which is linked via a shaft to the process valve and opens or closes it.



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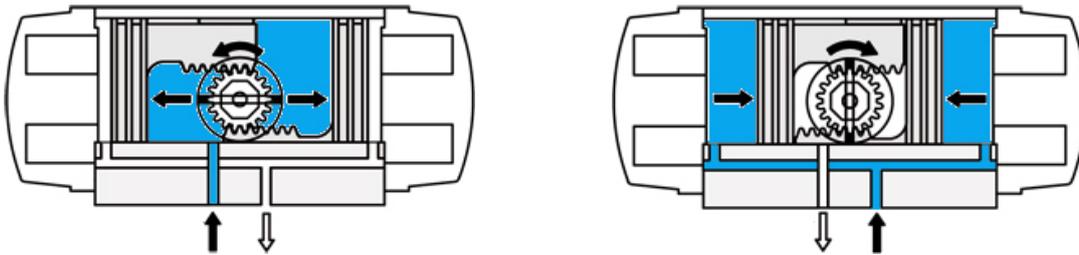
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The selected size of the actuator depends on the force required to open and close the process valve. Usually the manufacturer indicates the maximum torque the actuator offers at a specific pressure.

There are two versions of linear actuators:

- **Double-acting actuators**
- **Single-acting actuators** (with mechanic spring return)

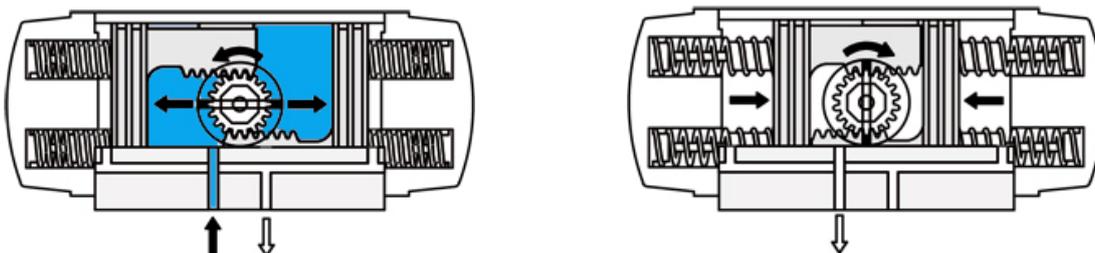
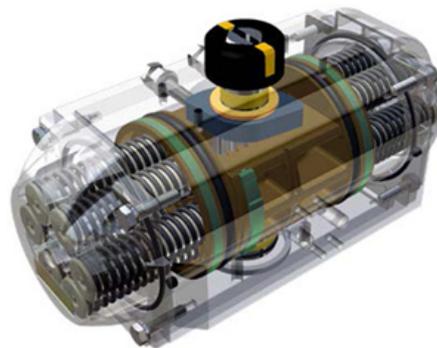
In **double acting actuators** - depending on the direction required - compressed air flows to the outside or to the inside of the two pistons. This can be easily controlled by **using 5-way directional control valves** (5/2-way for fully opening and closing the process valve, 5/3-way if intermediate positions are required).



In **single-acting actuators**, the reset to basic position is realized by using packs of mechanical springs.

Two packs of springs are positioned on the outside of the actuator, pushing the pistons into the middle position. The area the springs are in is called the **“spring chamber”**.

As soon as the actuation side of the actuator is exhausted, the springs push the pistons together, which turns the pinion and (depending on what is required) opens or closes the process valve.

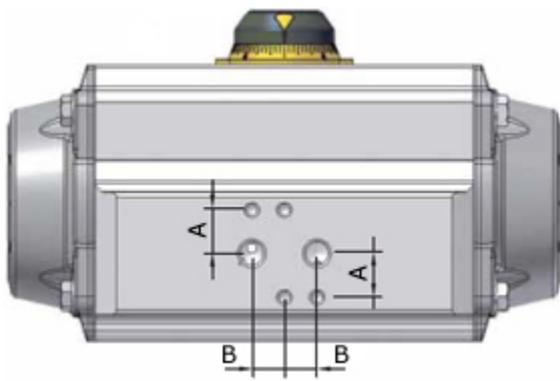


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There are standards for the contact interfaces of a rotary actuator, e.g.:

- Contact interface to the **control valve** | VDI/VDE 3845 (NAMUR)
- Contact interface to the **process valve** | ISO 5211 | DIN 3337



VDI/VDE 3845 (NAMUR)

Interface on the actuator that allows to flange directly a control valve with NAMUR-interface.



ISO 5211 | DIN 3337

Connection to the process valve.

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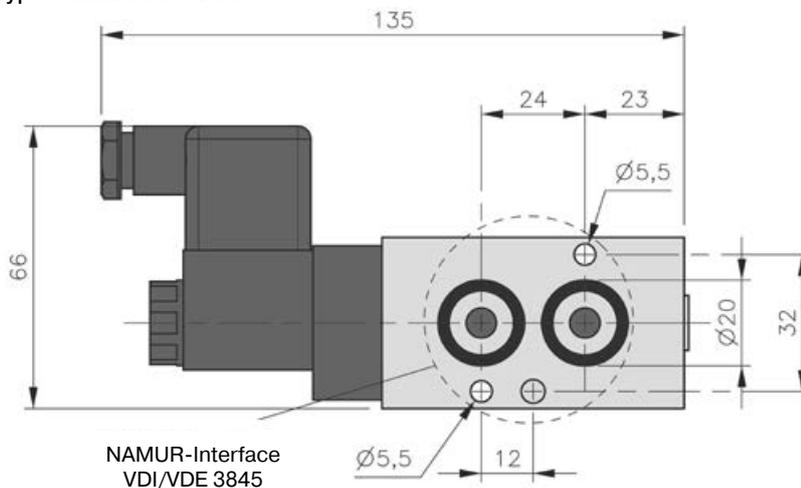
3. The NAMUR-interface

NAMUR-valves are **control valves** which offer **an assemblage interface according to the standard VDI/VDE 3845**.

NAMUR-valves are different from other in-line valves as they offer two ports on the flat side of the valve. In addition, there are holes for fixing the valve onto the actuator.

The drawing below shows a single solenoid 5/2-way valve with an interface according to NAMUR. The dimensions of the 1/4" -interface, among others, are shown as well.

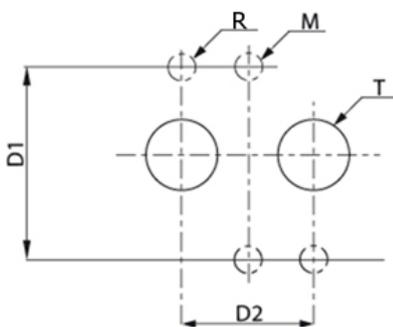
Type: **MNH 510 701**.



Besides the 1/4"-interface there is also one for larger actuators:

- **G 1/4"** - interface NAMUR valve | description: [NAMUR 1/4"] or NAMUR 1
- **G 1/2"** - interface NAMUR valve | description: [NAMUR 1/2"] or NAMUR 2

Dimensions of the NAMUR interfaces on the actuator



	T*	D1	D2	M
NAMUR 1/4"	G 1/8" / G 1/4"	32	24	M 5
NAMUR 1/2"	G 3/8" / G 1/2"	45	40	M 6

The hole **M** is typically used for mounting a setscrew onto the rotary cylinder, which fits into the blind bore of the valve and defines its operating direction.

The hole **R** is usually used for fastening screws.

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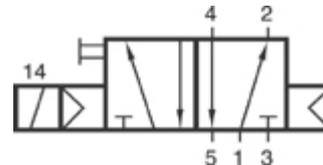
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The picture displays a **MNH 510 701**, which is a **5/2-way** single solenoid NAMUR-valve. It is used to control a double-acting actuator.

Ports **2** and **4** are on the side of the valve. The ports are sealed towards the actuator with O-rings.

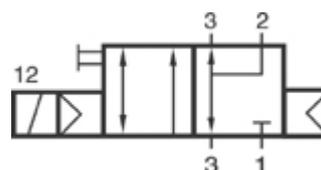
Port **1** (= supply) and ports **3** and **5** (= exhausts) are on the flat side of the valve (shown here on the top).



The picture displays an **MNH 310 701**, which is a **3/2-way** single solenoid NAMUR-valve. It is used to control a single-acting actuator.

Ports **2** and one port **3** are on the side of the valve. The ports are sealed towards the actuator with O-rings.

Port **1** (= supply) and the other port **3** (= exhaust) are on the flat side of the valve (shown here on the top).



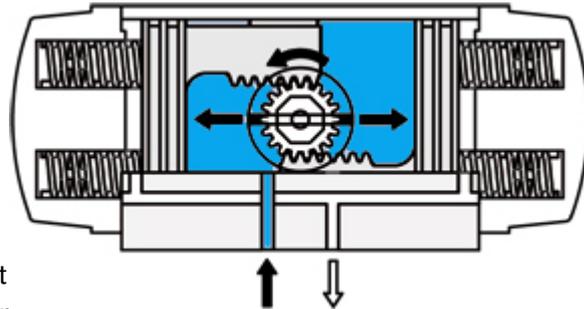
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A normal 3/2-way inline valve has 3 ports. The 3-way NAMUR-valve on the photo however has 4, which you can also see on its ISO symbol. WHY IS THAT?

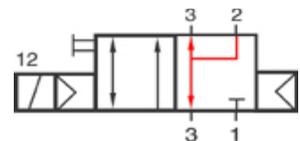
Single-acting actuators (the ones with springs) have 2 ports as well. One is connected to the **actuation side**, the other to the **spring chamber**.

In order to avoid air from the atmosphere (which might be wet, polluted or dirty) to enter the spring chamber, it should be ensured that (potentially cleaner) process air enters it instead in order to avoid corrosion of the springs.



That is why in process automation, we aim towards an **air recirculation** into the spring chamber, also called a “**purge**”.

When the actuation side of the actuator is exhausted (*3/2-way valve n.c. in standard position*), the actuation chambers are gradually becoming smaller and the spring chambers larger as the springs expand. The 3/2-way NAMUR-valve feeds part of the process air into the spring chambers before it is used to expand the actuation chambers. The excess air exhausts through the external (second) port 3. This function is indicated in red in the ISO symbol.



By feeding process air into the spring chambers, we want to reduce pollution inside the actuator due to dirt, dust, mist, moisture etc. that might have been sucked into the spring chambers and thus avoid corrosion of the springs.

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4. HAFNER valves with NAMUR-interface

HAFNER Pneumatik offers a uniquely wide range of valves with **NAMUR-interface**, as well as **a range of accessories**.

- Solenoid valves | 3/2- (n.c. / n.o.), 5/2- and 5/3-way
- Pneumatically actuated valves | 3/2-, 5/2- and 5/3-way
- Hand lever valves | 3/2-, 5/2- and 5/3-way
- Everything mentioned above both in NAMUR 1 and NAMUR 2
- Numerous products made of stainless steel, for cold and for explosion-hazardous environments
- Flow-regulator plates
- Quick-exhaust valves and „purge-blocks“
- Numerous safety valves (manually, pneumatically or electrically actuated)
- Plates and accessories

HAFNER does not only offer standard products but also offers:

- **NAMUR Flex** | 5/2-way valve with a kit to convert it into a 3/2-way valve with air recirculation
- **Stainless steel** valves | made from 1.4404 (316L)
- **Low temperature** valves | -50°C to +50°C
- **High temperature valves** | -20°C to +80°C
- **BSP** or **NPT** ported
- **ATEX**-certified products for explosion-hazardous environment
- Specially selected materials | **brass-free** products
- Products with **air springs** or **combined springs**
- Products with swapped ports
- Products with different types of **manual override**

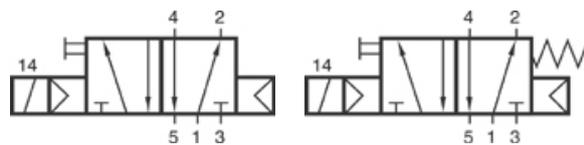
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Values of the standard Hafner 5/2-way NAMUR-valve type MNH 510 701:

- Orifice size : **DN 7 mm**
- Flow: **1250 l/min**
- Operating pressure : **2 - 10 bar**
- Power consumption: **3 W / 5 VA**
(in combination with standard coil MA 22)
- Ports 1, 2, 3: **G 1/4"**
- NAMUR 1: **1/4"**



MNH 510 701

MNH 511 701

MNH 511 701: same valve, but with a combined mechanical and pneumatic spring return.

Standard sizes of HAFNER NAMUR-valves:

Series **701** | orifice: **7 mm** | flow: **1250 l/min** | ports: **G 1/4" – 1/4" NPT** | **NAMUR 1, 1/4"**

Series **101** | orifice: **10 mm** | flow: **2250 l/min** | ports: **G 3/8"** | **NAMUR 1, 1/4" → maximized air-flow**

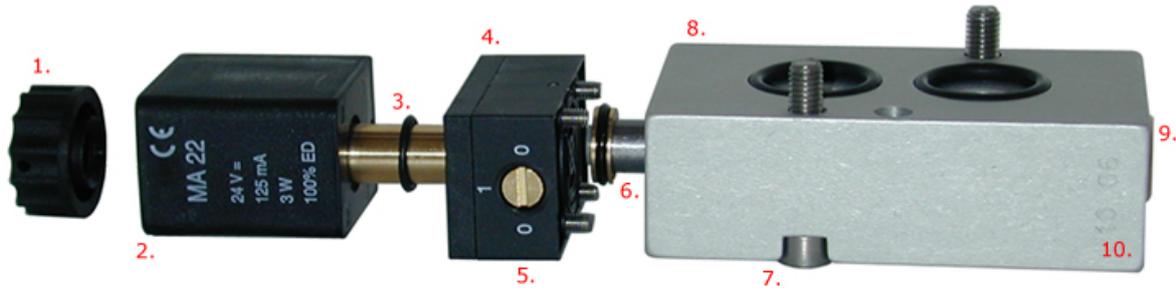
Series **121** | orifice: **12 mm** | flow: **3000 l/min** | ports: **G 1/2" – 1/2" NPT** | **NAMUR 2, 1/2"**

Conforming to standards, the flow measurement is shown as nominal flow in [l/min]. Nominal flow: at $p_1 = 6 \text{ bar}$, $\Delta p = 1 \text{ bar}$, stream-value of the compressed air (l/min).

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Besides maximum flow of 1.250 l/min in a compact design there are 10 more competitive advantages of the Hafner NAMUR-valves series 701.



1. PA fixing nut, which protects the solenoid system from wetness and moisture.
2. Coil MA 22 fully covered with PA or Epoxy (on request), 360° rotatable. Others (Ex-versions) available on request.
3. Brass operator tube, including O-ring to protect solenoid system from wetness from the bottom.
4. Head made from PA.
5. Brass manual override for turning; other versions and materials (e.g. stainless steel) on request.
6. Spool made of stainless steel; other inner parts are: brass, POM, NBR, FKM.
7. Fixing screws, stainless steel.
8. Body, anodized aluminum.
9. End-cap made from brass.
10. Unique sealing system, the HAFNER swimming O-Ring.

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5. Selection of Hafner NAMUR-Accessories

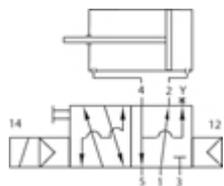
MNH 350 701: HAFNER NAMUR-Flex valve

HAFNER's **MNH 350 701** is a single solenoid 5/2-way NAMUR -valve, electrically actuated with air spring return. It is used to control double-acting actuators (*with the same function as the MNH 510 701*).

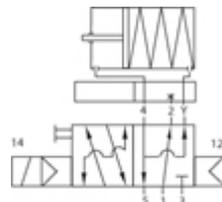


Adding the **Flex-Plate type FP 701**, the valve is converted into a 3/2-way NAMUR-valve with air recirculation for the spring chamber (purge).

The **MNH 351 701** offers a combined spring return.



MNH 350 701
works like a 5/2-way valve



MNH 350 701 + Flex plate
works like a 3/2-way valve

This valve is also available both in **stainless steel** and **NPT ported**.

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DRN...: Flow regulator plates

The Hafner flow regulator plates offer a very precise control of the opening- and closing speed of actuators. Regulation possible with 3- way and 5- way valves.

Additionally the DRN offers the only possibility to regulate the forward- and backward-stroke of single-acting actuators, which is controlled by a 3- way valve, **independently and precisely**.

Two different types of actuation are available:

1. DRN_601: to be operated manually
2. DRN_611: to be operated with a screwdriver

Plates are available with 1/4" and 1/2" NAMUR-interface.

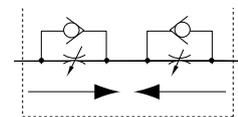
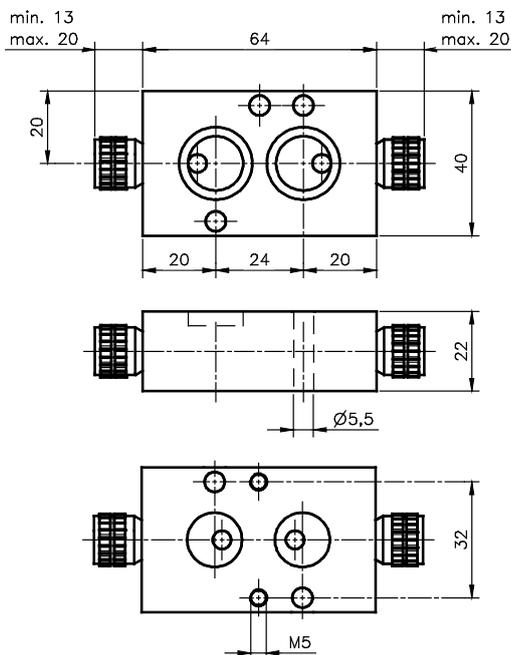
Assemblage between NAMUR pilot-valve and actuator or with threaded plate type GPN-1/4" for direct piping.



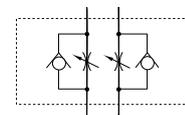
DRN 601



DRN 611



DRN 3 ... for single-acting actuators



DRN 5 ... for double-acting actuators

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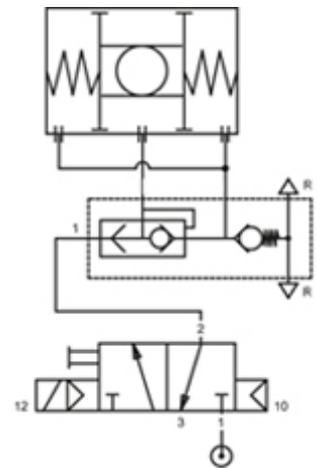
UB 701: NAMUR Air-recirculation block

The air-recirculation block guarantees, that only exhausting air from the actuation chamber is going into the spring chamber. No ambient atmosphere is sucked-in. It is used in combination with single-acting actuators when they get controlled by remote installed 3/2-way valves e.g. from a control cabinet.



The integrated non-return valve makes sure, that no ambient atmosphere can enter the actuator.

Block is designed for actuators with 1/4" NAMUR-interface. Port 1 for air-pressure supply G 1/4" threaded. 2 x G 1/4" exhaust ports.



Further information about our NAMUR-valves and accessories can be found in our catalogue "Competence in Valve Automation".

