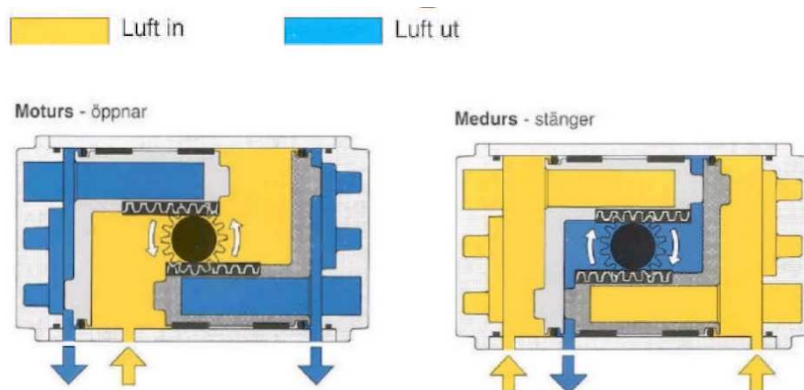# Pneumatic actuators and accessories – description of function

Pneumatic actuators:

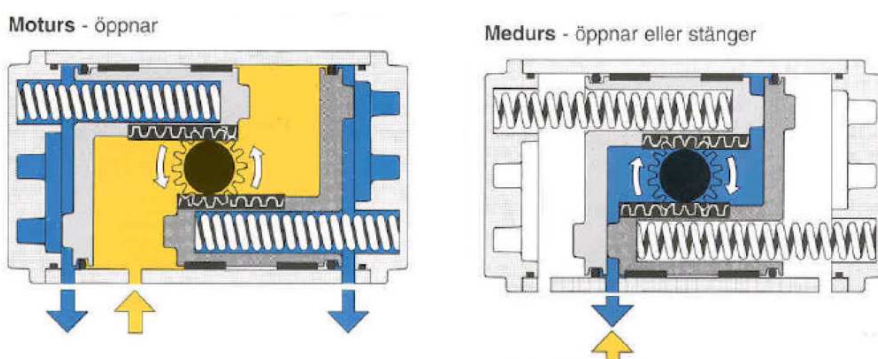**1. Double acting (DA)**

Air is supplied to either side of the actuator to produce rotation. When air supply is lost, the actuator will remain in its position.
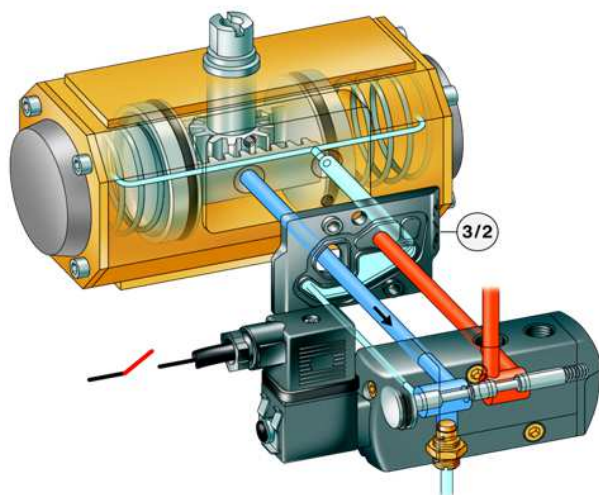

2. Single acting (SR – *spring return*)

This type of actuator is equipped with powerful springs that makes the actuator return to one of two states when air supply is lost: fail open (FO) or fail close (FC).
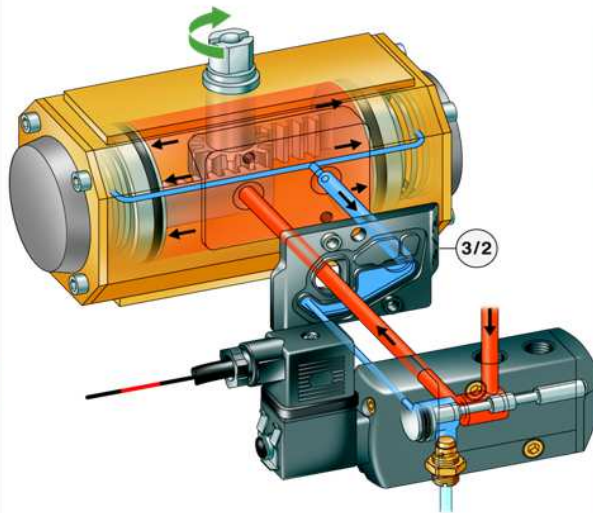
Solenoid and actuator in use

The figures below show the spring return (SR) actuator with a 3/2-way solenoid valve

No current through the solenoid: Current through the solenoid:

When no current is put through the solenoid, the springs inside the actuator force the air out to atmosphere and the actuator to its fail position.

When current is present, the solenoid switches state and compressed air flows into the actuator, compressing the springs and forcing the actuator to its other position.

Note that on single acting actuators, only one air intake is used.

Solenoid valves

Choosing solenoid
It is important to choose the correct type of solenoid for the two types of actuators:
3/2-way   used for SR-actuators (single acting actuators)
5/2-way   used for DA-actuators (double acting actuators)

NOTE!
Modern solenoid valves mounted directly on the actuator (NAMUR) uses one type of solenoid (5/2) for both functions. This is possible due to a reversible function plate that is mounted between the solenoid and the actuator. It is usually marked with "3/2" and "5/2" and it's important that the function plate is mounted correctly depending on the type of actuator used.

Also note that the flow capacity of the solenoid should be considered if faster actuation times are needed; less low = slower actuating (opening/closing) times.

Valves with 1 solenoid + spring

As standard, we use solenoids valves with 1 solenoid and a spring, called a *monostable solenoid valve*.
If the current is cut, the solenoid valve will return to its normal position; the spring forces the spool inside the valve to one side.
For NAMUR valves (when the solenoid valve is mounted directly on the actuator) the solenoid can be rotated 180° on the actuator plane to reverse the function on a double-acting actuator depending on if you want the damper to open or close when the current is cut to the solenoid. (A solenoid valve on a single acting actuator must follow the function of the actuator.)


3/2-way

5/2-way
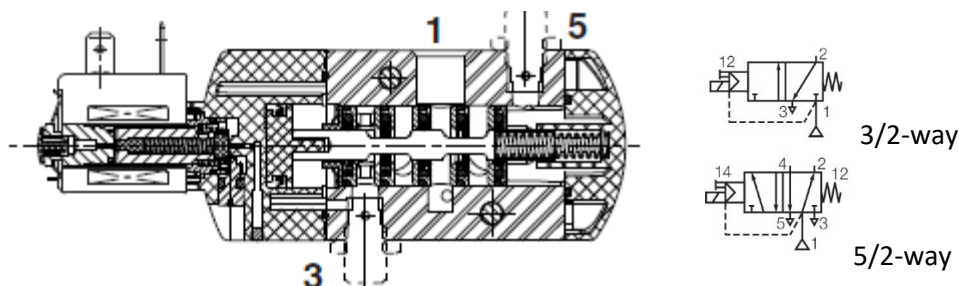
Valves with 2 solenoids

This type is called a *bistable solenoid valve*. It has two solenoids and no springs.
When current is put into one of the solenoids, the spool inside the valve will move towards it. If the power is cut, the spool will then remain in the same position. And the same is true for the actuator: it will remain in position.
To actuate the damper again, current is put on the opposite solenoid, moving the spool will move towards it, thus changing the position of the spool and the actuator performs the other stroke.
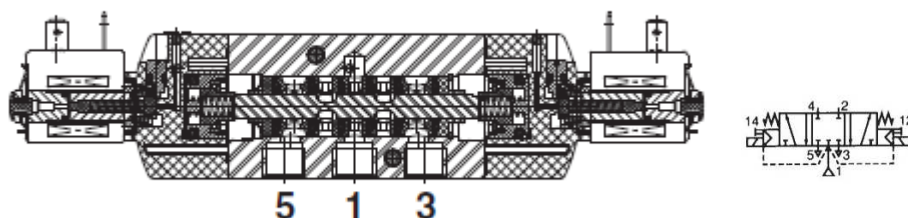
Positioners

As standard, we use digital positioners (a modern variant of the electro-pneumatic positioner), meaning the positioner is controlled via a digital, electrical control signal (normally 4-20mA) and that it delivers air out to the pneumatic actuator.

The purpose of the positioner is to regulate the damper using the electrical control signal, normally:
4 mA = the dampers is closed
20 mA = the damper is 100% open

(On most positioners you can reverse the function, making 4 mA open position and 20 mA closed positioner, which can be demanded in some control systems).

Safety systems and positioners

Sometimes there is a requirement for the damper to open or close immediately when an alarm is triggered, for example when the temperature is too high in a system.

In such cases, a 3/2-way solenoid valve, here called a blow-off valve, is mounted between the positioner and the single acting actuator (a spring return actuator is always needed for this type of safety function).
During normal operation the solenoid is energized and air flows through the blow-off valve.
When an alarm is triggered the current to the solenoid is cut, air is blocked from the positioner and the air inside the actuator is evacuated to the atmosphere. This way the safety function is guaranteed: The blow-off valve is above the positioner in the hierarchy, disconnecting the positioner completely from the system to ensure the actuator/damper moved to its fail position.

Feedback signal
This sends a feedback signal to the control system once the operation has been performed (when the damper has reached its desired position). Note that the feedback loop is separate from the control loop (the control signal).
The feedback signal is as standard 4-20 mA (4 mA = damper closed, 20 mA = damper fully open)

I some cases only a feedback signal of 0-1000 Ohm from a potentiometer is required, and no control signal. This makes it possible to get a visual indication in the control room, to see in which position the damper currently is in.

(Normally you don't need a solenoid valve when you equip an actuator with a positioner unless a safety function is needed as described above.)

Function table for actuator + solenoid valve or positioner

Actuator and solenoid valve type:	Function when loss of current:	Function when loss of air:
DA-actuator (double acting) + monostable valve (1 solenoid)	2	1
DA-actuator (double acting) + bistable valve (2 solenoids)	1	1
SR-actuator (single acting) + monostable valve (1 solenoid)	2	2
SR-actuator (single acting) + bistable valve (2 solenoids)	1	2
DA-actuator (double acting) + positioner	2	1
SR-actuator (single acting) + positioner	2	2

1- **No movement** of the damper
2- **Movement** of the damper (depending on its position), fail open or fail close.

For more information regarding air quality, see separate datasheet.

_____