Topic 2

Introduction to Electropneumatic Technology in Mechatronics

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An introduction to Electropneumatic

Both pneumatic and electropneumatic controllers have a pneumatic power section.

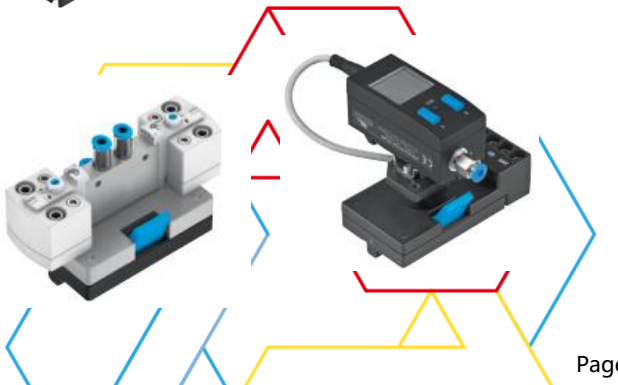
In a pneumatic control, pneumatic components are used, that is various types of valves, sequencers, air barriers, etc.

Gap sensor

Pneumatic timer

Pressure sequencer

In an electropneumatic control, the signal control section is made up of electrical components such as electrical input button, proximity switches, relays or PLC.



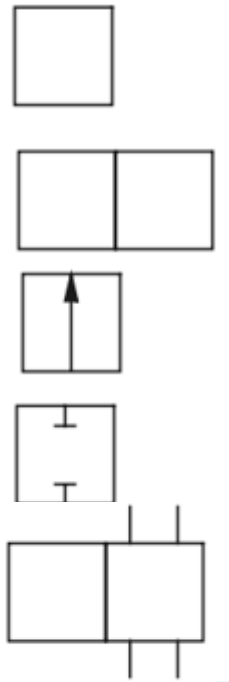
Advantages of using Electropneumatic

- Replace tubing to wire
- Reduce the working area
- Sensor can be included in limited space
- Controller such as PLC can be included

Pneumatic restudy (cont..)

Switching symbols for valves Pneumatic components are normally shown in the deenergized condition in circuit diagrams.

1. The valve switching position is shown by square.
2. The number of square corresponds to the number of switching positions.
3. Line indicate the flow path. arrows indicate the direction of flow.
4. Closed ports are shown by two lines drawn at right angles to one another.
5. The connecting lines for supply and exhaust air are drawn outside the square.

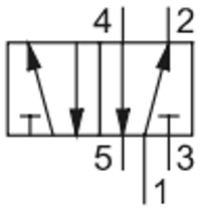


Pneumatic restudy (cont..)

Information about the type of valve can be established from the following features

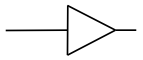
- Number of ports
- Number of switching positions
- Port numbering

ELECTRIC

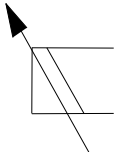


PNEUMATIC

Solenoid



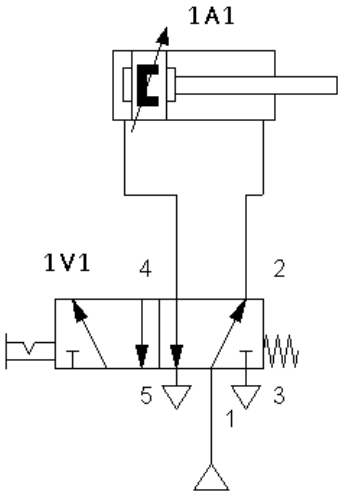
Pneumatic

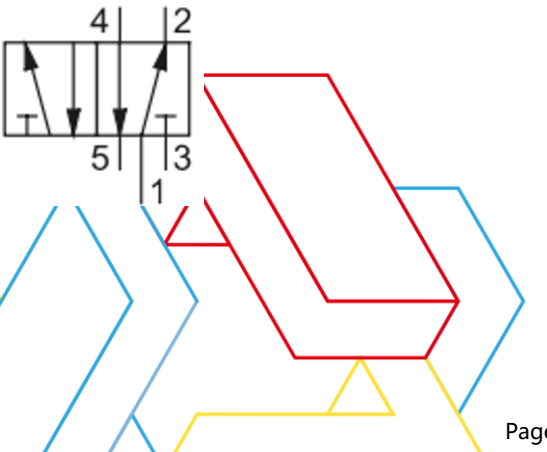


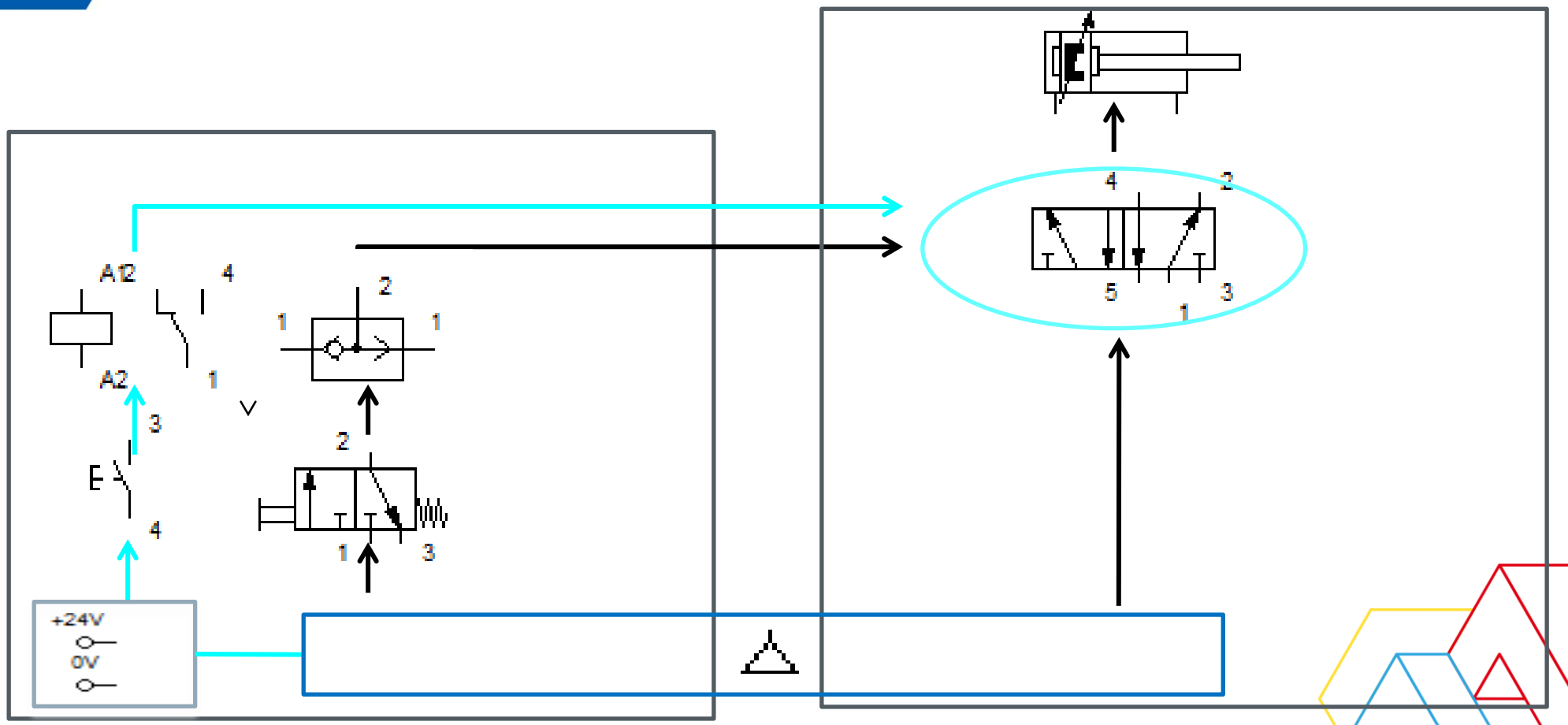
Proportional solenoid

The following applies to the numbering of the ports

- Air supply port 1
- Exhaust ports 3,5
- Working or outlet ports 2,4



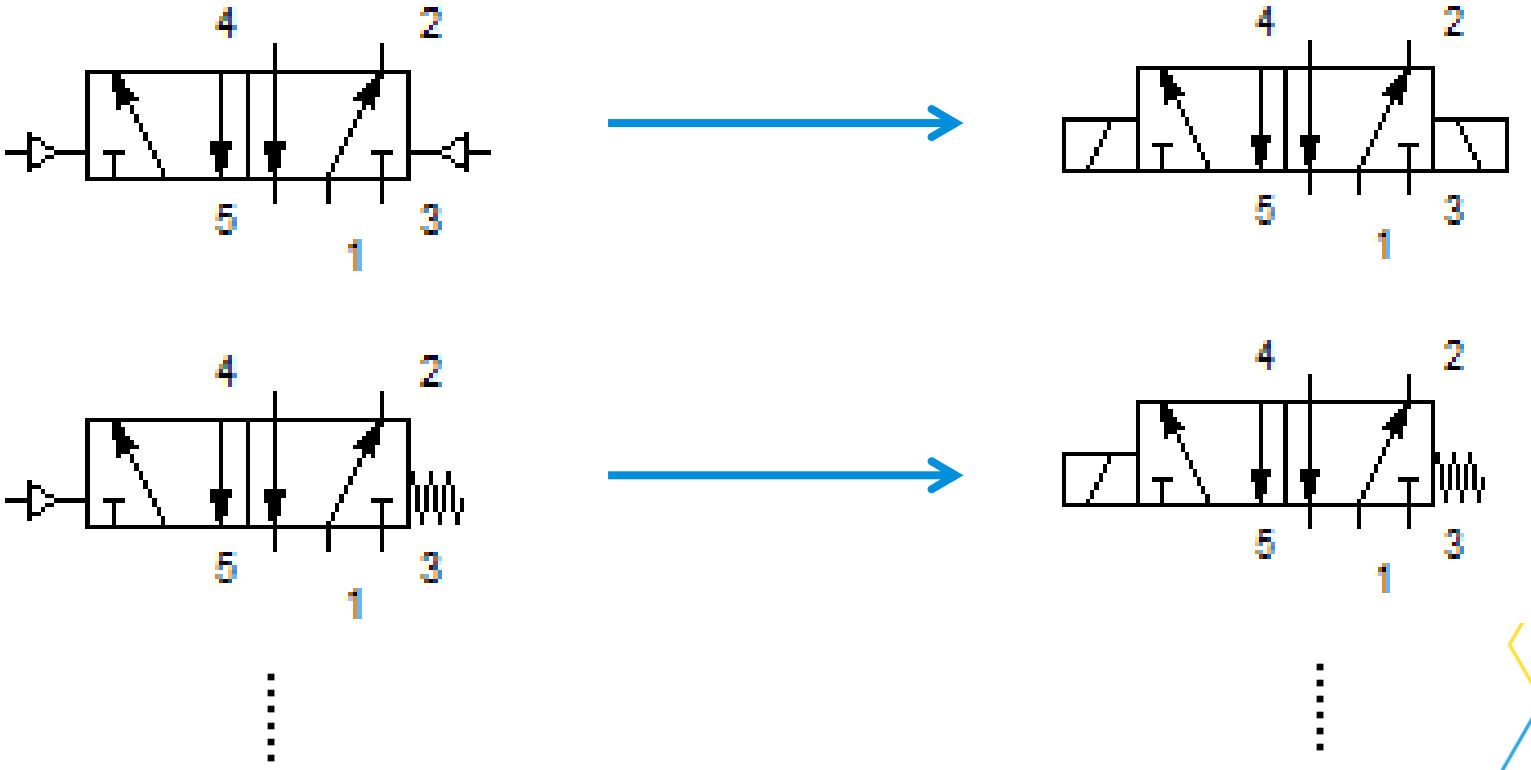




Control circuit(signal flow)

Power circuit

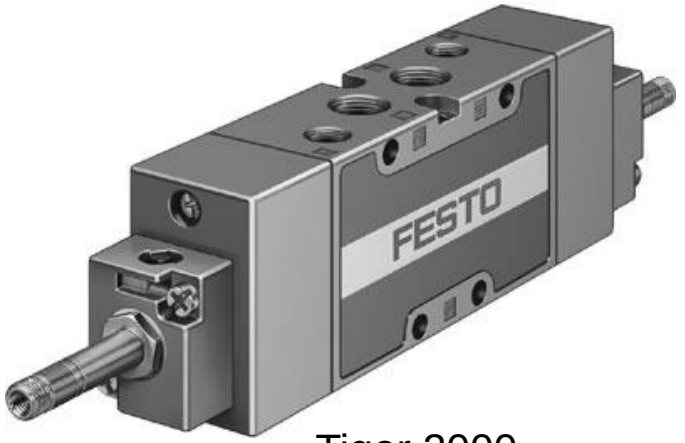
Main control valve



Magnet directional valve

Valves

CPE

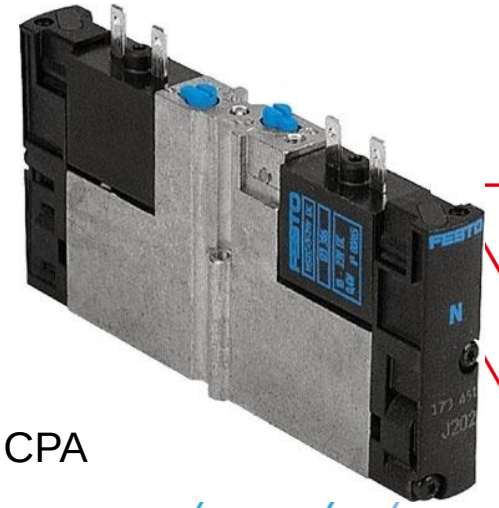


Tiger 2000

Tiger Classic

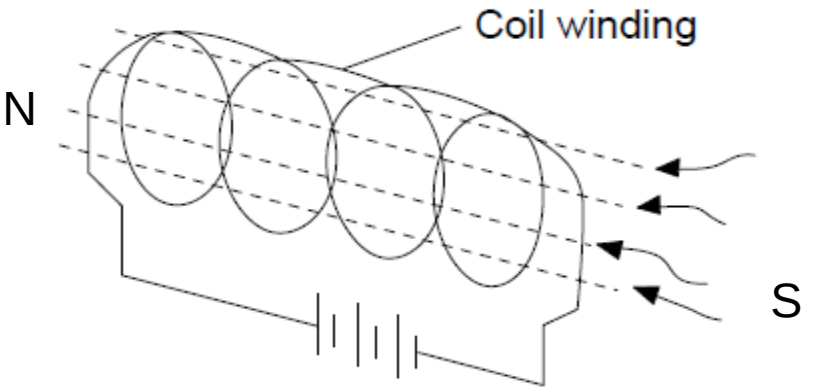
VUVB

CPV



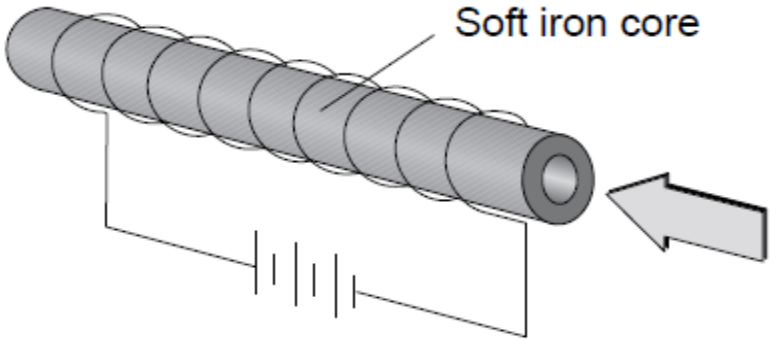
CPA

S Pole
N Pole

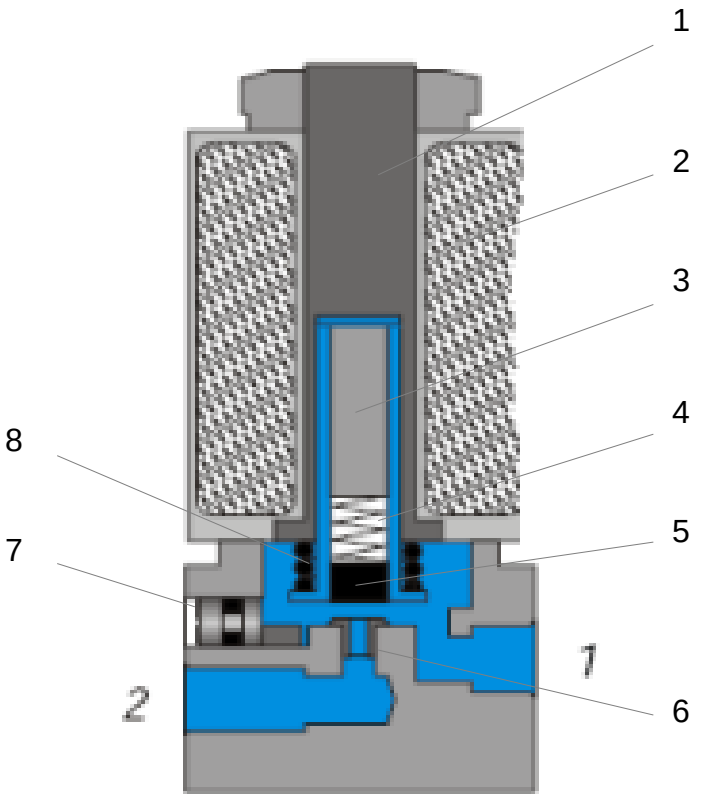


right-handed screw rule

Tiger Classic



Operational principle of a solenoid coil



1- Static iron core

2- Coil

3- Moving iron core

4, 8- Spring

5- Sealing gasket

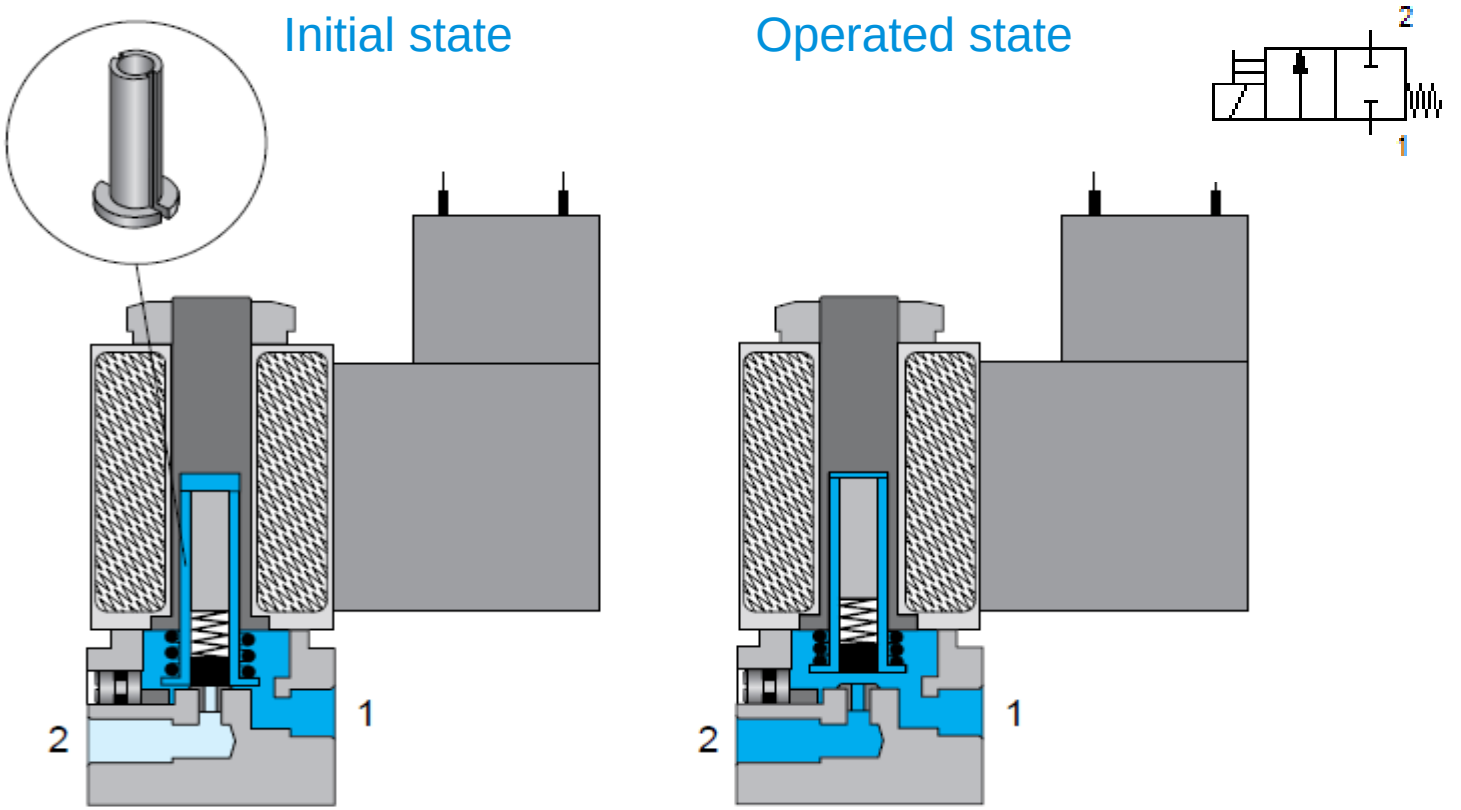
6- Valve seat

7- Manual device

Tiger 2000

Two position two way direct acting solenoid valve

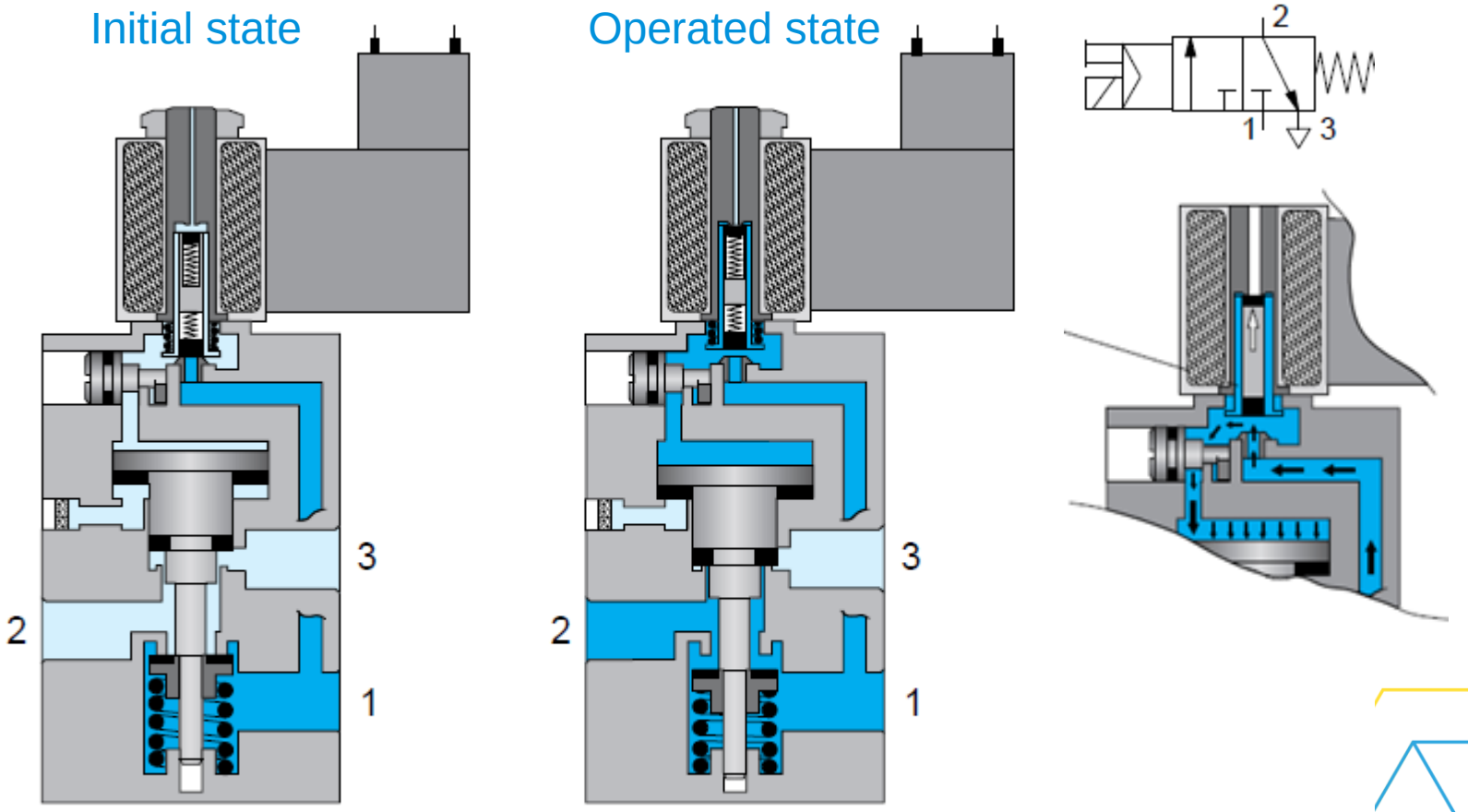
Direct acting type



2/2-way solenoid valve without pilot control

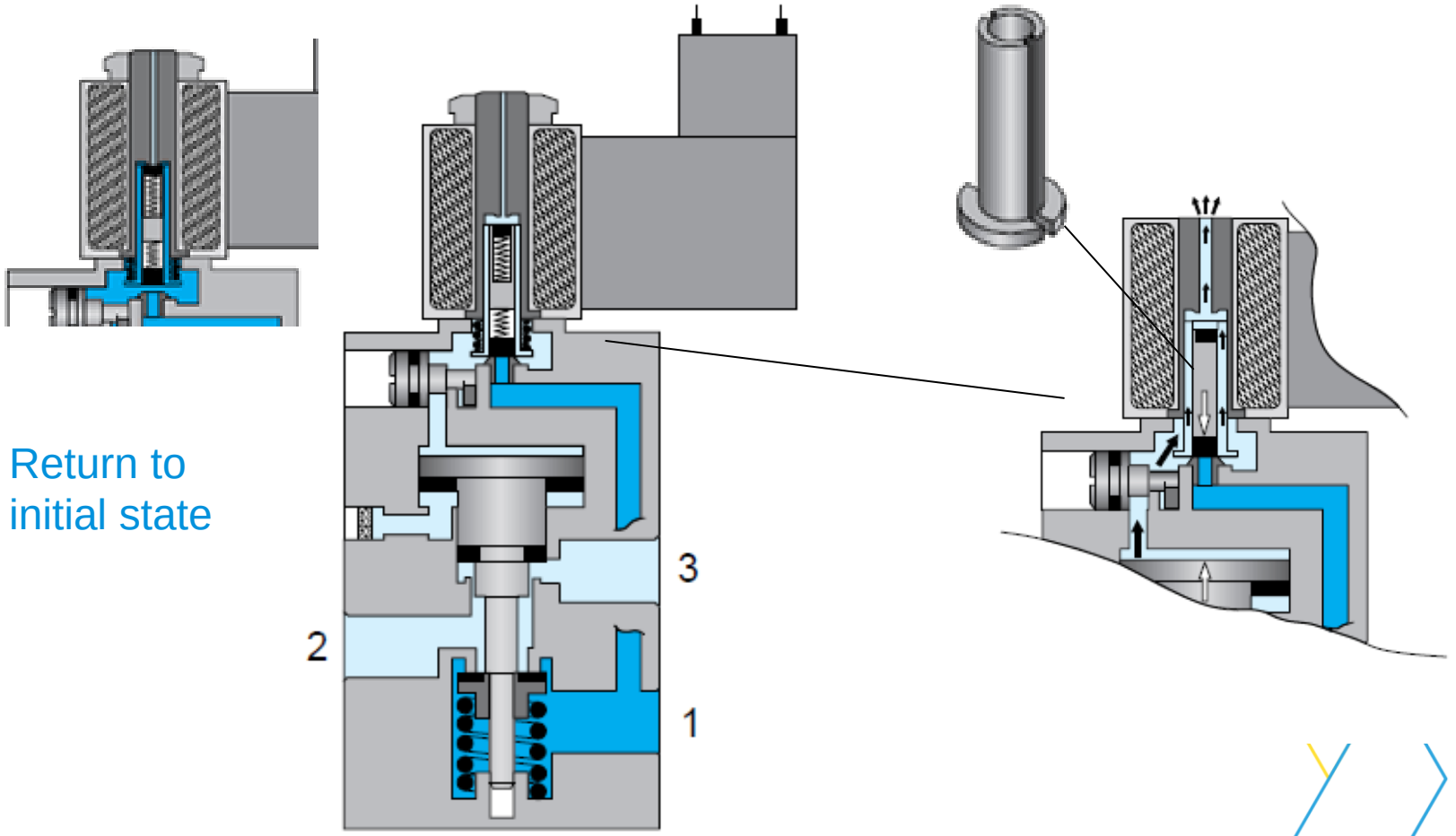
solenoid directional valve

Pilot type



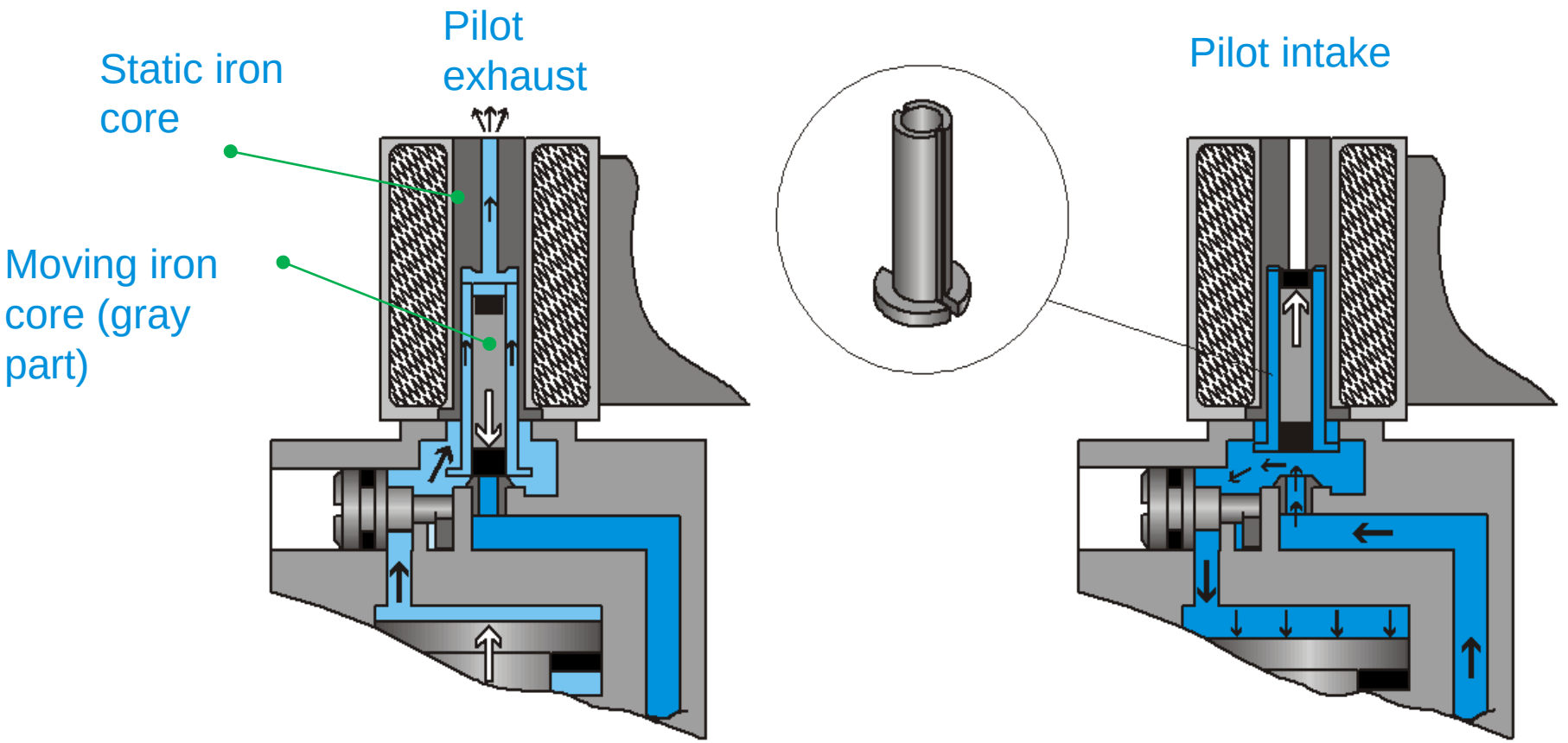
3/2-way solenoid valves with pilot control

solenoid directional valve



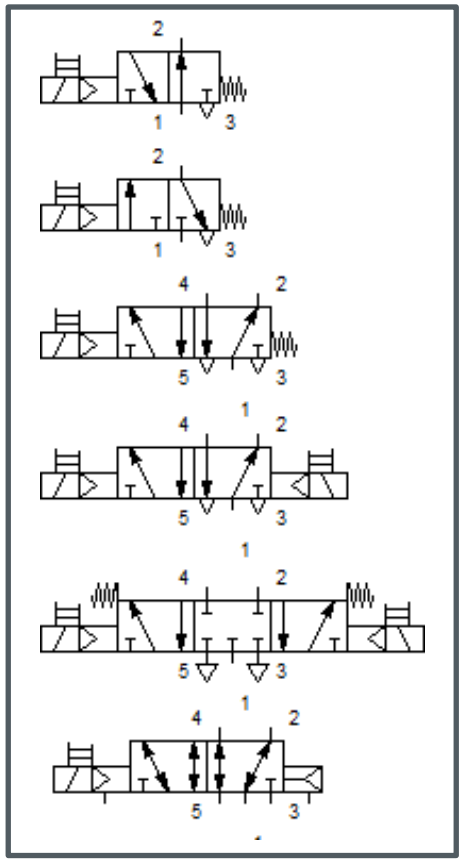
Return to initial state

solenoid directional valve

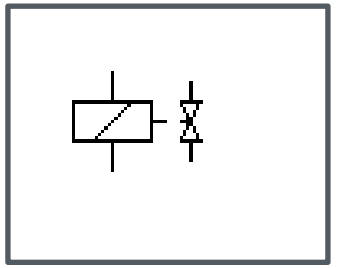


Symbols

Symbols for solenoid valves in pneumatic circuits



Symbols for solenoid valves in electric circuits



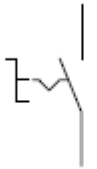
Contact symbols

Normally open contact

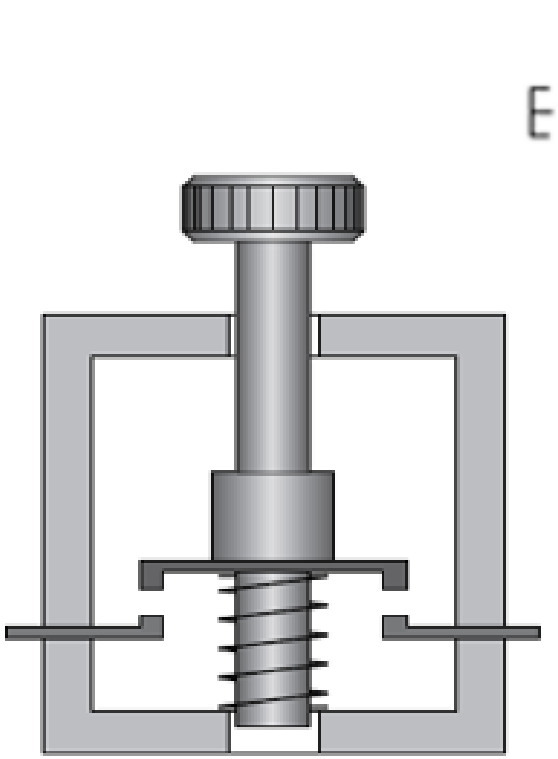
Normally closed contact

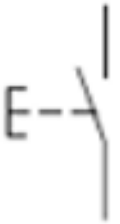
Changeover contact

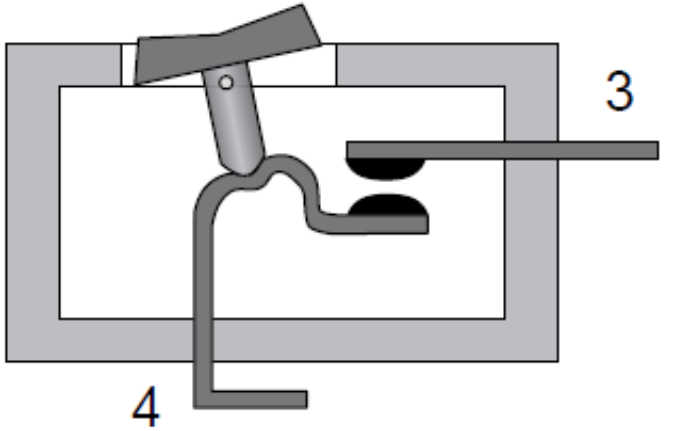
Rotary switch with
normally open contact,
manually operated by turning

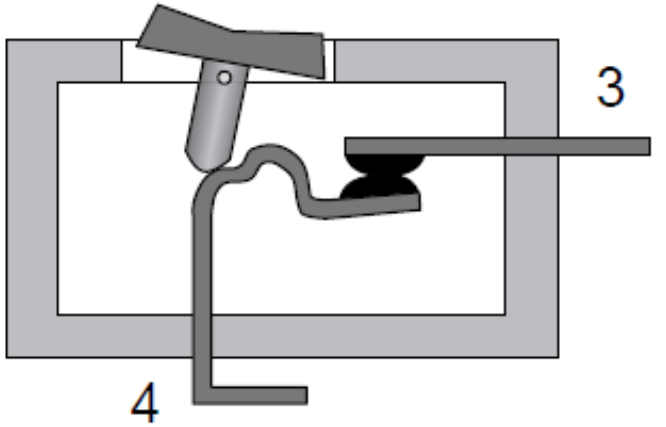


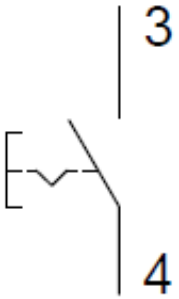
Contact switch





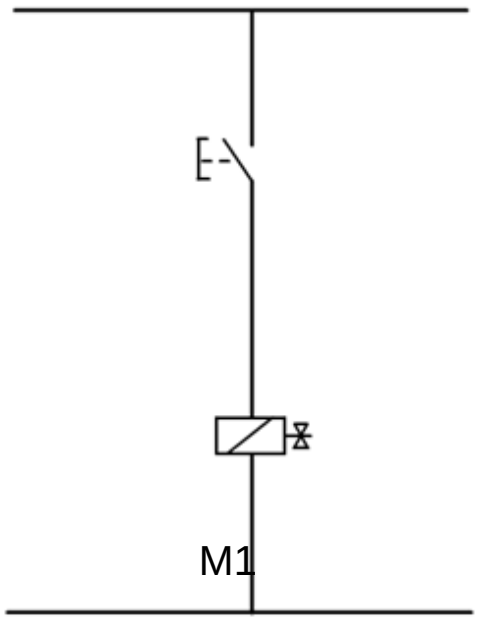


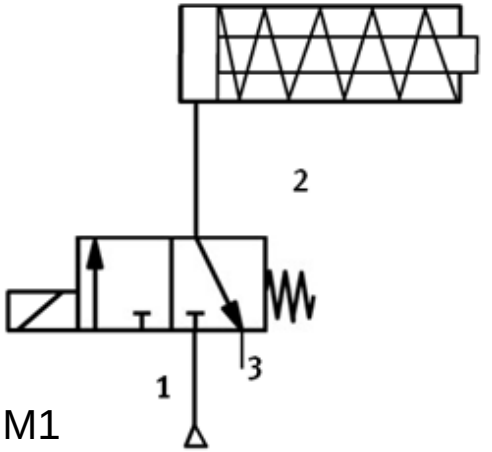




Electrical signal switching unit

Exercise 1 : Single acting cylinder

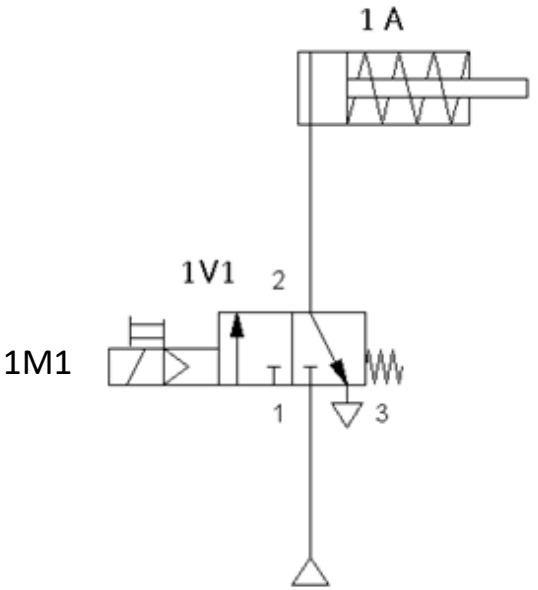




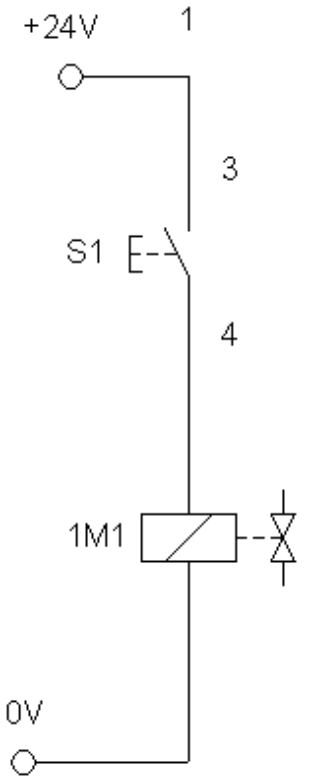
A

Exercise 1 : Single acting cylinder

Pneumatic circuit

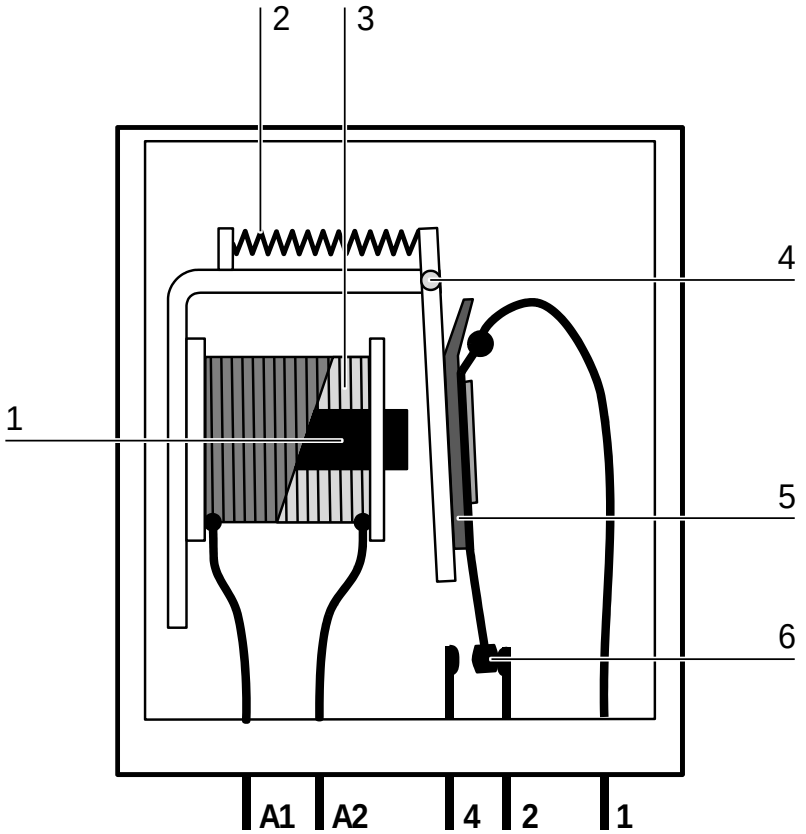


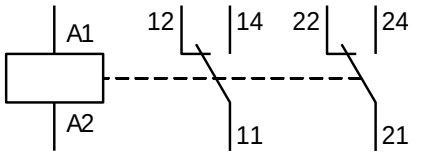
Electric circuit



Direct Control

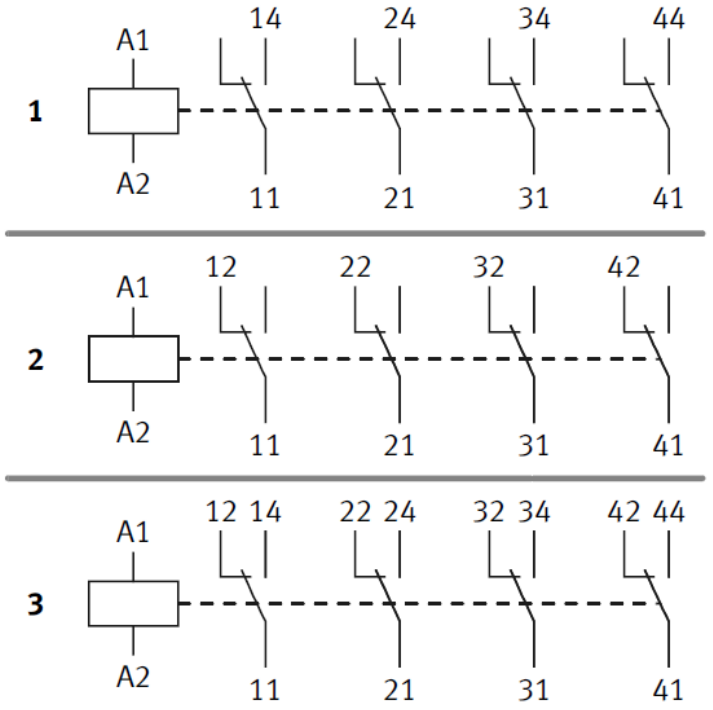
Structural principle of relays

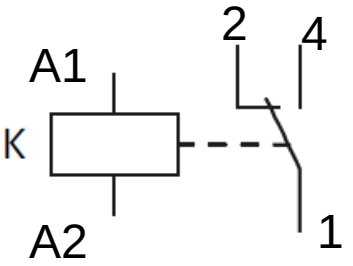




1: Coil core; 2: Return spring; 3: Relay coil; 4: Armature; 5: Insulation; 6: Contact

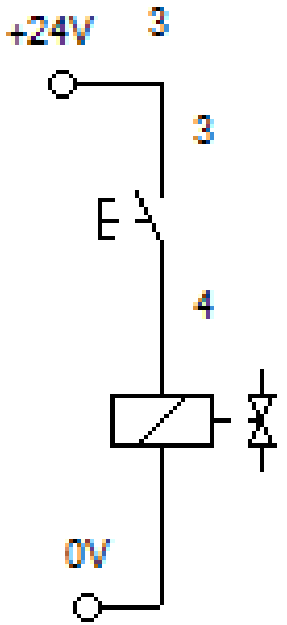
relay


1
A1
A2
14
24
34
44
11
21
31
41
2
A1
A2
12
22
32
42
11
21
31
41
3
A1
A2
12 14
22 24
32 34
42 44
11
21
31
41

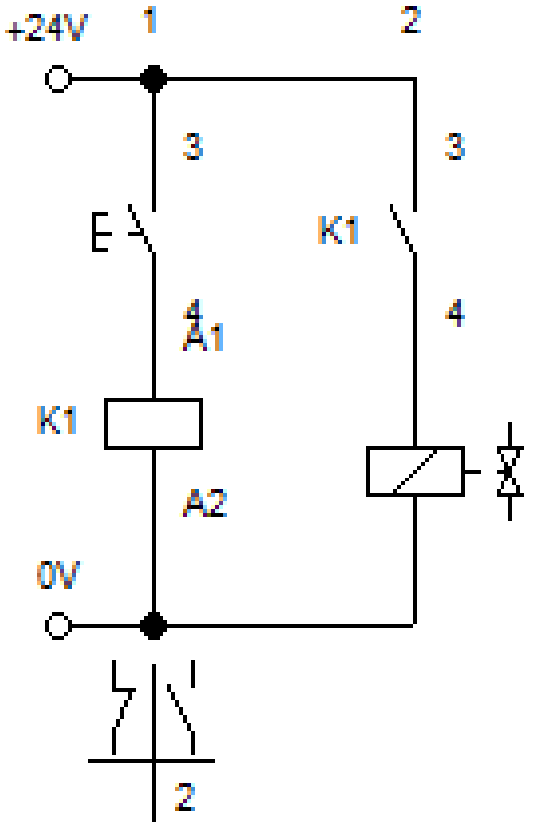

2
4
A1
K
A2
1

Application of relay

Switch control transformation (indirect control)



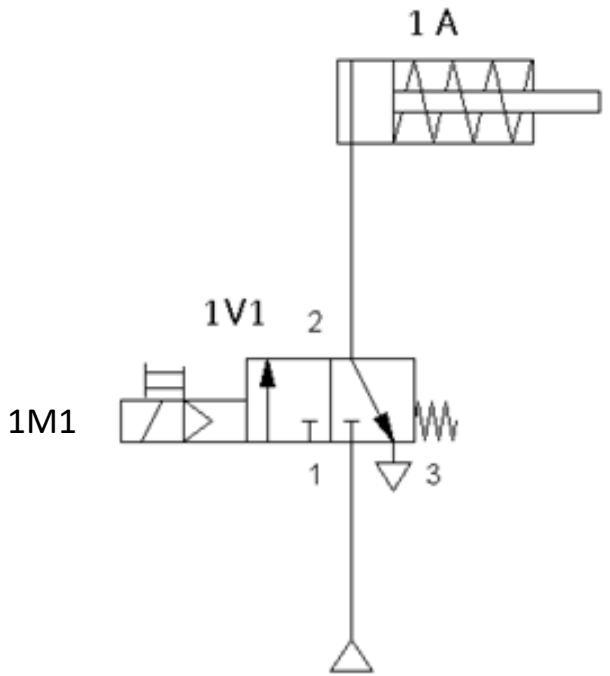
transform



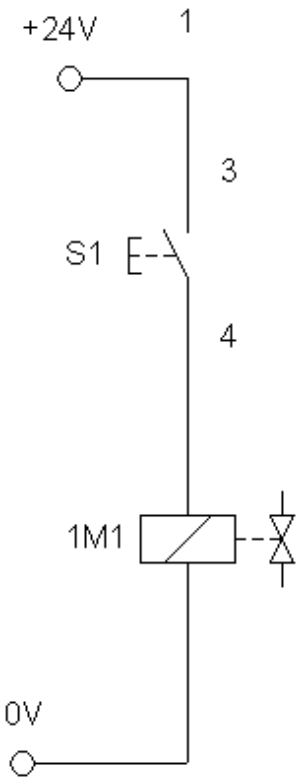
Indirect Control

Exercise 1 : Single acting cylinder

Pneumatic circuit

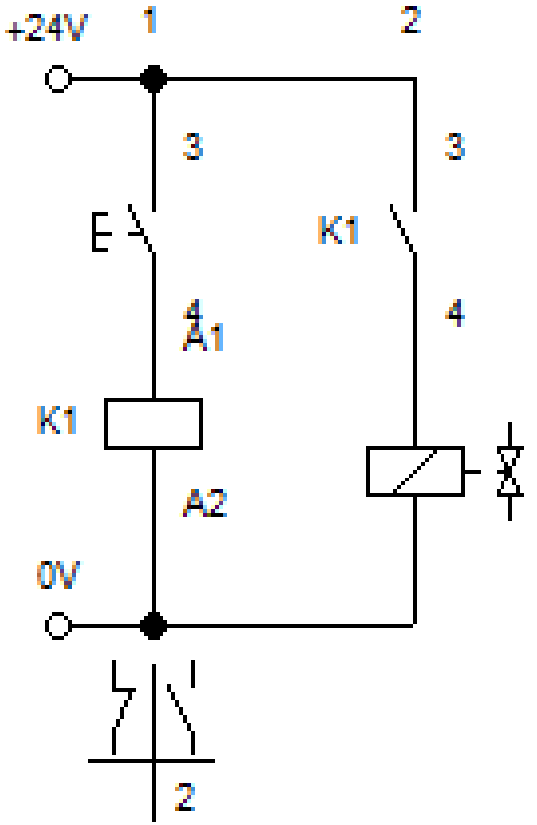


Electric circuit



Direct Control

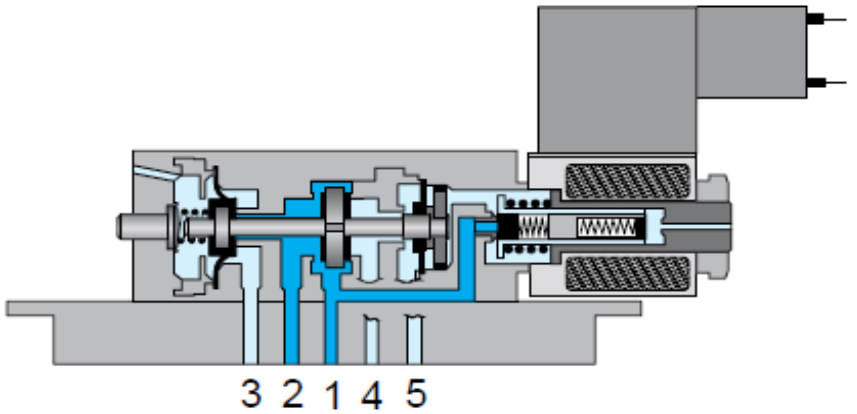
Electric circuit

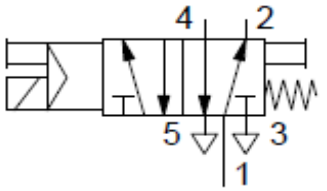


Indirect Control

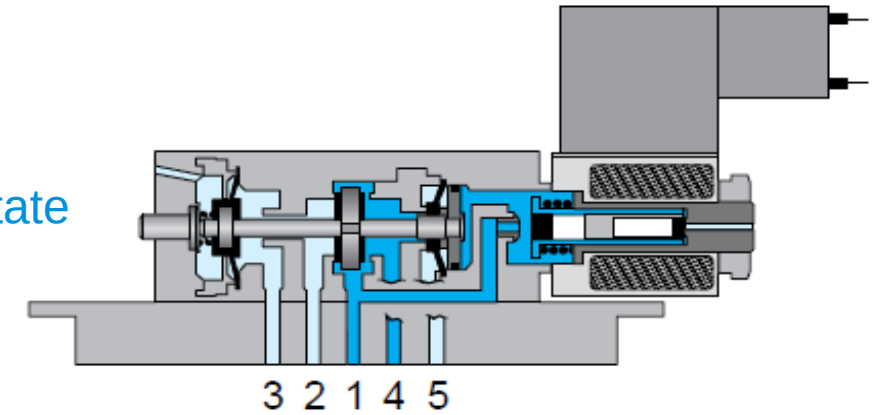
solenoid directional valve

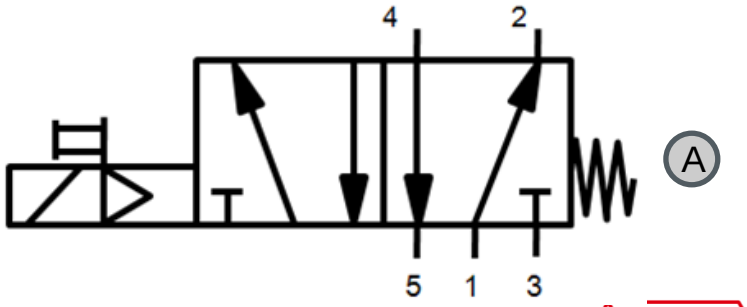
Initial state





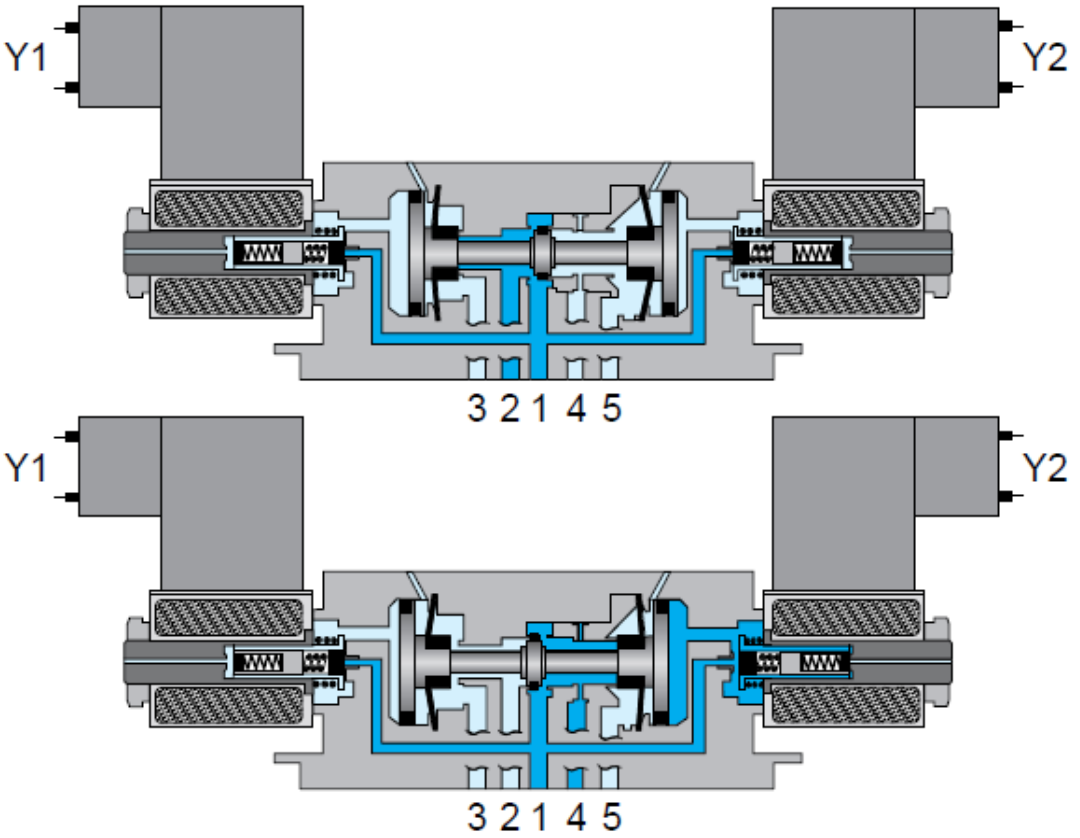
Operated state

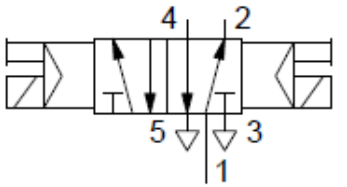


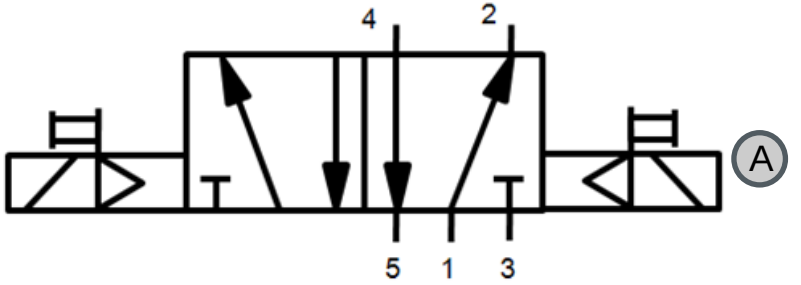


5/2-way solenoid valve with pilot control

solenoid directional valve

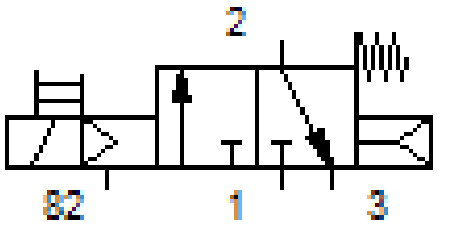






5/2-way double solenoid valve with pilot control

solenoid directional valve

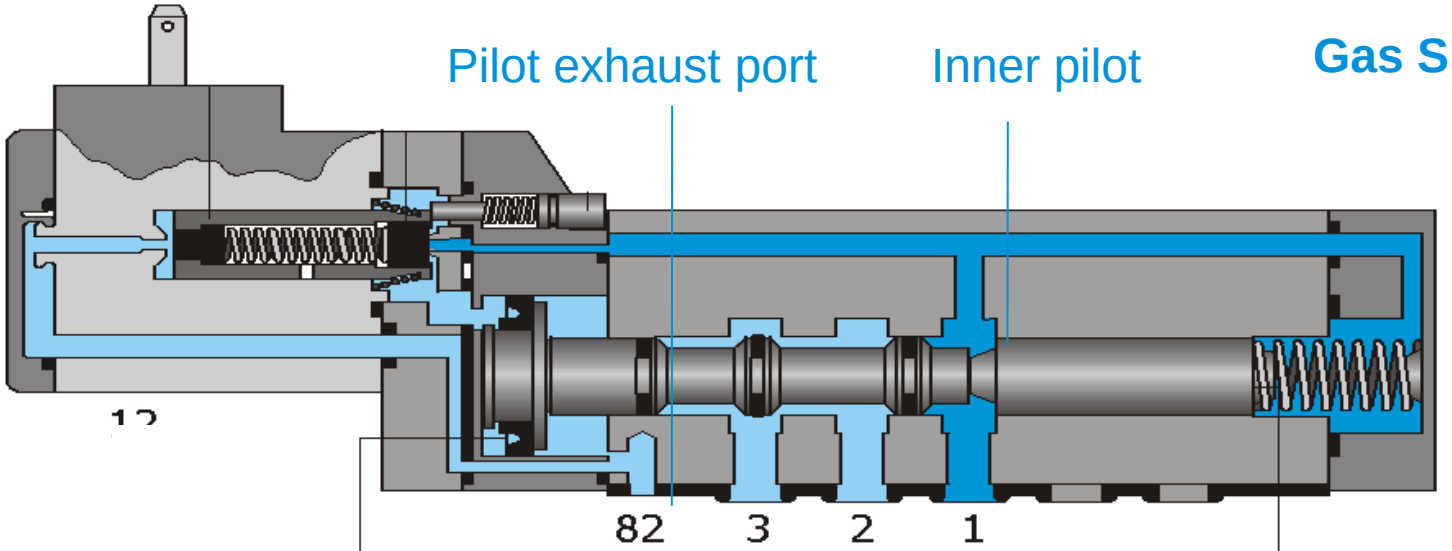


Pilot+manual

Pilot exhaust port

Inner pilot

Gas Spring type

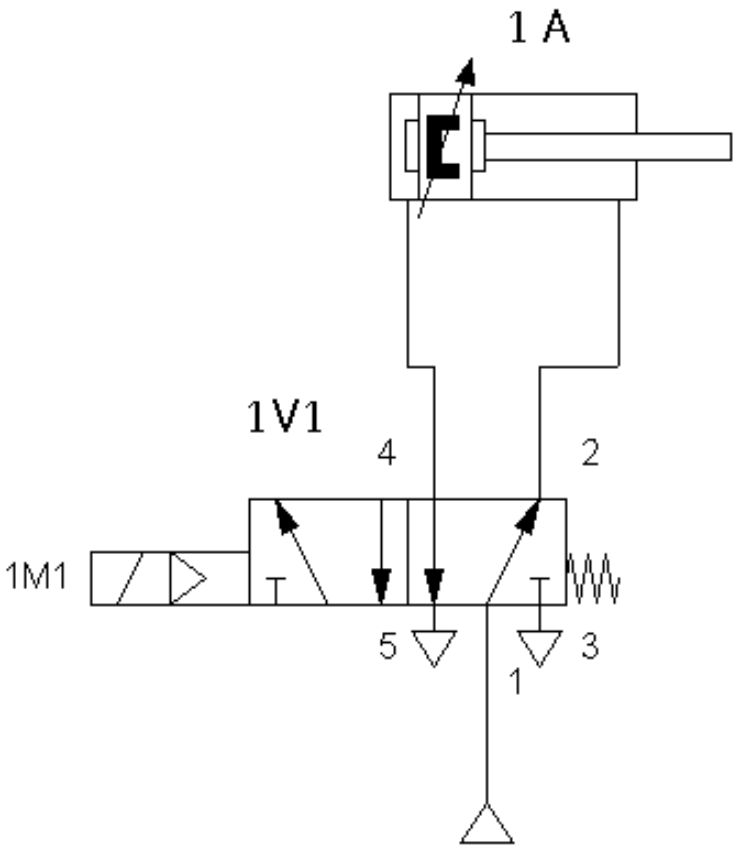


Big area

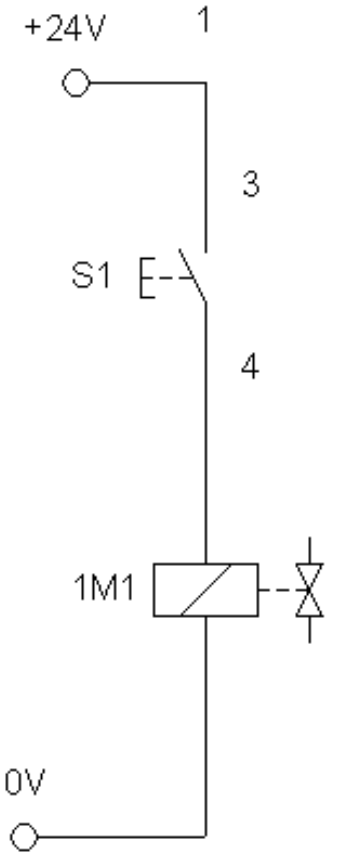
Small area

Exercise 2 : Double acting cylinder

Pneumatic circuit

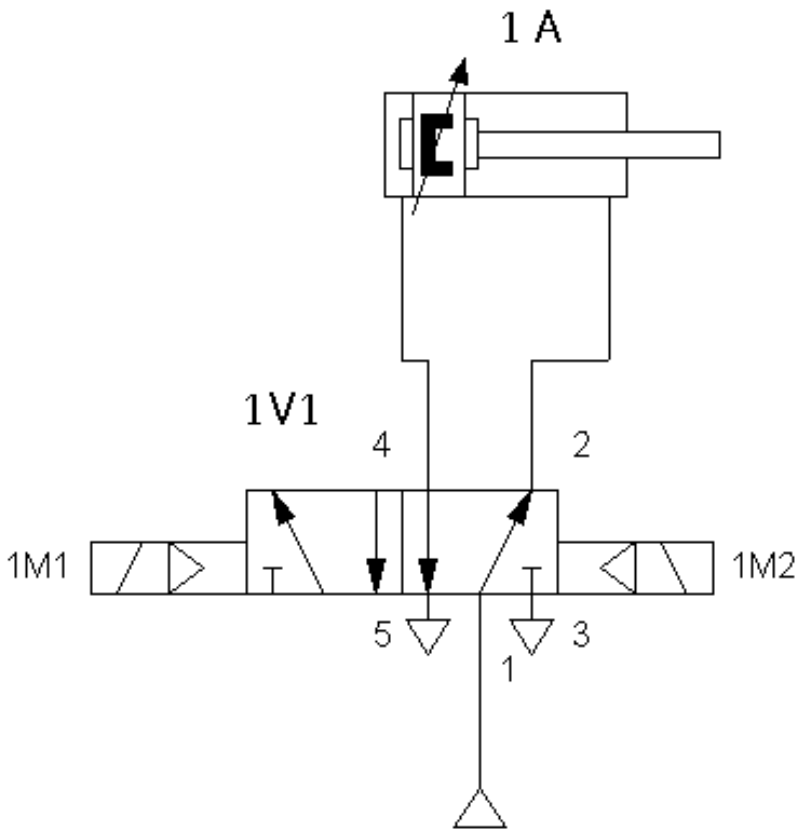


Electric circuit

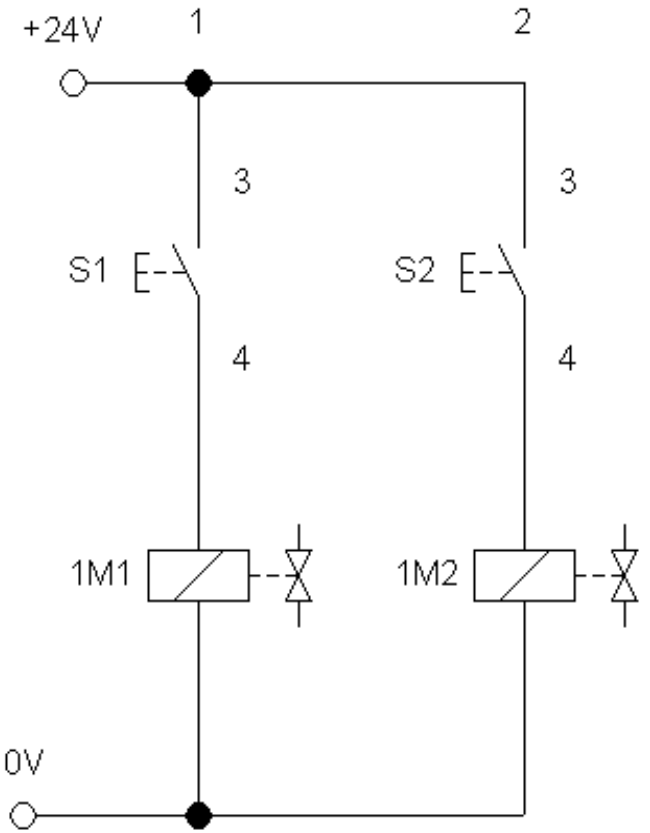


Exercise 2 : Double acting cylinder

Pneumatic circuit

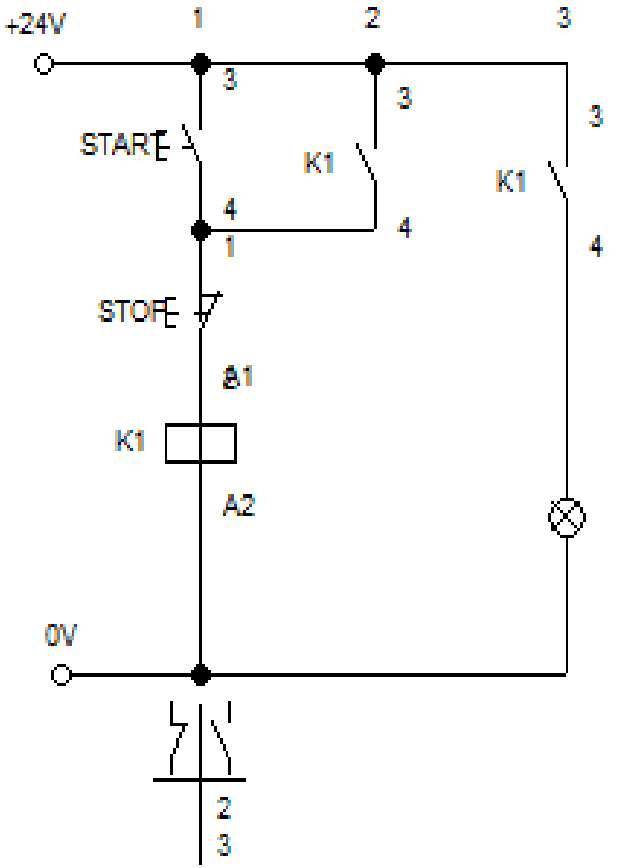


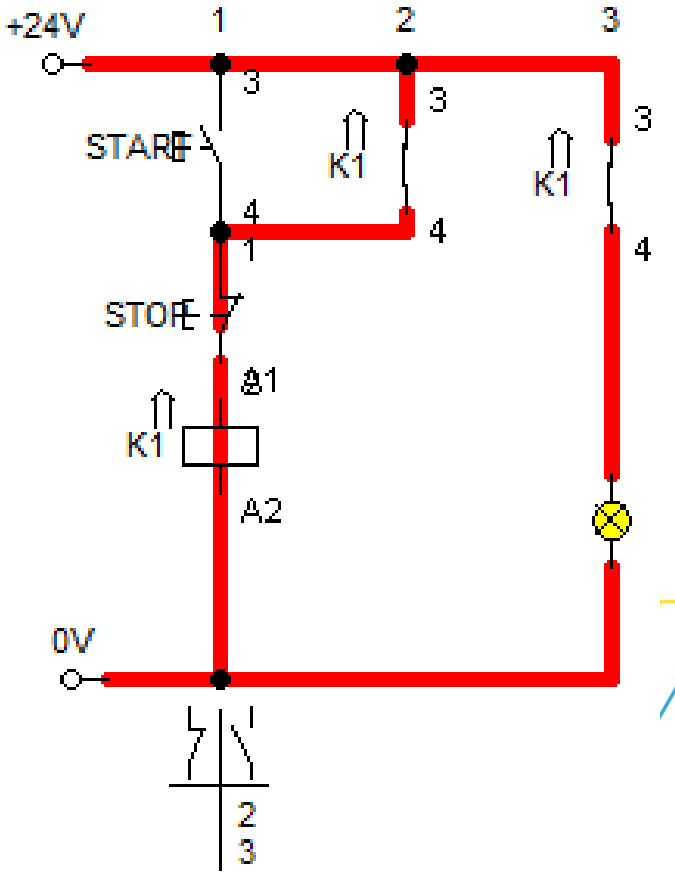
Electric circuit



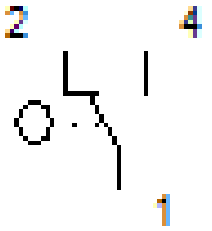
Application of relay

Self-locking circuit





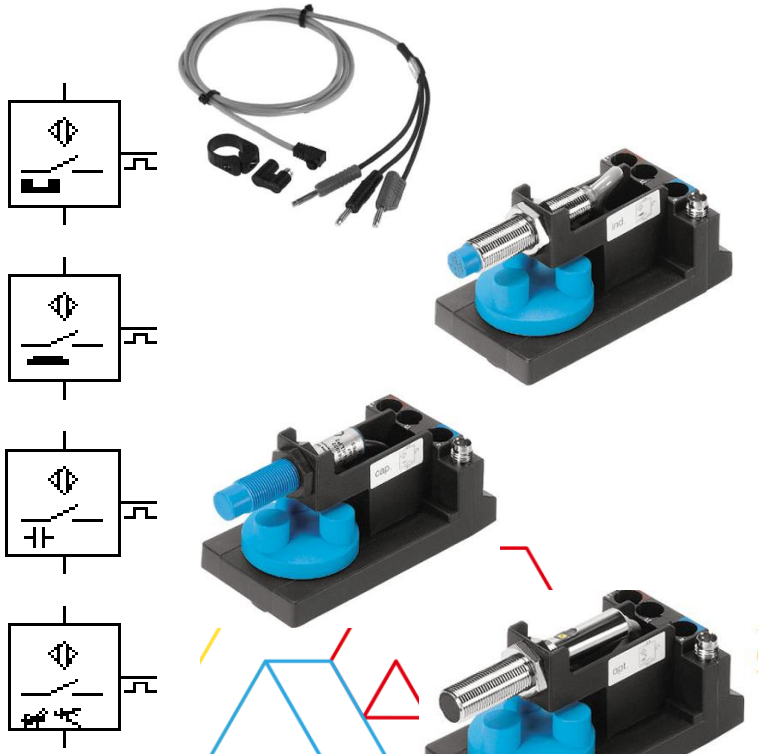
Limit switch



Normal sensors

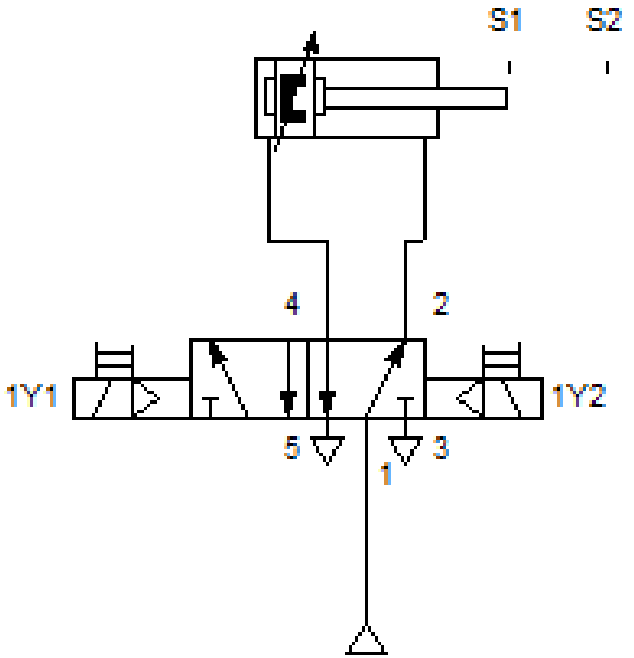
Non-contact type

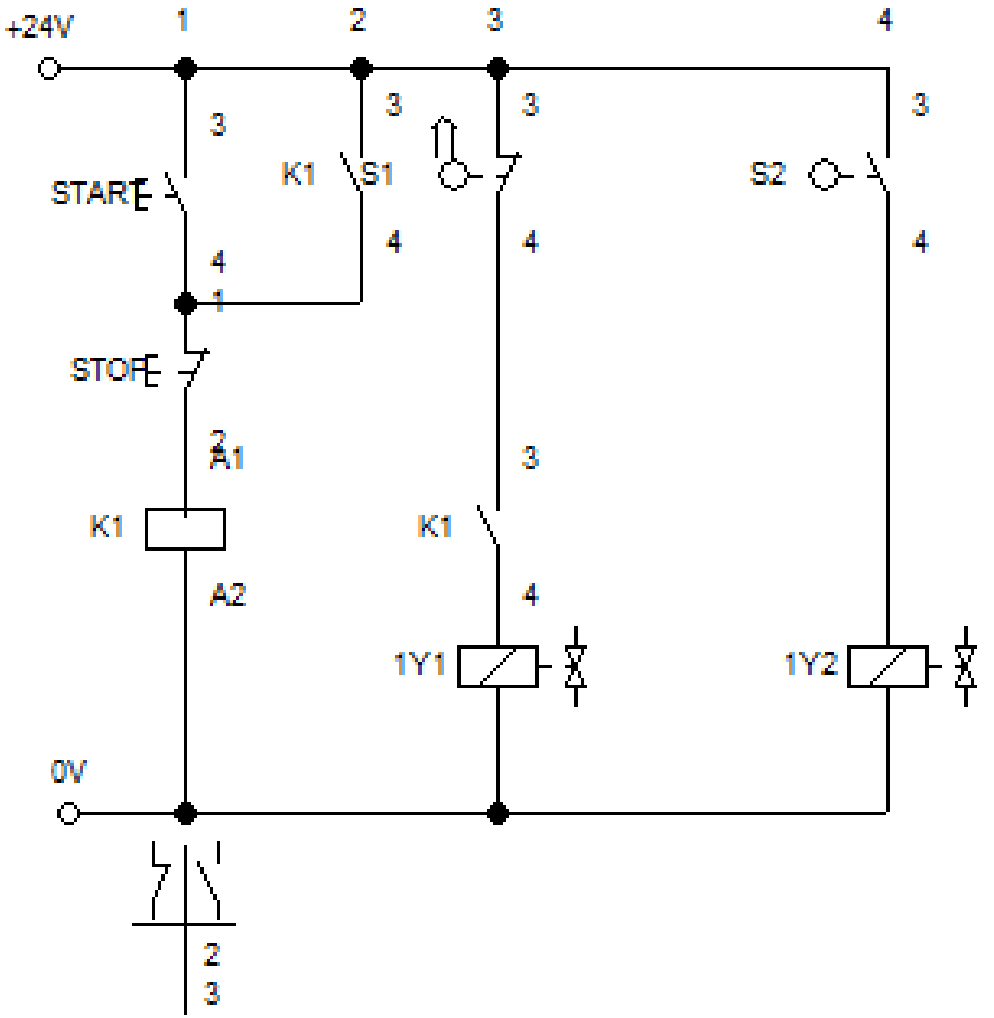
- •Magnetic induction proximity switch： Used for detecting magnetic fields
- •inductive sensor： used for detecting metal
- •Capacitive sensor： Used to detect any object
- •Optical sensor： Used to detect any object



reed switches

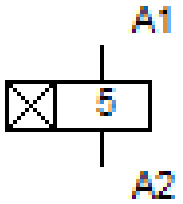
Exercise 3 : Double acting cylinder



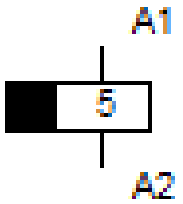


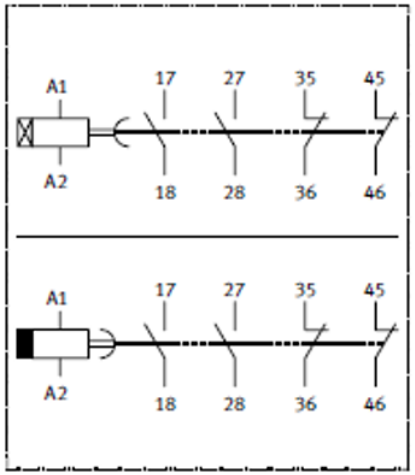
time relay

Close Delay



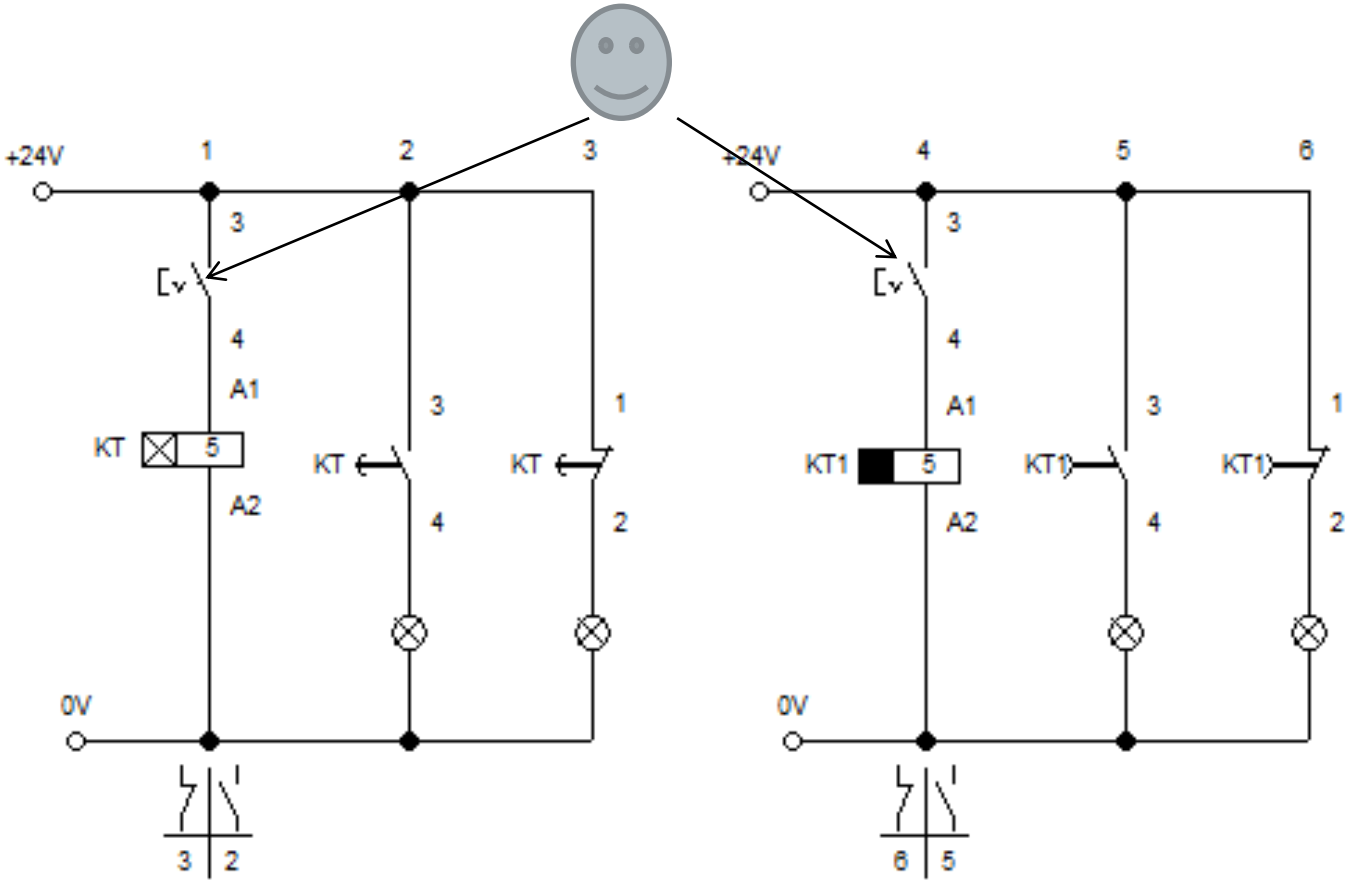
Open delay



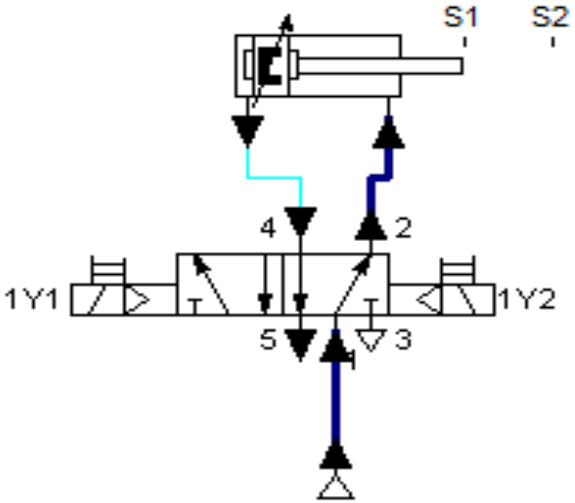


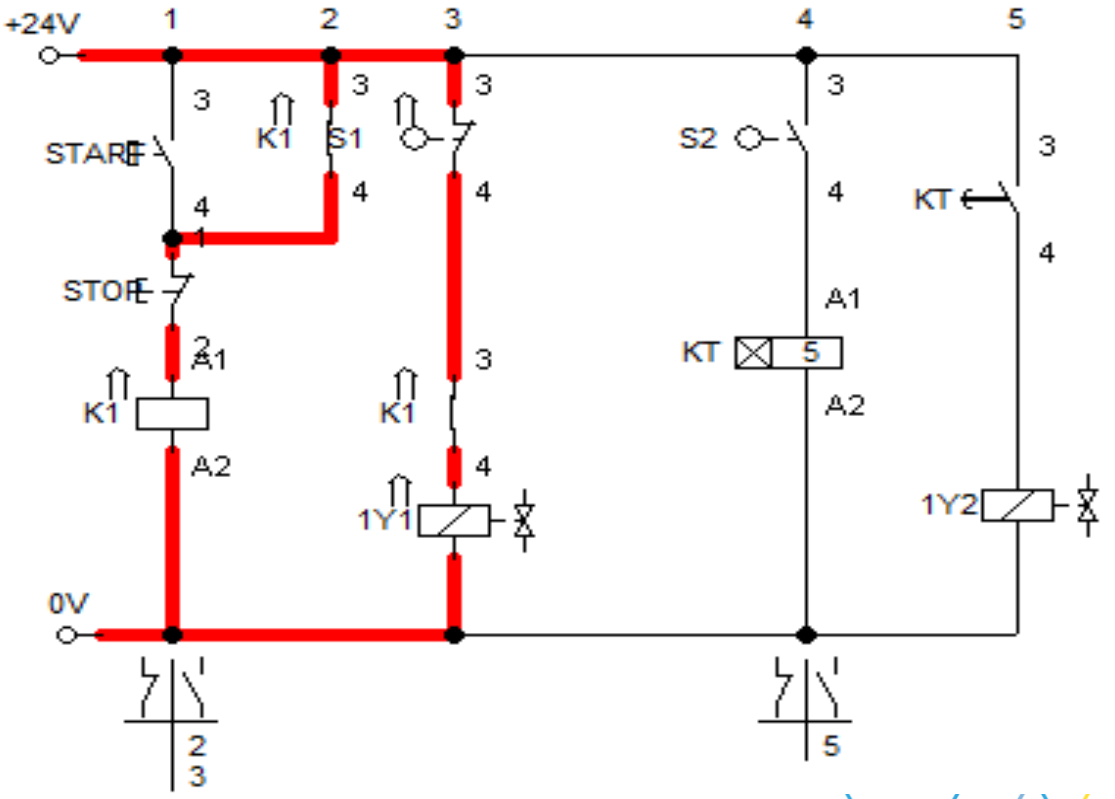
Delay between relay coil and contact

time relay


+24V
1
2
3
3
4
A1
KT
5
A2
KT
3
4
KT
1
2
0V
3
2
+24V
4
5
6
3
4
A1
KT1
5
A2
KT1
3
4
KT1
1
2
0V
6
5

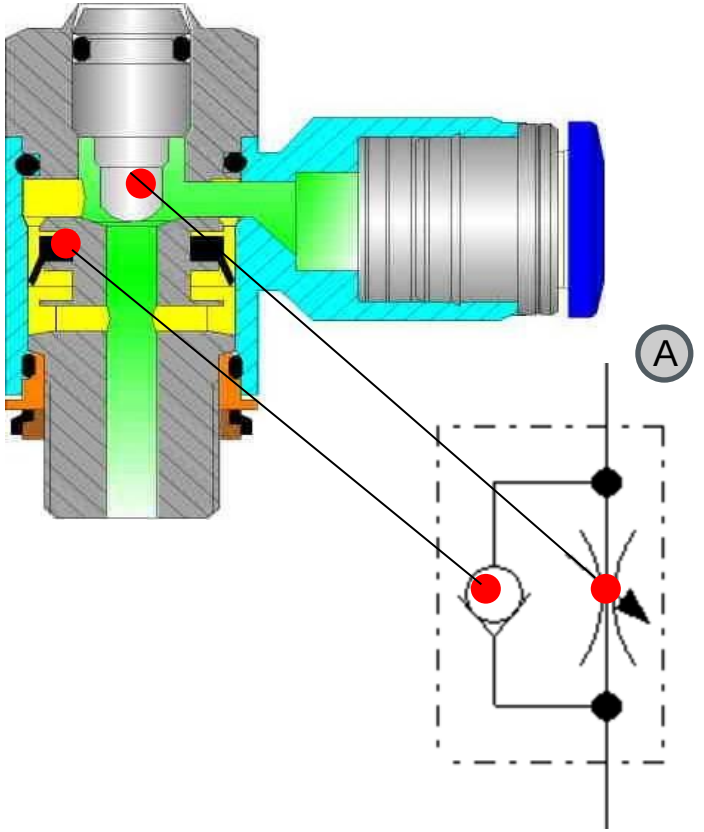
Exercise 4 : Application of time relay

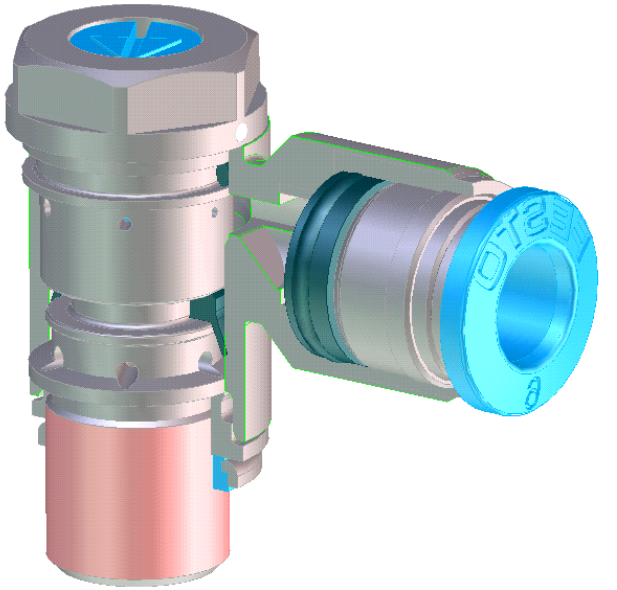




Decreasing the speed of the cylinders

One way flow control valve





Decreasing the speed of the cylinders

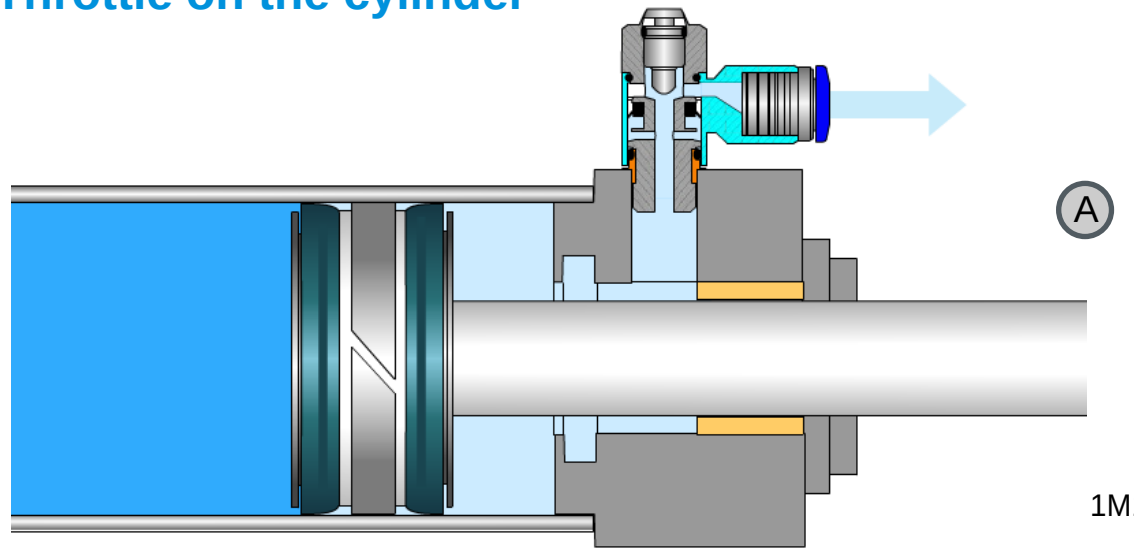
There are 2 different methods to decrease the speed of cylinders depending on the application

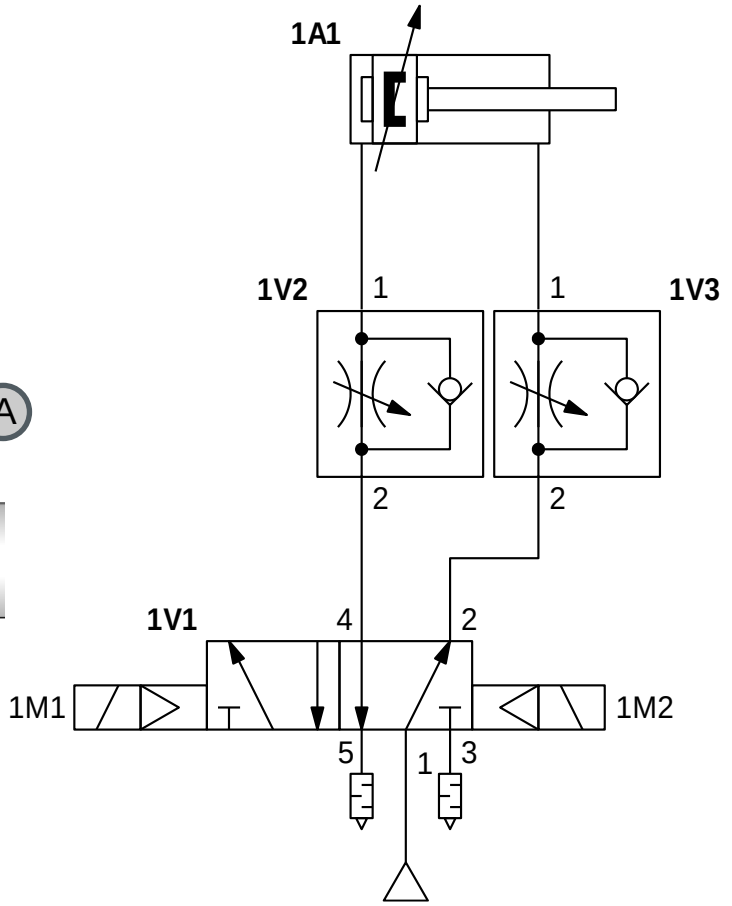
Exhaust air throttling
- Throttle on the cylinder
- Throttle on the valve

Supply air throttling
- Line throttling
- Single acting cylinder control
- Double acting cylinder control

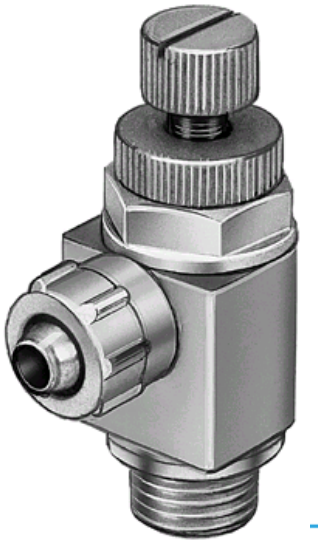
Exhaust air throttling

Throttle on the cylinder

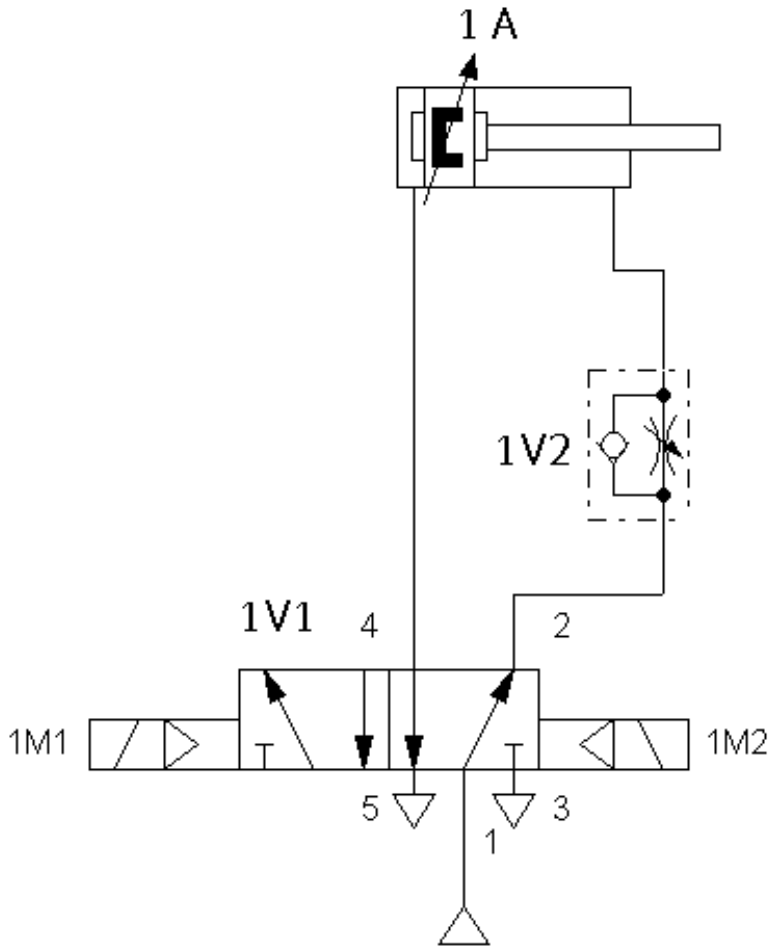


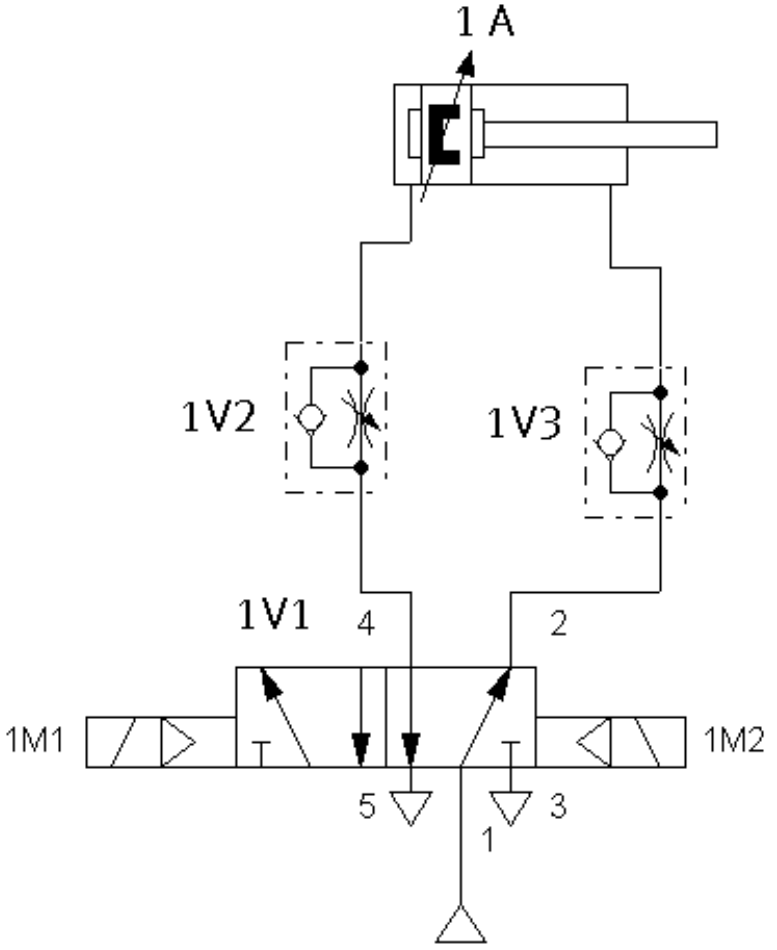


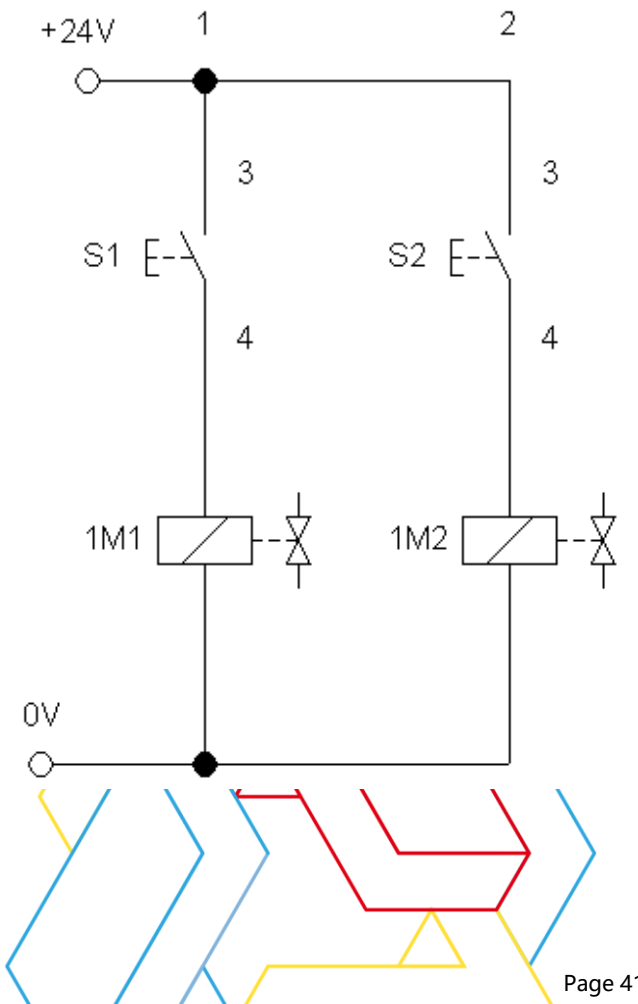
Throttle on the cylinder



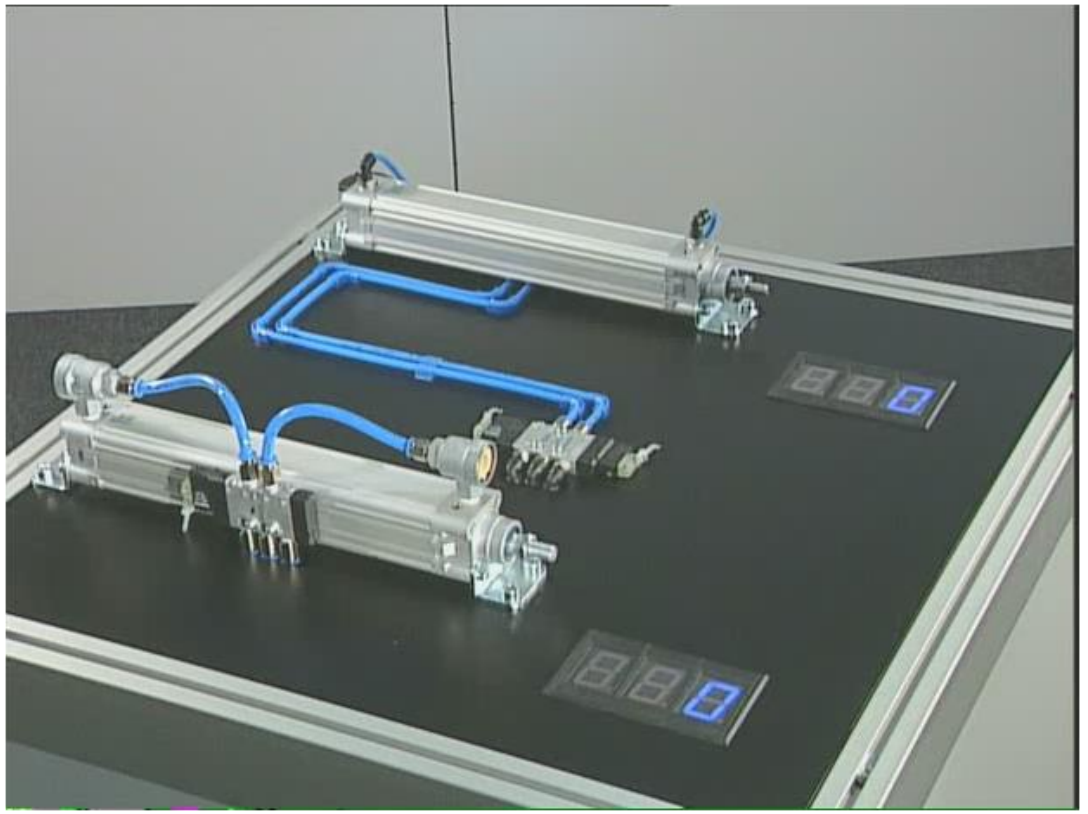
Exercise 5 : Reducing the speed of a cylinder







Increasing the speed of the cylinders



V

Thank You !