

# APA YANG DIKENDALIKAN DI SISTEM PNEUMATIC?

Actuators can be further broken down into groups:

- Linear actuators
  - Single-acting cylinder
  - Double-acting cylinder
- Rotary actuators
  - Air motors
  - Rotary actuators

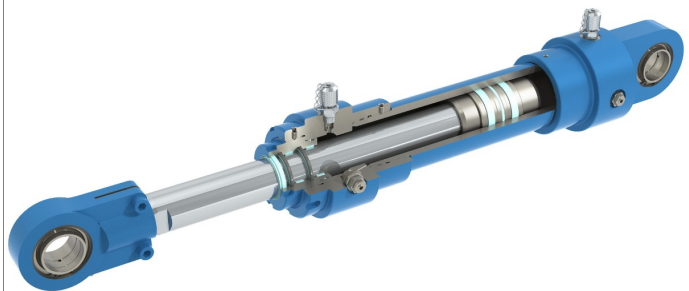
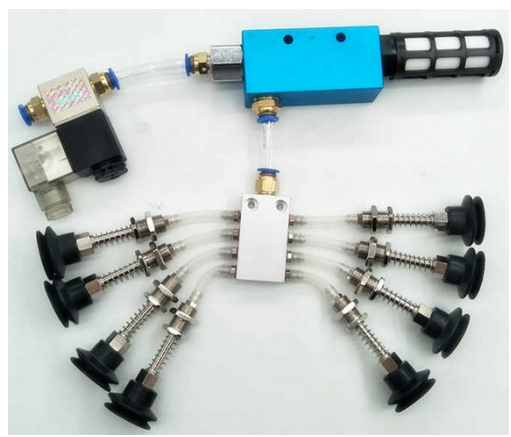
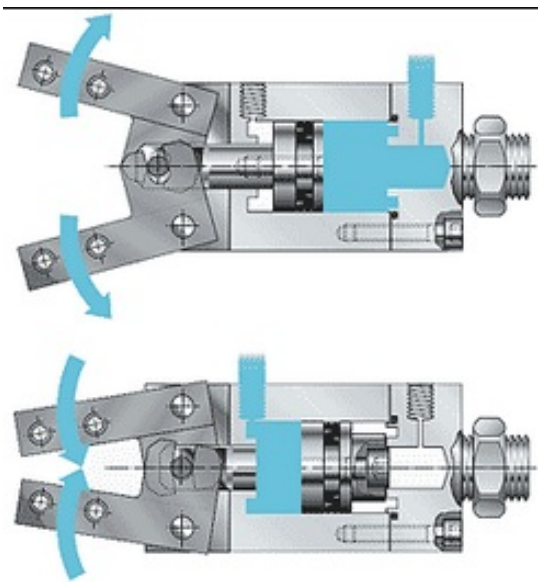
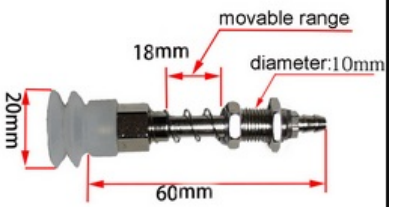


Fig. 2.13  
Actuators, linear and rotary



-----/ ROBOTIK --/ CAE  
XI MEKA A ---/ 5rgurij  
XI MEKA B ---/ fk2al3c  
XII MEKA A ---/ t2nhcnz --/ 6t7hfnw  
XII MEKA B ---/ 4p6pejv --/ vfyfn5g

# UNTUK APA AKTUATORNYA?

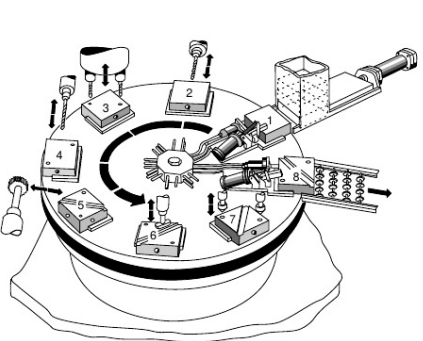


Fig. 1.2:  
Processing station

Fig. 1.2  
Points switch for two  
conveyor belts

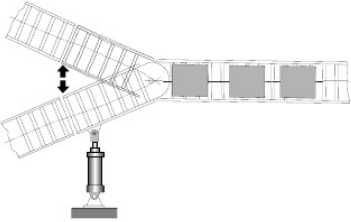


Fig. 5.2:  
Positional sketch of the  
lifting device

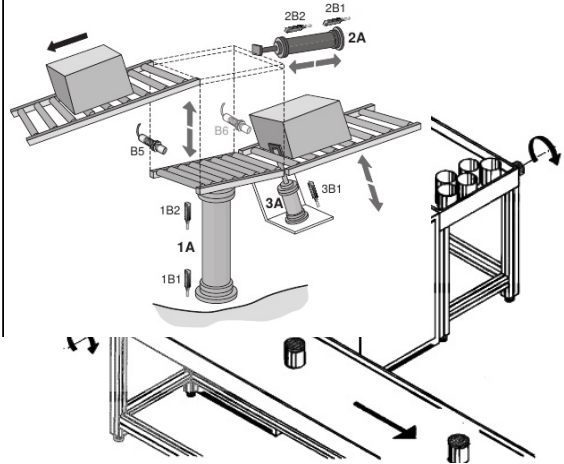
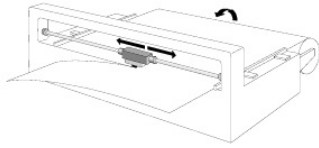


Fig. 1.3:  
Assembly device for  
mounting lids on cans

Fig. 1.3  
Pneumatic cutter



Pneumatic

Electropneumatic

# BAGIAN BAGIAN DARI PNEUMATIC

Fig. 5.2: Positional sketch of the lifting device

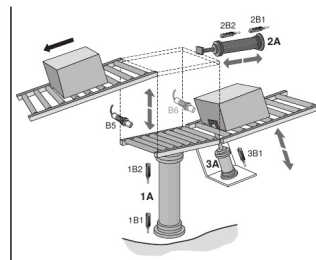
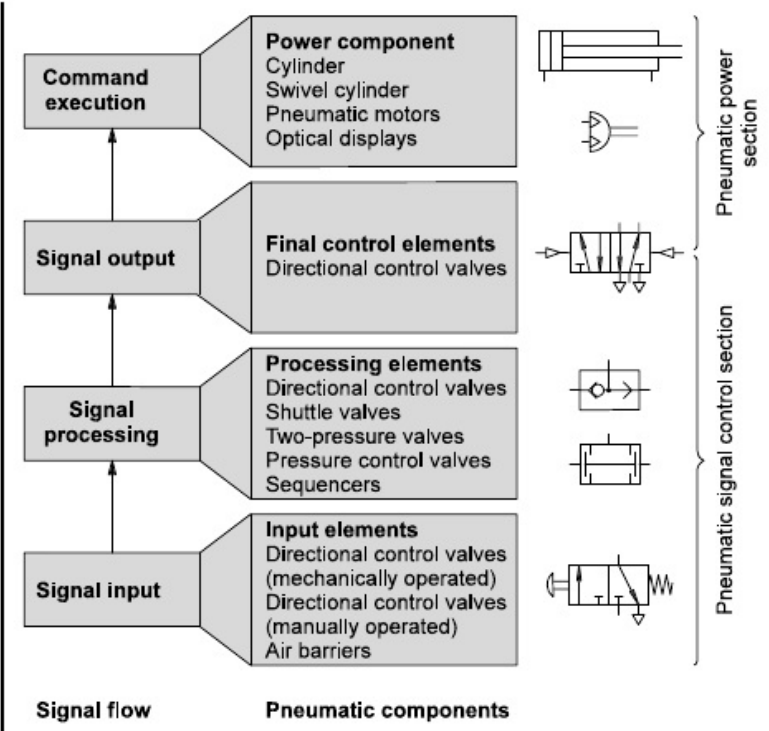
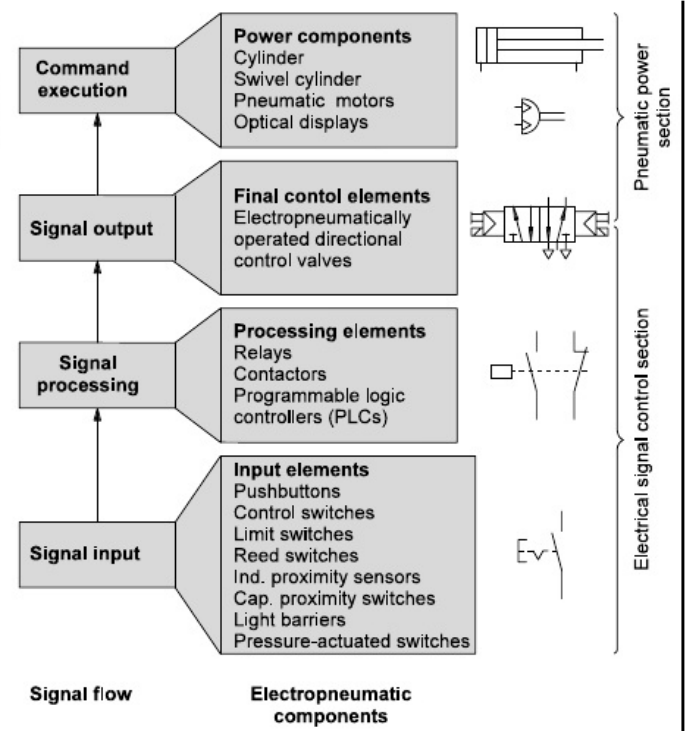


Fig. 1.7: Signal flow and components of a pneumatic control system



Pneumatic

Fig. 1.8: Signal flow and components of an electropneumatic control system



Electropneumatic

# BAGIAN BAGIAN DARI PNEUMATIC

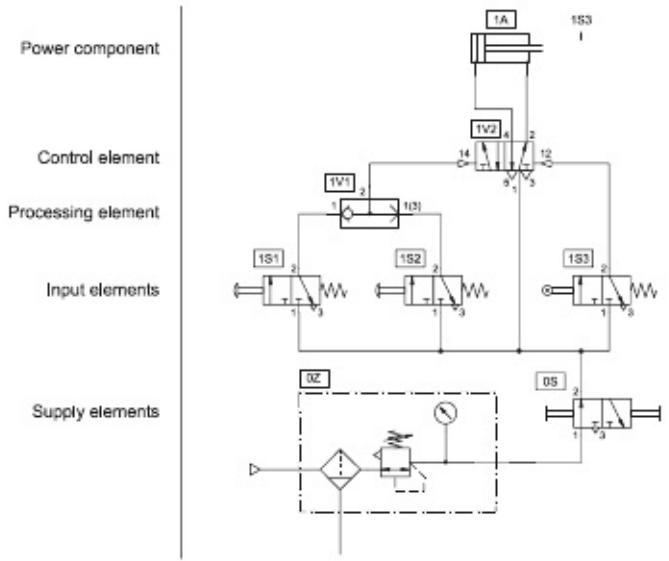


Fig. 5.5: Pneumatic circuit diagram of the lifting device

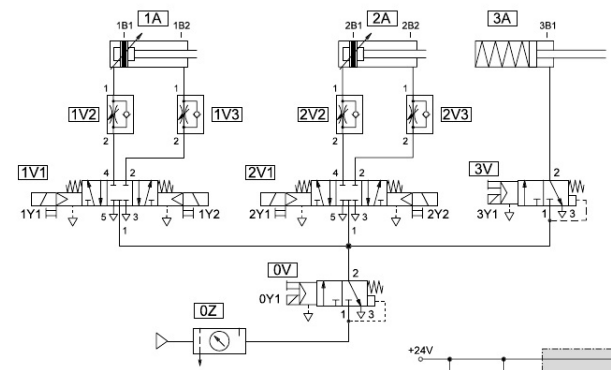


Fig. 4.3 Circuit diagram

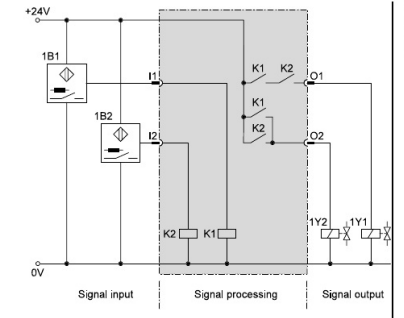


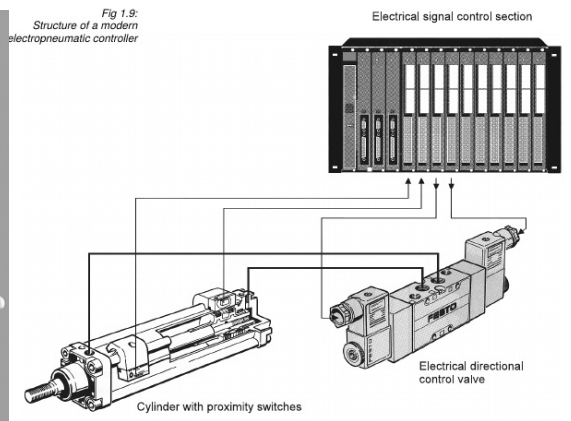
Fig. 3.20. Signal control section of relay control system (schematic, circuit diagram not compliant with standard)



Pneumatic

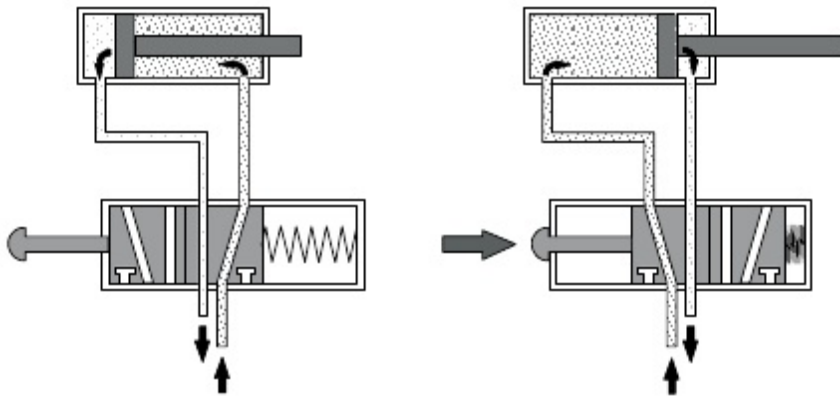


Fig 1.9: Structure of a modern electropneumatic controller



Electropneumatic

# BAGAIMANA MENGENDALIKAN AKTUATORNYA?



Pneumatic

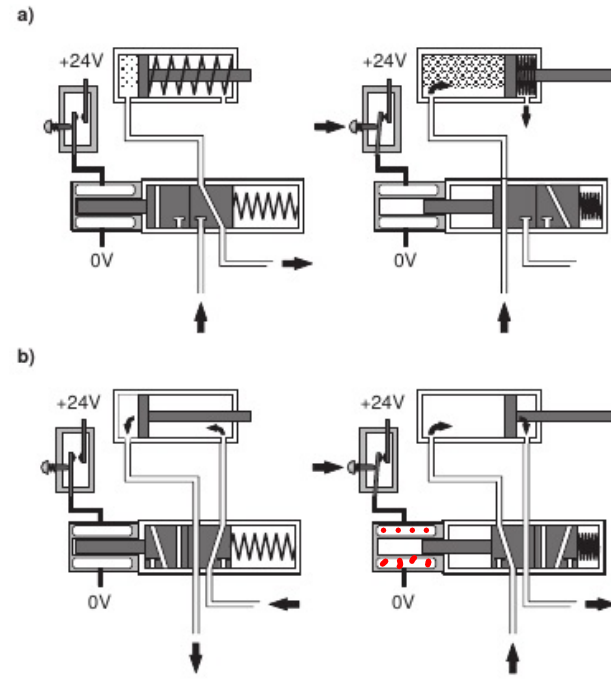
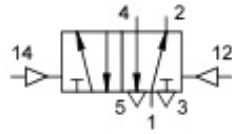
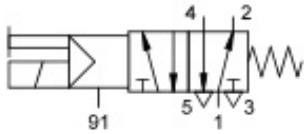
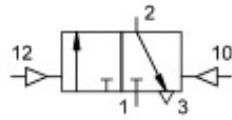
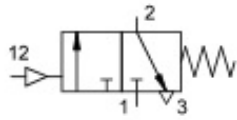


Fig. 4.1: Actuation of a pneumatic cylinder a) Single-acting b) Double-acting



Electropneumatic

# MENGENAL VALVE 1

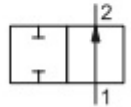


Working lines	ISO 5599-3	Lettering System	Port or Connection
	1	P	Pressure port
	2, 4	A, B	Working lines
	3, 5	R, S	Exhaust ports

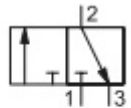
Pilot lines			
	10	Z	Applied signal inhibits flow from port 1 to port 2
	12	Y, Z	Applied signal connects port 1 to port 2
	14	Z	Applied signal connects port 1 to port 4
	81, 91	Pz	Auxiliary pilot air

Number of ports  
 Number of positions

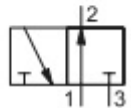
2/2 – Way directional control valve, normally open



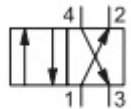
3/2 – Way directional control valve, normally closed



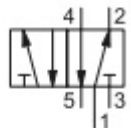
3/2 – Way directional control valve, normally open



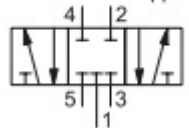
4/2 – Way directional control valve  
Flow from 1 → 2 and from 4 → 3



5/2 – Way directional control valve  
Flow from 1 → 2 and von 4 → 5



5/3 – Way directional control valve  
Mid position closed



Valve switching positions are represented as squares



The number of squares shows how many switching positions the valve has



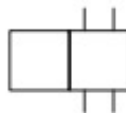
Lines indicate flow paths, arrows shows the direction of flow



Shut off positions are identified in the boxes by lines drawn at right angles

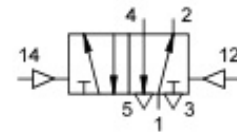
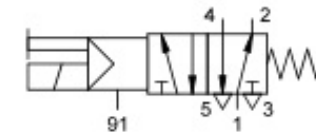
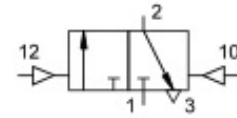
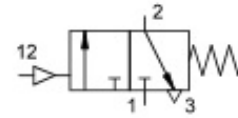


The connections (inlet and outlet ports) are shown by lines on the outside of the box



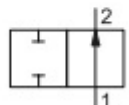
# MENGENAL VALVE 2

<b>Manual</b>	General	
	Pushbutton	
	Lever Operated	
	Detend lever operated	
	Foot pedal	
<b>Mechanical</b>	Plunger	
	Roller operated	
	Idle return, roller	
	Spring return	
	Spring centred	
<b>Pneumatic</b>	Direct pneumatic actuation	
	Indirect pneumatic actuation (piloted)	
<b>Electrical</b>	Single solenoid operation	
	Double solenoid operation	
<b>Combined</b>	Double solenoid and pilot operation with manual override	



Number of ports  
 Number of positions

2/2 – Way directional control valve, normally open



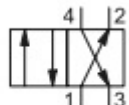
3/2 – Way directional control valve, normally closed



3/2 – Way directional control valve, normally open



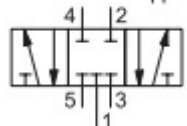
4/2 – Way directional control valve  
Flow from 1 → 2 and from 4 → 3



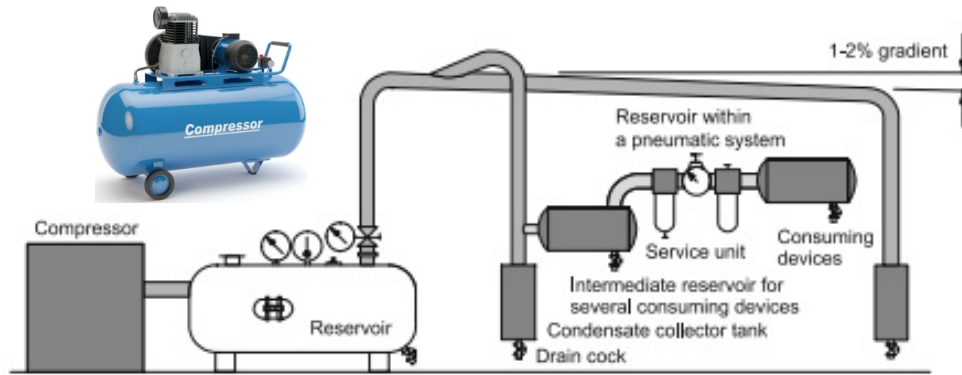
5/2 – Way directional control valve  
Flow from 1 → 2 and von 4 → 3



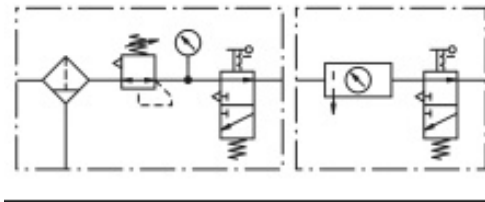
5/3 – Way directional control valve  
Mid position closed



# SUPLAY ELEMENT



Service unit with on-off valve



Manifold

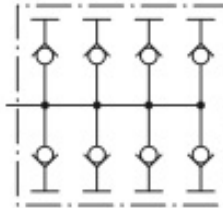
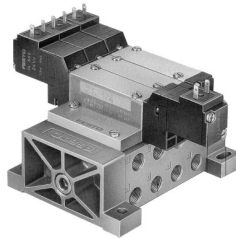


Fig. 4.12: Mounting of electrically actuated directional control valves on a valve manifold block (Festo)



Pneumatic

Electropneumatic

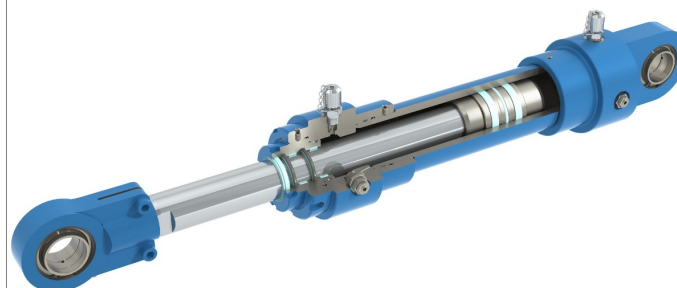


# POWER COMPONENTEN

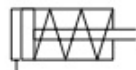
Actuators can be further broken down into groups:

- Linear actuators
  - Single-acting cylinder
  - Double-acting cylinder
- Rotary actuators
  - Air motors
  - Rotary actuators

Fig. 2.13  
Actuators, linear and rotary



Single-acting cylinder



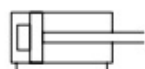
Double-acting cylinder



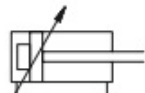
Double-acting cylinder with double ended piston rod



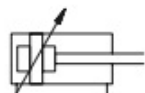
Double-acting cylinder with non-adjustable cushioning in one direction



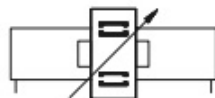
Double-acting cylinder with single adjustable cushioning



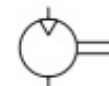
Double-acting cylinder with adjustable cushioning at both ends



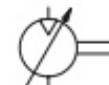
Linear drive with magnetic coupling



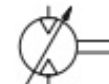
Air motor, rotation in one direction fixed capacity



Air motor, rotation in one direction variable capacity



Air motor, rotation in both directions variable capacity

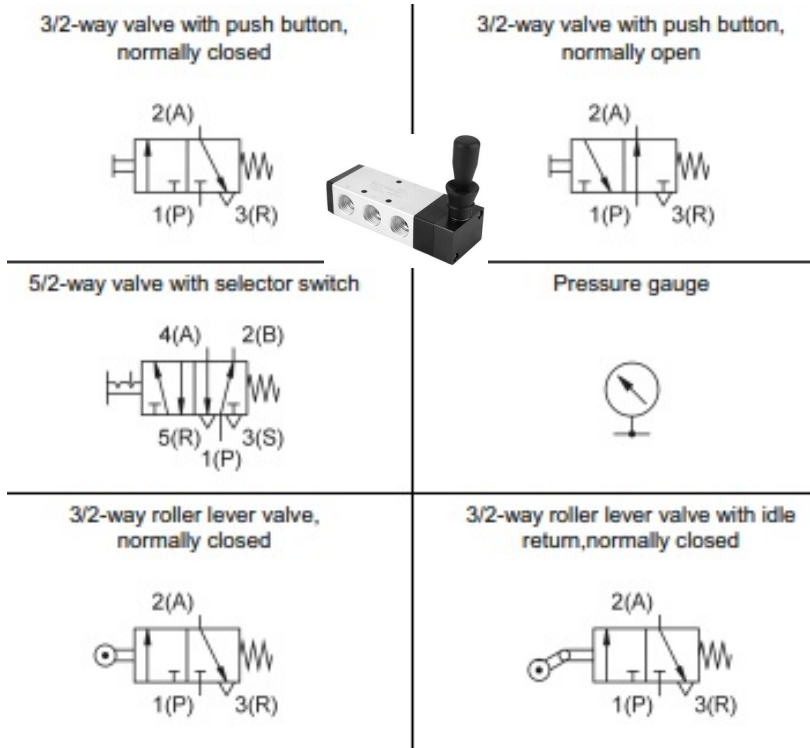


Rotary actuator



ctropneumatic  
Pneumatic

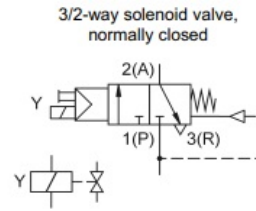
# INPUT ELEMENT 1



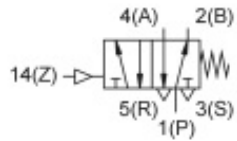
Pneumatic

Electropneumatic

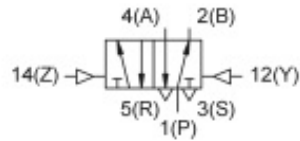
# FINAL CONTROL ELEMENT



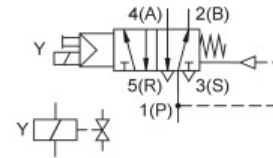
5/2-way pilot valve



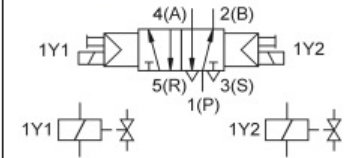
5/2-way double pilot valve



5/2-way solenoid valve



5/2-way double solenoid valve



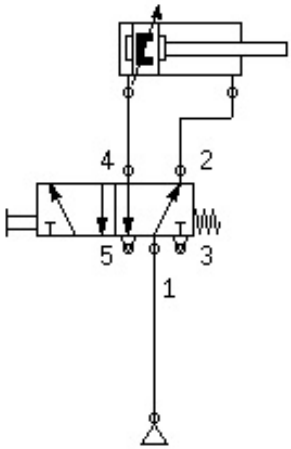
Indicator and distributor plate, electrical



Pneumatic

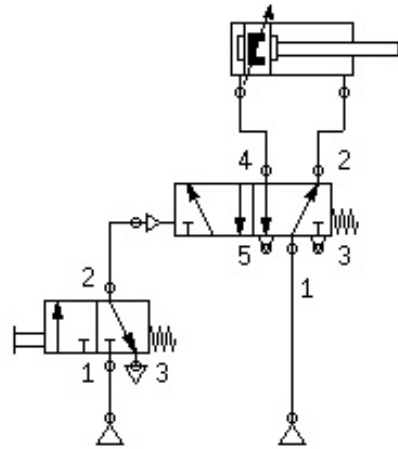
Electropneumatic

# KENDALI SECARA LANGSUNG DAN TIDAK LANGSUNG

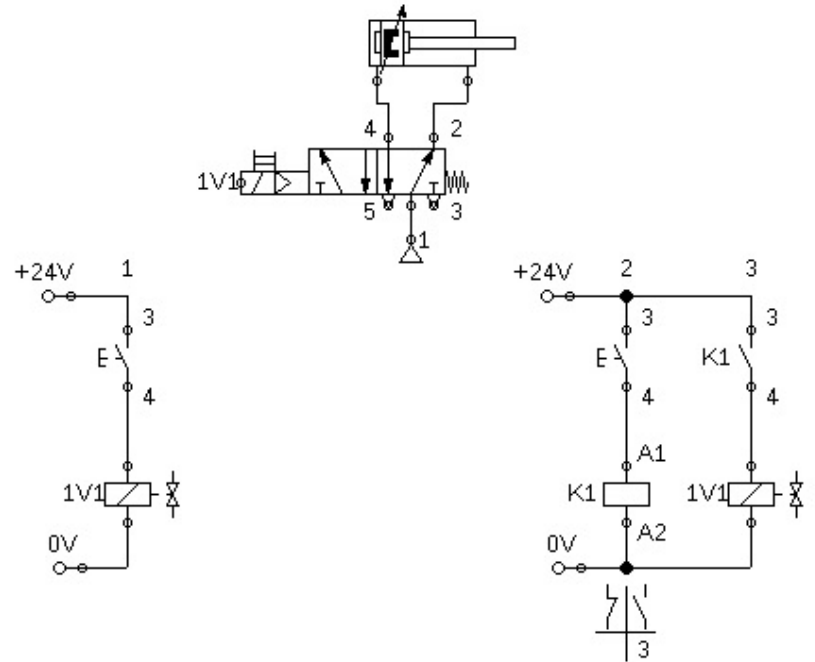


Langsung

Pneumatic



Tidak Langsung



Langsung

Electropneumatic

Tidak Langsung

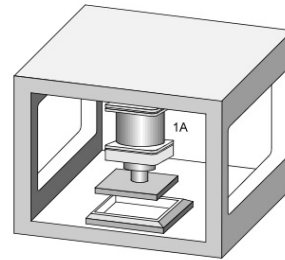
# Mendesain Rangkaian Dengan FluidSim

## 5.6 Exercise 2: Indirect control of a double-acting cylinder

**The Problem** A double-acting cylinder is to advance when a push button is operated. Upon release of the push button the cylinder is to retract. The cylinder is 250 mm diameter and consumes a large volume of air.

**Exercise** Draw the circuit diagram for the problem.  
Designate the valves and indicate the numbering system for the connections.

Fig. 5.7  
Positional sketch

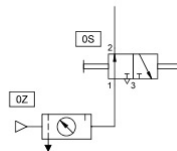


What happens to the cylinder, if the push button is pressed for a very short period and is then immediately released? **Question**

Describe the operation of the circuit.



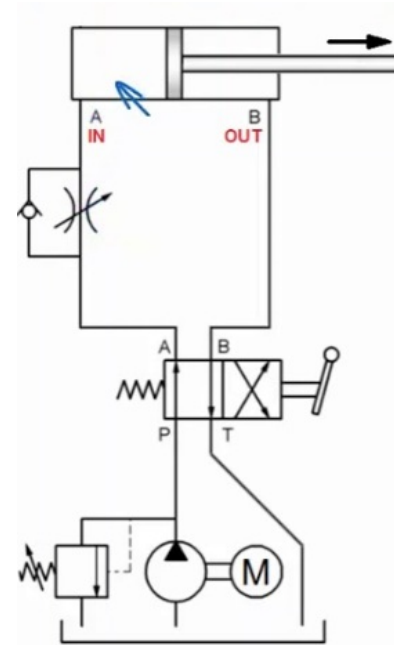
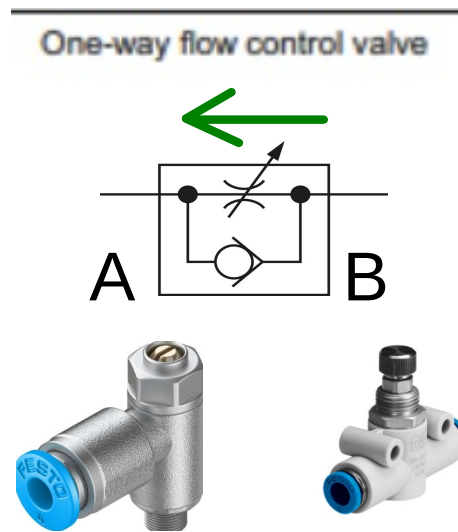
Fig. 5.8  
Circuit diagram



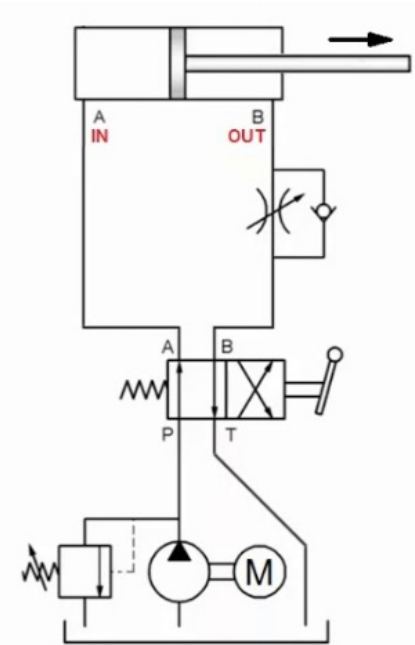
Pneumatic

Electropneumatic

# PROCESSING ELEMENT 1

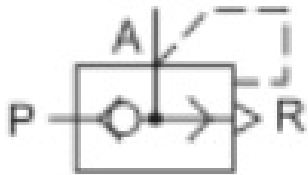


Meter-in for Extension  
Uncontrolled for Retraction



Meter-out for Extension  
Uncontrolled for Retraction

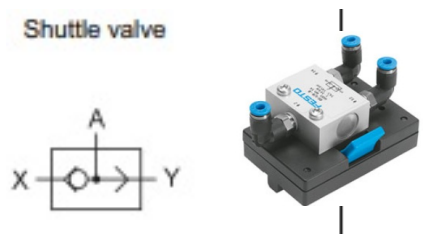
## Quick exhaust valve



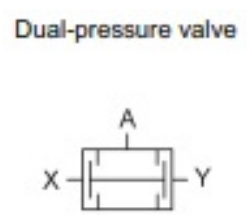
Pneumatic

# PROCESSING ELEMENT 2

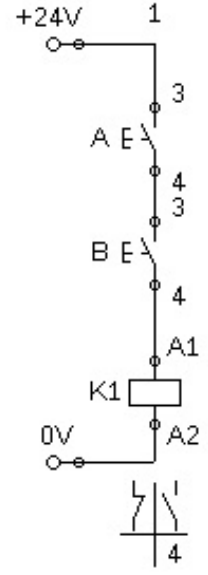
OR



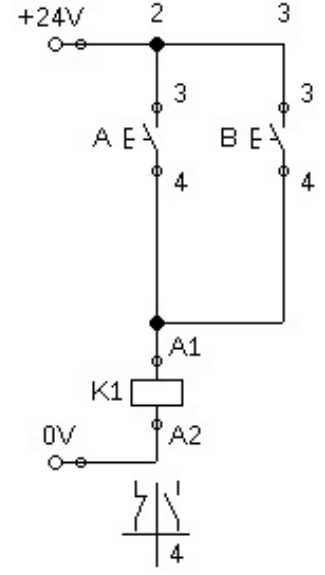
AND



AND



OR



AND

A	B	$A \wedge B$
True	True	True
True	False	False
False	True	False
False	False	False

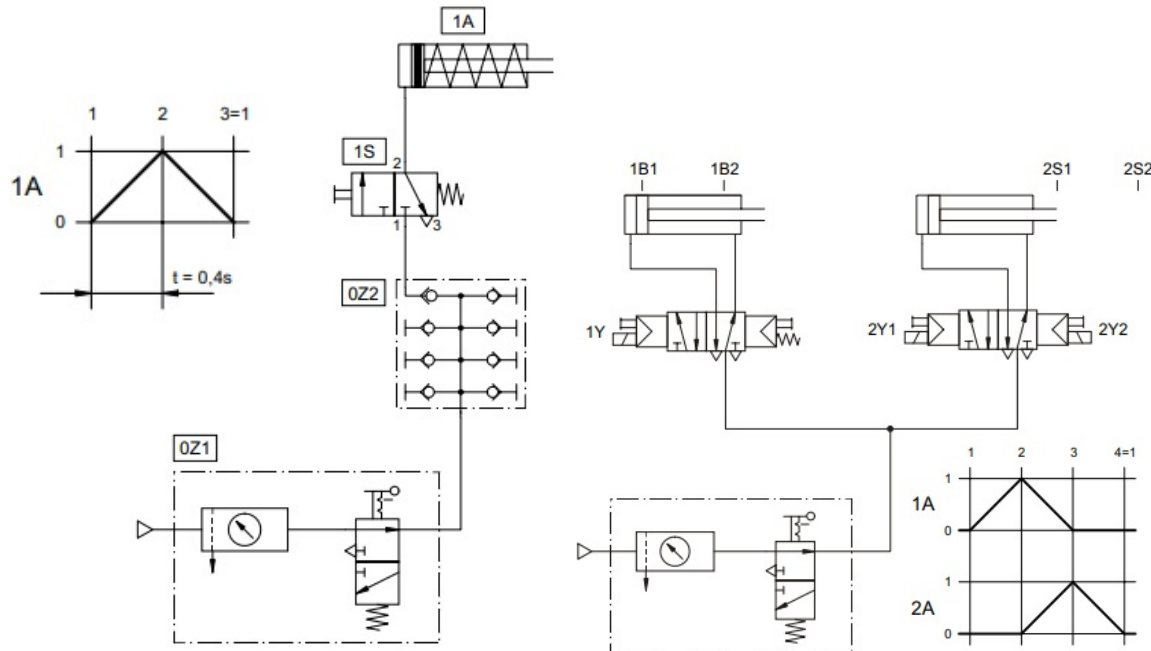
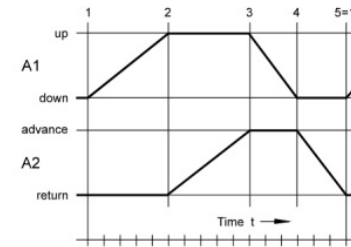
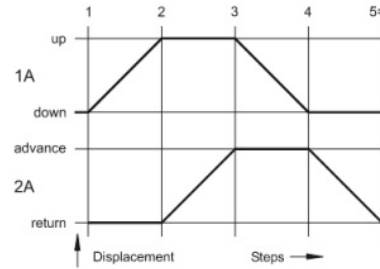
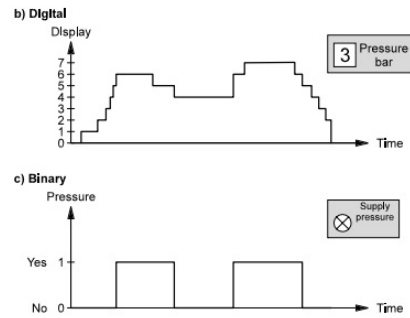
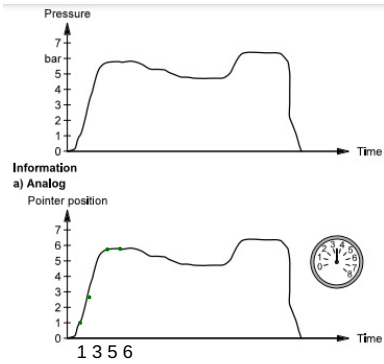
OR

A	B	$A \vee B$
True	True	True
True	False	True
False	True	True
False	False	False

Pneumatic

Electropneumatic

# Grafik Pergerakan Pneumatic





# PRAKTIKUM 1

# PEMBERIAN LABEL KOMPONEN

Fig. 6.21:  
Identification code for components in pneumatic circuit diagrams

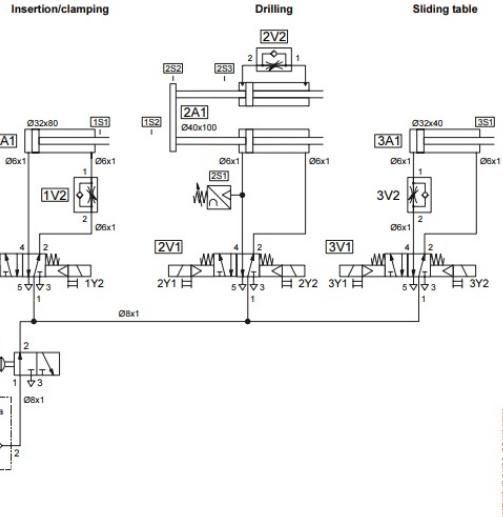
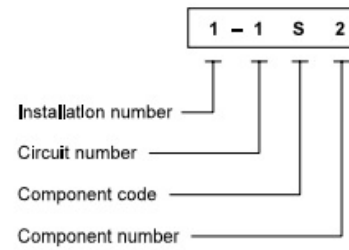


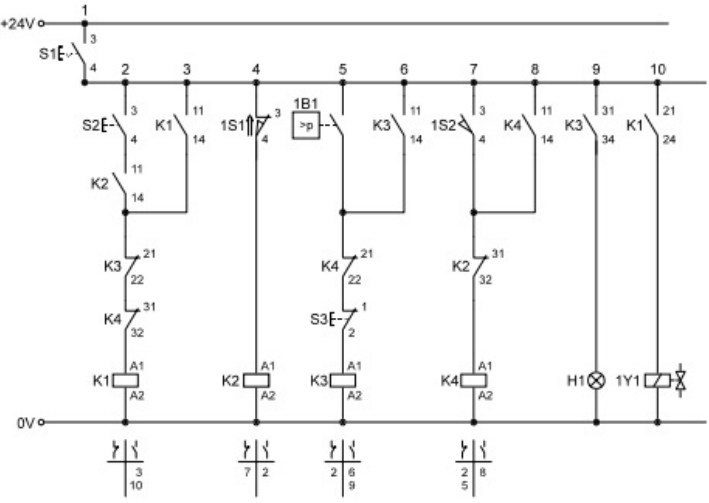
Fig. 6.20:  
Pneumatic circuit diagram of an electropneumatic control system with three control drives

Table 6.3:  
Identification codes for components in a pneumatic circuit diagram

Components	Identification
Compressors	P
Power components	A
Drive motors	M
Sensors	S
Valves	V
Valve coils	Y*
Other components	Z**

\* national supplement in German standard  
\*\* or any other letter not included in the list

Fig. 6.28:  
Electrical circuit diagram of an electropneumatic control system



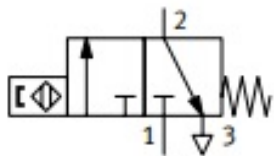
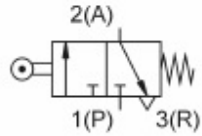
S1 = Main switch  
S2 = Start switch  
S3 = Acknowledgement switch  
1S1/1S2 = Limit switch  
1B1 = Pressure switch

Component type	Identification
Limit switch	S
Manually operated pushbutton, input elements	S
Reed switch	B
Electronic proximity switch	B
Pressure switch	B
Indicator	H
Relay	K
Contactors	K
Solenoid coil of a valve	Y

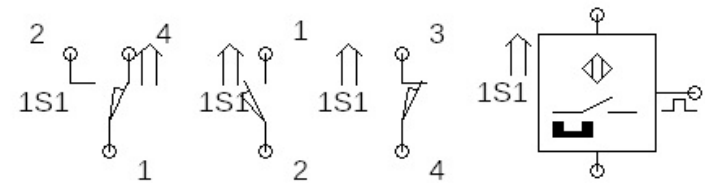
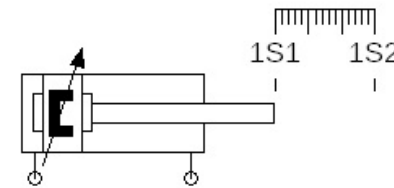
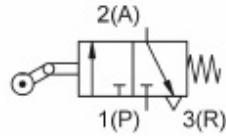
Table 6.4:  
Designation of components in an electrical circuit diagram (DIN 40719, Part 2)

# INPUT ELEMENT 2

3/2-way roller lever valve,  
normally closed



3/2-way roller lever valve with idle  
return, normally closed



Limit switch, electrical,  
Actuation from left or right\*

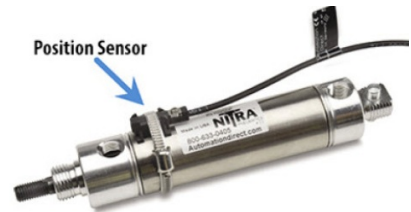
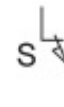
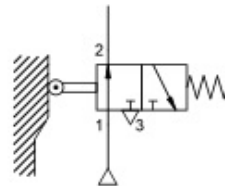
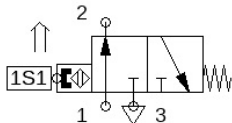


Fig. 4.6  
Actuated initial position

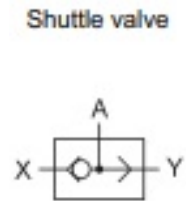


Pneumatic

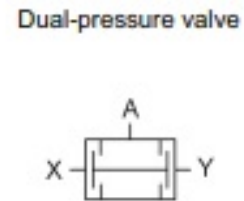
Electropneumatic

# PROCESSING ELEMENT 3

OR



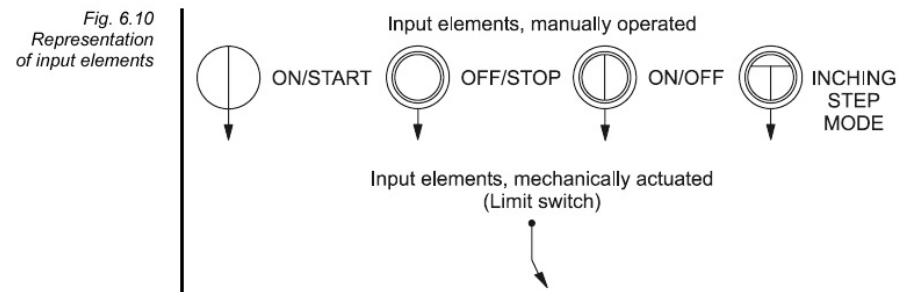
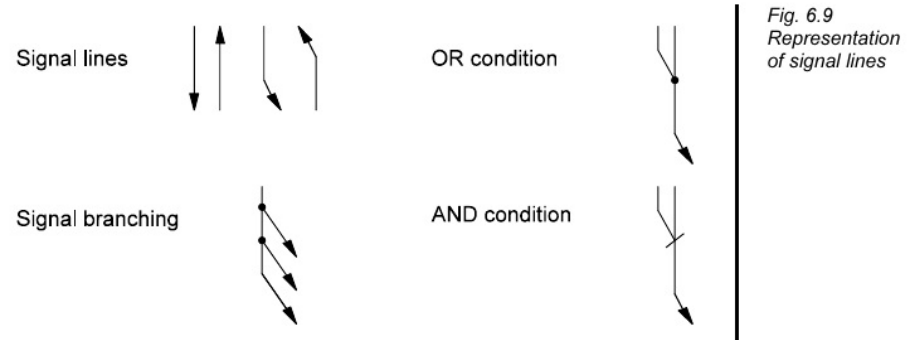
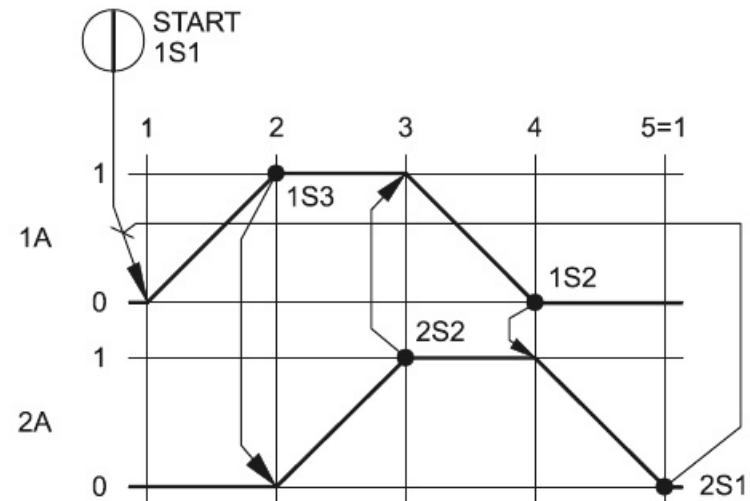
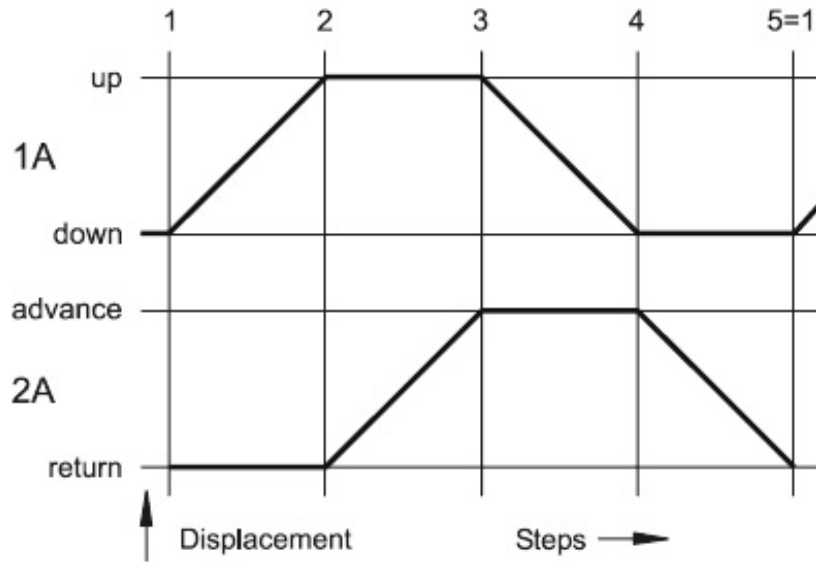
AND



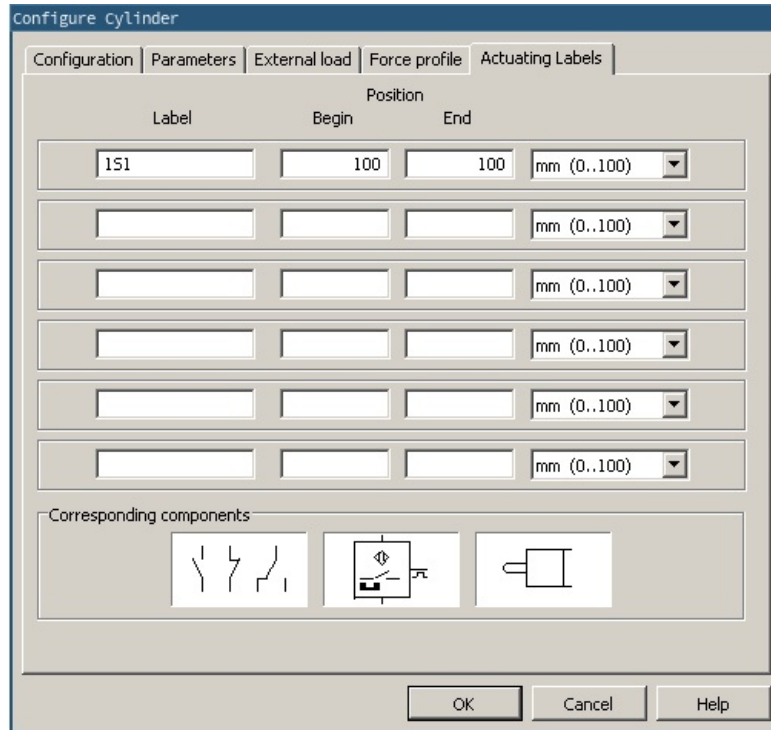
Pneumatic

Electropneumatic

# Grafik Pergerakan Pneumatic 2

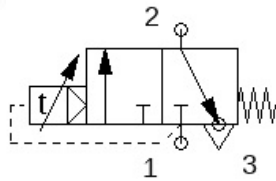
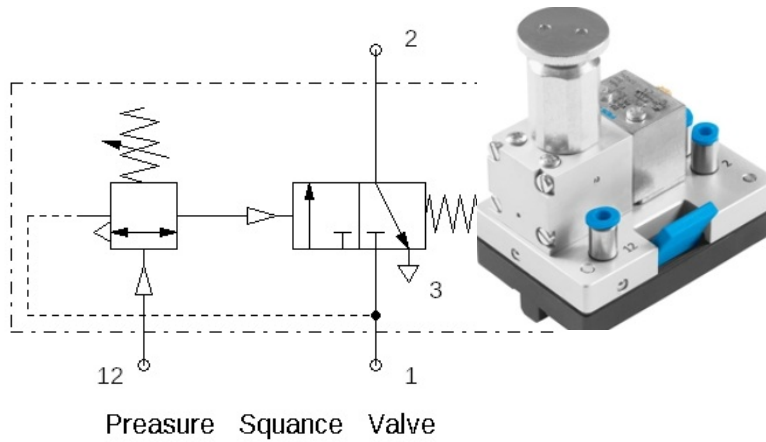


# Cara memberikan label limit



# PRAKTIKUM 2

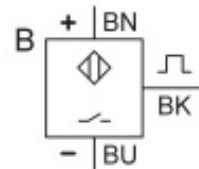
# INPUT ELEMENT 3



Pneumatic Timer, Normally Close

Pneumatic

Proximity sensor with cylinder mounting



Position Sensor

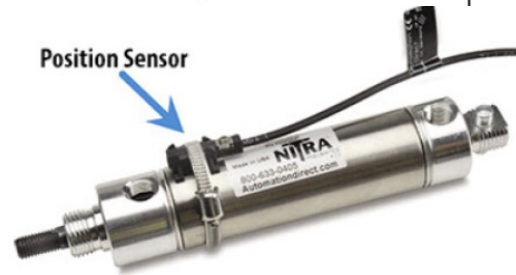
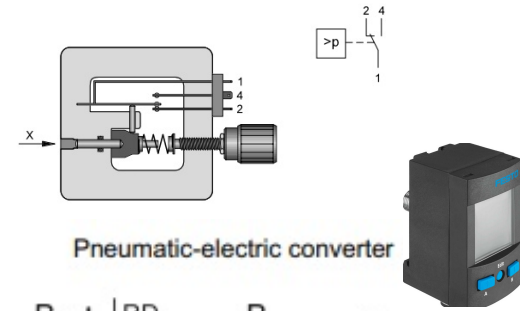
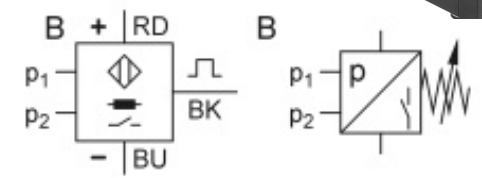


Fig. 3.12: Piston-actuated pressure switch



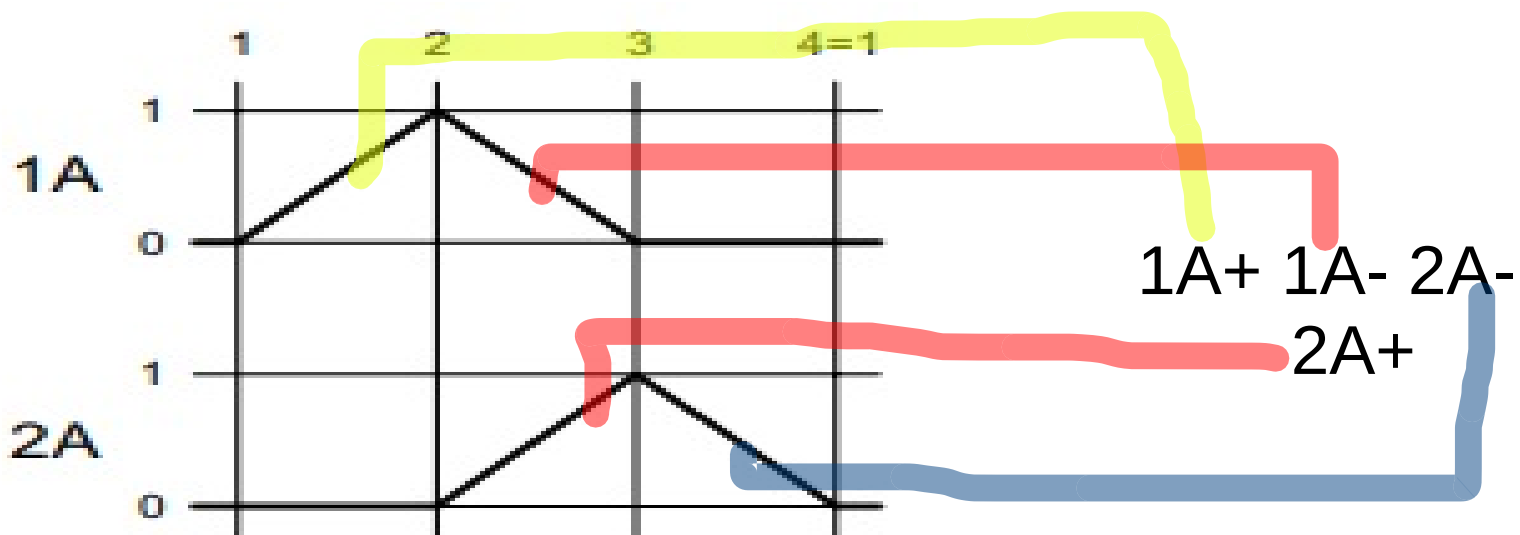
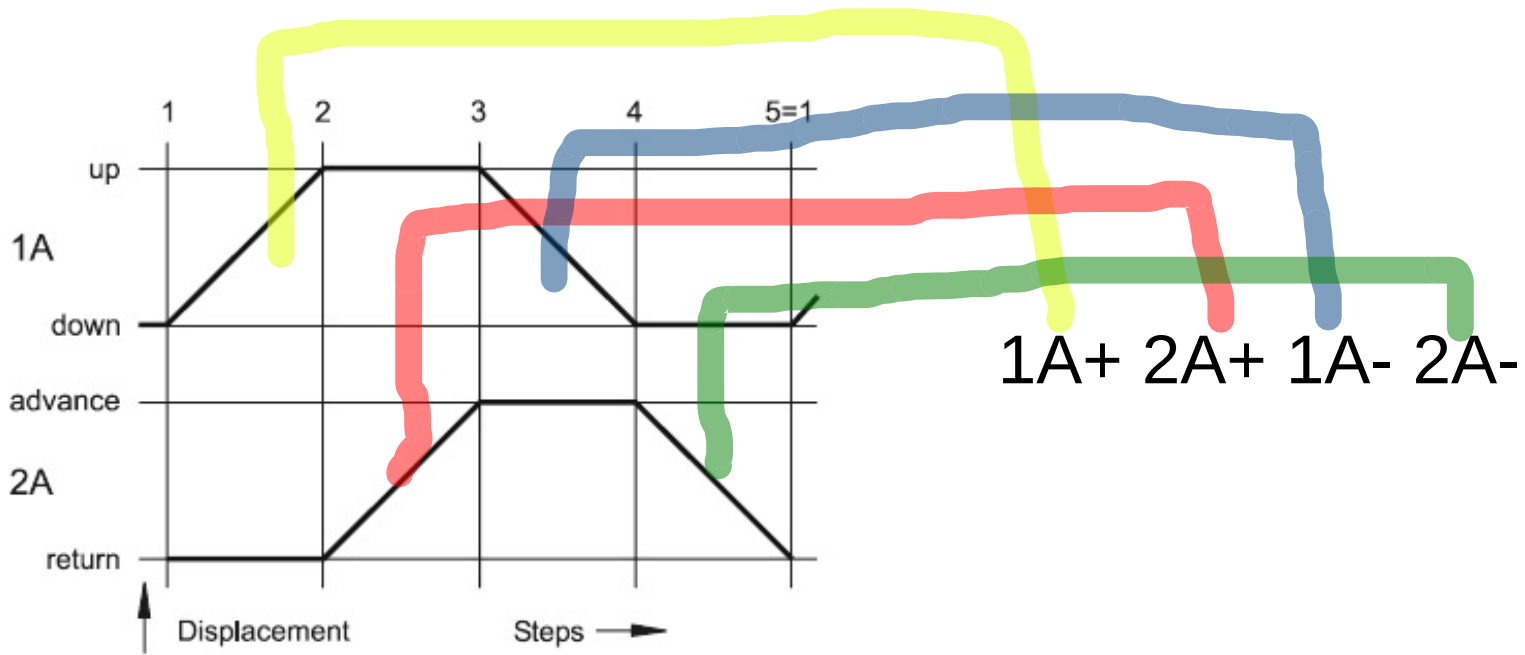
Pneumatic-electric converter



Electropneumatic



# Grafik Pergerakan Pneumatic 3

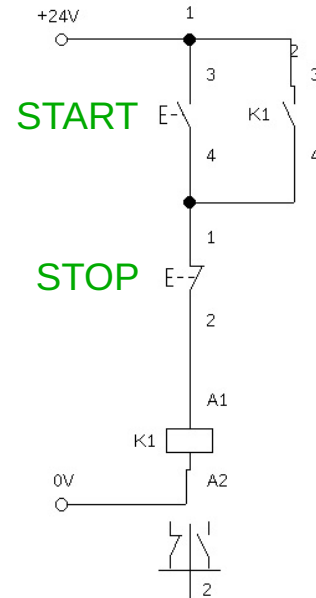
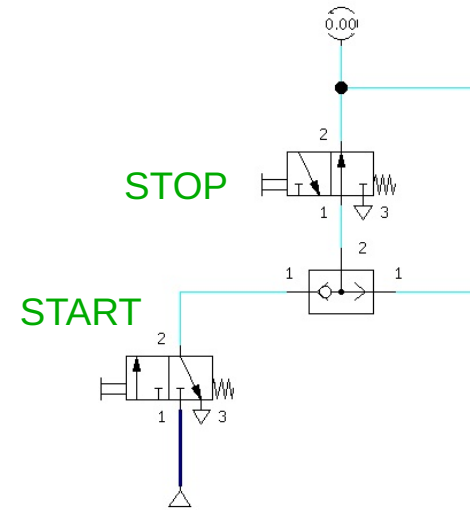


# PROCESSING ELEMENT 3

## Dominan-OFF

### Ciri - Ciri

- Valve Start ditekan, angin/listrik keluar dari valve Stop
- Valve Start ditekan, valve stop ditekan, **angin tidak keluar**



Pneumatic

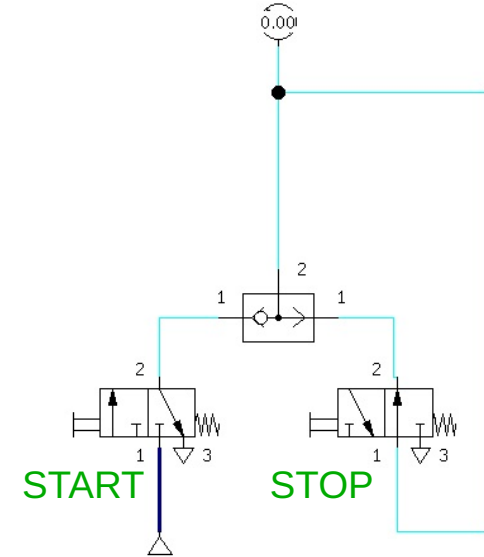
Electro-neumatic

# PROCESSING ELEMENT 3

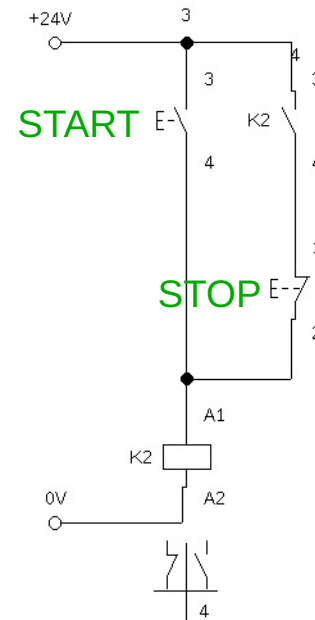
## Dominan-ON

### Ciri - Ciri

- Valve Start ditekan,  
    angin/listrik keluar dari valve Stop
- Valve Start ditekan, valve stop ditekan,  
    angin keluar



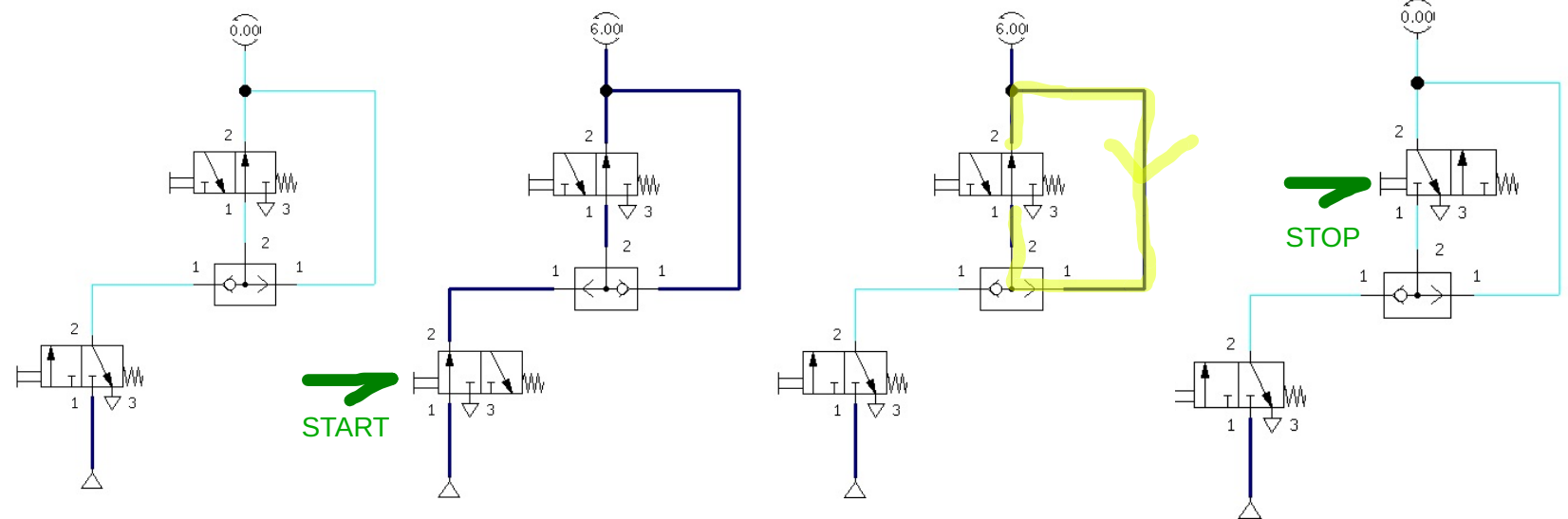
Pneumatic



Electropneumatic

# PROCESSING ELEMENT 3

## Dominan-OFF

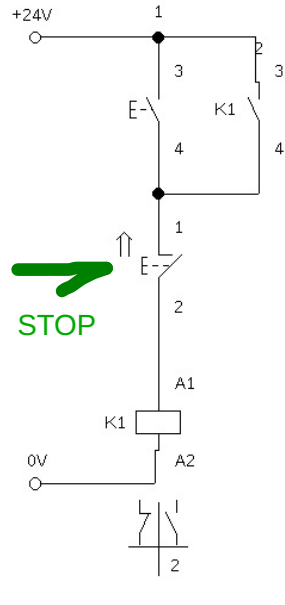
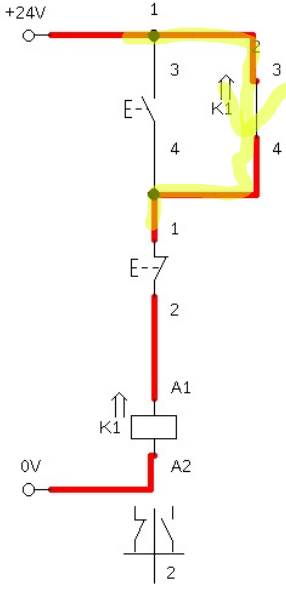
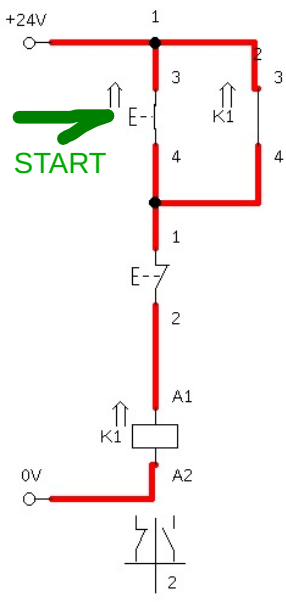
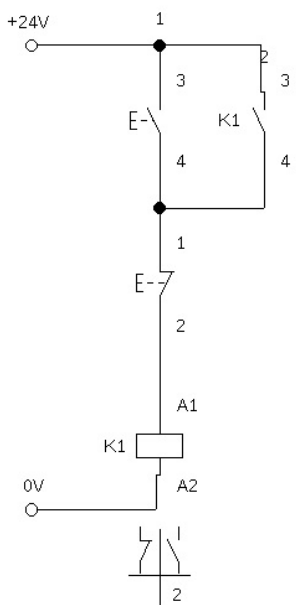


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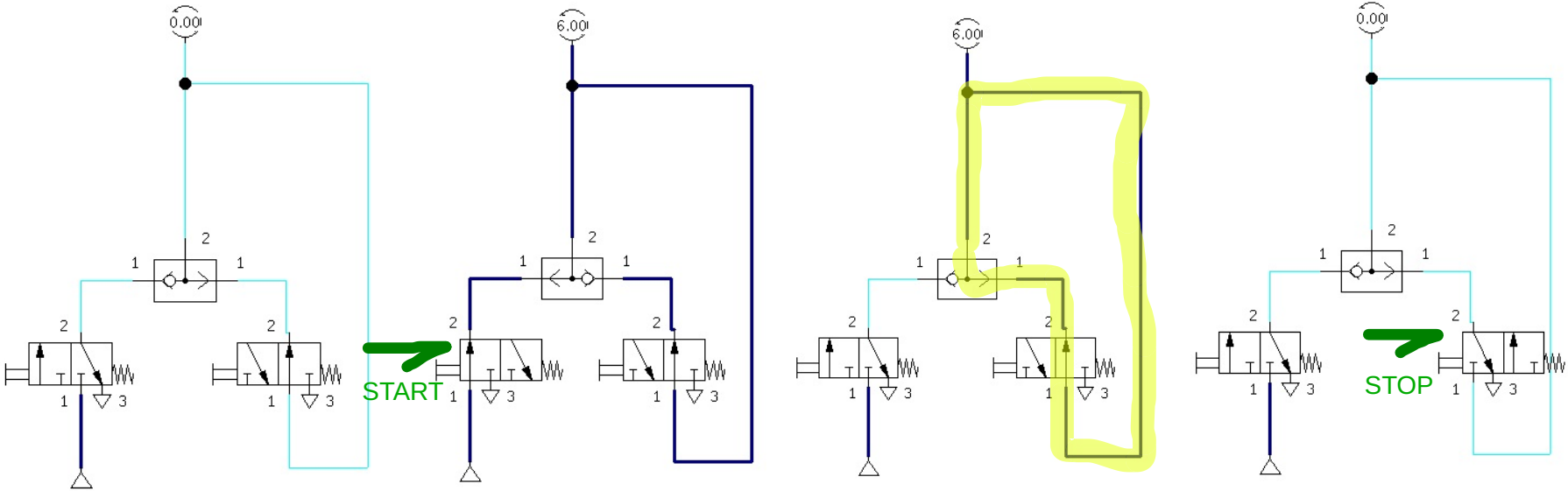


Pneumatic

Electropneumatic

# PROCESSING ELEMENT 3

## Dominan-ON

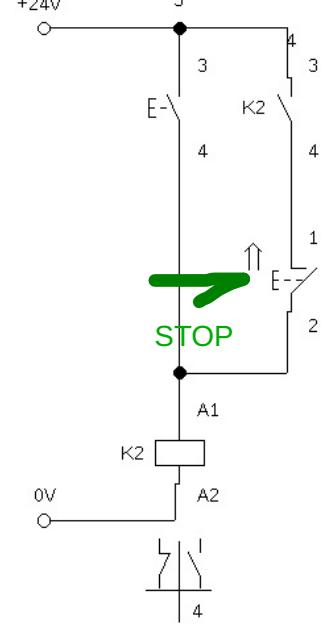
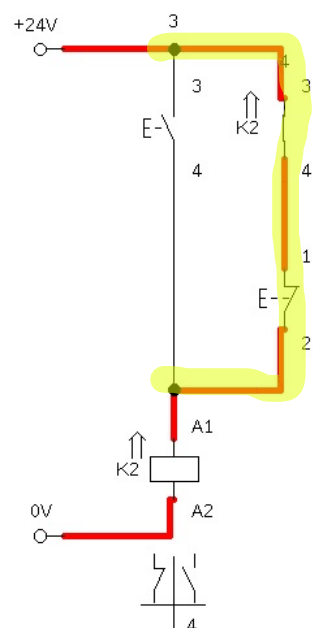
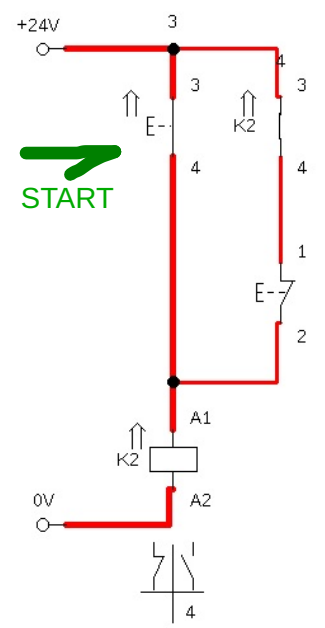
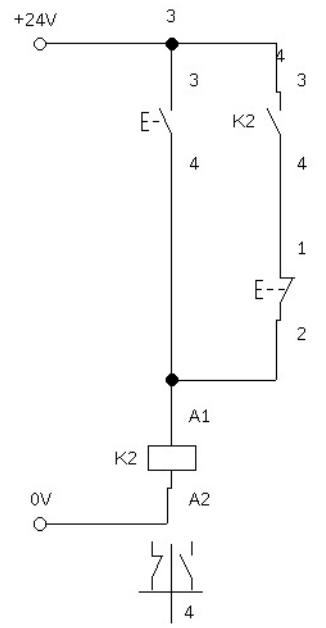


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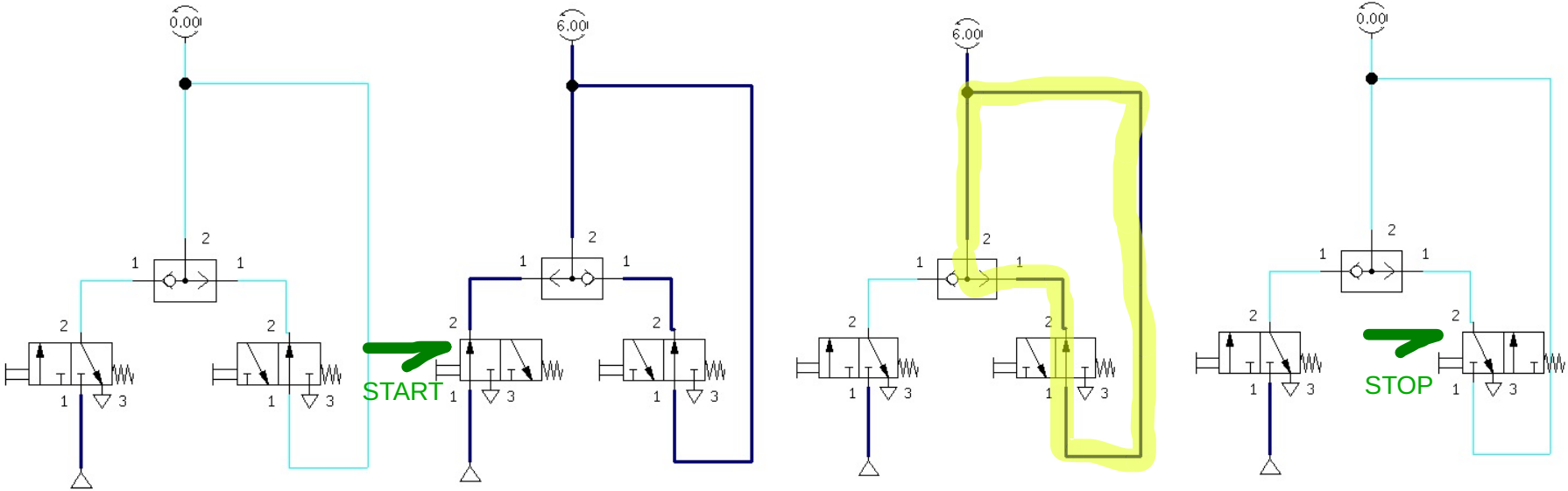
Pneumatic

Electroneumatic

# PRAKTIKUM 3

# PROCESSING ELEMENT 3

## Dominan-ON

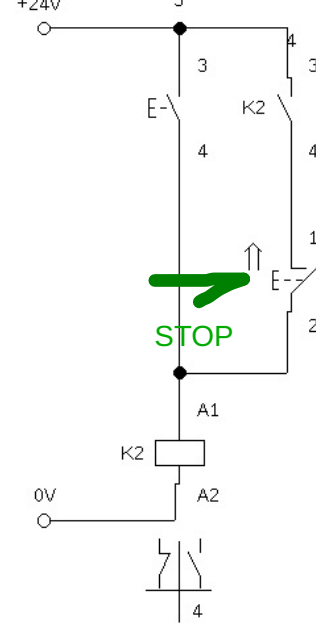
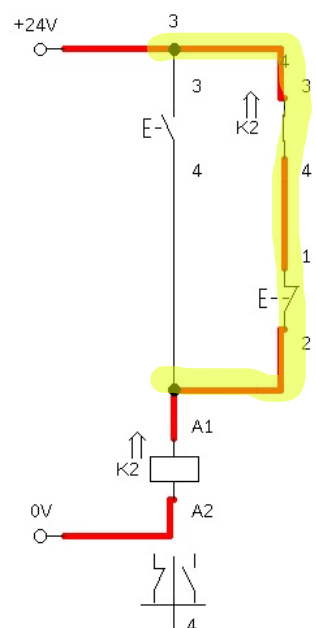
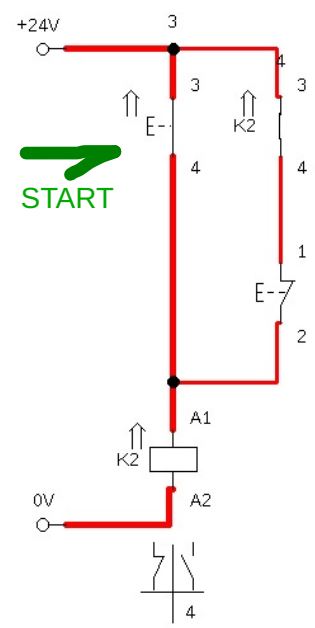
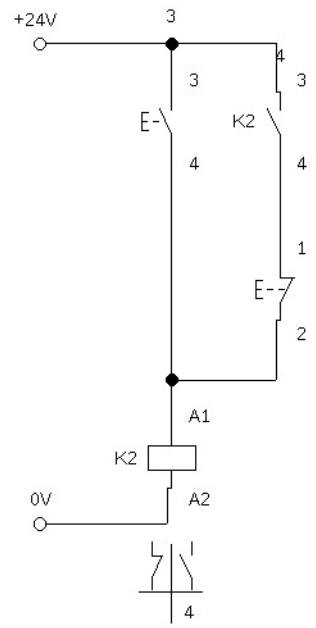


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Pneumatic

Electroneumatic