PELAJARAN HARI INI

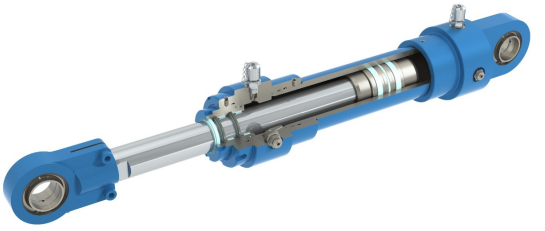
1. Fisika Dasar dan Satuan yang berkaitan dengan Sistem Pneumatik
2. Urutan Perangkat Penyuplai Angin
3. Cara Kerja Katup Sistem Pneumatik

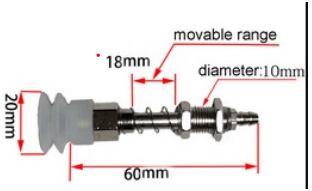
APA YANG DIKENDALIKAN DI SISTEM PNEUMATIC?

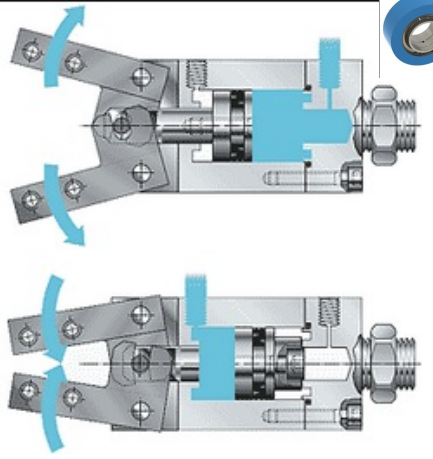
Actuators can be further broken down into groups:

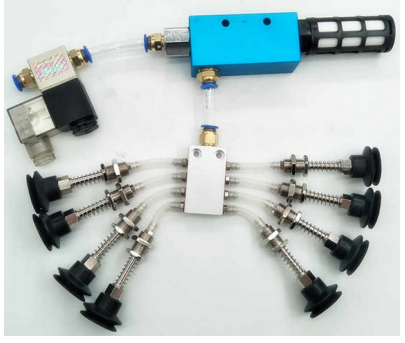
- Linear actuators
  - Single-acting cylinder
  - Double-acting cylinder
- Rotary actuators
  - Air motors
  - Rotary actuators

Fig. 2.13
Actuators, linear and rotary

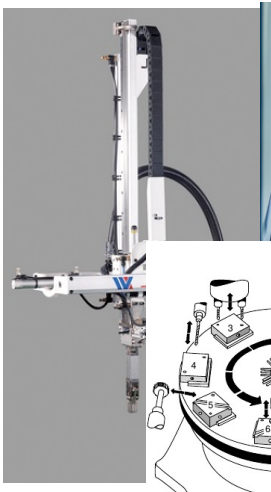


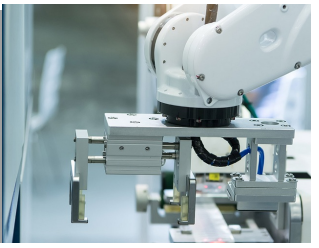






UNTUK APA AKTUATORNYA?





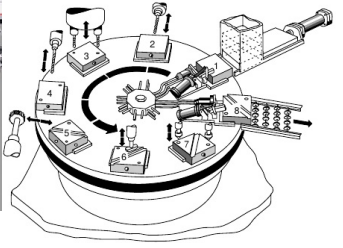


Fig. 1.2:
Processing station

Fig. 1.2
Points switch for two conveyor belts

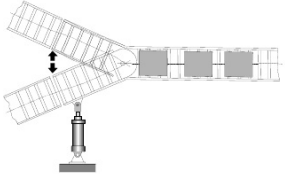


Fig. 1.3
Pneumatic cutter

Fig. 5.2:
Positional sketch of the lifting device

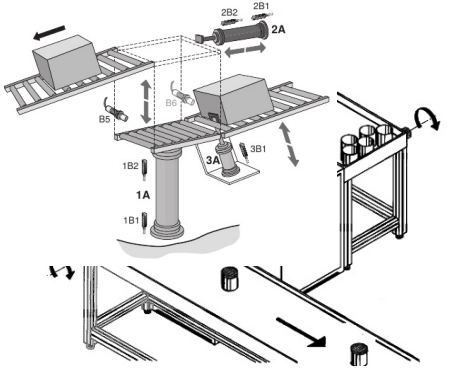


Fig. 1.3:
Assembly device for mounting lids on cans

Pneumatic

Electropneumatic

Mengenal Angin Bertekanan

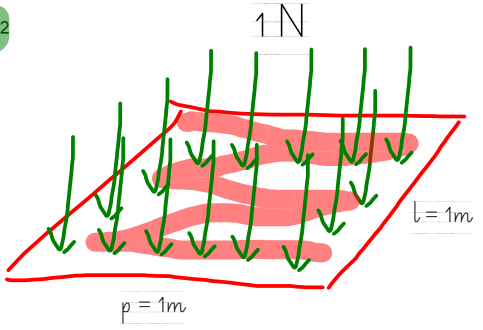
Basic units	**Quantity**	**Symbol**	**Units**
Panjang	Length	L	Meter (m)
Berat	Mass	m	Kilogram (kg)
Waktu	Time	t	Second (s)
Suhu	Temperature	T	Kelvin (K, 0 °C = 273.15 K)

Hukum 2 Newton

$$F = m\,a$$

Derived units	**Quantity**	**Symbol**	**Units**
Gaya	Force	F	Newton (N) = 1 kg • m/s^2
Luas	Area	A	Square metre (m^2)
Volume	Volume	V	Cubic metre (m^3)
Debit	Flowrate	q_v	(m^3/s)
Tekanan	Pressure	p	Pascal (Pa)
			1 Pa= 1 N/m^2
			1 bar = 10^5 Pa

Akselerasi a m/(s2)

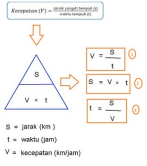


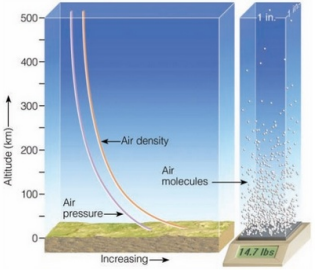
Rumus Percepatan:

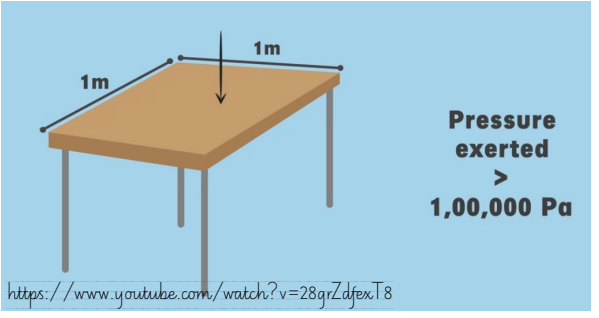
$$a = \frac{v_t - v_0}{t}$$

Keterangan:

a = percepatan (m/s^2)
v_0 = kecepatan mula-mula (m/s)
v_t = kecepatan akhir (m/s)
t = waktu (s)



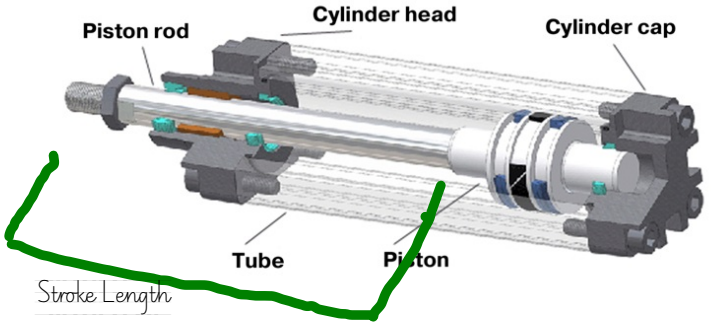




Menentukan Silinder

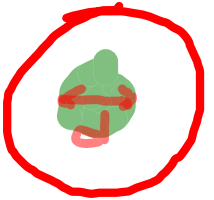
https://tameson.com/pages/pneumatic-cylinder-force-calculator

Components of a piston rod cylinder:



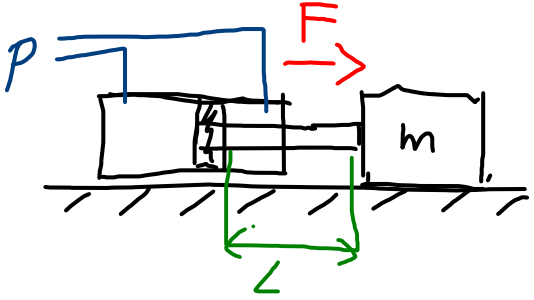
Piston Tampak Belakan (Forward)

$$A = \frac{\pi}{4} \times D^2$$



Piston Tampak Depan (Retract)

$$A = \pi \times \frac{(D^2 - d^2)}{4}$$



$$F = m \cdot a$$

$$= m \cdot \frac{v_2 - v_1 = 0}{t}$$

$$= m \cdot \frac{(L/t)}{t}$$

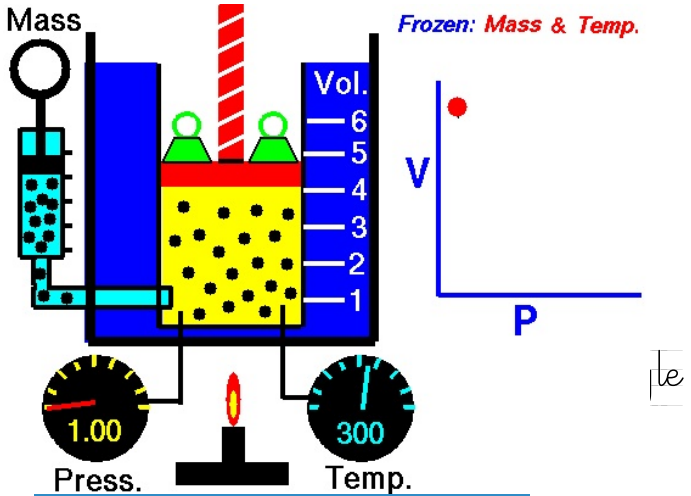
$$F = m \cdot \frac{L}{t^2}$$

$$P = \frac{F}{A}$$

$$\frac{\pi}{4} \times D^2 = \frac{F}{P}$$

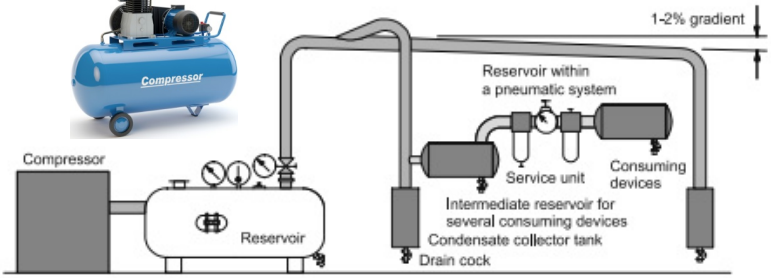
$$D = \sqrt{\frac{F \cdot 4}{P \cdot \pi}}$$

Karakteristik Angin

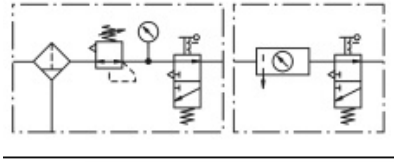


https://upload.wikimedia.org/wikipedia/commons/1/15/Boyles_Law_animated.gif

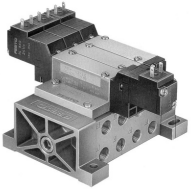
SUPLAY ELEMENT

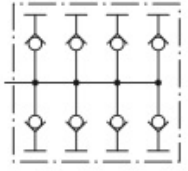


Service unit with on-off valve



Manifold





Pneumatic

Electropneumatic

BAGIAN BAGIAN DARI PNEUMATIC

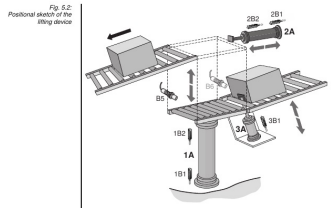
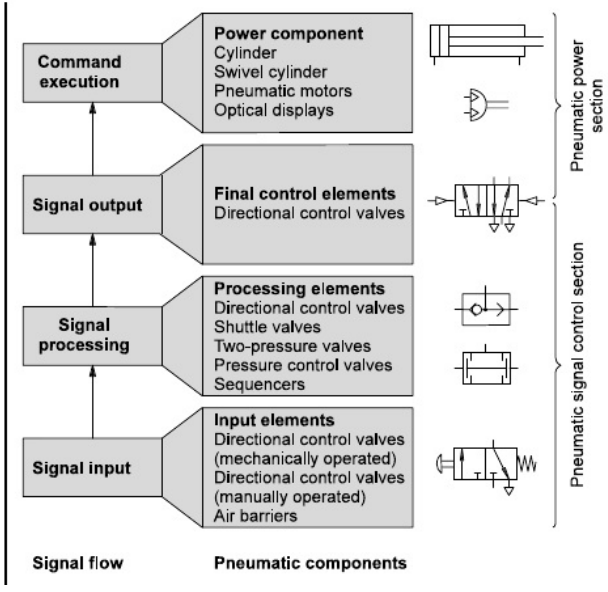


Fig. 1.7:
Signal flow and components of a pneumatic control system



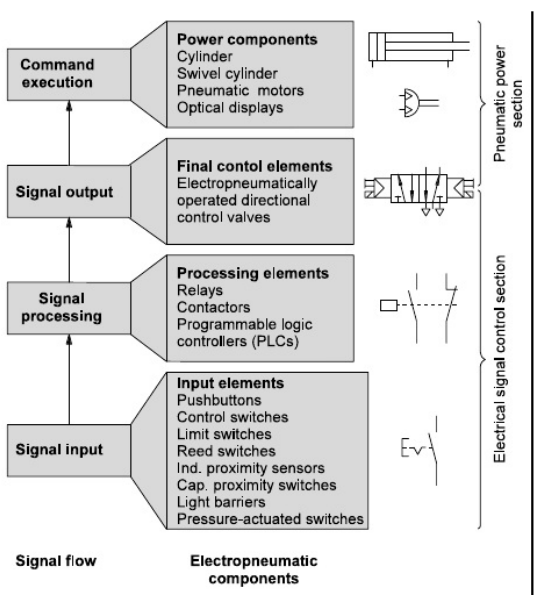
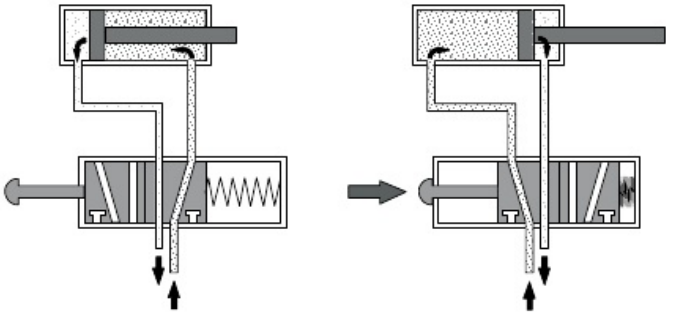


Fig. 1.8:
Signal flow and components of an electropneumatic control system

Pneumatic

Electropneumatic

BAGAIMANA MENGENDALIKAN AKTUATORNYA?



Pneumatic

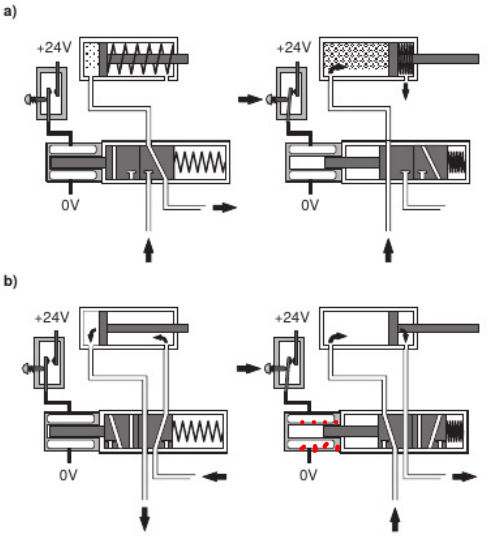
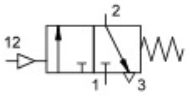
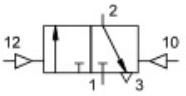


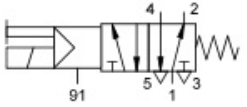
Fig. 4.1: Actuation of a pneumatic cylinder a) Single-acting b) Double-acting

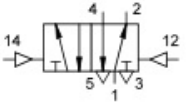
Electropneumatic

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

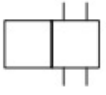
Valve switching positions
are represented as squares

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

Lines indicate flow paths,
arrows shows the direction of flow

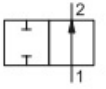
Shut off positions are identified in the boxes
by lines drawn at right angles

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

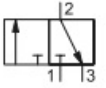


Number of ports
Number of positions

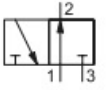
2/2 – Way directional control valve, normally open



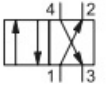
3/2 – Way directional control valve, normally closed



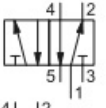
3/2 – Way directional control valve, normally open



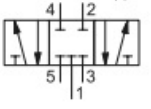
4/2 – Way directional control valve
Flow from 1 → 2 and from 4 → 3



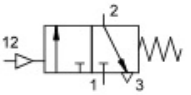
5/2 – Way directional control valve
Flow from 1 → 2 and von 4 → 5

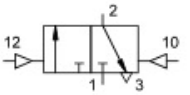


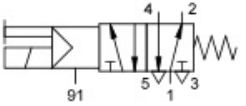
5/3 – Way directional control valve
Mid position closed

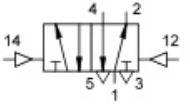


MENGENAL VALVE 2





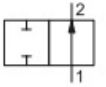




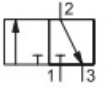
Manual	General	
	Pushbutton	
	Lever Operated	
	Detend lever operated	
	Foot pedal	
Mechanical	Plunger	
	Roller operated	
	Idle return, roller	
	Spring return	
	Spring centred	
Pneumatic	Direct pneumatic actuation	
	Indirect pneumatic actuation (piloted)	
Electrical	Single solenoid operation	
	Double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

Number of ports
Number of positions

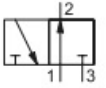
2/2 – Way directional control valve, normally open



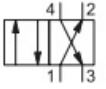
3/2 – Way directional control valve, normally closed



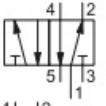
3/2 – Way directional control valve, normally open



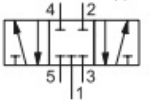
4/2 – Way directional control valve
Flow from 1 → 2 and from 4 → 3



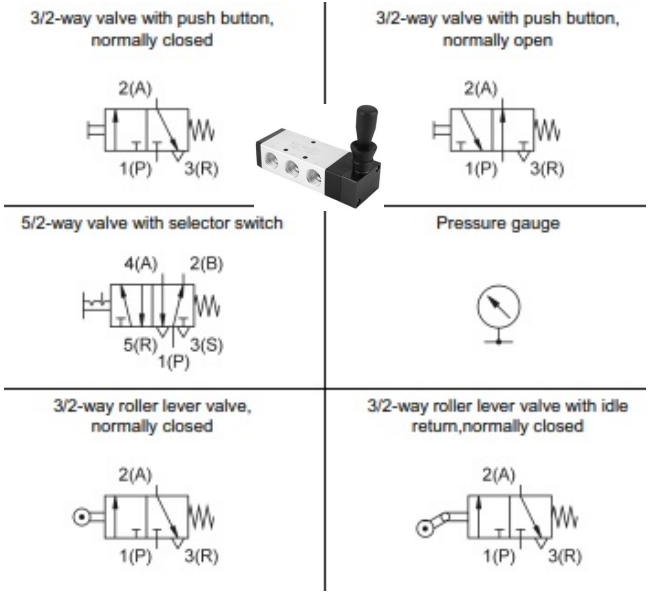
5/2 – Way directional control valve
Flow from 1 → 2 and von 4 → 5



5/3 – Way directional control valve
Mid position closed



INPUT ELEMENT 1



Pneumatic

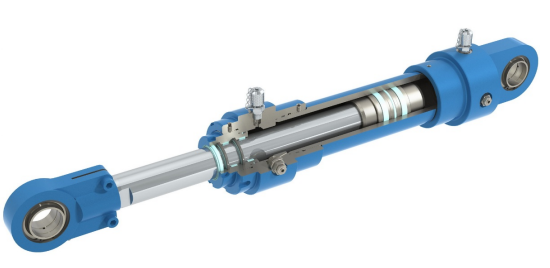
Electropneumatic

POWER COMPONEN

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

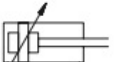
Double-acting cylinder

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

BAGIAN BAGIAN DARI PNEUMATIC

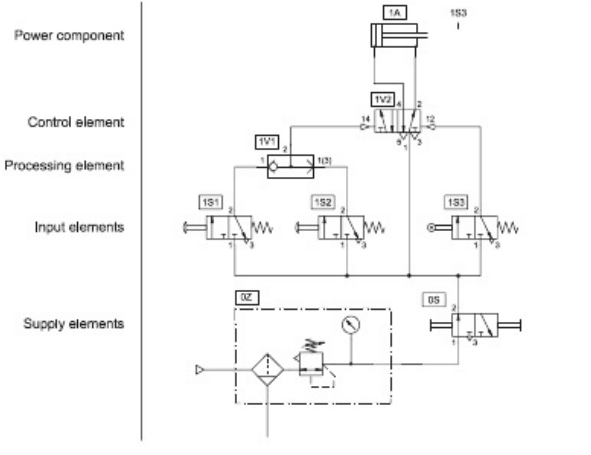


Fig. 4.3
Circuit diagram

Pneumatic

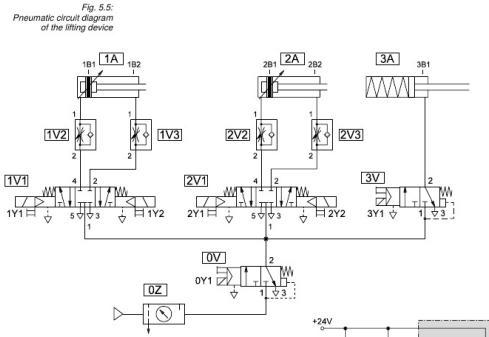
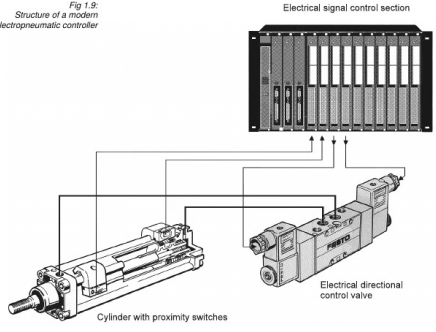


Fig. 3.20.
Signal control section of relay control system (schematic, circuit diagram not compliant with standard)

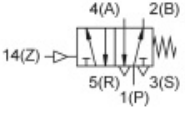
Fig 1.9:
Structure of a modern electropneumatic controller



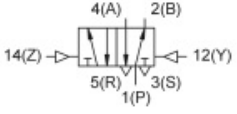
Electropneumatic

FINAL CONTROL ELEMENT

5/2-way pilot valve

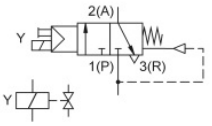


5/2-way double pilot valve

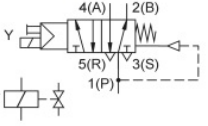


Pneumatic

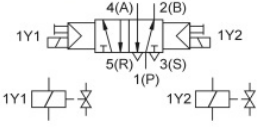
3/2-way solenoid valve, normally closed



5/2-way solenoid valve



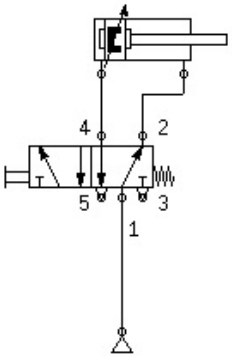
5/2-way double solenoid valve



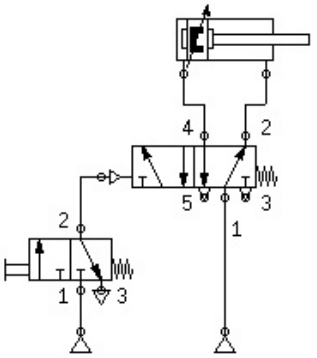
Indicator and distributor plate, electrical

Electropneumatic

KENDALI SECARA LANGSUNG DAN TIDAK LANGSUNG

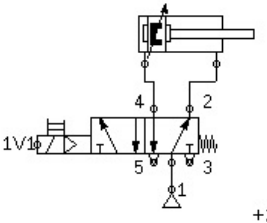


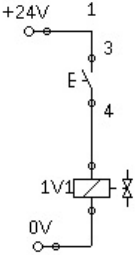
Langsung



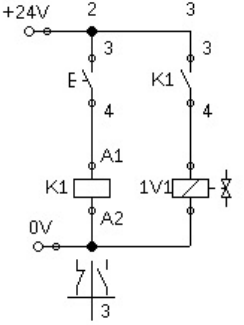
Tidak Langsung

Pneumatic





Langsung



Tidak Langsung

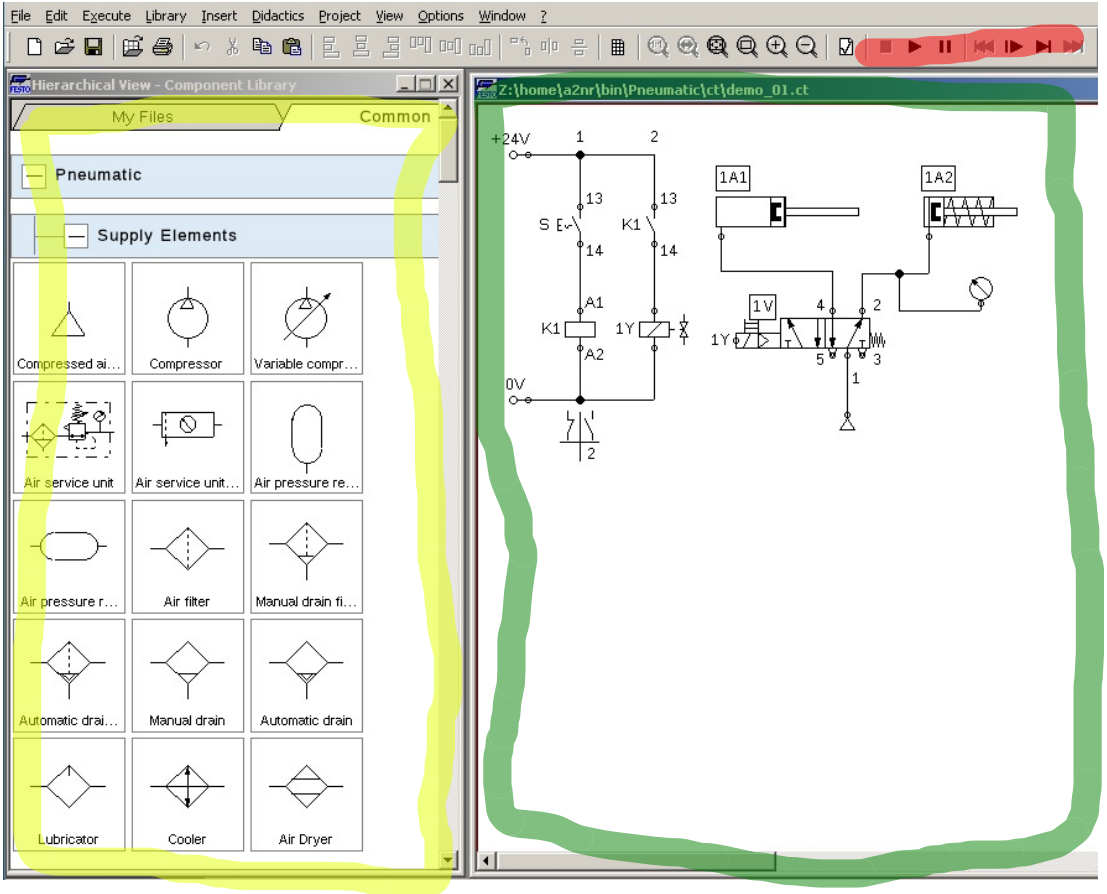
Electropneumatic

Mendesain Rangkaian Dengan FluidSim

*Untuk mencari komponen

*untuk meletakkan komponen

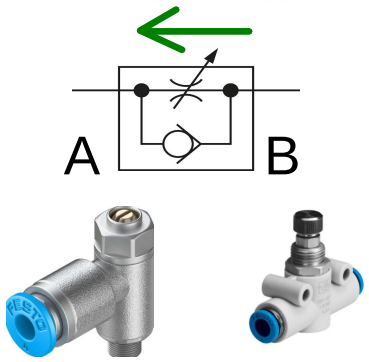
*untuk menjalankan simulasi

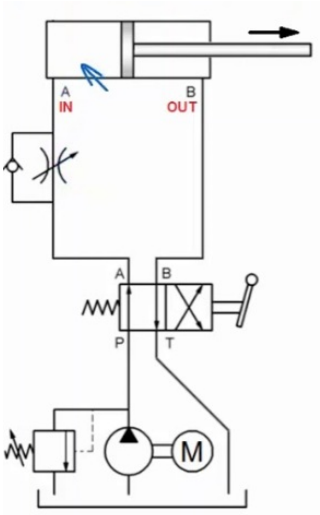


PRAKTIKUM 1

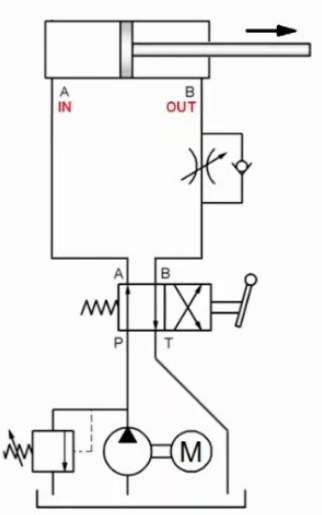
PROCESSING ELEMENT 1

One-way flow control valve



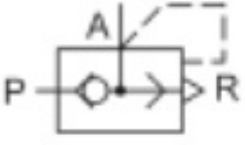


Meter-in for Extension
Uncontrolled for Retraction



Meter-out for Extension
Uncontrolled for Retraction

Quick exhaust valve

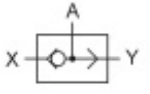


Pneumatic

PROCESSING ELEMENT 2

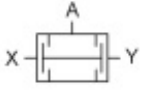
OR

Shuttle valve



AND

Dual-pressure valve



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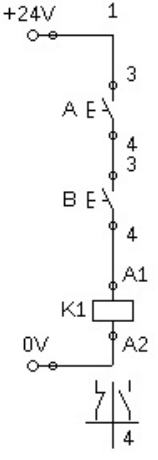

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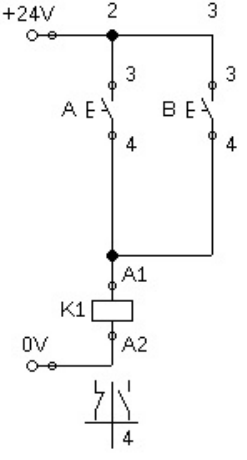


AND

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

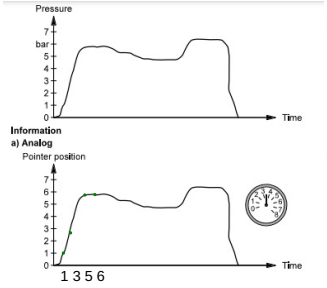
OR

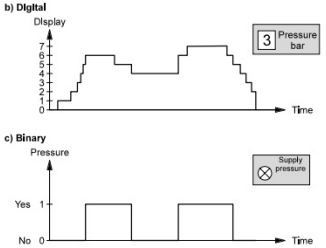
A	B	$A \vee B$
True	True	True
True	False	True
False	True	True
False	False	False

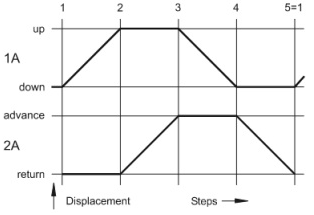
Pneumatic

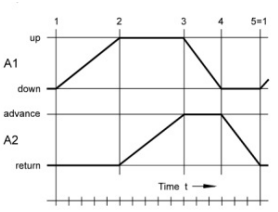
Electropneumatic

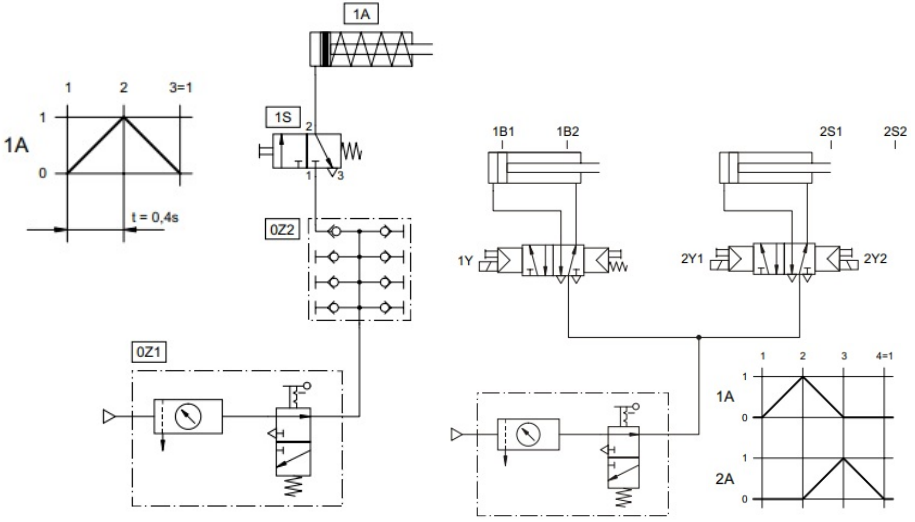
Grafik Pergerakan Pneumatic











PRAKTIKUM 2

PEMBERIAN LABEL KOMPONEN

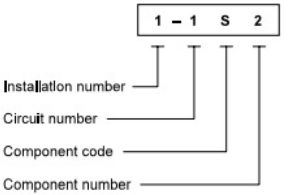


Fig. 6.21: Identification code for components in pneumatic circuit diagrams

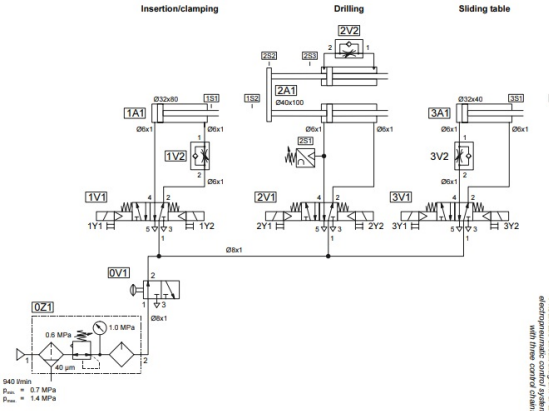
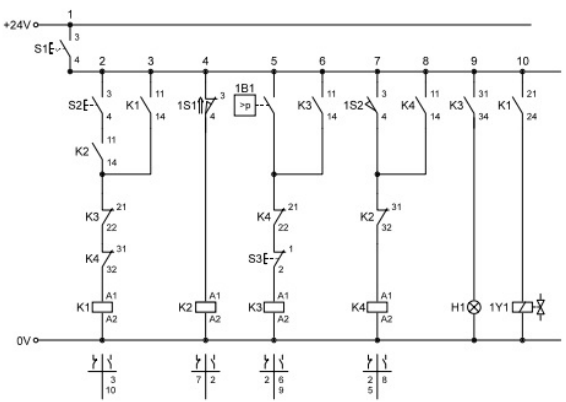


Fig. 6.20: Pneumatic circuit diagram of an electropneumatic control system with three control chains

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

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

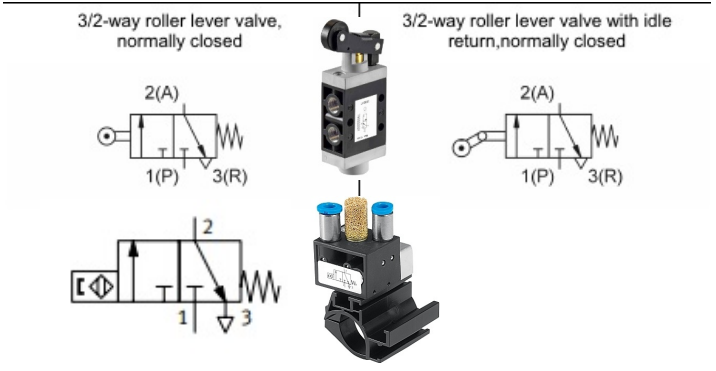
Components	*Identification*
Compressors	P
Power components	A
Drive motors	M
Sensors	S
Valves	V
Valve coils	Y*
Other components	Z**

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

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
Contactor	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



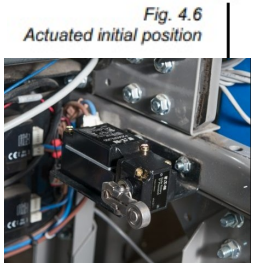
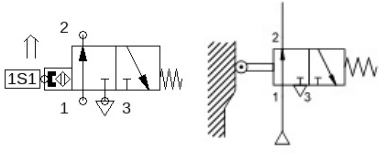
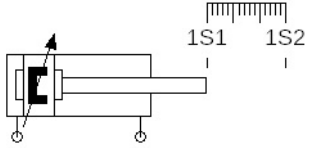
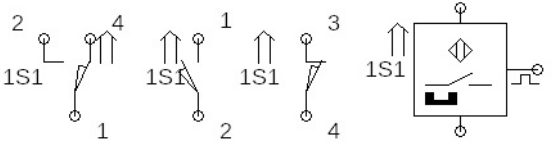


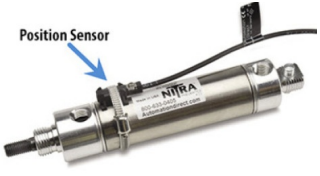
Fig. 4.6
Actuated initial position







Limit switch, electrical,
Actuation from left or right*

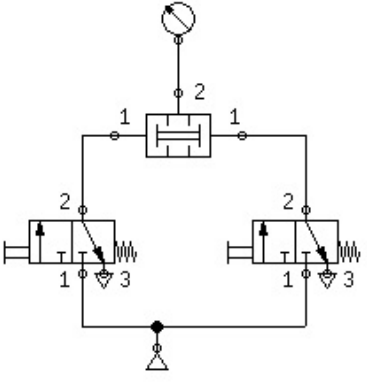


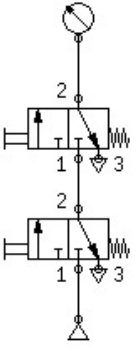
Pneumatic

Electropneumatic

PROCESSING
ELEMENT 3

Logika AND

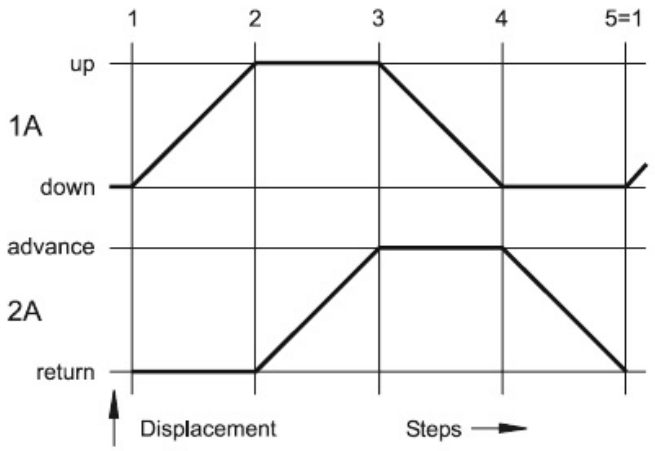


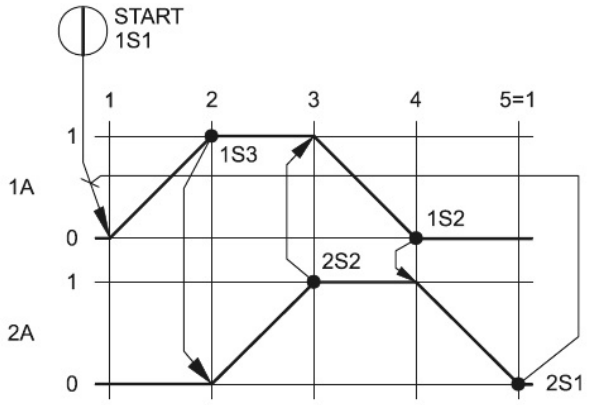


Pneumatic

Electropneumatic

Grafik Pergerakan Pneumatic 2





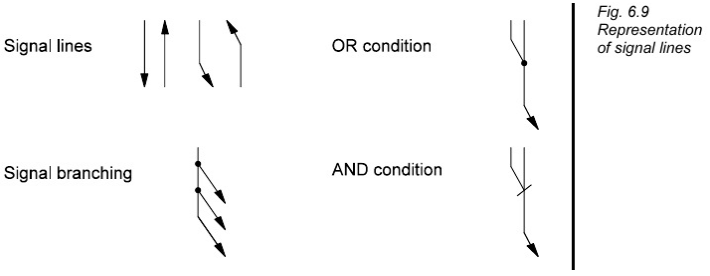
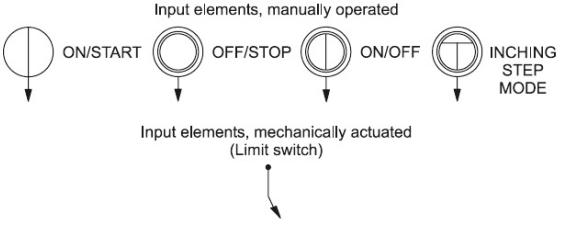


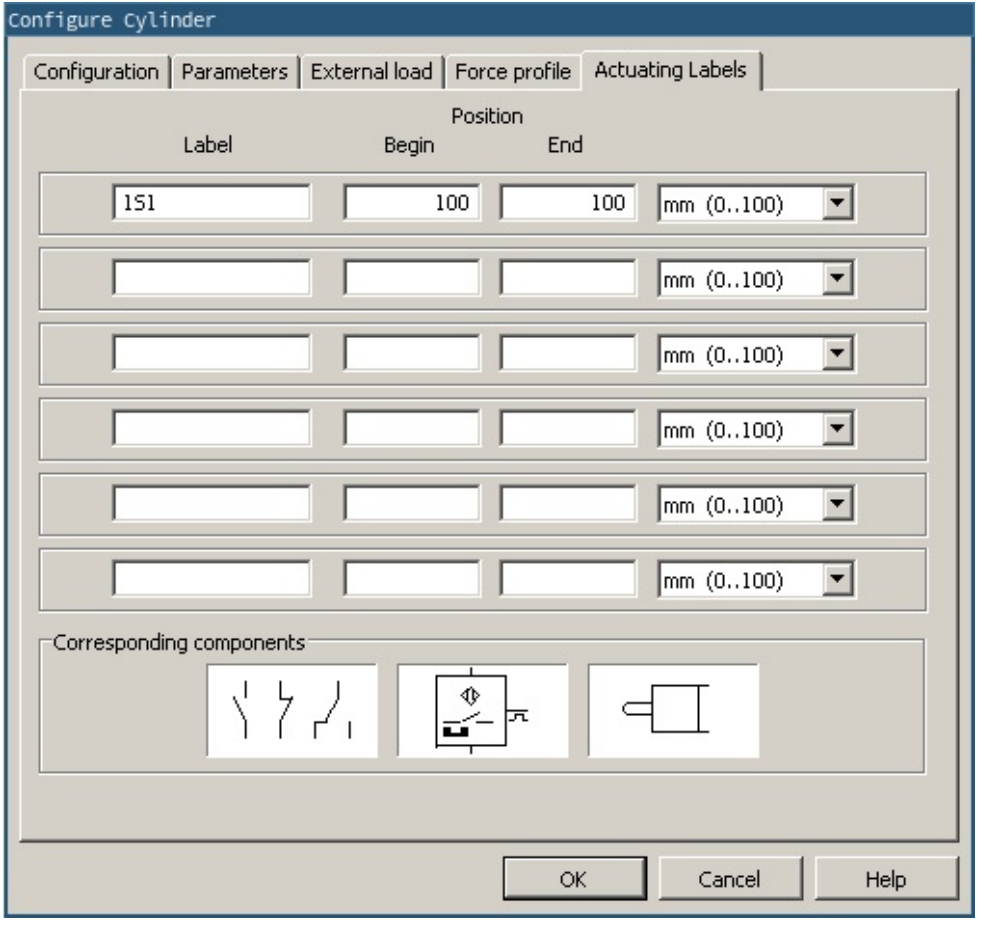
Fig. 6.9 Representation of signal lines

Fig. 6.10 Representation of input elements



buku Halaman 30

Cara memberikan label limit



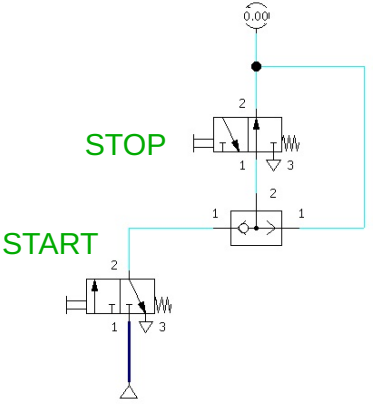
PRAKTIKUM 3

PROCESSING ELEMENT 3

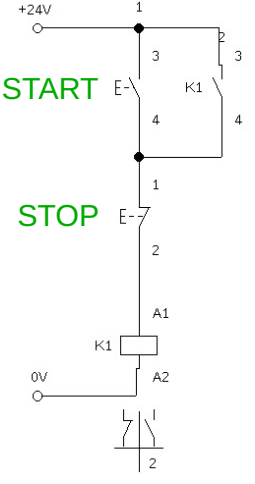
Dominan-OFF

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

Pneumatic



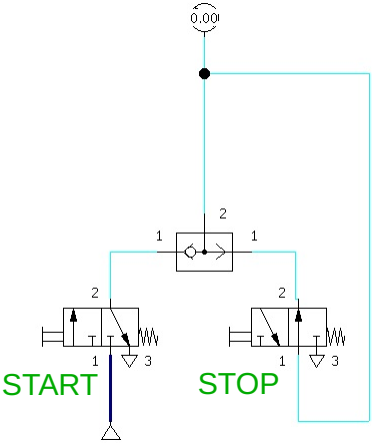
Electropneumatic



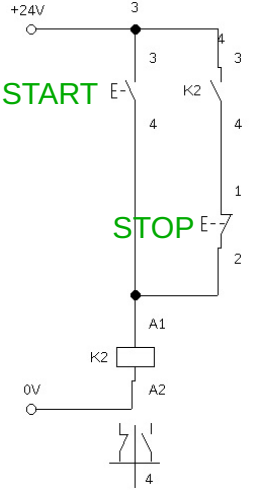
PROCESSING ELEMENT 3

Dominan-ON

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



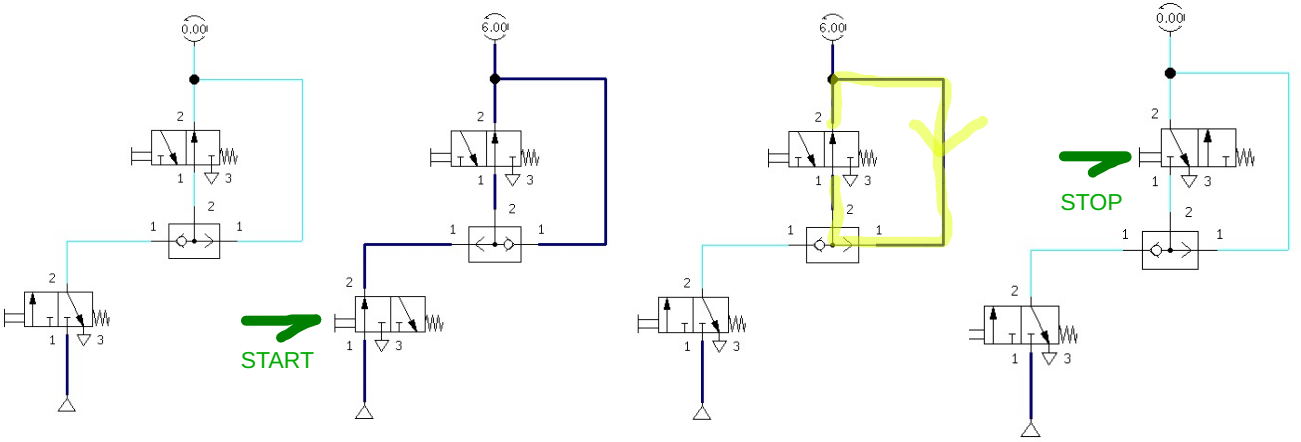
Pneumatic



Electropneumatic

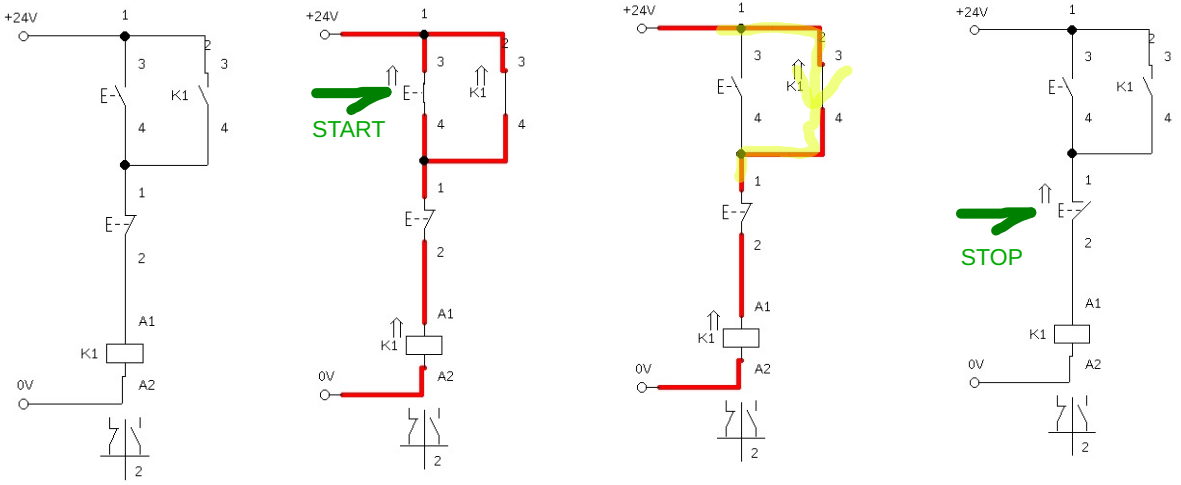
PROCESSING ELEMENT 3

Dominan-OFF



Pneumatic

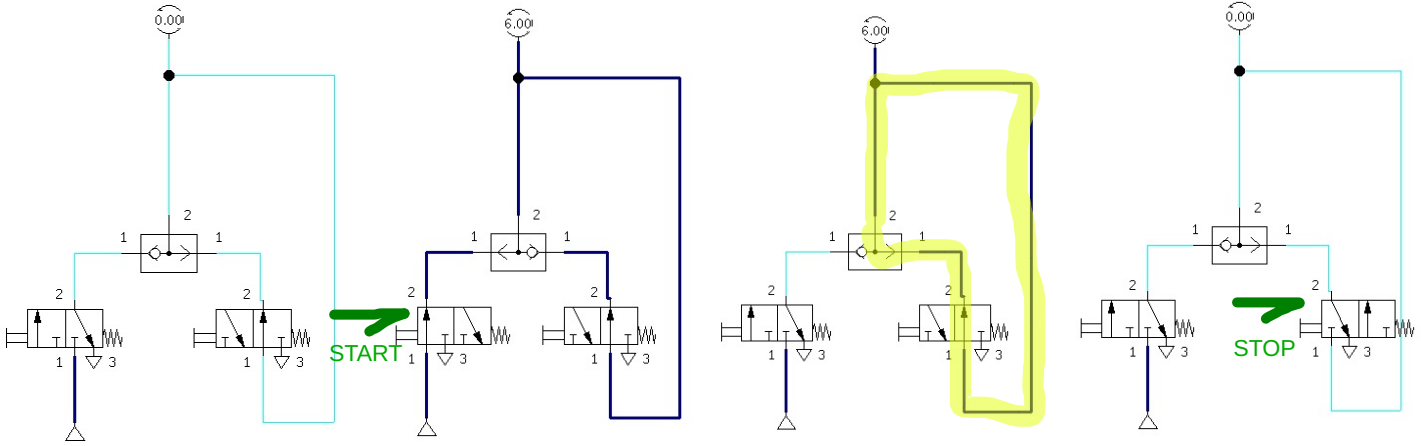
1 2 3 4



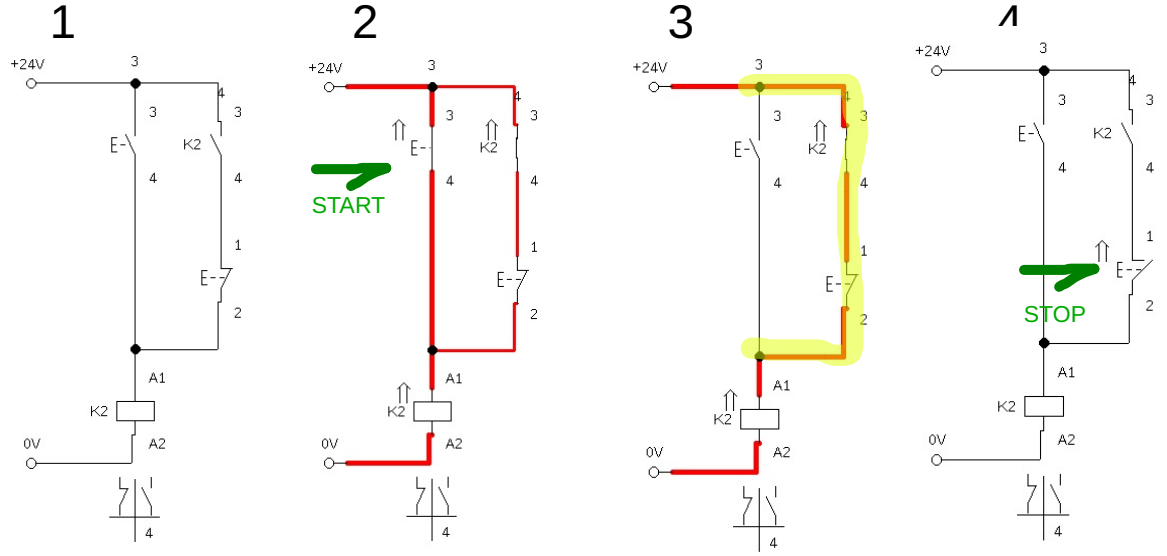
Electropneumatic

PROCESSING ELEMENT 3

Dominan-ON



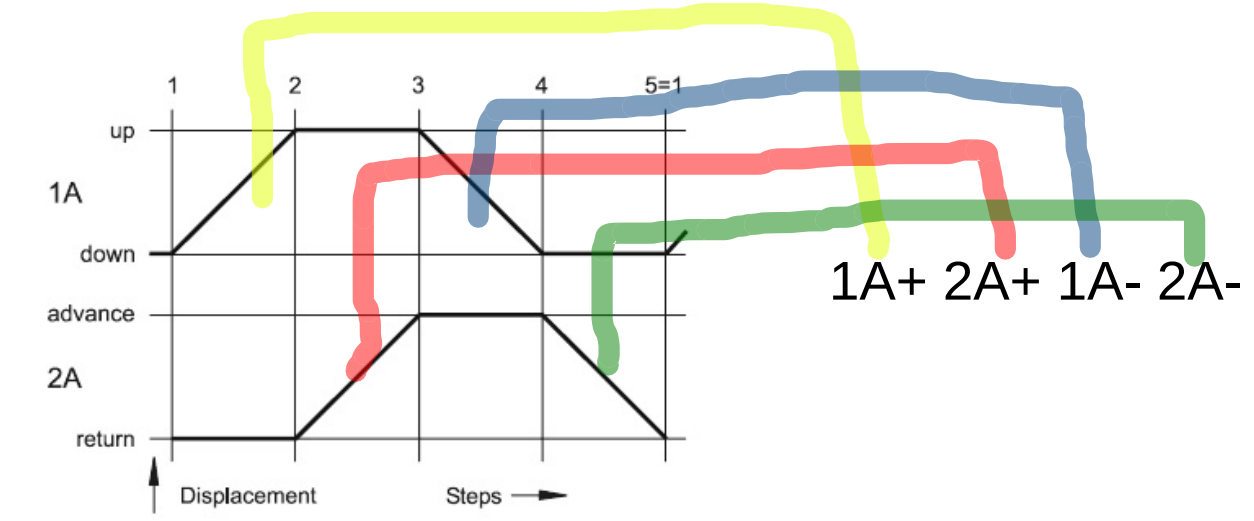
Pneumatic

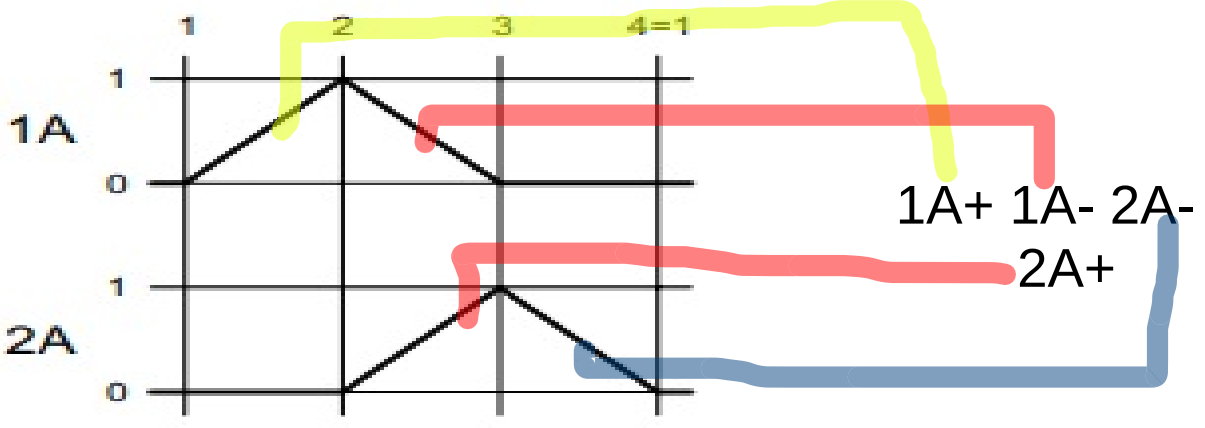


Electropneumatic

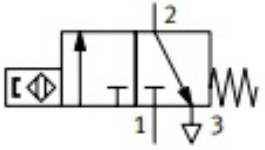
PRAKTIKUM 4

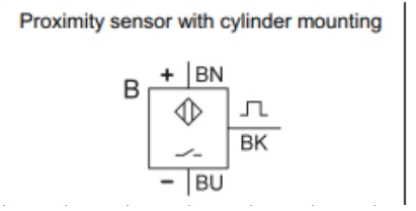
Grafik Pergerakan Pneumatic 3

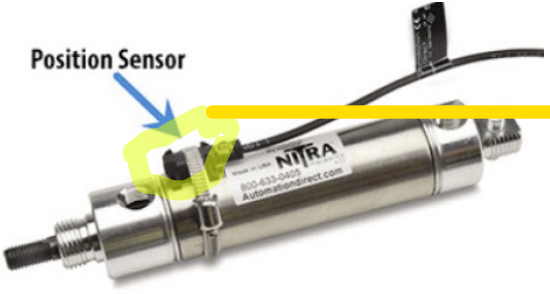


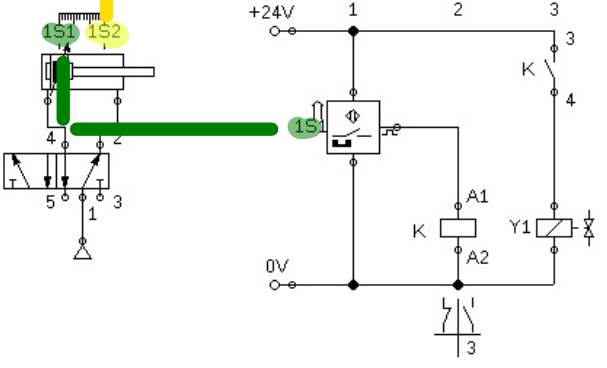


INPUT ELEMENT 3





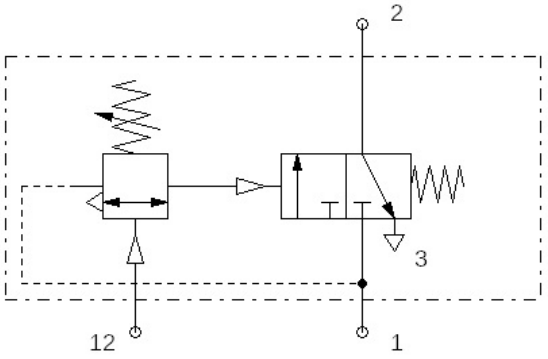




Pneumatic

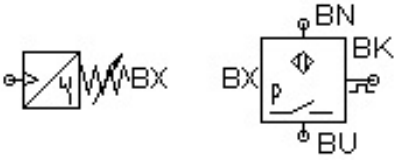
Electropneumatic

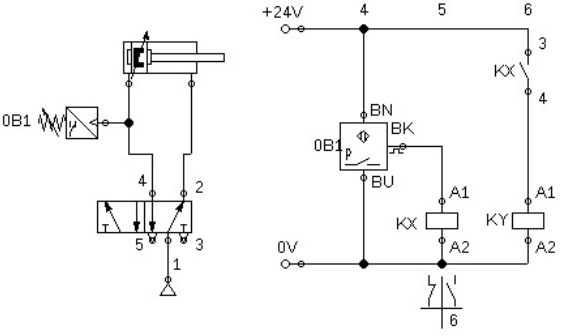
INPUT ELEMENT 3



Preasure Squance Valve

Pneumatic

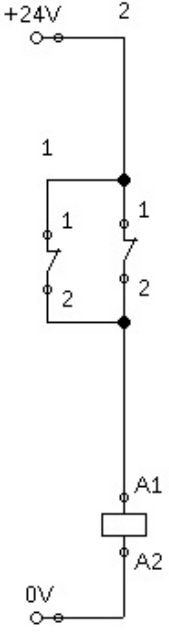




Electropneumatic

PROCESSING
ELEMENT 3

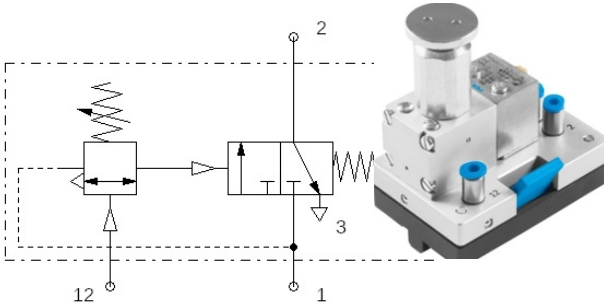
Logika NAND



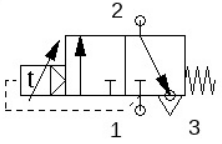
Pneumatic

Electropneumatic

INPUT ELEMENT 3



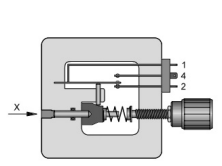
Preasure Squance Valve



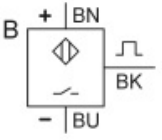
Pneumatic Timer, Normaly Close

Pneumatic

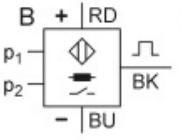
Fig. 3.12: Piston-actuated pressure switch

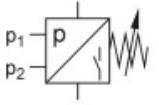


Proximity sensor with cylinder mounting



Pneumatic-electric converter

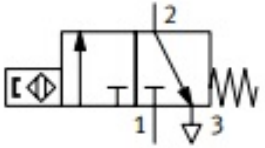


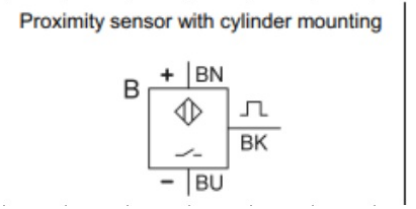


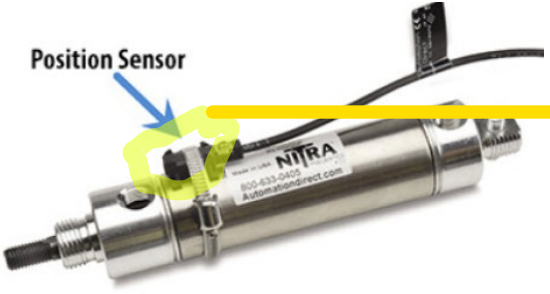
Electropneumatic

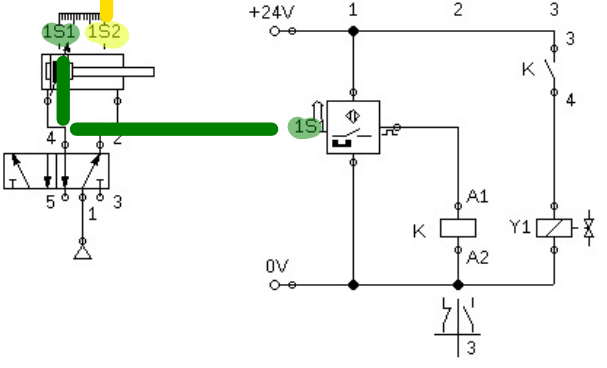
PRAKTIKUM 5

INPUT ELEMENT 3





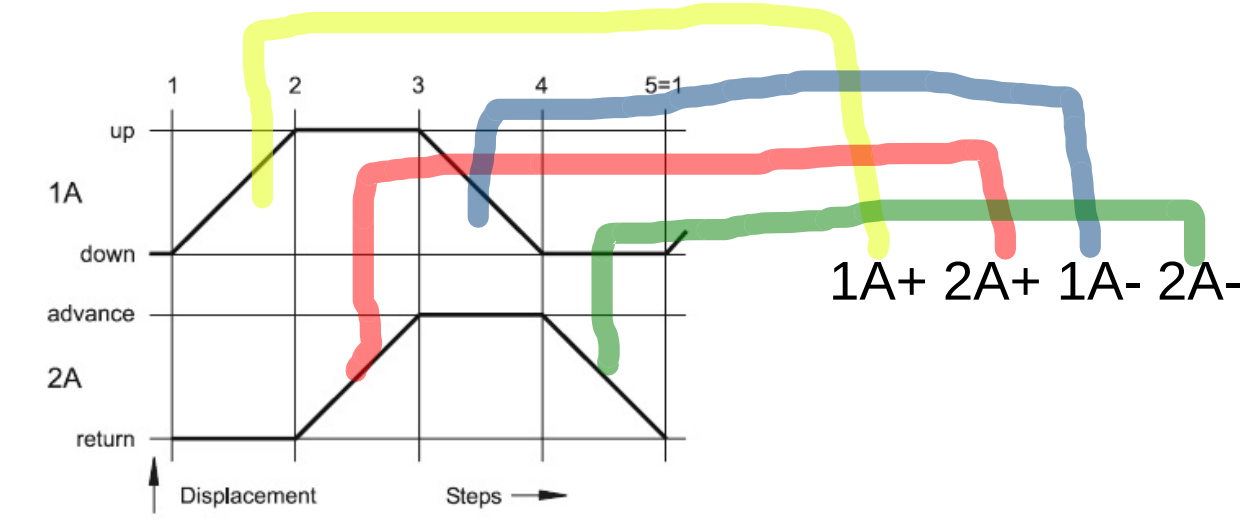


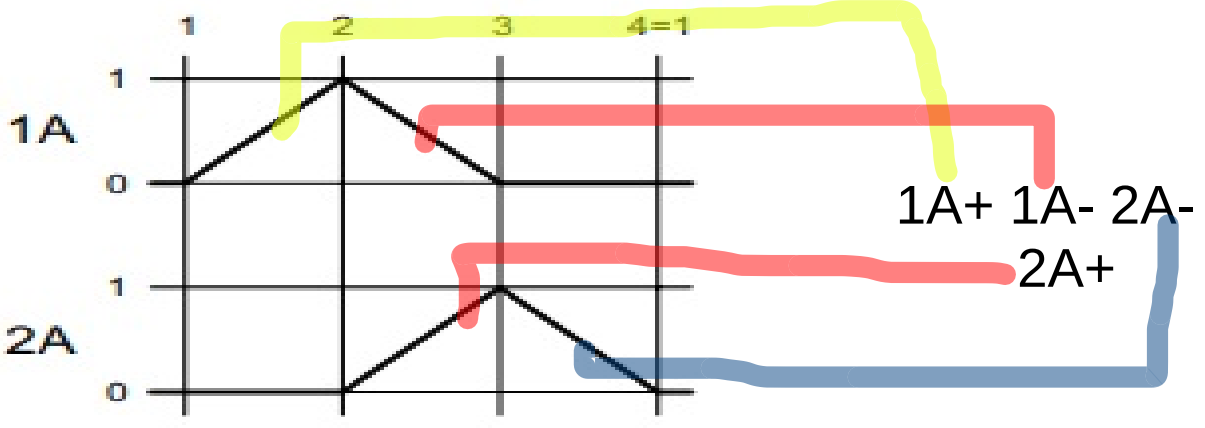


Pneumatic

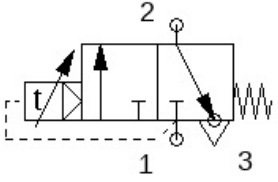
Electropneumatic

Grafik Pergerakan Pneumatic 3



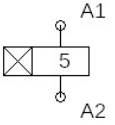


INPUT ELEMENT 3

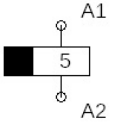


Pneumatic Timer, Normaly Close

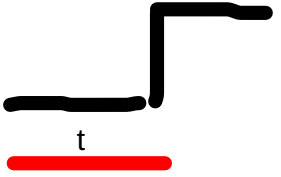
Pneumatic

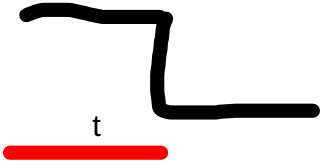


Switch-On Delay



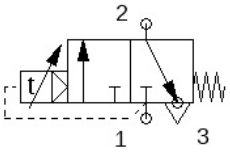
Switch-Off Delay



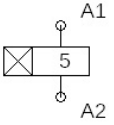


Electropneumatic

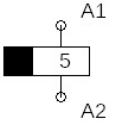
INPUT ELEMENT 3



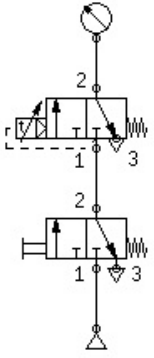
Pneumatic Timer, Normaly Close



Switch-On Delay



Switch-Off Delay



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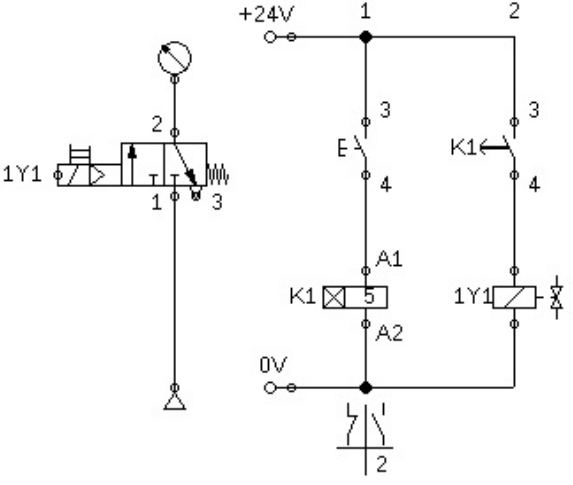
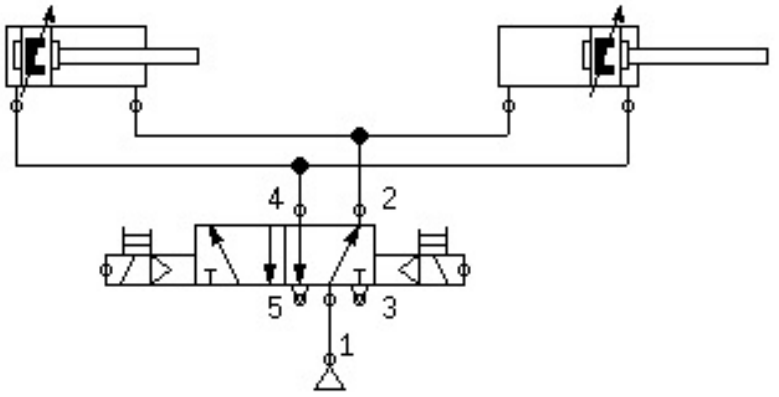


Electropneumatic

PRAKTIKUM 6

Mengendalikan Silinder Lebih Dari Satu

secara langsung

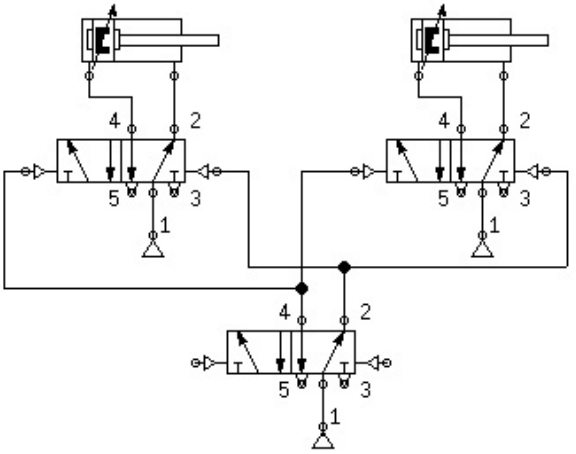


+ Satu valve mengendalikan banyak aktuator
+ Satu aktuator mempresentasikan kondisi aktuator lain

- Kendali setiap aktuator terbatas
- Gaya dorong satu valve terbagi menjadi dua

Mengendalikan Silinder Lebih Dari Satu

secara tidak langsung



+ Satu valve mengendalikan banyak aktuator
+ Banyak kombinasi gerak yang bisa dilakukan
+ Gaya dorong yang kuat dan sama

- Rangkaian menjadi kompleks
- Banyak membutuhkan komponen

PRAKTIKUM 7