PELAJARAN HARI INI

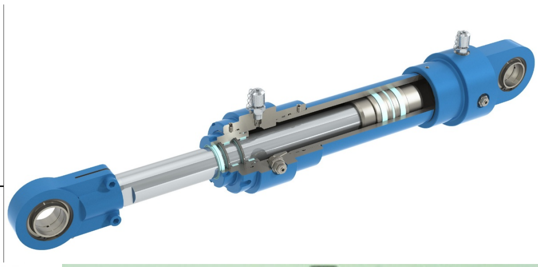
1. Fisika Dasar dan Satuan yang berkaitan dengan Sistem Pneumatik
2. Urutan Perangkat Penyuplai Angin
3. Cara Kerja Katup Sistem Pneumatik

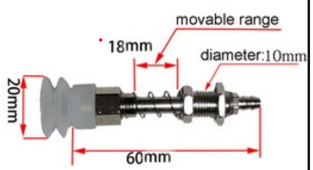
APA YANG DIKENDALIKAN DI SISTEM PNEUMATIC?

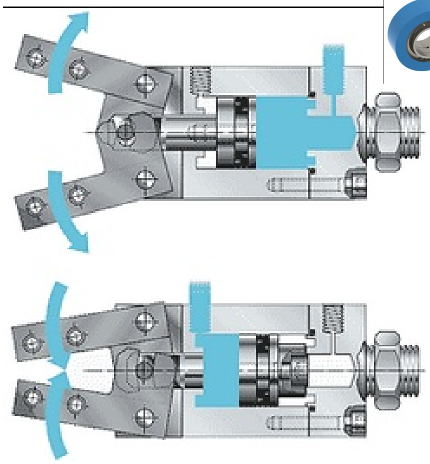
Actuators can be further broken down into groups:

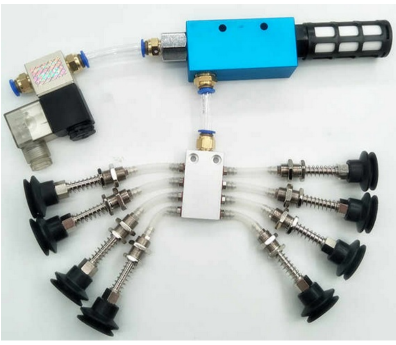
- Linear actuators
  - – Single-acting cylinder
  - – Double-acting cylinder
- Rotary actuators
  - – Air motors
  - – Rotary actuators

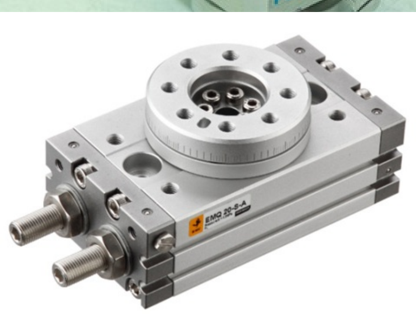
Fig. 2.13
Actuators, linear and rotary



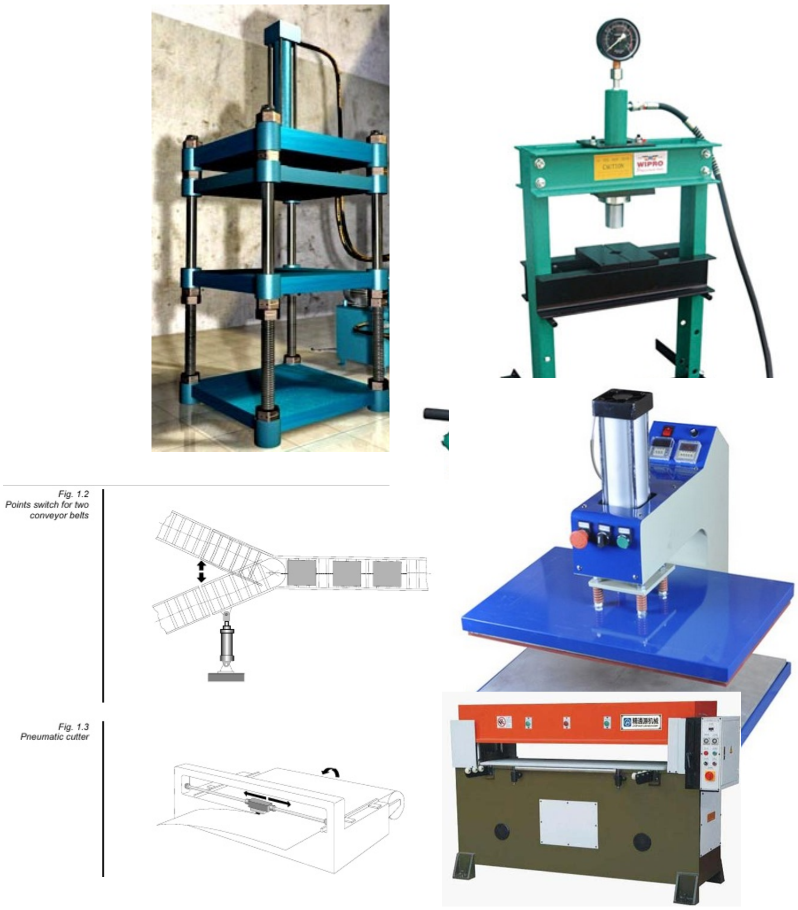




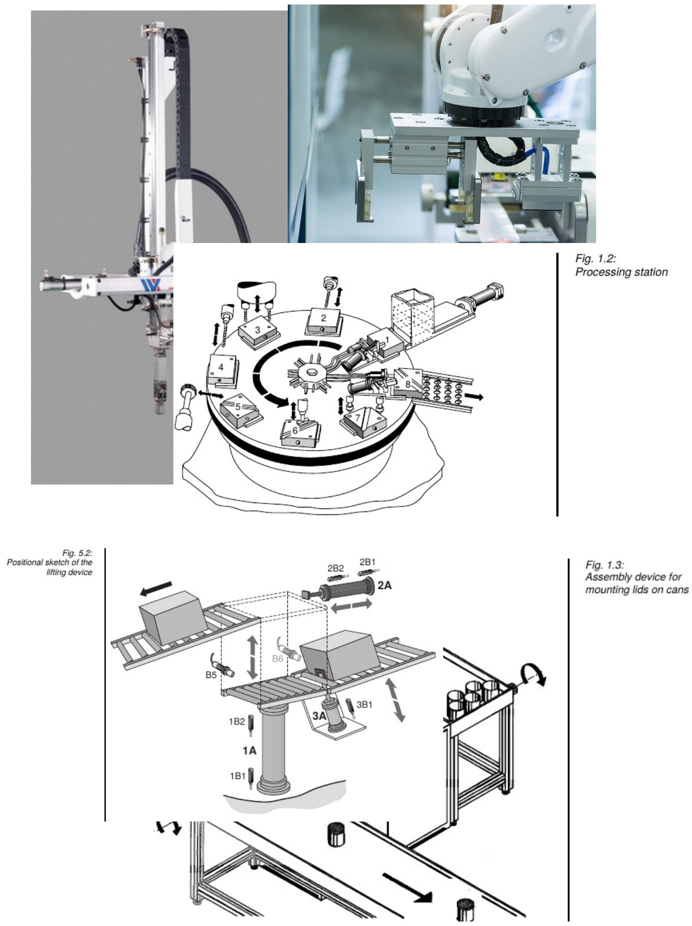




UNTUK APA AKTUATORNYA?



Pneumatic



Electropneumatic

Mengenal Angin Bertekanan

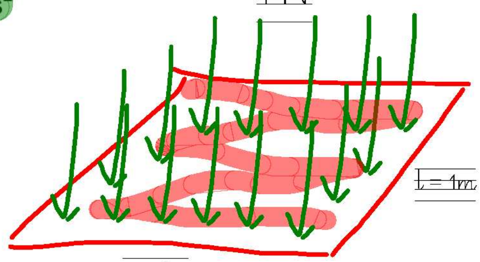
Basic units	Quantity	Symbol	Units
Panjang	Length	L	Meter (m)
Berat	Mass	m	Kilogram (kg)
Waktu	Time	t	Second (s)
Suhu	Temperature	T	Kelvin (K, 0 °C = 273.15 K)

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

1 N



L = 1m

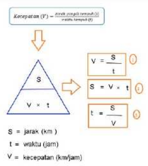
p = 1m

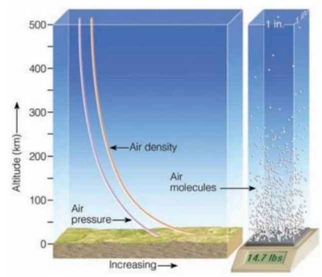
Rumus Percepatan:

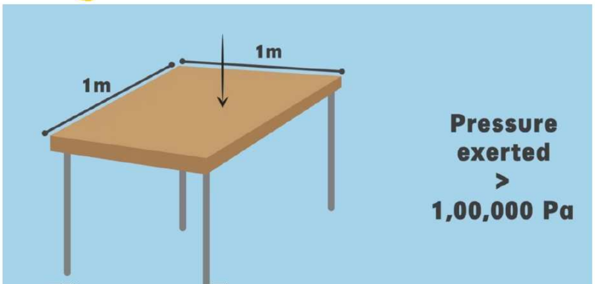
$$a = \frac{v_t - v_0}{t}$$

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

Akselerasi a m/(s2)



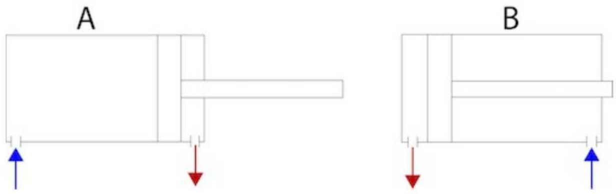




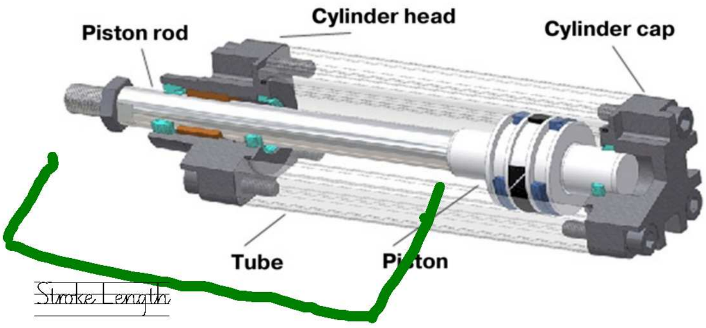
https://www.youtube.com/watch?v=28qr7dfexT8

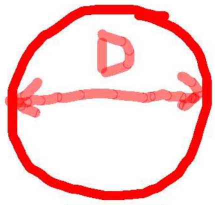
Menentukan Silinder

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



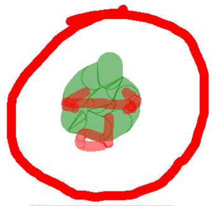
Components of a piston rod cylinder:





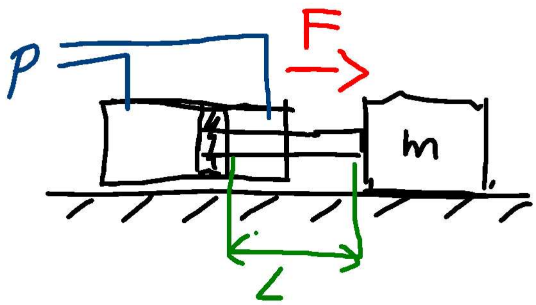
Piston Tampak Belakang (Forward)

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



Piston Tampak Depan (Retract)

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



$$F = m\,a$$

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

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

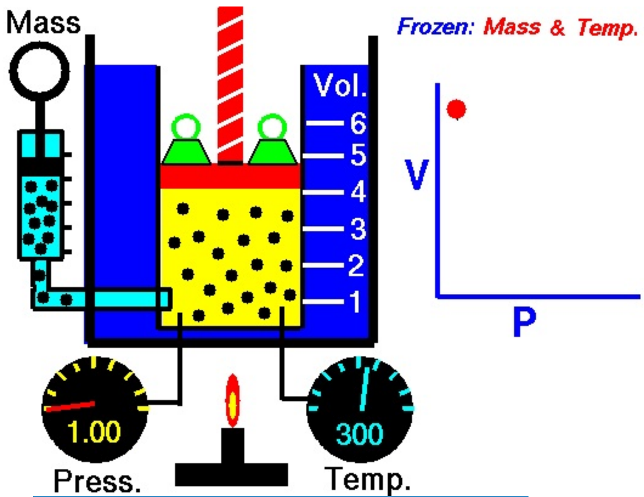
$$\boxed{F = m \cdot \frac{L}{t^2}}$$

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

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

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

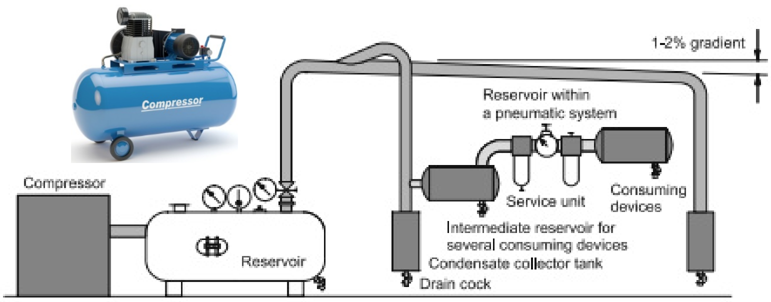
Karakteristik Angin

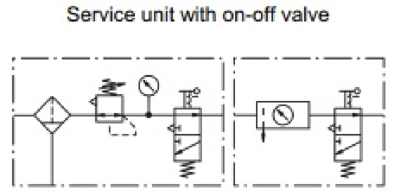


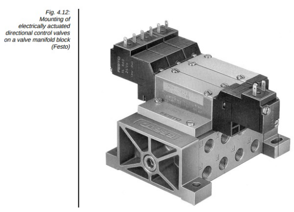
https://upload.wikimedia.org/wikipedia/commons/1/15/Boyles_Law_animated.gif

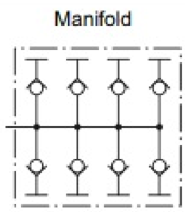
le

SUPLAY ELEMENT









Pneumatic

Electropneumatic

BAGIAN BAGIAN DARI PNEUMATIC

Fig. 5.2:
Positional sketch of the lifting device

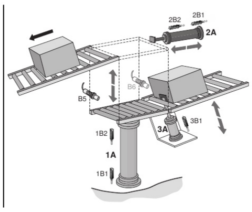


Fig. 1.7:
Signal flow and components of a pneumatic control system

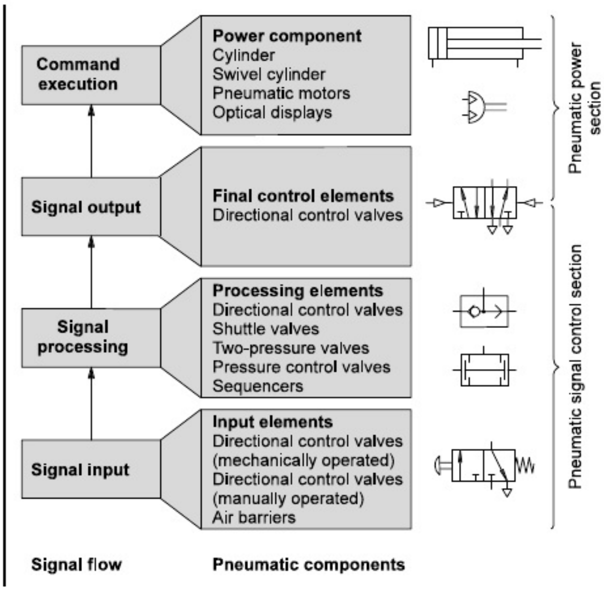
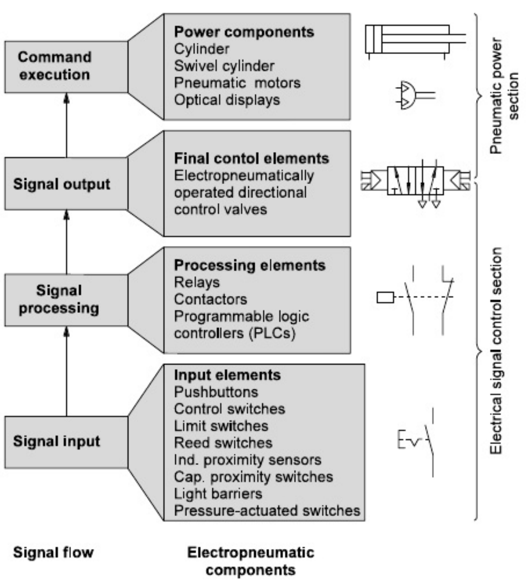


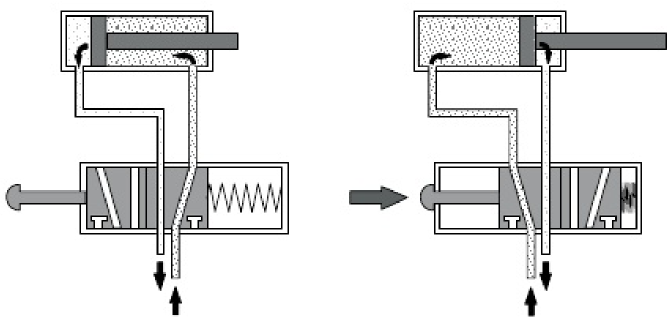
Fig. 1.8:
Signal flow and components of an electropneumatic control system



Pneumatic

Electropneumatic

BAGAIMANA MENGENDALIKAN AKTUATORNYA?



Pneumatic

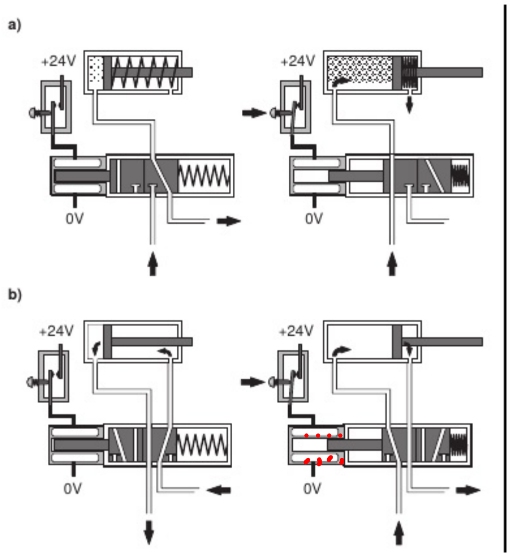
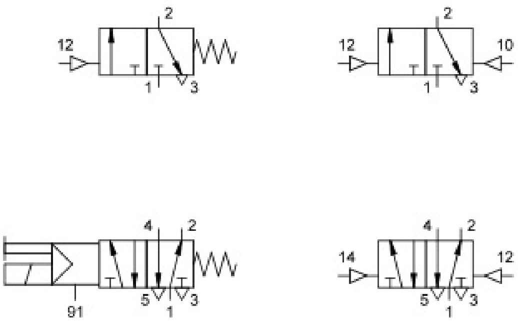


Fig. 4.1: Actuation of a pneumatic cylinder a) Single-acting b) Double-acting

Electropneumatic

MENGENAL VALVE 1



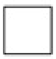
Working lines

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

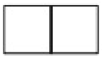
Pilot lines

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

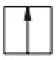
Valve switching positions
are represented as squares



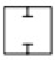
The number of squares shows how many
switching positions the valve has



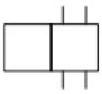
Lines indicate flow paths,
arrows shows the direction of flow



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

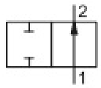


The connections (inlet and outlet ports) are shown
by lines on the outside of the box

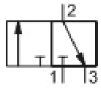


Number of ports
Number of positions

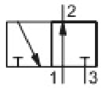
2/2 – Way directional control valve, normally open



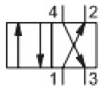
3/2 – Way directional control valve, normally closed



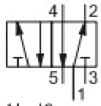
3/2 – Way directional control valve, normally open



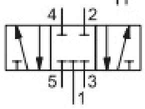
4/2 – Way directional control valve
Flow from 1 → 2 and from 4 → 3



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

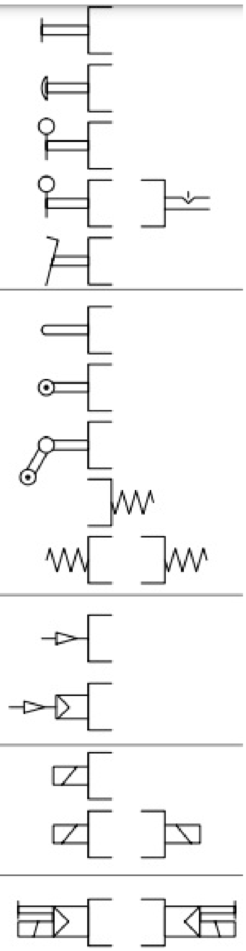


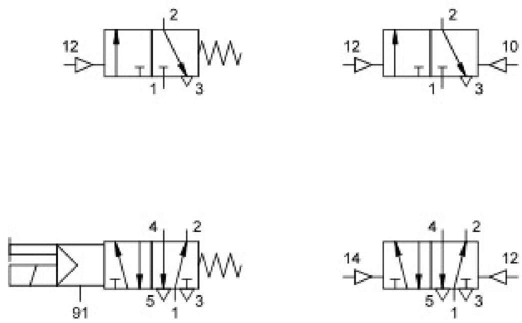
5/3 – Way directional control valve
Mid position closed



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

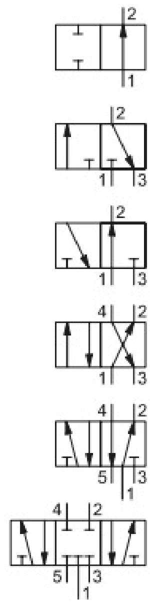
3/2 – Way directional control valve, normally closed

3/2 – Way directional control valve, normally open

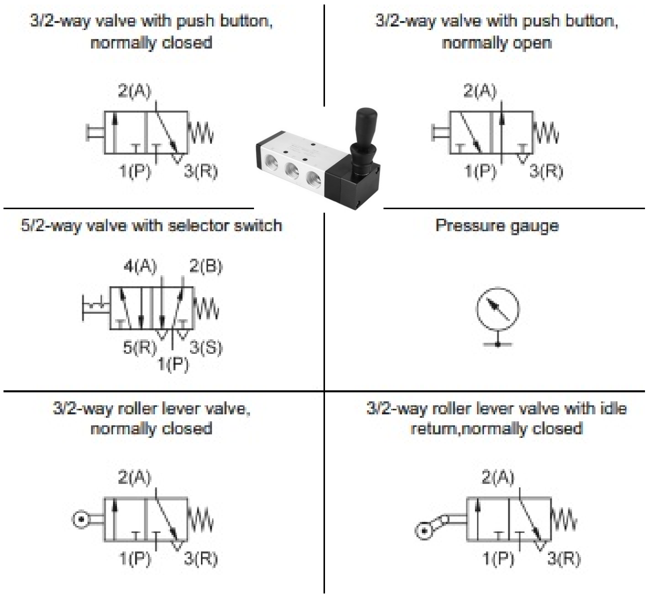
4/2 – Way directional control valve
Flow from 1 → 2 and from 4 → 3

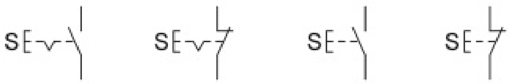
5/2 – Way directional control valve
Flow from 1 → 2 and von 4 → 5

5/3 – Way directional control valve
Mid position closed



INPUT ELEMENT 1





Pneumatic

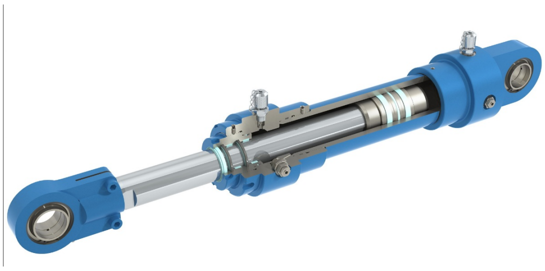
Electropneumatic

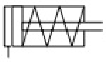
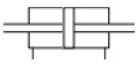
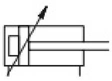
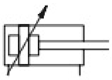
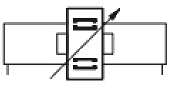
POWER COMPONEN

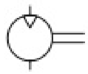
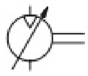
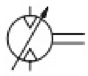
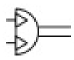
Actuators can be further broken down into groups:

- 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

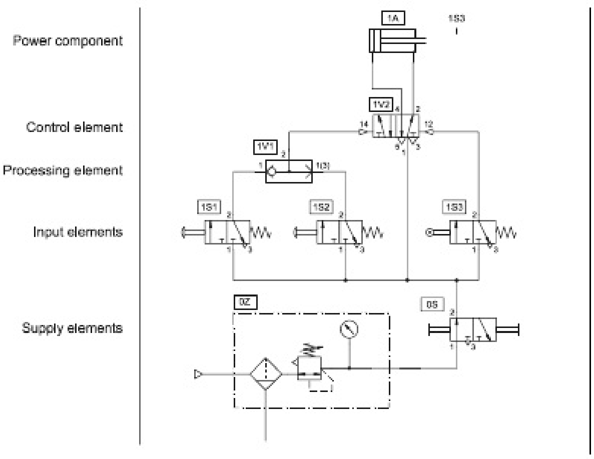
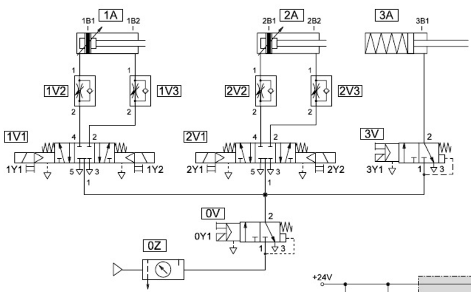


Fig. 4.3
Circuit diagram

Pneumatic

Fig. 5.5:
Pneumatic circuit diagram
of the lifting device



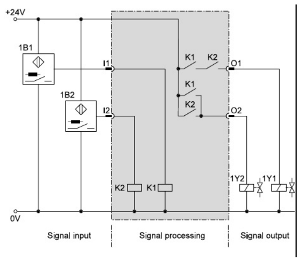
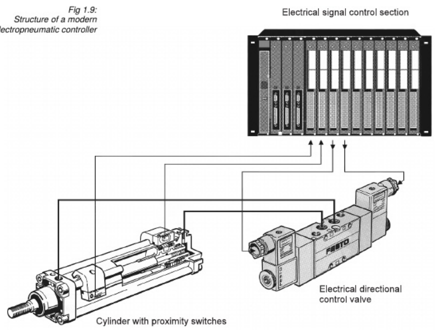


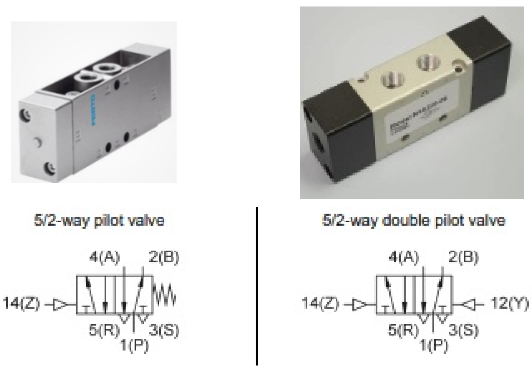
Fig. 3.20.
Signal control section of
relay control system
(schematic, circuit diagram
not compliant with standard)

Fig 1.9:
Structure of a modern
electropneumatic controller

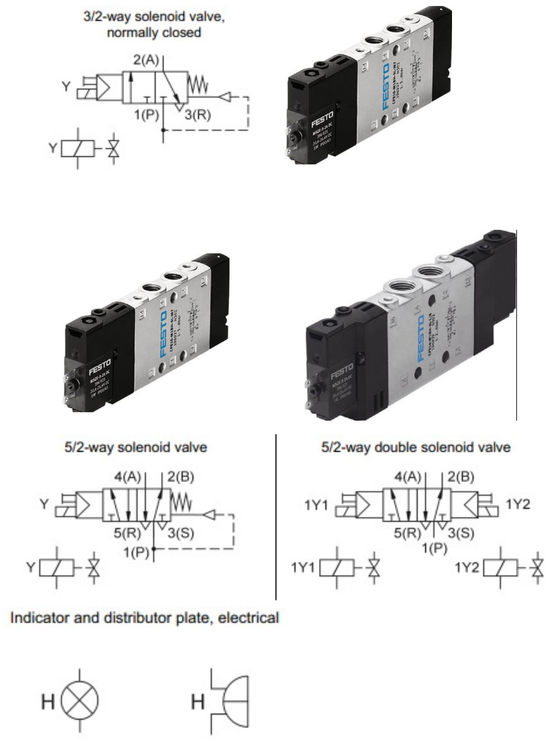


Electropneumatic

FINAL CONTROL ELEMENT

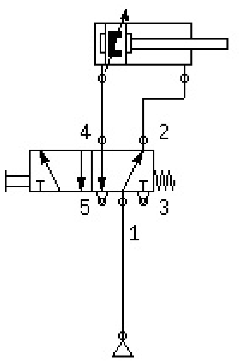


Pneumatic

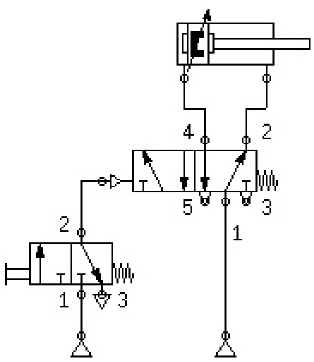


Electropneumatic

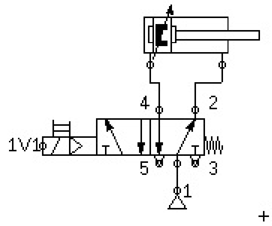
KENDALI SECARA LANGSUNG
DAN TIDAK LANGSUNG

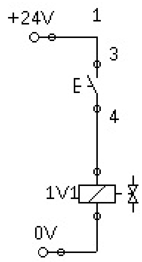


Langsung

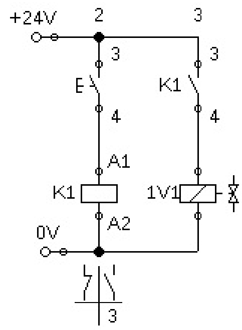


Tidak Langsung





Langsung



Tidak Langsung

Pneumatic

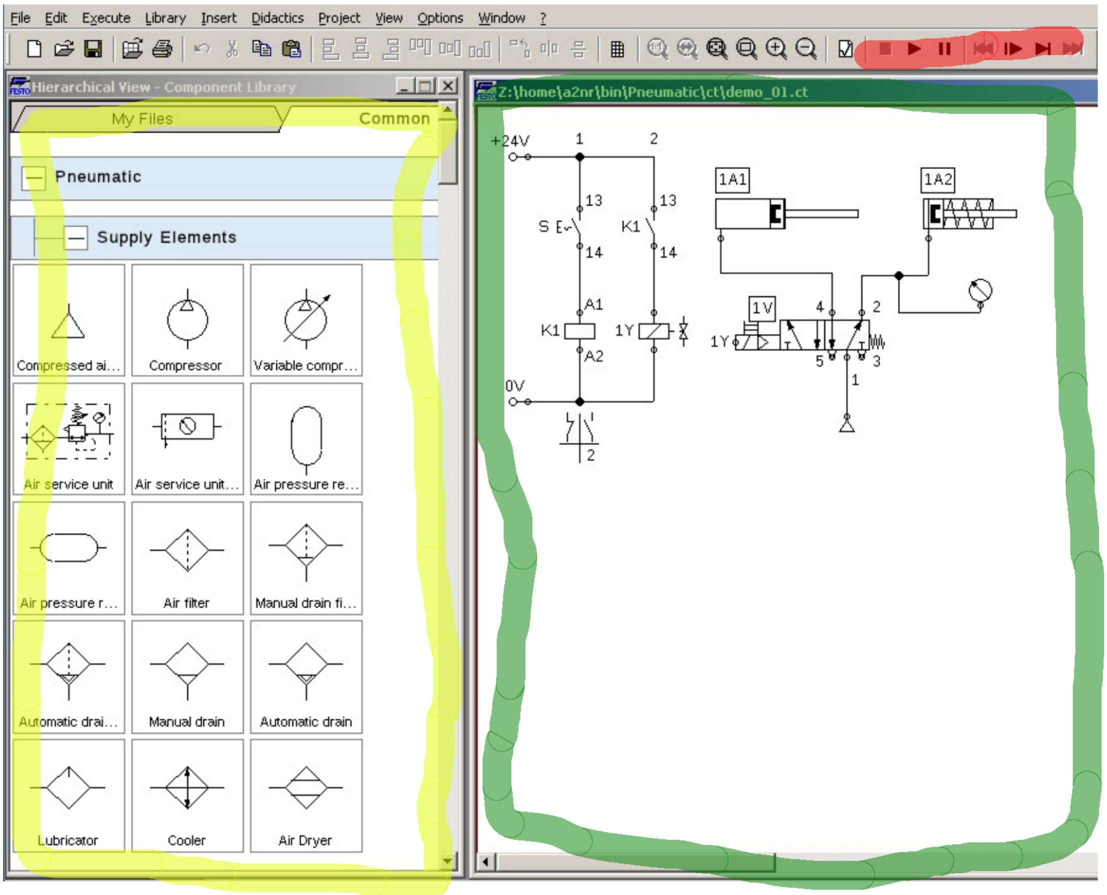
Electropneumatic

Mendesain Rangkaian Dengan FluidSim

*Untuk mencari komponen

*untuk meletakkan komponen

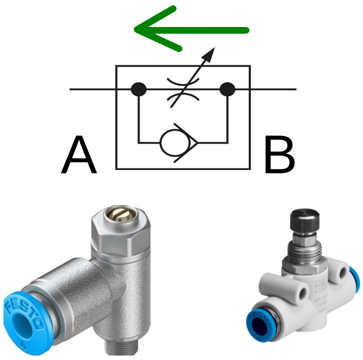
*untuk menjalankan simulasi

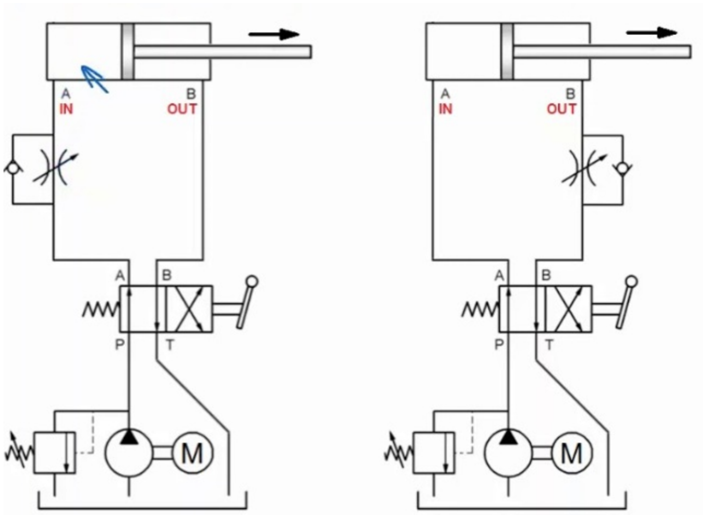


PRAKTIKUM 1

PROCESSING ELEMENT 1

One-way flow control valve

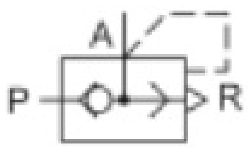




Meter-in for Extension
Uncontrolled for Retraction

Meter-out for Extension
Uncontrolled for Retraction

Quick exhaust valve

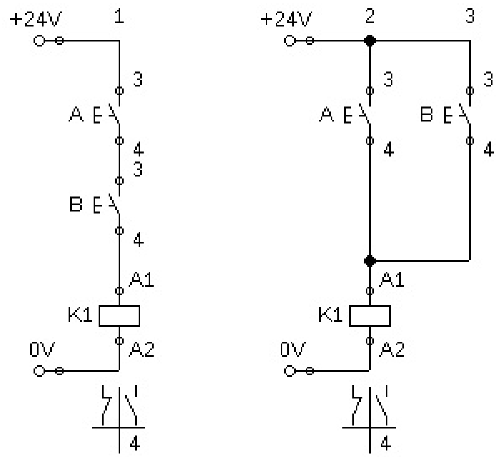


Pneumatic

PROCESSING ELEMENT 2

OR AND

AND OR



AND

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

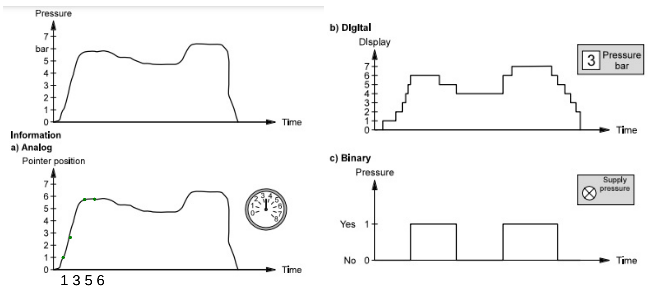
OR

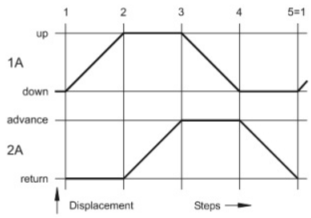
A	B	$A \vee B$
True	True	True
True	False	True
False	True	True
False	False	False

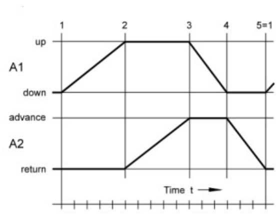
Pneumatic

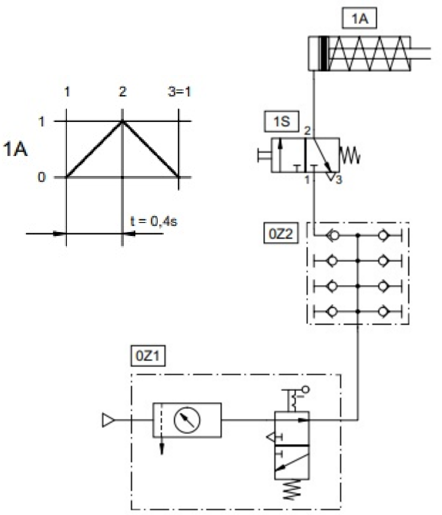
Electropneumatic

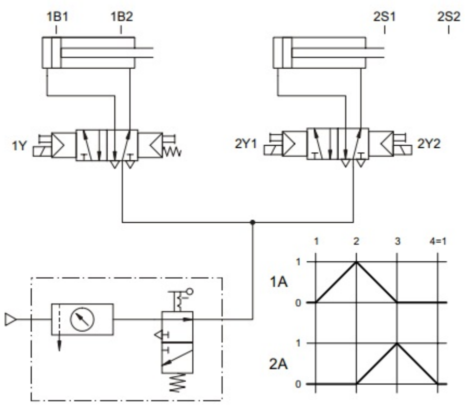
Grafik Pergerakan Pneumatic











PRAKTIKUM 2

PEMBERIAN LABEL KOMPONEN

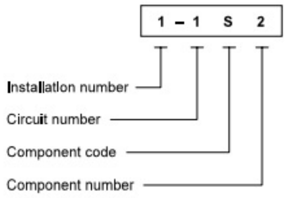


Fig. 6.21: Identification code for components in pneumatic circuit diagrams

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

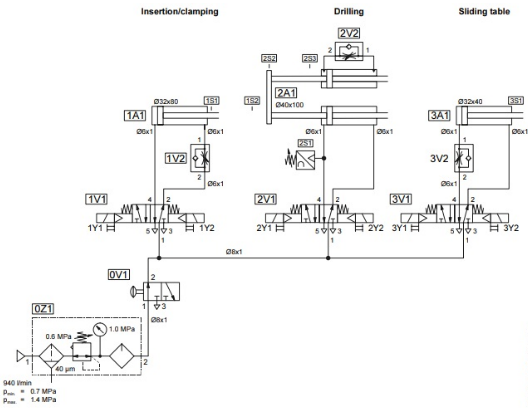
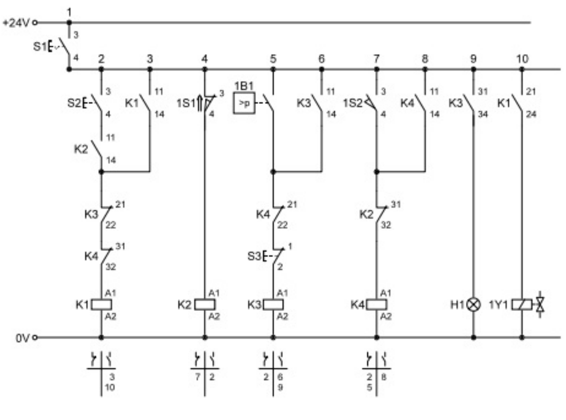


Fig. 6.20: Pneumatic circuit diagram of an electropneumatic control system with three control chains

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

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

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

INPUT ELEMENT 2

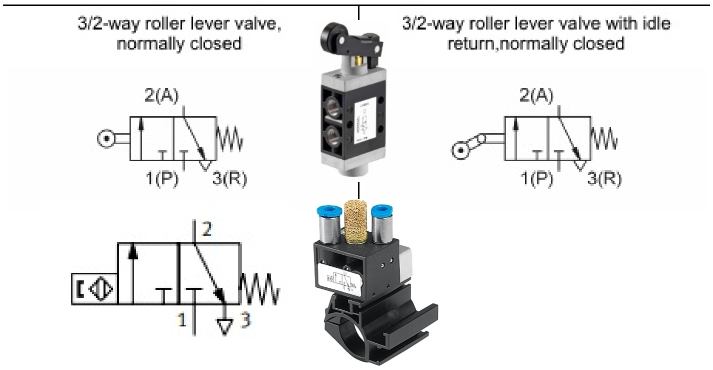
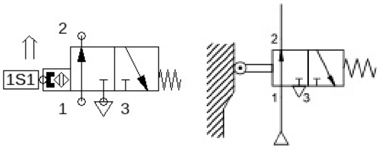
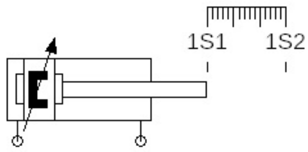
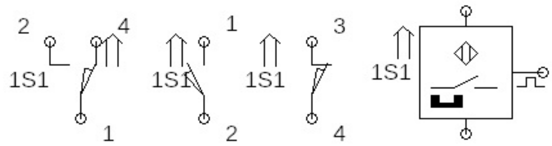


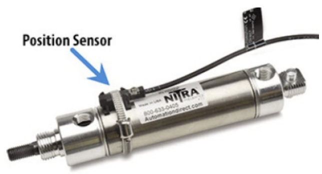
Fig. 4.6
Actuated initial position







Limit switch, electrical,
Actuation from left or right*

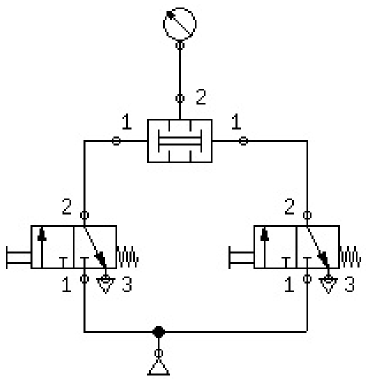


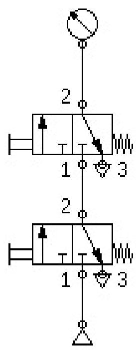
Pneumatic

Electropneumatic

PROCESSING
ELEMENT 3

Logika AND

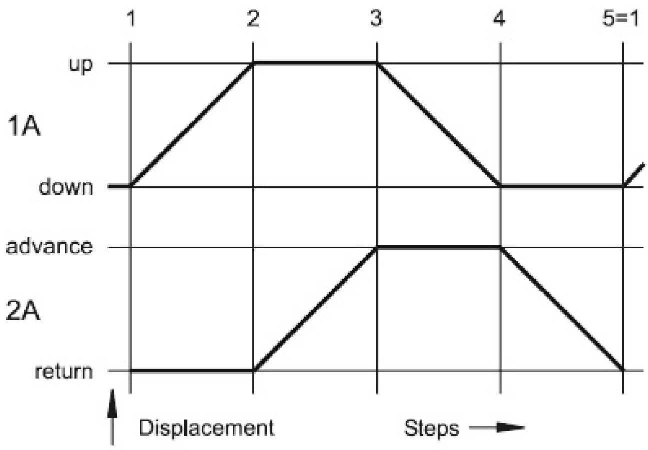




Pneumatic

Electropneumatic

Grafik Pergerakan Pneumatic 2



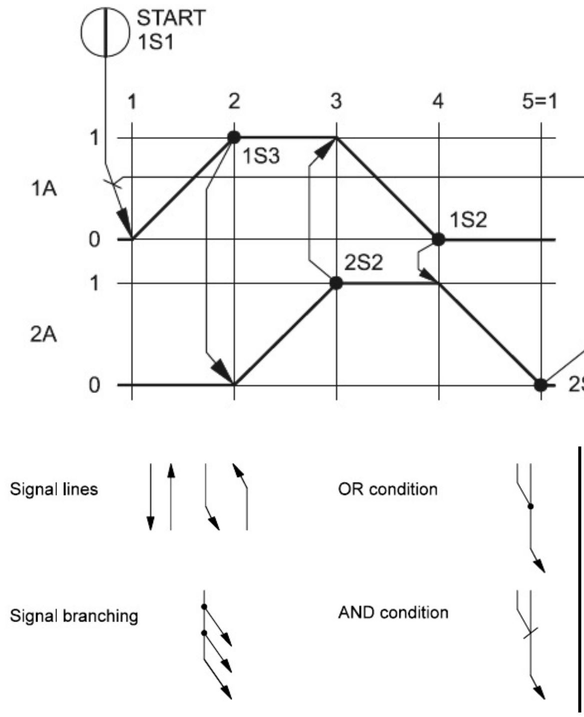
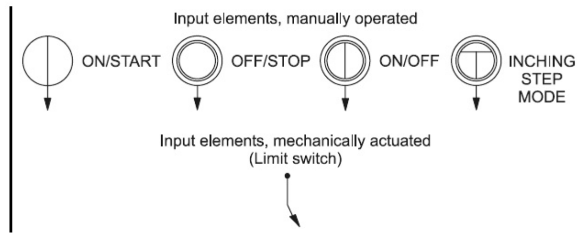


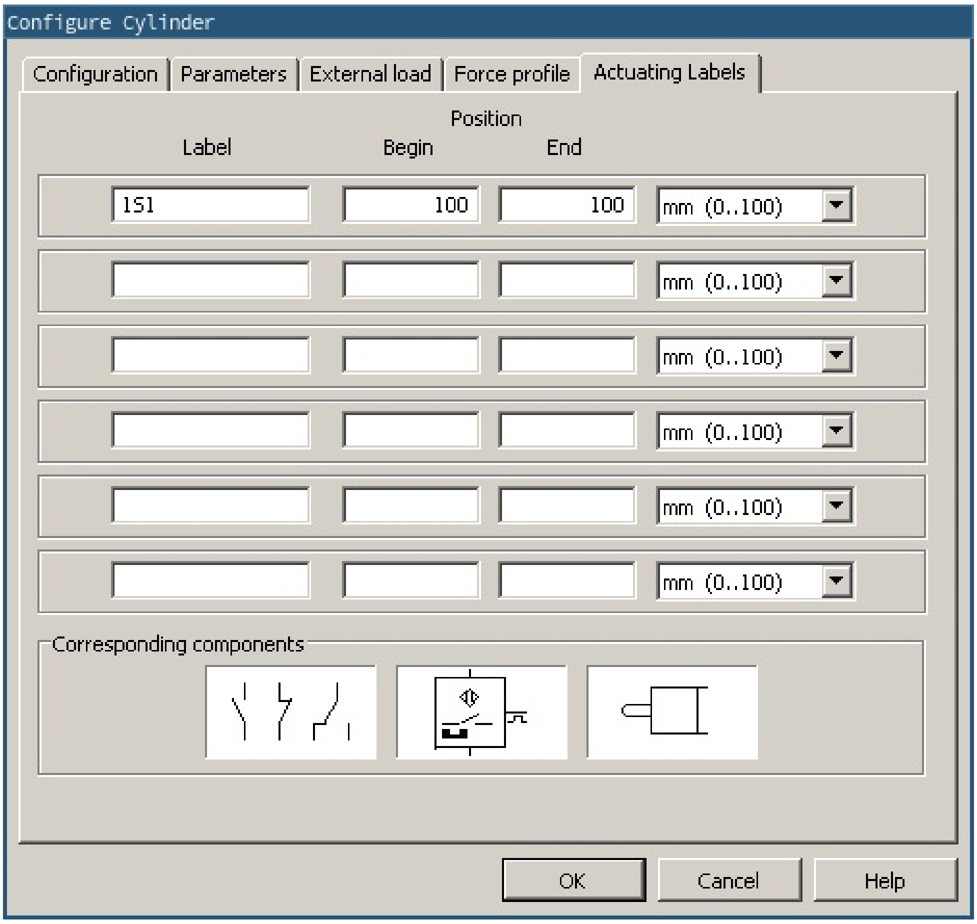
Fig. 6.9
Representation of signal lines

Fig. 6.10
Representation of input elements



buku Halaman 30

Cara memberikan label limit

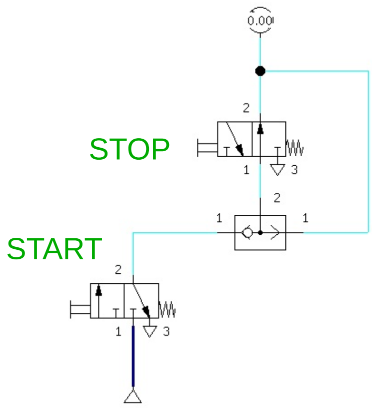


PRAKTIKUM 3

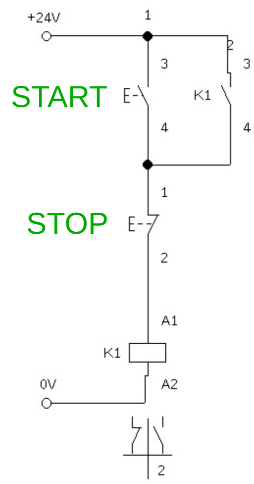
PROCESSING
ELEMENT 3

Dominan-OFF

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



Pneumatic



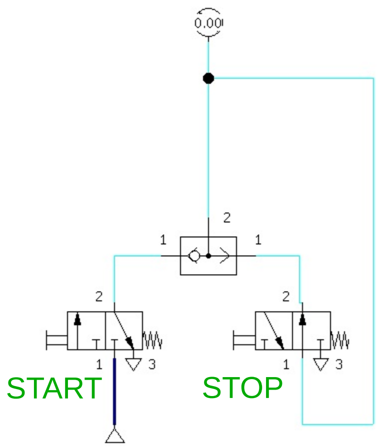
Electroneumatic

PROCESSING
ELEMENT 3

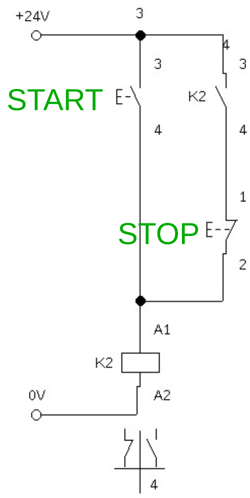
Dominan-ON

Ciri - Ciri

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



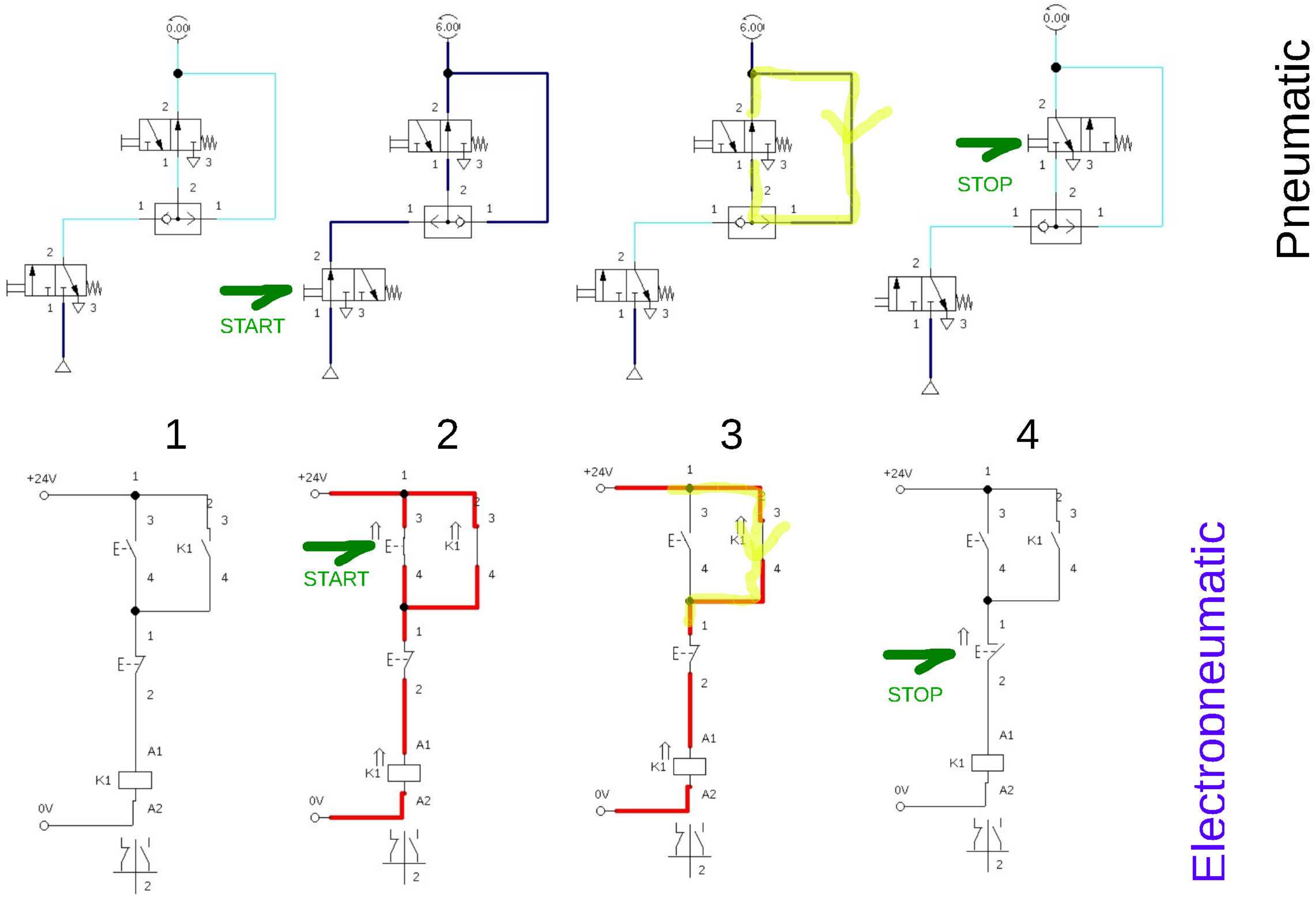
Pneumatic



Electropneumatic

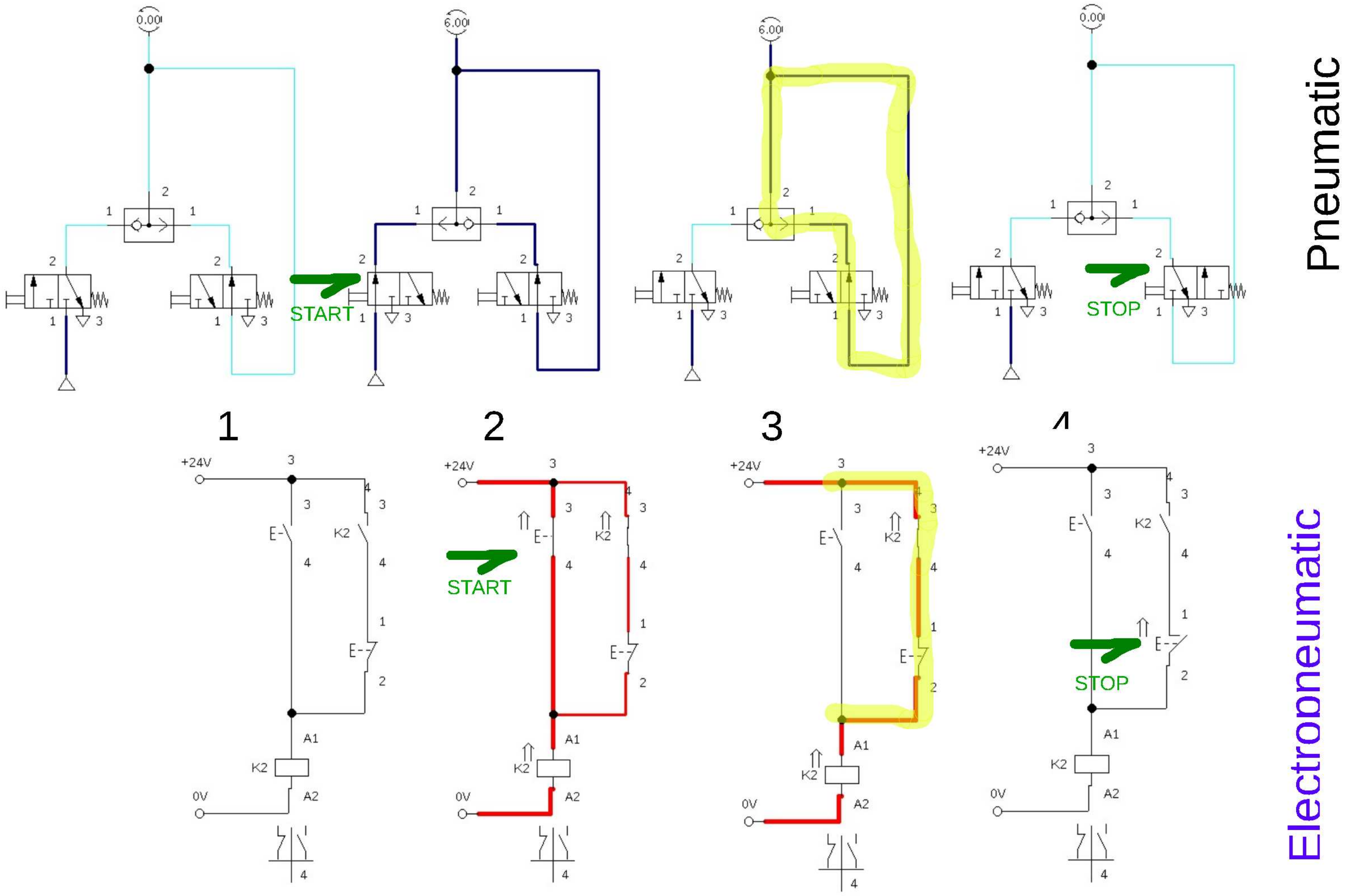
PROCESSING ELEMENT 3

Dominan-OFF



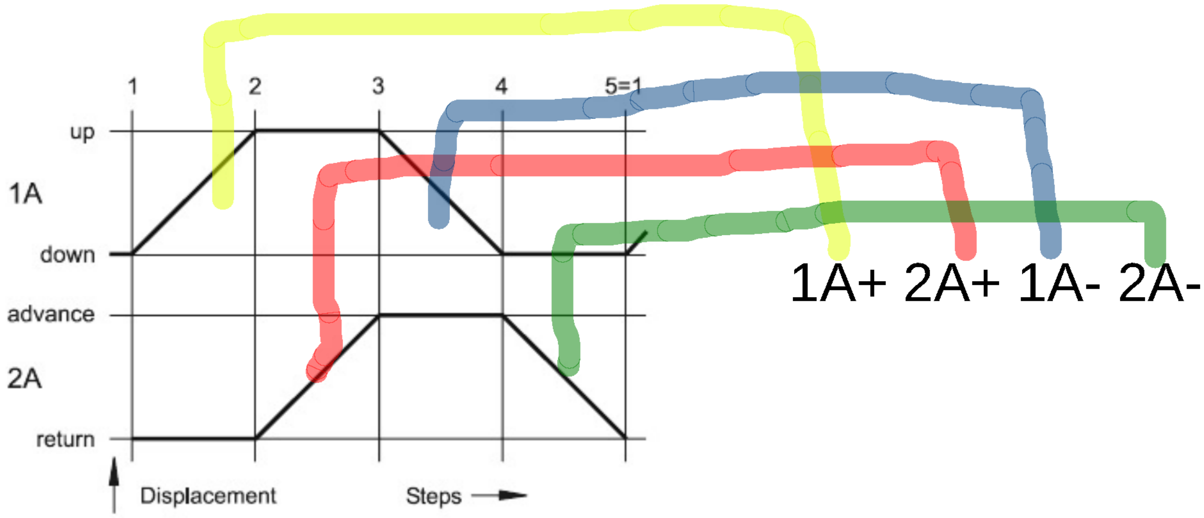
PROCESSING ELEMENT 3

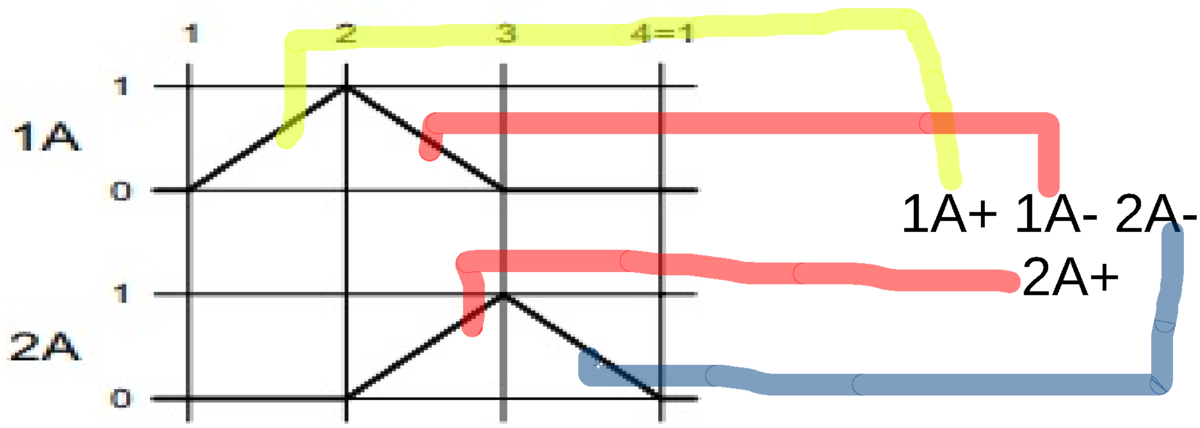
Dominan-ON



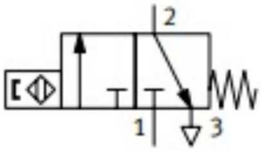
PRAKTIKUM 4

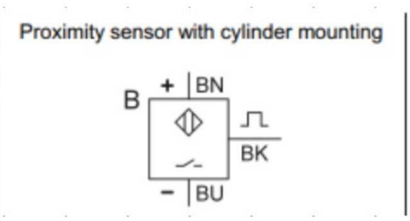
Grafik Pergerakan Pneumatic 3

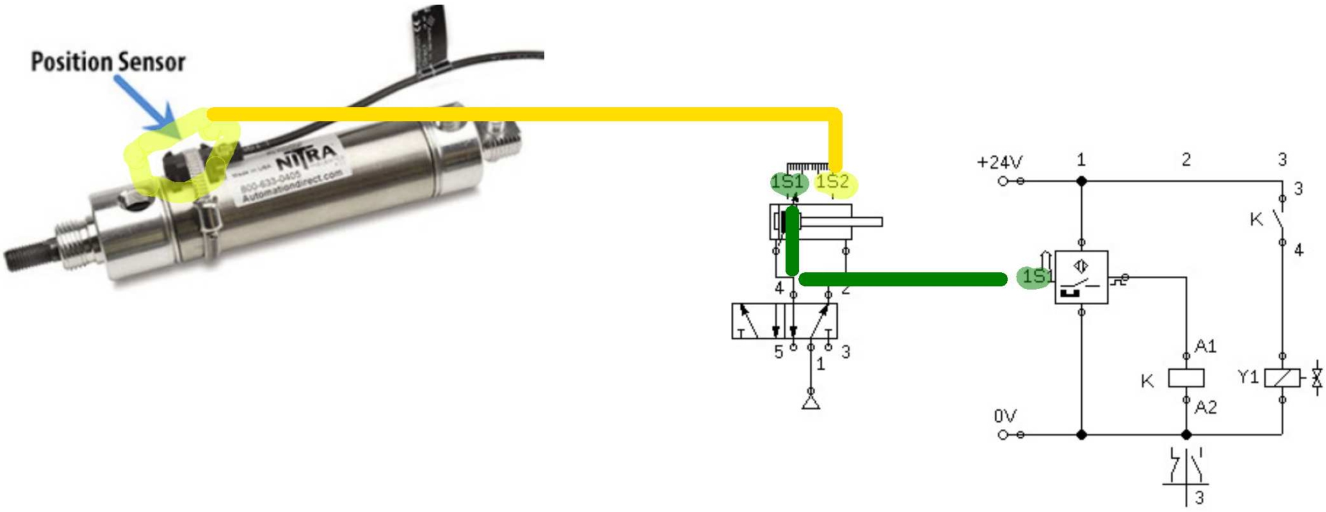




INPUT ELEMENT 3



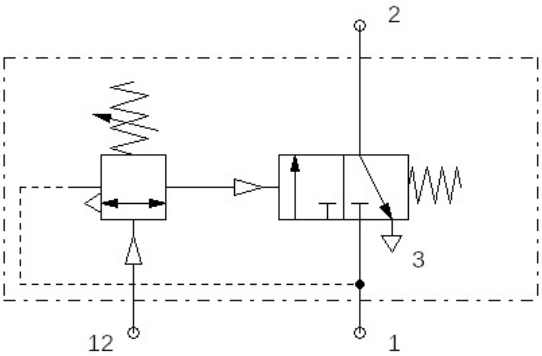




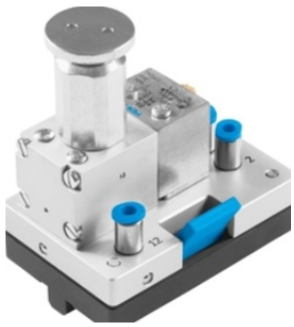
Pneumatic

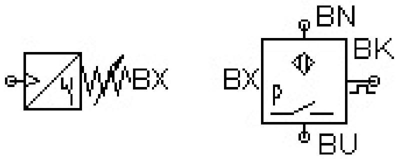
Electropneumatic

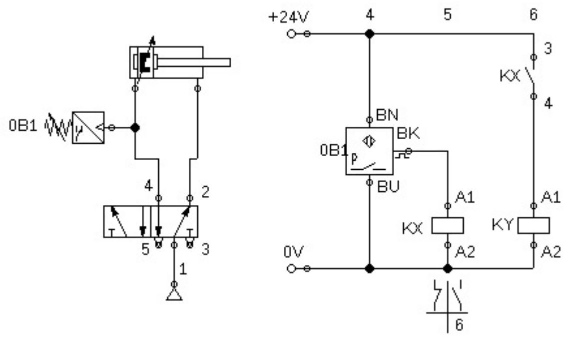
INPUT ELEMENT 3



Preasure Squance Valve





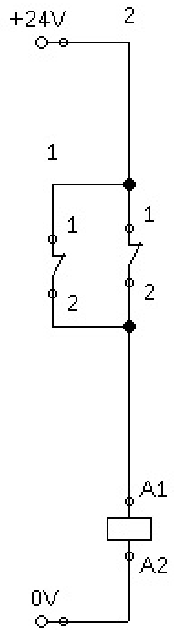


Pneumatic

Electropneumatic

PROCESSING
ELEMENT 3

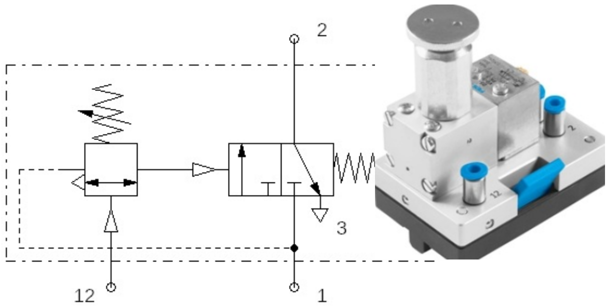
Logika NAND



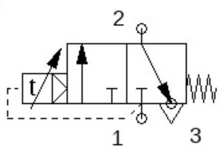
Pneumatic

Electropneumatic

INPUT ELEMENT 3

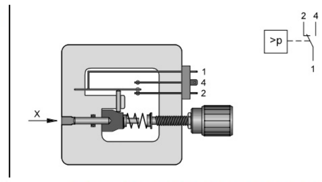


Preasure Squance Valve

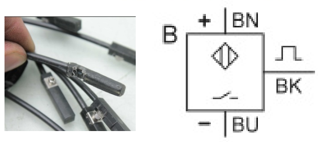


Pneumatic Timer, Normaly Close

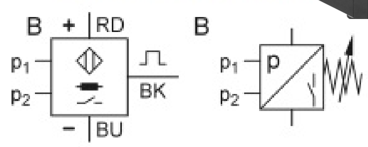
Fig. 3.12: Piston-actuated pressure switch

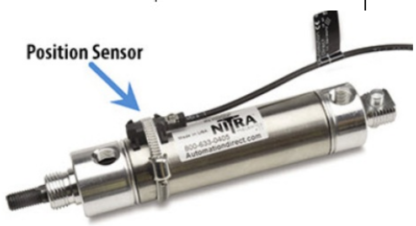


Proximity sensor with cylinder mounting



Pneumatic-electric converter



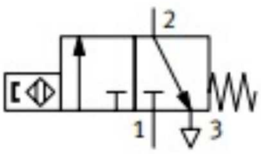


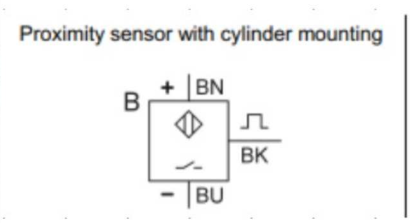
Pneumatic

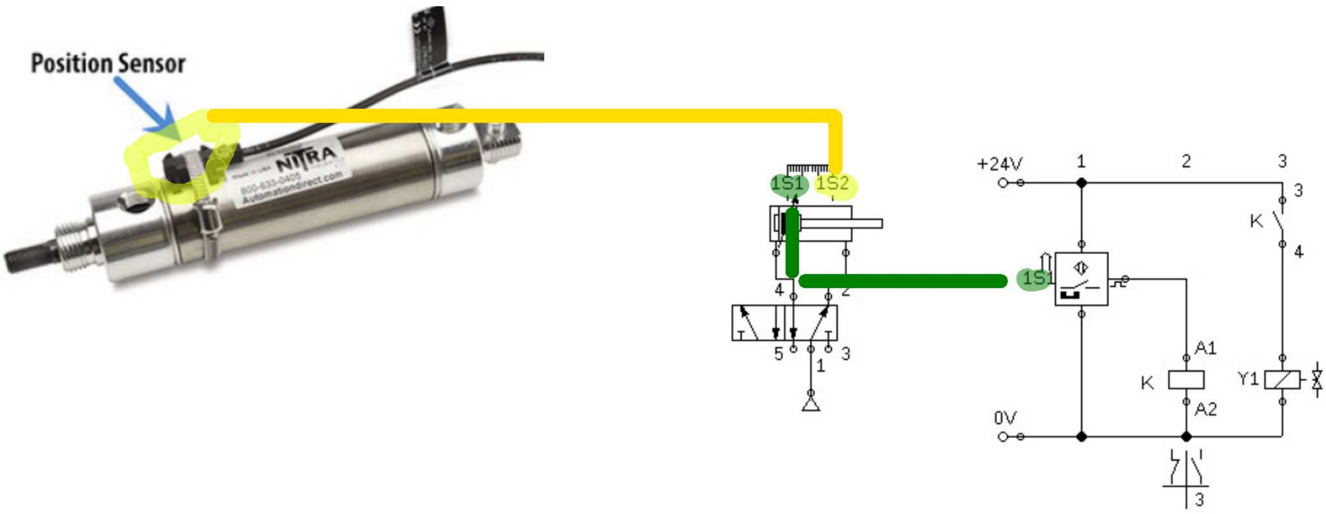
Electropneumatic

PRAKTIKUM 5

INPUT ELEMENT 3



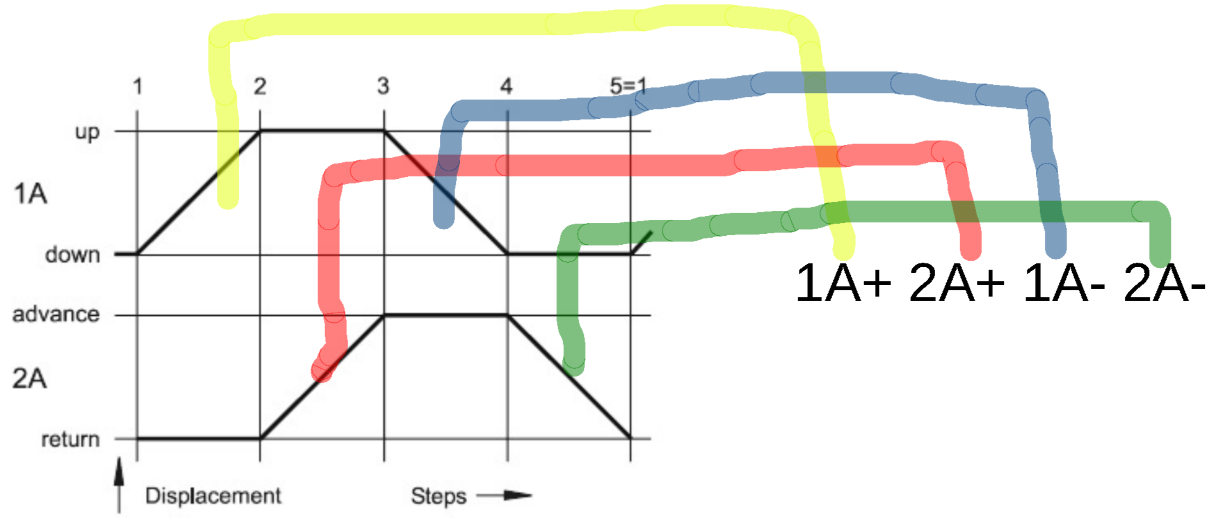


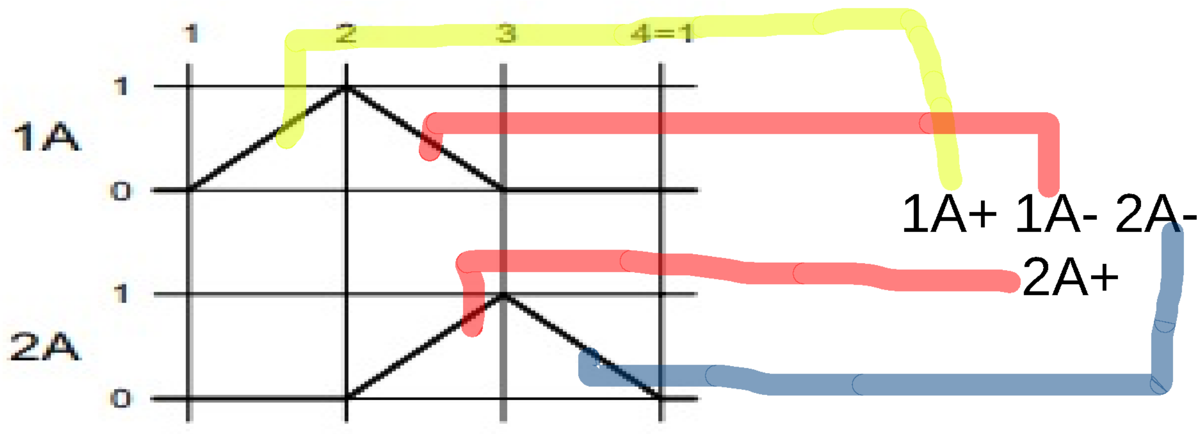


Pneumatic

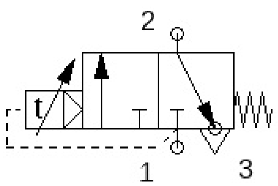
Electropneumatic

Grafik Pergerakan Pneumatic 3



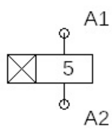


INPUT ELEMENT 3

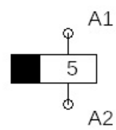


Pneumatic Timer, Normaly Close

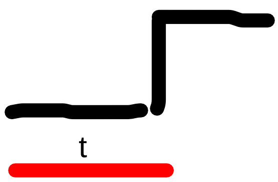
Pneumatic

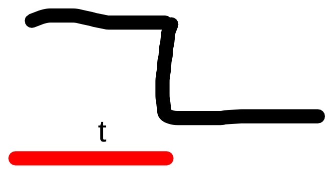


Switch-On Delay



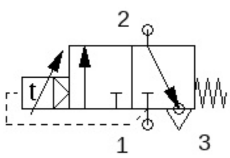
Switch-Off Delay



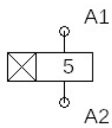


Electropneumatic

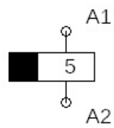
INPUT ELEMENT 3



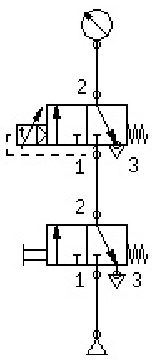
Pneumatic Timer, Normaly Close

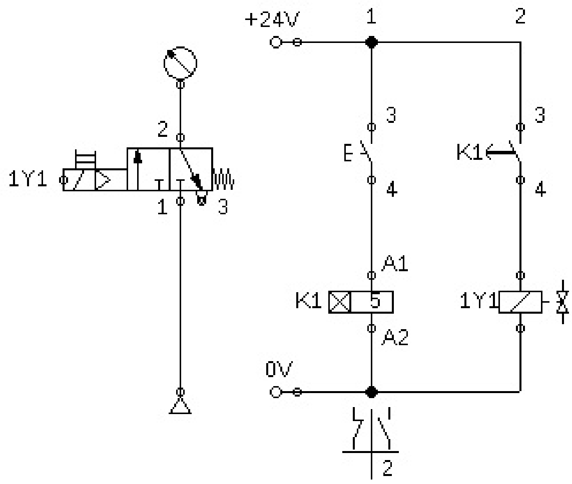


Switch-On Delay



Switch-Off Delay





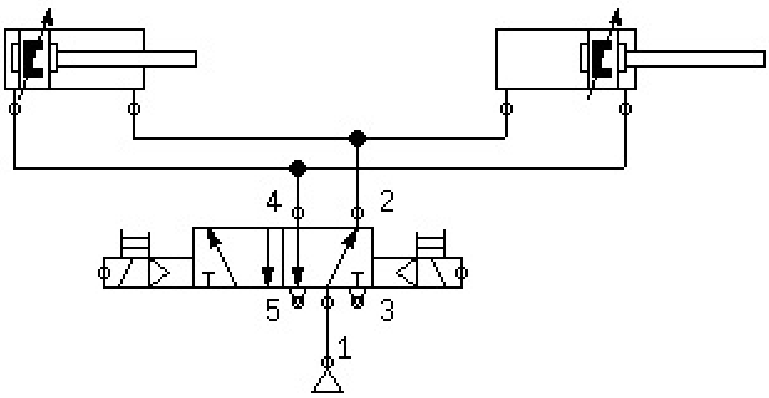
Pneumatic

Electropneumatic

PRAKTIKUM 6

Mengendalikan Silinder Lebih Dari Satu

secara langsung

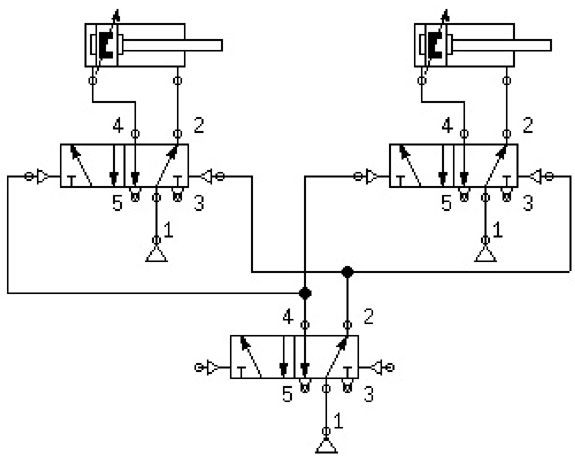


+ Satu valve mengendalikan banyak aktuator
+ Satu aktuator mempresentasikan kondisi aktuator lain

- 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