

# BAB V

## PENUTUP

### 5.1. Kesimpulan.

Ada pun kesimpulan yang didapat dalam pneumatik adalah :

1. Fungsi dari katup yang digunakan berfungsi untuk mengatur atau mengendalikan arah udara kempa yang akan bekerja untuk menggerakkan aktuator.
2. Peralatan yang digunakan seperti silinder kerja ganda tunggal, katup lambat, katup pembuangan cepat, katup 3/2, katup 5/2, katup OR, katup AND, push button, katup tunda waktu, filter regulator lubrication dan compressor dapat digunakan sesuai rangkaian sesuai kebutuhan.
3. Sistem pneumatik pada suatu rangkaian akan bekerja dengan benar jika penggunaan komponen sesuai dengan fungsinya.

## 5.2.

### Saran.

1. Supaya tidak sulit dalam membuat suatu rangkaian pneumatik mahasiswa seharusnya lebih mengetahui fungsi dari berbagai macam katup, dan komponen – komponen pneumatik lainnya.
2. Dalam membuat suatu rangkaian haruslah benar – benar teliti agar rangkaian yang dibuat sesuai dengan yang diinginkan.
3. Ketika ingin memasang selang dari *manifold* ke katup sebaiknya selang dipasang pada katup terlebih dahulu kemudian baru dipasang pada *manifold*, supaya selang tidak terbang ketika dipasang, dan jika selang sering lepas gunakanlah kain untuk mengganjalnya.
4. Ketika ingin melepas selang dari *manifold* hendaklah penjepit pada katup atau *manifold* ditekan kedalam terlebih dahulu.

## DAFTAR PUSTAKA

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7. [www.ardiansite.files.wordpress.com/2010/bahan-ajar-tmd218-pneumatik- hidrolik](http://www.ardiansite.files.wordpress.com/2010/bahan-ajar-tmd218-pneumatik- hidrolik), diakses pada 13 September 2013.
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## Konversi Satuan

<ul style="list-style-type: none"> <li>▪ <b>Satuan panjang</b></li> <li>1 ft = 0.3048 m</li> <li>1 inch = 2.540 cm</li> <li>1 mile = 5280 ft = 1609.3 km</li> <li>1 km = 1000 m</li> <li>1 m = 100 cm</li> <li>1 cm = 0.3937 inch = 7.4805 gal</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Volume</b></li> <li>1 liter = <math>10^{-3} \text{ m}^3 = 1 \text{ d m}^3</math></li> <li>1 gal = 3.7854 liter</li> <li>1 ft<sup>3</sup> = 28.317 liter</li> <li>1 inch<sup>3</sup> = 16.387 cm<sup>3</sup></li> </ul>
<ul style="list-style-type: none"> <li>▪ <b>Massa</b></li> <li>1 lb<sub>(m)</sub> = 0.45359237 kg</li> <li>1 kg = 1000 g</li> <li>1 ton = 1000 kg</li> <li>1 slug = 32.174 lb<sub>m</sub> = 14.5939 kg = 444,800 dyne</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Gaya</b></li> <li>1 lb<sub>f</sub> = 4.4482 N</li> <li>1 N = 1 kg·m/s<sup>2</sup></li> <li>1 ton = 0.22481 lb<sub>f</sub></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Tekanan</b></li> <li>1 kPa = 1000 N/m<sup>2</sup> = 20.886 lbf/ft<sup>2</sup></li> <li>1 atm = 760 torr = <math>1.01325 \times 10^5 \text{ N/m}^2</math></li> <li>1 Pa = 1 N/m<sup>2</sup></li> <li>1 bar = <math>1 \cdot 10^5 \text{ Pa}</math></li> <li>1 bar = 0.9869 atm</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Temperatur/suhu</b></li> <li>C = 5    R = 4    F = 9</li> <li>°R = <math>4/5 \times \text{°C}</math></li> <li>°C = <math>5/4 \times \text{°R}</math></li> <li>°F = <math>(9/5 \times \text{°C}) + 32^\circ</math></li> <li>°C = <math>5/9 \times (\text{°F} - 32^\circ)</math></li> <li>1 °K = 1.8 °R</li> <li>°K = °C + 273.15</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Energi</b></li> <li>1 torr = 1 mm Hg</li> <li>1 J = 1 kg·m<sup>2</sup>/s<sup>2</sup> = <math>1933 \times 10^{-2} \text{ psi}</math></li> <li>1 mm Hg = 0.01934 lbf/in<sup>2</sup> = 107 erg</li> <li>1 erg = 1 dyne·cm</li> <li>1 kalori = 4.186 J</li> <li>1 Btu = 252.16 kal</li> <li>1 in. Hg = 0.491 lbf/in<sup>2</sup> = 1.05504 kJ</li> <li>1 ft·lbf = 1.3558 J</li> <li>1 dyne/cm<sup>2</sup> = <math>10^{-1} \text{ N/m}^2</math></li> <li>1 ev = <math>160.2 \times 10^{-19} \text{ J}</math></li> <li>1 W = 1 J/s</li> </ul>	

**Biaya Bahan Baku Langsung.**

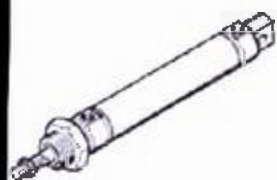
No	NAMA BAHAN	UKURAN	Qty.	HARGA	JUMLAH
1	SILINDER KERJA GANDA	16 x 100 mm	3 pcs	Rp. 210.000,-	Rp. 630.000,-
2	SOLENOID 1/2 VALVE	4A 220-08	6 pcs	Rp. 175.000,-	Rp. 1.050.000,-
3	QUICK EXHAUST VALVE	XQ 170600	1 pcs	Rp. 85.000,-	Rp. 85.000,-
4	ONE WAY FLOW CONTROL VALVE	MSL 6-01	1 pcs	Rp. 45.000,-	Rp. 45.000,-
5	OR VALVE	KS 01	2 pcs	Rp. 110.000,-	Rp. 220.000,-
6	PUSH BUTTON	MOV 01	1 pcs	Rp. 110.000,-	Rp. 110.000,-
7	AND VALVE	ZK-PK-3	4 pcs	Rp. 450.000,-	Rp. 1.800.000,-
8	TIME DELAY VALVE	TIMMER	1 pcs	Rp. 750.000,-	Rp. 750.000,-
9	FITTING (Sambungan Drat Ke Selang 1/8")	MPC 6-01	90 pcs	Rp. 10.000,-	Rp. 900.000,-
10	FITTING (Cabang Empat)	MPK 4	4 pcs	Rp. 8.000,-	Rp. 32.000,-
11	FITTING (Cabang Dua)	MPK 2	8 pcs	Rp. 8.000,-	Rp. 64.000,-
12	SILINDER	PSL 01 1/8"	20 pcs	Rp. 8.000,-	Rp. 160.000,-
13	FRL (Filter Regulator Lubrication)	AFC 2000	1 pcs	Rp. 150.000,-	Rp. 150.000,-
14	NEPPEL untuk FRL	MPC 6-02	2 pcs	Rp. 15.000,-	Rp. 30.000,-
15	SELANG PU	4 x 6 mm	20 mtr	Rp. 10.000,-	Rp. 200.000,-
16	LIMIT SWITCH 1/2 VALVE	JM07ROLLER	6 pcs	Rp. 150.000,-	Rp. 900.000,-
17	FITTING (Sambungan Drat Ke Selang 1/4")	MPC 6-02	54 pcs	Rp. 10.000,-	Rp. 540.000,-
18	FITTING (Sambungan Selang Ke Selang)	MPU6	10 pcs	Rp. 8.000,-	Rp. 80.000,-
19	TUBE ORANGE	4 x 5 mm	1 pcs	Rp. 40.000,-	Rp. 40.000,-
20	TRIPLEK	1500 x 1700 mm	1 lbr.	Rp. 200.000,-	Rp. 200.000,-
21	BAUT + RING	8 x 100 mm	20 pcs	Rp. 25.000,-	Rp. 500.000,-
22	RODA		8 pcs	Rp. 20.250,-	Rp. 162.000,-
23	KUNCIL (SANIFIX W 99)		1 set.	Rp. 55.000,-	Rp. 55.000,-
24	BAUT L	8 x 70mm	10 pcs	Rp. 5.000,-	Rp. 50.000,-
25	BAUT L	4 x 70 mm	46 pcs	Rp. 2.500,-	Rp. 115.000,-
26	MATA BOR	2 mm	2 pcs	Rp. 15.000,-	Rp. 30.000,-
27	MATA BOR	2,5 mm	3 pcs	Rp. 19.000,-	Rp. 57.000,-
28	CAT KUDA TERBANG		4kg	Rp. 9.500,-	Rp. 38.000,-
29	SIKU FULL	40 x 40 mm	4 pcs	Rp. 71.250,-	Rp. 285.000,-
<b>JUMLAH</b>					<b>Rp. 8.828.000,-</b>



# Standard cylinder DSN-16-PPV

Part number: 14533

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## Data sheet

Feature	values
Stroke	1... 200 mm
Piston diameter	16 mm
Piston rod thread	M6
Cushioning	PPV: Pneumatic cushioning adjustable at both ends
Assembly position	Any
Conforms to standard	CETOP RP 52 P ISO 6432
Piston-rod end	Male thread
Design structure	Piston Piston rod Cylinder barrel
Position detection	No
Variants	Single-ended piston rod
Operating pressure	1... 10 bar
Mode of operation	double-acting
Operating medium	Compressed air in accordance with ISO8573-1:2010 [7:4]
Note on operating and pilot medium	Lubricated operation possible (subsequently required for further operation)
Corrosion resistance classification CRC	2
Ambient temperature	-20... 80 °C
Impact energy in end positions	0,15 J
Cushioning length	12 mm
Theoretical force at 6 bar, return stroke	103,7 N
Theoretical force at 6 bar, advance stroke	120,6 N
Moving mass with 0 mm stroke	23 g
Additional weight per 10 mm stroke	4,6 g
Basic weight for 0 mm stroke	89,9 g
Additional mass factor per 10 mm of stroke	2 g
Mounting type	with accessories
Pneumatic connection	M6
Materials note	Conforms to RoHS
Materials information for cover	Wrought Aluminium alloy neutral anodisation
Materials information for seals	NBR TPE-U(PU)
Materials information for piston rod	High alloy steel, non-corrosive
Materials information for cylinder barrel	High alloy steel, non-corrosive

Valves VMEM, mechanically actuated

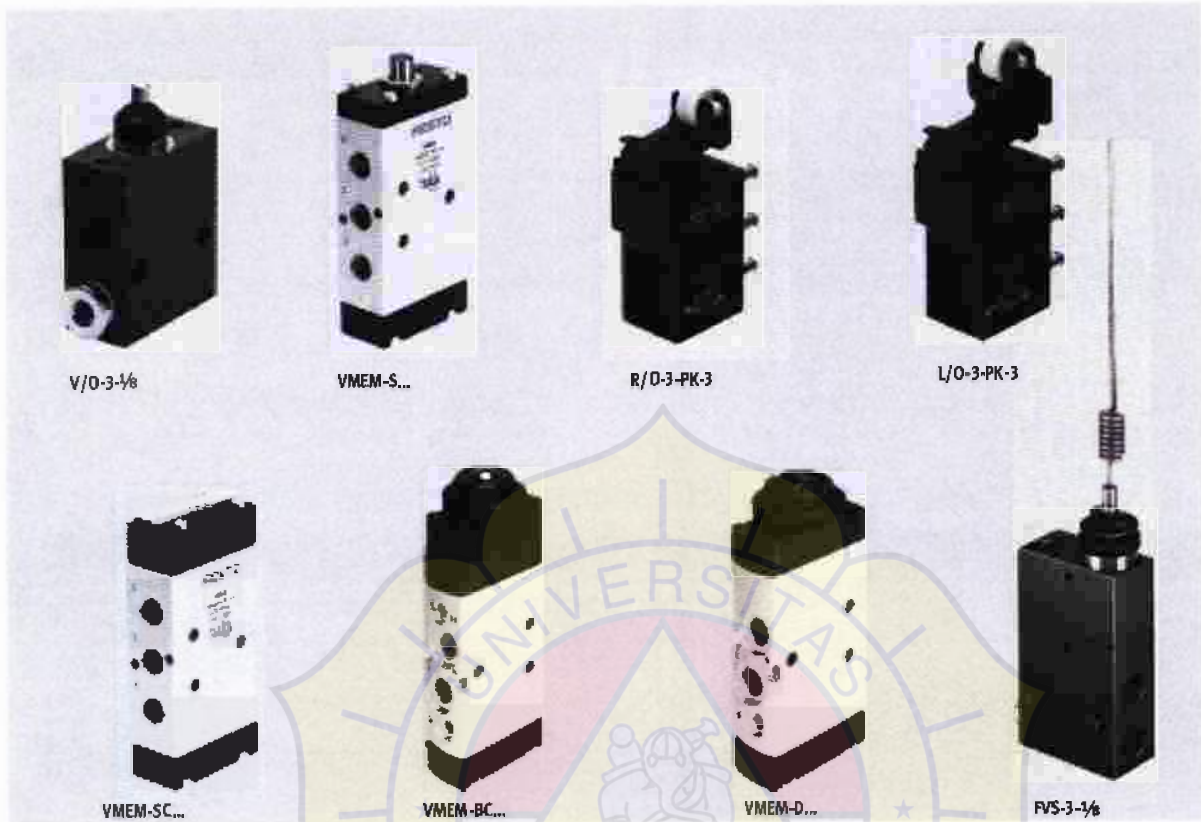
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# Valves VMEM, mechanically actuated

FESTO

Key features



## Innovative

- Small and compact for a wide range of pneumatic applications
- Large selection of valve functions: 3/2-way, 4/2-way and 5/2-way functions
- With flow rates of up to 1,000 l/min, valves VMEM offer outstanding pneumatic performance for a great variety of applications
- Low weight
- Minimal actuating forces

## Versatile

- Flexibility of the pneumatic working ports provides a practical solution to different requirements
- Round silencer for ducted exhaust air
- Suitable for vacuum in some cases
- Reverse operation possible in some cases
- Actuation: direct and piloted
- Pressure range from vacuum to 10 bar possible
- Version:
  - Stem actuated valve
  - Swivel lever valve
  - Roller lever valve, toggle lever valve
  - Whisker valve
  - Roller actuated valve
  - Ball actuated valve

## Reliable

- Durable thanks to proven piston spool and piston poppet valves
- Sturdy thanks to metal or plastic housing and connecting thread or connector

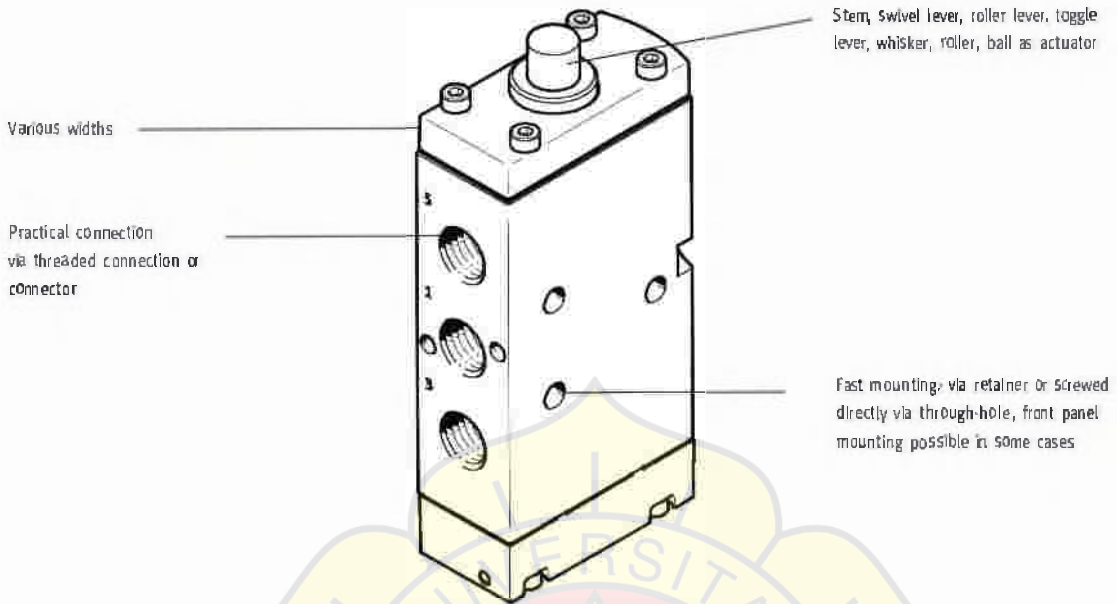
## Easy to mount

- Front panel mounting or mounting on bracket



# Valves VMEM, mechanically actuated

Key features



### Equipment options

#### 3/2-way valve, monostable

- Normally open/closed
- Mechanical spring
- Vacuum operation possible
- Directly actuated and pneumatically piloted
- Ducted exhaust air

#### 4/2-way valve, monostable

- Mechanical spring
- Pneumatically piloted
- Ducted exhaust air

#### 5/2-way valve, monostable

- Pneumatic spring/mechanical spring
- Vacuum operation possible

- Reverse operation in some cases
- Pneumatically piloted
- Ducted exhaust air

### Valve selection

You order mechanically and manually operated valves using the order code:

Ordering system for valves  
 → Internet: mechanically and manually operated directional control valves

→ Internet: [www.festo.com](http://www.festo.com)

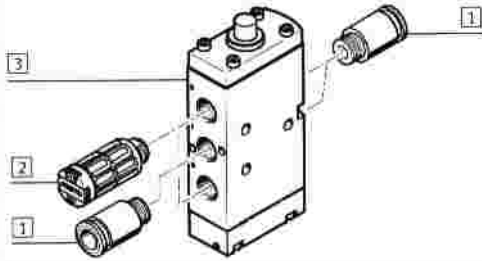
# Valves VMEM, mechanically actuated

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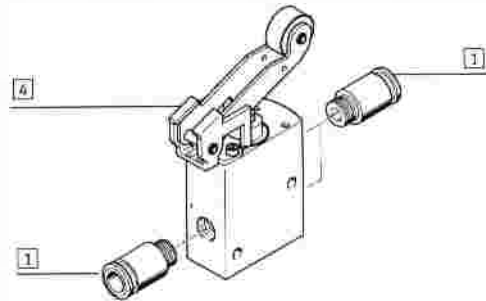
Peripherals overview

## Valves, mechanically actuated

5/2-way stem actuated valve VMEM-S

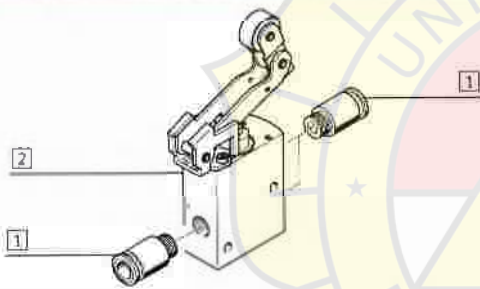


3/2-way roller lever valve R

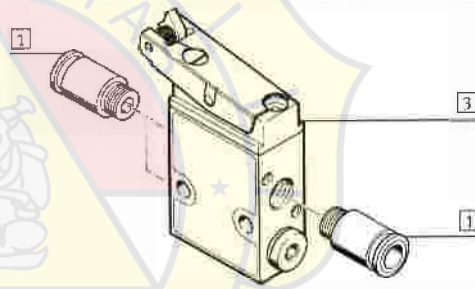


	Brief description	→ Page/Internet
1	Fitting For supply air/exhaust ports (1, 3, 5) and working ports (2, 4)	41
2	Silencer For exhaust ports (3, 5)	41
3	Stem actuated valve VMEM-S	11
4	Roller lever valve R	26

3/2-way roller lever valve with idle return L

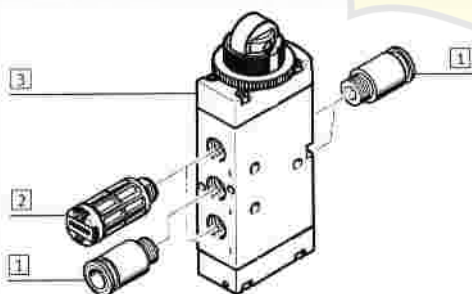


3/2-way toggle lever valve LS

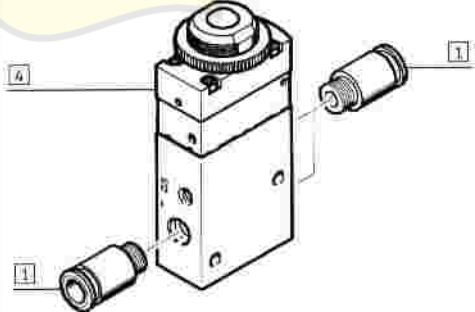


	Brief description	→ Page/Internet
1	Fitting For supply air/exhaust ports (1, 3, 5) and working ports (2, 4)	41
2	Roller lever valve with idle return L	26
3	Toggle lever valve LS	26

5/2-way roller actuated valve VMEM-D



3/2-way ball actuated valve VMEM-B



	Brief description	→ Page/Internet
1	Fitting For supply air/exhaust ports (1, 3, 5) and working ports (2, 4)	41
2	Silencer For exhaust ports (3, 5)	41
3	Roller actuated valve VMEM-D	32
4	Ball actuated valve VMEM-B	37

# Valves VMEM, mechanically actuated

Key features – Pneumatic components

## Mechanically actuated valves

Mechanically actuated valves are often used as "signal valves" and feed back a pneumatic signal to the controller. This feedback, e.g. "End position reached", is realised via a stem actuated valve or roller actuated

valve. This is a simple application, but it is an extremely popular solution for smaller machines and conveying systems, e.g. for controlling simple clamping and locking operations in

semi-automated assembly and production. The modern design with metal housing combines sturdiness and functionality. Advantages of mechanically actuated valves:

- No electronic controller required
- No programming effort required
- Easy to adjust and connect
- Control and measurement via sensors

Valve functions		
Circuit symbol	Type	Description
Stem actuated valve		
	VMEM-ST-M32C-M V-3-M5 V-3-1/4-B V/O-3-PK-3	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum (not V/O-3-PK-3)</li> </ul>
	VMEM-ST-M32U-M VO-3-1/4-B	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
	V/O-3-1/8	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open/closed</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
	VMEM-STC-M32C-M VS-3-1/8	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Pneumatically piloted, internal pilot air</li> <li>• Mechanical spring return</li> </ul>
	VMEM-STC-M32U-M	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Pneumatically piloted, internal pilot air</li> <li>• Mechanical spring return</li> </ul>
	VOS-3-1/8	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Pneumatically piloted, internal pilot air</li> <li>• Mechanical spring return</li> </ul>
	VMEM-STCZ-M32CM	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Pneumatically piloted, external pilot air</li> <li>• Mechanical spring return</li> </ul>
	VMEM-STCZ-M32U-M	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Pneumatically piloted, external pilot air</li> <li>• Mechanical spring return</li> </ul>
	VS-4-1/8	4/2-way valve, monostable <ul style="list-style-type: none"> <li>• Pneumatically piloted, internal pilot air</li> <li>• Mechanical spring return</li> </ul>



# Valves VMEM, mechanically actuated

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Key features – Pneumatic components

Valve functions		
Circuit symbol	Type	Description
<b>Stem actuated valve</b>		
	VMEM-S-M52-M	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> <li>• Reverse operation possible</li> </ul>
	VMEM-S-M52-A	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• (Internal) pneumatic spring return</li> </ul>
	VMEM-S-M52-E	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• (External) pneumatic spring return</li> <li>• Suitable for vacuum</li> <li>• Reverse operation possible</li> </ul>
	VMEM-SC-M52-M	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Pneumatically piloted, internal pilot air</li> <li>• Mechanical spring return</li> </ul>
	VMEM-SC-M52-A	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Pneumatically piloted, internal pilot air</li> <li>• (Internal) pneumatic spring return</li> </ul>
	VMEM-SC2-M52-M	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Pneumatically piloted, external pilot air</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> <li>• Reverse operation possible</li> </ul>
	VMEM-SC2-M52-E	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Pneumatically piloted, external pilot air</li> <li>• (External) pneumatic spring return</li> <li>• Suitable for vacuum</li> <li>• Reverse operation possible</li> </ul>
	V-5-1/4-B	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open/closed</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
<b>Swivel lever valve</b>		
	RW/O-3-1/4	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open/closed</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
<b>Whisker valve</b>		
	FVS-3-1/4	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Mechanical spring return</li> <li>• Pneumatically piloted, internal pilot air</li> </ul>
	FVS0-3-1/4	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Mechanical spring return</li> <li>• Pneumatically piloted, internal pilot air</li> </ul>

# Valves VMEM, mechanically actuated

Key features – Pneumatic components

Valve functions – Circuit symbol		
Circuit symbol	Type	Description
Roller lever valve with idle return		
	L/O-3-PK-3	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open/closed</li> <li>• Mechanical spring return</li> </ul>
	L-3-M5 L-3-1/4-B	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
	L-5-1/4-B	5/2-way valve, monostable <ul style="list-style-type: none"> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
Toggle lever valve		
	LS-3-1/8	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally closed</li> <li>• Mechanical spring return</li> <li>• Pneumatically piloted, internal pilot air</li> </ul>
	LOS-3-1/8	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Mechanical spring return</li> <li>• Pneumatically piloted, internal pilot air</li> </ul>
	LO-3-1/4-B	3/2-way valve, monostable <ul style="list-style-type: none"> <li>• Normally open</li> <li>• Mechanical spring return</li> <li>• Suitable for vacuum</li> </ul>
	LS-4-1/8	4/2-way valve, monostable <ul style="list-style-type: none"> <li>• Mechanical spring return</li> <li>• Pneumatically piloted, internal pilot air</li> </ul>



VMEM		-	SICZ		-	M32C		-	M		-	G14	
<b>Valve series</b>													
VMEM	Mechanically actuated valves												
<b>Version</b>													
<b>Actuation</b>													
S	Stem actuated valve												
D	Valve with roller actuation												
B	Valve with ball actuation												
<b>Design principle</b>													
-	Piston spool												
T	Disk seat												
<b>Actuation method</b>													
-	Directly actuated												
C	Pneumatically piloted												
<b>Pilot air supply</b>													
-	Internal												
Z	External												
<b>Switching function</b>													
-	Monostable valve												
A	Active (spring)												
X	Passive (air)												
<b>Valve function</b>													
M32C	3/2-way valve, monostable, normally closed												
M32U	3/2-way valve, monostable, normally open												
M52	5/2way valve, monostable												
<b>Reset method</b>													
-	None												
A	Pneumatic spring, internal												
E	Pneumatic spring, external												
M	Mechanical spring												
<b>Pneumatic connection</b>													
G14	Fitting G¼												
G18	Fitting G½												

