



Series LVM

Compact Direct Operated

2/3 Port Solenoid Valve for Chemicals



1 Safety Instructions

- This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.
- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of "DANGER", "WARNING" or "CAUTION", followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

⚠ DANGER	In extreme conditions, there is a possibility of serious injury or loss of life.
⚠ WARNING	If instructions are not followed there is a possibility of serious injury or loss of life.
⚠ CAUTION	If instructions are not followed there is a possibility of injury or equipment damage.

1 Safety Instructions (continued)

- Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
- An application which possibly having negative effects on people, property, or animals, requires special safety analysis.

- Do not use this product in applications what may adversely affect human life (e.g. medical equipment connected to the human body for drip infusion).**

⚠ CAUTION

- For air: Ensure that the air supply system is filtered to 5 microns.
- For water: Ensure a filter strainer of about 100 mesh is installed on the inlet side of the piping.
- For chemical fluids: Fluid can crystallize or clot depending on its properties. Leakage will occur when crystallized or clotted component is trapped between the sealing parts. Take measures to clean the valve if necessary.

2 Specifications (continued)

LVM10/100

Model		Body ported	
		LVM11	
Valve construction		Diaphragm type direct operated poppet	
Valve type		N. C.	
Number of ports		2	
Fluid ⁽¹⁾		Air, Water, Pure water, Diluent, Cleaning solvent	
Operating pressure range		0 to 0.25 MPa	
Orifice diameter		1.5 mm	
Response time		10 ms or less (at pneumatic pressure)	
Leakage		Zero leakage, either external or internal (at water pressure)	
Proof pressure ⁽²⁾		0.38 MPa	
Ambient temperature		0 to 50°C	
Fluid temperature		0 to 50°C (with no condensation)	
Volume of valve chamber ⁽³⁾		11 μℓ	
Mounting orientation ⁽⁴⁾		Free	
Enclosure		IP40 or equivalent	
Weight		30 g	
Rated voltage		12, 24 VDC	
Allowable voltage fluctuation ⁽⁵⁾		±10% of rated voltage	
Type of coil insulation		Class B	
Power consumption (When rated voltage is at 24 Volts)	Standard	2.5 W (0.1 A)	
	With power-saving circuit	In-rush Holding	1 W
Coil switching noise ⁽⁶⁾		50 dB	

2 Specifications (continued)

LVM10/100

Model		Base mounted		
		LVM10R3	LVM10R4	LVM105R
Valve construction		Diaphragm type direct operated poppet (Rocker type)		
Valve type		N. C.	N. O.	Universal
Number of ports		2		
Fluid ⁽¹⁾		Air, Water, Pure water, Diluent, Cleaning solvent		
Operating pressure range		-75 kPa to 0.25 MPa		
Orifice diameter		1.4 mm		
Response time		10 ms or less (at pneumatic pressure)		
Leakage		Zero leakage, either external or internal (at water pressure)		
Proof pressure ⁽²⁾		0.38 MPa		
Ambient temperature		0 to 50°C		
Fluid temperature		0 to 50°C (with no condensation)		
Volume of valve chamber ⁽³⁾		20 μℓ		
Mounting orientation ⁽⁴⁾		Free		
Enclosure		IP40 or equivalent		
Weight		34 g (without sub-plate), 42 g (with sub-plate)		
Rated voltage		12, 24 VDC		
Allowable voltage fluctuation ⁽⁵⁾		±10% of rated voltage		
Type of coil insulation		Class B		
Power consumption (When rated voltage is at 24 Volts)	Standard	1.5 W (0.06 A)		
	With power-saving circuit	In-rush	2.5 W (0.1 A)	
		Hold-ing	1 W	
Coil switching noise ⁽⁶⁾		50 dB		

⚠ WARNING

- The compatibility of equipment is the responsibility of the person who designs the system or decides its specifications.**

Since the products specified here can be used in various operating conditions, their compatibility with a specific system must be based on specifications, post analysis and/or tests to meet specific requirements. The expected performance and safety assurance will be the responsibility of the person who has determined the compatibility of the system. This person should continuously review the suitability of all items specified, referring to the latest catalogue information and taking into consideration the possibility of equipment failure when configuring a system. Be particularly careful in determining the compatibility with the fluid to be used.

- Only trained personnel should operate machinery and equipment.** The fluid can be dangerous if handled incorrectly. Assembly, handling or maintenance of the system should be performed by trained and experienced operators.

- Do not service machinery/equipment or attempt to remove components until safety is confirmed.**

1) Inspection and maintenance of machinery/equipment should only be performed once measures to prevent falling or runaway of driven component have been confirmed. Measures to prevent danger from the fluid should also be taken.

2) When equipment is to be removed, confirm the safety processes as mentioned above. Release the fluid pressure and be certain there is no danger from fluid leakage or fluid remaining in the system. Switch off electrical supplies.

3) Before machinery/equipment is re-started, ensure all safety measures are being implemented.

- Do not use this product outside of the specifications. Contact SMC if it is to be used in any of the following conditions:**

1) Conditions and environments beyond the given specifications, or if the product is to be used outdoors.

2) With fluids whose application causes concern due to the type of fluid or additives, etc.

2 Specifications

2.1 General Specifications

LVM09/090

Model	Base mounted		
	LVM09R3	LVM09R4	LVM095R
Valve construction	Diaphragm type direct operated poppet (Rocker type)		
Valve type	N. C.	N. O.	Universal
Number of ports	2		3
Fluid ⁽¹⁾	Air, Water, Pure water, Diluent, Cleaning solvent		
Operating pressure range	-75 kPa to 0.2 MPa		
Orifice diameter	1.1 mm		
Response time	10 ms or less (at pneumatic pressure)		
Leakage	Zero leakage, either external or internal (at water pressure)		
Proof pressure ⁽²⁾	0.3 MPa		
Ambient temperature	0 to 50°C		
Fluid temperature	0 to 50°C (with no condensation)		
Volume of valve chamber ⁽³⁾	18 μℓ		
Mounting orientation ⁽⁴⁾	Free		
Enclosure	IP40 or equivalent		
Weight	20 g		
Rated voltage	12, 24 VDC		
Allowable voltage fluctuation ⁽⁵⁾	±10% of rated voltage		
Type of coil insulation		Class B	
Power consumption (When rated voltage is at 24 Volts)	Standard	2 W (0.08 A)	
	With power-saving circuit	In-rush	3.3 W (0.14 A)
		Hold-ing	0.9 W
Coil switching noise ⁽⁶⁾		50 dB	

LVM10/100

Model		Body ported (Tubing type)		
		LVM10R1	LVM10R2	LVM102R
Valve construction		Diaphragm type direct operated poppet (Rocker type)		
Valve type		N. C.	N. O.	Universal
Number of ports		2		3
Fluid ⁽¹⁾		Air, Water, Pure water, Diluent, Cleaning solvent		
Operating pressure range		-75 kPa to 0.25 MPa		
Orifice diameter		1.4 mm		
Response time		10 ms or less (at pneumatic pressure)		
Leakage		Zero leakage, either external or internal (at water pressure)		
Proof pressure ⁽²⁾		0.38 MPa		
Ambient temperature		0 to 50°C		
Fluid temperature		0 to 50°C (with no condensation)		
Volume of valve chamber ⁽³⁾		20 μℓ		
Mounting orientation ⁽⁴⁾		Free		
Enclosure		IP40 or equivalent		
Weight		34 g		
Rated voltage		12, 24 VDC		
Allowable voltage fluctuation ⁽⁵⁾		±10% of rated voltage		
Type of coil insulation		Class B		
Power consumption (When rated voltage is at 24 Volts)	Standard	1.5 W (0.06 A)		
	With power-saving circuit	In-rush	2.5 W (0.1 A)	
		Hold-ing	1 W	
Coil switching noise ⁽⁶⁾		50 dB		

LVM15/150

Model		Base mounted		
		LVM15R3	LVM15R4	LVM155R
Valve construction		Diaphragm type direct operated poppet (Rocker type)		
Valve type		N. C.	N. O.	Universal
Number of ports		2		3
Fluid ⁽¹⁾		Air, Water, Pure water, Diluent, Cleaning solvent		
Operating pressure range		-75 kPa to 0.25 MPa [0 to 0.6 MPa]		
Orifice diameter		1.6 mm [1 mm]		
Response time		15 ms or less (at pneumatic pressure)		
Leakage		Zero leakage, either external or internal (at water pressure)		
Proof pressure ⁽²⁾		0.38 MPa [0.9 MPa]		
Ambient temperature		0 to 50°C		
Fluid temperature		0 to 50°C (with no condensation)		
Volume of valve chamber ⁽³⁾		50 μℓ		
Mounting orientation ⁽⁴⁾		Free		
Enclosure		IP40 or equivalent		
Weight		45 g		
Rated voltage		12, 24 VDC		
Allowable voltage fluctuation ⁽⁵⁾		±10% of rated voltage		
Type of coil insulation		Class B		
Power consumption (When rated voltage is at 24 Volts)	Standard	5.5 W (0.23 A)		
	With power-saving circuit	In-rush	1 W	
		Hold-ing	1 W	
Coil switching noise ⁽⁶⁾		60 dB		

[] - Indicates High Pressure type

2 Specifications (continued)

LVM20/200

Model	Base mounted		
	LVM20R3	LVM20R4	LVM205R
Valve construction	Diaphragm type direct operated poppet (Rocker type)		
Valve type	N. C.	N. O.	Universal
Number of ports	2		3
Fluid ⁽¹⁾	Air, Water, Pure water, Diluent, Cleaning solvent		
Operating pressure range	-75 kPa to 0.3 MPa		
Orifice diameter	2 mm		
Response time	20 ms or less (at pneumatic pressure)		
Leakage	Zero leakage, either external or internal (at water pressure)		
Proof pressure ⁽²⁾	0.45 MPa		
Ambient temperature	0 to 50°C		
Fluid temperature	0 to 50°C (with no condensation)		
Volume of valve chamber ⁽³⁾	84 μℓ		
Mounting orientation ⁽⁴⁾	Free		
Enclosure	IP40 or equivalent		
Weight	80 g		
Rated voltage	12, 24 VDC		
Allowable voltage fluctuation ⁽⁵⁾	±10% of rated voltage		
Type of coil insulation	Class B		
Power consumption (When rated voltage is at 24 Volts)	Standard	2.5 W (0.1 A)	
	In-rush	4 W (0.17 A)	
Coil switching noise ⁽⁶⁾	With power-saving circuit	0.6 W	
	Hold -ing	0.6 W	
Coil switching noise ⁽⁶⁾	60 dB		

Note 1) Select an appropriate material for the wetted part when fluid such as a cleaning solvent is used. Ensure fluid compatibility.
 Note 2) Indicates the pressure which does not generate breakage, cracks or external leakage after a one minute test.

Note 3) Indicates the volume of clearance inside the valve chamber after the volume of the diaphragm is subtracted.

Note 4) Since the body (orifice shape) is designed to eliminate residual liquid, mounting in a vertical direction with the coil at the top is recommended. When residual liquid is not considered, any mounting orientation is available.

Note 5) When the response speed is regarded as important, prevent negative fluctuation of the voltage by adequate regulation.

Note 6) The value is based on SMC's measurement conditions. The noise level will vary with conditions.

2.2 Flow Characteristics

LVM09/LVM090

Flow characteristics				
Water		Air		
Av	Cv	C	b	
0.43 x 10 ⁻⁶	0.018	0.06	0.2	

Table 1

LVM10/LVM100

Valve construction	Water		Air	
	Av	Cv	C	b
Direct operated poppet (LVM11)	0.96 x 10 ⁻⁶	0.04	0.13	0.22
Rocker type	0.72 x 10 ⁻⁶	0.03	0.1	0.2

Table 2

2 Specifications (continued)

LVM15/LVM150

Flow characteristics				
Water		Air		
Av	Cv	C	b	
0.96 x 10 ⁻⁶ [0.36 x 10 ⁻⁶]	0.04 [0.015]	0.13 [0.05]	0.22 [0.2]	

Table 3
 [] - Indicates High Pressure type

LVM20/LVM200

Flow characteristics				
Water		Air		
Av	Cv	C	b	
1.56 x 10 ⁻⁶	0.065	0.23	0.27	

Table 4

* The values of Av and Cv are based on JIS B 2005:1995, C and b are based on JIS B 8390:2000.

2.3 Piping (Valve ports)

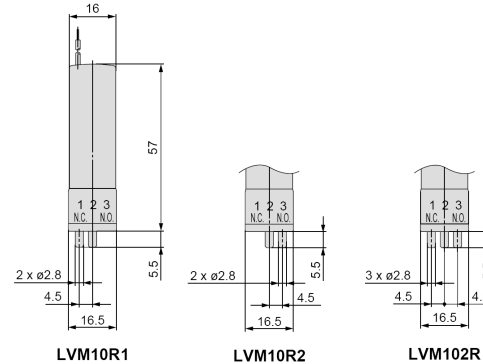
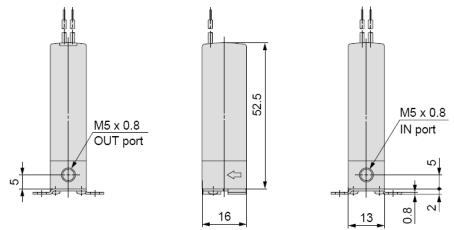


Figure 1



LVM11 (N.C.)

Figure 2

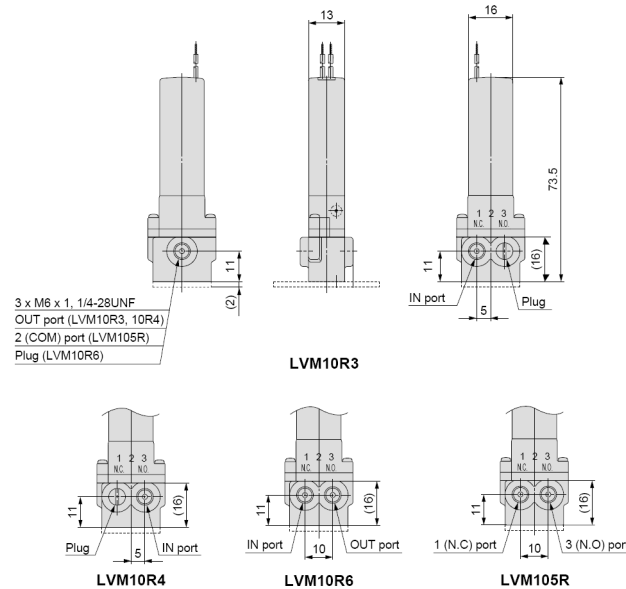


Figure 3

* The broken lines indicate with bracket.

3 Installation

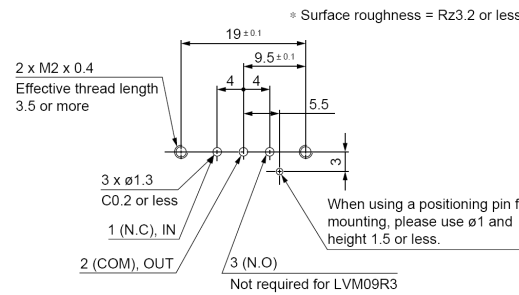
3.1 Installation

WARNING

Do not install the product unless the safety instructions have been read and understood.

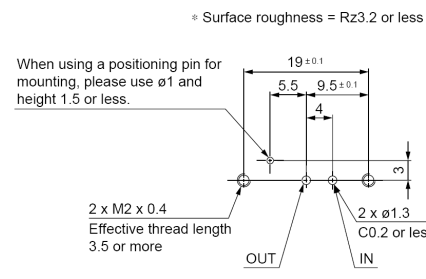
LVM09/090 Mounting Interface

Recommended interface dimensions



LVM09R3, LVM095R

Figure 4

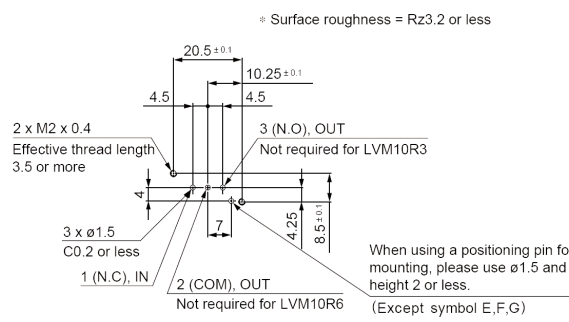


LVM09R4

Figure 5

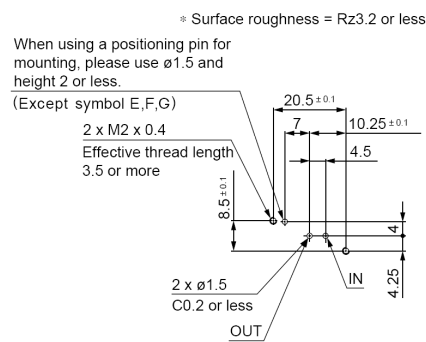
LVM10/100 Mounting Interface

Recommended interface dimensions



LVM10R3, LVM10R6, LVM105R

Figure 6



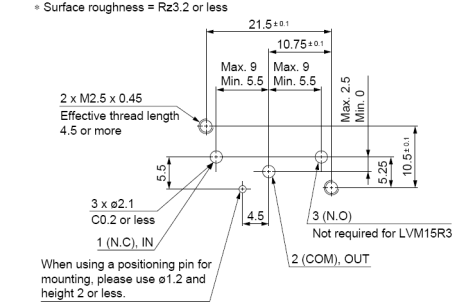
LVM10R4

Figure 7

3 Installation (continued)

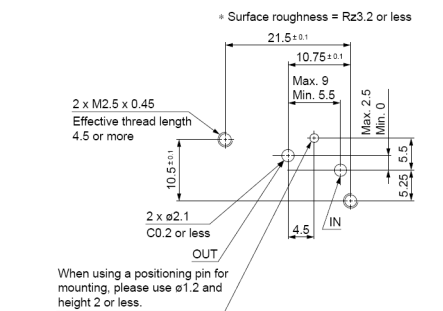
LVM15/150 Mounting Interface

Recommended interface dimensions



LVM15R3, LVM155R

Figure 8

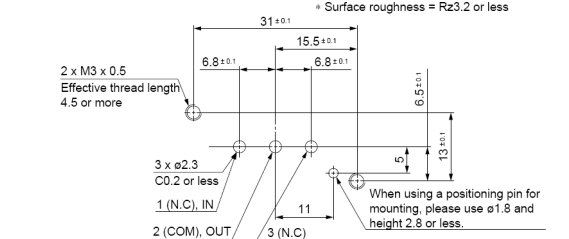


LVM15R4

Figure 9

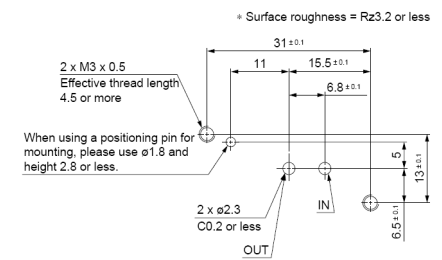
LVM20/200 Mounting Interface

Recommended interface dimensions



LVM20R3, LVM205R

Figure 10



LVM20R4

Figure 11

3 Installation (continued)

- The solenoid valve is attached with 2 mounting screws.
- Tighten mounting screws to appropriate tightening torque shown in Table 5.

Model	Thread	Tightening Torque – N•m
LVM09R3, 09R4, 095R	M2 x 0.4	0.1 to 0.14
LVM10R3, 10R4, 10R6, 105R	With-out sub-plate M2 x 0.4	0.15 to 0.2
LVM15R3, 15R4, 155R	M2.5 x 0.45	0.25 TO 0.35
LVM20R3, 20R4, 205R	M3 x 0.5	0.4 to 0.6

Table 5

- Please use valve pitches equal or above those shown in Table 6 when using multiple valves together.

Series	LVM09/090	LVM10/100	LVM15/150	LVM20/200
Valve pitch	10.5 mm	14 mm	17 mm	21 mm

Table 6

3.2 Environment

WARNING

- Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water or steam.
- Do not use in an explosive atmosphere.
- The product should not be exposed to prolonged sunlight. Use a protective cover.
- Do not mount the product in a location where it is subject to excessive vibrations and/or impacts. Impact resistance of this solenoid valve is 150 m/s². Vibration resistance of this solenoid valve is 30 m/s².
- Do not mount the product in a location exposed to radiant heat.

3.3 Piping

CAUTION

- Before piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings according to appropriate tightening torque shown in Table 7.

Model	Thread	Tightening Torque – N•m
LVM11	M5 x 0.8	1.5 to 2
LVM10R3, 10R4, 10R6, 105R	With sub-plate M6 x 1	1.5 to 2
	¼ -28UNF	1.5 to 2

Table 7

- M5, M6 and ¼-28UNF thread type fitting; Tighten by hand, then tighten approximately 1/6 of turn using tightening tool.
- When tubing is directly connected to the solenoid valve, insert the tubing straight onto the nipple for a complete fit.



LVM10/100

Figure. 12

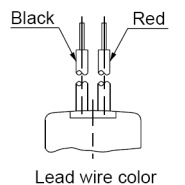
3 Installation (continued)

- The reference inner diameter of the tubing is Ø2.5mm or less. Exercise care in selecting the tubing so that the outer diameter of the tubing after being connected does not exceed Ø4.5mm.
- The holding force varies depending on the tubing material. Be sure to confirm the holding force of each material before operation.
- After connecting the tubing, care should be taken not to put excessive force (tensile force, compression, bending etc.) on the tubing. Applying an external force of greater than 20 N to the nipple may cause leakage. Models: LVM10R1, 10R2, 102R.

3.4 Electrical Connection

CAUTION

- Units with power-saving circuit use polarised electrical connections.



Red (+), Black (-)

Figure. 13

- Avoid mis-wiring, as this can cause malfunction, damage and fire to the product.
- To prevent noise and surge in signal lines, keep all wiring separate from power lines and high voltage lines. Otherwise this can cause malfunction.
- When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, adopt an option that comes with the surge voltage protection circuit.
- Use electrical circuits that do not generate chattering in their contacts.
- Use voltage that is within ±10% of the rated voltage. In cases with a DC power supply where responsiveness is important, stay within ±5% of the rated value. (The voltage drop is the value in the lead wire section connecting the coil).
- Generally use electrical wire with cross sectional area 0.5 to 1.25 mm².

- Do not bend or pull cables repeatedly.
- Connect the wires so that an external force greater than 10 N is not applied to the lead wire, otherwise the coil will burn.
- When connecting C-R element parallel to switching element, leakage current flows through C-R element and the leakage voltage increases.

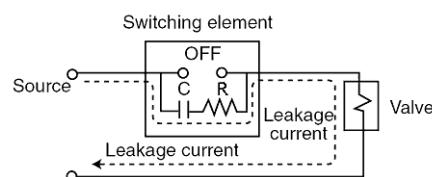


Figure. 14

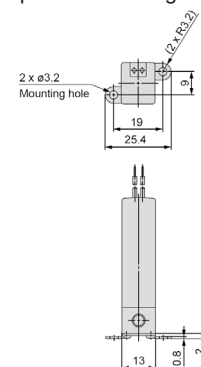
Ensure that the voltage leakage across the coil is as follows:
DC coil: No more than 2% of the rated voltage.

3.5 Mounting

- If air leakage increases or equipment does not operate properly, stop operation. After mounting is completed, confirm that it has been done correctly by performing a suitable function test.
- Since the body (orifice shape) is designed to eliminate residual liquid, mounting in a vertical direction with the coil at the top is recommended. When residual liquid is not considered, any mounting position is possible.

3 Installation (continued)

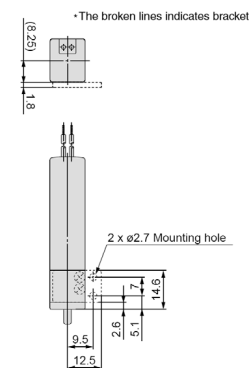
- LVM11 (N.C.) has an optional mounting bracket.



LVM11-□□□ (N.C.)

Figure. 15

- LVM10R1, 10R2, 102R have an optional mounting bracket.



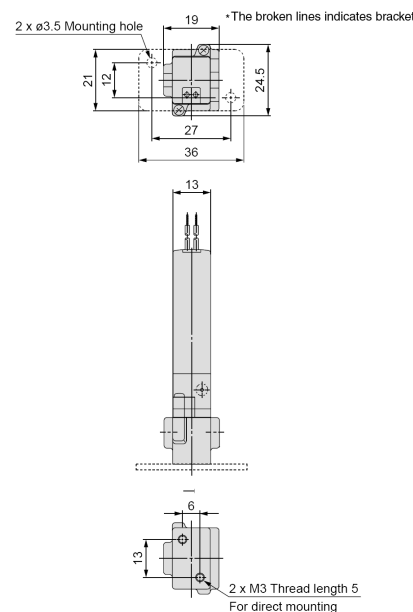
LVM10R1-□□□ (N.C.)

LVM10R2-□□□ (N.O.)

LVM102R-□□□ (Universal)

Figure. 16

- LVM10R3, 10R4, 10R6, 105R with sub-plate have an optional mounting bracket.



LVM10R3-□□□□ (N.C.)

LVM10R4-□□□□ (N.O.)

LVM10R6-□□□□ (N.C.)

LVM105R-□□□□ (Universal)

Figure. 17

4 Setting

4.1 Manual override

CAUTION

- Ensure conditions are safe, since connected equipment will operate when manual override is performed
- Non-locking push type (see Figure. 18).**
- Push on the manual override button using a small-bladed screwdriver or suitable tool until it stops ON.
- Hold this position for the duration of the check (ON position).
- Release the button and the override will re-set to OFF position.

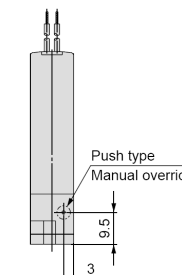


Figure. 18

5 Circuit Symbols

Valve	Number of ports	Valve type	
LVM11	2	N.C.	
LVM09R3, 10R1, 10R3, 15R3, 20R3		N.C.	
LVM10R6		N.C.	
LVM09R4, 10R2, 10R4, 15R4, 20R4		N.O.	
LVM095R, 102R, 105R, 155R, 205R	3	Universal	

Table 8

6 Internal Circuit & Wiring

- Standard (LVM09#, LVM10##, LVM20##).

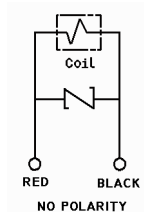


Figure. 19

- Power-Saving Circuit (LVM11, LVM10##Y).

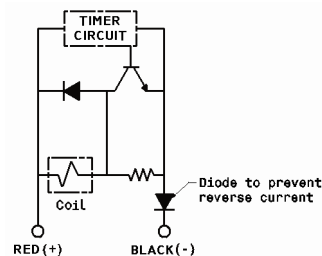


Figure. 20

- Power-Saving Circuit (LVM09##Y, LVM15##Y, LVM20##Y).

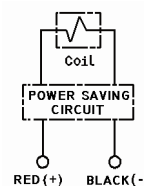


Figure. 21

7 Maintenance

7.1 General Maintenance

CAUTION

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.
- If handled improperly, compressed air can be dangerous. Maintenance of pneumatic systems should be performed by qualified personnel only.
- Drain: remove condensate from the filter bowl on regular basis.
- Before performing maintenance ensure the supply pressure is shut off and all residual fluid pressure is released from the system.
- After maintenance apply operating pressure and power to the equipment and check for proper operation and possible fluid leaks. If operation is abnormal, verify product set-up parameters.
- Do not make any modification to the product.
- Do not disassemble the product.
- Removal of valve base risks exposure to internal construction and fluids. Caution should be used when using aggressive/toxic fluids.

7.2 Valve Removal

WARNING

- Shut off the fluid supply and release the fluid pressure in the system.
- Shut off the power supply.
- Remove the valve, ensuring the O-rings/gaskets are retained.

8 Limitations of Use

WARNING

- Do not exceed any of the specifications in section 2 of this document or the specific product catalogue.

8.1 Confirm the specifications

- Give careful consideration to the operating conditions such as the application, fluid and environment and use within the operating ranges specified in the catalogue.

8.2 Fluid

- Be sure to confirm the compatibility between the component material and fluid.

8.3 Maintenance space

- The installation should allow sufficient space for maintenance activities.

8.4 Fluid pressure range

- Fluid pressure should be within the allowable pressure range.

8.5 Ambient environment

- Use within the allowable ambient temperature range.
- Ensure the fluid does not touch the external surface of the product.

8.6 Countermeasures against static electricity

- Take measures to prevent static electricity since some fluids can cause static electricity

8.7 Pressure (including vacuum) holding

- This product is not suitable for an application such as holding the pressure (including vacuum) inside a pressure vessel, because the valve has allowable leakage.

8.8 Cannot be used as an emergency shut-off valve etc.

- This product is not designed for safety applications such as an emergency shut-off valve. If the valves are used in this type of system, other reliable safety assurance measures should also be adopted.

8.9 Extended periods of continuous energization

- If solenoid valves are to be continuously energized for extended periods of time, use valves with power-saving circuit to minimise the amount of heat radiated by the coil.

Power-saving circuit waveform (example):

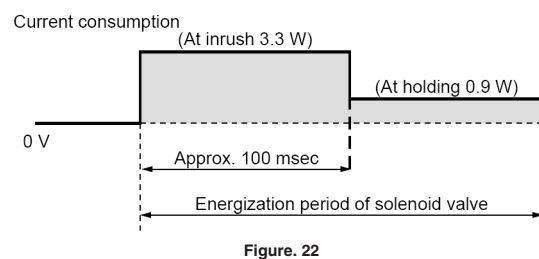


Figure. 22

- Power consumption for the waveform shown above is for the LVM09/090.
- For the LVM15/150, power-saving circuit is standard.
- For the LVM10/100, the inrush is 50 msec.

- When a solenoid valve without a power-saving circuit is continuously energized for long periods of time, temperature increase from coil heat radiated can result in deteriorating performance and shortened service life of the solenoid valve, as well as adverse effects on peripheral equipment in the vicinity. For this reason, when valves are to be continuously energized for extended periods, use a fan or take other measures to disperse heat and keep valve surface temperatures at 70°C or less.
- Table 9 shows reference values for continuously energized valves (single unit) when surface temperature is 70°C or less.

8 Limitations of Use (continued)

Series	LVM09/090	LVM10/100	LVM20/200
Period of continuous energization	5 min. or less	30 min. or less	30 min. or less
Duty ratio	50% or less		
Ambient temperature	25°C or less		
Power-saving circuit	None		

Table 9

- Duty ratio: ON time/(ON time + OFF time).
- For the LVM15/150, power-saving circuit is standard.
- Please use a fan or take other measures to disperse heat and keep temperatures within the specified range when mounting the solenoid valves inside control panels.
- Be especially careful when using three or more adjacent valves with manifolds and keeping them continuously energized for extended periods, as this may result in dramatic increases in temperature.

9 Contacts

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