Document No.DOC1021327-2

Operation Manual

Product Name

Micro Mechanical Valve

Model/ Series

VM1000 Series

SMC Corporation

Contents

Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of **"Caution," "Warning"** or **"Danger."** They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)*1), and other safety regulations.

*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1:Robots
etc.

Danger	**Danger** indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.
Warning	**Warning** indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
Caution	**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.

Safety Instructions

⚠ Caution

We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing business.
Use in non-manufacturing business is not covered.
Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.
The new Measurement Act prohibits use of any unit other than SI units in Japan.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
   This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***2) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Design precautions

⚠ Warning

1. Actuator drive

When an actuator, such as a cylinder, is to be driven take appropriate measures to prevent potential danger caused by actuator operation.

2. Maintenance space

When installing the products, allow access for maintenance.

3. Ventilation

When using the valve in a closed control panel, etc., install ventilating openings to prevent an increase of pressure inside the control panel, and to prevent heat generated by other equipment from building up.

Selection

⚠ Warning

1. Confirm the specifications.

The product is designed for use only in compressed air systems. Do not use fluids other than compressed air. Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction.

2. Use in low temperature environments

When using the valve in a low temperature condition, take appropriate measures to avoid freezing of drainage, moisture etc. in low temperature.

Mounting

⚠ Warning

1. If air leakage increases or the equipment does not operate properly, stop operation.

Unexpected motion can cause injury.

2. Check the mounting conditions

Make sure that screws and fittings are properly tightened and the piping is not bent or flattened. Connect the compressed air supply to the product and perform appropriate functional and leakage inspections to check it is mounted properly.

3. Painting of the valve

Models or specifications printed or marked on the product should not be erased, removed or covered up. Do not paint resin parts, as this may have an adverse effect due to the solvent in the paint.

⚠ Caution

1.Transportation, installation, piping, wiring, operation, handling, and maintenance should be performed by personnel with sufficient knowledge and experience.

There is a risk of injury.

2. Do not disassemble or modify the product.

This may cause human injury and/or an accident. Contact SMC for repairs and maintenance of the product.

3. Do not wipe the product using chemicals.

Piping

⚠ Caution

1. Before piping

Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.

2. Piping to product

When piping to the product, refer to the symbols and labels on the product to avoid mistakes in the position of the supply port, etc.

3. Cut the tube perpendicularly to the tube axis to a little longer than required length. (Use tube cutter "TK-1", "TK-2", "TK-3", "TK-5" or "TK-6".)

4. Push the tube until it comes to the end of the barb portion, or it may cause air leakage or release hose.

5. Follow the procedures of the manufacturer when tubing other than SMC are used. Confirm that no problem will occur in the operating conditions.

Lubrication

⚠ Caution

1. The product has been lubricated for life by the manufacturer, and does not require lubrication in service.

2. Use turbine oil Class 1, ISO VG32 (with no additives), if lubricated.

Besides, if the lubrication is suspended halfway, the original lubricant will be lost and may result in a malfunction. Be sure to keep lubricating continuously. Refer to SMC website for brand name of the lubricants compliant with Class 1 turbine oil (with no additives), ISO VG32.

Air Supply

⚠ Warning

1. Use clean air.

Do not use compressed air that contains chemicals, organic solvents based synthetic oils, salts or corrosive gases, etc., as this can cause damage or malfunction.

⚠ Caution

1. Install air filters.

Install air filters close to valves on the upstream side. A filtration degree of 5 micrometer or less should be selected.

2. Install an aftercooler, air dryer or drain catch before the filter.

Compressed air that contains excessive drainage may cause malfunction of valves and other pneumatic equipment. Therefore, take appropriate measures to ensure air quality, such as by providing an after cooler, water separator.

3. If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.

If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause malfunction.

4. Grease is applied to the inner parts of the valve.

Grease may enter on the downstream side of the valve.

For detailed information regarding the quality of the compressed air described above, refer to "SMC's Cleaning Systems".

Operating Environment

⚠ Warning

1. Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.

2. Do not operate in a location subject to vibration or impact.

3. Use a protective cover, etc. to shield the product from direct sunlight.

4. Shield the product from radiated heat generated by nearby heat sources.

5. Employ suitable protective measures in a location where there is contact with oil or welding spatter, etc.

⚠ Caution

1. Avoid using in a location where it could be splashed by liquids such as oils, coolant and water, and dust.

Maintenance

⚠ Warning

1. Removal of equipment, and supply/exhaust of compressed air

When equipment is serviced, first confirm that measures are in place to prevent dropping of driven objects and/-or equipment running out of control, etc. Then cut the supply pressure and power, and exhaust all compressed air from the system using its residual pressure release function.

When the equipment is to be started again after remounting, first confirm that measures are in place to prevent lurching of actuators, etc., and then confirm that the equipment can operate normally.

2. Before performing maintenance, confirm that measures are taken to prevent sudden action and protect workers.

3. Draining

Remove condensate from air filters regularly. If condensate in the drain bowl is not emptied on a regular basis, the condensate will overflow and allow it to enter the compressed air lines. This will cause a malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.

Specific Product Precautions for Mechanical Valve

Design precautions

⚠ Warning

1. Cannot be used for sealing pressure.

Since VM1000 is a poppet type valve, fluid flows backwards when the pressure on port 2 rises. Since the valve is subject to a little amount of air leakage, it cannot be used for applications such as holding pressure (including vacuum).

2. Not suitable for use as an emergency shutoff valve, etc.

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

Mounting

⚠ Warning

1. Do not move the mechanical operation beyond the operating limit position.

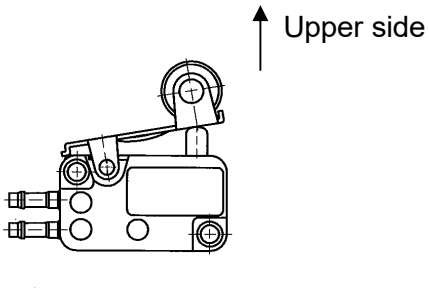
This could damage the mechanical valve itself and lead to equipment malfunction. Refer to Chapter 8, "Mechanical Operating Conditions" in this Operation Manual for the main precautions.

2. Never perform additional machining such as enlarging the body mounting hole or to the valve body.

Scratches or dust may result in air leakage or unexpected failure.

3. Roller lever type valve is recommended to be mounted in the orientation that the roller lever faces upward.

Strokes that are shown in Chapter 5 in this Operation Manual are the values when the valve is operated with the roller lever facing upward as shown in the Fig. If the valve is operated in other mounting orientations, the values may be different from those shown in Chapter 5 due to potential changes in the clearance of the components of the roller lever.



4. Avoid using in a location where it could be splashed by liquids such as oils, coolant and water, and dust.

Operation

⚠ Warning

1. Operate all manual mechanical valves (e.g. button type, flip toggle type) by hand only.

If tools or other equipment such as a cylinder, cam or hammer are used, the actuator or the mechanical valve will be damaged, which may result in malfunction of the equipment.

2. Select the angle and the maximum speed of the operating cam and the dog of the mechanism so that they do not exceed the maximum values.

This could damage the mechanical valve itself and lead to equipment malfunction. Refer to Chapter 8, "Mechanical Operating Conditions" in this Operation Manual for the main precautions.

⚠ Caution

1. After operating for a long time, it will take some time for the valve to restart as the resistance between the seal and the parts increases.

Please consult SMC if the operating condition is maintained for a long period of time.

Maintenance

⚠ Warning

1. Perform inspection on a regular basis as necessary, such as at the beginning of operation, to make sure that the mechanical valve operates properly.

2. Do not disassemble, repair and modify the product.

This may lead to malfunction of equipment, injury and equipment damage. Please contact SMC for repair and maintenance of the product.

3. Strokes of the roller lever type.

When the actuator performs strokes with something like a cam always rotated in contact with the roller of the actuator, the roller may be worn and it may cause change in the strokes. Ensure that the actuator stroke is within the stroke range shown in section 8-1 when the product is serviced.

2. Application

VM1000 mechanical valve is applied to a pneumatics air pressure control circuit in a machine tool, a small-size industrial machine, and others as a signal valve.

For actuator types, a roller lever for mechanical operation, and push button and flip toggle for manual operation are available.

For piping, tubes with an inside diameter of ø2.5 to ø3 are appropriate in general.

- Features

1. VM1000 mechanical valve has a cuboid shape, which facilitates easy installation. The installation dimensions are the same as micro switches for electrical circuits.
2. As the valve has a poppet valve structure, the motion made for opening the valve is small.
3. As the structure does not allow air to flow out from the supply port to the discharge port, at the time of switching of the valve, air is not wasted.

3. Specifications

Valve type			N.C. poppet		
Number of ports			2 or 3		
Piping			Side or bottom ported		
Fluid			Air		
Operating pressure			0 to 0.8 MPa		
Ambient and fluid temperature			–5 to 60°C (No freezing)		
Flow rate characteristics			C[dm^3/(S・bar)]	b	Cv
	Side ported	1(P)→2(A)	0.2	0.15	0.05
		2(A)→3(R)	0.2	0.15	0.05
	Bottom ported	1(P)→2(A)	0.2	0.25	0.05
		2(A)→3(R)	0.2	0.15	0.05
Lubrication			Not required (Use turbine oil Class 1 ISO VG32, if lubricated.)		
Fitting			With hose nipple		

4. How to Order

VM1 0 0 0 – 4N – 00 □

•Color of push button

R	Red
G	Green
B	Black

•Applicable tubing(Material/Size)

4N	Nylon ø4/2.5 (T0425)
4NU	Nylon ø4/3 (T0403)
	Soft Nylon ø4/2.5 (TS0425)
	Polyurethane ø4/2.5 (TU0425)

•Actuator type∗

00	Basic
01	Roller lever
02	One way roller lever
08	Toggle lever
32	Push button

•Piping

0	Side ported
1	Bottom ported

•Total travel/Basic (T.T.)

0	4.8mm
1	2.5 mm (Option)∗

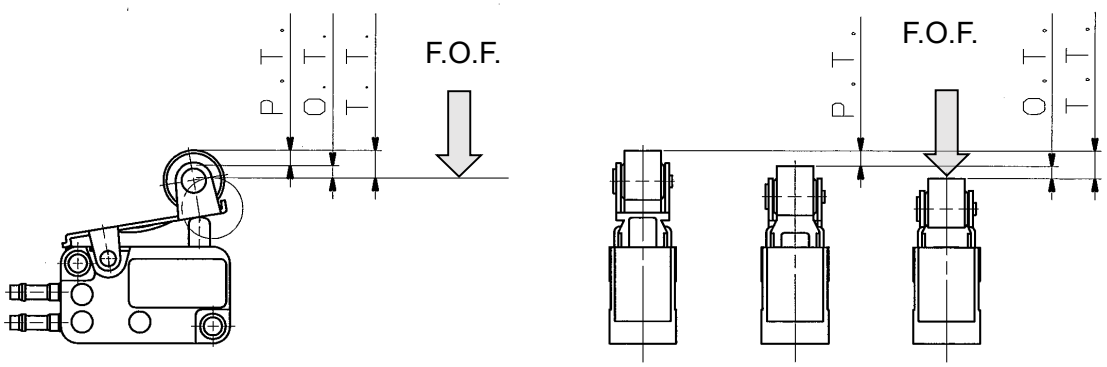
∗ Basic only.

•Number of ports

0	3 port
1	2 port

5.Strokes

5-1. Definition of Symbol



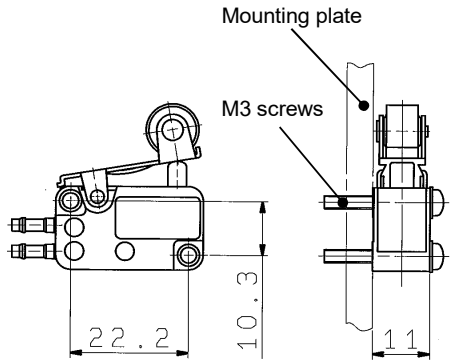
F.O.F. <Full Operating Force> --- Required force to total travel position, from free position of the actuator to total travel position.
P.T. <Pre-travel> --- From free position to initial valve operating position.
O.T. <Over Travel> --- From initial valve operating position to total travel position.
T.T. <Total Travel> --- From free position to total travel position.

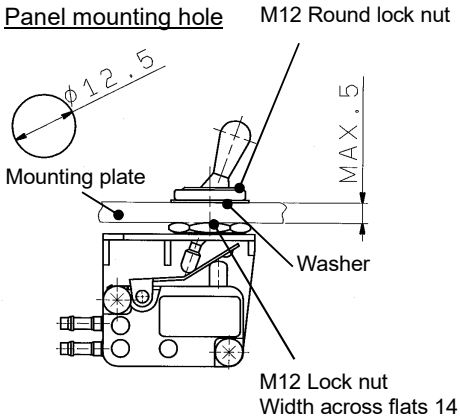
Type	Model		F.O.F. at 0.5 MPa (Note 1)	P.T. (Note 1)	O.T. (Note 1)	T.T. (Note 1)
	2 port	3 port				
Basic type	VM1100-4N-00 VM1110-4N-00 VM1100-4NU-00 VM1110-4NU-00	VM1000-4N-00 VM1010-4N-00 VM1000-4NU-00 VM1010-4NU-00	6N	2.5mm	2.3mm	4.8mm
Semi-standard for basic type	VM1101-4N-00 VM1111-4N-00 VM1101-4NU-00 VM1111-4NU-00	VM1001-4N-00 VM1011-4N-00 VM1001-4NU-00 VM1011-4NU-00	6N	2mm	0.5mm	2.5mm
Roller lever	VM1100-4N-01 VM1110-4N-01 VM1100-4NU-01 VM1110-4NU-01	VM1000-4N-01 VM1010-4N-01 VM1000-4NU-01 VM1010-4NU-01	6N	2.5mm	2mm	4.5mm
One way roller lever	VM1100-4N-02 VM1110-4N-02 VM1100-4NU-02 VM1110-4NU-02	VM1000-4N-02 VM1010-4N-02 VM1000-4NU-02 VM1010-4NU-02	6N	2.5mm	2mm	4.5mm
Toggle lever	VM1100-4N-08 VM1110-4N-08 VM1100-4NU-08 VM1110-4NU-08	VM1000-4N-08 VM1010-4N-08 VM1000-4NU-08 VM1010-4NU-08	4N	40°	—	—
Push button	VM1100-4N-32(R, B, G) VM1110-4N-32(R, B, G) VM1100-4NU-32(R, B, G) VM1110-4NU-32(R, B, G)	VM1000-4N-32(R, B, G) VM1010-4N-32(R, B, G) VM1000-4NU-32(R, B, G) VM1010-4NU-32(R, B, G)	6N	2.5mm	2mm	4.5mm

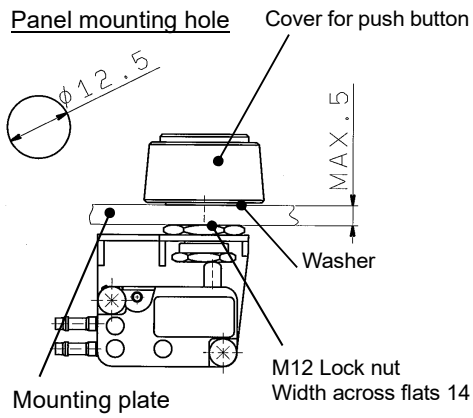
Note 1) Representative values are shown here.

6.Installation and Mounting Orientation

6-1.

<table>
<tr><th rowspan="2">Type</th><th colspan="2">Model</th><th rowspan="2">Mounting dimensions</th></tr>
<tr><th>2 port</th><th>3 port</th></tr>
<tr><td>Roller lever</td><td>VM1100-4N-01
VM1110-4N-01
VM1100-4NU-01
VM1110-4NU-01</td><td>VM1000-4N-01
VM1010-4N-01
VM1000-4NU-01
VM1010-4NU-01</td><td rowspan="2"> 

Fix at two points using M3 screws.</td></tr>
<tr><td>One way roller lever</td><td>VM1100-4N-02
VM1110-4N-02
VM1100-4NU-02
VM1110-4NU-02</td><td>VM1000-4N-02
VM1010-4N-02
VM1000-4NU-02
VM1010-4NU-02</td></tr>
<tr><td>Toggle lever</td><td>VM1100-4N-08
VM1110-4N-08
VM1100-4NU-08
VM1110-4NU-08</td><td>VM1000-4N-08
VM1010-4N-08
VM1000-4NU-08
VM1010-4NU-08</td><td> 

Use two lock nuts and washer for mounting.</td></tr>
<tr><td>Push button</td><td>VM1100-4N-32(R,B,G)</td><td>VM1000-4N-32(R,B,G)</td><td> 

Use lock nut, washer and cover for push button for mounting.</td></tr>
</table>

7.Operating Force

The force required for operating the whole actuator varies depending on the supply pressure. A rough guide for the force required for operating the whole actuator at a given pressure can be calculated by the following formula:

$$F \fallingdotseq \frac{F1}{20} \times K$$

F1: Full operating force at 0.5MPa of the product type (F.O.F on page 10)
K1: Supply pressure factor

K = 10 x P (MPa) + 15

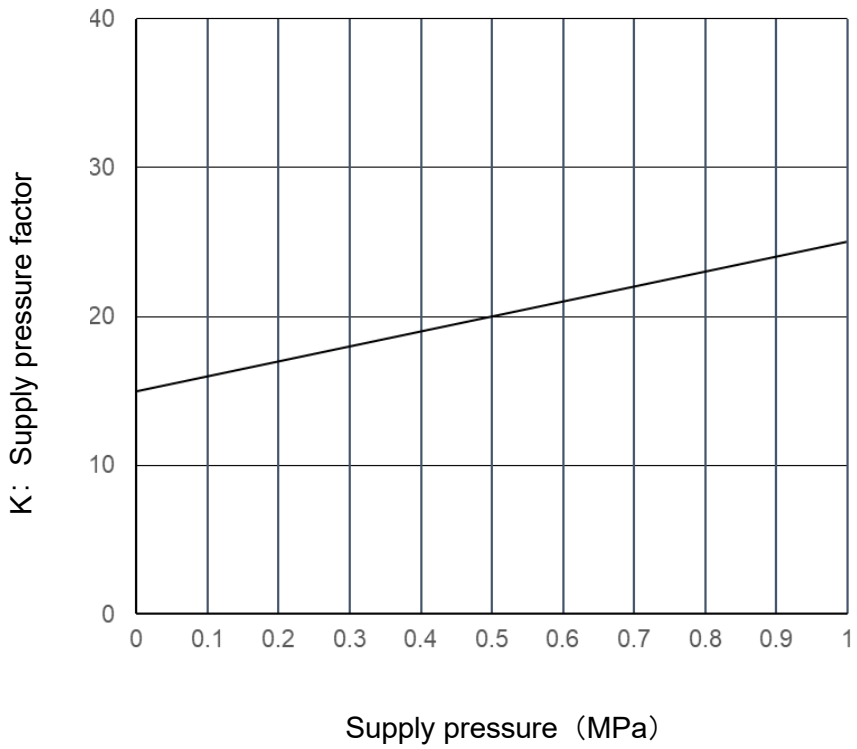


Fig. 1

8. Mechanical Operating Conditions

8-1. Stroke range

Use a mechanical operating product within the stroke range calculated by the formula below.

Stroke range = (P.T. + 0.5 x O.T.) to (P.T. + O.T. -0.1)

Actuator		Stroke range (mm)
Basic	T.T.=4.8mm (T.T=2.5mm)	3.7 ～ 4.7 (2.2～2.4)
Roller lever		3.5 ～ 4.4
One way lever		3.5 ～ 4.4

8-2. Maximum angle and maximum speed limit for cam and dog

Actuator	Max. angle for dog	Max. speed for dog (m/s) (m/s)
Roller lever	30°	0.7
	45°	0.3
One way roller lever	30°	0.7
	45°	0.3

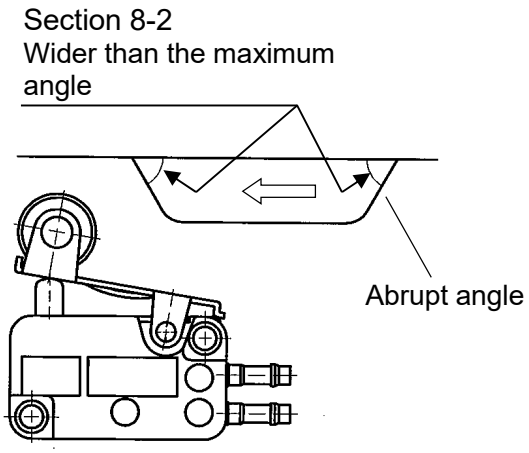
8-3. Cam and dog materials

Roller material	Dog material	Finish accuracy for dog
Polyacetal	Metal	Rz 6.3 or less

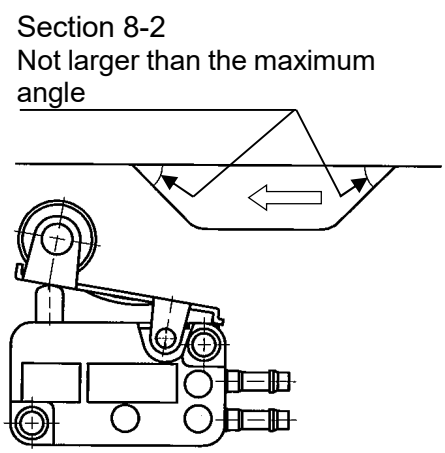
8-4. Operation mechanism and configuration

1. Avoid acute angles on limit switch actuator.

[Not acceptable]

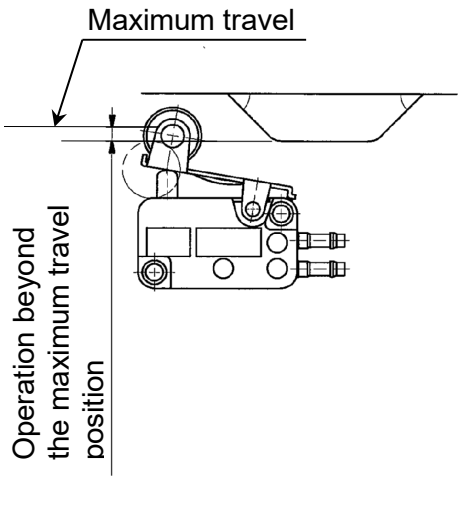


[Acceptable]

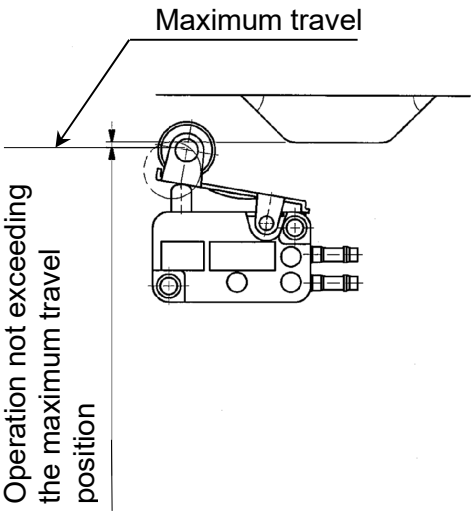


2. Do not allow stroke beyond the maximum travel position.

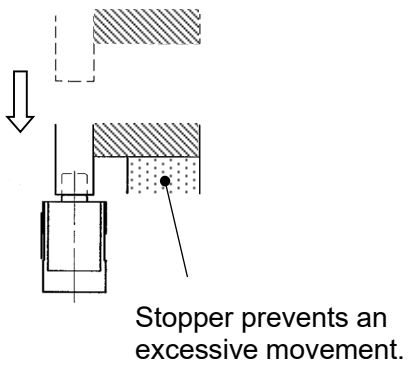
[Not acceptable]



[Acceptable]

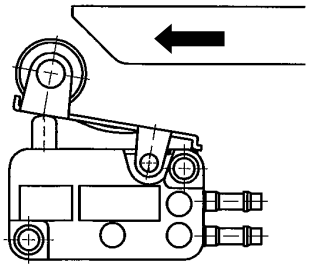


[Acceptable]

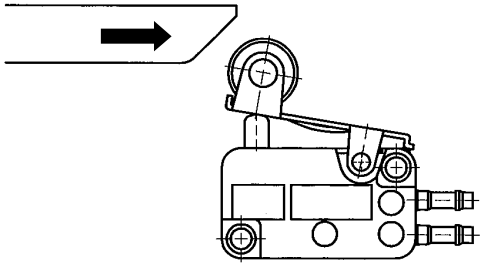


3. Operate the roller lever type from the direction shown below.
In cases where the dog goes over the actuator, select the one way roller lever type.

[Acceptable]



[Not acceptable]



9. Replacement Parts

[Button number]

Color	Push button	Cover for push button
Red	3410701-R	34107031A (White only)
Black	3410701-B	
Green	3410701-G	

Install the push button and the push button cover by screwing them into the bracket.
When installing a panel mount or replacing a push button, perform installation by means of hand tightening.

Revision history
0. A complete revision 1. Changed the part number of Cover for push button.2023.4 2. Safety Instructions changed. 2023.12

SMC Corporation

4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021 JAPAN
Tel: + 81 3 5207 8249 Fax: +81 3 5298 5362
URL https://www.smcworld.com