



Instruction Manual

3 Port Mechanical Valve

Series VM400



The intended use of this product is for signal transmission in pneumatic control circuits of machining equipment or general industrial machinery.

1 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)^{*)}, and other safety regulations.
^{*)} ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
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.
• Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
• Keep this manual in a safe place for future reference.

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

Warning

- **Always ensure compliance with relevant safety laws and standards.**
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

2 Specifications

2.1 Valve specifications

Function		N.C. / N.O.		
Fluid		Air		
Operating pressure range [MPa]		-100kPa to 1		
Ambient and fluid temperature [°C]		-5 to 60 (no freezing)		
Flow rate characteristics		C [dm³/(s.bar)]	b	Cv
	1(N.C.)↔3(OUT)	1.4	0.2	0.29
	2(N.O.)↔3(OUT)		0.15	
Minimum operating frequency		1 cycle / 30 days		
Maximum operating frequency [cpm]		60 (Toggle lever, Selector: 6) (Push button, Foot pedal: 30)		
Impact/vibration resistance [m/s²] ^{Note)}		1000/70		
Lubrication		Not required		
Port size		1/8"		
Mounting orientation		Unrestricted		
Weight		Refer to catalogue		

Table 1.

Note) Impact resistance: Two axes (horizontal and vertical) and two directions were tested and no malfunction of the valve occurred (pulse shape: sine shape), 3 times (test sample mounted with bracket).

2 Specification - continued

Vibration resistance: No malfunction occurred in a sweep cycle test between 10 to 150 Hz at vibration sweep 0.35mm. The test was performed in the two axes and two directions, 7 min per cycle (20 cycles).
Vibration test 1: 30Hz, amplitude: 2mm, acceleration: 7.2G, applied time: 4h.
Vibration test 2: 5Hz⇔50Hz, 10min/cycle, amplitude: 1mm, acceleration(max): 10G.
Tests were conducted on basic type.

2.2 Pneumatic symbols

Caution

Refer to catalogue for pneumatic symbol.

2.3 Special products

Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- When a valve is used for switching a vacuum, take measures to install a suction filter or similar to prevent external dust or other foreign matter from entering inside the valve.

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- Avoid using the product in environments where dust or liquids such as oil, coolants or water may come into contact with the product. As this

product is not water or dust proof, liquids or dust could enter the valve leading to product malfunction. Prevent direct contact from water droplets by mounting a protective cover.

- Do not use in high humidity environment where condensation can occur.

3.3 Piping

Caution

- Before connecting 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 thread exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Ports	Connection thread (R, NPT, G)	Tightening torque [N·m]
1(P), 2(A), 3(R)	1/8"	3 to 5

Table 2.

3.4 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, refer to catalogue for details.

3.5 Air supply

Warning

- Use clean air. If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas etc., it can lead to damage or malfunction.

Caution

- Install an air filter upstream of the valve. Select an air filter with a filtration size of 5 µm or smaller.
- Grease is used for the inside of the valves, so it may enter into the outlet port of the valve.

3 Installation - continued

3.6 Mounting

Warning

- Mount the mechanical operation type mechanical valve so that the valve does not operate over the operating limit range. Failure to do so may result in damage to the mechanical valve itself or lead to equipment malfunction.
- Never perform additional machining such as enlarging the body mounting holes as it could lead to unexpected abnormal conditions such as air leakage.
- For panel mount thickness and hole dimensions refer to catalogue.

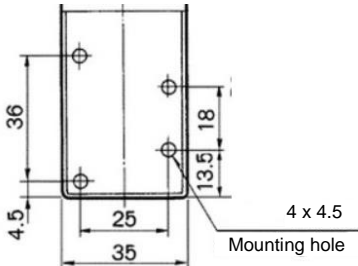


Figure 1 – VM430 Mounting dimensions

3.6.1 Stroke range

Warning

- Operate the mechanism within the stroke range given below:

Actuator	Actuator stroke [mm]
Basic	2.5 to 3.4
Roller lever	6.2 to 8.4
One way roller lever	6.5 to 8.9
Straight plunger / Roller plunger / Cross roller plunger	4.5 to 5.4

Table 3.

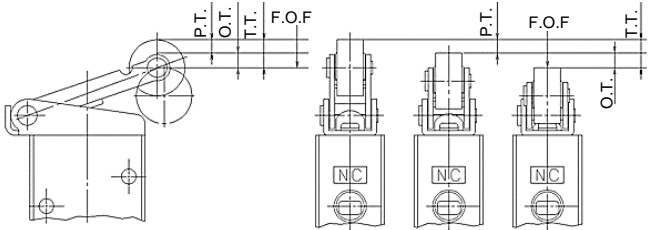


Figure 2.

- F.O.F (Full operating force): Required force 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.

Caution

- Refer to catalogue for F.O.F., P.T., O.T. and T.T. values.

- For the straight plunger and roller plunger, there are grooves indicating P.T. and T.T. for stroke adjustment.

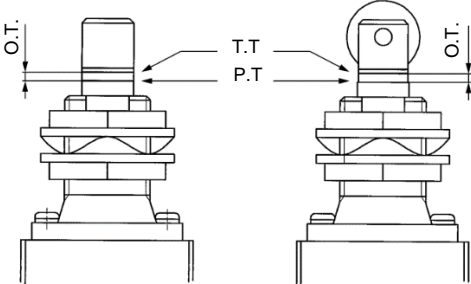


Figure 3.

3 Installation - continued

3.6.2 Cam and dog angle and maximum speed

- When using a mechanical operation type mechanical valve, select the angle and the maximum speed limit of the cam and dog so that the valve does not exceed the following maximum values. If operated over the maximum values, impact force from the cam and dog will be applied to the actuator, resulting in damage.

Actuator	Angle limit switch actuator	Maximum speed limit switch actuator [m/s]
Roller lever / One way roller lever	30° 45°	0.7 0.3
Straight plunger	-	0.2
Roller plunger / Cross roller plunger	30°	0.3

Table 4.

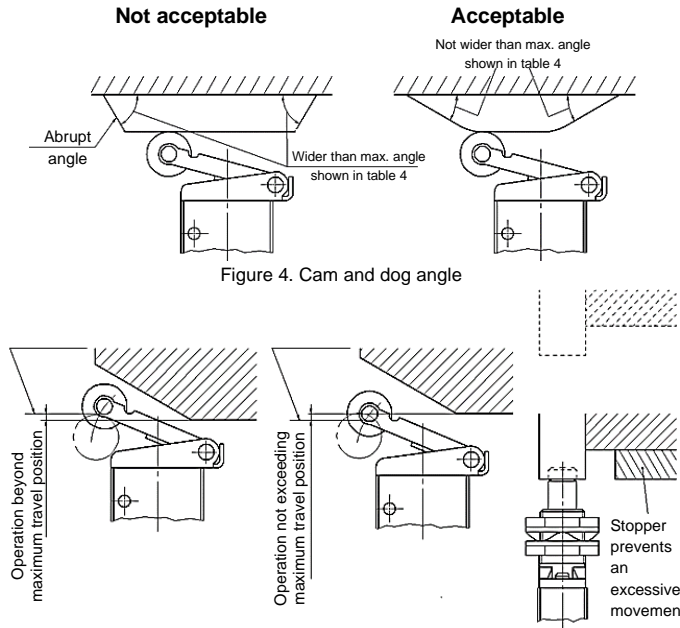


Figure 5. Maximum travel position

- Mount the roller lever type as shown below. In cases where the dog goes over the actuator, select the one way roller lever type or the roller plunger type.

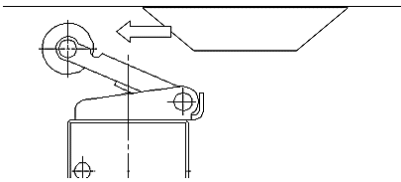


Figure 6.

- Be sure to always operate push button type, twist selector type, and toggle lever type mechanical valves with your finger. The use of tools such as hammers and equipment such as cylinders and cams to operate the product can damage the actuator and the valve body.

3.7 How to change the buttons

Caution

3.7.1 Push button (Flush type)

3.7.1.1 Installation

Of the four colours, red, green, black and yellow, select and align the protruding portion of the button with the recessed portion of the body and push in.

3.7.1.2 Removal

Remove the fastening ring and insert the tip of a small flat head screwdriver into the groove of the button to pry it up.

3 Installation - continued

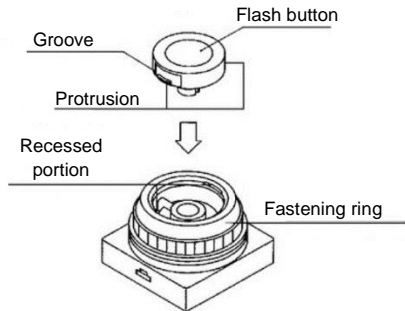


Figure 7.

3.7.2 Push button (Mushroom and extended types)

At the time of shipment, only 1 button of the colour that you specified is attached to the body.

	Mushroom type	Extended type
Installation	Align the protruding portion of the button with the recessed portion of the body and push in. (Use the mark on the button as a reference to align the protruding part.)	Align the protruding portion of the button with the recessed portion of the body and push in.
Removal	Placing your finger under the collar of the button on the side of the mark, tilt it upward.	Remove the fastening ring and insert the tip of a small flat head screwdriver into the groove of the button to pry it up.

Table 5.

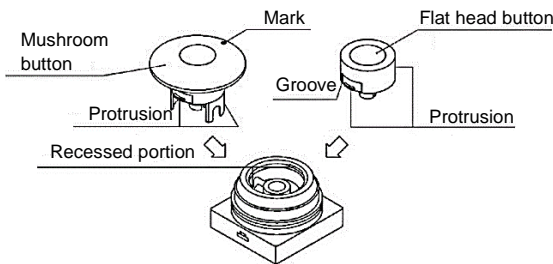


Figure 8.

3.7.3 How to remove a mushroom button

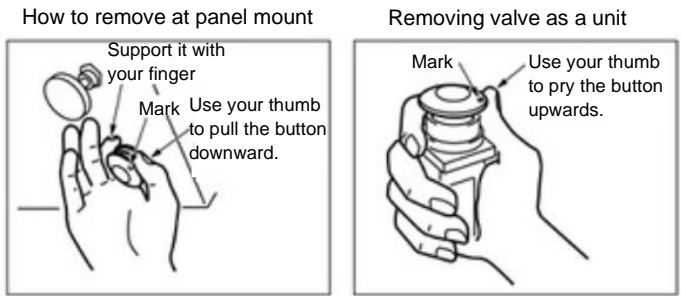
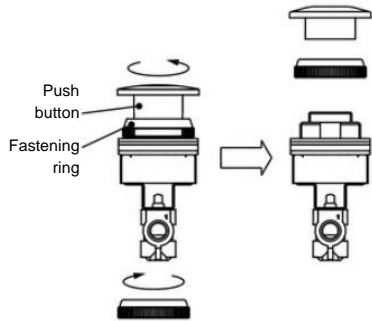


Figure 9.

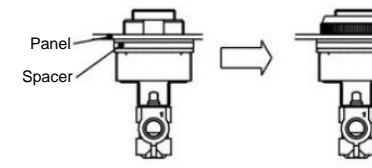
3 Installation - continued

3.8 Panel mounting of X207A/X219A mushroom type button

1) Rotate the push button and fastening ring counter clockwise in order to remove them.



2) Insert the valve into the panel and fix it with the fastening ring. Remove the spacers depending on the thickness of the panel.



3) Tighten the push button clockwise by hand until it comes to a stop. Do not apply excessive force.

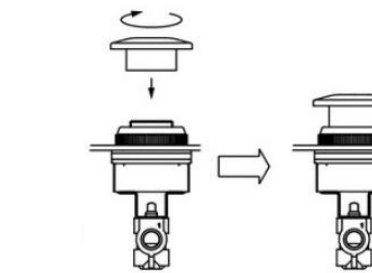


Figure 10.

Caution

For the removal of the standard mushroom button, please refer to 3.7.

4 How to Order

Refer to catalogue for 'How to Order' or to product drawing for special products.

5 Outline Dimensions

Refer to catalogue for outline dimensions.

Caution

Dimensions of the roller lever type may exceed the values specified in the catalogue if the roller lever is positioned in any direction other than upwards, due to the design of the lever.

6 Maintenance

6.1 General maintenance

Warning

- To prevent unexpected movements of the pneumatic actuator, the user shall consider the state of the valve before conducting maintenance. Additional consideration shall be given when the valve is held in the ON position by an external mechanism such as cam, lever, etc., or in the case that locking type valve actuators are used.

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 only by qualified personnel.
- Before performing maintenance, turn off the power supply and be sure to cut off the supply pressure. Confirm that the air is released to atmosphere.
- After installation and maintenance, apply operating pressure and power to the equipment and perform appropriate functional and leakage tests to make sure the equipment is installed correctly.
- If any electrical connections are disturbed during maintenance, ensure they are reconnected correctly and safety checks are carried out as required to ensure continued compliance with applicable national regulations.
- Do not make any modification to the product.

6 Maintenance - continued

- Do not disassemble the product, unless required by installation or maintenance instructions.

6.2 Maintainable parts

Caution

Refer to catalogue for replacement part numbers.

7 Limitations of Use

Warning

The system designer should determine the effect of the possible failure modes of the product on the system.

7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

Warning

7.2 Safety related applications

This product shall not be used as an emergency shut-off valve or as any part of an emergency stop circuit.

7.3 Holding of pressure (including vacuum)

Since valves are subject to air leakage, they cannot be used for applications such as holding pressure (including vacuum) in a system.

7.4 Strokes of the roller lever, roller plunger and cross roller plunger types.

When the actuator performs strokes, with something like a cam, rotated always 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 table 3 when the product is serviced.

7.5 Effect of energy loss on valve switching

- Valves may not be closed only by load pressure if the spring that closes the valve is damaged.
- Valves with locking type actuators or valves operated by an external mechanism such as cam, lever, etc. remain in the ON position even when the energy source is interrupted. If the air supply is reconnected again, e.g. after maintenance, it may behave unexpectedly.

7.6 Vacuum absorption

Stopping of continuous vacuum absorption can result in leakage, a workpiece dropping or problems from foreign matter sticking to the vacuum pad.

Caution

7.7 Low temperature operation

Unless otherwise indicated in the specifications for each valve, operation is possible to -5°C, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7.8 Extended operating condition

If the operating condition is maintained for long periods of time, it may take some time for the valve to restart due to the adherence of the seals and there might be a delay for recovery.

8 Product Disposal

This product shall not be disposed of as municipal waste. Check your local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

9 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor/importer.

SMC Corporation

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Template DKP50047-F-085M