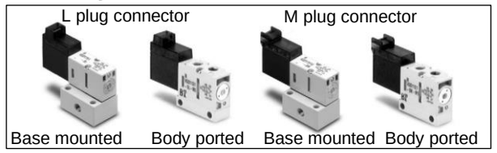
ORIGINAL INSTRUCTIONS

Instruction Manual
4 Port Solenoid Valve
Series VQD1000



The intended use of this valve is to control the movement of an actuator.

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) *1), and other safety regulations.

*1) 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.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

⚠ Caution

- The product is provided for use in manufacturing industries only. Do not use in residential premises.

2 Specifications

2.1 Valve specifications

Type	Standard single	Large-flow single	Large- flow latching
Fluid	Air		
Operating pressure range [MPa]	0 (Vacuum: -101.2 kPa) to 0.7		
Ambient and fluid temperature [°C]	-10 to 50 (no freezing)		
Flow characteristics	Refer to catalogue		
Response time [ms]	Refer to catalogue		
Duty cycle	Contact SMC		
Min. operating frequency	1 cycle / 30 days		
Max. operating frequency [Hz]	Contact SMC		
Manual override	Non-locking push type	Locking	
Lubrication	Not required		
Impact / Vibration resistance [m/s^2] Note 1)	150/30		
Enclosure (based on IEC60529)	IP40		

2 Specifications - continued

Mounting orientation	Unrestricted
Weight	Refer to catalogue

Table 1.

Note 1) Impact resistance: No malfunction occurred when it was tested with a drop tester in the axial direction and at right angles to the main valve and armature; in both energized and de-energised states and for every time in each condition. (Values at the initial period).
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Tests are performed at both energized and de-energized states in the axial direction and at right angles to the main valve and armature. (Values at the initial period).

2.2 Solenoid specifications

Type	Standard single	Large-flow single	Large-flow latching
Coil rated voltage [VDC]	12, 24		24
Electrical entry	L/M plug connector		
Coil insulation class	Class B or equivalent		
Allowable voltage fluctuation	-10% to +10% of rated voltage		
Power consumption [W] Note 1)	2	3.2 (Inrush) 1 (Holding)	2
Surge voltage suppressor	Varistor	Diode	Varistor
Indicator light	LED		

Table 2.

Note 1) Refer to catalogue for energy saving type power waveform.

2.3 Pneumatic symbol

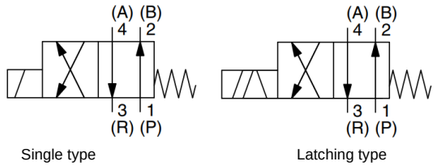


Figure 1. Pneumatic symbol

2.4 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.

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.

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.

Port	Thread	Tightening torque [N·m]
1(P), 3(R)	M5	1 to 1.5
2(B), 4(A)		
P(1), R(3) (Manifold)	1/8	3 to 5

Table 4.

3 Installation - continued

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.

3.6 Manual override

⚠ Warning

- Regardless of an electric signal for the valve, the manual override is used for switching the main valve. Since connected equipment will operate when the manual override is activated, confirm that conditions are safe prior to activation.
- Locked manual overrides might prevent the valve responding to being electrically de-energised or cause unexpected movement in the equipment.
- Refer to the catalogue for details of manual override operation.

3.7 Mounting

⚠ Caution

- Ensure gaskets are in good condition, not deformed and are dust and debris free.
- When mounting valves ensure gaskets are present, aligned and securely in place and tighten the mounting screws to a torque of 0.18 to 0.25 N·m.
- When piping and mounting valves, clamp the body part in place to avoid applying force to the coil. If you apply force over 120 N to coil, connection pins deform, which may cause malfunction. (Latching: 50 N or more).

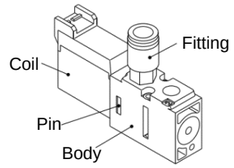


Figure 2.

3.8 Electrical circuits

⚠ Caution

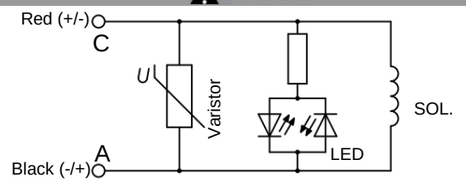


Figure 3. Single type (Standard: 2W)

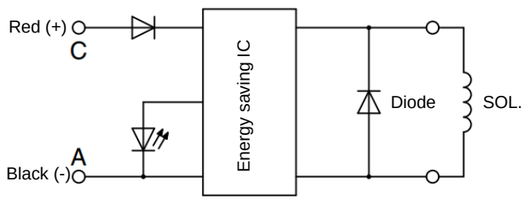


Figure 4. Single type (Large flow: 3.2 W)

Effective energizing time for the energy saving type is between 15 to 25 ms at 24 VDC. Refer to catalogue for electrical power waveform.

3 Installation - continued

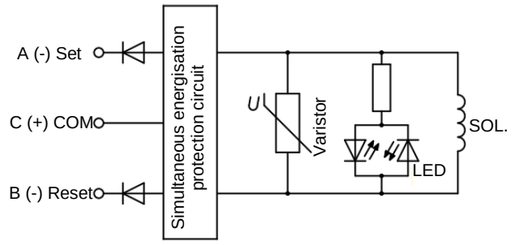


Figure 5. Latching solenoid type

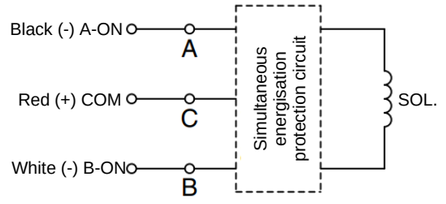


Figure 6. Positive common

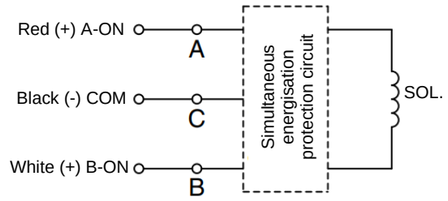


Figure 7. Negative common

3.9 Electrical connectors

⚠ Caution

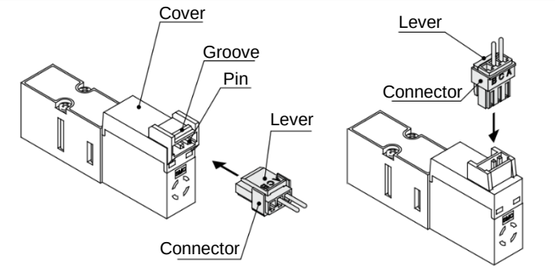


Figure 8. How to use plug connector

Pull lead wire with gently, otherwise it may cause contact failure or disconnection.
Refer to catalogue for guidance on how to use plug connector.

3.10 Residual voltage

⚠ Caution

- If a varistor voltage suppressor is used, the suppressor arrests the back EMF voltage from the coil to a level in proportion to the rated voltage.
- Ensure the transient voltage is within the specification of the host controller.
- Contact SMC for the varistor residual voltage.
- In the case of a diode, the residual voltage is approximately 1 V.
- Valve response time is dependent on surge suppression method selected.

3 Installation - continued

3.11 Countermeasure for surge voltage

Caution

- At times of sudden interruption of the power supply, the energy stored in a large inductive device may cause non-polar type valves in a de-energised state to switch.
- When installing a breaker circuit to isolate the power, consider a valve with polarity (with polarity protection diode), or install a surge absorption diode across the output of the breaker.

3.12 Extended period of continuous energization

Warning

- If a valve will be continuously energized for an extended period of time, or is mounted in a control panel, the temperature of the valve will increase due to the heat generated by the coil assembly. This will likely adversely affect the performance of the valve and any nearby peripheral equipment. Therefore, if the valve is to be energized for periods of longer than 30 minutes at a time or if during the hours of operation the energized period per day is longer than the de-energized period, we advise using a direct operated continuous duty type valve such as the VK series or the VT series, or consider use of the latching type for which continuous energization is not required.
- Coil temperature may get high due to ambient temperature or energizing duration. Do not touch the valve by hand directly. When there is such a dangerous case to be touched by hands directly, install a protective cover.
- The latching type should not be energized over 30 seconds. Ensure the de-energised period is longer than the energised time (both A and B should be turned off.) before the next operation.

3.13 Effect of back pressure when using a manifold

Warning

Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure.

3.14 Latching type

Caution

- Use in a circuit that does not have simultaneous energization of A-ON and B-ON signals.
- The minimum energization time required for self-holding is 50 ms.
- Although there is no problem for normal operations and environments. please consult SMC when operating in an environment with vibration (10G or more) or strong magnetic fields.
- When there is the magnetic body at the valve side, it may cause malfunction. Allow a space over 10 mm between the valve and magnetic body.
- Even though this valve is held on to B-ON position (passage: P → B), it may switch to the set position during transportation or due to impact when mounting valves, etc. Therefore, check the initial position by means of power supply or manual override prior to use.

Energisation		Passage	Light colour
A-ON (Set)	A(-) C(+) Black Red	P→A (B→R)	Red
B-ON (Reset)	B(-) C(+) White Red	P→B (A→R)	Green

Table 5.

Note) For positive common.

4 How to Order

Refer to catalogue for ‘How to Order’.

5 Outline Dimensions

Refer to catalogue for outline dimensions.

6 Maintenance

6.1 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 only by qualified personnel.

6 Maintenance - continued

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

6.2 Mounting

Caution

Refer to 3.7 Mounting for guidance on how to mount valve to base.

6.3 Maintainable parts

Caution

Refer to catalogue for how to order manifold accessories, sub-plates or electrical connector assemblies.

7 Limitations of Use

7.1 Limited warranty and disclaimer/compliance requirements

Caution

Refer to Handling Precautions for SMC Products.

7.2 Effect of energy loss on valve switching

Warning

	Single type	Latching type Note)
Air supply present, electrical supply cut	Valve spool returns to OFF position by spring force.	Valve spool holds position until reset signal is sent (B-ON), spool then returns to OFF position by spring force.
Electrical supply present, air supply cut	Valve operation is not dependent on presence of air supply. Spool position/movement is unaffected by loss of air supply.	

Table 6.

Note) Refer to 3.14 and catalogue for Latching type operation guidance.

7.3 Holding of pressure

Warning

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

7.4 Cannot be used as an emergency shut-off valve

Warning

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 be adopted.

7.5 Leakage voltage

Caution

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes ≤ 2% of the rated voltage across the valve.

7.6 Low temperature operation

Caution

Unless otherwise indicated in the specifications for each valve, operation is possible to -10˚C, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7 Limitations of Use - continued

7.7 Vacuum applications and use as a 3 port valve.

Caution

- Use a VQD(1/2)(2/3/5)1(V/W) valve for vacuum applications.
- Connect the vacuum source to the 3(R) port.
- Refer to catalogue for diagram.
- Air pressure cannot be applied to the 3(R) port.
- When used as a 3 port valve, conversion from N.O. to N.C. and vice versa is possible by plugging either port 4(A) or 2(B).
- The valve cannot be used as a 2 port valve.

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

URL : https:// www.smcworld.com (Global) https:// www.smc.eu (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan

Template DKP50047-F-085M