ORIGINAL INSTRUCTIONS

Instruction Manual
5 port solenoid valve
Series VQ(C)4000/5000

The intended use of this product is to control the movement on 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 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

- 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.

⚠ 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

- **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.

⚠ Caution

- The product is provided for use in manufacturing industries only. This product must not be used in residential areas.

2 Specifications

2.1 Valve specifications

			Metal seal	Rubber seal
Valve Type			5 Port Solenoid Valve	
Fluid			Air	
Internal pilot operating pressure range [MPa]		Single	0.15 to 1 (0.1 to 1 *1))	0.2 to 1
		Double	0.15 to 1 (0.1 to 1 *1))	
		3 position	0.15 to 1	0.2 to 1
External pilot [MPa]	Operating pressure range		-100 kPa to 1	
	Pilot pressure range		Same as internal pilot operating pressure range	
Minimum operating frequency			1 cycle / 30 days	
Maximum operating frequency	2 position single/ double	VQ(C)4000	20 Hz	5 Hz
		VQ(C)5000	10 Hz	
	3 position	VQ(C)4000	10 Hz	3 Hz
		VQ(C)5000	5 Hz	
Duty cycle			Contact SMC	
Response time			Refer to catalogue	
Flow rate			Refer to catalogue	
Ambient/fluid temperature			-10 to +50°C (-5 to +50°C for VQC5000) *2)	

2 Specifications - continued

Lubrication	Not required
Manual override	Non-locking Push type, Locking type (Tool required, Manual)
Impact/Vibration resistance	150/30 m/s² *3)
Mounting orientation	Refer to 3.2 and 7.4
Enclosure (based on IEC60529)	IP40 (IP65 and IP67 compatible) *4)

Table 1.

Note 1) For VQ(C)5000 metal seal
Note 2) Use dry air to prevent condensation at low temperatures.
Note 3) **Impact resistance:** No malfunction resulted from the impact test using a drop impact tester. Test was performed one time each in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (Values quoted are for a new valve)
Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed in the axial and right angle directions of the main valve and armature for both energized and de-energized states. (Values quoted are for a new valve)
Note 4) Refer to 2.3 for applicable variations.

2.2 Solenoid specifications

Rated coil voltage [VDC]		12, 24
Allowable voltage fluctuation		±10 % of rated voltage (Note 1)
Coil insulation type		Class B or equivalent
Power consumption (Current) [W]	24 VDC	0.95 (standard), 0.4 (low wattage)
	12 VDC	0.95 (standard), 0.4 (low wattage)
Surge voltage suppressor		Varistor
Indicator light		LED

Table 2.

Note 1) Valve state is not defined if electrical input is outside the specified operating range.

2.3 Manifold specifications

2.3.1 VQ4000/5000

Series			VQ4000	VQ5000	VQ4000	VQ5000
					Maximum number of stations (solenoids)	
Electrical entry and ingress protection (Based on IEC60529)	D-sub		IP40		18 (36)	12 (24)
	Terminal block box[1)]		IP65		18 (36)	12 (24)
	Individual terminal block kit			IP40		12 (24)
	Lead wire cable[1)]		IP65		16 (32)	12 (24)
	EX123, EX124[1)]		IP65		18 (36)	12 (24)
	Connector[J]		IP65		16 (32)	
Port size	1(P), 3(R1), 5(R2)		1/2	3/4		
	2(A), 4(B)	Side ported	C6, C8, C10, C12 1/4, 3/8 N7, N9, N11	3/8 1/2		
		Bottom ported	1/4	1/2		

Table 3.

Note 1) When W type is chosen.

2.3.2 VQC4000/5000

Series		VQC4000	VQC5000	VQC4000	VQC5000
				Maximum number of stations (solenoids)	
Electrical entry and ingress protection (Based on IEC60529)	D-sub, Flat ribbon cable, EX260	IP40		12 (24)	
	EX245	IP65			
	EX126	IP67		8 (16)	
	EX250 EX260 EX500 EX600 Lead wire Circular connector			12 (24)	
	Terminal block box			10 (20)	

2 Specifications - continued

Port size	1(P),3(R)		P: 1/2 R: 3/4	D-side: 1/2 U-side: 3/4	
	2(A),4(B)	Side ported	C6, C8, C10, C12 1/4 3/8	3/8, 1/2	
	2(A),4(B	Bottom ported	1/4	1/2	

Table 4.

2.4 Indicator light and override positions

In the double solenoid type, A side and B side energization are indicated by two colours which match the colours of the manual overrides.

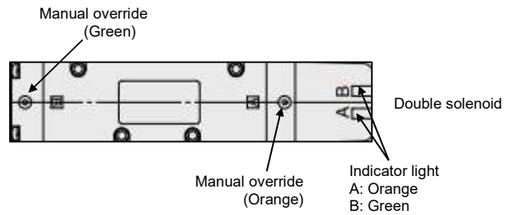

Figure 1. ON/OFF indicator and override buttons of VQ(C)5000.

2.5 Pneumatic symbols

Refer to catalogue and special drawings for ‘Pneumatic symbols’.

2.6 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 using double solenoid type for the first time, actuators may travel in an unexpected direction depending on the switching position of the valve. Implement countermeasures to avoid any danger that may occur due to the actuator’s operation.

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.
- Products with IP65 and IP67 enclosures (based on IEC60529) are protected against dust and water; however, these products cannot be used in water.
- Products compliant with IP65 and IP67 satisfy the specification through mounting the product properly. Be sure to read the Specific Product Precautions for each product
- When using built-in silencer type manifold with an IP67 enclosure, keep the exhaust port of the silencer from coming in direct contact with water or other liquids.
- If using in an atmosphere where there is possible contact with water drop-lets, oil, weld spatter, etc., take suitable preventative measures.
- When the solenoid valve is mounted in a control panel or is energized for a long time, make sure that the ambient temperature is within the valve’s specified range.
- The metal seal valve is provided with a hole to discharge the pilot EXH. When using in atmospheres containing water and dust, mount horizontally.

3 Installation - continued

- Do not use in high humidity environment where condensation can occur.
- Contact SMC for altitude limitations.

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.

Connection thread size (R, NPT)	Tightening Torque [N·m]
M5	1 to 1.5
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

Table 5.

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 One-touch fittings

⚠ Caution

When fittings are used, they may interfere with one another depending on their types and sizes. Therefore, the dimensions of the fittings to be used should first be confirmed in their respective catalogues.

3.5.1 Tube attachment and detachment

⚠ Caution

Refer to the Specific Precautions of Fittings and Tubing in the catalogue.

3.5.2 Precautions on other tube brands

⚠ Caution

- When using non-SMC brand tubes, refer to the Specific Precautions of Fittings and Tubing in the catalogue.

3.6 Light/Surge voltage suppressor

⚠ Caution

The valve is fitted with varistor surge suppressors, see Figure 2 and 3.

Refer to 3.8 for Residual voltage value.

3.6.1 Single solenoid

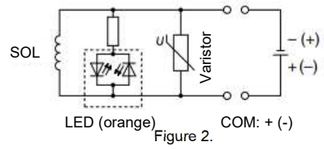

Figure 2.

3.6.2 Double solenoid

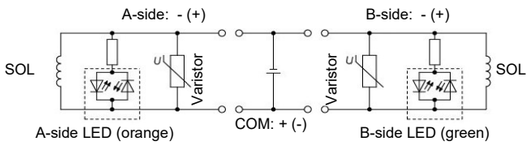

Figure 3.

⚠ Caution

The surge suppressors fitted to the valve are intended to protect the output device so that the surge generated inside the valve does not affect the output device. External overvoltage or overcurrent might damage the surge suppressor, the valve and the output device itself. Additional safety measures should be taken to prevent the effect of overcurrent on the valve and connected devices.

3 Installation - continued

3.7 Mounting

Caution

After confirming that the gasket is installed correctly, securely tighten the mounting screws (M3 for VQC4000 and M4 for VQC5000) according to the tightening torque shown below.

Proper Tightening Torque [N·m]	
VQ(C)4000 (M3 mounting screw)	0.8 to 1.2
VQ(C)5000 (M4 mounting screw)	1 to 1.8

Table 6.

Refer to Specific Product Precautions in the catalogue for more details.

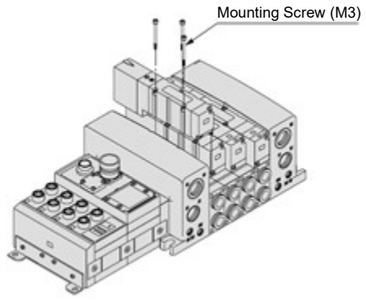

Figure 4. (Example shows VQC4000)

3.8 Residual voltage of the surge voltage suppressor

Caution

Note) If a varistor surge voltage suppressor is used, there is some residual voltage to the protection element and rated voltage. Therefore, refer to the table below and pay attention to the surge voltage protection on the controller side.

VQ(C)4000	Approx. 60 V
VQ(C)5000	Approx. 60 V

Table 7.

3.9 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.

3.10 Extended periods of continuous energization

Caution

- When the product is continuously energized for a long period of time (10 minutes or longer), select the low wattage type.
- Refer to '3, 4, 5 port solenoid valves precautions' for more details.
- When solenoid valves are mounted in a control panel, employ measures to radiate excess heat, so that temperatures remain within the valve specification range. Use special caution when three or more stations sequentially aligned on the manifold are continuously energized since this will cause a drastic temperature rise.

3.11 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 near the valve. Select an air filter with a filtration size 5 µm or smaller.

3.12 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.
- For a 3-position exhaust centre valve or single acting cylinder, take appropriate measures to prevent malfunction by using it with an individual EXH interface block.

3 Installation - continued

3.13 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.
- Do not apply excessive torque when turning the locking type manual override, (0.1 N·m or less).

3.14 External pilot exhausts

Caution

The external pilot variants use the exhaust port of the manifold. Ensure that this connection is always vented to atmosphere and do not block the exhaust port when arranging the piping.

3.15 Electrical wiring specification

Refer to catalogue for electrical wiring specifications.

4 How to Order

4.1 Standard products

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

5 Outline Dimensions

Refer to catalogue and special drawings 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.
- 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.
- When the 3-position closed centre type is in its rest position, air can be trapped between the valve and the cylinder. Exhaust this air pressure before removing piping or performing any maintenance.
- When the equipment is operated after remounting or replacement, first confirm that measures are in place to prevent lurching of actuators, etc. Then, confirm that the equipment is operating normally.
- Operate the valve according to the minimum operating frequency given in section 2.
- For maintenance purposes install a system for releasing residual pressure. Especially in the case of 3-position closed centre valve or double check valve type, ensure that the residual pressure between the valve and the cylinder is released.
- Dust on sealing surfaces of the gasket of solenoid valve can cause air leakage. Ensure gaskets are in place and parts are dust free.

6 Maintenance - continued

6.2 Replacement parts

6.2.1 Installation/removal of light cover

Caution

Refer to catalogue for additional information.

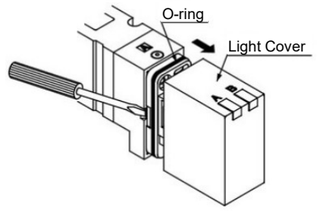

Figure 5. VQ(C)4000

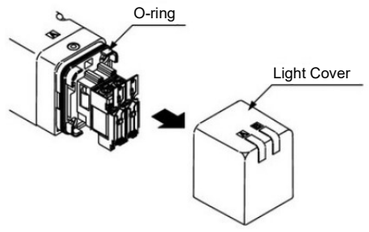

Figure 6. VQ(C)5000

6.2.2 Replacement of the pilot valve

Caution

After confirming the gasket is correctly placed under the valve, securely tighten the bolts with the proper torque shown in figure 7.

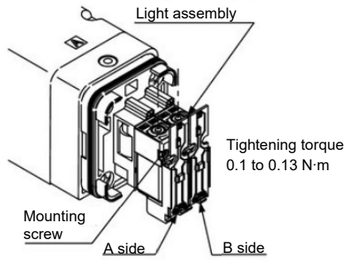

Figure 7.

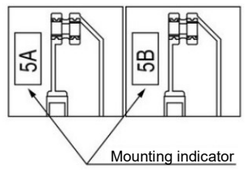

Figure 8.

Note) The light circuit boards: A side is red and the B side is green. It must be mounted on the pilot valve in accordance with the mounting indicators.

6 Maintenance - continued

6.2.3 Plug lead type

Caution

Refer to catalogue for additional information.

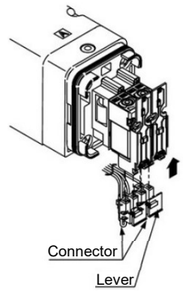

Figure 9.

7 Limitations of Use

Warning

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

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

7.2 Leakage voltage

Caution

Ensure that any leakage current when the switching element is OFF causes ≤ 3% of the rated voltage across the valve.

7.3 Low temperature operation

Caution

Unless otherwise indicated in the specifications for each valve, operation is possible to -10˚C (-5˚C for VQC5000), but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7.4 Mounting orientation

Caution

Valve type, coil type		Mounting orientation
Rubber	All types	Unrestricted (Universal)
Metal	Single	
	Double Including 3-position type	Main valve spool to be horizontal

Table 8.

7.5 Air returned or air/spring returned spool valves

Warning

- The use of 2-position single valves with air returned or air/spring returned spools has to be carefully considered.
- The return of the valve spool into the de-energized position depends on the pilot pressure. If the pilot pressure drops below the specified operating pressure the position of the spool cannot be defined.
- The design of the system must take into account such behaviour.
- Additional measures might be necessary. For example, the installation of an additional air tank to maintain the pilot pressure.

7 Limitations of Use - continued

Energy source status	Single	Double	3 position
Air supply present, electricity cut	Spool returns to the off position by air force and spring force	Spool stops moving after electricity cut (Position cannot be defined)	Spool returns to off position by spring force
Air supply cut before electricity cut	Spool stops moving after air pressure cut (Position cannot be defined)	Spool stops moving after air pressure cut (Position cannot be defined)	Spool stops moving after air pressure cut (Position cannot be defined)

Table 9.

7.6 Intermediate stopping

⚠ Warning

Refer to Handling Precautions for 3/4/5 port Solenoid Valves.

7.7 Holding of pressure

⚠ Warning

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

7.8 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.

7.9 Safety relay or PLC

⚠ Warning

If a safe output from a safety relay or PLC is used to operate this valve, ensure that any output test pulse duration is shorter than 1 ms to avoid the valve solenoid responding.

7.10 Momentary energization

⚠ Caution

If a double solenoid valve will be operated with momentary energization, it should be energized for at least 0.1 second. However, depending on the secondary load conditions, it should be energized until the cylinder reaches the stroke end position, as there is a possibility of malfunction otherwise.

7.11 EMC restrictions

⚠ Caution

7.11.1 Class and group description

- This product is group 1, class A equipment according to EN55011.
- Group 1 equipment does not intentionally generate radio-frequency energy in the range 9kHz to 400 GHz.
- Class A equipment is equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
- This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

7.11.2 Cable length to connect

The cable to connect the product shall be less than or equal to 30m.

7.11.3 Connecting the power supply

This product is not intended to be directly connected to any DC Distribution network.

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 for 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

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