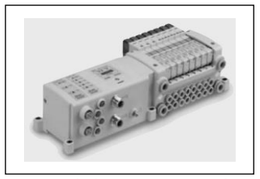
ORIGINAL INSTRUCTIONS

Instruction Manual
5 Port Solenoid Valve
Series VQ(C)1000/2000



The intended use of this product 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.

⚠ Caution

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

2 Specifications

2.1 Valve specifications

Valve Type		Metal seal	Rubber seal
Fluid		Air	
Internal pilot operating pressure range [MPa]	Single	0.1 to 0.7 (High pressure type: 0.1 to 1)	0.15 to 0.7
	Double		0.1 to 0.7
	3 position		0.2 to 0.7
	4 position dual 3 port	-	0.15 to 0.7
External pilot [MPa] Note 1, 2)	Operating pressure range	-100 kPa to 0.7 (High pressure type: -100 kPa to 1)	
	Pilot pressure range	Same as internal pilot operating pressure range	
Minimum operating frequency		1 cycle / 30 days	
Maximum operating frequency [Hz]	2 position single/double	20	5
	4 position dual 3 port		
	3 position	10	3
Duty cycle		Contact SMC	
Response time		Refer to catalogue	
Flow rate			
Ambient and fluid temperature [°C] Note 3)		-10 to 50 (No freezing)	
Lubrication		Not required	

2 Specification - continued

Manual override	Non-locking Push type, Locking type (Tool required, Manual), Slide locking type
Impact/Vibration resistance [m/s²] Note 4)	150 / 30
Mounting orientation	Refer to 3.2 and 7.5
Enclosure (Based on IEC60529) Note 5)	IP40 (IP67 compatible)
Weight	Refer to catalogue

Table 1.

Note 1) Dual 3 port is not applicable.

Note 2) Since the pilot EXH of this valve is released from R1 passage, it is not possible to vacuum from a part other than EXH pressure and SUP ports.

Note 3) Use dry air to prevent condensation at low temperatures.

Note 4) **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 5) Refer to 2.3 for applicable variations.

2.2 Solenoid specifications

Pilot valve (Note 1)		V112#-6A	V112#-5A
Rated coil voltage [VDC]		12	24
Allowable voltage fluctuation (Note 2)		±10 % of rated voltage	
Coil insulation type		Class B or equivalent	
Power consumption [W] (Current)	Standard [-]	0.4 (34 mA)	0.4 (17 mA)
	High-speed response type [B] High pressure type [K]	0.95 (80 mA)	0.95 (40 mA)
Surge voltage suppressor		Diode	
Indicator light		LED	

Table 2.

Note 1) The voltage cannot be changed by changing the pilot valve.

Note 2) Valve state is not defined if electrical input is outside the specified operating range.

2.3 Manifold specifications

2.3.1 VQ1000/2000

Series		VQ1000	VQ2000	Maximum number of stations (solenoids)	
Electrical entry and ingress protection (Based on IEC60529)	D-sub, Flat ribbon cable	IP40		24	
	Terminal block box	IP40	IP65[1)]	24	20
	Lead wire	IP65*		8	
	EX510	IP20		16	
	EX120	IP20		16	
	EX123,EX124	IP65*		16	
	Circular connector	-	IP40	-	24
Port size	1(P), 3(R)	C8, N9	C10, N11,		
	2(A),4(B)	C3, C4, C6 M5 thread N1, N3, N7	C4, C6, C8 N3, N7, N9		

Table 3.

Note 1) When W type is chosen.

2.3.2 VQC1000/2000

Series		VQC1000	VQC2000	Maximum number of stations (solenoids)
Electrical entry and ingress protection (Based on IEC60529)	D-sub, Flat ribbon cable	IP40		12 (24)
	EX245	-	IP65	
	EX126	IP67		8 (16)
	EX250 EX260 EX500 EX600 Lead wire Circular connector			12 (24)
	Terminal block box			10 (20)
Port size	1(P), 3(R)	C8, N9	C10, N11, (Branch type: C12, N13)	
	2(A),4(B)	C3, C4, C6 M5 thread N1, N3, N7	C4, C6, C8 N3, N7, N9	

Table 4.

2 Specification - continued

2.4 Indicator light and override positions

The lighting positions are concentrated on one side for both single solenoid type and double solenoid type. In the double solenoid type, A side and B side energization are indicated by two colours which match the colours of the manual overrides.

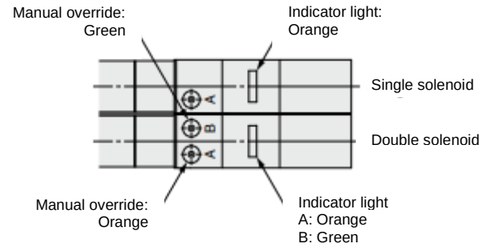


Figure 1. ON/OFF indicator and override buttons of VQC1000

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 are protected against dust and water; however, these products cannot be used in water.
- Products compliant with IP65 and IP67 enclosures 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.
- 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.

3 Installation - continued

- Tighten fittings to the specified tightening torque.

Connection thread size	Tightening Torque [N·m]
M5	1 to 1.5

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 in the catalogue.

3.5.2 Precautions on other tube brands

⚠ Caution

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

3.6 Light/Surge voltage suppressor

⚠ Caution

- Surge suppression should be specified by using the appropriate part number. If a valve type without suppression (Type ‘E’) is used, suppression must be provided by the host controller as close as possible to the valve.
- The valve is fitted with diode surge suppressors, see Figure 2 and 3.
- Refer to 3.8 for Residual voltage value.

3.6.1 Single solenoid

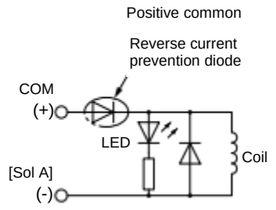


Figure 2. Surge suppressor

3.6.2 Double solenoid

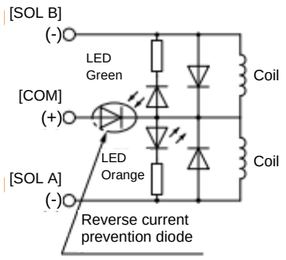


Figure 3. Surge suppressor

3 Installation - continued

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.

3.7 Mounting

Caution

- After confirming that the gasket is installed correctly, securely tighten the mounting screws according to the tightening torque shown below.
- Tighten to the specified tightening torque.

Screw type	Tightening torque [N·m]	
	VQ(C)1000	VQ(C)2000
Valve clamp screw	0.25 to 0.35	0.5 to 0.7
DIN rail mounting screws	1.1 to 1.3	1.4 to 1.6
Bracket to valve screws	0.22 to 0.25	0.8 to 1.0
Terminal block cover screw[1)]	0.7 to 1.2	

Table 6.

Note 1) Not applicable for VQ1000

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

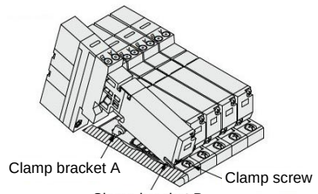


Figure 4.

3.8 Residual voltage of the surge voltage suppressor

Caution

- Ensure the transient voltage is within the specification of the host controller.
- In the case of a diode, the residual voltage is approximately 1 V.

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 (Type 'E') 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

Warning

- If a valve will be continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil. This will likely adversely affect the performance of the solenoid 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 power-saving type (continuous duty type) valve.
- For applications such as mounting a valve on a control panel, incorporate measure to limit the heat radiation so that it is within the operating temperature range.

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

3 Installation - continued

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

3.13 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.

Caution

- Do not apply excessive torque when turning the locking type manual override (0.1 N·m or less).
- Refer to the catalogue for details of manual override operation.

3.14 Back pressure check valves

Warning

- Back pressure from the common manifold exhausts can be prevented from affecting actuators connected to ports 2 and 4 by fitting VVQ#000-18A check valves.
- The flow capacity of the valve is reduced in these cases.
- See catalogue for full details on back pressure check valves.

3.15 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.

3.16 Electrical wiring specification

Refer to catalogue for electrical wiring specifications.

4 How to Order

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

5 Outline Dimensions (mm)

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.

6 Maintenance - continued

- 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.

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.

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, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

7.4 Intermediate stopping

Warning

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

7.5 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
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 7.

7.6 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.

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

Table 8.

7 Limitations of use - continued

7.7 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.

7.8 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 is 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.

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.smceu.com (Europe)
'SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan

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