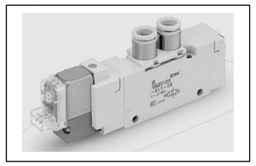
ORIGINAL INSTRUCTIONS

Instruction Manual
5 Port solenoid valve
VQZ1000/2000/3000-1



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 specification

Type of seal		Metal seal	Rubber seal
Fluid		Air	
Internal pilot operating pressure range [MPa] Note 1)	2 pos. single	0.1 to 0.7 (For VQZ3000, 3pos: 0.15 to 0.7)	0.15 to 0.7
	2 pos. double		0.1 to 0.7
	3 position		0.2 to 0.7
External pilot Note 1, 2)	Operating pressure range [MPa]	-100 kPa to 0.7	
	Pilot pressure range	Same as internal pilot operating pressure range	
Ambient and fluid temperature [°C]		-10 to 50 (No freezing)	

2 Specifications – continued

Maximum operating frequency [Hz]	2 pos. single	20	5
	2 pos. double		
	3 position	10	3
Minimum operating frequency		Once every 30 days	
Duty cycle		Contact SMC	
Manual override		Non-locking push type Push turn locking slotted type	
Flow characteristics		Refer to catalogue	
Response time		Refer to catalogue	
Lubrication		Not required	
Pilot exhaust method		Individual exhaust	
Mounting orientation		Single: Free Double/3pos.: Main valve horizontal	Free
Impact/vibration resistance [m/s^2] Note 3)		150/30	
Enclosure (based on IEC60529)		IP40 (DIN terminal IP65 Note 4)	
Weight		Refer to catalogue	

Table 1.

Note 1) In case of the high pressure type (Metal seal only), upper limit of max. operating pressure and external pilot pressure range is 1 MPa.

Note 2) VQZ1000 body ported type is not available with external pilot.

Note 3) 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 & armature; in both energized & de-energised states and for every time in each condition (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 at both energized and de-energized states in the axial direction and at right angles to the main valve & armature. (Values quoted are for a new valve.)

Note 4) Only when IP65 compliant DIN terminals are selected: VQZ2/3#21#-#Y##W1-#-#.

2.2 Solenoid specification

Electrical entry		Grommet (G) L-type plug connector (L) M-type plug connector (M) DIN terminal (Y)	
		G, L, M	Y
Pilot valve		Refer to catalogue	
Coil rated voltage [V]	DC	24, 12	
	AC 50/60 Hz	100, 110, 200, 220 Note 2)	
Coil insulation class		Contact SMC	
Allowable voltage fluctuation Note 1)		±10% of rated voltage Note 3)	
Power consumption [W] DC	Standard	0.35 (With light: 0.4)	0.35 (With light: 0.45)
	High speed response, high pressure	0.9 (With light: 0.95)	0.9 (With light: 1.0)
Apparent power [VA] Note 2) AC	100V	0.78 (With light: 0.81)	0.78 (With light: 0.87)
	110V [115V]	0.86 (With light: 0.89) [0.94(With light: 0.97)]	0.86 (With light: 0.87) [0.94 (With light: 1.07)]
	200V	1.18 (With light:1.22)	1.15 (With light: 1.30)
	220V [230]	1.3(With light: 1.34) [1.42 (With light: 1.46)]	1.27 (With light: 1.46) [1.39 (With light:1.60)]
Surge voltage suppressor		Varistor	
Indicator light		LED (Neon light when AC with DIN terminal)	

Table 2.

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

Note 2) Common solenoid between 110 VAC and 115 VAC, and between 220 VAC and 230 VAC.

Note 3) For 115 VAC and 230 VAC, the allowable voltage is –15% to +5% of rated voltage.

2 Specifications – continued

2.3 Manifold specifications

Series		VQZ1000	VQZ2000	VQZ3000
Max. number of stations		20		
Piping direction		Top		
Port size	1(P), 3(R)	Rc 1/8		Rc 1/4
	2(A)	C3, C4, C6 M5	C4, C6 M5	C6, C8, C10 Rc 1/4
	External pilot port		M3 x 0.5	M5 x 0.8

Table 3.

2.4 Pneumatic symbols

Refer to catalogue for pneumatic symbols.

2.5 Indicators

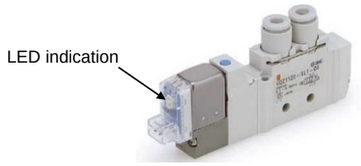


Figure 1.

The LED is located on the pilot valve assembly.
When the solenoid is energized, the valve switches and the LED remains illuminated while the solenoid is energized.

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.
- The solenoid valve is an electrical product. For safety install an appropriate fuse and circuit breaker before use.

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.
- If using in an atmosphere where there is possible contact with water droplets, oil, weld spatter, etc., take suitable preventative measures.
- When the solenoid valve is mounted in a control panel or it is energized for a long time, make sure that the ambient temperature is within the specification of the valve.
- Products compliant with IP65 enclosures are protected against dust and water, however, these products cannot be used in water.
- Products compliant with IP65 enclosures satisfy the specifications by mounting each product properly. Be sure to read the Specific Product Precautions for each product.
- 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.

3 Installation – continued

Connection threads	Proper tightening torque [N·m]
M3	0.4 to 0.5
M5	1 to 1.5
G1/16	3 to 5
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20

Table 4.

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 at the upstream side 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.

⚠ Caution

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

3.7 Mounting

⚠ Caution

3.7.1 Valve mounting

- 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 screws to a torque as per table below.

Model	Proper tightening torque [N·m]
VQZ1000	0.18 to 0.25
VQZ2000	0.25 to 0.35
VQZ3000	0.5 to 0.7

Table 5.

3.7.2 DIN rail mounting / removal

Removing

1. Loosen the clamp screws on the ⓐ side of both ends of the manifold.
2. Lift the ⓐ side ⇒ of the manifold off the DIN rail and slide it in the direction of the ⓑ side.

Mounting

1. Catch the hook of the DIN rail bracket on the ⓑ side on the DIN rail.
2. Push ⓐ side onto the DIN rail and tighten the clamp screw. The recommended tightening torque for screws is 0.3 to 0.4 N·m.

3 Installation – continued

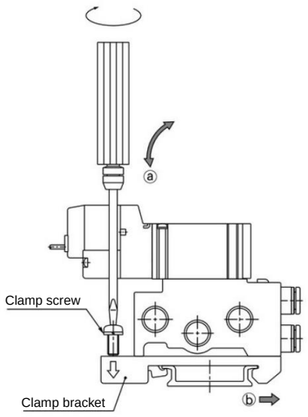
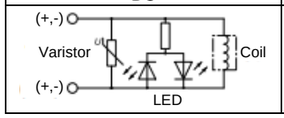
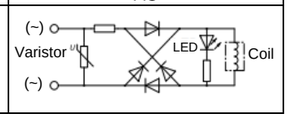


Figure 2

3.8 Light/surge voltage suppressor

Caution

If a valve without suppressor is used, suppression should be provided as close as possible to the valve by the host controller.

L/M type plug connector	
DC	AC
	

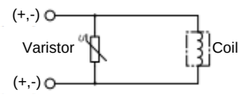
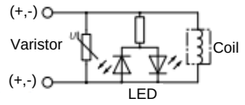
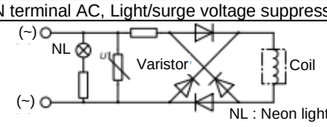
DIN terminal DC	
With surge voltage suppressor (YS, YOS)	Light/surge voltage suppressor (YZ)
	
DIN terminal AC, Light/surge voltage suppressor (YZ)	
	

Figure 3.

Note) Surge voltage suppressor with varistor has residual voltage corresponding to the protective element and rated voltage; therefore, protect the controller side from the surge.

3.9 Residual voltage

Caution

- 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.
- Valve response time is dependent on surge suppression method selected.

3.10 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, install a surge absorption diode across the output of the breaker.

3 Installation – continued

3.11 Extended periods of continuous energization

Caution

- Use standard (DC) specification for continuous duty.
- 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.

3.12 Wiring

Caution

External force applied to lead wire

If an excessive force is applied to the lead wire, this may cause faulty wiring. Take appropriate measures so that a force of 30 N or more is not applied to the lead wire. When instructions are given to the Specific Product Precautions, follow these specifications.

3.12.1 How to use L/M type plug connector

Caution

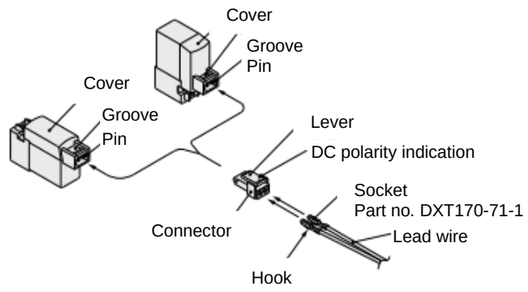


Figure 4.

3.12.1.1 Attaching and detaching connectors

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

3.12.2 Lead wire connection

Caution

3.12.2.1 Crimping of lead wires and sockets

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

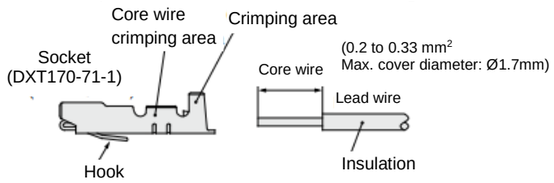


Figure 5.

3.12.2.2 Attaching and detaching sockets with lead wires

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

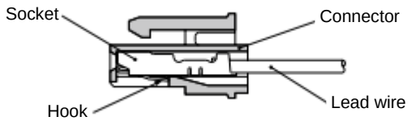


Figure 6.

3.13 How to use DIN terminal

3.13.1 DIN terminal conforming to EN175301-803C (former DIN 43650C) (8 mm between pins)

The DIN terminal type with an IP65 enclosure is protected against dust and water, however, it must not be used in water.

3 Installation – continued

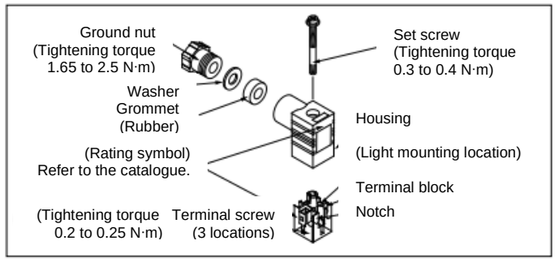


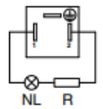
Figure 7.

Note 1) Applicable cable diameter Ø3.5 mm to Ø7 mm.
Note 2) (Reference) 0.5mm², 2-core or 3-core, equivalent to JIS C 3306.

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

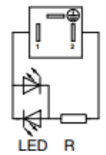
3.14 Circuit diagram with light

AC circuit



NL: Neon light
R: Resistor

DC circuit



LED: Light emitting diode
R: Resistor

Figure 8.

3.15 Solenoid valve for AC specification

Warning

AC specification solenoid valves with grommet or L/M-type plug connector have a built-in rectifier circuit in the pilot section to operate the DC coil. With AC specification pilot valves, this built-in rectifier generates heat when energized. The surface may become hot depending on the energized condition; therefore, do not touch the solenoid valves.

3.16 One-touch fittings

3.16.1 Tube attachment and detachment

Caution

Refer to the Specific Product Precautions in the fittings and tubing catalogue.

3.17 Precautions on other tube brands

Caution

Refer to the Specific Product Precautions in the fittings and tubing catalogue.

3.18 Effect of the 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.

3.19 Mixed installation of 3 port and 5 port valves on same manifold

Caution

- Refer to catalogue for additional details on mixed installation of VQZ valves.

3.19.1 Body ported-VQZ(1,2,3)82(0,1), N.C./VQZ(1,2,3)92(0 ,1), N.O.

Even though 3 port valves have the same construction as the 5 port single solenoid valves, the port plug is installed in the 2(B) port for N.C. type, and 4(A) port for N.O. type. By changing the port plug into a fitting, it can be used as the 5 port single solenoid valves, too.

3 Installation - continued

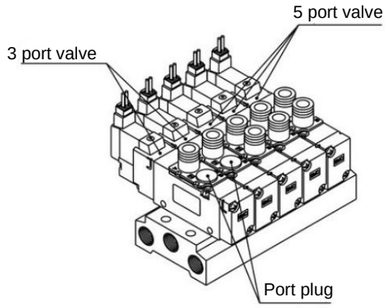


Figure 9.

3.19.2 Base mounted VQZ(1,2,3)85(0,1), N.C./VQZ(1,2,3)95(0 ,1), N.O.

3 port valves have the same external appearance as the 5 port valves. When using this type, 4(A) port on the 3 port valves can be used as 4(A) port on the 5 port valves' manifold, too. Besides, there's no problem, even though 2(B) port can be either plugged or unplugged.

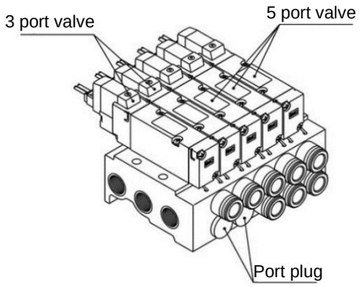


Figure 10.

4 How to Order

4.1 Standard products

Refer to catalogue for 'How to Order'.

4.2 Special products

Refer to drawings for 'How to Order' of special products.

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.
- 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 at least once every 30 days.

6 Maintenance – continued

6.2 Replacement parts

Refer to catalogue for details regarding replacement parts such us blanking plate assembly, restrictor spacer, individual SUP spacer, individual EXH spacer, name plate, blanking plug, DIN rail, silencer, port plug, plug connector assembly, perfect block, one-touch fittings, pilot valve assembly, gasket and screw assembly, sub-plate and bracket assembly, and DIN connector.

6.3 One-touch fittings

The built-in fittings on the valve can be changed easily. Refer to Specific Product Precautions in the catalogue for more details.

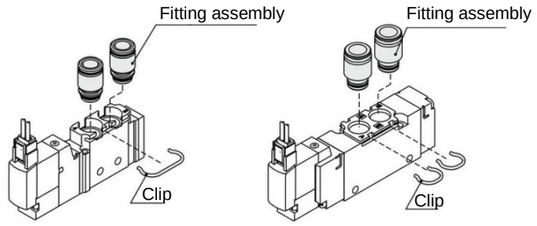


Figure 11. VQZ1000 and VQZ2000

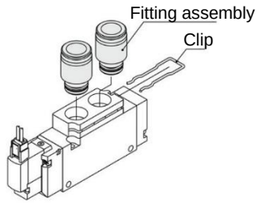


Figure 12. VQZ3000 and base mounted

6.4 Bracket assembly

⚠ Caution

Tightening torque when mounting a bracket on the valve is as per the table below.

Model	Proper tightening torque [N·m]
VQZ1000	0.2 to 0.26
VQZ2000 / 3000	0.25 to 0.35

Table 6.

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 Air returned or air/spring returned spool valves

- 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. Such measures must be evaluated by risk assessment within the validation process.

Energy source status	**Single**	**Double**	**3 position**
Air supply present, electricity cut	Spool returns to the off position by spring and air 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 returns to off position by spring force

Table 7.

7 Limitations of Use – continued

7.3 Intermediate stopping

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

7.4 Holding of pressure

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

7.5 Cannot be used as an emergency shut-off valve

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.

7.6 Safety relay or PLC

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.

⚠ Caution

7.7 Leakage voltage

Ensure that any leakage current when the switching element is OFF causes ≤3% of the rated voltage across the valve for DC coil and ≤ 8% for AC coils.

7.8 Low temperature operation

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.

7.9 External pilot

Use external pilot in the following cases:

- When the operating pressure is below the minimum operating pressure 0.1 to 0.2MPa.
- When valve is used for a vacuum application.
- When having 1 (P) port downsized in diameter.
- When using 4(A), 2(B) port as the atmospheric releasing port, e.g. air blower.

7.10 Momentary energization

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 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-085H