



Operation Manual

Solenoid Valve

PRODUCT NAME

VQC1000/2000 Series
(PILOT VALVE : V100)

MODEL/ Series

SMC Corporation

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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 10218-1992: Manipulating industrial robots -- Safety



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

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



Safety Instructions

Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.

Read and accept them before using the product.

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*2)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*2) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction(WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulation of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.



Precautions for 5 Port Solenoid Valve ①

Be sure to read before handling. Refer to main text for detailed precautions on every series.

Design / Selection

⚠ Warning

1. Confirm the specifications

Products represented in this instruction manual are designed only for use in compressed air systems (including vacuum).

Do not operate at pressures or temperatures, etc., beyond the range of specifications, as this can cause damage or malfunction.

We do not guarantee against any damage if the product is used outside of the specification range.

2. Actuator drive

When an actuator, such as a cylinder, is to be driven using a valve, take appropriate measures (cover installation or approach prohibition) to prevent potential danger caused by actuator operation.

3. Intermediate stops

For 3-position closed center or double check valve type, it is difficult to make a piston stop at the required position accurately due to the compressibility of air.

Furthermore, since valves and cylinders are not guaranteed for zero air leakage, it may not be possible to hold a stopped position for an extended period of time. Please contact SMC if it is necessary to hold a stopped position for an extended period of time.

4. Effect of back pressure when using a manifold.

Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure. For 3-position exhaust center valve of single acting cylinder, take appropriate measures to prevent the malfunction by using it with an individual exhaust manifold.

5. Holding pressure (including vacuum).

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

6. Not suitable for use as an emergency shut-off valve, etc.

The valves listed in this instruction manual are not designed for safety applications such as an emergency shutoff valve. If the valves are used for the mentioned applications, additional safety measures should be adopted.

7. Release of residual pressure

For maintenance purposes install a system for releasing residual pressure. Especially in the case of 3-position closed center valve or double check valve type, ensure that the residual pressure between the valve and the cylinder is released.

8. Operation in a vacuum condition

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. In addition, at the time of vacuum adsorption, be sure to vacuum at all times. Failure to do so may result in foreign matter sticking to the adsorption

9.Regarding a vacuum switch valve

For maintenance purposes install a system for releasing residual pressure.

10. Double solenoid type

When using the double solenoid type for the first time, actuators may travel in an unexpected direction depending on the switching position of the valve. Implement measures to prevent any danger from occurring when operating the actuator.

11. Ventilation

Provide ventilation when using a valve in a confined area, such as in a closed control panel. For example, install a ventilation opening, etc. in order to prevent pressure from increasing inside of the confined area and to release the heat generated by the valve.

12.Do not disassemble the product of make any modifications, including additional machining.

It may cause human injury and/or an accident.

⚠ Caution

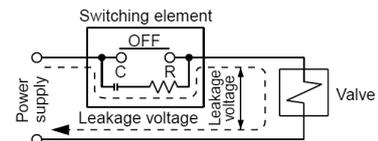
1. Momentary energization

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

2. Leakage voltage

Take note that the leakage voltage will increase when a resistor is used in parallel with switching element or a C-R circuit (surge voltage suppressor) is used for protecting a switching device because of the passing leakage voltage through the C-R circuit.

The suppressor residual leakage voltage should be as follows.



DC coil

Should be 3% or less of the rated voltage.



VQC1000/2000 Series

Precautions for 5 Port Solenoid Valve ②

Be sure to read before handling. Refer to main text for detailed precautions on every series.

Design / Selection

⚠ Caution

3. Surge voltage suppressor

If a surge protection circuit contains nonstandard diodes, such as Zener diodes or varistor, a residual voltage that is in proportion to the protective circuit and the rated voltage will remain. Therefore, take into consideration the surge voltage protection of the controller. In the case of diodes, the residual voltage is approximately 1 V.

4. Operation in a low temperature condition

It is possible to operate a valve in extreme temperature, as low as -10 °C. Take appropriate measures to avoid freezing of drainage, moisture etc. in low temperature.

5. Mounting orientation

Rubber seal : Mounting orientation is free.

Metal seal : Mounting orientation of a single solenoid is universal.

No specific orientation is necessary. When installing a double solenoid or a 3-position configuration, mount the valve so that spool valve is horizontal.

Mounting

⚠ Warning

1. Operation manual

Install the products and operate them only after reading the operation manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.

2. Ensure sufficient space for maintenance activities.

When installing the products, allow access for maintenance.

3. Tighten threads with the proper tightening torque.

When installing the products, follow the listed torque specifications.

4. If air leakage increases or equipment does not operated properly, stop operation.

Check mounting conditions when air and power supplies are connected. Initial function and leakage tests should be performed after installation.

5. Painting and coating

Warnings or specifications printed or affixed to the product should not be erased, removed or covered up. Please consult with SMC before applying paint to resinous parts, as this may have an adverse effect due to the solvent in the paint.

Piping

⚠ Caution

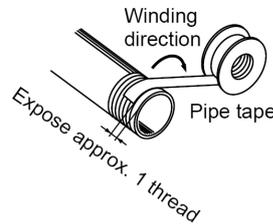
1. Refer to the Fittings and Tubing Precautions for handling one-touch fittings.

2. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

3. Wrapping of pipe tape

When screwing piping or fittings into ports, ensure that chips from the pipe threads or sealing material do not enter the piping. Also, if pipe tape is used, leave 1 thread ridges exposed at the end of the threads.



4. Closed center and double check valve types

For closed center or double check valve types, check the piping to prevent air leakage from the piping between the valve and the cylinder.

5. Connection of fittings

When screwing fittings into valves, tighten as follows.

(1) Follow the procedures below when installing an SMC fitting, etc.

1) M5 types

After tightening the fitting by hand, use a wrench to tighten the fitting an additional approximately 1/6 to 1/4 turn. As a reference value, tightening torque is 1 to 1.5 N·m.

Note) If tightened excessively, the thread of the product may break or the gasket may deform. If tightened insufficiently, the thread of the product may become loose. In either case, air leakage can occur.

(2) Follow the procedure of the manufacture when fittings other than SMC is used.

6. Piping to products

When piping to a product, avoid mistakes regarding the supply port, etc.



VQC1000/2000 Series

Precautions for 5 Port Solenoid Valve ③

Be sure to read before handling. Refer to main text for detailed precautions on every series.

Wiring

Caution

1. Polarity

When connecting power to a solenoid valve with a DC specification and equipped with a light or surge voltage suppressor, check for polarity. If there is polarity, take note of the following.

No diode to protect polarity.

If a mistake is made regarding the polarity, damage may occur to the diode in the valve, the switching element in a control device or power supply equipment, etc.

With diode to protect polarity.

If polarity connection is wrong, the valve does not operate.

2. Applied voltage

When electric power is connected to a solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.

3. Check the connections.

Check if the connections are correct after completing all wiring.

Lubrication

Warning

1. Lubrication

[Rubber seal]

- 1) The valve has been lubricated for life by the factory and does not require any further.
- 2) If a lubricant is used in the system, use class 1 turbine oil (no additive), ISO VG32.
Once a lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.
If turbine oil is used, refer to the Material Safety Data Sheet (MSDS) of the oil.

[Metal seal]

- 1) These valves can be used without lubrication.
- 2) If lubricant is used in the system, use class 1 turbine oil (no additive), ISO VG32.
If turbine oil is used, refer to the Material Safety Date Sheet (MSDS) of the oil.

Class 1 Turbine Oil (with no additive), ISO VG32

| Lubricant manufacturer | Class 1 turbine oil (with no additive), ISO VG32. |
|-------------------------|---|
| Idemitsu Kosan Co. Ltd. | Diana Fresia S32 |
| Nippon Oil Corp. | Turbine Oil 32 |
| Cosmo Oil Co. Ltd. | Cosmo Turbine 32 |
| Jpan Energy Corp. | Turbine 32 |
| Kygnus Oil Co. | Turbine Oil 32 |
| Fuji Kosan Co., Ltd. | Fucoal Turbine 32 |

Please contact SMC regarding class 2 turbine oil (with additives), ISO VG32.

Air Supply

Warning

1. Type of fluids

Please consult with SMC when using the product in applications other than compressed air.

2. When there is a large amount of drainage.

Compressed air containing a large amount of drainage can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.

3. Drain flushing

If condensation in the drain bowl is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. It causes malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.

For compressed air quality, refer to SMC's Best Pneumatics catalog.

4. Use clean air

Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gasses, etc., as it can cause damage or malfunction.

Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties in side the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.

2. Install an air filter.

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

3. Take measures to ensure air quality, such as by installing an aftercooler, air dryer, or water separator.

Compressed air that contains a large amount of drainage can cause malfunction of pneumatic equipment such as valves. Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer, or water separator.

4. If excessive carbon powder is seen, install a mist separator on the upstream side of the valve.

If excessive carbon dust is generated by the compressor, it may adhere to the inside of a valve and cause it to malfunction.

For compressed air quality, refer to SMC's Best Pneumatics catalog.



Precautions for 5 Port Solenoid Valve ④

Be sure to read before handling. Refer to main text for detailed precautions on every series.

Operating Environment

Warning

1. Do not use in an atmosphere having corrosive gases, chemicals, sea water, water, water steam, or where there is direct contact with any of these .
2. Products with IP65 enclosures (based on IEC60529) are protected against dust and water, however, these products cannot be used in water.
3. Products compliant to IP65 satisfy the specifications through mounting. Be sure to read the Precautions for each product.
4. Do not use in an environment where flammable gas or explosive gas exists. Usage may cause a fire or explosion. The products do not have an explosion proof construction.
5. Do not use in a place subject to heavy vibration and/or shock.
6. The valve should not be exposed to prolonged sunlight. Use a protective cover.
7. Remove any sources of excessive heat.
8. If it is used in an environment where there is possible contact with oil, weld spatter, etc., exercise preventive measures.
9. When the valve is mounted in a control panel or its energized for a long time, make sure ambient temperatures is within the specification of the valve.

Maintenance

Warning

- 1. Perform maintenance inspection according to the procedures indicated in the operation manual.**

If handled improperly, malfunction and damage of machinery or equipment may occur.
- 2. Removal of equipment, and supply/exhaust of compressed air**

When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply pressure and electric power, and exhaust all compressed air from the system using the residual pressure release function.

For 3-position closed center type, exhaust the residual pressure between the valve and the cylinder. 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.
- 3. Low frequency operation**

Valves should be operated at least once every 30 days to prevent malfunction. (Use caution regarding the air supply.)
- 4. Manual override operation**

When the manual override is operated, connected equipment will be actuated.

Operate after safety is confirmed.

Caution

1. Drain flushing

Remove drainage from the air filters regularly.

2. Lubrication

In the case of rubber seals, once lubrication has been started, it must be continued.

Use class 1 turbine oil (with no additive), VG32 because if other lubricant oil is used, it may cause malfunction. Please contact SMC for suggested class 2 turbine oil (with additive), VG32.



VQC1000/2000 series Specific Product Precautions 1

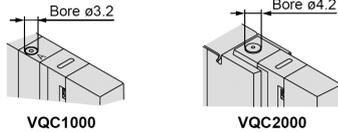
Be sure to read this before handling

Manual Override

⚠ Warning

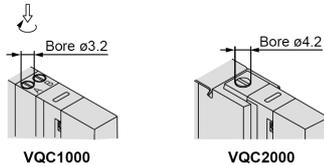
Connected actuator is started by manual operation. Use the manual override after confirming that there is no danger. Push type is standard. (Tool required) Locking type is semi-standard. (Tool required)

Non-locking push type (Tool required)



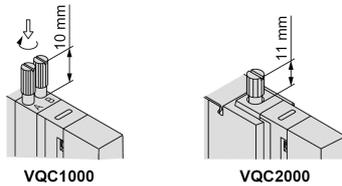
Push down on the manual override with a small screwdriver until it stops. Release the screwdriver and the manual override will return.

Locking type (Tool required) <Semi-standard>



Push down on the manual override with a small flat head screw driver until it stops. Turn it clockwise by 90° to lock it. Turn it counterclockwise to release it.

Locking type (Manual) <Semi-standard>



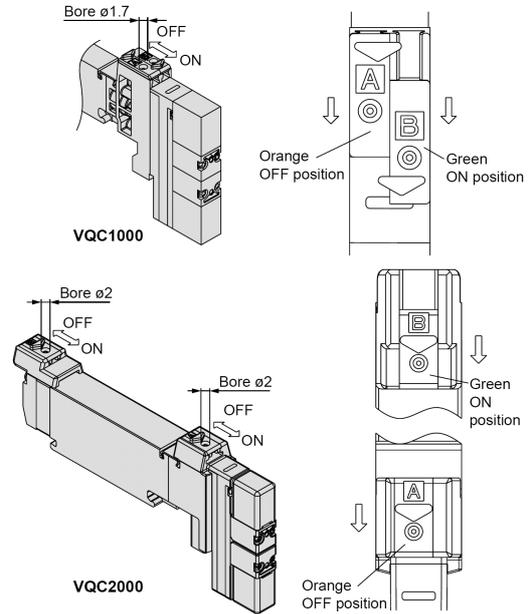
Push down on the manual override with a small screwdriver or with your fingers until it stops. Turn it clockwise by 90° to lock it. Turn it counterclockwise to release it.

⚠ Caution

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

⚠ Warning

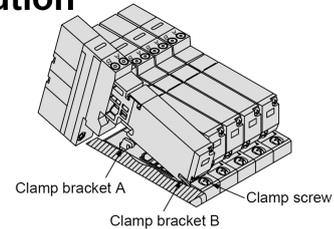
Slide locking type (Manual) <Semi-standard>



The manual override is locked by sliding it all the way to the pilot valve side (ON side) with a small flat head screwdriver or with your fingers. Slide it to the fitting side (OFF side) to release it. In addition, it can also be used as a push type by using a screwdriver, etc., of $\phi 1.7$ or less. ($\phi 2$ or less for VQC2000)

How to Mount/Remove Solenoid Valves

⚠ Caution



Removing

1. Loosen the clamp screw until it turns freely. (The screw is captive.)
2. Lift the coil side of the valve body while pressing down slightly on the screw head and remove it from the clamp bracket B. When the screw head cannot be pressed easily, gently press the area near the manual override of the valve.

Mounting

1. Press down on the clamp screw. Clamp bracket A opens. Diagonally insert the hook on the valve end plate side into clamp B.
2. Press the valve body downward. (When the screw is released, it will be locked by clamp bracket A.)
3. Tighten the clamp screw. (Proper tightening torque: VQC1000, 0.25 to 0.35 N·m; VQC2000, 0.5 to 0.7 N·m)

⚠ Caution

Dust on the sealing surface of the gasket or solenoid valve can cause air leakage.



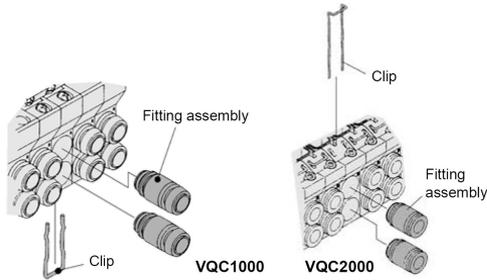
VQC1000/2000 series Specific Product Precautions 2

Be sure to read this before handling

Cylinder Port Fittings Replacement

⚠ Caution

One-touch fittings on the cylinder port are a cassette for easy replacement. The fittings are blocked by a clip. After removing the corresponding valve and take out the clip with a flat head screwdriver, etc., then replace the fittings. For mounting, insert the fitting until it strikes against the inside wall and then insert the clip to the specified position.



| Applicable tubing O.D. | Fitting assembly part no. | |
|--------------------------|---------------------------|----------------|
| | VQC1000 | VQC2000 |
| Applicable tubing ø3.2 | VVQ1000-50A-C3 | — |
| Applicable tubing ø4 | VVQ1000-50A-C4 | VVQ1000-51A-C4 |
| Applicable tubing ø6 | VVQ1000-50A-C6 | VVQ1000-51A-C6 |
| Applicable tubing ø8 | — | VVQ1000-51A-C8 |
| M5 | VVQ1000-50A-M5 | — |
| Applicable tubing ø1/8" | VVQ1000-50A-N1 | — |
| Applicable tubing ø5/32" | VVQ1000-50A-N3 | VVQ1000-51A-N3 |
| Applicable tubing ø1/4" | VVQ1000-50A-N7 | VVQ1000-51A-N7 |
| Applicable tubing ø5/16" | — | VVQ1000-51A-N9 |

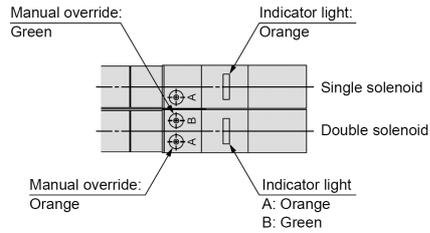
⚠ Caution

- 1) Use caution that O-rings must be free from scratches and dust. Otherwise, air leakage may result.
- 2) After screwing in the fittings, mount the M5 fitting assembly on the manifold base. (Tightening torque: 0.8 to 1.2 N·m)
- 3) Purchasing order is available in units of 10 pieces.

Light/Surge Voltage Suppressor

⚠ Caution

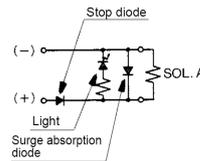
The lighting positions are concentrated on one side for both single solenoid type and double solenoid type. In the double solenoid type, A side and B side energization are indicated by two colors which match the colors of the manual overrides.



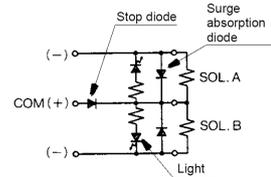
(Drawing shows a VQC1000 case.)

DC circuit diagram

Single solenoid



Double solenoid



Note) A-side energization:

A light (Orange) illuminates.

B-side energization:

B light (Green) illuminates.

With wrong wiring prevention (stop diode mechanism)

With a surge absorption (surge absorptio diode) mechanism



VQC1000/2000 series Specific Product Precautions 3

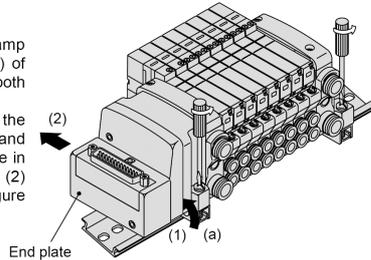
Be sure to read this before handling

How to Mount/Remove DIN Rail

⚠ Caution

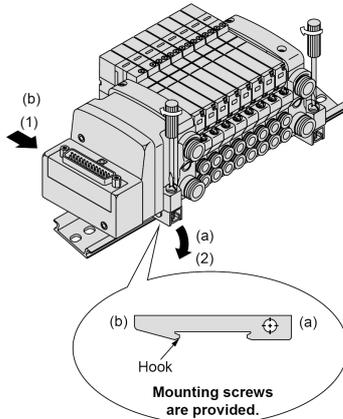
Removing

1. Loosen the clamp screw on side (a) of the end plate on both sides.
2. Lift side (a) of the manifold base and slide the end plate in the direction of (2) shown in the figure to remove.



Mounting

1. Hook side (b) of the manifold base on the DIN rail.
2. Press down side (a) and mount the end plate on the DIN rail. Tighten the clamp screw on side (a) of the end plate. The proper tightening torque for screws is 0.4 to 0.6 N·m.



IP67 Enclosure

⚠ Caution

Wiring connection for models conforming to IP67 should also have enclosures equivalent to or of stricter than IP67.

Built-in Silencer Element

⚠ Caution

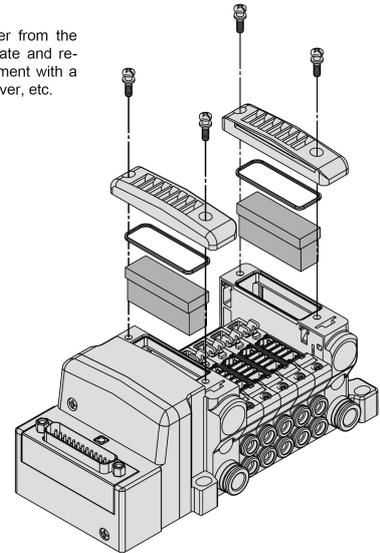
A filter element is incorporated in the end plate on both sides of the manifold base. A dirty and choked element may reduce cylinder speed or cause malfunction. Clean or replace the dirty element.

Element Part No.

| Type | Element part No. | |
|---|------------------|---------------|
| | VQC1000 | VQC2000 |
| Direct EXH. outlet with built-in silencer | VVQ1000-82A-1 | VVQ2000-82A-1 |

The minimum order quantity is 10 pcs.

Remove the cover from the top of the end plate and remove the old element with a flat head screwdriver, etc.



How to Calculate Flow Rate

$$\frac{P_2 + 0.1}{P_1 + 0.1} \leq 0.5, \text{ choked flow}$$

$$Q = 120 \times S (P_1 + 0.1) \sqrt{\frac{293}{273 + t}}$$

$$\frac{P_2 + 0.1}{P_1 + 0.1} > 0.5, \text{ subsonic flow}$$

$$Q = 240 \times S \sqrt{(P_2 + 0.1)(P_1 - P_2)} \sqrt{\frac{293}{273 + t}}$$

Conversion with sonic conductance C:
S=0.5XC

Q : Air flow rate [dm³/min(ANR)]

S : Effective area [mm²]

P₁ : Upstream pressure [MPa]

P₂ : Downstream pressure [MPa]

t : Temperature [°C]



VQC1000/2000 series

Specific Product Precautions 4

Be sure to read this before handling

EX500/EX250/EX126 Precautions

⚠ Warning

1. These products are intended for use in general factory automation equipment.
Avoid using these products in machinery/equipment which affects human safety, and in cases where malfunction or failure can result in extensive damage.
2. Do not use in explosive environments, in the presence of inflammable gases, or in corrosive environments. This can cause injury or fire.
3. Work such as transporting, installing, piping, wiring, operation, control and maintenance should be performed by knowledgeable and qualified personnel only. As handling involves the risk of a danger of electrocution, injury or fire.
4. Install an external emergency stop circuit that can promptly stop operation and shut off the power supply.
5. Do not modify these products. Modifications done to these products carry the risk of injury and damage.

⚠ Caution

1. Read the instruction manual carefully, strictly observe the precautions and operate within the range of the specifications.
2. Do not drop these products or submit them to strong impacts. This can cause damage, failure or malfunction.
3. In locations with poor electrical conditions, take steps to ensure a steady flow of the rated power supply. Use of a voltage outside of the specifications can cause malfunction, damage to the unit, electrocution or fire.
4. Do not touch connector terminals or internal circuit elements when current is being supplied. There is a danger of malfunction, damage to the unit or electrocution if connector terminals or internal circuit elements are touched when current is being supplied.
Be sure that the power supply is OFF when adding or removing manifold valves or input blocks or when connecting or disconnecting connectors.
5. Operate at an ambient temperature that is within the specifications. Even when the ambient temperature range is within the specifications, do not use in locations where there are rapid temperature changes.
6. Keep wire scraps and other extraneous materials from getting inside these products. This can cause fire, failure or malfunction.
7. Give consideration to the operating environment depending on the type of enclosure being used.
To achieve IP65 and IP67 protection class, provide appropriate wiring between all units using electrical wiring cables, communication connectors and cables with M12 connectors. Also, provide waterproof caps when there are unused ports, and perform proper mounting of input units, input blocks, SI units and manifold valves. Provide a cover or other protection for applications in which there is constant exposure to water.
8. Use the proper tightening torques.
There is a possibility of damaging threads if tightening exceeds the tightening torque range.
9. Provide adequate protection when operating in locations such as follows:
 - Where noise is generated by static electricity
 - Where there is a strong electric field
 - Where there is a danger of exposure to radiation
 - When in close proximity to power supply lines
10. When these products are installed in equipment, provide adequate protection against noise by using noise filters.

11. Since these products are components whose end usage is obtained after installation in other equipment, the customer should confirm conformity to EMC directives for the finished product.
12. Do not remove the name plate.
13. Perform periodic inspections and confirm normal operation, otherwise it may be impossible to guarantee safety due to unexpected malfunction or erroneous operation.

Safety Instructions on Power Supply

⚠ Caution

1. Operation is possible with a single power supply or a separate power supply. However, be sure to provide two wiring systems (one for solenoid valves, and one for input and control units).
2. Use the UL-certified products below for combined direct current power supply.
 - (1) Circuit in which voltage and current are controlled in accordance with UL508.
Circuit which makes the winding wire in the secondary side of the insulation transformer (which meets the following conditions) to be as the power supply
 - Maximum voltage (with no load):
30 Vrms (42.4 V at peak) or less
 - Maximum current:
 1. 8 A or less (including short-circuited)
 2. and in case of being controlled by circuit protection devices (fuse, etc) which meets the below rated voltages.

| Voltage with no load (V peak) | Maximum rated current |
|-------------------------------|-------------------------------|
| 0 to 20 (V) | 5.0 |
| Exceeding 20 (V) up to 30 (V) | 100 Voltage figure at peak |

- (2) Class 2 power supply unit in accordance with UL1310 or circuit (Class 2 circuit) in accordance with UL1585, that is powered by Class 2 transformer with the maximum of 30 Vrms (42.4 V at peak)

Safety Instructions on Cable

⚠ Caution

1. Avoid miswiring, as this can cause malfunction, damage and fire in the unit.
2. To prevent noise and surge in signal lines, keep all wiring separate from power lines and high-voltage lines. Otherwise, this can cause malfunction.
3. Check wiring insulation, as defective insulation can cause damage to the unit when excessive voltage or current is applied.
4. Do not bend or pull cables repeatedly, and do not place heavy objects on them or allow them to be pinched. This can cause broken lines.



VQC1000/2000 series

Specific Product Precautions 5

Be sure to read this before handling

EX600 Precautions

Design/Selection

⚠ Warning

1. **Use this product within the specification range.**
Using beyond the specified specifications range can cause fire, malfunction, or damage to the system. Confirm the specifications when operating.
2. **When using for an interlock circuit:**
 - Provide a multiple interlock system which is operated by another system (such as mechanical protection function).
 - Perform an inspection to check that it is working properly.

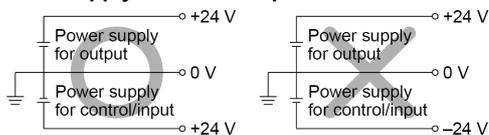
This may cause possible injury due to malfunction.

⚠ Caution

1. **Use the UL-certified products below for combined direct current power supply.**
 - (1) Circuit in which voltage and current are controlled in accordance with UL508.
Circuit which makes the winding wire in the secondary side of the insulation transformer (which meets the following conditions) to be as the power supply
 - Maximum voltage (with no load):
30 Vrms (42.4 V at peak) or less
 - Maximum current:
 1. 8 A or less (including short-circuited)
 2. and in case of being controlled by circuit protection devices (fuse, etc) which meets the below rated voltages.

| Voltage with no load (V peak) | Maximum rated current |
|-------------------------------|-------------------------------|
| 0 to 20 (V) | 5.0 |
| Exceeding 20 (V) up to 30 (V) | 100 Voltage figure at peak |

- (2) Class 2 power supply unit in accordance with UL1310 or circuit (Class 2 circuit) in accordance with UL1585, that is powered by Class 2 transformer with the maximum of 30 Vrms (42.4 V at peak)
2. **Use this product within the specified voltage range.**
Using beyond the specified voltage range is likely to cause the units and connecting devices to be damaged or to malfunction.
3. **The power supply for the unit should be 0 V as the standard for both power supply for output as well as power supply for control/input.**



4. **Do not install a unit in a place where it can be used as a foothold.**
Applying any excessive load such as stepping on the unit by mistake or placing a foot on it, will cause it to break.
5. **Keep the surrounding space free for maintenance.**
When designing a system, take into consideration the amount of free space needed for performing maintenance.
6. **Do not remove the name plate.**
Improper maintenance or incorrect use of instruction manual can cause failure and malfunction. Also, there is a risk of losing conformity with safety standards.
7. **Beware of inrush current when the power supply is turned on.**
Some connected loads can apply an initial charge current which will trigger the over current protection function, causing the unit to malfunction.

Mounting

⚠ Caution

1. **When handling and assembling units:**
 - Do not touch the sharp metal parts of the connector or plug.
 - Do not apply excessive force to the unit.
The connecting portions of the unit are firmly joined with seals.
 - When joining units, take care not to get fingers caught between units.
Injury can result.
2. **Do not drop, bump, or apply excessive impact.**
Otherwise, the unit can become damaged, malfunction, or fail to function.
3. **Observe the tightening torque range.**
Tightening outside of the allowable torque range will likely damage the product.
IP67 protection class cannot be guaranteed if the screws are not tightened to the specified torque.
4. **When lifting a large size manifold solenoid valve unit, take care to avoid causing stress to the valve connection joint.**
The connection parts of the unit may be damaged.
Because the unit may be heavy, carrying and installation should be performed by more than one operator to avoid strain or injury.
5. **When placing a manifold, mount it on a flat surface.**
Torsion in the whole manifold can lead to trouble such as air leakage or defective insulation.

Wiring

⚠ Caution

1. **Confirm grounding to maintain the safety of the reduced wiring system and for anti-noise performance.**
Provide a specific grounding as close to the unit as possible to minimize the distance to grounding.
2. **Avoid repeatedly bending or stretching the cable and applying a heavy object or force to it.**
Wiring applying repeated bending and tensile stress to the cable can break the circuit.
3. **Avoid miswiring.**
If miswired, there is a danger of malfunction or damage to the reduced wiring system.
4. **Do not wire while energizing the product.**
There is a danger of malfunction or damage to the reduced wiring system or input/output equipment.
5. **Avoid wiring the power line and high-pressure line in parallel.**
Noise or surge produced by signal line resulting from the power line or high pressure line could cause malfunction.
Wiring of the reduced wiring system or input/output device and the power line or high-pressure line should be separated from each other.
6. **Confirm the wiring insulation.**
Defective insulation (contact with other circuits, improper insulation between terminals, etc.) may cause damage to the reduced wiring system or input/output device due to excessive voltage or current.
7. **When a reduced wiring system is installed in machinery/equipment, provide adequate protection against noise by using noise filters, etc.**
Noise in signal lines may cause malfunction.

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VQC1000/2000 series

Specific Product Precautions 6

Be sure to read this before handling

Wiring

⚠ Caution

8. **When connecting wires of input/output device or handheld terminal, prevent water, solvent or oil from entering inside from the connector section.**
This can cause damage, equipment failure, or malfunction.
9. **Avoid wiring patterns in which excessive stress is applied to the connector.**
This may cause malfunction or damage to the unit due to contact failure.

Operating Environment

⚠ Warning

1. **Do not use in an atmosphere containing an inflammable gas or explosive gas.**
Use in such an atmosphere is likely to cause a fire or explosion. This system is not explosion-proof.

⚠ Caution

1. **Select the proper type of enclosure according to the environment of operation.**
IP65/67 protection class is achieved when the following conditions are met.
 - 1) The units are connected properly with wiring cable for power supply, communication connector, and cable with M12 connector.
 - 2) Suitable mounting of each unit and manifold valve.
 - 3) Be sure to mount a seal cap on any unused connectors.
If using in an environment that is exposed to water splashes, please take measures such as using a cover.
Also, the Handheld Terminal confirms to IP20, so prevent foreign matter from entering inside, and water, solvent or oil from coming in direct contact with it.
2. **Provide adequate protection when operating in locations such as the following.**
Failure to do so may cause damage or malfunction. The effect of countermeasures should be checked in individual equipment and machine.
 - 1) Where noise is generated by static electricity, etc.
 - 2) Where there is a strong electric field
 - 3) Where there is a danger of exposure to radiation
 - 4) When in close proximity to power supply lines
3. **Do not use in an environment where oil and chemicals are used.**
Operating in environments with coolants, cleaning solvents, various oils or chemicals may cause adverse effects (damage, malfunction) to the unit even in a short period of time.
4. **Do not use in an environment where the product could be exposed to corrosive gas or liquid.**
This may damage the unit and cause it to malfunction.
5. **Do not use in locations with sources of surge generation.**
Installation of the unit in an area around the equipment (electromagnetic lifters, high frequency induction furnaces, welding machine, motors etc.), which generates the large surge voltage could cause to deteriorate an internal circuitry element of the unit or result in damage. Implement countermeasures against the surge from the generating source, and avoid touching the lines with each other.

6. **Use the product type that has an integrated surge absorption element when directly driving a load which generates surge voltage by relay, solenoid valves or lamp.**
When a surge generating load is directly driven, the unit may be damaged.
7. **The product is CE marked, but not immune to lightning strikes. Take measures against lightning strikes in your system.**
8. **Keep dust, wire scraps and other extraneous material from getting inside the product.**
This may cause malfunction or damage.
9. **Mount the unit in such locations, where no vibration or shock is affected.**
This may cause malfunction or damage.
10. **Do not use in places where there are cyclic temperature changes.**
In case that the cyclic temperature is beyond normal temperature changes, the internal unit is likely to be adversely effected.
11. **Do not use in direct sunlight.**
Do not use in direct sunlight. It may cause malfunction or damage.
12. **Use this product within the specified ambient temperature range.**
This may cause malfunction.
13. **Do not use in places where there is radiated heat around it.**
Such a place is likely to cause malfunction.

Adjustment/Operation

⚠ Warning

1. **Do not perform operation or setting with wet hands.**
There is a risk of electrical shock.
<Handheld Terminal>
2. **Do not apply pressure to the LCD display.**
There is a possibility of the crack of LCD display and injuring.
3. **The forced input/output function is used to change the signal status forcibly. When operating this function, be sure to check the safety of the surroundings and installation.**
Otherwise, injury or equipment damage could result.
4. **Incorrect setting of parameters can cause malfunction. Be sure to check the settings before use.**
This may cause injury or equipment damage.

⚠ Caution

1. **Use a watchmaker's screwdriver with thin blade for the setting of each switch of the SI unit. When setting the switch, do not touch other unrelated parts.**
This may cause parts damage or malfunction due to a short circuit.
2. **Provide adequate setting for the operating conditions.**
Failure to do so could result in malfunction.
Refer to the instruction manual for setting of the switches.
3. **For the details of programming and address setting, refer to the manual from the PLC manufacturer.**
The content of programming related to protocol is designed by the manufacturer of the PLC used.



VQC1000/2000 series

Specific Product Precautions 7

Be sure to read this before handling

EX600 Precautions

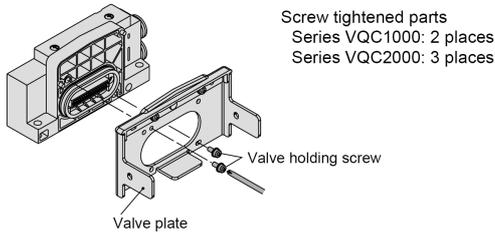
Adjustment/Operation

⚠ Caution

<Handheld Terminal>

4. Do not press the setting buttons with a sharp pointed object.
This may cause damage or malfunction.
5. Do not apply excessive load and impact to the setting buttons.
This may cause damage, equipment failure or malfunction.

When the order does not include the SI unit, the valve plate to connect the manifold and SI unit is not mounted. Use attached valve fixing screws and mount the valve plate.
(Tightening torque: 0.6 to 0.7 N·m)



Trademark

DeviceNet™ is a trademark of ODVA.
Product names described in this catalog may be used as trademarks by each manufacturer.

Maintenance

⚠ Warning

1. Do not disassemble, modify (including circuit board replacement) or repair this product.
Such actions are likely to cause injuries or breakage.
2. When an inspection is performed,
 - Turn off the power supply.
 - Stop the air supply, exhaust the residual pressure in piping and verify that the air is released before performing maintenance work.Unexpected malfunction of system components and injury can result.

⚠ Caution

1. When handling and replacing the unit:
 - Do not touch the sharp metal parts of the connector or plug.
 - Do not apply excessive force to the unit.
The connecting portions of the unit are firmly joined with seals.
 - When joining units, take care not to get fingers caught between units.
Injury can result.
2. Perform periodic inspection.
Unexpected malfunction in the system composition devices is likely to occur due to malfunction of machinery or equipment.
3. After maintenance, make sure to perform an appropriate functionality inspection.
In cases of abnormality such as faulty operation, stop operation.
Unexpected malfunction in the system composition devices is likely to occur.
4. Do not use benzene and thinner for cleaning units.
Damage to the surface or erasure of the display can result.
Wipe off any stains with a soft cloth.
If the stain is persistent, wipe off with a cloth soaked in a dilute solution of neutral detergent and wrung out tightly, and then finish with a dry cloth.

| Trouble | When the valve is failing, use this flow chart to clarify the cause of the failure and take countermeasures appropriate for the cause. | Possible cause | Countermeasures |
|--|--|--|--|
| <p>Operating failure The air supply does not switch the valve.</p> | <pre> graph TD Q1{Can manual override move the valve?} -- NO --> C1[1) Sliding failure or stick of main valve.] Q1 -- YES --> Q2{Does the indicator light keep turning on during energization?} Q2 -- NO --> C2[2) Pressure drop.] Q2 -- YES --> C3[1) Failure of electrical system] C3 --> C3_1[1) Voltage drop] C3 --> C3_2[2) Leakage current] C3_1 --> C4[1) Voltage drop] C3_2 --> C5[3) Failure of pilot valve] </pre> | <p>1) Sliding failure or stick of main valve. A foreign material included in supplied air is caught by main valve and makes the main valve unable to slide smoothly or sticky.</p> | <ul style="list-style-type: none"> • Replace with new valve. • Clean the supplied air. |
| | | <p>2) Pressure drop. The pressure of supplied air lowers the valve which can operate the valve (min. operating pressure).</p> | <p>Raise the pressure of supplied air up to operating pressure of the valve.</p> |
| | | <p>1) Failure of electrical system</p> <ul style="list-style-type: none"> • Incorrect wiring • Blow of fuse and breakage of lead wire. • Poor contact at contactor wire or connection part • Failure of sequencer • Lack of supply voltage | <p>Check these items and replace part and re-wire positively.</p> |
| | | <p>1) Voltage drop Even if the indicator light keeps turning on, the valve can't be operated due to the voltage drop.</p> <p>2) Leakage current When the power turns off, the valve can't be switched due to residual voltage.</p> | <ul style="list-style-type: none"> • Check the voltage and if it is not enough to operate the valve, take appropriate measures. • Confirm the residual voltage is follows. • DC is 3% or less of rated voltage. |
| | | <p>3) Failure of pilot valve</p> <ul style="list-style-type: none"> • Foreign matter caught in core of pilot valve. • Disconnection coil wire of pilot valve • Swelled out poppet of pilot valve • Burnt coil of pilot valve (Higher voltage or wrong coil used, Coil splashed by water) | <ul style="list-style-type: none"> • Replace part or re-wire positively. • Check voltage. Replace valve. (Pilot valve) • Replace valve (pilot valve). Protect the valve so that water does not splash the coil. |
| <p>Response failure The operation of the valve is delay.</p> | | <p>1) Current leakage When the power turns off, the valve can be switched late due to residual voltage.</p> <p>2) Clogging of filter element of manifold.</p> <p>3) Sliding failure or stick of main valve. A foreign material included in supplied air is caught by main valve and makes the main valve unable to slide smoothly or sticky.</p> | <ul style="list-style-type: none"> • Confirm the residual voltage is follows. • DC is 3% or less of rated voltage. • Clean the element or replace with new element. • Replace with new valve. • Clean the supplied air. |

| Trouble | When the valve is failing, use this flow chart to clarify the cause of the failure and take countermeasures appropriate for the cause. | Possible cause | Countermeasures |
|--------------------------------|---|--|--|
| Air leakage | <div style="border: 1px solid black; border-radius: 10px; padding: 5px; width: fit-content; margin: 0 auto;">Confirm there is air leakage.</div> <p>1. Between valve and base</p> | 1-1) Looseness of clamp screw or mounting bolt. | Give more torque to clamp screw. •VQC1000 : 0.25~0.35N·m •VQC2000 : 0.5~0.7N·m If the damage is seen on the gasket, replace with new gasket. |
| | | 1-2) Caught gasket | Replace with new gasket. |
| | | 1-3) Intrusion of foreign matter | To remove foreign matter by air blow of piping and when a gasket damaged, replace with new gasket. |
| | 2. Air leaks through One-touch fitting | 2-1) Tube is not inserted enough deeply. 2-2) Tube has a flaw. 2-3) Tube is cut diagonally. | } Check these items and replace part and re-wire positively. |
| | | 2-4) Packing of one touch fitting is damaged. | Replace with one-touch fitting. |
| | 3. Air leaks through exhaust port (R port) Note) The valve with metal seal allows air leakage from main valve approx. 200Ncc for each port (at 0.5MPa). The air leakage within the range should not be considered abnormal. | 3-1) Looseness of clamp screw or mounting bolt. | Give more torque to clamp screw. Tightening torque •VQC1000 : 0.25~0.35N·m •VQC2000 : 0.5~0.7N·m If the damage is seen on the gasket, replace with new gasket. |
| | | 3-2) A foreign material included into supplied air is caught by the main valve and increases internal air leakage. | <ul style="list-style-type: none"> • Replace with new valve. • Clean the supplied air. |
| 4. Air leaks through manifold. | Insufficient bolt tightening | After stopping air and re-tighten the bolts. | |

| Revision history |
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Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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