ORIGINAL INSTRUCTIONS

Instruction Manual

External pilot solenoid valve for actuator control:

VQC2201NR-5-X27 / VQC4201R-5-X17

The intended use of this product is to control the movement of an actuator.
Validated according to ISO13849. Refer to specification section for details.

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: Manipulating industrial robots -Safety. etc.

This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.

- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- To ensure safety of personnel and equipment the safety instructions in this manual must be observed, along with other relevant safety practices.

⚠ **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

- **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 catalogue information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.
- **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.

1 Safety Instructions - continued

- **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.
- **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, combustions 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 specification described in the product catalogue.
  3) An application which could have negative effects on people, property, or animals requiring special safety analysis outside the scope of ISO 13849 described in this document.
  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.
- **Always ensure compliance with relevant safety laws and standards.**

All electrical 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.
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.

2 Specifications

2.1 General specifications

Valve specifications	Series		VQC2201NR-5-X27	VQC4201R-5-X17
	Valve Type		5 Port 2 Position Solenoid Valve [Note 1)]	
	Valve Configuration		Rubber seal (Pilot valve V100)	Rubber seal (Pilot valve VQ100)
	De-energized actuation		Air	
	Fluid		Air / Inert gas	
	Minimum air quality		5 µm Filtration	
	Max. operating pressure		0.7 MPa	1.0 MPa
	Min. operating pressure		Vacuum	
	External pilot pressure range	Double	0.1 to 0.7 MPa	0.15 to 1.0 MPa
	Flow		Refer to Table 2	
	Proof pressure		1.05 MPa	1.5 MPa
	Min. frequency		1 cycle / 30 days	
	Max. frequency	2 position	5 Hz	
	Response time	2 position	26 ms or less [Note 2)]	15 ms or less [Note 2)]
	Mass		110 g	260 g
	Ambient/Fluid temperature		-10 to +50°C (No freezing)	
	Lubrication		Not required	
	Manual override		Non-locking push type	
	Vibration resistance (EN60068)		30 m/s^2 [Note 3)]	
	Impact resistance (EN60068)		150 m/s^2 [Note 4)]	
	Mounting orientation		universal	
	Enclosure		IP67	

2 Specifications - continued

	Standards	Complies with the basic and well-tried safety principles of EN ISO 13849-2:2012. Fault exclusion for “Spontaneous change of the initial switching position (without an input signal)” [Note 7)]	
	B_{10}	42 million cycles [Note 5)]	
	B_{10d}	84 million cycles [Note 5)]	
Elect.	Rated coil voltage	24 VDC	
	Polarity	- COM (negative COM)	Non polar
	Allowable voltage fluctuation	±10 % of rated voltage [Note 6)]	
	Coil insulation type	Class B or equivalent	
	Power consumption (Current) 24 VDC	0.4 W DC (17 mA)	1 W DC (42 mA)

Table 1

Note 1) When the external pilot pressure is removed or the coils are de-energized, the main valve remains in the last position.
Note 2) Based on JIS B 8375-1981 (Coil temperature: 20°C)
Note 3) No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Tests are performed at both energized and de-energized states in the axial direction and at right angles to the main valve and armature.
Note 4) No malfunction occurred when it was tested with a drop tester in the axial direction and at right angles to the main valve and armature; in both energized and de-energised states and for every time in each condition. (Values at the initial period)
Note 5) The B_{10} figure is estimated from SMC life tests. The B_{10d} figure is derived from B_{10} using the assumption in ISO 13849-1:2008 Annex C. Contact SMC for details.
Note 6) If power supply is under -10% of standard power supply 24 V DC the valve may not switch.

Note 7) Based on ISO 13849-2:2012-02 the following fault exclusion complies

Fault considered	Fault exclusion	Remarks
Spontaneous change of the initial switching position (without an input signal)	Yes, in case of spool valves with elastic sealing and if normal installation and operating conditions apply (see Remarks)	Normal installation and operating conditions apply when - The conditions laid down by the manufacturer have been taken into account. - The weight of the moving component is not acting unfavorably in terms of safety (e.g. horizontal installation). - There are no inertia forces acting adversely on moving components (e.g. direction of valve component motion takes into account magnitude and direction of inertia forces), and - No extreme vibration and shock stresses occur.

2.2 Flow characteristics

Model	1 -> 4,2 (P > A,B)			4,2 -> 5,3 (A,B > R1,R2)		
	C [dm^3/(s·bar)]	b	Cv	C [dm^3/(s·bar)]	b	Cv
VQC2201NR-5-X27	2.2	0.28	0.55	3.2	0.3	0.8
VQC4201R-5-X17	7.2	0.43	2.1	7.3	0.38	2.0

Table 2

2 Specifications - continued

2.3 Symbols

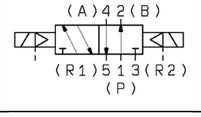
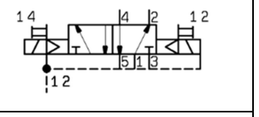
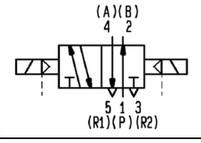
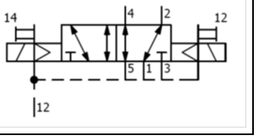
Model	JIS-Symbol	ISO-Symbol
VQC2201		
VQC4201		

Table 3

2.4 Indicators, override position and senses

2.4.1 VQC2201

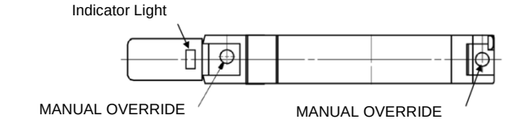


Figure 1

2.4.2 VQC4201

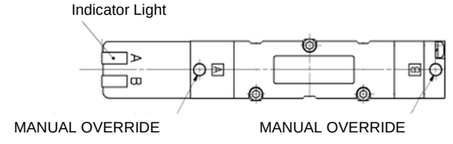


Figure 2

2.5 Light/Surge Voltage Suppressor

The VQC2201 valve is fitted with diode surge suppressors, shown in Figure 3. Note that this valve is configured negative common (PNP compatible). The surge suppressor will limit the transient voltage to about 1V.

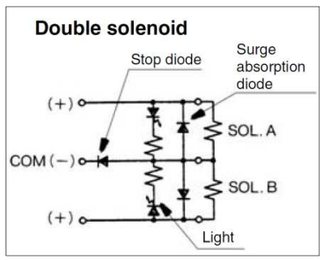


Figure 3: VQC2000

The VQC4201 valve is fitted with varistor surge suppressors, shown in Figure 4. Note that this valve has no polarity. Coil surge voltage generated when OFF is about 60V.

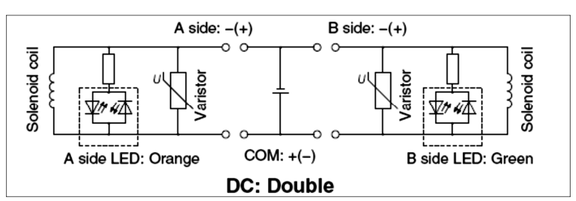


Figure 4: VQC4000

2 Specifications - continued

⚠ Caution

Special products might have specifications different from those shown in this section. Contact SMC for specific drawings. These drawings will give the appropriate specification details and compliance with the safety principles of ISO 13849, if applicable.

3 Installation

3.1 Installation

⚠ Warning

- Do not install the product unless the safety instructions have been read and understood.
- Use caution when valves are used on a manifold because an actuator may malfunction due to back-pressure.
- This valve is not suitable for use as an emergency shut-off valve. Additional safety measures should be adopted.
- Provide ventilation when using the valve in a confined space such as an enclosure to prevent the pressurising effect of released air and heat generation.
- Valves which are energised for a long period will become hot. Protect operators if this is a hazard.
- Do not disassemble this product or make any modifications.
- To ensure proper switching, the valve should be energised for at least 100 ms. Always ensure the energisation time is adequate for the application conditions.
- The pilot valve exhaust is connected to the main manifold exhaust line (5). Ensure that any transient manifold exhaust pressure does not cause unexpected pilot valve actuation when the valve is in the de-energised state (VQC2000). the pilot valve exhaust for the VQC4000 is in the PE-channel at the manifold.
- Warnings or specifications printed or affixed to the product should not be erased, removed or covered up.
- Do not paint this product.

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. Check the product specifications.
- Do not mount in a location exposed to radiant heat.
- Products with IP67 enclosures (based on IEC60529) are protected against dust and water; however, these products cannot be used in water.
- Do not use in an environment subject to heavy vibration and/or shock.
- Incorrect mounting of the product violates the IP67 rating. Be sure to read the precautions of mounting for each product.

3.3 Piping

⚠ Caution

- Before 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 1.5 to 2 threads exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.
- 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.
  Install piping so that it does not apply pulling, pressing, bending or other forces the valve body.
- Holding of pressure:
  Rubber sealed spool valves may have a slight leakage. This has to be taken into account for applications, in which the loss of pressure leads to a hazardous movement.

3 Installation - continued

- Maintenance space:
  The installation should have sufficient space for maintenance activities (removal of valve, etc.)
- Release of residual pressure:
  Provide a residual pressure release function for maintenance activities (removal of valve, etc.)

3.4 Valve Mounting

⚠ Warning

- Stop operation if air leakage increases and the equipment does not operate properly:
  Check mounting conditions after air and power supplies are connected. Initial function and leakage tests should be performed after installation.
- Instruction manual (this document):
  Install only after reading and understanding the safety instructions.
  Keep on file so that it can be referred to when necessary.

3.5 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, use turbine oil Class 1 (no additive), ISO VG32. Once lubricant is used in the system, lubrication must be continued because the original lubricant applied during manufacturing will be washed away.

3.6 Wiring

⚠ Caution

3.6.1. Applied voltage.
When electric power is connected to the solenoid valve, be careful to apply the proper voltage. Improper voltage may cause malfunction or coil damage.
3.6.2. Confirm the connections.
After completing the wiring, confirm that the connections are made correctly.

4 Settings

4.1 Manual override

⚠ Warning

Since connected equipment will operate when the manual override is activated, confirm that conditions are safe prior to activation. The non-locking push type (tool required) is standard.

Non-locking push type (Tool required)

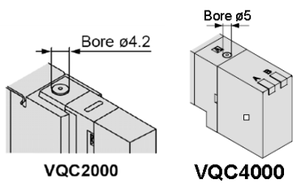


Figure 5

Push down the manual override button with a small screwdriver, etc., until it stops.
The manual override will return when released.

The manual override will actuating the pilot valve and the pilot valve pressure will actuating the main valve movement.

4.2 Solenoid Valve Removal and Mounting (VQC2000)

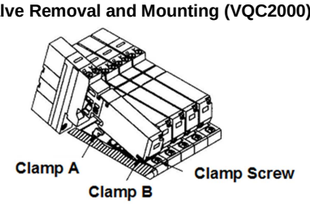


Figure 6

4 Settings - continued

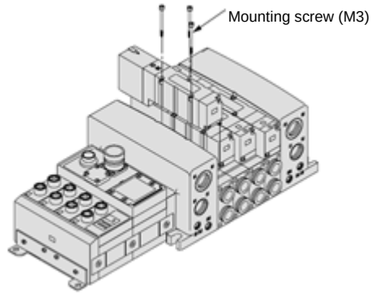
4.2.1 Removal steps
1. Loosen the clamp screw until they turn freely.
   (The screws do not come out.)
2. Remove the solenoid valve from clamp B by lifting the coil side of the valve while pushing on the screw top. If pushing down on the screw is difficult, you can alternately press down on the valve gently in the area near the manual override.

4.2.2 Mounting steps
1. Push the clamp screws. Clamp A opens. Now insert the end plate hook of the valve into clamp B at an angle.
2. Push the valve down into place. (When you release the screws, the valve will be locked into clamp A.)
3. Tighten the clamp screws with a tightening torque of 0.5 to 0.7 N·m.

4.3 Solenoid Valve Removal and Mounting (VQC4000)

After confirming that the gasket is installed correctly, securely tighten the mounting screws according to the tightening toque shown below.

Proper tightening torque (N·m)
0.8-1.2



4.3.1 Removal steps
1. Loosen the screws until they turn freely.
2. Remove the solenoid valve from the manifold.

4.3.2 Mounting steps
1. Push the valve down into place.
2. Tighten the clamp screws with a tightening torque shown in 4.3

⚠ Caution

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

Take care that the pilot pressure is able to exhaust. Do not block the Exhaust Ports.

4.4 Replacing One-touch fittings

⚠ Caution

Cylinder port fittings are available with cassette type manifolds and are easily replaced. Fittings are secured with a retaining clip that is inserted vertically from either the top or bottom of the manifold. After removing the valve, remove the clip with a flat head screwdriver to replace the fittings. To mount a fitting, insert the fitting assembly until it stops and reinsert the retaining clip to its designated position. Please see Figure 8.

4 Settings - continued

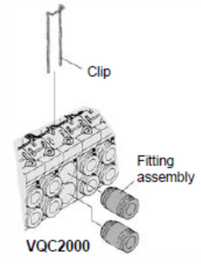


Figure 8

5 How to Order

Order Number	
VQC2201NR-5-X27	**2-position double**
VQC4201R-5-X17	**2-position double**

6 Outline Dimensions (mm)

6.1 Outline Dimensions (VQC2000)

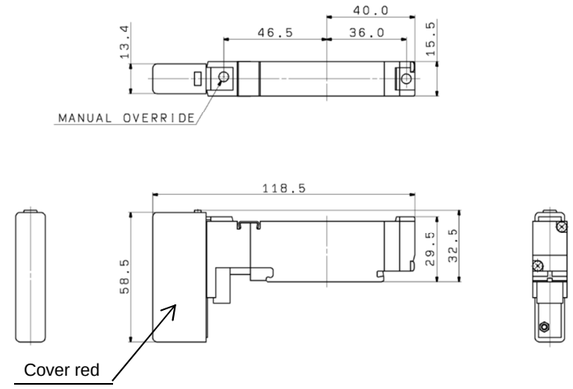


Figure 9: Special Pilot valve Cover (Color: Red)

6 Outline Dimensions (mm) - continued

6.2 Outline Dimensions (VQC4000)

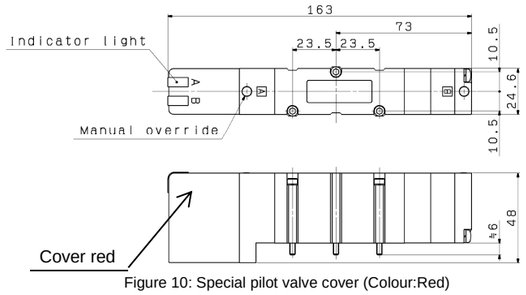


Figure 10: Special pilot valve cover (Colour:Red)

7 Maintenance

7.1 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.

⚠ Warning

7.2 Perform maintenance procedures as shown in this instruction manual.

If handled improperly malfunction or damage of machinery/equipment may occur.

7.3 Removing the product

To avoid the risk of being burned, ensure that the valve has had sufficient time to cool before performing work.

1. Shut off the fluid supply and release the fluid pressure in the system.
2. In the case of air pilot or air-operated type, shut off the supply air source and discharge the compressed air inside the pilot piping.
3. Shut off the power supply.
4. Remove the product.

7.4 Low frequency operation.

Valves should be operated at least once every 30 days to prevent malfunction. (Use caution regarding the air supply).

7.5 Manual override

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

7.6 Do not disassemble the product.

⚠ Caution

Cylinder port fittings are available with cassette type manifolds and are easily replaced. Fittings are secured with a retaining clip that is inserted vertically from either the top or bottom of the manifold. After removing the valve, remove the clip with a flat head screwdriver to replace the fittings. To mount a fitting, insert the fitting assembly until it stops and reinsert the retaining clip to its designated position.

7 Maintenance – continued

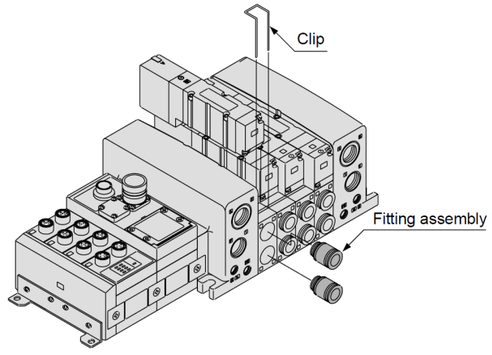


Figure 11

8 Limitations of Use

8.1 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, whichever is first[(1)]. 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 catalogue for the particular products.

(1) 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 regulations 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.

⚠ Caution

- **SMC products are not intended for use as instruments for legal metrology.**

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

⚠ Warning

Any use in an EN ISO 13849 system must be within the specified limits and application condition. The user is responsible for the specification, design, implementation, validation and maintenance of the safety system (SRP/CS).

8 Limitations of Use - continued

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.

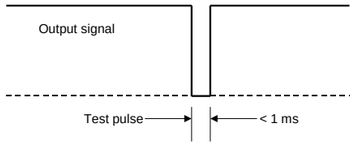


Figure 12

9 Contacts

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CROATIA	SMC Industrijska Automatika d.o.o. Zagrebačka Avenija 104,10 000 Zagreb
CZECH REP.	SMC Industrial Automation CZ s.r.o. Hudcova 78a, CZ-61200 Brno, Czech Republic
DENMARK	SMC Pneumatik A/S, Egeskovvej 1, DK-8700 Horsens, Denmark
ESTONIA	SMC Pneumatics Estonia Oü, Laki 12, EE-10621 Tallinn, Estonia
FINLAND	SMC Pneumatics Finland Oy, PL72, Tiistinniityntie 4, SF-02031 Espoo, Finland
FRANCE	SMC Pneumatique SA. 1, Boulevard de Strasbourg, Parc Gustave Eiffel, Bussy Saint Georges, F-77607 Marne La Vallee Cedex 3, France
GERMANY	SMC Pneumatik GmbH, Boschring 13-15, 63329 Egelsbach, Germany
GREECE	SMC Italia Hellas Branch, Anagenniseos 7-9-P.C. 14342 N.Philadelphia, Athens, Greece
HUNGARY	SMC Hungary Ipari Automatizálási Kft. Torbágy u. 19, HU-2045 Törökbálint, Hungary
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