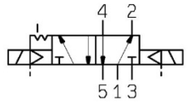
ORIGINAL INSTRUCTIONS

Instruction Manual

Bistable external pilot 5/2 spool valve with detent

VQC2201NR-51-X77





The intended use of this product is to control 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.
- **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	Valve Type	Special 5-Port Solenoid Valve [Note 1)]
	Valve Configuration	Rubber seal (Pilot valve V100)
	De-energized actuation	Bistable with mechanical detent
	Fluid	Air
	Minimum air quality	5μm filtration. See also section 3.6
	Max. operating pressure	0.7 MPa
	Min. operating pressure	Vacuum
	External pilot pressure range	0.2 to 0.7 MPa
	Flow	See Table 1
	Proof pressure	1.05 MPa
	Minimum frequency	1 cycle / 30 days
	Maximum frequency	5Hz
	Duty cycle	Continuous
	Response time	Less than 30ms [(Note 2)]
	Mass	105g
	Ambient temperature	-10 to +50℃ (No freezing)
	Lubrication	Not required
	Manual override	Push type
	Vibration resistance (EN60068)	50m/s² (0.35mm) [(Note 3)]
	Impact resistance (EN60068)	150m/s² at 11ms duration [(Note 4)]
	Mounting orientation	Universal
	Enclosure	IP67
	Standards	Complies with the basic and well-tried safety principles of ISO 13849-2:2012
	B_{10}	42×10^6 cycles [(Note 5)]
	B_{10d}	84×10^6 cycles [(Note 5)]
Elect.	Rated coil voltage	24 VDC
	Polarity	Negative common
	Allowable voltage fluctuation	±10 % of rated voltage
	Coil insulation type	Class B or equivalent
	Power consumption (Current) 24 VDC	0.4 W DC (17 mA)

Note 1) When the external pilot pressure is removed or the coils are de-energised the main valve remains in position. The valves are to be used with a suitable external pilot sub-base or manifold or VQC2101NY-5-X10.
Note 2) Based on JIS B 8375-1981 (Coil temperature: 20℃)
Note 3) No malfunction occurred in a round sweep test between 5 and 200Hz. The test was performed at both energised and de-energised states in the axial direction and at the right angles to the main valve and armature.
Note 4) No malfunction occurred when tested in the axial direction and at the right angles to the main valve and armature in both energised and de-energised states, five times for each condition.

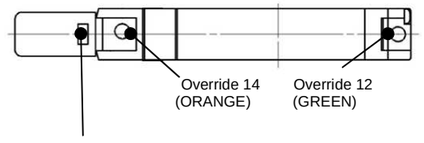
2 Specifications - continued

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.

Table 1. Flow Characteristics

Flow path			
1→4,2		4,2→5,3	
C (dm³/(s.bar))	b	C (dm³/(s.bar))	b
2.2	0.28	3.2	0.3

2.2 Indicators, override position and senses



ON Indicator: 12 green, 14 orange

Figure 1. ON/OFF indicator and Override buttons

2.3 Surge suppressors

The valve is fitted with diode surge suppressors, see Figure 2. Note that this valve is configured negative common (PNP compatible). The surge suppressor will limit the transient voltage to about 1V.

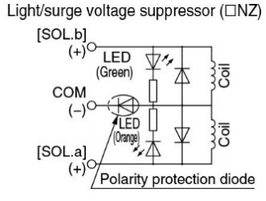


Figure 2. Surge suppressors

⚠ Caution

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

3 Installation

3.1 Installation

⚠ Warning

- Do not install the product unless the safety instructions have been read and understood.

1. Use caution when valves are used on a manifold because an actuator may malfunction due to back-pressure.
2. This valve is not suitable for use as an emergency shut-off valve. Additional safety measures should be adopted.
3. Operation in vacuum. Protect the valve from dirt and debris which might be drawn in.
4. Actuators may move unpredictably when connected to bi-stable valves for the first time. Ensure all bi-stable valves are in the correct position before the system is pressurised.
5. 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.
6. Valves which are energised for a long period will become hot. Protect operators if this is a hazard.
7. Do not disassemble this product or make any modifications.
8. To ensure proper switching, the valve should be energised for at least 100ms. Always ensure the energisation time is adequate for the application conditions.
9. 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.
10. Warnings or specifications printed or affixed to the product should not be erased, removed or covered up.
11. 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.
- Products compliant with IP67 satisfy the specification through mounting. Ensure the connections are made according to the appropriate product specification.
- Do not use in an environment subject to heavy vibration and/or shock.

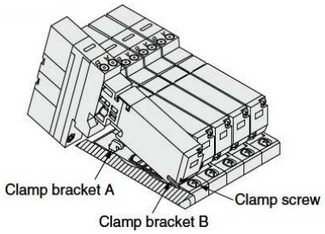
3.3 Piping and valve mounting

⚠ 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.

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: 0.5 to 0.7Nm

3.4 Wiring

⚠ Caution

1. This valve has polarity. Ensure the polarity of the supply is correct before connecting to the valve to prevent damage to the valve or connected system.
2. Ensure the supply voltage is correct before connecting to the valve to prevent damage to the valve or connected system.
3. Check if the connections are correct before completing the wiring.

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 Installation - continued

⚠ Warning

If excessive lubricant is used the oil may accumulate in the pilot valve causing malfunction or delayed response.

3.6 Air supply

⚠ Warning

1. 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.
2. Ensure filter drains are maintained regularly.
3. Use clean air. Do not use air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gasses, etc.

⚠ Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties inside the valve may occur, resulting in reduced reliability and service life. Refer to SMC if extremely dry air is used.
2. Install an air filter to protect the valve and connected system.
3. Take measures to ensure air quality such as installing an aftercooler, air dryer or water separator.
4. If excessive carbon dust is generated is seen, install a mist separator on the upstream side of the valve. Dust might accumulate inside the valve and cause malfunction.

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. Since two overrides are fitted, ensure the correct one is operated. Once the override is used the valve will remain in position until the other override is used or the appropriate coil energised. See Figure 1.

Non-locking push type (Tool required)

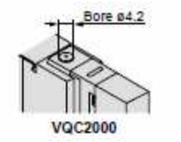


Figure 3. Manual overide

5 How to Order

There are no options for VQC2201NR-51-X77 valve.

6 Outline Dimensions (mm)

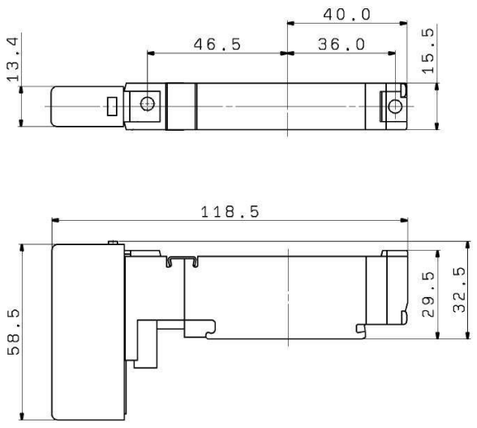


Figure 4. Dimensions

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.
- Operate the valve according to the minimum operating frequency given in section 2.

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.

8 Limitations of Use - continued

⚠ Caution

- **Leakage voltage**

Ensure that any leakage current when the switching element is OFF causes < 2% of the rated voltage across the valve.

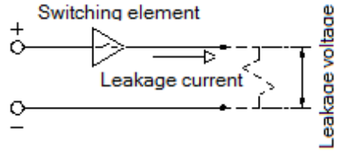


Figure 5. Leakage voltage

- **Low temperature operation**

According to the specification operation is possible to -10 , but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

⚠ Warning

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

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.

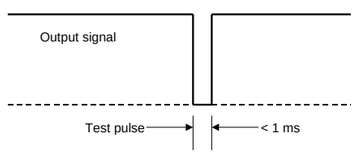


Figure 6

9 Contacts

AUSTRIA	SMC Pneumatik GmbH, Girakstrasse 8, AT-2100 Korneuburg, Austria
BELGIUM	SMC Pneumatics N.V./S.A. Nijverheidsstraat 20, B-2160 Wommelgem, Belgium
BULGARIA	SMC Industrial Automation Bulgaria EOOD, Business Park Sofia, Building 8-6th floor, BG-1715 Sofia, Bulgaria
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
IRELAND	SMC Pneumatics (Ireland) Ltd. 2002 Citywest Business Campus, Naas Road, Saggart, Co. Dublin, Ireland
ITALY	SMC Italia S.p.A. Via Garibaldi 62, I-20061Carugate, (Milano), Italy
LATVIA	SMC Pneumatics Latvia SIA, Dzelzavas str. 120g, Riga, LV-1021, Latvia
LITHUANIA	UAB "SMC Pneumatics", Oslo g. 1, LT-04123 Vilnius, Lithuania
NETHERLANDS	SMC Pneumatics B.V. De Ruyterkade 120, NL-1011 AB Amsterdam, the Netherlands
NORWAY	SMC Pneumatics Norway AS, Vollsveien 13 C, Granfos Næringspark, N-1366 Lysaker, Norway
POLAND	SMC Industrial Automation Polska Sp. z o.o. ul. Konstruktorska 11A, PL-02-673 Warszawa, Poland
PORTUGAL	SMC España S.A. Zuazobidea 14, 01015 Vitoria, Spain
ROMANIA	SMC Romania S.r.l. Str Frunzei 29, Sector 2, Bucharest, Romania
RUSSIA	SMC Pneumatik LLC. Business centre, building 3, 15 Kondratjevskij prospect, St.Petersburg, Russia, 195197
SLOVAKIA	SMC Priemyselná Automatizácia Spol s.r.o. Fantranská 1223, Teplicka nad vahom, 01301, Slovakia
SLOVENIA	SMC Industrijska Avtomatika d.o.o. Mirnska cesta 7, SLO-8210 Trebnje, Slovenia
SPAIN	SMC España S.A. Zuazobidea 14, 01015 Vitoria, Spain
SWEDEN	SMC Pneumatics Sweden AB, Ekhagsvägen 29-31, SE-141 71 Segeltorp, Sweden
SWITZERLAND	SMC Pneumatik AG, Dorfstrasse 7, Postfach, 8484 Weisslingen, Switzerland
TURKEY	SMC Pnömatik Sanayi Ticaret ve Servis A.Ş. Gülbahar Caddesi, Aydın Plaza, No: 9/4 Güneşli – 34212 , Istanbul
UK	SMC Pneumatics (U.K.) Ltd. Vincent Avenue, Crownhill, Milton Keynes, Buckinghamshire MK8 0AN, United Kingdom

SMC Corporation

URL : http// www.smcworld.com (Global) http// www.smceu.com (Europe)
'SMC Corporation, Akihabara UDX15F, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101 0021

Specifications are subject to change without prior notice from the manufacturer.

© *2015* SMC Corporation All Rights Reserved. DKP50047-F-085B Feb. 2015