SY-TFR43

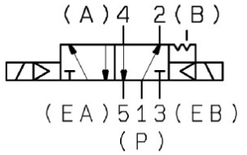
ORIGINAL INSTRUCTIONS

Instruction Manual

Bistable 5/2 spool valve with detent

SY5200##-5#1-#-X25





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.

1 Safety Instructions - continued

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
	Max. operating pressure		0.7 MPa
	Min. operating pressure		0.15 MPa
	Flow		See Table 1
	Proof pressure		1.05 MPa
	Minimum frequency		1 cycle / 30 days
	Maximum frequency		5Hz
	Duty cycle		Continuous [Note2)]
	Air quality required		Filtered to 5 µm
	Ambient temperature		-10 to +50°C (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		Unrestricted
	Enclosure		IP67
	Standards		Complies with the basic and well-tried safety principles of ISO 13849-2:2012
	B_{10}		10.3×10^6 cycles [(Note 5)]
	B_{10d}		20.6×10^6 cycles [(Note 5)]
	Mission time		5 years
Elect.	Rated coil voltage		24 VDC
	Polarity		See section 5 – How to order
	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)
	Response time without light/surge voltage suppressor		12ms or less
	Response time with light/surge voltage suppressor	S/Z type	15ms or less
		R/U type	12ms or less

Note 1) When the coils are de-energised the main valve remains in position.
Note 2) If the valve is energised continuously for a long period of time, the rise in temperature due to heat build-up of the coil assembly may cause a decline in solenoid valve performance, reduce service life or have adverse effects on peripheral equipment. In particular, if three or more adjacent stations are energised simultaneously for extended periods of time or if the valves on A side or B side are energised simultaneously for a long period of time, take special care as the temperature rise will be greater.
Note 3) No malfunction occurred in a round sweep test between 5 and 200 Hz. 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.

2 Specifications - continued

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.

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

		Valve flow rate characteristics			
		1 →4/2 (P→A/B)		4/2 →5/3 (A/B→E)	
		C [dm³/(s.bar)]	b	C [dm³/(s.bar)]	b
Plug-in metal base	Side ported	2.6	0.28	2.6	0.14
	Bottom ported	2.7	0.35	2.8	0.20
Plug-in connector base	Side ported	3.3	0.30	3.6	0.17
	Bottom ported	3.3	0.29	4.2	0.26

2.2 Indicators, override position and senses

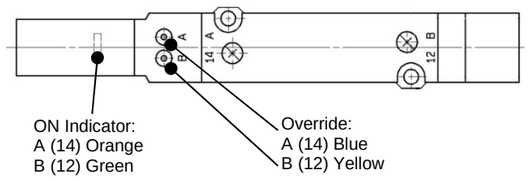


Figure 1. ON/OFF indicator and Override buttons

2.3 Surge suppressors

Some variants of this valve are fitted with surge suppressors, see section 5. Note that if a variant without surge suppressors is chosen, the connected system must provide surge suppression in order to comply with the basic safety principles of ISO 13849 quoted in section 2

The types of surge suppressors fitted are given in Figure 2 and Figure 3.

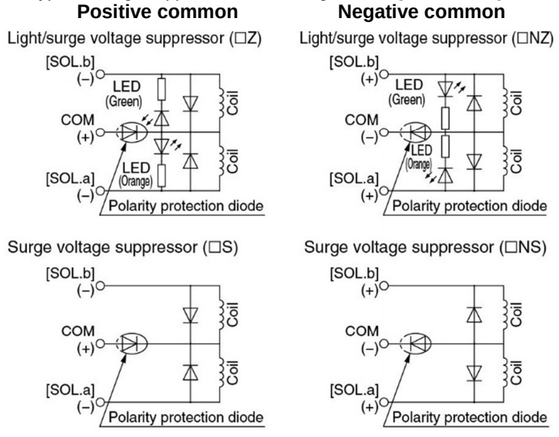


Figure 2. Polar type

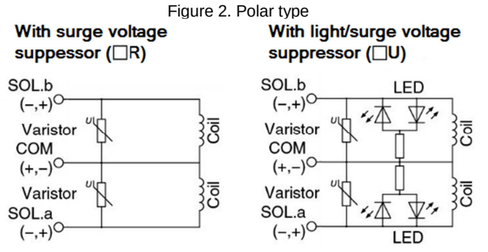


Figure 3. Non-polar type

2 Specifications - continued

Table 2. Residual voltage of the surge voltage suppressor

Suppressor type	Residual voltage
S, Z	Approx. 1 V
R, U	Approx. 47 V

2.4 Surge voltage from external power isolation

⚠ Caution

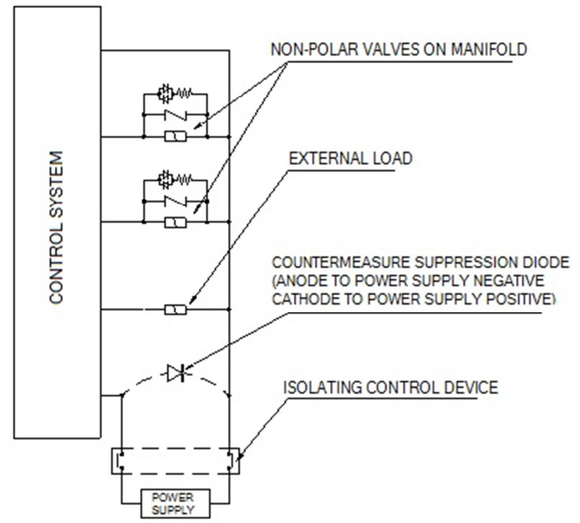


Figure 4. Control system setup

Countermeasures are required if non-polar valves are used in a system with a power supply isolating device.
When the power supply is suddenly isolated due to emergency stop etc, transient surge voltage can be caused by energy stored in energised devices within the control system. This transient voltage can cause bipolar valves to be temporarily energised.
As a countermeasure, a power supply suppression diode should be fitted within the control system as shown.
Contact SMC for more details.

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 on common manifold exhaust connections.
2. This valve is not suitable for use as an emergency shut-off valve. Additional safety measures should be adopted.
3. 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.
4. 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.
5. Valves which are energised for a long period will become hot. Protect operators if this is a hazard.
6. Do not disassemble this product or make any modifications.
7. To ensure proper switching, the valve should be energised for at least 100ms. Always ensure the energisation time is adequate for the application conditions.

3 Installation - continued

8. Warnings or specifications printed or affixed to the product should not be erased, removed or covered up.
9. Do not paint this product.

3.2 Use of a 5 port valve as a 3 port valve

Caution

This valve can be used as a normally closed (NC) or normally open (NO) 3 port valve by closing one of the actuator ports 4(A) or 2 (B) with a plug. However, the valve exhaust ports 5 (EA) or 3 (EB) must be kept open.



Figure 5. Use of a 5 port valve as a 3 port valve

3.3 Environment

Warning

- Do not use in an environment where the product is directly exposed to corrosive gases, chemicals, salt water, water, steam or weld spatter.
- 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

3.4 Piping and valve mounting

Caution

- Before connecting to the supply circuit make sure to clean up chips, cutting oil, dust etc from the supply piping.
- Mount the valve so there is no slippage or deformation of the gaskets and tighten with the torque shown below:

Thread size	Tightening torque
M3	0.8 Nm

3.5 Wiring

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

3.6 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.

Warning

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

3.7 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.

3 Installation - continued

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 6. Press the override in the direction of the arrow to operate (tool required).

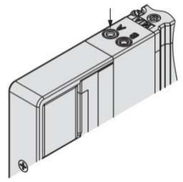
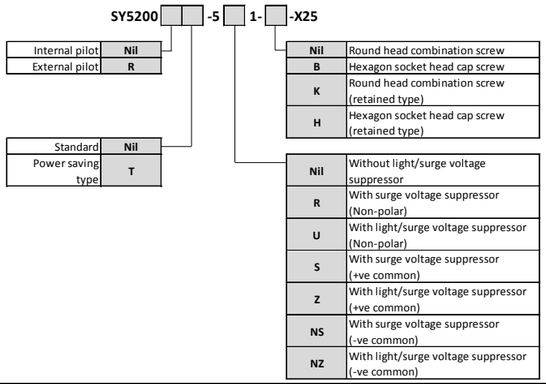
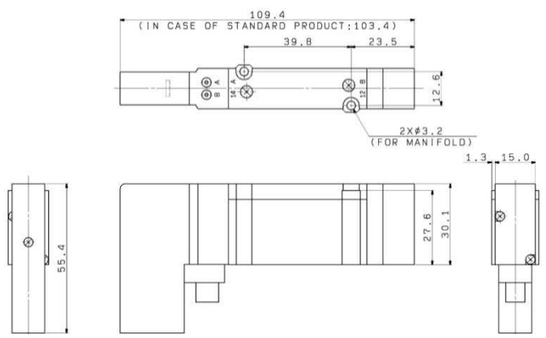


Figure 6. Manual overide

5 How to Order



6 Outline Dimensions (mm)



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.
- 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

- **Leakage voltage**

Ensure that any leakage current when the switching element is OFF causes < 3% of the rated voltage across the valve.

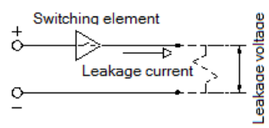


Figure 7

- **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,

8 Limitations of Use - continued

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.

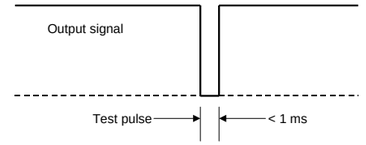


Figure 8. Test pulse

9 Contacts

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