

Instruction Manual

5 Port Solenoid Valve

Series SV1000/2000/3000/4000



Cassette base manifold

Tie-rod base

The intended use of this valve is to control the movement of an actuator.

1 Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of "Caution," "Warning" or "Danger." They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC¹⁾, and other safety regulations.

¹⁾ ISO 4414: Pneumatic fluid power - General rules relating to systems.
ISO 4413: Hydraulic fluid power - General rules relating to systems.
IEC 60204-1: Safety of machinery - Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to product catalogue, Operation Manual and Handling Precautions for SMC Products for additional information.
- Keep this manual in a safe place for future reference.

	Caution	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
	Warning	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
	Danger	Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

- Always ensure compliance with relevant safety laws and standards.
- All work must be carried out in a safe manner by a qualified person in compliance with applicable national regulations.

Caution

- The product is provided for use in manufacturing industries only. Do not use in residential premises.

2 Specifications

2.1 Standard specifications

Fluid	Air	
Internal pilot operating pressure range [MPa]	2 position single 4 position dual 3 port valve	0.15 to 0.7
External pilot operating pressure range [MPa]	2 position double 3 position	0.1 to 0.7 0.2 to 0.7
	Operating pressure range	-100kPa to 0.7
Ambient and fluid temperature [°C]	2 position single, double 4 position dual 3 port valve	-10 to 50 (no freezing)
	3 position	
Minimum operating frequency	1 cycle / 30 day	
Duty cycle	Contact SMC	
Maximum operating frequency [Hz]	2 position single, double 4 position dual 3 port valve	5
	3 position	
Response time	Refer to catalogue	
Flow rate	Refer to catalogue	
Manual override	Non-locking push type	Push-turn locking slotted type
	Push-turn locking slotted type	

2 Specifications - continued

Pilot exhaust method	Internal pilot	Main valve / Pilot valve common exhaust
	External pilot	Pilot valve individual exhaust
Lubrication	Not required	
Mounting orientation	Unrestricted	
Impact/vibration resistance [m/s ²] ^{Note 1)}	150 / 30 (45 to 2000 Hz)	
Enclosure	IP67 (based on IEC60529)	
Weight	Refer to catalogue	

Table 1.

Note 1) **Impact resistance:** No malfunction when tested with a drop tester in the axial direction and at a right angle to the main valve and armature, one time each in energized and de-energized states (Values quoted are for a new valve).

Vibration resistance: No malfunction when tested with one sweep of 45 to 2000 Hz in the axial direction and at a right angle to the main valve and armature, in both energized and de-energized states (Values quoted are for a new valve).

2.2 Solenoid specifications

Rated coil voltage [VDC]	24, 12
Allowable voltage fluctuation ^{Note 1)}	±10% of rated voltage
Power consumption [W]	0.6 (With light: 0.65)
Surge voltage suppressor	Zener diode
Indicator light	LED
Polarity	Non-polar

Table 2.

Note 1) Valve state is not defined if electrical input is outside of specified operating ranges.

2.3 Manifold specifications

Applicable series	Cassette base		Tie-rod base			
	SV1000	SV2000	SV1000	SV2000	SV3000	SV4000
Manifold type	Stacking type cassette base manifold		Tie-rod base manifold			
1 (P: SUP) / 3, 5 (E: EXH) type	Common SUP, EXH		Common SUP, EXH			
Valve stations (maximum)	18 stations	20 stations	20 stations			
Max. number of solenoids	18 points	26 points	32 points			

Port size	1(P)/3,5(E) port	C8, N9	C10, N11	C8, N9	C10, N11	C12, N11	C12, N11, 03
	4(A)/2(B) port	C3, C4, C6 N1, N3, N7	C4, C6, C8 N3, N7, N9	C3, C4, C6 N1, N3, N7	C4, C6, C8 N3, N7, N9	C6, C8, C10 N7, N9, N11	C8, C10, C12 N9, N11, 02, 03

Table 3.

2.4 Pneumatic symbols

Refer to catalogue or drawing for pneumatic symbols.

2.5 Light indication

Caution

When equipped with light and surge voltage suppressor, the indicator light window turns orange when solenoid A is energized, and it turns green when solenoid B is energized.

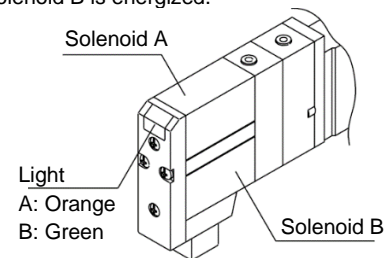


Figure 1.

2.6 Special products

Warning

Special products (-X) might have specifications different from those shown in this section. Contact SMC for specific drawings.

3 Installation

3.1 Installation

Warning

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

3 Installation - continued

3.2 Environment

Warning

- Do not use in an environment where corrosive gases, chemicals, salt water or steam are present.
- Do not use in an explosive atmosphere.
- Do not expose to direct sunlight. Use a suitable protective cover.
- Do not install in a location subject to vibration or impact in excess of the product's specifications.
- Do not mount in a location exposed to radiant heat that would result in temperatures in excess of the product's specifications.
- Products compliant with IP65 and IP67 enclosures (Based on IEC60529) are protected against dust and water, however, these products cannot be used in water.
- Products compliant with IP65 and IP67 enclosures satisfy the specifications by mounting each product properly. Be sure to read the Specific Product Precautions for each product.
- When using built-in silencer type manifold with an IP67 enclosure, keep the exhaust port of the silencer from coming in direct contact with water or other liquids. Liquid entry through the exhaust port of the silencer can cause damage to the valve.
- Do not use in high humidity environment where condensation can occur.
- Contact SMC for altitude limitations.

3.3 Piping

Caution

- Before connecting piping make sure to clean up chips, cutting oil, dust etc.
- When installing piping or fittings, ensure sealant material does not enter inside the port. When using seal tape, leave 1 thread exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Connection thread size (R, NPT)	Tightening Torque [N·m]
M5	1 to 1.5
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

Table 4.

3.4 Lubrication

Caution

- SMC products have been lubricated for life at manufacture, and do not require lubrication in service.
- If a lubricant is used in the system, refer to catalogue for details.

3.5 Air supply

Warning

- Use clean air. If the compressed air supply includes chemicals, synthetic materials (including organic solvents), salinity, corrosive gas etc., it can lead to damage or malfunction.

Caution

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

3.6 Effect of back pressure when using a manifold

Warning

- Use caution when valves are used on a manifold, because an actuator may malfunction due to back pressure.
- Special caution must be taken when using 3 position exhaust centre valve or when driving a single acting cylinder. To prevent a malfunction, implement counter measures such as using a single EXH spacer assembly or an individual exhaust manifold.

3.7 One-touch fitting

Caution

When fittings are used, they may interfere with one another depending on their types and sizes. Therefore, the dimensions of the fittings to be used should first be confirmed in their respective catalogues.

3.7.1 Tube attachment and detachment

Caution

Refer to the Specific Precautions in the catalogue.

3 Installation - continued

3.7.2 Replacement of fittings

Caution

By replacing a valve's fitting assembly, it is possible to change the connection diameter of the ports. When replacing it, pull out the fitting assembly after removing the clip with a flat head screwdriver, etc. To mount a new fitting assembly, put it into place and then fully reinsert the clip.

Caution

Do not scratch or put foreign matter on the O-rings as this will cause air leakage.

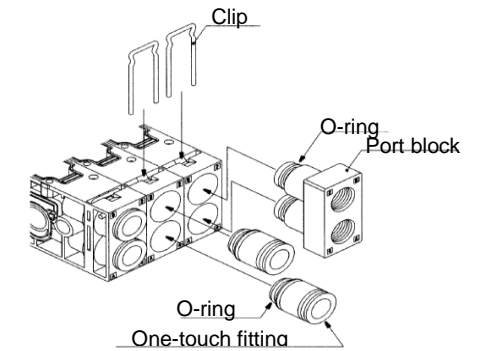


Figure 2.

3.8 Precautions on other tube brands

Caution

When using non-SMC brand tubes, refer to the Specific Precautions in the catalogue.

3.9 Mounting

Caution

- Ensure gaskets are in good condition, not deformed and are dust and debris free.
- When mounting valves ensure gaskets are present, aligned and

securely in place and tighten screws to the torque indicated in table 5.

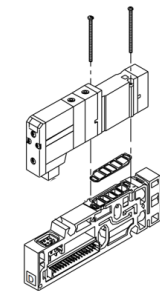


Figure 3.

3.10 Light/surge voltage suppressor

Caution

3.10.1 Light/surge voltage suppressor

3.10.1.1 Single solenoid type

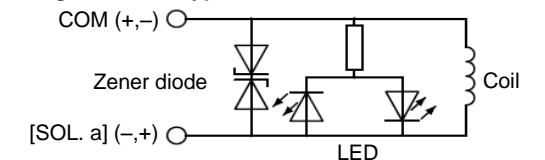


Figure 4.

3 Installation - continued

3.10.1.2 Double solenoid, 3 position type

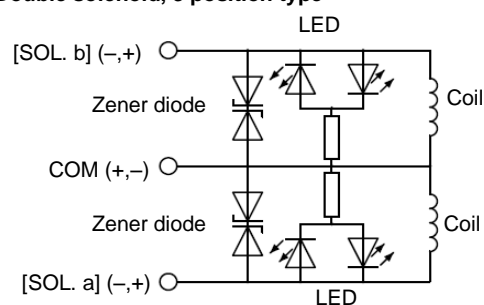


Figure 5.

3.10.2 Surge voltage suppressor

3.10.2.1 Single solenoid type

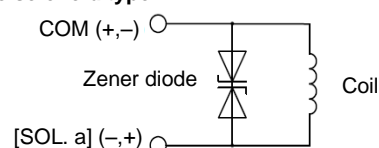


Figure 6.

3.10.2.2 Double solenoid, 3 position type

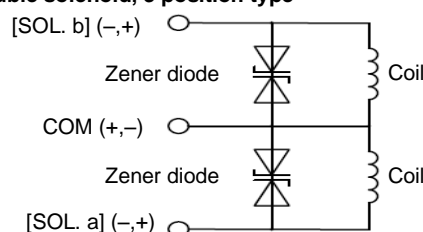


Figure 7.

3.11 Electrical wiring specifications

⚠ Caution

Refer to catalogue for electrical wiring specifications.

3.12 Residual voltage

⚠ Caution

- If a Zener diode voltage suppressor is used, the suppressor arrests the back EMF voltage from the coil to a level in proportion to the rated voltage.
- Ensure the transient voltage is within the specification of the host controller.
- Contact SMC for the Zener diode residual voltage.

3.13 Countermeasure for surge voltage

⚠ Caution

- At times of sudden interruption of the power supply, the energy stored in a large inductive device may cause non-polar type valves in a de-energised state to switch.
- When installing a breaker circuit to isolate the power, consider a valve with polarity (with polarity protection diode), or install a surge absorption diode across the output of the breaker.

3.14 Manual override

⚠ Warning

- Regardless of an electric signal for the valve, the manual override is used for switching the main valve. Since connected equipment will operate when the manual override is activated, confirm that conditions are safe prior to activation.
- Locked manual overrides might prevent the valve responding to being electrically de-energised or cause unexpected movement in the equipment.
- Refer to the catalogue for details of manual override operation.

3 Installation - continued

3.15 Extended period of continuous energization

⚠ Warning

- If a valve will be continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil assembly. This will likely adversely affect the performance of the valve and any nearby peripheral equipment. Therefore, if the valve is to be energized for periods of longer than 30 minutes at a time or if during the hours of operation the energized period per day is longer than the de-energized period, we advise using a valve with specifications listed below.
- Pilot operated: A 0.4 W or lower valve, such as the SY series, or a valve with a power-saving circuit

3.16 Exhaust restriction

⚠ Caution

Since the series SV is a type in which the pilot valve exhaust joins the main valve exhaust inside the valve, care must be taken so that the piping from the exhaust port is not restricted.

3.17 Use as a 3-Port Valve

⚠ Caution

- Series SV valves can be used as normally closed (N.C.) or normally open (N.O.) 3-port valves by closing one of the cylinder ports 4(A) or 2(B) with a plug. However, they should be used with the exhaust ports kept open.
- Refer to Specific Product Precautions in the catalogue for additional details.

3.18 Back pressure check valve built-in type

⚠ Caution

- Valves with built-in back pressure check valve prevent back pressure inside the valve. For this reason, external pilot type is not allowed to be pressurised from exhaust port [3/5(E)]. Valves with integrated back pressure check valve have a reduced flow compared to those without check valve. For details, please contact SMC.
- Do not switch valves when A or B port is open to the atmosphere, or while the actuators and air operated equipment are in operation. The back pressure prevention seal may be damaged, which may cause air leakage or malfunctions. Use caution especially when performing a

trial operation or maintenance work.

3.19 Tightening torques

⚠ Caution

3.19.1 Mounting screws

Screw type	Recommended tightening torque [N·m]	
	Valve and blanking plate	Cassette and tie rod
M2	0.16	0.15
M3	0.8	0.6
M4	1.4	1.4
M5	-	2.9

Table 5.

3.19.2 DIN rail holding screws

Manifold type	Recommended tightening torque [N·m]
General	1.4
For EX250/600	0.5

Table 6.

4 Settings

4.1 Connector entry directions

⚠ Caution

Refer to Specific Product Precautions in the catalogue.

5 How to Order

Refer to catalogue for 'How to order' or product drawing for special products.

6 Outline Dimensions

Refer to the catalogue for outline dimensions.

7 Maintenance

7.1 General maintenance

⚠ Caution

- Not following proper maintenance procedures could cause the product to malfunction and lead to equipment damage.

7 Maintenance - continued

- 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.
- 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.
- Blanking plate assemblies are used in situations where valves will be added in the future, and for maintenance, etc.
- When the 3-position closed centre type is in its rest position, air can be trapped between the valve and the cylinder. Exhaust this air pressure before removing piping or performing any maintenance.

7.2 Mounting

⚠ Caution

Refer to section 3.9 for guidance on mounting valves.

7.3 Maintainable parts

⚠ Caution

- Refer to catalogue for how to order replacement sub-plates, gaskets, round head combination mounting screws and fitting assemblies.
- For recommended tightening torques please refer to 3.19.

8 Limitations of Use

⚠ Warning

The system designer should determine the effect of the possible failure

modes of the product on the system.

8.1 Limited warranty and disclaimer/compliance requirements

⚠ Caution

Refer to Handling Precautions for SMC Products.

8.2 Leakage voltage

⚠ Caution

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes $\leq 3\%$ of the rated voltage across the valve.

8.3 Low temperature operation

⚠ Caution

Unless otherwise indicated in the specifications for each valve, operation is possible to -10°C , but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc.

8.4 Intermediate stopping

⚠ Warning

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

8.5 Holding pressure

⚠ Warning

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

8.6 Cannot be used as an emergency shut-off valve

⚠ Warning

This product is not designed for safety applications such as an emergency shut-off valve. If the valves are used in this type of system, other reliable safety assurance measures should be adopted.

8 Limitations of Use - continued

8.7 Air returned spool valves

⚠ Warning

- The use of 2-position single valves with air returned spools has to be carefully considered.
- The return of the valve spool into the de-energized position depends on the pilot pressure. If the pilot pressure drops below the specified operating pressure the position of the spool cannot be defined.
- The design of the system must take into account such behaviour.
- Additional measures might be necessary. For example, the installation of an additional air tank to maintain the pilot pressure.

Energy source status	Single	Double	3 position
Air supply present, electricity cut	Spool returns to the off position by air force	Spool stops moving after electricity cut (Position cannot be defined)	Spool returns to off position by spring force
Air supply cut before electricity cut	Spool stops moving after air pressure cut (Position cannot be defined)	Spool stops moving after air pressure cut (Position cannot be defined)	Spool returns to off position by spring force

Table 7.

8.8 Safety relays or PLC

⚠ Warning

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.

8.9 Momentary energization

⚠ Caution

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

9 Product disposal

This product shall not be disposed of as municipal waste. Check your

local regulations and guidelines to dispose this product correctly, in order to reduce the impact on human health and the environment.

10 Contacts

Refer to www.smcworld.com or www.smc.eu for your local distributor/importer.

SMC Corporation

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101 0021, Japan
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