



ORIGINAL INSTRUCTIONS

Instruction Manual

5 Port Solenoid Valve Plug-in Type Series SY3000/5000/7000



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/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: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.

- Refer to product catalogues, 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 Manifold specifications

2.1.1 Plug-in Metal Base

Model	D-sub connector		Flat ribbon cable			Serial wiring
	F type	P type	PG type J type	PH type	S5 type (EX510)	
Enclosure (Based on IEC60529)	IP40		IP40			IP20

Table 1

2.1.2 Plug-in Connector Connection Base

Model	D-sub		Flat ribbon cable			Terminal block box	Lead wire	Circular connector
	F type	FW type	P type	PG type J type G type	PH type			
Enclosure (Based on IEC60529)	IP40	IP67*	IP40			IP67*		

Table 2

2 Specifications - continued

Model	Serial wiring			
	S6□ type (EX600)	SA2 type (EX500) S4□ type (EX126)	S1□ type (EX250)	S3□ type (EX120)
Enclosure (Based on IEC60529)	IP67* (I/O unit: partially IP40)	IP67* (EX500 gateway unit, input unit: IP65)	IP67* (EX260 D-Sub communication connector: IP40, EX500 GW unit IP65)	IP20

Table 3

*See section 3.2, environment, for mounting and operating environment restrictions for metal seal type.

2.2 Valve specifications

Valve type		Rubber seal	Metal seal	
Fluid		Air		
Internal pilot	2 position single	0.15 to 0.7	0.1 to 0.7 (High pressure type: 0.1 to 1)	
	2 position double	0.1 to 0.7		
	3 position	0.2 to 0.7		
	4 position dual 3 port	0.15 to 0.7		
External pilot	Operating pressure range [MPa] Note 1)	-100 kPa to 0.7 (4 position: -100 kPa to 0.6)	-100 kPa to 0.7 (4 position: -100 kPa to 1)	
	2 position single		0.1 to 0.7	
	2 position double	0.25 to 0.7	High pressure type: 0.1 to 1)	
	3 position			
4 position dual 3 port		Operating pressure + 0.1 or more (Min.0.25) to 0.7	-	
Ambient and fluid temperature [°C]		-10 to 50 (No freezing)		
Minimum Operating frequency		1 cycle / 30 days		
Maximum Operating Frequency [Hz]	SY3000 SY5000	2 position single/double	5	20 Note2)
		4 position dual 3 port		
	3 position	3	10 Note 2)	
	SY7000	2 position single/double	5	10 Note 2)
		4 position dual 3 port	3	10 Note 2)
		3 position	3	10 Note 2)
Duty cycle		Continuous (0.15W standard pressure power saving type). For other types contact SMC		
Flow rate		Refer to catalogue		
Response time		Refer to catalogue		

Manual override	Non-locking push type Push turn-locking slotted type Push turn locking lever type Slide locking type		
Pilot exhaust type	Internal pilot	Main/Pilot valve common exhaust	Main/Pilot valve individual exhaust
	External pilot	Pilot valve individual exhaust	
Lubrication	Not required		
Mounting orientation	Unrestricted Single: Unrestricted. Double/3 position: Main valve is horizontal.		
Impact/vibration resistance Note 3) [ms ⁻²]	150/30		
Enclosure	IP67 (Based on IEC60529)		
Weight	Refer to catalogue		

Table 4

Note 1) See section 3.18
 Note 2) 5Hz or less for power saving circuit type.
 Note 3) **Impact resistance:** No malfunction occurred when it was tested with a drop tester in the axial direction and at right angles to the main valve & armature; in both energized & de-energized states and for every time in each condition. (Values at the initial period.)
Vibration resistance: 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 & armature. (Values at the initial period.)

2.3 Solenoid Specifications

Pilot valve part number	Refer to catalogue	
Coil rated voltage [VDC]	24, 12	
Coil insulation class	Contact SMC	
Allowable voltage fluctuation	±10% of rated voltage Note 1,2)	
Power consumption [W]	Standard	0.35 (With indicator light: 0.4)
	High pressure type, Quick response type	0.9 (With indicator light: 0.95)
	With power saving circuit	Standard: 0.1 holding (With indicator light only), High pressure type: 0.4 holding (With indicator light only)
Surge voltage suppressor	Diode(Varistor for non-polar type)	
Indicator light	LED	

Table 5

Note 1) Due to the internal circuit in S/Z type and T type (power saving circuit), the allowable voltage fluctuation should be within the following:
 S/Z type 24 VDC: -7% to +10% T type 24 VDC: -8% to +10%
 12 VDC: -4% to +10% 12 VDC: -6% to +10%

2 Specifications - continued

Note 2) Valve state is not defined if electrical input is outside the specified operating range.

2.4 Special products

Warning

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

2.5 Pneumatic symbols

Refer to catalogue for pneumatic symbols.

3 Installation

3.1 Installation

Warning

- Do not install the product unless the safety instructions have been read and understood.
- When using double solenoid type for the first time, actuators may travel in an unexpected direction depending on the switching position of the valve. Implement countermeasures to avoid any danger that may occur due to the actuator's operation.

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 IP65 and IP67 enclosures (based on IEC60529) are protected against dust and water; however, these products cannot be used in water.
- Products compliant to IP65 and IP67 satisfy the specifications by mounting the product appropriately. Be sure to read the Specific Product Precautions for each product.
- When using built-in silencer type manifold with an IP65 or IP67 enclosure, keep the exhaust port of the silencer from coming in direct

contact with water or other liquids.

- The metal seal valve is provided with a hole to discharge the pilot EXH. When using in atmospheres containing water and dust, mount horizontally.
- Do not use in high humidity environment where condensation can occur.
- If using in an atmosphere where there is possible contact with water drop-lets, oil, weld spatter, etc., take suitable preventive measures.
- When the solenoid valve is mounted in a control panel or it is energized for a long time, make sure that the ambient temperature is within the specification of the valve.
- Contact SMC for altitude limitations.

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 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]
1/8	3 to 5
1/4	8 to 12

Table 6

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 One-touch fittings

3.5.1 Tube attachment and detachment

Caution

Refer to the Specific Precautions in the catalogue.

3 Installation - continued

3.6 Precautions on other tube brands

Caution

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

3.7 Indicator Light/Surge Voltage Suppressor

If a valve type without suppression is used, suppression should be provided as close as possible to the valve by the host controller.

3.8 Polarity

3.8.1 Polar type

Positive common Single solenoid	Negative common Single solenoid
Light/surge voltage suppressor (□Z) 	Light/surge voltage suppressor (□NZ)
Surge voltage suppressor (□S) 	Surge voltage suppressor (□NS)
Positive common Double solenoid, 3-position, 4-position	Negative common Double solenoid, 3-position, 4-position

Light/surge voltage suppressor (□Z) 	Light/surge voltage suppressor (□NZ)
Surge voltage suppressor (□S) 	Surge voltage suppressor (□NS)

Figure 1

3.8.2 Non-polar type

With surge voltage suppressor (□R)

Single solenoid	Double solenoid

3 Installation - continued

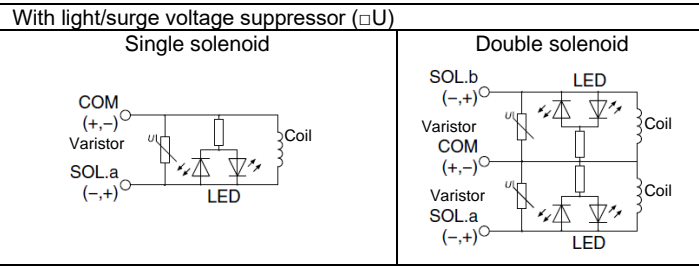


Figure 2

3.9 With power saving circuit

Power consumption is decreased by approximately 1/3rd by reducing the wattage required to hold the valve in an energized state. (Effective energizing time is over 67 ms at 24 VDC).
*Be careful of the energizing time, as quick response and high pressure types will become operational when the energizing time is over 40 ms.

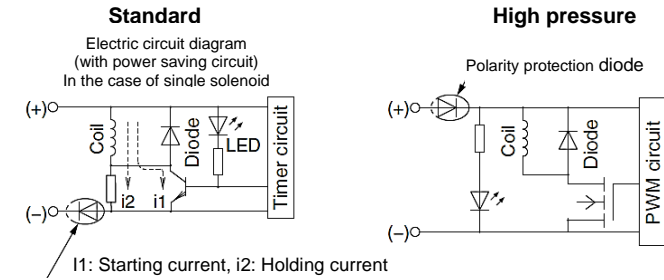


Figure 3

Not available for the 12 VDC specification

- The above circuit reduces the power consumption for holding in order to save energy. Refer to the catalogue for details.
- The 12 VDC specification with power saving circuit (standard specification) does not have the polarity protection diode. Do not make a mistake with the polarity.
- Since the voltage will drop by approx. 0.5 V due to the transistor, pay

attention to the allowable voltage fluctuation. (For details, refer to the solenoid specifications of each type of valve.)

3.10 Residual Voltage

Caution

- If a varistor or diode surge voltage suppressor is used, the suppressor arrests the back EMF voltage from the coil to the level indicated in Table 7. Ensure the transient voltage is within the specification of the host controller.
- Valve response time is dependent on surge suppression method selected.

Surge voltage suppressor	DC	
	24 V	12 V
S,Z	Approx. 1 V	
R,U	Approx. 47 V	Approx. 32 V

Table 7

3.11 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-energized 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.

3.12 Continuous Duty

Warning

If a valve is energized continuously for a long period of time, the rise in temperature due to heating-up of the coil assembly may cause a decline in solenoid valve performance, reduce service life, or have adverse effects on peripheral equipment. If the valve is energized continuously for a long period of time, be sure to use a valve with power saving circuit. In particular, if three or more adjacent stations on the manifold are energized simultaneously for extended periods of time or if the valves on A side and B side are energized simultaneously for a long period of time, take special care as the temperature rise will be greater.

3 Installation - continued

3.13 Momentary energization

Caution

If a double solenoid valve will be 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.

3.14 Light Indication

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

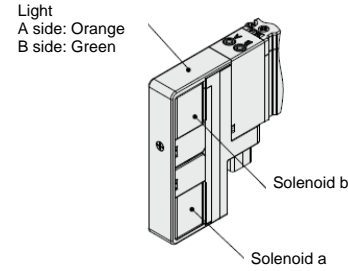


Figure 4

3.15 Valve Mounting

Caution

- Mount the valve so that there is no slippage or deformation in gaskets and tighten with the tightening torque as shown below.

Model	Thread size	Tightening torque
SY3000	M2	0.16 N·m
SY5000/7000	M3	0.8 N·m

Table 8

- Refer to catalogue for other screw torque values.

3.16 Manual override

Warning

Regardless of an electric signal for the valve, the manual override is

used for switching the main valve. Connected actuator is started by manual operation. Only use the manual override after confirming that there is no danger.

Warning

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.

3.17 Changing Connector Entry Direction

Caution

Refer to the Specific Product Precautions in the catalogue.

3.18 Reverse flow

Caution

Only the external pilot variants are suitable for reverse flow with pressure supplied on ports 3 and 5 provided the pressure is less than 0.7 MPa. Reverse flow cannot be applied to 'H' variants with built in check-valves or valves fitted with SY#0M-24-1A check valves.

3.19 Back pressure check valves

Back pressure from the common manifold exhausts can be prevented from affecting actuators connected to ports 2 and 4 by using the 'H' variant valve or fitting SY#0M-24-1A check valves. The flow capacity of the valve is reduced in these cases. See catalogue for full details on back pressure check valves.

3.20 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. For 3-position exhaust centre valve or single acting cylinder, take appropriate measures to prevent malfunction by using it with an individual EXH interface block or an individual exhaust manifold.

3 Installation - continued

3.21 External pilot exhausts

Caution

The external pilot variants use the manifold PE connection for pilot exhaust. Ensure that this connection is always vented to atmosphere and not subject to any pressure pulses from other devices.

3.22 Change of piping types between Top and Side, port block while mounted on a manifold and one-touch fittings

Caution

Refer to the Specific Product Precautions in the catalogue.

3.23 One-touch Fittings

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.

4 How to Order

4.1 Standard products

Refer to catalogue for 'How to order' information.

4.2 Special products

For special products (-X number) refer to product drawing for 'How to order' details and specifications.

5 Outline Dimensions (mm)

Refer to the catalogue for outline dimensions.

6 Maintenance

6.1 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.
- 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.
- 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.
- Operate the valve at least once every 30 days.

6.2 Supply air

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

Install an air filter upstream of the valve. Filtration degree should be 5µm or less.

7 Limitations of Use

Warning

The system designer should determine the effect of the possible failure modes of the product on the system.

7 Limitations of use - continued

7.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

7.2 Holding of pressure

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

7.3 Cannot be used as an emergency shut-off valve

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.

7.4 Mounting orientation

Refer to Section 2.2, table 4 and Section 3.2.

7.5 Intermediate stopping

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

Caution

7.6 Leakage voltage

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

7.7 Low temperature operation

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.

7.8 Air returned or air/spring returned spool valves

Warning

- The use of 2-position single valves with air returned or air/spring 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. Such measures must be evaluated by risk assessment within the validation process.

Energy source status	Single	Double	3 position	Dual 3 Port
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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	Spools return to off position by air 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	Spool stops moving after air pressure cut (Position cannot be defined)

Table 9

7.9 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 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.

9 Contacts

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

SMC Corporation

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Template DKP50047-F-085F