



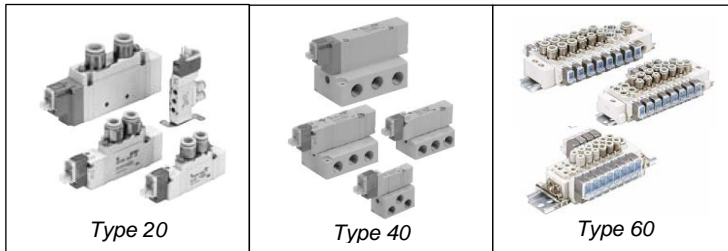
ORIGINAL INSTRUCTIONS

Instruction Manual

5 port Solenoid Valve

Series SY300/500/3000/5000/7000/9000

Type 20/40/60



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 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.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Caution

The product is provided for use in manufacturing industries only. This product must not be used in residential areas.

2 Specifications

2.1 Valve specifications

Series		SY300 SY3000	SY500 SY5000	SY7000	SY9000*
Fluid		Air			
Internal pilot operating pressure range [MPa]	2 position single	0.15 to 0.7			
	2 position double	0.1 to 0.7			
External pilot Operating pressure range [MPa]	3 position	0.2 to 0.7			
	Operating pressure range	-100 kPa to 0.7			
Pilot pressure range [MPa]	2 position single/double	0.25 to 0.7			
	3 position	0.25 to 0.7			
Ambient and fluid temperature [°C]		-10 to 50 (no freezing)			
Max. operating frequency [Hz]	2 position single/double	10	5	5	5
	3 position	3	3	3	3

2 Specifications – continued

Min. operating frequency	1 cycle / 30 days
Manual override (Manual operation)	Non-locking push type, Push-turn locking slotted type, Push turn locking lever type
Pilot exhaust method	Common exhaust type for main and pilot valve
Flow rate	Refer to catalogue
Response time	Refer to catalogue
Duty cycle	Contact SMC
Lubrication	Not required (Note 1)
Mounting orientation	Unrestricted
Impact/Vibration resistance [m/s ²]	150/30 (Note 2)
Enclosure	IP40 (DIN terminal and M8 connector: IP65 (Note 3))
Weight [g]	Refer to catalogue

Table 1
*SY9000 only available for Type 20 and 40.

Note 1) If lubrication is used in the system, use class 1 turbine oil (no additive), ISO VG32

Note 2) **Impact resistance:** No malfunction occurred when tested in the axial direction and at the right angles to the main valve and armature in both energized and de-energized states every time for each condition. (Values at the initial period)

Vibration resistance: No malfunction occurred in a one-sweep test between 45 and 2000 Hz. Test was performed at both energized and de-energized states in the axial direction and at the right angles to the main valve and armature. (Values at the initial period)

Note 3) Based on IEC60529

2.2 Solenoid specifications

Electrical entry	Grommet (G), (H) DIN terminal (D), (Y) L plug connector (L) M plug connector (M) M8 connector (W), (WA)		
	G, H, L, M, W, WA	D, Y	
Coil rated voltage [V]	DC	24, 12, 6, 5, 3	24, 12
	AC 50/60 Hz	100, 110, 200, 220	
Allowable voltage fluctuation	±10 % of rated voltage (Note 1, 2)		
Power consumption [W] - DC	Standard	0.35 (With indicator light: 0.4 DIN terminal with indicator light: 0.45)	
	With power saving circuit	0.1 (With indicator light only) (Note 3) [Starting 0.4, Holding 0.1]	

Apparent power [VA] (Note 3) - AC	100 V (With indicator light)	0.78 (0.81)	0.78 (0.87)
	110 V [115 V] (With indicator light)	0.86 (0.89) [0.94 (0.97)]	0.86 (0.97) [0.94 (1.07)]
	200 V (With indicator light)	1.18 (1.22)	1.15 (1.30)
	220 V [230 V] (With indicator light)	1.30 (1.34) [1.42 (1.46)]	1.27 (1.46) [1.39 (1.60)]
Surge voltage suppressor	Diode (Varistor is for DIN terminal and Non-polar type.)		
Indicator light	LED (AC of DIN connector is neon light)		

Table 2

Note 1) In common between 110 VAC and 115 VAC, and between 220 VAC and 230 VAC.

* For 115 VAC and 230 VAC, the allowable voltage is -15 % to +5 % of rated voltage.

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

Note 3) DIN terminal and M8 connector with power saving circuit are not available.

* For details, refer to the catalogue.

2.3 Port size

Refer to catalogue.

2.4 Symbol

Refer to catalogue.

2.5 Energization indication

Options 'Z' and 'U' include LED indication of coil energization.

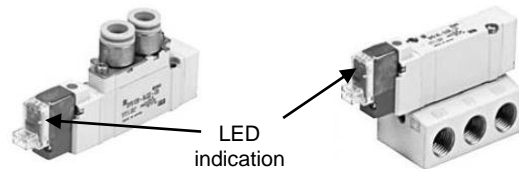


Figure 1
The LED is located on the pilot valve assembly, see Figure 1.

2 Specifications – continued

When the solenoid is energized, the valve switches and the LED remains illuminated while the solenoid is energized.

2.6 Special products

Warning

Special products 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.
- The solenoid valve is an electrical product. For safety, install an appropriate fuse and circuit breaker before use.

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 with IP65 enclosures are protected against dust & water; however, these products cannot be used in water.
- Products compliant to IP65 satisfy the specifications by mounting each product properly. Be sure to read the Specific Precautions for each product.
- 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.
- 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 3

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 specific Precautions in the catalogue.

3.5.2 Precautions on other tube brands

Caution

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

3.6 Indicator light/surge voltage suppressor

Caution

3 Installation – continued

Surge suppression should be specified by using the appropriate part number. If a valve type without suppression (Type "NIL") is used, suppression must be provided by the host controller as close as possible to the valve.

• Grommet, L/M plug connector

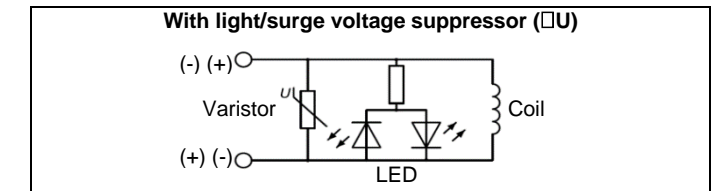
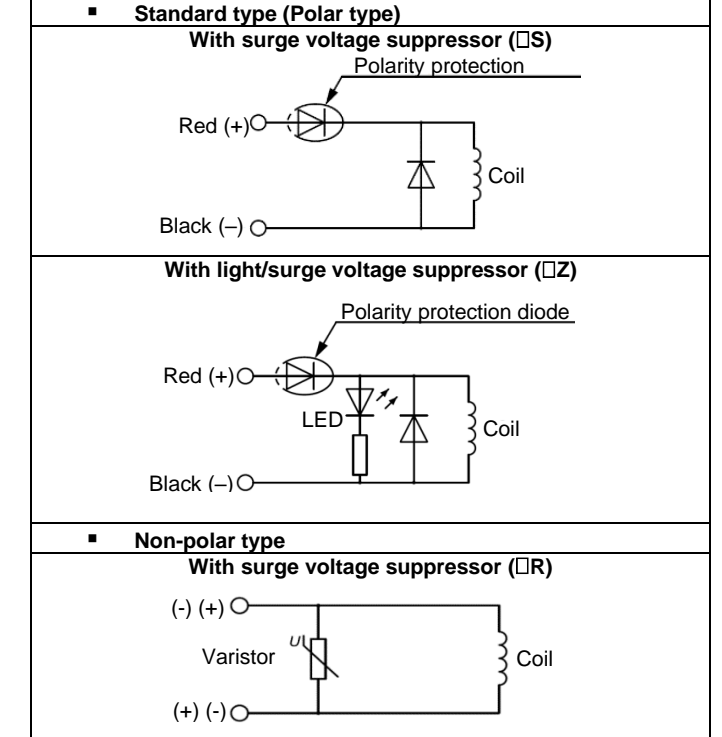


Figure 2

- Connect the standard type in accordance with the +, - polarity indication. (The non-polar type can be used with the connections made either way.)
- Since voltage specifications other than standard 24 VDC and 12 VDC do not have diodes for polarity protection, be careful not to make errors in the polarity.
- When wiring is done at the factory, positive (+) is red and negative (-) is black.

• With power saving circuit

Power consumption is decreased to 1/4 by reducing the wattage required to hold the valve in an energized state. (Effective energizing time is over 62 ms at 24 VDC.)

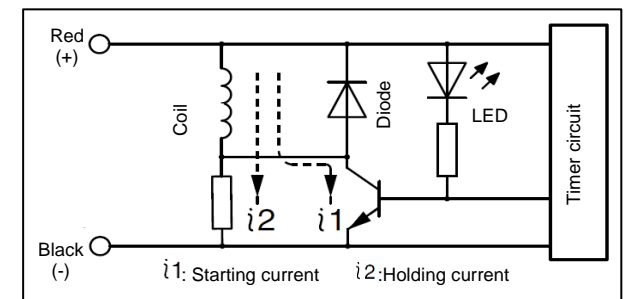


Figure 3

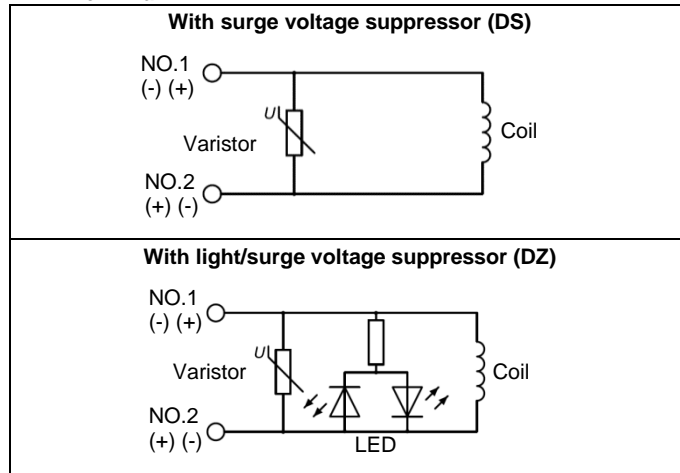
The above circuit reduces the current consumption when holding in order to save energy. Refer to the electrical power waveform as shown below.

- Please be careful not to reverse the polarity, since a diode to prevent the reversed current is not provided for the power saving circuit.

3 Installation – continued

Please use caution regarding the allowable voltage fluctuation because there is about a 0.5 volt drop due to the transistor. (For details, refer to the solenoid specifications of each type of valve.)

DIN Terminal



* DIN terminal type has no polarity.

Figure 4

M8 Connector

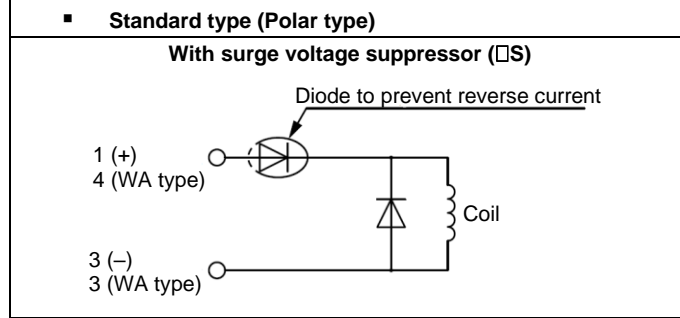
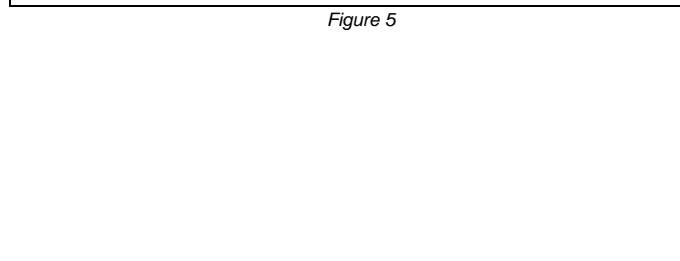
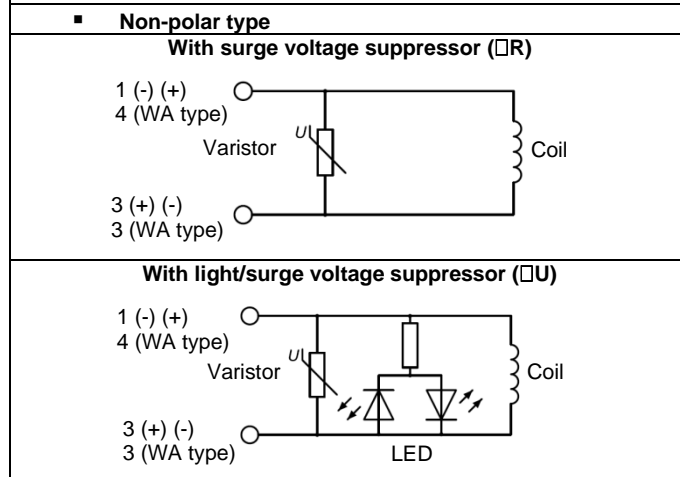
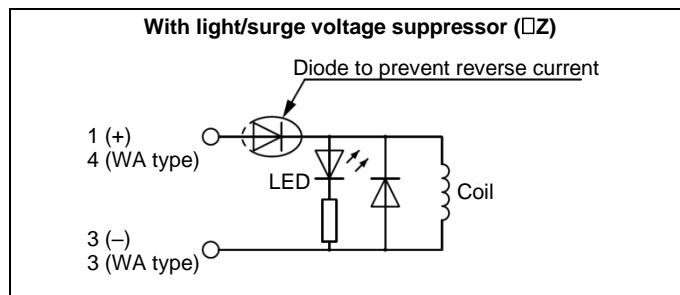


Figure 5



3 Installation – continued

Solenoid valve side pin wiring diagram

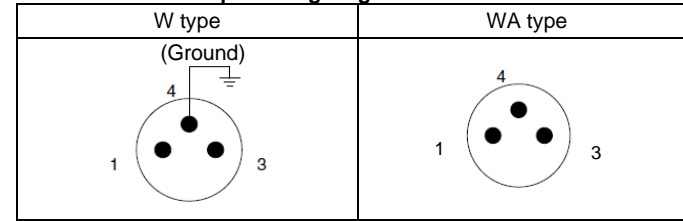


Figure 6

- For the standard type, connect + to 1 and – to 3 for Type W according to polarity, while + to 4 and – to 3 for Type WA.
- For DC voltages other than 12 V and 24 V, incorrect wiring will cause damage to the surge suppressor circuit.
- The WA-type valve cannot be grounded.

<For AC>

(There is no “S” option, because the generation of surge voltage is prevented by a rectifier.)

Grommet, L/M plug connector

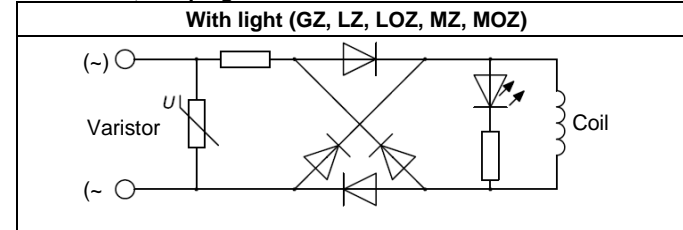


Figure 7

DIN terminal

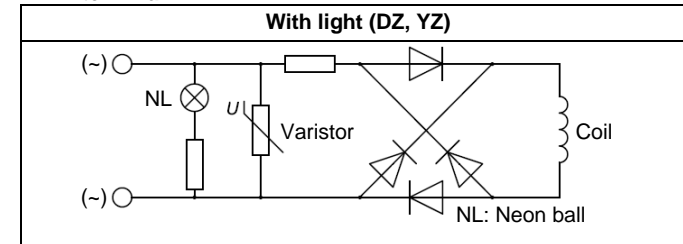


Figure 8

3.7 Circuit diagram with light

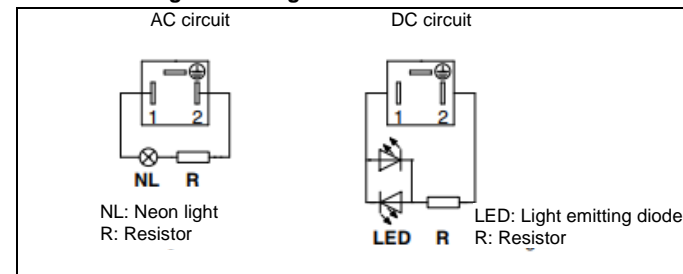


Figure 9

3.8 Residual voltage

Caution

The surge voltage suppressor of a varistor has residual voltage corresponding to the protective element and rated voltage; therefore, protect the controller side from the surge voltage. The residual voltage of the diode is approximately 1V.

3.9 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.

3 Installation – continued

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.

3.10 Extended periods of continuous energization

Warning

If a valve is continuously energized for an extended period of time, the temperature of the valve will increase due to the heat generated by the coil. This will likely adversely affect the performance of the solenoid valve and nearby peripheral equipment. Therefore, when it is continuously energized for an extended period of time or when the energized period per day is longer than the de-energized period, use SY series DC specifications or power saving circuit type.

3.11 Valve mounting

Caution

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

Model	Thread size	Tightening torque [N·m]
SY300 / SY3000	M2	0.16
SY500 / SY5000	M3	0.8
SY7000	M4	1.4
SY9000	M3	0.8

Table 4

3.12 Manual override

Warning

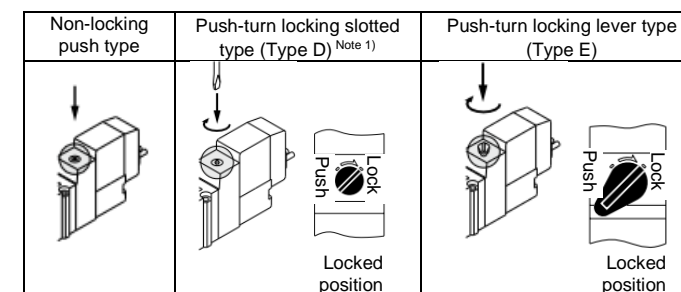
Regardless of an electric signal for the valve, the manual override is used for switching the main valve. Connected actuator is started by manual operation. Use the manual override after confirming that there is no danger.

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.

Caution

When locking the manual override on the push-turn locking types (D, E), be sure to push it down before turning. Turning without first pushing it down can cause damage to the manual override and trouble such as air leakage, etc.



Note 1) Torque less than 0.1 N·m.

3.13 How to use plug connector

3.13.1 Attaching and detaching connectors

Refer to catalogue for additional details.

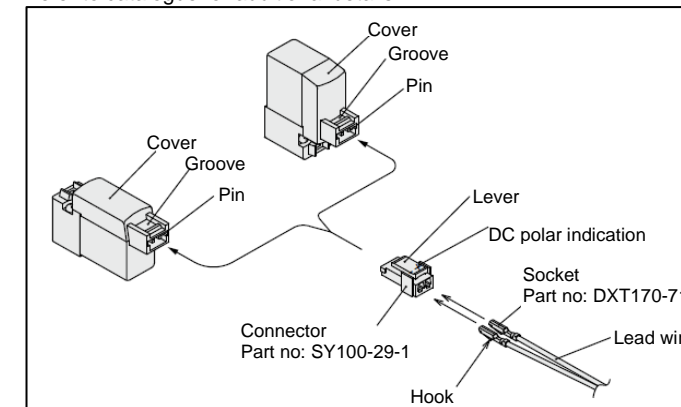


Figure 10

3 Installation – continued

3.13.2 Crimping connection of lead wire and socket

Refer to catalogue for additional details.

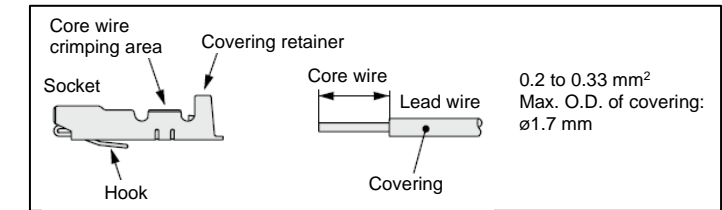


Figure 11

3.13.3 Attaching and detaching lead wires with sockets

Refer to catalogue for additional details.

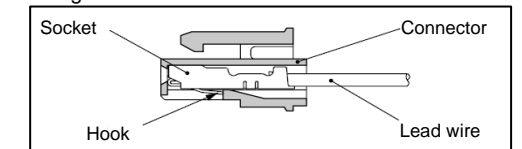


Figure 12

3.14 How to Use DIN terminal

Refer to catalogue for additional details.

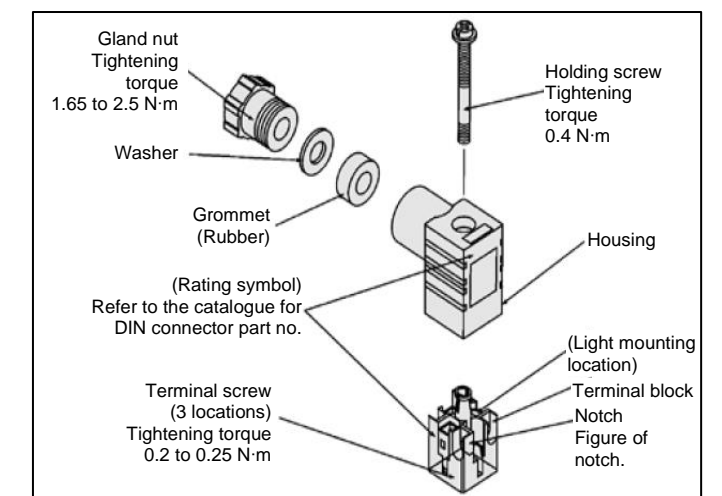


Figure 13

Type “Y”

DIN connector type Y is a DIN connector that conforms to the DIN EN 175301-803 (DIN pitch 8-mm standard).

- D type DIN connector with 9.4 mm pitch between terminals is not interchangeable.
- To distinguish from the D type DIN connector, “N” is listed at the end of voltage symbol. (For connector parts without lights, “N” is not indicated. Please refer to the name plate to distinguish.)
- Dimensions are completely the same as D type DIN connector.

3.14.1 Series SY3000

Caution

- SMC can provide a DIN style terminal connector for the series SY3000. This cannot be assembled to a standard manifold and sub-plate since the DIN connector width (15.8 mm) exceeds that of the valve body (10 mm). Contact SMC if you wish to use with a manifold and sub-plate.

3 Installation – continued

* The DIN style terminal connector and single manifold unit have no external pilot specifications.

3.15 L/M connector assembly with cover

Caution

This connector assembly with cover helps prevent contamination entering the connector.

Refer to catalogue for additional details.

3.16 DIN rail for series SY7000/9000

Caution

The DIN rail used with Series SY7000/9000 is stronger than that used with Series SY3000 and SY5000. Use this exclusive DIN rail with Series SY7000 and SY9000. Furthermore, if using a DIN rail other than that supplied by SMC, refer to the manifold mounting section below, and mount using the same method as prescribed for side facing and rear facing, regardless of the mounting orientation.

3.17 DIN rail manifold mounting

Caution

For Type 23, 43, 45 45# and 60 DIN rail mounting, when attaching a manifold to a mounting surface, etc., with bolts, if the entire bottom surface of the DIN rail contacts the mounting surface in a horizontal mounting, it can be used by simply securing both ends of the DIN rail. However, for any other mounting method or for side facing and rear facing, etc., secure the DIN rail with bolts at uniform intervals using the following as a guide: 2 to 5 stations at 2 locations, 6 to 10 stations at 3 locations, 11 to 15 stations at 4 locations, 16 to 20 stations at 5 locations.

In addition, even in the case of a horizontal mounting, if the mounting surface is subject to vibration, etc., take the same measures indicated above. If secured at fewer than the specified number of locations, warping or twisting may occur in the DIN rail and manifold, causing trouble such as air leakage.

Also, when using mounting screws for the DIN rail on the bottom side (L3

dimension in the dimension table) of the manifold valve body, the height of the screw head has to be as follows:

Type 23, 43 (SY9000): 8 mm or less.

Type 45 (SY3000, 5000): 5.8 mm or less.

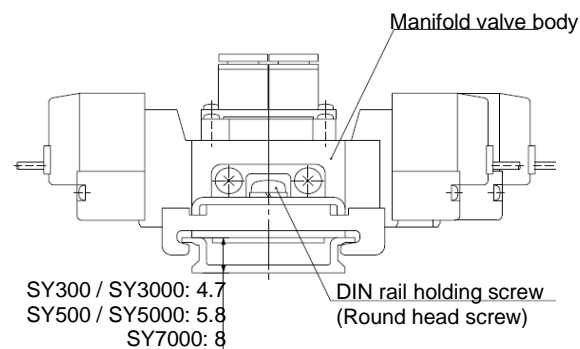


Figure 14 – Type 60

3.18 Tightening torque for DIN rail holding screw

Caution

Refer to catalogue for more details.

The recommended tightening torque for DIN rail holding screw is shown below.

Model	Tightening torque [N·m]
	SY##60 (See figure 14)
SY300 / SY3000	1
SY500 / SY5000	1.4
SY7000	1.4

Table 5

3 Installation – continued

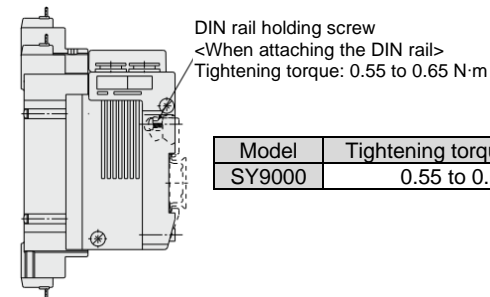


Figure 15 – Example SY9000 Type 43

3.19 M8 connector

Caution

- M8 connector types have an IP65 (enclosure) rating, offering protection from dust and water. However please note: these products are not intended for use in water. Select a SMC connector cable (V100-49-1-□) or a FA sensor type connector, with M8 threaded 3 pin specifications conforming to Nippon Electric Control Equipment Association Standard, NECA4202 (IEC60947-5-2). Make sure the connector O.D. is 10.5 mm or less when used with the SY3000 series manifold. If more than 10.5 mm, it cannot be mounted due to the size.
- Do not use a tool to mount the connector, as this may cause damage. Only tighten by hand (0.4 to 0.6 N·m).
- The excessive stress on the cable connector will not be able to satisfy the IP65 rating. Please use caution and do not apply a stress of 30 N or greater.
- Failure to meet IP65 performance may result if using alternative connectors than those shown above, or when insufficiently tightened.

Caution

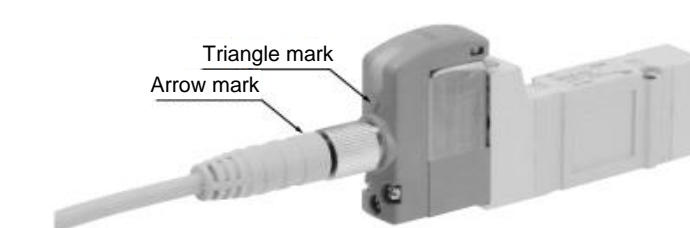


Figure 16

- Note) Connector cable should be mounted in the correct direction. Make sure that the arrow symbol on the connector is facing the triangle symbol on the valve when using SMC connector cable (V100-49-1-□). Be careful not to squeeze it in the wrong direction, as problems such as pin damage may occur.

3.20 Exhaust throttle

Caution

The SY series pilot valve and main valve share a common exhaust inside the valve. Therefore, do not block the exhaust port when arranging the piping.

3.21 Use as a 3-port valve

Caution

The SY3000/5000/7000/9000 series 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 catalogue for additional details.

3 Installation – continued

3.22 Change of port block assembly

Caution

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

Model	Thread size	Tightening torque [N·m]
SY300 /3000	M2	0.2
SY500 / 5000 / 7000	M3	0.6
SY9000	M4	1.4

Table 6

Refer to catalogue for additional details.

3.23 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.

3.24 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 5 μm or smaller.

4 How to Order

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

5 Outline Dimensions

Refer to 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.

6.2 Replacement parts

Refer to catalogue for replacement part details.

6 Maintenance – continued

6.3 Solenoid valve for 200, 220 VAC specifications

Warning

Solenoid valves with DIN-Terminal and L/M type plug connector AC specifications have a built-in rectifier circuit in the pilot section to operate the DC coil.

With 200 V, 220 VAC specification pilot valves, this built-in rectifier generates heat when energized. The surface may become hot depending on the energized condition; therefore, do not touch the solenoid valves.

6.4 Increase manifold stations

Refer to catalogue for details on how to increase manifold stations.

Caution

Make sure that power and air supplies are shut off before disassembly. Furthermore, since air may remain inside the actuator, piping and manifold, confirm that the air is completely exhausted before performing any work.

6.4.1 For SY3000/50000 type 45, 45-A and 45-NA

When disassembly and assembly are performed, air leakage may result if connections between blocks and tightening of the end block's holding screw, is inadequate. Before supplying air, confirm that there are no gaps, etc. between blocks, and that manifold blocks are securely fastened to the DIN rail. Then supply air and confirm that there is no air leakage before operating. The tightening torque for the DIN rail holding screw 1.4 N·m.

6.4.2 For SY9000 series type 23, 23P, 43, 43P and 43SA

When disassembly and assembly is performed, if the tightening of the tension bolt is inadequate, it may result in air leakage. The tightening torque for tension bolts is 2.9 N·m.

The tightening torque for the clamp sub assembly screws is 1.4 N·m.

7 Limitations of Use

Warning

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

7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

Caution

7.2 Leakage voltage

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes ≤ 3% of the rated voltage across the valve for DC coil and ≤ 8% for AC coils.

7.3 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.

7.4 Momentary energisation

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.

7.5 Mounting orientation

Mounting orientation is universal.

7.6 EMC restrictions

7.6.1 Class and group description

- This product is group 1, class A equipment according to EN55011.
- Group 1 equipment does not intentionally generate radio-frequency energy in the range 9kHz to 400 GHz.
- Class A equipment is equipment suitable for use in all locations other than those allocated in residential environments and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

Caution

- This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

7 Limitations of Use – continued

7.6.2 Cable length to connect

The cable to connect the product shall be less than or equal to 30m.

7.6.3 Connecting the power supply

This product is not intended to be directly connected to any DC Distribution network.

Warning

7.7 Air returned spool valves

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

7.8 Intermediate stopping

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

7.9 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.

7.10 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.

7.11 Safety relays or PLC

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

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)
 'SMC Corporation, 4-14-1, Sotokanda, Chiyoda-ku, Tokyo 101-0021, Japan
 Specifications are subject to change without prior notice from the manufacturer.
 © 2022 SMC Corporation All Rights Reserved.
 Template DKP50047-F-0851