

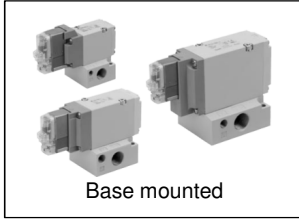
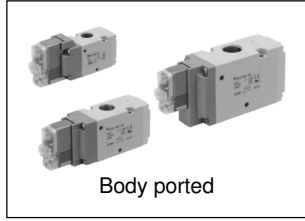


ORIGINAL INSTRUCTIONS



Refer to Declaration of Conformity for relevant Directives

Instruction Manual
3 Port solenoid valve
Series VP300/500/700



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: Manipulating industrial robots - Safety, etc.

- 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.

2 Specifications

2.1 General Specifications

Fluid	Air	
Type of actuation	N.C. or N.O. (Convertible)	
Internal pilot operating pressure range (MPa)	Standard	0.2 to 0.7
	High-pressure type	0.2 to 1.0
External pilot operating pressure range (MPa)	Standard	-100 kPa to 0.7
	High-pressure type	-100 kPa to 1.0
Pilot pressure range	Same as operating pressure (Min. 0.2 MPa)	
Ambient and fluid temperature (°C)	-10 to 50 (No freezing)	
Max. operating frequency (Hz)	5	
Minimum operating frequency	Once every 30 days	
Duty cycle	Contact SMC	
Manual override	Non-locking push type	
	Push-turn locking slotted type	
	Push-turn locking lever type	
Pilot exhaust type	Individual exhaust	
Lubrication	Not required (See also 3.4)	
Mounting orientation	Unrestricted	
Impact/Vibration resistance (m/s ²) ^{Note 1)}	300/50	
Response Time	Refer to catalogue	
Flow	Refer to catalogue	

2 Specifications - continued

Filtration	5 µm filtration or smaller
Enclosure	Dust-tight (IP65 for D, Y, T)

Table 1

Notes:

Note 1) **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 once 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 in 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)

2.2 Solenoid Specifications

Electrical entry	Grommet (G), (H)	DIN terminal (D)	DIN (EN175301-803)
	L-type plug connector (L)	terminal (Y)	Conduit terminal (T)
Coil rated voltage (V)	DC	24, 12	
	AC (50/60 Hz)	24, 100, 110, 200, 220, 240	
Allowable voltage fluctuation	±10% of rated voltage ^{Note 2, 3, 4)}		
Power consumption (W), DC	Standard	1.5 (With light: 1.55)	1.5 (With light: 1.75)
	With power saving circuit	0.55 (With light only) [Starting 1.55, Holding 0.55]	0.75 (With light only) [Starting 1.75, Holding 0.75]
Apparent power (VA) ^{Note 1)} , AC	24 V	1.5 (With light: 1.55)	1.5 (With light: 1.75)
	100 V		
	110 V [115 V]	1.55 (With light: 1.65)	1.55 (With light: 1.7)
	200 V		
220 V [230 V]			
240 V			
Surge voltage suppressor	Diode (Non-polar type: Varistor)		
Indicator light	LED (Neon bulb is used for AC mode of D, Y, T)		

Table 2

Notes:

Note 1) It is in common between 110 VAC and 115 VAC, and between 220 VAC and 230 VAC.
 Note 2) Allowable voltage fluctuation is -15% to +5% of the rated voltage for 115 VAC or 230 VAC.
 Note 3) Since voltage drops due to the internal circuit in S, Z, T types (with power saving circuit), the allowable voltage fluctuation should be within the following range.
 24 VDC: -7% to +10%
 12 VDC: -4% to +10%
 Note 4) Valve state is not defined if electrical input is outside the specified operating range.

2.3 Pneumatic symbols

Refer to catalogue for pneumatic symbols.

2.4 Indicators

Options 'Z' and 'U' include LED indication of coil energization. Note: Neon bulb is used for AC models D, Y, T.

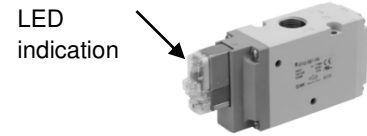


Figure 1

The LED is located on the pilot valve assembly, see Figure 1. When the solenoid is energized, the valve switches and the LED remains illuminated while the solenoid is energized.

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.

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. Note that the valve is not for outdoor use.
- 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.
- If using in an atmosphere where there is possible contact with water drop-lets, oil, weld spatter, etc., take suitable preventative measures.
- When the solenoid valve is mounted in a control panel or is energized for a long time, make sure that the ambient temperature is within the valve's specified range.
- Do not use in high humidity environment where condensation can occur.
- Contact SMC for altitude limitations.

Caution

- Temperature of ambient environment**
Use the valve within the range of the ambient temperature specification of each valve. In addition, pay attention when using the valve in environments where the temperature changes drastically.
- Humidity of ambient environment**
When using the valve in environments with low humidity, take measures to prevent static. If the humidity rises, take measures to prevent adhesion of water droplets on the valve.

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.
- When connecting piping to a product, refer to its instruction manual to avoid mistakes regarding the supply port, etc.

- Tighten fittings to the specified tightening torque.

3.3.1 Connection of piping and fittings

When screwing the piping or fitting into the valve, tighten it as follows. For the fitting with sealant R or NPT, first, tighten it by hand, then use a wrench appropriate for the hexagon flats of the body to tighten it a further two or three turns. For a tightening torque guide, refer to the table below.

Connection threads	Proper tightening torque N·m
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25

Table 3

Note) Excessive tightening may damage the thread portion or deform the gasket and cause air leakage. Insufficient tightening may loosen the threads, or cause air leakage.

- When using a fitting other than SMC fitting, follow the instructions given by relevant fitting manufacturer.

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 Light/Surge Voltage Suppressor

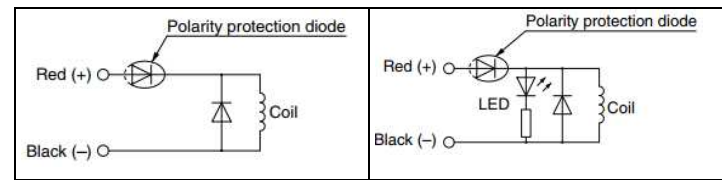
Caution

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

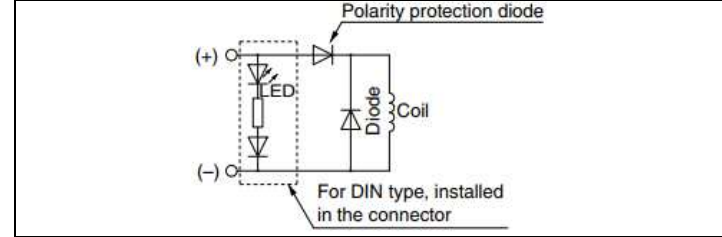
3.5.1 DC

Polar type	
With surge voltage suppressor (□S)	Grommet or L/M-type plug connector With light/surge voltage suppressor (□Z)

3 Installation - continued

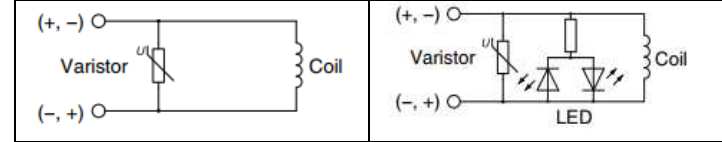


DIN or Conduit terminal
With light/surge voltage suppressor (□Z)

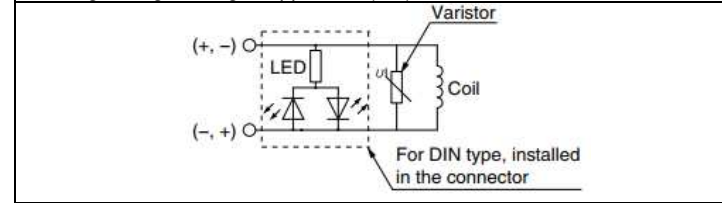


Non-polar type

With surge voltage suppressor (□R)	Grommet or L/M-type plug connector With light/surge voltage suppressor (□U)
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DIN or Conduit terminal
With light/surge voltage suppressor (□U)



- Please connect correctly the lead wires to + (positive) and - (negative) indications on the connector. (For non-polar type, the lead wires can be connected to either one.)
- When the valve with polarity protection diode is used, the voltage will drop by approx. 1 V. Therefore, pay attention to the allowable voltage fluctuation (For details, refer to the solenoid specification of each type of valve).
- Solenoids, whose lead wires have been pre-wired: + (positive) side red and - (negative) side black.

With power saving circuit

Power consumption is decreased by approx. 1/3 by reducing the wattage required to hold the valve in an energized state. (Effective energizing time is over 40 ms at 24 VDC.)

- 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.)

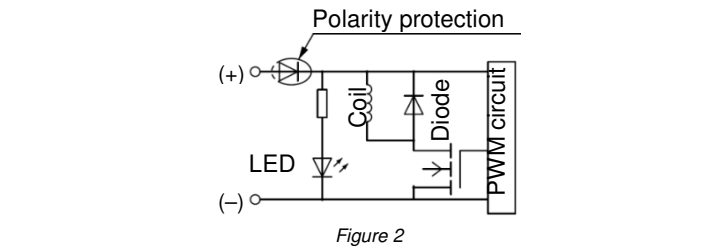


Figure 2

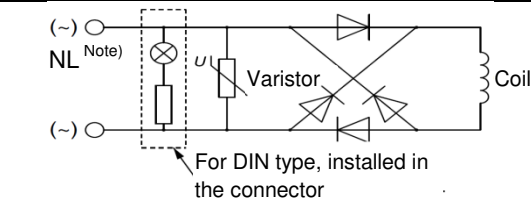
3.5.2 AC

There is no S option, since a rectifier prevents surge voltage generation.

Polar type	
With surge voltage suppressor (□S)	Grommet or L/M-type plug connector With light/surge voltage suppressor (□Z)

3 Installation – continued

- DIN or Conduit terminal
With light/surge voltage suppressor (□Z)



NL: Neon bulb
Note) LED for 24 VAC.

3.6 Residual voltage of the surge voltage suppressor

Caution

Note) If a varistor or diode surge voltage suppressor is used, there is some residual voltage to the protection element and rated voltage. Therefore, refer to the table below and pay attention to the surge voltage protection on the controller side. Also, since the response time does change, refer to the specifications in Section 2.

Residual voltage

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

Table 4

3.7 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.

3.8 Extended periods of continuous energization

Caution

Refer to '3, 4, 5 port solenoid valves precautions' for more details.

- When solenoid valves are mounted in a control panel, employ measures to radiate excess heat, so that temperatures remain within the valve specification range. Use special caution when three or more stations sequentially aligned on the manifold are continuously energized since this will cause a drastic temperature rise.

3.9 Wiring

Caution

External force applied to lead wire

If an excessive force is applied to the lead wire, this may cause faulty wiring. Take appropriate measures so that a force of 30 N or more is not applied to the lead wire. When instructions are given to the Specific Product Precautions, follow these specifications.

3.10 How to Use L/M-Type Plug Connector

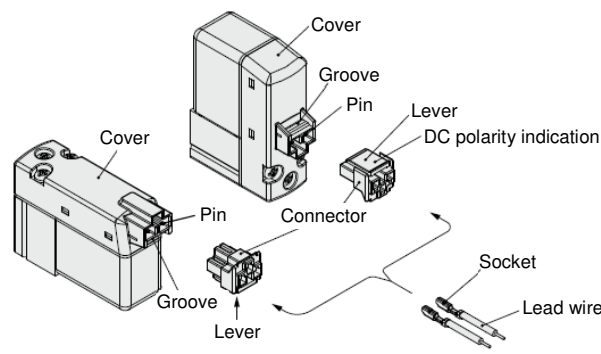


Figure 4

Refer to Specific Product Precautions in the catalogue for more details.

3 Installation – continued

3.11 How to Use DIN Terminal

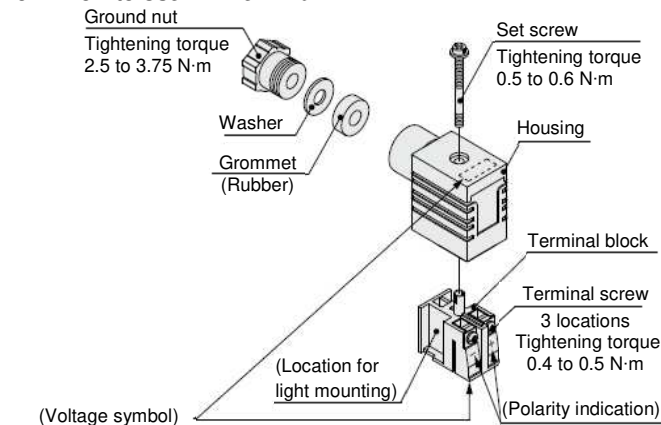


Figure 5

Refer to Specific Product Precautions in the catalogue for more details.

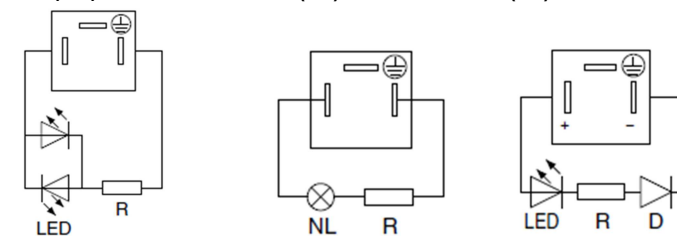
3.12 DIN (EN175301-803) Terminal

Y type DIN terminal corresponds to the DIN connector with terminal pitch 10 mm, which complies with EN175301-803B. Since the terminal pitch is different from the D type DIN connector, these two types are not interchangeable.

Refer to Specific Product Precautions in the catalogue for more details.

3.13 Circuit with indicator light (Built-in connector)

DC (□U) circuit AC (□Z) circuit * DC (□Z) circuit



LED: Light emitting diode NL: Neon bulb LED
R: Resistor R: Resistor R: Resistor
D: Protective diode

* Note) The 24 VAC specifications are the same as those in the DC.

Figure 6

3.14 How to Use Conduit Terminal

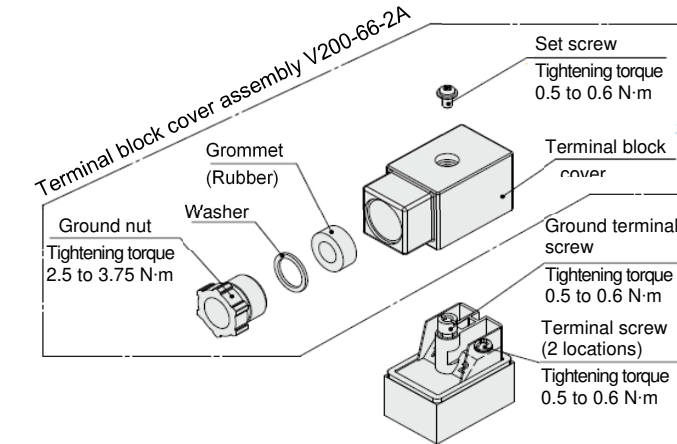


Figure 7

Refer to Specific Product Precautions in the catalogue for more details.

3.15 Solenoid Valve for AC Specification

Warning

AC specification solenoid valves with grommet or L/M-type plug connector have a built-in rectifier circuit in the pilot section to operate the DC coil. With AC 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.

3.16 Air supply

Warning

Use clean air

3 Installation – continued

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 at the upstream side of the valve. Filtration degree should be 5 μm or less.

3.17 Effect of back pressure when using a manifold

Use caution when valves are used on a manifold, because an actuator may malfunction due to back-pressure.

3.18 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.

4 Settings

4.1 Changing type of Actuation

Warning

When changing the actuation or restarting the valve after the change, make sure that safety is fully assured and pay great attention.

Example: Changing N.C. to N.O.

Refer to Specific Product Precautions in the catalogue for more details.

5 How to Order

5.1 Standard products

Refer to catalogue for 'How to Order'.

5.2 Special products

Refer to drawings for 'How to Order' of special products.

6 Outline Dimensions (mm)

Refer to 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.
- 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.
- Low frequency operation
Valves should be operated at least once every 30 days to prevent malfunction. (Use caution regarding the air supply.)
- **If the volume of air leakage increases or the valve does not operate normally, do not use the valve.**
Perform periodic maintenance of the valve to confirm the operating condition, and if there is any air leakage.
- **Removal of equipment, and supply/exhaust of compressed air**
When components are removed, first confirm that measures are in place to prevent workpieces from dropping, run-away equipment, etc. Then, cut off the supply air and electric power, and exhaust all air pressure from the system using the residual pressure release function.

8 Limitations of Use

Warning

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

8.1 Limited warranty and Disclaimer/Compliance Requirements

Refer to Handling Precautions for SMC Products.

Caution

8.2 Leakage voltage

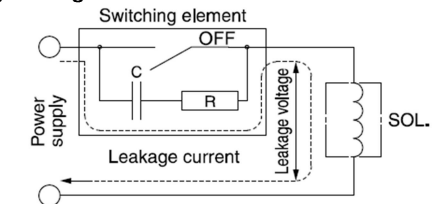


Figure 3

Take note that the leakage voltage will increase when a resistor is used in parallel with switching element or a C-R circuit (surge voltage suppressor) is used to protect a switching device because of the passing leakage voltage through the C-R circuit. The suppressor residual leakage voltage should be as follows.

DC coil: 3% or less of the rated voltage
AC coil: 8% or less of the rated voltage

8.3 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.

8.4 External pilot

Use external pilot in the following cases:

- For vacuum or for low pressure 0.2 MPa or less.
- Please consult SMC for use in a vacuum hold application.
- When having P port downsized in diameter.
- When using A port as the atmospheric releasing port, e.g. air blower.
- If manifold, external pilot piping can be centralized in manifold base.

Warning

8.5 Air/spring returned spool valves

8.5.1 Internal pilot type

For internal pilot type, the main valve returns to the original (de-

energized) position by means of the spring when the air supply is cut. When only the electrical power is cut, the return is by means of the pilot pressure and spring force.

8.5.2 External pilot type

For external pilot type, the main valve returns to the original (de-energized) position by means of the spring when the main air supply, and the external pilot supply, is cut.

When only the electrical power is cut, the return is by means of the external pilot pressure and spring force.

8.6 Safety relays

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.

9 Contacts

Refer to Declaration of Conformity and www.smworld.com for contacts.

SMC Corporation

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