ORIGINAL INSTRUCTIONS

Instruction Manual
Large Size 3 Port Solenoid Valve
VP3145/3165/3185(-X80/X81) Series

For ISO symbols, refer to catalogue

The intended use of this product is to control the flow of air in a circuit or 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. Do not use in residential premises.

2 Specifications

2.1 Valve specifications

- **VP31#5** (standard)

Actuation type		N.C or N.O. (convertible)		
Fluid		Air		
Pilot type		Internal	External	
		General	Vacuum/Low pressure	General
Operating pressure range [MPa]	Main	0.2 to 0.8	-101.2 kPa to 0.2	0.2 to 0.8
	Pilot		0.2 to 0.3	See fig.1
Ambient/Fluid Temperature [°C]		0 (No freezing) to 60		
Flow characteristics		Refer to catalogue		

2 Specifications - continued

Response time [ms] Note 1)	ON	AC	≤ 30	OFF	≤ 30
		DC	≤ 40		
Duty cycle	Contact SMC				
Min. operating frequency	1 cycle / 30 days				
Max. operating frequency [Hz]	3				
Manual override	Yes (non-locking)				
Lubrication Note 2)	Required				
Impact/vibration resistance [m/s²] Note 3)	150/50				
Enclosure	IP50				
Mounting orientation	Unrestricted				
Weight	Refer to catalogue				

Note 1) Based on dynamic performance test, JIS B 8419:2010 (at 0.5 MPa).
Note 2) These solenoid valves require lubrication. Use turbine oil equivalent to Class 1 ISO VG32.
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 and armature; in both energized and de-energised states and for every time in each condition. (Values quoted are for a new valve)
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 and armature. (Values quoted are for a new valve).

- **VP31#5-X80/X81** (where different to standard)

Valve configuration		External pilot 3 port solenoid valve
Actuation type	-X80	Double solenoid
	-X81	Single solenoid
Operating pressure range [MPa]		-101.2 kPa to 0.8
Pilot pressure [MPa]		85 to 115% of main pressure, Min 0.2
Ambient/Fluid Temperature [°C]		0 (No freezing) to 50

2.2 Solenoid specifications

- **VP31#5** (standard)

Coil rated voltage [V]	AC (50/60 Hz)		100, 200, (110, 220, 240)*
	DC		12, 24
Electrical entry	Grommet, Conduit terminal, DIN terminal		
Coil insulation class	B		
Allowable voltage fluctuation	–15 to +10% of rated voltage		
Apparent power [VA] Note 1)	AC	Inrush	73 (50 Hz), 58 (60 Hz)
		Holding	28 (50 Hz), 17 (60 Hz)
Power consumption [W] Note 1)	DC	12	
Surge voltage suppressor	Varistor		
Indicator light	LED (DC), Neon (AC)		

* Semi-standard
Note 1) At rated voltage.

- **VP31#5** (-X80/X81)

Coil rated voltage [V]	AC (50/60 Hz)		100, 200, 110, 220, 240
	DC		12, 24
Electrical entry	Grommet, Conduit terminal, DIN terminal, L/M plug connector		
Coil insulation class	B		
Allowable voltage fluctuation	–10 to +10% of rated voltage		
Apparent power [VA] Note 1)	AC*	1.55	With indicator light: 1.65, DIN / Conduit terminal: 1.7
Power consumption [W] Note 1)	DC	Without indicator light	1.5
		With indicator light	1.55 (DIN/Conduit terminal 1.75)
Surge voltage suppressor	Varistor		
Indicator light	LED (DC), Neon (AC)		

* A rectifying circuit is used in the AC types.
Note 1) At rated voltage.

2 Specifications - continued

2.3 External pilot pressure

Must be kept within the specified pressure range, see fig.1.

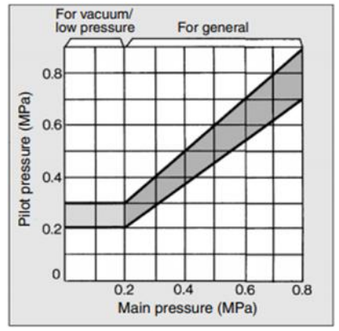


Figure 1.

Note) Conversion of internal pilot and external pilot is not possible.

⚠ Warning

The only special products (-X) covered by this IM are the ‘-X80’ and the ‘-X81’ type, other special products may have specifications different from these. Contact SMC for specific details of other special products.

3 Installation

3.1 Installation

⚠ Warning

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

⚠ Caution

- Install an air filter (see 3.5) and lubricator upstream of the valve.

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.
- If using the valve in a dusty environment, install silencers in the EXH and PE ports to prevent dust from entering.

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 (Rc, G, NPT, NPTF)	Tightening torque (N·m)
1/8	3 to 5
1/4	8 to 12
3/8	15 to 20
1/2	20 to 25
3/4	28 to 30
1	36 to 38
1 1/4	40 to 42
1 1/2	48 to 50
2	48 to 50

3 Installation - continued

- If supply port air pressure drops to less than 0.2 MPa*, the valve may malfunction.
  *Examples include: When throttling the IN port, operating with the OUT port open to atmosphere or similar operation.
- **Pressure balance among each port:**
  This solenoid valve is not pressure balanced. Operate it within the pressure range: IN ≥ OUT ≥ EXH. If not operated in this range, the valve will malfunction.
- **Use as a 2-port valve*:** Positive pressure - Plug EXH port.
  Vacuum pressure - Plug IN port.
  * Due to the small air leakage from the valves, they are not suitable for applications such as holding air pressure (including vacuum).
- **Vacuum use**
  General piping:
  EXH port = Vacuum pump/Blower (Suction side)
  OUT port = Tank/Vacuum pad (Load side)
  Plug (2 port valve)
  IN port = Air releasing
  Air pressure-in

  Following the above piping, vacuum passage is switched between OUT and EXH, therefore, N.C./N.O. indication on the function plate and switching of the vacuum passage are reversed; N.C. (Normally closed) in vacuum passage are reversed:
  - “N.C.” indicated on the plate → N.O. in vacuum passage (Normally open)
  - “N.O.” indicated on the plate → N.C. in vacuum passage (Normally closed)

3.4 Lubrication

⚠ Caution

- These solenoid valves require lubrication. Use turbine oil equivalent to Class 1 ISO VG32.

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 5 µm or smaller.

3.6 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.
- Refer to the catalogue for details of manual override operation.

3.7 Mounting

The valves can be mounted using the 2 through holes provided in the valve body, see catalogue for details.

3.8 Residual voltage

⚠ Caution

- If a Zener diode or varistor 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 or varistor residual voltage.
- Valve response time is dependent on surge suppression method selected.

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.
- 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 Installation - continued

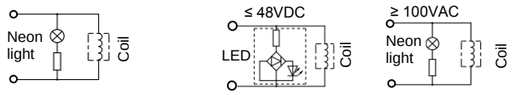
3.10 Electrical circuits

Caution

Surge suppression should be specified by using the appropriate part number. If a valve type without suppression (Type 'G, T, D') is used, suppression must be provided by the host controller as close as possible to the valve.

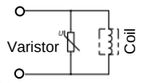
3.10.1 Light/Surge voltage suppressor

- With indicator light (L)
  Grommet (G): None.
  Conduit terminal (T):

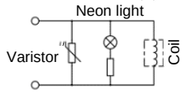


DIN terminal (D):

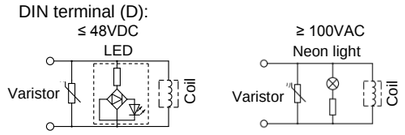
- Surge voltage suppressor (S):



- With light/surge voltage suppressor (Z)
  Grommet (G): None.
  Conduit terminal (T):



DIN terminal (D):



Note) All circuits are non-polar type.

3.10.2 DIN terminal connection

Refer to catalogue for additional information.

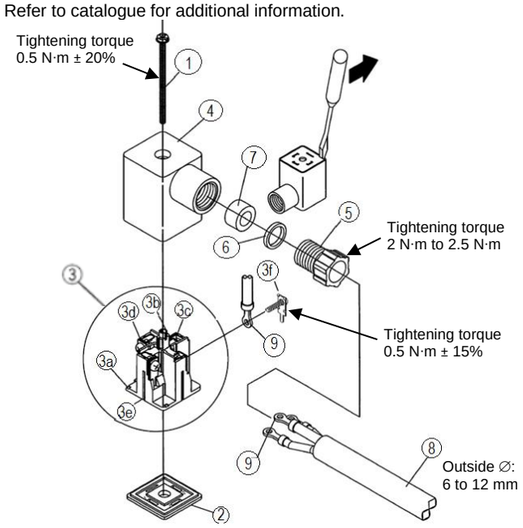


Figure 2.

Note 1) It is also possible to connect bare (unterminated) wires. In this case, loosen screw (3f) and place the lead wire behind the washer in the bracket of the terminal block and then tighten it to the correct torque.

Note 2) The connector cable entry direction can be changed as desired (4 directions at 90° intervals). The housing (4) is rotated on the terminal block (3) as necessary.

Note 3) For cables (8) with outside diameter 9 ~ 12 mm, remove the seal (7) before assembly.

3 Installation - continued

Warning

The ground terminal is connected to the coil assembly only and does not provide a protective earth for the body of the valve.

3.11 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.
- Direct operated: A continuous duty type valve such as the VK series or the VT series.

4 Settings

4.1 Conversion - N.C./N.O.

- A function plate makes it possible to use as a N.C. or N.O. valve with the port unchanged.

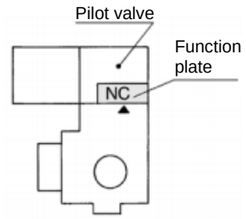


Figure 3.

- To convert valve operation from N.C. to N.O. or N.O. to N.C., remove the pilot valve, move the function plate along the gasket, both top and bottom until the mark ▲ meets N.C. (N.O.)
  Please note however, that the N.O. valve functions properly only when the appropriate pressure is applied to the valve.

Caution

- When changing the direction of a function plate to convert from N.C. to N.O. and vice versa, note that the equipment to be connected will act reversely.

5 How to Order

Refer to catalogue for 'How to Order'.

6 Outline Dimensions

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.

7 Maintenance - continued

7.2 Replacement parts

- Replacement pilot valve assemblies are available, refer to catalogue for details.

Caution

- Ensure pilot valve gasket is in good condition, not deformed and is dust and debris free.
- When mounting pilot valves ensure gaskets are present, aligned and securely in place and tighten screws to a torque of 1.4 N·m.

8 Limitations of Use

8.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

Warning

8.2 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.

8.3 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.

Caution

8.4 Leakage voltage

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes ≤5% (for DC coils) or ≤15% (for AC coils) of the rated voltage across the valve.

8.5 Low temperature operation

Unless otherwise indicated in the specifications for each valve, operation is possible to 0˚C, but appropriate measures should be taken to avoid solidification or freezing of drainage and moisture, etc..

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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