



ORIGINAL INSTRUCTIONS

Instruction Manual

Direct Operated 3 Port Solenoid Valve Series VX31/32/33



The intended use of this valve is to control the flow of air, vacuum, water, oil or steam to downstream pressure systems.

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^{*)}, and other safety regulations.

*) 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 General valve specifications

Model	VX31	VX32	VX33
Valve construction	Direct operated poppet		
Valve function	N.C, N.O, COM		
Fluid	Air, Medium Vacuum, Water, Oil, Steam		
Maximum system pressure [MPa]	3.0		
Minimum operating pressure [MPa]	0		
Operating pressure range [MPa]	See Catalogue		
Ambient temperature [°C]	AC	-20 to 60	
	DC	-20 to 40	
Flow characteristics	Refer to catalogue		
Response time [ms]	Variable ^{Note 1)}		
Duty cycle	Contact SMC		
Min. operating frequency	1 cycle / 30 days		
Max. operating frequency [Hz]	10	6	1

3 Installation - continued

Manual override	None	
Lubrication	Not required	
Impact/Vibration resistance [m/s ²] ^{Note 1)}	150/30	
Enclosure (based on IEC60529)	IP65 ^{Note 2)}	
Mounting orientation	Coil vertically up	
Wetted parts materials	Body	Brass, SUS
	Seal	NBR, FKM, EPDM, PTFE, FFKM
	Guide Pin	PPS, SUS
	Shading coil	Cu, Ag
Weight	Refer to catalogue	

Table 1.

Note 1) 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-energized 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).

Note 2) Grommet with surge voltage suppressor IP40.

2.2 Solenoid specifications

Model		VX31	VX32	VX33
Coil rated voltage	DC [VDC]	24, 12		
	AC [VAC]	100, 200, 110, 220, 230, 240, 48		
Electrical entry	Grommet, Conduit, Conduit Terminal, DIN terminal			
Coil insulation class	Class B, Class H ^{Note 1)}			
Allowable voltage fluctuation	± 10% of rated voltage			
Power consumption [W]	Class B Coil	4.5	7	10.5
	Class H Coil	7	9.5	12
Apparent power [VA] 50 Hz (60 Hz)	Class H Inrush	33 (28)	65 (55)	94 (79)
	Coil Energised	14 (12)	33 (27)	50 (41)
Allowable leakage voltage	AC (Class B coil)	±5% of rated voltage		
	AC (Class H coil)	±20% of rated voltage		
	DC	±2% of rated voltage		
Surge voltage suppressor	Varistor			
Indicator light	VDC	LED		
	VAC	Neon Light		

Table 2.

Note 1) Class H Coil insulation is for AC specification only.

2.3 Fluid temperature specifications

Fluid	Code	Voltages	Fluid temperature range [°C]
Air	Nil, G	AC & DC	-10 to 60
Air, Vacuum	V, M	AC & DC	-10 to 40
Water	Nil, G	AC	1 to 60
		DC	1 to 40
Heated Water	E, P	AC	1 to 99
Oil	A, H	AC	-5 to 60
		DC	-5 to 40
Steam	D, N	AC	-5 to 120
		S, Q	AC

Table 3.

2.4 Valve leakage specifications

Fluid	Seal	Leak rate
Air	NBR, FKM	1 cm ³ or less (Air)
		2 cm ³ or less (Air)
Air (Non-Leak), Vacuum	FKM	10 ⁻⁶ Pa.m ³ /sec or less
Water	NBR, FKM, EPDM	0.1 cm ³ or less (Water)
		0.2 cm ³ or less (Water)
Oil	FKM	0.1 cm ³ or less (Oil)
		0.2 cm ³ or less (Oil)
Steam	FFKM (Internal)	150 cm ³ /min or less (Air)
	PTFE (External)	1 cm ³ /min or less (Air)

Table 4.

2.5 Manifold specifications

Valve sizes	VX31	VX32	VX33
Fluid options	Air, Vacuum, Oil		
Port size [Rc]	P (1), E (3)	1/4	
	A (2)	1/8, 1/4	
Stations	2 to 10		

Table 5.

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.
- If there is a possibility of back pressure being applied to the valve, take countermeasures such as mounting a check valve on the downstream side 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.
- Products compliant with IP65 and IP67 enclosures 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.

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 1.5 to 2 thread exposed on the end of the pipe/fitting.
- Tighten fittings to the specified tightening torque.

Thread (Rc, G, NPT, NPTF)	Tightening torque [N·m]
1/8	7 to 9
1/4	12 to 14
3/8	22 to 24

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 Fluid supply

Warning

- The use of a fluid that contains foreign matter can cause problems, such as malfunction and seal failure by promoting the wear of the valve seat and armature, by sticking to the sliding parts of the armature, etc. Install a suitable filter (strainer) immediately upstream of the valve. Select a filter with a filtration size of 5 µm or smaller for air, and 100 mesh for water.

3.5.1 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.
- Compressed air that includes excessive drainage may cause the malfunction of valves and other pneumatic equipment. Install an aftercooler or an air dryer on the inlet side of the valve as a countermeasure against drainage.
- If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valves and cause a malfunction. Install a mist separator on the inlet side of the valve as a countermeasure to remove any carbon powder.
- When operating fluid air with a dew point of -70°C or lower, the inside of the valve may wear, and the product life will be shortened.

3.5.2 Water

Warning

- Be aware that rust stains, chloride separation, etc., from the piping may cause malfunction, leakage, or, in worse case scenarios, damage due to corrosion. Also, such damage may result in the spraying of fluids or scattering of parts. Please be sure to have protective measures in place in case such incidents should occur.

3 Installation - continued

- In the case that water contains substances such as calcium and magnesium, which generate hard scale and sludge, install water softening equipment and a filter (strainer) directly upstream from the valve to remove these substances, as this scale and sludge can cause the valve to malfunction.
- The water pressure of tap water is usually 0.4 MPa or less, but the pressure can sometimes increase to 1.0 MPa in tall buildings. Therefore, pay attention to the max. operating pressure differential.

3.5.3 Oil

Warning

- Generally, FKM is used as seal material, as it is resistant to oil. However, the resistance of the seal material may deteriorate depending on the type of oil, manufacturer, or additives. Check the resistance before using. The kinematic viscosity of fluid must not exceed 50 mm²/s.
- The special construction of the armature adopted in the built-in full-wave rectifier type gives an improvement in OFF response by providing clearance on the absorbed surface when it is switched ON. Select the DC spec. or AC spec. built-in full-wave rectifier type when the dynamic viscosity is higher than water or when the OFF response is prioritized.

3.5.4 Steam

Warning

- Do not use steam that contains chemicals, synthetic oils containing organic solvents, salts, or corrosive gases etc., as these can cause damage or deterioration.

3.6 Mounting

Warning

- Do not mount the coil downwards. When mounting a valve with its coil positioned downwards, foreign objects in the fluid will adhere to the iron core leading to a malfunction.

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 the mounting screws to the torque given in the table below.

Model	Tightening torque [N·m]
VX31	1.5 to 2
VX32	2.5 to 3
VX33	

Table 7.

3.7 Electrical circuits

Caution

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

DC Circuits

Grommet, Conduit, Conduit terminal DIN Type

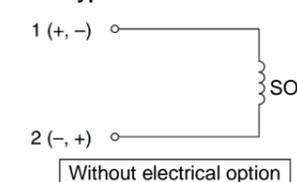


Figure 1.

Grommet, Conduit terminal DIN Type

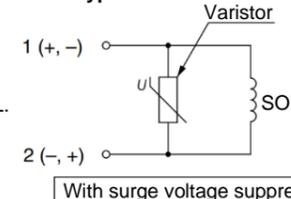


Figure 2.

Conduit terminal DIN Type

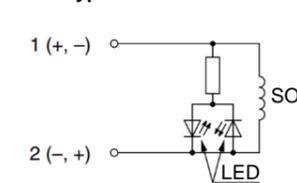


Figure 3.

Conduit terminal DIN Type

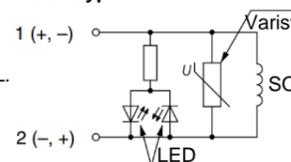


Figure 4.

3 Installation - continued

AC, Class B (Built-in full wave rectifier type) Circuits

*For AC/Class B, the standard product is equipped with surge voltage suppressor.

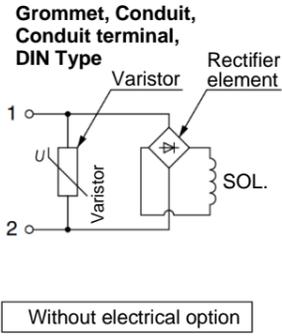


Figure 5.

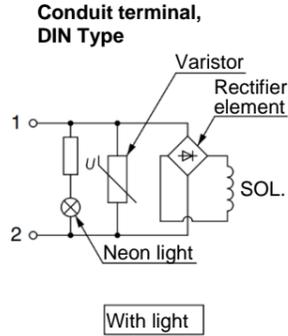


Figure 6.

AC Class B/H Circuits

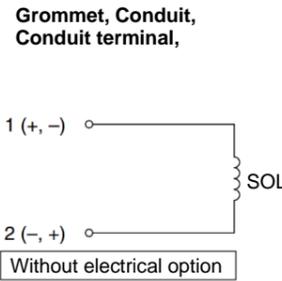


Figure 7.

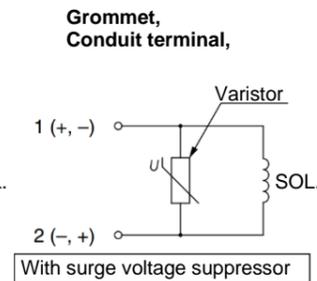


Figure 8.

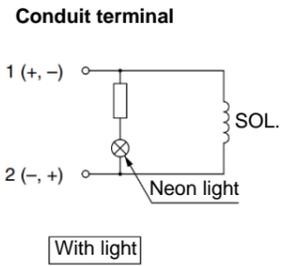


Figure 9.

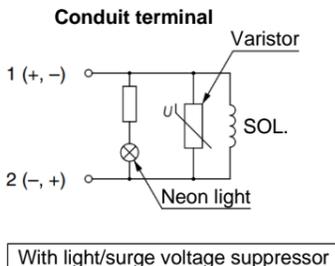


Figure 10.

3.8 Electrical connectors

3.8.1 Grommet

- Class H coil: AWG18 Insulator O.D. 2.2 mm
- Class B coil: AWG20 Insulator O.D 2.5 mm
- DC Voltages are for Class B only (There is no polarity)

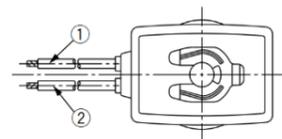


Figure 11.

Voltage	Lead Wire Colour	
	1	2
DC	Black	Red
110 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

Table 8.

3.8.2 DIN terminal

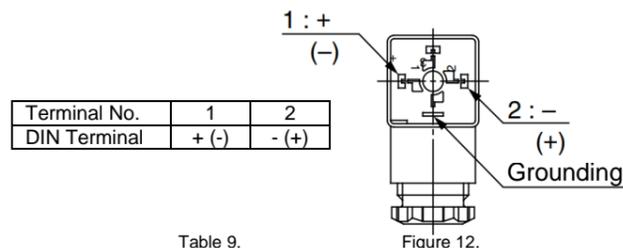


Figure 12.

Terminal No.	1	2
DIN Terminal	+ (-)	- (+)

Table 9.

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.

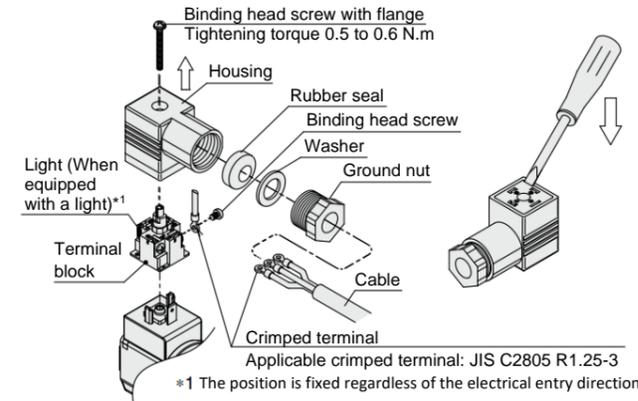


Figure 13.

3.8.2.1 DIN (EN175301-803) terminal

- This DIN terminal corresponds to the Form A DIN connector with an 18 mm terminal pitch, which complies with EN175301-803B

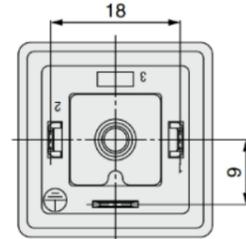
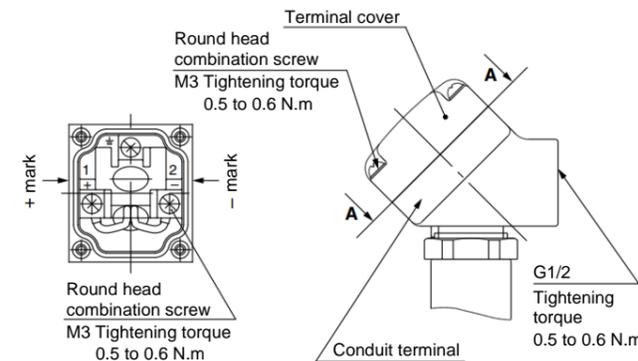


Figure 14.

3.8.3 Conduit terminal

Make connections according to the marks shown below

- Use the tightening torques below for each section.
- Properly seal terminal connection with the special wiring conduit, etc.



View A-A
(Internal connection diagram)

Figure 15.

3 Installation - continued

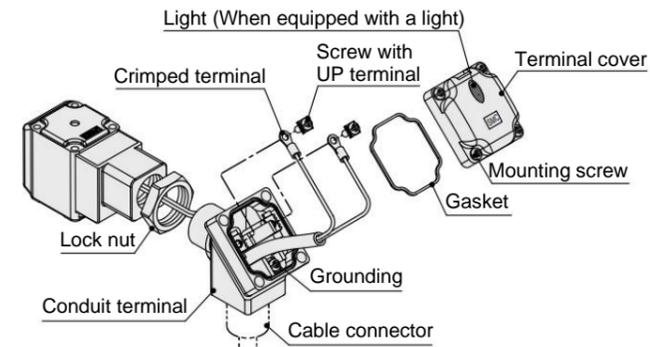


Figure 16.

3.8.4 Conduit

- When used as an IP65 equivalent, use seal (part no. VCW20-15-6) to install the wiring conduit. Also use the tightening torque below for the conduit.

Class H coil: AWG18 Insulator O.D. 2.2 mm

Class B coil: AWG20 Insulator O.D. 2.5 mm

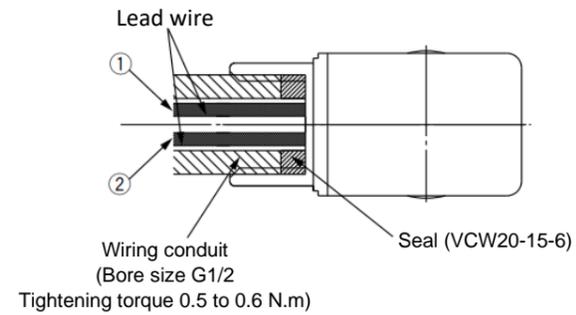


Figure 17.

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
110 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

Table 10.

3.9 Residual voltage

Caution

- If a 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 varistor residual voltage.

3.10 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.

3.11 Extended period of continuous energization

Warning

- The solenoid coil will generate heat when continuously energized so avoid installing in an enclosed space. Install the valve in a well-ventilated area.
- Do not touch the coil while it is being energized or immediately after energization.

3 Installation - continued

3.12 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.

4 How to Order

Refer to catalogue for 'How to Order'.

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.

6.2 Mounting

Caution

- Refer to section 3.6

6.3 Replacement parts

Replacement parts (Solenoid coil, Nameplate and Clip) are available; Refer to catalogue for how to order.

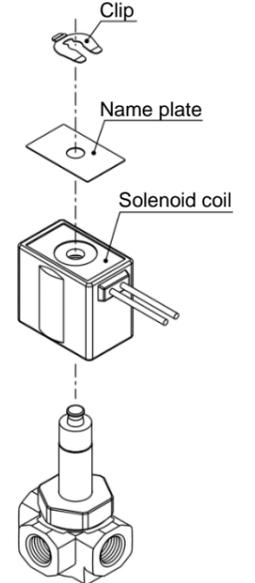


Figure 18.

7 Limitations of Use

7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

Warning

7.2 Effect of energy loss on valve switching

Fluid supply present, electrical supply cut	Valve returns to OFF position by spring force
Electrical supply present, fluid supply cut	Valve remains in the ON position

Table 11.

7.3 Low temperature operation

- The valve can be used in an ambient temperature of -20°C. However, take measures to prevent freezing or solidification of impurities, etc.
- When using valves for water application in cold climates, take appropriate countermeasures to prevent the water from freezing in tubing after cutting the water supply from the pump, by draining the water, etc. When warming by a heater, etc., be careful not to expose the coil portion to a heater. Installation of a dryer, heat retaining of the body is recommended to prevent freezing condition in which the dew point temperature is high and the ambient temperature is low, and the high flow runs.

7.4 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.

7.5 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.

7.6 Closed liquid circuit

In a closed circuit, when liquid is static, pressure could rise due to changes in temperature. This pressure rise could cause malfunction and damage to components such as valves. To prevent this, install a relief valve in the system.

7.7 Closed circuit

- The compatibility of the components of this product with the fluid used may vary depending on the type of fluid, additives, concentration, temperature, etc. Check the compatibility with the actual machine before use.
- Take measures to prevent static electricity since some fluids can cause static electricity.
- Do not use the product with the fluids listed below:
 - Fluids that are harmful to humans.
 - Combustible or flammable fluids.
 - Corrosive gas and fluid.
 - Sea water, saline.

Caution

7.8 Leakage voltage

Ensure that any leakage voltage caused by the leakage current when the switching element is OFF causes $\leq 2\%$ (for DC coils) or $\leq 5\%$ (for AC full-wave rectifier coils) or $\leq 20\%$ (for AC coils) of the rated voltage across the valve.

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 Return of Product

Warning

If the product to be returned is contaminated or is possibly contaminated with substances that are harmful to humans, for safety reasons, please contact SMC beforehand and then employ a specialist cleaning company to decontaminate the product. After the decontamination prescribed above has been carried out, submit a Product Return Request Sheet or the Detoxification/Decontamination Certificate to SMC and await SMC's approval and further instructions before attempting to return the item. Please refer to the International Chemical Safety Cards (ICSC) for a list of harmful substances. If you have any further questions, please don't hesitate to contact your SMC sales representative.

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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