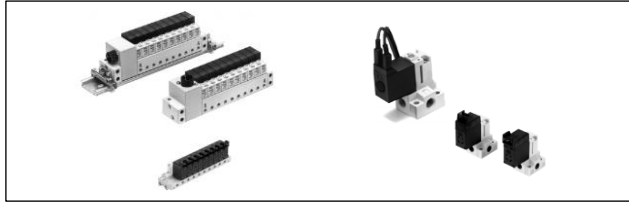




ORIGINAL INSTRUCTIONS

**Instruction Manual**  
**3-Port Solenoid Valve**  
**Series VQ100**



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<sup>\*)</sup>, and other safety regulations.

- <sup>\*)</sup> 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.

<b>Caution</b>	Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
<b>Warning</b>	Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.
<b>Danger</b>	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 Standard valve specifications**

Type	Standard	High-pressure	Low-wattage
Fluid	Air		
Max. operating pressure [MPa]	0.7	0.8	0.7
Min. operating pressure (Vacuum) [MPa]	0 (-0.1 Note 1)		
Ambient and fluid temperature [°C]	-10 to 50 (No freezing)		
Flow characteristics	Refer to catalogue		
Response time [ms] Note 2)	Refer to catalogue		
Duty cycle	Contact SMC		
Min. operating frequency	1 cycle / 30 days		
Max. operating frequency [Hz]	20		

**2 Specification - continued**

Manual override	Non-locking push type/ Locking type (Tool required)
Lubrication	Not required
Impact/Vibration resistance [m/s <sup>2</sup> ] Note 3)	150/30
Enclosure (based on IEC60529)	IP40
Mounting orientation	Unrestricted
Weight [g]	12.6 g (L/M plug connector, Without sub-plate)

Table 1.

Note 1) For vacuum, please use the 10- clean series. The 3(R) port can be used for vacuum, and the 1(P) port can be used for vacuum release pressure. (For the differential pressure between the 3(R) port and the 1(P) port, use within the max. operating pressure of each type.)

Note 2) Based on JIS B 8374-1993. With light/surge voltage suppressor (clean air), Dispersion accuracy ±1 ms.

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-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).

**2.2 Standard solenoid specifications**

Type	Standard	High-pressure	Low wattage
Coil rated voltage	DC [VDC] AC [VAC] (semi-standard)	12, 24 100, 110	
Electrical entry	Grommet, Plug-in, L plug connector, M plug connector		
Coil insulation class	Equivalent to class B		
Allowable voltage fluctuation	±10%		
Power consumption [W]	DC	1 (42 mA)	1.5 (63 mA) 0.5 (21 mA)
Surge voltage suppressor	Varistor (ZNR)		
Indicator light	LED		

Table 2.

**2.3 Semi-standard specifications**

Type	Latching	AC	Large flow capacity	Normally open	Power saving
Max. operating pressure [MPa] Note 1, 2)	0.7				
Min. operating pressure (Vacuum) [MPa]	0 (-0.1 Note 1, 2)				
Flow characteristics	Refer to catalogue				
Response time [ms] Note 3)	Refer to catalogue				
Manual override	Latching type: Push-locking type (Tool required)	Non-locking push type/Locking type (Tool required)			
Power consumption	12 VDC [W]	1 (42 mA)	0.35 Note 4) (15 mA)	1 (42 mA)	0.25 (11 mA)
	24 VDC [W]	1 (83 mA)	0.35 Note 4) (30 mA)	1 (83 mA)	0.25 (21 mA)
	100 VAC [VA]	0.6 (6 mA)	0.5 (5 mA)		
Surge voltage suppressor	DC	Diode	-	Varistor (ZNR)	
	AC	Varistor (ZNR)	Diode		

Table 3.

Note 1) For vacuum, please use the 10- clean series. The 3(R) port can be used for vacuum, and the 1(P) port can be used for vacuum release pressure. (For the differential pressure between the 3(R) port and the 1(P) port, use within the max. operating pressure of each type.)

Note 2) If the 1(P) port is to be used for vacuum, and the 3(R) port is to be used for vacuum release, please select the VQ120 (normally open type). In this case, the 10- is not required.

Note 3) Based on JIS B 8374-1993. With light/surge voltage suppressor (clean air), Dispersion accuracy ±1 ms.

Note 4) Inrush: 3.1 W (10 ms after energized); Holding: 0.35 W (It has both + and - polarity.)

**2 Specification - continued**

**2.4 Pneumatic symbol**

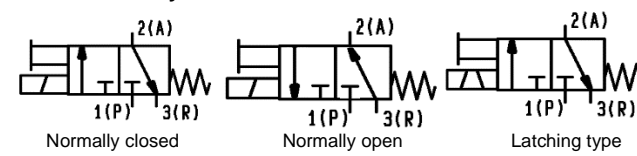


Figure 1. Pneumatic symbols

**2.5 Indicator light**

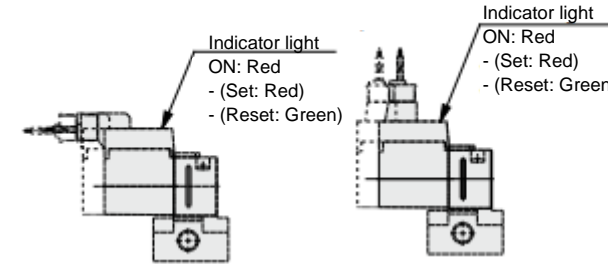


Figure 2. Indicator light locations

( ) and the dotted lines indicate the latching, AC and large flow type.

Latching	Passage	Indicator light
A-C ON (set)	P→A	Red
B-C ON (reset)	A→R	Green

Table 4.

Single	Passage	Indicator light
A-C ON	P→A	Red
OFF	A→R	-

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.

**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.

**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.

Port	Thread	Tightening torque [N·m]
P, A, E (sub-plate)	M3	0.4 to 0.5
P, A, E (VV3Q11/VV3Q12 manifold)	M5	1 to 1.5
A (VV3Q12U manifold)		
P, E (VV3Q12U manifold)	1/8"	3 to 5

Table 6.

**3 Installation - continued**

**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 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.
- 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.
- Do not apply excessive torque when turning the locking type manual override (0.1 N·m or less)

**3.7 Mounting**

**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 indicated.

Mounting	Mounting screw size	Tightening torque [N·m]
Valve to base	M1.7	0.15 to 0.18
Manifold to DIN rail	M4	0.8 to 1.2

Table 7.

- Refer to catalogue for more information about mounting manifold to DIN rail.

**3.8 Electrical circuits**

**Caution**

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

**3.8.1 Single solenoid**

**Caution**

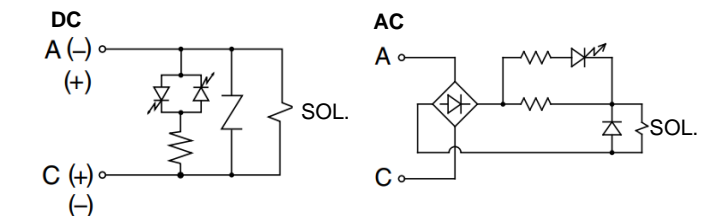


Figure 3. Single solenoid surge voltage suppressor circuit diagram

Note) There is no polarity.

### 3 Installation - continued

#### 3.8.2 Latching solenoid

**Caution**

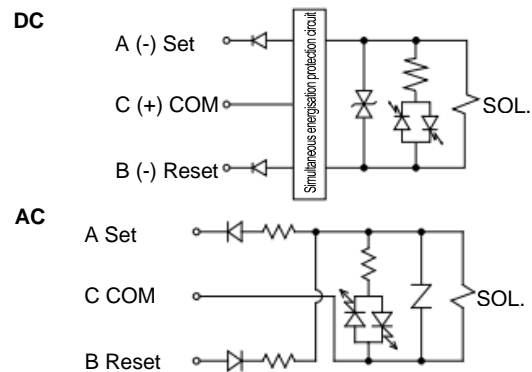


Figure 4. Latching solenoid surge voltage suppressor circuit diagram

- A (set) side energizing: P → A
- B (set) side energizing: A → R
- Negative common specification is applicable.

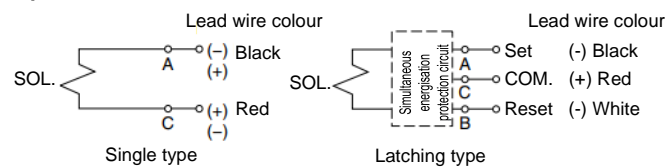
#### 3.9 Electrical connectors

##### 3.9.1 Wiring specification – plug connector, grommet

**Caution**

- Wiring should be connected as shown below. Connect with the power supply respectively.

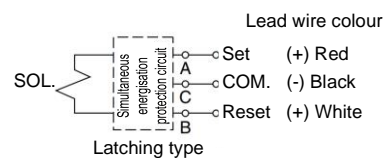
##### DC positive common



##### DC negative common

There is no polarity for the single type.

However, there is polarity for the large flow type.



##### AC type

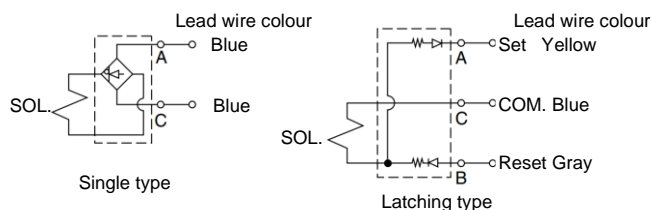


Figure 5. Wiring Specifications

##### 3.9.2 How to use plug connector

**Caution**

Refer to catalogue for how to order plug connector assembly and additional information.

### 3 Installation - continued

#### 3.9.2.1 Attaching and detaching connector

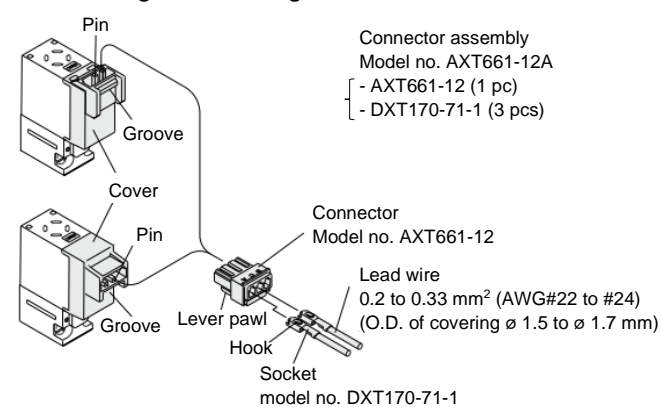


Figure 6. Attaching and detaching connector

#### 3.9.2.2 Crimping connection of lead wire and socket

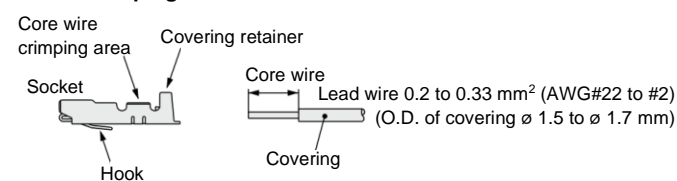


Figure 7. Crimping connection of lead wire and socket

#### 3.9.2.3 Attaching and detaching lead wires with sockets

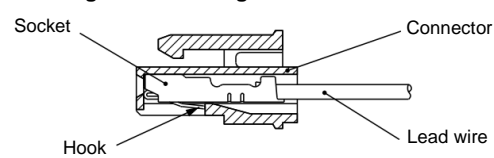


Figure 8. Attaching and detaching lead wires with sockets

#### 3.9.3 How to use circular connector

**Caution**

Refer to catalogue for how to use circular connector.

#### 3.10 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.
- In the case of a diode, the residual voltage is approximately 1 V.
- Valve response time is dependent on surge suppression method selected.

#### 3.11 Countermeasure for surge voltage

**Caution**

- At times of sudden interruption of the power supply, the energy stored in a large inductive device may cause non-polar type valves in a de-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.

#### 3.12 Extended period of continuous energization

**Warning**

- If a valve will be continuously energized for an extended period of time, or is mounted in a control panel, 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 selecting "Y" (low-wattage type).

### 3 Installation - continued

- Do not continuously energize the latching type. When it is necessary to energize it continuously, keep the energized period to 10 minutes or less, and then leave a de-energized period (on both the A side and B side) lasting longer than the energized period, before operating it again. The duty ratio should be 50% or less. However, a minimum energization time of 20 ms is recommended. Refer to catalogue for more information on latching type duty cycle.

#### 3.13 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.

#### 3.14 Latching type

**Caution**

- Do not continuously energize the latching type. When it is necessary to energize it continuously, keep the energized period to 10 minutes or less, and then leave a de-energized period (on both the A side and B side) lasting longer than the energized period, before operating it again. The duty ratio should be 50% or less. However, a minimum energization time of 20 ms is recommended.
- Use a circuit in which the set and reset signals will not be energized at the same time.
- Even when there is no problem with normal operations and locations, please consult with SMC before using in locations with a vibration of 30 m/s<sup>2</sup> or more or a strong magnetic field.
- Even though this valve is set to the reset position at the time of shipment (passage: A → R), it may switch to the set position during transportation or due to impact when mounting valves, etc. Therefore, check the initial position with the power supply or by performing a manual override prior to use.

### 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 3.7 Mounting and to catalogue for information regarding mounting valves to base and manifolds to DIN rail.

#### 6.3 Maintainable parts

**Caution**

Refer to catalogue for how to order manifold accessories and plug connectors.

### 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

	Single type	Latching type <sup>Note)</sup>
Air supply present, electrical supply cut	Valve armature returns to the OFF position by the force of the spring	Valve armature holds position until reset signal is sent (B-ON), armature then returns to OFF position by spring force.
Electrical supply present, air supply cut	Valve operation is not dependent on presence of air supply. Armature position/movement is unaffected by loss of air supply.	

Table 8.

Note) Refer to 3.14 and catalogue for Latching type operation guidance.

#### 7.3 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.

#### 7.4 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**

#### 7.5 Leakage voltage

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

#### 7.6 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 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](http://www.smcworld.com) or [www.smc.eu](http://www.smc.eu) for your local distributor/importer.

## SMC Corporation

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