



ORIGINAL INSTRUCTIONS

Instruction Manual

2 Port Solenoid Valve

Direct Operated Poppet Type

Series XSA1/2/3



The intended use of this product is the control of compressed air or vacuum in pneumatic industrial automation 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) (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.

<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.

2 Specifications

2.1 General specifications

Valve specifications	Valve construction	Direct operated poppet
	Fluid	Air, Inert gas
	Withstand pressure	1.5 MPa
	Max. operating pressure	1.0 MPa
	Min. operating pressure	1 x 10 <sup>-6</sup> Pa
	Fluid and ambient temperature range (°C)	5 to 60
	Body material	Stainless steel
	Seal material	FKM
	Environment	Location without corrosive or explosive gases
	Duty cycle	Continuous (Note 1)
	B <sub>10</sub>	2.9 million cycles
	Air quality required	5 µm or smaller
	Impact and vibration resistance	See section 3.2
	Maximum operating frequency	0.5 cycles / sec
	Minimum operating frequency	See section 6.1
Valve response time	<b>ON:</b> 50ms or less <b>OFF:</b> 150ms or less	
Leakage Pa m <sup>3</sup> /s <small>Note 2)</small>	Internal	1.3 x 10 <sup>-9</sup>
	External	2.3 x 10 <sup>-11</sup>

2 Specifications- continued

General specifications- continued

Coil specifications	Rated voltage <small>Note 3)</small>	AC	100 VAC, 200VAC, 110VAC, 230VAC, 220VAC, 240VAC, 48VAC, 24VAC
		DC	24 VDC, 12VDC
	Allowable voltage fluctuation		±10% of rated voltage
	Allowable leakage voltage	AC	5% or less of rated voltage
	DC	2% or less of rated voltage	
Coil insulation type			Class B

Note 1) In case of fluid / ambient temperature of 40°C or less. For 40 to 60°C, contact SMC.  
 Note 2) Leakage when the ambient temperature is at 20°C and there is 0.1MPa of differential pressure. Gas permeation is not included.  
 Note 3) AC type is equipped with full-wave rectifier.

2.4 Coil Specifications

DC Specification

Model	Power consumption (W) <small>Note 1)</small>	Temperature rise (°C) <small>Note 3)</small>
XSA1	4.5	50
XSA2	7	55
XSA3	10.5	65

AC Specification (Built-in Full-wave Rectifier Type)

Model	Apparent Power (VA) <small>Note 1,2)</small>	Temperature rise (°C) <small>Note 3)</small>
XSA1	7	60
XSA2	9.5	70
XSA3	12	70

Note 1) Power consumption, apparent power: The value at an ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)  
 Note 2) There is no difference in the frequency, inrush or energized apparent power, since a rectifying circuit is used for AC.  
 Note 3) The value at an ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is a reference value.

2.5 Flow Specifications

2.5.1 Face seal fitting/ Compression fitting

Model	Port Size	Orifice Dia. (mm)	Flow characteristics		Max. operating pressure difference (MPa)	Reverse pressure potential (MPa) <sup>Note 1)</sup>	Wt.(kg) <sup>Note 2)</sup>
			C [dm <sup>3</sup> /s.bar]	b			
XSA1	1/4	2	0.55	0.41	0.8	0.5	0.28
XSA1	1/4	3	1.07	0.36	0.3	0.25	0.28
XSA2	1/4	3	1.07	0.34	1.0	0.4	0.41
		4.5	1.51	0.24	0.3	0.2	
XSA2	3/8	6	2.78	0.21	0.1	0.05	0.42
		1/4	4.5	1.54	0.24	0.8	0.2
XSA3	3/8	6	2.89	0.21	0.3	0.15	0.55 (0.62)

Note 1) The reverse pressure potential indicates the pressure which can be applied from Port 2 when Port 1 is at atmospheric pressure.  
 Note 2) Weight of compression seal fitting/Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type respectively. Weight in (brackets) is for face seal fitting type

2.5.2 Female Thread

Model	Port Size	Orifice Dia. (mm)	Flow characteristics		Max. operating pressure difference (MPa)	Reverse pressure potential (MPa) <sup>Note 2)</sup>	Wt. (kg) <sup>Note 1)</sup>
			C [dm <sup>3</sup> /s.bar]	b			
XSA1	1/8	2	0.54	0.36	0.8	0.5	0.33
		3	1.14	0.39	0.3	0.25	
XSA2	1/4	3	1.14	0.42	1.0	0.4	0.53
		4.5	2.23	0.38	0.3	0.2	
XSA3	3/8	4.5	2.37	0.40	0.8	0.2	0.74
		6	3.50	0.15	0.3	0.15	

Note 1) Weight of Grommet type. Add 10g for Conduit type, 30g for DIN terminal type, 60g for Conduit terminal type respectively.  
 Note 2) The reverse pressure potential indicates the pressure which can be applied from Port 2 when Port 1 is at atmospheric pressure

3 Installation

**Warning**

- Do not install the product unless the safety instructions have been read and understood.
- System designer should determine the effects of the possible failure modes of the product on the system

3.1 Selection

• Type of fluid

Before using a fluid, check whether it is compatible with the materials of component parts of each model shown in Table 1, by referring to the fluids listed in the specification table.

No.	Description	Material
1	Solenoid coil	Cu + Fe + Resin
2	Core	FE
3	Tube	Stainless steel
4	Seat	PET
5	Armature assembly	FKM, Stainless Steel, Resin (PPS)
6	Spring	Stainless steel
7	Body	Stainless steel
8	O-ring	FKM
9	Spacer	Al

Table 1 : Parts in contact with gas

• Fluid quality

<Air>

1) Use clean air.

Do not use compressed air that contains chemicals, synthetic oils that include organic solvents, salt, corrosive gases, etc., as it can cause damage or malfunction.

2) Install an air filter, if necessary.

Install an air filter close to the valve on the upstream side.

3) Install an aftercooler or air dryer, if necessary.

Compressed air that contains excessive drainage may cause the malfunction of the valve or other pneumatic equipment. To prevent this, install an aftercooler, air dryer, etc.

4) If excessive carbon powder is generated, eliminate it by installing a mist separator on the upstream side of the valve.

If excessive carbon powder is generated by the compressor, it may adhere to the inside of the valve and cause a malfunction.

<Vacuum>

Vacuum piping direction: Connect the piping so that the pressure in the secondary side is lower. Avoid the entry of foreign matter.

• Ambient environment

Use within the operable ambient temperature range. Check the compatibility between the product's materials and any fluid contained in the ambient atmosphere. Ensure that any harmful fluid used does not touch the external surface of the product.

• Countermeasures against static electricity

Take measures to prevent static electricity since some fluids can cause static electricity.

**Caution**

• Leakage voltage

Particularly when using a resistor in parallel with a switching element and when using a C-R element (surge voltage suppressor) to protect the switching element, take note that leakage current will flow through the resistor, C-R element, etc., which may prevent the valve from turning off. Ensure that any leakage current, when the switching element is OFF, meets the following limits:

- AC coil: 5% or less of the rated voltage
- DC coil: 2% or less of the rated voltage

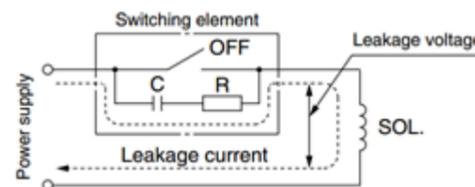


Figure 1

3 Installation- continued

3.2 Valve Mounting

**Warning**

- If air leakage increases or equipment does not operate properly, stop operation. After mounting is completed, confirm that it has been done correctly by performing a suitable function test.
- Do not apply external force to the coil section. When tightening is performed, apply a wrench or other tool to the outside of the piping connection ports.
- The solenoid valve can be mounted in any direction, but the recommended mounting direction of the coil is upward. When mounting a valve with its coil positioned downward, foreign matter in the fluid will adhere to the iron core, leading to a malfunction. Especially for strict leakage control, the coil must be positioned upward.
- Do not warm the coil assembly with a heat insulator, etc. Use tape, heaters, etc., for freeze prevention on the piping and body only. Warming the coil can cause it to burn out.
- Avoid sources of vibration or adjust the arm from the body to the minimum length so that resonance will not occur.
- Painting and coating. Warnings or specifications printed or labelled on the product should not be erased, removed, or covered up.
- Valve state is not defined if electrical input is outside of specified operating ranges.
- The valve moves to the OFF position by spring return when the product is de-energised.
- There is no locking manual override option.
- Response time of valve will depend on pressure, voltage fluctuations, piping conditions, etc
- Additional mounting information/dimensions:

Face seal/ Compression fitting Female thread

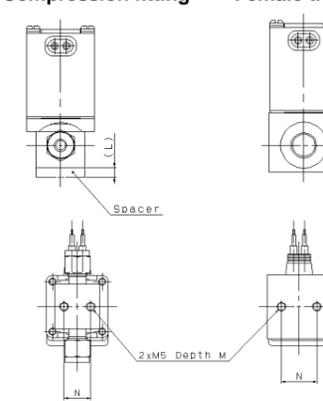


Figure 2

Model	L (mm)	M (mm)	N (mm)
XSA1	3	8	20
XSA2	5	10	20
XSA3	5	10	22

Table 2

3.3 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. Check the product specifications.
- Do not install in a location where vibration or impact may occur.

### 3 Installation- continued

- Do not mount in a location exposed to radiant heat from nearby sources.
- Employ suitable protective measures in locations where there is contact with water droplets, oil or welding splatter, etc.
- Do not use in a high humidity environment where condensation may occur.

#### 3.4 Piping

- Before piping make sure to clean out chips, cutting oil, dust etc.
- Prepare piping by cleaning the sealing surface with ethanol etc.
- Avoid connecting ground lines to piping, as this may cause the electric corrosion of the system.
- Tighten fittings to the specified tightening torque. After tightening, confirm that there is no leakage from the fitting.

Fitting	Tightening
Compression seal fitting	1 1/4 turns after tightening by hand
Face seal fitting	1/8 turns after tightening by hand
NPT, Rc1/8	7 to 9 Nm
NPT, Rc1/4	12 to 14 Nm
NPT, Rc3/8	22 to 24 Nm

Table 3

- Install piping so that it does not apply pulling, pressing, bending or other forces on the valve body.
- In applications such as vacuum and non-leak specifications, use caution against contamination of foreign objects and air tightness of fittings.
- When connecting piping to a product, avoid mistakes regarding the supply port, etc. (For port sizes, see section Dimensions).

#### 3.5 Precautions on Design

##### Caution

- Not suitable for use as an emergency shut-off valve, etc.**

These valves are not designed for safety applications such as an emergency shutoff valve.

If the valves are used for the mentioned applications, additional safety measures should be adopted.

- Extended periods of continuous energization.

##### Caution hot surface

- \* Be aware that the valve surface may get hot.

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

Be especially careful when using three or more adjacent valves with manifolds and keeping them continuously energized for extended periods, as this may result in dramatic increases in temperature.

#### 3.6 Wiring

##### Caution

- When DC power is connected to a solenoid valve equipped with light and/or surge voltage suppressor, check for polarity indications.
- Avoid miswiring, as this can cause malfunction and damage the product.
- To prevent noise and surge in signal lines, keep all wiring separate from power lines and high voltage lines. Otherwise this can cause malfunction.
- When a surge from the solenoid affects the electrical circuitry, install a surge absorber, etc., in parallel with the solenoid. Or, use an option that comes with surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with SMC.)
- Use electrical circuits that do not generate chattering in their contacts.
- Use voltages that are within ±10% of the rated voltage. In cases with a DC power supply where responsiveness is important, stay within ±5% of the rated value. (The voltage drop is the value in the lead wire section connecting to the coil).
- As a rule, use electrical wire with cross sectional area 0.5 to 1.25 mm<sup>2</sup> for wiring.
- Do not bend or pull cables repeatedly.

### 3 Installation- continued

- Connect the wires so that an external force greater than 10 N is not applied to the lead wire, otherwise the coil will burn.
- Product is rated to IP40

#### 3.7 Electrical Connections

##### 3.7.1 Grommet

Class B coil : AWG20 Outside insulator diameter of 2.5 mm.

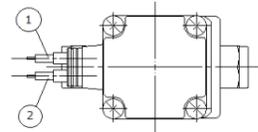


Figure 3

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

Note) There is no polarity

Table 4

##### 3.7.2 DIN Terminal (Class B coil only)

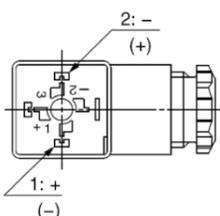


Figure 4

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

Note) There is no polarity

Table 5

- Use a heavy-duty cord with an outside cable diameter of Ø6 to 12 mm.
- Tighten screws and fittings according to Figure 5.

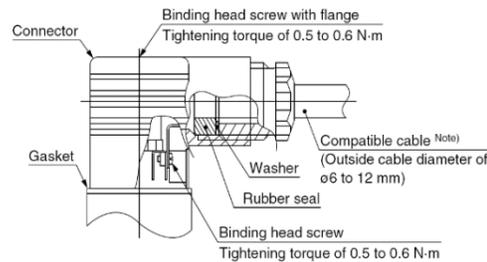


Figure 5

Note) For cables with an O.D. of Ø9 to Ø12 mm, remove the internal parts of the rubber seal before using.

##### 3.7.3 Conduit Terminal

- Make connections according to the marking shown in Figure 6.
- Tighten screws and fittings according to Figure 6.
- Properly seal the terminal connection (G1/2) with special wiring conduit, etc

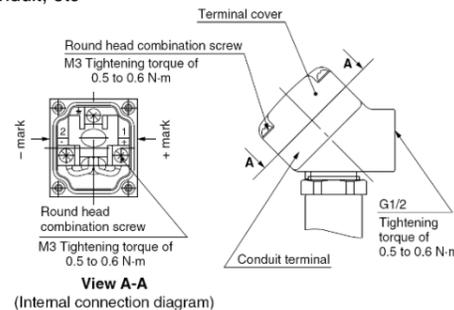


Figure 6

### 3 Installation- continued

#### 3.7.4 Conduit

- When used as an IP65 equivalent use seal (part number VCW20-15-6 ordered separately) to install the wiring conduit.
- Tighten conduit to torque shown in Figure 7.

Class B coil : AWG20 Outside insulator diameter of 2.5 mm

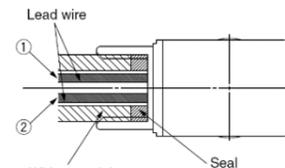


Figure 7

Rated Voltage	Lead wire colour	
	1	2
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Grey	Grey

Note) There is no polarity.

Table 6

Description	Part no.
Seal	VCW20-15-6

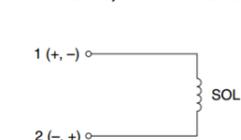
Note) Please order separately.

Table 7

#### 3.8 Electrical Circuits

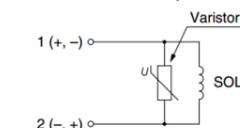
##### 3.8.1 DC Circuit

###### Grommet, Flat terminal



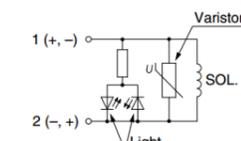
Without electrical option

###### Grommet, DIN terminal, Conduit terminal, Conduit



With surge voltage suppressor

###### DIN terminal, Conduit terminal



With light/surge voltage suppressor

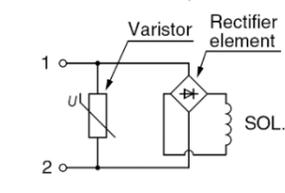
Figure 8

### 3 Installation- continued

#### 3.8.2 AC Circuits

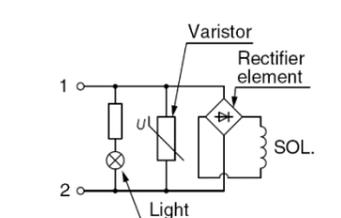
- For AC (Class B), the standard product is equipped with surge voltage suppressor.

##### Grommet, DIN terminal, Conduit terminal, Conduit



Without electrical option

##### DIN terminal, Conduit terminal



With light/surge voltage suppressor

Figure 9

#### 3.9 Lubrication

##### Caution

- Do not lubricate the product

#### 4 How to Order

Please see catalogue for How to Order

#### 5 Dimensions

Please see catalogue for 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.

##### Warning

##### Removing the product

Confirm that the valve temperature has dropped sufficiently before performing work. If touched inadvertently, there is a danger of being burned.

- Shut off the fluid supply and release the fluid pressure in the system.
- Shut off the power supply.
- Dismount the product.

##### Low frequency operation

Valves should be operated at least once every 30 days to prevent malfunction. (Use caution regarding the air supply). Also, in order to use them under the optimum state, conduct a regular inspection biannual

#### 7 Limitations of Use

##### 7.1 Limited warranty and disclaimer/compliance requirements

Refer to Handling Precautions for SMC Products.

#### 8 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

URL : <https://www.smcworld.com> (Global) <https://www.smc.eu> (Europe)  
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