Normal Close

High Vacuum Solenoid Valve

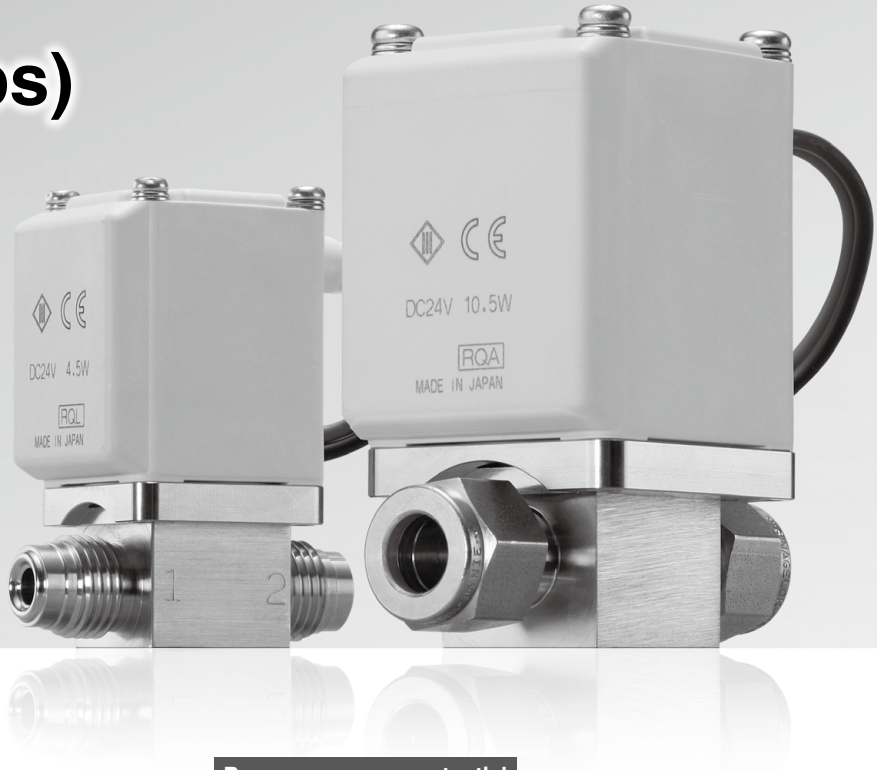
*1 Excluding grommet/AC

XSA Series

Minimum operating pressure

1×10^{-6} *1 Pa(abs)

*1 OUT side



Leakage

Internal

1.3×10^{-9} Pa·m³/s

External

1.3×10^{-11} Pa·m³/s

Power consumption

Max. 25% reduction

Size	XSA [W]	Previous model [W]
XSA1	4.5	6
XSA2	7	8
XSA3	10.5	11.5

Weight

Max. 18% *1 lighter

*1 XSA2-$^{2}_{3}$2

0.5 kg → 0.41 kg

Reverse pressure potential

0.5 MPa(G)*1

*1 XSA1-12 (Refer to the Specifications on page 119.)

Consistent clean room production

Washed, assembled and inspected in a Class 100 environment, and sealed in double bags

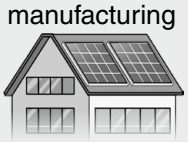
Manufacturing process

Clean booth Class 100

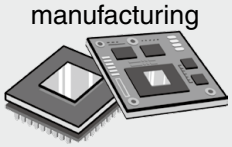
Degrease/ Wash → Pure water (16 MΩ-cm) wash → Assembly → Inspection → Package

Applications

Photovoltaic cell manufacturing

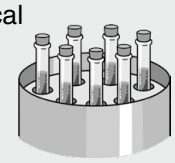


Semiconductor manufacturing



LCD manufacturing

Medical



Food

Female thread type (Rc, NPT) added

Flame resistance UL94V-0 compliant

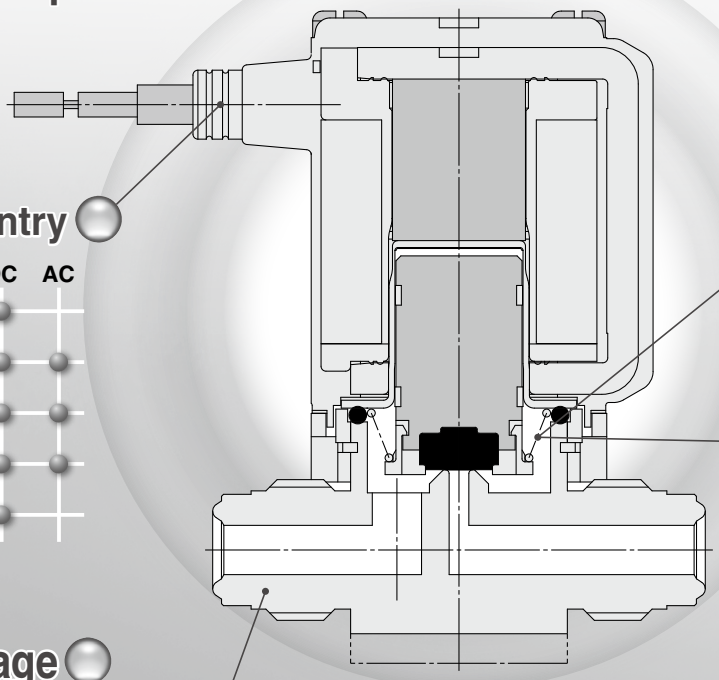
Power consumption:

* DC/Class B

4.5 W (Size 1)

7 W (Size 2)

10.5 W (Size 3)



Electrical entry

	DC	AC
Grommet	●	
DIN terminal	●	●
Terminal	●	●
Conduit	●	●
Flat terminal	●	

Reduced particle generation

Moving the spring from the sliding part of the armature to the body reduces contact with the spring, thus reducing particle generation.

Improved sealing performance

The larger spring creates a firm seal!
Leakage (Internal): 1.3 x 10^{-9} Pa·m^3/s

Fluid temperature

5 to 60°C

Rated voltage

AC	100 V, 200 V, 110 V, 220 V, 240 V, 48 V, 24 V, 230 V
DC	24 V, 12 V

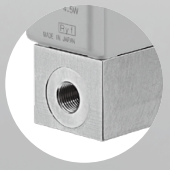
2 types of fittings and female threads available

A fitting with high leak integrity for vacuum to positive pressure, that forms a seal through the placement of a metal gasket at the end of the sleeve and the tightening of the nut.

Face seal fitting

A self-aligning tube fitting that uses ferrule rings to compress the tubing, creating a seal when the nut is tightened.

Compression fitting



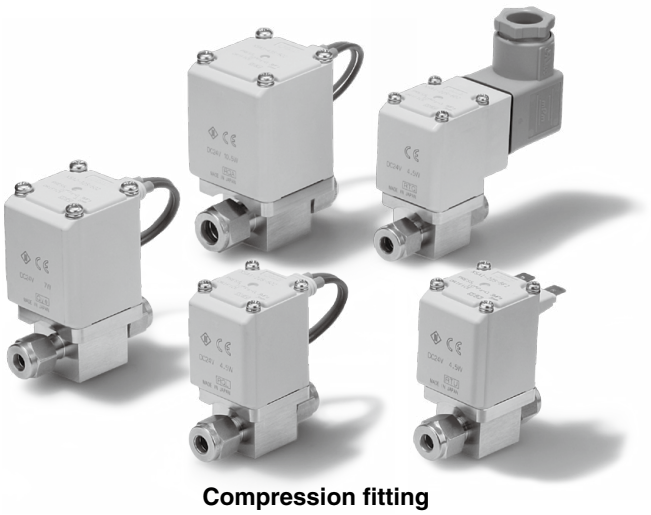
Female thread (Rc, NPT)

Variations

Face seal fitting / Compression fitting	Model	Orifice diameter				Fitting/Port size (inch)		Minimum operating pressure Pa(abs)	Leakage Pa·m^3/s (He)	
		ø2	ø3	ø4.5	ø6	1/4	3/8		Internal	External
	XSA1	●	●	—	—	●	—	1 x 10^{-6}	1.3 x 10^{-9}	1.3 x 10^{-11}
	XSA2	—	●	●	●	●	●			
	XSA3	—	—	●	●	●	●			

Female thread (Rc, NPT)	Model	Orifice diameter				Female thread (Rc, NPT)			Minimum operating pressure Pa(abs)	Leakage Pa·m^3/s (He)	
		ø2	ø3	ø4.5	ø6	1/8	1/4	3/8		Internal	External
	XSA1	●	●	—	—	●	—	—	1 x 10^{-6}	1.3 x 10^{-9}	1.3 x 10^{-11}
	XSA2	—	●	●	—	—	●	—			
	XSA3	—	—	●	●	—	—	●			

Face seal fitting



Compression fitting

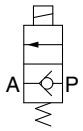
Female thread (Rc, NPT)

Normal Close
High Vacuum Solenoid Valve
XSA Series

*1 Excluding grommet/AC

RoHS

Symbol



Face seal fitting

Compression fitting

How to Order

Face seal fitting / Compression fitting XSA 1 – 1 2 S – 5 G 2 – □

Female thread type XSA 1 – 1 1 P – 5 G 2

Female thread type

Valve size / Orifice diameter / Fitting size

Face seal fitting/Compression fitting

Valve size		Orifice diameter		Fitting size	
1	Size 1	1	ø2	2	1/4
		2	ø3		
2	Size 2	2	ø3	2	1/4
		3	ø4.5	3	3/8
		4	ø6		
3	Size 3	3	ø4.5	2	1/4
		4	ø6	3	3/8

Female thread type

Valve size		Orifice diameter		Fitting size	
1	Size 1	1	ø2	1	1/8
		2	ø3		
2	Size 2	2	ø3	2	1/4
		3	ø4.5		
3	Size 3	3	ø4.5	3	3/8
		4	ø6		

Spacer

Nil	None
A	With spacer

* The spacer is used to raise the body when fastening it onto a flat area. Refer to the table below if spacers are required separately.

Fitting type

Face seal fitting/Compression fitting

V	Face seal fitting
S	Compression fitting

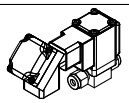
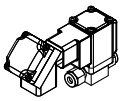
Female thread type

P	Rc female thread
N	NPT female thread

Voltage

1	100 VAC
2	200 VAC
3	110 VAC
4	220 VAC
5	24 VDC
6	12 VDC
7	240 VAC
8	48 VAC
B	24 VAC
J	230 VAC

Electrical entry

		DC	AC
G	Grommet 	●	—
GS	Grommet (With surge voltage suppressor) 	●	●*1
D	DIN terminal (With surge voltage suppressor) 	●	●
DL	DIN terminal with light (With surge voltage suppressor) 	●	●
DO	DIN terminal without connector (With surge voltage suppressor) 	●	●
T	Terminal (With surge voltage suppressor) 	●	●
TL	Terminal with light (With surge voltage suppressor) 	●	●
C	Conduit (With surge voltage suppressor) 	●	●
F	Flat terminal 	●	—

*1 Not CE/UKCA-compliant

Table: Spacer Part No.
(Applicable to the face seal fitting/compression fitting)

Model	Part no.
XSA1	XSA1R-8-1
XSA2	XSA2R-8-1
XSA3	

For the special option below, refer to page 123.

Special electrical entry direction

Specifications

Model		XSA1-1$\frac{1}{2}$	XSA1-2$\frac{1}{2}$	XSA2-22	XSA2-32	XSA2-43*3	XSA3-3$\frac{2}{3}$	XSA3-43
Action		Normally closed						
Fluid		Air, Inert gas						
Orifice diameter mmø		2	3		4.5	6	4.5	6
Withstand pressure MPa(G)		1.5						
Minimum operating pressure Pa(abs)/OUT side		1×10^{-6}						
Maximum operating pressure MPa(G)/IN side		1.0						
Maximum operating pressure differential MPa *1		0.8	0.3	1.0	0.3	0.1	0.8	0.3
Reverse pressure potential MPa(G) *2		0.5	0.25	0.4	0.2	0.05	0.2	0.15
Leakage Pa·m³/s (He) *4	**Internal**	1.3×10^{-9}						
	External	1.3×10^{-11}						
Piping connection system		Face seal fitting/Compression fitting/(Rc, NPT) Female thread						
Connection size	**Face seal fitting (inch) Compression fitting (inch)**	1/4				3/8	1/4	3/8
	(Rc, NPT) Female thread	1/8		1/4		—	3/8	
Ambient and fluid temperature °C		5 to 60						
Rated voltage *5		100/110/200/220/230/240/24/48 VAC 12/24 VDC						
Power consumption W *6	**DC**	4.5		7			10.5	
Apparent power VA *6	**AC**	7		9.5			12	
Coil temperature rise °C *7	**DC**	50		55			65	
	AC	60		70			70	
Allowable voltage fluctuation		±10% or less of the rated voltage						
Allowable leakage voltage	**DC**	2% or less of the rated voltage						
	AC	5% or less of the rated voltage						
Coil insulation type		Class B						
Weight kg *8	**Face seal fitting**	0.28		0.41		0.42	0.53	0.62
	Compression fitting	0.28		0.41		0.42	0.53	0.55
	(Rc, NPT) Female thread	0.33		0.53		—	0.74	0.74

*1 The operating pressure differential indicates the difference between Port 1 (high pressure side) and Port 2 (low pressure side).
Example) In the case of 0.3 MPa, Port 2 is a vacuum (1 Torr or less), while Port 1 can be pressurized to 0.2 MPa(G).
*2 The reverse pressure potential indicates the pressure which can be applied from Port 2 when Port 1 is at atmospheric pressure.
*3 Face seal fitting/compression fitting only
*4 Leakage when the ambient temperature is at 20°C and there is 0.1 MPa of differential pressure. Gas permeation is not included.
*5 AC type is equipped with full-wave rectifier.
*6 Power consumption/Apparent power: The value when there is an ambient temperature of 20°C and when the rated voltage is applied. (Variation: ±10%)
*7 The value when there is an ambient temperature of 20°C and when the rated voltage is applied. The value depends on the ambient environment. This is for reference.
*8 Indicates case of grommet type

Flow Rate Characteristics

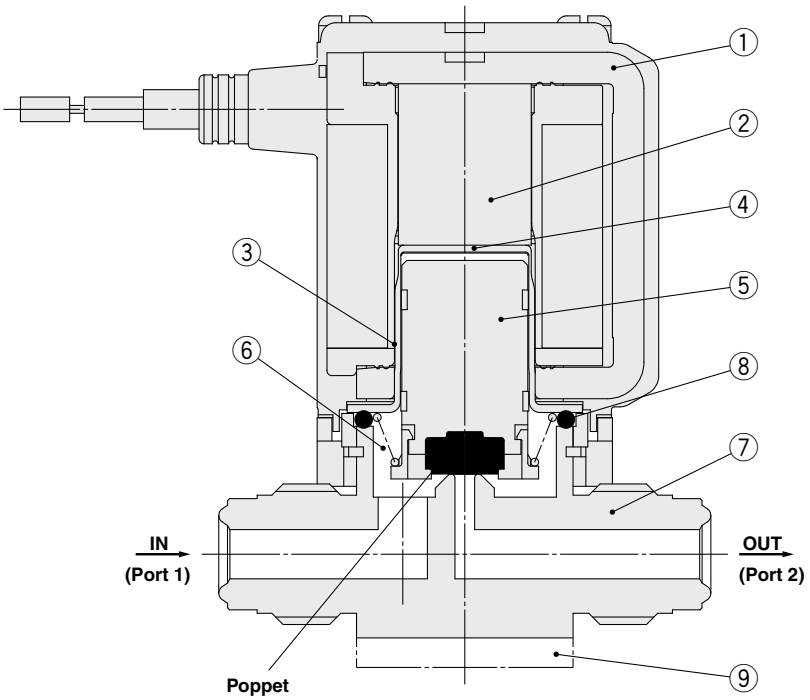
Face seal fitting/Compression fitting

		XSA1-12	XSA1-22	XSA2-22	XSA2-32	XSA2-43	XSA3-32	XSA3-43
Flow rate characteristics	**C[dm³/(s·bar)]**	0.55	1.07	1.07	1.51	2.78	1.54	2.89
	b	0.41	0.36	0.34	0.24	0.21	0.24	0.21

(Rc, NPT) Female thread

		XSA1-11	XSA1-21	XSA2-22	XSA2-32	XSA3-33	XSA3-43
Flow rate characteristics	**C[dm³/(s·bar)]**	0.54	1.14	1.14	2.23	2.37	3.50
	b	0.36	0.39	0.42	0.38	0.40	0.15

Construction/Operation



Component Parts

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

: Parts in contact with gas

<Option>

⑨ Spacer (Face seal fitting/compression fitting only): The spacer is used to raise the body when fastening it onto a flat area.

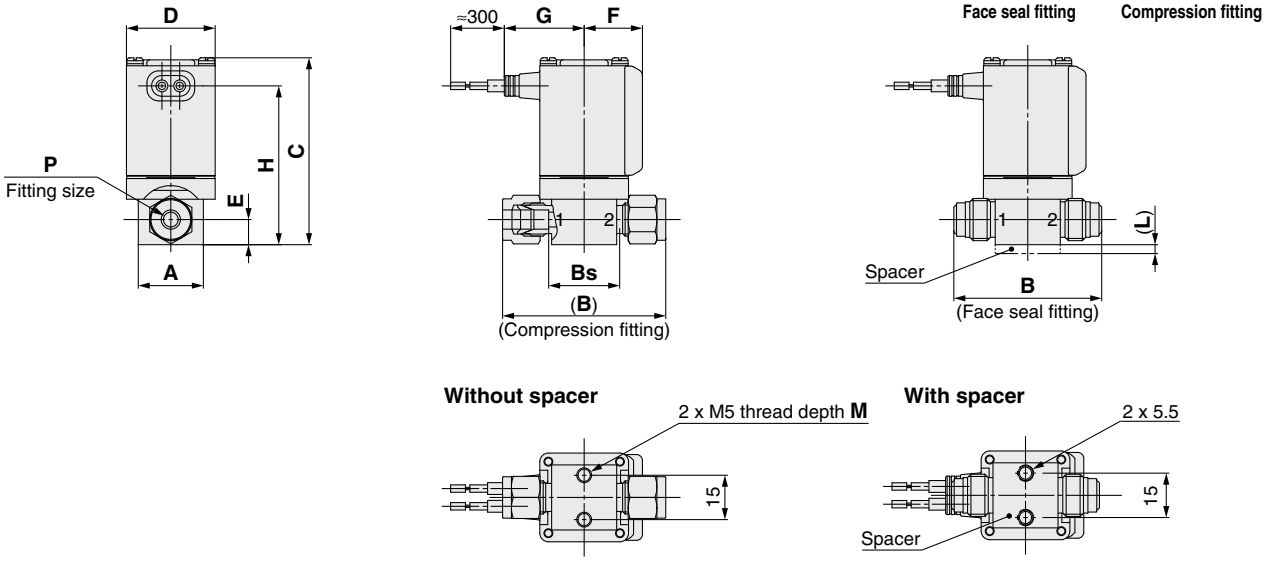
<Operating principle>

By energizing the solenoid coil ①, the armature assembly ⑤ overcomes the composite force, which consists of the force acting on the poppet due to differential pressure and the reactive force of the spring ⑥, and is adsorbed to the core ② side, thus opening the poppet.
When the energizing of the solenoid coil ① is canceled, the armature assembly ⑤ is separated from the core ② side by the reactive force of the spring ⑥, thus closing the poppet.

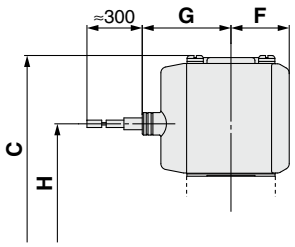
Dimensions: Face Seal Fitting, Compression Fitting

Face seal fitting Compression fitting

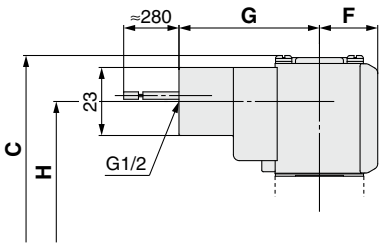
Grommet: G



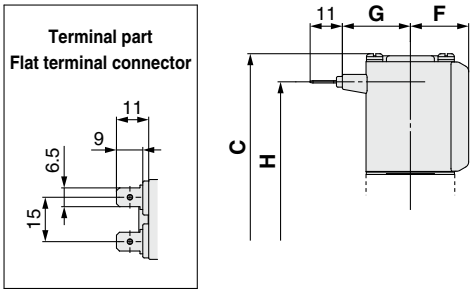
Grommet: GS



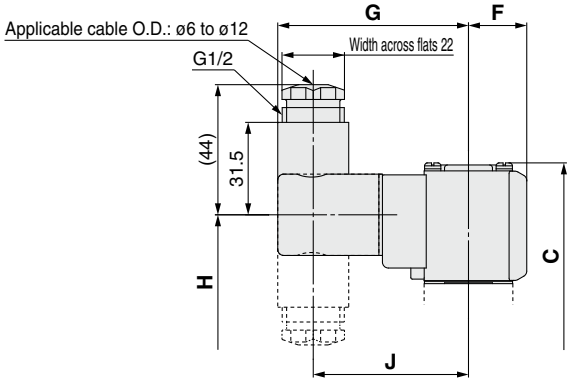
Conduit: C



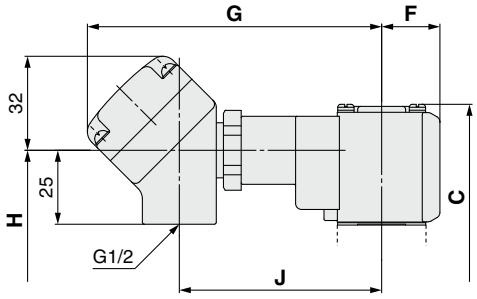
Flat terminal: F



DIN terminal: D



Terminal: T



Dimensions

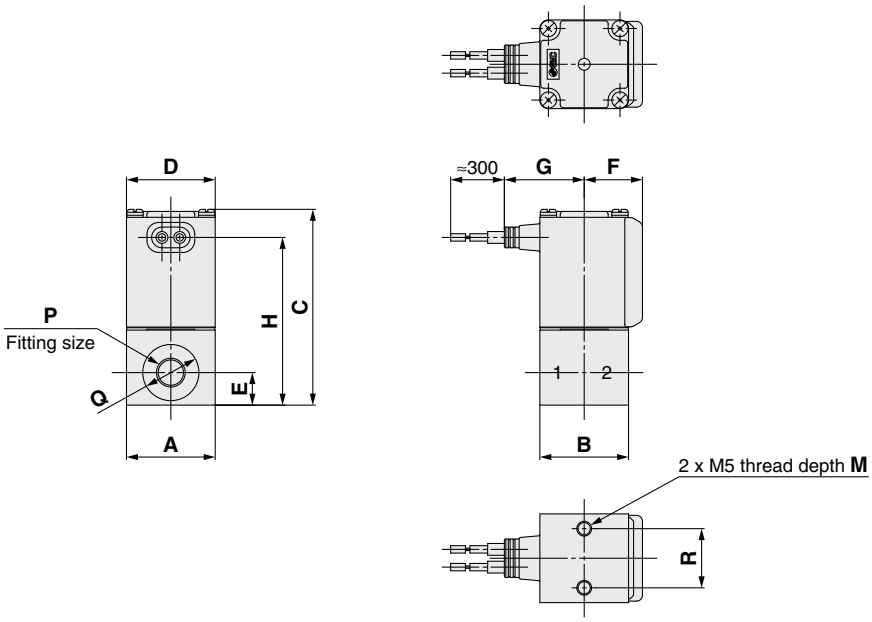
[mm]

Model	A	B	Bs	C	D	E	F	L	M	P [inch]	Grommet: G		Grommet: GS		Conduit: C		Flat terminal: F		DIN terminal: D			Terminal: T		
											G	H	G	H	G	H	G	H	G	H	J	G	H	J
XSA1-□2S	22	55	24	63	30	8.5	20	3	8	1/4	27	53.5	30	40	47.5	47.5	23	53.5	64.5	45.5	52.5	99.5	47.5	68.5
XSA1-□2V		50	—																					
XSA2-□2S	25	63	31.5	73.5	35	11.5	22	5	10	1/4	29.5	63	32.5	49.5	50	57	25.5	63	67	55	55	102	57	71
XSA2-□2V		56	—																					
XSA2-43S		64.5	31							3/8														
XSA2-43V		67	—	78																				
XSA3-32S		63	31.5		40		24.5			1/4	32	67.5	35	54	52.5	61.5	28	67.5	69.5	59.5	57.5	104.5	61.5	73.5
XSA3-32V		56	—																					
XSA3-43S		64.5	31							3/8														
XSA3-43V		67	—	82.5								72		58.5		66		72		64			66	

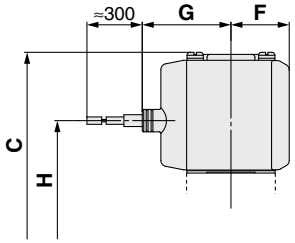
Female thread type

Dimensions: (Rc, NPT) Female Thread

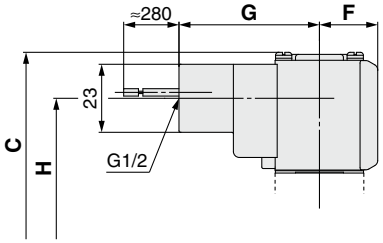
Grommet: G



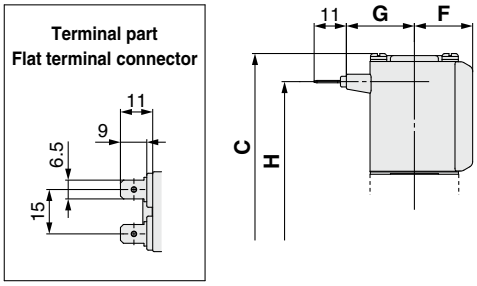
Grommet: GS



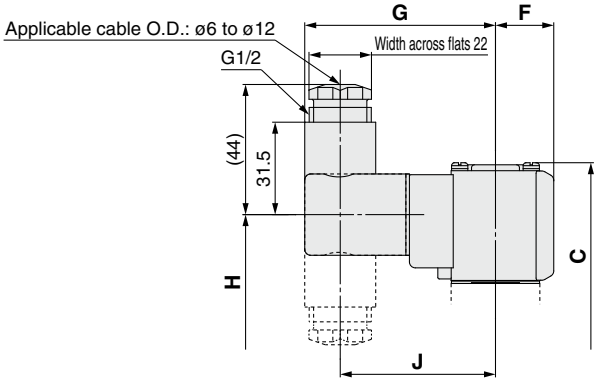
Conduit: C



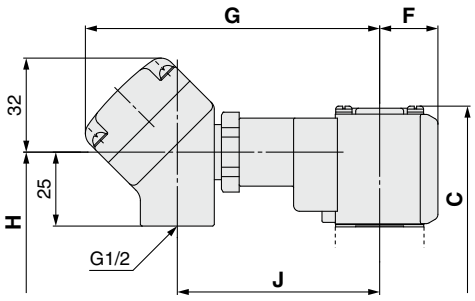
Flat terminal: F



DIN terminal: D



Terminal: T



Dimensions

[mm]

Model	A	B	C	D	E	F	M	P	Q	R	Grommet: G		Grommet: GS		Conduit: C		Flat terminal: F		DIN terminal: D			Terminal: T		
											G	H	G	H	G	H	G	H	G	H	J	G	H	J
XSA1-□1P(N)	30	30	66	30	11	20	8	1/8	ø19	20	27	56.5	30	43	47.5	50.5	23	56.5	64.5	48.5	52.5	99.5	50.5	68.5
XSA2-□2P(N)	36	36	79	35	14	22	10	1/4	ø24	20	29.5	68.5	32.5	55	50	62.5	25.5	68.5	67	60.5	55	102	62.5	71
XSA3-□3P(N)	40	40	88	40	16.5	24.5		3/8	ø29	22	32	77.5	35	64	52.5	71.5	28	77.5	69.5	69.5	57.5	104.5	71.5	73.5

XSA Series
Special Option/Replacement Parts

Special Option

Special Electrical Entry Direction

XSA 1 – 1 2 S – 5 G 2 □ – □

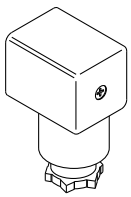
Enter standard product number.

Special electrical entry direction

Symbol	Electrical entry direction
A	90° (90°) IN → OUT →
B	180° (180°) IN → OUT →
C	270° (270°) IN → OUT →

Replacement Parts

● DIN Connector Part No.



<For Class B Coil>

Electrical option	Rated voltage	Connector part no.
None	24 VDC	**3G-GDM2A-G**
	12 VDC	
	100 VAC	
	110 VAC	
	200 VAC	
	220 VAC	
	230 VAC	
	240 VAC	
	24 VAC	
	48 VAC	
With light	24 VDC	**GDM2A-L5**
	12 VDC	**GDM2A-L6**
	100 VAC	**GDM2A-L1**
	110 VAC	**GDM2A-L1**
	200 VAC	**GDM2A-L2**
	220 VAC	**GDM2A-L2**
	230 VAC	**GDM2A-L2**
	240 VAC	**GDM2A-L2**
	24 VAC	**GDM2A-L5**
	48 VAC	**GDM2A-L15**

∗ Select an appropriate DIN connector suitable for the coil insulation type.

● Gasket Part No. for DIN Connector

VCW20-1-29-1 (For Class B Coil)

● Lead Wire Assembly for Flat Terminal (Set of 2 pcs.)

VX021S-1-16FB

XSA Series
Specific Product Precautions 1

Be sure to read this before handling the products. Refer to page 166 for safety instructions. For common precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: https://www.smcworld.com

Design

⚠Warning

1. Cannot be used as an emergency shutoff valve, etc.
The valve presented in this catalog is not designed for safety applications such as an emergency shutoff valve. If valves are used in this type of system, other reliable safety assurance measures should also be adopted.

2. Extended periods of continuous energization
The solenoid coil will generate heat when continuously energized. Avoid using in a tightly shut container. Install the valve in a well ventilated area. Furthermore, do not touch it while it is being energized or right after it has been energized.

Selection

⚠Warning

1. Fluid

1) Type of fluid
Before using a fluid, check whether it is compatible with the materials of each model by referring to the fluids listed in this catalog. (Refer to the Component Parts on page 120.)

2. 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. A filtration size of 5 μm or smaller should be selected.

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.

Refer to "SMC Air Preparation System" for further details on compressed air quality.

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

3. Ambient environment
Use within the operable ambient temperature range. Check the compatibility between the product's composition materials and the ambient atmosphere. Be certain that the fluid used does not touch the external surface of the product.

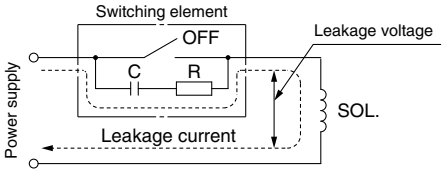
Selection

⚠Warning

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

⚠Caution

1. 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.



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

Mounting

⚠Warning

1. 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.

2. 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.

3. 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.

4. 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.

5. Avoid sources of vibration, or adjust the arm from the body to the minimum length so that resonance will not occur.

6. Painting and coating
Warnings or specifications printed or labeled on the product should not be erased, removed, or covered up.

XSA Series
Specific Product Precautions 2

Be sure to read this before handling the products. Refer to page 166 for safety instructions. For common precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: https://www.smcworld.com

Piping

⚠Caution

1. Preparation before piping
Before mounting, clean the sealing surface with ethanol, etc.

2. Avoid connecting ground lines to piping, as this may cause the electric corrosion of the system.

3. Tightening
Tighten the fitting or female thread as follows.
After tightening, confirm that there is no leakage from the fitting.

Tightening of Fitting

Face seal fitting	1/8 turn after tightening by hand
Compression fitting	1 1/4 turns after tightening by hand

Tightening of Female Thread

NPT, Rc1/8	7 to 9 N·m
NPT, Rc1/4	12 to 14 N·m
NPT, Rc3/8	22 to 24 N·m

4. Connection of piping to products
When connecting piping to a product, avoid mistakes regarding the supply port, etc.

Wiring

⚠Warning

1. The solenoid valve is an electrical product. For safety, install an appropriate fuse and circuit breaker before use.
When using multiple solenoid valves, it is not sufficient to merely install one fuse on the inlet side. In order to ensure the safety of the devices, select and install a fuse for each circuit.

⚠Caution

1. As a rule, use electrical wire with a cross sectional area of 0.5 to 1.25 mm^2 for wiring.
Furthermore, do not allow excessive force to be applied to the lines.

2. Use electrical circuits which do not generate chattering in their contacts.

3. Use a voltage which is within ±10% of the rated voltage. In cases with a DC power supply where importance is placed on responsiveness, stay within ±5% of the rated value. The voltage drop is the value in the lead wire section connecting the coil.

4. When a surge from the solenoid affects the electrical circuitry, install a surge voltage suppressor, etc., in parallel with the solenoid. Or, select an option that comes with a surge voltage protection circuit. (However, a surge voltage occurs even if the surge voltage protection circuit is used. For details, please consult with SMC.)

Operating Environment

⚠Warning

1. Do not use in an atmosphere containing corrosive gases, chemicals, sea water, water, water vapor, or where there is direct contact with any of these.

2. Do not use in explosive atmospheres.

3. Do not use in locations subject to vibration or impact.

4. Do not use in locations where radiated heat will be received from nearby heat sources.

5. Employ suitable protective measures in locations where there is contact with water droplets, oil, welding spatter, etc.

Maintenance

⚠Warning

1. Removing the product
Confirm that the valve temperature has dropped sufficiently before performing work. If touched inadvertently, there is a danger of being burned.
1) Shut off the fluid supply and release the fluid pressure in the system.
2) Shut off the power supply.
3) Dismount the product.

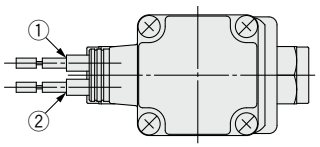
2. Low frequency operation
Switch valves at least once every 30 days to prevent a malfunction. Also, in order to use them under the optimum state, conduct a regular inspection biannually.

Electrical Connections

⚠Caution

■ Grommet

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



Rated voltage	Lead wire color	
	①	②
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

∗ There is no polarity.

XSA Series
Specific Product Precautions 3

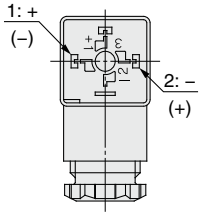
Be sure to read this before handling the products. Refer to page 166 for safety instructions. For common precautions, refer to the "Handling Precautions for SMC Products" and the "Operation Manual" on the SMC website: https://www.smcworld.com

Electrical Connections

⚠Caution

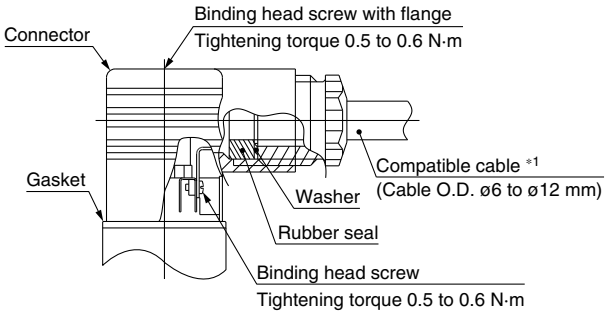
■ DIN terminal

Internal connections for the DIN terminal are shown below. Please make connections to the power supply accordingly.



Terminal no.	1	2
DIN terminal	+ (–)	– (+)

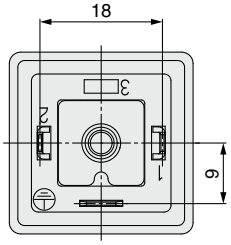
∗ There is no polarity.
- Use a heavy-duty cord with a cable O.D. of ø6 to ø12 mm.
- Use the tightening torques below for each section.



∗1 For cables with an O.D. of ø9 to ø12 mm, remove the internal parts of the rubber seal before using.

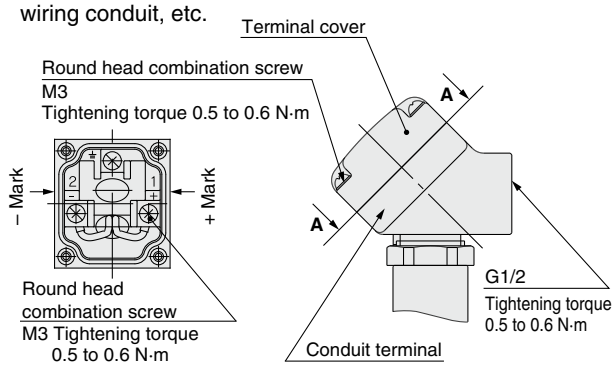
Pitch between the terminals

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



■ Conduit terminal

In the case of the conduit terminal, make connections according to the marks shown below.
- Use the tightening torques below for each section.
- Properly seal the terminal connection (G1/2) with the special wiring conduit, etc.



View A-A

(Internal connection diagram)

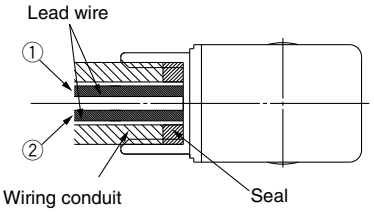
Electrical Connections

⚠Caution

■ Conduit

Use the tightening torque below for the conduit.

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



(Bore size G1/2 Tightening torque 0.5 to 0.6 N·m)

Rated voltage	Lead wire color	
	①	②
DC	Black	Red
100 VAC	Blue	Blue
200 VAC	Red	Red
Other AC	Gray	Gray

∗ There is no polarity.

Description	Part no.
Seal	VCW20-15-6

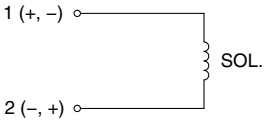
∗ Please order separately.

Electrical Circuits

⚠Caution

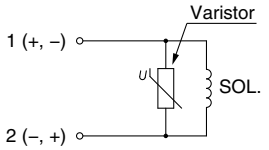
[DC circuit]

Grommet, Flat terminal



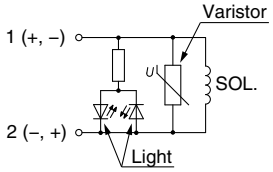
Without electrical option

Grommet, DIN terminal, Conduit terminal, Conduit



With surge voltage suppressor

DIN terminal, Conduit terminal

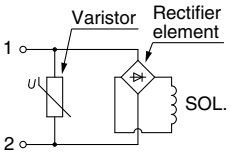


With light/surge voltage suppressor

[AC circuit]

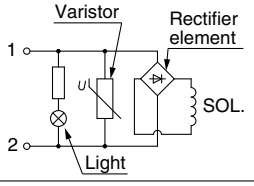
∗ For AC, the standard product is equipped with a surge voltage suppressor.

Grommet, DIN terminal, Conduit terminal, Conduit



Without electrical option

DIN terminal, Conduit terminal



With light/surge voltage suppressor