Installation and Maintenance Manual Series SX3000/5000/7000 Body Ported/Base Mounted Solenoid Valves

For future reference, please keep this manual in a safe place

This manual should be read in conjunction with the current valve catalogue

Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger". To ensure safety, be sure to observe ISO4414 (Note1), JIS B 8370 (Note2) and other safety practices.
Note 1: ISO 4414: Pneumatic fluid power – Recommendations for the application of equipment to transmission and control systems.
Note 2: JIS B 8370: Pneumatic system axiom.

⚠ **CAUTION :** *Operator error could result in injury or equipment damage.*

⚠ **WARNING:** *Operator error could result in serious injury or loss of life.*

⚠ **DANGER :** *In extreme conditions, there is a possible result of serious injury or loss of life.*

⚠ WARNING

1. **The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.**
   Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.
2. **Only trained personnel should operate pneumatically operated machinery and equipment.**
   Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.
3. **Do not service machinery/equipment or attempt to remove component until safety is confirmed.**
   1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
   2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.
   3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of cylinders etc. (Bleed air into the system gradually to create back-pressure, i.e. incorporate a soft-start valve).
4. **Contact SMC if the product is to be used in any of the following conditions:**
   1) Conditions and environments beyond the given specifications, or if product is used outdoors.
   2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage, recreation equipment, emergency stop circuits, press applications, or safety equipment.
   3) An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

⚠ CAUTION

Ensure that the air supply system is filtered to 5 micron.

Valve specifications (body ported)

Series		SX3000	SX5000	SX7000
Fluid		Air		
Internal pilot operating pressure range MPa (kgf/cm²)	2 position single	0.15~0.7 (1.5~7.1)		
	2 position double	0.1~0.7 (1~7.1)		
	3 position	0.2~0.7 (2~7.1)		
Ambient and fluid temperature °C		Max. 50*		
Max. operating frequency Hz	2 position single, double	10	5	5
	3 position	3	3	3
Manual override		Non-locking push type, push-turn locking slotted type		
Pilot exhaust		Common exhaust for main and pilot valve		
Lubrication		Not required		
Mounting position		Free		
Impact/vibration resistance m/s²		150/30 Note		
Protection structure		IP40		

* Use dry air for operation at low temperature to prevent bedewing.
Specifications are subject to change without notice.

Note: Impact resistance: No malfunction from test, using drop impact tester, to axis and right angle direction of main valve and armature , each time when energized and de-energized.
Vibration resistance: No malfunction from test with from 8.3 to 2000Hz 1 sweep, to axis and right angle direction of main valve and armature, each time when energized and de-energized. (Value in the initial stage.)

Valve specifications (base mounted)

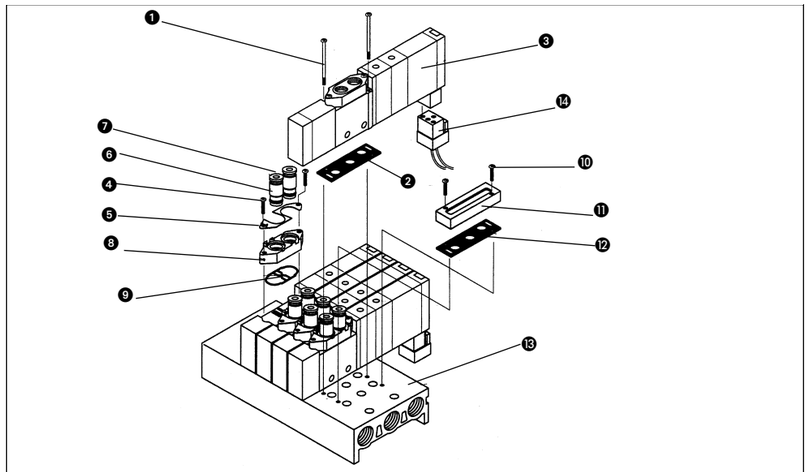
Series			SX3000	SX5000	SX7000
Fluid			Air		
Internal pilot operating pressure range MPa (kgf/cm²)	2 position single		0.15~0.7 (1.5~7.1)		
	2 position double		0.1~0.7 (1~7.1)		
	3 position		0.2~0.7 (2~7.1)		
External pilot operating pressure range MPa (kgf/cm²)	Operating pressure range		-100kPa~0.7 (10 Torr~7.1)		
	Pilot pressure range	2 position single	0.25~0.7 (2.5~7.1)		
		2 position double	0.25~0.7 (2.5~7.1)		
		3 position	0.25~0.7 (2.5~7.1)		
Ambient and fluid temperature °C			Max. 50*		
Max. operating frequency Hz	2 position single, double		10	5	5
	3 position		3	3	3
Manual override			Non-locking push type, push-turn locking slotted type		
Pilot exhaust	Internal pilot		Common exhaust for main and pilot valve		
	External pilot		Individual exhaust for pilot valve		
Lubrication			Not required		
Mounting position			Free		
Impact/vibration resistance m/s²			150/30 Note		
Protection structure			IP40		

* Use dry air for operation at low temperature to prevent bedewing.
Specifications are subject to change without notice.

Note: Impact resistance: No malfunction from test, using drop impact tester, to axis and right angle direction of main valve and armature , each one time when energized and de-energized.
Vibration resistance: No malfunction from test with from 8.3 to 2000Hz 1 sweep, to axis and right angle direction of main valve and armature, each one time when energized and de-energized. (Value in the initial stage.)

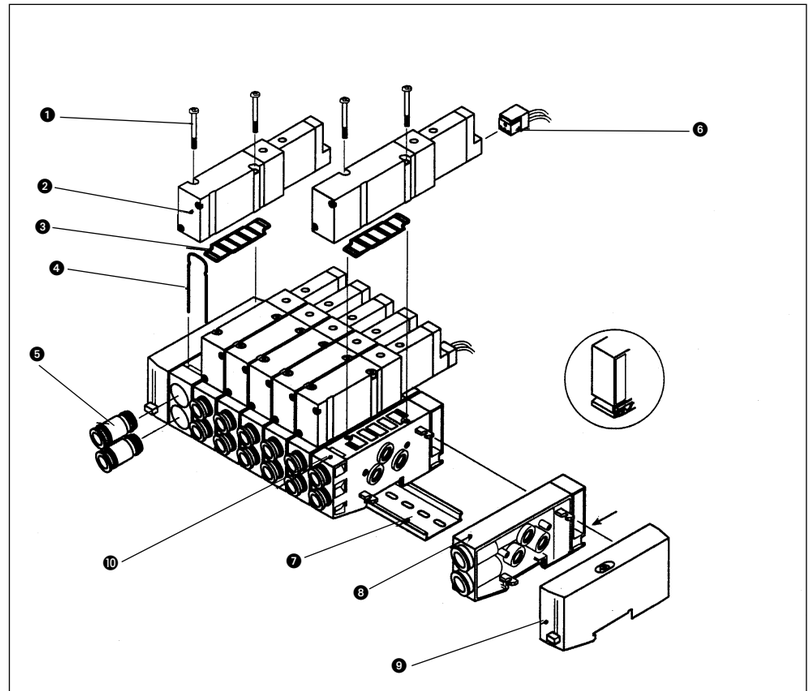
Solenoid specifications

Electrical entry		Grommet (G) · (H), L type plug connector (L), M type plug connector (M)
Coil rated voltage V	DC	24, 12, 6, 5, 3
Allowable voltage		±10% rated voltage
Power consumption W	DC	0.6 (with light: 0.65)
Surge voltage suppressor		Diode
Indicator light		LED



Body ported type
1. Valve mounting screw
2. Gasket (valve)
3. Valve
4. Port block screw
5. Retaining plate
6. Fitting
7. Collet
8. Port block housing
9. Gasket
10. Blanking plate screw
11. Blanking plate
12. Gasket
13. Bar manifold
14. Connector (electrical)

Fig 1



Base mounted type
1. Valve mounting screw
2. Valve
3. Gasket
4. Retaining clip
5. Fitting assembly
6. Connector (electrical)
7. Din-rail
8. Supply and exhaust block
9. End block
10. Manifold block

Fig 2

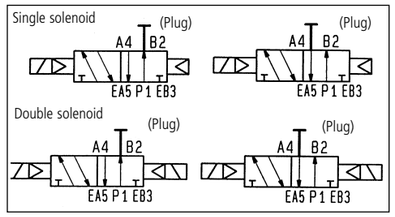
Installation

⚠ CAUTION

Ensure all air and power supplies are isolated before commencing installation.

⚠ WARNING

DO NOT INSTALL THESE VALVES IN EXPLOSIVE ATMOSPHERES.
If these valves are exposed to water or oil droplets, ensure that the valves are protected.
If it is intended to energise a valve for an extended period please consult SMC.



Tube connections (push-in fittings) (Fig 3)

Ensure that the end of the tube is cut square. Push the tube firmly into the fitting until it stops. Pull back on the tube to ensure that it is gripped.

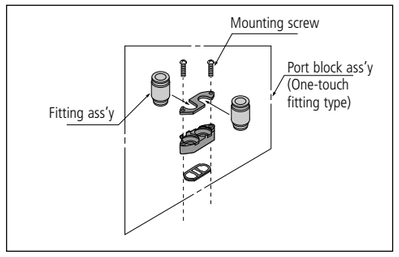


Fig 3

To disconnect the tube push down on the collet flange, hold down, and withdraw the tube from the fitting.

One touch Fittings

The pitch between ports (P, A, B, etc.) of the SX series has been determined subject to use of the series KJ one-touch fittings.
Therefore, use of other fitting models may not be possible due to limited space.

Electrical connection (plug connector) (Fig 4)

Push the connector straight onto the pins of the solenoid valve ensuring that the lip of the lever is securely positioned in the groove of the solenoid cover.

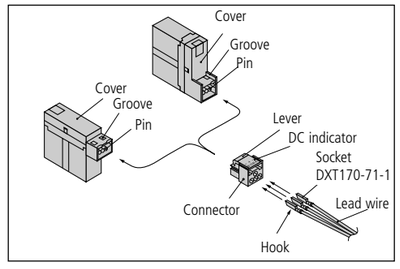


Fig 4

Disconnection (Fig 4)

Press the lever against the connector and pull the connector away from the solenoid.

Lubrication

The valve has been lubricated for life at manufacture and requires no additional lubrication.

⚠ CAUTION

However if a lubricant is to be used, a turbine oil type #1 (ISO VG32) should be used. If a lubricant is used, continuous lubrication must be carried out, as the original lubricant will be washed away.

⚠ WARNING

Manual override operation

Exercise extreme CAUTION when operating a solenoid manual override as connected equipment will commence operation. Ensure all safety measures are in place.

Non locking push type (Fig 5)

1. Push down on the manual override button, until it stops, using a small-bladed screwdriver.

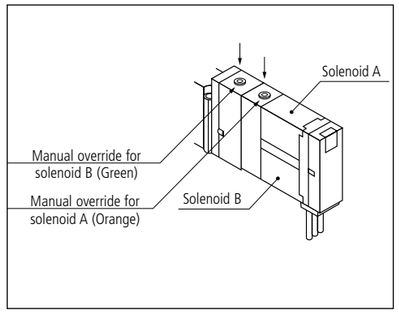


Fig 5

2. Hold this position for the duration of the check (ON position).
3. Release the button and the override will re-set to the OFF position.

Push-locking slotted type (Fig 6)

To lock

1. Using a small-bladed screwdriver in the slot push the manual override down until it stops.

Fig 6

2. Turn the override 90° in the direction of the arrow until it stops (ON position).
3. Remove the screwdriver.

⚠ WARNING

In this position the manual override is in the locked 'ON' position.

To un-lock

1. Place a small-bladed screwdriver into the slot of the manual override.
2. Turn the screwdriver 90° in the reverse direction.
3. Remove the screwdriver. The manual override will re-set to the OFF position.

⚠ CAUTION

The design of the SX series valve is such that the solenoid pilot valve exhausts into the adjacent main valve exhaust.
Ensure that the piping of this common exhaust is not restricted.
Use as a 3 port valve (Fig 7).
The series SX3000, 5000, 7000 may be used as a 3 port valve by plugging one of the A, B, ports.
Be sure not to plug the exhaust port.

Plug position		B port	A port
Configuration		N.C.	N.O.
Number of solenoids	Single	Plug	Plug
	Double	Plug	Plug

Fig 7

Ensure that the exhaust ports are NOT plugged. This allows the valve to be used, for example, as a 3 port double solenoid valve.

⚠ CAUTION

Leakage voltage (Fig 8)

Please note, when connecting a C-R element, in parallel to the switching element, leakage current flows through the C-R element and the leak voltage will increase.

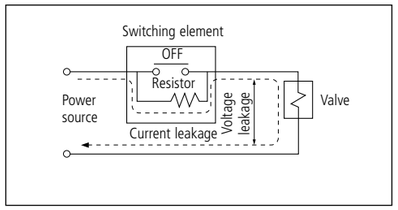


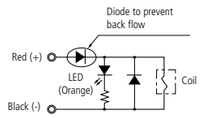
Fig 8

Ensure that the voltage leakage across the coil does not exceed 3% of the rated voltage.

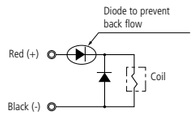
Surge voltage suppressor (Fig 9)

Positive common specification

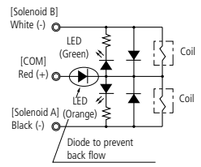
Single solenoid type
Indicator light and surge voltage suppressor



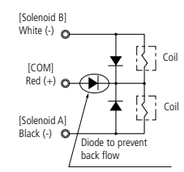
Surge voltage suppressor



Double solenoid, 3 position type
Indicator light and surge voltage suppressor

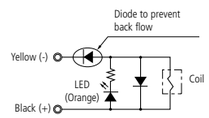


Surge voltage suppressor

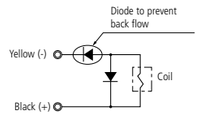


Negative common specification

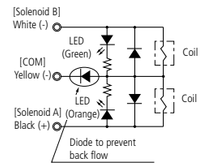
Single solenoid type
Indicator light and surge voltage suppressor



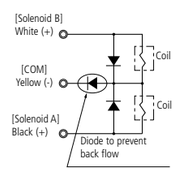
Surge voltage suppressor



Double solenoid, 3 position type
Indicator light and surge voltage suppressor



Surge voltage suppressor



- Please correctly connect the lead wire to (+) (positive) and (-) (negative) indications on the connector.
- For DC voltages other than 12, 24 incorrect wiring will cause damage to the surge voltage suppressor circuit. (Wrong polarity will cause trouble.)
- Solenoids, whose lead wires have been pre-wired, are positive side red and negative side black.

Positive common specification	A (-):	Black
	COM (+):	Red
	B (-):	White (without lead wire in case of single solenoid)
Negative common specification	A (+):	Black
	COM (-):	Yellow
	B (+):	White (without lead wire in case of single solenoid)

Fig 9

Indicator light (Fig 10)

When indicator lights with surge voltage suppressor are used, the orange indicator light refers to solenoid A, and the green indicator light to solenoid B, when energised.

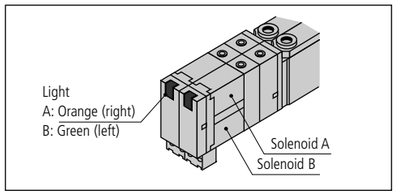


Fig 10

⚠ CAUTION

Installation of DIN Rail Manifold
When DIN Rail manifold (type 45, 45x) is installed with a bolt fix by the bolt at 2 places for 2~5 stations, at 3 places for 6~10 stations, at 4 places for 11~15 stations and 5 places for 16~20 stations..
If fixed number of stations is insufficient, DIN Rail and manifold may bend. Finally air leakage will occur.

Fittings tightening torque

Thread	Tightening torque N-m (kgf/cm)
M5	1.5~2 (15~20)
Rc (PT) 1/8	7~9 (70~90)
Rc (PT) 1/4	12~14 (120~140)
Rc (PT) 3/8	22~24 (220~240)

Maintenance

⚠ WARNING

Ensure air and electrical supplies are isolated before commencing any maintenance work.

Porting block (body ported) (Fig 1)

To remove/replace the fittings (SX3000 series only)
1. Remove the two retaining screws ❹.
2. Remove retaining plate ❺, port block ❽, fittings ❻ and retain gasket ❾.
3. Remove fittings ❻ from port block ❽.

Replacement
1. Fit replacement fitting ❻ into port block ❽.
2. Refit retaining clip ❺.
3. Ensure gasket ❾ is in position.
4. Replace port block ❽ complete with retainer ❺ and fittings ❻.
5. Replace and tighten retaining screws ❹ to the following torque figures: 0.09N-m (0.9 kgf/cm).

To change port block assembly (SX5000/7000 series) (Fig 11)

1. Remove retaining screws ❶.
2. Lift off porting block ❷ or ❹ retain gasket.
3. Ensure gasket ❸ is in position.
4. Replace porting block ❷ or ❹.
5. Replace and tighten screw ❶ to the correct torque.

Tighten to the following torque figure:
0.6N-m (6 kgf/cm).

Manifold push-in fitting removal/replacement (Fig 2)

Removal of a valve (Fig 2)
1. Disconnect electrical connector ❻.
2. Remove two retaining screws ❶.
3. Lift valve off the manifold block ❿.
4. Retain gasket ❸.

Removal of fittings (Fig 2)
1. Prise out retaining clip ❹.
2. Remove fittings ❺ from manifold block ❿.
3. Replace fittings ❺ into manifold block ❿.
4. Re-fit retaining clip ❹.

Note1) P and R ports cannot be changed.
Note 2) O-rings must be free from scratches and dust. Otherwise, air leakage may result.

Replacing the valve (Fig 2)
1. Ensure gasket ❸ is correctly in position on the manifold block ❿.
2. Position the valve ❷ onto the manifold block ❿.
3. Re-fit and tighten the two retaining screws ❶.
4. Re-connect the electrical connector ❻.

Tighten valve retaining screws to the following torque figures:

SX3000	0.15N-m {1.5 kgf/cm}
SX5000	0.6 N-m {6 kgf/cm}
SX7000	1.4 N-m {14 kgf/cm}

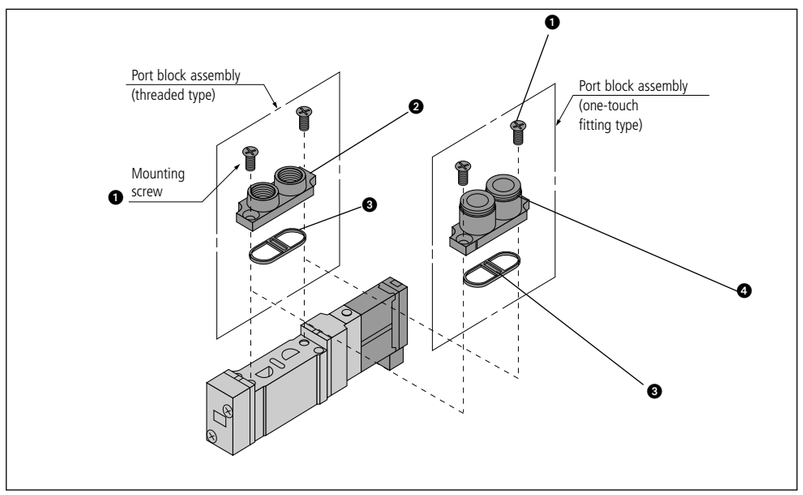


Fig 11

Blanking plate (Fig 12)

A blanking plate may be fitted on an unused manifold station.

Fitting blanking plate
Ensure gasket ❸ is correctly fitted to manifold.

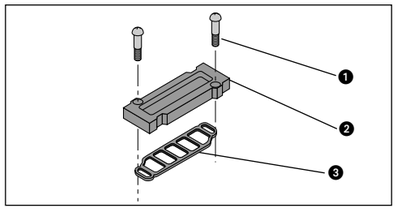


Fig 12

Fit blanking plate ❷ to manifold.
Fit and tighten retaining screws.
Removal is the reverse of the above. Ensure gasket is retained.

Supply block disc (Fig 13)

When supplying a manifold with more than one pressure insert a block disc between the stations subjected to independent pressure supplies.

Exhaust block disc (Fig 13)

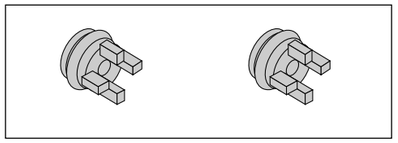


Fig 13

If a valve exhaust has an effect on other stations in the circuit or an externally piloted dual pressure valve is used on a standard manifold, insert exhaust block disc(s) in between stations to isolate the exhaust.

Block disc indication (Fig 14 a, b, c)

These indicators are applied to the manifold block containing block discs for external confirmation.

Label for SUP block disc

Fig 14a

Label for EXH block disc

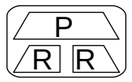


Fig 14b

Label for SUP, EXH block disc

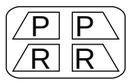


Fig 14c

Note: When ordering block disc installed at the factory, labels will be attached to the manifold showing the locations.

Individual supply spacer assembly (Fig 15)

When it is required to supply a valve, on a manifold station with an independent air supply, individual supply spacer can be fitted between the valve and manifold base.

Fitting an individual supply spacer (Fig 15)
Remove the valve from the manifold (see above).
Fit supply spacer gasket ❺ to manifold.
Fit supply spacer ❹ to manifold.
Fit valve gasket ❸ to supply spacer.
Re-fit valve to supply spacer.
Fit and tighten valve retaining screws.

Individual SUP spacer assembly

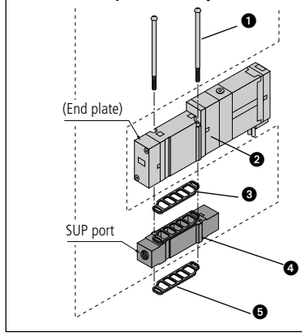


Fig 15

Individual exhaust spacer assembly (Fig 16)

When it is required to separate an individual valve exhaust an individual exhaust spacer can be fitted.

Fitting an individual exhaust spacer (Fig 16)
As for fitting supply spacer (above).

Individual EXH spacer assembly

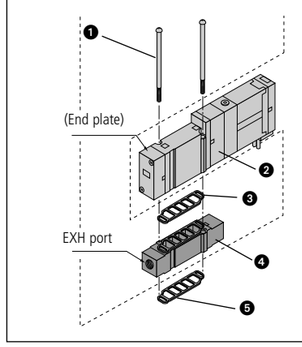


Fig 16

⚠ CAUTION

The supply and exhaust ports may be fitted either at the lead wire end of the valve or the end plate side. If supplied factory-assembled they are fitted at the end plate side.
For protection of the wiring unit section from drain, piping at the EA port shall be so arranged that it will not be directly exposed to exhaust from the valve.

Increasing manifold stations (Figs 17, 18, 19, 20 & 21)

Slacken captive bolt (a) (Fig 17). Press DIN rail release button (c) (Fig 17) and separate the manifold base from the DIN rail.

Note: Additional bases must be added to the 'U' side of the manifold.

Press splitting button (b) (Fig 17), until the button locks, and then separate the manifold blocks.
Separate the connector block (Fig 18) as in 3 above. Remove, and retain the connector mounting screw ❶ (Fig18).

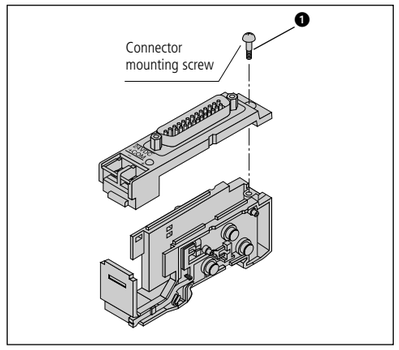


Fig 18

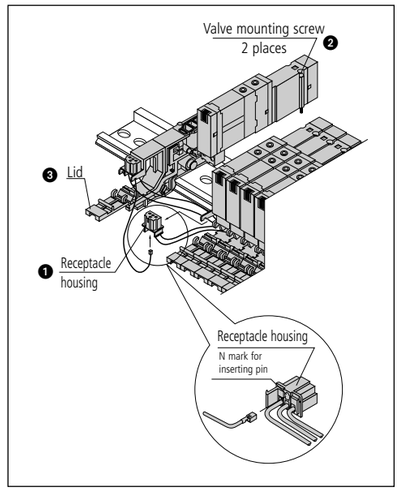
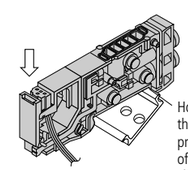


Fig 19

Note 1) When adding manifold bases to use more than 10 stations, add SUP/EXH block assemblies as well.
Note 2) When bolt for the end block is not sufficently tightened during reassembly air leakage may result. Before supplying air, check that there is no gap between blocks and that the manifold block is firmly fixed to the DIN rail in order to ensure air supply without leakage.



Hook this section on the DIN rail and press in the direction of the arrow until a click sound is generated

Fig 20

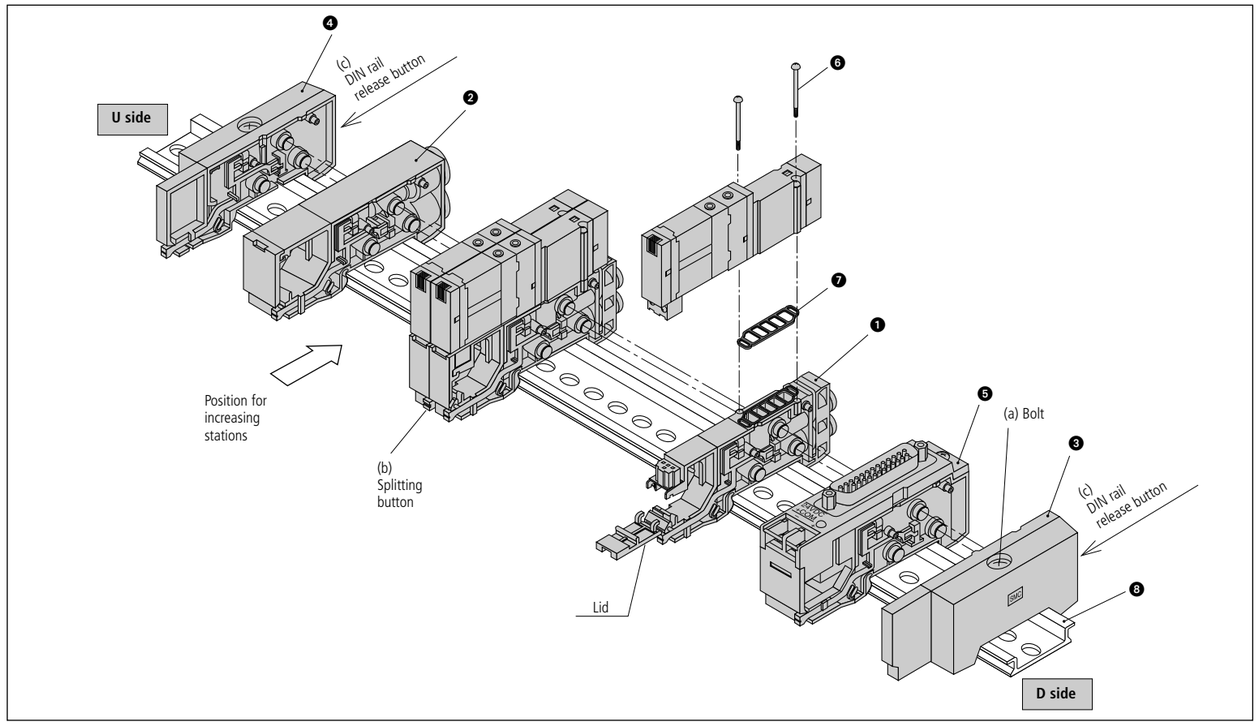
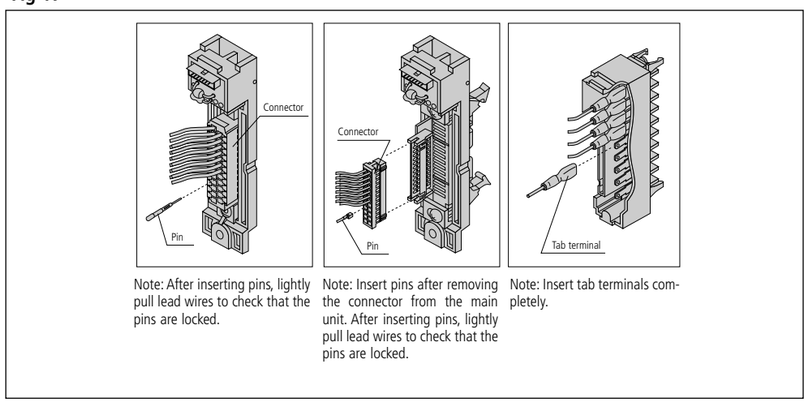


Fig 17



Note: After inserting pins, lightly pull lead wires to check that the pins are locked.

Note: Insert pins after removing the connector from the main unit. After inserting pins, lightly pull lead wires to check that the pins are locked.

Note: Insert tab terminals completely.

Fig 21

Slacken the valve mounting screws ❷ (Fig 19), on the 'U' side, remove the valve, and take out the receptacle housing ❶ (Fig 19).
Insert the common wire (red) of the manifold block to be added into the pin insertion section (N mark) (Fig 19), of the receptacle removed in 5 above. Refit the receptacle to the manifold.
Fit the additional manifold block to the DIN rail, on the 'U' side. Refer to the circuit diagram, and the lead wires into the connector (Fig 21).
Note: SOL. A black wire, SOL. B white wire (Fig 21).
Re-fit the connector block assembly.
Press the blocks together until an audible 'click' is heard.
Feed the lead wire into the manifold block, taking care not to trap the wire, close the lid ❸ (Fig 19).
Ensure that there is no gap between the blocks, re-tighten bolt (a) (Fig 17) to a torque figure of 1N-m.

⚠ CAUTION

1. Depending on the type of connector there is a limit to the number of solenoids that can be used. Manifold bases that are to be added cannot exceed the number of usable solenoids. When all manifold stations are wired for double solenoids, expansion of the manifold may not be possible. Consult SMC for further information.
2. The manifold block assembly mounting position for addition of manifold bases is always on the U side, because wires are connected to respective connectors sequentially from the D side.
3. When bolt (a) for the end block is not sufficently tightened during reassembly, air leakage may result. Before supplyiing air, check that there is no gap between blocks and that the manifold block is firmly fixed to the DIN rail in order to ensure air supply without leakage.

'Q' suffix modification

Valve orientation

Body ported

In order to prevent incorrect valve assembly to a base or manifold, a machined hole ❹ is inserted into the valve body and also into the base/manifold ❺.
The valve sealing gasket ❸ has upper and lower protrusions which insert into the above-mentioned holes in the body and manifold.

Manifold mounted

The base mounted valve is fitted with a location pin ❹ adjacent to the solenoid end. A matching hole ❺ is machined into the manifold, and the gasket ❸ has a matching hole to accept the above pin, ensuring that location is correct on assembly.

When you enquire about the product, please contact the following

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