Installation and Maintenance Manual
Series VFR2000, VFR3000, VFR4000, VFR5000, VFR6000 5 Port Solenoid Valves
Base Mounted Type (Plug-in, Non Plug-in)

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

This manual should be read in conjunction with the current 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.

Standard specifications

			VFR2000	VFR3000	VFR4000	VFR5000	VFR6000
Valve	Fluid		Air				
	Operating pressure range Mpa {kgf/cm²}	2 position single, 3 position	0.2~0.9 {2~9.2}				
		2 position double	0.1~0.9 {1~9.2}				
	Ambient and fluid temperature ºC		Max. 50				
	Max. operating frequency (Hz)	2 position, single, double	10	5	5	5	2
		3 position	5	3	3	3	1
	Lubrication		Note) Not required				
	Manual override		Non-locking push type, direct manual (VFR2000)				
	Impact/vibration resistance (G) note1)		300/50m/s²				
	Protection structure		Din connector: IP65 Plug-in type: IP54				
Electricity	Coil insulation		100. 200VAC (50/60Hz), 24VDC				
	Allowance voltage range		-15%~+10% Rated voltage				
	Apparent power AC	Inrush VA	5.6/50Hz, 5.0/60Hz				
		Holding VA	3.4/50Hz, 2.3/60Hz				
	Power consumption DC W		1.8				
	Electrical entry		Plug-in type	Conduit terminal			
			Non plug-in type	DIN connector			

Note: Use turbine oil No. 1 (ISO VG32) if lubricated.
Note 1: Shock 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 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. (Primary value)

Installation

⚠ WARNING

Ensure all air and power supplies are ISOLATED before commencing installation.
Do not install these valves in explosive atmospheres.
If these valves are exposed to water or oil droplets, ensure that they are protected.
If it is intended to energise a valve for an extended period, please consult SMC.
If air leakage causes associated equipment to malfunction cease using valve and inspect for cause.
Check fixings while pressure and power are applied. Initial function and leakage tests should be performed after installation.
Install only once safety instructions have been read and understood.

Electrical connection

Wiring

⚠ CAUTION

Isolate both power and air supplies before removing/replacing connector.

Series VFR2000, 3000, 4000

Electrical entry (Fig 2, 3)

Plug-in type (with terminal block board)
If you remove the junction cover ❶ on the subplate, you will see the plug-in type terminal block board ❷ attached to the inside of subplate.

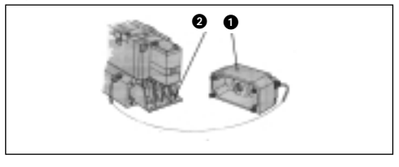
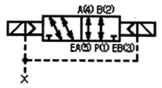
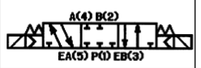
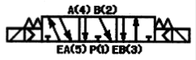
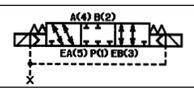
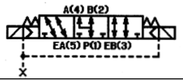
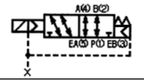
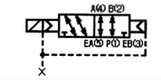
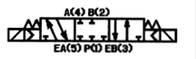
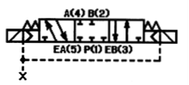
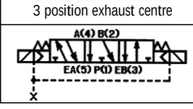
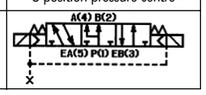


Fig 2

VFR2000, VFR3000 5 port			
Internal pilot type		External pilot type	
2 position single	2 position double	2 position single	2 position double
			
3 position closed centre	3 position exhaust centre	3 position closed centre	3 position exhaust centre
			
3 position pressure centre		3 position pressure centre	
			

VFR4000, VFR5000, VFR6000 5 port			
Internal pilot type		External pilot type	
2 position single (VFR4000)	2 position single (VFR5000/6000)	2 position single (VFR 4000)	2 position single (VFR5000)
			
2 position double	3 position closed centre	2 position double	3 position closed centre
			
3 position exhaust centre	3 position pressure centre	3 position exhaust centre	3 position pressure centre
			

The following marking are these on the terminal block board. Connect with corresponding power side.

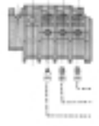


Fig 3

+, - indicate the direction of DC solenoid valve with light or with surge voltage suppressor. However, in the case of VFR 3000 there is no polarity.
Applicable terminal
VFR2000, VFR3000: 1.25-3, 1.25-3S, 1.25Y-3N, 1.25Y-3S
VFR4000: 1:25-3.5M, 1.25Y-3L, 1.25Y-3M

Plug-in type (with terminal block box) (Fig 4,5,6,7)
Series VFR5000
Remove junction cover for sub-plate ❶, depress levers ❸ of terminal block assembly ❷, draw out terminal block assembly.

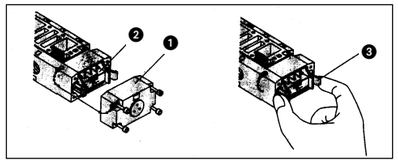
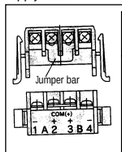


Fig 4

Terminal block assembly is marked as below. Connect it to power supply side.



Model \ Terminal block box marking	A-(1)	B+(3)	B-(4)
VFR510 □	A side	COM	
VFR520 □	A side	COM	B side
VFR540 □ (3,4,5)	A side	COM	B side

Fig 5

The terminal block assembly can be used as positive and negative common regardless of markings. Do not remove jumper bar because it is used for common connection.

Applicable connecting terminal
1.25-4, 1.25-4M

Series VFR6000
Remove junction cover ❶ of sub-plate, connect it to terminal block assembly ❷.

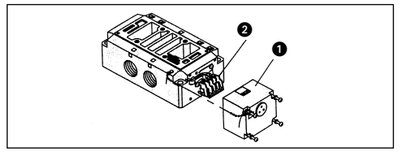
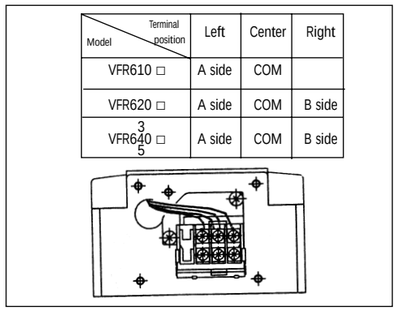


Fig 6

Terminal block assembly is wired as following figure. Connect it to each power supply side.
Since there is no polarity, it is possible to use as positive or negative common.

Applicable connecting terminal
1.25-4, 1.25-4M



Model \ Terminal position	Left	Center	Right
VFR610 □	A side	COM	
VFR620 □	A side	COM	B side
VFR640 □ (3,5)	A side	COM	B side

Fig 7

Non plug-in type
Series VFR2000

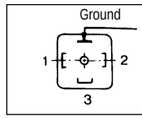
D-type: In the case of a DIN connector the internal wiring is shown below (Fig 5). Please connect with corresponding power side.

With DIN connector board

Fig 8

Cable
D-type: ø6~ø8mm (made by O.M.A.L.)
ø4.5~ø7mm (made by Hirschman)
Applicable terminal (made by Hirschman)
1.25-3, 1.25-35, 1.25Y-3, 1.25Y-3.5

Series VFR3000, 4000, 5000, 6000 (VFR3□10, 4□10)
DIN connector type
Male pin terminal of DIN connector block board of solenoid valves are wired as shown below (Fig 9). Please connect each valve to corresponding terminal block board on connector.



Terminal No.	Internal wiring
1	A side -
2	B side -
3	COM+
⏚	Ground

Fig 9

+, - indicate the direction of DC solenoid valve with light, surge voltage suppressor.

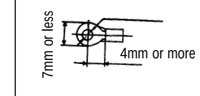
Cabtyre cable
ø6.8~ø11.5mm (Made by Hirschman)
ø8~ø10mm (Made by Jalco)

Applicable terminal
Maximum size of terminal is up to 1.25 mm²-3.5 in the case of O terminal and is up to 1.25 mm²-4 in the case of Y terminal (made by Hirschman).

Connector/clamping torque
Set screw 5kgf·cm (made by Hirschman)
Terminal screw 5kgf·cm (made by Hirschman)

Applicable torque of connector area
Connector cap thread 0.5 to 0.6Nm {5.1 to 6.1 kgf/cm} (made by Jalco)
Terminal thread 0.5 to 0.6Nm {5.1 to 6.1 kgf/cm} (made by Jalco)

Applicable connecting terminal
As below (made by Jalco)



Equivalent to R1.25-3 regulated JIS C2805

Equivalent to 1.25-3X made by Japan Connecting Terminal Sales Corporation

Fig 10

Incorrect common (DIN connector No. 3) causes damage on power side circuit.

Table ❶ Series VFR2000 (VFR2□00), Series VFR3000, 4000 (VFR3□0, 4□0), Series VFR5000, 6000

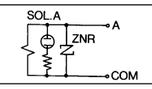
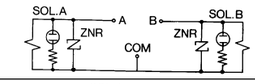
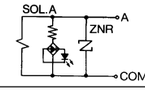
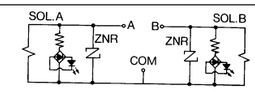
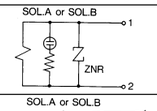
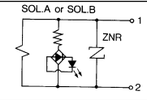
Voltage specifications		Indicator light and surge voltage suppressor
AC and 100VDC or more	Single solenoid	
	Double solenoid	
24 VDC or less	Single solenoid	
	Double solenoid	

Table ❷ Series VFR2000 (VFR2□10), Series VFR3000, 4000 (VFR3□40, 4□40)

Voltage specifications	Indicator light and surge voltage suppressor
AC and 100VDC or more	
24 VDC or less	

* For rated voltages between 25VDC~99VDC please contact your SMC representative.

Lead wire wiring: Manifold/plug-in type

Type 01T with terminal block board (Fig 11)
Series VFR2000
Remove junction cover of manifold exposing terminal block board attached to the manifold block. Lead wires from solenoid valve are connected with the terminals on upper side of terminal block board. (On the terminal block board, lead wire is connected with both A and B sides of solenoid valve in accordance with the corresponding markings A and B on the block board).
Connect each lead wire of power side corresponding to each respective solenoid valve on the lower terminal block board. Terminal block wiring specification is in accordance with +COM.

Model \ Block board marking	A-	B+	B-
VFR2100	A side-	COM+	
VFR2200	A side-	COM+	B side-
VFR (3,4,5) 00	A side-	COM+	B side-

Applicable terminal:
1.25-3, 1.25-3S, 1.25Y-3N, 1.25Y-3S
+, - indicate the direction of DC solenoid valve with light-surge voltage suppressor.

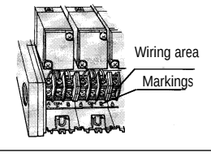


Fig 11

Series VFR3000

Model \ Block board marking	A-	B+	B-
VFR3100	A side-	COM+	
VFR3200	A side-	COM+	B side-
VFR3 $\frac{1}{5}$ 00	A side-	COM+	B side-

Applicable terminal:
1.25-3.5M, 1.25Y-3L, 1.25-3M
VFR3000 has the marking +COM on the block board, but -COM specification is also available.

Series VFR4000

Model \ Block board marking	A-	B+	B-
VFR4100	A side-	COM+	
VFR4200	A side-	COM+	B side-
VFR4 $\frac{2}{5}$ 00	A side-	COM+	B side-

Applicable terminal:
1.25-3.5M, 1.25Y-3L, 1.25-3M
+, - indicate the direction of DC solenoid valve with light/surge voltage suppressor.

Series VFR5000

Model \ Terminal block marking	A-	COM+	B-
VFR5100	A side	COM	
VFR5200	A side	COM	B side
VFR5 $\frac{2}{5}$ 00	A side	COM	B side

Applicable contact terminal:
1.25-3.5M, 1.25Y-3L, 1.25-3M
It is possible to use as positive and negative COM even though "A-", "B+" and "B-" are marked on VFR5000 terminal block.

Piping (Fig 12)

1. Ensure that the pipe is clean of swarf, cutting oil, dust etc.
2. When screwing the pipe of fitting into a port ensure that any sealant is prevented from entering the valve. When using sealing tape leave the first 1.5~2 threads free of tape.

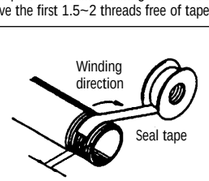


Fig 12

Tightening torque

Thread	Correct clamping torque (kgf/cm) (N-m)
Rc(PT) $^1/_8$	70~90 (7~9)
Rc(PT) $^1/_4$	120~140 (12~14)
Rc(PT) $^3/_8$	220~240 (22~24)
Rc(PT) $^1/_2$	280~300 (28~30)
Rc(PT) $^3/_4$	280~300 (28~30)
Rc(PT) 1	360~380 (36~38)

Leakage Voltage (Fig 13)

Note that when using a C-R device (Surge voltage suppresser) for contact protection, the voltage leakage may increase due to the current leakage flowing through the C-R device.

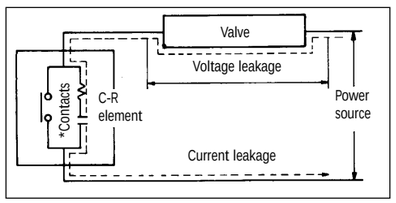


Fig 13

Suppress residual voltage leakage as follows:
DC Coil 3% or less of rated voltage
AC Coil 20% or less of rated voltage

Lubrication

These valves have been lubricated for life during manufacture and as such require no further lubrication.

⚠ CAUTION

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

Manual override operation (Fig 14).

⚠ WARNING

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

Slotted locking type
To lock
1. Insert a small-bladed screwdriver into the slot.
2. Turn the override through 90° (ON position).
3. Remove screwdriver

⚠ WARNING

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

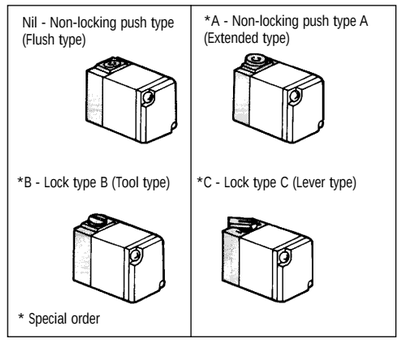


Fig 14

To Unlock
1. Insert 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.

Lever locking type
As above but lever can be turned without tool.

Maintenance

⚠ WARNING

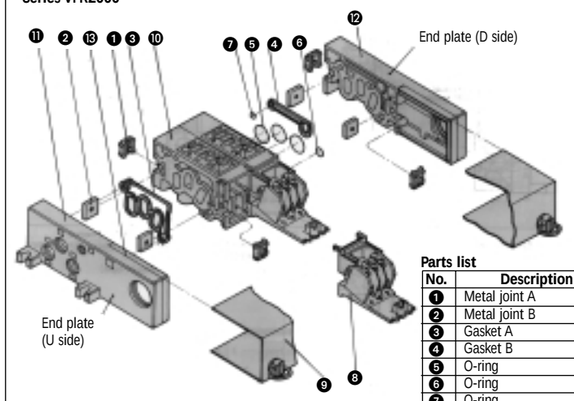
Ensure air and electrical supplies are isolated before commencing any maintenance work.

Mounting
When disassembling and reassembling ensure that all components are in their proper positions. Prevent gaskets from moving and torque screws down equally.
Single solenoid operated valves may be mounted in any attitude. However, double solenoid should be mounted so the spool is horizontal. If valves are subjected to vibration ensure spool is aligned perpendicular to the vibration. Never use in conditions where vibrations exceed 5G.
Completely flush dust and scale from the inside of both supply and secondary ports before connecting.

Manifolds (Fig 15, 16, 17)

Manifold base construction: Plug-in type/non plug-in type/dimensions (mm)

Series VFR2000

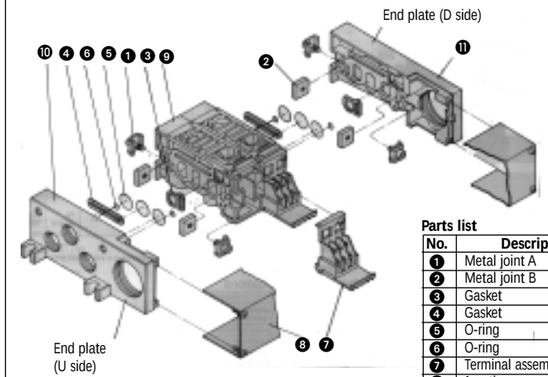


Parts list

No.	Description	Material
1	Metal joint A	Steel plate
2	Metal joint B	Steel plate
3	Gasket A	NBR
4	Gasket B	NBR
5	O-ring	NBR
6	O-ring	NBR
7	O-ring	NBR
8	Terminal assembly	-
9	Junction cover assembly	-

Fig 15

Series VFR3000

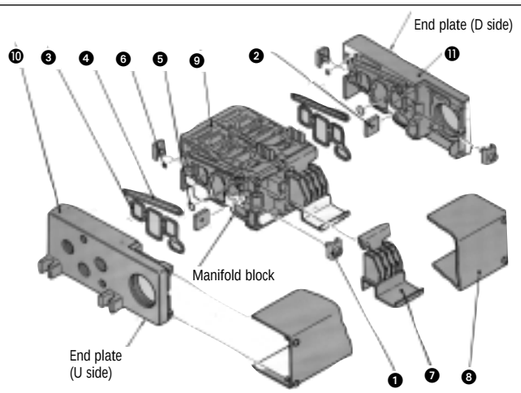


Parts list

No.	Description	Material
1	Metal joint A	Steel plate
2	Metal joint B	Steel plate
3	Gasket	NBR
4	Gasket	NBR
5	O-ring	NBR
6	O-ring	NBR
7	Terminal assembly	-
8	Junction cover assembly	-

Fig 16

Series VFR4000



Parts list

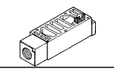
No.	Description	Material
1	Metal joint A	Steel plate
2	Metal joint B	Steel plate
3	Gasket	NBR
4	Gasket	NBR
5	O-ring	NBR
6	O-ring	NBR
7	Terminal assembly	-
8	Junction cover assembly	-

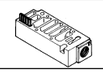
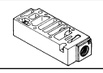
Fig 17

Accessories

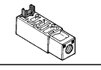
Individual Supply spacer
An individual supply spacer complete with gasket may be fixed between valve and subplate so as to provide an individual pressure supply to any valve.

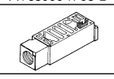
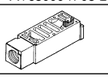
Body type		Plug-in type	Non plug-in type
Part No.	$^1/_8$	VVFS2000-P-01-1	VVFS2000-P-01-2
	$^1/_4$	VVFS2000-P-02-1	VVFS2000-P-02-2
Type			

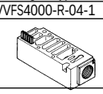
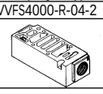
Body type	Plug-in type	Non plug-in type
Part No.	VVFS3000-P-03-1	VVFS2000-P-03-2
Type		

Body type	Plug-in type	Non plug-in type
Part No.	VVFS4000-P-03-1	VVFS4000-P-03-2
Type		

Individual Exhaust spacer
An individual exhaust spacer complete with gasket may be fixed between valve and subplate so as to provide an individual exhaust for any valve.

Body type		Plug-in type	Non plug-in type
Part No.	$^1/_8$	VVFS2000-R-01-1	VVFS2000-R-01-2
	$^1/_4$	VVFS2000-R-02-1	VVFS2000-R-02-2
Type			

Body type	Plug-in type	Non plug-in type
Part No.	VVFS3000-R-03-1	VVFS3000-R-03-2
Type		

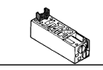
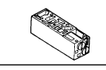
Body type	Plug-in type	Non plug-in type
Part No.	VVFS4000-R-04-1	VVFS4000-R-04-2
Type		

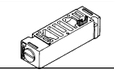
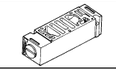
Exhaust block disk

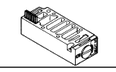
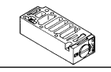
If valve exhaust affects the function of other valves on the manifold then an exhaust block disk may be fitted between the sub plates so as to occlude exhaust galleries.

Body type	Plug-in type	Non plug-in type
Part No.	AXT625-12A	
Type		

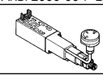
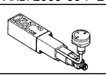
Interface speed control
Needle valve set on the manifold block can control cylinder speed by throttling the exhaust.

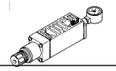
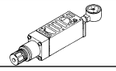
Body type	Plug-in type	Non plug-in type
Part No.	VVFS2000-2OA-1	VVFS2000-2OA-2
Type		

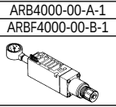
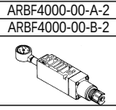
Body type	Plug-in type	Non plug-in type
Part No.	VVFS3000-2OA-1	VVFS3000-2OA-2
Type		

Body type	Plug-in type	Non plug-in type
Part No.	VVFS4000-2OA-1	VVFS4000-2OA-2
Type		

Interface pressure regulator
Spacer type regulating valve set on manifold block can regulate the pressure to each valve.

Body type	Plug-in type	Non plug-in type
Pressure regulation P	ARBF2000-00-P-1	ARBF2000-00-P-2
Type		

Body type	Plug-in type	Non plug-in type
Pressure regulation P.	ARBF3000-00-P-1	ARBF3000-00-P-2
Pressure regulation A	ARBF3000-00-A-1	ARBF3000-00-A-2
Pressure regulation B.	ARBF3000-00-B-1	ARBF3000-00-B-2
Type		

Body type	Plug-in type	Non plug-in type
Pressure regulation P.	ARBF4000-00-P-1	ARBF4000-00-P-2
Pressure regulation A	ARB4000-00-A-1	ARBF4000-00-A-2
Pressure regulation B.	ARBF4000-00-B-1	ARBF4000-00-B-2
Type		

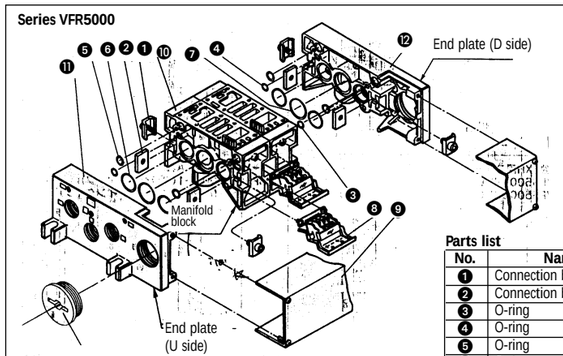
Blanking plate

Where spare manifold stations are required , a blanking plate can be fixed to the manifold.

Environment

When valve is mounted in a control panel or is energised for long periods of time, make sure the ambient temperature is within the specified range.

Series VFR5000

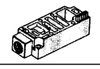
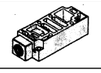


Parts list

No.	Name	Material
1	Connection bracket A	Steel plate
2	Connection bracket B	Steel plate
3	O-ring	NBR
4	O-ring	NBR
5	O-ring	NBR
6	O-ring	NBR
7	O-ring	NBR
8	Terminal block assembly	-
9	Junction cover assembly	For 01T
		For 01SU
13	Rubber plug	NBR

Fig 18

Individual SUP interface
Supply port can be located at each valve individually after individual SUP interface is mounted on manifold block.

Body type	Plug-in type	Non plug-in type
Part No.	VVFS5000-P-04-1	VVFS5000-P-04-2
Type		

Individual EXH interface
Exhaust port can be located at each valve individually after individual EXH interface is mounted on manifold block. (Common EXH type)

Body type	Plug-in type	Non plug-in type
Part No.	VVFS5000-R-04-1	VVFS5000-R-04-2
Type		

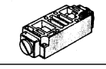
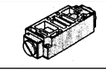
SUP block plate
When 2 or more pressures (high and low) are supplied to one manifold, insert the block between the stations which are supplied different pressure.

Body type	Plug-in type	Non plug-in type
Part No.	AXT628-12A	

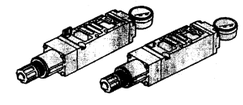
EXH block plate
Use exhaust blocks to eliminate back flow to other stations. Use supply blocks to operate two pressure on the same manifold.

Body type	Plug-in type	Non plug-in type
Part No.	AXT512-14-1A	
Type	EXH block plate	SUP block plate

Interface speed controller
Mount interface speed controller on manifold block. Cylinder speed can be controlled by metered out flow.

Body type	Plug-in type	Non plug-in type
Part No.	VVFS5000-20A-1	VVFS5000-20A-2
Type		

Interface regulator
When interface regulator is mounted on manifold block, regulation to that valve is possible.

Body type	Plug-in type	Non plug-in type
P regulation	ARBF5050-00-P-1	ARBF5050-00-P-2
A regulation	ARBF5050-00-A-1	ARBF5050-00-A-2
B regulation	ARBF5050-00-B-1	ARBF5050-00-B-2
		

Blank plate
Used to reserve a valve mounting space on the manifold for future use.

Body type	Plug-in type	Non plug-in type
Part No.	VVFS5000-10A	

When you enquire about the product, please contact the following

SMC Corporation:

ENGLAND	Phone 01908-563888	**TURKEY**	Phone 212-2211512
ITALY	Phone 02-92711	**GERMANY**	Phone 6103-402-0
HOLLAND	Phone 020-5318888	**FRANCE**	Phone 01-64-76-10-00
SWITZERLAND	Phone 052-396 31 31	**SWEDEN**	Phone 08-603 07 00
SPAIN	Phone 945-184100	**AUSTRIA**	Phone 02262-62-280
	Phone 902-255255	**IRELAND**	Phone 01-4501822
GREECE	Phone 01-3426076	**DENMARK**	Phone 70 25 29 00
FINLAND	Phone 09-68 10 21	**NORWAY**	Phone 67-12 90 20
BELGIUM	Phone 03-3551464	**POLAND**	Phone 48-22-6131847
		PORTUGAL	Phone 02-610 8922