



# Installation and Maintenance Manual ZX Series Vacuum Unit

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.

## Specifications (Fig 2) and Figs 1, 3, 4 and 5

Unit combinations available for either ejector system or vacuum pump system, with modular design. See Fig 17.

No.	Designation	Material	Note
1	Poppet valve assembly	—	ZX1-PV-0
2	Vacuum switch	—	ZSE2-OX-15, ZSP1OX-15
3	Pilot valve	—	VJ100.300.Air operated/Models: as per following list
4	Valve body assembly	—	ZX1-VD
5	Ejector assembly	—	Models: as per following list
6	Silencer case	PBT	
7	Manifold base	Aluminum	
8	Breaking flow rate regulation needle	SUS	
9	Interface plate	PBT	
10	Filter element	PVF	ZX1-FE, Filtration 30µm

Note: Return spring: For vacuum pump system use only.

## Fig 1

### Ejector Unit

Specifications	Unit port No.	ZX1-W05	ZX1-W07	ZX1-W10
Nozzle diameter mm ø		0.5	0.7	1.0
Max. suction flow rate Nl/min		5	10	22
Air consumption Nl/min		13	23	46
Max. vacuum pressure			-630mm/Hg	
Max. operating pressure			7 kgf/cm <sup>2</sup>	
Supply pressure			2~5.5 kgf/cm <sup>2</sup>	
Standard supply pressure			4.5 kgf/cm <sup>2</sup>	
Operating temperature			5~50°C	
*Type (Ejector/Exhaust)	Symbol 1	Built-in silencer.....Single • manifold		
	Symbol 2	Port exhaust.....Single • manifold		
Weight		35/gf	35/gf	45/gf

\* Symbol 1 and 2. See Ejector/Exhaust in 'How to Order'.

• Provided as standard.....Bracket B

## Fig 2

### Solenoid valve/Specifications

	VJ114	VJ314, VJ324
Rated voltage	100VAC, 110VAC, 3,5,6,12,24VDC	
Electrical entry	L-type connector, grommet	L-type connector, M-type connector, grommet
Indicator light/surge voltage suppressor	With or Without (Note)	
Manual override	Non-lock push type, locking screwdriver type	

Note: Indicator light/surge voltage suppressor is not available for grommet type.

## Fig 3

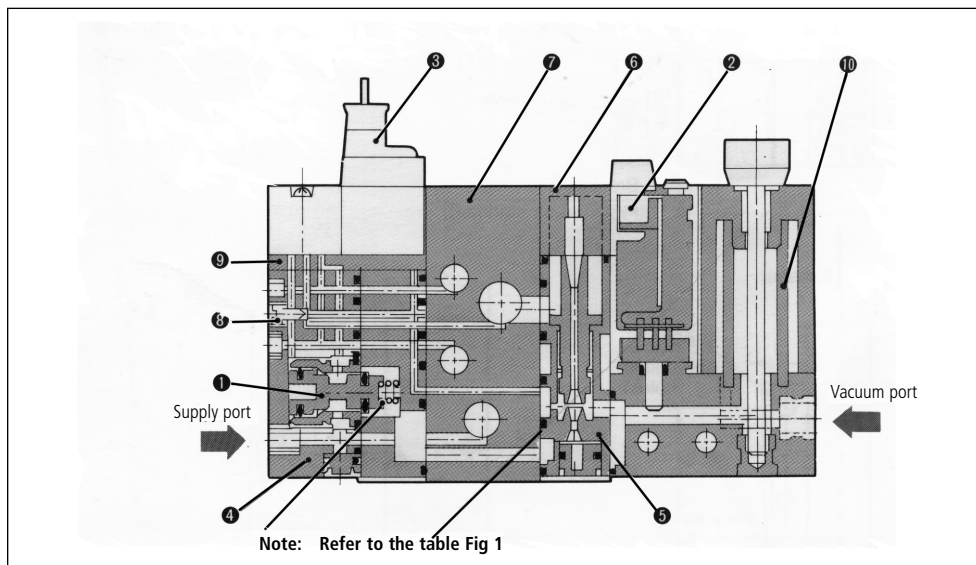


Fig 1

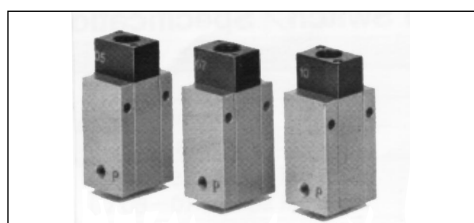


Fig 2

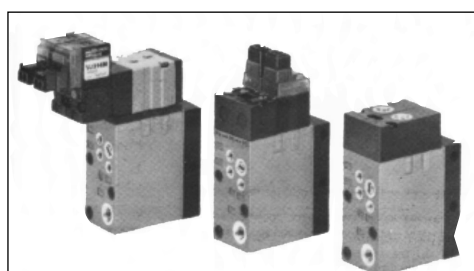


Fig 3



Fig 5

### Valve Unit

Specifications	Vacuum pump ZX1-VB						Ejector ZX1-VA									
	Vacuum switch valve Pilot operated			Vacuum breaking valve Direct operated			Air supply valve Pilot operated			Vacuum breaking valve Direct operated						
Construction	Solenoid valve N.C(VJ114)	Solenoid valve N.O(VJ324)	Air operated N.C(ZX1A)	Air operated N.O(VA324)	Solenoid valve N.C(VJ114)	Solenoid valve N.C(VJ314)	External destruction (ZX1A)	Air operated N.C(VA314)	Solenoid valve N.C(VJ114)	Solenoid valve N.O(VJ324)	Air operated N.C(ZX1A)	Air operated N.O(VA324)	Solenoid valve N.C(VJ114)	Solenoid valve N.C(VJ314)	External destruction (ZX1A)	Air operated N.C(VA314)
Operating pressure	3~6 kgf/cm <sup>2</sup>						3~6 kgf/cm <sup>2</sup>									
Effective orifice mm <sup>2</sup>	3 (Main valve)	0.07	0.45	—	—	—	3 (Main valve)	0.07	0.45	—	—	—	—	—	—	—
Cv factor	0.17	0.004	0.025	—	—	—	0.17	0.004	0.025	—	—	—	—	—	—	—
Max. operating cycle	5 c/s						5 c/s									
Operating temperature	5~50°C						5~50°C									
Interface plate symbol	(PV • (PS ↔ PD))						(PV ↔ PS ↔ PD)									

\* Provided as standard: Bracket B, Spacer 2

## Fig 3

### Piping tightening torques

Thread	Appropriate tightening torque kgf·cm (N·m)
M3	3~5 (0.3~0.5)
M5	15~20 (1.5~2.0)
M6	17~23 (1.7~2.3)
1/8	70~90 (7~9)

Fig 6

### Port exhaust type/Piping

Install piping adapter before mounting onto ejector body.

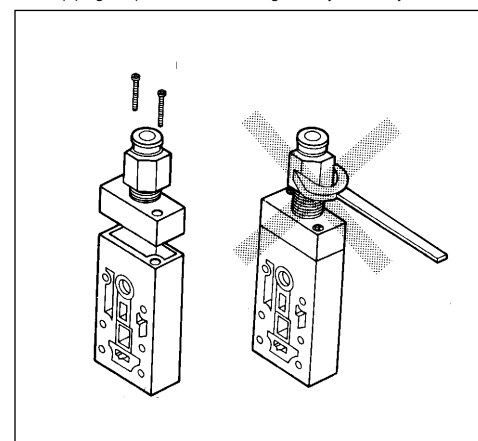


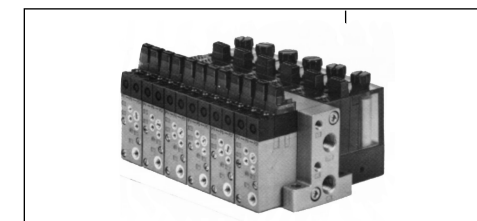
Fig 7

### Suction Filter Unit

Specifications	ZX1-F
Unit part No.	
Operating pressure	Negative pressure ~ 5/kgf/cm <sup>2</sup>
Operating temperature	5~50°C
Filtration	30µm
Filtration material	PVF
Weight	35/gf

## Manifold Specifications

Specifications		8-stations	
Port	Port size	Function	Note
PV-port	1/8	Air supply, connection with external vacuum pump	
PS-port	M5	External pilot	ZX100 only
EXH port	1/8	Common exhaust	
Weight	Basic weight for one station: 730gf Additional weight for each extra station: 50gf		



(1) All PD ports are blocked.

(2) When using 4 or more stations with ZX1103 type manifold, EXH ports on both sides should be utilised.

(3) When using 6 or more stations with ZX100 type External Vacuum pump Suction, PV ports on both sides should be connected to vacuum pump.

## Circuit

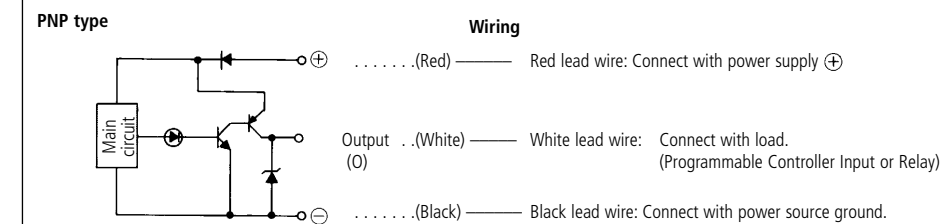
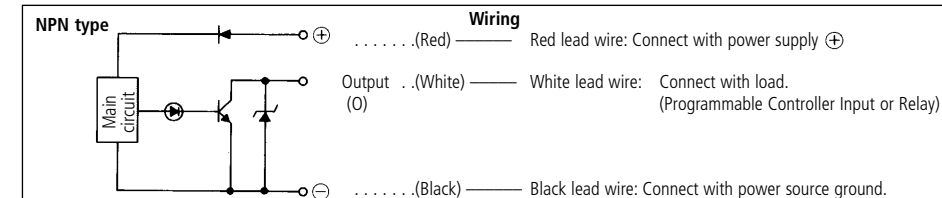
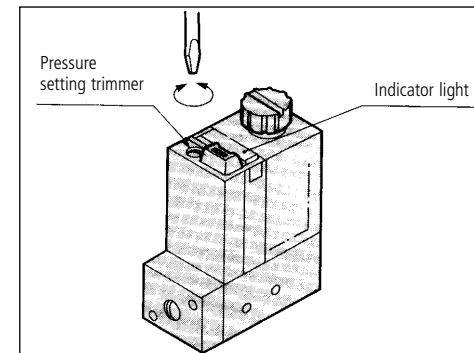


Fig 9

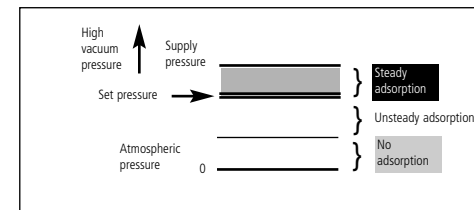
## Vacuum Pressure Setting

### ZSE2

Pressure set trimmer selects the on-pressure. Clockwise rotation increases vacuum pressure.



When using the switch to confirm correct adsorption the set pressure should be as low as possible, but not so low that a confirmation signal is given when adsorption is incomplete. If the switch set pressure is excessively high then a confirmation signal will not be given even when adsorption is good.

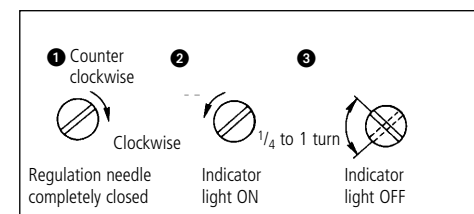


### ZSP1

1 Supply vacuum pressure and electrical power source to unit. Turn the regulation needle clockwise until it stops.

2 With the adsorption nozzle remote from the work-piece (open), turn the regulation needle counter-clockwise until the indicator lights.

3 From the above 2 position, turn the regulation needle 1/4 to 1 turn clockwise.



4 Re-adjust the needle so that the indicator lights only when the work adsorption is steady.

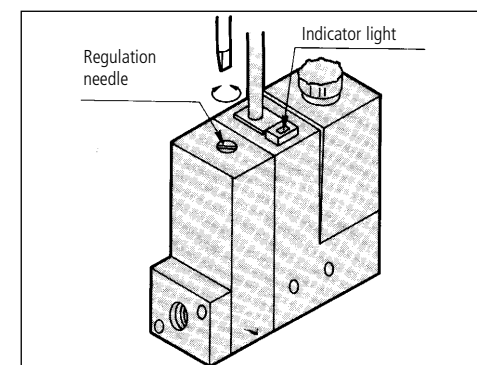


Fig 10

### Hysteresis

Hysteresis is the actual pressure variance from set pressure occurring when the output signal turns from ON to OFF.

The set pressure is the pressure selected to switch from OFF to ON mode.

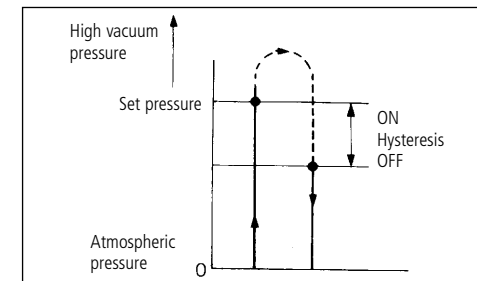


Fig 11

## Installation

### Air supply circuit (ejector system)

When designing the air supply circuit ensure that pipe sizes have sufficient capacity to prevent any possible pressure to valves and fittings. Ensure supply air is filtered and oil free. The air supply should have a capacity greater than the maximum demand from the ejectors and associated equipment.

### External vacuum circuit (vacuum pump system)

Pipe sizes must be kept as large as possible and piping lengths as short as possible.

**Vacuum side**

The piping between the ZX ejector and vacuum pad should be kept as short as possible, so as to prevent any unnecessary restriction and leakage.

**Number of pads**

Vacuum pads should be restricted to **one** pad per ejector. If more than one pad per ejector is proposed, adsorption (vacuum) loss on one side pad will lead to loss of vacuum on the other pads.

**Selection of nozzle diameter**

When selecting nozzle diameter the following criteria **must** be considered:

Suction flow rate, required vacuum pressure, time allowed for absorption. When a large suction flow is required to overcome unavoidable leakage, then an ejector with a large nozzle diameter should be selected. If the piping area between ejector and absorption area is large, a higher flow rate nozzle ejector must be selected to offset the time required to reach correct vacuum level.

**Common exhaust type manifold**

When multiple stations are manifolded together, and the ejectors are operated concurrently, back pressure can occur, due to the common exhaust feature, causing incorrect ejector operation. Remedies are as follows:

1. Change ejector exhaust to either silencer-type or port the exhaust away.
2. Exhaust from both end plates.

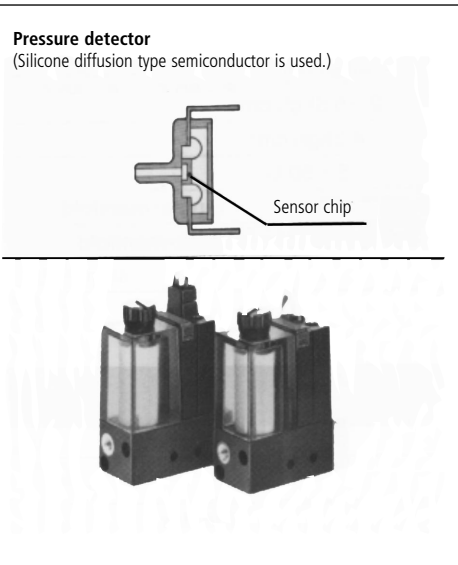


Fig 12

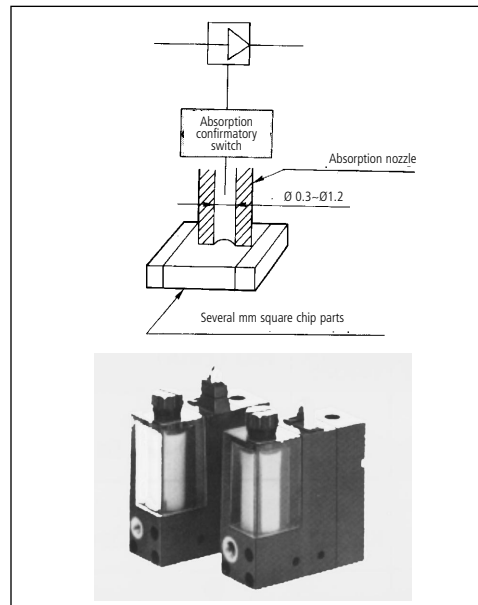


Fig 13

**Vacuum Pressure Switch Specifications and Wiring Diagram**

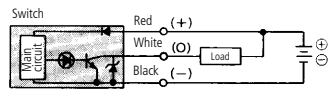
Unit part No.	ZSE2-OX
Operating fluid	Air
Pressure setting range	0~ -760mm Hg
Hysteresis	3% or less
Accuracy	±3% full square (5~40°C) ±5% full square (0~60°C)
Supply voltage	12~24VDC (Ripple ±10% max)
Port size	M5x0.8

- **Weight:** 50gf • **Output:** Open collector (NPN/PNP) 30V, 80mA • **Indicator light:** Lights at 'ON' condition
- **Consumption current:** 17mA (at 24VDC ON) • **Operating temperature:** 0~60°C
- **Maximum operating pressure:** 2kgf/cm<sup>2</sup>

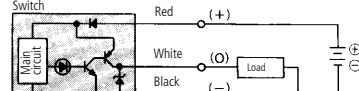
\* When using ejector, instantaneous pressure up to 5kgf/cm<sup>2</sup> will not damage the pressure switch.

**Wiring**

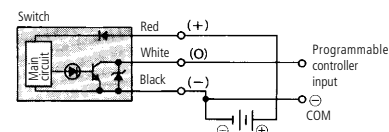
**NPN type**



**PNP type**



**Connection with Programmable Controller at common terminal**



**Connection with Programmable Controller at common terminal**

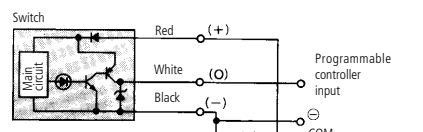


Fig 12

**Absorption Switch Specifications**

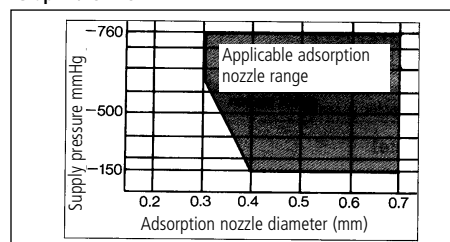
Unit part No.	ZSP1-S	ZSP1-B
Fluid	Air	
Operating pressure	-150~ -760mmHg	
Applicable adsorption nozzle diameter	φ0.3~φ0.7 (refer to graph 1)	φ0.5~φ1.2 (refer to graph 2)
Hysteresis	4mmHg	
Internal orifice diameter	φ0.5	φ0.8

- **Weight:** 62gf • **Supply voltage:** 12~24VDC (Ripple ±10% max) • **Output:** Open collector 30V 80mA
- **Indicator light:** Lights at 'ON' condition • **Consumption current:** 17mA (at 24VDC ON)
- **Operating temperature:** 0~60°C • **Port size:** M5x0.8

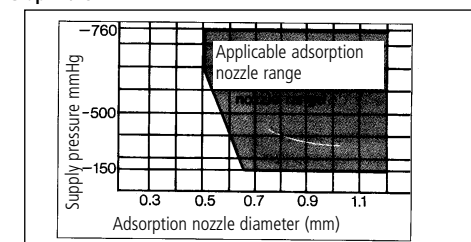
**Applicable Adsorption Confirmatory Switch**

The relation between supply pressure and adsorption nozzle diameter is as following graphs.

Graph 1/ZSP1-S



Graph 2/ZSP1-B



Note: The wiring of the absorption switch is identical to the vacuum pressure switch. Fig 12 (ZSE2)

**Maintenance**

**Port exhaust type**

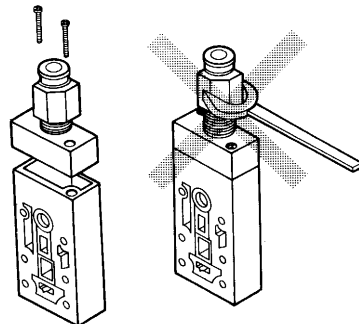


Fig 14

Install the exhaust port piping adapter before mounting onto ejector body.  
Note: Do not subject ejector body to any external force.

**Piping Tightening Torques**

Tighten piping to the torque figures shown in the table below (Fig 15)

Thread	Appropriate tightening torque kgf-cm (N-m)
M3	3~5 (0.3~0.5)
M5	15~20 (1.5~2.0)
M6	17~23 (1.7~2.3)
1/8	70~90 (7~9)

Fig 15

**Filter Element**

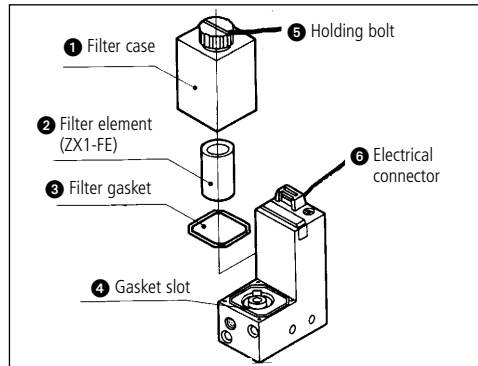


Fig 16

If the filter element becomes clogged, vacuum performance and response times will degrade. In this case cease operating and replace the element.

**Modular design combinations**

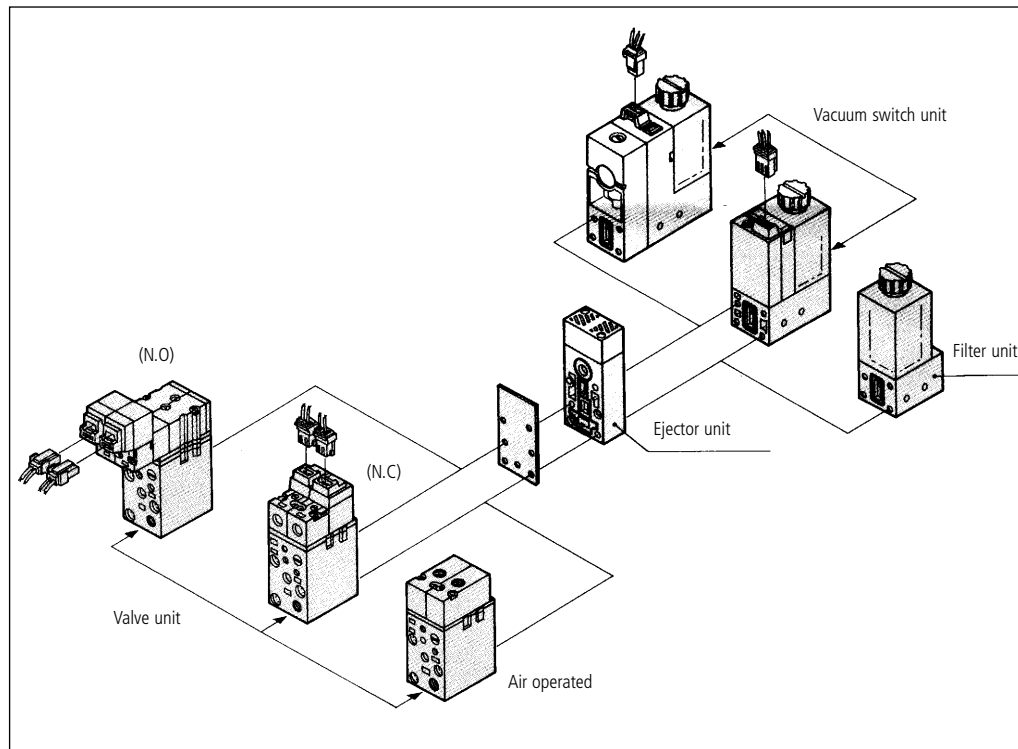


Fig 17

**Removal**

1. Isolate air and electrical supplies.
  2. Slacken holding bolt (5) (captive).
  3. Remove filter case (1) complete with element (2).
- Note: Ensure sealing gasket (3) remains in position.
4. Withdraw filter element (2) and discard.
  5. Fit new element (2) (part No. EX1-FE).

**Replacement**

1. Ensure gasket (3) is in place. Refit filter case (1).
2. Tighten holding bolt finger tight.
3. Reconnect air and electrical supplies.

**Circuit Combinations**

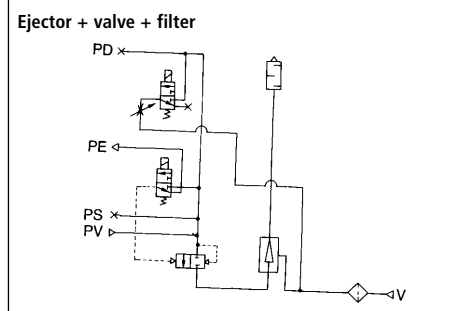


Fig 18

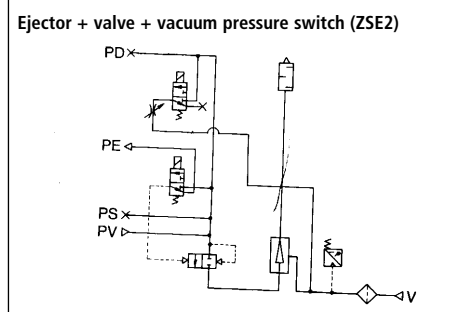


Fig 19

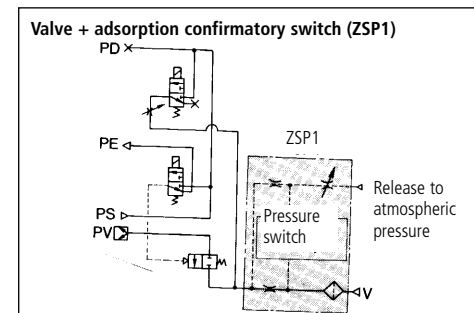


Fig 20

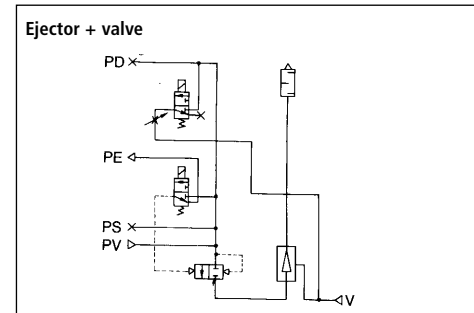


Fig 21

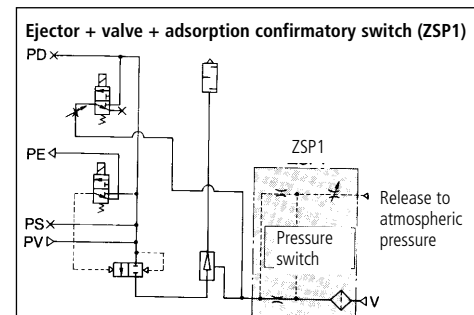


Fig 22

**Ejector + vacuum pressure switch (ZSE2)**

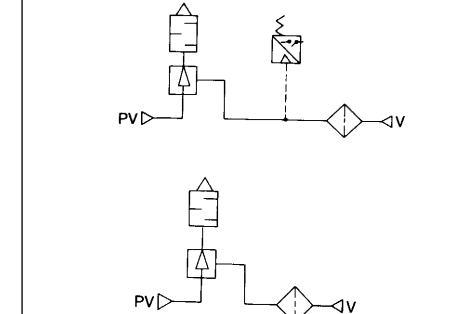


Fig 23

**Ejector + adsorption confirmatory switch (ZSP1)**

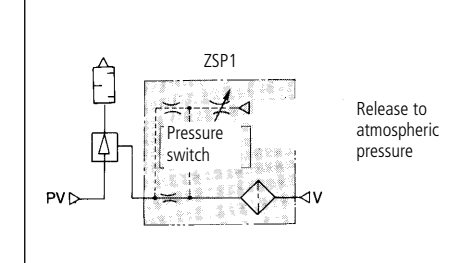


Fig 24

**Valve + vacuum pressure switch (ZSE2)**

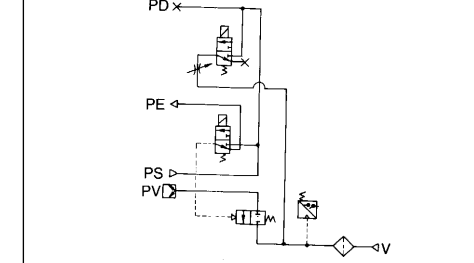


Fig 25

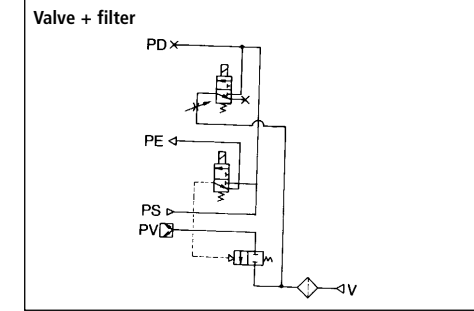


Fig 26

The above combinations are possible as a result of the modular design of the product.  
\* → X = Plugged port. Note: All PD ports are plugged.

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 052-34-0022	SWEDEN	Phone 08-603 07 00
SPAIN	Phone 945-184100	AUSTRIA	Phone 02262-62-280
GREECE	Phone 01-3426076	IRELAND	Phone 01-4501822
FINLAND	Phone 09-68 10 21	DENMARK	Phone 87 38 87 00
BELGIUM	Phone 03-3551464	NORWAY	Phone 67-12 90 20
		POLAND	Phone 48-22-6131847