



Operation Manual

PRODUCT NAME

Multistage Ejector

MODEL / Series / Product Number

ZL112A Series

SMC Corporation

Contents

Safety Instructions	2
Model Indication and How-to-Order	7
Names of Parts	8
Operating Environment	9
Mounting and Installation	10
Air Supply	11
Piping	12
Electrical wiring	14
Solenoid valve	15
Vacuum pressure switch	15
Construction	16
Maintenance and Inspection	17
Exhaust from ejector	21
Specifications	22
Circuit diagram	24
Exhaust characteristics, flow characteristics, time required to reach the specified vacuum, release flow characteristics	25
Flow characteristics curve	26
Troubleshooting	27



Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions are categorized into three groups, "Caution", "Warning" and "Danger" depending on the level of hazard and damage, and the degree of emergency. They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)^{*1)} and other safety regulations^{*2)}.

- *1) ISO 4414: Pneumatic fluid power -- General rules relating to systems.
 ISO 4413: Hydraulic fluid power -- General rules relating to systems.
 IEC 60204-1: Safety of machinery --Electrical equipment of machines. (Part1: General requirements)
 ISO 10218-1992: Manipulating industrial robots -Safety.
 JIS B 8370: General rules for pneumatic equipment.
 JIS B 8361: General rules for hydraulic equipment.
 JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)
 JIS B 8433-1993: Manipulating industrial robots - Safety, etc.
 *2) Labor Safety and Sanitation Law, etc.



Caution

Caution indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.



Warning

Warning indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.



Danger

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

An operator who is appropriately trained and experienced must perform the assembly, operation and maintenance of machines or equipment.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent dropping of driven objects or run-away of machinery/equipment have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut. Read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a location exposed to direct sunlight.
2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation. Check the product regularly in order to confirm normal operation.



Safety Instructions

Caution

1. The product is provided for use in manufacturing industries.

The product herein described is basically provided for use in manufacturing industries.

If the product is being considered for use in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.

If anything is unclear, contact your nearest sales branch.

Limited Warranty and Disclaimer/Compliance Requirements

The product used is subject to the following "Limited warranty and Disclaimer" and "Compliance Requirements". Read and accept them before using the product.

Limited Warranty and Disclaimer

1. The warranty period of the product is 1 year in service or within 1.5 years after the product is delivered. *3)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period, which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to the SMC product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*3) Vacuum pads are excluded from this 1 year warranty.

A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.

Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

■ Explanation of Symbols

Symbol	Definition
	Things you must not do. Instructions are provided as a drawing or sentence next to the symbol.
	Things you must do Instructions are provided as a drawing or sentence next to the symbol.

■ Operator

1. This Operation Manual is intended for those who have knowledge of machinery using pneumatic equipment, and have sufficient knowledge of assembly, operation and maintenance of such equipment.
Only those persons are allowed to perform assembly, operation and maintenance.
2. Read and understand this Operation Manual carefully before assembling, operating or providing maintenance to the product.

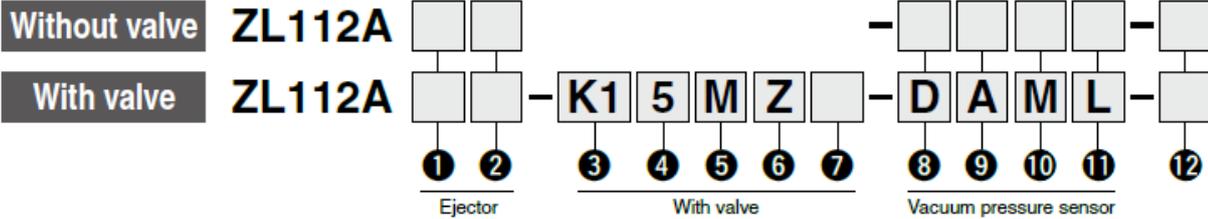
■ Safety Instructions

 Warning	
 Disassembly prohibited	Do not disassemble, modify (including the replacement of board) or repair other than instructed in this manual. Otherwise, an injury or failure can result.
 Do not	Do not operate the product outside of the specifications. Do not use for flammable or harmful fluids. Fire, malfunction, or damage to the product can result. Please check the specifications before use.
 Do not	Do not use in an atmosphere containing flammable or explosive gases. Fire or an explosion can result. The product is not designed to be explosion proof.
 Do not	Do not use the product in a place where static electricity is a problem. Otherwise failure or malfunction of the system can result.
 Do not	Do not cut off the power and compressed air supplied to this product while it is operating. Otherwise it can cause injury due to dropping of workpieces or damage to the system.
 Instruction	If using the product in an interlocking circuit - Provide a double interlocking system, for example a mechanical system. - Check the product for proper operation. Otherwise malfunction can result, causing an accident.
 Instruction	The following instructions must be followed during maintenance - Turn off the power supply - Stop the air supply, exhaust the residual pressure in piping and verify that the air is released before performing maintenance work. It may cause an injury.


Caution

 Do not touch	<p>Do not touch the terminals and connectors while the power is on. Otherwise electric shock, malfunction or damage to the switch can result.</p>
 Instruction	<p>Perform sufficient trial run. Otherwise, injury or damage to the system can result due to suction failure depending on the conditions of the suction of the workpiece or the pressure switch settings. Perform sufficient verification before using this product.</p>
 Instruction	<p>After maintenance is complete, perform appropriate functional inspections and leak test. Stop operation if the equipment does not function properly or there is leakage of fluid. If there is leakage from parts other than the piping, the product might be broken. Cut off the power supply and stop the fluid supply. Do not supply fluid if there is leakage. Safety cannot be assured in the case of an unexpected malfunction.</p>

Model Indication and How to Order



1 Supply (P), Vacuum (V) port/One-touch fitting connection size

Symbol	Supply (P) port	Vacuum (V) port	Vacuum pressure gauge unit specifications*1
Nil	ø6	ø12	kPa
N	ø1/4"	ø1/2"	inHg·psi

*1 When the vacuum pressure gauge (Symbol: G) is selected for 8, these are the unit specification options. Under the New Measurement Act, products with inHg·psi unit specifications are not permitted for use in Japan.

2 Exhaust type

Nil	Silencer exhaust
P	Rc1/2 port exhaust
PF	G1/2 port exhaust*1
PN	1/2-14NPT port exhaust

*1 The thread ridge shape is conforming to G thread standard (JIS B 0202), but other shapes are not conforming to ISO 1603 and ISO 1179.

3 Supply valve/Release valve combination

K1	Supply valve (N.C.), Release valve (N.C.)
K2	Supply valve (N.C.)
B1	Supply valve (N.O.), Release valve (N.C.)
B2	Supply valve (N.O.)

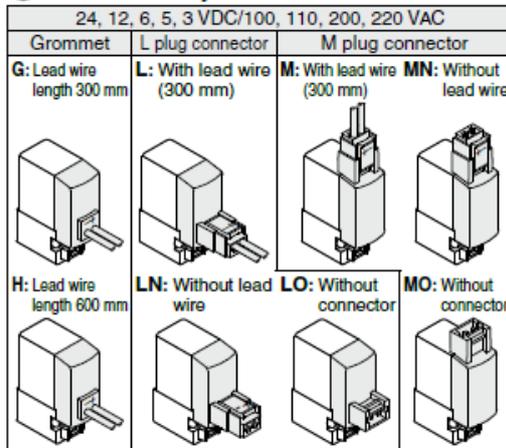
4 Rated voltage

DC		CE-compliant
5	24 VDC	●
6	12 VDC	●
V	6 VDC	●
S	5 VDC	●
R	3 VDC	●

AC (50/60 Hz)		CE-compliant
1	100 VAC	—
2	200 VAC	—
3	110 VAC [115 VAC]	—
4	220 VAC [230 VAC]	—

* CE-compliant: For DC only

5 Electrical entry



* LN, MN type: With 2 sockets per valve

* Refer to page 5 for the lead wire length of L and M plug connectors.

6 Light/Surge voltage suppressor

Nil	Without light/surge voltage suppressor
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (Non-polar type)

* Type U is 24 or 12 VDC only.

* There is no "S" option for AC voltage valves because the generation of surge voltage is prevented by a rectifier.

7 Manual override

Nil	Non-locking push type
D	Push-turn locking slotted type

8 Vacuum pressure sensor

Nil	None
GN	Vacuum port adapter Rc1/8
G	Vacuum pressure gauge*1
D	Digital vacuum pressure switch

*1 In 1, the units for mm spec fittings are in kPa.

The units for inch spec fittings are in inHg·psi. (Under the New Measurement Act, products with these unit specifications are not permitted for use in Japan.)

10 Unit specifications

(Applicable only when the vacuum pressure sensor specification is "D" for digital vacuum pressure switch)

Nil	With unit switching function
M	SI unit only (kPa)
P	With unit switching function (Initial value psi)

* Under the New Measurement Act, switches with the unit switching function are not permitted for use in Japan.

11 Lead wire specifications

(Applicable only when the vacuum pressure sensor specification is "D" for digital vacuum pressure switch)

Nil	Without lead wire
L	Lead wire with connector (2 m)

* Output type N and P: 3 core lead wire is included. For other output options, 4 core lead wire is included.

9 Output specifications

(Applicable only when the vacuum pressure sensor specification is "D" for digital vacuum pressure switch)

N	NPN open collector 1 output
P	PNP open collector 1 output
A	NPN open collector 2 outputs
B	PNP open collector 2 outputs
C	NPN open collector 1 output + Analog voltage output
D	NPN open collector 1 output + Analog current output
E	PNP open collector 1 output + Analog voltage output
F	PNP open collector 1 output + Analog current output

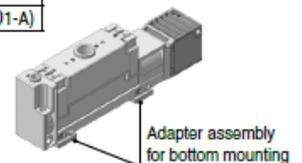
12 Option (Included)

Nil	None
B	Adapter assembly for bottom mounting (ZL112A-AD1-A)

* Bottom mounting screw pitch = 28 mm (Interchangeable with the current model ZL112)

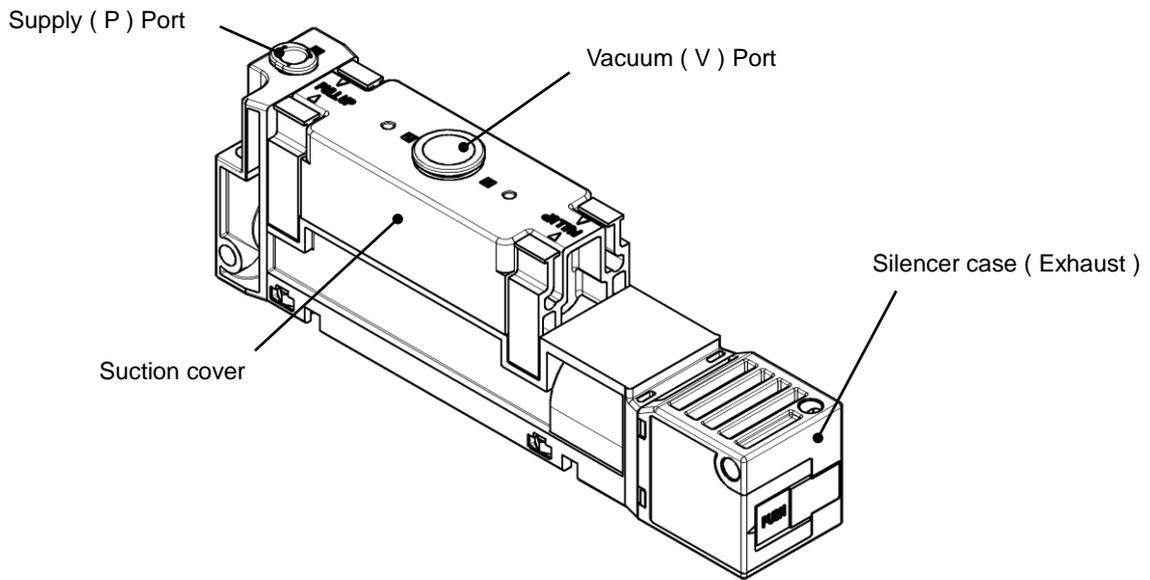
* 2 pcs./set, with 4 bolts

* Mounting holes at the top and on the side are compatible without optional parts.

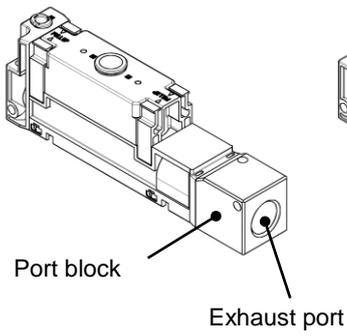


Names of Parts

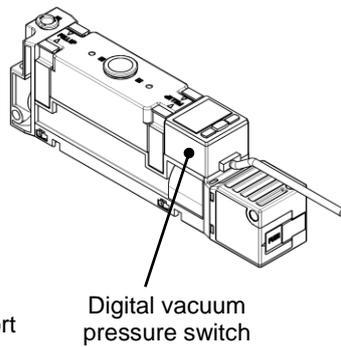
Without valve



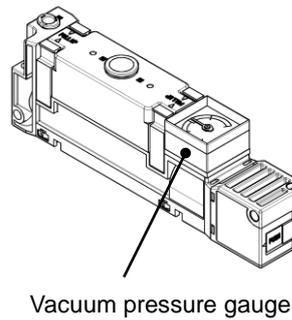
With port exhaust



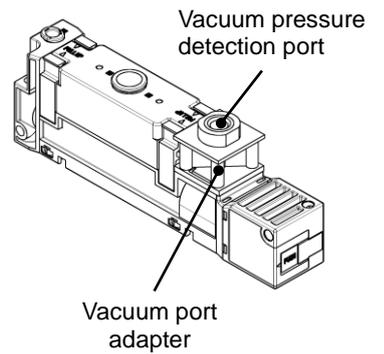
With digital vacuum pressure switch



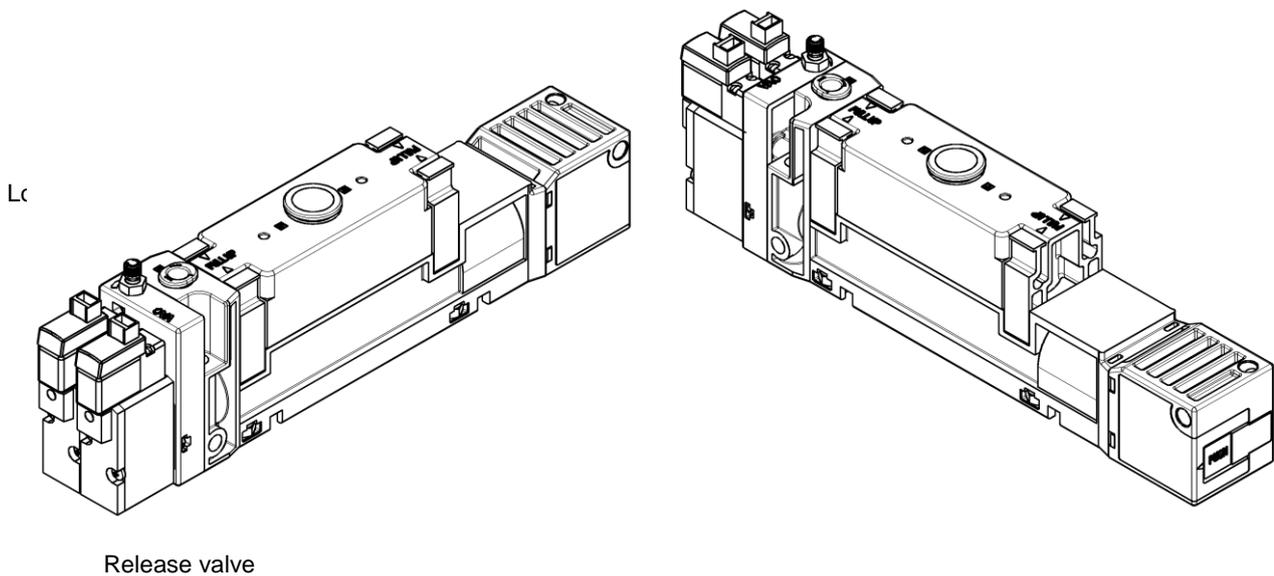
With Vacuum pressure gauge



With Vacuum port adapter



With valves

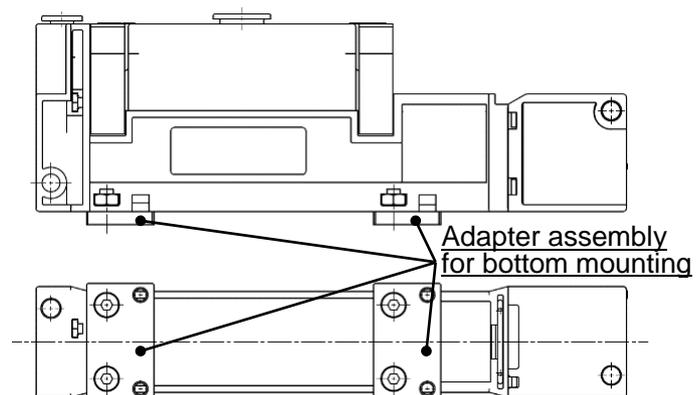


Operating Environment

- Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present. These can cause failure or malfunction.
- Do not use the product in a place where the product could be splashed by oil or chemicals. If the product is to be used in an environment containing oils or chemicals such as coolant or cleaning solvent, even for a short time, it may be adversely affected (damage, malfunction, or hardening of the lead wires).
- Keep the ambient temperature of the product between 5 and 50°C. In environments such as inside a panel where heat radiation efficiency is poor, the ambient temperature will rise due to the heat generation of the coil of the solenoid valve, causing malfunction. At the same time, avoid rapid temperature changes even within the specified temperature range.
- Do not use this product in places where there are cyclic temperature changes. Heat cycles other than ordinary changes in temperature can adversely affect the inside of the product.
- Do not use where the product is exposed to direct sunlight. Shade the sunlight in locations where the product is exposed to direct sunlight. Failure and malfunction can result.
- Do not use in a location where the product is exposed to radiant heat from surrounding heat sources. This can cause operating failure.
- Do not use the product in an area where surge is generated. When there are machines or equipment that generate large surge near the pressure switch (magnetic type lifter, high frequency inductive furnace, motor, etc.), this can result in deterioration and damage of the internal elements. Take measures against the surge sources, and prevent the lines from coming into close contact.
- Do not let foreign matter, such as wire debris, get inside the product. In order to avoid failure and malfunction, do not let foreign matter, such as wire debris, get inside the product.
- The use of resin piping can cause static electricity to be generated, depending on the fluid. Therefore, when connecting the vacuum pressure switch assembly, take appropriate measures against static electricity at the customer's equipment side, and separate the grounding for the product from the grounding for any equipment which generates a strong electromagnetic noise or high frequency. Otherwise, static electricity can break the vacuum pressure switch assembly.

Mounting and Installation

1. Tighten the body to the recommended tightening torque (For top and side mounting: 1.2 to 1.5N·m, for bottom mounting: 0.60 to 0.74 Nm). If the recommended tightening torque is exceeded, the body, mounting screws and brackets may be damaged. Insufficient torque can cause displacement of the body from its proper position and the looseness of the mounting screws.
2. If air leakage increases or the equipment does not operate properly, stop operation. After installation and maintenance, apply air and power supplies to the equipment and perform appropriate functional and leakage inspections to make sure the equipment is mounted properly.
3. Do not drop, hit or apply excessive shock to the product. The inner parts can be damaged leading to malfunction even if the sensor body is not damaged.
4. Mount the product in a location that is not affected by vibration or impact. Failure and malfunction can occur.
5. Do not fix the product such that a load is always applied to the air pressure supply port, vacuum port, vacuum pressure detection port and exhaust port in a bending or pulling direction. This can damage this product.
6. Do not pull the lead wire forcefully, or lift the product by the lead wire (Lead wire tensile strength: within 30N). Hold the product body when handing.
7. Do not obstruct the exhaust port of the ejector. Do not cover the exhaust port. Otherwise, vacuum is not generated. Do not block the exhaust port to release the work piece. This can damage the vacuum ejector.
8. If the product is operated in a dusty environment or if there is dust on the surface of the work pieces, it can cause clogging of the silencing material as well as the suction filter. Secure space necessary for the maintenance checks and replacement of the silencer when the ejector performance decreases.
9. Be sure to connect the ground terminal F.G. to ground when using a commercially available switch-mode power supply.
10. Although this product is interchangeable with the ZL112 multistage ejector (old product), adapter assembly for bottom porting (ZL112A-AD1-A) is required only for the bottom porting. When the adapter assembly for bottom porting is mounted to the product, please follow the direction specified on the right side.
(Recommended tightening torque: 0.60 to 0.74 Nm)



Supply air

1. For the compressed air quality, refer to 2.4.3, 2.5.3 and 2.6.3 of ISO8573-1:2001 (JIS B8392-1:2003).
2. It is recommended that an air filter and a mist separator are connected to the upstream side of the ejector and the pump system. (Refer to Air Preparation Equipment Selection Guide in Best Pneumatics 5 for detail.)
3. Using compressed air which contains chemicals, synthetic oils containing organic solvents, salts or corrosive gases, etc. can cause damage or malfunction. Do not use compressed air containing toxic impurities.
4. If the compressed air contains excessive moisture or carbon powder, it can stick to the vacuum parts (the nozzle diffuser), inside of the solenoid valve or the pressure switch and cause a decrease in performance or operation failure. An air dryer, mist separator, and filter should be installed upstream from filters.
If condensation in the drain bowl and air filter is not emptied on a regular basis, the bowl will overflow and allow the condensation to enter the compressed air lines. This causes malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, installation of a drain bowl with an auto drain option is recommended.
5. Use the product within the specified supply pressure range (0.2 to 0.5 MPa). Operation over the specified supply pressure range can cause damage to the product.

Piping

■ Piping for Air Pressure Supply and Vacuum Pressure Supply

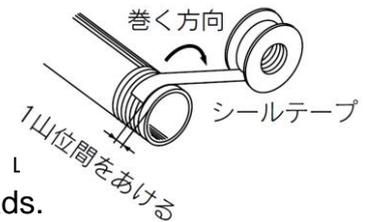
(1) Preparation before piping

Before piping, perform air blow (flushing) or cleaning to remove any cutting chips, cutting oil, dust, etc. from the piping.

(2) Wrapping of pipe tape

When installing piping or a tube fitting into a port, prevent cutting chips and sealant material from getting inside the product.

If a sealant tape is used, leave 1 thread exposed at the end of threads.



(3) When connecting tubing, consider factors such as changes in the tubing length due to pressure, and allow a sufficient margin.

Otherwise, it can damage the fitting and cause the tube to come off. Refer to Fittings & Tubing Precautions from 1 to 4 shown in Best Pneumatics 6 on SMC's website (URL <http://www.smcworld.com>) for the recommended piping conditions.

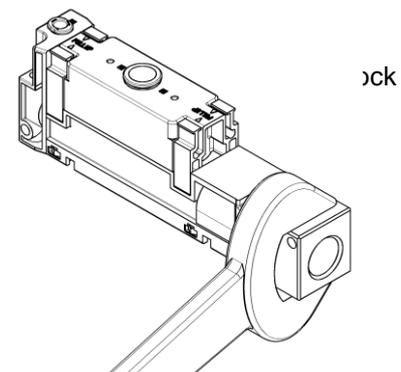
■ Piping to the Exhaust Port, Vacuum Port Adapter

Piping to the Exhaust Port

When mounting or removing the piping to or from the exhaust port, hold the exhaust block with a wrench (across the flats 36).

Recommended tightening torque: 20 to 25 N·m

The product may break, if it is held by hand.

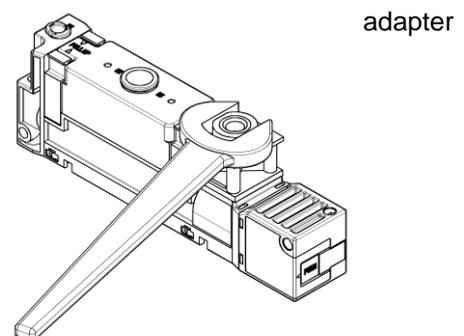


Piping to the Vacuum Port Adapter

When mounting or removing the fitting, etc. to or from the vacuum port adapter, hold the vacuum port adapter with a wrench (across the flats 19).

Recommended tightening torque: 3 to 5 N·m

The product may break, if it is held by hand.



When piping is connected to the exhaust port block and vacuum port adapter, pay attention that no twisting, tensile, moment loads, vibration or impact should be applied to the piping. This can cause displacement or damage of the port.

■ Piping to the Vacuum (V) Port

- (1) Allow a sufficient margin of tube length when piping, in order to prevent twisting, tensile, moment loads, vibration or impact being applied to the tubes and fittings. This can cause damage to the tube fittings and crushing, bursting or disconnection of tubing.
- (2) Piping to the product is assumed to be static piping. If the tube moves, it may become worn, elongated or torn due to tensile forces, or disconnected from the fitting. Ensure the tube is in a static condition at all times before using.
- (3) Prevent the connected tube from being rotated. If the fittings are used in this way, the fitting may fail.
- (4) Do not lift the product by holding the piping after the tube is connected to the vacuum (V) port.

■ One-touch Fittings Precautions

1. Insertion of tube

- 1) Cut the tube perpendicularly, being careful not to damage the external surface. Use SMC's tube cutter TK-1, 2 or 3 for cutting. Do not cut the tube with pliers, nippers, scissors, etc. If the tube is cut by any tools other than a tube cutter, the cut surface of the tube will be slanted or flat, making it impossible to be connected securely, or causing the tube to come off or air leakage after the tube is connected. Also, allow a sufficient margin of tube length.
- 2) Hold the tube and push it in slowly, inserting it securely all the way into the fitting.
- 3) After inserting the tubing, pull on it gently to confirm that it will not come out. If it is not installed securely all the way into the fitting, problems such as leakage or disconnection of the tube can occur.

2. Removal of the tube

- 1) KQ2 series is used for the vacuum (V) port. For this series, the tube can be removed by pushing one part of the release button.
- 2) Hold down the release button while pulling out the tube. If the release button is not held down fully, there will be more bite so it will be more difficult to pull out the tube.
- 3) If the removed tubing is to be used again, cut off the section of the tubing which has been gripped. Using the gripped portion of the tube as it is can cause problems such as air leakage or difficulty in removing the tube.

■ Precautions for Use of Other Manufacturers' Tubes

If tubes of brands other than SMC are used, confirm that the materials and tolerance of the tubing outside diameter will satisfy the following specifications.

- 1) Nylon tube within +/-0.1mm
- 2) Soft nylon tube within +/-0.1mm
- 3) Polyurethane tube within +/-0.15mm and -0.2mm

Do not use tubing which does not meet these outside diameter tolerances. Connection to the fitting may fail, causing disconnection of the tube and air leakage.

Electrical wiring

1. Use the specified voltage. Otherwise failure or malfunction can occur.
2. Do not exceed the specified maximum allowable load. Otherwise it can cause damage or shorten the life of the product.
3. Design the product to prevent reverse current when the circuit is opened or the product is forced to operate for operational check. Reverse current can cause malfunction or damage the product.
4. Do not pull the lead wire forcefully, or lift the product by the lead wire (Lead wire tensile strength: within 30N). Hold the product body when handling.
5. Avoid repeatedly bending or stretching the lead wires, or placing a heavy load or applying force to them. If the bending stress and tensile force is repeatedly applied to the lead wires, sheath might be removed. If the lead wire can move, fix it near the body of the product. The recommended bending radius of the lead wire is R40 mm or more. For details, please contact SMC. Replace the damaged lead wire with a new one.
6. Incorrect wiring can damage the switch and cause malfunction. Connections should be done while the power supply is turned off.
7. Do not perform wiring while the power is on. Otherwise damage to the solenoid valve or the internal parts of the pressure switch/sensor can result, causing malfunction.
8. Do not attempt to insert or pull out the connector from the pressure switch while the power is on. This may cause switch output malfunction.
9. Malfunctions stemming from noise may occur if the wire is installed in the same route as that of power or high-voltage cable. Wire the pressure switch independently.
10. Confirm proper insulation of wiring. Poor insulation (interference with other circuits, poor insulation between terminals etc.) can apply excessive voltage or current to the solenoid valve or the pressure sensor, causing damage.
11. Keep wiring as short as possible to prevent interference from electromagnetic noise and surge voltage. Do not use a cable longer than 10 m. Wire the DC (-) line (solenoid valve: black, pressure switch: blue) as close as possible to the power supply.
12. Do not use the product in an area where surge is generated. When there are machines or equipment that generate large surge near the pressure switch (magnetic type lifter, high frequency inductive furnace, motor, etc.), this can result in deterioration and damage of the internal elements. Take measures against the surge sources, and prevent the lines from coming into close contact.

Solenoid Valve

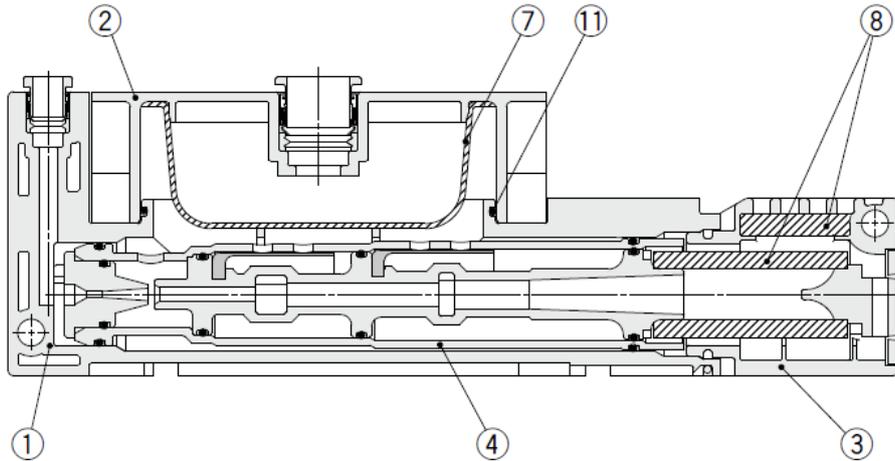
1. Avoid energizing the solenoid valve for long periods of time. If a solenoid valve is continuously energized for an extended period of time, the heat generated by the coil assembly may reduce performance and life of the valve or have adverse effects on peripheral equipment. Therefore, when it is continuously energized for an extended period of time or when the energized period per day is longer than the de-energized period, use N.O. (normally open) type product. When the valve is mounted onto a control panel, take measures to radiate heat in order to keep the product temperature within the specified range.
2. For details of the SYJ500 3-port solenoid valve other than the above-mentioned series, please refer to the SMC website URL: <http://www.smcworld.com>.

Digital Pressure Switch for Vacuum

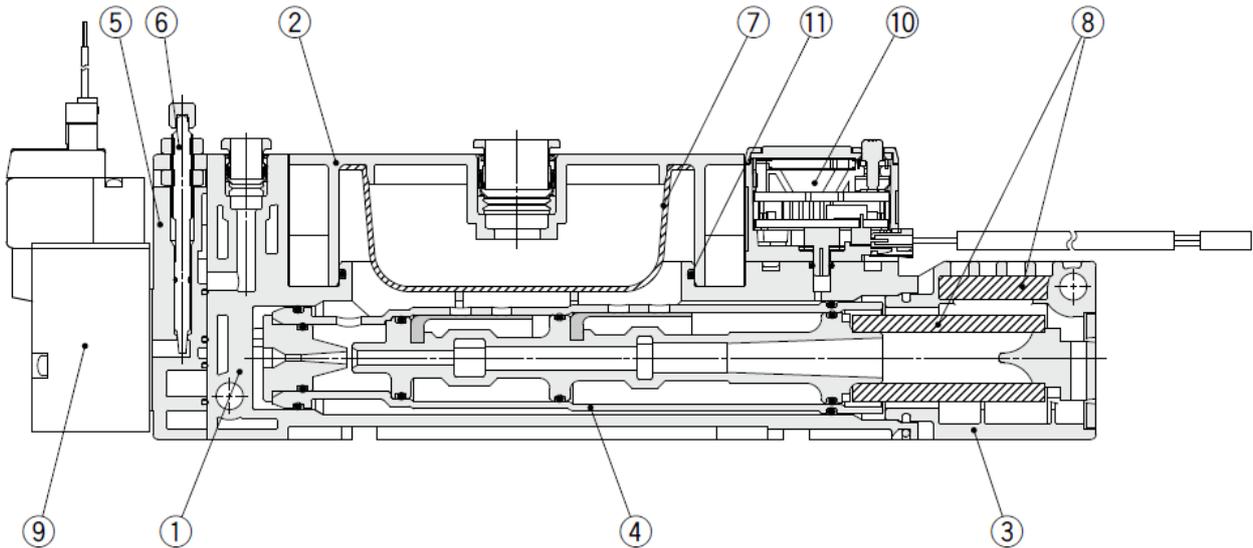
1. Connect a load before turning the power supply on. If the power supply is turned on with no load, over current may flow, causing the pressure switch to break instantly.
2. Do not short circuit the load. An error is displayed when the load of the pressure switch is short circuited, but over current may flow, causing damage to the pressure switch.
3. Do not press the setting buttons with a sharp pointed object. This may damage the setting buttons.
4. If using the product to detect very small pressures, warm up the product for 10 to 15 minutes first.
There will be a drift on the display of approx. 1% for 10 minutes after the power supply is turned on.
5. Perform settings suitable for the operating conditions. Incorrect setting can cause operation failure.
For details of each setting, refer to the Operation Manual of the pressure switch.
6. Do not touch the LED during operation. The display can vary due to static electricity.
7. For details of the ZSE30A 2-Color Display High-Precision Digital Pressure Switch other than the above-mentioned series, please refer to the SMC website URL: <http://www.smcworld.com>.

Construction

Without valves and switch



With valves and switch



Components

No.	Description	Material	Note
1	Body assembly	Resin, NBR, Steel	
2	Suction cover assembly (Filter element included)	Resin, NBR, Steel, Non-woven fabric	
3	Silencer case assembly (Sound absorbing material and clip included)	Resin, Steel	For silencer exhaust
	Port block assembly (Clip included)	Aluminum alloy, NBR, Steel	For port exhaust
4	Ejector assembly	Resin, NBR, Fluororubber	
5	Valve plate assembly (Needle is included for models with release valves.)	Resin, NBR, HNBR, Steel	
6	Vacuum break flow adjusting needle	Brass (Electroless nickel plating), Resin, NBR, Steel	
7	Filter element	Non-woven fabric	
8	Sound absorbing material	Resin	
9	Supply valve, Release valve	-	
10	Digital vacuum pressure switch	-	For Digital vacuum pressure switch
	Vacuum port adapter assembly	Resin, Aluminum alloy, NBR, Steel	For Vacuum port adapter
	Pressure gauge assembly	-	For Vacuum pressure gauge
11	O-ring	NBR	

The components other than (1) and (6) are available as service parts. Refer to "Maintenance and Check" on the next pages for details.

Maintenance and Inspection

■ Implement the maintenance and check shown below in order to use the ejector and the vacuum system safely and in an appropriate way for a long period of time.

1. Maintenance should be performed according to the procedure indicated in the Operation Manual. Improper handling can cause damage and malfunction of equipment and machinery.
2. Maintenance work
Compressed air can be dangerous when handled incorrectly. Therefore, in addition to observing the product specifications, replacement of elements and other maintenance activities should be performed by personnel with sufficient knowledge and experience pertaining to pneumatic equipment.
3. Draining
Remove condensate from air filters and mist separators regularly. If the collected drainage is drained to the downstream side, it can stick inside of the product, causing operation failure and failure to reach the specified vacuum pressure.
4. Replace the filter element built into the ejector and the vacuum pump system and the silencer regularly. (Refer to the replacement procedure below.)
It is recommended to replace the filter element and the silencer when the pressure drop reaches 5kPa as a guideline. The replacement cycle varies depending on the operating conditions, operating environment and supply air quality.
However, if there is a vacuum pressure drop and/or delay in the vacuum (adsorption) response time which causes problem with the settings during operation, stop the operation of the product and replace the element regardless of the above mentioned replacement guideline.
5. Operation in an environment where there is a lot of dust in the air
The processing capacity of the filter element built into the product may be insufficient. It is recommended to use SMC's air suction filter (ZFA, ZFB, ZFC series) in order to avoid problems beforehand.
6. Check before and after the maintenance work
When the product is to be removed, turn off the power supply, and be sure to cut off the supply pressure and exhaust the compressed air. Confirm that the air is released to atmosphere.
When mounting the product after the maintenance work, supply compressed air, connect to the power, check if it functions properly and have a leakage inspection. Especially for the latching type supply valve, be sure to check that the supply valve is OFF in the initial condition because it is possible that it is ON due to vibration.
7. Do not disassemble or modify the product, other than the replacement parts specified in this manual.
8. Do not use solvents such as benzene and thinner for cleaning. These can damage the surface and erase the marking on the pressure switch. Use a soft cloth to remove stains. For heavy stains, use a damp cloth that has been soaked with diluted neutral detergent and fully squeezed, then wipe up the stains again with a dry cloth.

Replacement parts list

No.	Description	Part number	Note
2	Suction cover assembly (Filter element included)	ZL112A-FC1□-A	□: Vacuum port size Nil: ø12, N: ø1/2"
3	Silencer case assembly (Sound absorbing material and clip included)	ZL112A-SC1-A	For silencer exhaust
	Port block assembly (Clip included)	ZL112A-EP1□-A	For port exhaust □: Exhaust port size Nil: Rc1/2, G: G1/2, N: 1/2-14NPT
4	Ejector assembly	ZL112A-EJ1-A	
5	Vacuum break flow adjusting needle	ZL112A-VP□-A	□: Supply valve/Release valve combination*1 1: Supply valve + Release valve, 2: Supply valve only
7	Filter element	ZL112A-FE1-A	1 pc. (page 17)
8	Sound absorbing material	ZL112A-SE1-A	1 pc. of each/set: Sound absorbing material 1 and 2 (page 17)
9	Supply valve, Release valve	SYJ5□4-□□□□-□	Refer to how to order the supply valve and release valve. (page 16)*1
10	Digital vacuum pressure switch	ZL-ZSE30A-00-□-□□	Vacuum pressure sensor: Digital vacuum pressure switch Refer to how to order the digital vacuum pressure switch. (page 16)
	Vacuum port adapter assembly	ZL112A-AD2-A	Vacuum pressure sensor: Vacuum port adapter
	Pressure gauge assembly	ZL112A-PG□-A	Vacuum pressure sensor: Vacuum pressure gauge □: Units for pressure 1 = kPa, 2 = inHg: psi*2
11	O-ring	ZL112A-OR1-A	5 pcs./set

*1 It is not possible to switch between models without valves and with valves.

*2 Under the New Measurement Act, products with inHg·psi unit specifications are not permitted for use in Japan.

How to Order Replacement Parts

Supply valve/Release valve

SYJ5 1 4 - 5 M Z - Q

Type of actuation

1	Normally closed
2	Normally open (Supply valve only)

Rated voltage

DC		CE-compliant
5	24 VDC	●
6	12 VDC	●
V	6 VDC	●
S	5 VDC	●
R	3 VDC	●

AC (50/60 Hz)

		CE-compliant
1	100 VAC	—
2	200 VAC	—
3	110 VAC [115 VAC]	—
4	220 VAC [230 VAC]	—

* CE-compliant: For DC only

CE-compliant

Nil	— (For AC)
Q	CE-compliant (For DC)

Manual override

Nil	Non-locking push type
D	Push-turn locking slotted type

Light/Surge voltage suppressor
(Electrical entry: G, H, L, or M)

Nil	Without light/surge voltage suppressor
S	With surge voltage suppressor
Z	With light/surge voltage suppressor
U	With light/surge voltage suppressor (Non-polar type)

* There is no "S" option for AC voltage valves because the generation of surge voltage is prevented by a rectifier.
* For type "U", DC voltage is only available.

Electrical entry

24, 12, 6, 5, 3 VDC/100, 110, 200, 220 VAC			
Grommet	L plug connector	M plug connector	
G: Lead wire length 300 mm	L: With lead wire (300 mm)	M: With lead wire (300 mm)	MN: Without lead wire
H: Lead wire length 600 mm	LN: Without lead wire	LO: Without connector	MO: Without connector

* LN, MN type: With 2 sockets
* Refer to Table 1 for the lead wire length of L and M plug connectors.

How to order connector assembly

For DC SY100-30-4A-□
For 100 VAC SY100-30-1A-□
For other AC SY100-30-3A-□

Lead wire length

Nil	300 mm (Standard)
6	600 mm
10	1000 mm
15	1500 mm
20	2000 mm
25	2500 mm
30	3000 mm
50	5000 mm

Digital vacuum pressure switch

ZL - ZSE30A - 00 - A - M L

Output specifications

N	NPN open collector 1 output
P	PNP open collector 1 output
A	NPN open collector 2 outputs
B	PNP open collector 2 outputs
C	NPN open collector 1 output + Analog voltage output
D	NPN open collector 1 output + Analog current output
E	PNP open collector 1 output + Analog voltage output
F	PNP open collector 1 output + Analog current output

Connector/Lead wire specifications

Nil	Without lead wire
L	Lead wire with connector (Length: 2 m)

* Output type N and P: 3 core lead wire is included. For other output options, 4 core lead wire is included.

Unit specifications

Nil	With unit switching function*1
M	SI unit only*2
P	With unit switching function (Initial value psi)*1

*1 Under the New Measurement Act, switches with the unit switching function are not permitted for use in Japan.
*2 Fixed unit: kPa

* The vacuum pressure switch mounted on this product is equivalent to our SMC product, the ZSE30A series digital pressure switch.

For details on vacuum pressure switch functions, refer to the operation manual of the ZSE30A series on the SMC website (<http://www.smcworld.com>).

Pressure switch correspondence table

Digital pressure switch
ZSE30A series

(ZL-) ZSE30A-00-□-□-□

Multistage ejector
ZL series

ZL112A-□□□□□-D□-□-□

Unit specifications

Output specifications

Lead wire specifications

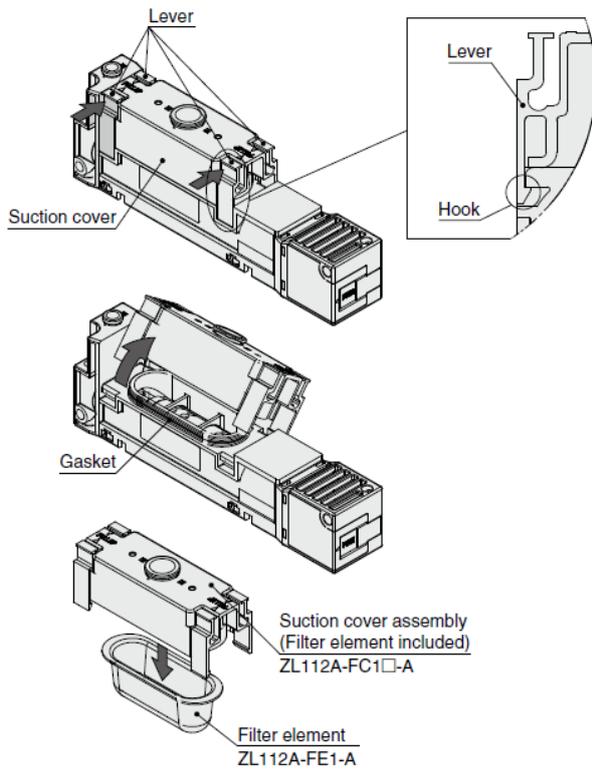
Lead wire assembly with connector How to order

ZS-38-□-L

Number of cores

3	3 cores, 1 output
4	4 cores, 2 outputs

■Replacement Procedure for Filter element (ZL112A-FE1-A)



The suction cover can be attached or detached at a touch.

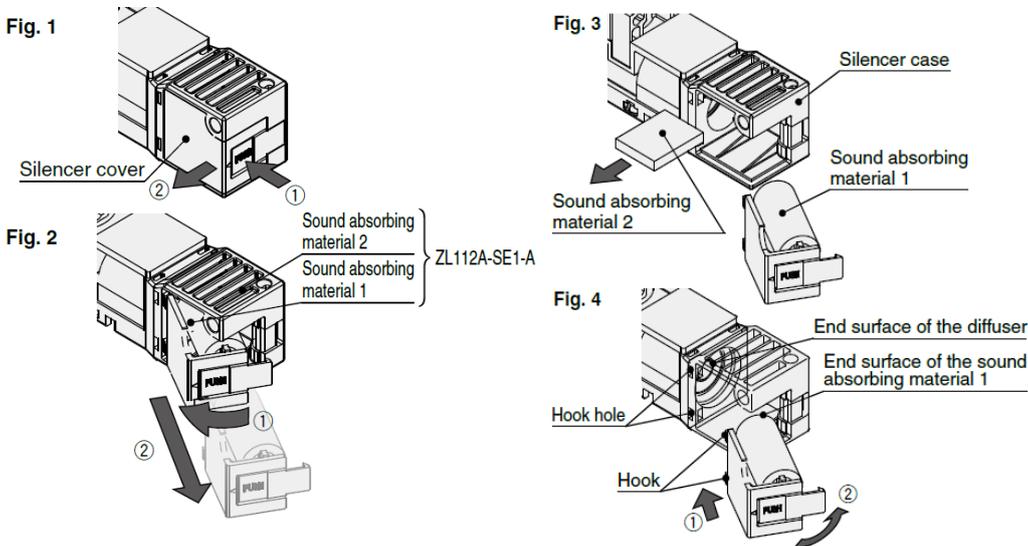
Suction cover can be removed by pushing the suction cover levers (2 pcs.) on the side. (It can be removed from the opposite side as well.)

Replace the filter element assembled in the filter case.

Check that the gasket is correctly fit in the groove before mounting the suction cover.

Check that the lever hook is locked in the correct position when mounting the suction cover. If the hook or the lever is damaged or deformed, replace the suction cover assembly.

■Replacement procedure for Sound absorbing material (ZL112A-SE1-A)



* When the product is mounted with the silencer cover side facing to the wall, maintenance shown in the figures above is not possible. Remove the product from the wall for maintenance.

The sound absorbing material can be replaced with a single operation.

Push the area where word “PUSH” is printed on the silencer cover in direction shown in Fig. 1.

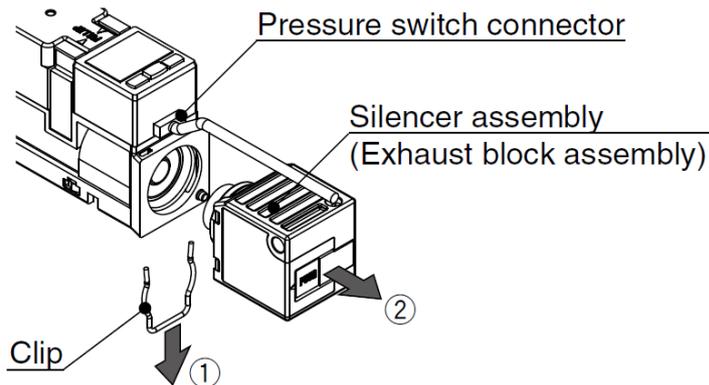
The silencer cover will come out. (See Fig. 2) Remove the sound absorbing material 1 and 2 and replace with the new ones. (See Fig. 3)

After replacing the sound absorbing material, place the end surface of the sound absorbing material 1 to the end surface of the diffuser while engaging the hooks to the hook holes and push the silencer cover back into the place. (See Fig. 4)

■Removal/Mounting of the Solenoid Valve or Pressure Switch Connector

Do not attempt to insert or pull out the connector while the power is on. Otherwise, it may cause switch output malfunction.

Before removal or mounting of the pressure switch connector, it is necessary to remove the silencer assembly (exhaust block assembly). Remove the silencer assembly (exhaust block assembly) following the procedure below in order to remove or to mount the pressure switch connector.



Remove the clip using flat blade screwdriver from the bottom of the product. Remove the silencer assembly (exhaust block assembly) from the body. Remove or mount the pressure switch connector.

Exhaust from Ejector

1. The exhaust resistance should be as small as possible to obtain the full ejector performance. There should be no shield around the exhaust port for the silencer exhaust specification. For the port exhaust specification, the back pressure should be 5 kPa or less, as exhaust resistance is generated with some piping bore sizes and piping lengths.
DO NOT block the exhaust port. The product will fracture or break.
2. If the sound absorbing material is clogged, it will cause a reduction in the ejector performance. In particular, if it is used in a dusty environment, not only the filter element, but also the sound absorbing material can be clogged. It is recommended to replace the sound absorbing material periodically.
3. Air is exhausted from the connecting part between the silencer case and silencer cover. This does not affect the performance of the product.

Specifications

■ Ejector Specifications

Model	ZL112A	
Nozzle diameter	1.2 mm	
Standard supply pressure	Without valve: 0.33 MPa	With valve: 0.35 MPa
Maximum vacuum pressure*1	-84 kPa	
Air consumption*1	57 L/min (ANR)	
Maximum suction flow rate*1	100 L/min (ANR)	
Supply pressure range	0.2 to 0.5 MPa	
Operating temperature range	5 to 50°C (No condensation)	
Fluid	Air	
Vibration resistance*2	30 m/s ² (Without pressure switch), 20 m/s ² (With pressure switch)	
Impact resistance*3	150 m/s ² (Without pressure switch), 100 m/s ² (With pressure switch)	

*1 Values are at the standard supply pressure and based on SMC's measurement standards.

They depend on atmospheric pressure (weather, altitude, etc.) and the measurement method.

*2 10 to 500 Hz for 2 hours in each direction of X, Y, and Z (De-energized, Initial value)

*3 3 times in each direction of X, Y, and Z (De-energized, Initial value)

■ Weight

ZL112A (Basic)	180 g
Port exhaust	+70 g
Digital vacuum pressure switch (Excluding lead wire)	+25 g
Digital vacuum pressure switch (Including 3 cores lead wire)	+56 g
Digital vacuum pressure switch (Including 4 cores lead wire)	+60 g
With supply valve and release valve	+105 g
With supply valve and without release valve	+65 g

■ Supply Valve/Release Valve Specifications

Response time (at 0.5 MPa)*1	25 ms or less
Maximum operating frequency	5 Hz
Manual override	Non-locking push type, Push-turn locking slotted type

*1 Based on JIS B 8419: 2010 dynamic performance test (Standard type: Coil temperature 20°C, at rated voltage, without surge voltage suppressor)

* Refer to the **Web Catalog** for details on valves.

■ Vacuum Pressure Gauge Specifications

Part no.	GZ30S	NGZ30S
Fluid	Air	
Pressure range	-100 kPa to 100 kPa	-30 inHg to 14 psi
Scale range (Angular)	230°	
Accuracy	±3% F.S. (Full span)	
Class	Class 3	
Operating temperature range	0 to 50°C	
Material	Housing: Polycarbonate/ABS resin	

■ Digital Vacuum Pressure Switch Specifications

Rated pressure range		0.0 to -101.0 kPa	
Set pressure range		10.0 to -105.0 kPa	
Withstand pressure		500 kPa	
Smallest settable increment		0.1 kPa	
Applicable fluid		Air, Non-corrosive gas, Non-flammable gas	
Power supply voltage		12 to 24 VDC $\pm 10\%$ (with power supply polarity protection)	
Current consumption		40 mA (at no load)	
Switch output		NPN or PNP open collector 1 output NPN or PNP open collector 2 outputs (selectable)	
	Maximum load current	80 mA	
	Maximum applied voltage	28 V (at NPN output)	
	Residual voltage	1 V or less (with load current of 80 mA)	
	Response time	2.5 ms or less (with anti-chattering function: 20, 100, 500, 1000, 2000 ms)	
	Short-circuit protection	Yes	
Repeatability		$\pm 0.2\%$ F.S. ± 1 digit	
Hysteresis	Hysteresis mode	Variable (0 to variable)	
	Window comparator mode		
Analog output	Voltage *1 output	Output voltage (Rated pressure range)	1 to 5 V $\pm 2.5\%$ F.S.
		Linearity	$\pm 1\%$ F.S. or less
		Output impedance	Approx. 1 k Ω
	Current *2 output	Output current (Rated pressure range)	4 to 20 mA $\pm 2.5\%$ F.S.
		Linearity	$\pm 1\%$ F.S. or less
		Load impedance	Maximum load impedance: Power supply voltage 12 V: 300 Ω , Power supply voltage 24 V: 600 Ω Minimum load impedance: 50 Ω
Display		4-digit, 7-segment, 2-color LCD (Red/Green) Sampling cycle: 5 times/s	
Display accuracy		$\pm 2\%$ F.S. ± 1 digit (Ambient temperature of 25°C)	
Indicator light		Lights up when switch output is turned ON. (OUT1: Green, OUT2: Red)	
Environmental resistance	Enclosure		IP40
	Operating temperature range		Operating: 0 to 50°C, Stored: -10 to 60°C (No freezing or condensation)
	Operating humidity range		Operating/Stored: 35 to 85% RH (No condensation)
	Withstand voltage		1000 VAC for 1 minute between terminals and housing
	Insulation resistance		50 M Ω or more (500 VDC measured via megohmmeter) between terminals and housing
Temperature characteristics		$\pm 2\%$ F.S. (25°C standard)	
Lead wire		Oilproof heavy-duty vinyl cable, 3 cores $\phi 3.5$, 2 m 4 cores Conductor area: 0.15 mm ² (AWG26) Insulator O.D.: 1.0 mm	
Standards		CE, RoHS compliant	

Note 1) If the applied voltage fluctuates around the set value, the hysteresis must be set to a value more than the fluctuating width, otherwise chattering will occur.

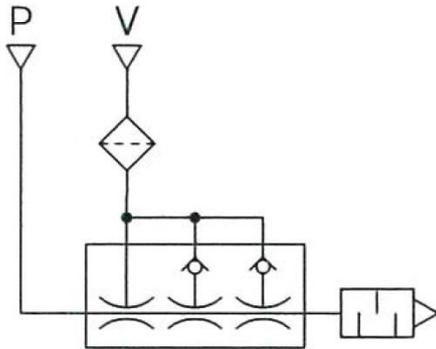
Note 2) When the analog voltage output is selected, the analog current output cannot be selected simultaneously.

Note 3) When the analog current output is selected, the analog voltage output cannot be selected simultaneously.

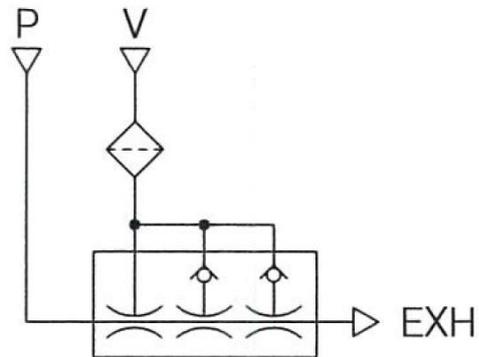
Note 4) For details of the pressure switch, please visit the SMC website URL: <http://www.smcworld.com>.

Circuit diagram

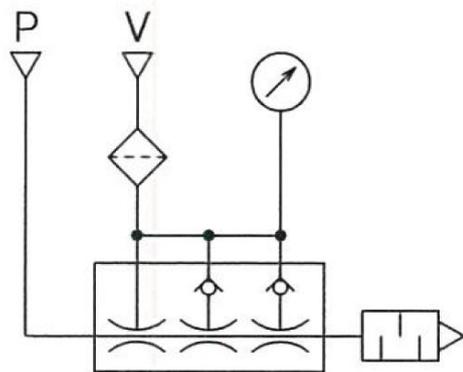
Without valve
ZL112A



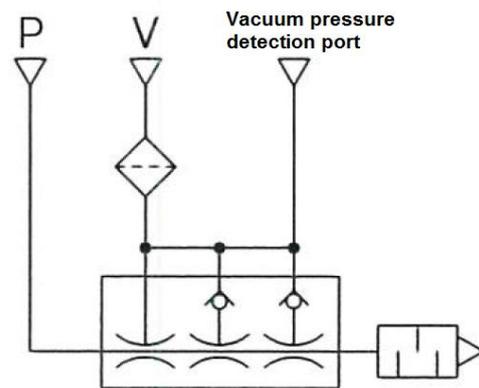
Port exhaust
ZL112AP□



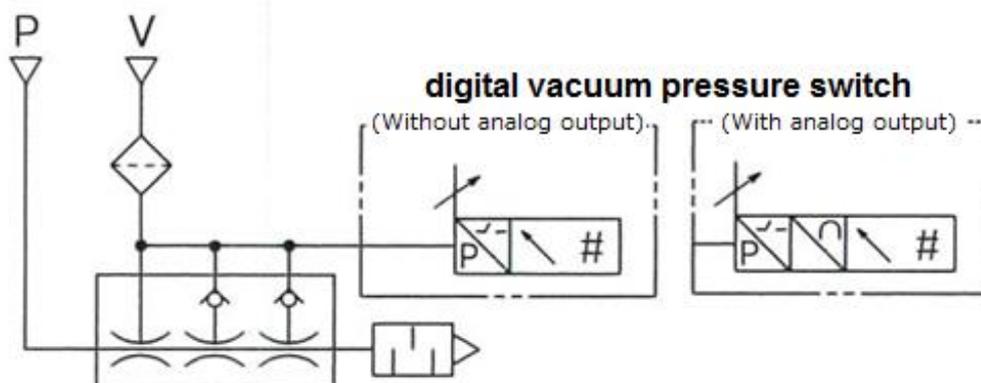
With vacuum pressure gauge
ZL112A-G



With vacuum port adapter
ZL112A-GN



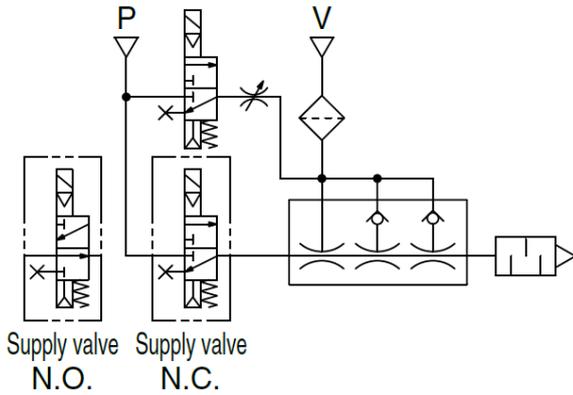
With digital vacuum pressure switch
ZL112A-D□□□



With supply valve and release valve

ZL112A-K1□□□□

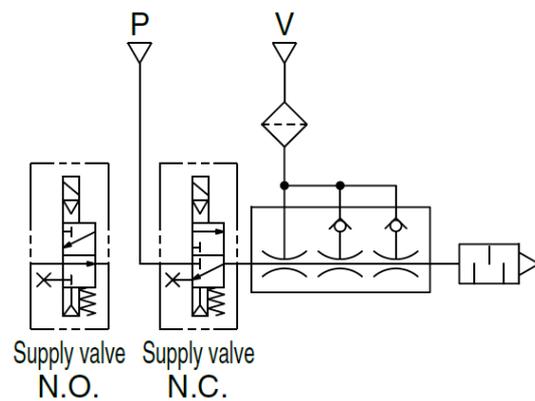
ZL112A-B1□□□□



With supply valve

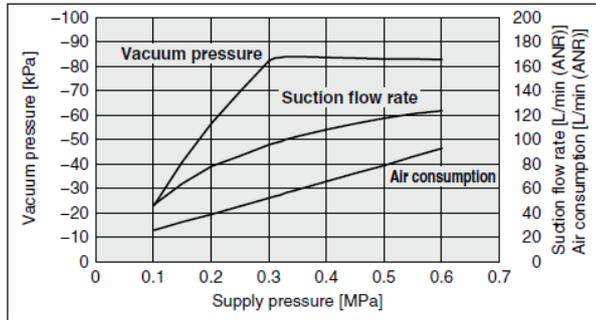
ZL112A-K2□□□□

ZL112A-B2□□□□

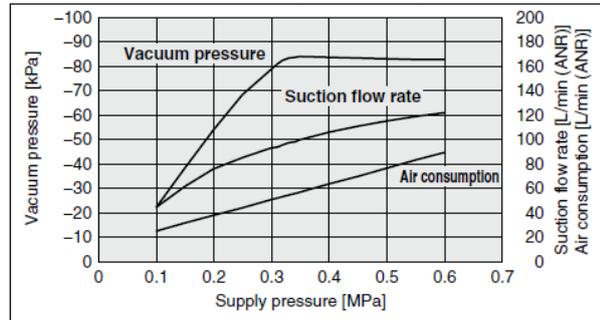


Exhaust Characteristics/Flow Rate Characteristics/Time to Reach Vacuum

Exhaust Characteristics (Without valve)

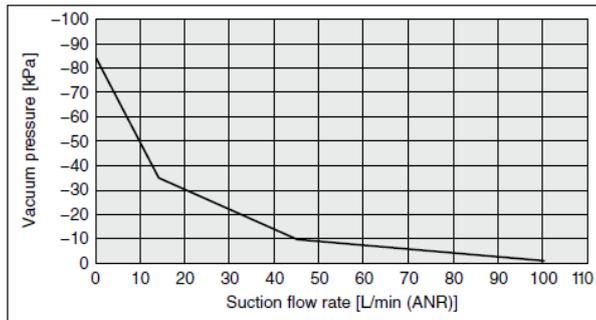


Exhaust Characteristics (With valve)



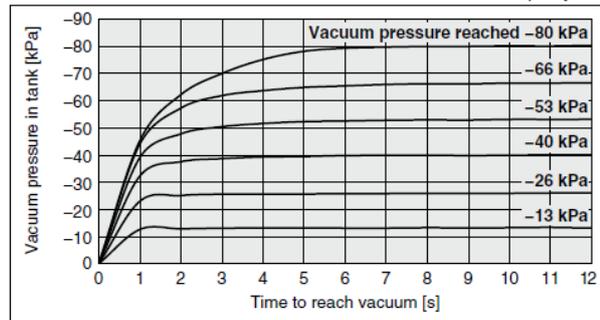
Standard supply pressure: 0.33 MPa (Without valve)
0.35 MPa (With valve)

Flow Rate Characteristics



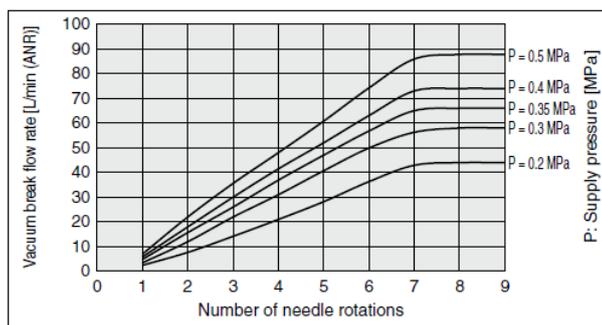
Time to Reach Vacuum

Tank capacity: 1 L



Vacuum Break Flow Adjusting Needle

The graph shows the flow rate characteristics at different supply pressures when the vacuum break flow adjusting needle is open from the fully closed state.



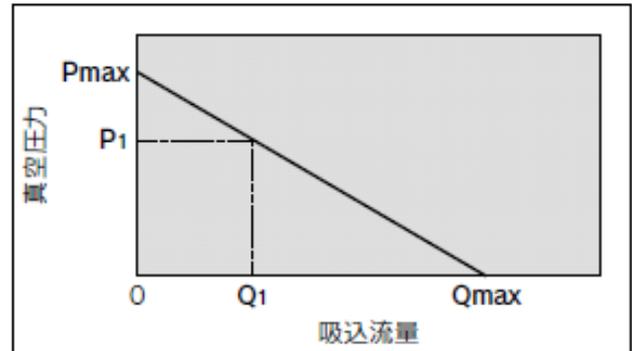
* The flow rates shown in this graph are representative values for the ejector with silencer exhaust specification, and the suction flow may vary depending on the piping conditions at the vacuum (V) port and exhaust (EXH) port, etc.

Flow Characteristics Curve

■ How to read the flow characteristics curves of ejector

The flow characteristics curve shows the relationship between the vacuum pressure and the suction flow of the ejector/vacuum pump system. It shows that the vacuum pressure changes when the suction flow changes.

Generally, the curve shows the relationship at the standard supply pressure of the ejector. In the graph on the right, P_{max} means the maximum vacuum pressure and Q_{max} means the maximum suction flow.



The value shown in this graph is what is shown in this operation manual and the catalogs as the specifications. The change of vacuum pressure is explained in sequence as follows.

- 1) When the vacuum port (V) is closed, the suction flow will be "0" and the vacuum pressure will reach its maximum (P_{max}).
- 2) When the vacuum port (V) is opened gradually, air will flow. (If there is bleeding air, the suction flow will increase, but the vacuum pressure will decrease.): [State of $P_1 - Q_1$]
- 3) If the vacuum port (V) is opened fully, the suction flow will reach its maximum (Q_{max}), but the vacuum pressure will become almost "0" (atmospheric pressure).

As described above, the vacuum pressure changes when the suction flow changes.

Converting this to the adsorption state of the workpiece, the vacuum pressure reaches its maximum when the pad and the piping on the vacuum port (V) have no leakage. Vacuum pressure decreases when there is a lot of leakage when adsorbing a workpiece. When the amount of leakage and the maximum suction flow are equal, the vacuum pressure becomes almost "0", and it fails to adsorb the workpiece.

Vacuum pressure will not increase if the product is used for adsorption of permeable workpieces or in an adsorption state with leakage. In such a case, sufficient verification and prior tests are required.

Troubleshooting

■ Problems when using ejector/ vacuum pump system and troubleshooting

Trouble	Cause	Countermeasures
Initial adsorption failure (It fails to adsorb during the trial run.)	The adsorption area is too small; the adsorption force is not strong enough compared with the weight of the work piece and the force applied during transfer.	Increase the lifting force. → Increase the pad diameter → Increase the number of pads.
	Vacuum pressure is too small, due to leakage at the adsorption part or generation of a space between the pad and the work piece due to deformation of the work piece.	Reduce the vacuum leakage (by increasing the vacuum pressure). → Change the pad configuration. Increase the adsorption area. → Change the pad material (e.g. to a material that fits the uneven surface). → If the workpiece is thin, change to a suitable pad.
	Vacuum pressure is too small, due to leakage of vacuum pressure because of permeability of the work piece.	Check the vacuum pressure and the suction flow. → Change to an ejector with larger suction flow.
	Vacuum pressure is too small due to leakage from the vacuum piping.	→ Repair vacuum leaking part.
	Suction flow is too small. (Ejector performance is not high enough.)	→ Change to an ejector with larger suction flow.
	Suction flow is too small because the piping diameter is too small and the length is too long, causing restriction of suction flow from the ejector.	→ Increase the piping diameter and decrease length on the vacuum side.
	Vacuum pressure and/or suction flow are too small, because supply pressure to the ejector is insufficient.	→ Measure the supply pressure when the vacuum is generated, and increase the supply pressure to the standard supply pressure. Especially when more than one product is operated at the same time in a manifold, the supply air can be insufficient, causing decrease of the supply pressure.
	Vacuum pressure and/or suction flow are too small, due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Perform flushing and mount an air filter on the supply side to prevent it happening again.
	Supply valve malfunction.<0}	Measure the supply voltage to the solenoid valve. → Revise the electrical circuit, wiring and connectors. → Use within the rated voltage range.

Trouble	Cause	Countermeasures
Adsorption response is not quick enough.	Internal capacity of the circuit on the vacuum side is too large for the ejector performance.	→ Reduce the internal capacity of the vacuum circuit. → Change to an ejector with larger suction flow.
	The set vacuum pressure for the suction verification is too high, making the time before it reaches the set value longer.	Optimize the lifting force and change the setting to have the suction verification of vacuum pressure as low as possible.
Fluctuation of vacuum pressure	Supply pressure fluctuates.	Install a tank in the compressed air line on the supply side, and reduce the air consumption of other equipment.
	The generated vacuum pressure fluctuates, making the exhaust noise intermittent at a certain supply pressure range.	This is a phenomenon peculiar to ejectors which is caused when the supply pressure is a little lower than the standard supply pressure. → Increase or decrease the supply pressure a small amount.
Vacuum failure over time (absorbs properly initially.)	Vacuum pressure is reduced, due to clogging of the suction filter (caused by dust in the environment on the vacuum side, sucking of foreign matter from surface of work piece, adsorption of humidity, etc.)	→ Replace the filter element with a new one. → Increase the number of suction filters (such as ZFA, ZFB and ZFC)
	Vacuum pressure is reduced, because of the clogging of the silencer (due to foreign matter such as drainage and carbon particles in the supply air).	Clean the supply air. → Control the drainage. → Add an air filter and a mist separator. → Replace the silencer with a new one.
	Vacuum pressure and/or suction flow is reduced due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Mount an air filter on the supply side to prevent it from happening again.
	Vacuum pressure and/or suction flow is reduced due to clogging of the nozzle and the diffuser.	→ Remove foreign matter and substances sticking to it. (Needs to be repaired.) Mount an air filter on the supply side to prevent it happening again.

Trouble	Cause	Countermeasures
Vacuum failure over time (absorbs properly initially.)	Adsorbing part has some problem, such as deterioration of the vacuum pad, or leakage due to frictional wear.	→ Replace the vacuum pad with a new one. → Revise the adsorption conditions (such as compatibility of the vacuum pressure with the pad/work piece)
	The filter case gasket has come off when the filter element was replaced.	Vacuum pressure leaks if the gasket has come off or out of the groove when maintenance of the filter was performed . → Check if it is mounted properly.
	Defective operation caused by energization of solenoid valve for an extended period of time. (Energized for 10 minutes or more or operated with the duty ratio of 50% or more.)	→ Shorten the energization time of the solenoid valve. → Provide forced ventilation in the operating environment in order to prevent temperature increase around the solenoid valve.
Work piece is not released smoothly.	Vacuum break flow is not large enough.	→ Open the vacuum break flow adjusting needle. → For the ejector with individual ports for release pressure (PD) and supply pressure (PV), increase the pressure at the release pressure port.
	The vacuum pad surface is worn out, making it sticky.	→ Replace the vacuum pad with a new one. → Revise the material and configuration of the vacuum pad. → Use a special pad which has a blasted adsorption surface. (Made-to-order)
	Vacuum pressure is too high.	→ Decrease the supply pressure to lower the vacuum pressure. → Decrease the pressure in the piping on the vacuum side with a vacuum regulator.
	Work piece sticks to the pad due to static electricity.	→ Use a conductive pad.
	Vacuum break signal timing is inappropriate .	If the pad is lifted before the work piece is completely released from the pad, the work piece is lifted together with the pad due to the viscosity of the pad. → Revise the timing of the vacuum break and the lifting of the pad.

If the countermeasures above are not effective, there may be some problem with the product. In that case, stop using the product immediately **without disassembling or repairing it.**

If any of the examples below are applicable, there may be a problem with the product.

1) It was used with a voltage other than the rated voltage. 2) Lubricant was contained in the supply air. 3) Liquid such as water was directly splashed onto the product body. 4) A strong impact was applied to the product. 5) Drainage and dust got mixed into the supply air. 6) Other actions corresponding to the precautions mentioned in this operation manual have occurred.

When removing the product from the application, be sure to confirm that the safety measures are taken, and shut off the compressed air supply and the power supply before removing the product.

Revision history

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URL <http://www.smcworld.com>

Note: Specifications are subject to change without prior notice and any obligation on the part of the manufacturer.

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