



# Operation Manual

## PRODUCT NAME

Electric Vacuum Gripper

## MODEL / Series / Product Number

*ZXPE5\*011P-\*\*\*\*-\*\*\**

The outward appearance showed on this manual is an example of the vacuum gripper with suction cups which is indicated by the product number: ZXPE5A011P-25JS-\*. Refer to the suction cup catalog for the detail of other applicable suction cups.

**SMC Corporation**

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# Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage. These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC)\*1), and other safety regulations.

\*1) ISO 4414: Pneumatic fluid power - General rules and safety requirements for systems and their components  
ISO 4413: Hydraulic fluid power - General rules and safety requirements for systems and their components  
IEC 60204-1: Safety of machinery - Electrical equipment of machines - Part 1: General requirements  
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots  
etc.



## Danger

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



## Warning

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



## Caution

**Caution** indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate 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. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

### 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 falling or runaway of the driven objects 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, and 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. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments. Use under such conditions or environments is not covered.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogs and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.



# Safety Instructions

## Caution

**We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.**

**Use in non-manufacturing industries is not covered.**

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

## 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 1.5 years after the product is delivered, whichever is first.\*2)

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 our 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.

**\*2) Suction cups are excluded from this 1 year warranty.**

A suction cup 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 suction cup or failure due to the deterioration of rubber material are not covered by the limited warranty

### Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.

2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.









## ■ 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

 <b>Warning</b>	
 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.

 <b>Caution</b>	
 Do not touch	Do not touch the terminals and connectors while the power is on. Otherwise electric shock, malfunction or damage to the switch can result.
 Instruction	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. Perform sufficient verification before using this product.
 Instruction	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.

## ■ Precautions for Handling

Follow the instructions given below for selecting and handling of the electric vacuum gripper.

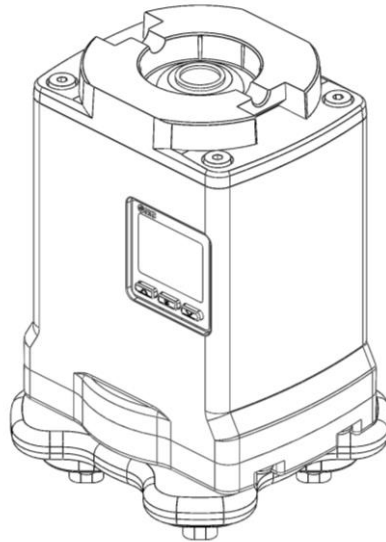
### Product specifications

- Ensure to provide enough space for maintenance.  
Design the system allowing the required space for maintenance.
- Use the specified voltage. Otherwise, failure or malfunction can result.
- Do not exceed the specified maximum allowable load. Otherwise, it can cause damage or shorten the life of the product.
- 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.
- Data duration of input data to the pressure monitor is 20 years.

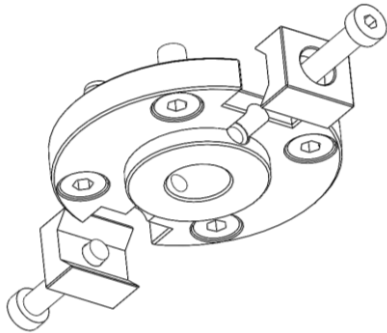
### Operating environment

- Do not use the product in environments where the following atmospheres exist:
  1. Corrosive gases, chemicals, sea water, water, water stream, or where there is contact with any of these
  2. Flammable gases or explosive gases
  3. Oil or chemicals
  4. Thermal cycles other than normal temperature changes
  5. Direct sunlight (ultraviolet rays) or outdoor
  6. Ambient temperature exceeds the operating temperature range (refer to the specification table)
  7. A source of heat, causing radiant heat
- Do not use the product in an area where surges are generated.  
When there are machines or equipment that generate a large surge near the product (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 use the product in an area where a strong magnetic field or strong electric field is generated; this can result in damage to internal parts and product malfunction.
- Do not allow oil, moisture, particles, dust, cutting chips, spatter, or other foreign objects to enter inside the product; this can result in deterioration in product performance or malfunction. Provide appropriate protection when using the product in an environment where contamination may occur.
- Do not apply vibration or impact to the product. Handle the product with care as vibration and impact may cause deterioration in product performance or malfunction.

# 1. Parts included in the package



Electric Vacuum Gripper: 1 pc.



Main plate assembly

Part No. RMTM2-4M1

Parallel pin (6x10) × 1, Parallel pin (6x15) × 1,  
Hexagon thin socket head bolt (M6 x 10) × 4, Hexagon  
thin socket head bolt (M6 x 8) × 4, Hexagon thin  
socket head bolt (M5x25) × 2  
(When "With main plate assembly" is selected.)

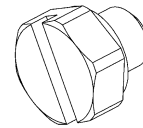


Connector cable: 1 pc.

Part No. RMH-A00-11-A  
(When "With connector cable" is  
selected.)



Cup with adapter: 4 pcs.  
(When "Cup diameter" is selected.)



Plug: 4 pcs.

Part No. M-3P

(When "With flange assembly" is selected)  
(Used for decreasing the number of suction  
cups)

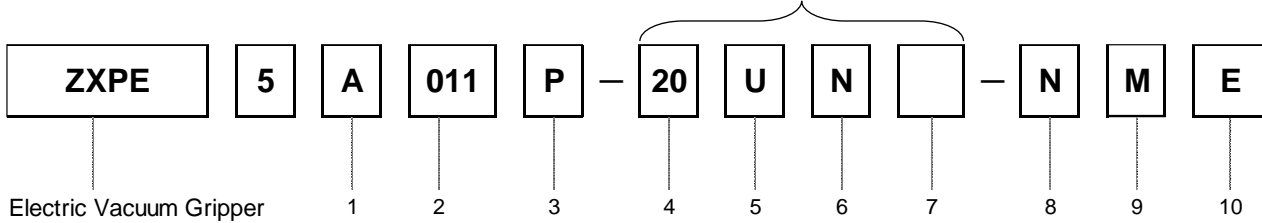




## 2. How to order

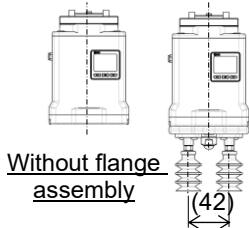
Suction cup part \*1

Refer to “■ Suction Cup Part Numbers and Weights” for the applicable cups.



### 1. Cup mounting flange assembly

A	With flange assembly (42mmx42mm)
N	Without flange assembly



With flange assembly

### 2. Compatible robot

Symbol	Robot manufacturer	Supported models
011	UNIVERSAL ROBOTS	UR3(e) *2
		UR5(e) *2
		UR10(e) *2
		UR16e

\*2 URcap is only available for the e-Series.

### 3. Output type

P	PNP
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### 4. Cup diameter

Nil	Without cup
08	Φ8
10	Φ10
13	Φ13
16	Φ16
20	Φ20
25	Φ25
30	Φ30
32	Φ32

### 5. Cup form

Nil	Without cup
U	Flat
C	Flat with rib
B	Bellows
UT	Thin flat
J	Multistage bellows
JT2	2.5-stage bellows
JT5	5.5-stage bellows
PT	Flat type for film packaging workpieces

### 6. Cup material

Nil	Without cup
N	NBR
S	Silicone rubber (White)*3
U	Urethane rubber
F	FKM
SF	Silicone rubber (Blue)*3

\*3 The silicone material is compliant with the FDA (U.S. Food and Drug Administration) regulation 21CFR § 177.

### 7. Cup attachment \*4

Nil	With (guide) attachment
M	With mesh attachment
F	With flat attachment

\*4 Only applicable to the cup form “JT\*.” Note that “M” applies only to cup form: JT2.

### 8. Robot connection cable

Nil	With connector cable
N	Without connection cable

### 9. Pressure monitor unit specifications

C	With unit switching function *5
M	SI unit only *6

\*5 Under the New Measurement Act, switches with the unit selection function are not permitted for use in Japan.

\*6 Fixed unit: kPa, MPa

### 10. Manual changer

E	With main plate assembly
F	Without main plate assembly

The main plate assembly is required to mount the gripper to the robot. In addition, when the main plate assembly is mounted to the robot, several different tool models can be used with the robot. Customers who already have a main plate assembly can select option “F” (Without main plate assembly).

- See “■ Suction Cup Part Numbers and Weights” for the suction cup part combination.
- Refer to the catalog of suction cup on the SMC website for the detail of suction cup.

\*1


## ■ Suction Cup Part Numbers and Weights

ZXPE5(A,N)011P - 4 5 6 7 -\*

Applicable cups

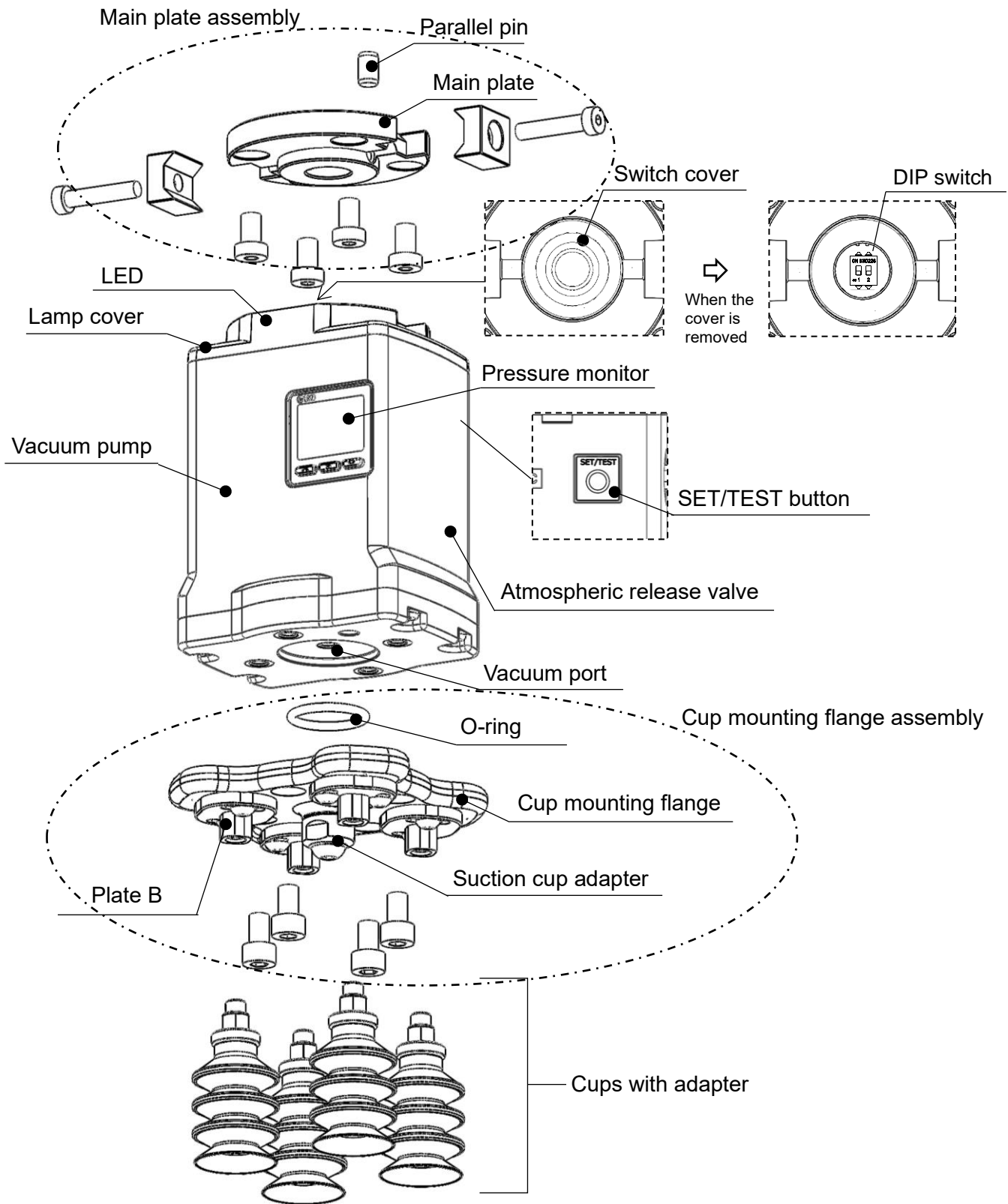
4 Cup diameter	5 Cup form	6 Cup material	7 Cup attachment
08	U	*	
08	B	*	
10	UT	*	
13	UT	*	
16	UT	*	
10	U	*	
13	U	*	
16	U	*	
20	U	*	
25	U	*	
32	U	*	
10	C	*	
13	C	*	
16	C	*	
20	C	*	
25	C	*	
32	C	*	
10	B	*	
13	B	*	
16	B	*	
20	B	*	
25	B	*	
32	B	*	
20	UT	*	
16	J	*	
25	J	*	
30	J	*	
20	JT2	SF	
20	JT2	SF	M
20	JT2	SF	F
25	JT2	SF	
25	JT2	SF	M
25	JT2	SF	F
32	JT2	SF	
32	JT2	SF	M
32	JT2	SF	F
20	JT5	SF	
25	JT5	SF	
32	JT5	SF	
20	PT	SF	
25	PT	SF	

Cup part numbers

Part No.	Weight by cup material (g/cup)				Adapter unit Vacuum inlet: Male thread M6 × 1	Cup unit	
	N (NBR)	S/SF (Silicone rubber)	U (Urethane rubber)	F (FKM)			
	Cup with adapter 						
ZPT08U*-A6	4	4	4	4	ZPT1-A6	ZP08U*	
ZPT08B*-A6	4	4	4	4		ZP08B*	
ZPT10UT*-A6	4	4	4	4		ZP10UT*	
ZPT13UT*-A6	4	4	4	4		ZP13UT*	
ZPT16UT*-A6	4	4	4	4		ZP16UT*	
ZPT10U*-AS6	7	7	7	7	ZPT2-AS6	ZP10U*	
ZPT13U*-AS6	7	7	7	8		ZP13U*	
ZPT16U*-AS6	7	7	7	8		ZP16U*	
ZPT20U*-AS6	9	10	10	10		ZP20U*	
ZPT25U*-AS6	10	10	10	11	ZPT3-AS6	ZP25U*	
ZPT32U*-AS6	10	11	11	12		ZP32U*	
ZPT10C*-AS6	7	7	7	7		ZPT2-AS6	ZP10C*
ZPT13C*-AS6	7	7	7	7			ZP13C*
ZPT16C*-AS6	7	7	7	8	ZP16C*		
ZPT20C*-AS6	9	10	10	11	ZP20C*		
ZPT25C*-AS6	10	10	10	11	ZPT3-AS6	ZP25C*	
ZPT32C*-AS6	10	11	11	12		ZP32C*	
ZPT10B*-AS6	7	7	7	8		ZPT2-AS6	ZP10B*
ZPT13B*-AS6	7	8	8	8			ZP13B*
ZPT16B*-AS6	8	8	8	9	ZP16B*		
ZPT20B*-AS6	11	11	11	13	ZP20B*		
ZPT25B*-AS6	11	12	12	14	ZPT3-AS6	ZP25B*	
ZPT32B*-AS6	14	15	15	18		ZP32B*	
ZP2-T20UT*-A6	4	4	4	4		ZPT1-A6	ZP2-20UT*
ZP2-T16J*-AS6	8	8	8	9		ZPT2-AS6	ZP2-16J*
ZP2-TB25J*-AS6	14	15	15	18	ZPT3-AS6	ZP2-B25J*	
ZP2-TB30J*-AS6	18	19	19	25		ZP2-B30J*	
ZP3P-T20JT2SF-W-AS6	-	21	-	-		ZP3PA-T1JT-AS6	ZP3P-20JT2SF-W
ZP3P-T20JT2SF-WM-AS6	-	21	-	-			ZP3P-20JT2SF-WM
ZP3P-T20JT2SF-WF-AS6	-	21	-	-	ZP3P-20JT2SF-WF		
ZP3P-T25JT2SF-W-AS6	-	21	-	-	ZP3P-25JT2SF-W		
ZP3P-T25JT2SF-WM-AS6	-	21	-	-	ZP3P-25JT2SF-WM		
ZP3P-T25JT2SF-WF-AS6	-	21	-	-	ZP3P-25JT2SF-WF		
ZP3P-T32JT2SF-W-AS6	-	37	-	-	ZP3PA-T2JT-AS6	ZP3P-32JT2SF-W	
ZP3P-T32JT2SF-WM-AS6	-	37	-	-		ZP3P-32JT2SF-WM	
ZP3P-T32JT2SF-WF-AS6	-	37	-	-		ZP3P-32JT2SF-WF	
ZP3P-T20JT5SF-AS6	-	23	-	-		ZP3PA-T1JT-AS6	ZP3P-20JT5SF-WG
ZP3P-T25JT5SF-AS6	-	25	-	-	ZP3P-25JT5SF-WG		
ZP3P-T32JT5SF-AS6	-	43	-	-	ZP3PA-T2JT-AS6		ZP3P-32JT5SF-WG
ZP3P-T20PTSF-AS6	-	20	-	-	ZP3PA-T1-AS6		ZP3P-20PTSF
ZP3P-T25PTSF-AS6	-	20	-	-		ZP3P-25PTSF	

### 3. Names and descriptions of parts

#### 3.1. Names of parts of the product

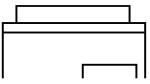
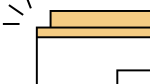

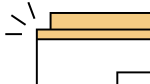
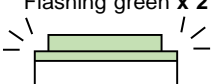

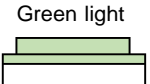
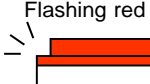
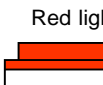


## 3.2. Descriptions of parts

Main plate assembly:	Connects the gripper with the robot.
LED:	Indicates the gripper status.
DIP switch:	Changes the gripper operation mode.
Pressure monitor:	Displays real-time vacuum pressure, the gripper operation mode and sets parameter threshold values.
Vacuum pump:	Generates vacuum.
Atmospheric release valve:	Releases air to atmosphere upon the release command.
SET/TEST button:	Moves to initial setup and diagnostic function or between parameters.
Cup mounting flange assembly:	Connects a cup with the gripper body.
Cups with adapter:	Grips workpieces. Select a cup suitable for the workpiece. (Refer to " <a href="#">8.1. How to calculate theoretical lifting force</a> " and the suction cup catalog for how to select a suction cup.)

### 3.2.1. LED

Table 1. LED light and status of the gripper

LED	Gripper status	LED	Gripper status
No light 	No supply voltage	Flashing orange 	Initial setup and diagnostic
Flashing green 	Idle state	Flashing orange x 2 	At the start of initial setup and diagnostic
Flashing green x 2 	Set value fixed	Flashing red 	Alarm
Green light 	Grip success	Flashing red x 2 	Execute "Factory reset", Setting values invalid
		Red light 	Grip/release failure, Work drop detection, Setpoint error


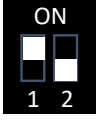






### 3.2.2. DIP switch (for changing the gripper operation mode)

To change the gripper operation mode, use the 2-pole DIP switch on the top of the product. Change the operation mode before mounting the electric vacuum gripper on the robot, while the power is off.

#### How to change

1. Remove the switch cover above the Lamp cover and switch ON or OFF the DIP switch as shown in the table below.
2. Return the switch cover and connect the electric vacuum gripper to the robot. (Refer to [“4.1. Mounting”](#).)

Table 2. Gripper operation modes

Gripper operation mode	Automatic mode (Factory default)	Manual mode	Continuous mode	Automatic mode and auto-diagnostic*
Output	1pole:OFF 2pole:OFF	1pole:ON 2pole:OFF	1pole:OFF 2pole:ON	1pole:ON 2pole:ON
Image of DIP switch				
Pressure monitor sub screen display (left) (After power on)				

\* In “Automatic mode and auto-diagnostic” mode, the vacuum pressure without workpiece is automatically diagnosed when the gripper is turned on. (For details on operation, see [“5.1. Initial setup and diagnostic function”](#)).

### 3.2.3. Gripper operation modes

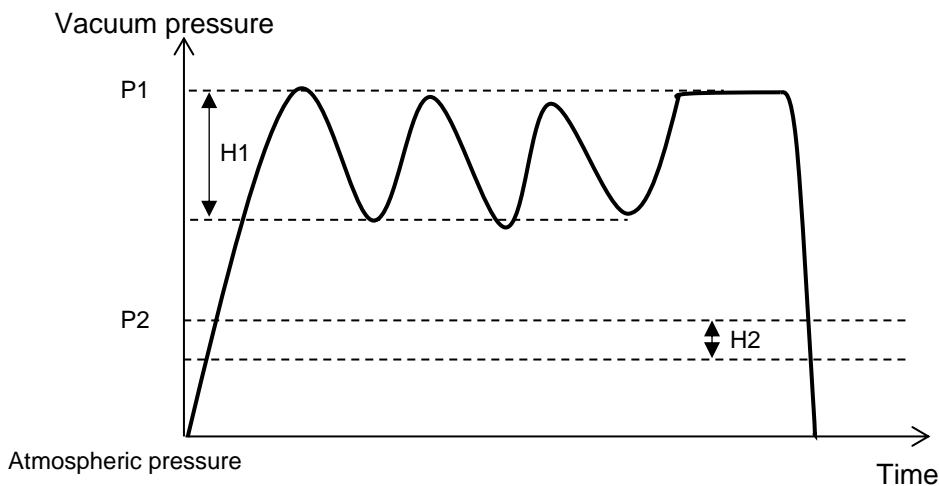
#### 3.2.3.1. Automatic mode

In automatic mode, the electric vacuum gripper operates in an energy-saving manner, automatically setting a threshold value based on the vacuum pressure at gripping, the maximum vacuum pressure of the product, and the pre-determined vacuum pressure without workpiece (\*).

Below is the description of the energy-saving operation.

Upon the grip command, the pump engages and starts suctioning. According to the vacuum pressure after suction has started, the gripper performs one of the following five actions:

1. When the vacuum pressure reaches P1, the pump stops. After that, when the vacuum pressure drops by H1, the pump starts again and maintains the vacuum. If the vacuum pressure reaches P1 again, the pump stops, and thereafter it repeats the on and off cycle. If the on and off cycle is repeated a predetermined number of times, the pump will operate continuously.
2. When the vacuum pressure reaches P1, the pump stops. When the vacuum pressure drops by H1, the pump starts again. However, if the vacuum pressure does not reach P1, the pump runs continuously.
3. If the vacuum pressure does not increase sufficiently after the start of suction, the pump does not stop and runs continuously.
4. If the vacuum pressure does not reach P2, it indicates that gripping has failed, and the pump stops.
5. If the vacuum pressure drops to P2+H2 during suction, it indicates that a dropped workpiece event has been detected, and the pump stops.



- P1: Threshold of pressure for energy-saving operation
- H1: Energy-saving operation range
- P2: Pressure for gripping success detection
- H2: Hysteresis of pressure for gripping success detection
- (P2+H2: Pressure for workpiece drop detection)

\*Vacuum pressure without workpiece means the pressure when the grip command is given without workpiece.

### 3.2.3.2. Manual mode

In manual mode, threshold values are manually set, and the vacuum gripper operates in an energy-saving manner (which controls the pump's actions) similarly to automatic mode. The following four threshold values can be set with the buttons on the pressure monitor as described in "[5.2.4. Viewing and setting thresholds](#)". Refer to "[6.2. List of setting items](#)" for default values and adjustable ranges.

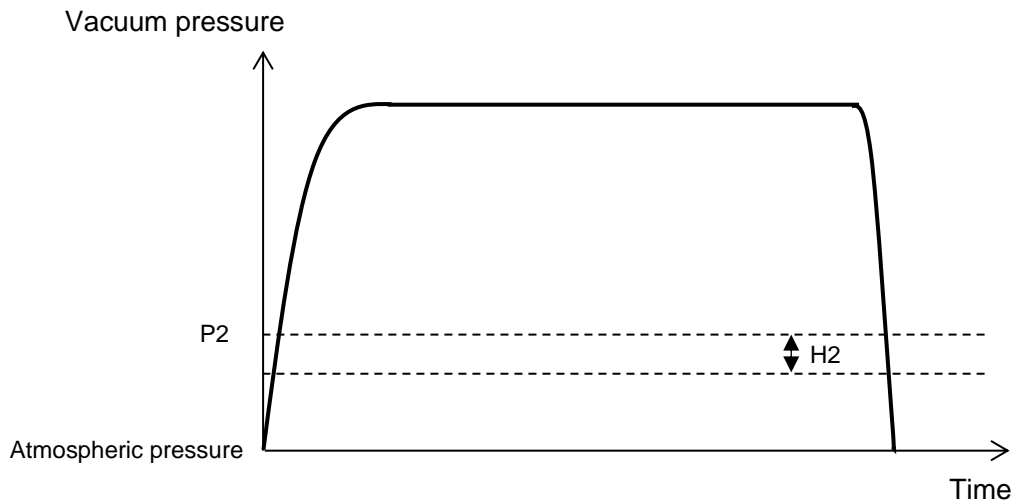
- P1: Threshold of pressure for energy-saving operation
- H1: Energy-saving operation range
- P2: Pressure for gripping success detection
- H2: Hysteresis of pressure for gripping success detection
- (P2+H2: Pressure for workpiece drop detection)

### Caution

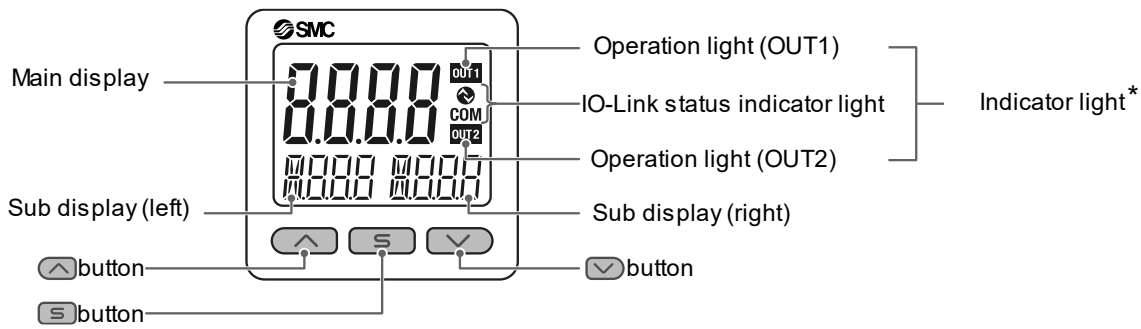
In manual mode, each threshold value can be set arbitrarily within adjustable range, but depending on the set value, malfunctions may occur.  
For example, if the vacuum pressure without workpiece  $P_e$  at initial setup is higher than the manually set the pressure for workpiece drop detection  $P2+H2$ , the workpiece drop detection cannot be judged correctly. In that case, set the value appropriately or use automatic mode or continuous mode.

### 3.2.3.3. Continuous mode

In continuous mode, the pump operates continuously while the grip command is valid. The pressure for gripping success detection  $P2$  and the hysteresis of pressure for gripping success detection  $H2$  are automatically determined based on the gripper maximum vacuum pressure and the pre-determined vacuum pressure without workpiece.



### 3.2.4. Pressure monitor display



**Main display:** Displays pressure measurement values. (in red)

**Sub display (left):** Displays the current gripper operation mode or parameter (in orange)

**Sub display (right):** Displays the set value, peak value or bottom value (in orange)

The buttons on the pressure monitor are used only in manual mode or to change the measurement unit.

**▲ button:** Increases a set value and changes the parameter to display.

**▼ button:** Decreases a set value and changes the parameter to display.

**S button:** Changes a set value.

\*Indicator lights indicate as follows:

**IO-Link status indicator:** Always turns on while the gripper is energized as IO-Link communication is used inside the product.

**Gripper's vacuum status indicator: (OUT1/OUT2):** Turns on or off according to the threshold values of each parameter. But it is not relevant to the product's specification.



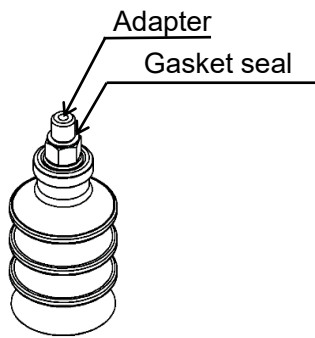
## 4. Mounting

### 4.1. Mounting

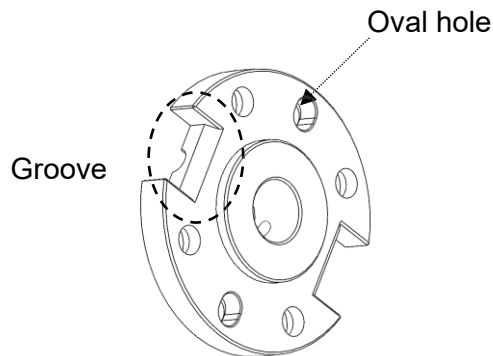
#### ■ Mounting the gripper on the robot

- 1) Insert the parallel pin into the robot tool flange pin hole.
- 2) Aligning the parallel pin with the oval hole of the main plate, mount the main plate on the robot with 4 hexagon thin socket head bolts provided, with a tightening torque of  $5.2 \pm 0.5$  N·m.
- 3) Aligning the grooves of the main plate and the lamp cover, insert the clamber into the grooves and mount the gripper by tightening the hexagon thin socket head bolts (M5 X 25) with a tightening torque of  $1.5 \pm 0.1$  N·m.
- 4) With the gasket seal in place on the adapter, mount 4 cups with adapter on the electric vacuum gripper with a tightening torque of 1 N·m or tighten by 1/4 turn using a spanner after tightening by hand.

To remove the gripper, follow the mounting procedure in reverse.

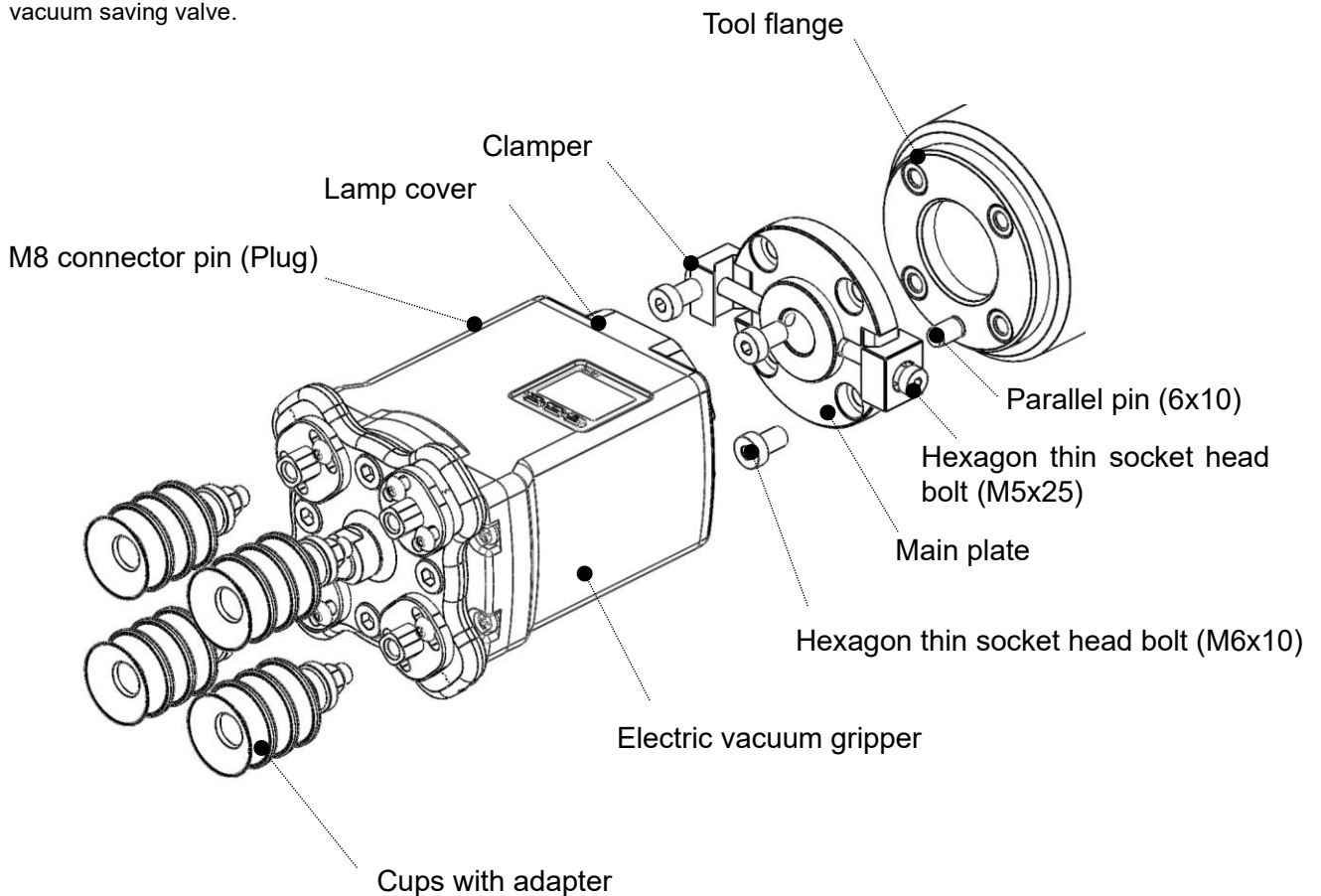


Cup with adapter



Main plate

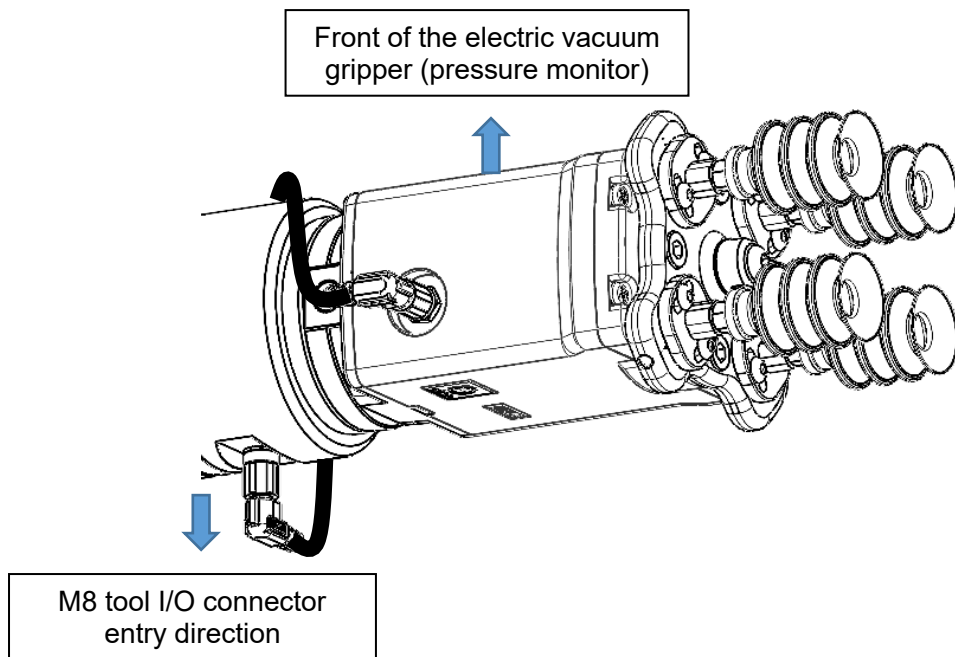
\*Refer to "[8.3. Suction with a vacuum saving valve](#)", when using the ZP2V vacuum saving valve.



 **Caution**

Mount the electric vacuum gripper on the robot in an orientation that minimizes slack in the M8 connector cable. If the cable slack is large, the cable may cause an unexpected accident by pulling on the surrounding equipment, workpieces, or people while the robot is in operation.

<Example of mounting>

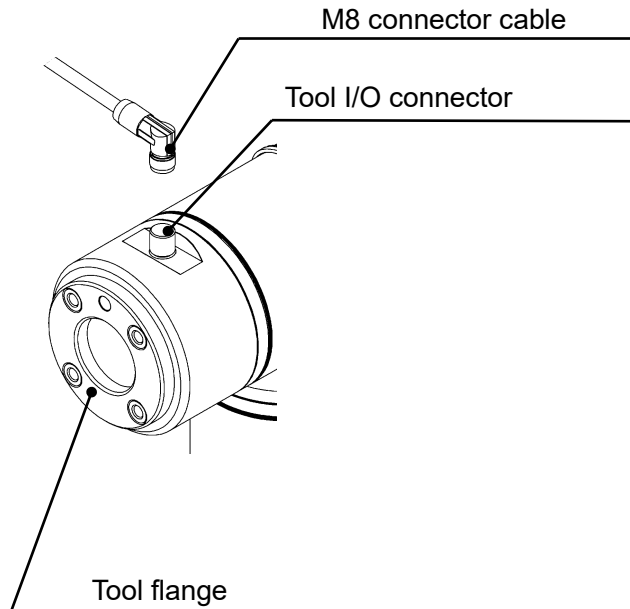


## 4.2. Wiring

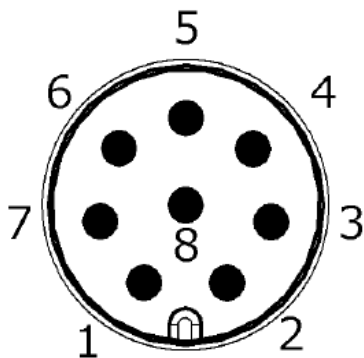
### ■ Mounting the M8 connector cable

Connect the electric vacuum gripper's M8 connector pin and the tool flange's tool I/O connector together with the M8 connector cable.

Do not energize while securing the connector.  
Check that the connector is not loose.



### ■ M8 Connector pin



M8 connector plug angle

Table 3. M8 connector pin assign

Pin no.	Function
1	RS485+
2	RS485-
3	Digital output 1
4	Digital output 0
5	Power supply voltage (24V)
6	Digital input 1 *
7	Digital input 0 *
8	Power supply voltage (GND)

\* Set the digital output 0/1 in the robot tool I/O to sourcing (PNP).

### 4.3. Power on

When supply voltage is applied to the M8 connector cable, the pressure monitor is turned on and performs zero-clear (\*). The LED flashes green, indicating that the electric vacuum gripper is idling.

#### Caution

Power on the electric vacuum gripper with the vacuum port released to atmosphere. This product clears the display value to zero upon power on. If it is powered on with pressure applied (performs zero-clear), the displayed pressure value may deviate. If this happens, power it on again after powering off and removing the pressure from the vacuum port to release to atmosphere.




\*Zero-clear: Function to adjust the displayed pressure to zero.

## 5. Operation

### 5.1. Initial setup and diagnostic function

The following initial setup and diagnostic can be performed.

Table 4. Initial setup and diagnostic items

Function	Setup and diagnostic item Note 1	Execution timing	Vacuum port status	Pressure monitor sub screen display
Initial setup	Vacuum pressure without workpiece: Pe	When the cup conditions are changed Note 2	Atmospheric release	
Diagnostic	Gripper maximum vacuum pressure: Pp	Arbitrary	Plug *Seal the vacuum port.	
	Vacuum pressure without workpiece: Pe	Arbitrary or When the gripper is activated Note 3 (When "Automatic mode and auto-diagnostic" mode is selected.)	Atmospheric release	

Note 1: Vacuum pressure without workpiece: Pressure when the grip command is given without workpiece.

Gripper maximum vacuum pressure: Pressure when the grip command is given with the vacuum port plugged.

Note 2: The threshold values for automatic and continuous mode are defined based on the vacuum pressure without workpiece at the initial setup. If the cup or other conditions are changed, perform the initial setup without workpiece before operating the gripper.

Note 3: If "Automatic mode and auto-diagnostic" is selected using the DIP switch on the top of the product, the diagnostic starts automatically when the product is turned on and the result is displayed on the sub screen. Refer to "[3.2.2. DIP switch \(for changing the gripper operation mode\)](#)" for switching method.


#### • Initial setup - Vacuum pressure without workpiece

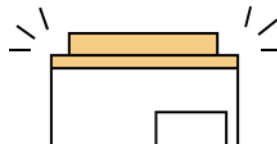
The vacuum pressure is measured while the pump is operating for five seconds and the calculated vacuum pressure is automatically set as the new vacuum pressure without workpiece. Based on this newly set vacuum pressure, the threshold values for automatic and continuous mode are defined. If the cup specifications are changed, perform this initial setup before operating the gripper.


#### • Diagnostic - Gripper maximum vacuum pressure and vacuum pressure without workpiece

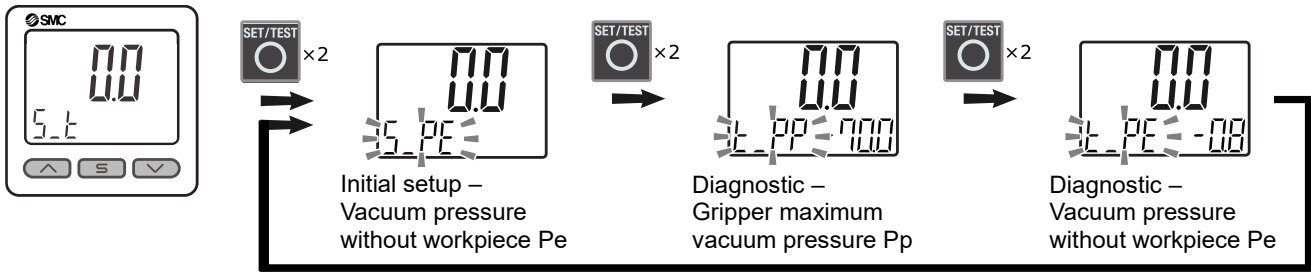
The vacuum pressure is measured while the pump is operating for five seconds and the current vacuum pressure is calculated. The current pressure is diagnosed by comparing with the pressure when the gripper is in appropriate condition and the LED indicates the result. Refer to [#Table 5](#) for details.


#### How to use buttons

- Press and hold the SET/TEST button () for five or more seconds and less than ten seconds. Release the button when [S\_T] is displayed on the left of the sub screen. The LED will flash orange, indicating that the initial setup is now ready to be performed.



2. Double click  to change the display on the left of the sub screen.



3. With the item to be measured or diagnosed displayed, press  for one or more seconds and less than three seconds to operate the pump for five seconds and measure the pressure.
4. After measurement, the measured pressure will be displayed on the left of the sub screen for five seconds.

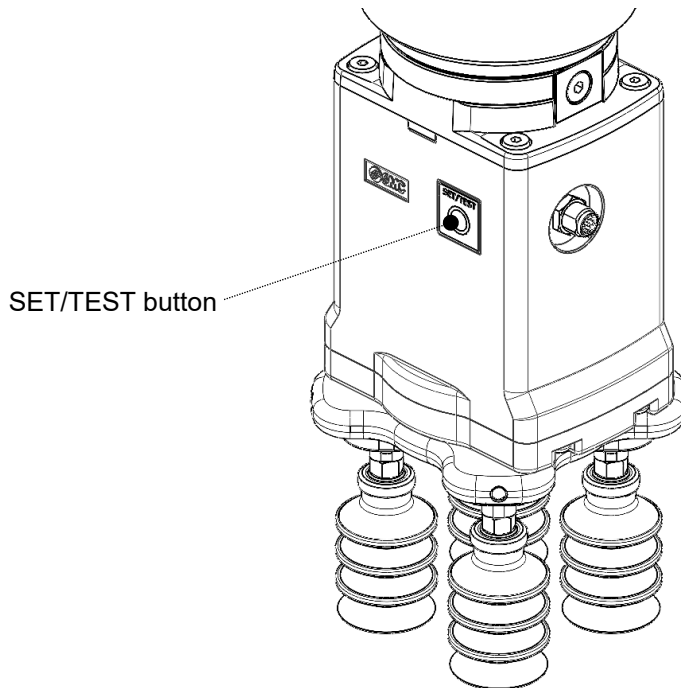





Table 5. Initial setup and diagnostic results display and diagnostic details

Function	Setup and diagnostic item	Display of setup and diagnostic results	Contents of diagnostic	Countermeasure
Initial setup	Vacuum pressure without workpiece: Pe	<p>•Pressure monitor</p>  <p>Left: Setup measurement value, Right: No display</p> <p>•LED <span style="float: right;">Note 1</span> If setup is completed: Green light If it could not be set up: Red light</p>		
Diagnostic	Gripper maximum vacuum pressure: Pp	<p>•Pressure monitor</p>  <p>Left: Diagnostic measurement value, Right: Value at shipping inspection</p> <p>•LED Normal: Green light Caution: Red light</p>	<p>A diagnostic measurement value of less than -70 kPa indicates a "caution" decision. The gripper maximum vacuum pressure may be reduced due to a loose plug or cup mounting flange fastening or air leakage inside the product.</p> <p>e.g. Diagnostic measurement value = -74.5 kPa: Normal Diagnostic measurement value = -69.0 kPa: Caution</p>	<p>Check that there are no loose plug or cup mounting flange fastenings. If there are no loose connections, air leaks inside the product (e.g. internal product failure or poor vacuum pump performance) may be the cause.</p>
	Vacuum pressure without workpiece: Pe	<p>•Pressure monitor</p>  <p>Left: Diagnostic measurement value, Right: Initial setup value</p> <p>•LED Normal: Green light Caution: Red light</p>	<p>If the diagnostic measurement value is outside the permissible range, a "caution" decision is made. The following possibilities are considered.</p> <ul style="list-style-type: none"> <li>• The vacuum pressure without workpiece is increasing due to clogging of the mesh on the cup mounting flange.</li> <li>• The cup conditions are different from the initial setup.</li> </ul> <p>The threshold is determined by the gripper maximum vacuum pressure and the initial setup value.</p> <p>e.g. When Pp= -75.2 kPa and Pe=0.0 kPa Permissible range: -4.0 kPa &lt; diagnostic measurement value &lt; 4.0 kPa Diagnostic measurement value = -3.9 kPa: Normal Diagnostic measurement value = -4.0 kPa: Caution</p>	<p>If the operation continues in the state of "caution", there is a risk of malfunction, please carry out the following.</p> <ul style="list-style-type: none"> <li>• Clean the mesh. Note 2</li> <li>• Re-perform the initial setup.</li> </ul>

Note 1: If the initial setup measurement value is outside the adjustable range, the LED lights up red for 5 seconds and the measurement value is not set.

Note 2: Refer to "[9.2. Maintenance for suction cup 2\) Mesh](#)" for details.

 **Caution**

The gripper maximum vacuum pressure at the time of shipment from the factory is recorded in the gripper as a value converted at standard atmospheric pressure (101.3 kPa). On the other hand, the measurement of the gripper maximum vacuum pressure at diagnostic is based on the atmospheric pressure at the time of diagnostic.

If the atmospheric pressure at the time of diagnostic differs significantly from the standard atmospheric pressure, the diagnostic judgement may be affected. So it is recommended to use diagnostic measurement value corrected for atmospheric pressure to make a decision.

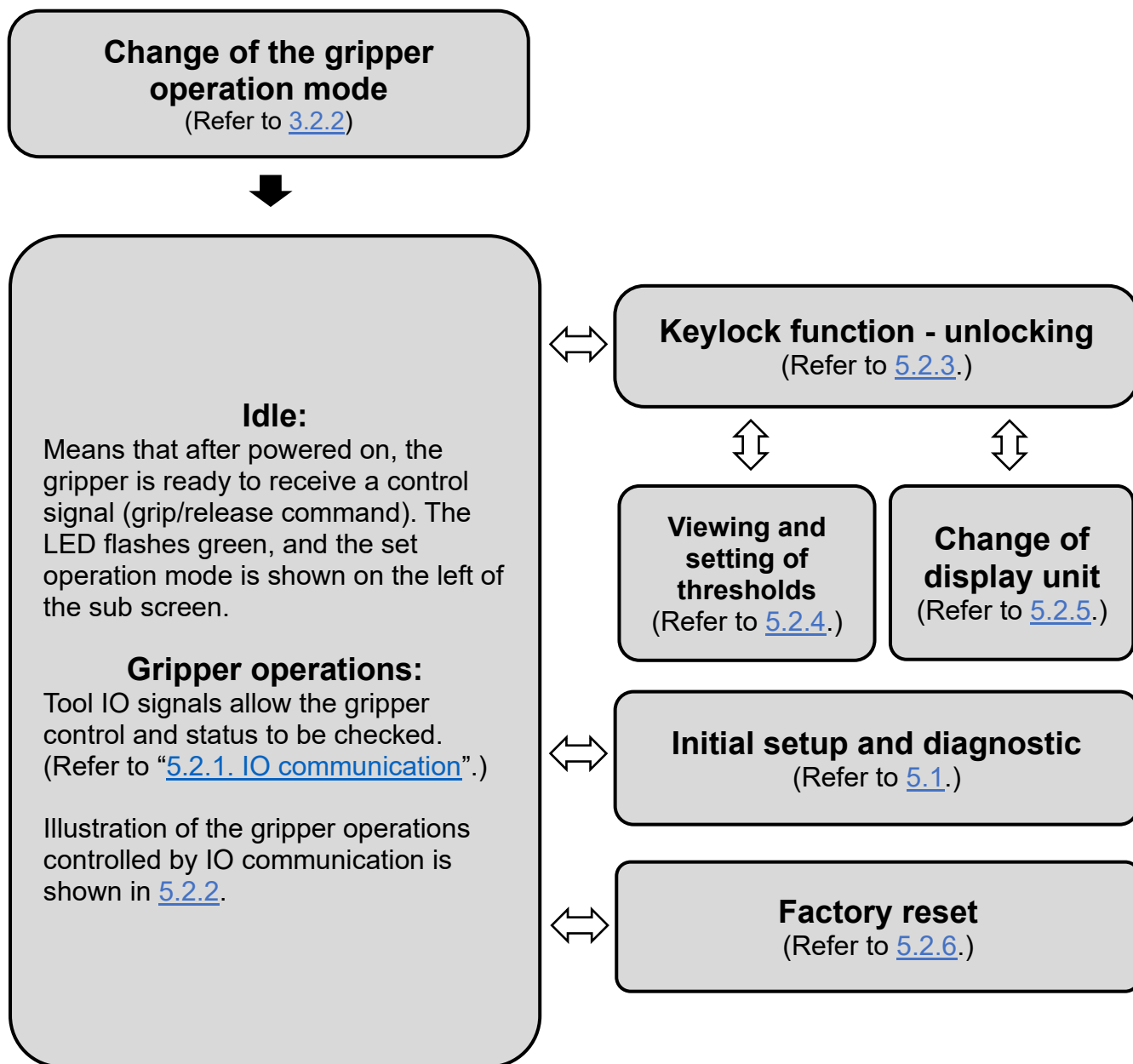
Example: When the atmospheric pressure at diagnostic is 96.3 kPa,

Diagnostic measurement value (-69 kPa) - [standard atmospheric pressure (101.3 kPa) - atmospheric pressure at time of measurement (96.3 kPa)] = diagnostic measurement value (-74 kPa)

The diagnostic measurement value -69 kPa is less than the judgment value -70 kPa, so a "caution" judgment is made, after atmospheric pressure correction, the value is -74 kPa and a "normal" judgement is made.

## 5.2. Gripper operation

Use the buttons on the gripper body to set each parameter. See the diagram below for how to set digital signals and buttons on the gripper.



### Caution

The pressure monitor has functions that are not used for gripper operation, but malfunctions may occur when using functions not described in this manual. Do not perform any operations other than those described in this manual. In case of malfunction, perform the factory reset (Refer to "[5.2.6. Factory reset](#)").



### 5.2.1. IO communication

#### Tool IO signals

Digital inputs are allocated to the gripper’s control signals, and digital outputs are allocated to the status signals.

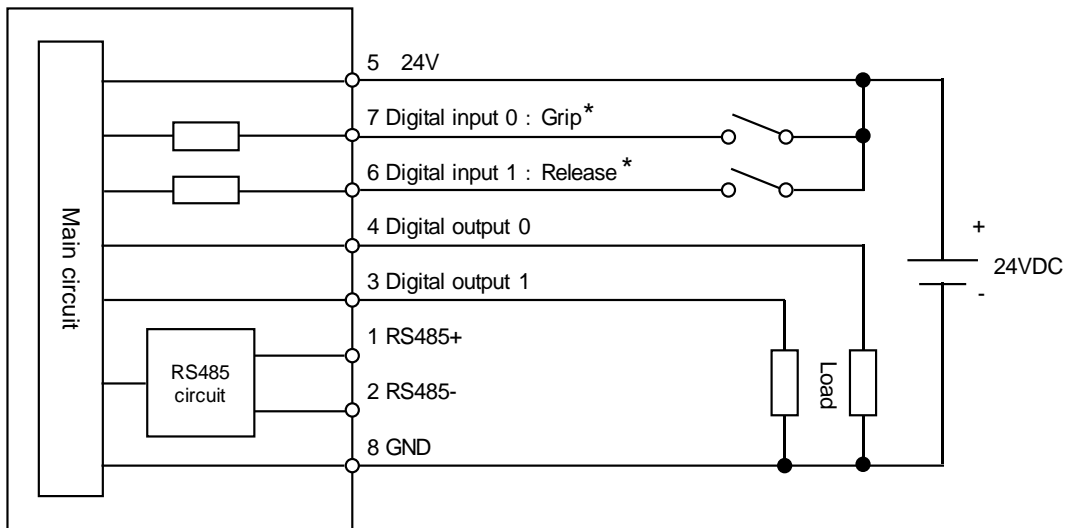
Table 6. Digital inputs (control signals from the robot to the gripper)

Digital input 0	Digital input 1	Status
OFF	OFF	Idle
ON	OFF	Grip command
OFF	ON	Release command
ON	ON	Idle

Table 7. Digital outputs (status signals from the gripper to the robot)

Digital output 0	Digital output1	Status
OFF	OFF	Idle
ON	OFF	Grip/release success
OFF	ON	Grip failed, work drop detection or release failed
ON	ON	Alarm occurred

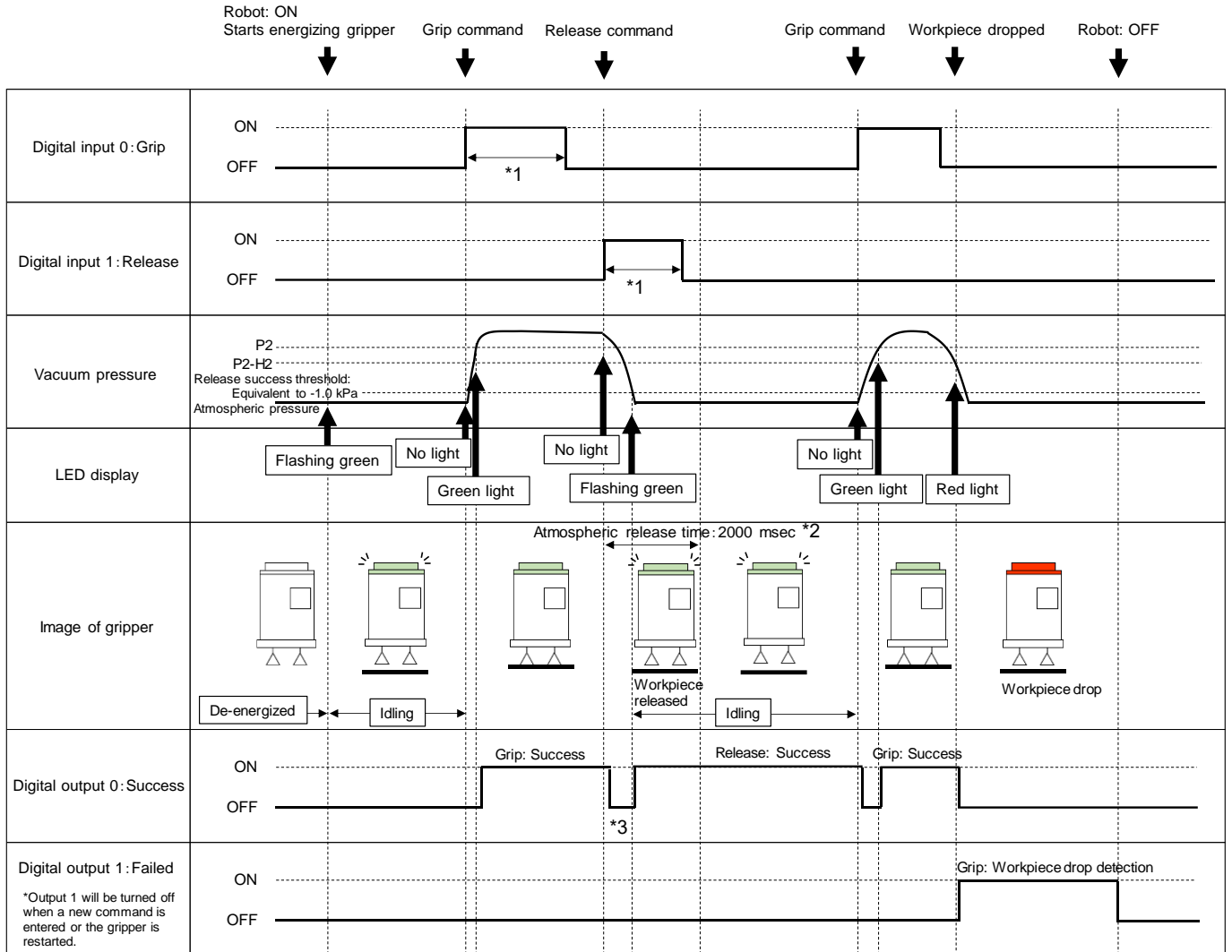
#### Internal circuit and wiring example



\*Set the digital output 0/1 in the robot tool I/O to sourcing (PNP).

## 5.2.2. Illustration of the gripper operation via IO communication

### Example 1 – Grip/release motion and work drop detection



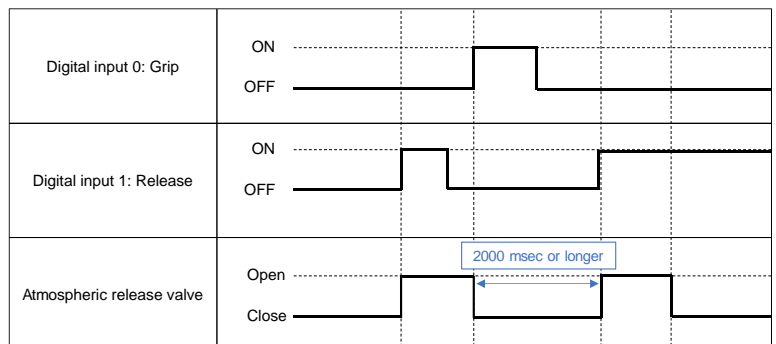
\*1 Enter digital input signals for 200 msec or longer.

\*2 At the time of release, the atmospheric release valve opens for an atmospheric release time of 2000 msec (fixed value).

If the release success signal is output even during the atmospheric release time, the grip command can be input without waiting 2000 msec, and the atmospheric release valve is closed at the same time as the grip command is input.

### ⚠ Caution

To restrain the rise in the coil surface temperature of the atmospheric release valve, an interval of at least 2000 msec should be allowed between when the valve closes and when the valve opens by inputting a release command.

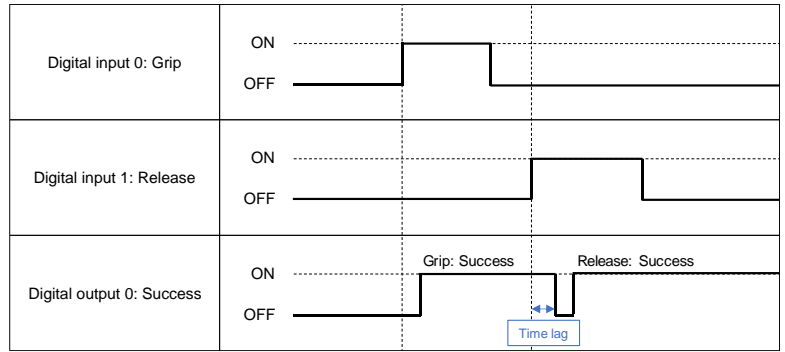


\*3

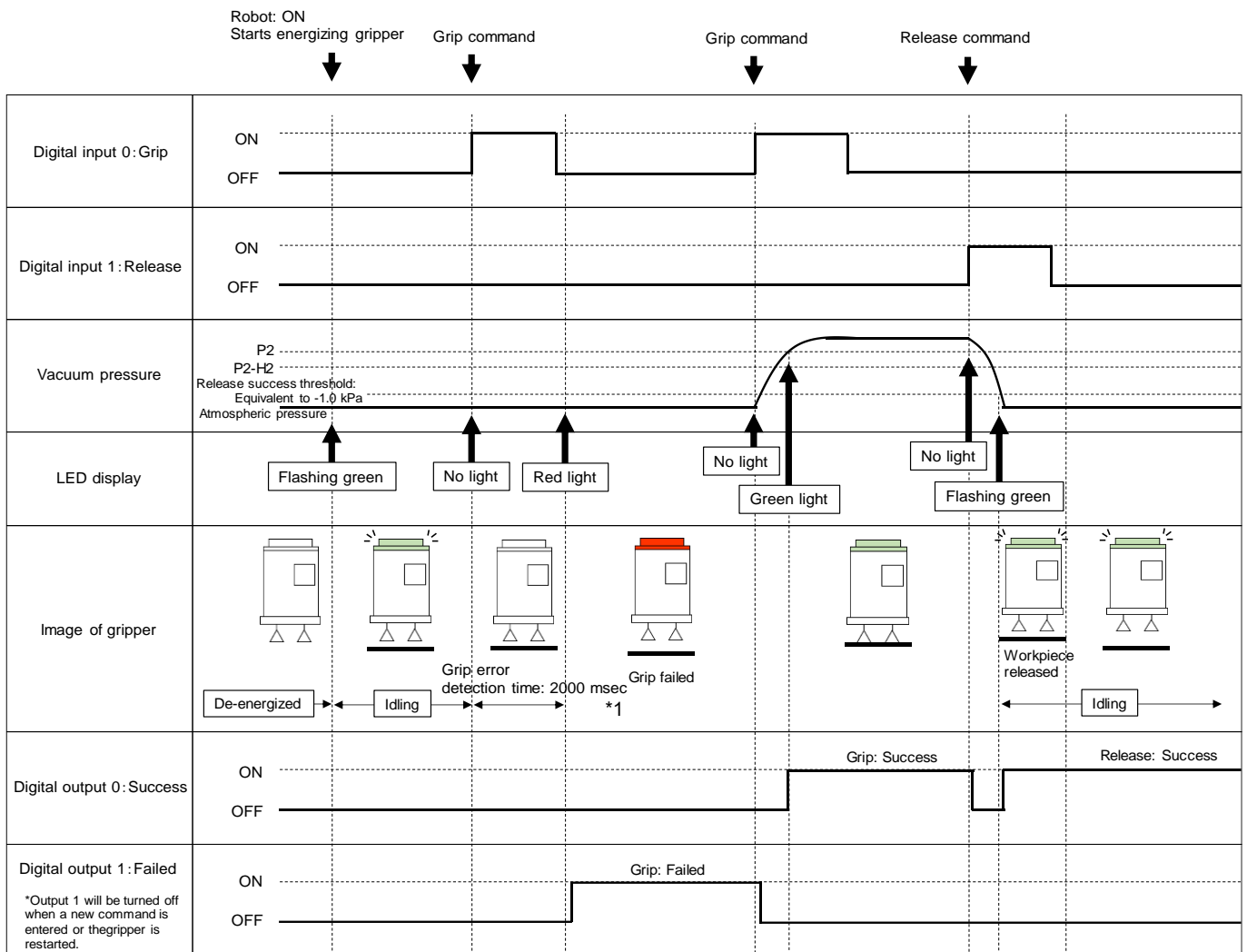
**Caution**

Both the success signals for grip and release operations are output at digital output 0. As there is a time lag of up to 99 msec between the input and the output, the success signal should be checked after 100 msec from the input of the current command.

Example - Each signal at entering release



Example 2 – Gripping failed



\*1 Grip error detection time: If the vacuum pressure does not rise to a predetermined value within 2000 msec (fixed value), the grip failed is judged.

### 5.2.3. Keylock function

The set button (S) on the pressure monitor is locked by default.

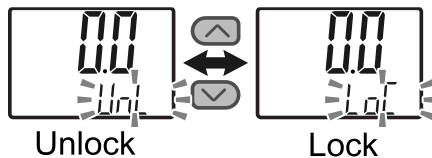
Unlock the button as shown below before changing threshold values (in manual mode) or changing the measurement unit. After setting is completed, lock the button again or power off and on the electric vacuum gripper to lock the button.

#### How to unlock the button

1. Press the (S) button on the pressure monitor for 5 seconds or longer and stop pressing the button once [oPE] is displayed on the main screen. [LoC] will be displayed on the sub screen.



2. Press (Up) or (Down) button to select [UnL] and press the (S) button to unlock it. Similarly, to lock the button, select [LoC] and press the (S) button.



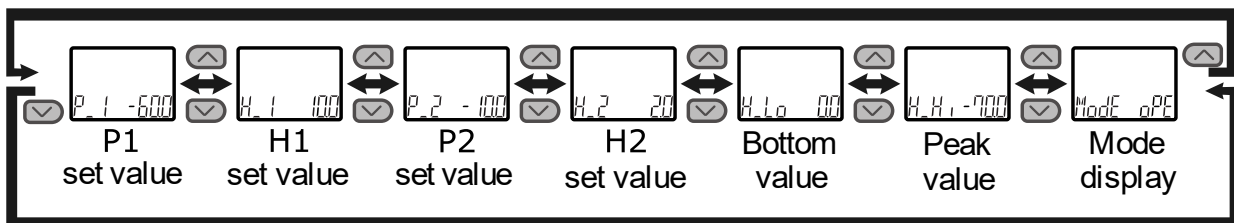
### 5.2.4. Viewing and setting thresholds (in Manual mode only)

View or set values after unlocking the set button on the pressure monitor.

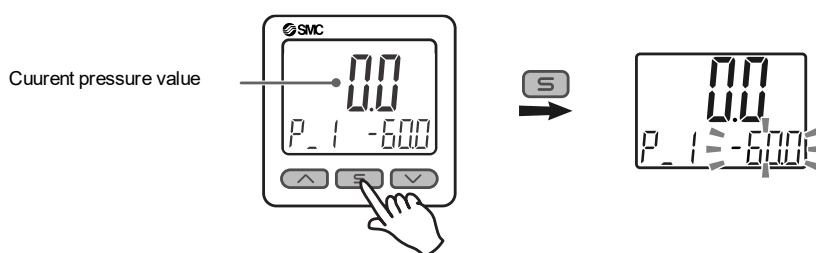
The set value becomes valid, and the gripper operates accordingly only in Manual mode. Refer to [“6.2. List of setting items”](#) for the adjustable range.



#### How to set values





1. Pressing the up or down button on the pressure monitor changes the parameter to display on the sub screen.

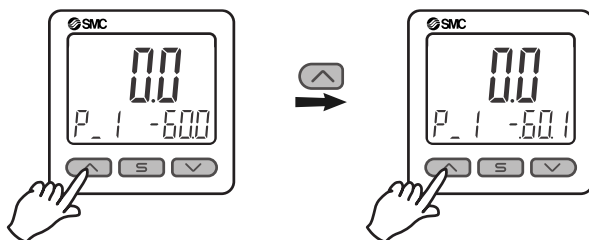




2. With the parameter to be changed displayed on the sub screen, press the (S) button once; the set value on the right of the sub screen will start flashing.




- Press the  or  button to change the set value.

The  button increases the value, and the  button decreases it. Pressing the  (or ) button once increases (or decreases) the value by one digit, pressing and holding the button increases (or decreases) the value continuously.



- After pressing the  button, press the  button on the back of the gripper twice to confirm the new value. The LED will flash twice in green.

If the  button is not pressed, the value will be set after about 10 seconds (with no LED flashing).




If the new value is outside of the allowable range, the LED will light red when the set button is pressed. The invalid value will not be stored; [Er\*\*] is displayed on the left of the sub screen. (In \*\*, P1, H1, P2 or H2 is shown to indicate the parameter of which set value is invalid.) The right of the sub screen shows the existing threshold value. The error message disappears once a value within the allowable range is set or the gripper is restarted. If the value is not reset, the gripper performs according to the previous set value.

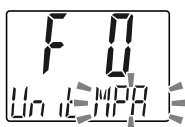
### 5.2.5. Change of measurement unit


Ensure to unlock the set button in advance to enable the buttons on the pressure monitor.


The measurement unit on the display can be changed. The changeable unit depends on the unit specification of the selected pressure unit. Refer to "[6.2. List of setting items](#)" for details.


#### How to change the unit

- Press and hold the  button for 3 seconds or longer and less than 5 seconds to show [F 0] on the main screen.
- Press  or  to select the measurement unit to display.



- Press the  button for 2 seconds or longer to return to the display screen of gripper operation mode. (Refer to [#Table 2](#) for details of display screen.)

- Press the  button on the back of the gripper twice to confirm the unit switching. The LED will flash twice in green.


If the  button is not pressed, the unit will be switched after about 10 seconds (with no LED flashing).

### 5.2.6. Factory reset

The gripper can be reset to the factory settings if the current settings are uncertain. For the default values, refer to [“6.2. List of setting items”](#).

#### How to reset



1. Press and hold the  button for 10 seconds or longer until [RSET] is shown on the left of the sub screen of the pressure monitor, and then release the button. The LED flashes orange twice; the gripper is now reset to the factory settings.

## 6. Specifications

### 6.1. Specifications

#### ■ Product specifications

Table8. Specifications

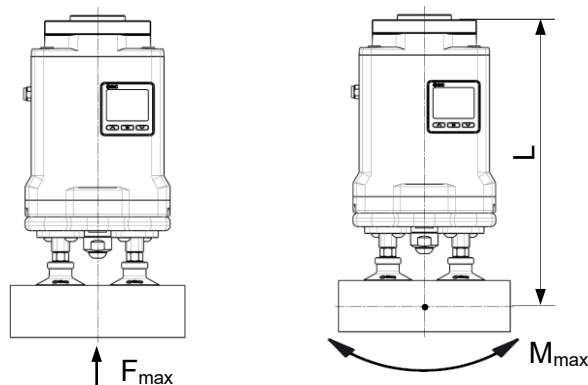
Body specifications	Standards	Conforming to "ISO 9409-1-50-4-M6"	
	Operating temperature range [°C]	5 to 40	
	Connector type	M8 8-pin (Plug)	
	Weight [g] excluding cups with adapter <sup>1)</sup>	722 (556)	
	Max. work load [kg] <sup>2)</sup>	5	
	Static allowable load $F_{max}$ [N] <sup>3)</sup>	150	
	Static allowable moment $M_{max}$ [N·m] <sup>3)</sup>	1	
	Max. vacuum pressure [kPa] <sup>4)</sup>	-74	
	Max. suction flow rate [L/min(ANR)] <sup>4)</sup>	4.5	
	Impact / Vibration resistance [m/s <sup>2</sup> ] <sup>5)</sup>	150 / 30	
	Noise level [dB(A)] <sup>6)</sup>	60	
Power specifications	Power supply voltage [V]	24 VDC ±10%	
	Current consumption [mA] <sup>7)</sup>	Max. current <sup>8)</sup>	1,400
		Standby current <sup>9)</sup>	60
IO communication input specifications	Input type	PNP	
	Input ON voltage [V]	15 or more	
	Input ON current [mA]	3 or more	
	Input OFF voltage [V]	5 or less	
IO communication output specifications	Input OFF current [mA]	0.5 or less	
	Output type	PNP	
	Max. load current [mA]	200	
	Protection	Short-circuit protection	
Pressure monitor specifications	Rated pressure range [kPa]	0.0 to -101.0	
	Display pressure range [kPa]	10.0 to -105.0	
	Display/Smallest adjustable increment [kPa]	0.1	
	Display accuracy [%]	±2 F.S. ±1 digit (Ambient temperature of 25±3°C)	
	Repeatability [%]	±0.2 F.S. ±1 digit	
Applicable suction cups	Temperature characteristics [%]	±2 F.S. (25°C standard)	
	Standard	Refer to "2. How to order". CE / UKCA MARKED	

1) The weight in parentheses refers to the weight of the product without a cup mounting flange. The weight differs according to the suction cups. Refer to "2. How to order".

2) The maximum workload is restricted by the cup diameter, mounting orientation and workpieces. Use this product within its maximum workload. Grip or transport of a workpiece exceeding the maximum workload may cause a reduction in vacuum pressure due to air leakage.

3) Limit values of the product itself. If there are other restrictions, such as a robot to be connected, use the ZXPE within these limits. When combining a load and moment such as at the time of transportation, make sure the load factor is 1 or less according to the equation below.

$$F/F_{max} + M/M_{max} \leq 1 \text{ (Load factor)}$$



- 4) These are the values under SMC measurement conditions when the gripper is in continuous mode (the vacuum pump working continuously) and may vary depending on the atmospheric pressure (weather, altitude, etc.) and the measurement method.
- 5) Impact resistance: The characteristics are satisfied after being tested one time in each of the X, Y and Z directions with energization. (Initial value)  
Vibration resistance: The characteristics are satisfied after being tested a one sweep in each of the X, Y and Z directions at 10 to 500 Hz with energization. (Initial value)
- 6) Actual values under SMC's measurement conditions (Not guaranteed values)
- 7) When supply voltage of 24VDC is applied.
- 8) Including inrush current.
- 9) The standby current is an average current when the electric vacuum gripper is on standby.



## 6.2. List of setting items

Table 9. List of setting items

Setting items	Factory default	Adjustable range	Note
Gripper operation modes	Automatic mode	Refer to <a href="#">#Table 2.</a>	Dip switch 1 pole: OFF, 2 pole: OFF
Display pressure unit	kPa	Refer to <a href="#">#Table 10.</a>	
P1: Threshold of pressure for energy-saving operation	-60.0	-40.0 to -70.0	Value when display unit kPa is selected. For values when other units are selected, refer to <a href="#">#Table 11.</a>
H1: Energy-saving operation range	10.0	0.0 to 10.0	
P2: Pressure for gripping success detection	-10.0	-10.0 to -30.0	
H2: Hysteresis of pressure for gripping success detection	2.0	0.0 to 10.0	
Pe: Vacuum pressure without workpiece	Shipping inspection value	0.0 to -49.9	Set by initial setup. ( <a href="#">#Table 4</a> )
Pp: Gripper maximum vacuum pressure	Shipping inspection value		Not configurable
Grip error detection time	2000 msec	Fixed value	
Atmospheric release time	2000 msec	Fixed value	

Table 10. Adjustable unit

Part No.	Adjustable unit
ZXPE5*011P-**-**C*	kPa(Factory default)、MPa、kgf/cm <sup>2</sup> 、bar、psi、InHg、mmHg
ZXPE5*011P-**-**M*	kPa(Factory default)、MPa

Table 11. Factory default and settable range of each parameter

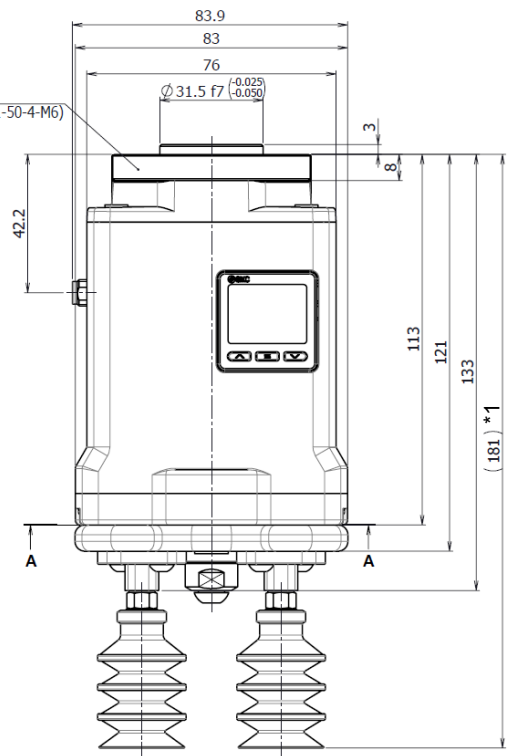
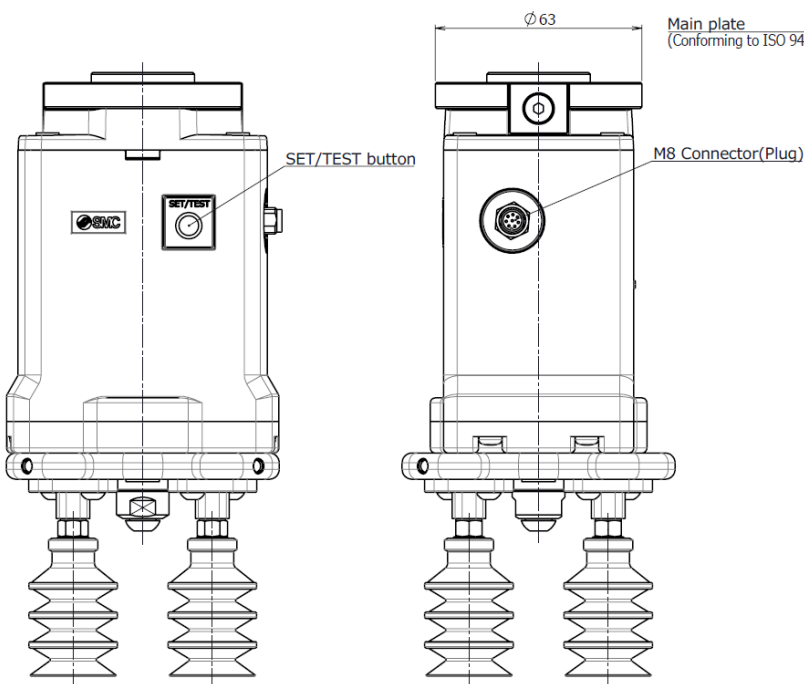
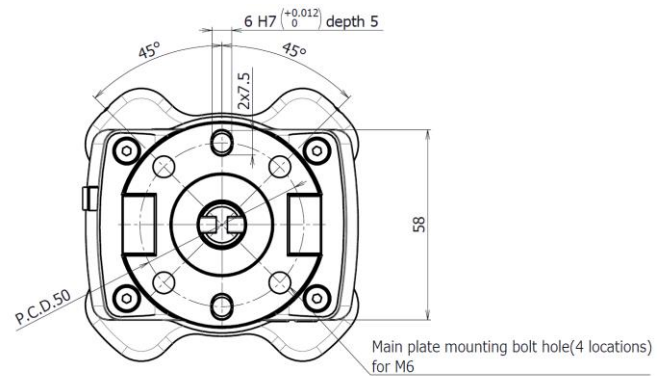
		kPa	MPa	kgf/cm <sup>2</sup>	bar	psi	InHg	mmHg
P1	Factory default	-60.0	-0.060	-0.612	-0.600	-8.70	-17.7	-450
	Max.	-70.0	-0.070	-0.713	-0.700	-10.15	-20.6	-525
	Min.	-40.0	-0.040	-0.408	-0.400	-5.80	-11.9	-300
H1	Factory default	10.0	0.010	0.102	0.100	1.45	2.9	75
	Max.	10.0	0.010	0.102	0.100	1.45	3.0	75
	Min.	0.0	0.000	0.000	0.000	0.00	0.0	0
P2	Factory default	-10.0	-0.010	-0.102	-0.100	-1.45	-3.0	-75
	Max.	-30.0	-0.030	-0.306	-0.300	-4.35	-8.8	-225
	Min.	-10.0	-0.010	-0.102	-0.100	-1.45	-3.0	-75
H2	Factory default	2.0	0.002	0.020	0.020	0.29	0.6	15
	Max.	10.0	0.010	0.102	0.100	1.45	2.9	75
	Min.	0.0	0.000	0.000	0.000	0.00	0.0	0

### Caution

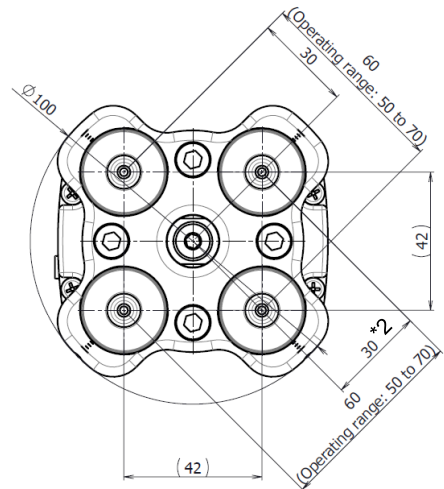
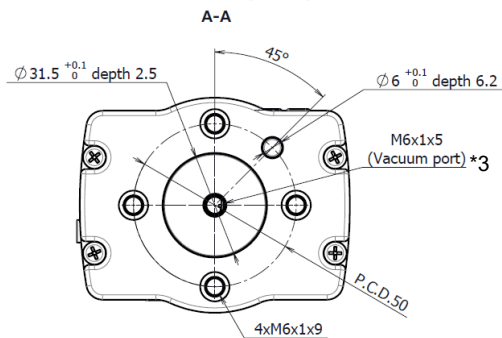
If the value is set at the maximum / minimum of the settable range, setting error may occur because switching units causes conversion errors in the values.

# 7. Dimensions

## 7.1. Electric Vacuum Gripper



Without cup mounting flange assembly



- \*1 The cup with adapter ZP2-TB25JS-AS6 is used.
- \*2 Operating range: 25 to 35 (when a cup is mounted in the center). Cups interfere each other depending on the cup diameter. Select the cup diameter according to the pitch to be used.
- \*3 No mesh is fitted to the vacuum port.

## 7.2. Tool center point and center of gravity

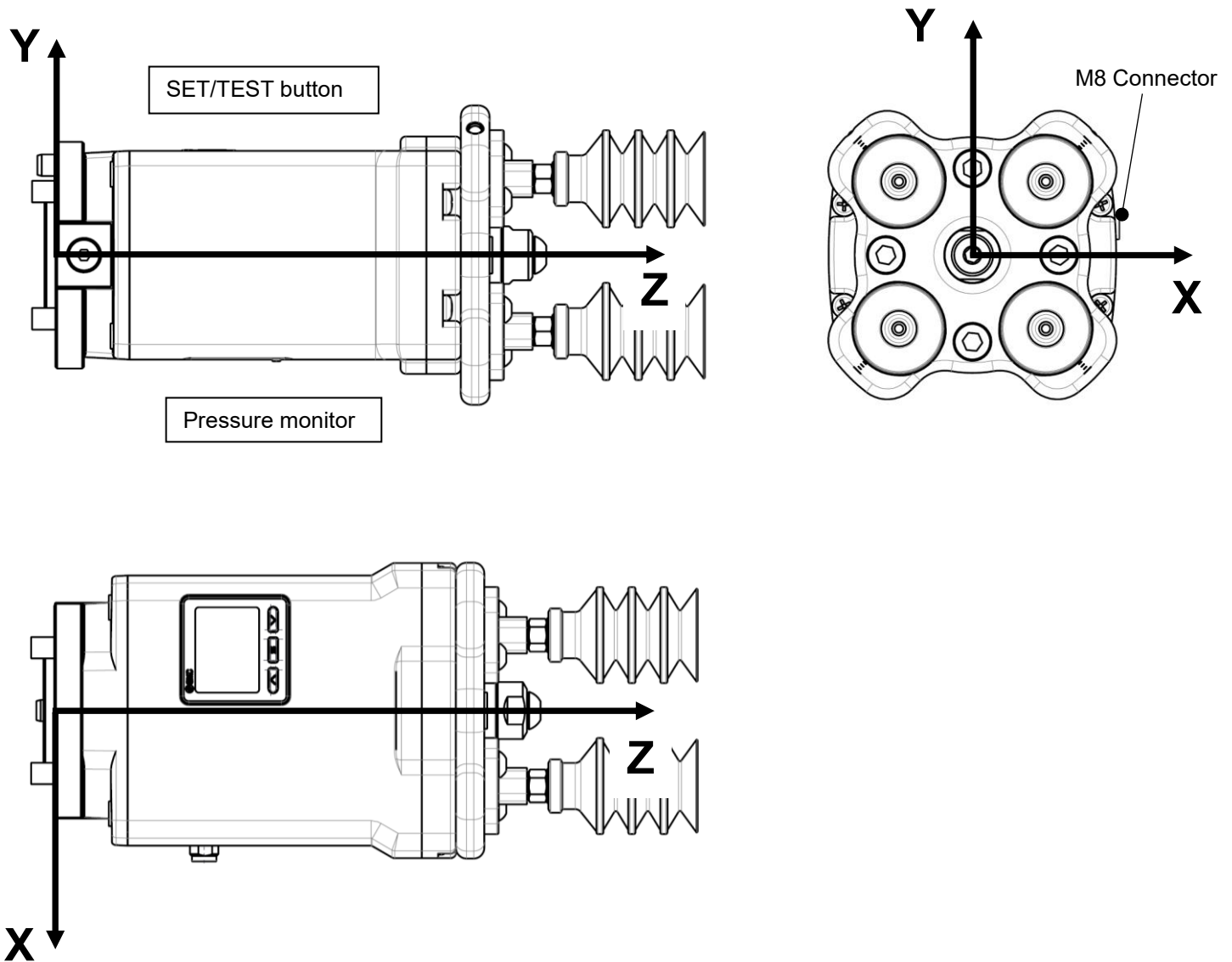


Table 12. ZXPE5A011P-\*\*-\*\* (When “With flange assembly (42 mm×42 mm)” is selected)

	X	Y	Z
Tool center point (T.C.P.)	0.0	0.0	133.0+Cup
Center of gravity (C.O.G.)	1.4	-1.5	69.5

(Unit: mm)

Table 13. ZXPE5N011P-\*\*-\*\* (When “Without flange assembly” is selected)

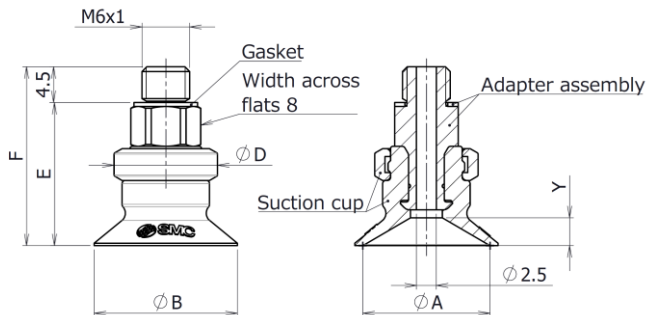
	X	Y	Z
Tool center point (T.C.P.)	0.0	0.0	113.0+Cup
Center of gravity (C.O.G.)	1.9	-2.0	54.7

(Unit: mm)

### 7.3. Suction cup with adapter

Representative models only are shown. See the suction cup catalog for the other models.

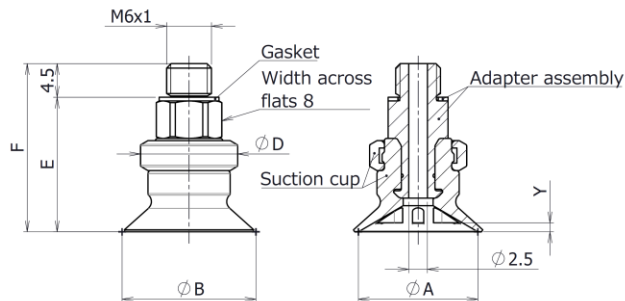
Model : ZPT\*U\*-AS6  
(Suction cup: Flat type)



Dimensions

Model	A	B	D	E	F	Y
ZPT10U*-AS6	10	12	13	17.5	22	3
ZPT13U*-AS6	13	15		18	22.5	3.5
ZPT16U*-AS6	16	18		19.5	24	4
ZPT20U*-AS6	20	23	15	19.5	24	4
ZPT25U*-AS6	25	28		20	24.5	4.5
ZPT32U*-AS6	32	35				

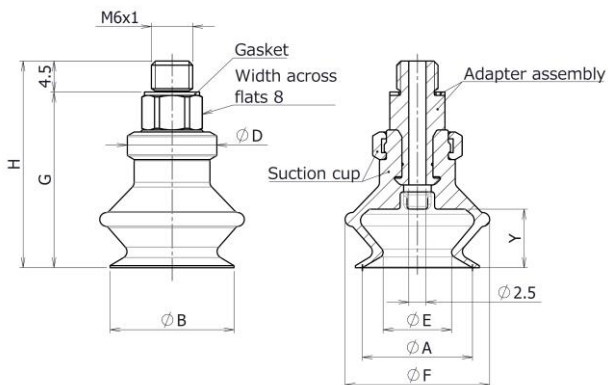
Model: ZPT\*C\*-AS6  
(Suction cup: Flat type with ribs)



Dimensions

Model	A	B	D	E	F	Y
ZPT10C*-AS6	10	12	13	17.5	22	1.7
ZPT13C*-AS6	13	15		18	22.5	1.2
ZPT16C*-AS6	16	18		19.5	24	1.8
ZPT20C*-AS6	20	23	15	19.5	24	1.7
ZPT25C*-AS6	25	28		20	24.5	2.3
ZPT32C*-AS6	32	35				

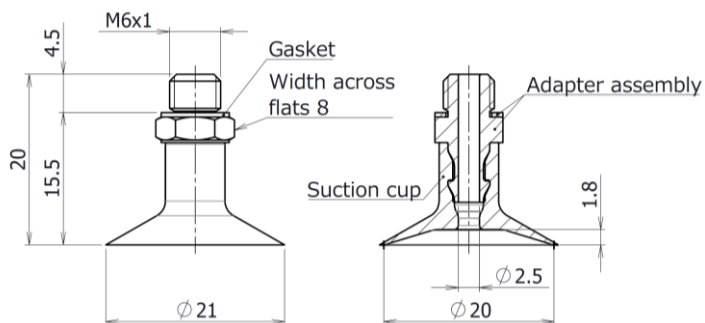
Model: ZPT\*B\*-AS6  
(Suction cup: Bellows type)



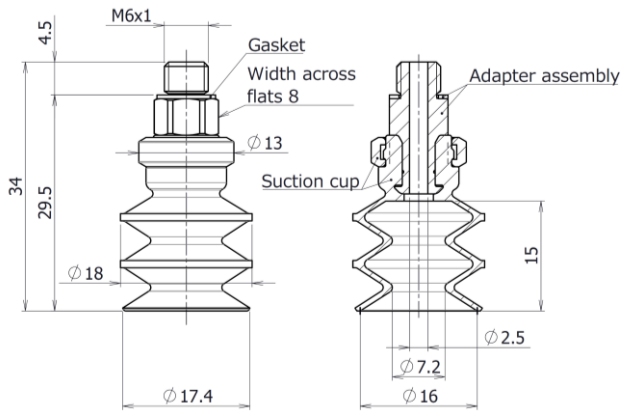
Dimensions

Model	A	B	D	E	F	G	H	Y
ZPT10B*-AS6	10	12	13	5.5	13.5	21.5	26	5.5
ZPT13B*-AS6	13	15		8.7	19	24	28.5	7.5
ZPT16B*-AS6	16	18		10	21	25.5	30	8.5
ZPT20B*-AS6	20	22	15	12.6	25	29	33.5	10.5
ZPT25B*-AS6	25	27		16	28	29.5	34	
ZPT32B*-AS6	32	34		18.9	37	34.5	39	14

Model: ZP2-T20UT\*-AS6  
(Suction cup: Thin flat type)



Model: ZP2-T16J\*-AS6  
 (Suction cup: Multistage bellows type 2.5-Stage)



Model: ZP2-T(B25, B30)J\*-AS6  
 (Suction cup: Multistage bellows type 3.5-Stage)

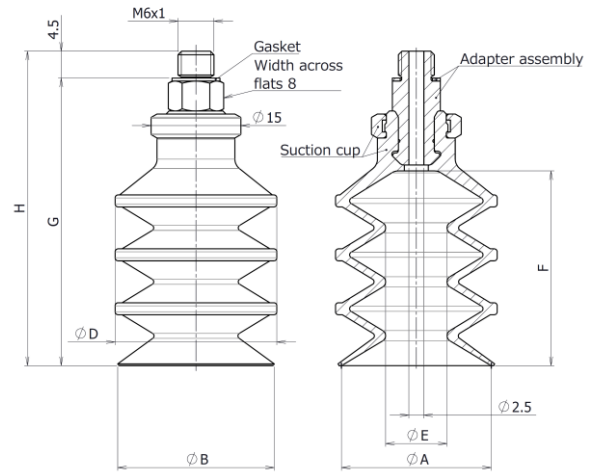


Table. Dimensions

Model	A	B	D	E	F	G	H
ZP2-TB25J*-AS6	25	26.2	27	10.2	32.5	48	52.5
ZP2-TB30J*-AS6	30	32.9	32	13.8	38	54.5	59

## 8. Technical information

### 8.1. How to calculate theoretical lifting force

This manual only shows how to calculate the theoretical lifting force of a cup. Refer to the catalog of suction cups for details on how to select a suction cup.

#### ■ How to calculate theoretical lifting force

The theoretical lifting force of a cup can be found by calculation or from the theoretical lifting force table.

#### Calculation

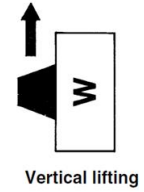
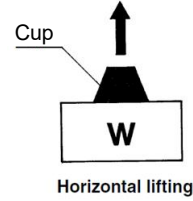
$$W = P \times S \times 0.1 \times \frac{1}{t}$$

**W:** Lifting force [N]

**P:** Vacuum pressure [kPa]

**S:** Cup area [cm<sup>2</sup>]

**t:** Safety factor    Horizontal lifting: 4 or more  
Vertical lifting: 8 or more



(This type of application should generally be avoided.)

#### Theoretical lifting force table

The theoretical lifting force (not including the safety factor) can be determined by the cup diameter and vacuum pressure.

The required lifting force can then be determined by dividing the theoretical lifting force by the safety factor t.

$$\text{Lifting force} = \text{Theoretical lifting force} / t$$

**Theoretical lifting force** (Theoretical lifting force = P x S x 0.1)

**Cup diameter (Φ8 to Φ32)**

Unit: N

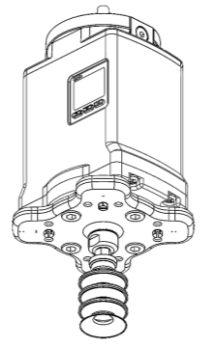
Cup diameter [mm]	Φ8	Φ10	Φ13	Φ16	Φ20	Φ25	Φ32
S: Cup area [cm <sup>2</sup> ]	0.50	0.79	1.33	2.01	3.14	4.91	8.04
Vacuum pressure [kPa]	-85	4.2	6.6	11	17	26	68
	-80	4.0	6.2	10	16	25	64
	-75	3.7	5.8	10	15	23	60
	-70	3.5	5.5	9.3	14	22	56
	-65	3.2	5.1	8.6	13	20	52
	-60	3.0	4.7	8.0	12	18	48
	-55	2.7	4.3	7.3	11	17	44
	-50	2.5	3.9	6.7	10	15	40
-45	2.2	3.5	6.0	9.0	14	36	
-40	2.0	3.1	5.3	8.0	12	32	

## 8.2. How to change the number of cups

### 8.2.1. Change to 1 cup (with flange)

#### 1. Removal of the cup

- (1) Remove the suction cup with adapter from Plate B using a spanner.
- (2) Loosen the bolt (M4x8) to remove Plate B from Plate A.  
Be careful not to lose the O-ring.
- (3) Loosen the bolt for sealing (M6x8) to remove the cup from Plate A.

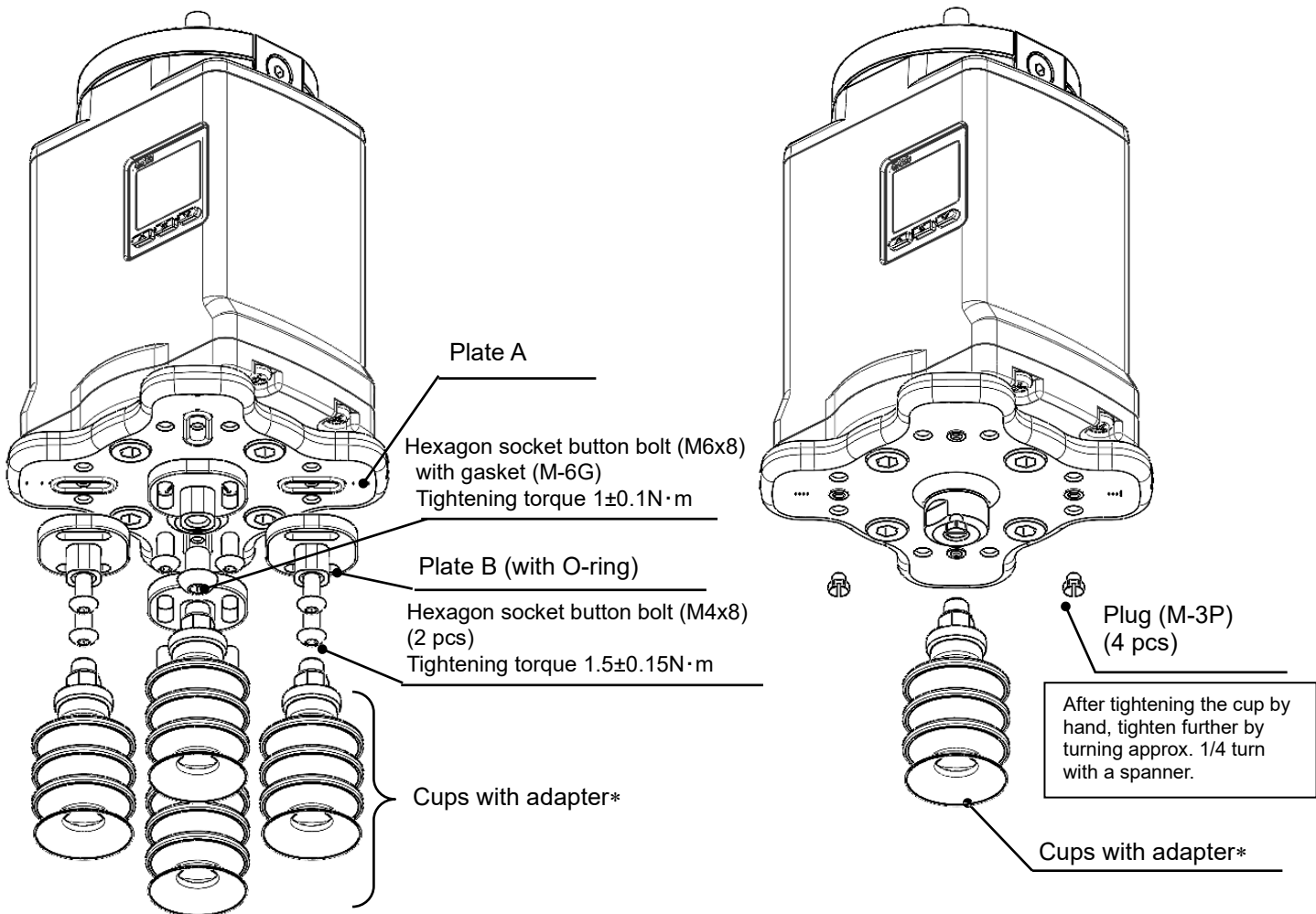


Finished product

#### 2. Mounting of the plug and suction cup with adapter

- (1) After making sure that each of the plugs provided has a gasket seal inside it, mount the plugs to Plate A. (4 places)
- (2) After making sure that the adapter has a gasket seal inside it, mount the suction cup with adapter removed in the step (1) to Plate A.

To reassemble the parts, follow these steps in reverse with the specified tightening torque.



(1) Removal of the suction cup

(2) Mounting of plugs and a suction cup with adapter

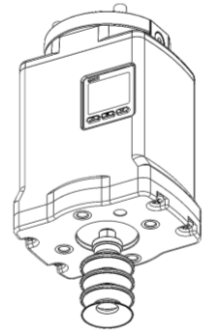
### ⚠ Caution

- \* Tightening torque: 1 N·m (As reference, tighten the cup by turning 1/4 turn using a spanner after tightening by hand) If tightened excessively, the thread may be damaged and gasket may be deformed. This will cause air leakage. Insufficient tightening may loosen the thread or cause air leakage.

## 8.2.2. Change to 1 cup (without flange)

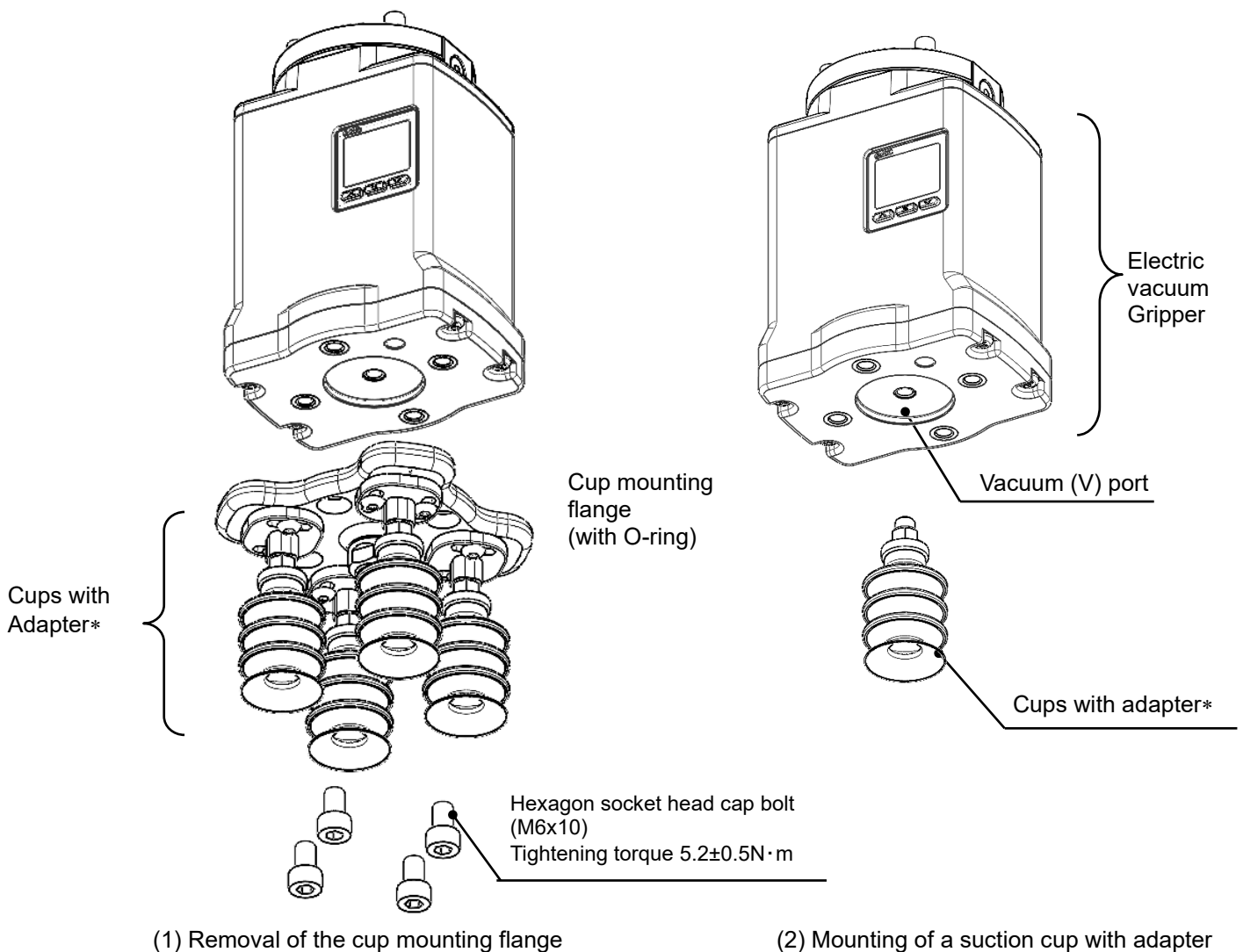
### Caution

No mesh is fitted to the gripper's vacuum port (V-port). If a mesh is required, use a cup mounting flange. If the flange is not used, take care to prevent foreign objects from entering the vacuum port.



Finished product

1. Removal of the cup mounting flange
    - (1) Loosen the bolt (M6x10) to remove the cup mounting flange.  
Be careful not to lose the O-ring.
    - (2) Remove the parallel pin.
  2. Mounting of the suction cup with adapter
    - (1) Remove the suction cup with adapter from the flange with cup removed in the above step.
    - (2) Making sure that the adapter has a gasket seal inside it, mount the suction cup with adapter removed in the step (1) to the product.
- To reassemble the parts, follow these steps in reverse with the specified tightening torque.



### Caution

\* Tightening torque: 1 N·m (As reference, tighten the cup by turning 1/4 turn using a spanner after tightening by hand) If tightened excessively, the thread may be damaged and gasket may be deformed. This will cause air leakage. Insufficient tightening may loosen the thread or cause air leakage.



### 8.2.3. Change to 2 cups

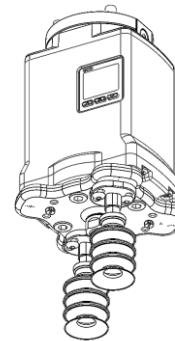
#### 1. Removal of the cup

- (1) Remove the suction cup with adapter from the plate B using a spanner.
- (2) Loosen the bolt (M4x8), then remove plate B from plate A.  
Be careful not to lose the O-ring.

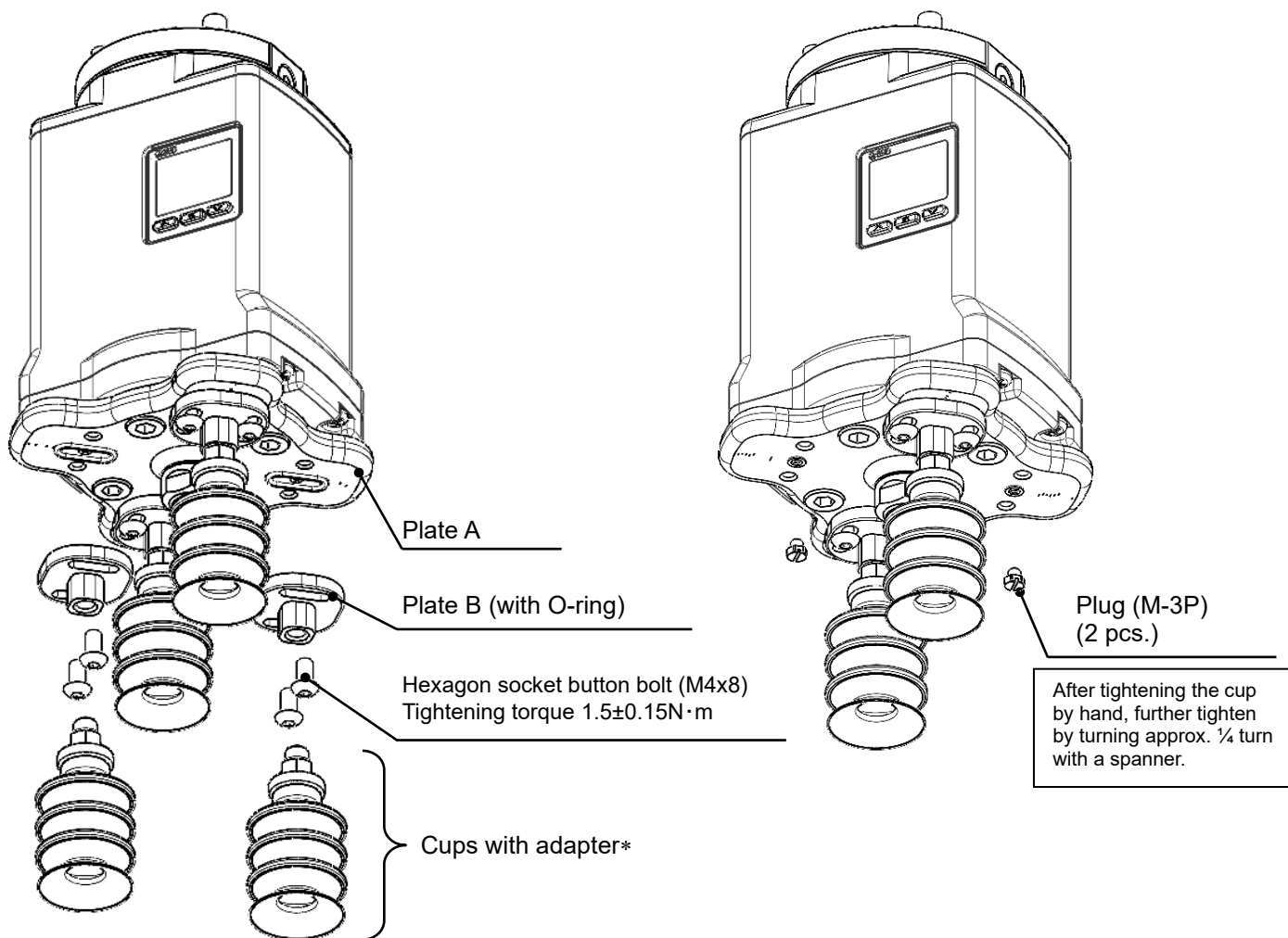
#### 2. Mounting of the plug

Confirm the gasket seal in the plug, then mount the plugs to plate A.

Reassemble the parts by reversing the disassembling process with specified tightening torque.



Finished product



(1) Removal of the suction cup

(2) Plug mounting

### Caution

- \* Tightening torque: 1 N·m (As reference, tighten the cup by turning 1/4 turn using a spanner after tightening by hand) If tightened excessively, the thread may be damaged and gasket may be deformed. This will cause air leakage. Insufficient tightening may loosen the thread or cause air leakage.

### 8.3. Suction with a vacuum saving valve

This product connects four suction cups to one vacuum pump. This means that gripping failure of one cup leads to further failures of the other cups. Take safety measures to prevent workpieces from being dropped during transport. If one of the cups may not have a workpiece to grip, the use of the ZP2V series vacuum saving valve (Part number depends on the number of cups. Refer to #Table 14.) can reduce the possibility of vacuum pressure drop and aid the suction of the other cups. The vacuum saving valve is only available in continuous mode. The user is advised to test the vacuum saving valve in their application to verify suitability for their workpiece and operating conditions.

**⚠ Caution**

The number of suction cups that can be used is limited to three or less. Plug any unused cup port. Also, the construction of the vacuum saving valve allows slight air venting, which may adversely affect the energy saving function. So do not use the vacuum saving valve in automatic or manual mode.

Table 14. Applicable ZP2V part no.

The number of cups	Applicable part no.
3 cups	ZP2V-B6-03
2 cups	ZP2V-B6-05

**⚠ Caution**

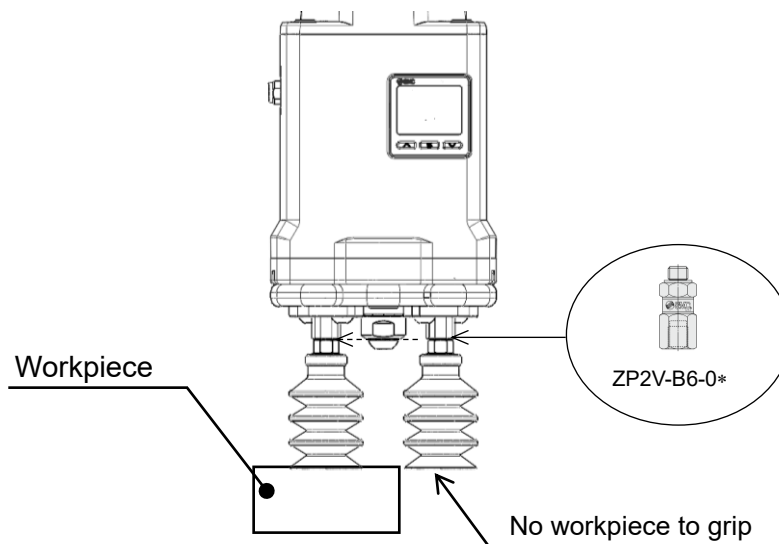
When using the vacuum saving valve for suction, ensure to set up the gripper according to [“5.1. Initial setup and diagnostic function”](#); otherwise, it cannot be correctly judged whether gripping has been successful.

Table 15. Reference: Theoretical lifting force of vacuum cup diameter 32 mm [N / pc.]

	With ZP2V-B6-03			With ZP2V-B6-05		
	Vacuum pressure [kPa]	Theoretical lifting force	Horizontal lifting force (Safety factor 1/4)	Vacuum pressure [kPa]	Theoretical lifting force	Horizontal lifting force (Safety factor 1/4)
1 cup gripping	-45	36	9	-40	32	8
2 cups gripping	-60	48	12	-74	59	14
3 cups gripping	-74	59	14			

Calculated by  $W = P \times S, S = \pi \cdot r^2, r = \phi 32 / 2$ . Refer to [8.1. How to calculate theoretical lifting force](#) for the detail.

These are theoretical lifting forces for the suction of an impermeable workpiece. When the workpiece is permeable, the lifting force is reduced.



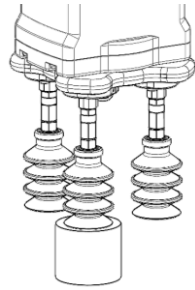
## Examples

- Handling a narrow workpiece

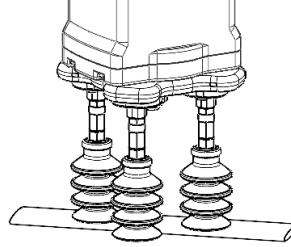
The vacuum saving valve helps the suction of a narrow workpiece, as shown in the figure below when gripping with 2 cups.

- Handling more than one workpiece

The vacuum saving valve helps to hold workpieces gripped by the gripper one at a time in each cup and to transport them all at the same time.



1 cup gripping



2 cups gripping

## 9. Maintenance

Perform the maintenance and inspection shown below in order to use the electric vacuum gripper in a safe and appropriate manner for a long time.

### 9.1. Maintenance for electric vacuum gripper

#### Caution

##### 1) Inspection before and after maintenance

When removing the product from the robot, ensure that the power supply is turned off and the vacuum pressure inside the product is released. When returning the product on the robot after maintenance, connect to the power and check if it functions properly.

##### 2) Perform diagnostic function of product regularly.

For details of diagnostic function, refer to [“5.1. Initial setup and diagnostic function”](#).

##### 3) Regularly tighten connections which may be loosened by the use for a long period.

The parts connections may be loosened by vibration or impact when the gripper is operated for a long time. Tighten the following connections regularly to ensure that parts do not fall off and the gripper is properly installed on the robot.

###### 1. Clamper

Tighten the clamper in the same manner as the initial installation. (Refer to [4.1 Mounting.](#))

###### 2. Cup mounting flange

Refer to [“8.2. How to change the number of cups”](#) and tighten to the specified tightening torque respectively.

##### 4) Do not disassemble or modify the product, other than replacement of the parts specified in this manual.

## 9.2. Maintenance for suction cup

### Caution

#### 1) Suction cups are consumables. Replace them on a regular basis.

Continued use of suction cups will cause wear and tear on the gripping surface, and the exterior dimensions will be gradually reduced, which can lead to a reduction in lifting force, whilst gripping will remain possible. It is extremely difficult to predict when a suction cup should be replaced. This is because there are numerous factors at work, including surface roughness, operating environment (temperature, humidity, ozone, solvents, etc.), and operating conditions (vacuum pressure, workpiece weight, pressing force of the suction cups on the workpieces, presence or absence of a buffer, etc.).

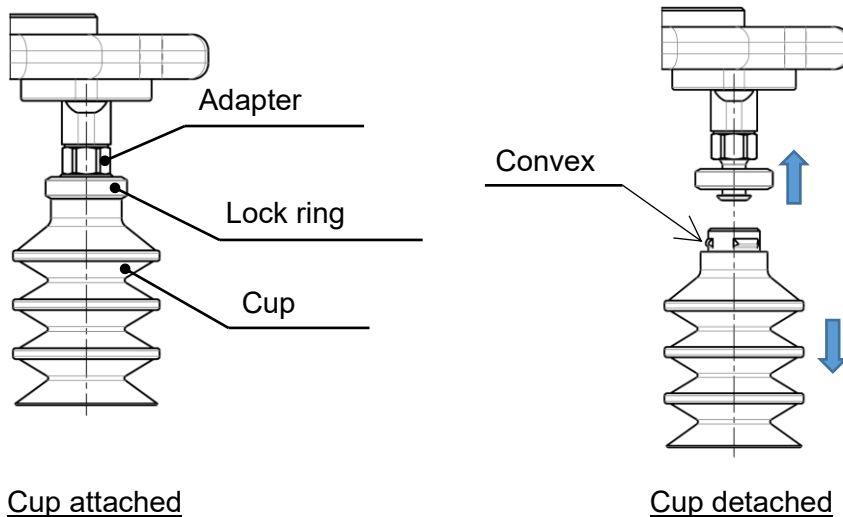
(With the bellows type cup, weakened bents, wear, or sticking of rubber parts may occur.)

The customer is required to decide when suction cups should be replaced, based on their operating condition at the time of initial use.

The bolts may become loose depending on the operating conditions and environment. Be sure to perform regular maintenance.

#### How to replace the suction cup

- Pull the lock ring upward, and, after lifting it up to the adapter, remove the old cup by pulling it downward.
  - While holding the lock ring in the raised position place a new cup onto the adapter.
  - Confirm that the cup is securely in place, and then return the lock ring to its original position.
- \* The cup without lock ring should be inserted to the end of the adapter.

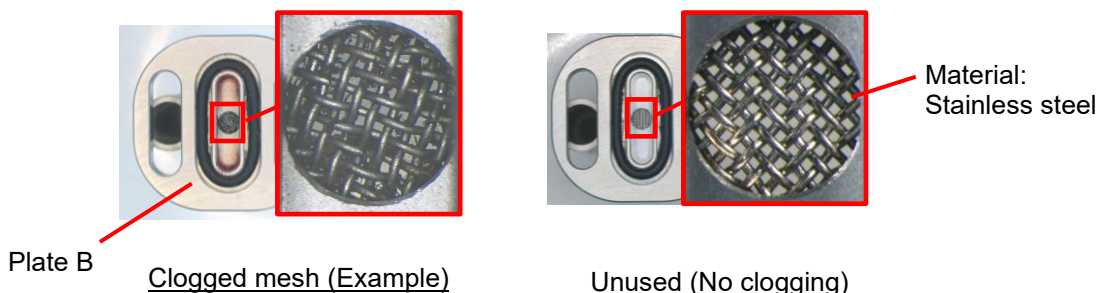


#### 2) Mesh

If the mesh is used in such a way that foreign matter is absorbed from the air or the workpiece, it may become clogged, which will cause a reduction in the vacuum performance. Clean the mesh periodically as necessary by washing, air blow and so on. If mesh clogging cannot be resolved by cleaning, replace Plate B or Suction cup adapter.

Plate B spare part number: ZXPE5-APL6-A

Suction cup adapter spare part number: ZXPE5-EXP6



### 9.3. Spare parts

Table 16. Spare part numbers

Description	Part number	Included parts
Cup mounting flange assembly	ZXPE5-PFL1-A	Cup mounting flange, Plate B, Suction cup adapter, Mounting bolt, Plug, O-ring
Plate B	ZXPE5-APL6-A	Plate B, Mounting bolt, O-ring
Suction cup adapter	ZXPE5-EXP6	Extension adapter, Plug, O-ring
Main plate assembly	RMTM2-4M1	Main plate, Mounting bolt, Clamper, Parallel pin
Connector cable	RMH-A00-11-A	
Cup with adapter	Refer to <a href="#">P.9 Suction Cup Part Numbers and Weights</a>	
Plug	M-3P	

Refer to [1. Parts included in the package](#) and [3.1. Names of parts of the product](#) for the names of the parts.

## 10. Precautions

### 10.1. Electric vacuum gripper precautions

#### ■ Designing

##### Warning

**If power or air supply is shutdown, vacuum pressure may decrease and this product may drop a workpiece during gripping.**

It is necessary to take measures such as drop prevention so that injury and damage to machinery or equipment can be prevented.

##### Caution

**Restart after a long period of product inactivity**

When the product is not in use for a long time, its response to the grip or release command may delay due to seizure. It will be resolved by a few conditioning-runs. Consider commissioning the gripper before restarting full operation. It is recommended to switch on and off the valve once every thirty days to prevent malfunction.

#### ■ Mounting

##### Warning

**1) Tighten to the specified tightening torque.**

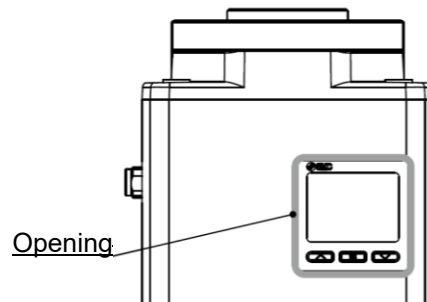
If the tightening torque is exceeded, the body and the mounting screws may break. However, insufficient torque may cause displacement of the body and loosening of the mounting screws.

**2) Hold the product itself when handling.**

Do not pull the M8 connector cable strongly or lift up the product by holding this cable. It can cause the malfunction of the product.

**3) Do not restrict the exhaust air, such as blocking the opening.**

Exhaust air is released from the opening in the product. If exhaust air is restricted, vacuum performance could be reduced.



#### ■ Wiring

##### Warning

**1) Do not wire while energizing the product.** Doing so may result in damage to the internal parts of the solenoid valve or pressure sensor. In some cases, this damage may result in a malfunction.

**2) Do not disassemble the M8 connector cable or make any modifications, including additional machining.** Doing so may cause human injury and/or an accident.

##### Caution

**Avoid repeatedly bending or stretching the M8 connector cable as well as applying force to it.**

#### ■ Operation

##### Caution

**1) Do not press the buttons on the product with a sharp object.**

It may damage the buttons.

**2) Do not touch the LCD display of the pressure monitor while it is in use.**

It may generate static electricity, causing the display to become erratic.

**3) The electric vacuum gripper monitors the pressure and controls the operations for grip and release movements. The integrity of the system should be determined after thorough verification on the actual machine.**

## ■ Workpiece

### Caution

**Do not use the product for workpieces with water or dust attached.**

If water or dust adheres to the surface of a workpiece, they may enter the inside of the product, causing a decline in vacuum performance. If the workpiece is permeable, the gripper may not generate sufficient lifting force. Assess the suitability of the gripper with the workpiece before the equipment is put into service.

## ■ Storage

### Warning

- 1) **Do not store the product in a place where it is exposed to rain, water, harmful gases or liquids.**
- 2) **Store the product out of direct sunlight and within the product's operating temperature range.**
- 3) **Do not apply vibration or impact to the product during storage.**

## 10.2. Suction cup precautions

### ■ Design

#### Warning

**In cases where the workpieces are heavy or dangerous objects, etc., take measures to address a possible loss of gripping force (installation of a drop prevention guide, etc.).**

In the case of transportation by vacuum gripping using suction cups, the gripping force is lost when there is a drop in vacuum pressure. Furthermore, since vacuum pressure can also deteriorate due to the wear and cracking of cups, vacuum leakage from piping, etc., be certain to perform maintenance on vacuum equipment.

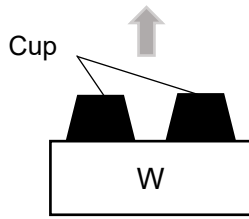
### ■ Selection

#### Caution

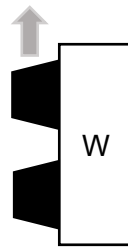
- 1) **The cup materials which can be used differ depending upon the operating environment.**  
An appropriate cup material should be selected. Furthermore, since suction cups are manufactured for use with industrial products, they should not come into direct contact with medicines, food products, etc.
- 2) **Depending upon the weight and shape of the workpieces, the diameter, quantity, and shape of cups suitable for use will vary.**  
Refer to "[8.1. How to calculate theoretical lifting force](#)" for the theoretical lifting force. Also, the selectable cups will differ based upon conditions other than the above, such as the condition of the workpiece surface (presence or absence of oil or water), the workpiece material, and its gas permeability. Confirmation is necessary by actually performing vacuum gripping on the subject workpieces.
- 3) **Do not apply an impact or large force to a cup when gripping a workpiece.**  
This will cause the deformation, cracking, and wear of the cup to be accelerated. The stiffening ribs, etc., should touch lightly, while staying within the cup skirt's deformation range. Positioning should be performed accurately, especially in the case of small-diameter cups.
- 4) **When transporting vertically, factors such as acceleration, wind pressure, and impact force must be considered in addition to the workpiece weight.**  
Use caution particularly when lifting items such as glass plates and circuit boards because a large force will be applied by wind pressure. When a workpiece which is oriented vertically is transported horizontally, large forces are applied by acceleration when movement is started and stopped. Furthermore, in cases where the cup and workpiece can slip easily, accelerations and decelerations of horizontal movement should be kept to a minimum.
- 5) **When transporting flat shaped workpieces that have large surface areas using multiple cups, care must be taken in arranging the cups, so that the workpieces are evenly gripped.**



- 6) **Use caution since the workpiece could rotate during transfer.**  
Use of more than one cup for each workpiece is recommended.



Horizontal lifting



Vertical lifting  
(This type of application should generally be avoided.)

## ■ Storage



### Caution

**It is recommended to store suction cups in the environment shown in the table below.**  
Storing in an environment other than that recommended below may lead to changes in properties (deformation, discoloration, cracking, increased adhesiveness, etc.).

Temperature	15 to 25 °C
Humidity	50[%] or less, No condensation
Other	Location that is shaded from direct sunlight or fluorescent light Location without the presence of ozone (For NBR and conductive NBR)

# 11.Troubleshooting

## List of problems and countermeasures

Problem	Cause	Countermeasure
Initial gripping problem (During commissioning)	Gripping area is small. (Lifting force is lower than the workpiece mass.)	Recheck the relationship between workpiece mass and lifting force. - Use a suction cup with a large gripping area. - Increase the quantity of suction cups.
	Vacuum pressure is low. (Leakage from gripping surface) (Air permeable workpiece)	Eliminate (reduce) leakage from gripping surface. - Reconsider the shape of a suction cup. Check the relationship between suction flow rate and arrival pressure of vacuum. - Increase gripping area.
	Air leakage	Tighten the cup and flange to the specified torque. If the number of cups has been changed and a plug is used, check that a gasket is securely fitted and not loose.
	Cup shape	Response time differs by cup shape or piping condition. Select the cups by the time of grip error detection time within 2 seconds.
	High P2 set value (pressure at which suction is judged to have failed)	Set a suitable pressure for the workpiece and cup conditions.
	Unsuitable initial set value of vacuum pressure without workpiece: Pe	Inadequate initial set value may cause malfunction. If the cup or other conditions are changed, set up the gripper again according to " <a href="#">5.1. Initial setup and diagnostic function</a> ".
	Unsuitable settings for gripper operation mode	Perform a test run with the actual workpiece to determine suitable settings. Continuous mode is recommended for breathable workpieces.
	Abnormality inside the product	Contact our sales representative.
Slow response	Cup shape	Response time differs by cup shape or piping condition. Select the cups by the time of grip error detection time within 2 seconds.
Gripping problem over time (Gripping is normal during trial operation.)	Clogging of the mesh	Clean the mesh periodically as necessary by washing, air blow and so on or replacing plate B. Refer to " <a href="#">9.2. Maintenance for suction cup</a> ".
	Cup (rubber) deterioration, cracking, etc.	Replace cups. Check the compatibility of vacuum cup material and workpiece condition.
	Insufficient warm up	After power on, the pressure display drifts. Allow ten to fifteen minutes of warm-up before detecting low pressure.
	Contamination inside the product	Contact our sales representative for removal of contamination.
	Product failure	Replace the product.

Problem	Cause	Countermeasure
Workpiece is not released.	Insufficiently short atmospheric release time	Select the piping condition to fit atmospheric release time within 0.5 seconds.
	The increase of stickiness due to the wearing of the cup (rubber).	Replace cups. Check the compatibility of the cup material and workpiece condition.
	Seizure of atmospheric release valve	Carry out a few conditioning-runs to resolve this problem.
	Product failure	Replace the product.
Pressure monitor error (pressure value fluctuation, lost or missing values or lines from the display, or flashing)	Incorrect power supply	Supply voltage must be 24VDC $\pm$ 10%. Check if the supply voltage is correct.
	Product failure	Replace the product.
Wrong zero point of the pressure monitor	Zero-clear failure	This product clears the display value to zero upon power on. Power on the product again after powering off and releasing the vacuum port to atmosphere.
	Product failure	Replace the product.
The display units cannot be changed.	Incorrect model (no measurement unit change function is available)	Check the part number if it indicates that the product has the measurement unit selection function. If the model has only the SI unit, the unit cannot be changed (except for between kPa and MPa).
	Product failure	Replace the product.
SET/TEST button does not work	The button is not recognized as pressed.	The button is unlikely to be recognized as pressed. Press the button until you hear a click.
	Product failure	Replace the product.
The pressure monitor buttons don't work.	The set button is locked.	The set button on the pressure monitor is locked by default. Unlock the button according to " <a href="#">5.2.3. Keylock function</a> ".
	Product failure	Replace the product.
The product is noisy.	Air leakage	Tighten the cup and flange to the specified torque. If the number of cups has been changed and a plug is used, check that a gasket is securely fitted and not loose.
	A ticking sound is heard when the cup is sealed.	To prevent the workpiece from being unintentionally gripped, the atmospheric release valve is turned on when the cup is sealed during idling status. The ticking sound is created by the valve and it's not failure.
	A ticking sound is heard during idling status. (The valve switches at regular intervals)	Power on again after powering off and releasing the V-port to atmosphere.
	Product failure	Replace the product.
Gripper malfunction	Malfunction due to out-of-specification settings of the pressure monitor (operations other than those described in this manual).	Perform the "Factory reset". (Refer to " <a href="#">5.2.6. Factory reset</a> ".)

## Alarms

When an alarm occurs, the LED will flash red.

Table 17. List of alarms

Alarm	Product status	Countermeasure
Temporary pressure monitor error	LED: flashes red Pressure monitor: shows “HHH” or “LLL”	A pressure outside of the upper or lower limit of the pressure monitor display has been applied. Adjust the pressure to fall within the display range.
Internal part overcurrent error	LED: flashes red	The load current on an internal part exceeds the maximum value. Turn the power off and check that the wiring is correct. After ensuring the wiring is correct, power on again. Check the operating environment if strong magnetic field has been generated.
Communication error	LED: flashes red	An internal error has occurred. Turn the power off and on again.
Pressure monitor internal error	LED: flashes red Pressure monitor: shows an error code (Er 0/4/6/7/8/9)	
System error	LED: flashes red	

If the error cannot be reset after the above measures are taken, or errors other than above are displayed, please contact SMC.

Revision history
Rev. A: Separation of software chapter, Add to specifications, Revise errors. [March 2024]

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