



Operation Manual

PRODUCT NAME

Air Gripper Unit for Collaborative Robots

MODEL / Series / Product Number

JMHZ2-16D-X7400B-TM

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 relating to systems.

ISO 4413: Hydraulic fluid power -- General rules relating to systems.

IEC 60204-1: Safety of machinery -- Electrical equipment of machines .(Part 1: General requirements)

ISO 10218: Manipulating industrial robots -Safety.

etc.



Caution

Warning

Danger

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

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

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.

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. 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 place 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.



Safety Instructions

Caution

The product is provided for use in manufacturing industries.

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

If considering using the product 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 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) 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

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 regulation 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.

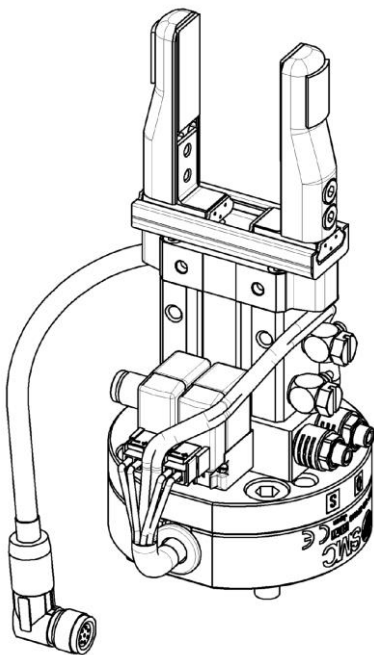
Caution

SMC products are not intended for use as instruments for legal metrology.

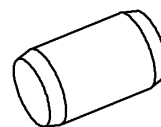
Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country.

Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

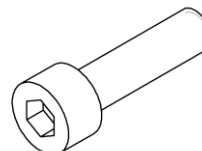
1. List of included items



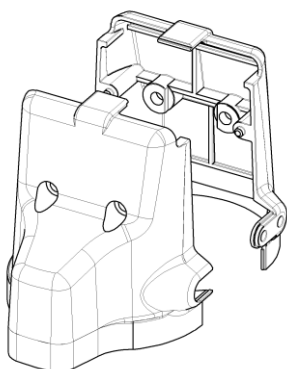
Air Gripper unit 1pc.



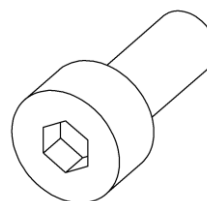
Parallel pin (6×10) 1pc.
For positioning the product.



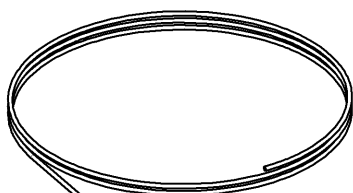
Hexagon socket head cap screw
(M6×23) 4pcs.
For mounting the product.



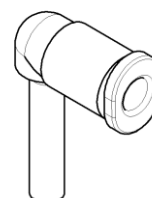
Protection cover (Valve side) 1pc.
Protection cover (Switch side) 1pc.



Hexagon socket head cap screw
(M4×10) 4pcs.
For mounting the cover.

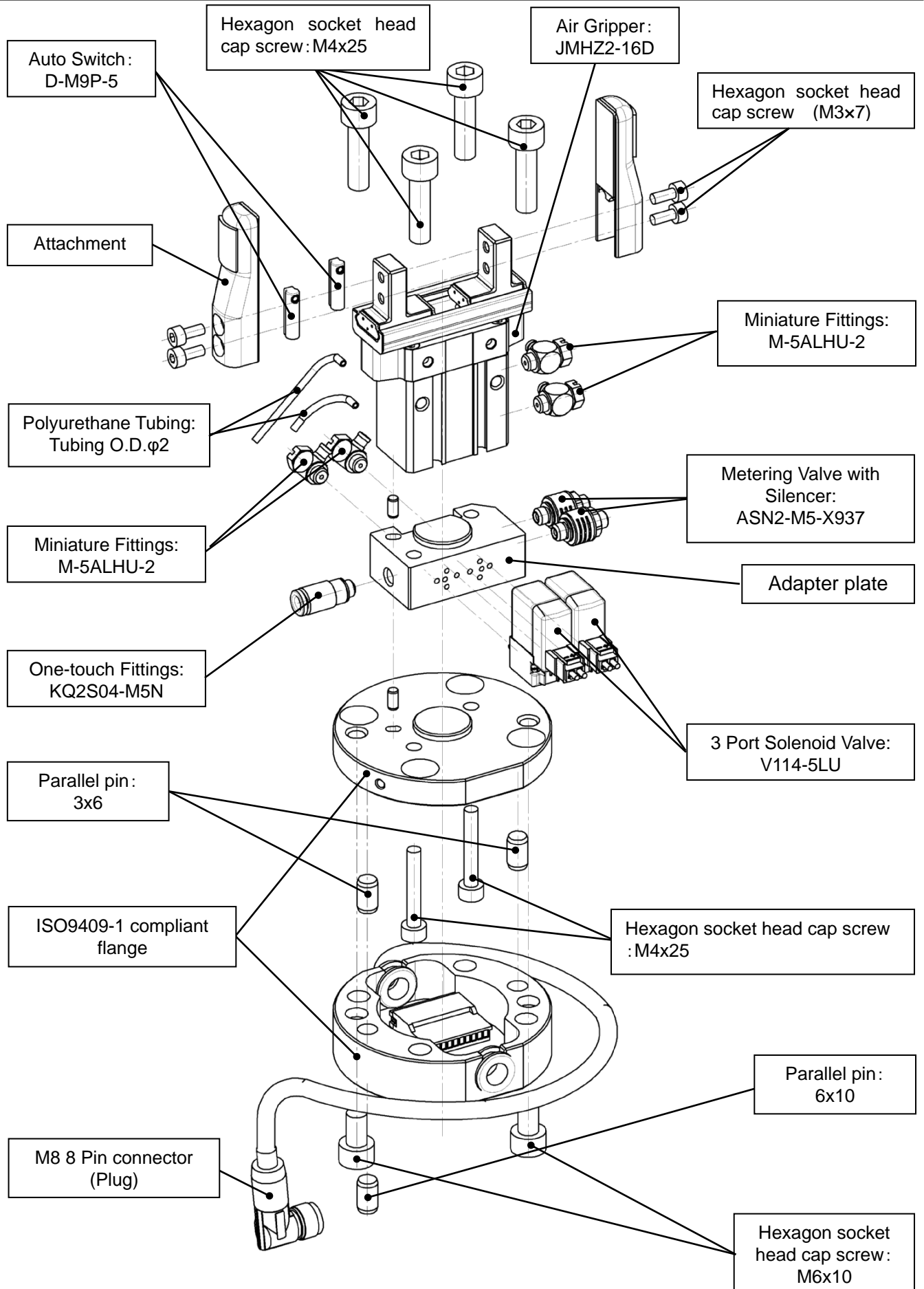


Polyurethane Tubing (TU0425) 2m



One touch fitting
(KQ2L04-99A1) 1pc.

2. Parts description of the air gripper



3. Product Specifications

3-1. Specifications

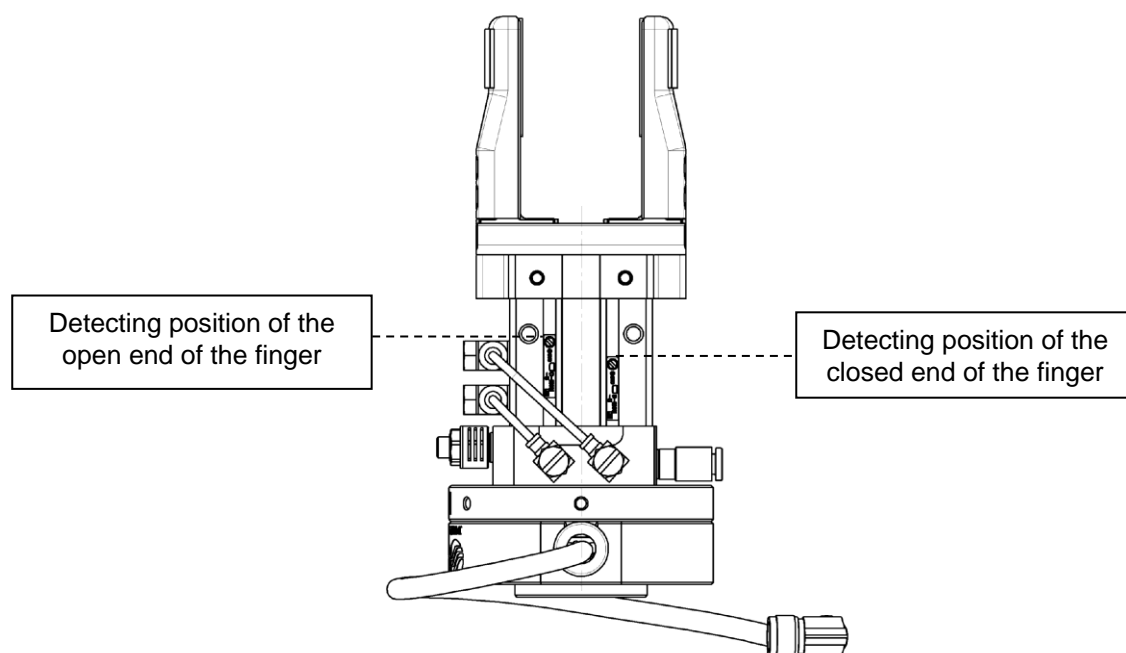
Specifications

Model		JMHZ2-16D-X7400B-TM
Bore size (mm)		16
Fluid		Air
Operating pressure [MPa]		0.1 to 0.7
Ambient and fluid temperature (°C)		-10 to 50
Repeatability (mm)		±0.01
Maximum operating frequency (c.p.m.)		120
Lubrication		Non-lube
Action		Double acting
Gripping force Actual value per finger (N)	External gripping Force (N)	32.7
	Internal gripping Force (N)	43.5
Opening/closing stroke (both) (mm)		10
Weight (g)		430
Auto switch model		D-M9N-5
Standard for mounting interface		ISO9409-1-50-4-M6
Connector configuration		M8 8Pin(Plug)

*The sensing position of the auto switch is fixed to the open end and closed end of the finger.

* When detecting the gripping position of the workpiece, secure the auto switch at the appropriate position according to the shape of the workpiece.

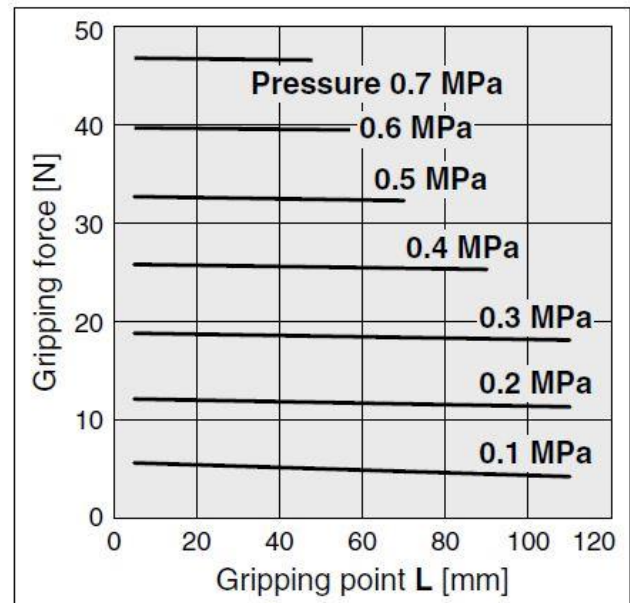
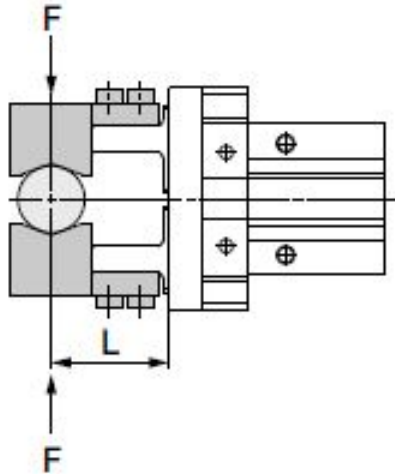
* For examples of setting auto switch and setting of mounting position of auto switches, please refer to the JMHZ2 Series catalogue P.15 onwards on our website (www.smcworld.com).



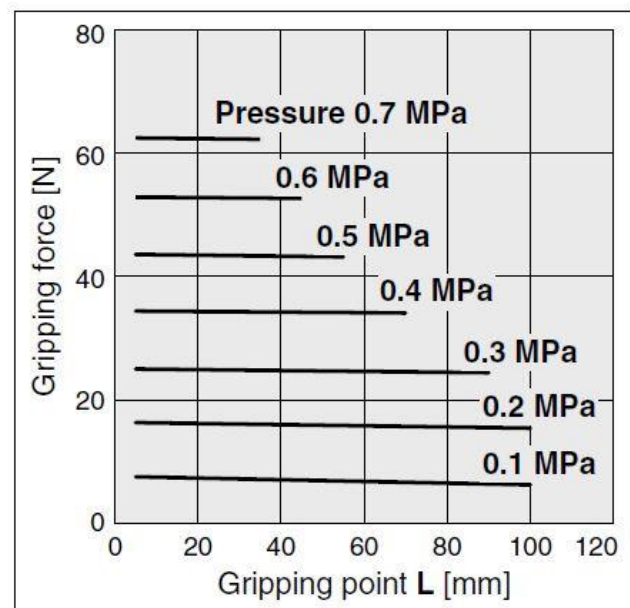
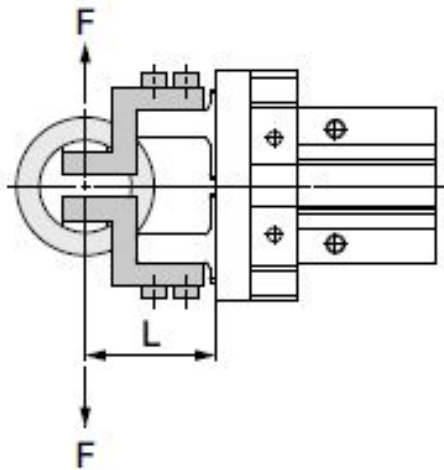
3-2. Gripping force

The gripping force shown in the graph to the right represents the gripping force of one finger when all fingers and attachments are in contact with the workpiece.

External gripping state.



Internal gripping state.

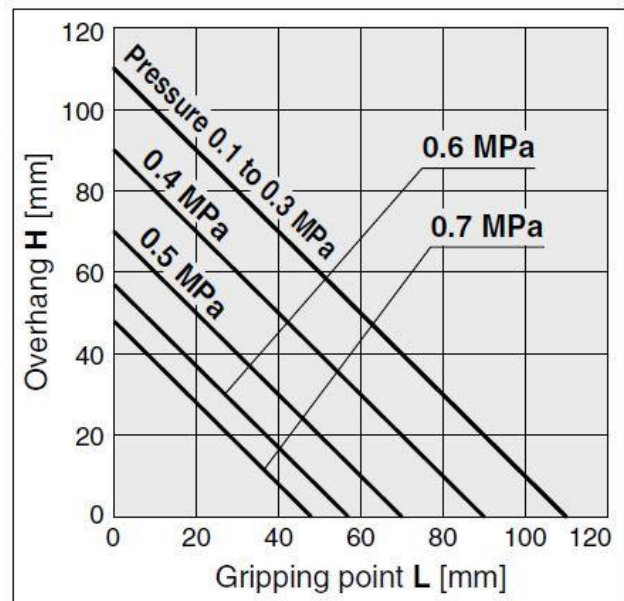
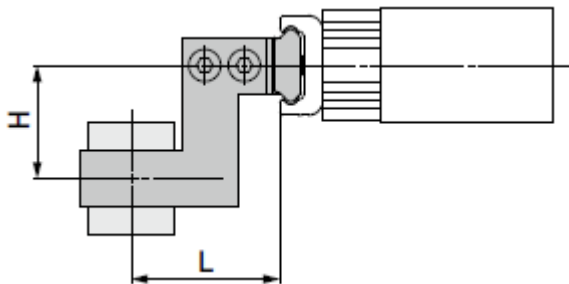


3-3. Gripping point

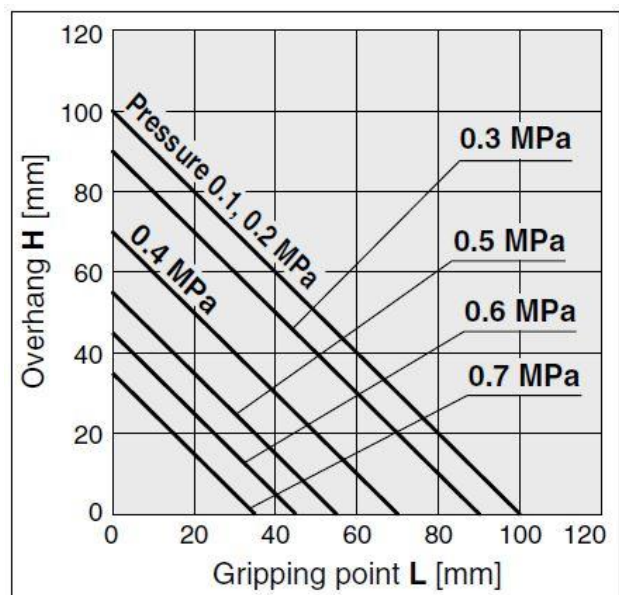
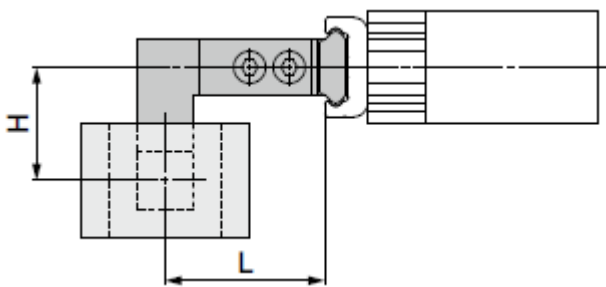
The air gripper should be operated so that the workpiece gripping point “L” and the amount of overhang “H” stay within the range shown for each operating pressure given in the graphs to the right.

If the workpiece gripping point goes beyond the range limits, this will have an adverse effect on the life of the air gripper.

External gripping state.

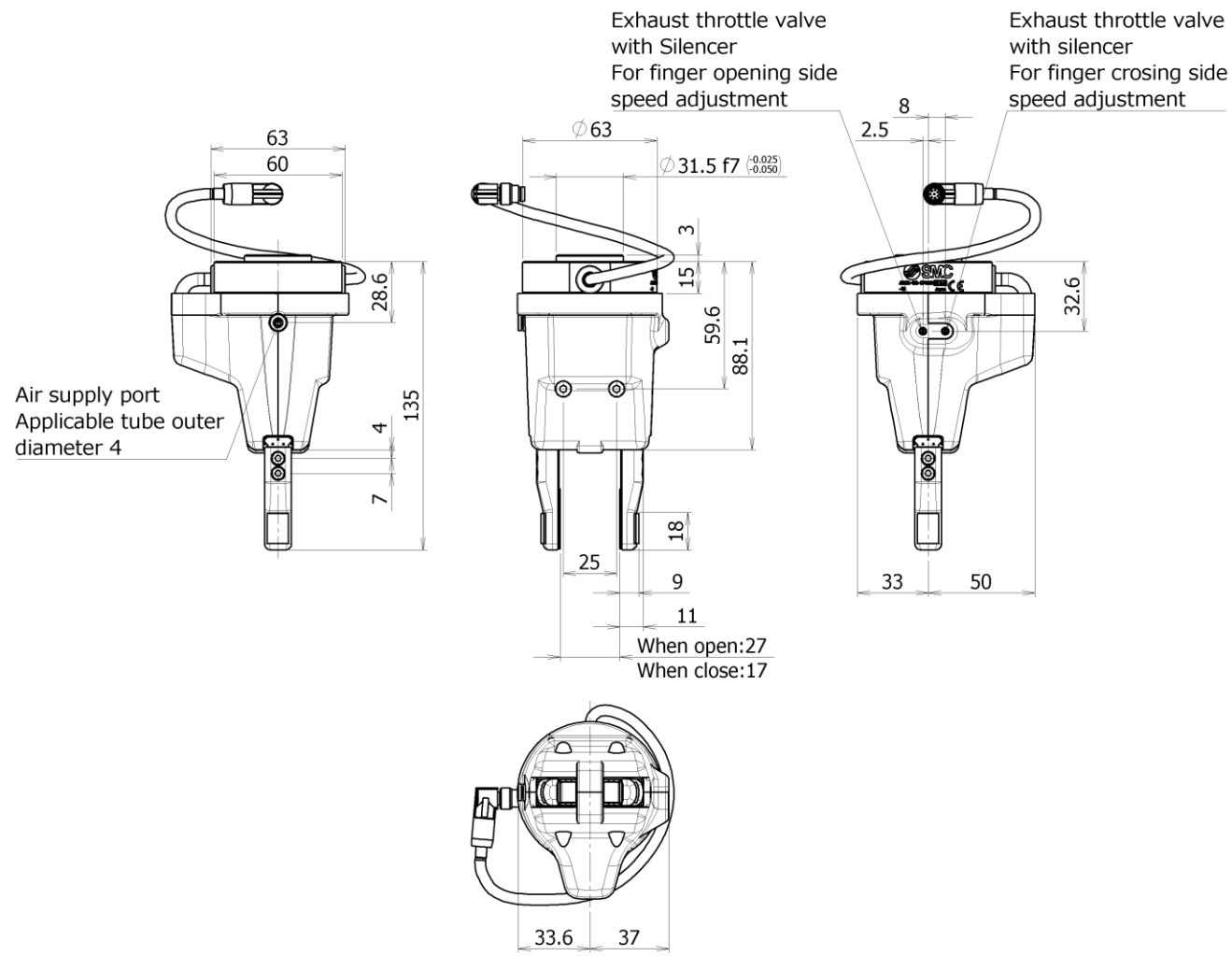


Internal gripping state.



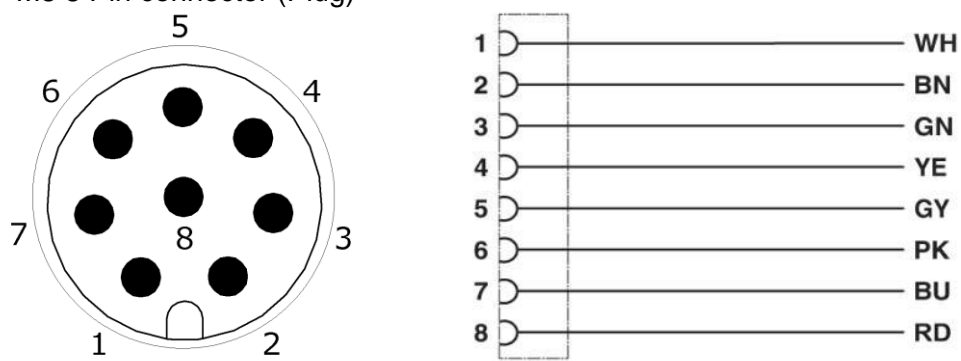
3-4. Dimensions (when the cover and attachment are mounted)

Refer to P11, P12 and P13 for the dimensions of the air gripper, valves and auto switches.



3-5. Connector and pin layout

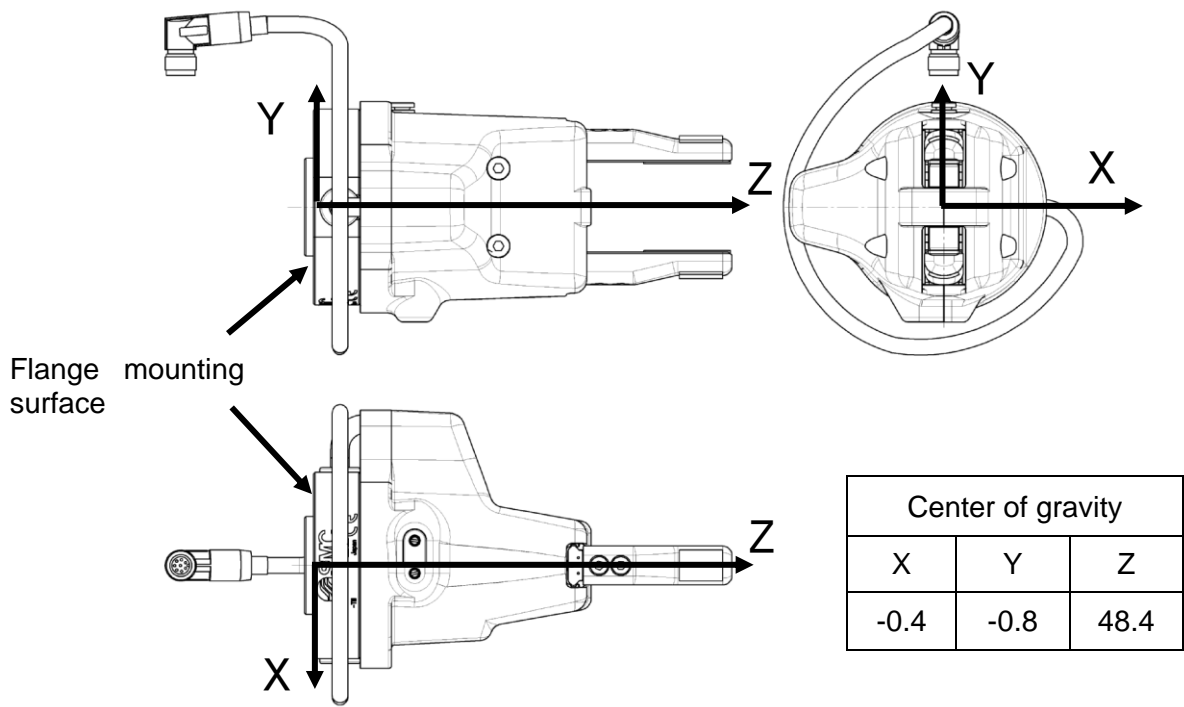
M8 8 Pin connector (Plug)



PIN number	Coating color	Function	Description
1	White	+24V	Power supply for 24 VDC
2	Brown	Auto switch(finger opening direction)	-
3	Green	Auto switch(finger closing direction)	-
4	Yellow	-	NC
5	Grey	Valve On/Off(finger opening direction)	-
6	Pink	Valve On/Off(finger closing direction)	-
7	Blue	-	NC
8	Red	GND	Power supply for 0 VDC

3-6.Center of gravity

*The origin of the gravity center point Z axis is the flange mounting surface.



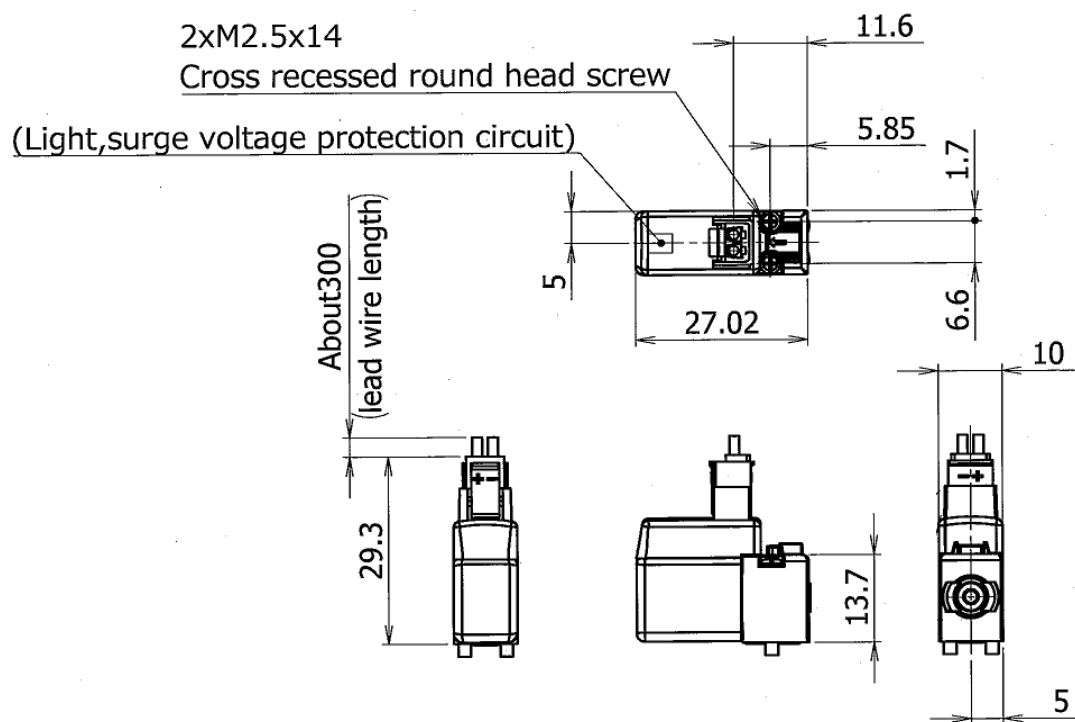
4-2. 3 Port Solenoid Valve

Specifications.

Model	V114-5LU
Fluid	Air
Ambient and fluid temperature (°C)	−10 to 50 (No freezing)
Response time (DC) (ms)	ON: 5 or less OFF: 4 or less
Max. operating frequency (Hz)	20
Lubrication	Not required
Mounting position	Unrestricted
Impact/Vibration resistance (m/s ²)	150/30
Enclosure rating	Dust proof

Solenoid Specifications

Model	V114-5LU
Electrical entry	L plug connector(L)
Coil rated voltage (V)	24
Allowable voltage fluctuation	-10 to 10%
Power consumption (W)	0.4 [Starting 0.4, Holding 0.1]
Surge voltage suppressor	Please refer to page 1367 of the Best pneumatics catalogue.
Indicator LED	LED



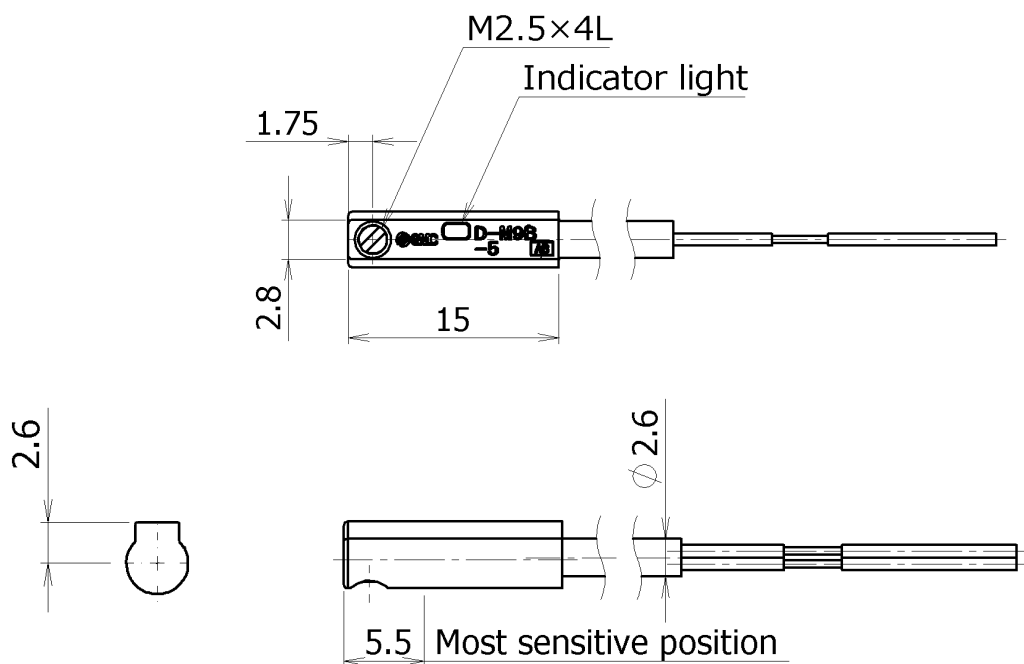
4-3. Auto switch

Auto Switch Specifications

D-M9N-5(With indicator light)	
Auto switch model	D-M9N-5
Electrical entry direction	In-line
Wiring	3-wire
Output	NPN type
Applicable load	IC circuit, Relay, PLC
Power supply voltage	5 , 12 , 24 VDC (4.5 to 28 V)
Current consumption	10 mA or less
Load voltage	28 VDC or less
Load current	40 mA or less
Internal voltage drop	0.8 V or less at 10 mA (2 V or less at 40 mA)
Current leakage	100 μ A or less at 24 VDC
Indicator LED	Red LED illuminates when turned ON.
Standard	CE marking、RoHS

Dimensions

D-M9N-5



5. Operating method / operation

5-1. Design

Warning

1. The product is designed for use only in compressed air systems. Do not operate at pressures or temperatures, etc., beyond the range of the specifications, as this can cause damage or malfunction of the cylinder and other equipment. (Refer to the specifications.)
Please contact SMC if using fluids other than compressed air. The product cannot be guaranteed if is used outside of the specification range.
2. Take safety measures (e.g. mounting protective covers) when there is a danger of fingers being caught in a gripper or workpieces causing damage, etc.
3. There is a danger of workpieces dropping if there is a decrease in gripping force due to a drop in circuit pressure caused by a power failure or trouble with the air source. It is necessary to take measures such as drop prevention so that injury and damage to machinery or equipment can be prevented.
4. If the product is used for a purpose other than the transportation of a workpiece such as positioning or clamping, please consult SMC.

Caution

1. Finite orbit type guide is used in the actuator finger part. By using this, when there is inertial force which cause by movements or rotation to the actuator, steel ball will move to one side and this will cause a large resistance degrade the accuracy. When there is inertial force which cause by movements or rotation to the actuator, operate the finger to full stroke.

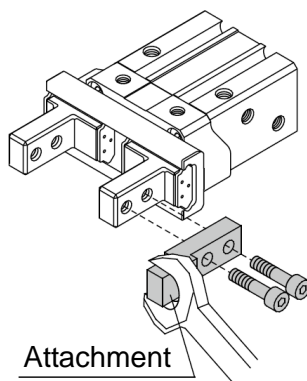
5-2. Installation

Warning

1. Install and operate the product only after reading the Operation Manual carefully and understanding its contents. Also, keep the manual where it can be referred to as necessary.
2. Allow sufficient space for maintenance and inspection.
3. Do not scratch or dent the air gripper by dropping or bumping it when mounting.
Slight deformation can cause inaccuracies or a malfunction.
4. Tighten the screw within the specified torque range when mounting the attachment.
Tightening with a torque above the limit can cause malfunction, while insufficient tightening can cause slippage and dropping.

How to mount attachment to the finger

Make sure to mount the attachments on fingers with the tightening torque in the table below by using bolts, etc., for the female threads on fingers.



Model	Bolt	Max.tightening Torque (Nm)
JMHZ2-16D	M3 x 0.5	0.59

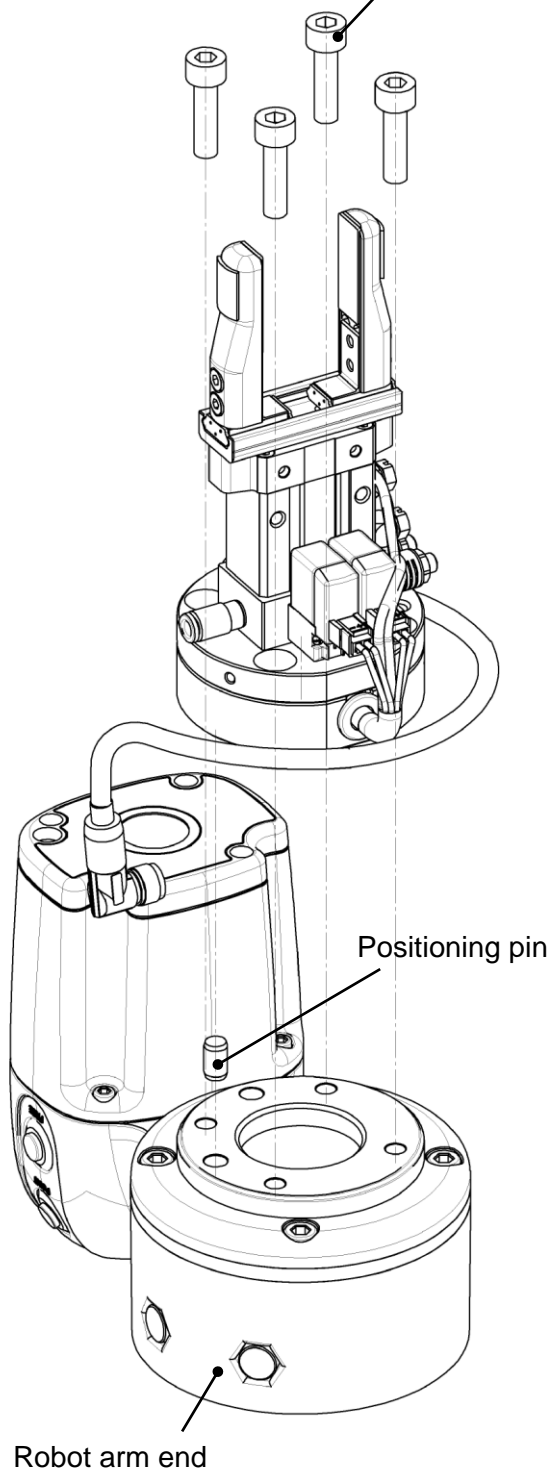
How to Mount Air Gripper

Adjust the robot arm position before mounting so that the mounting is easy.

(1) Mounting to the robot arm

Hexagon socket head cap screw

Max. tightening
Torque : 6.3 (Nm)

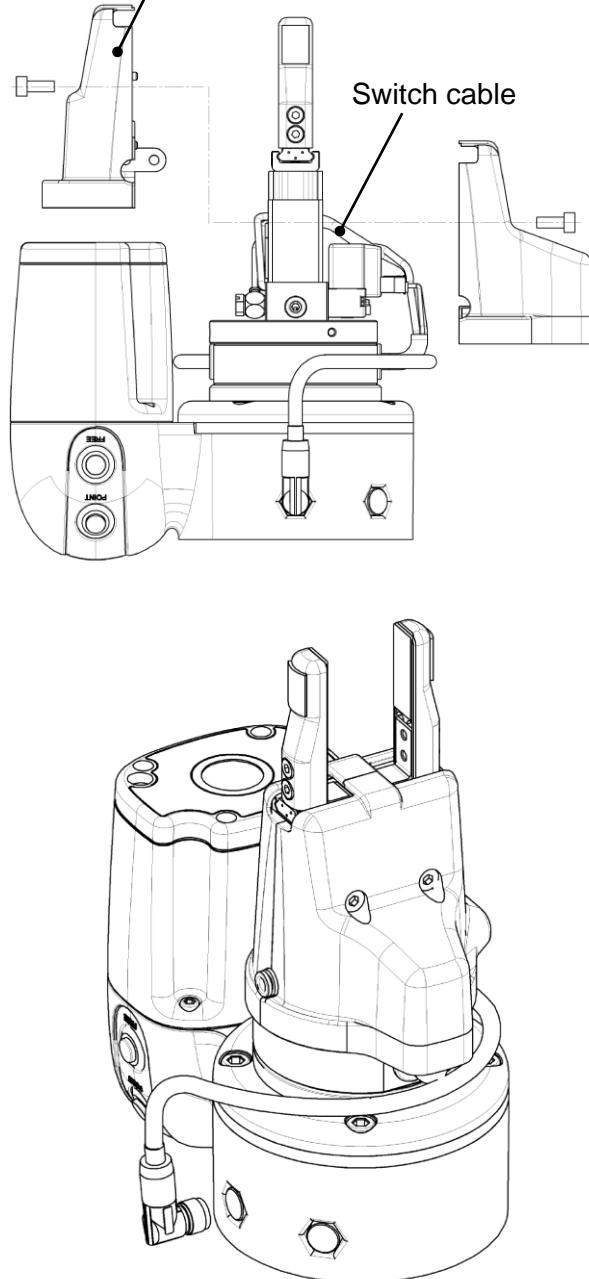


(2) Mounting of the cover

Take care not to get the switch cable
Caught when mounting the cover.

Hexagon socket head cap
screw(M4 x 10)

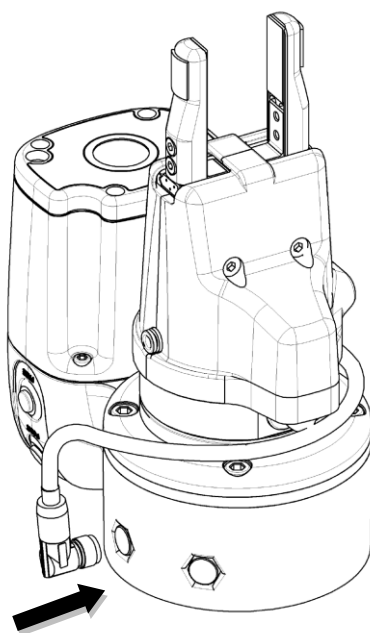
Max. tightening
Torque : 1.0 (Nm)



(3) Secure the connector

*Do not energize while securing the connector.

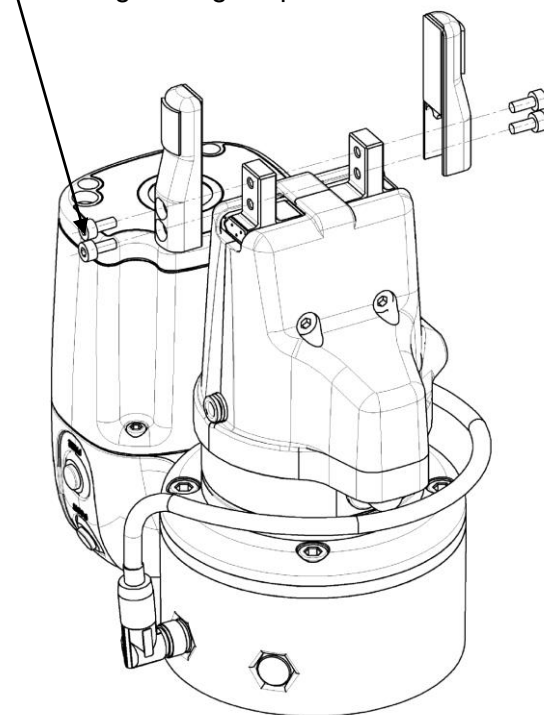
*Check that the connector is not loose



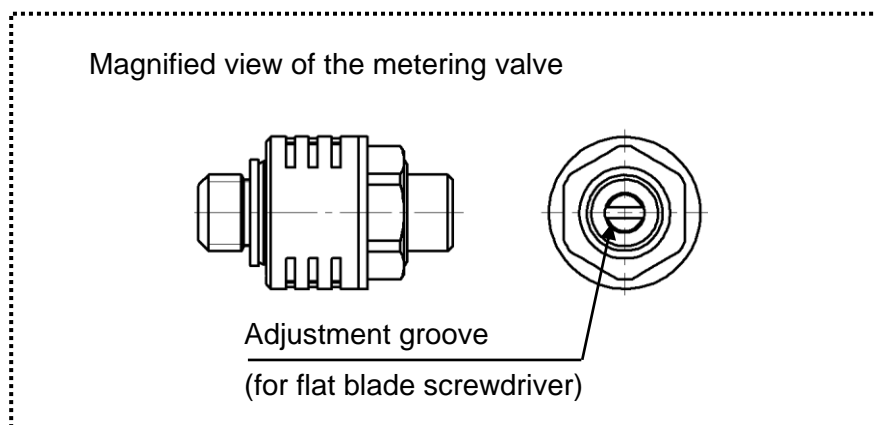
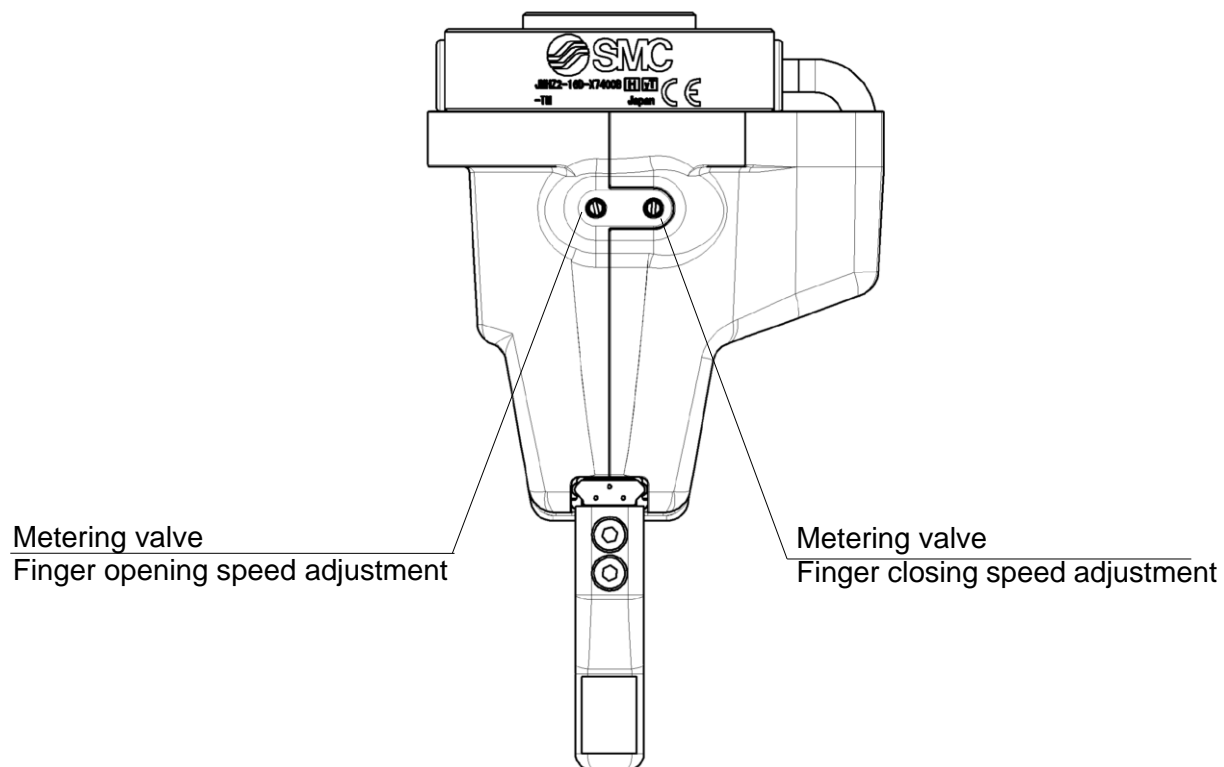
(4) Mount the finger attachments.

For mounting and removal of the attachment, refer to the drawing below. Refer to P14, "5-2 Installation" for mounting of the finger to the attachment.

Hexagon socket head cap screw
Max. tightening torque :0.59Nm



Finger open / close speed adjustment



- * Use a flat blade screwdriver for adjusting the restriction of the metering valves.
- * Keep the restriction of the 2 metering valves approximately the same. If they differ too much, the operation may become unstable.

5-3. TMComponent

TMComponent is an independent software package for the robot applications and you need to import the software package to use in TMflow (robot software) directly.

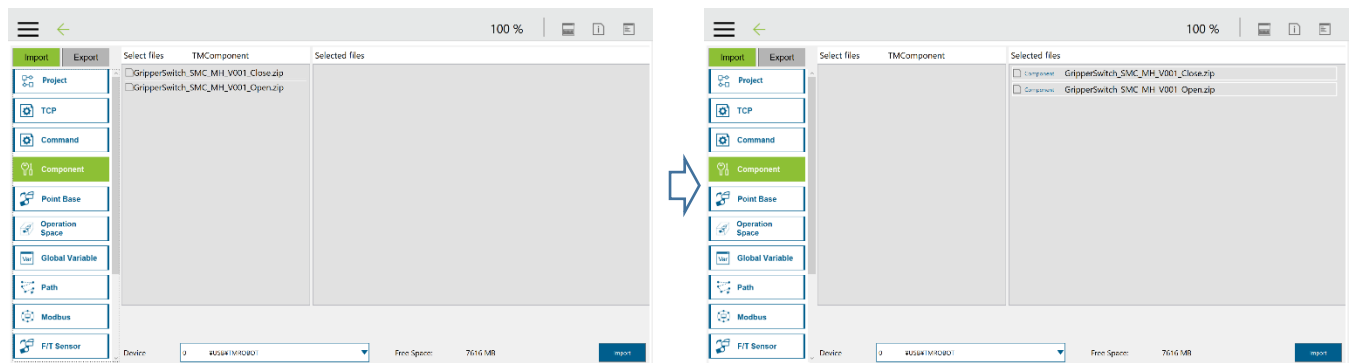
Here is the list of the SMC Air Gripper TMComponents.

- GripperSwitch_SMC_MH_V***_Open (The gripper operates in the direction to open the finger)
- GripperSwitch_SMC_MH_V***_Close (The gripper operates in the direction to close the finger)

Note) *** is the version number starting from 001.

Import TMComponent

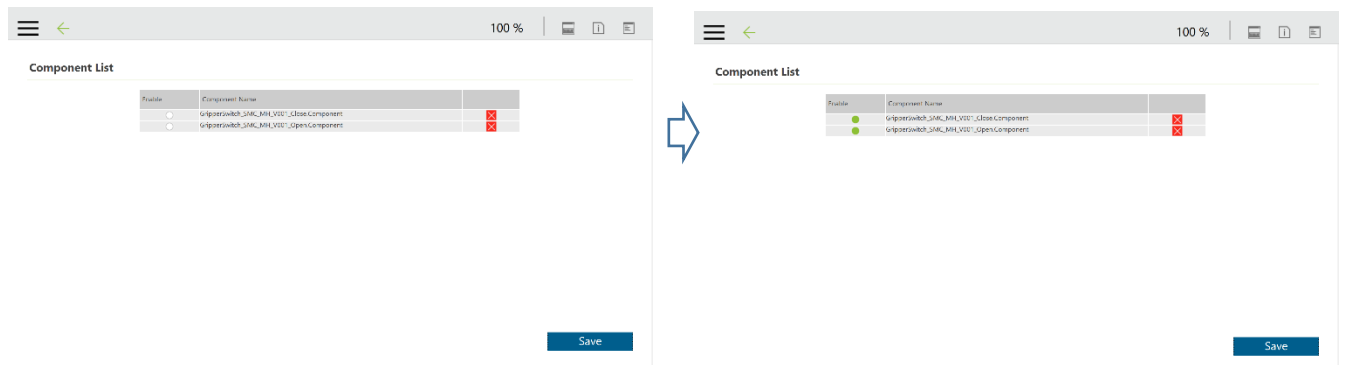
1. Download the TMComponent from the SMC website.
2. Label the USB drive with "TMROBOT".
3. Place the downloaded the zipped component files in the USB with the folder directory TMROBOT:\TM_Export\TMComponent\ComponentObject\.
4. Insert the USB storage device in the robot controller
5. In TMflow, click the **triple bar** icon and select **System**
6. Select **Import/Export** and click **Import**. Then select the TMComponent in the Robot List window and click on **OK**.
7. Click on the **Component** button of the Import navigation panel. Then select the relevant SMC components to be added and click **Import**.



Enable TMComponent

8. Click the **triple bar** icon and go back to the main menu. Then select **Setting** to display the System Setting window.
9. Click on the **Component** icon
10. Enable required Components in the Component List by ticking the radio button beside each of them.

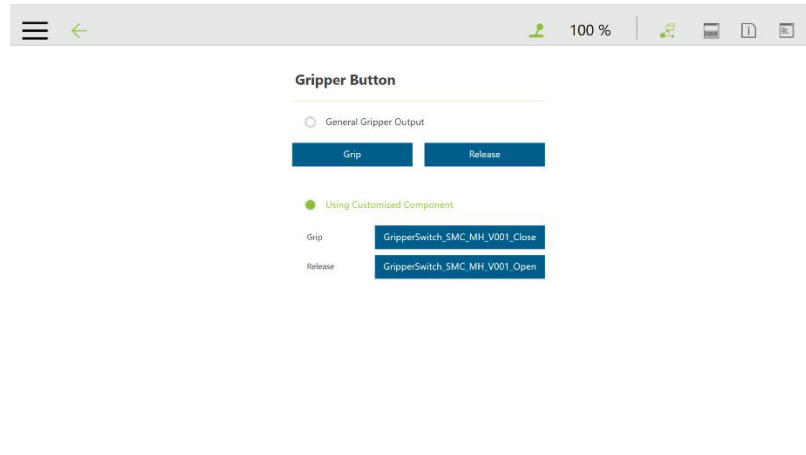
A Component that is enabled displays a green radio button. Then click on the **Save** button.



Configure gripper button

The user can assign SMC Gripper Components to the Gripper button and use to open and close the gripper.

1. Click the **triple bar** icon and go back to the main menu. Then select **Setting** icon.
2. Click on **Gripper Button** icon.
3. In the Gripper Button window, tick the **Using Customized Component** radio button and select the Component you want to assign to either one of the Gripper actions.

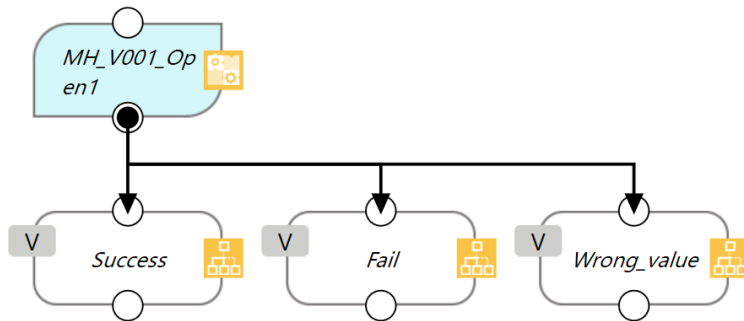


Use TMComponent

Component OPEN node

This component is used to open the gripper.

It can be used to release a part after an outside grip or to grip a part with an inside grip.



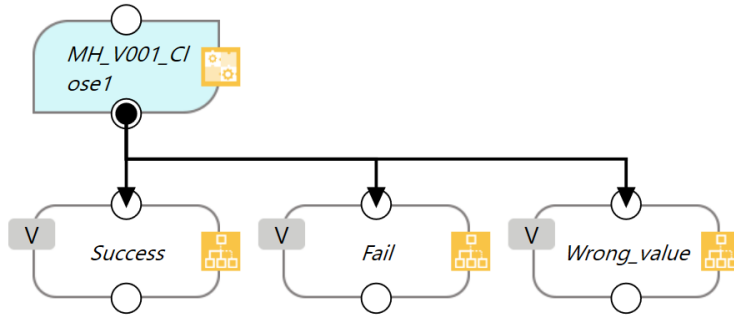
- Success : The gripper completes to open (When Open_and_CheckSignal is set to false), or auto switch signal at open side is ON meaning a part is detected with an inside grip (Open_and_CheckSignal is set to true).
- Fail : Auto switch signal at open side is not ON meaning a part is not detected with an inside grip (When Open_and_CheckSignal is set to true).
- Wrong_value : Set value of WaitTime_Setting or TimeoutVal_Setting is out of range.

Function	Type	Default	Description
Open_and_CheckSignal	bool	false	CheckSignal function enable/disable setting When set to true, after opening the gripper auto switch signal is monitored and move to the next operation if the signal is ON. When set to false, after opening the gripper move to the next operation. Auto switch signal is not monitored in this case.
WaitTime_Setting	int	500	WaitTime setting after valve operation (Unit: ms, Range: 0..1000ms) It is a wait time value after the valve for opening gripper is energized. Set an appropriate value according to the opening speed of the gripper by adjusting the opening of the metering valve.
TimeOutVal_Setting	int	500	Timeout setting of checking the auto switch signal (Unit: ms, Range: 0..1000ms) Note) It will only be appeared when the Advanced setting is checked

Component CLOSE node

This component is used to close the gripper.

It can be used to grip a part with an outside grip or to release a part after an inside grip.



- Success : The gripper completes to close (When Close_and_CheckSignal is set to false), or auto switch signal at close side is ON meaning a part is detected with an outside grip (Close_and_CheckSignal is set to true).
- Fail : Auto switch signal at close side is not ON meaning a part is not detected with an outside grip (When Close_and_CheckSignal is set to true).
- Wrong_value : Set value of WaitTime_Setting or TimeoutVal_Setting is out of range.

Function	Type	Default	Description
Close_and_CheckSignal	bool	false	CheckSignal function enable/disable setting When set to true, after closing the gripper auto switch signal is monitored and move to the next operation if the signal is ON. When set to false, after closing the gripper move to the next operation. Auto switch signal is not monitored in this case.
WaitTime_Setting	int	500	WaitTime setting after valve operation (Unit: ms, Range: 0..1000ms) It is a wait time value after the valve for closing gripper is energized. Set an appropriate value according to the closing speed of the gripper by adjusting the opening of the metering valve.
TimeOutVal_Setting	int	500	Timeout setting of checking the auto switch signal (Unit: ms, Range: 0..1000ms) Note) It will only be appeared when the Advanced setting is checked

5-4. Air supply

Warning

1. Please contact SMC when using the product in applications other than with compressed air.
2. Compressed air containing a large amount of condensate can cause malfunction of pneumatic equipment. An air dryer or water separator should be installed upstream from filters.
3. If condensate in the drain bowl is not emptied on a regular basis, the condensate will overflow into the compressed air lines. This will cause a malfunction of pneumatic equipment. If the drain bowl is difficult to check and remove, the installation of a drain bowl with an auto drain option is recommended.
4. Use clean air.
Do not use compressed air that contains chemicals, synthetic oils including organic solvents, salt or corrosive gases, etc., as it can cause damage or malfunction of equipment.
Refer to "SMC Air Preparation System" for further details on compressed air quality.

Caution

1. When extremely dry air is used as the fluid, degradation of the lubrication properties inside the equipment may occur, resulting in reduced reliability (or reduced service life) of the equipment. Please consult with SMC.
2. Install air filters.
Install an air filter at the upstream side of valve. A filtration degree of 5µm or less should be selected.
3. Install an aftercooler, air dryer or drain catch before the filter and take appropriate measures.
Compressed air that contains excessive foreign material may cause malfunction of valves and other pneumatic equipment.
Therefore, take appropriate measures to ensure air quality, such as by providing an aftercooler, air dryer or water separator.
4. Use the product within the specified fluid and ambient temperature range.
If the fluid temperature is 5°C or less, the moisture in the circuit could freeze, causing damage to the seals and leading to equipment malfunction. Therefore, take appropriate measures to prevent freezing.

Refer to "SMC Air Preparation System" for further details on compressed air quality.

5-5. Piping

Caution

1. Refer to the Fittings and Tubing Precautions (Best Pneumatics) for handling one touch fittings.
2. Before piping
Before piping, blow air (flush) or clean the piping to remove any cutting chips, cutting oil, dust, etc.

5-6. Operating environment

Warning

1. Do not use in an environment where corrosive gases, chemicals, sea water, water or steam are present.
2. Do not use in direct sunlight.
3. Do not operate in a location subject to vibration or impact.
4. Do not mount the product in locations where it is exposed to radiant heat.
5. Do not use this product in an area that is dusty, or in an environment in which water or oil splashes on to the cylinder.

Caution

1. Martensitic stainless steel is used for the finger guide, so make sure that anti-corrosiveness is inferior to the austenitic stainless steel. Especially, rust may be generated in environments that allow water drops from condensation to stay on the surface.

5-7. Lubrication

Caution

1. The non-lube type air gripper is lubricated at the factory and can be used without any further lubrication.
If a lubricant is used in the system, use turbine oil Class 1 (with no additive) ISO VG32.
Furthermore, once lubrication is applied, it must be continued.
If lubrication is later stopped, malfunction can occur due to loss of the original lubricant.
Refer to the Material Safety Data Sheet (MSDS) of the hydraulic fluid when supplying the fluid

6. Maintenance

Warning

1. If handled improperly, compressed air can be dangerous. Assembly, handling, repair and element replacement of pneumatic systems should be performed by a knowledgeable and experienced person.
2. Remove drainage moisture from air filters regularly.
3. When air grippers are removed, first confirm that measures are in place to prevent any workpieces from dropping, run-away of equipment, etc. Then cut off the supply pressure and electric power and exhaust all compressed air from the system using the residual pressure release function.
When the equipment is restarted, proceed with caution after confirming that appropriate measures are in place to prevent cylinders from sudden movement.
4. Do not allow people to enter or place objects in the carrying path of the air gripper.
Otherwise, injury or an accident may occur.
5. Do not put hands, etc. in between the air gripper fingers or attachments
6. When removing the air gripper, first confirm that no workpieces are being held and then release the compressed air before removing the air gripper.
If a workpiece is still being held, there is a danger of it being dropped.

Revision history

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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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