



Operation Manual

PRODUCT NAME

Air Gripper for collaborative robots.

MODEL / Series / Product Number

JMHZ2-16D-X7400B

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

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

Warning

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

Danger

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

Warning

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

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

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

The product specified here may become unsafe if handled incorrectly.

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

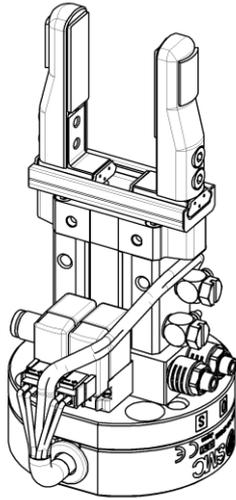
Caution

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.

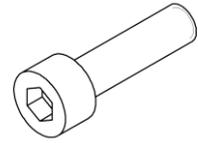
1. List of included items



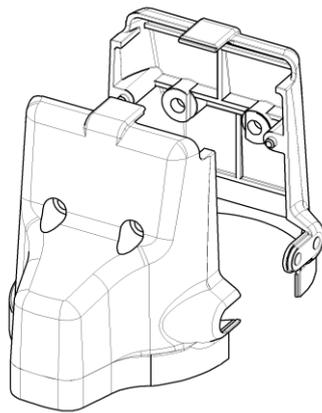
Air Gripper 1pcs.



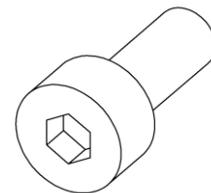
Positioning pin (6×10) 1pc.
For positioning the product.



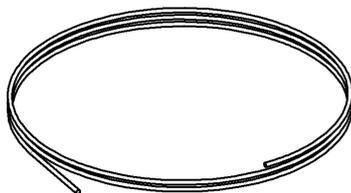
Hexagon socket head cap screw (M6×23) 4pcs.
For mounting the product.



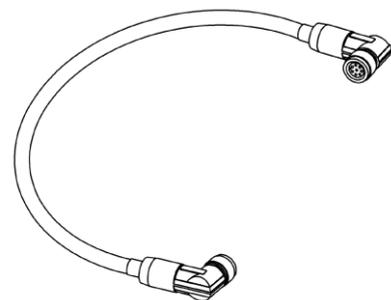
Protection cover (Valve side) 1pc.
Protection cover (switchside) 1pc.



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

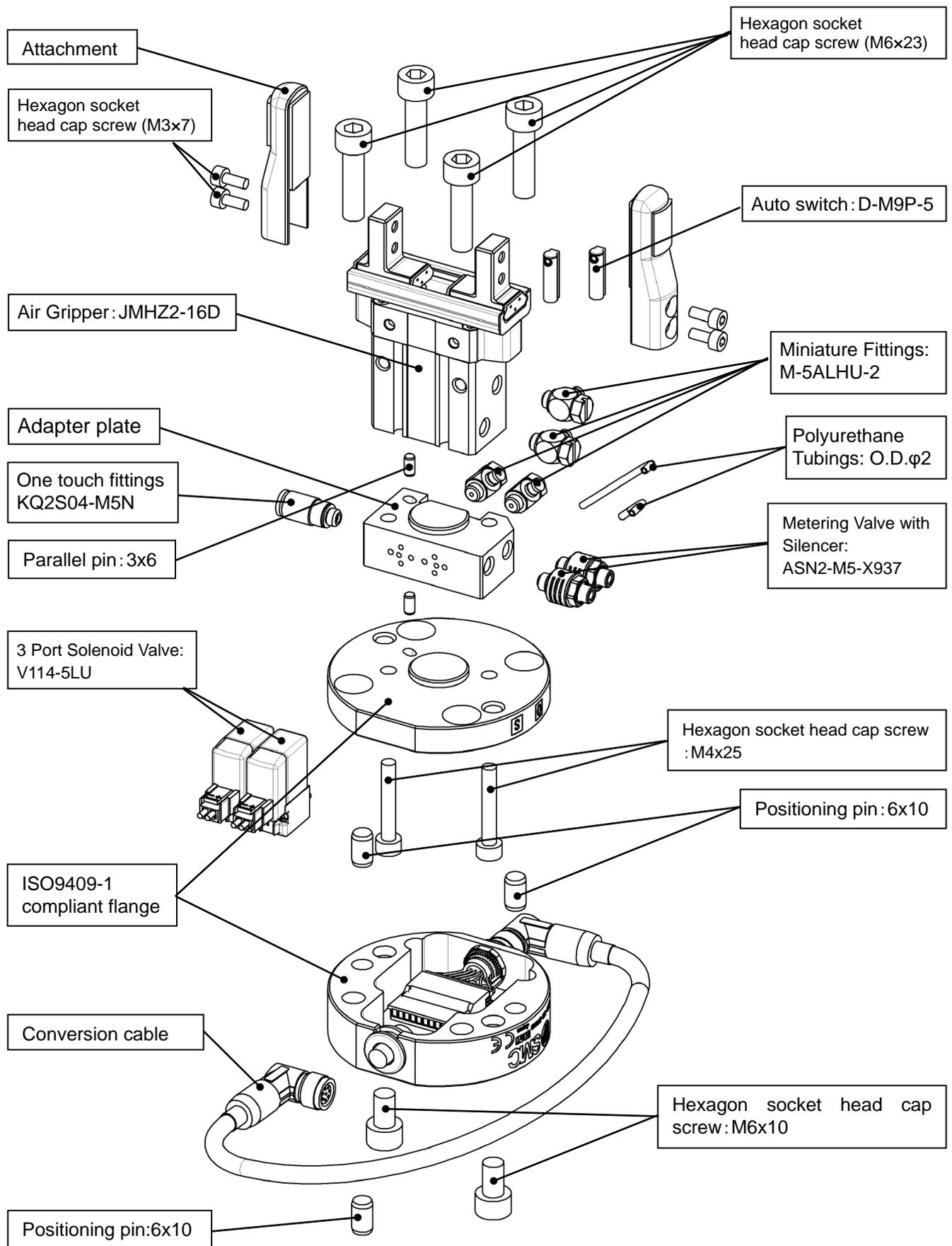


Polyurethane tube for piping $\phi 4$ (TU0425BU-100) 2m.



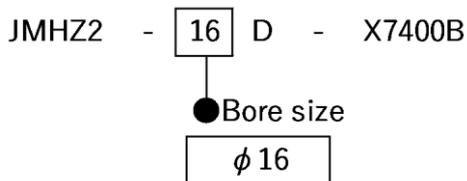
Conversion cable 1pc.

2. Parts description of the air gripper



3. Product Specifications

3-1. How to order



3-2. Specifications

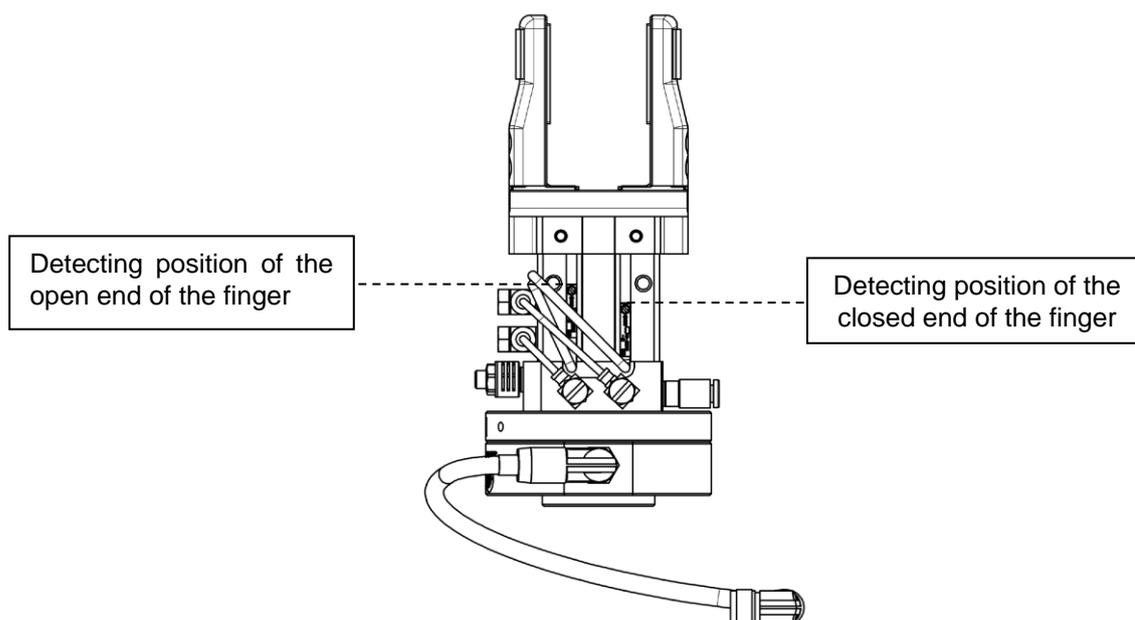
Specifications

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	
Holding force Actual value per finger (N)	External gripping force	32.7
	Internal gripping force	43.5
Opening/closing stroke (both) (mm)	10	
Weight (g)	430	

*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.

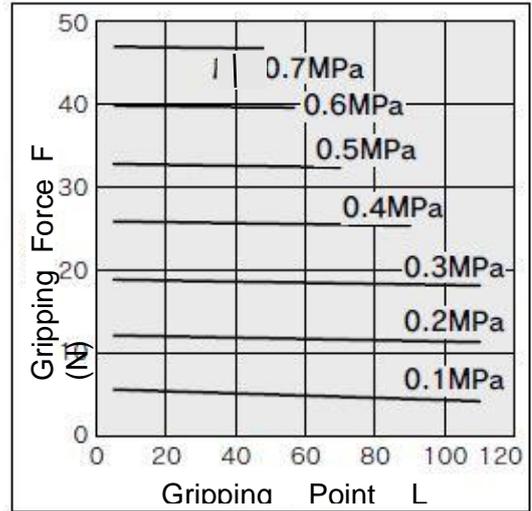
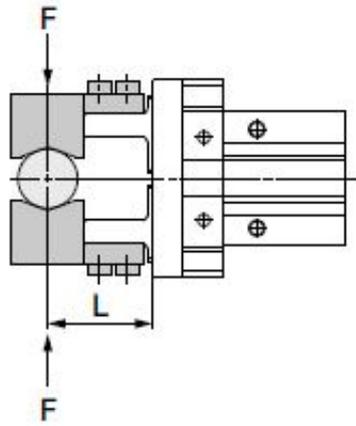
* For examples of setting auto switch and setting of mounting position of auto switches, please refer to the JMHZ2 Series catalogue P.15 onwards on our website (www.smcworld.com).



3-2. Gripping force

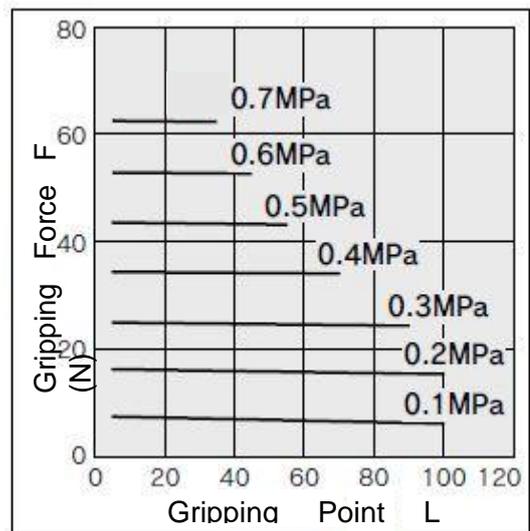
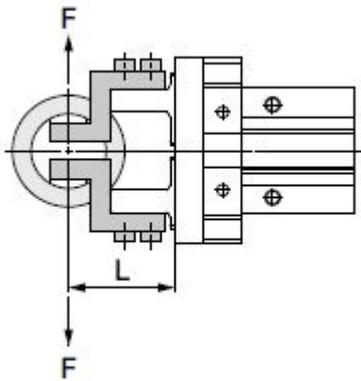
External gripping state Indication of effective gripping force

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.



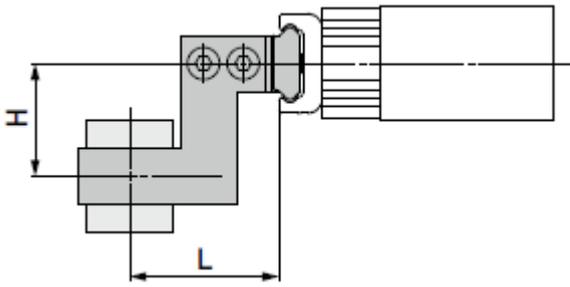
Internal gripping state Indication of effective gripping force

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.

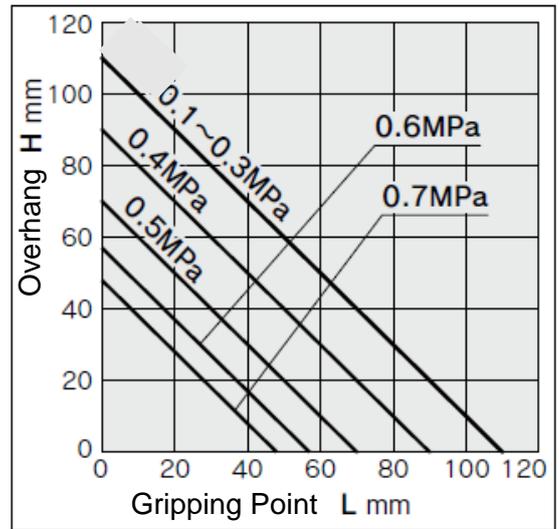


3-3. Gripping point

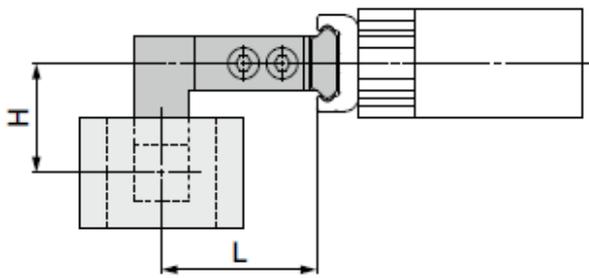
External gripping state



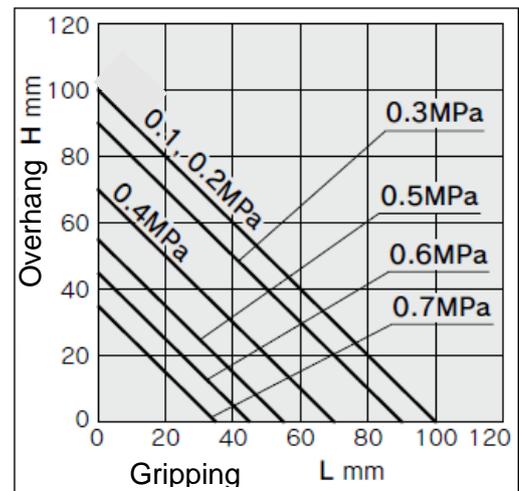
External gripping



Internal gripping state



Internal gripping



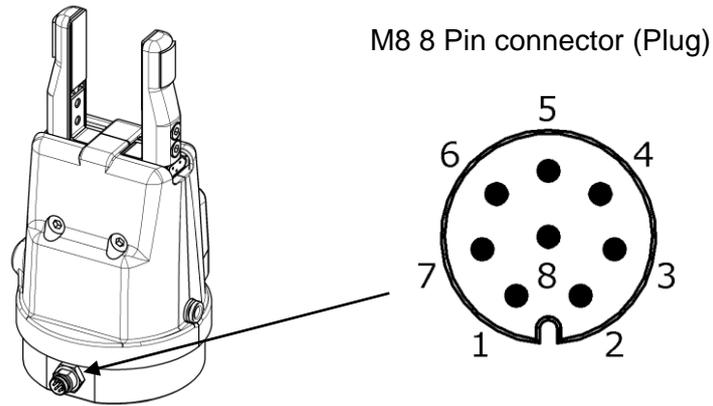
● The air gripper should be operated so that the workpiece gripping point "L" and the amount of overhang "H" stay within the range shown for each operating pressure given in the graphs to the right.

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

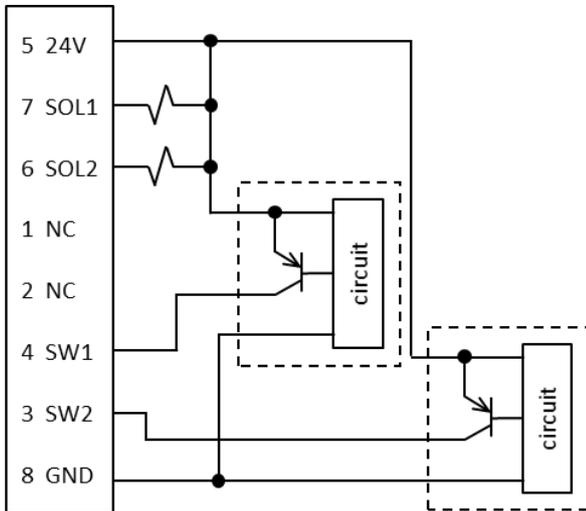
3-5. Connector and pin layout

Attached cable is fixed to the product.

Connect the communication cable correctly. Refer to P.18 for assembling method.

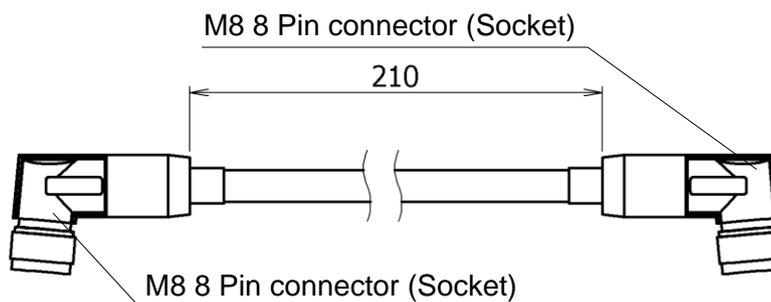


PNP output

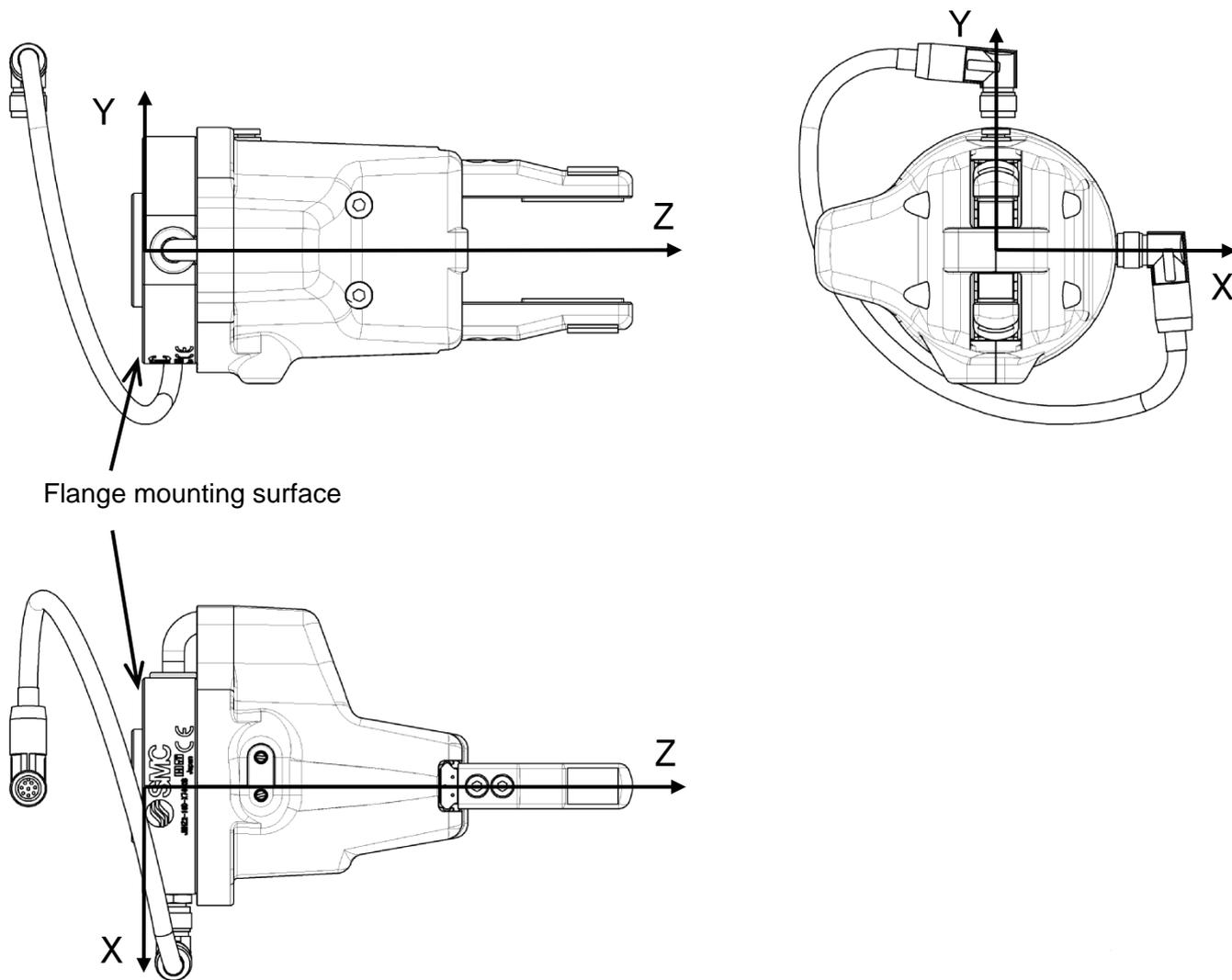


PIN No	Function	Description
1	-	NC
2	-	NC
3	Auto switch(Finger crossing direction)	
4	Auto switch(Finger opening direction)	
5	+24V	Power supply for 24VDC
6	Valve ON/OFF(Finger crossing direction)	
7	Valve ON/OFF(Finger opening direction)	
8	GND	Power supply for 0VDC

Conversion cable



3-6. Center of gravity



Center of gravity		
X	Y	Z
2.4	0.0	42.6

4. Product Specifications

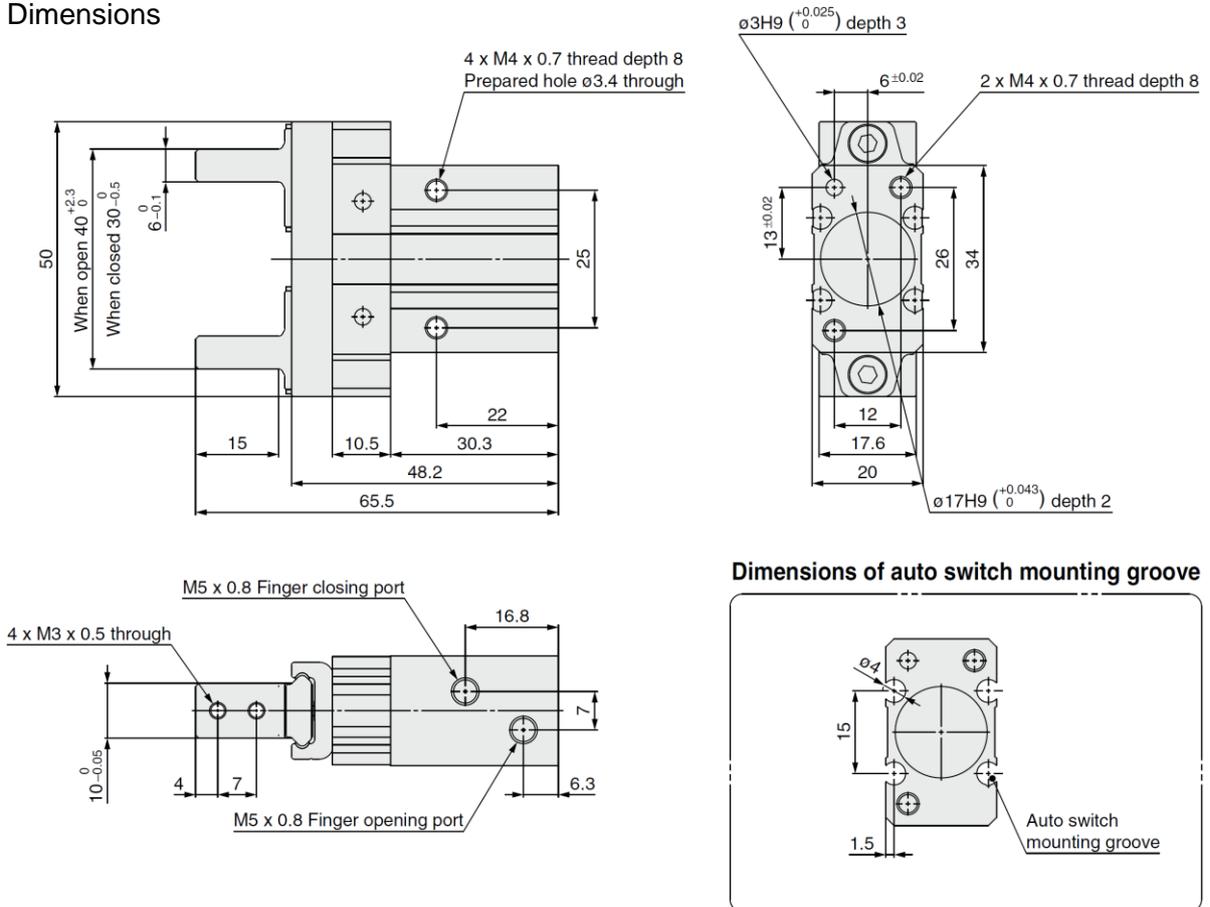
* For detailed specifications not included in this document, please refer to our website (www.smcworld.com) or operation manual.

4-1. Air Gripper

Specifications

Model		JMHZ2-16D
Bore size (mm)		16
Fluid		Air
Operating pressure [MPa]		0.1 to 0.7
Ambient and fluid temperature (°C)		-10 to 60
Repeatability (mm)		±0.01
Maximum operating frequency (c.p.m.)		120
Lubrication		Non-lube
Action		Double acting
Holding force Actual value per finger	O.D. holding force (N)	32.7
	I.D. holding force (N)	43.5
Opening / closing stroke (both) (mm)		10
Weight [g]		128

Dimensions



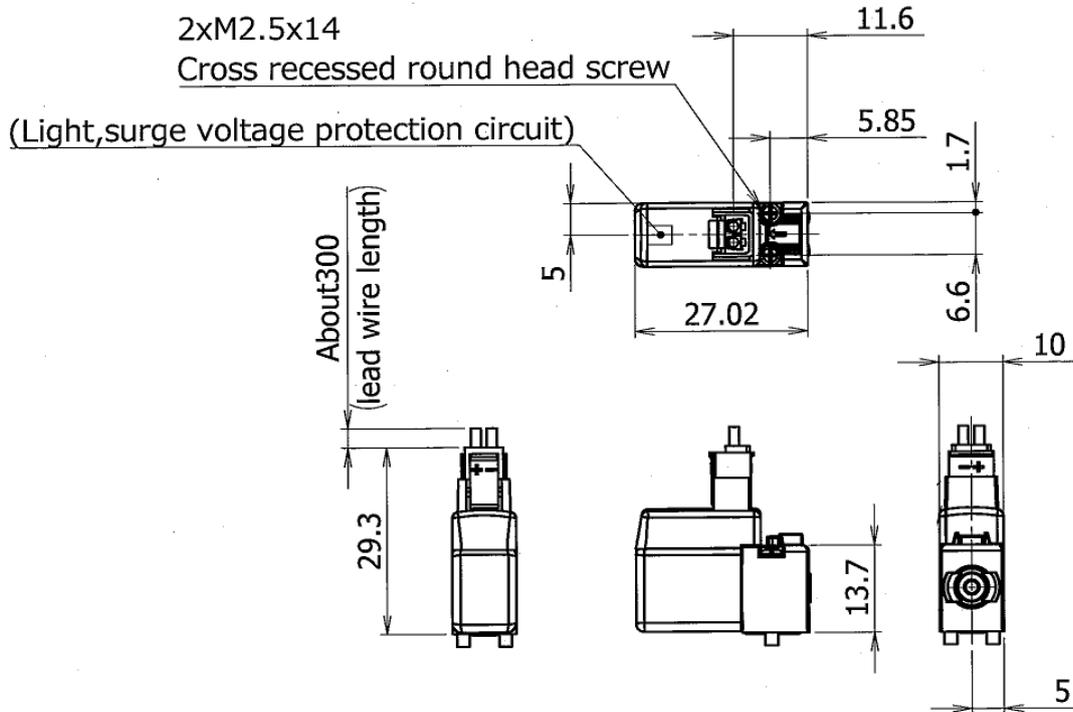
4-2. 3 Port Solenoid Valve

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



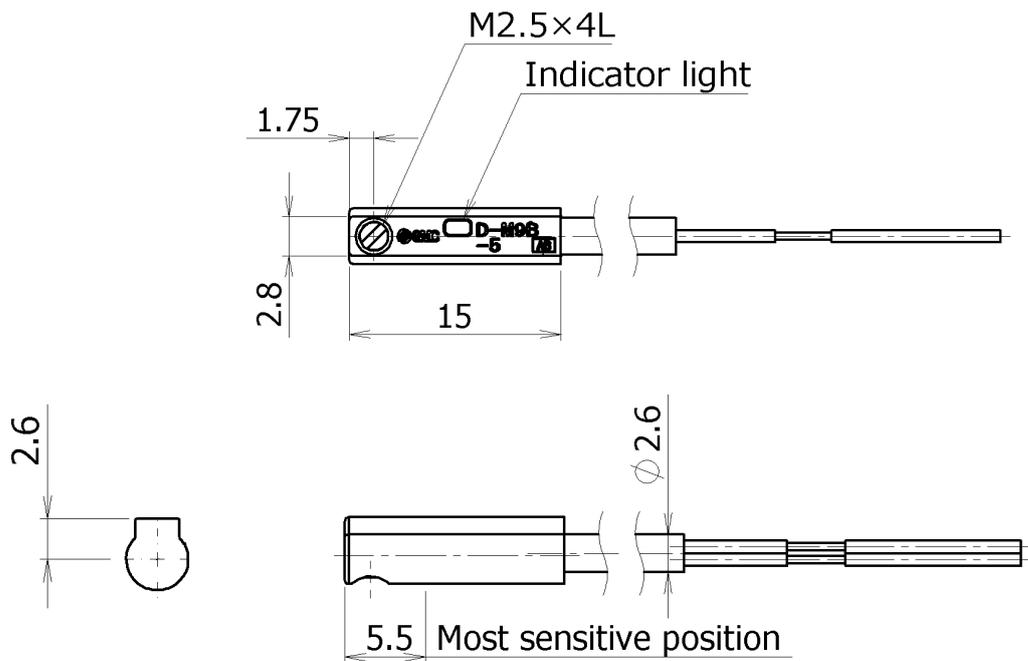
4-3. Auto switch

Auto Switch Specifications

D-M9□-5(With indicator light)	
Auto switch model	D-M9P-5
Wiring	3-wire
Output	PNP 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 μA or less at 24 VDC
Indicator LED	Red LED illuminates when turned ON.
Standard	CE marking、RoHS

Dimensions

D-M9□-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.

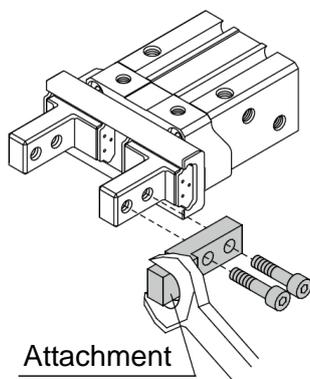
5-2. Installation

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

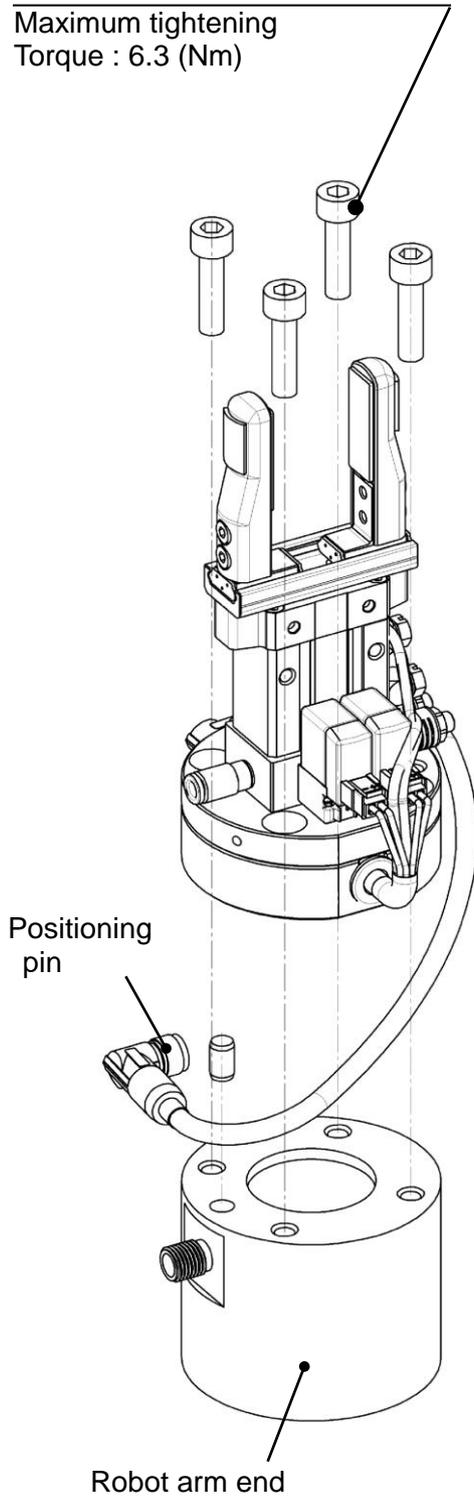
How to Mount Air Gripper

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

(1) Mounting to the robot arm

Hexagon socket head cap screw
(M6x23)

Maximum tightening
Torque : 6.3 (Nm)

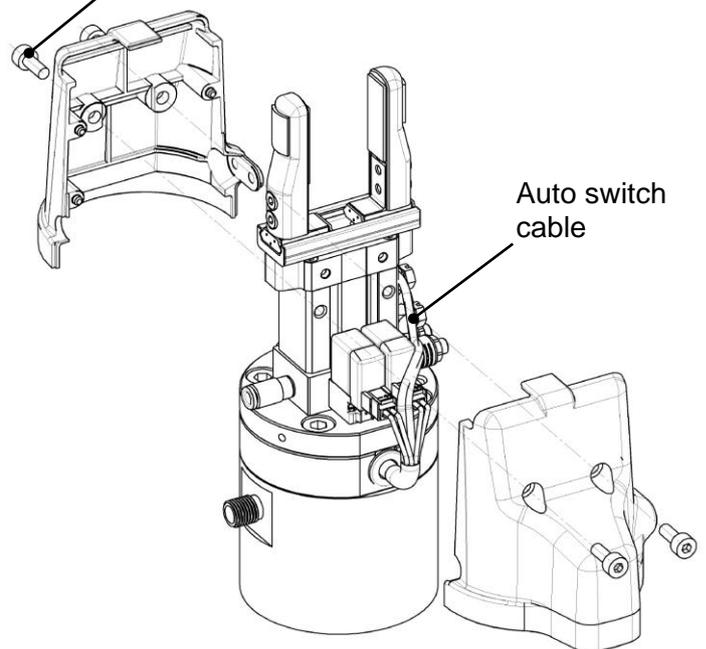


(2) Mounting of the cover

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

Hexagon socket Head cap screw
(M4X10)

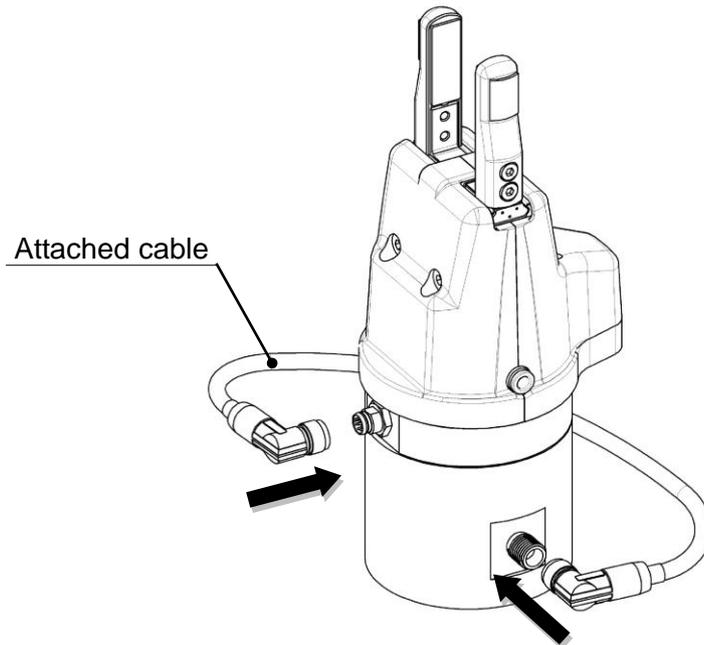
Max. tightening torque: 1.0Nm



③Connecting the M8 connector

* Do not energize while securing the connector.

* Check that the connector is not loose.

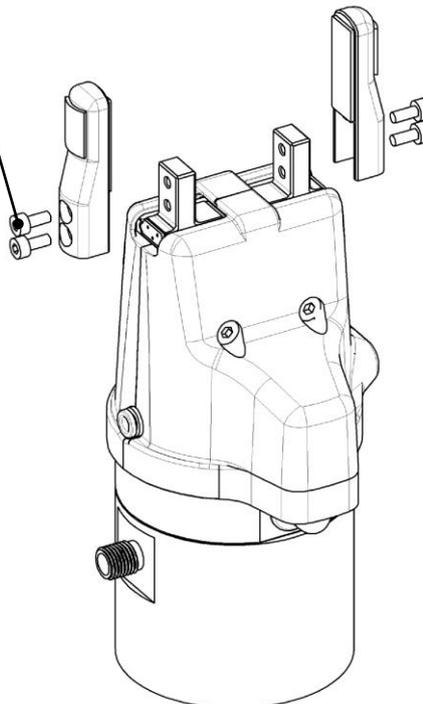


(4)For mounting attachment

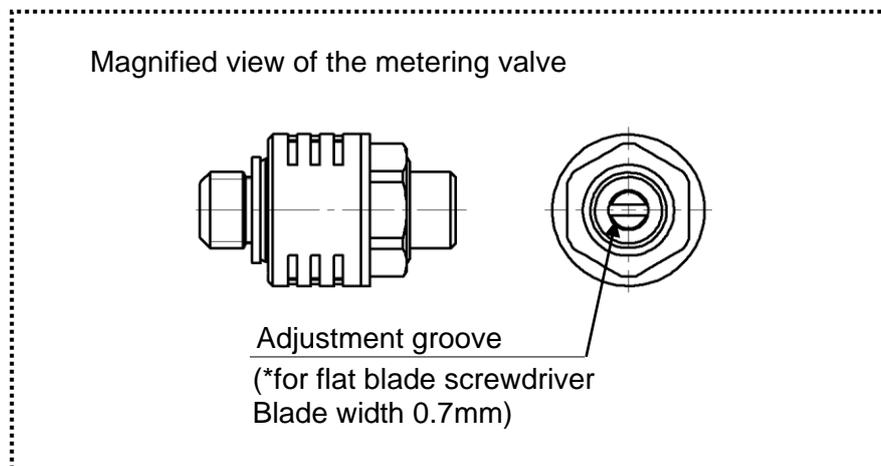
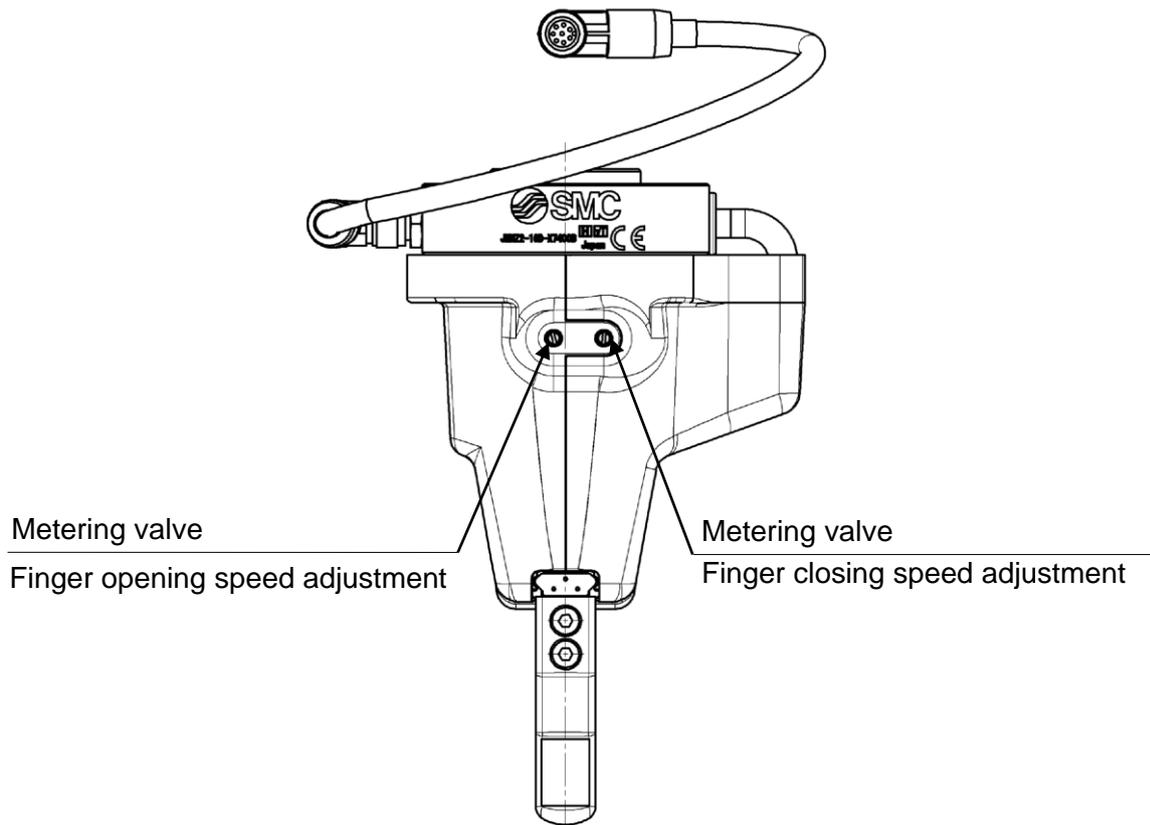
For mounting and removal of the attachment, refer to the drawing below. Refer to P16, "5-2 Installation" for mounting of the finger to the attachment.

Hexagon socket head cap screw (M3 x 7)

Max. tightening torque: 0.59Nm



Finger open / close speed adjustment



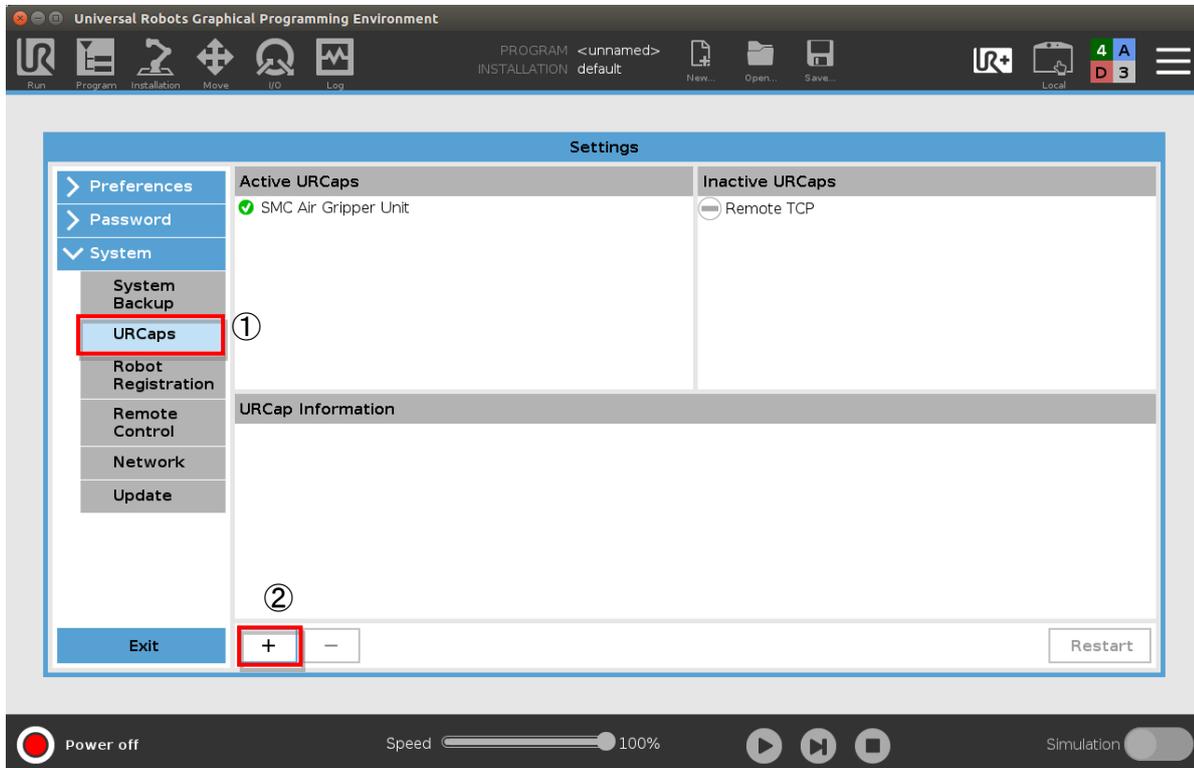
- * Use a flat blade screwdriver for adjusting the restriction of the metering valves.
- * Keep the restriction of the 2 metering valves approximately the same. If they differ too much, the operation may become unstable.

5-3. URCap

Installation and basic setting

1. Installation of URCap

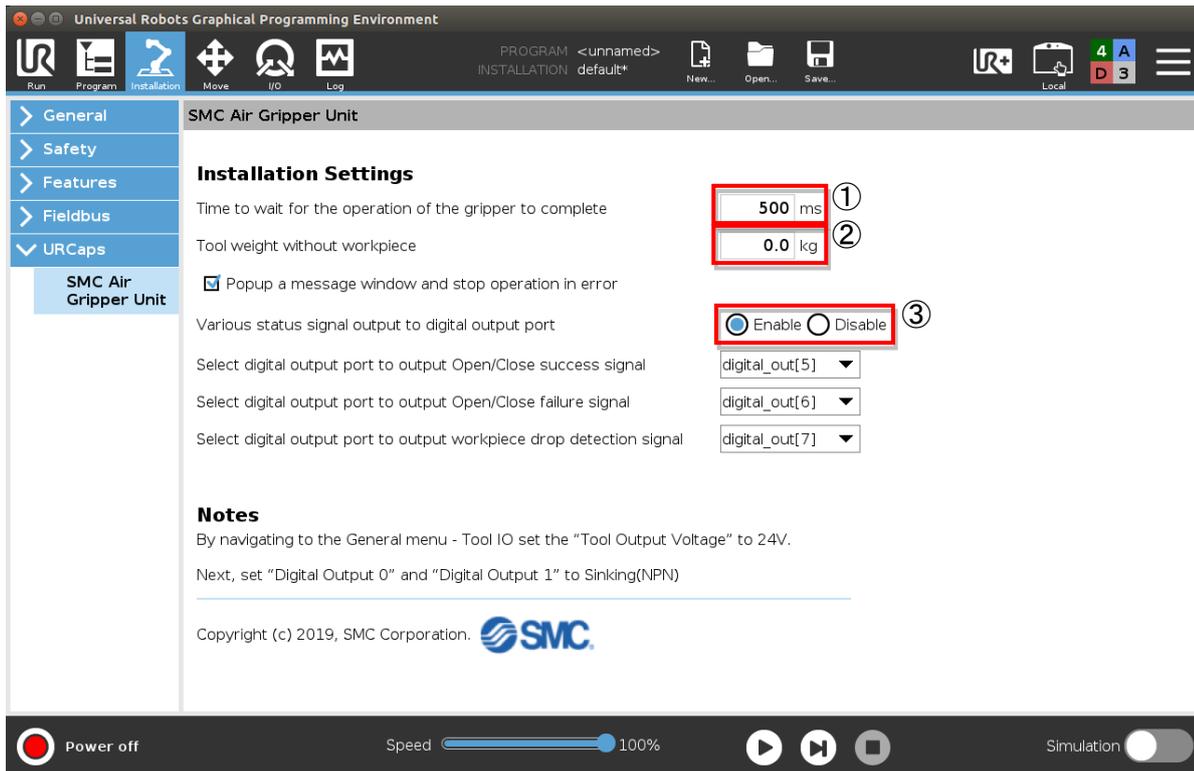
- (1) Tap the "URCap" menu from the robot settings screen.
- (2) Insert the USB memory with a copy of the downloaded file into the teaching pad and tap the "+" button.



- (3) Select "SMC-Air Gripper Unit-xxx.urcap" from the file screen and tap the "open" button.
- (4) Tap the "Restart" button to restart the robot.

*Before you make a change to the basic settings after the software installation, set the Tool Output Voltage to "24V" in the "Tool IO" setting from the "General" menu on the "Installation" tab. Set "Digital Output 0" and "Digital Output 1" to "Sinking(NPN)".

2. Select "SMC Air Gripper Unit" on the "URCaps" menu for basic settings.



①: "Time to wait for the operation of the gripper to complete":

If the NODE is "OPEN ONLY NODE" or "CLOSE ONLY NODE" (see P.21 for NODE), the delay time between outputting the valve switching signal and the transition of the robot to the next operation can be set.

If the NODE is "OPEN AND CHECK SIGNAL NODE" or "CLOSE AND CHECK SIGNAL NODE", the delay time between outputting the valve switching signal and starting of the monitoring of the auto switch input signal can be set.

Enter the appropriate value according to the opening/closing speed of the finger by adjusting the metering valve.

Example 1. **Set value 500ms**, "OPEN ONLY NODE" or "CLOSE ONLY NODE".

When the valve switching signal is output, the robot operation moves to next operation in 500ms. If the finger operation time is less than 500ms, the robot will only move to the next operation when 500ms has passed, even if the finger has completed its operation at less than 500ms from the valve switching. If the finger operation time is 500ms or more, it is necessary to be careful because the robot moves to the next operation before the finger operation is completed.

Example 2. **Set value 500ms**, "OPEN AND CHECK SIGNAL NODE" or "CLOSE AND CHECK SIGNAL NODE".

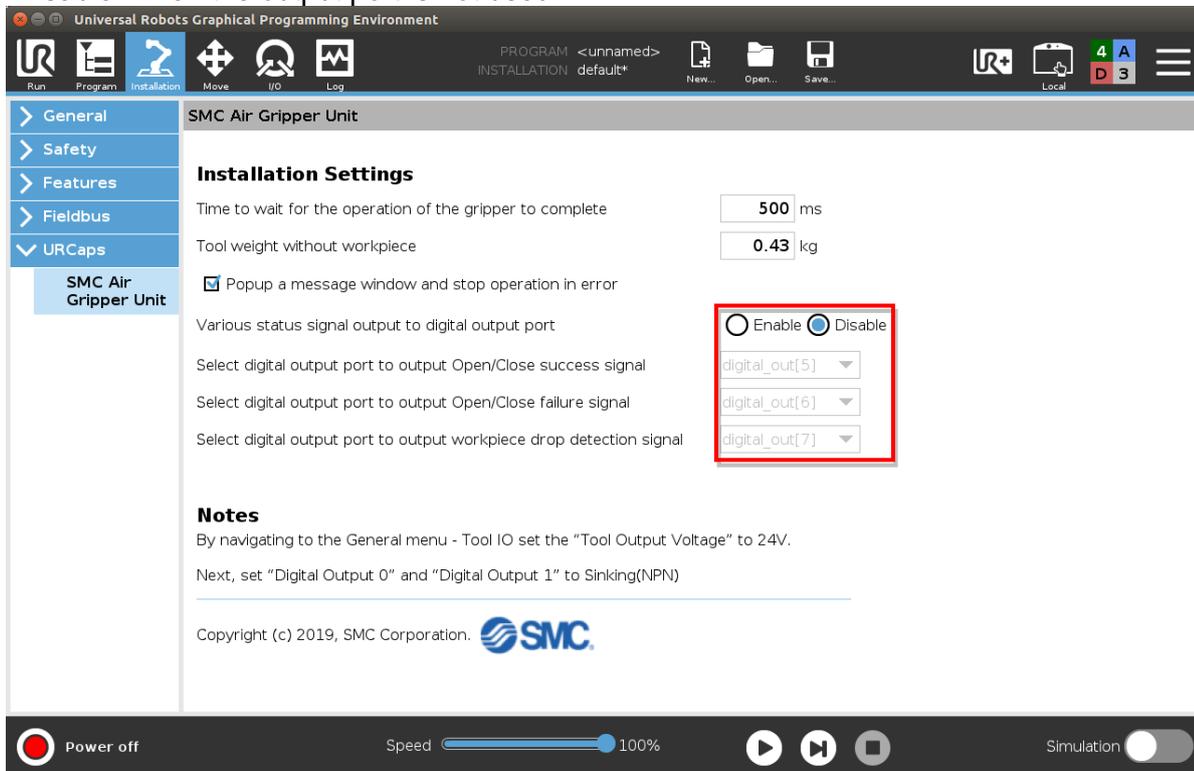
In 500ms after the valve switching signal is output, the monitoring of the auto switch input signal begins. If the finger operation time is less than 500ms, the monitoring of the auto switch signal begins when 500ms has passed, even if the finger has completed its operation at less than 500ms from the valve switching. If the finger operation time is more than 500ms, the auto switch signal monitoring begins when 500ms has passed even when the finger is in operation.

②:“Tool weight without work piece”:

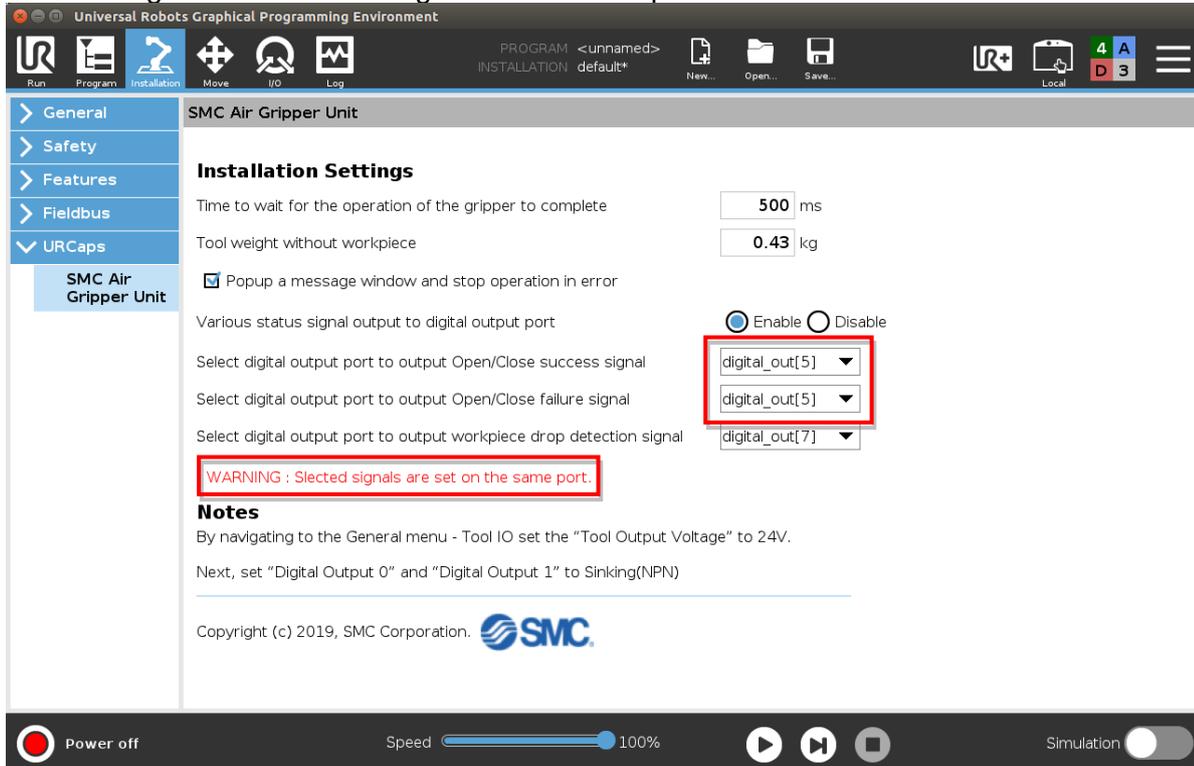
The mass of the air gripper is entered. If there are tools to attach to the robot arm other than the transferred object, add the mass. The robot performs the optimum operation according to the entered mass.

③:“Various status signal output to digital output port”:

Sets the status of the output port. If "Enable" is selected, the signal for open/close success, failure, and workpiece drop detection can be assigned to the output port No.5 / 6 / 7, respectively. Select “Disable” when the output port is not used.



Different signals cannot be assigned to the same port.



Program setting

Operation program can be set from the “Program” tab.

①:“Select operation”

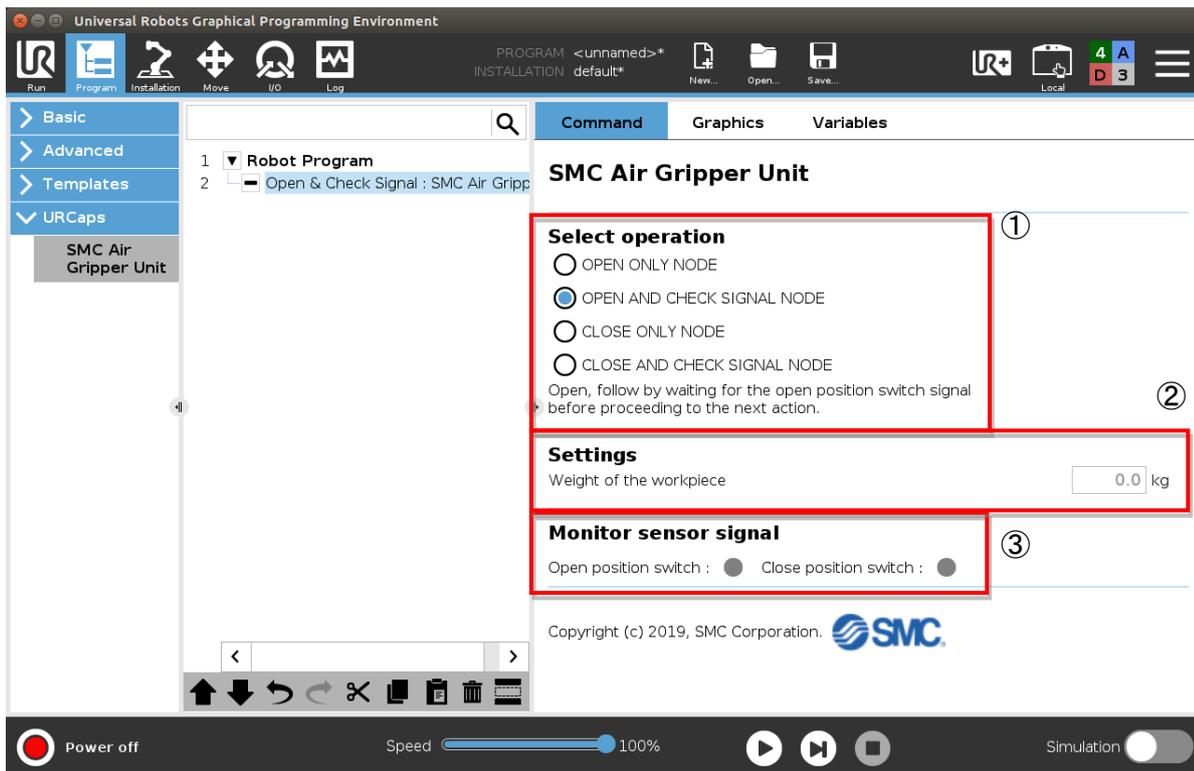
4 type of operation NODEs are available.

1: “OPEN ONLY NODE” opens the finger. This does not monitor the auto switch signal.

2: Fingers are open when “OPEN AND CHECK SIGNAL NODE” is executed. In this case, after checking the auto switch signal and confirming the reaction, the transition of the operation occurs.

3: “OPEN ONLY NODE” closes the finger. This does not monitor the auto switch signal.

4: Fingers are closed when “CLOSE AND CHECK SIGNAL NODE” is executed. In this case, after checking the auto switch signal and confirming the reaction, the transition of the operation occurs.



②:“Settings”

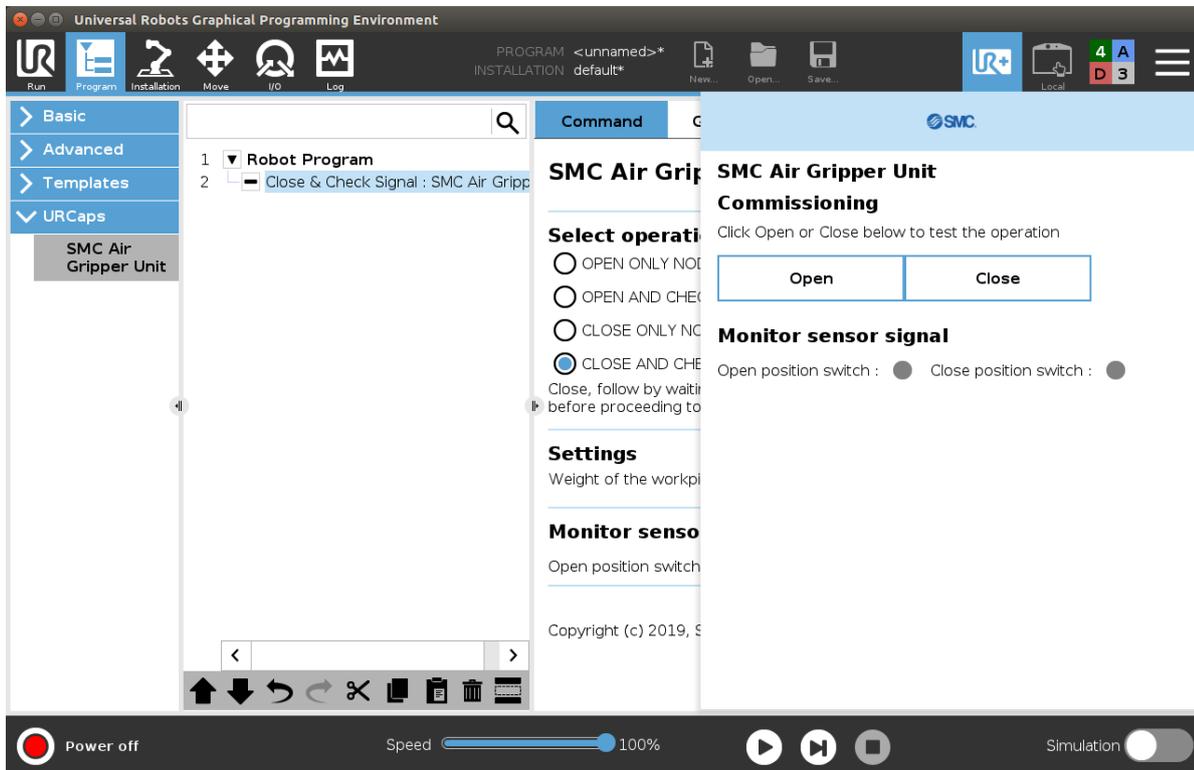
Enter the mass of the transferred object.

③:“Monitor sensor signal”

Auto switch signal detection can be confirmed on the screen.

Manual operation

From the UR+ icon in the upper right corner of the screen, the manual operation of the gripper can be checked. The gripper operation (open or close) and the auto switch reaction can be checked by tapping the Open/ Close button.



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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