SMC

Operation Manual

Electric Vacuum Gripper

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

-Software (URCap)-

SMC Corporation

Contents

1. Software overview

This plug-in software is exclusively for the UR Robot e series and is controlled via RS485 communication. The following shows the operation flow with the software.

Installation of URCap
Refer to Chapter 3 for how to install the software.

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Basic settings
Set the following:
・Tool I/O (Refer to 4.1)
・General Settings (Refer to 4.2)
・Pump Settings (Refer to 4.3)

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Programming
Create a program according to the robot manual. Two commands will be added to URCap. Refer to Chapter 5 for how to set these commands.

・GRIP: Gripping of workpieces
　　Automatic mode
　　Manual mode
　　Continuous mode
・RELEASE: Release of workpieces

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Running the program
Illustrates gripper status while the program is running. (Refer to 5.3)

Commissioning
Allows to test gripping or release motion at an arbitrary setting. (Refer to Chapter 6)

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No. DOC1075117

2. How to Download Software

Download the relevant plugin software from the SMC website (https://www.smcworld.com) and copy it to a USB memory. Search the product number (ZXPE) on the TOP page and proceed to the detail page to download the software.
Please note that the plugin software is different depending on the gripper to be used.

Table 1. Plugin software

Part No.	Plugin software
ZXPE5∗011P-∗-∗**C**∗	SMC-ElectricVacuumGripper-x.x.x.urcap
ZXPE5∗011P-∗-∗**M**∗	SMC-ElectricVacuumGripperSI-x.x.x.urcap

∗The following description is in case that "SI units only" is selected.

No. DOC1075117

3. Install

⚠ **Caution**

> The plugin software is compatible with a UR robot Polyscope version 5.9.1 or later. Before installing the plugin software, update the Polyscope to the 5.9.1 or later version if it is prior to 5.9.1.
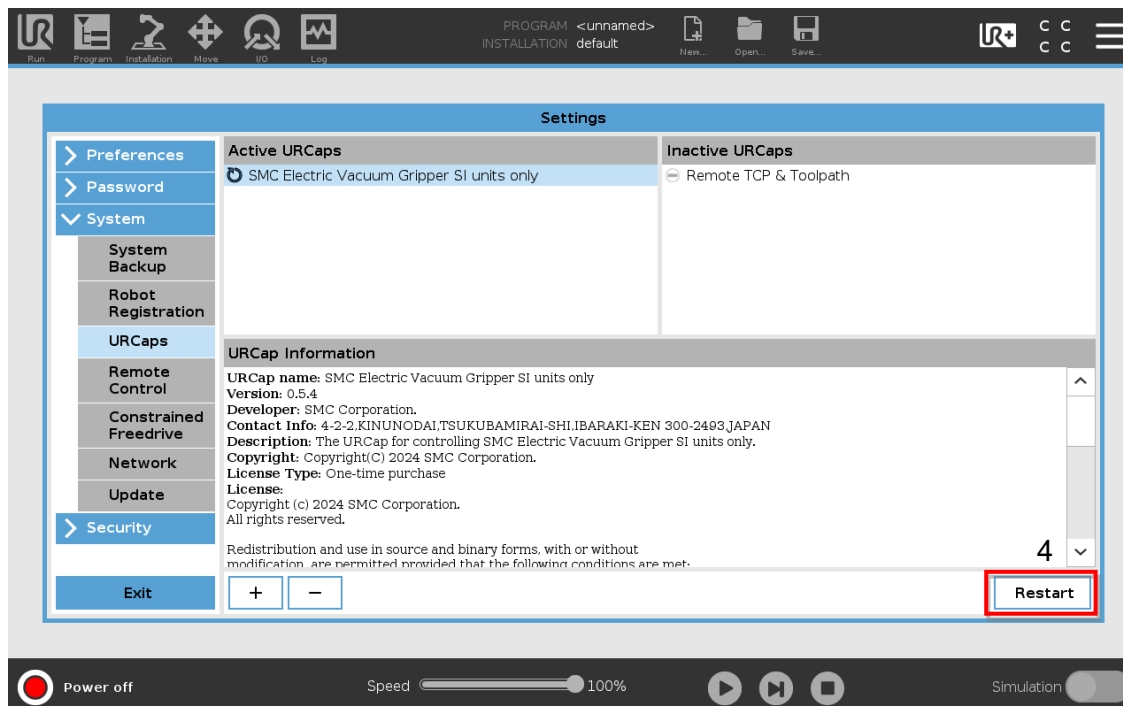
1. Go to "Setting" from the menu on the top right of the screen and tap "URCaps" from "System".
2. Insert the USB memory with a copy of the URCap into the teaching pad and tap the "+" button.
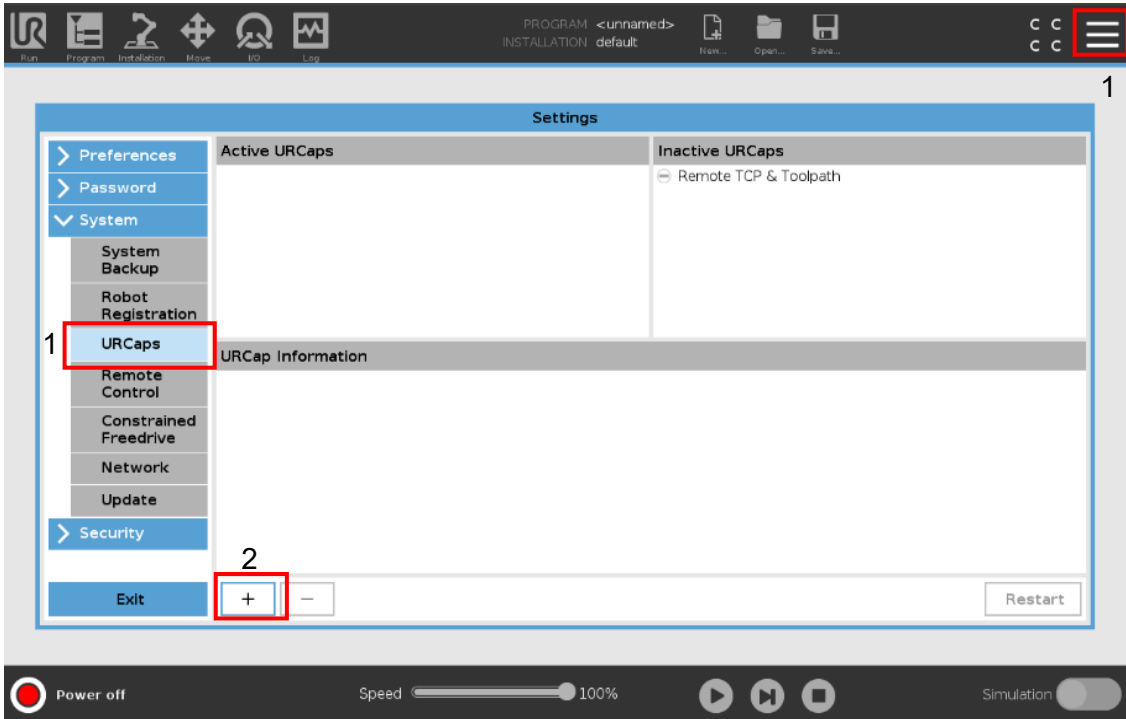
3. Select "SMC-ElectricVacuumGripperSI-x.x.x.urcap" from "Files" and tap the "Open" button.
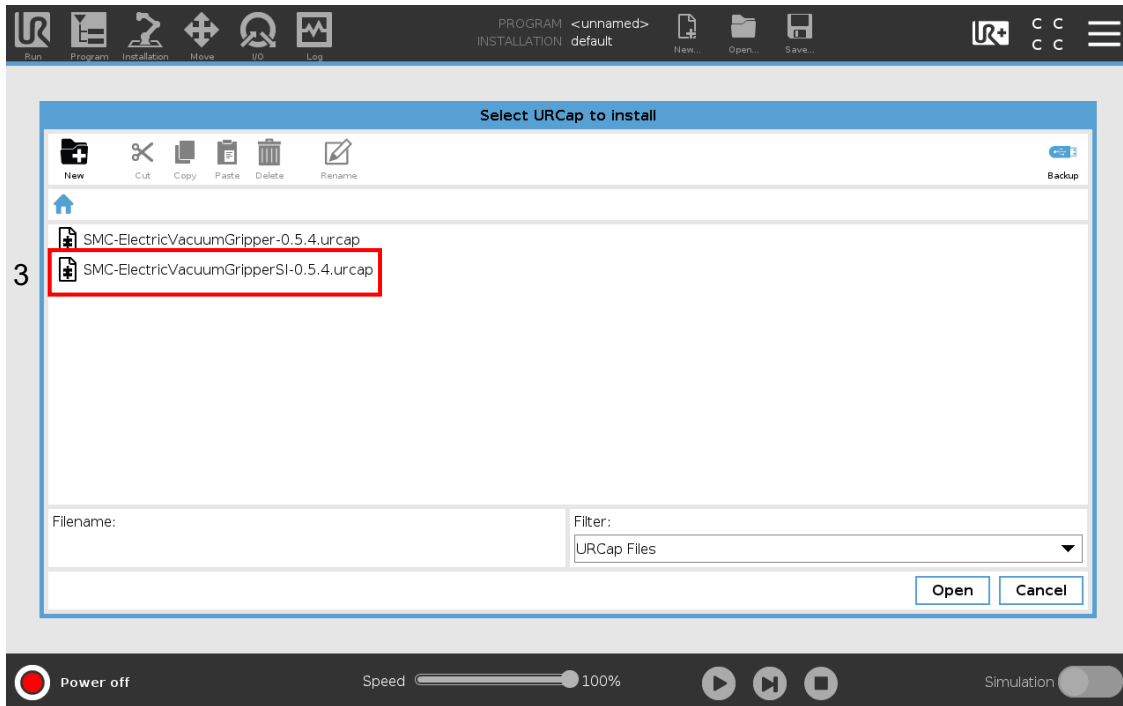
4. Tap the "Restart" button to restart the robot.

⚠️**Caution**

URCap which is installed on "Active URCaps" must be "SMC Electric Vauum Gripper SI units only" only and uninstall any other URCaps. It causes communication failure, and it may not go online when more than one URCaps are installed.

-5-

No. DOC1075117

4. Basic settings

4.1. Tool I/O

After restarting the robot, press "Installation" to open 'Tool I/O' from "General". Then, select "SMC Electric Vacuum Gripper SI units only" from the "Controlled by" drop down list.
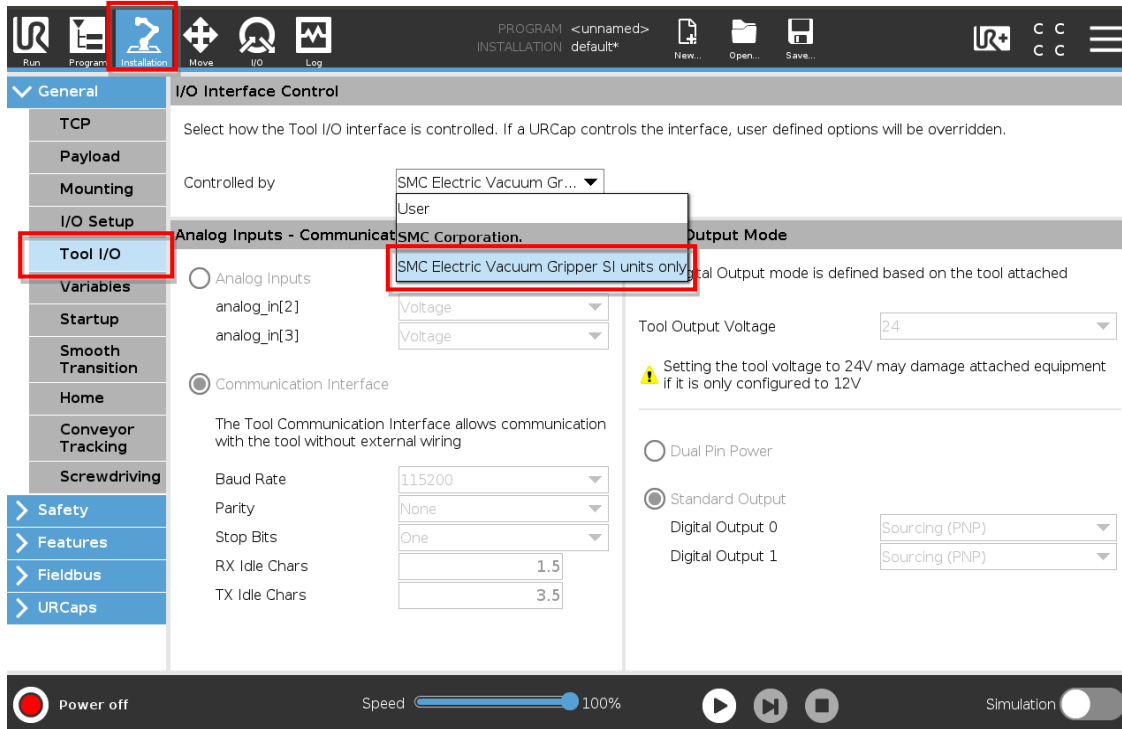
"Analog Inputs – Communication Interface" and "Digital Output Mode" will be set automatically.

No. DOC1075117

4.2. General Settings

Open "General Settings" from the "URCaps" menu in the "Installation" tab.

1. Select the display pressure unit: allows the user to change the measurement unit and set the pressure unit displayed on the URCap as well as the pressure unit displayed on the gripper's pressure monitor. Selecting the pressure unit in the pull-down menu and tapping "APPLY" opens a window asking whether the unit is to change. When "OK" is selected, the unit of indicated and set pressure will be changed. Refer to "7. List of setting items" for details.

⚠️ **Caution**

> Change the measurement unit before programming.
> - If it is changed after programming, the parameter threshold value within the program may cause a conversion difference, resulting in malfunction. If the measurement unit is changed after programming, review all pressure set values in the existing program and test run the gripper before starting full operation.
> Change the measurement unit by URCap.
> - Unit switching by the pressure monitor button is not retained and will return to the original unit when the gripper power is cycled.

2. Popup a message window and stop operation in error: allows the user to select whether a popup window should appear and the program should be stopped when a failure (gripping or release failure) occurs.
   This option is set to ☑ Popup message window and stop operation in error by default.
3. Various status signal output to digital output port: allows the user to select whether to enable or disable the output ports. When "Enable" is selected, the user can select the output port numbers for the signals for success, failure, and workpiece drop detection. Note that different signals cannot be assigned to one port. When an output port is not used, select "Disable".
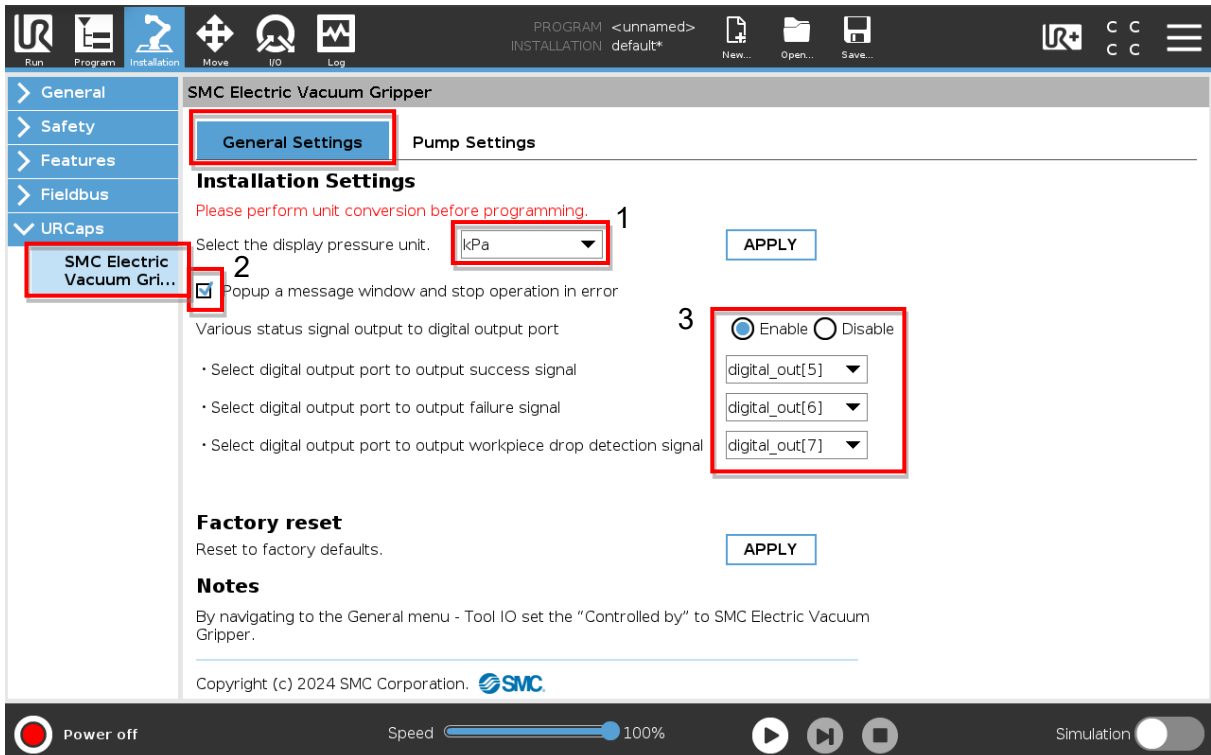   This option is set to "Enable" by default.
   The default port numbers are as follows:
   success signal - digital_out[5]
   failure signal - digital_out[6]
   workpiece drop detection signal – digital_out[7]

No. DOC1075117

4. Factory reset: Allows the user to reset the gripper to the factory settings if the current settings are uncertain. Tapping "APPLY" opens a window asking whether "Factory reset" is to perform. When "OK" is selected, the settings of the gripper and on the URCap will be reset to default. For the default values, refer to "7. List of setting items".

No. DOC1075117
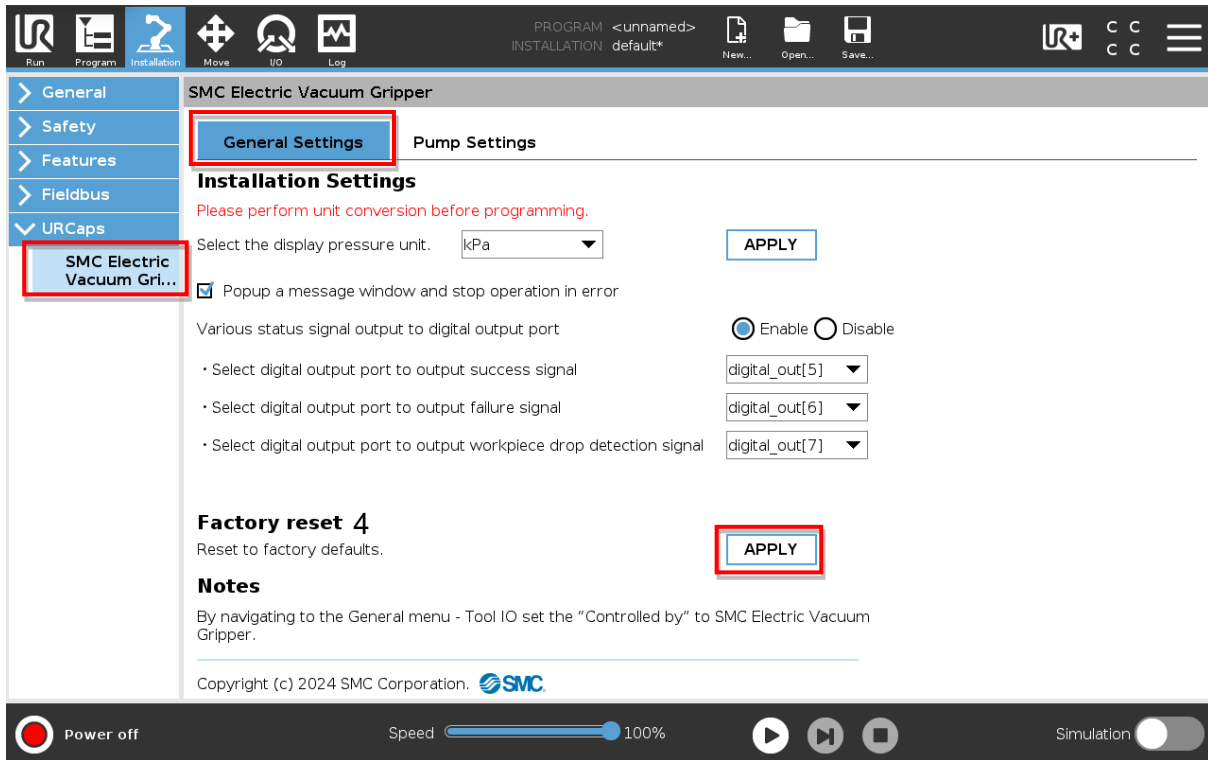
4.3. Pump Settings

Open "Pump Settings" from the "URCaps" menu in the "Installation" tab.

1. Default mode:
   Allows the user to change the default gripper operation mode on the program and commissioning windows. Refer to operation manual of Electric vacuum gripper ZXPE5 for details of the operation modes.
   The gripper has three operation modes: "Automatic" (default), "Manual" and "Continuous".

2. Default pump settings:
   Allows the user to change each of the parameter threshold values if "Manual" has been selected on the program or commissioning window. For the adjustable range of the threshold values, refer to "7. List of setting items".

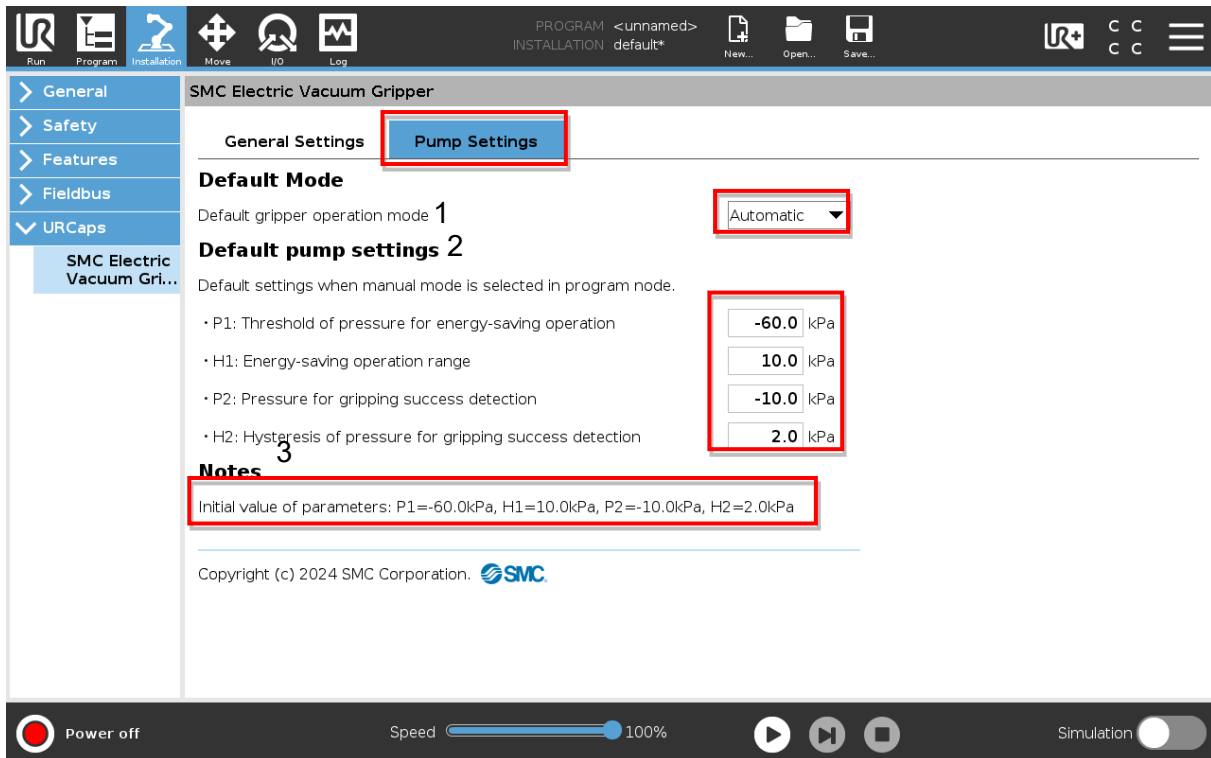   "P1: Threshold of pressure for energy-saving operation"
   "H1: Energy-saving operation range"
   "P2: Pressure for gripping success detection"
   "H2: Hysteresis of pressure for gripping success detection"
   (P2+H2: Pressure for workpiece drop detection)

3. Notes: Shows the default values of each parameter.

No. DOC1075117

5. Command settings

This product has two program commands: "GRIP" and "RELEASE".

5.1. GRIP command

From the "URCaps" menu in the "Program" tab, tap "SMC Electric Vacuum Gripper. Select "Grip" in "Select operation" to add "Grip: SMC Electric Vacuum Gripper" command to the "Robot Program".

1. Settings: Allows the user to set the parameters for each command.
   Gripper operation mode: Shows the operation mode set according to "4.3. Pump Settings". The user can also change the mode here.
   Grip error detection time: Sets the time to determine that gripping has failed. If, after the start of gripping, the vacuum pressure at which the gripping success signal is sent, is not reached within the set duration of time, the gripping failed signal is sent.
   The time can be set between 500 to 5000 msec.
   Note that if the set time is too short, energy-saving operation may not be possible depending on the cups. In this case, adjust the set time so that the gripper can save energy.

   P1 to H2 (only when manual mode is selected): Shows the values set according "4.3. Pump Settings". The user can also change the values here.

2. Monitor sensor signal: Allows the user to check the status of the gripper and vacuum pressure.
   🟢 Green: Gripping success
   🔴 Red: Gripping failed, workpiece drop detection, or release failed
   ⚪ Grey: Idle
   "-kPa" is shown when no wiring has been made.

No. DOC1075117
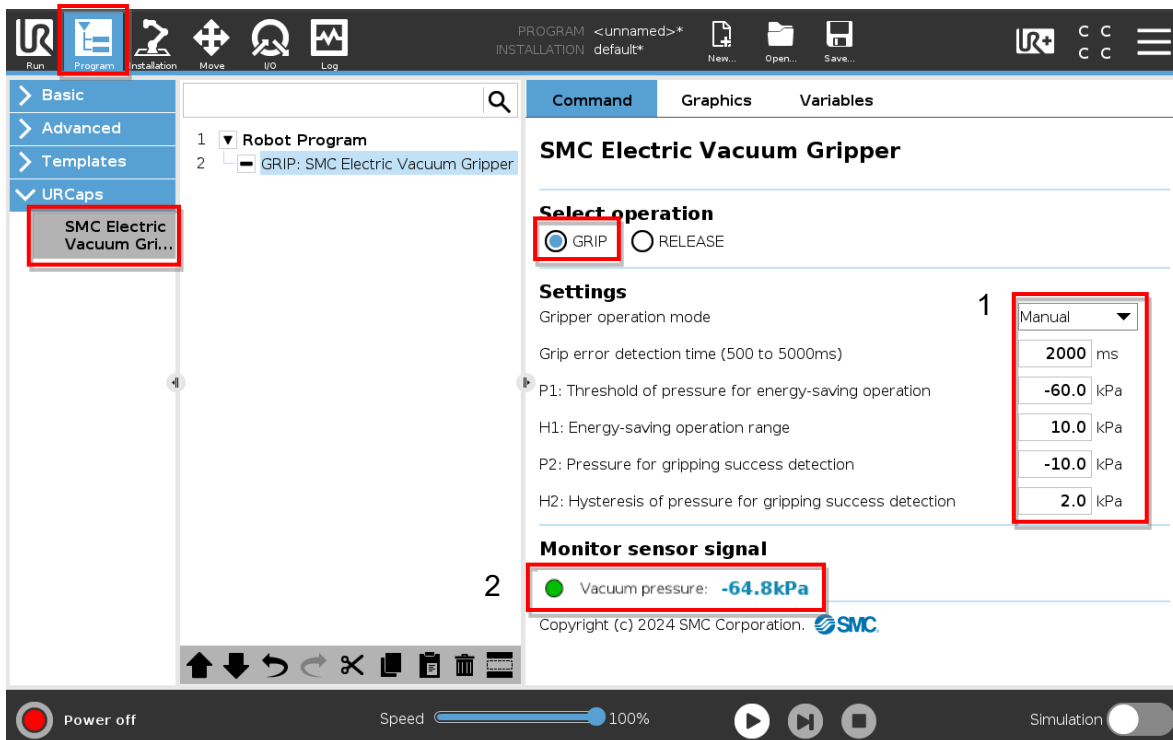
5.2. RELEASE command

From the "URCaps" menu, tap "SMC Electric Vacuum Gripper". Select "RELEASE" in "Select operation" to add the "Release: SMC Electric Vacuum Gripper" command to the "Robot Program".

1. Settings: Allows the user to set the parameters for each command.
   Atmospheric release time: Sets the duration of time for a valve to release air to atmosphere.
   The time can be set between 200 to 5000 msec.
2. Monitor sensor signal: Same as the gripping motion.
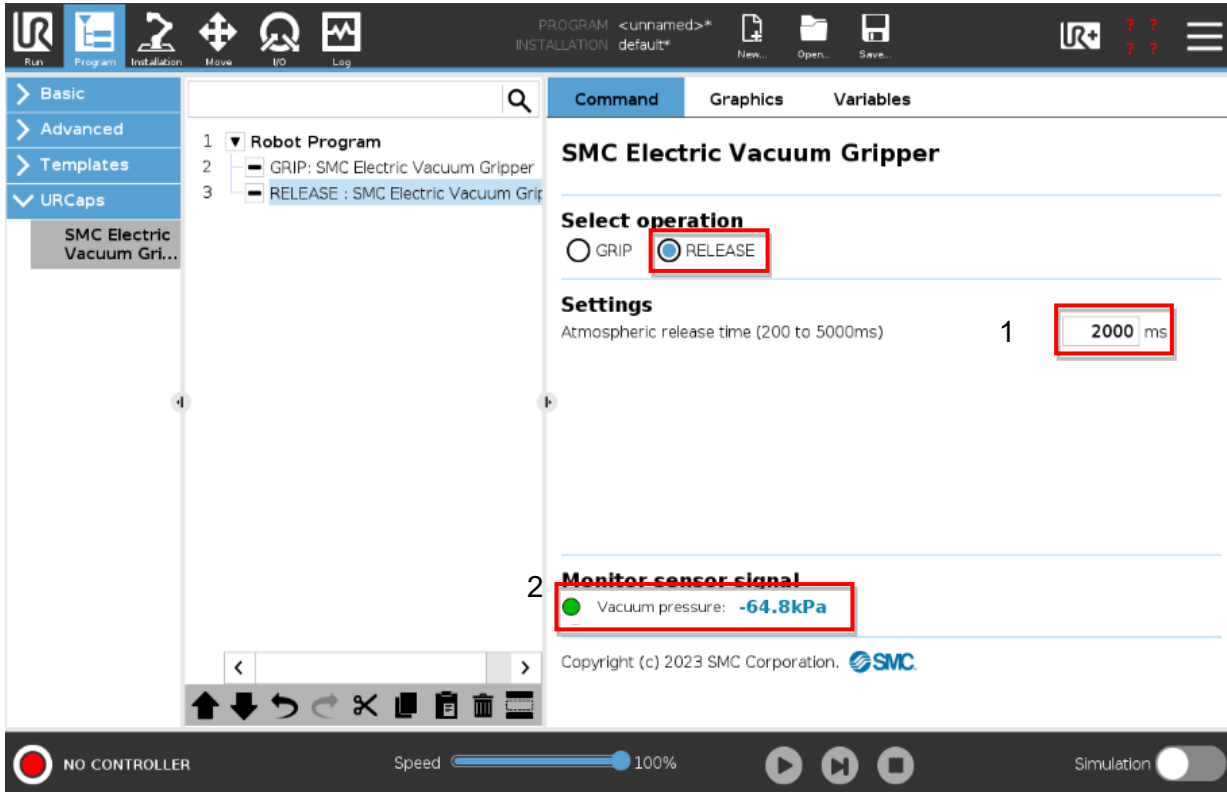
5.3. Illustration of the gripper status while the program is running

5.3.1. Pressure monitor display

After the electric vacuum gripper is energized, the sub screen (left) of the pressure monitor shows the gripper operation mode set by the DIP switch. While the program is running, the gripper operation mode set by each GRIP command is displayed. When the program ends, the mode set by the last command will continue to be displayed.

Table 2. Gripper operation modes and pressure monitor display

Gripper operation mode	Automatic mode	Manual mode	Continuous mode
Pressure monitor sub screen (left)	0.0 Auto	0.0 MAnU	0.0 Cont

⚠️ **Caution**

Changing the gripper operation mode requires the processing time. If the mode is changed during program operation, a waiting time of 0.5 sec is provided. There is a time difference from the operation without mode change. Please take care when creating the program.

5.3.2. URCap display

The UR+ icon on the top right of the interface allows the user to check the status of the gripper while the program is running.

Monitor sensor signal
⚫ Vacuum pressure: Same as the program window
Gripper status: Displays the status of the gripper.
🟢 online (green): The gripper is connected with the robot and operating normally.
🟡 offline (yellow): The gripper is not connected with the robot.
🔴 "Error message" (red): An alarm has occurred. Refer to "8. Troubleshooting" for details.
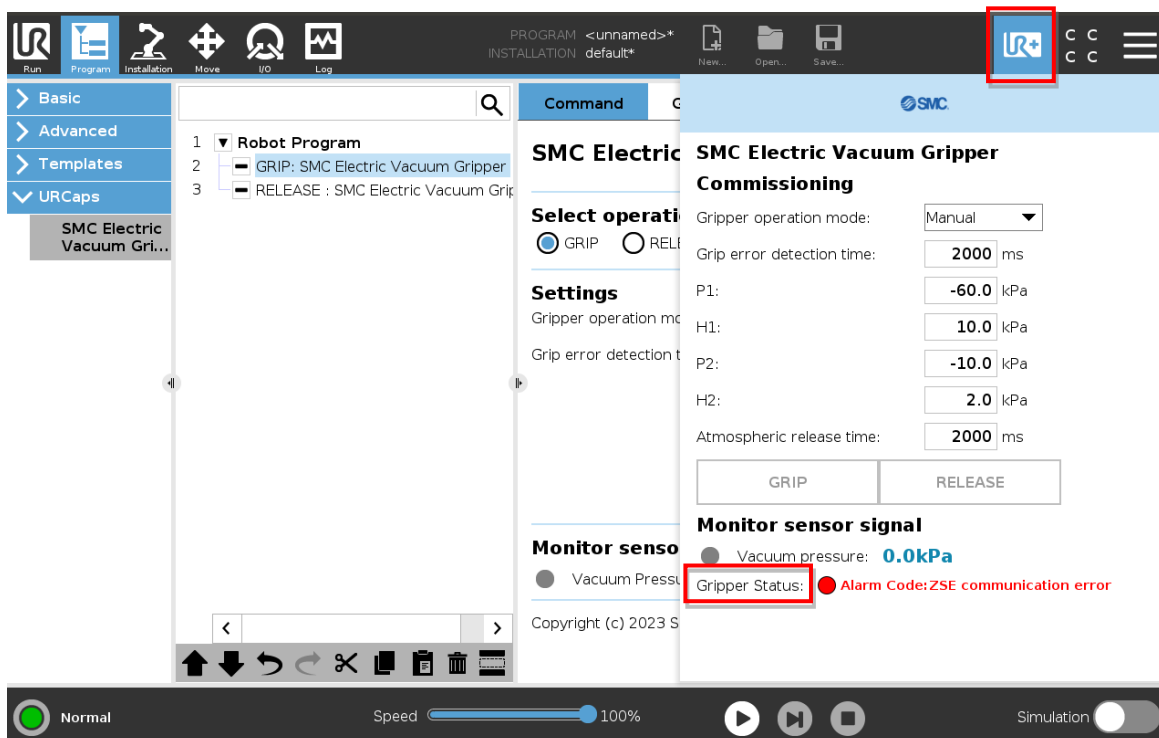
5.3.3. Electric vacuum gripper status and output signals

While the program is running, a signal according to the status of the gripper (success, failed or occurrence of an alarm) is sent, and the program continues or stops.

Table 3. Status signal outputs and program actions

Gripper status	Output status signal Note 1	Program operation Note 2		Note
		Popup message ☑	Popup message ☐	
Grip success	"success signal"	Continue	Continue	
Grip failed	"failure signal"	Pause and Popup a message appears	Continue	When "Stop program" is selected on popup, the program stops. When "Continue" is selected on popup, the program resumes from this command. Note 4
Work drop detection	"workpiece drop detection signal"	Continue	Continue	The program can be stopped by using the "if" command.
Release success	"success signal"	Continue	Continue	
Release failed	"failure signal"	Pause and Popup a message appears	Continue	When "Stop program" is selected on popup, the program stops. When "Continue" is selected on popup, the program resumes from this command. Note 4
Alarm Note 3	-	Continue	Continue	The program can be stopped by using the "if" command.

Note 1: The status signal output for each action is made to the port number set according to "4.2. General settings".

Note 2: The gripper's operation differs depending on how settings are made in "4.2. General settings", such as a popup window and program stop.

Note 3: Alarms may occur not only while the program is running but also while the gripper is being energized. The generated alarms are shown on the "Gripper status" on the toolbar.

Note 4: The popup is displayed in case of operation failure as follows.

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No. DOC1075117

6. Commissioning

The "UR+" icon on the top right of the interface can be used to check the manual operation of the gripper.

Tap [GRIP] or [RELEASE] to perform the gripper's grip or release operation and see status, and vacuum pressure.
Note that the status signals set according to "4.2. General settings" are not sent during commissioning.

1. Commissioning: Sets the gripper operation mode and threshold values of each parameter during commissioning.
2. Monitor sensor signal: Refer to "5.3.2. URCap display" display.

No. DOC1075117
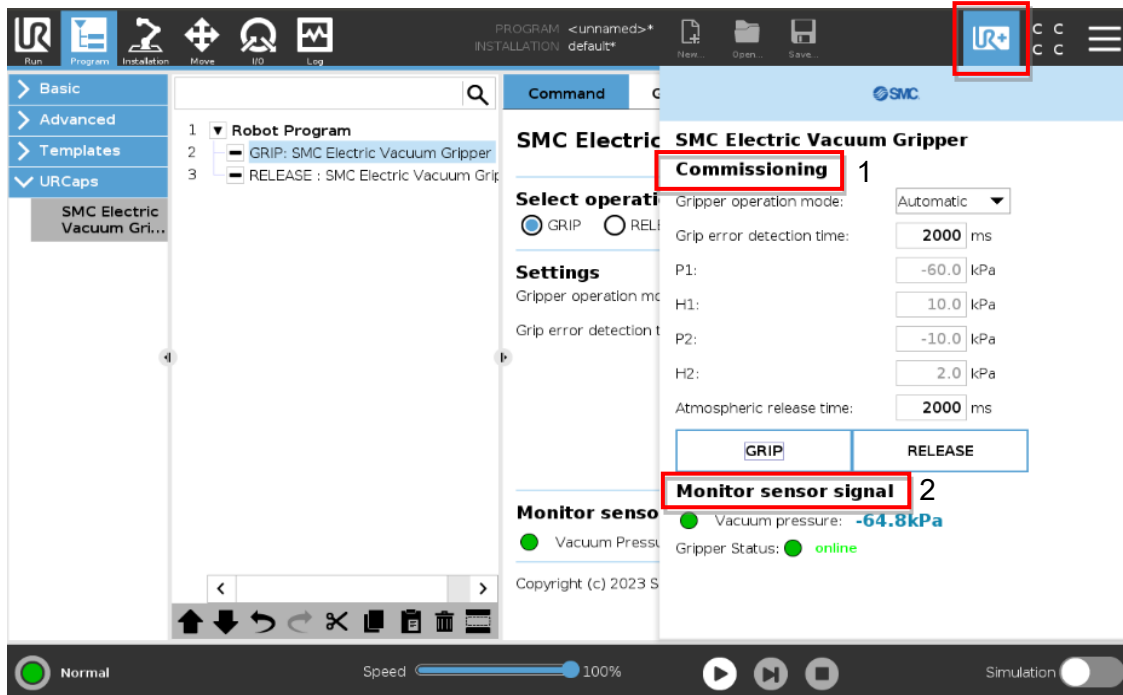
7. List of setting items

Table 4. List of setting items

Setting items	Factory default	Adjustable range	Note
Gripper operation mode	Automatic	Automatic, Manual, Continuous	
Display pressure unit	kPa	Refer to #Table 5.	
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 #Table 6.
H1: Energy-saving operation range	10.0	0.0 to 10.0	
P2 : Vacuum pressure for gripping success detection	-10.0	-10.0 to -30.0	
H2 : Hysteresis of Vacuum pressure of gripping success detection	2.0	0.0 to 10.0	
Grip error detection time	2000msec	500 to 5000	
Atmospheric release time	2000msec	200 to 5000	

Table 5. Adjustable unit

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

Table 6. Factory default and settable range of each parameter

		kPa	MPa	kgf/cm^2	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	-0.714	-0.700	-10.15	-20.7	-525
	Min.	-40.0	-0.040	-0.408	-0.400	-5.80	-11.8	-300
H1	Factory default	10.0	0.010	0.102	0.100	1.45	3.0	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	-8.9	-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	3.0	75
	Min.	0.0	0.000	0.000	0.000	0.00	0.0	0

8.Troubleshooting

List of problems and countermeasures

Problem	Cause	Countermeasure
Gripper Status goes offline.	Multiple plugin software is installed.	There may be interference from plugin software. Uninstall any plugin software other than this product.
Initial gripping problem (During commissioning)	High P2 set value (pressure at which grip is judged to have failed)	Set a suitable pressure for the workpiece and cup conditions.
	Unsuitable settings for gripper operation mode and set values.	Perform a test run with the actual workpiece to determine suitable settings. Continuous mode is recommended for breathable workpieces.
Slow response	Cup shape	Response time differs by cup shape or piping condition. Check the appropriate suction error detection time in commissioning. Select a cup under conditions that allow suction within a maximum value of 5.0 sec.
Workpiece is not released.	Insufficiently short atmospheric release time	If the exposure time is short, the release may not be successful. Check the appropriate suction atmospheric release time in commissioning. Select piping conditions that allow release within a maximum value of 5.0 sec.
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).

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No. DOC1075117

Alarms

When an alarm occurs, the LED lamp on the gripper and the toolbar on the teaching pendant inform you.
(Refer to <u>5.3.2. URCap display</u>.)

Table 7. List of alarms

Alarm	Product status	Message	Countermeasure
Temporary pressure monitor error	LED: flashes red Pressure monitor: shows "HHH" or "LLL"	Pressure monitor recoverable fault	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	Over current error "----"	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	Pressure monitor communication error	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)	Pressure monitor internal error	
System error	LED: flashes red	System error	

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

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Revision history

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No. DOC1075117