Software manual
MTB Application Kit for Universal Robots
SCHUNK software module for URCap

Superior Clamping and Gripping

Imprint

Technical changes:

We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

Customer Management

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Please read the operating manual in full and keep it close to the product.

Table of Contents

1 General

1.1 About this manual

This manual contains information about the SCHUNK software module "URCap" and its use in the robot control interface UR Polyscope.

The software is used to easily integrate and control the following products in Universal Robots applications:

- MTB Application Kit SG-JGP-P
- MTB Applikations-Kit DG-JGP-P
- MTB Application Kit KS-PGS3

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

This manual describes the software environment on an e-Series UR robot. Compatibility with the CB series is not provided.

In addition to these instructions, the documents listed under ▸ 1.4 [🗋 5] are applicable.

1.2 Symbol definition

The following symbols are used in this manual:

■ Prerequisite for an action

1. Action 1
2. Action 2
   ✓ Intermediate results

✓ Final results

▸ 1.2 [🗋 4]: chapter number and [page number] in hyperlinks

1.3 Presentation of Warning Labels

To make risks clear, the following signal words and symbols are used for safety notes.

⚠ DANGER

Danger for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.4 Applicable documents

- Assembly and operating manual for the product:
  - MTB Application Kit SG-JGP-P *c
  - MTB Application Kit DG-JGP-P **
  - MTB Application Kit KS-PGS3 **
- Assembly and operating manual of the sensor MMS 22-PI2 *
- Operating manual for the UR robot e-Series

The documents labeled with an asterisk (*) can be downloaded from **schunk.com**.

The documents labeled with an asterisk (**) can be downloaded from **schunk.com/mtb-downloads**.

2 Functional description of "URCap"

The "URCap" software module facilitates operation and application creation for SCHUNK products on a collaborative robot from Universal Robots.

All necessary controls are installed via the software module. After the installation is complete, the programming elements are deployed within the Polyscope graphical user interface (GUI). The GUI supports the entire configuration of SCHUNK products as well as the necessary control and programming options.

The following functions are available in the software module and can be used in a robot program:

- **MTB Enable**: Activates the gripper or the clamping force block **IMPORTANT! Activation leads to dangerous movement of the product!**
- **MTB Gripper**: Opens or closes the gripper
- **MTB Vise**: Opens or closes the clamping force block
- **MTB Blow Off Valve**: Activates the blow off nozzle

Further Information on the functions ▶ 6 [🗋 18].

The "URCap" software module has been tested under the Polyscope version 5.11 of Universal Robots. SCHUNK recommends installing the current Polyscope version on the robot used.

To avoid compatibility problems, check the operating software of the UR control unit before using "URCap" and update it if necessary.

3 Connecting the product to the robot control system

Before connecting or commissioning the product, read the operating manual of the robot and observe the instructions in this manual!

⚠ WARNING

Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

⚠ CAUTION

Risk of injury from electric shock due to contact with live parts!

- Follow the operating manual for the robot.
- Before starting any work on the product: Switch off the energy supply and secure against re-connection.

NOTE

Safety-relevant signals (e.g. emergency stop) must be wired externally, e.g. via safety relays, thus completely disconnecting the product from the power supply.

- Perform a risk assessment for the entire robotic application based on legal requirements to evaluate all safety-related aspects of the application.

- There is no power or compressed air supply on.
- Product is mounted on the robot. Compressed air hose and cable are connected to the product, see product assembly and operating manual.

1. Connect the wire strands of the M12 cable to the terminals of the control unit. For connection assignment, see the following table.
2. Connect logic and power supply.
   ✓ LED "Power" lights up green.

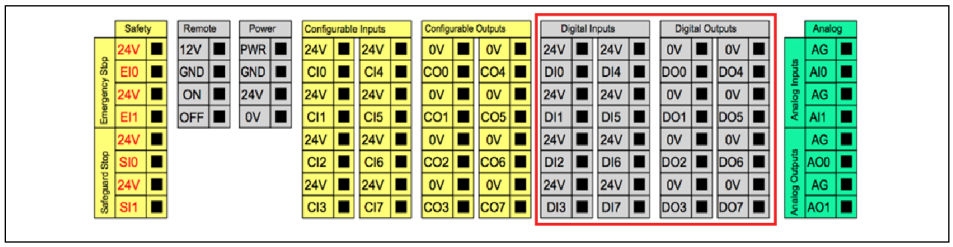
Connection assignment MTB to UR e-series

Pin	Wire strand	Signal	Robot interface	
			Register	Assignment *
1	Brown	+24 VDC	Power *or* digital inputs	24V
2	Blue	GND	Power *or* digital outputs	0V
3	White	Sensor Gripper A, Position 1	Digital inputs	DI0
4	Green	Sensor Gripper A, Position 2	Digital inputs	DI1
5	Pink	Sensor Gripper B, Position 1	Digital inputs	DI2
6	Yellow	Sensor Gripper B, Position 2	Digital inputs	DI3
7	Black	Teach function, Sensor Gripper A	Digital outputs	DO3
8	Grey	Teach function, Sensor Gripper B	Digital outputs	DO5
9	Red	Switching Gripper A *or* Switching clamping force block	Digital outputs	DO1
10	Violet	Switching Gripper B	Digital outputs	DO4
11	Grey/ Pink	Enable signal	Digital outputs	DO0
12	Red/ Blue	Switching blow-off nozzle	Digital outputs	DO2

*** Recommendation - Use digital inputs and outputs**

NOTE

When wiring with the control unit, the user can basically freely select the assignment of the digital connections. SCHUNK recommends using the digital inputs and outputs – as marked below.



Recommended use of the digital inputs and outputs

If other digital outputs have been selected, these ports can also be set in the settings in the "Installation" menu, ▶ 5 [🗋 13].

4 Installing the software module

CAUTION

Possible damage to product!

The product or the robot may get damaged if electrical cables are connected or disconnected during operation.

- Connect or disconnect electrical connections only when the device is switched off.

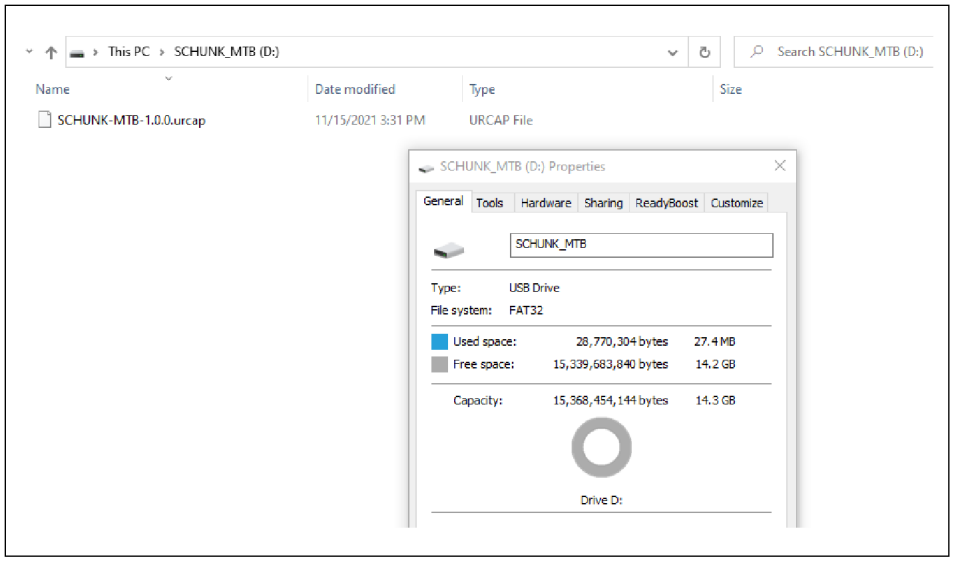
NOTE

To install the software, SCHUNK recommends using the enclosed USB stick.

Prepare the USB stick

The USB stick must meet the following requirements:

- Formatted in FAT32 format
- Designation of the removable drive: "SCHUNK_MTB".



Designation of the USB stick

Installing the software module

NOTE

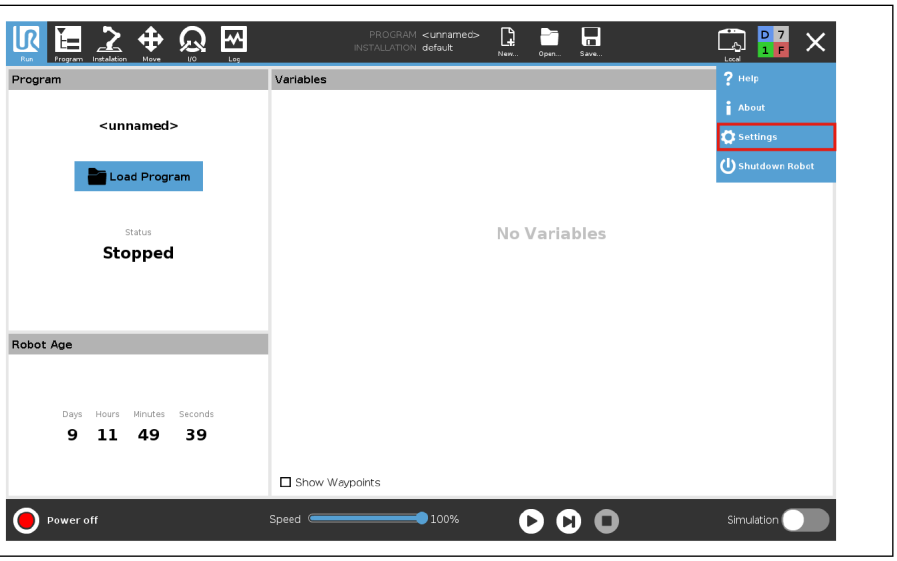
To avoid malfunctions, SCHUNK recommends installing the latest version of the software module.

1. Download the latest URCap version at **schunk.com/mtb-downloads** and copy it to the USB stick.

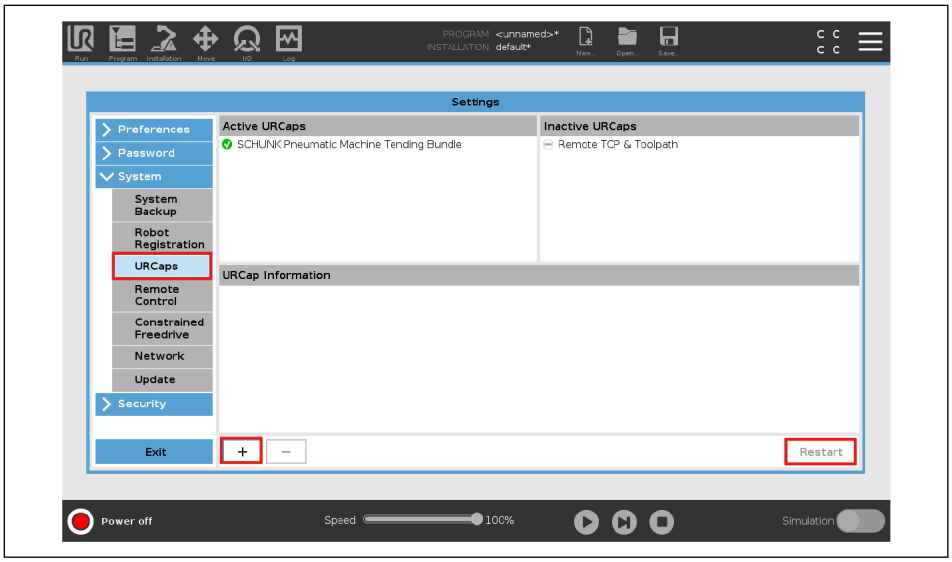
2. Connect the USB stick to the robot control system. The USB interface is located at the back.

3. Switch on the robot control system.

✓ The robot control system is started.



4. Select the "System" button in the left menu.
   ✓ A sub-menu opens.
5. Select the "URCaps" button.
6. Select the "+" button.
7. Select URCaps software module.
8. Select the "Open" button.
   ✓ The software module is added and displayed in the Explorer window.
9. Select the "Restart" button to complete the installation.
   ✓ The system restarts.



4.1 Uninstalling the software module

1. Switch on the robot control system.
   ✓ The robot control system is started.
2. Open the menu at the top right and choose "Settings".
3. Select the "System" button in the left menu.
   ✓ A sub-menu opens.
4. Select the "URCaps" button.
5. Select URCaps software module.
6. Select the "-" button.
7. Select the "Restart" button to complete the deinstallation.
   ✓ The system restarts.

5 Configuring and testing the software module

⚠ WARNING

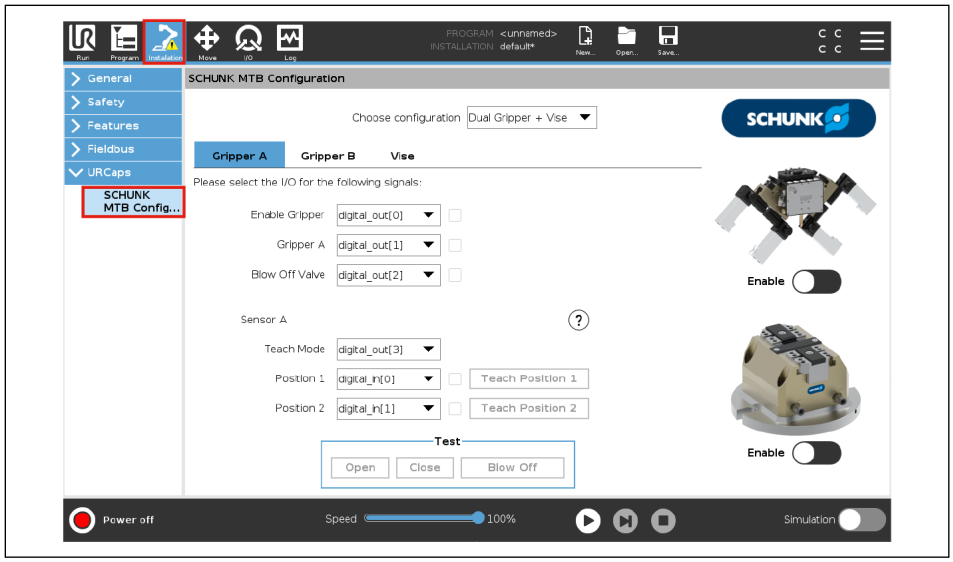
Risk of injury due to sudden movements!

Components could move unexpectedly and result in serious injuries.

- During commissioning, observe all warnings displayed on the software interface.
- Keep a safe distance and wear suitable protective equipment.

■ Robot is switched on.

1. Switch on the compressed air supply. **WARNING! Activated digital inputs and outputs can lead to immediate movement of the gripper fingers or clamping jaws.**
2. Select the "Installation" button in the header line.
3. Select the "URCaps" button.
4. Select the "MTB Plugin Configuration" button.
   ✓ The explorer window shows the configurable parameters and product images.

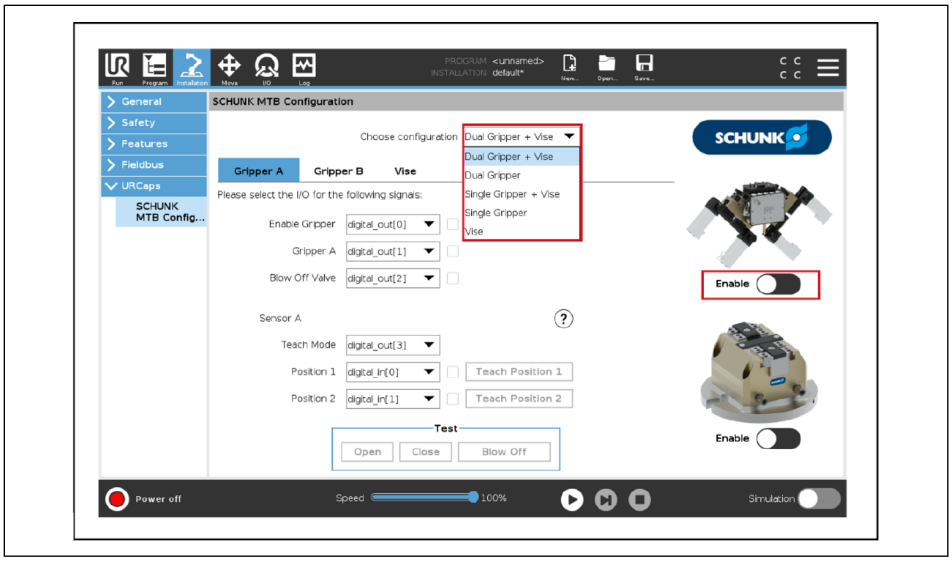


The following settings can be made in the menu item "MTB Plugin Configuration":

- Selection of configurable products (single gripper, double gripper, clamping force block)
- Selection of digital inputs and outputs
- Enabling/disabling the products
- Manual control or function test of the products

Configuring and testing the gripper and clamping force block

1. Select the desired product configuration from the drop-down menu.
   ✓ Depending on the selection made, the content in the explorer window changes. Different tabs appear, e.g. Gripper A, Gripper B or Clamping force block.
2. Select digital inputs and outputs in the drop-down menus.
   Note: The designations of the digital inputs and outputs refer to the numbering of the ports in the robot control unit, ▶ 3 [🗋 8].
3. **CAUTION! Risk of injury due to moving parts!** Activate the "Enable" button for the selected product.
   Select "Open", "Close" or "Blow Off" to test the settings.
4. Configure other products, e.g. the second gripper or clamping force block, in the same way. To do this, switch to the corresponding tab.

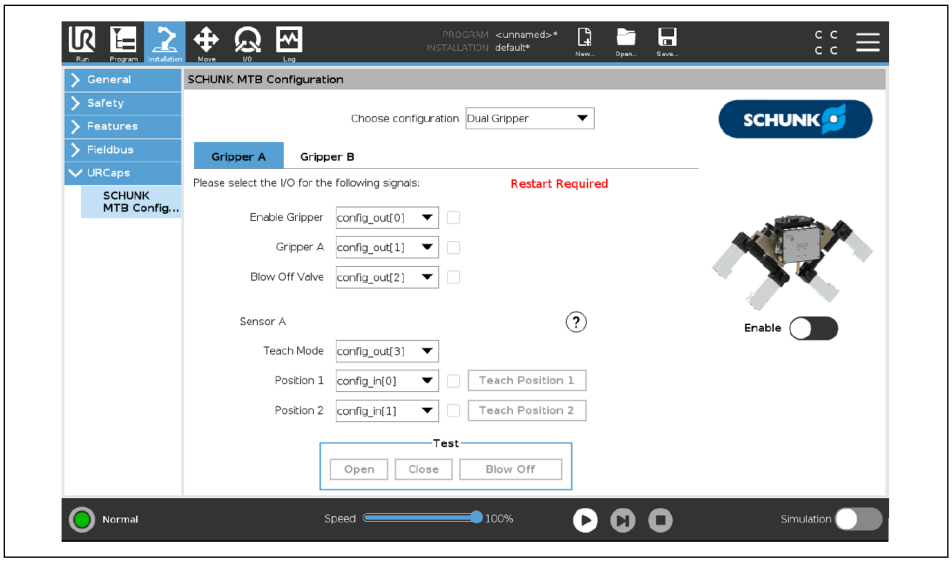


Configuration of gripper A - with selection of double gripper and clamping force block

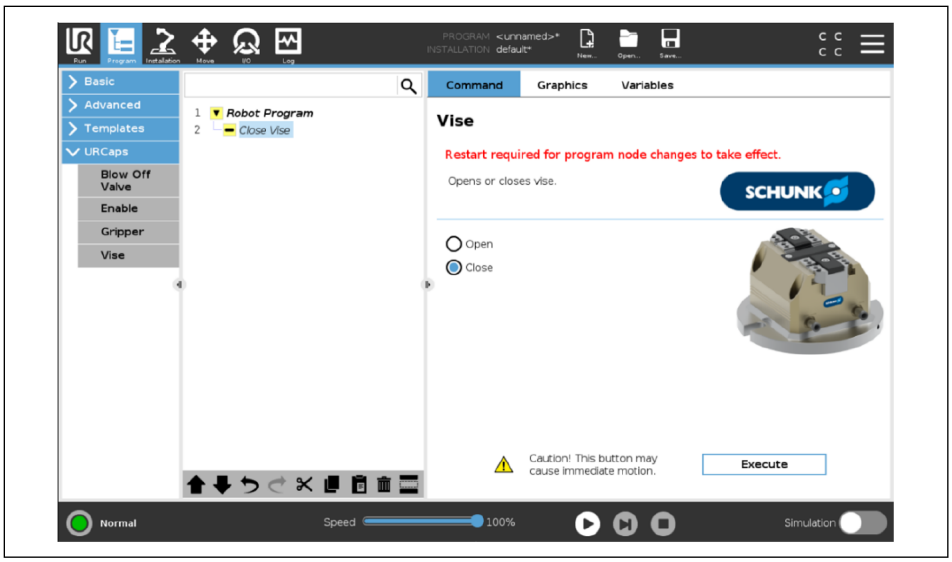
Change configuration - restart required

After configurations have been changed, it may be necessary to restart the robot control system.

1. Save installation file.
   ✓ Changed settings can be loaded after restart.
2. Perform a restart.
3. Check whether robot programs already created must be adapted to the new configuration.



Restart required with configuration changes



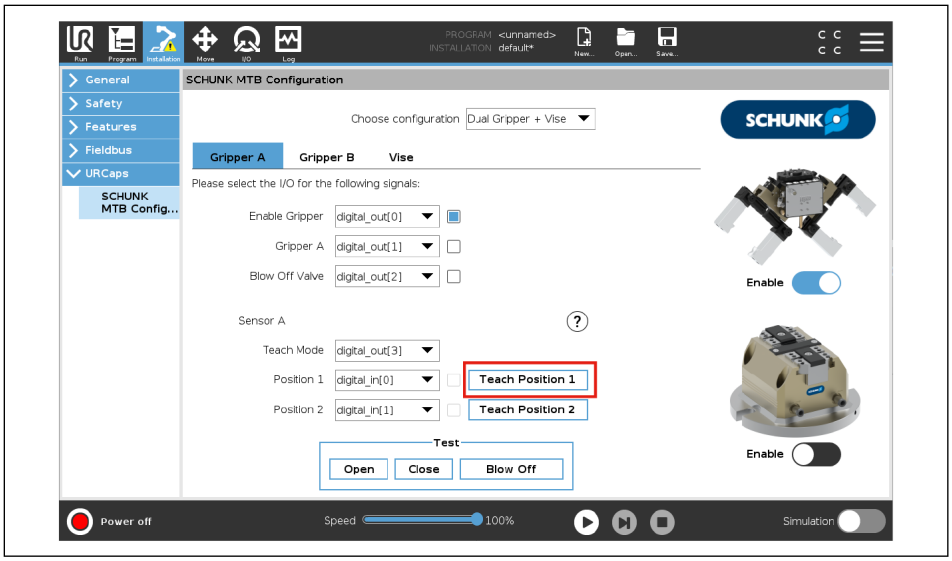
Restart required with program changes

Teaching sensors

The sensor can detect two positions of the gripper.

- Digital channels are configured.

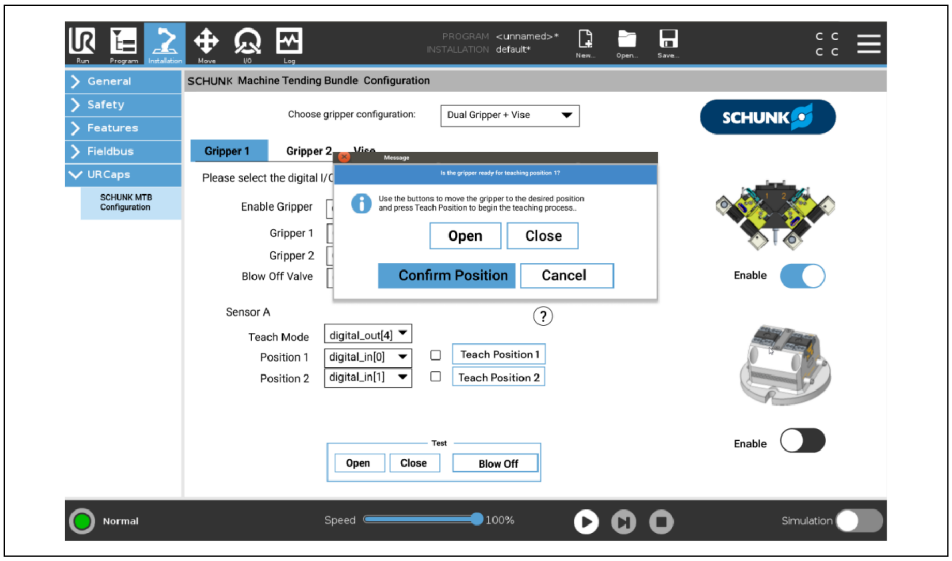
1. Press the "Teach Position 1" button.



2. **CAUTION! Risk of injury! Gripper fingers move at max. speed and force.** Select the "Open" and "Close" buttons.

   ✓ Gripper fingers move to the corresponding end position. Note: If another position is to be taught, a workpiece of the corresponding dimension must be gripped. Do not attempt to move the gripper fingers by hand, as there is a risk of injury.

3. Press the "Begin Teaching" button to start the teach-in process.

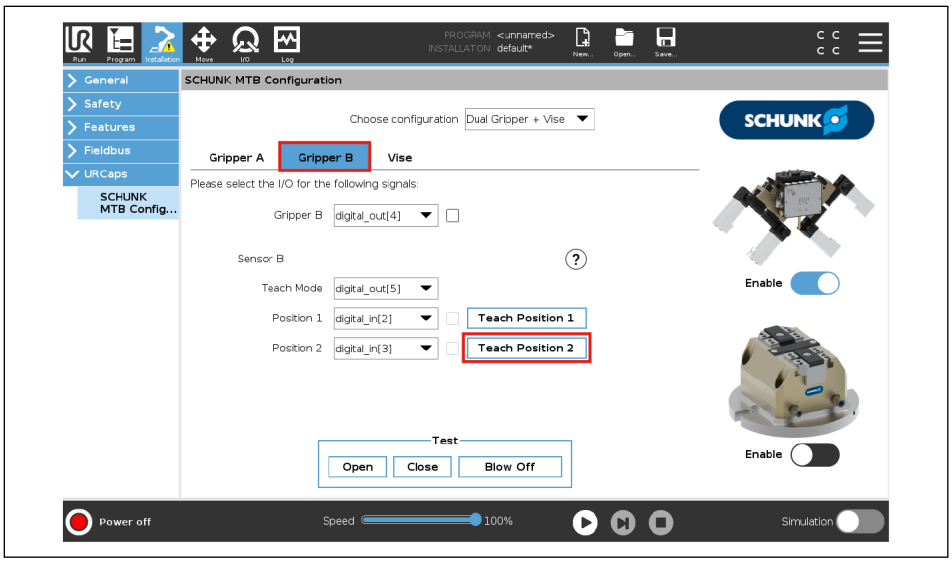


✓ The LEDs built into the sensor signal the teach status. For details, see the Assembly and Operating Manual for the sensor.

4. Select the "OK" button.

✓ Status display lights up next to the "Teach Position 1" button.

5. Teach sensor analog to second position.
6. *Depending on the selection made*: Repeat action steps for gripper B.



Teaching sensor, gripper B - with selection of double gripper and clamping force block

✓ The positions were taught in.

✓ Within the program, the positions taught in this way can be monitored via the digital inputs, ▶ 7 [🗋 23].

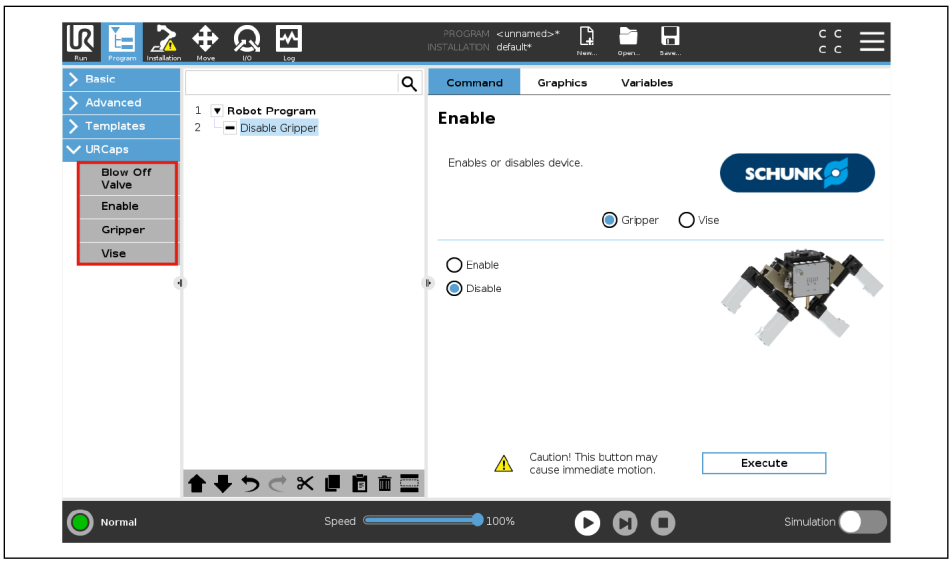
6 Creating robot program

After installing the software module "SCHUNK Machine Tending Bundle", the following actions can be inserted into a robot program.

Function	Description	Command	Activity
MTB Enable [🗋 19]	Activate gripper or clamping force block	Enable	Turns on the air supply for the selected product.
		Disable	Turns off the air supply for the selected product.
MTB Gripper [🗋 20]	The gripper opens or closes	Open	The gripper finger opens.
		Close	The gripper finger closes.
MTB Vise [🗋 21]	The clamping force block opens or closes	Open	The chuck jaws open.
		Close	The chuck jaws open.
MTB Blow Off Valve [🗋 22]	Switching the blow-off nozzle on or off	On	Compressed air flows through the blow-off nozzle.
		Off	Stops the air supply to the blow-off nozzle.
		On for a duration	Blow-off nozzle switches on and switches off automatically after the specified time in seconds.

Add function to robot program

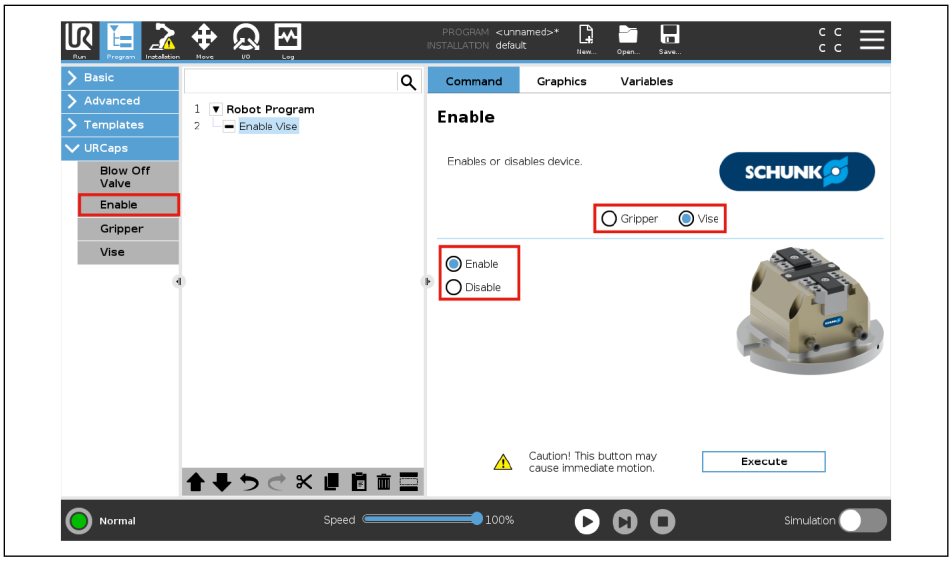
1. Select the "Program" button in the header line.
   ✓ The robot program and a short description for creating the program are displayed in the Explorer window.
2. In the robot program, select the position where the function is to be inserted.
3. Press the "URCaps" button.
   ✓ All available functions are displayed in the menu.
4. For further information on the functions, see the following sections.



6.1 MTB Enable

- In the robot program, the position where the function is to be inserted is marked.

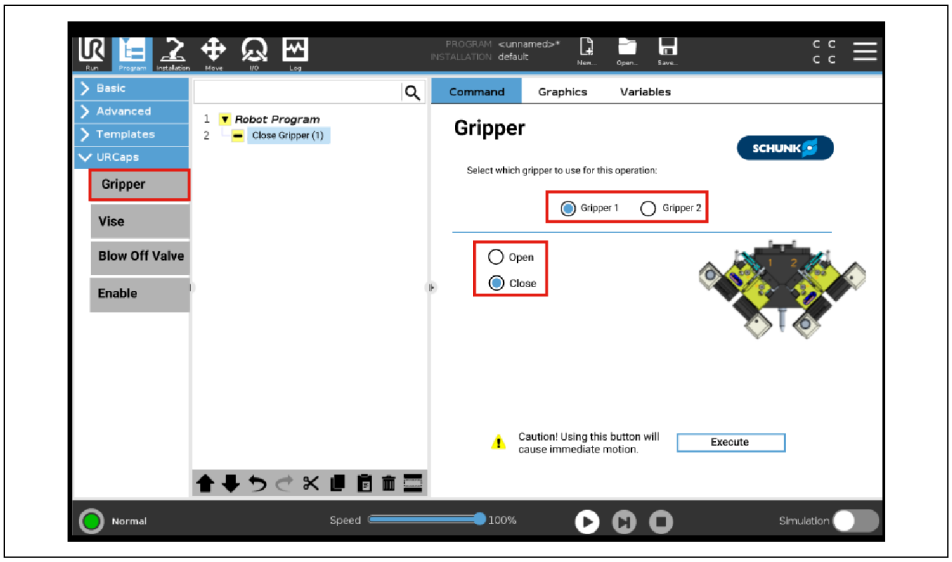
1. Press the button "URCaps" > "Enable".
   ✓ "Command" tab is displayed in the Explorer window.
2. Select the desired product (gripper or clamping force block).
3. Select the desired command.
4. **CAUTION! Risk of injury! Moving parts.** Select the "Execute" button to test the function.
   ✓ The selected function has been added to the program code.



6.2 MTB Gripper

- In the robot program, the position where the function is to be inserted is marked.

1. Press the "URCaps" > "Gripper" button.
   ✓ "Command" tab is displayed in the Explorer window.
2. *If a double gripper has been configured*: Select the desired gripper.
3. Select the desired command.
4. **CAUTION! Risk of injury! The gripper fingers move.** Select the "Execute" button to test the function.
   ✓ The selected function has been added to the program code.

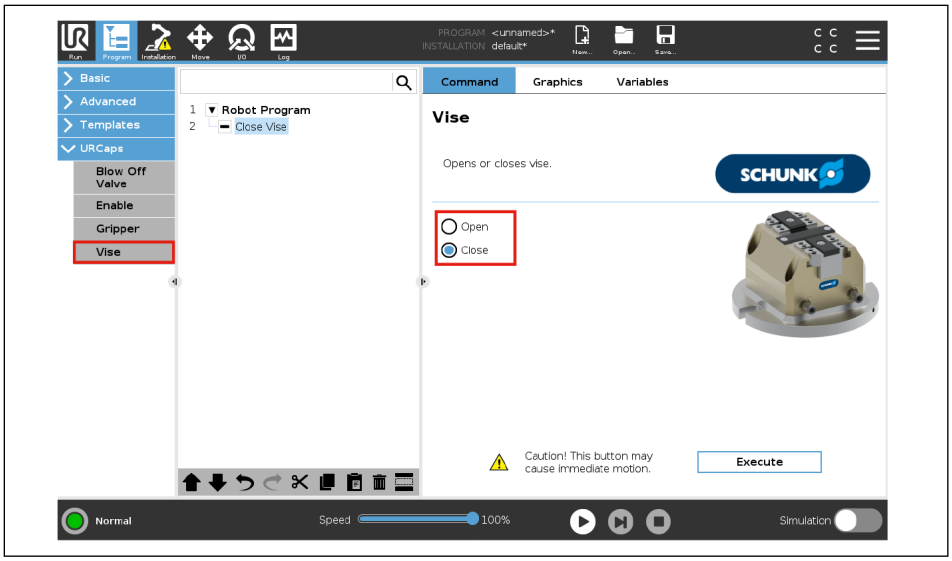


"Gripper" function - when double gripper is selected

6.3 MTB Vise

- In the robot program, the position where the function is to be inserted is marked.

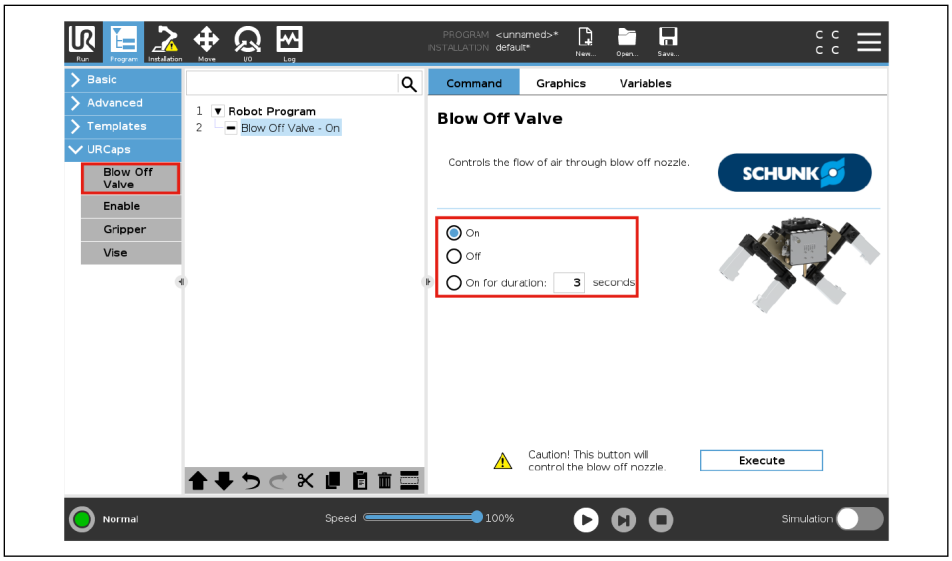
1. Press the button "URCaps" > "Vise".
   ✓ "Command" tab is displayed in the Explorer window.
2. Select the desired command.
3. **CAUTION! Risk of injury! The chuck jaws move.** Select the "Execute" button to test the function.
   ✓ The selected function has been added to the program code.



6.4 MTB Blow Off Valve

- In the robot program, the position where the function is to be inserted is marked.

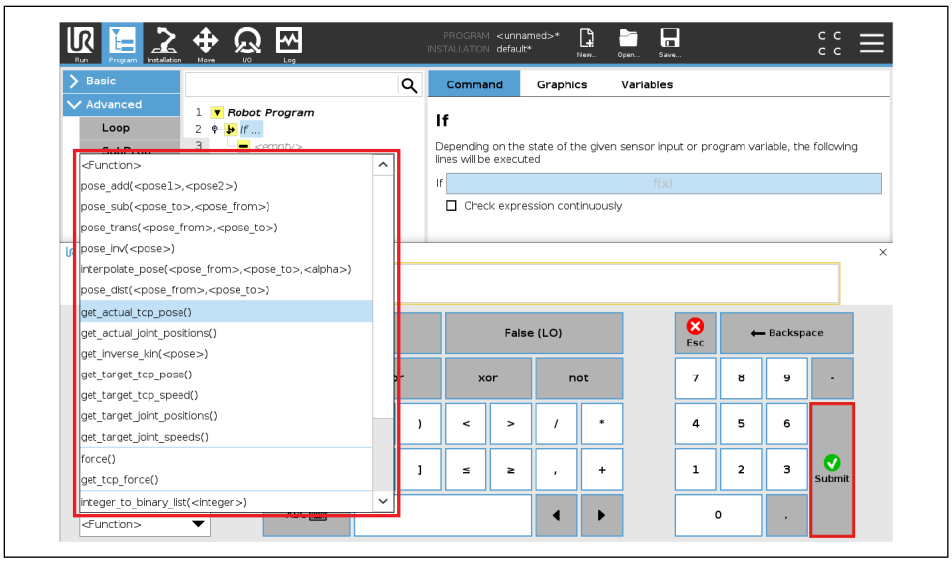
1. Press the button "URCaps" > "Blow Off Valve".
   ✓ "Command" tab is displayed in the Explorer window.
2. Select the desired command.
   ✓ On: Compressed air flows through the blow-off nozzle.
   ✓ Off: Stops the air supply.
   ✓ On for a duration __ sec: Compressed air flows through the blow-off nozzle for a certain period of time, after which the air supply stops.
3. **CAUTION! Increased noise level! Compressed air escapes.**
   Select the "Execute" button to test the function.
   ✓ The selected function has been added to the program code.



7 Monitoring of the position status within a program

URCap provides functions to perform sensor interrogation with respect to the taught positions. This is illustrated below using the example of an if query.

1. Select the "Program" button in the header line.
2. Select the button "Advanced" > "If" > Box "f(x)".
   ✓ A sub-menu opens.
3. Select drop-down menu <Function> at the bottom left.
4. Select desired function to be assigned to the If command and assign values "False" or "True".
   For further information on the functions, see the following table.
5. Select the "Submit" button.
   ✓ The command is displayed in the robot program.

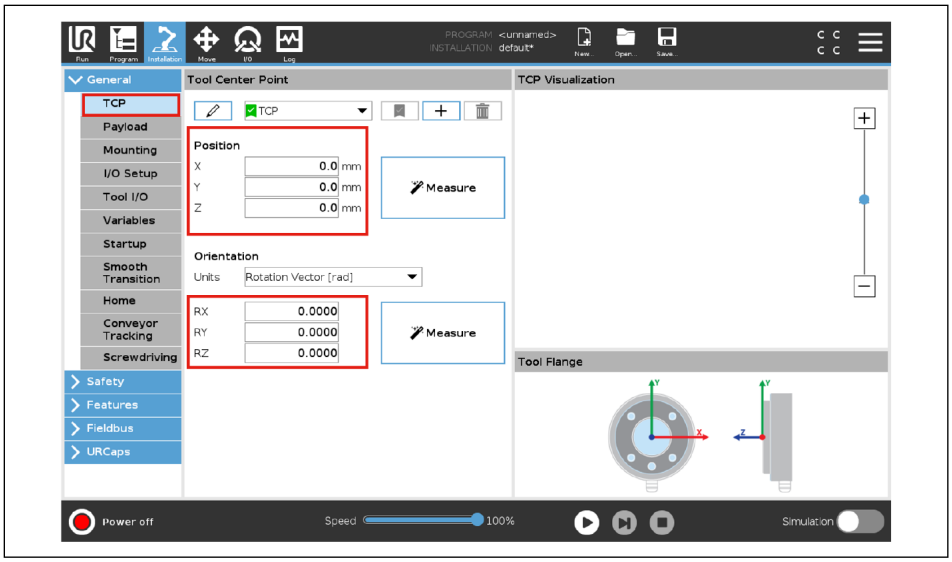


Function	Value	Description
get_gripper_one_pos_one( )	True/ False	**True** is returned if the taught position 1 for gripper A is detected. Otherwise, **False** is returned.
get_gripper_one_pos_two( )	True/ False	**True** is returned if the taught position 2 for gripper A is detected. Otherwise, **False** is returned.
get_gripper_two_pos_one( )	True/ False	**True** is returned if the taught position 1 for gripper B is detected. Otherwise, **False** is returned.
get_gripper_two_pos_two( )	True/ False	**True** is returned if the taught position 2 for gripper B is detected. Otherwise, **False** is returned.

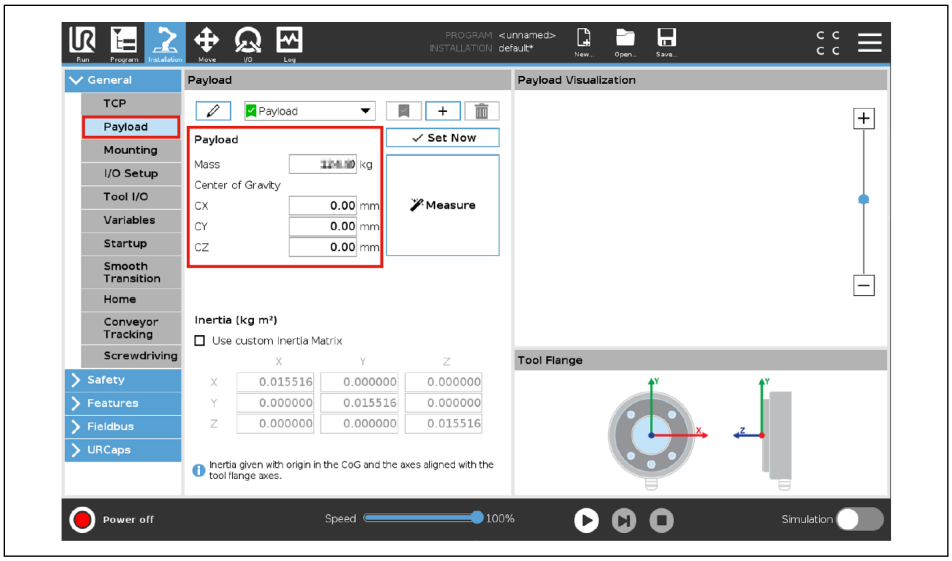
8 Setting the Tool Center Point (TCP) and gripper weight

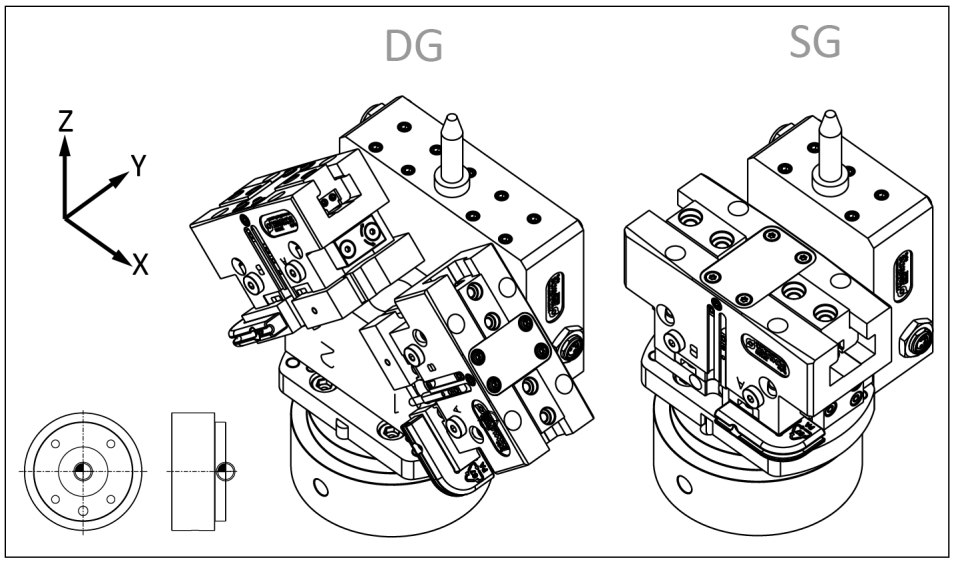
For proper use of the gripper on a UR robot, it is recommended to store the Tool Center Point (TCP) and the gripper weight in the robot settings.

1. Select the "Installation" button in the header line.
2. Select the "General" button in the left menu.
   ✓ A sub-menu opens.
3. Select the "TCP" button.
4. Enter the corresponding values in the "Position" and "Orientation" area, see the following table.



5. Select the "Payload" button.
6. In the "Payload" area, enter the gripper weight and the center of gravity (CX, CY and CZ), see the following table.





Tool Center Point, DG: double gripper, SG: single gripper

Size	TCP				Center of gravity			Weight [kg]
	X [mm]	Y [mm]	Z [mm]	RY [deg]	CX [mm]	CY [mm]	CZ [mm]	
MTB DG-JGP-P 64 *	62.6	0	68.5	±45	-0.5	12.8	44.5	1.62
MTB DG-JGP-P 80 *	69.7	0	75.5	±45	-0.5	15.3	37.6	2.1
MTB SG-JGP-P 80	0	0	65.5	-	-0.5	10	49.3	0.99
MTB SG-JGP-P 100	0	0	71.5	-	-0.5	11.4	40.9	1.38

* For the double gripper: Note the angle of 45° when calculating the TCP values.

NOTE

The blow-off nozzle may protrude beyond the TCP, creating an interference contour. For dimensions, see catalog data sheet at **schunk.com/mtb-downloads**.

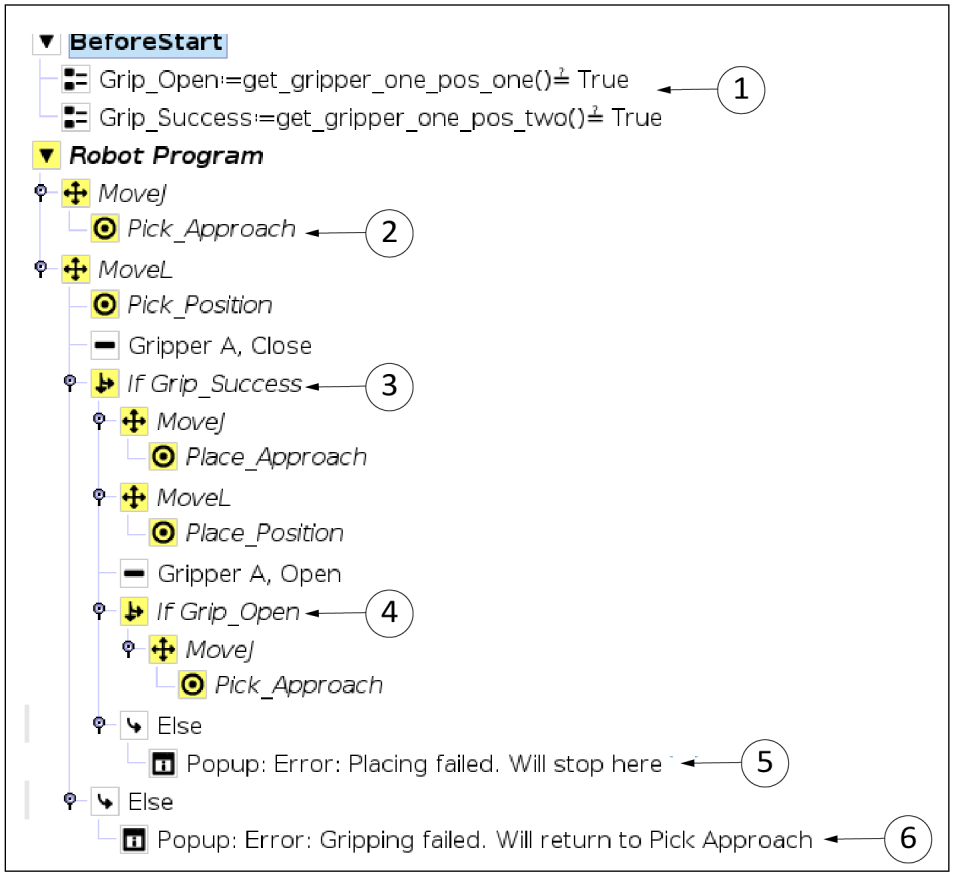
NOTE

If a workpiece with a certain weight is gripped, the total useful load can be dynamically adjusted within the robot program under "Program" > "Basic".

The operating manual of the UR robot contains further information on TCP ▶ 1.4 [🗋 5].

9 Example of a robot program

The following sample program shows a pick-and-place application. Two positions must be taught in: Gripper open (position 1) and workpiece gripped (position 2).



Example program

Item	Description
1	• Select line in robot program. • Activate the "Add Before Start Sequence" checkbox. The following variables or monitoring tasks have already been defined in advance: • Grip_Open: The first position (gripper completely open) has been reached. • Grip_Success: The second position (corresponding to the dimension of the workpiece to be gripped) was detected by the sensor. Each of the two defined functions returns a true value when the sensor detects the corresponding position. These functions are used in the further course of the program.
2	Use the move commands to move the robot to the waypoints "Pick_Approach" and in a separate step "Pick_Position". New workpieces are fed in this area (in a tray or similar).

Item	Description
3	• Call up the "Gripper A Close" program node to grip the workpiece. • Check the variable "Grip_Success" in the If node. If gripper A is in position 2 and has thus gripped the workpiece, the command was successful.
4	• Use the move commands to move the robot to the waypoints "Place_Approach" and "Place_Position". The workpieces are placed in this area (in a tray or similar). • Call up the "Gripper A Open" program node. • Check that gripper A is open and in position 1.
5	If the opening of the gripper in step (4) was not successful, an error message is displayed on the teach pendant. To stop the robot program here, tap the "Stop Program" button in the pop-up window.
6	If gripping the workpiece in step (3) was not successful, an error message is displayed on the teach pendant. Select "Continue" in the pop-up window. The robot program starts again at the "Pick_Approach" waypoint.

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Clamping and gripping technology

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