Software manual
MTB application kit for Doosan Robotics
SCHUNK software module for WCI (work cell item)

Superior Clamping and Gripping

SCHUNK®

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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Fax +49-7133-103-2189

cmg@de.schunk.com

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 on the SCHUNK software plugin for Doosan robots and its use in "WCI – work item cell".

The plugin enables the simple integration and control of the following products in Doosan applications:

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

This manual describes the software environment for a DOOSAN robot.

The software plugin for WCI has been tested with the DART simulator, version 2.8.

Before installing, check whether a more recent version of the software module is available at **schunk.com/mtb-downloads**.

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

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 DOOSAN robot

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 Description of function

The following functions are provided and are used to control the gripper and clamping force block:

WCI SCHUNK_MTB_JGP-P

With this WCI, an instance of a JGP gripper can be produced, its functionality tested during commissioning and a position sensor taught. The digital inputs and outputs can be allocated by the user as required. Each gripper requires its own gripper instance.

WCI SCHUNK_MTB_KS_PGS3

With this WCI, an instance of clamping force block KS-PGS3 can be produced and its functionality tested during commissioning. The digital inputs and outputs can be allocated by the user as required.

Skill SCHUNK_JGP_Open

When opening the gripper, the digital output *MTB_Control* is set to LOW. If the bundle is not yet activated, the digital output *MTB_Enable* is automatically set to HIGH. The process is completed after a fixed period of 120 ms.

Skill SCHUNK_JGP_Close

When closing the gripper, the digital output *MTB_Control* is set to HIGH. If the bundle is not yet activated, the digital output *MTB_Enable* is automatically set to HIGH. The process is completed after a fixed period of 120 ms.

Skill SCHUNK_JGP_BlowOff

The blow-off nozzle is controlled via the digital output *MTB_Control_N*. The following options are possible in this function: activate blow-off nozzle, deactivate blow-off nozzle, or activate blow-off nozzle for a certain time.

Skill SCHUNK_Vise_Open

When opening the clamping force block, the digital output *MTB_Control_Vise* is set to LOW. If the clamping force block is not yet activated, the digital output *MTB_Enable_Vise* is automatically set to HIGH. The process is completed after a fixed period of 120 ms.

Skill SCHUNK_Vise_Close

When closing the clamping force block, the digital output *MTB_Control_Vise* is set to HIGH. If the clamping force block is not yet activated, the digital output *MTB_Enable_Vise* is automatically set to HIGH. The process is completed after a fixed period of 120 ms.

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.

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

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 DOOSAN

Pin	Wire strand	Signal	Robot interface	
			Register	Assignment
1	Brown	+24 VDC	Digital I/O power (TBPWR)	24V
2	Blue	GND	Digital I/O power (TBPWR)	GND
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	DO4
8	Grey	Teach function, Sensor Gripper B *	Digital Outputs	DO5
9	Red	Switching Gripper A	Digital Outputs	DO1
		Switching clamping force block	Digital Outputs	DO7
10	Violet	Switching Gripper B *	Digital Outputs	DO2
11	Grey/ Pink	Enable signal Gripper	Digital Outputs	DO0
		Clamping force block enable signal		DO6
12	Red/ Blue	Switching blow-off nozzle	Digital Outputs	DO3

* not relevant for single grippers

4 Install software component

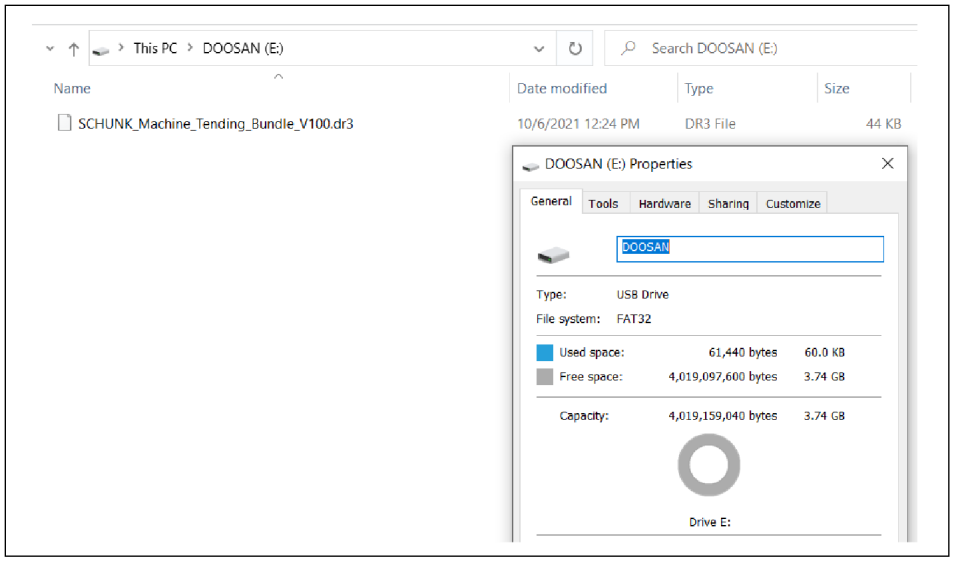
NOTE

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

Prepare the USB stick

The USB stick must meet the following requirements:

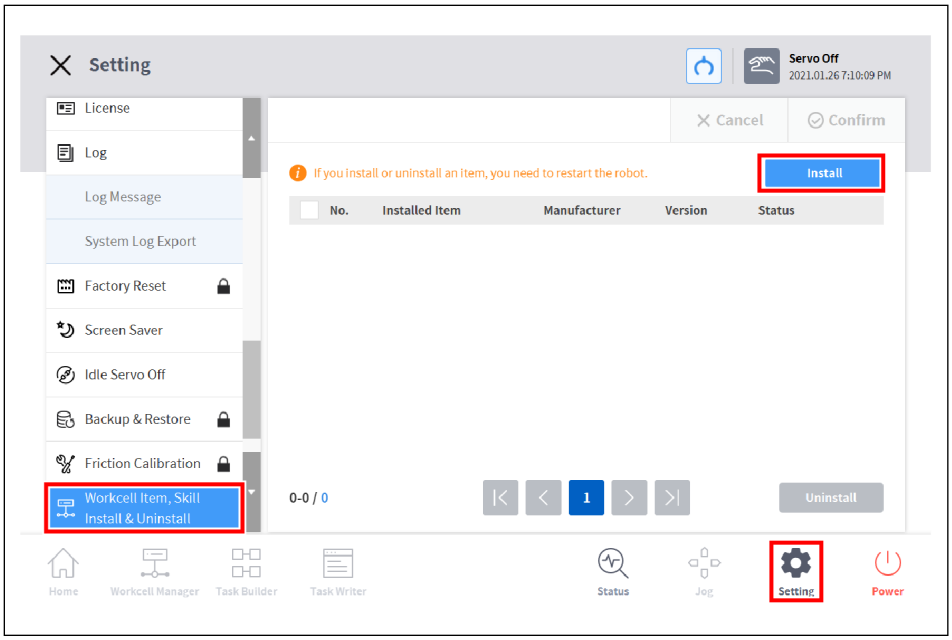
- Formatted in FAT32 format
- Designation of the removable drive: "DOOSAN".



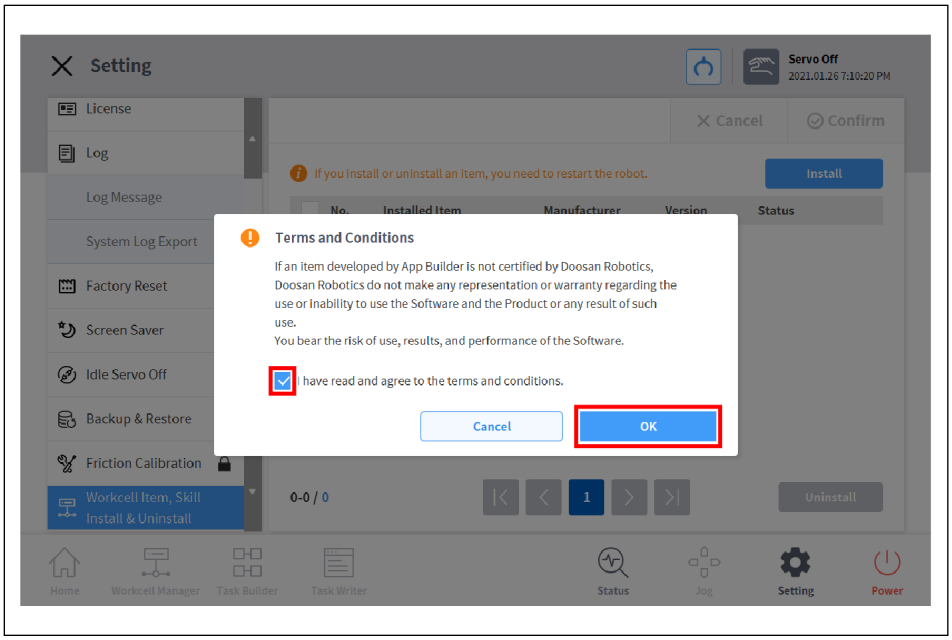
USB stick designation

1. Download the latest WCI version at **schunk.com/mtb-downloads** and copy it to the USB stick.
2. Connect the USB stick to the control unit of the robot.
3. Start the control unit.

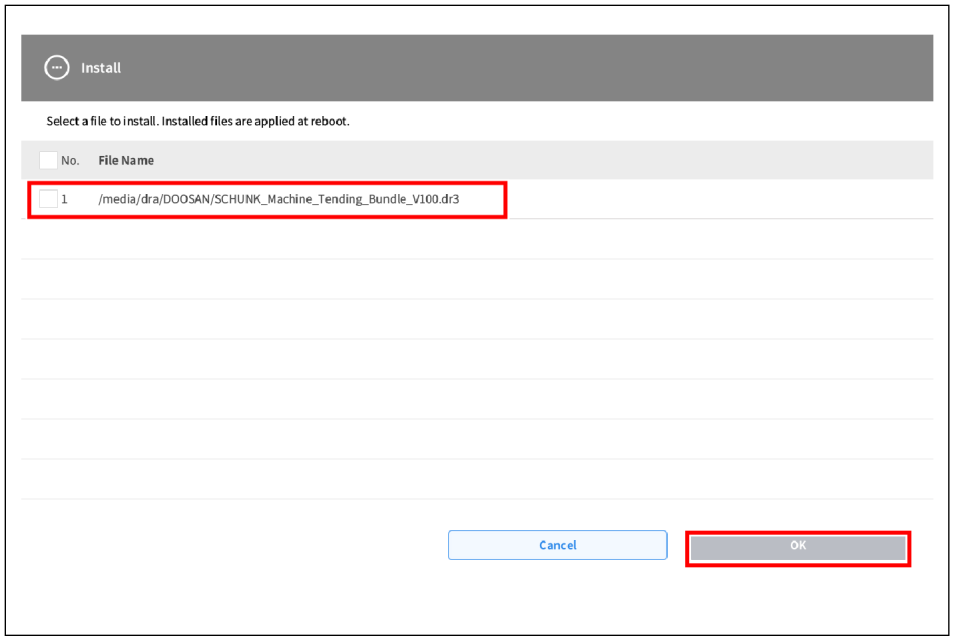
4. Select "*Teach panel > Setup > Install/Uninstall skill*".
5. Select "Install" button.



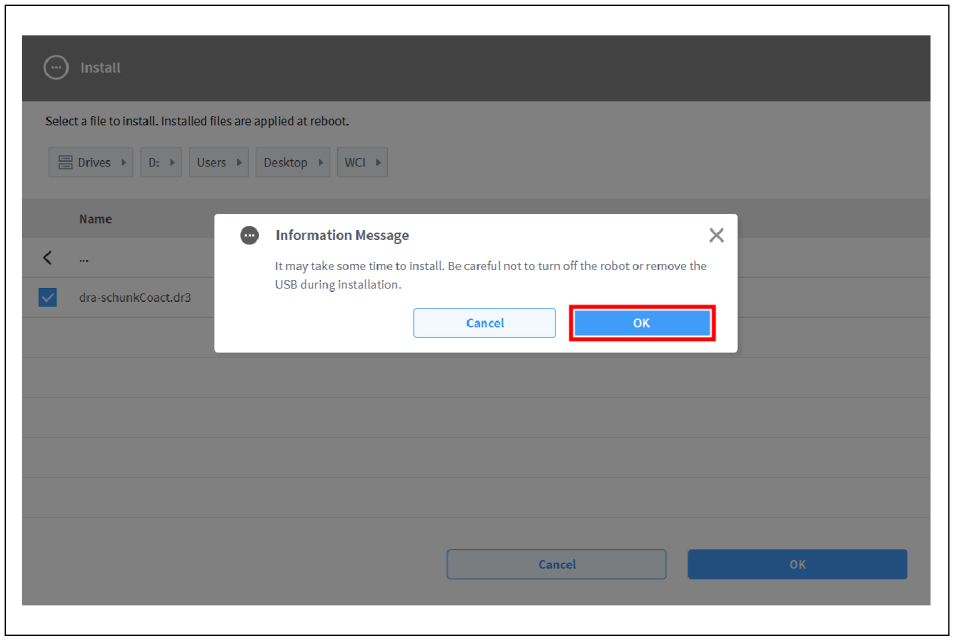
6. Accept the general terms and conditions.



7. Select the WCI file.



8. Ensure that the USB stick is not removed during installation.
9. Select the "OK" button.

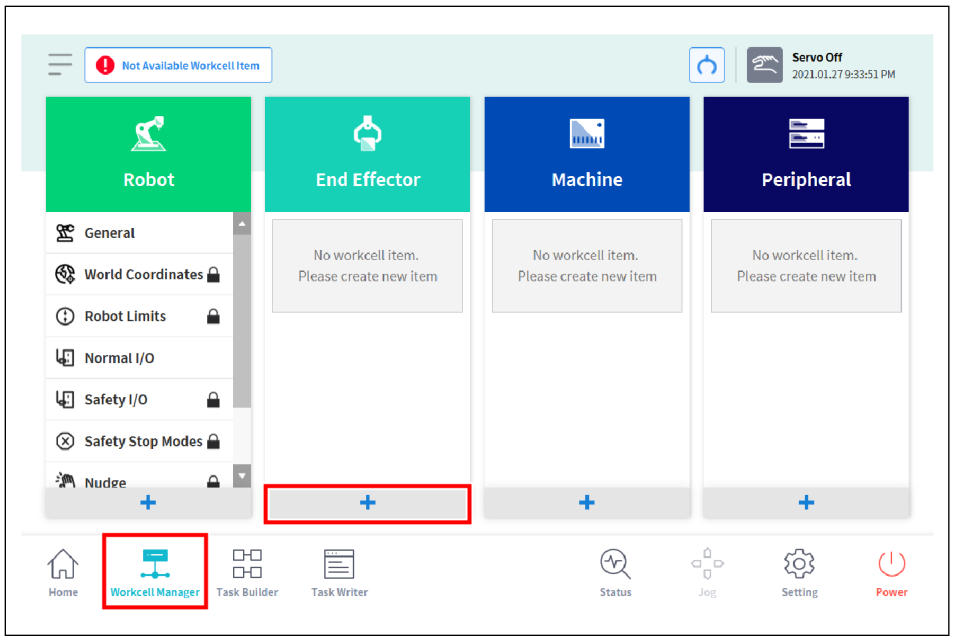


✓ The software module has been installed.

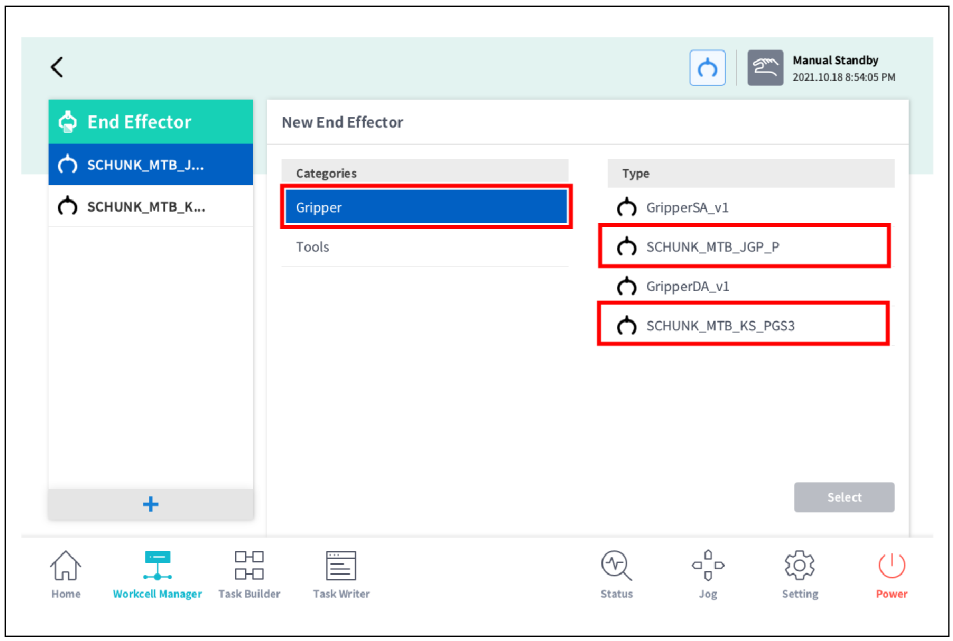
5 Configuring and testing the software module

5.1 Configuring gripper or clamping force block

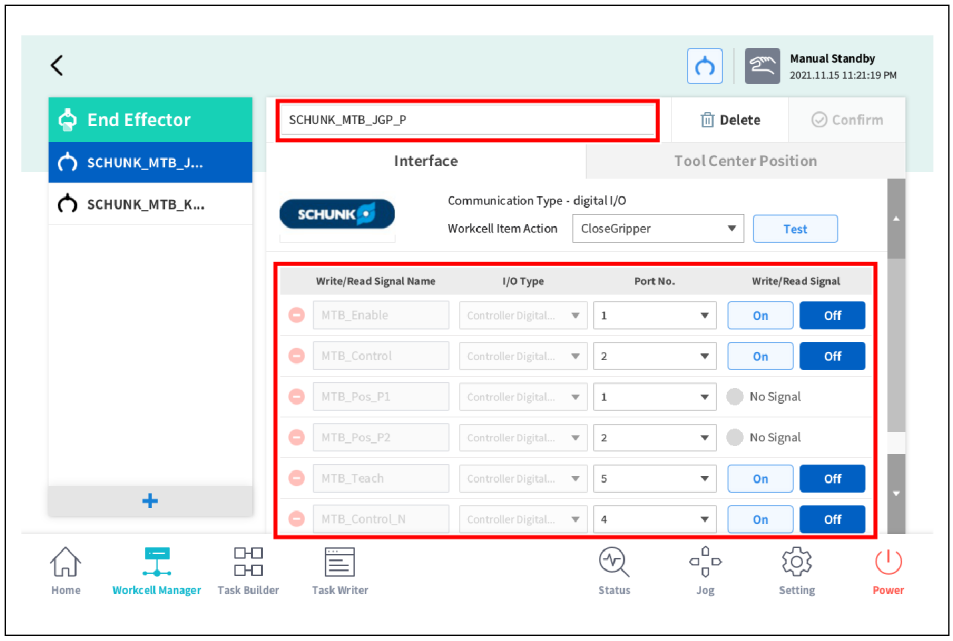
1. Select "*Workcell Manager* > *Effector* > *+*".



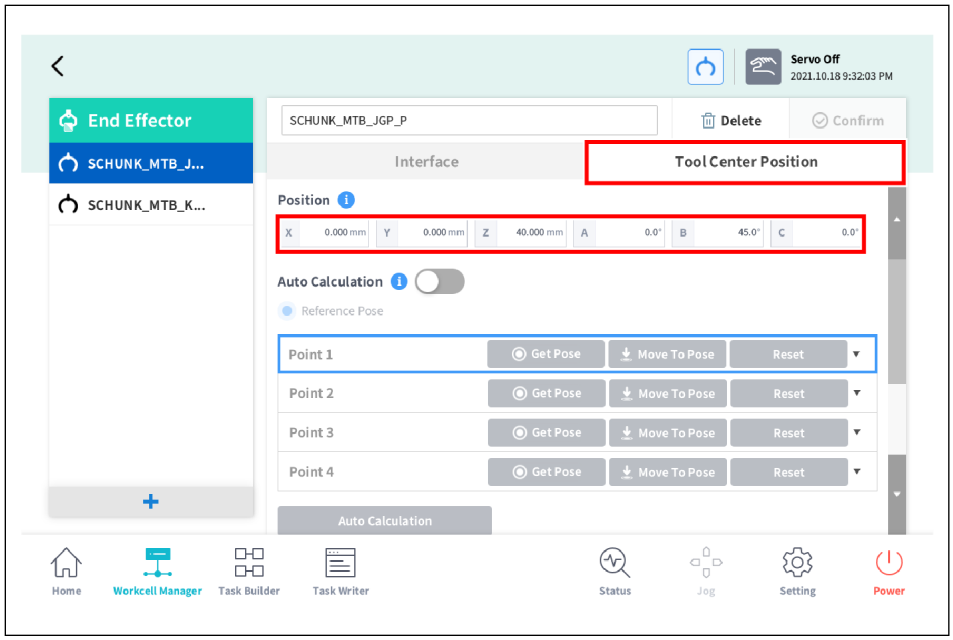
2. Select the category "Gripper".
3. Select type "SCHUNK_MTB_JGP_P" or "SCHUNK_MTB_KS_PGS3".



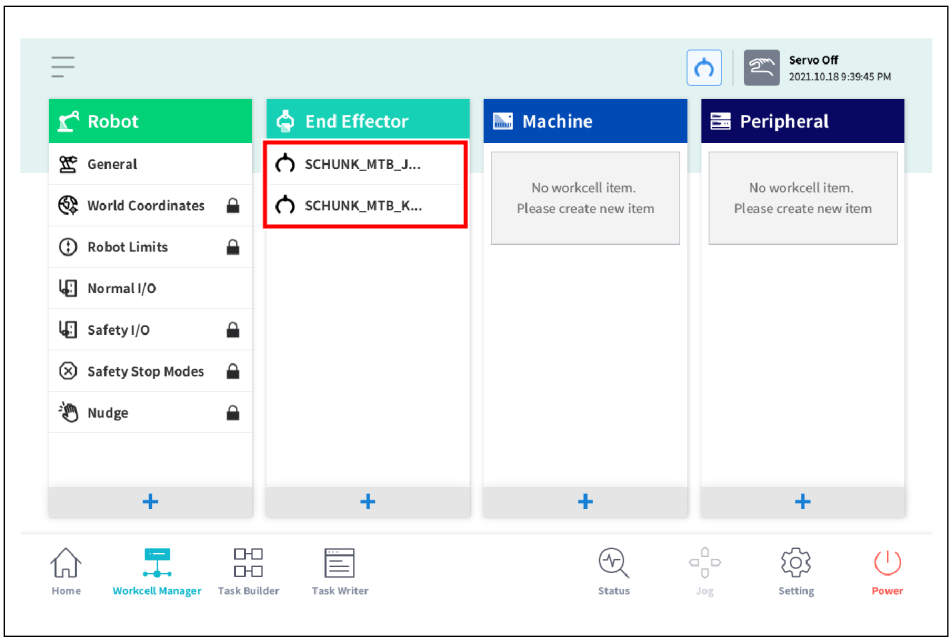
4. Enter the unique name of the gripper and the WCI in the input field. Note: The same WCI may be inserted twice to realize a double gripper configuration.
5. Set the input and output signals, ▶ 3 [🗋 8].
6. Select the "Confirm" button.



7. Set the tool reference point (Tool Center Position - TCP): Enter the adjusted values in the input fields depending on the finger length, see the following tables for this ▶ 5.1 [🗋 15].
8. Select the "Confirm" button.

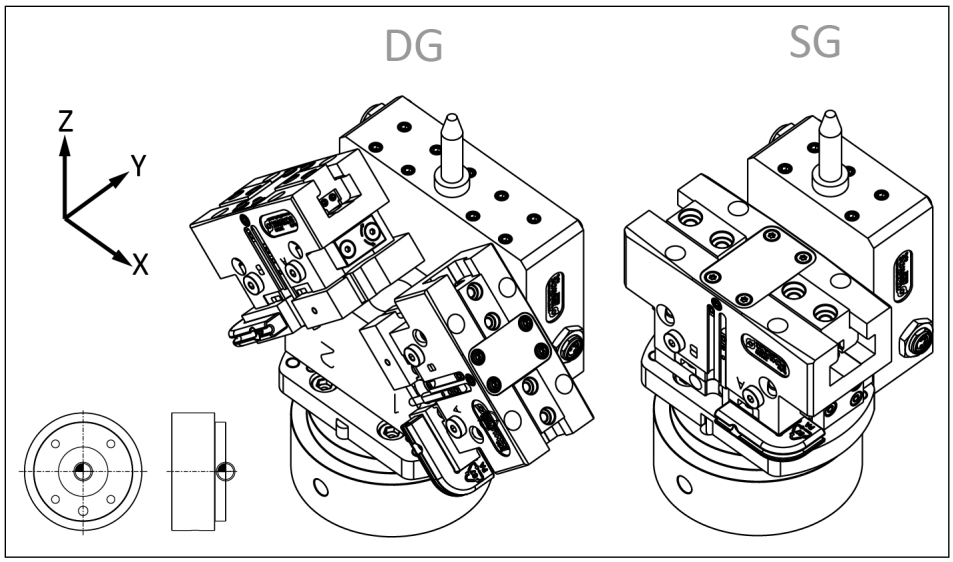


9. Activate the gripper.
   ✓ The name of the gripper is displayed in the Workcell Manager.



10. *When using a double gripper:* Repeat previous steps and configure second gripper.
11. *When using a clamping force block:* Repeat previous steps. Select "SCHUNK_MTB_KS_PGS3" and configure the clamping force block.

TCP values



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

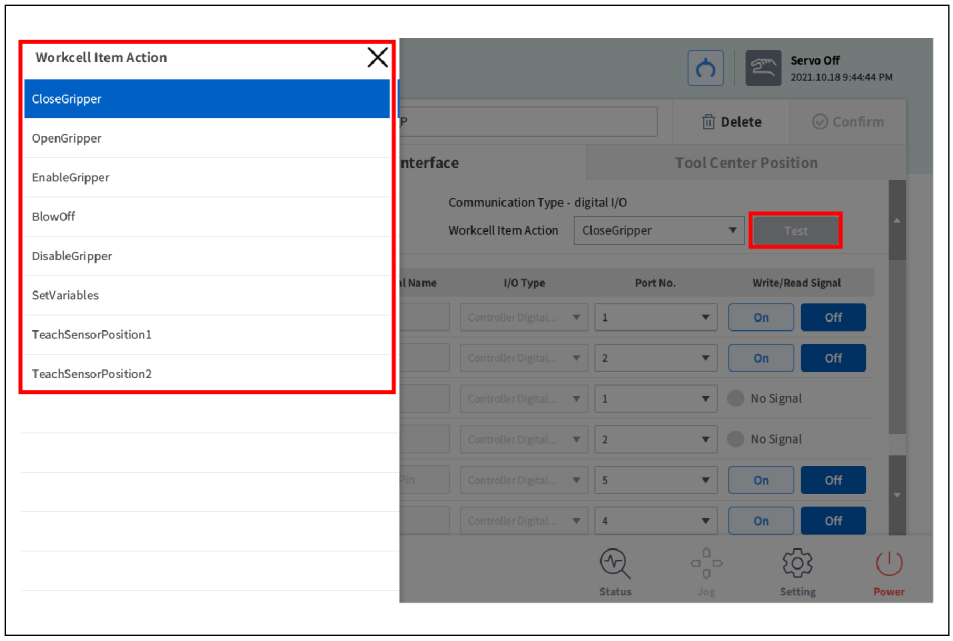
* For the double gripper: Note the angle of 45° when calculating the TCP values.

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**.

5.2 Testing functions

1. Select the desired function from the dropdown menu.
2. **CAUTION! Risk of injury! Moving parts. Components may move when testing the "EnableGripper" function.** Select the "Test" button.



5.3 Teaching sensors

The position sensor of the gripper can be taught either in the Workcell Manager or by adding skills in the robot program.

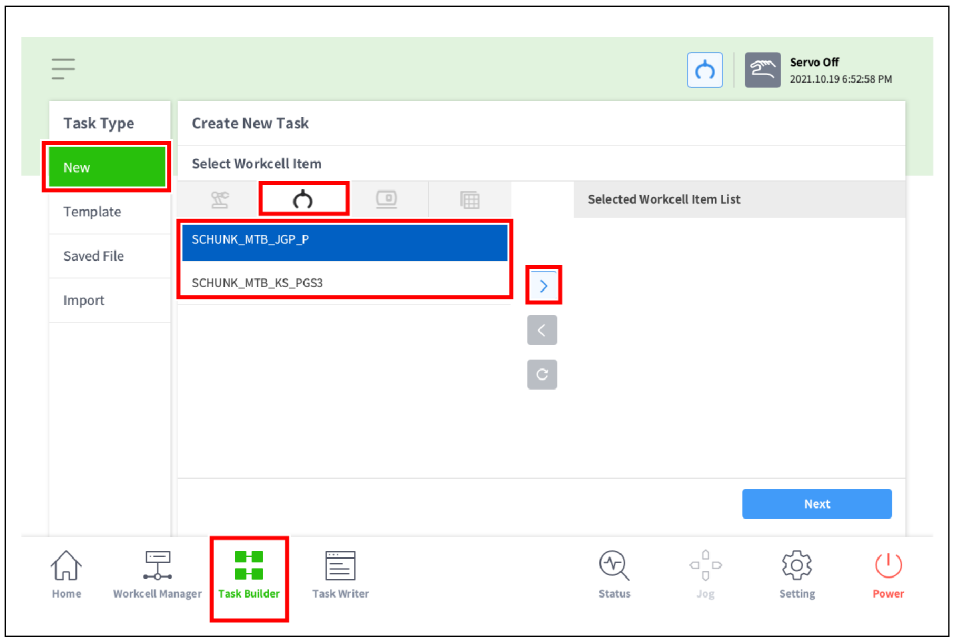
Teach position sensor in the Workcell Manager:

1. Move gripper fingers to the desired position. To do this, select the "OpenGripper" or "CloseGripper" buttons.
2. Select "TeachSensorPosition1" > "Test" or "TeachSensorPosition2" > "Test" buttons.

   ✓ The sensor is taught. Teaching of the sensor can take up to 30 seconds. During this time the GUI is not responsive.

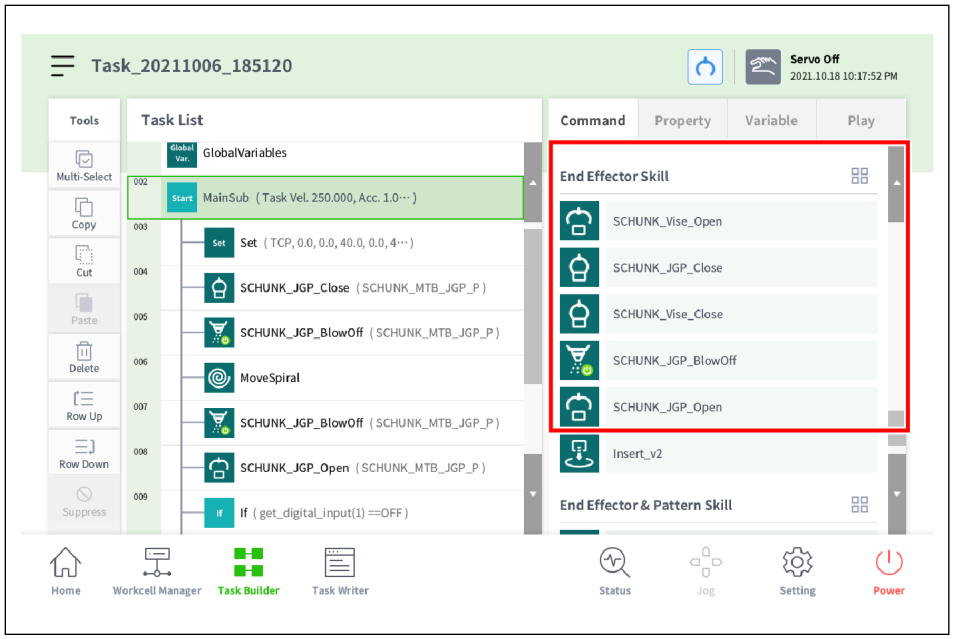
6 Inserting the functions into the program code

1. Select "*Task Builder > New*".
2. Select the gripper and add it to the list.
3. Select the "Next" button.



✓ Possible commands are displayed in the list on the right.

4. Pull the commands to the desired point in the task list.

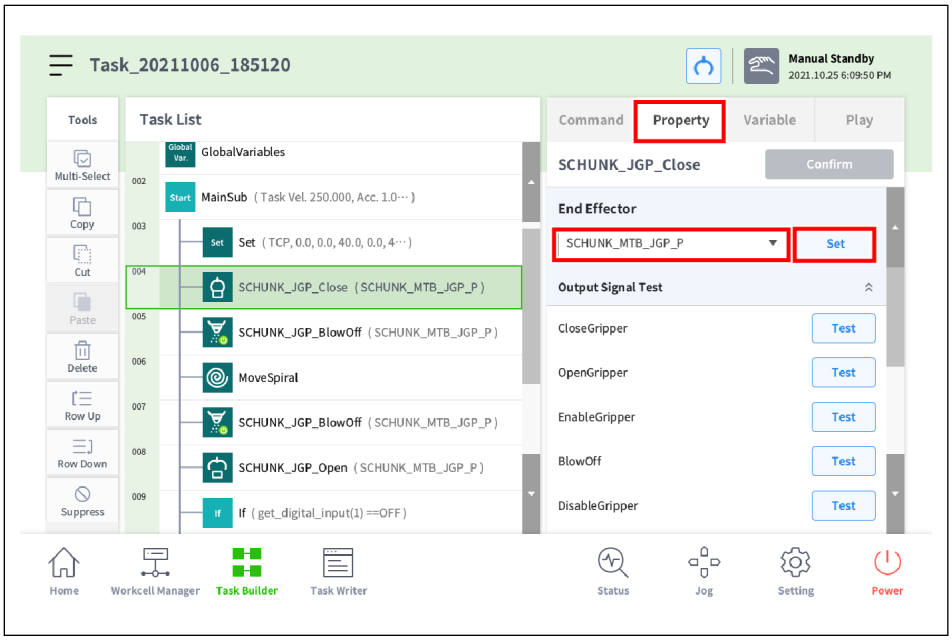


6.1 Command: Open, Close

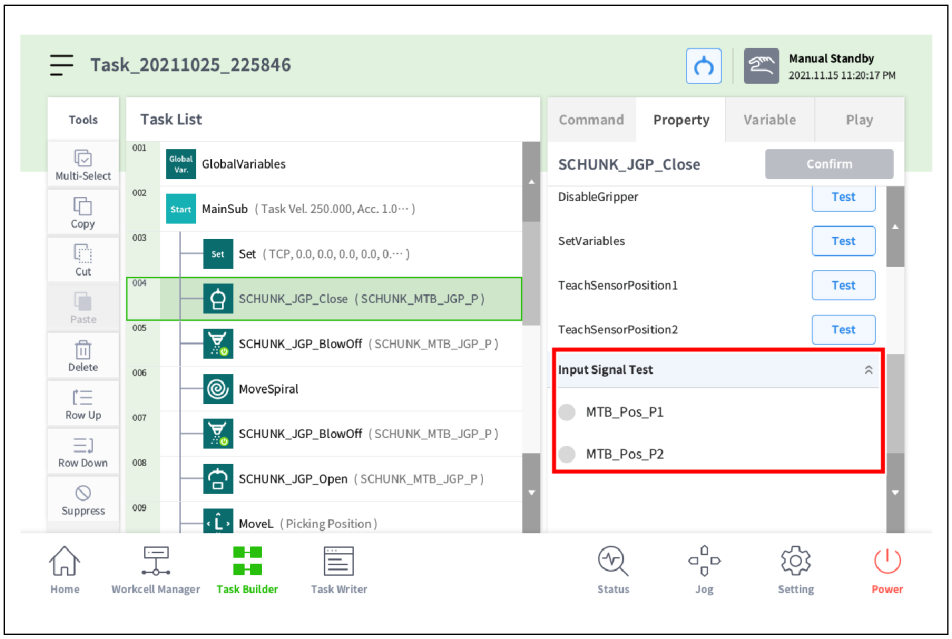
After dragging a command to the task list, the corresponding instance must be assigned and the command must be tested.

- Command is located in the appropriate place in the task list.

1. Select "Property" tab.
2. In the dropdown menu, select gripper or clamping force block.
3. Select the "Adjust" button.
   - ✓ All functions available in the corresponding WCI can be tested during programming.
   - ✓ All gripper functions including teaching can also be tested: To do this, select the "Test" button next to the relevant function.



✓ While opening and closing commands are being executed, check whether the sensor has been taught correctly. In the "Input signal test" section, the LED lights up green when the corresponding position has been detected.

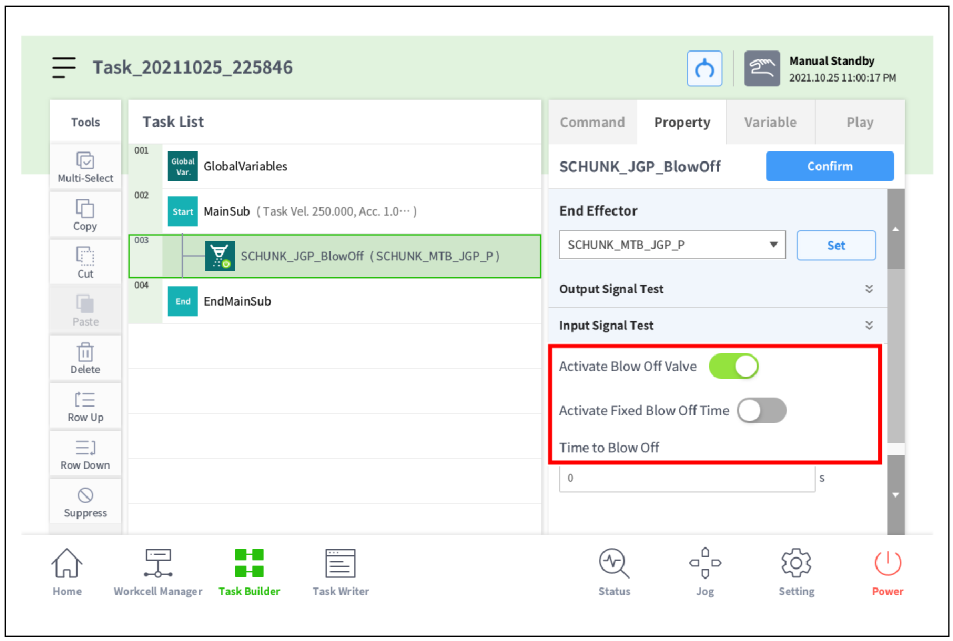


6.2 Command: BlowOff

The "BlowOff" command controls the blow-off nozzle.

- Command is located in the appropriate place in the task list.

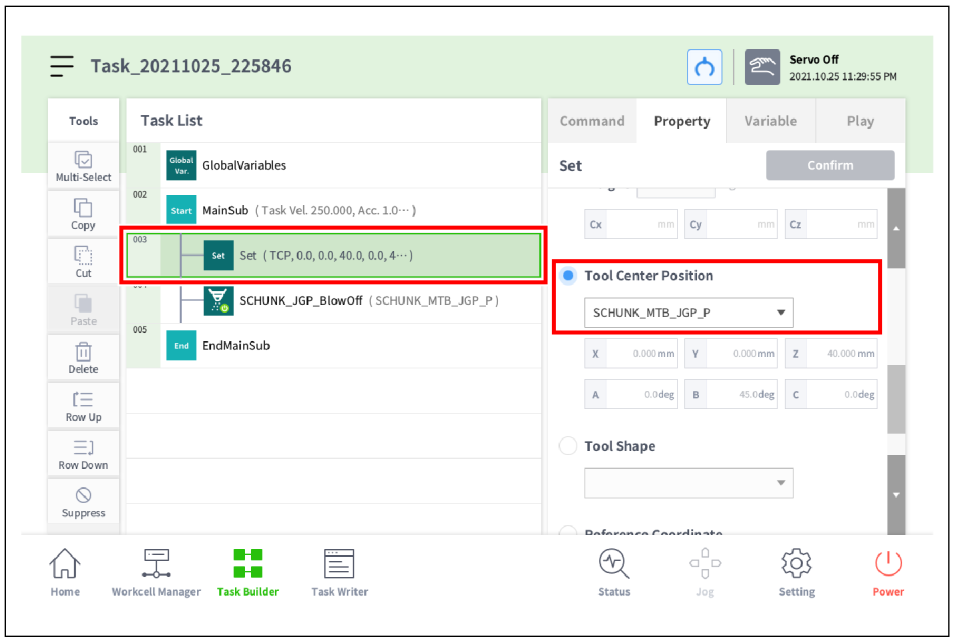
1. Select "Property" tab.
2. Switching the blow-off valve on or off:
   - ✓ Switch on blow-off valve for an indefinite period: Switch on "Activate Blow Off Valve".
   - ✓ OR: Switch off blow-off valve for an indefinite period: Switch off "Activate Blow Off Valve".
   - ✓ OR: Switch on blow-off valve for an definite period: Switch on "Activate Blow Off Valve" and "Activate Fixed Blow Off Time" and enter time in the input field.



6.3 TCP settings

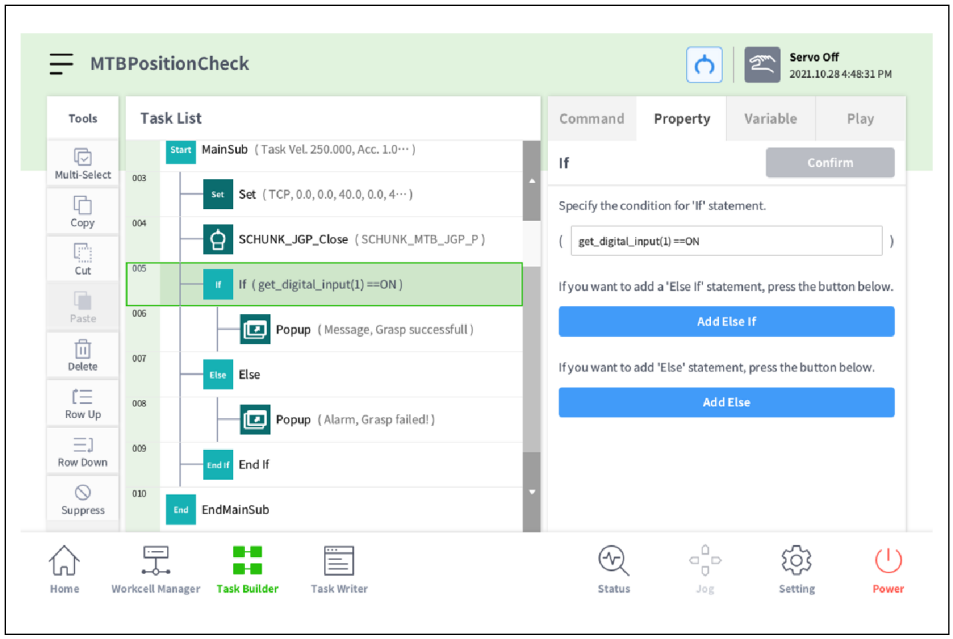
The tool reference point (TCP) can be changed during program execution.

1. Add "Set" function to the task list.
2. Select "Property" tab > "Tool reference point".
3. Select gripper instance from the dropdown menu.
   ✓ Current end effector TCP has been set to the values of the gripper TCP, ▶ 5.1 [🗋 15].



6.4 Checking position when opening and closing the gripper

The position of the sensor can be checked with an IF loop.

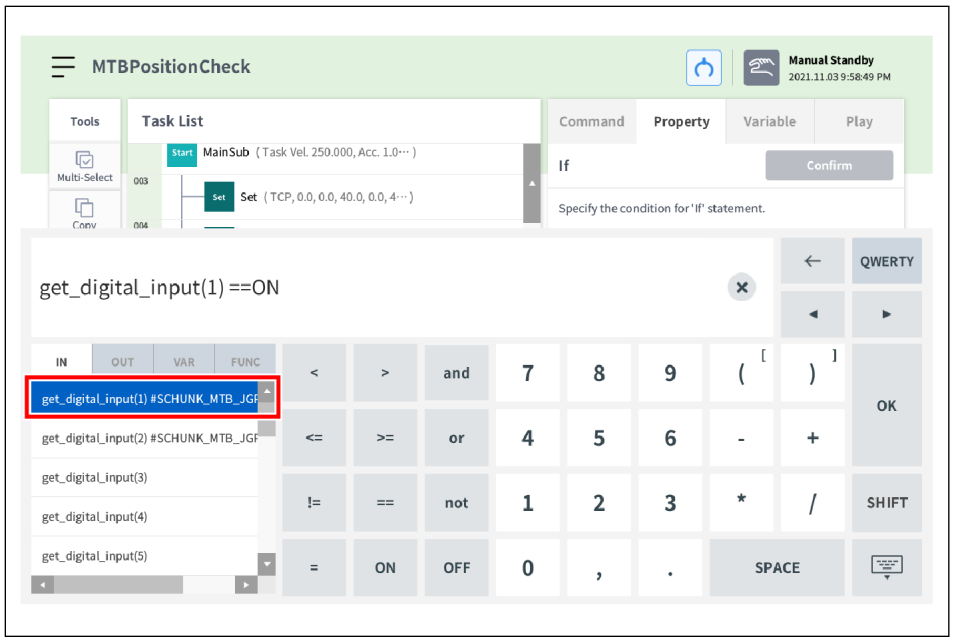


The gripper instance "SCHUNK_MTB_JGP_P" is closed and then the position is checked. The following sensor behavior is monitored for the gripper instance:

- The digital input "MTB_Pos_P1_G1" changes to HIGH when taught position 1 is reached.
- When position 1 is reached, the program execution can be continued. In this example, a popup with the message "Grasp successful!" is displayed.
- When position 1 is not reached, the program execution can be stopped. In this example, a popup appears with the message "Grasp failed!"

Configuration of the IF loop

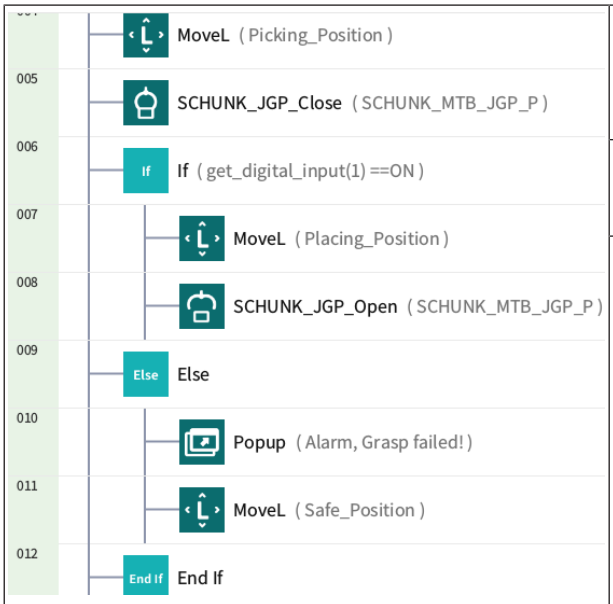
1. Select "Property" tab > "IF".
2. Enter condition in the input field.
   ✓ The gripper instance assigned is displayed after the digital input. In the example, "get_digital_input(1) #SCHUNK_MTB_JGP_P_MTB_Pos_P1" checks the digital input assigned to MTB_Pos_P1.
   ✓ This is followed by the status of the digital input. In the example, the condition is true if the digital input 1 is ON (HIGH)



7 Example programs

7.1 Pick & Place application

This example shows the use of a gripper to pick up an object at a given position ("Picking_Position") and place it at a second position ("Placing_Position"). If the gripping or placing fails, the robot should move to a safe position ("Safe_Position").

<table>
<tr>
<td rowspan="6"> 
</td>
<td>MoveL (Picking_Position)
The robot moves to the previously defined position where the object is to be gripped.</td>
</tr>
<tr>
<td>SCHUNK_JGP_Close
Gripper 1 is closed to grip the object.</td>
</tr>
<tr>
<td>IF loop
Checks whether the gripper has reached its previously taught position and therefore gripped the object correctly.
If the digital input is 1 -> HIGH, the object has been gripped successfully. The robot can move to the depositing position to deposit the object.
If the digital input is 0 -> LOW, a popup "Grasp failed!" appears. The robot moves to a safe position to wait for further user inputs.</td>
</tr>
<tr>
<td>MoveL(Placing_Position)
The robot moves to the previously defined position where the object is to be deposited.</td>
</tr>
<tr>
<td>SCHUNK_JGP_Open
Gripper 1 is opened to deposit the object.</td>
</tr>
</table>

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