USER MANUAL

FOR UR ROBOTS

v1.2.1

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1. Introduction

1.1. Important Safety Notice

DANGER:

You must read, understand, and follow all safety information in this manual, and the robot manual and all associated equipment before initiating robot motion. Failure to comply with safety information could result in death or serious injury.

1.2. Scope of the Manual

The manual covers the following OnRobot products and its components:

Tools	Version
3FG15	v1
RG2	v2
RG2-FT	v2
RG6	v2
Screwdriver*	v1
SG	v1
VG10	v2
VGC10	v1

* For the Screwdriver, a Compute Box with hardware version of at least v3.4 is required. To check the HW version of the Compute Box, refer to the sticker on the device. Or check the HW version in the Web Client software.

Sensors	Version
HEX-E QC	v3
HEX-H QC	v3

Where applicable the combination of the products is also covered in the manual.

NOTE:

Generally, the products without the Quick Changer v2 interface, are not in the scope of this manual.

The manual covers the following software/firmware versions:

Software	Version
URCap	v5.2.0
Compute Box	v5.2.0

Firmware	Version
SG*	1.0.18

*only when used on UR CB3 controller via tool connector. To update the SG firmware without a Compute Box please contact your distributor.

NOTE:

In case when the used Compute Box has lower software/firmware version, please update before use. For detailed instructions on the update refer to Web Client description at the end of this Manual.

1.3. Naming Convention

1.3.1. HEX-E QC/HEX-H QC

The HEX-E QC and HEX-H QC names as model variants are used separately or together as HEX-E/H QC if the information is relevant for both variants.

1.3.2. 3FG15

The 3FG15 product sometimes will be called TFG as Three-Finger Gripper.

1.3.3. RG2/RG6

The RG2 and RG6 names as model variants are used separately or together as RG2/6 if the information is relevant for both variants.

2. Safety

The robot integrators are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that any significant hazards in the complete robot application are eliminated. This includes, but is not limited to:

- Performing a risk assessment for the complete robot system
- Interfacing other machines and additional safety devices if defined by the risk assessment
- Setting up the appropriate safety settings in the robot software
- Ensuring that the user will not modify any safety measures
- Validating that the total robot system is designed and installed correctly
- Specifying instructions for use
- Marking the robot installation with relevant signs and contact information of the integrator
- Collecting all documentation in a technical file; including the risk assessment and this manual

2.1. Intended Use

OnRobot tools are intended to be used on collaborative robots and light industrial robots with different payloads depending on the end-of-arm tooling specifications. OnRobot tools are normally use in pick-and-place, palletizing, machine tending, assembly, quality testing and inspection and surface finishing applications.

The end-of-arm tooling should only operate under conditions noted in **8.1. Technical Sheets** section.

Any use or application deviating from intended use is deemed to be impermissible misuse. This includes, but is not limited to:

- Use in potentially explosive atmospheres
- Use in medical and life critical applications
- Use before performing a risk assessment
- Use outside the permissible operational conditions and specifications
- Use close to a human's head, face and eye area
- Use as a climbing aid

2.2. General Safety Instructions

Generally, all national regulations, legislations and laws in the country of installation must be observed. Integration and use of the product must be done in compliance with precautions in this manual. Particular attention must be paid to the following warnings:

DANGER:

You must read, understand, and follow all safety information in this manual, and the robot manual and all associated equipment before initiating robot motion. Failure to comply with safety information could result in death or serious injury.

The information in this manual does not cover designing, installing, and operating a complete robot application, nor does it cover other peripheral equipment that can influence the safety of the complete system. The complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

Any safety information provided in this manual must not be construed as a warranty, by OnRobot A/S, that the robot application will not cause injury or damage, even if robot application complies with all safety instructions.

OnRobot A/S disclaims any and all liability if any of OnRobot tools tooling are damaged, changed or modified in any way. OnRobot A/S cannot be held responsible for any damages caused to any of OnRobot tools tooling, the robot, or any other equipment due to programming errors or malfunctioning of any of OnRobot tools.

WARNING:

OnRobot tools are not allowed to be exposed to condensing conditions when power is on or when connected to a robot. If condensing conditions appear during transport or storage, the product must be placed between 20 and 40 Celsius degrees for 24 hours before power is applied or before connected to a robot.

It is recommended that OnRobot tools are integrated in compliance with the following guides and standards:

- ISO 10218-2
- ISO 12100
- ISO/TR 20218-1
- ISO/TS 15066

2.3. Risk Assessment

The robot integrator must perform a risk assessment on the complete robot application. OnRobot tools are only components in a robot application and therefore they can be only safely operated if the integrator has considered the safety aspects of the whole application. OnRobot tools are designed with relatively smooth and round design with a limited amount of sharp edges and pinch points

In collaborative applications, the trajectory of the robot can play a significant safety role. The integrator must consider the angle of contact with a human body, e.g. orientate OnRobot tools and workpieces so that the contact surface in the direction of movement is as large as possible. It is recommended that the tool connectors are pointed in the direction opposite to the movement.

OnRobot A/S have identified the potential hazards listed below as significant hazards that must be considered by the integrator:

- Objects flying from OnRobot tools due to loss of grip
- Objects falling down from OnRobot tools due to loss of grip
- Injuries due to collisions between humans and workpieces, OnRobot tools tooling, robot or other obstacles
- Consequences due to loosen of bolts
- Consequences if OnRobot tools cable gets stuck to something
- Workpiece itself represents a hazard

2.4. Environmental Safety

OnRobot A/S products must be disposed of in accordance with the applicable national laws, regulations and standards.

The product is produced with restricted use of hazardous substances to protect the environment; as defined by the EU RoHS Directive 2011/65/EU. These substances include mercury, cadmium, lead, chromium VI, polybrominated biphenyls and polybrominated diphenyl ethers.

Observe national **registration** requirements for importers according to EU WEEE Directive 2012/19/EU.

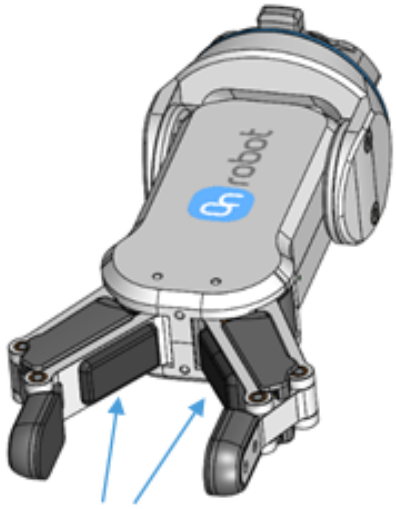
2.5. PLd CAT3 Safety Function

A safety-rated function has been designed as two buttons at the two arms of the product, conforming to ISO 13849-1 PLd CAT3.

This Safety Function has a max response time of 100 ms and a MTTF of 2883 years.

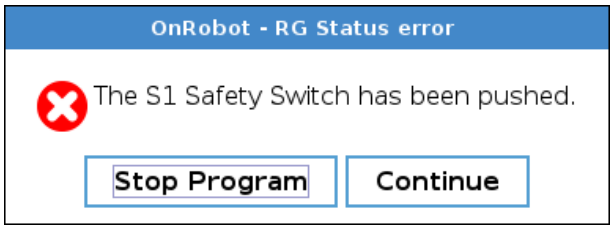
The behavior of the safety system is described below:

If something activates the two Safety Buttons, see picture below, the safety control system stops motion of the two arms of the product. Motion is then prevented as long as one or both of the two buttons are activated.

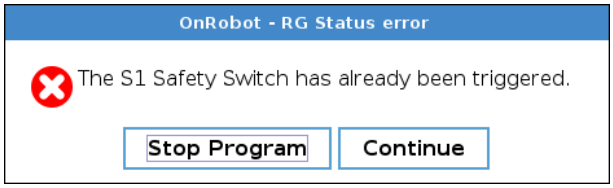


PLd CAT3 Safety Buttons

If this happens while running the robot program, the following popup dialog will be shown.

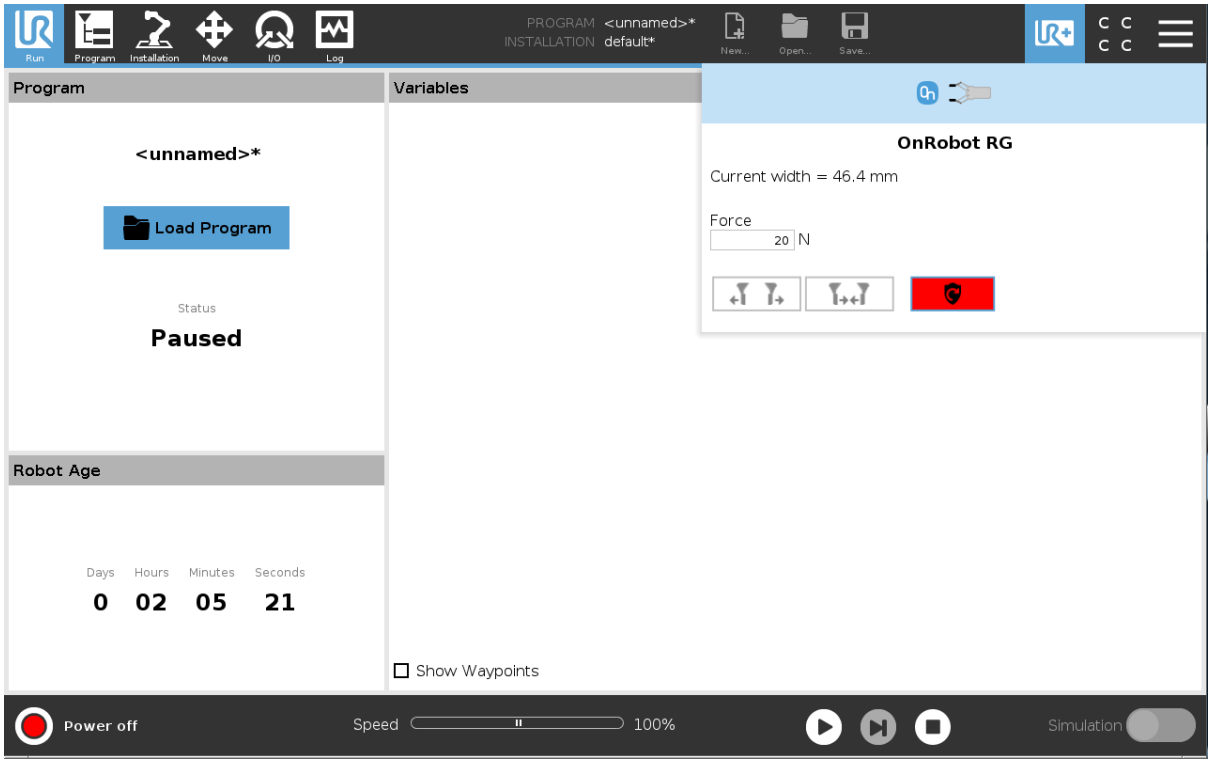


When any of the buttons in this dialog is pressed , the safety system will show the following popup dialog.



When any of the buttons in this dialog is pressed, the robot will be unlocked.

To reinitialize the gripper, open the toolbar and press the icon. Then, robot program can be re-started.



CAUTION:

Before pressing the button always make sure that no part will be dropped due to the loss of gripper power. If Dual Quick Changer is used it will cycle the power for both sides.

NOTE:

If the robot program is started and one of the safety switches has been previously pressed, the second popup will appear. The process to unlock the gripper is the same.

2.6. Screwdriver Safety Features

2.6.1. Screw-bit System Always Hidden

The Screwdriver has been designed so that the Screw-bit System can always be hidden inside the housing to enhance safety.

The Move Shank command will allow the user to hide the Screw-bit System inside the housing at any time.

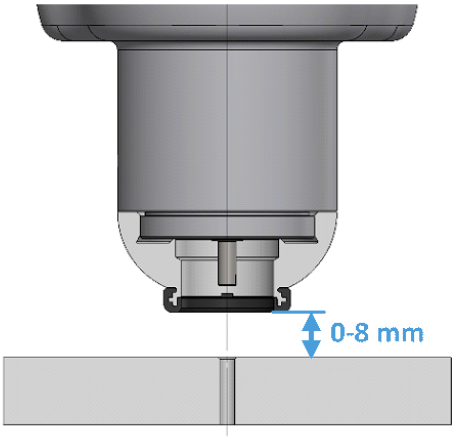
Additionally, the software has been designed so that after running a Tighten, Loosen or Pick Screw command, the Screw-bit System will be automatically hidden inside the housing.

NOTE:

As mentioned in the technical sheet, this safety functionality will be achieved if the screw length is equal or less than 35 mm.

2.6.2. Operational Safety

The Screwdriver has been designed so that its operations must be executed when the distance between the Screwdriver's bottom part and the surface where the action takes place is within the range of 0-8 mm (see image below). If the distance is higher than this, the Screwdriver operations will not be successful, and the system will generate an error.



From a safety perspective, this ensures that nothing larger than 8 mm is exposed to be harmed by the Screw-bit System while executing a Screwdriver operation.

For instance, if a hand is located on the workpiece when the robot moves toward the recorded waypoint, the robot in a collaborative installation will have a protective stop when hitting the hand as it does not reach the recorded waypoint (as a hand is thicker than 8 mm). Additionally, If the robot reaches the recorded waypoint and starts the screwing operation, the <8 mm distance prevents the user from placing a hand/finger underneath during a Screwdriver operation.

NOTE:

As mentioned in the technical sheet, this safety functionality will be achieved if the screw length is up to 35 mm.

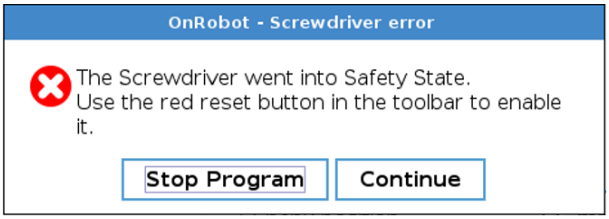
2.6.3. Automatic Safety Feature

An automatic safety feature has been implemented to reduce the possibility of the users to be in danger.

This safety feature is activated if the Screw-bit System detects a force above 40N during operation. In such a case, a mechanical mechanism will immediately retract the shank and hide it (up to 35 mm screw length).

Screw-bit System out	Automatic Safety Activated

If this happens while running the robot program, it will stop, and the following popup dialog will be shown.



After pressing any of these 2 buttons, the Screwdriver can be enabled by opening the toolbar and pressing the button. Then, robot program can be re-started.

Additionally, if the bottom part of the Screw-bit System detects an unexpected force above 20N while not in operation, the Screw-bit system will retract and be temporarily hidden into the housing (up to 35 mm screw length). This will not stop the robot program, only temporarily hide the Screw-bit System.

CAUTION:

This retract functionality does not work if the power is interrupted. Further actions may be required to eliminate the risk, identified by the risk assessment.

3. Operation Mode(s)

This document covers installation and operation for both:

- UR CB3 series robot controllers
- and UR e-Series robot controllers.

Since the two controllers have similar installation and operation screens in these cases only the e-Series screens are shown. Where the two requires different steps or screens it is highlighted and referred as:

- CB3 series
- e-Series.

There are two ways how the product(s) could be used on both UR series:

Modes of Operation	
via **Compute Box** *works with all products and product combinations*	via **UR's Tool Connector** *works with only one of these:* • *3FG15 (Only on e-Series) or* • *RG2 or* • *RG6 or* • *SG or* • *VG10 or* • *VGC10*

Generally, the two modes of operation require the same installation/operation steps. Where the two modes require different steps, it is highlighted and referred as:

- via Tool Connector
- via Compute Box

4. HW Installation

4.1. Overview

For a successful installation the following steps will be required:

- Mount the components
- Setup the software

In the following sections, these installation steps will be described.

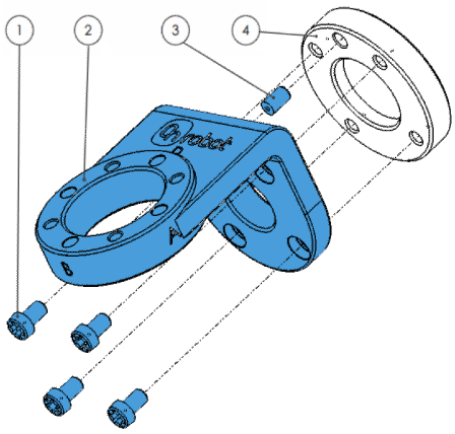
4.2. Mounting

Required steps:

- Optional - mount the Angle Bracket
- Mount the Quick Changer option
- Mount the tool(s)

In the following two subsections these two mounting steps will be described.

4.2.1. Optional - Angle Bracket



Angle Bracket

1. M6x10 screws (ISO14580 8.8)
2. Angle Bracket (ISO 9409-1-50-4-M6)
3. Dowel pin Ø6x10 (ISO2338 h8)
4. Adapter/Robot tool flange (ISO 9409-1-31.5-4-M5)

Use 10 Nm tightening torque.

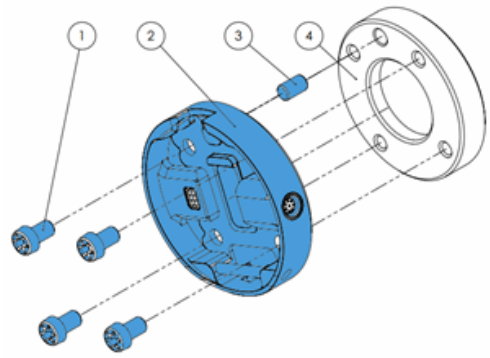
NOTE:

If using the optional Angle Bracket, make sure to always adjust the TCP as described in the 8.3.10. COG, TCP section. Otherwise some of the functionality may not work properly.

NOTE:

With Angle Bracket the HEX-E/H QC and the Dual QC is not supported.

4.2.2. Quick Changer - Robot Side



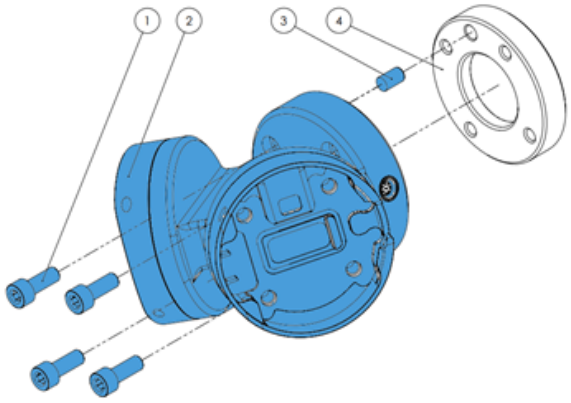
Quick Changer - Robot Side

1. M6x8mm (ISO14580 8.8)
2. Quick Changer (ISO 9409-1-50-4-M6)
3. Dowel pin Ø6x10 (ISO2338 h8)
4. Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 10 Nm tightening torque.

Quick Changer	3FG15	RG2/6	RG2-FT	Screwdriver	VG10/VGC10
QC-R v2	✓	✓	✓	X	✓
QC-R v2-4.5 A	✓	✓	✓	✓	✓

4.2.3. Dual Quick Changer



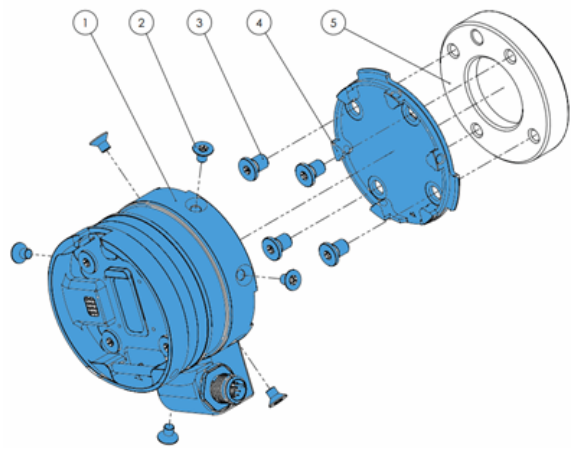
Dual Quick Changer

1. M6x20mm (ISO14580 8.8)
2. Dual Quick Changer
3. Dowel pin Ø6x10 (ISO2338 h8)
4. Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 10 Nm tightening torque.

Quick Changer	3FG15	RG2/6	Screwdriver	VG10/VGC10
Dual QC v2	✓	✓	X	✓
Dual QC v2-4.5 A	✓	✓	✓	✓

4.2.4. HEX-E/H QC



HEX-E/H QC

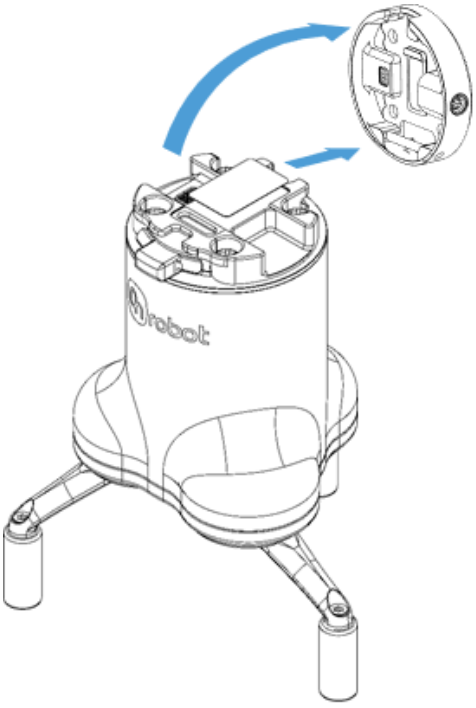
1. HEX-E/H QC sensor
2. M4x6mm (ISO14581 A2)
3. M6x8mm (DIN7984LT A2)
4. HEX-E/H QC adapter
5. Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 1.5 Nm tightening torque for M4x6mm

Use 3.8 Nm tightening torque for M6x8mm

4.2.5. Tools

4.2.5.1. 3FG15



Step 1:

Move the tool close to the Quick Changer as illustrated.

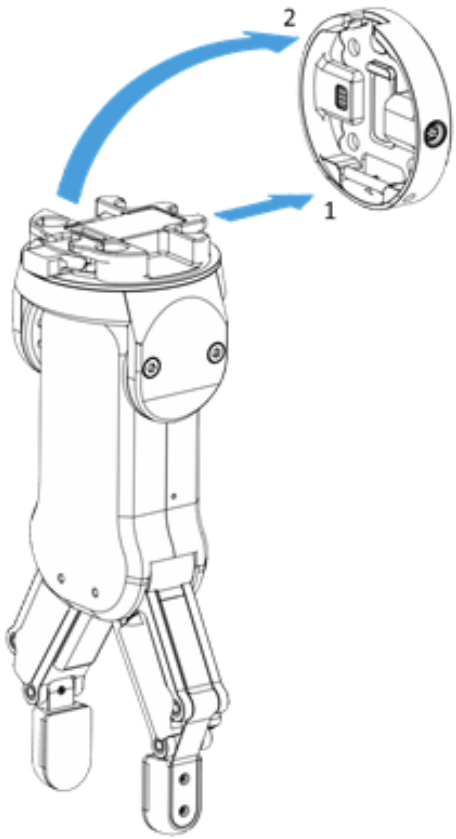
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

4.2.5.2. RG2



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

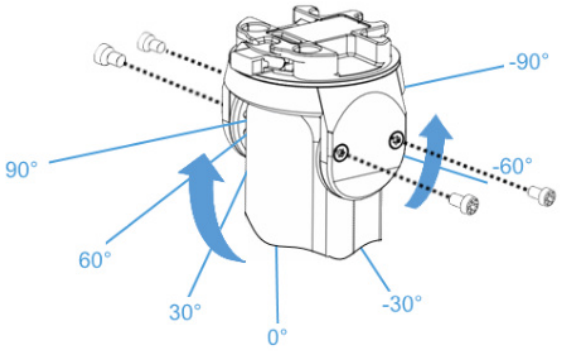
Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

To change the relative angle of the gripper to the Quick Changer:

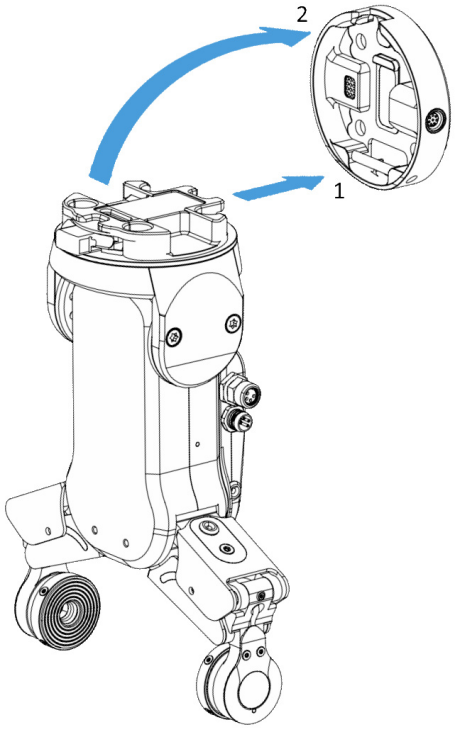
- first remove the four M4x6 screws
- tilt the gripper between -90° and 90°
- then put the four M4x6 screws back and use 3.5 Nm tightening torque to fix it.



WARNING:

Never use the device while any of the four M4x6 screws are removed.

4.2.5.3. RG2-FT



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

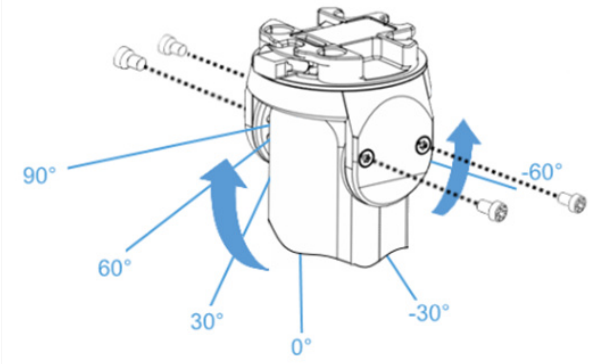
Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

To change the relative angle of the gripper to the Quick Changer:

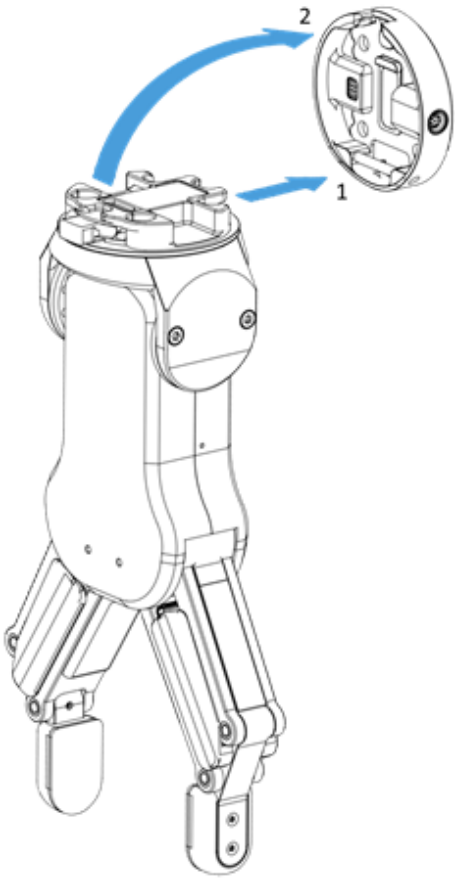
- first remove the four M4x6 screws
- tilt the gripper between -60° and 90°
- then put the four M4x6 screws back and use 3.5 Nm tightening torque to fix it.



WARNING:

Never use the device while any of the four M4x6 screws are removed.

4.2.5.4. RG6



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

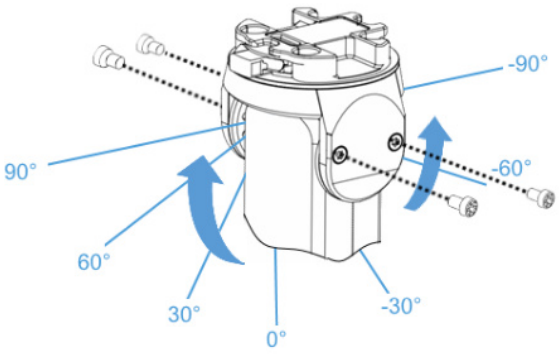
Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

To change the relative angle of the gripper to the Quick Changer:

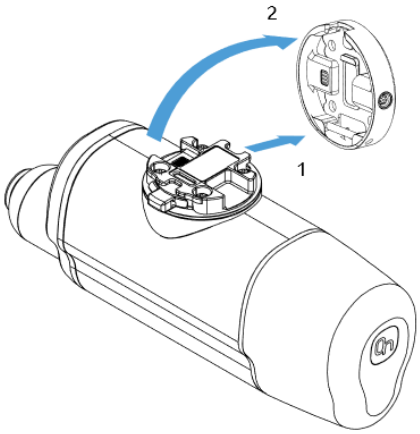
- first remove the four M4x6 screws
- tilt the gripper between -90° and 90°
- then put the four M4x6 screws back and use 3.5 Nm tightening torque to fix it.



WARNING:

Never use the device while any of the four M4x6 screws are removed.

4.2.5.5. Screwdriver



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

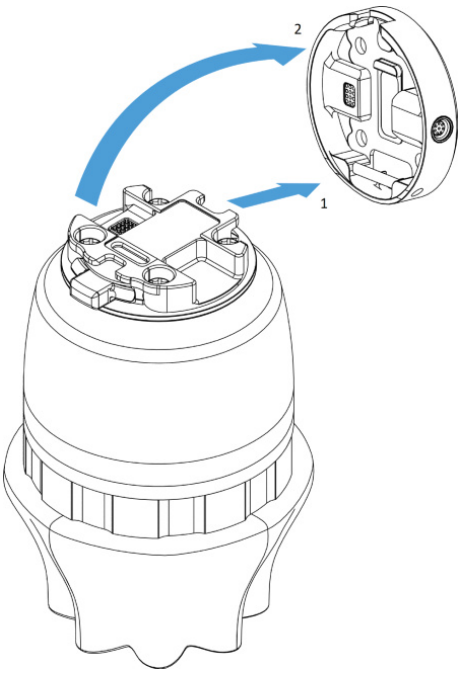
Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

CAUTION:

Make sure to use the 4.5A version of the Quick Changers.

4.2.5.6. SG



Step 1:

Move the tool close to the Quick Changer as illustrated.

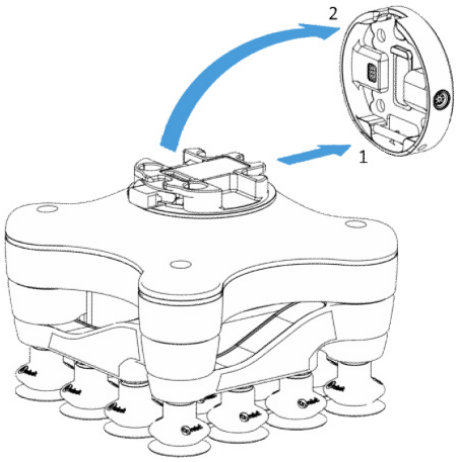
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

4.2.5.7. VG10



Step 1:

Move the tool close to the Quick Changer as illustrated.

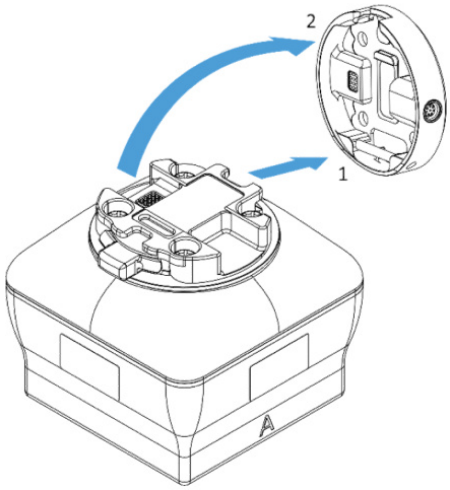
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

4.2.5.8. VGC10



Step 1:

Move the tool close to the Quick Changer as illustrated.

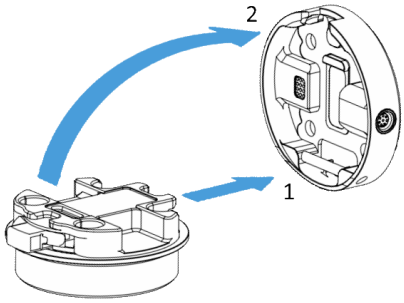
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

4.2.5.9. Quick Changer - Tool Side



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

4.3. Wiring

The two operation modes require different wiring.

DANGER:

Use only original OnRobot tool data cables.

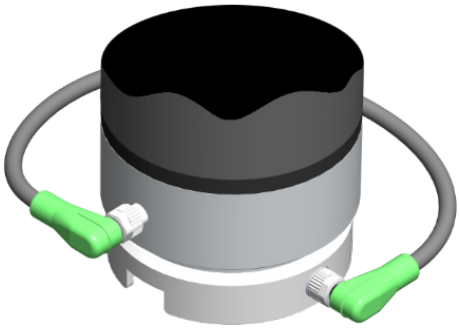
Via Tool Connector

This operation mode can be used with only one of these devices:

- 3FG15 (Only for e-Series)
- RG2 / RG6
- SG
- VG10 / VGC10

For e-Series

Connect the Quick Changer to the UR's tool connector.



DANGER:

Never connect the Quick Changer for I/O to an e-Series UR robot's Tool Connector.

NOTE:

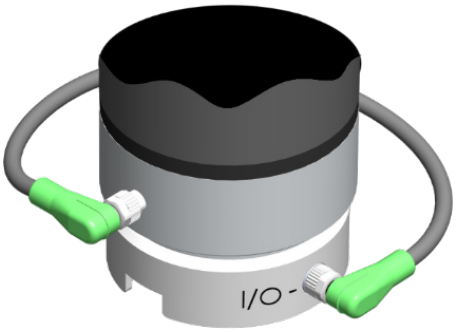
VG10 / VGC10 can only be attached when the UR controller is started (not in IDLE mode) and no program is running or completely powered off.

CAUTION:

Dual Quick Changer cannot be connected to the Tool Connector, it must be used via Compute Box.

For CB3

Connect the Quick Changer for I/O to the UR's tool connector.



DANGER:

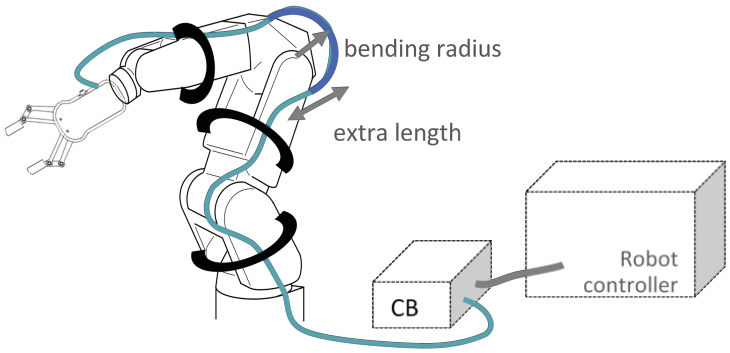
Never connect the Quick Changer or Dual Quick Changer to a CB3 UR robot's tool connector.

Wiring via Tool Connector is finished.

Via Compute Box

Three cables need to be connected to wire the system properly:

- Tool data cable between the tool(s) and the Compute Box
- Ethernet communication cable between the robot controller and the Compute Box
- Power supply of the Compute Box



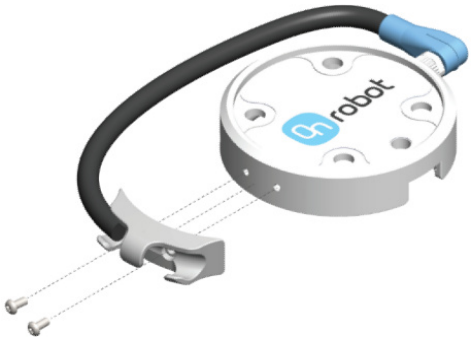
NOTE:

For the Quick Changer - Robot Side no cable is needed to be connected.

4.3.1. Tool Data Cable

4.3.1.1. 3FG15, RG2, RG6, Screwdriver, SG, VG10, VGC10

First connect the data cable to the tool.



Use the M8-8pin connector on the Quick Changer or on the Dual Quick Changer.

Use the cable holder as illustrated on the left.

CAUTION:

Make sure to use the supplied cable holder to prevent any excessive strain on the 90-degree M8 connector caused by the rotation of the cable.

Then route the Tool data cable to the Compute Box (CB) and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Also make sure that the cable bending radius is minimum 40mm (for the HEX-E/H QC it is 70mm).

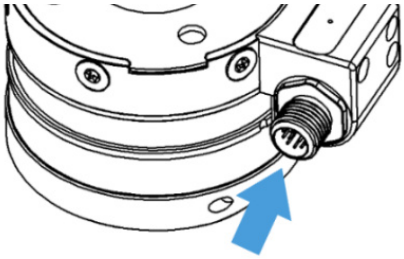
Finally, connect the other end of the Tool data cable to the Compute Box's DEVICES connector.

CAUTION:

Quick Changer and Dual Quick Changer can only be used to power OnRobot tools.

4.3.1.2. HEX-E/H QC

First connect the data cable to the tool.



Use the marked M12-12pin connector on the HEX-E/H QC.

Then route the Tool data cable to the Compute Box (CB) and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Also make sure that the cable bending radius is minimum 40mm (for the HEX-E/H QC it is 70mm).

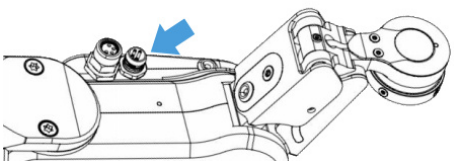
Finally, connect the other end of the Tool data cable to the Compute Box's DEVICES connector.

CAUTION:

Quick Changer and Dual Quick Changer can only be used to power OnRobot tools.

4.3.1.3. RG2-FT

First connect the data cable to the tool.



For RG2-FT the Quick Changer tool data connector cannot be used. Instead use the marked M8-4pin connector.

Then route the Tool data cable to the Compute Box (CB) and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Also make sure that the cable bending radius is minimum 40mm (for the HEX-E/H QC it is 70mm).

Finally, connect the other end of the Tool data cable to the Compute Box's DEVICES connector.

CAUTION:

Quick Changer and Dual Quick Changer can only be used to power OnRobot tools.

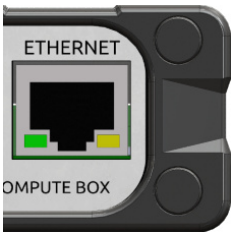
4.3.2. Ethernet Cable

Connect one end of the supplied Ethernet (UTP) cable to the robot controller's Ethernet (LAN) port.

NOTE:

If the robot controller's Ethernet port is in use, use a standard 4-port Ethernet switch to be able to use two network devices at the same time.

Connect the other end of the supplied cable to the Compute Box's ETHERNET connector.



CAUTION:

Use only shielded, maximum 3m long Ethernet cables.

WARNING:

Check and make sure that the Compute Box enclosure (metal) and the robot controller enclosure (metal) are not connected (no galvanic connection between the two).

4.3.3. Power Supply

Connect the supplied power supply to the Compute Box 24V connector.

Quick Changer	3FG15	HEX-E/H QC	RG2/6	RG2-FT	Screwdriver	VG10/VGC10
1.5 A	✓	✓	✓	✓	X	✓
5 A	✓	✓	✓	✓	✓	✓

NOTE:

To disconnect the power connector, make sure to pull the connector housing (where the arrows are shown) and not the cable.

CAUTION:

Use only original OnRobot power supplies.

Finally, power up the power supply that will power the Compute Box and the connected Tool(s).

5. SW Installation

5.1. Install URCap

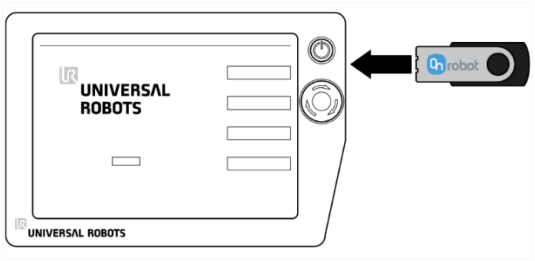
UR CB3

NOTE:

The minimum UR PolyScope version is **3.10**. Please remove all previous OnRobot URCap version(s) before the installation. The controller version must be CB3.1.

For the HEX-E/H QC products the **3.12** is not recommended.

1. Insert the OnRobot USB drive in the USB slot on the right side of the Teach Pendant.



2. Select the **Setup Robot** option from the main menu, then the **URCaps** option.

3. Tap on the **+** sign to browse for the OnRobot URCap file. It can be found in the usbdisk/UR/URCAP folder. Tap on **Open**.

UR e-Series

NOTE:

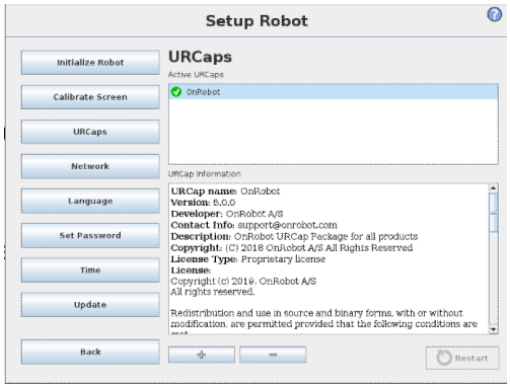
The minimum UR PolyScope version is **5.4**. Please remove all previous OnRobot URCap version(s) before the installation.

For the HEX-E/H QC products the **5.6** is not recommended, instead please use the **5.7**.

1. Insert the OnRobot USB drive in the USB slot on the top right side of the Teach Pendant.

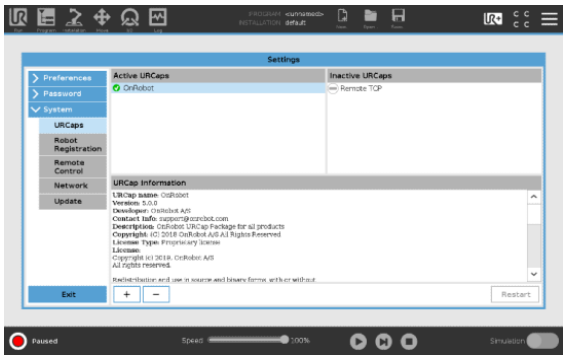
2. Then tap on the menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.
3. Tap on the + sign to browse for the OnRobot URCap file. It can be found in the usbdisk/UR/URCAP folder. Tap on Open.

4. The system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



5. Initialize the robot.

4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



5. Initialize the robot.

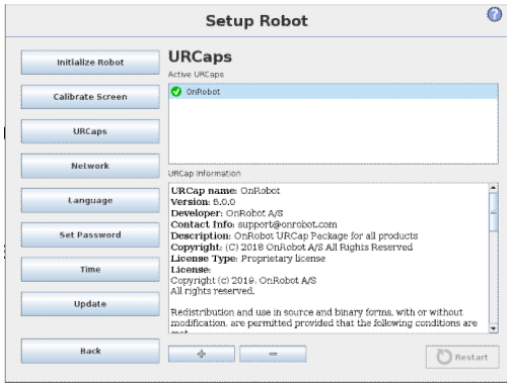
NOTE:

For more information on the URCap installation please refer to UR documentation.

5.2. Uninstall Software

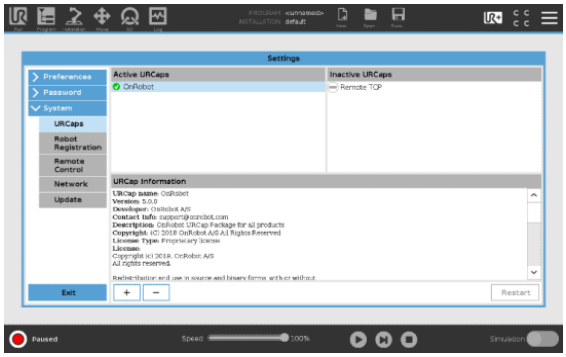
UR CB3

1. Select the **Setup Robot** option from the main menu, then the **URCaps** option.
2. Select the OnRobot URCap file.
3. Tap on the - sign.
4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



UR e-Series

1. Tap on the ☰ menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.
2. Select the OnRobot URCap file.
3. Tap on the - sign.
4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.

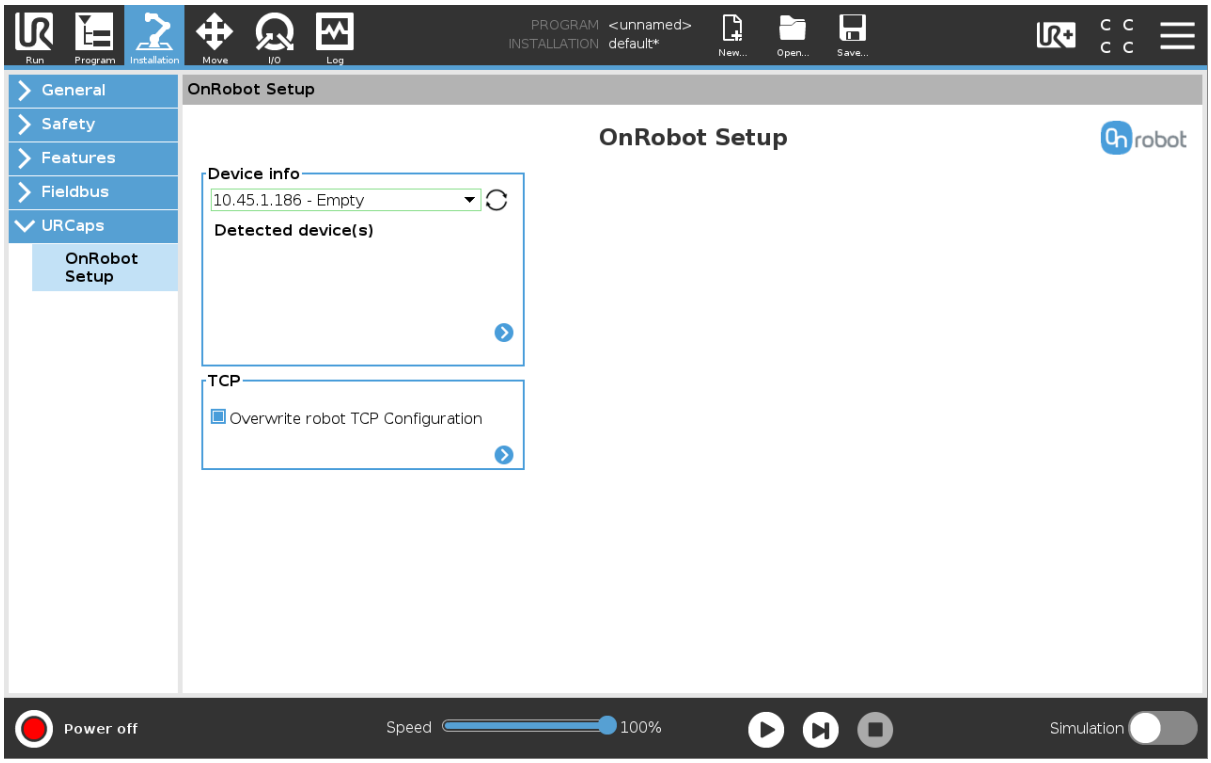


5. Initialize the robot.

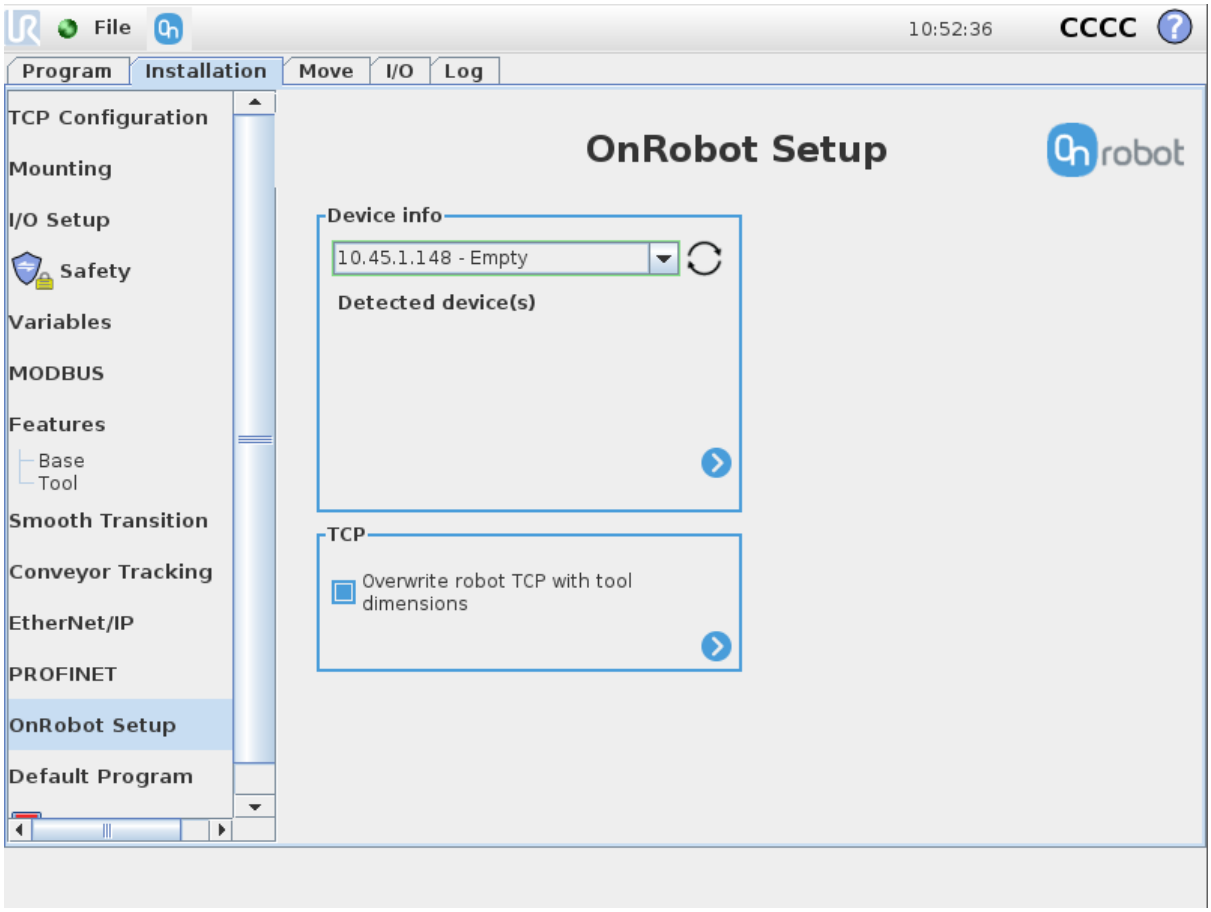
5. Initialize the robot.

5.3. URCap Setup

For the e-Series UR robots, tap on the **Installation** tab in the top menu. Then tap on the **URCaps**.

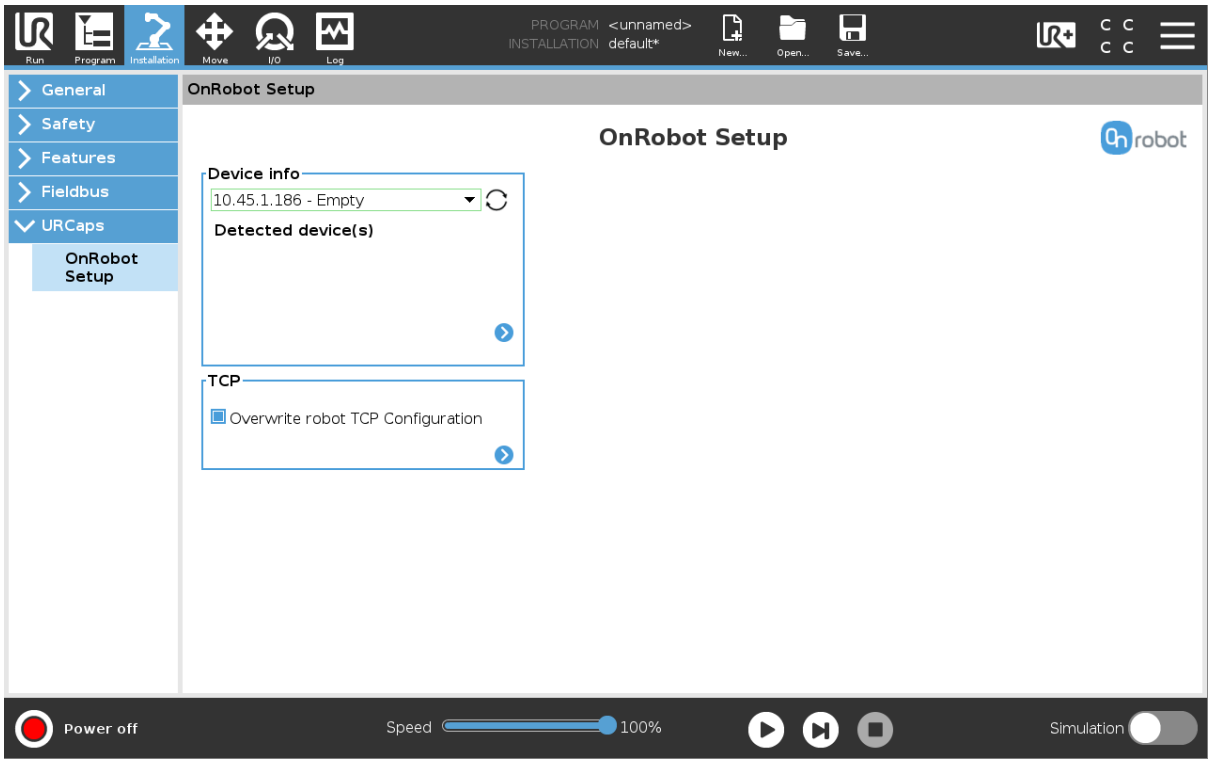


For the CB3 UR robots select the **Installation** tab, then select **OnRobot Setup**. The following screen is shown:



Device info

In the normal view of the panel, the available functions are shown below:



Dropdown menu to select a device-robot communication channel: Select whether you want to discover the devices connected to the tool connector or to the compute box.

Use the reload button to find new available devices.

NOTE:

To use the newly discovered devices you might need to restart PolyScope. To do that simply press the **Restart now** button. Remember to save it before, if there are any unsaved changes in your program or settings.

NOTE:

After setting up the device the changes need to be saved to be part of the current installation.

For the e-Series UR robots tap on the **Save** button (from the top menu and use the **Save Installation** button .

For the CB3 UR robots use the **Save** button .

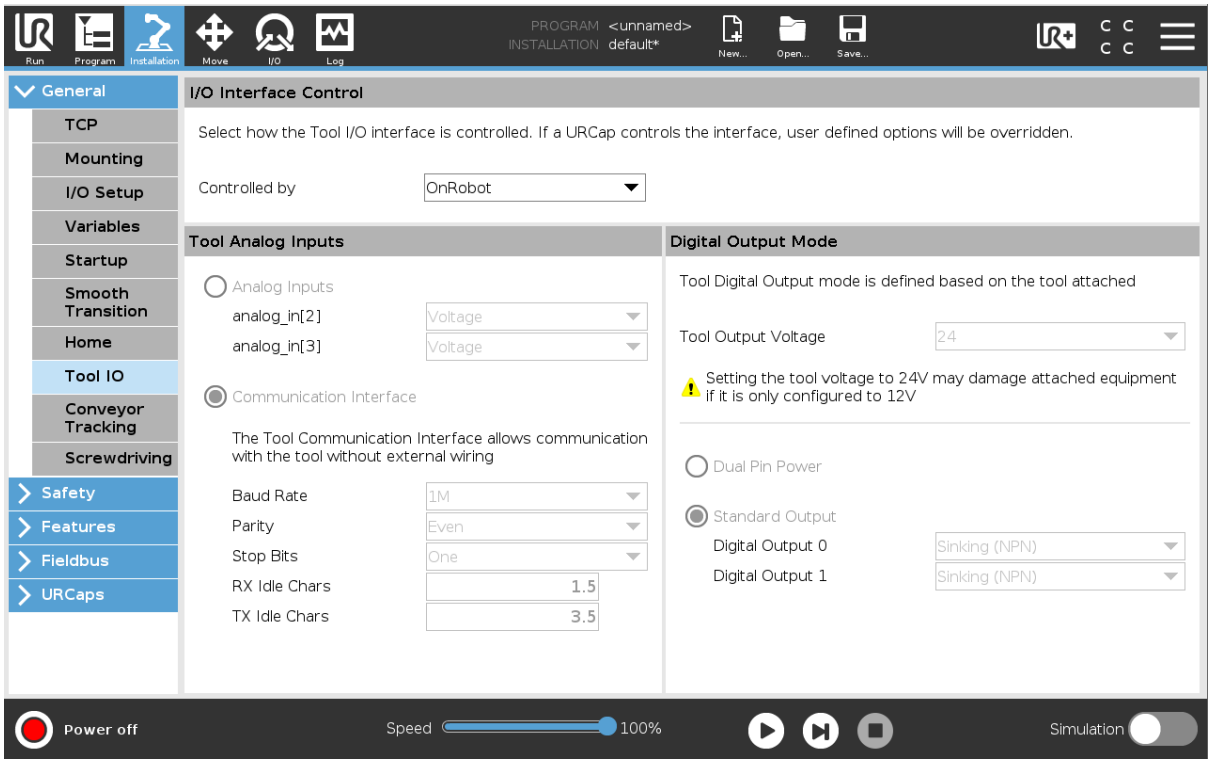
NOTE:

OnRobot products are checked after the robot is restarted and the saved settings are restored while loading a program. That check could take up to 5 seconds via the Quick Changer for I/O. Therefore make sure to wait at least 5 seconds before you start your program. To make sure that the device is connected check the **Device info**.

If the connected OnRobot product is changed, always go to the **Device info** to check if the change was successful.

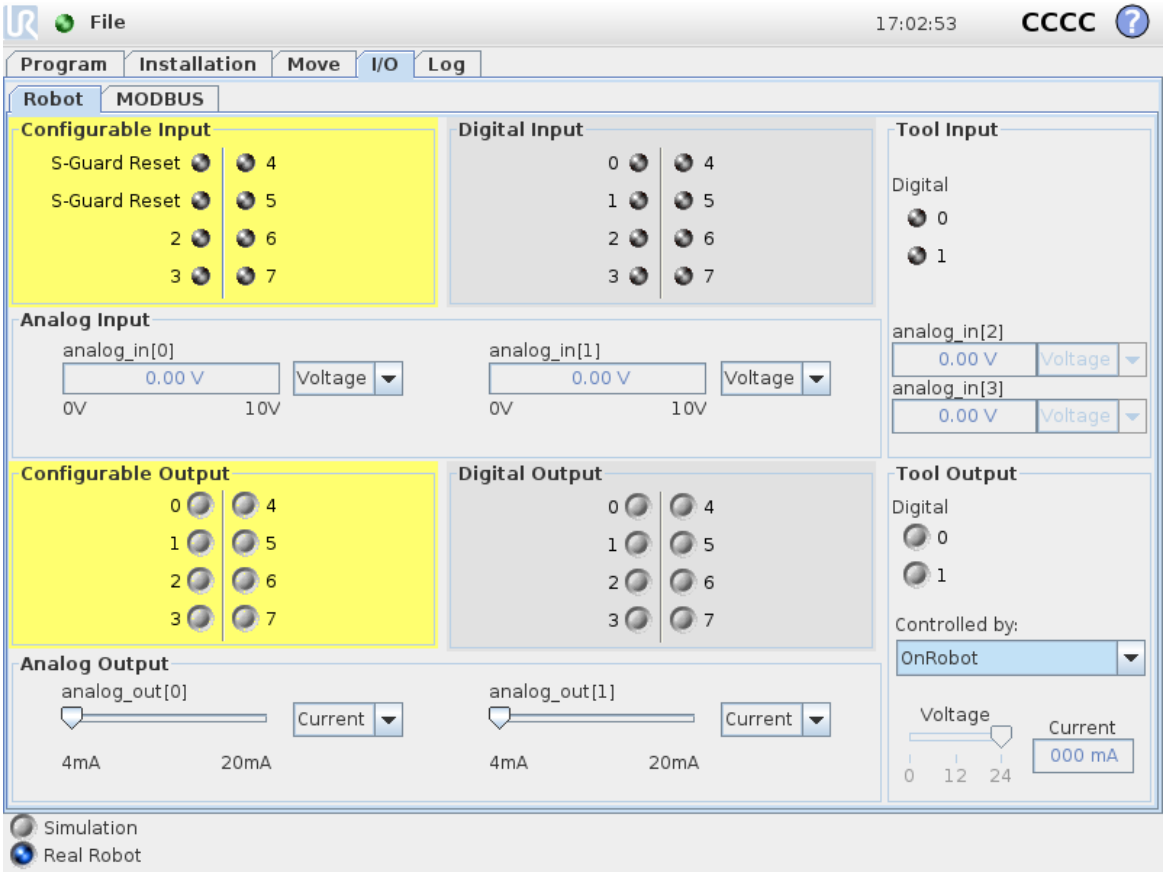
To communicate through the tool connector on an e-Series UR robot please set the following configuration:

1. Press the **General** dropdown menu on the left side.
2. Press the **Tool IO** tab.
3. In the **Controlled by** dropdown menu select **OnRobot** as shown in the image below.
4. Make sure to save the changes to be part of the current installation.



To communicate through the tool connector on CB3 UR robot please set the following configuration:

1. Go to the **I/O** tab.
2. In the **Controlled by** dropdown menu select **OnRobot** as shown in the image below.
3. Make sure to save the changes to be part of the current installation.



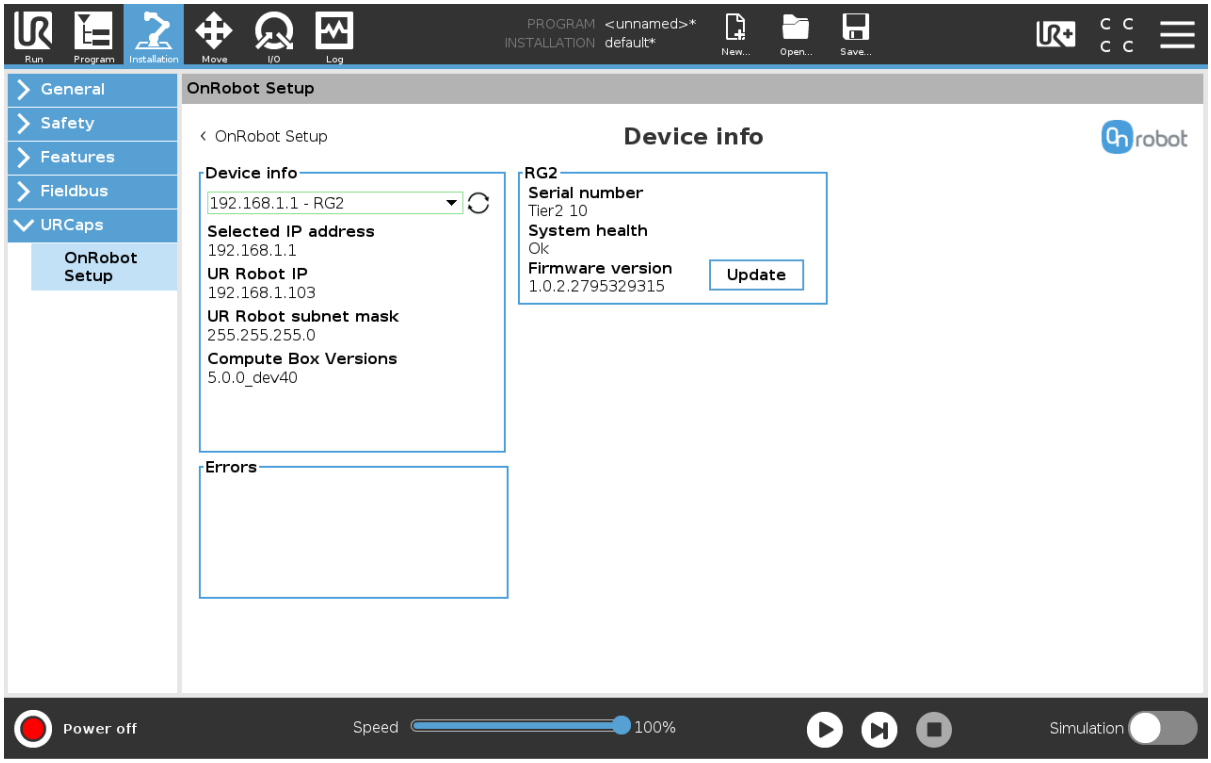
NOTE:

If the Tool connector option is selected in the **Device info** drop-down menu but no OnRobot product is connected to the tool connector then a background service program is running every 2 seconds. In addition to that the Tool IO is set to be logic high and low randomly.

CAUTION:

After any error message is shown that is related to the connection to our devices, please go to the **Device info** to make sure that the right settings (e.g.: TCP) are used.

To get more information about the devices press on and the following screen will show:



Device info
The **Selected IP address**, **Compute Box Versions**, **UR Robot IP** and **UR Robot subnet mask** are shown.

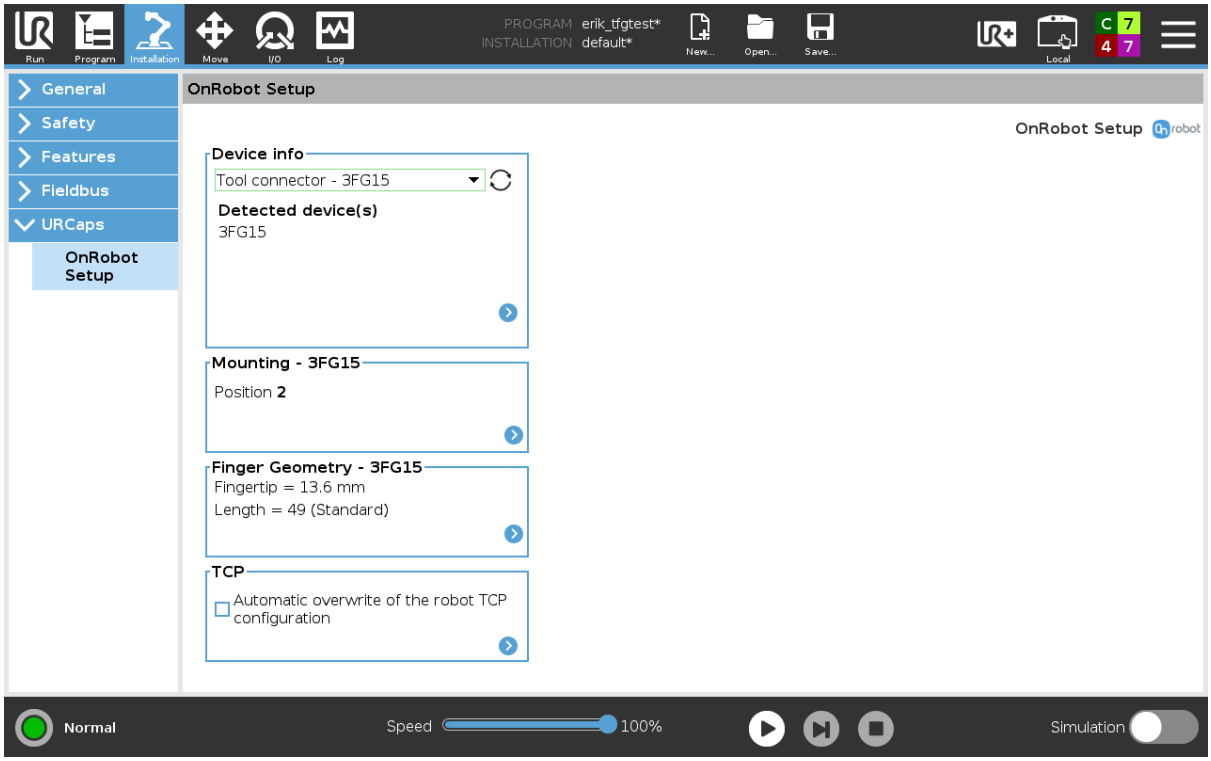
Errors
This displays information about the errors if there is any.

Device name
The **Serial number**, **System health** and **Firmware version** are shown.
Update: this will update the firmware if an update is available.

Depending on the selected devices, different panels will become available to configure the devices.

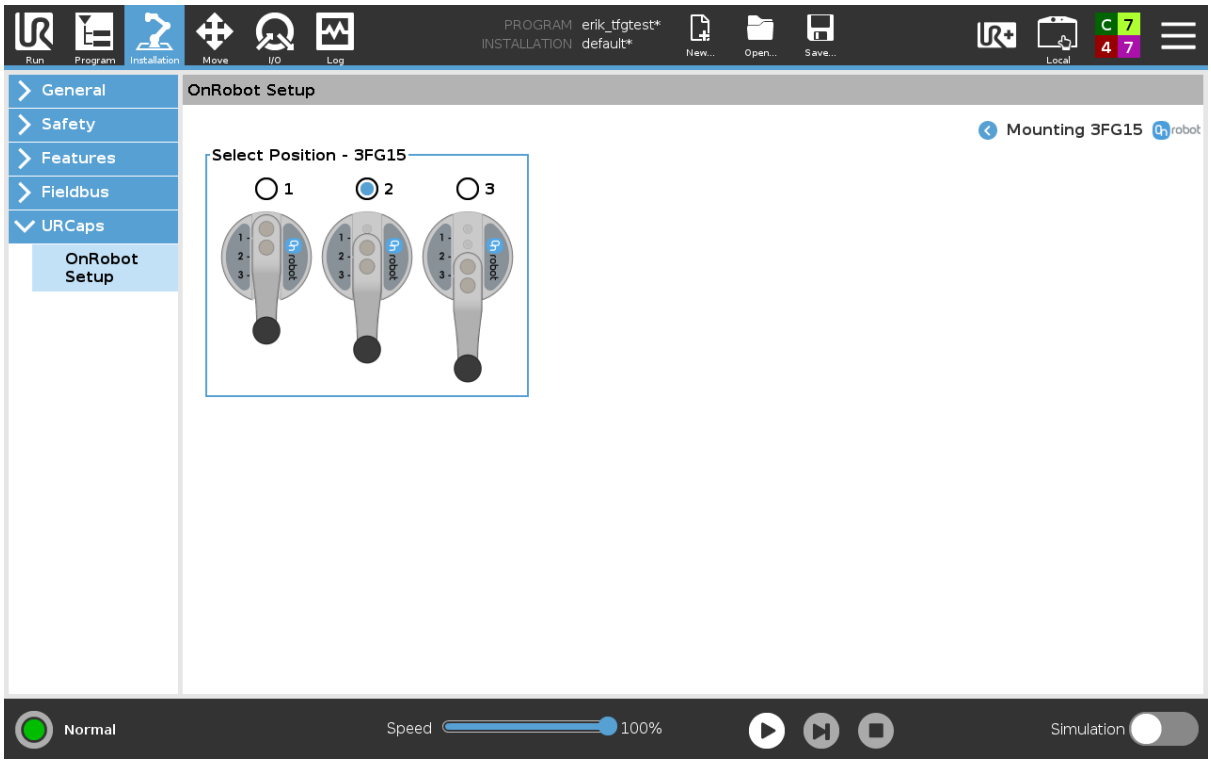
5.3.1. 3FG15

The configuration panels for the 3FG15 are shown in the image below:



Mounting

In the normal view of the panel, the selected **Position** is shown. Different **Mounting Positions** will allow to achieve different diameters and forces. Find more information in section Gripping Force and different Gripping Diameter. To select a different Mounting Position press on .

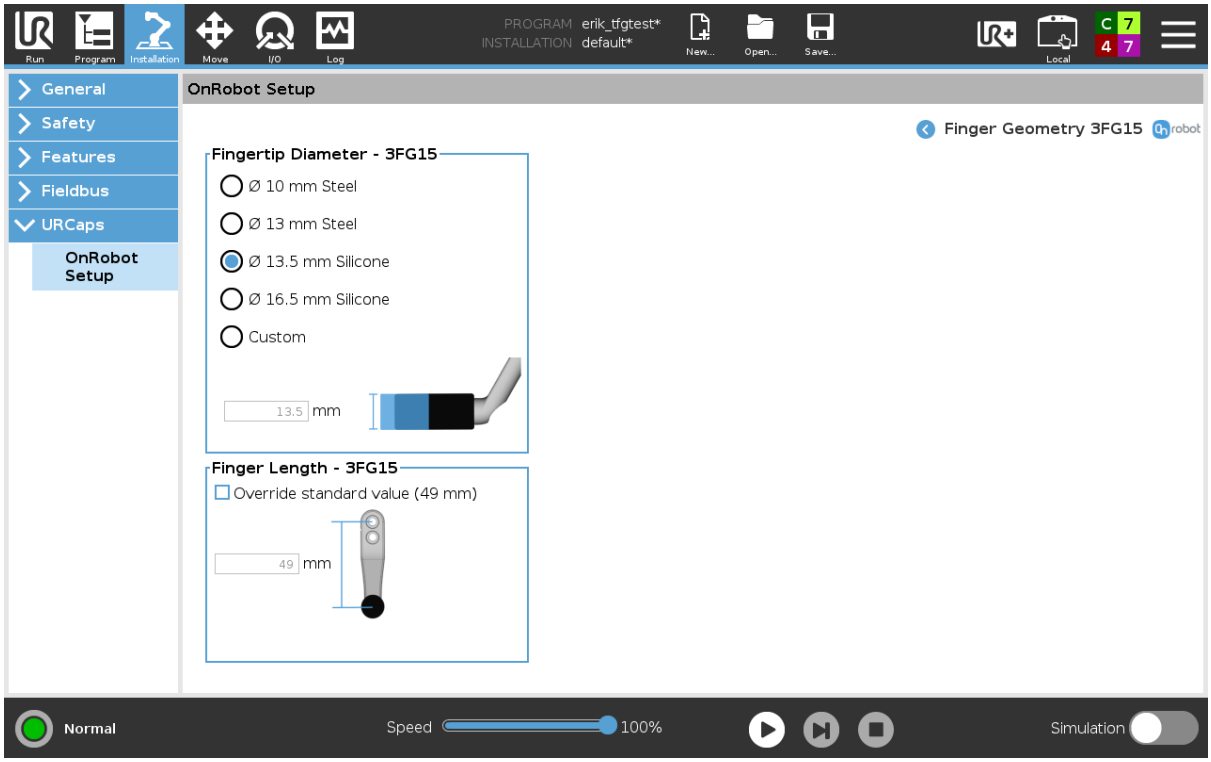


NOTE:

The new selected **Mounting Position** will be saved in the gripper and not in the installation file. Therefore, if the gripper is moved to another robot, the settings will remain the same. However, if another gripper is used in the same robot the settings might need to be reset again.

Finger Geometry

In the normal view of the panel, the selected **Fingertip Diameter** and **Length** are shown. These two settings will, as well as the **Mounting**, allow to achieve different diameters and forces. Find more information in section Gripping Force and different Gripping Diameter. To select a different **Fingertip Diameter** and/or **Length** press on .



Fingertip Diameter

The 4 different types that are delivered with the gripper can be selected by pressing the radio button. If customized fingertips are made, the custom option can be selected, and the new diameter can be entered in the input field. The selection of a fingertip diameter will automatically change the allowed diameter and force ranges in the commands.

Finger Length

If customized fingers are made, the **Override standard value (49 mm)** can be selected and the **Finger Length** can be entered in the input field. This value will automatically change the allowed diameter and force ranges in the commands.

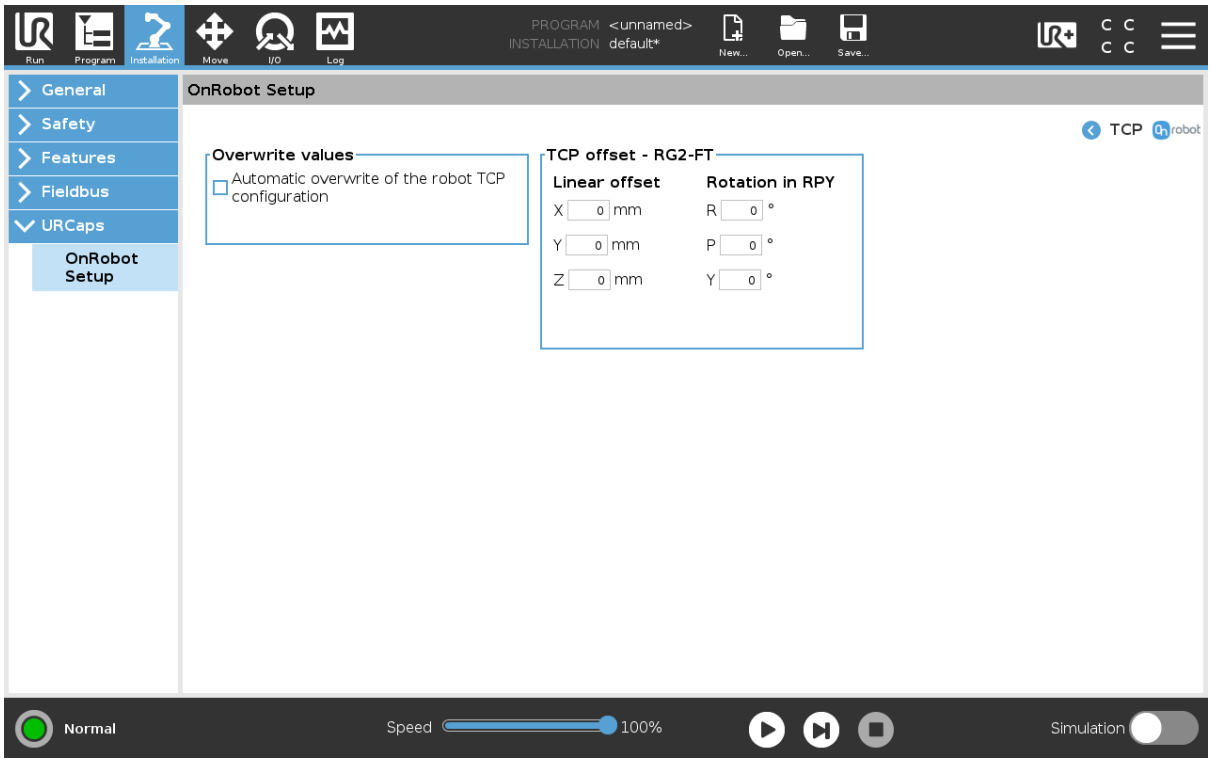
NOTE:

The changes in the **Finger Geometry** settings will be saved in the gripper and not in the installation file. Therefore, if the gripper is moved to another robot, the settings will remain the same. However, if another gripper is used in the same robot the settings might need to be reset again.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

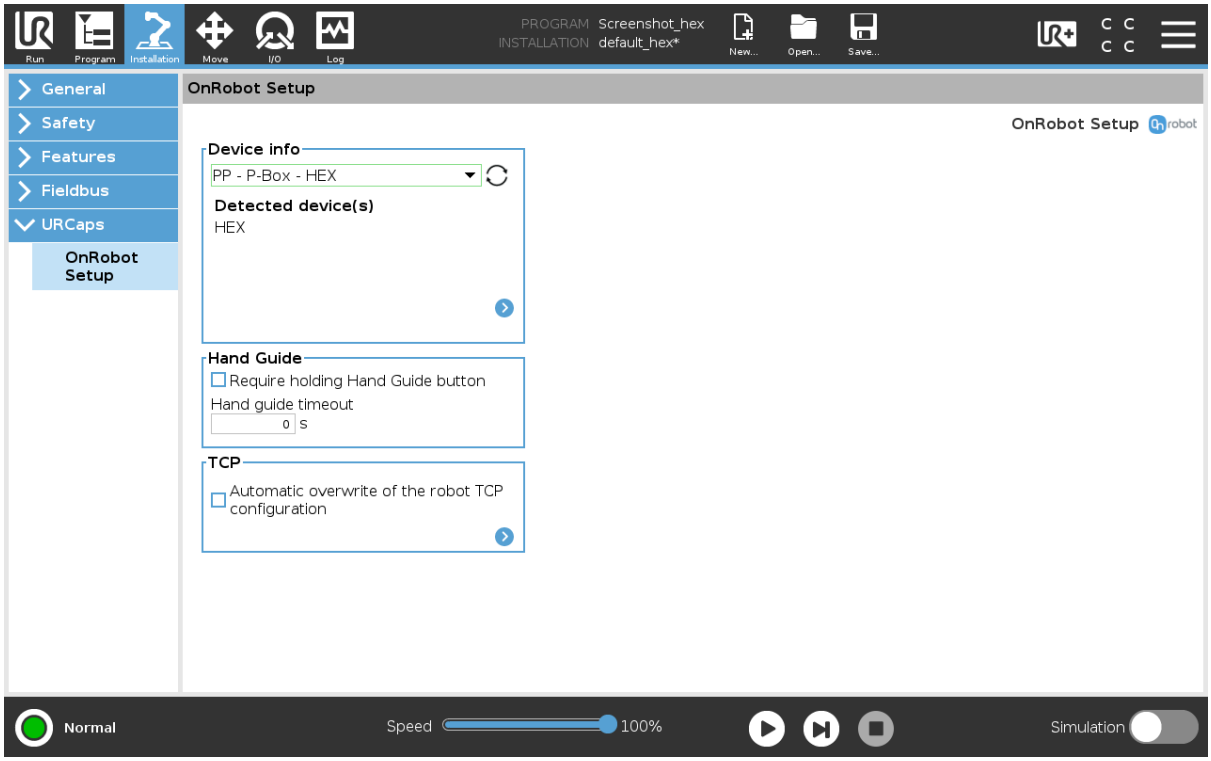
For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

5.3.2. HEX

The configuration panels for the HEX are shown in the image below:



Hand Guide

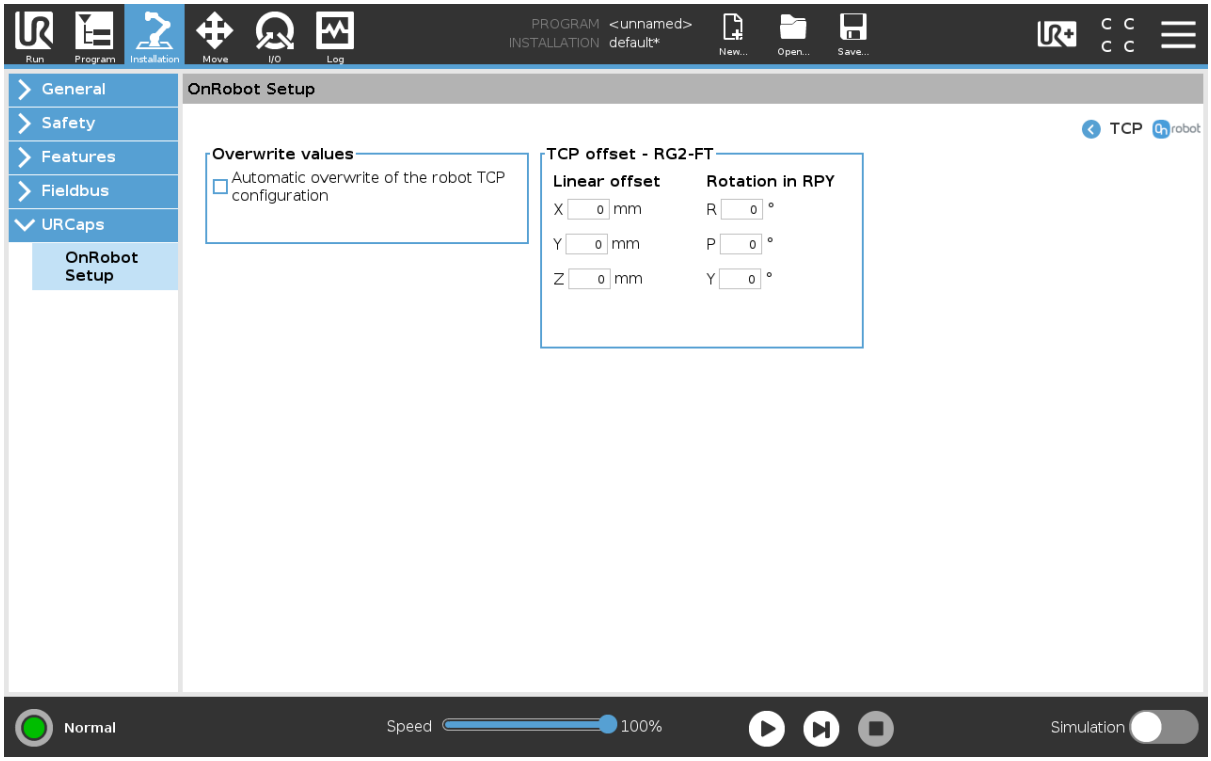
Require holding Hand Guide button: If checked (recommended) the Hand Guide enable button needs to be pressed constantly during the hand guiding. If unchecked, the hand guiding could be started by pressing the enable button and stopped by pressing the enable button again.

Timeout: After the set timeout value, the hand guiding will be stopped automatically. The default value is 0 that sets the timeout to infinite.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

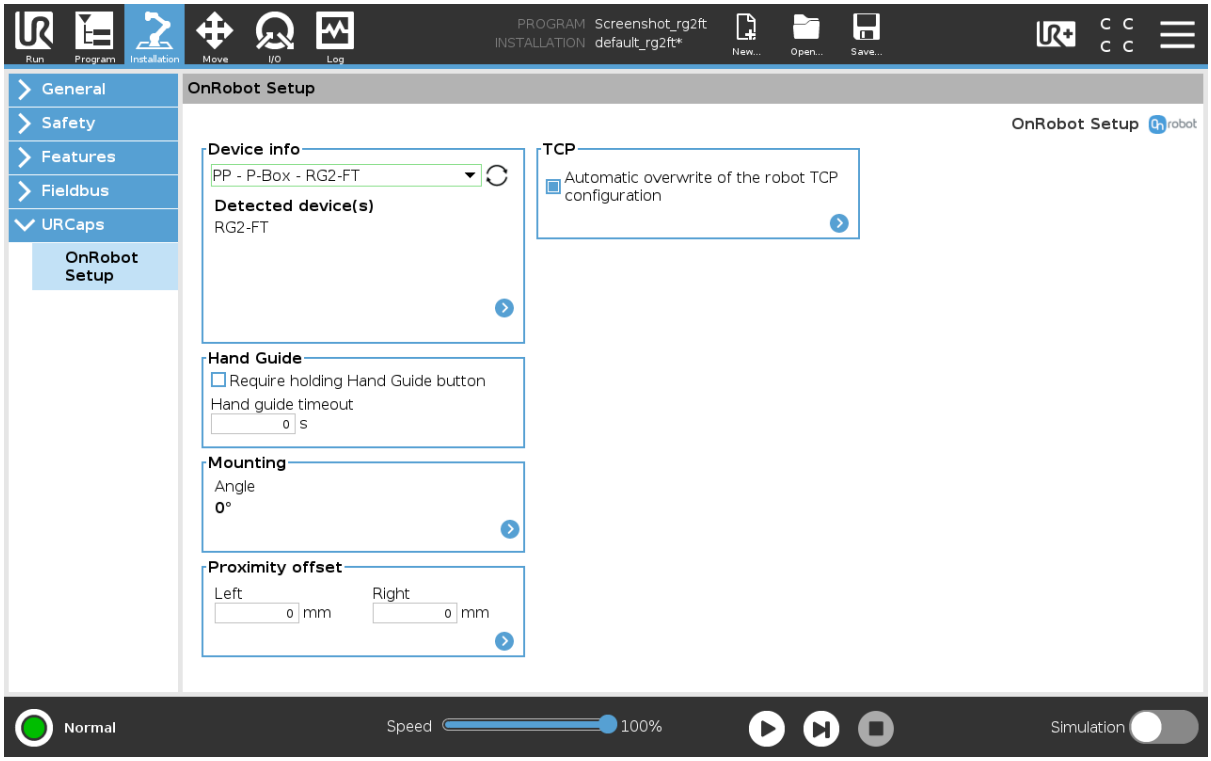
For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

5.3.3. RG2-FT

The configuration panels for the RG2-FT are shown in the image below:



Hand Guide

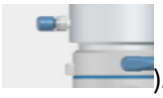
Require holding Hand Guide button: If checked (recommended) the Hand Guide enable button needs to be pressed constantly during the hand guiding. If unchecked, the hand guiding could be started by pressing the enable button and stopped by pressing the enable button again.

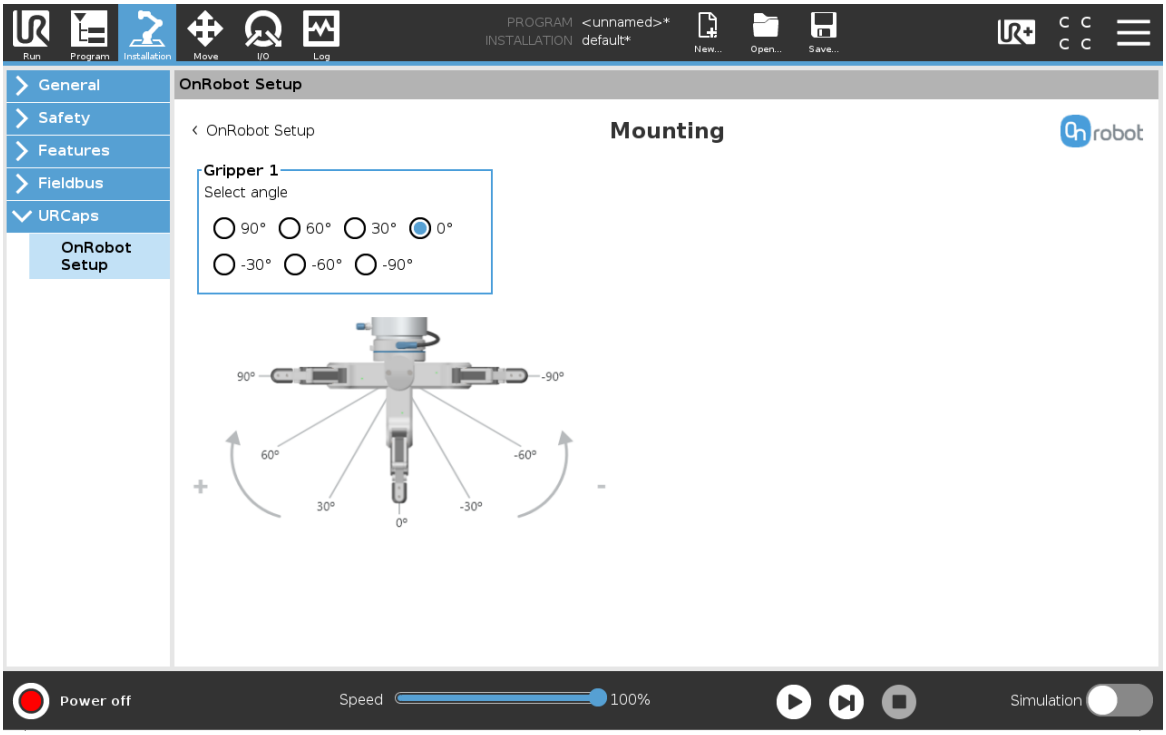
Timeout: After the set timeout value, the hand guiding will be stopped automatically. The default value is 0 that sets the timeout to infinite.

Mounting

In the normal view of the panel, the selected mounting angle is shown. To set the mounting angle press on .

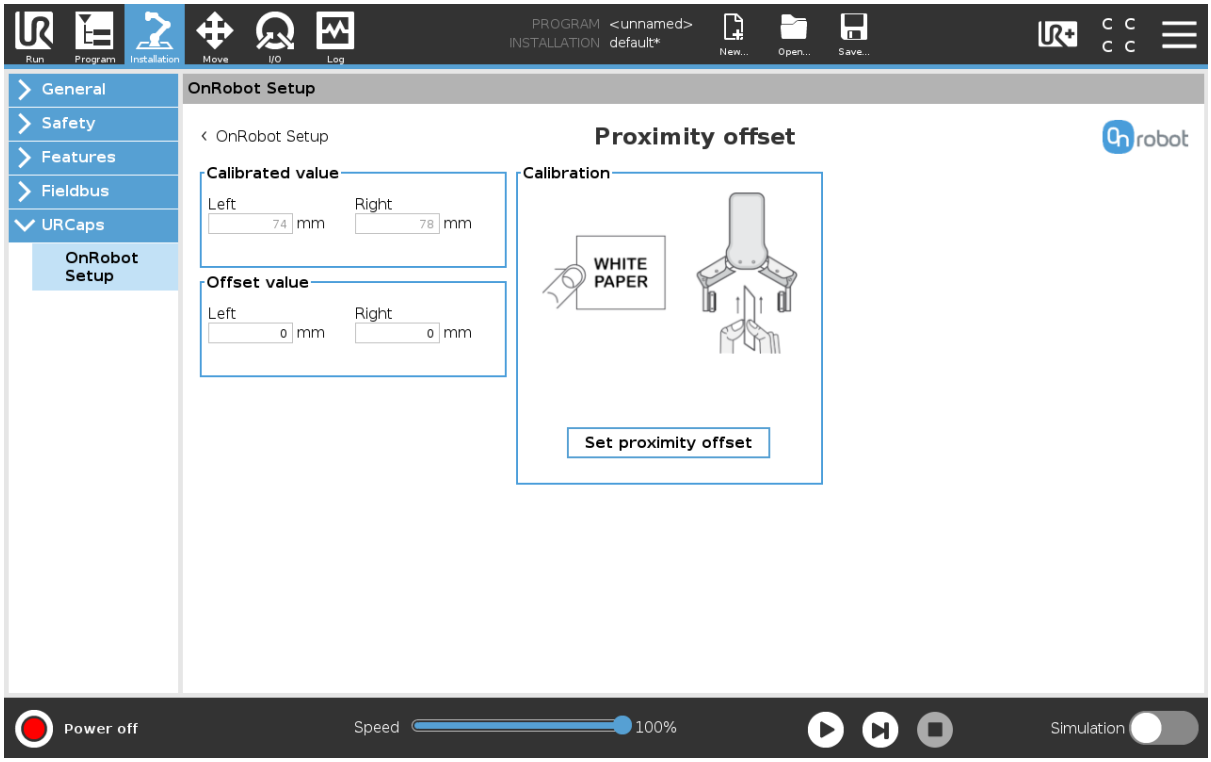
If only one gripper is mounted, follow the steps bellow. If there are 2 grippers, follow the steps half a page below.

1. Make sure you are looking at the cable from the same side as it is shown on the picture .
2. Select the angle the gripper is mounted with (positive angle towards the Quick Changer release button ).



Proximity offset

In the normal view of the panel, the set values are shown. To change the values, press on and the following screen will show:

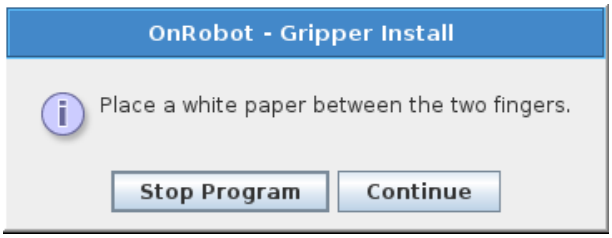


Calibrated value: shows the value to use for the application. This value is calculated as the **Raw value** minus the **Offset value**.

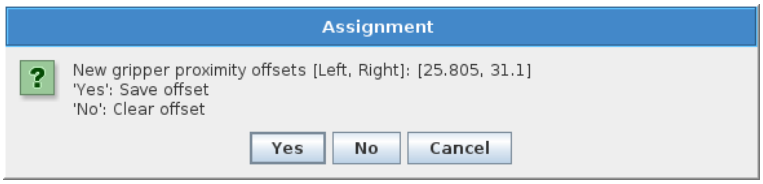
Offset value: shows the value that, after calibration, will compensate the **Raw value** to have usable **Calibrated value**.

Calibration
To calibrate the proximity sensor, follow the steps below.

1. Prepare a white paper and tap on **Set proximity offset**.
2. The gripper is opened (if it was closed) and a popup window will be shown.



3. Place the white paper between the fingers and tap on **Continue**.
4. The gripper will close and make a measurement to set the right offset. Wait until the gripper is closed.
5. Once the gripper is opened the measurement is ready.

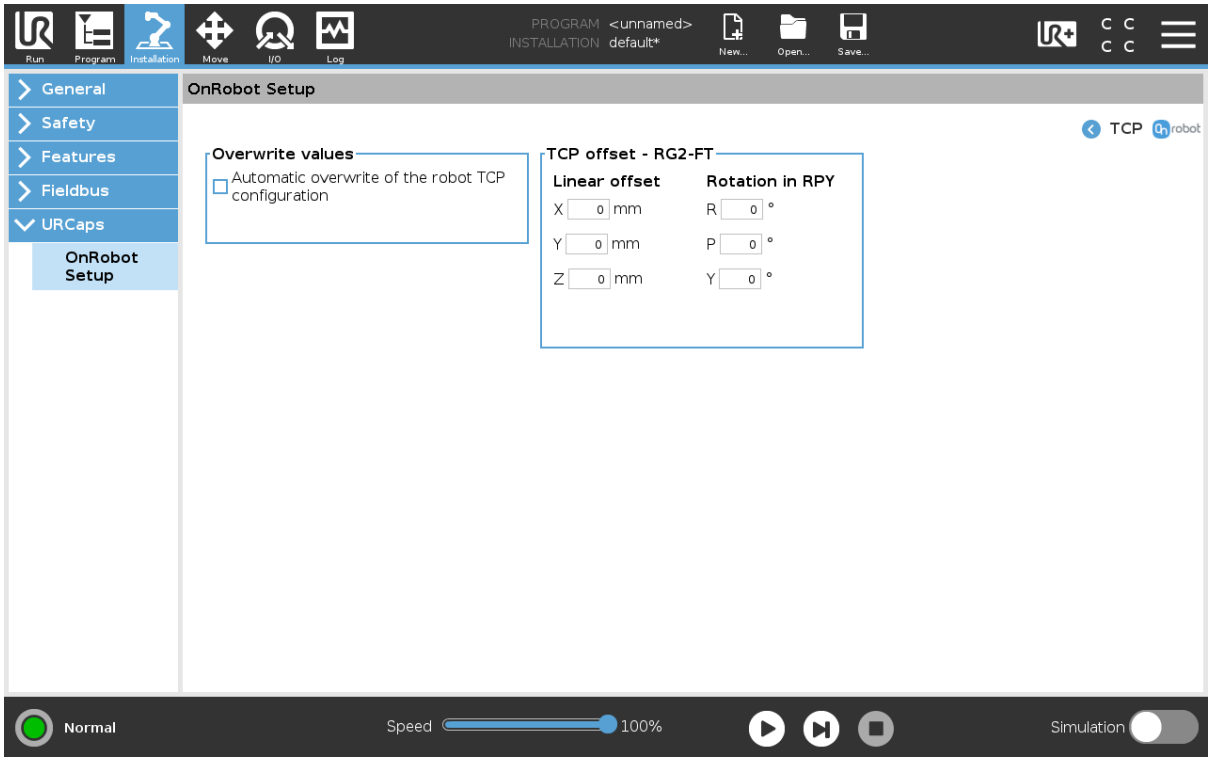


6. Tap on **Yes** to save the new offset and the setup is finished. To clear any offset previously been set tap on **No**. To prevent any changes of the proximity offsets, tap on **Cancel** and confirm it by taping on that again.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

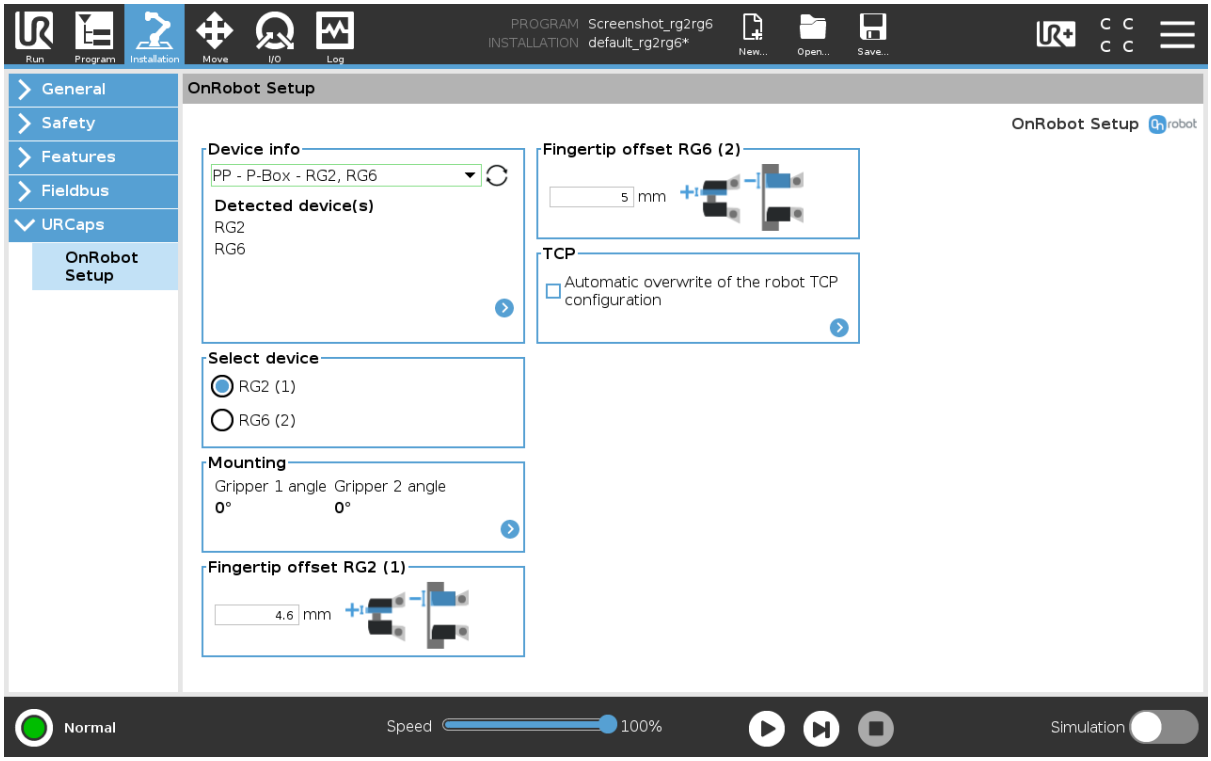
For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

5.3.4. RG2/6

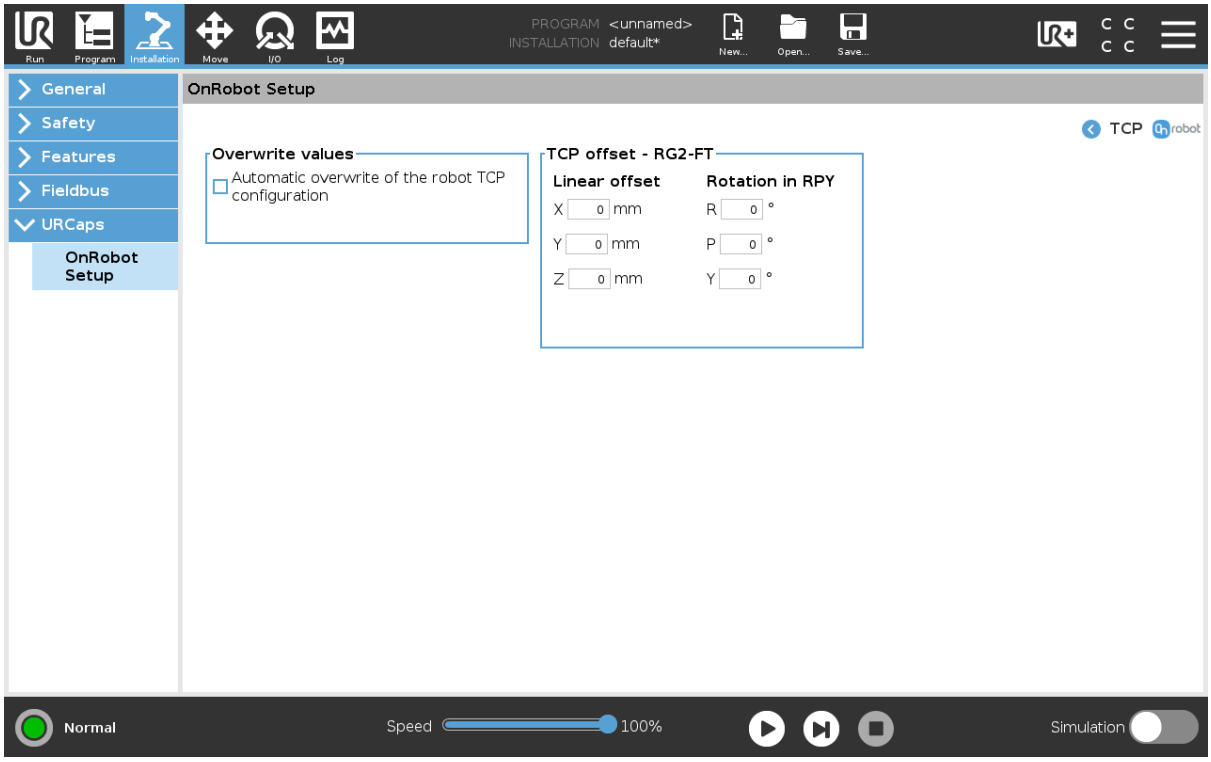
The configuration panels for the RG2/6 are shown in the image below:



TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

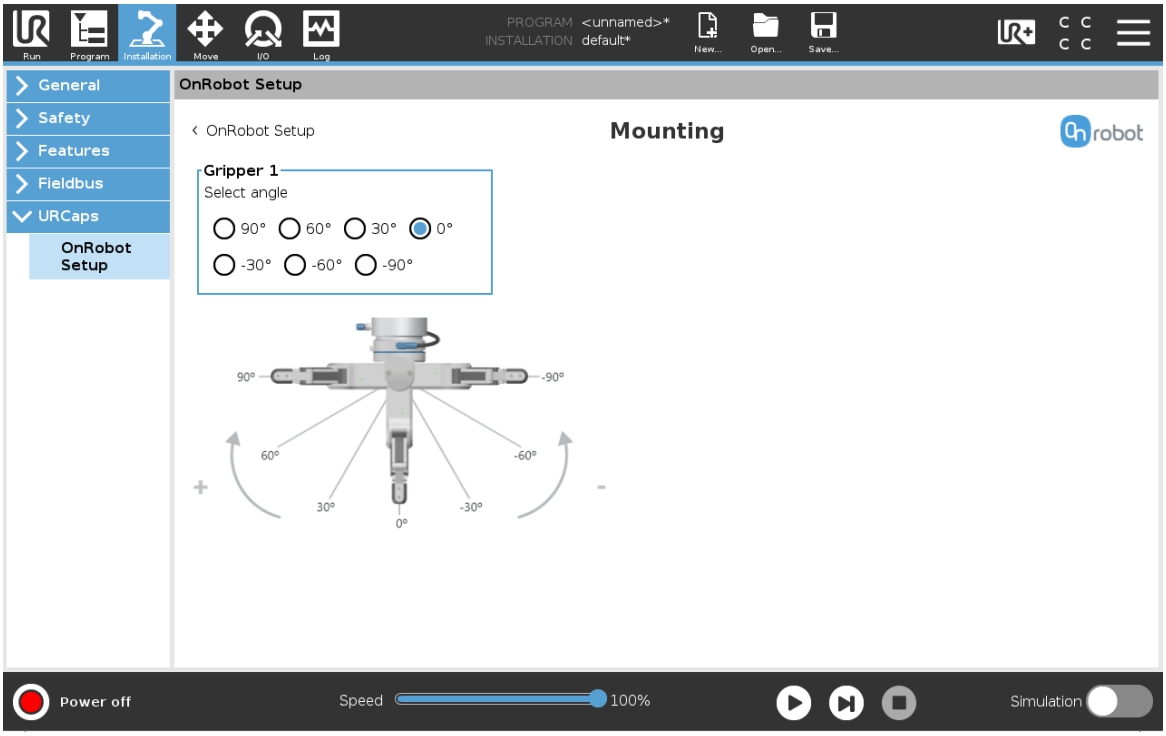
Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Mounting

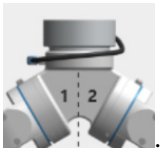
In the normal view of the panel, the selected mounting angle is shown. To set the mounting angle press on .

If only one gripper is mounted, follow the steps bellow. If there are 2 grippers, follow the steps half a page below.

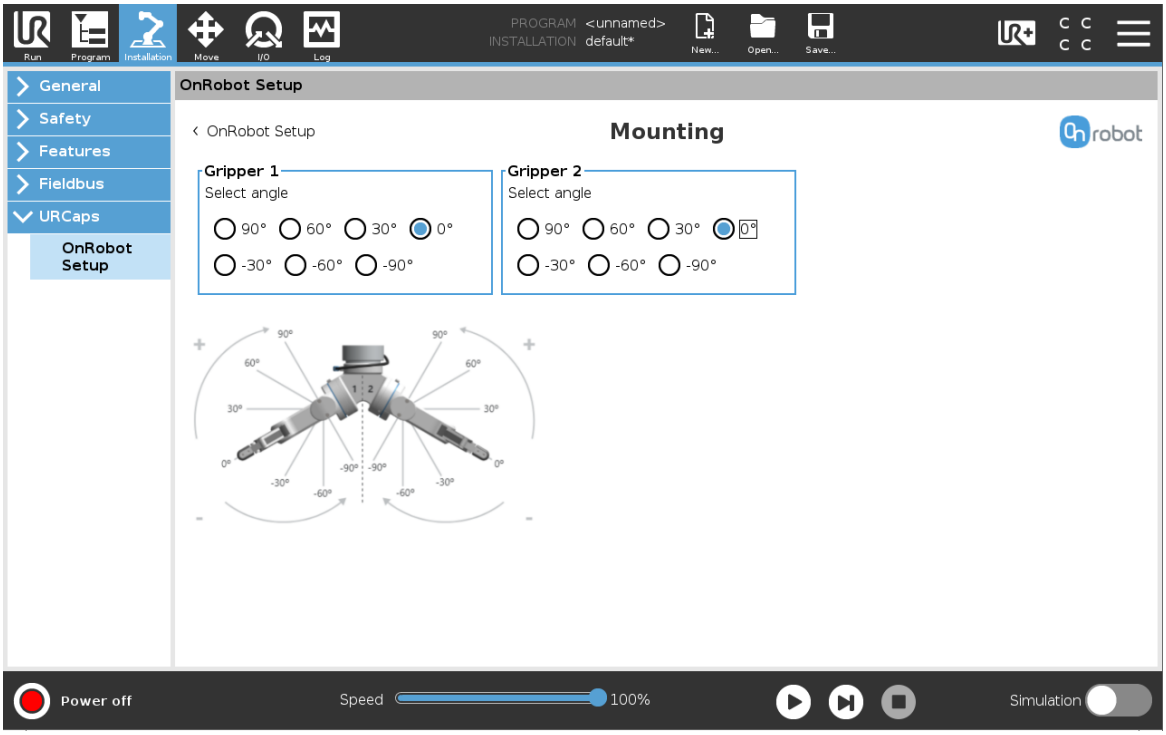
1. Make sure you are looking at the cable from the same side as it is shown on the picture .
2. Select the angle the gripper is mounted with (positive angle towards the Quick Changer release button).



If two grippers are mounted, follow the steps bellow:

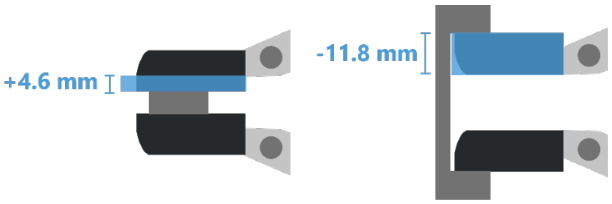
1. When looking at the grippers, make sure that the Quick Changer is orientated with the part 1 on the left side and the part 2 on the right side 

. The numbers are written on the side of the Quick Changer that connects to the robot.
2. Select the angle of one gripper and then select the angle of the other gripper (positive angle towards the Quick Changer release button).



Fingertip offset

This is used to specify the distance from the inside of the gripper's aluminum fingertip to the reference point on the attached fingertip. The Fingertip offset for the Standard Fingertips is 4.6 mm when placed in the inner side and - 11.8 mm when placed in the outer side (see image below).



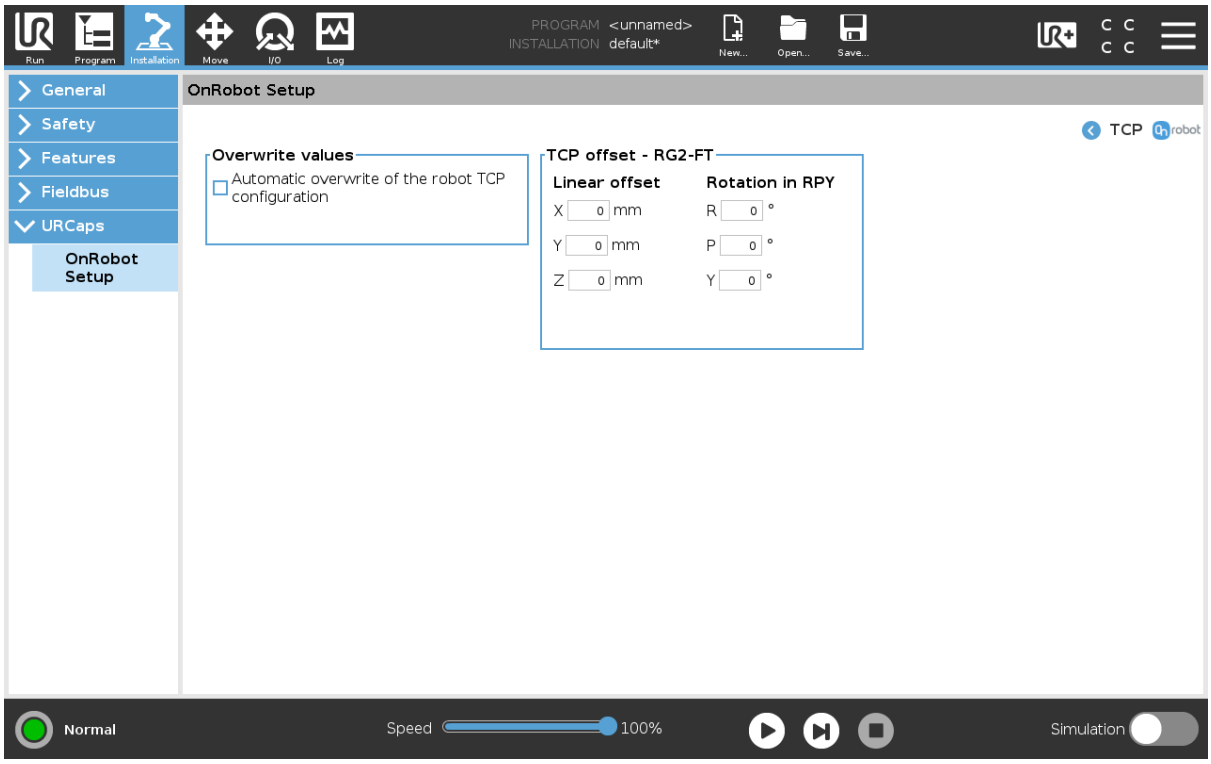
5.3.5. Screwdriver

The Screwdriver does not need any software installation to be setup. Only changes in the TCP part if needed.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

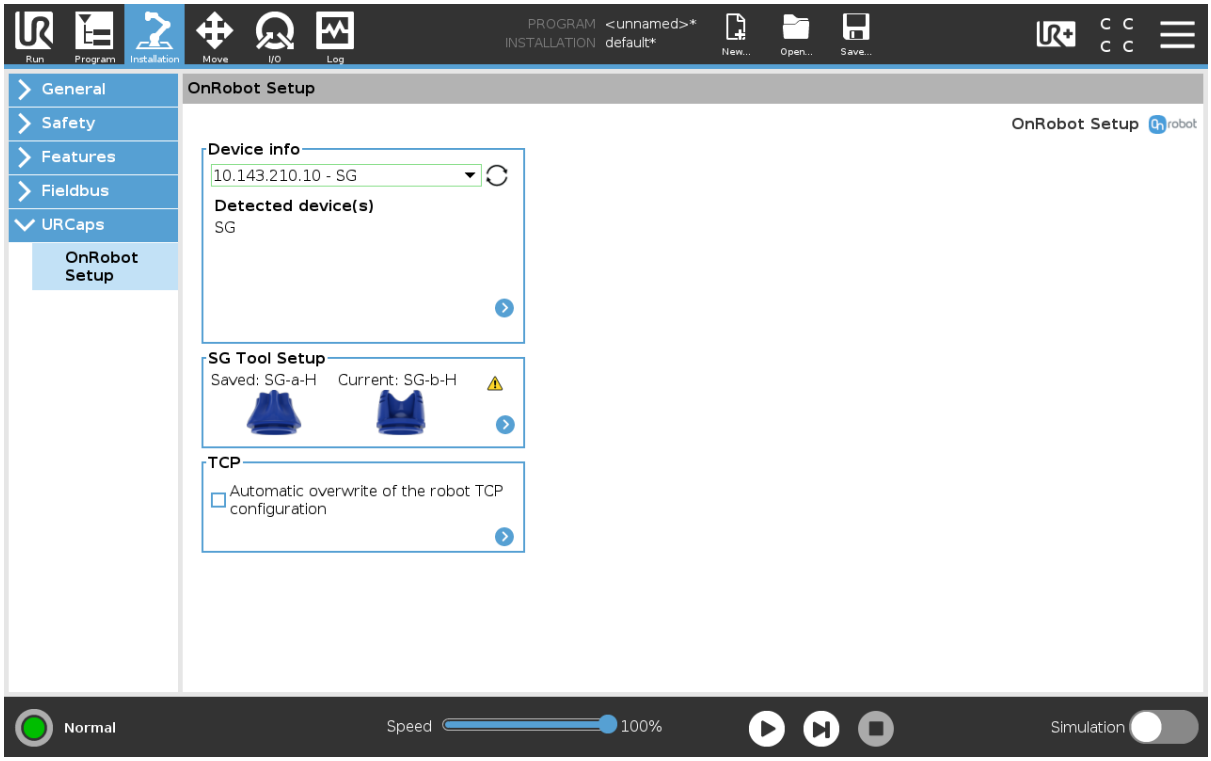
For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

5.3.6. SG

The configuration panels for the SG are shown in the image below:



SG Tool Setup

In the normal view of the panel, the **Saved** tool can be seen.

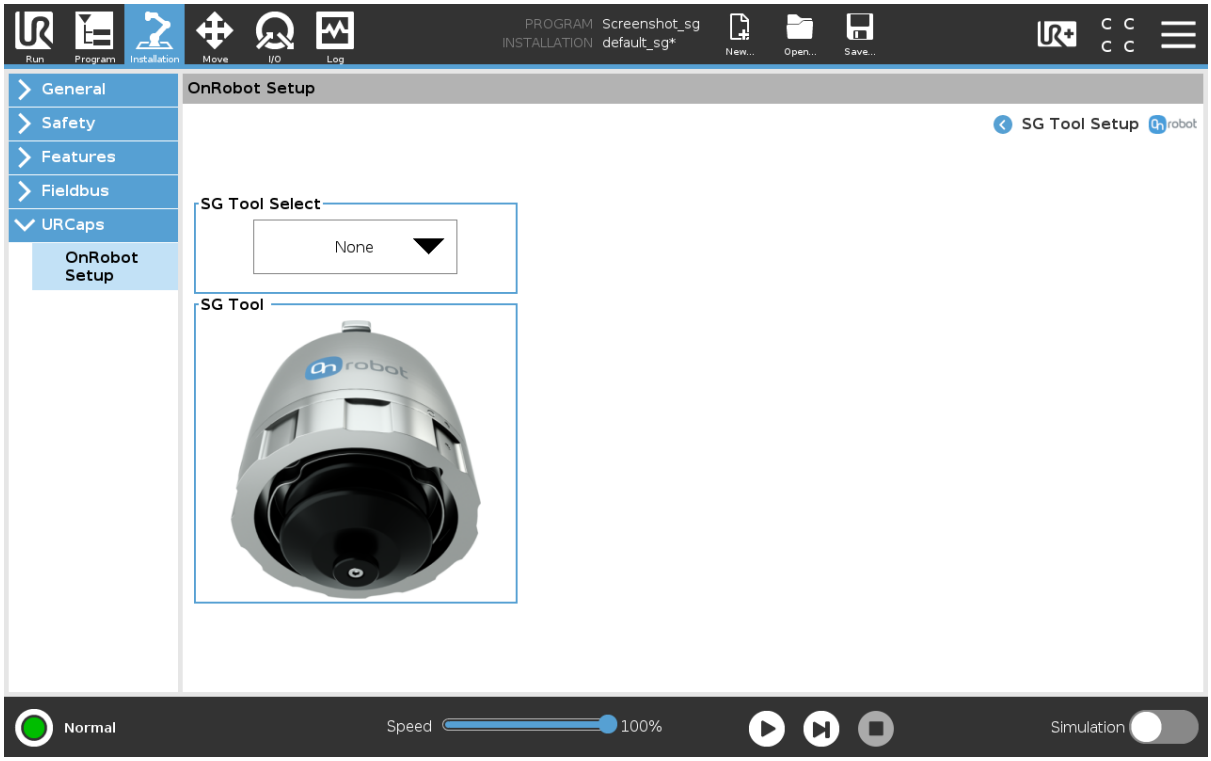
If there is a mismatch between the **Saved** tool and the **Current** initialized tool, the **Current** tool will be shown and this ⚠ will appear in the top right corner of the card.

If the tool is not initialized, the **Current** tool label will appear and this ⚠ will also appear under the **Current** label instead of the tool image.

To select a new SG and initialize the gripper with this new tool press ›. The screen below will show up and the desired tool to be installed can be selected.

NOTE:

If the SG is connected via the CB3 tool connector, the silicone selection is not available. A generic silicone is automatically used instead.



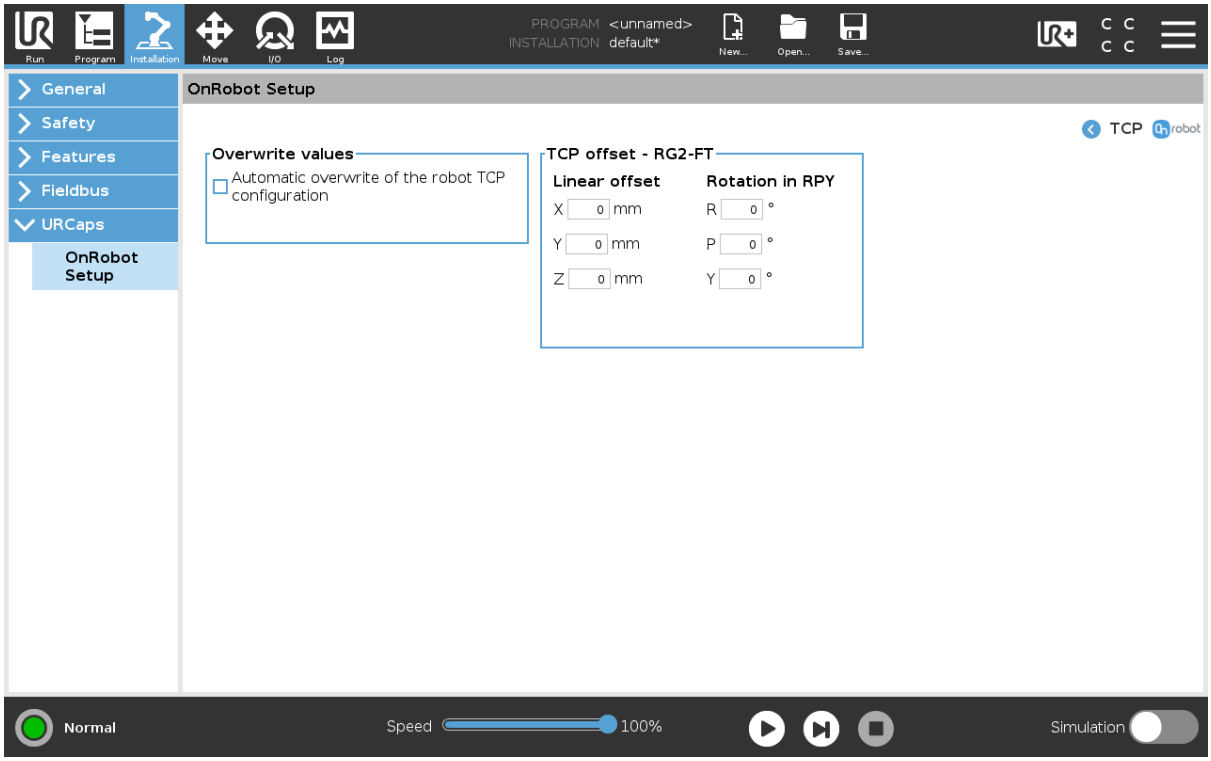
When choosing a tool, in the dropdown menu, the gripper will automatically initialize to the chosen tools neutral position. This will also automatically set the right tool operating parameters such as width, TCP and tool Center of Mass.

The gripper can also be initialized by pressing the **Initialize** button in the toolbar.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

For further information and best practices on the TCP setting see **6.4. TCP Configuration** section.

TCP offset

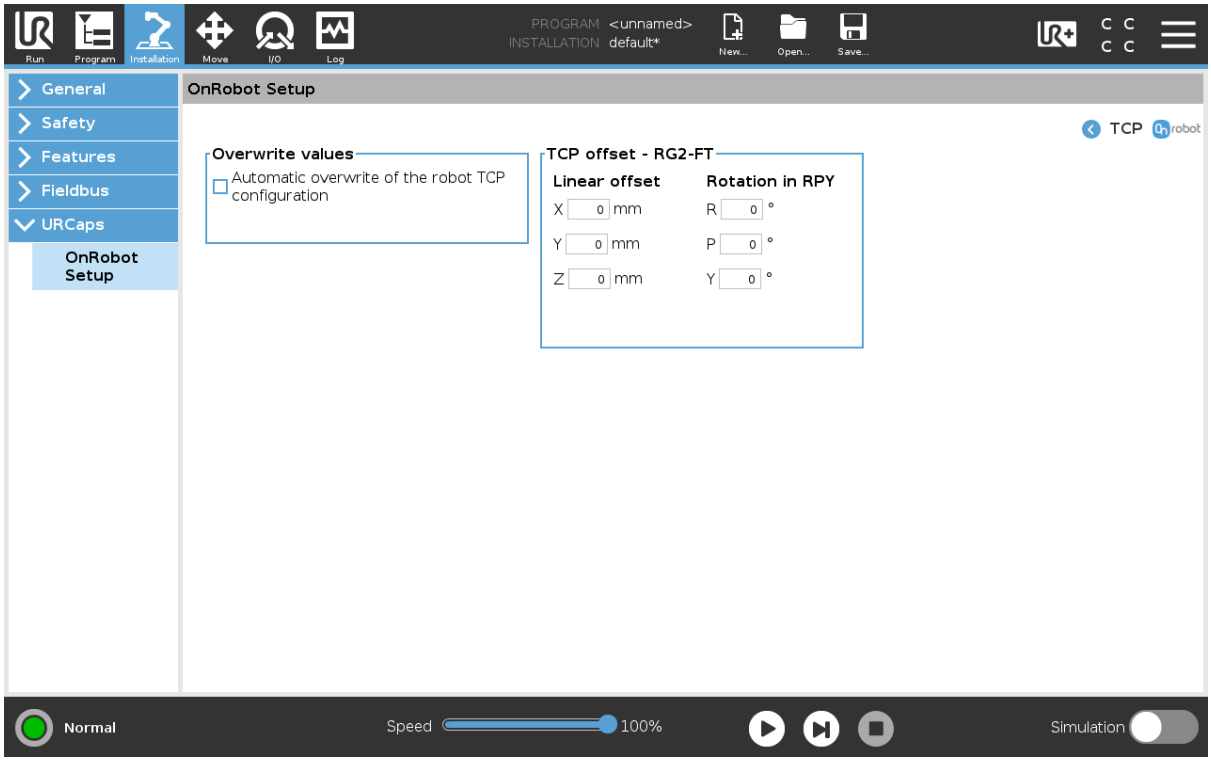
Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

5.3.7. VG10

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

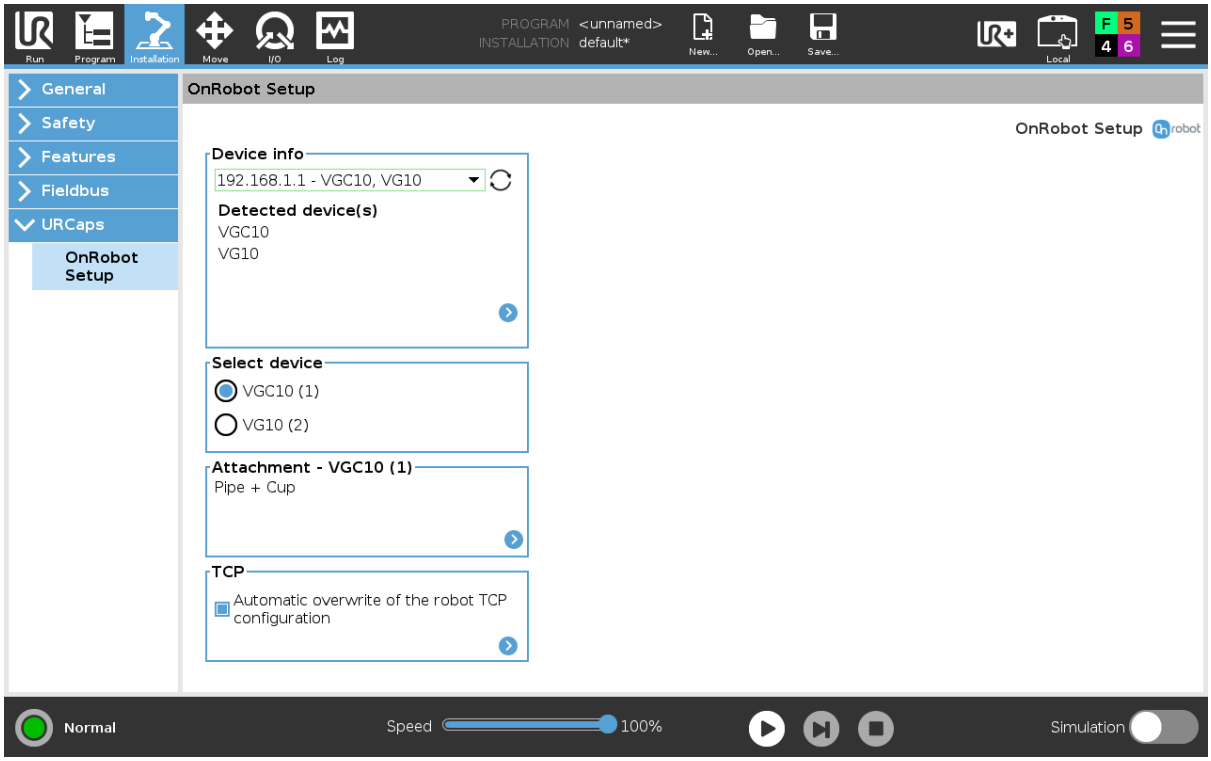
For further information and best practices on the TCP setting see 6.4. TCP Configuration section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

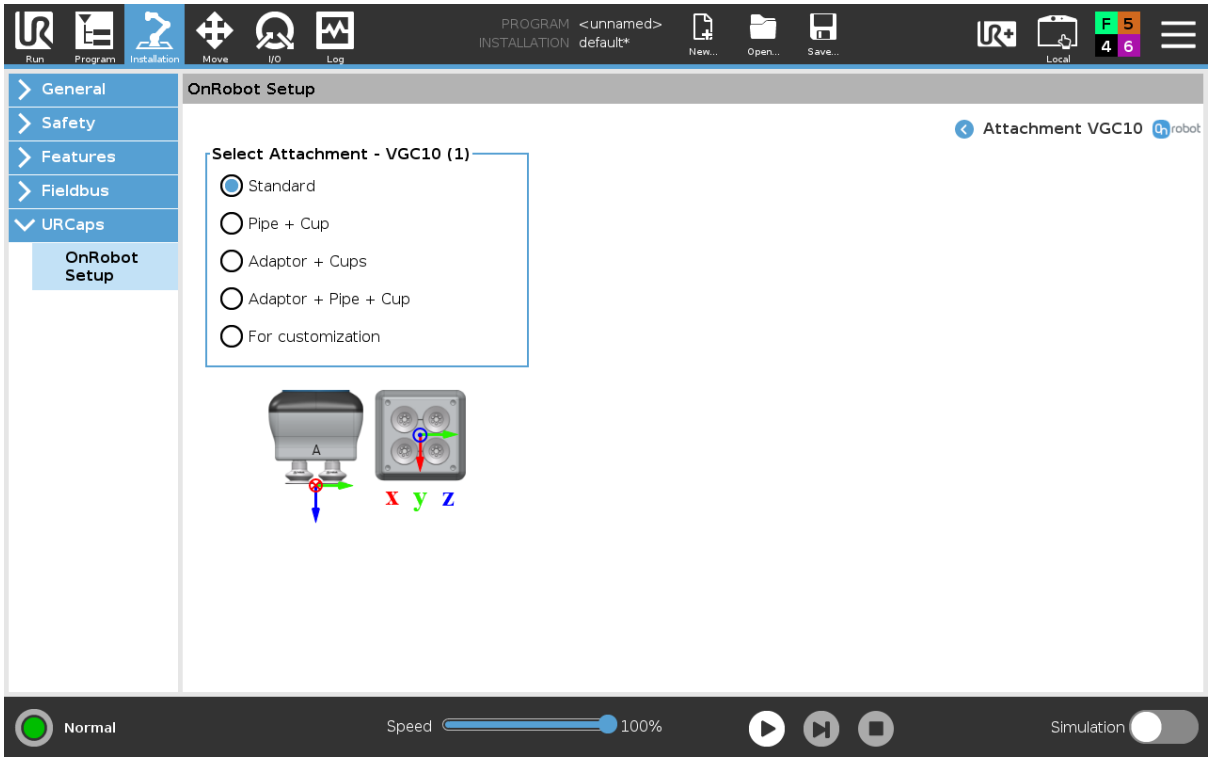
5.3.8. VGC10

The configuration panels for the VGC10 are shown in the image below:



Attachment

In the normal view of the panel, the selected attachment types such as **Standard**, **Pipe + Cup**, **Adaptor + Cups**, **Adaptor + Pipe + Cup** and **For customization** are mentioned. This configuration panel is used to set the TCP in the right position as well as to move the Center of Gravity of the workpiece to the new TCP. To select a different attachment configuration press on .

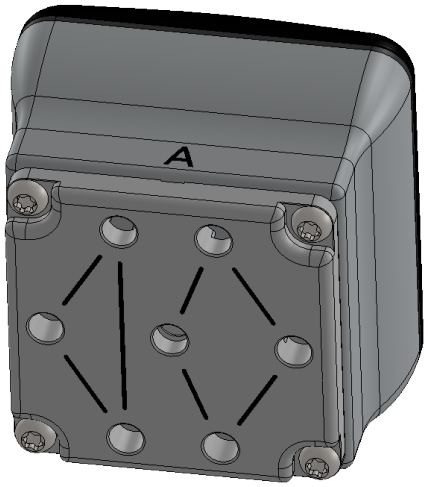


Here the actual mounting can be selected to set up the TCP correctly. The different options are:

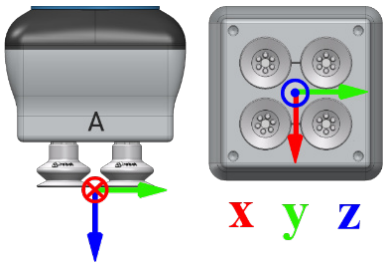
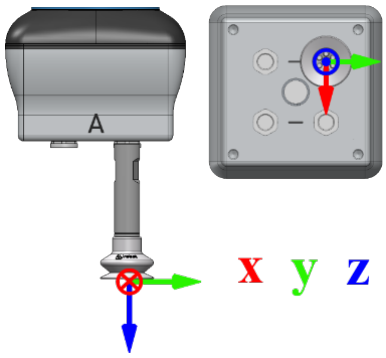
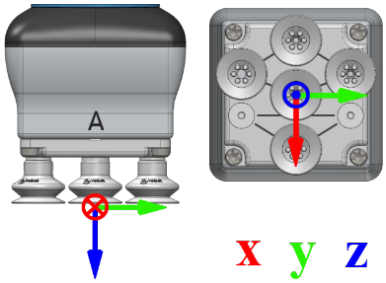
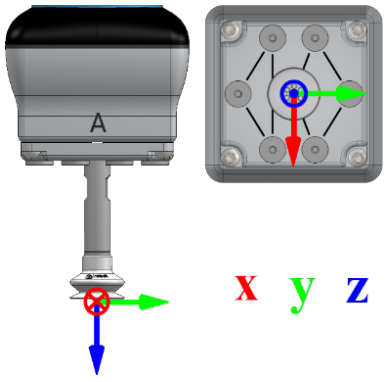
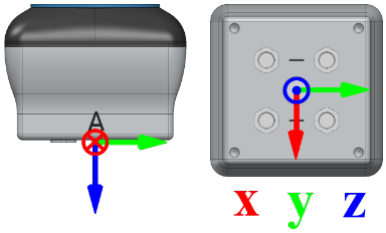
- **Standard**: Device with only four cups attached to it. This selection will set the TCP at the center of the end side of the cups (see table below).
- **Pipe + Cup**: Device with the extension pipe with a cup placed in the right side using the letter A as reference. This selection will set the TCP at the end of the cup placed on the extension pipe (see table below).
- **Adaptor + Cups**: Device with the adaptor with cups. This adaptor allows to create several configurations. This selection will set the TCP at the center of the end side of the cups, considering also the adaptor height (see table below).
- **Adaptor + Pipe + Cup**: Device with the adaptor with the extension pipe in the middle with a cup. This selection will set the TCP at the end of the cup placed on the extension pipe (see table below).
- **For customization**: Device with no attachments on. This selection will set the TCP at the center of the bottom side of the device (see table below). This option is useful when the user utilizes a customized configuration and, to edit the offset of the TCP, wants to start by having a reference at the end of the device with no attachments on.

NOTE:

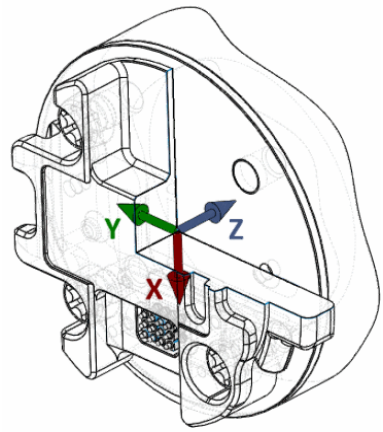
A higher flow can be achieved, by combining both channels, if the adaptor place is mounted 90º rotated as shown in the picture below. See more info in subsection **Adaptor Plate**.



The table below provides an overview of the different attachment combinations, the TCP values that will be set in the robot and an image with a visual representation of the TCP location.

Attachment	TCP (x, y, z) [mm]	Image
Standard	(0, 0, 100)	
Pipe + Cup	(-17, 17, 150)	
Adaptor + Cups	(0, 0, 110)	
Adaptor + Pipe + Cup	(0, 0, 160)	
For customization	(0, 0, 75)	

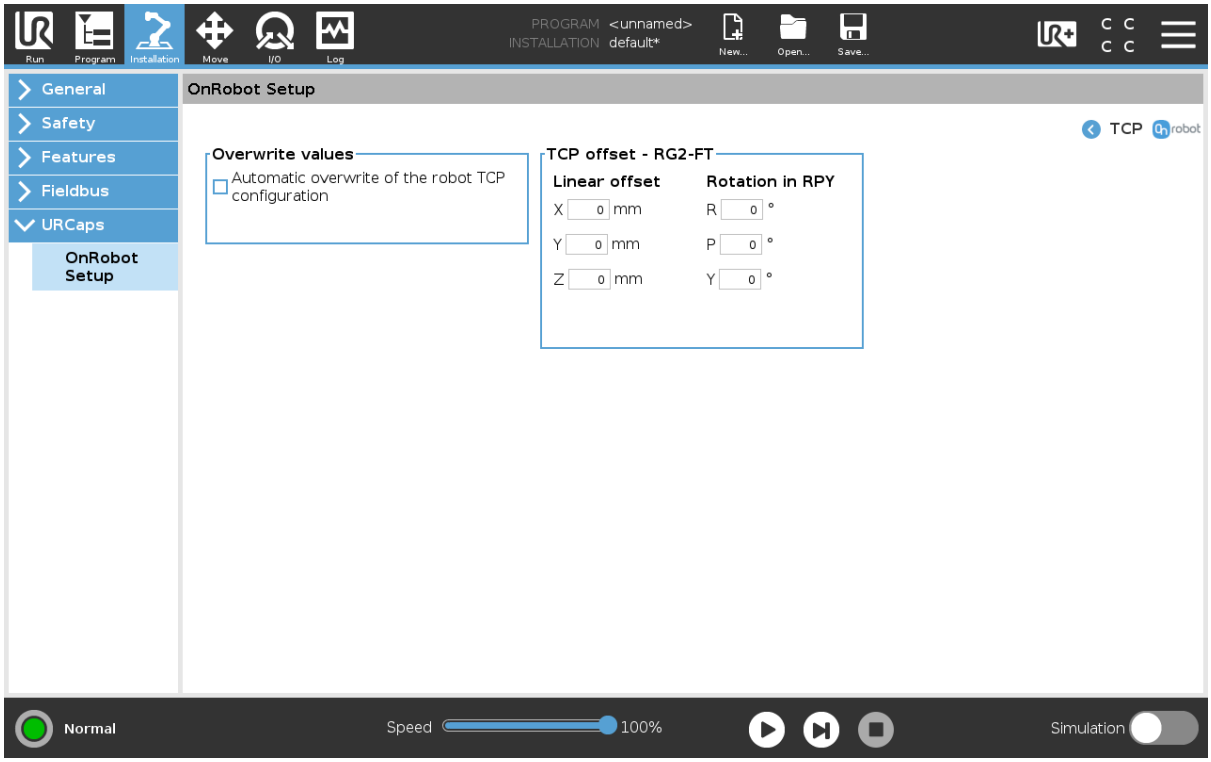
The TCP values have their origin in the top part of the gripper as shown in the image below.



TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

For further information and best practices on the TCP setting see 6.4. TCP Configuration section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

6. Operation

NOTE:

It is assumed that the Installation has finished successfully. If not, first do the installation steps in the previous section.

The OnRobot devices can be operated in 3 different ways.

- **URCap Commands** - provide an easy way to program an application
- **UR Toolbar** - makes it simple to operate the tools while you are programming or during runtime.
- **URScript commands** - can be used alongside other scripts.

NOTE:

OnRobot functions only accept input and returns output in metric units. If you have values to provide in US Standard units, use the following conversion rates.

US Standard unit	Metric unit	Convert US Standard unit into metric parameter input	Convert metric function output to US Standard unit
Linear measure (Length/Distance)			
1 inch (in or ")	25.4 millimetres	Multiply the US Standard input by 25.4 to get the metric unit input.	Divide the metric output by 25.4 to get the US Standard unit output.
1 foot (ft or ')	0.304 metre	Multiply the US Standard input by 0.304 to get the metric unit input.	Divide the metric output by 0.304 to get the US Standard unit output.
Mass (Weight)			
1 pound (lb)	0.453 kilogram	Multiply the US Standard input by 0.453 to get the metric unit input.	Divide the metric output by 0.453 to get the US Standard unit output.
Torque			
1 lbft	1.355 Nm	Multiply the US Standard input by 1.355 to get the metric unit input.	Divide the metric output by 1.355 to get the US Standard unit output.

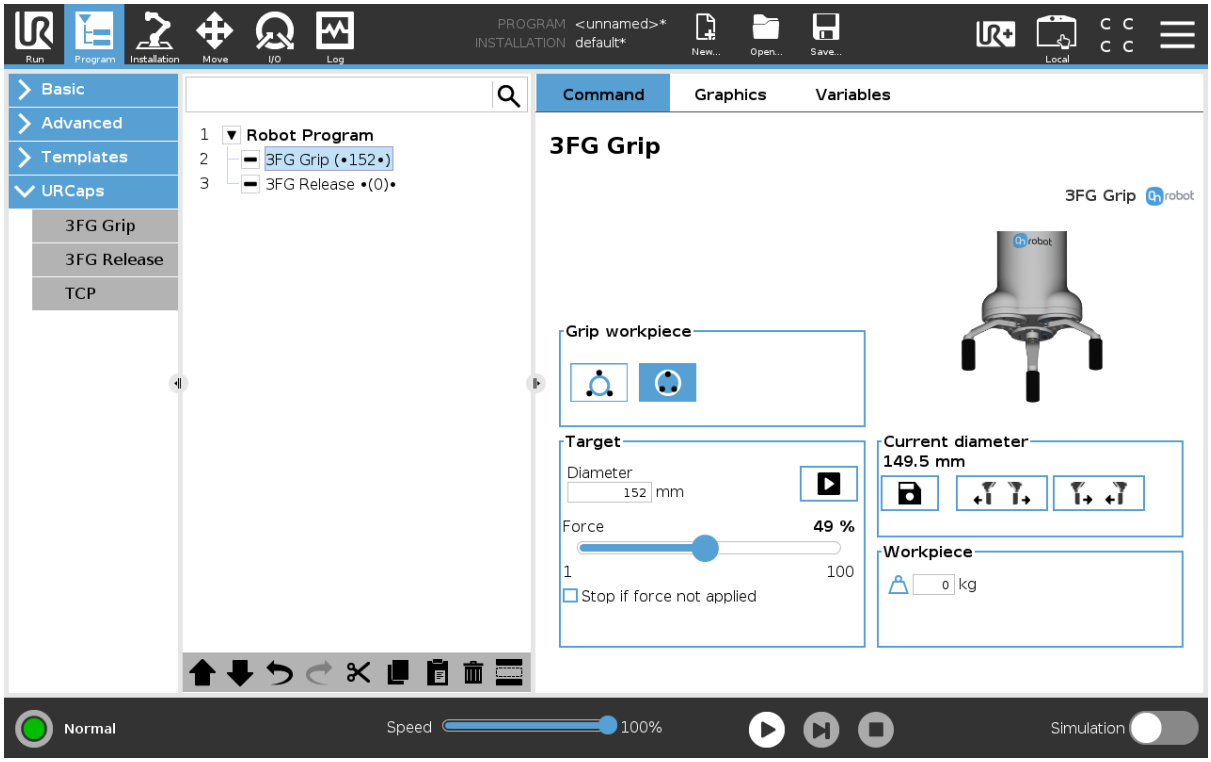
6.1. URCap Commands

URCap commands provide an easy way to program an application.

6.1.1. 3FG15

3FG Grip

When the 3FG Grip command is executed, the gripper will try to reach the specified target (**Diameter** and **Force**). The different functions are explained below.



The command name in the robot program shows bullets • and a number in parenthesis (X).

- •(x)• Bullets outside the parenthesis means external grip
- (•x•) Bullets inside the parenthesis means internal grip
- The number in parenthesis shows the target diameter

Select device
When two grippers are used, these buttons will select which one of the two grippers performs the action. The active button will have a blue background.

Grip workpiece

select this if the workpiece will be gripped externally. If this is selected the internal gripper diameter will be shown on the target and current diameter.

select this if the workpiece will be gripped internally. If this is selected the external gripper diameter will be shown on the target and current diameter.

Target

Diameter: The target gripping diameter can be set by using the Save as **Target** button (recommended) or by typing it in manually. The external gripper diameter will be shown if grip internally is selected and the internal gripper diameter will be show if grip externally is selected.

Force: Set the target gripping Force.

Stop if force not applied: If this is enabled and the Target Force is not applied, the robot program will stop.

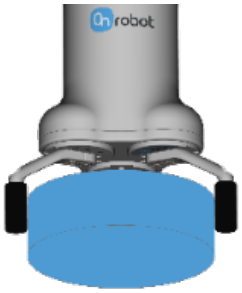
When pressed, the gripper will act as if the command is executed.

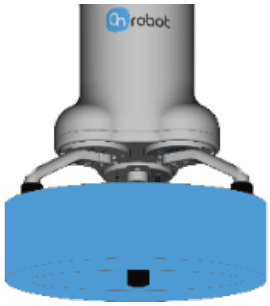
NOTE:

To achieve the Target Force, the Target Diameter must be the workpiece diameter - [1-5] mm for external grip and + [1-5] mm for internal grip depending on the softness of the workpiece. To ensure that target diameter is correct, it is recommended to use the open and close buttons to find the workpiece diameter and use save as target button to save the diameter with ± 3 mm accordingly.

More information about the force can be found on section **Gripping Force**.

In the table below, the different states of the gripper are shown. This helps to ensure that the command is programmed to grip with the specified force.

State	Feedback image
No grip detected	
External grip with target force detected	

State	Feedback image
Internal grip with target force detected	

Current diameter

The number shows the **Current diameter** value.

will set:

- the **Target Diameter** as **Current diameter** – 3 mm if **grip workpiece** is selected.
- the **Target Diameter** as **Current diameter** + 3 mm if **grip workpiece** is selected.

These are open and close hold-to-run buttons.

NOTE:

To enhance **Diameter** precision the **Target Force** is not applied when using these buttons

Workpiece

- the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

3FG Release

When the `3FG Release` command is executed, the gripper will try to reach the specified **Target Diameter**. The different functions are explained below.

The command name in the robot program shows bullets • and a number in parenthesis (XX).

- •(xx)• Bullets outside the parenthesis means external release
- (•xx•) Bullets inside the parenthesis means internal release
- The number in parenthesis shows the target diameter

Select device

When two grippers are used, these buttons will select which one of the two grippers performs the action. The active button will have a blue background.

Release workpiece

select this if the workpiece will be released externally

select this if the workpiece will be released internally

Target

Diameter: The target release diameter can be set by using the Save as Target button (recommended) or by typing it in manually. The external gripper diameter will be shown if release internally is selected and the internal gripper diameter will be show if release externally is selected.

When pressed, the gripper will act as if the command is executed.

Current diameter

The number shows the **Current diameter** value.

will set the **Current diameter** as target diameter.

These are open and close hold-to-run buttons.

6.1.2. HEX-E/H QC

F/T Control

Applications such as polishing, deburring, sanding or grinding may require holding constant force/torque to a defined direction during movements.

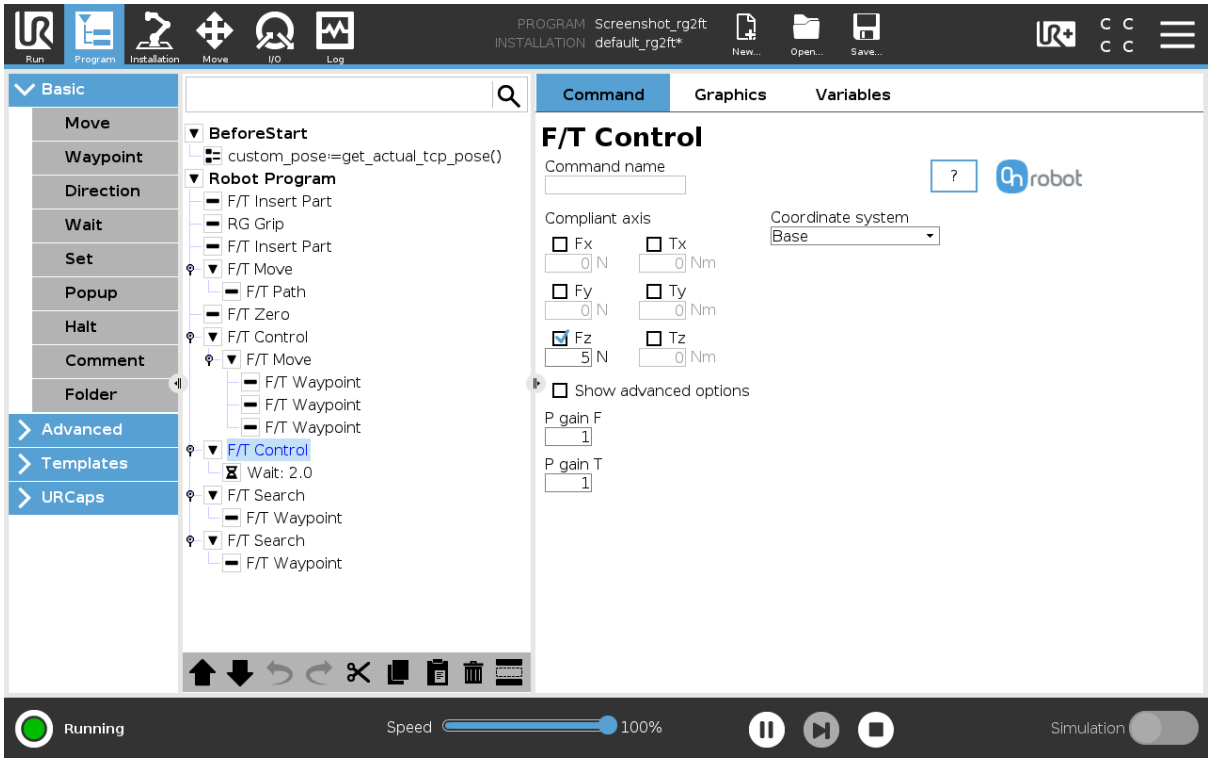
This command alters the trajectory of its child node(s) in order to keep the force/torque values constant along/about the selected axes.

NOTE:

UR's built-in Move commands cannot be used under the `F/T Control` command. To move the robot under the force control, use the `F/T Move` or `F/T Search` command instead.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Control` command and make sure the tool is not in contact with any object before starting the `F/T Control`, otherwise the command may not work properly.



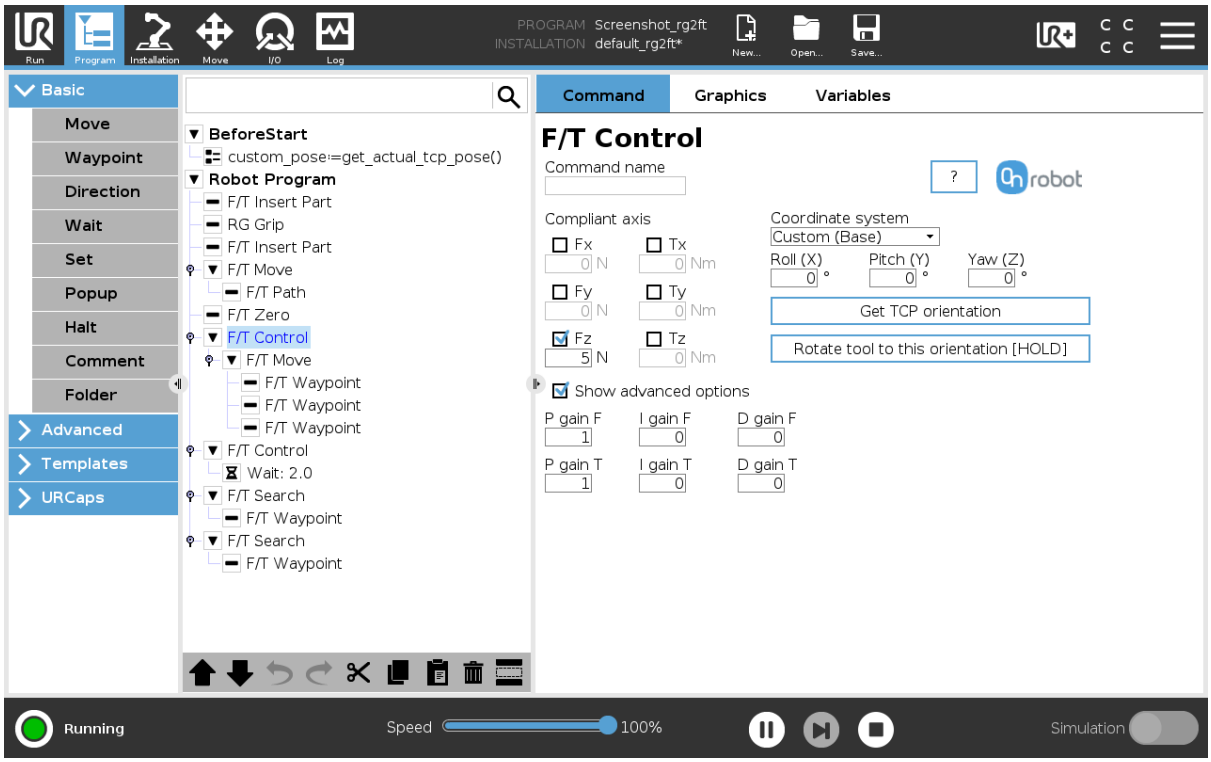
Compliant axis Fx, Fy, Fz, Tx, Ty, Tz: The axis selection that needs to be compliant. If an axis is enabled (compliant) the movement along/about that axis is force/torque controlled otherwise (non-compliant) position controlled. The enabled axis is controlled to keep the set force/torque value constant. At least one compliant axis must be selected.

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

P gain F: The force controller can be tuned with this proportional gain parameter. If any overshoots or vibrations occur, try lowering the gain value (e.g.: 0.5).

P gain T: The torque controller can be tuned with this proportional gain parameter. If any overshoots or vibrations occur, try lowering the gain value (e.g.: 0.5).

Show advanced options: If checked then more options become available:



I gain F: The force controller can be tuned with this integral gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

I gain T: The torque controller can be tuned with this integral gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

D gain F: The force controller can be tuned with this derivative gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

D gain T: The torque controller can be tuned with this derivative gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

This command has no return value.

Guidelines to PID force/torque controller settings:

The PID force/torque controller continuously calculates the error value for the force/torque measured by the sensor, compared to the values set by the `F/T Control` command, and applies correction based on this error.

P gain F and **P gain T**: The proportional term produces a correction that is proportional to the current error value. Increasing this parameter, has the following effects: faster reaction, overreaction, lower error, stability degradation.

I gain F and **I gain T**: The integral term produces a correction that is proportional to both, the magnitude, and duration of the past error values. Increasing this parameter, has the following effects: faster reaction, overreaction, lower error, stability degradation.

D gain F and **D gain T**: The derivative term produces a correction that is proportional to the slope or changing speed of past error values. Increasing this parameter, has the following effects: less overreaction, stability increase.

If the force control is too slow, that is, the tool occasionally leaves the surface instead of continually touching it, try increasing the **P gain F**, **P gain T**, **I gain F** and **I gain T** values.

If the force control is overreacting to changes, that is, the tool bounces off the surface, try decreasing the **P gain F** and **P gain T** (or **D gain F** and **D gain T**, if it is above 1).

If the force control is reacting to changes too slowly, that is it keeps pushing the surface hard after touching it, try decreasing the I Gain.

As a rule of thumb, it is recommended to use values:

```
P Gain < 5\
I Gain < 0.25\
D Gain < 1\
The ratio of P Gain/I Gain = 10
```

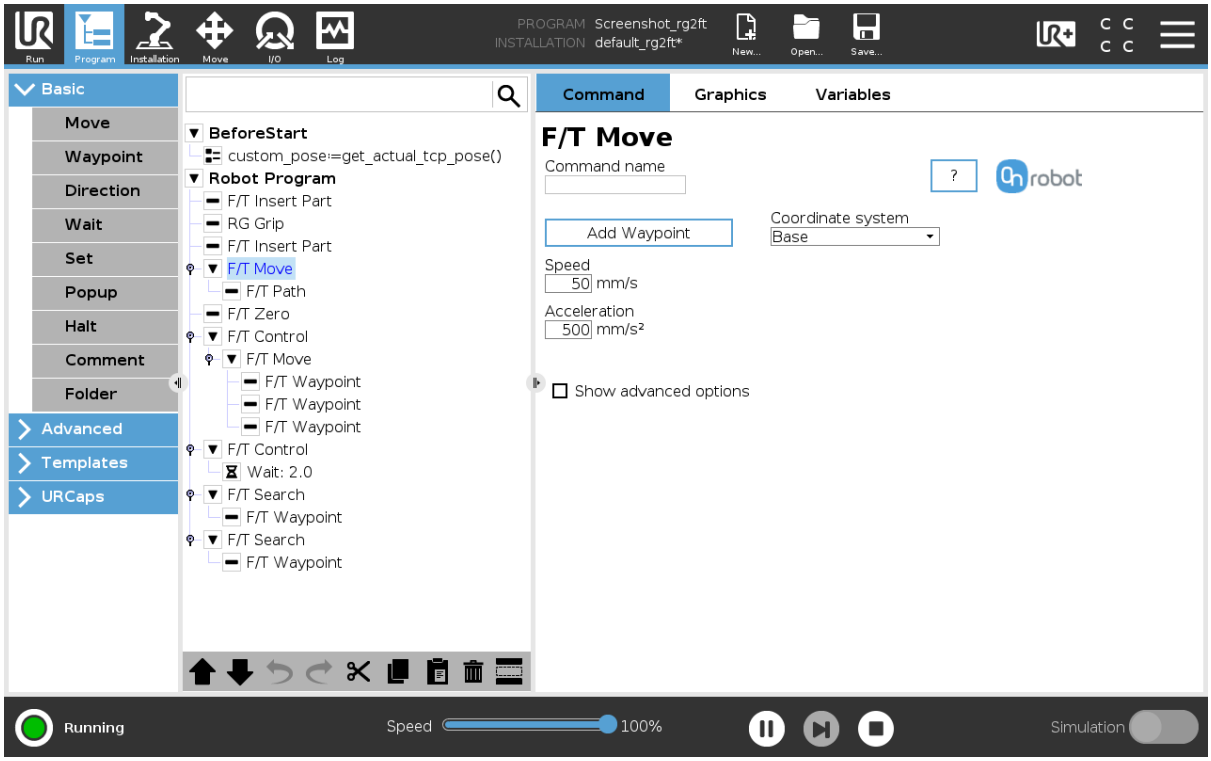
Values that can be used as a base for tuning are:
P Gain F =1, I Gain F = 0.1, D Gain F = 0.3
P Gain T =0.2, I Gain T = 0, D Gain T = 0

F/T Move

The `F/T Move` command can be used together with the `F/T Waypoint`, to move the robot along a route, or together with the `F/T Path` to move the robot along a path and stop once the defined force/torque limits are reached (movement interrupted). In this case a warning can be generated. If the movement reaches the last waypoint, the move is successful.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Move` command and make sure the tool is not in contact with any object before starting the `F/T Move`, otherwise the command may not stop at the given force/torque limit.



To operate the `F/T Move` command tap on the **Add {{ waypoint.title }}** button to add an `F/T Waypoint` as a child node. More waypoints can be added in the same way. To remove a waypoint, use the **Structure** tab **Delete** button.

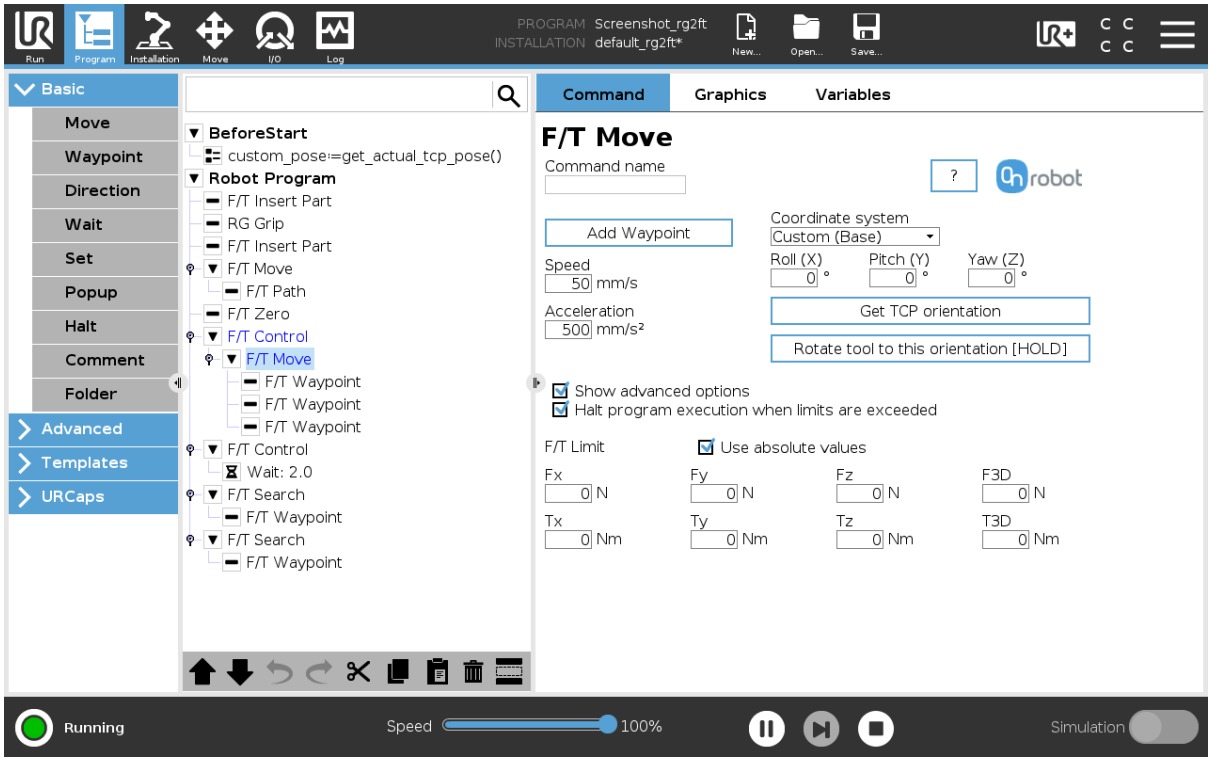
Alternatively, `F/T Waypoint` or `F/T Path` could be added as a child node of the `F/T Move` command by using the **Structure** tab.

Speed: The movement speed limit while moving. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

Acceleration: The acceleration and deceleration parameter of the movement.

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

Show advanced options: If checked then more options become available:



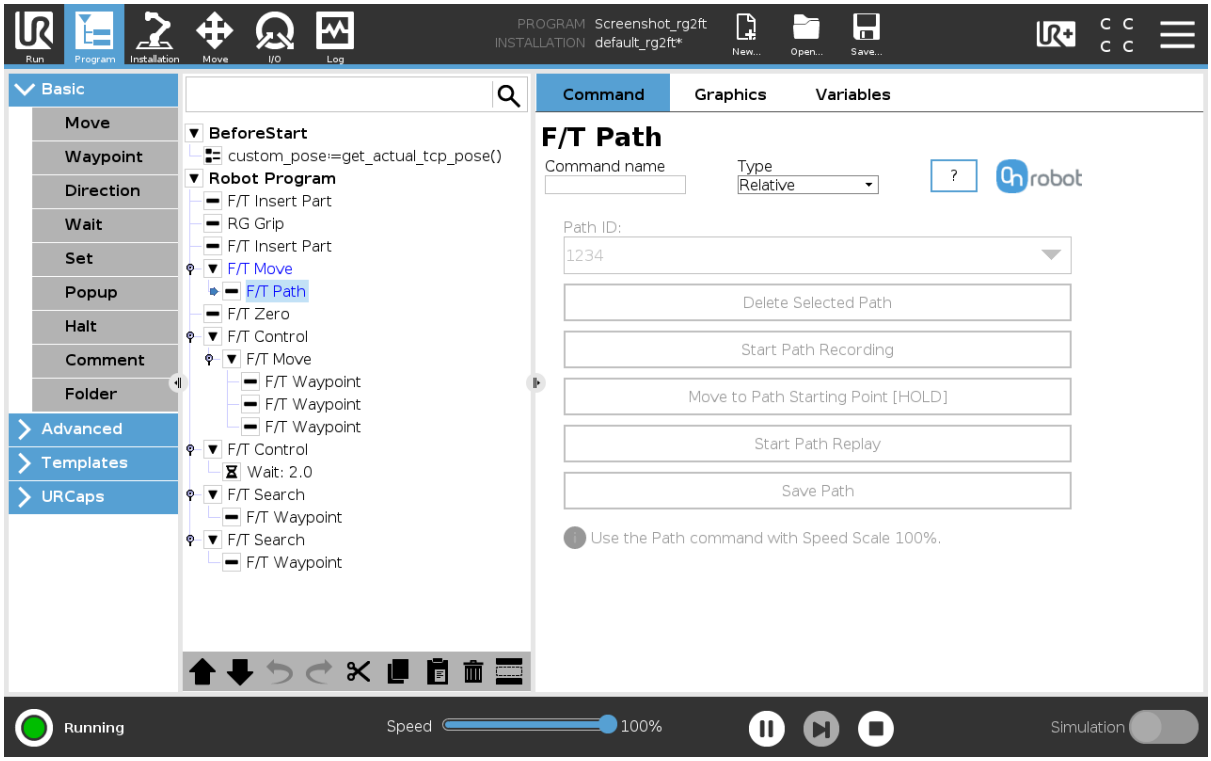
F/T Limit Fx,Fy,Fz,Tx,Ty,Tz,F3D,T3D: If any of the values reach the set threshold the stop is triggered. Values equal to zero are neglected. More than one option can be set.

If the **Use absolute values** option is enabled, then it is not important whether the entered value is positive or negative (e.g.: |Fz| > = 3), otherwise the sign defines how the threshold is calculated (e.g.: Fz > = 3 or Fz <= -3)

Halt program execution when limits are exceeded: If enabled then the program execution will be stopped when the target position is not reached (the move is not successful since the F/T Limit is reached). If the move is successful, then the program continues. If disabled, then no pop-up message is shown but the user can handle any possible errors using the return value of the command. See return values in the 6.5. Return Values section.

F/T Path

The `F/T Path` command can be used together with the `F/T Move` or `F/T Search` command, to record and replay a Path.



Type: If relative is selected, the Path is replayed starting from the actual position of the Tool, instead of the absolute position where it was recorded. If absolute is selected, the Tool moves to the original starting point, and replays the Path from there.

Path ID:: Lists identifiers of all the Paths saved on the Compute Box. A Path ID is assigned to a path, when the path is saved. If there is no recorded unsaved path, there is a Record new... item, select it to record a new path. If there is a recorded Path that is not saved, there is an Unsaved item in the List.

NOTE:

Only one unsaved Path can exist, and it will be overwritten by starting a Path recording while the Unsaved Path is selected.

Delete Selected Path: Deletes the path currently selected in the Path ID dropdown list from the Compute Box, permanently.

NOTE:

Do not delete a Path that any other `F/T Path` commands is using.

Start Path Recording: Starts recording a Path by automatically enabling the Hand Guide function.

Stop Path Recording: Stops the Hand Guide function and stores the recording to the memory. It does not permanently save the Path.

Move to Path Starting Point [HOLD]: Moves the Tool to the starting position of the Path, it can only be used if the path is not relative.

Start Path Replay: Replays the Path, even if it is not saved, only stored in the memory.

Stop Path Replay: Stops replaying the Path.

Save Path: Saves the Unsaved Path to the Compute Box.

NOTE:

The robot speed must always be 100%, replaying at lower speed can create a significant deviation from the recorded trajectory.

NOTE:

Rotational movements related to translational movements in Path recording are limited to 2.8 degrees/mm or less, since a larger ratio would cause the Robot to replay the path at a very low translational speed. Rotational movement without translational movement therefore cannot be recorded as Path.

NOTE:

The maximum error of the replayed Path compared to the original recorded movement can be up to 1 mm.

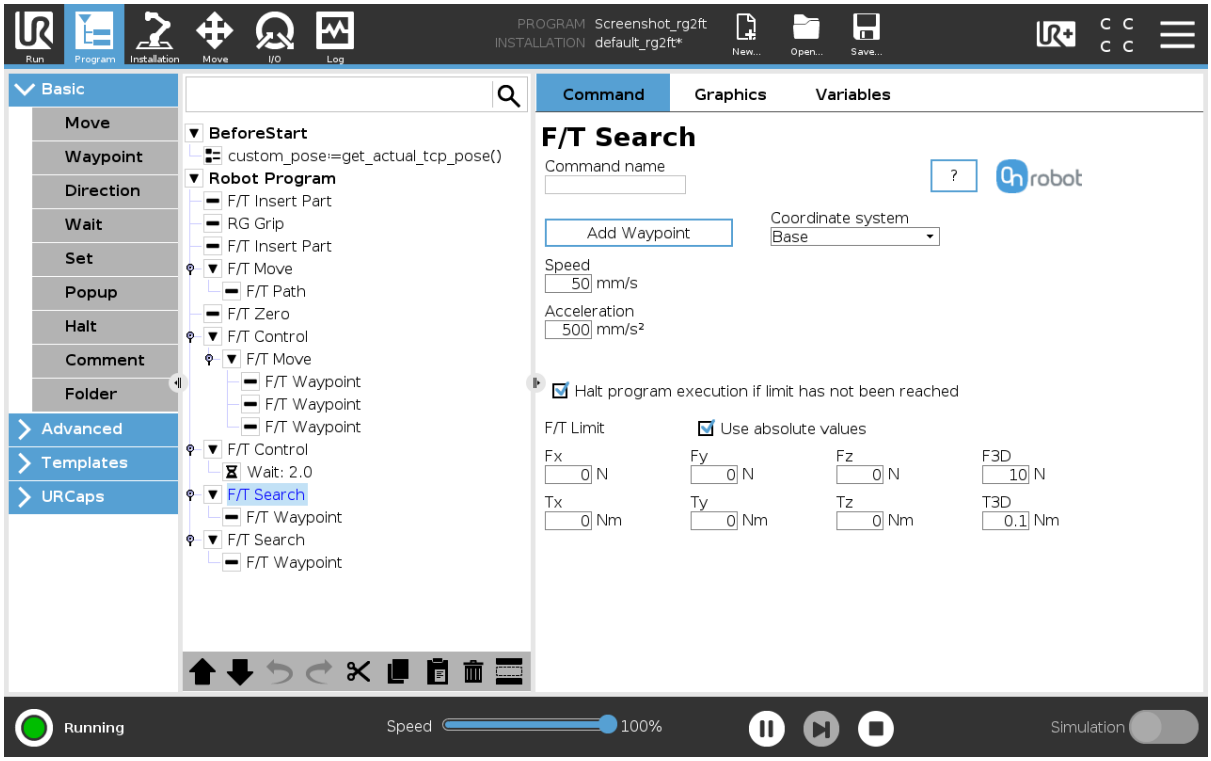
This command has no return value.

F/T Search

The `F/T Search` command is used together with the `F/T Waypoint` command, to move the robot along a route, or together with the `F/T Path` to move the robot along a Path and stop once the defined force/torque limits are reached (object found). If the movement reaches the last waypoint or the last point of the path, the search is not successful (the object is not found) and a warning is generated.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` at the beginning of the `F/T Search` command and make sure the tool is not in contact with any object before starting the `F/T Search`, otherwise the command may not stop at the given force/torque limit.



To operate the `F/T Search` command tap on the **Add Waypoint** button to add an `F/T Waypoint` as a child node. More waypoints can be added in the same way. To remove a waypoint, use the **Structure** tab **Delete** button.

Alternatively, `F/T Waypoint` or `F/T Path` could be added as a child node of the `F/T Search` command by using the **Structure** tab.

Speed: The movement speed while searching for collision. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

NOTE:

Overshooting can occur during search, especially with hard contacts (e.g. metal surfaces). To limit overshoots you should lower the speed.

Acceleration: The acceleration and deceleration parameter of the movement.

F/T Limit Fx,Fy,Fz,Tx,Ty,Tz,F3D,T3D: This is the detection limit. From the Fx, Fy, Fz, Tx, Ty, Tz, F3D, T3D available options more than one can be set. In this case, if any of the values reach the set threshold the stop is triggered. Values equal to zero are neglected.

If the **Use absolute values** option is enabled, then it is not important whether the entered value is positive or negative (e.g.: |Fz| > = 3), otherwise the sign defines how the threshold is calculated (e.g.: Fz > = 3 or Fz <= -3)

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the

coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

Halt program execution if limit has not been reached: If enabled, then the program execution will be stopped when the target position is reached or was already in collision (so the search is not successful). If the search is successful, then the program continues. If disabled, then no pop-up message is shown but the user can handle any possible errors by the return value of the command.

See return values in the **6.5. Return Values** section.

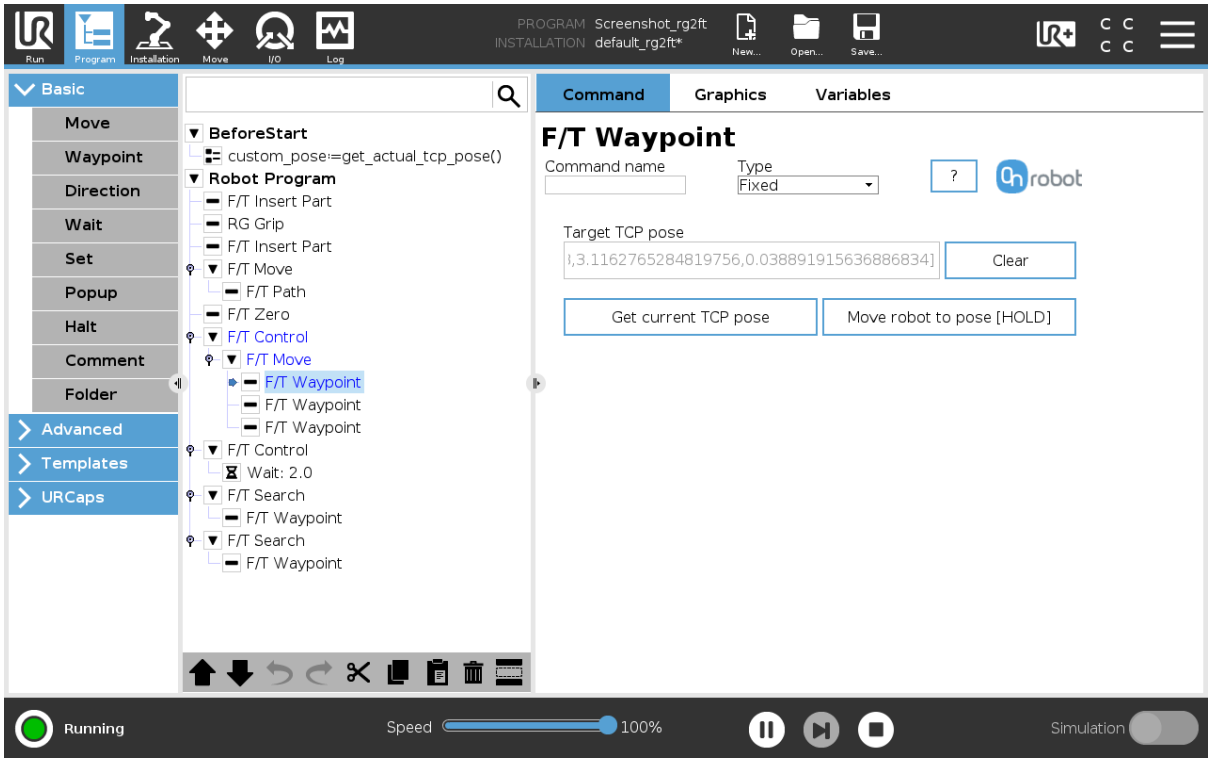
F/T Waypoint

The `F/T Waypoint` command is used together with the `F/T Move` or `F/T Search` command, to move the robot along a route. There are three types of waypoints (Fixed, Relative, and Variable), that can be used in any combination.

NOTE:

Do not use consecutive `F/T Waypoint`s that only contain rotations in the same `F/T Move` command. Use more than one `F/T Move` commands to achieve rotations without translational movements.

Type: The type of the waypoint. It can be set to Fixed, Relative, or Variable.

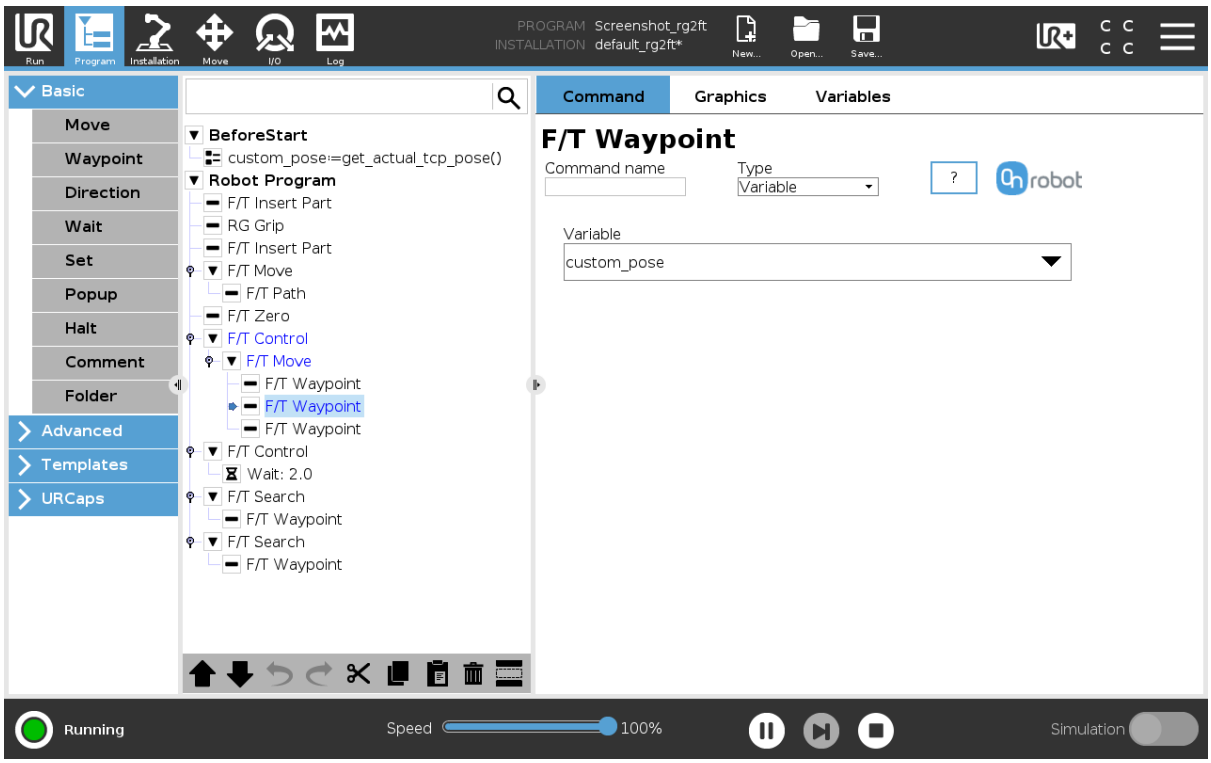


Target TCP pose: The position represented by the waypoint in the robot route. It is a read-only field and can be filled by using the **Get current TCP pose** button.

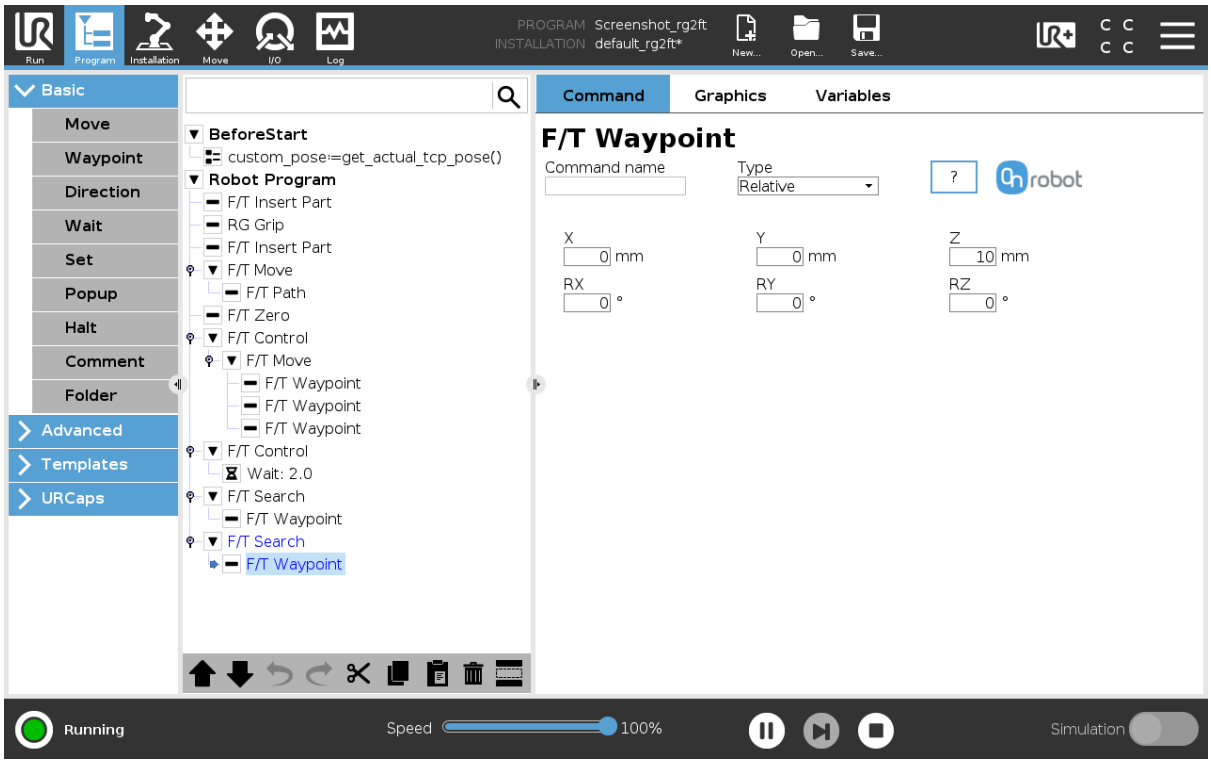
Clear: deletes the contents of the **Target TCP pose** field.

Get current TCP pose: inserts the current TCP coordinates into the **Target TCP pose** field.

Move robot to pose [HOLD]: moves the robot to the pose set in the **Target TCP pose** field, if the button is pressed. Once it is released the robot stops.



Variable: The position represented by the waypoint in the robot route. A variable can define the target pose. The variable needs to be created first.

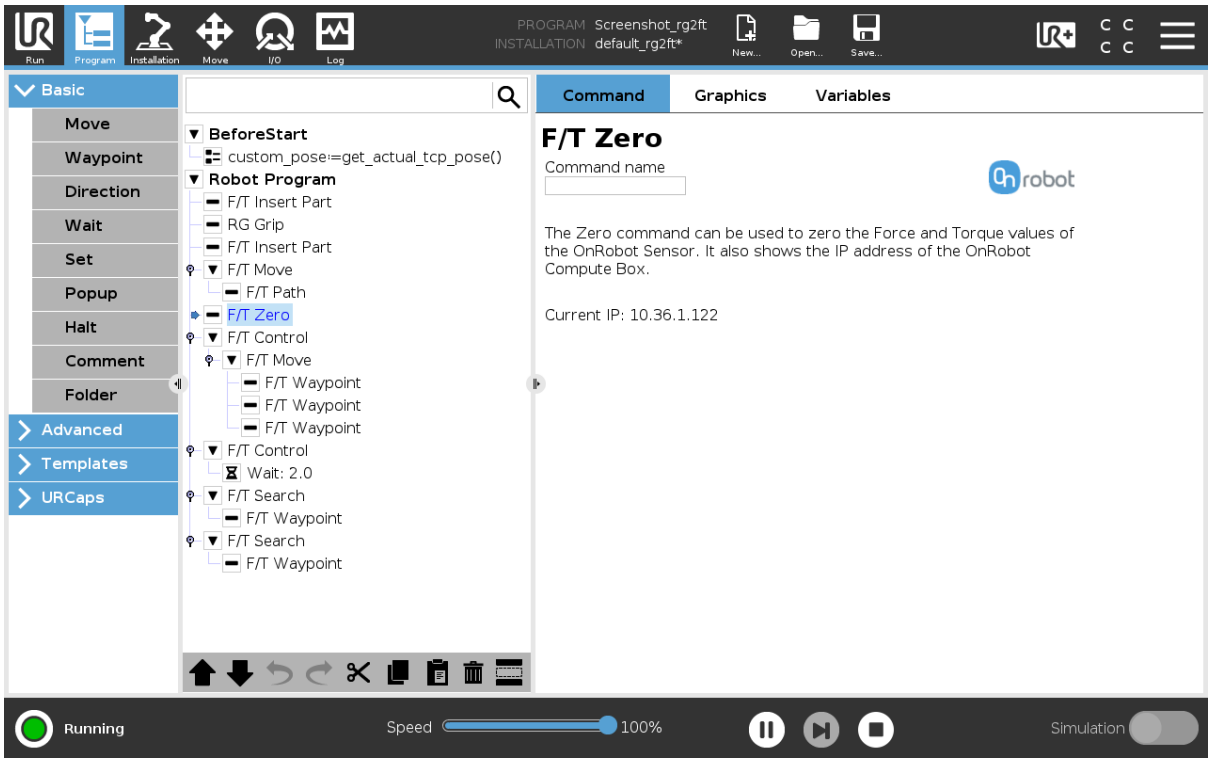


Relative X, Y, Z, RX, RY, RZ: the distances and rotations this waypoint represents, compared to the previous robot position.

This command has no return value.

F/T Zero

The `F/T Zero` command can be used to zero the force/torque values.



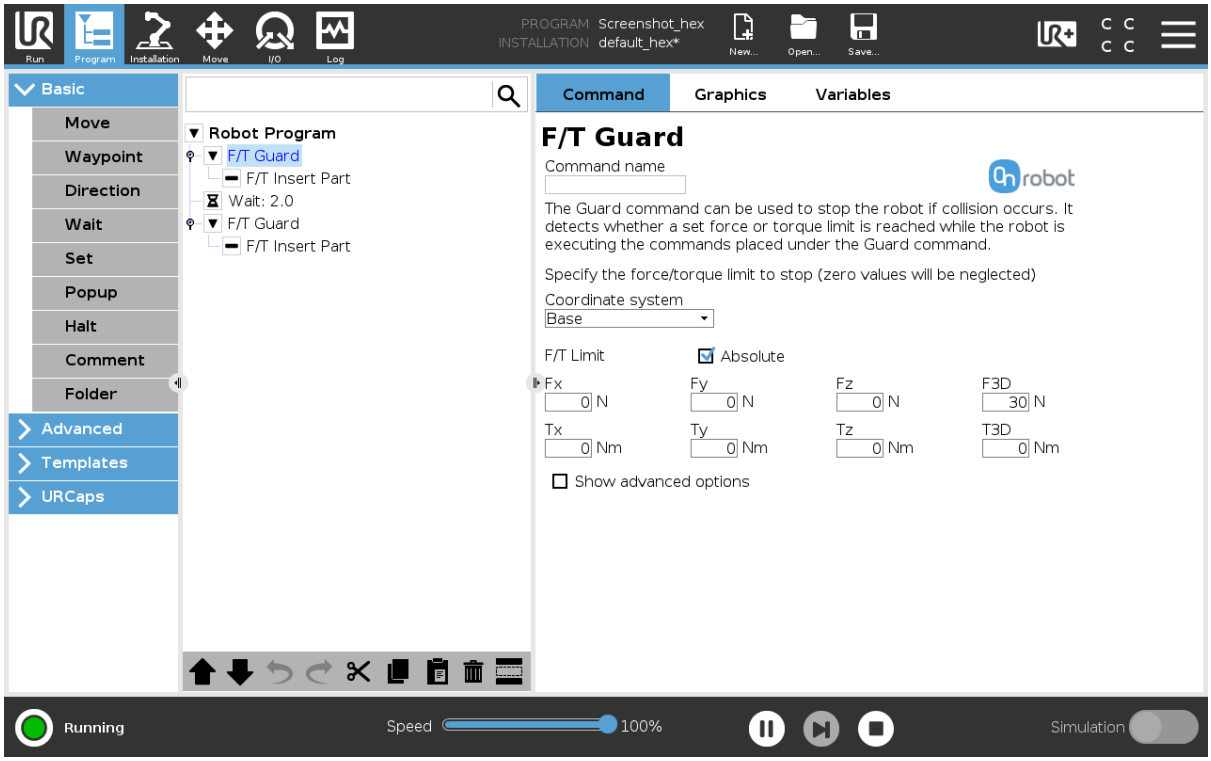
This command has no return value.

F/T Guard

Every UR commands that are put under the `F/T Guard` will be executed, but the robot will stop once one of the set limits is reached. The force limiting can be mixed with an external I/O signal (e.g.: `stop if Fz>5 AND digital_in[7] == True`).

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` at the beginning of the `F/T Guard` command and make sure the tool is not in contact with any object before starting the `F/T Guard`, otherwise the command may not stop at the given force/torque limit.

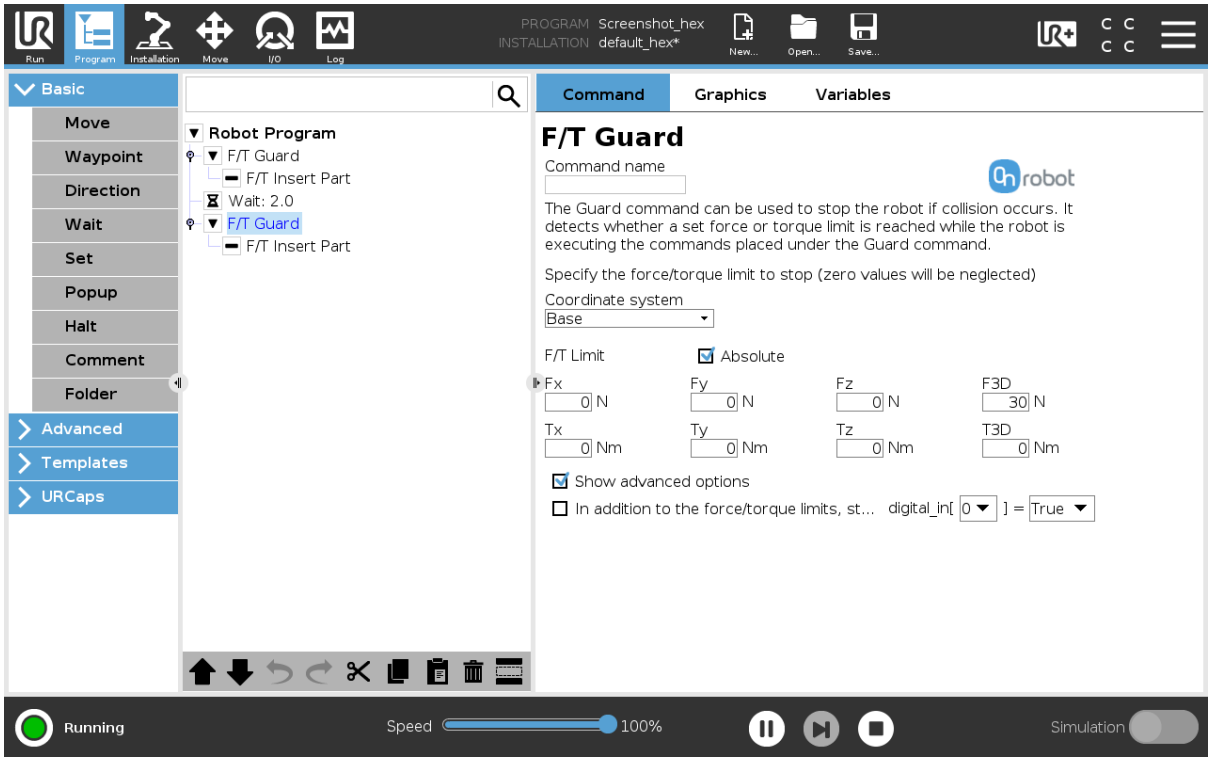


Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base or Tool (according to the UR's reference frames).

F/T Limit: This is the detection limit. From the Fx, Fy, Fz, Tx, Ty, Tz, F3D, T3D available options more than one can be set. In this case, if any of those values reached the set threshold the stop is triggered. The values equal to zero are neglected.

If the **Absolute** option is enabled, then it is not important whether the entered value is positive or negative (e.g.: stop if |Fz| > = 3), otherwise the sign defines how the threshold is calculated (e.g..: stop if Fz > = 3 or stop if Fz <= -3)

Show advanced options: If enabled then more options become available:



If the **In addition to the force/torque limits, stop if** is enabled, then the set digital I/O will also be monitored and once the condition is met (along with the force/torque limit) the robot will be stopped. (e.g.: `stop if Fz>5 AND digital_in\[7\] == True`).

This command has no return value, and halts the program when limits are reached.

F/T Insert Part

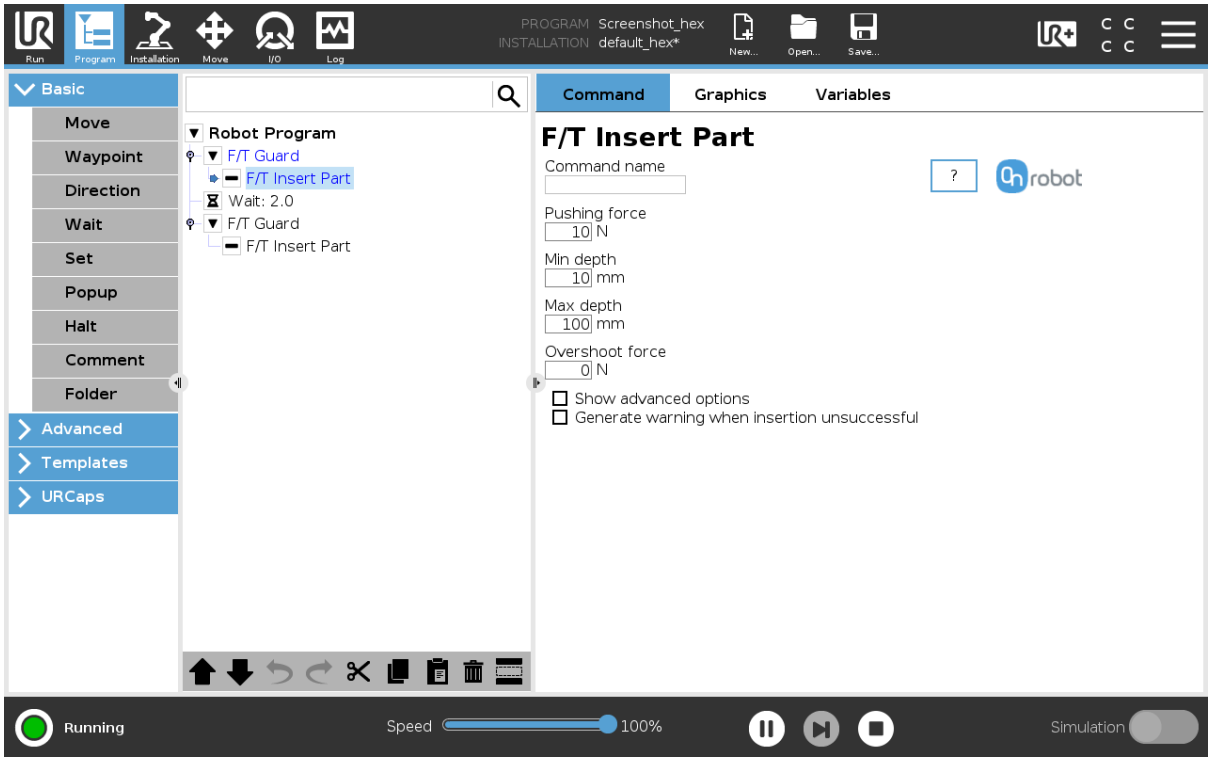
First position the pin or peg that needs to be inserted to the hole pointing in the right direction and close to the hole entrance. The final position and orientation will be corrected by the `F/T Insert Part` command. It tries to push the pin with the predefined force limit and adjusts the orientation if necessary. It stops when the defined insertion depth is reached.

NOTE:

It is important to set the TCP (Tool Center Point) at the tip of the part.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Insert Part` command and make sure the tool is not in contact with any object before starting the `F/T Insert Part`, otherwise the command may not stop at the given force/torque limit.



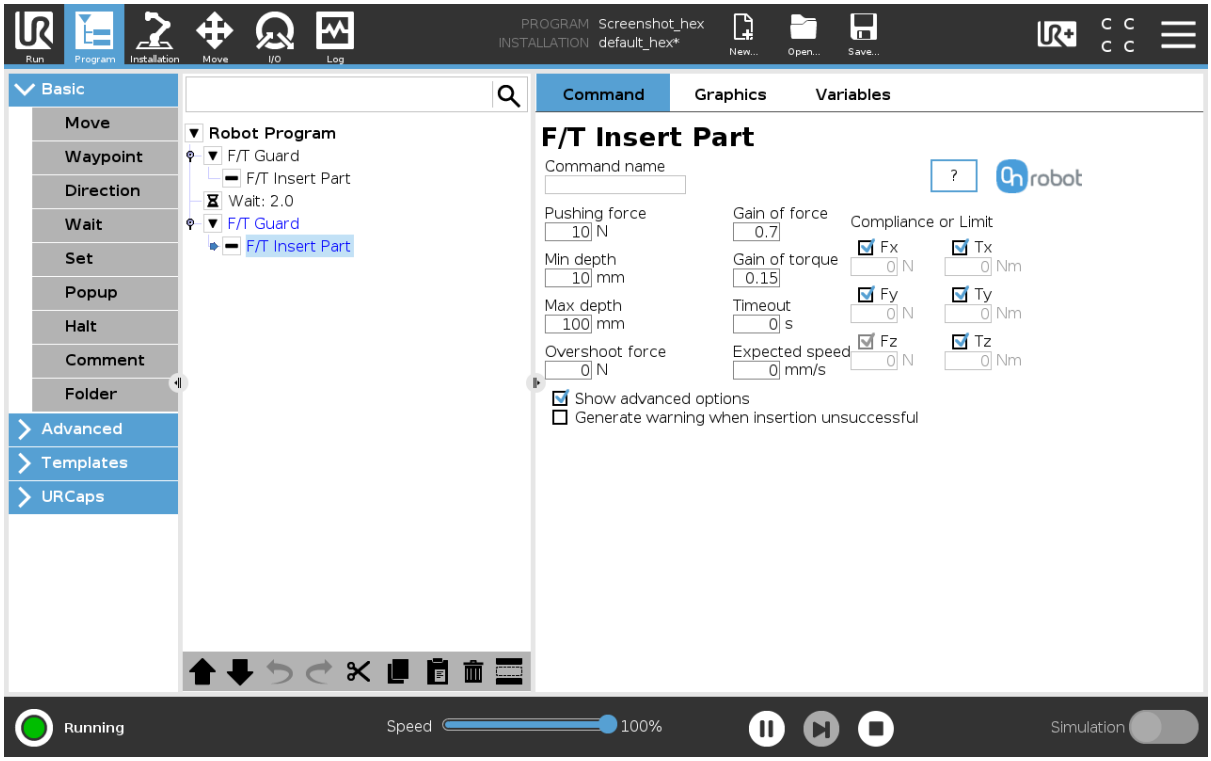
Pushing force: The force target used for the force control to gently push the part into the hole.

Min depth: The minimum distance required to consider the insertion successful, from the starting point along the Z axis (in Tool coordinate system).

Max depth: The maximum distance the insertion can reach, from the starting point along the Z axis (in Tool coordinate system).

Overshoot force: If this parameter is set, after the **Min depth** has been reached, a ‘bump’, an increase in the pushing force is expected (such as closing a snap-fit joint). This parameter is the additional force on top of **Pushing force** that the insertion allows, between the min and max depths.

Show advanced options: If checked then more options become available:



Gain of force: The proportional gain parameter of the force control for the pushing force, and the side forces on compliant axes.

Gain of torque: The proportional gain parameter of the torque control for the compliant axes.

NOTE:

High gain values can result vibration and protective stop. Higher mass and bigger distance can be vibrating more easily.

Timeout: The maximal allowed length of time for the whole insertion function. If it is set to zero, this exit criterium is neglected.

Expected speed: The minimum speed the insertion is expected to progress with. If this parameter is set, and the insertion is progressing at a slower pace, it is interrupted and considered unsuccessful. If it is set to zero, this exit criterium is neglected.

Compliance or Limit (Fx, Fy, Tx, Ty, Tz): The axis selection that needs to be compliant. If an axis is enabled (compliant) the movement along/about that axis is force/torque controlled otherwise (non-compliant) position controlled. The enabled axis is controlled to keep the set force/torque value constant. At least one compliant axis must be selected.

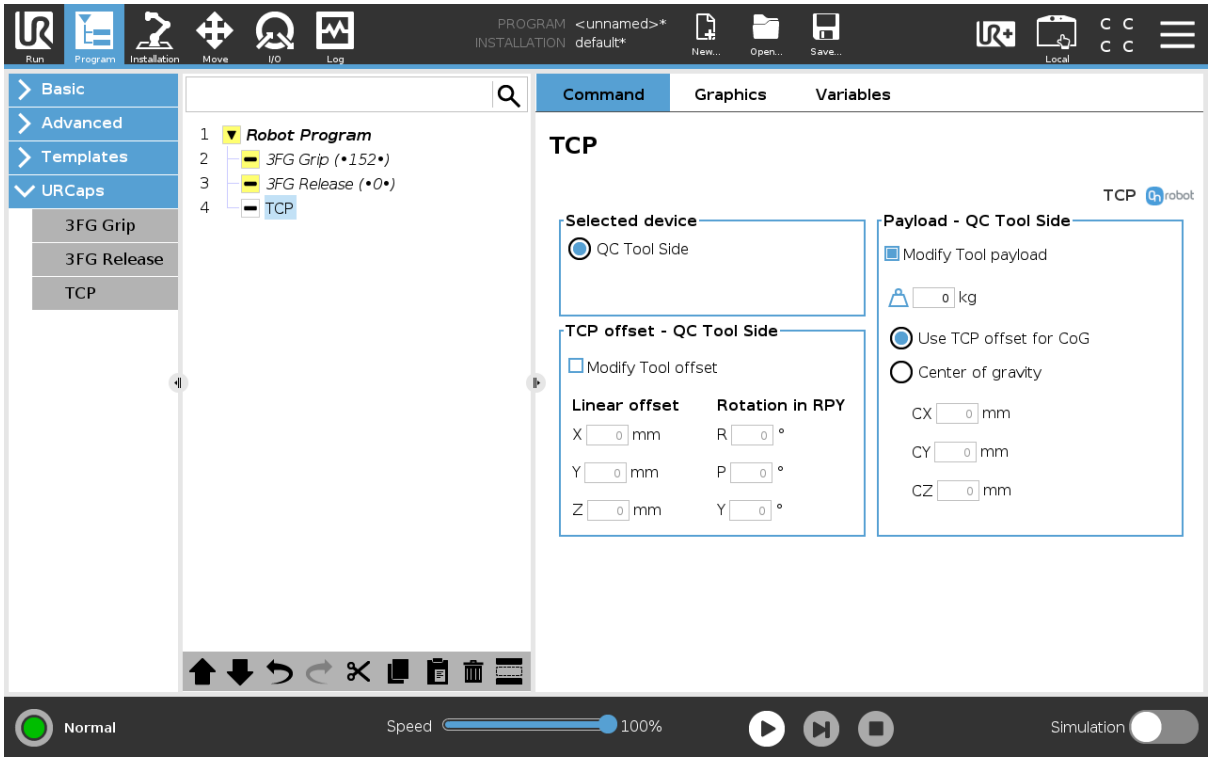
Generate warning when insertion unsuccessful: If enabled then a pop-up message (blocking) appears if the insertion was not successful.

If disabled, then no pop-up message is shown but the user can handle any possible errors by the return value of the command.

See return values in the **6.5. Return Values** section.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

6.1.3. RG2-FT

NOTE:

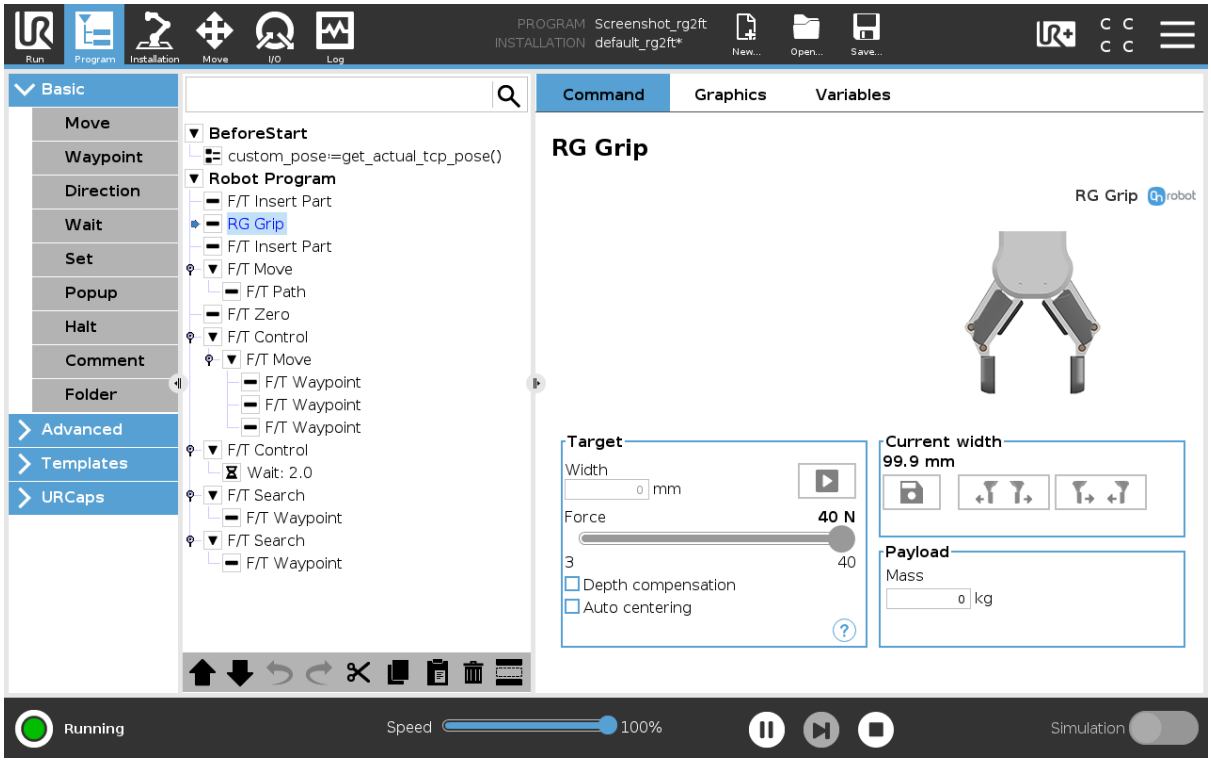
At program start the force/torque finger sensors are automatically zeroed so no need to place an `F/T` Zero at the beginning of the program. Please make sure that the fingers are not in contact with any obstacle when the program is started. Otherwise the sensors will not be properly zeroed.

RG Grip

When the `RG Grip` command is executed, the gripper will try to reach the specified target (**W (Width)** and **F (Force)**) and, if selected, **Depth compensation ON** and/or **Automatic centering ON**. The different functions are explained below.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `RG Grip` command and make sure the gripper is not in contact with any object before starting the `F/T Width`, otherwise the command may not work properly.



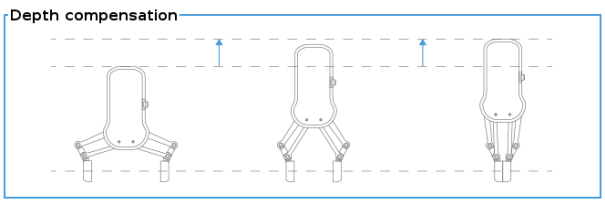
Target

Width: The target gripping width can be set by using the Save as Target/Save Grasp button (recommended) or by typing it in manually.

When pressed, the gripper will act as if the command is executed.

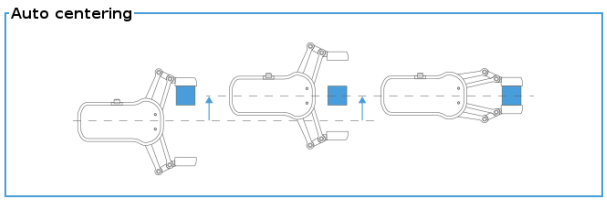
Force: Set the target gripping Force (3-40 N).

Depth compensation: If checked, during closing and opening the gripper, the robot moves to compensate for the circular movement of the fingers, so that the fingertips remain on the target. when pressed, the following graphical illustration will appear in a new page.



Auto centering: if checked, during closing and opening the gripper, the robot moves the gripper sideways to grab the item symmetrically based on the proximity signals of the fingers.

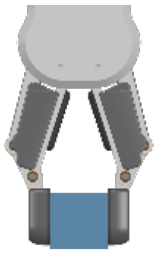
when pressed, the following graphical illustration will appear in a new page.

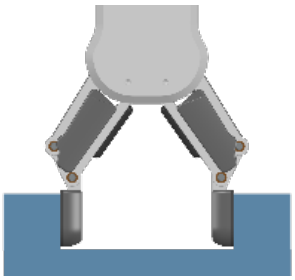


Current width

The number shows the **Current width** value.

will set the **Current width** as target width. If used when a grasp is detected (see image below) this will set the **Target Width** as **Current width** – 3 mm if the workpiece is grabbed externally and + 3 mm if the workpiece is grabbed internally.





These are open and close hold-to-run buttons. Notice that to enhance width precision the target Force is not applied when using these buttons.

Workpiece

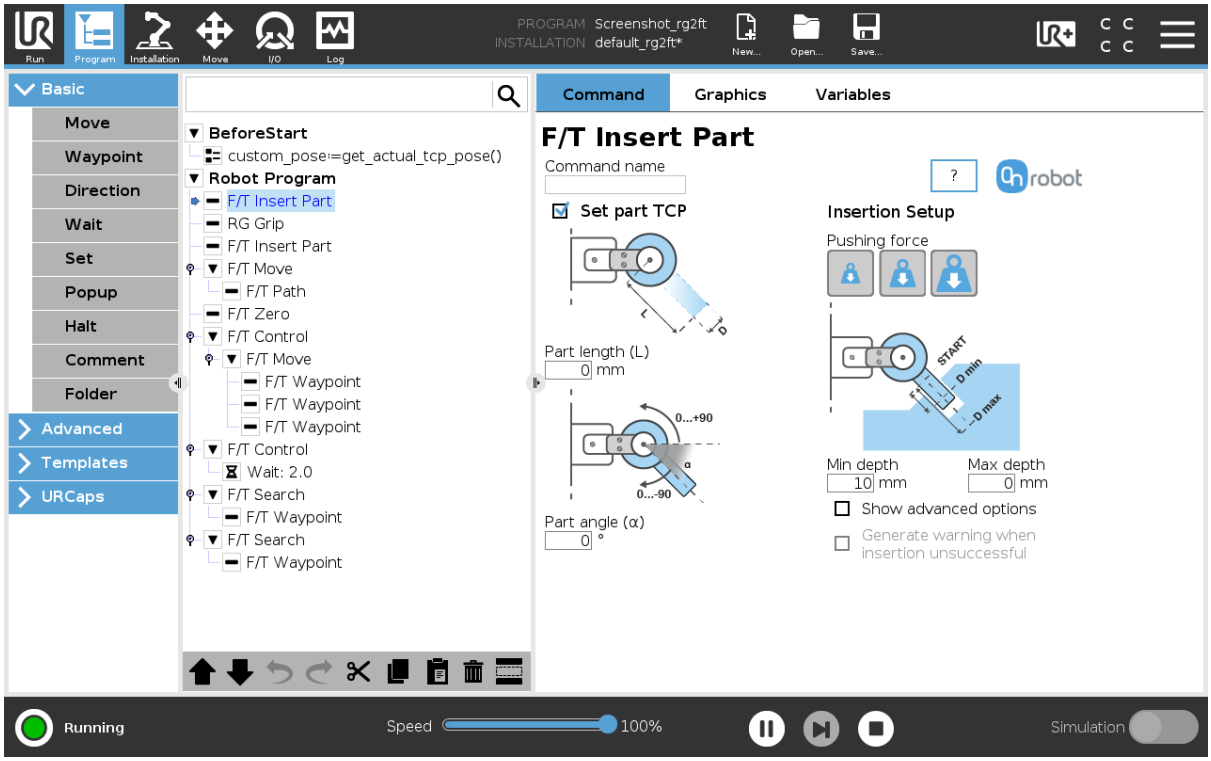
Mass: the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

F/T Insert Part

The `F/T Insert Part` command can be used for precision fitting an object into a hole.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Insert Part` command and make sure the tool is not in contact with any object before starting the `F/T Insert Part`, otherwise the command may not stop at the given force/torque limit.



If the **Set part TCP** checkbox is checked the TCP will be set at the further end of the part. It requires the following two parameters to be given:

Part length (L): the distance between the center point of the fingertip sensors and the center point of the item to be inserted.

Part angle (α): the angle between the +Y axis of the fingertip sensor and the insertion direction of the item to be inserted.

Pushing force: the pushing force can be selected:

sets the pushing force to be 3N.

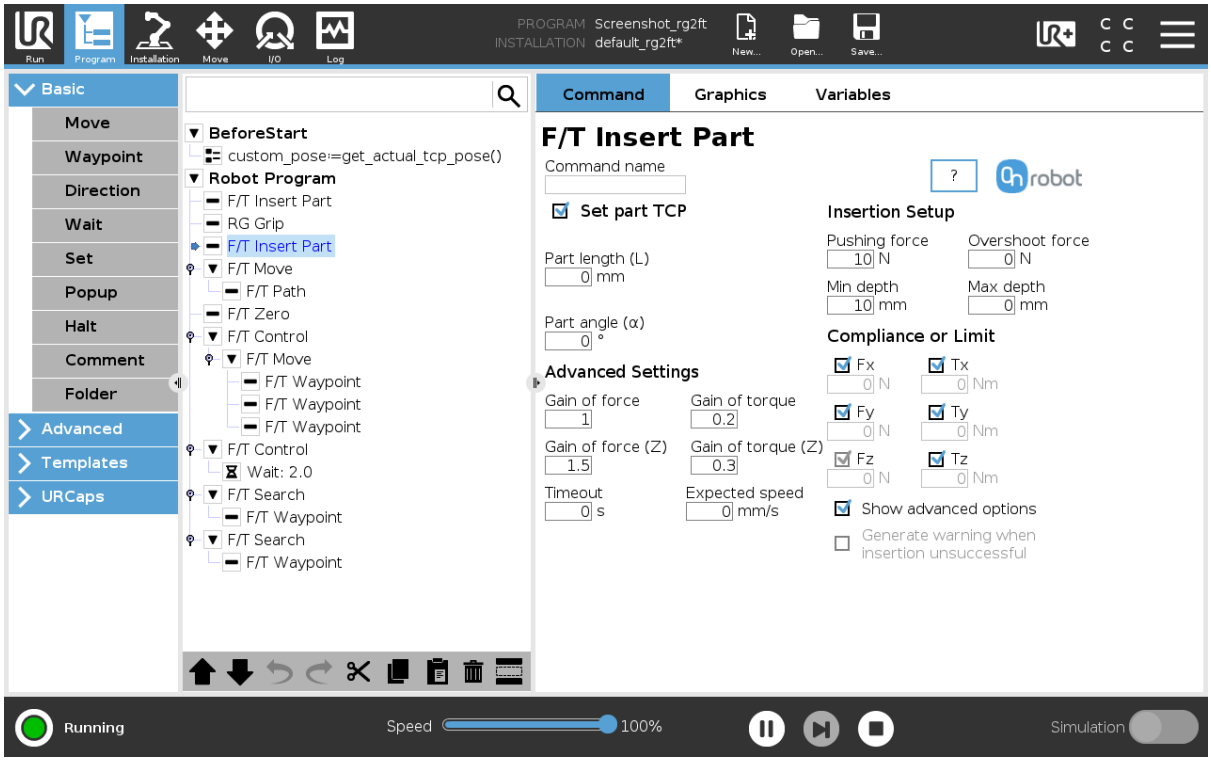
sets the pushing force to be 6N.

sets the pushing force to be 12N.

Min depth: The minimum distance required to consider the insertion successful, from the starting point.

Max depth: The maximum distance the insertion can reach, from the starting point.

Show advanced options checkbox: If checked, more options become available:



Gain of force: The proportional gain parameter of the force control for the side forces on compliant axes.

Gain of torque: The proportional gain parameter of the torque control for the compliant axes.

Gain of force (Z): The proportional gain parameter of the force control for the pushing force.

Gain of torque (Z): The proportional gain parameter of the torque control parallel to the insertion direction.

NOTE:

High gain values can result vibration and protective stop. Higher mass and bigger distance can be vibrating more easily.

Timeout: The maximal allowed time for the whole insertion function. If it is set to zero, this exit criterium is neglected.

Expected speed: The minimum speed the insertion is expected to progress with. If this parameter is set, and the insertion is progressing at a slower pace, it is interrupted and considered unsuccessful. If it is set to zero, this exit criterium is neglected.

Pushing force: The force target used for the force control to push the item into the hole.

Overshoot force: If this parameter is set, after the Minimum depth has been reached, a ‘bump’, an increase in the pushing force is expected (such as closing a snap-fit joint). This parameter is the additional force on top of Pushing force that the insertion is performed with, between the minimum and maximum depths.

Compliance or Limit Fx, Tx, Fy, Ty, Tz checkboxes: if checked, the selected axis is compliant, meaning that the movement tries to keep the forces zero in the selected directions. If not checked a limit can be set for the force or torque, that if reached, stops the command.

Generate warning when insertion unsuccessful: If enabled, a pop-up message (blocking) appears if the insertion was not successful.

NOTE:

The option is only active when a valid limit has been set at the advanced screen.

If disabled, then no pop-up message is shown but the user can handle any possible errors by the return value of the command.

See return values in the **6.5. Return Values** section.

F/T Control

Applications such as polishing, deburring, sanding or grinding may require holding constant force/torque to a defined direction during movements.

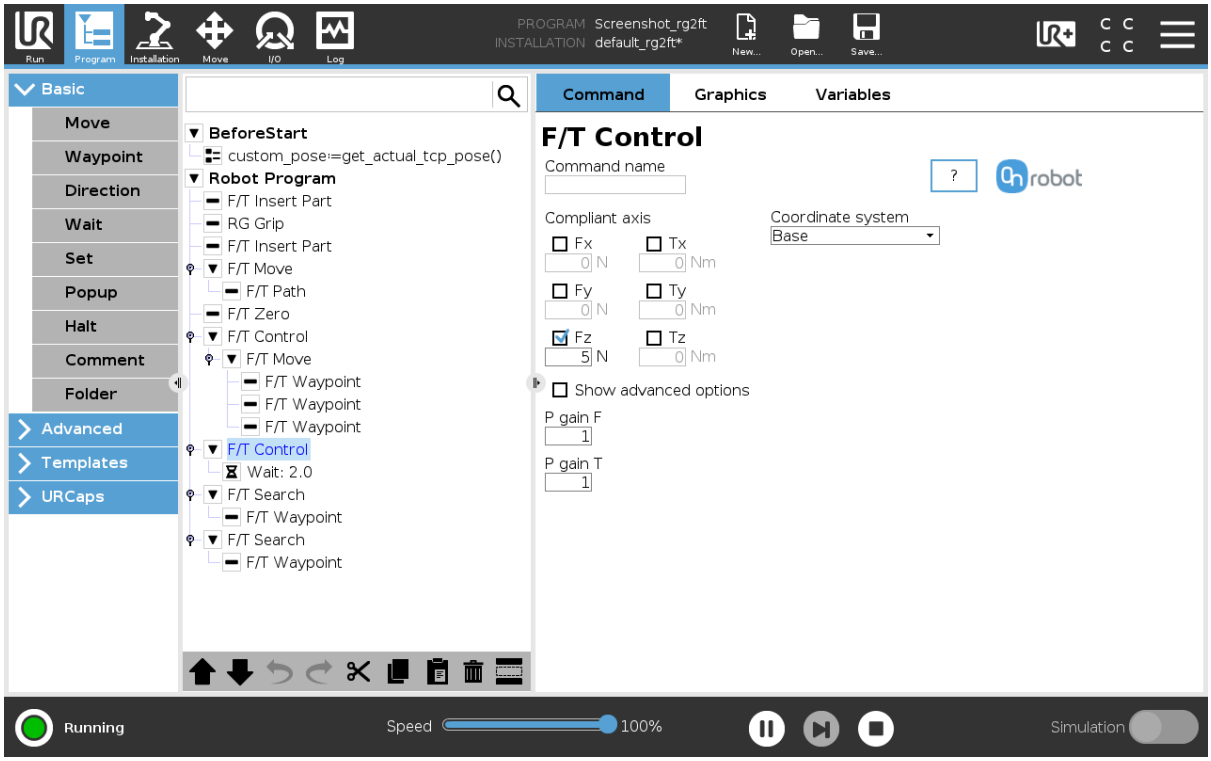
This command alters the trajectory of its child node(s) in order to keep the force/torque values constant along/about the selected axes.

NOTE:

UR's built-in Move commands cannot be used under the `F/T Control` command. To move the robot under the force control, use the `F/T Move` or `F/T Search` command instead.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Control` command and make sure the tool is not in contact with any object before starting the `F/T Control`, otherwise the command may not work properly.



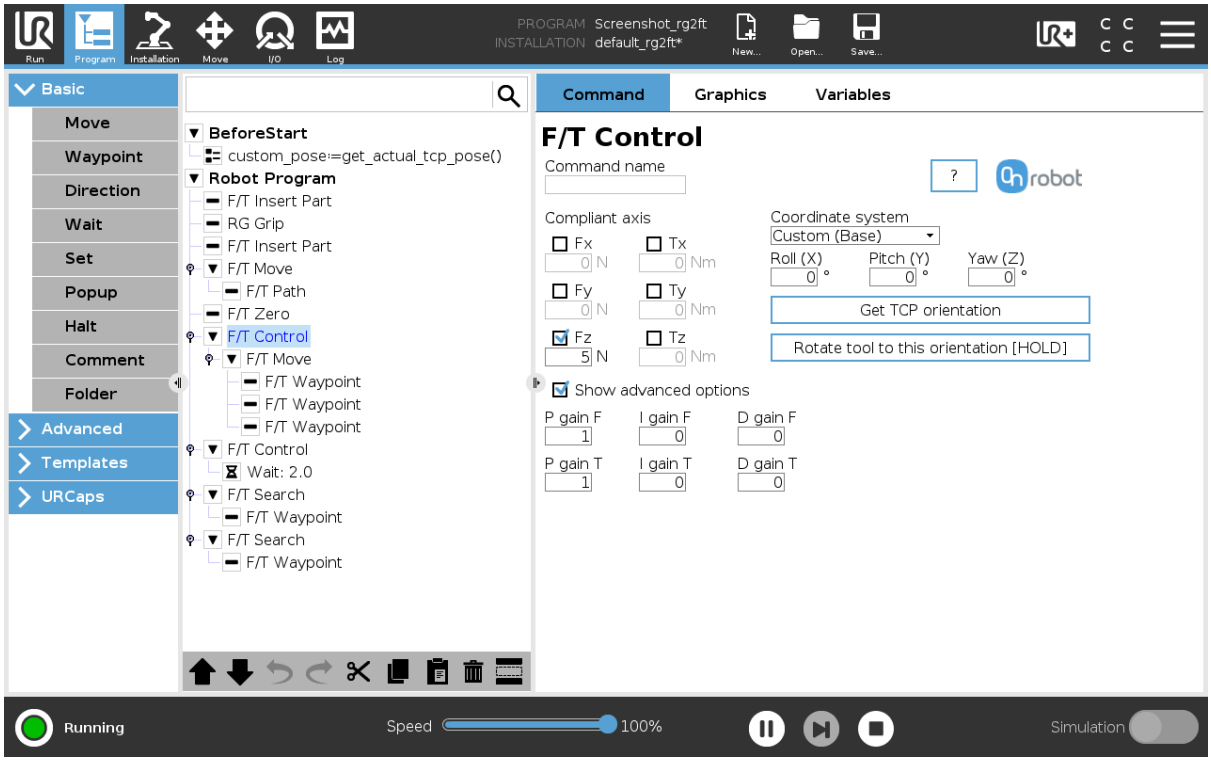
Compliant axis Fx, Fy, Fz, Tx, Ty, Tz: The axis selection that needs to be compliant. If an axis is enabled (compliant) the movement along/about that axis is force/torque controlled otherwise (non-compliant) position controlled. The enabled axis is controlled to keep the set force/torque value constant. At least one compliant axis must be selected.

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

P gain F: The force controller can be tuned with this proportional gain parameter. If any overshoots or vibrations occur, try lowering the gain value (e.g.: 0.5).

P gain T: The torque controller can be tuned with this proportional gain parameter. If any overshoots or vibrations occur, try lowering the gain value (e.g.: 0.5).

Show advanced options: If checked then more options become available:



I gain F: The force controller can be tuned with this integral gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

I gain T: The torque controller can be tuned with this integral gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

D gain F: The force controller can be tuned with this derivative gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

D gain T: The torque controller can be tuned with this derivative gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

This command has no return value.

Guidelines to PID force/torque controller settings:

The PID force/torque controller continuously calculates the error value for the force/torque measured by the sensor, compared to the values set by the `F/T Control` command, and applies correction based on this error.

P gain F and **P gain T**: The proportional term produces a correction that is proportional to the current error value. Increasing this parameter, has the following effects: faster reaction, overreaction, lower error, stability degradation.

I gain F and **I gain T**: The integral term produces a correction that is proportional to both, the magnitude, and duration of the past error values. Increasing this parameter, has the following effects: faster reaction, overreaction, lower error, stability degradation.

D gain F and **D gain T**: The derivative term produces a correction that is proportional to the slope or changing speed of past error values. Increasing this parameter, has the following effects: less overreaction, stability increase.

If the force control is too slow, that is, the tool occasionally leaves the surface instead of continually touching it, try increasing the **P gain F**, **P gain T**, **I gain F** and **I gain T** values.

If the force control is overreacting to changes, that is, the tool bounces off the surface, try decreasing the **P gain F** and **P gain T** (or **D gain F** and **D gain T**, if it is above 1).

If the force control is reacting to changes too slowly, that is it keeps pushing the surface hard after touching it, try decreasing the I Gain.

As a rule of thumb, it is recommended to use values:

```
P Gain < 5\
I Gain < 0.25\
D Gain < 1\
The ratio of P Gain/I Gain = 10
```

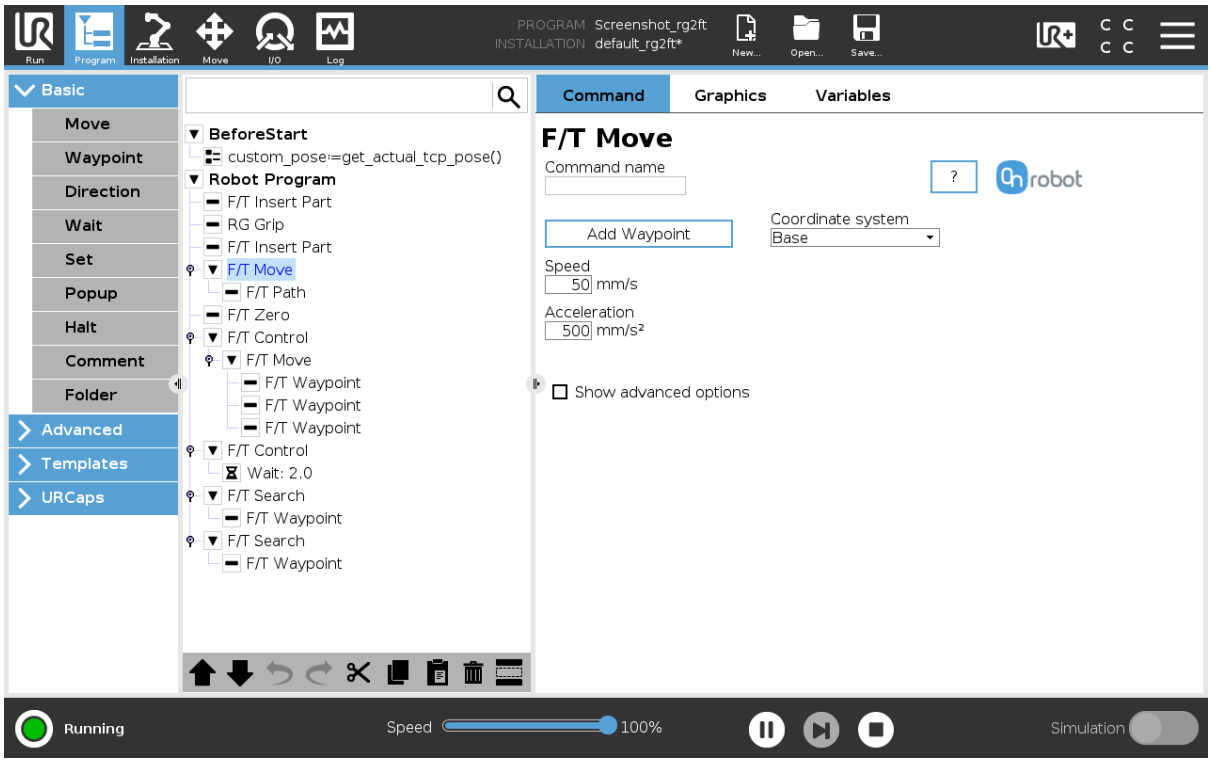
Values that can be used as a base for tuning are:
P Gain F =1, I Gain F = 0.1, D Gain F = 0.3
P Gain T =0.2, I Gain T = 0, D Gain T = 0

F/T Move

The `F/T Move` command can be used together with the `F/T Waypoint`, to move the robot along a route, or together with the `F/T Path` to move the robot along a path and stop once the defined force/torque limits are reached (movement interrupted). In this case a warning can be generated. If the movement reaches the last waypoint, the move is successful.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` command at the beginning of the `F/T Move` command and make sure the tool is not in contact with any object before starting the `F/T Move`, otherwise the command may not stop at the given force/torque limit.



To operate the `F/T Move` command tap on the **Add {{ waypoint.title }}** button to add an `F/T Waypoint` as a child node. More waypoints can be added in the same way. To remove a waypoint, use the **Structure** tab **Delete** button.

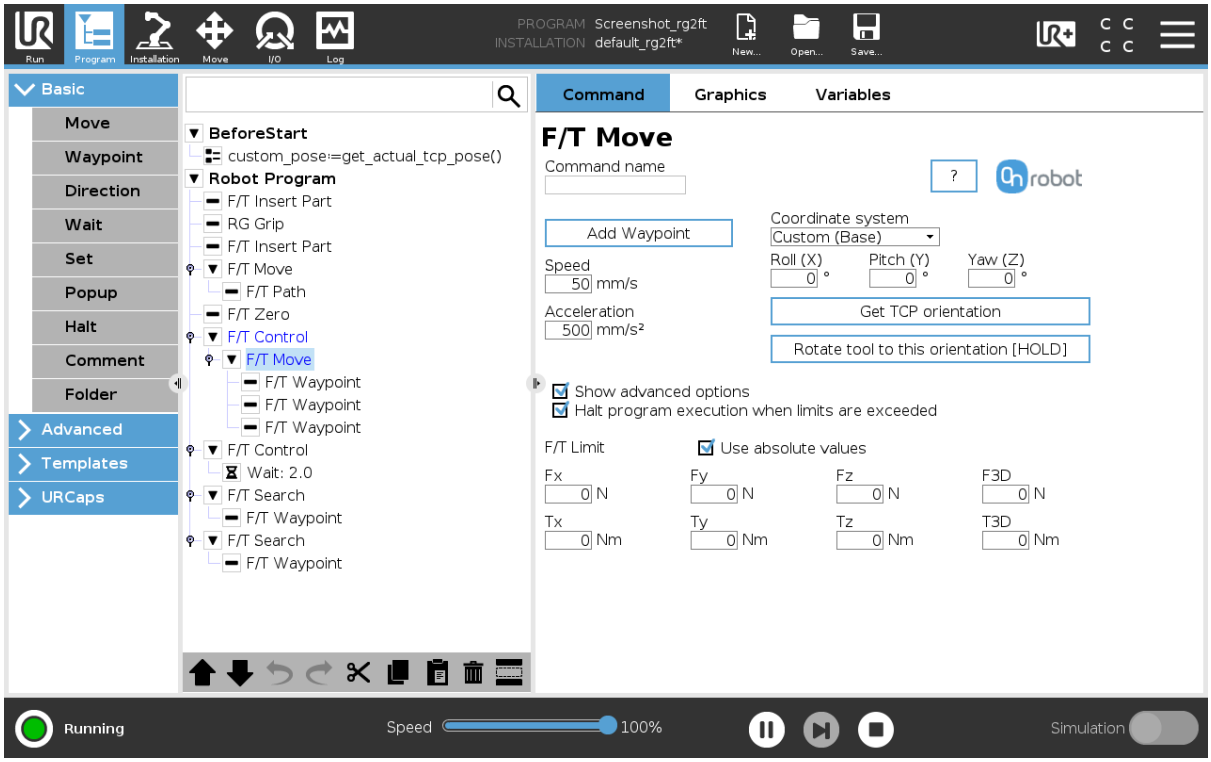
Alternatively, `F/T Waypoint` or `F/T Path` could be added as a child node of the `F/T Move` command by using the **Structure** tab.

Speed: The movement speed limit while moving. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

Acceleration: The acceleration and deceleration parameter of the movement.

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

Show advanced options: If checked then more options become available:



F/T Limit Fx,Fy,Fz,Tx,Ty,Tz,F3D,T3D: If any of the values reach the set threshold the stop is triggered. Values equal to zero are neglected. More than one option can be set.

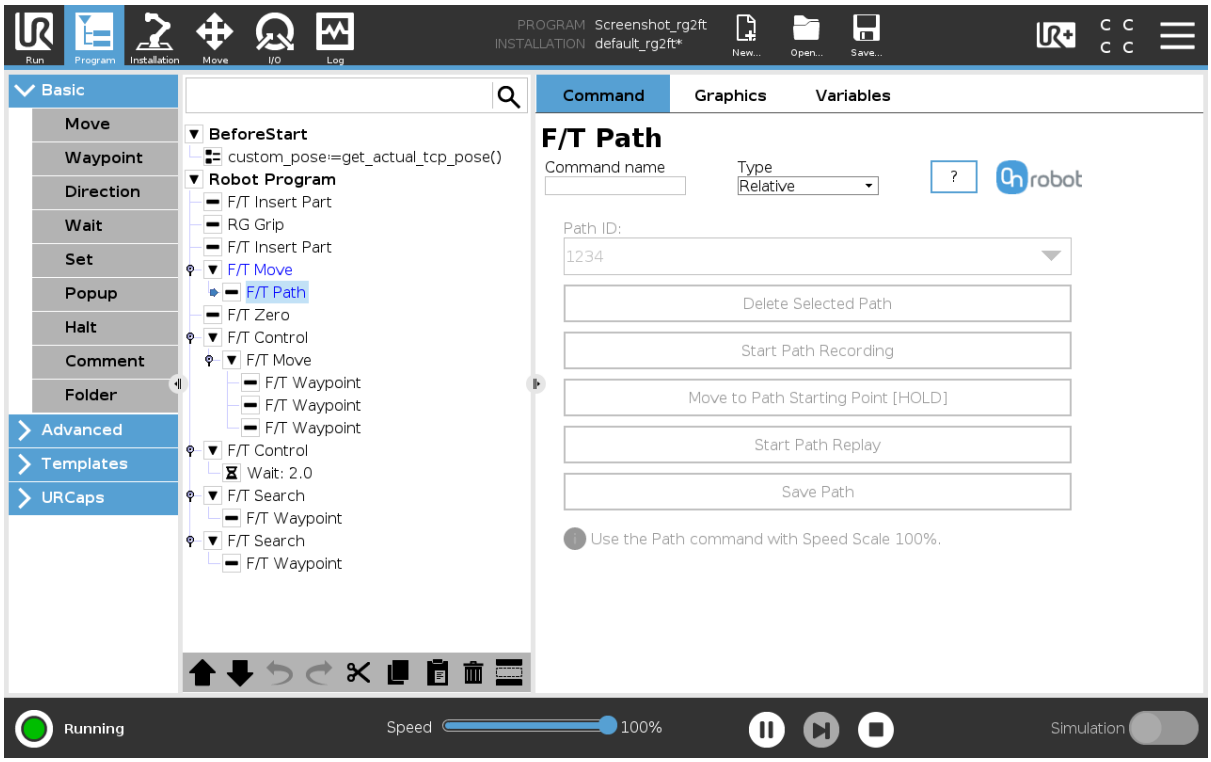
If the **Use absolute values** option is enabled, then it is not important whether the entered value is positive or negative (e.g.: |Fz| > = 3), otherwise the sign defines how the threshold is calculated (e.g.: Fz > = 3 or Fz <= -3)

Halt program execution when limits are exceeded: If enabled then the program execution will be stopped when the target position is not reached (the move is not successful since the F/T Limit is reached). If the move is successful, then the program continues. If disabled, then

no pop-up message is shown but the user can handle any possible errors using the return value of the command. See return values in the **6.5. Return Values** section.

F/T Path

The `F/T Path` command can be used together with the `F/T Move` or `F/T Search` command, to record and replay a Path.



Type: If relative is selected, the Path is replayed starting from the actual position of the Tool, instead of the absolute position where it was recorded. If absolute is selected, the Tool moves to the original starting point, and replays the Path from there.

Path ID:: Lists identifiers of all the Paths saved on the Compute Box. A Path ID is assigned to a path, when the path is saved. If there is no recorded unsaved path, there is a Record new... item, select it to record a new path. If there is a recorded Path that is not saved, there is an Unsaved item in the List.

NOTE:

Only one unsaved Path can exist, and it will be overwritten by starting a Path recording while the Unsaved Path is selected.

Delete Selected Path: Deletes the path currently selected in the Path ID dropdown list from the Compute Box, permanently.

NOTE:

Do not delete a Path that any other `F/T Path` commands is using.

Start Path Recording: Starts recording a Path by automatically enabling the Hand Guide function.

Stop Path Recording: Stops the Hand Guide function and stores the recording to the memory. It does not permanently save the Path.

Move to Path Starting Point [HOLD]: Moves the Tool to the starting position of the Path, it can only be used if the path is not relative.

Start Path Replay: Replays the Path, even if it is not saved, only stored in the memory.

Stop Path Replay: Stops replaying the Path.

Save Path: Saves the Unsaved Path to the Compute Box.

NOTE:

The robot speed must always be 100%, replaying at lower speed can create a significant deviation from the recorded trajectory.

NOTE:

Rotational movements related to translational movements in Path recording are limited to 2.8 degrees/mm or less, since a larger ratio would cause the Robot to replay the path at a very low translational speed. Rotational movement without translational movement therefore cannot be recorded as Path.

NOTE:

The maximum error of the replayed Path compared to the original recorded movement can be up to 1 mm.

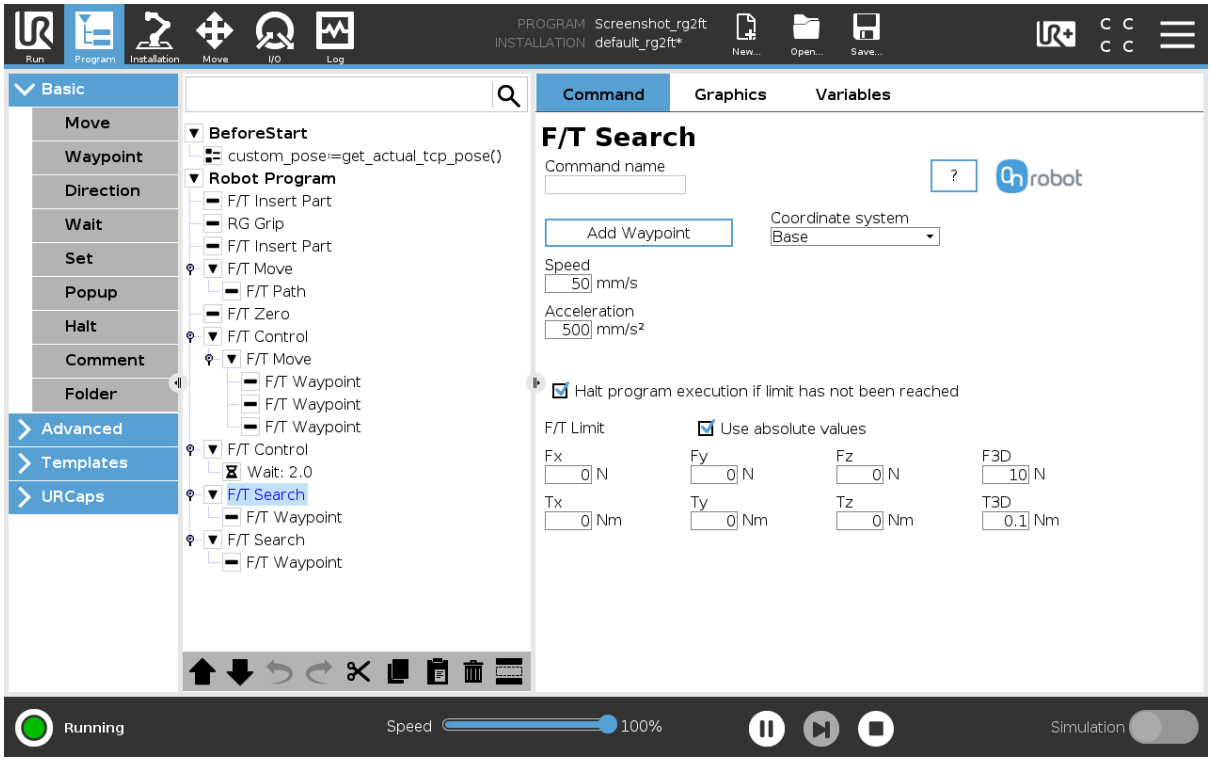
This command has no return value.

F/T Search

The `F/T Search` command is used together with the `F/T Waypoint` command, to move the robot along a route, or together with the `F/T Path` to move the robot along a Path and stop once the defined force/torque limits are reached (object found). If the movement reaches the last waypoint or the last point of the path, the search is not successful (the object is not found) and a warning is generated.

NOTE:

To cancel any force/torque offset, execute an `F/T Zero` at the beginning of the `F/T Search` command and make sure the tool is not in contact with any object before starting the `F/T Search`, otherwise the command may not stop at the given force/torque limit.



To operate the `F/T Search` command tap on the **Add Waypoint** button to add an `F/T Waypoint` as a child node. More waypoints can be added in the same way. To remove a waypoint, use the **Structure** tab **Delete** button.

Alternatively, `F/T Waypoint` or `F/T Path` could be added as a child node of the `F/T Search` command by using the **Structure** tab.

Speed: The movement speed while searching for collision. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

NOTE:

Overshooting can occur during search, especially with hard contacts (e.g. metal surfaces). To limit overshoots you should lower the speed.

Acceleration: The acceleration and deceleration parameter of the movement.

F/T Limit Fx,Fy,Fz,Tx,Ty,Tz,F3D,T3D: This is the detection limit. From the Fx, Fy, Fz, Tx, Ty, Tz, F3D, T3D available options more than one can be set. In this case, if any of the values reach the set threshold the stop is triggered. Values equal to zero are neglected.

If the **Use absolute values** option is enabled, then it is not important whether the entered value is positive or negative (e.g.: |Fz| > = 3), otherwise the sign defines how the threshold is calculated (e.g.: Fz > = 3 or Fz <= -3)

Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The Custom coordinate systems are calculated from the basis coordinate system and the given Roll, Pitch and Yaw values. For the Custom (Base) coordinate system, it is also possible to use the **Get TCP orientation** button to specify the orientation of the

coordinate system, by the orientation of the current TCP. To test the given orientation, the **Rotate tool to this orientation [HOLD]** button can be used.

Halt program execution if limit has not been reached: If enabled, then the program execution will be stopped when the target position is reached or was already in collision (so the search is not successful). If the search is successful, then the program continues. If disabled, then no pop-up message is shown but the user can handle any possible errors by the return value of the command.

See return values in the **6.5. Return Values** section.

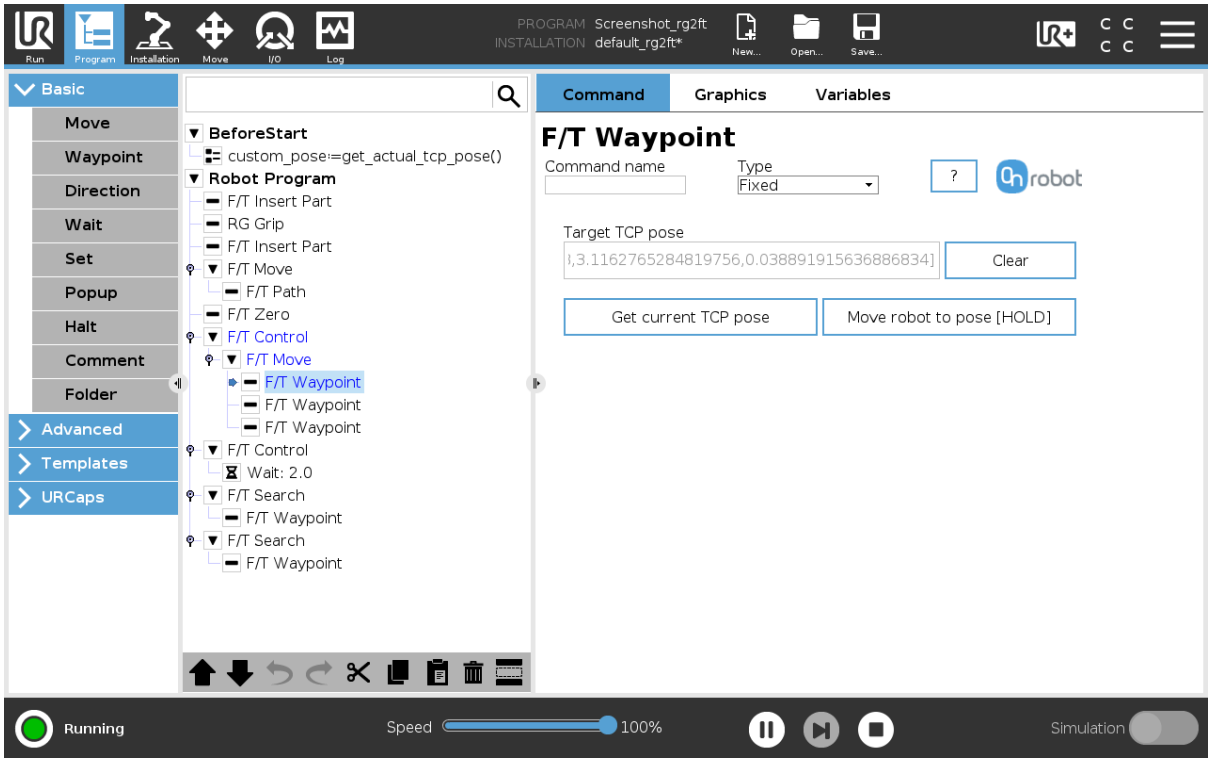
F/T Waypoint

The `F/T Waypoint` command is used together with the `F/T Move` or `F/T Search` command, to move the robot along a route. There are three types of waypoints (Fixed, Relative, and Variable), that can be used in any combination.

NOTE:

Do not use consecutive `F/T Waypoint`s that only contain rotations in the same `F/T Move` command. Use more than one `F/T Move` commands to achieve rotations without translational movements.

Type: The type of the waypoint. It can be set to Fixed, Relative, or Variable.

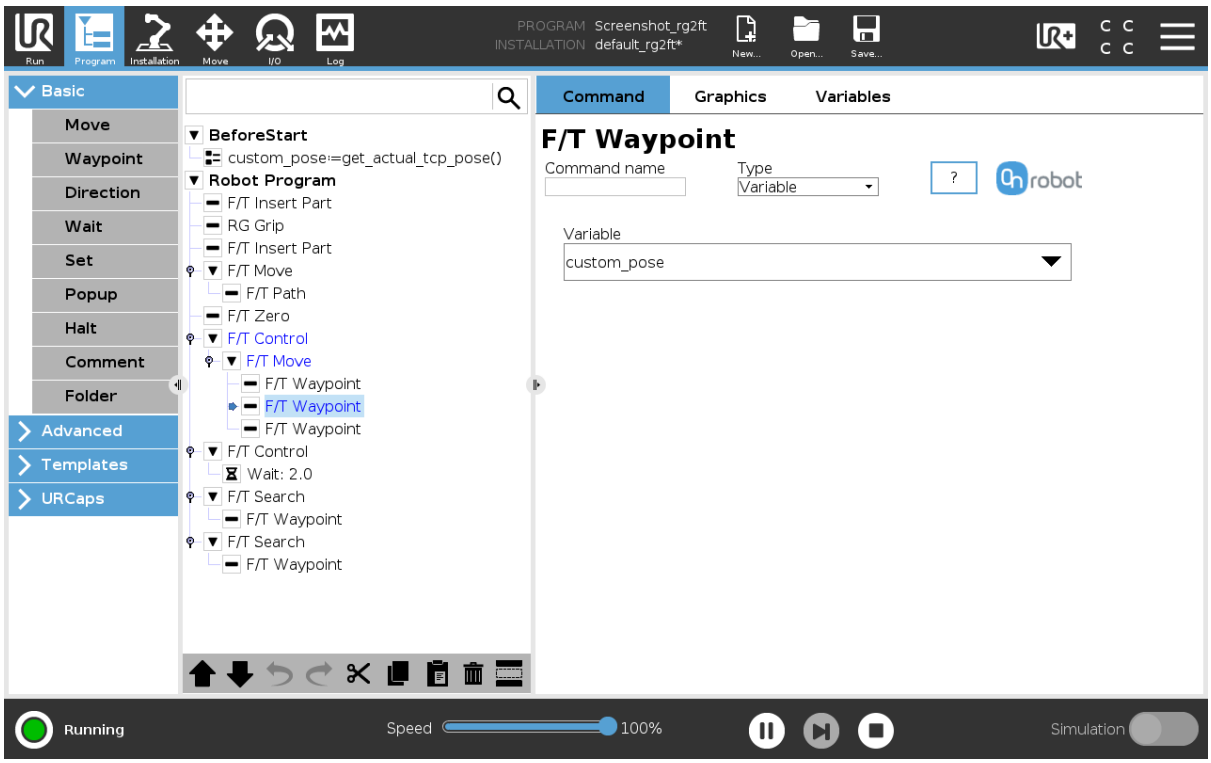


Target TCP pose: The position represented by the waypoint in the robot route. It is a read-only field and can be filled by using the **Get current TCP pose** button.

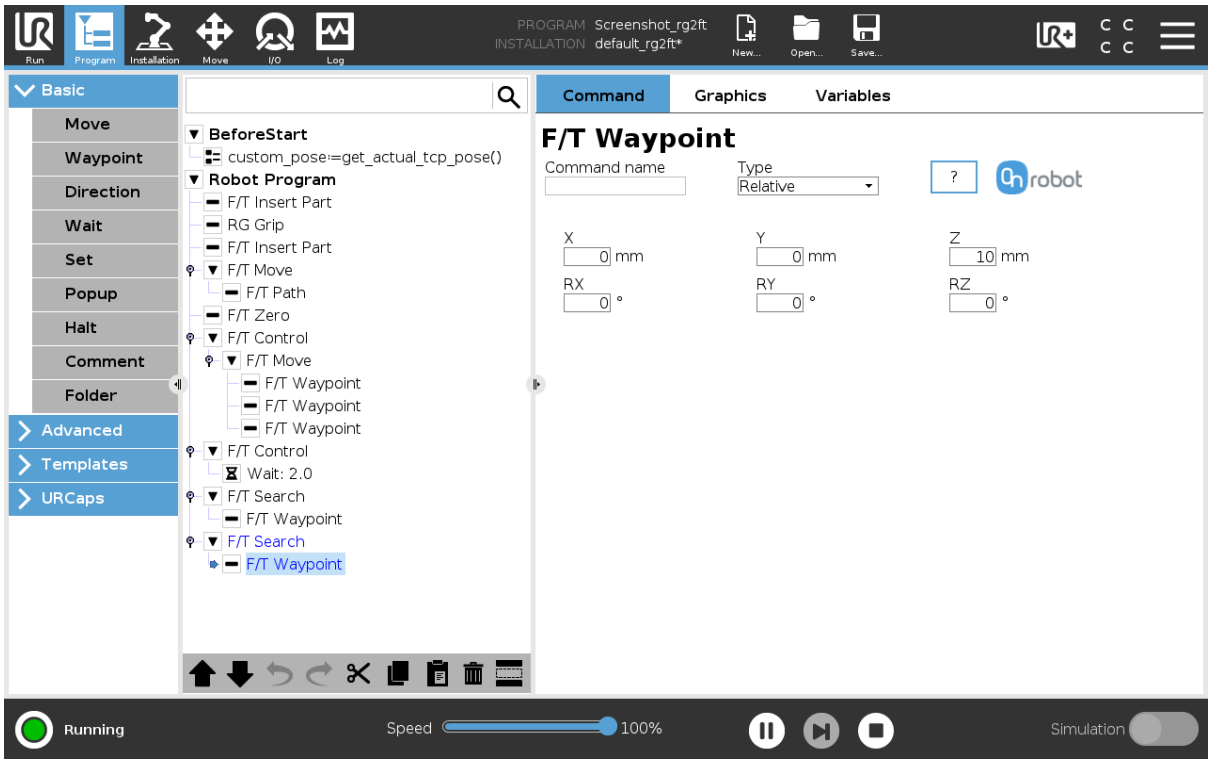
Clear: deletes the contents of the **Target TCP pose** field.

Get current TCP pose: inserts the current TCP coordinates into the **Target TCP pose** field.

Move robot to pose [HOLD]: moves the robot to the pose set in the **Target TCP pose** field, if the button is pressed. Once it is released the robot stops.



Variable: The position represented by the waypoint in the robot route. A variable can define the target pose. The variable needs to be created first.

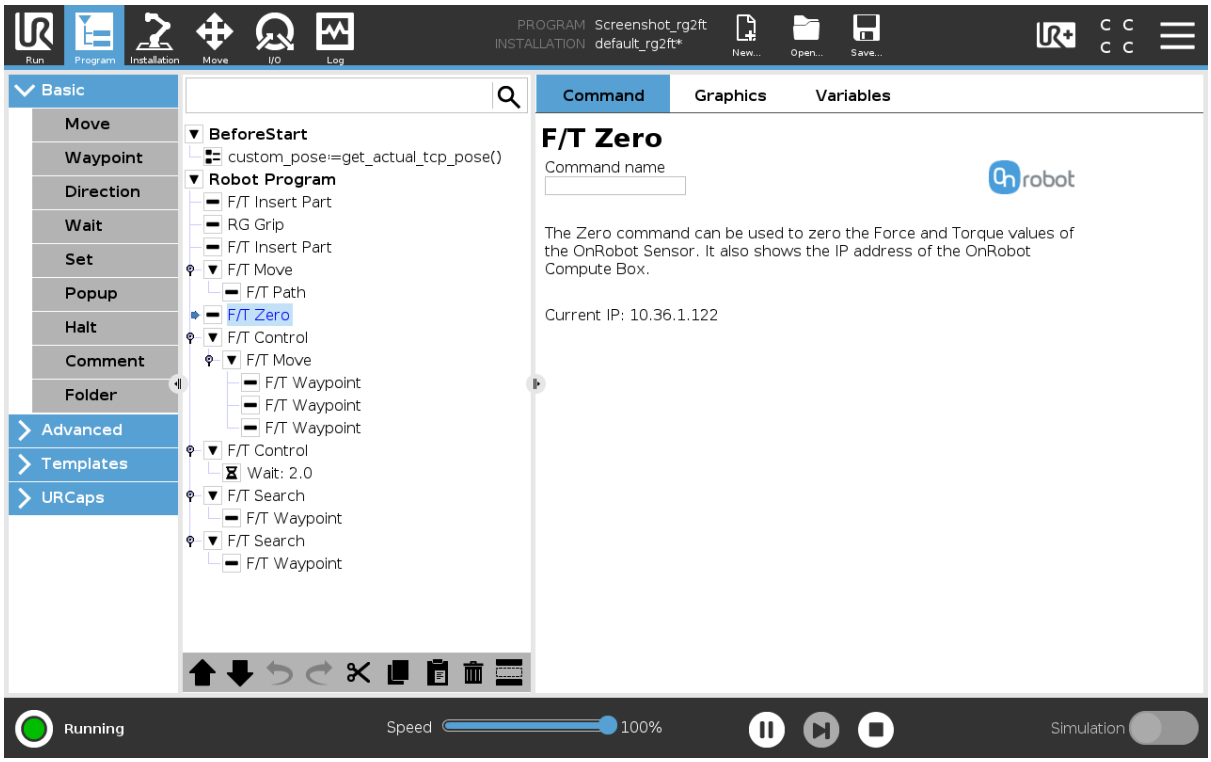


Relative X, Y, Z, RX, RY, RZ: the distances and rotations this waypoint represents, compared to the previous robot position.

This command has no return value.

F/T Zero

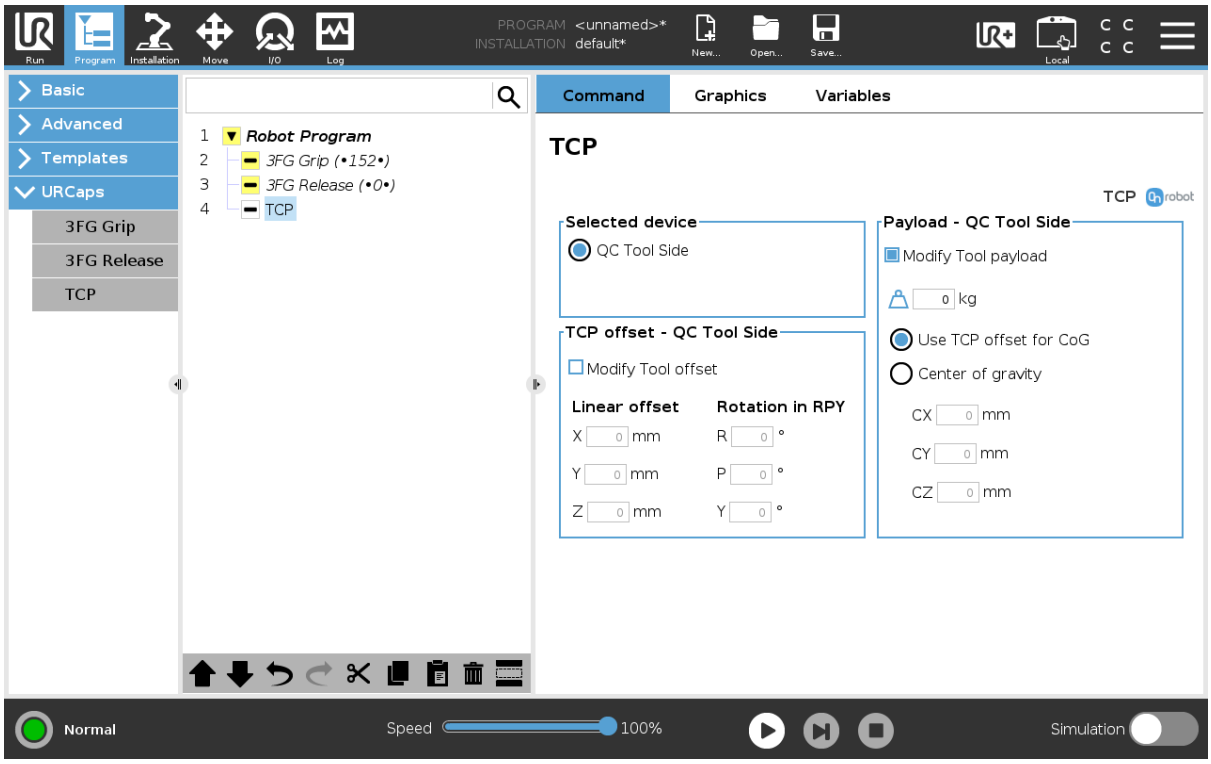
The `F/T Zero` command can be used to zero the force/torque values.



This command has no return value.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

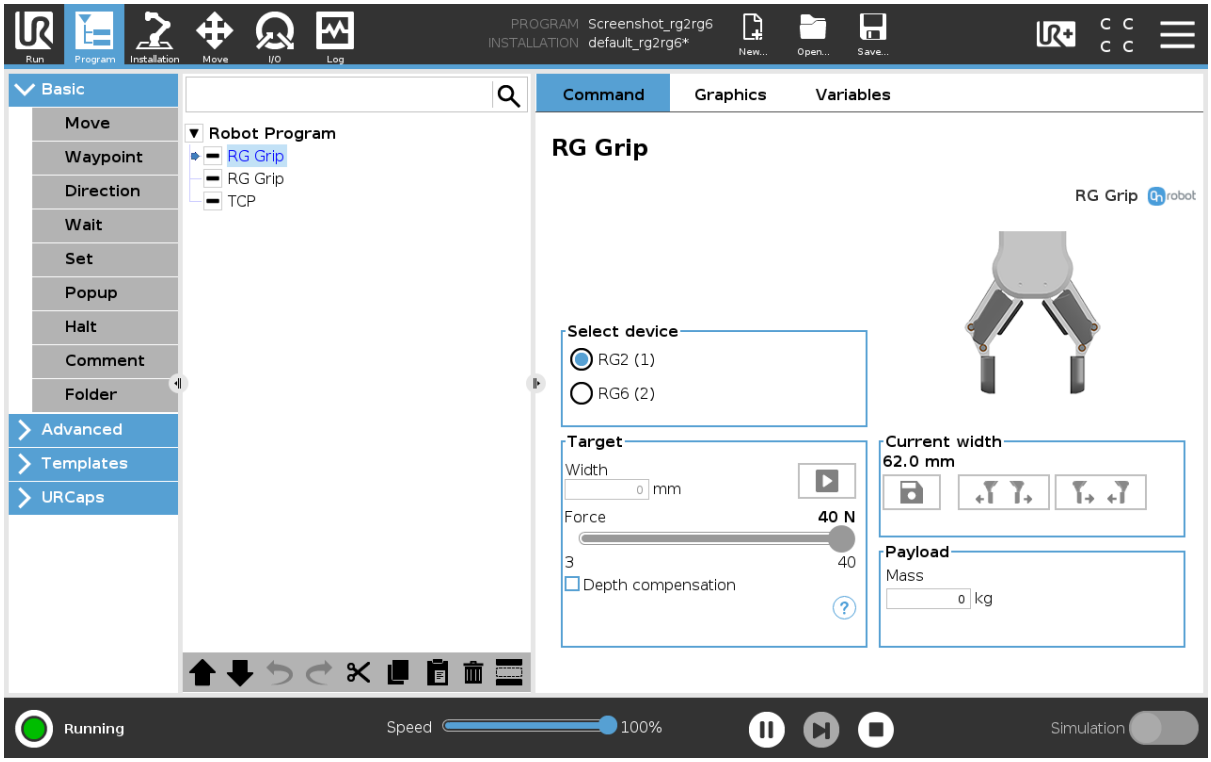
Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

6.1.4. RG2/6

RG Grip

The `RG Grip` command is used to grip/release a workpiece.

When the `RG Grip` command is executed, the gripper will try to reach the specified target (**Width** and **Force**) and, if selected, **Depth compensation**. The different functions are explained below.



Select device

When two grippers are used, the radio buttons with the gripper's name will appear. These buttons will select which one of the two grippers performs the action.

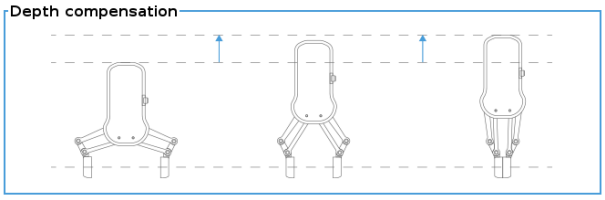
Target

Width: The target gripping width can be set by using the Save as Target/Save Grasp button (recommended) or by typing it in manually.

When pressed, the gripper will act as if the command is executed.

Force: Set the target gripping Force (3-40 N for the RG2 and 25-120 N for the RG6).

Depth compensation: During closing and opening the gripper, the robot moves to compensate for the circular movement of the fingers, so that the fingertips remain on the target. When the icon is pressed, the following graphical illustration will appear in a new page.



NOTE:

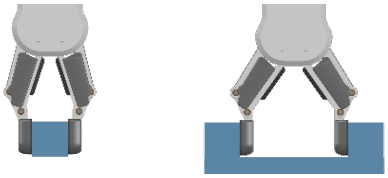
For optimal performance of gripping Force, set the **Target Width** 1 to 4 mm lower than the **Width** of the workpiece if the workpiece is grabbed externally or 1 to 4 mm higher if grabbed internally.

For optimal performance of **Depth compensation** set the robot speed slider to 100%.

Current width

The number shows the **Current width** value.

will set the **Current width** as target width. If used when a grasp is detected (see image below) this will set the target width as current width – 3 mm if the workpiece is grabbed externally and + 3 mm if the workpiece is grabbed internally.



These are open and close hold-to-run buttons.

NOTE:

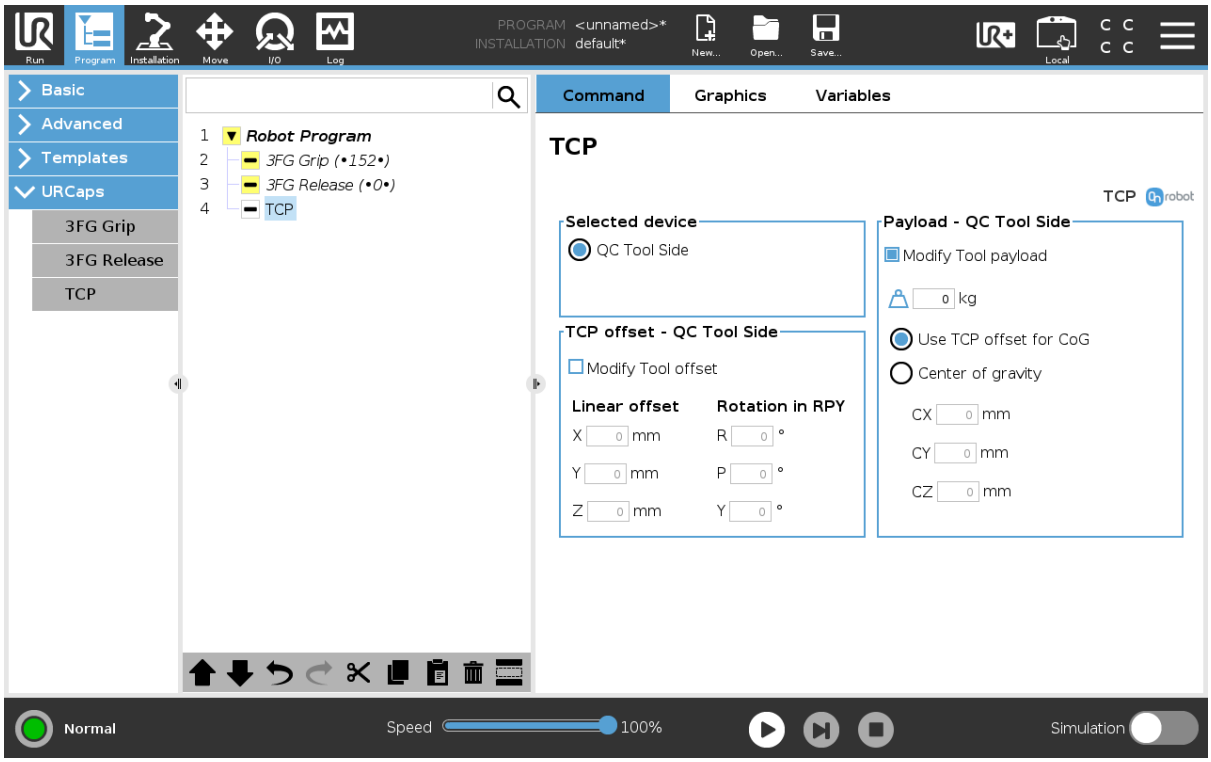
To enhance width precision the target Force is not applied when using these buttons

Workpiece

Mass: the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

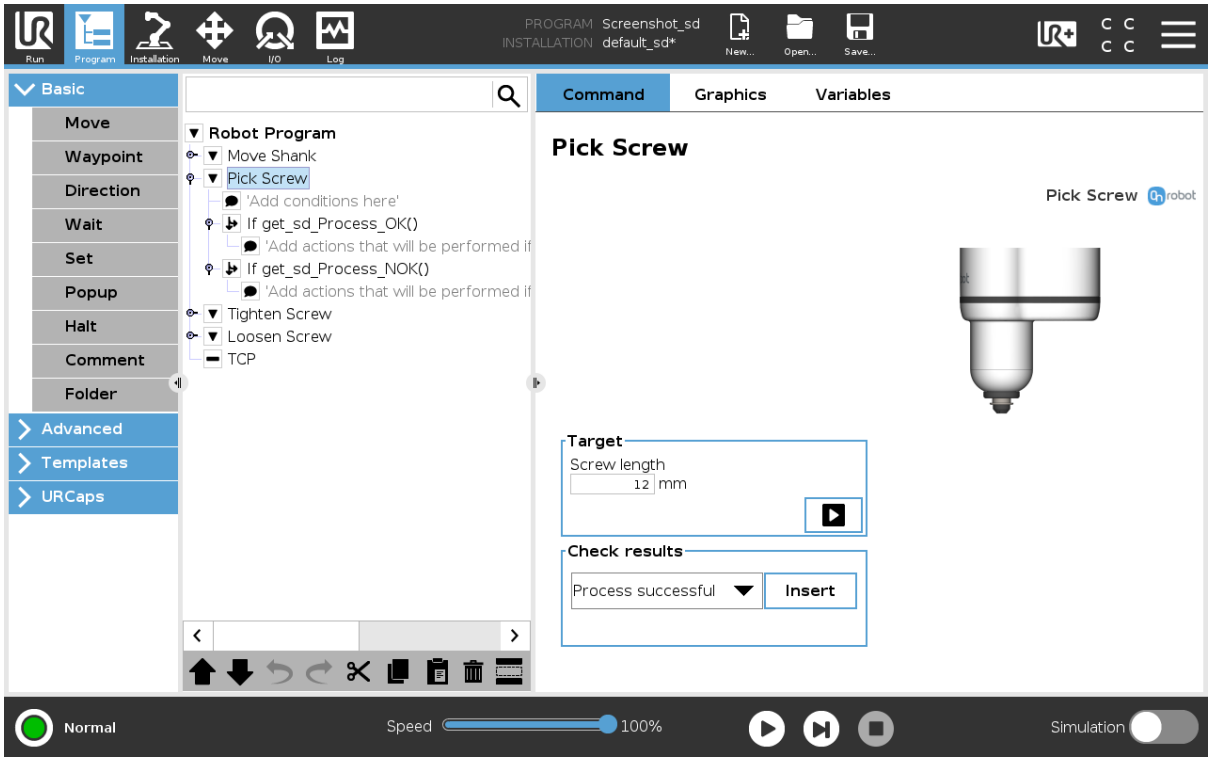
6.1.5. Screwdriver

6.1.5.1. Pick Screw

When the `Pick Screw` command is executed, the screwdriver will move and rotate the bit to align it with the screw head, then it will pick up the screw and hide it inside the housing.

In the 6.6.5. Feedback Variables section, the variables that provides information about the result of the command are explained.

The different functions are explained below.



Target

Screw length: Input the length of the screw.

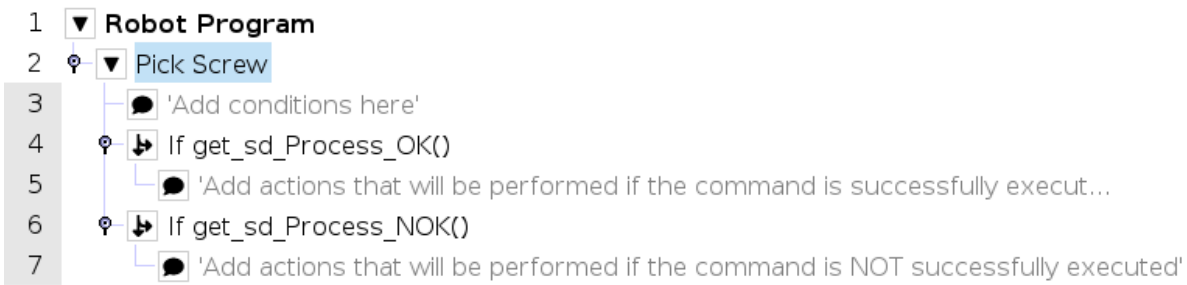
When pressed, the screwdriver will act as if the command is executed.

Check results

Selecting one of the 2 options from the dropdown list and pressing **Insert** will add an if statement in the robot program based on the selected option as shown in the screenshot below.

The Dropdown list options are:

- **Process successful**: Uses the function **get_sd_Process_OK()** and returns true if the command is executed correctly.
- **Process NOT successful**: Uses the function **get_sd_Process_NOK()** and returns true if the command is not executed correctly.



NOTE:

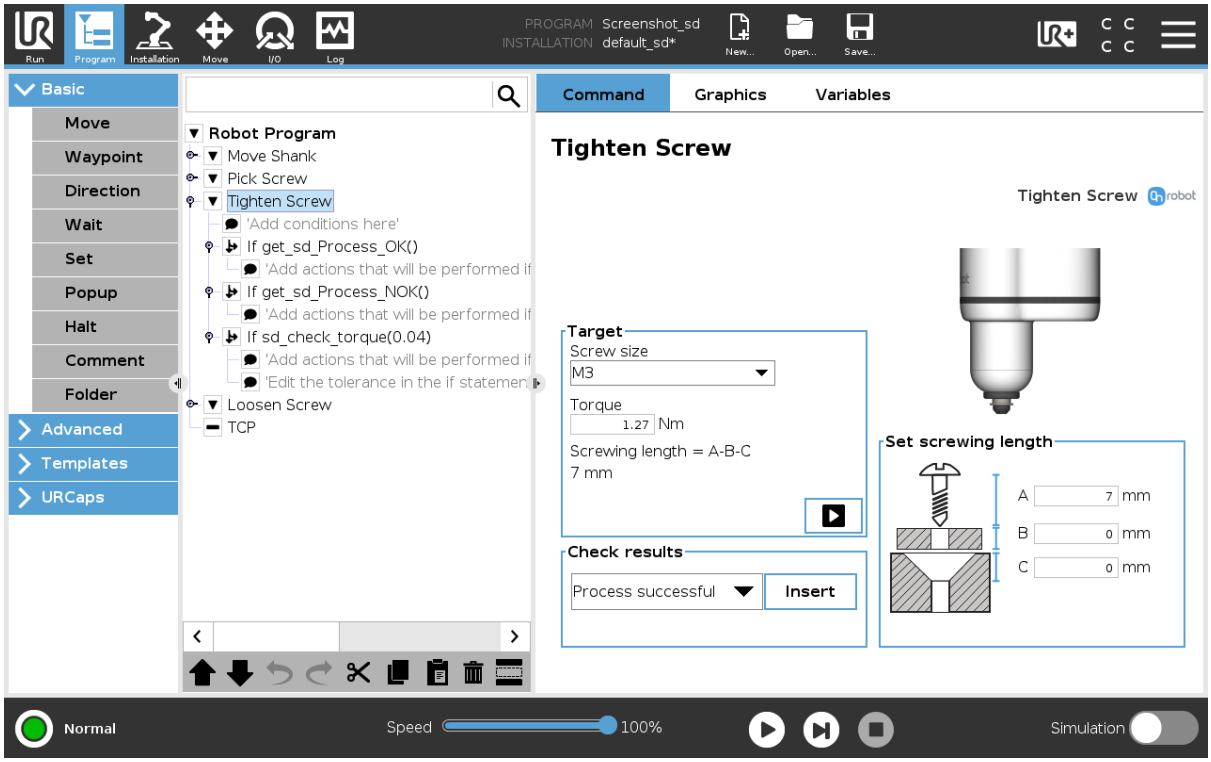
The screwdriver's bit should be at least 50 mm away from the picking point until the screw is waiting in place. Otherwise, the magnetic force of the Screw-bit System will attract the screw sidewise and it might cause a misalignment between the screw and the bit.

6.1.5.2. Tighten Screw

When the `Tighten Screw` command is executed, the screwdriver will move and rotate the Screw-bit System until it reaches the thread. Then, it will start to screw in the screw until 90% of the **Screwing length** is inside. During the rest 10% of the **Screwing length**, the screwdriver will tighten the screw applying the **Target Torque**.

In the 6.6.5. Feedback variables section, the variables that provides information about the result of the command are explained.

The different functions are explained below.



Target

Screw size: The screw sizes from M1.6 to M6 can be selected. This selection will autofill a suggested torque value for that particular screw type.

Torque: Input the target tightening torque.

Screwing length = **A-B-C**: The resulting screwing length is shown here. This is the amount of the screw that will be screwed into the thread. To set the value use the **Set screwing length** card and the resulting amount will be the **A** (screw length) - **B** (Washer thickness) - **C** (Chamfer deepness).

▶ When pressed, the screwdriver will act as if the command is executed.

Check results

Selecting one of the 3 options from the dropdown list and pressing **Insert** will add an if statement in the robot program based on the selected option.

The Dropdown list options are:

- **Process successful**: Uses the function **get_sd_Process_OK()** and returns true if the command is executed correctly.
- **Process NOT successful**: Uses the function **get_sd_Process_NOK()** and returns true if the command is not executed correctly.
- **Torque**: Uses the function **sd_check_torque(0.04)** and returns true if the **sd_Achieved_torque** is within the range of the **sd_Target_torque** +/- the tolerance. This tolerance is the number in brackets and can be edited by pressing on the if statement in the robot program and then pressing on the if input field in the command.

```
1  Robot Program
2    Tighten Screw
3      'Add conditions here'
4      If get_sd_Process_OK()
5        'Add actions that will be performed if the command is successfully execut...
6      If get_sd_Process_NOK()
7        'Add actions that will be performed if the command is NOT successfully executed'
8      If sd_check_torque(0.04)
9        'Add actions that will be performed if the sd_Achieved_torque = sd_Target_torque +/- tolerance'
10       'Edit the tolerance in the if statement above'
```

Set screwing length

The image shows 3 different lengths:

A = This is the screw length, distance from the screw bit to the bottom part of the screw head.

B = This is the washer thickness (or piece in between screw and thread), if no piece is used set it as 0. This amount will be subtracted from the Screw length to provide the resulting **Screwing length**.

C = This is the chamfer deepness. This amount will be subtracted from the Screw length to provide the resulting **Screwing length**.

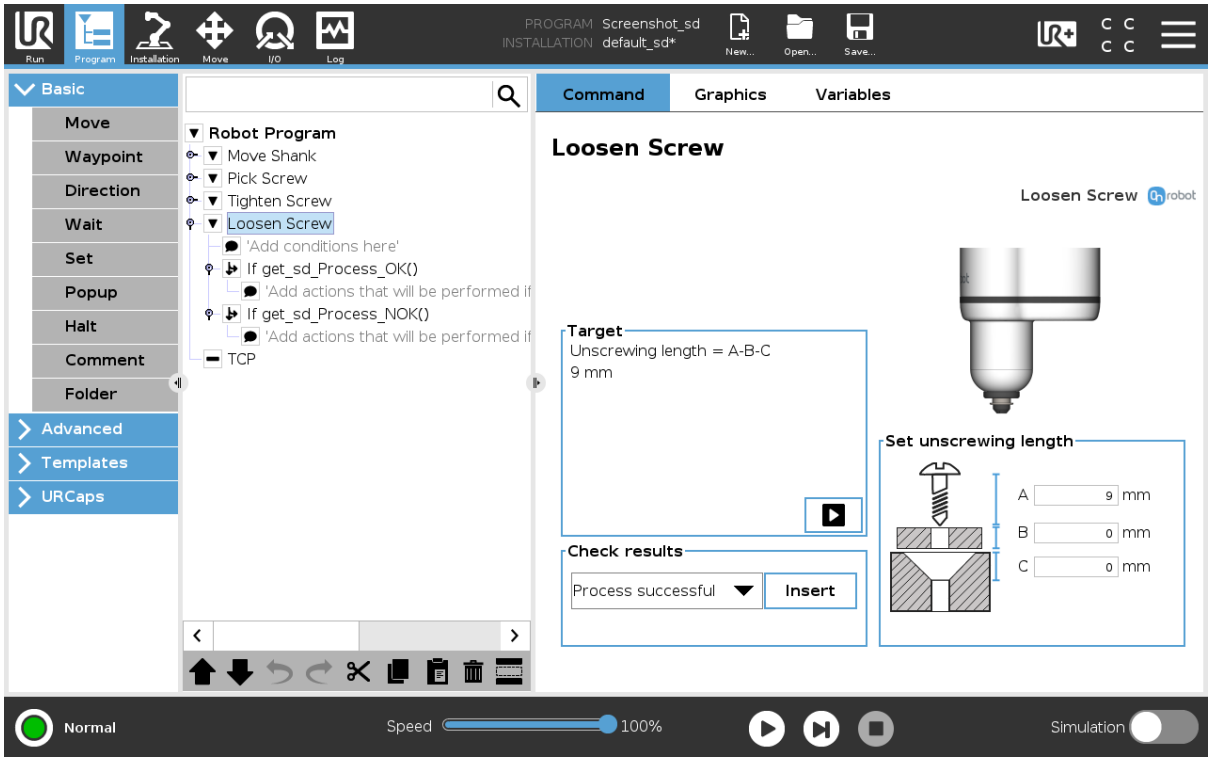
The background of the **A**, **B**, and **C** fields becomes yellow, respectively, when the **Screwing length** is out of range.

6.1.5.3. Loosen Screw

When the `Loosen Screw` command is executed, the Screwdriver will move and rotate the bit to align it with the screw head. Then, it will loosen and unscrew the screw until it is out the thread (specified **Unscrewing length**). Afterwards, it will hide the Screw-bit System inside the housing.

In the 6.6.5. Feedback variables section, the variables that provides information about the result of the command are explained.

The different functions are explained below.



Target

Unscrewing length = **A-B-C**: The resulting unscrewing length is shown here. This is the amount of the screw that will be unscrewed from the thread. To set the value use the **Set unscrewing length** card and the resulting amount will be the **A** (screw length) - **B** (Washer thickness) - **C** (Chamfer deepness).

When pressed, the screwdriver will act as if the command is executed.

Check results

Selecting one of the 2 options from the dropdown list and pressing **Insert** will add an if statement in the robot program based on the selected option as shown in the screenshot below.
The Dropdown list options are:

- **Process successful**: Uses the function **get_sd_Process_OK()** and returns true if the command is executed correctly.
- **Process NOT successful**: Uses the function **get_sd_Process_NOK()** and returns true if the command is not executed correctly.

```
1 Robot Program
2   Loosen Screw
3     'Add conditions here'
4     If get_sd_Process_OK()
5       'Add actions that will be performed if the command is successfully execut...
6     If get_sd_Process_NOK()
7       'Add actions that will be performed if the command is NOT successfully executed'
```

Set unscrewing length

The image shows 3 different lengths:

A = This is the screw length, distance from the screw bit to the bottom part of the screw head.

B = This is the washer thickness (or piece in between screw and thread), if no piece is used set it as 0. This amount will be subtracted from the Screw length to provide the resulting **Unscrewing length**.

C = This is the chamfer deepness. This amount will be subtracted from the Screw length to provide the resulting **Unscrewing length**.

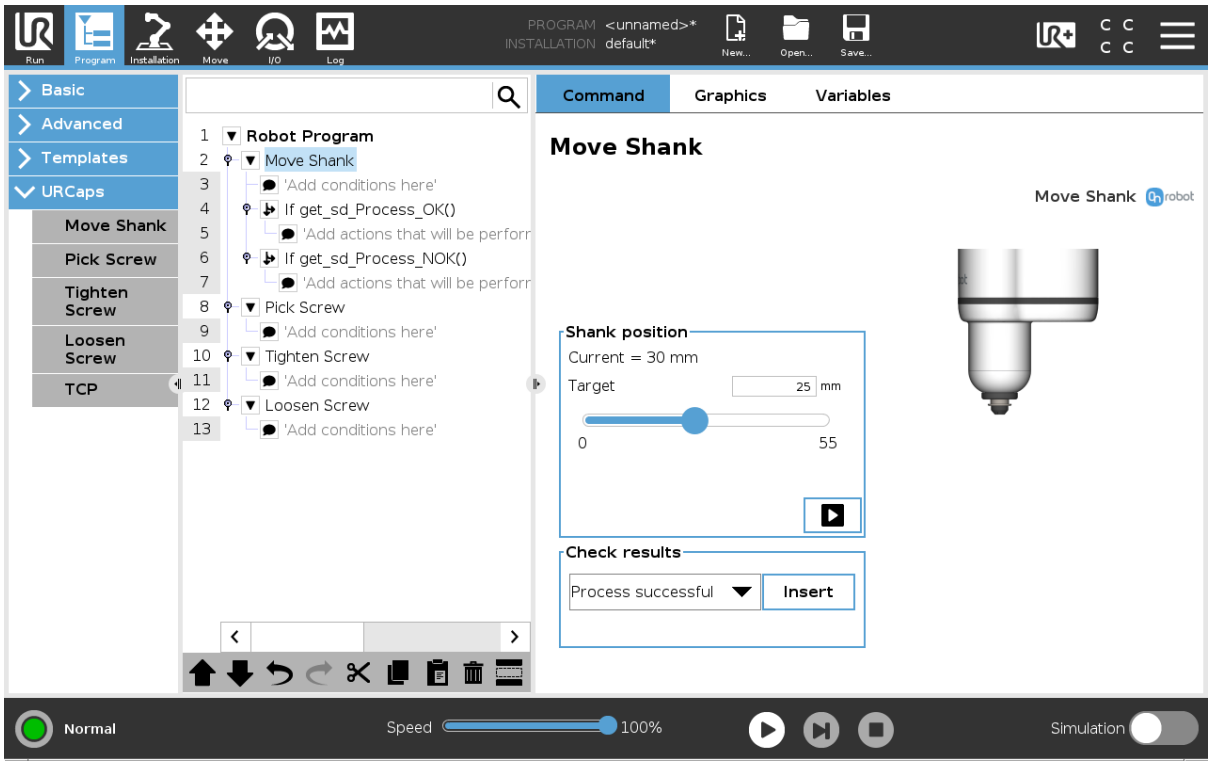
The background of the **A**, **B**, and **C** fields becomes yellow, respectively, when the **Unscrewing length** is out of range.

6.1.5.4. Move Shank

When the `Move Shank` command is executed, the screwdriver will move the shank showing the Screw-bit system or hiding it inside the housing.

In the 6.6.5. Feedback variables section, the variables that provides information about the result of the command are explained.

The different functions are explained below.



Shank position

Current: shows the current position of the shank.

Target: selects the target shank position. The target position can also be set by using the input field above the slider.

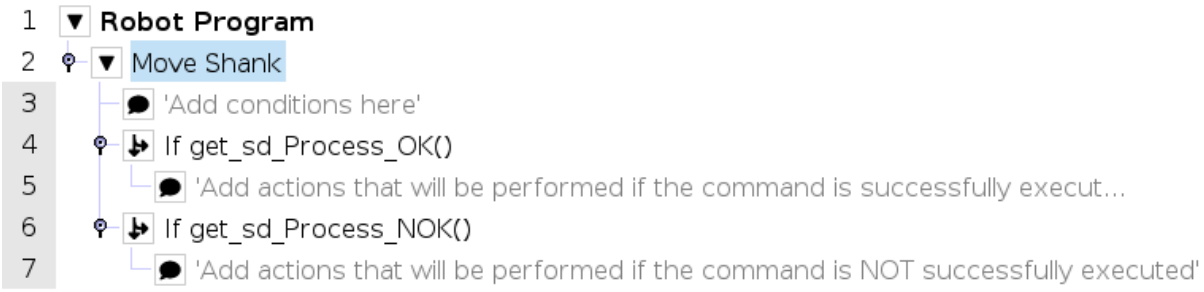
▶ When pressed, the screwdriver will act as if the command is executed.

Check results

Selecting one of the 2 options from the dropdown list and pressing **Insert** will add an if statement in the robot program based on the selected option as shown in the screenshot below.

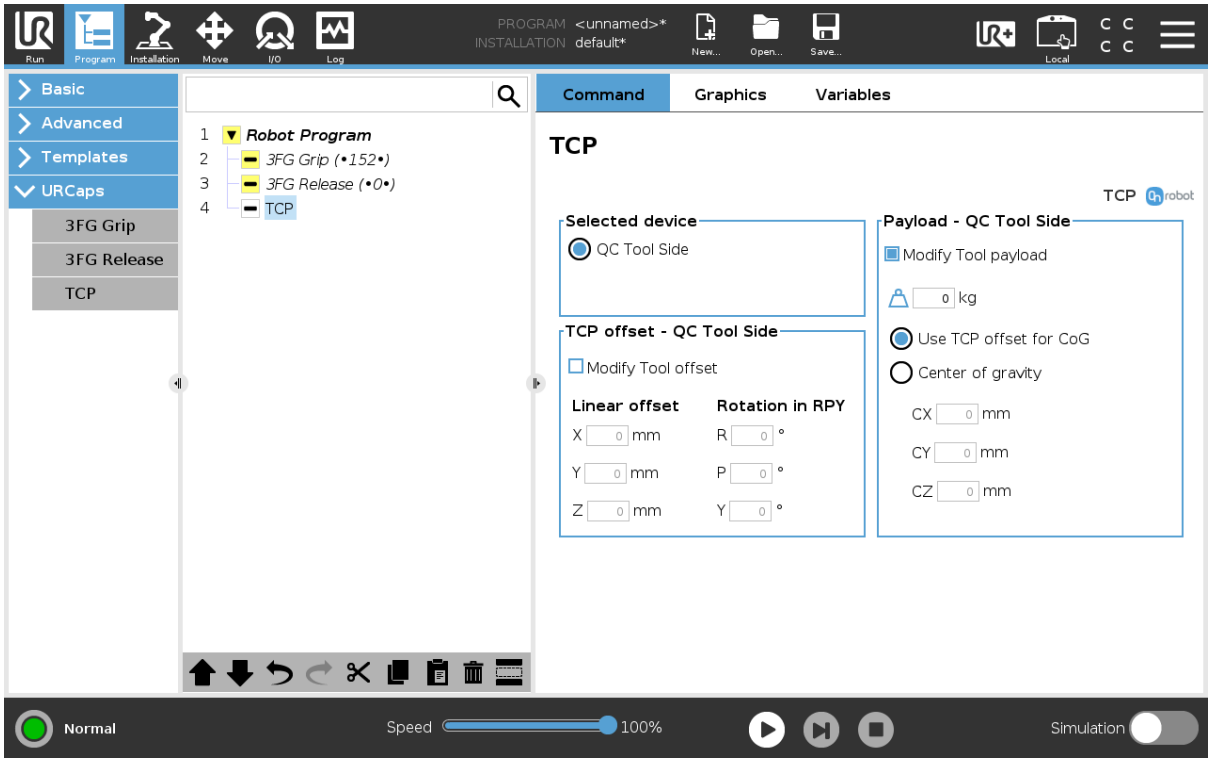
The Dropdown list options are:

- **Process successful**: Uses the function **get_sd_Process_OK()** and returns true if the command is executed correctly.
- **Process NOT successful**: Uses the function **get_sd_Process_NOK()** and returns true if the command is not executed correctly.



6.1.5.5. TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

6.1.6. SG

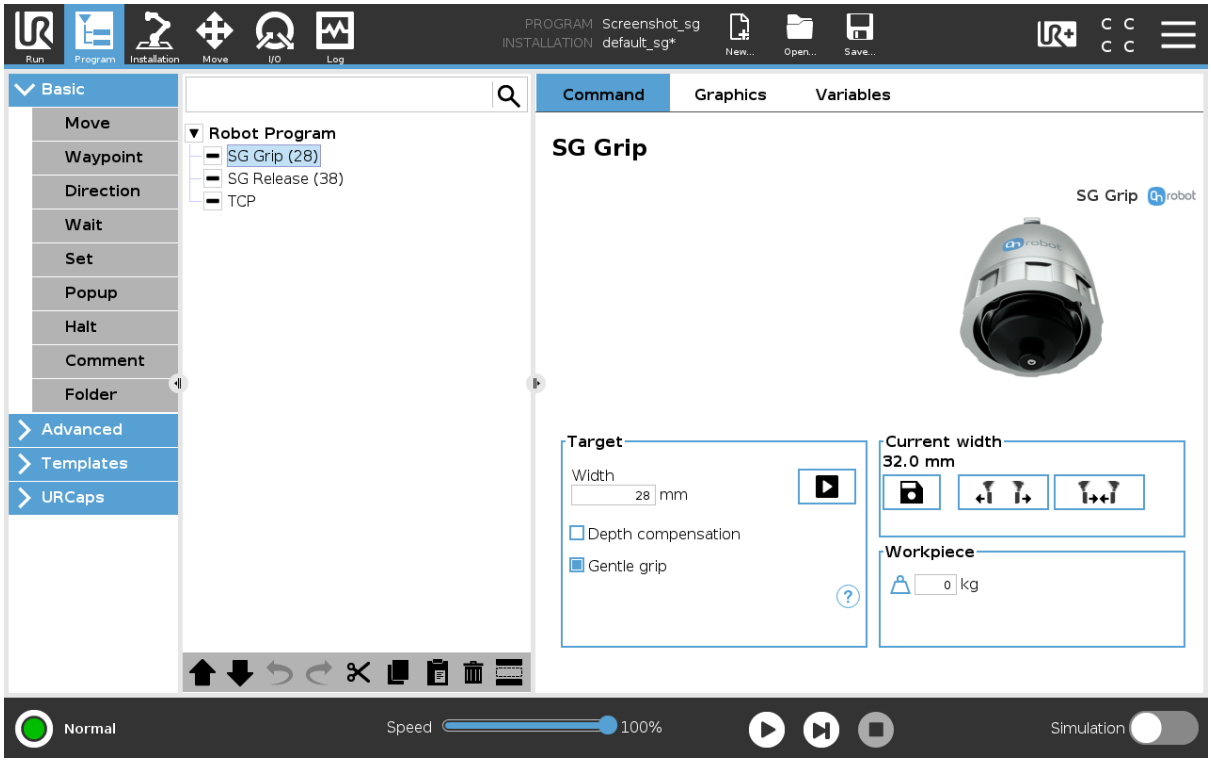
SG Grip / SG Release

The `SG Grip/SG Release` command is used to grip or release a workpiece.

When the `SG Grip/SG Release` command is executed, the gripper will try to reach the specified target **Width**, moving by the default **Gentle grip speed**, and if selected, **Depth compensation**. The different functions are explained below.

NOTE:

The gripper first needs to be initialized, otherwise “Program is not finished” error message can appear. In this case open the Toolbar and click on the **Initialize** button.



WARNING:

When working with the SG, please make sure that the grippers inward/outward motion is not obstructed, otherwise the positioning system may get out of sync. If that were to happen, move the grip/release point away from the workpiece, and reinitialize the gripper.

The command name in the robot program shows a number in brackets that represent the target width. If two SG gripper are used, a number in squared bracket will show what gripper performs the action.

NOTE:

Gentle grip and **Workpiece** options are only available in the `SG Grip` command.

Select device

If two SG grippers are connected, select whether it is the SG (1) or SG (2) that performs the action

Target

Width: The target gripping width can be set by using the Save as Target/Save Grasp button (recommended) or by typing it in manually. If the set value is not within the limits of this tool, this ⚠ will appear next to mm.

NOTE:

If the SG is connected via the CB3 tool connector, the **Current width** and the **Target Width**, is shown in percent instead of mm. In each SG Tool manual, you can find a percentage to mm conversion graph.

When pressed, the gripper will act as if the command is executed.

Depth compensation: During grip/release operations, the robot moves to compensate for movement of the gripper, so that the gripper remains on target.

Gentle grip: When selected, the gripping speed is reduced at 12.5mm before the specified target width, this results in a gentler grip, compared to normal grip settings. For the release command, the gripper moves at full speed and this feature is deactivated.

When the ? icon is pressed, a graphical illustration of the **Depth compensation** and the **Gentle grip** will appear.

NOTE:

This ⚠ will appear under the gripper image if there is a mismatch between the current and the saved tool.

NOTE:

It is highly recommended to use the hold-to-run buttons for finetuning, especially when handling fragile items. See the Technical section on **How to Handle a Workpiece** for more information.

Current width

The number shows the **Current width** value.

will set the **Current width** as target width.

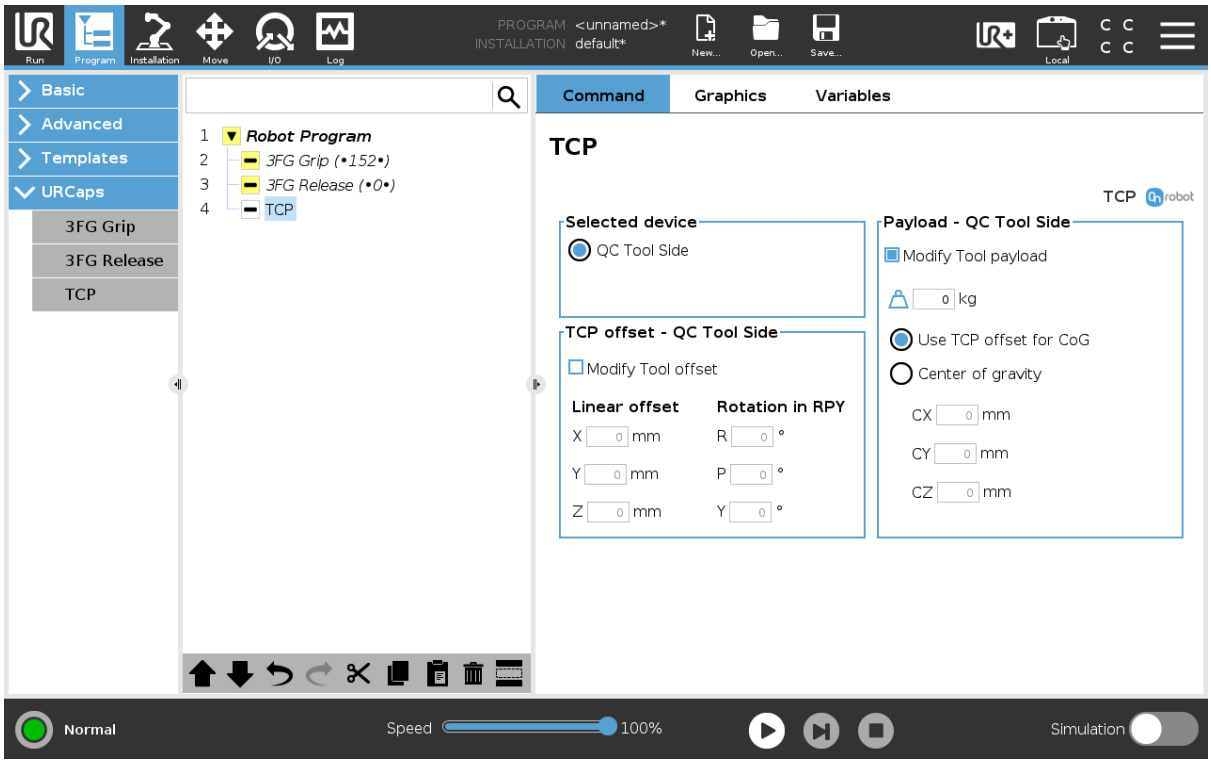
These are open and close hold-to-run buttons.

Workpiece

the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

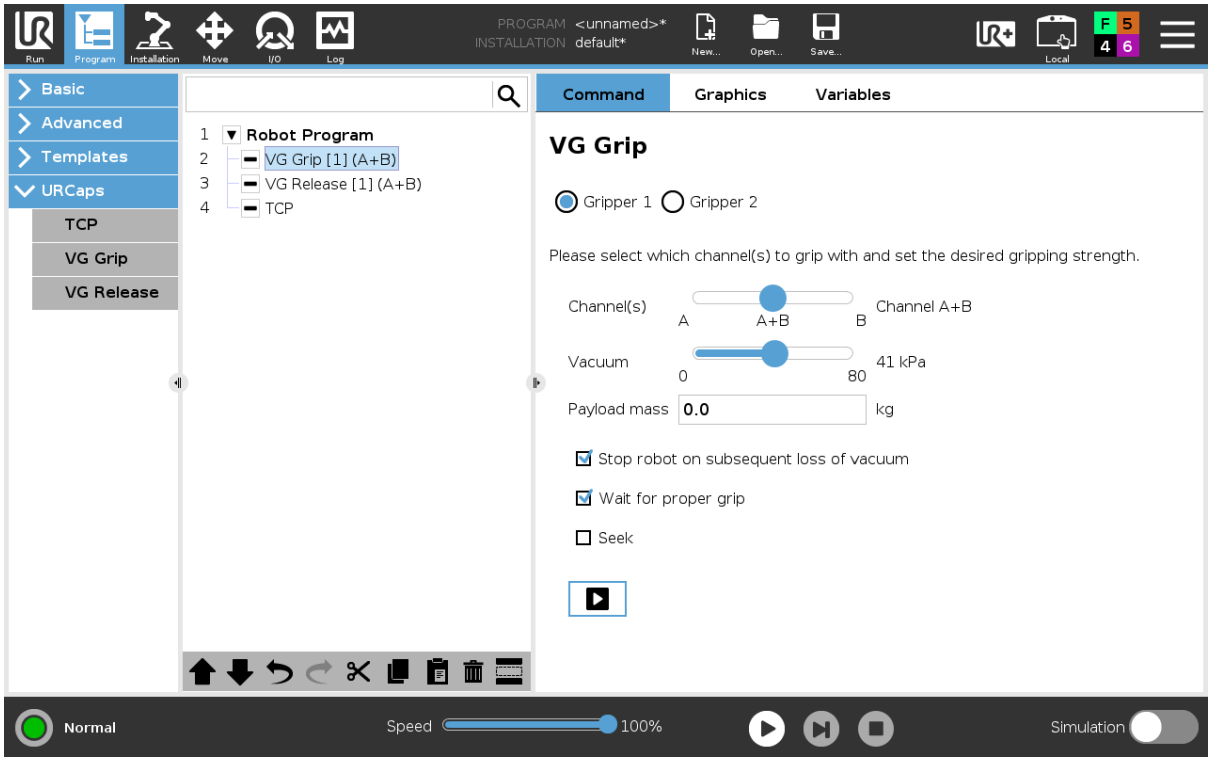
Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

6.1.7. VG10/VGC10

VG Grip

This command is used to activate the pump and generate vacuum to grip a workpiece.



When 2 grippers are used, the radio buttons **Gripper 1** and **Gripper 2** will appear. These buttons will select which one of the 2 grippers performs the action. In the robot program, the command name will show [1] or [2] to indicate which grippers is performing the action.

Channel(s): Select which channel perform the action. It is possible to select channel A, B or both. To see which one is channel A and B, for VG10 see stickers under the arms and for VGC10 see the letters on the sides on the housing.

Vacuum: The higher the vacuum is set (up to 80 kPa) the more the lifting power is.

Payload mass: the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

Stop robot on subsequent loss of vacuum: when checked, the vacuum is monitored continuously and if the vacuum disappears unexpectedly the robot will stop with a popup.

Wait for proper grip: when checked, the program will stay in the VG Grip structure until commanded vacuum is achieved. If the commanded vacuum is not achieved in 3 seconds the program halts.

When pressed, the gripper will act as if the command is executed.

When any of the VG grippers is used in combination with a HEX-E/H QC the following extra option becomes available:

Seek and auto level: when checked, the gripper will be moved by the robot in the +Z direction (in Tool coordinate system) until it reaches a surface (this is the seek part) with both channels. This feature is only useful if both channels are going to do the grip at the same time. During the motion the gripper's orientation is automatically adjusted to be parallel to the surface (this is the auto level part).

NOTE:

In order to help the Auto-level part to function, make sure to use the same suction caps for A and B channels and set the arms to be symmetrical.

When any of the VG grippers is used without a HEX-E/H QC but used on an E-series controller the following extra option becomes available:

Seek: when checked, the same seeking action will happen as above. Since the auto leveling part is not used the VG grippers need to be parallel to the surface.

NOTE:

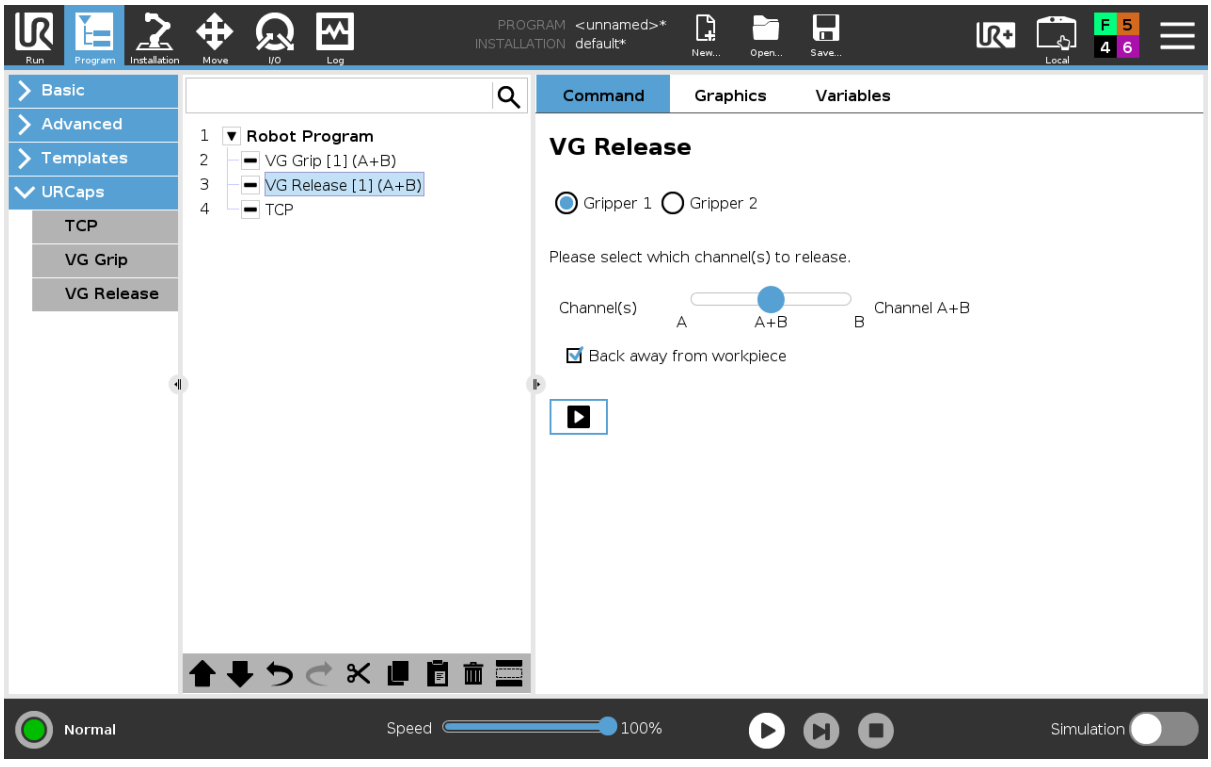
Setting a lower vacuum gives a faster grip with less wear on the vacuum cups. It also reduces the risk of leaving suction marks on delicate workpieces.

It can take a few seconds when pressing **Play** or **Test** before the robot program starts. This is normal.

When the two channels are set to different vacuum percentages the VG grippers automatically release air into the channel with lower pressure. This feature is activated when the pressure is more than 20% vacuum over the setting. Releasing air generates a characteristic rumbling sound and change in pumping speed.

VG Release

This command is used to release the grip of the workpiece by removing vacuum.



When 2 grippers are used, the radio buttons **Gripper 1** and **Gripper 2** will appear. These buttons will select which one of the 2 grippers performs the action. In the robot program, the command name will show [1] or [2] to indicate which grippers is performing the action.

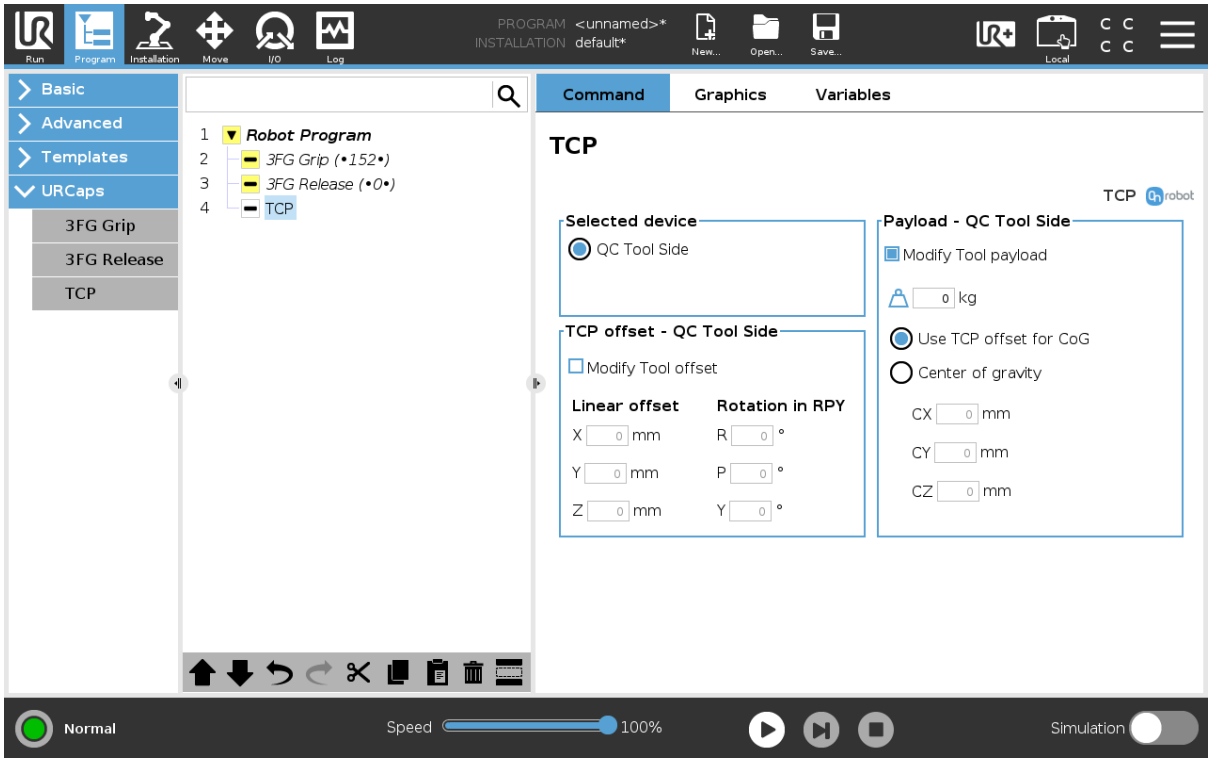
Channel(s): Select which channel perform the action. It is possible to select channel A, B or both. To see which one is channel A and B, for VG10 see stickers under the arms and for VGC10 see the letters on the sides on the housing.

Back away from workpiece: when the workpiece is released, the robot will travel away 15 mm.

When pressed, the gripper will act as if the command is executed.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

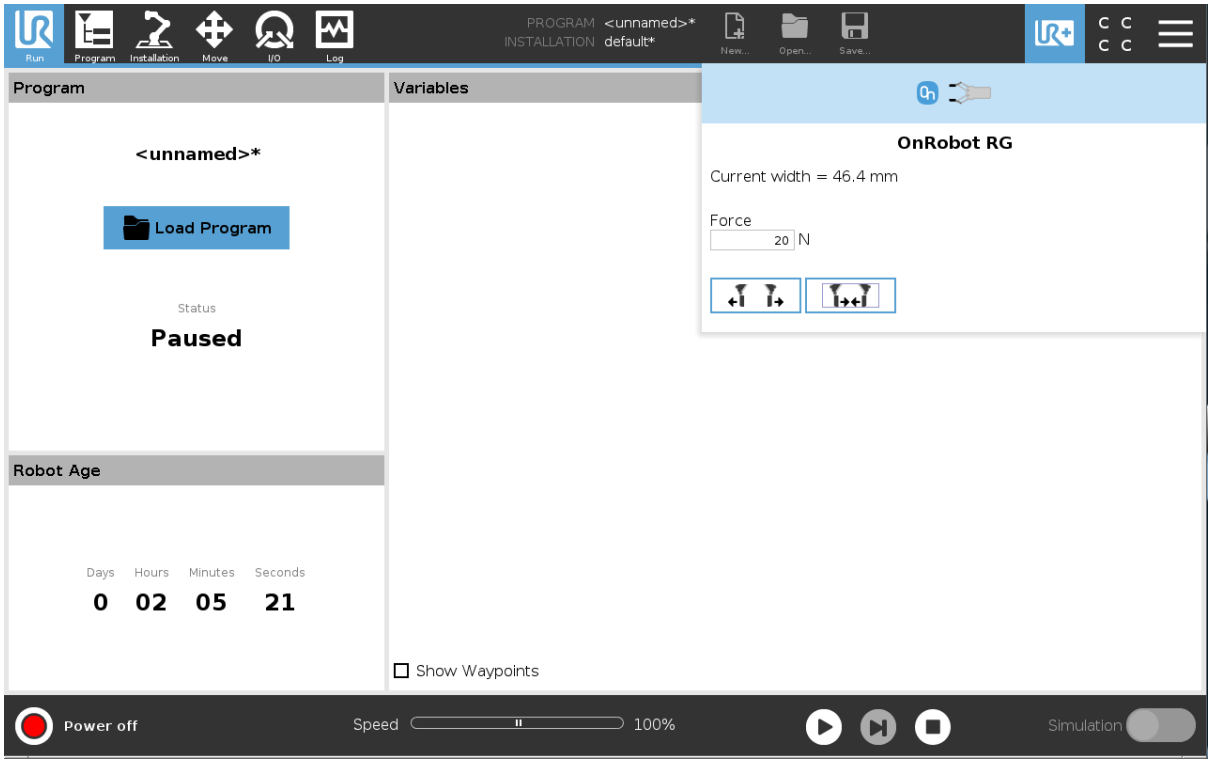
6.2. URCap Toolbar

The Toolbar makes it simple to operate the tools while you are programming or during runtime.

How to Access the Toolbar

The way how the toolbar can be accessed is different on the e-Series and the CB3 UR robots, but the functionality is the same.

To open up the toolbar in the e-Series, press on the UR+ icon on the top right side. Then press on the OnRobot icon .

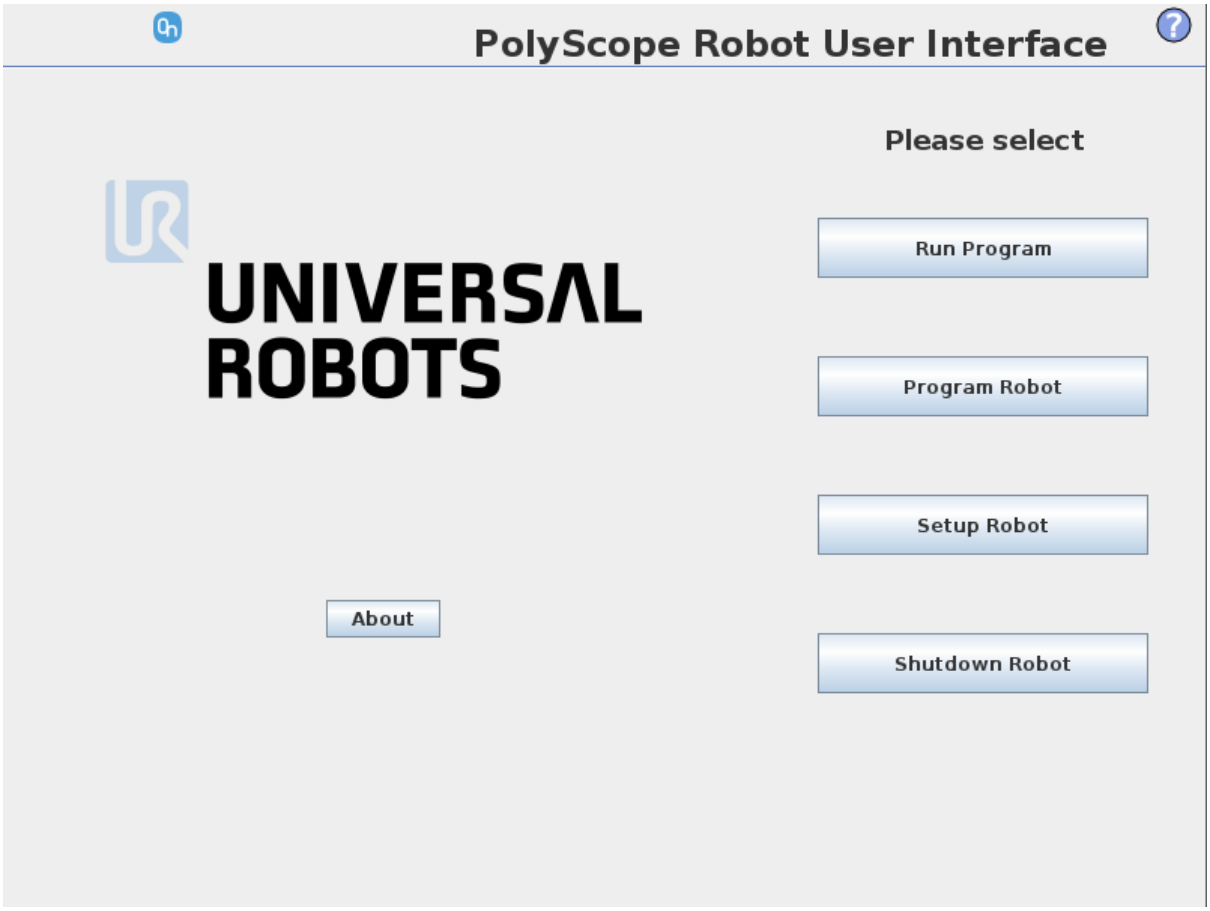


Each OnRobot End of Arm Tooling has its own functionality and that is explained in the sections below.

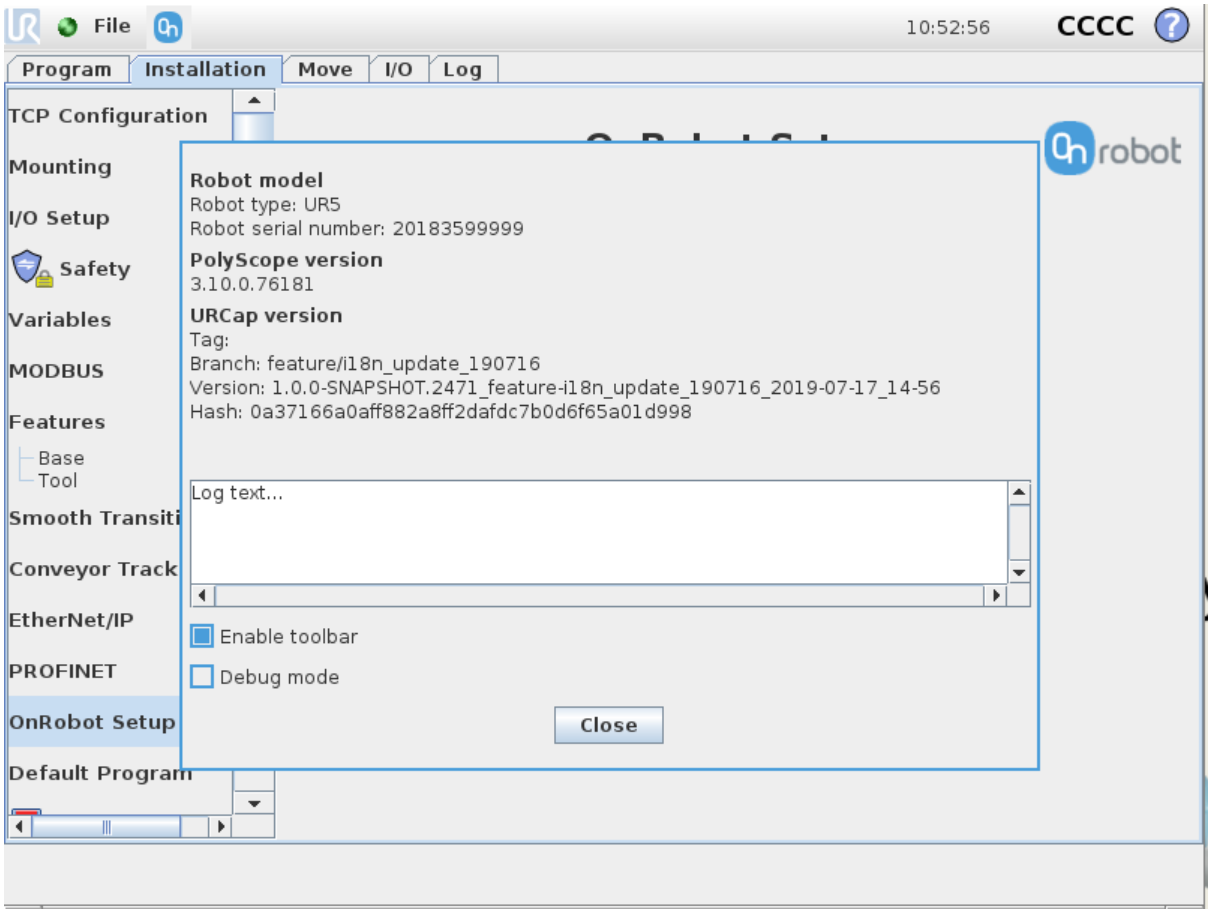
To open up the toolbar in the CB3, press on the OnRobot icon on the top left side. The icon might take around 20 seconds to appear after robot power up.

NOTE:

All toolbars are disabled while any robot program is running. Some toolbars are also disabled and cannot be used while the robot is not initialized.



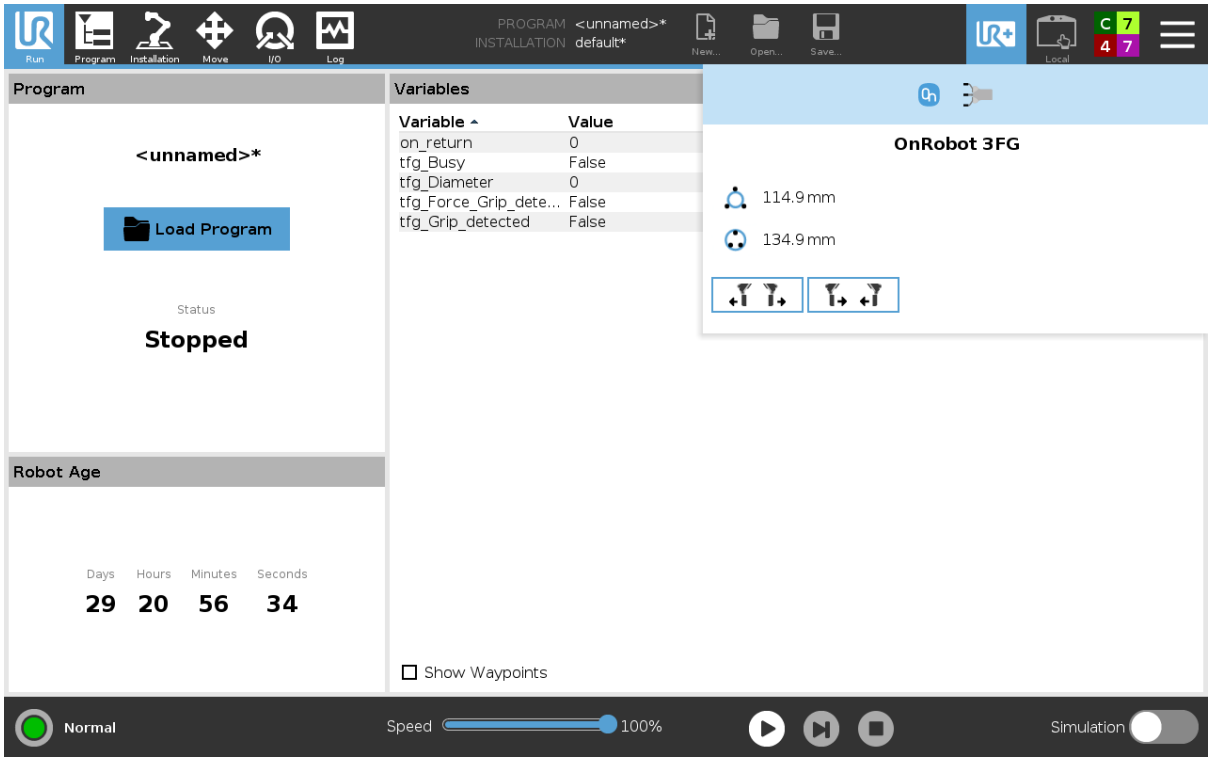
To enable/disable the toolbar, press on the OnRobot logo on the top right corner and check/uncheck the **Enable toolbar** checkbox.



6.2.1. 3FG15

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

The toolbar for the 3FG15 gripper is shown below.



Current internal diameter.

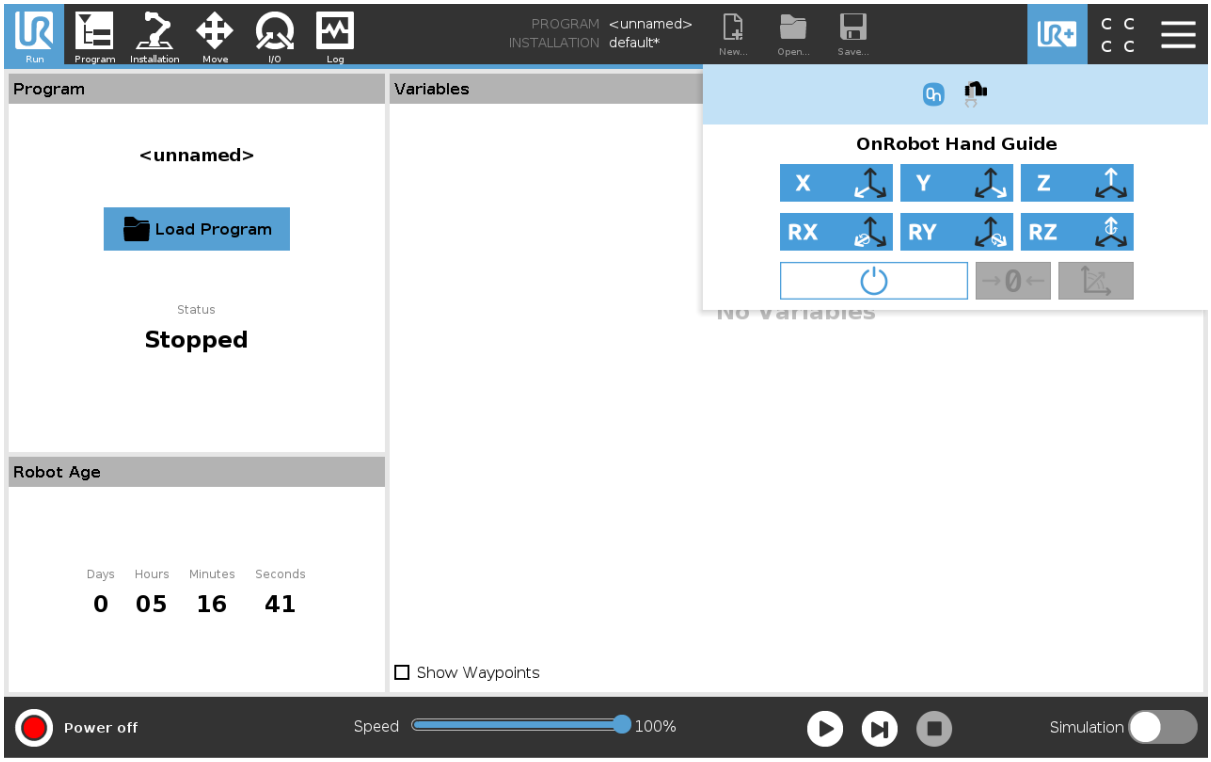
Current external diameter.

These are open and close hold-to-run buttons.

6.2.2. HEX-E/H QC

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

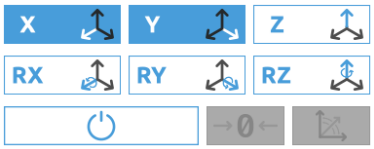
The toolbar for the HEX is called Hand Guide and it is shown below. This toolbar is used to hand guide the robot by holding the End of Arm Tooling with your hand. It is possible to lock some of the axes to reduce the degrees of freedom.



The toolbar contains the available axes, the enable button , the zero button and the snap to axes button .

To select an axis, tap on the appropriate item. An axis is selected if it turns from white to blue .

In the following example, the X and the Y items are selected to limit the movement along the X and Y axis (planar):



NOTE:

The used coordinate system is the Tool.

To deactivate any axis that has been selected, tap on the item again.

NOTE:

It is possible to activate or deactivate axes during hand guiding.

To start hand guiding the UR robot, first make sure that you do not touch the tool and then press and hold the enable button . The button turns to an hourglass icon

while the hand guiding is being initiated. Wait until the enable button turns blue and drive the robot by hand with the help of the OnRobot sensor.

NOTE:

Make sure that you do not touch the tool before the hand guiding is activated (enable button turned to blue), otherwise the robot can behave abnormally (e.g..: the robot could move without any external force exerted). In this case, press the zero button, while you are not touching the tool.

Make sure that you do not use the zero button while touching the tool.

To stop hand guiding the UR Robot, press the enable button .

NOTE:

The hand guiding could be configured (in the OnRobot installation page) to be enabled with a single tap on the enable button (instead of holding) and stopped with a second tap. However, the holding behavior is recommended for increased safety.

NOTE:

Please always set the speed slider of the robot to 100% while using the hand guiding to have an optimal user experience.

The zero button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

The snap to axes button rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

NOTE:

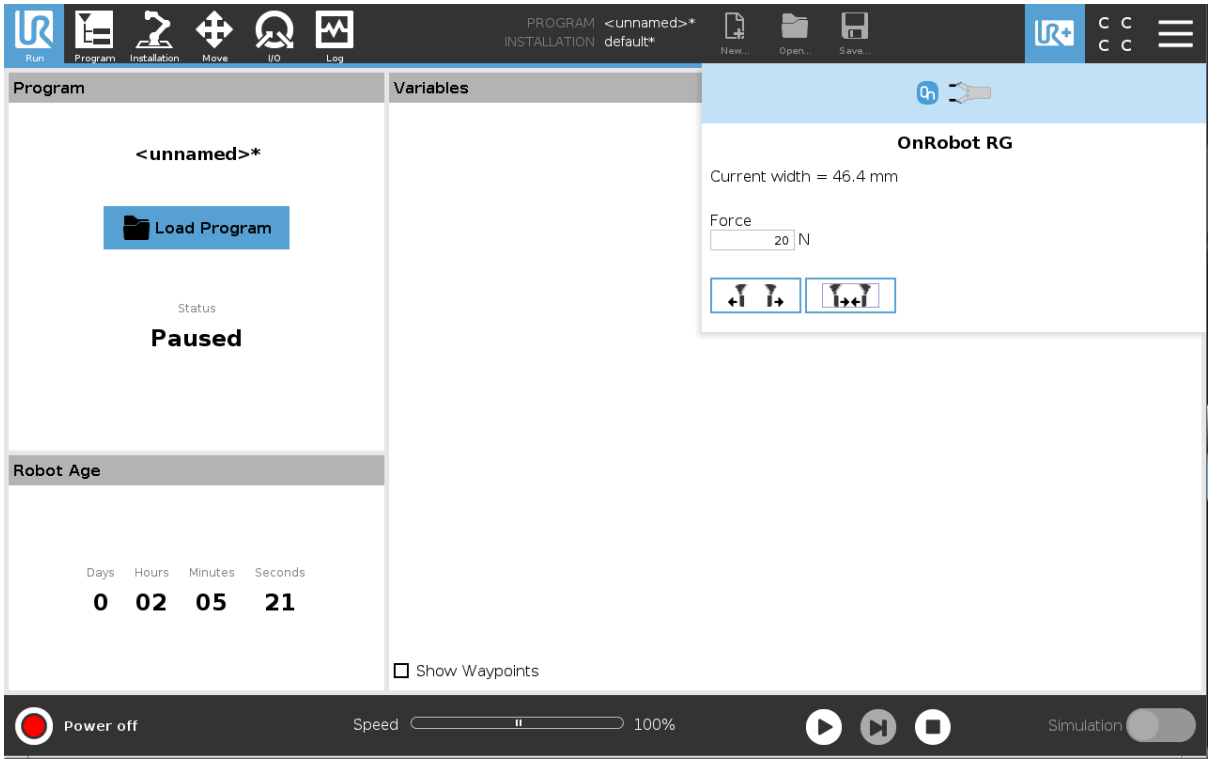
If you are experiencing vibration, grab and guide the tool at the Center of Gravity (roughly it is at the center).

6.2.3. RG2-FT

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

The RG2-FT has a toolbar for gripping functionality and another toolbar for hand guiding. Both are described below.

The toolbar for gripping functionality is shown below.

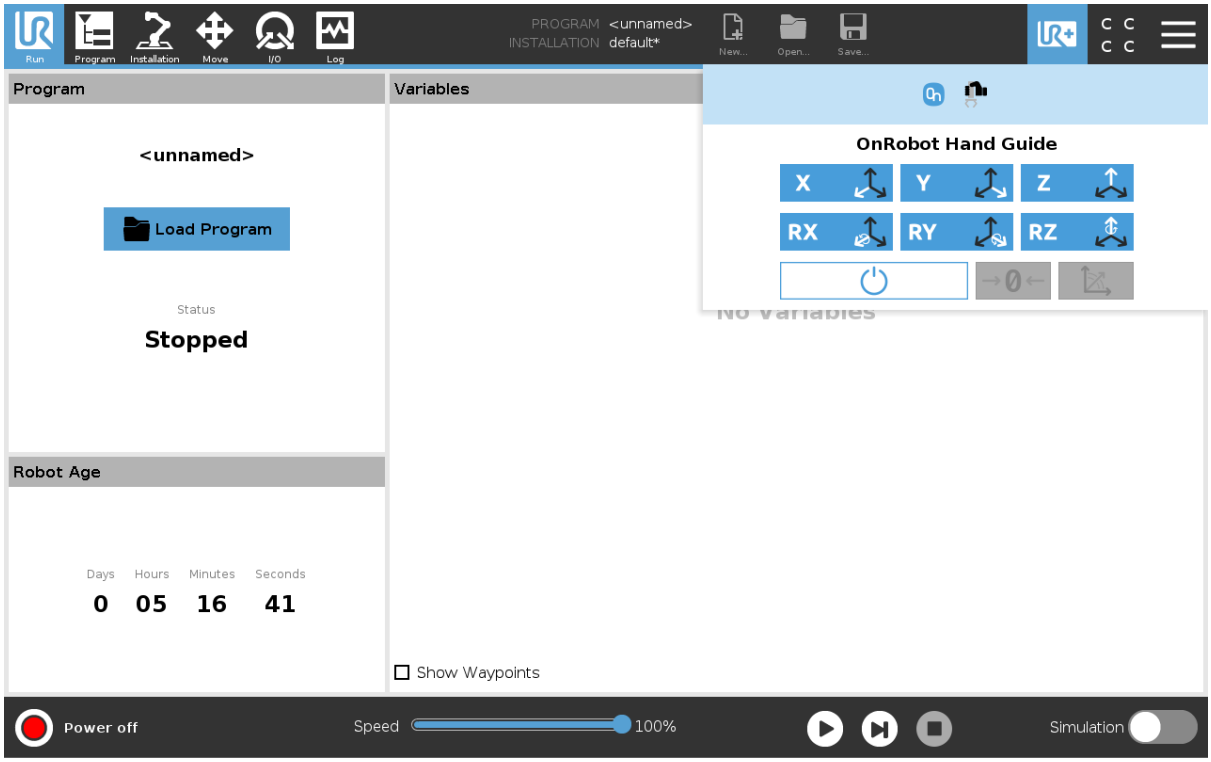


Current width: shows how wide the gripper is opened.

Force: Set the target gripping force.

: These are open and close hold-to-run buttons.

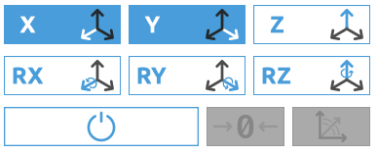
The toolbar for hand guiding is shown below.



The toolbar contains the available axes, the enable button , the zero button and the snap to axes button .

To select an axis, tap on the appropriate item. An axis is selected if it turns from white to blue .

In the following example, the X and the Y items are selected to limit the movement along the X and Y axis (planar):



NOTE:

The used coordinate system is the Tool.

To deactivate any axis that has been selected, tap on the item again.

NOTE:

It is possible to activate or deactivate axes during hand guiding.

To start hand guiding the UR robot, first make sure that you do not touch the tool and then press and hold the enable button . The button turns to an hourglass icon while the hand guiding is being initiated. Wait until the enable button turns blue and drive the robot by hand with the help of the OnRobot sensor.

NOTE:

Make sure that you do not touch the tool before the hand guiding is activated (enable button turned to blue), otherwise the robot can behave abnormally (e.g..: the robot could move without any external force exerted). In this case, press the zero button, while you are not touching the tool.

Make sure that you do not use the zero button while touching the tool.

To stop hand guiding the UR Robot, press the enable button .

NOTE:

The hand guiding could be configured (in the OnRobot installation page) to be enabled with a single tap on the enable button (instead of holding) and stopped with a second tap. However, the holding behavior is recommended for increased safety.

NOTE:

Please always set the speed slider of the robot to 100% while using the hand guiding to have an optimal user experience.

The zero button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

The snap to axes button rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

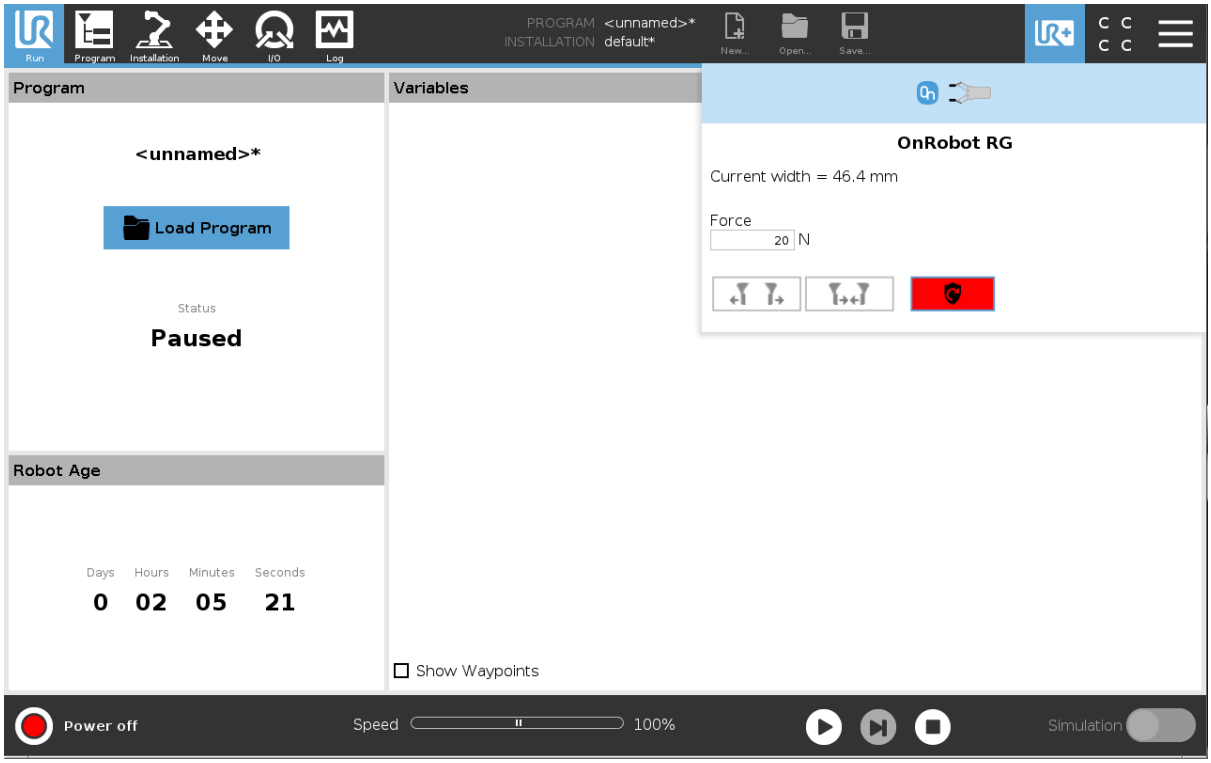
NOTE:

If you are experiencing vibration, grab and guide the tool at the Center of Gravity (roughly it is at the center).

6.2.4. RG2 / RG6

To open up the toolbar follow the instructions in the **How to Access the Toolbar** the toolbar section.

The toolbar for the RG grippers is shown below.



Gripper 1 and **Gripper 2**: In case of using two RG grippers you can select which one performs the action.

Current width: shows how wide the gripper is opened.

Force: Set the target gripping force.

: These are open and close hold-to-run buttons.

:This button can be used to reactivate the RG2 or RG6 after any of the gripper's Safety Switch is activated. Pressing this button will cycle the tool power for a few seconds.

CAUTION:

Before pressing the button always make sure that no part will be dropped due to the loss of gripper power. If Dual Quick Changer is used it will cycle the power for both sides.

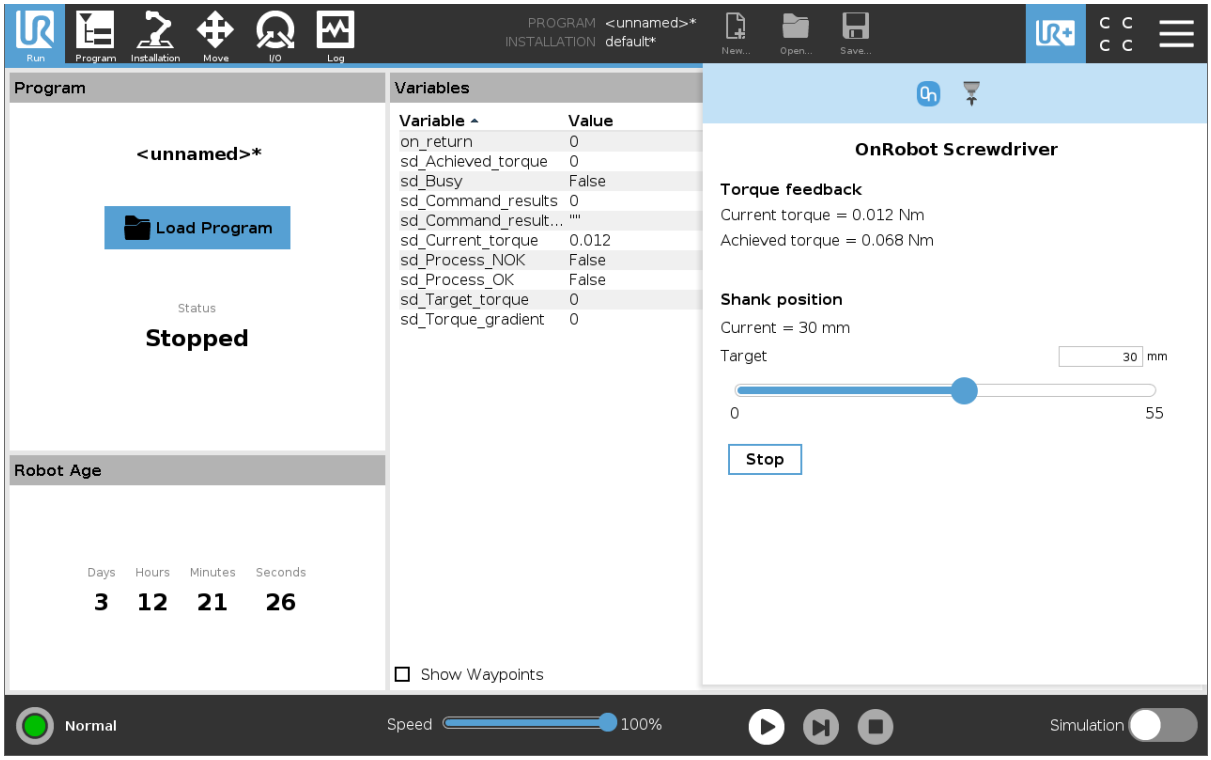
NOTE:

To operate, - when connected via the Tool Connector - the Tool IO must set to be controlled by OnRobot.

6.2.5. Screwdriver

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

The toolbar for the Screwdriver is shown below.



Torque feedback

Current torque: show the current torque the screwdriver is applying at the moment.

Achieved torque: shows the achieved torque on the last `Tighten` command executed.

Shank position

Current: shows the current position of the shank.

Target: changes the position of the shank immediately. The target position can also be set by using the input field above the slider.

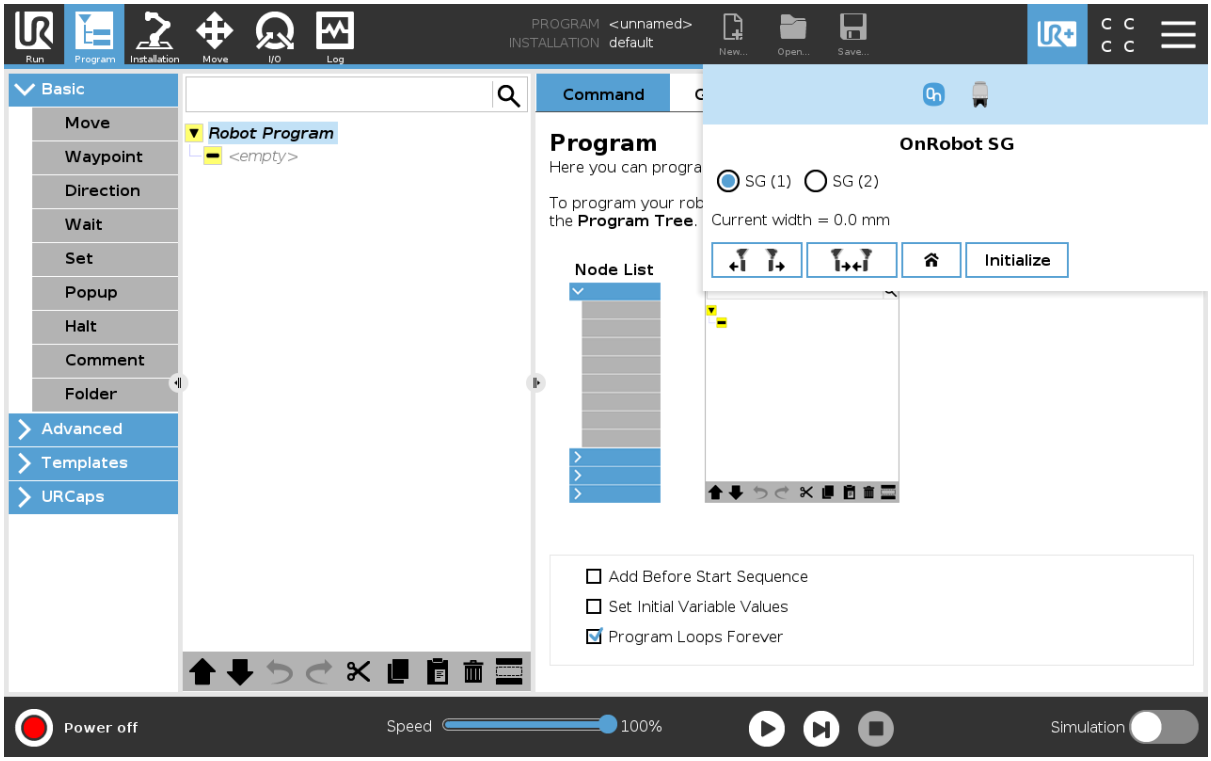
Stop: Will stop the screwdriver command that is being executed at that time.

if the mechanical safety is activated, this button will show up. Pressing this button will enable back the screwdriver from the safety state.

6.2.6. SG

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

The toolbar for the SG grippers is shown below.



GS (1) and **GS (2)**: In case of using 2 SG grippers, you can select which one performs the action.

Current width: shows the value.

These are open and close hold-to-run buttons.

This is for homing the SG.

Initialize: Press here to initialize the gripper with the current tool. This button will only appear if the gripper is not initialized or if there is a mismatch between the **Saved** and the **Current** tool.

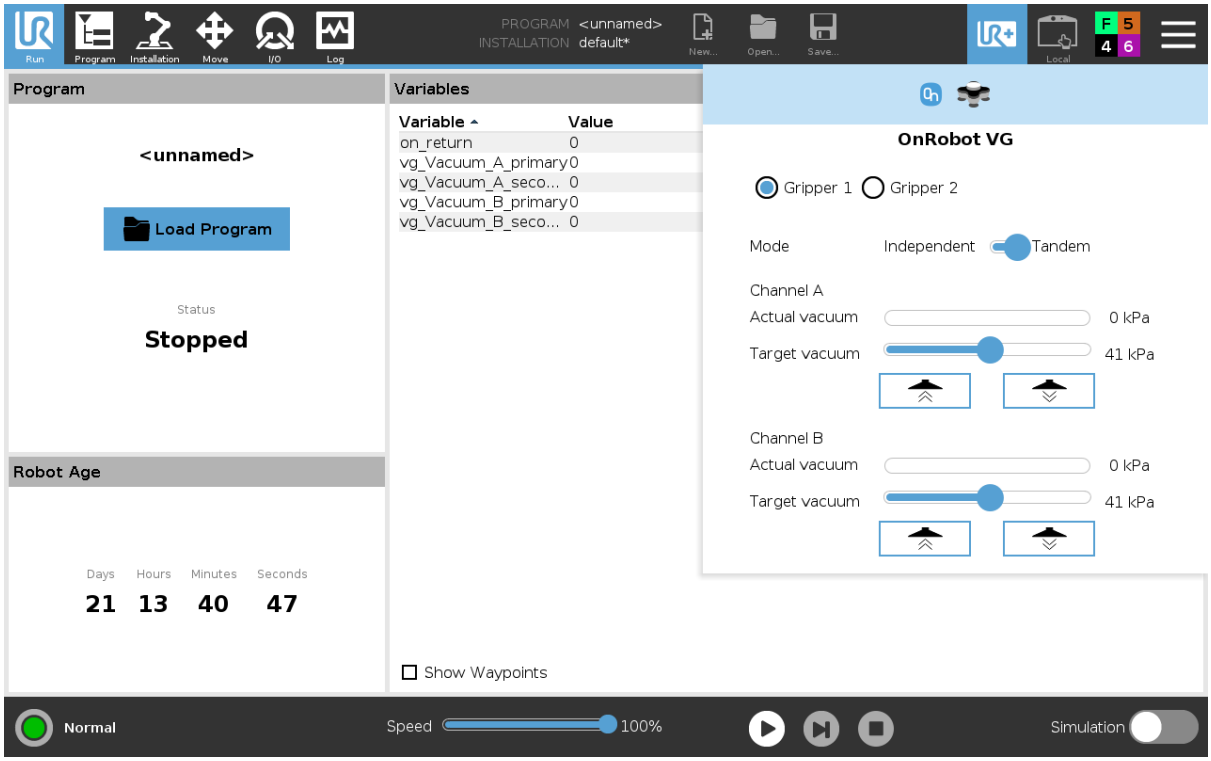
CAUTION:

Before pressing or buttons always make sure that no part will be dropped due to the homing procedure.

6.2.7. VG10 / VGC10

To open up the toolbar follow the instructions in the **How to Access the Toolbar** section.

The toolbar for the VG grippers is shown below.



Gripper 1 and **Gripper 2**: In case of using 2 VG grippers you can select which one performs the action.

Mode: Select **Independent** (actuate a channel individually) or **Tandem** (actuate both channels together).

Actual vacuum: shows the current vacuum in each channel.

Target vacuum: defines target vacuum in each channel.

(Grip button): when pressed, the pump will start to generate vacuum at the selected level on the selected channel(s).

(Release button): when pressed, the test-grip will terminate and release any workpieces that may be held by the selected channel.

6.3. URScript Commands

URScript commands can be used alongside other scripts.

6.3.1. 3FG15

When the OnRobot URCap is enabled, there will be several 3FG script functions available:

```
tfg_grip(diameter, force, external_grip= True, stop_if_no_force =true,
tool_index=0, blocking=True)
```

`diameter`: The diameter that the gripper will open to. [mm]

`force`: The force that the gripper will try to reach. [N]

`external_grip`: If true, the internal gripper diameter to do an external grip will be used. If false, the external gripper diameter to do an internal grip will be used.

`stop_if_no_force =true`: If true, the robot program will stop if the force is not reached.

`tool_index`: Select what gripper performs the action. 0 only one gripper connected, 1 for gripper in position 1 and 2 for gripper position 2. Positions of the dual quick changer.

`blocking`=True: the function waits for the gripper to finish the grip command.

```
tfg_release(diameter,  external_release= True, tool_index=0,
select_releasing=0, blocking=True)
```

`diameter`: The diameter that the gripper will open to. [mm]

`external_release`: If true, the internal gripper diameter to do an external release will be used. If false, the external gripper diameter to do an internal release will be used.

`tool_index`: Select what gripper performs the action. 0 only one gripper connected, 1 for gripper in position 1 and 2 for gripper position 2. Positions of the dual quick changer.

`blocking`=True: the function waits for the gripper to finish the grip command.

For example, a relative movement for quickly releasing a workpiece can be done as follows: If only one gripper is connected:

`tfg_release(3fg_Diameter+5, 3fg_index_get())` This will open the Gripper 5mm with the default speed.

If two 3FG grippers are attached, use:

`tfg_release (3fg_Diameter_primary+5, 1) -> for primary`

`tfg_release (3fg_Diameter_primary+5, 2) -> for secondary`

6.3.2. RG2-FT

When the OnRobot URCap is enabled, there will be a defined RG2-FT script function:

```
rg2ft_proxi_offsets_set(ProxL = 0.0, ProxR = 0.0)
```

This function can be used to manually set offset values of the optical (proximity) finger sensor. The `ProxL` and `ProxR` are in millimeters.

When the OnRobot URCap is enabled, there will be a defined RG script function:

```
rg_grip(rg_width, force, tool_index=0, blocking=True,
depth_compensation=False, popupmsg=True)
```

Blocking=True: the function waits for the gripper to finish the grip command

(popupmsg: future function, do not need to fill)

All the input arguments are the same as the ones used by the `RG Grip` command and it includes the fingertip offset.

For example, a relative movement for quickly releasing a workpiece can be done as follows:

If only one gripper is connected:

`rg_grip(rg_Width+5, 40, rg_index_get())` ➔ This will open the Gripper 5mm with the target force set at 40N.

If two RG grippers attached, use:

`rg_grip(rg_Width_primary+5, 40, 1)` ➔ for primary

`rg_grip(rg_Width_secondary+5, 40, 2)` ➔ for secondary

6.3.3. RG2/RG6

When the OnRobot URCap is enabled, there will be a defined RG script function:

```
rg_grip(rg_width, force, tool_index=0, blocking=True,
depth_compensation=False, popupmsg=True)
```

Blocking=True: the function waits for the gripper to finish the grip command

(popupmsg: future function, do not need to fill)

All the input arguments are the same as the ones used by the `RG Grip` command and it includes the fingertip offset.

For example, a relative movement for quickly releasing a workpiece can be done as follows:

If only one gripper is connected:

`rg_grip(rg_Width+5, 40, rg_index_get())` ➜ This will open the Gripper 5mm with the target force set at 40N.

If two RG grippers attached, use:

`rg_grip(rg_Width_primary+5, 40, 1)` ➜ for primary

`rg_grip(rg_Width_secondary+5, 40, 2)` ➜ for secondary

6.3.4. Screwdriver

When the OnRobot URCap is enabled, there will be several Screwdriver script functions available:

- `get_sd_Process_OK()`: True if the command is executed correctly.
- `get_sd_Process_NOK()`: True if the command is not executed correctly.
- `get_sd_Achieved_torque()`: Achieved torque in Nm after a tighten command has been executed.
- `get_sd_Torque_gradient()`: Achieved torque gradient in Nm/rad after a tighten command has been executed.
- `get_sd_Command_results()`: The possible values are:
  - 0 - no additional result data
  - 1 - command unknown
  - 2 - not screwing in
  - 3 - timeout waiting for correct torque (2sec)
  - 4 - torque exceeded unexpected (premature)
  - 5 - unable to loosen screw (maximum torque exceeded)
  - 6 - Shank reached the 55 mm position
  - 7 - Shank obstructed during move
- `get_sd_Target_torque()`: Last Tighten command Target torque in Nm after it has been executed.
- `sd_check_torque(tolerance_nm)`: This will return true if the sd_Achieved_torque is within the range of the sd_Target_torque +/- the `tolerance_nm`.
  - `Tolerance_nm`: the toque error allowed.
- `sd_move(shank_pos_mm, tool_index)`
  - `shank_pos_mm`: the position the shank will move to.

    - `tool_index`: Select what screwdriver performs the action. 0 only one screwdriver connected, 1 for screwdriver in position 1 and 2 for screwdriver position 2. Positions of the dual quick changer.
- `sd_pick(shank_force_n, screw_length_mm, tool_index, timeout_ms)`
    - `shank_force_n`: The force the shank is going to apply. Default value 20N.
    - `Screw_lenght_mm`: The length of the screw.
    - `tool_index`: Select what screwdriver performs the action. 0 only one screwdriver connected, 1 for screwdriver in position 1 and 2 for screwdriver position 2. Positions of the dual quick changer.timeout_ms: the time the command will keep trying to be executed. If it is not executed in the given time, a return variable will show an error.
- `sd_tighten(shank_force_n, screwing_l_mm, torque_nm, tool_index, timeout_ms)`:
    - `shank_force_n`: The force the shank is going to apply. Default value 20N.
    - `screwing_l_mm`: The length the screw will be screwed into the thread.
    - `torque_nm`: The target torque the screw will be tighten with.
    - `tool_index`: Select what screwdriver performs the action. 0 only one screwdriver connected, 1 for screwdriver in position 1 and 2 for screwdriver position 2. Positions of the dual quick changer.
    - `timeout_ms`: the time the command will keep trying to be executed. If it is not executed in the given time, a return variable will show an error.
- `sd_loosen(shank_force_n, unscrewing_lenght_mm, tool_index, timeout_ms)`:
    - `shank_force_n`: The force the shank is going to apply. Default value 20N.
    - `unscrewing_l_mm`: The length the screw will be screwed out from the thread.
    - `tool_index`: Select what screwdriver performs the action. 0 only one screwdriver connected, 1 for screwdriver in position 1 and 2 for screwdriver position 2. Positions of the dual quick changer.
    - `timeout_ms`: the time the command will keep trying to be executed. If it is not executed in the given time, a return variable will show an error.
- `sd_stop(tool_index)`: The screwdriver will stop the running command.
- `get_sd_Busy()`: True if the screwdriver is executing a command.
- `get_sd_Current_torque()`: Provides the current measured torque

6.3.5. SG

When the OnRobot URCap is enabled, there will be several SG script functions available:

`sg_grip(target_width, gentle_grip, tool_index=0, blocking=True, depth_compensation=False)`

`target_width`: The width that the gripper will open to. [mm]

`gentle_grip`: True: the grip will be done with the gentle grip feature (slow down close to target_width)

`tool_index`: The index of the gripper to send the command to.

`blocking`=True: the function waits for the gripper to finish the grip command.

`depth_compensation`=False: The robot will move during the grip to compensate for the difference in depth between the start and the end. (False by default)

`sg_release(target_width, tool_index=0, blocking=True, depth_compensation=False)`

`target_width`: The width that the gripper will open to. [mm]

`tool_index`: The index of the gripper to send the command to.

`blocking`=True: the function waits for the gripper to finish the grip command.

`depth_compensation`=False: The robot will move during the release to compensate for the difference in depth between the start and the end. (False by default)

For example, a relative movement for quickly releasing a workpiece can be done as follows:

If only one gripper is connected:

`sg_release (sg_Width_primary+5, 1)` ➔ for primary

`sg_release (sg_Width_secondary+5, 2)` ➔ for secondary

6.3.6. VG10/VGC10

`vg10_grip (channel, vacuum, timeout, alert, tool_index)`

Commands the VG10 to perform a grip.

`channel`: Tells which channel to be gripped with.

`0 = Channel A`

`1 = Channel B`

`2 = Channel A and Channel B`

If not set, this parameter defaults to 2 (A and B).

`vacuum`: Tells how hard to grasp in the range of 0% to 80 % vacuum.

`60 = 60% vacuum`. A typical firm grip

`30 = 30% vacuum`. A typical soft grip

If not set, this parameter defaults to 60%.

`timeout`: Tells how long to wait for commanded vacuum to be achieved. If vacuum is not achieved, an air leakage at the workpiece or vacuum cups is reported in a popup and the robot program stops.

0 = The function will not wait for vacuum, but return immediately after the command is sent

>0 = Waiting time [s]. Floating point numbers can be used. E.g. 0.6 = 600 ms.

If not set, this parameter defaults to 5 seconds.

`alert`: Whether the grip should be monitored after vacuum (grip) is established. If vacuum is lost while handling a workpiece, a popup warning is shown, and the robot program stops. This setting cannot be used without a proper timeout setting, see above.

`False` = Vacuum is not monitored

`True` = Vacuum is continuously monitored. Popup warning enabled

If not set, this parameter defaults to True.

`tool_index=vg_index_get()` ➔ when only a 1 VG10 gripper attached.

If two VG10 grippers attached, use:

`tool_index=1` for primary

`tool_index=2` for secondary

`vg10_release(channel, timeout, autoidle, tool_index)`

Commands the VG10 to perform a release.

`channel`: Tells which channel to be released.

`0 = Channel A`

`1 = Channel B`

`2 = Channel A and Channel B`

If not set, this parameter defaults to 2 (A and B).

`timeout`: Tells how long to wait for vacuum to be removed.

0 = The function will not wait, but return immediately after the command is sent

>0 = Waiting time [s]. Floating point numbers can be used. E.g. 0.6 = 600ms.

If not set, this parameter defaults to 5 seconds.

`autoidle`: Tells if the release valve should automatically be turned off when the release is completed and the robot has moved 5cm away from the release position.

If not set, this parameter defaults to True.

`tool_index=vg_index_get()` ➔ when only a 1 VG10 gripper attached.

If two VG10 grippers attached, use:

`tool_index=1` for primary

`tool_index=2` for secondary

`vg10_vacuum_A or vg10_vacuum_B`

Returns current vacuum in the selected channel.

If two grippers are attached use _primary or _secondary

Ex: `vg10_vacuum_A_secondary`

`vg10_idle(channel, tool_index)`

Commands the VG10 to idle the selected channel. When a channel is in idle, the power consumption is slightly lower, but parts may 'stick' to the suction cup as the air return channel is closed.

`channel`: Tells which channel to be in idle.

`0 = Channel A`

`1 = Channel B`

`2 = Channel A and Channel B`

`tool_index=vg_index_get()` ➔ when only a 1 VG10 gripper attached.

If two VG10 grippers attached, use:

`tool_index=1` for primary

`tool_index=2` for secondary

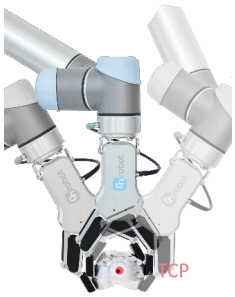
6.4. TCP Configuration

TCP is the abbreviation of the Tool Center Point.

TCP is a point that is in the beginning (by default) located at the middle point of the UR's tool flange. This is an important point during robot programming since UR's Move commands are always referenced to a given TCP point and rotations could only be carried out about these points.

If a tool is attached to the robot, it makes easier for the user to change that point to the tool's “end” point (see illustration on the left).

In this way it is easy to rotate the tool while the workpiece is being stationary in space (see illustration on the right).



More than one TCP point could be defined but at a given time only one TCP can be active. In UR, it is called the Active TCP.

By default, UR's Move commands are always recording the Waypoints according to the Active TCP.

For further info about the UR's TCP handling read the UR's Manual.

How “far” the TCP needs to be moved to be at the “end” of the OnRobot tools could be found in the **8.3. COG, TCP** section.

Since, it could be hard to enter these values by hand, OnRobot provides two ways to get these parameters configured for you:

- Static TCP mode - Recommended to be used
- Dynamic TCP mode

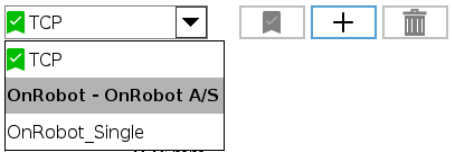
The mode could be selected on the TCP panel in the OnRobot Installation (see in the **5.3. URCap Setup** setup section).

In the following these two modes will be described.

Static TCP Mode

In this mode the user can manually change the Active TCP based on the predefined OnRobot TCP options:

- **OnRobot_Single**
  If no Dual Quick Changer is detected, so only one tool is used.
- **OnRobot_Dual_1** and **OnRobot_Dual_2**



If a Dual Quick Changer is detected, so two tools are used.

NOTE:

OnRobot_Dual_1 belongs to the tool that is attached to the Primary side of the Dual Quick Changer.

The TCP values are created and precalculated based on the detected tool(s). So, if the RG2 is mounted in 30° (with the built-in tilting mechanism) the precise TCP is defined accordingly.

The calculation is only carried out when a new device is detected or when the mounting angle is changed (only for RG2/6 and RG2-FT).

The calculated values are static parameters and do not change during program execution.

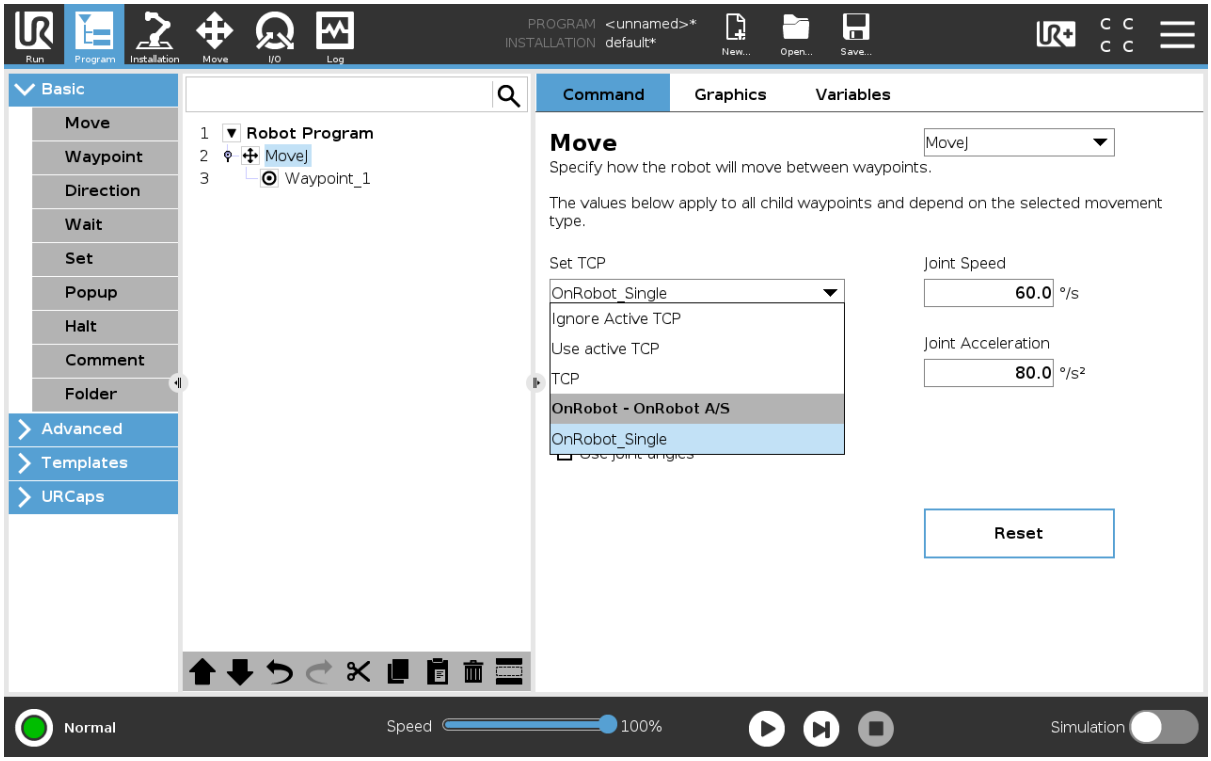
NOTE:

For the RG2, RG6 and RG2-FT grippers the TCP is calculated always assuming that the gripper is fully closed.

It is a good practice to set the used TCP option as the Default TCP ( ) in the UR's TCP Configuration, but it is not mandatory.

However, it is highly recommended to create the Waypoints in the UR's Move command in a way that the referencing TCP is set first.

So, if only a single OnRobot device is used, before the Waypoints are defined, set the UR's Move command's TCP to use the **OnRobot_Single**.



If two OnRobot devices are used, select **OnRobot_Dual_1** or **OnRobot_Dual_2** accordingly.

If not the UR's Move command but the OnRobot `F/T Move` command is used (for HEX-E/H QC or RG2-FT only):

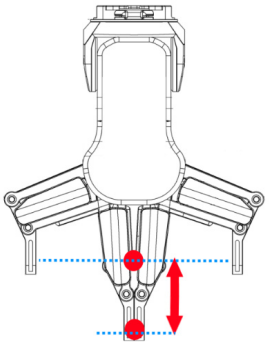
- Use the OnRobot TCP command just before the `F/T Move` to set the Active TCP to the right value

As summary here is a code example:

Single	Dual
Not mandatory to set OnRobot TCP as Default TCP	Not mandatory to set OnRobot TCP as Default TCP

`Robot program`
 	
`MoveJ (Set TCP = OnRobot_Single)`
 	
`#Alternatively`
`TCP`
`F/T Move`
	`Robot program`
	
	`MoveJ (Set TCP = OnRobot_Dual_1)`
	
	`MoveJ (Set TCP = OnRobot_Dual_2)`

Dynamic TCP Mode



In this mode the UR's Active TCP is set automatically according to the detected OnRobot device.

This mode is useful when the TCP effect of the width value of the gripper (RG2, RG6 or RG2-FT only) is needed to be considered.

During the robot program execution if the `RG Grip` commands are used to open or close the gripper TCP is automatically set accordingly.

Furthermore, if the OnRobot Toolbar is used to open or close the gripper the Active TCP is adjusted immediately.

However, the Active TCP is overwritten directly, there is also an OnRobot defined TCP, that is called:

- **OnRobot_Default**
  This is the name in both the Single and Dual device case.

It is recommended to set the **OnRobot_Default** option as the Default TCP ( ) in the UR's TCP Configuration.

To let the system to automatically update the TCP during the program execution the UR's Move commands needs to be left at its default setting of **Set as Active TCP**. (Compared to the Static TCP mode where it is needed to be changed to a predefined TCP).

In case when two grippers are used, the Active TCP needs to be selected to which gripper to belong to:

- first use an OnRobot `TCP` command and select from Gripper 1 and Gripper 2 which one to be used
- then the UR's Move will have an updated Active TCP that could be used for multiple Move commands
- when it will be necessary to change to the other gripper just use another TCP and select the other gripper.

Before you teach any Waypoint make sure to set the Active TCP beforehand:

- for Single device go to the OnRobot Installation panel
- for Dual devices go to the OnRobot Installation panel and Select the Device (1 or 2) that you are using at the time of the teaching

As summary here is a code example:

Single	Dual
Recommended to set **OnRobot_Default** TCP as the UR's Default TCP	Recommended to set **OnRobot_Default** TCP as the UR's Default TCP
	Before each program execution make sure to select on the OnRobot Installation panel the right gripper that will be the first used in the program

Single	Dual
Robot program TCP (Optional) MoveJ (Set TCP = Active TCP)	Robot program TCP (Select Gripper 1) MoveJ (Set TCP = Active TCP) TCP (Select Gripper 2) MoveJ (Set TCP = OnRobot_Dual_2)

6.5. Return Values

Those OnRobot commands that has return values updates the `on_return` variable once the command exit. This global variable can be used with the UR's built in `If` conditional expressions (for example: `if on_return == 1` then do something) to evaluate how the command has ended.

6.5.1. HEX-E/H QC, RG2-FT

F/T Move Command Return Values

0 The move ended without detecting a force or torque greater than the set limit.

1 The move ended, because a force or torque greater than the set limit was detected.

3 The move was interrupted by a command.

11 The move cannot start, because there is no recorded path on the Compute Box with the selected ID.
Program halted.

12 The move cannot start, because there are no recorded points in this Path.
Program halted.

13 The move cannot start, because the Path file found at this Path ID is empty.
Program halted.

14 The move cannot start, because the Path file is corrupted.
Program halted.

F/T Search Command Return Values

0 The search ended successfully, because a force or torque greater than the set limit was detected.

1 The search ended without detecting a force or torque greater than the set limit.

3 The search was interrupted by a command.

11 The search cannot start, because there is no recorded path on the Compute Box with the selected ID.
Program halted.

12 The search cannot start, because there are no recorded points in this Path.
Program halted.

13 The search cannot start, because the Path file found at this Path ID is empty.
Program halted.

14 The search cannot start, because the Path file is corrupted.
Program halted.

F/T Insert Part Command Return Values

0 The insertion has reached the maximal insertion depth.

1 The insertion bumped after the minimal insertion depth.

2 The insertion slowed down after the minimal insertion depth.

3 The insertion got stuck before the minimal insertion depth.

4 The command has timed out after the minimal insertion depth.

5 The command has timed out before the minimal insertion depth.

6 The side-force/-torque limit has been reached after the minimal insertion depth.

7 The side-force/-torque limit has been reached before the minimal insertion depth.

8 Parameter error returned from the Compute Box.
Check the parameters for the F/T Insert Part command.

6.6. Feedback Variables

6.6.1. 3FG15

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
tfg_Busy	True/false	Whether the gripper is active or not
tfg_Diameter	[mm]	Width between the fingers of the Gripper
tfg_Grip_detected	True/False	True if Gripper has detected a workpiece

Feedback Variable	Unit	Description
tfg_Force_Grip_detected	True/False	True if Gripper has done a grip with the target force

6.6.2. HEX-E/H QC

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
F3D	[N]	Length of the 3D force vector $F3D = \sqrt{Fx^2 + Fy^2 + Fz^2}$
FT_Base	[3xN,3xNm]	Force and torque values calculated in the Base Coordinate system, in an array
FT_Tool	[3xN,3xNm]	Force and torque values calculated in the Tool Coordinate system, in an array
Fx	[N]	Force value along the X axis
Fy	[N]	Force value along the Y axis
Fz	[N]	Force value along the Z axis
T3D	[Nm]	Length of the 3D torque vector $T3D = \sqrt{Tx^2 + Ty^2 + Tz^2}$
Tx	[Nm]	Torque value about the X axis
Ty	[Nm]	Torque value about the Y axis
Tz	[Nm]	Torque value about the Z axis

6.6.3. RG2-FT

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
F3D	[N]	Length of the 3D force vector $F3D = \sqrt{Fx^2 + Fy^2 + Fz^2}$

Feedback Variable	Unit	Description
F3D_Left	[N]	Length of the 3D force vector for the left finger sensor $F3D_Left = \sqrt{Fx_L^2 + Fy_L^2 + Fz_L^2}$
F3D_Right	[N]	Length of the 3D force vector for the right finger sensor $F3D_Right = \sqrt{Fx_R^2 + Fy_R^2 + Fz_R^2}$
FT_Base	[3xN, 3xNm]	Force and torque values calculated in the Base Coordinate system, in an array
FT_Left	[3xN, 3xNm]	list of {Fx,Fy,Fz,Tx,Ty,Tz} for the left finger sensor
FT_Right	[3xN, 3xNm]	list of {Fx,Fy,Fz,Tx,Ty,Tz} for the right finger sensor
FT_Tool	[3xN, 3xNm]	Force and torque values calculated in the Tool Coordinate system, in an array
Part_Width	[mm]	The actual value of the detected part width (-1 if it not applicable) measured by the proximity sensors
Proximity_Left	[mm]	The left proximity (distance) sensor actual value
Proximity_Right	[mm]	The right proximity (distance) sensor actual value
T3D_Left	[Nm]	Length of the 3D torque vector for the left finger sensor $T3D_Left = \sqrt{Tx_L^2 + Ty_L^2 + Tz_L^2}$
T3D_Right	[Nm]	Length of the 3D torque vector for the right finger sensor $T3D_Right = \sqrt{Tx_R^2 + Ty_R^2 + Tz_R^2}$
T3D	[Nm]	Length of the 3D torque vector $T3D = \sqrt{Tx^2 + Ty^2 + Tz^2}$
Width	[mm]	Distance between the fingers of the Gripper (calculated by finger angle encoders)

6.6.4. RG2 / RG6

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands

Feedback Variable	Unit	Description
rg_Busy	True/false	Whether the gripper is active or not
rg_Depth	[mm]	Distance the robot (due to depth compensation) has moved towards the z axes having as reference the gripper at 0 mm width
rg_DepthRel	[mm]	Distance the robot (due to depth compensation) has moved towards the z axes having as reference the previous gripper's width
rg_Grip_detected	True/ False	True if Gripper has detected a workpiece
rg_Width	[mm]	Width between the fingers of the Gripper

6.6.5. Screwdriver

Feedback Variable	Unit	Description
on_return		-1 xmlrpc command failed
d_Achieved_torque	Nm	Achieved torque after a Tighten command has been executed
sd_Busy	True/ False	True if the Screwdriver is active
sd_Command_results		0 - No additional result data 1 - Unknown command 2 - Not screwing in 3 - Timeout waiting for torque 4 - Torque exceeded prematurely 5 - Unable to loosen screw 6 - Shank reached the end 7 - Shank obstructed during move
sd_Current_torque	Nm	Current torque the Screwdriver is applying at the moment
sd_Process_NOK	True/ False	True if the command was not executed correctly
sd_Process_OK	True/ False	True if the command was executed correctly

Feedback Variable	Unit	Description
sd_Target_torque	Nm	Last Tighten command Target torque after it has been executed
sd_Torque_gradient	Nm/rad	Achieved torque gradient after a Tighten command has been executed

6.6.6. SG

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
sg_Busy	True/false	Whether the gripper is active or not
sg_Depth	[mm]	Distance the robot (due to depth compensation) has moved towards the z axes having as reference the gripper at 0 mm width
sg_Width	[mm]	Width inside of the Gripper

6.6.7. VG10 / VGC10

Feedback Variable	Unit	Description
on_return	0	The return value for the OnRobot commands
vg_Vacuum_A	%Vacuum	Returns the %Vacuum achieved on channel A
vg_Vacuum_B	%Vacuum	Returns the %Vacuum achieved on channel B

6.7. Application Examples

6.7.1. Screwdriver

Below a simple **Screw in application** is explained:

Lines 2 - 7: the robot moves to the screw feeder and wait for a digital input signal from the screw feeder saying that the screw is ready to be picked up.

NOTE:

The screwdriver's bit should be at least 50 mm away from the picking point until the screw is waiting in place. Otherwise, the magnetic force of the Screw-bit system will attract the screw sidewise and it might cause a misalignment between the screw and the bit.

Lines 8 -14: the `Pick Screw` command is executed. If the command is not successful, the robot will move to separate from the screw feeder and a popup will be displayed saying “Missing screws”. Else the robot program will continue.

Lines 15 - 22: the robot moves form the screw feeder to the thread

Lines 21 - 27: the `Tighten Screw` command is executed. An if statement will check that the achieved torque is within the range of the target torque +/- the tolerances. The tolerances in this case are 0.04 Nm. If the achieved torque is within range, the condition will return true and the program will continue. Else a popup will be displayed saying “Unexpected Torque”.

```
1  Robot Program
2  MoveJ
3      Appr_scr_feeder
4  Wait DI[0]=LO
5  MoveL
6      Above_screw
7  'Wait for screw feeder signal that the screw is ready'
8  Pick Screw
9      If get_sd_Process_NOK()
10         MoveL
11             Separate_1
12         Popup: Missing screws
13     Else
14         'Continue'
15 MoveL
16     Separate_2
17 MoveL
18     Appr_thread
19 MoveL
20     Above_thread
21 Tighten Screw
22     If sd_check_torque(0.04)
23         'Continue with program'
24     Else
25         Popup: Unexpected Torque
26 MoveL
27     Separate_3
```

7. Additional Software Options

7.1. Compute Box

7.1.1. Interfaces

There are two interface types that could be used:

- **Ethernet interface**

  This interface can be used to access the Web Client that can be used to monitor, control, and update the grippers/devices. Furthermore, via this interface the OnRobot WebLogic™ can also be accessed to program the Digital I/O Interface.

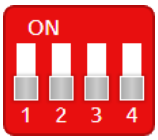
- **Digital I/O interface**

  This interface could be used to communicate via simple digital I/O lines with the robots. There are 8 digital input and 8 digital output that could be used. These inputs and outputs can be programmed through the OnRobot WebLogic™ that requires the Ethernet interface to be used (only for programming time).

7.1.2. Web Client

To access the Web Client on your computer first the Ethernet interface needs to be set up to have a proper communication between your computer and the Compute Box. It is recommended to use **Auto mode**.

Configure the IP address in **Auto Mode** as follows:



Use the factory default settings (DIP switch 3 and 4 in OFF position).

In this case, the Compute Box has both Dynamic Host Configuration Protocol (DHCP) client, and DHCP server enabled.

DHCP Client enabled means, Compute Box will automatically obtain (“get”) IP address FROM the connected robot/computer if that is capable of assigning (“give”) IP to the Compute Box.

DHCP Server enabled means, Compute Box will automatically assign (“give”) IP address TO the connected robot/computer if that was configured to obtain (“get”) IP address automatically.

NOTE:

The assigned IP range is 192.168.1.100-105 (with subnet mask 255.255.255.0).

If the Compute Box is used in a company network where a DHCP server is already in use, it is recommended to disable the DHCP server of the Compute Box by setting DIP switch 4 to the ON position.

If no IP was assigned to the Compute Box within a minute, it will automatically get a fallback IP address (192.168.1.1).

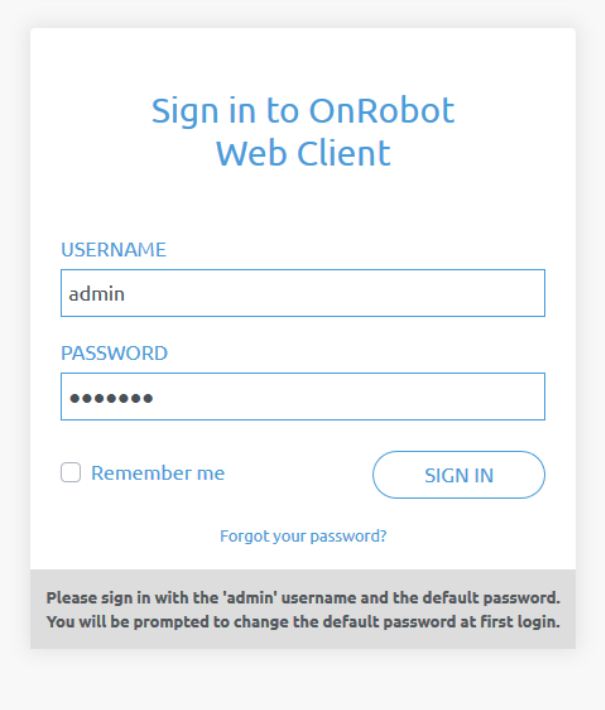
NOTE:

If the Compute Box was in **Advanced mode**, first reset the IP setting by switching to **Fixed IP mode** and then switch back to **Auto mode**.

After the IP address is configured, do the following steps:

- Connect the Compute Box to your computer with the supplied UTP cable.
- Power the Compute Box with the supplied power supply
- Wait one minute for the Compute Box LED to turn from blue to green.
- Open a web browser on your computer and type in the IP address of the Compute Box (factory default is 192.168.1.1).

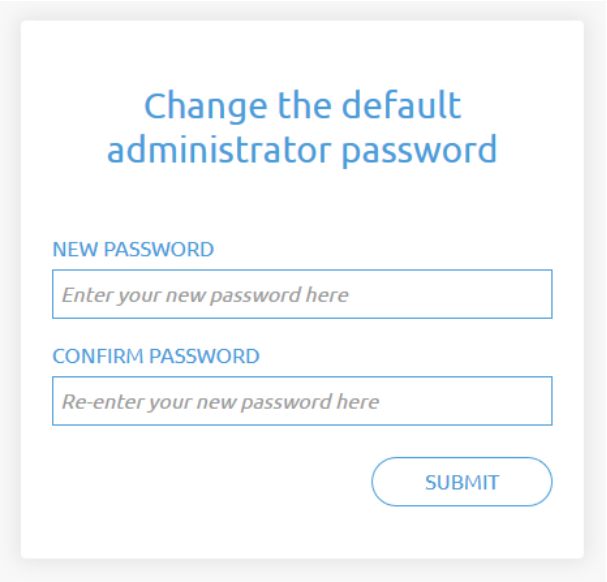
The Sign-in page opens:



The factory default administrator login is:

Username: admin
Password: OnRobot

For the first login a new password needs to be entered: (password must be at least 8 characters long)



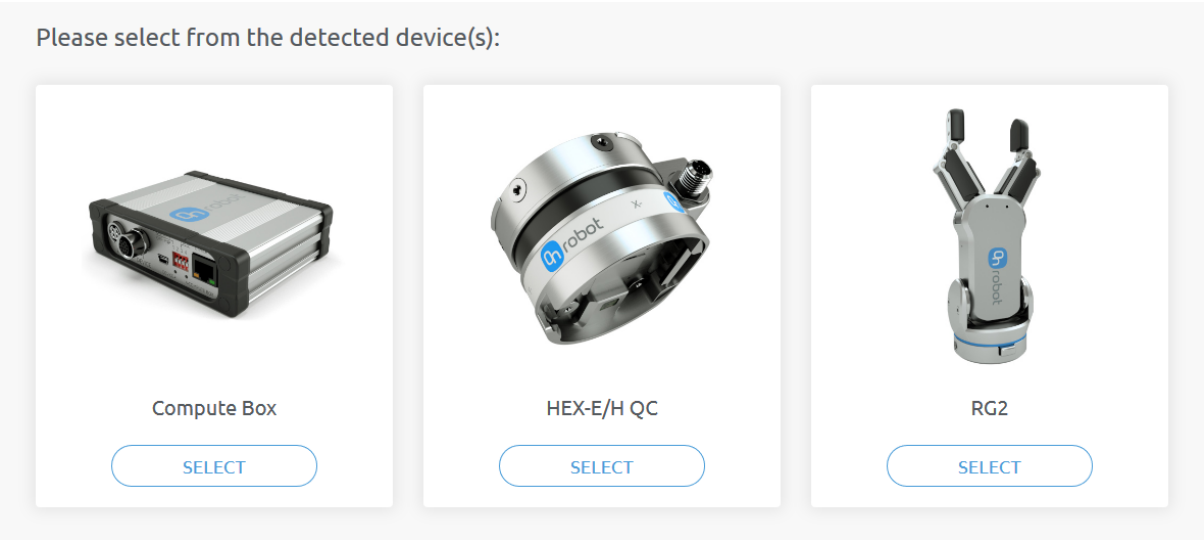
Once signed in the following top menus appear:

- **Devices** - Monitor and control the connected devices (e.g.: grippers)
- **Configuration** - Change the Compute Box's settings
- **WebLogic**™ - Program the Digital I/O interface through OnRobot WebLogic™
- **Paths** - Import/export the recorded Paths (not available to all robots)
- **Update** - Update the Compute Box and the devices
- Account settings (e.g.: change password, add new user)
- Select the language of the Web Client

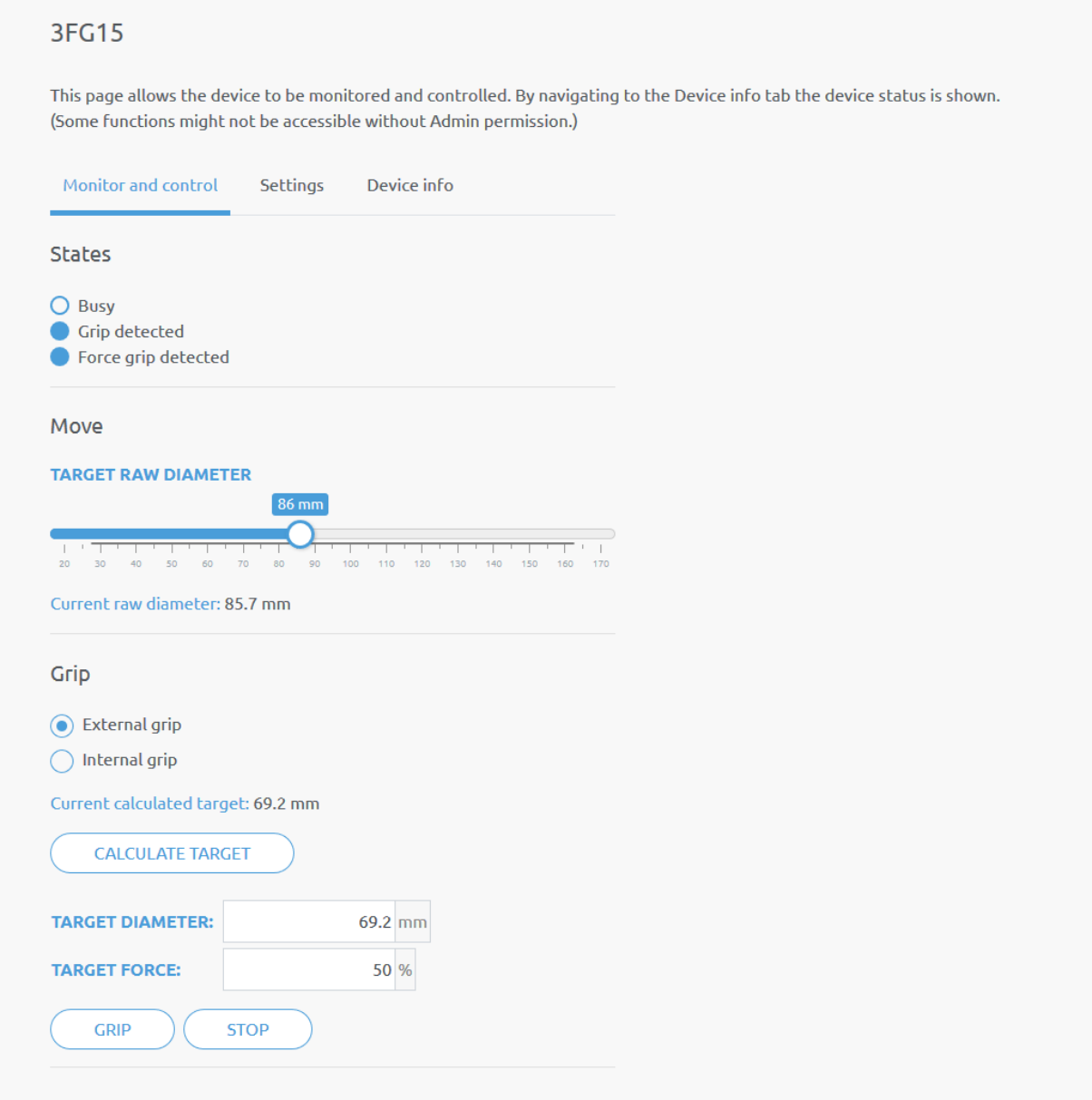
In the following, these menus will be described.

7.1.3. Web Client: Devices Menu

To control/monitor a device click on the **Select** button.



7.1.3.1. 3FG15



The state of the gripper could be:

- **Busy** - the gripper is in motion
- **Grip detected** - the gripper has detected a workpiece
- **Force grip detected** - the gripper has applied the target force to a workpiece. This also activates a break. See more info in section **Finger Movement and Force**.

The gripper can be controlled in two modes:

- **Move** mode - The easiest way to move the gripper but the gripping force is limited (<50N). This should be used to release a part and open the gripper.
- **Grip** mode - This should be used to properly grip a part with a given target force. If the part is properly gripped (target force is reached) the break will engage to make sure the part will not be dropped in case of a power loss.

In **Move** mode:

The gripper can be controlled by adjusting the **Target raw diameter** slider. The actual values of the fingers are shown by the **Current raw diameter**. The raw diameter is without the fingertip offset.

In **Grip** mode:

First set how to grip the part:

- Externally or
- Internally

To grip on a part set the **Target diameter** and **Target force** and click on the **Grip** button.

There are two ways how the target diameter can be given:

- Enter manually - make sure to add 3mm to the part diameter if it is gripped internally and subtract 3mm if it is gripped externally
- Use the **Calculate target** button:

  Move the fingers with the slider to touch the part and activate the **Grip detected** (open fully for an internal grip or close fully for an external grip).

  Based on whether it will be external or internal the **Current calculated target** (diameter) for the grip is shown. The fingertip offset is either added or subtracted to compensate for the set fingertip.

Grip type	Current calculated target value
External grip	**Current raw diameter** - **Fingertip offset** - **3 mm**
Internal grip	**Current raw diameter** + **Fingertip offset** + **3 mm**

  Click on the **Calculate target** button to load the calculated value to the **Target diameter**.

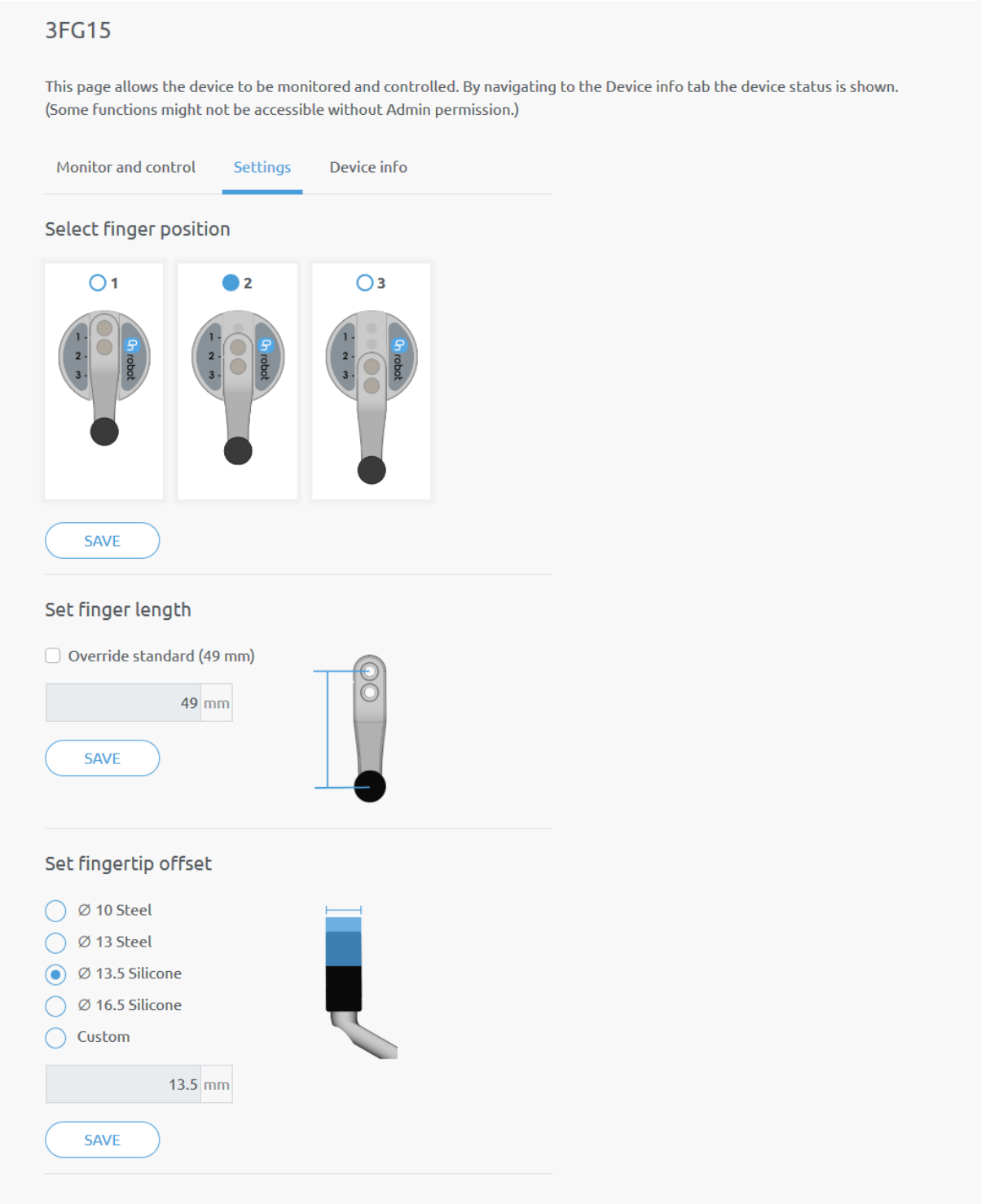
If the grip was successful, the **Force grip detected** signal should be activated and the engaged brake should make a clicking sound.

During the gripping the motion of the finger can be terminated by clicking on the **Stop** button.

To release the part from a gripped status, move the gripper:

- Outward in case of an external grip
- Inward in case of an internal grip.

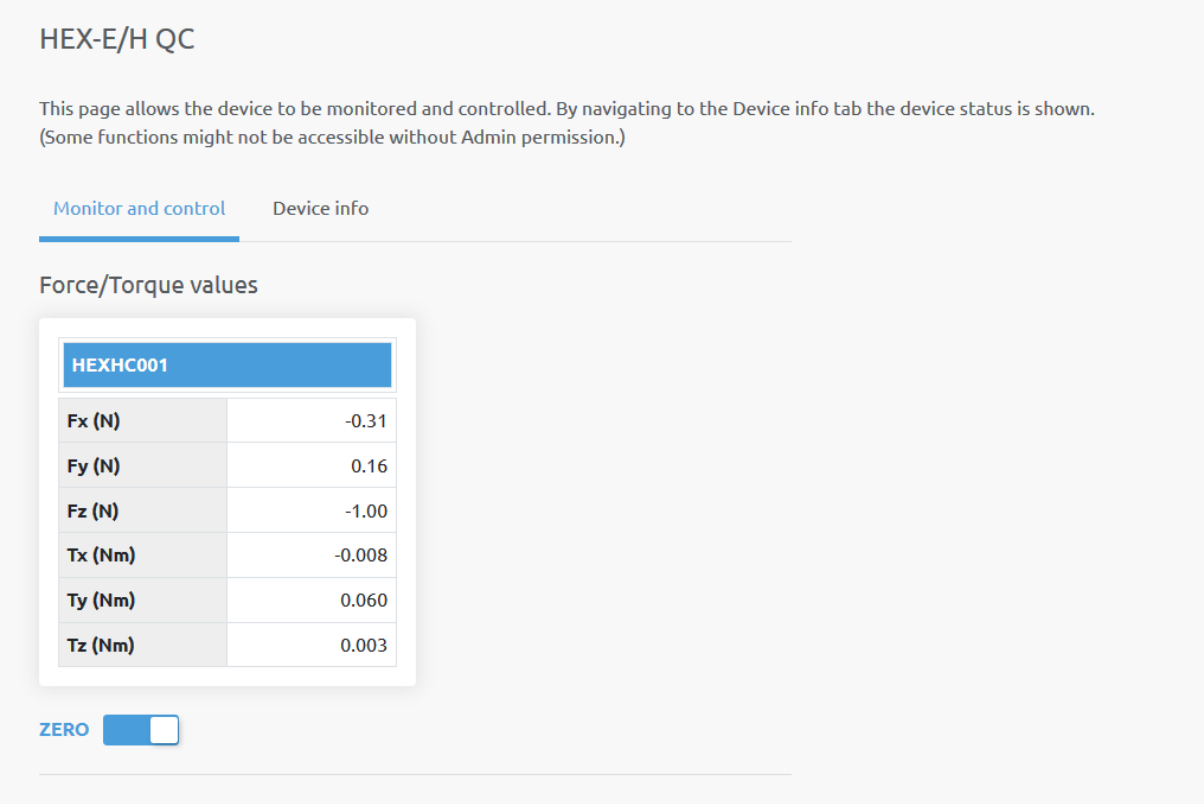
The default finger setting can be changed on the **Settings** tab:



- **Select finger position** - Select the mounted finger position and **Save**.
- **Set finger length** - If customized fingers are needed, the checkbox can be enabled, and the new finger length can be entered.
- **Set fingertip offset** - The 4 different types that are delivered with the gripper can be selected by pressing the radio button. If customized fingertips are made, the custom option can be selected.

Saving any of these 3 settings will automatically apply the changes. Different finger positions, fingertip diameters and finger lengths will allow to achieve different diameters and forces. Find more information in sections **Gripping Force** and **Gripping Diameter**.

7.1.3.2. HEX-E/H QC



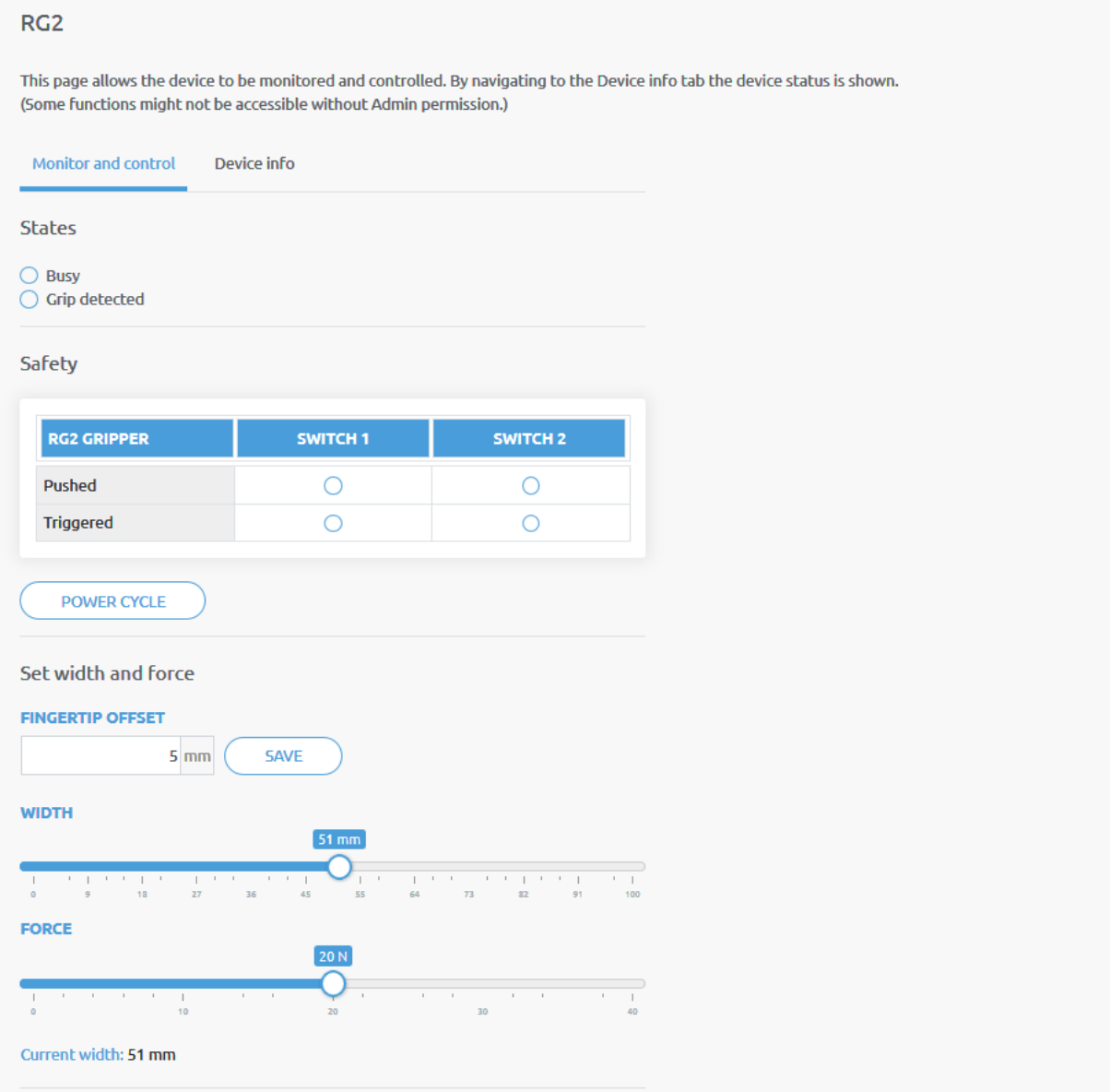
The force and torque values (**Fx,Fy,Fz** and **Tx,Ty,Tz**) are shown in N/Nm.

The **Zero** toggle switch can be used to zero the force and torque reading.

NOTE:

Zero value set on this page is not stored permanently and are restored to the default values on power reset.

7.1.3.3. RG2/6



The state of the gripper could be:

- **Busy** - the gripper is moving
- **Grip detected** - the set force limit is reached but the set width is not.

The status of the two safety switch shows:

- **Pushed** - the safety switch 1/2 is still being pushed
- **Triggered** - the safety switch 1/2 has been activated and gripper is stopped.

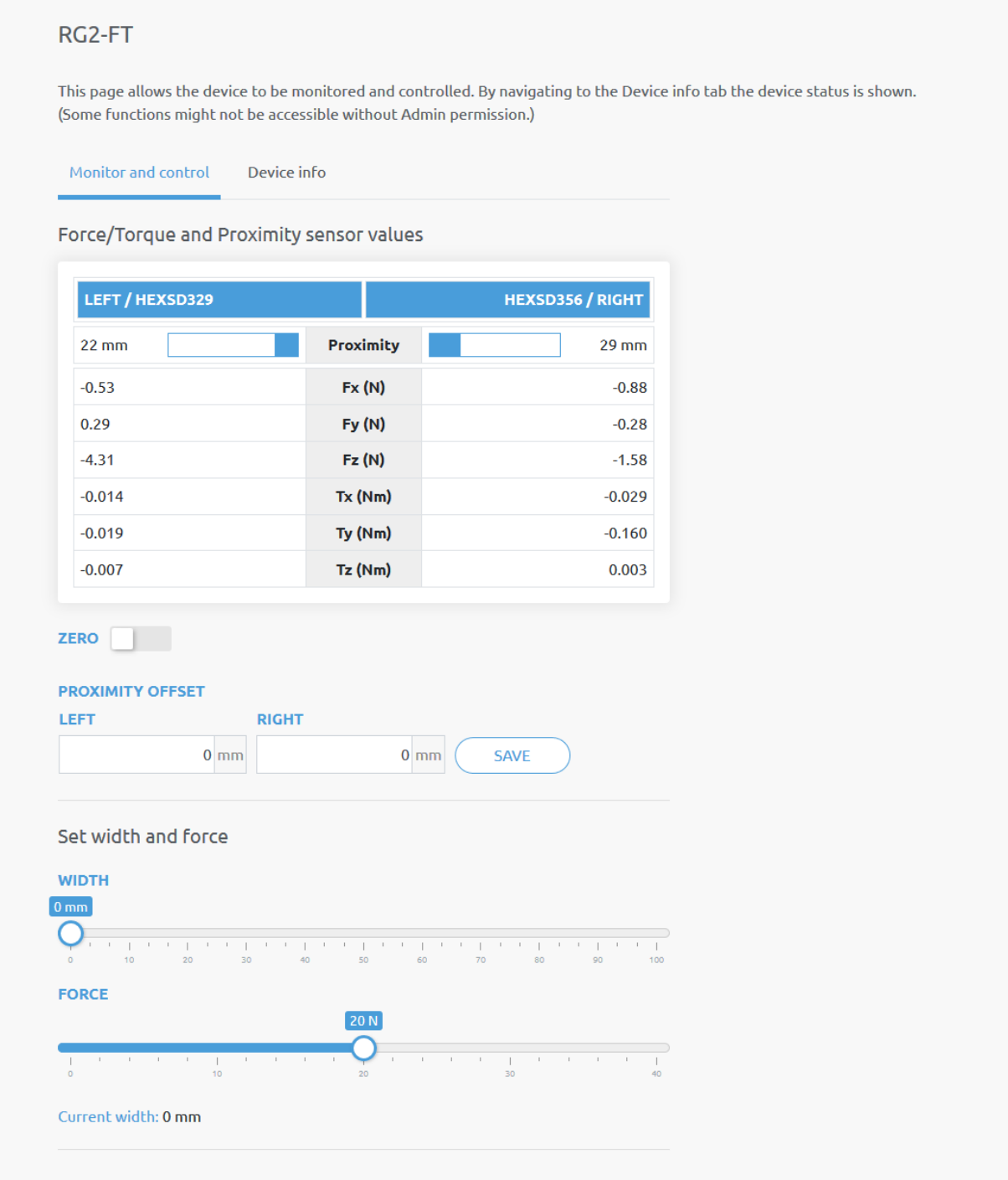
To recover from a Triggered state:

- Check if any of the safety switch is being pushed
- If yes, remove the object pushing the switch
- Click on **Power cycle** to power all devices off and then on to recover.

Fingertip offset must be set according to the current fingertips attached to the gripper. Offset is measured from the inner mating face of the bar metal fingertips. To save the value to the gripper permanently click **Save**.

The gripper can be controlled by adjusting the **Force** and **Width** value. First set the required gripping force and then adjust the width slider that will immediately control the gripper.

7.1.3.4. RG2-FT



The force and torque values (**Fx,Fy,Fz** and **Tx,Ty,Tz**) are shown in N/Nm along with the Proximity sensor values (optical distance sensor built in the fingertip) are show in mm for the left and right fingertip sensor.

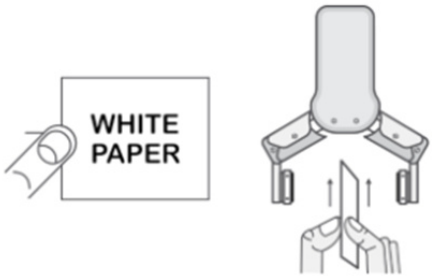
The **Zero** toggle switch can be used to zero the force and torque reading.

NOTE:

Zero value set on this page is not stored permanently and are restored to the default values on power reset.

The **Proximity offset** can be used to calibrate the proximity reading. The calibration requires the following steps to be done:

- Write 0 mm to the **Left** and **Right** edit box and click on the **Save** button.
- Close the gripper fully (set the **Width** to 0) while you hold a white paper between the fingertips.



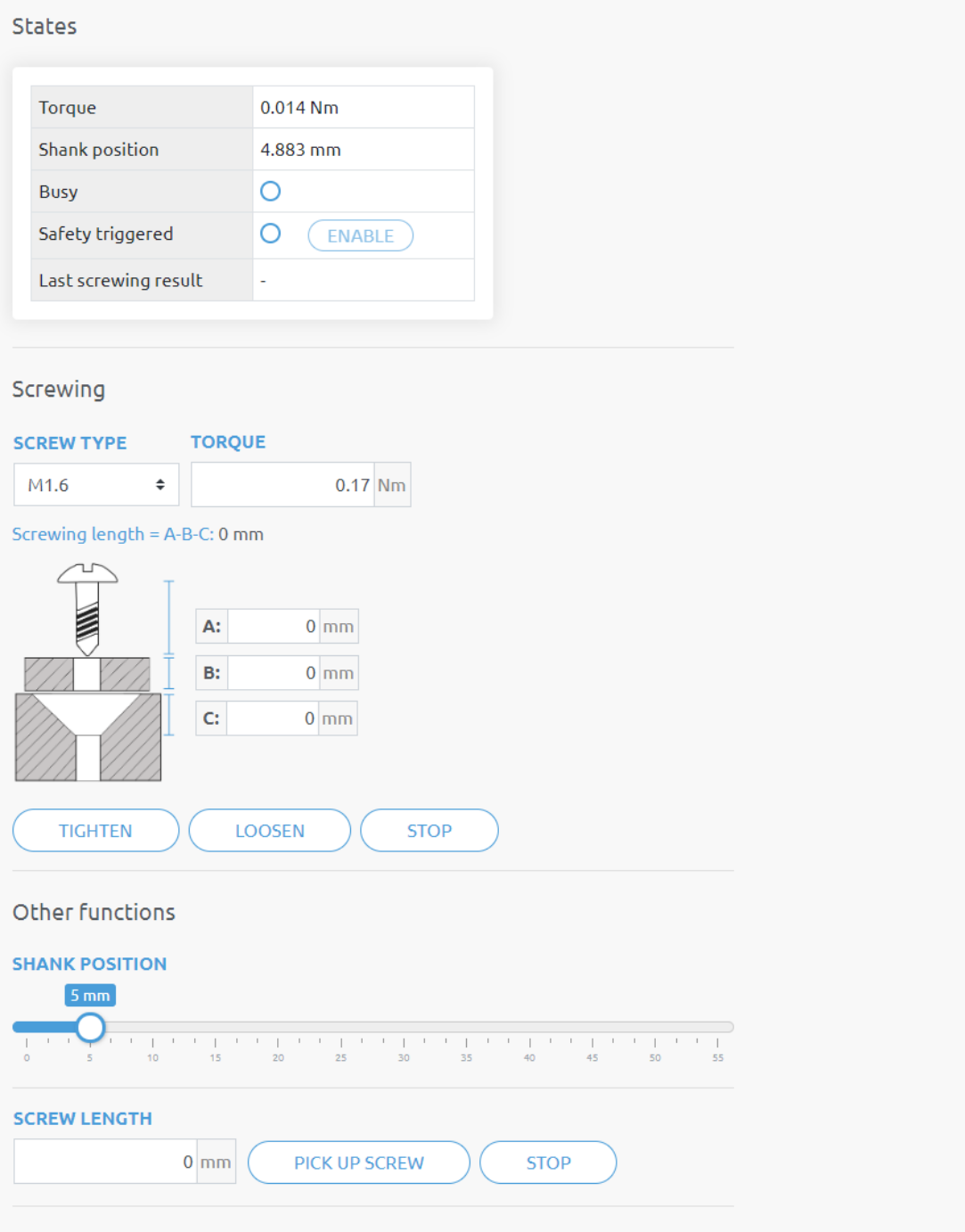
- Read the actual **Left** and **Right Proximity** values (e.g.: 19mm and 25mm)
- Write these values to the **Left** and **Right** edit boxes and click on the **Save** button to store it permanently.
- Open the gripper and the calibration is finished.

NOTE:

Setting the offsets too high may clip the proximity reading at 0 mm (negative distance is not shown). In case of clipping (reading 0 mm), try to decrease the offset values.

The gripper can be controlled by adjusting the **Force** and **Width** value. First set the required gripping force and then adjust the width slider that will immediately control the gripper.

7.1.3.5. Screwdriver



The state of the gripper:

- **Torque** - Shows the current torque.
- **Shank position** - Shows the current shank position.
- **Busy** - the screwdriver is in motion
- **Safety triggered** - shows if the mechanical safety is being trigger.
- **Enable** - Press to enable the screwdriver after the mechanical safety is being trigger.
- **Last screwing result** - will show additional results such as:
  - - (no error)

- Not screwing in
- Timeout waiting for torque
- Torque exceeded prematurely
- Unable to loosen screw
- Shank reached the end
- Shank obstructed during move

Screwing parameters and functions:

- **Screw type** - The screw sizes from M1.6 to M6 can be selected. This selection will autofill the standard torque value for that particular screw type.
- **Torque** - Input the target tightening torque.
- **Screwing length = A-B-C:** The resulting screwing length is shown here. This is the amount of the screw that will be screwed into/unscrewed from the thread. To set the value use input fields below and the resulting amount will be **A** (screw length) - **B** (Washer thickness) - **C** (Chamfer deepness).

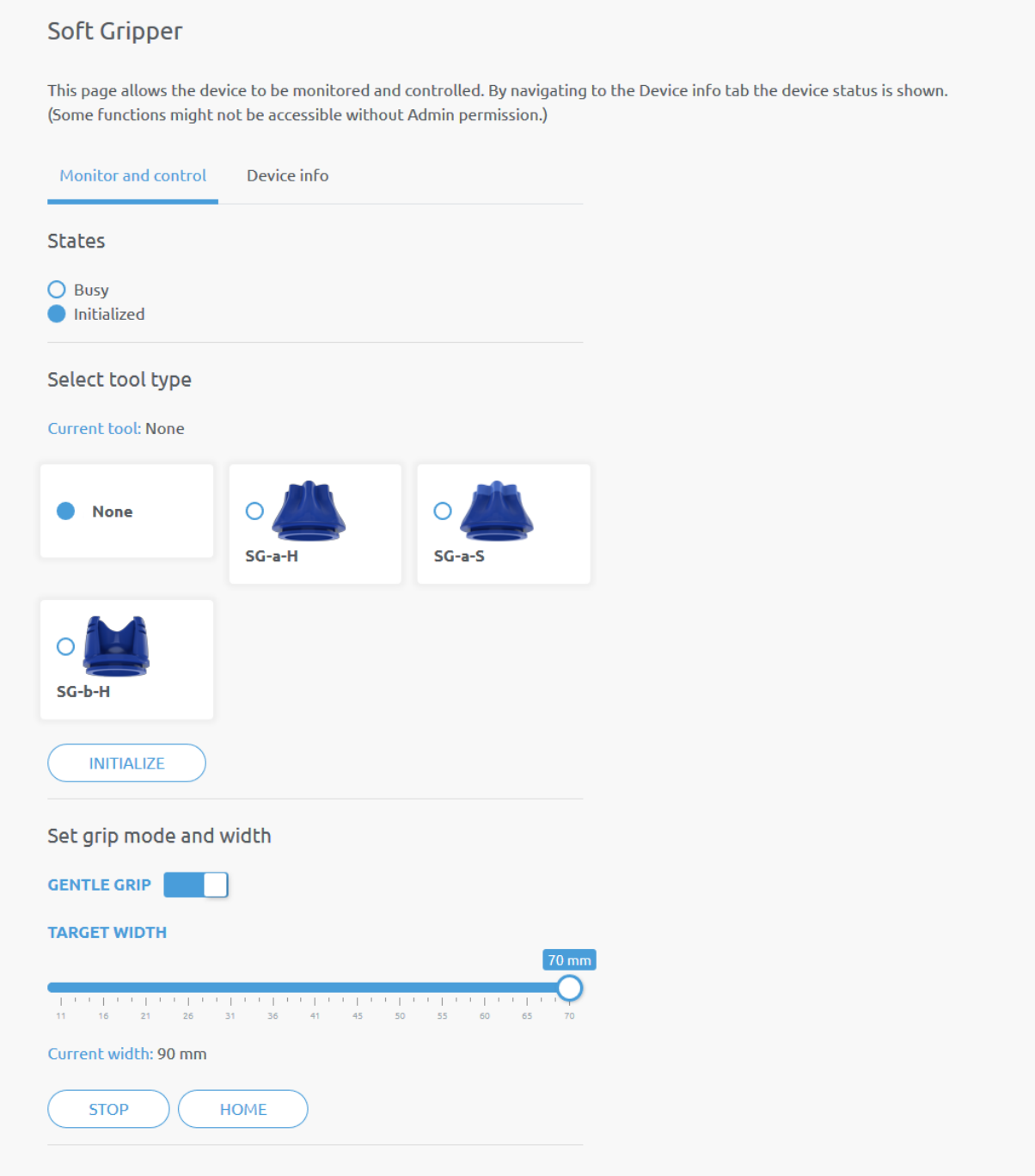
  The image shows 3 different lengths:

  - **A** = This is the screw length, distance from the bottom to the head of the screw.
  - **B** = This is the washer thickness (or piece in between screw and thread), if no piece is used set it as 0. This amount will be subtracted from the Screw length to provide the resulting Screwing length.
  - **C** = This is the chamfer deepness. This amount will be subtracted from the Screw length to provide the resulting Screwing length.
- **Tighten** - When this command is executed, the screwdriver will move and rotate the Screw-bit system until it reaches the thread. Then, it will start to screw in the screw until 90% of the Screwing length is inside the thread. During the rest 10% of the Screwing length, the screwdriver will tighten the screw applying the Target Torque.
- **Loosen** - When this command is executed, the screwdriver will move and rotate the bit to align it with the screw head. Then, it will loosen and unscrew the screw until it is out the thread (specified screwing length). Afterwards, it will hide the Screw-bit system inside the housing.
- **Stop** - This will stop the screwdriver command that is executed at that time.

Other functions

- **Shank position** - changes the position of the shank immediately.
- **Screw length** - input the length of the screw that will be picked up.
- **Pick up screw** - When this command is executed, the screwdriver will move and rotate the bit to align it with the screw head, then it will pick up the screw and hide it inside the housing.
- **Stop** - This will stop the screwdriver command that is executed at that time.

7.1.3.6. SG



The **States** of the gripper could be:

- **Busy** - the gripper is moving
- **Initialized** - the gripper has been initialized.

Select tool type

- **Current tool** - Shows the currently selected SG tool. Select the desired SG tool, by clicking the adjacent radio button.
- Click on **Initialize** to initialize the selected SG tool

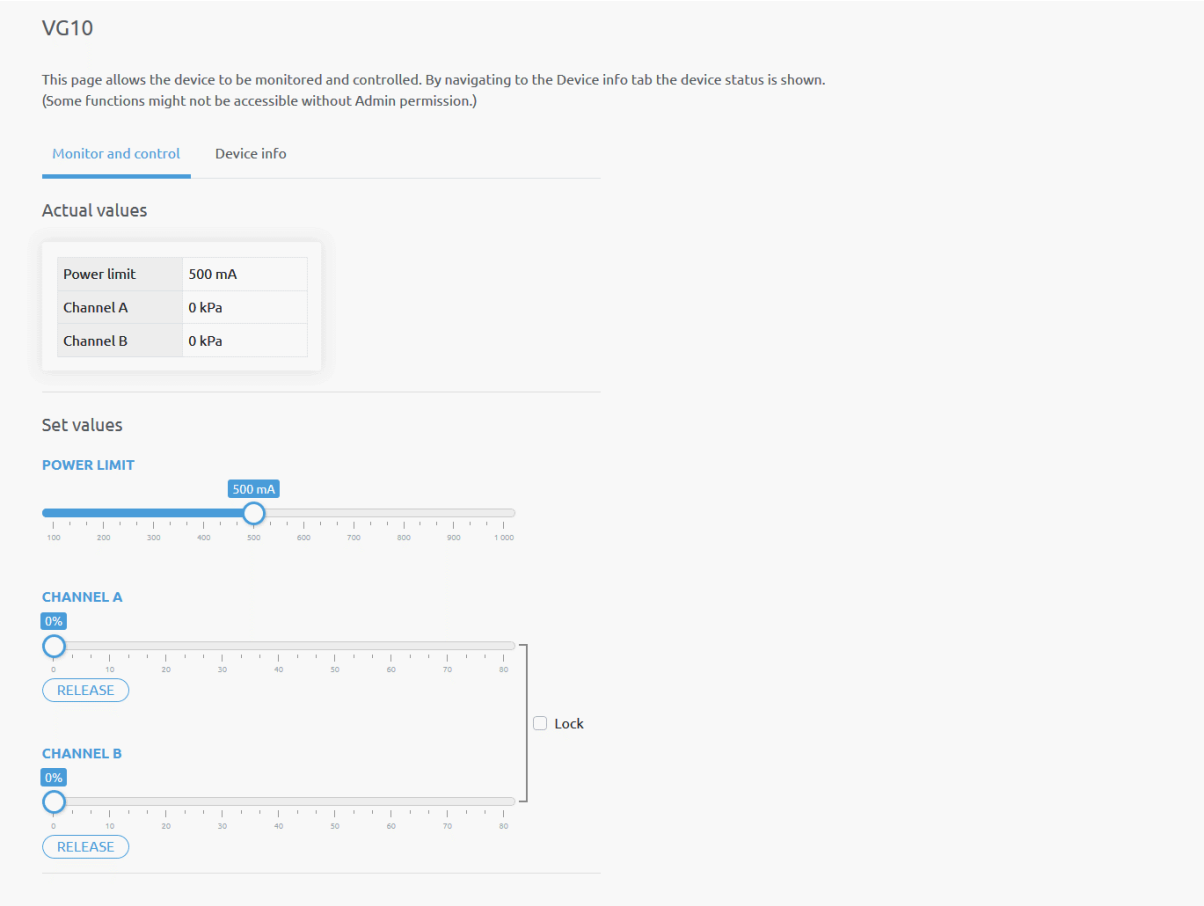
Set grip mode and width

The default gripping speed is set as **Gentle grip**, the gripping speed is reduced at 12.5mm before the specified target width, this results in a gentler grip, compared to normal grip settings.

The gripper can be controlled by adjusting the **Target width** slider, this will immediately control the gripper.

- **Current width** - shows the current width of the gripper.
- **Stop** button - stops the ongoing procedure.
- **Home** button - moves the gripper to its home position.

7.1.3.7. VG10 / VGC10



The actual vacuum level for **Channel A** and **Channel B** can be seen in percentage (in the range of 0...80 kPa vacuum). The actual value of the **Power limit** is shown in mA.

The **Power limit** can be adjusted in the range of 0...1000mA with the slider.

NOTE:

The power limit set in this page is not stored permanently and always restored to the default value on power reset.

Higher power limit value means the required vacuum level is reached faster (higher airflow), but if it is set too fast overshoot may occur.

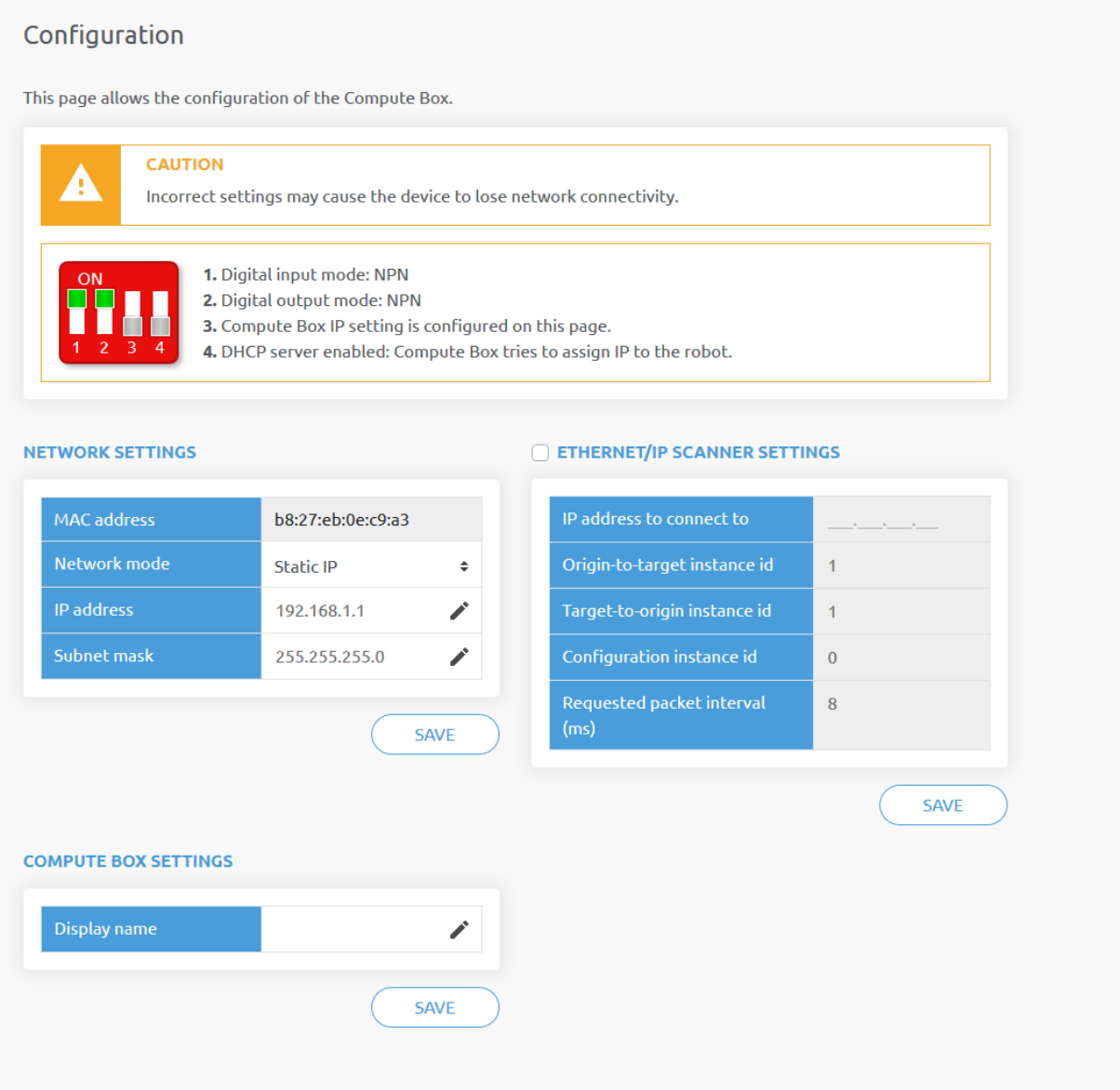
Low power limit may not be enough for higher percentage of vacuum and the target vacuum level may not be reached.

The **Channel A** and **Channel B** vacuum level can be set individually or in tandem by checking the **Lock** checkbox.

Make sure to set high enough vacuum before you grip and lift any object.

To release the gripped object, click on the **Release** button.

7.1.4. Web Client: Configuration Menu



Network settings:

The **MAC address** is a world-wide unique identifier that is fixed for the device.

The **Network mode** drop-down menu can be used to decide if the Compute Box will have a static or a dynamic IP address:

- If it is set to **Dynamic IP**, the Compute Box expects an IP address from a DHCP server. If the network that the device is connected to has no DHCP server, then the fixed 192.168.1.1 IP is used for the device (after 60 seconds of timeout).

- If it is set to **Static IP**, then a fixed IP address and subnet mask must be set.
- If it is set to **Default Static IP**, the fixed IP revert to the factory default and cannot be changed.

After all parameters are set, click on the **Save** button to store the new values permanently. Wait 1 minute and reconnect to the device using the new settings.

Compute Box / Eye Box settings:

In case, more than one Compute Box is used within the same network, for identification purpose any user specific name can be entered to the **Display name**.

EtherNet/IP scanner settings:

NOTE:

This is a special option of the EtherNet/IP connection for some robots.

In case when the robot is the Adapter and the Compute Box needs to be the Scanner the following addition information is required for the communication:

- **IP address to connect to** - the robot IP address
- **Origin-to-target instance id** - refer to the robot's EtherNet/IP manual (Scanner mode)
- **Target-to-origin instance id** - refer to the robot's EtherNet/IP manual (Scanner mode)
- **Configuration instance id** - refer to the robot's EtherNet/IP manual (Scanner mode)
- **Requested packet interval (ms)** - RPI value in ms (minimum 4)

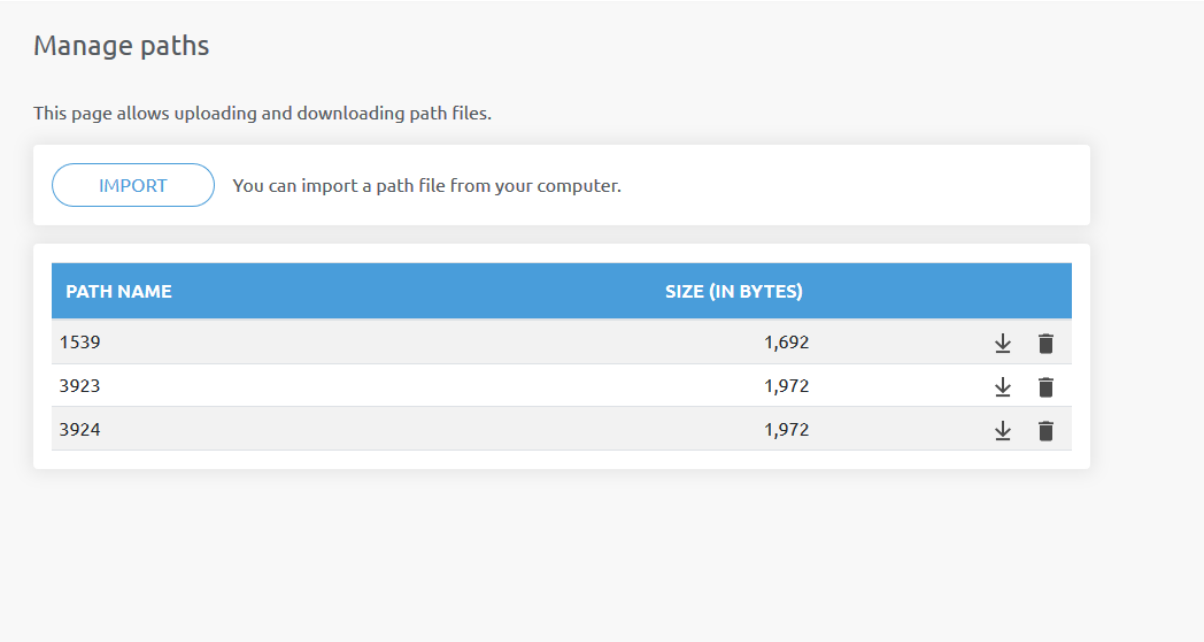
Check the checkbox and the Compute Box will try to automatically connect to the robot (via the given IP address).

7.1.5. Web Client: Path Menu

NOTE:

The Path feature may not be available to your robot type.

This page can be used to import, export, and delete the previously recorded paths. In this way a Path can be copied to a different Compute Box.



To import a previously exported Path (.ofp file) click on **Import** and browse for the file.

The available Paths are listed at the end of the page. Any paths can be exported and downloaded as a .ofp file or permanently deleted to free up the list if a path is not needed anymore.

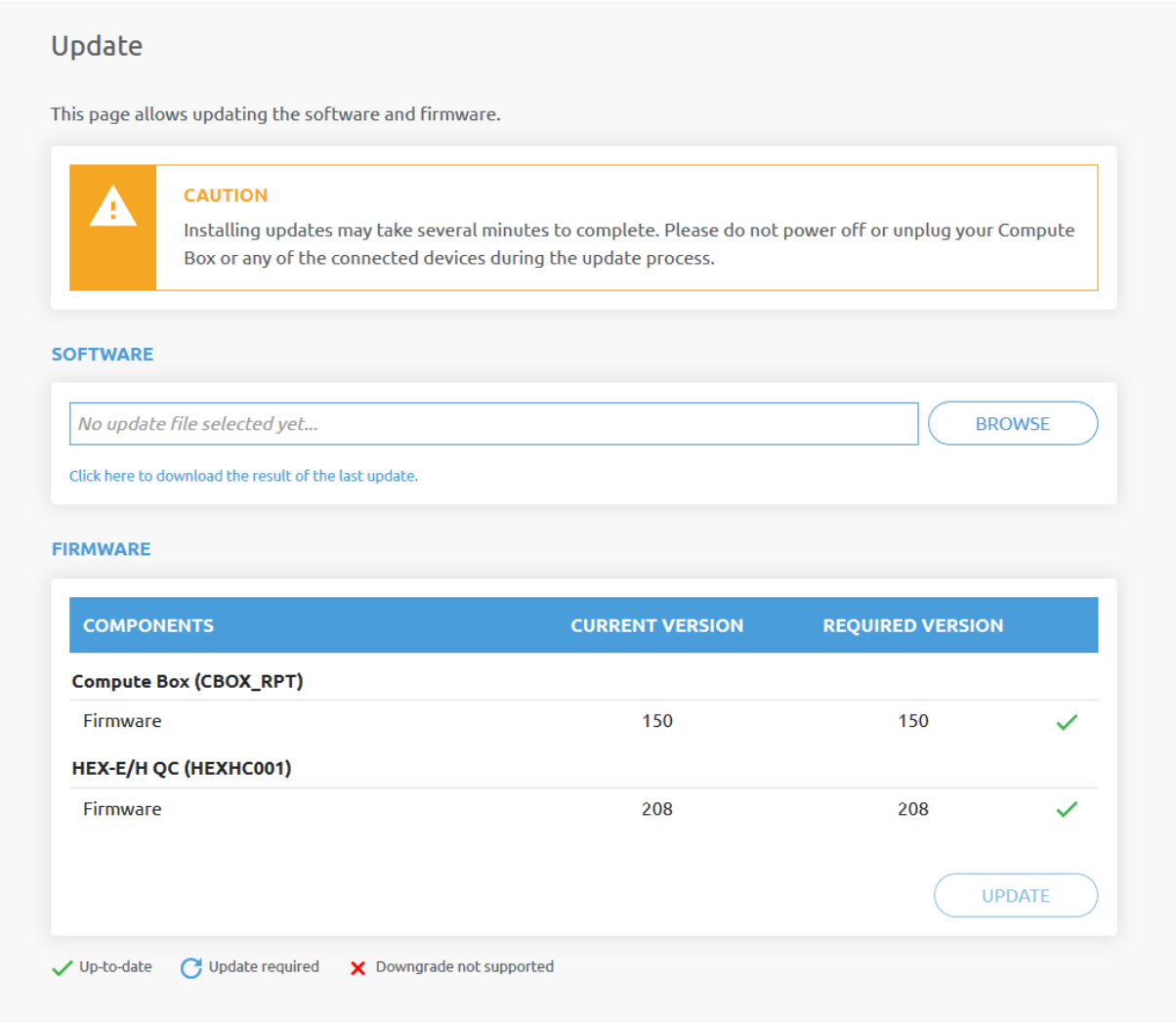
NOTE:

Always make sure that you do not delete any path that is currently in use in any of your robot programs. Otherwise the path will need to be re-recorded, since the delete operation cannot be undone.

The Compute Box can store up to 100 Mbytes of paths that is roughly equal to 1000 hours of recordings.

7.1.6. Web Client: Update Menu

This page can be used to update the software on the Compute Box and the firmware on the devices.



CAUTION:

During the update process (takes about 5-10 minutes) DO NOT unplug any device or close the browser window. Otherwise the updated device could be damaged.

The loading screens during the update process are the same for the software and the firmware updates.

Software Update

Start the software update by clicking on the **Browse** button to browse for the. cbu software update file.

Then the **Browse** button will turn to **Update**.

Click on that **Update** button to start the software update process, see below.

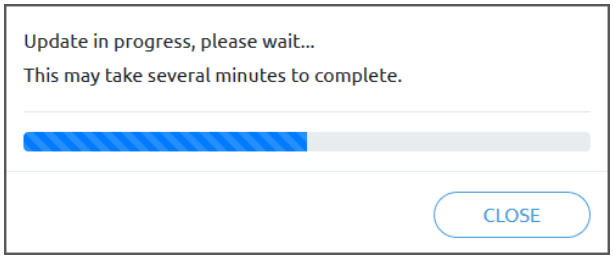
If the update is finished and was successful, the message below is shown.

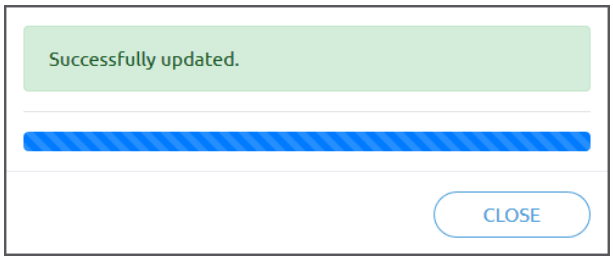
Firmware Update

The firmware update is only required when any of the components is out of date.

To start the firmware update, click on **Update** button in the firmware section of the page, see below.

If the update is finished and was successful, the message below is shown.

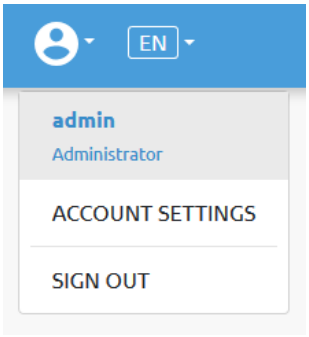




7.1.7. Web Client: Account Settings

This menu can be used to:

- See the currently sign-id user
- Go to **Account settings**
- Sign-out

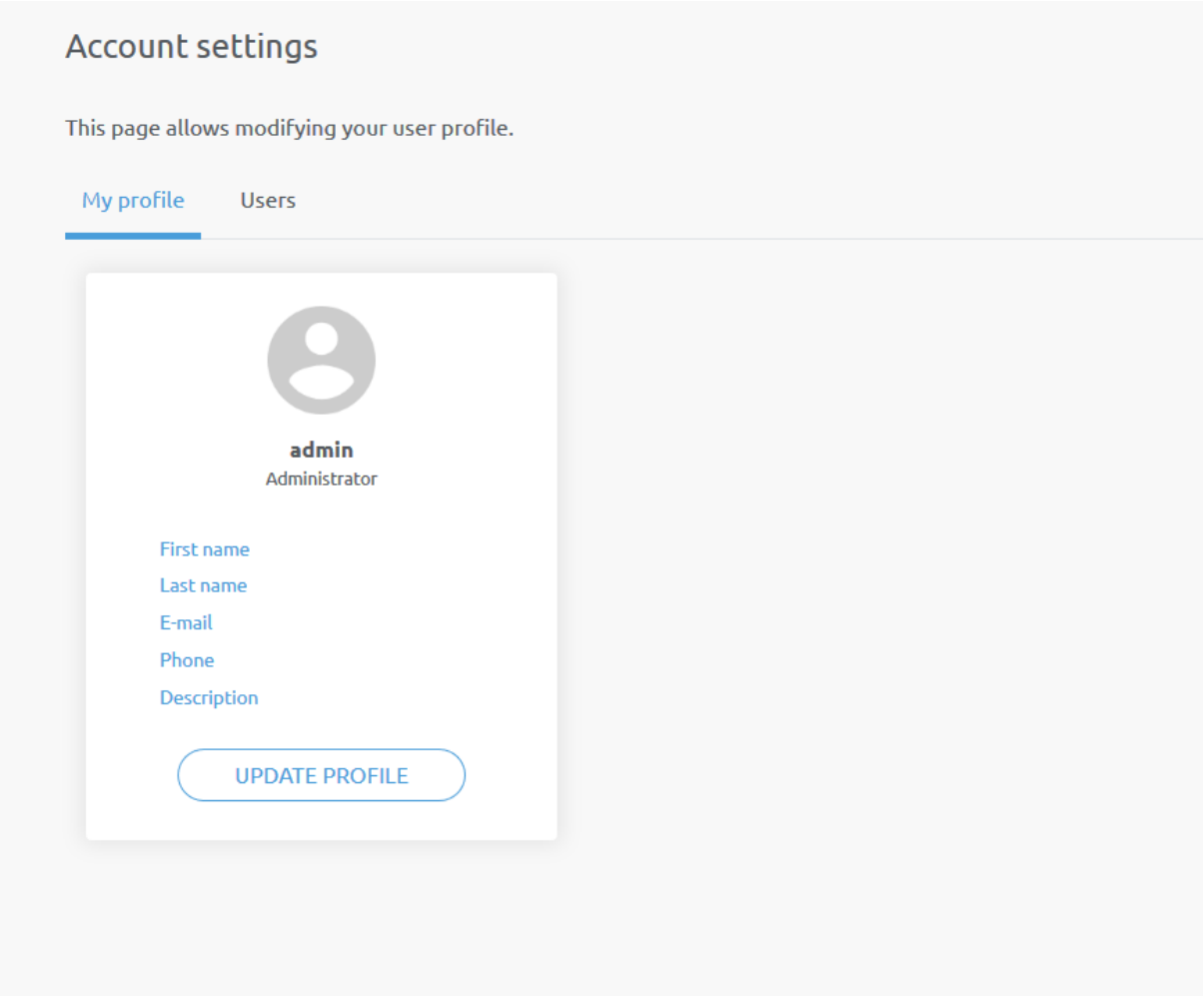


Account settings:

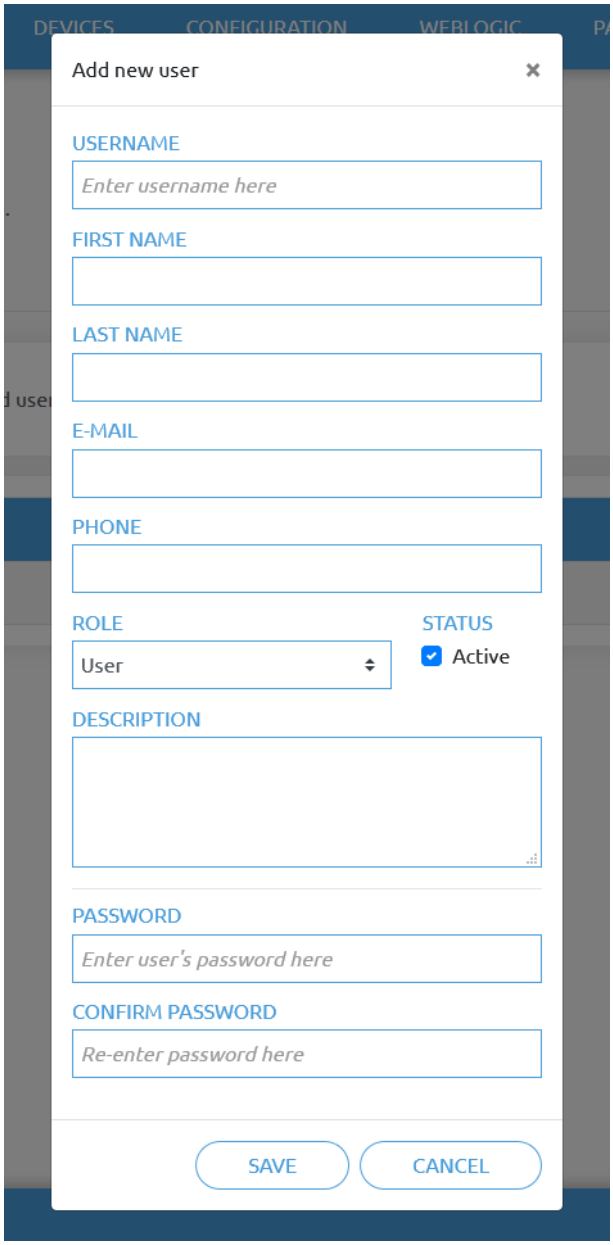
This page has two tabs:

- **My profile** - to see and update the currently logged in users' profile (e.g.: change password)
- **Users** - to manage users (e.g.: add/remove/edit)

On the **My profile** tab to change any profile data (e.g.: password) click on the **Update profile** button.



On the **Users** tab click on the **Add new user** button to add more users:

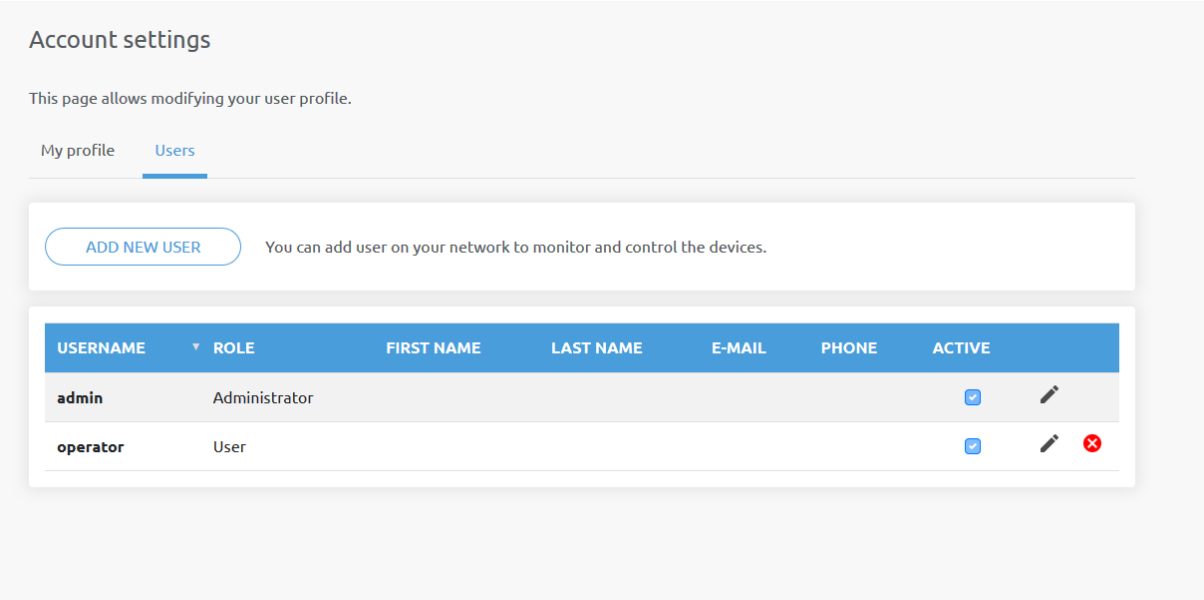


There are three user levels:

- Administrator
- Operator
- User

Fill in the user information and click **Save**.

Later on to change any user information just click on the edit icon.



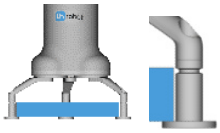
To prevent a user to sign-in either could be:

- deactivated by changing its **Active** status in the edit mode
- or removed by clicking the delete icon.

8. Hardware Specification

8.1. Technical Sheets

8.1.1. 3FG15

General Properties		Minimum	Typical	Maximum	Unit
Payload Force Fit		- -	- -	10 22	[kg] [lb]
Payload Form Fit 		- -	- -	15 33	[kg] [lb]
Grip Diameter*	External	4 0.16	- -	152 5.98	[mm] [inch]
	Internal	35 1.38	- -	176 6.93	[mm] [inch]
Finger position resolution		- -	0.1 0.004	- -	[mm] [inch]
Diameter repetition accuracy		- -	0.1 0.004	0.2 0.007	[mm] [inch]
Gripping force		10	-	240	[N]
Gripping force (adjustable)		1	-	100	[%]
Gripping speed (diameter change)		-	-	125	[mm/s]
Gripping time (including brake activation)**		-	500	-	[ms]
Hold workpiece if power loss?		Yes			
Storage temperature		0 32	- -	60 122	[°C] [°F]
Motor		Integrated, electric BLDC			
IP Classification		IP67			
Dimensions [L, W, Ø]		156 x 158 x 180 6.14 x 6.22 x 7.08			[mm] [inch]
Weight		1.15 2.5			[kg] [lb]

* With the scope of delivery

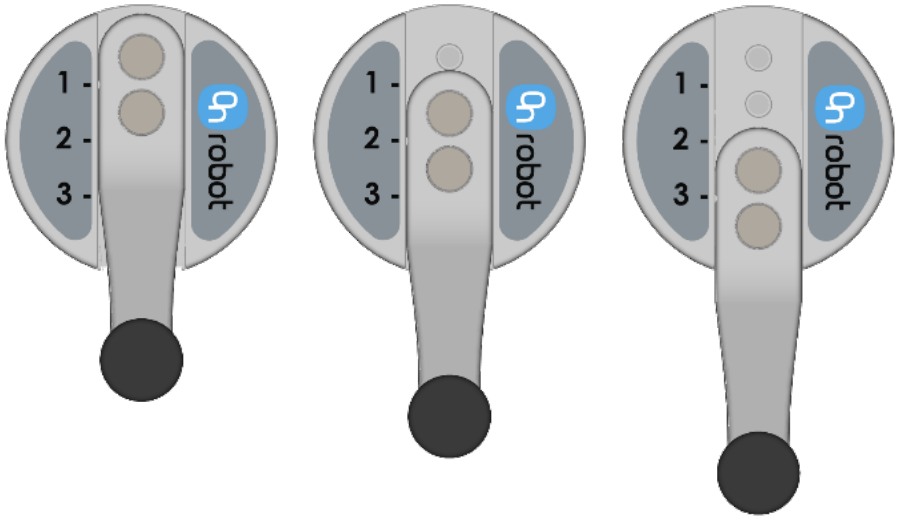
** 10 mm diameter distance. Also see section Finger Movement and Force

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	43	-	1500*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	95	[Hours]

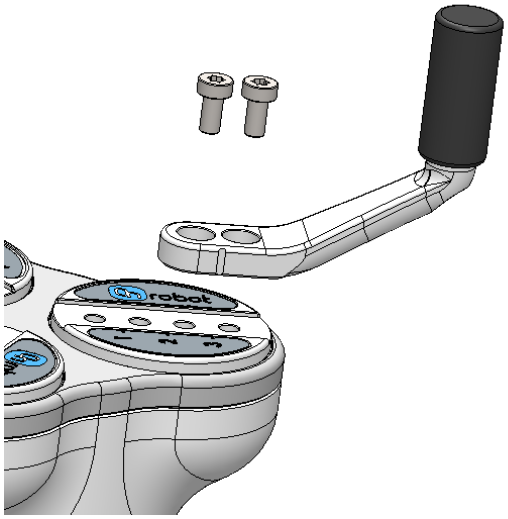
*600 mA set as default.

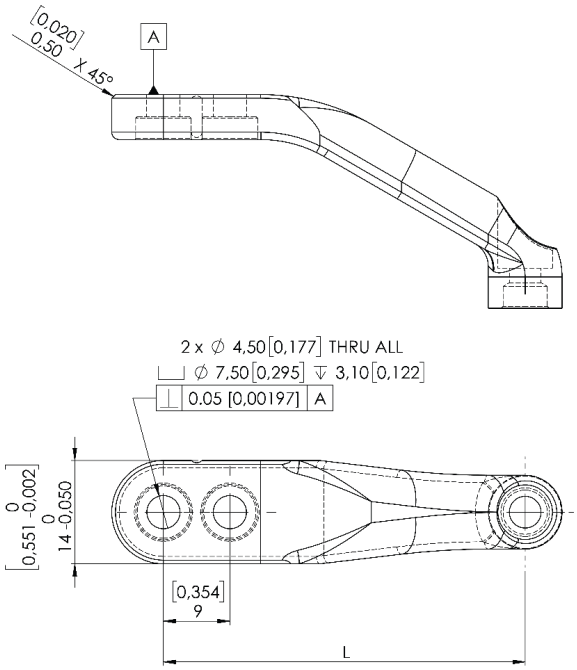
Fingers

The supplied fingers can be mounted in 3 different positions to achieve different **Gripping Forces** and different **Gripping Diameters**.



The delivered finger length is 49 mm (L in the drawing below). If custom fingers are required, they can be made to fit the Gripper according to the dimensions (mm)[inch] shown below. The needed screws are M4x8mm (use 3 Nm tightening torque):



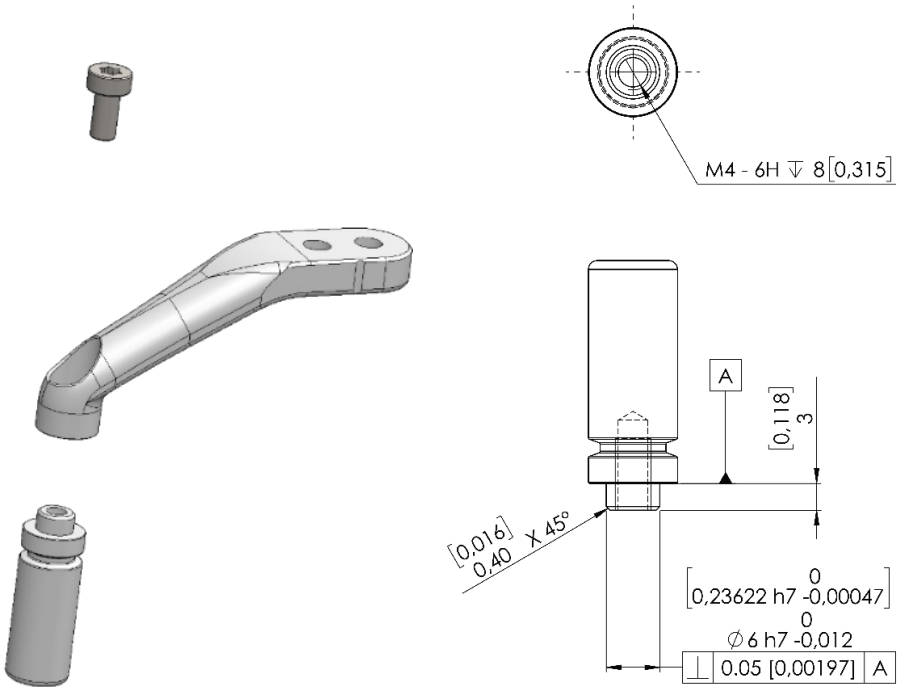


Fingertips

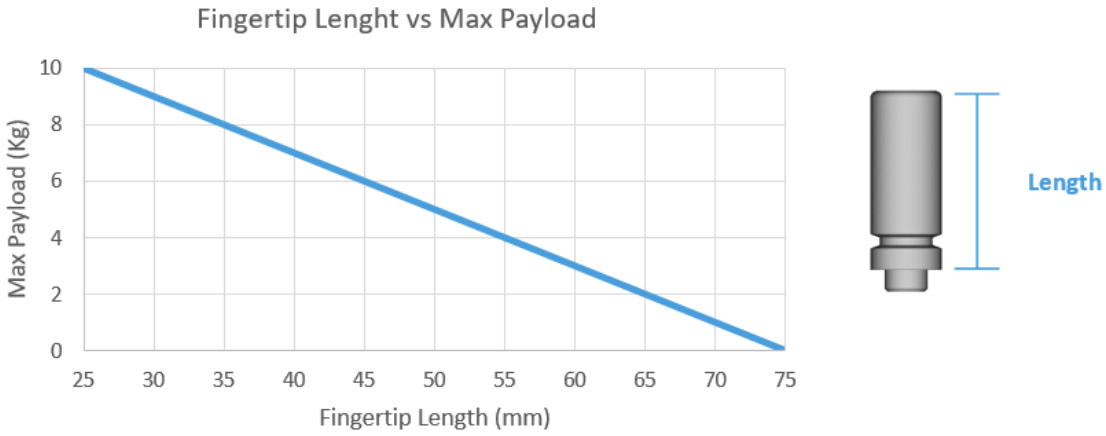
The supplied fingertips are listed below. Different fingertips will allow to achieve different **Gripping Forces** and different **Gripping Diameters**.

- Ø10 mm steel
- Ø13 mm steel
- Ø13.5 mm silicone
- Ø16.5 mm silicone

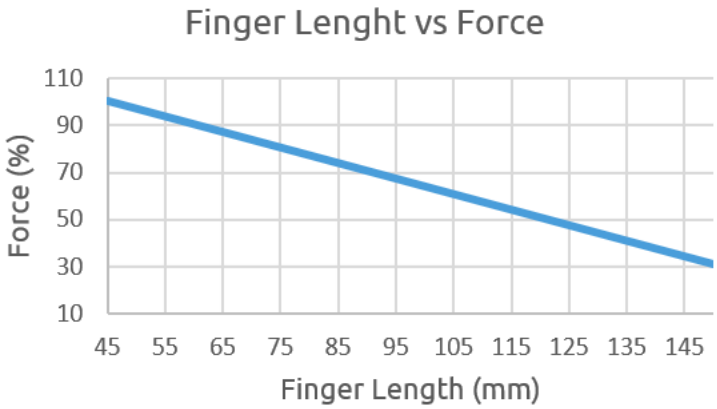
If custom fingertips are required, they can be made to fit the Gripper's fingers according to the dimensions (mm)[inch] shown below. The needed screws are M4x8mm:

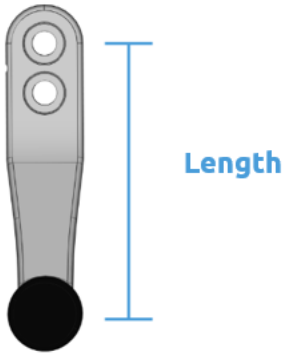


In the graph below, the maximum payload allowed for customized fingertip given a length is shown.



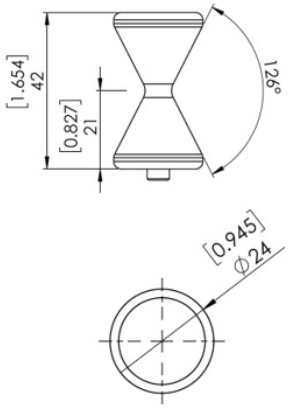
In the graph below, how the % of maximum achievable force decreases as the finger length increases when customized fingertips are used.





X-shape fingertips

These fingertips improve the gripper's ability to pick and place round workpieces with collar like features. By combining the force fit and the form fit gripping approaches, the fingertips increase the stability and payload of the workpiece to be gripped.

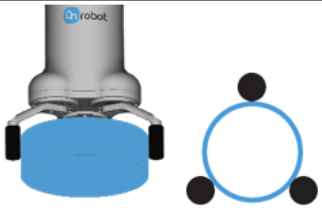
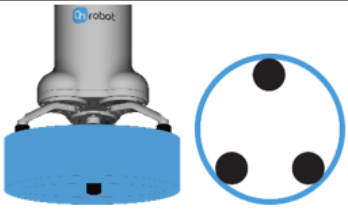


When these fingertips are used, set the fingertip diameter to 16 mm in the robot program. These fingertips are optional accessories and need to be purchased separately. To purchase these fingertips, please contact the distributor.

- 3FG X-Shape fingertips PN 105877

Types of Grips

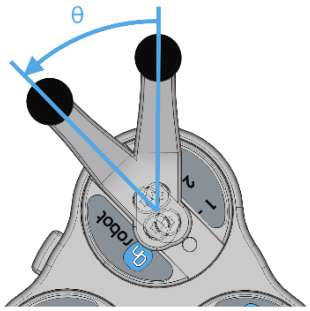
In the document the internal and external grip terms are used. These grips are related to how the workpiece is gripped.

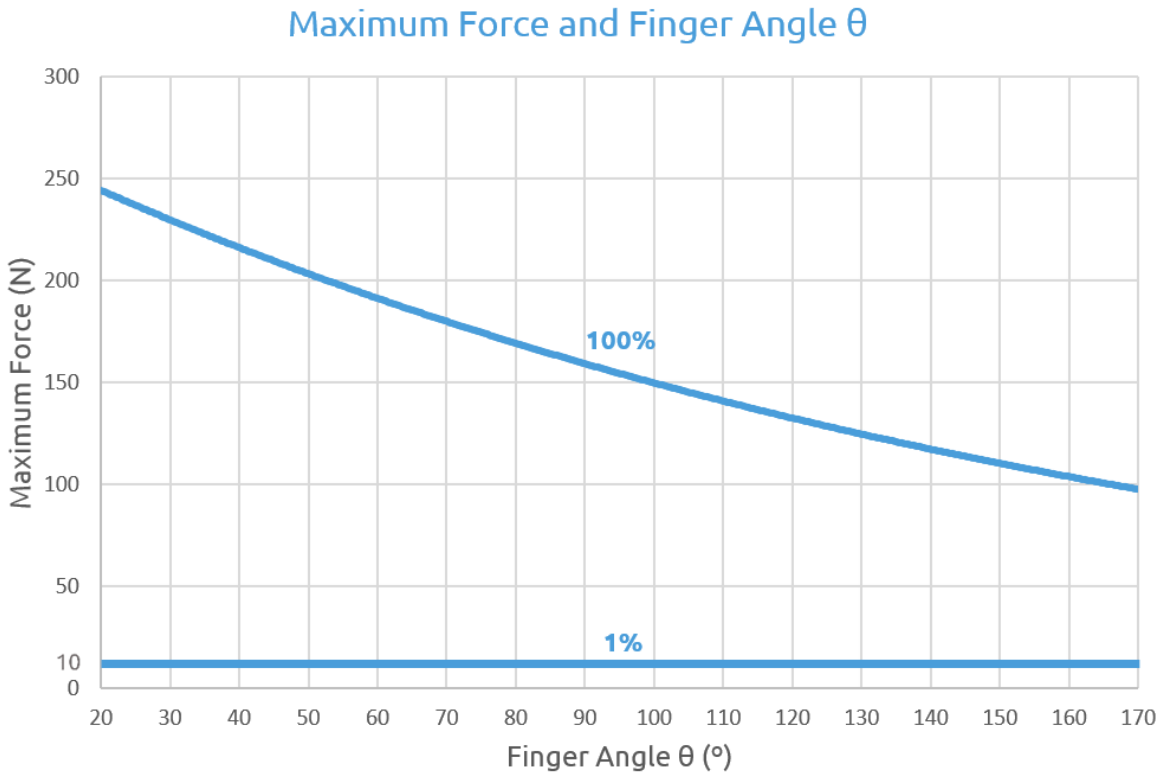
External Grip	Internal Grip
	

Gripping Force

The total gripping force highly depends on the finger angle θ. For both internal and external grip, the lower the finger angle, the higher the force that will be applied as shown in the graph below.

Although the fingers can move from 0 to 180, the angle range of an external grip is 30°-165° and for an internal grip 20°-160°





Graph plotted using measurements with 1 A current, silicone fingertips and a metal workpiece.

NOTE:

The total force applied depends on the finger angle, the input current (limited in some robots' tool flange connection) and the friction coefficient between the materials of the fingertips and the workpiece.

Finger Movement and Force

The gripping action has two phases:

Phase 1: For a safety reason, the fingers will start moving with a low force (maximum ~50 N) to avoid damaging anything that could get clamped between the gripper fingers and the workpiece.

Phase 2: When the gripper diameter is very close to the programed target diameter, the gripper will increase the force to grip with the programed target force. After the grip, a break will be activated (tic sound). The activation of the brake, also known as, Force grip detected, can be verified in the GUI. This brake will hold the workpiece with the applied force, with no power consumption and holding the workpiece in case of power loss. This brake will automatically be deactivated when the gripper performs a release or a new grip command. While programming the gripper, the brake can be deactivated by using the features in the GUI.

Gripping Diameter

The different configurations of the delivered finger and fingertips allow to achieve a wide range of diameters.

Finger Position	Fingertip (mm)	External Gripping range (mm)	Internal Gripping range (mm)
1	Ø10	10 - 117	35 - 135
	Ø13	7 - 114	38 - 138
	Ø16.5	4 - 111	41 - 140
2	Ø10	26 - 134	49 - 153
	Ø13	23 - 131	52 - 156
	Ø16.5	20 - 128	55 - 158
3	Ø10	44 - 152	65 - 172
	Ø13	41 - 149	68 - 174
	Ø16.5	38 - 146	71 - 176

Based on:

- Angle for external gripping min 165° (Pos 1), 163 ° (Pos 2), 161 ° (Pos 3) and max 30° (all 3 positions)
- Angle for internal gripping min 160° and max 30°

The closer to the maximum diameter range, the lower the angle and, therefore, the higher the force.

8.1.2. HEX-E QC

General Properties	6-Axis Force/Torque Sensor				Unit
	Fxy	**Fz**	**Txy**	**Tz**	
Nominal Capacity (N.C)	200	200	10	6.5	[N] [Nm]
Single axis deformation at N.C (typical)	± 1.7 ± 0.067	± 0.3 ± 0.011	± 2.5 ± 2.5	± 5 ± 5	[mm] [°] [inch] [°]
Single axis overload	500	500	500	500	[%]
Signal noise* (typical)	0.035	0.15	0.002	0.001	[N] [Nm]
Noise-free resolution (typical)	0.2	0.8	0.01	0.002	[N] [Nm]

General Properties	6-Axis Force/Torque Sensor				Unit
Full scale nonlinearity	< 2	< 2	< 2	< 2	[%]
Hysteresis (measured on Fz axis , typical)	< 2	< 2	< 2	< 2	[%]
Crosstalk (typical)	< 5	< 5	< 5	< 5	[%]
IP Classification	67				
Dimensions (H x W x L)	50 x 71 x 93 1.97 x 2.79 x 3.66				[mm] [inch]
Weight (with built-in adapter plates)	0.347 0.76				[kg] [lb]

* Signal noise is defined as the standard deviation (1 σ) of a typical one second no-load signal.

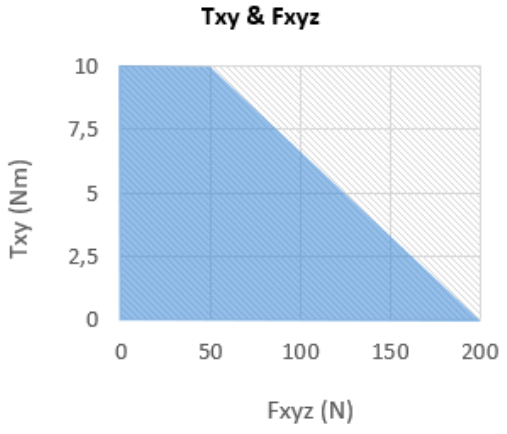
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

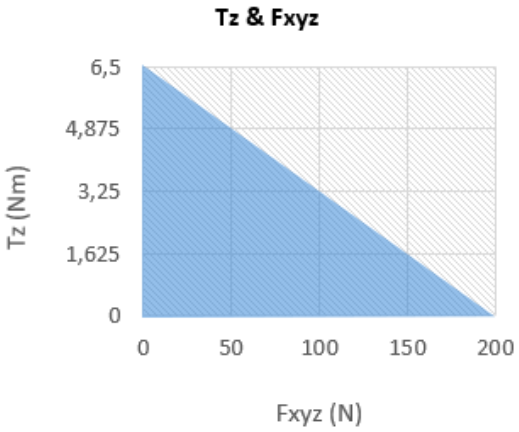
Complex Loading

During single-axis loading, the sensor can be operated up to its nominal capacity. Above the nominal capacity the reading is inaccurate and invalid.

During complex loading (when more than one axis is loaded) the nominal capacities are reduced. The following diagrams show the complex loading scenarios.

The sensor cannot be operated outside of the Normal Operating Area (marked with blue on the diagrams below).





8.1.3. HEX-H QC

General Properties	6-Axis Force/Torque Sensor				Unit
	Fxy	**Fz**	**Txy**	**Tz**	
Nominal Capacity (N.C)	200	200	10	13	[N] [Nm]
Single axis deformation at N.C (typical)	± 0.6 ± 0.023	± 0.25 ± 0.009	± 2 ± 2	± 3.5 ± 3.5	[mm] [°] [inch] [°]
Single axis overload	500	400	300	300	[%]
Signal noise* (typical)	0.1	0.2	0.006	0.002	[N] [Nm]
Noise-free resolution (typical)	0.5	1	0.036	0.008	[N] [Nm]
Full scale nonlinearity	< 2	< 2	< 2	< 2	[%]
Hysteresis (measured on Fz axis , typical)	< 2	< 2	< 2	< 2	[%]
Crosstalk (typical)	< 5	< 5	< 5	< 5	[%]
IP Classification	67				
Dimensions (H x W x L)	50 x 71 x 93 1.97 x 2.79 x 3.66				[mm] [inch]
Weight (with built-in adapter plates)	0.35 0.77				[kg] [lb]

* Signal noise is defined as the standard deviation (1 σ) of a typical one second no-load signal.

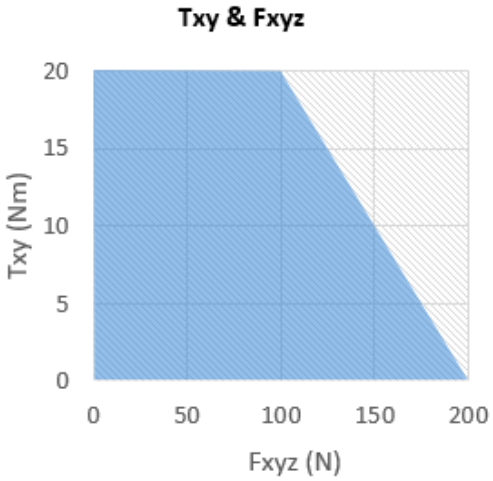
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

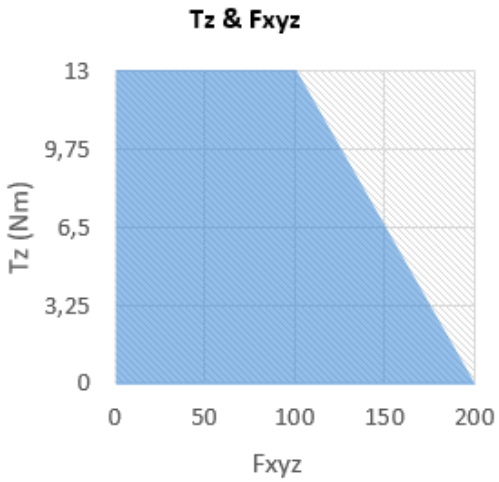
Complex Loading

During single-axis loading, the sensor can be operated up to its nominal capacity. Above the nominal capacity the reading is inaccurate and invalid.

During complex loading (when more than one axis is loaded) the nominal capacities are reduced. The following diagrams show the complex loading scenarios.

The sensor cannot be operated outside of the Normal Operating Area (marked with blue on the diagrams below).





8.1.4. Quick Changers

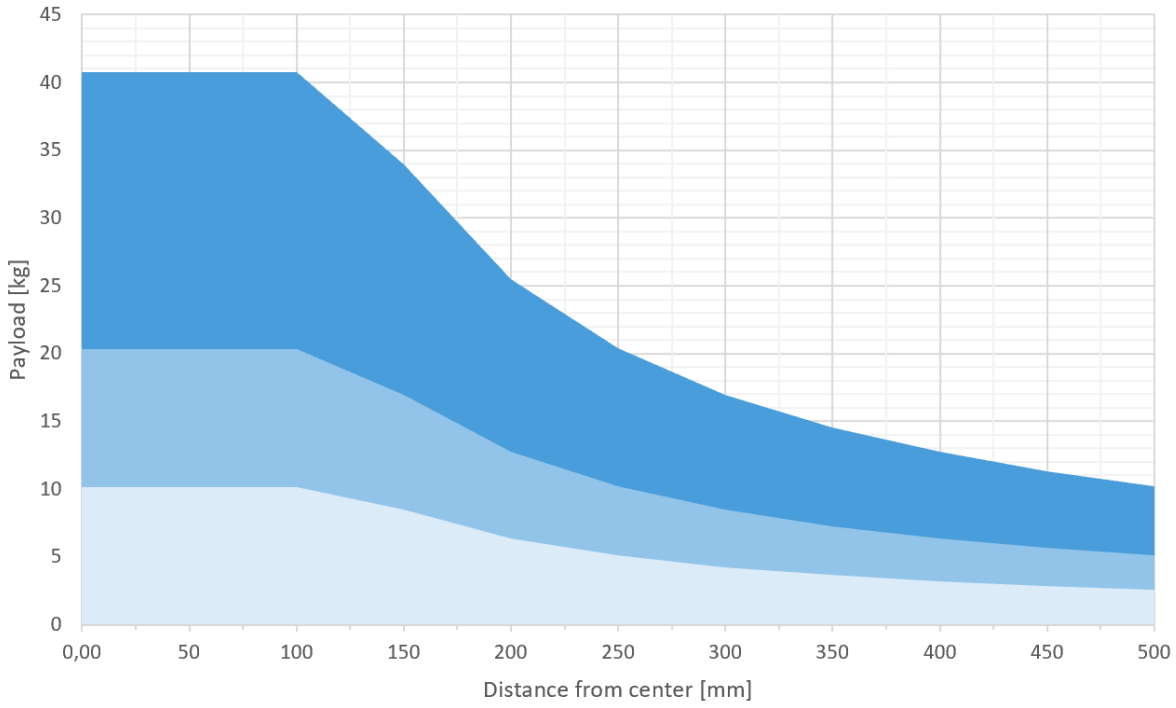
If not specified, the data represent the combination of the different Quick Changer types/ sides.

Technical data	Min	Typical	Max	Units
Permissible force *	-	-	400*	[N]
Permissible torque *	-	-	50*	[Nm]
Rated payload *	- -	- -	20* 44	[kg] [lbs]
Repeatability	-	-	±0.02	[mm]
IP Classification	67			
Operating life (Tool change)	-	5.000	-	[cycles]
Operating life (Robot operation)	10	-	-	[M cycles]

* See load capacity graph below.

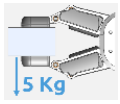
	Quick Changer	Quick Changer for I/O	Dual Quick Changer	Quick Changer - Tool Side	Units
Weight	0.06 0.13	0.093 0.21	0.41 0.9	0.14 0.31	[kg] [lb]
Dimensions	See Mechanical dimension section				

Load Capacity



- Static
- Acceleration 2g
- Acceleration 4g

8.1.5. RG2

General Properties	Minimum	Typical	Maximum	Unit
Payload Force Fit	- -	- -	2 4.4	[kg] [lb]
Payload Form Fit 	- -	- -	5 11	[kg] [lb]
Total stroke (adjustable)	0 0	- -	110 4.33	[mm] [inch]
Finger position resolution	- -	0.1 0.004	- -	[mm] [inch]
Repetition accuracy	- -	0.1 0.004	0.2 0.007	[mm] [inch]
Reversing backlash	0.1 0.004	- -	0.3 0.011	[mm] [inch]

General Properties	Minimum	Typical	Maximum	Unit
Gripping force (adjustable)	3	-	40	[N]
Gripping force deviation		±25		%
Gripping speed *	38	-	127	[mm/s]
Gripping time **	0.06	-	0.21	[s]
Adjustable bracket tilting accuracy	-	< 1	-	°
Storage temperature	0 32	- -	60 140	[°C] [°F]
Motor	Integrated, electric BLDC			
IP Classification	IP54			
Dimensions	213 x 149 x 36 8.3 x 5.9 x 1.4			[mm] [inch]
Weight	0.78 1.72			[kg] [lb]

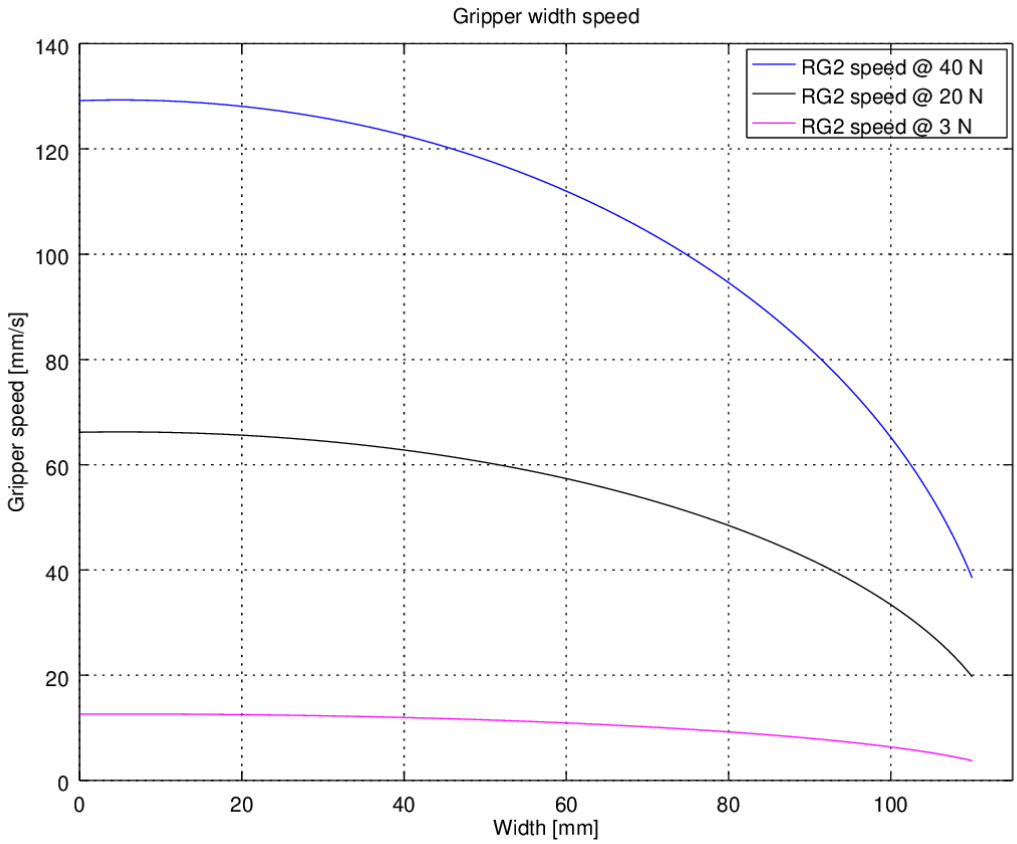
* See table on the next page

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on next page.

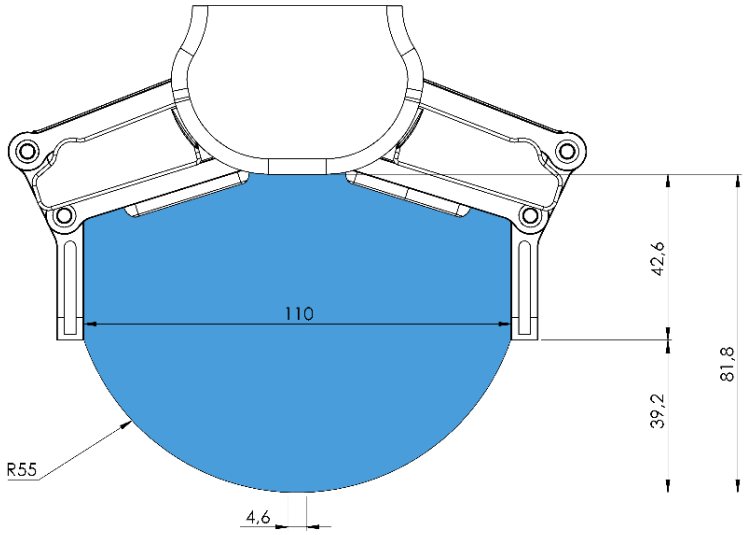
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	70	-	600*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

* Current spikes up to 3A (max 6mS) may occur during the release action.

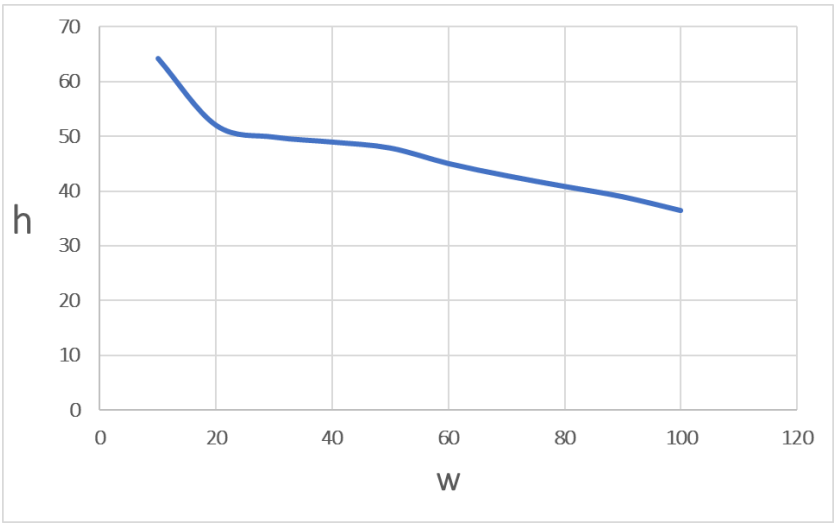
RG2 Gripping Speed Graph



RG2 Work Range

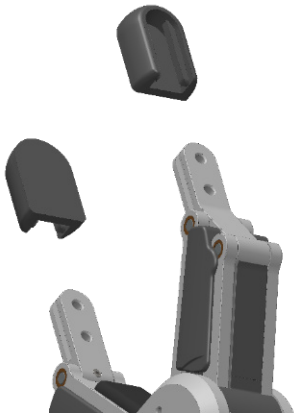


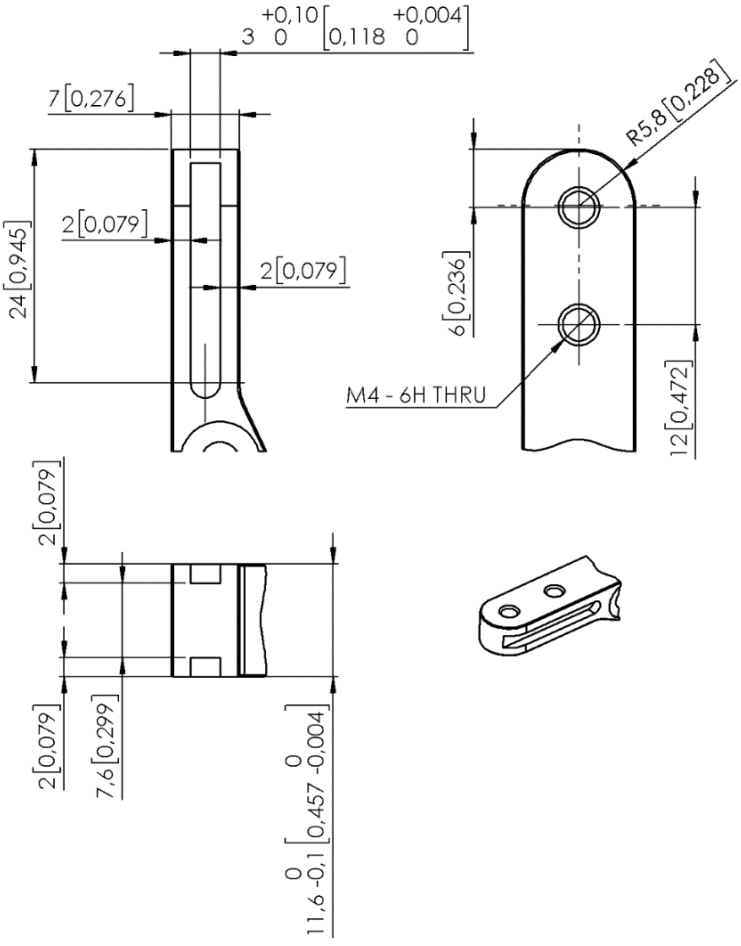
Gripping on long objects can unintentionally activate the Safety switches. The maximum workpiece height (calculated from the end of the fingertips) is dependent on the gripping width (w). For various width values the height (h) limit is given below:



Fingertips

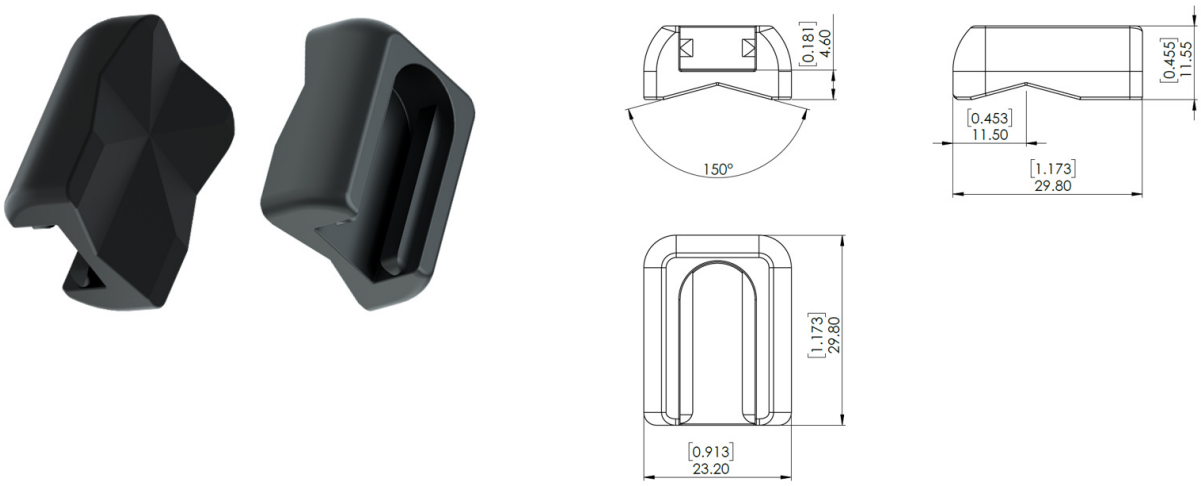
The standard fingertips can be used for many different workpieces. If custom fingertips are required, they can be made to fit the Gripper's fingers according to the dimensions (mm) shown below:





X-Shaped fingertips

These fingertips improve the gripper's ability to pick and place cylindrical workpieces. By combining the force fit and the form fit gripping approaches, the fingertips increase the stability and payload of the workpiece to be gripped.

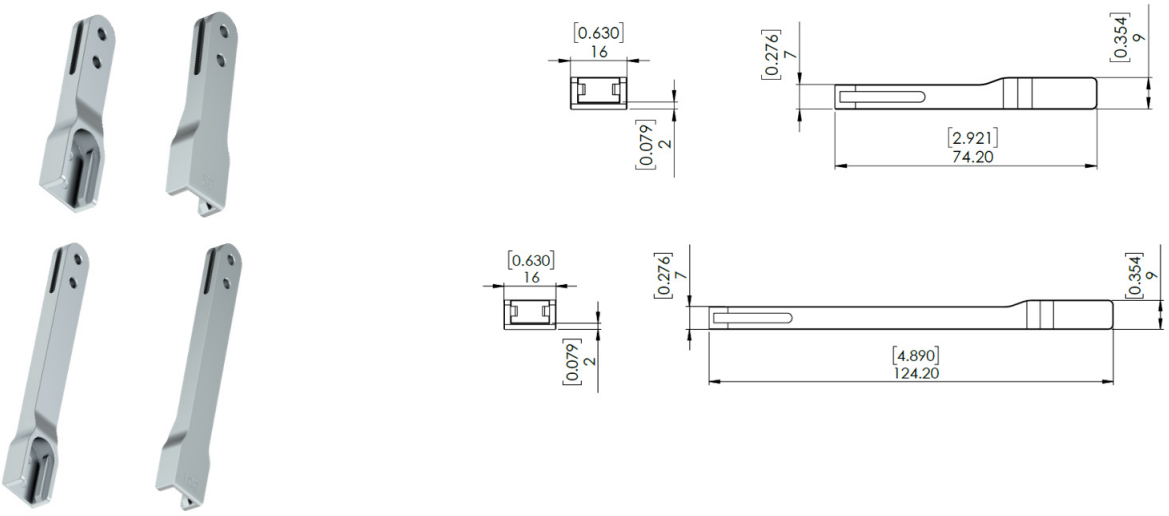


These fingertips are an accessory and need to be purchased separately. To purchase these fingertips, please contact the vendor from where the RG gripper has been purchased.

- RG2 X-Shape fingertips PN 105871

Fingertip extension 50 and 100 mm

These fingertips enable the gripper to pick and place workpieces in tight spaces where the gripper would normally be too wide, for instance boxes and crates.



The extensions will decrease the gripping force:

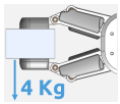
- 50 mm - 66.67 % of target gripping force.
- 100 mm - 50.00 % of target gripping force.

These fingertips are an accessory and need to be purchased separately. To purchase these fingertips, please contact the vendor from where the RG gripper has been purchased.

- RG2 fingertip extension 50 mm PN 105872

- RG2 fingertip extension 100 mm PN 105873

8.1.6. RG2-FT

General Properties	Minimum	Typical	Maximum	Unit
Payload Force Fit	- -	- -	2 4.4	[kg] [lb]
 Payload Form Fit	- -	- -	4 8.8	[kg] [lb]
Total stroke (adjustable)	0 0	- -	100 3.93	[mm] [inch]
Finger position resolution	- -	0.1 0.004	- -	[mm] [inch]
Repetition accuracy	- -	0.1 0.004	0.2 0.007	[mm] [inch]
Reversing backlash	0.2 0.007	0.4 0.015	0.6 0.023	[mm] [inch]
Gripping force (adjustable)	3	-	40	[N]
Gripping speed *	55	110	184	[mm/s]
Gripping time **	0.04	0.07	0.11	[s]
Adjustable bracket tilting accuracy	-	< 1	-	°
Ambient operating temperature	5	-	50	[°C]
Storage temperature	0	-	60	[°C]
Motor	Integrated, electric BLDC			
IP Classification	IP54			
Dimensions	219 x 149 x 49 8.6 x 5.9 x 1.9			[mm] [inch]
Product weight	0.98 2.16			[kg] [lb]

* see **RG2-FT Gripping Speed Graph**

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see **RG2-FT Gripping Speed Graph**.

Force Sensor Properties	Fxy	Fz	Txy	Tz	Units
Nominal capacity (N.C.)	20	40	0.7	0.5	[N] [Nm]
Single axis overload	200	200	200	200	[%]

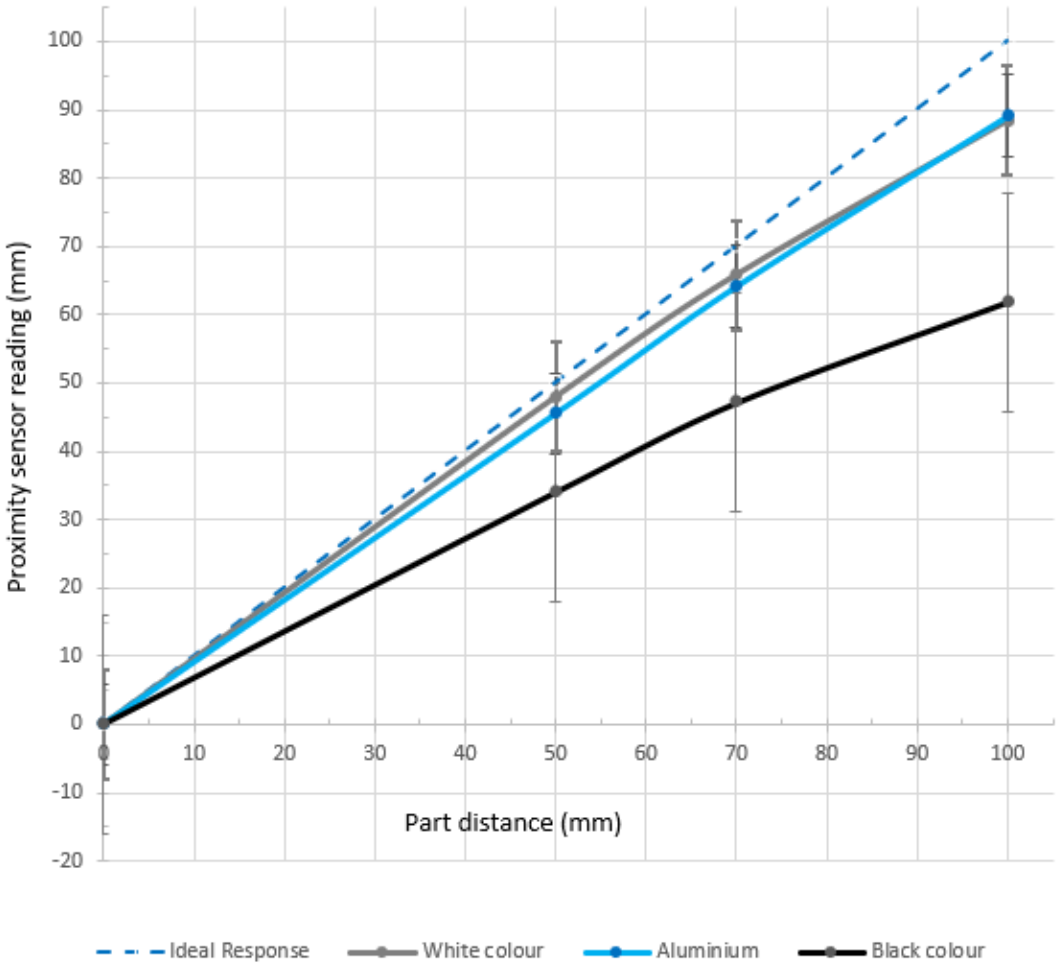
Force Sensor Properties	Fxy	Fz	Txy	Tz	Units
Noise free resolution	0.1	0.4	0.008	0.005	[N] [Nm]
Single axis deformation at N.C.	0.4 0.015	0.1 0.04	2	5	[mm] [°] [inch] [°]
Full scale nonlinearity Temperature compensation	< 2				[%]

Proximity Sensor Properties	Min	Typical	Max	Units
Sensing range	0 0	- -	100 3.93	[mm] [inch]
Precision	- -	2 0.078	- -	[mm] [inch]
Non-linearity *	-	12	-	[%]

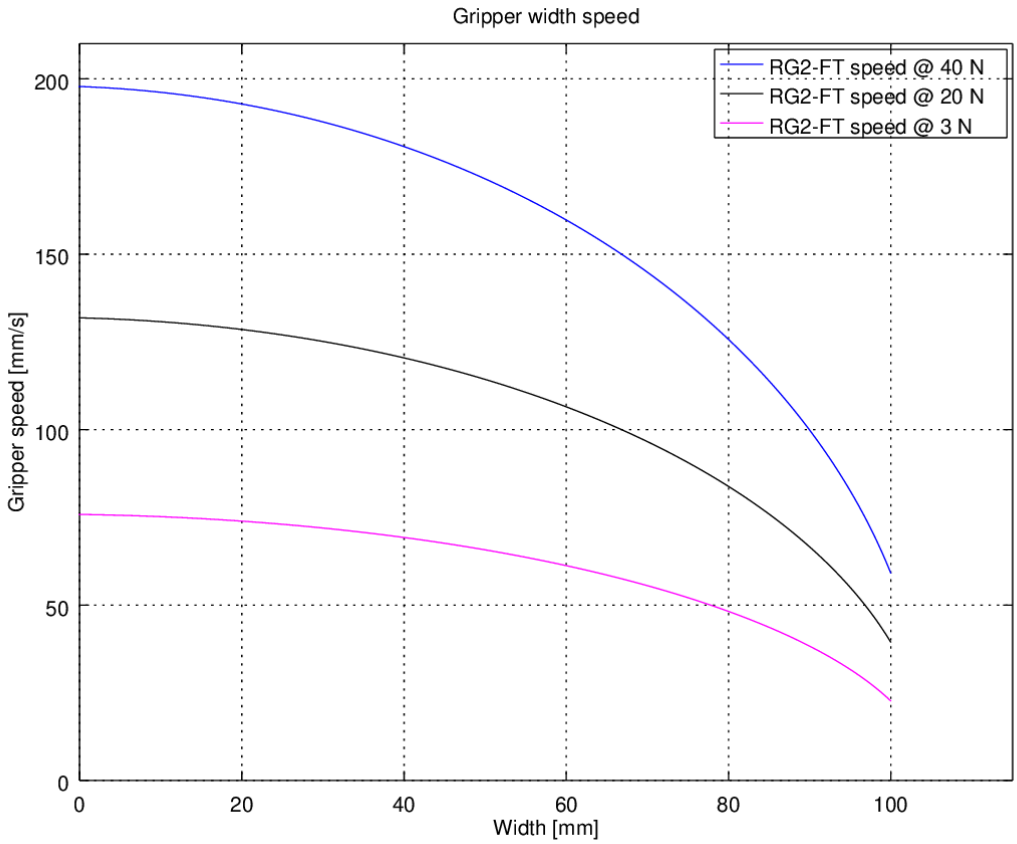
* the non-linearity refers to the max value and depends on the object properties (e.g. surface type and color)

Operating Conditions	Minimum	Typical	Maximum	Unit
Power requirement (PELV)	24	-	24	[V]
Power consumption	6.5	-	22	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

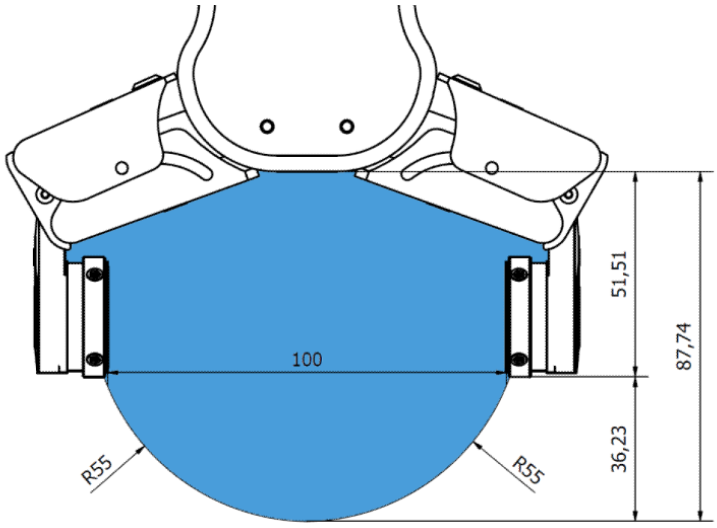
Proximity Sensor Typical Accuracy



RG2-FT Gripping Speed Graph



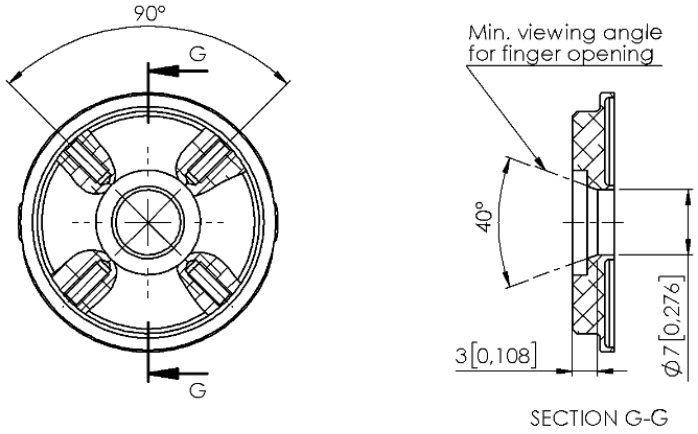
Gripper Working Range

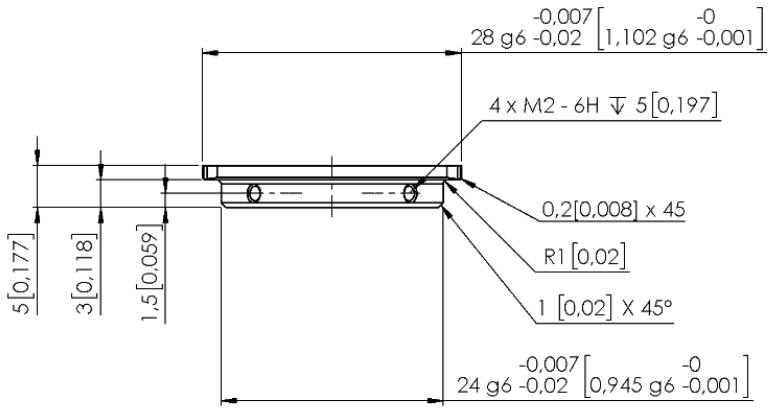


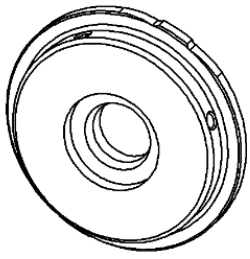
The dimensions are in millimeters.

Fingertips

The standard fingertips can be used for many different workpieces. If custom fingertips are required, they can be made to fit the Gripper fingers.







Dimensions of the Gripper's finger, in millimeters.

NOTE:

During the fingertip design, the following shall be considered to maintain optimal performance:

Clear optical path for the proximity sensors

Protect the proximity sensors from direct sunlight or strong light source

Avoid dust and liquid penetration

WARNING:

The proximity sensors are sensitive parts and shall be protected against:

Direct strong light (such as directional laser sources)

Direct high temperature

Mechanical contacts in any case

Expose to any liquid or fine conductive dust

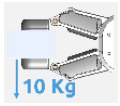
NOTE:

Please clean regularly the proximity sensor surface with low pressure compressed air (<5 bar) from a 5 cm distance. For stronger contamination use isopropyl alcohol with a soft cotton swab to keep it clean.

Finger Thickness

The default fingertips are considered while the finger thickness has been set and could not be changed in the software. In case when custom fingertips are used, the user should manually compensate for the difference in the finger thickness.

8.1.7. RG6

General Properties	Minimum	Typical	Maximum	Unit
Payload Force Fit	- -	- -	6 13.2	[kg] [lb]
 Payload Form Fit	- -	- -	10 22.04	[kg] [lb]
Total stroke (adjustable)	0 0	- -	160 6.3	[mm] [inch]
Finger position resolution	- -	0.1 0.004	- -	[mm] [inch]

General Properties	Minimum	Typical	Maximum	Unit
Repetition accuracy	- -	0.1 0.004	0.2 0.007	[mm] [inch]
Reversing backlash	0.1 0.004	- -	0.3 0.011	[mm] [inch]
Gripping force (adjustable)	25	-	120	[N]
Gripping force deviation		±25		%
Gripping speed *	51	-	160	[mm/s]
Gripping time **	0.05	-	0.15	[s]
Adjustable bracket tilting accuracy	-	< 1	-	°
Storage temperature	0 32	- -	60 140	[°C] [°F]
Motor	Integrated, electric BLDC			
IP Classification	IP54			
Dimensions	262 x 212 x 42 10.3 x 8.3 x 1.6			[mm] [inch]
Weight	1.25 2.76			[kg] [lb]

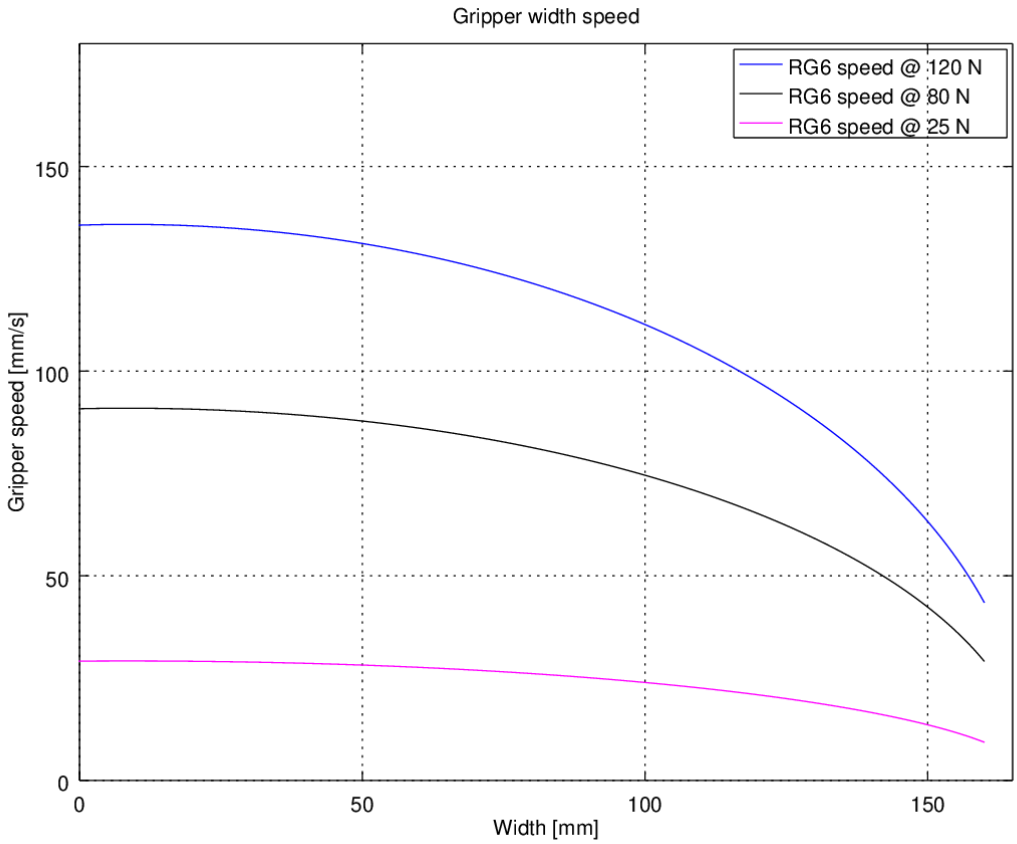
* See table on the next page

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on next page.

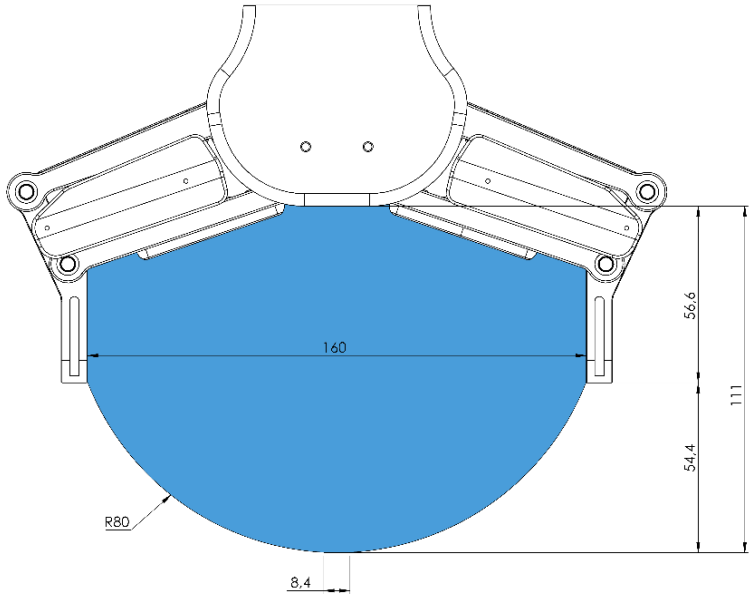
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	70	-	600*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

* Current spikes up to 3A (max 6mS) may occur during the release action.

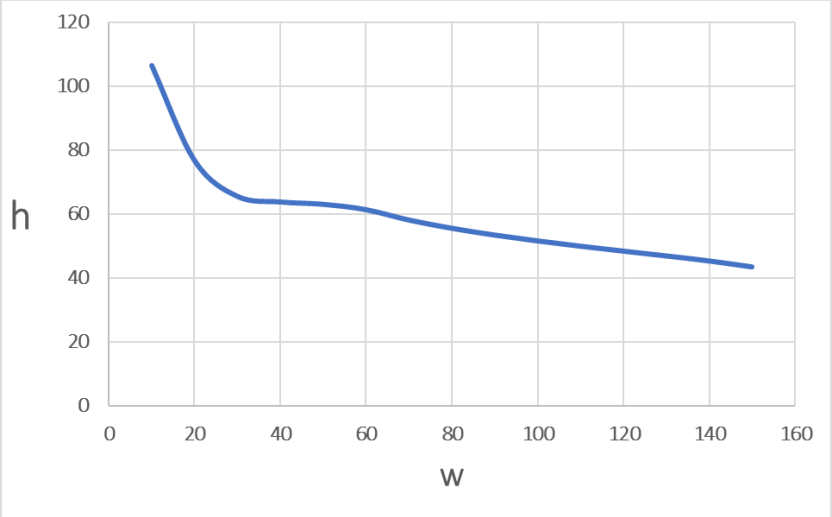
RG6 Gripping Speed Graph



RG6 Work Range

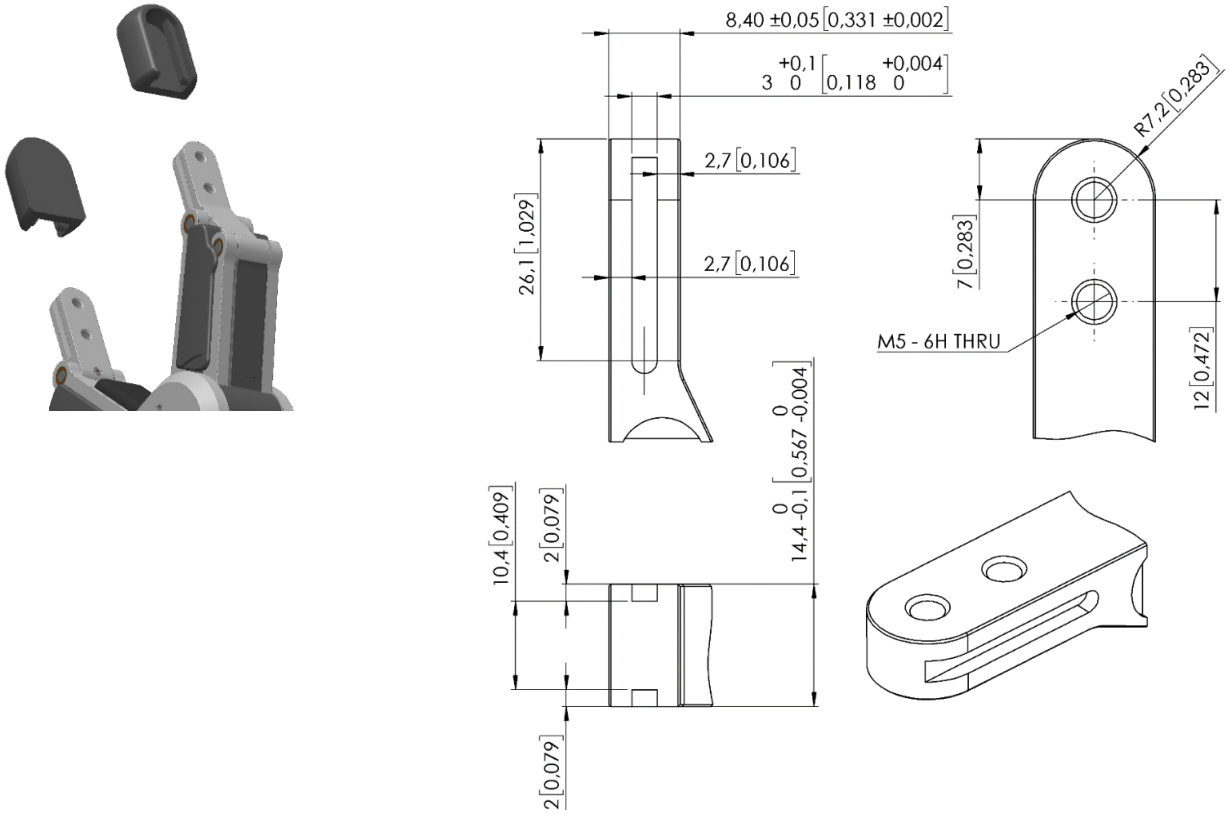


Gripping on long objects can unintentionally activate the Safety switches. The maximum workpiece height (calculated from the end of the fingertips) is dependent on the gripping width (w). For various width values the height (h) limit is given below:



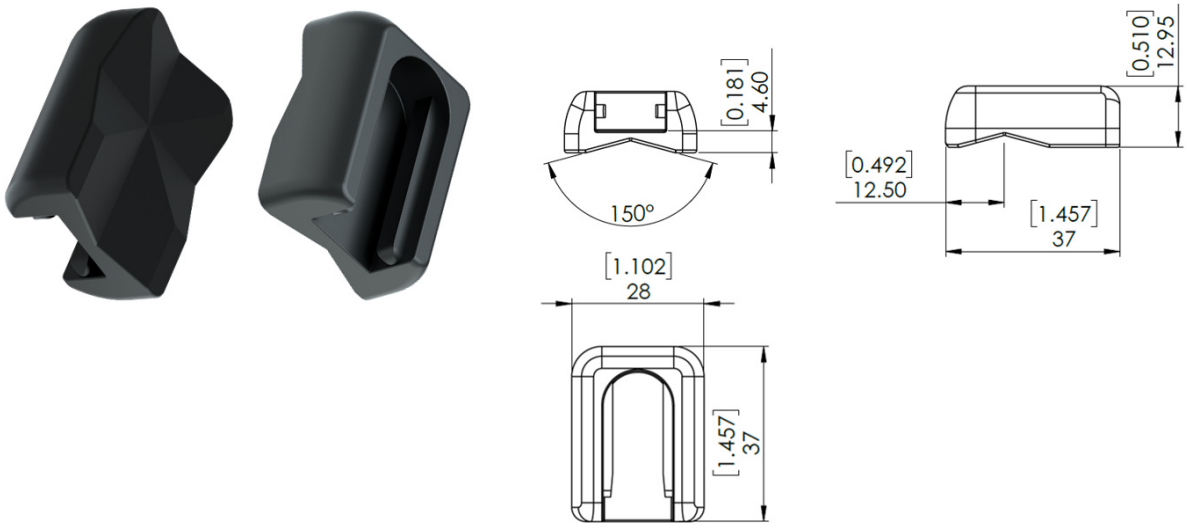
Fingertips

The standard fingertips can be used for many different workpieces. If custom fingertips are required, they can be made to fit the Gripper's fingers according to the dimensions (mm) shown below:



X-Shaped fingertips

These fingertips improve the gripper's ability to pick and place cylindrical workpieces. By combining the force fit and the form fit gripping approaches, the fingertips increase the stability and payload of the workpiece to be gripped.

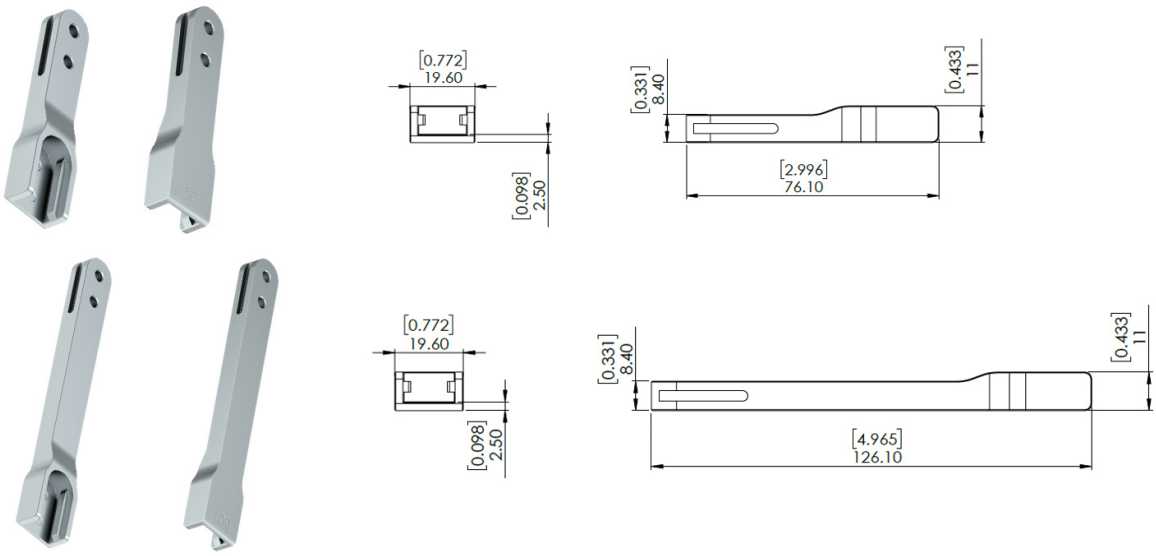


These fingertips are an accessory and need to be purchased separately. To purchase these fingertips, please contact the vendor from where the RG gripper has been purchased.

- RG6 X-Shape fingertips PN 105876

Fingertip extension 50 and 100 mm

These fingertips enable the gripper to pick and place workpieces in tight spaces where the gripper would normally be too wide, for instance boxes and crates.



The extensions will decrease the gripping force:

- 50 mm - 73 % of target gripping force.
- 100 mm - 57.5 % of target gripping force.

These fingertips are an accessory and need to be purchased separately. To purchase these fingertips, please contact the vendor from where the RG gripper has been purchased.

- RG6 fingertip extension 50 mm PN 105874
- RG6 fingertip extension 100 mm PN 105875

8.1.8. Screwdriver

General Properties		Minimum	Typical	Maximum	Unit
Torque range		0.15 0.11	-	5 3.68	[Nm] [lbft]
Torque accuracy*	If torque < 1.33 Nm/ 0.98 lbft	-	0.04 0.03	-	[Nm] [lbft]
	If torque > 1.33 Nm/ 0.98 lbft	-	3	-	[%]
Output speed		-	-	340	[RPM]
Screw length within full safety		-	-	35 1.37	[mm] [inch]
Shank stroke (screw axis)		-	-	55 2.16	[mm] [inch]
Shank preload (adjustable)		0	10	25	[N]
Safety feature force		35	40	45	[N]
Storage temperature		0 32	- -	60 140	[°C] [°F]
Motor (x2)		Integrated, electric BLDC			
IP Classification		IP54			
ESD Safe		Yes			
Dimensions		308 x 86 x 114 12.1 x 3.4 x 4.5			[mm] [inch]
Weight		2.5 5.51			[kg] [lb]

* See **Torque Accuracy Graph** for further information.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	75	-	4500	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

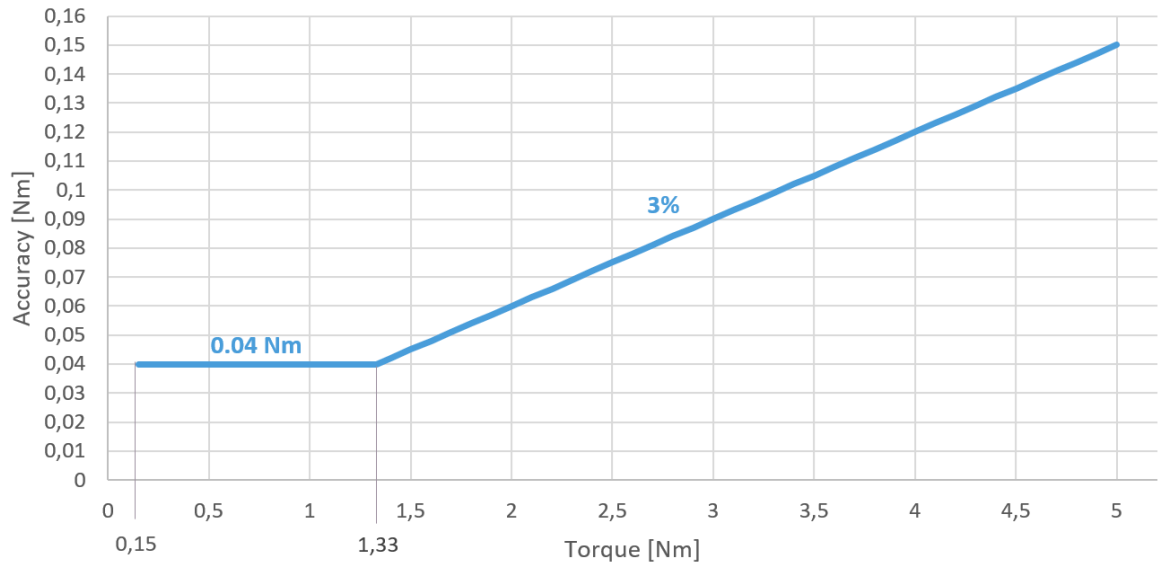
Supported Screws Metric	
Material type	Magnetic
Screw length	Up to 50 mm (35 mm thread length)

Supported Screws Metric						
Head type		Cylinder			Counter sunk	Button head
Appearance						
Standard		Din 912 / ISO 4762	ISO 14579	ISO 14580	ISO 14581	DIN 7985A
Supported Thread Size	M1.6	✓	N/A	N/A	N/A	N/A
	M2	✓	✓	N/A	✓	✓
	M2.5	✓	✓	N/A	✓	✓
	M3	✓	✓	✓	✓	✓
	M4	✓	✓	✓	✓	✓
	M5	✓	✓	✓	✓	✓
	M6	✓	✓	✓	✓	✓

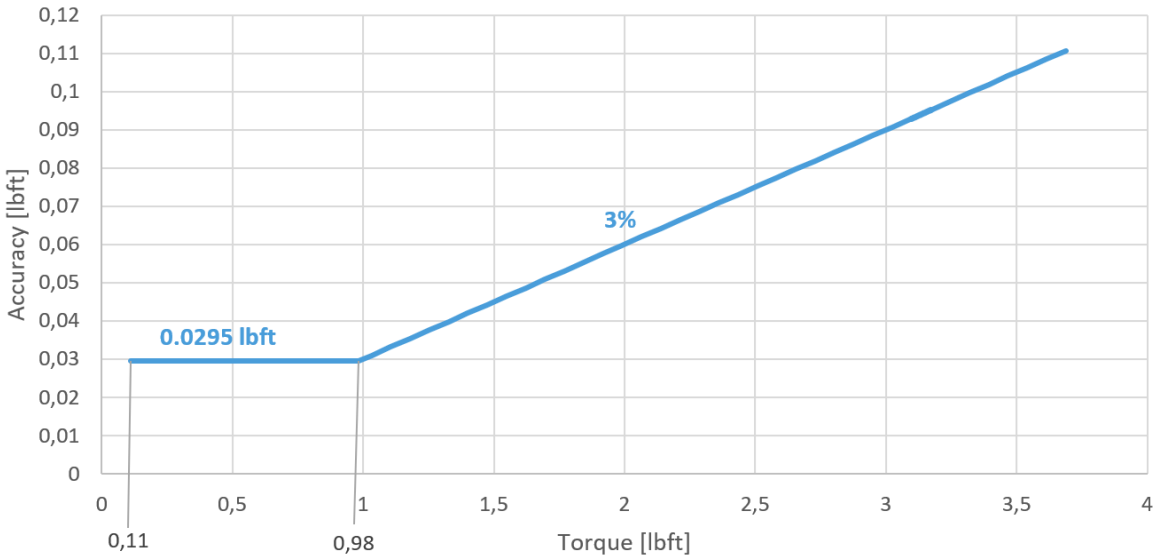
Supported Screws US Standard					
Material type	Magnetic				
Screw length	Up to 1.96 inches (1.37 inches thread length)				
Head type	Cylinder	Button head		Counter sunk	
Appearance					

Supported Screws US Standard						
Standard		ASME B18.3	ASME B18.6.3	ASME B18.6.3	ASME B18.3	ASME B18.6.3
Supported Thread Size	1#	✓	N/A	N/A	N/A	N/A
	2#	✓	✓	✓	N/A	✓
	4#	✓	✓	✓	✓	✓
	6#	✓	✓	✓	✓	✓
	8#	✓	✓	✓	✓	✓
	10#	✓	✓	✓	✓	✓
	12#	N/A	✓	✓	N/A	N/A
	1/4"	✓	N/A	N/A	✓	N/A

Torque accuracy Metric



Torque accuracy US Standard



Screw-bit System

This system will highly increase the efficacy of the screws to be picked up, aligned with the bit, moved around with the Screwdriver and screwed in/out. Therefore, it is highly recommended to set up the Screw-bit System correctly to keep a high success rate.

Example of the Screw-bit System for an ISO 14579 screw.

1 - Screw

2 - Screw fix

3 - Screw carrier

4 - Bit

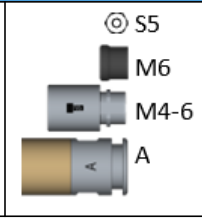
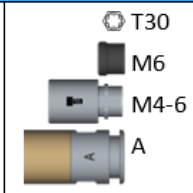
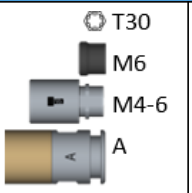
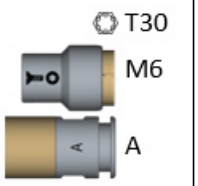
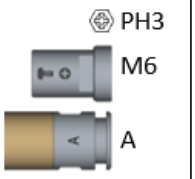
5 - Bit holder

The sections below explain the different components of the Screw-bit System and how to set it up correctly.

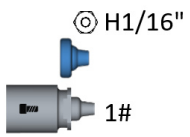
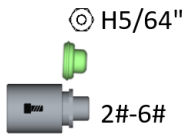
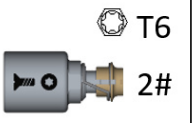
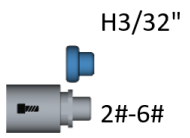
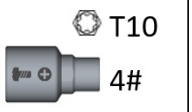
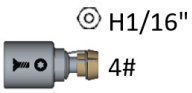
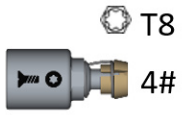
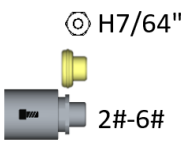
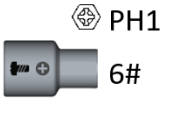
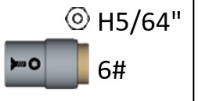
In the following tables, an overview of the items needed depending on the Screw type and size are shown.

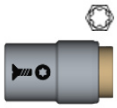
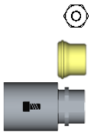
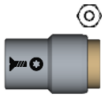
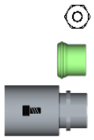
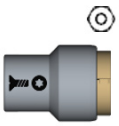
Items Needed Depending on Screw Type and Size for Metric Screws

Items Needed Depending on Screw Type and Size for Metric Screws					
Head type	Cylinder			Counter sunk	Button head
Screw standard	Din 912 / ISO 4762	ISO 14579	ISO 14580	ISO 14581	DIN 7985A
Thread Size	Bit holder, bit, screw carrier and screw fix needed				
M1.6	S1.5 M1.6 M1.6 B	N/A	N/A	N/A	N/A
M2	S1.5 M2 M2-3 A	T6 M2 M2-3 A	N/A	T6 M2 B	PH1 M2 B
M2.5	S2 M2.5 M2-3 A	T8 M2.5 M2-3 A	N/A	T8 M2.5 B	PH1 M2.5 B
M3	S2.5 M3 M2-3 A	T10 M3 M2-3 A	T10 M3 M2-3 A	T10 M3 A	PH1 M3 A
M4	S3 M4 M4-6 A	T20 M4 M4-6 A	T20 M4 M4-6 A	T20 M4 A	PH2 M4 A
M5	S4 M5 M4-6 A	T25 M5 M4-6 A	T25 M5 M4-6 A	T25 M5 A	PH2 M5 A

Items Needed Depending on Screw Type and Size for Metric Screws					
M6					

Items Needed Depending on Screw Type and Size for US Standard Screws

Items Needed Depending on Screw Type and Size for US Standard Screws					
Head type	Cylinder	Button head		Counter sunk	
Screw standard	ASME B18.3 HEX	ASME B18.6.3 Cross recessed	ASME B18.6.3 Torx	ASME B18.3 HEX	ASME B18.6.3 Torx
Thread Size	Bit holder, bit, screw carrier and screw fix needed				
1#		N/A	N/A	N/A	N/A
2#				N/A	
4#					
6#					

Items Needed Depending on Screw Type and Size for US Standard Screws					
8#					
10#					
12#	N/A			N/A	N/A
1/4"		N/A	N/A		N/A

1. Screws

The first step is to know what type of screw is going to be used. The screw type will define what type of bit, screw carrier, screw fix (if any) and bit holder shall be used.

The recommended screw types for the Screwdriver are the ones that have the properties mentioned previously on the **Supported Screws** table.

2. Bit Holder

Select the right bit holder depending on the screw type and size to maximize the efficacy of the Screw-bit System based on the table in section **Items Needed Depending on Screw Type and Size for Metric** or **Items Needed Depending on Screw Type and Size for US Standard Screws**.

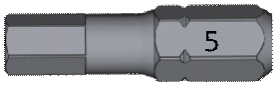
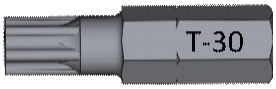
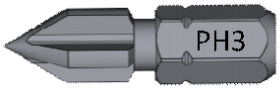
The Bit holder generates a magnetic force that will keep the screw attached and aligned to the bit. The Bit holder **A** generates a higher magnetic force than **B**. Therefore, the bit holder B is commonly used for the smaller and lighter screws.

3. Bits

Select the right bit depending on the screw type and size to maximize the efficacy of the Screw-bit System based on the table in section **Items Needed Depending on Screw Type**

and Size for Metric or Items Needed Depending on Screw Type and Size for US Standard Screws.

The bits have signifiers to help identifying what bit type and size these are.

Screw type standard	Shows bit size and type
Din 912 / ISO 4762 ASME B18.3 HEX Cylinder	
ISO 14579 ISO 14580 ISO 14581 ASME B18.6.3 Torx Button head ASME B18.6.3 Torx Counter sunk	
DIN 7985A ASME B18.6.3 Cross recessed Button head	

Supported bit shank properties:

- Type 1/4" HEX
- Length 25 mm

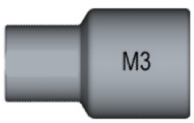
NOTE:

Bits longer that 25 mm could be used. However, the screw carrier and the screw fix might not hold the screw properly in place.

4. Screw Carrier and Screw Fix

Select the right screw carrier and screw fix depending on the screw type and the size to maximize the efficacy of the Screw-bit System based on the table on section Items needed depending on Screw type and size.

The screw carriers have signifiers to help identifying what screw type and size these can be used with.

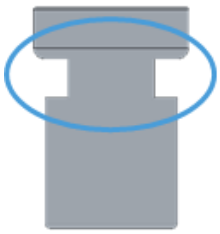
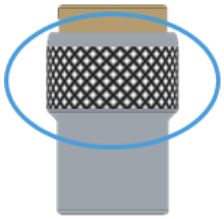
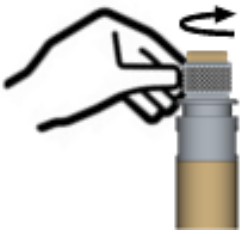
Screw thread size	Screw type illustration
	

The screw fixes are only needed for the Din 912, ISO 4762, ISO 14579, ISO 14580 and ASME B18.3 HEX Cylinder screw types. The screw fixes also have signifiers to show what size of screw they support.

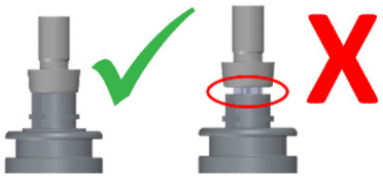
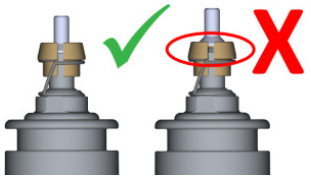
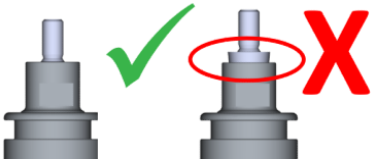
Screw fixes for Metric - Din 912, ISO 4762, ISO 14579, ISO 14580						
M1.6	M2	M2.5	M3	M4	M5	M6

Screw fixes for US Standard - ASME B18.3 HEX Cylinder						
1#	2#	4#	6#	8#	10#	1/4"

All screw carries must be adjusted to ensure high performance of the Screw-bit System.

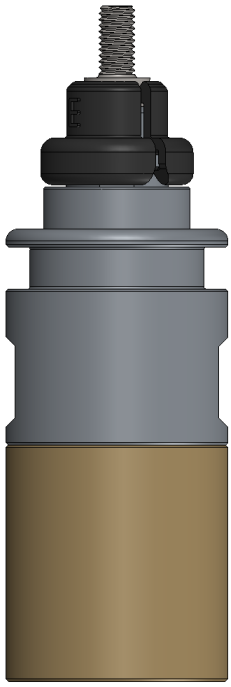
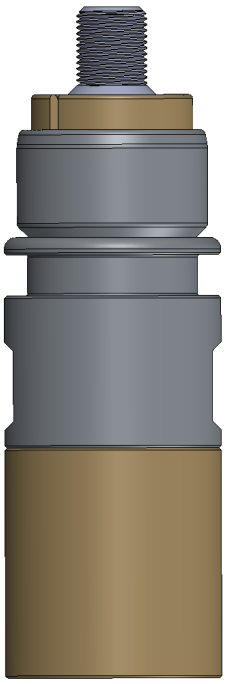
Appearance	Adjustment method
	
	

The screw carries must be adjusted so that the screw head seats stable on the screw carrier avoiding a gap in between. See the pictures below as reference.

Din 912 / ISO 4762 / ISO 14579 / ISO 14580 / ASME B18.3 Hex Cylinder		ISO 14581 / ASME B18.6 HEX Counter sunk / ASME B18.6.3 Torx Counter sunk		DIN 7985A / ASME B18.6.3 Cross recessed Button head / ASME B18.6.3 Torx Button head	
					

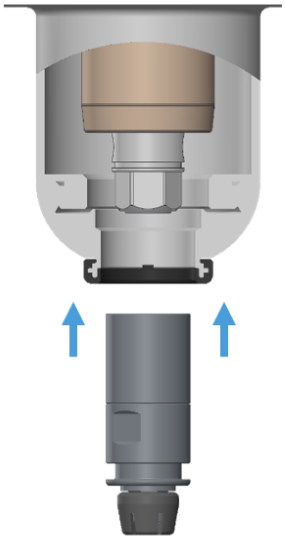
When this is achieved, remove the screw and push in the screw fix (only Din 912, ISO 4762, ISO 14579, ISO 14580 and ASME B18.3 HEX Cylinder screw types).

The final setup of the Screw-bit System with the screw in place should look like picture below.

Screw standard	Din 912 / ISO 4762 / ISO 14579 / ISO 14580 / ASME B18.3 Hex Cylinder		ISO 14581 / ASME B18.6 HEX Counter sunk / ASME B18.6.3 Torx Counter sunk		DIN 7985A / ASME B18.6.3 Cross recessed Button head / ASME B18.6.3 Torx Button head	
Screw-bit System appearance						

5. Attaching and Detaching the Screw-bit System to/from the Screwdriver

The last step is to attach the system to the Screwdriver by placing the hex shape of the bit holder inside of the end of the screwdriver's shank as shown in the picture below. The system will be attached to the screwdriver by a magnetic force.



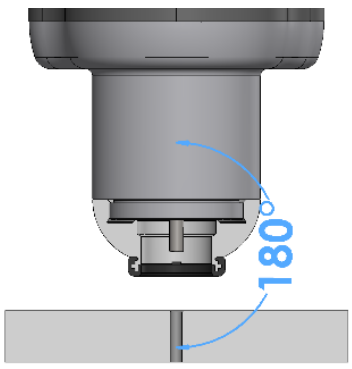
To remove the Bit holder from the screwdriver's shank, follow the steps below:

1. Move the shank all the way out to position 55 by operating the user interface in the robot or in the Web Client.
2. As shown in the images below, use the provided key to grab the Bit holder.
3. While holding the key, move the shank inwards by operating the user interface in the robot or in the Web Client.

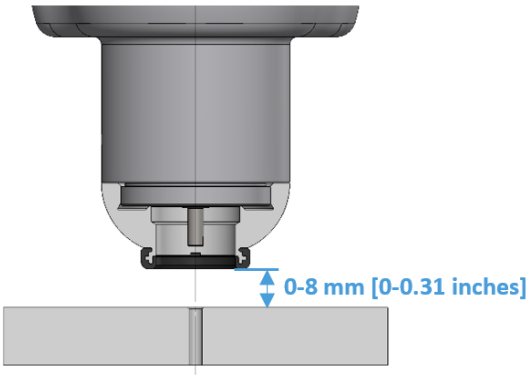
Screwdriver Position to Execute Commands

To successfully execute the screwdriver commands, it is fundamental to position the screwdriver correctly. This is achieved if the following two conditions are met:

1. The Screw-bit System must be perfectly aligned to the screw or thread.



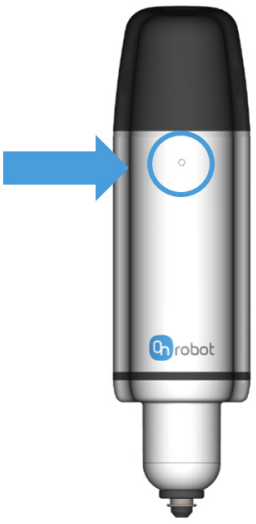
2. The distance between the Screwdriver's bottom part and the surface where the action takes place must be within the range of 0-8 mm [0-0.31 inches].



LED - Device Status

The screwdriver has a LED that shows the device status.

Color	Device Status
No light	Power missing
Steady green	Ready to work - Idle - Static
Blinking green	Initializing
Steady orange	Busy – Moving/rotating shank
Blinking orange	Operational malfunction
Steady red	Not working – Hardware problem
Blinking red	Safety – Emergency stop



Torque Angle Curve and Torque Gradient

The torque gradient shows how the torque is applied in the last phase of the Tightening screw command. This could be used as an indicator to detect if a Tightening command is performed correctly.

For instance, the torque gradient could be different if:

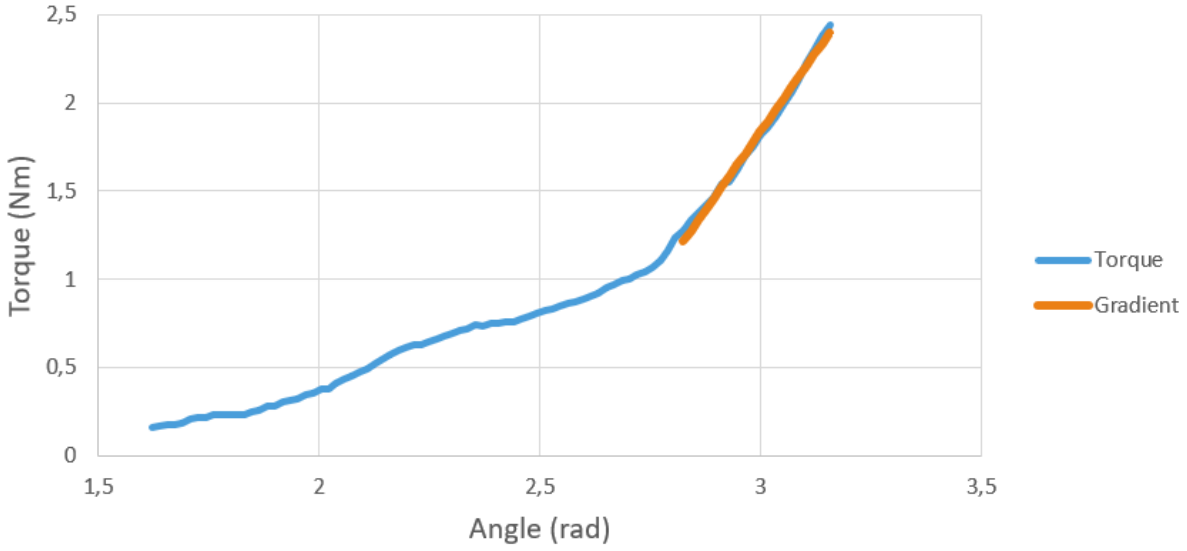
- The hole thread is not long enough

- The hole thread is different from the screw thread
- The hole thread is not clean (for instance by deburrs from CNC machining)
- The friction between the screw thread and the hole thread is too low or too high
- The friction between the screw head and the tighten part is too low or too high

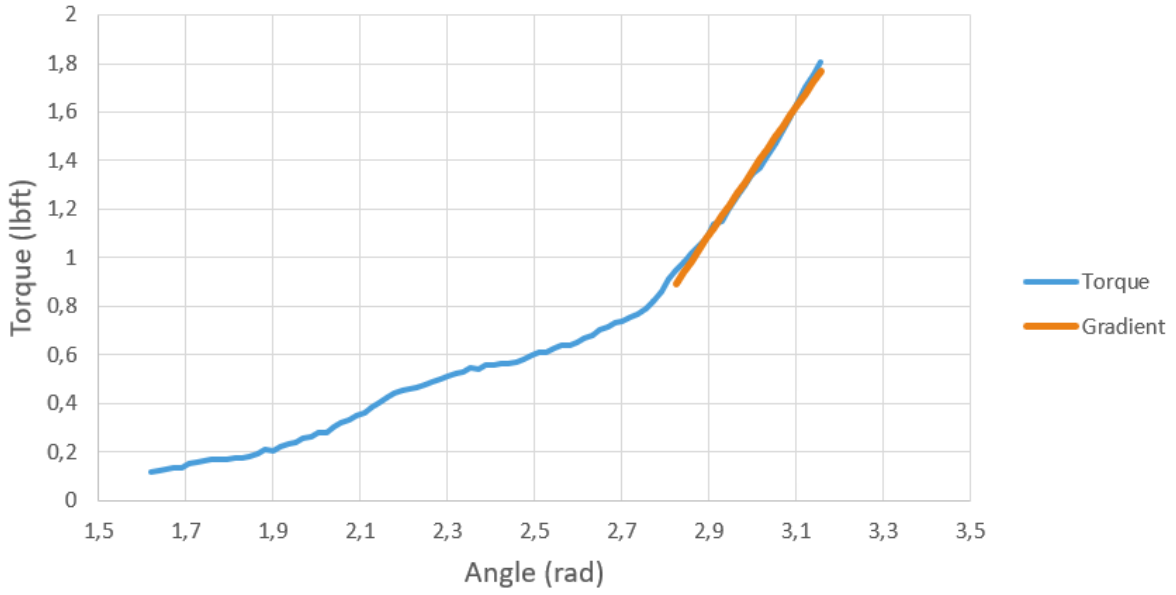
A torque gradient variable is made available to be checked in the robot program.

The graph below shows a normal Torque/Angle curve. In this case has been made with a M4 screw and 2.4 Nm as target torque.

Torque angle curve Metric



Torque angle curve US Standard



8.1.9. SG

General Properties	Minimum	Typical	Maximum	Unit
Total spindle stroke	11 0.43	-	40 1.57	[mm] [inch]
Spindle position resolution	-	0.1 0.0039	-	[mm] [inch]
Spindle force	-	-	380	[N]
Spindle speed	-	-	37 1.46	[mm/s] [inch/s]
Gripping time* (SG-a-H)	-	-	32	[grip/min]
SG-tool attachment mechanism	Smart lock			
Motor	Integrated, electric BLDC			
IP Classification	IP67			
Dimensions (H x Ø)	84 x 98 3.3 x 3.85			[mm] [inch]
Weight	0.77 1.69			[kg] [lb]

*Gripping time is tool depended. See the separate SG Datasheet for the tool specific gripping time.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	45	-	600	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Storage temperature	0 32	- -	60 140	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

NOTE:

For technical specification for the SG-tools, see the separate SG Datasheet.

How to Handle a Workpiece

With the elastic silicone SG tools, the gripper can handle a wide range of workpieces, for a high number of applications. Different tool designs have some overlap in capability when handling the same workpiece, but the tools have different characteristics and do have individual effectiveness on a given workpiece.

Soft Silicone

Some SG tool designs has a soft silicone part in the top of the gripper. These tools are better suited for handling fragile workpieces and/or workpieces with a high variance in size, compared to the hard silicone tools. This is due to the more “forgiving” nature of the soft part. The user may experience a reduced payload compared to the hard silicone tools.

To handle a workpiece properly, the user must know some parameters that are defined by the general conditions of the workpiece and its presentation in the application. This helps to define which tool to choose and the actual grip width on it.

A general overview of such parameters is listed below:

- Shape
- Dimension
- Weight
- Roughness
- Fragility
- Orientation of pick/placement

For a better understanding of how to handle workpieces with different parameters, tests were conducted with a SG-a-H tool, see table below.

Example of material	Workpiece	Dimension	Weight	Roughness	Shape	Actual gripping width
Smooth wood (Sanded)	Round stick	27mm	32g	5	Cylinder	20mm
Polished metal	Aluminum cube	35x25mm	512g	1	Square	15mm
Rough metal	Aluminum cylinder	60mm	490g	8	Cylinder	55mm
Plastic	PET Bottle POM-C POM-C	65mm 50mm 50mm	431g 221g 1410g	1 2 2	Cylinder Cylinder Cylinder	50mm 42mm 15mm
Glass	Drinking glass	68mm	238g	1	Cylinder	50mm
Organic material	Tomato Mushroom Grape	54mm 40mm 20mm	92g 8g 7g	2 10 10	Round Round Oval	53mm 39mm 16mm
Carbonfiber	Carbonfiber cylinder	38mm	48g	7	Cylinder	29mm

Notice objects with high weight needs higher force asserted upon them, therefor the small gripping width.

NOTE:

The results shown in the table above, should be considered as indicative and may vary. The actual grip width always require testing, for verification.

It is often a good idea to set a target width smaller, than actual workpiece width, to reach a higher surface contact area and to accommodate for vibrations and other unexpected conditions.

For heavy and large workpieces test at low velocity and with caution.

NOTE:

For individual SG-tool examples. See the separate SG-tool manual.

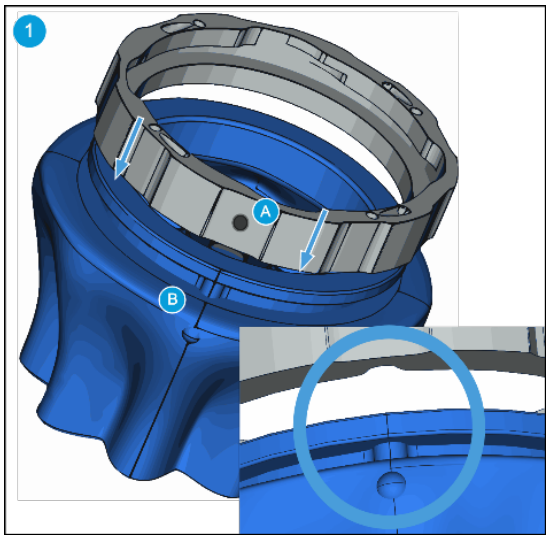
The criteria for roughness are a basic scale from 1-10, here are the benchmarks used to determine the values.

Roughness	Description	Example
1	Polished/Smooth	Polished Metal
5	Textured	Cardboard
10	Rough	Sandblasted Metal

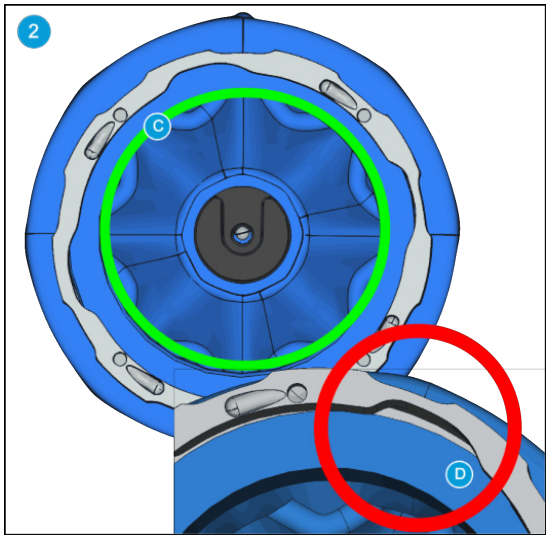
WARNING:

Sharp edges, on a workpiece, may damage the silicone and reduce lifetime of the tool.

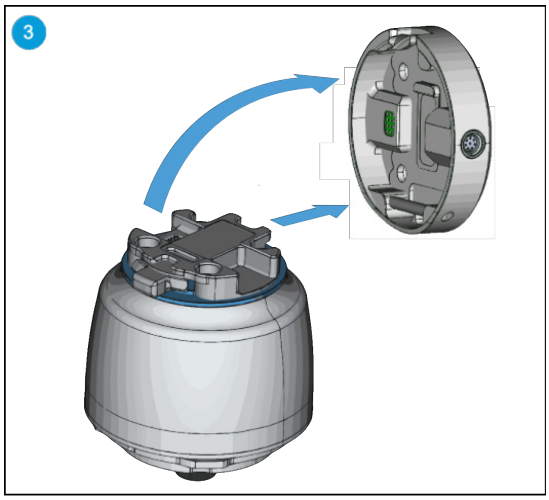
SG Tool Mounting Guide



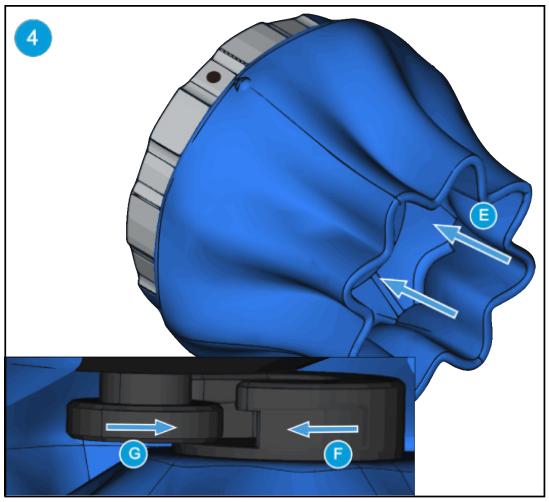
Rotate the ring so marking **(A)** facing you. Align the dot on the SG tool **(B)** with marking **(A)**. Make them fit together and mount the ring onto the SG tool.



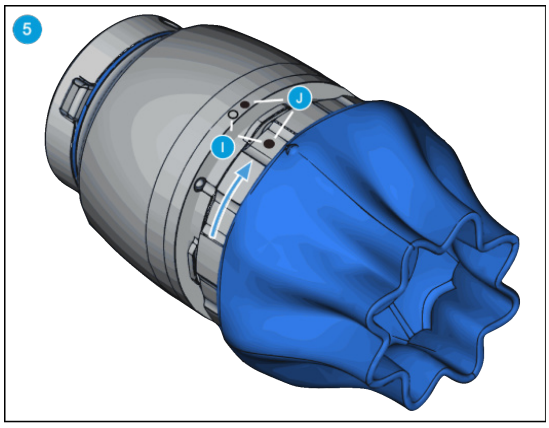
Press the SG tool up against the ring until it fits perfectly **(C)**. Make sure there is no gap between the SG tool and the ring **(D)**.



It is highly recommended to install the SG Base Part on the robot before installing the SG tool. Make sure the SG Base Part is in home position or initialized.



Use your thumbs to press the inside of the SG tool **(E)**. This will make the smart lock female **(F)** visible. Locate the marking on the ring as described in step 1. Slide the SG tool smart lock female **(F)** and the smart lock male **(G)** together.



Align the markings **(I)**. Press the SG tool into the SG Base Part and rotate CW to align the two markings **(J)**.

Scan for mounting guide video.

WARNING:

When working with the SG, please make sure that the grippers inward/outward motion is not obstructed, otherwise the positioning system may get out of sync. If that were to happen, move the grip/release point away from the workpiece, and reinitialize the gripper.

8.1.10. VG10

General Properties	Minimum	Typical	Maximum	Unit
Vacuum	5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow	0	-	12	[L/min]
Arms adjustment	0	-	270	[°]
Arm holding torque	-	6	-	[Nm]

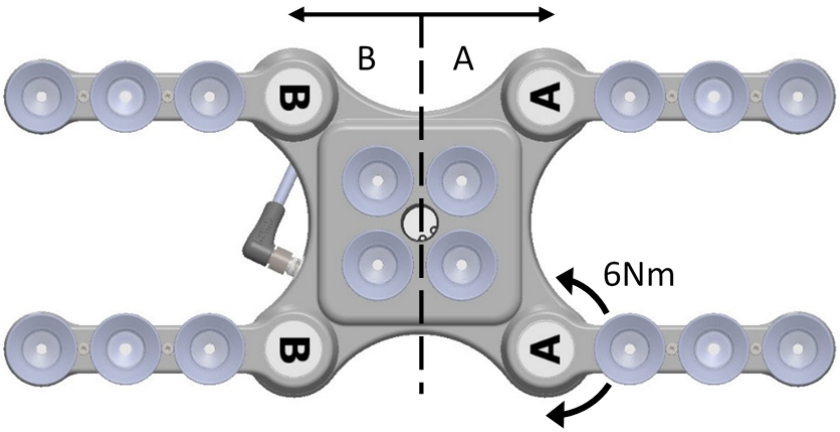
General Properties		Minimum	Typical	Maximum	Unit
Payload	Rated	10 22			[kg] [lb]
	Maximum	15 33			[kg] [lb]
Vacuum cups		1	-	16	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Vacuum pump		Integrated, electric BLDC			
Arms		4, adjustable by hand			
Dust filters		Integrated 50µm, field replaceable			
IP Classification		IP54			
Dimensions (folded)		105 x 146 x 146 4.13 x 5.75 x 5.75			[mm] [inch]
Dimensions (unfolded)		105 x 390 x 390 4.13 x 15.35 x 15.35			[mm] [inch]
Weight		1.62 3.57			[kg] [lb]

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[hours]

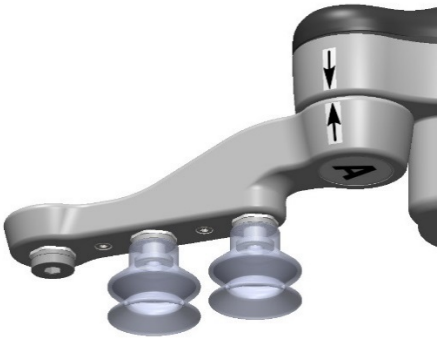
Positioning the VG10 Arms and Channels

The arms can be folded to the preferred position simply by pulling in the arms. The torque needed to overcome the friction in the rotatable joints of the arm is high (6 N/m) to ensure that the arms do not move when handling 15 kg payloads.

The VG10 suction cups are grouped into two independent channels.



When the four arms are adjusted to preferred angles, it is recommended to add the accompanied arrow stickers. This allows for easy realignment and exchanging between different work items.



Payload

The lifting capacity of the VG grippers depends primarily on the following parameters:

- Vacuum cups
- Vacuum
- Air flow

Vacuum Cups

Choosing the right vacuum cups for your application is essential. The VG grippers come with common 15, 30 and 40 mm silicone vacuum cups (see table below) which are good for hard and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards.

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	15	6	29

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	30	16	200
	40	24	450

For non-porous materials, the OnRobot suction cups are highly recommended. Some of the most common non-porous materials are listed below:

- Composites
- Glass
- High density cardboard
- High density paper
- Metals
- Plastic
- Porous materials with a sealed surface
- Varnished wood

In an ideal case, working with non-porous material workpieces where there are no air flow going through the workpiece, the table below shows the number of cups and the cup size needed depending on the payload (workpiece mass) and the vacuum used.

Number of Cups needed for non-porous materials depending on payload and vacuum :

	15 mm				30 mm				40 mm			
Payload (kg)	**Vacuum (kPa)**				**Vacuum (kPa)**				**Vacuum (kPa)**			
	20	**40**	**60**	**75**	**20**	**40**	**60**	**75**	**20**	**40**	**60**	**75**
0.1	3	2	1	1	1	1	1	1	1	1	1	1
0.5	13	7	5	4	2	1	1	1	1	1	1	1
1	-	13	9	7	4	2	2	1	2	1	1	1
2	-	-	-	14	8	4	3	2	4	2	2	1
3	-	-	-	-	12	6	4	3	5	3	2	2
4	-	-	-	-	15	8	5	4	7	4	3	2
5	-	-	-	-	-	10	7	5	9	5	3	3
6	-	-	-	-	-	12	8	6	10	5	4	3
7	-	-	-	-	-	13	9	7	12	6	4	4
8	-	-	-	-	-	15	10	8	14	7	5	4
9	-	-	-	-	-	-	12	9	15	8	5	4
10	-	-	-	-	-	-	13	10	-	9	6	5
11	-	-	-	-	-	-	14	11	-	9	6	5
12	-	-	-	-	-	-	15	12	-	10	7	6
13	-	-	-	-	-	-	16	13	-	11	8	6
14	-	-	-	-	-	-	-	14	-	12	8	7
15	-	-	-	-	-	-	-	15	-	13	9	7

NOTE:

To use more than 7 (15mm), 4 (30mm) or 3 (40mm) vacuum cups with the VGC10 a customized adaptor plate is needed.

The table above is created with the following formula that equalizes the lifting force with the payload considering 1.5G of acceleration.

$$Amount_{Cups} * Area_{Cup}[mm] = 14700 \frac{Payload\ [kg]}{Vacuum\ [kPa]}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

When using porous materials, the vacuum that can be achieve by using the OnRobot suction cups will depend on the material itself and will be between the range stated in the specifications. Some of the most common non-porous materials are listed below:

- Fabrics
- Foam
- Foam with open cells
- Low density cardboard
- Low density paper
- Perforated materials
- Untreated wood

See the table below with general recommendations, in case other suction cups are needed for specific materials.

Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:

It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

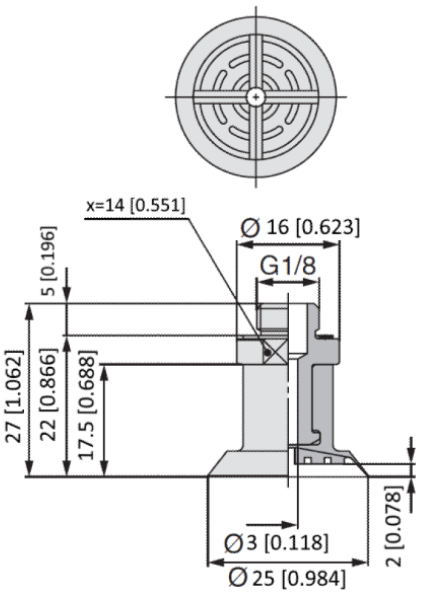
Suction Cups for Foil and Bags Ø25

This suction cup improves the vacuum gripper's ability to pick and place workpieces with surface of foil, thin paper, and plastic bags during irregular and angular arm movement.

	25 mm			
Number of Cups	**1**	**2**	**3**	**4**
Surface	**kg**			
Foil	0.83	1.07	1.43	1.57
Thin paper	1.08	1.71	2.23	3.21
Foil - round shape	1.28	2.32	3.32	4.25
Plastic bag	0.32	0.54	0.63	0.74

The vacuum cup is silicone rubber compliant with the USA Food and Drug Administration (FDA).

Using this vacuum cup reduces the wrinkles made on thin workpieces (film, vinyl, and so on) during absorption: .



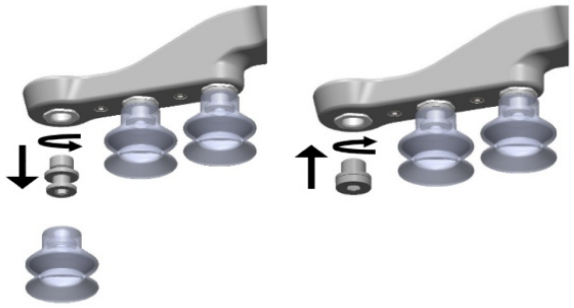
This vacuum cup is an accessory and need to be purchased separately. To purchase the vacuum cup, contact the vendor from where the VGx gripper has been purchased.

- Suction Cups for foil and bags Ø25 - PN 105922

Fittings and Blind Screws

It is possible to change suction cups simply by pulling them off the fittings. It might be a bit challenging to remove the 15 mm Diameter vacuum cups. As suggestion try to stretch the silicon to one of the sides and then pull it out.

Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. The fittings and the blinding screws are mounted or dismounted by screwing (2Nm tightening torque) or unscrewing them with the provided 3 mm Allen key.



The thread size is the commonly used G1/8”; allowing for standard fittings, blinders and extenders to be fitted directly to the VG grippers.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs.	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum in kPa setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.

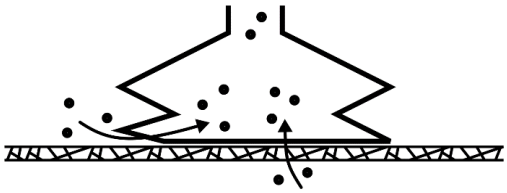
The pressure in the atmosphere varies with weather, temperature and altitude. The VG grippers automatically compensate for altitudes up to 2km, where the pressure is about 80% of sea level.

Air Flow

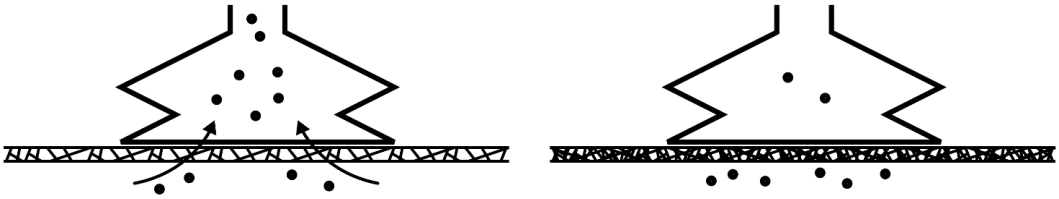
Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips
- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).



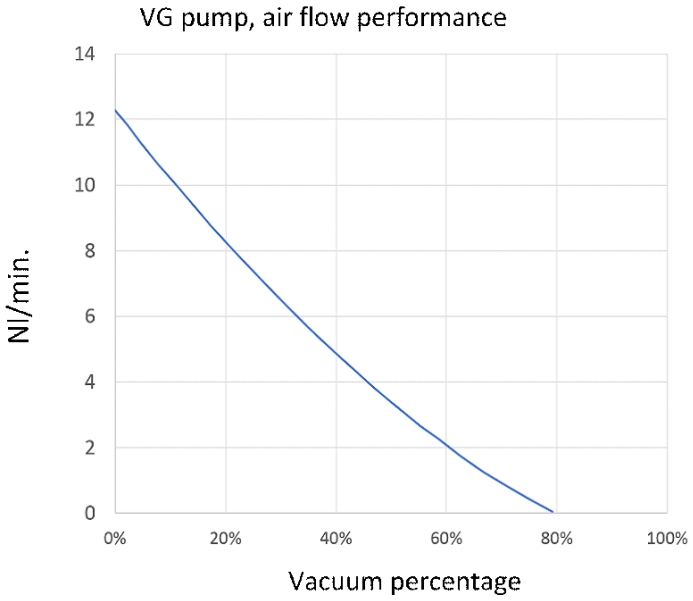
Leaking workpieces can be even harder to identify. Things that look completely tight might not be tight at all. A typical example is coarse cardboard boxes. The thin outer layer is often requiring a lot of air flow to create a pressure difference over it (see figure below).



Therefore, the users must be aware of the following:

- VG grippers are not suitable for most uncoated, coarse cardboard boxes.
- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG grippers is shown in the graph below:



NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG grippers.

A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG gripper filters and vacuum cups will last longer.

8.1.11. VGC10

General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[L/min]
Payload	With default attachments	- -	- -	6 * 13.2 *	[kg] [lb]
	With customized attachments	- -	10 20	15 33.1	[kg] [lb]
Vacuum cups		1	-	7	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Vacuum pump		Integrated, electric BLDC			
Dust filters		Integrated 50µm, field replaceable			
IP Classification		IP54			
Dimensions		101 x 100 x 100 3.97 x 3.94 x 3.94			[mm] [inch]
Weight		0.814 1.79			[kg] [lb]

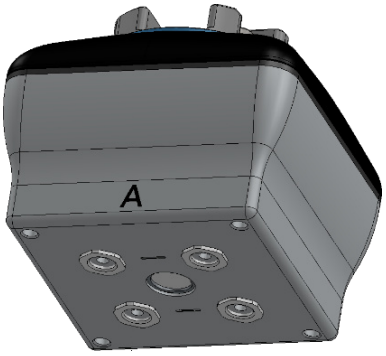
* By using three 40mm cups. More info in the table **Number of Cups needed for non-porous materials depending on payload and vacuum**.

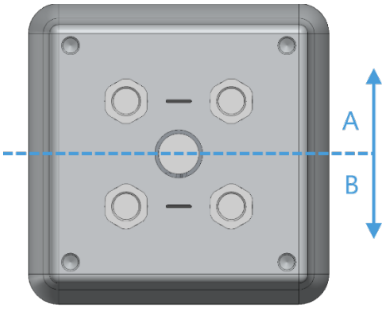
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]

Operating Conditions	Minimum	Typical	Maximum	Unit
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[hours]

2 Channels

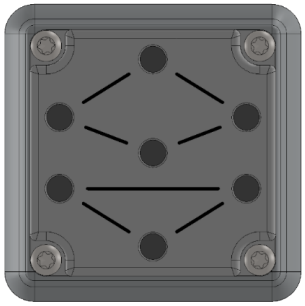
The VGC10 has 4 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channels A and B independently for vacuum.



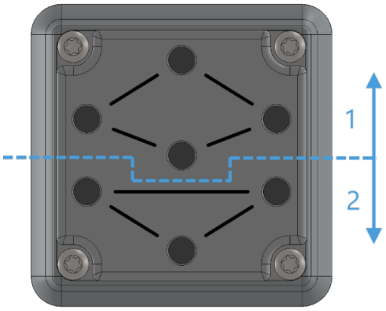


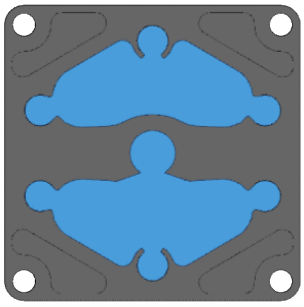
Adaptor Plate

The VGC10 comes with an Adaptor Plate which provides extra flexibility to locate the vacuum cups in different configurations.

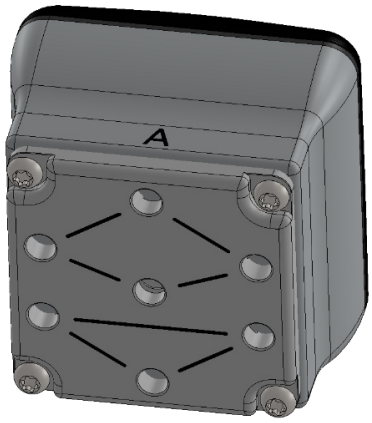


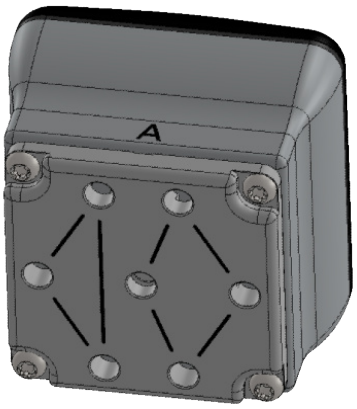
The Adaptor Plate has 7 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channel A and B independently for vacuum.



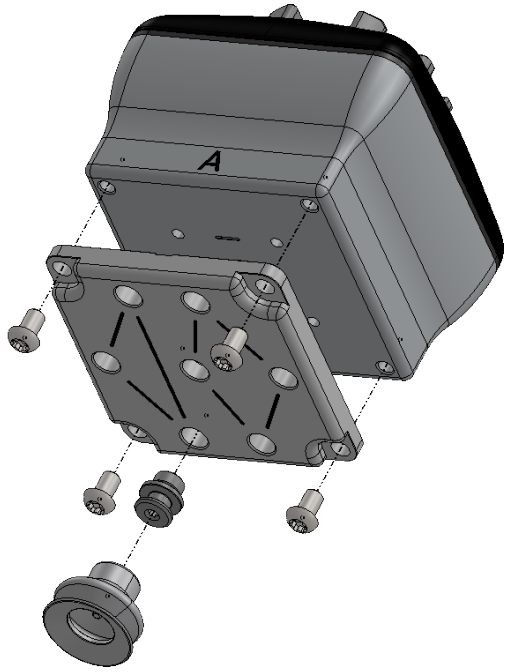


The Adaptor Plate can be placed in different positions by rotating it 90º. Having as reference the letters A and B written on the gripper housing, the Adaptor Plate can be placed to separate both channels or to communicate them. If the Adaptor Plate is placed as in picture below on the left, both channels will be separated, and they can be used independently or combined. If the Adaptor Plate is placed as in picture below on the right, both channels will be communicated and a higher air flow can be achieved, although both channels will have to be used combined.





To mount the Adaptor Plate simply remove the 4 fittings or blinding screws from the gripper, place the Adaptor Plate by choosing the right angle according to the desired configuration, and tighten the 4 screws with 4 Nm tighten torque.



NOTE:

Please, note that the O-Ring in the Adaptor Plate is not glued therefore it can be pulled out. If that happens simply put it back in place and the gripper will work as before.

Extension Pipe

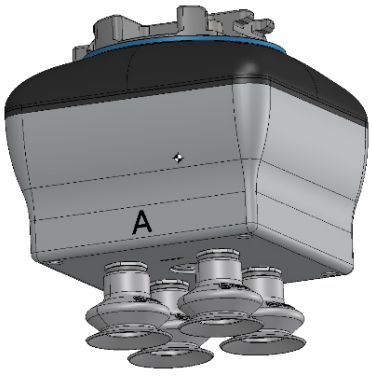
The Extension Pipe provides an extra length of 50 mm to reach narrow spaces.

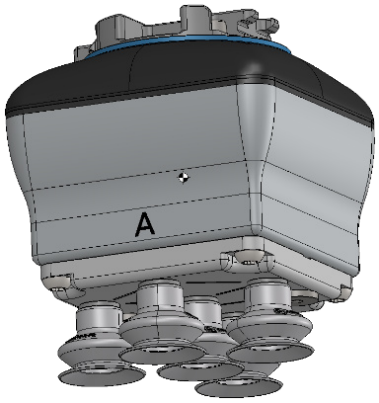
NOTE:

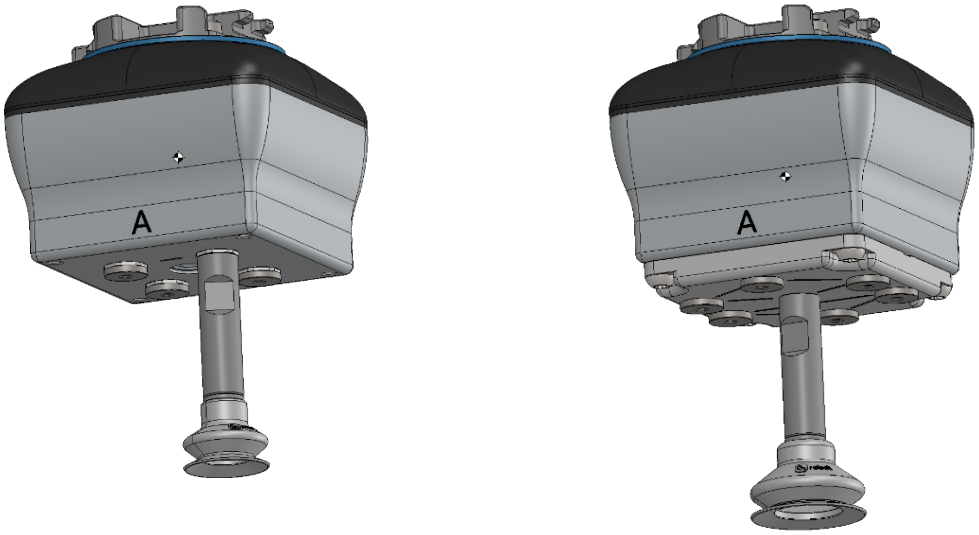
Remember to use the Adaptor Plate rotated to achieve a higher air flow when using both channels together.

The Extension Pipe can be mounted in any of the holes by simply screwing it in and adding a fitting on top as shown in the image below.

Below different mounting configurations with the provided attachments are shown.

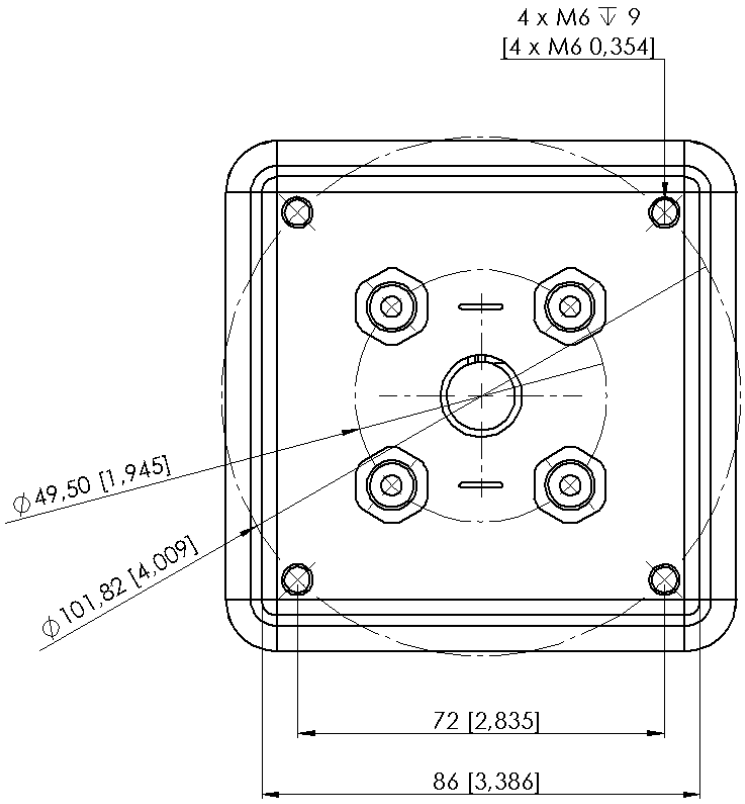




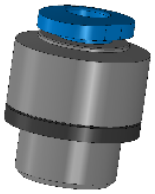


Customized Adaptor Plates and Push-in Fittings

The design of the VGC10 is meant to facilitate the users to make their own adaptor plates to create different kinds of configurations. The dimensions needed to create a customized adaptor plate are shown in the image below.

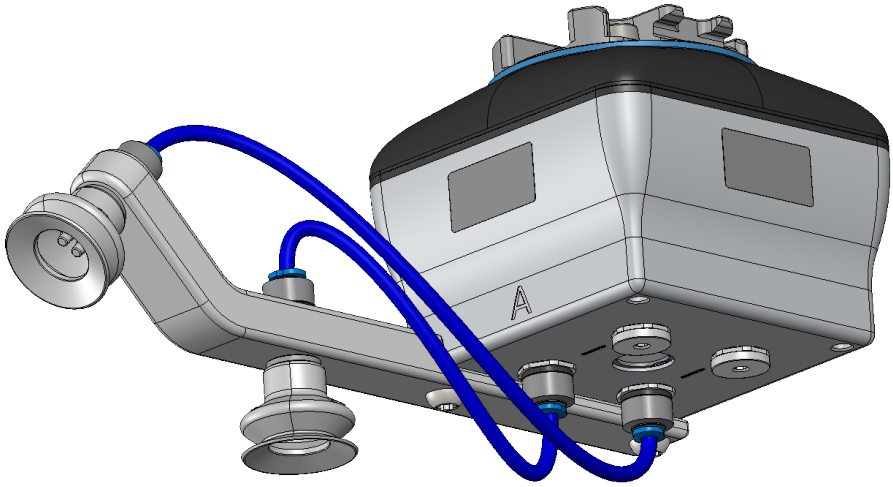


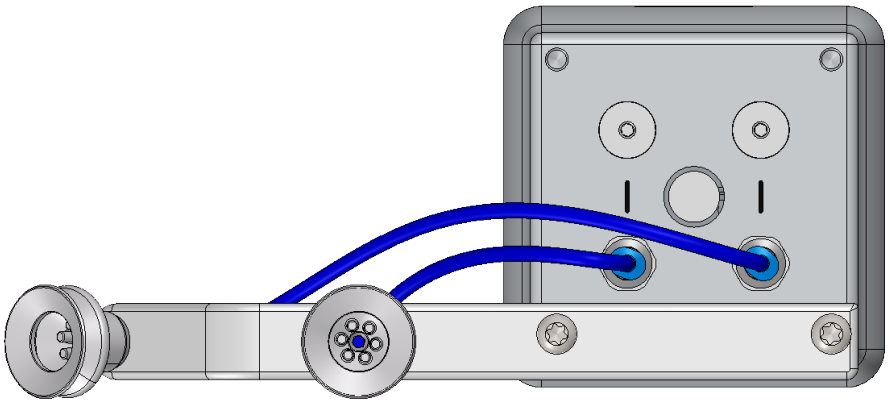
The Push-in Fittings are used to attach 4 mm vacuum tubes to create customized configuration that required remote vacuum. In most cases, this size is enough for generating the needed vacuum from the pump in the gripper.



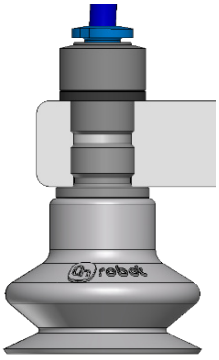
The commercial name of the Push-in Fittings is Fitting QSM-G1/8-4-I-R in case some more units need to be purchased.

An example of a customized configuration with a homemade adaptor plate and remote vacuum is shown below.





The image below shows how the push-in fittings and the normal fittings are communicated.



Payload

The lifting capacity of the VG grippers depends primarily on the following parameters:

- Vacuum cups
- Vacuum
- Air flow

Vacuum Cups

Choosing the right vacuum cups for your application is essential. The VG grippers come with common 15, 30 and 40 mm silicone vacuum cups (see table below) which are good for hard and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards.

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	15	6	29
	30	16	200
	40	24	450

For non-porous materials, the OnRobot suction cups are highly recommended. Some of the most common non-porous materials are listed below:

- Composites
- Glass
- High density cardboard
- High density paper
- Metals
- Plastic
- Porous materials with a sealed surface
- Varnished wood

In an ideal case, working with non-porous material workpieces where there are no air flow going through the workpiece, the table below shows the number of cups and the cup size needed depending on the payload (workpiece mass) and the vacuum used.

Number of Cups needed for non-porous materials depending on payload and vacuum :

	15 mm				30 mm				40 mm			
Payload (kg)	**Vacuum (kPa)**				**Vacuum (kPa)**				**Vacuum (kPa)**			
	20	**40**	**60**	**75**	**20**	**40**	**60**	**75**	**20**	**40**	**60**	**75**
0.1	3	2	1	1	1	1	1	1	1	1	1	1
0.5	13	7	5	4	2	1	1	1	1	1	1	1
1	-	13	9	7	4	2	2	1	2	1	1	1
2	-	-	-	14	8	4	3	2	4	2	2	1
3	-	-	-	-	12	6	4	3	5	3	2	2
4	-	-	-	-	15	8	5	4	7	4	3	2
5	-	-	-	-	-	10	7	5	9	5	3	3
6	-	-	-	-	-	12	8	6	10	5	4	3
7	-	-	-	-	-	13	9	7	12	6	4	4
8	-	-	-	-	-	15	10	8	14	7	5	4
9	-	-	-	-	-	-	12	9	15	8	5	4
10	-	-	-	-	-	-	13	10	-	9	6	5
11	-	-	-	-	-	-	14	11	-	9	6	5
12	-	-	-	-	-	-	15	12	-	10	7	6
13	-	-	-	-	-	-	16	13	-	11	8	6
14	-	-	-	-	-	-	-	14	-	12	8	7
15	-	-	-	-	-	-	-	15	-	13	9	7

NOTE:

To use more than 7 (15mm), 4 (30mm) or 3 (40mm) vacuum cups with the VGC10 a customized adaptor plate is needed.

The table above is created with the following formula that equalizes the lifting force with the payload considering 1.5G of acceleration.

$$Amount_{Cups} * Area_{Cup}[mm] = 14700 \frac{Payload\ [kg]}{Vacuum\ [kPa]}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

When using porous materials, the vacuum that can be achieve by using the OnRobot suction cups will depend on the material itself and will be between the range stated in the specifications. Some of the most common non-porous materials are listed below:

- Fabrics
- Foam
- Foam with open cells
- Low density cardboard
- Low density paper
- Perforated materials
- Untreated wood

See the table below with general recommendations, in case other suction cups are needed for specific materials.

Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:

It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

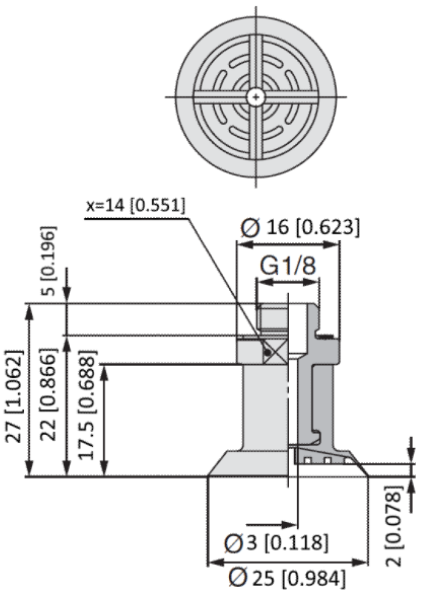
Suction Cups for Foil and Bags Ø25

This suction cup improves the vacuum gripper's ability to pick and place workpieces with surface of foil, thin paper, and plastic bags during irregular and angular arm movement.

	25 mm			
Number of Cups	**1**	**2**	**3**	**4**
Surface	**kg**			
Foil	0.83	1.07	1.43	1.57
Thin paper	1.08	1.71	2.23	3.21
Foil - round shape	1.28	2.32	3.32	4.25
Plastic bag	0.32	0.54	0.63	0.74

The vacuum cup is silicone rubber compliant with the USA Food and Drug Administration (FDA).

Using this vacuum cup reduces the wrinkles made on thin workpieces (film, vinyl, and so on) during absorption: .



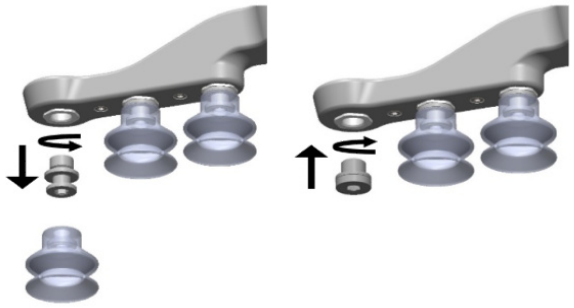
This vacuum cup is an accessory and need to be purchased separately. To purchase the vacuum cup, contact the vendor from where the VGx gripper has been purchased.

- Suction Cups for foil and bags Ø25 - PN 105922

Fittings and Blind Screws

It is possible to change suction cups simply by pulling them off the fittings. It might be a bit challenging to remove the 15 mm Diameter vacuum cups. As suggestion try to stretch the silicon to one of the sides and then pull it out.

Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. The fittings and the blinding screws are mounted or dismounted by screwing (2Nm tightening torque) or unscrewing them with the provided 3 mm Allen key.



The thread size is the commonly used G1/8”; allowing for standard fittings, blinders and extenders to be fitted directly to the VG grippers.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs.	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum in kPa setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.

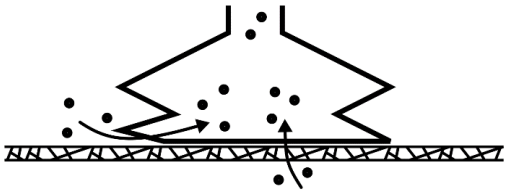
The pressure in the atmosphere varies with weather, temperature and altitude. The VG grippers automatically compensate for altitudes up to 2km, where the pressure is about 80% of sea level.

Air Flow

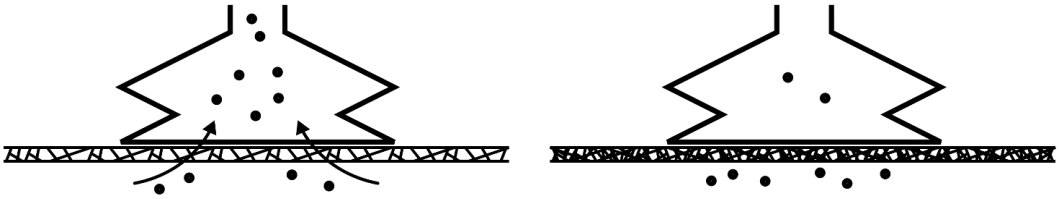
Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips
- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).



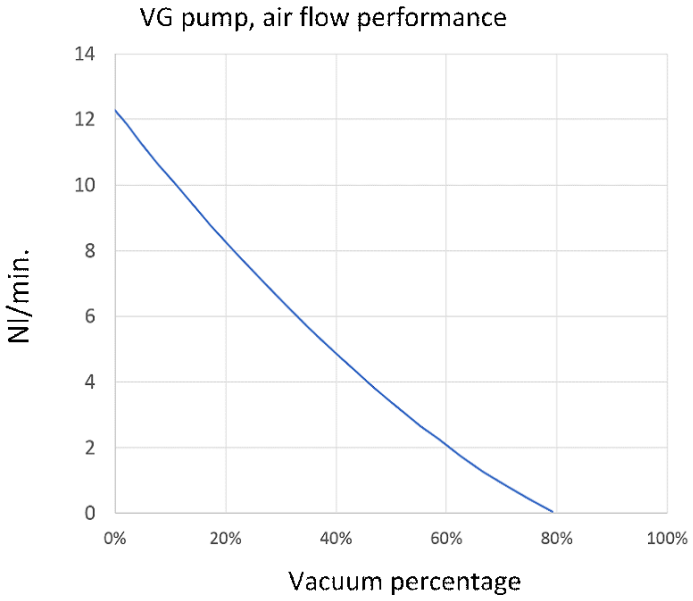
Leaking workpieces can be even harder to identify. Things that look completely tight might not be tight at all. A typical example is coarse cardboard boxes. The thin outer layer is often requiring a lot of air flow to create a pressure difference over it (see figure below).



Therefore, the users must be aware of the following:

- VG grippers are not suitable for most uncoated, coarse cardboard boxes.
- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG grippers is shown in the graph below:



NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG grippers.

A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG gripper filters and vacuum cups will last longer.

8.1.12. Compute Box

8.1.12.1. With 1.5A Wall Adapter (36W)

Supplied Wall Adapter	Minimum	Typical	Maximum	Unit
Input voltage (AC)	100	-	240	[V]
Input current	-	-	1	[A]
Output voltage	-	24	-	[V]
Output current	-	1.5	-	[A]

Compute Box Power input (24V connector)	Minimum	Typical	Maximum	Unit
Supply voltage	-	24	25	[V]
Supply current	-	1.5	-	[A]

Compute Box Power output (Device connector)	Minimum	Typical	Maximum	Unit
Output voltage	-	24	25	[V]
Output current	-	1.5	-	[A]

8.1.12.2. With 5A Wall Adapter (120W)

Supplied Wall Adapter	Minimum	Typical	Maximum	Unit
Input voltage (AC)	100	-	240	[V]
Input current	-	-	2	[A]
Output voltage	-	24	-	[V]
Output current	-	5	-	[A]

Compute Box Power input (24V connector)	Minimum	Typical	Maximum	Unit
Supply voltage	-	24	25	[V]
Supply current	-	5	-	[A]

Compute Box Power output (Device connector)	Minimum	Typical	Maximum	Unit
Output voltage	-	24	25	[V]
Output current (CB HW v3.4)	-	5	5.5*	[mA]
Output current (CB HW v3.1)	-	4.5	4.5*	[mA]

* Peak currents.

8.1.12.3. Compute Box I/O interface

Power Reference (24V, GND)	Minimum	Typical	Maximum	Unit
Reference output voltage	-	24	25	[V]
Reference output current	-	-	100	[mA]

Output (DO1-DO8)	Minimum	Typical	Maximum	Unit
Output current - altogether	-	-	100	[mA]
Output resistance (active state)	-	24	-	[Ω]

Input (DI1-DI8) as PNP	Minimum	Typical	Maximum	Unit
Voltage level - TRUE	18	24	30	[V]
Voltage level - FALSE	-0.5	0	2.5	[V]
Input current	-	-	6	[mA]
Input resistance	-	5	-	[kΩ]

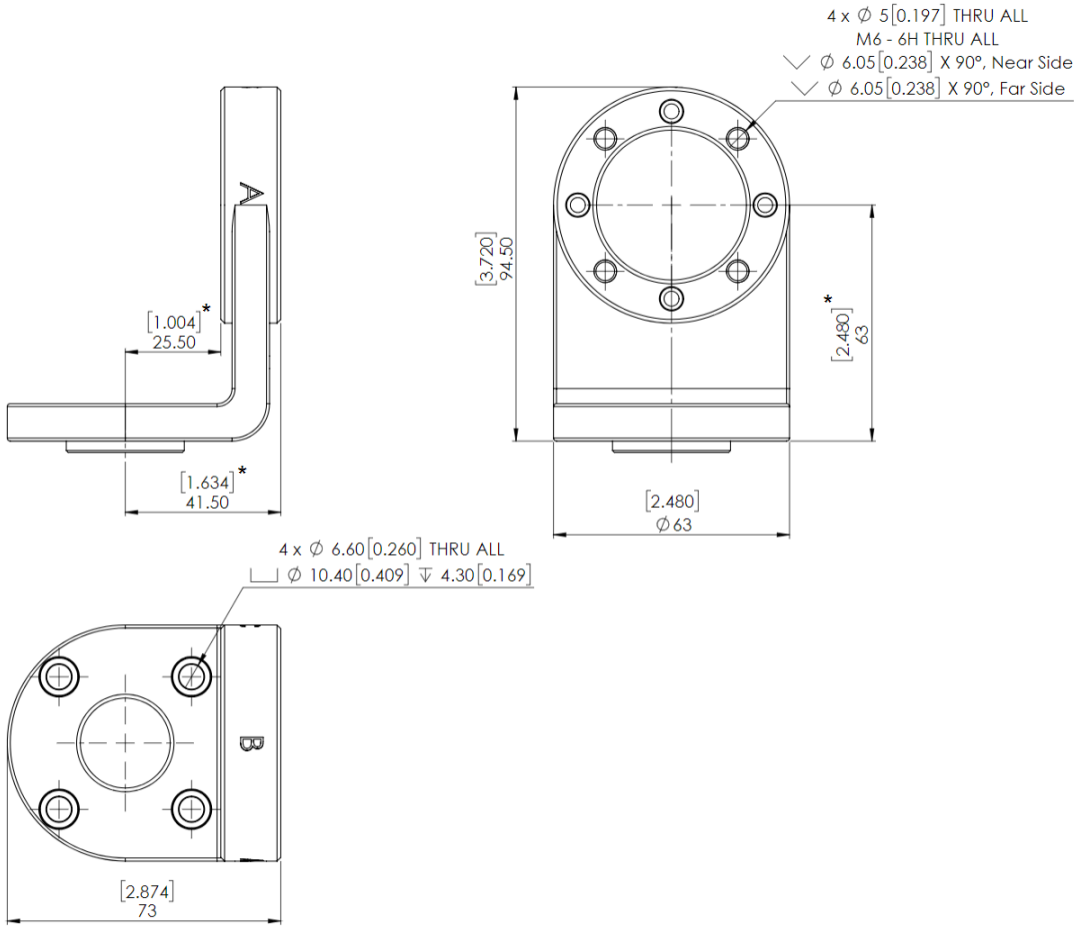
Input (DI1-DI8) as NPN	Minimum	Typical	Maximum	Unit
Voltage level - TRUE	-0.5	0	5	[V]
Voltage level - FALSE	18	24	30	[V]
Input current	-	-	6	[mA]
Input resistance	-	5	-	[kΩ]

8.2. Mechanical Drawings

8.2.1. Adapter Plate

No adapter plate is required.

8.2.2. Angle Bracket

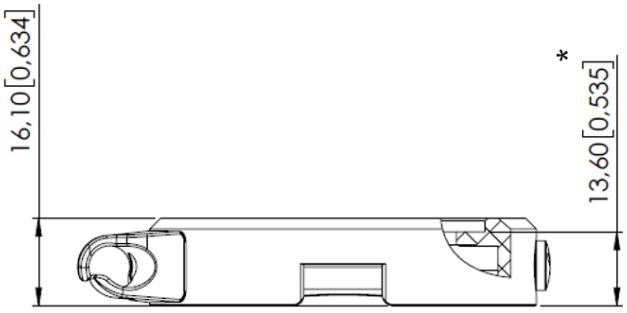


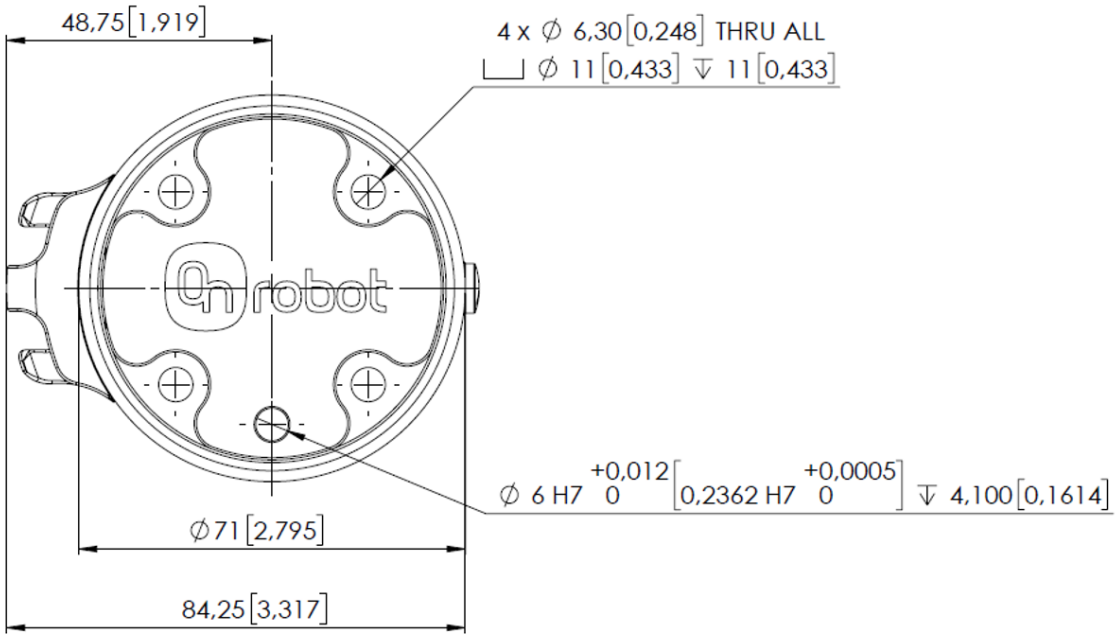
* Distance from Robot flange interface to OnRobot Quick Changer.

All dimensions are in mm and [inches].

8.2.3. Mountings

8.2.3.1. Quick Changer - Robot Side





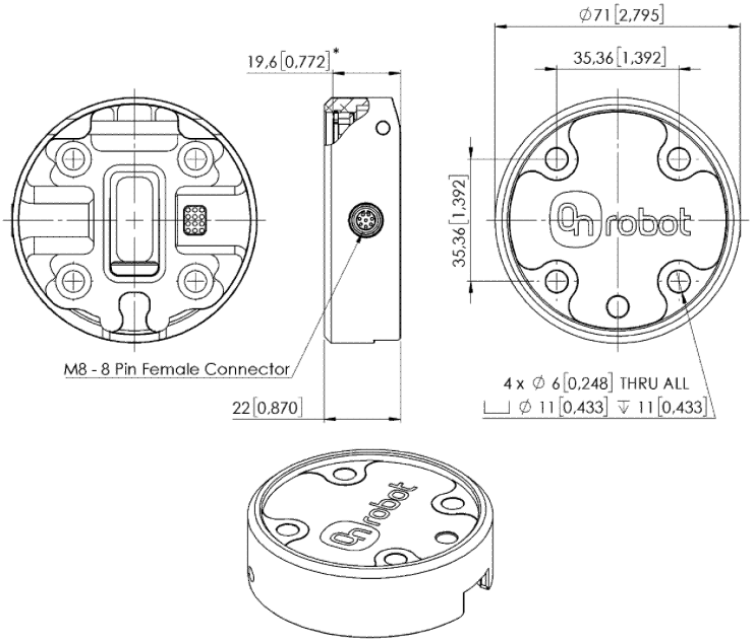
* Distance from Robot flange interface to OnRobot tool.

All dimensions are in mm and [inches].

NOTE:

The cable holder (on the left side) is only required with the long (5 meter) cable.

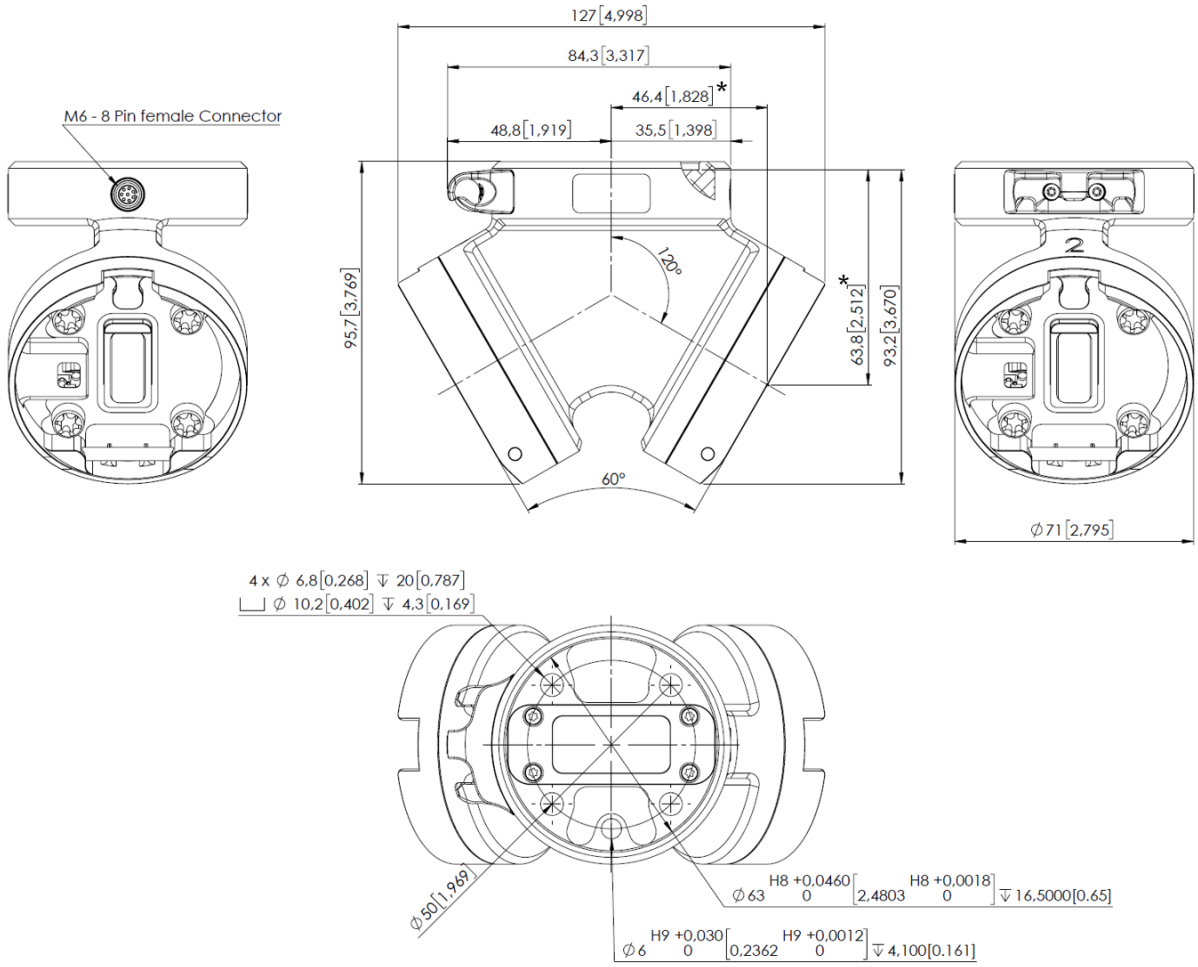
8.2.3.2. Quick Changer for I/O - Robot Side



* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

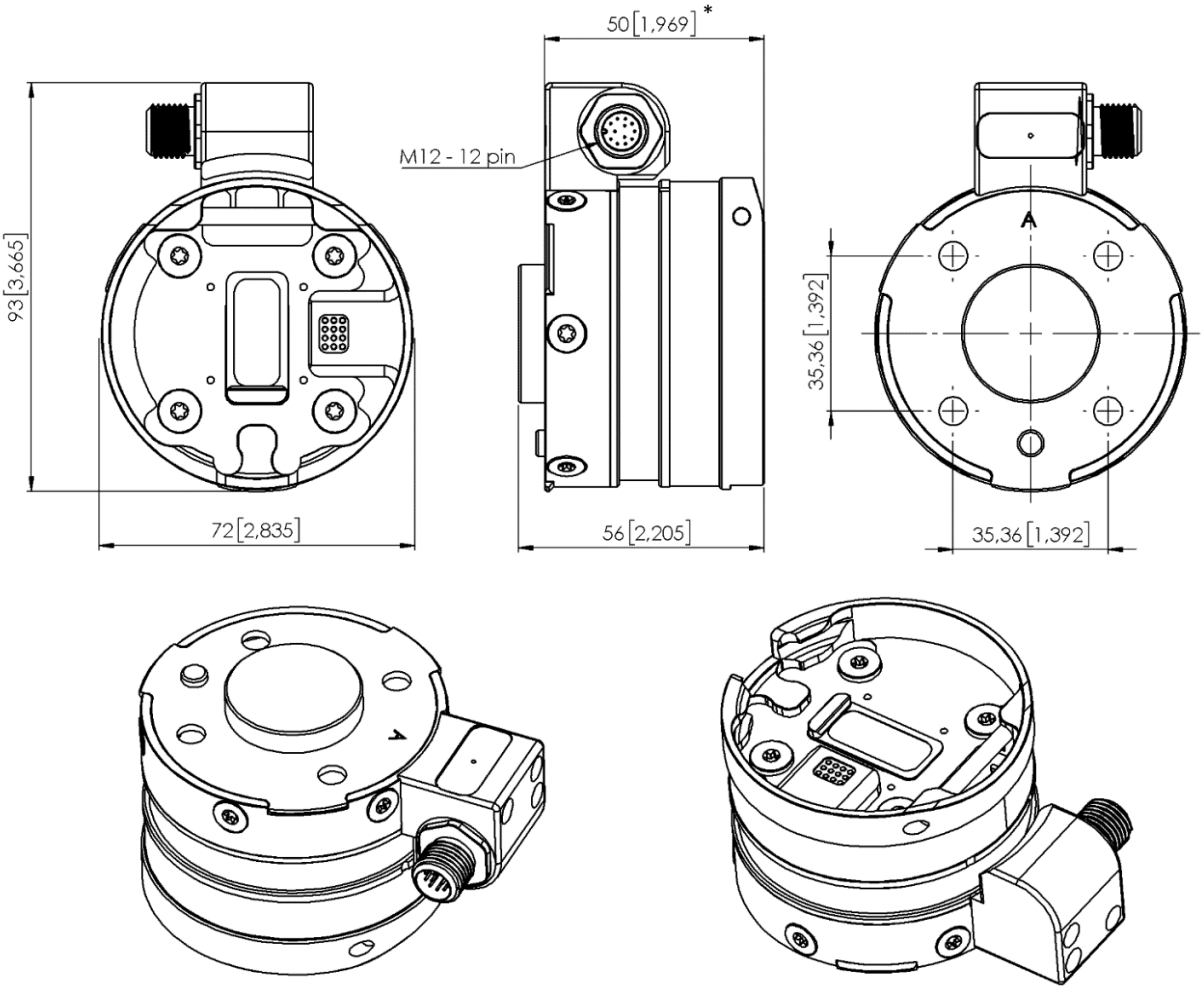
8.2.3.3. Dual Quick Changer



* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

8.2.3.4. HEX-E/H QC

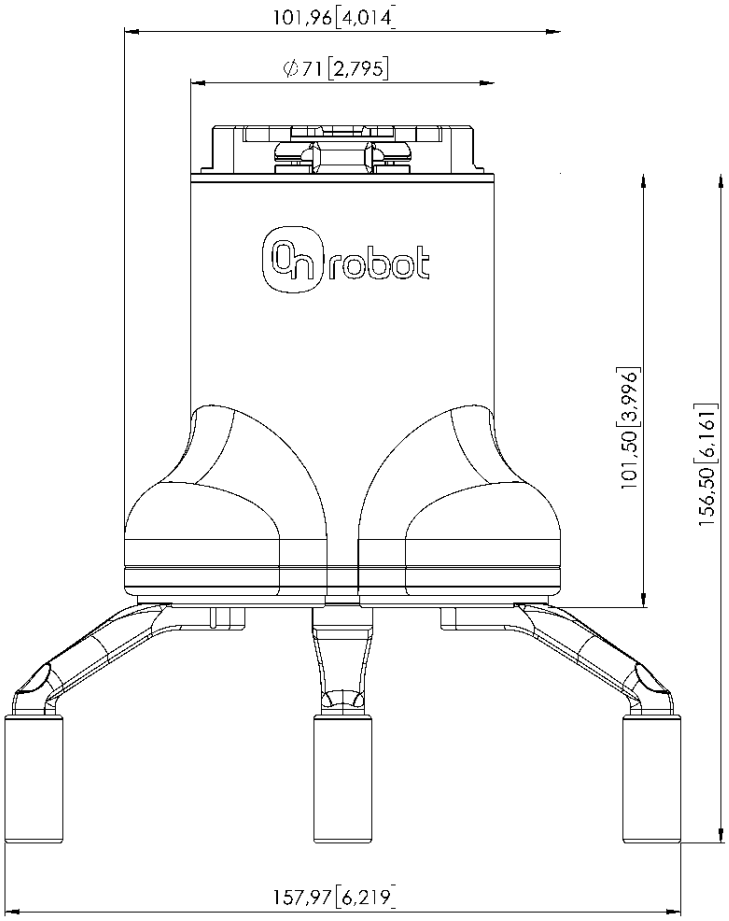


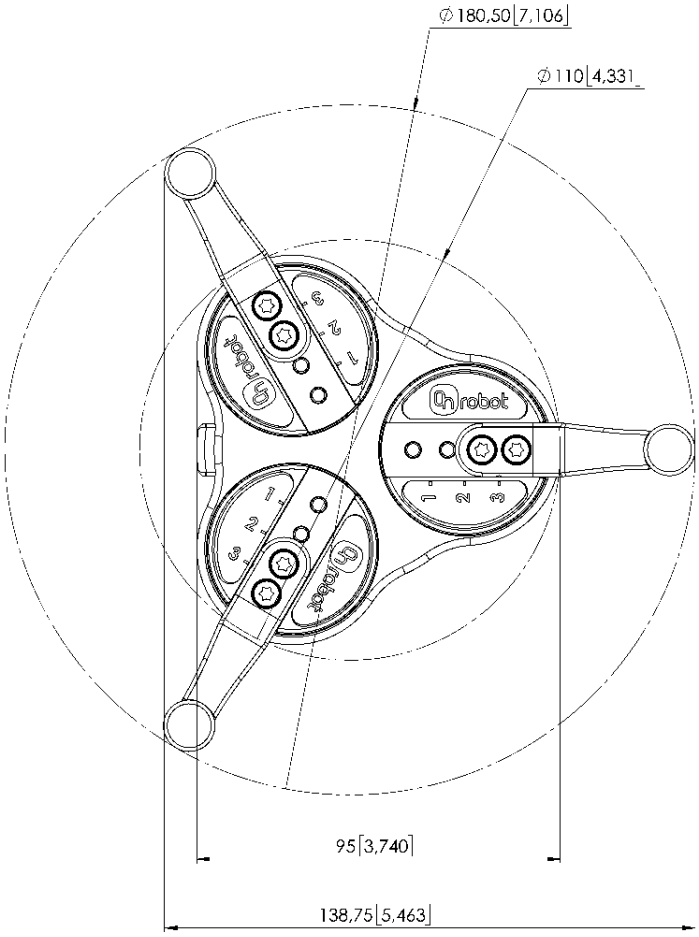
* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

8.2.4. Tools

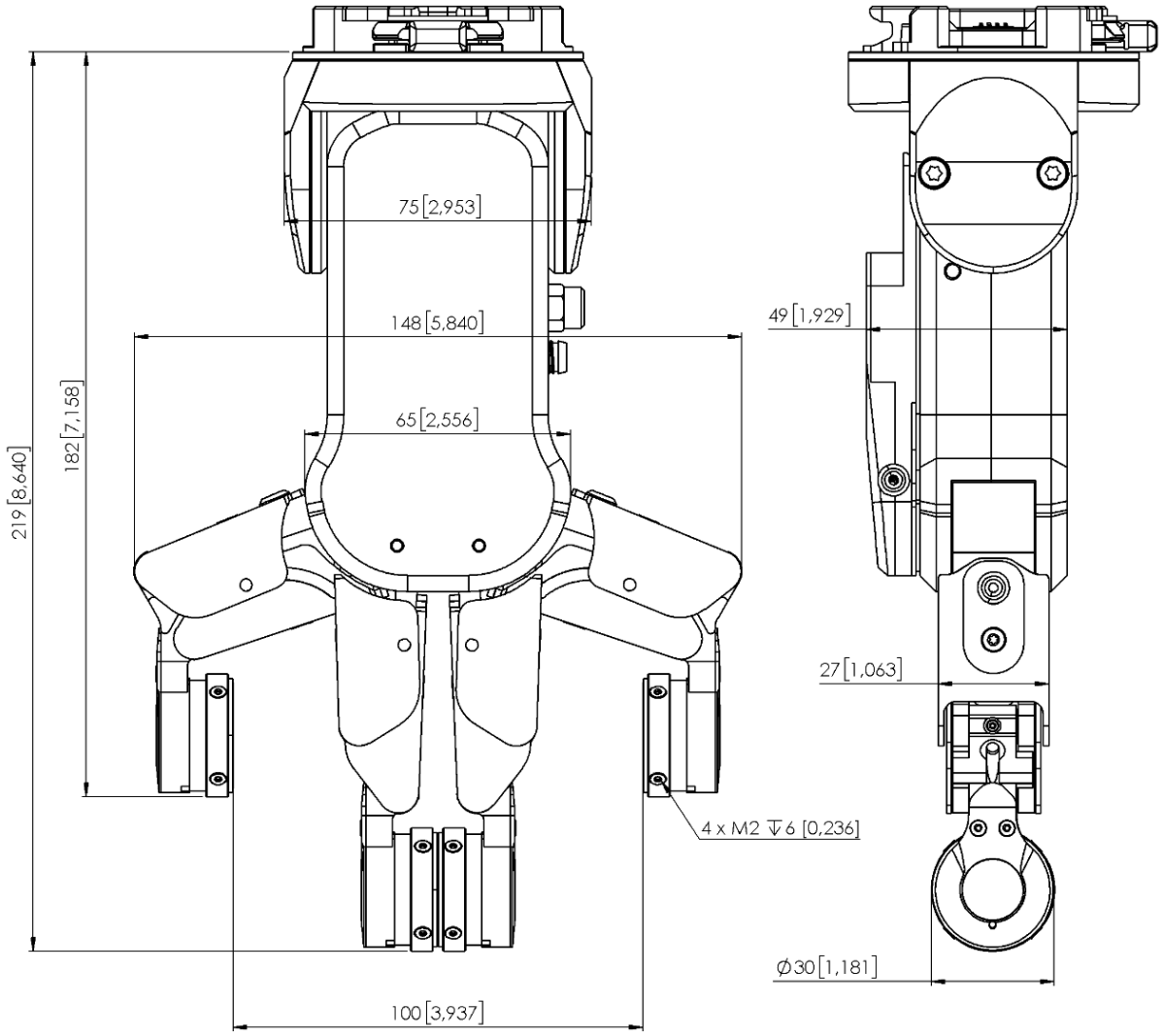
8.2.4.1. 3FG15





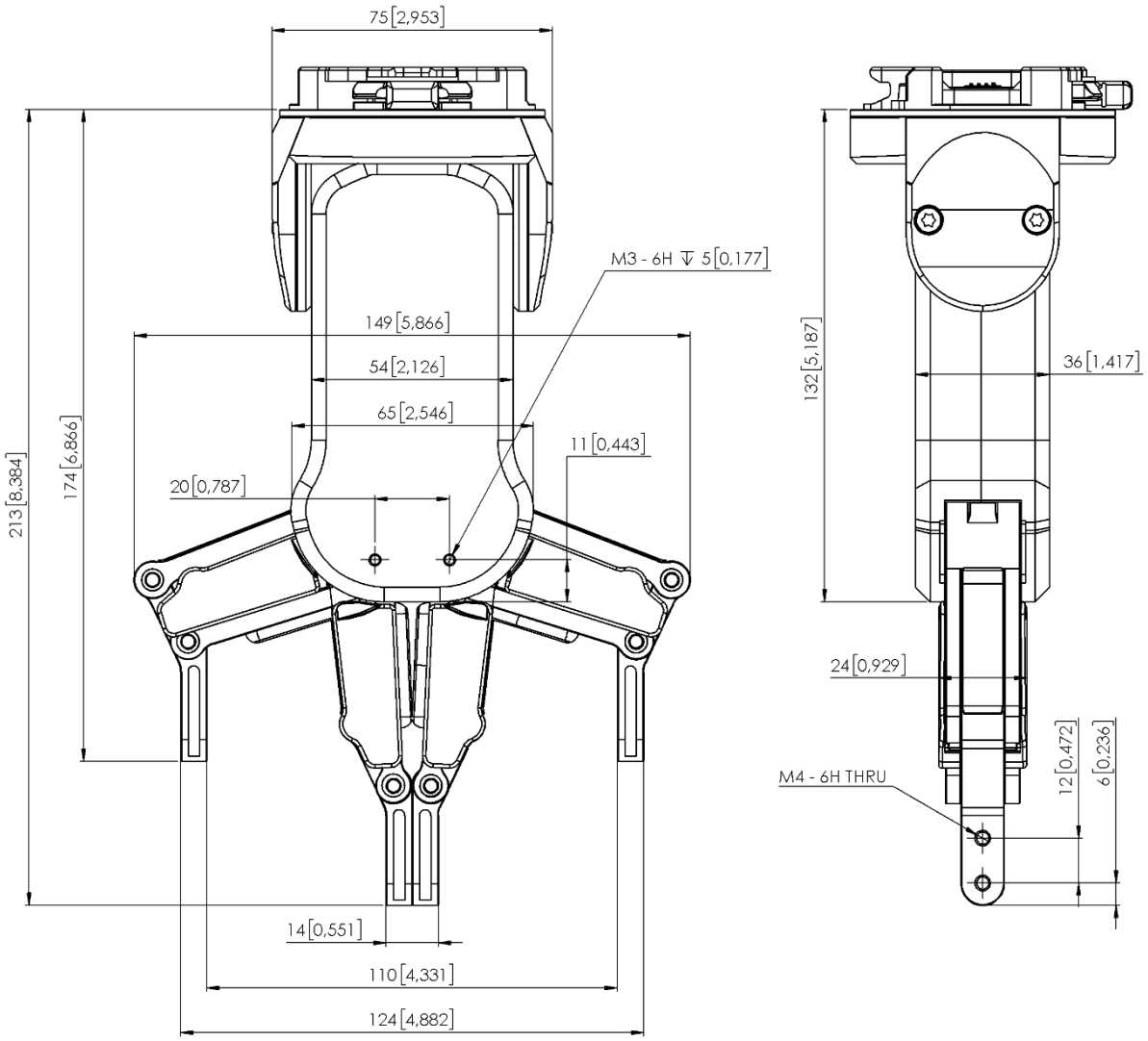
All dimensions are in mm and [inches].

8.2.4.2. RG2-FT



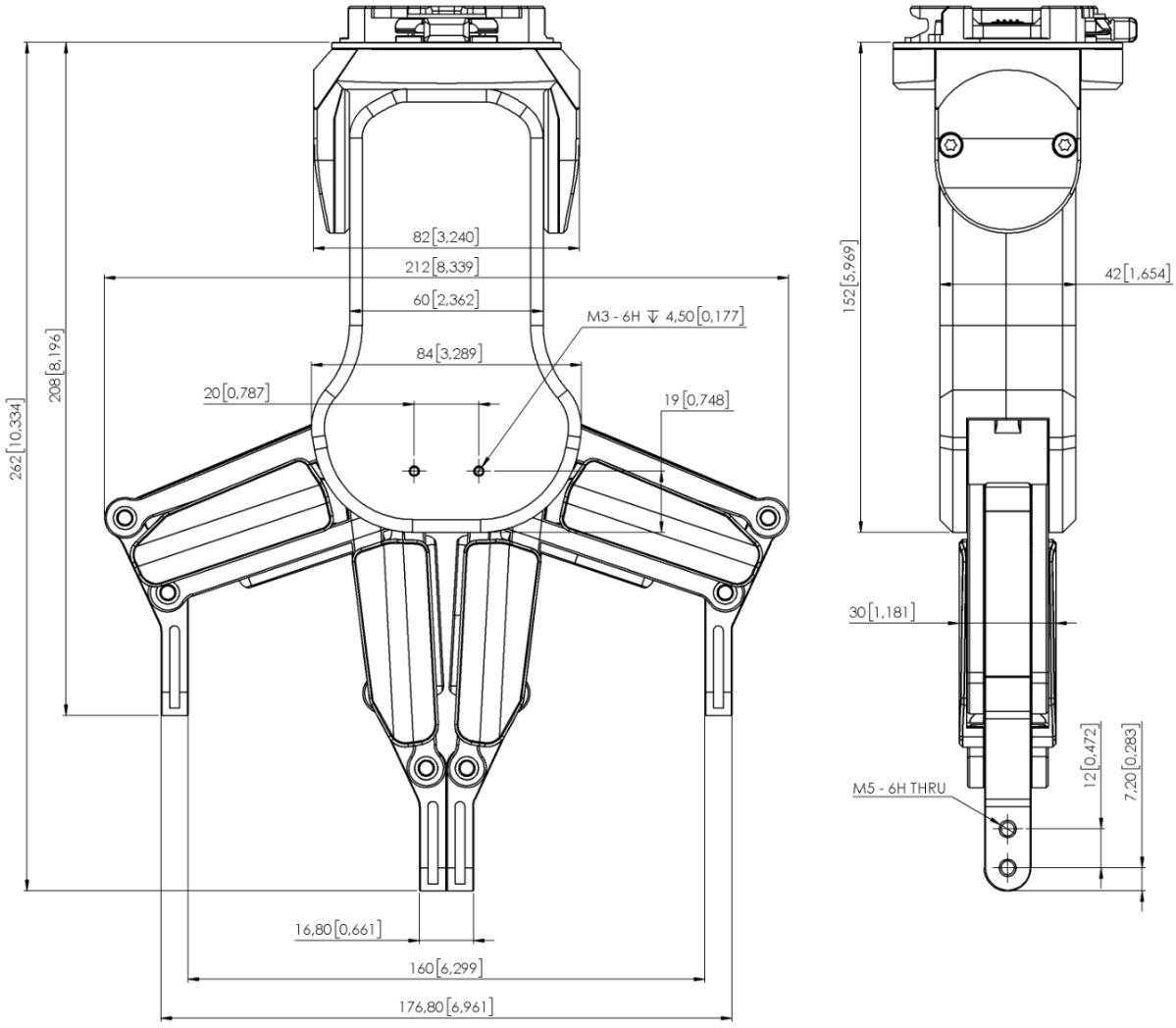
All dimensions are in mm and [inches].

8.2.4.3. RG2



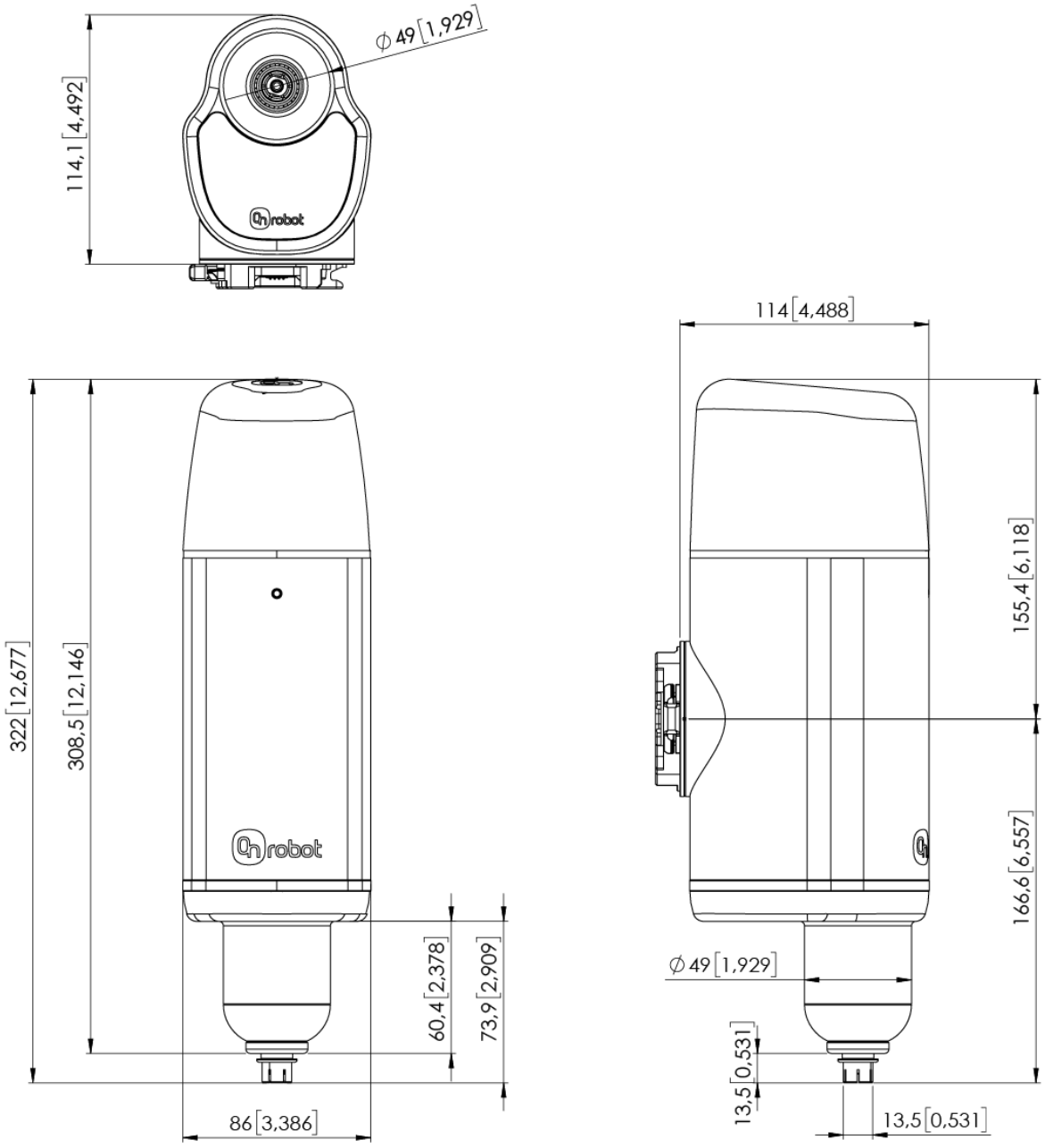
All dimensions are in mm and [inches].

8.2.4.4. RG6



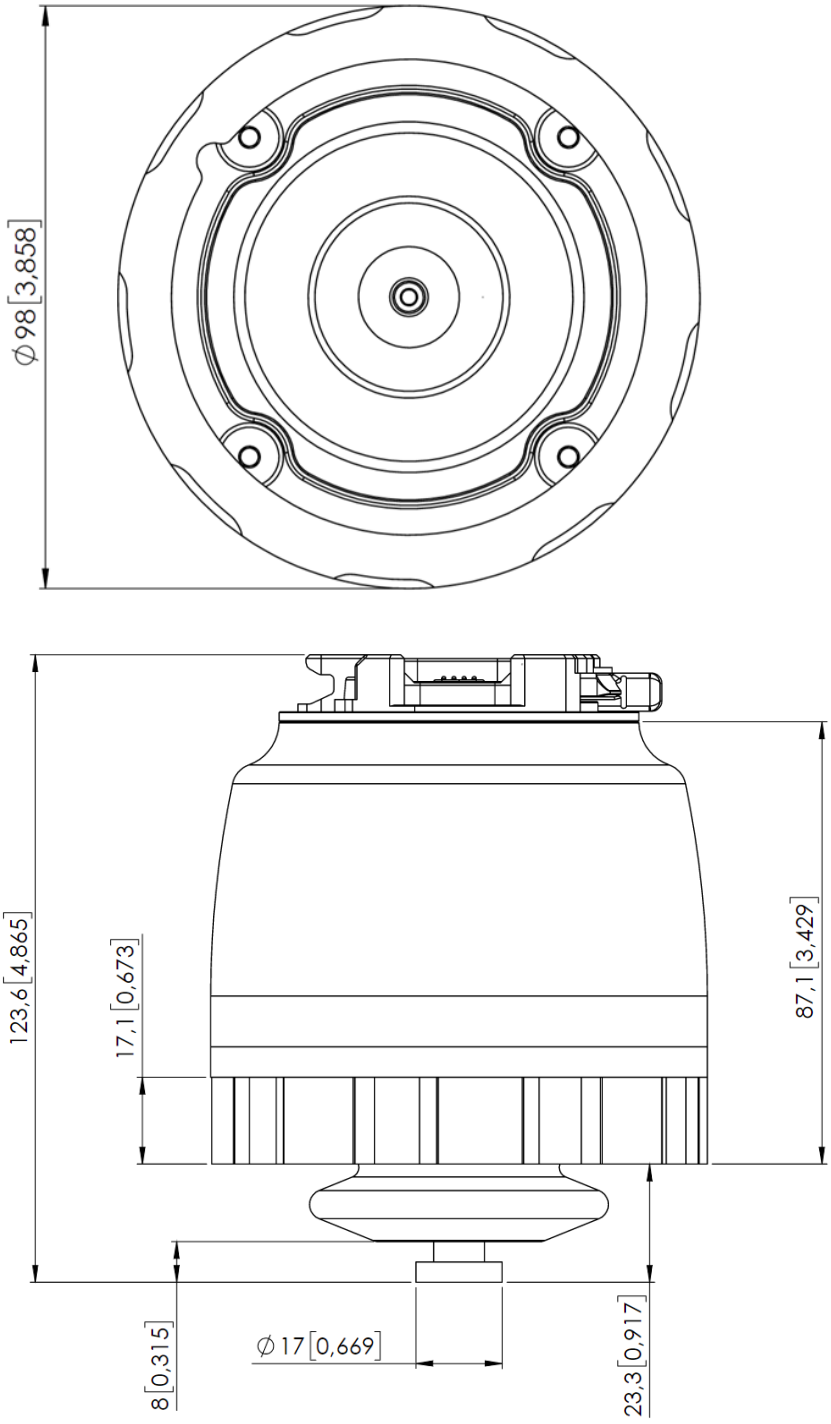
All dimensions are in mm and [inches].

8.2.4.5. Screwdriver



All dimensions are in mm and [inches].

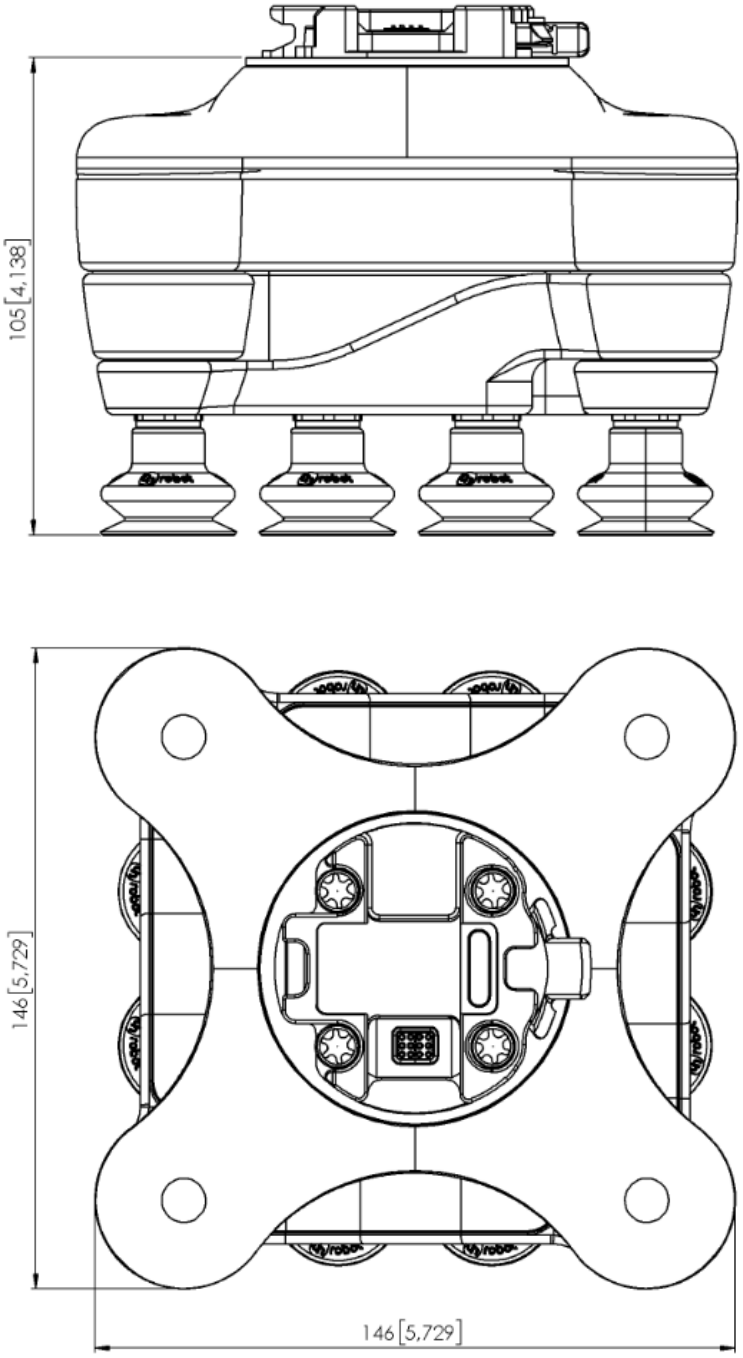
8.2.4.6. SG



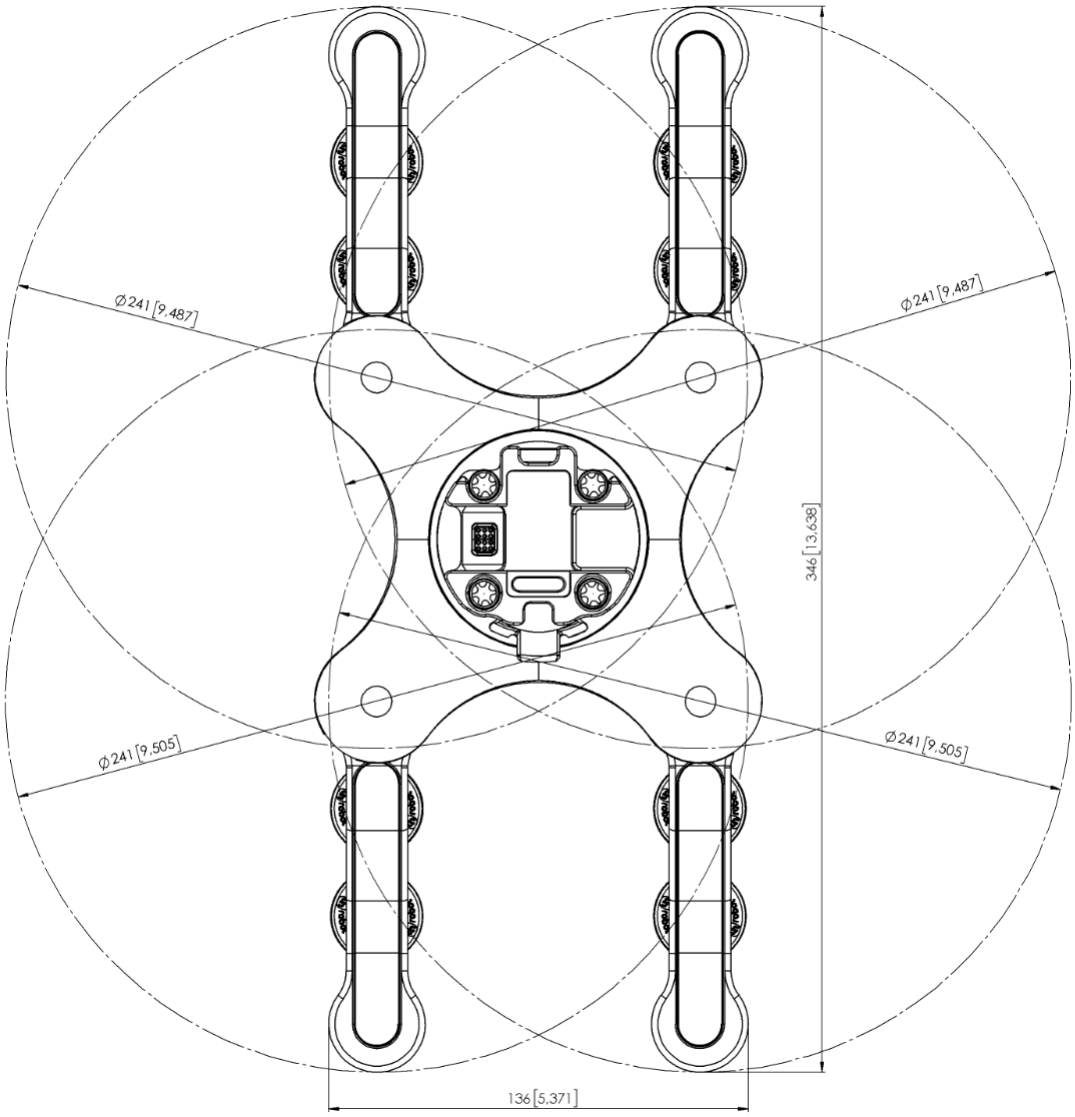
All dimensions are in mm and [inches].

The Silicone Tool parts - that are attached to the SG base part -, are described in the SG Datasheet.

8.2.4.7. VG10

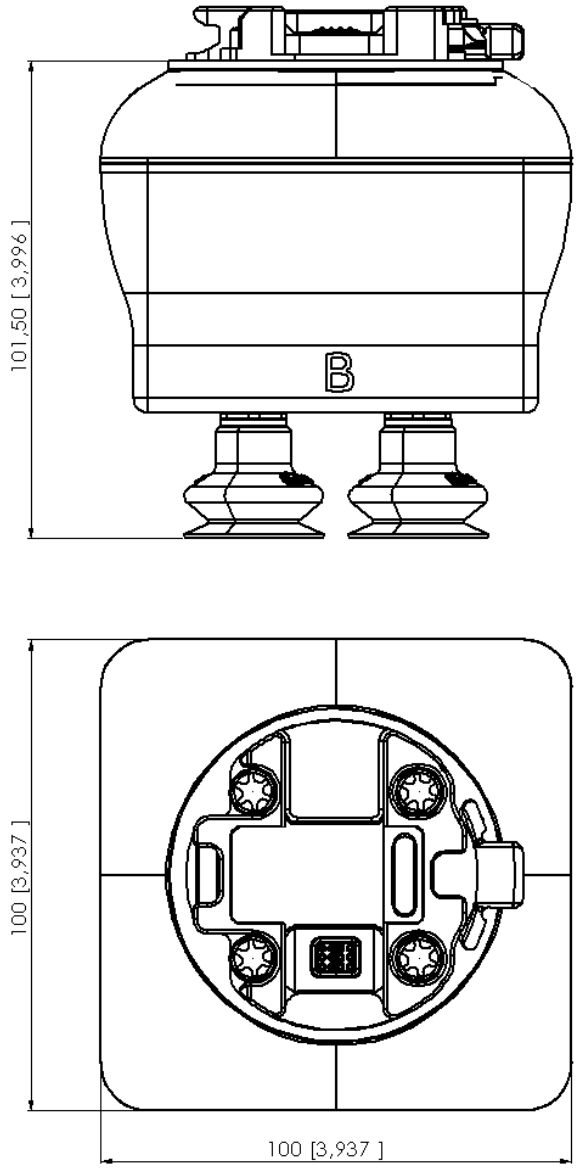


All dimensions are in mm and [inches].

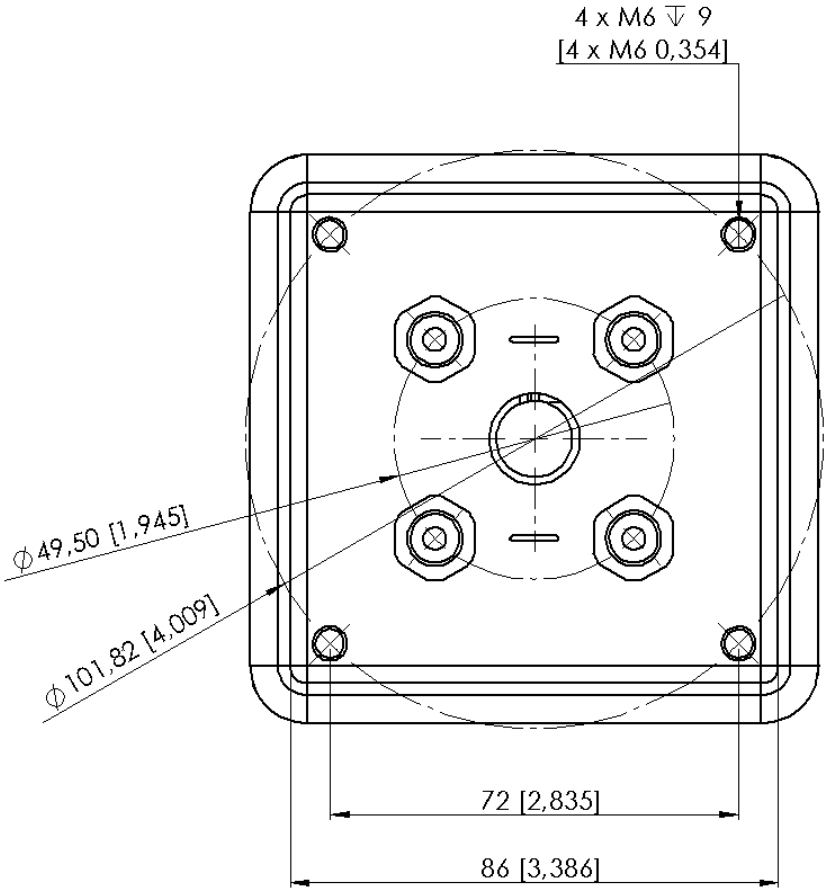


All dimensions are in mm and [inches].

8.2.4.8. VGC10

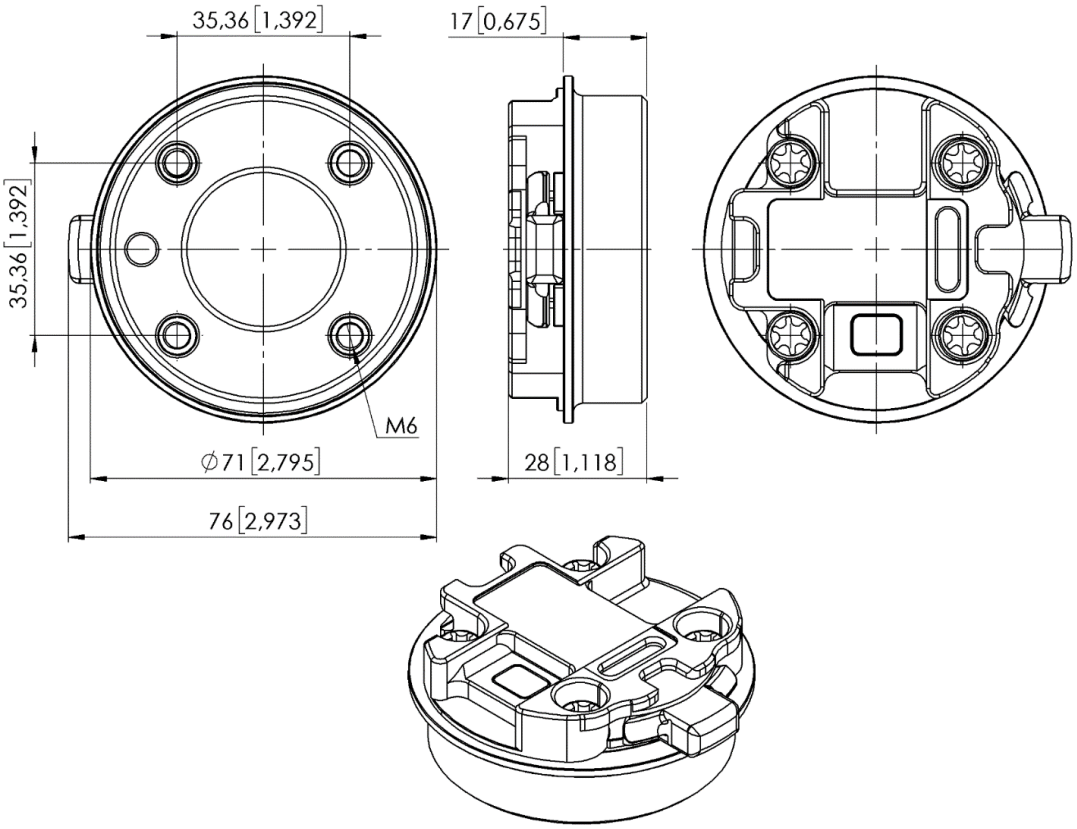


All dimensions are in mm and [inches].



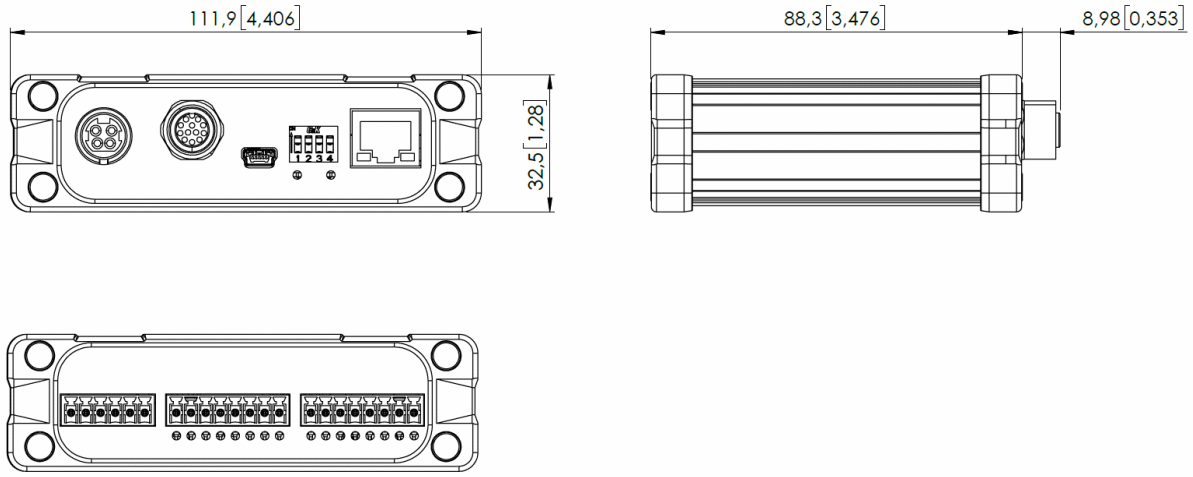
All dimensions are in mm and [inches].

8.2.4.9. Quick Changer - Tool Side



All dimensions are in mm and [inches].

8.2.4.10. Compute Box

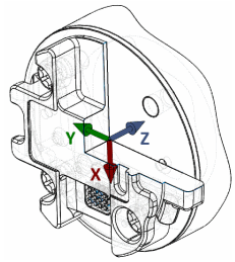


All dimensions are in mm and [inches].

8.3. COG, TCP

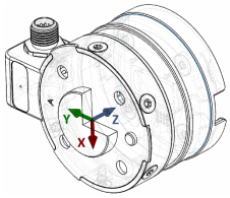
COG, TCP, and weight parameters of the single devices (without any mounting/adapter):

8.3.1. 3FG15

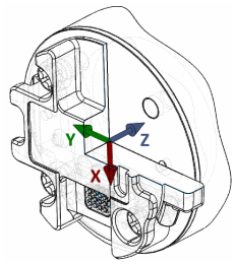
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=156	cX=0 cY=0 cZ=83	1.15 kg 2.5 lb

* With delivered fingers and 13.5 silicone fingertips on.

8.3.2. HEX-E/H QC

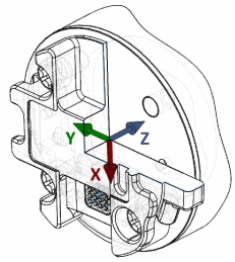
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=50	cX=0 cY=5 cZ=20	0.35 kg 0.77 lb

8.3.3. RG2-FT

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=205	cX=0 cY=0 cZ=65	0.98 kg 2.16 lb

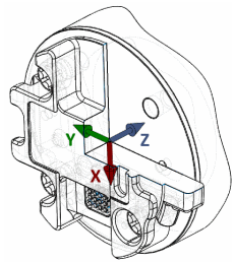
* Mounted at 0˚

8.3.4. RG2

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=200	cX=0 cY=0 cZ=64	0.78 kg 1.72 lb

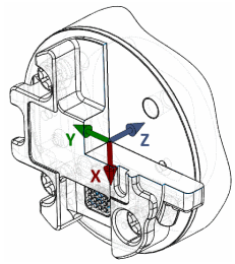
* Mounted at 0°

8.3.5. RG6

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=250	cX=0 cY=0 cZ=90	1.25 kg 2.76 lb

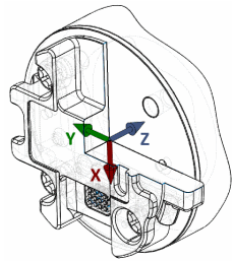
* Mounted at 0°

8.3.6. Screwdriver

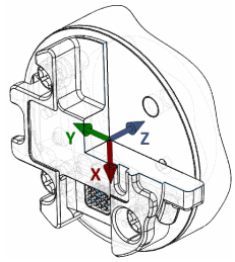
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=153 Y=0 Z=81	cX=0 cY=4 cZ=50	2.5 kg 5.51 lb

8.3.7. SG

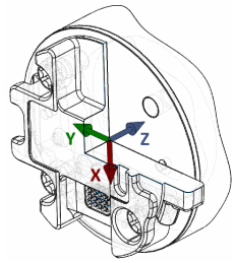
Without any Silicone Tool, only the SG Base Part with spindle in.

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=113	cX=-13 cY=-5 cZ=31	0.77 kg 1.69 lb

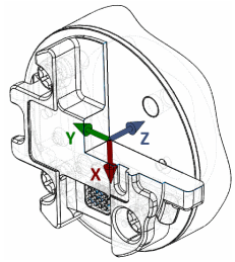
With Silicone Tool Type A on (SG-a-S/H).

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=154	cX=-12 cY=-5 cZ=45	0.932 kg 2.05 lb

With Silicone Tool Type B on (SG-b-H).

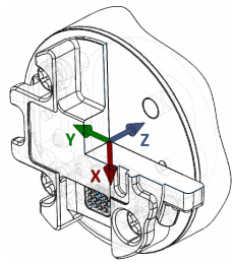
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=155	cX=-12 cY=-5 cZ=46	0.937 kg 2.06 lb

8.3.8. VG10

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=105	cX=15 cY=0 cZ=54	1.62 kg 3.57 lb

* With arms folded back

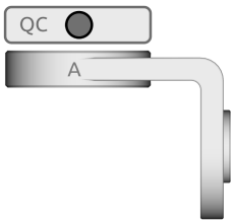
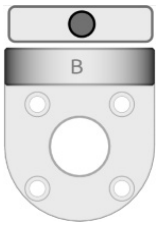
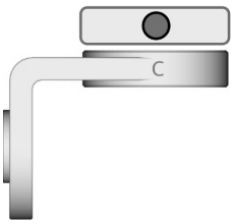
8.3.9. VGC10

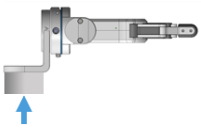
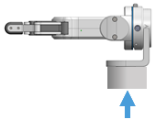
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=75	cX=-1 cY=-1 cZ=37	0.814 kg 1.79 lb

* With no attachments

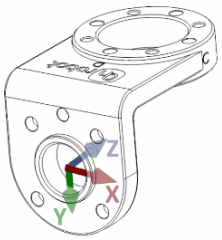
8.3.10. Angle Bracket

Options for mounting

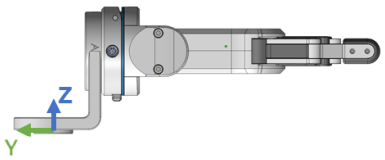
	Rotation of the QC and the tool - whether the QC connector points to A,B,C,D side of the Angle Bracket when mounted			
	A 	B 	C 	D

	Rotation of the QC and the tool - whether the QC connector points to A,B,C,D side of the Angle Bracket when mounted			
External mounting (QC and tool are mounted outward)  robot arm	Calculated (see below)	Not calculated but possible to use	Not calculated but possible to use	Not calculated but possible to use
Internal mounting (QC and tool are mounted inward)  robot arm	Calculated (see below)	Not calculated but possible to use	Not calculated but possible to use	Not possible to use

External mounting with QC connector on the A side

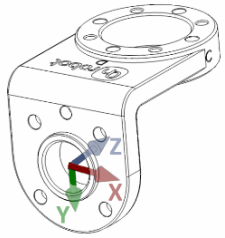
Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y= - 55 - (Tool Z value) Z=63 + (Tool Y value) RX=90° RY=0° RZ=0°	cX=0 cY= - 55 - (Tool Z value) cZ= 63 + (Tool Y value)	0.207 kg 0.456 lb

Example with an RG2 tool:

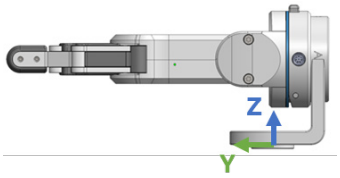


TCP [mm]	Center of Gravity [mm]
X=0 Y= - 55 - 200 = - 255 Z= 63 + 0 = 63 RX=90° RY=0° RZ=0°	cX=0 cY= - 55 - 64 = - 119 cZ= 63 + 0 = 63

Internal mounting with QC connector on the A side

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y= - 12 + (Tool Z value) Z= 63 - (Tool Y value) RX=90° RY=0° RZ=0°	cX=0 cY= - 55 - (Tool Z value) cZ= 63 + (Tool Y value)	0.207 kg 0.456 lb

Example with an RG2 tool:



TCP [mm]	Center of Gravity [mm]
X=0 Y= - 12 + 200 = 188 Z= 63 - 0 = 63 RX=90° RY=0° RZ=0°	cX=0 cY= -12 + 64 = 52 cZ=63 - 0 = 63

9. Maintenance

WARNING:

An overall inspection of the OnRobot's End of Arm Tooling must be performed regularly and at least once every 6 months. This inspection must include but is not limited to check for defective material and clean gripping surfaces.

Use original spare parts, and original service instructions for the OnRobot's End of Arm Tooling and the robot. Failure to comply with this precaution can cause unexpected risks, resulting in severe injury.

If you have questions regarding spare parts and repair, please visit our website **www.onrobot.com** to contact us.

9.1. 3FG15

WARNING:

Please check regularly the silicon fingertips since these parts can wear out.

If the fingertip is worn out , it can be ordered as spare part:

- Ø10 mm steel, PN 104160
- Ø13 mm steel, PN 104241
- Ø13.5 mm silicone, PN 104162
- Ø16.5 mm silicone, PN 104240

9.2. RG2/6

WARNING:

An overall inspection of the PLd CAT3 Safety Buttons must be performed regularly and at least once every 6 months.

9.3. RG2-FT

WARNING:

Please clean the proximity sensor surface regularly with low pressure compressed air (<5 bar) from a 5 cm distance. For stronger contamination use isopropyl alcohol with a soft cotton swab to keep it clean.

9.4. Screwdriver

Screw Fix and Bit

NOTE:

The screw fixes and bits are wear and tear parts, therefore they must be inspected regularly.

At a minimum, these parts must be inspected once a week or after 60.000 cycles.

If a screw fix is damaged due to misuse, it will be evident enough to be visually detected. In such cases, the screw fix must be replaced.

If the Pick Screw process is failing, this might be an indicator that the screw fix is worn or has been damaged. This is evident enough to be visually detected.

WARNING:

The Screw-bit system should be visually inspected every time the robot is reset or once per week, depending on application and use.

WARNING:

Check the inside of the screw bit holder regularly for debris. Make sure that the magnetic interface is clear from metal shavings and dirt.

Calibration

The Screwdriver has been calibrated at the factory to comply with the specifications stated in the technical sheet. A calibration report has been provided in the Screwdriver packaging.

If used according to recommended guidelines and conditions and maintained correctly, the Screwdriver performs according to these specifications across its lifetime.

In case an updated calibration report is required, please contact the vendor from where the Screwdriver has been purchased.

Spare Parts

- Bit holder A - Spare part kit 1 - PN 104197 (1 unit)
- Bit holder B - Spare part kit 2 - PN 104991 (1 unit)

The table below shows the Kit number and the Part Number of the spare part kits. These are composed of:

- Screw carrier (1 unit)
- Screw fixes (10 units and only for Din 912 / ISO 4762 / ASME B18.3 Hex Cylinder screws)
- Bits (10 units)

For example, the kit 3 - PN 105150 contains the following:

- 1x Screw carrier M1.6 for Din 912 / ISO 4762 screws

- 10x Screw fixes M1.6
- 10x H1.5 Bits

Screw carrier, (screw fix) and bit spare part kits Metric					
Screw Standard	Din 912 / ISO 4762	ISO 14579	ISO 14580	ISO 14581	DIN 7985A
Thread Size	Spare part kit number Part Number				
M1.6	Kit 3 PN 105150	N/A	N/A	N/A	N/A
M2	Kit 4 PN 105151	Kit 10 PN 105157	N/A	Kit 16 PN 105163	Kit 22 PN 105169
M2.5	Kit 5 PN 105152	Kit 11 PN 105158	N/A	Kit 17 PN 105164	Kit 23 PN 105170
M3	Kit 6 PN 105153	Kit 12 PN 105159	Kit 12 PN 105159	Kit 18 PN 105165	Kit 24 PN 105171
M4	Kit 7 PN 105154	Kit 13 PN 105160	Kit 13 PN 105160	Kit 19 PN 105166	Kit 25 PN 105172
M5	Kit 8 PN 105155	Kit 14 PN 105161	Kit 14 PN 105161	Kit 20 PN 105167	Kit 26 PN 105173
M6	Kit 9 PN 105156	Kit 15 PN 105162	Kit 15 PN 105162	Kit 21 PN 105168	Kit 27 PN 105174

Screw carrier, (screw fix) and bit spare part kits US Standard					
Screw Standard	ASME B18.3 Hex Cylinder	ASME B18.6.3 Cross recessed Button head	ASME B18.6.3 Torx Button head	ASME B18.3 Hex Counter sunk	ASME B18.6.3 Torx Counter sunk
Thread Size	Spare part - Part Number				
1#	PN 106310	N/A	N/A	N/A	N/A
2#	PN 106311	PN 106324	PN 106324	N/A	PN 106318
4#	PN 106313	PN 106329	PN 106329	PN 106319	PN 106319
6#	PN 106314	PN 106330	PN 106330	PN 106320	PN 106320
8#	PN 106315	PN 106331	PN 106331	PN 106321	PN 106321
10#	PN 106316	PN 106333	PN 106333	PN 106322	PN 106322
12#	N/A	PN 106334	PN 106334	N/A	N/A
1/4"	PN 106317	N/A	N/A	PN 106323	N/A

9.5. SG

For the SG Base Part

WARNING:

Please, clean the SG Base Part regularly by using a cloth and a cleaning agent with a pH value between 6-8.
When cleaning the SG Base Part please keep it mounted on the robot to prevent water getting into the connector.
After cleaning, use a cloth and clean water, to rinse of any leftover cleaning agent.
Please ensure that the used cleaning agent does not contain chlorine as this can lead to corrosion.

WARNING:

On a regular basis, check that the silicone bellow has not come loose from neither the aluminum base nor the Smart Lock male. If the bellow is not sitting correctly, this can lead to water seeping into the SG base part.

For the SG Tools

The silicone part and the smart lock female are dishwasher and autoclave safe, at temperatures =< 120°C (248°F).

Various cleaners can be used for cleaning the silicone part. Dish soap. Alcohol, regular ethanol, isopropanol and acetone works as well for cleaning.

Do not use concentrated acids and alkalis, since these can potentially damage the silicone, in particularly oxidizing acids such as sulfuric or nitric acid. It is recommended to use cleaning agent with a pH value between 2 and 13.

On a regular basis, please do a visual inspection of the smart-lock female and the ball spring. If needed clean it with a brush or cloth.

9.6. VG10/VGC10

The VG grippers are equipped with one filter for each suction cup socket, and one filter for the exhaust. How often the filters need to be changed depends on the nature of the work piece and the working environment. The VG grippers automatically de-dust the filters every time a grip is released. However, particles can eventually get stuck and build up inside the filter, lowering the VG grippers performance.

A filter service kit is available, which include both new filters and tools needed.

- Filter service kit for VG10, PN 100064
- Filter service kit for VGC10, PN 103757

Neither use nor power on the VG grippers without filters. Dust, hair and larger particles can get stuck in pump membranes and valve seats, causing permanent damage to the VG grippers.

DANGER:

Identify how often the filters need service and schedule maintenance with a fixed period short enough to ensure a firm grip at all times.

An overall inspection of the VG grippers must be performed regularly and at least once every 6 months.

Never power the VG grippers without filters or with filters mounted incorrectly. Failure to comply with this precaution can cause irreversible failure of pump or valves.

10. Troubleshooting

If an error occurs during operation, try the following:

1. Restart the robot and check the functionality.
2. If the error is still present, contact the distributor from where the product has been purchased.

11. Warranties

11.1. Patents

Products of OnRobot A/S are protected by several patents; some still in global publication process (Patents pending). All manufacturers of copies and similar products violating any patent claims will be prosecuted.

11.2. Product Warranty

Without prejudice to any claim the user (customer) may have in relation to the dealer or retailer, the customer shall be granted a manufacturer's warranty under the conditions set out below:

In the case of new devices and their components exhibiting defects resulting from manufacturing and/or material faults within 12 months of entry into service (maximum of 15 months from shipment), OnRobot A/S shall provide the necessary spare parts, while the customer (user) shall provide working hours to replace the spare parts, either replace the part with another part reflecting the current state of the art, or repair the said part. This warranty shall be invalid if the device defect is attributable to improper treatment and/or failure to comply with information contained in the user guides. This warranty shall not apply to or extend to services performed by the authorized dealer or the customer themselves (e.g. installation, configuration, software downloads). The purchase receipt, together with the date of purchase, shall be required as evidence for invoking the warranty. Claims under the warranty must be submitted within two months of the warranty default becoming evident. Ownership of devices or components replaced by and returned to OnRobot A/S shall vest in OnRobot A/S. Any other claims resulting out of or in connection with the device shall be excluded from this warranty. Nothing in this warranty shall attempt to limit or exclude a customer's statutory rights nor the manufacturer's liability for death or personal injury resulting from its negligence. The duration of the warranty shall not be extended by services rendered under the terms of the warranty. Insofar as no warranty default exists, OnRobot A/S reserves the right to charge the customer for replacement or repair. The above provisions do not imply a change in the burden of proof to the detriment of the customer. In case of a device exhibiting defects, OnRobot A/S shall not be liable for any indirect, incidental, special or consequential damages, including but not limited to, lost profits, loss of use, loss of production or damage to other production equipment.

In case of a device exhibiting defects, OnRobot A/S shall not cover any consequential damage or loss, such as loss of production or damage to other production equipment.

11.3. Disclaimer

OnRobot A/S continues to improve reliability and performance of its products, and therefore reserves the right to upgrade the product without prior warning. OnRobot A/S ensures that the content of this manual is precise and correct but takes no responsibility for any errors or missing information.

12. Certifications

intertek
Total Quality. Assured.

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

OnRobot A/S

Main Site: Teglværksvej 47 H, 5220 Odense SØ, Denmark
Chamber of Commerce: 36492449

Additional Site: OnRobot A/S, Cikorievej 44, 5220 Odense SØ, Denmark

has been registered by Intertek as conforming to the requirements of

ISO 9001:2015

The management system is applicable to:

Development and sales of End-of-Arms tools for industrial customers worldwide.

Certificate Number:
0096721

Initial Certification Date:
26 November 2019

Date of Certification Decision:
26 November 2019

Issuing Date:
26 November 2019

Valid Until:
25 November 2022

ISO 9001:2015 CERTIFICATION ™
Intertek

SWEDAC ACKREDITERING
Accred. no. 1639
Certification of Management Systems
ISO/IEC 17021-1

Carl-Johan von Plomgren
MD, Business Assurance Nordics

Intertek Certification AB
P.O. Box 1103, SE-164 22 Kista, Sweden

In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartphone.

The certificate remains the property of Intertek, to whom it must be returned upon request.

12.1. Compute Box / Eye Box

Assessment no. 120-23225-A1

Assessment holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Controllers: Compute box, Eye Box.
Power Supplies: VER36U240-JA, VES120PS24.
Mountings: Dual QC V2 (101788), HEX-E QC (102111), HEX-H QC (102376), QC-R (102037), QC-R 4,5 A (104277).
Tools: 3FG15 (103666), OnRobot Eyes (103903), RG2 (102012), RG2-FT (102075), RG6 (102021), Screwdriver (103961), Soft Gripper (103546), VG10 (101661), VGC10 (102844).

FORCE Technology test reports

117-29737, 118-33022, 119-29901-1, 119-29901-2, 119-29901-3, 119-31690-1, 120-21521-1, 120-22174-1, 120-23225-1.

Other technical documentation

FORCE Technology assessments 118-33022-A1, 119-29901-A1, 19-31690-A1, 119-35885-A1, 119-35885-A1, 119-35885-A2, 120-21521-A1, 120-22174-A1.
E-mail from OnRobot to FORCE Technology, dated 22 May 2020, explaining the difference between HEX-E (102111) and HEX-H (102376).

Conclusion

By the above listed FORCE Technology test reports the above listed products have been found to be in conformity with the below listed normative references 1.
By the test reports 118-33022, 119-29901-2 and assessment 118-33022-A1, the tools RG2 (102012) and RG6 (102021) have additionally been found to be in conformity with the below listed Standard list no. 2.
FORCE Technology has assessed the test reports, the technical documentation and the information of the e-mail dated 22 May 2020. Based on this assessment FORCE Technology can conclude all possible combinations of the above listed products are also in conformity with the below listed Standards list no. 1.

Standards list no. 1:

IEC 61000-3-2:2014	EMC Directive 2014/30/EU, Article 6
IEC 61000-3-3:2013	EN 61000-3-2:2014
IEC 61000-6-2:2016	EN 61000-3-3:2013
IEC 61000-6-4:2006/AMD1:2010	EN 61000-6-2:2005/AC:2005
IEC 61000-6-4:2018	EN 61000-6-2:2019
	EN 61000-6-4:2007/A1:2011
	EN 61000-6-4:2019

Standard list no. 2: (applicable specifically to RG2 (102012) and RG6 (102021))
IEC 61326-3-1:2017, Industry locations, SIL 2

Signature

Knud A. Baltsen
Digitally signed by Knud A. Baltsen
Date: 2020.06.16 19:41:00 +02'00'

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

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12.2. 3FG15

Attestation of Conformity no. 120-21521-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Robot tool: Three finger gripping tool 3FG15 (103666).

Manufacturer

OnRobot A/S

Technical documentation

FORCE Technology test report 120-21521-1.

Standards/Normative documents

IEC 61000-3-2:2014
IEC 61000-3-3:2013
IEC 61000-6-2:2016
IEC 61000-6-4:2006/AMD1:2010

EMC Directive 2014/30/EU, Article 6
EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61000-6-2:2005/Corr.:2005
EN 61000-6-4:2007/A1:2011

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
Digitally signed by Knud A. Baltsen
Date: 2020.03.30 19:48:21 +02'00'

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

12.3. RG2

Attestation of Conformity no. 118-33022-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Gripper RG2 2.0

Manufacturer

OnRobot A/S

Technical documentation

FORCE Technology Test Report 117-29737, dated 01 September 2017
FORCE Technology Assessment Sheet 1668, dated 17 October 2017
FORCE Technology Test Report 118-33022-2 Rev. 1, dated 06 February 2019
FORCE Technology Assessment 118-33022-A1, dated 21 February 2019

Standards/Normative documents

IEC 61000-6-2:2005	EMC Directive 2014/30/EU, Article 6
IEC 61000-6-4:2006 + A1:2010	EN 61000-6-2:2005 + AC:2005
IEC 61326-3-1:2017, Industrial locations, SIL 2	EN 61000-6-4:2007 + A1:2011
FCC Part 15B, Class A	EN 61326-3-1:2017, Industrial locations, SIL 2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
2019-02-21
Digitally signed by Knud A. Baltsen
kab@force.dk
Senior Specialist

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

GTS ADVANCED TECHNOLOGY GROUP

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Tel.+45 43 25 14 00
Fax

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+47 64 00 35 01
info@forcetechnology.no

FORCE Technology Sweden AB
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+46 (0)21-490 3001
info@forcetechnology.se

FORCE Technology
Park Allé 345
2605 Brøndby, Denmark
+45 43 25 00 00
+45 43 25 00 10
info@forcetechnology.dk
www.forcetechnology.com

12.4. RG2 / RG6

TÜV NORD

ZERTIFIKAT
CERTIFICATE

Hiermit wird bescheinigt, dass die Firma / *This certifies that the company*

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

berechtigt ist, das unten genannte Produkt mit dem abgebildeten Zeichen zu kennzeichnen
is authorized to provide the product mentioned below with the mark as illustrated

Fertigungsstätte:
Manufacturing plant:
OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Beschreibung des Produktes:
(Details s. Anlage 1)
Description of product:
(Details see Annex 1)
Safety Gripper for collaborative robots
RG2 v2 and RG6 v2

TÜV NORD
TÜV NORD CERT GmbH
Type Tested

Geprüft nach:
Tested in accordance with:
EN ISO 13849-1:2015 Cat. 3, PL ‚d'

Registrier-Nr. / *Registered No.* 44 780 18106002
Prüfbericht Nr. / *Test Report No.* 3523 2689
Aktenzeichen / *File reference* 8000489144

Gültigkeit / Validity
von / *from* 2019-06-04
bis / *until* 2024-06-03

Zertifizierungsstelle der
TÜV NORD CERT GmbH

Essen, 2019-06-04

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de technology@tuev-nord.de

Bitte beachten Sie auch die umseitigen Hinweise
Please also pay attention to the information stated overleaf

12.5. RG6

Attestation of Conformity no. 118-33022-A2

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Gripper RG6 2.0

Manufacturer

OnRobot A/S

Technical documentation

FORCE Technology Test Report 117-29737, dated 01 September 2017
FORCE Technology Assessment Sheet 1668, dated 17 October 2017
FORCE Technology Test Report 118-33022-2 Rev. 1, dated 06 February 2019
FORCE Technology Assessment 118-33022-A1, dated 21 February 2019

Standards/Normative documents

	EMC Directive 2014/30/EU, Article 6
IEC 61000-6-2:2005	EN 61000-6-2:2005 + AC:2005
IEC 61000-6-4:2006 + A1:2010	EN 61000-6-4:2007 + A1:2011
IEC 61326-3-1:2017, Industrial locations, SIL 2	EN 61326-3-1:2017, Industrial locations, SIL 2
FCC Part 15B, Class A	

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
2019-02-21
Digitally signed by Knud A. Baltsen
kab@force.dk
Senior Specialist

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

GTS ADVANCED TECHNOLOGY GROUP

FORCE Technology
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Park Allé 345
2605 Brøndby, Denmark
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www.forcetechnology.com

12.6. Screwdriver

Attestation of Conformity no. 120-23225-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Screwdriver (103961), QC-R 4,5 A (104277), VES120PS24 (Power supply).

Manufacturer

OnRobot A/S

Technical documentation

FORCE Technology test report 120-23225-1.

Standards/Normative documents

IEC 61000-3-2:2014	EMC Directive 2014/30/EU, Article 6
IEC 61000-3-3:2013	EN 61000-3-2:2014
IEC 61000-6-2:2016	EN 61000-3-3:2013
IEC 61000-6-4:2006/AMD1:2010	EN 61000-6-2:2005/AC:2005
	EN 61000-6-4:2007/A1:2011

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
Digitally signed by Knud A. Baltsen
Date: 2020.06.17 11:12:34 +02'00'

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

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2970 Hørsholm, Denmark
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+45 43 25 00 10
info@forcetechnology.dk

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1395 Hvalstad, Norway
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+47 64 00 35 01
info@forcetechnology.no

FORCE Technology
Park Allé 345
2605 Brøndby, Denmark
+45 43 25 00 00
+45 43 25 00 10
info@forcetechnology.dk

12.7. SG

Attestation of Conformity no. 119-31690-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
DENMARK

Product identification

Compute box with Power Supply Unit (PSU) VER36U240-JA.
Mounting: Quick Changer HEX-E QC V3 (101904).
Robot Tool: Soft Gripper (103546).

Manufacturer

OnRobot A/S

Technical documentation

Test report. 119-31690-1

Standards/Normative documents

IEC 61000-3-2:2014
IEC 61000-3-3:2013
IEC 61000-6-2:2016
IEC 61000-6-4:2018

EMC Directive 2014/30/EU, Article 6
EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61000-6-2:2005
EN 61000-6-2:2019
EN 61000-6-4:2007 + A1:2011

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Johan Weisbjerg
2020-01-24

Digitally signed by Johan Weisbjerg
jow@force.dk
Technician

Signed by: Johan Weisbjerg, Specialist, Product Compliance

12.8. SG-x-H

DECLARATION OF CONFORMITY

According to Regulation (EC/EU) No.1935/2004 Article 3, it is required that food contact articles "*must be sufficient inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties*".

This document stands to certify that all OnRobot SG-x-H materials, intended for food contact complies with:

1. Europe:

   Regulation (EC/EU) No. 1935/2004 and national provisions (Article 6). The materials of SG Tools are suitable for food contact, materials and articles under article 3 of the before mentioned egulation. Compliance with the, requirements of Regulation (EC/EU) No.1935/2004 for the food contact material or article, concerning any limitations in particular max. use limits or limits on migration or extraction, the effect on taste and smell of the food and the suitability of the article for the specific use must be in compliance with the recommendations of the BfR.

   See results next page.

2. USA:

   FDA 21 CFR 177.2600 "*Rubber articles intended for repeated use in contact with food*".

   Tested and approved for use on non-fatty food objects.

   See results next page.

The above product is also produced according to EC regulation 2023/2006 "*Good manufacturing practice for materials and articles intended to come into contact with food*" and is subject to control by the Danish food and health authorities.

To the best knowledge of the manufacturer, that the information presented in this certificate, is correct as of date of the declaration. It is the responsibility of the end-user to ensure that the status of the regulation is still in effect at the date of use.

Odense, April 6th, 2020

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

Results

The materials and color additive have been tested for extraction and migration limits by an independent testing organization (Eurofins Product Testing A/S. Accreditation number 522)

Sensory Analysis:

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1.5 (Just recognizable to slight deviation, chemical)	2.5
Taste	Water	2.5 (Slight to intense deviation, chemical and flavoured)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	5 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch^2]	Limit Value [mg/inch^2]
Water-extracted residue after 7 hours	0.19	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

12.9. SG-x-S

DECLARATION OF CONFORMITY

According to Regulation (EC/EU) No.1935/2004 Article 3, it is required that food contact articles "*must be sufficient inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties*".

This document stands to certify that all OnRobot SG-x-S materials, intended for food contact complies with:

1. Europe:

   Regulation (EC/EU) No. 1935/2004 and national provisions (Article 6). The materials of SG Tools are suitable for food contact, materials and articles under article 3 of the before mentioned egulation. Compliance with the, requirements of Regulation (EC/EU) No.1935/2004 for the food contact material or article, concerning any limitations in particular max. use limits or limits on migration or extraction, the effect on taste and smell of the food and the suitability of the article for the specific use must be in compliance with the recommendations of the BfR.

   See results next page.

2. USA:

   FDA 21 CFR 177.2600 "*Rubber articles intended for repeated use in contact with food*".

   Tested and approved for use on non-fatty food objects.

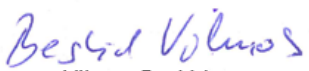
   See results next page.

The above product is also produced according to EC regulation 2023/2006 "*Good manufacturing practice for materials and articles intended to come into contact with food*" and is subject to control by the Danish food and health authorities.

To the best knowledge of the manufacturer, that the information presented in this certificate, is correct as of date of the declaration. It is the responsibility of the end-user to ensure that the status of the regulation is still in effect at the date of use.

Odense, April 6th, 2020

Group Management



Vilmos Beskid
CTO

Results

The materials and color additive have been tested for extraction and migration limits by an independent testing organization (Eurofins Product Testing A/S. Accreditation number 522)

For the Hard Part

Sensory Analysis:

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1.5 (Just recognizable to slight deviation, chemical)	2.5
Taste	Water	2.5 (Slight to intense deviation, chemical and flavoured)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	5 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch^2]	Limit Value [mg/inch^2]
Water-extracted residue after 7 hours	0.19	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

For the Soft Part

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1 (Just recognizable to slight deviation, chemical)	2.5
Taste	Water	1 (Slight to intense deviation, chemical and flavoured)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	10 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch^2]	Limit Value [mg/inch^2]
Water-extracted residue after 7 hours	1.5	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

12.10. Declaration of Incorporation

12.10.1. 3FG15

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	3FG15
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, February 14th, 2020

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

12.10.2. HEX-E

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-E QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

12.10.3. HEX-H

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-H QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

12.10.4. RG2

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	RG2
Generation:	V2
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

12.10.5. RG2-FT

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	RG2-FT
Generation:	V2
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

12.10.6. RG6

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	RG6
Generation:	V2
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

12.10.7. Screwdriver

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Robotic Screwdriver
Model:	OnRobot Screwdriver
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)
ANSI/ESD SP10.1-2007 – For the Protection of Electrostatic Discharge Susceptible Items – Automated Handling Equipment (AHE)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, Jun 6th, 2020

Group Management

Vilmos Beskid
CTO

12.10.8. SG

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	SG
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Odense, April 6th, 2020

Group Management

Vilmos Beskid
CTO

12.10.9. VG10

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	VG10
Generation:	V2
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

12.10.10. VGC10

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	VGC10
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Beskid Vilmos

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