USER MANUAL

FOR **UR** ROBOTS

ORIGINAL INSTRUCTION (EN)

v1.03

Contents

Contents **2**

1 Introduction **4**
1.1 Important Safety Notice 4
1.2 Scope of the Manual 4
1.3 Naming convention 4
1.4 How to read the Manual 5

2 Safety **6**
2.1 Intended Use 6
2.2 General Safety Instructions 7
2.3 Risk Assessment 8
2.4 Environmental Safety 8
2.5 PLd CAT3 Safety Function 9

3 Operation mode(s) **11**

4 Installation **12**
4.1 Overview 12
4.2 Mounting 12
4.2.1 Quick Changer options 13
4.2.2 Tools 15
4.3 Wiring 20
4.3.1 Tool data cable 21
4.3.2 Ethernet cable 23
4.3.3 Power supply 23
4.4 Software setup 25
4.4.1 Install URCap 25
4.4.2 Uninstall software 27
4.4.3 URCap setup 30

5 Operation **47**
5.1 URCap commands 48
5.2 URCap toolbar 94
5.2.1 How to access the toolbar 94
5.3 URScript commands 105
5.4 TCP Configuration 107
5.5 Return Values 112
5.6 Feedback variables 113

6 Additional Software Options **116**
6.1 Compute Box 116
6.1.1 Interfaces 116
6.1.2 Web Client 116

7 Hardware Specification 135
7.1 Technical sheets 135
7.2 Mechanical Drawings 161
7.2.1 Adapter plate(s) 161
7.2.2 Mountings 161
7.2.3 Tools 165
7.3 Center of Gravity 172

8 Maintenance 173

9 Warranties 176
9.1 Patents 176
9.2 Product Warranty 176
9.3 Disclaimer 176

10 Certifications 177

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:

Grippers	Version
Gecko Gripper	v2
RG2	v2
RG2-FT	v2
RG6	v2
VG10	v2

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.

1.3 Naming convention

In the user manual Gecko Gripper is called Gecko only.

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

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.

1.4 How to read the Manual

The manual covers all OnRobot products and its components that is available for your robot.

To make it easy to follow what type of product (or combination) or component is the given information is relevant for, the following visual highlights are used:

RG2

This is an instruction relevant for the RG2 product only.

RG2-FT

This is an instruction relevant for the RG2-FT product only.

VG10

This is an instruction relevant for the VG10 product.

All text without these visual marks are relevant for all products or components.

For convenience, in each part that contains visual highlights (that span across pages) a table is provided in the beginning, to guide you which page contains the relevant information for your product or component:

RG2 5
RG2-FT 5
VG10 5

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 **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:

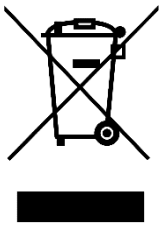
- Objects flying from OnRobot tools due to loss of grip
- Objects falling down from OnRobot tools due to loss of grip
- Injuries due to collisions between humans and workpieces, OnRobot tools tooling, robot or other obstacles
- Consequences due to loosen of bolts
- Consequences if OnRobot tools cable 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

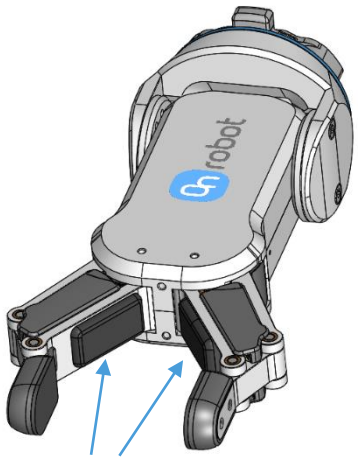
RG2
RG6

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.

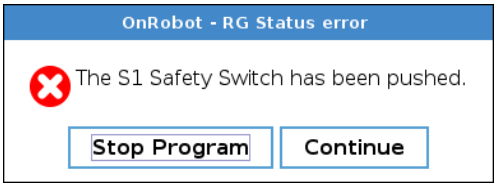
The behavior of the safety system is described below:

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.

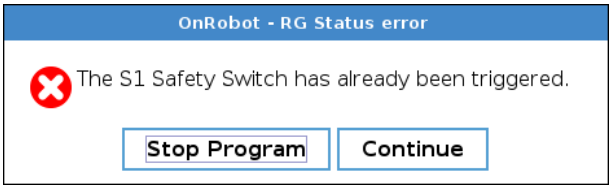


PLd CAT3 Safety Buttons

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

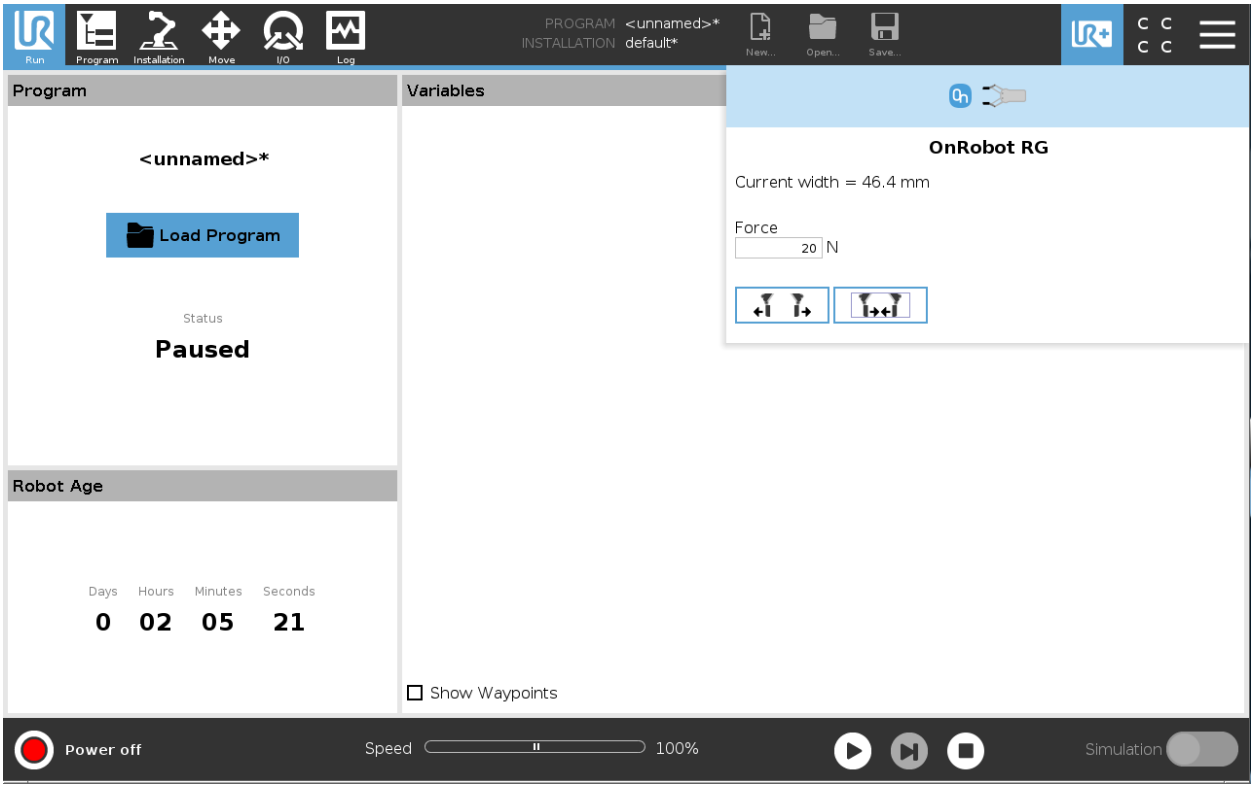


When any of the buttons in this dialog is pressed , the safety system will show the following popup dialog.



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.

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:* *- RG2 or* *- RG6 or* *- VG10*

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 Installation

4.1 Overview

For a successful installation the following steps will be required:

- Mount the components
- Wire the cables
- Setup the software

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

4.2 Mounting

Required steps:

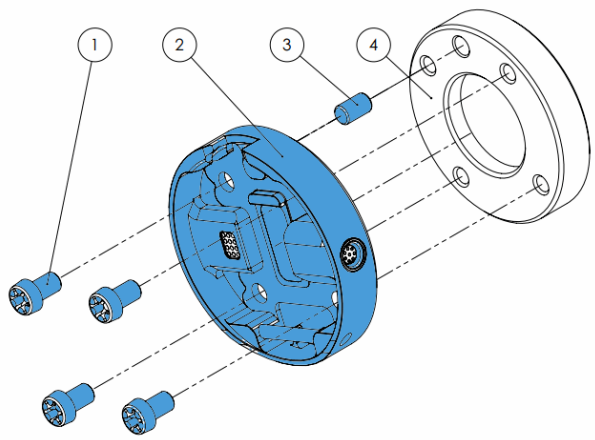
- Mount the Quick Changer option
- Mount the tool(s)

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

4.2.1 Quick Changer options

Quick Changer - Robot Side

Quick Changer for I/O



Quick Changer - Robot Side
and
Quick Changer for I/O

1 M6x8mm (ISO14580 8.8)

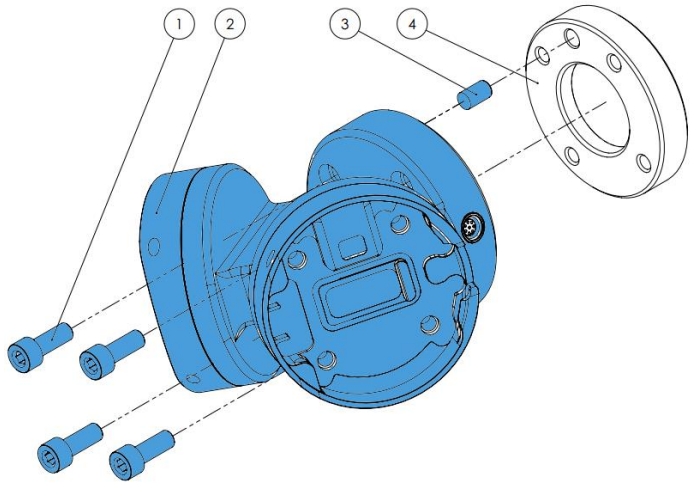
2 Quick Changer (ISO 9409-1-50-4-M6)

3 Dowel pin Ø6x10 (ISO2338 h8)

4 Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 10 Nm tightening torque.

Dual Quick Changer



Dual Quick Changer

1 M6x20mm (ISO14580 8.8)

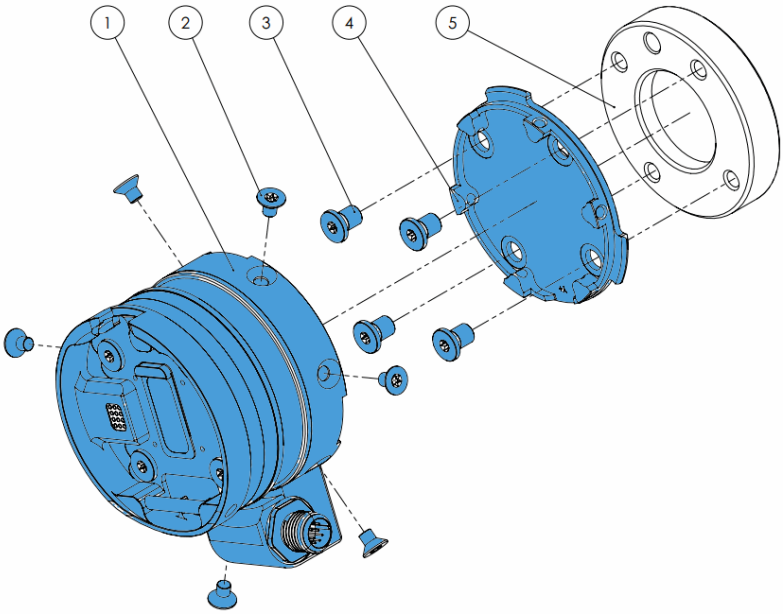
2 Dual Quick Changer

3 Dowel pin Ø6x10 (ISO2338 h8)

4 Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 10 Nm tightening torque.

HEX-E/H QC



HEX-E/H QC

1	HEX-E/H QC sensor
2	M4x6mm (ISO14581 A4-70)
3	M6x8mm (NCN20146 A4-70)
4	HEX-E/H QC adapter
5	Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

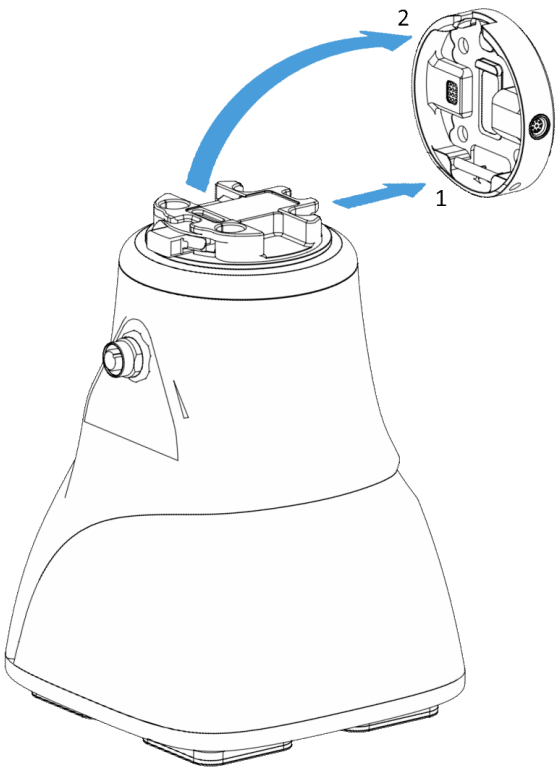
Use 1.5 Nm tightening torque. for M4x6mm

Use 10 Nm tightening torque. for M6x8mm

4.2.2 Tools

- Gecko 15
- RG2 16
- RG2-FT 17
- RG6 18
- VG10 19
- Quick Changer - Tool side 19

Gecko



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:

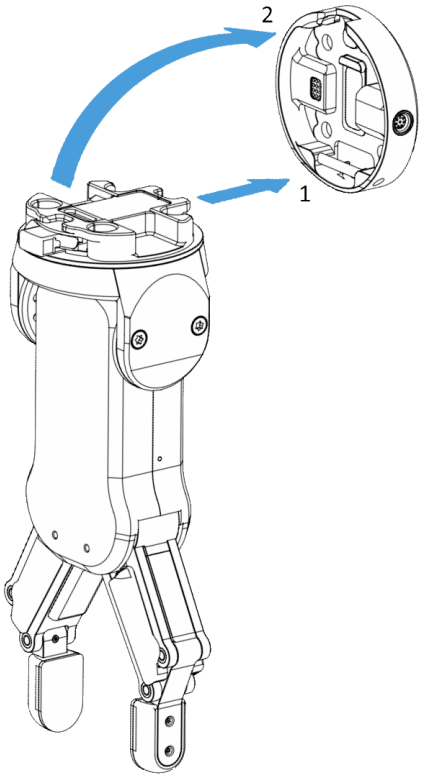
Flip the tool until it is fully mated, and you hear a clicking sound.

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

CAUTION:

With a Dual Quick Changer the Gecko Gripper can only be mounted on the Secondary (2) side. Mounting on the Primary (1) side will prevent the devices to function correctly.

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.

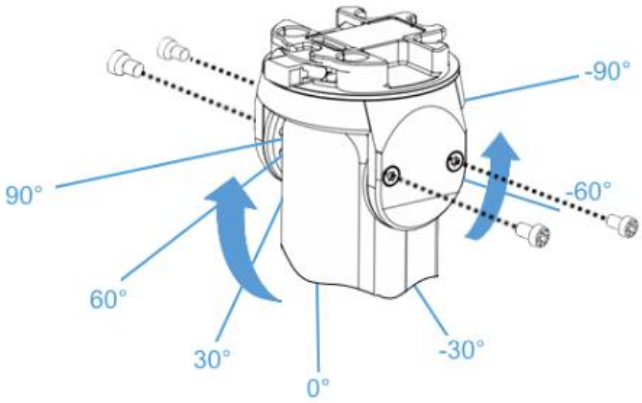
Step 2:

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:

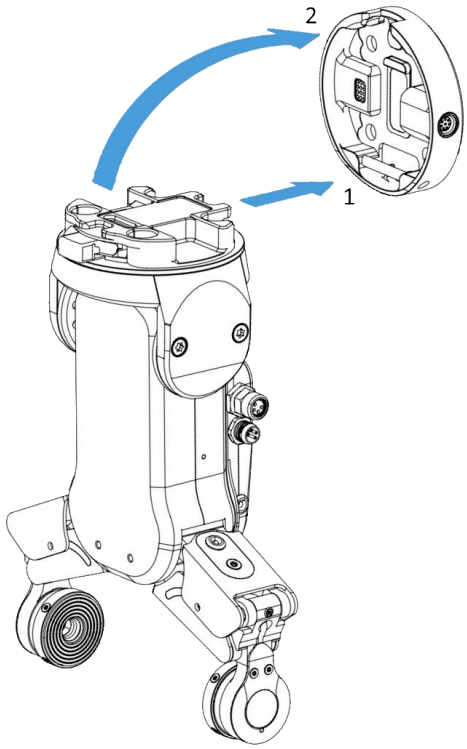
- first remove the four M4x6 screws
- tilt the gripper between -90° and 90°
- then put the four M4x6 screws back and use 1.35 Nm tightening torque to fix it.



WARNING:

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

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.

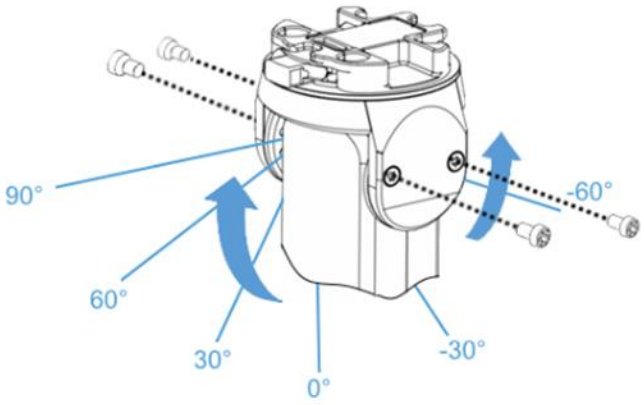
Step 2:

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:

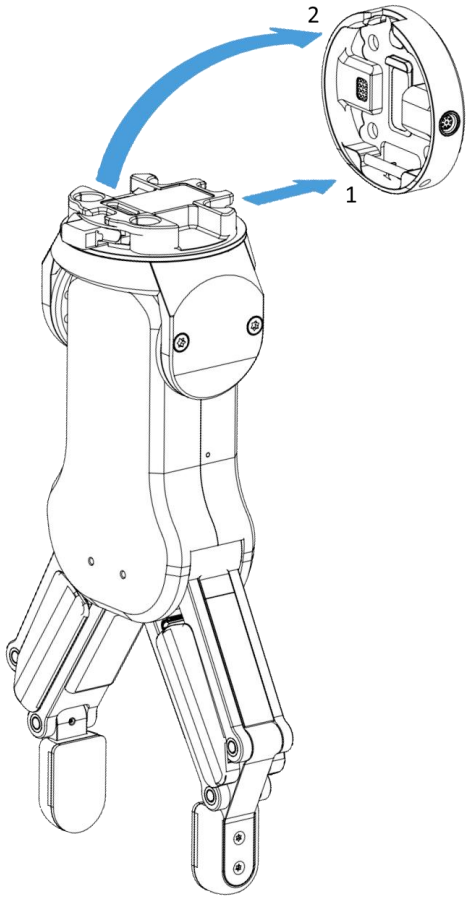
- first remove the four M4x6 screws
- tilt the gripper between -60° and 90°
- then put the four M4x6 screws back and use 1.35 Nm tightening torque to fix it.



WARNING:

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

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.

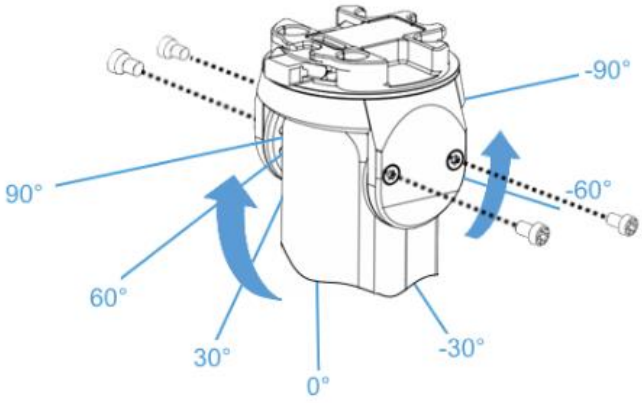
Step 2:

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:

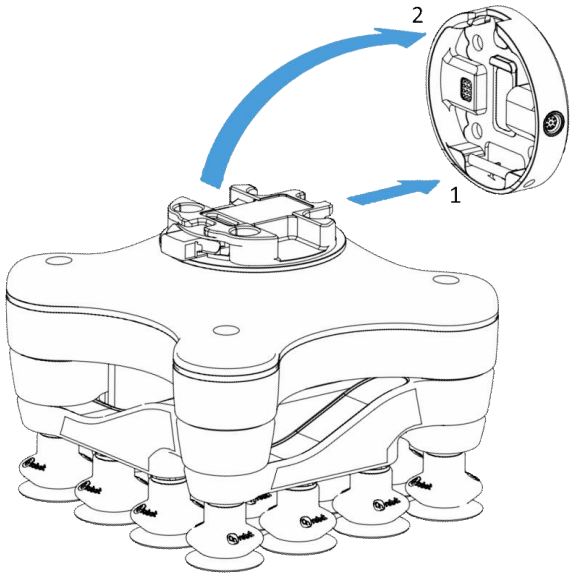
- first remove the four M4x6 screws
- tilt the gripper between -90° and 90°
- then put the four M4x6 screws back and use 1.35 Nm tightening torque to fix it.



WARNING:

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

VG10



Step 1:

Move the tool close to the Quick Changer as illustrated.

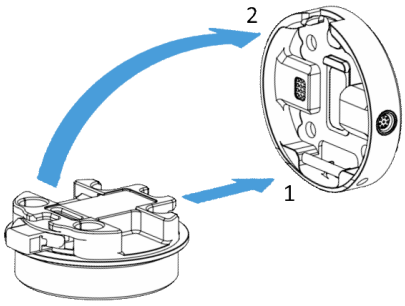
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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.

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.

Via Tool Connector 20
Via Compute Box 21

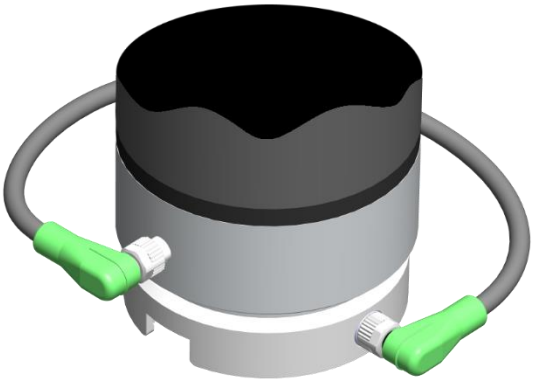
DANGER:

Use only original OnRobot tool data cables.

Via Tool Connector

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:

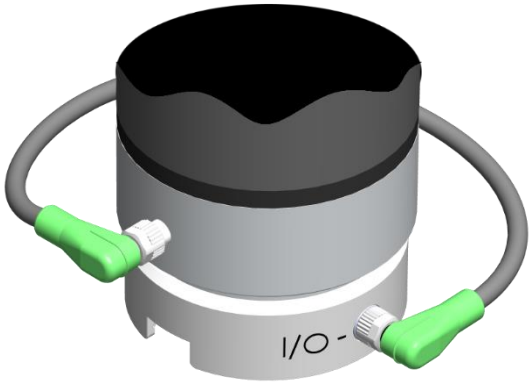
VG10 can only be attached when the UR controller is started (not in IDLE mode) and no program is running or completely powered off.

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.



NOTE:

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

- RG2
- RG6
- VG10

DANGER:

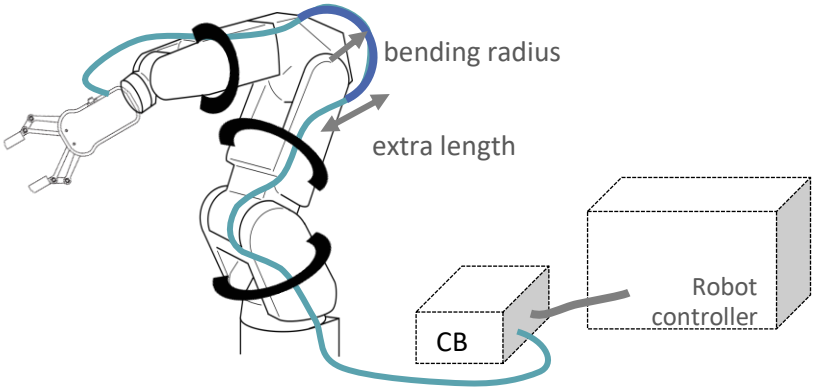
Never connect the Quick Changer or Dual Quick Changer to a CB3 UR robot's tool connector.

Wiring via Tool Connector is finished.

Via Compute Box

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

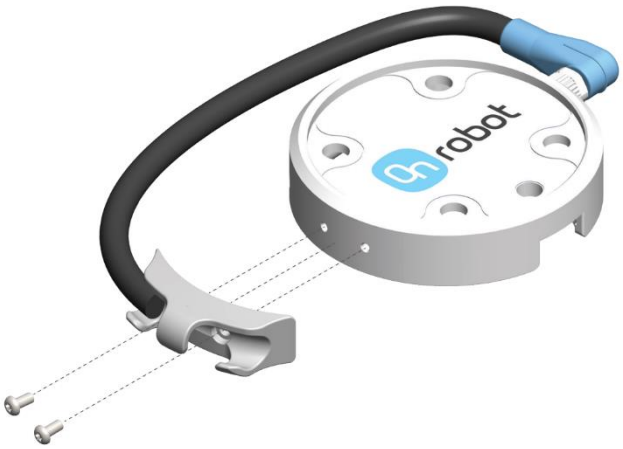
- Tool data cable between the tool(s) and the Compute Box
- Ethernet communication cable between the robot controller and the Compute Box
- Power supply of the Compute Box



4.3.1 Tool data cable

First connect the data cable to the tool.

For Single or Dual RG2, RG6, VG10 or Gecko Gripper



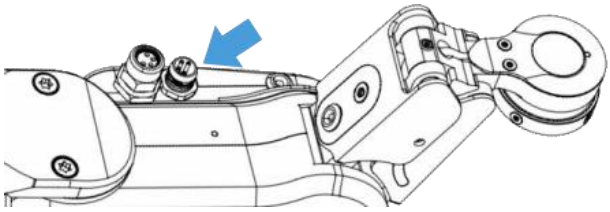
Use the M8-8pin connector on the Quick Changer or on the Dual Quick Changer.

Use the cable holder as illustrated on the left.

CAUTION:

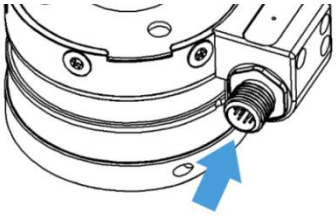
Make sure to use the supplied cable holder to prevent any excessive strain on the 90-degree M8 connector caused by the rotation of the cable.

For RG2-FT



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

For HEX-E/H QC



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:

Use only original OnRobot tool data cables. Do not cut or extend these cables.

CAUTION:

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

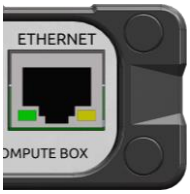
4.3.2 Ethernet cable

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.

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).

Wiring via Compute Box is finished.

4.4 Software setup

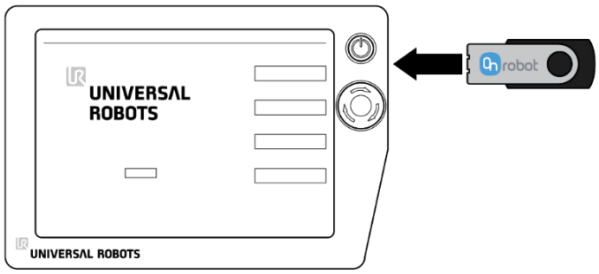
4.4.1 Install URCap

UR CB3

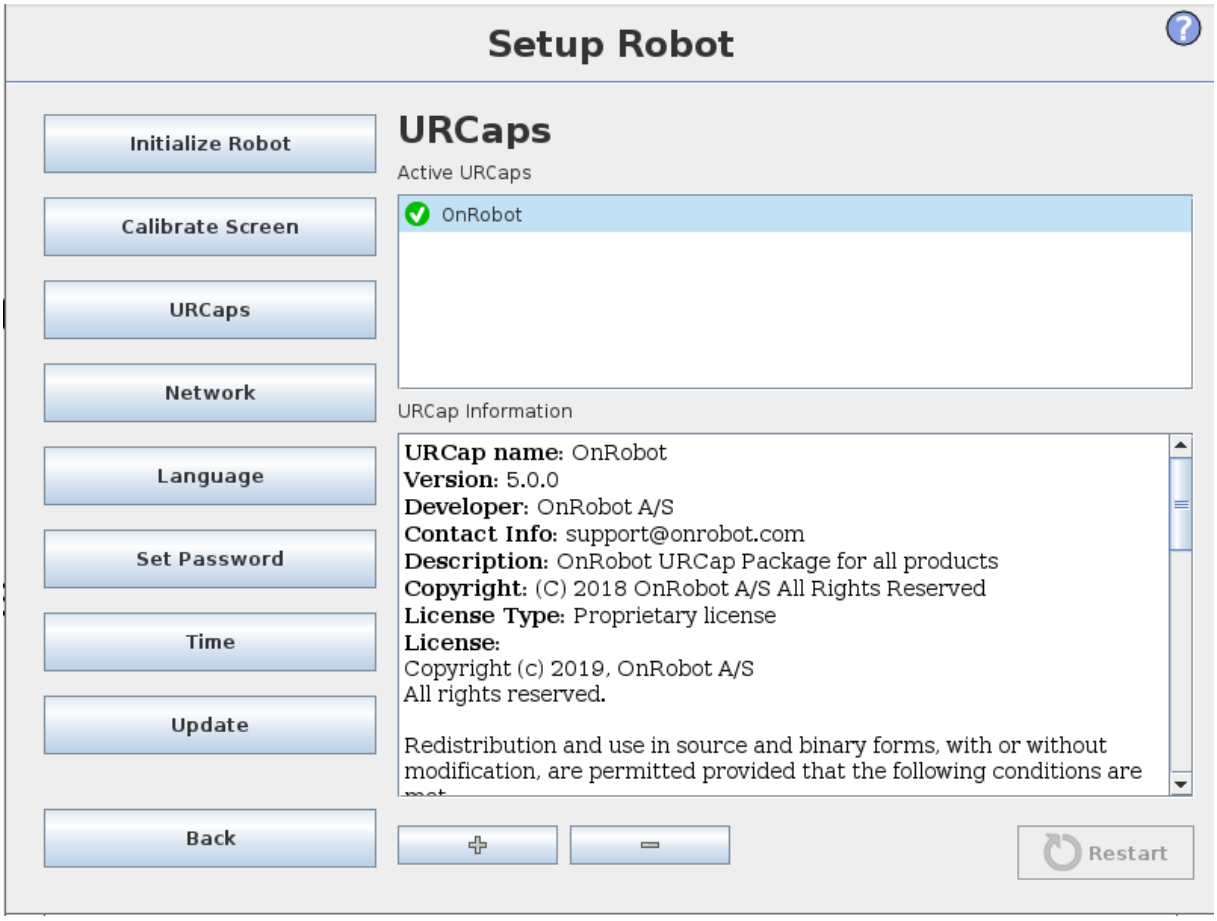
NOTE:

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.

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**.
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.

UR e-Series

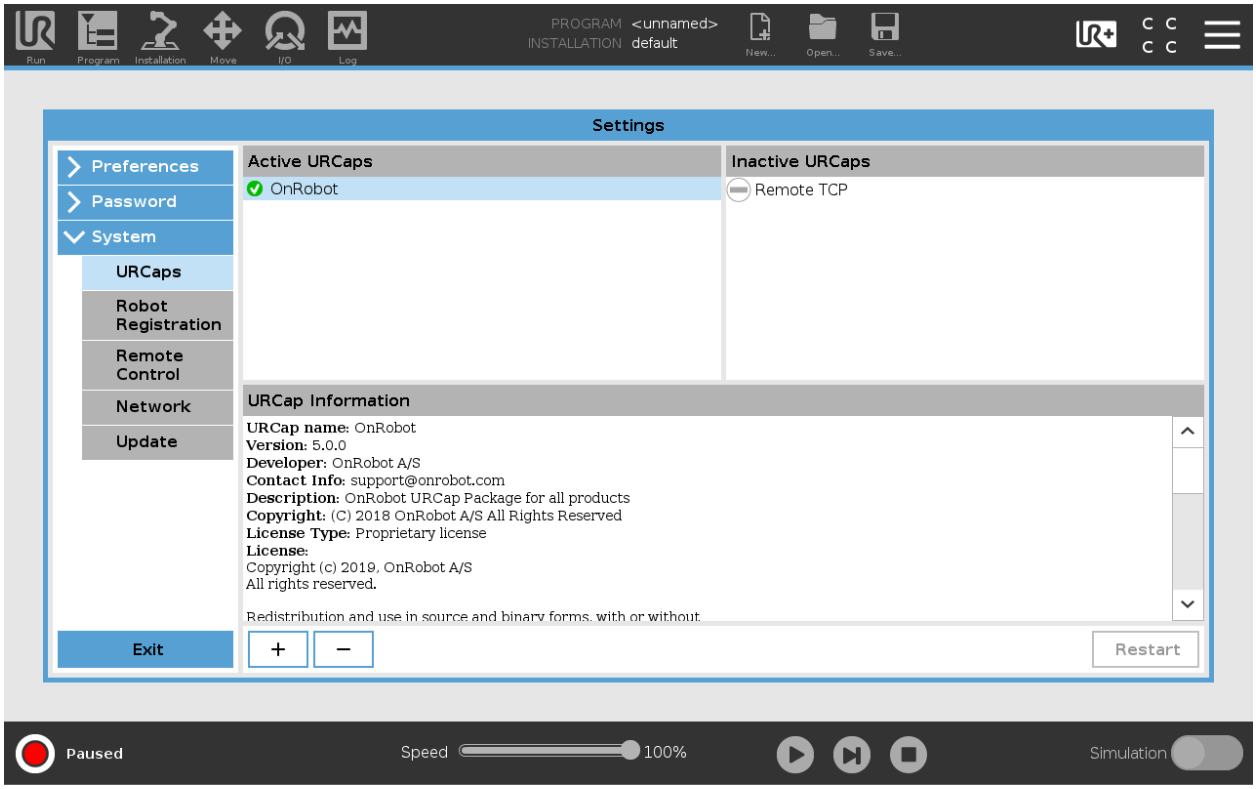
NOTE:

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

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

7. Then tap on the menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.

8. Tap on the + sign to browse for the OnRobot URCap file. It can be found in the usbdisk/UR/URCAP folder. Tap on Open.
9. 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.



10. Initialize the robot.

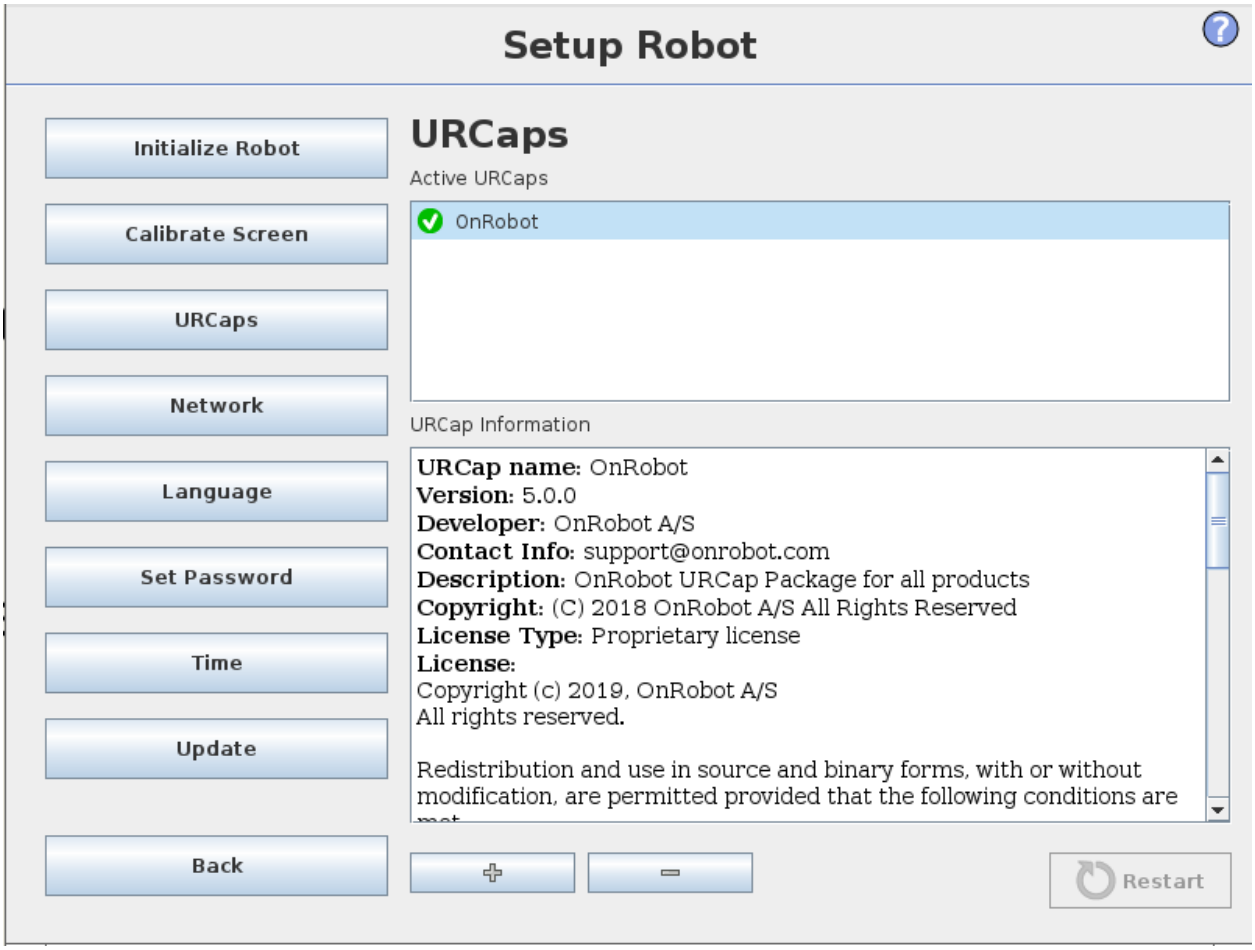
NOTE:

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

4.4.2 Uninstall software

UR CB3

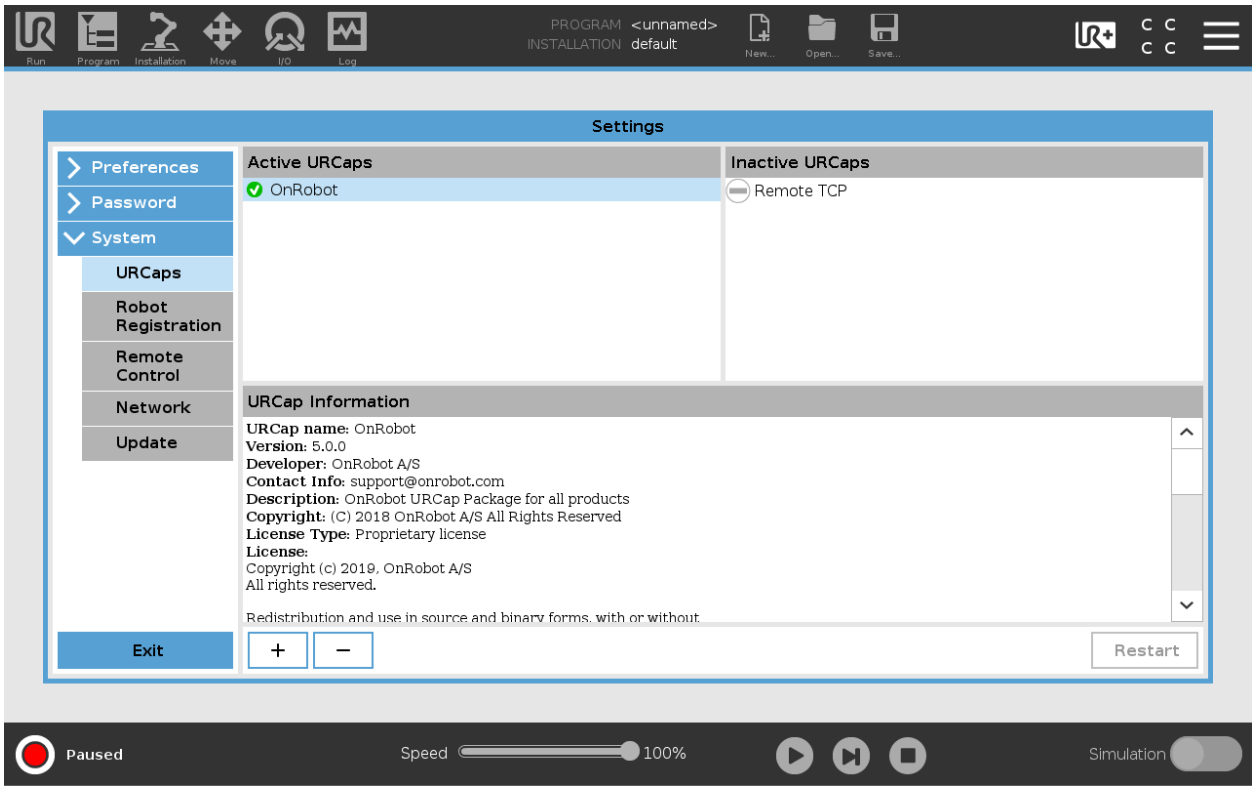
11. Select the **Setup Robot** option from the main menu, then the **URCaps** option.
12. Select the OnRobot URCap file.
13. Tap on the **-** sign.
14. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



15. Initialize the robot.

UR e-Series

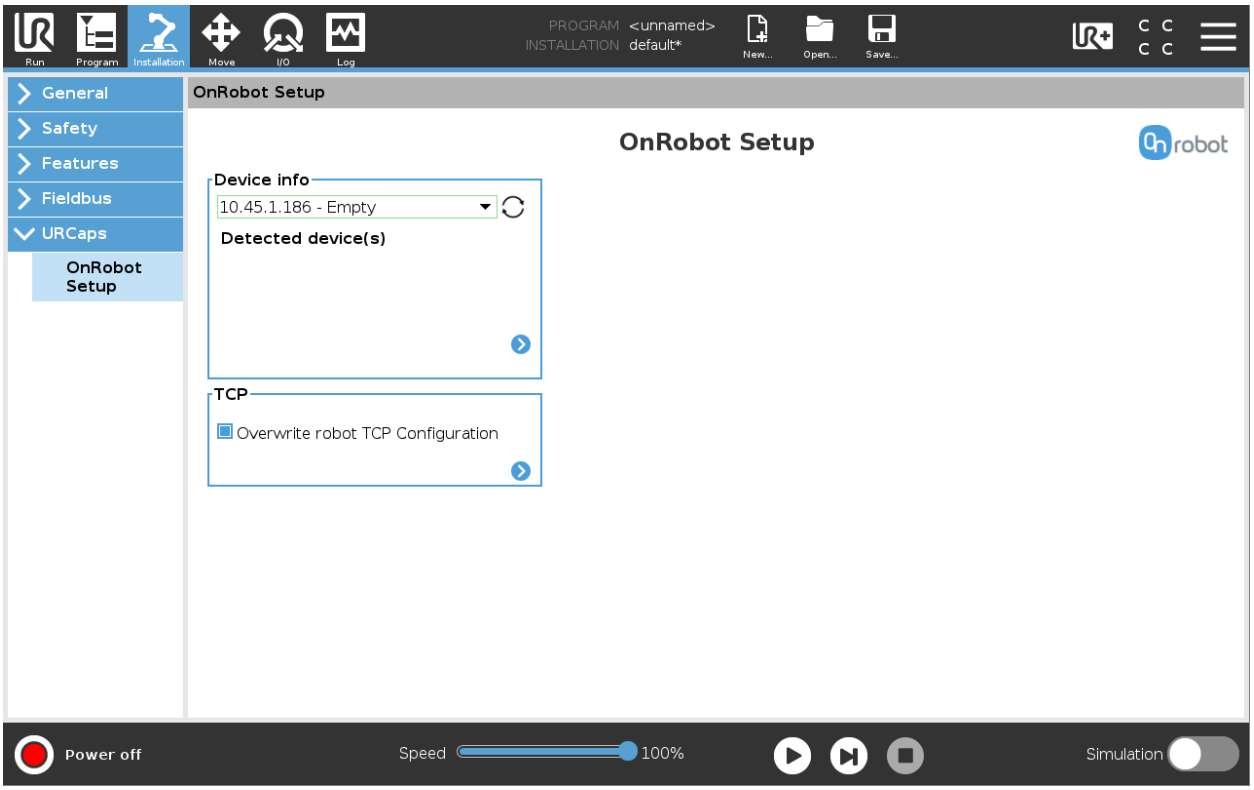
16. Tap on the ☰ menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.
17. Select the OnRobot URCap file.
18. Tap on the **-** sign.
19. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for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



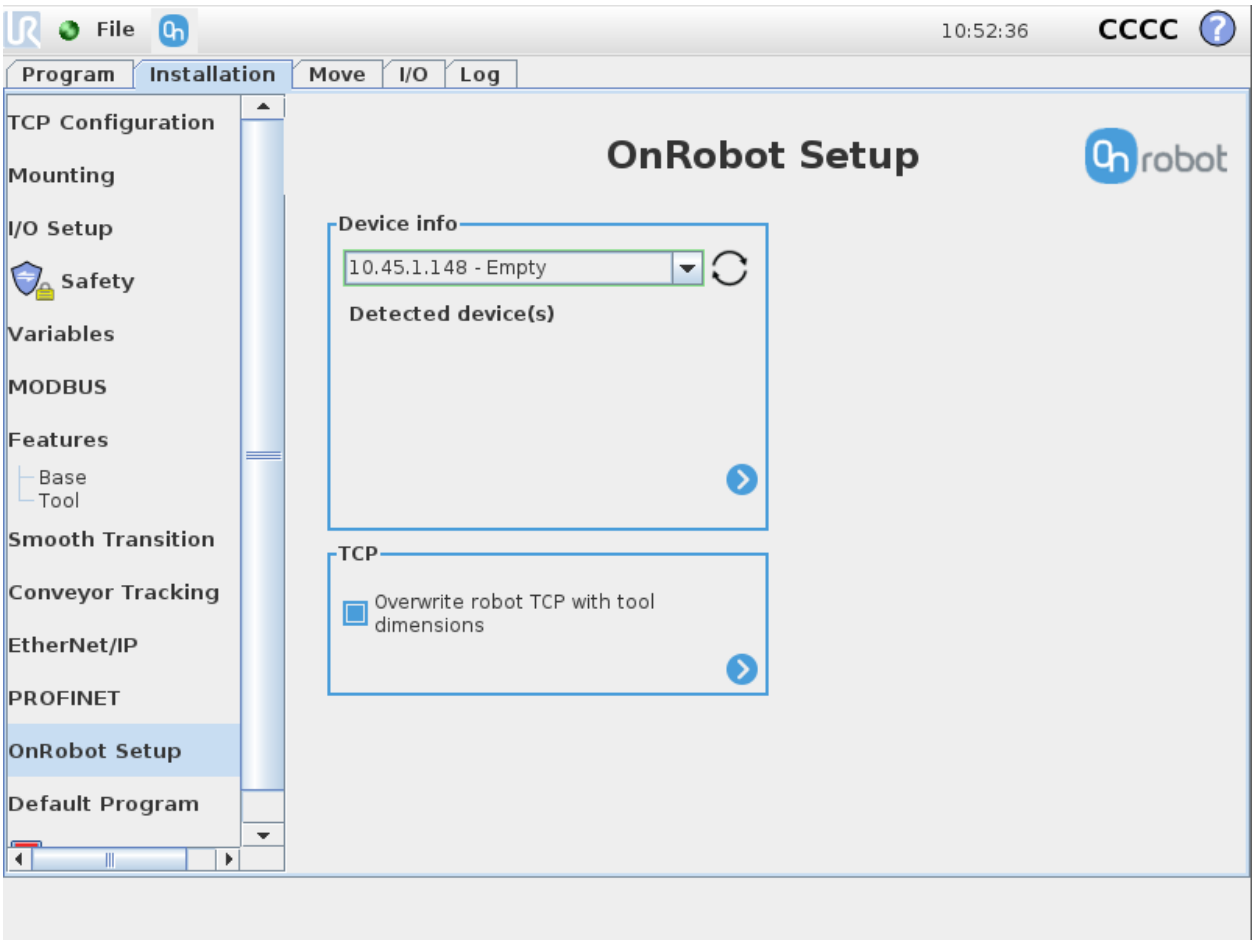
20. Initialize the robot.

1.1.1 URCap setup

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

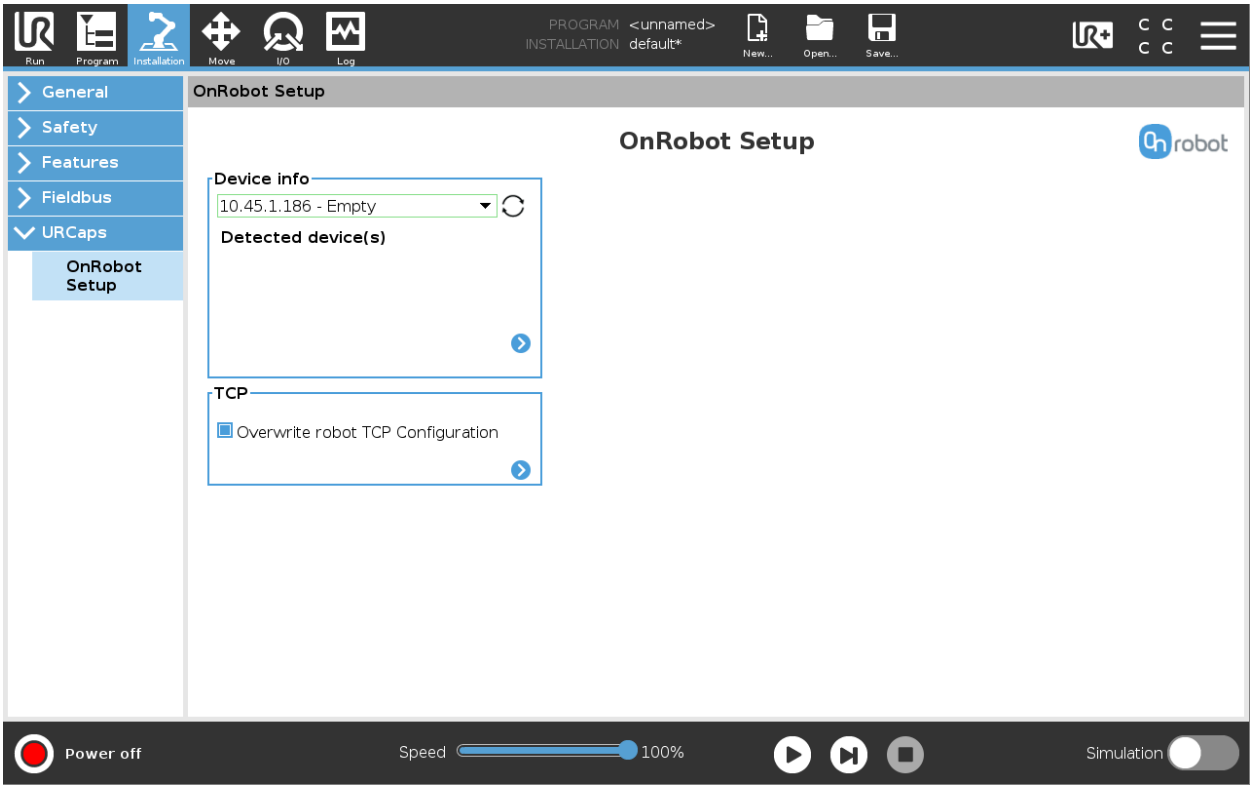


For the CB3 UR robots select the **Installation** tab, then select **OnRobot Setup**. The following screen is shown:



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.

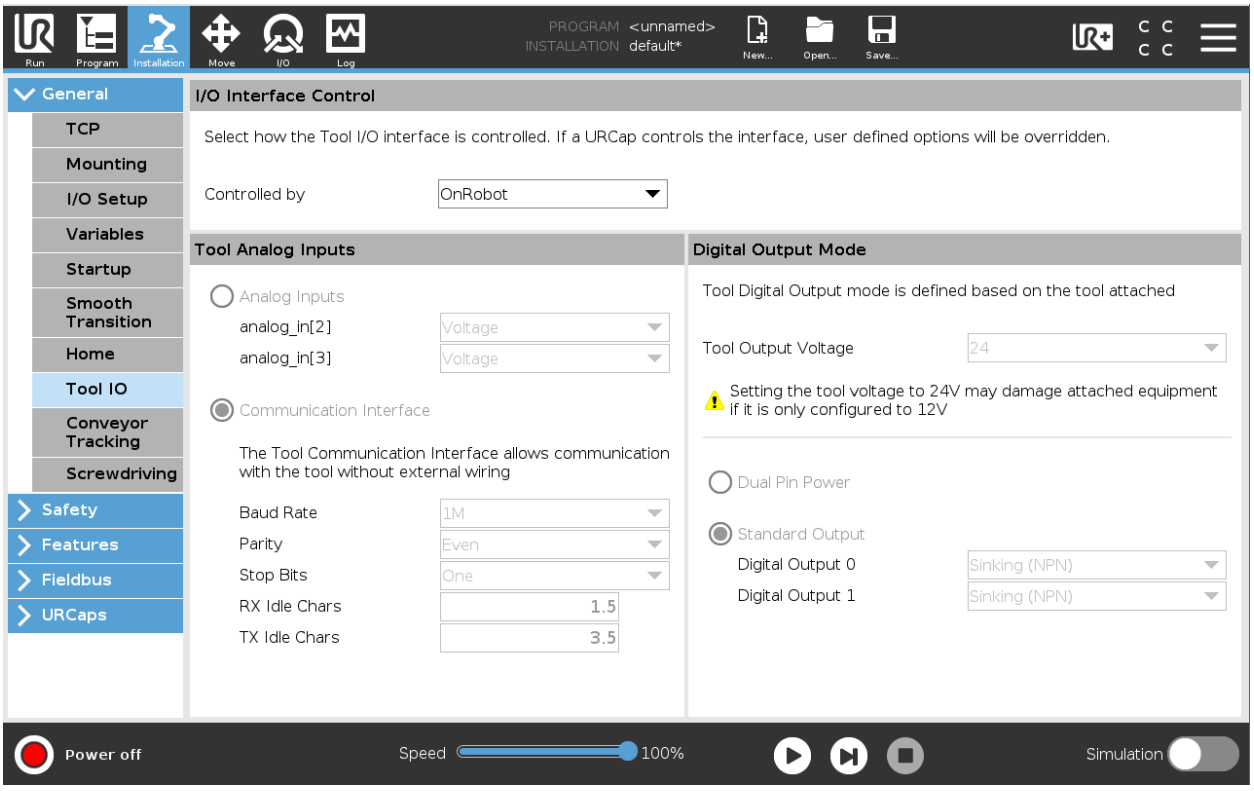
NOTE:

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.

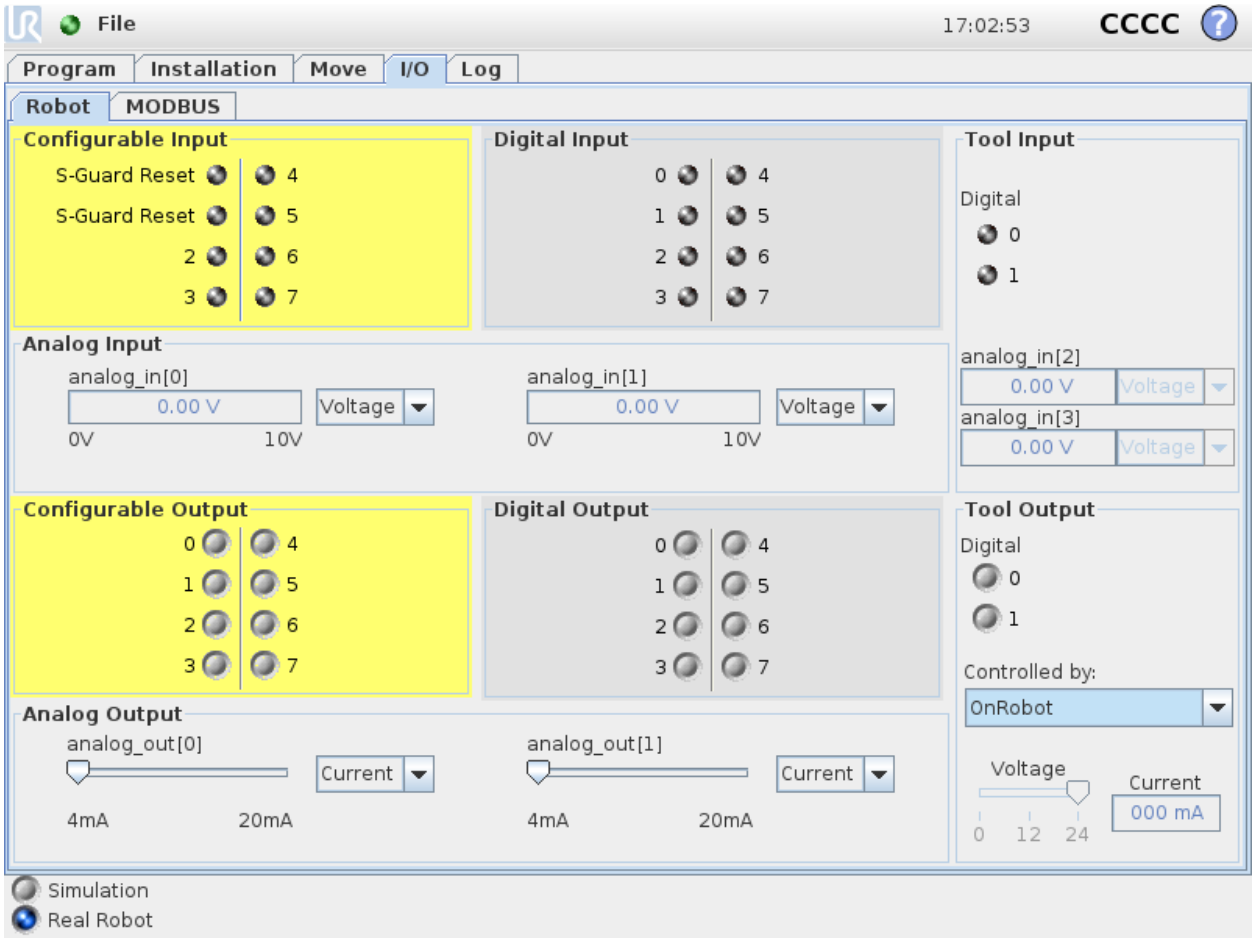
To communicate through the tool connector on an e-Series UR robot please set the following configuration:

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.



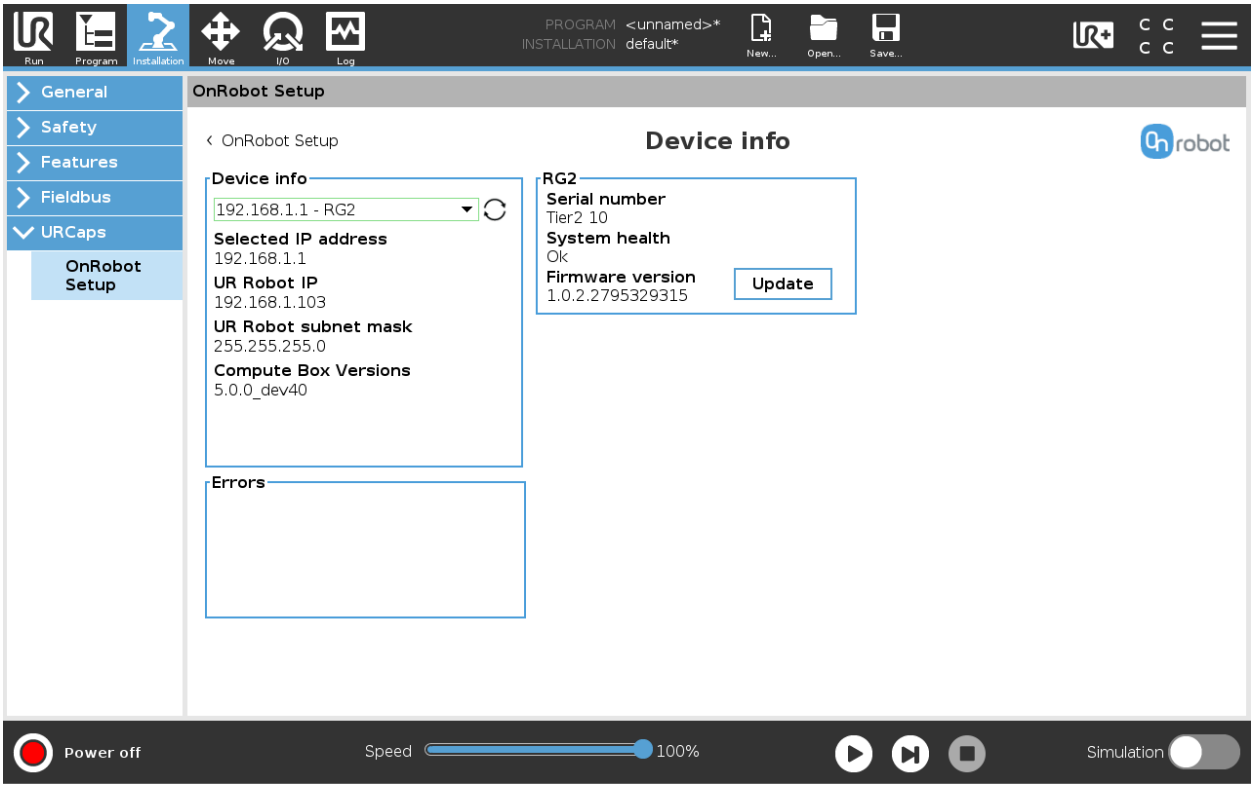
NOTE:

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.

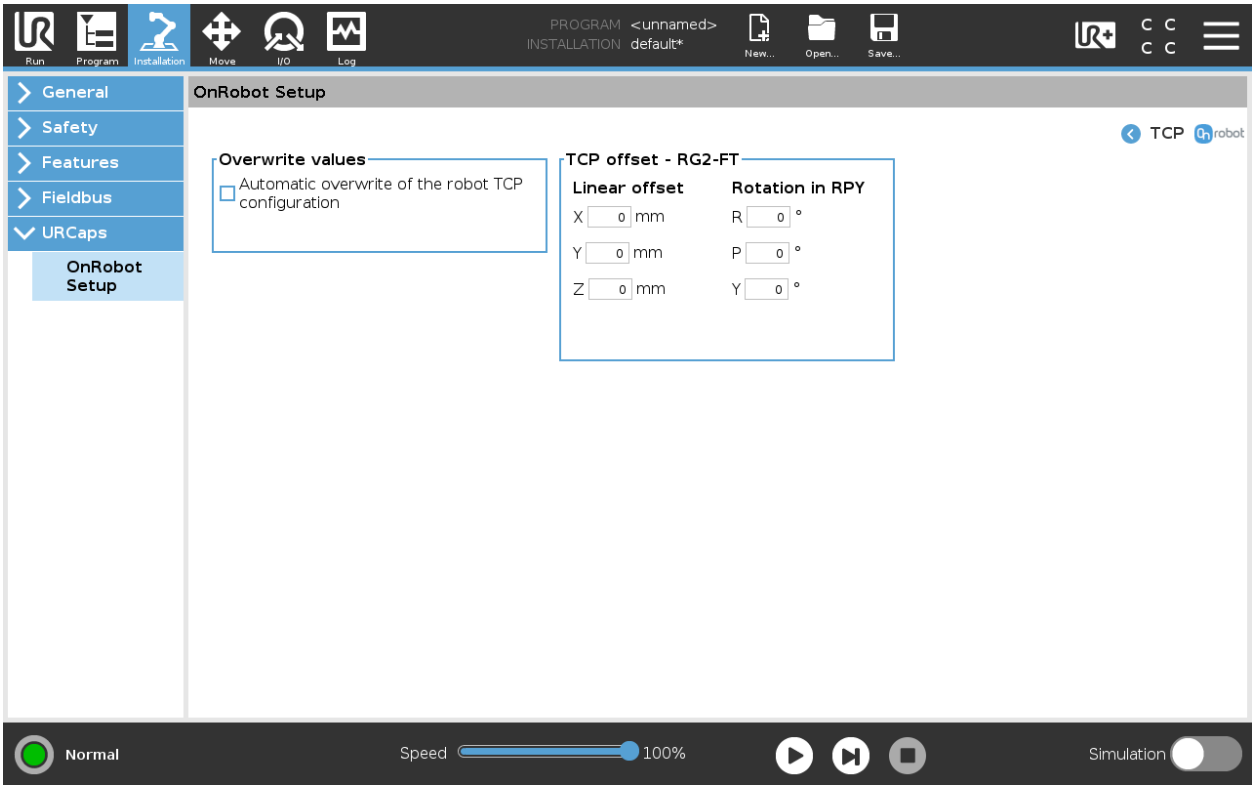
Gecko 36
HEX 37
RG2-FT 39
RG2/6 43
VG10 46

Gecko

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).

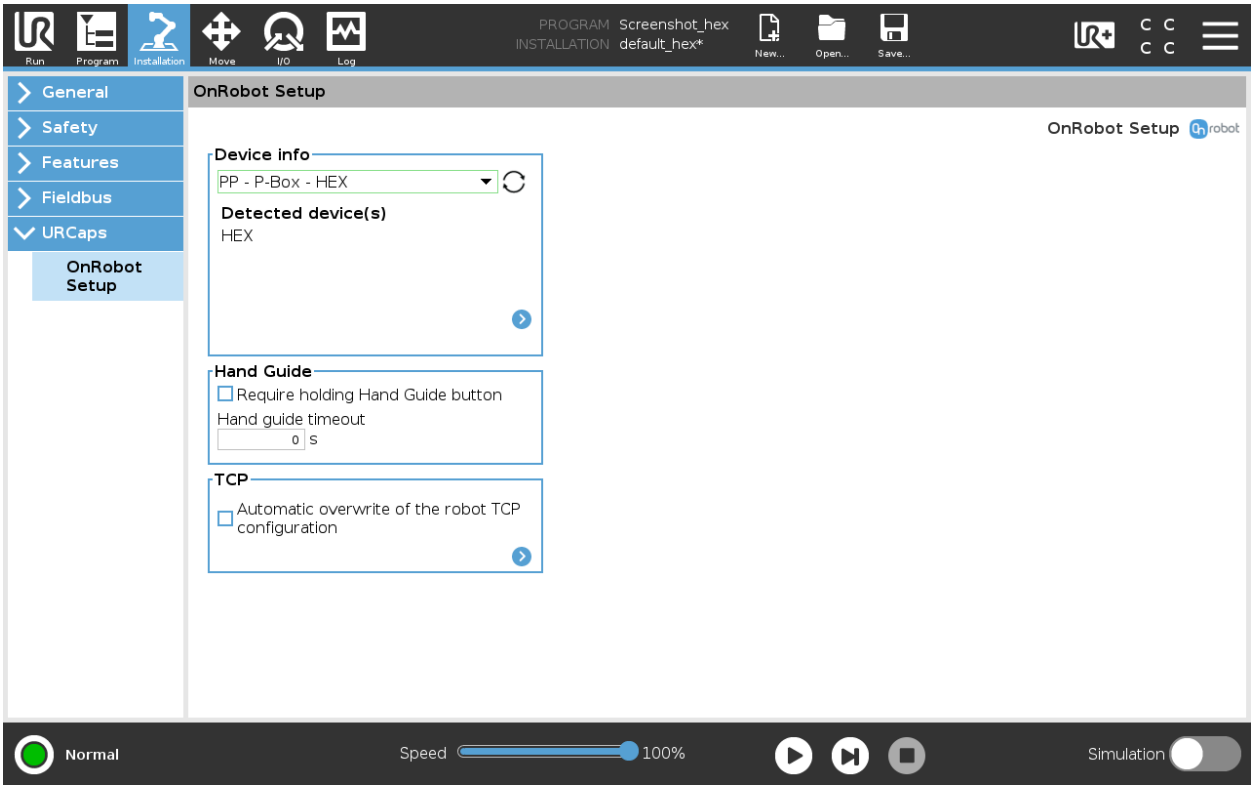
For further information and best practices on the TCP setting see *TCP Configuration* section.

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.

HEX

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



Hand Guide

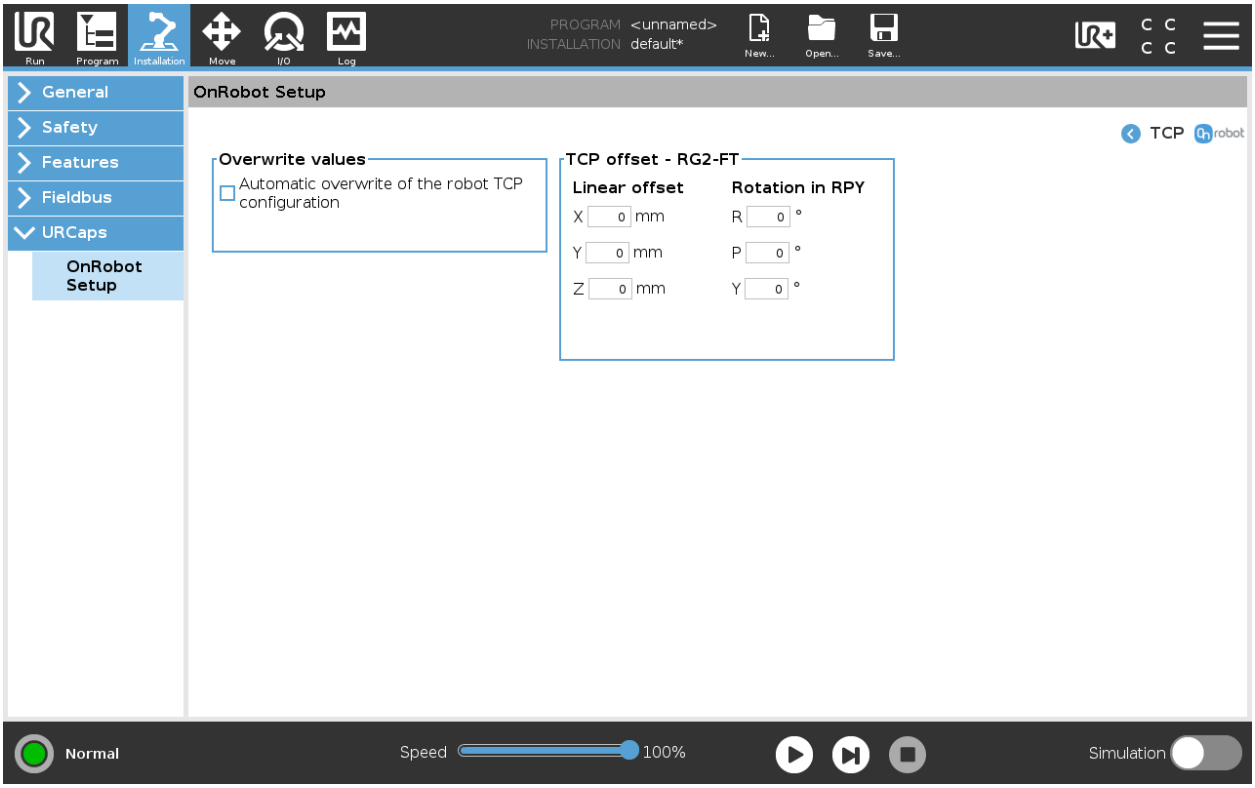
Require holding Hand Guide button: If checked (recommended) the Hand Guide enable button needs to be pressed constantly during the hand guiding. If unchecked, the hand guiding could be started by pressing the enable button and stopped by pressing the enable button again.

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).

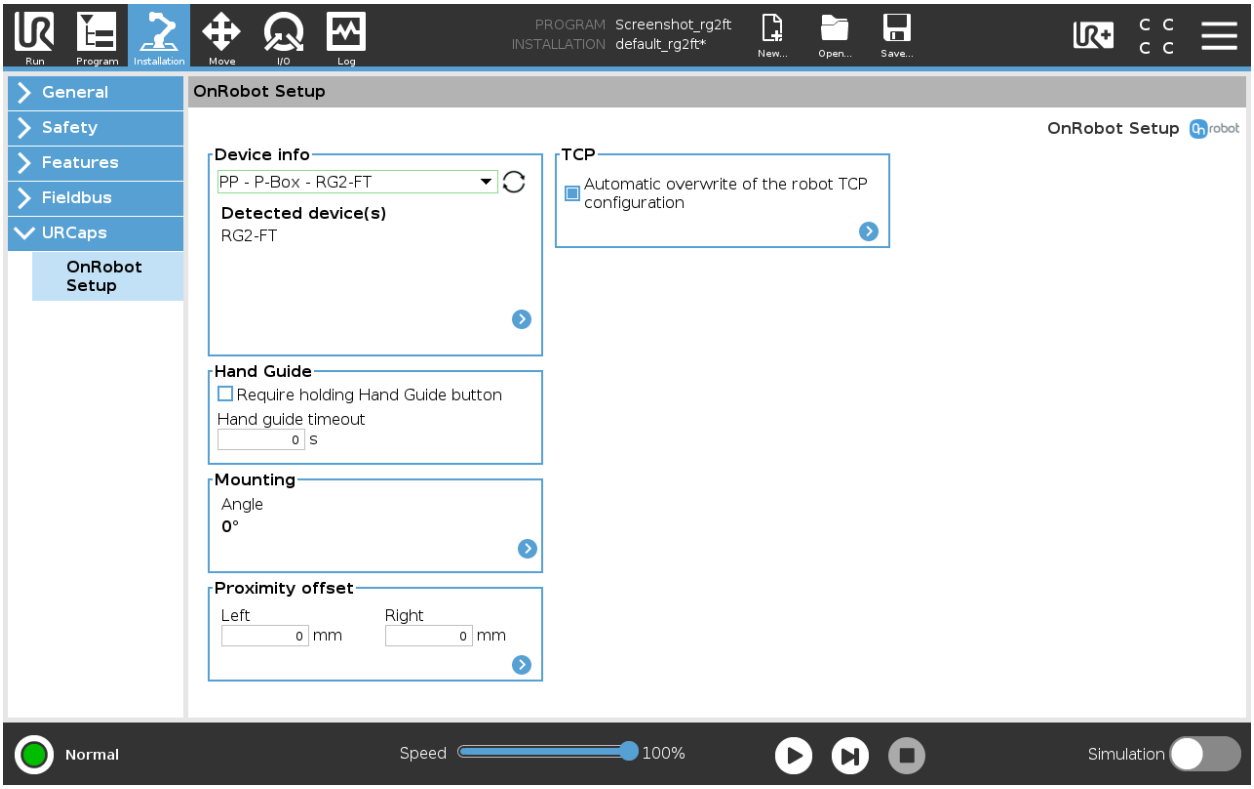
For further information and best practices on the TCP setting see *TCP Configuration* section.

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.

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.

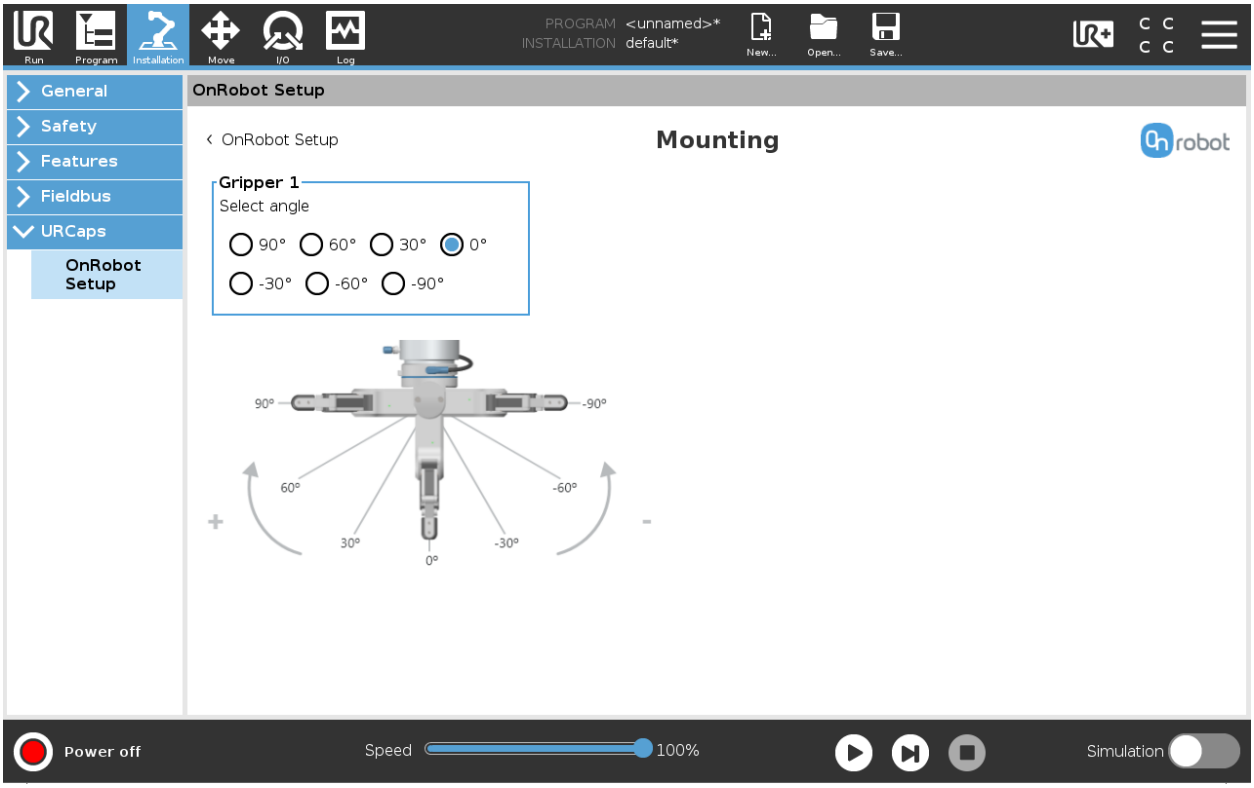
Timeout: After the set timeout value, the hand guiding will be stopped automatically. The default value is 0 that sets the timeout to infinite.

Mounting

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

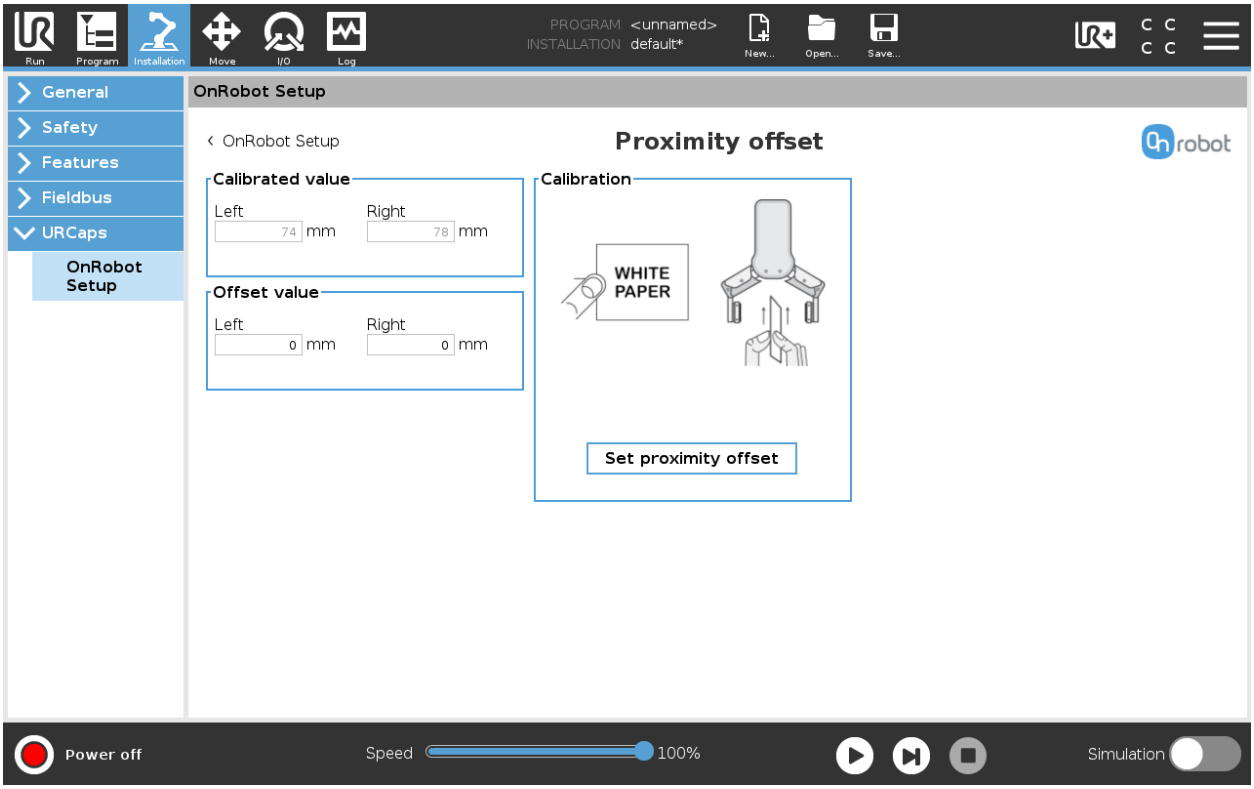
If only one gripper is mounted, follow the steps bellow. If there are 2 grippers, follow the steps half a page below.

21. Make sure you are looking at the cable from the same side as it is shown on the picture .
22. 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:



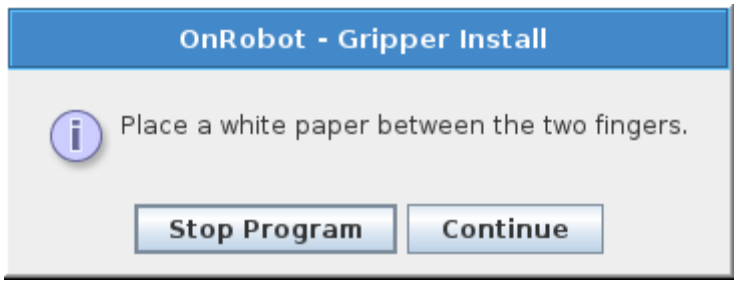
Calibrated value: shows the value to use for the application. This value is calculated as the **Raw value** minus the **Offset value.**

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

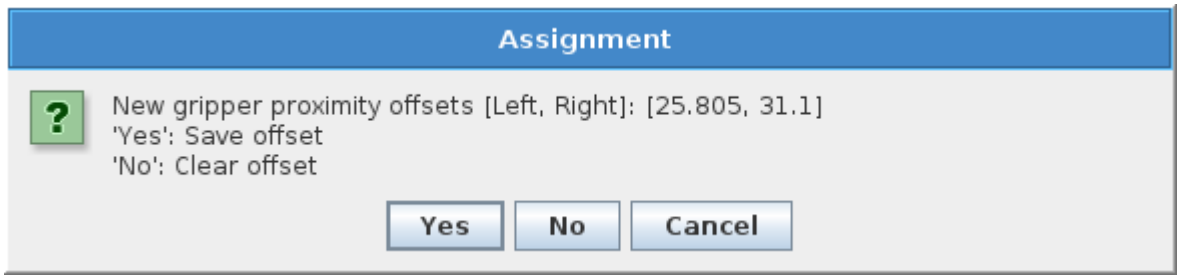
Calibration

To calibrate the proximity sensor, follow the steps below.

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



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

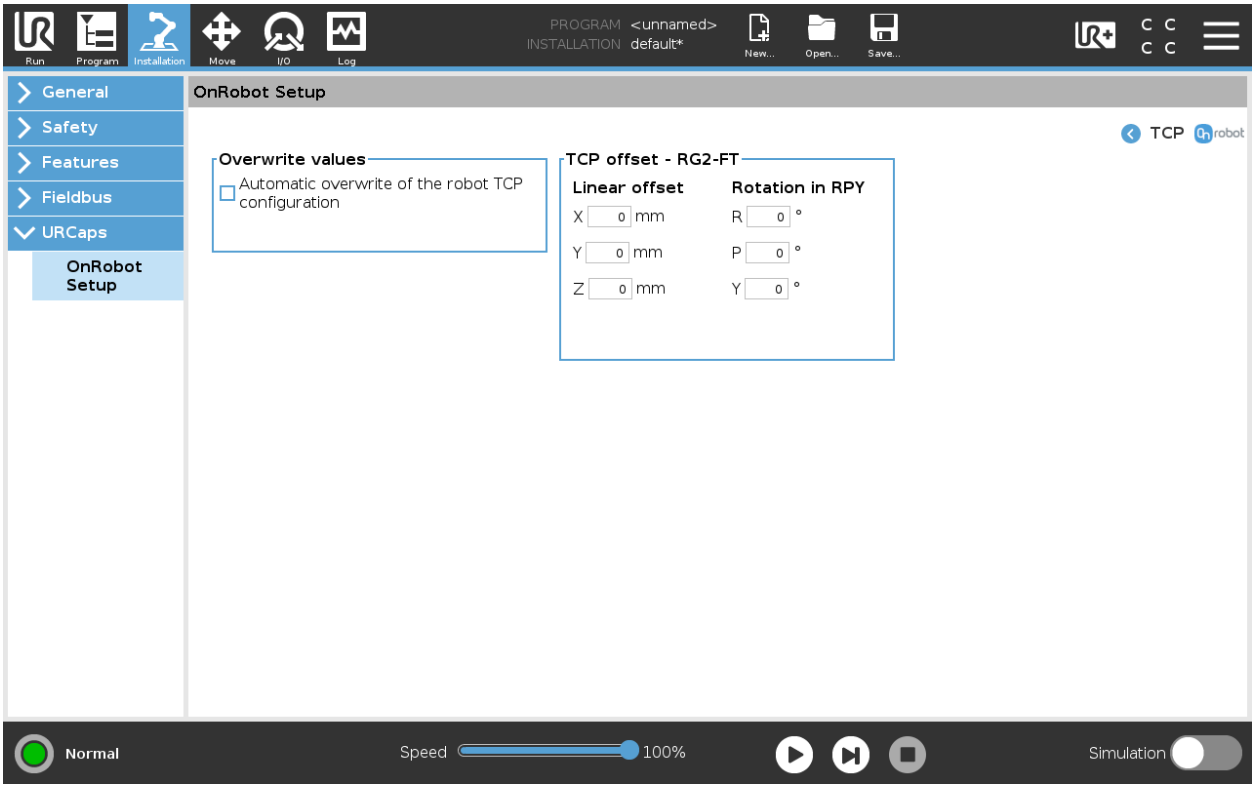


28. Tap on **Yes** to save the new offset and the setup is finished. To clear any offset previously been set tap on **No**. To prevent any changes of the proximity offsets, tap on **Cancel** and confirm it by taping on that again.

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).

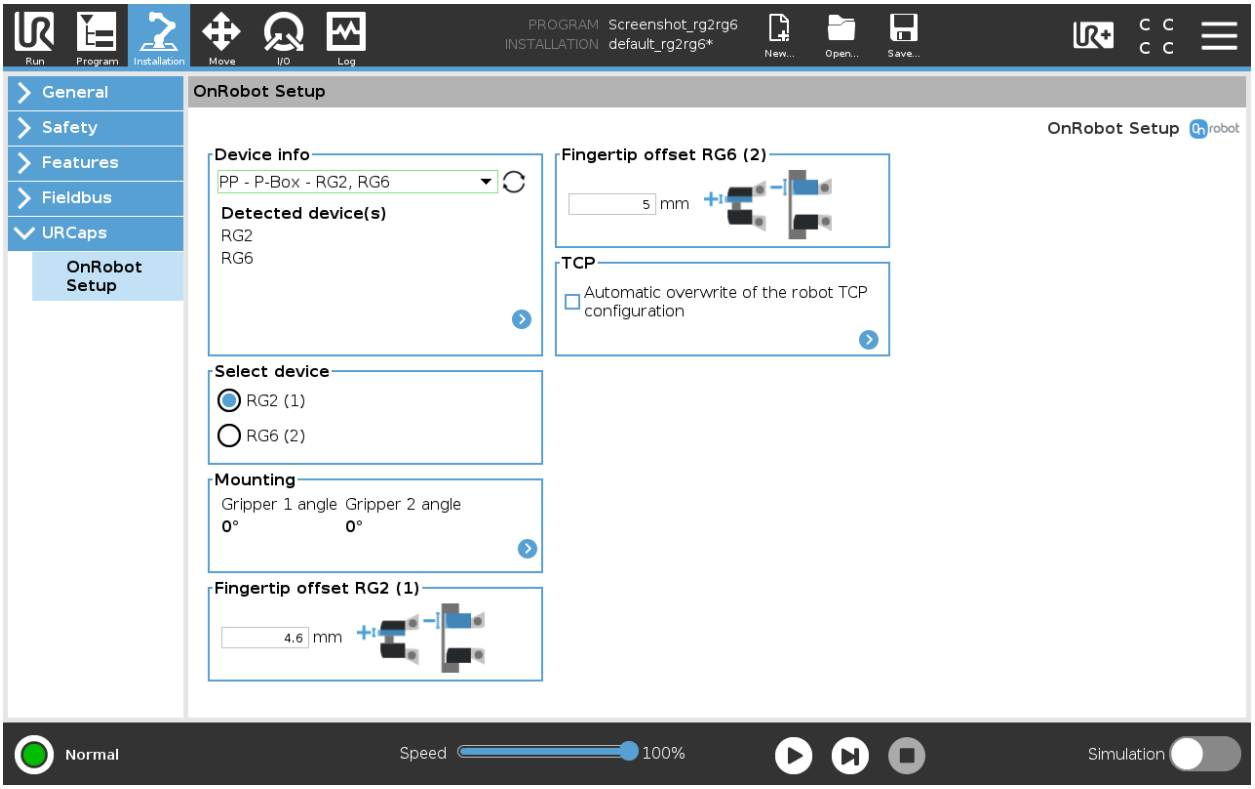
For further information and best practices on the TCP setting see *TCP Configuration* section.

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.

RG2/6

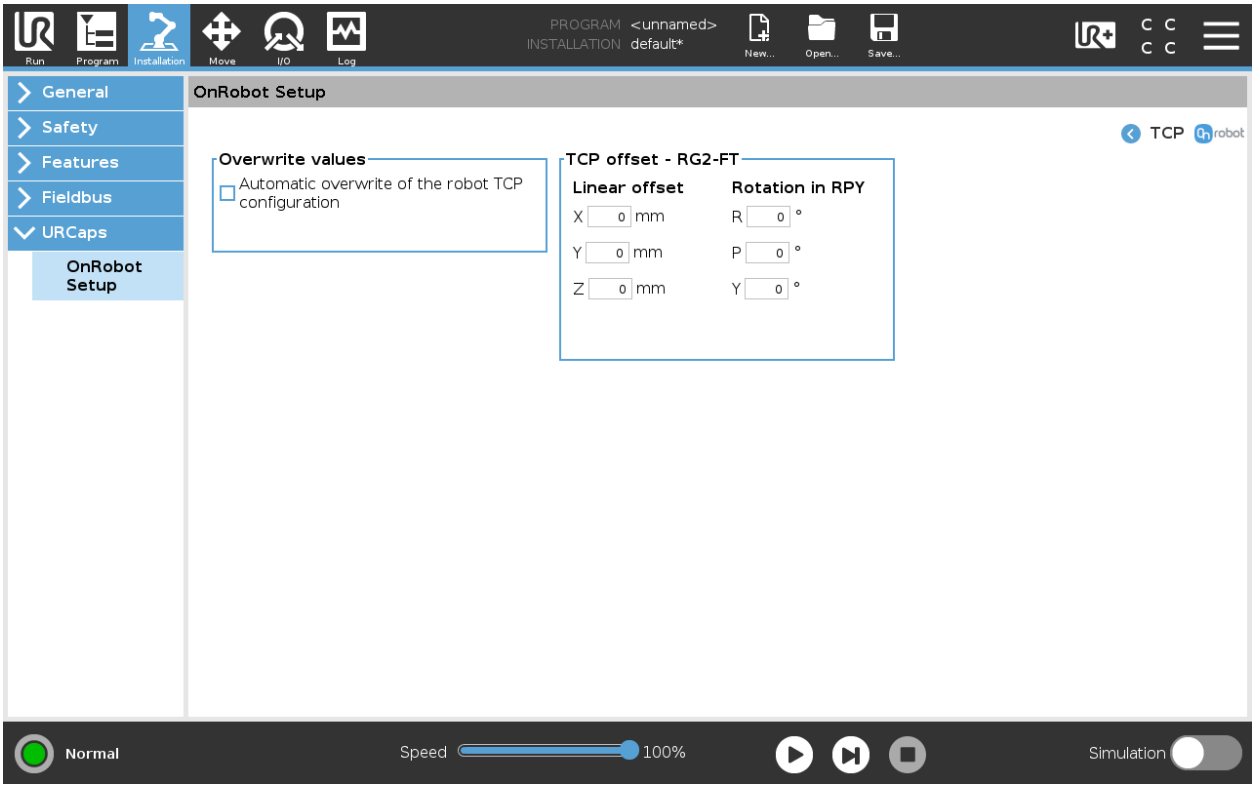
The configuration panels for the RG2/6 are shown in the image below:



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 *TCP Configuration* section.

TCP offset

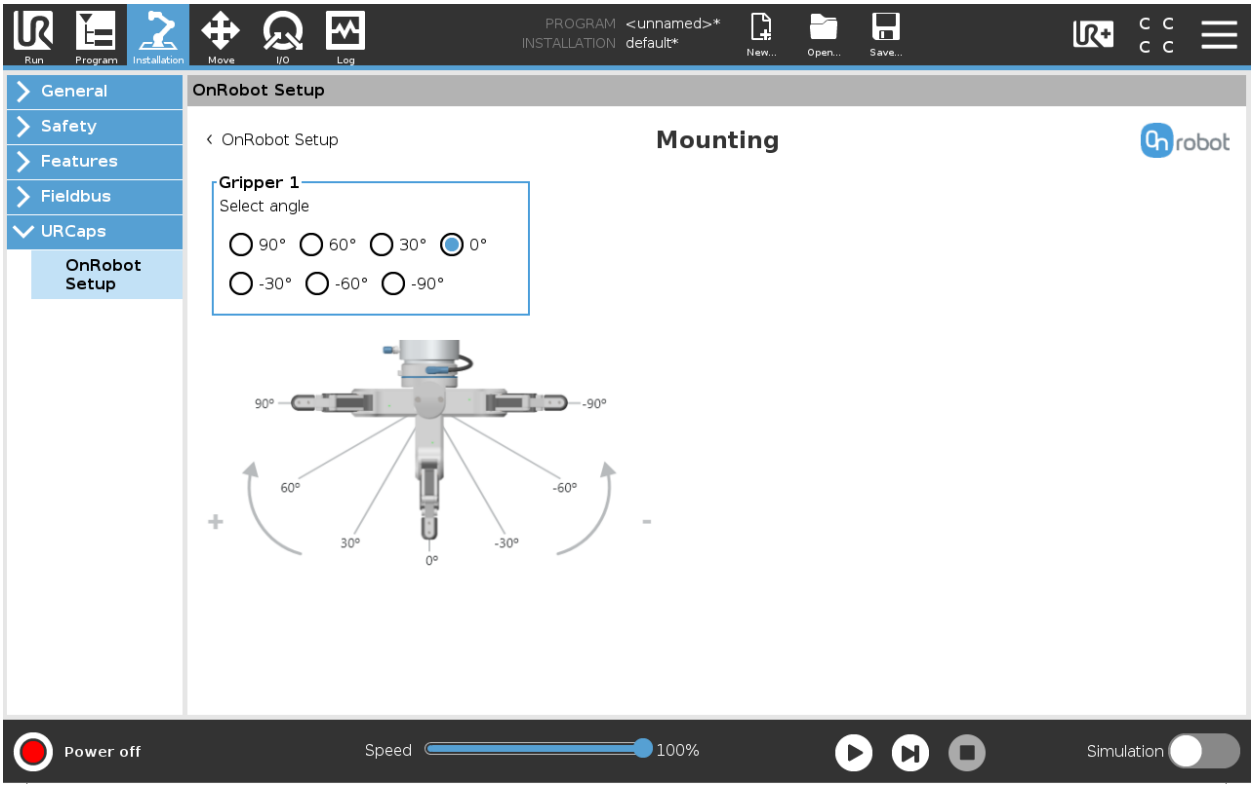
Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Mounting

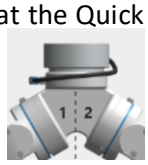
In the normal view of the panel, the selected mounting angle is shown. To set the mounting angle press on .

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

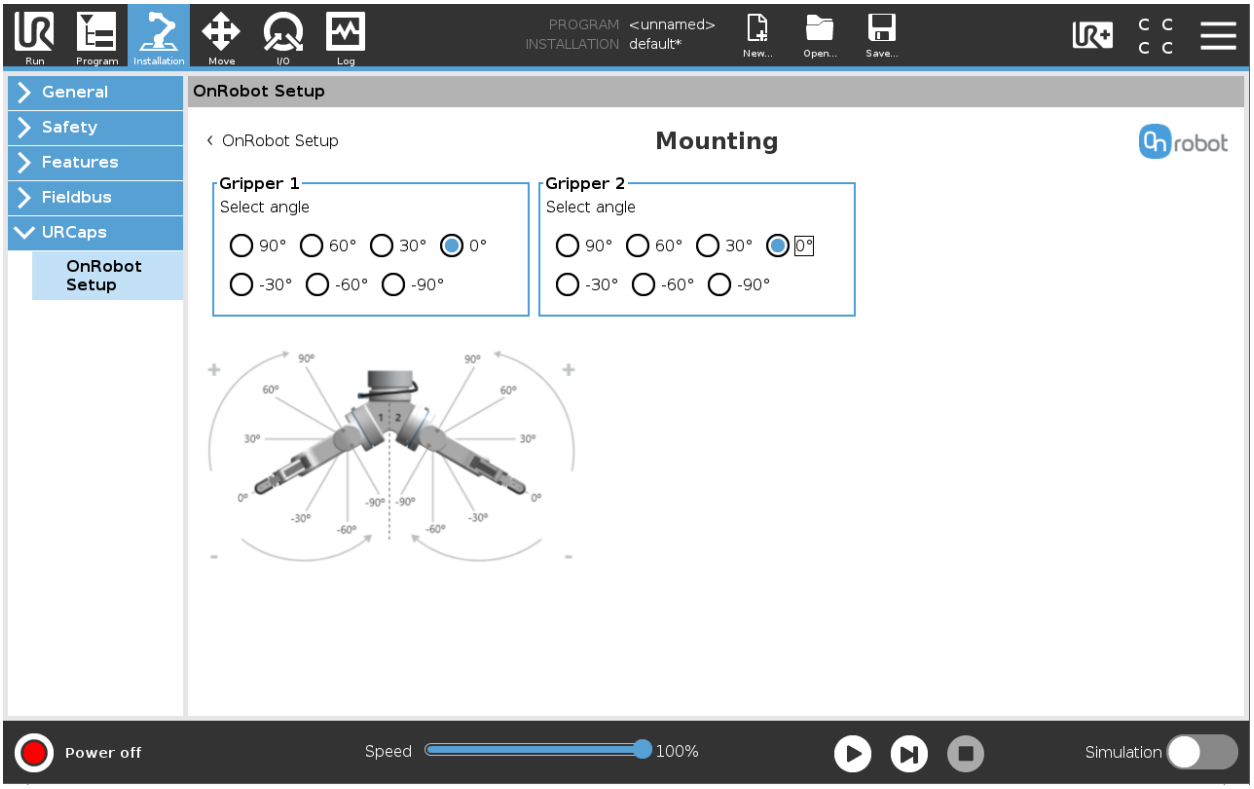
29. Make sure you are looking at the cable from the same side as it is shown on the picture .
30. Select the angle the gripper is mounted with (positive angle towards the Quick Changer release button).



If two grippers are mounted, follow the steps bellow:

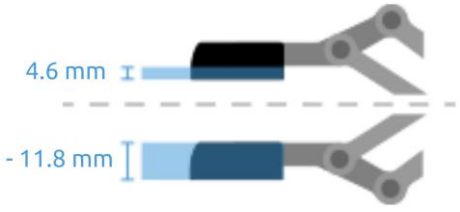
31. When looking at the grippers, make sure that the Quick Changer is orientated with the part 1 on the left side and the part 2 on the right side 

. The numbers are written on the side of the Quick Changer that connects to the robot.
32. 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).

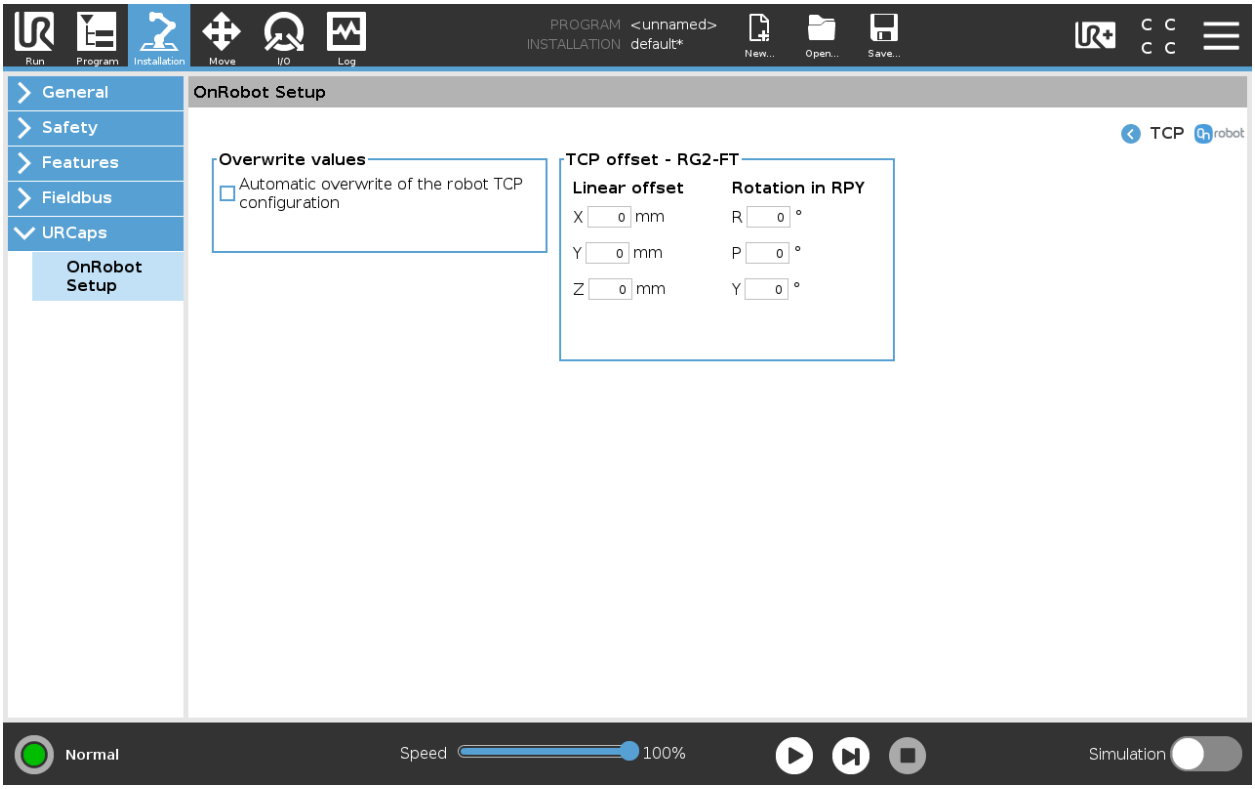


VG10

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 *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 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.

5.1 URCap commands

URCap commands provide an easy way to program an application.

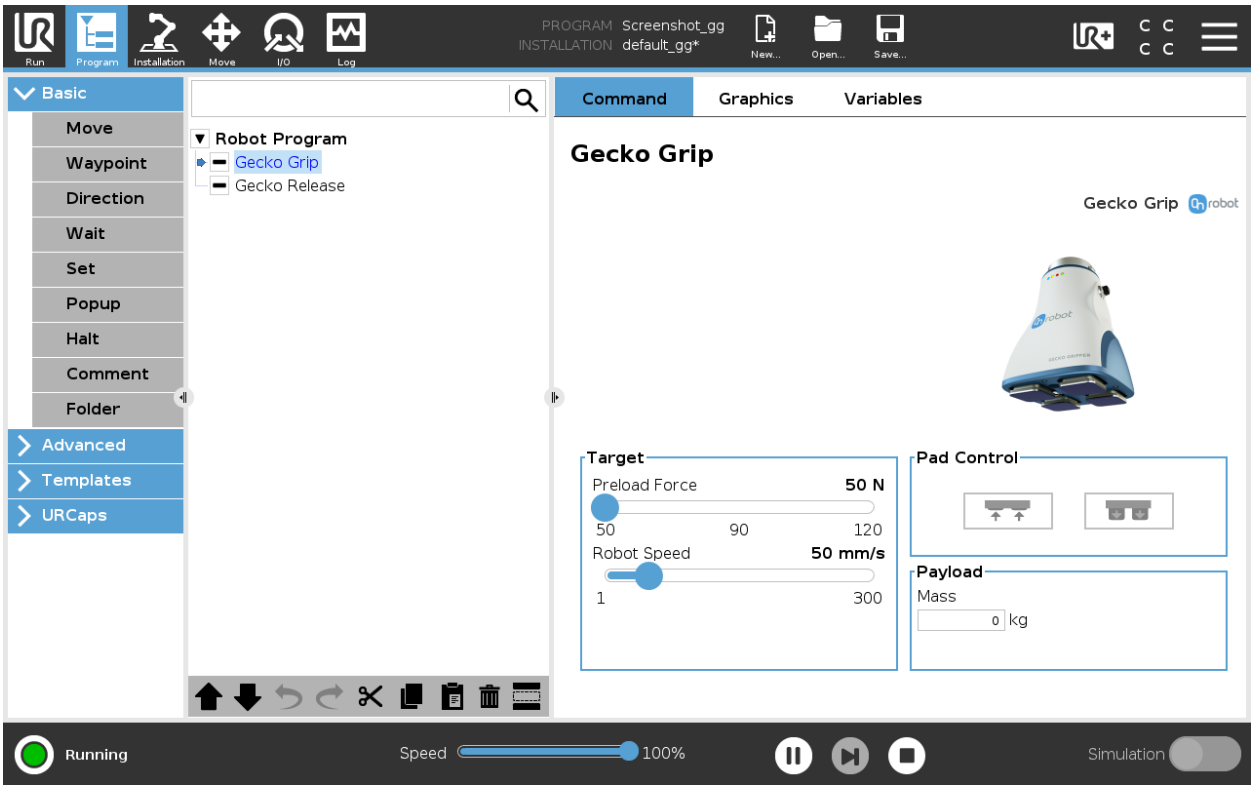
Gecko 48
HEX-E/H QC 51
RG2-FT 68
RG2/6 86
VG10 89

Gecko

Gecko Gripper - Grip

The `Gecko Gripper - Grip` command controls the Gecko Gripper and the robot to grip a part by applying the specified preload force and moving at the specified speed.

To grip a part with the Gecko Gripper, first the pads are pulled out and then the robot is moved down with the set speed and stopped when the set Preload Force is reached. If the set force is not reached within 300 mm the movement is stopped. Therefore, always start the gripping within that distance, preferably as close as possible.



Target

Preload Force: Specify the desired preload force to grip the part. The gripper will perform its grip command until the preload force is reached, at which point the robot will terminate the grip motion and immediately continue onto the next command. The possible values are 50, 90 and 120 N.

NOTE:

The robot safety settings may need to be changed to allow forces above 50N to be exerted. UR3 and UR5 cannot exert forces above 50N.

Robot Speed: Specify the robot's downward speed during the pick motion. Values between 0 and 300 mm/s.

Pad Control

press to move the Gecko pads in.

press to move the Gecko pads out.

Payload

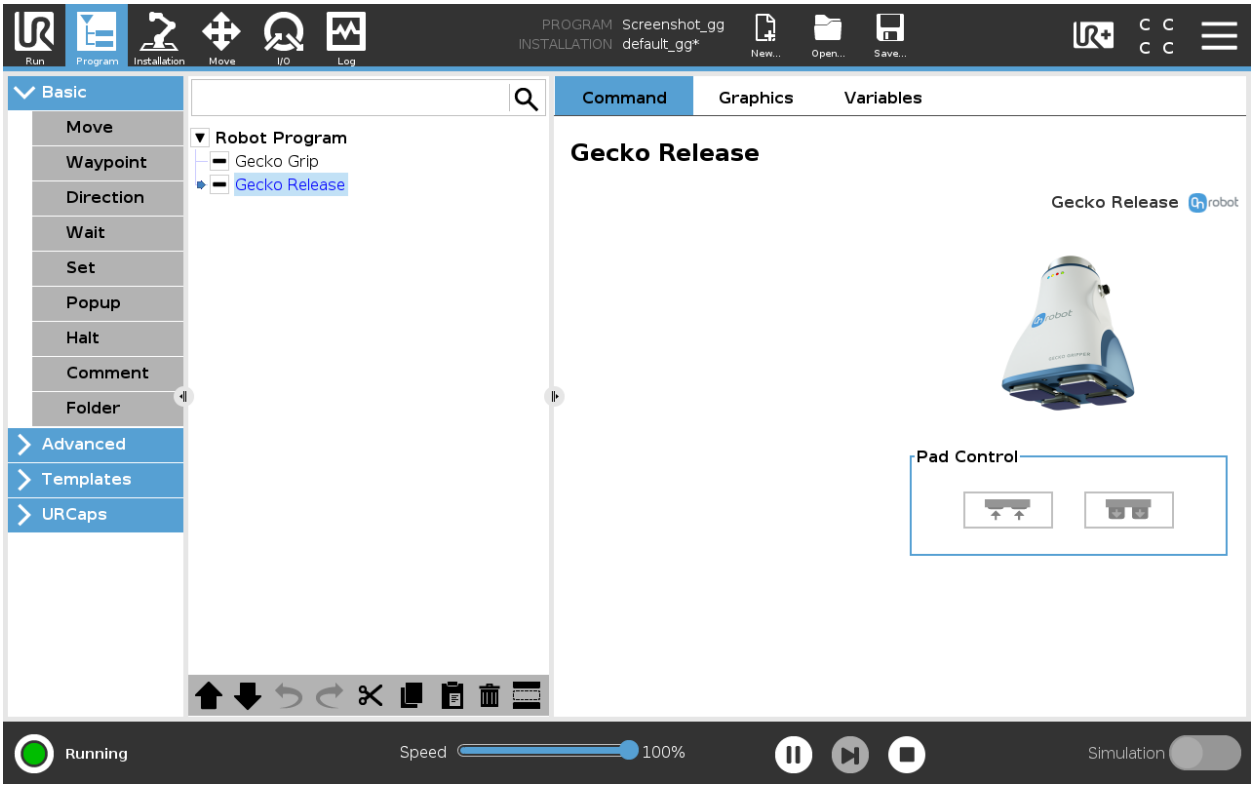
Mass: the workpiece weight can be entered. The URCap software will then perform the calculation of the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

NOTE:

When the pads are needed to be replaced a warning message is displayed. It will re-appear on every program running until the pads are not pulled in and out or the error has not been reset on the toolbar.

Gecko Gripper - Release

The `Gecko Gripper – Release` command controls the Gecko Gripper and the robot to release the part at a specific waypoint.



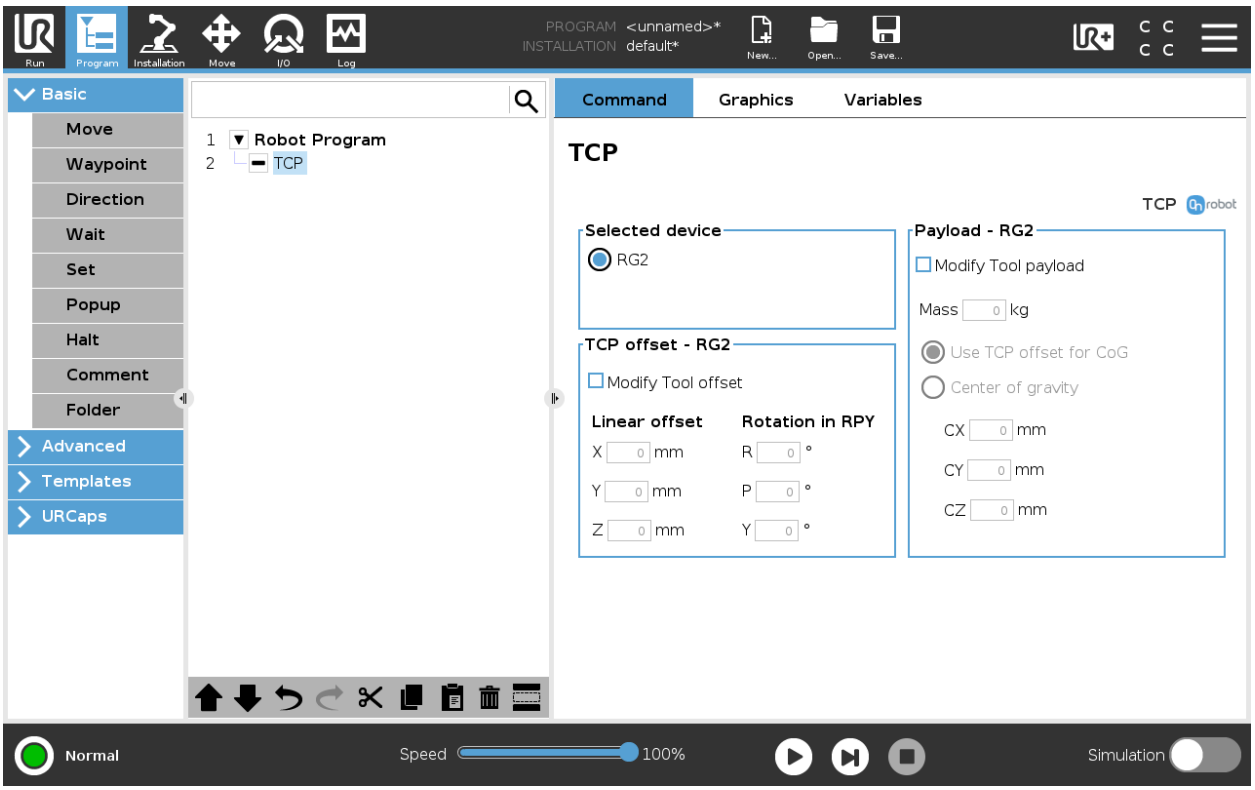
Pad Control

press to move the Gecko pads in.

press to move the Gecko pads out.

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.

Mass: 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.

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.

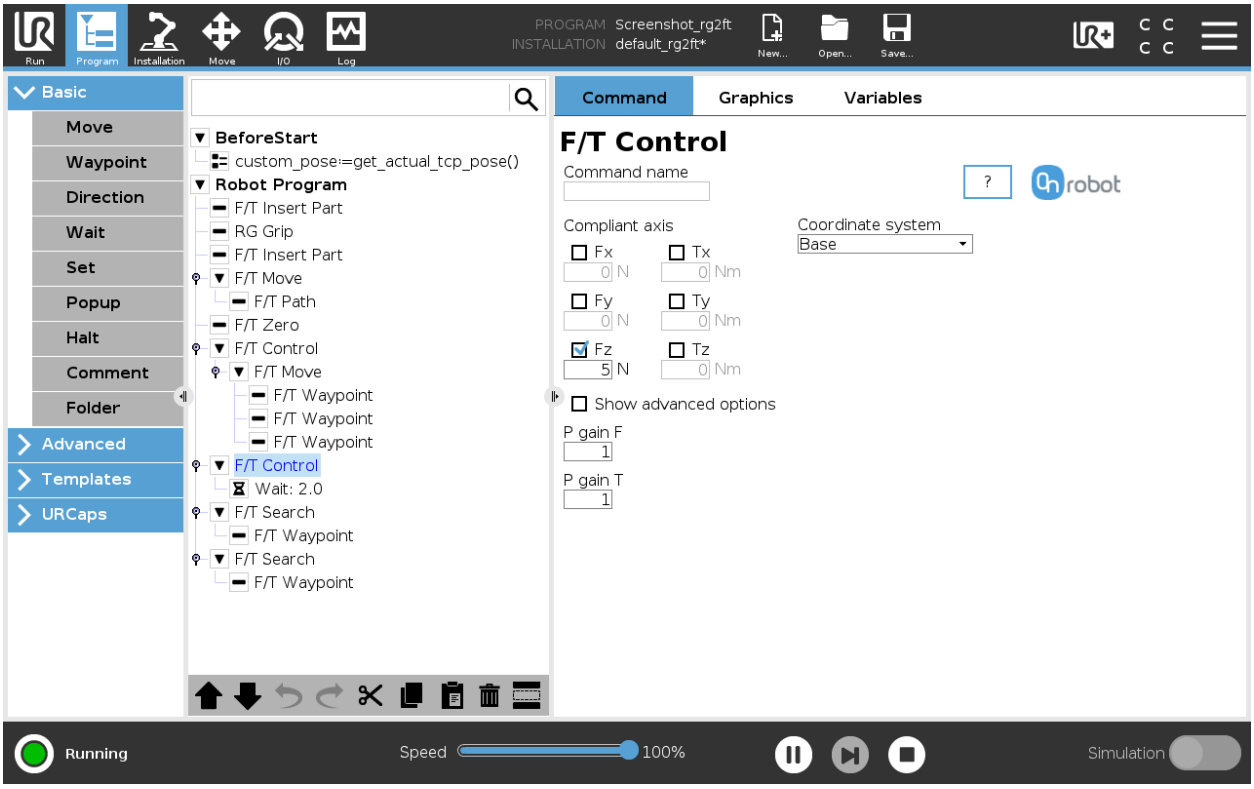
This command alters the trajectory of its child node(s) in order to keep the force/torque values constant along/about the selected axes.

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.

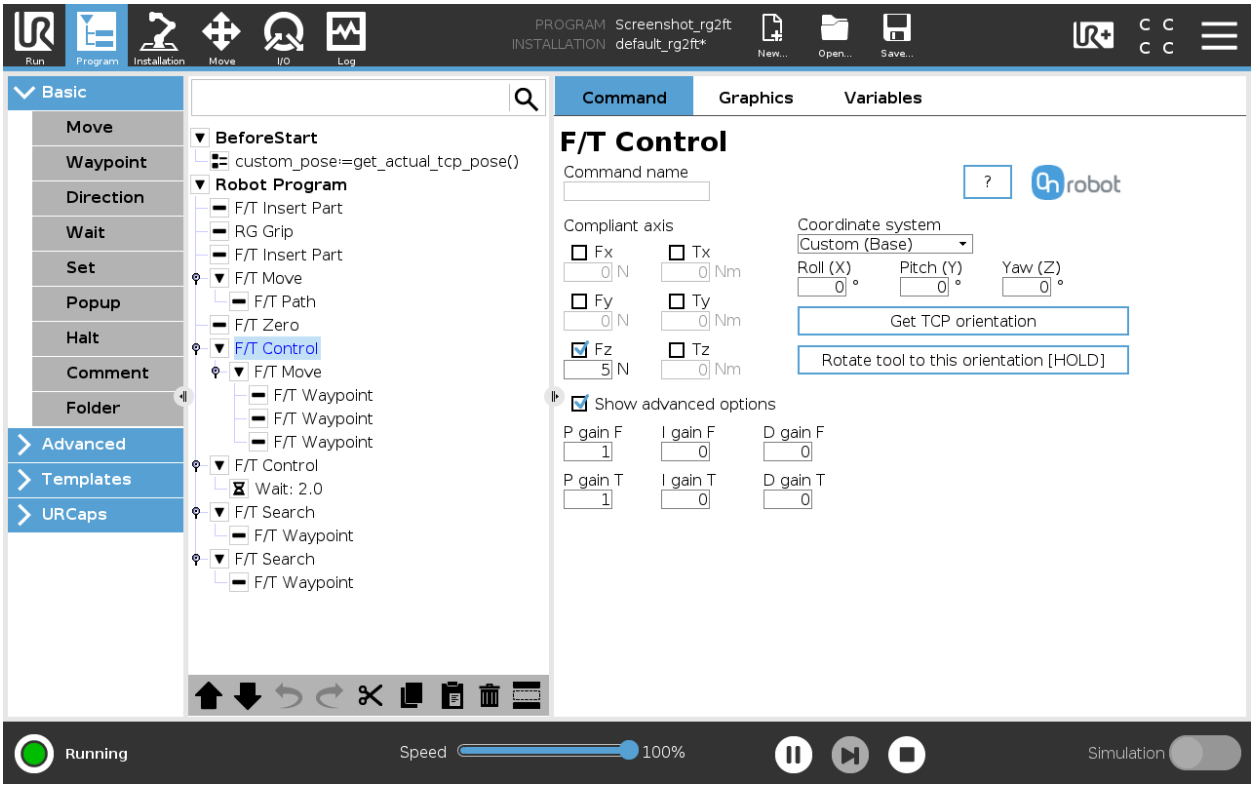
Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base, Tool, Custom (Base), Custom (Tool) (according to the UR's reference frames). The

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

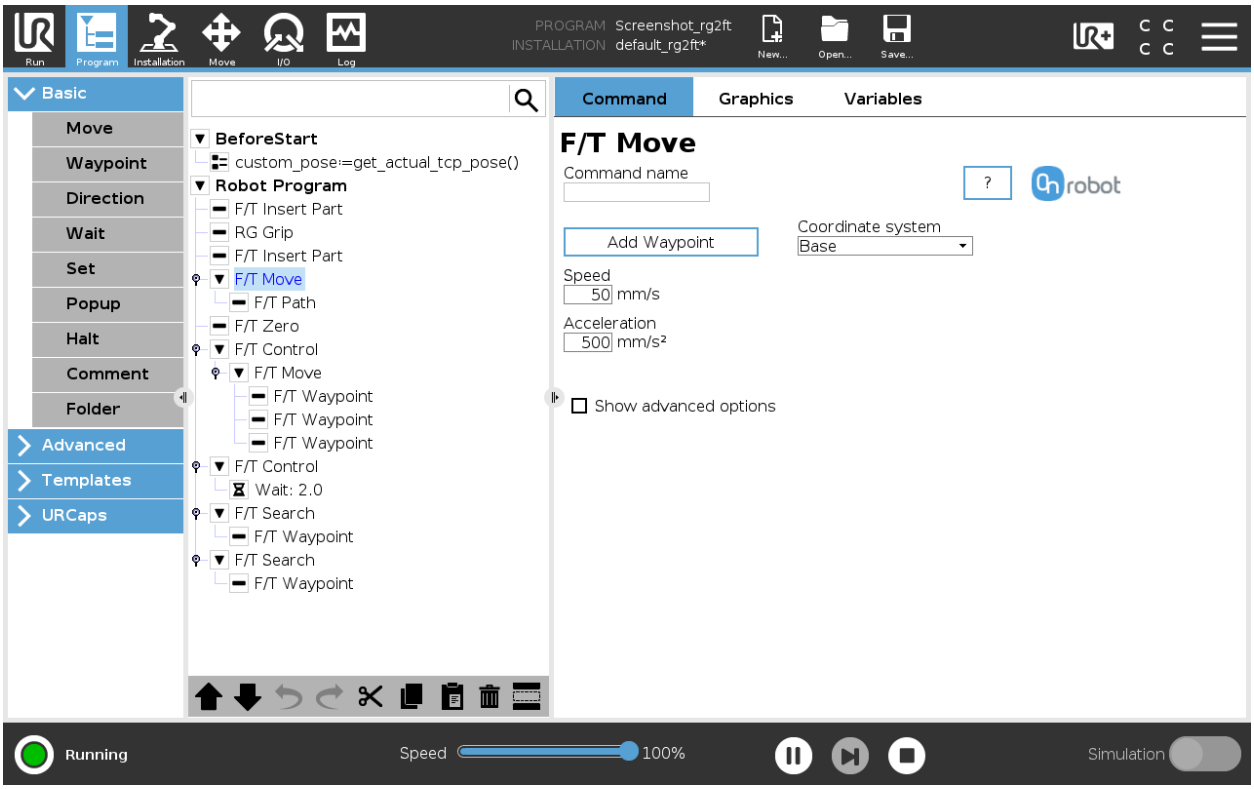
P Gain T =0.2, I Gain T = 0, D Gain T = 0

F/T Move

The F/T Move command can be used together with the F/T Waypoint 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 (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.

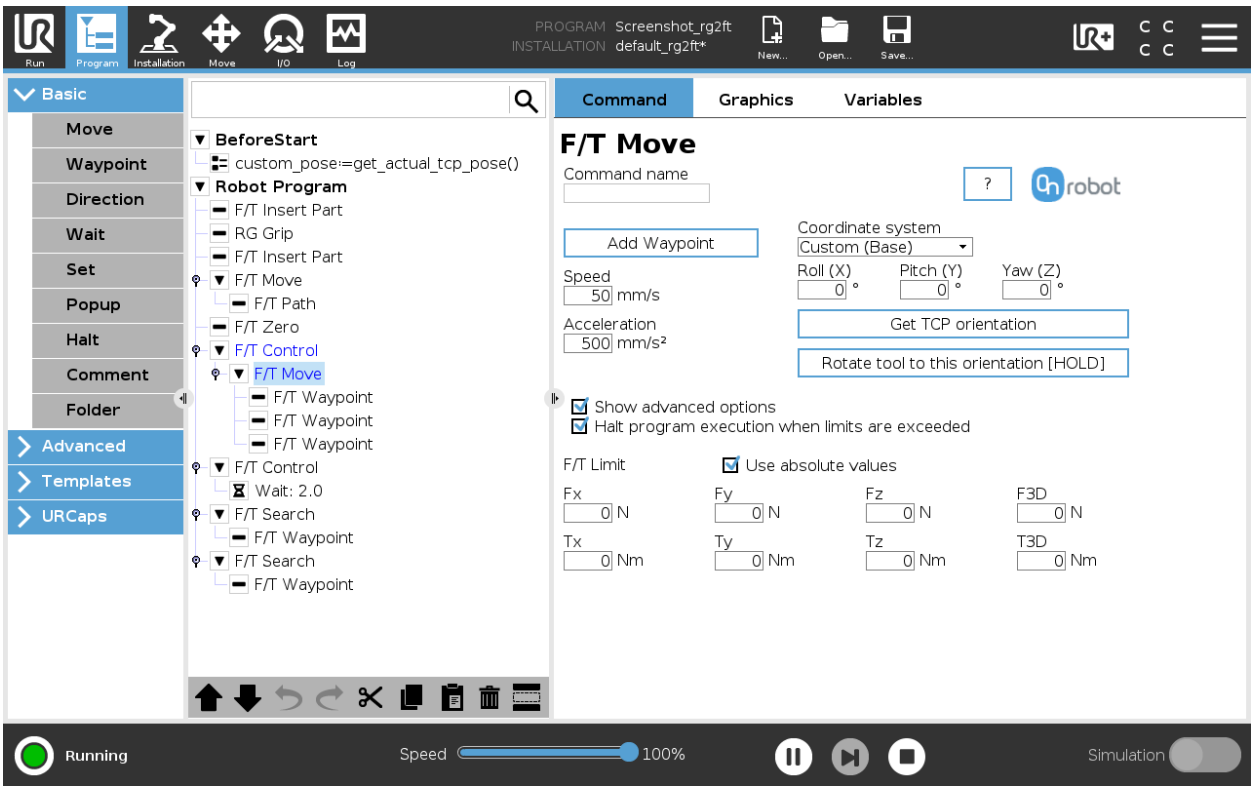
Speed: The movement speed limit while moving. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

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 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.

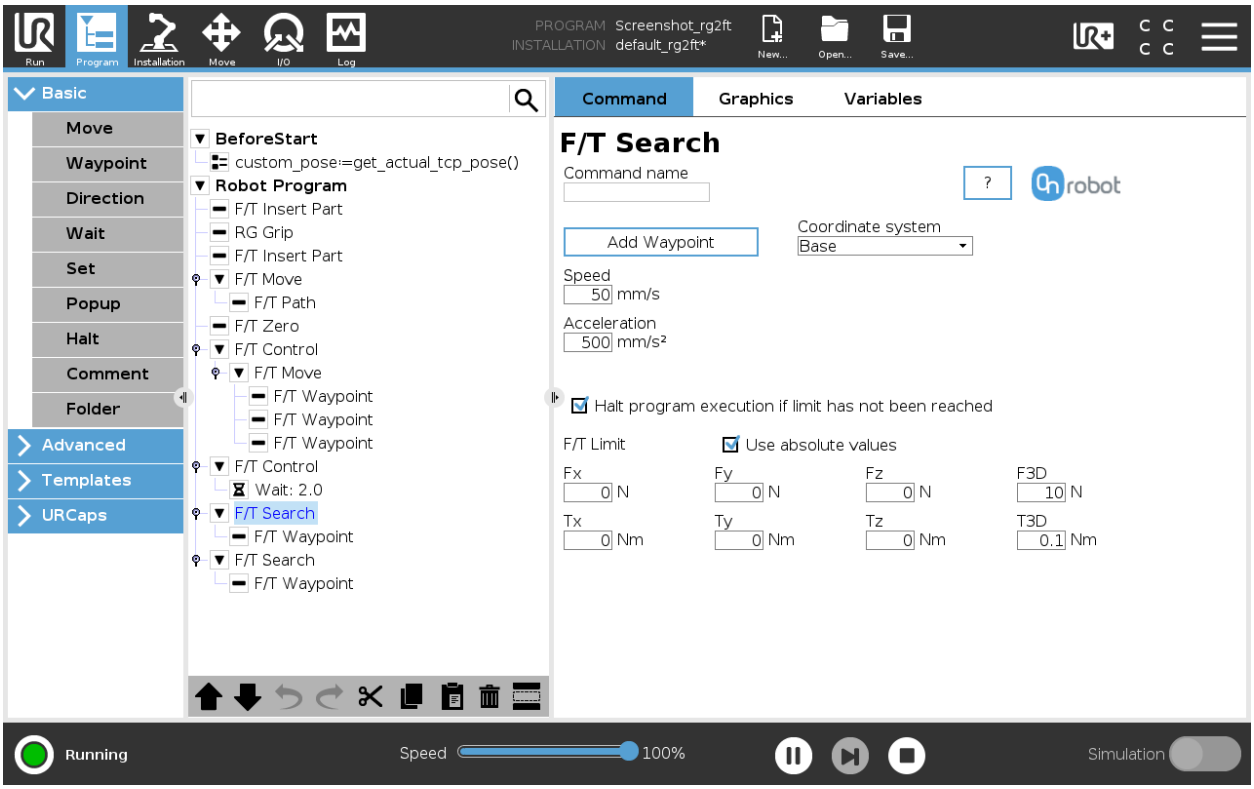
This command has no return value.

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 command 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 Return Values section.

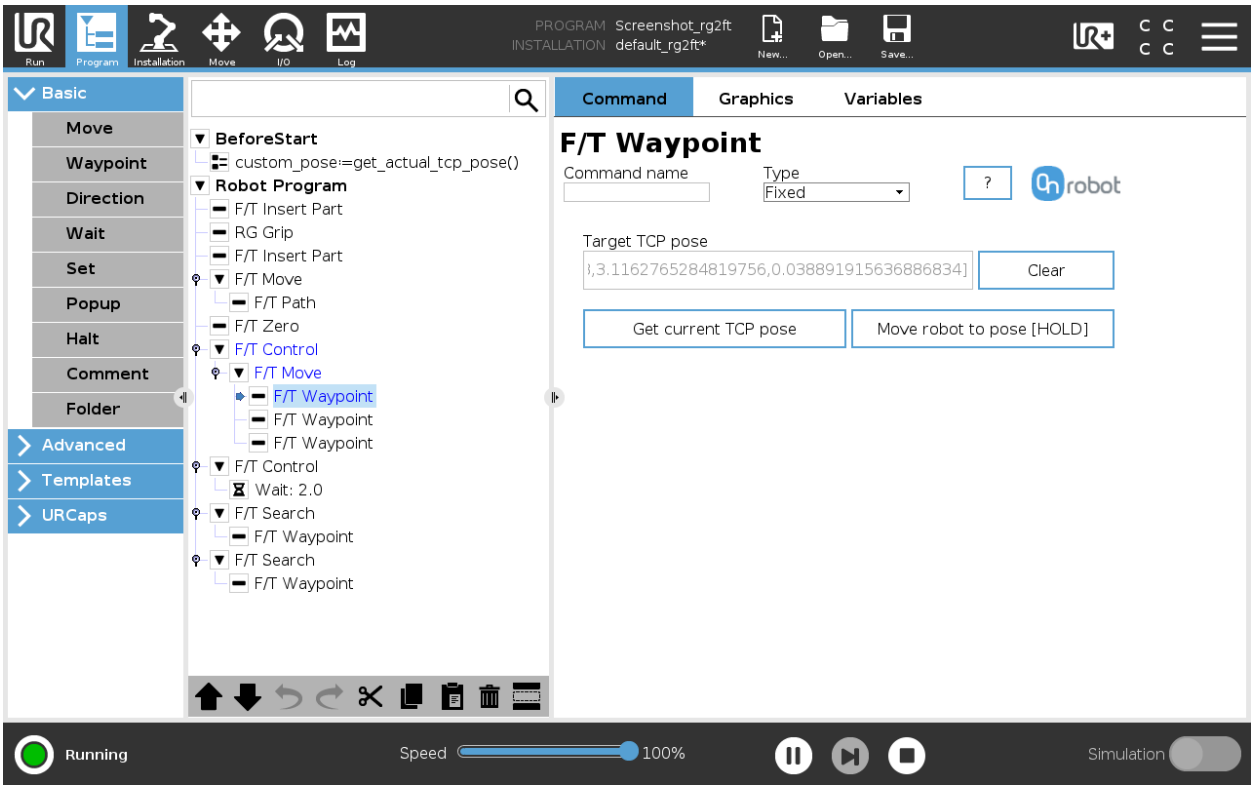
F/T Waypoint

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 Waypoints` 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.

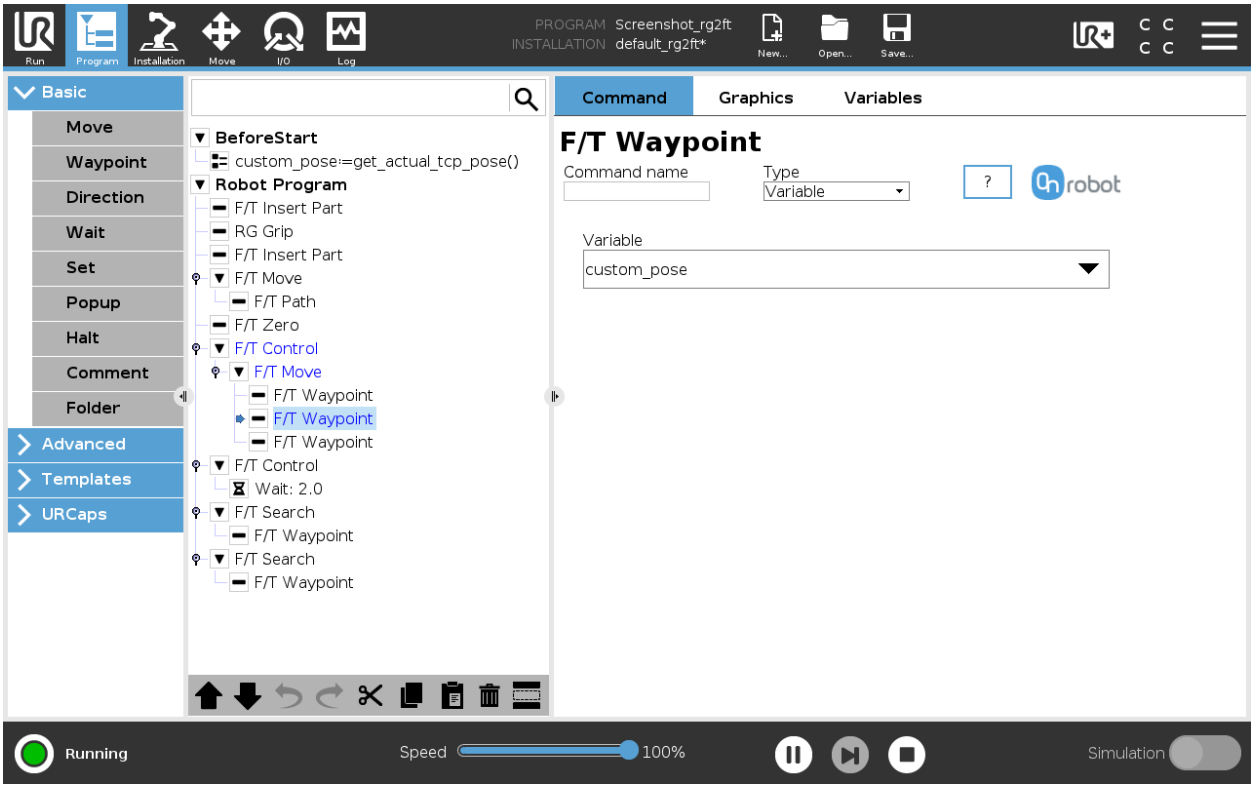


Target TCP pose: The position represented by the waypoint in the robot route. It is a read-only field and can be filled by using the **Get current TCP pose** button.

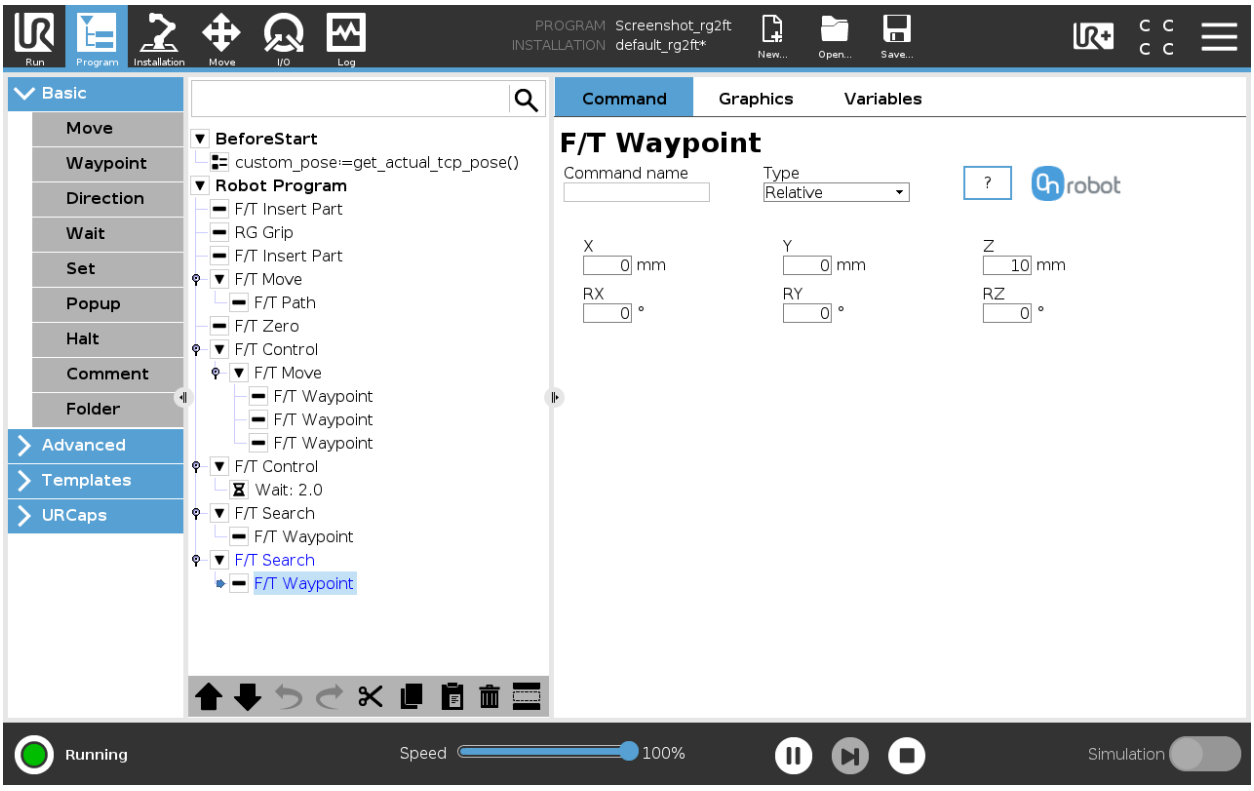
Clear: deletes the contents of the **Target TCP pose** field.

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.

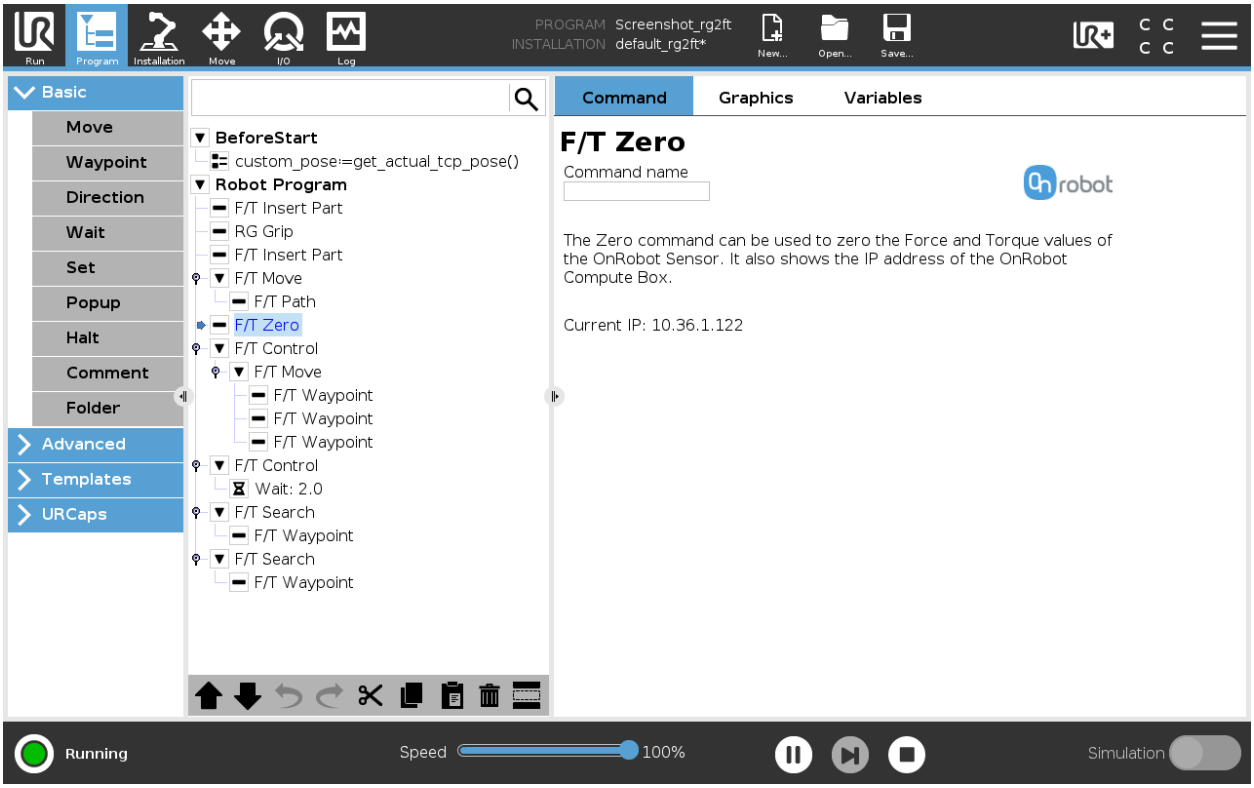


Relative X, Y, Z, RX, RY, RZ: the distances and rotations this waypoint represents, compared to the previous robot position.

This command has no return value.

F/T Zero

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



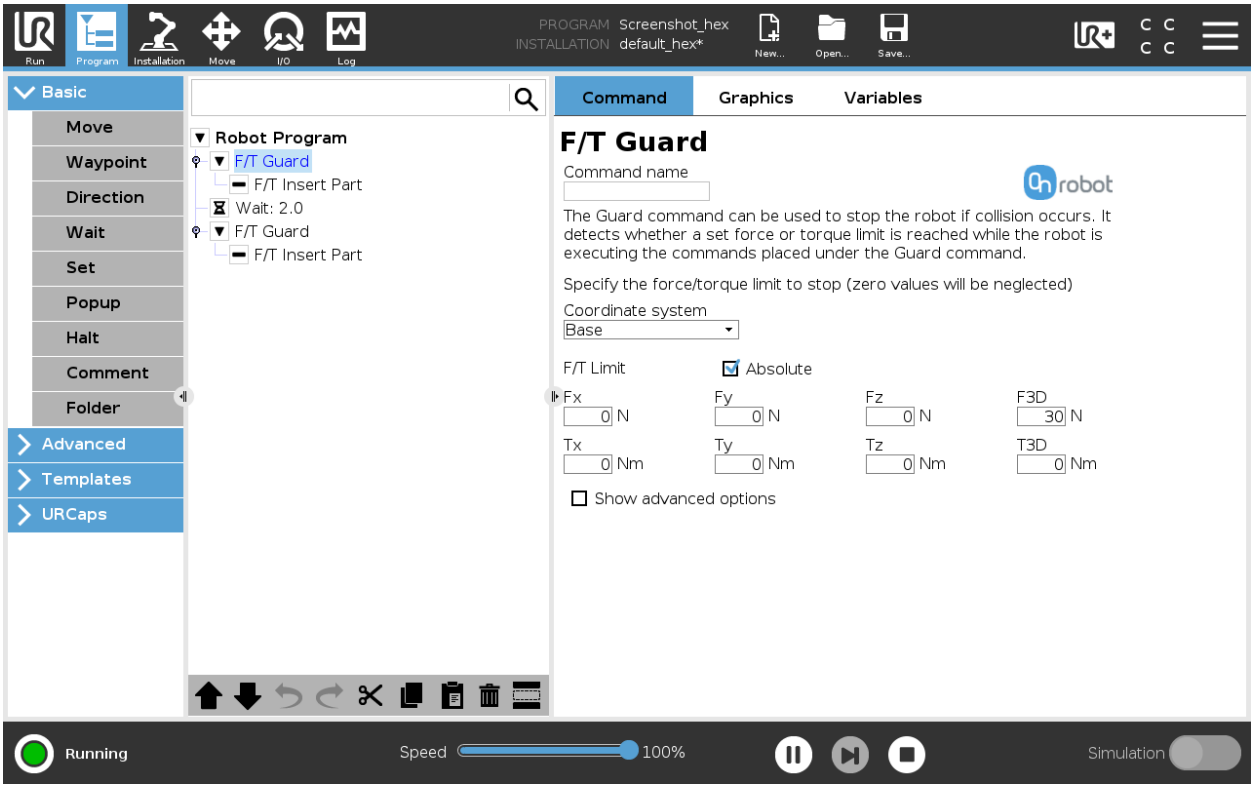
This command has no return value.

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` command 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.

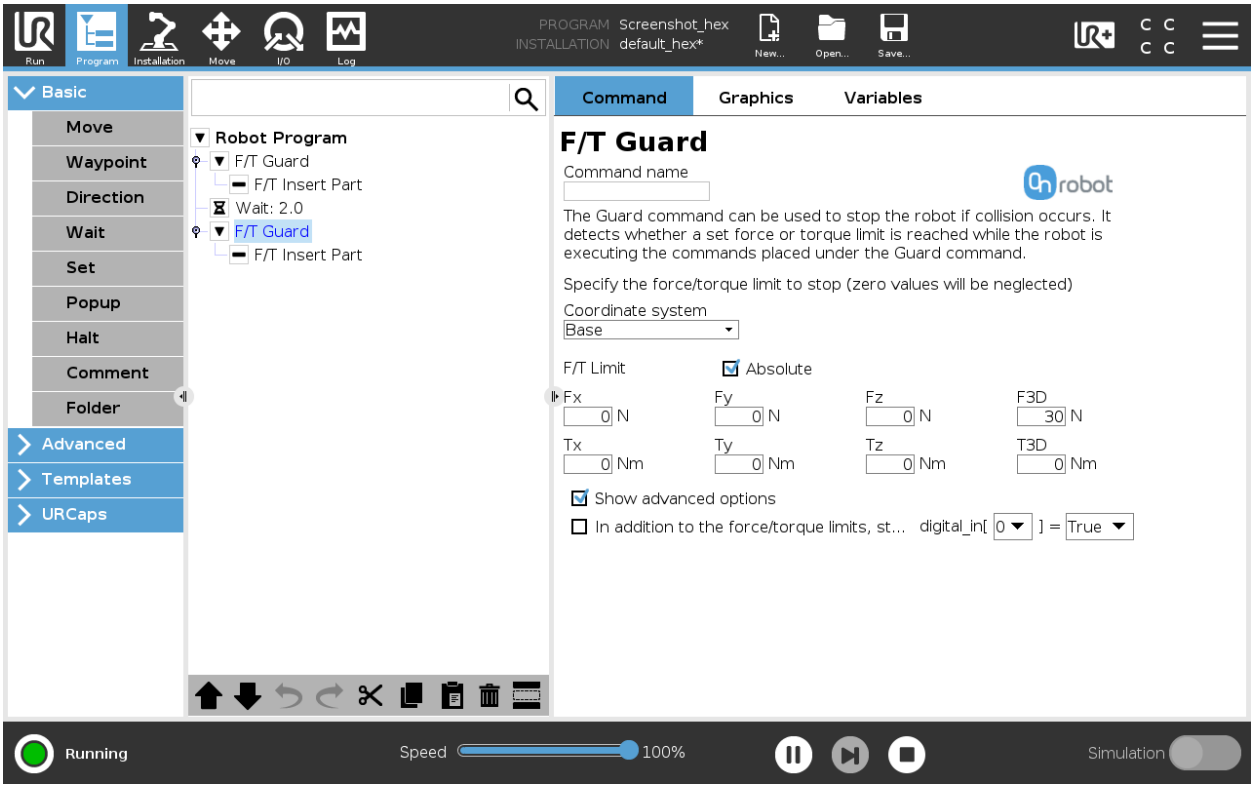


Coordinate system: The coordinate system used both for the movement and for the sensor reading. It can be set to Base or Tool (according to the UR's reference frames).

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

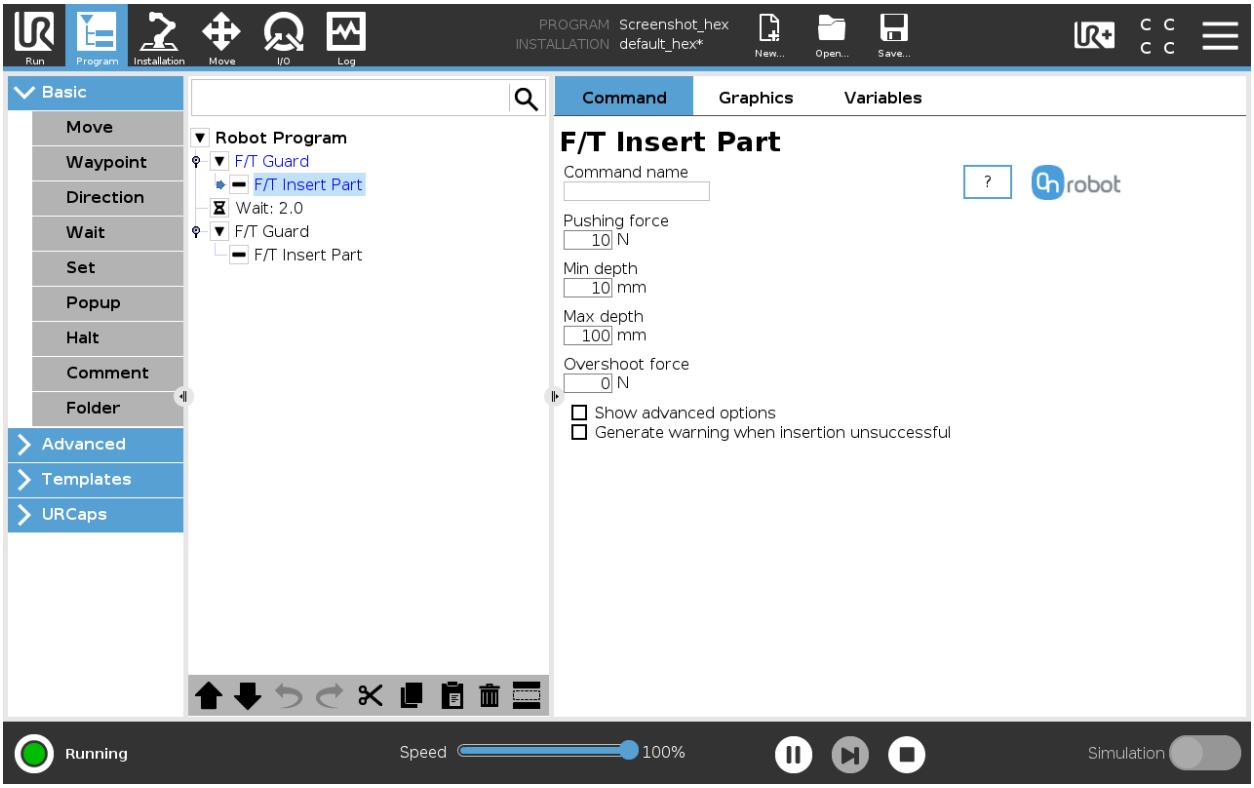
First position the pin or peg that needs to be inserted to the hole pointing in the right direction and close to the hole entrance. The final position and orientation will be corrected by the `F/T Insert Part` command. It tries to push the pin with the predefined force limit and adjusts the orientation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



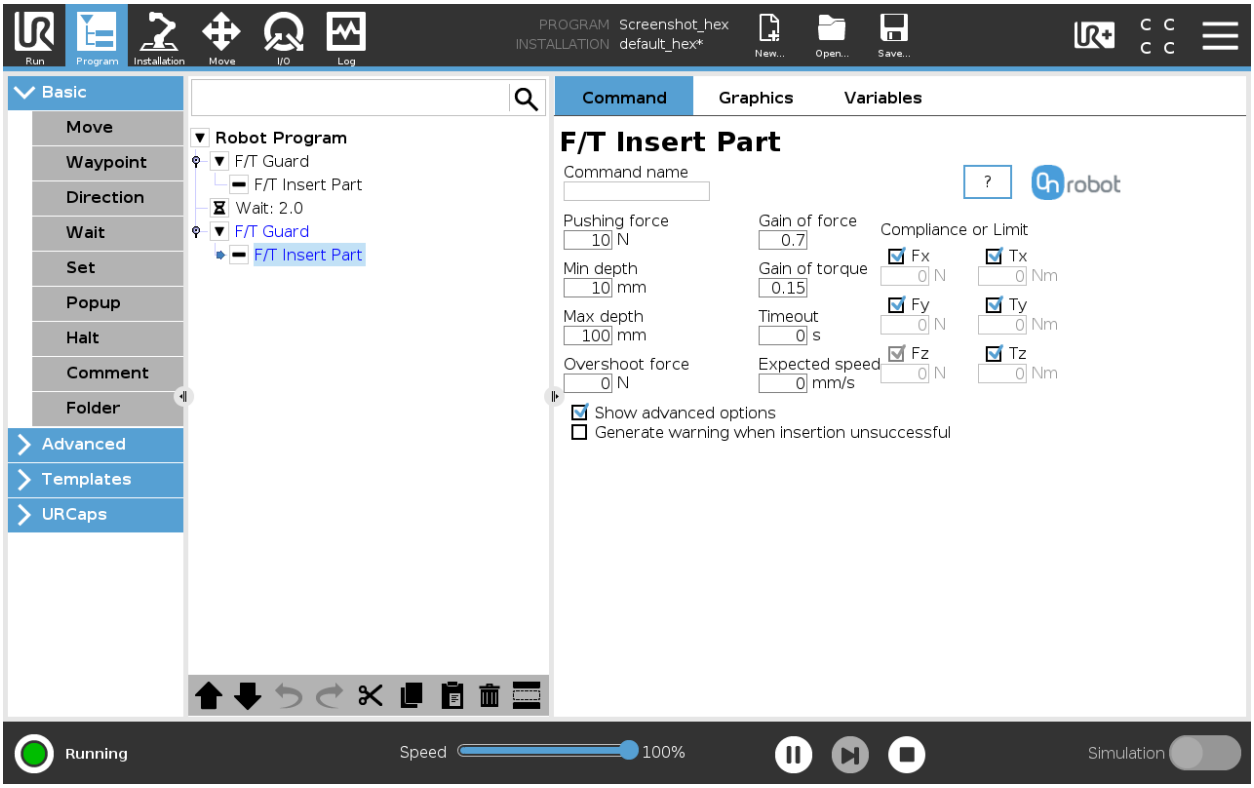
Pushing force: The force target used for the force control to gently push the part into the hole.

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.

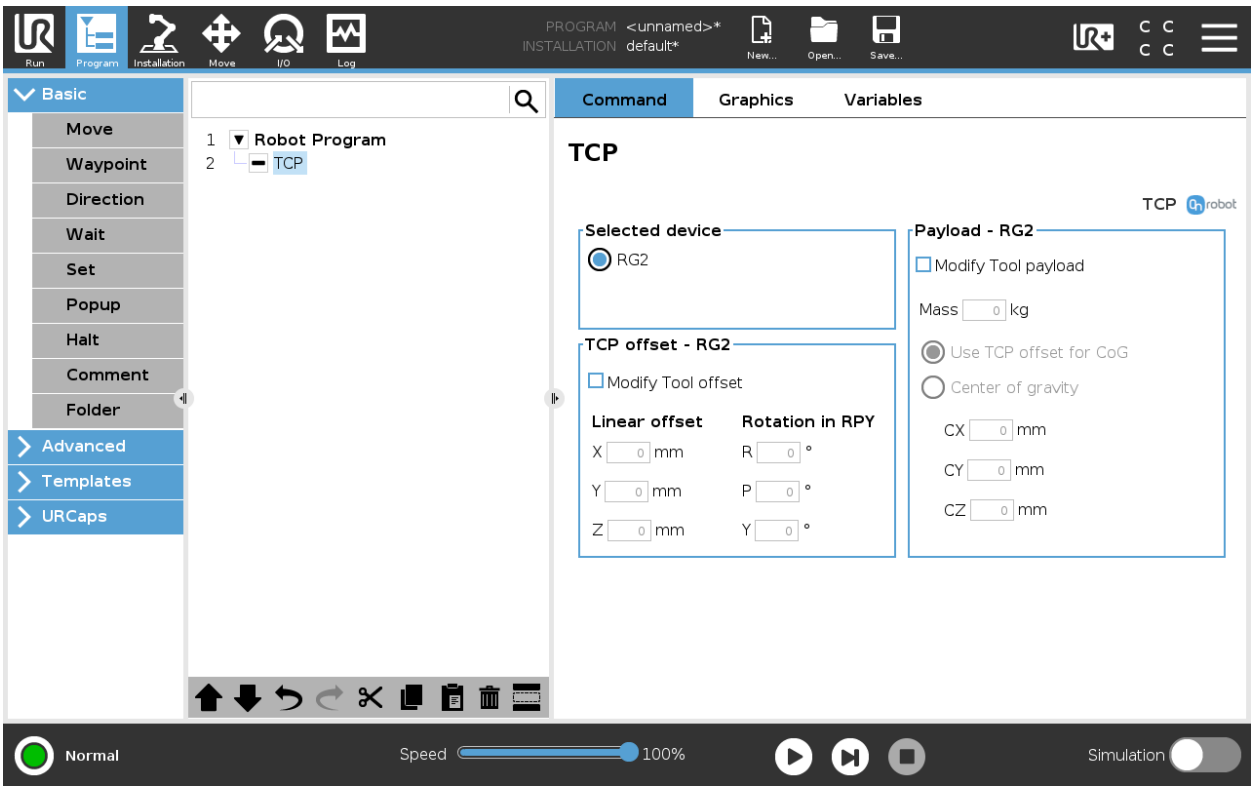
Generate warning when insertion unsuccessful: If enabled then a pop-up message (blocking) appears if the insertion was not successful.

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 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.

Mass: 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.

RG2-FT

NOTE:

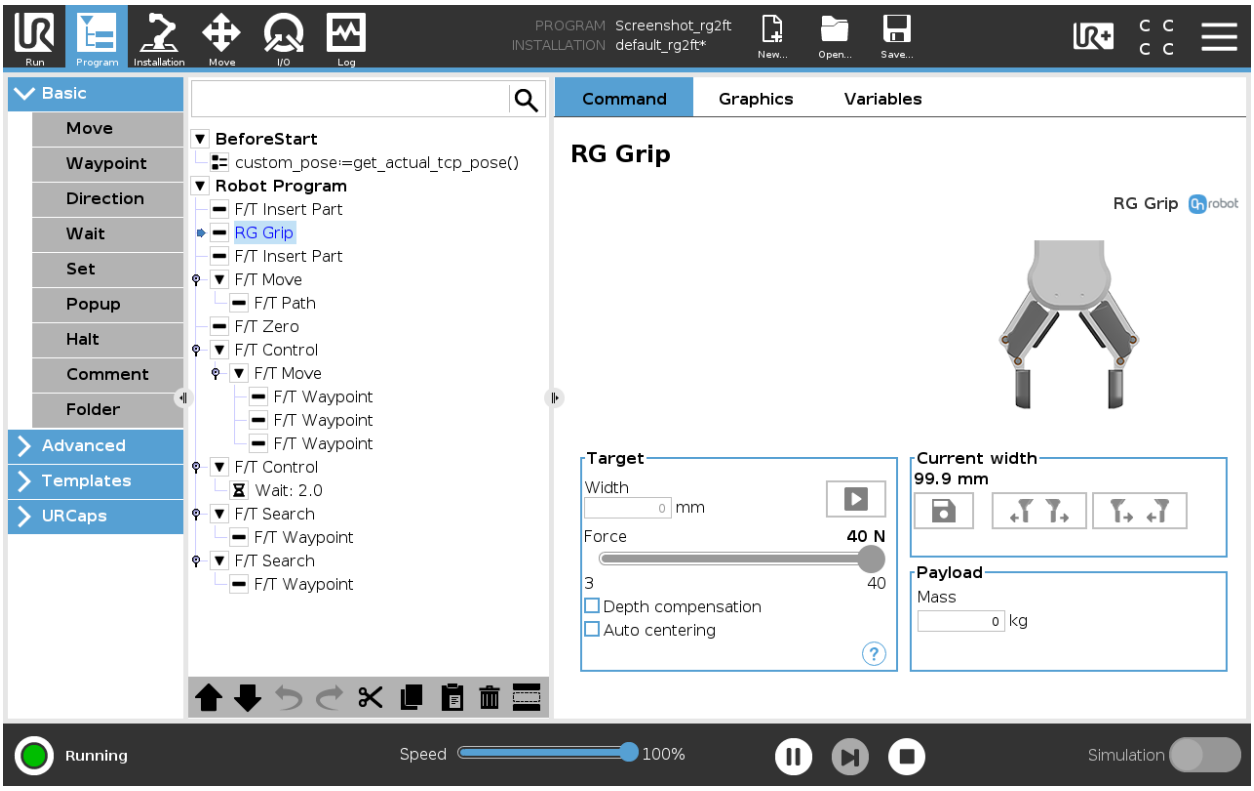
At program start the force/torque finger sensors are automatically zeroed so no need to place an `F/T Zero` at the beginning of the program. Please make sure that the fingers are not in contact with any obstacle when the program is started. Otherwise the sensors will not be properly zeroed.

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

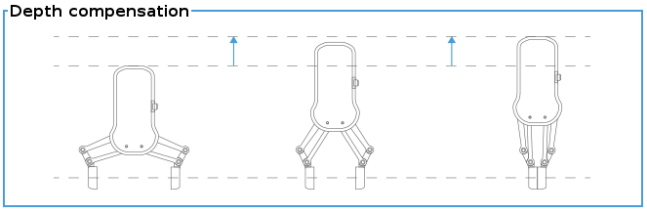
Width: The target gripping width can be set by using the Save as Target/Save Grasp button (recommended) or by typing it in manually.

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

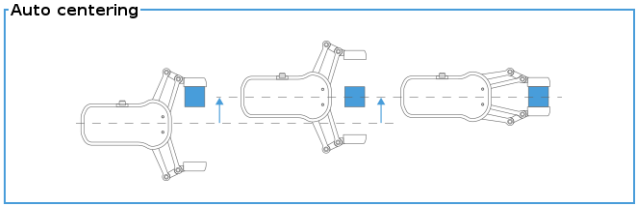
Force: Set the target gripping Force (3-40 N).

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.



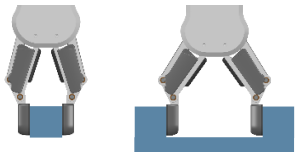
Auto centering: if checked, during closing and opening the gripper, the robot moves the gripper sideways to grab the item symmetrically based on the proximity signals of the fingers. when pressed, the following graphical illustration will appear in a new page.



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.

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.

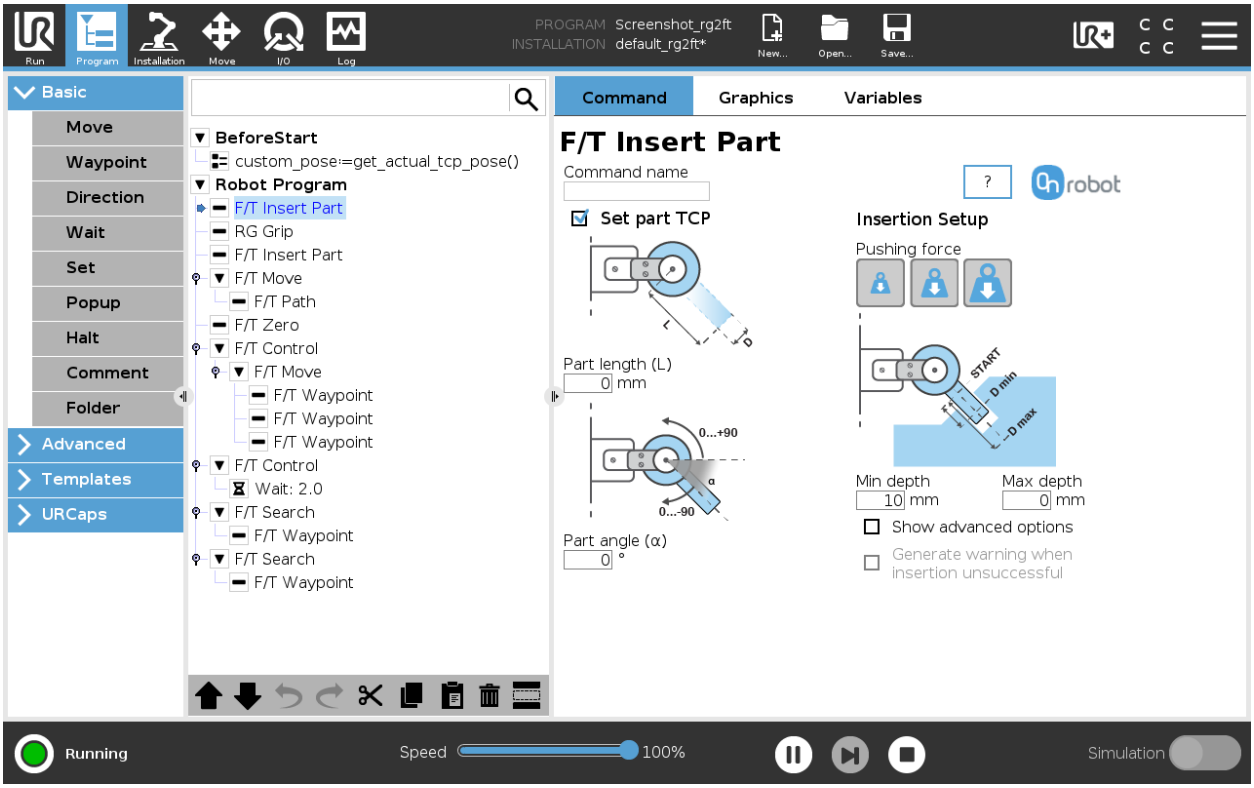
.

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.

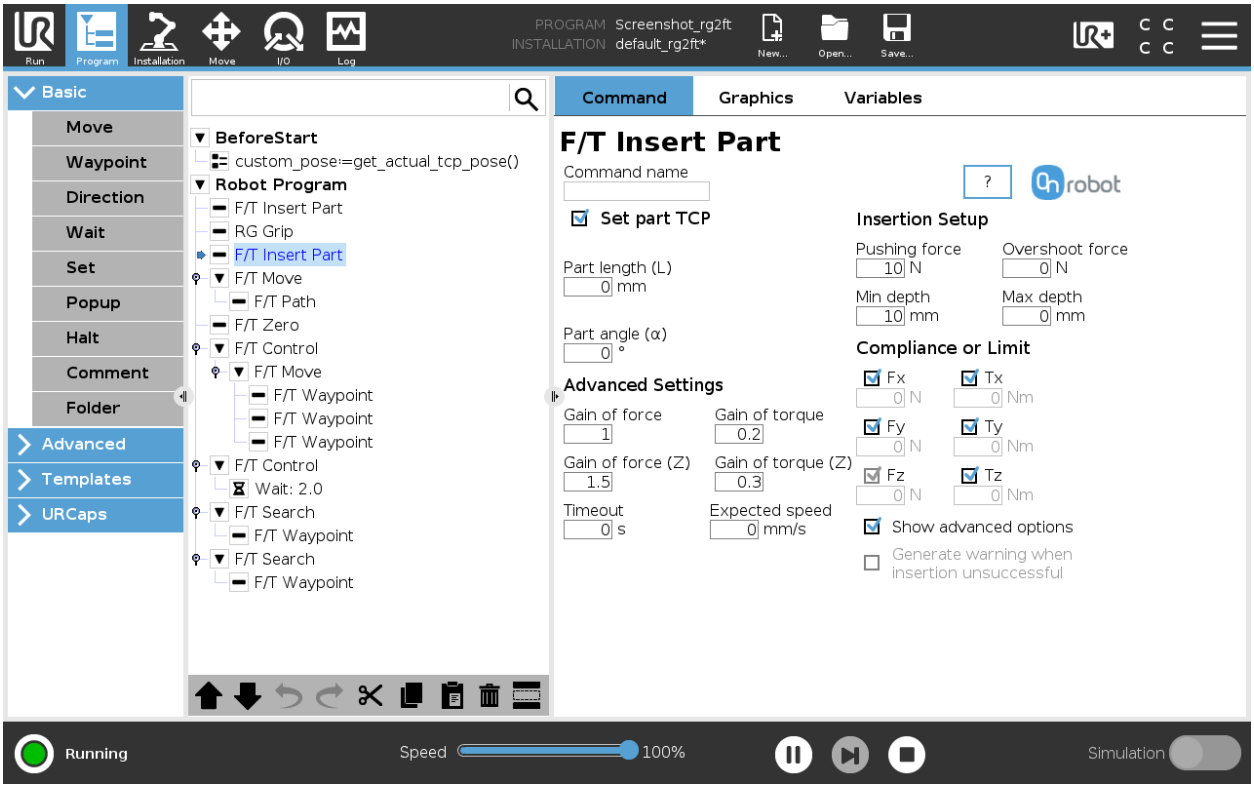
: sets the pushing force to be 6N.

: 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 parameters 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 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.

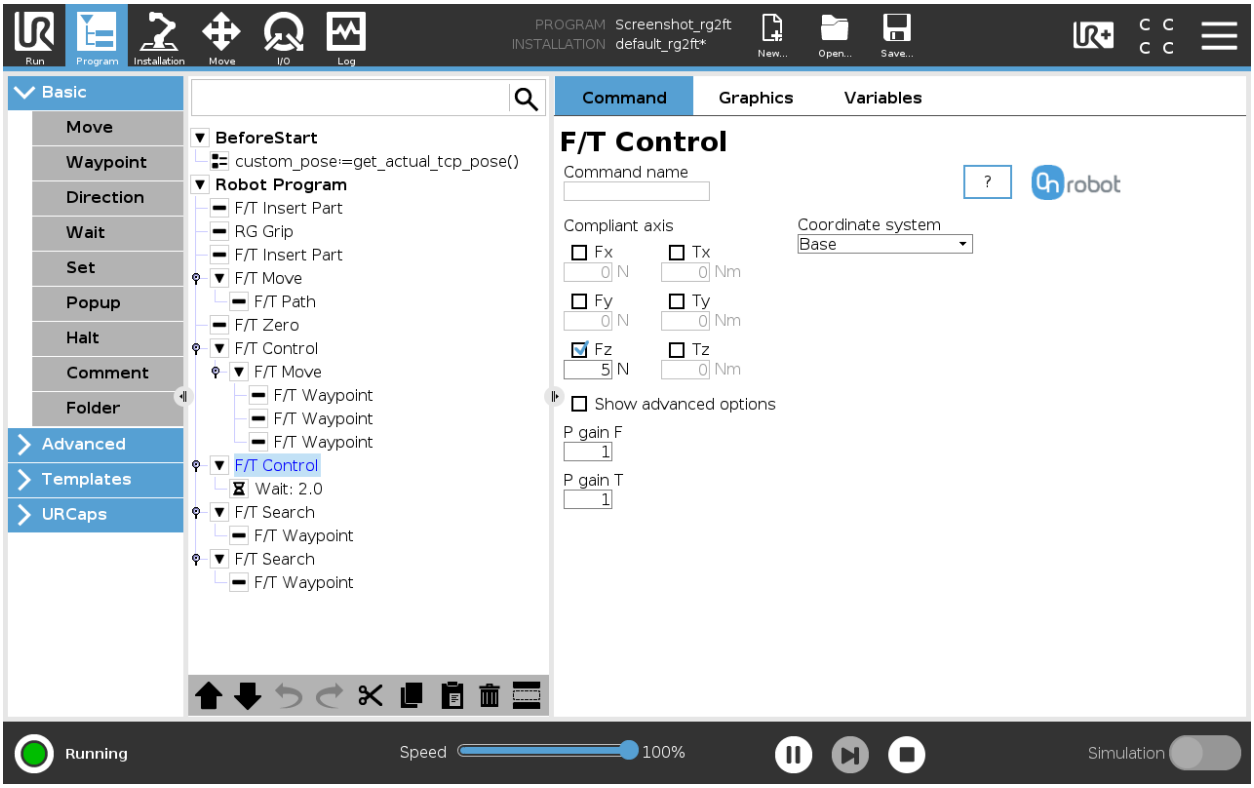
This command alters the trajectory of its child node(s) in order to keep the force/torque values constant along/about the selected axes.

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.



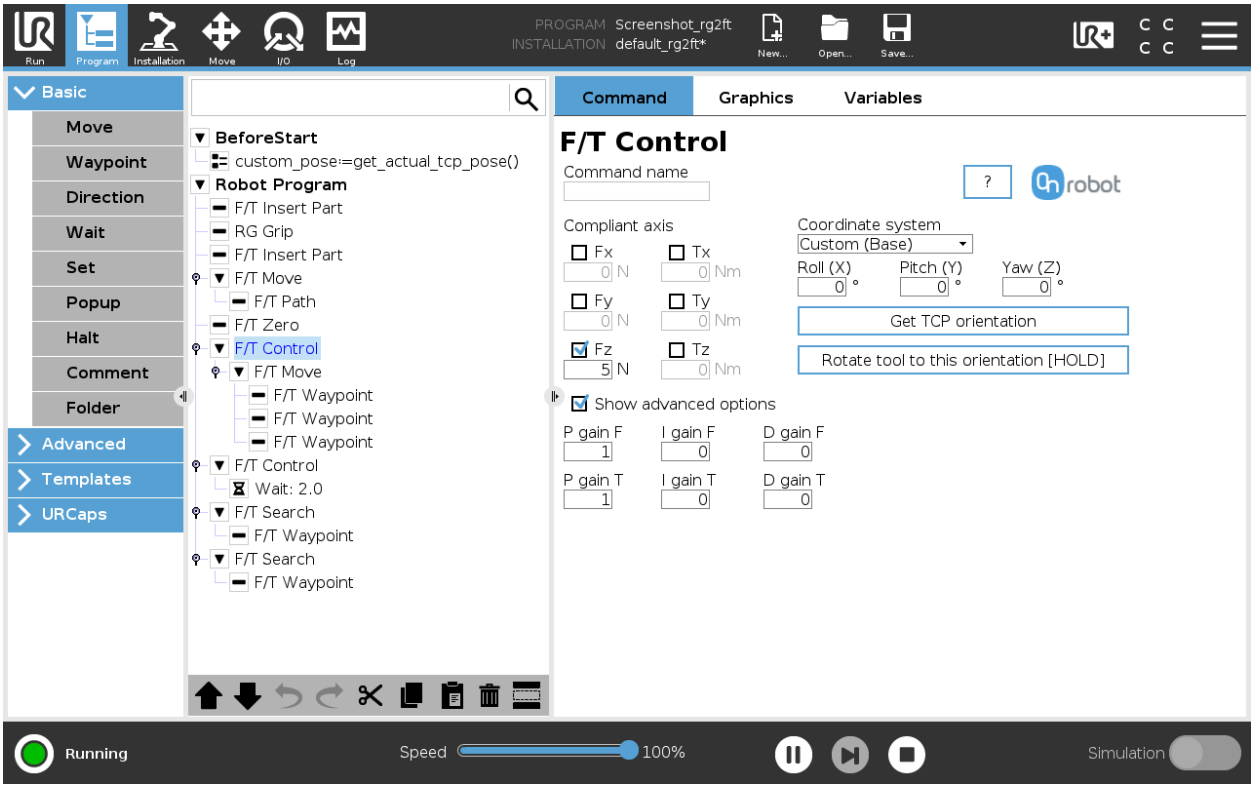
Compliant axis Fx, Fy, Fz, Tx, Ty, Tz: The axis selection that needs to be compliant. If an axis is enabled (compliant) the movement along/about that axis is force/torque controlled otherwise (non-compliant) position controlled. The enabled axis is controlled to keep the set force/torque value constant.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

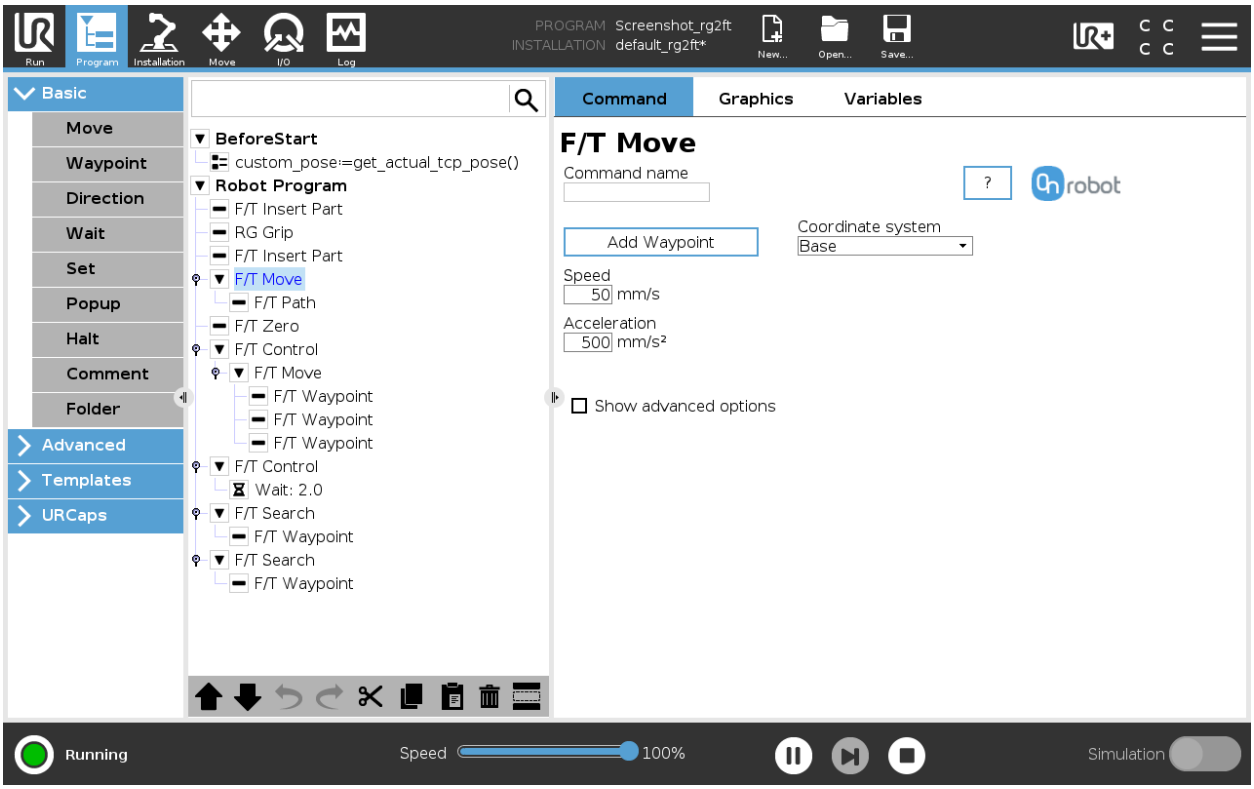
P Gain T =0.2, I Gain T = 0, D Gain T = 0

F/T Move

The `F/T Move` command can be used together with the `F/T Waypoint` 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 (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.

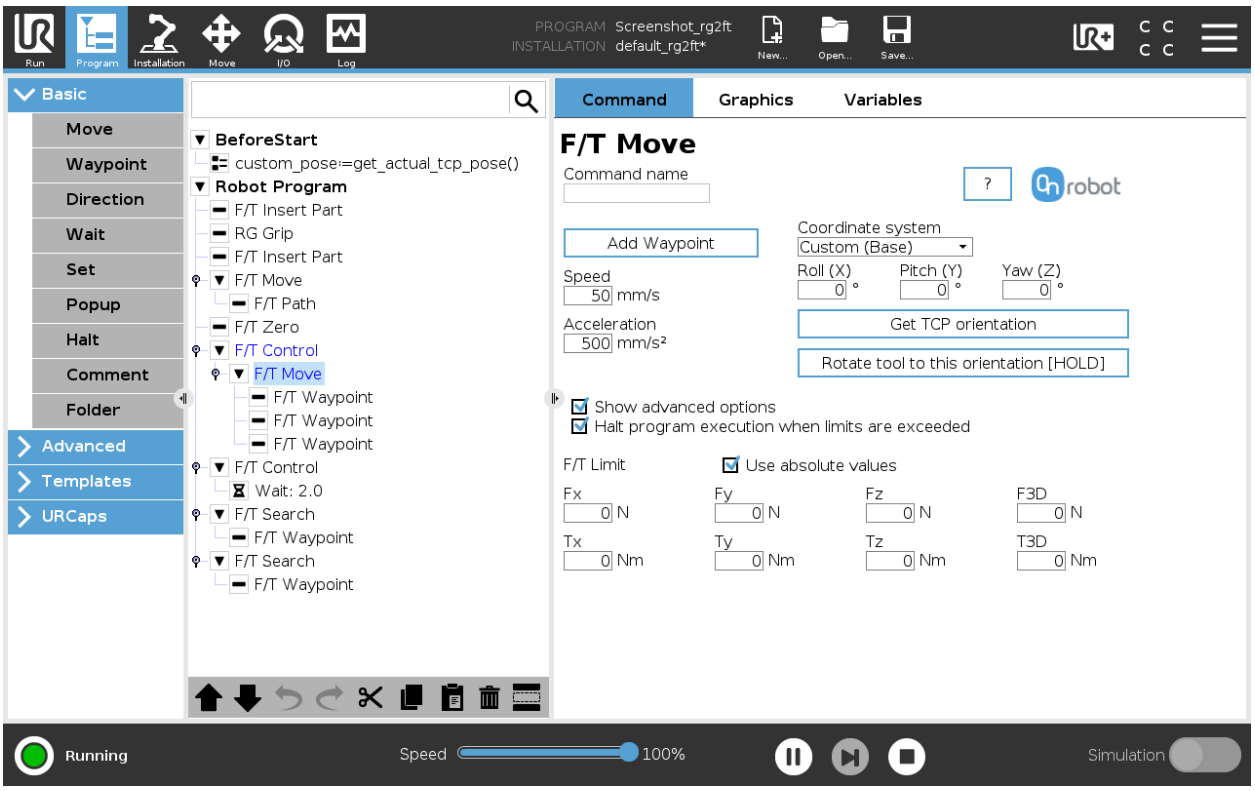
Speed: The movement speed limit while moving. The movement is carried out in a constant translational speed. If the route or path has sharp changes in the direction, or the orientation, the actual speed of the robot may be less than specified, but still constant throughout the route or Path.

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 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.

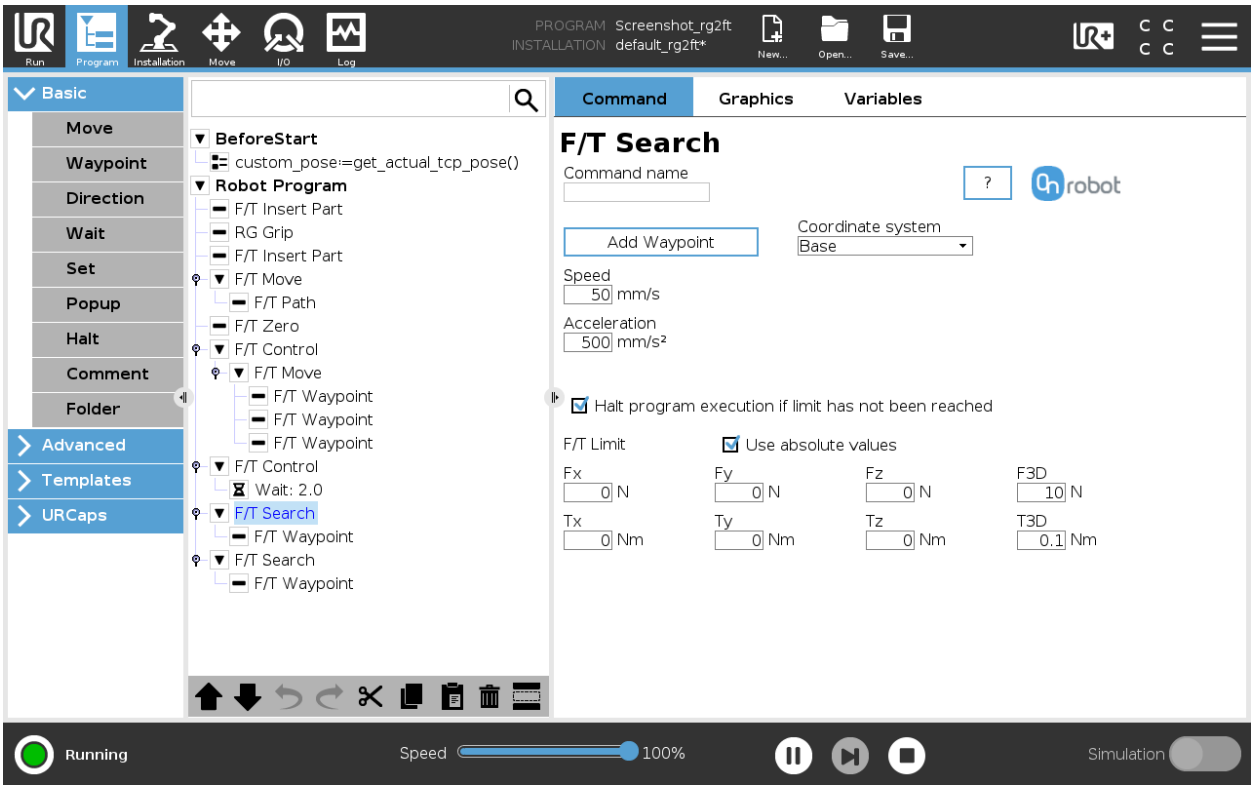
This command has no return value.

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 command 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 Return Values section.

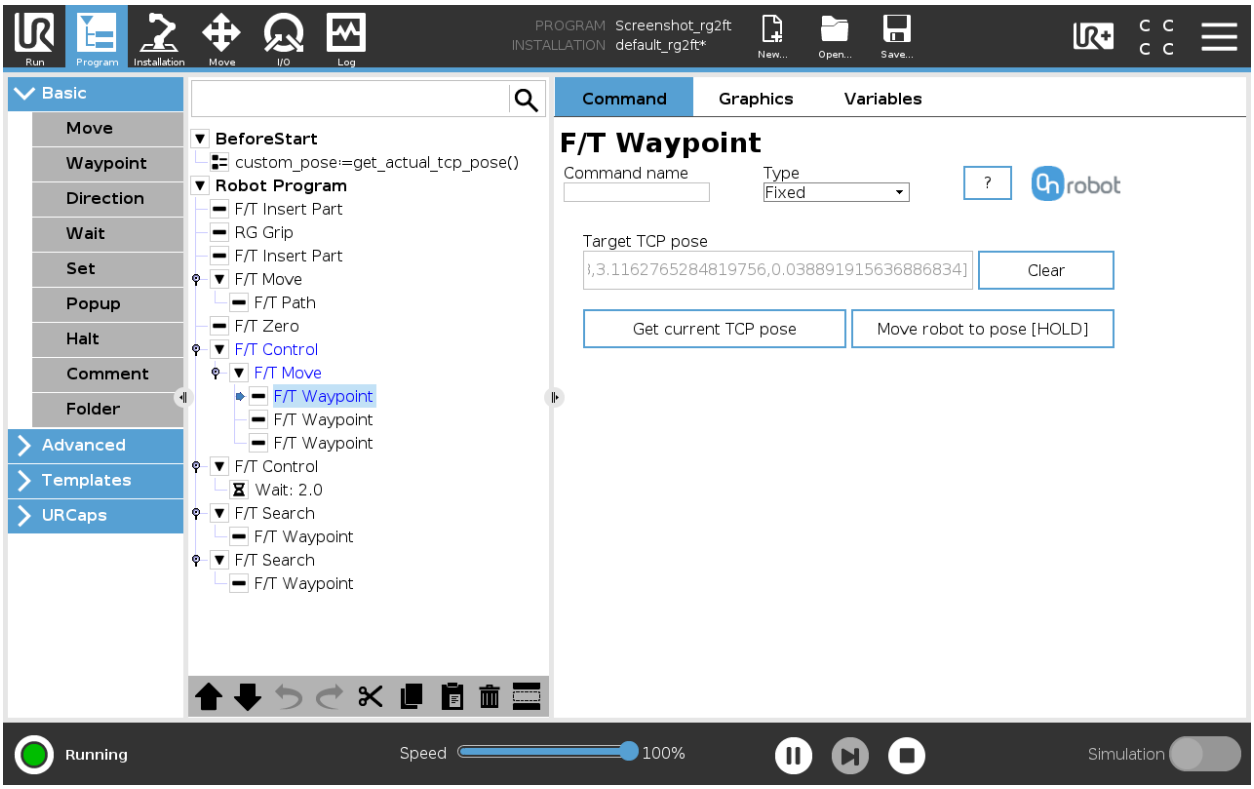
F/T Waypoint

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 Waypoints` 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.

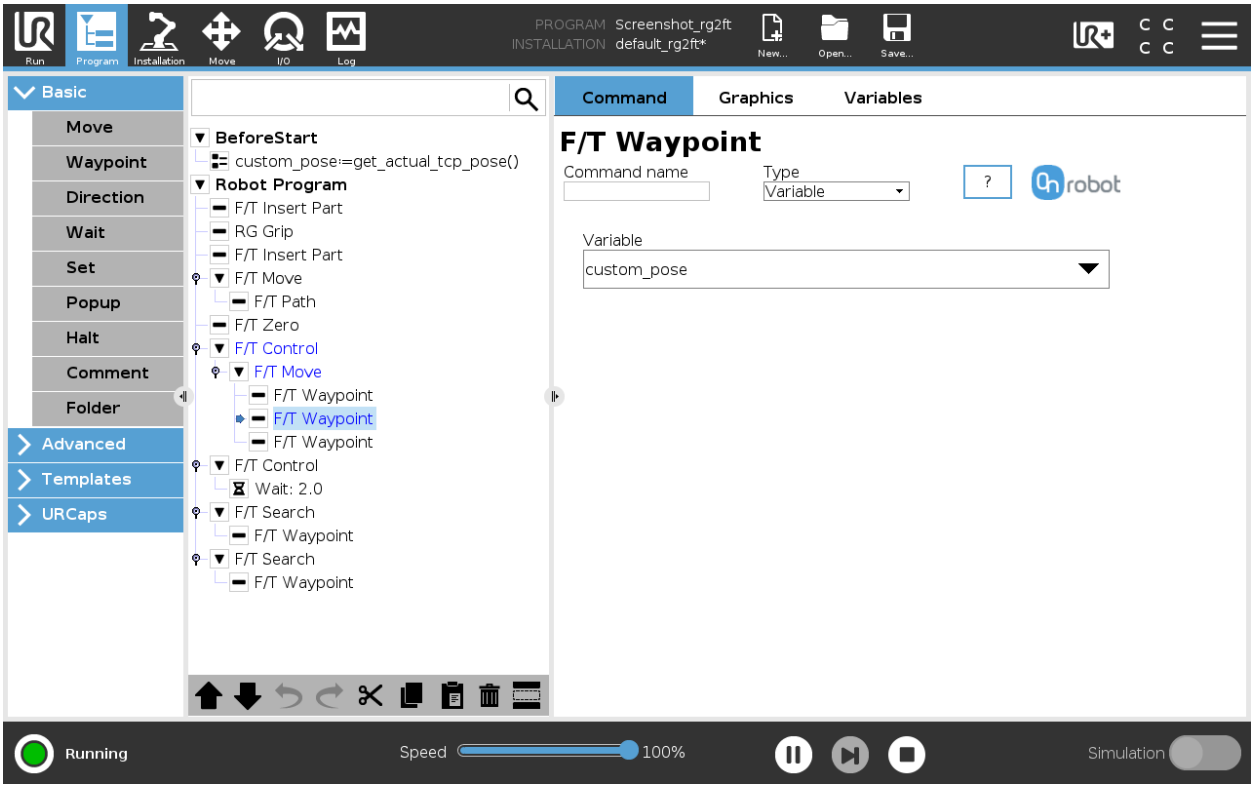


Target TCP pose: The position represented by the waypoint in the robot route. It is a read-only field and can be filled by using the **Get current TCP pose** button.

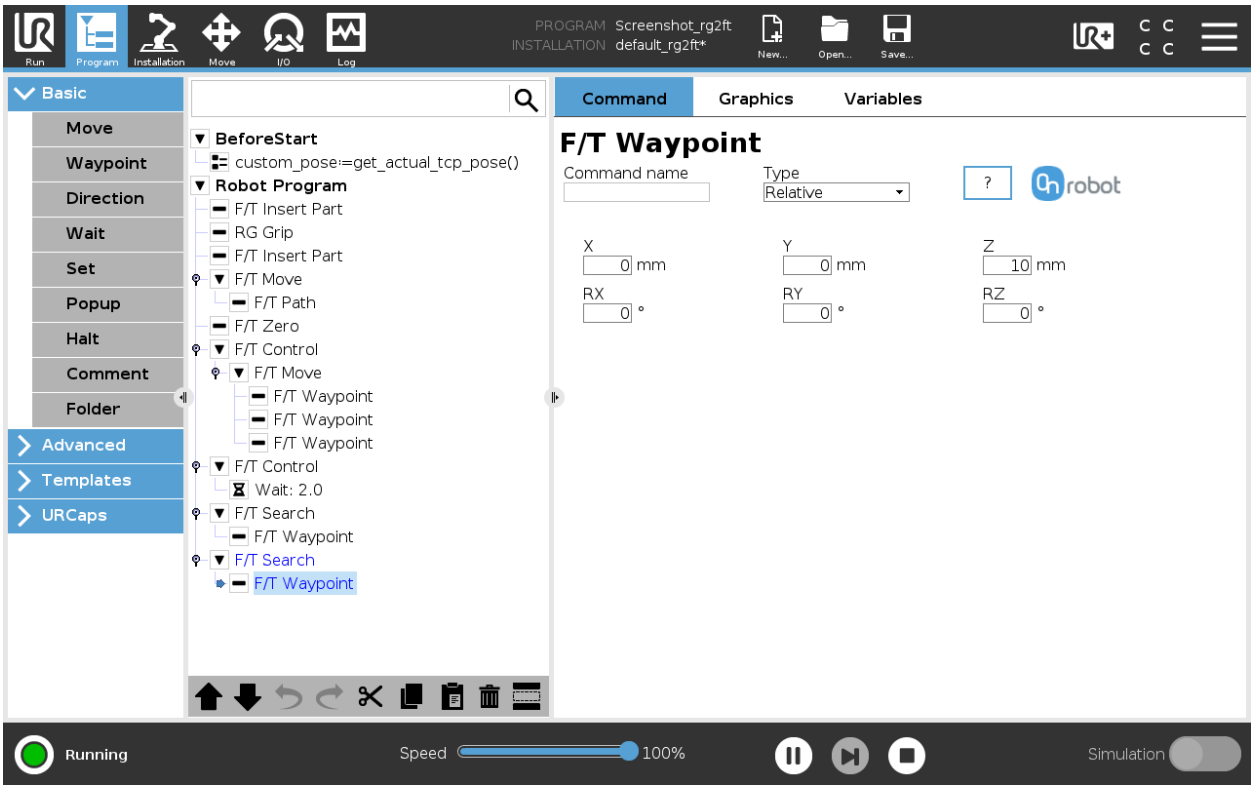
Clear: deletes the contents of the **Target TCP pose** field.

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.

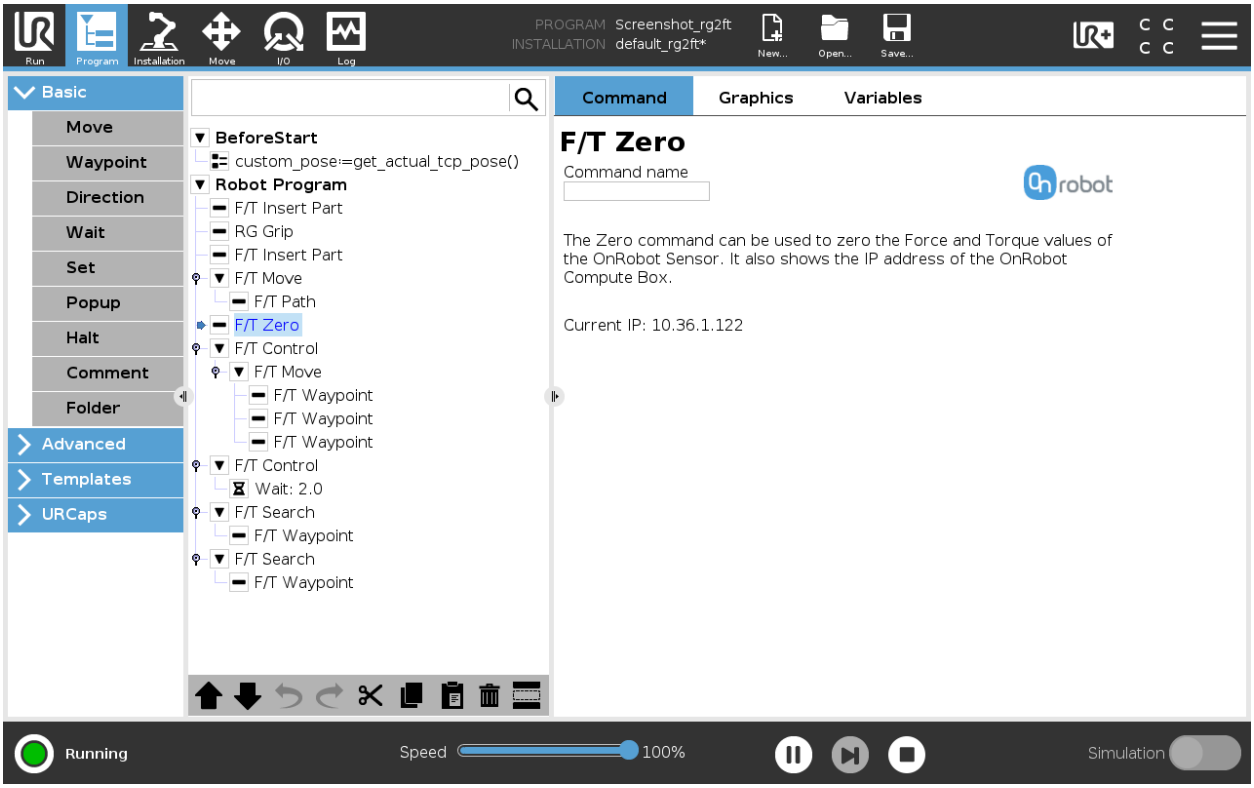


Relative X, Y, Z, RX, RY, RZ: the distances and rotations this waypoint represents, compared to the previous robot position.

This command has no return value.

F/T Zero

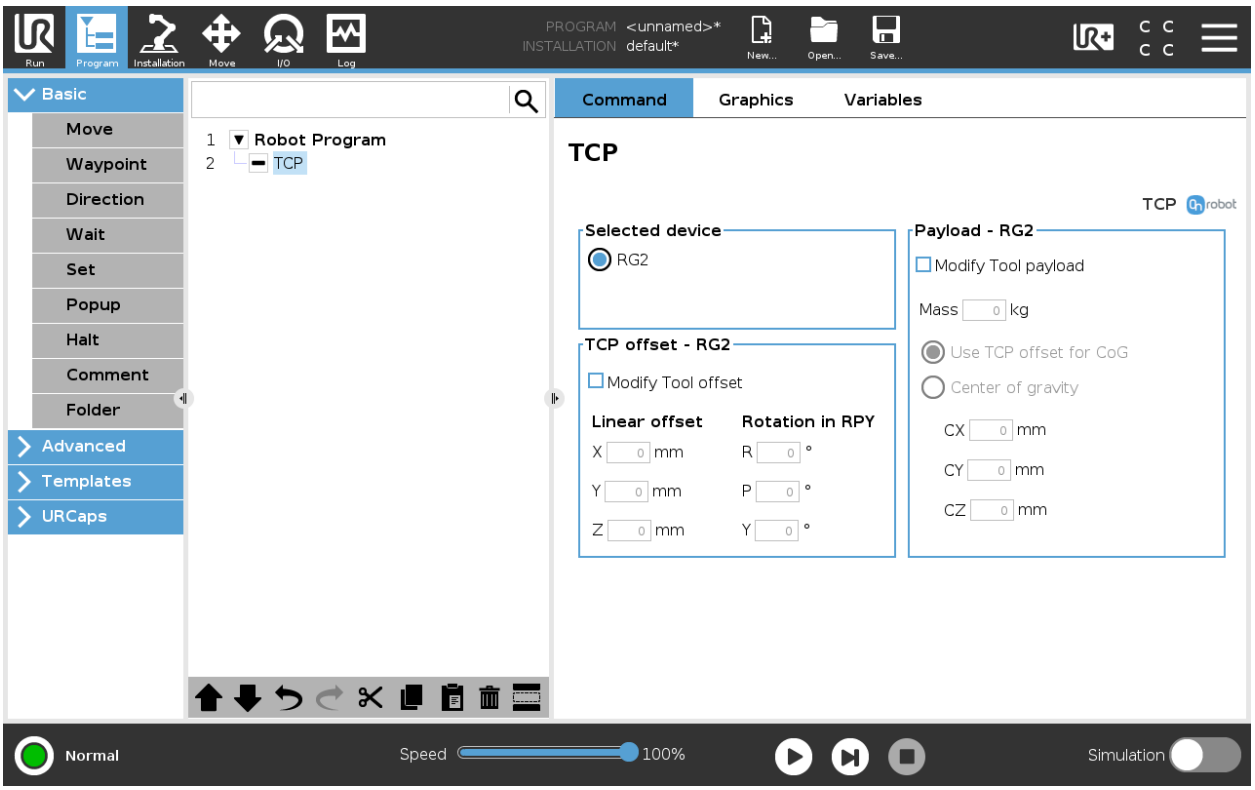
The `F/T Zero` command can be used to zero the force/torque values.



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.

Mass: 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.

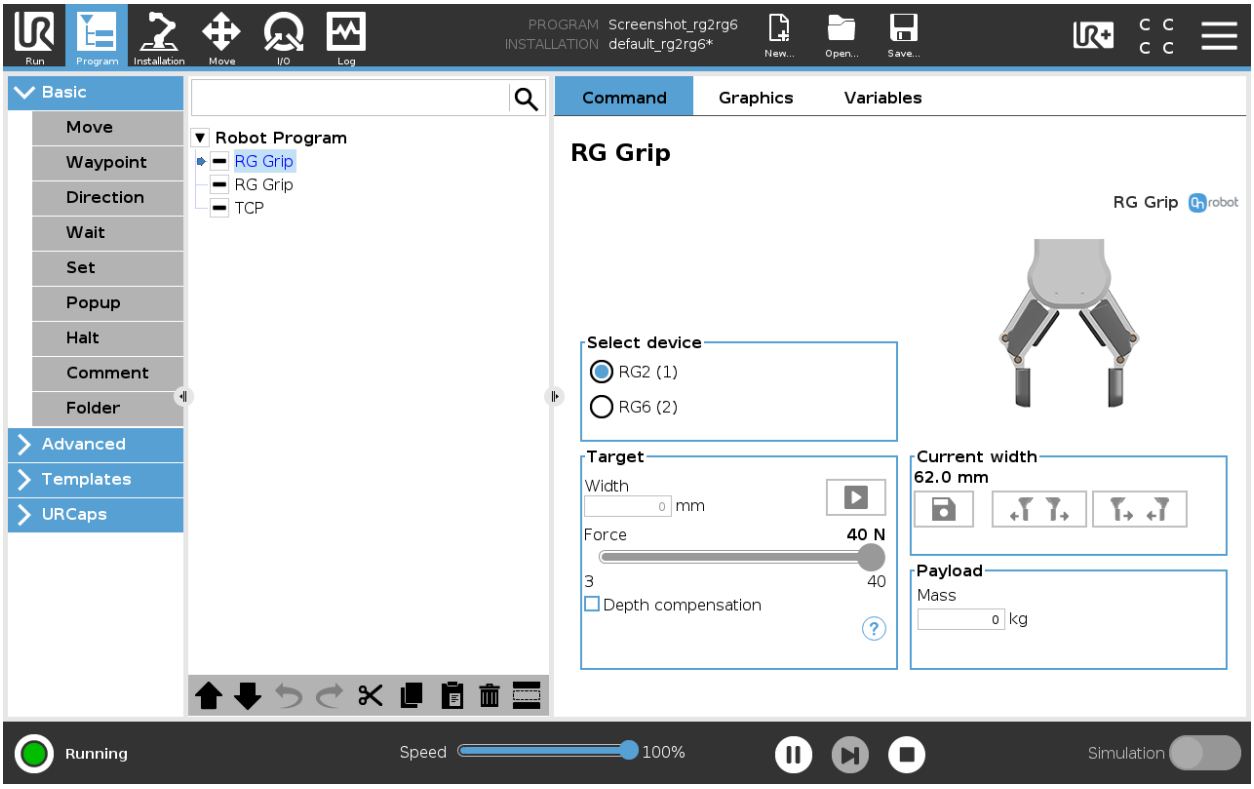
Center of Gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

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.

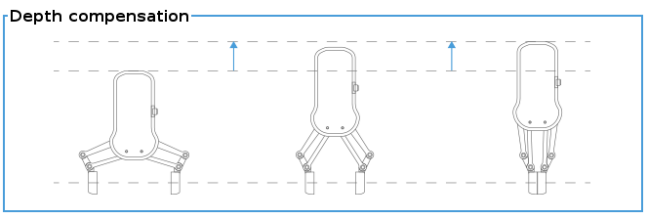
Target

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:

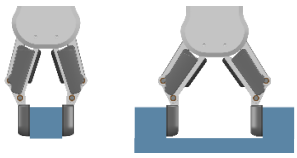
For optimal performance of gripping Force, set the **Target Width** 1 to 4 mm lower than the **Width** of the workpiece if the workpiece is grabbed externally or 1 to 4 mm higher if grabbed internally.

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:

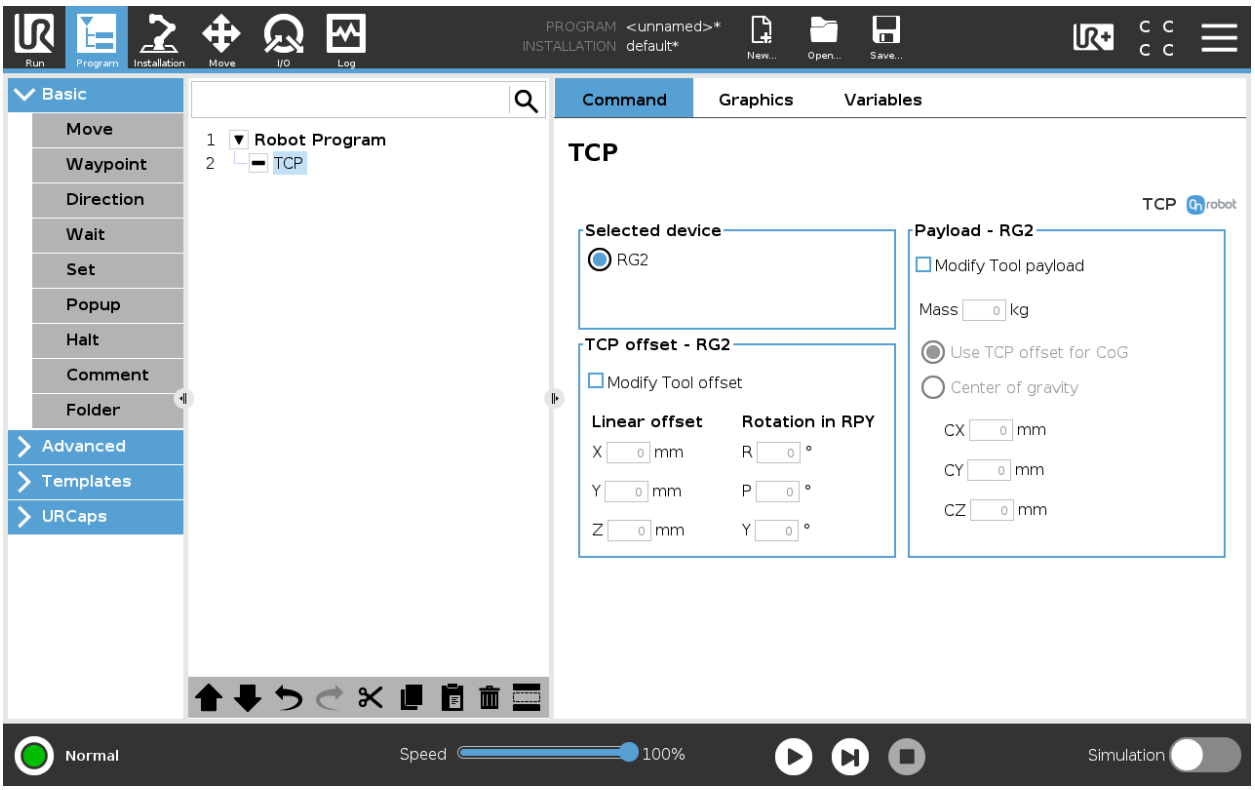
To enhance width precision the target Force is not applied when using these buttons

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.

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.

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

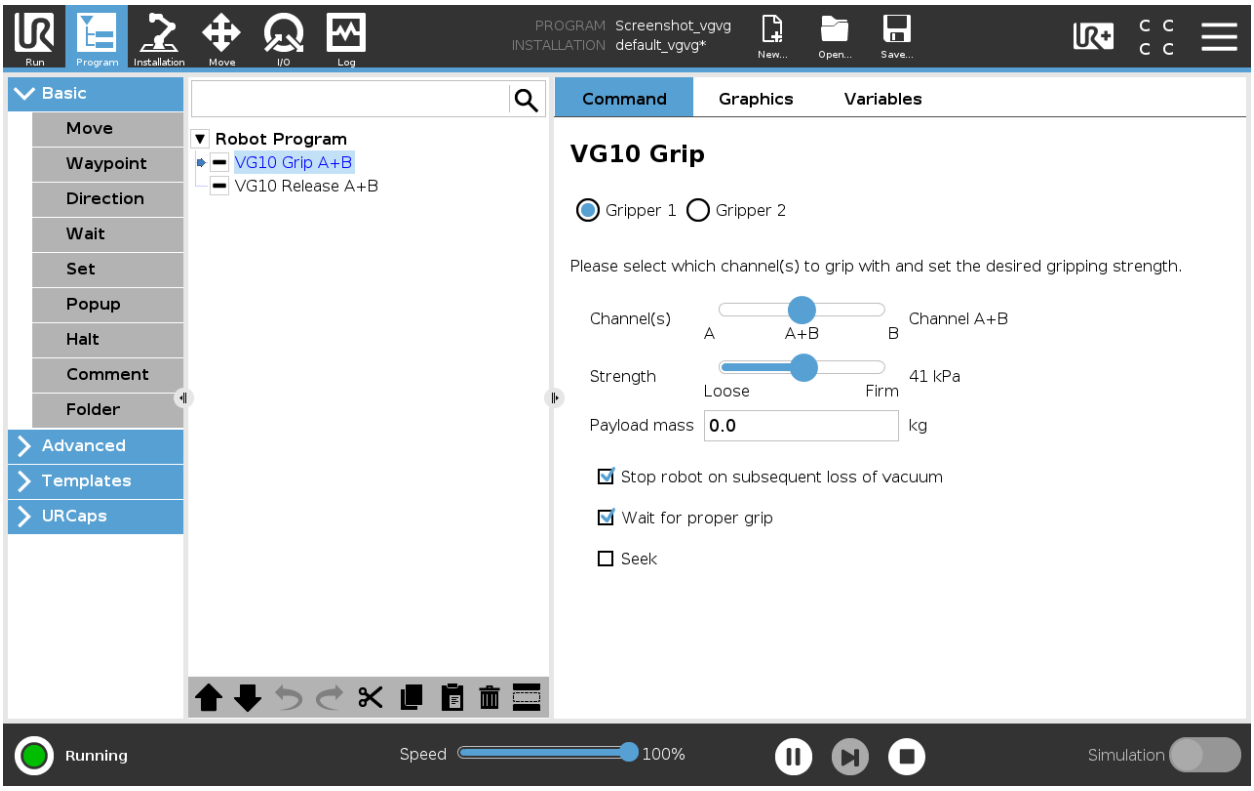
Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

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

VG10

VG10 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.

Channel(s): Select which channel perform the action. It is possible to select channel A, B or both (See stickers under the VG10 arms to see which arms channel A is and which is channel B).

Strength: 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 VG10 Grip structure until commanded vacuum is achieved. If the commanded vacuum is not achieved in 3 seconds the program halts.

When the VG10 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 the VG10 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 VG10 needs to be parallel to the surface.

NOTE:

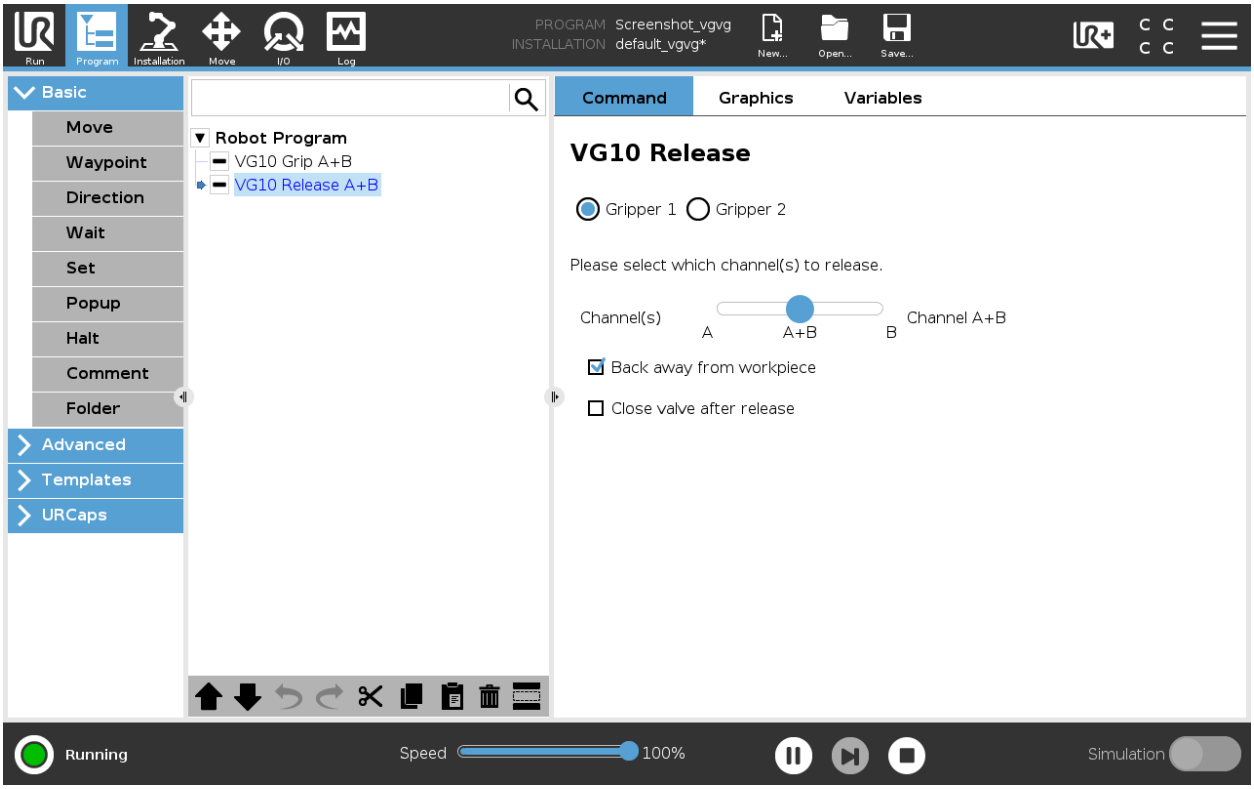
Setting a lower vacuum gives a faster grip with less wear on the vacuum cups. It also reduces the risk of leaving suction marks on delicate workpieces.

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 VG10 automatically releases 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.

VG10 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.

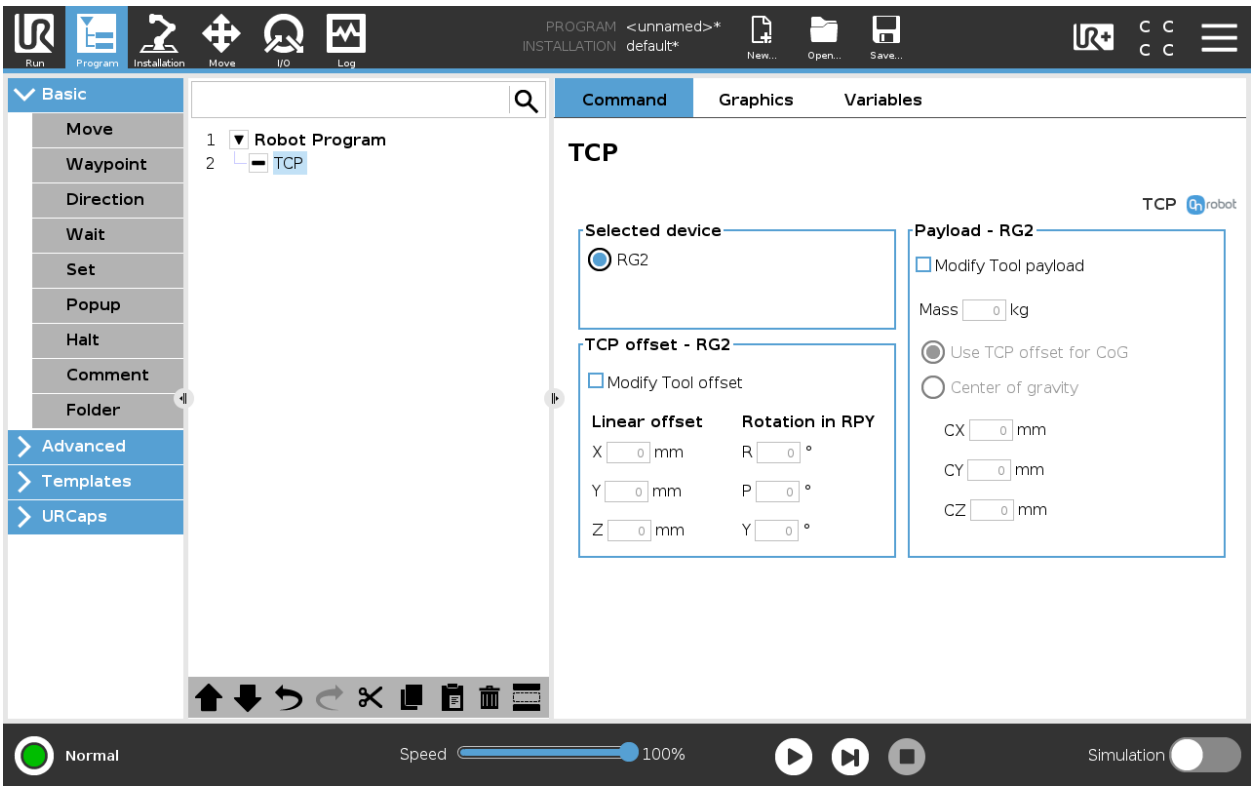
Channel(s): Select which channel perform the action. It is possible to select channel A, B or both (See stickers under the VG10 arms to see which arms channel A is and which is channel B).

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

Close valve after release: when checked, after the workpiece is released it will turn off the power to the release-valves to save power. The power will be removed when the robot has traveled 50 mm away from the release position. This option is especially suitable for situation where multiple work pieces are handled, as turning off the valve will free up power to the pump to improve vacuum levels and cycle times.

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.

Mass: 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.

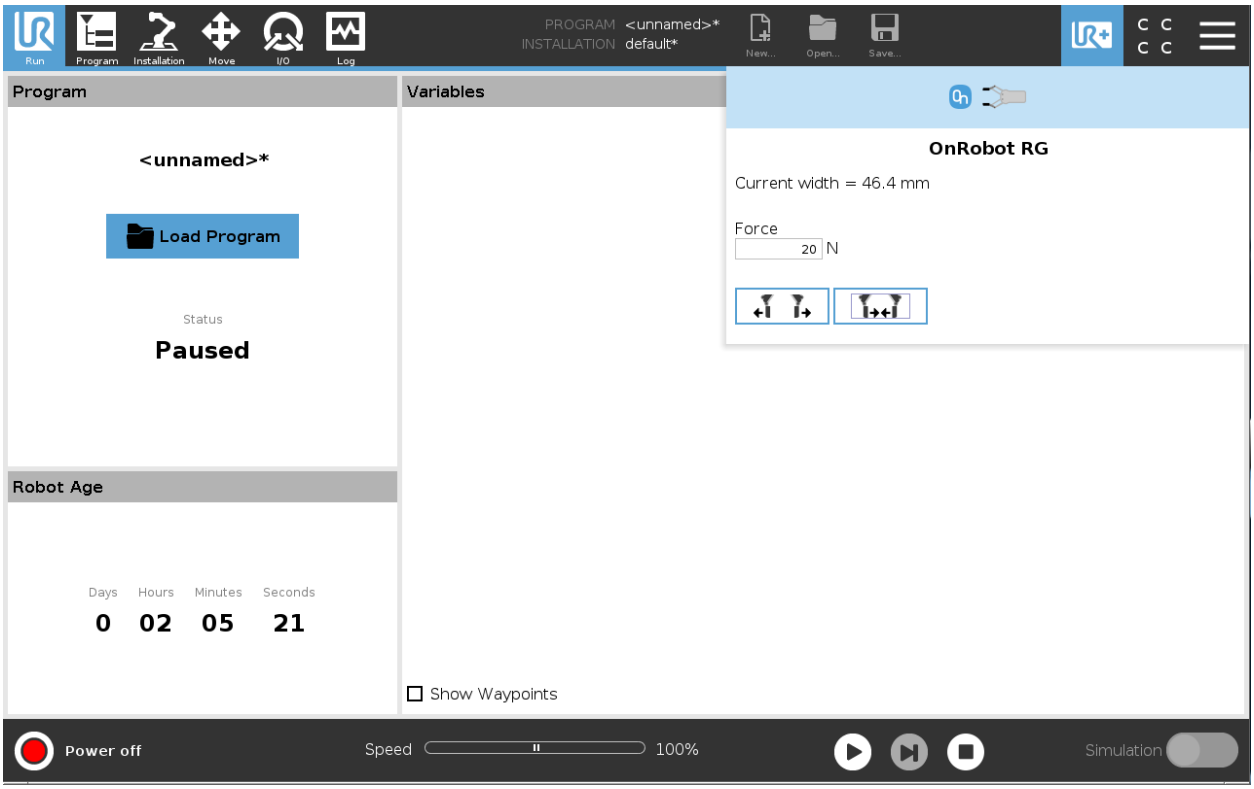
5.2 URCap toolbar

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

5.2.1 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 .

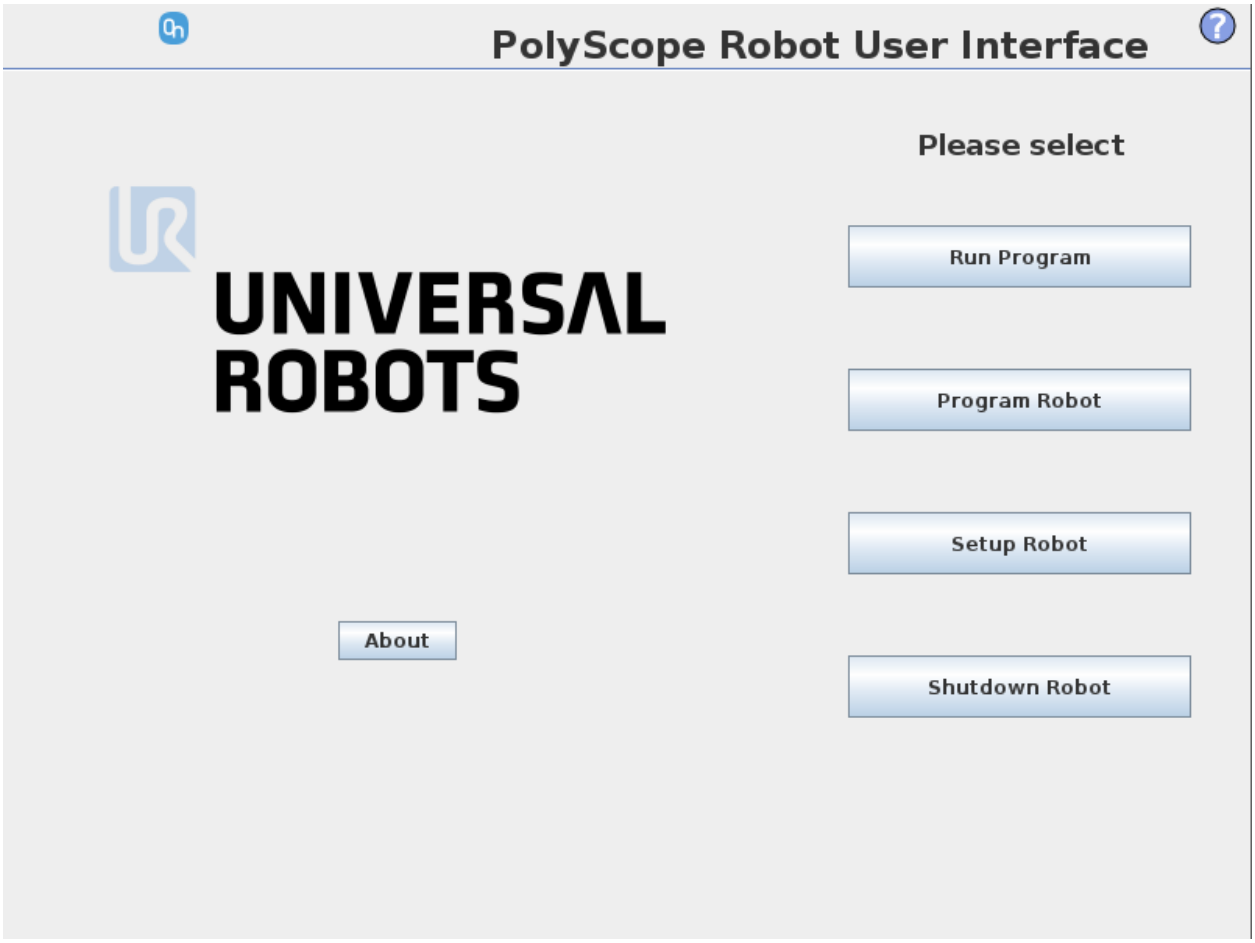


Each OnRobot End of Arm Tooling has its own functionality and that is explained in the sections below.

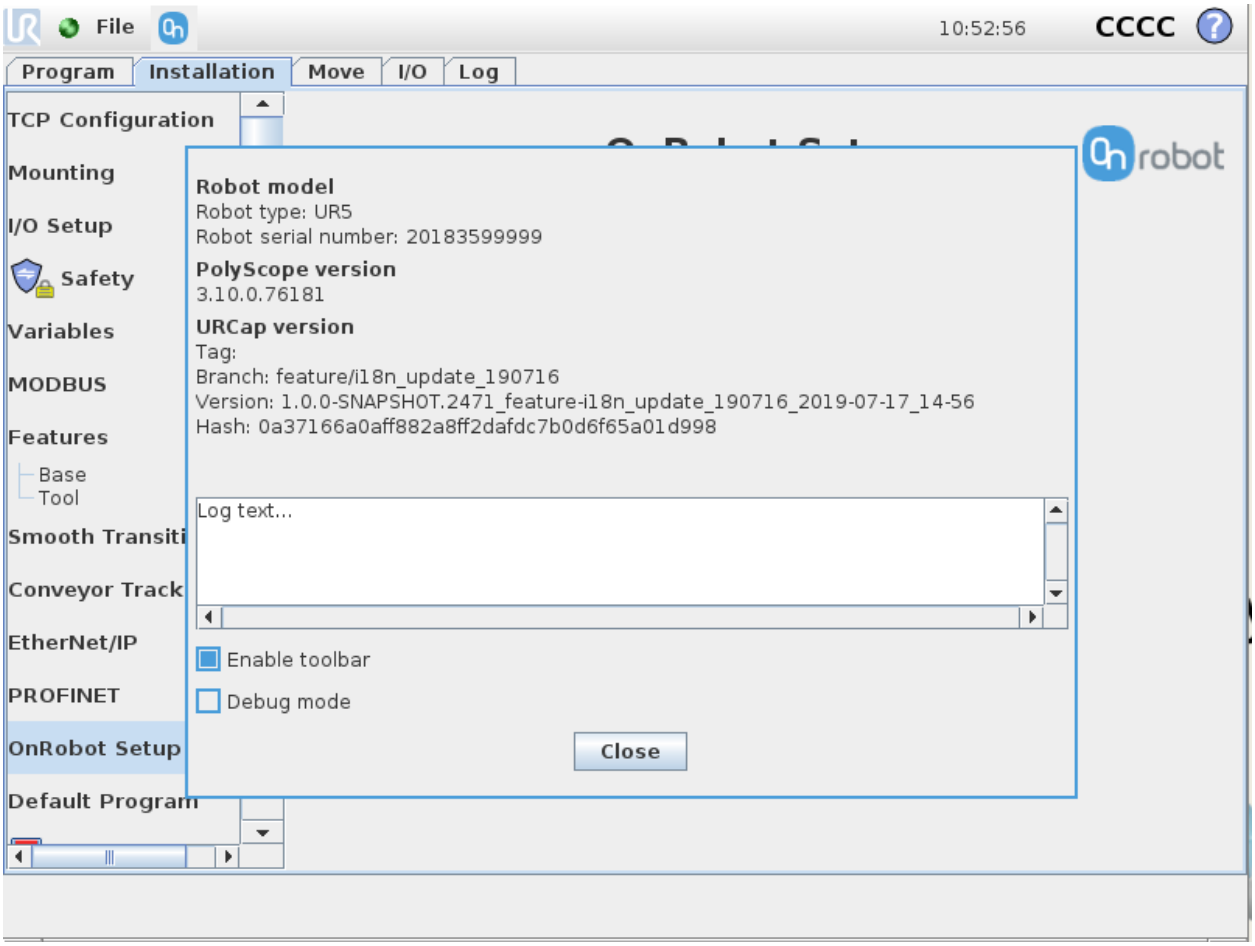
To open up the toolbar in the CB3, press on the OnRobot icon on the top left side. The icon might take around 20 seconds to appear after robot power up.

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.



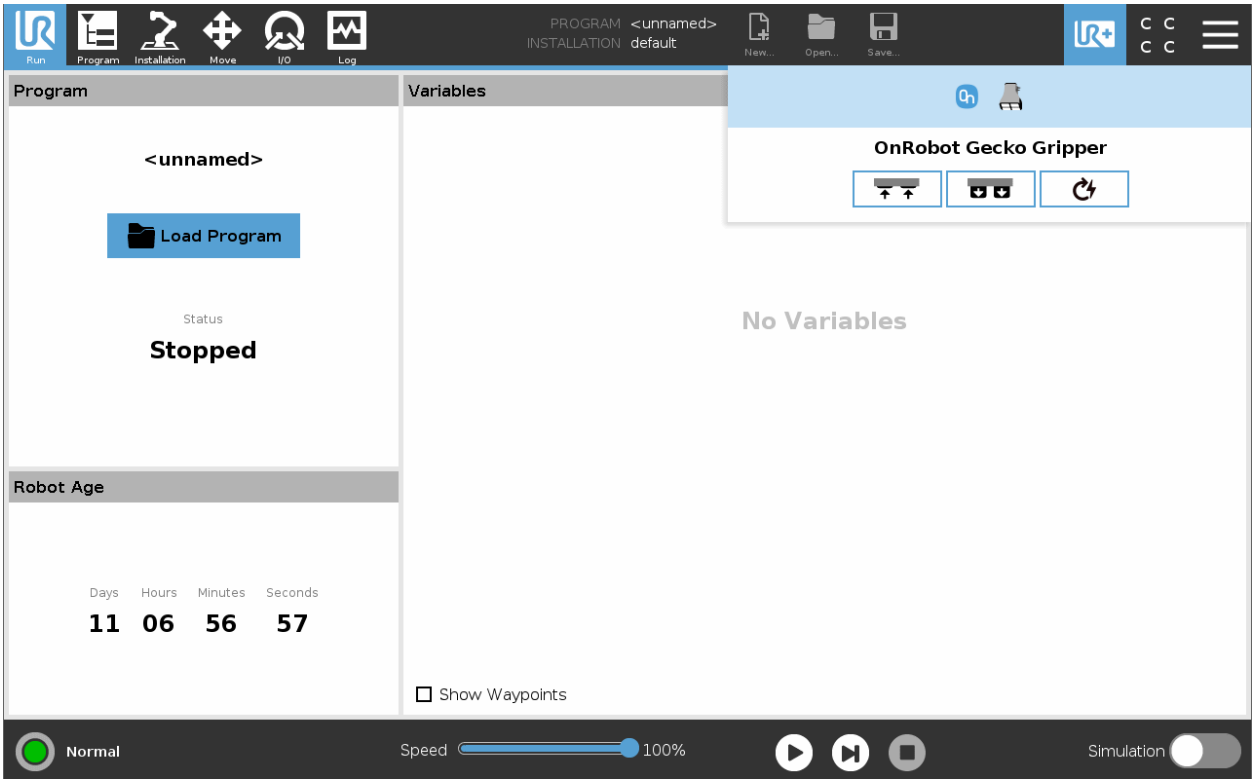
The table below shows the page where the toolbar for each OnRobot device is explained.

- Gecko 97
- HEX-E/H QC 98
- RG2-FT 100
- RG2 RG6 103
- VG10 104

Gecko

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

The toolbar for the Gecko is shown below.



press to get the Gecko pads in.

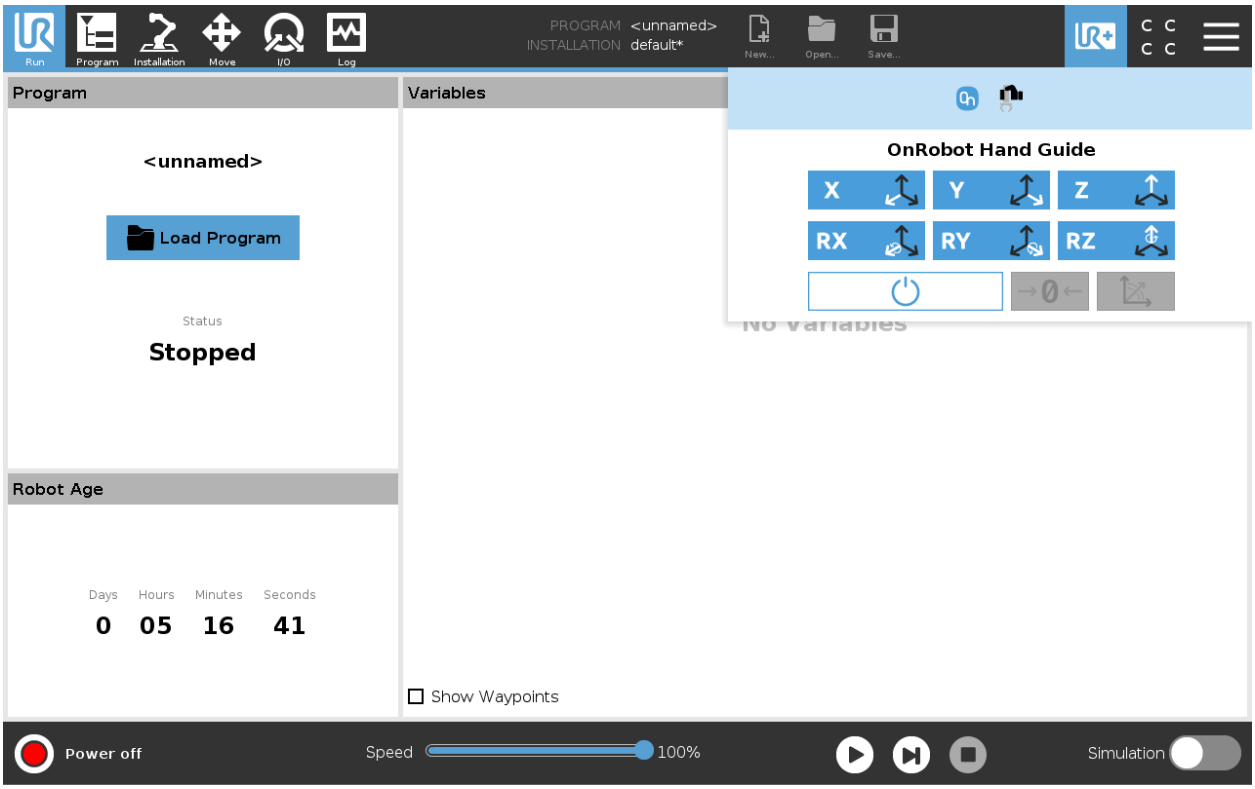
press to get the Gecko pads out.

: This button only appears if the pads are worn and needs to be replaced. Pressing this button clears the warning for the pad replacmenet.

HEX-E/H QC

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

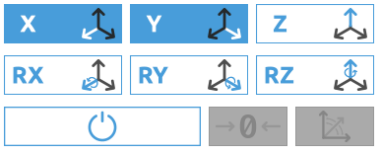
The toolbar for the HEX is called Hand Guide and it is shown below. This toolbar is used to hand guide the robot by holding the End of Arm Tooling with your hand. It is possible to lock some of the axes to reduce the degrees of freedom.



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):



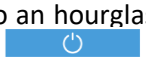
NOTE:

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.

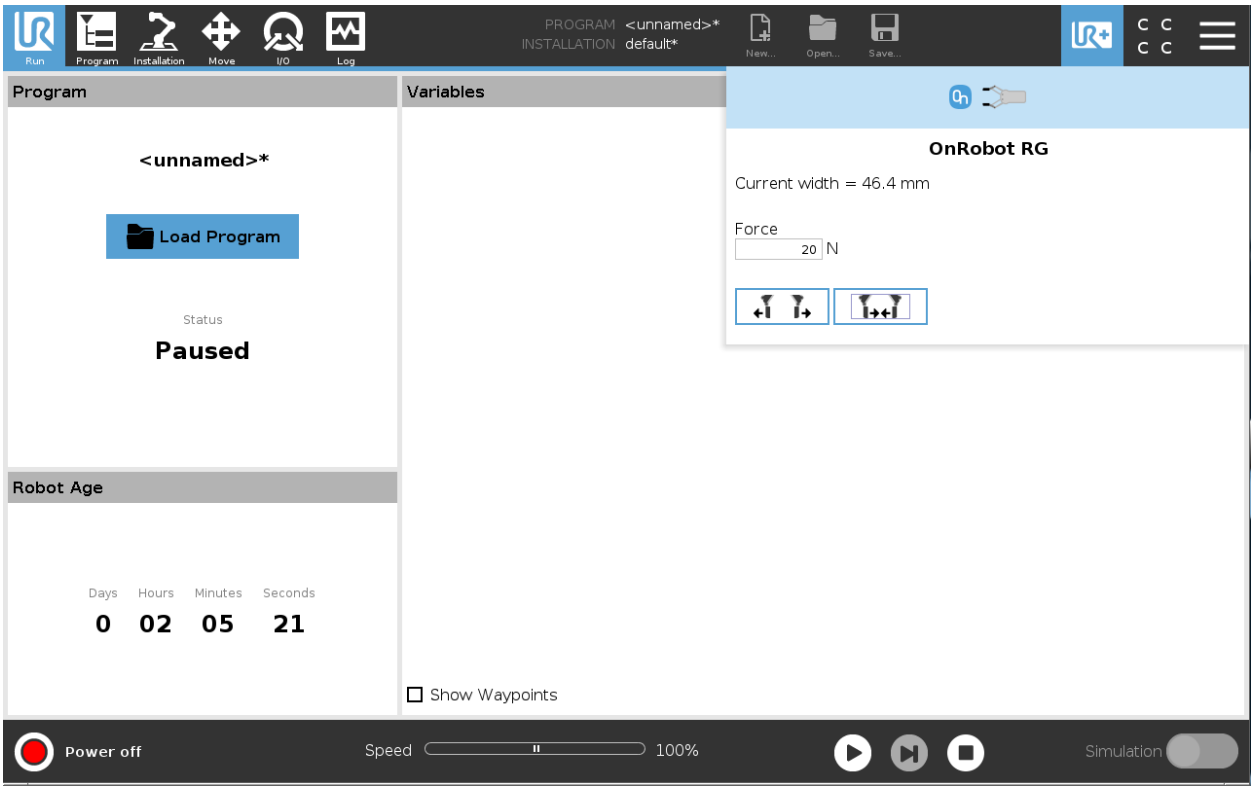
The snap to axes button rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

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.



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

Current width: shows the value.

Force: Set the target gripping force.

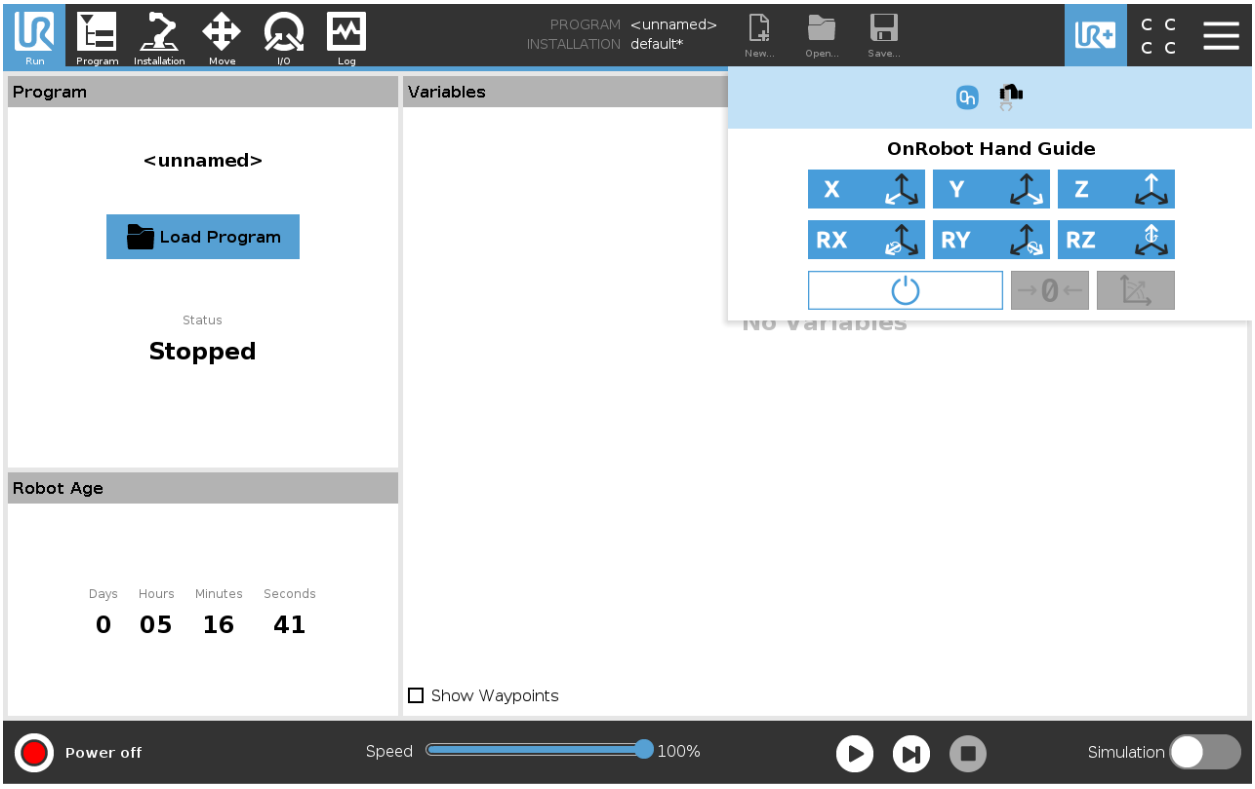
:These are open and close hold-to-run buttons.

: 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.

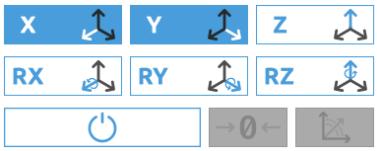
The toolbar for hand guiding is shown below.



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.

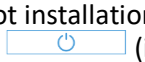
NOTE:

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.

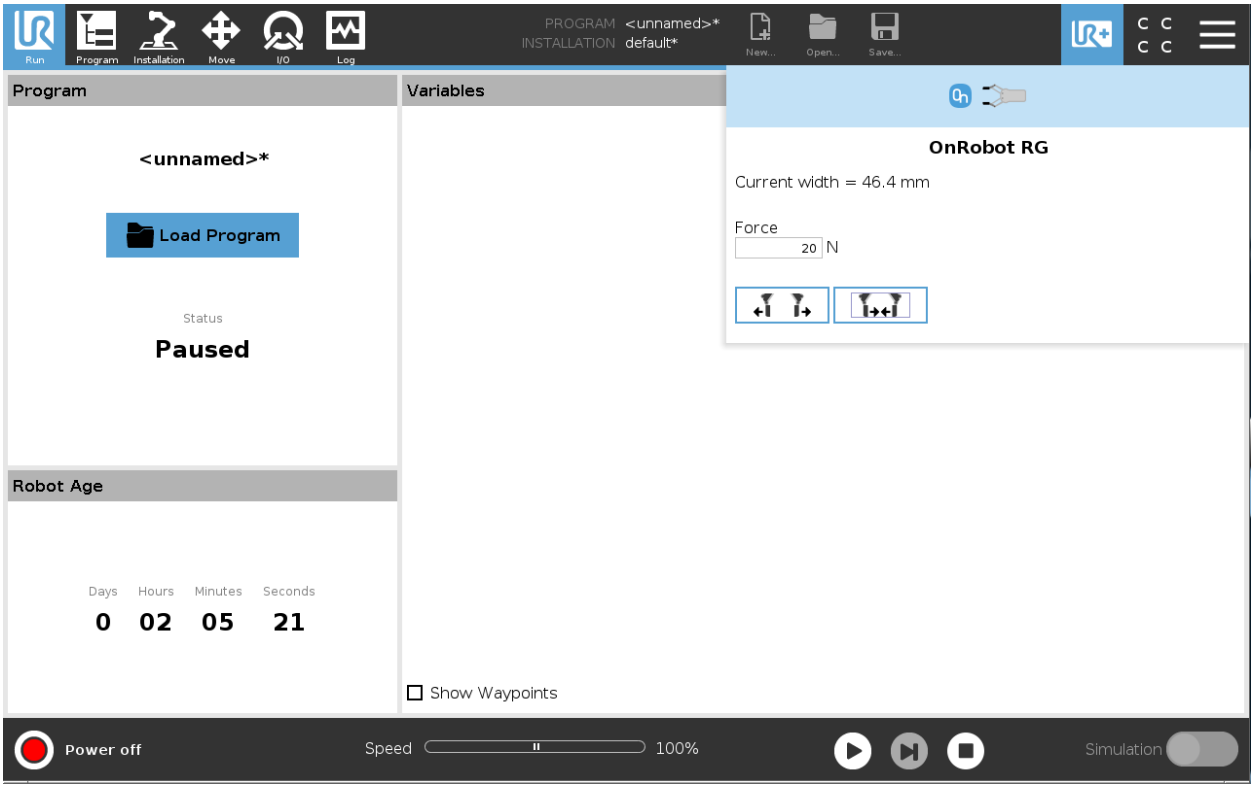
The zero button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

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.

RG2
RG6

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

The toolbar for the RG grippers is shown below.



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

Current width: shows the value.

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.

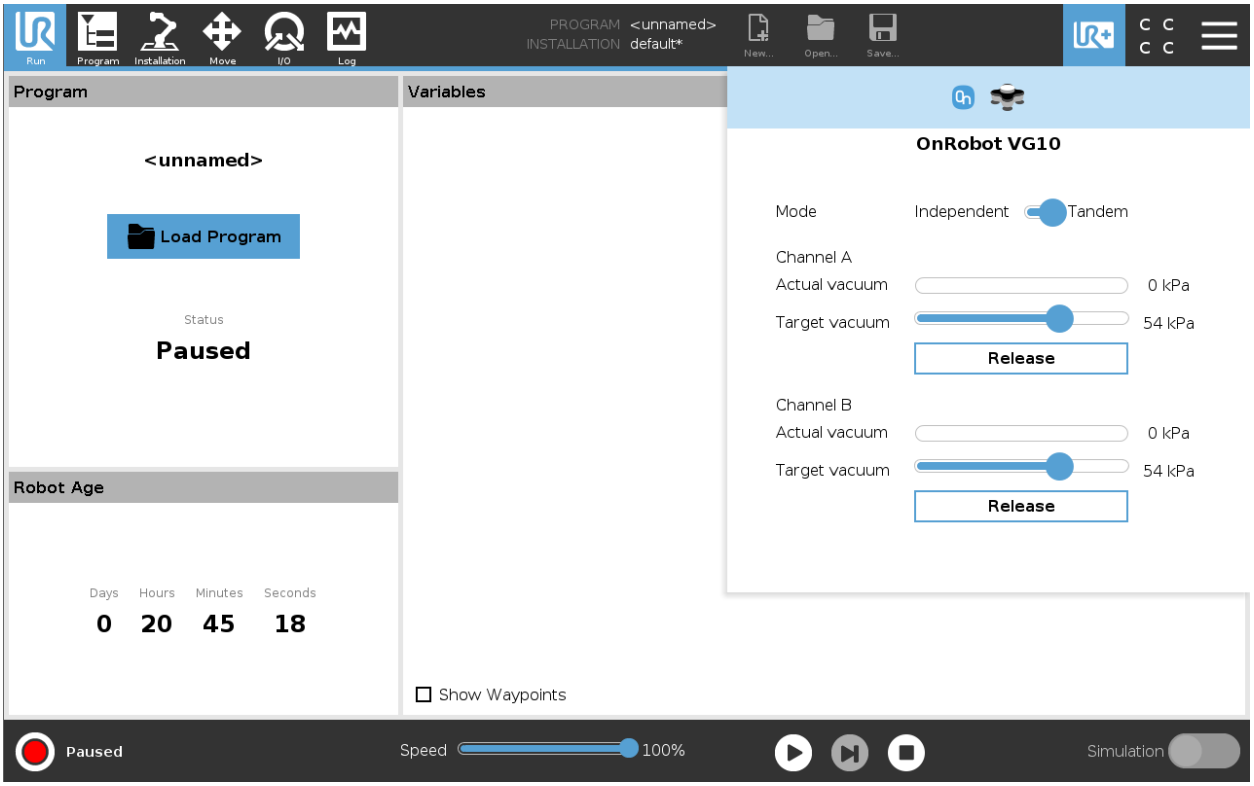
CAUTION:

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.

VG10

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

The toolbar for the VG10 is shown below.



Gripper 1 and **Gripper 2**: In case of using 2 VG10 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. When a new value is chosen the pump will start to generate vacuum at the selected level on the selected channel(s).

Release: when pressed will terminate the test-grip and releasing any workpieces that may be held by the selected channel.

5.3 URScript commands

URScript commands can be used alongside other scripts.

RG2-FT 105
RG2-FT RG2/6 105
VG10 106

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.

RG2-FT RG2/6

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 2 RG grippers attached, use:

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

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

VG10

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 2 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 2 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 2 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.

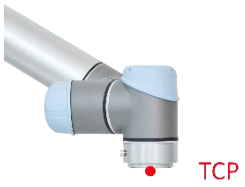
If 2 VG10 grippers attached, use:

`tool_index=1` for primary

`tool_index=2` for secondary

5.4 TCP Configuration

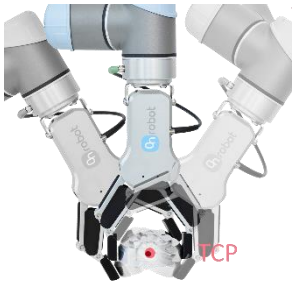
TCP is the abbreviation of the Tool Center Point.



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 *Center of Gravity* section.

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

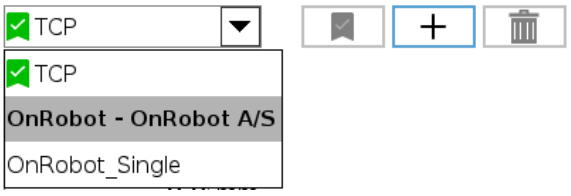
- **Static TCP mode** - Recommended to be used
- **Dynamic TCP mode**

The mode could be selected on the TCP panel in the OnRobot Installation (see in the *URCap 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.

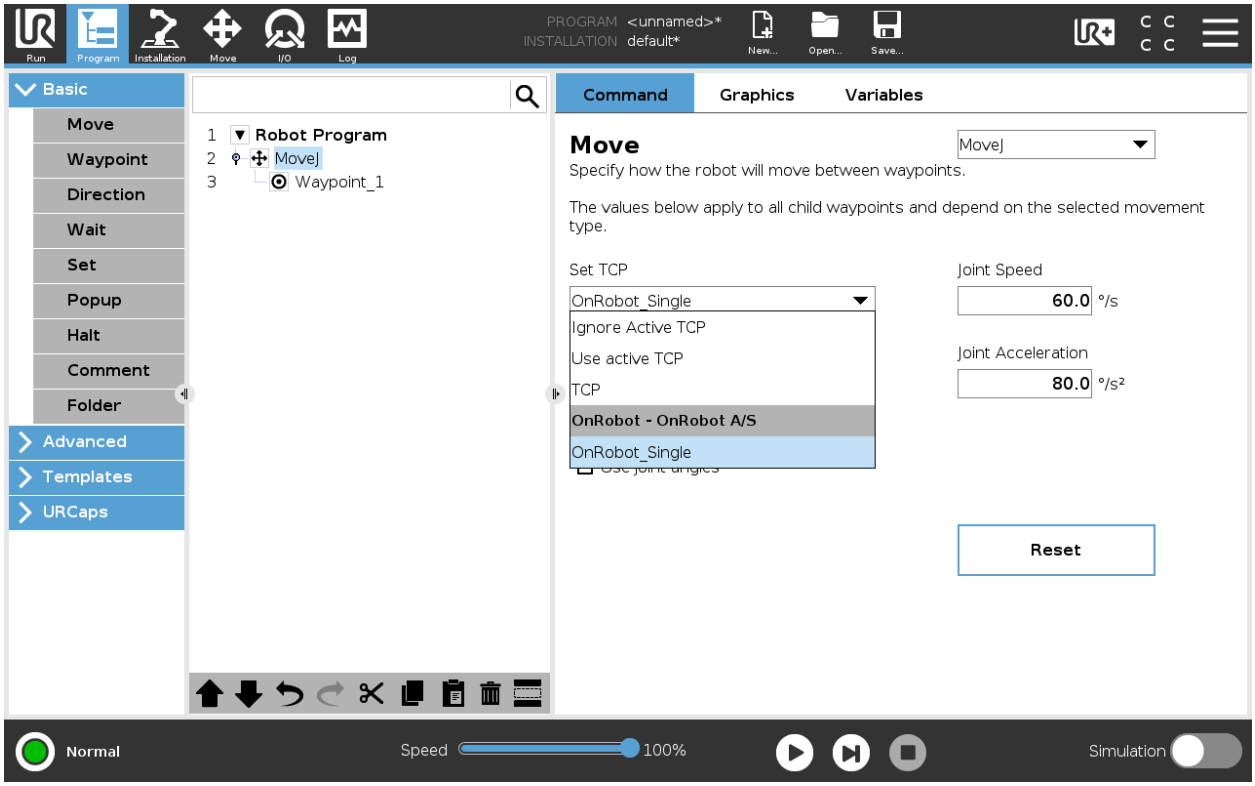
NOTE:

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):

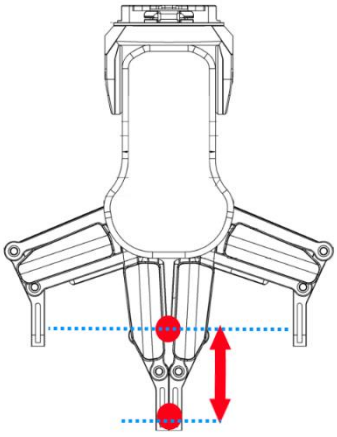
- Use the OnRobot `TCP` command just before the `F/T Move` to set the Active TCP to the right value

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

`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)`

5.5 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.

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.

5.6 Feedback variables

- Gecko 113
- HEX-E/H QC 113
- RG2-FT 114
- RG2 RG6 115
- VG10 115

Gecko

Feedback Variable	Unit	Description
gecko_distance	mm	Distance between the gripper bottom part and the object
gecko_force	N	Force applied by the gripper/robot while doing a grip
gecko_part_detected	True/False	True if Gripper has detected a workpiece
gecko_pads_worn	True/False	True if Gripper has lost a workpiece so pads needs to be cleaned
on_return		The return value for the OnRobot commands

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 (Fx2 +Fy2 +Fz2)
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 (Tx2 +Ty2 +Tz2)
Tx	[N]	Torque value about the X axis
Ty	[N]	Torque value about the Y axis
Tz	[N]	Torque value about the Z axis

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 (Fx2 +Fy2 +Fz2)
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 (Tx2 +Ty2 +Tz2)
Width	[mm]	Distance between the fingers of the Gripper (calculated by finger angle encoders)

RG2
RG6

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
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

VG10

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 Additional Software Options

6.1 Compute Box

6.1.1 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).

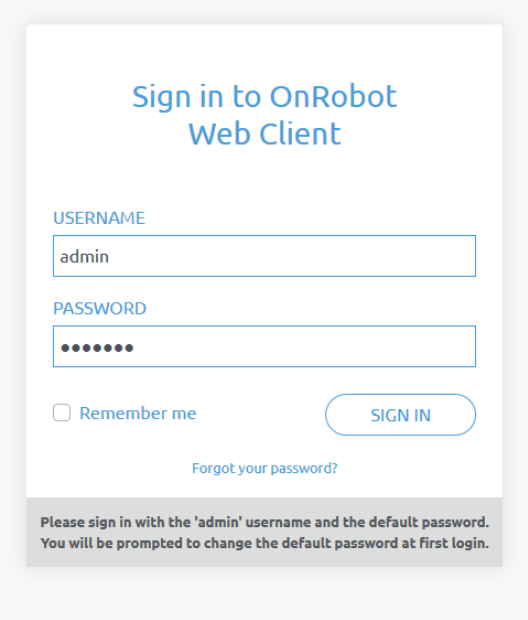
6.1.2 Web Client

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 (for further details see section **Ethernet Interface Setup**).

Then 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:

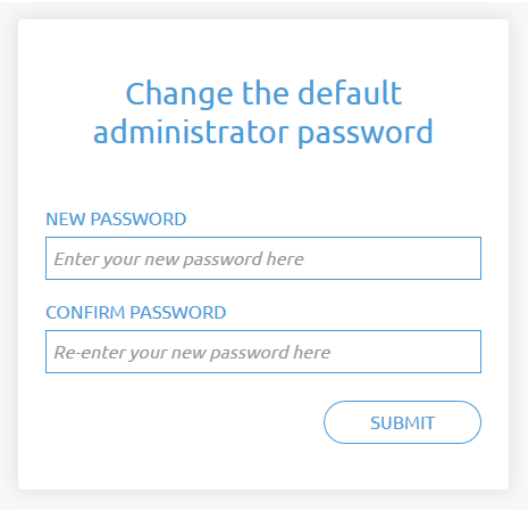


The factory default administrator login is:

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:

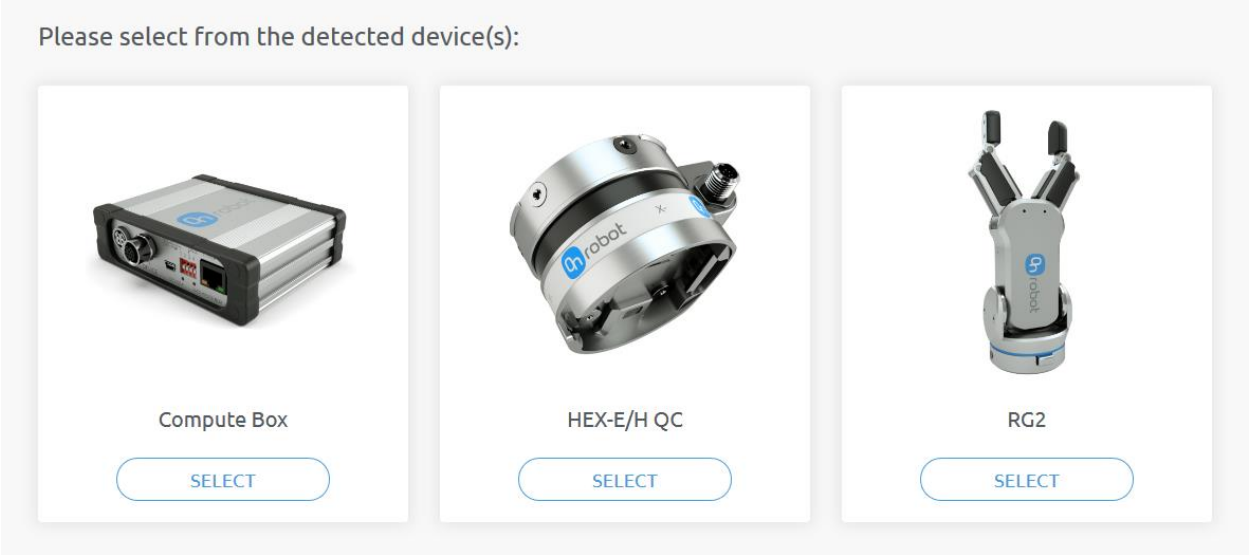
- **Devices** - Monitor and control the connected devices (e.g.: grippers)
- **Configuration** - Change the Compute Box's settings
- **WebLogic** - Program the Digital I/O interface through OnRobot WebLogic
- **Paths** - Import/export the recorded Paths (not available to all robots)
- **Update** - Update 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.

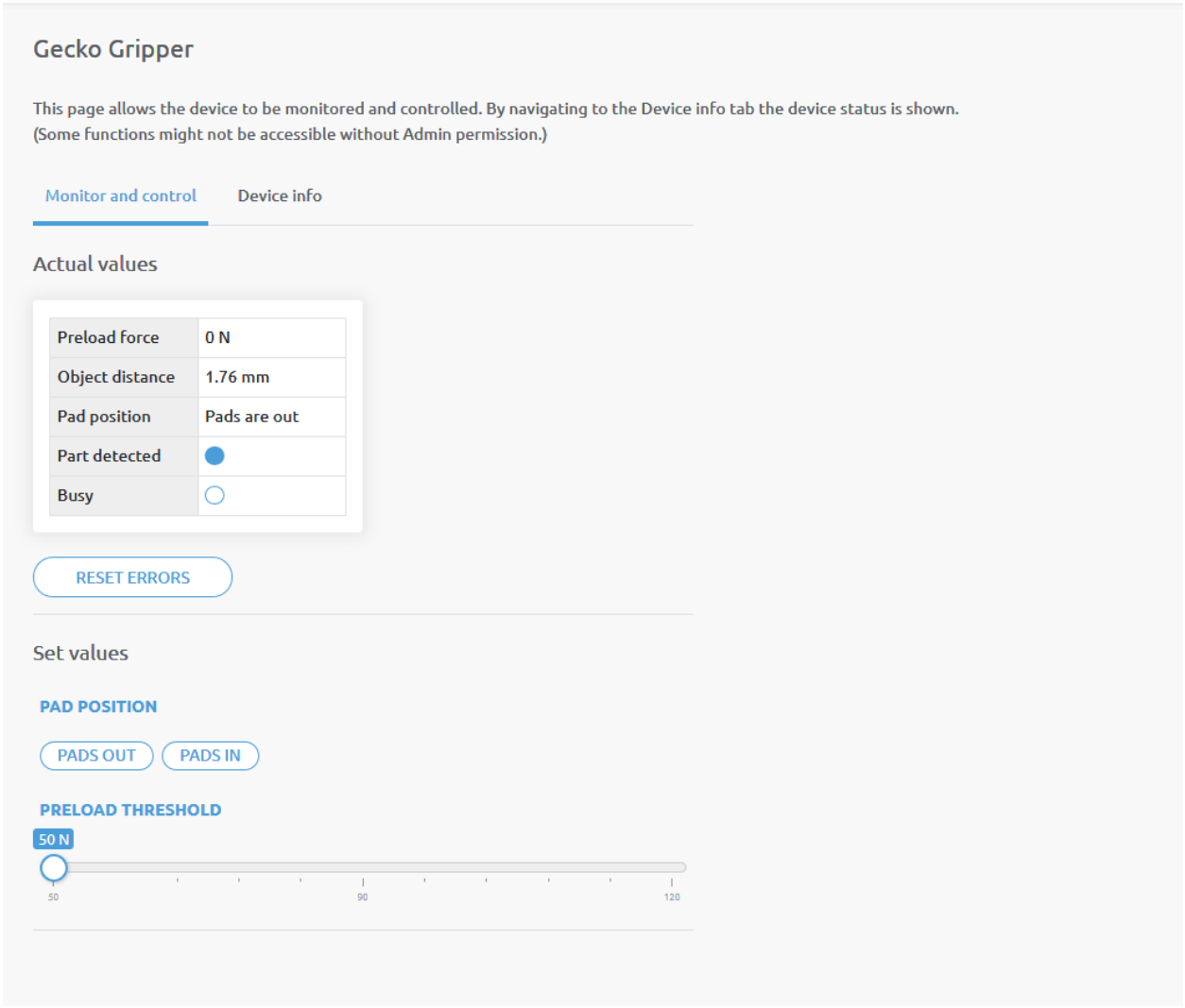
Devices menu

To control/monitor a device click on the **Select** button.



Gecko 120
HEX-E/H QC 122
RG2/6 123
RG2-FT 125
VG10 127

Gecko



There is a force and an ultrasonic distance sensor in the gripper. The actual values of these sensors are:

- **Preload** - the current forces acting on the pads (below 50N it displays 0N)
- **Object distance** - how far the object is from the bottom of the gripper

The state of the gripper could be:

- **Pad position**- Pads are either In or Out (out means ready for gripping)
- **Part detected** - the set preload force limit is reached, and object distance is < 18mm
- **Busy** - the pads are moving

The pads can be controlled by clicking on the **Out** and **In** buttons.

The **Preload threshold** value can be changed if higher preload force is required for a proper grip.

This value is only used to generate a proper **Part detected** signal.

NOTE:

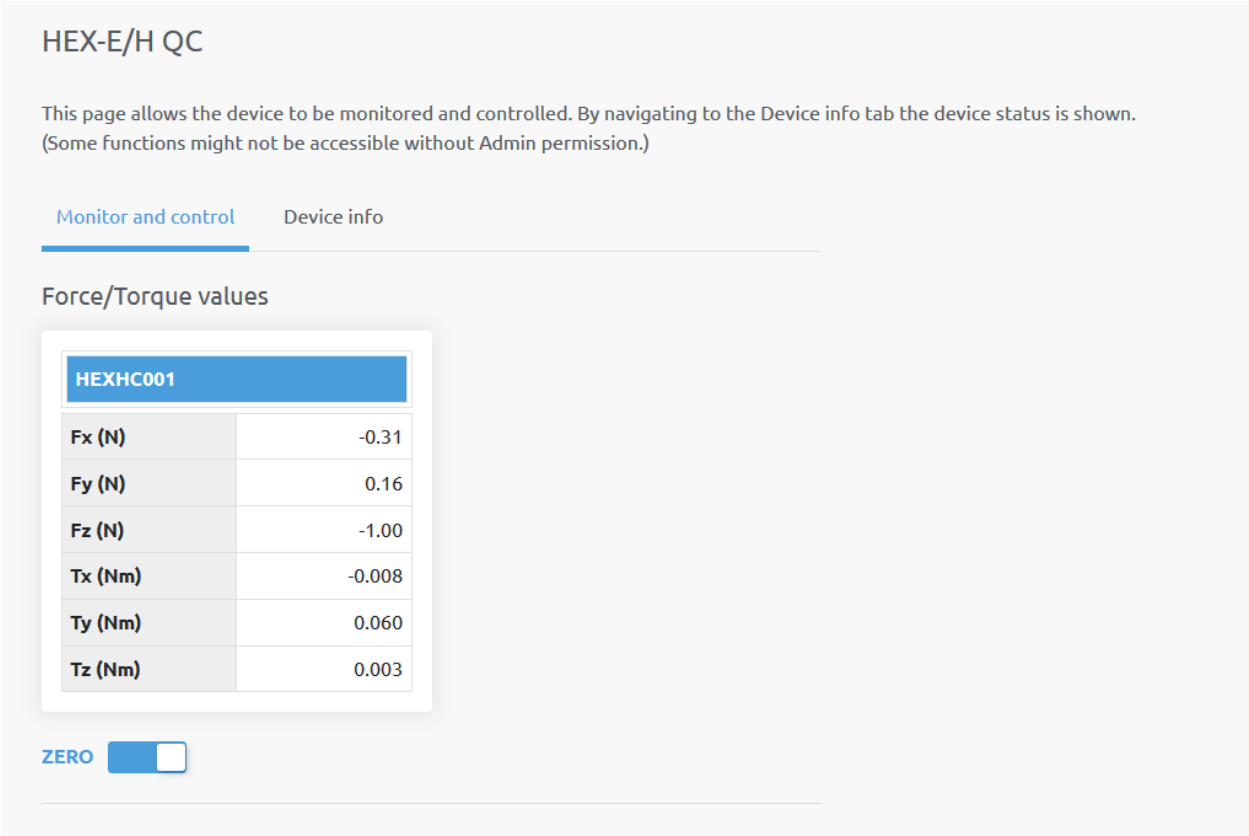
Preload threshold value set on this page is not stored permanently and are restored to the default value (90N) on power reset.

If a part was detected and the object distance becomes > 18mm (part is lost) BEFORE the pads are set to be IN (normal release) the **Pads worn** warning is displayed in the **Device info** tab.

To reset the warning:

- either click on the **RESET ERRORS** button
- or click on the **Out** button.

HEX-E/H QC



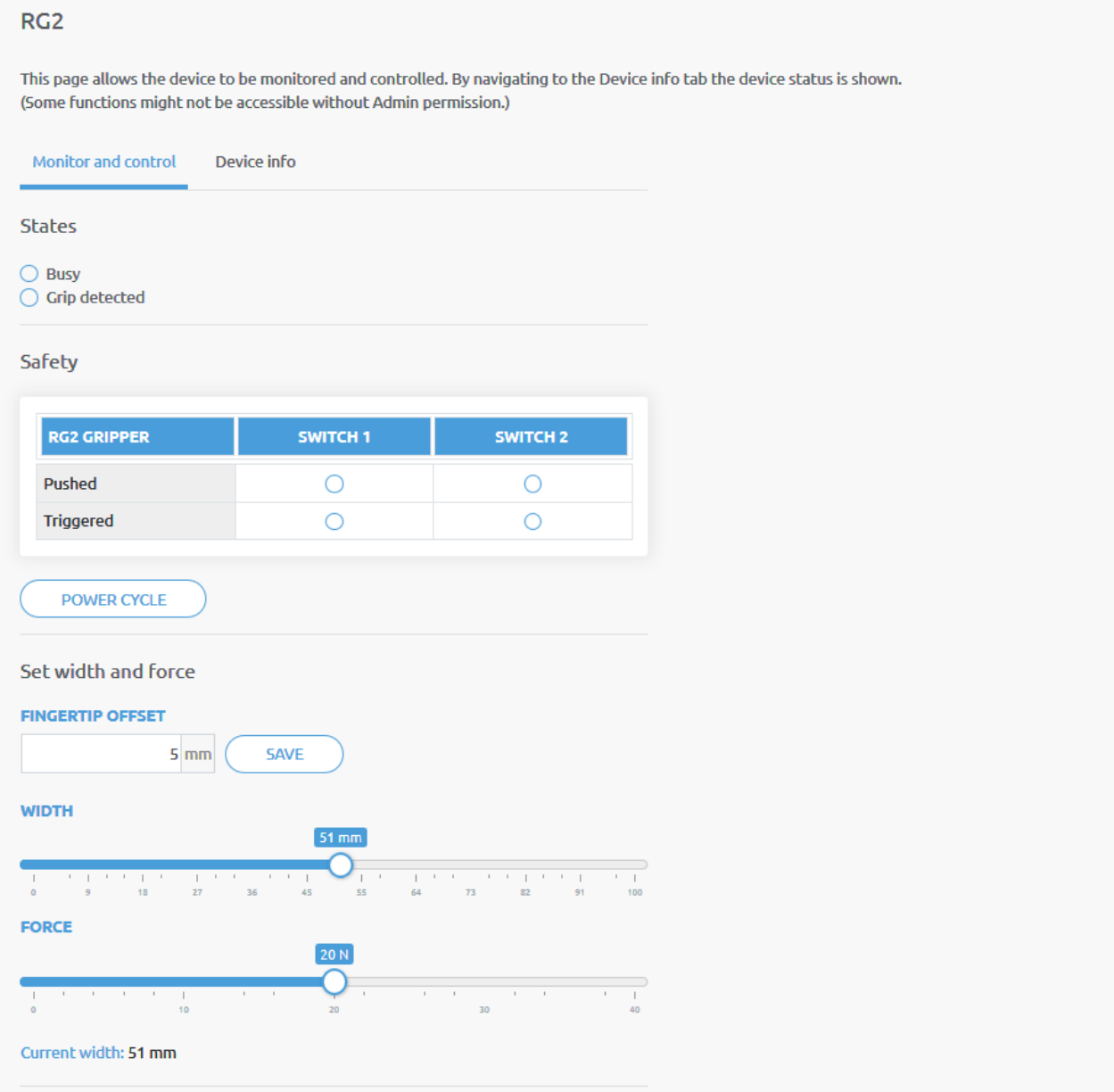
The force and torque values (**Fx,Fy,Fz** and **Tx,Ty,Tz**) are shown in N/Nm.

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.

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:

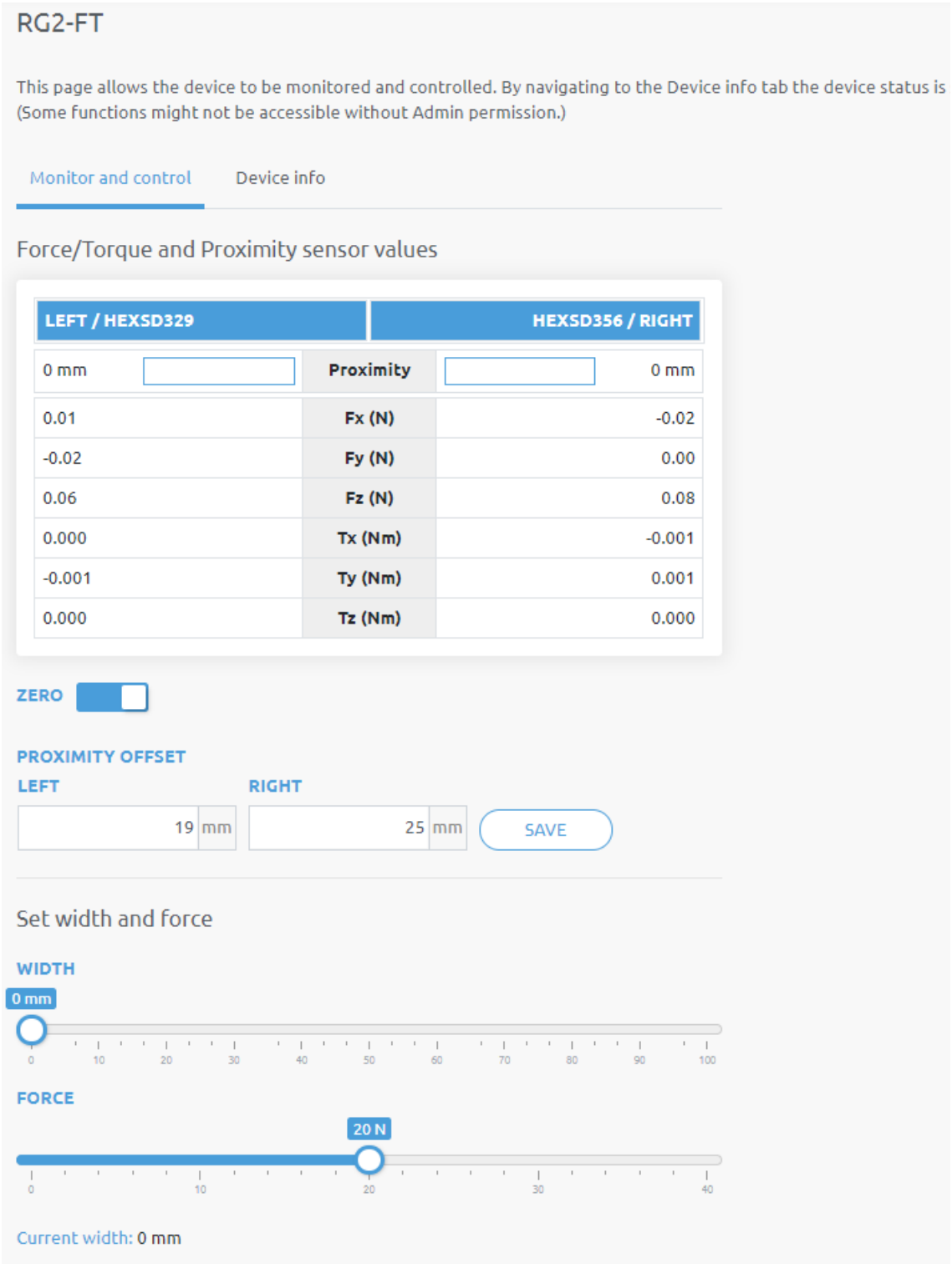
- Check if any of the safety switch is being pushed
- If yes, remove the object pushing the switch

- 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.

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.

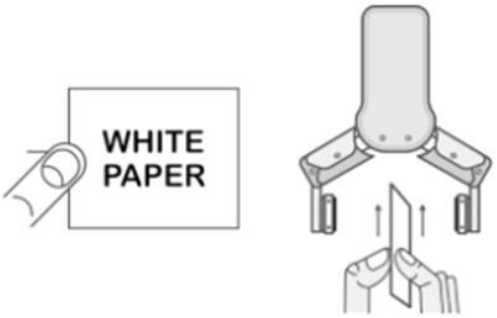
The **Zero** toggle switch can be used to zero the force and torque reading.

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.



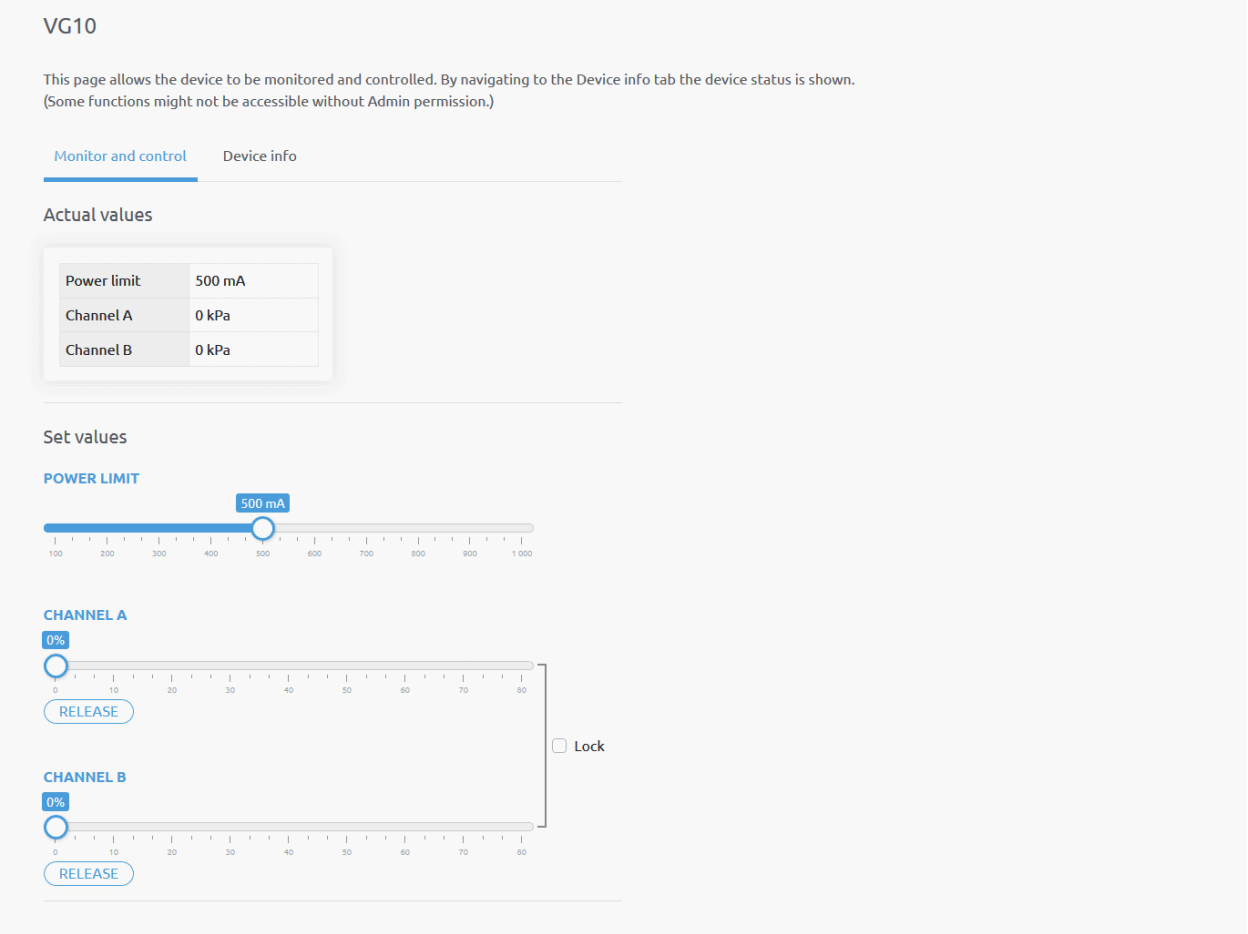
- Read the actual **Left** and **Right Proximity** values (e.g.: 19mm and 25mm)
- Write these values to the **Left** and **Right** edit boxes and click on the **Save** button to store it permanently.
- Open the gripper and the calibration is finished.

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.

VG10



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.

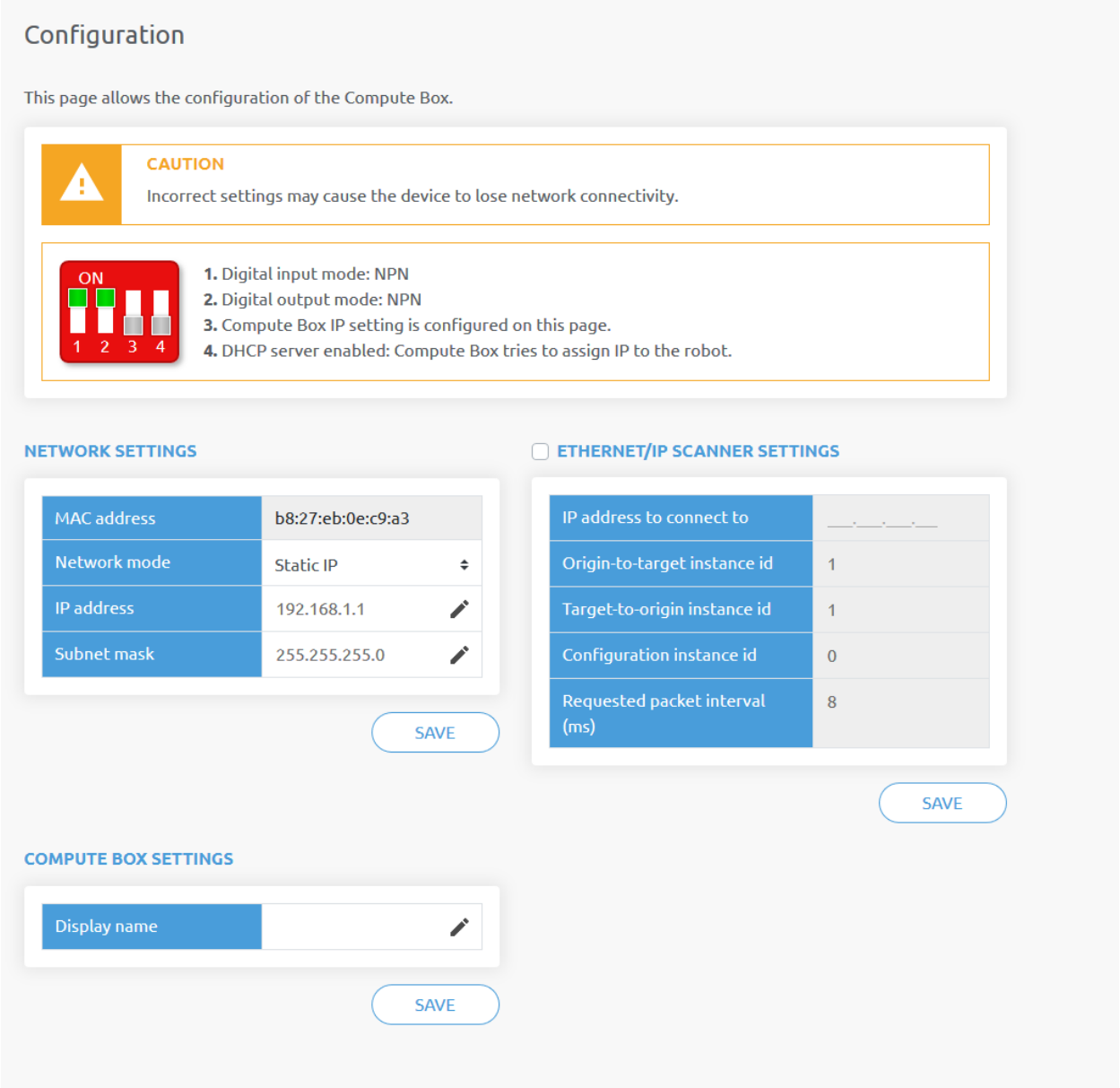
Low power limit may not be sufficient for higher percentage of vacuum and the target vacuum level may not be reached.

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.

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 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)

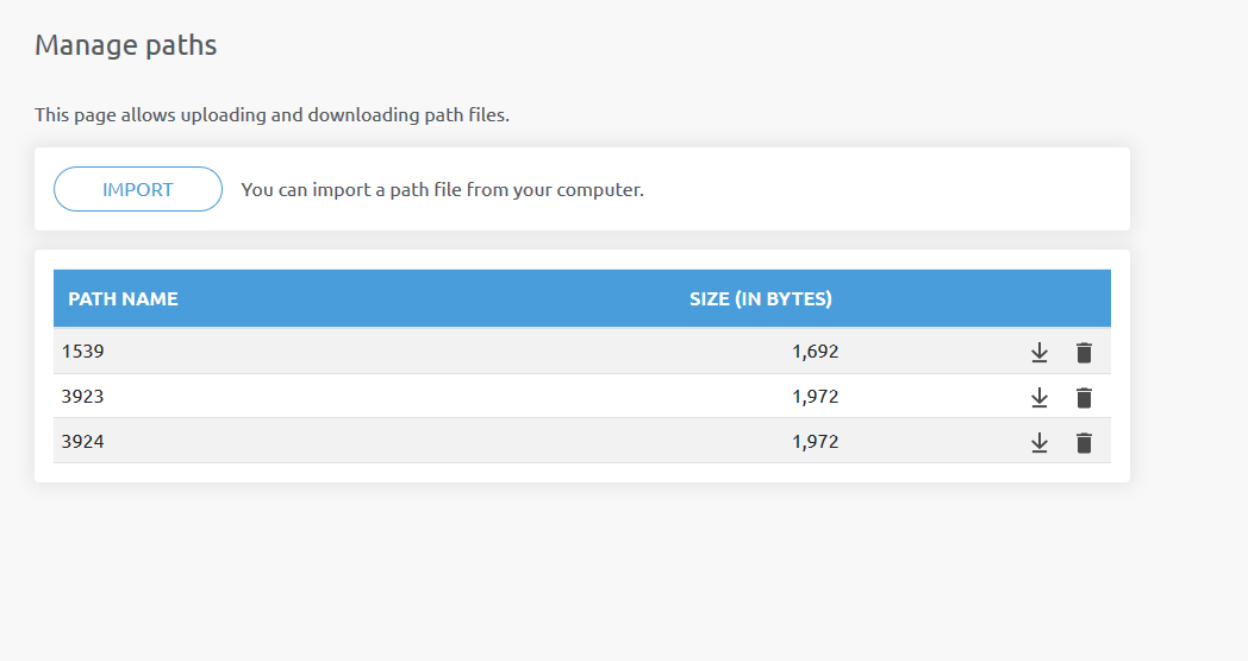
Check the checkbox and the Compute Box will try to automatically connect to the robot (via the given IP address).

Paths 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.

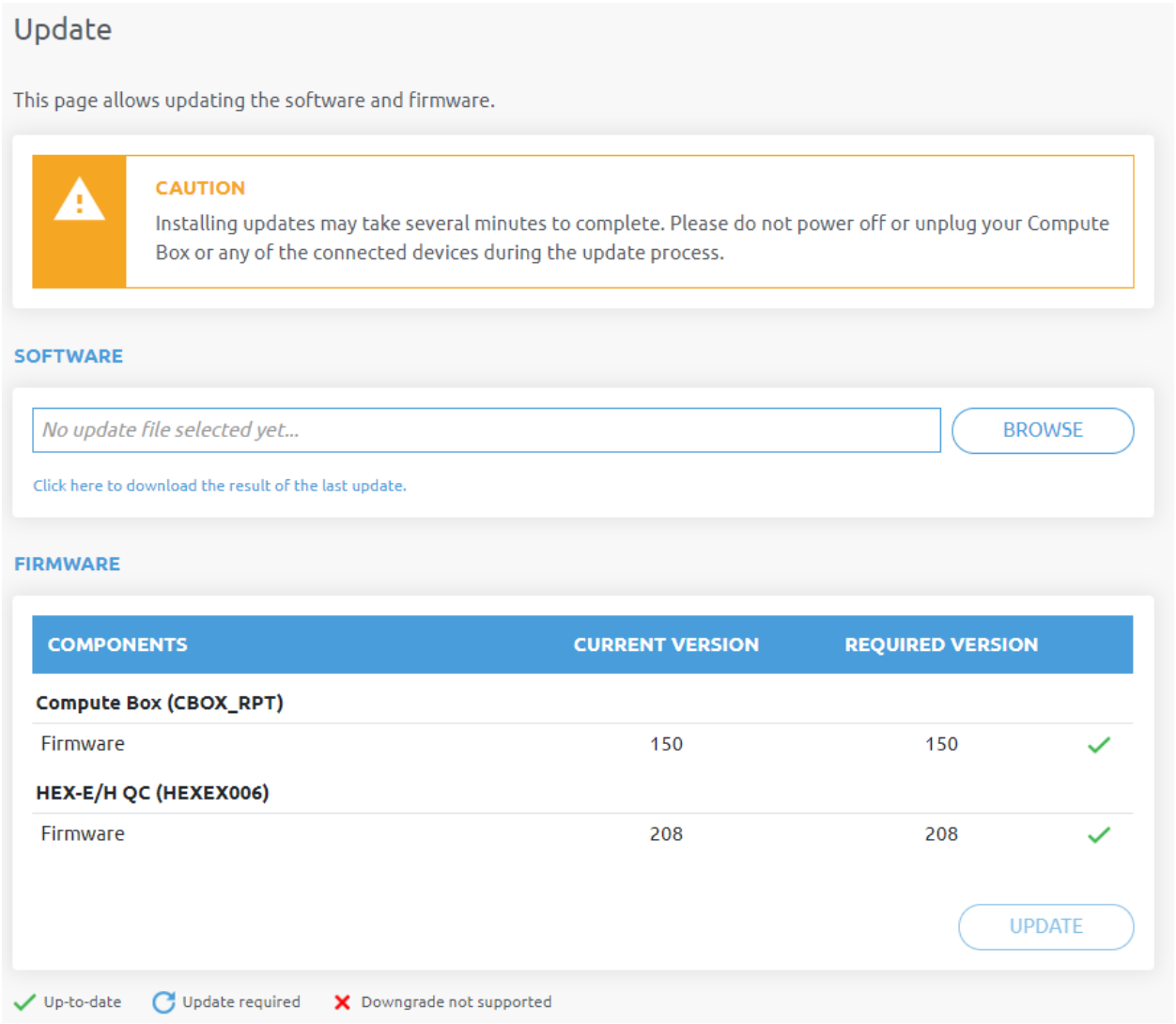
NOTE:

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.

Update menu

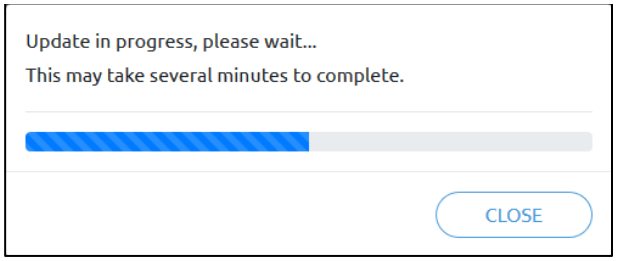
This page can be used to update the software on the Compute Box and the firmware on the devices.



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**.

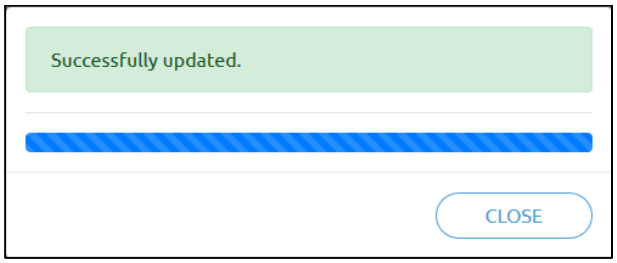
Click on that **Update** button to start the software update process:



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.

If the update is finished and was successful, the following message is shown:



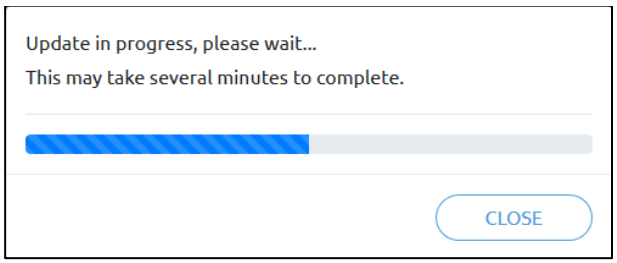
Now disconnect the device and use it as usual.

NOTE:

If the software update failed, please contact your distributor.

The firmware update is only required when any of the components is out of date.

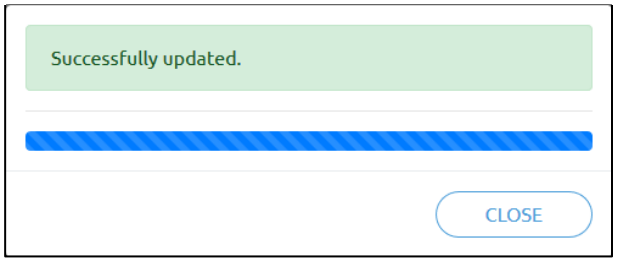
To start the firmware update, click on **UPDATE** button in the firmware section of the page.



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.

If the update is finished and was successful, the following message is shown:



Now disconnect the device and use it as usual.

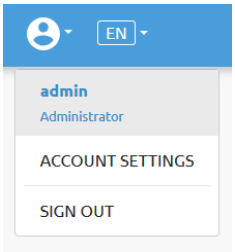
NOTE:

If the update is failed, please contact your distributor.

Account settings

This menu can be used to:

- See the currently sign-id user
- Go to **Account settings**
- Sign-out

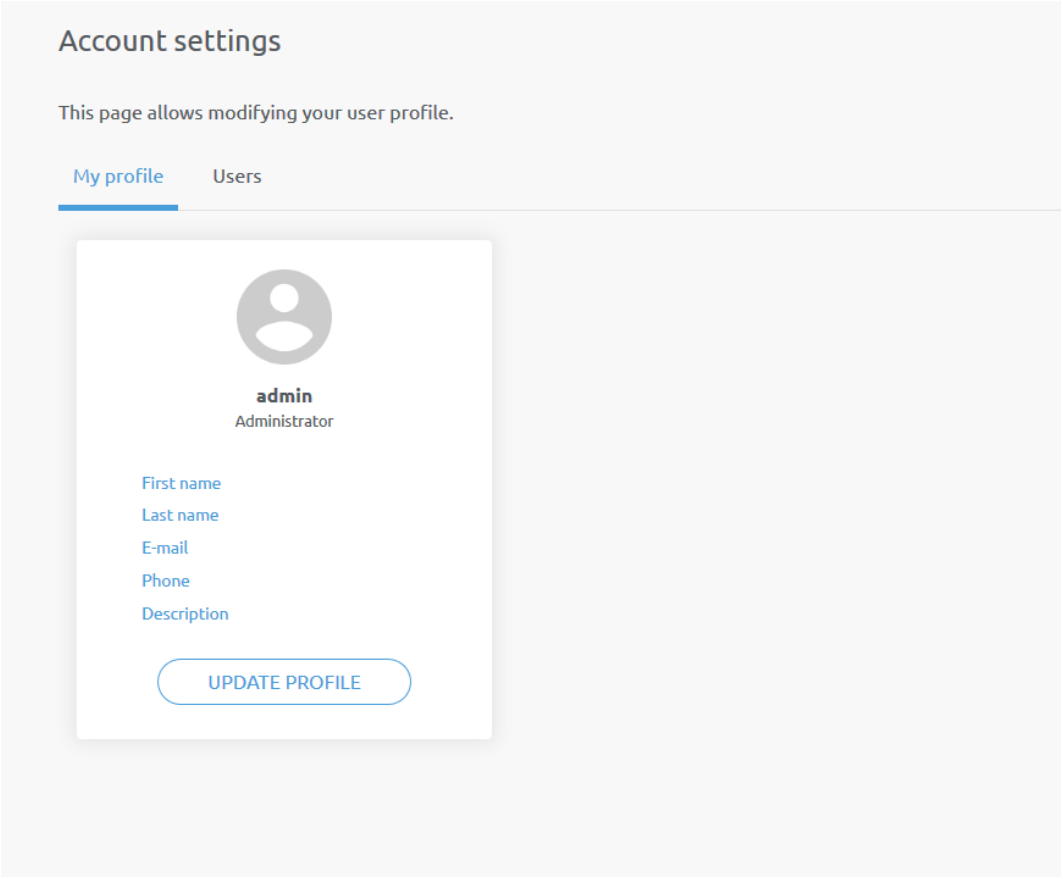


Account settings:

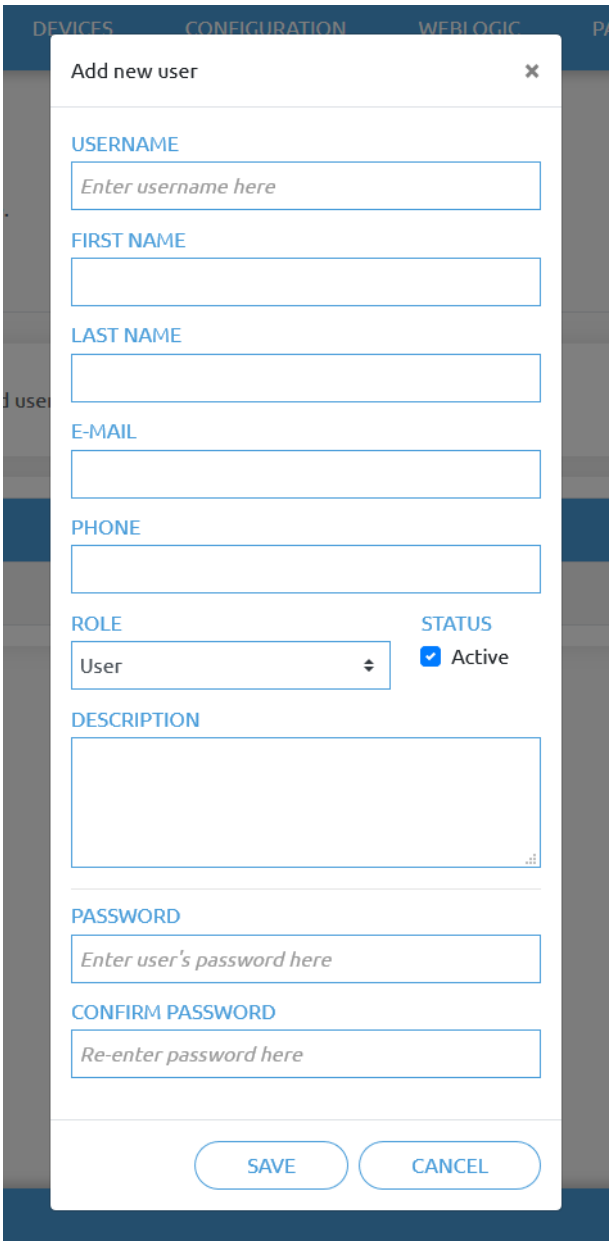
This page has two tabs:

- **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:

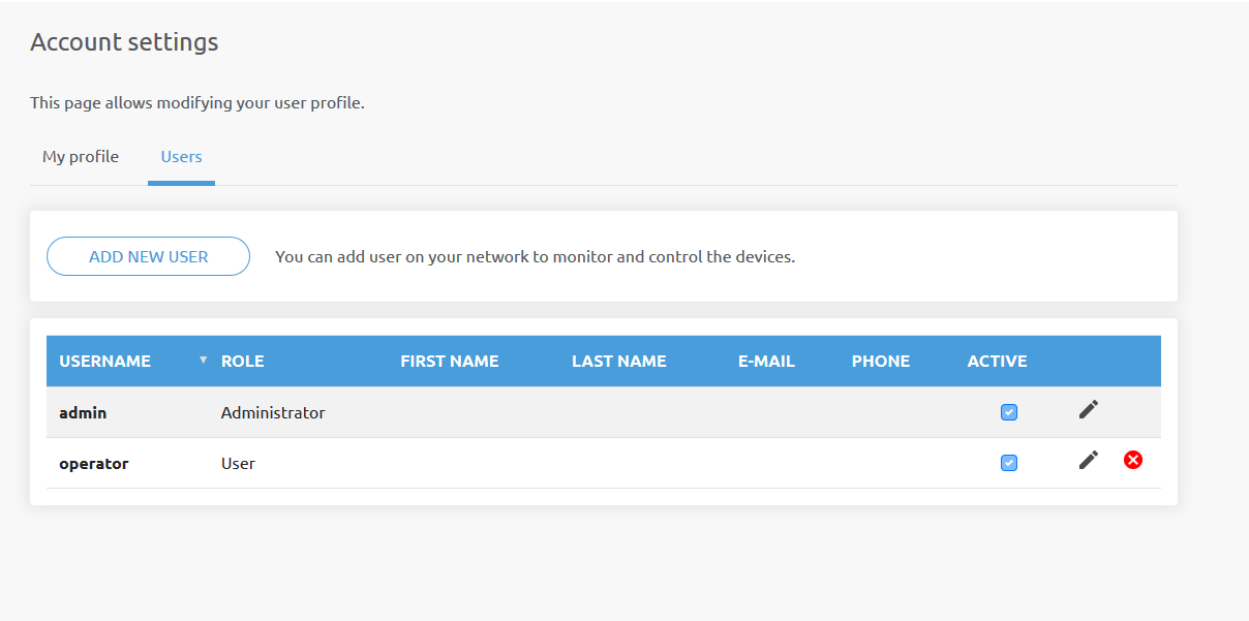


There are three user levels:

- 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.

7 Hardware Specification

7.1 Technical sheets

- Gecko 136
- HEX-E QC 139
- HEX-H QC 141
- Quick Changer 143
- Quick Changer for I/O 143
- Dual Quick Changer 143
- Quick Changer - Tool side 143
- RG2-FT 145
- RG2 150
- RG6 153
- VG10 156

Gecko

General Properties					Unit
Gripper					
Workpiece Material	**Polished Steel**	**Acrylic**	**Glass**	**Sheet Metal**	
Maximum payload (x2 safety factor)	6.5 14.3	6.5 14.3	5.5 12.1	5.5 12.1	[kg] [lb]
Preload required for max adhesion	140				[N]
Detachment time	300				[msec]
Holds workpiece on power loss?	yes				
Pads					
Change-out interval	150 000 to 200 000 cycles for HIGH preload 200 000 to 250 000 cycles for LOW preload				[cycles]
Manual Cleaning	Isopropyl alcohol and lint free cloth				
Robotic cleaning system	Cleaning Station				
Robotic cleaning interval and % recovery	Refer to Cleaning Station User Guide				
Sensors					
	Pre-load sensor		Ultrasonic Range sensor		
Range	45 [N] 9 [lb]	140 [N] 31 [lb]	0	260 [mm] 10 [inch]	[N][mm] [lb][inch]
Error	7%		2%		
IP Classification	42				
Dimensions (HxW)	187 x 146 7.3 x 5.7				[mm] [inch]
Weight	2.85 6.3				[kg] [lb]

NOTE:

Avoid preloading the gripper with an inverted robot or in non-vertical loading conditions. If preloaded whilst inverted, preload sensor will not meet typical performance standards.

Operating Conditions	Minimum	Typical	Maximum	Unit
Temperature	0 32	- -	50 122	[°C] [°F]
Surface Characteristics*	Matte finish	Highly polished	-	

* Smoother surfaces require less preload force for a desired payload force.

Specification or Feature	Target value
Parts Presence Sensing	Yes (Ultrasonic)
Pad Material	Proprietary silicone blend
Wear Properties	Depends on surface roughness and preload
Pad Attachment Mechanism	Magnetic
Change-out interval	150000 – 200000 for HIGH PRELOAD 200000 – 250000 for LOW PRELOAD
Cleaning system	Cleaning station
Cleaning interval and % recovery	See Cleaning Station Manual

Effectiveness on Different Materials

The Gecko Gripper is best suited for smooth, low surface roughness substrates that are generally flat, stiff, and rigid. For other materials, the Gecko Gripper's effectiveness drops depending the stiffness and roughness of the picking surface. The table below shows a relationship between rigid and flexible substrates, surface finish, payload and the required preload to pick up said substrate. For example, if the customer knows that their part/substrate is rigid, with a mirror-like finish and weighs 2kg, the preload required to pick up the part/substrate is a medium-level preload.

Flexibility	Surface finish	Payload (kg)	Required Preload
Rigid	Mirror-like finish	0 to 2	Low
		2 to 4	Medium
		4 to 6	High
	Smooth	0 to 2	Medium
		2 to 4	High
		4 to 6	N/A
	Matte	0 to 2	High
		2 to 4	N/A
		4 to 6	N/A
Flexible	Mirror-like finish	0 to 2	Medium
		2 to 4	High
		4 to 6	N/A
	Smooth	0 to 2	High
		2 to 4	N/A
		4 to 6	N/A
	Matte	0 to 2	N/A
		2 to 4	N/A
		4 to 6	N/A

To further elaborate the significance between preload and payload, the table below shows visual matrix that displays the capability of the gecko gripper to pick up different materials with varying stiffness and roughness, at three different preload values (low 40N, medium 90N, high 140N).

Stiffness	Roughness	Example of material	Preload - 140N						Preload - 90N						Preload - 40N					
			Payload [kg]						Payload [kg]						Payload [kg]					
			0.1	0.5	1	2	4	6	0.1	0.5	1	2	4	6	0.1	0.5	1	2	4	6
1	1	Mylar	✓	✓	✓	*			✓	✓	*				✓	*				
5	1	Transparency sheet	✓	✓	✓	✓	*		✓	✓	*				✓	*				
10	1	Polished mirror-like steel, solar panel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	*	✓	✓	✓	✓	*	
1	5	Cling film, ziploc bags	✓	✓	*				✓	*					✓	*				
5	5	Glossy carboard (cereal box)	✓	✓	*				✓	*					✓	*				
10	5	Printed circuit board	✓	✓	✓	✓	*		✓	✓	*				✓	*				
1	10	Laminating plastic / film	*																	
5	10	Corrugated cardboard																		
10	10	Sandblasted aluminum																		

✓ the gripper can easily pick up the material

***** the gripper can pick up the material in some cases (requires caution and testing to verify)

Nothing the gripper cannot pick up this type of material.

NOTE:

This table is to be utilized as a guide to better understand the payload capacity and substrate type for the Gecko Gripper.

The criteria for stiffness and roughness is a basic scale from 1-10, here are the benchmarks used to determine the values.

Stiffness	Description	Example
1	Flexible	Fabric
5	Semi-flexible	Cardboard
10	Stiff	Metal

Roughness	Description	Example	RMS Value
1	Polished/Smooth	Polished Metal	0.1 micron
5	Textured	Carboard	7 microns
10	Rough	Sandblasted Metal	28 microns

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]
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.

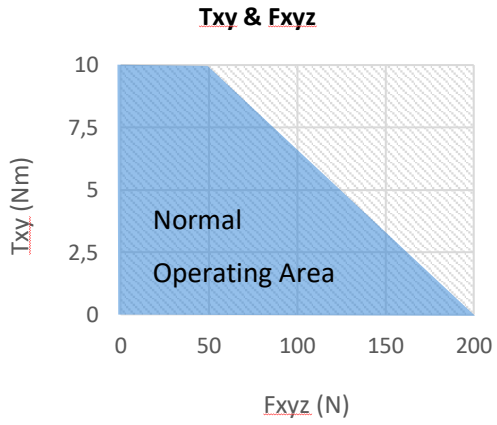
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

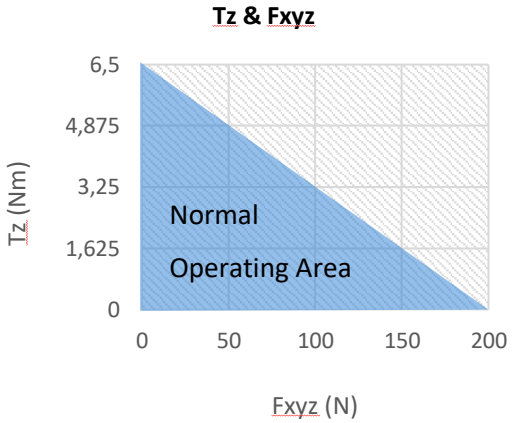
Complex loading

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.





HEX-H QC

General Properties	6-Axis Force/Torque Sensor				Unit
	Fxy	**Fz**	**Txy**	**Tz**	
Nominal Capacity (N.C)	200	200	20	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.

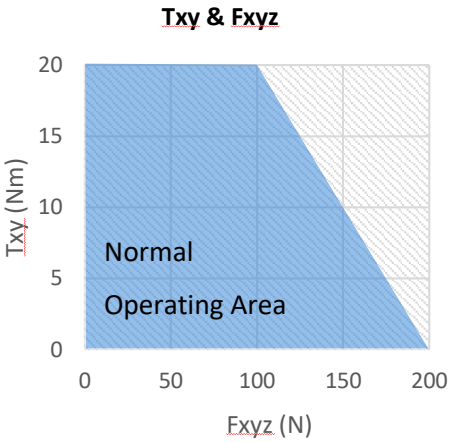
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

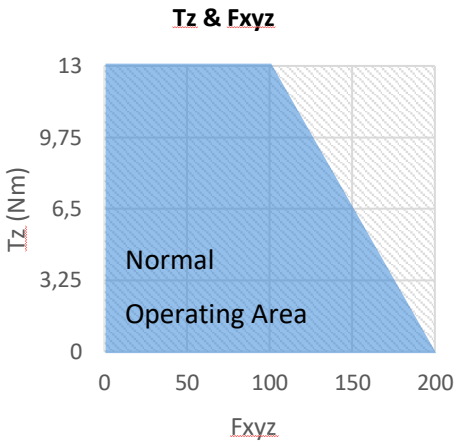
Complex loading

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.





Quick Changer

Quick Changer for I/O

Dual Quick Changer

Quick Changer - Tool side

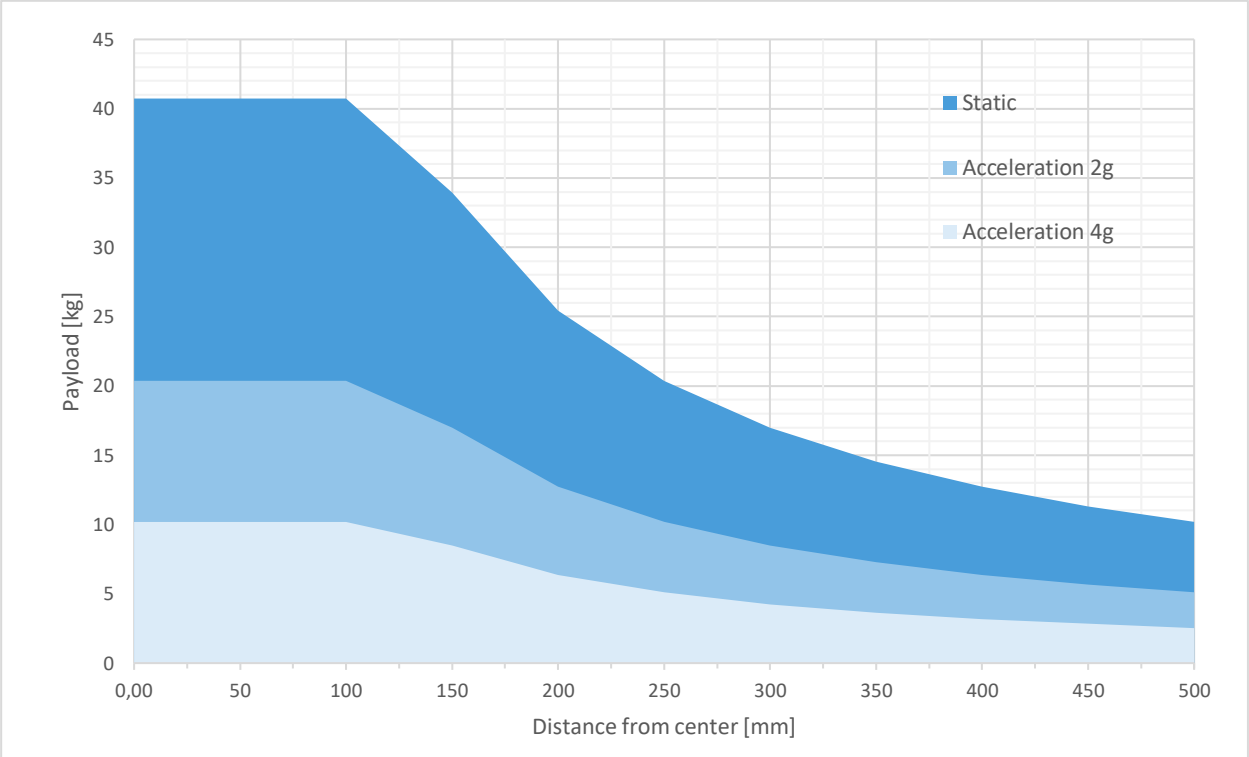
If not specified, the data represent the combination of the different Quick Changer types/sides.

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	64			
Operating life (Tool change)	-	5.000	-	[cycles]
Operating life (Robot operation)	10	-	-	[M cycles]

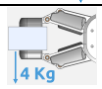
* See load capacity graph on the next page.

	Quick Changer	Quick Changer for I/O	Dual Quick Changer	Quick Changer - Tool Side	Units
Weight	0.06 13.22	0.093 2.05	0.41 90.39	0.14 30.86	[kg] [lb]
Dimensions	See Mechanical dimension section				[mm] [inch]

Load capacity



RG2-FT

General Properties	Min	Typical	Max	Units
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 speed table 148

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on page 148.

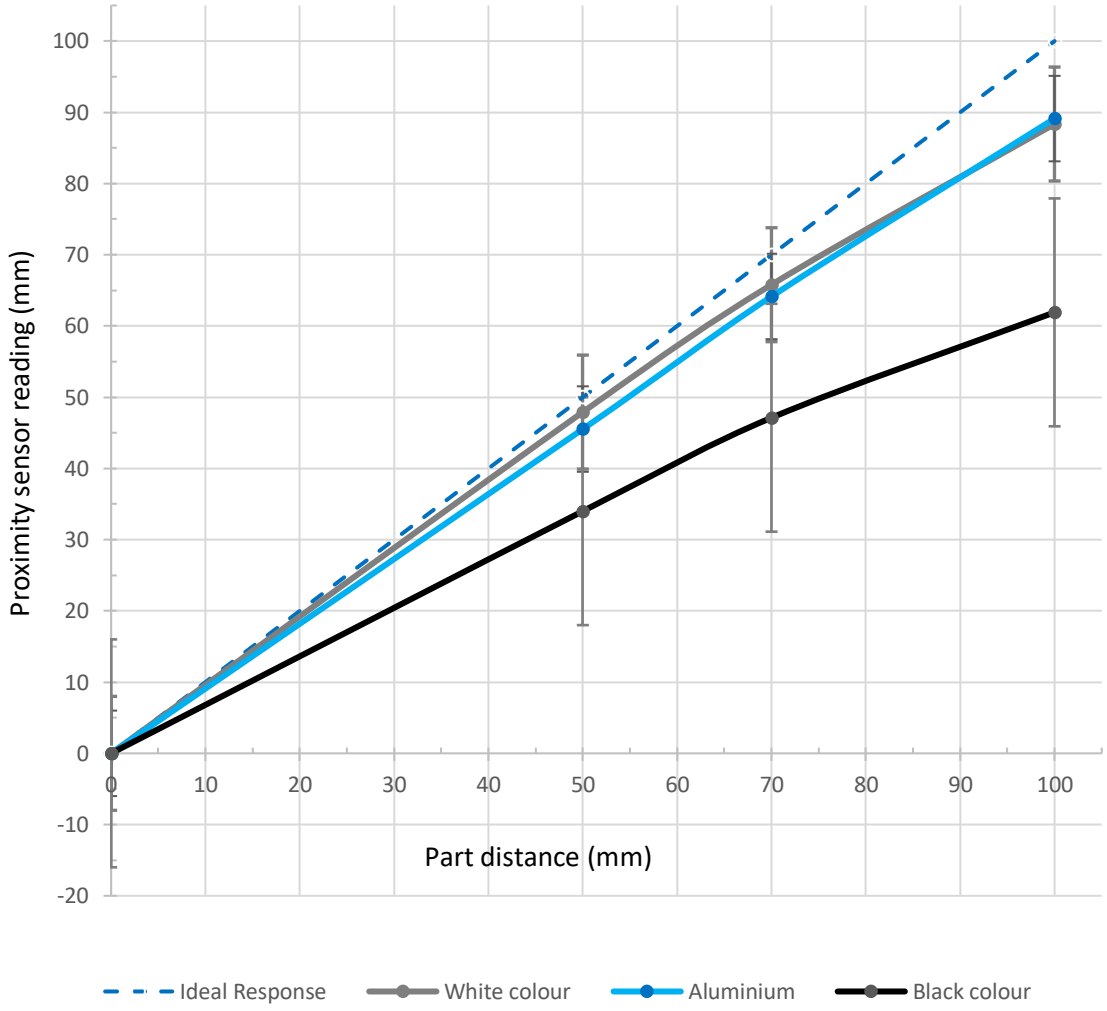
Force Sensor Properties	Fxy	Fz	Txy	Tz	Units
Nominal capacity (N.C.)	20	40	0.7	0.5	[N] [Nm]
Single axis overload	200	200	200	200	[%]
Noise free resolution	0.1	0.4	0.008	0.005	[N] [Nm]
Single axis deformation at N.C.	0.4 0.015	0.1 0.04	2	5	[mm] [°] [inch] [°]
Full scale nonlinearity Temperature compensation	< 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	-	[%]

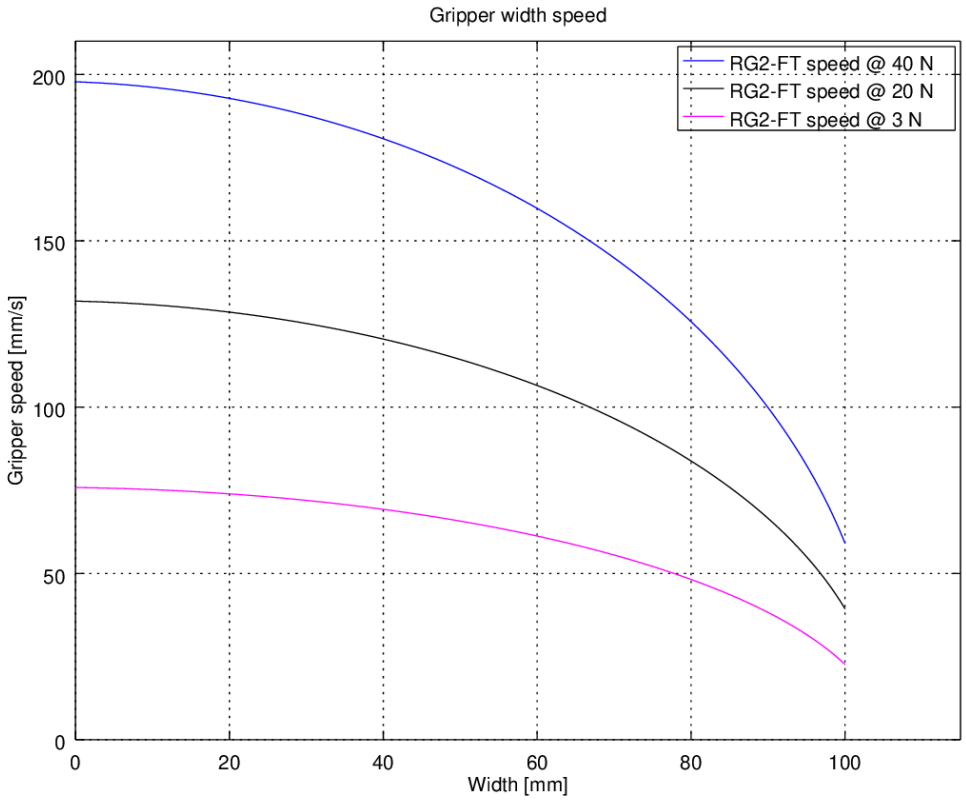
* the non-linearity refers to the max value and depends on the object properties (e.g. surface type and color)

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]

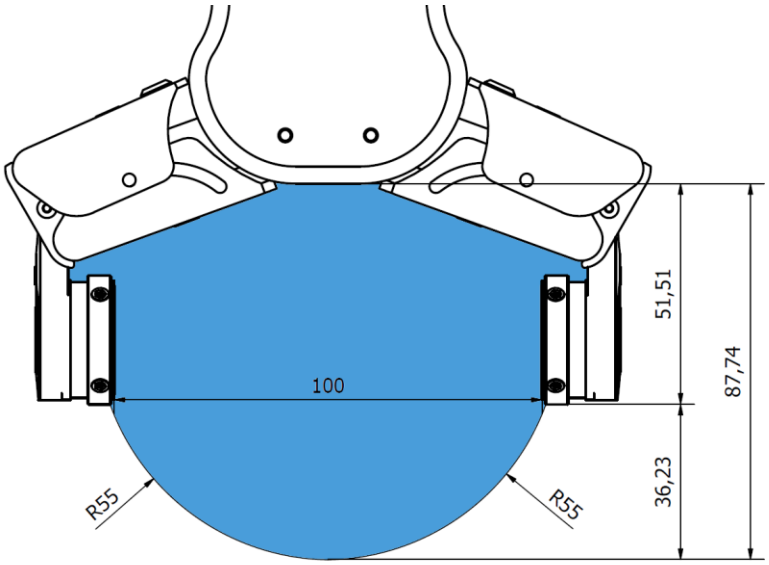
Proximity sensor typical accuracy



RG2-FT Gripping Speed Graph



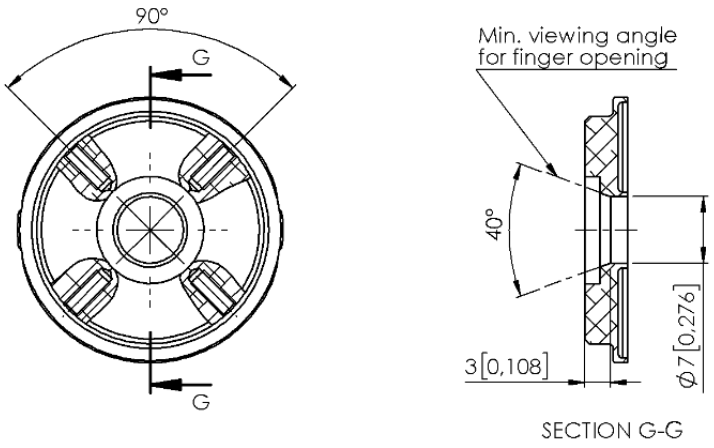
Gripper Working Range

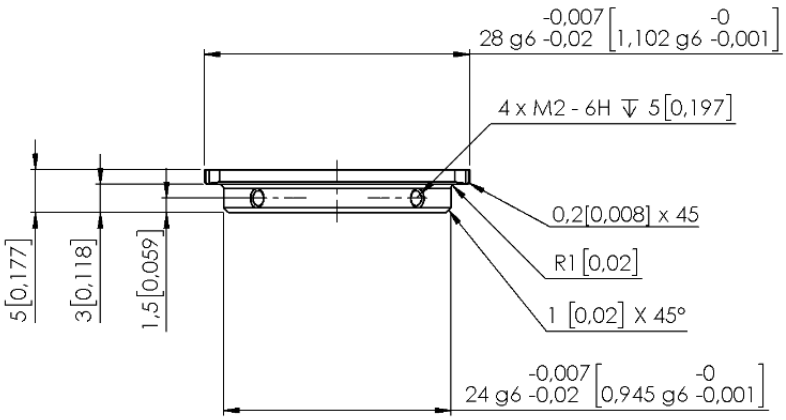


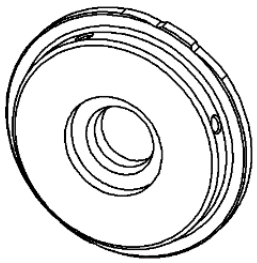
The dimensions are in millimeters.

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

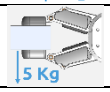
NOTE:

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.

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]
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	- -	60 122	[°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]

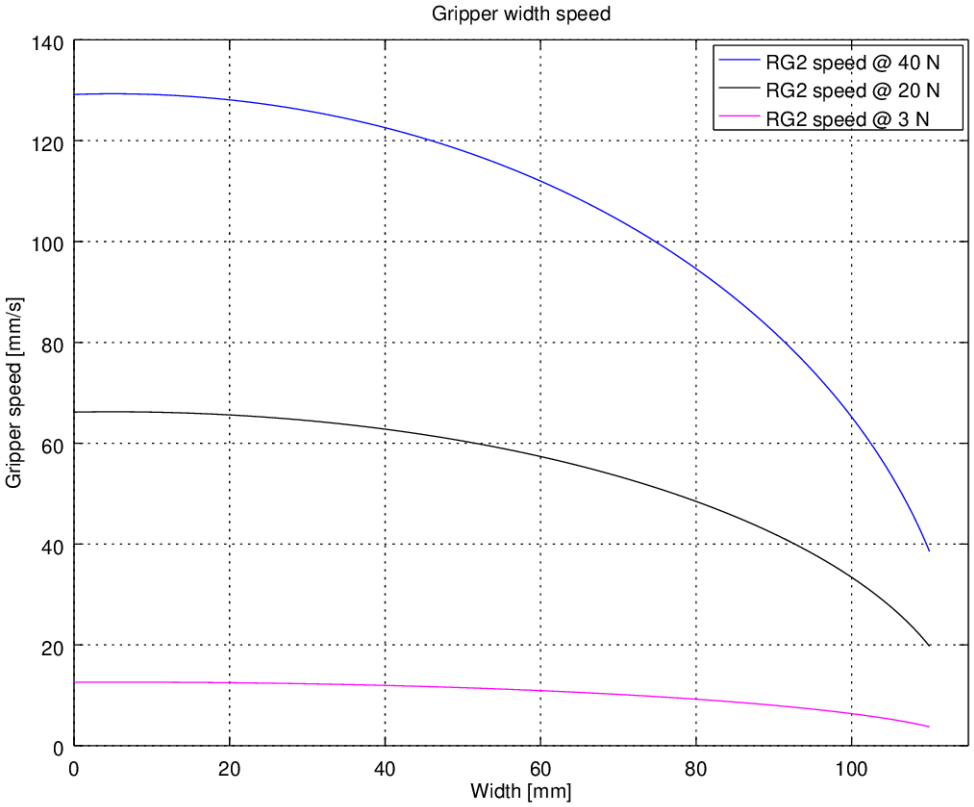
*See table on the next page

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on next page.

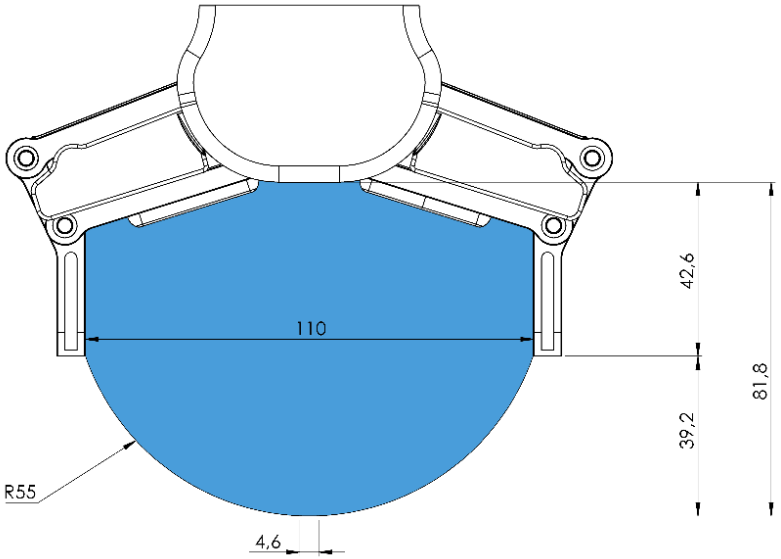
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	70	-	600*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

*Current spikes up to 3A (max 6mS) may occur during the release action.

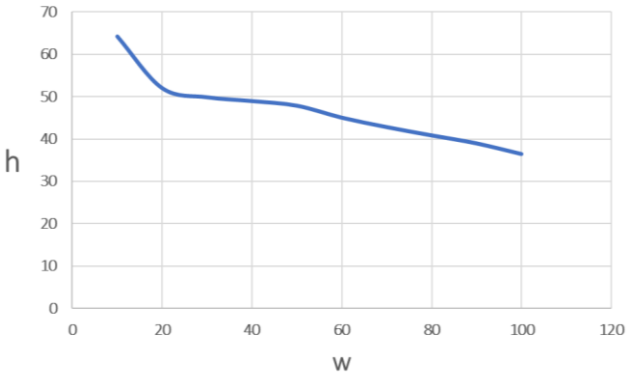
RG2 Gripping Speed Graph



RG2 Work Range

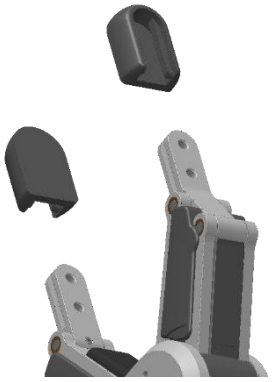


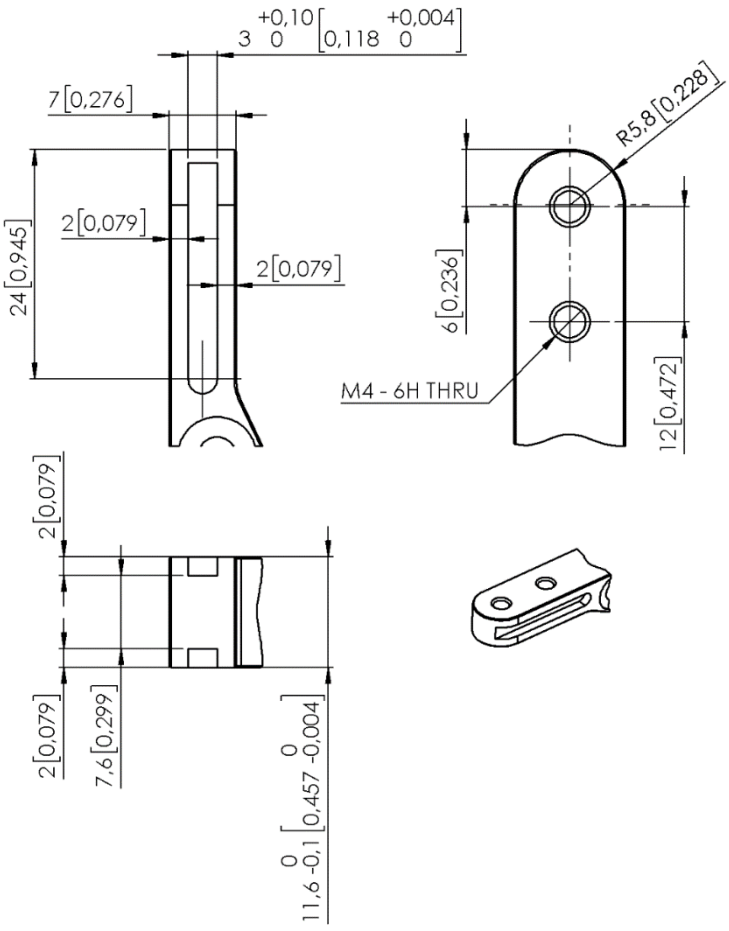
Gripping on long objects can unintentionally activate the Safety switches. The maximum workpiece height (calculated from the end of the fingertips) is dependent on the gripping width (w). For various width values the height (h) limit is given below:



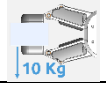
Fingertips

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:





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 -	- -	160 6.3	[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]
Gripping force (adjustable)	25	-	120	[N]
Gripping force deviation		±25		%
Gripping speed*	51	-	160	[mm/s]
Gripping time**	0.05	-	0.15	
Adjustable bracket tilting accuracy		< 1		°
Storage temperature	0 32		60 122	[°C] [°F]
Motor	Integrated, electric BLDC			
IP Classification	54			
Dimensions	262 x 212 x 42 10.3 x 8.3 x 1.6			[mm] [inch]
Weight	1.25 2.76			[kg] [lb]

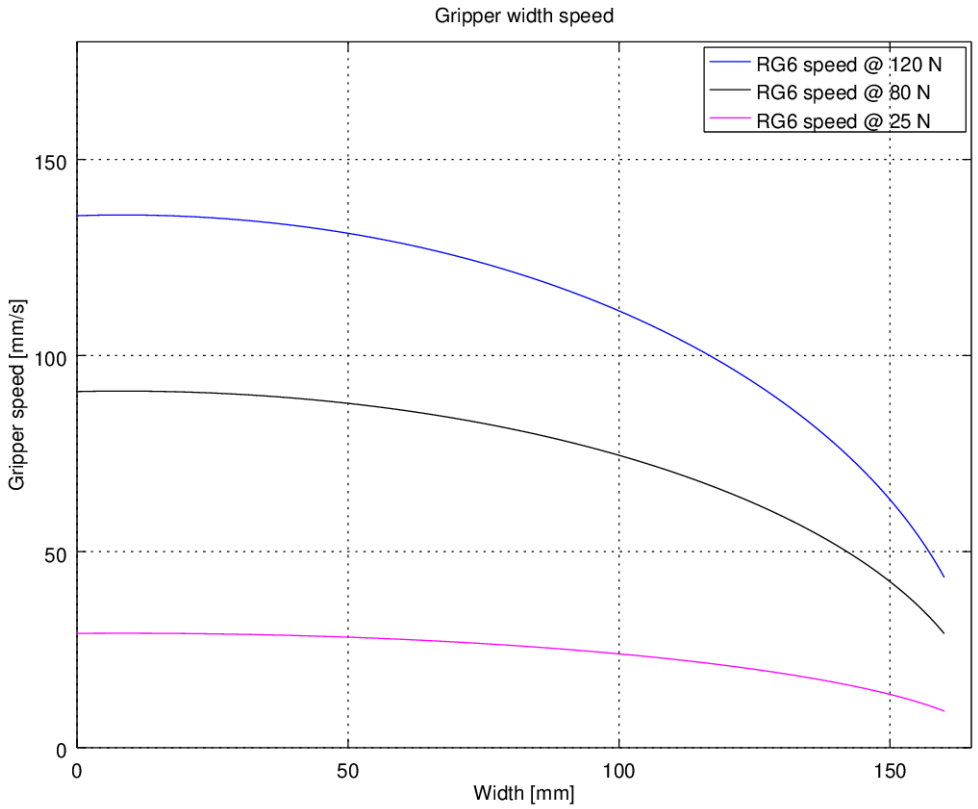
*See table on the next page

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on next page.

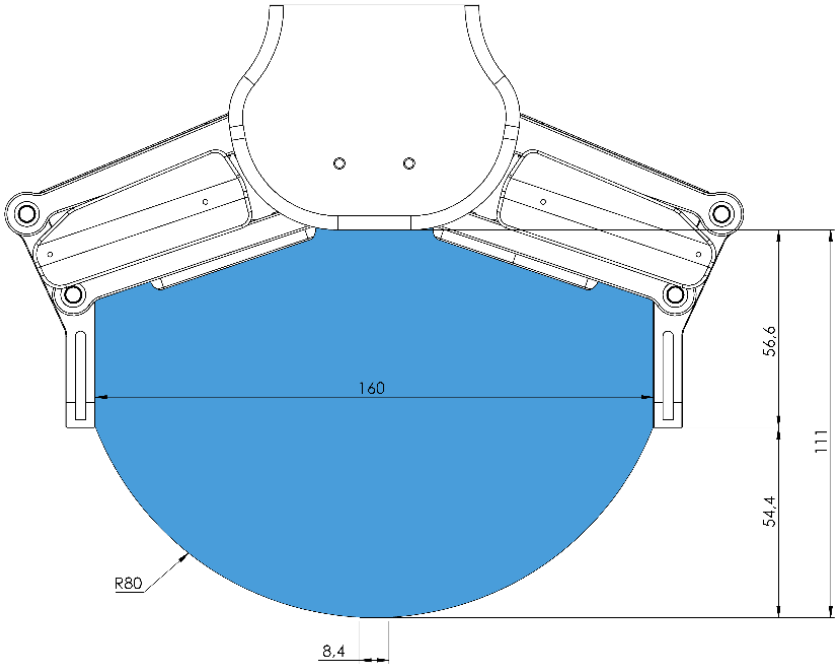
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	70	-	600*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

*Current spikes up to 3A (max 6mS) may occur during the release action.

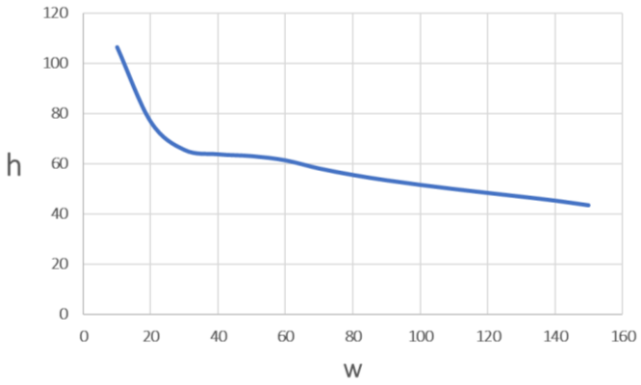
RG6 Gripping Speed Graph



RG6 Work Range

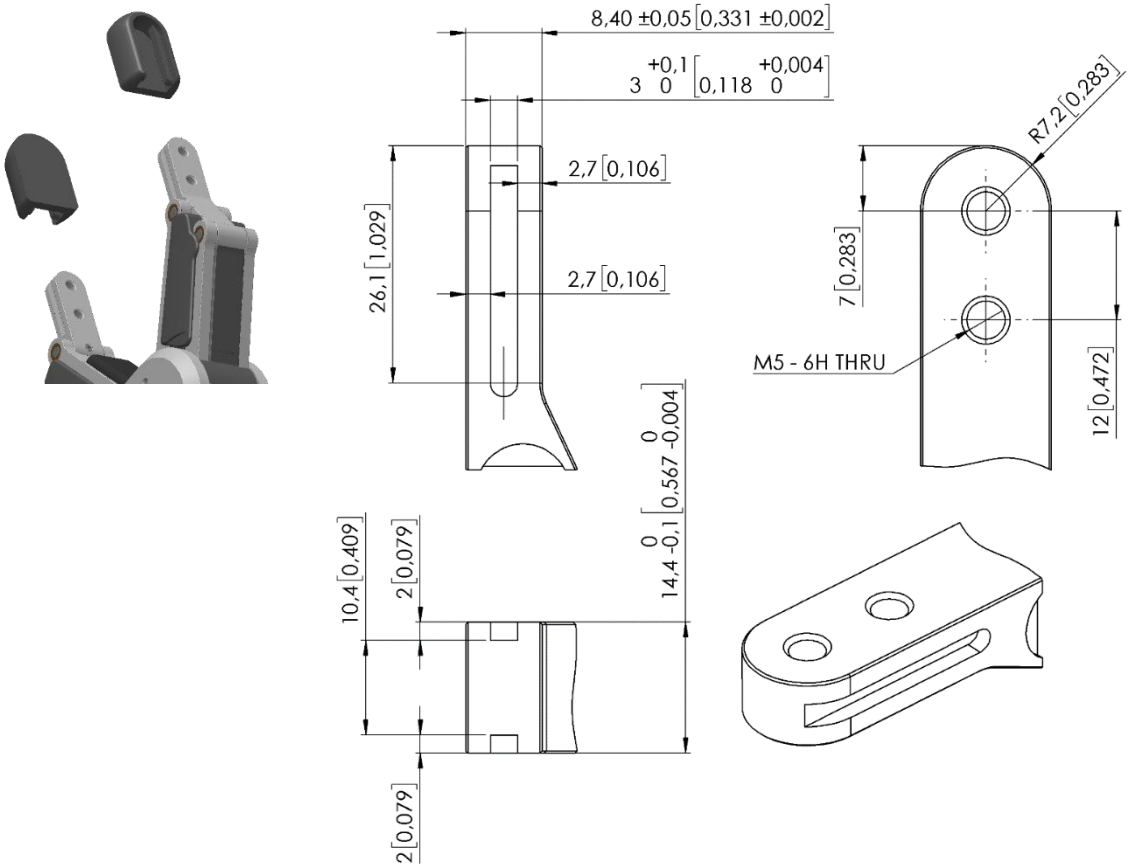


Gripping on long objects can unintentionally activate the Safety switches. The maximum workpiece height (calculated from the end of the fingertips) is dependent on the gripping width (w). For various width values the height (h) limit is given below:



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:



VG10

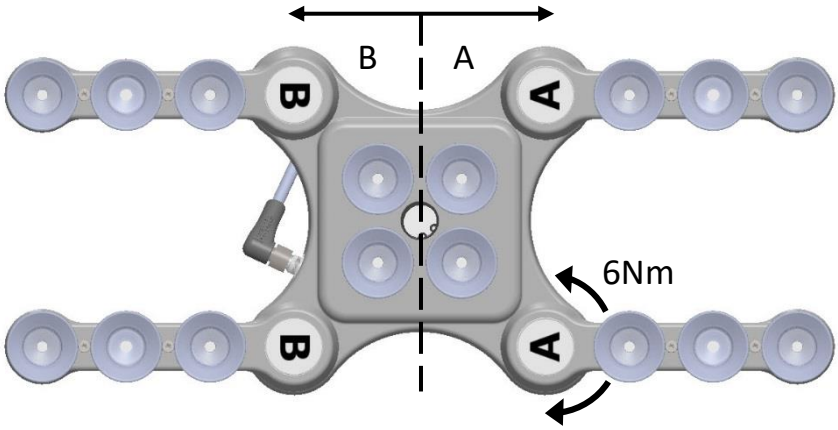
General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[Nl/min]
Arms adjustment		0	-	270	[°]
Arm holding torque		-	6	-	[Nm]
Payload	Rated	10 22			[kg] [lb]
	Maximum	15 33			[kg] [lb]
Vacuum cups		1	-	16	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Foot-inch-foot		-	1.40	-	[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

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 10 kg payloads.

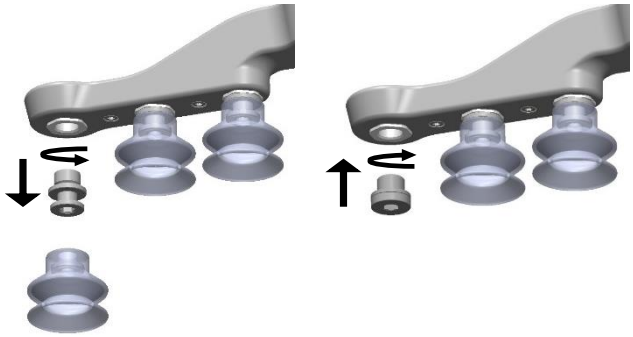
The VG10 suction cups are grouped into two independent channels.



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.

Vacuum cups and fittings

It is possible to change suction cups simply by pulling them off the fittings. 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. Use a 3 mm Allen key for changing to blind screws or another type of fitting.



The thread size is the commonly used G1/8”; allowing for standard fittings, blinders and extenders to be fitted directly to the VG10 arms and housing, see mechanical details in the 7.2.

Choosing the right vacuum cups for your application is essential. The VG10 comes with common 30 mm silicone vacuum cups 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. Below is a table with general recommendations.

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.

Payload, vacuum and air flow

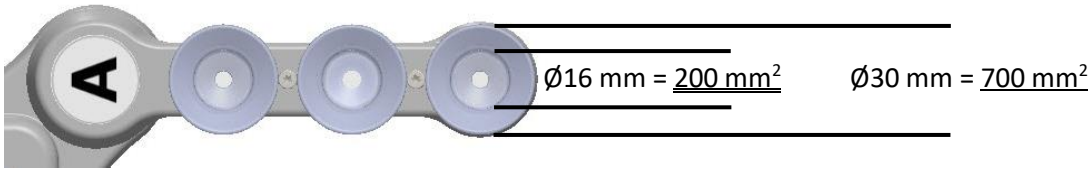
The lifting capacity (payload) of the VG10 depends primarily on the following parameters:

- Suction area
- Vacuum
- Air flow

These three parameters are explained in the following subsections.

Suction area

The higher suction area, the higher lifting capacity. Be aware that the actual suction area is smaller than the outer diameter of your vacuum cups, as the vacuum cup libs forms around the workpiece, the actual suction area is reduced (see figure below)



With a typical vacuum of 60% and one vacuum cup with a 200 mm2 suction area, the lifting force is:

$$F_{cup} = p \cdot A = [\Delta Pa] \cdot [m^2] = 60\% \cdot 101.3kPa \cdot 10^3 \cdot 200\ mm^2 \cdot 10^{-6} = 12.2\ N$$

With this force per vacuum cup, to lift 10 kg and accelerate with 2g’s, this many vacuum cups are needed:

$$Number\ of\ cups = \frac{m \cdot a}{F_{cup}} = \frac{[kg] \cdot \left[{}^{m}/_{s^2} \right]}{[N]} = \frac{10 \cdot 2 \cdot 9.81}{12.2} = 16 \text{ vacuum cups}$$

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.

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 percentage 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.

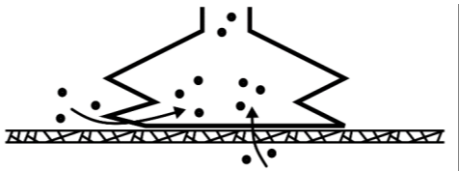
The pressure in the atmosphere varies with weather, temperature and altitude. The VG10 automatically compensates for altitudes up to 2km, where the pressure is about 80% of sea level.

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).

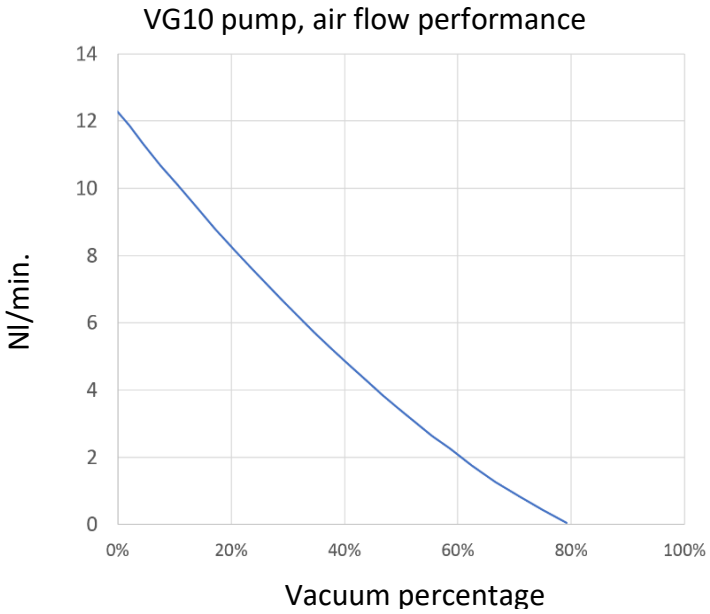


Leaking workpieces can be even harder to identify. Things that look completely tight might not be tight at all. A typical example is coarse cardboard boxes. The thin outer layer is often requiring a lot of air flow to create a pressure difference over it (see figure below).

Therefore, the users must be aware of the following:

- VG10 is 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 VG10 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 VG10.

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 VG10 filters and vacuum cups will last longer.

7.2 Mechanical Drawings

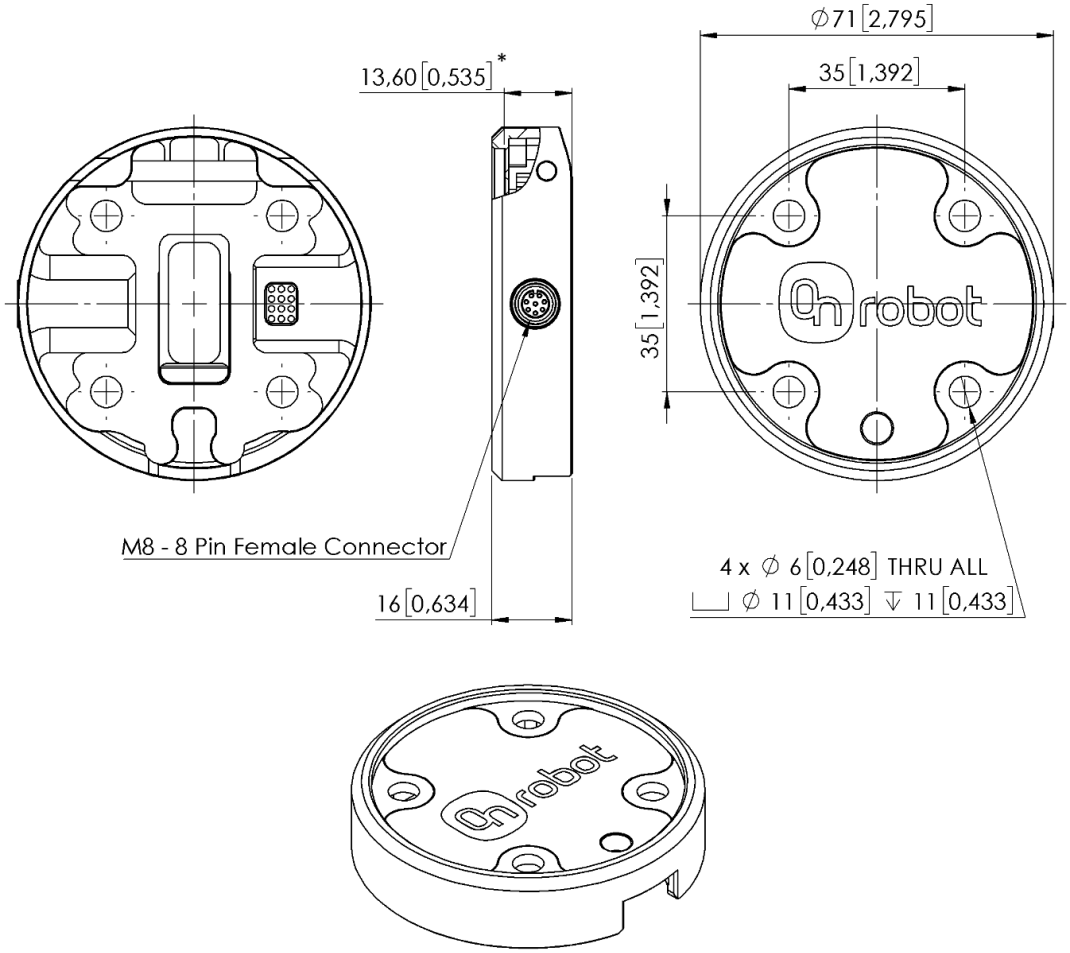
7.2.1 Adapter plate(s)

No adapter plates are required.

7.2.2 Mountings

Quick Changer - Robot side 161
Quick Changer for I/O - Robot side ... 162
Dual Quick Changer 163
HEX-E QC 164

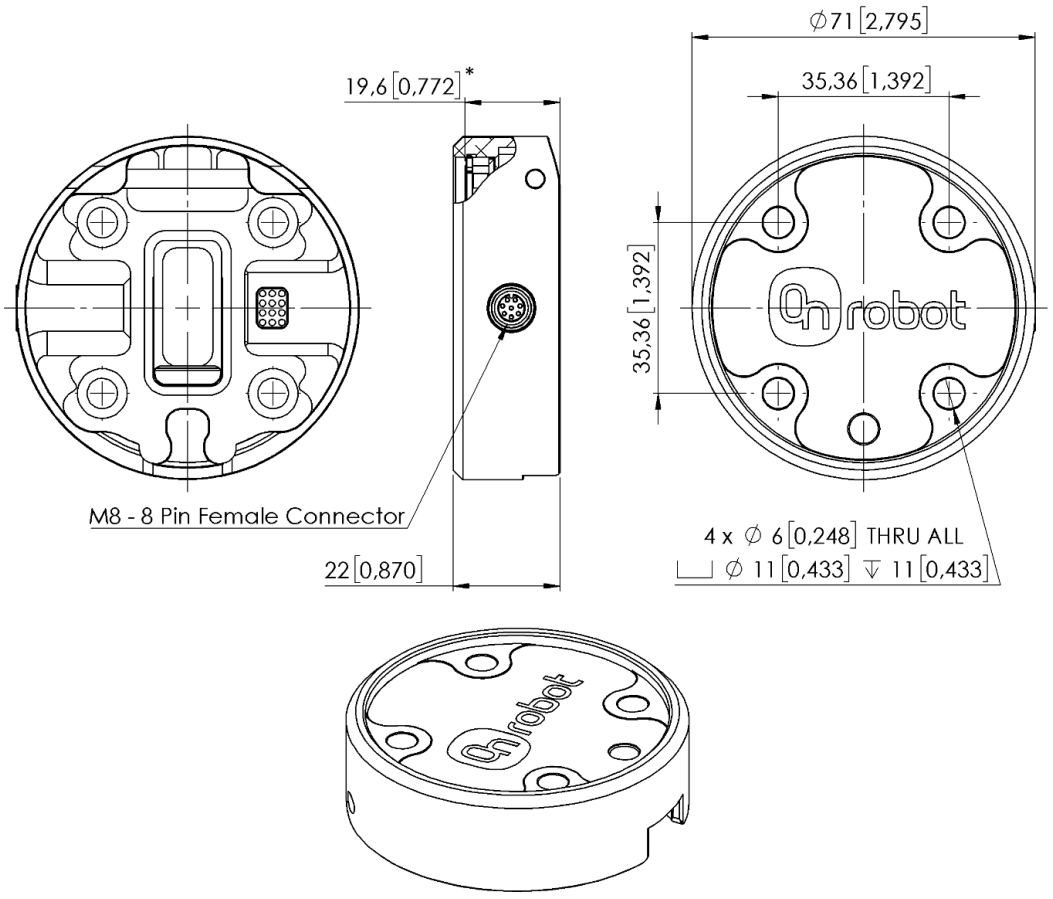
Quick Changer - Robot side



* Distance from Robot flange interface to OnRobot tool.

All dimensions are in mm and [inches].

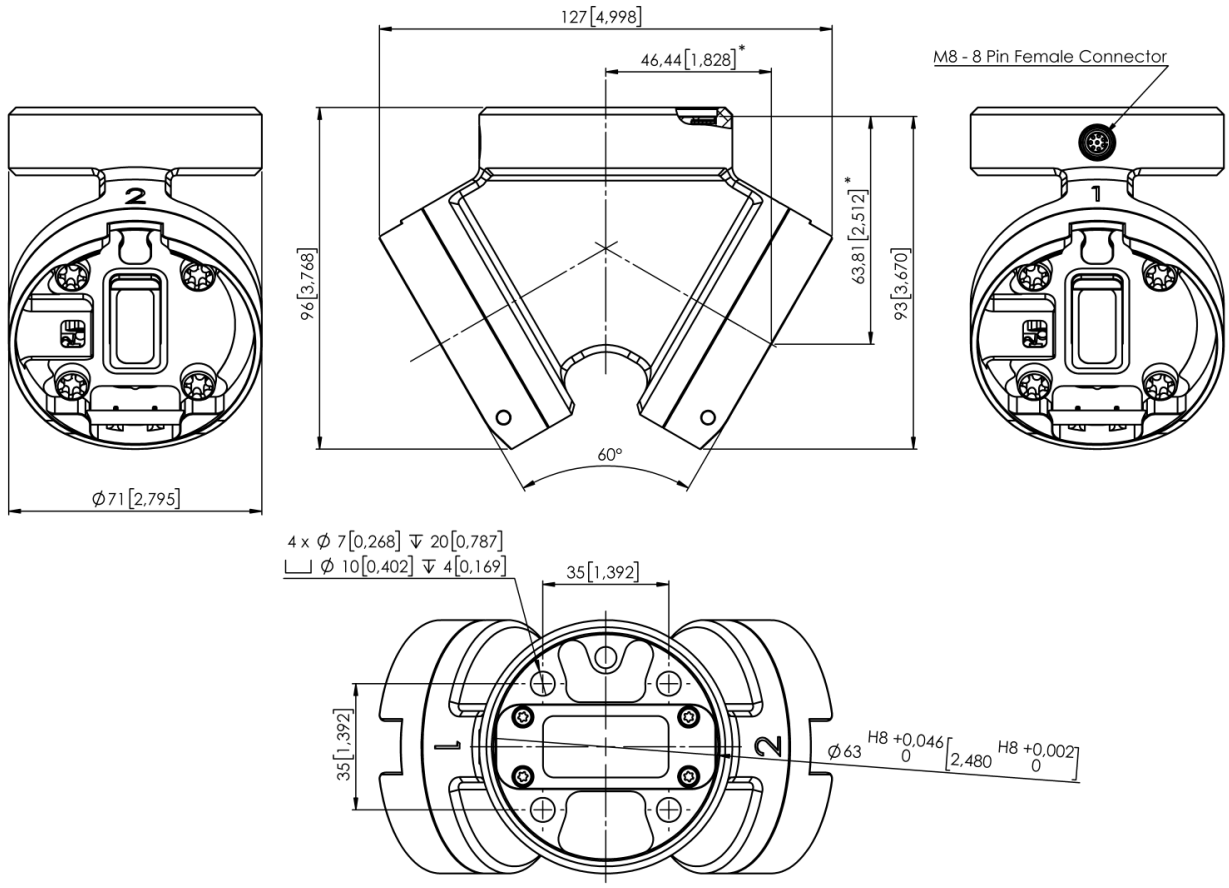
Quick Changer for I/O - Robot side



* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

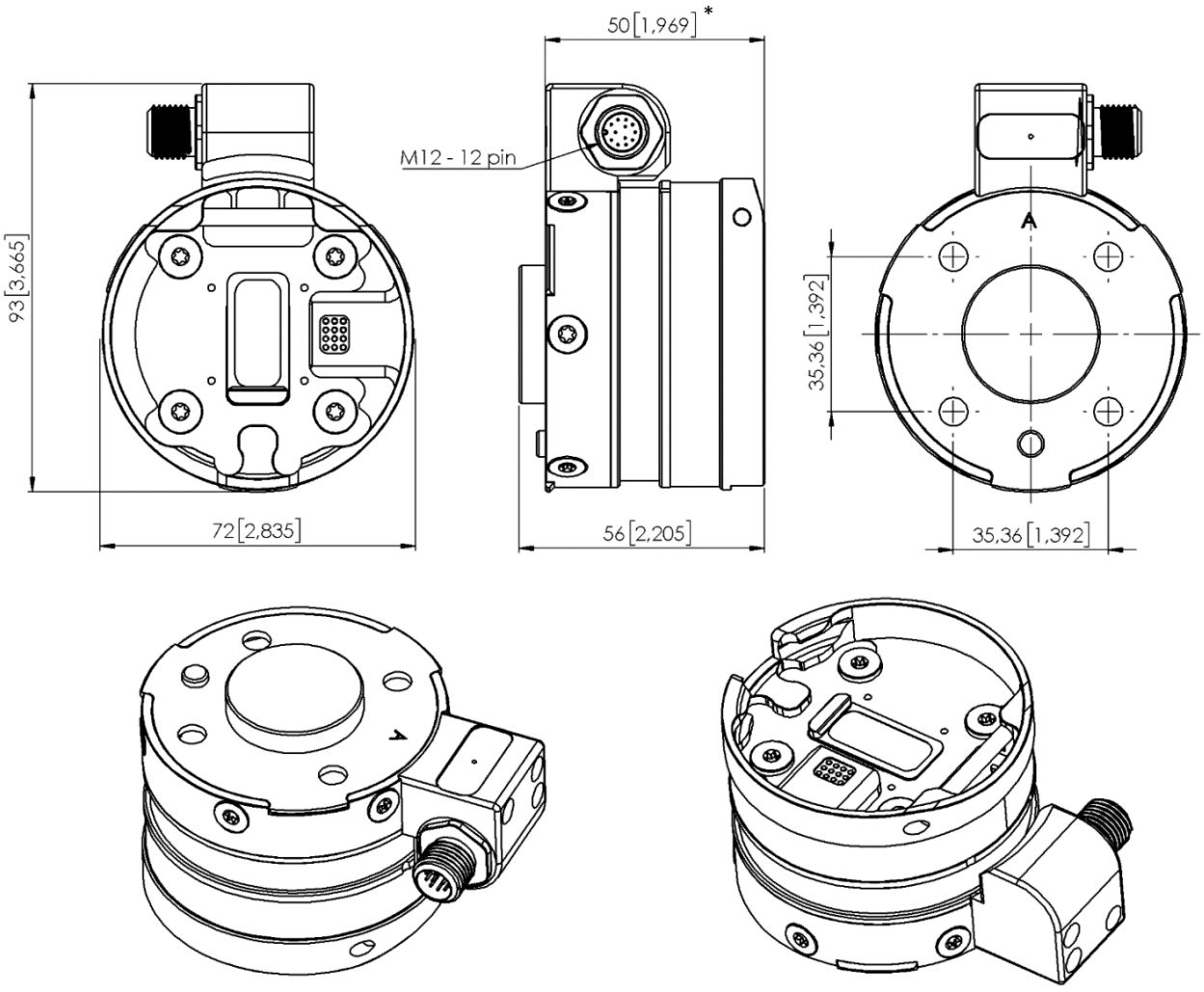
Dual Quick Changer



* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

HEX-E QC



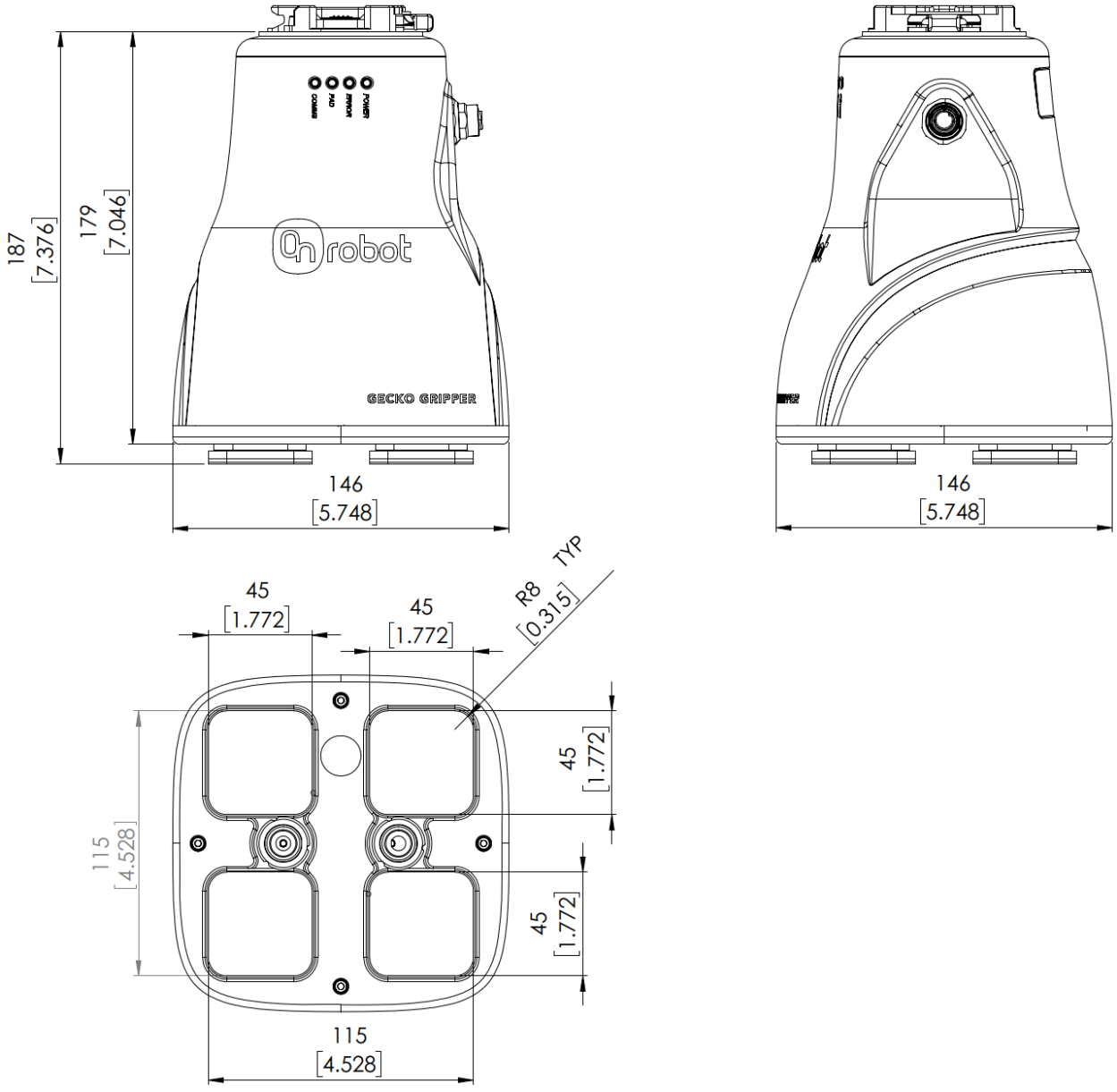
* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

7.2.3 Tools

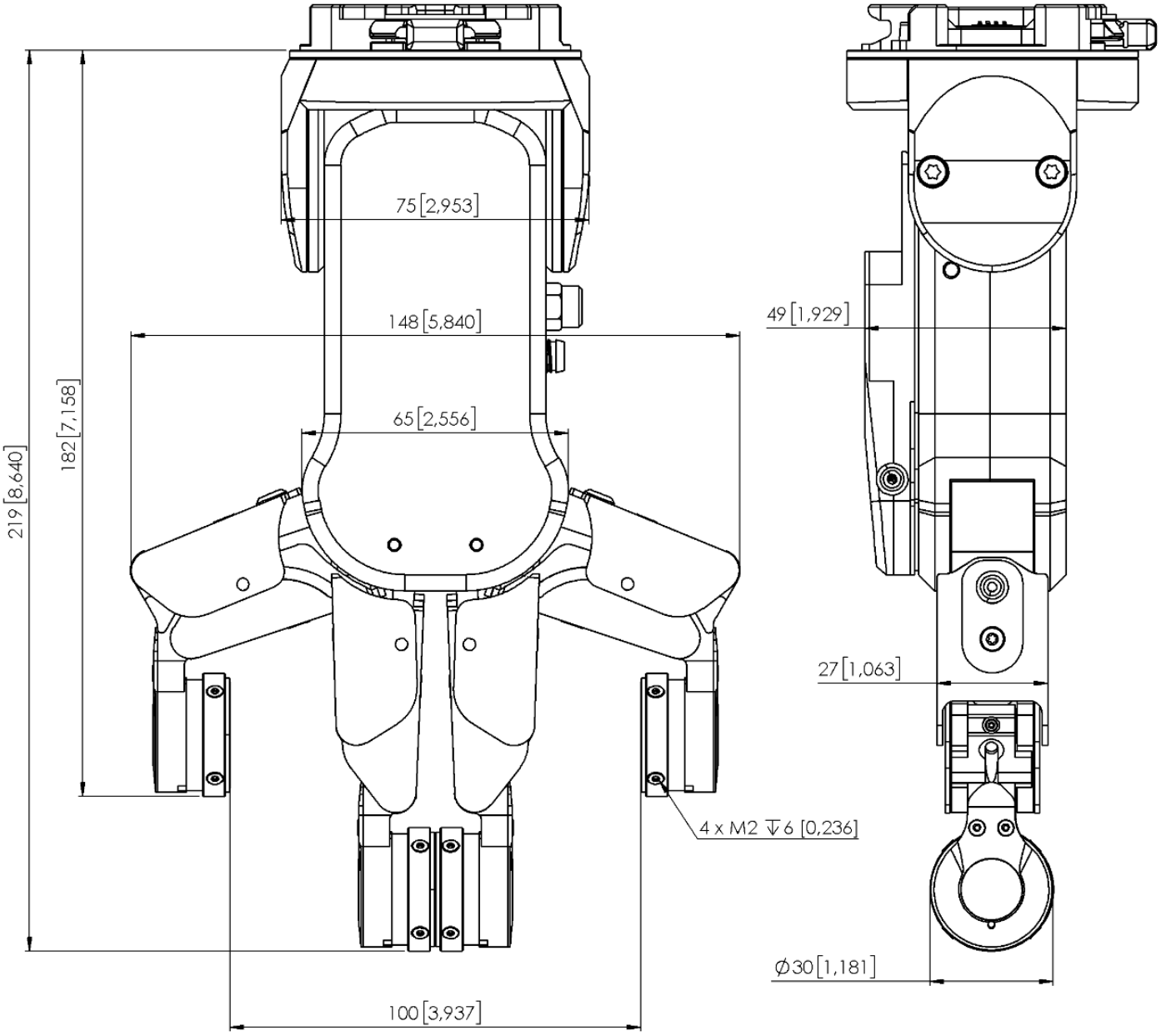
- Gecko 165
- RG2-FT 166
- RG2 167
- RG6 168
- VG10 169
- Quick Changer - Tool side 171

Gecko



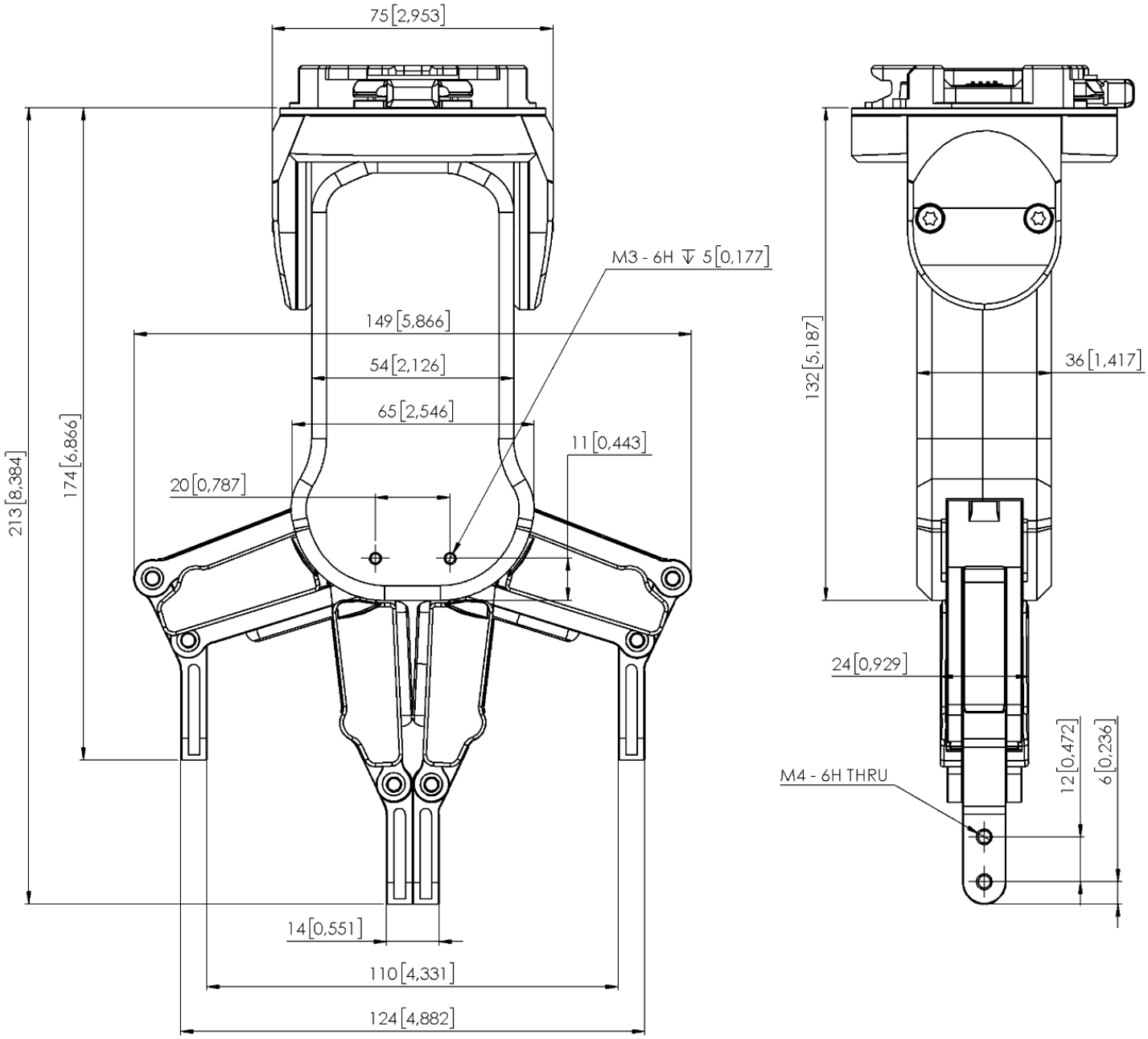
All dimensions are in mm and [inches].

RG2-FT



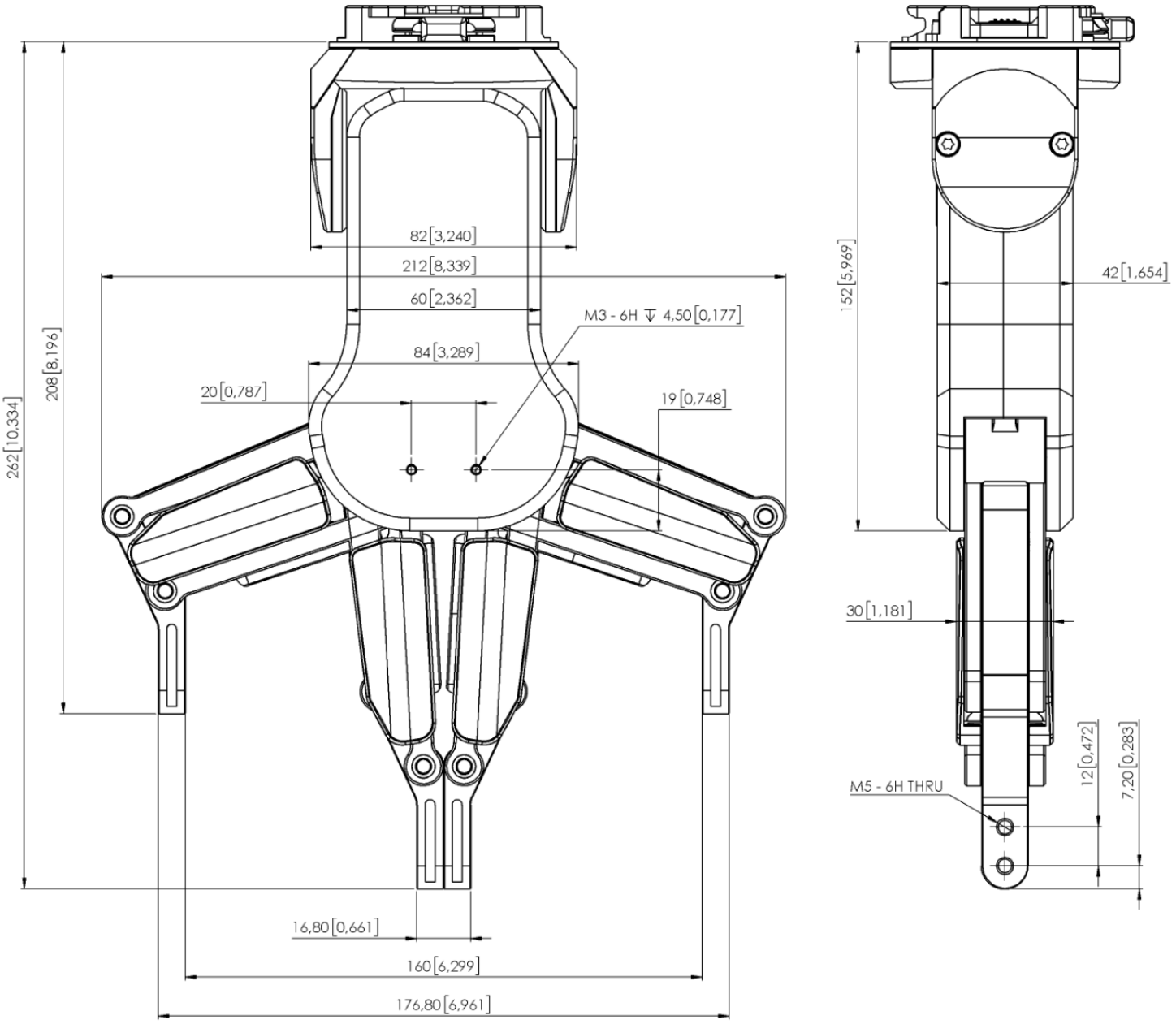
All dimensions are in mm and [inches].

RG2



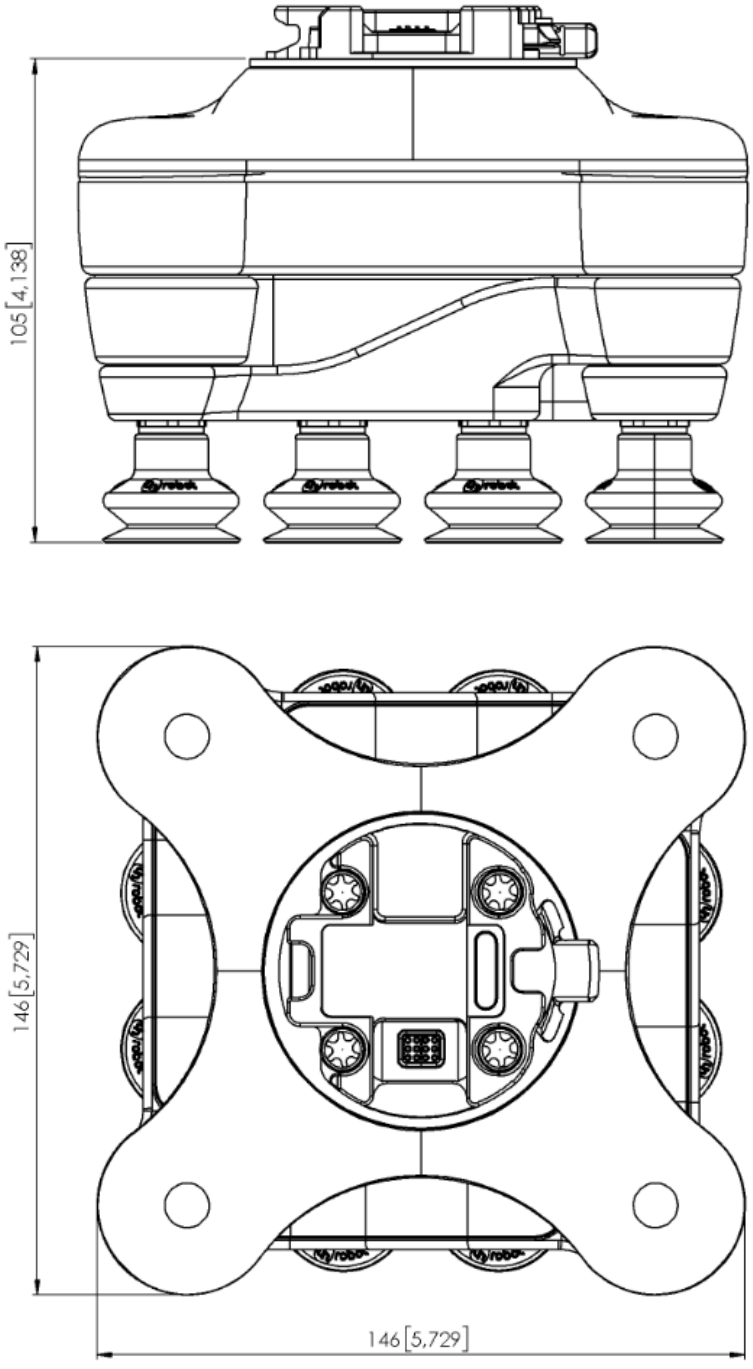
All dimensions are in mm and [inches].

RG6

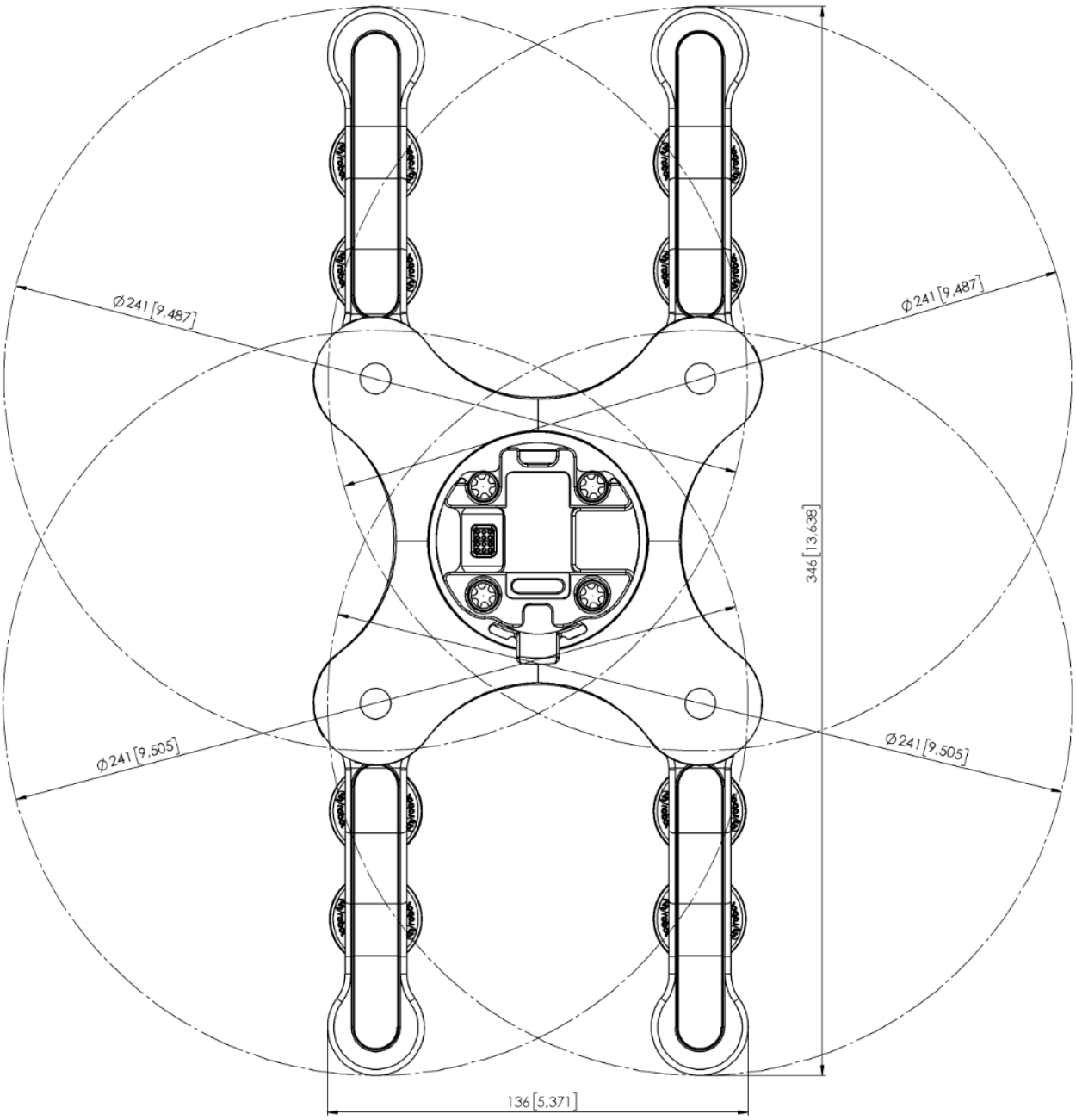


All dimensions are in mm and [inches].

VG10

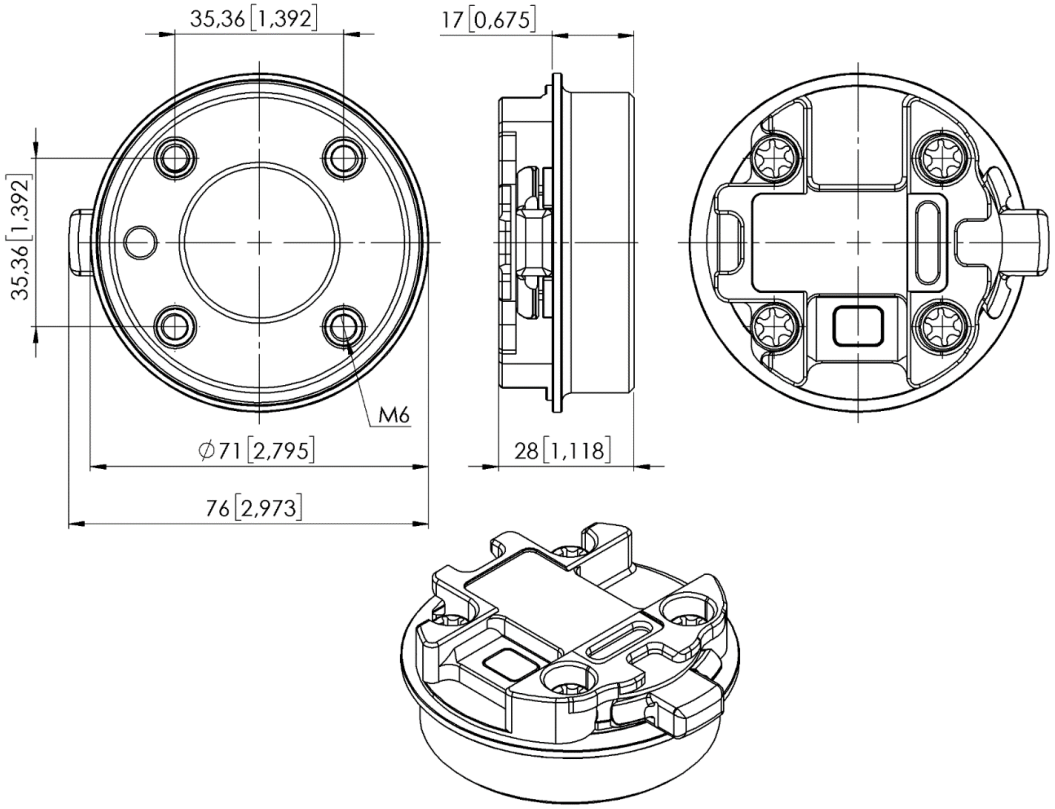


All dimensions are in mm and [inches].



All dimensions are in mm and [inches].

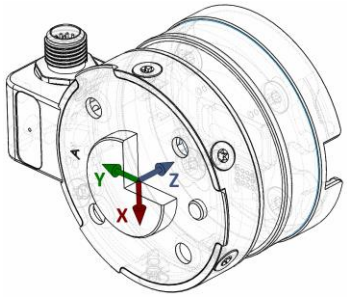
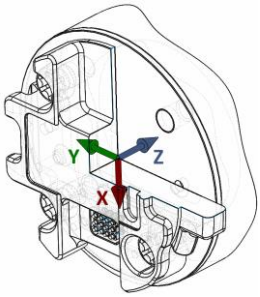
Quick Changer - Tool side



All dimensions are in mm and [inches].

7.3 Center of Gravity

COG, TCP, and weight parameters of the single devices (without any mounting/adapter):

Devices	Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
HEX-E/H QC		X=0 Y=0 Z=50	cX=0 cY=5 cZ=20	0.35 kg 0.77 lb
Gecko Gripper		X=0 Y=0 Z=187	cX=0 cY=0 cZ=113	2.83 kg 6.10 lb
RG2-FT*		X=0 Y=0 Z=205	cX=0 cY=0 cZ=65	0.98 kg 2.16 lb
RG2*		X=0 Y=0 Z=200	cX=0 cY=0 cZ=64	0.78 kg 1.72 lb
RG6*		X=0 Y=0 Z=250	cX=0 cY=0 cZ=90	1.25 kg 2.76 lb
VG10**		X=0 Y=0 Z=105	cX=15 cY=0 cZ=54	1.62 kg 3.57 lb

* Mounted at 0˚

** With arms folded back

8 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.

Gecko 173
RG2/6 175
RG2-FT 175
VG10 175

Gecko

Gecko Gripper pads are made from a precision cast silicone or polyurethane film with a gecko microstructure. Contact with sharp objects may damage the pad surface and impair function. The Gecko Gripper performance is maximized when the pads are clean and dry. The pads can collect dust, so it is best to use the Gecko Gripper in a clean environment and/or establish a routine cleaning schedule.

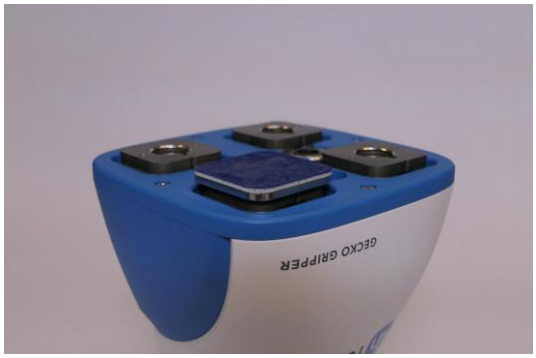
Part	Description of Maintenance	Frequency
Pad Cleaning	Routine cleaning: Cleaning Station	Dependent on operating conditions. Guidelines are: See Cleaning Station User Guide
Pad Wear	Replacement due to wear	150000 – 200000 for HIGH preload operation 200000 – 250000 for LOW preload operation

Replacing the Gripper Pads

Gecko Gripper pads are designed to last for 200,000-300,000 cycles under typical operating conditions. If the pads do not seem to be gripping properly, even with routine cleaning (see table in the previous page), we recommend fully replacing the gripper pads.

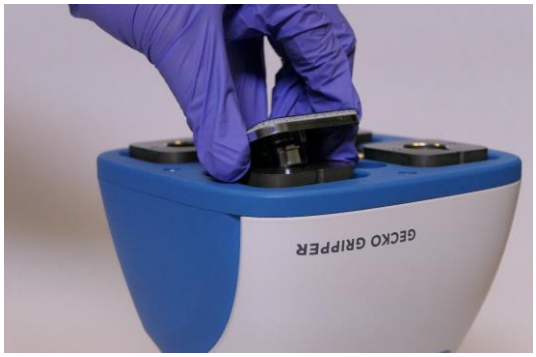
To replace the gripper pads, use the provided pad removal tool.

Step 1: Move gripper pads to the maximum extruded setting such that the pads are maximally exposed/visible.



Step 2: Insert the edge of the pad removal tool between the shiny silver plate of the pads and the dull backing plate. Leverage the pad removal tool against the gripper housing to pry off the used pad. Repeat for all pads.

Step 3: To install new replacement pads, align the notch of the pad with the tab in the mounting hole. Push the pad into the gripper until there are no gaps between the shiny silver pad plate and backing plate.



RG2/6

WARNING:

An overall inspection of the PLd CAT3 Safety Buttons must be performed regularly and at least once every 6 months.

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.

VG10

The VG10 is 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 VG10 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 VG10 performance.

A filter service kit is available, which include both new filters and tools needed.

- Filter service kit, PN 100064

Neither use nor power on the VG10 without filters. Dust, hair and larger particles can get stuck in pump membranes and valve seats, causing permanent damage to the VG10.

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 VG10 must be performed regularly and at least once every 6 months.

Never power the VG10 without filters or with filters mounted incorrectly. Failure to comply with this precaution can cause irreversible failure of pump or valves.

9 Warranties

9.1 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.

9.2 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.

9.3 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.

10 Certifications

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