USER MANUAL

FOR **KUKA** ROBOTS

ORIGINAL INSTRUCTION (EN)

v1.1.2

Contents

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
3FG15	v1
Gecko Gripper	v2
RG2	v2
RG2-FT	v2
RG6	v2
SG	v1
VG10	v2
VGC10	v1

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

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

NOTE:

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

The manual covers the following Compute Box software version:

Software	Version
Compute Box	v5.1.2

NOTE:

In case when the used Compute Box has lower software version, please update the Compute Box. For detailed instructions refer to WebClient description at the end of this Manual.

NOTE:

The EtherNet/IP functions used with the v5.0.x are not compatible with the ones required for the v5.1.x. Please remove the older functions before using the newer ones.

1.3   Naming convention

In the user manual Gecko Gripper is called Gecko only.

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

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:

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, user can detect this condition with the help of the provided status information and execute any necessary step on the robot.

To come back to normal operation with the gripper there are provided commands to reset the gripper.

⚠️ **CAUTION:**

Before resetting the gripper 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.

For further details refer to the Operation section.

3   Operation mode(s)

The sensor and the grippers have different ways how could be operated. The sensor has three and the grippers have two alternative ways how could be integrated to the robot, and the user can select which one to be used (based on the availability of the required package/interface).

The following table shows the available ways of integration:

Devices	Modes of Operation				
HEX-E/H QC	**OnRobot EtherNet/IP** *required in the robot: EtherNet/IP KUKA package*	or	**OnRobot WebLogic™** *required in the robot: digital I/O KUKA interface*	or	**OnRobot F/T software (Ethernet)** *required in the robot: RSI (Robot Sensor Interface) KUKA package*
3FG15					**EtherNet/IP** or **WebLogic™** (see on the left)
Gecko					
RG2/6					
RG2-FT					
VG10 / VGC10					

> **NOTE:**
>
> If HEX-E/H QC and a gripper is used together, then two ways of operation could be necessary to be installed.

OnRobot EtherNet/IP

This mode uses the EtherNet/IP industrial network protocol to operate the grippers/sensor.

EtherNet/IP is a fieldbus that uses the standard Ethernet networking (simple UTP cable, standard network switch can be used, etc.).

The Compute Box implements an EtherNet/IP Adapter (slave device) and requires the robot controller to implement an EtherNet/IP Scanner (master device) to operate.

With configurable cycle time (e.g.: 4ms) the robot can "read" and "write" to the Computer Box and therefore control or monitor the grippers/sensor.

There are functions provided (on the USB stick) to make it easy to access the product features.

OnRobot WebLogic™

This mode allows simple Digital I/O communication to be used to operate the grippers/sensor.

For example, the Compute Box could be easily programmed to:

- when one of the robot digital outputs is set to HIGH, then the RG2 gripper opens to 77mm
- or when the force values measured with the HEX-E QC reach 50N, the Compute Box sends a HIGH digital output to the robot.

The Compute Box has 8 digital inputs and 8 digital outputs that can be freely configured for any "logic".

In this way the user can configure:

Operation mode(s)

- eight gripper/sensor controlling functionality (e.g.: set width to X, close, zero, set preload, etc.)
- and eight gripper/sensor monitoring functionality (e.g.: is grip detected, is preload > 50N, etc.).

Furthermore, the "logic" can be complex, like:

- is grip detected AND force >20 N

These "logics" can be programmed through the Compute Box's web interface called Web Client. It requires only a normal computer with a browser.

OnRobot F/T Software

This mode works only with the HEX-E/H QC. In this mode these features are available:

- Force/Torque control
- Guide the robot by moving the tool by hand (Hand Guide)
- Teach robot trajectory by Hand Guide and replay the recorded path

In this document all three modes of operation will be covered and will be referred to as:

- OnRobot F/T software
- OnRobot EtherNet/IP
- OnRobot WebLogic™

Mode I - OnRobot EtherNet/IP

4 Installation

4.1 Overview

For a successful installation the following steps will be required:

- Mount the components
- Setup the software

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

4.2 Mounting

Required steps:

- Mount the robot dependent adapter
- Mount the Quick Changer option
- Mount the tool(s)

In the following three subsections these three mounting steps will be described.
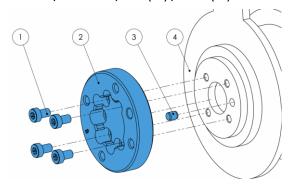
4.2.1 Adapter(s)

For KR 3 Agilus,

KR 6 R1820 / 1820 HP / 700(-2) / 900(-2),

KR 8 R1620 / 1620 HP,

KR 10 R1420 / 1420 HP / 900(-2) / 1100(-2) models

Adapter B (4 screws)

1   M5x8 screws (ISO14580 A4-70)

2   OnRobot adapter flange (ISO 9409-1-50-4-M6)

3   Dowel pin Ø5x6 (ISO2338 h8)

4   Robot tool flange (ISO 9409-1-31.5-4-M5)

Use 5 Nm tightening torque.

For KR 8 R2010 and KR 12 R1810 models
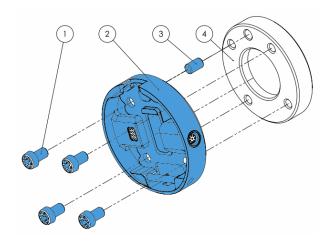
No adapter plate is required.

4.2.2 Quick Changer options

Quick Changer - Robot Side

Quick Changer - Robot Side

1   M6x8mm (ISO14580 8.8)

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

3   Dowel pin Ø6x10 (ISO2338 h8)

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

Use 10 Nm tightening torque.

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
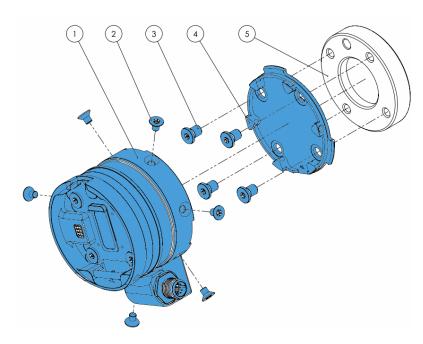
Use 10 Nm tightening torque. for M6x8mm

4.2.3 Tools

3FG15

Step 1:

Move the tool close to the Quick Changer as illustrated.

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

Step 2:

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

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

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.

SG

Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.
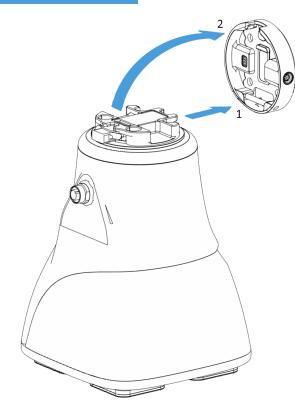
Step 2:

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

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

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.
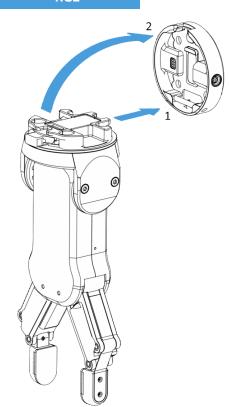
VGC10

Step 1:

Move the tool close to the Quick Changer as illustrated.

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

Step 2:

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

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

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.
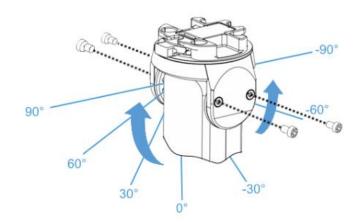
Step 2:

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

Three cables need to be connected to wire the system properly:
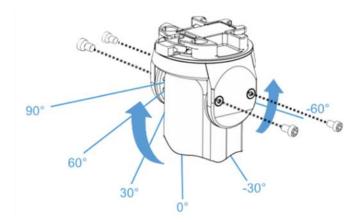
- Tool data cable between the tool(s) and the Compute Box
- Ethernet communication cable between the robot controller and the Compute Box
- Power supply of the Compute Box

> **NOTE:**
>
> For the Quick Changer - Robot Side no cable is needed to be connected.

4.3.1 Tool data cable

First connect the data cable to the tool.

For Single or Dual 3FG15, RG2, RG6, SG, VG10, VGC10 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 as shown below:

Use the X66 (KLI) 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).

4.4 Software setup

4.4.1 Overview

The following steps are required to set up the OnRobot devices for operation with your KUKA robot:

- Set the IP address of the Compute Box.
- Set the IP address of the robot (KLI).
- Install the KUKA EtherNet/IP package to the robot.
- Setup the Compute Box to be a Scanner.
- Setup the EtherNet/IP of the robot (as an Adapter).
- Run the OnRobot installer to upload the required files.

Listed below are the supplementary software accessory that is required for the setup:

Software Component	Item Number
KUKA EtherNet/IP package	Call your KUKA representative.

NOTE:

Please call your local KUKA representative for pricing and purchase options.

NOTE:

The terms *Scanner, Master,* and *Client* can be used interchangeably. Here, we will use the term **Scanner**. (E.g. The OnRobot Compute Box is a scanner.)

The terms *Adapter, Slave,* and *Server* can be used interchangeably. Here, we will use the term **Adapter**. (E.g. The robot is an adapter.)

4.4.2 Compute Box IP setup

A proper IP address must be set for the Compute Box and the robot/computer to be able to use the Ethernet interface. There are three ways how it could be configured (using the DIP switch 3 and 4):

- **Auto mode** (factory default)

  This is the easiest way of getting the IP addresses to be configured for both the Compute Box and the robot/computer. It is recommended to start with this mode, so this is the factory default setting.

- **Fixed IP mode** (192.168.1.1)

  If the **Auto mode** does not work, use this mode to have a fixed IP for the Compute Box. This requires a manual IP address configuration for the robot/computer. (This mode could also be used to reset the IP address to a known value if the Compute Box become unreachable in **Advanced mode**.)

- **Advanced mode** (any static IP/subnet mask)

  If the Fixed IP address (192.168.1.1) is already in use in your network or a different subnet needs to be configured, in this mode the IP address and subnet mask can be changed to any value. This also requires a manual IP address configuration for the robot/computer.

NOTE:

To change between modes, first change the DIP switches and then the Compute Box power needs to be cycled for the changes to take effect.

Auto mode

Use the factory default settings (DIP switch 3 and 4 in OFF position).

In this case, the Compute Box has both Dynamic Host Configuration Protocol (DHCP) client, and DHCP server enabled.

DHCP Client enabled means, Compute Box will automatically obtain ("get") IP address FROM the connected robot/computer if that is capable of assigning ("give") IP to the Compute Box.

DHCP Server enabled means, Compute Box will automatically assign ("give") IP address TO the connected robot/computer if that was configured to obtain ("get") IP address automatically.

NOTE:

The assigned IP range is 192.168.1.100-105 (with subnet mask 255.255.255.0).

If the Compute Box is used in a company network where a DHCP server is already in use, it is recommended to disable the DHCP server of the Compute Box by setting DIP switch 4 to the ON position.

If no IP was assigned to the Compute Box within a minute, it will automatically get a fallback IP address (192.168.1.1).

NOTE:

If the Compute Box was in **Advanced mode**, first reset the IP setting by switching to **Fixed IP mode** and then switch back to **Auto mode**.

Fixed IP mode

Set the DIP switch 3 and 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box is set to 192.168.1.1 (subnet mask is 255.255.255). Both the DHCP Client and Server options are disabled.

Make sure to set the robot/computer IP address manually. To have a proper communication the robot/computer IP address must be in the range of 192.168.1.2 - 192.168.1.254.

Example robot/computer setting:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Other settings like Gateway, DNS Server, etc. could be kept empty or set to 0.0.0.0.

Advanced mode

Set the DIP switch 3 in OFF and DIP switch 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box could be set to any value by using the Web Client. For more details see section Configuration menu.

In this mode, the DHCP server option is disabled.

Make sure to have a matching IP setting to your robot/computer network for a proper communication.

NOTE:

If the Compute Box become unreachable (due to improper or forgotten IP settings), switch to **Fixed IP mode** to reset the IP setting.

It is recommended to use Fixed IP mode for OnRobot EtherNet/IP.

In the following, it is assumed that the Compute Box IP is left at the default 192.168.1.1. If other IP address is selected, remember to always enter the chosen one whenever required to be entered.
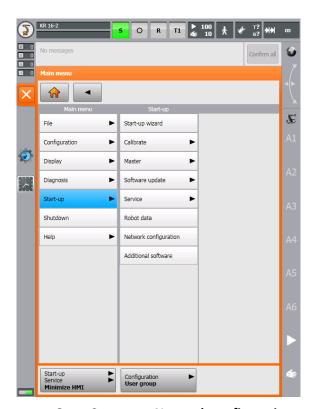
4.4.3 KUKA Line Interface (KLI) IP setup

To change the IP settings of the KUKA robot controller, follow this process:

1. Go to **Configuration** > **User group**

2. Select **Expert** and type in your password

3. Go to **Start-up** > **Network configuration**
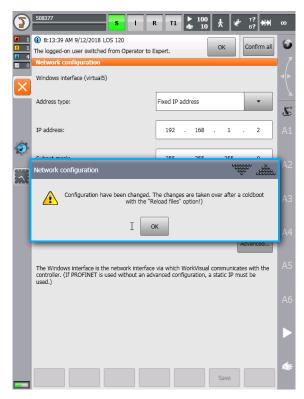
4. Set the IP address to be on the same subnet as the Compute Box (e.g.: 192.168.1.2). Then click on Save button.

5. Accept the prompts and restart the robot controller

4.4.4 KUKA EtherNet/IP package installation
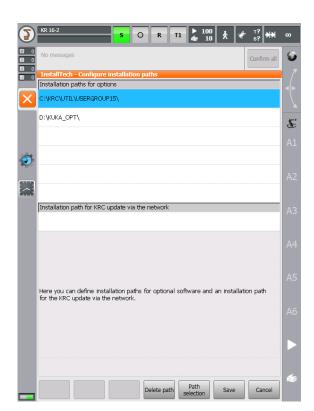
The OnRobot EtherNet/IP require KUKA EtherNet/IP package to be installed.

To install these KUKA packages do the following steps:
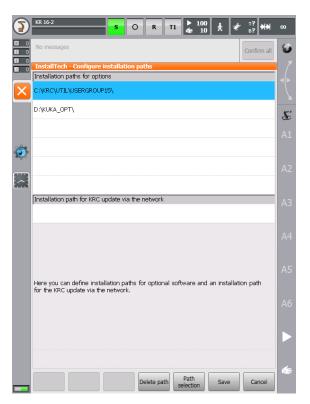
1. Go to **Start-up** > **Additional software**, click on **New software**

2. If no packages are listed, click on **Configure**.

3. Click on an empty slot and click **Path selection**

4. Browse for the installation folder of package to be installed, then click **Save** twice.

5. Check the check box next to the package name to be installed

6. Wait for the installation, accept all prompts.

7. Click **Yes** when asked to reboot the robot controller

For further info please refer to the KUKA user manual.

8. After the reboot go to **Start-up** > **Service** > **Minimize HMI**.
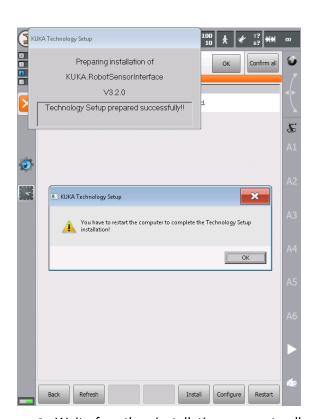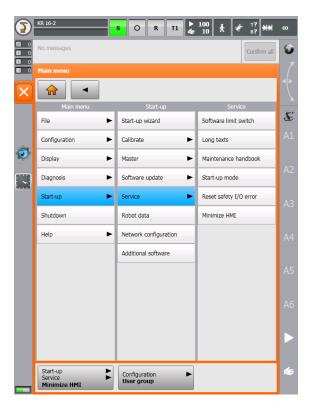
4.4.5 Setup the Compute Box as Scanner

NOTE:
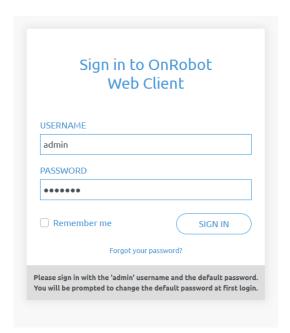
Temporarily the Compute Box will be needed to be connected to your computer.

To configure the Compute Box to be a Scanner you will need to access the Web Client interface of the Compute Box on your computer. To do that 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 the Auto Mode (factory default) for IP settings of the Compute Box. For further details on the available IP settings modes see **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
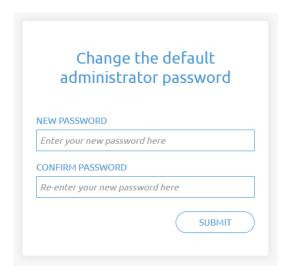
For the first login a new password needs to be entered: (password must be at least 8 characters long)

Once logged in, click on the **Configuration** menu.

Enable the **EtherNet/IP scanner settings** checkbox and set the values as shown above:

- **IP address to connect to**: *Robot IP address (if default values are used enter 192.168.1.2)*
- **Origin-to-target instance id**: 150

- **Target-to-origin instance id**: 100
- **Configuration instance id**: 102
- **Requested packet interval (ms)**: 8

Finally, click the **Save** button to store the new settings.

NOTE:

Now unplug the UTP cable from your computer and plug it back to the robot.

4.4.6 Setup the EtherNet/IP of the robot

Summary of the steps:

- Download the current configuration from the robot in WorkVisual
- Add new EtherNet/IP scanner node
- Configure the EtherNet/IP node
- Map the EtherNet/IP inputs and outputs to the robot's $IN and $OUT signals
- Deploy the changes to the robot
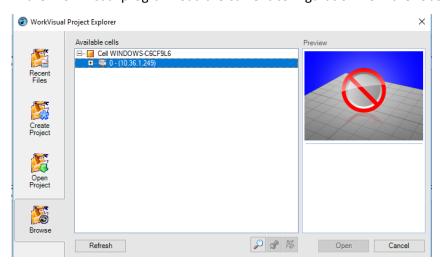
> **NOTE:**
>
> This guide assumes that, the EtherNet/IP option has already been installed to the robot.

Download the current configuration from the robot in WorkVisual
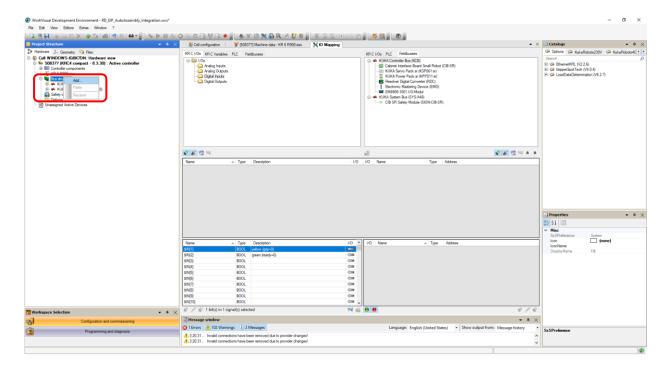
In the WorkVisual program load the current configuration from the robot:
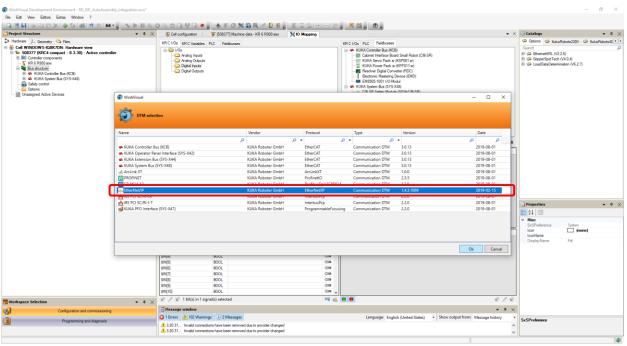
Add new EtherNet/IP scanner node

- In WorkVisual, open the **Project Structure** window.
- In the **Hardware** tab, double click the robot controller to activate it.
- Expand the robot controller's tree structure.
- In the tree structure right click on **Bus structure** and select **Add…**

- In the pop-up window select **Ethernet/IP** and click **OK**.
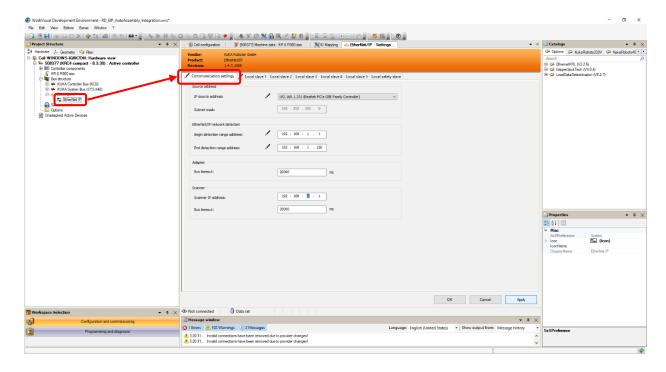
Configure the EtherNet/IP node

- In the tree structure right click on **EtherNet/IP** and select **Settings**.
- Select the **Communication setting**s tab.
- Select on which IP address the PC connects to the robot.
- Fill in the Ethernet/IP section with the data of the own network.
- The Adapter and the Scanner Bus timeout can be on default setting.
- Enter the IP address of the Computer Box in the **Scanner** section (default is 192.168.1.1).
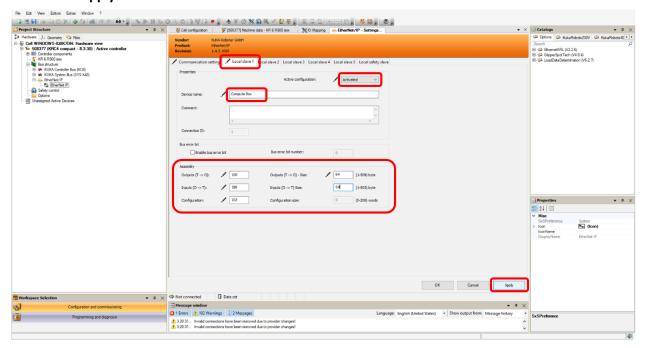
- On the **Local slave** tab choose **Activate** in the drop-down menu
- Enter a name for the device
- In the **Assembly** section enter the data you did earlier at the Computer Box scanner configuration

NOTE:

Make sure the Target-to-Origin (T -> O) and the Origin-to-Target (O -> T) values are not swapped.
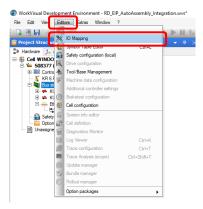
- Click **Apply**

Map the EtherNet/IP inputs and outputs to the robot's $IN and $OUT signals

- In the **Editors** menu choose IO mapping.
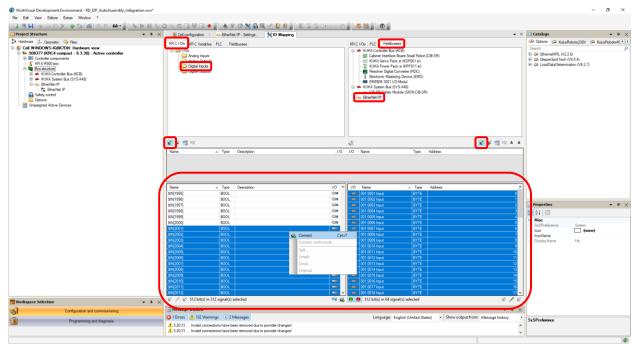
- In the **KRC I/Os** tab choose **Digital inputs**
- In the **Fieldbuses** tab choose **EtherNet/IP**
- With the two green filter button you can narrow down the lists to the inputs only
- On the right side select the input signals 0 to 63
- On the left side select from any free signal (recommended 2001) a range of 512 signals

NOTE:
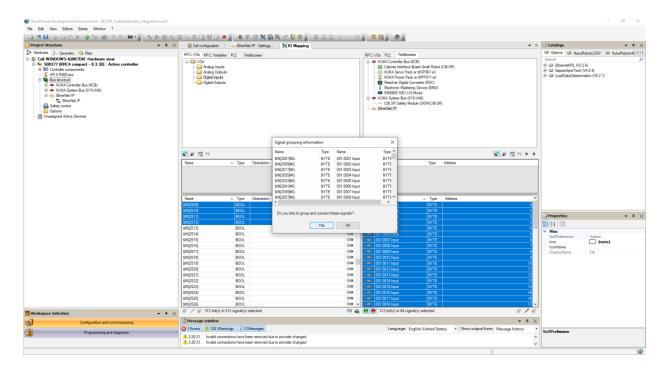
If the starting signal is not 2001 please note the starting number, it will be required later during the installation.

- Right click on one of the selected elements on the left side and choose **Connect**

- In the **Signal Grouping Information** window click **Yes**
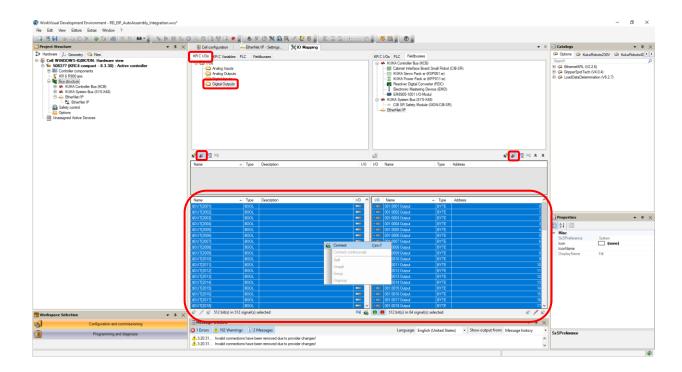
- In the **KRC I/Os** tab choose **Digital outputs**.

- With the two red filter buttons narrow down the list to the outputs only.

- On the right side select everything, from 0 to 63.

- On the left side select from any free signal (recommended 2001) a range of 512 signals

NOTE:
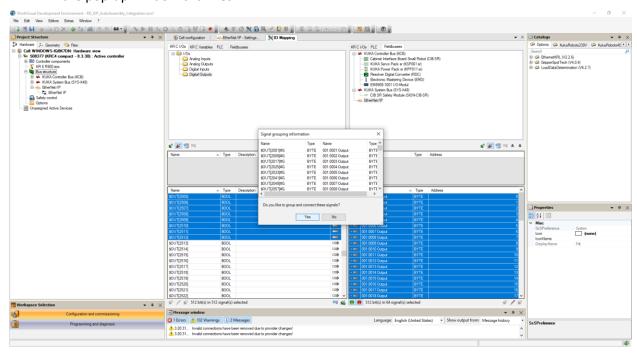
If the starting signal is not 2001 please note the starting number, it will be required later during the installation.

- On the left side right click on one selected element and choose **Connect**.

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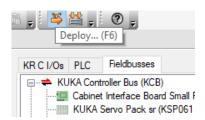
- In the pop-up window click **Yes**

Deploy the changes to the robot

Click on **Deploy…** button:

4.4.7 Run the OnRobot installer to upload the required files

Go to **Main Menu**>**Configuration**>**User group** and select **Expert** mode. Enter your password, then go to **Start-up**>**Service**>**Minimize HMI**.

Plug the provided USB-drive into one of the USB ports on the control box.

Browse for the OnRobot KUKA Setup program and launch it. This program has multiple purposes: You can use it for the initial installation of the OnRobot KUKA package, but also as a network configuration tool.
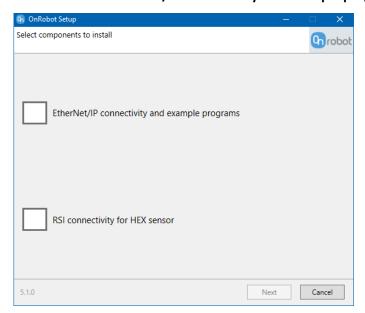
On the welcome screen click **Next**.
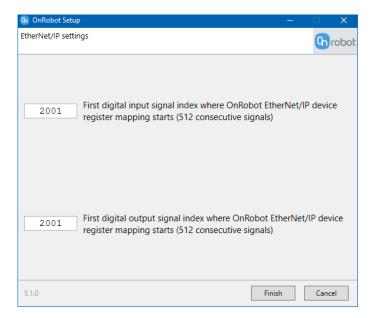
Then check the **EtherNet/IP connectivity and example programs** and click **Next**.

On the next window you must enter the chosen starting signals (Input and Output), that you have set during the IO mapping.

After filling in the fields click on **Finish** to complete the installation/configuration. If the installation has been successful, the following window will pop-up:
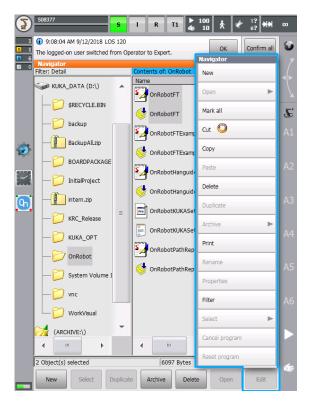
NOTE:
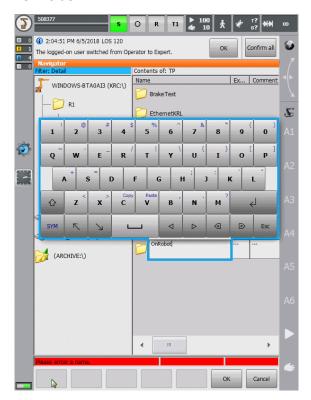
Installation failure can happen if there's write protection on the robot controller's hard drive.

To complete the setup, go back to the Smart HMI and in the Navigator go to `D:\OnRobot`. Select all `OnRobot_xxxx.src` and `OnRobot_xxxx.dat`, then in the **Edit** menu press **Copy**.

Go to `KRC:\R1\TP` and create a folder with the following name: OnRobot. Paste the two files into the new folder.
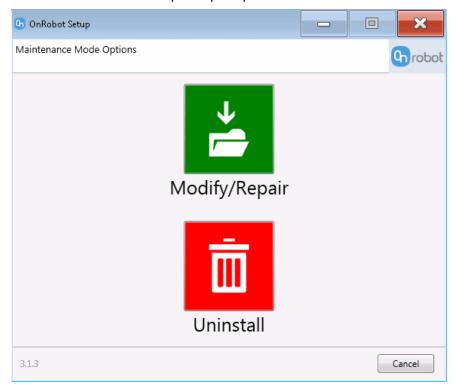
Restart the robot controller.

4.4.8 Uninstallation

The following steps will uninstall the OnRobot F/T Software from your robot controller:

- Enter **Expert** mode by going to the Main Menu then **Configuration**>**User group**.

- Minimize the user interface with **Start-up**>**Service**>**Minimize HMI**.

- Open the file explorer and go to `D:\OnRobot`.

- Launch the OnRobot Setup executable file.

- Click on **Uninstall** and accept the prompts.

- Restart the robot controller.

5   Operation

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

5.1 Overview

In order to make it easier to use the OnRobot products, high level functions have been written into the `OR_xxxxx.SRC` and `.DAT` files. Some mandatory parameters, which shall be configured, are stored in the first program (`OR_EIP_INIT()`). The functions (programs) are uploaded to the robot during the installation.

These high-level functions can be used by calling these functions in your program:

```
OR_RGX_MOVE(instance, width, force, wait);
```

When a function reads information, it returns the desired values.

```
DECL REAL CURRENTWITDH

…

CURRENTWITDH = OR_RGX_GETWIDTH(#PRI)
```

All user programs must start with calling the `OR_EIP_INIT` function. It is used to set up which tools are mounted on the robot, in which configuration:

```
OR_EIP_INIT()
```

5.2 List of functions

Function	OR_EIP_INIT ()		
	Name	Type	Description
Input	-	-	-
Output	-	-	-
Behavior	Function to initialize the communication for the current tool used. Make sure that this function is called before using any other function.		
Example	`OR_EIP_INIT()`		

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Function	OR_TFG_ISCONN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: TFG is absent TRUE: TFG is present
Behavior	Returns connection state of TFG		
Example	`DECL BOOL tfg_connection_state` `tfg_connection_state  = OR_TFG_ISCONN(#PRI)`		

Function	OR_TFG_ISBUSY (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: device is idle TRUE: device is busy
Behavior	Returns busy state		
Example	`DECL BOOL busy_state` `busy_state  = OR_TFG_ISBUSY(#PRI)`		

Function	OR_TFG_ISGRIP (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: No grip detected TRUE: Grip detected
Behavior	Returns grip state		
Example	`DECL BOOL tfg_grip_detected` `tfg_grip_detected  = OR_TFG_ISGRIP(#PRI)`		

Function	OR_TFG_ISFORCEGRIP (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: No force grip detected TRUE: Force grip detected when the force reached the desired level after a GRIP command
Behavior	Returns force grip state		
Example	`DECL BOOL tfg_forcegrip_detected` `tfg_forcegrip_detected = OR_TFG_ISFORCEGRIP(#PRI)`		

Function	OR_TFG_CALIBRATIONVALID (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: Calibration is not valid TRUE: Calibration is valid
Behavior	Returns calibration state		
Example	`DECL BOOL tfg_calibration_state` `tfg_calibration_state = OR_TFG_CALIBRATIONVALID(#PRI)`		

Function	OR_TFG_HASERROR (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: the device state has no error TRUE: the device state has any error
Behavior	Returns error state		
Example	`DECL BOOL tfg_haserror` `tfg_haserror = OR_TFG_HASERROR(#PRI)`		

Function	OR_TFG_HAS_SAFETYDCERROR (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: the device state has no safety DC error TRUE: the device state has safety DC error
Behavior	Returns safety DC error state		
Example	`DECL BOOL tfg_safety_error` `tfg_safety_error = OR_TFG_HAS_SAFETYDCERROR(#PRI)`		

Function	OR_TFG_HAS_GENERALERROR (instance)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: the device state has no general error TRUE: the device state has general error
Behavior	Returns general error state		
Example	DECL BOOL tfg_general_error tfg_general_error = OR_TFG_HAS_GENERALERROR(#PRI)		

Function	OR_TFG_GET_DIAMETER_RAW (instance)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current raw diameter in mm, decimal precision: 1
Behavior	Returns current raw diameter (diameter without fingertip offset)		
Example	DECL REAL tfg_diameter_raw tfg_diameter_raw = OR_TFG_GET_DIAMETER_RAW(#PRI)		

Function	OR_TFG_GET_DIAMETER_FT (instance)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current diameter in mm, decimal precision: 1
Behavior	Returns current diameter (diameter with fingertip offset)		
Example	DECL REAL tfg_diameter tfg_diameter = OR_TFG_GET_DIAMETER_FT(#PRI)		

Function	OR_TFG_GET_FORCE (instance)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Integer	Current force in Newtons
Behavior	Returns current force		
Example	DECL INT tfg_force tfg_force = OR_TFG_GET_FORCE(#PRI)		

Function	OR_TFG_GET_DIAMETER_MIN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Minimum diameter in mm, decimal precision: 1
Behavior	Returns the possible minimum diameter of the current setup		
Example	`DECL REAL tfg_diameter_min` `tfg_diameter_min  = OR_TFG_GET_DIAMETER_MIN(#PRI)`		

Function	OR_TFG_GET_DIAMETER_MAX (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Maximum diameter in mm, decimal precision: 1
Behavior	Returns the possible maximum diameter of the current setup		
Example	`DECL REAL tfg_diameter_max` `tfg_diameter_max  = OR_TFG_GET_DIAMETER_MAX(#PRI)`		

Function	OR_TFG_GET_LIMITS (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	TFGLIMITS (Struct of Real: MIN, MAX)	Minimum and Maximum diameter in mm, decimal precision: 1
Behavior	Returns the possible minimum and maximum diameter of the current setup		
Example	`DECL TFGLIMITS tfg_diameter_limits` `tfg_diameter_limits  = OR_TFG_GET_LIMITS(#PRI)`		

Function	OR_TFG_SET_FINGER_POS (instance,fingerPos)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`fingerPos`	Integer	Possible positions: 1, 2, 3
Output	-	-	-
Behavior	Sets the finger position		
Example	`OR_TFG_SET_FINGER_POS(#PRI)`		

Function	OR_TFG_SET_FINGER_LENGTH (instance,fingerLength)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`fingerLength`	Real	finger length in mm, decimal precision: 1
Output	-	-	-
Behavior	Sets the finger length		
Example	`OR_TFG_SET_FINGER_LENGTH(#PRI,49)`		

Function	OR_TFG_SET_FT_OFFSET (instance,ftOffset)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`ftOffset`	Integer	fingertip diameter in mm, decimal precision: 2
Output	-	-	-
Behavior	Sets the fingertip size		
Example	`OR_TFG_SET_FT_OFFSET(#PRI,13.5)`		

Function	OR_TFG_MOVE (instance,diameter,wait)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`diameter`	Real	Target raw diameter (without fingertips) in mm, decimal precision: 1 Diameter must be between the current minimum and maximum
	`wait`	Boolean	FALSE: return after command is executed (without waiting for execution to be complete) TRUE: return after fingers reached the position
Output	-	-	
Behavior	Moves the fingers to the desired position.		
Example	`OR_TFG_MOVE(#PRI,20,TRUE)`		

Function	OR_TFG_GRIP (instance,diameter,force,gripType,wait)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`diameter`	Real	Target diameter (corrected fingertips) in mm, decimal precision: 1 Diameter must be between the current minimum and maximum plus/minus fingertip offset
	`force`	Real	define the desired gripping force percentage, decimal precision: 1
	`gripType`	OR_TFG_GRIPTYPE_EN	#EXTERN: external grip #INTERN: internal grip
	`wait`	Boolean	FALSE: return after command is executed (without waiting for execution to be complete) TRUE: return after fingers reached the position
Output	-	-	-
Behavior	Moves the fingers to the desired position with the given force. If the movement ends without force grip detection, the program will stop.		
Example	`OR_RGX_MOVE(#PRI,100,40,TRUE)`		

Function	OR_TFG_STOP (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	-	-	-
Behavior	Stops the fingers motion in progress.		
Example	`OR TFG STOP(#PRI)`		

Gecko

Function	OR_GECKO_ISCONN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: Gecko is absent TRUE: Gecko is present
Behavior	Returns connection state		
Example	`DECL BOOL gecko_connection_state` `gecko_connection_state  = OR_GECKO_ISCONN(#PRI)`		

Function	OR_GECKO_ISPART (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: No workpiece is present TRUE: Workpiece detected
Behavior	Returns part detected state		
Example	`DECL BOOL gecko_part_detected` `gecko_part_detected  = OR_GECKO_ISPART(#PRI)`		

Function	OR_GECKO_GET_ULTRASONIC (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current ultrasonic distance in mm. decimal precision: 2. Valid values: 0-220.
Behavior	Returns ultrasonic distance		
Example	`DECL REAL gecko_part_distance` `gecko_part_distance  = OR_GECKO_GET_ULTRASONIC(#PRI)`		

Function	OR_GECKO_GET_FORCE (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current ultrasonic distance in Newtons, decimal precision: 2. Typical values: 0 or 45-150.
Behavior	Returns current force		
Example	`DECL REAL gecko_force` `gecko_force  = OR_GECKO_GET_FORCE(#PRI)`		

Function	OR_GECKO_GET_PADPOS (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	BOOL	FALSE: Pads are in TRUE: Pads are out
Behavior	Returns pad position		
Example	`DECL BOOL gecko_pad_position` `gecko_pad_position  = OR_GECKO_GET_PADPOS(#PRI)`		

Function	OR_GECKO_ISBUSY (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	BOOL	FALSE: device is idle TRUE: device is busy
Behavior	Returns busy state		
Example	`DECL BOOL gecko_busy_state` `gecko_busy_state  = OR_GECKO_ISBUSY(#PRI)`		

Function	OR_GECKO_ISPADWORN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	BOOL	FALSE: Pads are good TRUE: Pads are worn
Behavior	Returns pads worn state		
Example	`DECL BOOL gecko_pad_state` `gecko_pad_state  = OR_GECKO_ISPADWORN(#PRI)`		

Function	OR_GECKO_SETPRELOAD (instance,preloadIndex)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`preloadIndex`	Integer	Preload force threshold: 1: 50 N 2: 90 N 3: 120N
Output	-	-	-
Behavior	Set the preload force threshold to the preset values		
Example	OR_GECKO_SETPRELOAD(#PRI,1)		

Function	OR_GECKO_RESETERRORS (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	-	-	-
Behavior	Resets the errors		
Example	OR_GECKO_RESETERRORS(#PRI)		

Function	OR_GECKO_PADIN (instance,wait)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`wait`	Boolean	FALSE: program will continue while pad is moving TRUE: program wait until pads have stopped moving
Output	-	-	-
Behavior	Pull in Gecko pads		
Example	OR_GECKO_PADIN(#PRI,TRUE)		

Function	OR_GECKO_PADOUT (instance,wait)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`wait`	Boolean	FALSE: program will continue while pad is moving TRUE: program wait until pads have stopped moving
Output	-	-	-
Behavior	Push out Gecko pads		
Example	`OR_GECKO_PADOUT(#PRI,TRUE)`		

HEX-E/H QC

Function	OR_HEX_ISCONN ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Boolean	FALSE: HEX is absent TRUE: HEX is present
Behavior	Returns connection state		
Example	`DECL BOOL hex_connection_state` `hex_connection_state  = OR_HEX_ISCONN()`		

Function	OR_HEX_HASERROR ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Boolean	FALSE: HEX has no error TRUE: HEX has error code in its status
Behavior	Returns error state		
Example	`DECL BOOL hex_error_state` `hex_error_state  = OR_HEX_HASERROR()`		

Function	OR_HEX_ZERO ()		
	Name	Type	Description
Input	-	-	-
Output	-	-	-
Behavior	Sets biasing of the HEX sensor		
Example	`OR_HEX_ZERO()`		

Function	OR_HEX_UNZERO ()		
	Name	Type	Description
Input	-	-	-
Output	-	-	-
Behavior	Clears biasing of the HEX sensor		
Example	`OR_HEX_UNZERO()`		

Function	OR_HEX_GETFILTER ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Integer	Filtering indexes 1: No filter 2: 500 Hz 3: 150 Hz 4: 50 Hz 5: 15 Hz 6: 5 Hz 7: 1.5 Hz
Behavior	Returns with current filter index of the HEX sensor		
Example	`DECL INT filter_index` `filter_index = OR_HEX_GETFILTER()`		

Function	OR_HEX_SETFILTER (filterPreset)		
	Name	Type	Description
Input	`filterPreset`	Integer	Filtering indexes: 1: No filter 2: 500 Hz 3: 150 Hz 4: 50 Hz 5: 15 Hz 6: 5 Hz 7: 1.5 Hz
Output	-	-	-
Behavior	Sets the filtering of the HEX sensor to the given filter		
Example	`OR_HEX_SETFILTER(1)`		

Function	OR_HEX_GETDATA ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	HEXDATA - STRUCT of REAL FX,FY,FZ,TX,TY,TZ	FX, FY, FZ: Force values in Newtons, decimal precision: 1 TX, TY, TZ: Torque values in Newton meters, decimal precision: 2
Behavior	Returns the current HEX sensor Force and Torque data		
Example	`DECL HEXDATA current_hex_data` `current hex data = OR HEX GETDATA()`		

RG2-FT

Function	OR_RG2FT_ISCONN ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Boolean	FALSE: RG2FT is absent TRUE: RG2FT is present
Behavior	Returns connection state		
Example	`DECL BOOL rg2ft_connection_state` `rg2ft_connection_state = OR_RG2FT_ISCONN()`		

Function	OR_RG2FT_HASERROR ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Boolean	FALSE: RG2FT has no error TRUE: RG2FT has error code in its status
Behavior	Returns error state		
Example	`DECL BOOL rg2ft_error_state` `rg2ft_error_state  = OR_RG2FT_HASERROR()`		

Function	OR_RG2FT_ISBUSY ()		
	Name	Type	Description
Input	–	-	-
Output	Return value	BOOL	FALSE: device is idle TRUE: device is busy
Behavior	Returns busy state		
Example	`DECL BOOL rg2ft_busy_state` `rg2ft_busy_state  = OR_RG2FT_ISBUSY(#PRI)`		

Function	OR_RG2FT_ISGRIP ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Boolean	FALSE: No grip detected TRUE: Grip detected
Behavior	Returns grip state		
Example	`DECL BOOL rg2ft_grip_detected` `rg2ft_grip_detected  = OR_RG2FT_ISGRIP()`		

Function	OR_RG2FT_GETOBJECTWIDTH ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Real	Object size in mm, decimal precision 1. Calculated: Gripper width - Left Proximity - Right Proximity
Behavior	Returns the object size between the fingers. Warning! The accuracy of the result depends on the accuracy of the proximity sensors.		
Example	`DECL BOOL rg2ft_grip_detected` `rg2ft_grip_detected = OR_RG2FT_ISGRIP()`		

Function	OR_RG2FT_MOVE (width,force,wait)		
	Name	Type	Description
Input	`width`	Real	Define the desired opening in mm, decimal precision 1.
	`force`	Real	Define the desired gripping force in N
	`wait`	Boolean	FALSE: return after command is executed (without waiting for execution to be complete) TRUE: return after fingers reached the position
Output	-	-	-
Behavior	Moves the fingers to the desired position.		
Example	`OR_RG2FT_MOVE(100,40,TRUE)`		

Function	OR_RG2FT_STOP ()		
	Name	Type	Description
Input	–	-	-
Output	-	-	-
Behavior	Stops the fingers the fingers motion in progress.		
Example	`OR_RG2FT_STOP()`		

Function	OR_RG2FT_HEXZERO ()		
	Name	Type	Description
Input	-	-	-
Output	-	-	-
Behavior	Sets biasing of the HEX sensors		
Example	`OR_RG2FT_HEXZERO()`		

Function	OR_RG2FT_HEXUNZERO ()		
	Name	Type	Description
Input	-	-	-
Output	-	-	-
Behavior	Clears biasing of the HEX sensors		
Example	`OR_RG2FT_HEXUNZERO()`		

Function	OR_RG2FT_HEXGETFILTER ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	Integer	Filtering indexes 1: No filter 2: 500 Hz 3: 150 Hz 4: 50 Hz 5: 15 Hz 6: 5 Hz 7: 1.5 Hz
Behavior	Returns with current filter index of the HEX sensors		
Example	`DECL INT filter_index` `filter_index = OR_RG2FT_HEXGETFILTER()`		

Function	OR_RG2FT_HEXSETFILTER (filterPreset)		
	Name	Type	Description
Input	`filterPreset`	Integer	Filtering indexes: 1: No filter 2: 500 Hz 3: 150 Hz 4: 50 Hz 5: 15 Hz 6: 5 Hz 7: 1.5 Hz
Output	-	-	-
Behavior	Sets the filtering of the HEX sensor to the given filter		
Example	`OR_RG2FT_HEXSETFILTER(1)`		

Operation

Function	OR_RG2FT_SETPROXOFFACT ()		
	Name	Type	Description
Input	−	-	-
Output	-	-	-
Behavior	Sets the proximity offset to the current measured value		
Example	;Put a white paper between the fingers of the gripper ;Close the gripper OR_RG2FT_MOVE(0,40,TRUE) ;Measure and store the current offset (to the white paper) OR_RG2FT_SETPROXOFFACT() ;Open the gripper OR_RG2FT_MOVE(50,40,TRUE) ;Gripper Proximity sensors are now calibrated		

Function	OR_RG2FT_SETPROXOFFVAL (proximityOffsetL,proximityOffset)		
	Name	Type	Description
Input	proximityOffsetL	Integer	Left proximity offset in mm, valid range 0 - 120 mm
	proximityOffsetR	Integer	Right proximity offset in mm, valid range 0 - 120 mm
Output	-	-	-
Behavior	Sets a custom offset for the left and the right proximity sensors.		
Example	OR RG2FT SETPROXOFFVAL(22,24)		

Function	OR_RG2FT_GETWIDTH ()		
	Name	Type	Description
Input	−	-	-
Output	Return value	Real	Current fingertip distance in mm, decimal precision: 1
Behavior	Returns current fingertip distance		
Example	DECL REAL gripper_width gripper_width = OR_RG2FT_GETWIDTH()		

Function	OR_RG2FT_GETLHEX ()		
	Name	Type	Description
Input	–	-	-
Output	Return value	RG2FTHEXDATA (STRUCT of REAL FX,FY,FZ,TX,TY,TZ)	FX, FY, FZ: Force values in Newtons, decimal precision: 1 TX, TY, TZ: Torque values in Newton meters, decimal precision: 2
Behavior	Returns the current Force and Torque data of the left HEX sensor		
Example	`DECL RG2FTHEXDATA current_left_hexdata` `current_left_hexdata = OR_RG2FT_GETLHEX()`		

Function	OR_RG2FT_GETRHEX ()		
	Name	Type	Description
Input	-	-	-
Output	Return value	RG2FTHEXDATA (STRUCT of REAL FX,FY,FZ,TX,TY,TZ)	FX, FY, FZ: Force values in Newtons, decimal precision: 1 TX, TY, TZ: Torque values in Newton meters, decimal precision: 2
Behavior	Returns the current Force and Torque data of the right HEX sensor		
Example	`DECL RG2FTHEXDATA current_right_hexdata` `current_right_hexdata = OR_RG2FT_GETRHEX()`		

Function	OR_RG2FT_GETLPROX ()		
	Name	Type	Description
Input	–	-	-
Output	Return value	Integer	Current left proximity distance in mm
Behavior	Returns current left proximity distance		
Example	`DECL INT left_proximity` `left_proximity = OR_RG2FT_GETLPROX()`		

Function	OR_RG2FT_GETRPROX ()		
	Name	Type	Description
Input	–	-	-
Output	Return value	Integer	Current right proximity distance in mm
Behavior	Returns current right proximity distance		
Example	`DECL INT right_proximity` `right_proximity = OR_RG2FT_GETRPROX()`		

Function	OR_RG2FT_GETPROX ()		
	Name	Type	Description
Input	–	-	- 67
Output	Return value	RG2FTPROXIMITY (STRUCT of INT: LEFT, RIGHT)	Current left and right proximity distances in mm
Behavior	Returns current left and right proximity distances		
Example	DECL RG2FTPROXIMITY proximity proximity = OR_RG2FT_GETPROX() IF proximity.LEFT > 5 THEN …		

Operation

RG2/6

Function	OR_RGX_ISCONN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: RG2 or RG6 is absent TRUE: RG2 or RG6 is present
Behavior	Returns connection state of RG2 or RG6		
Example	`DECL BOOL rgx_connection_state` `rgx_connection_state  = OR_RGX_ISCONN(#PRI)`		

Function	OR_RGX_ISRG2 (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: RG2 is absent TRUE: RG2 is present
Behavior	Returns connection state of RG2		
Example	`DECL BOOL rg2_connection_state` `rg2_connection_state  = OR_RGX_ISRG2(#PRI)`		

Function	OR_RGX_ISRG6 (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: RG6 is absent TRUE: RG6 is present
Behavior	Returns connection state of RG6		
Example	`DECL BOOL rg6_connection_state` `rg6_connection_state  = OR_RGX_ISRG6(#PRI)`		

Function	OR_RGX_ISBUSY (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: device is idle TRUE: device is busy
Behavior	Returns busy state		
Example	`DECL BOOL busy_state` `busy_state  = OR_RGX_ISBUSY(#PRI)`		

Function	OR_RGX_ISGRIP (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: No grip detected TRUE: Grip detected
Behavior	Returns grip state		
Example	`DECL BOOL rgx_grip_detected` `rgx_grip_detected  = OR_RGX_ISGRIP(#PRI)`		

Function	OR_RGX_ISSAFETY_ON (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: Safety switch is not activated TRUE: Safety switch is activated
Behavior	Returns safety switch status		
Example	`DECL BOOL rgx_safety_activated` `rgx_safey_activated  = OR_RGX_ISSAFETY_ON(#PRI)`		

Function	OR_RGX_GETWIDTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current width value in mm, decimal precision: 1
Behavior	Returns current width value		
Example	`DECL REAL gripper_width` `gripper_width = OR_RGX_GETWIDTH(#PRI)`		

Function	OR_RGX_GETDEPTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current absolute depth in mm, decimal precision: 1
Behavior	Returns the current absolute depth		
Example	`DECL REAL gripper_depth` `gripper_depth = OR_RGX_GETDEPTH(#PRI)`		

Function	OR_RGX_GET_RELATIVEDEPTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current relative depth in mm, decimal precision: 1
Behavior	Returns actual relative depth from beginning of last actuation		
Example	`DECL REAL gripper_relativedepth` `gripper_elativedepth = OR_RGX_GET_RELATIVEDEPTH(#PRI)`		

Function	OR_RGX_SET_FTOFFSET (instance,fingertipOffset)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`fingertipOffset`	Real	Fingertip offset in mm, decimal precision: 1
Output	-	-	-
Behavior	Sets the fingertip offset		
Example	`OR_RGX_SET_FTOFFSET(#PRI,5)`		

Function	OR_RGX_RESETPOWER(instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	-	-	-
Behavior	Function to reset tool power on Compute Box		
Example	`OR_RGX_RESETPOWER(#PRI)`		

Function	OR_RGX_MOVE (instance,width,force,wait)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	width	Real	Define the desired opening in mm, decimal precision 1.
	force	Real	Define the desired gripping force in N
	wait	Boolean	FALSE: return after command is executed (without waiting for execution to be complete) TRUE: return after fingers reached the position
Output	-	-	-
Behavior	Moves the fingers to the desired position		
Example	OR_RGX_MOVE(#PRI,100,40,TRUE)		

Function	OR_RGX_STOP (instance)		
	Name	Type	Description
Input	instance	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	-	-	-
Behavior	Stops the fingers motion in progress.		
Example	OR_RGX_STOP(#PRI)		

SG

Function	OR_SG_ISCONN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: SG is absent TRUE: SG is present
Behaviour	Returns connection state		
Example	`DECL BOOL sg_connection_state` `sg_connection_state  = OR_SG_ISCONN(#PRI)`		

Function	OR_SG_ISBUSY (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: SG is not busy TRUE: SG is busy
Behaviour	Returns busy state		
Example	`DECL BOOL busy_state` `busy_state  = OR_SG_ISBUSY(#PRI)`		

Function	OR_SG_ISINITIALIZED (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	TRUE: gripper is initialized FALSE: gripper is not initialized or not connected
Behaviour	Returns initialization state		
Example	`DECL BOOL init_state` `init_state  = OR_SG_ISINITIALIZED(#PRI)`		

Function	OR_SG_HASERROR (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: SG has no error TRUE: SG has error
Behaviour	Returns error state		
Example	`DECL BOOL haserror` `haserror  = OR_SG_HASERROR(#PRI)`		

Function	OR_SG_GET_DEPTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Return value [REAL] current depth in mm, decimal precision: 1
Behaviour	Returns current depth		
Example	`DECL REAL current_depth` `current_depth  = OR_SG_GET_DEPTH(#PRI)`		

Function	OR_SG_GET_RELATIVEDEPTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Return value [REAL] current relative depth in mm, decimal precision: 1
Behaviour	Returns current relative depth		
Example	`DECL REAL relative_depth` `relative_depth  = OR_SG_GET_RELATIVEDEPTH(#PRI)`		

Function	OR_SG_GET_SILICONEDEPTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Return value [REAL] static silicone depth in mm, decimal precision: 1
Behaviour	Returns static silicone depth		
Example	`DECL REAL silicone_depth` `silicone_depth  = OR_SG_GET_SILICONEDEPTH(#PRI)`		

Function	OR_SG_GET_WIDTH (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Integer	Return value [INT] current width in mm
Behaviour	Returns current width		
Example	`DECL INT current_width` `current_width  = OR_SG_GET_WIDTH(#PRI)`		

Function	OR_SG_GET_OPENMIN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Integer	Return value [INT] minimum width in mm
Behaviour	Returns minimum width		
Example	`DECL INT minimum_width` `minimum_width  = OR_SG_GET_OPENMIN(#PRI)`		

Function	OR_SG_GET_OPENMAX (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Integer	Return value [INT] maximum width in mm
Behaviour	Returns maximum width		
Example	`DECL INT maximum_width` `maximum_width  = OR_SG_GET_OPENMAX(#PRI)`		

Function	OR_SG_GET_OPENLIMITS (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	SGLIMITS (Struct of Integer: MIN, MAX)	Return value [SGLIMITS] special [INT] struct for sg with MIN and MAX elements
Behaviour	Returns the possible minimum and maximum diameter of the current setup		
Example	`DECL SGLIMITS open_limits` `open_limits = OR_SG_GET_OPENLIMITS(#PRI)`		

Function	OR_SG_INIT (instance,sg_tool_id)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`sg_tool_id`	Integer	1: None 2: SG-a-H 3: SG-a-S 4: SG-b-H
Output	-	-	-
Behaviour	Sends an initialize command, sets the silicone type		
Example	`OR_SG_INIT(#PRI,2)`		

Function	OR_SG_GRIP (instance, target_width, waitmove)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`target_width`	Integer	Target width in mm
	`waitmove`	Boolean	Blocks the running, while gripper is moving (busy)
Output	-	-	-
Behaviour	Grip to the designated position		
Example	`OR_SG_GRIP(#PRI,20,TRUE)`		

Function	OR_SG_GENTLEGRIP (instance, target_width, waitmove)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`target_width`	Integer	Target width in mm
	`waitmove`	Boolean	Blocks the running, while gripper is moving (busy)
Output	-	-	-
Behaviour	Grip to the designated position and slows down when the gripper is close to the target width		
Example	`OR_SG_GENTLEGRIP(#PRI,20,TRUE)`		

Function	OR_SG_RELEASE (instance, target_width, waitmove)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`target_width`	Integer	Target width in mm
	`waitmove`	Boolean	Blocks the running, while gripper is moving (busy)
Output	-	-	-
Behaviour	Releases the object by moving to the designated width		
Example	`OR_SG_RELEASE(#PRI,20,TRUE)`		

Function	OR_SG_STOP (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	-	-	-
Behaviour	Sends a stop command, the gripper will stop any movement		
Example	`OR_SG_STOP(#PRI)`		

Function	OR_SG_HOME (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`waitmove`	Boolean	Blocks the running, while gripper is moving (busy)
Output	-	-	-
Behaviour	Sends a stop command, the gripper will stop any movement		
Example	`OR_SG_HOME(#PRI,TRUE)`		

VG10 / VGC10

Function	OR_VGX_ISCONN (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: VG10 or VGC10 is absent TRUE: VG10 or VGC10 is present
Behavior	Returns connection state of VG10 or VGC10		
Example	`DECL BOOL vgx_connection_state` `vgx_connection_state  = OR_VGX_ISCONN(#PRI)`		

Function	OR_VGX_ISVG10 (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: VG10 is absent TRUE: VG10 is present
Behavior	Returns connection state of VG10		
Example	`DECL BOOL vg10_connection_state` `vg10_connection_state  = OR_VGX_ISVG10(#PRI)`		

Function	OR_VGX_ISVGC10 (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Boolean	FALSE: VGC10 is absent TRUE: VGC10 is present
Behavior	Returns connection state of VGC10		
Example	`DECL BOOL vgc10_connection_state` `vgc10_connection_state  = OR_VGX_ISVGC10(#PRI)`		

Operation

Function	OR_VGX_GET_VAC_CH_A (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current vacuum level on channel A in kPa, decimal precision: 1
Behavior	Returns current vacuum level on channel A		
Example	`DECL REAL vac_level_chA` `vac_level_chA = OR_VGX_GET_VAC_CH_A(#PRI)`		

Function	OR_VGX_GET_VAC_CH_B (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Real	Current vacuum level on channel B in kPa, decimal precision: 1
Behavior	Returns current vacuum level on channel B		
Example	`DECL REAL vac_level_chB` `vac level chA = OR VGX GET VAC CH B(#PRI)`		

Function	OR_VGX_GET_VAC (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	VGVAC (Struct of Real: CHA, CHB)	Current vacuum level on channel A and B in kPa, decimal precision: 1
Behavior	Returns current vacuum levels on channel A and channel B		

Example	`DECL VGVAC vacuum_levels`
	`vacuum_levels = OR_VGX_GET_VAC(#PRI)`
	`IF vacuum_levels.CHA > 5 THEN …`		

Function	OR_VGX_GET_LIMIT (instance)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
Output	Return value	Integer	The current power limit in mA
Behavior	Returns current power limit		
Example	`DECL INT power_limit` `Power_limit = OR_VGX_GET_LIMIT#PRI)`		

Function	OR_VGX_RELEASE (instance,control_Ch_A,control_Ch_B)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`Control_Ch_A`	Boolean	FALSE: No change on Channel A TRUE: Release vacuum on Channel A
	`Control_Ch_B`	Boolean	FALSE: No change on Channel B TRUE: Release vacuum on Channel B
Output	-	-	-
Behavior	Turn off the pumps and open the valves on the affected channels to release the workpiece		
Example	`;Release Channel A only` `OR VGX RELEASE(#PRI,TRUE,FALSE)`		

Function	OR_VGX_IDLE (instance,control_Ch_A,control_Ch_B)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`Control_Ch_A`	Boolean	FALSE: No change on Channel A TRUE: Set Channel A to idle
	`Control_Ch_B`	Boolean	FALSE: No change on Channel B TRUE: Set Channel B to idle
Output	-	-	-
Behavior	Turn off the pumps on the desired channels. The valves on the affected channels will be still closed. This is a low energy state that can keep the object gripped until several seconds		
Example	`;Set idle on Channel B only` `OR VGX IDLE(#PRI,FALSE,TRUE)`		

Function	OR_VGX_GRIP (instance,vacuumA,vacuumB,wait)		
	Name	Type	Description
Input	`instance`	OR_TOOL_INSTANCE_EN	#PRI: single or primary - in dual configuration #SEC: secondary in dual configuration
	`vacuumA`	Integer	Requested vacuum level for channel A 0: No change 1 to 80: vacuum percentage
	`vacuumB`	Integer	Requested vacuum level for channel B 0: No change 1 to 80: vacuum percentage
	`wait`	Boolean	FALSE: returns after command is executed TRUE: returns after requested vacuum level is reached
Output	-	-	-
Behavior	Sets the vacuum level for the gripper channels		
Example	`OR VGX GRIP(#PRI,20,20,TRUE)`		

Mode II - OnRobot WebLogic™

6   Installation

6.1 Overview

For a successful installation the following steps will be required:

- Mount the components
- Setup the software

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

6.2 Mounting

Required steps:

- Mount the robot dependent adapter
- Mount the Quick Changer option
- Mount the tool(s)

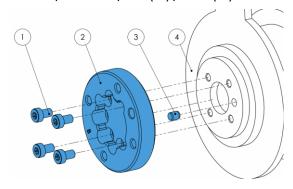In the following three subsections these three mounting steps will be described.

6.2.1 Adapter(s)

For KR 3 Agilus,

KR 6 R1820 / 1820 HP / 700(-2) / 900(-2),

KR 8 R1620 / 1620 HP,

KR 10 R1420 / 1420 HP / 900(-2) / 1100(-2) models

Adapter B (4 screws)

1   M5x8 screws (ISO14580 A4-70)

2   OnRobot adapter flange (ISO 9409-1-50-4-M6)

3   Dowel pin Ø5x6 (ISO2338 h8)

4   Robot tool flange (ISO 9409-1-31.5-4-M5)

Use 5 Nm tightening torque.

For KR 8 R2010 and KR 12 R1810 models
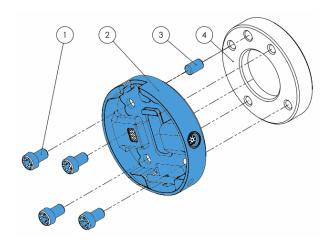
No adapter plate is required.

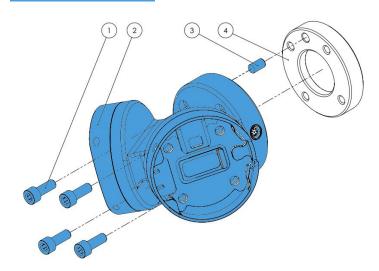### 6.2.2 Quick Changer options

Quick Changer - Robot Side

Quick Changer - Robot Side

1   M6x8mm (ISO14580 8.8)

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

3   Dowel pin Ø6x10 (ISO2338 h8)

4   Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)
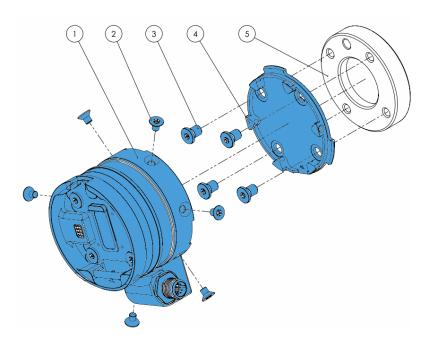
Use 10 Nm tightening torque.

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)
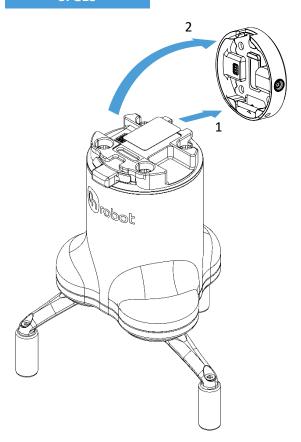
Use 1.5 Nm tightening torque. for M4x6mm

Use 10 Nm tightening torque. for M6x8mm

6.2.3 Tools

3FG15

Step 1:

> Move the tool close to the Quick Changer as illustrated.

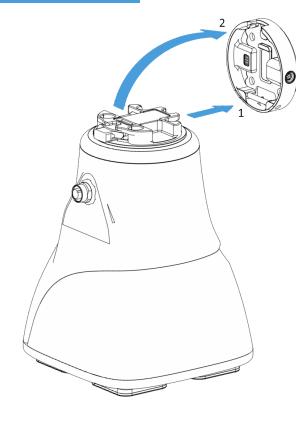> The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

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

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

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.
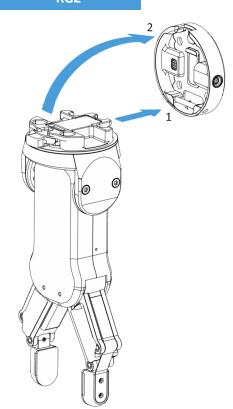
CAUTION:

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.

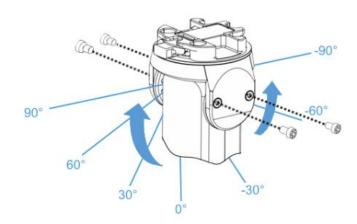The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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.
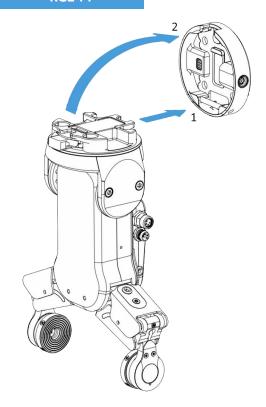
WARNING:

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.

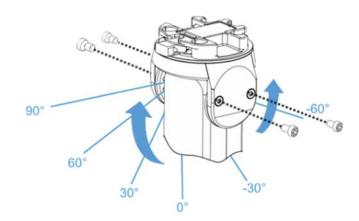> The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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°

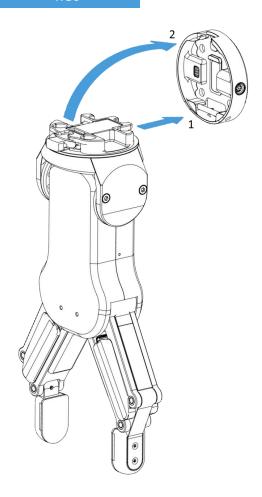- then put the four M4x6 screws back and use 1.35 Nm tightening torque to fix it.

WARNING:

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

SG

Step 1:

Move the tool close to the Quick Changer as illustrated.

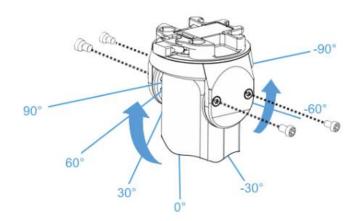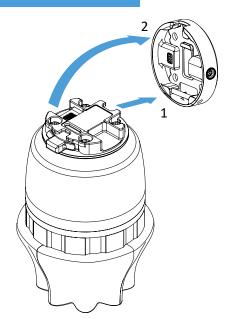The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

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

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

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.

VGC10

Step 1:

Move the tool close to the Quick Changer as illustrated.
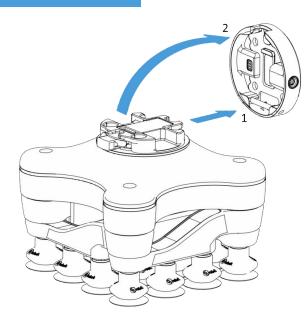
The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

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

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

Quick Changer - Tool side

Step 1:

Move the tool close to the Quick Changer as illustrated.

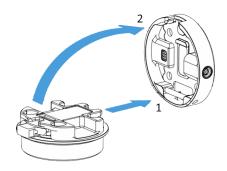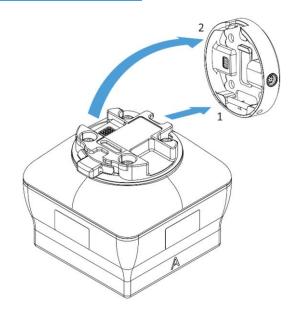The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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.

6.3 Wiring

Four kind of cables must be connected to wire the system properly:

- Tool data cable between the tool(s) and the Compute Box
- The provided Digital I/O wires between the Computer Box and the robot controller
- Ethernet communication cable between the Compute Box and your computer
- Power supply of the Compute Box

6.3.1 Tool data

Connect the data cable to the tool(s) then route the cable (blue line) to the Compute Box (CB) and use the supplied Velcro tape (black) to fix it.

> **NOTE:**
>
> Leave some extra cable length around the joints so that the 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)

Then, connect the other end to the Compute Box's DEVICES connector.

> **CAUTION:**
>
> Use only original OnRobot tool data cables.

6.3.2 Digital I/O wires

For Agilus robots the **X12** optional I/O interface in the control cabinet can be used to connect the Compute Box to the robot controller.

Make sure that the robot is powered off completely.

First locate the X12 connector on the back side of the KRC4 compact cabinet. Prepare the spare X12 (D-SUB 50) mating connectors that was shipped with the robot.

Check your digital I/O module installed in the control cabinet and configure the Compute Box DIP switches (red) accordingly:

For **PNP** type set the 1. and 2. DIP switches to OFF position (down).

For **NPN** type set the 1. and 2. DIP switches to ON position (up).

DIP switch 1: Digital Input mode

DIP switch 2: Digital Output mode
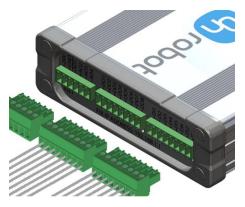
NOTE:

Do not change the DIP switch 3 and 4 otherwise the network settings will be changed.

The Beckhoff EL1809 and EL2809 modules are **PNP** type and the Beckhoff EL1889 and EL2889 modules are **NPN** type.

Plug in the supplied green pluggable connectors.

The supplied connector types are:

2 x Phoenix Contact MC 1,5/8-ST-3,5 Terminal Block

1 x Phoenix Contact MC 1,5/6-ST-3,5 Terminal Block

Wire the digital I/O wires from the Compute Box to the robot.

DO1-8: Digital outputs of the Compute Box (signals from the grippers/sensor to the robot)

DI1-8: Digital inputs of the Compute Box (signals from the robot to the grippers/sensor)

GND: To be used to have a common ground between the robot and the gripper/sensor

It is recommended to connect all 8 inputs and 8 outputs for simplicity.

CAUTION:

If some of the DO1-8 or DI1-8 wires will not be connected, make sure to unscrew it from the terminal block to avoid an accidental short circuit.

CAUTION:

The 24V and GND pins are only Reference Voltage Output. It cannot be used to power any equipment.

It is recommended to use the supplied wires only. If it is necessary to use different wire, use one that is shorter than 3 m.
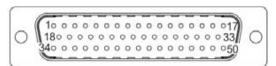
Connect the Compute Box inputs to the robot outputs and the Compute Box outputs to robot inputs.

For simplicity, it is recommended to map the pins in order:

DO1 to the robot's Digital input 1

DO2 to the robot's Digital input 2

…

DO8 to the robot's Digital input 8

DI1 to the robot's Digital output 1

DI2 to the robot's Digital output 2

…

DI8 to the robot's Digital output 8

List of the important pins of the X12 connector: (viewed from connection side)

Pin	Description	Pin	Description
1	Digital input 1	17	Digital output 1
2	Digital input 2	18	Digital output 2
3	Digital input 3	19	Digital output 3
4	Digital input 4	20	Digital output 4
5	Digital input 5	21	Digital output 5
6	Digital input 6	22	Digital output 6
7	Digital input 7	23	Digital output 7
8	Digital input 8	24	Digital output 8
9	Digital input 9	25	Digital output 9
10	Digital input 10	26	Digital output 10
11	Digital input 11	27	Digital output 11
12	Digital input 12	28	Digital output 12
13	Digital input 13	29	Digital output 13
14	Digital input 14	30	Digital output 14
15	Digital input 15	31	Digital output 15
16	Digital input 16	32	Digital output 16

Please note which pin you used during the wiring; in a later step it is going to be needed for the mapping.

6.3.3 Ethernet cable

Connect the provided Compute Box (ETHERNET connector) and your computer with the supplied UTP cable.

This connection is only needed for programming.

CAUTION:

Use only original OnRobot ethernet cables or replace it with one that is shielded and no more than 3 meter long.

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).

6.3.4 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).

7 Operation

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

7.1 Overview

OnRobot WebLogic™ requires to be programmed first with the help of a computer connected to the Compute box. Then it can run standalone without any Ethernet connection.

Steps to program it:

- Setup the Compute Box's Ethernet interface and connect to the Compute Box
- Open the Web Client on your computer to access the WebLogic™ menu
- Write your program in the WebLogic™ menu

The following subsections will guide you through these steps.

7.2 Ethernet Interface setup

A proper IP address must be set for the Compute Box and the robot/computer to be able to use the Ethernet interface. There are three ways how it could be configured (using the DIP switch 3 and 4):

- **Auto mode** (factory default)

  This is the easiest way of getting the IP addresses to be configured for both the Compute Box and the robot/computer. It is recommended to start with this mode, so this is the factory default setting.

- **Fixed IP mode** (192.168.1.1)

  If the **Auto mode** does not work, use this mode to have a fixed IP for the Compute Box. This requires a manual IP address configuration for the robot/computer. (This mode could also be used to reset the IP address to a known value if the Compute Box become unreachable in **Advanced mode**.)

- **Advanced mode** (any static IP/subnet mask)

  If the Fixed IP address (192.168.1.1) is already in use in your network or a different subnet needs to be configured, in this mode the IP address and subnet mask can be changed to any value. This also requires a manual IP address configuration for the robot/computer.

NOTE:

To change between modes, first change the DIP switches and then the Compute Box power needs to be cycled for the changes to take effect.

Auto mode

Use the factory default settings (DIP switch 3 and 4 in OFF position).

In this case, the Compute Box has both Dynamic Host Configuration Protocol (DHCP) client, and DHCP server enabled.

DHCP Client enabled means, Compute Box will automatically obtain ("get") IP address FROM the connected robot/computer if that is capable of assigning ("give") IP to the Compute Box.

DHCP Server enabled means, Compute Box will automatically assign ("give") IP address TO the connected robot/computer if that was configured to obtain ("get") IP address automatically.

NOTE:

The assigned IP range is 192.168.1.100-105 (with subnet mask 255.255.255.0).

If the Compute Box is used in a company network where a DHCP server is already in use, it is recommended to disable the DHCP server of the Compute Box by setting DIP switch 4 to the ON position.

If no IP was assigned to the Compute Box within a minute, it will automatically get a fallback IP address (192.168.1.1).

NOTE:

If the Compute Box was in **Advanced mode**, first reset the IP setting by switching to **Fixed IP mode** and then switch back to **Auto mode**.

Fixed IP mode

Set the DIP switch 3 and 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box is set to 192.168.1.1 (subnet mask is 255.255.255). Both the DHCP Client and Server options are disabled.

Make sure to set the robot/computer IP address manually. To have a proper communication the robot/computer IP address must be in the range of 192.168.1.2 - 192.168.1.254.

Example robot/computer setting:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Other settings like Gateway, DNS Server, etc. could be kept empty or set to 0.0.0.0.

Advanced mode

Set the DIP switch 3 in OFF and DIP switch 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box could be set to any value by using the Web Client. For more details see section Configuration menu.

In this mode, the DHCP server option is disabled.

Make sure to have a matching IP setting to your robot/computer network for a proper communication.

NOTE:

If the Compute Box become unreachable (due to improper or forgotten IP settings), switch to **Fixed IP mode** to reset the IP setting.

7.3 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 logged in you can access top menus. Select **WebLogic™** menu.

7.4 OnRobot WebLogic™ menu

There are two tabs to choose from:

- **Browser -** manage (import/export, etc.) the WebLogic™ programs
- **Program Editor -** create/edit or run WebLogic™ programs

In the following these two will be described.

7.4.1 Browser

This tab lists the WebLogic™ programs that are stored on the Compute Box.

- To create a new program, go to the **Program Editor** tab.
- To edit a stored program, click on the pencil ✎ icon and it will be loaded in the **Program Editor**
- Any program can be deleted by clicking on the trash 🗑 icon.
- Programs can be exported to your computer by clicking on the down arrow ⤓ icon.
- Exported programs can be imported with the **Import** button.

NOTE:

The program name that are edited in the **Program Editor** is bolded.

OnRobot WebLogic

This page allows to browse/manage the OnRobot WebLogic programs. You can create new program and run it on the Editor tab. (To make your program run automatically on power-on, leave it running while powering the Compute Box off.)

Browser   Program Editor

IMPORT   You can import a program file from your computer.

PROGRAM NAME	ROWS	SIZE			
Program 1	2	2,742	✎	⤓	🗑
Program 2	**3**	**3,609**	✎	⤓	🗑
Program 3	13	20,480	✎	⤓	🗑

7.4.2 Program Editor

This tab shows the currently edited WebLogic™ program.

WebLogic™ programs contains 1 or more "rows".

A row contains conditions (blue part) and commands (gray part) like this:

(**If**)   DI1=1   → (**Then**)   RG2-Width=77 (force=20N)
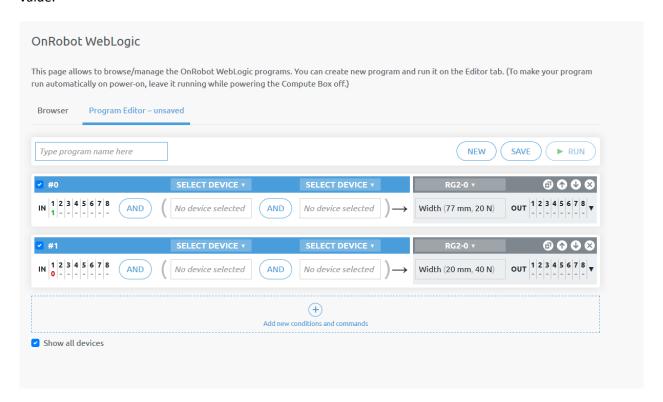
(If the robot sets the Digital Input 1 (DI1) of the Compute Box to high, **then** open the RG2 gripper to 77 mm.)

Another row in a program can be like this:

(**If**)   DI1=0   → (**Then**)   RG2-Width=20 (force=40N)

(If the robot sets the Digital Input 1 (DI1) of the Compute Box to low, **then** close the RG2 gripper to 20 mm.)

With the above two rows in a program an RG2/6 gripper could be operated (opened and closed) with a single Digital output of a robot, while the opening and closing width and force can be programmed to any value.

To execute a WebLogic™ program first make sure to enter a program name and click on the **Save** button to store it and then click on the ▶ **Run** button.

> **NOTE:**
>
> To make a program run automatically when the Compute Box is powered on just leave the program running while you power the Compute Box off.

To start a new program, click on the **New** button.

- To add a new row, click on the ⊕ **Add new conditions and commands**.

- To delete a row, click on the ⊗ icon.

- To move the row up or down click on the ⬆ ⬇ icons.

> **NOTE:**
>
> Conditions and commands are executed from the top to the bottom. Same commands at the bottom can override the ones at the top.

- To duplicate a row, click on the ⧉ icon.

- To disable a row (not to be executed), uncheck the checkbox ☑ # next to the row number.

The rows must have at least one condition and at least one command to be executed.

Conditions

Conditions are the input fields marked by blue.
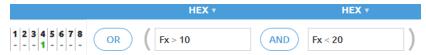
There are two types of conditions:

- Digital Input type - like DI4=1
1	2	3	4	5	6	7	8
-	-	-	1	-	-	-	-

- Device specific value type - like HEX Fx > 10N `Fx > 10` (HEX ▾)

These types of conditions can be combined with AND or OR logic to form a more complex condition:

If (DI4=1) **OR** (HEX Fx > 10 N **AND** HEX Fx < 20N)

1	2	3	4	5	6	7	8
-	-	-	1	-	-	-	-

(OR) (Fx > 10 (HEX ▾) (AND) Fx < 20 (HEX ▾))

Condition is true if Fx is between 10N and 20N or robot has signaled high in Digital Input 4.

Digital inputs (DI1-DI8) can have the following three states: (click to cycle through the states)

- - - Don't care (this bit is masked and will give true result for the bit)
- 0 - give logic true if Input bit is low
- 1 -give logic true if Input bit is high

Operation

NOTE:

If no Digital Input type of condition is needed set DI1-DI8 to ⁻ don't care.

For Device specific values first set the **Select device** by clicking on the arrow icon.

NOTE:

The list contains only the connected devices. If you would like to select a device that is not currently connected check the **Show all devices** checkbox.

For 3FG15, RG2/6, SG, VG10, VGC10 and Gecko there are three numbers after the device name:

- **0** - If the device is mounted on a Quick Changer or a HEX-E/H QC
- **1** - If the device is mounted on the Primary side of a Dual Quick Changer
- **2** - If the device is mounted on the Secondary side of a Dual Quick Changer

NOTE:

If a Device specific value type condition is not needed set it to **-- Not selected --** and it will give true result.

Commands

Commands are the input fields marked with gray.

There are two types of commands:

- Device specific value type - like (set RG2 width 77 mm and with force = 20N)
- Digital Output type - like DO4=1 (set Digital Output 4 to logic high)
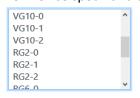
NOTE:

Both types are always executed so make sure that the not relevant part is always set to ⁻ Don't change or **-- Not selected --**.

For Device specific value first set the **Select device** by clicking on the arrow icon.

NOTE:

The list contains only the connected devices. If you would like to select a device that is not currently connected check the **Show all devices** checkbox.

For 3FG15, RG2/6, SG, VG10, VGC10 and Gecko there are three numbers after the device name:

- **0** - If the device is mounted on a Quick Changer or a HEX-E/H QC
- **1** - If the device is mounted on the Primary side of a Dual Quick Changer
- **2** - If the device is mounted on the Secondary side of a Dual Quick Changer

Digital outputs (DO1-DO8) can have the following three states: (click to cycle through the states)

- ◻ - Don't change
- **0** - set the Output bit to logic low
- **1** - set the Output bit to logic high

List of Device specific values

NOTE:

Each device has an **OnStart** condition that becomes True only once the device is connected or the program is started and then becomes immediately False. This can be used to detect if a device is connected or set any initial value on program start.

3FG15

Conditions	Description
Dimeter	Actual raw diameter of the fingers [mm]
Dia. with fingertips	Actual diameter of the fingers with the fingertips [mm]
Force	Actual force in percentage
Busy	Becomes **TRUE** when the gripper is moving otherwise **FALSE**.
Grip detected	Becomes **TRUE** when the gripper was commanded to move and the move was stopped by gripping on a part otherwise **FALSE**.
Force grip detected	Becomes **TRUE** when the gripper was commanded to gripping and the target force is reached otherwise **FALSE**.
Error	Becomes **TRUE** when there is any error otherwise **FALSE**.

Commands	Description
Grip internal	To grip internally on a part with the given target force (1-100%). The target diameter needs to be 3mm more than the part diameter to be gripped.
Grip external	To grip externally on a part with the given target force (1-100%). The target diameter needs to be 3mm less than the part diameter to be gripped.
Move to diameter	Moves the fingers to the given diameter [mm]
Stop	Stops the fingers motion

Gecko

Conditions	Description
Preload	Actual force applied to the pads [N] (below 50N it reads 0N)
Ultrasonic	Actual distance measured from the bottom of the gripper to the object.[mm]
Pad position	Actual position of the pads either **In** or **Out**
Pads worn	If a Grip was detected and then object distance becomes more than 18mm (without the pads being pulled IN) the object is lost so the Pads are **Bad** otherwise reads **Good**.
Busy	Pads are in motion
Grip	While the pads are OUT if the **Preload** force is reached and the object distance is less than 18mm, then Grip becomes **TRUE** otherwise **FALSE**. (resets to **FALSE** by pulling the pads IN)

Commands	Description
Pad position	To pull the pads **In** or push the pads **Out**
Preload threshold	To set the preload force limit that is used to detect a successful **Grip**. Available options are: 50N, 90N, 120N
Reset error logs	Clears the errors (e.g.: Pads worn)

HEX-E/H QC

Conditions	Description
Bias	**TRUE** if the sensor has been zeroed (biased).
F3D, T3D	F3D= $\sqrt{Fx^2 + Fy^2 + Fz^2}$ [N] T3D= $\sqrt{Tx^2 + Ty^2 + Tz^2}$ [Nm]
Fx, Fy, Fz, Tx, Ty, Tz	Actual force [N] and torque [Nm] values

Commands	Description
Bias	Set to **TRUE** to zero the F/T sensor signals (not permanent, will revert on power reset)

RG2/6

Conditions	Description
Width	Actual width of the gripper [mm]
Busy	True if the gripper is in motion (can only accept new commands when not busy)
Grip	Internal or external grip is detected.
Safety pressed	True if any of the gripper's safety switch is currently being pressed.
Safety triggered	True if any of the gripper's safety switch is triggered.

Commands	Description
Width	Set the gripper to a new width [mm] with a gripping force [N]
Fingertip offset	Set the fingertip offset from the inner side of the metal [mm]. Positive number means inward.
Power cycle	If safety switch stopped the gripper use this to get back to normal operation. Resets the tool power for a second. If another gripper is connected, that will also be powered off and powered on for a second. (Make sure that during power off no part to will be dropped.)

RG2-FT

Conditions	Description
Proximity (L,R)	Actual values of the left and right fingertip proximity sensors [mm]
Width	Actual width of the gripper [mm]
Busy	True if the gripper is in motion (can only accept new commands when not busy)
Grip	Internal or external grip is detected.
FT Bias	**TRUE** if the sensor has been zeroed (biased).
Left and Right F3D,T3D	F3D= $\sqrt{Fx^2 + Fy^2 + Fz^2}$ [N] where Fx, Fy, Fz are the fingertip sensor force components T3D= $\sqrt{Tx^2 + Ty^2 + Tz^2}$ [Nm] where Tx, Ty, Tz are the fingertip sensor torque components
Both F3D,T3D	The combined F3D and T3D acting on an object that the gripper gripped on

Commands	Description
Width	Set the gripper to a new width [mm] with a gripping force [N]
Bias	Set to **TRUE** to zero the F/T sensor signals (not permanent, will revert on power reset)

SG

Conditions	Description
Width	Actual gripper width [mm]
Initialized	Becomes **TRUE** when the gripper received a valid **Initialize** command otherwise **FALSE**.
Busy	Becomes **TRUE** when the gripper is moving otherwise **FALSE**.

Commands	Description
Initialize	The gripper first needs to be initialized by setting what type of SG Tool is used.
Grip	Set the small enough target width to grip on a part. If the **Gentle grip** option is **TRUE** than the speed of the grasp will be decreased 10mm before the set target width.
Release	Set the large enough target width to release the part.

VG10 / VGC10

Conditions	Description
Actual vacuum A **Actual vacuum B**	Actual vacuum level [0-80%] for channel A and channel B

Commands	Description
Current limit	Set the current limit (0-1000mA), default is 500mA
Grip	Sets the vacuum level (0-80%) for channel A (param1) and channel B (param2)
Idle	Switch of the motor but keep the valve closed for channel A, B or A+B
Release	Opens the valve to quickly release the vacuum for channel A, B or A+B

Mode III - OnRobot F/T Software

8   Installation

8.1   Overview

For a successful installation the following steps will be required:

- Mount the components
- Setup the software

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

8.2   Mounting

Required steps:

- Mount the robot dependent adapter
- Mount the Quick Changer option
- Mount the tool(s)

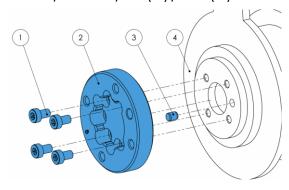In the following three subsections these three mounting steps will be described.

8.2.1 Adapter(s)

For KR 3 Agilus,

KR 6 R1820 / 1820 HP / 700(-2) / 900(-2),

KR 8 R1620 / 1620 HP,

KR 10 R1420 / 1420 HP / 900(-2) / 1100(-2) models

Adapter B (4 screws)

1   M5x8 screws (ISO14580 A4-70)

2   OnRobot adapter flange (ISO 9409-1-50-4-M6)

3   Dowel pin Ø5x6 (ISO2338 h8)

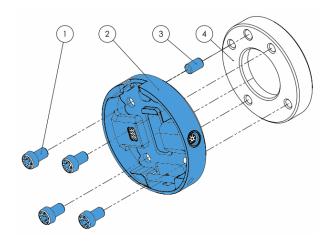4   Robot tool flange (ISO 9409-1-31.5-4-M5)

Use 5 Nm tightening torque.

For KR 8 R2010 and KR 12 R1810 models

No adapter plate is required.

8.2.2 Quick Changer options

Quick Changer - Robot Side

Quick Changer - Robot Side

1   M6x8mm (ISO14580 8.8)

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

3   Dowel pin Ø6x10 (ISO2338 h8)

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

Use 10 Nm tightening torque.

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
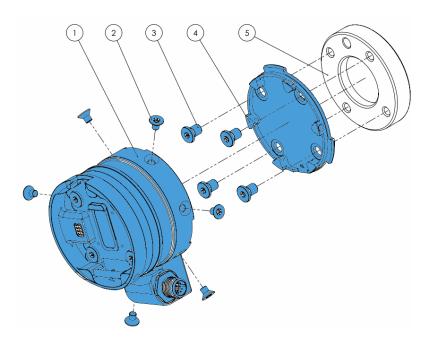
1   HEX-E/H QC sensor

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

8.2.3 Tools

3FG15

Step 1:

Move the tool close to the Quick Changer as illustrated.

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

Step 2:

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

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

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.

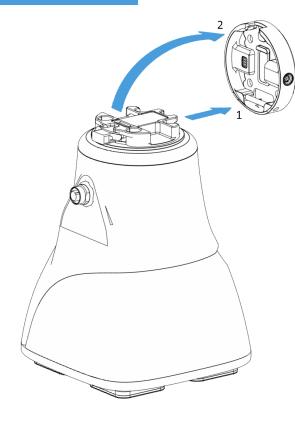The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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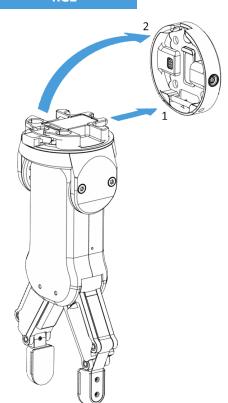
To change the relative angle of the gripper to the Quick Changer:

- 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.

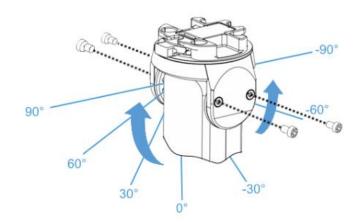> The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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°
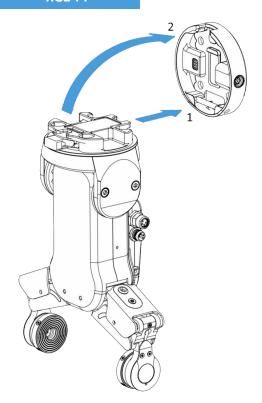- then put the four M4x6 screws back and use 1.35 Nm tightening torque to fix it.

WARNING:

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

SG

Step 1:

Move the tool close to the Quick Changer as illustrated.

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

Step 2:

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

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

VG10

Step 1:

Move the tool close to the Quick Changer as illustrated.

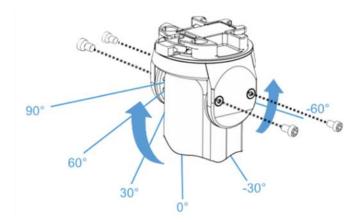The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

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.

VGC10

Step 1:

Move the tool close to the Quick Changer as illustrated.

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

Step 2:

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

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

**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.
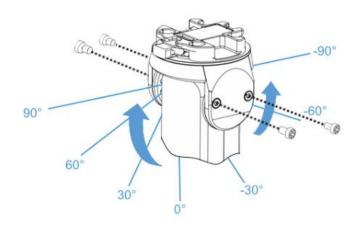
Step 2:

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.

8.3 Wiring

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

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

NOTE:

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

8.3.1 Tool data cable

First connect the data cable to the tool.
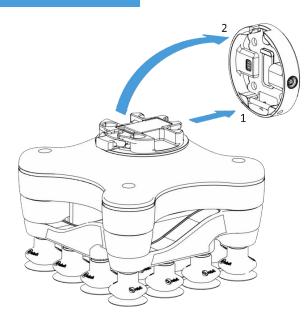
For Single or Dual 3FG15, RG2, RG6, SG, VG10, VGC10 or Gecko Gripper

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.

8.3.2 Ethernet cable

Connect one end of the supplied Ethernet (UTP) cable to the robot controller's Ethernet (LAN) port as shown below:

Use the X66 (KLI) 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).

8.3.3 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).

8.4 Software setup

8.4.1 Compute Box IP setup

NOTE:

It is recommended to use Fixed IP mode for OnRobot F/T.

In the following, it is assumed that the Compute Box IP is left at the default 192.168.1.1. If other IP address is selected, remember to always enter the chosen one whenever required to be entered.

8.4.2 Ethernet Interface Setup

A proper IP address must be set for the Compute Box and the robot/computer to be able to use the Ethernet interface. There are three ways how it could be configured (using the DIP switch 3 and 4):

- **Auto mode** (factory default)

  This is the easiest way of getting the IP addresses to be configured for both the Compute Box and the robot/computer. It is recommended to start with this mode, so this is the factory default setting.

- **Fixed IP mode** (192.168.1.1)

  If the **Auto mode** does not work, use this mode to have a fixed IP for the Compute Box. This requires a manual IP address configuration for the robot/computer. (This mode could also be used to reset the IP address to a known value if the Compute Box become unreachable in **Advanced mode**.)

- **Advanced mode** (any static IP/subnet mask)

  If the Fixed IP address (192.168.1.1) is already in use in your network or a different subnet needs to be configured, in this mode the IP address and subnet mask can be changed to any value. This also requires a manual IP address configuration for the robot/computer.

NOTE:

To change between modes, first change the DIP switches and then the Compute Box power needs to be cycled for the changes to take effect.

Auto mode

Use the factory default settings (DIP switch 3 and 4 in OFF position).

In this case, the Compute Box has both Dynamic Host Configuration Protocol (DHCP) client, and DHCP server enabled.

DHCP Client enabled means, Compute Box will automatically obtain ("get") IP address FROM the connected robot/computer if that is capable of assigning ("give") IP to the Compute Box.

DHCP Server enabled means, Compute Box will automatically assign ("give") IP address TO the connected robot/computer if that was configured to obtain ("get") IP address automatically.

NOTE:

The assigned IP range is 192.168.1.100-105 (with subnet mask 255.255.255.0).

If the Compute Box is used in a company network where a DHCP server is already in use, it is recommended to disable the DHCP server of the Compute Box by setting DIP switch 4 to the ON position.

If no IP was assigned to the Compute Box within a minute, it will automatically get a fallback IP address (192.168.1.1).

NOTE:

If the Compute Box was in **Advanced mode**, first reset the IP setting by switching to **Fixed IP mode** and then switch back to **Auto mode**.

Fixed IP mode

Set the DIP switch 3 and 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box is set to 192.168.1.1 (subnet mask is 255.255.255). Both the DHCP Client and Server options are disabled.

Make sure to set the robot/computer IP address manually. To have a proper communication the robot/computer IP address must be in the range of 192.168.1.2 - 192.168.1.254.

Example robot/computer setting:

IP address: 192.168.1.2

Subnet mask: 255.255.255.0

Other settings like Gateway, DNS Server, etc. could be kept empty or set to 0.0.0.0.

Advanced mode

Set the DIP switch 3 in OFF and DIP switch 4 in ON position and cycle the power for the changes to take effect.

In this case the IP address of the Compute Box could be set to any value by using the Web Client. For more details see section Configuration menu.

In this mode, the DHCP server option is disabled.

Make sure to have a matching IP setting to your robot/computer network for a proper communication.

NOTE:

If the Compute Box become unreachable (due to improper or forgotten IP settings), switch to **Fixed IP mode** to reset the IP setting.

8.4.3 KUKA Line Interface (KLI) IP setup

To change the IP settings of the KUKA robot controller, follow this process:
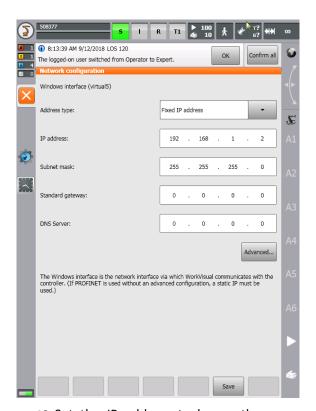
9. Go to **Configuration** > **User group**

10. Select **Expert** and type in your password

11. Go to **Start-up** > **Network configuration**

12. Set the IP address to be on the same subnet as the Compute Box (e.g.: 192.168.1.2). Then click on **Save** button.

13. Accept the prompts and restart the robot controller

8.4.4 KUKA package install

The OnRobot F/T software require KUKA Robot Sensor Interface (RSI) package to be installed.
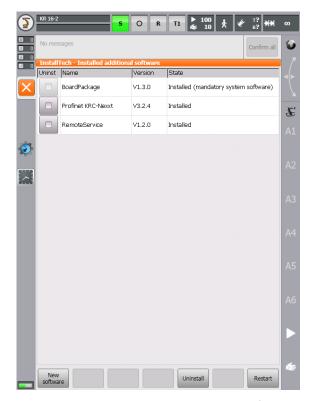
NOTE:

Please contact your local KUKA representative for pricing and purchase options.

To install these KUKA packages do the following steps:
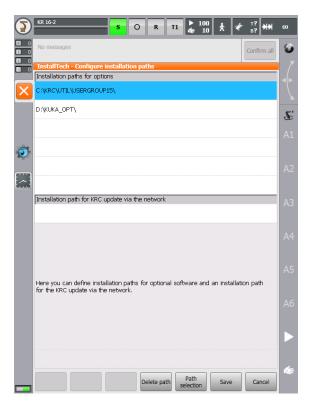
1. Go to **Start-up** > **Additional software**, click on **New software**

2. If no packages are listed, click on **Configure**.

3. Click on an empty slot and click **Path selection**

4. Browse for the installation folder of package to be installed, then click **Save** twice.

5. Check the check box next to the package name to be installed

6. Wait for the installation, accept all prompts.
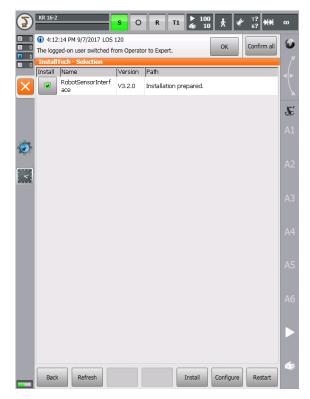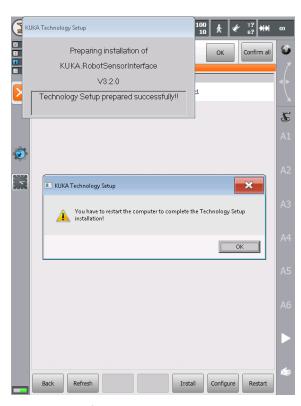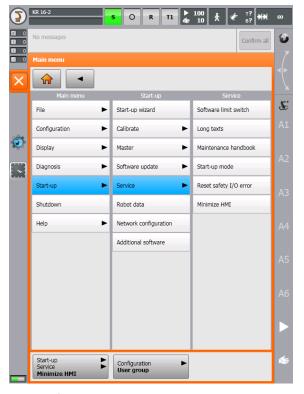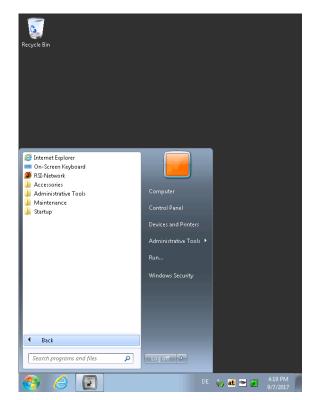
7. Click **Yes** when asked to reboot the robot controller

8. After the reboot go to **Start-up** > **Service** > **Minimize HMI**.
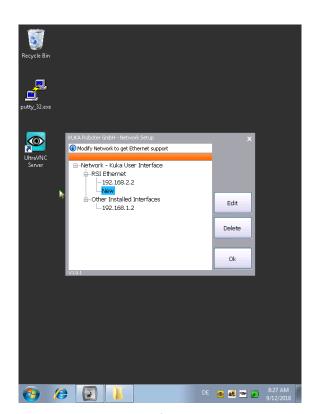
9. Click on the Start menu and open the **RSI-Network** application

10. Click on the **New** field under **RSI-Ethernet** and click **Edit**. Enter an IP address with a different subnet than KLI

For further info please refer to the KUKA user manual.

Installation
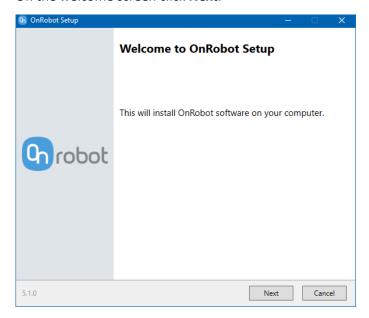
8.4.5 OnRobot F/T Software Installation

Go to **Main Menu**>**Configuration**>**User group** and select **Expert** mode. Enter your password, then go to **Start-up**>**Service**>**Minimize HMI**.

Plug the provided USB-drive into one of the USB ports on the control box.

Browse for the OnRobot KUKA Setup program and launch it. This program has multiple purposes: You can use it for the initial installation of the OnRobot KUKA package, but also as a network configuration tool.
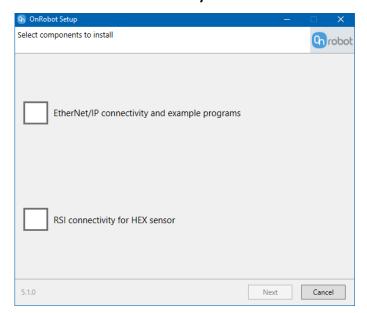
On the welcome screen click **Next**.

Then check the **RSI connectivity for HEX sensor** and click **Next**.

NOTE:

If this program has been installed earlier, please uninstall it first.

On the next window you will find three input fields. The first is for defining the Compute Box to be used with your robot. The second and third one is for defining the RSI connection.

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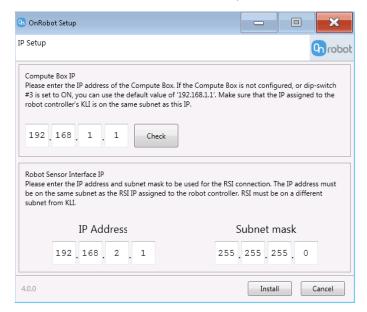
First enter the IP address of the compute box you want to use with the robot. The default address is 192.168.1.1, use this if your Compute Box has not been configured yet or if it is set to fixed IP mode.
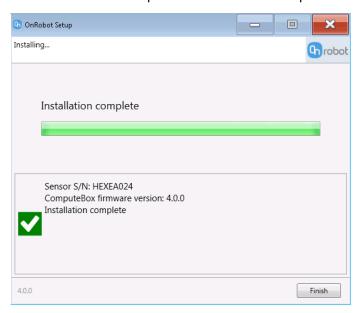
After entering the IP address click on **Check**. If the program successfully makes a connection to the Compute Box a green tick mark will appear along with the name of the sensor plugged into the box, and the version of the Compute Box software.

After successfully setting the Compute Box IP, continue by entering the IP and subnet mask for the RSI connection.

The IP you enter here must be on the same subnet as the one you defined during the RSI setup. (E.g.: if you set 192.168.173.1 for RSI on the robot controller set 192.168.173.X here. X can be any number between 2 and 255.) Make sure that you also use the same subnet mask as on the robot controller.
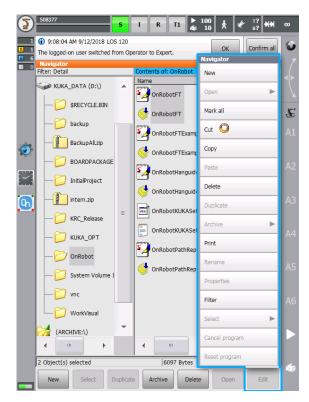
After filling in all the fields click on **Install** to complete the installation/configuration. If the installation has been successful a green tick mark will appear. Installation failure can happen if there's a problem with the connection to the Compute Box or there's write protection on the robot controller's hard drive.

To complete the setup, go back to the Smart HMI and in the Navigator go to `D:\OnRobot`. Select `OnRobotFT.src` and `OnRobotFT.dat`, then in the **Edit** menu press copy.

Go to $KRC:\R1\TP$ and create a folder with the following name: OnRobot. Paste the two files into the new folder.
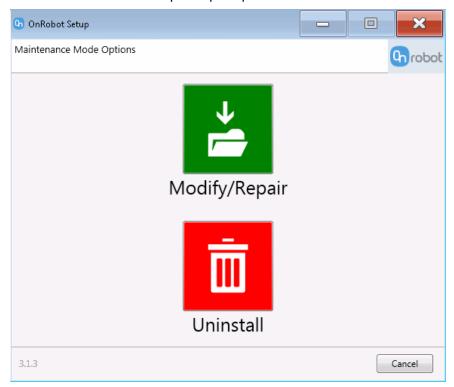
Restart the robot controller.

8.4.6 Uninstallation

The following steps will uninstall the OnRobot F/T Software from your robot controller:

- Enter **Expert** mode by going to the Main Menu then **Configuration**>**User group**.
- Minimize the user interface with **Start-up**>**Service**>**Minimize HMI**.
- Open the file explorer and go to `D:\OnRobot`.
- Launch the OnRobot Setup executable file.
- Click on **Uninstall** and accept the prompts.

- Restart the robot controller.

9   Operation

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

9.1   Overview

9.1.1 KRL variables

`STRUC OR_AXEN BOOL X,Y,Z,A,B,C`

Structure used for enabling or disabling axes for force control.

`STRUC OR_FORCE_TORQUE_PARAM`

Structure used for defining the force control parameters. This structure has numerous fields that will be discussed in the force-torque control section.

9.1.2 KRL functions and subprograms

`OR_INIT()`

`OR_BIAS()`

`OR_HANDGUIDE()`

`OR_PATH_REPLAY()`

`OR_WAIT()`

`OR_FORCE_TORQUE_ON()`

`OR_FORCE_TORQUE_OFF()`

9.2   Initialization

The `OR_INIT()` subprogram must be inserted into any code using OnRobot force control commands to initialize parameters for the proper behavior of all commands. It must be included only once and must be before the first OnRobot command

9.3   Hand Guide

The `OR_HANDGUIDE()` subprogram launches the sensor guided hand-guide on the robot. The program includes a BCO move to the actual position the program is launched at.

> **NOTE:**
>
> Do not touch the sensor or any attached tools upon starting the program.

The argument of this subprogram is used for limiting the motion of the robot along or about certain axes. In the example below movement along the Z-axis is disabled along with rotations around the A- and B-axes.

`OR_HANDGUIDE` has a conservative speed limit.

Example:

```
DECL OFAXEN ENABLED_AXES
ENABLED_AXES={X TRUE, Y TRUE, Z FALSE, A FALSE, B FALSE, C TRUE}
OR_INIT()
OR_HANDGUIDE(ENABLED_AXES)
```

9.4 Path record and replay

9.4.1 Recording a path
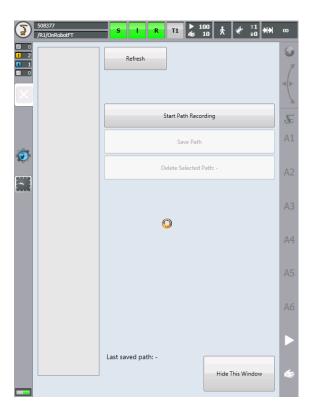
You can record any movement the robot does, be it a path created by manually hand guiding the robot or the shape of a surface during a force-controlled movement. In any case, the path recording must be initiated manually using the path recording GUI. The GUI can be summoned using the icon on the left side toolbar of the SmartHMI.
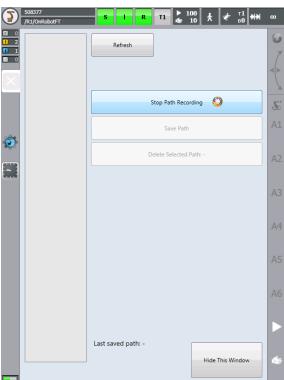
To record a hand guided path, the following steps should be followed:

11. Create a program (or use the provided example program) that has an `OR_HANDGUIDE()` command in it to launch hand guiding.

12. Select the program and start it. It is recommended that you use a Teach mode for this.

13. Move the robot into the position that you want to start the path recording from. You can use hand guiding for this, but since all recorded paths are considered as relative motions it is recommended to use explicit programmed positions as starting points. This makes replaying and path reusability easier.

14. When the robot is in hand guiding mode and in the correct initial position, select the icon on the left toolbar to bring up the path recording GUI.

15. Press **Start Path Recording** to begin your recording session.
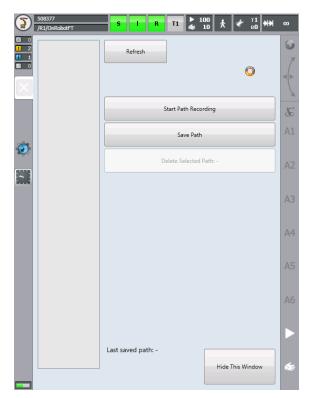
16. Move the robot along the path you wish to record.

17. When you're done with the recording press **Stop Path Recording**.
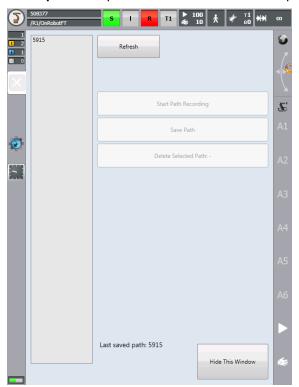
18. If you're satisfied with the recorded path click on **Save Path**.

The new path will be added to the list on the left and its identifier will be displayed next to **Last saved path**. The path is now saved on the Compute Box.

This process can be used to record force-controlled movements too. This can greatly improve the accuracy and speed of the force control.

Saved paths can be exported via the Compute Box webpage and uploaded to a different Compute Box. Saved paths are interchangeable between robot makes (e.g. a path recorded on a KUKA robot can be replayed on any other robot supported by the Compute Box)

9.4.2 Replaying a path

The `OR_PATH_REPLAY()` function can be used to replay paths stored on the Compute Box. The commands have three arguments:

`OR_PATH_REPLAY(SPEED:IN,ACCELERATION:IN,PATHID:IN)`

`SPEED`: The constant translational speed, in mm/s, used for replaying the path. This speed is global; thus, the robot will attempt to replay all movements at this speed. For this reason, rotations without translation should be avoided.

`ACCELERATION`: The acceleration and the deceleration, in mm/s2, used for replaying the path. Use a lower number to achieve a softer acceleration at the beginning and the end of the path.

`PATHID`: The 4-number identifier of the path to be replayed.

Return values:

> 9: Path completed
>
> -1: General error
>
> -11: Specified path not found
>
> -13: Specified path is empty
>
> -14: Unable to open specified path file.

Example:

```
DECL INT retval
OR_INIT()
PTP {A1 0,A2 -90, A3 90, A4 0, A5 90, A6 0}
retval = OR_PATH_REPLAY(50, 50, 9159)
```

9.5   Force control

9.5.1 OR_BIAS()

Used for resetting (zeroing) the sensor values for a given load. Used for initial biasing of the sensor values during force control (except hand guiding) or biasing when the orientation of the sensor changes.

9.5.2 OR_FORCE_TORQUE_ON()

Activates the force control with predefined parameters. After the activation of the force control all movements will be superposed on the force control (either KUKA movement commands or path replay).

`OR_FORCE_TORQUE_ON(PARAM:IN)`

`PARAM` is the structure OR_FORCE_TORQUE_PARAM with the following fields:

`FRAME_TYPE`: The movement frame used for the force control. #BASE is the base coordinate system of the robot, fixed to the robot base. #TOOL is the frame fixed to the robot flange.

`ENABLE`: Defines the compliant axes with the OR_AXEN structure.

`FRAME_MOD`: Frame offset of the used coordinate system. Primary use is the rotation of the coordinate axes for force control along an oblique axis or plane.

`P_GAIN`: Proportional gain for the force controller. This is the most used parameter for basic force control. Determines how quickly the robot reacts to changes in force but can cause oscillations. These values should start small (1 for force, 0.1 for torque) and gradually increased to improve behavior.

`I_GAIN`: Integral gain of the force controller. Can be used to correct for persistent force errors (e.g. a sloped surface). Slows robot reactivity, increases overshooting.

`D_GAIN`: Derivative gain of the force controller. Can be used for damping controller induced oscillations. Slows robot reactivity, high value increases oscillations.

`FT`: Definition of the target force to be held along the axes defined by FRAME_TYPE and FRAME_MOD. Disabled axes will ignore this parameter.

`F_SQR_TH`: Force threshold for squared force sensitivity. Can be used as a soft force cutoff in low force cases (the lower the force, the less sensitive, reduces oscillations). If used all GAIN values must be drastically reduced.

`T_SQR_TH`: Torque threshold for squared torque sensitivity. Can be used as a soft torque cutoff in low torque cases (the lower the torque, the less sensitive, reduces oscillations). If used all GAIN values must be drastically reduced.

`MAX_TRANS_SPEED`: Maximum translational speed allowed by the force controller. [mm/s]

`MAX_ROT_SPEED`: Maximum angular velocity allowed by the force controller. [deg/s]

9.5.3 OR_FORCE_TORQUE_OFF()

This subprogram switches off the force control.

9.5.4 OR_WAIT()

Wait specified amount of time during force control.

`OR_WAIT(TIMEOUT:IN)`

`TIMEOUT`: Amount of time elapsed during the wait in milliseconds.

Return value:

   The specified amount of time passed.

9.5.5 Example force control

This example shows the parametrization of a force control movement that is compliant along all three translational axes while holding 20N in tool-z direction. After activation the robot waits two seconds (e.g. robot moves into contact) then moves 200 mm in the X-direction.

```
DECL OR_AXEN enable
DECL OR_FORCE_TORQUE_PARAM param
DECL POS pgain, dgain, igain, framemod, force
DECL INT retval, tmp


OR_INIT()


PTP {A1 0,A2 -90, A3 90, A4 0, A5 90, A6 0}


OR_BIAS()
enable = {X TRUE, Y TRUE, Z TRUE, A FALSE, B FALSE, C FALSE}
pgain = {X 1, Y 1, Z 1, A 0.1, B 0.1, C 0.1}
dgain = {X 0, Y 0, Z 0, A 0, B 0, C 0}
```

```
igain = {X 0, Y 0, Z 0, A 0, B 0, C 0}
framemod = {X 0, Y 0, Z 0, A 0, B 0, C 0}
force = {X 0, Y 0, Z 20, A 0, B 0, C 0}
param.FRAME_TYPE = #TOOL
param.ENABLE = enable
param.FRAME_MOD = framemod
param.P_GAIN = pgain
param.I_GAIN = igain
param.D_GAIN = dgain
param.FT = force
param.F_SQR_TH = 0
param.T_SQR_TH = 0
param.MAX_TRANS_SPEED = 0
param.MAX_ROT_SPEED = 0
OR_FORCE_TORQUE_ON(param)

;WAIT 2 sec
tmp = OR_WAIT(2000)

;KUKA MOVE
PTP_REL {X 200}
OR_FORCE_TORQUE_OFF()
```

10   Additional Software Options

10.1 Compute Box

10.1.1 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).

10.1.2 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
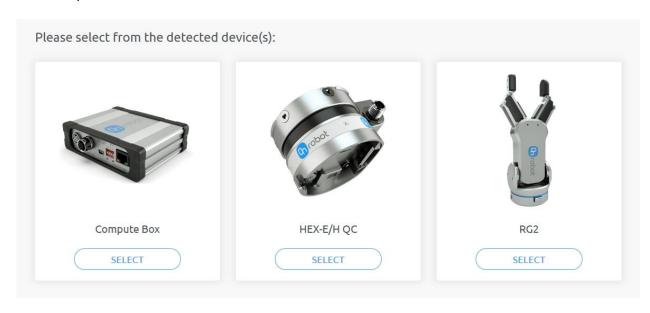
- - Account settings (e.g.: change password, add new user)

- - Select the language of the Web Client

In the following, these menus will be described.
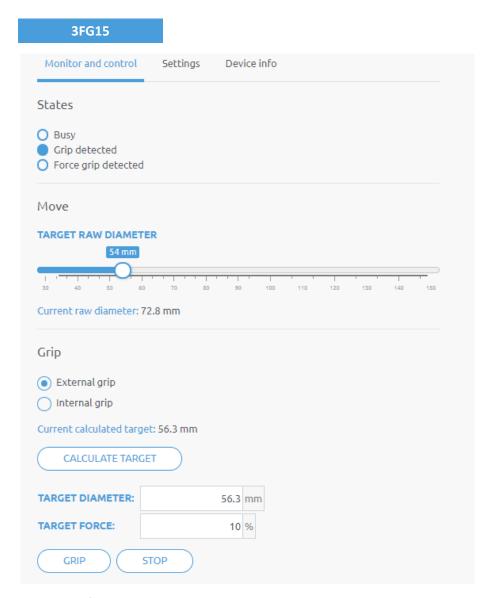
Devices menu

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

Please select from the detected device(s):

Compute Box	HEX-E/H QC	RG2
SELECT	SELECT	SELECT

3FG15

Monitor and control   Settings   Device info

States

○ Busy
● Grip detected
○ Force grip detected

Move

TARGET RAW DIAMETER

54 mm

30   40   50   60   70   80   90   100   110   120   130   140   150

Current raw diameter: 72.8 mm

Grip

⦿ External grip
○ Internal grip

Current calculated target: 56.3 mm

CALCULATE TARGET

TARGET DIAMETER: 56.3 mm

TARGET FORCE: 10 %

GRIP   STOP

The state of the gripper could be:

- **Busy** - the gripper is in motion

- **Grip detected** - the gripper has detected a workpiece

- **Force grip detected** - the gripper has applied the target force to a workpiece. This also activates a break. See more info in section

The gripper can be controlled in two modes:

- **Move** mode - The easiest way to move the gripper but the gripping force is limited (<50N). This should be used to release a part and open the gripper.

- **Grip** mode - This should be used to properly grip a part with a given target force. If the part is properly gripped (target force is reached) the break will engage to make sure the part will not be dropped in case of a power loss.

In **Move** mode:

The gripper can be controlled by adjusting the **Target raw diameter** slider. The actual values of the fingers are shown by the **Current raw diameter**. The raw diameter is considered to be without the finger tip offset.

In **Grip** mode:

First set how to grip the part:

- Externally or
- Internally

To grip on a part set the **Target Diameter** and **Target force** and click on the **Grip** button.

There are two ways how the target diameter can be given:

- Enter manually - make sure to add 3mm to the part diameter if it is gripped internally and subtract 3mm if it is gripped externally
- Use the **Calculate target** button:

  Move the fingers with the slider to touch the part and activate the **grip detected** (open fully for an internal grip or close fully for an external grip).

  Based on whether it will be external or internal the **Current calculated target** (diameter) for the grip is shown. The fingertip offset is either added or subtracted to compensate for the set fingertip.
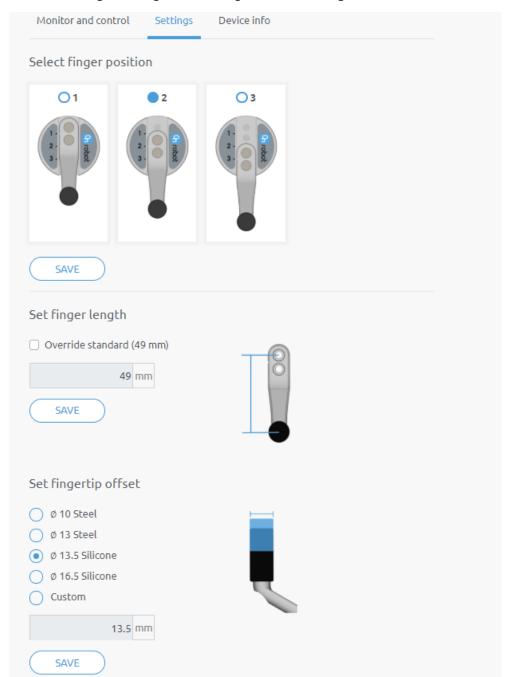
Grip type	Current calculated target value
External Grip	Current raw diameter - fingertip offset - 3 mm
Internal Grip	Current raw diameter + fingertip offset + 3 mm

  Click on the **Calculate target** button to load the calculated value to the **Target diameter**.

- If the grip was successful, the **Force grip detected** signal should be activated and the engaged brake should make a clicking sound.
- During the gripping the motion of the finger can be terminated by clicking on the **Stop** button.
- To release the part from a gripped status, move the gripper:
- Outward in case of an external grip
- Inward in case of an internal grip.

The default finger setting can be changed on the **Settings** tab:

- **Select finger position** - Select the mounted finger position and **Save**.
- **Set finger length** - If customized fingers are needed, the checkbox can be enabled, and the new finger length can be entered.
- **Set fingertip offset** - The 4 different types that are delivered with the gripper can be selected by pressing the radio button. If customized fingertips are made, the custom option can be selected.

Saving any of these 3 settings will automatically apply the changes. Different finger positions, fingertip diameters and finger lengths will allow to achieve different diameters and forces. Find more information in sections Gripping Forces and Gripping Diameters

Gecko

Gecko Gripper

This page allows the device to be monitored and controlled. By navigating to the Device info tab the device status is shown.
(Some functions might not be accessible without Admin permission.)

Monitor and control   Device info

Actual values

Preload force	0 N
Object distance	1.76 mm
Pad position	Pads are out
Part detected	●
Busy	○

(RESET ERRORS)

Set values

PAD POSITION

(PADS OUT) (PADS IN)

PRELOAD THRESHOLD

50 N

50   90   120

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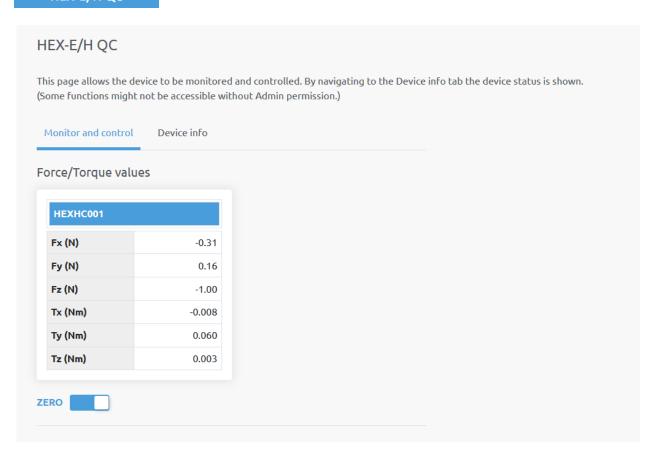
If a part was detected and the object distance becomes > 18mm (part is lost) BEFORE the pads are set to be IN (normal release) the **Pads worn** warning is displayed in the **Device info** tab.

To reset the warning:

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

HEX-E/H QC

HEX-E/H QC

This page allows the device to be monitored and controlled. By navigating to the Device info tab the device status is shown. (Some functions might not be accessible without Admin permission.)

Monitor and control   Device info

Force/Torque values

HEXHC001	
Fx (N)	-0.31
Fy (N)	0.16
Fz (N)	-1.00
Tx (Nm)	-0.008
Ty (Nm)	0.060
Tz (Nm)	0.003

ZERO

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.
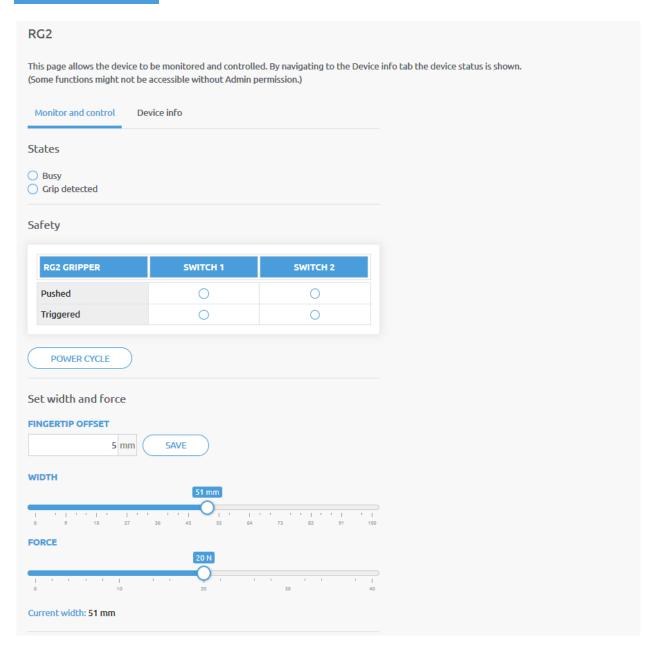
NOTE:

Zero value set on this page is not stored permanently and are restored to the default values on power reset.

RG2/6

RG2

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This page allows the device to be monitored and controlled. By navigating to the Device info tab the device status is shown. (Some functions might not be accessible without Admin permission.)

Monitor and control   Device info

States

○ Busy
○ Grip detected

Safety

RG2 GRIPPER	SWITCH 1	SWITCH 2
Pushed	○	○
Triggered	○	○

(POWER CYCLE)

Set width and force

FINGERTIP OFFSET

[5] mm   (SAVE)

WIDTH

51 mm

0	9	18	27	36	45	55	64	73	82	91	100

FORCE

20 N

0	10	20	30	40

Current width: 51 mm

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
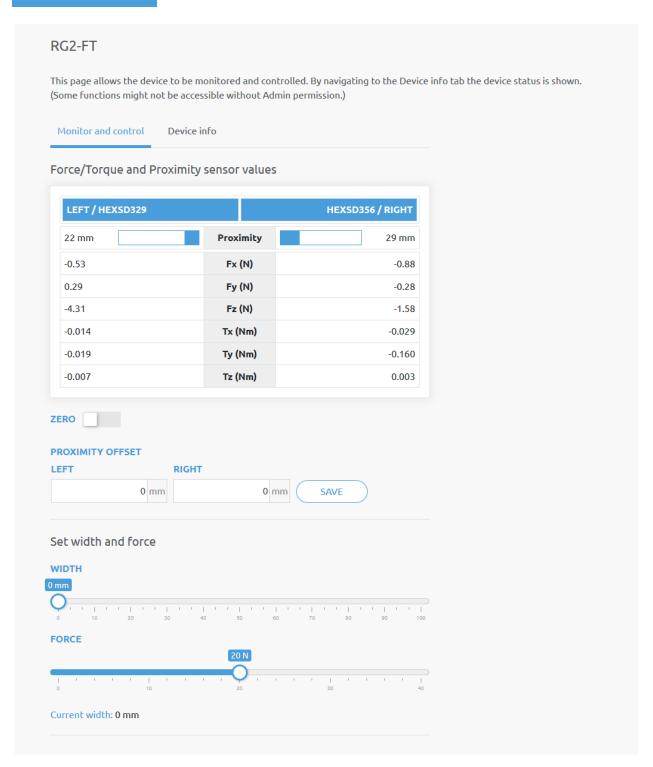
- Click on **Power cycle** to power all devices off and then on to recover.

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.

onrobot

RG2-FT

RG2-FT

This page allows the device to be monitored and controlled. By navigating to the Device info tab the device status is shown. (Some functions might not be accessible without Admin permission.)

Monitor and control   Device info

Force/Torque and Proximity sensor values

LEFT / HEXSD329		HEXSD356 / RIGHT
22 mm	Proximity	29 mm
-0.53	Fx (N)	-0.88
0.29	Fy (N)	-0.28
-4.31	Fz (N)	-1.58
-0.014	Tx (Nm)	-0.029
-0.019	Ty (Nm)	-0.160
-0.007	Tz (Nm)	0.003

ZERO

PROXIMITY OFFSET

LEFT   **RIGHT**

0 mm   0 mm   SAVE

Set width and force

WIDTH

0 mm

0   10   20   30   40   50   60   70   80   90   100

FORCE

20 N

0   10   20   30   40

Current width: 0 mm

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.
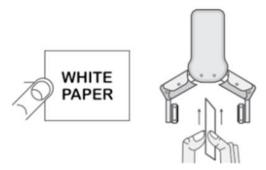
NOTE:

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.
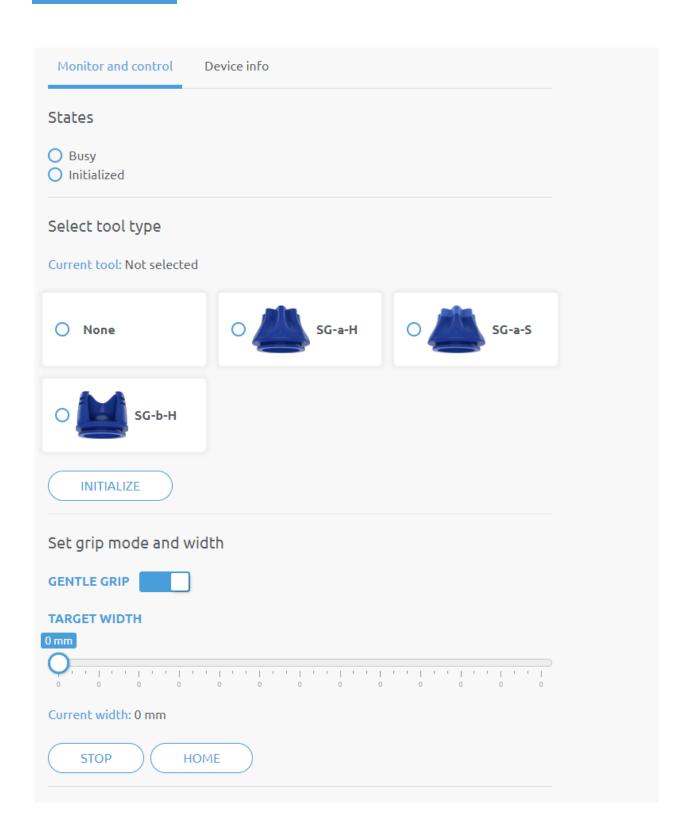
NOTE:

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.

SG

Monitor and control   Device info

States

○ Busy
○ Initialized

Select tool type

Current tool: Not selected

○ None

○ SG-a-H

○ SG-a-S

○ SG-b-H

INITIALIZE

Set grip mode and width

GENTLE GRIP

TARGET WIDTH

0 mm

0   0   0   0   0   0   0   0   0   0   0   0

Current width: 0 mm

STOP   HOME

The **state** of the gripper could be:

- **Busy** - the gripper is moving
- **Initialized** - the gripper has been initialized.

Select tool type

- **Current tool** - Shows the currently selected SG tool. Select the desired SG tool, by clicking the adjacent radio button.
- Click on **Initialize** to initialize the selected SG tool

The state of the gripper could be:

- **Busy** - the gripper is moving
- **Initialized** - the gripper is initialized

Set grip mode and width
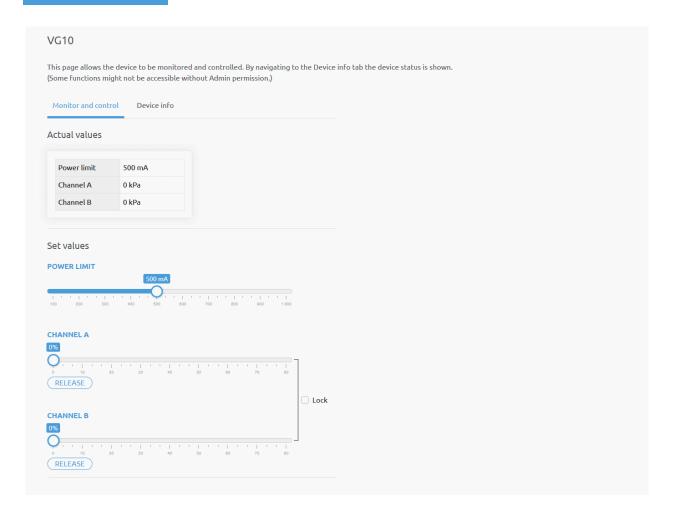
The default gripping speed is set as **Gentle Grip**, the gripping speed is reduced at 12.5mm before the specified target width, this results in a gentler grip, compared to normal grip settings.

The gripper can be controlled by adjusting the **Target Width** slider, this will immediately control the gripper.

- **Current Width** - shows the current width of the gripper.
- **Stop** button - stops the ongoing procedure.
- **Home** button - moves the gripper to its home position.

VG10 / VGC10

VG10

This page allows the device to be monitored and controlled. By navigating to the Device info tab the device status is shown.
(Some functions might not be accessible without Admin permission.)

Monitor and control   Device info

Actual values

Power limit	500 mA
Channel A	0 kPa
Channel B	0 kPa

Set values

POWER LIMIT

500 mA

100   200   300   400   500   600   700   800   900   1 000

CHANNEL A

0%

0   10   20   30   40   50   60   70   80

RELEASE

☐ Lock

CHANNEL B

0%

0   10   20   30   40   50   60   70   80

RELEASE

The actual vacuum level for **Channel A** and **Channel B** can be seen in percentage (in the range of 0...80 kPa vacuum). The actual value of the **Power limit** is shown in mA.

The **Power limit** can be adjusted in the range of 0...1000mA with the slider.

NOTE:

The power limit set in this page is not stored permanently and always restored to the default value on power reset.

Higher power limit value means the required vacuum level is reached faster (higher airflow), but if it is set too fast overshoot may occur.

Low power limit may not be enough for higher percentage of vacuum and the target vacuum level may not be reached.
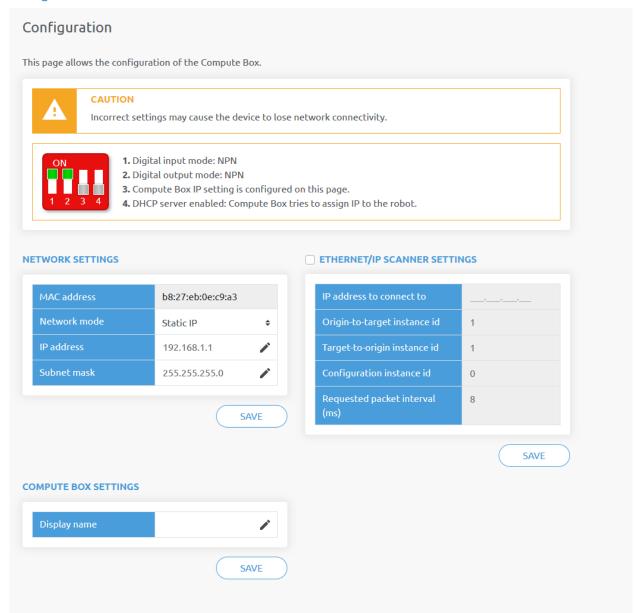
The **Channel A** and **Channel B** vacuum level can be set individually or in tandem by checking the **Lock** checkbox.

Make sure to set high enough vacuum before you grip and lift any object.

To release the gripped object, click on the **Release** button.

Configuration menu

Configuration

This page allows the configuration of the Compute Box.

> ⚠️ **CAUTION**
> Incorrect settings may cause the device to lose network connectivity.

1. Digital input mode: NPN
2. Digital output mode: NPN
3. Compute Box IP setting is configured on this page.
4. DHCP server enabled: Compute Box tries to assign IP to the robot.

NETWORK SETTINGS

MAC address	b8:27:eb:0e:c9:a3
Network mode	Static IP
IP address	192.168.1.1
Subnet mask	255.255.255.0

SAVE

☐ **ETHERNET/IP SCANNER SETTINGS**

IP address to connect to	___.___.___.___
Origin-to-target instance id	1
Target-to-origin instance id	1
Configuration instance id	0
Requested packet interval (ms)	8

SAVE

COMPUTE BOX SETTINGS

Display name	

SAVE

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.

  (placeholder)

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).
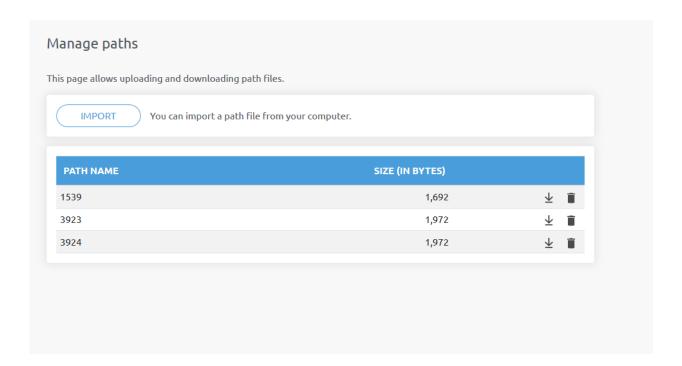
Paths menu

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:
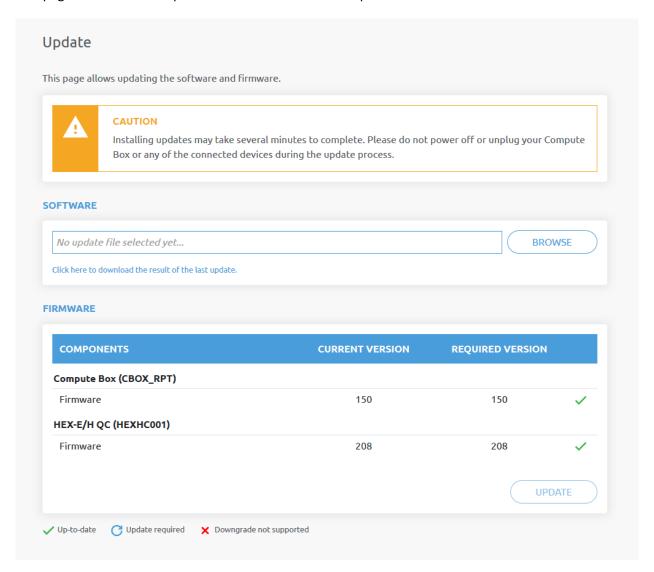
Always make sure that you do not delete any path that is currently in use in any of your robot programs. Otherwise the path will need to be re-recorded, since the delete operation cannot be undone.

The Compute Box can store up to 100 Mbytes of paths that is roughly equal to 1000 hours of recordings.

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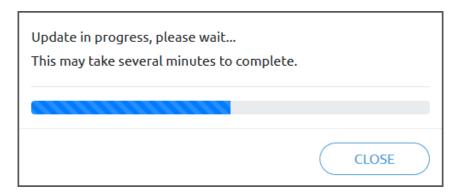
This page can be used to update the software on the Compute Box and the firmware on the devices.

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:

Successfully updated.

CLOSE
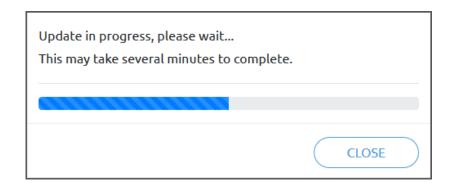
Now disconnect the device and use it as usual.

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.
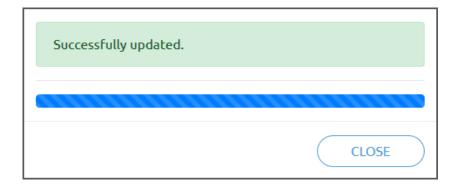
Update in progress, please wait...
This may take several minutes to complete.

CLOSE

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.

![OnRobot logo]

Account settings

This menu can be used to:

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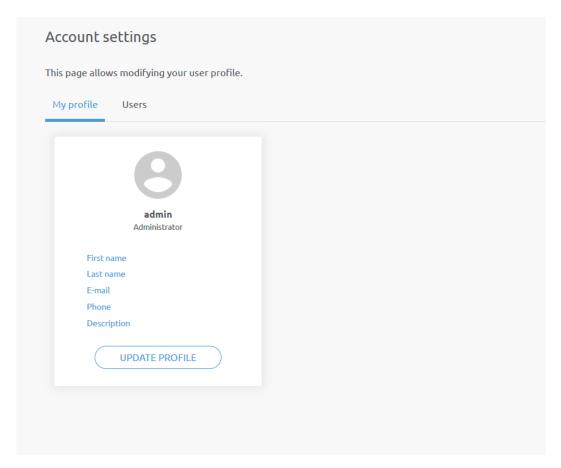
Account settings:

This page has two tabs:
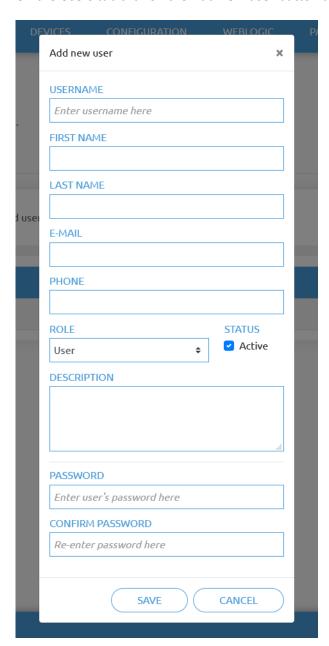
- **My profile** - to see and update the currently logged in users' profile (e.g.: change password)
- **Users** - to manage users (e.g.: add/remove/edit)

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:
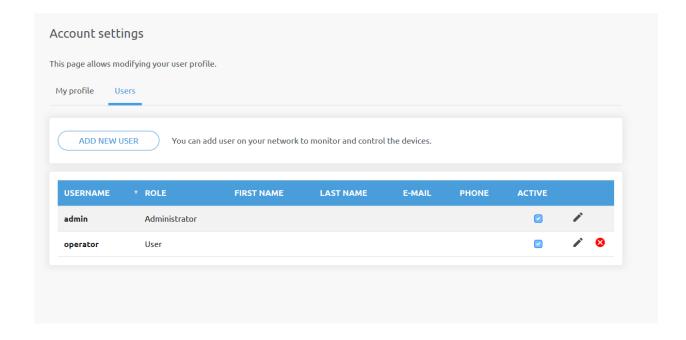
There are three user levels:

- 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.

11 Hardware Specification

11.1 Technical sheets

3FG15

General Properties		Minimum	Typical	Maximum	Unit
Payload Force Fit		- -	- -	10 22	[kg] [lb]
Payload Form Fit		- -	- -	15 33	[kg] [lb]
Grip Diameter*	External	4 0.16		152 5.98	[mm] [inch]
	Internal	35 1.38	- -	176 6.93	[mm] [inch]
Finger position resolution		- -	0.1 0.004	- -	[mm] [inch]
Diameter repetition accuracy		- -	0.1 0.004	0.2 0.007	[mm] [inch]
Gripping force		10	-	240	[N]
Gripping force (adjustable)		1	-	100	[%]
Gripping speed (diameter change)		-	-	125	[mm/s]
Gripping time (including brake activation)**		-	500	-	[ms]
Hold workpiece if power loss?		Yes			
Storage temperature		0 32	- -	60 122	[°C] [°F]
Motor		Integrated, electric BLDC			
IP Classification		IP67			
Dimensions [L, W, Ø]		156 x 158 x 180 6.14 x 6.22 x 7.08			[mm] [inch]
Weight		1.15 2.5			[kg] [lb]

* With the scope of delivery

** 10 mm diameter distance. Also see section **Finger movement and force on page 171**

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	43	-	1500*	[mA]
Operating temperature	5 41	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

*600 mA set as default.
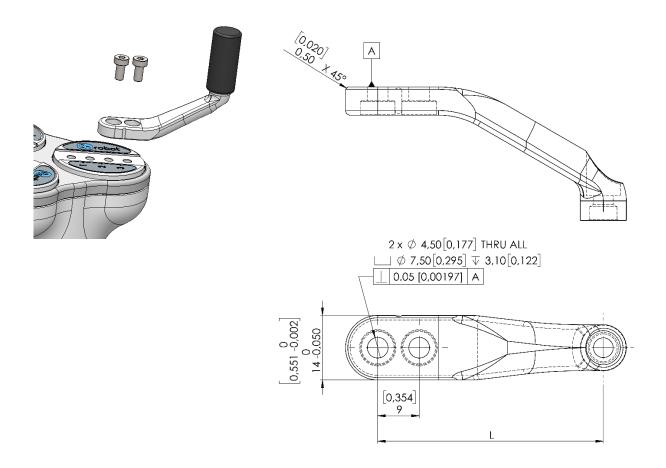
Fingers

The supplied fingers can be mounted in 3 different positions to achieve different **Gripping Forces below** and different **Gripping Diameters below**.

The delivered finger length is 49 mm (L in the drawing below). If custom fingers are required, they can be made to fit the Gripper according to the dimensions (mm)[inch] shown below. The needed screws are M4x8mm:

$[0.020]$
0.50 X 45°

A

2 x ⌀ 4,50 [0,177] THRU ALL
⌀ 7,50 [0,295] ⤓ 3,10 [0,122]
⟂ 0.05 [0,00197] A

$[0.551 \; ^{0}_{-0,002}]$
$14 \; ^{0}_{-0,050}$

$[0,354]$
9

L
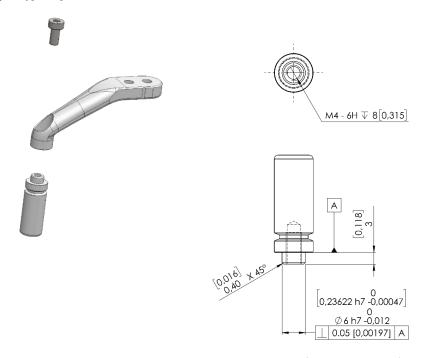
Fingertips
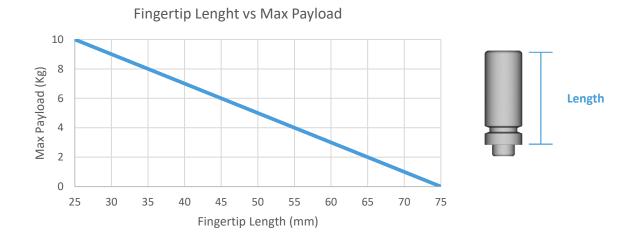
The supplied fingertips are listed below. Different fingertips will allow to achieve different **Gripping Forces below** and different **Gripping Diameters below**.

- Ø10 mm steel
- Ø13 mm steel
- Ø13.5 mm silicone
- Ø16.5 mm silicone

If custom fingertips are required, they can be made to fit the Gripper's fingers according to the dimensions (mm)[inch] shown below. The needed screws are M4x8mm:
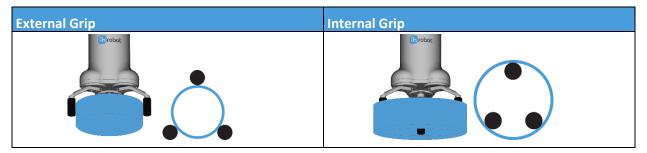
In the graph below, the maximum payload allowed for customized fingertip given a length is shown.

Types of Grips
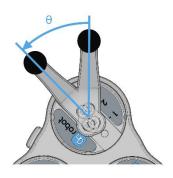
In the document the internal and external grip terms are used. These grips are related to how the workpiece is gripped.

External Grip	Internal Grip
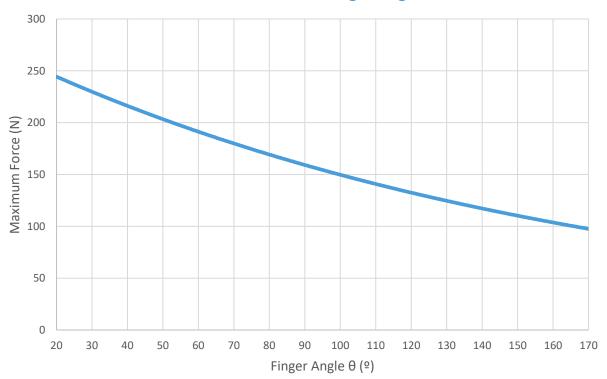
Gripping Force

The total gripping force highly depends on the finger angle θ. For both internal and external grip, the lower the finger angle, the higher the force that will be applied as shown in the graph below.

Although the fingers can move from 0 to 180, the angle range of an external grip is 30º-165º and for an internal grip 20º-160º

Maximum Force and Finger Angle θ

Graph plotted using measurements with 1 A current, silicone fingertips and a metal workpiece.

> **NOTE**:
>
> The total force applied depends on the finger angle, the input current (limited in some robots' tool flange connection) and the friction coefficient between the materials of the fingertips and the workpiece.

Finger movement and force

The gripping action has two phases:

Phase 1: For a safety reason, the fingers will start moving with a low force (maximum ~50 N) to avoid damaging anything that could get clamped between the gripper fingers and the workpiece.

Phase 2: When the gripper diameter is very close to the programed target diameter, the gripper will increase the force to grip with the programed target force. After the grip, a break will be activated (tic sound). The activation of the brake, also known as, Force grip detected, can be verified in the GUI. This brake will hold the workpiece with the applied force, with no power consumption and holding the workpiece in case of power loss. This brake will automatically be deactivated when the gripper performs a release or a new grip command. While programming the gripper, the brake can be deactivated by using the features in the GUI.

Gripping Diameter

The different configurations of the delivered finger and fingertips allow to achieve a wide range of diameters.

Finger Position	Fingertip (mm)	External Gripping range (mm)	Internal Gripping range (mm)
1	Ø10	10 - 117	35 - 135
	Ø13	7 - 114	38 - 138
	Ø16.5	4 - 111	41 - 140
2	Ø10	26 - 134	49 - 153
	Ø13	23 - 131	52 - 156
	Ø16.5	20 - 128	55 - 158
3	Ø10	44 - 152	65 - 172
	Ø13	41 - 149	68 - 174
	Ø16.5	38 - 146	71 - 176

Based on:

- Angle for external gripping min 165º (Pos 1), 163 º (Pos 2), 161 º (Pos 3) and max 30º (all 3 positions)
- Angle for internal gripping min 160º and max 30º

The closer to the maximum diameter range, the lower the angle and, therefore, the higher the force.

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 Payload [kg]						Preload - 90N Payload [kg]						Preload - 40N 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.

Txy & Fxyz

Tz & Fxyz

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]

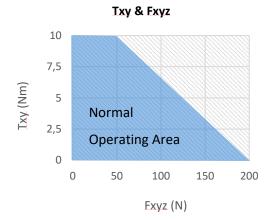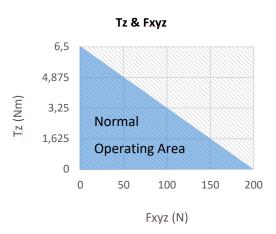### Complex loading

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.

Txy & Fxyz

Normal Operating Area

Txy (Nm) vs Fxyz (N)

Tz & Fxyz

Normal Operating Area

Tz (Nm) vs Fxyz

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 below.

	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				

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 184

** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on page 184.

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				[%]
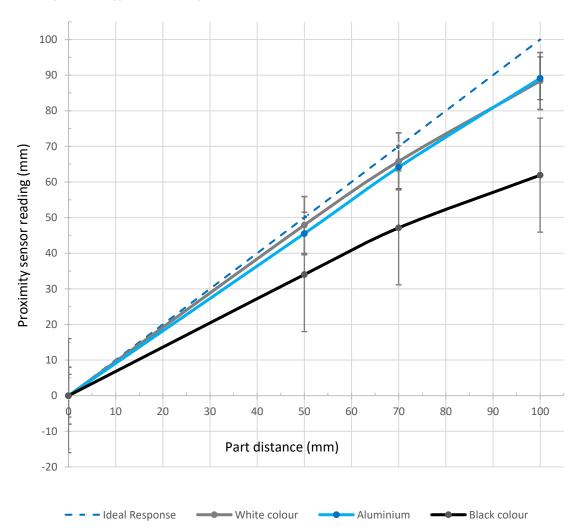
Proximity Sensor Properties	Min	Typical	Max	Units
Sensing range	0 0	- -	100 3.93	[mm] [inch]
Precision	- -	2 0.078	- -	[mm] [inch]
Non-linearity*	-	12	-	[%]

* the non-linearity refers to the max value and depends on the object properties (e.g. surface type and color)
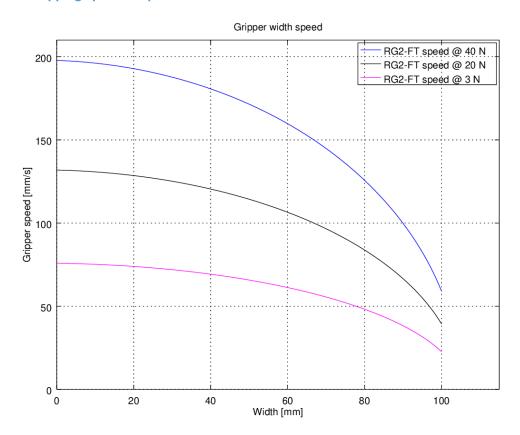
Operating Conditions	Minimum	Typical	Maximum	Unit
Power requirement (PELV)	24	-	24	[V]
Power consumption	6.5	-	22	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

Proximity sensor typical accuracy

185
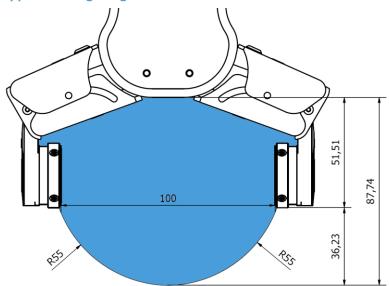
RG2-FT Gripping Speed Graph

Gripper Working Range
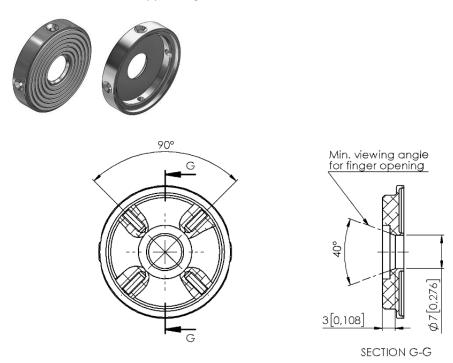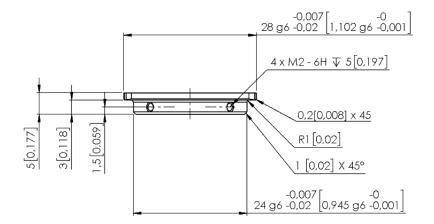
The dimensions are in millimeters.
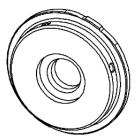
Fingertips

The standard fingertips can be used for many different workpieces. If custom fingertips are required, they can be made to fit the Gripper fingers.

90°

Min. viewing angle
for finger opening

40°

3[0,108]   Ø7[0,276]

SECTION G-G

$$28 \text{ g6} \begin{array}{c} -0,007 \\ -0,02 \end{array} \left[1,102 \text{ g6} \begin{array}{c} -0 \\ -0,001 \end{array} \right]$$

4 x M2 - 6H ⍌ 5[0,197]

0,2[0,008] x 45

R1[0,02]

1 [0,02] X 45°

$$24 \text{ g6} \begin{array}{c} -0,007 \\ -0,02 \end{array} \left[0,945 \text{ g6} \begin{array}{c} -0 \\ -0,001 \end{array} \right]$$

5[0,177]   3[0,118]   1,5[0,059]

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	- -	60 140	[°C] [°F]
Motor	Integrated, electric BLDC				
IP Classification	IP54				
Dimensions	213 x 149 x 36 8.3 x 5.9 x 1.4				[mm] [inch]
Weight	0.78 1.72				[kg] [lb]

*See table on the next page

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

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

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

RG2 Gripping Speed Graph

RG2 Work Range

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

Fingertips

The standard fingertips can be used for many different workpieces. If custom fingertips are required, they can be made to fit the Gripper's fingers according to the dimensions (mm) shown below:

RG6

General Properties		Minimum	Typical	Maximum	Unit
Payload Force Fit		-	-	6	[kg]
		-	-	13.2	[lb]
Payload Form Fit		-	-	10	[Kg]
		-	-	22.04	[lb]
Total stroke (adjustable)		0	-	160	[mm]
		-	-	6.3	[inch]
Finger position resolution		-	0.1	-	[mm]
		-	0.004	-	[inch]
Repetition accuracy		-	0.1	0.2	[mm]
		-	0.004	0.007	[inch]
Reversing backlash		0.1	-	0.3	[mm]
		0.004	-	0.011	[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		60	[°C]
		32		140	[°F]
Motor		Integrated, electric BLDC			
IP Classification		54			
Dimensions		262 x 212 x 42			[mm]
		10.3 x 8.3 x 1.6			[inch]
Weight		1.25			[kg]
		2.76			[lb]

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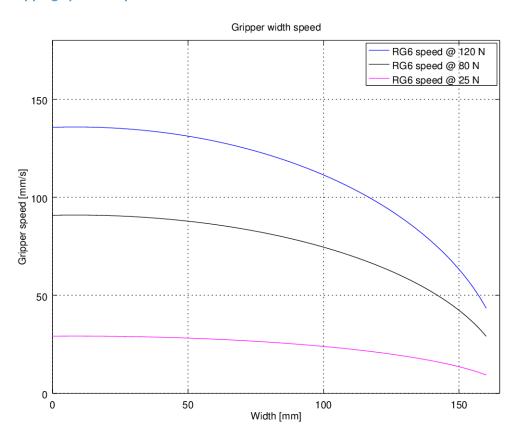
** based on 8mm total movement between fingers. The speed is linearly proportional to the force. For more details see speed table on next page.

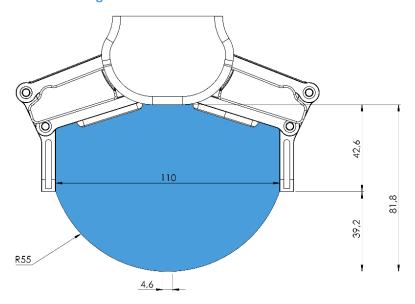| Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	70	-	600*	[mA]
Operating temperature	5	-	50	[°C]
	41	-	122	[°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]
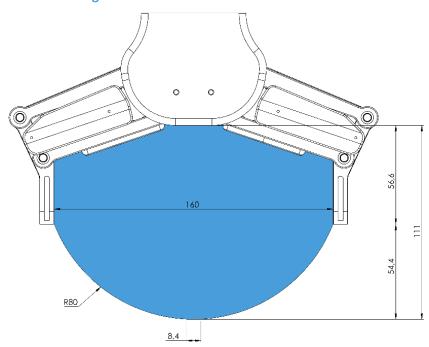
*Current spikes up to 3A (max 6mS) may occur during the release action.
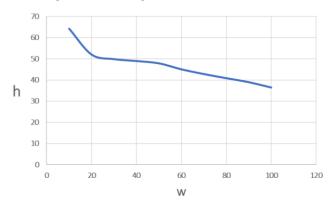
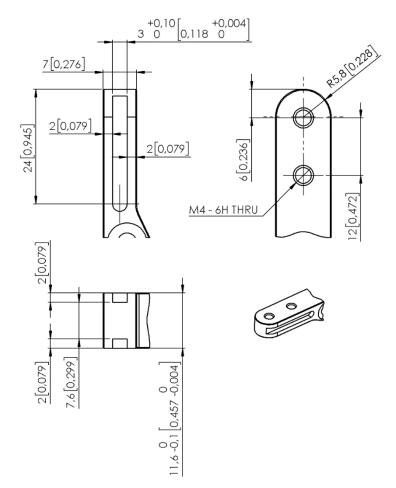### RG6 Gripping Speed Graph
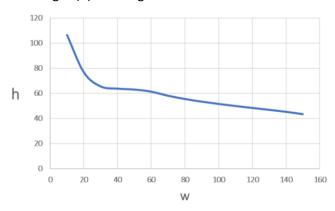
RG6 Work Range
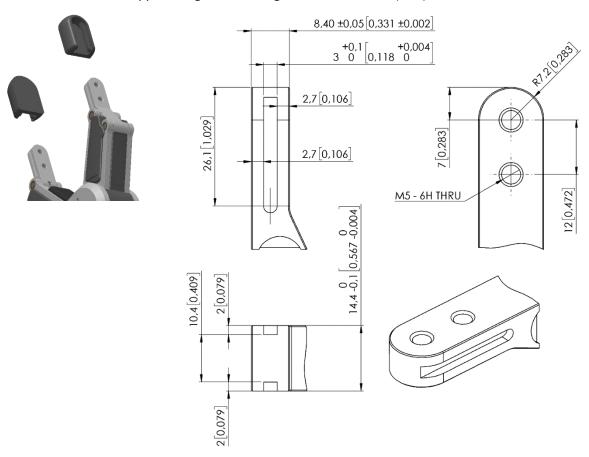
Gripping on long objects can unintentionally activate the Safety switches. The maximum workpiece height (calculated from the end of the fingertips) is dependent on the gripping width (w). For various width values the height (h) limit is given below:

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:

| SG | | | | |

General Properties	Minimum	Typical	Maximum	Unit
Total spindle stroke	11 0.43	-	40 1.57	[mm] [inch]
Spindle position resolution	-	0.1 0.0039	-	[mm] [inch]
Spindle force	-	-	380	[N]
Spindle speed	-	-	37 1.46	[mm/s] [inch/s]
Gripping time* (SG-a-H)	-	-	32	[grip/min]
SG-tool attachment mechanism	Smart lock			
Motor	Integrated, electric BLDC			
IP Classification	IP67			
Dimensions (H x Ø)	84 x 98 3.3 x 3.85			[mm] [inch]
Weight	0.77 1.69			[kg] [lb]

*Gripping time is tool depended. See the separate SG Datasheet for the tool specific gripping time.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20	24	25	[V]
Current consumption	45	-	600	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Storage temperature	0 32	- -	60 140	[C] [F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[Hours]

NOTE:

For technical specification for the SG-tools, see the separate SG Datasheet.

How to handle a workpiece

With the elastic silicone SG tools, the gripper can handle a wide range of workpieces, for a high number of applications. Different tool designs have some overlap in capability when handling the same workpiece, but the tools have different characteristics and do have individual effectiveness on a given workpiece.

Soft silicone

Some SG tool designs has a soft silicone part in the top of the gripper. These tools are better suited for handling fragile workpieces and/or workpieces with a high variance in size, compared to the hard silicone tools. This is due to the more "forgiving" nature of the soft part. The user may experience a reduced payload compared to the hard silicone tools.

To handle a workpiece properly, the user must know some parameters that are defined by the general conditions of the workpiece and its presentation in the application. This helps to define which tool to choose and the actual grip width on it.

A general overview of such parameters is listed below:

- Shape
- Dimension
- Weight
- Roughness
- Fragility
- Orientation of pick/placement

For a better understanding of how to handle workpieces with different parameters, tests were conducted with a SG-a-H tool, see table below.

Example of material	Workpiece	Dimension	Weight	Roughness	Shape	Actual gripping width
Smooth wood (Sanded)	Round stick	27mm	32g	5	Cylinder	20mm
Polished metal	Aluminum cube	35x25mm	512g	1	Square	15mm
Rough metal	Aluminum cylinder	60mm	490g	8	Cylinder	55mm
Plastic	PET Bottle	65mm	431g	1	Cylinder	50mm
	POM-C	50mm	221g	2	Cylinder	42mm
	POM-C	50mm	1410g	2	Cylinder	15mm
Glass	Drinking glass	68mm	238g	1	Cylinder	50mm
Organic material	Tomato	54mm	92g	2	Round	53mm
	Mushroom	40mm	8g	10	Round	39mm
	Grape	20mm	7g	10	Oval	16mm
Carbonfiber	Carbonfiber cylinder	38mm	48g	7	Cylinder	29mm

Notice objects with high weight needs higher force asserted upon them, therefor the small gripping width.

NOTE:

The results shown in the table above, should be considered as indicative and may vary. The actual grip width always require testing, for verification.

It is often a good idea to set a target width smaller, than actual workpiece width, to reach a higher surface contact area and to accommodate for vibrations and other unexpected conditions.

For heavy and large workpieces test at low velocity and with caution.

NOTE:

For individual SG-tool examples. See the separate SG-tool manual.

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

Roughness	Description	Example
1	Polished/Smooth	Polished Metal
5	Textured	Cardboard
10	Rough	Sandblasted Metal
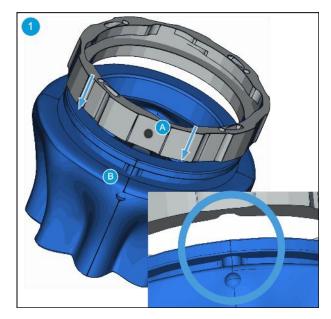
WARNING:
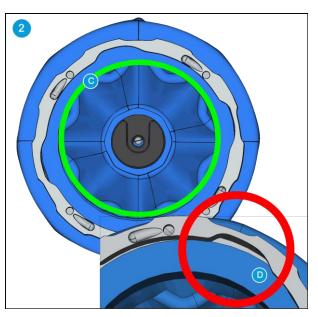
Sharp edges, on a workpiece, may damage the silicone and reduce lifetime of the tool.

SG Tool Mounting Guide
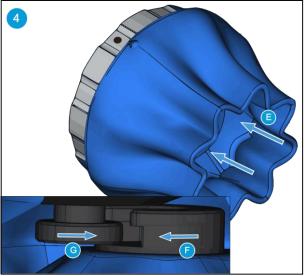
Rotate the ring so marking **(A)** facing you. Align the dot on the SG tool **(B)** with marking **(A)**. Make them fit together and mount the ring onto the SG tool.

Press the SG tool up against the ring until it fits perfectly **(C)**. Make sure there is no gap between the SG tool and the ring **(D)**.
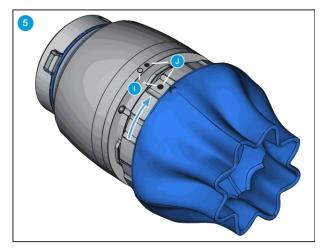
It is highly recommended to install the SG Base Part on the robot before installing the SG tool. Make sure the SG Base Part is in home position or initialized.

Use your thumbs to press the inside of the SG tool **(E)**. This will make the smart lock female **(F)** visible. Locate the marking on the ring as described in step 1. Slide the SG tool smart lock female **(F)** and the smart lock male **(G)** together.

Align the markings **(I)**. Press the SG tool into the SG Base Part and rotate CW to align the two markings **(J)**.

Scan for mounting guide video.

⚠️ **WARNING:**

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

VG10

General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[L/min]
Arms adjustment		0	-	270	[°]
Arm holding torque		-	6	-	[Nm]
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]		
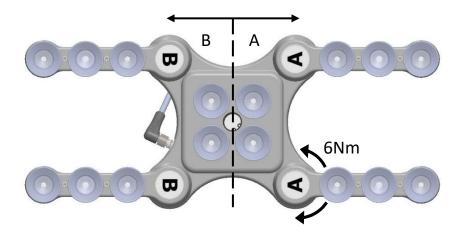
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[hours]

Positioning the VG10 arms and channels

The arms can be folded to the preferred position simply by pulling in the arms. The torque needed to overcome the friction in the rotatable joints of the arm is high (6 N/m) to ensure that the arms do not move when handling 15 kg payloads.

The VG10 suction cups are grouped into two independent channels.

When the four arms are adjusted to preferred angles, it is recommended to add the accompanied arrow stickers. This allows for easy realignment and exchanging between different work items.

Payload

The lifting capacity of the VG grippers depends primarily on the following parameters:

- Vacuum cups
- Vacuum
- Air flow

Vacuum Cups

Choosing the right vacuum cups for your application is essential. The VG grippers come with common 15, 30 and 40 mm silicone vacuum cups (see table below) which are good for hard and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards.

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	15	6	29
	30	16	200
	40	24	450

For non-porous materials, the OnRobot suction cups are highly recommended. Some of the most common non-porous materials are listed below:

- Composites
- Glass
- High density cardboard
- High density paper
- Metals
- Plastic
- Porous materials with a sealed surface
- Varnished wood

In an ideal case, working with non-porous material workpieces where there are no air flow going through the workpiece, the table below shows the number of cups and the cup size needed depending on the payload (workpiece mass) and the vacuum used.

Number of Cups needed for non-porous materials depending on payload and vacuum:

Payload (kg)	15mm Vacuum (kPa)				30mm Vacuum (kPa)				40mm Vacuum (kPa)			
	20	40	60	75	20	40	60	75	20	40	60	75
0.1	3	2	1	1	1	1	1	1	1	1	1	1
0.5	13	7	5	4	2	1	1	1	1	1	1	1
1	-	13	9	7	4	2	2	1	2	1	1	1
2	-	-	-	14	8	4	3	2	4	2	2	1
3	-	-	-	-	12	6	4	3	5	3	2	2
4	-	-	-	-	15	8	5	4	7	4	3	2
5	-	-	-	-	-	10	7	5	9	5	3	3
6	-	-	-	-	-	12	8	6	10	5	4	3
7	-	-	-	-	-	13	9	7	12	6	4	4
8	-	-	-	-	-	15	10	8	14	7	5	4
9	-	-	-	-	-	-	12	9	15	8	5	4
10	-	-	-	-	-	-	13	10	-	9	6	5
11	-	-	-	-	-	-	14	11	-	9	6	5
12	-	-	-	-	-	-	15	12	-	10	7	6
13	-	-	-	-	-	-	16	13	-	11	8	6
14	-	-	-	-	-	-	-	14	-	12	8	7
15	-	-	-	-	-	-	-	15	-	13	9	7

NOTE:

To use more than 7 (15mm), 4 (30mm) or 3 (40mm) vacuum cups with the VGC10 a customized adaptor plate is needed.

The table above is created with the following formula that equalizes the lifting force with the payload considering 1.5G of acceleration.

$$\text{Amount}_{\text{Cups}} * \text{Area}_{\text{Cup}}[\text{mm}] = 14700 \frac{\text{Payload [kg]}}{\text{Vacuum [kPa]}}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

When using porous materials, the vacuum that can be achieve by using the OnRobot suction cups will depend on the material itself and will be between the range stated in the specifications. Some of the most common non-porous materials are listed below:

- Fabrics
- Foam
- Foam with open cells
- Low density cardboard

- Low density paper

- Perforated materials

- Untreated wood

See the table below with general recommendations, in case other suction cups are needed for specific materials.

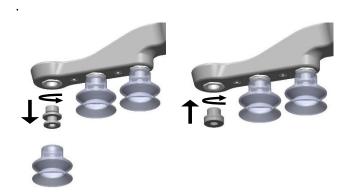| Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:

It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

Fittings and Blind Screws.

It is possible to change suction cups simply by pulling them off the fittings. It might be a bit challenging to remove the 15 mm Diameter vacuum cups. As suggestion try to stretch the silicon to one of the sides and then pull it out.

Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. The fittings and the blinding screws are mounted or dismounted by screwing (2Nm tightening torque) or unscrewing them with the provided 3 mm Allen key.

.

The thread size is the commonly used G1/8"; allowing for standard fittings, blinders and extenders to be fitted directly to the VG grippers.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum in kPa setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.
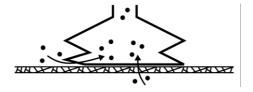
The pressure in the atmosphere varies with weather, temperature and altitude. The VG grippers automatically compensate for altitudes up to 2km, where the pressure is about 80% of sea level.

Air flow

Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips

- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).

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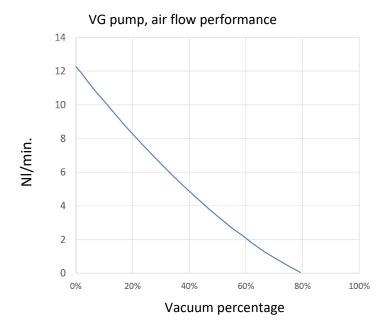

Therefore, the users must be aware of the following:

- VG grippers are not suitable for most uncoated, coarse cardboard boxes.

- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG grippers is shown in the graph below:

VG pump, air flow performance

NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG grippers.

A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG gripper filters and vacuum cups will last longer.

VGC10

General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[L/min]
Payload	With default attachments	- -	- -	6 * 13.2 *	[kg] [lb]
	With customized attachments	- -	10 22	15 33.1	[kg] [lb]
Vacuum cups		1	-	7	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Vacuum pump		Integrated, electric BLDC			
Dust filters		Integrated 50µm, field replaceable			
IP Classification		IP54			
Dimensions		101 x 100 x 100 3.97 x 3.94 x 3.94	[mm] [inch]		
Weight		0.814 1.79	[kg] [lb]		

* By using three 40mm cups. More info in the table **Number of Cups needed for non-porous materials depending on payload and vacuum**.
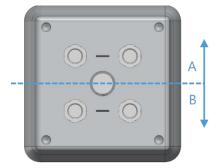
Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated MTBF (operating life)	30.000	-	-	[hours]

2 channels

The VGC10 has 4 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channels A and B independently for vacuum.

Adaptor Plate

The VGC10 comes with an Adaptor Plate which provides extra flexibility to locate the vacuum cups in different configurations.

The Adaptor Plate has 7 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channel A and B independently for vacuum.
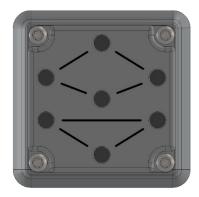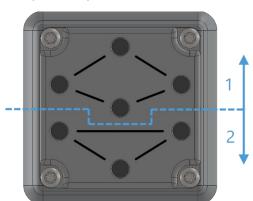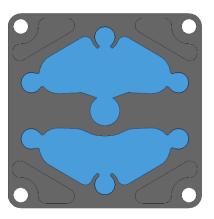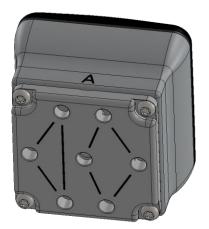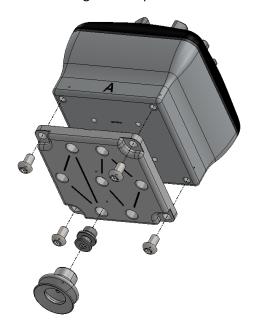

The Adaptor Plate can be placed in different positions by rotating it 90º. Having as reference the letters A and B written on the gripper housing, the Adaptor Plate can be placed to separate both channels or to communicate them. If the Adaptor Plate is placed as in picture below on the left, both channels will be separated, and they can be used independently or combined. If the Adaptor Plate is placed as in picture below on the right, both channels will be communicated and a higher air flow can be achieved, although both channels will have to be used combined.

To mount the Adaptor Plate simply remove the 4 fittings or blinding screws from the gripper, place the Adaptor Plate by choosing the right angle according to the desired configuration, and tighten the 4 screws with 4 Nm tighten torque.

NOTE:

Please, note that the O-Ring in the Adaptor Plate is not glued therefore it can be pulled out. If that happens simply put it back in place and the gripper will work as before.

Extension Pipe

The Extension Pipe provides an extra length of 50 mm to reach narrow spaces.

NOTE:

Remember to use the Adaptor Plate rotated to achieve a higher air flow when using both channels together.

The Extension Pipe can be mounted in any of the holes by simply screwing it in and adding a fitting on top as shown in the image below.
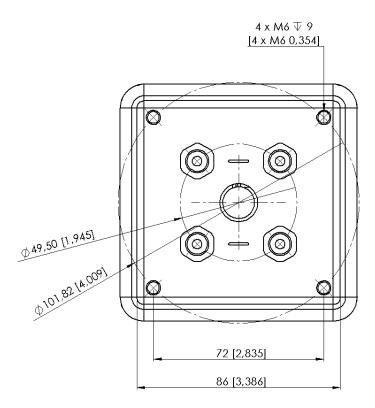
Below different mounting configurations with the provided attachments are shown.

Customized Adaptor Plates and Push-in Fittings

The design of the VGC10 is meant to facilitate the users to make their own adaptor plates to create different kinds of configurations. The dimensions needed to create a customized adaptor plate are shown in the image below.
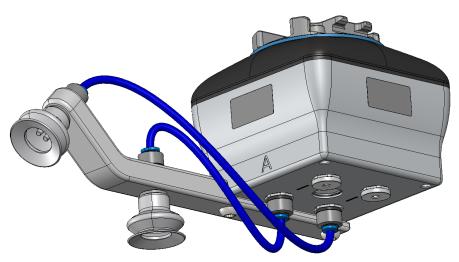
The Push-in Fittings are used to attach 4 mm vacuum tubes to create customized configuration that required remote vacuum. In most cases, this size is enough for generating the needed vacuum from the pump in the gripper.
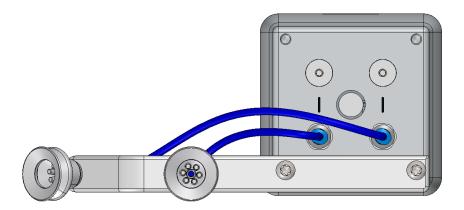
The commercial name of the Push-in Fittings is Fitting QSM-G1/8-4-I-R in case some more units need to be purchased.

An example of a customized configuration with a homemade adaptor plate and remote vacuum is shown below.

The image below shows how the push-in fittings and the normal fittings are communicated.

Payload

The lifting capacity of the VG grippers depends primarily on the following parameters:

- Vacuum cups
- Vacuum
- Air flow

Vacuum Cups

Choosing the right vacuum cups for your application is essential. The VG grippers come with common 15, 30 and 40 mm silicone vacuum cups (see table below) which are good for hard and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards.

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	15	6	29
	30	16	200
	40	24	450

For non-porous materials, the OnRobot suction cups are highly recommended. Some of the most common non-porous materials are listed below:

- Composites
- Glass
- High density cardboard
- High density paper
- Metals
- Plastic
- Porous materials with a sealed surface
- Varnished wood

In an ideal case, working with non-porous material workpieces where there are no air flow going through the workpiece, the table below shows the number of cups and the cup size needed depending on the payload (workpiece mass) and the vacuum used.

Number of Cups needed for non-porous materials depending on payload and vacuum:

	15mm				30mm				40mm			
Payload (kg)	Vacuum (kPa)				Vacuum (kPa)				Vacuum (kPa)			
	20	40	60	75	20	40	60	75	20	40	60	75
0.1	3	2	1	1	1	1	1	1	1	1	1	1
0.5	13	7	5	4	2	1	1	1	1	1	1	1
1	-	13	9	7	4	2	2	1	2	1	1	1
2	-	-	-	14	8	4	3	2	4	2	2	1
3	-	-	-	-	12	6	4	3	5	3	2	2
4	-	-	-	-	15	8	5	4	7	4	3	2
5	-	-	-	-	-	10	7	5	9	5	3	3
6	-	-	-	-	-	12	8	6	10	5	4	3
7	-	-	-	-	-	13	9	7	12	6	4	4
8	-	-	-	-	-	15	10	8	14	7	5	4
9	-	-	-	-	-	-	12	9	15	8	5	4
10	-	-	-	-	-	-	13	10	-	9	6	5
11	-	-	-	-	-	-	14	11	-	9	6	5
12	-	-	-	-	-	-	15	12	-	10	7	6
13	-	-	-	-	-	-	16	13	-	11	8	6
14	-	-	-	-	-	-	-	14	-	12	8	7
15	-	-	-	-	-	-	-	15	-	13	9	7

NOTE:

To use more than 7 (15mm), 4 (30mm) or 3 (40mm) vacuum cups with the VGC10 a customized adaptor plate is needed.

The table above is created with the following formula that equalizes the lifting force with the payload considering 1.5G of acceleration.

$$\text{Amount}_{\text{Cups}} * \text{Area}_{\text{Cup}}[\text{mm}] = 14700 \frac{\text{Payload [kg]}}{\text{Vacuum [kPa]}}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

When using porous materials, the vacuum that can be achieve by using the OnRobot suction cups will depend on the material itself and will be between the range stated in the specifications. Some of the most common non-porous materials are listed below:

- Fabrics

- Foam

- Foam with open cells

- Low density cardboard

- Low density paper

- Perforated materials

- Untreated wood

See the table below with general recommendations, in case other suction cups are needed for specific materials.

Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:
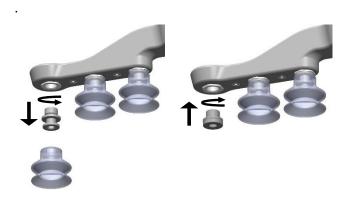
It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

Fittings and Blind Screws.

It is possible to change suction cups simply by pulling them off the fittings. It might be a bit challenging to remove the 15 mm Diameter vacuum cups. As suggestion try to stretch the silicon to one of the sides and then pull it out.

Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. The fittings and the blinding screws are mounted or dismounted by screwing (2Nm tightening torque) or unscrewing them with the provided 3 mm Allen key.

.

The thread size is the commonly used G1/8"; allowing for standard fittings, blinders and extenders to be fitted directly to the VG grippers.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum in kPa setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.
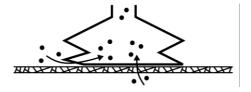
The pressure in the atmosphere varies with weather, temperature and altitude. The VG grippers automatically compensate for altitudes up to 2km, where the pressure is about 80% of sea level.

Air flow

Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips
- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).

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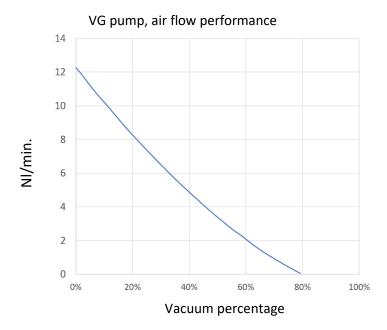

Therefore, the users must be aware of the following:

- VG grippers are not suitable for most uncoated, coarse cardboard boxes.

- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG grippers is shown in the graph below:

VG pump, air flow performance

NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG grippers.

A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG gripper filters and vacuum cups will last longer.

11.2 Mechanical Drawings

11.2.1 Adapter plate(s)

Adapter B

All dimensions are in mm and [inches].
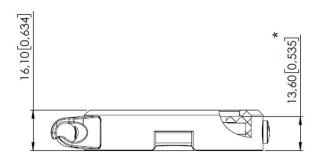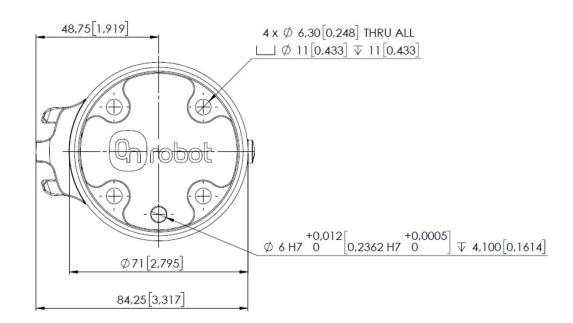
11.2.2 Mountings

**Quick Changer -
Robot side**

* Distance from Robot flange interface to OnRobot tool.

All dimensions are in mm and [inches].
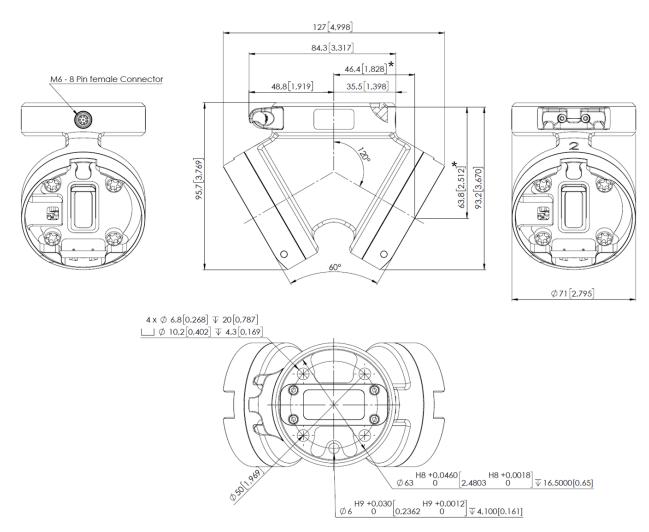
NOTE:

The cable holder (on the left side) is only required with the long (5 meter) cable.
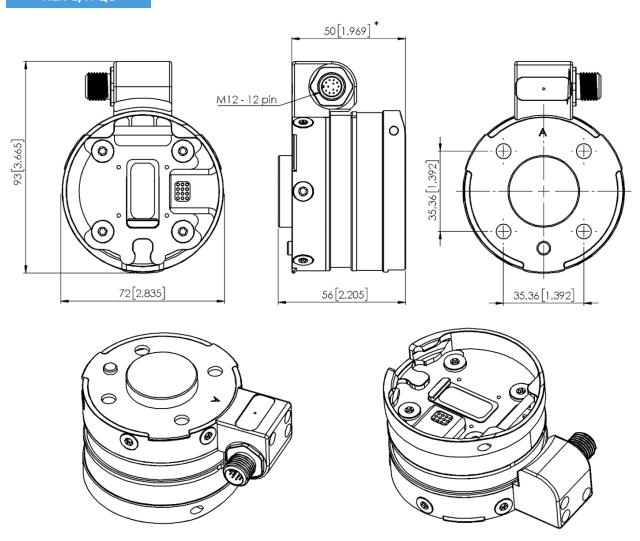
Dual Quick Changer

M6 - 8 Pin female Connector

127 [4,998]
84,3 [3,317]
46,4 [1,828] *
48,8 [1,919]
35,5 [1,398]
95,7 [3,769]
120°
63,8 [2,512]
93,2 [3,670]
*
60°

Ø71 [2,795]
2

4 x Ø 6,8 [0,268] ↧ 20 [0,787]
⌴ Ø 10,2 [0,402] ↧ 4,3 [0,169]

Ø50 [1,969]

Ø 63 H8 +0,0460 / 0 [2,4803 H8 +0,0018 / 0] ↧ 16,5000 [0,65]

Ø 6 H9 +0,030 / 0 [0,2362 H9 +0,0012 / 0] ↧ 4,100 [0,161]

* Distance from Robot flange interface to OnRobot tool

All dimensions are in mm and [inches].

HEX-E/H QC

* Distance from Robot flange interface to OnRobot tool
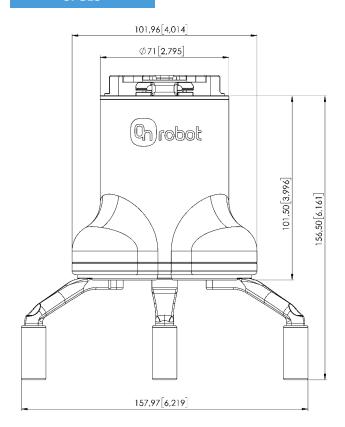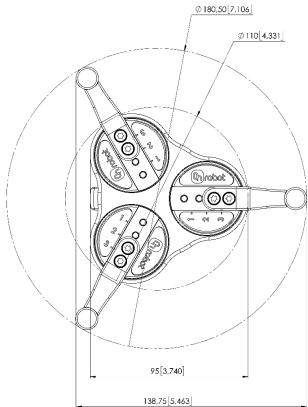
All dimensions are in mm and [inches].

11.2.3 Tools

3FG15

All dimensions are in mm and [inches].

Hardware Specification

Gecko

187
[7.376]

179
[7.046]

146
[5.748]

146
[5.748]

45
[1.772]

45
[1.772]

R8 TYP
[0.315]

45
[1.772]

45
[1.772]

115
[4.528]

115
[4.528]

All dimensions are in mm and [inches].

RG2-FT

All dimensions are in mm and [inches].
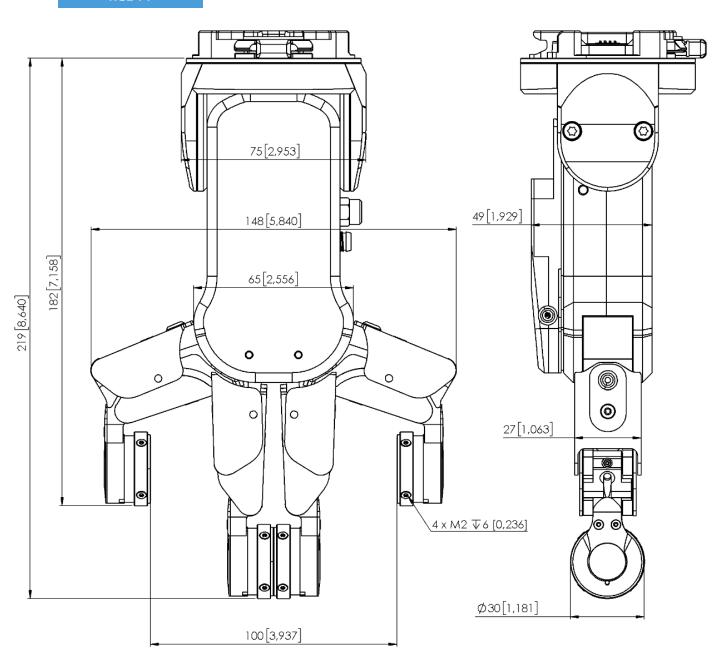
RG2

75 [2,953]

M3 - 6H ⤓ 5 [0,177]

149 [5,866]

54 [2,126]

65 [2,546]

11 [0,443]

20 [0,787]

213 [8,384]

174 [6,866]

132 [5,187]

36 [1,417]

24 [0,929]

12 [0,472]

6 [0,236]

M4 - 6H THRU

14 [0,551]

110 [4,331]

124 [4,882]

All dimensions are in mm and [inches].

RG6

All dimensions are in mm and [inches].

SG
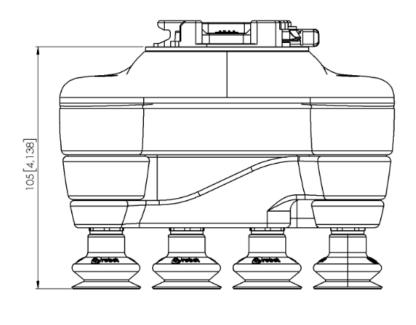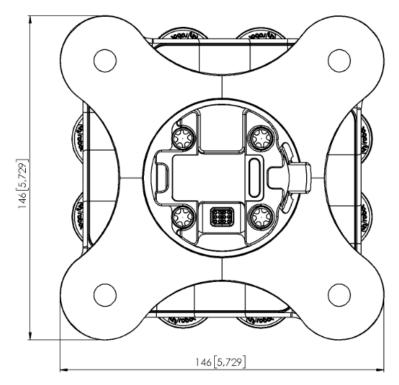
All dimensions are in mm and [inches].

The Silicone Tool parts - that are attached to the SG base part -, are described in the SG Datasheet.

Hardware Specification

VG10

All dimensions are in mm and [inches].

All dimensions are in mm and [inches].

VGC10

101,50 [3,996]

B

100 [3,937]

100 [3,937]

All dimensions are in mm and [inches].

4 x M6 ⫱ 9
[4 x M6 0,354]

⌀ 49,50 [1,945]

⌀ 101,82 [4,009]

72 [2,835]

86 [3,386]

All dimensions are in mm and [inches].

**Quick Changer -
Tool side**

All dimensions are in mm and [inches].
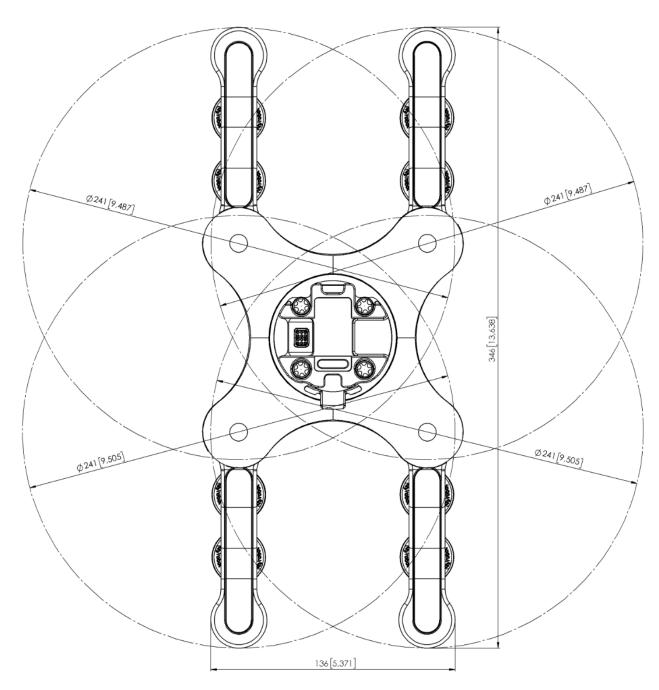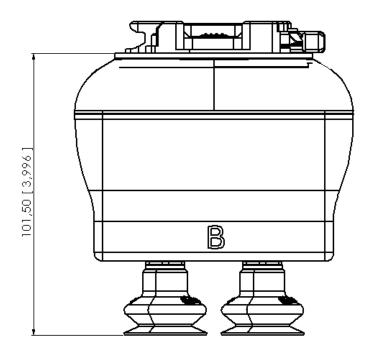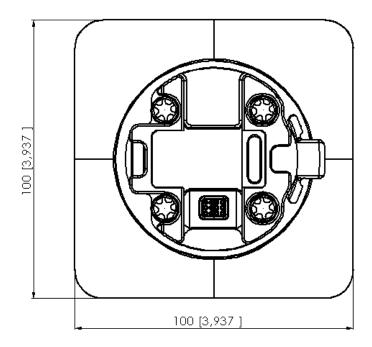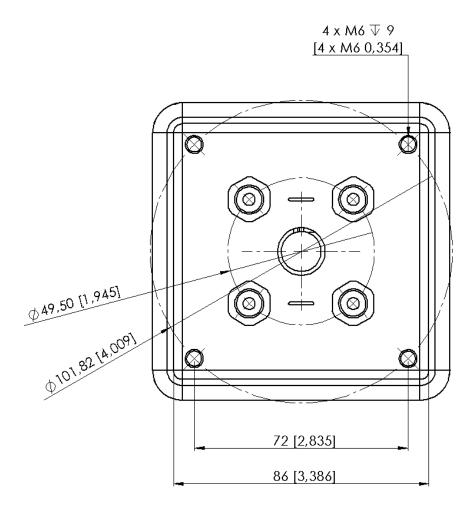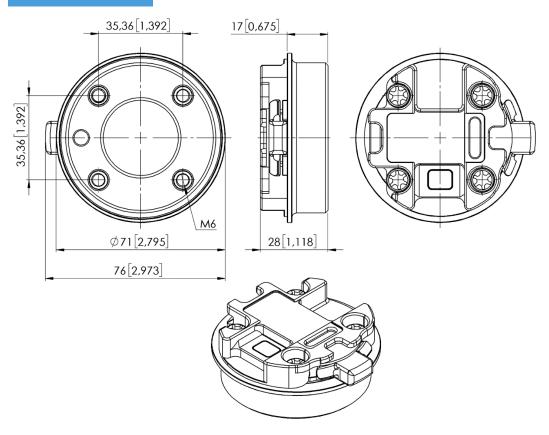
11.3 Center of Gravity

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

3FG15

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=156	cX= 0 cY= 0 cZ= 83	1.15 kg 2.5 lb

* With delivered fingers and 13.5 silicone fingertips on.

HEX-E/H QC

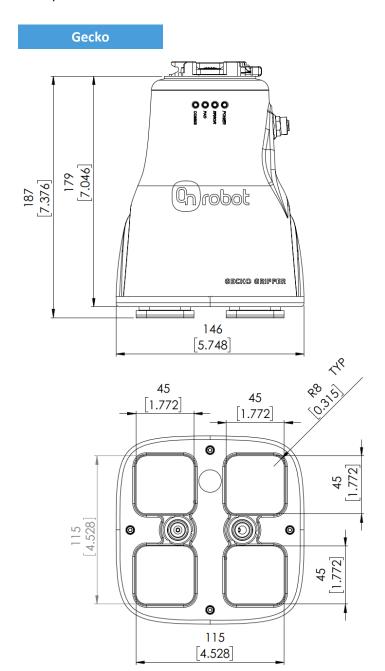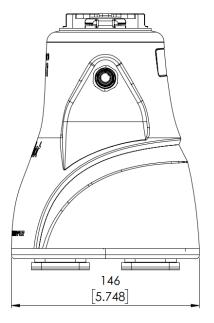| Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=50	cX=0 cY=5 cZ=20	0.35 kg 0.77 lb

Gecko

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=187	cX=0 cY=0 cZ=113	2.83 kg 6.10 lb

RG2-FT

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=205	cX=0 cY=0 cZ=65	0.98 kg 2.16 lb

* Mounted at 0˚

RG2

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=200	cX=0 cY=0 cZ=64	0.78 kg 1.72 lb

* Mounted at 0˚

RG6

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=250	cX=0 cY=0 cZ=90	1.25 kg 2.76 lb

* Mounted at 0˚

SG

Without any Silicone Tool, only the SG Base Part with spindle in.

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=113	cX=-13 cY=-5 cZ=31	0.77 kg 1.69 lb

With Silicone Tool Type A on (SG-a-S/H).

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=154	cX=-12 cY=-5 cZ=45	0.932 kg 2.05 lb

With Silicone Tool Type B on (SG-b-H).

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=155	cX=-12 cY=-5 cZ=46	0.937 kg 2.06 lb

VG10

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=105	cX=15 cY=0 cZ=54	1.62 kg 3.57 lb

* With arms folded back

VGC10

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=75	cX=-1 cY=-1 cZ=37	0.814 kg 1.79 lb

* With no attachments

12 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.

3FG15

⚠️ **WARNING:**

Please check regularly the silicon fingertips since these parts can wear out.

If the fingertip is worn out , it can be ordered as spare part:

- ⌀10 mm steel, PN 104160
- ⌀13 mm steel, PN 104241
- ⌀13.5 mm silicone, PN 104162
- ⌀16.5 mm silicone, PN 104240

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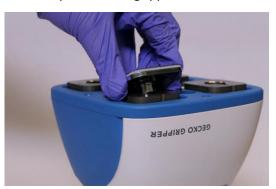
Step 2: Insert the edge of the pad removal tool between the shiny silver plate of the pads and the dull backing plate. Leverage the pad removal tool against the gripper housing to pry off the used pad. Repeat for all pads.

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.

SG

For the SG Base Part

⚠️ **WARNING:**

Please, clean the SG Base Part regularly by using a cloth and a cleaning agent with a pH value between 6-8.

When cleaning the SG Base Part please keep it mounted on the robot to prevent water getting into the connector.

After cleaning, use a cloth and clean water, to rinse of any leftover cleaning agent.

Please ensure that the used cleaning agent does not contain chlorine as this can lead to corrosion.

⚠️ **WARNING:**

On a regular basis, check that the silicone bellow has not come loose from neither the aluminum base nor the Smart Lock male. If the bellow is not sitting correctly, this can lead to water seeping into the SG base part.

For the SG Tools:

The silicone part and the smart lock female are dishwasher safe, at temperatures =< 80°C (176°F).

Various cleaners can be used for cleaning the silicone part. Dish soap. Alcohol, regular ethanol, isopropanol and acetone works as well for cleaning.

Do not use concentrated acids and alkalis, since these can potentially damage the silicone, in particularly oxidizing acids such as sulfuric or nitric acid. It is recommended to use cleaning agent with a pH value between 2 and 13.

On a regular basis, please do a visual inspection of the smart-lock female and the ball spring. If needed clean it with a brush or cloth.

NOTE:

In the cleaning process please make sure the smart-lock female is placed upside down to prevent water being caught inside the ball spring.

VG10 / VGC10

The VG grippers are equipped with one filter for each suction cup socket, and one filter for the exhaust. How often the filters need to be changed depends on the nature of the work piece and the working environment. The VG grippers automatically de-dust the filters every time a grip is released. However, particles can eventually get stuck and build up inside the filter, lowering the VG grippers performance.

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

- Filter service kit for VG10, PN 100064
- Filter service kit for VGC10, PN 103757

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

DANGER:

Identify how often the filters need service and schedule maintenance with a fixed period short enough to ensure a firm grip at all times.

An overall inspection of the VG grippers must be performed regularly and at least once every 6 months.

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

13   Warranties

13.1 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.

13.2 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.

13.3 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.

14 Certifications

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: **OnRobot A/S**
Manufacturing plant: **Teglværksvej 47H**
                     5220 Odense SØ
                     Denmark

Beschreibung des Produktes: **Safety Gripper for collaborative robots**
(Details s. Anlage 1)   **RG2 v2 and RG6 v2**
Description of product:
(Details see Annex 1)

Geprüft nach: **EN ISO 13849-1:2015 Cat. 3, PL ,d'**
Tested in accordance with:

Registrier-Nr. / *Registered No.* 44 780 18106002   Gültigkeit / *Validity*
Prüfbericht Nr. / *Test Report No.* 3523 2689   von / *from* 2019-06-04
Aktenzeichen / *File reference* 8000489144   bis / *until* 2024-06-03

Zertifizierungsstelle der   Essen, 2019-06-04
TÜV NORD CERT GmbH

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

intertek

Total Quality. Assured.

CERTIFICATE
OF REGISTRATION

This is to certify that the management system of:

OnRobot A/S

Main Site: Teglværksvej 47 H, 5220 Odense SØ, Denmark
Chamber of Commerce: 36492449

Additional Site: OnRobot A/S, Cikorievej 44, 5220 Odense SØ, Denmark

has been registered by Intertek as conforming to the requirements of

ISO 9001:2015

The management system is applicable to:

Development and sales of End-of-Arms tools for industrial customers worldwide.

Certificate Number:
0096721

Initial Certification Date:
26 November 2019

Date of Certification Decision:
26 November 2019

Issuing Date:
26 November 2019

Valid Until:
25 November 2022

Accred. no. 1639
Certification of
Management
Systems
ISO/IEC 17021-1

Carl-Johan von Plomgren
MD, Business Assurance Nordics

Intertek Certification AB
P.O. Box 1103, SE-164 22 Kista, Sweden

GENERAL REPORT SUMMARY

This electromagnetic emission and immunity test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

This report must not be used to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the federal government.

Device Tested:	Gecko Gripper Model: GEN2 S/N: RAPUNZEL
Product Description:	The equipment under test is a robotic attachment that makes it possible to lift flat, smooth, and level surfaces.
Modifications:	The EUT was not modified in order to comply with specifications.
Customer:	OnRobot Los Angeles 8928 Ellis Avenue Los Angeles, California 90034
Test Dates:	October 4; November 12, 13, 14 and 15, 2019

Test Specifications covered by Accreditation:
Emissions and Immunity Requirements European Standards:

EN 61000-6-2 (2005), EN 55011 (2016) + A1 (2017); IEC 61000-3-2 (2014); and IEC 61000-3-3 (2013)

EN 61000-6-2 (2005) is a product family immunity standard that references the following specifications:

EN 61000-4-2 (2009)
EN 61000-4-3 (2006) + A1 (2008) + A2: 2010
EN 61000-4-4 (2004) + A1 (2010)
EN 61000-4-5 (2006)
EN 61000-4-6 (2009)
EN 61000-4-8 (2009)
EN 61000-4-11 (2004)

Attestation of Conformity no. 119-29901-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder	
OnRobot A/S Teglværksvej 47H 5220 Odense SØ Denmark.	
Product identification	
Compute box with Power Supply Unit (PSU) VER36U240-JA. Mountings: HEX-E QC V3 (101904), QC – R v2 (102037), Dual QC v2 (101788). Tools: VG10 v2 (101661), RG2 v2 (102012), RG2-FT v2 (102075), RG6 v2 (102021).	
Manufacturer	
On Robot A/S	
Technical documentation	
Assessment no. 119-29901-A1	

Standards list no. 1:

IEC 61000-3-2:2014 IEC 61000-3-3:2013 IEC 61000-6-2:2016 IEC 61000-6-4:2018	EMC Directive 2014/30/EU, Article 6 EN 61000-3-2:2014 EN 61000-3-3:2013 EN 61000-6-2:2005 EN 61000-6-2:2019 EN 61000-6-4:2007 + A1:2011

Standard list no. 2: (applicable specifically to RG2 v2 (102012) and RG6 v2 (102021))

IEC 61326-3-1:2017, Industry locations, SIL 2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen

Digitally signed by Knud A. Baltsen
Date: 2019.11.15 19:38:04 +01'00'

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

Attestation of Conformity no. 118-33022-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder
OnRobot A/S Teglværksvej 47H 5220 Odense SØ Denmark
Product identification
Gripper RG2 2.0
Manufacturer
OnRobot A/S
Technical documentation
FORCE Technology Test Report 117-29737, dated 01 September 2017 FORCE Technology Assessment Sheet 1668, dated 17 October 2017 FORCE Technology Test Report 118-33022-2 Rev. 1, dated 06 February 2019 FORCE Technology Assessment 118-33022-A1, dated 21 February 2019

Standards/Normative documents

IEC 61000-6-2:2005
IEC 61000-6-4:2006 + A1:2010
IEC 61326-3-1:2017, Industrial locations, SIL 2
FCC Part 15B, Class A

EMC Directive 2014/30/EU, Article 6
EN 61000-6-2:2005 + AC:2005
EN 61000-6-4:2007 + A1:2011
EN 61326-3-1:2017, Industrial locations, SIL 2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
2019-02-21
Digitally signed by Knud A. Baltsen
kab@force.dk
Senior Specialist

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

Attestation of Conformity no. 118-33022-A2

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Gripper RG6 2.0

Manufacturer

OnRobot A/S

Technical documentation

FORCE Technology Test Report 117-29737, dated 01 September 2017
FORCE Technology Assessment Sheet 1668, dated 17 October 2017
FORCE Technology Test Report 118-33022-2 Rev. 1, dated 06 February 2019
FORCE Technology Assessment 118-33022-A1, dated 21 February 2019

Standards/Normative documents

IEC 61000-6-2:2005	EMC Directive 2014/30/EU, Article 6
IEC 61000-6-4:2006 + A1:2010	EN 61000-6-2:2005 + AC:2005
IEC 61326-3-1:2017, Industrial locations, SIL 2	EN 61000-6-4:2007 + A1:2011
FCC Part 15B, Class A	EN 61326-3-1:2017, Industrial locations, SIL 2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen
2019-02-21

Digitally signed by Knud A. Baltsen
kab@force.dk
Senior Specialist

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

Certifications

Attestation of Conformity no. 119-31690-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
DENMARK

Product identification

Compute box with Power Supply Unit (PSU) VER36U240-JA.
Mounting: Quick Changer HEX-E QC V3 (101904).
Robot Tool: Soft Gripper (103546).

Manufacturer

OnRobot A/S

Technical documentation

Test report. 119-31690-1

Standards/Normative documents

IEC 61000-3-2:2014	EMC Directive 2014/30/EU, Article 6
IEC 61000-3-3:2013	EN 61000-3-2:2014
IEC 61000-6-2:2016	EN 61000-3-3:2013
IEC 61000-6-4:2018	EN 61000-6-2:2005
	EN 61000-6-2:2019
	EN 61000-6-4:2007 + A1:2011

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Johan Weisbjerg
2020-01-24

Digitally signed by Johan Weisbjerg
jow@force.dk
Technician

Signed by: Johan Weisbjerg, Specialist, Product Compliance

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Attestation of Conformity no. 120-21521-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder	
OnRobot A/S Teglværksvej 47H 5220 Odense SØ Denmark	
Product identification	
Robot tool: Three finger gripping tool 3FG15 (103666).	
Manufacturer	
OnRobot A/S	
Technical documentation	
FORCE Technology test report 120-21521-1.	
Standards/Normative documents	
IEC 61000-3-2:2014 IEC 61000-3-3:2013 IEC 61000-6-2:2016 IEC 61000-6-4:2006/AMD1:2010	EMC Directive 2014/30/EU, Article 6 EN 61000-3-2:2014 EN 61000-3-3:2013 EN 61000-6-2:2005/Corr.:2005 EN 61000-6-4:2007/A1:2011

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature

Knud A. Baltsen

Digitally signed by Knud A. Baltsen
Date: 2020.03.30 19:48:21 +02'00'

Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

SG-x-H

DECLARATION OF CONFORMITY

According to Regulation (EC/EU) No.1935/2004 Article 3, it is required that food contact articles "*must be sufficient inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties*".

This document stands to certify that all OnRobot SG-x-H materials, intended for food contact complies with:

1. Europe:

Regulation (EC/EU) No. 1935/2004 and national provisions (Article 6). The materials of SG Tools are suitable for food contact, materials and articles under article 3 of the before mentioned egulation. Compliance with the, requirements of Regulation (EC/EU) No.1935/2004 for the food contact material or article, concerning any limitations in particular max. use limits or limits on migration or extraction, the effect on taste and smell of the food and the suitability of the article for the specific use must be in compliance with the recommendations of the BfR.

See results next page.

2. USA:

FDA 21 CFR 177.2600 "*Rubber articles intended for repeated use in contact with food*".

Tested and approved for use on non-fatty food objects.

See results next page.

The above product is also produced according to EC regulation 2023/2006 "*Good manufacturing practice for materials and articles intended to come into contact with food*" and is subject to control by the Danish food and health authorities.

To the best knowledge of the manufacturer, that the information presented in this certificate, is correct as of date of the declaration. It is the responsibility of the end-user to ensure that the status of the regulation is still in effect at the date of use.

Odense, April 6th, 2020

Group Management

Vilmos   Beskid
CTO

Results

The materials and color additive have been tested for extraction and migration limits by an independent testing organization (Eurofins Product Testing A/S. Accreditation number 522)

Sensory Analysis:

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1.5 (Just recognizable to slight deviation, chemical)	2.5
Taste	Water	2.5 (Slight to intense deviation, chemical and flavoured)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	5 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch²]	Limit Value[mg/inch²]
Water-extracted residue after 7 hours	0.19	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

SG-x-S

DECLARATION OF CONFORMITY

According to Regulation (EC/EU) No.1935/2004 Article 3, it is required that food contact articles "*must be sufficient inert to preclude substances from being transferred to food in quantities large enough to endanger human health or to bring about an unacceptable change in the composition of the food or a deterioration in its organoleptic properties*".

This document stands to certify that all OnRobot SG-x-S materials, intended for food contact complies with:

1. Europe:

Regulation (EC/EU) No. 1935/2004 and national provisions (Article 6). The materials of SG Tools are suitable for food contact, materials and articles under article 3 of the before mentioned egulation. Compliance with the, requirements of Regulation (EC/EU) No.1935/2004 for the food contact material or article, concerning any limitations in particular max. use limits or limits on migration or extraction, the effect on taste and smell of the food and the suitability of the article for the specific use must be in compliance with the recommendations of the BfR.

See results next page.

2. USA:

FDA 21 CFR 177.2600 "*Rubber articles intended for repeated use in contact with food*".

Tested and approved for use on non-fatty food objects.

See results next page.

The above product is also produced according to EC regulation 2023/2006 "*Good manufacturing practice for materials and articles intended to come into contact with food*" and is subject to control by the Danish food and health authorities.

To the best knowledge of the manufacturer, that the information presented in this certificate, is correct as of date of the declaration. It is the responsibility of the end-user to ensure that the status of the regulation is still in effect at the date of use.

Odense, April 6th, 2020

Group Management

Vilmos   Beskid
CTO

Results

The materials and color additive have been tested for extraction and migration limits by an independent testing organization (Eurofins Product Testing A/S. Accreditation number 522)

For the Hard part

Sensory Analysis:

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1.5 (Just recognizable to slight deviation, chemical)	2.5
Taste	Water	2.5 (Slight to intense deviation, chemical and flavoured)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	5 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch²]	Limit Value[mg/inch²]
Water-extracted residue after 7 hours	0.19	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

Certifications

For the Soft part

Sensory Analysis:

Parameter:	Food Simulant:	Median Grade:	Limit Value*
Odour	Water	1 (Just noticable deviation)	2.5
Taste	Water	1 (Just noticable deviation)	2.5

* From 61. Statement of BfR, Bundesgesundheitsbl. 46, 2003, 362-5.

Analysis - BfR recommendation XV on silicone:

Parameter:	Result:	Limit value **
Extractable components in water	< 0.2 %	0.5 %
Extractable components in 3% acetic acid	< 0.3 %	0.5 %
Extractable components in 10% ethanol	< 0.2 %	0.5 %
Volatile Compounds	< 0.1 %	0.5 %
Platinum	10 mg/kg	50 mg/kg

** According to BfR recommendation XV on silicone

Extraction Analysis:

Parameter:	Single determinations [mg/inch²]	Limit Value[mg/inch²]
Water-extracted residue after 7 hours	1.5	< 20
Water-extracted residue after +2 hours	< 0.1	< 1

For the Soft part

14.1 Declaration of Incorporation

3FG15

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	3FG15
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, February 14th, 2020

Group Management

Vilmos Beskid
CTO

Gecko

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type: Industrial Robot Gripper
Model: Gecko Gripper
Generation: V2
Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

HEX-E

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

> OnRobot A/S
> Teglværskvej 47H
> DK-5220, Odense SØ
> DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-E QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

> 2014/30/EU — Electromagnetic Compatibility Directive (EMC)
> 2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

> 2014/35/EU — Low Voltage Directive (LVD)
> 2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

HEX-H

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-H QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

RG2-FT

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type: Industrial Robot Gripper
Model: RG2-FT
Generation: V2
Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

RG2

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

> OnRobot A/S
> Teglværskvej 47H
> DK-5220, Odense SØ
> DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	RG2
Generation:	V2
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

> 2014/30/EU — Electromagnetic Compatibility Directive (EMC)
> 2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

> 2014/35/EU — Low Voltage Directive (LVD)
> 2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

RG6

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type: Industrial Robot Gripper
Model: RG6
Generation: V2
Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

Vilmos Beskid
CTO

SG

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Robot Gripper
Model:	SG
Generation:	V1
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Odense, April 6th, 2020

Group Management

Vilmos Beskid
CTO

VG10

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

> OnRobot A/S
> Teglværskvej 47H
> DK-5220, Odense SØ
> DENMARK

declares that the product:

> Type: Industrial Robot Gripper
> Model: VG10
> Generation: V2
> Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

> 2014/30/EU — Electromagnetic Compatibility Directive (EMC)
> 2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

> 2014/35/EU — Low Voltage Directive (LVD)
> 2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

> Group Management

> Vilmos Beskid
> CTO

VGC10

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type: Industrial Robot Gripper
Model: VGC10
Generation: V1
Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, December 16th, 2019

Group Management

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CTO