ROBOTIQ

HAND-E

Original Notice

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Robotiq Hand-E
for Universal Robots

Instruction Manual

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Revisions

Robotiq may modify this product without notice, when necessary, due to product improvements, modifications or changes in specifications. If such modification is made, the manual will also be revised, see revision information. See the latest version of this manual online at robotiq.com/support.

Revision 2019/12/19

- Major Revision: fused sections that were exclusive to e-Series or to CB-Series , to be displayed in a single Instruction Manual
- Removed Section 5: User Interface
- Remove sections "Retro-compatibility of URCaps with legacy driver programs "and "Control over Universal Robots without URCaps"
- Section "Troubleshooting"
  - Rewrote section, formatted troubleshooting instructions in tables
  - Added subsection "Troubleshooting with RUI"
- Section "Control"
  - Added subsection "Limiting your Gripper Force and Speed"
  - Added subsection "Visual Cues of Force and Speed Limitation"
  - Removed subsections which were empty except for the note "Coming Soon"
    - "Measured grip force for steel of specific hardness (Vickers)"
    - "Measured grip force for silicone of specific hardness (Durometer)"
  - Revised data on register and bits in subsection "Modbus RTU Communication"
- Section "Installing URCap Package"
  - Created subsection "Activating a Gripper Connected to the Robot Wrist"
- Section "Specifications"
  - Updated subsection "Fingers and Fingertips" with latest information on V-groove fingertips
  - Updated subsection "Mechanical Specifications"

Revision 2019/10/10

- Added section "Electrostatic Discharge Safety

Revision 2019/07/04

- Basic gripper kits now include by default NBR overmolded fingers. Updated **Specifications** section and **Spare Parts, Kits and Accessories** section
- Added subsection **Flat Rubber (NBR) Overmolded Fingers** to **Specifications** section
- Modified Figure 3 from the **General Presentation** section.
- Changes to schematics shown under subsections **Coupling for PCD 60 with 4 x M5** (Figure 6-8) and **Coupling for PCD 63 with 6 x M6** (Figure 6-9).

Revision 2019/05/17

- Updated Environmental and Operating Conditions (Section 3.3)

Revision 2019/03/13

- Updated mechanical specifications (Section 6.2)

Revision 2019/02/19

- Updated Section 6 to modify the grip force

Revision 2018/09/11

- Updated Section 3 according to the robot used (CB-Series vs. e-Series)
- Updated Section 4
  - Input & Output Registers
  - Control over Universal Robots depending on the robot software used (PolyScope 3.6 and later version vs. PolyScope 5.0 and later versions)
  - Added LED and move functions to the list of available functions
- Updated Section 8 with new spare parts, kits and accessories

Revision 2018/05/24

- Official release

1. General Presentation

The terms "Gripper", "Robotiq Gripper", "Hand-E Gripper" and "Hand-E" used in this manual are used interchangeably to designate the "Robotiq Hand-E Gripper". The Robotiq Hand-E Gripper is a robotic peripheral designed for industrial applications. It is a unique robotic end-of-arm tool designed to quickly pick, place and handle parts in a broad range of sizes and shapes.

> **Note**
>
> This manual uses the metric system. Unless otherwise specified, **all dimensions are in millimeters**.

> **Note**
>
> The following section presents the key features of the Gripper and must not be considered as appropriate to Gripper operation, each feature is detailed in the appropriate section of the Manual. Safety guidelines must be read and understood before any operation is attempted with the Gripper.

1.1. Gripper nomenclature

The Hand-E gripper is a parallel gripper. Its two fingers are actuated by a single motor.

Fingers

Rack

Rack housing

Threaded holes
for accessories

M5 screws

ROBOTIQ

Coupling

Fig. 1-1: Robotiq Hand-E gripper.

Please refer to the **Scope of Delivery** section and **Spare Parts, Kits and Accessories** section for details on standard and optional parts. The Hand-E basic gripper unit includes flat aluminum fingers overmolded with NBR. Note that these fingers are not shown in Figure 1.1: Robotiq Hand-E gripper.

The user can install fingers directly on the racks, or fasten fingertips to fingertip holders, which are in turn installed on the racks. Refer to the **Mounting Hand-E on the Robot** section for more information on how to integrate custom fingers and fingertips to Hand-E.
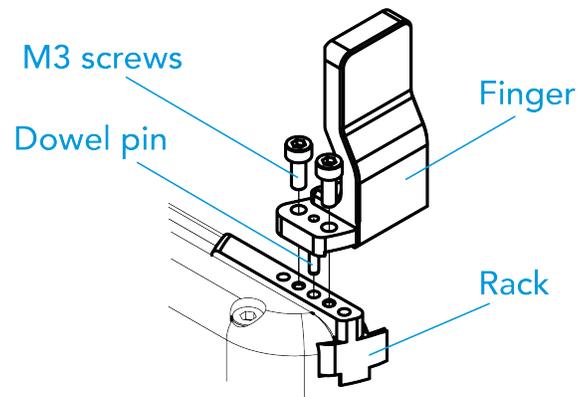
Fig. 1-2: Mounting a finger on a rack.

When ordered as a kit (please refer to the **Scope of Delivery** section), a fingertip starting kit is included (please refer to the **Spare Parts, Kits and Accessories** section). These fingertips should be mounted onto fingertip holders.
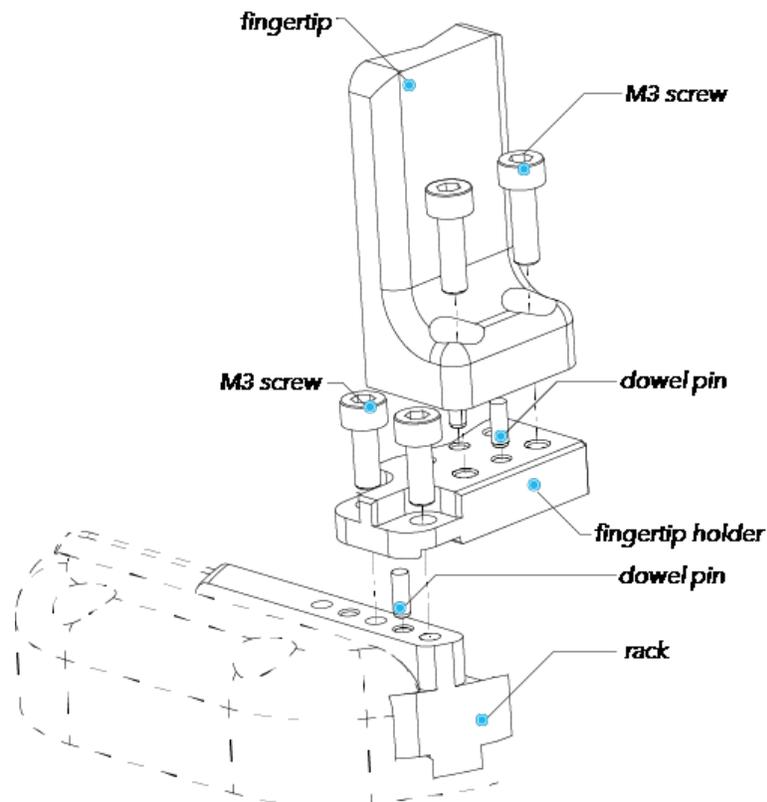
Fig. 1-3: Mounting a fingertip on a fingertip holder (example).

> **Tip**
>
> You can customize fingers and fingertips. Mount custom fingers on racks, and fingertips on fingertip holders.

1.2. Object picking

The Hand-E gripper has a single actuator for opening and closing the fingers. It also allows internal gripping. The fingers can pick hollow parts from the inside by applying pressure with the outer surface of the fingers.

See the figure below for a representation and refer to the **Picking Features** section for details on avaible position commands for your gripper.
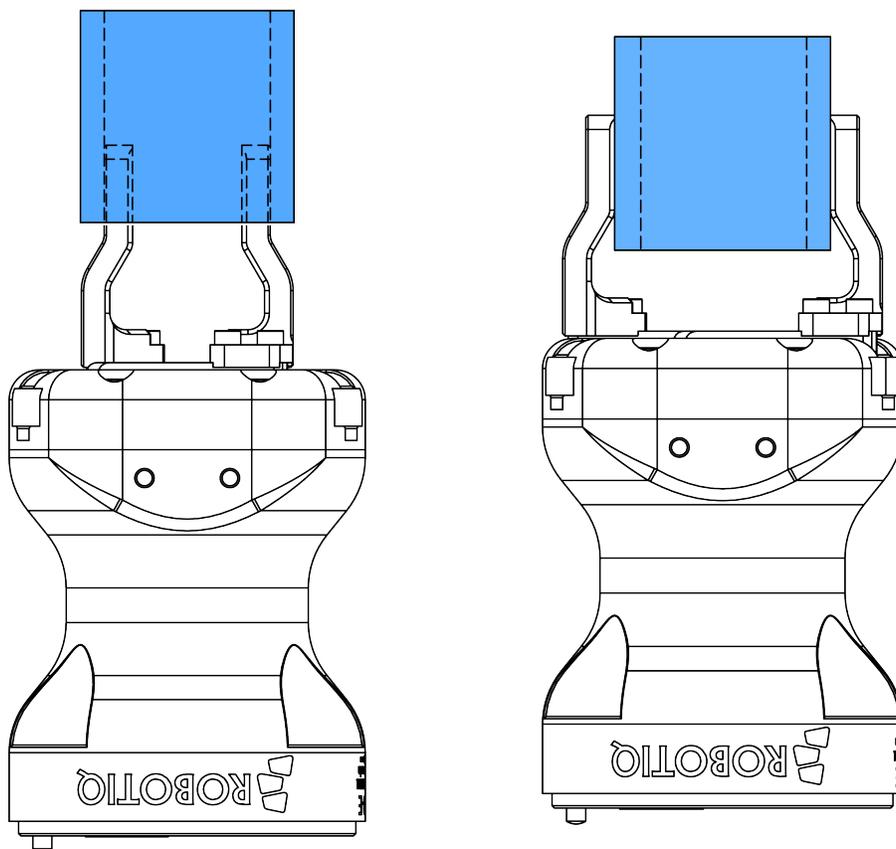
Fig. 1-4: Hand-E gripper internal and external gripping.

1.3. Setup and control

The Gripper is powered and controlled directly via a single device cable that carries a 24V DC supply and Modbus RTU communication over RS-485. Please refer to the **Electrical Setup** section for wiring information and to the **Control** section for control of the Gripper (software packages are available for control via some types of robot controllers).

A gripper coupling is required for using Hand-E; the coupling will provide mechanical and electrical connectivity. Please refer to the **Mechanical Installation** section for installation of the coupling, to the **Technical dimensions** section for technical drawings, and to the **Spare Parts, Kits and Accessories** section for available couplings.

The Hand-E gripper has an embedded object detection feature using indirect sensing methods. When picking an object with the "go to" command, the Gripper status will allow you to know if an object is picked or not via a simple object detection bit (0 or 1). When an object is detected, the Gripper will stop. If the object is being dropped, the Gripper will automatically close to keep the object until the object is detected or until the position target from the "go to command" is reached. For details on object detection, please refer to the **Control** section.

2. Safety

> **Warning**
>
> The operator must have read and understood all of the instructions in the following manual before handling the Robotiq Hand-E Gripper.

> **Info**
>
> The term "operator" refers to anyone responsible for any of the following operations on the Robotiq Hand-E Gripper:
>
> - Installation
> - Control
> - Maintenance
> - Inspection
> - Calibration
> - Programming
> - Decommissioning

This documentation explains the various components of the Robotiq Hand-E Gripper and general operations regarding the whole lifecycle of the product from installation to operation and decommissioning.

The drawings and photos in this documentation are representative examples; nonetheless, discrepancies may be observed between those and the delivered product.

2.1. Warning

> **Info**
>
> Any use of the Gripper in noncompliance of these warnings is inappropriate and may cause injury or damage.

> **Warning**
>
> - The Gripper needs to be properly secured before operating the robot.
> - Do not install or operate a Gripper that is damaged or lacking parts.
> - Never supply the Gripper with an alternative current source.
> - Make sure all cord sets are always secured at both ends, at the Gripper and at the robot.
> - Always meet the recommended keying for electrical connections.
> - Make sure no one is in the robot and/or Gripper path before initializing the robot's routine.
> - Always meet the Gripper's payload specifications.
> - Set the Gripper's pinch force and speed accordingly, based on your application.
> - Keep fingers and clothes away from the Gripper while the power is on.
> - Do not use the Gripper on people or animals.
> - For welding applications, make sure there are no Gripper parts on the ground path of the welding power source.

Risk assessment and final application:

The Robotiq Hand-E Gripper is meant to be used on an industrial robot. The robot, the Gripper and any other equipment used in the final application must be evaluated via a thorough risk assessment. It is the robot integrator's duty to ensure that all local safety measures and regulations are met. Depending on the application, there may be risks that require additional protection/safety measures; for example, the work-piece the Gripper is manipulating might be inherently dangerous to the operator.

2.2. Intended Use

The Gripper unit is designed for gripping and temporarily securing or holding objects.

The product is intended for installation on a robot or other automated machinery and equipment.

> **Info**
>
> Always comply with local and/or national laws, regulations and directives on automation safety and general machine safety.

The unit should be used exclusively within the range of its technical data. Any other use of the product is deemed improper and unintended use. Robotiq will not be liable for any damages resulting from any improper or unintended use.

3. Installation

The following subsections will guide you through the installation and general setup of your Robotiq Hand-E gripper.

> **Warning**
>
> Before installing:
>
> - Read and understand the safety instructions related to the Hand-E gripper.
> - Verify your package according to the scope of delivery and your order.
> - Have the required parts, equipment and tools listed in the requirements readily available.

> **Warning**
>
> When installing:
>
> - Meet the recommended environmental conditions.
> - Do not operate the gripper, or even turn on the power supply, before it is firmly anchored and the danger zone is cleared. The fingers of the gripper may move and cause injury or damage.

3.1. Scope of Delivery

> **Caution**
>
> The following is not included as part of a standard delivery:
>
> - Options such as adapter plates or couplings for mounting on various industrial robots, fingertips or finger pads.
> - Hardware required for options; accessories or fixtures for the Hand-E gripper, unless specified.
> - Power supply units, power supply wiring or fuses.

> **Info**
>
> When bought as a kit, the Hand-E gripper will come in a package with the appropriate coupling, fingers/fingertips and cabling. Please refer to the **Spare Parts, Kits and Accessories** section.

3.1.1. Robotiq Hand-E gripper UR Standard Kit

Standard upon delivery for CB Series and e-Series

- Robotiq Hand-E basic gripper unit (**HND-GRP-001**)
  - Hand-E gripper
  - Hand-E NBR overmolded aluminum fingers kit
  - Screw kit
  - USB stick
- Hand-E Fingertip Starting Kit (**HND-TIP-START-KIT**)

For CB-Series

- USB to RS485 signal converter (**ACC-ADT-USB-RS485**)
- Coupling for connection to the robot controller (**GRP-CPL-062**)
- Robotiq device cable (**CBL-COM-1065-10-HF**)

For e-Series

- Gripper Coupling Kit (**GRP-ES-CPL-062**)
  - Wrist connection protector
  - Coupling for connection to robot wrist

> **Info**
>
> See the **Spare Parts, Kits and Accessories** section section for a list of available couplings.

3.1.2. UR Wrist connection Kit for CB-Series

Hand-E Wrist Connection Kit for CB-Series (HND-UR-KIT-W)

Standard upon delivery

- Robotiq Hand-E basic gripper unit (**HND-GRP-001**)
    - Hand-E gripper
    - Hand-E NBR overmolded aluminum fingers kit
    - Screw kit
    - USB stick

- Hand-E Fingertip Starting Kit (**HND-TIP-START-KIT**)
- I/O Coupling Kit (**IO-CPL-UR-CB-KIT**) :
    - Screw Kit to install on the robot
    - Micro-USB to USB cable
    - USB stick

3.2. Required Tools and Equipment

The following tools are required to install the Hand-E gripper:

- 4 mm hex key to mount the Gripper onto its coupling .
- Metric hex key according to your coupling to mount the coupling onto the robot.
- 3 mm hex key to install the wrist connection protector (on e-Series only)

Optional tools if installing fingertip/holder kits: HND-FIN-ALU-KIT, HND-TIP-VGR-KIT, HND-TIP-HLD-KIT

- 2,5 mm hex key

The following parts are required for setup :

- Power supply (see below).
- Fuse, see information below.
- Emergency stop is not provided, but its use is strongly advised.

The gripper needs to be supplied by a DC voltage source. This power supply is not included with the gripper. Required power supply must match the Robotiq device. The following table shows the specifications with regards to the power supply required to operate the gripper and the optional Robotiq Controller.

SPECIFICATION	VALUE
Output voltage	24 V DC ±10%
Output current	1 A
Overcurrent	Recommended power supply with internal protection, otherwise fusing is required. 2 A fuse at 25°C [77°F][1]

Table 3-1: Hand-E power supply requirements.

[1] Suggested fuse is a: Phoenix Contact # 0916605 2 A thermal, use AWG #20 wiring.

Warning

If your power supply could exceed the specified regulation, over-voltage protection is required.

Robotiq recommends the use of the following power supplies:

- For the 1A output current: TDK-Lambda DPP Series, *100W Single Output DIN Rail Mount Power Supply*: **DPP30-24**.

Tip

Optional Robotiq Universal Controller can use the same power supply.

3.3. Environmental and Operating Conditions

CONDITION	VALUE
Minimum storage temperature	-30°C [-22°F]
Maximum storage temperature	70°C [158°F]
Minimum operating temperature	-10°C [14°F]
Maximum operating temperature	50°C [122°F]
Humidity (non-condensing)	20-80% RH
Maximum vibration (storage/transit)	5G
Maximum vibration (operating)	2G
IP Rating	IP 67

Table 3-2: Environmental and operating conditions of the Hand-E gripper.

3.4. Mechanical Installation

3.4.1. Mounting Hand-E on the Robot

Single Gripper Installation

Instructions

1. Secure the gripper coupling on the robot wrist, and use the coupling dowel pin to align parts.

2. Secure Hand-E to coupling.

3. Install the wrist connection protector (for e-Series only)

> **Caution**
>
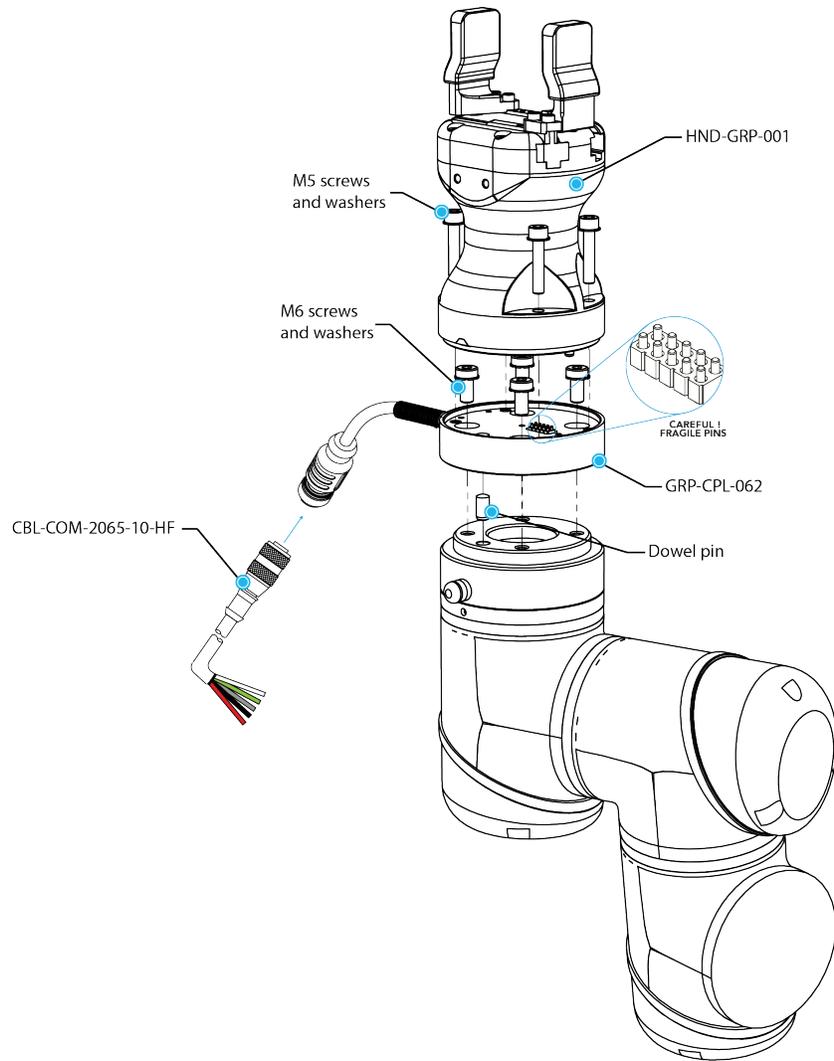> When no toothlock washer is present, lock screws in place using medium strength threadlocker.

Fig. 3-1: Installing Hand-E on the robot tool flange for CB-Series.
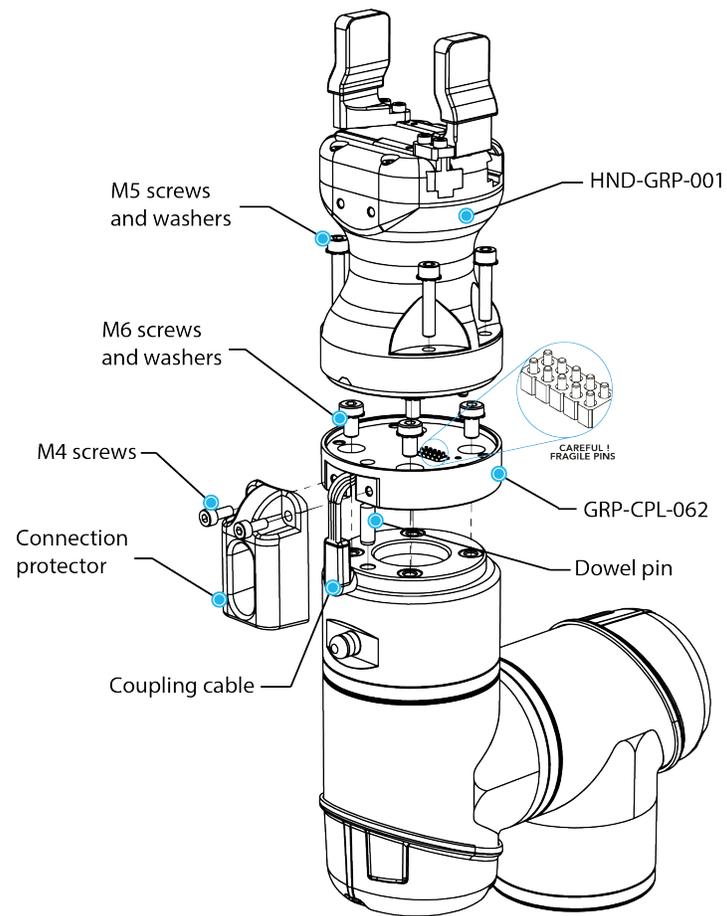
Fig. 3-2: Installing Hand-E on the robot tool flange for e-Series.

M5 screws and washers

HND-GRP-001

M6 screws and washers

M4 screws

CAREFUL !
FRAGILE PINS

Connection protector

GRP-CPL-062

Dowel pin

Coupling cable

Installation with the UR Wrist connection Kit for CB-Series (I/O Coupling)

I/O Coupling: General Presentation and Nomenclature

The Robotiq I/O Coupling is a robotic peripheral designed to allow a direct connection of the Robotiq Hand-E gripper to the Universal Robots CB-Series tool flange. It removes the need of any cable management and avoids downtime caused by cable issues. Depending on the robot tool I/Os, the I/O Coupling will send the selected presets to the Robotiq Hand-E gripper to allow its full programming.
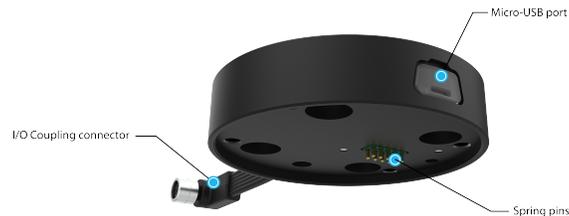
Fig. 3-3: Robotiq I/O Coupling

The status LED, integrated in the micro-USB port presented in the figure above, will be:

- **Solid blue/red** when booting
- **Solid red** when looking for product or waiting for communication
- **Solid blue** when powered with no errors (while communication is active)
- **Solid green** when communicating with USB

> **Info**
>
> The object detection feature remains available with the I/O Coupling, while the position feedback isn't due to the robot tool connector nature.

The I/O Coupling comes with four (4) factory presets, as shown in the table below. These four (4) presets can be reconfigured on a computer before using them on a robot.

> **Info**
>
> To configure the presets, please follow the instructions in the Robotiq User Interface (RUI) manual, available on support.robotiq.com.

	Preset 1	Preset 2	Preset 3	Preset 4
Position	100	0	100	0
Speed	100	100	0	0
Force	100	100	1*	1*

*To preserve object lost detection, force is not set to 0.

Table 3-3: Presets for Hand-E gripper

Safety

> **Warning**
>
> When changing the Hand-E gripper, it is important to follow the steps in order:
>
> 1. Unplug the I/O coupling connector.
> 2. Remove the Gripper with the 4mm hex key.
> 3. Install the new Gripper with the required tools.
> 4. Plug the I/O coupling connector in the robot Tool connector.

Installing the I/O coupling

Mounting the I/O Coupling

1. Insert the provided dowel pin into the tool flange.
2. Mount the I/O Coupling on the robot tool flange. Align it properly with the dowel pin.
3. Use the provided M6 screws, the M6 toothlock washers and the 4mm hex key to secure the I/O Coupling installation.

Mounting the Gripper onto the I/O Coupling

1. Fasten the Gripper onto the I/O Coupling using the M5 screws and toothlock washers of the Gripper.

> **Caution**
>
> Be careful with the fragile pins while installing the Gripper onto the I/O Coupling. Any abrupt movement can damage the pins and lead to product malfunction.

2. Plug the I/O Coupling connector into the robot tool flange connector.

> **Caution**
>
> Make sure to close the silicone door of the I/O coupling micro-USB port to prevent any dust or liquid infiltration.

3. Make sure the voltage is set at 24V to operate the Gripper:
   i. Select the **I/O Tab.**
   ii. On the bottom right corner of the page, select **Robotiq_Wrist_Connection** in the *Controlled by* drop down menu.
   iii. Make sure to save in the **Installation Tab**.

Firmware Update

> **Warning**
>
> A Gripper firmware update is required to use your Hand-E Gripper with the I/O Coupling. Make sure you have the **GD1-1.3.16** version installed, or the latest.

1. Connect the Hand-E Gripper to your PC via the I/O Coupling using the USB cable.
2. Run the Robotiq User Interface (RUI) to update the firmware.

You can now use your Gripper with the four (4) factory presets on the I/O Coupling. You can also program and save your own presets by connecting the I/O Coupling to your PC using the USB cable. To do so, refer to the Robotiq User Interface Manual available at robotiq.com/support.
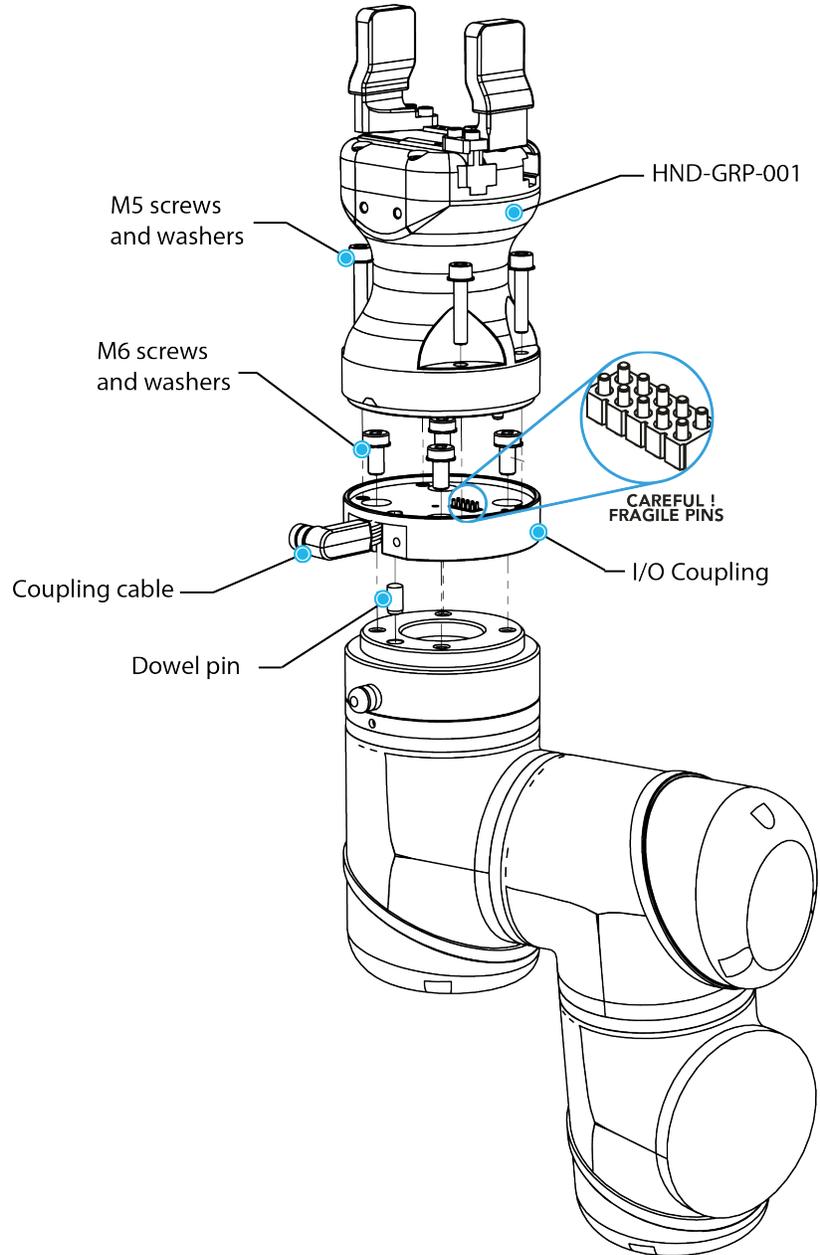
Fig. 3-4: Mechanical installation of the I/O Coupling and the Hand-E gripper

Multiple Grippers Installation

When installing multiple grippers on one robot, every gripper must have its own coupling.

1. Install the mounting plate on the robot arm (AGC-APL-159-02).
2. Mount the grippers' couplings on the mounting plate using the provided M6 X 12mm screws and toothlock washers.
3. Mount the grippers onto the coupling using the provided M5 X 25 mm screws and toothlock washers.
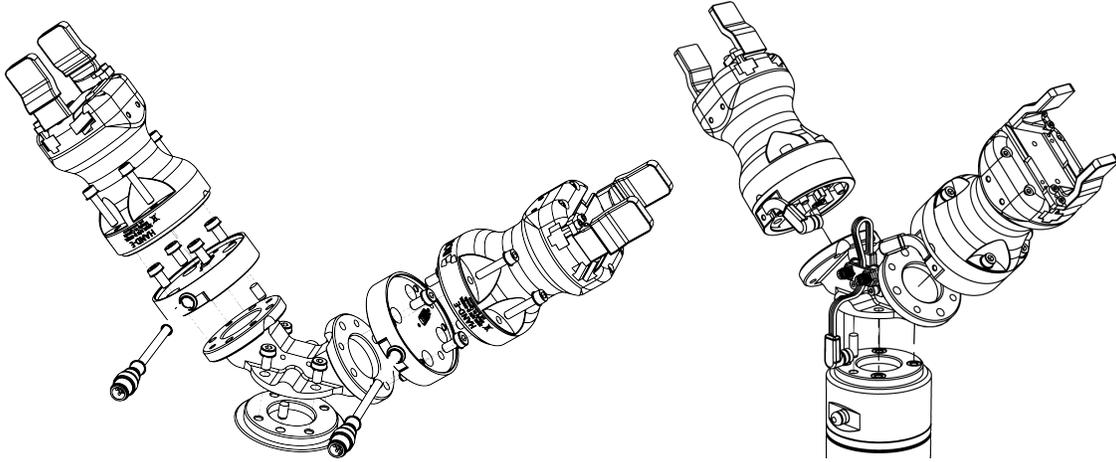
Fig. 3-5: Dual Hand-E Gripper Configuration (CB-Series and e-Series)

For e-Series:

1. Fasten the M8 splitter (ACC-SPLIT-M8-2:1) to the dual gripper adapter plate (AGC-APL-159-002)
   a. Make sure the splitter is fastened on the side of the adapter plate that receives the dowel pin
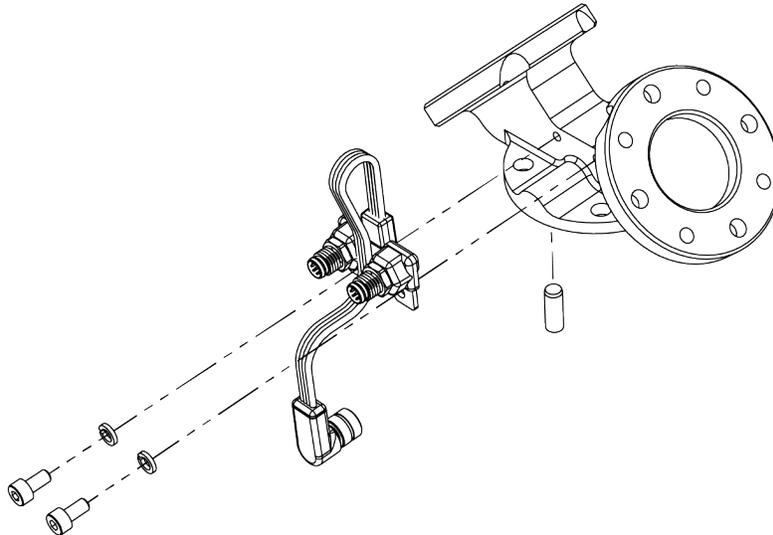
Fig. 3-6: Fastening the splitter to the dual gripper adapter plate

3.4.2. Mounting fingers, fingertips and holders on Hand-E

The figures below list the material needed to mount fingers or fingertips/holders onto the racks of the Hand-E gripper.

NO	ITEM
1	HAND-E ALUMINUM FLAT FINGER
2	SOCKET HEAD CAP SCREW M3-0.5 X 8mm
3	DOWEL PIN M2 X 6mm LG.
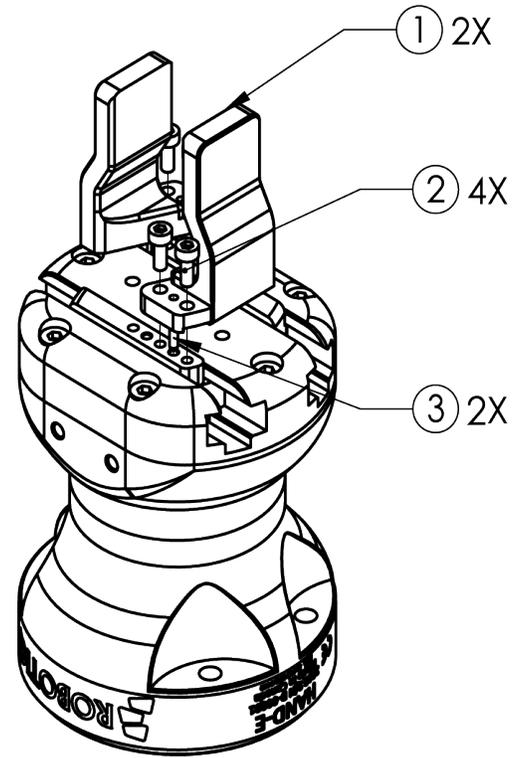
Fig. 3-7: Mounting fingers on racks.

NO	ITEM
1	HAND-E RUBBER FLAT FINGERTIP
2	DOWEL PIN M2 X 6mm LG.
3	SOCKET HEAD CAP SCREW M3-0.5 X 8mm
4	FINGERTIP HOLDER
5	SOCKET HEAD CAP SCREW M3-0.5 X 8mm
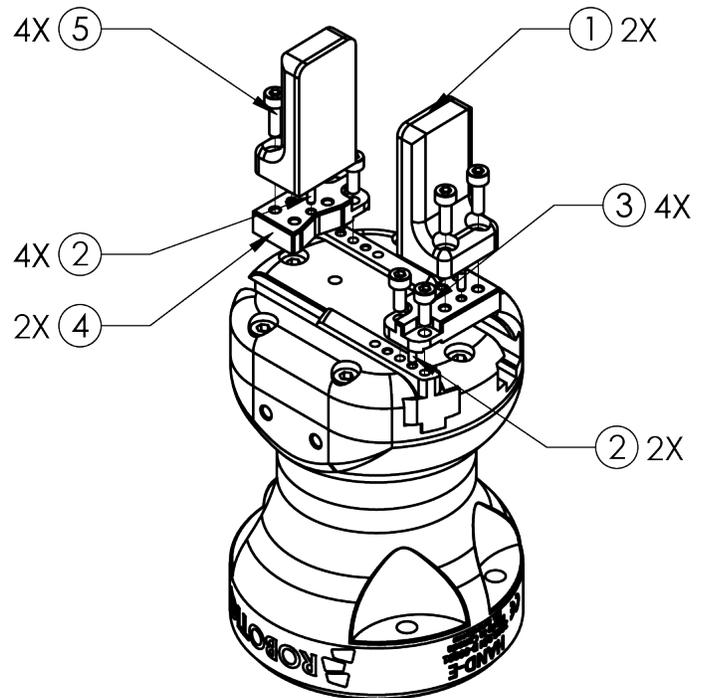
Fig. 3-8: Mounting fingertips on holders, and holders on racks.

3.5. Electrical Setup

Power and communication are established with the Hand-E gripper via a single device cable. The device cable provides a 24V power supply to the Gripper and enables serial RS485 communication to the robot controller.

> **Info**
>
> RS485 signals (485+, 485- and 485 GND) are isolated from the main 24V power supply. GND can be connected to any other ground reference as long as the voltage potential between the grounds does not exceed 250V. Grounding reference is at the user's discretion.

3.5.1. Electrostatic Discharge Safety

Robotiq Hand-E Gripper is not ESD safe. If installed properly using the toothlock washers, the casing and internal mechanism are grounded through the screws used to mount the gripper on the coupling. The same is true for the coupling. For the Hand-E Gripper, the top part mounted on the casing using 6 screws, the fingertips and rails are isolated from the rest of the gripper. It is therefore not possible to discharge any electrostatic charge that would build up on the part through the gripper.

3.5.2. Pinout Interface

The Gripper interfaces with its coupling via a 10-spring pin connector located on its outer surface.

Pin	Description	Pin	Description
1	GND	6	V on
2	GND	7	485+
3	24V	8	485-
4	24V	9	Internal Use
5	Earth	10	485 GND

Coupling Top View

Gripper Bottom View
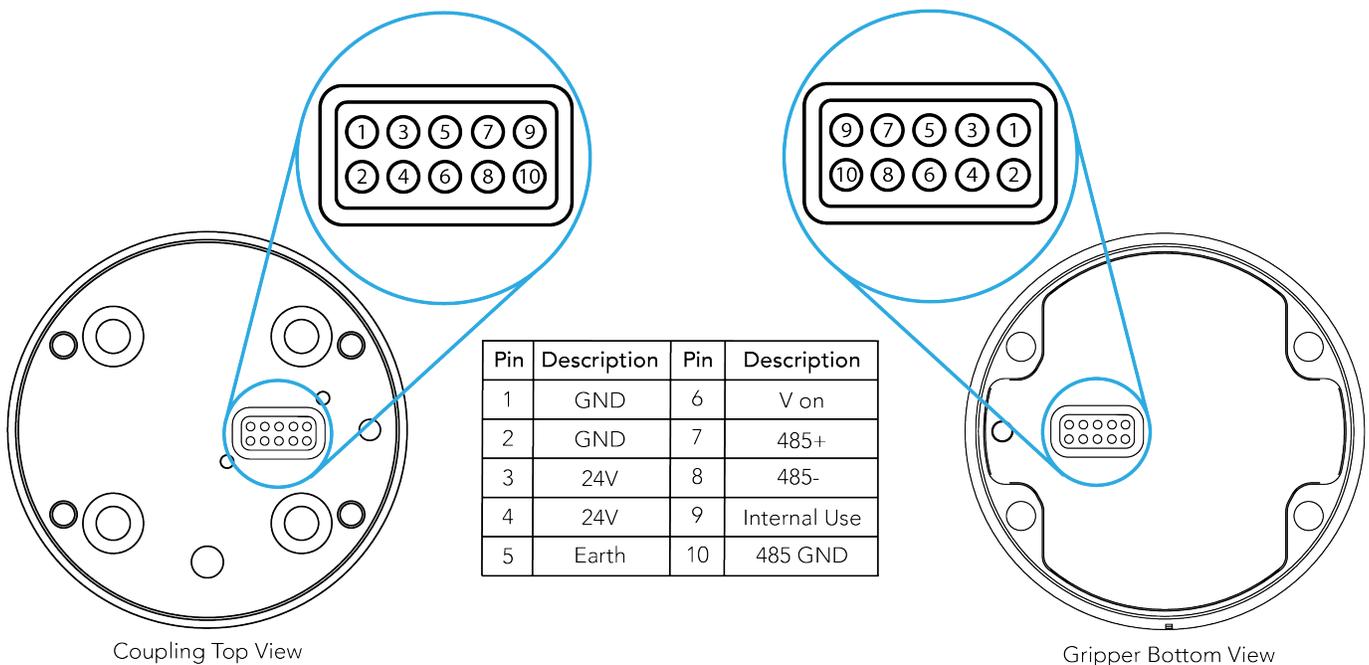
3.5.3. Coupling to Controller

> **Caution**
>
> Use proper cabling management. Make sure to leave enough slack in the cabling to allow movement of the Gripper along all axes without pulling out the connectors. Always protect the controller side (robot side) connector of the cable with a strain relief cable clamp.

The figure below illustrates the Hand-E gripper pigtail connector from the coupling (**GRP-CPL-062** or **AGC-CPL-XXX-002**), the device cable on the robot side (**CBL-COM-2065-10-HF**) and their associated pinout.
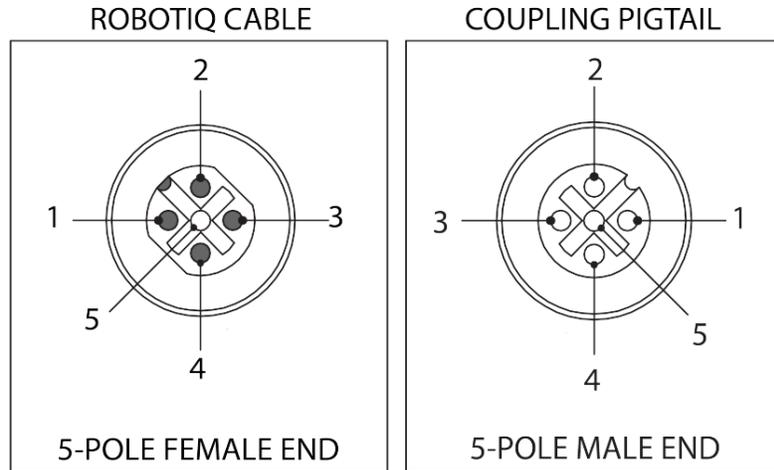
PIN	END OF CABLE COLOR	SIGNAL
1.	(SHIELD)	RS485 GND
2.	RED	24 V
3.	BLACK	GND
4.	WHITE	RS485 +
5.	GREEN	RS485 -

Table 3-4: Pinout of the Hand-E gripper pigtail and device cable.

If additional cables are used, suggested cable specifications are as follows:

Power supply, fusing

- minimum #22 AWG TEW, 300 V or 600 V

RS485 signal

- minimum #24 AWG TEW, 300 V or 600 V
- A and B signals must be balanced at 120 Ohms

3.5.4. Coupling to Tool Connector for I/O Coupling

M8 right angle 8 Position Receptacle Female pins

FRONT VIEW OF CONNECTOR

Pin #	Function
1	Not connected
2	Not connected
3	Digital output 1
4	Digital output 0
5	24V
6	Digital input 1
7	Digital input 0
8	0V
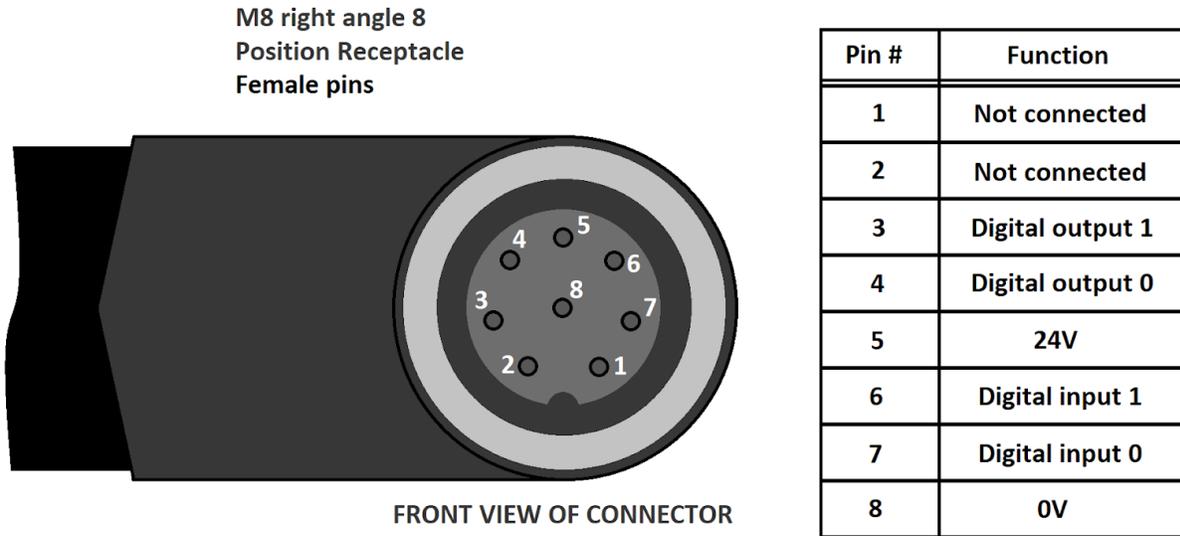
Fig. 3-9: Pinout of the I/O Coupling

3.5.5. Coupling to Wrist for e-Series

Single Gripper

The figure below represents the wiring schematic of Hand-E with a coupling connecting directly to the robot wrist.

HAND-E

ROBOTIQ DEVICE CABLE
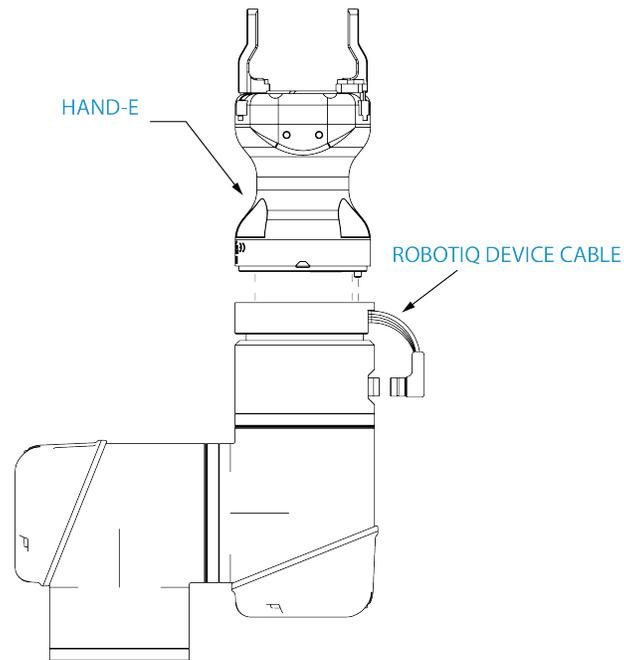
Fig. 3-10: Robotiq Hand-E with device cable wiring scheme

PIN	SIGNAL
1	24V
2	GND
3	RS485 +
4	RS485 -
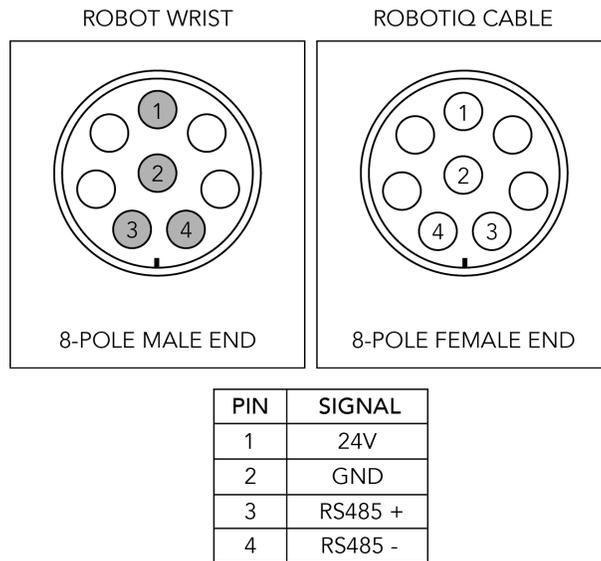
Fig. 3-11: Pinout of the 2-Finger cable-to-wrist coupling

Info

Power supply, communication signals, grounding, electrical resistance and fusing are managed by the robot itself.

Multiple Grippers

Caution

For multiple gripper configurations, connect the M8 splitter to the robot wrist connector.

Warning

In order to connect two or more Grippers at the same time on a robot, each Gripper must have a coupling for the transmission of power and communication signals, a dual gripper adapter plate to mechanically mount the Gripper on the robot arm, and a splitter.

Please refer to the **Spare Parts, Kits and Accessories** section for more details.

3.6. Testing the Gripper with the Robotiq User Interface (RUI)

Once installed and properly secured, your Robotiq Hand-E gripper should be tested with the Robotiq User Interface test software using the provided USB converter. Follow these instructions.

1 Install the Robotiq User Interface (RUI). For details, see the Robotiq User Interface, available from robotiq.com/support.

> **Info**
>
> For CB-Series, use the provided RS-485 to USB converter ACC-ADT-USB-RS485 (see **RS-485 to USB converter ACC-ADT-USB-RS485 pinout.** section) to plug into a PC with the Robotiq User Interface installed.

2 Power up your Gripper with the previously recommended power supply.

3 Execute the RUI software and select "auto-connect" on the connection screen.

4 You are now connected to your Gripper; you can click "activate" to begin using the Gripper.

> **Caution**
>
> The Activate command will initiate movement of the Gripper for the auto-calibration procedure. Do not interfere with the Gripper. Be sure you have met robot safety measures.

Pin	Signal
1	485+ (WHITE)
2	485- (GREEN)
3	485 GND (BARE)
4	120 OHMS
5	120 OHMS
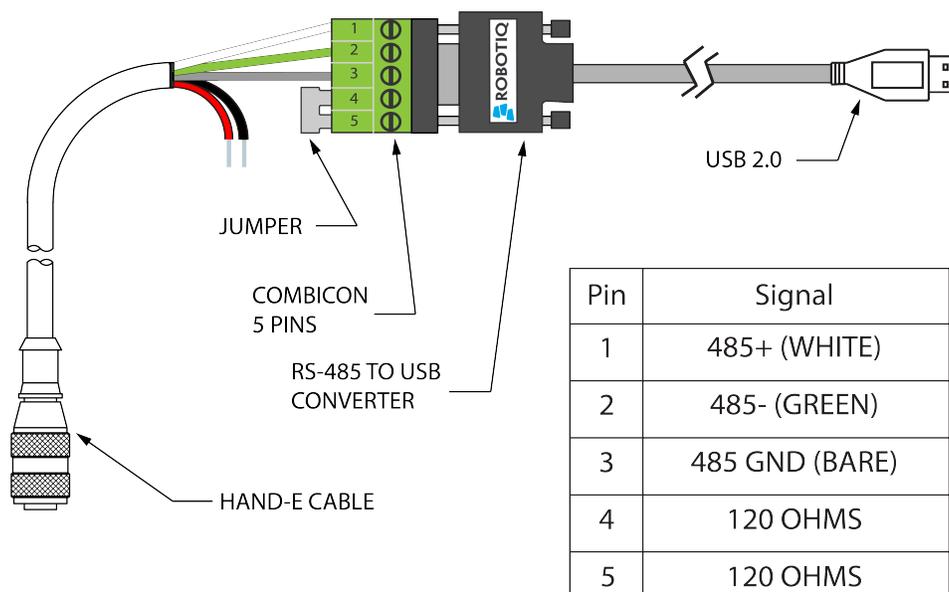
*24 V AND GND ARE NOT SUPPLIED VIA USB
*120 Ohms resistance JUMPER BETWEEN PINS 4 AND 5

Fig. 3-12: RS-485 to USB converter ACC-ADT-USB-RS485 pinout.

> **Tip**
>
> With the RUI controlling the Gripper, you can go to the "view" menu to see input and output register values to further your understanding on how to command the Gripper. You can also test gripping your parts with various speed and force settings. Please refer to the **Control** section for details.

3.7. Installation for Universal Robots

The table below shows which Robotiq software to use with your Universal Robots controller. If you are using a CB3 or CB3.1 controller, it is recommended to use the Hand-E gripper URCaps Package.

Robotiq Software	Controller CB1	Controller CB2	Controller CB3	Controller CB3.1	e-Series Controller
Driver Package (includes Gripper toolbar)	Incompatible	Compatible	Compatible	Compatible	Incompatible
Robotiq Grippers URCap Package 1.2.1 and earlier versions	Incompatible	Incompatible	Compatible	Compatible	Incompatible
Robotiq Grippers URCap Package 1.3.0	Incompatible	Incompatible	Incompatible	Compatible	Incompatible
Robotiq Grippers URCap Package 1.3.1 and later versions	Incompatible	Incompatible	Incompatible	Compatible	Compatible

Table 3-5: Compatibility between Robotiq software and robot controller

Refer to the **URCap Package** section for the installation of the UR software package for Hand-E.

> **Caution**
>
> The robot PolyScope version must be 3.5 or later in order to install the URCap.

> **Caution**
>
> Prior to use over Universal Robots, adjust the payload and the center of gravity in the **Installation** tab (refer to the **Mechanical Specifications** section).

> **Caution**
>
> Please refer to the **Installing URCap Package** section to configure the grippers properly before controlling and programming them.

3.8. URCap Package

Robotiq provides you with a Universal Robots URCap package that enables direct serial communication to your robot controller.

> **Info**
>
> To download the URCap package for your Universal Robots controller, go to robotiq.com/support, select your product from the list, then go to **Software > Gripper Software > DOWNLOAD ZIP**.

Mount Hand-E gripper on tool flange. For details on installation, see section **Mechanical Installation** section. Before installing the URCap package, make sure your Universal Robots controller is compatible with the package (see section **Installation for Universal Robots** section).

The Gripper URCap package installs the following elements:

- Gripper URCap
- Gripper toolbar
- Gripper node

For details on controlling the Gripper, see **Control** section.

> **Info**
>
> For details on programming with the URCap package, see the **Control** section

3.8.1. Installing URCap Package

Make sure the Hand-E gripper is properly mounted to the robot arm. Refer to the **Mechanical Installation** section for detailed information on the mechanical installation. Before proceeding with the installation of the URCap package, make sure your Universal Robots controller is compatible with the package (refer to the **Installation for Universal Robots** section).

Installing URCap Package on CB-Series

To install the gripper URCap, follow these instructions.

- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Gripper's URCap package.
- Browse to support.robotiq.com and click on **Select product > Hand-E Adaptive Gripper > Software > Gripper Software**.
- Download the **UCG-X.X.X** and extract its content on the root of a blank USB stick.
- If an I/O coupling is present, install the appropriate URCap by downloading the **UCH-X.X.X** in the I/O Coupling Software tab and extract on the root of a blank USB stick.
- Insert the USB stick in the UR teach pendant or controller.
- Go to **Setup Robot**.
- Tap **URCaps Setup**.

> **Tip**
>
> To identify your PolyScope version, go to the PolyScope home page and tap **About**. A window containing the Universal Robots software version is then displayed.

Setup Robot

URCaps Setup

Active URCaps:

URCap Information:

Initialize Robot · Language and Units · Update Robot · Set Password · Calibrate Screen · Setup Network · Set Time · URCaps Setup · Back · Restart

- Tap the **plus** button (**+**) to add the Gripper's URCaps package.
- Open **Robotiq_Grippers-X.X.X.urcap** from the USB storage device.
- If an I/O coupling is present, tap the **plus** button (**+**) to add the Wrist Connection's URCaps package. Open **Robotiq_Wrist_connection-X.X.X.X.urcap** from the USB storage device.

Setup Robot — ActiveDrive

URCaps

Active URCaps

Robotiq_Grippers

URCap Information

URCap name: Robotiq_Grippers
Version: 1.2.0
Developer: Robotiq Inc.
Contact Info: 966, chemin Olivier, Suite 325, Levis, Qc, G7A 2N1, Canada
Description: URCap for programming

Copyright: Copyright (c) 2016, Robotiq inc.. All rights reserved.
License Type: See End-User License Agreement below
License:
END-USER LICENSE AGREEMENT

YOU SHOULD CAREFULLY READ THE FOLLOWING AGREEMENT
BEFORE USING THE Software (as this term is hereinafter defined)

Initialize Robot · Language · Update · Set Password · Calibrate Screen · Network · Time · URCaps · Back · Restart

- Restart PolyScope to complete the URCap installation. By doing so, you accept the License Agreement that is detailed in the URCap information text box (please refer to the **License Agreement** section below).

Gripper — **PolyScope Robot User Interface**

UNIVERSAL ROBOTS

Please select

Run Program · Program Robot · Setup Robot · Shutdown Robot · About
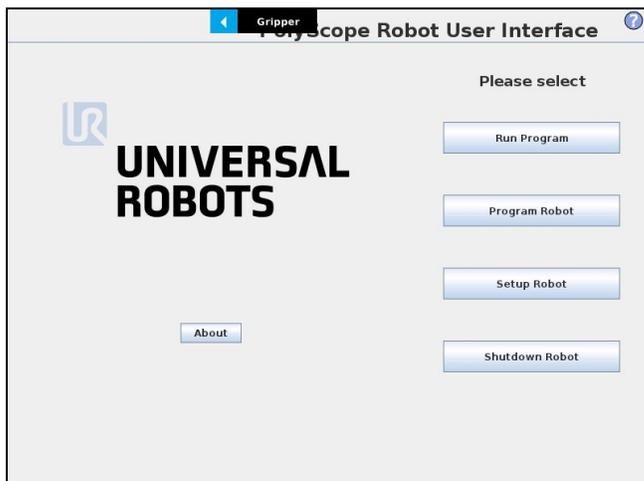
- When PolyScope reopens, the Gripper toolbar will appear on the screen.
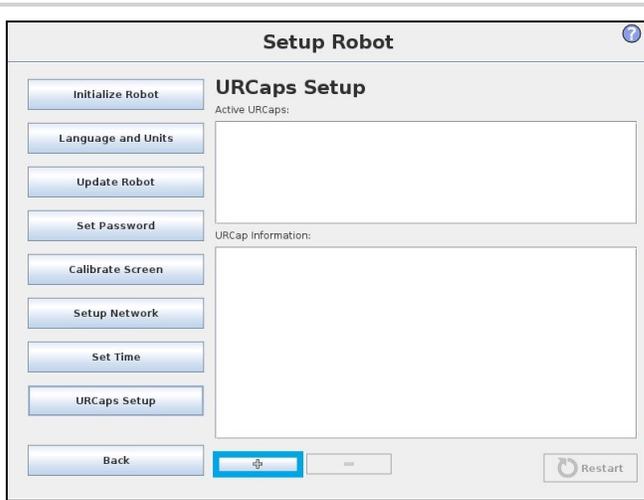
Installing URCap Package on e-Series
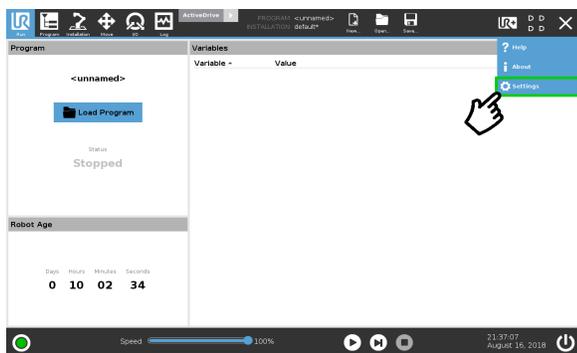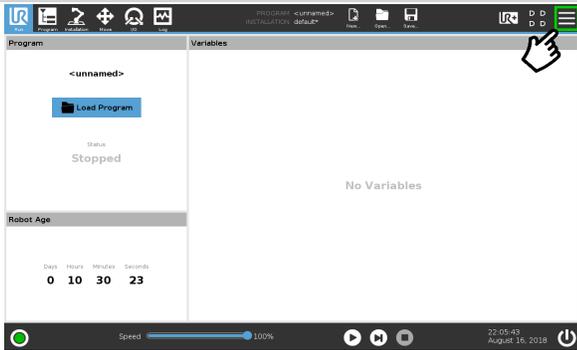
- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Gripper's URCap package.
- Go to support.robotiq.com and click on the Hand-E product page.
- Download the corresponding URCap and extract it on the root of a blank USB stick.
- Insert the USB stick in the UR teach pendant or controller.
- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.
- Tap **Settings**.
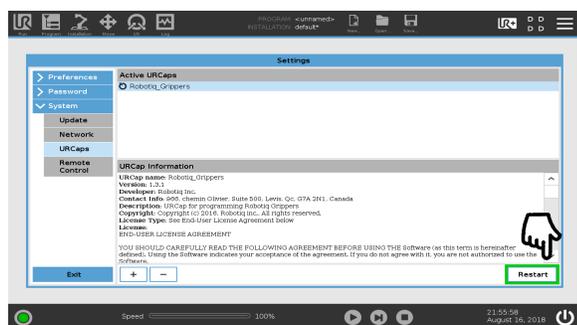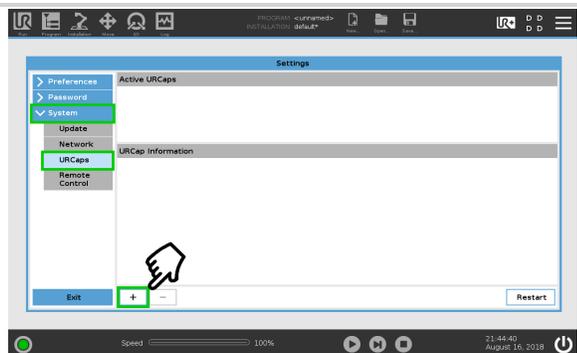
- Tap the **System** button in the navigation pane on the left.
- Select **URCaps** in the dropdown list.
- Press the plus (**+**) button to look for the .urcap file in the available drives.
- Once the file is selected, it will display in the **Active URCaps** box, next to a rounded arrow.
- Tap the **Restart** button to activate the URCap.

Info

Tap the **triple bar icon** and select the **About** button to view the UR software version.

Activating a Gripper Connected to the Robot Wrist on a e-Series Robot

When connecting a gripper to the robot wrist connector, you need to manually set it up in PolyScope. Otherwise, your gripper will not be activated. Follow these instructions.

1. Mechanically mount your gripper on your robot. For details, see the **Mounting Hand-E on the Robot** section
2. Go to **Installation > URCaps > Gripper > Dashboard**.
3. Check the box "Gripper cable is connected to the wrist".

*Fig. 3-13: **Gripper cable is connected to the wrist** Check Box.*

4. Go to **Installation > General > Tool I/O**.

5. Go to section "I/O Interface Control" and select "Robotiq_Grippers" in the drop down list of "Controlled by".

Fig. 3-14: I/O Interface Control.

> **Tip**
>
> To reload these settings when your restart your robot, save the `Installation` file.

6. Go back to the gripper "Dashboard", and tap **Scan**. An icon should confirm your gripper is connected. To activate it, tap **Activate**. You can now use your gripper. Tap **E-Open** or **E-Close** to jog it.

> **Info**
>
> The number inset in the gripper icon corresponds to the gripper ID.

Activating Multiple Grippers

It is possible to connect and control up to four grippers on the same UR robot.

When installing multiple grippers on a UR robot, set an ID for each gripper. To do so, perform the following steps for each Gripper.

> **Caution**
>
> Connect only one gripper at a time using the splitter (refer to the **Mounting Hand-E on the Robot** section and the **Electrical Setup** section for details instructions). After a gripper has been identified by PolyScope, disconnect it and repeat the installation procedure for each additional gripper.
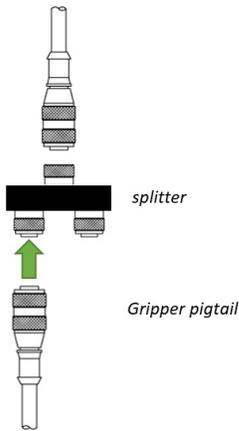
splitter *Gripper pigtail*	1. Connect only one gripper at a time using the splitter.
Scan — Change ID — Activate — E-Open — E-Close Not activated ☑ Show Gripper Toolbar	For CB-Series: 1. From the PolyScope home page, go to **Program Robot**, and tap the **Installation** tab. 2. Tap **Gripper**. 3. Tap the **Dashboard** tab. 4. Tap the **Scan** button to detect Grippers. For e-Series: 1. Tap **Installation** in the top ribbon. 2. From the left navigation pane, tap **URCaps**. 3. Tap **Gripper**. 4. Tap the **Dashboard** tab. 5. Perform steps 3 to 6 listed under the **Activating a Gripper Connected to the Robot Wrist on a e-Series Robot** section
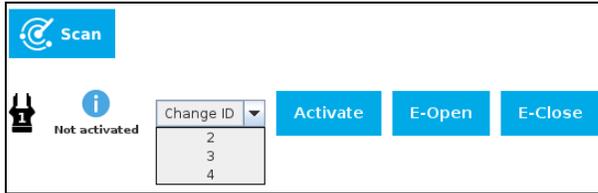
	1. Check that gripper ID is different from that of other grippers that will be connected to the robot, and if required, select a different ID from the "Change ID" dropdown list. **Caution** Make sure that each gripper has a ID different from other grippers to the robot. Otherwise, communication issues will occur. By default, Gripper ID is set to 1 in all grippers internal memory. When you change gripper ID through PolyScope, that change is committed to gripper memory. 2. Click on **Activate** to activate the Gripper. 3. Perform the same routine for all grippers, if applicable, connecting only one at the time.
	1. Once all grippers ID have been set, connect them all to the splitter. 2. Go back to the **Dashboard** tab, and confirm that all grippers are recognized and can be controlled. Tap **E-Open** and **E-Close** to jog each gripper.
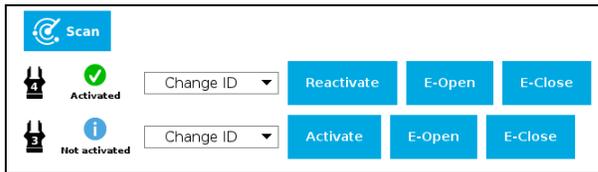
3.8.2. Uninstalling URCap Package

If you wish to uninstall the Hand-E gripper URCap, follow this procedure:

For CB-Series
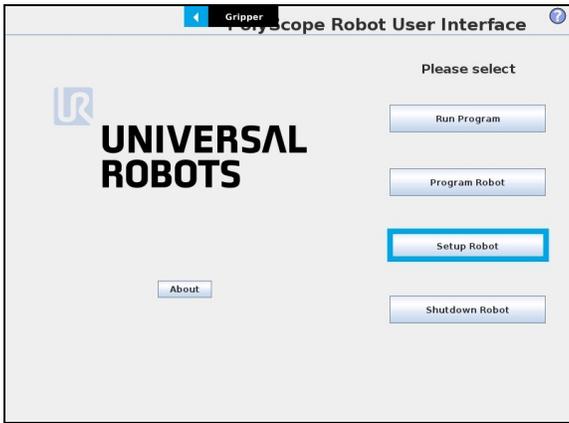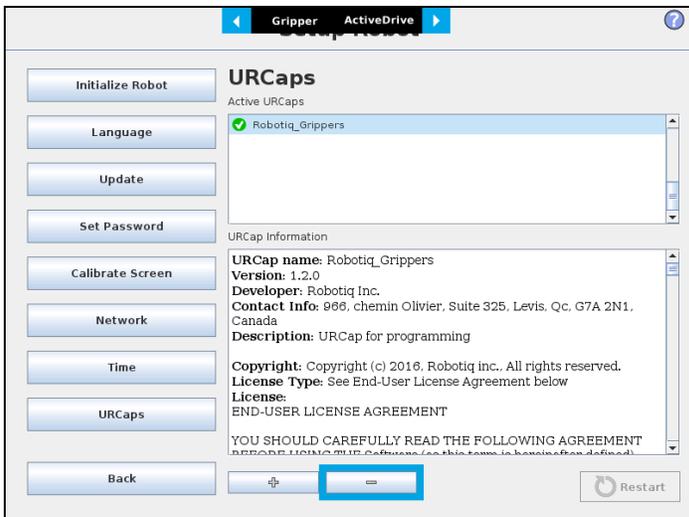
	• Go to **Setup Robot**.
	• Tap **URCaps Setup**.
	• In the **Active URCaps** text box, tap the **Gripper** URCap. • The Gripper URCap should be highlighted. • Tap the **minus** button (**-**) to uninstall the URCap. • Restart PolyScope to complete the uninstallation process.

For e-Series
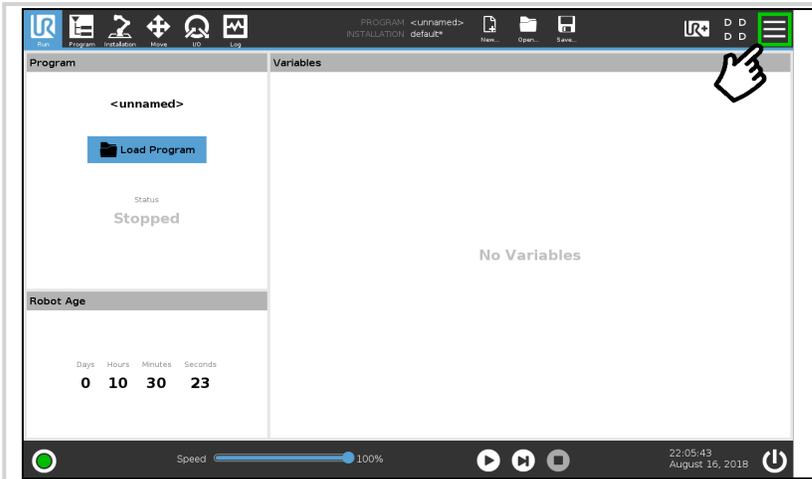
- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.
- Tap **Settings**.
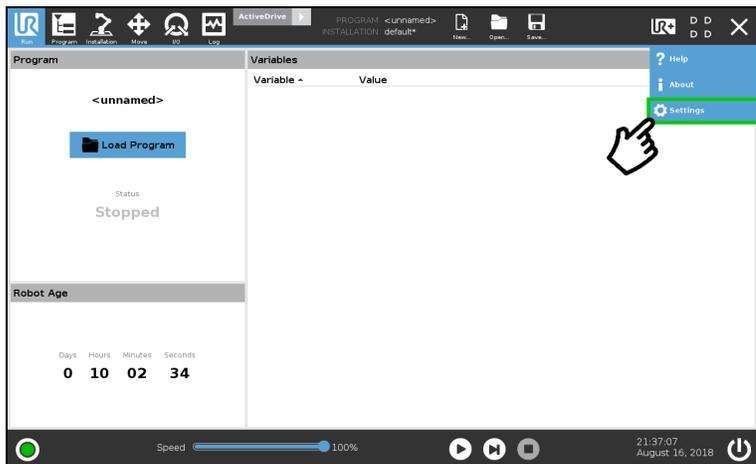
- Tap the **System** button in the navigation pane on the left.
- Select **URCaps** in the dropown list.
- Select the URCap to uninstall.
- Press the minus (**-**) button to remove the URCap.
- Tap the **Restart** button to deactivate the URCap.
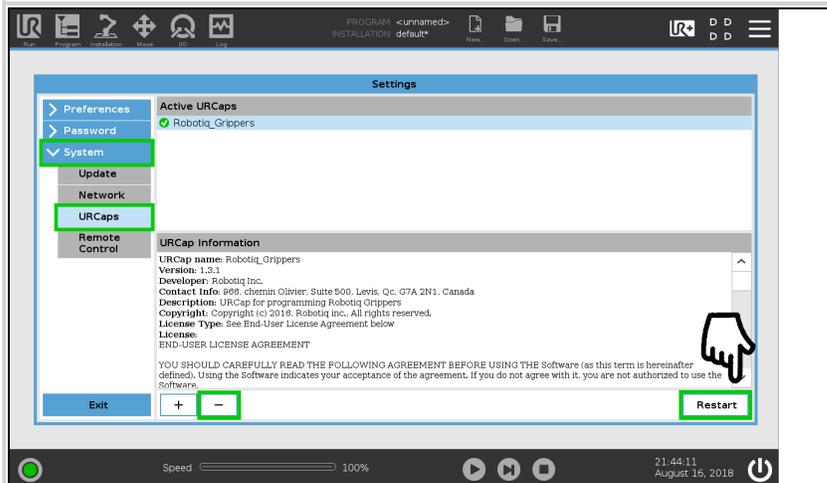
3.8.3. License Agreement

END-USER LICENSE AGREEMENT

YOU SHOULD CAREFULLY READ THE FOLLOWING AGREEMENT BEFORE USING THE Software (as this term is hereinafter defined). Using the Software indicates your acceptance of the agreement. If you do not agree with it, you are not authorized to use the Software.

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   b. "Software" means any of the Licensor's softwares provided to its customers for the purposes mentioned in Sub-section 1.4 hereof including their modifications and upgrades and their related materials;
   c. "Licensor" means Robotiq inc., a corporation incorporated under the laws of Quebec, having its registered office at 500-966 chemin Olivier, Lévis, Québec, Canada, G7A 2N1, which specializes into the conception, advanced manufacturing and sale of robotic products (the "Licensor's Business");
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   f. "UR's Products" means those products developed by UR in the course of the UR's Business;
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12. Expiration and Termination. The Licensor may terminate this Agreement for default by the End-User. This Agreement will also be automatically terminated upon the election of such by the Licensor or the official launch of the Software, whichever event comes first. Upon termination of this Agreement for any reason, the End-User shall promptly uninstall the Software on any UR's Products and Licensor's Products, computer, or server on which it has been installed, deliver to the Licensor all CDs, DVDs, magnetic tapes, cards, and other tangible items and materials embodying the Software, and return to the Licensor all copies thereof or destroy such copies and warrant in writing that all copies thereof have been destroyed. In the event of termination of this Agreement, all obligations of the parties under this Agreement due for performance on the date of termination shall survive the termination, and the party terminating shall not be liable to the other party for any damages arising out of the termination.

13. Miscellaneous.

   a. This Agreement constitutes the entire understanding and agreement between the Licensor and the End-User and replaces any prior agreement relating to the same subject matter.

   b. This Agreement shall be governed and construed in accordance with the laws of the province of Quebec and the federal laws of Canada applicable therein. Any legal action or proceeding between the Licensor and the End-User for any purpose concerning this Agreement or the parties' obligations hereunder shall be brought exclusively in a court of competent jurisdiction sitting in the judicial district of Trois-Rivières, Quebec.

   c. The Licensor's failure to insist upon or enforce strict performance of any provision of this Agreement shall not be construed as a waiver of any provision or right. Neither the course of conduct between the parties nor trade practice shall act to modify any provision of this Agreement.

   d. The Licensor may assign its rights and duties under this Agreement to any party at any time without notice to the End-User. The End-User may not assign this Agreement without the prior written consent of the Licensor.

   e. If any part of this Agreement is null, illegal or non-enforceable, this Agreement shall be interpreted as if this part was never part of this Agreement.

   f. The provisions of this Agreement are for the benefit of the Licensor and its officers, directors, employees, agents, licensors and suppliers. Each of these individuals or entities shall have the right to assert and enforce those provisions directly against the End-User on its own behalf. This Agreement is also for the benefit of, and binds, the End-User and its heirs, successors, legal representatives and permitted assigns.

   g. Any rights not expressly granted herein are reserved.

   h. The parties confirm that they have agreed that this Agreement and all related documents be drafted in English only. Les parties aux présentes confirment qu'elles ont accepté que la présente convention et tous les documents y afférents soient rédigés en anglais seulement.

4. Control

> **Info**
>
> Unless specified, all values in this section are in hexadecimal values.

4.1. Overview

The Robotiq Hand-E gripper is controlled directly via Modbus RTU using a RS485 signal.

> **Tip**
>
> To test various gripper features such as object detection and force control, use the Robotiq User Interface. To download it, go to robotiq.com/support, click on **Select product > Hand-E Adaptive Gripper > [any robot brand] > Software > Robotiq User Interface > DOWNLOAD ZIP**.

Since the Robotiq Hand-E gripper has its own embedded controller, you can use high-level commands such as "Go to requested position" to control it.

> **Info**
>
> The operator can control force, speed, and position of gripper fingers.
>
> - Finger movement is always synchronized.
> - Finger movement is initiated via a single "Go to requested position" command.
> - Parallel or encompassing grip is performed automatically.
> - Object detection is built-in. Operator is notified after an object is picked once the "Go to" command has been initiated. The feature also works for lost or dropped objects, and the user can be alerted if an object is dropped after being detected.
> - In case of emergency, auto-release is engaged (open or close).

Control using registers

Grippers share their internal memory with a robot controller. One part of the memory is for the robot output; **gripper functionalities**. The other part of the memory is for the robot input; **gripper status**. Two types of actions are then available to a robot controller:

1. Write in the **robot output** registers to activate **functionalities**;

2. Read in the **robot input** registers to get the **status** of the Gripper.

The **Gripper Register Mapping** section maps the registers used to control the Gripper or to read its status while the **Robot Output Registers and Functionalities** section will detail the output (write) register functions, and **Robot Input Registers and Status** section details the input (read) register status. The figure below is a representation of the memory and the control logic of the Gripper. For details, see the **Control Logic Example** section
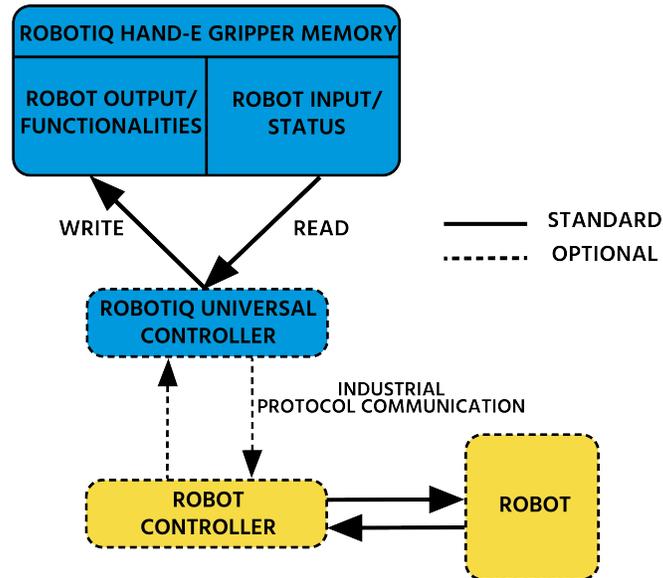
Fig. 4-1: Hand-E control logic overview

4.2. Gripper Register Mapping

> **Caution**
>
> Byte numbering starts at zero and not at 1 for the functionalities and status registers.

Register	Robot Output / Functionalities	Robot Input / Status
Byte 0	ACTION REQUEST	GRIPPER STATUS
Byte 1	RESERVED	RESERVED
Byte 2	RESERVED	FAULT STATUS
Byte 3	POSITION REQUEST	POS REQUEST ECHO
Byte 4	SPEED	POSITION
Byte 5	FORCE	CURRENT
Byte 6 to 15	RESERVED	RESERVED

Table 4-1: Registers of the Hand-E gripper.

4.3. Robot Output Registers and Functionalities

4.3.1. Register: ACTION REQUEST

Address: **Byte 0**

Bits	7	6	5	4	3	2	1	0
Symbols	Reserved		rARD	rATR	rGTO	Reserved		rACT

rACT

First action to be made prior to any other actions; the **rACT** bit will activate the Gripper. Clear the **rACT** bit to reset the Gripper and clear any fault status.

- 0x0 - Deactivate Gripper.
- 0x1 - Activate Gripper (must stay on after activation routine is completed).

> **Warning**
>
> When setting **rACT** (rACT ==1), the Gripper will begin movement to complete its activation feature.

> **Info**
>
> Power loss will set **rACT** (rACT == 1); the **rACT** bit must then be cleared (rACT == 0), then set again to allow operation of the Gripper.

> **Caution**
>
> The **rACT** bit must stay on afterwards for any other action to be performed.

rGTO

The "Go To" action moves the Gripper fingers to the requested position using the configuration defined by the other registers, **rGTO** will engage motion while bytes 3, 4 and 5 will determine aimed position, force and speed. The only motions performed without the **rGTO** bit are activation and automatic release routines.

- 0x0 - Stop.
- 0x1 - Go to requested position.

rATR

Automatic Release routine action slowly opens the Gripper fingers until all motion axes reach their mechanical limits. After all motions are completed, the Gripper sends a fault signal and needs to be reinitialized before any other motion is performed. The **rATR** bit overrides all other commands excluding the activation bit (**rACT**).

- 0x0 - Normal.
- 0x1 - Emergency auto-release.

> **Caution**
>
> The automatic release is meant to disengage the Gripper after an emergency stop of the robot.
> The automatic release is not intended to be used under normal operating conditions.
> Automatic release requires the rACT to be cleared (rACT == 0) then set (rACT == 1).

rARD

Auto-release direction. When auto-releasing, **rARD** commands the direction of the movement. The **rARD** bit should be set prior to or at the same time as the **rATR** bit, as the motion direction is set when the auto-release is initiated.

- 0x0 - Closing auto-release
- 0x1 - Opening auto-release

4.3.2. Register: GRIPPER OPTIONS

Address: **Byte 1**

Bits	7	6	5	4	3	2	1	0
Symbol	Reserved							

4.3.3. Register: GRIPPER OPTIONS 2

Address: **Byte 2**

Bits	7	6	5	4	3	2	1	0
Symbol	Reserved							

4.3.4. Register: POSITION REQUEST

Address: **Byte 3**

Bits	7	6	5	4	3	2	1	0
Symbol	rPR							

This register is used to set the target position for the Gripper's fingers. The positions 0x00 and 0xFF correspond respectively to the fully opened and fully closed mechanical stops. For detailed finger trajectory, see section **Specifications** section.

- 0x00 - Open position, with 50 mm opening
- 0xFF - Closed
- Opening / count: ≈0.2 mm for 50 mm stroke

> **Info**
>
> The activation will allow the Gripper to adjust to any fingers/fingertips. No matter what is the size and/or shape of the fingers/fingertips, 0 will always be fully opened and 245 fully closed, with a quasi-linear relationship between the two values.

4.3.5. Register: SPEED

Address: **Byte 4**

Bits	7	6	5	4	3	2	1	0
Symbol	rSP							

This register is used to set the Gripper closing or opening speed in real time, however, **setting a speed will not initiate a motion**.

- 0x00 - Minimum speed
- 0xFF - Maximum speed

4.3.6. Register: FORCE

Address: **Byte 5**

Bits	7	6	5	4	3	2	1	0
Symbol	rFR							

The force setting defines the final gripping force for the Gripper. The force will fix the maximum current sent to the motor . If the current limit is exceeded, the fingers stop and trigger an object detection notification. Please refer to the **Picking Features** section for details on force control.

- 0x00 - Minimum force
- 0xFF - Maximum force

> **Info**
>
> Register bytes 6 to 15 are reserved and should be set to 0.

4.4. Robot Input Registers and Status

4.4.1. Register: GRIPPER STATUS

Address: **Byte 0**

Bits	7	6	5	4	3	2	1	0
Symbols	gOBJ		gSTA		gGTO	Reserved		gACT

gACT

Activation status, echo of the **rACT** bit (activation bit).

- 0x0 - Gripper reset.
- 0x1 - Gripper activation.

gGTO

Action status, echo of the **rGTO** bit (**go to** bit).

- 0x0 - Stopped (or performing activation / automatic release).
- 0x1 - Go to Position Request.

gSTA

Gripper status, returns the current status and motion of the Gripper fingers.

- 0x00 - Gripper is in reset (or automatic release) state. See Fault Status if Gripper is activated.
- 0x01 - Activation in progress.
- 0x02 - Not used.
- 0x03 - Activation is completed.

gOBJ

Object detection status, is a built-in feature that provides information on possible object pick-up. Ignore if **gGTO** == 0.

- 0x00 - Fingers are in motion towards requested position. No object detected.
- 0x01 - Fingers have stopped due to a contact while opening before requested position. Object detected opening.
- 0x02 - Fingers have stopped due to a contact while closing before requested position. Object detected closing.
- 0x03 - Fingers are at requested position. No object detected or object has been loss / dropped.

> **Caution**
>
> In some circumstances the object detection feature may not detect an object even if it is successfully grasped. For instance, picking up a thin object may be successful without the object detection status being triggered. In such applications, the "Fingers are at requested position" status of register gOBJ is sufficient to proceed to the next step of the routine.

> **Tip**
>
> Checking for the correct position of the fingers (byte 4), **as well as** object detection (byte 0, bit 6 & 7) before proceeding to the next step of a routine is a more reliable method than object detection or finger position alone.

4.4.2. Register: RESERVED

Address: **Byte 1**

Bits	7	6	5	4	3	2	1	0
Symbol	Reserved							

4.4.3. Register: FAULT STATUS

Address: **Byte 2**

Bits	7	6	5	4	3	2	1	0
Symbols		kFLT				gFLT		

gFLT

Fault status returns general error messages that are useful for troubleshooting. Fault LED (red) is present on the Gripper chassis, LED can be blue, red or both and be solid or blinking.

- 0x00 - No fault (solid blue LED)
- Priority faults (solid blue LED)
    - 0x05 - Action delayed; the activation (re-activation) must be completed prior to perform the action.
    - 0x07 - The activation bit must be set prior to performing the action.

Minor faults (solid red LED)

- 0x08 - Maximum operating temperature exceeded (≥ 85 °C internally); let cool down (below 80 °C).
- 0x09 - No communication during at least 1 second.

Major faults (LED blinking red/blue) - Reset is required (rising edge on activation bit (**rACT**) needed).

- 0x0A - Under minimum operating voltage.
- 0x0B - Automatic release in progress.
- 0x0C - Internal fault, contact support@robotiq.com
- 0x0D - Activation fault, verify that no interference or other error occurred.
- 0x0E - Overcurrent triggered.
- 0x0F - Automatic release completed.

> **Info**
>
> While booting, status LED will be solid blue/red.

kFLT

See your optional controller manual (input registers and status).

4.4.4. Register: POSITION REQUEST ECHO

Address: **Byte 3**

Bits	7	6	5	4	3	2	1	0
Symbol	gPR							

gPR

Echo of the requested position for the Gripper, value between 0x00 and 0xFF.

- 0x00 - Full opening.
- 0xFF - Full closing.

4.4.5. Register: POSITION

Address: **Byte 4**

Bits	7	6	5	4	3	2	1	0
Symbol	gPO							

gPO

Actual position of the Gripper obtained via the encoders, value between 0x00 and 0xFF.

- 0x00 - Fully opened.
- 0xFF - Fully closed.

4.4.6. Register: CURRENT

Adress: **Byte 5**

Bits	7	6	5	4	3	2	1	0
Symbol	gCU							

gCU

The current is read instantaneously from the motor drive, value between 0x00 and 0xFF, approximate current equivalent is 10 * value read in mA.

> **Tip**
>
> Built-in features like object detection and force control use the fingers' electrical current readings. The user does not need to create these features.

4.5. Picking Features

As stated in previous sections, object picking is done via a simple "Go To" command, **rGTO** bit calls for movement, while **rPR** byte is the aimed position, **rSP** and **rFR** will be the desired speed and force settings respectively. This section describes key features in object picking applications:

- Force control
- Re-grasp
- Object detection
- Object contact loss

4.5.1. Force control

The gripping force is controlled via the **rFR** byte (please refer to the **Robot Output Registers and Functionalities** section).The Gripper behavior will change according to the **rFR** force requested.

- **rFR** = 0 : Very fragile objects or deformable objects mode
    - Lowest force
    - Re-grasp feature is off
- 1 **rFR** 255 : Solid & firm objects
    - High torque mode
    - Re-grasp feature is on

4.5.2. Re-Grasp

Re-grasp feature is a built-in feature meant to prevent object lost due to slipping or inaccurate initial grip. The Re-grasp feature will allow the Gripper to initiate a movement when an object is slipping or dropped. When Re-grasping, the Gripper will attempt to close until it reaches the position request (**rPR**).

- This feature is automatically set according to the force request **rFR**.

> **Info**
>
> Feature is off at force request rFR = 0, otherwise it is on.

- Re-grasp will keep the position setting:
    - Finger motion will stop when **rPR** position is reached, even if there is no object.
- Force and speed settings are not used, Re-grasp force and speed will automatically adjust to keep the object from being lost / dropped.

> **Info**
>
> While your initial settings for force and speed are not used for Re-grasp, they will never be eceeded to prevent damaging the part.

> **Caution**
>
> The rOBJ status is cleared when a motion is detected.

4.5.3. Object detection

When the Gripper grabs an object, the **gOBJ** status will allow you to know if contact with the object was successful. This is a built-in feature for adaptive grippers meant to be used by the robot controller (or PLC) commanding the overall application. The Object detection feature will change the gOBJ status and can be used inside your robot program.

As stated in the previous section:

gOBJ: Only valid if **gGTO** = 1.

- 0x00 - Fingers are in motion towards requested position. No object detected.
- 0x01 - Fingers have stopped due to a contact while opening before requested position. Object detected.
- 0x02 - Fingers have stopped due to a contact while closing before requested position. Object detected.
- 0x03 - Fingers are at requested position. No object detected or object has been lost / dropped.

Example of contact detected with an object:

1. Set position, speed and force at maximum (full closing):
   a. **rPR** == 0xFF, **rSP** == 0xFF, **rFR** ==0xFF,
2. Set "go to requested" will initiate movement :
   a. **rGTO** == 0x01
3. Then object detection status will be "in motion"
   a. **gOBJ** == 0x00
4. Until an object is picked, object detection status will then be "stopped due to contact while closing"
   a. **gOBJ** == 0x02
5. The user can now assume it is holding the payload, and proceed to the next step.


Example of contact lost with an object:

1. From the previous example, after an object is picked
   a. **gOBJ** == 0x02
2. If the gOBJ status displays 0x03 after it was 0x02, user can assume contact with the object has been lost.

4.5.4. Brake engagement

Hand-E is equipped with a brake that engages at the end of every gripper move, and disengages between moves. For instance, when fully closing on an object, the Gripper touches the object, activates the brake, and sends the object detection signal to the robot.

4.6. Control Logic Example
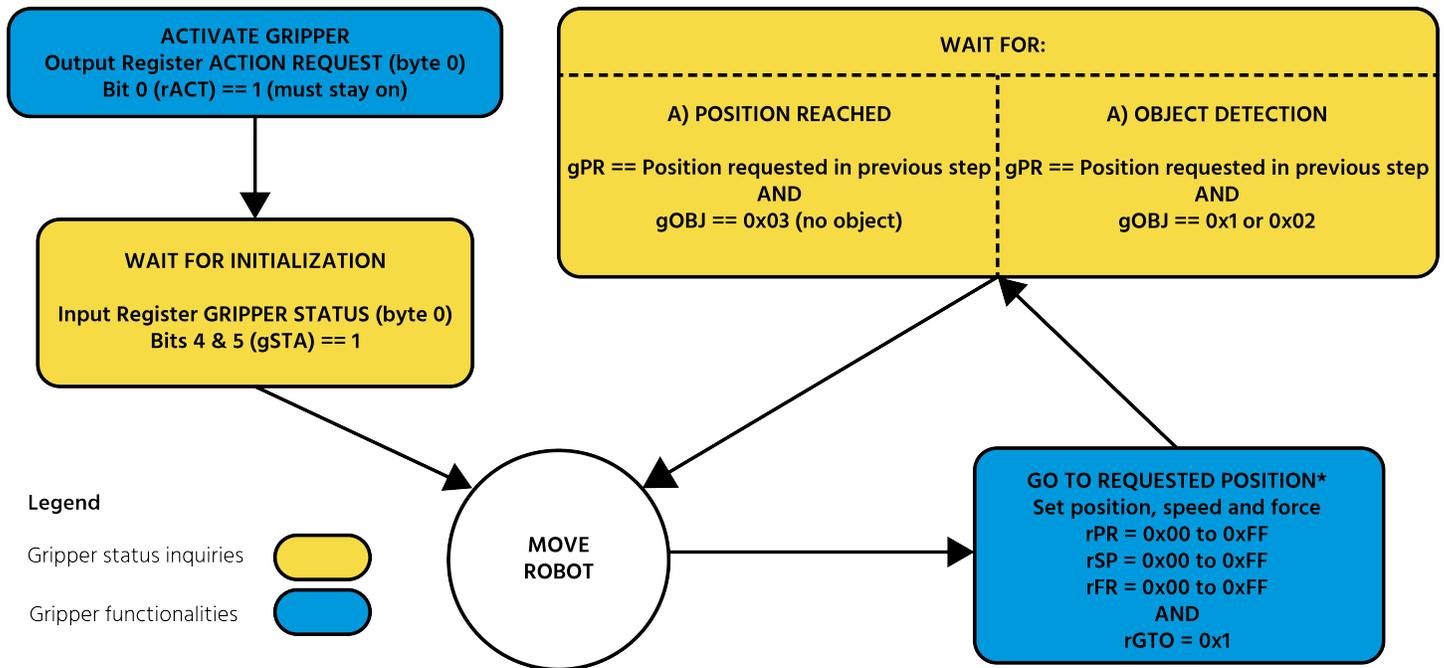
Go to requested position is used to open/close the Gripper until a contact with the object is detected, or the requested position is reached.

Fig. 4-2: Example of Gripper control logic with corresponding registers.

4.7. Modbus RTU Communication

The Gripper can be controlled by Modbus RTU directly with RS485 or over USB using the ACC-ADT-USB-RS485. This section is intended to provide guidelines for setting up a Modbus master that will adequately communicate with the Gripper.

For a general introduction to Modbus RTU and for details regarding the CRC algorithm, the reader is invited to read the Modbus over serial line specification and implementation guide available at: http://www.modbus.org/docs/Modbus_over_serial_line_V1_02.pdf.

For debugging purposes, the reader is also invited to download one of many free Modbus scanners such as the *CAS Modbus Scanner from Chipkin Automation Systems* available at: http://www.store.chipkin.com/products/tools/cas-modbus-scanner.

> **Info**
>
> Modbus RTU is a communication protocol based on a Big Endian byte order. Therefore, the 16-bit register addresses are transmitted with the most significant byte first. However, the data port is in the case of Robotiq products based on the Little Endian byte order. As such, the data parts of Modbus RTU messages are sent with the less significant byte first.

> **Tip**
>
> Modbus RTU specifications and details can be found at www.modbus.org.

4.7.1. Connection Setup

The following table describes the connection requirements for controlling the Gripper using the Modbus RTU protocol.

PROPRIETY	DEFAULT VALUE
Physical Interface	RS-485[1]
Baud Rate[2]	115,200 bps
Data Bits	8
Stop Bit[2]	1
Parity[2]	None
Supported Functions	Read Input Registers (FC04) Preset Multiple Registers (FC16) Master read & write multiple registers (FC23)
Exception Responses	Not supported
Slave ID[2]	0x0009 (9)
Robot Output / Gripper Input First Register	0x03E8 (1000)
Robot Input / Gripper Output First Register	0x07D0 (2000)
Termination Resistor[2]	120 ohms

[1] Various converters are available in the **Spare Parts, Kits and Accessories** section.

[2] These parameters can be adjusted using the Robotiq User Interface.

Each register (word - 16 bits) of the Modbus RTU protocol is composed of **2** bytes (8 bits) from the Gripper. The first Gripper output Modbus register(0x07D0) is composed from the first **2** Robotiq Gripper bytes (byte 0 and byte 1).

> **Info**
>
> 200 Hz is the maximum speed when commanding / reading from the Robotiq Gripper. It is therefore recommended to send commands with a minimum delay of 5 ms between them.

> **Info**
>
> 120 Ohms termination resistor is already present on the converter and the Gripper. If multiple grippers are connected in parallel on the same RS485 cable, termination resistor must be set to OFF in communication parameters.

4.7.2. Read input registers (FC04)

Function code 04 (FC04) is used for requesting the status of the Gripper analog input register. Examples of such data are Gripper status, object status, finger position, etc.

Example of an FC04 read function:

This message asks for register 0x07D0 (2000) and register 0x07D1 (2001) which contains Gripper Status, Object Detection, Fault Status and Position Request Echo.

Request is: 09 04 07 D0 00 02 70 0E

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
07D0	Address of the first requested register
0002	Number of registers requested (2)
700E	Cyclic Redundancy Check (CRC)

Response is: 09 04 04 E0 00 00 00 45 84

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
04	Number of data bytes to follow (2 registers x 2 bytes/register = 4 bytes)
E000	Content of register 07D0
0000	Content of register 07D1
4584	Cyclic Redundancy Check (CRC)

4.7.3. Preset multiple registers (FC16)

Function code 06 (FC16) is used to activate functionalities of the Gripper (robot output). Examples of such data are action request, speed, force, etc.

Example of setting multiple registers FC16:

This message requests to set position request, speed and force of the Gripper by setting register 0x03E9 (1002) and 0x03EA.

Request is: 09 10 03 E9 00 02 04 60 E6 3C C8 EC 7C

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E9	Address of the first register
0002	Number of registers written to
04	Number of data bytes to follow (2 registers x 2 bytes/register = 4 bytes)
60E6	Value written to register 0x03E9
3CC8	Value written to register 0x03EA
EC7C	Cyclic Redundancy Check (CRC)

Response is: 09 10 03 E9 00 02 91 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E9	Address of the first register
0002	Number of written registers
9130	Cyclic Redundancy Check (CRC)

4.7.4. Master read and write multiple registers FC23

Function code 23 (FC23) is used for reading the status of the Gripper (robot input) and activating gripper functionalities (robot output) simultaneously. Examples of such data are gripper status, object status, finger position, etc. Action requests are speed, force, etc.

Example of reading and writing multiple registers FC23:

This message reads registers 0x07D0 (2000) and 0x07D1 (2001), which contains Gripper Status, Object Detection, Fault Status and Position Request Echo. It also sets the position request, speed and force of the Gripper by writing to registers 0x03E9 (1001) and 0x03EA (1002).

Request is: 09 17 07 D0 00 02 03 E9 00 02 04 00 E6 3C C8 2D 0C

Bits	Description
09	SlaveID
17	Function Code 23 (read and write multiple registers)
07D0	Address of the first requested register, **read**
0002	Number of registers requested (2), **read**
03E9	Address of the first register **written to**
0002	Number of registers **written** to (2)
04	Number of data bytes to follow (2 registers X 2 bytes/registers = 4 bytes)
00E6	Value written to register 0x03E9
3CC8	Value written to register 0x03EA
2D0C	Cyclic Redundancy Check (CRC)

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Response is: 09 17 04 01 00 09 E6 F6 C1

Bits	Description
09	SlaveID
17	Function Code 23 (read and write multiple registers)
04	Number of data bytes to follow (2 registers x 2 bytes/register = 4 bytes)
1000	Content of register 07D0
09E6	Content of register 07D1
F6C1	Cyclic Redundancy Check (CRC)

> **Tip**
>
> Response contents might change depending on gripper status.

> **Info**
>
> Gripper executes the input command ("write" command), executes one cycle of motion, updates the output, then returns the Modbus response read.

4.7.5. Modbus RTU example

This section depicts the example from the **Control Logic Example** section, when programmed using the Modbus RTU protocol. The example is typical of a pick and place application. After activating the Gripper, the robot is moved to a pick-up location to grip an object. It moves again to a second location to release the gripped object.

Step 1: Activation Request (clear and set rACT)

Request is (clear rAct): 09 10 03 E8 00 03 06 00 00 00 00 00 00 73 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers written to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0000	Value to write to register 0x03E9 (ACTION REQUEST = 0x01 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate**

Bits	Description
	Gripper"
0000	Value written to register 0x03EA
0000	Value written to register 0x03EB
7330	Cyclic Redundancy Check (CRC)

Response is: 09 10 03 E8 00 03 01 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of written registers
0130	Cyclic Redundancy Check (CRC)

Request is (set rAct): 09 10 03 E8 00 03 06 01 00 00 00 00 00 72 E1

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers written to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0100	Value to write to register 0x03E9 (ACTION REQUEST = 0x01 and GRIPPER OPTIONS = 0x00): rACT = 1 for "Activate Gripper"
0000	Value written to register 0x03EA
0000	Value written to register 0x03EB
72E1	Cyclic Redundancy Check (CRC)

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Response is: 09 10 03 E8 00 03 01 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of written registers
0130	Cyclic Redundancy Check (CRC)

Step 2: Read Gripper status until the activation is completed

Request is: 09 04 07 D0 00 01 30 0F

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
07D0	Address of the first requested register
0001	Number of registers requested (1)
85CF	Cyclic Redundancy Check (CRC)

Response (if the activation IS NOT completed): 09 04 02 11 00 54 A1

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
02	Number of data bytes to follow (1 register x 2 bytes/register = 2 bytes)
1100	Content of register 07D0 (GRIPPER STATUS = 0x11, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gSTA = 1 for "Activation in progress"
54A1	Cyclic Redundancy Check (CRC)

Response (if the activation IS completed): 09 04 02 31 00 4D 61

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
02	Number of data bytes to follow (1 register x 2 bytes/register = 2 bytes)
3100	Content of register 07D0 (GRIPPER STATUS = 0x31, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gSTA = 3 for "Activation is completed"
4D61	Cyclic Redundancy Check (CRC)

Step 3: Move the robot to the pick-up location

Step 4: Close gripper at full speed and full force

Request is: 09 10 03 E8 00 03 06 09 00 00 FF FF FF 42 29

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers written to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value written to register 0x03E8 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): rACT = 1 for "Activate Gripper", rGTO = 1 for "Go to Requested Position"
00FF	Value written to register 0x03E9 (GRIPPER OPTIONS 2 = 0x00 and POSITION REQUEST = 0xFF): rPR = 255/255 for full closing of the Gripper
FFFF	Value written to register 0x03EA (SPEED = 0xFF and FORCE = 0xFF): full speed and full force
4229	Cyclic Redundancy Check (CRC)

Response is: 09 10 03 E8 00 03 01 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of written registers
0130	Cyclic Redundancy Check (CRC)

Step 5: Read Gripper status until the grip is completed

Request is: 09 04 07 D0 00 03 B1 CE

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
07D0	Address of the first requested register
0003	Number of registers requested (3)
B1CE	Cyclic Redundancy Check (CRC)

Example of response if the grip **is not completed**: 09 04 06 39 00 00 FF 0E 0A B6 6D

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
3900	Content of register 07D0 (GRIPPER STATUS = 0x39, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gGTO = 1 for "Go to Position Request" and **gOBJ = 0 for "Fingers are in motion"**
00FF	Content of register 07D1 (FAULT STATUS = 0x00, POSITION REQUEST ECHO = 0xFF): the position request echo tells that the command was well received and that the GRIPPER STATUS is valid.

Bits	Description
0E0A	Content of register 07D2 (POSITION = 0x0E, FINGER CURRENT = 0x0A): the position is 14/255 and the motor current is 100mA (these values will change during motion)
B66D	Cyclic Redundancy Check (CRC)

Example of response if the grip **is completed**: 09 04 06 B9 00 00 FF BD 00 5C 9A

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
B900	Content of register 07D0 (GRIPPER STATUS = 0xB9, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gGTO = 1 for "Go to Position Request" and **gOBJ = 2 for "Fingers have stopped due to a contact while closing"**
00FF	Content of register 07D1 (FAULT STATUS = 0x00, POSITION REQUEST ECHO = 0xFF): the position request echo tells that the command was well received and that the GRIPPER STATUS is valid.
BD00	Content of register 07D2 (POSITION = 0xBD, FINGER CURRENT = 0x00): the position is 189/255 (can be used to validate the size of the seized object)
5C9A	Cyclic Redundancy Check (CRC)

Step 6: Move gripper to release location

Step 7: Open the Gripper at full speed and full force

Request is: 09 10 03 E8 00 03 06 09 00 00 00 FF FF 72 19

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers written to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value written to register 0x03E8 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper", rGTO = 1 for "Go to Requested Position"**

Bits	Description
0000	Value written to register 0x03E9 (GRIPPER OPTIONS 2 = 0x00 and POSITION REQUEST = 0x00): **rPR = 0/255 for full opening of the Gripper (partial opening would also be possible)**
FFFF	Value written to register 0x03EA (SPEED = 0xFF and FORCE = 0xFF): full speed and full force
7219	Cyclic Redundancy Check (CRC)

Response is: 09 10 03 E8 00 03 01 30

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of written registers
0130	Cyclic Redundancy Check (CRC)

Step 8: Read Gripper status until the opening is completed

Request is: 09 04 07 D0 00 03 B1 CE

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
07D0	Address of the first requested register
0003	Number of registers requested (3)
B1CE	Cyclic Redundancy Check (CRC)

Example of response if the opening **is not completed**: 09 04 06 39 00 00 00 BB 10 71 06

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
3900	Content of register 07D0 (GRIPPER STATUS = 0x39, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gGTO = 1 for "Go to Position Request" and **gOBJ = 0 for "Fingers are in motion"**
0000	Content of register 07D1 (FAULT STATUS = 0x00, POSITION REQUEST ECHO = 0x00): the position request echo tells that the command was well received and that the GRIPPER STATUS is valid.
BB10	Content of register 07D2 (POSITION = 0xBB, FINGER CURRENT = 0x10): the position is 187/255 and the motor current is 160mA (these values will change during motion)
7106	Cyclic Redundancy Check (CRC)

Example of response if the opening **is completed**: 09 04 06 F9 00 00 00 0D 00 17 AA

Bits	Description
09	SlaveID
04	Function Code 04 (Read Input Registers)
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
F900	Content of register 07D0 (GRIPPER STATUS = 0xF9, RESERVED = 0x00): gACT = 1 for "Gripper Activation", gGTO = 1 for "Go to Position Request" and **gOBJ = 3 for "Fingers are at requested position"**
0000	Content of register 07D1 (FAULT STATUS = 0x00, POSITION REQUEST ECHO = 0x00): the position request echo tells that the command was well received and that the GRIPPER STATUS is valid.
0D00	Content of register 07D2 (POSITION = 0x0D, FINGER CURRENT = 0x00): the position is 13/255 (the fingers have reached their software limit)
17AA	Cyclic Redundancy Check (CRC)

Step 9: To grip additional objects, loop from step 3.

4.8. Hand-E gripper and I/O Coupling communication

The following communication parameters must be present:

- **Baud rate**: 115200 bps
- **Parity**: None
- **Data**: 8 bit
- **Stop bit**: 1 bit
- **Slave ID**: 1 to 9

Activation sequence

In order to activate the sequence:

- Wait at least 10 ms between steps
- The whole sequence can not exceed 5 seconds
- The Robotiq Hand-E Gripper must be connected to the I/O Coupling. The I/O Coupling detection of the Gripper has to be confirmed (led blue) before doing the sequence, otherwise it will not be valid.
- Doing the sequence once the I/O coupling is activated will reactivate the I/O Coupling.
- Activating the I/O Coupling may lead to an action on the connected device
- Activation of the I/O Coupling must be done each time you connect a new device or when a power cycle is done so you can use the connected device, otherwise it will do nothing.

Steps (> 10 ms between)	Digital Input 0	Digital Input 1
1	Low	Low
2	High	-
3	Low	-
4	-	High
5	-	Low

4.9. Control over Universal Robots

4.9.1. Control with the Standard Coupling Kit

The URCap package contains many features to program and control the Gripper. The package provides:

- Gripper toolbar: The Gripper toolbar is automatically installed with the URCaps package. It allows jogging and testing of the Gripper. It is a great tool to try grasps with the Gripper while programming.
- Gripper node: The URCaps package adds a Gripper node that is used to add a Gripper command. A node can make the Gripper move to a specific opening, grasp an object and modify the speed and force applied by the Gripper.

> **Caution**
>
> Starting from Gripper URCap version 1.0.2, the gripper activation script command (**rq_activate()** or **rq_activate_and_wait()**) must be preceded by the reset command (**rq_reset()**). This will force the gripper's activation routine. Thus, if the gripper was already activated, it will activate again.

4.9.2. Control with the Wrist Connection Kit (I/O Coupling)

> **Info**
>
> A Gripper firmware update is required to use your Hand-E gripper with the I/O Coupling. Make sure you have the **GD1-1.3.16** version installed or the latest. If an update is necessary on the I/O Coupling or the Hand-E gripper, the Robotiq User Interface (RUI) will warn you and request the execution.

> **Info**
>
> Make sure to delete the old Hand-E gripper URCap before using the I/O Coupling one.

> **Info**
>
> The robot's PolyScope version must be 3.10 and later in order to install the URCap.

Wrist Node

Multiple Wrist Nodes are available:

- Wrist Connection Activation
- Wrist Connection
- Wrist Grip Check
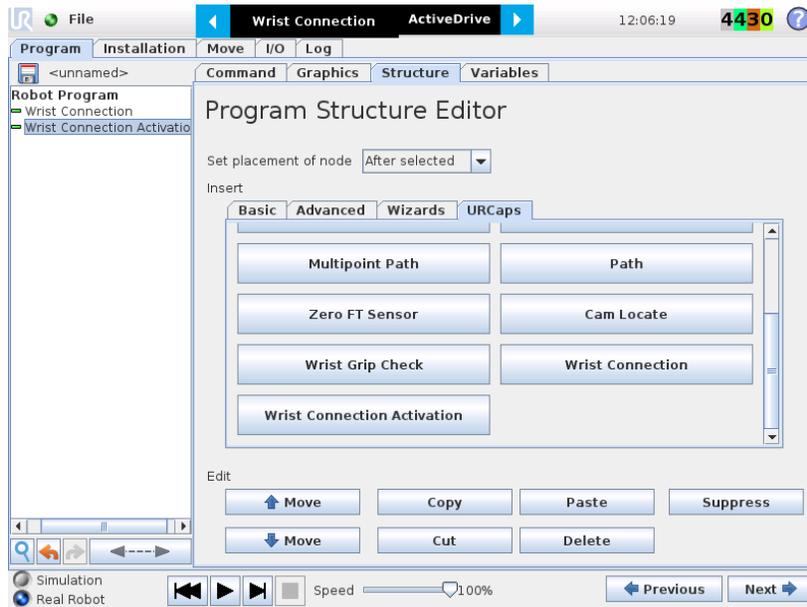
Fig. 4-3: Program Structure Editor. Multiple Wrist nodes are available.

- The **Wrist connection Activation** node will activate the device in the program.

Fig. 4-4: Wrist Connection Activation Interface.

- For each **Wrist connection** node, select the desired presets. You can click on the **Test** button to try each preset.

Fig. 4-5: Wrist Connection Node Interface.

- The **Wrist Grip Check** node is pre-packaged as an *If statement* that prompts the user to select between if the object is detected and if the object is not detected.
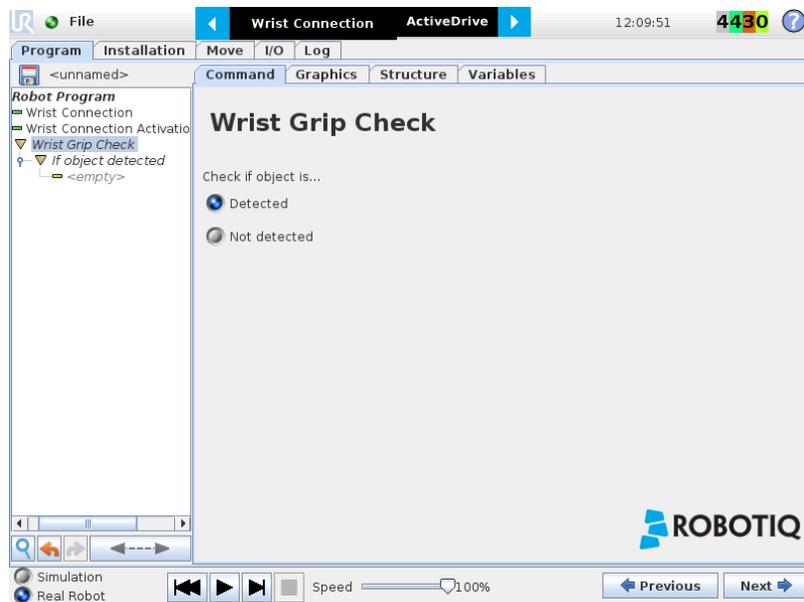
Fig. 4-6: Wrist Grip Check Node Interface.

- In the **Wrist Connection Toolbar**, you can:
  - Test the 4 presets;
  - See the Object Detection;
  - Activate the Gripper
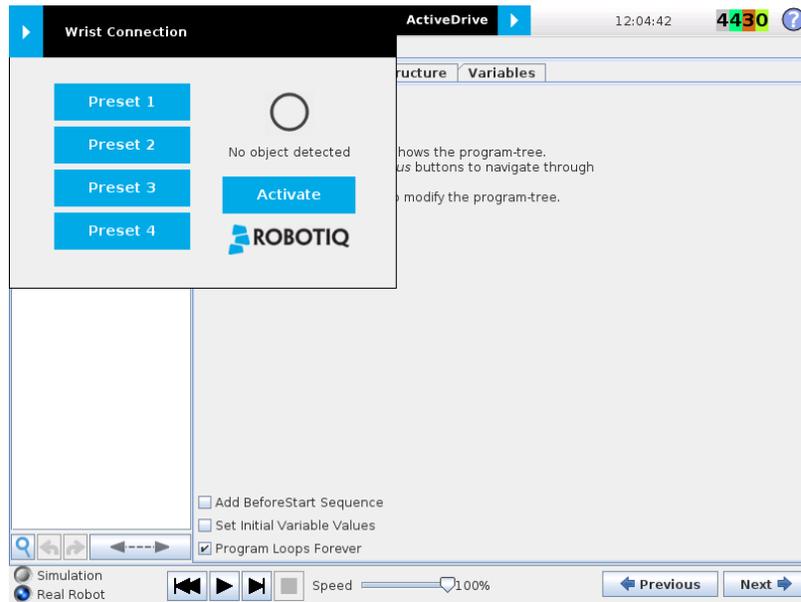
Fig. 4-7: Wrist Connection Toolbar Interface.

To make sure to operate the Gripper, set the voltage at 24V:

1 Click on the **I/O** tab.

2 In the **Tool Output** section, select **Robotiq_Wrist_connection** on the *Controlled by* drop down menu.

Robotiq Hand-E gripper Instruction Manual
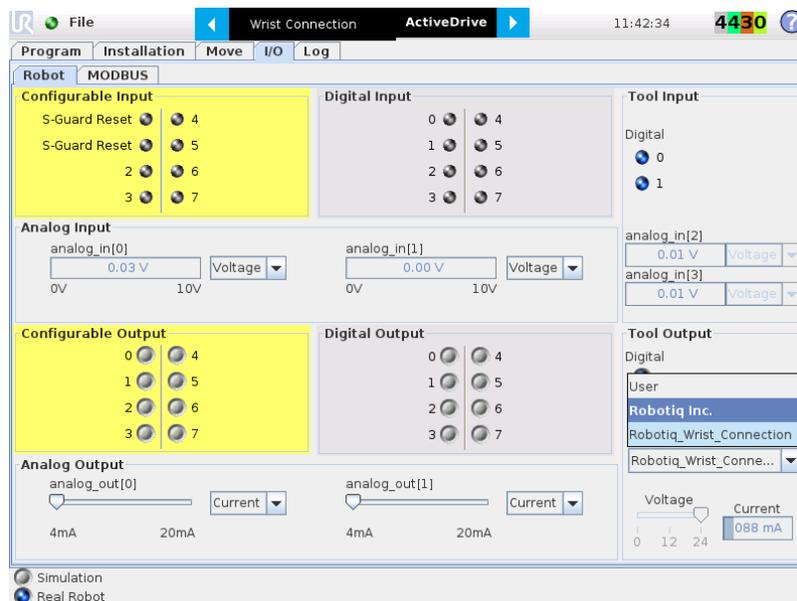
4.9.3. Gripper Dashboard

Overview

Single Gripper for e-Series
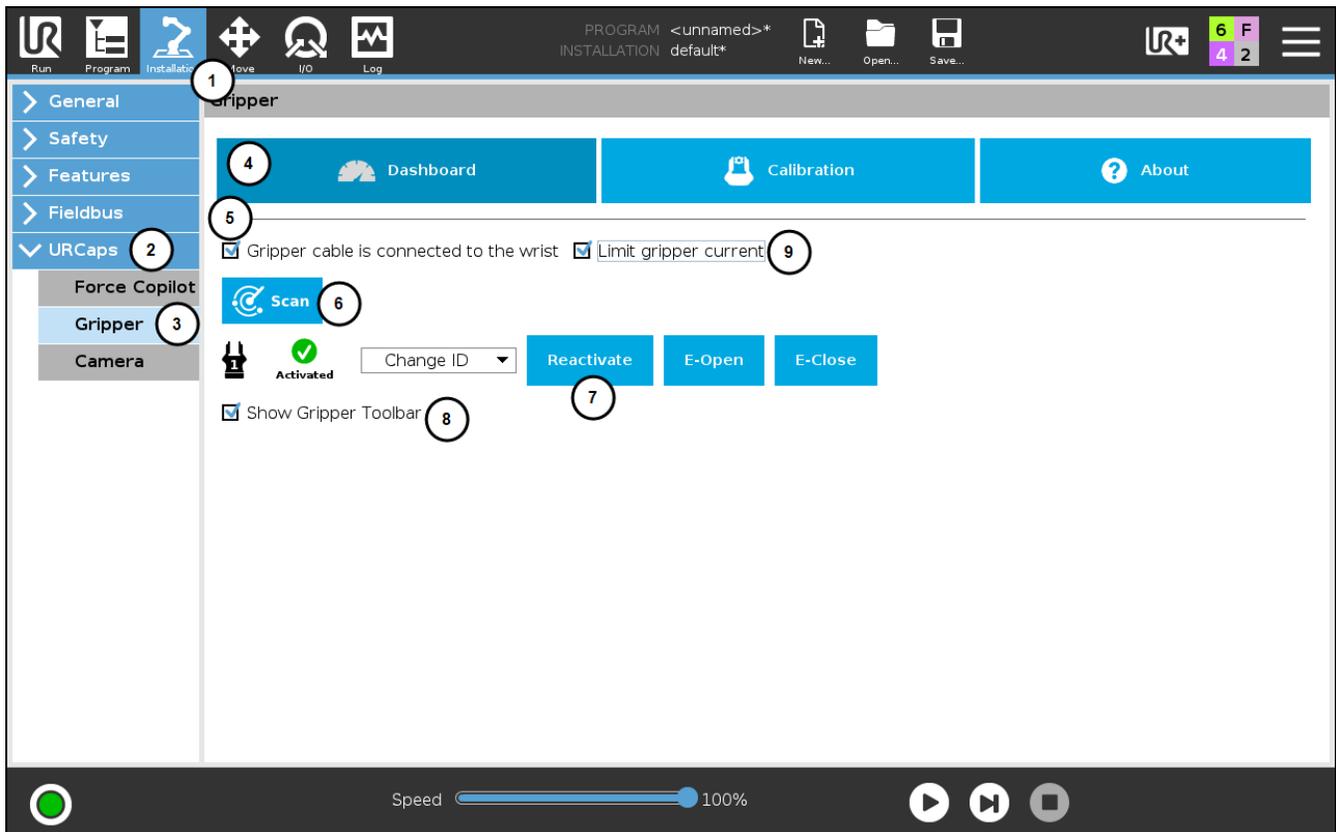
Fig. 4-8: Gripper Dashboard (steps highlighted)

1 On the teach pendant, tap the **Installation** button.

2 Select **URCaps** in the navigation pane on the left.

3 Tap the **Gripper** button.

4 Select the **Dashboard** tab.

5 If the Gripper is connected to the robot wrist (and not to the robot controller or via a Robotiq Wrist Camera) tick the "**Gripper cable is connected to the wrist** box.

6 If no Gripper is found, tap the **Scan** button to detect any Gripper that might be connected to the robot

7 Tap the **Activate/Reactivate** button.

8 In order to display the Gripper Toolbar in the UR+ menu in the top ribbon of PolyScope, tick the **Show Gripper Toolbar** box.

9 In order to prevent overcurrent conditions (for instance when grasping soft objects or using multiple Grippers at the same time), tick the **Limit gripper current** box.

    a Limits the current at 600 mA for a single Gripper

    b Limits the current at 450 mA for each Gripper connected in a multiple Gripper configuration

> **Info**
>
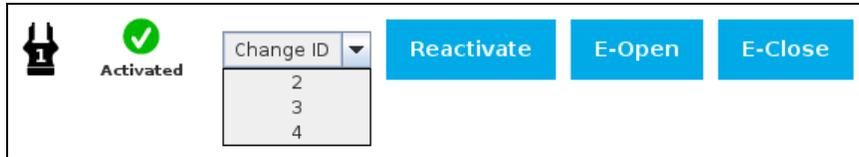> The default Gripper ID allocated to the first device connected is **1**.

Fig. 4-9: Gripper ID modification in the Gripper Dashboard

> **Info**
>
> The **E-Open** and **E-Close** buttons allow the user to open and close the Gripper even if the latter is not activated. These emergency commands use very low speed and force settings.

Single Gripper for CB-Series

Open or create a robot program

1 Go the **Installation** tab

2 Select **Gripper** in the left pane

3 Tap the **Dashboard** button

4 If no Gripper is found, tap the **Scan** button to detect any Gripper that might be connected to the robot

5 Tap the **Activate** button
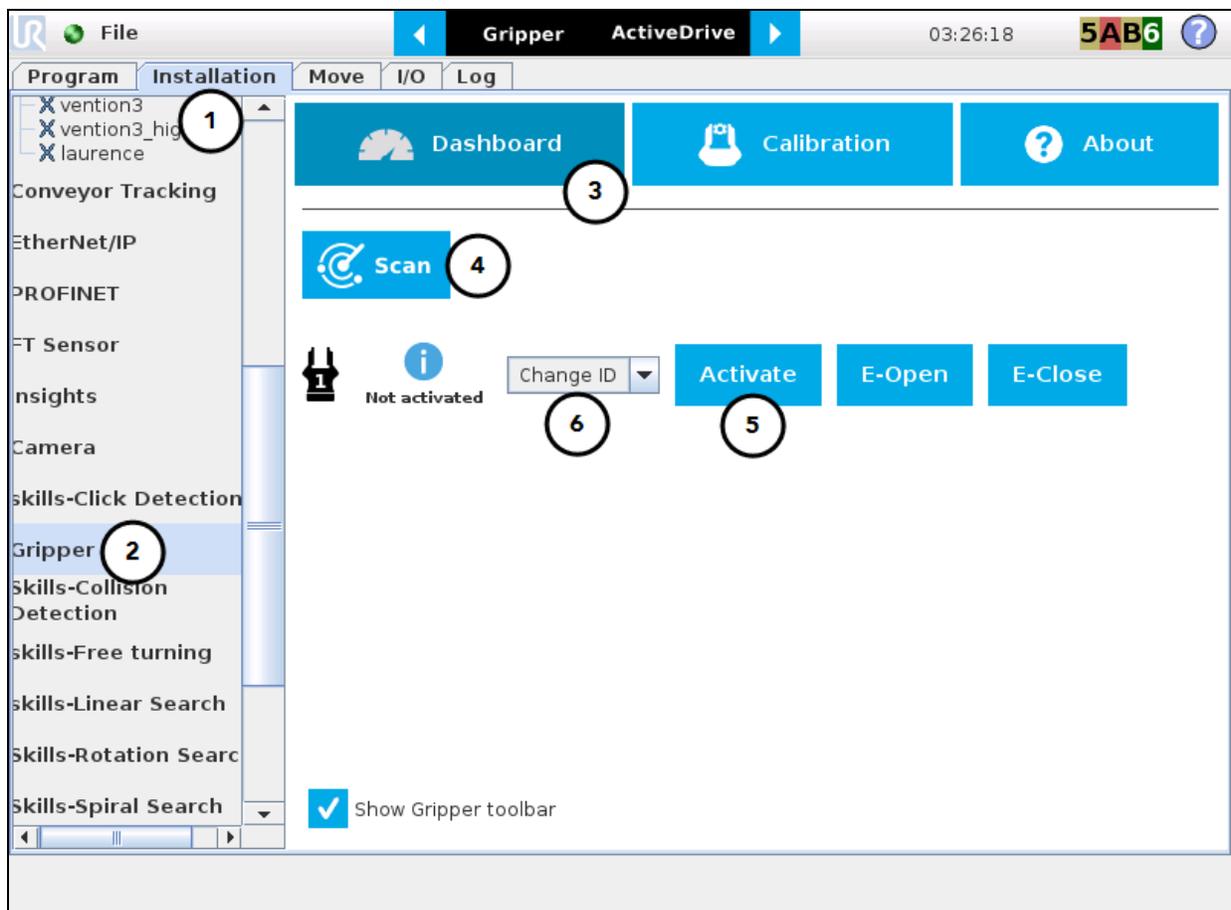
Fig. 4-10: Gripper Dashboard (steps highlighted)

6 If required, change the ID of the Gripper; ID numbers range from 1 to 4

> **Info**
>
> The default Gripper ID allocated to the first device connected is **1**.

Fig. 4-11: Gripper ID modification in the Gripper Dashboard

> **Info**
>
> The **E-Open** and **E-Close** buttons allow the user to open and close the Gripper even if the latter is not activated. These emergency commands use very low speed and force settings.

Multiple Grippers

> **Info**
>
> The URCap allows the user to connect and control up to **4** Grippers at the same time.

> **Caution**
>
> If you wish to program using multiple grippers at the same time, connect them to the robot **one after the other**; each Gripper connection requiring its own **scan** and **activation** before going on to the next.

For each Gripper connected, follow the required steps in one of the two following sections depending on your robot model: the **Single Gripper for CB-Series** section or the **Single Gripper for e-Series** section

Features

Icon	Functionality Name	Description
	Dashboard	After selecting Gripper in the left pane of the Installation tab, tap this button to access the Gripper Dashboard.
	Activate/Reactivate	The Activate and Reactivate buttons enables the corresponding Gripper.
	Not activated/Activated	Gripper status: One or the other of these icons is displayed next to the corresponding Gripper icon.

Icon	Functionality Name	Description
✔ Activated		
Gripper	Gripper	Label indicating the Gripper's ID, ranging from 1 to 4.
Scan	Scan	Command allowing for a detection of connected Grippers. After tapping this button, the latter will display in the Gripper Dashboard.
Change ID ▼	Change ID	Tap the arrow next to the textbox to expand a list of available Gripper IDs. Selecting an available number will allocate it to the corresponding Gripper.
E-Open	E-Open	Tapping this button sends an emergency open command to the corresponding Gripper, whether it is activated or not.
E-Close	E-Close	Tapping this button sends an emergency close command to the corresponding Gripper, whether it is activated or not.

4.9.4. Limiting your Gripper Force and Speed

Grippers can have their force and speed limited at root-level when using the Teach Pendant. Follow these instructions to enable this.
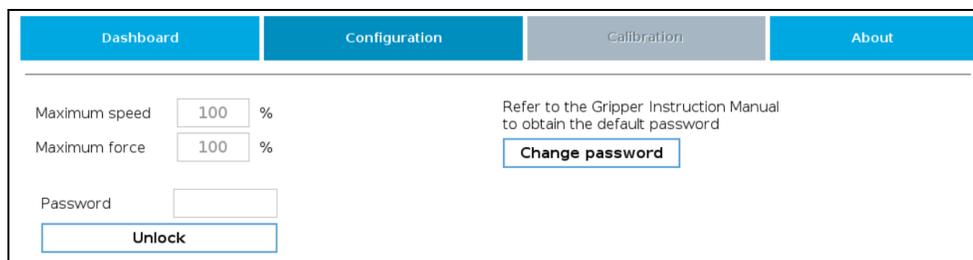
Fig. 4-12: Limiting the Gripper Force and Speed

1. Depending on your robot:
   - For e-Series: Go to **Installation > URCaps > Gripper > Configuration**.
   - For CB-Series: Go to **Installation > Gripper > Configuration**

2. Tap **Unlock**.

3. Enter your password. Default is `rqsafe`.

4. To set a maximum opening/closing speed for your grippers (noted as a percentage of its default speed), select the box next to the "Maximum Speed" field, and enter a value. You can also limit grip strength by setting a value under field "Maximum force". Values are set, tap **Lock**. This saves values you entered.
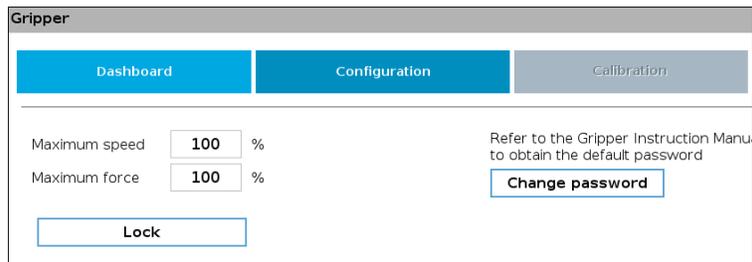
Fig. 4-13: Lock the Maximum Force and Speed

5. To choose a new password, tap the **Change password** button, and follow instructions on screen. To save your new password, tap **Change**.
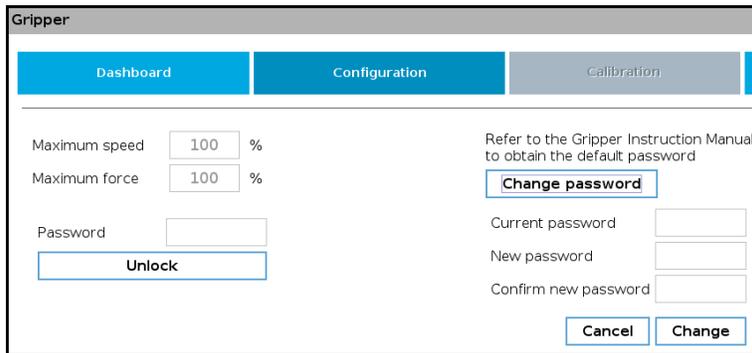
Fig. 4-14: Modification of the current password.

> **Tip**
>
> Default password: `rqsafe`. If you lose your password, contact support team to reset it.

4.9.5. Visual Cues of Force and Speed Limitation

When a limitation is effective, some reminders appear in PolyScope. When adding gripper commands to a program or issuing them via the Adaptive Gripper tab, the label "Limited" will be shown under the Speed and Force icons, if they have been limited.
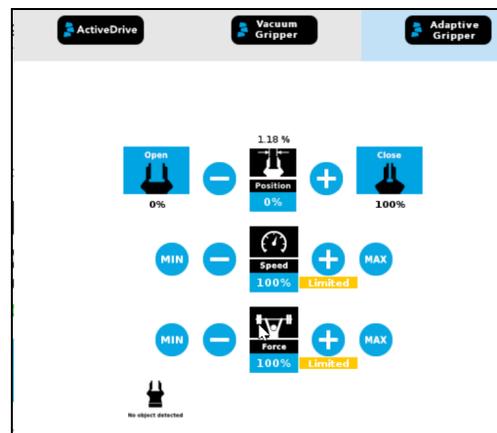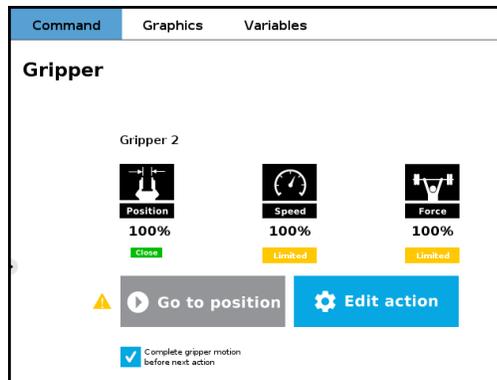
Fig. 4-15: Label "Limited" appears when limitations are effective.

4.9.6. Gripper Calibration menu and wizard

Depending on the fingers/fingertips used, the operator will calibrate the Gripper and measure the stroke by defining the fully open and fully closed positions.

Make sure the Gripper is activated.

For e-Series

1 On the teach pendant, tap the **Installation** button.
2 Select **URCaps** in the navigation pane on the left.
3 Tap the **Gripper** button.

For CB-Series

1 Go to the **Installation** tab
2 Select **Gripper** in the left pane

> **Info**
>
> A gripper that has not been calibrated will display open and closed values in percentage.
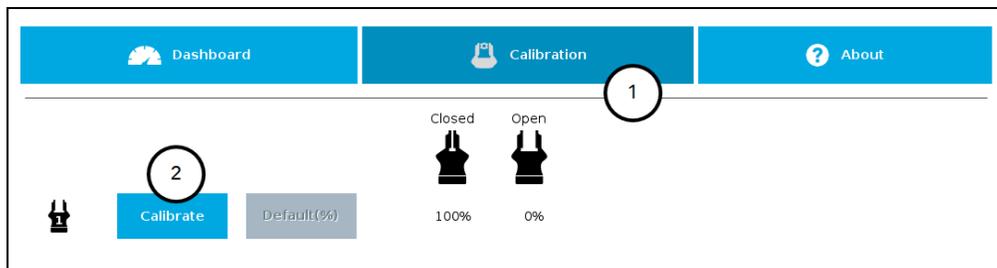
For both models:

1 Tap the Calibration tab
2 Tap the Calibrate button corresponding to the Gripper you want to calibrate

Tapping the **Calibrate** button in the Gripper Calibration menu launches the **Calibration wizard**.

Follow the instructions on the screen of the teach pendant.

> **Tip**
>
> Depending on the PolyScope settings defined by the user, the units of measurement can either display according to the metric or imperial system.
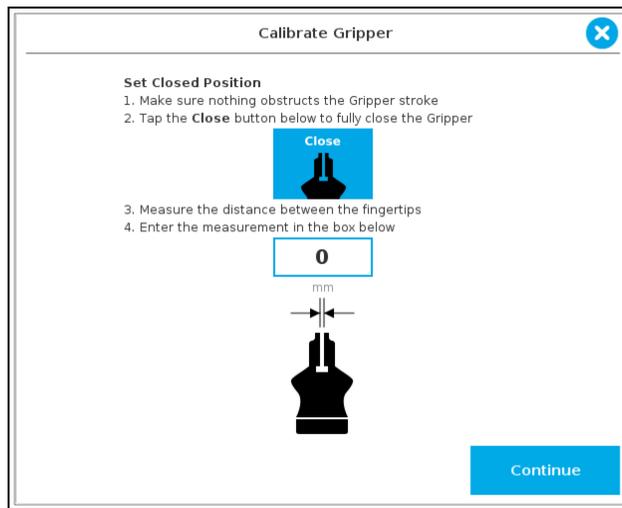
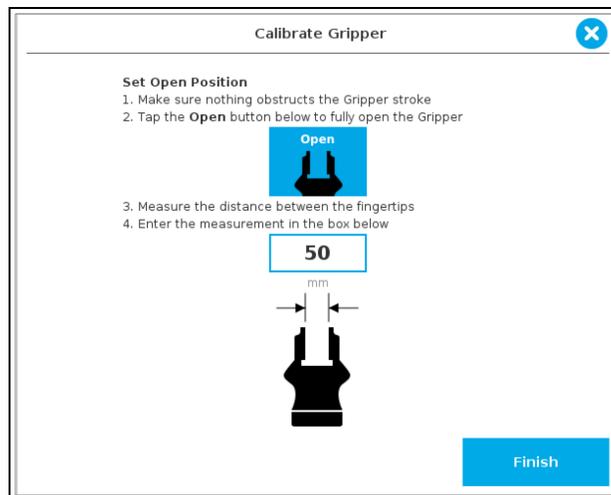Fig. 4-16: First step of the calibration wizard

Fig. 4-17: Second step of the calibration wizard

Following their respective calibration, the Grippers will display their actual stroke, from the fully closed to the fully open position.
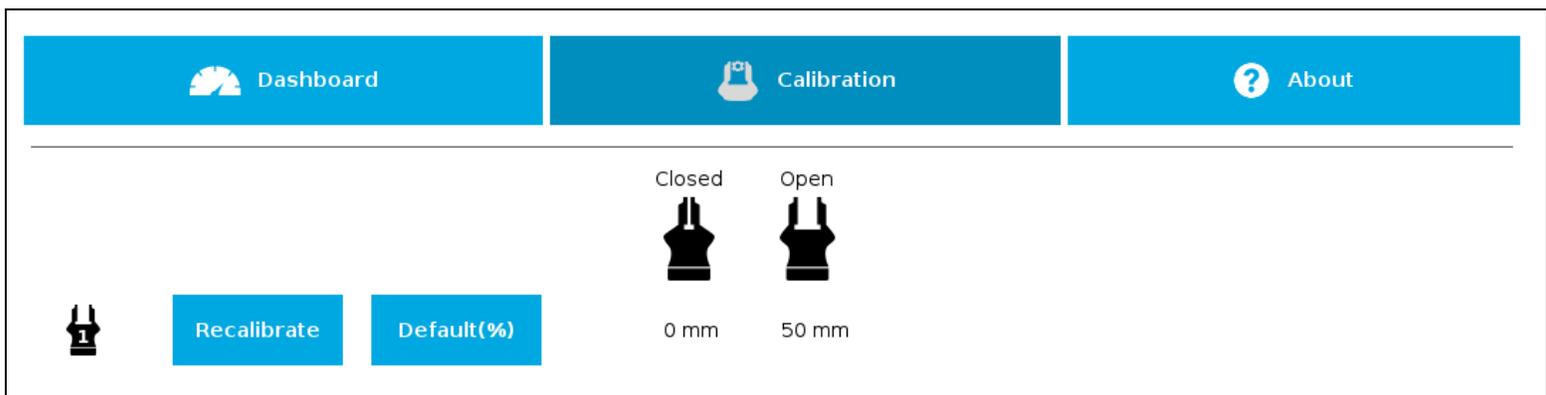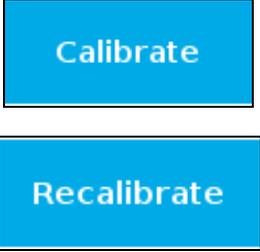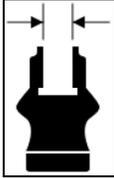

Fig. 4-18: Single Gripper, calibrated

Features

Icon	Functionality Name	Description
Calibration	Calibration	After selecting the Gripper in the left pane of the Installation tab, tap this button to access the Gripper Calibration menu.
Calibrate **Recalibrate**	Calibrate/Recalibrate	The Calibrate and Recalibrate buttons launch the Gripper Calibration wizard.
Default(%)	Default (%)	Following a calibration, tap this button to reset the calibration and return to the default percentage values. The button is greyed out if no calibration has been performed for the corresponding Gripper.
1	Gripper	Label indicating the Gripper's ID , ranging from 1 to 4.
Closed	Fully closed dimension table header	Visual aid above the fully closed dimensions in the Calibration menu.
Open	Fully open dimension table header	Visual aid above the fully open dimensions in the Calibration menu
Close	Close	Tap this button to close the Gripper in the Calibration wizard.

Icon	Functionality Name	Description
Open	Open	Tap this button to open the Gripper in the Calibration wizard.
	Fully closed	Visual aid for entering the fully closed dimension in the Calibration wizard.
	Fully open	Visual aid for entering the fully open dimension in the Calibration wizard.
Continue	Continue	Tap this button at the end of the first step of the Calibration wizard in order to go to the next step.
Finish	Finish	Tap this button at the the end of the Calibration wizard to complete the calibration process for the corresponding Gripper.

4.9.7. Gripper Toolbar

The Gripper Toolbar is generally used to test and jog the Gripper, meaning it has no effect on the programming of the robot.

> **Info**
>
> The Gripper URCap package contains the Gripper toolbar. Therefore, the toolbar is automatically installed with the URCap package. The Gripper toolbar can be installed and used without the URCap package (please refer to the **Control** section for information on how to install the toolbar and the driver package without the URCap).

Overview

Prior to using the Gripper Toolbar, the user needs to go to the Gripper Dashboard and tick the **Show Gripper Toolbar**. Please refer to the **Gripper Dashboard** section

Following the proper installation of the Gripper URCap, the user can tap the **UR+** button at the top of the screen to expand the Gripper Toolbar. Please refer to the figure below.

*Fig. 4-19: **UR+** Button to Expand the Gripper Toolbar.*

If the user has omitted to tick the Show Gripper Toolbar box in the Gripper Dashboard, tapping the UR+ button will display this meesage:
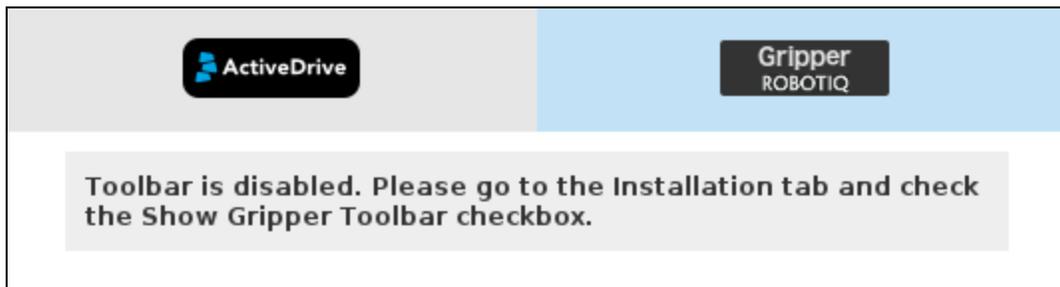

Fig. 4-20: Disabled Gripper Toolbar

On CB-Series, right after the installation of the Gripper URCap, a collapsed Gripper toolbar will display at the top of the screen; please refer to the figure below.

Fig. 4-21: Gripper toolbar (collapsed)

An expanded Gripper Toolbar prior to the activation of the Gripper looks like the figure below:
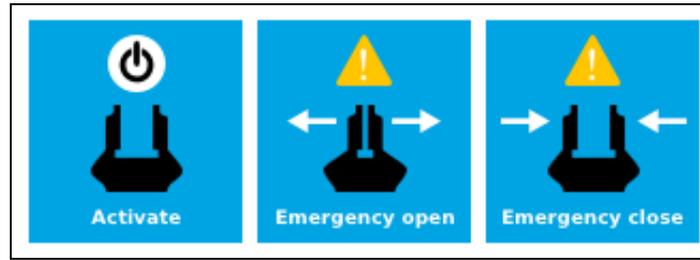

Fig. 4-22: Gripper Toolbar before activation

> **Info**
>
> The **Emergency open** and **Emergency close** buttons allow the user to open and close the Gripper even if the latter is not activated.
> The emergency commands use very low speed and force settings.

- Tap the **Activate** button to enable the Gripper

Single Gripper

> **Caution**
>
> If the Gripper has not been calibrated at this point, the Open and Close values will remain in percentage. Please refer to the **Gripper Calibration menu and wizard** section for instructions.

Once the Gripper is activated, the toolbar can be expanded and used to test and jog the Gripper
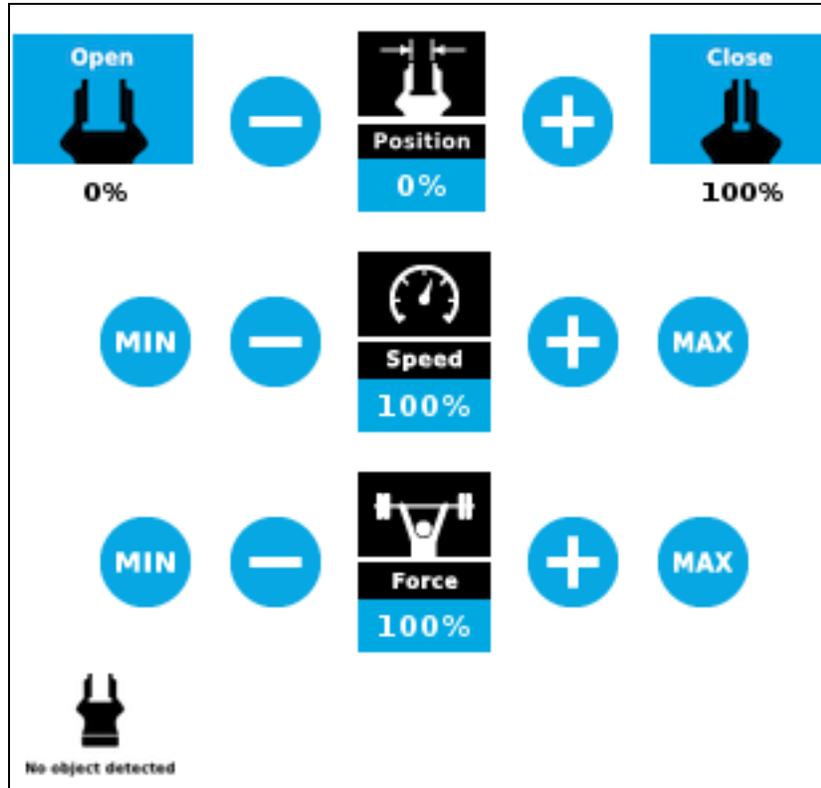

Fig. 4-23: Gripper toolbar after activation

Multiple Grippers

If multiple Grippers are used, check one or several Grippers and test their settings and features.

> **Tip**
>
> The first Gripper selected is the "master", meaning that its settings will be copied over to the others when they are selected. In order to modify each Gripper's settings individually, select a Gripper, edit it, uncheck its box and carry on to the next Gripper.

> **Info**
>
> For consistency, selecting multiple Grippers at the same time displays the open and close values in percentage since their stroke might be different.
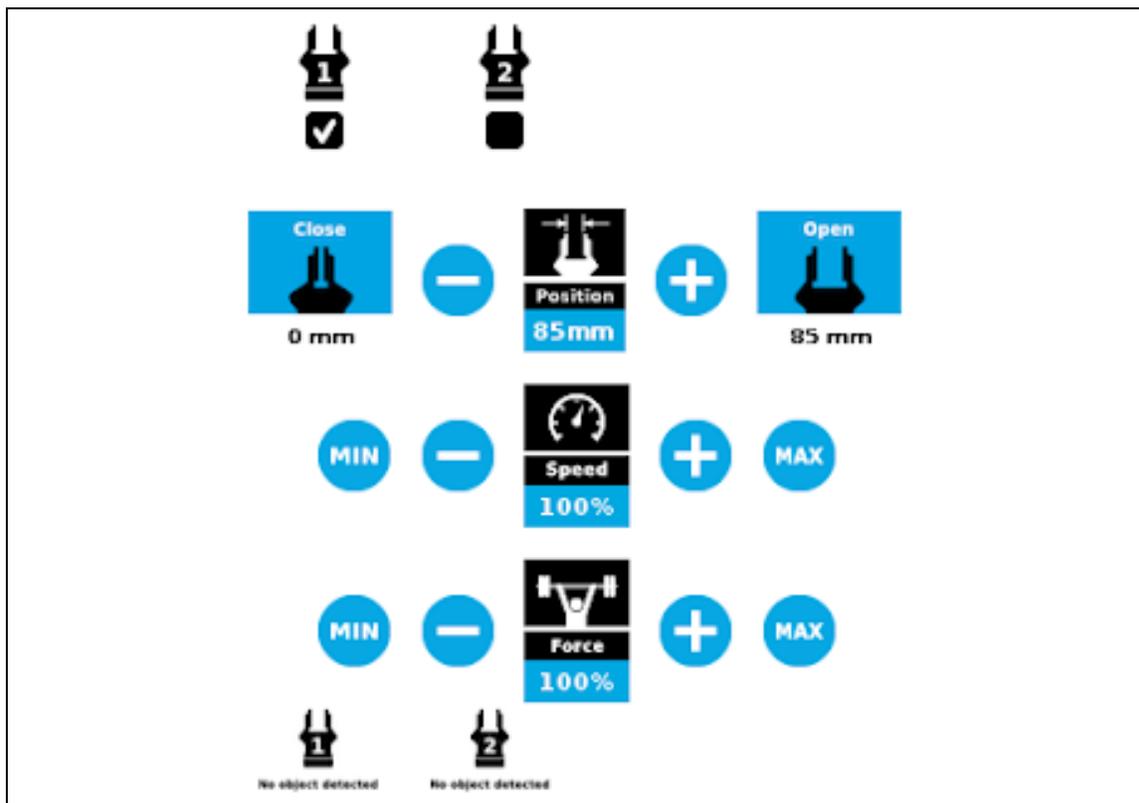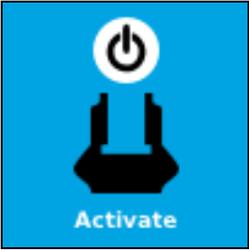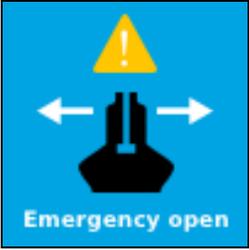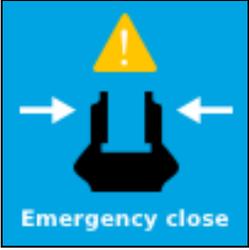

Fig. 4-24: Gripper toolbar (expanded, multiple Grippers)

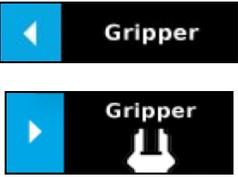# Features

Gripper activation

Icon	Functionality Name	Description
◀ Gripper / ▶ Gripper	CB-Series Gripper toolbar	Tap to toggle between the expanded and collapsed Gripper toolbar. When greyed out, the functionality is not available.
UR+ (black) / UR+ (blue)	e-Series UR+ Menu (Gripper Toolbar)	Tap to toggle between the expanded (blue) and collapsed (black) Gripper Toolbar.
Activate	Activate	Tap to activate the Gripper. The Gripper will fully open and close to set the zero of the position value.
Emergency open	Emergency open	Slowly moves the Gripper to its fully closed position.
Emergency close	Emergency close	Slowly moves the Gripper to its fully open position.

Gripper operation window

Primary Icon	Functionality Name	Description
Gripper	CB-Series Gripper toolbar	Tap to toggle between expanded and collapsed Gripper toolbar. When greyed out, the functionality is not available.
UR+	e-Series UR+ Menu (Gripper Toolbar)	Tap to toggle between the expanded (blue) and collapsed (black) Gripper Toolbar.
Open	Open	Tap to fully open the Gripper.
Close	Close	Tap to fully close the Gripper.
Position	Requested position	Shows the actual position of the Gripper according to the system of units defined in PolyScope (imperial vs. metric). If the Gripper is not calibrated, the values will display in percentage.
Speed	Requested speed	Shows the actual speed set of the Gripper. • 0% = minimum speed • 100% = maximum speed
Force	Requested force	Shows the actual force set of the Gripper: • 0% : minimum force, regrasp feature disabled • 1% : minimum force, with regrasp feature enabled • 100% : maximum force, with regrasp feature enabled
+	Plus	Tap to increase the corresponding parameter.

Primary Icon	Functionality Name	Description
⊖	Minus	Tap to decrease the corresponding parameter.
No object detected	No object detected	Icon shown when no object is detected during a grasp.
Object detected	Object detected	The icon shows a green checkmark when an object is detected during a grasp.

Show/hide Gripper Toolbar

It is possible to toggle between a shown and a hidden Gripper Toolbar.

1 Create or load a robot program

2 Tap the **Installation** tab

3 Select **Gripper** in the left pane

4 Tap the **Dashboard** submenu
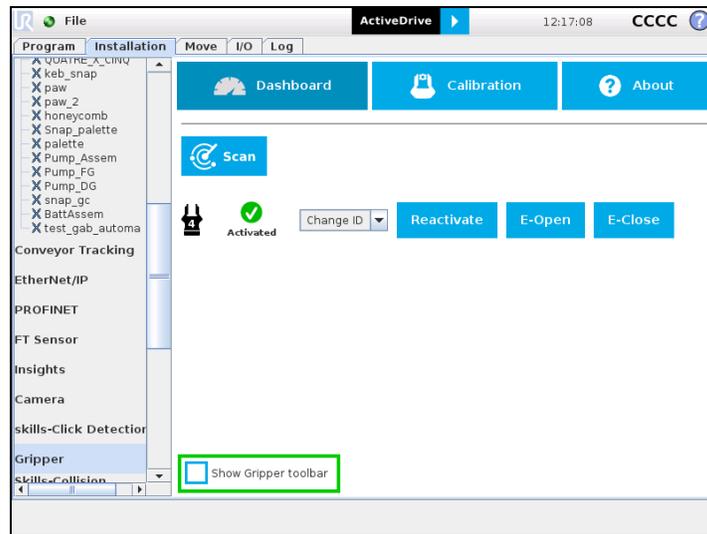
5 Check/Uncheck the box in the lower left corner

Fig. 4-25: **Show Gripper toolbar** Check Box.

4.9.8. Gripper Node

To add and edit a Gripper node inside your robot program, follow the steps below:

For e-Series

1 On the teach pendant, at the top of the screen, tap the **New** icon to create a program or the **Open** icon to load a program.

2 Select **Program**. The **Program** window will display.

3 Tap the **URCaps** menu in the navigation pane on the left.

4 Tap the **Gripper** button.

5 Select the node in the robot program and tap the **Command** tab.

6 Tap the **Edit** action button to edit the node's parameters.

For CB-Series

1 Tap **Program Robot**.

2 Open an empty program or load one.

3 Go the **Structure** tab and tap the **URCaps** submenu.

4 **Tap the Gripper button.**

5 Go to the **Command** tab to edit the **Gripper** node inserted.

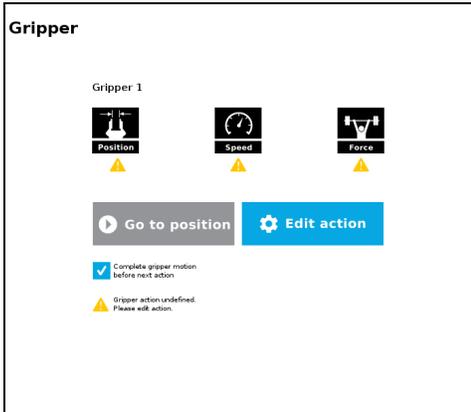6 Tap the **Edit** action button to edit the node's parameters.

> **Info**
>
> The Gripper needs to be activated before it can receive a command. To do so, use the rq_activate_and_wait() function script at the beginning of the program or activate with the Gripper toolbar. Starting from Gripper URCap version 1.0.2, the Gripper activation script command (**rq_activate()** or **rq_activate_and_wait()**) must be preceded by the reset command (**rq_reset()**). This will force the Gripper's activation routine. Thus, if the Gripper was already activated, it will activate again.

Command window

The Command window shows the requested action parameters for the Gripper node. Depending on the position, speed and force parameters, warning messages may display.
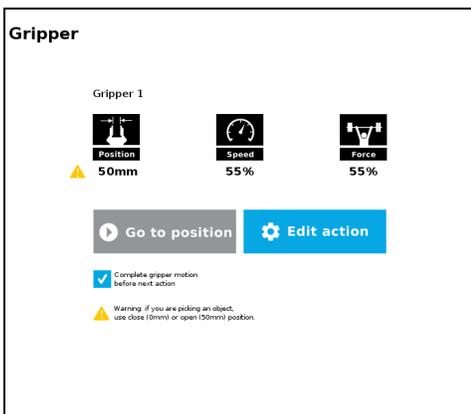
To edit the Gripper node, tap **Edit action** (please refer to the **Edit action screen** section for more details).

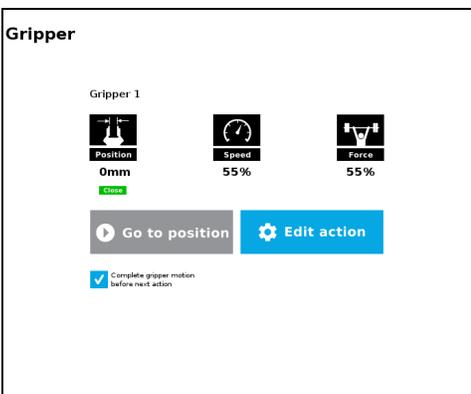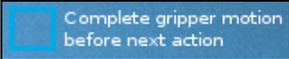|	
Gripper Gripper 1 Position / Speed / Force Go to position / Edit action ☑ Complete gripper motion before next action ⚠ Gripper action undefined. Please edit action.	When the node is not defined, the Command window shows warning messages. Tap **Edit action** to modify the Gripper's action. **Caution** Tap the **Go to position** button prior to editing the action. Whereas the command window displays the command that the Gripper should execute in this particular node, the Edit action screen displays the current Gripper position.
Gripper Gripper 1 Position 50mm / Speed 55% / Force 55% Go to position / Edit action ☑ Complete gripper motion before next action ⚠ Warning: if you are picking an object, use close (0mm) or open (50mm) position.	When the node requests the Gripper to close/open, the Command window warns that a partial opening/closing should not be performed for picking an object. • For positioning and partial movement of the hand, moving to a specific position (between the fully open and fully close positions) is suitable. • To pick an object, use the close (or open) actions along with the object detection feature (please refer to the **Edit action screen** section). **Info** When the action is set for multiple Grippers, the header lists the selected Grippers (e.g. Grippers 1,2,3,4)
Gripper Gripper 1 Position 0mm / Speed 55% / Force 55% Close Go to position / Edit action ☑ Complete gripper motion before next action	When the Gripper action is set to **close**, a green "Close" icon appears. When the Gripper action is set to **open**, a green "Open" icon appears.

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Features

Icon	Functionality Name	Description
Position	Requested position	Shows the position requested for the current Gripper node. Read only.
Speed	Requested speed	Shows the speed requested for the selected Gripper node. Read only.
Force	Requested force	Shows the force requested for the selected Gripper node. Read only.
Go to position	Go to position	Sends all node parameters (position, force, speed) to the Gripper. Note: This button is disabled (grey) when the Gripper is already at the node position or when the Gripper is not powered/activated.
Edit action	Edit action	Opens the Edit action screen, where you can edit the Gripper's action parameters.
✓ Complete gripper motion before next action	Complete motion	Selected by default. Selected: The Gripper completes its motion before executing the next action on the PolyScope program tree. This is slower but safer.
Complete gripper motion before next action	Do not complete motion	Selected by default. Unselected: As soon as the Gripper starts moving, PolyScope will execute the next action on the program tree. This allows you to move the Gripper and robot at the same time.
⚠️	Warning message section	-
⚠️	Gripper not activated	"Warning, the Gripper is not powered or not activated. The Gripper will not move." Make sure that the Gripper is installed correctly and powered. You need to activate it using the Gripper toolbar before running Gripper

Icon	Functionality Name	Description
		commands.
⚠	Gripper action undefined	"Gripper action undefined! Please edit action." When creating a new node, all action parameters are undefined. Tap the edit action button to define parameters.
⚠	Object picking warning	"Warning, if you are picking an object, use close (100%) or open (0%) position." It is highly recommended to only use 0% or 100% position when trying to pick an object.
▬ Gripper	Node name	Node name is automatically set to: • Gripper Open, when position = 0% or fully open value as defined in the Calibration wizard • Gripper Close, when position = 100% or fully closed value as defined in the Calibration wizard. • Gripper Move x%/mm/in, when position is between the fully open and fully closed values.
Open	Open request	When position requested is 0%, or the fully opened value defined in the Calibration wizard.
Close	Close request	When position request is 100%.

Edit action screen

Tap **Edit action** from the Command window and use the Edit action screen to edit the Gripper's parameters and adjust its position, speed and force. In normal usage conditions, the Gripper will move as soon as you change the position setting. The Gripper will not move if it is not properly powered, connected and activated.

> **Caution**
>
> The Gripper needs to be activated before it can receive a command. To do so, use the rq_activate_and_wait() function script at the beginning of the program or activate with the Gripper toolbar. Starting from Gripper URCap version 1.0.2, the gripper activation script command (**rq_activate()** or **rq_activate_and_wait()**) must be preceded by the reset command (**rq_reset()**). This will force the gripper's activation routine. Thus, if the gripper was already activated, it will activate again.
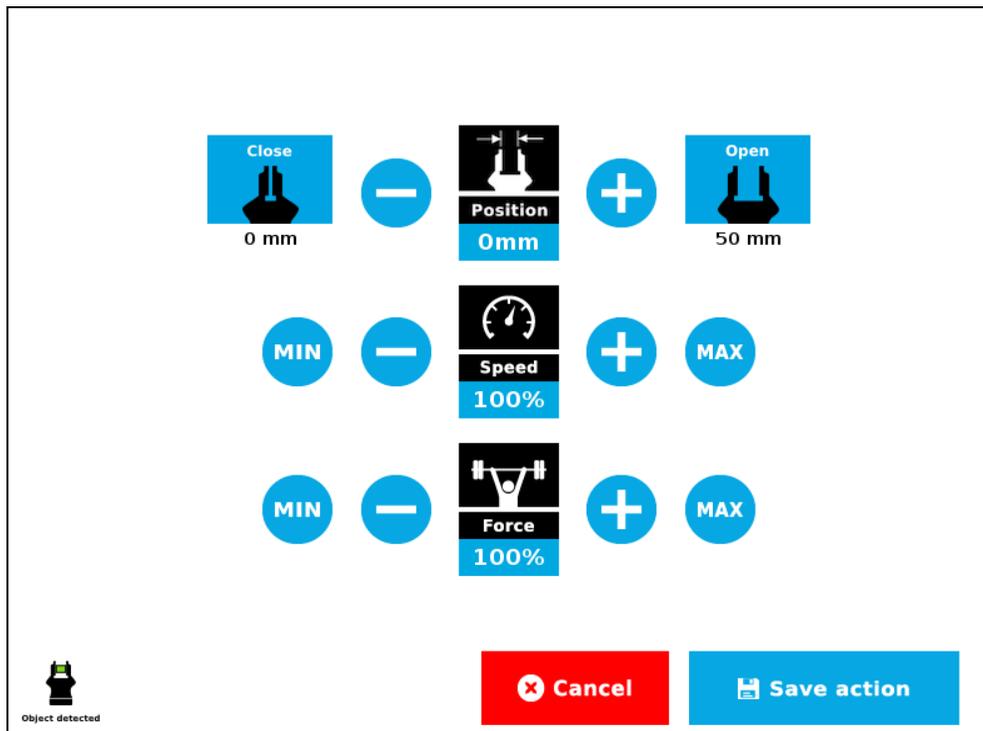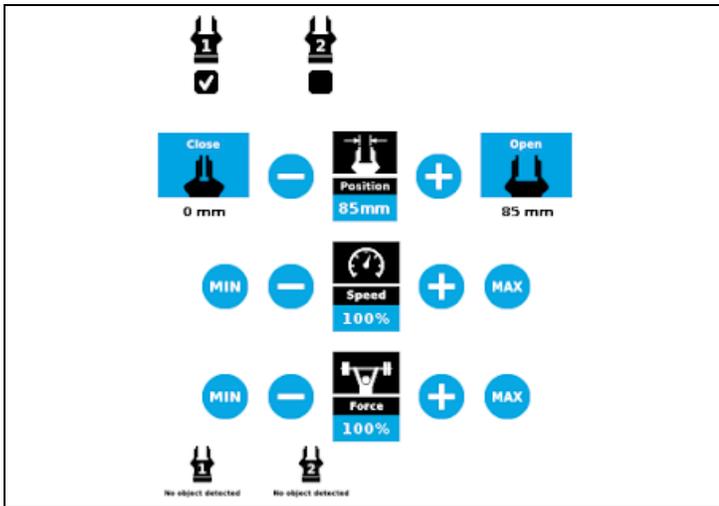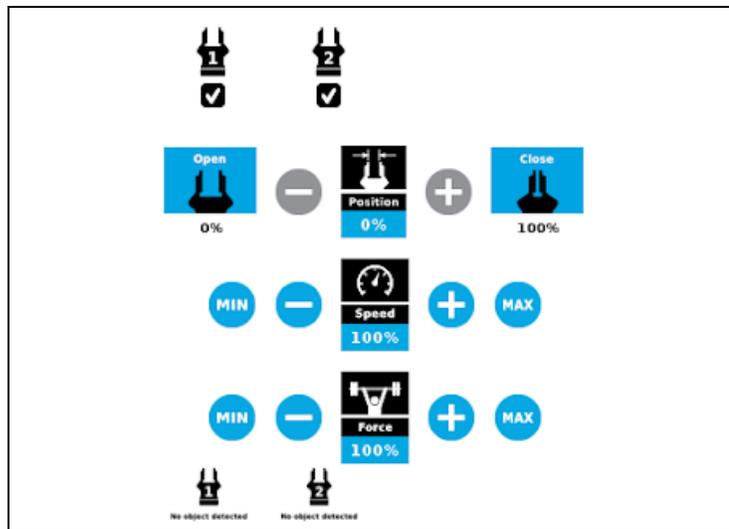
Single Gripper

*Fig. 4-26: Edit action screen*

Multiple Grippers

- When selecting one gripper, all buttons are available. The action will apply to the selected gripper.
- When jogging the position, the selected gripper will move automatically.
- It is possible to jog the position (%).

- When selecting two or more grippers, it is not possible to jog the position.
- To jog the position, select only one gripper, jog the position and then select all grippers. The second gripper will move to the requested position.
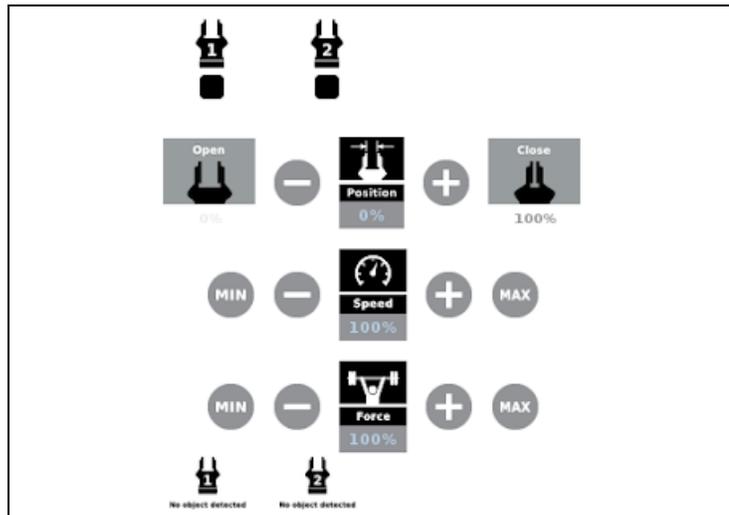
- When no grippers are selected, the action cannot be edited.

Features

Primary Icon	Functionality Name	Description
Open	Open	Tap to fully open the Gripper. Use this when you want to grip an object (internal grip), for example.
Close	Close	Tap to fully close the Gripper. Use this when you want to grip an object (external grip), for example.
Position	Requested position	Shows the position request for the selected Gripper node.
Speed	Requested speed	Shows the speed requested for the selected Gripper node. Use the Plus and Minus icons to modify.
Force	Requested force	Shows the force requested for the selected Gripper node. Use the Plus and Minus icons to modify.
Plus	Plus	Tap to increase the corresponding parameter.
Minus	Minus	Tap to decrease the corresponding parameter.
Cancel	Cancel	Cancels modifications and brings back the Gripper node command screen.
Save action	Save action	Saves settings into the selected Gripper node and brings back the Gripper node command screen. Note: This functionality is not available (grey) when the Gripper has the same action parameters as the selected Gripper node.
No object detected	No object detected	Icon shown when no object is detected during a grasp.
Object detected	Object detected	Icon shows a green checkmark when an object is detected during a grasp.

> **Warning**
>
> If the Gripper is powered and activated, it will move as soon as a change to the parameter is made (position, speed, force).

> **Tip**
>
> Change speed and force when grasping fragile objects or other specific parts. In all other cases, it is recommended to use maximum speed and force.

Grip Check node

In order to add and edit a Grip Check node:

For e-Series

1 On the teach pendant, at the top of the screen, tap the **New** icon to create a program or the **Open** icon to load a program.
2 Select **Program**. The Program window will display.
3 Tap the **URCaps** menu in the navigation pane on the left.
4 Tap the **Grip Check** button.
5 Select the node in the robot program to edit it.

For CB-Series

1 Open a robot program or create one
2 Go to the **Installation** tab
3 Tap the **URCaps** submenu
4 Select **Grip Check**

The Grip Check node is pre-packaged as an If statement that prompts the user to select between if the object *is* detected and if the object *is not* detected.

Selecting the former option allows the user to check a box and choose whether or not the grasp should be validated according to the object's dimension (in percentage if the Gripper is not calibrated, or in mm/in if the Gripper is calibrated—depending on the PolyScope configuration).
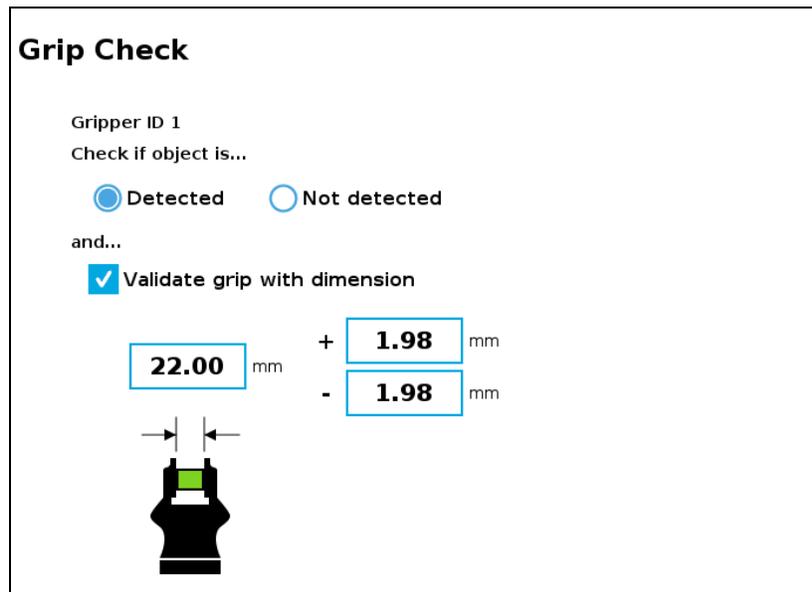

Fig. 4-27: Grip Check node interface

Fig. 4-28: Grip Check node interface with dimension validation

Given that the Grip Check node is an If statement, tapping the actual node in the Command tab brings up the option to add an **Else** instruction to the program tree.

About

In this window, the user can access information such as the Gripper's hardware, software and firmware versions, the number of cycles completed by the device and more.

1 Create or load a robot program

2 Tap the **Installation** tab

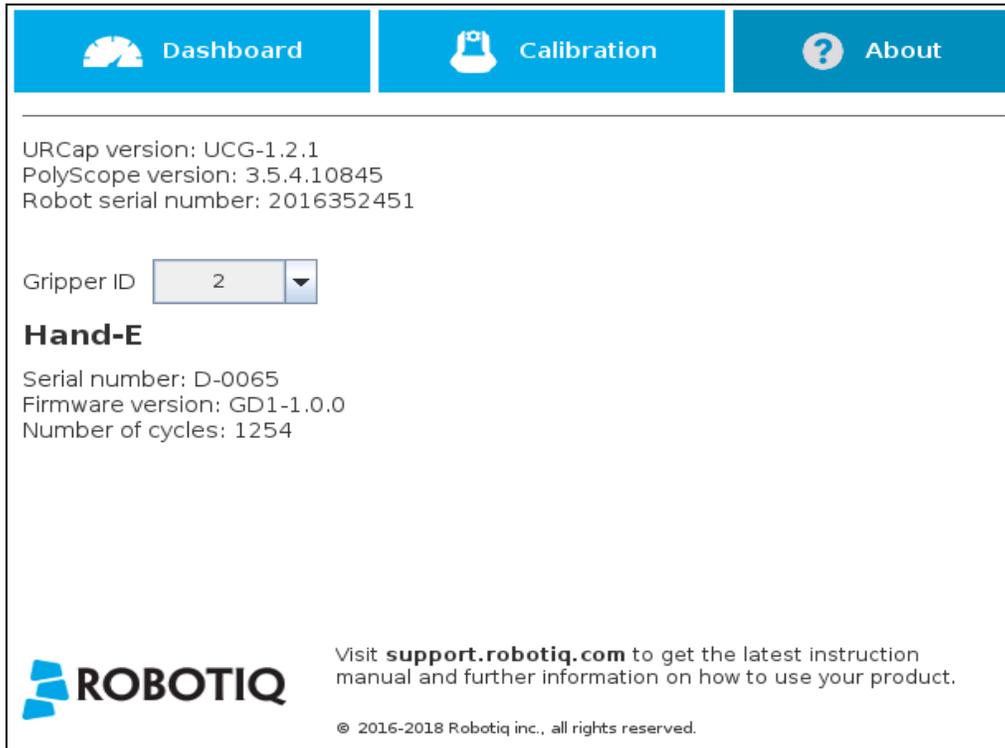3 Select **Gripper** in the left pane

4 Tap the **About** submenu

Fig. 4-29: **About** submenu.

If the Gripper version is obsolete, a warning message will display and an Upgrade firmware button will prompt the user to upgrade the firmware to the latest available version.

Error messages overview

If a program is running without the Gripper being activated, the program will stop at the execution of a Gripper node and the following message will be displayed in a popup. Tap **Stop Program** and activate the gripper with the toolbar to continue or add an activation command in the program (please refer to the **Advanced Gripper Functions** section).

> ### Popup
>
> (i) The gripper is not activated. Please activate the gripper using the Gripper Toolbar and run the program again.
>
> [Stop Program]   [Continue]

> **Caution**
>
> Starting from Gripper URCap version 1.0.2, the Gripper activation command (**rq_activate()** or **rq_activate_and_wait()**) must be preceded by the reset command (**rq_reset()**). This will force the gripper's activation routine. Thus, if the gripper was already activated, it will activate again.

Gripper Program Template

With the URCap package installation, a program template will automatically be installed in the program folder of PolyScope. It contains comments and pop up windows that explain Gripper nodes and advanced functions.

Load and open the gripper_tutorial.urp program located in the root program folder. Make sure the Gripper is well connected to the UR controller. Run the program. You will see pop up windows with comments on the Gripper nodes and advanced functions.

> **Tip**
>
> Use the gripper_tutorial.urp to learn how to program the Gripper using nodes and advanced functions. You can copy the tutorial and start a new program based on it.

Advanced Gripper Functions

The use of Gripper URCap nodes allows to move the Gripper and modify its speed and force. However, some advanced functions are only available through UR Script commands.

> **Info**
>
> The Gripper needs to be activated before it can receive a command. To do so, use the **rq_activate_and_wait()** function script at the beginning of the program or activate with the Gripper toolbar.

The functions listed below can be called using subprograms in PolyScope or with a script. Functions with the suffix **_and_wait** will wait for the Gripper to complete its operation before going to the next step.

Single Gripper with I/O coupling (UCH-1.0.0 +)

To use the **Object Detection** feature, the Tool Inputs can be used.
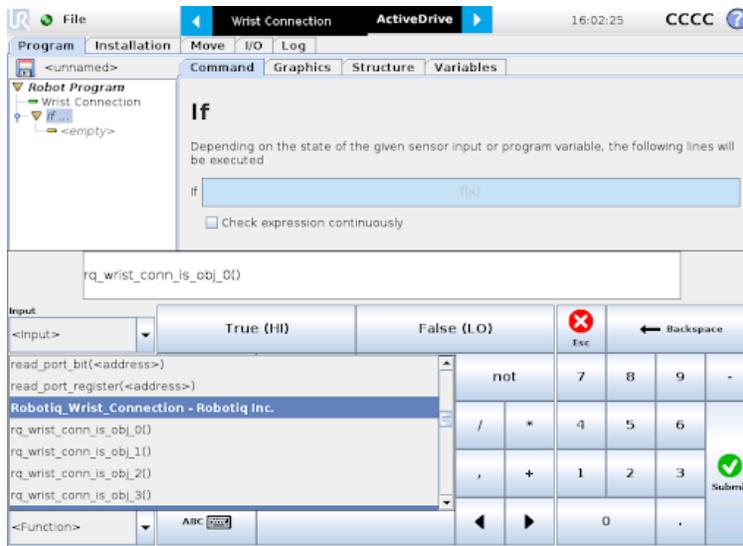
Tool Inputs configuration and **Object Detect** status are:

Name	Description
rq_wrist_conn_is_obj_0()	Fingers are in motion towards requested position. No object detected.
rq_wrist_conn_is_obj_1()	Fingers have stopped due to a contact while opening before requested position. Object detected opening.
rq_wrist_conn_is_obj_2()	Fingers have stopped due to a contact while closing before requested position. Object detected closing.
rq_wrist_conn_is_obj_3()	Fingers are at requested position. No object detected or object has been lost / dropped.

Single and Multiple Grippers (UCG-1.6.0 +)

All following functions require a final but optional parameter named gripper_socket. This parameter represents the gripper identifier as defined in the installation node. By default, the value of gripper_socket is 1. The admissible values are 1, 2, 3 and 4.

Name	Description
rq_activate_and_wait()	Sends the Gripper activation command. If it is already activated, nothing happens. Note that the Gripper must be activated to complete any other operation. Program execution waits for the activation.
rq_close_and_wait()	Moves the Gripper to its fully closed position and waits until the motion is completed to execute the next command.
rq_current_pos_norm()	Returns the current position of the fingers, normalized from 0% to 100%. Can be used to verify that the pick is successful, by comparing the finger position when the pick was taught with the similar-sized object.
rq_current_pos_mm()	Returns the current position of the fingers in millimeters, considering that the PolyScope configuration has been set to use the metric system as measurement system. Can be used to verify that the pick is successful, by comparing the finger position when the pick was taught with the similar-sized object.
rq_current_pos_inches()	Returns the current position of the fingers in inches, considering that the PolyScope configuration has been set to use the imperial system as measurement system. Can be used to verify that the pick is successful, by comparing the finger position when the pick was taught with the similar-sized object.
rq_get_gripper_max_cur(current_mA)	Returns the maximum supply current value of the appropriate Gripper in mA.
rq_gripper_led_off()	Forces the LEDs to OFF status.
rq_gripper_led_on()	Allows the firmware to turn ON the LEDs when they have been force to OFF status.
rq_is_object_detected()	Returns True if the Gripper motion has stopped due to an object. Returns False if Gripper motion was not impeded by an object. Useful for verifying that an object has been picked correctly before going to the next step. Note: this function is not reliable for very small objects. Refer to the user manual for more details.
rq_move_and_wait_norm(position)	Moves the Gripper to the position defined by the argument, normalized from 0% to 100%. Waits until the motion is completed.
rq_move_and_wait_mm(position)	Moves the Gripper to the position defined by the argument.
rq_move_and_wait_inches(position)	Moves the Gripper to the position defined by the argument.

Name	Description
rq_open_and_wait()	Moves the Gripper to its fully opened position and waits until the motion is completed.
rq_reset()	Resets the Gripper's activation status. Use after an autorelease before activating the Gripper.
rq_set_force_norm(force)	Sets the Gripper's force defined by the argument, normalized from 0% to 100%.
rq_set_speed_norm(speed)	Sets the Gripper's speed defined by the argument, normalized from 0% to 100%.

Multiple Grippers

Here is an example of how to use the script commands with more than one gripper.
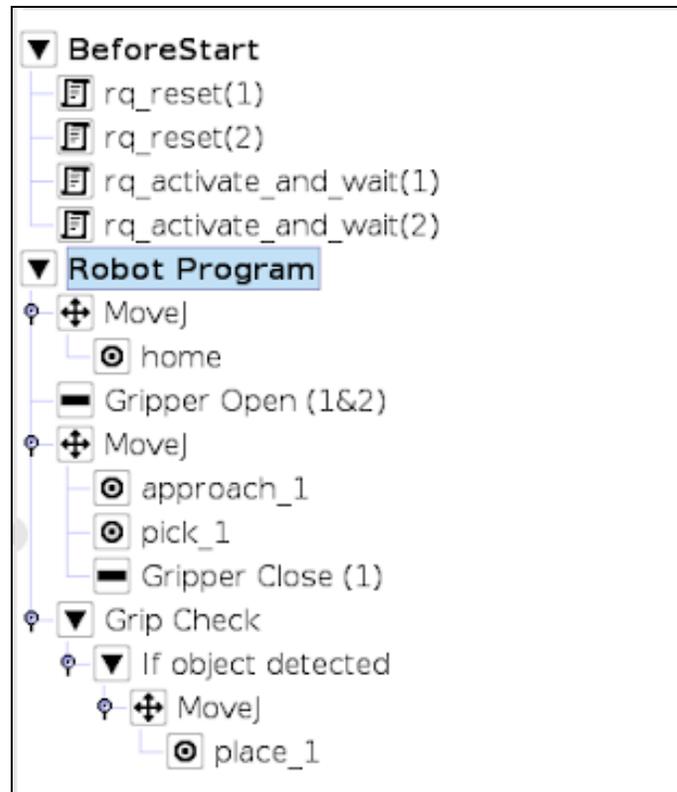

Fig. 4-30: Example of UR script commands with multiple Grippers

5. Specifications

> **Info**
>
> This manual uses the metric system. Unless otherwise specified, **all dimensions are in millimeters**.

The following subsections provide data on the various specifications for Hand-E.

- **Technical dimensions** section
  - Dimensions of couplings
  - Dimensions for custom fingertips
  - Dimensions of standard fingertips

- **Mechanical Specifications** section
- **Electrical specifications** section

5.1. Technical dimensions

5.1.1. Hand-E Gripper

The figure below represents the gripper dimensions with axes X, Y, Z, and origin referenced for finger motion.

> **Info**
>
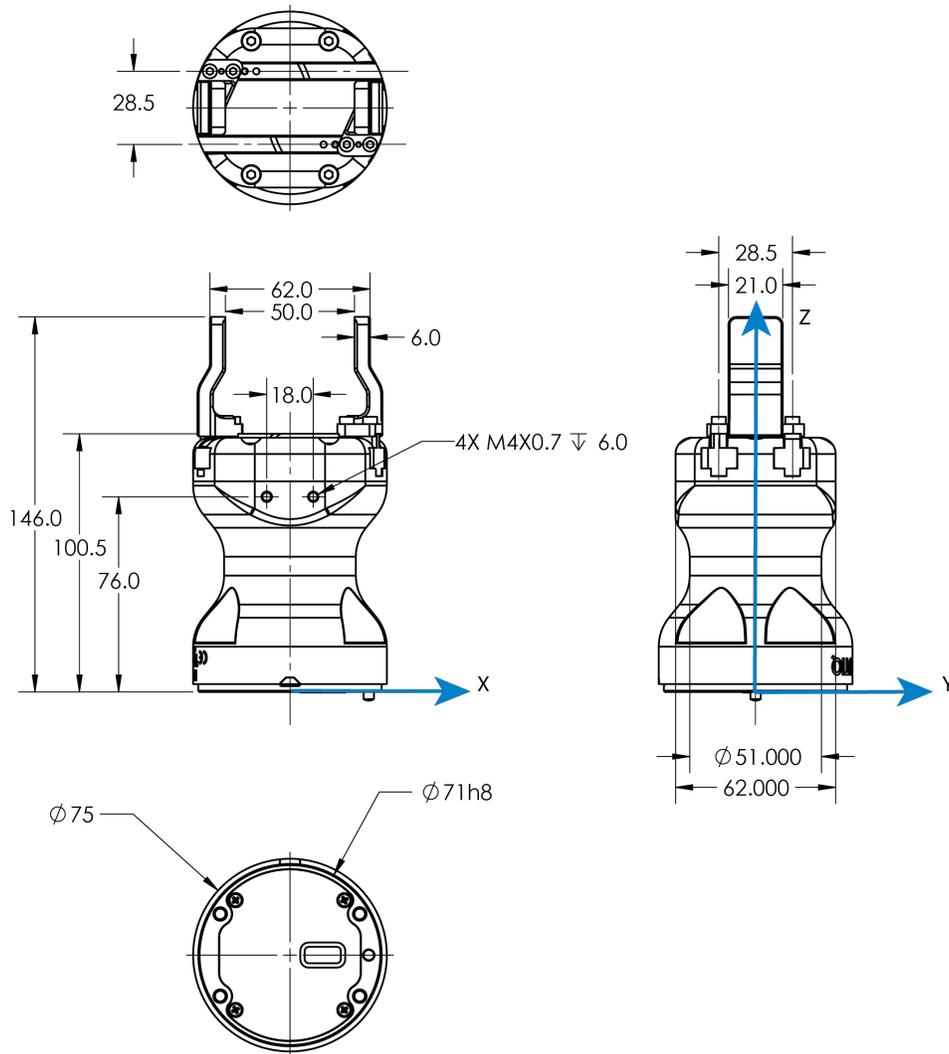> All technical drawings in the current section depict aluminum fingers.

Fig. 5-1: General dimensions of Hand-E (open).

5.1.2. Couplings

Hand-E requires a coupling provided by Robotiq to operate. The coupling is mandatory since it integrates electronics and electrical contacts.

Blank coupling

Below are the dimensions of the blank coupling, **AGC-CPL-BLANK-002** (please refer to the **Spare Parts, Kits and Accessories** section), available to create a custom bolt pattern. The blue section can be fully customized (holes can be placed in any part of this section) while the grey section can only be worked to a depth of 3 mm.
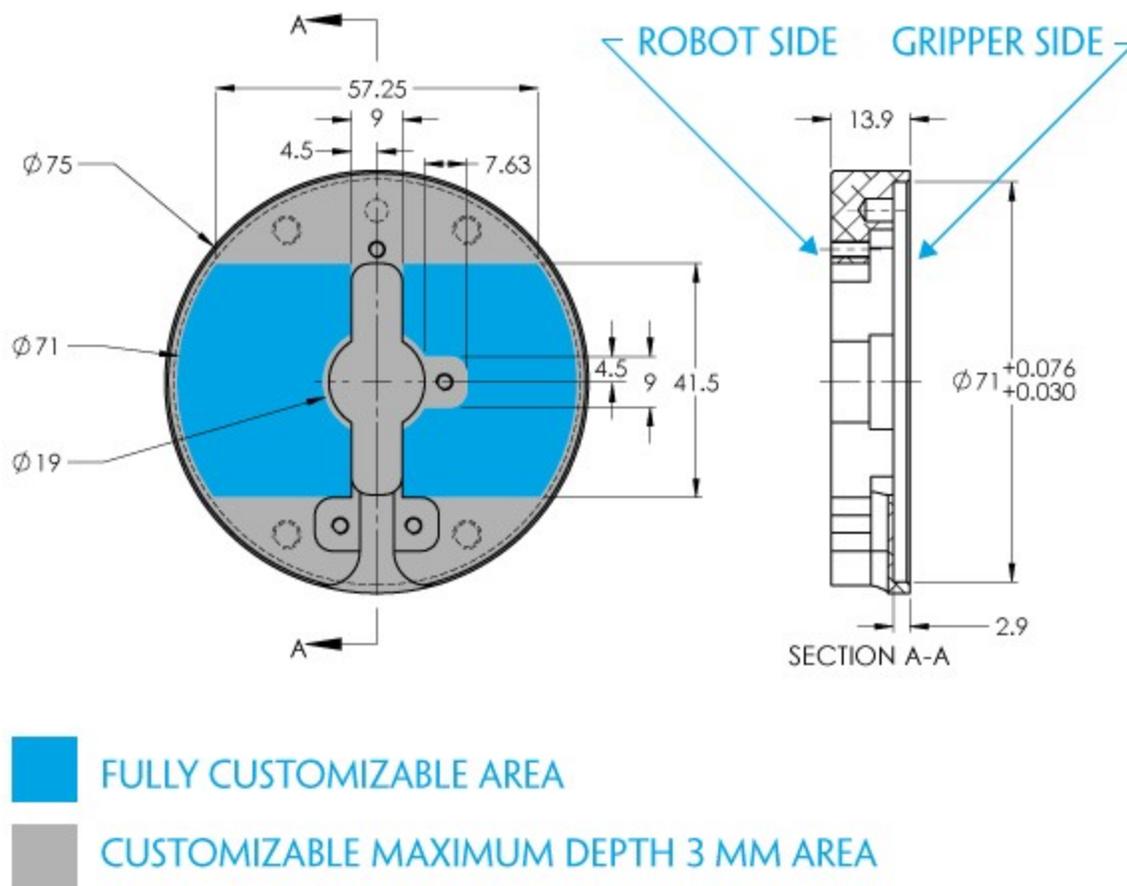

Fig. 5-2: Workable area dimensions of blank coupling AGC-CPL-BLANK-002

Coupling for ISO 9409-1-50-4-M6

Bolt pattern for coupling **GRP-CPL-062** (please refer to the **Spare Parts, Kits and Accessories** section) is compatible with:

- 50 mm pitch circle diameter:
    - (4) M6-1.0 low head socket cap screw clearance
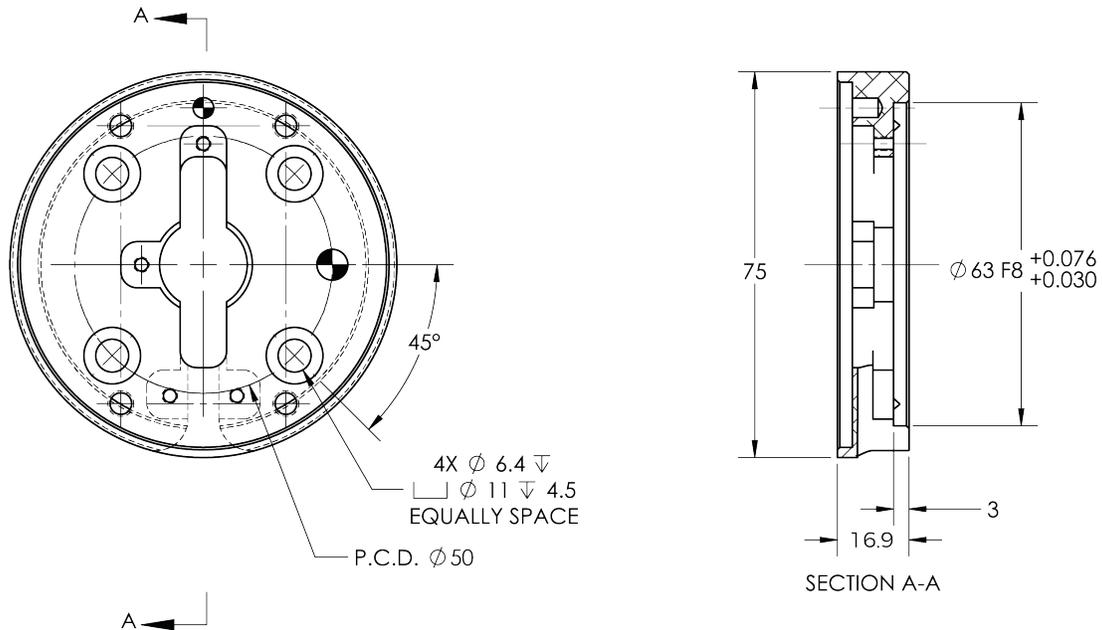   - (1) M6 dowel pin
    - ISO 9409-1 standard 50-4-M6

Fig. 5-3: Coupling for ISO 9409-1-50-4-M6.

5.1.3. Fingers and Fingertips

The contact grip points for Hand-E are its two fingertip pads.

Robotiq offers a selection of fingertips (see the **Spare Parts, Kits and Accessories** section), and users can create custom fingertips. The figure below represents the fingertip holder, the permanent, non customizable part of the gripper finger on which the fingertip must be mounted. Hand-E is shipped mounted with standard flat rubber (NBR) overmolded fingers.

Custom fingertip design must meet the following specifications:

- Forces exerted at the end of the fingertips must not exceed 100 N , regardless of the direction. Please refer to the **Moment and force limits** section for more details.

> **Warning**
>
> The following limits must be respected at all times.
> Calculation of maximum moment and force should include robot acceleration and safety factors.

- Refer to the **Mechanical Specifications** section to evaluate the grip force according to your fingertip design.

> **Info**
>
> You can install custom fingertips directly on the rack or on the fingertip holder.

Rack

Fingers are installed directly on a rack. You may customize your own fingers to mount them on this part. NBR overmolded flat fingers (HND-FIN-MLD-KIT) are mounted directly onto it.
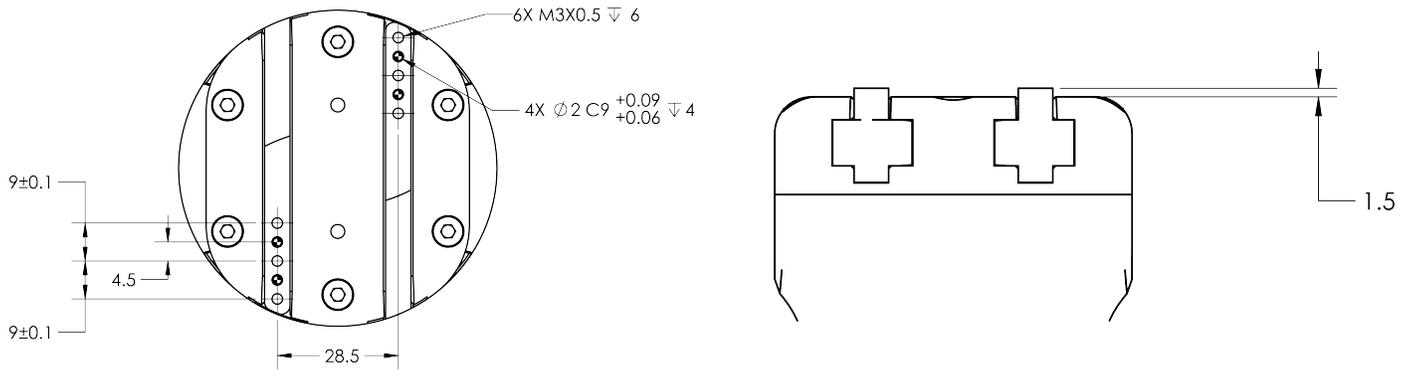

Fig. 5-4: Racks in rack housing

Fingertip Holders

To install fingertips on racks use fingertip holders (HND-TIP-HLD-KIT), and refer to the **Spare Parts, Kits and Accessories** section. You may customize fingertips to install directly on those. V-groove fingertips (HND-TIP-VGR-KIT) can be installed on fingertip holders.
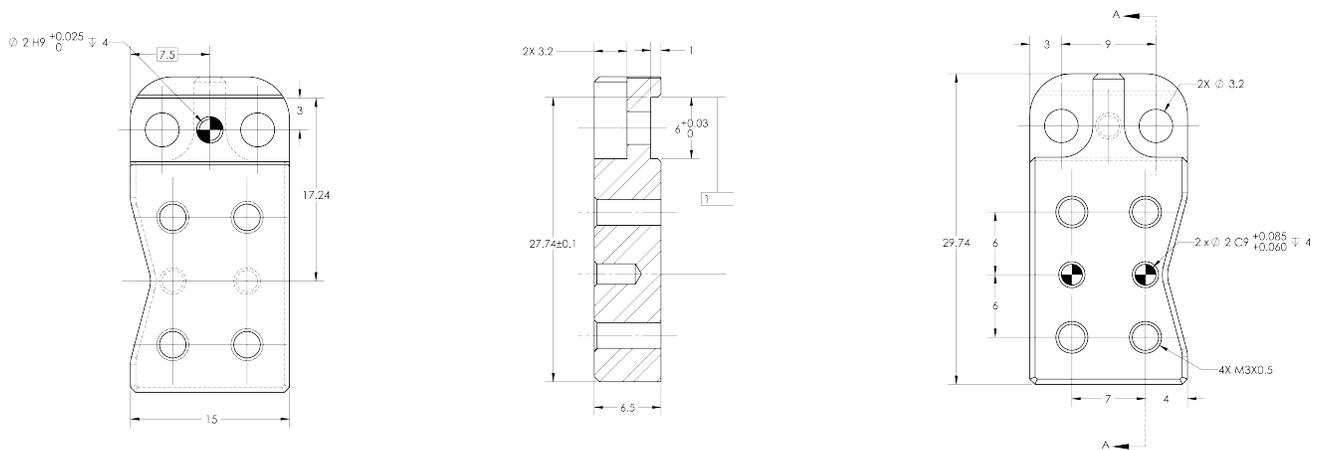

Fig. 5-5: Fingertip holder.

Flat Rubber (NBR) Overmolded Fingers

The figure below represents flat rubber (NBR) overmolded fingers (HND-FIN-MLD-KIT). For details, see the **Spare Parts, Kits and Accessories** section. This finger allows a 50 mm stroke.
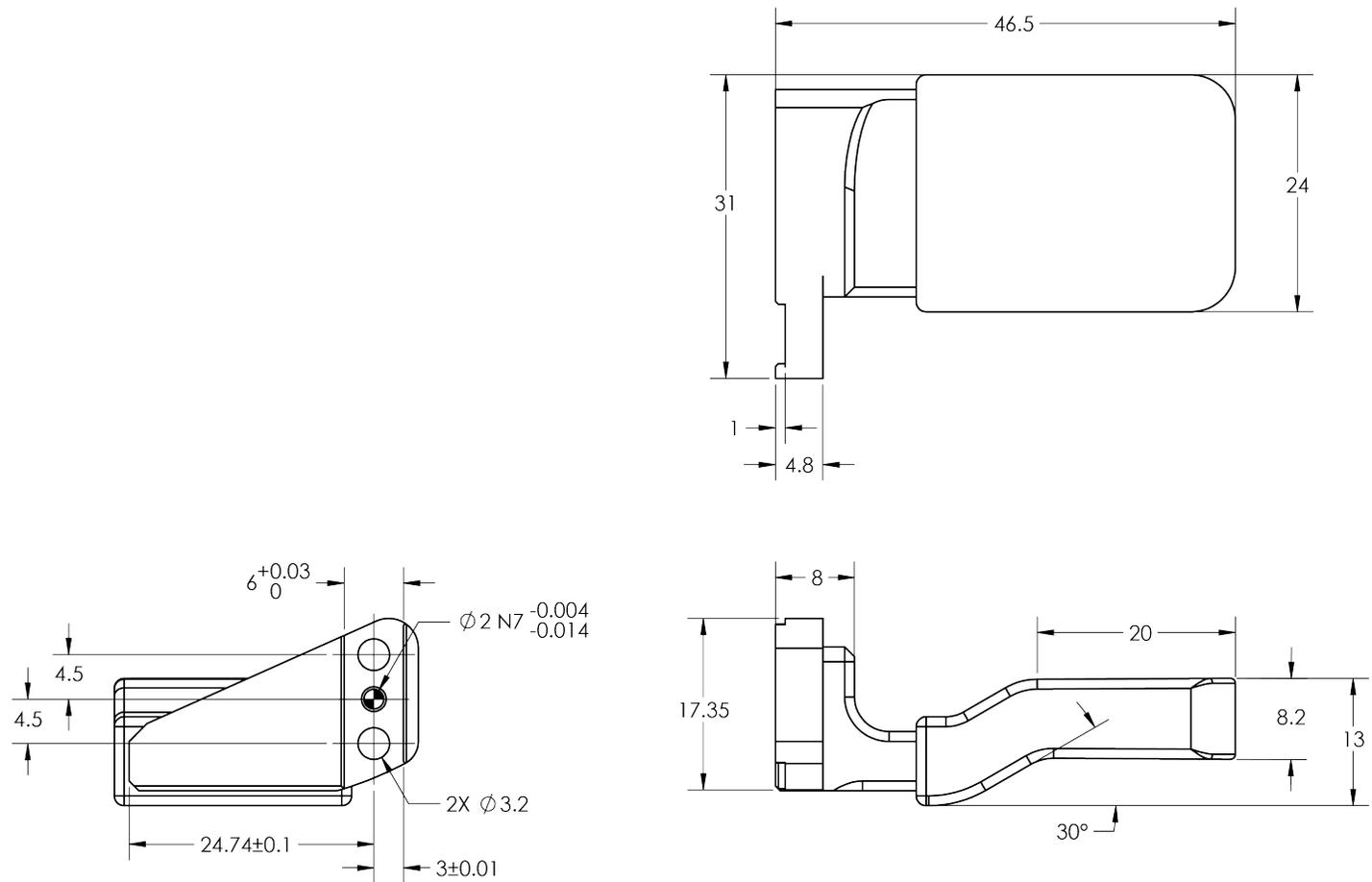

Fig. 5-6: Flat NBR overmolded finger.

Flat Aluminum Finger

The figure below represents a flat aluminum finger (HND-FIN-ALU-KIT). For more details, refer to the **Spare Parts, Kits and Accessories** section. This finger allows a 50 mm stroke.

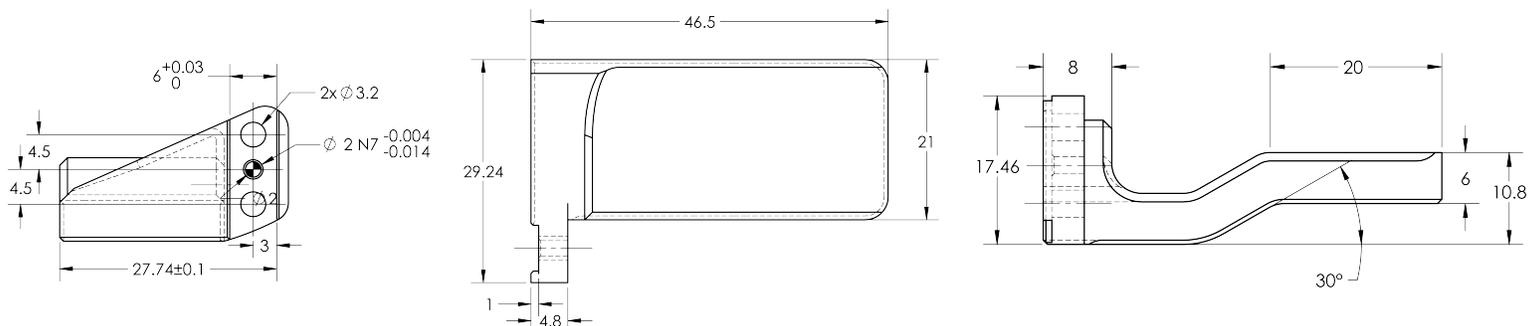Fig. 5-7: Flat aluminum finger.

V-Groove Fingertip

The figure below shows the V-groove fingertip (HND-TIP-VGR-KIT). For details, see **Spare Parts, Kits and Accessories** section. This fingertip inner surface has vertical grooves, making it ideal for picking cylindrical parts. This fingertip must be mounted on the racks using the fingertip holder (HND-TIP-HLD-KIT).
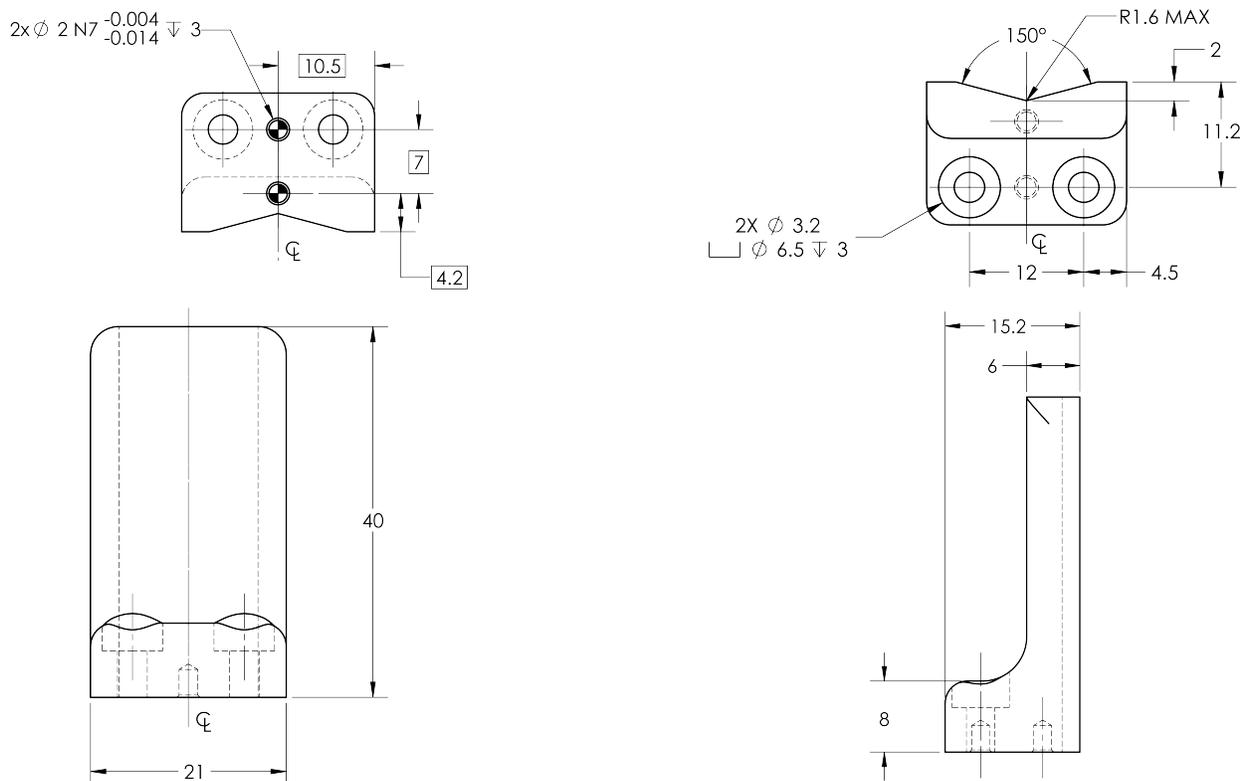

Fig. 5-8: Grooved fingertip

5.2. Mechanical Specifications

5.2.1. Hand-E Assembly

> **Info**
>
> Data shown in the table below is typical for new products, and will vary with use.

Specification	Metric	Imperial
Stroke	50 mm	1.97 in
Maximum recommended payload - Form-fit grasp	5 kg	11 lbs
Maximum recommended payload - Friction grasp	3 kg	6.6 lbs
Height - No fingertip	112 mm	4.41 in
Height - With fingertips	157 mm	6.18 in
Diameter	75 mm	2.95 in
Weight	1070 g	2.3 lbs
Grip force	20 N - 130 N	4.5 lbf - 27 lbf
Finger speed	20 - 150 mm/sec	0.8 - 5.9 in/sec

Table 5-1: Mechanical specifications of the Hand-E gripper fitted with coupling GRP-CPL-062 and aluminum fingertips.

Payload and force

Friction Grip payload equation:

$$W = \frac{2FC_f}{S_f}$$

Where:

- W is payload weight
- F is the force applied by the gripper to the load
- C_f is the friction coefficient between fingertip and part load
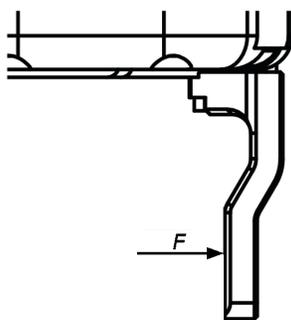- S_f is a safety factor to be determined by the robot integrator

Fig. 5-9: Grasping force on Hand-E fingertip.

> ### And Now, Some Terminology
> **grasping force**   Force applied to an object via a gripper finger.

> ### Info
> The gripper has a power off brake. Without power, gripper fingers are blocked.

> ### Info
> For example, if the silicone fingertips (HND-TIP-SLC-KIT) are used to lift a lubricated steel part (machine tending with cutting oils), the friction coefficient would be 0.3 (tested static coefficient of friction).
>
> The maximum weight with a safety factor of 2.4 using the maximum grasping force of 130 N would be:
>
> W = (2 x 130 N x 0.3) / 2.4 = 32.5 N
>
> This calculation means that a 3.3 kg part will be held by the gripper when not moving (standing still). When accelerating, the payload will decrease.
>
> The biggest factor in such calculations will always be the **friction coefficient**, we recommend testing the coefficient.

> ### Warning
> In payload calculations, take **robot acceleration** into account.
> **Robot emergency stops will lead to major deceleration velocities**.

Maximum payload/External force vs. Custom finger design

The maximum payload force recommended depends on the distance on the Z-axis at which the force/payload (F) is applied when using custom fingers on Hand-E.
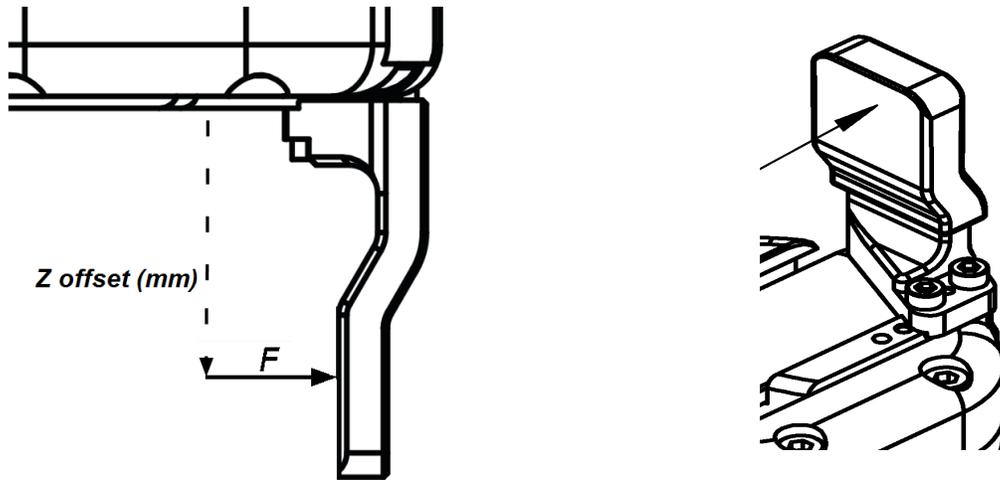

Fig. 5-10: Z-axis offset at which force/payload is applied.
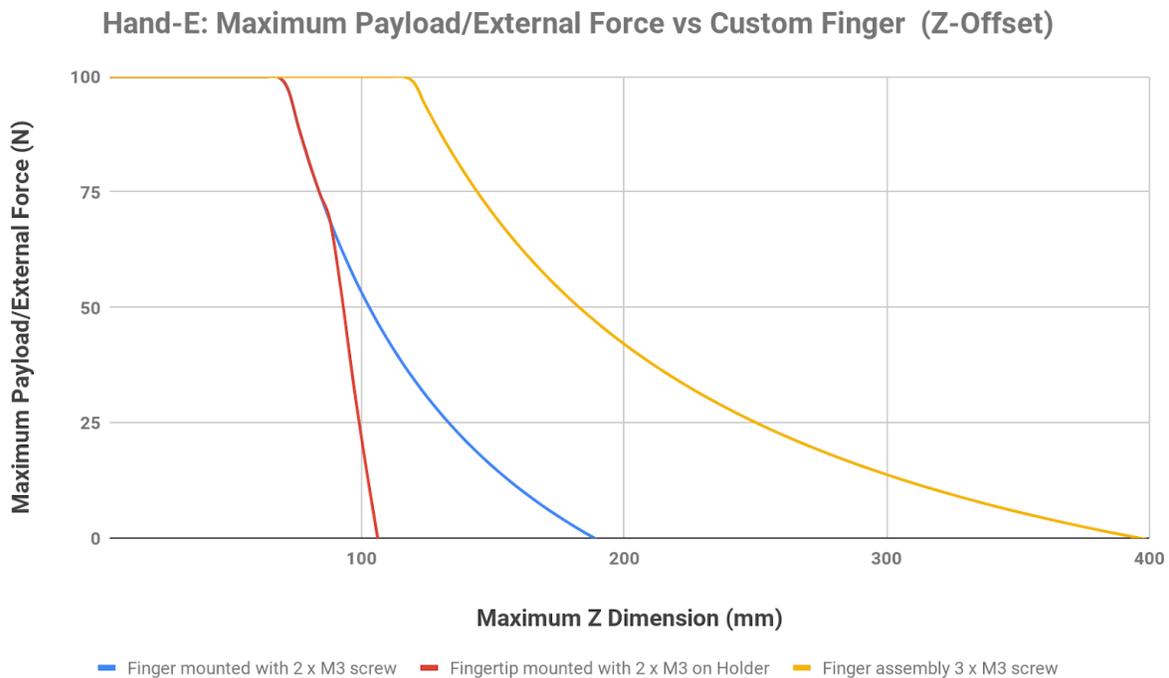
Fig. 5-11: Graph illustrating Maximum Payload/External Force vs. Z-Offset on Custom finger.

- The **blue curve** in the graph represents the maximum force/payload (F) recommended at given Z offset for a custom finger design **mounted directly on the rack with two (2) M3 screws**.
- The **red curve** in the graph represents the maximum force/payload (F) recommended at given Z offset for a custom finger design **mountend on a fingertip holder with two (2) M3 screws**.
- The **yellow curve** in the graph represents the maximum force/payload (F) recommended at given Z offset for a custom finger design **mounted directly on the rack with three (3) M3 screws**.

Friction grasp and form-fit grasp

Fig. 5-12: Friction grasp and form-fit grasp.

Maximum payload by grasp type
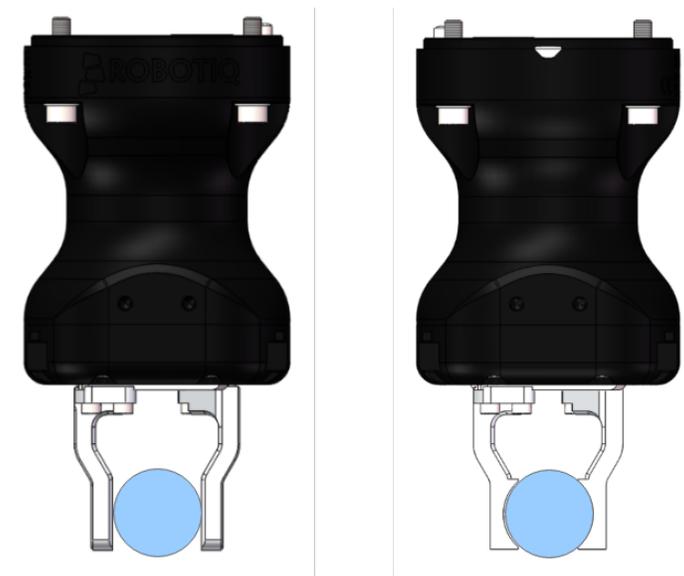
Grasp Type	Maximum Payload
Friction grasp	3 kg
Form-fit grasp	5 kg

5.2.2. Center of Mass and Tool Center Point

When grippers are not mounted on the Wrist Camera, a coupling is included. A dual gripper adapter plate is included when required.

Products	Center of mass (mm)			TCP (mm)						Mass (g)
				Gripper 1			Gripper 2			
	X	Y	Z	X	Y	Z	X	Y	Z	
FT Sensor	-3.0	0.0	17.0	0.0	0.0	37.5	-	-	-	300.0
Camera	-3.0	4.5	9.0	0.0	0.0	23.5	-	-	-	245.0
2F-85	0.0	0.0	58.0	0.0	0.0	174.0	-	-	-	925.0
2F-140	0.0	0.0	73.0	0.0	0.0	244.0	-	-	-	1025.0
Hand-E	0.0	0.0	57.5	0.0	0.0	157.0	-	-	-	1090.0
Dual grippers plate	0.0	0.0	15.5	-	-	-	-	-	-	265.0
FT Sensor + 2F-85	-0.7	0.0	76.3	0.0	0.0	211.5	-	-	-	1225.0
FT Sensor + 2F-140	-0.7	0.0	89.3	0.0	0.0	281.5	-	-	-	1325.0
FT Sensor + Hand-E	-0.6	0.0	78.2	0.0	0.0	194.5	-	-	-	1390.0
Camera + 2F-85	-0.7	1.2	57.1	0.0	0.0	175.5	-	-	-	975.0
Camera + 2F-140	-0.7	1.1	72.4	0.0	0.0	246.5	-	-	-	1075.0
Camera + Hand-E	-0.6	1.0	57.4	0.0	0.0	159.5	-	-	-	1135.0
FT Sensor + Camera + 2F-85	-1.3	0.9	76.3	0.0	0.0	213.0	-	-	-	1275.0
FT Sensor + Camera + 2F-140	-1.2	0.8	89.6	0.0	0.0	284.0	-	-	-	1375.0
FT Sensor + Camera + Hand-E	-1.1	0.8	78.6	0.0	0.0	197.0	-	-	-	1435.0
Hand-E/Hand-E	0.0	0.0	62.0	154.0	0.0	138.0	-154.0	0.0	138.0	2445.0
Hand-E/2F-85	5.9	0.0	61.7	154.0	0.0	138.0	-166.0	0.0	150.0	2280.0
Hand-E/2F-140	-2.4	0.0	66.6	154.0	0.0	138.0	-215.5	0.0	199.5	2380.0
2F-85/2F-85	0.0	0.0	61.4	166.0	0.0	150.0	-166.0	0.0	150.0	2115.0
2F-85/2F-140	-8.7	0.0	66.6	166.0	0.0	150.0	-215.5	0.0	199.5	2215.0
2F-140/2F-140	0.0	0.0	71.4	215.5	0.0	199.5	-215.5	0.0	199.5	2315.0
Camera + Hand-E/Hand-E	-0.3	0.4	78.5	154.0	0.0	161.5	-154.0	0.0	161.5	2690.0
Camera + Hand-E/2F-85	5.0	0.4	77.8	154.0	0.0	161.5	-166.0	0.0	173.5	2525.0
Camera + Hand-E/2F-140	-2.5	0.4	82.5	154.0	0.0	161.5	-215.5	0.0	223.0	2625.0
Camera + 2F-85/2F-85	-0.3	0.5	77.0	166.0	0.0	173.5	-166.0	0.0	173.5	2360.0
Camera + 2F-85/2F-140	-8.1	0.4	82.1	166.0	0.0	173.5	-215.5	0.0	223.0	2460.0
Camera + 2F-140/2F-140	-0.3	0.4	86.7	215.5	0.0	223.0	-215.5	0.0	223.0	2560.0
FT Sensor + Hand-E/Hand-E	-0.3	0.0	90.5	154.0	0.0	175.5	-154.0	0.0	175.5	2745.0
FT Sensor + Hand-E/2F-85	4.9	0.0	89.7	154.0	0.0	175.5	-166.0	0.0	187.5	2580.0
FT Sensor + Hand-E/2F-140	-2.5	0.0	94.3	154.0	0.0	175.5	-215.5	0.0	237.0	2680.0
FT Sensor + 2F-85/2F-85	-0.4	0.0	88.8	166.0	0.0	187.5	-166.0	0.0	187.5	2415.0
FT Sensor + 2F-85/2F-140	-8.0	0.0	93.7	166.0	0.0	187.5	-215.5	0.0	237.0	2515.0
FT Sensor + 2F-140/2F-140	-0.3	0.0	98.4	215.5	0.0	237.0	-215.5	0.0	237.0	2615.0
FT Sensor + Camera + Hand-E/Hand-E	-0.5	0.4	106.1	154.0	0.0	199.0	-154.0	0.0	199.0	2990.0
FT Sensor + Camera + Hand-E/2F-85	4.2	0.4	104.9	154.0	0.0	199.0	-166.0	0.0	211.0	2825.0
FT Sensor + Camera + Hand-E/2F-140	-2.5	0.4	109.4	154.0	0.0	199.0	-215.5	0.0	260.5	2925.0
FT Sensor + Camera + 2F-85/2F-85	-0.6	0.4	103.5	166.0	0.0	211.0	-166.0	0.0	211.0	2660.0
FT Sensor + Camera + 2F-85/2F-140	-7.6	0.4	108.4	166.0	0.0	211.0	-215.5	0.0	260.5	2760.0
FT Sensor + Camera + 2F-140/2F-140	-0.6	0.4	112.9	215.5	0.0	260.5	-215.5	0.0	260.5	2860.0

The coordinate system used to calculate the moment of inertia and center of mass of the Gripper is shown in the figure below.

$$
I = \begin{bmatrix} I_{XX} & I_{XY} & I_{XZ} \\ I_{YX} & I_{YY} & I_{YZ} \\ I_{ZX} & I_{ZY} & I_{ZZ} \end{bmatrix} = \begin{bmatrix} 5341 & 0 & 0 \\ 0 & 5447 & 0 \\ 0 & 0 & 636 \end{bmatrix} = \begin{bmatrix} 18.3 & 0 & 0 \\ 0 & 18.6 & 0 \\ 0 & 0 & 2.2 \end{bmatrix}
$$

$$kg * mm^2 \qquad\qquad lb * in^2$$

Fig. 5-13: Inertia matrix for Hand-E.

5.2.3. Moment and force limits

The Hand-E gripper has limits for moment and force values. The maximum moment and force values are independent of the grasp force the gripper applies on its payload. For payload calculation, see the **Payload and force** section.

> **Warning**
>
> Always operate within range.
>
> Calculation of maximum moment and force should include robot acceleration and safety factors.

Parameter	Hand-E with Aluminum Fingers
F_x, F_y, F_z	100 N
M_x*	2.65 Nm
M_y*	3.74 Nm
M_z*	2.00 Nm

*Moments in x and y are calculated from the base of the fingers, as shown in the figure below.
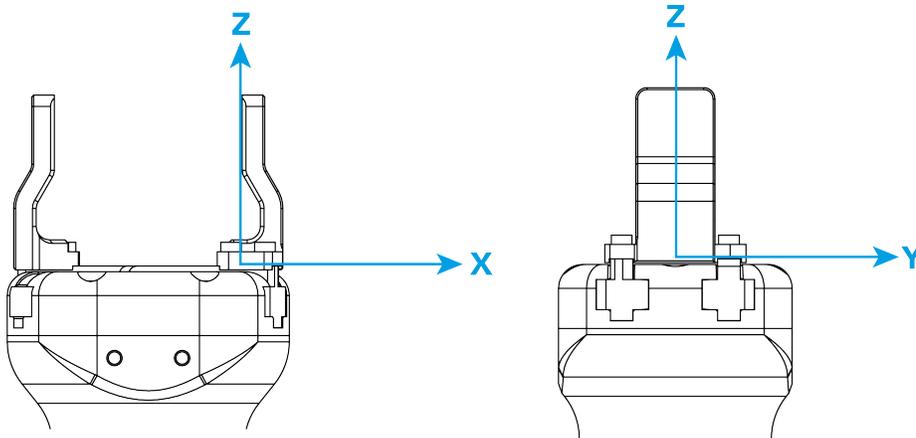

Fig. 5-14: Reference frame for maximum force and moment values applied to the fingers

Usage examples with listed limits:

- After picking its normal payload, the robot can use Hand-E to apply up to 100 N of force in any direction. Applying more than 100 N can damage the gripper or result in payload loss.

- A gripper can pick up a screwdriver and apply 2 Nm of torque to screw (such a moment would be applied in the Z axis).

5.3. Electrical specifications

SPECIFICATION	VALUE
Operating supply voltage	24 V DC ±10%
Quiescent power (minimum power consumption)	1 W
Peak current	1.1 A

6. Maintenance

Hand-E requires only external maintenance with limited downtime.

Maintenance is required after specified usage, measured in cycles (see Info box below for details about cycle definition).

Following the maintenance interval will ensure :

- Correct functioning of your Gripper.
- Validity of your warranty.
- Proper lifetime for your Gripper.

> **Warning**
>
> Unless otherwise indicated, any **repairs** done on the Gripper will be performed by Robotiq.

> **Info**
>
> A cycle is defined as a **go to requested position** command that results in grip force being applied (closing the fingers on themselves or picking an object while opening or closing).

Operation	Daily	Weekly	1 M cycles	2 M cycles
Gripper Cleaning	Dirty conditions	Normal conditions		
Periodic Inspection			X	
Rack and pinion mechanism cleaning				X

Table 6-1: Maintenance Intervals.

> **Caution**
>
> Always turn off the robot and the Gripper power supply before performing any maintenance operations.

Maintenance operations are for the average normal usage of the Gripper, the maintenance intervals must be adjusted according to environmental conditions such as:

- Operating temperature
- Humidity
- Presence of chemical(s)
- Presence of physical parts (debris, scraps, dust, grease etc.)
- Interaction with operated parts (sharp or rough)
- Dynamics of the operation (accelerations)

6.1. Gripper cleaning

Maintenance Interval	Tools You Need	Parts You Need
Weekly or daily in dirty operating conditions	• 4 mm hex key • Dry tissue or towel • Low strength thread locker	None (unless damage is detected)

> **Caution**
>
> Always turn off the robot and the Gripper power supply before performing any maintenance operations.

> **Caution**
>
> The maintenance operator must be grounded to prevent electrostatic discharge that could damage the Gripper electronics.

1. Remove the Gripper from its coupling using the 4 mm hex key to unscrew the four (4) M5-0.8 x 25mm socket head cap screws. Note that each screw uses a tooth lock washer, do not lose them.
2. Clean the Gripper with a dry towel, remove all debris, dirt and dust from the surface of the Gripper, clean all pads, dry thoroughly.
3. Clean the coupling with a dry towel, pay particular attention to the electrical contact.
4. Visually inspect the Gripper and pay attention to any visible damage.
5. Put the gripper back on and secure it with the four (4) M5-0.8 x 25mm socket head cap screws and tooth lock washers.

When cleaning the Gripper, verify that the fingers or fingertips are still intact. If there is wear visible, you can change the fingers or fingertips, using the ones provided by Robotiq or custom ones. See **Spare Parts, Kits and Accessories** section to order Hand-E replacement parts.

In order to replace a finger:

• Remove the worn finger by removing the M3 screws.
• Clean the rack and dry thoroughly.
• Insert the new finger on the rack.
• Secure the finger using the provided M3 screws, apply low strength thread locker to the M3 screw threads.
• Repeat for remaining finger.

In order to replace a fingertip:

• Remove the worn fingertip by removing the M3 screws.
• Clean the fingertip holder and dry thoroughly.
• Insert the new fingertip in the fingertip holder.
• Secure the fingertip using the provided M3 screws, apply low strength thread locker to the M3 screw threads.
• Repeat for remaining fingertip.

6.2. Periodic inspection

Maintenance Interval	Tools You Need	Parts You Need
Monthly	• 4 mm hex key • Dry tissue or towel	None (unless damage is detected)

> **Caution**
>
> Always turn off the robot and the Gripper power supply before performing any maintenance operations.

1. Remove and clean the Gripper following instructions in the **Gripper cleaning** section

2. Inspect the Gripper
   - Finger movement must be symmetric and fluid; test opening and closing of the Gripper:
   - Finger or fingertip wear must not affect gripping, if wear is visible and affects movement, change accordingly (refer to the **Gripper cleaning** section)
   - Check for any collision damage, if damage is visible, contact support@robotiq.com
   - Check for any sign of wear on the Gripper chassis; if wear is present and may affect the Gripper, contact support@robotiq.com

3. Put back in place according to the instructions from the **Gripper cleaning** section

6.3. Rack & pinion mechanism cleaning

Maintenance Interval	Tools You Need	Parts You Need
Every 2M cycles or more frequently in dirty operating conditions	4 mm hex key - Dry tissue or towel - Low strength thread locker - Grease (Mobilith SHC1500 or equivalent.)	- Grease (Mobilith SHC1500 or equivalent) - Degreaser

> **Caution**
>
> Always turn off the robot and the Gripper power supply before performing any maintenance operations.

- Open the Gripper to an intermediate position, so you do not hide the six (6) M4 screws holding the rack housing in place.
- Remove the Gripper from its coupling using the 4 mm hex key to unscrew the four (4) M5-0.8 x 25mm screws. Note that each screw uses a toothed lock washer, do not lose them.
- Remove the six (6) M4 screws holding the rack housing.
- Gently pull the rack housing away from the body of the Gripper.
- Remove the pinion and key from the drive shaft, make sure you keep them in a safe space.
- The finger's racks will slide off freely from the rack housing. Clean the rack housing, the racks and the pinion using a degreaser. Dry thoroughly. Clean the fingers (finger holders and fingertips if that is the case) with a dry towel. Remove all debris, dirt and dust.
- Also clean the Gripper itself with a dry towel. Dry thoroughly.
- Clean the coupling with a dry towel, pay particular attention to the electrical contact.
- You can clean the Gripper according to the procedure described in the **Gripper cleaning** section.
- Visually inspect the Gripper and pay attention to any visible damage.
- Apply grease on the racks. Put it on **all surfaces except the face with the tapped holes**.

> **Info**
>
> Use Mobilith SHC1500 grease or an equivalent.

- Insert the pinion with the key in the keyhole on the shaft.
- Slide the racks back in the rack housing.
- Reinsert the rack housing with racks on the Gripper. Make sure the racks go in symmetricaly compared to the center of the gripper.
- Fix the six (6) M4 screws to secure the rack housing. Apply low strength thread locker to the M4 screw threads.
- Put the gripper back on the coupling and secure it with the four (4) M5-0.8 x 25mm screws and tooth lock washers.

7. Spare Parts, Kits and Accessories

The following list is up-to-date at print time (12/19/2019) and is subject to change. Check online for updates.

> **Info**
>
> Unless specified, screws, dowel pins and other hardware are only included for grippers, and not for robots.

Item	Description	Ordering Number
Hand-E Basic Gripper Unit	Hand-E basic gripper unit, includes flat rubber (NBR) overmolded fingers (HND-FIN-MLD-KIT)	HND-GRP-001
Kit for *Universal Robots* (*CB-Series*)	• Basic gripper unit (HND-GRP-001) • Fingertip starting kit (HND-TIP-START-KIT) • End-effector coupling kit (GRP-CPL-062) • 10-meter Robotiq device cable • RS485 to USB adapter • Screw kit • USB stick to install the UR software package	HND-UR-KIT
Kit for *Universal Robots* (*e-Series*)	• Basic gripper unit (HND-GRP-001) • Fingertip starting kit (HND-TIP-START-KIT) • End-effector coupling kit (GRP-ES-CPL-062) • Screw kit • USB stick to install the UR software package	HND-ES-UR-KIT
Controller	Optional controller for industrial communications. See Robotiq Universal Controller manual for more information.	UNI-CTR-XXXX
Hand-E flat rubber (NBR) overmolded finger kit	• 2 x flat rubber (NBR) overmolded fingertips • 1 x screw kit	HND-FIN-MLD-KIT
Aluminum Finger Kit	Aluminum finger kit includes: • 2 x aluminum fingers • 1 x screw kit	HND-FIN-ALU-KIT
Fingertip Starting Kit	Fingertip Starting Kit includes: • 1 x Fingertip Holder Kit • 1 x V-Groove Fingertip Kit	HND-TIP-START-KIT

Item	Description	Ordering Number
	1 x Aluminum Fingertip Kit 1 x hex key 6 x dowel pins M2 X 6 8 x M3-0.5 X 8 screws	
Flat Silicone Fingertip Kit	2 x flat rubber fingertips 1 x screw kit **Tip** Silicone fingertips must be mounted on fingertip holders (HND-TIP-HLD-KIT).	HND-TIP-SLC-KIT
V-Groove Fingertip Kit	2 x V-groove aluminum fingertips 1 x screw kit **Tip** V-groove fingertips must be mounted on fingertip holders (HND-TIP-HLD-KIT).	HND-TIP-VGR-KIT
Hand-E Fingertip Holder Kit	2 x fingertips holder 1 x screw kit	HND-TIP-HLD-KIT
10m Device Cable	10 m Robotiq device cable for power and communication. Straight M12 5-pins female on one side, single ended on the other, shielded	CBL-COM-2065-10-HF
USB to RS485 adapter	USB to RS485 adapter, can be used with device cable for USB connection	ACC-ADT-USB-RS485
Hand-E Screw Kit	The screw kit contains: 4 x M5 screws 4 x toothlock washers	HND-SCREW-KIT
16G USB Stick	USB stick to install the UR software package	ACC-USB-16G
End-Effector Coupling Kit	ISO 9409-1-50-4-M6 coupling for Adaptive Robot Grippers, with screws and tools for Gripper fixation and 1 m pigtail cable	GRP-CPL-062
Adapter plate to 63-4M6-61_4-2D6	Wrist adapter plate for use with AGC-CPL-064-002. Interface to 63 mm PCD[1] with (4) M6 screws and 61.4 mm	AGC-APL-152-002

Item	Description	Ordering Number
	PCD 1 with (2) M6 dowel pins	
Adapter plate to 80-6M8-2D82D8	Wrist adapter plate for use with AGC-CPL-064-002. Interface to 80 mm PCD[1] with (6) M8 screws and (2) M8 dowel pins.	AGC-APL-153-002

[1]Pitch Circle Diameter

To install Hand-E on a robot that has a different bolt pattern than part GRP-CPL-062 (ISO 9409-1-50-4-M6), you can use one of the following. The couplings listed below fit with both Hand-E and the 2-Finger Gripper.

Item	Description	Ordering Number
Blank coupling	Blank coupling for Adaptive Robot Grippers, with screws for Gripper fixation and 1 m pigtail cable	AGC-CPL-BLANK-002
ISO 9409-1-50-4-M6 (cable-to-controller)	ISO 9409-1-50-4-M6 coupling for Robot Grippers with screws for Gripper fixation and 1 m pigtail cable	GRP-CPL-062
ISO 9409-1-50-4-M6 (cable-to-wrist)	ISO 9409-1-50-4-M6 coupling for Robot Grippers with screws for Gripper fixation	GRP-ES-CPL-062
ISO 9409-1-31.5-4-M5 coupling	ISO 9409-1-31.5-4-M5 coupling for Adaptive Robot Grippers, with screws for Gripper fixation and 1 m pigtail cable	GRP-CPL-063
ISO 9409-1-40-4-M6 coupling	ISO 9409-1-40-4-M6 coupling for Adaptive Robot Grippers, with screws for Gripper fixation and 1 m pigtail cable	GRP-CPL-064
56-8M4-1D4 coupling	Coupling for 56 mm PCD[1] with (8) M4 and (1) 4mm dowel pin, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-065-002
56-6M4-1D6 coupling	Coupling for 56 mm PCD[1] with (6) M4 and (1) 6mm dowel pin, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-066-002
60-4Ø5-1D5 coupling	Coupling for 60 mmPCD[1] with (4) M5 thread and (1) 5mm dowel pin, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-067-002
63-6M6-2D6 coupling	Coupling for 63 mm PCD[1] with (6) M6 and (2) 6mm dowel pins, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-068-002

Item	Description	Ordering Number
40-4M5-1D3 coupling	Coupling for 40 mm PCD[1] with (4) M5 and (1) 3mm dowel pins, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-070-002
31.5-4M4 coupling	Coupling for 31.5 mm PCD[1] with (4) M4, with screws for Adaptive Robot Grippers fixation and 1 m pigtail cable	AGC-CPL-071-002
Adapter plate to 63-4M6-71-2D3	Wrist adapter plate for use with AGC-CPL-064-002. Interface to 63 mm PCD[1] with (4) M6 screws and 71 mm PCD[1] with (2) M3 dowel pins	AGC-APL-151-002
Adapter plate to 63-4M6-61_4-2D6	Wrist adapter plate for use with AGC-CPL-064-002. Interface to 63 mm PCD[1] with (4) M6 screws and 61.4 mm PCD 1 with (2) M6 dowel pins	AGC-APL-152-002
Adapter plate to 80-6M8-2D82D8	Wrist adapter plate for use with AGC-CPL-064-002. Interface to 80 mm PCD[1] with (6) M8 screws and (2) M8 indexing pins	AGC-APL-153-002

[1]Pitch Circle Diameter

8. Troubleshooting

8.1. Using the LED of the Hand-E gripper

When using Hand-E with a USB to RS485 serial converter, the color of the LED on your Hand-E can provide information on the issue you are facing.

LED status	Description	Solutions
Off	Gripper is not powered.	Check Gripper power supply and electrical setup. See **Electrical Setup** section.
Solid blue and red	Gripper is in fault.	1. Disconnect the communication and power cycle the Gripper. The led should turn solid red when powered. 2. While powered with red LED, connect the communication, LED should turn solid blue when connection is established.
Blinking blue and red	Gripper is in fault.	1. Gripper may be in auto-release, wait for auto-release to be completed, then turn off auto-release and initialize the Gripper. 2. Gripper may have a major fault, check the error from fault status and contact support.
Solid blue	No fault, and communicating.	1. If you can control the Gripper from the Teach Pendant , check your program structure. 2. If you can not control the Gripper from the Teach Pendant, contact support.
Solid red	No fault, but Gripper is not communicating.	Check the LED of the USB to RS485 converter. See table below for details.

Table 8-1: Troubleshooting Solutions Depending on Gripper LED Status

130

8.2. Using the LED of the USB to RS485 converter

When your Hand-E gripper LED is solid red, and you are using a USB to RS485 converter, refer to current subsection to troubleshoot. Check the LED on your converter, and read the table below for details.

LED status	Description	Solutions
Off	No USB communication.	1. Check USB connection. 2. Re-install drivers. 3. Contact support.
Solid red	Data sent from USB to RS-485 serial port.	Communicating. No problem.
Solid green	Data sent from RS-485 serial port to USB.	Communicating. No problem.
Slowly blinking, red	-	1. Check the DB-9 connector. 2. Check the cable. 3. Check the communication parameters from the Robotiq User Interface, and see recovery procedure. 4. Contact support.
Quickly blinking, red and green	-	1. Check fault status, maximum operating temperature could be exceeded. 2. Contact support.

Table 8-2: Troubleshooting Solutions Depending on USB to RS-485 Converter LED Status

8.3. Using the Robotiq User Interface (RUI)

Use the Robotiq User Interface to check that your gripper functions properly:

1. Install the Robotiq User Interface on a computer.
2. Connect your Gripper to a computer USB port.
3. Send instructions to your gripper via the Robotiq User Interface. If this fails, check that all cables are connected to your gripper and to your computer.
4. Contact support@robotiq.com.

> **Info**
>
> For details on the Robotiq User Interface, see its Instruction Manual, available on robotiq.com/support.

8.4. Troubleshooting Universal Robots Models

8.4.1. From the Universal Robots Teach Pendant

To install a URCap, see the **Installing URCap Package** section. In case the URCap is already installed, but Hand-E cannot be controlled with the Teach Pendant, follow these instructions:

1. Hand-E LED is not blue: see table **Troubleshooting Solutions Depending on Gripper LED Status** section
2. Hand-E LED is blue: the latest version of the URCap is installed. Contact support@robotiq.com.

8.4.2. For CB-Series: Troubleshooting the I/O Coupling

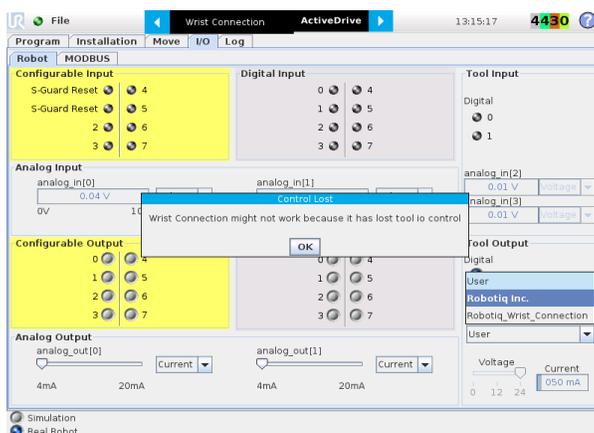To take the control back of the I/O Coupling, follow the steps:

1 Remove the USB cable;

Fig. 8-1: Control Lost message when removing the USB cable.
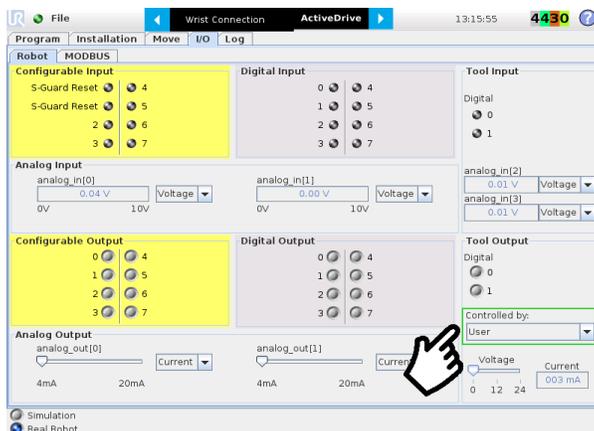
2 Select **User** in the *Controlled by* drop down menu

Fig. 8-2: Tool output must be controlled by the user.

3 Use the 24V slider in the I/O tab under the *Tool Output* section to slide it to 0 and then back to 24V. It should enable the communication with the robot.
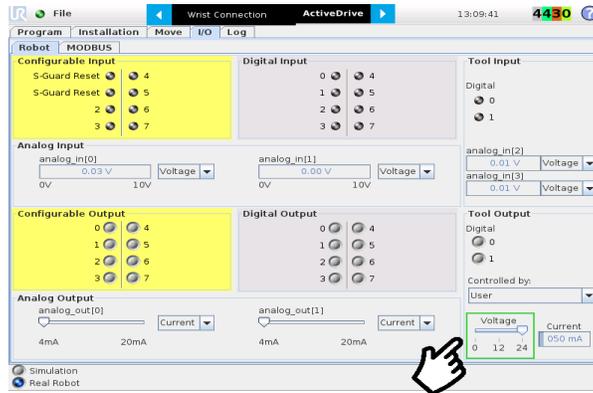

Fig. 8-3: Voltage set to 24V.

9. Warranty and Patent

Robotiq warrants Hand-E against defects in material and workmanship for a period of one year from the date of reception when utilized as intended. Robotiq also warrants that this equipment will meet applicable specifications under normal use.

The warranty applies under the following conditions:

- Usage respects the operating and storage conditions specified in the **Environmental and Operating Conditions** section
- Proper installation of the Gripper specified in the **Installation** section and following subsections.
- Until a 2 000 000 cycle count[1] has been reached.
- Usage respects maintenance specified in the **Maintenance** section.
- Usage respects recommended payload and forces specified in the **Mechanical Specifications** section.

---

[1]*Cycle count: One (1) cycle is defined as an object picking attempt, successful or not(open or closing onto an object, or closing on itself). It is calculated in the internal memory of the Hand-E gripper and can been seen on the teach pendant when using with Universal Robots or with the Robotiq User Interface.*

During the warranty period, Robotiq will repair or replace any defective <MadCap:variable name="Robotiq Products.Hand-E" />, as well as verify and adjust the Gripper free of charge if the equipment should need to be repaired or if the original adjustment is erroneous. If the equipment is sent back for verification during the warranty period and found to meet all published specifications, Robotiq will charge standard verification fees.

The unit is considered defective when at least one of the following conditions occurs:

- The Gripper fingers cannot close or open;
- The Gripper feedback necessary for the robot program is not accessible.

Parts that come into contact with the work piece and wearing parts such as the finger and fingertips are not covered by the warranty.

> **Caution**
>
> The warranty will become null and void if:
>
> - The unit has been tampered with, repaired or worked on by unauthorized individuals.
> - The warranty sticker has been removed.
> - The screws, other than as explained in this guide, have been removed.
> - The unit has been opened other than as explained in this guide.
> - Unit serial number has been altered, erased, or removed.
> - Unit has been misused, neglected, or damaged by accident.

This warranty is in lieu of all other warranties expressed, implied, or statutory, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. In no event shall Robotiq be liable for special, incidental, or consequential damages.

Robotiq shall not be liable for damages resulting from the use of the Hand-E, nor shall Robotiq be responsible for any failure in the performance of other items to which Hand-E is connected or the operation of any system of which the Gripper may be a part.

9.1. I/O Coupling Warranty

Robotiq warrants the I/O Coupling against defects in material and workmanship for a period of one year from the date of reception when utilized as intended. Robotiq also warrants that this equipment will meet applicable specifications under normal use.

10. Harmonized Standards, Declarations and Certificates

10.1. Translation of original EC declaration of incorporation

ROBOTIQ

Translation of Original Declaration of Incorporation

In terms of the Directive 2006/42/EC, Annex II, part B of the European Parliament and of the Council on machinery, we, the manufacturer,

Robotiq Inc.
966, Chemin Olivier, suite 500
Lévis, Québec, Canada, G7A 2N1

hereby declares that the following product:

Robotiq Hand-E Gripper

meets the applicable requirements of the **Machinery Directive 2006/42/EC** of the European Parliament and of the Council. The incomplete machine may not be operated until the machine in which it is integrated has been declared compliant with the relevant provisions of the 2006/42/CE Machinery Directive.

The manufacturer agrees to forward upon request of national competent authorities the relevant technical documents specified by Annex VII, part B, within the required time.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2011/65/EU Restriction of the use of certain hazardous substances (RoHS)

Person responsible for documentation: Annick Mottard, Jr. Eng., address: see manufacturer address

Lévis, May 2018

Jean-Philippe Jobin
Vice President Research and Development
Robotiq Inc.

The following standards have been applied:

NF EN ISO 12100	2010	Safety of machinery — General principles for design — Risk assessment and risk reduction
CEI 60204-1 Ed6.0	2016	Safety of machinery — Electrical equipment of machines — Part 1: General requirements
NF EN ISO 14539	2000	Manipulating industrial robots — Object handling with grasp-type grippers — Vocabulary and presentation of characteristics
NF EN ISO 9409-1 2004	2004	Manipulating industrial robots — Mechanical interfaces — Part 1: Plates

10.2. Applied standards

This section describes all applied harmonized standards for the design and production of the Robotiq Hand-E gripper. Standards are applied were applicable, some points may not be applied if not applicable to this specific product. Conformity is not enforced by any laws, it is self-applied and the aim is to define normal safety and performance requirements for similar products.

> **Caution**
>
> Conformity of the product is only met if all instructions of this manual are followed. Among others: installation, safety measures and normal usage must be met.

The following standards have been applied:

NF EN ISO 12100	2010	Safety of machinery — General principles for design — Risk assessment and risk reduction
CEI 60204-1 Ed6.0	2016	Safety of machinery — Electrical equipment of machines — Part 1: General requirements
NF EN ISO 14539	2000	Manipulating industrial robots — Object handling with grasp-type grippers — Vocabulary and presentation of characteristics
NF EN ISO 9409-1 2004	2004	Manipulating industrial robots — Mechanical interfaces — Part 1: Plates

10.3. Ingress Protection Certificate

NTS

October 12th 2018

Purpose: Ingress Protection (IP67) – Hand-E Test Certificate

To whom it may concern,

This certificate is to attest that Ingress Protection (IP) tests were carried out by NTS Canada in the months of June and July 2018 on Hand-E units manufactured by Robotiq. No ingress of dust or water was observed inside the units after the tests. No insertion of the rod or induced damage was observed. No functional anomaly was noticed or reported by the Robotiq engineering representative on-site during the tests. This test certificate does not supersedes the test report FTR0201898 Rev 00 issued by NTS Canada.

The acceptance status for the units tested is "PASS" for the following tests;

- Ingress protection against access to hazardous parts – Rod (code IP6X)
- Ingress protection against solid foreign objects - Dust (code IP6X)
- Ingress protection against immersion in water (code IPX7)

Sincerely yours,

Jean-Pierre Rioux

Digitally signed by Jean-Pierre Rioux
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