ROBOTIQ

2F-85

2F-140

Robotiq 2F-85 & 2F-140
for Universal Robots

Instruction Manual

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Table of Contents

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 support.robotiq.com.

Revision 2024/02/22

Addition of the key scripts for Gripper use with a tool changer.

Revision 2021/05/19

- Updated figure (section 3.4.1.1)

- Updated Warranty and Patent (section 9)

- Updated Spare Parts, Kits and Accessories (section 7)

- Updated figures (section 5.1.1)

- Updated Center of mass and TCP table (section 5.2.3)

- Updated Preset multiple registers (section 4.7.3)

Revision 2020/02/11

- Major Revision:
  - Fused sections that were exclusive to e-Series or to CB-Series , to be displayed in a single Instruction Manual
  - Multiple modifications to standardize with our other manuals

Revision 2019/10/10

- Update of the I/O Coupling sections
- Addition of the Electrostatic Discharge Safety section

Revision 2019/07/25

Addition of the I/O Coupling section.

Revision 2019/06/21

Updated Section 4.8 to add Gripper Configuration section.

Revision 2019/05/17

Environmental and Operating Conditions updated.

Revision 2019/03/13

Updated mechanical specifications (section 6.2)

Revision 2018/11/07

New major revision of the Gripper hardware

- All external visual supports changed to reflect the hardware changes

- Updated Section 1

- Updated Section 3

- Updated Section 4

- Updated Section 6

- Updated Section 7

- Updated Section 8

- Updated Section 9

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 2018/05/23

- Major update following the release of UCG-1.2.0
  - New subsections in Section 4: Control
    - Gripper Dashboard

    - Gripper Calibration menu and Calibration wizard for object validation

Revision 2017/06/06

Added section:

- 4.8.2.1 Multiple Grippers

Revised sections:

- 3.8.1 Installation procedure for URCaps

- 4.8.1 Gripper Toolbar

Revision 2016/07/04

Major revision : Updated for URcaps release Section added :

- 3.8 URCaps Package

- 3.9 UR Package without URCaps

- 4.8 Control over Universal Robots with URCaps

- 4.9 Control over Universal Robots without URCaps

Revision 2015/09/15

Major revision : Updated for 2-Finger 140

Revision 2015/07/21

Section added :

- 4.5 Picking features : Force control, re-grasp and object detection.

- A. Harmonized standards, declarations and certificates

Minor modifications :

- Section 1. General Presentation

- Section 3.7 Universal Robots package

Revision 2014/11/05

Modification for Robotiq 2-Finger 85 Adaptive Robot Gripper version 3

Revision 2014/07/22

Modification for use on Robotiq Universal Controller

Minor modifications : User Interface section, maintenance section

Revision 2013/02/06

Section added : Couplings ISO models and Baxter robots Minor modifications

Revision 2013/02/06

Section added : Communication with UR robots Minor modifications

Revision 2012/10/18

Official release

Revision 2012/03/02

Beta release

Copyright

1. General Presentation

The terms "Gripper", "Adaptive Gripper", "Robotiq Gripper", "Robotiq Adaptive Gripper", "2-Finger 85", "2-Finger 140", "2F-85" and "2F-140" used in the following manual all refer to the Robotiq 2-Finger Adaptive Robot Gripper. The Robotiq 2-Finger Adaptive Gripper has two versions, 85 and 140. The 2-Finger version will change finger opening dimensions, which will be 85 mm (2F-85) or 140 mm (2F-140). Both versions use the same base, installation and control will be exactly the same. The 2-Finger Gripper is a robotic peripheral that is designed for industrial applications. Its design makes it a unique robotic end-of-arm tool to quickly pick, place, and handle a large range of objects of varying sizes and shapes.

> **Info**
>
> Unless specified, information in this manual applies to both the 85 and the 140 mm version of the 2-Finger Adaptive Gripper.

> **Info**
>
> The following manual uses the metric system, unless specified, **all dimensions are in millimeters**.

> **Info**
>
> 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 2-Finger Gripper has two articulated fingers that each have two joints (two phalanxes per finger), as shown in the figure below. The grasp-type gripper can engage up to five points of contact with an object (two on each of the phalanges plus the palm). The fingers are under-actuated, meaning they have fewer motors than the total number of joints. This configuration allows the fingers to automatically adapt to the shape of the object they grasp which simplifies the control of the gripper.

Palm pad · Fingertip · Finger · Distal phalanx · Proximal phalanx · Bar · Status LED
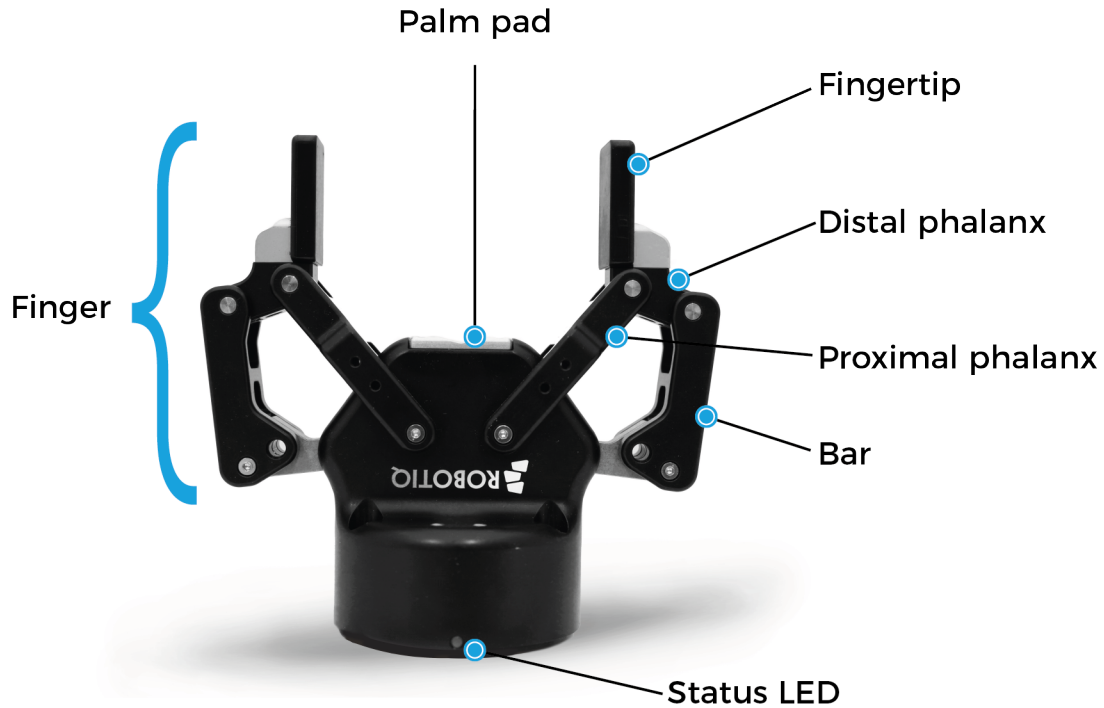
Fig. 1-1: Robotiq 2-Finger Adaptive Gripper.

Please refer to the **Spare Parts, Kits and Accessories** section for details on standard and optional parts.

The status LED presented in the figure above will be :

- solid blue/red when booting

- solid blue when powered with no errors (while communication is active)

- solid red if minor fault occurs, see status details in the **Control** section.

- blinking red/blue if major fault occurs, see status details in the **Control** section.

1.2. 2F-85 vs. 2F-140

The 2-Finger Gripper has two configurations either 85 mm opening (2-Finger 85) or 140 mm opening (2-Finger 140). The chassis remains the same, only the fingers will change. Please refer to the **Mechanical Installation** section for installation instructions. Finger kits are available in the **Spare Parts, Kits and Accessories** section.

> **Info**
>
> Details on the 2-Finger 85 and 2-Finger 140 (dimensions and specifications) can be found in the **Specifications** section.

2F-85

2F-140

140 mm

85 mm
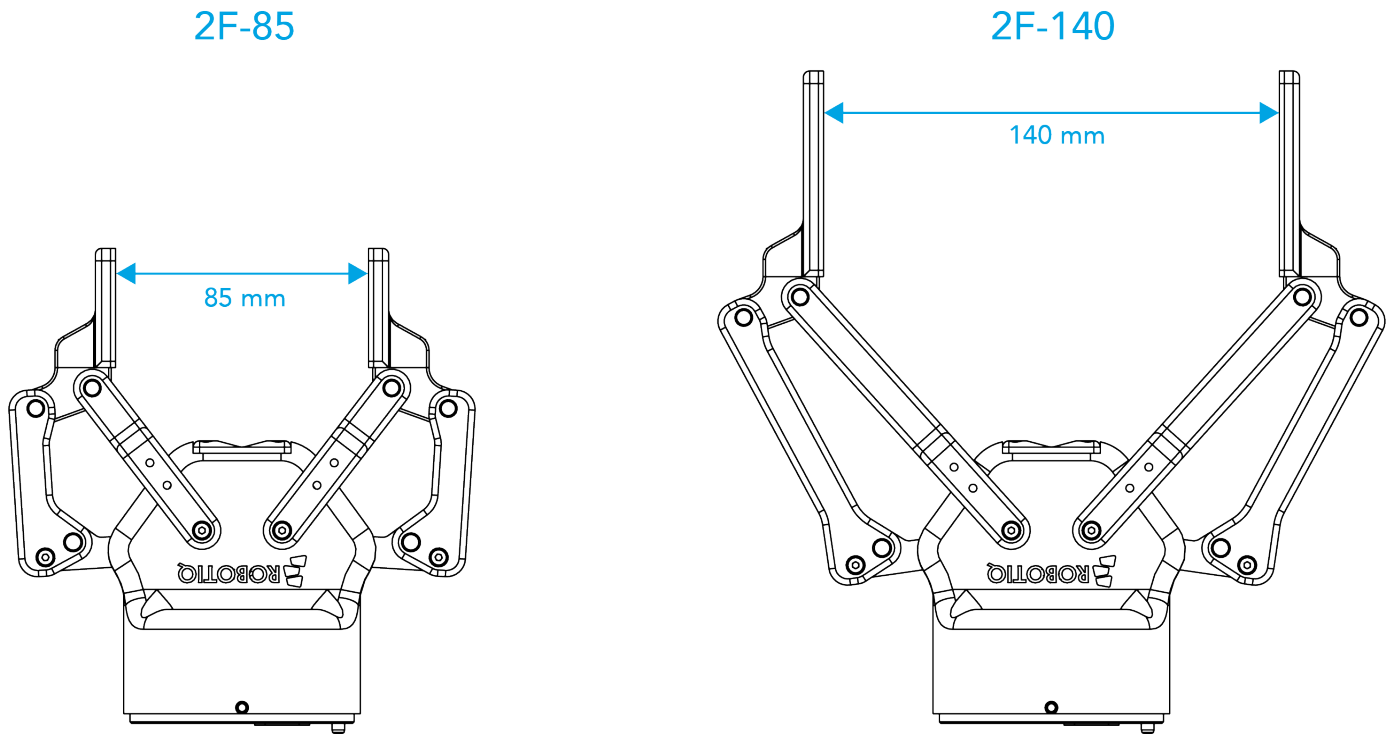
Fig. 1-2: The 2-Finger 85 and 140 mm versions.

1.3. Object picking

The 2-Finger Gripper has a single actuator for opening and closing the fingers. The fingers automatically adapt to the shape of the object manipulated.

Fingers will adopt either a parallel grasp or encompassing grasp as shown in the figure below.

> **Info**
>
> Closing or opening is done via the "Go to requested position" command sent to the gripper. **Whether the fingers close to produce an encompassing or parallel grasp is determined mechanically by:**
>
> - The objects's geometry;
>
> - The relative position of the object with respect to the gripper.
>
> In other words, picking the same object could result in either an encompassing or fingertip grasp based on an object's position and geometry.
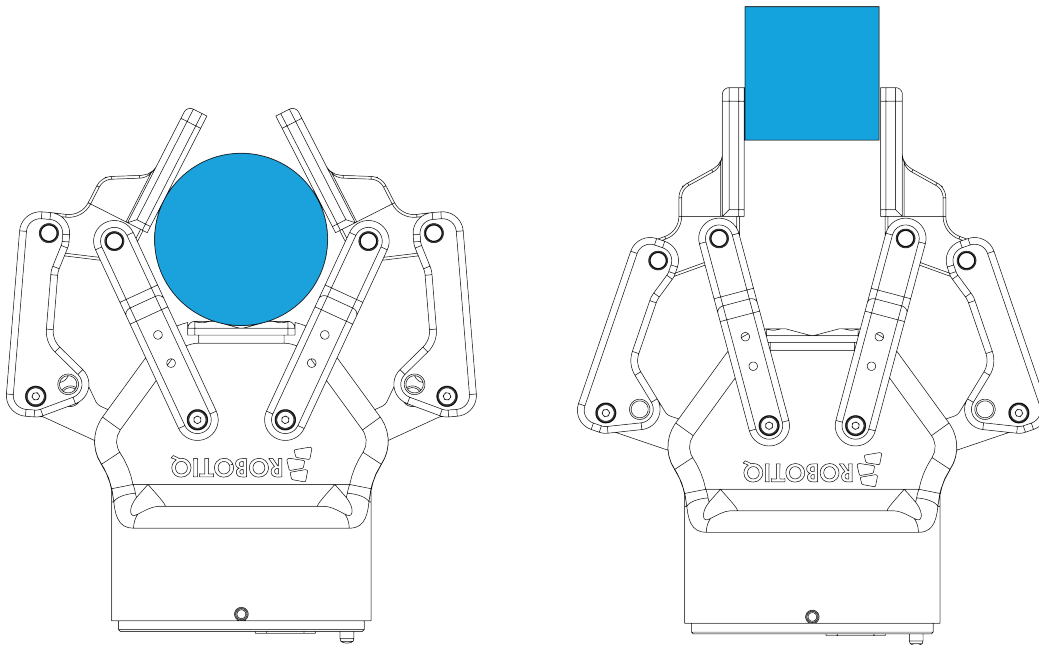
Fig. 1-3: 2-Finger parallel and encompassing grips.

> **Info**
>
> It is important to note that a fingertip grasp can only be performed when the fingers touch the object with the upper section of the distal phalanxes first. Inversely, for an encompassing grip, the fingers must touch the object with the proximal or the lower section of the distal phalanxes first. Also, to ensure stability, the object should be held against the gripper palm while performing an encompassing grip. Refer to Fig. 1-5 for a visual representation of the parallel and encompassing grasp regions on the distal phalanx of the 2-Finger Gripper.

The 2-Finger Adaptive Gripper also allows for internal grasping. The fingers can pick hollow objects from the inside by applying pressure with the outside of the fingers. Refer to the figure below for a visual representation and to the **Picking Features** section for details on the possible position commands of your gripper.

External grasp   **Internal grasp**
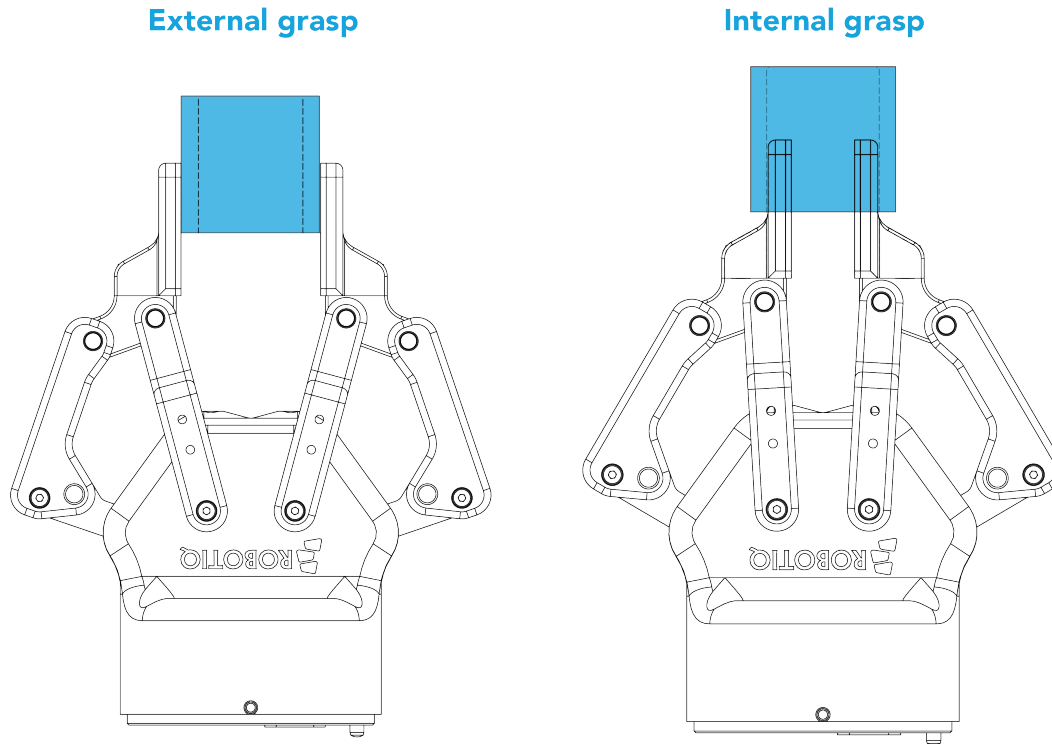
Fig. 1-4: Finger internal and external grasping.

The gripper equilibrium line is the grasping region that separates the encompassing grasp from the parallel grasp. When grasping an object close enough to the inside (palm) of the gripper, the encompassing grasp will occur (unless the object size or shape is not adequate) and the fingers will close around the object.

If grasped above the equilibrium line, the same object will be picked up in a parallel grasp by the fingertips and the fingers will close with a parallel motion. The figure below shows the **encompassing grasp region**, the **equilibrium line**, and the **parallel grasp region** on the 2-Finger Adaptive Gripper.

> **Info**
>
> The details of the equilibrium line relation between opening angle and the related position d can be found in the **Mechanical specifications** section.
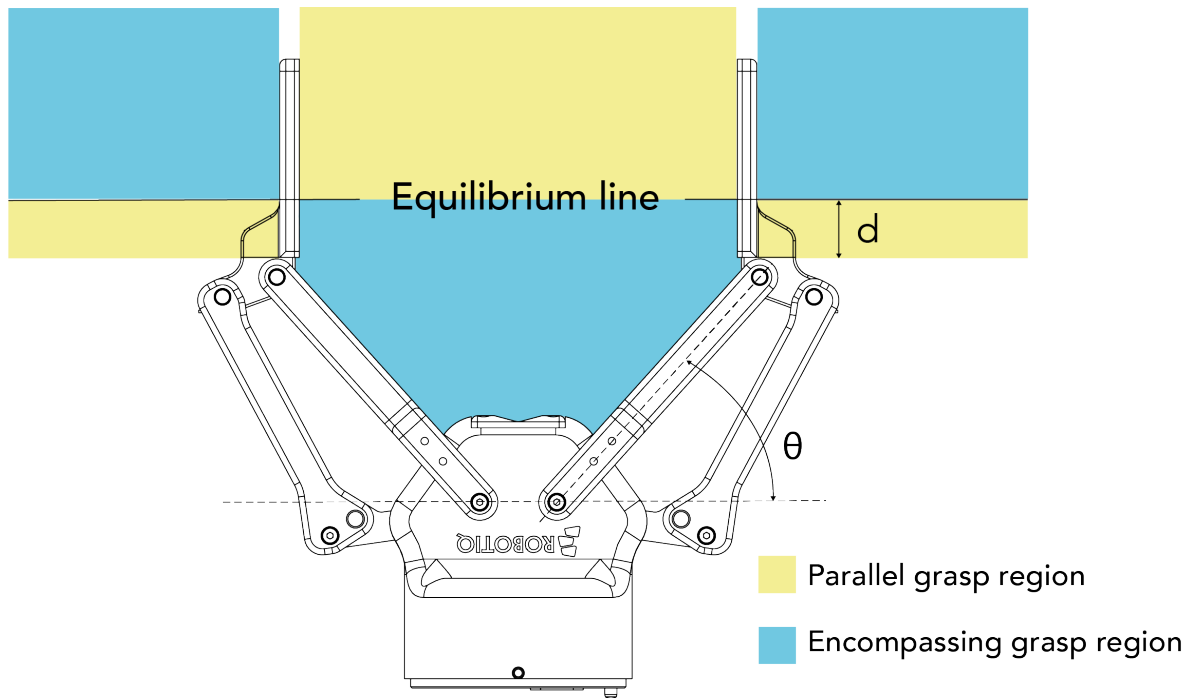

Fig. 1-5: Equilibrium line on the 2-Finger.

> **Tip**
>
> Grasping an object that could be grasped by an encompassing grasp (a cylinder for example) on the equilibrium line is not recommended, as slight variations on the position will switch the grasp from parallel to encompassing and vice versa. Robot programming should be done so that the grasping mode will be predetermined.

1.4. 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. Refer to the **Electrical Setup** section for wiring information and the **Control** section for control of the gripper (various software packages are available for control via various robot controllers).

A gripper coupling is required for using 2-Finger, the coupling will provide mechanical and electrical connectivity. Please refer to the **Mechanical Installation** section for installation of the coupling, to the **Specifications** section for technical drawings, and to the **Spare Parts, Kits and Accessories** section for available couplings.

The 2-Finger has an embedded object detection feature using indirect sensing methods. When picking an object via 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, see **Control** section.

2. Safety

Warning

The operator must have read and understood all of the instructions in the following manual before handling the Robotiq 2-Finger Adaptive Robot Gripper.

Caution

The term "operator" refers to anyone responsible for any of the following operations on the 2-Finger Adaptive Robot Gripper:

- Installation
- Control
- Maintenance
- Inspection
- Calibration
- Programming
- Decommissioning

This documentation explains the various components of the 2-Finger and general operations regarding the whole life-cycle 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

> **Caution**
>
> 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.

2.1.1. Risk assessment and final application:

The Robotiq 2-Finger Adaptive Gripper is meant to be used on an industrial robot. The robot, Gripper, and any other equipment used in the final application must be evaluated with a 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 grasping 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 2-Finger Adaptive Gripper.

- The **Scope of Delivery** section

- The **Required Tools and Equipment** section

- The **Environmental and Operating Conditions** section

- The **Mechanical Installation** section

- The **Electrical Setup** section

- The **Testing the Gripper with the Robotiq User Interface (RUI)** section

- The **Installation for Universal Robots** section

- The **URCap Package** section

> **Warning**
>
> Before installing:
>
> - Read and understand the safety instructions related to the 2-Finger Adaptive 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.

- Hardware required for options; accessories or fixtures for the gripper, unless specified.

- Power supply units, power supply wiring or fuses.

Info

When bought as a kit, the 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 2F-85 and 2F-140 grippers UR Standard Kit

Standard upon delivery for CB Series and e-Series

- Robotiq 2F basic gripper unit (**GRIPPER-2F85** / **GRIPPER-2F140**)

- Screw kit

- USB Stick

For CB-Series

- USB to RS485 signal converter (**AGC-ADT-USB-RS485**)

- Coupling for connection to the robot controller (**GRP-CPL-062**)

- Robotiq device cable (**CBL-COM-2065-10-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 for a list of available couplings

3.1.2. UR Wrist connection Kit for CB-Series

Robotiq 2F-85 Wrist Connect Kit for UR CB (AGC-UR-KIT-85-W)	Robotiq 2F-140 Wrist Connect Kit for UR CB (AGC-UR-KIT-140-W)

Included:
 	
• 1 x Robotiq 2-Finger Adaptive Gripper 85 (**GRIPPER-2F85**)
• 1 x I/O Coupling Kit (**IO-CPL-UR-CB-KIT**) including:
    • 1 x I/O Coupling (**IO-CPL-CB**)
    • 1 x Screw kit to install on the robot (**CPL-SCREW-KIT**)
    • 1 x Micro-USB to USB cable (**CBL-MICRO-USB-6FT**)
    • 1 x 16 Go USB Stick (**ACC-USB-16G**)
	Included:
	
	• 1 x Robotiq 2-Finger Adaptive Gripper140 (**GRIPPER-2F140**)
	• 1 x I/O Coupling Kit (**IO-CPL-UR-CB-KIT**) including:
	    • 1 x I/O Coupling (**IO-CPL-CB**)
	    • 1 x Screw kit to install on the robot (**CPL-SCREW-KIT**)
	    • 1 x Micro-USB to USB cable (**CBL-MICRO-USB-6FT**)
	    • 1 x 16 Go USB Stick (**ACC-USB-16G**)

3.2. Required Tools and Equipment

The following tools are required to install the 2-Finger Adaptive 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 mount the wrist connection protector (on e-Series only)

Optional tools if installing finger kits: **AGC-FIN-KIT-085** or **AGC-FIN-KIT-140**:

• 2 mm hex key

Optional tools if installing other fingertips: **AGC-TIP-MLD-KIT-85**, **AGC-TIP-MLD-140**, **AGC-TIP-204-085**, **AGC-TIP-205-085**, **AGC-TIP-420-140**, **AGC-TIP-421-140**

• 4 mm hex key

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: 2-Finger power supply requirements.

Info

[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/transit temperature	-30°C [-22°F]
Maximum storage/transit 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 40
Other	• Free from dust, soot or fluids • Free from corrosive liquids or gases • Free from explosive liquids or gases • Free from powerful electromagnetic inter-ference

Table 3-2: Environmental and operating conditions of the 2-Finger Adaptive Gripper

3.4. Mechanical Installation

3.4.1. Installing the Gripper on the robot

Single Gripper Installation
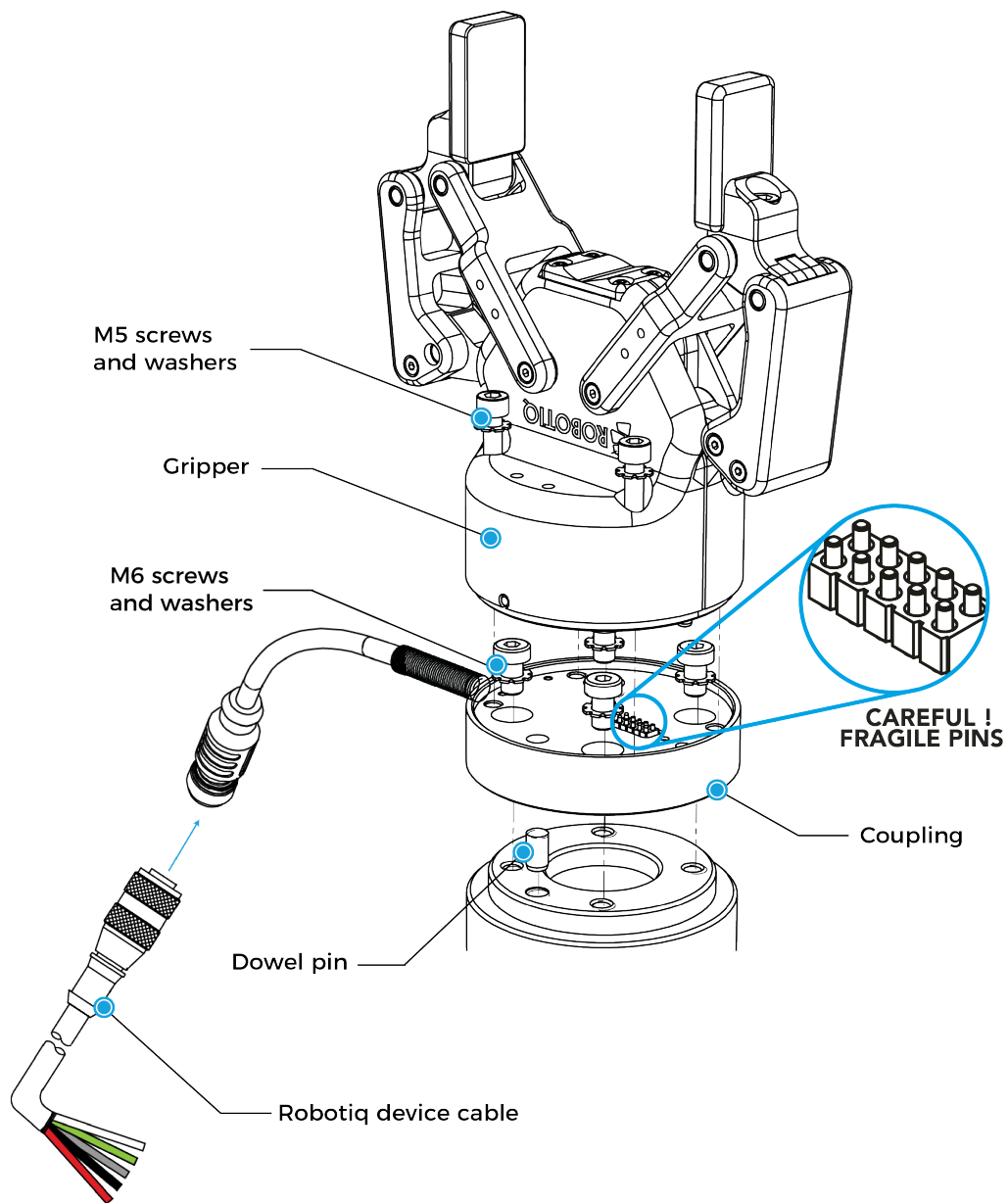
Instructions

You must use a coupling to attach the gripper on the robot. Here are the steps to follow to mount the gripper on the robot (exploded views in the figure below).

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

2. Secure the gripper to the coupling

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

> **Caution**
>
> When no tooth lock washer is present, lock screws in place using medium strength threadlocker. Tooth lock washers provide grounding for the casing of the gripper through the mounting screws. For more information, refer to the **Electrostatic Discharge Safety** section.

M5 screws
and washers

Gripper

M6 screws
and washers

CAREFUL !
FRAGILE PINS

Coupling

Dowel pin

Robotiq device cable

Fig. 3-1: Installing the gripper on the robot wrist for CB-Series

M5 screws and washers

Gripper

M6 screws and washers

Dowel pin

M4 screws

Connection protector

Coupling cable

CAREFUL !
FRAGILE PINS
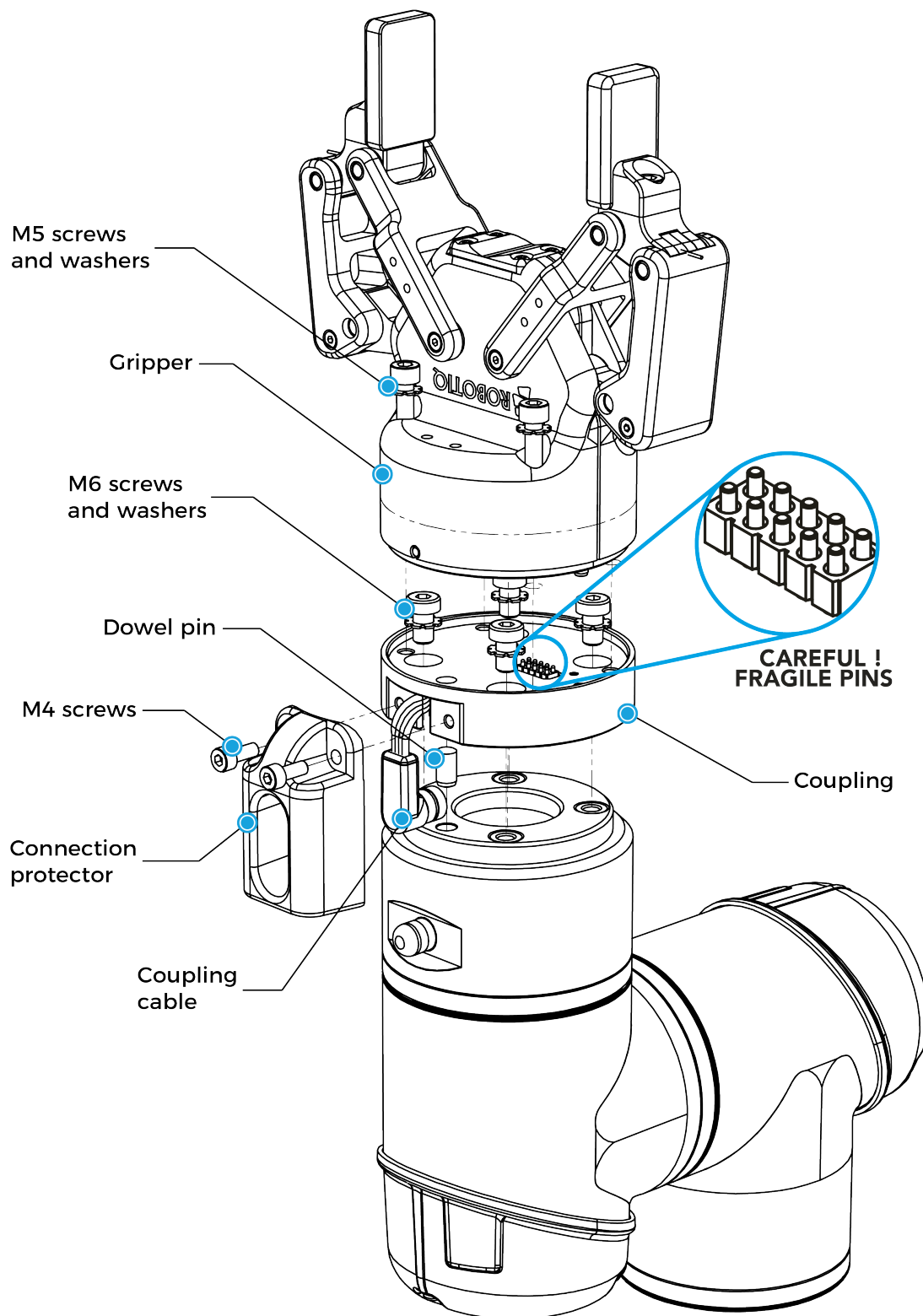
Coupling

*Fig. 3-2: Installing the gripper onto the robot wrist for e-Series*

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 2F-85 & 2F-140 Grippers to the Universal Robots CB-Series tool flange. It removes the need of any cable management and avoids downtime caused by cable issues. The robot sends I/O signals to the coupling which sends Modbus RTU commands to the gripper based on four possible presets. The presets are determined by the I/O signals.
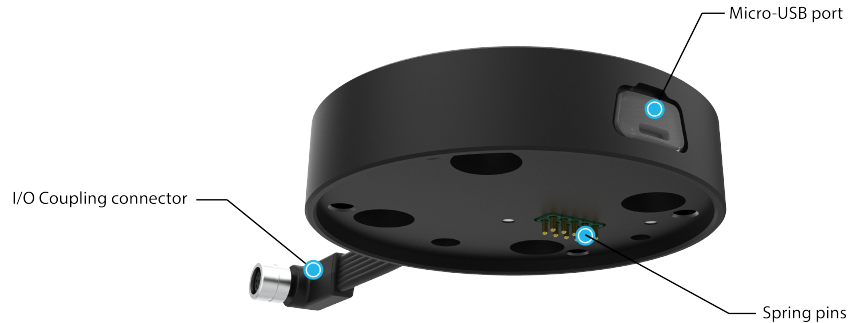
Fig. 3-3: Robotiq I/O Coupling

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. The position feedback, however, is not available due to the robot tool connector nature.

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

> **Info**
>
> To configure your own 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: Factory presets for 2F-85 & 2F-140 Grippers

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 tooth lock washers, and the 4mm hex key to secure the I/O Coupling.

Mounting the Gripper onto the I/O Coupling

1. Fasten the gripper onto the I/O Coupling using the M5 screws and tooth lock 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 2F-85 or 2F-140 Gripper with the I/O Coupling. Make sure you have the latest version installed.

1. Connect the 2F-85 or 2F-140 Gripper to your computer via the I/O Coupling using the USB cable. If the I/O coupling got wet, make sure the micro USB port is properly dryed before connecting 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 support.robotiq.com.
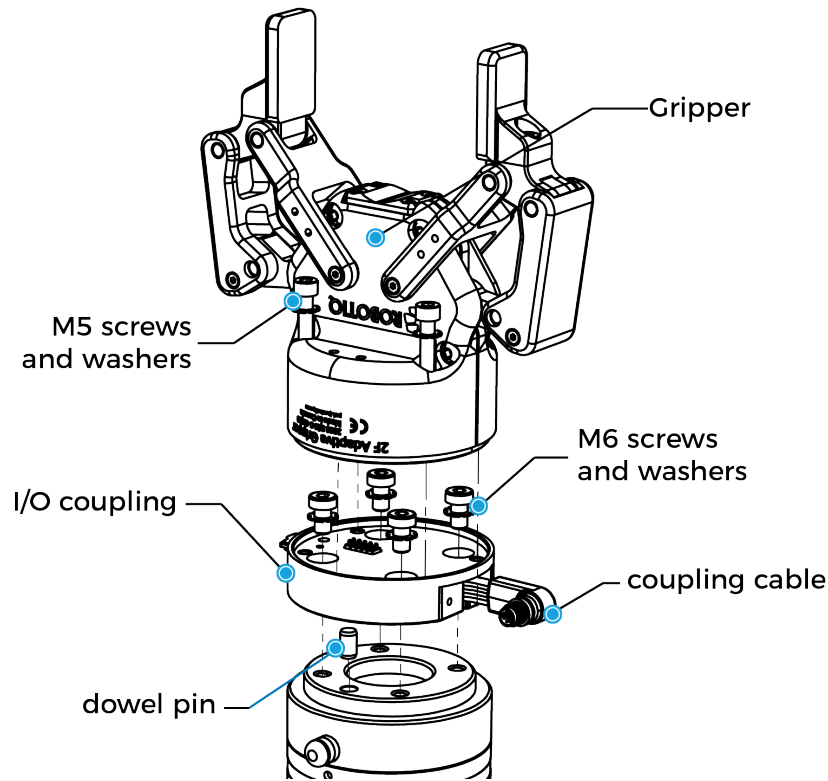

Fig. 3-4: Mechanical Installation of the I/O Coupling.

Multiple Grippers Installation

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

1. Install a mounting plate first on the robot arm (AGC-APL-159-02).

2. Mount the grippers' couplings on the mounting plate using the provided M6 X 12 mm screws and tooth lock washers.

3. Mount the grippers onto the coupling using the provided M5 X 25 mm screws and tooth lock washers.
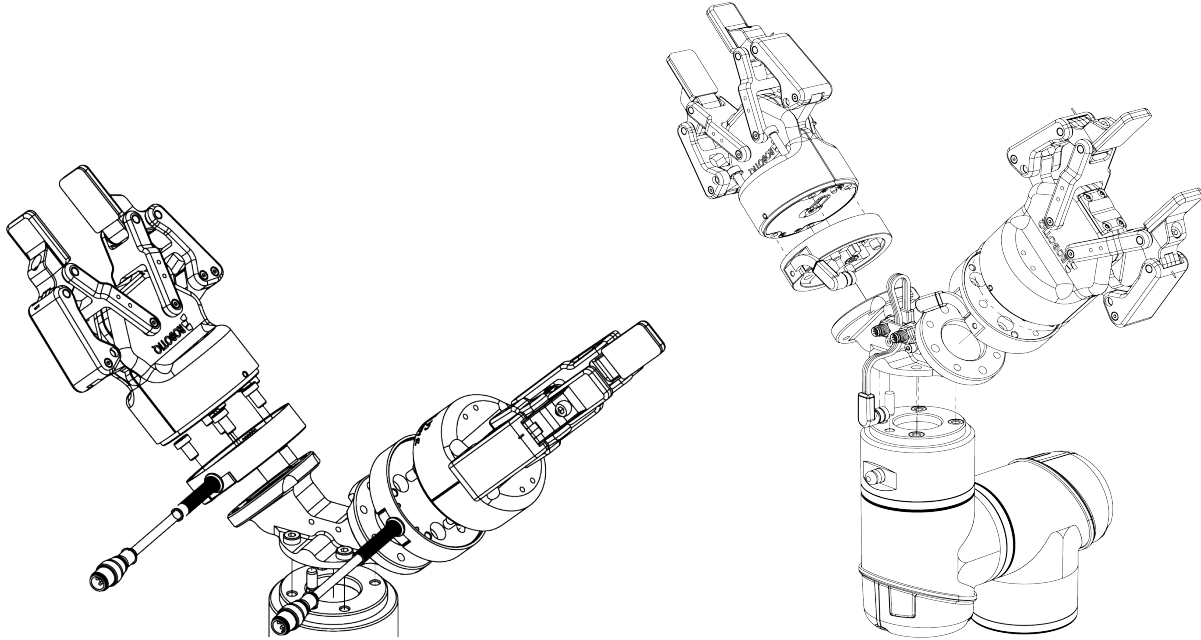
Fig. 3-5: Dual 2F Gripper Configuration (CB-Series and e-Series)

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.
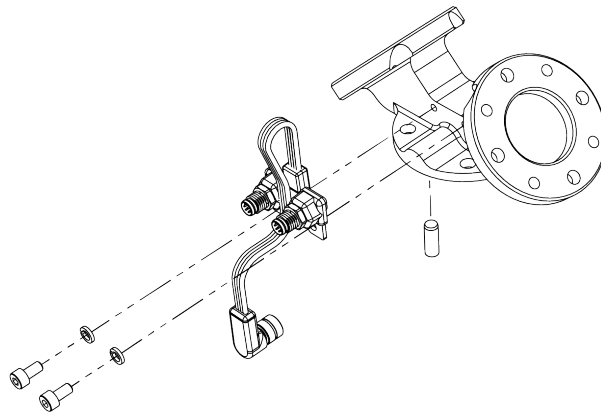

Fig. 3-6: Fastening the splitter to the dual gripper adapter plate

3.4.2. Installing Fingers on the Gripper

If you need to change the fingers, follows the instructions below.

1. Align finger with chassis axis. To do so, the holes on the bar and the proximal should be aligned correctly with the corresponding chassis axis.

2. Insert the bar axis in the bar hole and through the chassis axis (top hole is for parallel locking while bottom hole is for finger installation).

3. Insert the proximal axis in the holes located on the proximal and through the chassis axis.

4. Apply medium strength threadlocker on the provided screws and secure the finger to the chassis.

5. Repeat for the other finger.
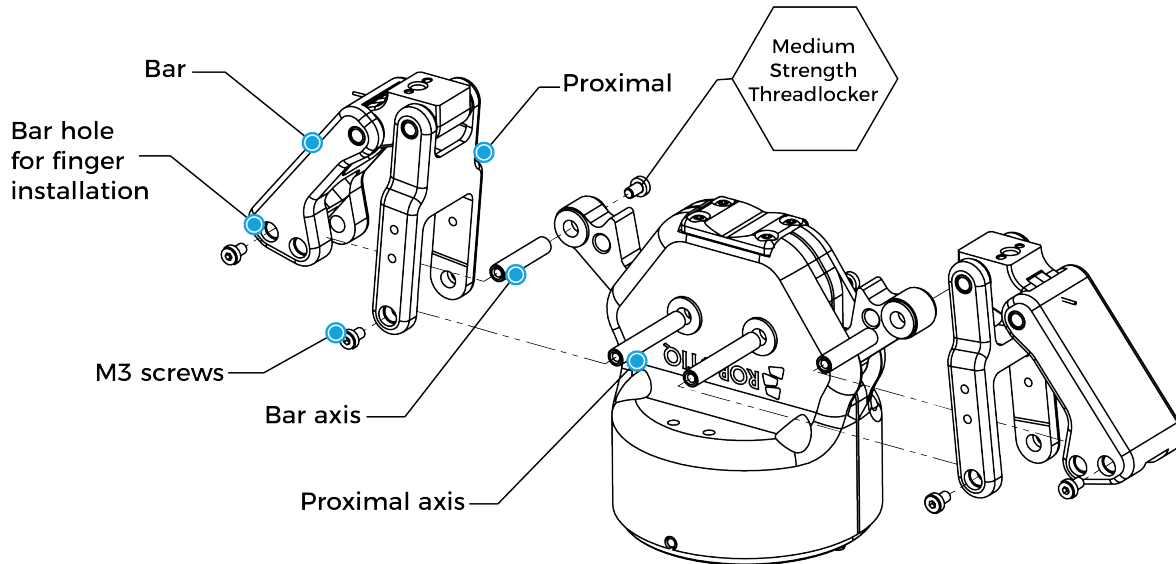
Fig. 3-7: Installing the Fingers on the Gripper.

3.4.3. Installing the fingertips on the Gripper

If you need to change the fingertips, follow the instructions below.

1. Align the fingertip dowel pins with the finger dowel holes.

2. Apply low strength threadlocker on the provided screws and secure the fingertips to the fingers.

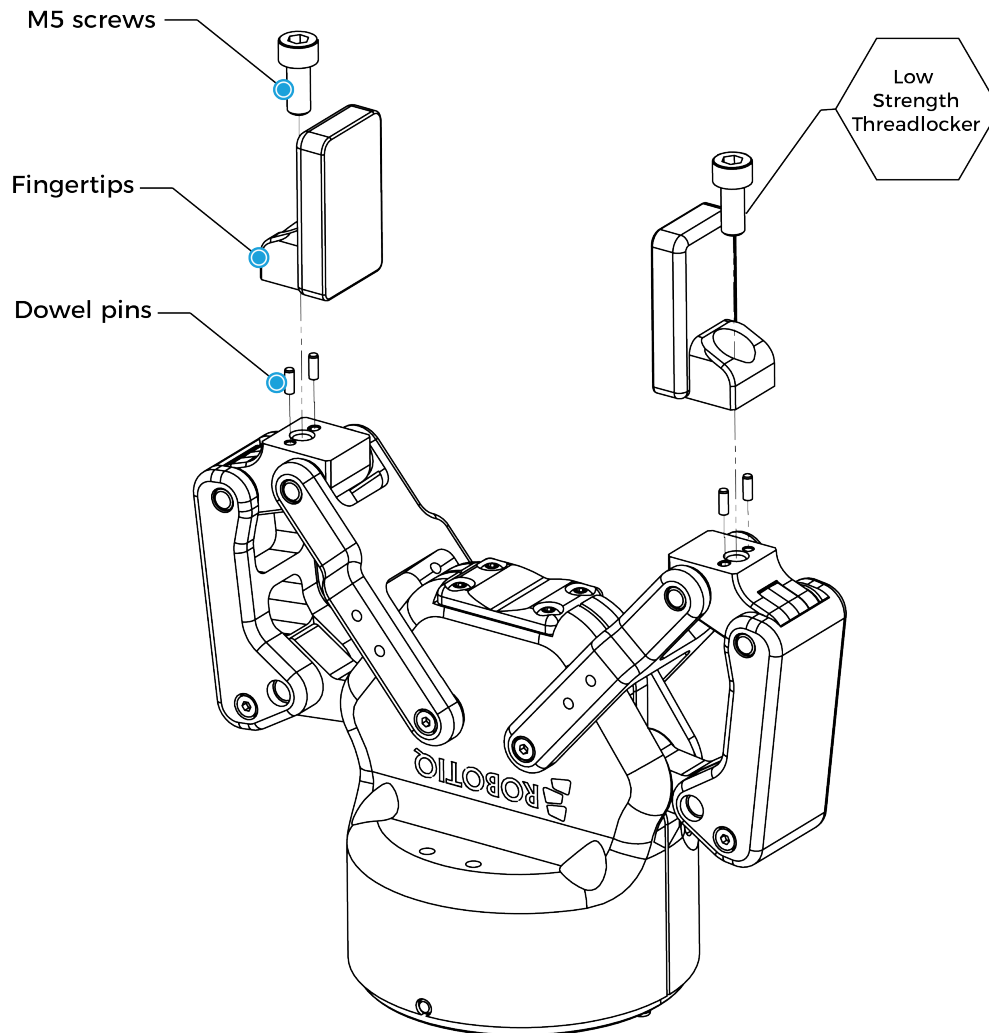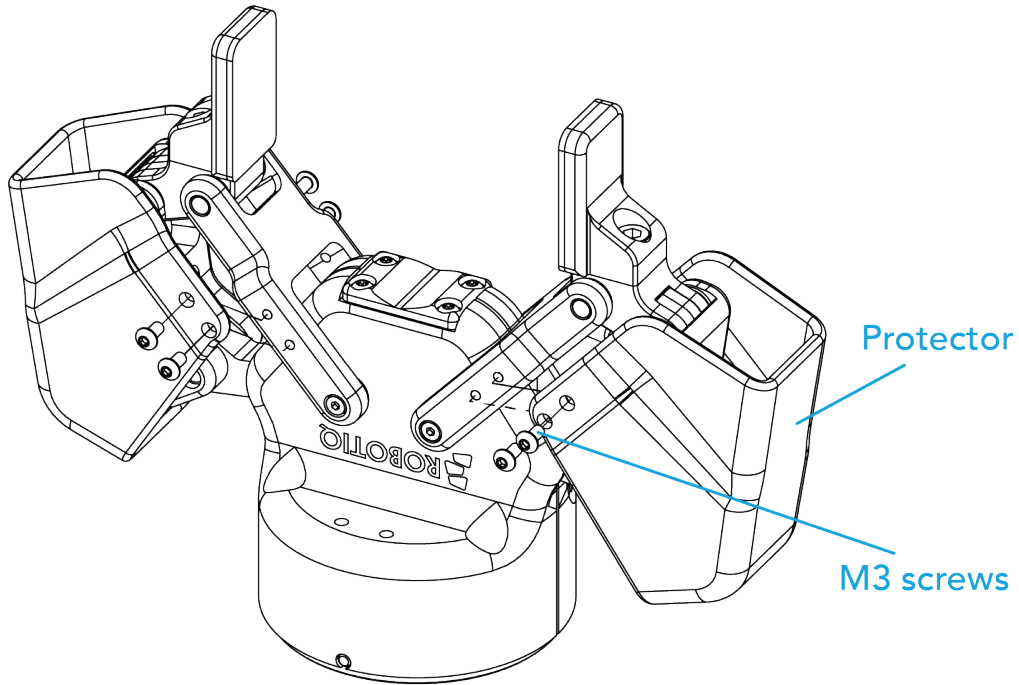*Fig. 3-8: Installing the Fingertips on the Gripper.*

3.4.4. Installing a Protector Kit on the Gripper Fingers

An optional protector kit (AGC-PRO-KIT-V4 / AGC-PRO-KIT-140) can be ordered to cover the fingers of the 2F-85/2F-140 and therefore protect users and assets against pinch points.

You can install them using eight (8) M3 screws.

Protector

M3 screws

Fig. 3-9: Protector Kit Installation

3.5. Electrical Setup

Power and communication are established with the 2-Finger Adaptive 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.
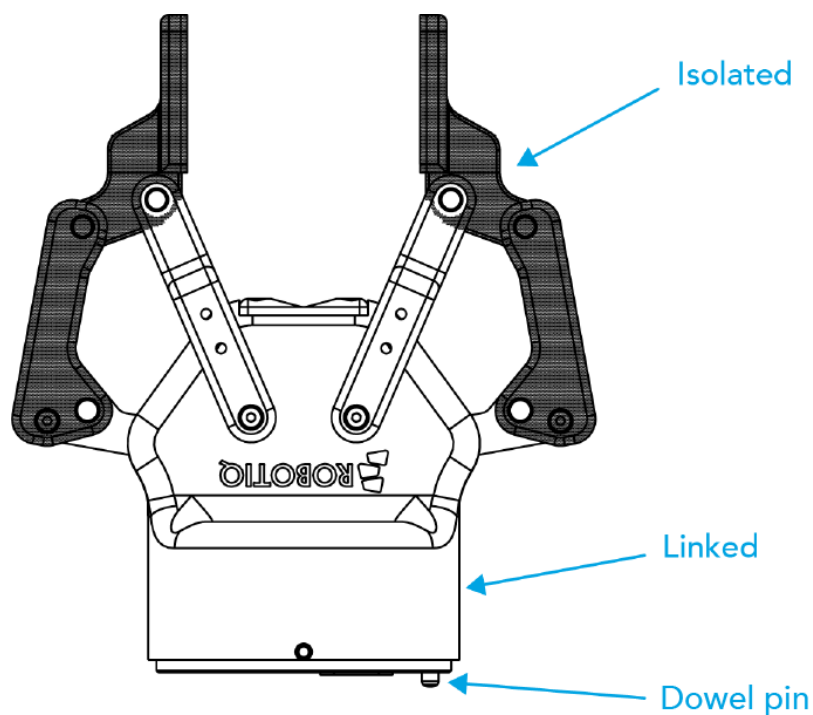

Fig. 3-10: Robotiq 2-Finger electrical isolation / grounding.

3.5.1. Electrostatic Discharge Safety

Robotiq 2F-85 & 2F-140 Gripper are not ESD safe. If installed properly using the tooth lock 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 2F grippers, the finger mechanisms and fingertips 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

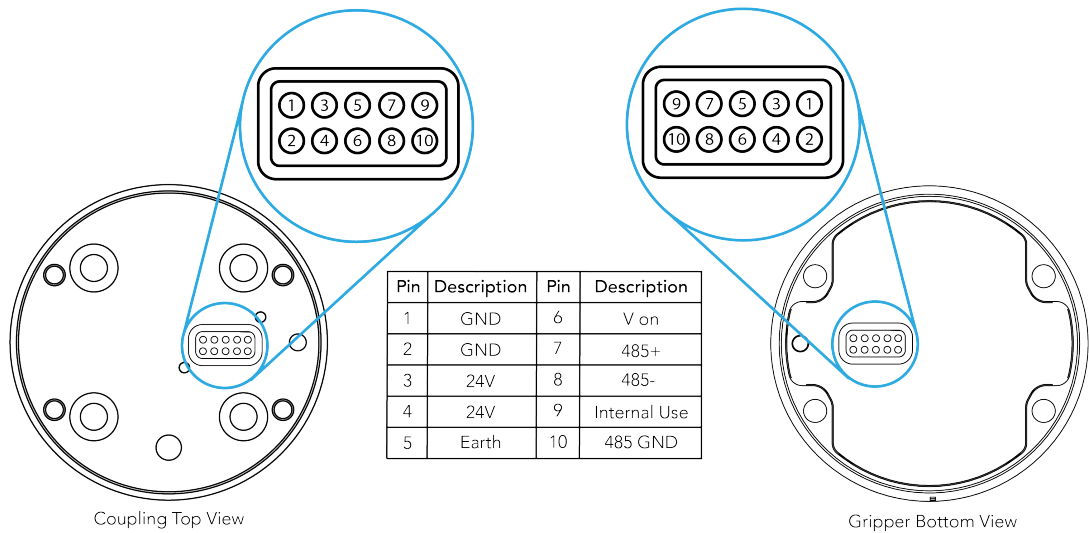The gripper interfaces with its coupling via a 10-spring pin connector located on its outer surface.

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

Fig. 3-11: Pinout of the 2F-85 & 2F-140 Gripper cable-to-wrist coupling

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 2-Finger pigtail connector from the coupling (**GRP-CPL-062 or AGC-CPL-XXX-002**), the device cable on the robot side (**CBL-COM-2065-XX**) and their associated pinout.

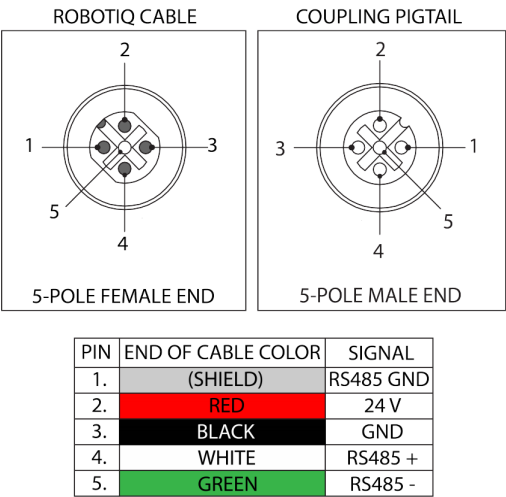| PIN	END OF CABLE COLOR	SIGNAL
1.	(SHIELD)	RS485 GND
2.	RED	24 V
3.	BLACK	GND
4.	WHITE	RS485 +
5.	GREEN	RS485 -

Fig. 3-12: Pinout of the 2-Finger pigtail and device cable.

If additional cable is 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

Single Gripper

Prior to any software installation on Universal Robots, connect the white, green and bare wires to the Robotiq RS-485 signal converter (ACC-ADT-USB-RS485) as shown in the figure below. Also connect the red (24V) and black (0V) wires in the controller according to that same figure.
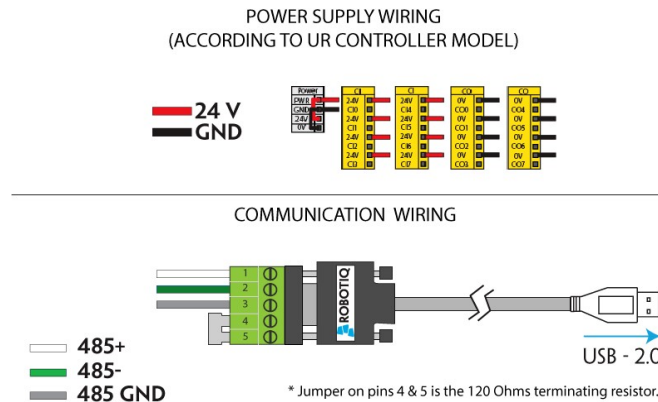

Fig. 3-13: 2-Finger Adaptive Gripper wiring to robot controller.

Multiple Grippers

It is possible to connect and control up to four grippers on the same UR robot. Only one RS485 to USB converter (ACC-ADT-USB-RS485) must be used. Use M12 splitters (ACC-SPLIT-M12-2:1) to connect all the grippers pigtails to one 10m cable (CBL-COM-2065-10-HF) that connects to the RS485 to USB converter.
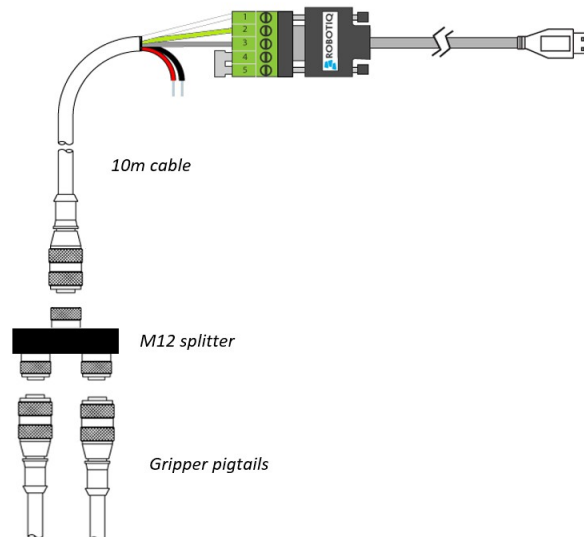

Fig. 3-14: Multiple grippers wiring on CB-Series Universal Robots.

3.5.4. Coupling to Tool Connector for I/O Coupling

**M8 right angle 8
Position Receptacle
Female pins**

FRONT VIEW OF CONNECTOR

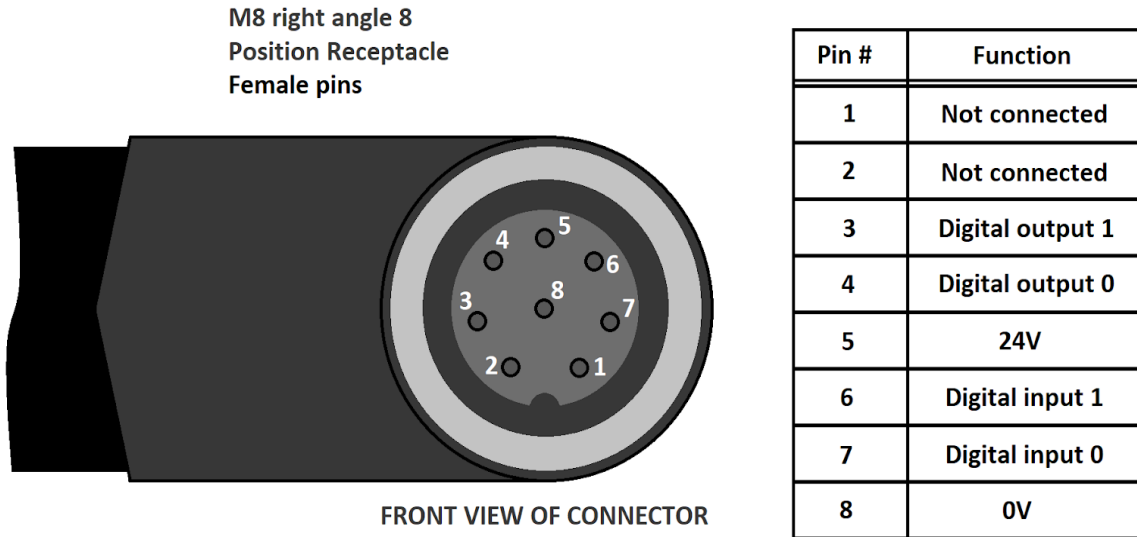| Pin #	Function
1	Not connected
2	Not connected
3	Digital output 1
4	Digital output 0
5	24V
6	Digital input 1
7	Digital input 0
8	0V

Fig. 3-15: 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 the 2-Finger with a coupling connecting directly to the robot wrist.
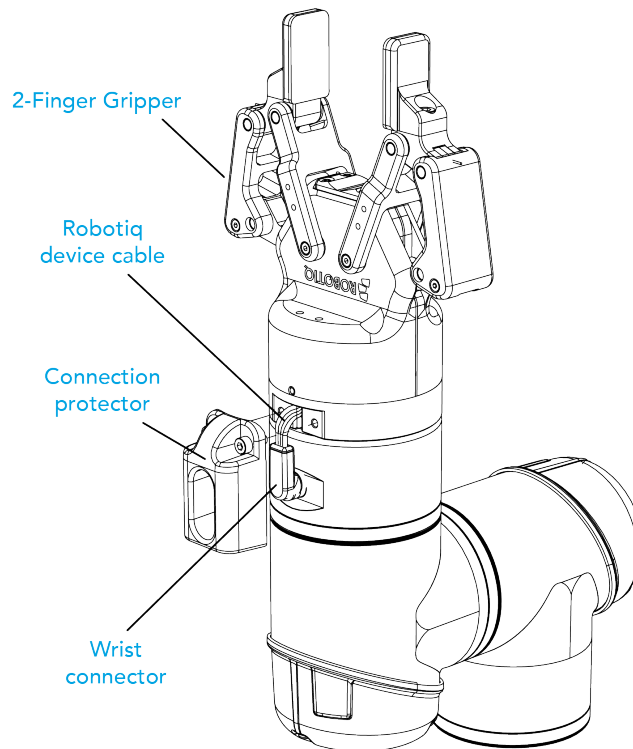
2-Finger Gripper

Robotiq
device cable

Connection
protector

Wrist
connector

Fig. 3-16: Robotiq 2-Finger with cable and device cable wiring scheme

ROBOT WRIST   ROBOTIQ CABLE

8-POLE MALE END   8-POLE FEMALE END

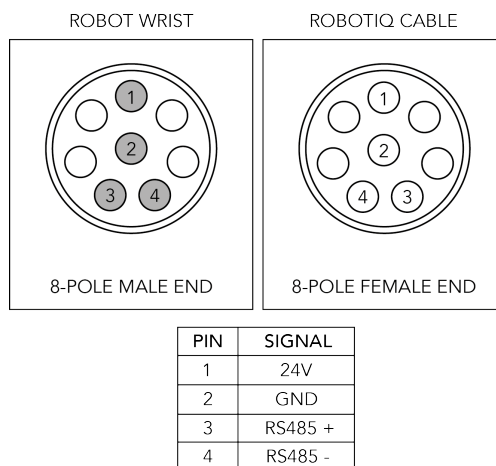| PIN	SIGNAL
1	24V
2	GND
3	RS485 +
4	RS485 -

Fig. 3-17: 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 2-Finger Adaptive 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 manual, available at 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-ADTUSB-RS485 pinout figure below) 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 auto-calibration procedures. Do not interfere with the gripper. Be sure you have satisfied robot safety measures.

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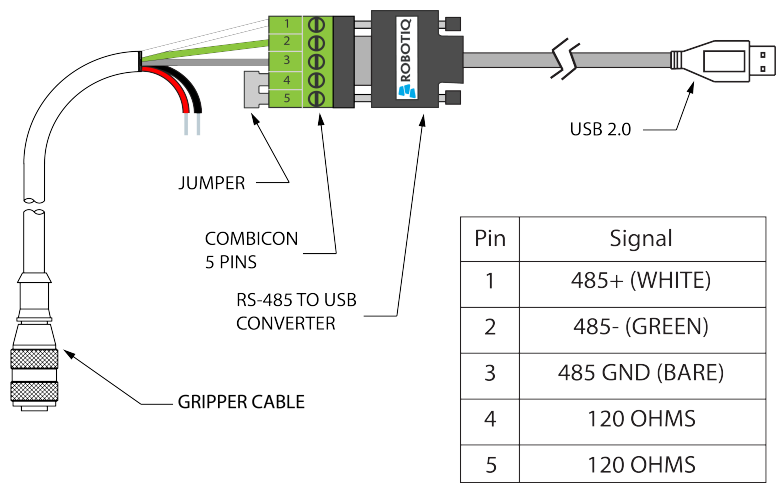
*24 V AND GND ARE NOT SUPPLIED VIA USB
*120 Ohms resistance JUMPER BETWEEN PINS 4 AND 5

Fig. 3-18: 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 grasping objects with various speed and force settings. See 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, CB3.1 or e-Series controller, it is recommended to use a Robotiq Grippers URCap 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 3-4: Compatibility between Robotiq software and robot controller

Refer to the **URCap Package** section for the installation of the UR software package for 2-Finger Adaptive Gripper.

Caution

The robot's PolyScope version must be 3.5 and later in order to install the URCap.

Caution

Prior to use over *Universal Robots*, adjust the payload and the center of gravity from 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 support.robotiq.com, select your product and robot brand from the list, then go to **Software > Gripper Software > DOWNLOAD ZIP**.

Make sure the 2-Finger Adaptive Gripper is properly mounted to the robot arm. Refer to the **Mechanical Installation** section for detailed information on the mechanical installation. Before installing the URCap package, make sure your Universal Robots controller is compatible with the package (refer to the **Installation for Universal Robots** section).

The Gripper URCap package installs the following elements:

- Gripper URCap
- Gripper Toolbar
- Gripper nodes

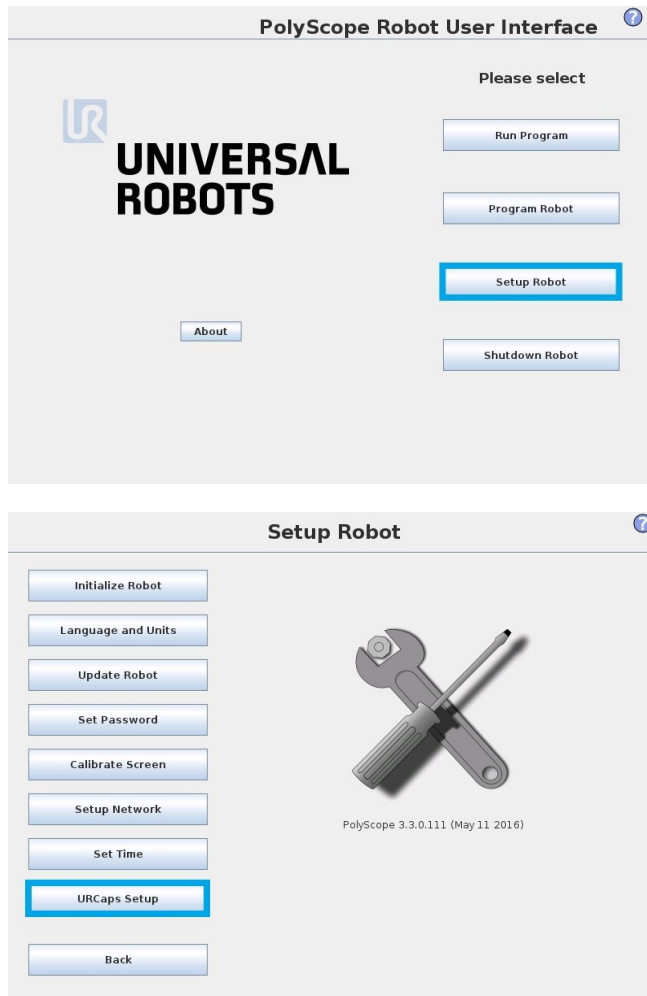For details on controlling the gripper, please refer to the **Control** section.

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

3.8.1. Installing URCap Package

Installing URCap Package on CB-Series

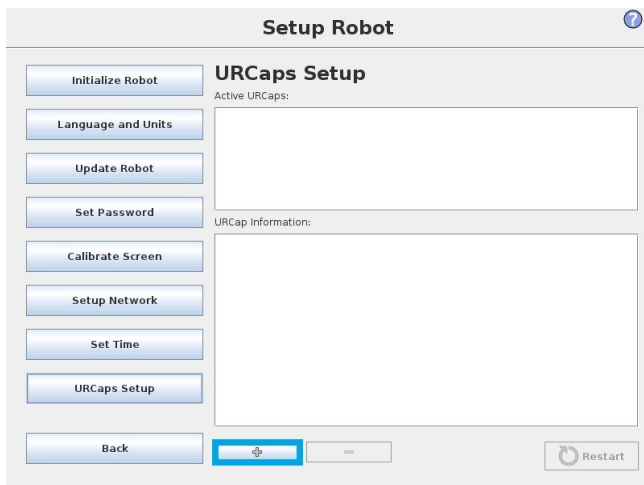To install the gripper URCap, follow these insctructions.

- 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 **Select product > 2 fingers Adaptive Gripper > Universal Robots > 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 its content on the root of a blank USB stick.

- Insert the USB stick in the UR teach pendant or controller.

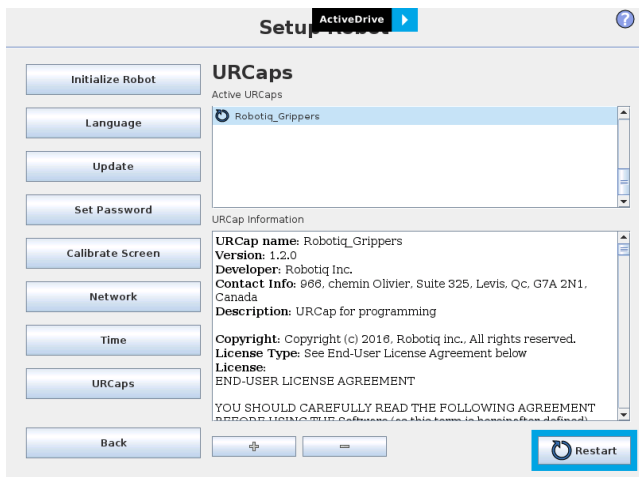- Go to **Setup Robot**.

- 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.
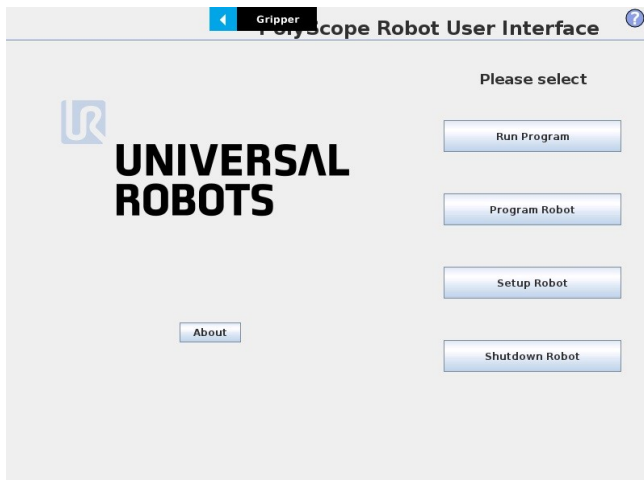
Setup Robot

URCaps Setup

Active URCaps:

URCap Information:

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

- Tap the **plus** button (**+**) to add the gripper's URCap 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_connectionX.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.)

Gripper ◀ — **PolyScope Robot User Interface**

Please select

UNIVERSAL ROBOTS

- 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
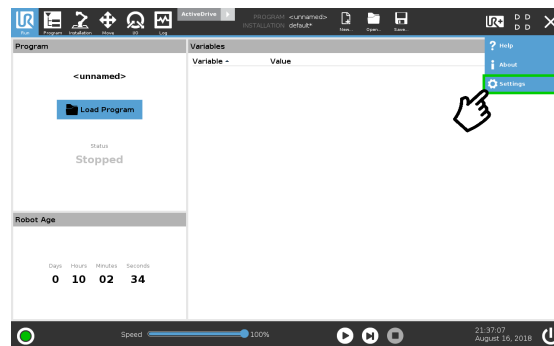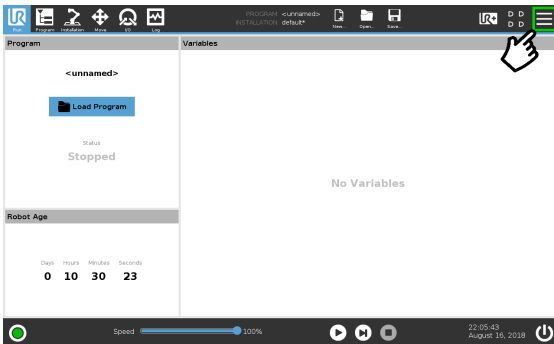
- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Gripper's URCap package.

- Go to support.robotiq.com and click on **Select product > 2 fingers Adaptive Gripper > Universal Robots > Software > Gripper Software**.

- Download the UCG-X.X.X and extract its content 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**.
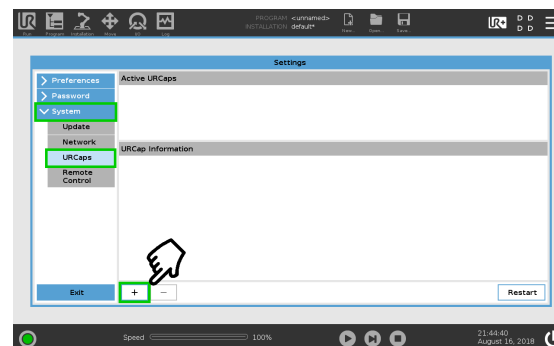
- Tap the **System** button in the navigation pane on the left.

- 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.

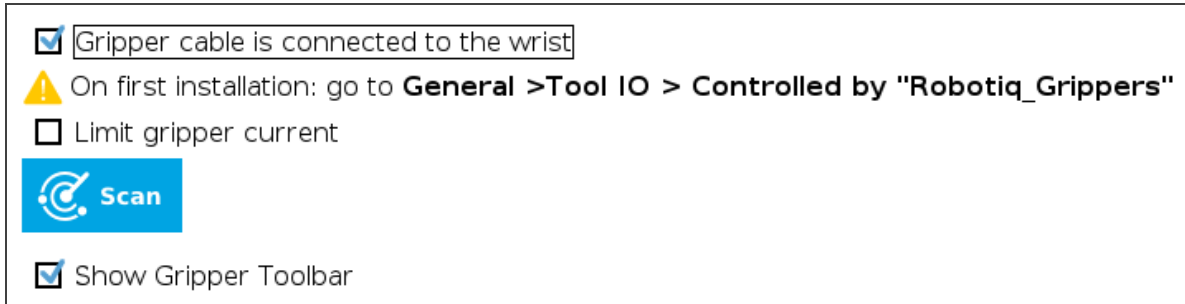- Tap the **Restart** button to activate the URCap.
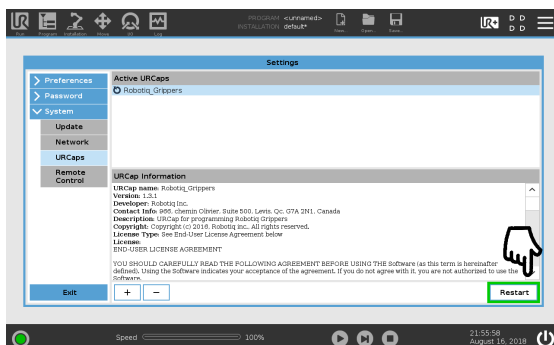
Tip

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.

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 **Installing the Gripper on the robot** section

2. Go to **Installation > URCaps > Gripper > Dashboard**.

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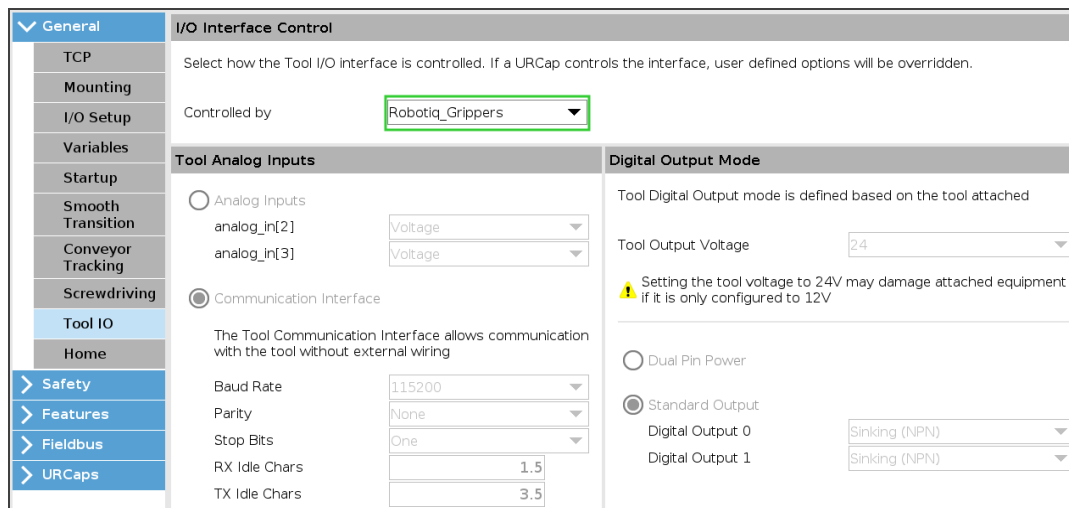
Fig. 3-13: **Gripper cable is connected to the wrist** Check Box.

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 test it.

> **Info**
>
> The number written in the gripper icon corresponds to the gripper ID.
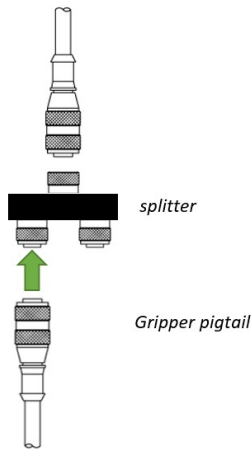
2F-85 & 2F-140 - Instruction Manual

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 **Installing the Gripper on the robot** section and the **Electrical Setup** section for detailed instructions). After a gripper has been identified by PolyScope, disconnect it and repeat the installation procedure for each additional gripper.

|	
splitter *Gripper pigtail*	• 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 then 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
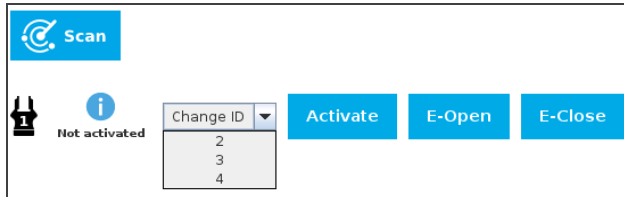
1. Check that gripper ID is different from that of other grippers that will be connected to the robot, and if required, select a different ID from the "Change ID" dropdown list.

> **Caution**
>
> Make sure that each gripper has an ID different from other grippers. 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 a time.
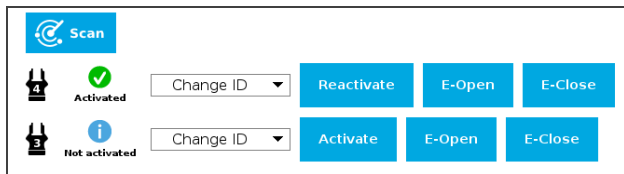
- Once all gripper IDs have been set, connect them all to the splitter.

- Go back to the **Dashboard** tab and confirm that all grippers are recognized and can be controlled. Tap **E-Open** and **E-Close** to test each gripper.

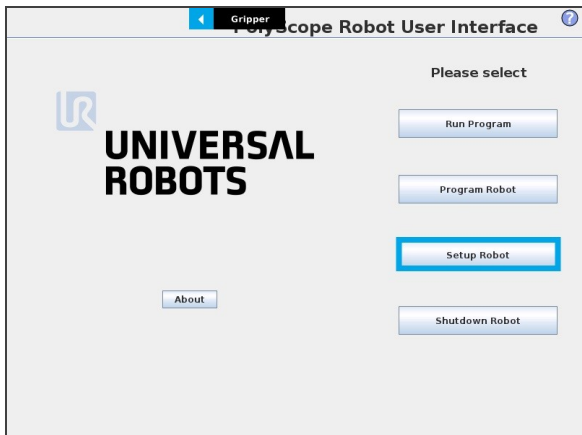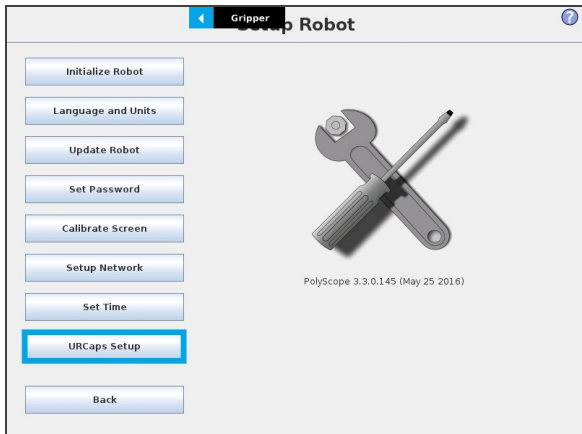# 3.8.2. Uninstalling URCap Package

If you wish to uninstall the 2-Finger Gripper URCap, follow this procedure:

For CB-Series

- Go to **Setup Robot**.

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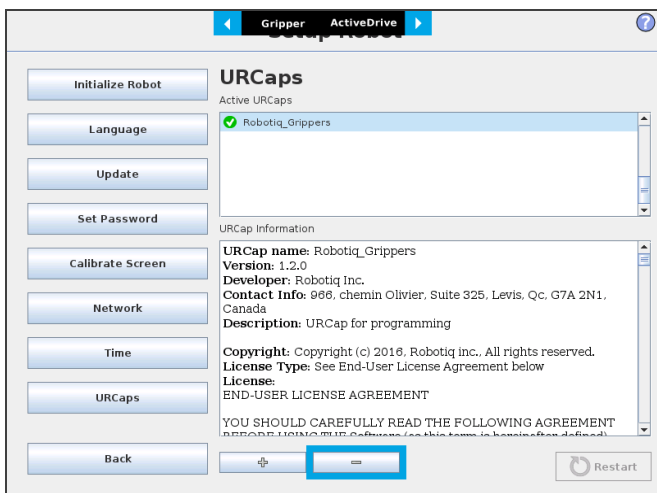
- In the **Active URCaps** text box, tap the **Gripper** URCap.
- The Gripper URCap should be highlighted.
- Tap the **minus (-)** button to uninstall the URCap.
- Restart PolyScope to complete the uninstallation process.

For e-Series
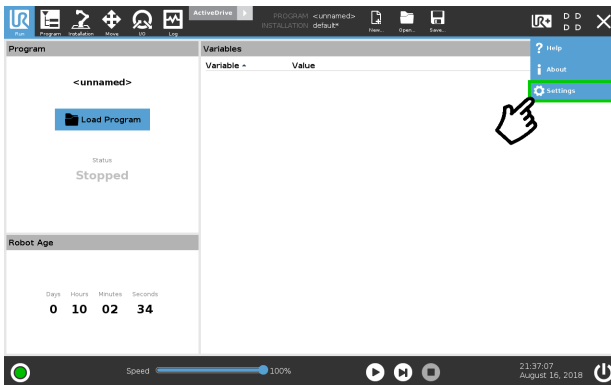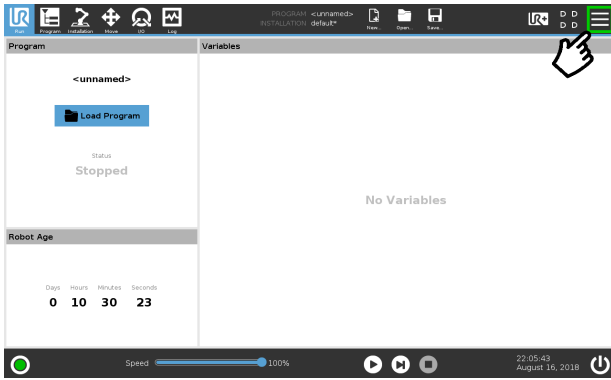
- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.

- Tap **Settings**.

- Tap the **System** button in the navigation pane on the left.

- Select **URCaps** in the dropdown list.

- Select the URCap to uninstall.

- Press the minus (**-**) button to remove the URCap.

- Tap the **Restart** button to deactivate the URCap.

4. Control

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

4.1. Overview

The Robotiq 2-Finger Adaptive Gripper is controlled directly via Modbus RTU using a RS 485 signal.

> **Tip**
>
> To test various gripper features such as object detection and force control, use the Robotiq User Interface. To download it, go to support.robotiq.com, click on **Select product > 2F-85 and 2F-140 Grippers > [any robot brand] > Software > Robotiq User Interface > DOWNLOAD ZIP**.

Since the Robotiq 2-Finger 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 the 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 the 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 & Functionalities** section details the output (write) register functions, and the **Robot Input Registers & 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.
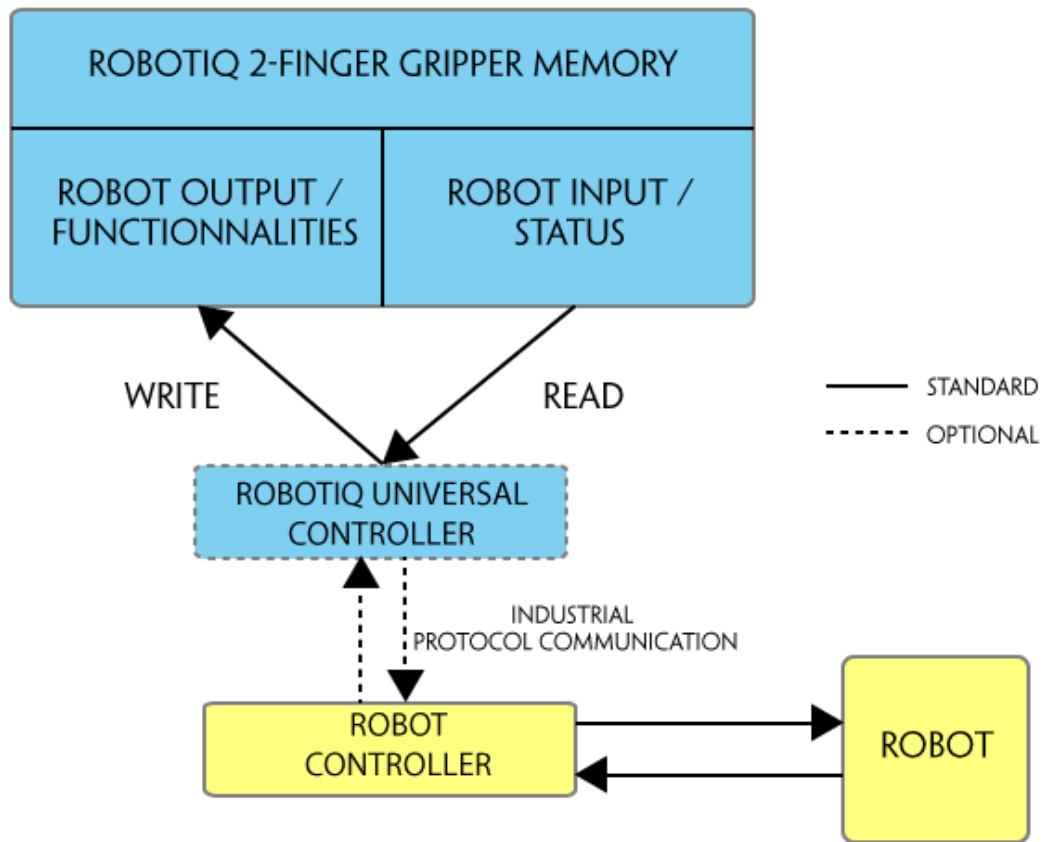
Fig. 4-1: 2-Finger control logic overview

4.2. Gripper Register Mapping

> **Caution**
>
> Byte numeration 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 2-Finger Gripper.

4.3. Robot Output Registers & 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, **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 byte 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 will require 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, please refer to the **Specifications** section.

- 0x00 - Open position, with 85 mm or 140 mm opening respectively

- 0xFF - Closed

- Opening / count: 0.4 mm (for 85 mm stroke) and 0.65 mm (for 140 mm stroke)

> **Info**
>
> The activation will allow the gripper to adjust to any fingertips. No matter what is the size and/or shape of the fingertips, 0 will always be fully opened and 255 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 & 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.

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 performing 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 (refer to the **Robot Output Registers & Functionalities** section). The gripper behavior will change according to the **rFR** force requested.

- **rFR** = 0 : Very fragile objects
    - Lowest force
    - Re-grasp feature is off
- 1 **rFR** 255 : Fragile to robust object
    - Re-grasp feature is on

Object type	Solid Fragile	Deformable Fragile		Solid Robust
rFR value	0	1	rFR	255
Force Level	Low Force			High Force
Re-grasp	OFF	ON		

The table below shows the expected applied force according to the payload material hardness, speed setting **rSP** and force setting **rFR**. All tests were done with the 2-Finger Gripper with firmware GC3-1.3.9. Data was obtained with a Load Cell from *Phidget*, *S Type*, *model 3138*.

FINGERTIP		PAYLOAD		MEASURED FORCE MIN / MAX (N)	
TYPE	**HARDNESS**	**TYPE**	**HARDNESS**	**2-Finger 85**	**2-Finger 140**
Steel 4340	220 HV	Steel 4340	220 HV[3]	25 - 220	15 - 120
Aluminium 6061[1]	95 HV	Aluminium 6061	95 HV	25 - 220	15 - 120
Aluminium 6061[1]	95 HV	Silicone (TIP-204)[2]	60 A Durometer	25 - 220	15 - 120
Aluminium 6061[1]	95 HV	Silicone rubber	40 A Durometer[4]	25 - 155	15 - 100
Aluminium 6061[1]	95 HV	Neoprene rubber	10 A Durometer	25 - 115	15 - 75
Aluminium 6061[1]	95 HV	Polyurethane rubber	30 OO Durometer	25 - 115	15 - 75

[1] Available with V-Groove fingertip AGC-TIP-205-0085 / AGC-TIP-421-140.

[2] Available with flat silicone fingertip AGC-TIP-204-085 / AGC-TIP-420-140.

[3] HV refers to Vickers hardness test.

[4] Durometer refers to Shore durometer hardness, scale A or scale OO.

MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 220 HV HARDNESS MATERIAL (STEEL)
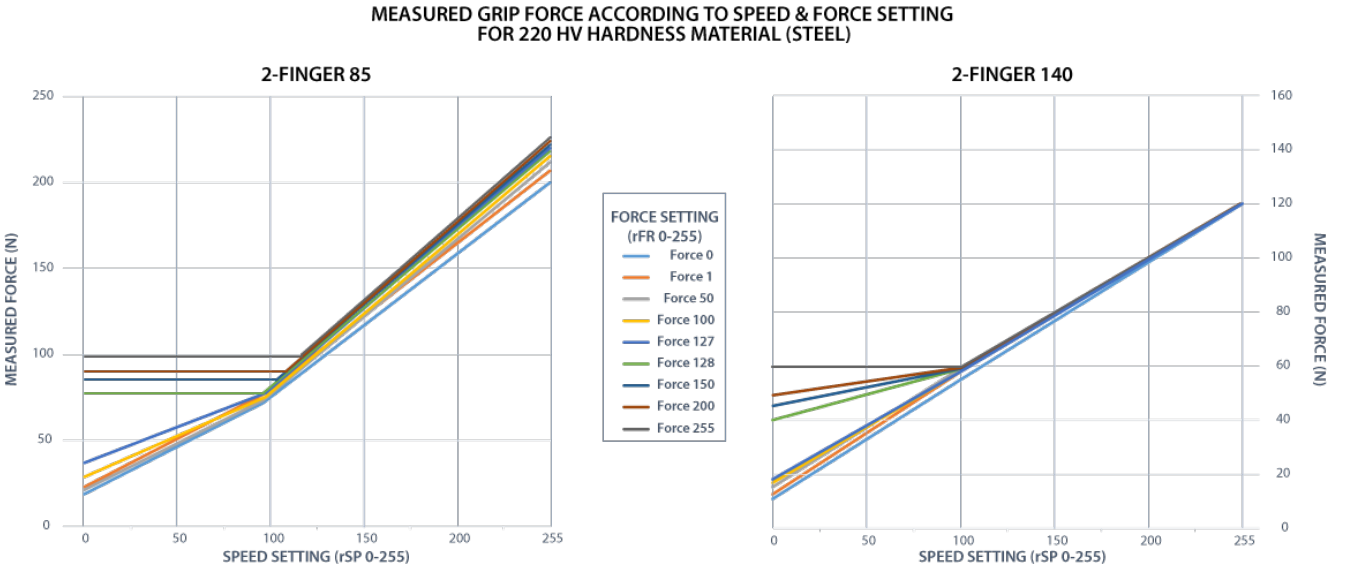
Fig. 4-2: Grip force on hardness 220 HV (4340 annealed carbon steel).

MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 95 HV HARDNESS MATERIAL (ALUMINIUM)
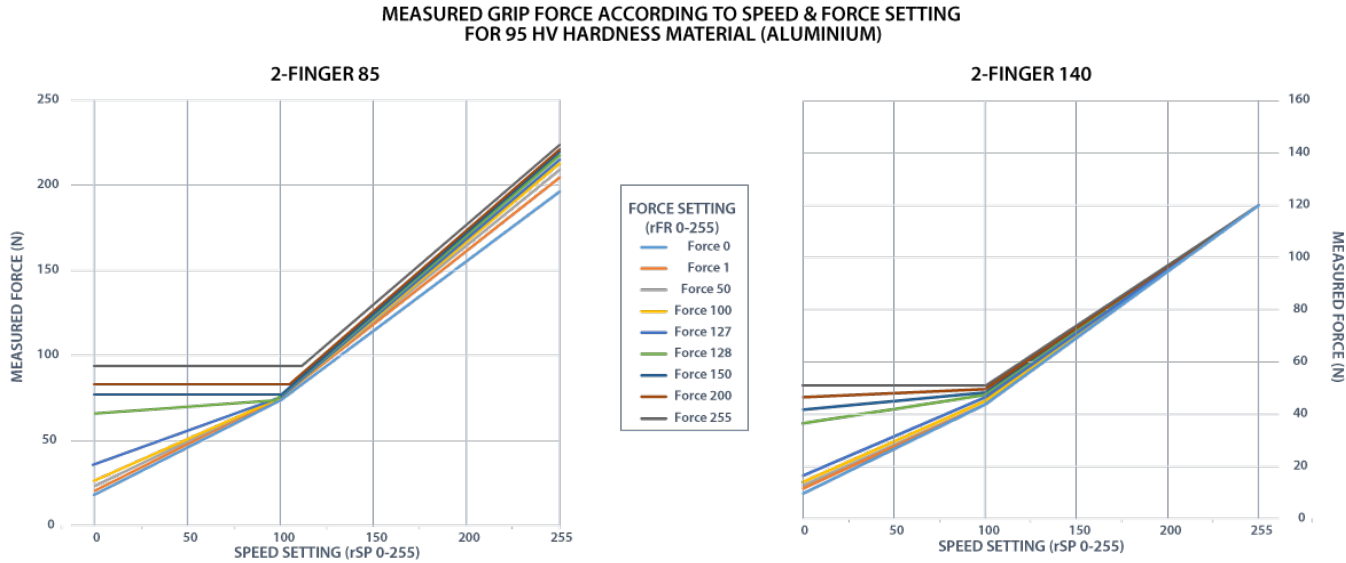
Fig. 4-3: Grip force on hardness 95 HV (6061-T6 aluminium).

**MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 60A DUROMETER MATERIAL**
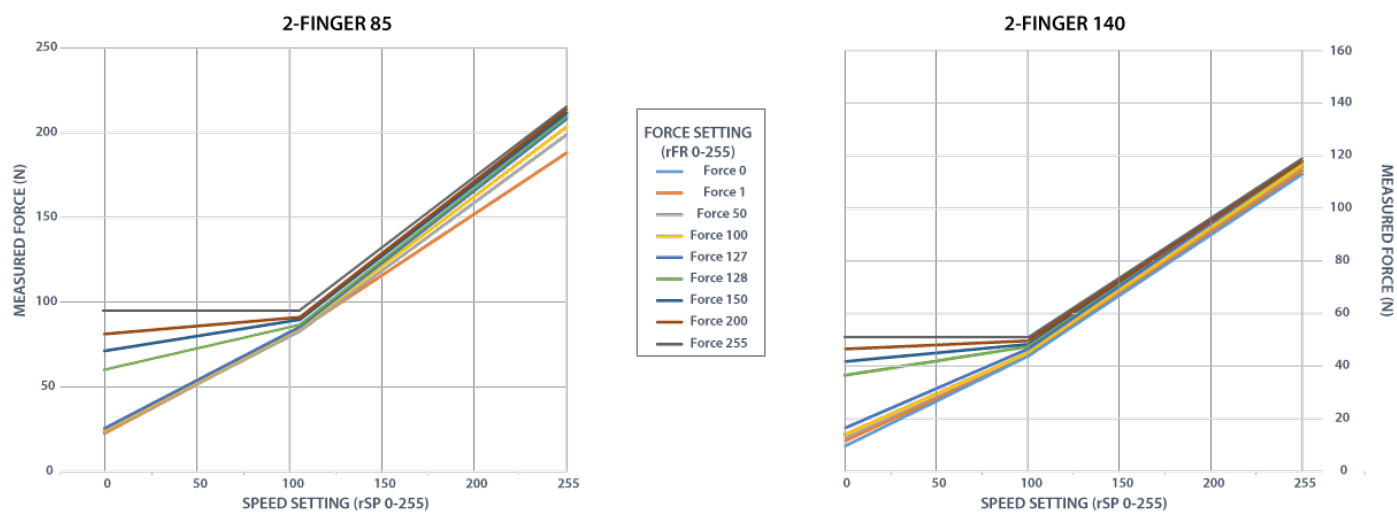
Fig. 4-4: Grip force on hardness 60A (silicone).

**MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 40A DUROMETER MATERIAL**
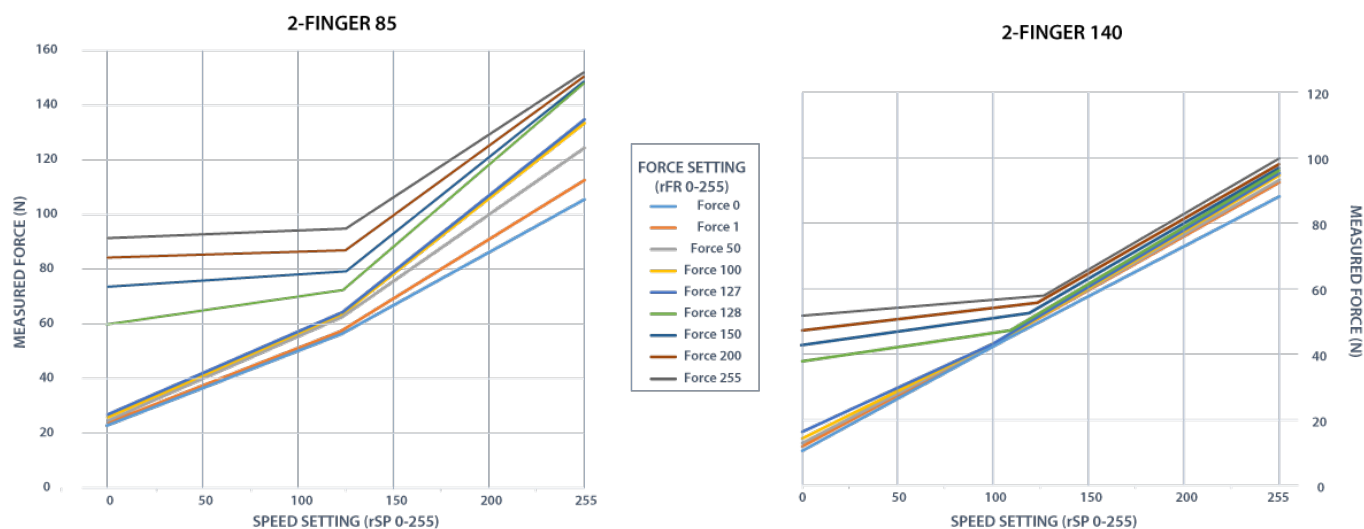
Fig. 4-5: Grip force on hardness 40 A (silicone).

**MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 10A DUROMETER MATERIAL**

2-FINGER 85

2-FINGER 140

FORCE SETTING
(rFR 0-255)
- Force 0
- Force 1
- Force 50
- Force 100
- Force 127
- Force 128
- Force 150
- Force 200
- Force 255
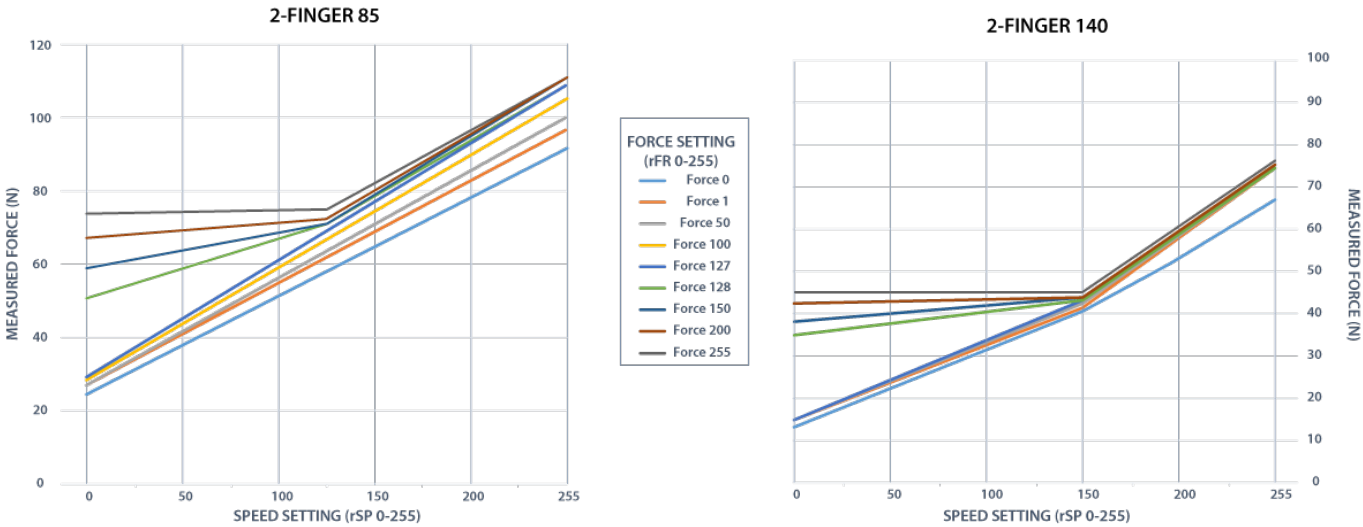
Fig. 4-6: Grip force on hardness 10 A (neoprene).

**MEASURED GRIP FORCE ACCORDING TO SPEED & FORCE SETTING
FOR 30OO DUROMETER MATERIAL**

2-FINGER 85

2-FINGER 140

FORCE SETTING
(rFR 0-255)
- Force 0
- Force 1
- Force 50
- Force 100
- Force 127
- Force 128
- Force 150
- Force 200
- Force 255
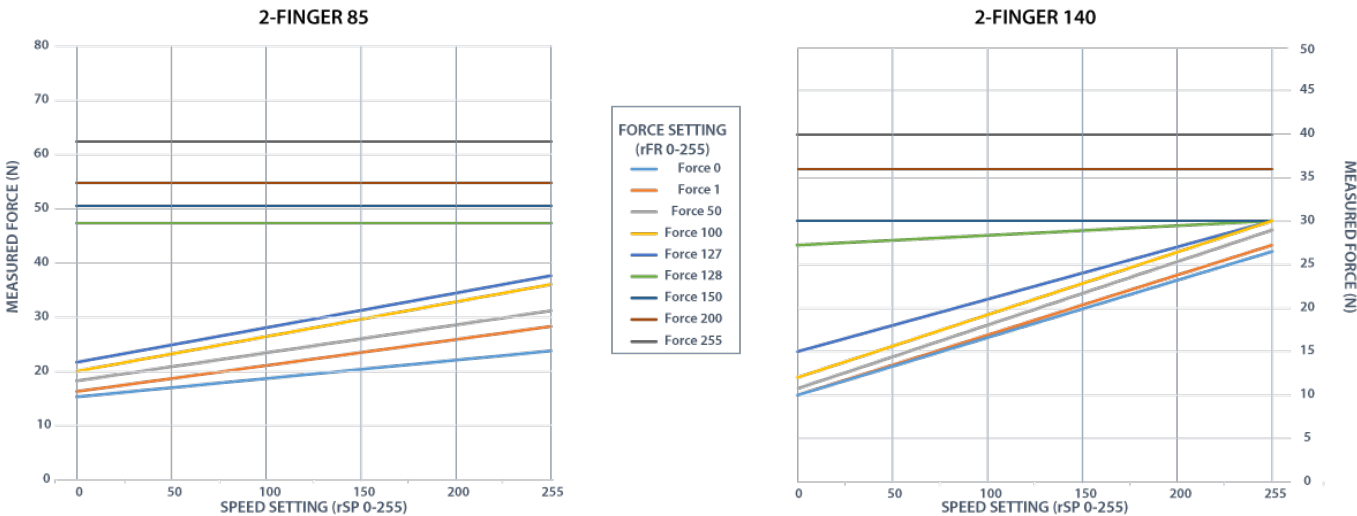
Fig. 4-7: Grip force on hardness 30 OO (polyurethane).

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 allows the gripper to initiate 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 exceeded to prevent damaging the object.

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

4.5.3. Object detection

When the gripper grabs an object, **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 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.

4.6. Control Logic Example

ACTIVATE GRIPPER
Output Register ACTION REQUEST (byte 0)
Bit 0 (rACT) == 1 (must stay on)

WAIT FOR INITIALIZATION

Input Register GRIPPER STATUS (byte 0)
Bits 4 & 5 (gSTA) == 1

WAIT FOR:

A) POSITION REACHED

gPR == Position requested in previous step
AND
gOBJ == 0x03 (no object)

A) OBJECT DETECTION

gPR == Position requested in previous step
AND
gOBJ == 0x1 or 0x02

Legend

Gripper status inquiries

Gripper functionalities

MOVE ROBOT

GO TO REQUESTED POSITION*
Set position, speed and force
rPR = 0x00 to 0xFF
rSP = 0x00 to 0xFF
rFR = 0x00 to 0xFF
AND
rGTO = 0x1

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. 4-8: Example of Gripper control logic with corresponding registers.

4.7. Modbus RTU Communication

The gripper can be controlled by Modbus RTU directly with RS485-RS232 using the ACC-ADT-RS232-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 specification 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 Register (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**
>
> Maximum baud rate of **ACC-ADT-USB-RS485** is 115200 bps.
>
> 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 16 (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 (1001) 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 & 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)

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 0x03E8 (ACTION REQUEST = 0x01 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**
0000	Value written to register 0x03E9
0000	Value written to register 0x03EA
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)

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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 0x03E8 (ACTION REQUEST = 0x01 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**
0000	Value written to register 0x03E9
0000	Value written to register 0x03EA
72E1	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 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)
300F	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 the 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 grasp 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 grasp **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.
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 grasp **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 the robot to the 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"**
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. 2F-85 & 2F-140 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 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 triggers the activation sequence of the gripper.

- 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 URCap 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 URCap 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 gripper with the I/O Coupling. Make sure you have the latest version installed. If an update is necessary on the I/O Coupling or the gripper, the Robotiq User Interface (RUI) will warn you and request the update.

> **Info**
>
> To avoid confusion between the two RUCaps, make sure to delete the old Gripper URCap before using the I/O Coupling URCap.

> **Info**
>
> Make sure your polyscope version is compatible with the URCap version. Visit robotiq.com/support for details.

Wrist Node

Multiple Wrist Nodes are available:

- Wrist Connection Activation

- Wrist Connection

- Wrist Grip Check
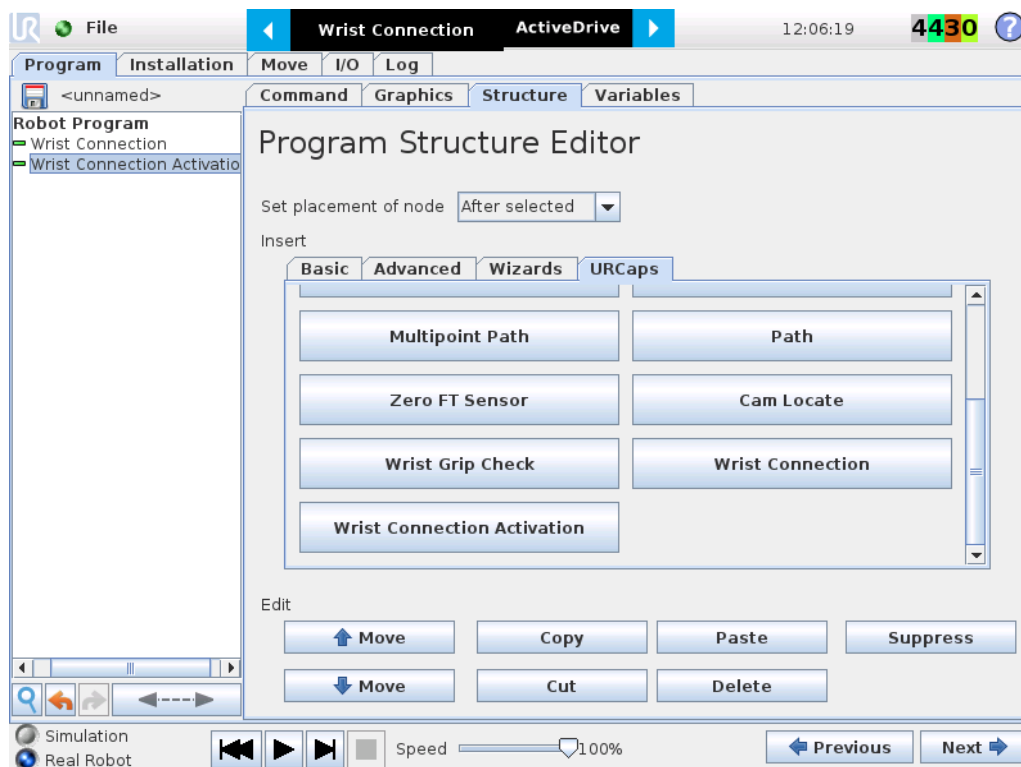
Fig. 4-9: Program Structure Editor. Multiple Wrist nodes are available.

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

Fig. 4-10: Wrist Connection Activation Interface

- For each **Wrist connection** node, select the desired presets. Tap on the **Test** button to try each preset.
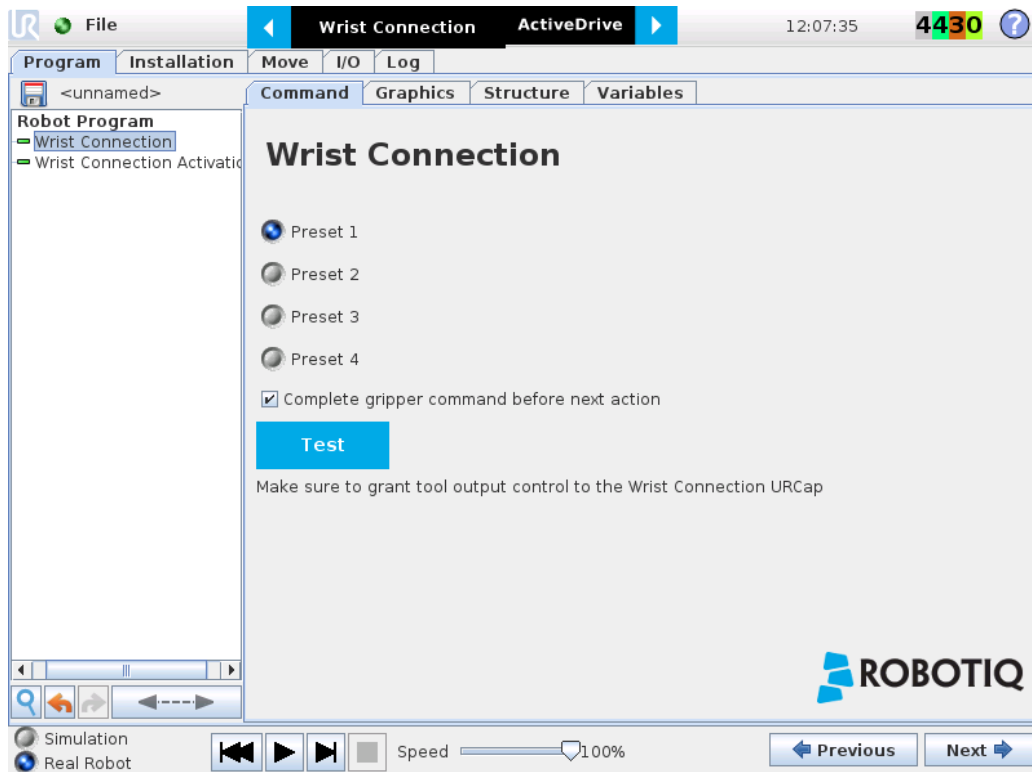
Fig. 4-11: Wrist Connection Node Interface.

- 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.
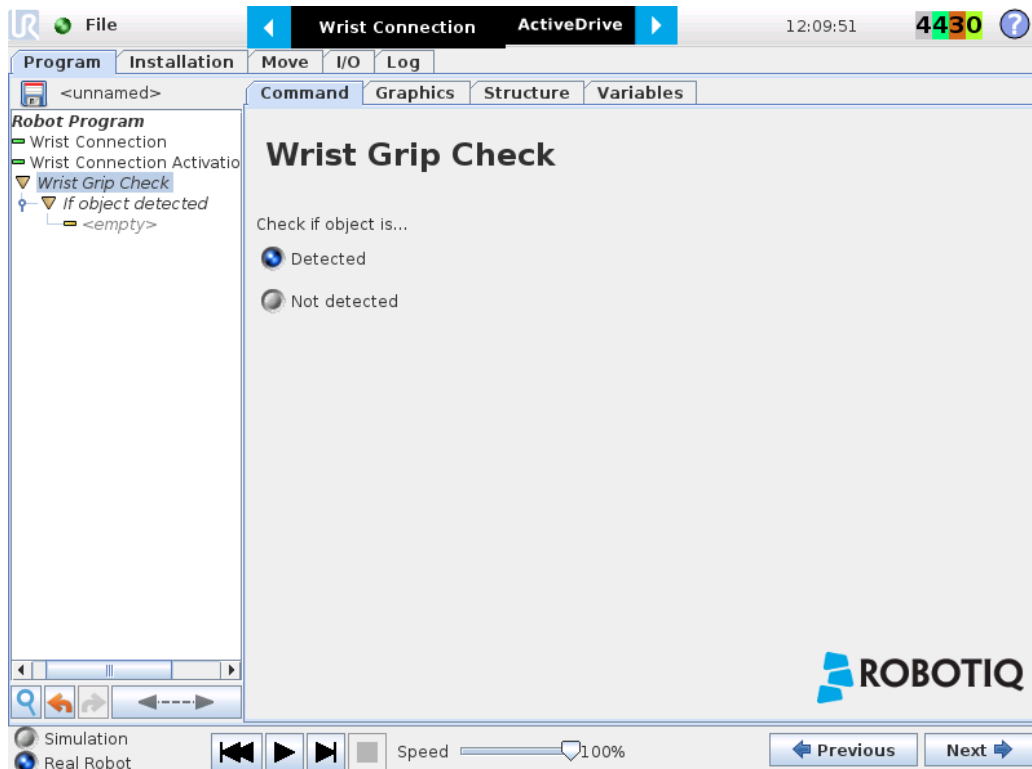
Fig. 4-12: Wrist Grip Check Node Interface.

- In the **Wrist Connection Toolbar**, you can:
  - Test the 4 presets;
  - See the Object Detection Status;
  - Activate the Gripper
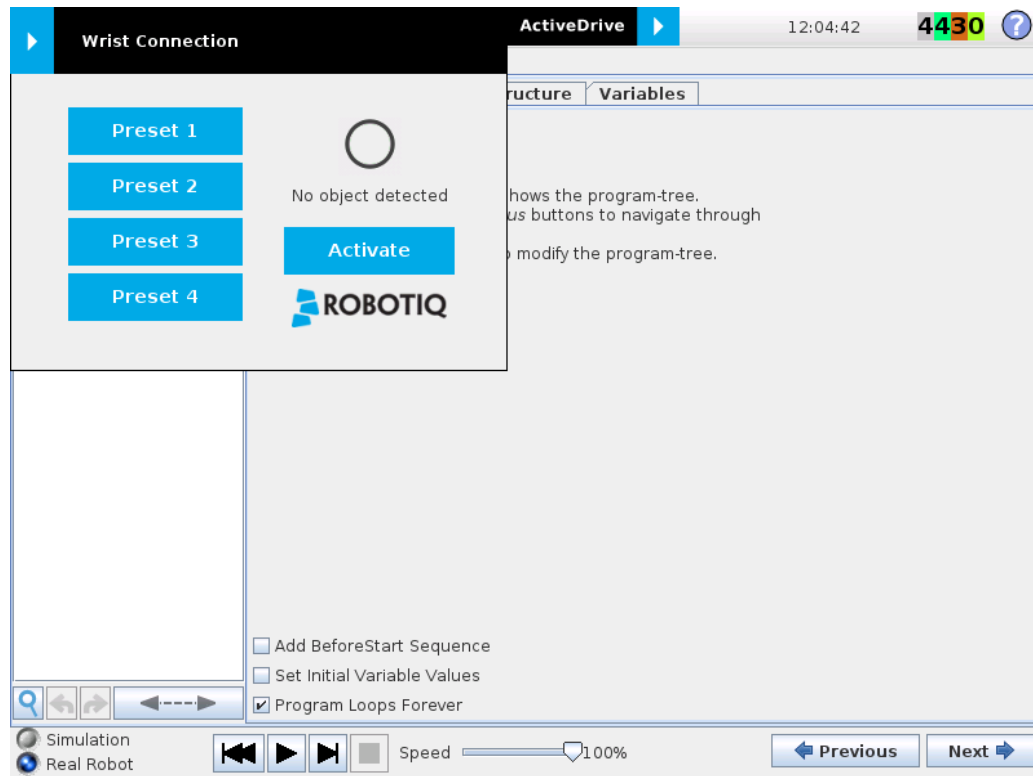
Fig. 4-13: Wrist Connection Toolbar Interface.

4.9.3. Gripper Dashboard

Overview

Single Gripper for e-Series
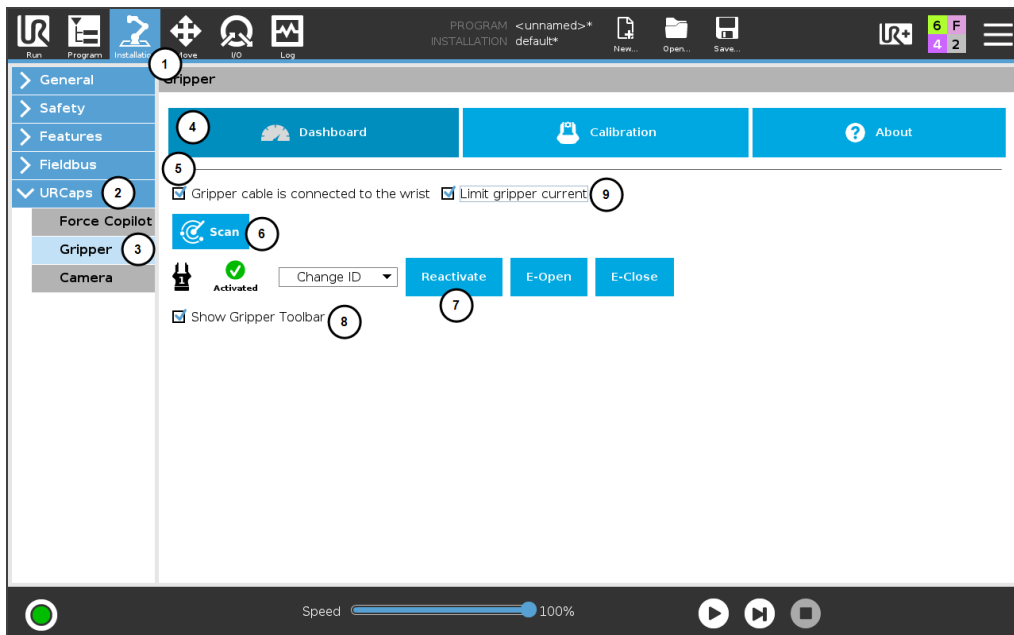
Fig. 4-14: Gripper Dashboard (steps highlighted)

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 of 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**.

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Fig. 4-15: 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 it 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 Tap 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
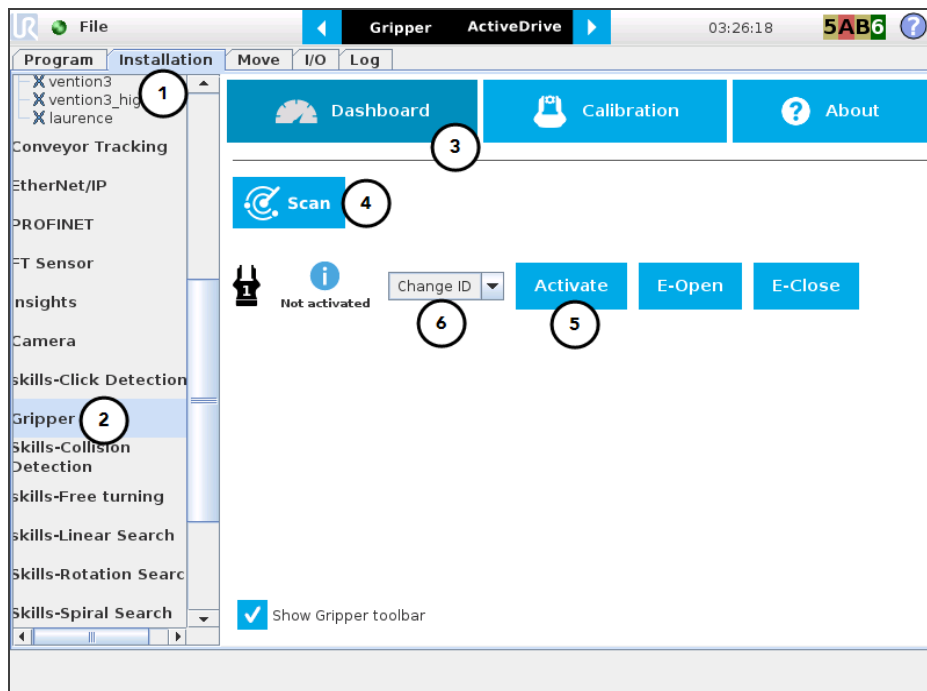
Fig. 4-16: Gripper Dashboard (steps highlighted)

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. 4-17: 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 it 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.
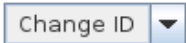
> **Caution**
>
> If you wish to program using multiple grippers at the same time, connect them to the robot **one after the other**; each gripper connection requiring its own **scan** and **activation** before going on to the next.

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
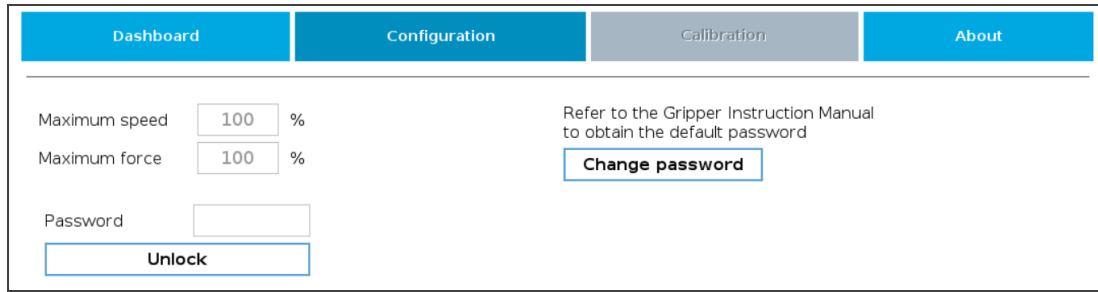
Icon	Functionality Name	Description
Dashboard	Dashboard	After selecting Gripper in the left pane of the Installation tab, tap this button to access the Gripper Dashboard.
Activate / Reactivate	Activate/Reactivate	The Activate and Reactivate buttons enable the corresponding gripper.
Not activated / Activated	Not activated/Activated	Gripper status: One or the other of these icons is displayed next to the corresponding Gripper icon.
Gripper	Gripper	Label indicating the gripper's ID, ranging from 1 to 4.

Icon	Functionality Name	Description
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 text box 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
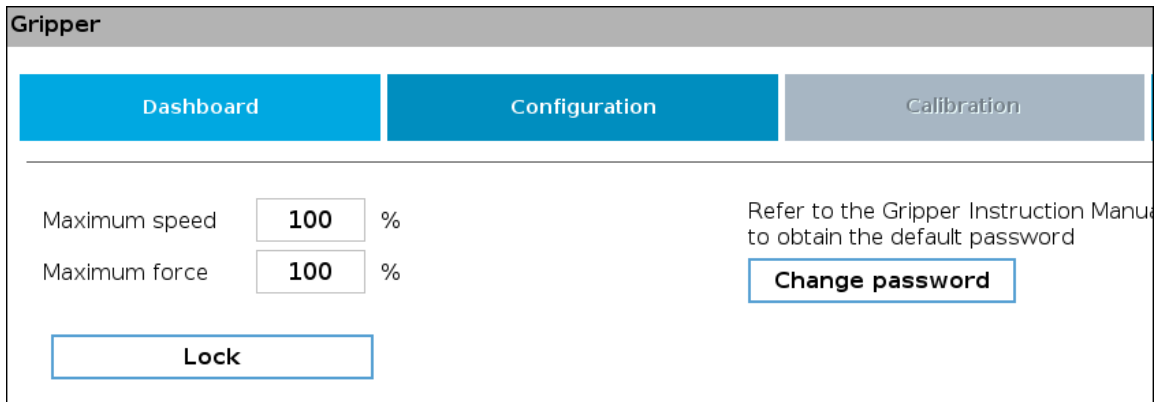
Grippers can have their force and speed limited at root-level when using the teach pendant. Follow these instructions to enable this.

Fig. 4-18: 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. Enter your password. Default is *rqsafe*.

3. Tap **Unlock**

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. 4-19: 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. 4-20: Modification of the current password.

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

> **Caution**
>
> - This feature reduces the risk, but is not safety-certified.
>
> - The values (%) stand as references only. The actual maximum force (in newtons) can vary depending on the application and needs to be measured by its user by an external measuring system on each gripper for high precision.

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.
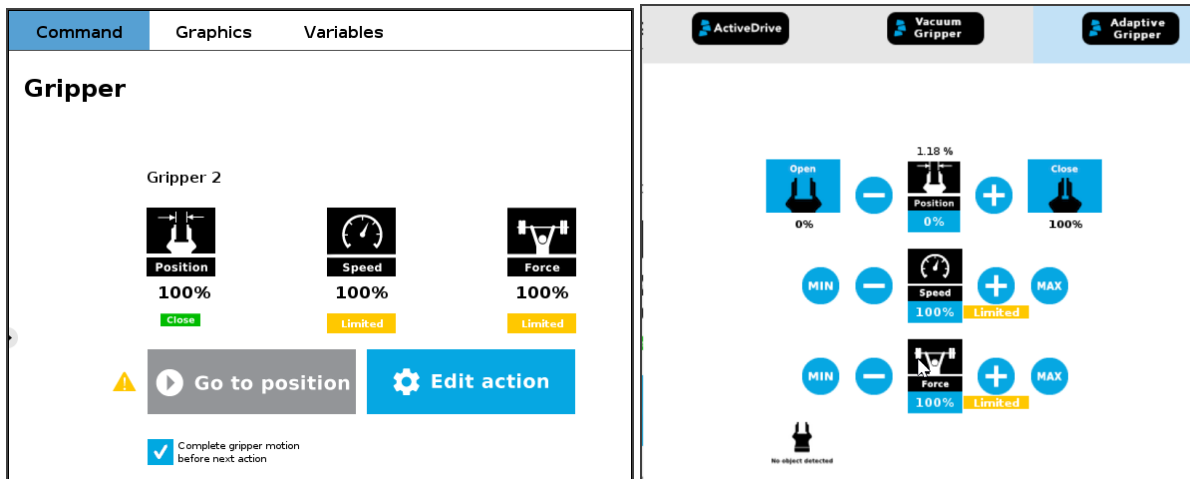
Fig. 4-21: Label "Limited' appears when limitations are effective.

4.9.6. Gripper Calibration menu and wizard

Depending on the 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.
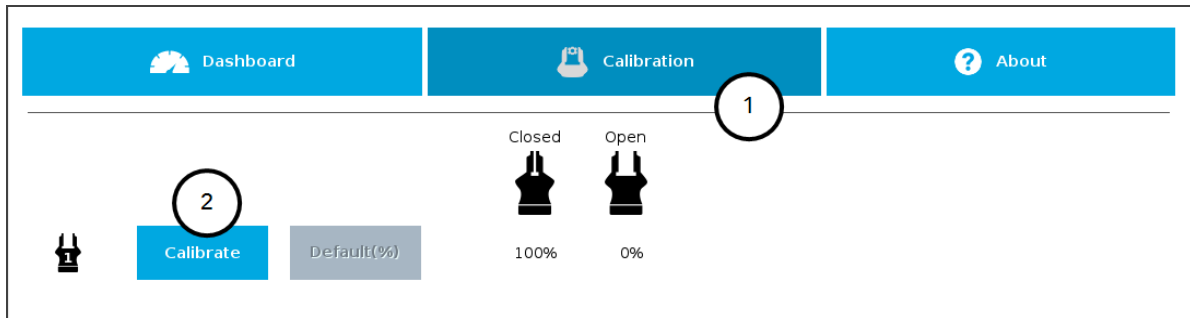
Fig. 4-22: Sequence Toward Calibration, Single Gripper

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. 4-23: First step of the calibration wizard

Fig. 4-24: 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.
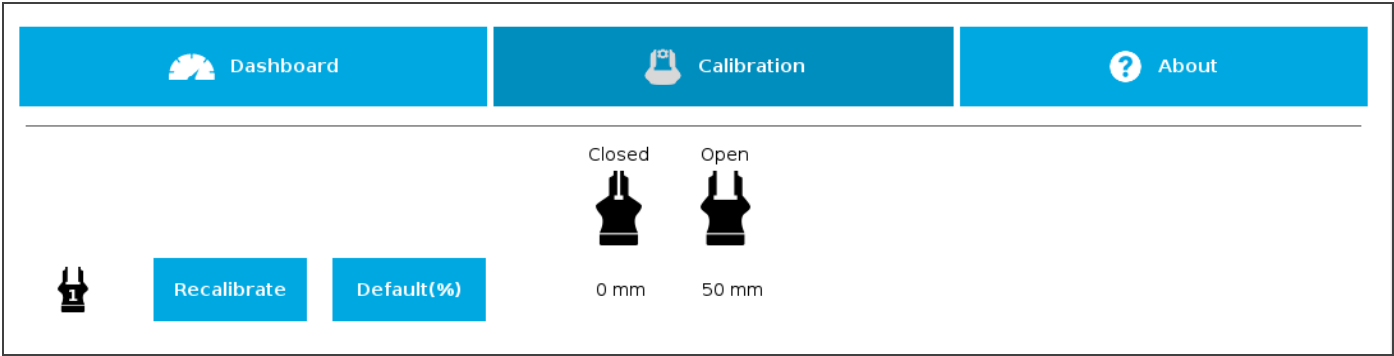
Fig. 4-25: Single Gripper, Calibrated

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.
Gripper	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.

Icon	Functionality Name	Description
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.
Open	Open	Tap this button to open the Gripper in the Calibration wizard.
(fully closed icon)	Fully closed	Visual aid for entering the fully closed dimension in the Calibration wizard.
(fully open icon)	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.

Overview

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

*Fig. 4-26: **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 message:
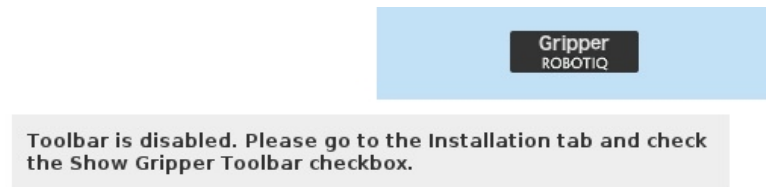
Fig. 4-27: Disabled Gripper Toolbar

On CB-Series, right after the installation of the Gripper URCap, a collapsed Gripper Toolbar will display at the top of the screen.
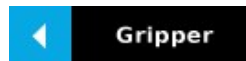

Fig. 4-28: Gripper Toolbar (collapsed)

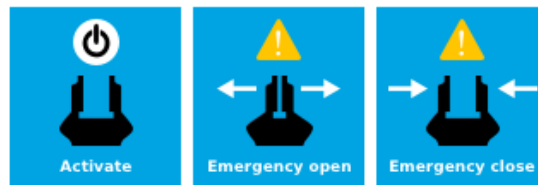An expanded Gripper Toolbar prior to the activation of the gripper looks like the figure below:

Fig. 4-29: Gripper Toolbar Before Activation

> **Info**
>
> The **Emergency open** and **Emergency close** buttons allow the user to open and close the gripper even if it 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 .
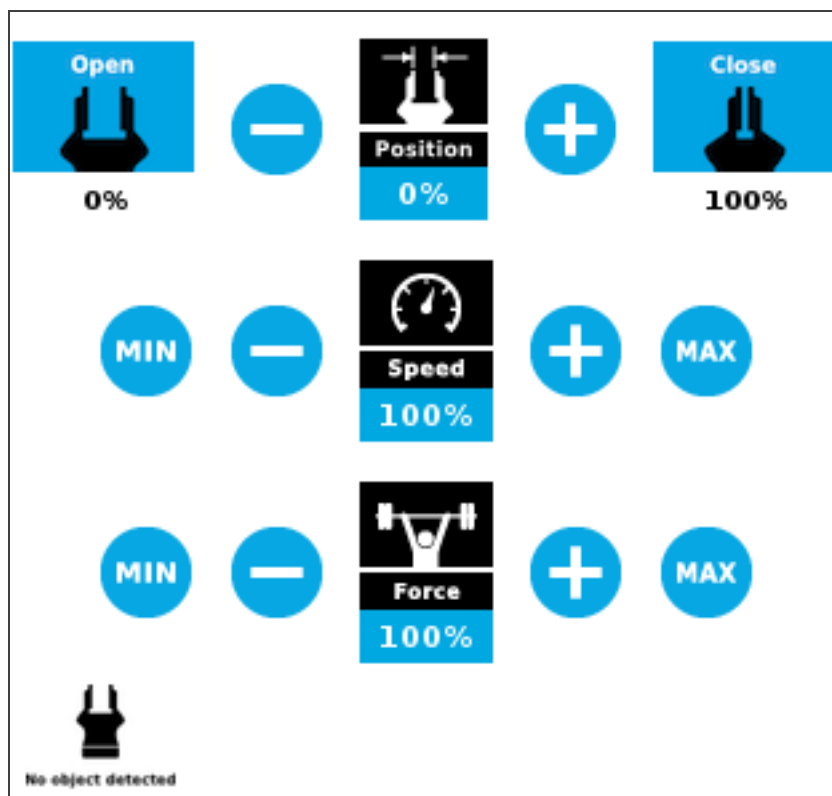

Fig. 4-30: Gripper Toolbar After Activation

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.
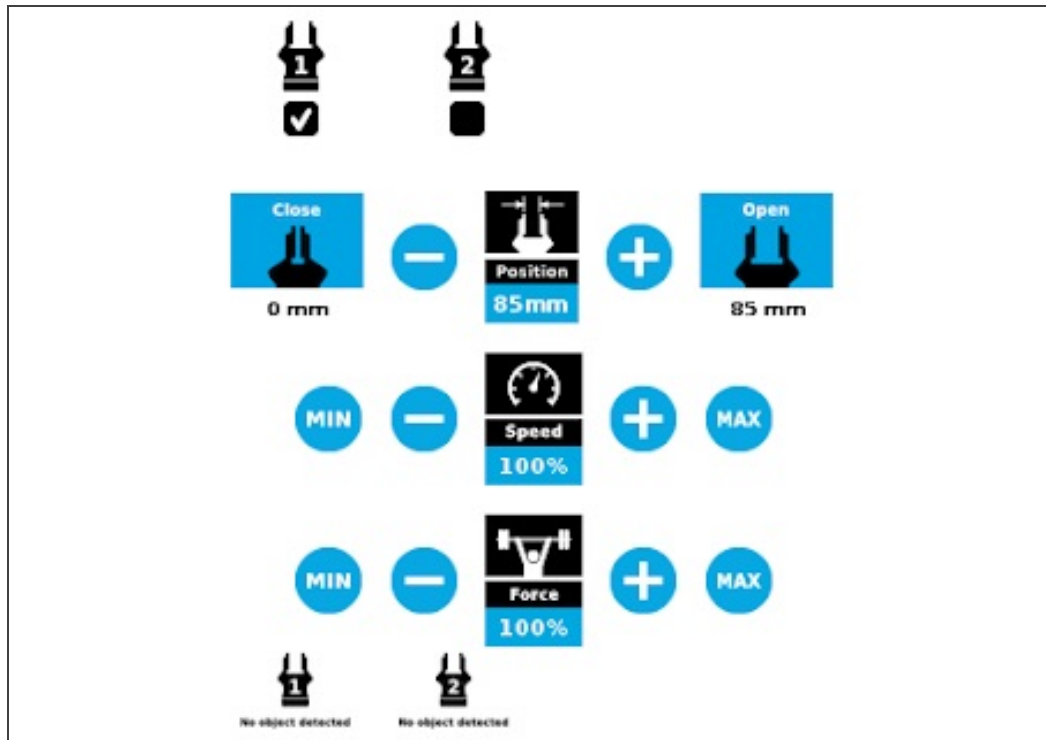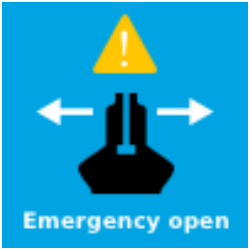

Fig. 4-31: Gripper Toolbar (expanded, multiple grippers)
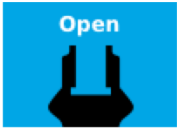
Features

Gripper activation

Icon	Functionality Name	Description
Gripper	CB-Series Gripper Toolbar	Tap to toggle between the 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.
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 / ▶ 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	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.

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	Speed	Force
⚠️ 50mm	55%	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 gripper, 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	Speed	Force
0mm	55%	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.

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	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 commands.

Icon	Functionality Name	Description
⚠️	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.
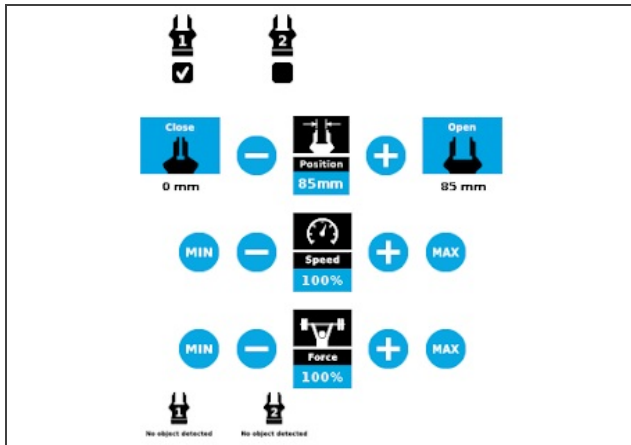
	• When selecting one gripper, all buttons are available. The action will apply to the selected gripper. • When jogging the position, the selected gripper will move automatically. • It is possible to jog the position (%).
	• When selecting two or more grippers, it is not possible to jog the position. • 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.
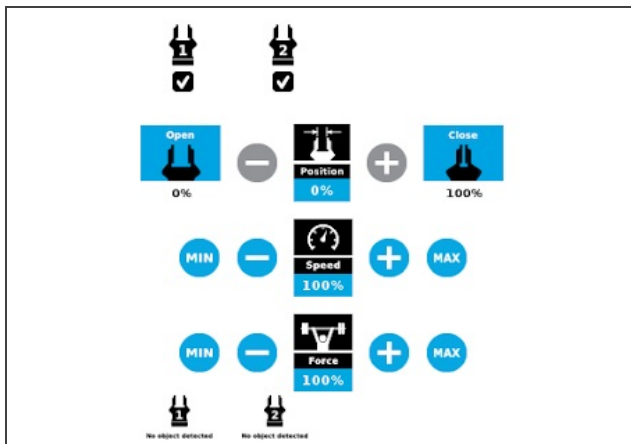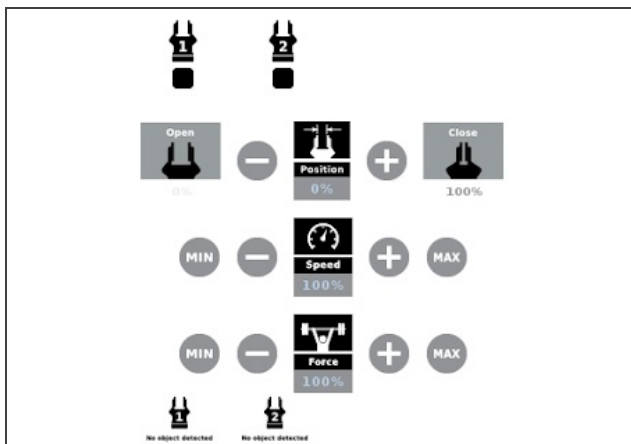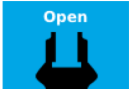
Features

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	Tap to increase the corresponding parameter.
−	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 **Structure** 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).

Grip Check

Gripper ID 1
Check if object is...

(●) Detected   ( ) Not detected

and...

[ ] Validate grip with dimension

Fig. 4-32: Grip Check node interface
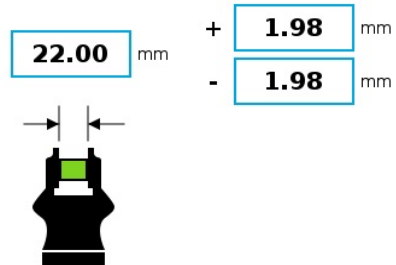
Fig. 4-33: Grip Check node interface with dimension validation

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
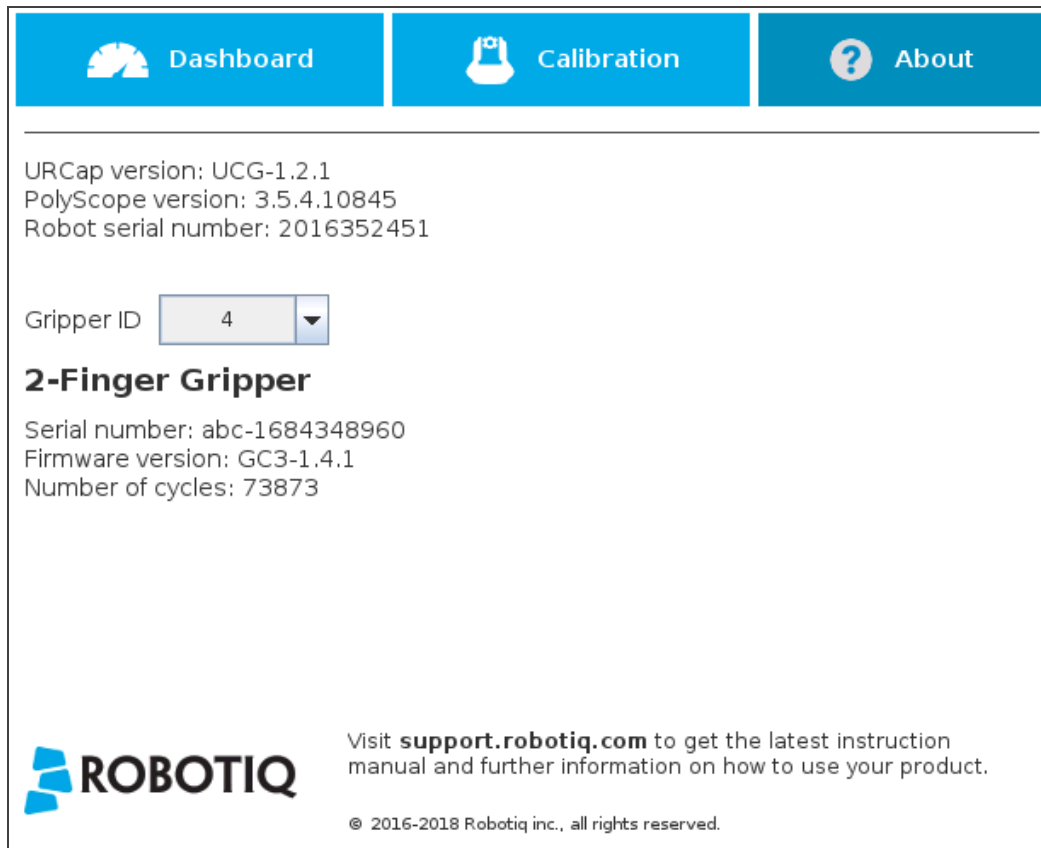
*Fig. 4-34: **About** submenu.*

If the Gripper firmware 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 (see **Advanced Gripper Functions** section).

Advanced Gripper Functions

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

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.
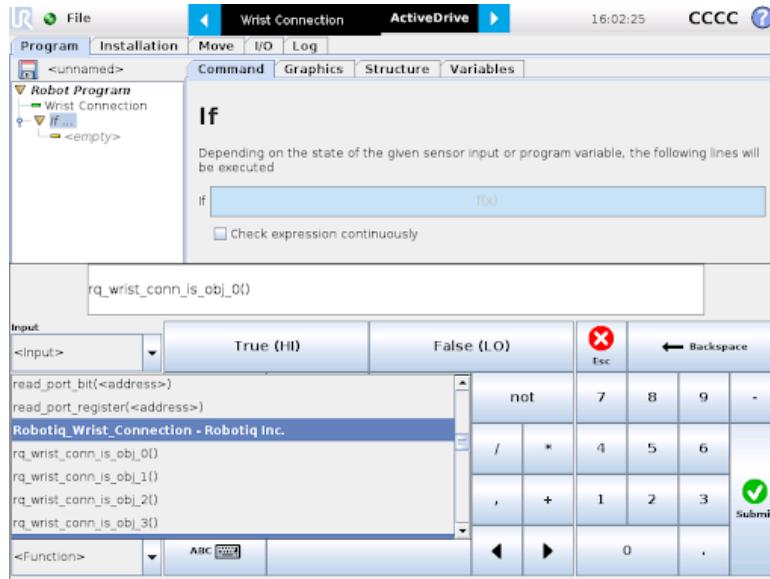
Fig. 4-35: Command window.

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 the 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 LED to OFF status.
rq_gripper_led_on()	Allows the firmware to turn ON the LEDs when they have been forced 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 **Object detection** section 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.
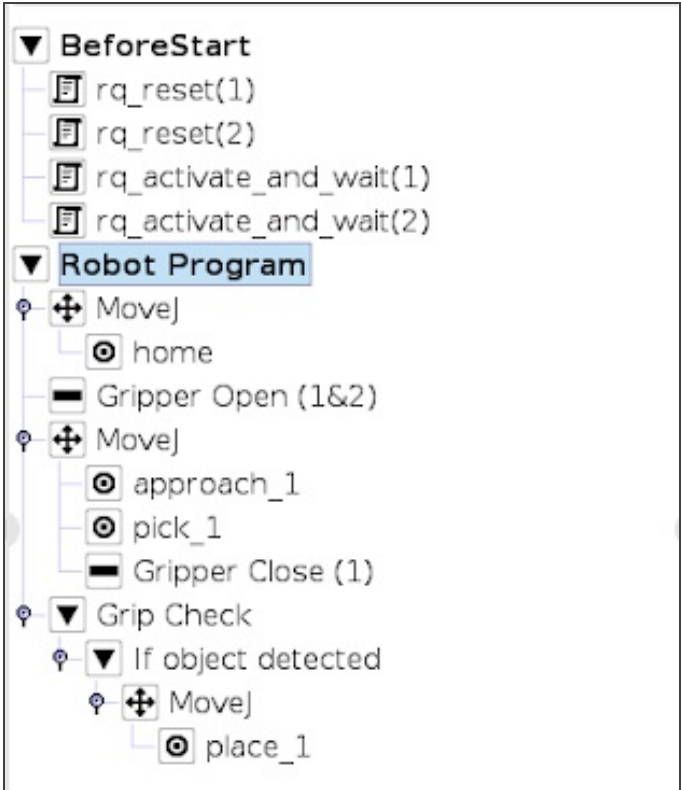
Fig. 4-36: Example of UR script commands with multiple Grippers

Key script functions for use of the Gripper with a tool changer

Name	Description
rq_reconnect_grippers(blocking, slave_ids)	The function will resume the scanning mechanism of the software, allowing communication with the available grippers. When the function returns its argument, the user can expect communication and interaction with the grippers. If the grippers are not available in the 30 seconds following the request, the function will display a timeout error. This function should always be used directly after physically reconnecting the gripper or turning on the power.
	Parameters: • blocking (default = TRUE): If True, the reconnection function will block the program's execution until it is completed. If False, the function will return the argument immediately and run in the background. This allows the user to move the robot and perform other tasks in the program while the reconnection occurs. In the robot program, a gripper interaction (open/close/other) reached before the reconnection is completed will be blocked. The robot will wait for the reconnection process to be done before pursuing with the gripper interaction. • slave_ids (default = []): If an empty list is provided, as it is by default, the function will make sure you reconnect to all the grippers that were present when the " rq_disconnect_grippers()" function was last called. If the " rq_disconnect_grippers()"

Name	Description
	function has never been called before, the software will wait until at least one gripper is available before activating it. If a specific list of slave_ids are provided, it will prompt the user to reconnect the grippers corresponding to the slave_ids. The slave id for the gripper identified as "1" in the user interface should be passed as the numeric value "9". Slave id 2, 3 and 4 can be passed directly.
rq_disconnect_grippers()	This instructs the Gripper software to disconnect from any connected gripper, but to remember which grippers were available and how to communicate with them. Also, this disables any scanning mechanism of the software until the current program is stopped or the reconnection function is called. This ensures that if a device other than a Robotiq device is being used, the software will behave as intended and will not attempt to communicate with said device, thus preventing hardware issues. This function should be used directly before physically disconnecting the grippers or turning their power off.

As mentioned in the descriptions of the script functions above, it is important to always turn on and off the power while using a tool changer. This action can be performed using the following UR script:

- *set_tool_voltage(voltage)* The voltage argument can be 0, 12 or 24. In the specific case of the Robotiq gripper, use 24 to turn the power on and 0 to turn it off.

To ensure a reliable tool change, Robotiq recommends using the following sequence in the program:

- Connection of the grippers:
    1. Physically connect the grippers
    2. Apply the required voltage using *set_tool_voltage(24)*
    3. Call the *rq_reconnect_grippers(False)* function to launch the reconnection process in the background of the program
    4. Perform the rest of the program

- Disconnection of the grippers:
    1. Call the *rq_disconnect_grippers()* function
    2. Turn off the voltage using *set_tool_voltage(0)*
    3. Physically disconnect the 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 the Robotiq 2-Finger 85 and 140 Adaptive Grippers.

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

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

5.1. Technical dimensions

5.1.1. 2-Finger 85 and 2-Finger 140 Gripper

The 2-Finger 85 and 2-Finger 140 share the same basic chassis and thus have the same technical dimensions for everything except the fingers. The figure below represents the Robotiq 2-Finger 85 Adaptive Gripper's dimensions with axis X, Y, Z and origin referenced for finger motion. Fig. 5-3 shows the equivalent with 140 mm fingers (2-Finger 140).

> **Info**
>
> All technical drawings in the present section are shown with NBR overmolded fingertip option: **AGC-TIP-MLD-85** (2-Finger 85) or **AGC-TIP-MLD-140** (2- Finger 140).
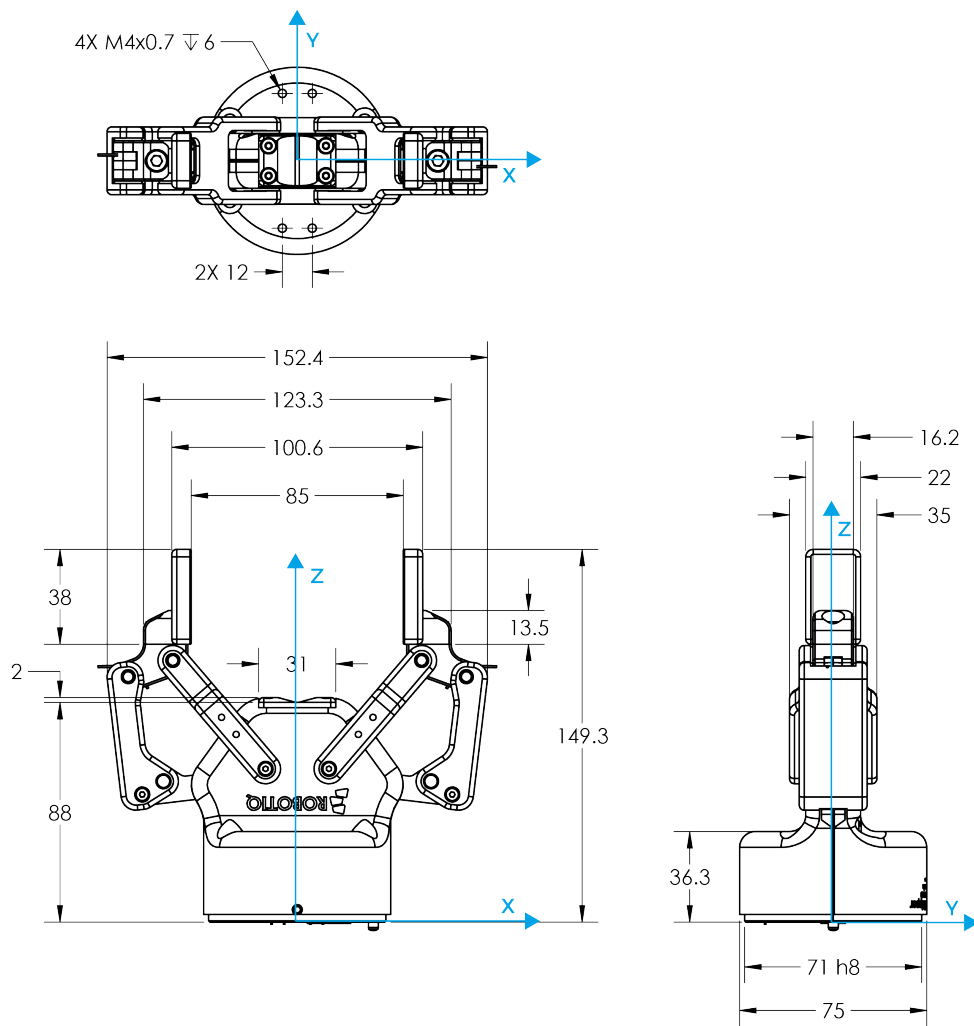
Fig. 5-1: General dimensions of 2F-85 (opened).

The height and width of the fingers vary with opening position. The figure above represents the 2F-85 Gripper in the opened position (position request = 0), while the figure below represents the 2F-85 Gripper in the closed position (position request = 255).
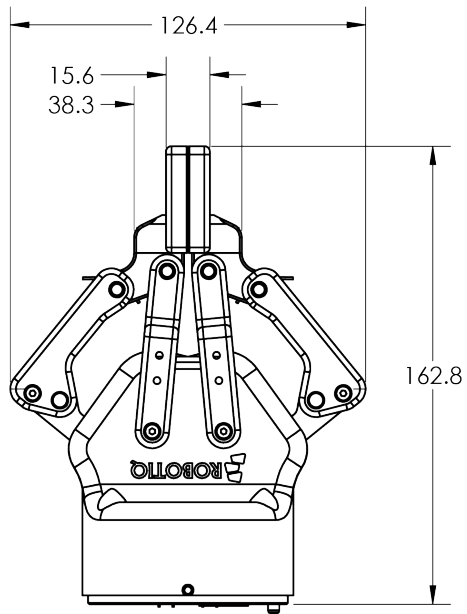
Fig. 5-2: 2F-85 dimensions (closed).
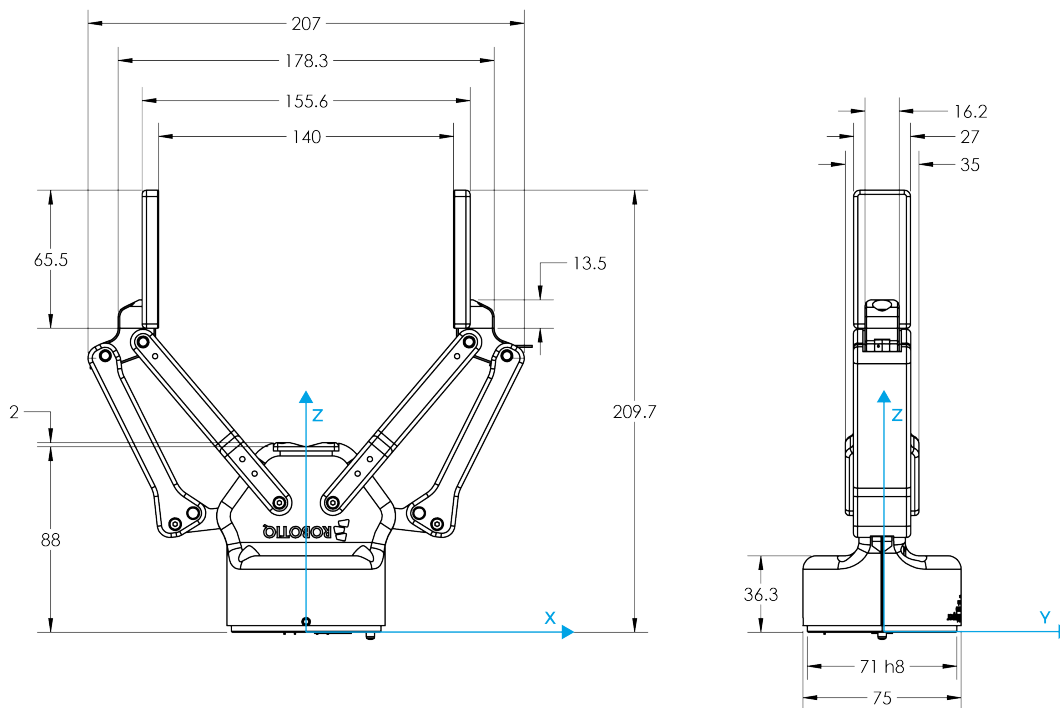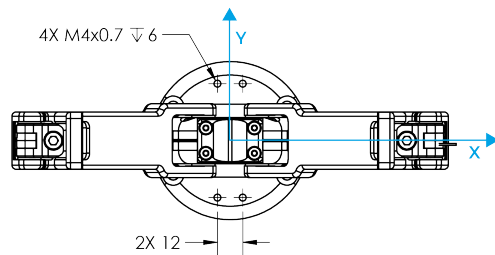
Fig. 5-3: General dimension of 2F-140 (opened).
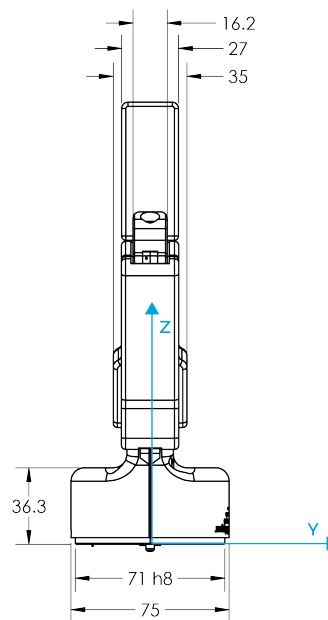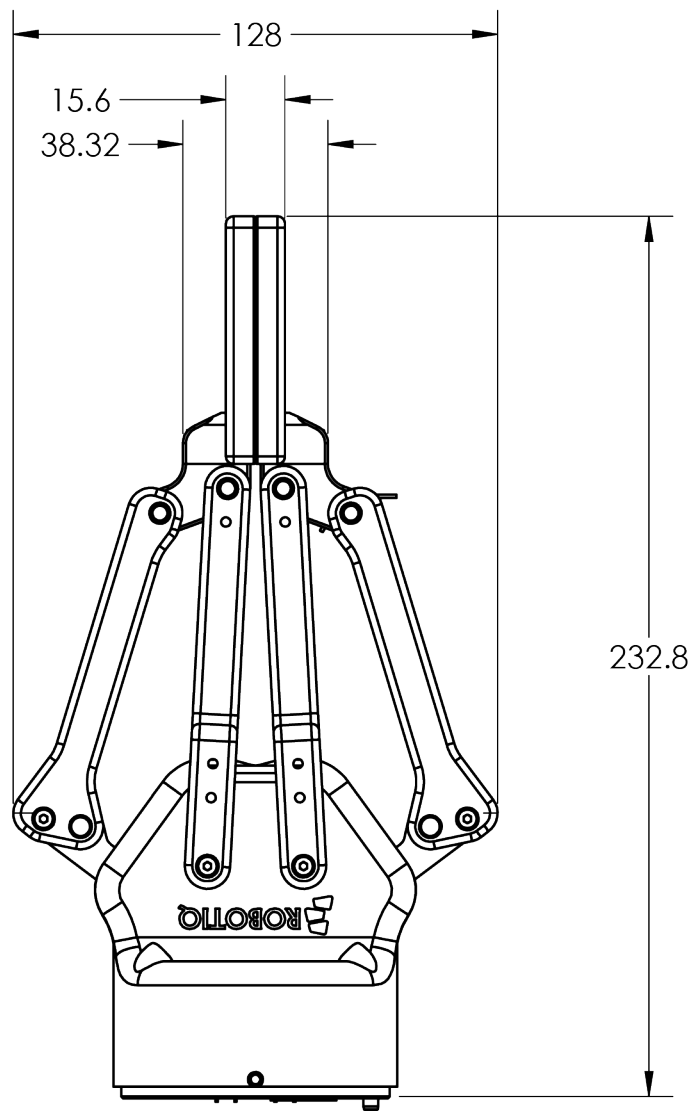
Fig. 5-4: 2F-140 dimensions (closed).

The height and width of the fingers vary with opening position. Fig. 5-3 represents the 2F-140 Gripper in the opened position (position request = 0), while Fig. 5-4 represents the 2F-140 Gripper in the closed position (position request = 255).

5.1.2. Couplings

The 2-Finger Adaptive Gripper requires a coupling provided by Robotiq to operate. The coupling is mandatory since it integrates electronics and electrical contacts.

> **Info**
>
> The coupling is common to both the 2F-85 and the 2F-140.

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

Bolt pattern for couplings **GRP-CPL-062** and **GRP-ES-CPL-062** (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
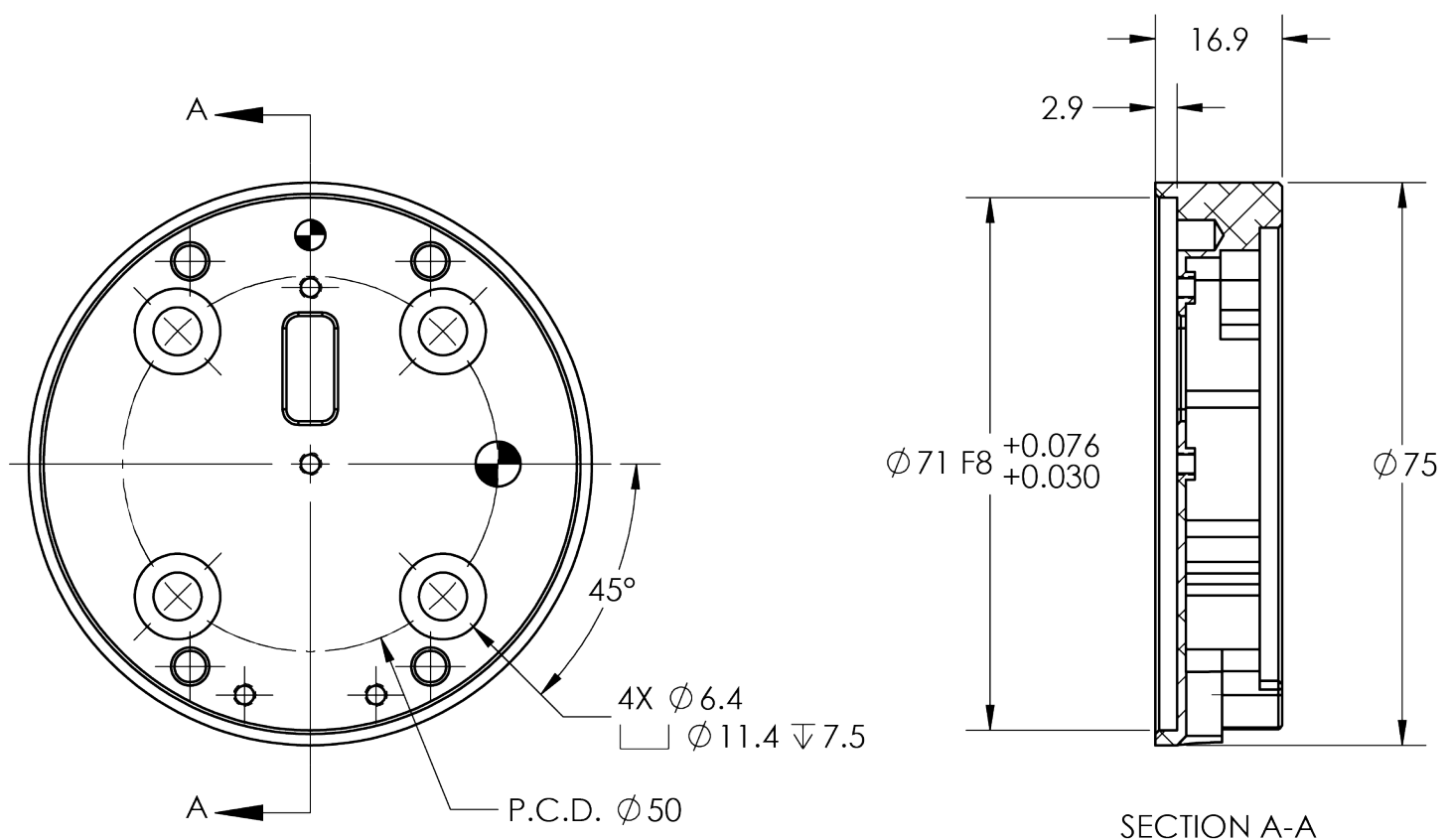
Fig. 5-5: Coupling for ISO 9409-1-50-4-M6.

5.1.3. Fingertips

The contact grip points for the Robotiq 2-Finger Adaptive Gripper are its two fingertips and palm pad.

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 distal phalanx (which acts as the fingertip holder). This part is the permanent, non customizable part of the gripper finger on which the fingertip must be mounted.

Custom fingertip designs must meet the following specifications:

- Fingertip must not exceed 100 mm in height from the fingertip's base.

- Fingertip must not exceed 100 mm in width from the fingertip's base (refer to Y axis from Fig. 5-15).

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

- Applied forces to the gripper must not exceed moment and force limits detailed in the **Moment and Force Limits** section.

Info

Both 2-Finger 85 and 2-Finger 140 use the same finger holder.
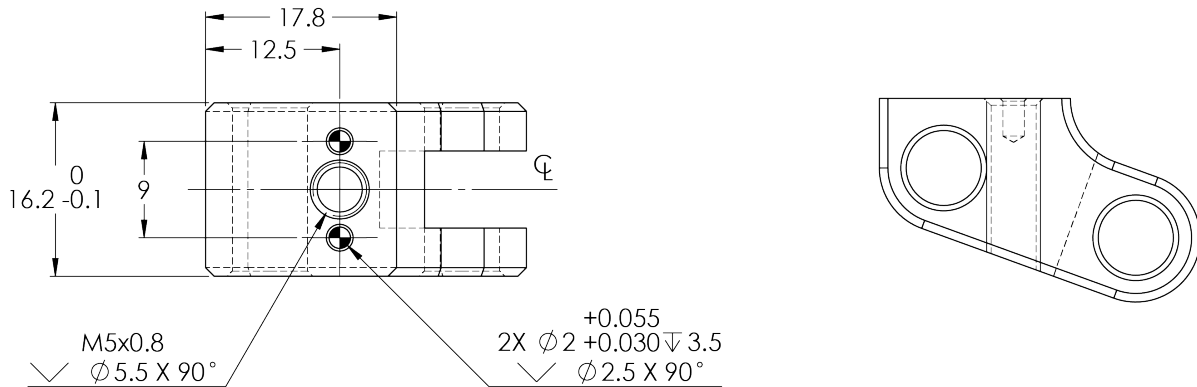
Fig. 5-6: Distal phalanx for holding standard or custom fingertips.

Tip

Custom fingertips will still be subject to the equilibrium line rule for proper actuation of the gripper, see **Object picking** section.

Flat Rubber (NBR) Overmolded Fingertip

The figure below represents a flat rubber (NBR) overmolded fingertip (**AGC-TIP-MLD-KIT-85** for 2F-85 and **AGC-TIP-MLD-KIT-140** for 2F-140). For details, see the **Spare Parts, Kits and Accessories** section.
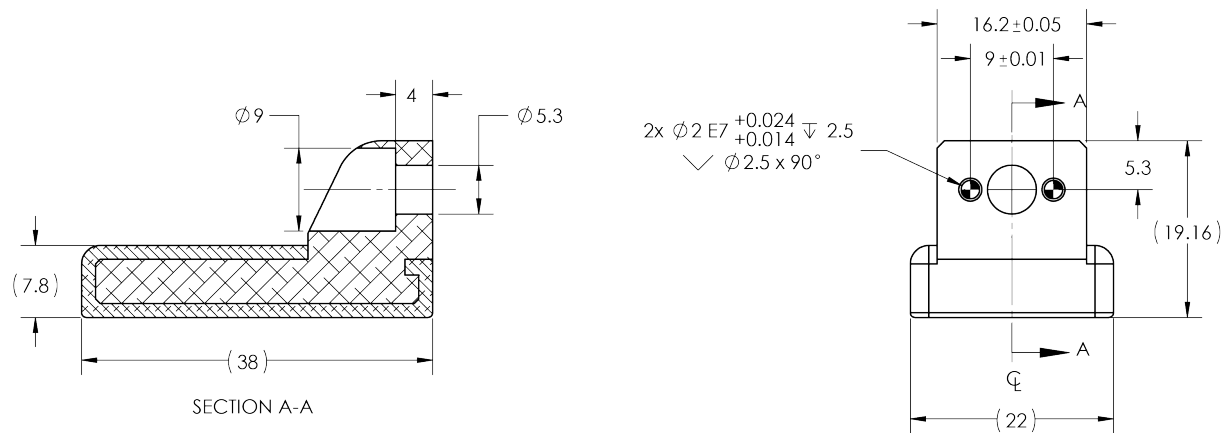
Fig. 5-7: Flat Rubber (NBR) Overmolded Fingertip for 2F-85
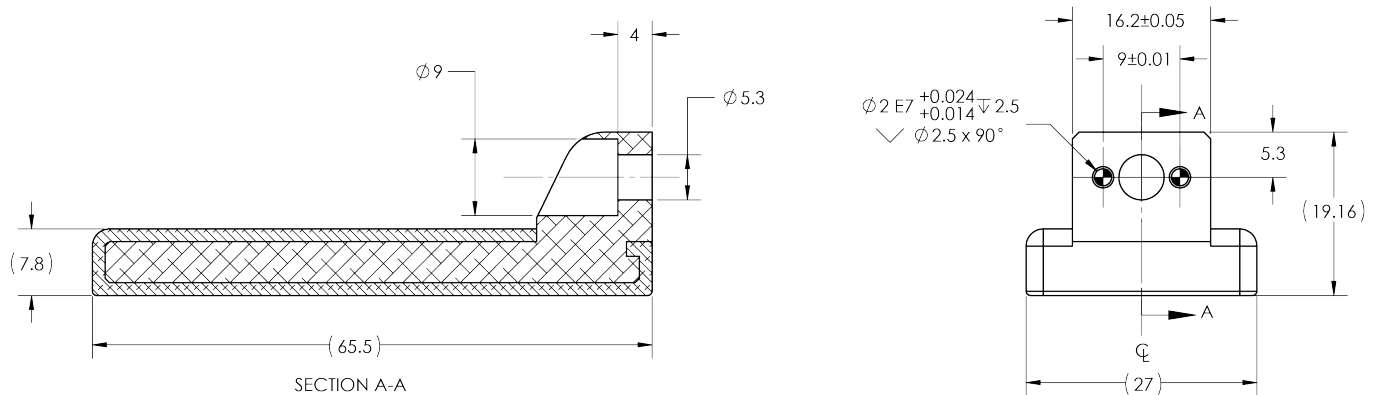
Fig. 5-8: Flat Rubber (NBR) Overmolded Fingertip for 2F-140

Grooved fingertip

The figure below represents the available grooved fingertip **AGC-TIP-205-085** (2-Finger 85) and **AGC-TIP-421-140** (2-Finger 140); please refer to the **Spare Parts, Kits and Accessories** section. This fingertip inner surface has vertical grooves, making ideal for picking cylindrical parts.

Fig. 5-9: Grooved fingertip AGC-TIP-205-085

Fig. 5-10: Grooved fingertip AGC-TIP-421-140

5.2. Mechanical specifications

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

Specification	2-FINGER 85		2-FINGER 140	
	Metric Units	Imperial Units	Metric Units	Imperial Units
Stroke	85 mm	3.35 in	140 mm	5.5 in
Minimum object diameter (for encompassing)	43 mm	1.69 in	90 mm	3.5 in
Maximum height	162.8 mm	6.4 in	232.8 mm	9.15 mm
Maximum width	148.6 mm	5.85 in	202.1 mm	8.0 in
Weight	925 g	2.04 lbs	1,025 g	2.25 lbs
Grasp Force	20 to 235 N	4.5 to 52.8 lbf	10 to 125 N	2.2 to 28.1 lbf
Finger speed	20 to 150 mm/s	0.8 to 5.9 in/s	30 to 250 mm/s	1.2 to 9.8 in/s
Position repeatability[1]	0.05 mm	0.002 in	0.08 mm	0.003 in
Force repeatability	+/- 10%			
Position resolution[2]	0.4 mm	0.016 in	0.6 mm	0.022 in
Grasp force resolution	Maximum force calculation below; refer to the **Force Control** section			

Table 5-1: Mechanical specifications of the Robotiq 2-Finger 85 and 140 Adaptive Grippers fitted with coupling GRP-CPL-062 and fingertip AGC-TIP-MLD-KIT-85 (2-Finger 85) or AGC-TIP-MLD-KIT-140 (2-finger 140)

[1]Repeatability is defined as the positional deviation resulting from the average displacement determined when picking an object with a parallel grasp using standard NBR overmolded fingertips. For more details see the blog.robotiq.com article on repeatability. Position repeatability varies depending on the product wear and operating conditions. The presented values are typical for the newly-manufactured products.

[2]Resolution is the increment modified from a 1 bit difference of position/speed/force request (from 0 to 255).

5.2.1. 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
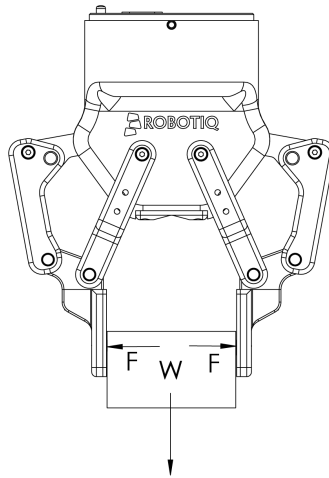
Fig. 5-11: Grasping force on 2-Finger 85 fingertips.

Info

- The Gripper is self-locking.

Info

For example, if the NBR overmolded fingertips **AGC-TIP-MLD-KIT-85** 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.

Friction grasp and form-fit grasp
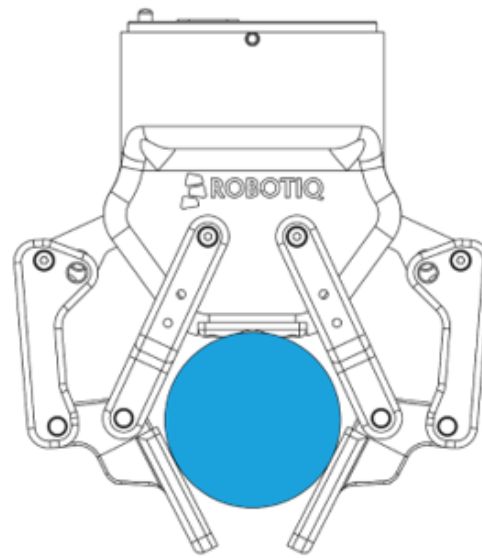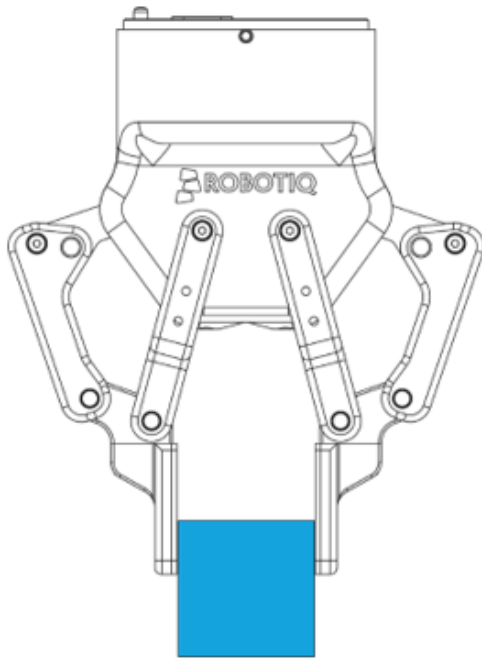
Maximum payload by grasp type

Grasp Type	2F-85	2F-140
Friction grasp	5 kg	2.5 kg
Form-fit grasp	5 kg	2.5 kg

5.2.2. Equilibrium Line

Equilibrium line position (explained in the **General Presentation** section) is detailed in the figure below, where:

- θ is the opening angle between the gripper proximal bar and center line

- D is the distance between the bottom of the fingertips and the equilibrium line as seen on the Z axis in Fig. 1-5.
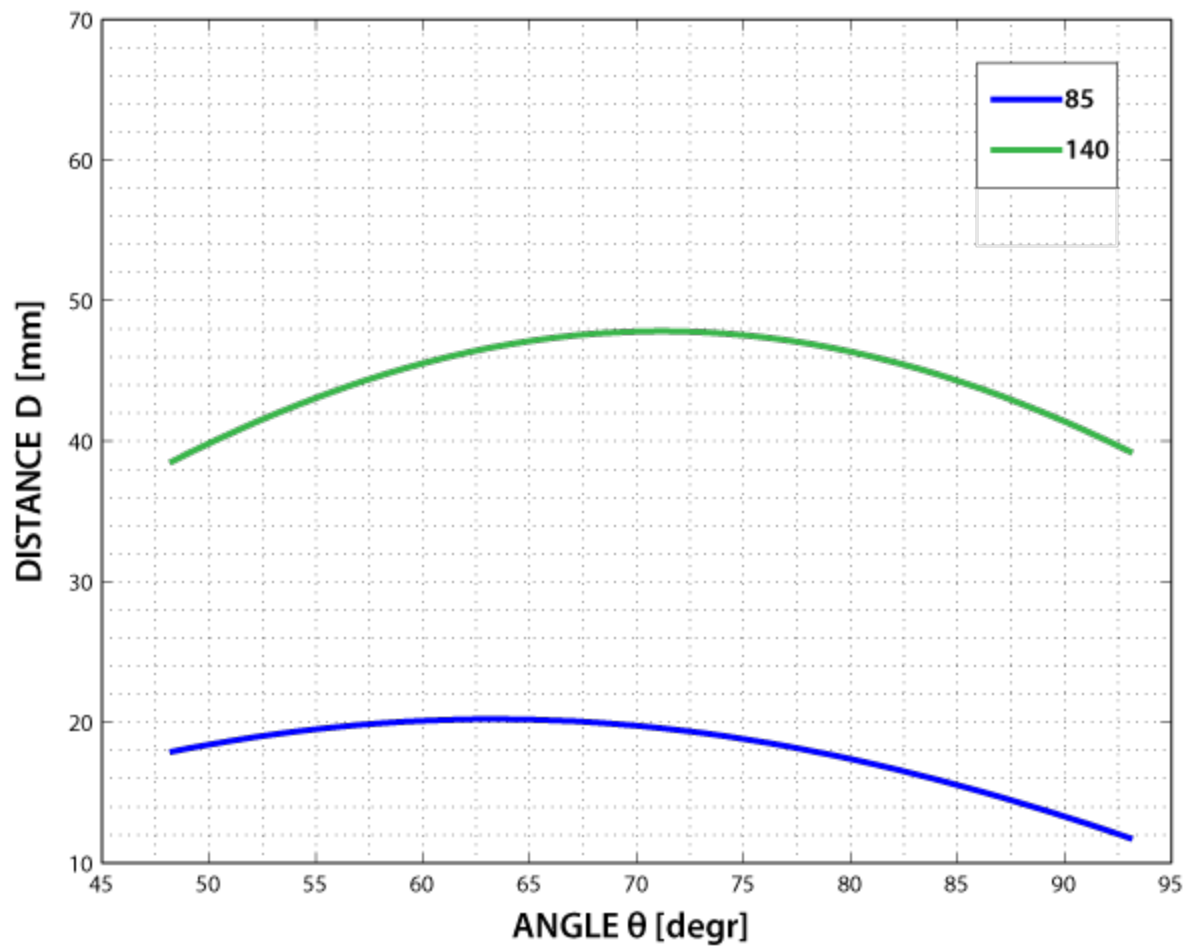
Fig. 5-12: Position of the Gripper equilibrium line according to the opening angle for 2-Finger 85 and 2-Finger 140 options.

5.2.3. Center of mass, tool center point and moment of inertia

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)
	X	Y	Z	X	Y	Z	
2F-85	0.0	0.0	60.0	0.0	0.0	174.0	921
2F-140	0.0	0.0	75.5	0.0	0.0	244.0	1013

> **Info**
>
> For TCP and center of mass of the 2F-85 or the 2F-140 used in combination with other Robotiq products, please consult the specific table provided on our support website.

> **Info**
>
> The angle to calculate the TCP for grippers mounted on a dual gripper assembly is as follows:
>
> - Rx = 0
>
> - Ry+/Ry- = 0.7854
>
> - Rz = 0

The moment of inertia are calculated for a configuration where the fingers are fully open. Here is the approximate moment of inertia matrix for the gripper:

2-FINGER 85 OPTION

$$I = \begin{bmatrix} I_{XX} & I_{XY} & I_{XZ} \\ I_{YX} & I_{YY} & I_{YZ} \\ I_{ZX} & I_{ZY} & I_{ZZ} \end{bmatrix} = \begin{bmatrix} 4180 & 0 & 0 \\ 0 & 5080 & 0 \\ 0 & 0 & 1250 \end{bmatrix} = \begin{bmatrix} 14.3 & 0 & 0 \\ 0 & 17.4 & 0 \\ 0 & 0 & 4.3 \end{bmatrix}$$
$$kg * mm^2 \qquad\qquad lb * in^2$$

2-FINGER 140 OPTION

$$I = \begin{bmatrix} I_{XX} & I_{XY} & I_{XZ} \\ I_{YX} & I_{YY} & I_{YZ} \\ I_{ZX} & I_{ZY} & I_{ZZ} \end{bmatrix} = \begin{bmatrix} 7400 & 0 & 0 \\ 0 & 9320 & 0 \\ 0 & 0 & 2260 \end{bmatrix} = \begin{bmatrix} 25.3 & 0 & 0 \\ 0 & 31.8 & 0 \\ 0 & 0 & 7.7 \end{bmatrix}$$
$$kg * mm^2 \qquad\qquad lb * in^2$$

Fig. 5-13: Inertia matrix for Robotiq 2-Finger .

5.2.4. Moment and Force Limits

The 2-Finger Adaptive 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, refer to the **Payload and force** section.

> **Warning**
>
> Always operate within range.
> Calculation of maximum moments and forces should include robot accelerations and safety factors.

Parameters	Finger Option	
	2-Finger 85	2-Finger 140
Fx, Fy, Fz	50 N	25 N
Mx*	5 Nm	5 Nm
My*	5 Nm	5 Nm
Mz	3 Nm	3 Nm

* Moments in x and y are calculated from the base of the fingertips as shown in Fig. 5-15.

Fig. 5-14: Maximum moment and force values
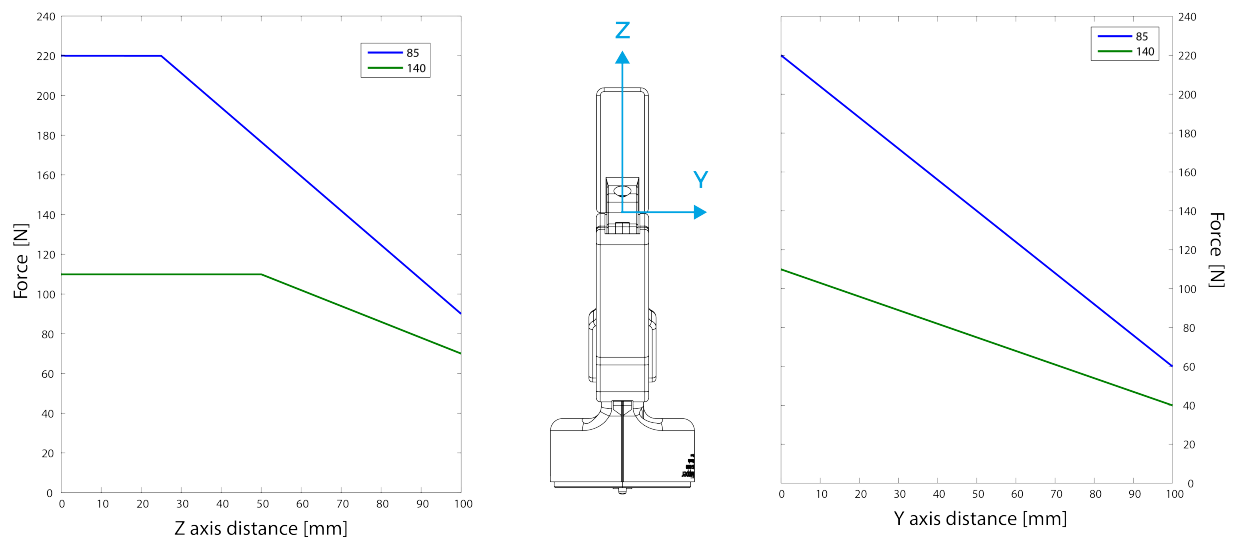
Fig. 5-15: Maximum recommended grip force in the Y and Z axis for the 2-Finger 85 and 2-Finger 140.

Usage example with listed limits :

- After picking its normal payload, the robot can use the 2-Finger 85 Gripper to apply up to 50 N of force in any direction. Applying more then 50 N can damage the gripper or result in payload loss.

- A gripper can pick up a screwdriver and apply 3 Nm of torque to screw (such moment would be applied in the Z axis).

5.3. Electrical specifications

SPECIFICATION	VALUE
Operating supply voltage	24 V DC ± 10%
Absolute maximum supply voltage	28 V DC
Quiescent power (minimum power consumption)	< 1 W
Peak current	1 A

6. Maintenance

The Adaptive Gripper requires only external maintenance with limited downtime.

Maintenance for both 2-Finger Adaptive Grippers is required after specified usage, measured in time (normal 40h week) or 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	
Fingertip Replacement[1]			X	
Overhaul[2]				X

Table 6-1: Maintenance intervals for the 2-Finger Grippers

[1]Replace fingertip before if wear is visible.

[2]Overhaul is recommended after 2M cycles and is done by Robotiq at the user's expense, please contact Robotiq support.

> **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 chemicals

- 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	• Flat head precision 2 mm screwdriver • 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.

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

> **Caution**
>
> The Robotiq 2-Finger Adaptive Gripper is not waterproof or water resistant without additional protection, only clean the gripper with a dry towel.

1 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 tooth lock washer, do not lose them.

2 Use the flat head precision screwdriver to open or close the gripper by turning the flat head screw located under the gripper, where the coupling connects (illustrated in the figure below).

    a Open or close to access the palm pad and other parts of the gripper.

3 Clean the gripper with a dry towel, remove all debris, dirt and dust from the surface of the gripper, clean all fingertips, dry thoroughly.

4 Clean the coupling with a dry towel, pay particular attention to the electrical contact.

5 Visually inspect the gripper and pay attention to any visible damage.

6 Put the gripper back on and secure it with the four (4) M5-0.8 x 25mm screws and tooth lock washers.

Flat head screwdriver slot

Bottom view without coupling
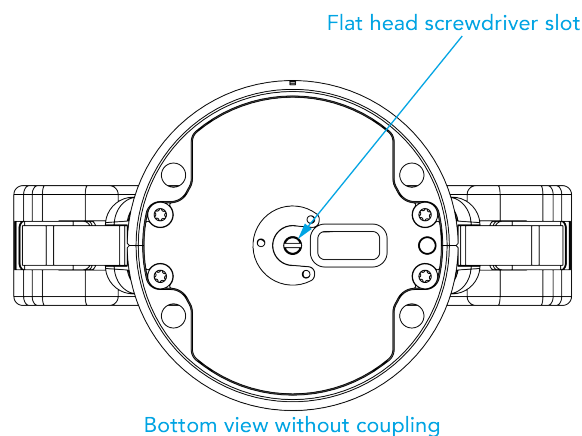
Fig. 6-1: Flat head screwdriver slot for manual opening and closing of the Gripper.

6.2. Periodic inspection

Maintenance Interval	Tools You Need	Parts You Need
Monthly	• Flat head precision 2 mm screwdriver • 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 :

    a Finger movement must be symmetric and fluid:

        i. Test the return movement by pushing fingers open, the fingers must come back to the initial starting position on its own.

        ii. Test the general movement of the fingers by turning the flat head screw under the gripper (see Fig. 6-1).

    b Fingertip wear must not affect gripping, if wear is visible and affects movement, change accordingly (refer to the **Gripper cleaning** section).

    c Check for any collision damage, if damage is visible, contact support@robotiq.com.

    d 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 respecting instructions from the **Gripper cleaning** section.

6.3. Fingertip replacement

Maintenance Interval	Tools You Need	Parts You Need
1 Million cycles or when wear is visible	• 4 mm hex key • Dry tissue or towel • Low strength thread locker	2 x Robotiq 2-Finger Adaptive Gripper fingertip (overmolded or V-grooved).

Refer to the **Spare Parts, Kits and Accessories** section to order Robotiq 2-Finger Adaptive Gripper replacement parts.

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

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

2 Remove the worn fingertip by removing the M5 screw with the 4 mm hex key; make sure not to mislay the 2 mm dowel pins.

3 Clean the fingertip holder and dry thoroughly.

4 Insert the new fingertip by inserting the dowel pins in the fingertip holder.

5 Secure the fingertip using the provided M5 screw, apply low strength threadlocker to the M5 screw threads.

6 Repeat for remaining finger.

6.4. Overhaul

Maintenance Interval	Tools You Need	Parts You Need
2 Million cycles or at warranty expiration	None	None

Gripper overhaul is necessary when the gripper reaches 2 Million cycles or when warranty expires. Overhaul is done by Robotiq, please contact Robotiq support service.

Gripper overhaul includes, but is not limited to :

- Worn parts changed
    - Power transmission gearing mechanism
    - Plain bearings
    - Ball bearings

- Quality control
    - Specification test (force, speed, position)

Overhaul takes a maximum of 5 business days after reaching Robotiq, shipping is at customer's expense.

> **Tip**
>
> Loan units are available while your gripper is under maintenance.

7. Spare Parts, Kits and Accessories

The following list is up to date at print time and is subject to change, check online for updates.

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

Item	Description	Ordering Number (2-Finger 85)	Ordering Number (2-Finger 140)
Gripper basic unit	Adaptive Gripper 2-Finger basic unit with fingers (no fingertip, no coupling)	AGC-GRP-2F85	AGC-GRP-2F140
Kit for *Universal Robots* (CB-Series)	Gripper basic unit, 10 m cable and coupling for Universal Robots with NBR overmolded fingertips	AGC-UR-KIT-002	AGC-UR-KIT-140
Kit for *Universal Robots* (e-Series)	Gripper basic unit, NBR overmolded fingertips, and cable-to-wrist coupling for Universal Robots	AGC-ES-UR-KIT-85	AGC-ES-UR-KIT-140
Controller	Optional controller for industrial communications. See Robotiq Universal Controller manual for more information.	UNI-CTR-XXXX	
Finger Kit	Finger upgrade kit for 85 or 140 mm option. Included: • 2 x Replacement finger • 2 x Hardware kit • 1 x hex key	AGC-FIN-KIT-85-V4	AGC-FIN-KIT-140-V4
Wrist connection Kit UR CB-Series	Gripper basic unit, I/O Coupling Kit for Universal Robots CB-Series	AGC-UR-KIT-85-W	AGC-UR-KIT-140-W
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	
Flat overmolded fingertip kit	• 2 x flat overmolded fingertips. • 4 x dowel pins M2 x 6 mm • 2 x M5-0.8 x 12 mm SHCS	AGC-TIP-MLD-KIT-85	AGC-TIP-MLD-KIT-140

Item	Description	Ordering Number (2-Finger 85)	Ordering Number (2-Finger 140)
Grooved fingertips	• 2 x V-grooved fingertips • 2 x M5-0.8 x 12 mm SHCS • 4 x dowel pins M2 x 6 mm	AGC-TIP-205-085	AGC-TIP-421-140
Replacement finger	• 1 x finger • 4 x screws M3-0.5 X 5 LHCS • 1 x proximal locking shaft • 1 x parallel locking shaft	AGC-FIN-085	AGC-FIN-140
Finger protector	• 2 x protector • 8 x M3 screws	AGC-PRO-KIT-V4	AGC-PRO-KIT-140
Parallel locking shaft	• 2 x parallel locking shafts • 4 x M3-0.5 x 5 mm LHCS	AGC-PARA-KIT	
Fingertip conversion Kit	• 2 x Fingertip adapters • 1 x Screw Kit	AGC-TIP-CONV-KIT	

To install the 2-Finger Gripper 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 and adapter plates listed below fit with both the 2-Finger Gripper and Hand-E.

Item	Description	Ordering Number
Blank coupling	Blank coupling for Adaptive Gripper 2-Finger, with screws for Gripper fixation and 1 m pigtail cable	GRP-CPL-BLANK
ISO-9409-1-50-4-M6 coupling (coupling-to-wrist)	ISO 9409-1-50-4-M6 coupling for 2-Finger Grippers, with screws for Gripper fixation	GRP-ES-CPL-062
ISO 9409-1-50-4-M6 coupling (coupling to controller)	ISO 9409-1-50-4-M6 coupling for 2-Finger Grippers, with screws for Gripper fixation and 1 m pigtail cable	GRP-CPL-062
ISO 9409-1-31.5-4-M5 coupling	ISO 9409-1-31.5-4-M5 coupling for Adaptive Gripper 2-Finger, 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 Gripper 2-Finger, 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 2-F Gripper 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 2-F Gripper fixation and 1 m pigtail cable	AGC-CPL-066-002
60-4Ø5-1D5 coupling	Coupling for 60 mm PCD[1] with (4) M5 thread and (1) 5mm dowel pin, with screws for 2-F Gripper 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 2-F Gripper fixation and 1 m pigtail cable	AGC-CPL-068-002
40-4M5-1D3 coupling	Coupling for 40 mm PCD[1] with (4) M5 and (1) 3mm dowel pins, with screws for 2-F Gripper 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 2-F Gripper 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 dowel pins	AGC-APL-153-002

[1]Pitch Circle Diameter

Tip

For legacy part replacement visit the documentation archives and the appropriate manual or consult your Robotiq distributor.

8. Troubleshooting

8.1. Using the LED of the 2F-Finger gripper

When using 2-Finger with a USB to RS485 serial converter, the color of the LED on your gripper 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 autorelease 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

8.2. Using the LED of the USB to RS485 converter

When your 2-Finger 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.

Fig. 8-1: 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 2-Finger Adaptive Gripper cannot be controlled with the teach pendant, follow these instructions:

1. 2-Finger Adaptive Gripper LED is not blue: see **Table 8-1: Troubleshooting Solutions Depending on Gripper LED Status**

2. 2-Finger Adaptive Gripper 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;
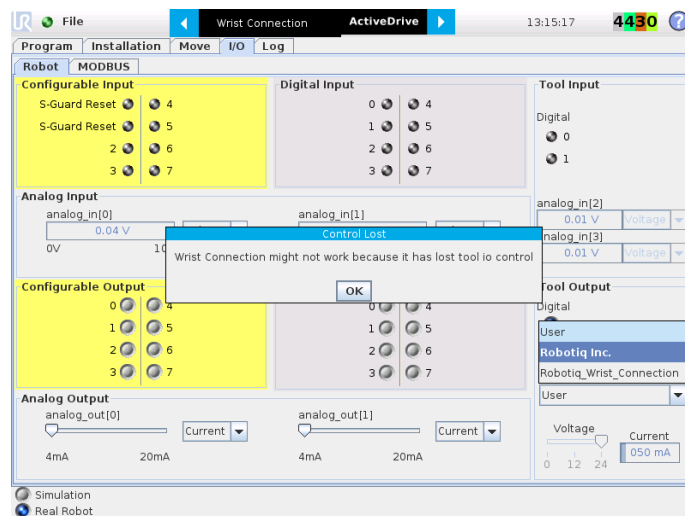

Fig. 8-2: Control Lost message when removing the USB cable

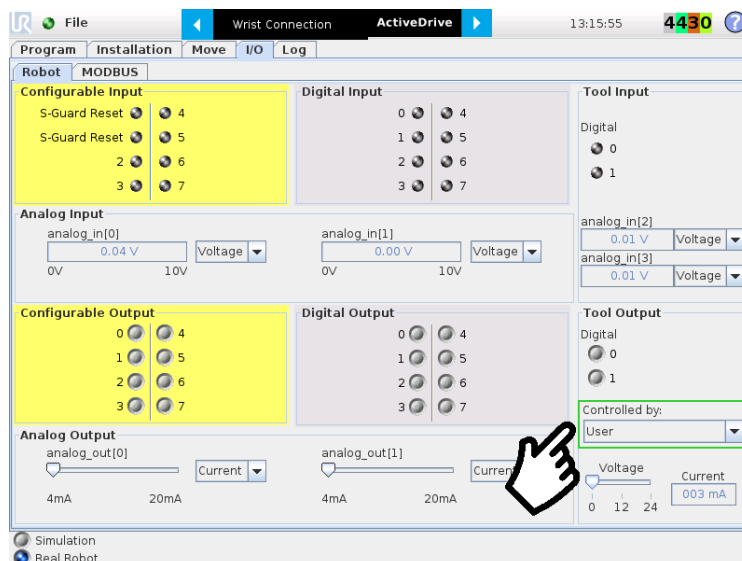**2** Select **User** in the *Controlled by* drop down menu

Fig. 8-3: : 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.
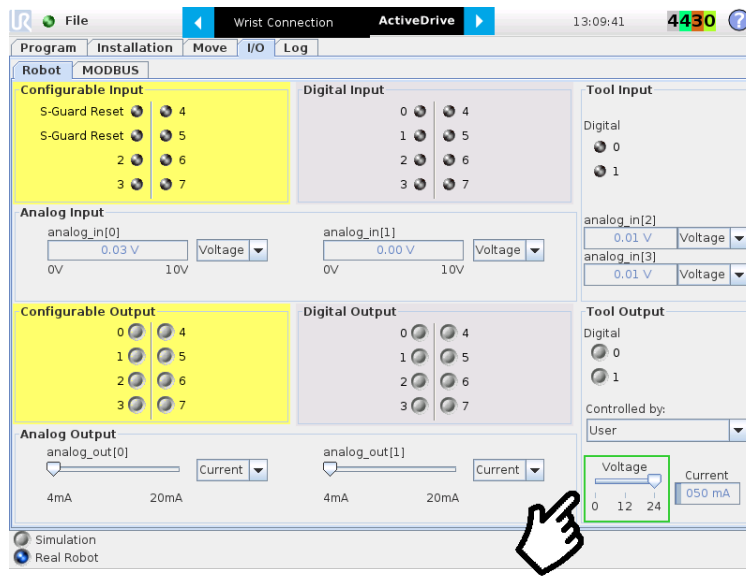

Fig. 8-4: Voltage set to 24V.

9. Warranty and Patent

Robotiq warrants the 2F-85 and 2F-140 Adaptive Robot Grippers 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.

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 **Installation** section and the following subsections.

- Until one of these condition is reached:

    - 1 year

    - 2 000 000 cycle count[1]

- Usage respects maintenance specified in the **Maintenance** section.

- Usage respects recommended payload and force specified in the **Payload and force** 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 2-Finger Adaptive Gripper and can been seen on the teach pendant when using Universal Robots or with the Robotiq User Interface.

During the warranty period, Robotiq will repair or replace any defective 2-Finger Adaptive Robot Gripper, 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 palm pads 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 (if present)
>
> - 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 Robotiq 2-Finger Adaptive Robot Gripper, nor shall Robotiq be responsible for any failure in the performance of other items to which the 2-Finger Adaptive Robot Gripper 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.

Exclusions

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the Gripper or other factors beyond Robotiq's control. It also excludes all consumable parts, such as fingertips and their normal wear.

Robotiq reserves the right to make changes in the design or construction of any of its products at any time without incurring any obligation to make any changes whatsoever on units already purchased.

Patent

This product incorporates technology developed by Lionel Birglen, professor at Polytechnique Montreal, and is used under license of Polyvalor LP.

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 325
Lévis, Québec, Canada, G7A 2N1

Hereby declare that the following product:

Robotiq 2-Finger Adaptive Gripper – 85 / 140
Identified C-3001 and over

Meets the applicable basic requirements of the **Machinery Directive 2006/42/EC**

The incomplete machine may not be put into operation until conformity of the machine into which the incomplete machine is to be installed with the provisions of the Machinery Directive is confirmed. Compliance with all essential requirements of Machinery Directive relies on the specific robot application and overall risk assessment.

The manufacturer agrees to forward on demand of national 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:

     2004/108/EC   Electromagnetic Compatibility Directive (EMC)

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

Person responsible for documentation: Mr. Étienne Samson, address: see manufacturer address

Lévis, September 2015
(place and date of emission)

Jean-Philippe Jobin
Chief Technical Officer
Robotiq Inc.

10.2. Applied standards

This section describes all applied harmonized standards for the design and production of the Robotiq 2-Finger Adaptive 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 14539	2000	Manipulating industrial robots — Object handling with grasp-type grippers — Vocabulary and presentation of characteristics
NF EN ISO 12100	2010	Safety of machinery — General principles for design — Risk assessment and risk reduction
NF EN IEC 60204-1	2006	Safety of machinery — Electrical equipment of machines — Part 1: General requirements

10. 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.

IMPORTANT-READ CAREFULLY: This End-User License Agreement (the "Agreement") is a legal agreement between you and the Licensor (as this term is hereinafter defined), the licensor of the Software. This Agreement covers the Software. The Software includes any "on-line" or electronic documentation and all modifications and upgrades related thereto. By installing, or otherwise using the Software, you agree to be bound by the terms of this Agreement. If you do not agree to the terms of this Agreement, the Licensor cannot and does not license the Software to you. In such event, you must not use or install the Software.

1. Definition.

    1. "UR" means Universal Robots A/S, a corporation incorporated under the laws of Denmark, having its registered office at Energivej 25, DK-5260 Odense S, which specializes into the conception, advanced manufacturing and sale of robotic products (the "UR's Business");

    2. "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;

    3. "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");

    4. "End-User" means a customer authorized pursuant to this Agreement to install or use the Software in order to make a specific product from the Licensor's Products compatible and functional with a specific product of the UR's Product;

    5. "Licensor's Products" means those products developed by the Licensor in the course of the Licensor's Business;

    6. "UR's Products" means those products developed by UR in the course of the UR's Business;

    7. "Licensor's Authorized Representatives" means and includes the Licensor and Licensor's authorized vendors, resellers, distributors and licensors;

    8. "Purchase Agreement" means an agreement between the End-User and the Licensor pursuant to which the End-User purchased one or more of the Licensor's Products.

2. License. Subject to the terms and conditions hereof, the Licensor grants to the End-User a personal, temporary, non-exclusive, non-assignable and non-transferable and revocable license to use the Software in accordance with the terms and conditions hereof.

3. Software and Documentation. The Licensor may provide, if applicable, all documentation containing the detailed specifications for operation and use of the Software, which Software shall be used in accordance with such documentation. This documentation, if applicable, will be provided, wholly or in part, within (i) this Agreement, (ii) the Licensor's Web site http://robotiq.com/ (iii) the Licensor's Products and the Purchase Agreement therewith, or (iv) any other agreement, document, support, whatsoever decided by the Licensor.

    The use of the Software requires the Licensor's Products, UR's Products, compatible systems and certain software (which may require some expenses), may require periodical updating and may be affected by such elements. Most equipment will be compatible with the Software. However, the Software may not function on certain types of equipment.

4. Modifications and Upgrades. The Licensor shall be under no obligation to provide any upgrade or modification to the Software. However, the End-User shall be entitled to receive free of charge all modifications and upgrades of the Software provided by the Licensor if, at such time, the End-User is not in default in respect of any of its obligation contained herein. Such modifications and upgrades of the Software shall be installed by the End-User itself by consulting the Licensor's Website http://robotiq.com/ where a link to proceed to such installation will be made available thereof. A new version of the Software shall not be covered by this Section 4 but shall require that a new End-User Software License Agreement be entered into between the Licensor and the End-User.

5. Fees. The grant by Licensor to the End-User of the present license shall be free to the extent that the End-User agrees and complies to the term and conditions herein at all time.

6. Maintenance. During the term of this Agreement, the Licensor will maintain the Software in an operable condition and will make available any corrections and improvements as are generally incorporated in the Software by the Licensor without additional charge to the End-User. The Licensor may temporarily and without notice suspend or limit access to the Software if necessary or desirable in order to maintain, restore, modify or repair any part of the Software or for any reason related to business. During such works, the Software will not be available but the Licensor undertakes to deploy its best efforts to perform such works at appropriate times and to limit any inconvenience arising therefrom.

7. Title to Software. The licensed Software is composed of confidential data and trade secrets and is proprietary to and constitutes trade secret information and intellectual property of the Licensor. Title and ownership rights to the Software, including the intellectual property rights related thereto, shall remain with the Licensor. The End-User agrees to maintain the confidential nature of the Software and related materials provided for the End-User's own internal use under this Agreement. The license granted herein does not include the right to sublicense to others, and may not be assigned to others, in whole or in part, without the prior written consent of the Licensor. The End-User may not or allow others to modify or prepare directive works, copy (except for normal backups for recovery purposes), reproduce, republish, reverse engineer, upload, post, transmit, or distribute, in any manner, the Software.

8. Restricted Use. The Software shall be used solely and exclusively by the End-User and its employees for the purpose mentioned in Sub-section 1.4 hereof. Any other use of the Software, including resell derivative modifications or extensions, is expressly prohibited.

9. Exclusion of Warranty on Software. The End-User expressly acknowledges and agrees that use of the Software is at the End-User sole risk. The Software is provided " AS IS" and without warranty of any kind. THE LICENSOR AND THE LICENSOR'S AUTHORIZED REPRESEN-TATIVES DO NOT WARRANT THAT Software WILL BE FREE OF ERRORS AND YOU ACKNOWLEDGE THAT THE EXISTENCE OF ANY SUCH ERRORS DOES NOT CONSTITUTE A BREACH OF THIS AGREEMENT. TO THE EXTENT PERMITTED BY LAW LICENSOR AND LICENSOR'S AUTHORIZED REPRESEN-TATIVES EXPRESSLY DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING , BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTA-BILITY AND FITNESS FOR A PARTICULAR PURPOSE UNLESS OTHERWISE STATED HEREIN. LICENSOR AND LICENSOR'S AUTHORIZED REPRESENTATIVES DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE Software WILL MEET THE END-USER REQUIREMENTS OR THAT THE OPERATION OF THE Software WILL BE CORRECT. FURTHERMORE, LICENSOR AND LICENSOR'S AUTHORIZED REPRESEN-TATIVES DO NOT WARRANT OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE Software IN TERMS OF ITS CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. NO ORAL OR WRITTEN INFORMATION OR ADVICE GIVEN BY LICENSOR AND LICENSOR'S AUTHORIZED REPRESENTATIVE SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THIS WARRANTY. SHOULD THE Software PROVE DEFECTIVE IN YOUR TECHNOLOGY ENVIRONMENT, YOU ASSUME THE ENTIRE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION TO YOUR OWN TECHNOLOGY ENVIRONMENT.

10. Limitation of liability. TO THE MAXIMUM EXTENT PERMITTED BY LAW, LICENSOR AND LICENSOR'S AUTHORIZED REPRESENTATIVES SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY OR ANY OTHER LEGAL THEORY RELATED TO THE Software. SUCH DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF PROFITS, LOSS OF REVENUE, LOSS OF DATA, LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT, DOWN TIME AND USER'S TIME, EVEN IF THE LICENSOR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN ANY CASE, LICENSOR ENTIRE LIABILITY UNDER ANY PROVISION OF THIS AGREEMENT SHALL BE LIMITED TO THE AMOUNT ACTUALLY PAID IN RESPECT OF THE LICENSOR'S PRODUCTS PURCHASED BY THE END-USER PURSUANT TO A PURCHASE AGREEMENT.

11. Training, Maintenance and Support There is no entitlement to training, maintenance and support under this license unless otherwise specified in the Purchase Agreement or any other written agreement between the End-User and the Licensor. The

End-User may provide the Licensor with details regarding any bug, defect or failure in the Software promptly and with no delay from such event; the End-User shall comply with the Licensor's request for information regarding bugs, defects or failures and furnish him with information, screenshots and try to reproduce such bugs, defects or failures upon Licensor's demand.

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.

    1. 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.

    2. 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.

    3. 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.

    4. 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.

    5. 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.

    6. 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.

    7. Any rights not expressly granted herein are reserved.

    8. 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.

11. Contact

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