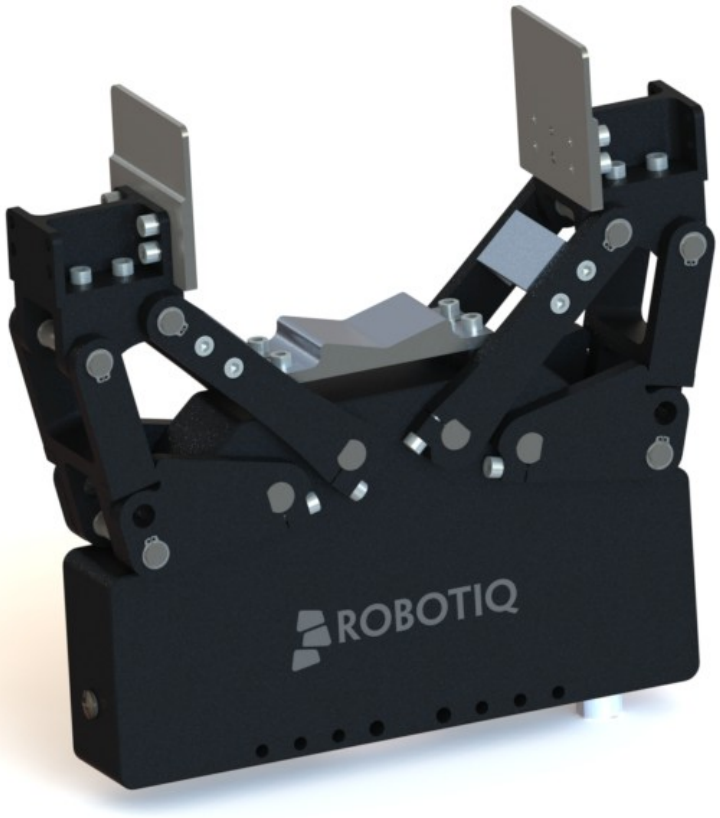
Robotiq 2-Finger Adaptive Robot Gripper - 200 Instruction Manual



ROBOTIQ

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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: http://support.robotiq.com/.

Revision 2013/06/03
Initial release (some technical specifications still under evaluation).

1. General Presentation

The terms "Gripper", "Adaptive Gripper", "Robotiq Gripper", "Robotiq Adaptive Gripper", "B-Model", "2-Finger Gripper" and "2-Finger – 200" used in the following manual all refer to the **Robotiq 2-Finger Adaptive Robot Gripper – 200**.

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

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

The 2-Finger Adaptive Robot Gripper – 200 is an electric robot peripheral that is designed for industrial applications, featuring high grip force, rugged design and sealed casing. Its design makes it a unique robotic end-of-arm tool to quickly pick, place and handle a large range of parts of varying sizes and shapes.

The Gripper has two articulated fingers that each have two joints (two phalanxes per finger), as shown in Figure 1.1. The Gripper can engage up to six contact points with an object (two on each of the phalanges and on the palm). The fingers are underactuated, 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 grip and it also simplifies the control of the Gripper.

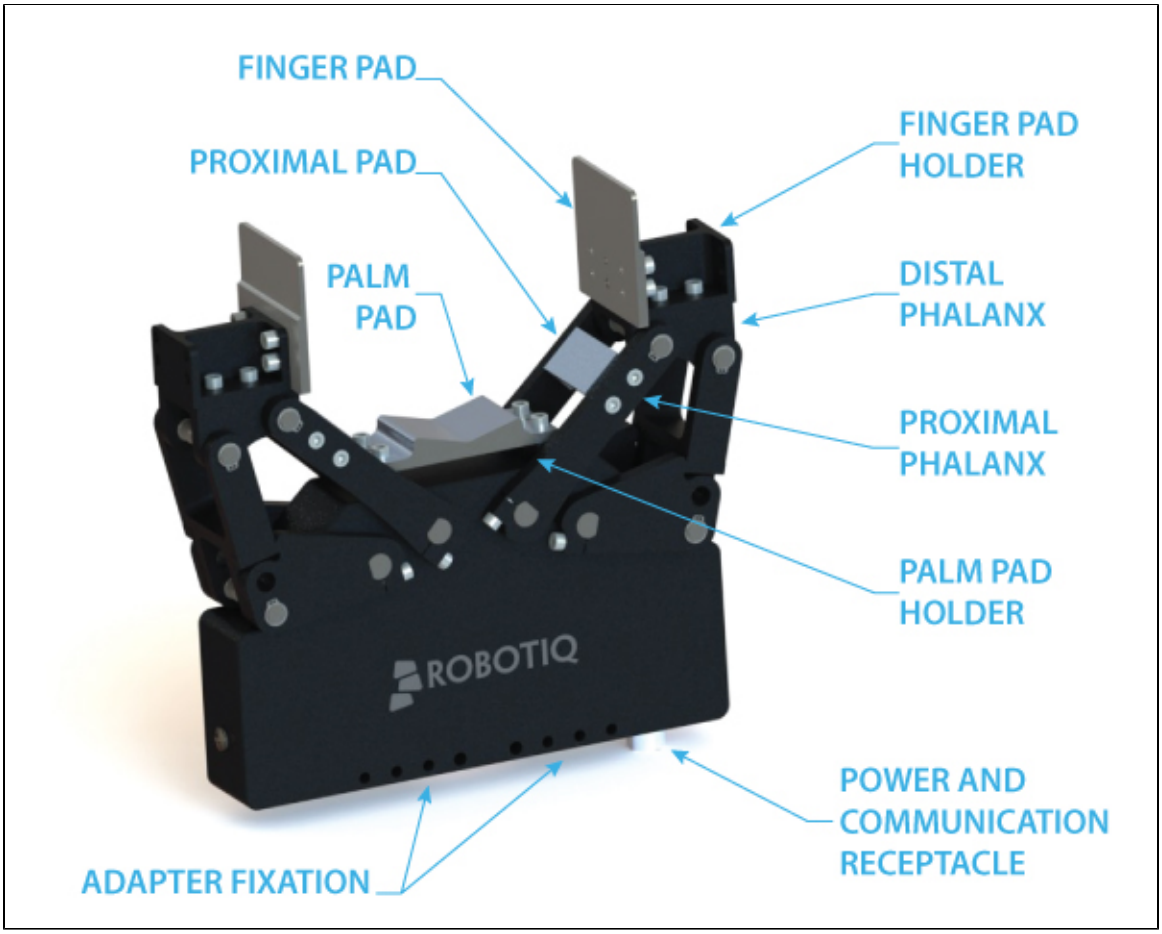


Figure 1.1 : The 2-Finger Adaptive Robot Gripper – 200.

Each of the Gripper features present on Figure 1.1 are detailed :

- Finger movement is detailed in section 6.5 Finger Movement.
- Standard pads and custom design guidelines are in section 6.4 Pad design and customization.
- Adapter mechanical connection and custom design guidelines are in sections 3.3 Mechanical connection and 3.3.2 Dimension for custom Adapter.
- Details on the power wiring and communication wiring can be found in section 3.5 Wiring and its subsections.

The 2-Finger Gripper has a single electric actuator for opening and closing the fingers, the fingers automatically adapt to the shape of the object manipulated. Fingers will adopt either a parallel grip or encompassing grip as shown in figure 1.2.

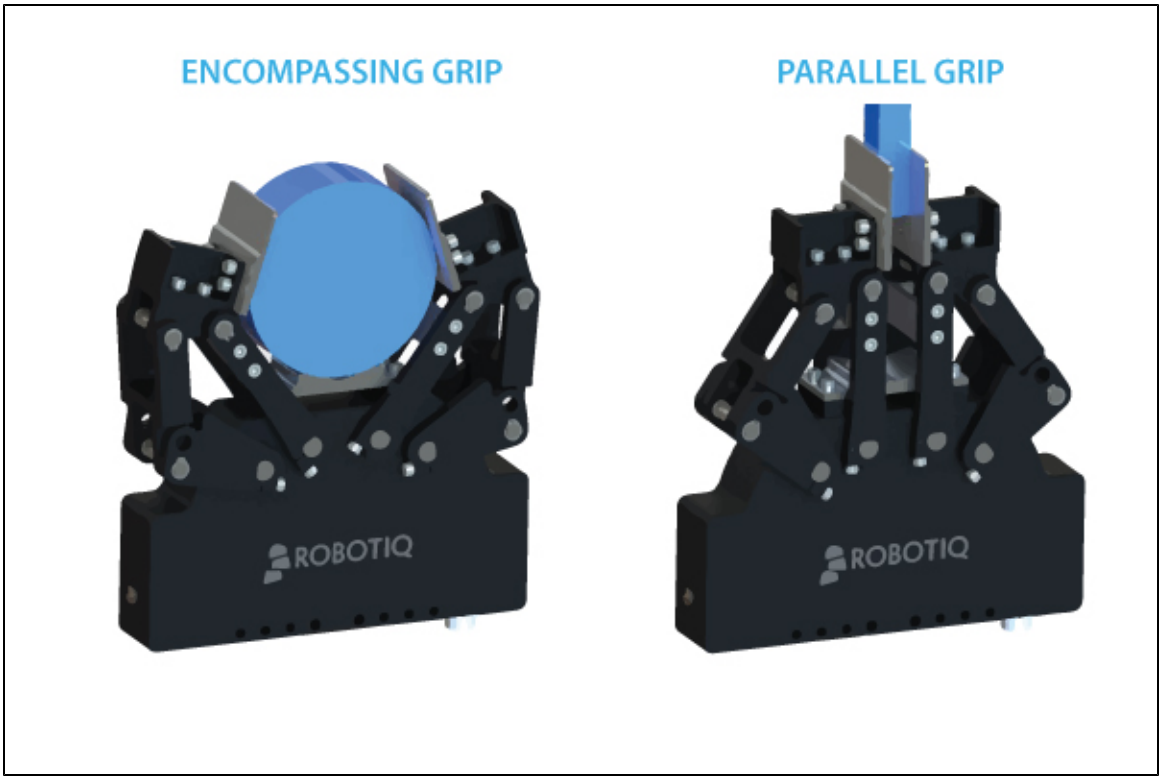


Figure 1.2 : The 2-Finger Adaptive Robot Gripper – 200 encompassing and parallel grip.

Note

It is important to note that a parallel grip can only be performed when the fingers touch the object with 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 before performing an encompassing grip.

Info

Closing or opening is done via "Go to requested position" command and is input to the Gripper. **Whether the fingers close to produce an encompassing or fingertip grip is decided at the Gripper level automatically**. It will depend on:

- The part's geometry;
- The relative position of the part with respect to the Gripper.

In other words, picking the same part could result in either an encompassing or fingertip grip based on a part's position and geometry.

The 2-Finger Adaptive Robot Gripper – 200 encompassing mechanism can also be locked allowing only parallel movement of the fingertips, the Gripper then acts as a classic parallel claw. Locking the parallel movement mechanism only requires a 12 mm axle (see Spare Parts) to be inserted on each finger in the appropriate hole, see section 3.3.1 for details and Figure 1.3 for location of locking hole.

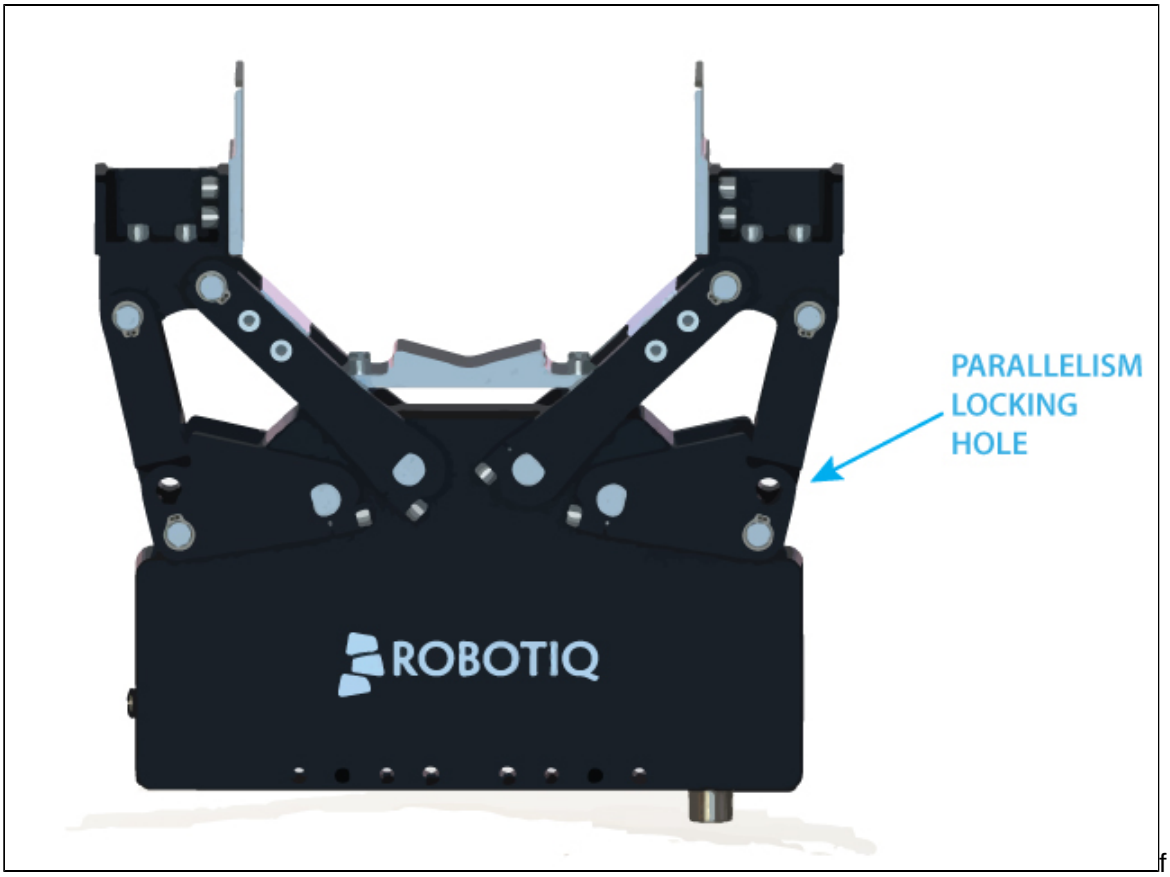


Figure 1.3 : The 2-Finger Adaptive Robot Gripper – 200 parallel locking mechanism.

The 2-Finger Adaptive Robot Gripper – 200 also offers internal and external gripping. The fingers can pick hollow parts by applying pressure with the outside of the fingers. See Figure 1.4 for representation and see section 4.6 for details on the possible position commands for your Gripper.

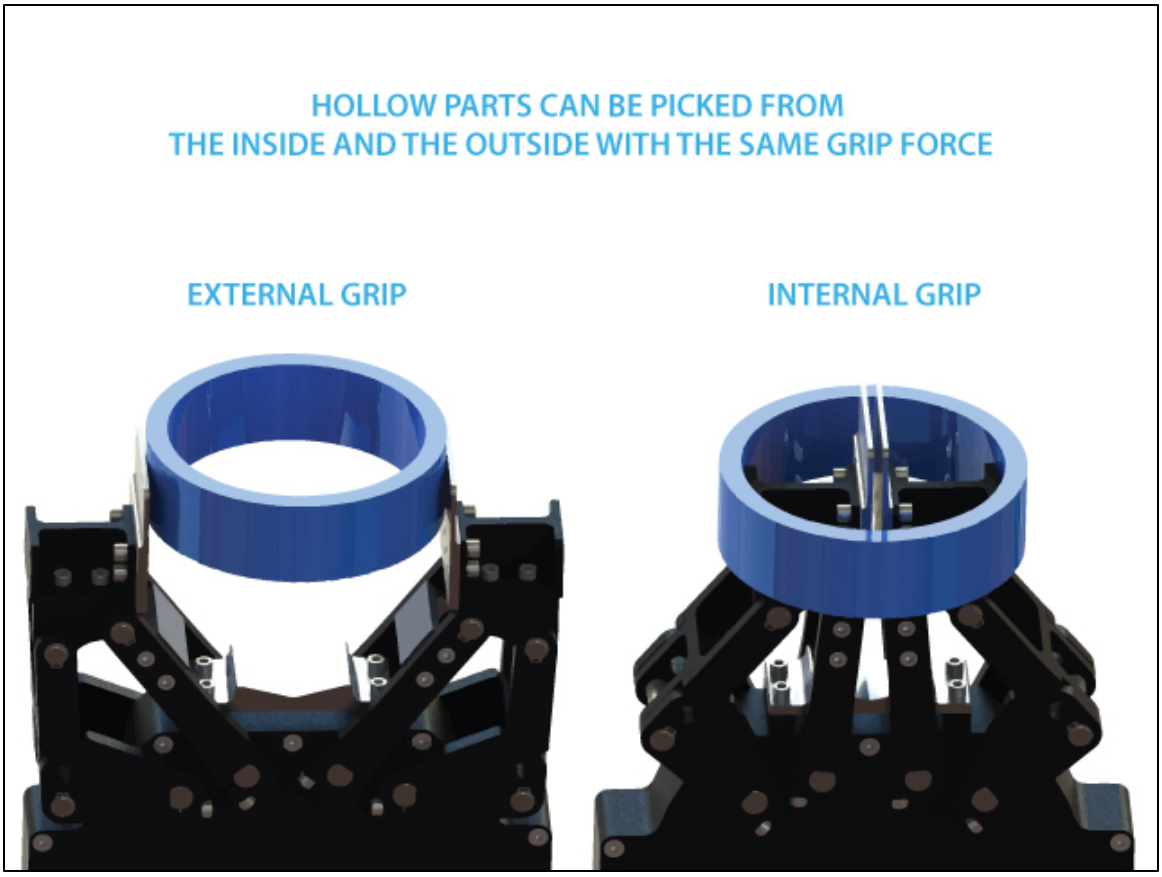


Figure 1.4 : The 2-Finger Adaptive Robot Gripper – 200 external and internal gripping.

Note

The Gripper actuator provides the same force with the inside or the outside of the fingers, but beware that surface contact may not be the same.

The Gripper is powered and controlled via the Robotiq Controller (2-Finger Adaptive Robot Gripper – 200 Controller, Figure 1.5). Upon delivery your controller will be set with the adequate communication option and ready to use. The details on the controller wiring and usage are described in section 3 and section 4.

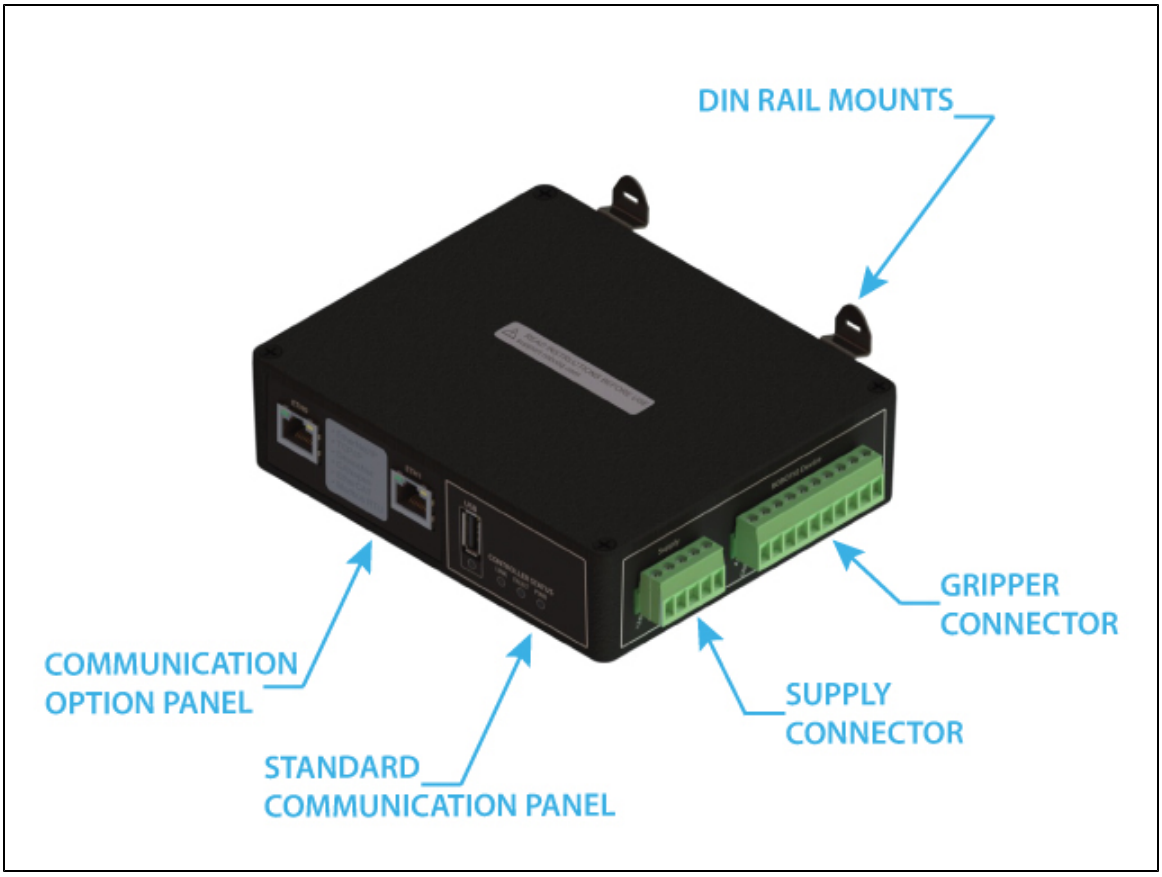


Figure 1.5 : The 2-Finger Adaptive Robot Gripper – 200 Controller.

The Robotiq 2-Finger – 200 Gripper equilibrium region is the gripping region that separates the encompassing grip from the parallel grip. When gripping an object close enough to the inside (palm) of the Gripper, the encompassing grip will occur (unless the object size or shape is not adequate) and the fingers will close around the object. If gripped above the equilibrium zone, the same object will be picked up in a parallel grip and the fingers will close with a parallel motion.

The following Figure 1.6 shows the **encompassing grip region**, the **equilibrium zone**, and the **parallel grip region** on the 2-Finger – 200 Gripper finger pad :

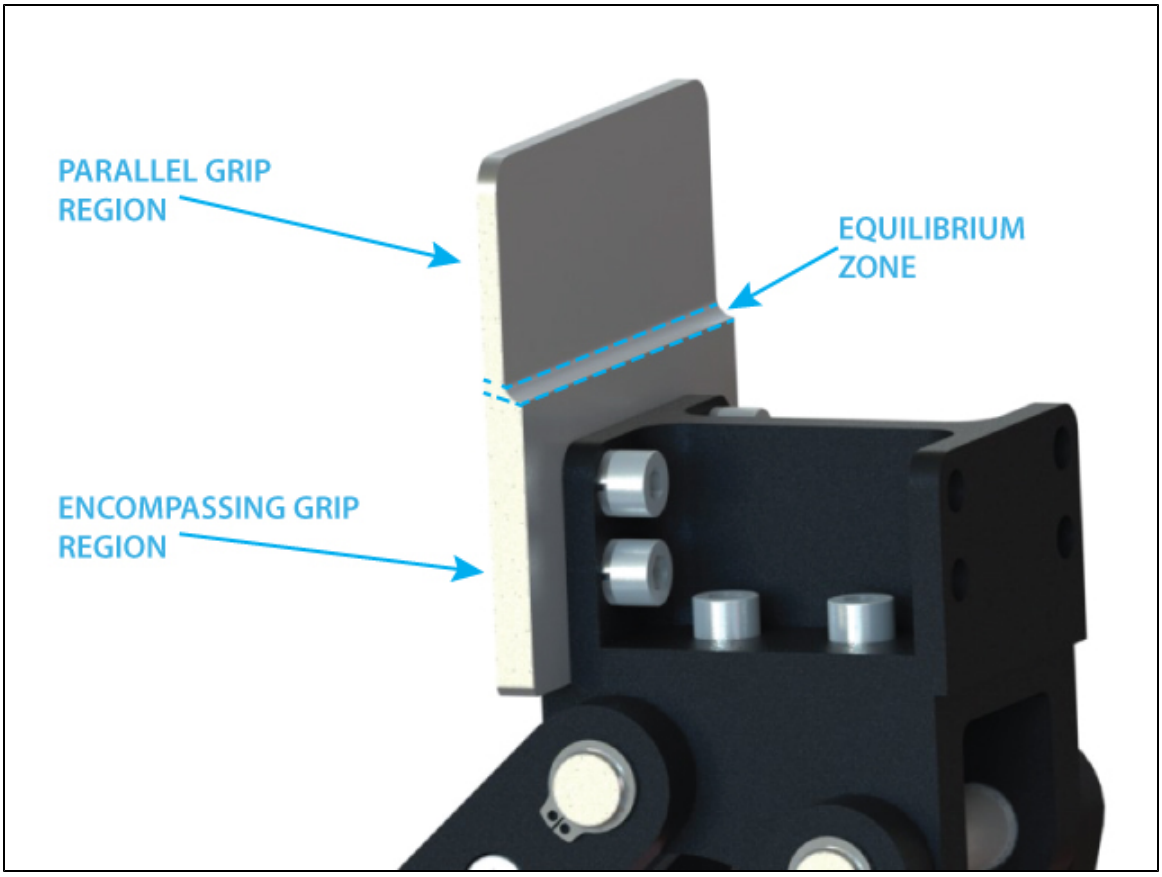


Figure 1.6 : Equilibrium zone for the Gripper finger pad.

Info

The same principles apply for an inside grip, but the encompassing grip region becomes the parallel grip region and vice-versa.

Info

The equilibrium zone will remain the same even with custom made fingers.

Hint

Picking an object directly in the desired region is a good way of predicting the grip mode that will occur, when contact is on the equilibrium zone, small variations in the size of the part and the position of the Gripper will result in different gripping modes.

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 – 200.

The term "operator" refers to anyone responsible for any of the following operations on the 2-Finger Adaptive Robot Gripper – 200 :

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

This documentation explains the various components of the 2-Finger – 200 and general operations regarding the whole lifecycle of the product from installation to operation and decommissioning.

The drawings and photos in this documentation are representative examples and differences may exist between them and the delivered product.

2.1 Warning

Note

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

Warning

Concerning installation and operation :

- The Gripper needs to be properly secured before operating the robot.
- Always disconnect power supply when handling the Gripper.
- Do not install or operate a Gripper that is damaged or lacking parts.
- Never supply the Gripper with an alternative current source.
- Always respect the recommended keying for electrical connections.
- Always respect the Gripper payload.
- Set the Gripper pinch force and speed accordingly, based on your application.

Warning

Never interfere with the Gripper when operating or powered :

- Never move by hand any parts handled by the Gripper as long as the power supply is connected.
- Never grasp onto uncovered mechanisms.
- Never grasp between fingers.
- Keep fingers and clothes away from the Gripper while the power is on.
- Do not use the Gripper on people or animals.
- Be sure no one is in the robot or Gripper path before initializing the robot's routine.
- Gripper has a passive self-locking mechanism, even when the power supply is disconnected, but there is a risk of objects slipping out of the Gripper, therefore precautions must be taken to prevent any possible injury from falling objects.

Warning

Concerning use on robot :

- Make sure all cord sets are always secured at both ends, at the Gripper and at the robot.
- Always handle the Gripper outside the robot danger zone for maintenance and inspection work or ensure complete shutdown of the robot.
- For welding applications, make sure there are no Gripper parts on the ground path of the welding power source.
- There is a risk of an object being dropped or catapulted by the Gripper during use with a robot, precautions must be taken to prevent any possible injury.

2.2 Intended use

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

> **Caution**
>
> The Gripper is NOT intended for applying force against objects or surfaces.

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

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

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

3. Installation

Warning

Be sure to read and understand the safety instructions related to the 2-Finger Adaptive Robot Gripper - 200 prior to installation.

Warning

Do not operate the Gripper, or even turn on the power supply, before it is firmly anchored and danger zone is cleared. The Gripper's fingers may move and cause injury or damage.

Note

Unless specified, every fixture, replacement parts, adapter, options, etc. in the following manual use ISO 4762 / DIN 912 Socket Head Cap Screws.

3.1 Scope of delivery

Standard upon delivery :

- Robotiq 2-Finger Adaptive Robot Gripper – 200 unit (**AGB-GRP-001**)
  - Default fingertip (see Technical dimensions)

Mandatory but not standard :

- Robotiq 2-Finger Adaptive Robot Gripper Controller unit (**AGB-CTR-001-XXXX**) with (1) choice of :
  - **ENIP** - EtherNet / IP communication protocol.
  - **MTCP** - Modbus TCP communication protocol.
  - **ECAT** - EtherCAT communication protocol.
  - **DNET** - DeviceNet communication protocol.
  - **CANO** - CANopen communication protocol.
- Gripper cable **CBL-COM-Y2062** (between the 2-Finger Adaptive Gripper – 200 and it's controller unit).
- USB cable **CBL-USB-Y2057** (for reconfiguration of the 2-Finger Adaptive Gripper – 200 controller).

> **Note**
>
> The following are not included on delivery :
>
> - Hardware required for any options, accessories or fixture of the 2-Finger Adaptive Robot Gripper – 200 unless specified.
> - Power supply unit, power supply wiring and fuse.

See Spare Parts, Kits and Accessories section for a list of available parts.

3.2 Environmental and operating conditions

The Gripper is designed for industrial applications. Always respect the following specified storage and operating environmental conditions:

Minimum storage/transit temperature	-22°F [-30°C]
Maximum storage/transit temperature	140°F [60°C]
Minimum operating temperature	14°F [-10°C]
Maximum operating temperature	122°F [50°C]
Humidity (non-condensing)	20-80% RH
Vibration	< 0.5G
Others	• Free from dust, soot or water [1] • Free from corrosive liquids or gases • Free from explosive liquids or gases • Free from powerful electromagnetic interference

[1] IP rating under evaluation during beta phase.

3.3 Mechanical connections

You must use Robotiq's coupling to attach the Gripper to the robot. Be sure to use the coupling and optional adapters related to your robot model. If there is no options for your robot, you can modify a blank adapter plate, Robotiq can create a custom version for you or you can build one based on the dimensions in section 3.3.2. Please refer to the Spare Parts section for a list of available coupling and adapters.

Here are the steps to follow for the installation of the Gripper (see Figure 3.3.1). Note that all screws must be locked in place using medium strength thread locker (Loctite 248).

1. Attach the Coupling to the Gripper by aligning the indexing dowel pins with the associated holes
    a. All dowel pins are **Ø**8 m6 x 20 standard stainless steel (**Y-997**).
    b. Dowel pins must be press-fitted in the Coupling.
2. Secure the Gripper with coupling screws (socket head cap screws M8 x 40 **Y-830**).
3. Screw the Coupling to your robot arm with the robot side screws (socket head cap screws M8 x 30 **Y-829**).
    a. With optional adapter plate : Screw the adapter plate to the robot arm and then your Coupling to the adapter plate(if your cables are running through the robot, be sure to use an adapter plate with a groove).

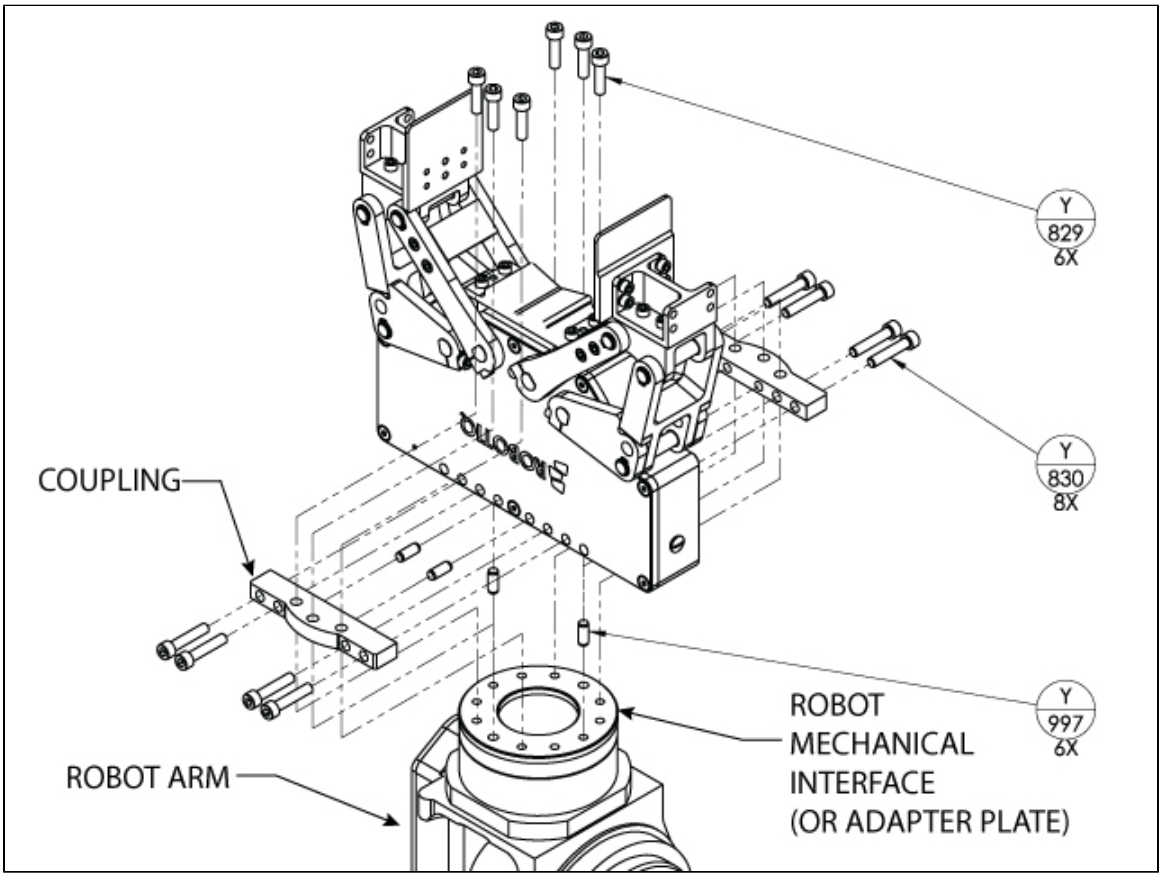


Figure 3.3.1 : Attaching the 2-Finger Adaptive Robot Gripper – 200 to a robot arm with Robotiq coupling.

The 2-Finger Adaptive Robot Gripper – 200 Controller Unit is equipped with DIN rail mounting clips and is designed to be clipped on #3 DIN rails. It is recommended to fix the Controller Unit inside the robot controller cabinet.

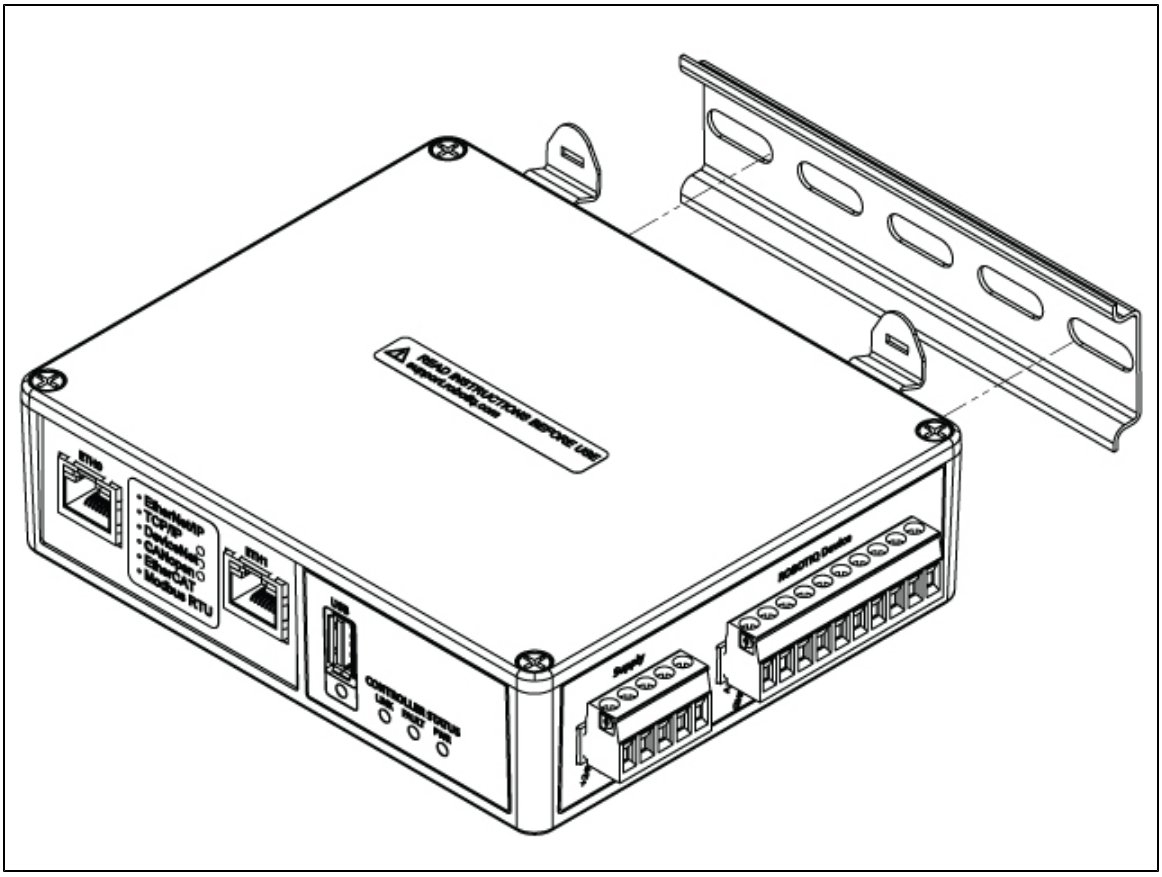


Figure 3.3.2 : 2-Finger Adaptive Robot Gripper – 200 Controller Unit fixed on DIN rails.

3.3.1 Parallelism mechanism

The Robotiq 2-Finger Adaptive Robot Gripper – 200 features encompassing and parallel grips, the parallelism mechanism can be locked to prevent the use of the encompassing grip. To do so, lock the parallelism mechanism using two (2) 12mm axles from the parallelism locking kit **AGB-KIT-B022** provided by Robotiq (see Spare Parts and Accessories section). Follow the instruction in figure 3.3.1.1 to lock or unlock the mechanism.

> **Info**
>
> Note that locking the mechanism will not alter the stroke of the Gripper or the cinematic of the fingers, only the encompassing grip will be prevented from activating and only parallel grasping will be possible.

What you need :

- (2) 12 mm stainless steel axles **B-022** (parallelism locking kit **AGB-KIT-B022**) .
- (4) 12 mm external retaining rings **Y-945** (parallelism locking kit **AGB-KIT-B022**) .
- Retaining ring pliers.

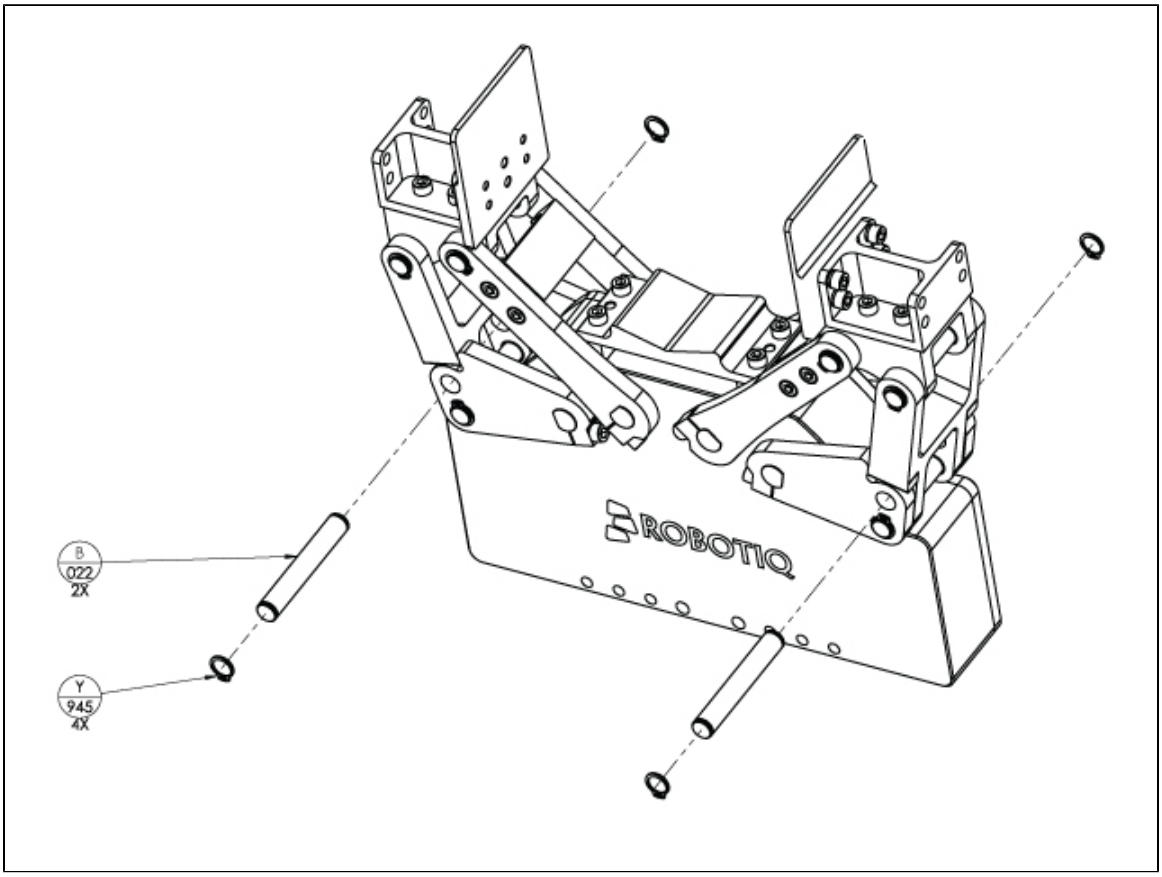


Figure 3.3.1.1 : Assembly or removal of the parallel locking axles.

Assembly instructions :

1. Insert the 12mm stainless steel axle **B-022.**
2. Fix the retaining rings **Y-945** on each side of the axle using retaining ring pliers.

Warning

Retaining rings can cause injury if they slip out of retaining ring pliers. Wear safety goggles when manipulating the retaining rings.

3.3.2 Dimensions for custom coupling

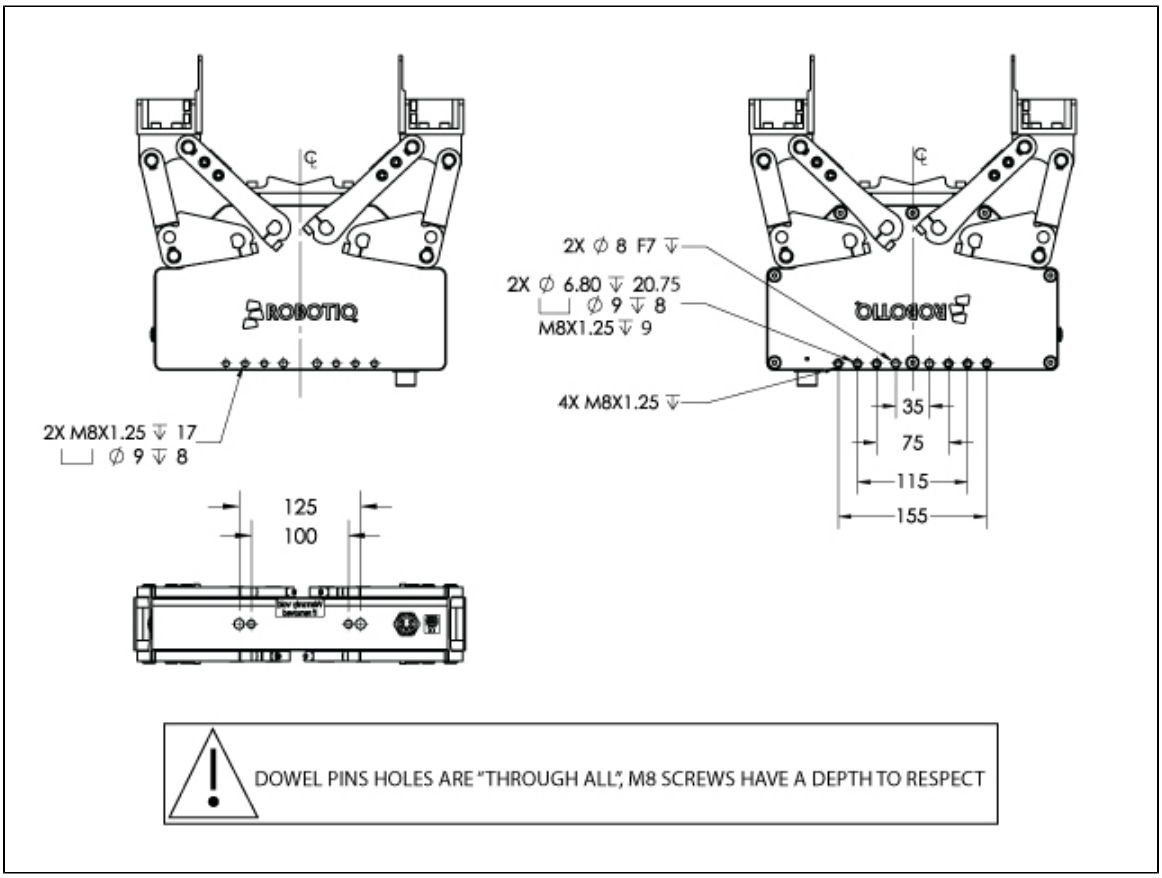


Figure 3.3.2.1 : 2-Finger Adaptive Robot Gripper – 200 dimensions for custom coupling.

The Gripper must be fixed with at least four (4) of the six (6) M8 screws available on each side of the Gripper to ensure a secure attachment.

Hint

Use M8 screw length according to your design, total length must cover :

1. Your coupling plate depth
2. 8 mm for the chassis cover.
3. The Gripper chassis M8 hole depth.

3.4 Power supply specifications

The Gripper needs to be supplied with a DC voltage source. This power supply is not included with the Gripper. The following table shows the specifications regarding the power supply required to operate the Gripper properly.

Specification	Value
Output voltage	24 V DC
Output current	20A
Ripple	2-3 % peak-peak
Output regulation	2% maximum
Overvoltage protection	Not required[1]

1. The Gripper has built-in over-voltage protection.

Robotiq recommends the use of the following power supply : TDK-Lambda DPP480 Series, *480W Single Output DIN Rail Mount Power Supplies*, **DDP480-24-1**

3.5 Wiring

Three connections are needed for the 2-Finger Adaptive Robot Gripper – 200, one for power,one for communication to the controller unit and one from the Controller to the Gripper. Power and communication are established with the 2-Finger Adaptive Robot Gripper – 200 Controller via the Controller Communication port (shown in figure 3.5.1) and Supply port (shown in figure 3.5.2). The Gripper is connected to the controller via a single Gripper Signal Cable (shown in figure 3.5.3) which connect onto the Robotiq Device port.

Info

Note that the Communication Option Panel shown in figure 3.5.1 will change according to the provided communication protocol. The Standard Panel, which include the Status LEDs and the USB 2.0 port is standard on every Robotiq 2-Finger Adaptive Robot Gripper Controller unit.

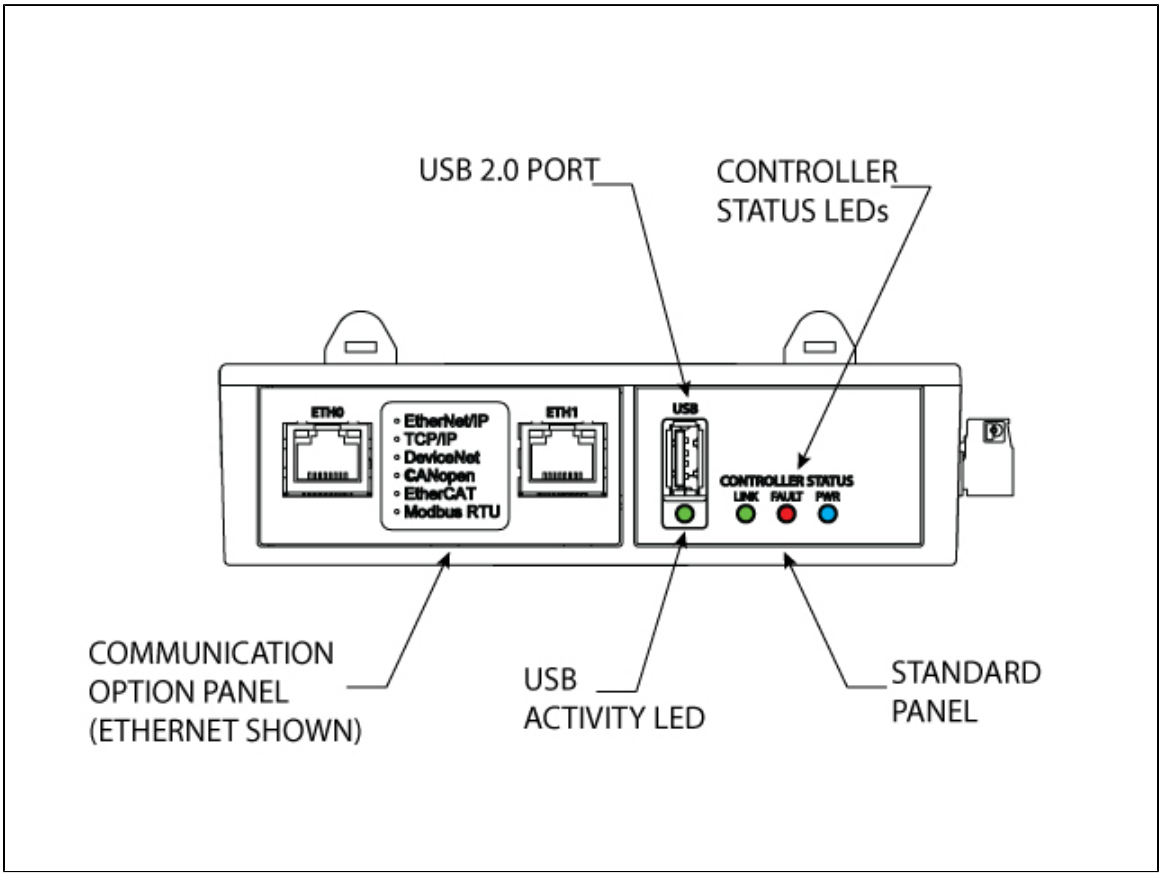


Figure 3.5.1 : The Robotiq 2-Finger Adaptive Robot Gripper – 200 Controller communication panel.

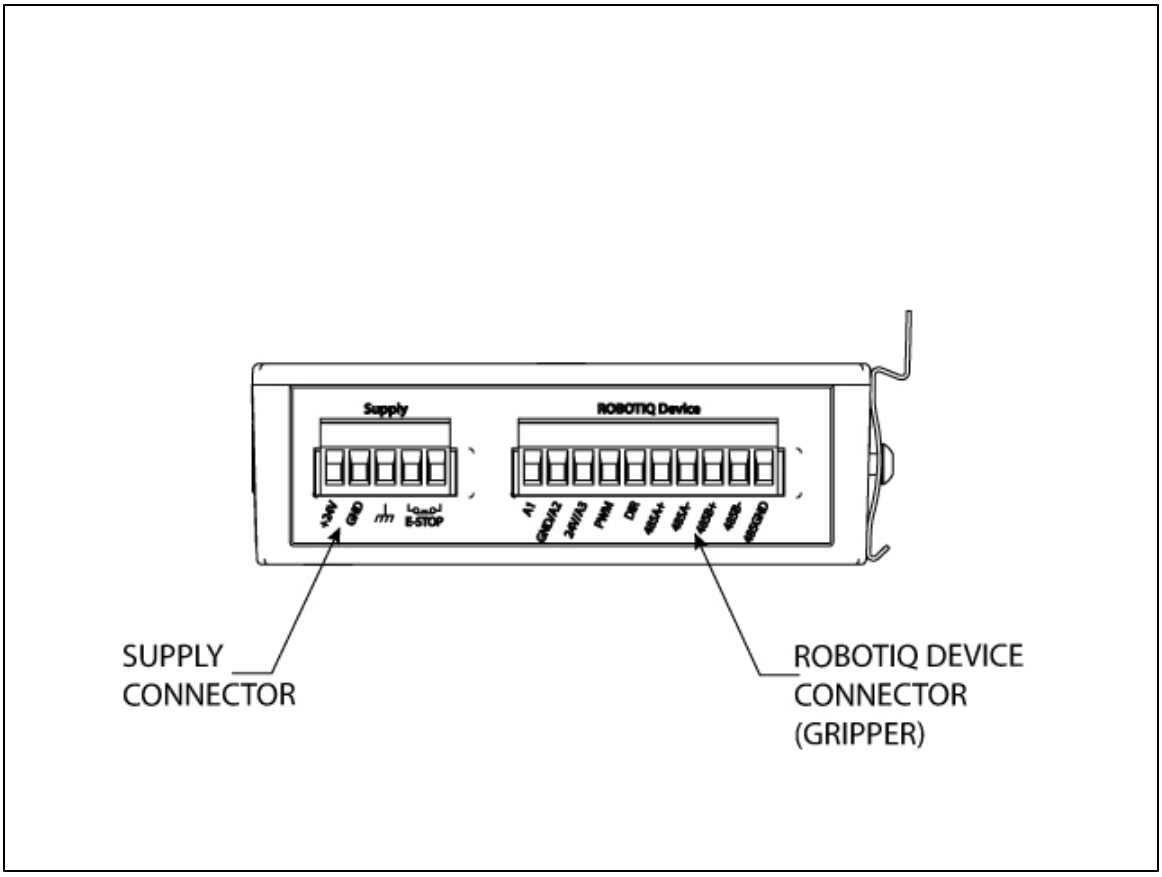


Figure 3.5.2 : Controller supply connection and Robotiq Device connector for the Robotiq 2-Finger Adaptive Robot Gripper – 200 Controller.

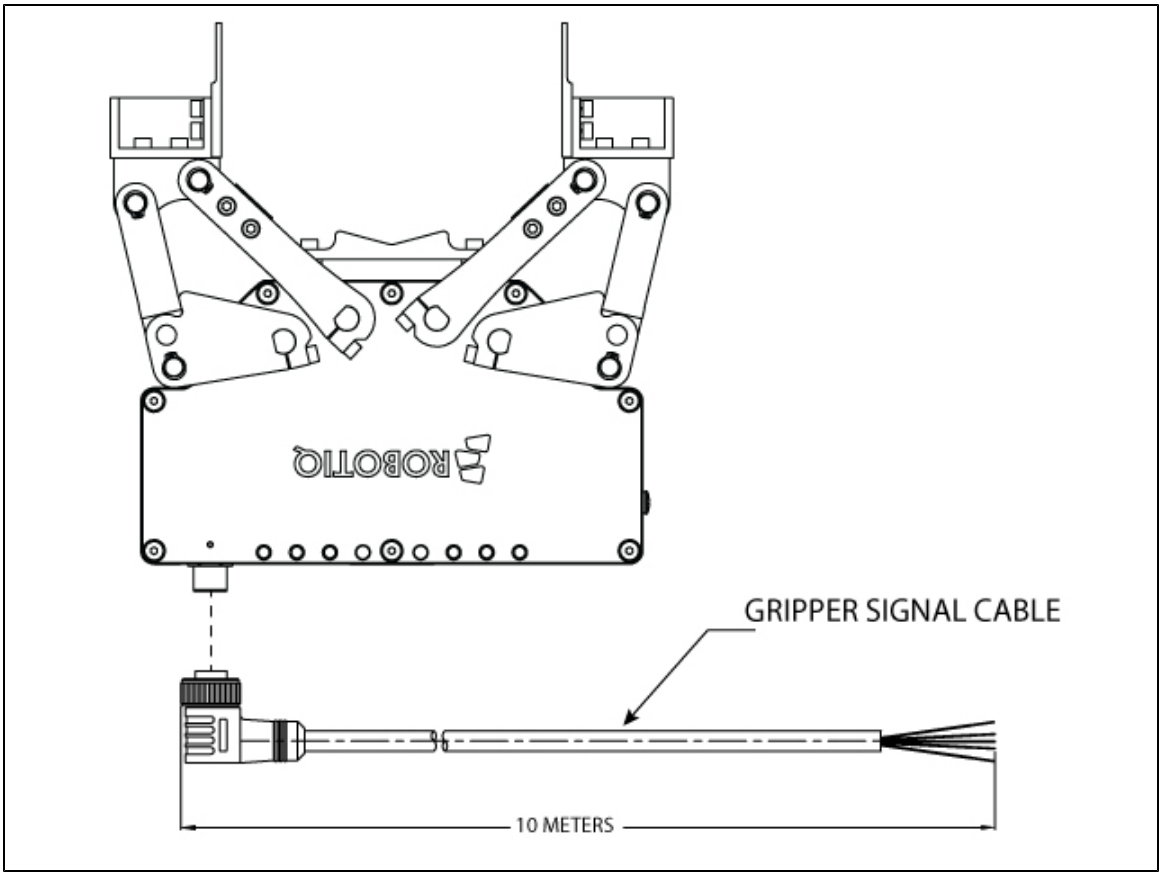


Figure 3.5.3 : Gripper Signal Cable for the Robotiq 2-Finger Adaptive Robot Gripper – 200.

Info

Gripper signal cable is supplied by Robotiq, see Spare Parts, Kits and Accessories section.

Warning

Use proper cabling management. Be sure to have enough forgiveness in the cabling to allow movement of the Gripper along all axes without pulling out the connectors. Always protect the controller-side of the cable with a strain relief cable clamp.

3.5.1 Power connection

Here is the way the Gripper should be connected to a power source (Figure 3.5.1.1).

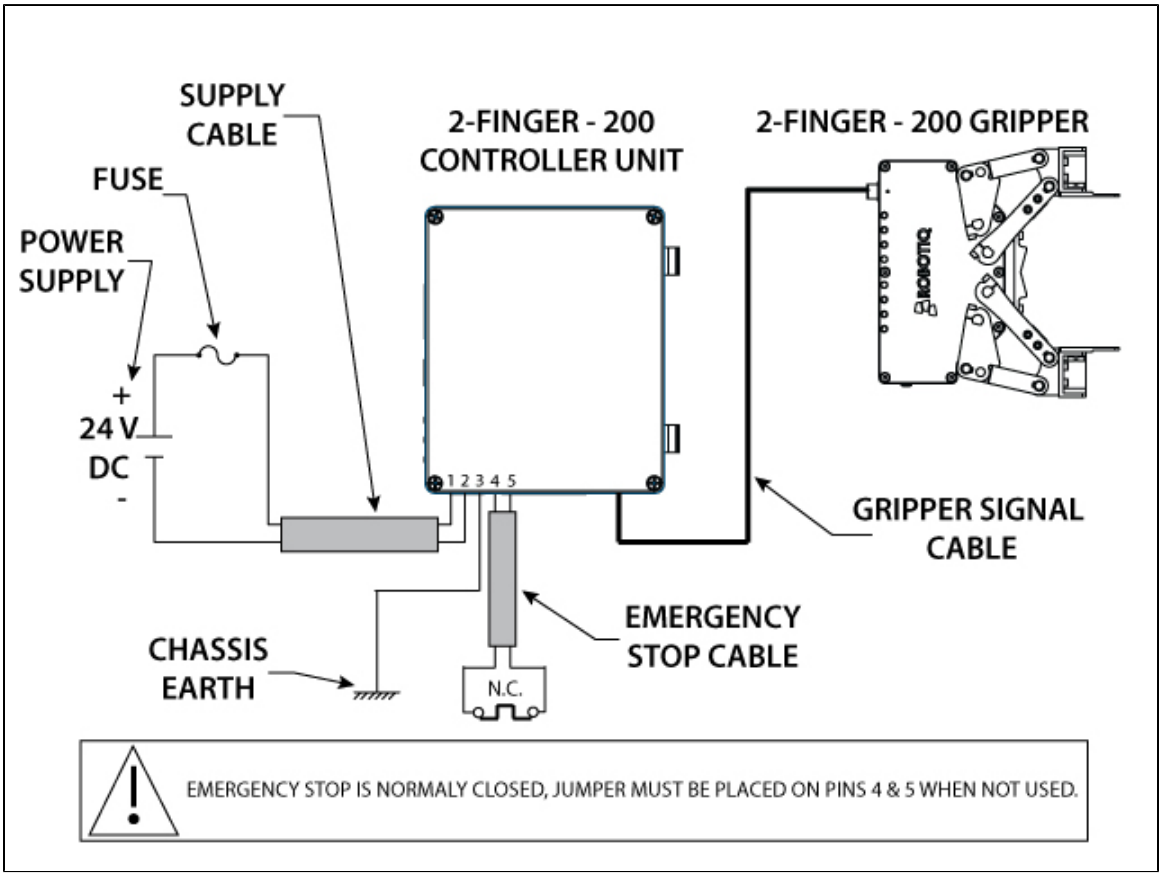
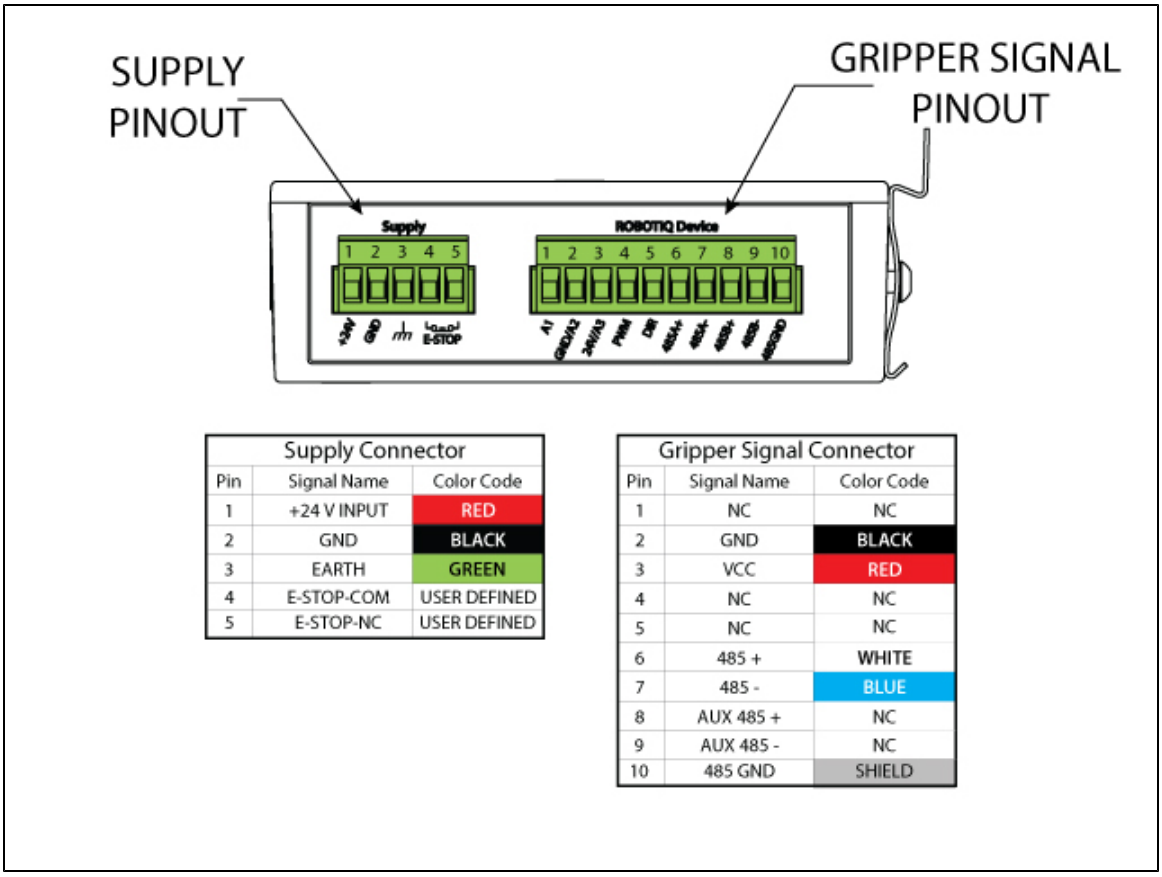


Figure 3.5.1.1 : Power connection diagram of the 2-Finger Adaptive Robot Gripper – 200.

Caution

The fuse is external to the Gripper and Gripper Controller. It is not provided by Robotiq and the user is responsible for proper installation. Suggested fuse is Phoenix Contact # 0916610 10 A thermal, use AWG #12 wiring.

The pin-out for the power connectors is detailed in Figure 3.5.1.2.



Supply Connector		
Pin	Signal Name	Color Code
1	+24 V INPUT	RED
2	GND	BLACK
3	EARTH	GREEN
4	E-STOP-COM	USER DEFINED
5	E-STOP-NC	USER DEFINED

Gripper Signal Connector		
Pin	Signal Name	Color Code
1	NC	NC
2	GND	BLACK
3	VCC	RED
4	NC	NC
5	NC	NC
6	485 +	WHITE
7	485 -	BLUE
8	AUX 485 +	NC
9	AUX 485 -	NC
10	485 GND	SHIELD

Figure 3.5.1.2 : Supply connector and Gripper Signal connector.

The Gripper supply cable should have the following specifications :

- Minimum 16 AWG TEW, 300 V or 600 V.

The emergency stop cable should have the following specifications :

- Minimum 22 AWG TEW (recommended, current is 500 mA), 300 V or 600V.
- Using a "normally closed" emergency stop button.
- Installed in compliance with the Machinery Directive or compliance to national standards derived from the directive used in your country.

Warning

Robotiq strongly advised the use of an emergency stop switch on the power connector. The emergency stop must be in proximity of the work zone, easily reachable and visible.

Info

When not using an emergency stop (see diagram Figure 3.5.1.1) jumper must be placed on pin 4 and 5 of the power connector.

Earth grounding cable should have the following specifications :

- Minimum 22 AWG TEW, 300 V or 600 V.

Gripper signal cable is supplied by Robotiq, see Spare Parts, Kits and Accessories section.

3.5.2 Communication connection

The following table summarizes the communication protocols available for the Gripper. The same 2-Finger Adaptive Robot Gripper – 200 Controller is used for all the communication protocols we support. The Controller will be setup for your options with a single communication protocol.

> **Note**
>
> Only one protocol option is available for a given Controller unit.

Family	Protocol
Real-Time Ethernet	• EtherNet / IP • Modbus TCP/IP • EtherCAT
Fieldbus	• DeviceNET • CANopen
USB	Modbus RTU

The figure 3.5.2.1 shows the communication side of the Robotiq Adaptive Gripper 2-Finger – 200 Controller. The communication port will vary depending on the communication protocol chosen. Real-Time Ethernet family protocols (EtherNet IP, EtherCAT, Modbus TCP) will come with two (2) RJ45 standard ports. DeviceNet protocol will come with a 5-pin Combicon connector. Finally, CANopen will come with a standard DB-9 connector.

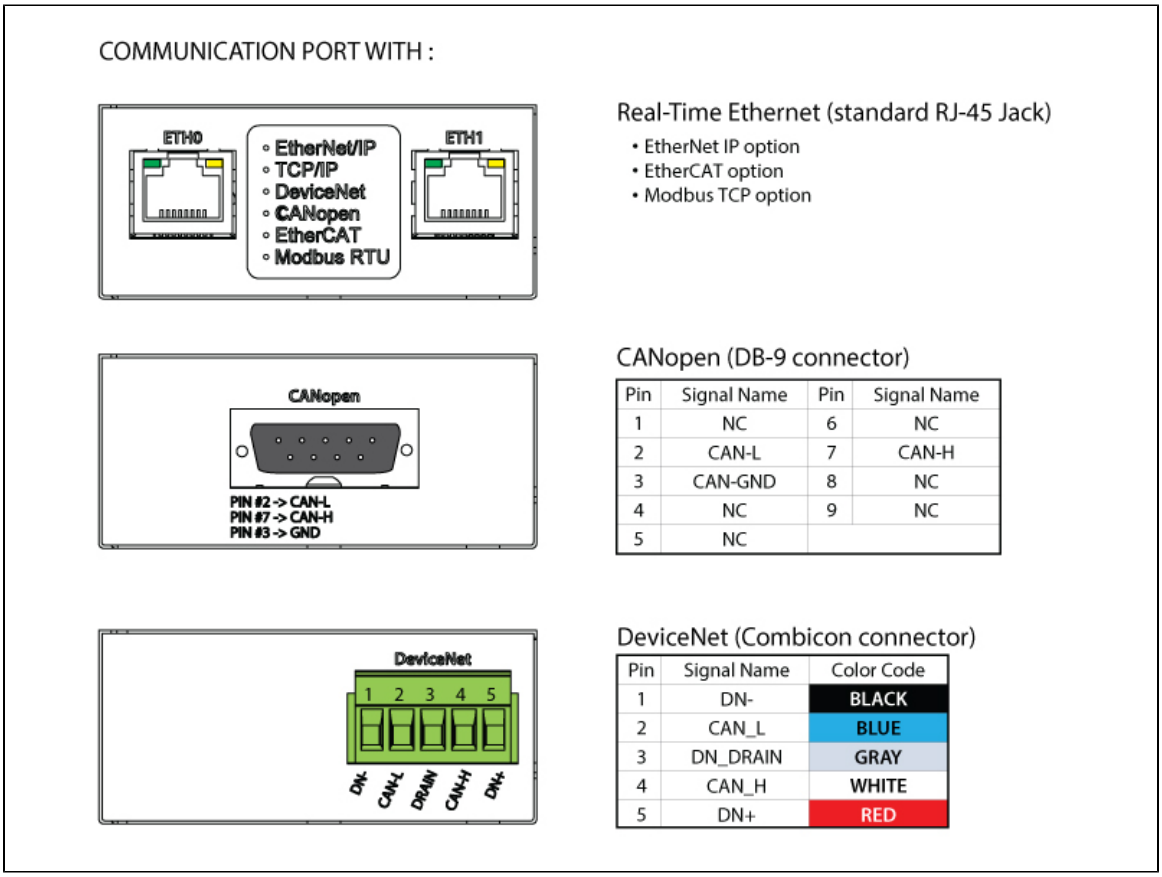


Figure 3.5.2.1 : Representation of the communication panel options for the Robotiq Adaptive Gripper 2-Finger – 200 Controller.

It is the users responsibility to setup the right cable between the controller unit and the master controller. Robotiq can provide you with appropriate cables. See Spare Parts, Kits and Accessories section for a list of available parts.

Warning
Be sure to use the appropriate cables and pin-outs for your communication protocol as any other setup may damage the Gripper.

DeviceNet communication protocol

The DeviceNet communication is established via the Communication Panel pin-out. Figure 3.5.2.1 shows the pin-out for the DeviceNet communication protocol for the receptacle (Cubicon male) present on the 2-Finger Adaptive Robot Gripper – 200.

Caution

- There is no terminating resistor mounted in the Gripper.
- The shield for the cable must be grounded in the robot controller.

The DeviceNet communication and the Gripper use 24 V power supply. Robotiq suggests you separate power supplies as shown in Figure 3.5.2.2.

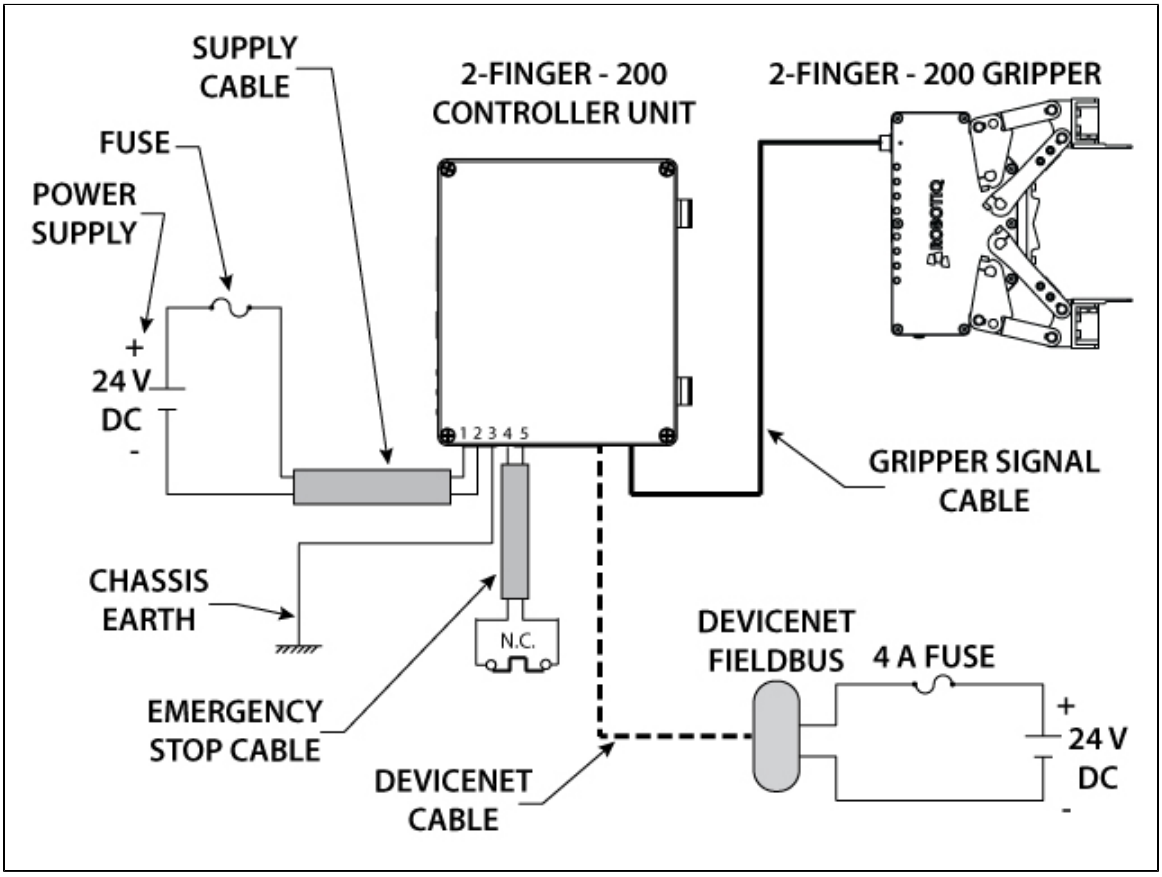


Figure 3.5.2.2 : Power connection diagram of the 2-Finger Adaptive Robot Gripper – 200 using DeviceNet Fieldbus.

Factory settings for DeviceNet protocol:

IDENTIFICATION SETTINGS		
Info	**Decimal value (base 10)**	**Hexadecimal value (base 16)**
Vendor ID :	283	0x0000011B
Product Code :	35	0x00000023
Serial Number :	0	0x00000000
Product Type :	12	0x0000000C
Major Revision :	1	
Minor Revision :	1	
Product Name :	AG-DNS	AG-DNS

BUS SETTINGS	
MAC ID :	11
Baud Rate :	250 kBaud

DATA SETTINGS	
Prod. Data Length :	6
Cons. Data Length :	6

Hint

Mac Address settings and Baud Rate settings can be set on the Robotiq Controller using the Robotiq UI. See the User Interface section for details.

CANopen communication protocol

The CANopen communication is established via the Communication Panel pin-out. Figure 3.5.2.1 shows the pin-out for the CANopen communication protocol for the receptacle (DB-9 male) present on the 2-Finger Adaptive Robot Gripper – 200.

Caution

- There is no terminating resistor mounted in the Gripper.
- The shield of the cable must be grounded in the robot controller.

Factory settings for CANopen protocol:

IDENTIFICATION SETTINGS		
Info	**Decimal value (base 10)**	**Hexadecimal value (base 16)**
Vendor ID :	68	0x00000044
Product Code :	1541540	0x001785A4
Revision Number :	131072	0x00020000
Serial Number :	0	0x00000000

BUS SETTINGS	
Node Adress :	11
Baud Rate :	1 MBaud

DATA SETTINGS		
	Index	**Size**
Send Object :	0x2000	128
Receive Object :	0x2200	128
Output Databytes :		512

Hint

Node Address settings and Baud Rate settings can be set on the Robotiq Controller using the Robotiq UI. See the User Interface section for details.

Hint

The CANopen communication interface supports SDO (Service Data Object) and PDO (Process Data Object) protocols.

Real-time Ethernet communication protocols

The Real-Time Ethernet communication protocols are established via the Communication Panel pin-out. Figure 3.5.2.1 shows the pin-out of the RJ45 receptacle present on the 2-Finger Adaptive Robot Gripper – 200 Controller.

> **Note**
>
> All Ethernet family protocols use the same RJ45 port.

> **Caution**
>
> The crossover on the RX/TX signals is made inside the Gripper.

Factory settings for each Ethernet protocol :

EtherCAT		EtherNet / IP		Modbus TCP/IP
IDENTIFICATION SETTINGS				
Vendor ID :	0x0000FFFF	Vendor ID :	0x0000011B	N / A
Product Code :	0x0000000B	Product Code :	0x0000010D	
Serial Number :	0x00000000	Product Type :	0x0000000C	
Revision Number :	0x00000000	Major Revision :	1	
		Minor Revision :	1	
		Device Name :	AG-EIS	

EtherCAT	EtherNet / IP		Modbus TCP/IP	
BUS SETTINGS				
N / A (see info note)	IP Address :	192.168.1.11	IP Address :	192.168.1.11
	Netmask :	255.255.255.0	Netmask :	255.255.255.0
	Gateway :	Disabled	Gateway :	Disabled
	BootP :	Disabled	BootP :	Disabled
	DHCP :	Disabled [1]	DHCP :	Disabled [1]
	100Mbit :	Enabled	100Mbit	always on
	Full Duplex:	Enabled	Full Duplex	always on
	Auto-neg :	Enabled	Auto-neg	always on
	Assembly Instance (input) :	101		
	Assembly Instance (output) :	100		
	Configuraton Instance :	1		
	Connection Type :	Run/Idle Header		

EtherCAT		EtherNet / IP		Modbus TCP/IP
DATA SETTINGS				
Input Data Bytes :	6	Prod. Data Length :	10	N / A
Output Data Bytes :	6	Cons. Data Length :	10	N / A

Hint

IP Address settings and Netmask settings can be set on the Robotiq Controller using the Robotiq UI. See the User Interface section for details.

Info

EtherCAT protocol uses inherent dynamic addressing thus bus settings cannot be customized.

4. Control

4.1 Generalities

The Robotiq 2-Finger Adaptive Robot Gripper – 200 is operated from the robot controller (see Figure 4.1.1) using an industrial protocol (EtherNet/IP, DeviceNet, CANopen, EtherCAT, etc.). The programming of the Gripper can be done with the *Teach Pendant* of the robot or by offline programming.

Info

- The operator can control the force and the speed of the fingers.
- The fingers movement is always synchronized, movement is done with a single "Go to requested position" command (the motion of each mechanical phalanx is done automatically).

Since the Robotiq 2-Finger Adaptive Robot Gripper – 200 has its own controller, high-level commands such as "Go to requested position" are used to operate it. The Robotiq Adaptive Gripper 2-Finger – 200 Controller takes care of the regulation of the speed and the force prescribed, while the mechanical design of the fingers automatically adapt to the shape of object(s).

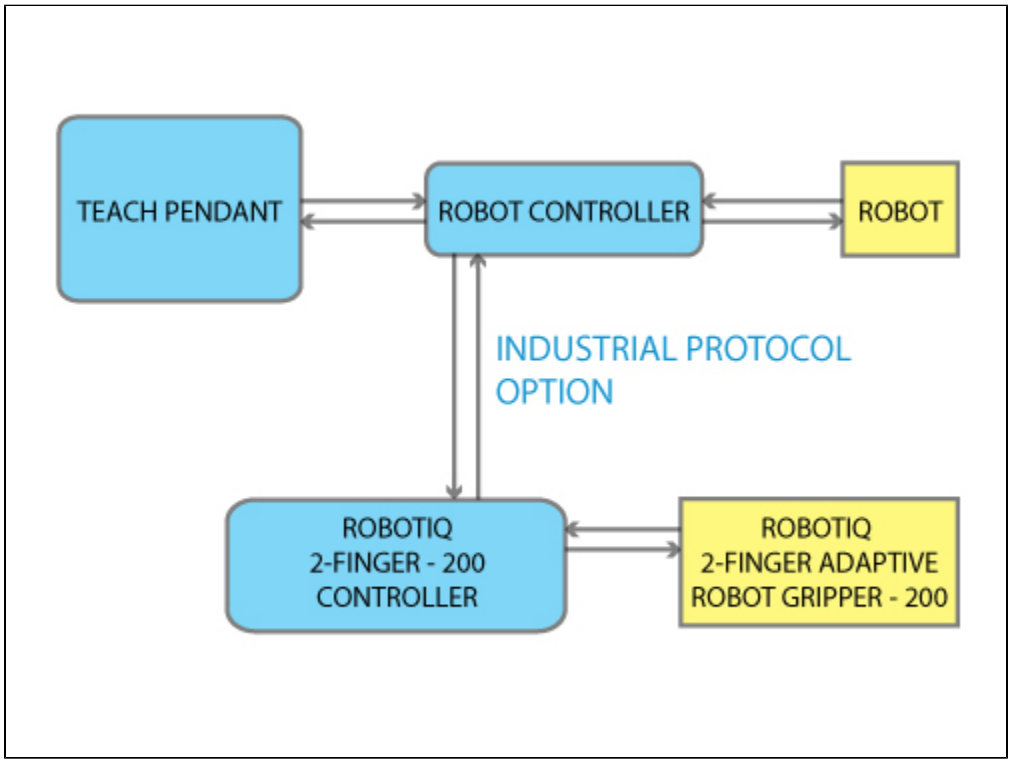


Figure 4.1.1 : Robotiq 2-Finger Adaptive Robot Gripper – 200 connections.

4.2 Status overview

The 2-Finger Adaptive Robot Gripper – 200 returns several registers of information to the robot controller:

- **Global Gripper Status** - A global Gripper status is available. This gives information such as if the Gripper is closed or open.
- **Object Status** - There is also an object status that lets you know if there is an object in the Gripper.
- **Fault Status** - The fault status gives additional details about the cause of a fault or warnings about the current controller status.
- **Position Request Echo** - The Gripper returns the position requested by the robot to make sure that the new command has been received correctly.
- **Motor Position Status** - The information of the motor position is also available.
- **Current Status** - The current of the motor can also be known. The force applied at the actuation linkage of the finger can be known from the current, since the torque of the motor is a linear function of the current.

4.3 Control overview

The Gripper Controller has an internal memory that is shared 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** (see Figure 4.3.1). Two types of actions can then be done by the 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.

> **Info**
>
> The Gripper must be initialized (activation bit) whenever the power is turned on. This procedure takes a few seconds and allows the Gripper to be calibrated against internal mechanical stops.

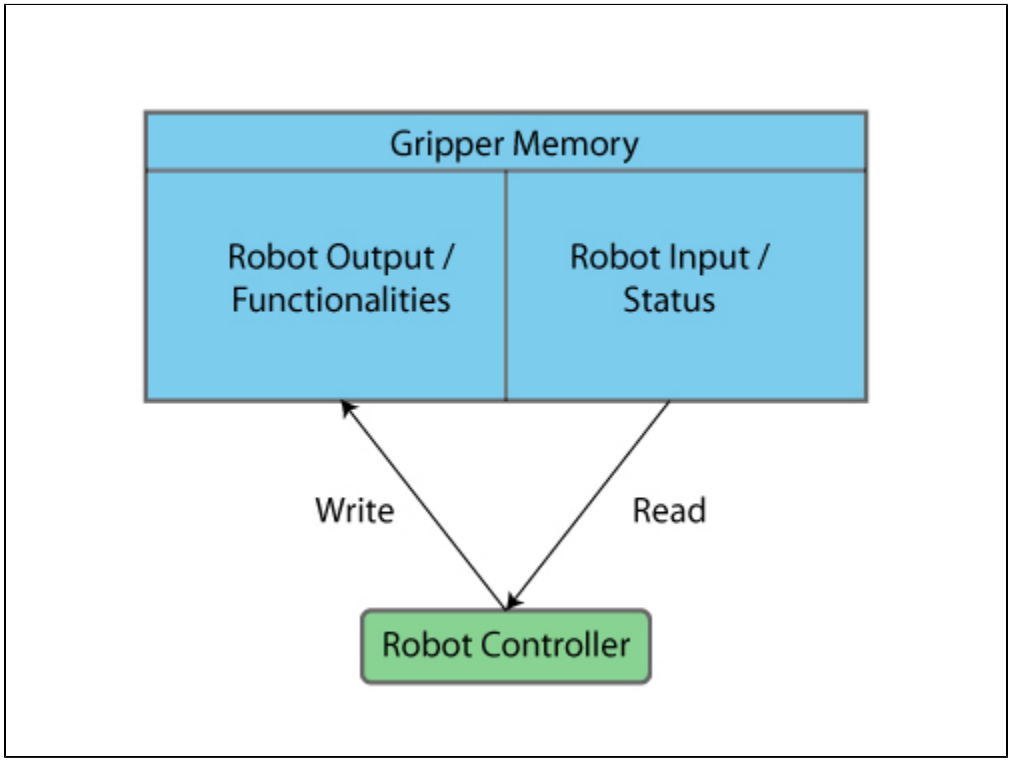


Figure 4.3.1 : Gripper memory shared with the robot controller.

4.4 Status LEDs

Four LED lights provide general information about the Gripper status on the controller communication panel. Figure 4.4.1 shows the LEDs and their locations.

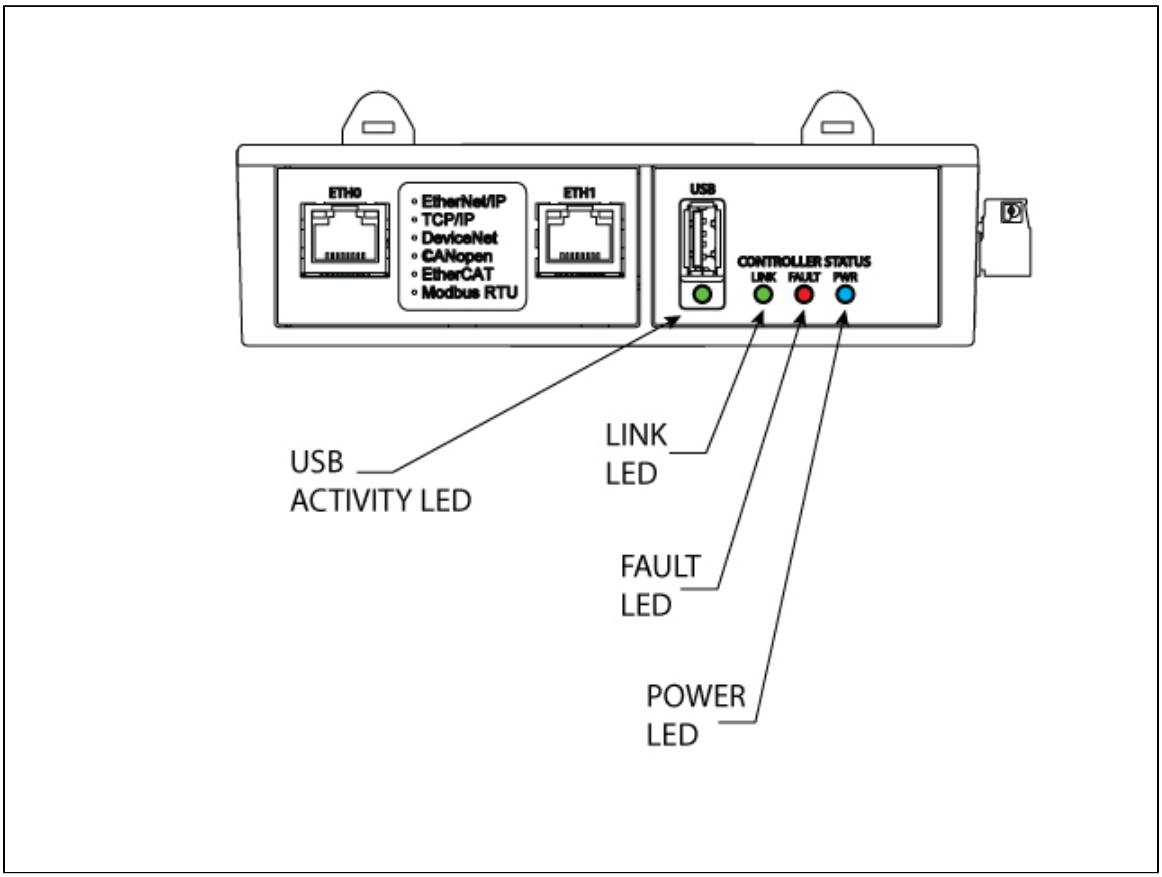


Figure 4.4.1 : Controller status LEDs.

There is an additional LED on the Gripper next to the Signal Cable Connector shown in figure 4.4.2

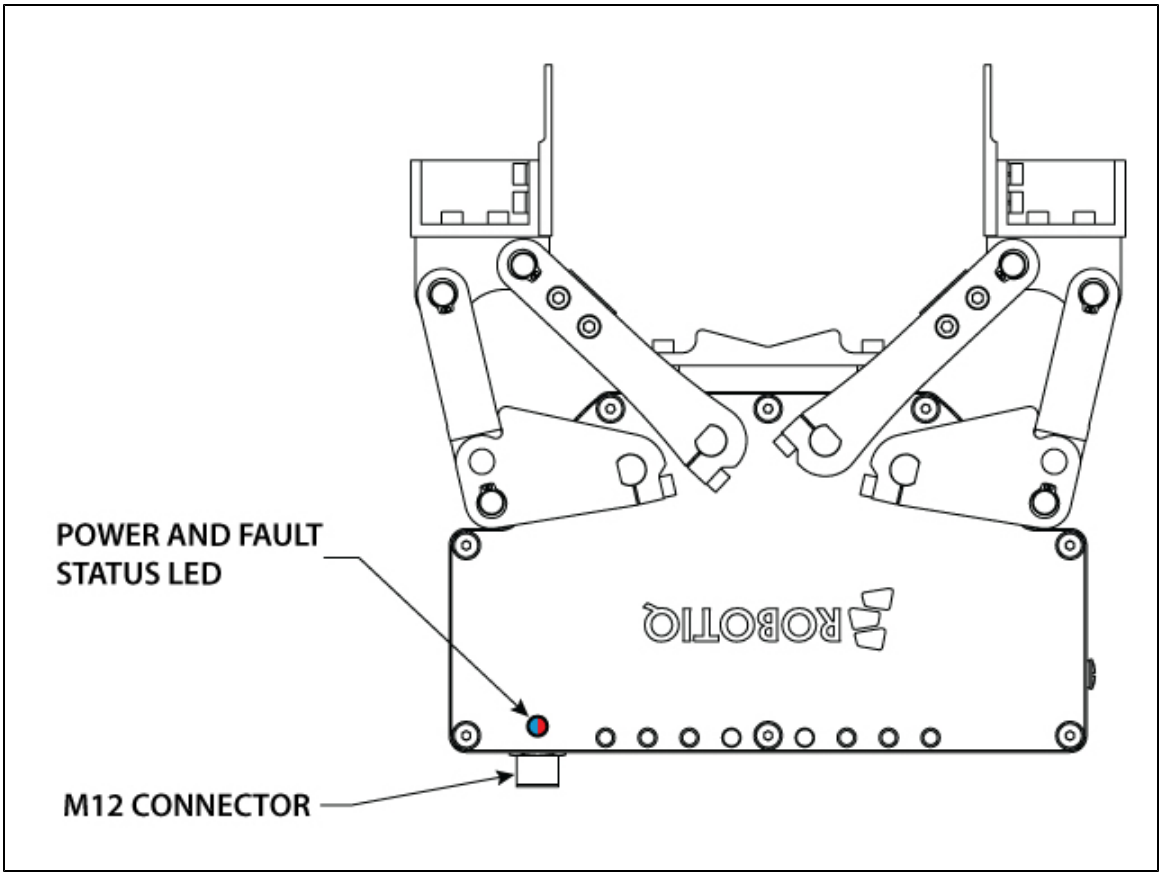


Figure 4.4.2 : 2-Finger Adaptive Robot Gripper – 200 status LEDs.

4.4.1 Power LEDs

The following applies to both the Controller power LED and the Gripper power LED, both are blue (note that the Gripper LED is a dual blue/red LED).

Color	State	Information
---	Off	No power supplied
Blue	On	Correctly supplied and the control board is running (for the control board LED)

4.4.2 Communication LED

Color	State	Information
---	Off	No network detected
Green	Blinking	A network has been detected, but no connection has been established
Green	On	A network has been detected and at least one connection is established

4.4.3 Fault LED

Both the Gripper and the Controller have a red Fault LED, however, their signification is not the same (note that the Gripper LED is a dual blue/red LED).

> **hint**
>
> Error code can be obtained reading the Fault Status byte described in section 4.7 Robot Input registers & status or using the Robotiq User Interface menu option "Input Registers".

For the Gripper LED :

Color	State	Code	Information
---	Off	**0x00**	No fault detected
			Priority Fault
		0x05	Action delayed, initialization must be completed prior to action
		0x07	The activation bit must be set prior to action
Red	On		Minor fault occurred
		0x0B	Automatic release in progress
		0x0E	Overcurrent protection triggered (gripper)
Red	Blinking		A major fault occurred
		0x0F	Automatic release completed

> **Info**
>
> A major fault refers to a situation where the Gripper must be reactivated, see rACT bit for details about activation procedures.

For the Controller LED :

Color	State	Code	Information
---	Off	**0x00**	No fault detected
			Warning
		0x04	24V not detected (reconfiguration through usb is possible)
		0x05	No device detected
Red	On		Minor fault occurred
		0x09	The main communication protocol is not ready (may be booting)
Red	Blinking		A major fault occurred
		0x0C	Emergency stop triggered
		0x0E	Overcurrent protection triggered (controller)

4.5 Gripper register mapping

Info

Register format is Little Endian (Intel format), namely from LSB (Less Significant Bit) to MSB (Most Significant Bit).

The Gripper firmware provides many functionalities such as the direct position control of the fingers via "go to" commands.

Register mapping:

Caution

Byte **numeration starts on zero** and not at 1 for the functionalities and status registers.

Register	Robot Output / Functionalities	Robot Input / Status
Byte 0	ACTION REQUEST / GO TO / AUTO-RELEASE	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

4.6 Robot output registers & functionalities

> **Info**
>
> Register format is Little Endian (Intel format), namely from LSB (Less Significant Bit) to MSB (Most Significant Bit).

Register: ACTION REQUEST
Address: Byte 0

Bit	Name	Description
0	rACT	0 – Reset Gripper 1 – Activate Gripper (Must stay on after activation routine is completed)
1	rRS1	RESERVED
2	rRS2	RESERVED
3	rGTO	0 – Stop 1 – Go to Requested Position
4	rATR	0 – Normal 1 – Automatic release
5	rARD	0 – Opening 1 – Closing
6 - 7	rRS3,rRS4	RESERVED

rACT : First action to be made prior to any other actions, **rACT** bit will initialize the Gripper. Clear **rACT** to reset Gripper and fault status.

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

rGTO : The "Go To" action moves the Gripper's fingers to the requested position using the configuration defined by the other registers. The only motions performed without the **rGTO** bit are the activation and the automatic release routines.

rATR : Automatic release routine action slowly opens the Gripper's fingers until all motion axes reach their mechanical limits. After the motion is 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**).

> **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.

rARD : Auto-release direction, when auto-releasing **rARD** shows the direction of the movement, 0 if the Gripper is

closing and 1 if the Gripper is opening. The rARD bit should be set prior or at the same time as rATR bit as the motion direction is set when the auto-release is initiated.

Register: GRIPPER OPTIONS
Address: Byte 1

Bit	Name	Description
0 – 7	rRS6	Reserved

Register: GRIPPER OPTIONS 2

Address: Byte 2

Bit	Name	Description
0 – 7	rRS7	Reserved

Register: POSITION REQUEST

Address: Byte 3

Bit	Name	Description
0 – 7	rPR	Set Position Request for the Gripper. 0x00 (Minimum position) to 0xFF (Maximum position)

This register is used to set the Gripper fingers' target position. The positions 0x00 and 0xFF correspond respectively to the fully opened and fully closed mechanical stops. See the 6. Specifications section for details on the corresponding movement and the finger movement path.

Register: SPEED
Address: Byte 4

Bit	Name	Description
0 – 7	rSP	Set closing/opening speed of the Gripper. 0x00 (Minimum speed) to 0xFF (Maximum speed)

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

Info

0x00 speed does not mean absolute zero speed. It is the minimum speed of the Gripper.

- Minimum speed: 18 mm/s
- Maximum speed: 114 mm/s
- Speed / count : under evaluation

Register: FORCE
Address: Byte 5

Bit	Name	Description
0 – 7	rFR	Set Gripping Force 0x00 (Minimum force) to 0xFF (Maximum force)

The force setting defines the final gripping force for the Gripper. The force will fix the maximum current sent to the motor while in motion. If the current limit is exceeded, the fingers stop and trigger an object detection notification.

Info

Force setting is overridden for a short distance when the motion is initiated. Also, note that 0x00 force does not mean zero force; it is the minimum force that the Gripper can apply.

- Minimum force: 150 N
- Maximum force : 730 N
- Force / count: under evaluation

4.7 Robot input registers & status

Info

Register format is Little Endian (Intel format), namely from LSB (Less Significant Bit) to MSB (Most Significant Bit).

Register: GRIPPER STATUS
Address: Byte 0

Bit	Name	Description
0	gACT	Initialization status (Echo of the rACT bit) : 0 – Gripper reset. 1 – Gripper activation.
1	gRS1	RESERVED
2	gRS2	RESERVED
3	gGTO	Go To request status : 0 – Standby (or performing activation/automatic release). 1 – Go to Position Request.
4	gSTA	Gripper status : 00 – Gripper is in reset (or automatic release) state. see Fault Status if Gripper is activated. 10 – Activation in progress. 01 – Not used. 11 – Activation is completed.
5		
6	gOBJ	Object detection status : 00 – Fingers are in motion (only meaningful if gGTO = 1). 10 – Fingers have stopped due to a contact while opening. 01 – Fingers have stopped due to a contact while closing. 11 – Fingers are at requested position.
7		

Caution

The object detection is precise only to the order of a few mm. In some circumstances object detection may not detect an object even if it is successfully gripped. For example, picking up a thin object in a fingertip grip may be successful without object detection occurring. For this reason, use this feature with caution. In such applications the "Fingers are at requested position" status of register **gOBJ** is sufficient to proceed to the next step of the routine.

Tip

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

Register: RESERVED
Address: Byte 1

Bit	Name	Description
0 – 7	gRS3	RESERVED

Register: FAULT STATUS

Address: Byte 2

Bit	Name	Description
0 – 3	gFLT	**0x00** – No Fault Priority Fault **0x05** – Action delayed, initialization must be completed prior to action **0x07** – The activation bit must be set prior to action Minor Fault (red LED continuous) **0x0B** – Automatic release in progress **0x0E** – Overcurrent protection triggered Major Fault (red LED blinking) – Reset is required **0x0F** – Automatic release completed
4 – 7	kFLT	**0x00** – No Fault Warning **0x04** – 24V not detected (reconfiguration through USB is possible) **0x05** – No device detected Minor Fault (red LED continuous) **0x09** - Communication is not ready Major Fault (red LED blinking) – Reset is required **0x0C** – Emergency stop triggered **0x0E** – Overcurrent protection triggered (**Gripper**)

Register: POSITION REQUEST ECHO
Address: Byte 3

Bit	Name	Description
0 – 7	gPR	Echo of the requested position for the Gripper 0x00 (Full Opening) to 0xFF (Full Closing)

Register: POSITION
Address: Byte 4

Bit	Name	Description
0 – 7	gPO	Position of Fingers 0x00 (Fully opened) to 0xFF (Fully closed)

Register: FINGER CURRENT
Address: Byte 5

Bit	Name	Description
0 – 7	gCU	Current of Fingers 0.025 * Current (in mA)

4.8 Example

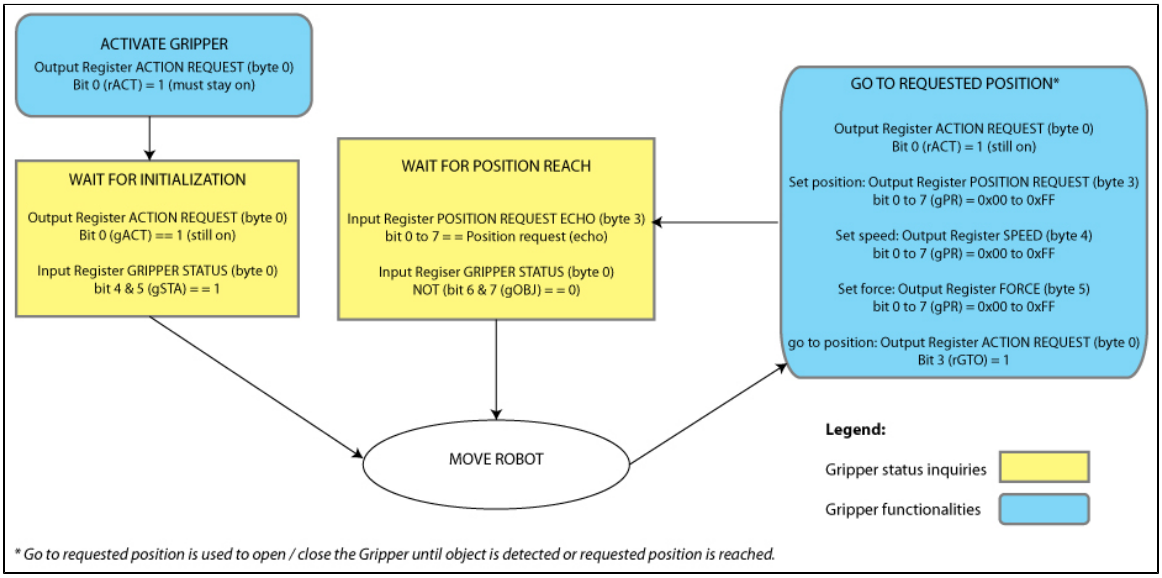


Figure 4.8.1 : Example of 2-Finger Adaptive Robot Gripper – 200 registers.

4.9 MODBUS RTU communication protocol

The Gripper can be controlled over USB using the Modbus RTU protocol on the mini-USB port. This section is intended to provide guidelines for setting up a Modbus scanner 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.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.chipkin.com/cas-modbus-scanner.

4.9.1 Connection setup

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

PROPRIETY	VALUE
Physical Interface	USB (virtual serial connector) drivers can be found at ftdichip.com
Baud Rate	115,200 bps
Data Bits	8
Stop Bit	1
Parity	None
Number Notation	Hexadecimal
Supported Functions	Read Holding Registers (FC03) Preset Single Register (FC06) Preset Multiple Registers (FC16)
Exception Responses	Not supported
Slave ID	0x0009 (9)
Robot Output / Gripper Input First Register	0x03E8 (1000)
Robot Input / Gripper Output First Register	0x07D0 (2000)

Each register (word - 16 bits) of the Modbus RTU protocol is composed of **2** registers (bytes – 8 bits) from the Gripper. The first Gripper output Modbus register (0x07D0) is composed from the first **2** Robotiq Adaptive Gripper 2-Finger – 200 registers (byte 0 and byte 1).

4.9.2 Read holding registers (FC03)

Function code 03 (FC03) is used for reading the status of the Gripper (robot input). Examples of such data are Gripper status, object status, finger position, etc.

Ex: 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 03 07 D0 00 02 C5 CE

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding Registers)
07D0	Address of the first requested register
0002	Number of registers requested (2)
C5CE	Cyclic Redundancy Check (CRC)

Response is:

09 03 04 E0 00 00 00 44 33

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding 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
4433	Cyclic Redundancy Check (CRC)

Note

The Adaptive Gripper 2-Finger – 200 register values are updated at a 200Hz frequency. It is therefore recommended to send FC03 commands with a minimum delay of 5ms between them.

4.9.3 Preset multiple registers (FC16)

Function code 06 (FC06) is used to activate functionalities of the Gripper (robot output). Examples of such data are action request, speed, force, etc.

Ex: 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

where

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E9	Address of the first register
0002	Number of registers to write to
04	Number of data bytes to follow (2 registers x 2 bytes/register = 4 bytes)
00E6	Value to write to register 0x03E9
3CC8	Value to write to register 0x03EA
EC7C	Cyclic Redundancy Check (CRC)

Response is:

09 10 03 E9 00 02 91 30

where

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)

4.9.4 Master read & write multiple registers (FC23)

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

Ex: This message asks for register 0x07D0 (2000) and register 0x07D1 (2001) which contains Gripper Status, Object Detection, Fault Status and Position Request Echo while setting position request, speed and force of the Gripper by setting register 0x03E9 (1001) and 0x03EA (1002).

Request is:

09 23 07 D0 00 02 03 E9 00 02 04 00 E6 3C C8 00 FF

where

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 to **write**
0002	Number of registers to **write** (3) to
04	Number of data bytes to follow (2 registers X 2 bytes/registers = 4 bytes)
00E6	Value to write to register 0x03E9
3CC8	Value to write to register 0x03EA
00FF	Cyclic Redundancy Check (CRC)

Response is:

09 17 04 E0 00 00 00 47 27

where

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)
E000	Content of register 07D0
0000	Content of register 07D1
4727	Cyclic Redundancy Check (CRC)

Note

The Adaptive Gripper 2-Finger - 200 register values are updated at a 200Hz frequency. It is therefore recommended to send FC23 commands with a minimum delay of 5ms between them.

4.9.5 Modbus RTU example

This section depicts the example given in section 4.8 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

Request is:

09 10 03 E8 00 03 06 01 00 00 00 00 00 72 E1

where

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

Response is:

09 10 03 E8 00 03 01 30

where

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 03 07 D0 00 01 85 CF

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding Registers)
07D0	Address of the first requested register
0001	Number of registers requested (1)
85CF	Cyclic Redundancy Check (CRC)

Response (if the activation IS NOT completed):

09 03 02 11 00 55 D5

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding Registers)
02	Number of data bytes to follow (1 registers 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"**
55D5	Cyclic Redundancy Check (CRC)

Response (if the activation IS completed):

09 03 02 31 00 4C 15

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding Registers)
02	Number of data bytes to follow (1 registers 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"**
4C15	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

where

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers to write to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value to write to register 0x03E9 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**, **rGTO = 1 for "Go to Requested Position"**
00FF	Value to write to register 0x03EA (GRIPPER OPTIONS 2 = 0x00 and POSITION REQUEST = 0xFF): **rPR = 255/255 for full closing of the Gripper**
FFFF	Value to write to register 0x03EB (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

where

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

Step 5: Read Gripper status until the grip is completed

Request is:

09 03 07 D0 00 03 04 0E

where

Bits	Description
	SlaveID
03	Function Code 03 (Read Holding Registers)
07D0	Address of the first requested register
0003	Number of registers requested (3)
040E	Cyclic Redundancy Check (CRC)

Example of response if the grip **is not completed**:

09 03 06 39 00 00 FF 0E 0A F7 8B

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding 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)
F78B	Cyclic Redundancy Check (CRC)

Example of response if the grip **is completed**:

09 03 06 B9 00 00 FF BD 00 1D 7C

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding 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)
F78B	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

where

Bits	Description
09	SlaveID
10	Function Code 16 (Preset Multiple Registers)
03E8	Address of the first register
0003	Number of registers to write to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value to write to register 0x03E9 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**, **rGTO = 1 for "Go to Requested Position"**
0000	Value to write to register 0x03EA (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 to write to register 0x03EB (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

where

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 03 07 D0 00 03 04 0E

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding Registers)
07D0	Address of the first requested register
0003	Number of registers requested (3)
040E	Cyclic Redundancy Check (CRC)

Example of response if the opening **is not completed**:

09 03 06 39 00 00 00 BB 10 30 E0

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding 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)
30E0	Cyclic Redundancy Check (CRC)

Example of response if the opening **is completed**:

09 03 06 F9 00 00 00 0D 00 56 4C

where

Bits	Description
09	SlaveID
03	Function Code 03 (Read Holding 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)
564C	Cyclic Redundancy Check (CRC)

Step 9: Loop back to step 3 if other objects have to be gripped.

4.10 MODBUS TCP-IP communication protocol

The Robotiq 2-Finger Adaptive Robot Gripper – 200 can be controlled using the Modbus TCP/IP protocol (note that this is an option). This section is intended to provide guidelines for setting up a Modbus TCP/IP communication to adequately send commands and read input from the Gripper.

For a general introduction to Modbus TCP/IP and to understand its differences from Modbus RTU, the reader is invited to read the information provided on the following website:

http://www.simplymodbus.ca/TCP.htm

4.10.1 Connection Setup

The following table describes the connection requirements for controlling the Gripper using the Modbus TCP/IP protocol.

Connection requirement	Value
Required protocol	Modbus TCP/IP
Port	502
Gripper IP address	Configurable (most Grippers are shipped with the 192.168.1.X address)
Supported Functions	Read Input Registers (FC04) Preset Multiple Registers (FC16)
UnitID	0x0002 (2)
Robot Output / Gripper Input First Register	0x0000 (0000)
Robot Input / Gripper Output First Register	0x0000 (0000)

Each register (word - 16 bits) of the Modbus TCP/IP protocol is composed of **2** registers (bytes – 8 bits) from the Gripper. The first Gripper output Modbus register (0x0000) is composed from the first **2** Robotiq 2-Finger Adaptive Robot Gripper – 200 registers (byte 0 and byte 1).

Caution

For safety reasons, communication with the Gripper must stay open during operation, shutting down communication will stop the Gripper.

4.10.2 Read Input Registers (FC04)

Function code 04 (FC04) is used for reading the status of the Gripper (robot input). Examples of such data are Gripper status, object status, finger position, etc. For example, this message asks for registers 0x0000 (0000) to 0x0006 (0006) which contain all the robot input statuses.

Request is:

01 00 00 00 00 06 02 04 00 00 00 06

where

Bits	Description
01 00	Transaction identifier
00 00	Protocol identifier
00 06	Length
02	UnitID
04	Function 04 (Read input registers)
00 00	Address of the first register
00 06	Word count

Response is:

01 00 00 00 00 0f 02 04 0c e9 00 00 00 06 06 06 8a 00 00 00 00

where

Bits	Description
01 00	Transaction identifier
00 00	Protocol identifier
00 0f	Length
02	UnitID
04	Function 04 (Read input registers)
0c	The number of data bytes to follow
e9 00 00 00 06 06 06 8a 00 00 00 00	Data

Note

The Gripper register values are updated at a 200Hz frequency. It is therefore recommended to send FC04 commands with a minimum delay of 5ms between them.

4.10.3 Preset Multiple Registers (FC16)

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

Ex: This message requests to set several options for the Gripper by setting registers from 0x0000 (0000) to 0x0003.

Request is:

01 00 00 00 00 0d 02 10 00 00 00 03 06 09 00 64 64 00 ff

where

Bits	Description
01 00	Transaction identifier
00 00	Protocol identifier
00 0d	Length
02	UnitID
10	Function 16 (Preset multiple registers)
00 00	Address of the first register
00 03	The number of registers to write to
06	The number of data bytes to follow
09 00 00 64 00 ff	Data

Response is:

01 00 00 00 00 06 02 10 00 00 00 03

where

Bits	Description
01 00	Transaction identifier
00 00	Protocol identifier
00 06	Length
02	UnitID
10	Function 16 (Preset multiple registers)
00 00	Address of the first register
00 03	The number of registers written

4.10.4 Modbus TCP example

This section depicts the example given in section 4.8 when programmed using the Modbus TCP 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

Request is:

33 9A 00 00 00 0D 02 10 00 00 00 03 06 01 00 00 00 00 00

where

Bits	Description
339A	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
000D	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of registers to write to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0100	Value to write to register 0x0000 (ACTION REQUEST = 0x01 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**
0000	Value to write to register 0x0001
0000	Value to write to register 0x0002

Response is:

33 9A 00 00 00 06 02 10 00 00 00 03

where

Bits	Description
339A	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of written registers

Step 2: Read Gripper status until the activation is completed

Request is:

45 33 00 00 00 06 02 04 00 00 00 01

where

Bits	Description
4533	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
04	Function Code 04 (Read Input Registers)
0000	Address of the first requested register
0001	Number of registers requested (1)

Response (if the activation IS NOT completed):

45 33 00 00 00 05 02 04 02 11 00

where

Bits	Description
4533	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0005	Length
02	SlaveID
04	Function Code 04 (Read Input Registers)
02	Number of data bytes to follow (1 registers x 2 bytes/register = 2 bytes)
1100	Content of register 0000 (GRIPPER STATUS = 0x11, RESERVED = 0x00): gACT = 1 for "Gripper Activation", **gSTA = 1 for "Activation in progress"**

Response (if the activation IS completed):

45 33 00 00 00 05 02 04 02 31 00

where

Bits	Description
4533	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0005	Length
02	SlaveID
04	Function Code 04 (Read Input Registers)
02	Number of data bytes to follow (1 registers x 2 bytes/register = 2 bytes)
3100	Content of register 0000 (GRIPPER STATUS = 0x31, RESERVED = 0x00): gACT = 1 for "Gripper Activation", **gSTA = 3 for "Activation is completed"**

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

Step 4: Close the Gripper at full speed and full force

Request is:

71 EE 00 00 00 0D 02 10 00 00 00 03 06 09 00 00 FF FF FF

where

Bits	Description
71EE	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
000D	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of registers to write to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value to write to register 0x0000 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**, **rGTO = 1 for "Go to Requested Position"**
00FF	Value to write to register 0x0001 (GRIPPER OPTIONS 2 = 0x00 and POSITION REQUEST = 0xFF): **rPR = 255/255 for full closing of the Gripper**
FFFF	Value to write to register 0x0002 (SPEED = 0xFF and FORCE = 0xFF): full speed and full force

Response is:

71 EE 00 00 00 06 02 10 00 00 00 03

where

Bits	Description
71EE	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of written registers

Step 5: Read Gripper status until the grip is completed

Request is:

77 6B 00 00 00 06 02 04 00 00 00 03

where

Bits	Description
776B	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
04	Function Code 04 (Read Input Registers)
0000	Address of the first requested register
0003	Number of registers requested (3)

Example of response if the grip **is not completed**:

77 6B 00 00 00 09 02 04 06 39 00 00 FF 0E 0A

where

Bits	Description
776B	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0009	Length
02	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 0x0000 (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 0x0001 (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 0x0002 (POSITION = 0x0E, FINGER CURRENT = 0x0A): the position is 14/255 and the motor current is 100mA (these values will change during motion)

Example of response if the grip **is completed**:

77 6B 00 00 00 09 02 04 06 B9 00 00 FF BD 00

where

Bits	Description
776B	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0009	Length
02	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 0x0000 (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 0x0001 (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 0x0002 (POSITION = 0xBD, FINGER CURRENT = 0x00): the position is 189/255 (can be used to validate the size of the seized object)

Step 6: Move the robot to the release location

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

Request is:

34 AB 00 00 00 0D 02 10 00 00 00 03 06 09 00 00 00 FF FF

where

Bits	Description
34AB	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
000D	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of registers to write to
06	Number of data bytes to follow (3 registers x 2 bytes/register = 6 bytes)
0900	Value to write to register 0x0000 (ACTION REQUEST = 0x09 and GRIPPER OPTIONS = 0x00): **rACT = 1 for "Activate Gripper"**, **rGTO = 1 for "Go to Requested Position"**
0000	Value to write to register 0x0001 (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 to write to register 0x0002 (SPEED = 0xFF and FORCE = 0xFF): full speed and full force

Response is:

34 AB 00 00 00 06 02 10 00 00 00 03

where

Bits	Description
34AB	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
10	Function Code 16 (Preset Multiple Registers)
0000	Address of the first register
0003	Number of written registers

Step 8: Read Gripper status until the opening is completed

Request is:

D6 05 00 00 00 06 02 04 00 00 00 03

where

Bits	Description
D605	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0006	Length
02	SlaveID
04	Function Code 04 (Read Input Registers)
0000	Address of the first requested register
0003	Number of registers requested (3)

Example of response if the opening **is not completed**:

D6 05 00 00 00 09 02 04 06 39 00 00 00 BB 10

where

Bits	Description

D605	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0009	Length
02	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 0x0000 (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 0x0001 (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 0x0002 (POSITION = 0xBB, FINGER CURRENT = 0x10): the position is 187/255 and the motor current is 160mA (these values will change during motion)

Example of response if the opening **is completed**:

D6 05 00 00 00 09 02 04 06 F9 00 00 00 0D 00

where

Bits	Description
D605	Unique transaction identifier (chosen randomly)
0000	Protocol Identifier (Modbus)
0009	Length
02	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 0x0000 (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 0x0001 (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 0x0002 (POSITION = 0x0D, FINGER CURRENT = 0x00): the position is 13/255 (the fingers have reached their software limit)

Step 9: Loop back to step 3 if other objects have to be gripped.

4.10.5 Application with Universal Robots

This section contains some additional information related to the communication between the Gripper and the ***Universal Robots*** model ***UR-5*** and ***UR-10*** using the ***Modbus TCP*** protocol.

Modbus TCP works with 16-bits registers, whereas the Adaptive Gripper is configured using 8-bit bytes. Therefore, it is necessary to compute the value of each 16-bits register using two bytes. Also, the endianness is different for the Gripper than for the ***UR*** robots. This means that the first register is built using the following formula:

REGISTER0 = BYTE1 + 256 * BYTE0

> **Tip**
>
> One thing to try first is to send the value 256 to the REGISTER0. This command (1 on the activate bit) will trigger the initialization routine and therefore you should see the Gripper open and close to reach its mechanical stops.

Writing and reading other registers will be based on similar computations. Also, please note that the read/write registers are not the same.
As an example, writing to REGISTER0 will send a command to the Gripper whereas reading REGISTER0 will give you the status of the Gripper.

5. User Interface

Section in development while Robotiq 2-Finger Adaptive Robot Gripper – 200 is in beta testing.

6. Specifications

6.1 Technical dimensions

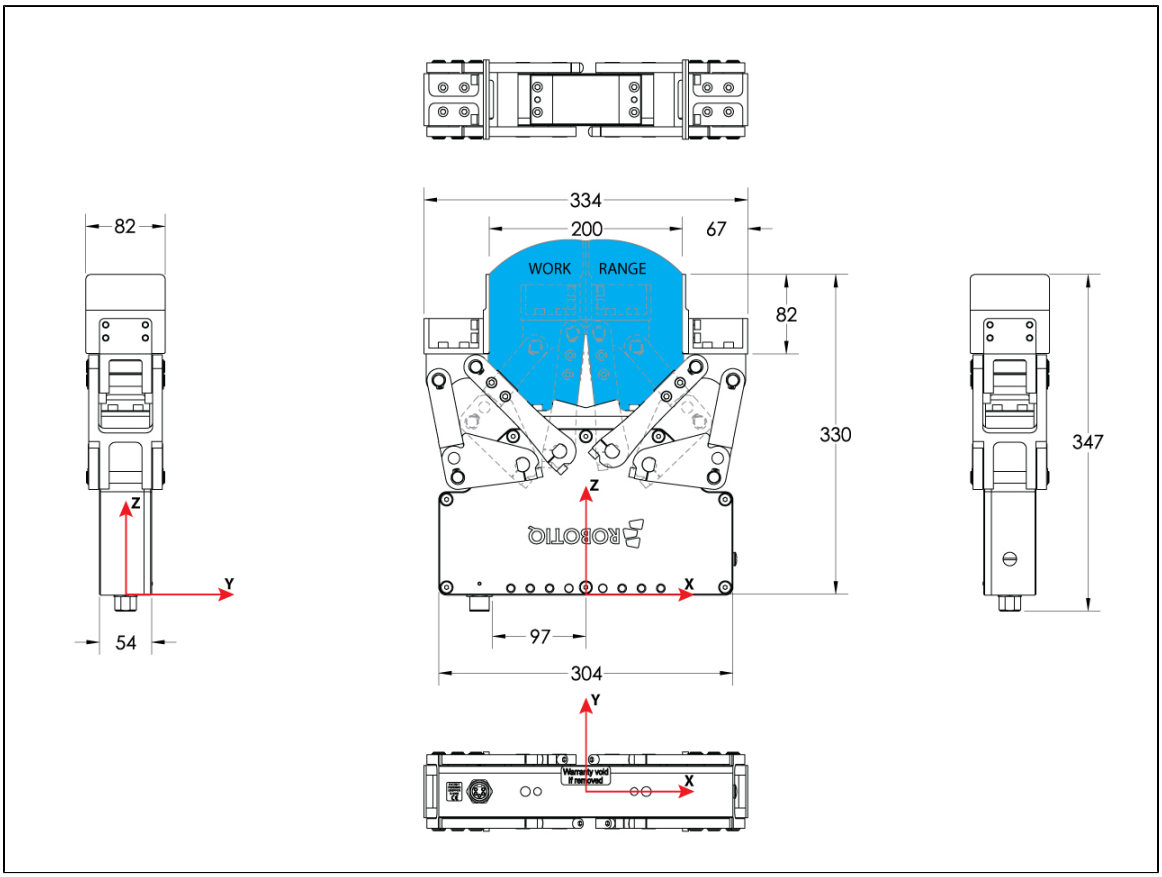


Figure 6.1.1 : Robotiq 2-Finger Adaptive Robot Gripper – 200 technical dimensions in open position.

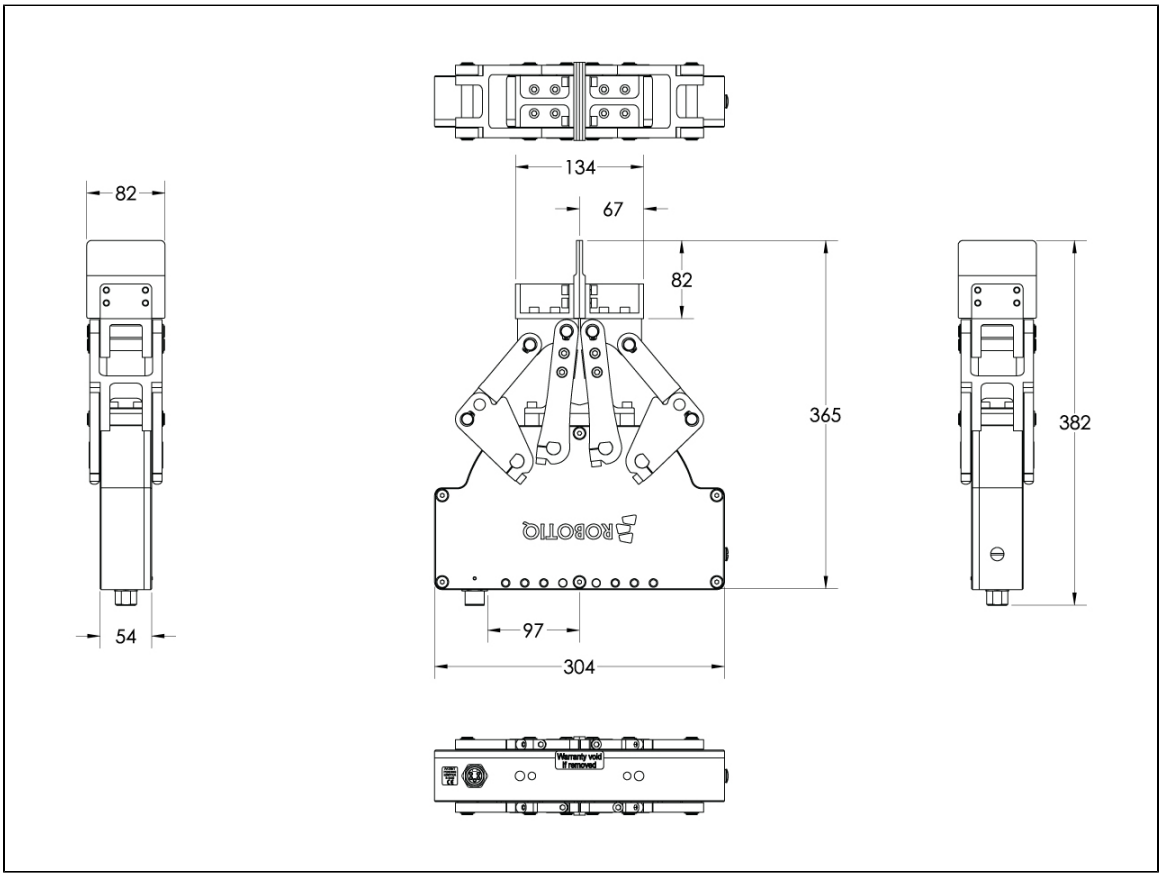


Figure 6.1.2 : Robotiq 2-Finger Adaptive Robot Gripper – 200 technical dimensions in closed position.

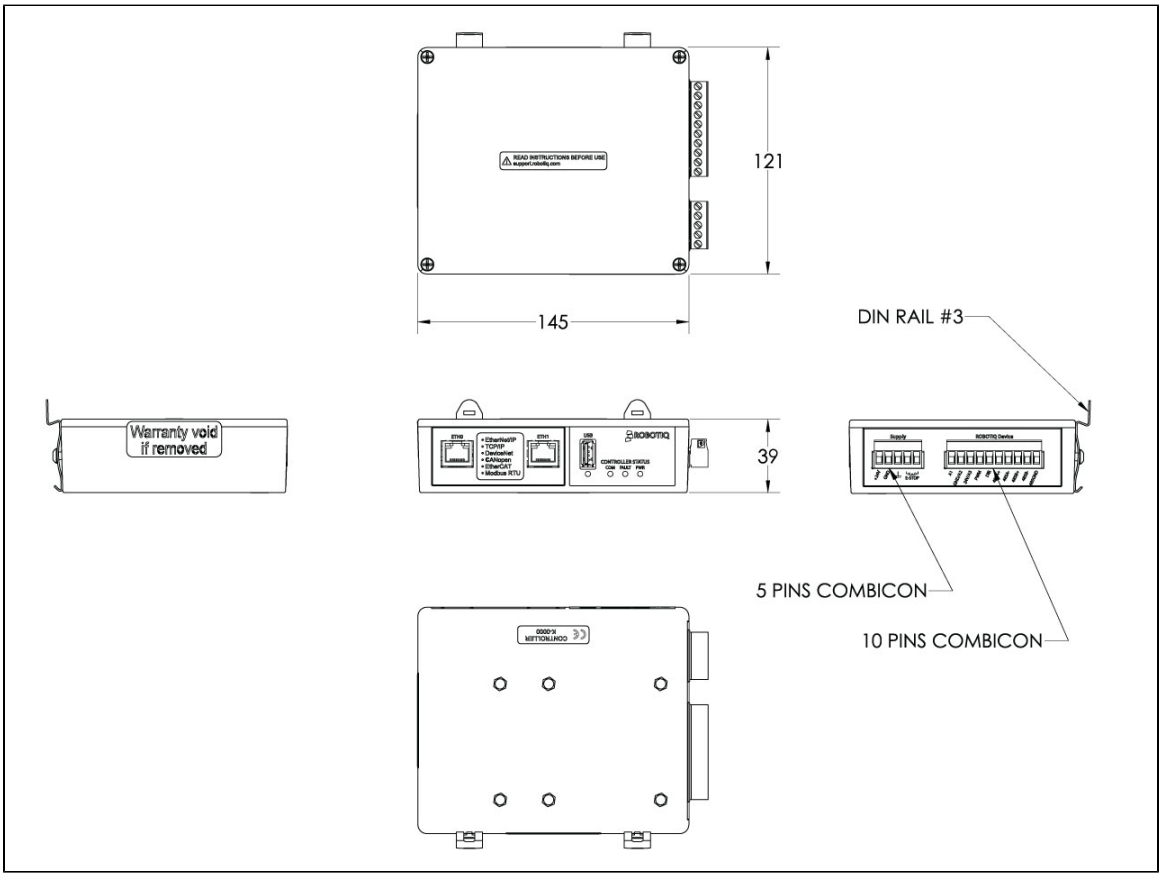


Figure 6.1.3 : Robotiq 2-Finger Adaptive Robot Gripper – 200 controller unit technical dimensions.

6.2 Mechanical specifications

Specification	Metric units	Imperial units
Gripper opening (see section 6.4 Pad design and customization)	0 to 200 mm	0 to 7.9 in
Object diameter for encompassing	103 to 191 mm	4 to 7.5 in
Partial opening resolution	0.93 mm	0.037 in
Gripper approximate weight	8.9 kg	19.6 lbs
Recommended payload[1]	22.9 kg	50.5 lbs
Grip force	150 to 750 N	33.7 to 168.6 lbf
Closing speed of one finger (Fingertip Grip)	18 to 114 mm/s	0.71 to 4.47 in/s
Finger position repeatability (Fingertip Parallel Grip)	0.03 mm	0.001 in

[1] 0.6 friction coefficient between finger steel and steel part, safety factor of 2.

Actuation force model used to calculate recommended payload is described in figure 6.2.1 :

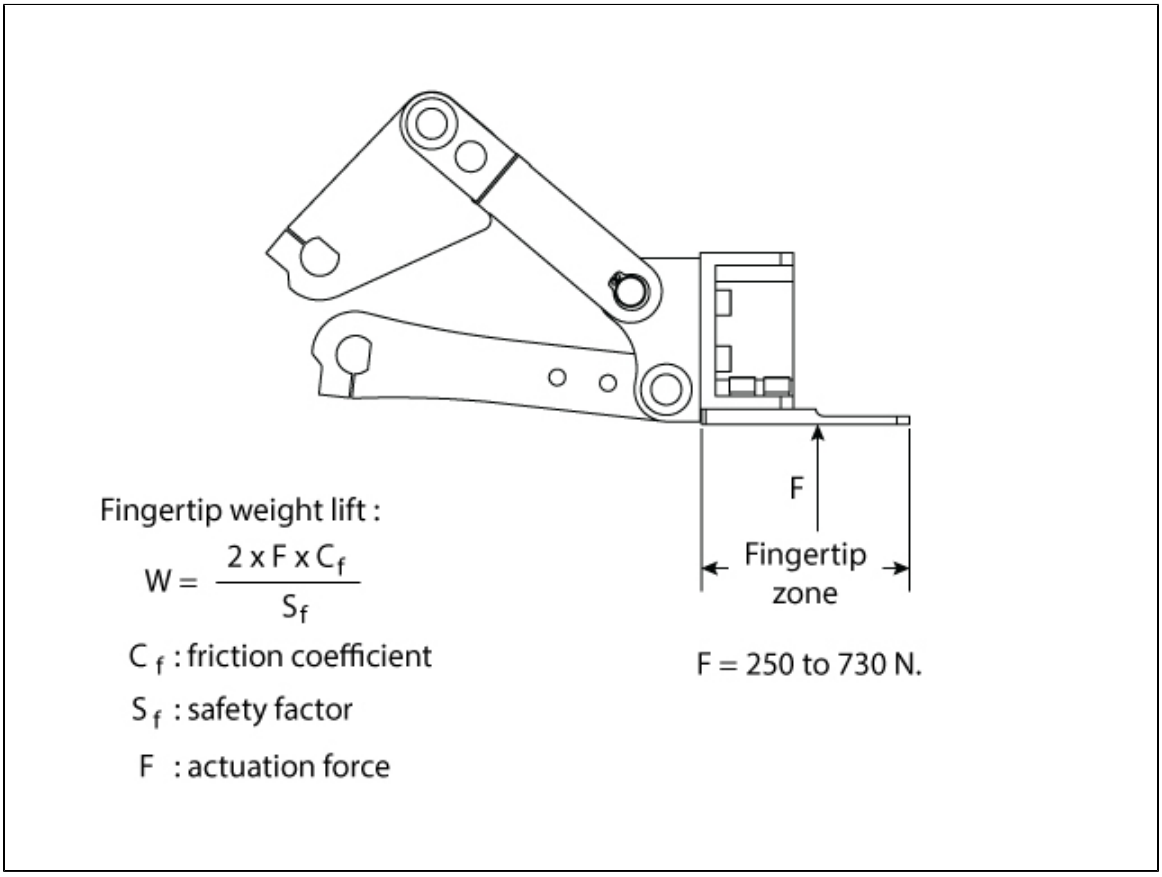


Figure 6.2.1 : Actuation force on the fingertip of the Adaptive Gripper 2-Finger – 200.

Info

- The "Actuation Force" is the force that can be applied to an object by the motors of the Gripper.
- The Gripper is self-locking.

The user of the Gripper must always ensure that the result of the forces being applied to the finger is always lower than the maximum holding Force.
As defined in figure 6.2.1, the weight that can be lifted is defined by :

- F is the force that is applied to the load by the Gripper.
- C_f is the coefficient of friction between the fingertip pads and the load.
- S_f is a safety factor to be determined by the robot integrator.

6.3 Moment of inertia and center of mass

The coordinate system used for calculating the moment of inertia and center of mass for the Gripper is shown in Figure 6.3.1. The center of mass and moment of inertia are calculated for a configuration where the fingers are fully open (at position 0).

Info

All values are approximate. Actual coordinates may vary according to fingertip type and various options present on the Gripper.

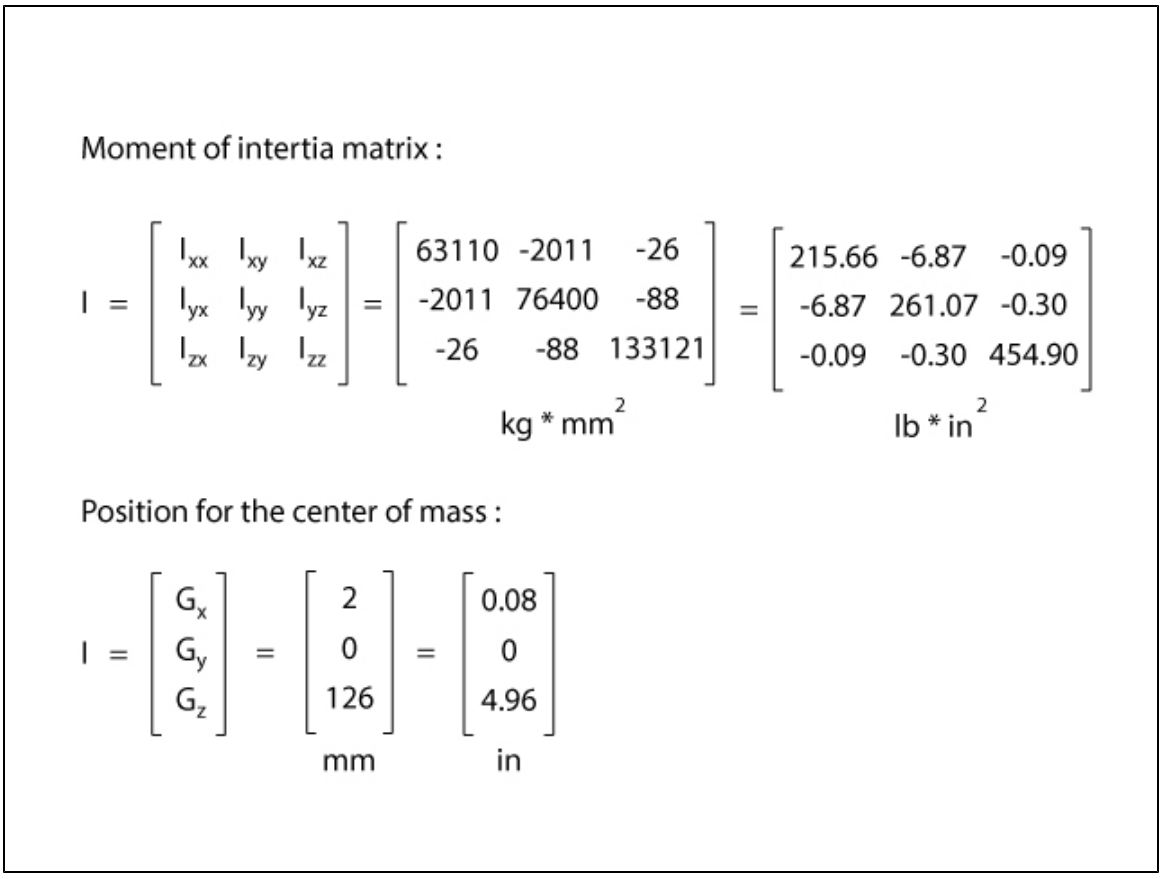


Figure 6.3.1 : Approximate value for the moment of inertia and the center of mass of the 2-Finger Adaptive Robot Gripper – 200.

6.4 Pad design and customization

Pads for the Robotiq 2-Finger Adaptive Robot Gripper – 200 can be customized to fit your gripping application. The following subsection details the design of standard Finger Pads, Palm Pads and Proximal Pads, information for custom design is also provided. For a list of available parts to replace the various pads see section 8. Spare Parts, Kits and Accessories.

6.4.1 Finger Pad

The Robotiq 2-Finger Adaptive Robot Gripper – 200 Finger Pads can be customized to fit your gripping application. The Finger Pad B-012 is fixed to the Pad Holder B-005 and the Pad Holder is fixed to the Gripper as shown in figure 6.4.1.1. For a list of available parts see section 8. Spare Parts, Kits and Accessories.

> **Hint**
>
> Note that the B-005 Pad Holders can be oriented so that the finger pads point to the inside or the outside of the Gripper fingers. This possibility allows for part picking from the inside or the outside of the fingers, so you can orient the pad holders to suit your application.

To assemble standard or custom Finger Pad :

1. Press **Y-996 Ø6**m6 x 12 Dowel Pins into the Pad Holder. Dowel pins must meet DIN 7-m6 standard.
2. Align the Finger Pad **B-012** to the Pad Holder **B-005**, fix with **Y-826** M6 x 12 Socket Head Cap Screws (SHCS) using the **Y-931** lock washers.
3. Align the Pad Holder **B-005** to the Gripper finger using the dowel holes present on the finger phalanx, fix with **Y-826** M6 x 12 Socket Head Cap Screws (SHCS) using medium strength Loctite (248).

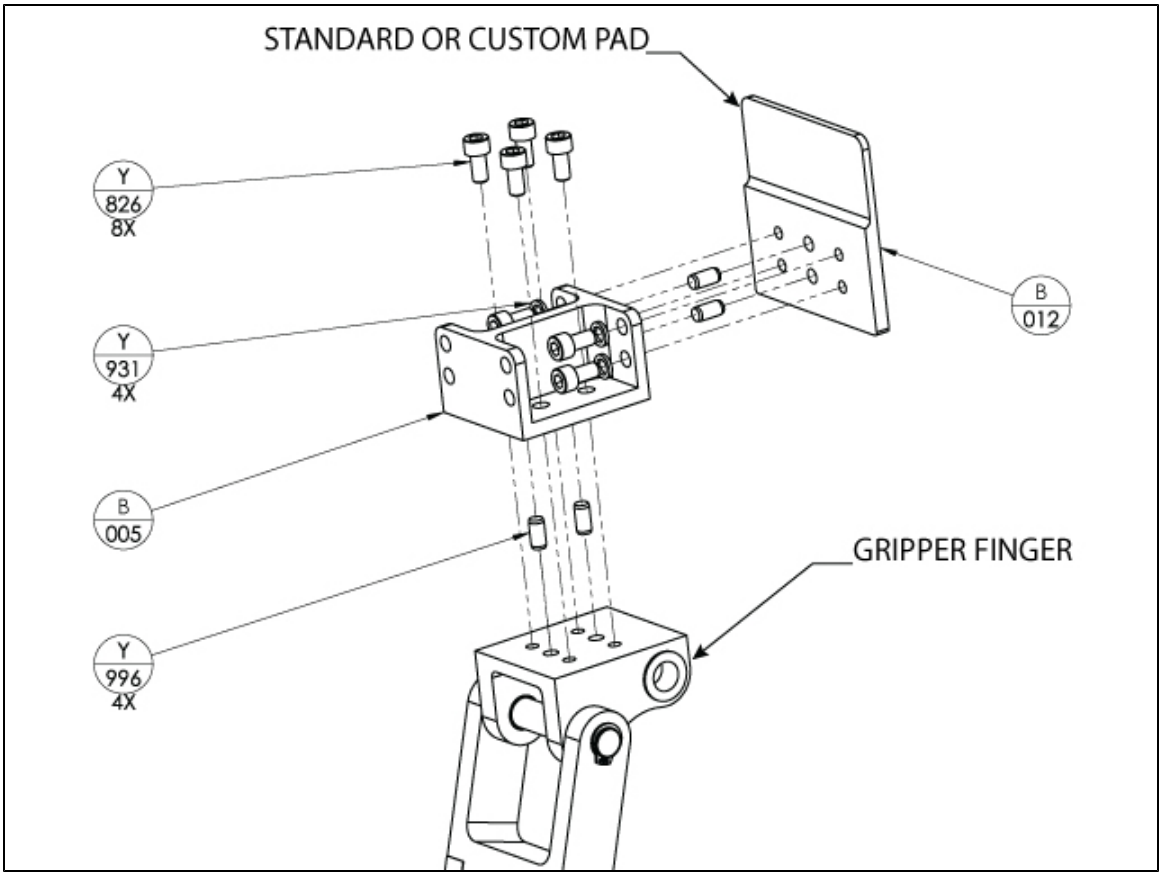


Figure 6.4.1.1 : Assembly of the Finger Pad B-012 to the Pad Holder B-005 and assembly of the Pad Holder to the Robotiq 2-Finger Adaptive Robot Gripper – 200.

You can design your own custom finger pads to fit the Pad Holder B-005 detailed in Figure 6.4.1.2 or design the whole block (replacing Pad Holder and Finger Pad) following the technical dimensions of the Gripper finger distal phalanx in Figure 6.4.1.3.

Design of your finger pads must respect :

- Maximum permissible weight : 400g
- Maximum center of mass distance (mm): (20000 / mass in grams) - 13 mm
  (distance from the top of the Gripper Distal Phalanx, shown in figure 6.4.1.3)

Exemple maximum center of mass

If your gripper pads weights 400g :
Maximum center of mass is : (20000/400) -13 = 37 mm above the top of the Gripper Distal Phalanx

Modifying the Gripper fingers by any means (drilling holes, adding fixtures, etc.) without Robotiq Engineering Service approval does not respect safety measures and warranty conditions. Never modify the Gripper without consent from Robotiq.

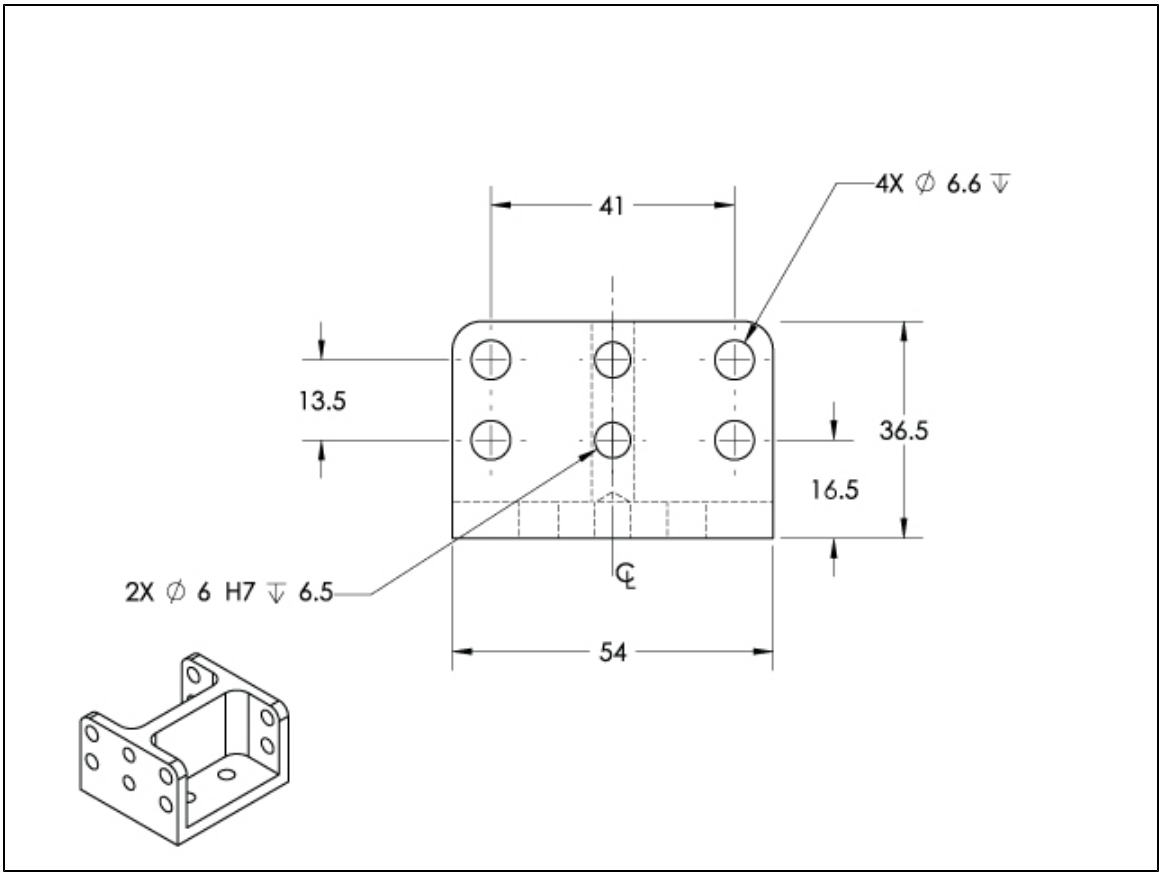


Figure 6.4.1.2 : Technical dimensions for the B-005 Finger Pad Holder.

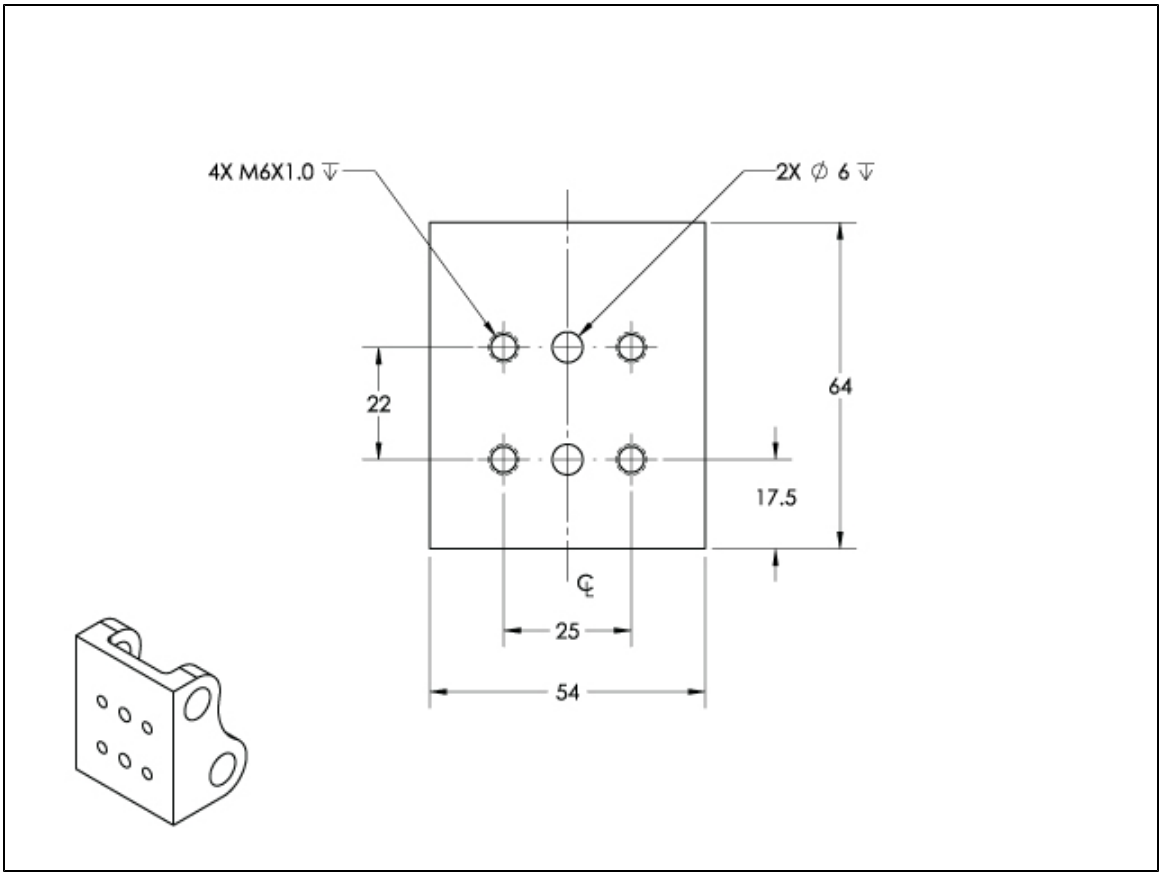


Figure 6.4.1.3 : Technical dimensions of the Gripper Distal Phalanx.

Note

When designing a completely custom fingertip (replacing Finger Holders and Finger Pads) your design must use the four (4) M6 Socket Head Cap Screw fixation points on the Gripper Distal Phalanx. Use of the Dowel Pins is strongly advised.

6.4.2 Proximal Pad

The Robotiq 2-Finger Adaptive Robot Gripper – 200 Proximal Pads can be customized to fit your gripping application. The Proximal Pad **B-011** is fixed directly to the Gripper as shown in figure 6.4.2.1. For a list of available parts see section 8. Spare Parts, Kits and Accessories.

To assemble standard or custom Proximal Pad :

1. Align the Proximal Pad **B-011** to the Gripper Proximal Phalanx.
2. Fix with **Y-826** M6 x 8 Socket Head Cap Screws (SHCS) using medium strength Loctite (248).

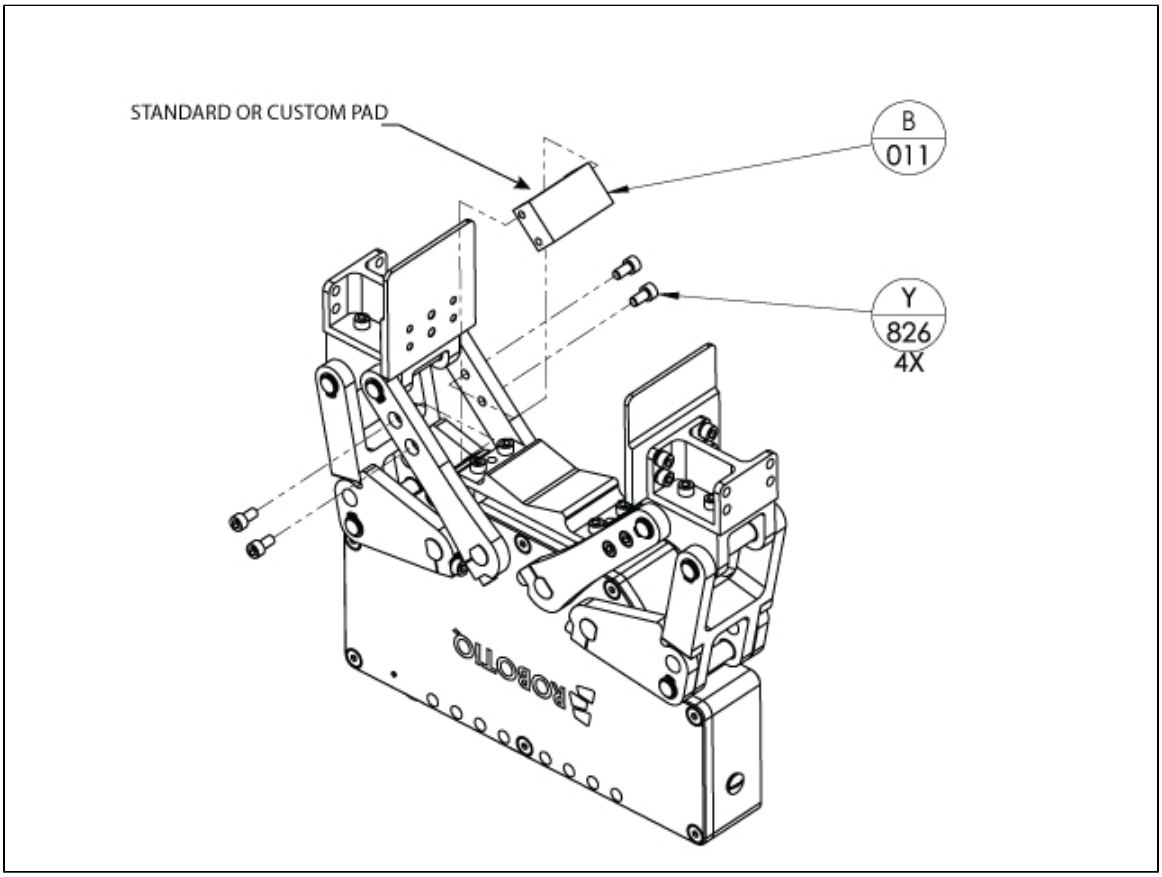


Figure 6.4.2.1 : Proximal Pad B-011 assembly

You can design your custom Proximal Pads to fit the Gripper fingers detailed in Figure 6.4.2.2. Note that the screw pattern must be present on both side of your pad and that both screw fixations are required to secure the pad.

⚠ Design of your finger pads must respect :

- Maximum permissible weight : 50 g
- Maximum center of mass distance : Center of mass located in the middle of the screw pattern shown in figure 6.4.2.2.

⚠ Modifying the Gripper fingers by any means (drilling holes, adding fixtures, etc.) without Robotiq Engineering Service approval does not respect safety measures and warranty conditions. Never modify the Gripper without consent from Robotiq.

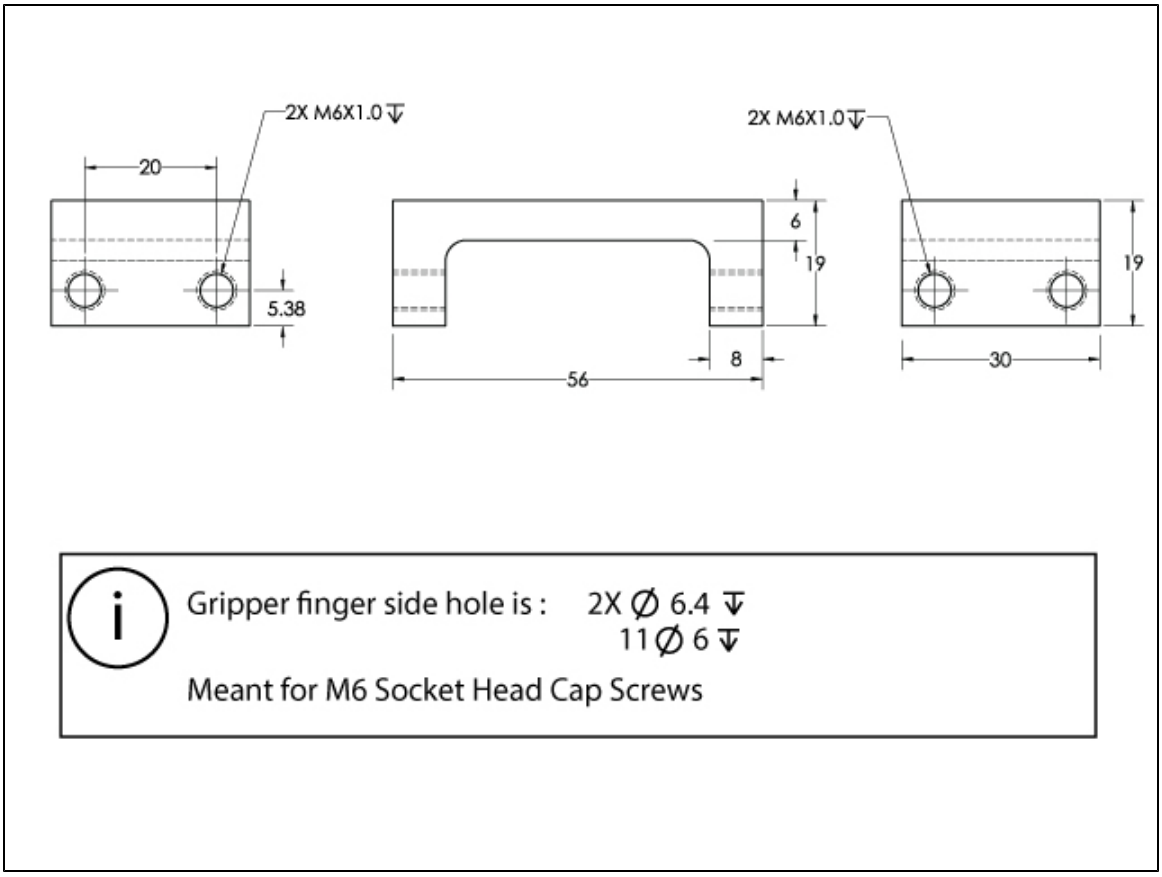


Figure 6.4.2.2 : Proximal Pad screw thread patterns.

6.4.3 Palm pad

The Robotiq 2-Finger Adaptive Robot Gripper – 200 Proximal Palm Pad can be customized to fit your gripping application. The Palm Pad **B-010** is fixed directly to the Gripper as shown in figure 6.4.3.1. For a list of available parts see section 8. Spare Parts, Kits and Accessories.

To assemble standard or custom Proximal Pad :

1. Align the Proximal Palm Pad **B-010** to the Gripper Proximal Palm Phalanx.
2. Fix with **Y-828** M6 x 4 Socket Head Cap Screws (SHCS) using medium strength *Loctite* (248).
3. If you wish to raise the Palm Pad, insert Palm Pad Spacer **B-009** x2 between Proximal Palm Pad **B-010** and the Gripper Proximal Palm Phalanx, attach with **Y-995** x2 dowel pins to align, then secure with **Y-828** M6 x 4 Socket Head Cap Screws (SHCS) using medium strength *Loctite* (248). Standard 2-Finger Adaptive Robot Gripper – 200 comes with one Palm Pad Spacer on each side.

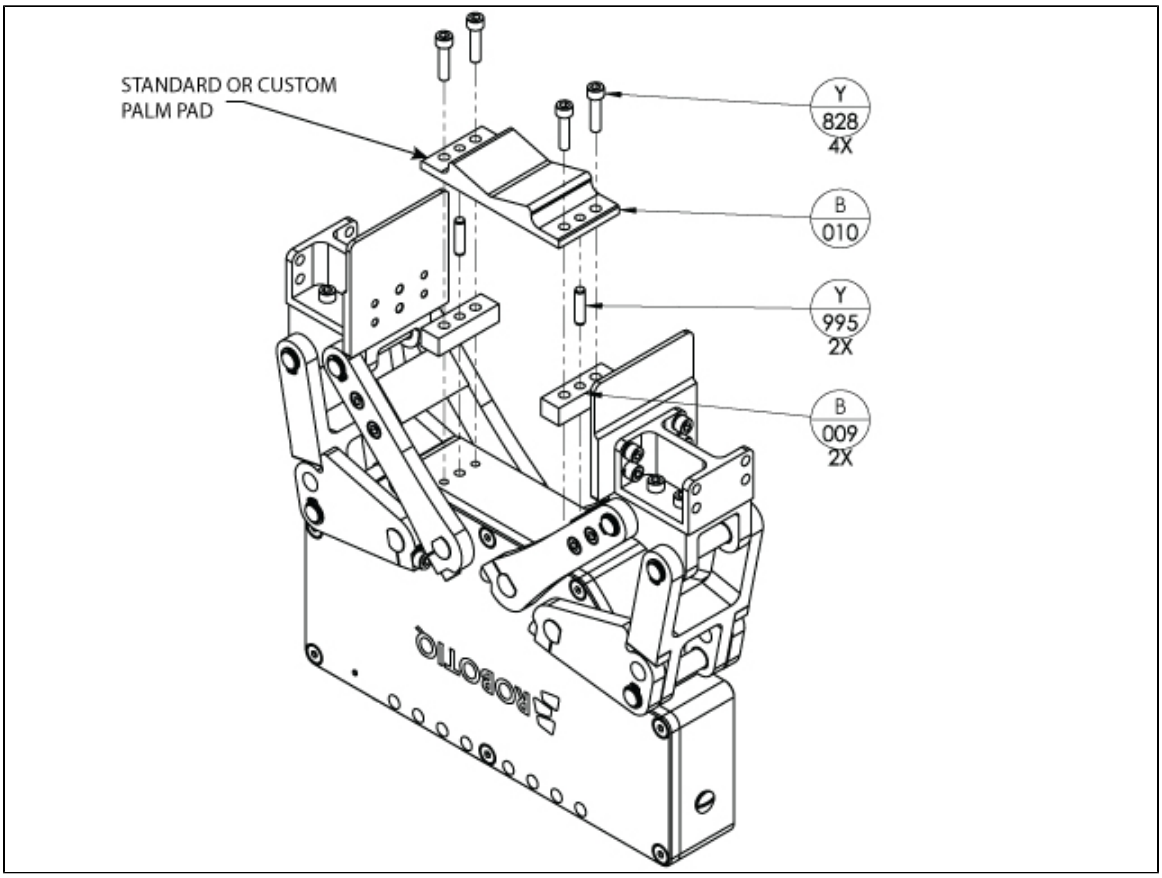


Figure 6.4.3.1 : Palm Pad **B-010** assembly.

B-009 Palm Pad Spacer can be stacked or customized to various size. Adjusting the height of the Palm Pad Spacer is crucial for adequate grasping of cylindrical parts.

You can design your own custom Proximal Palm Pads to fit the Gripper detailed in Figure 6.4.3.1. Use of dowel pins is recommended.

> ⚠ Design of your palm pad must respect the working envelope of the Gripper fingers shown in figure 6.4.3.2, **Palm Pad and Proximal Pad must avoid contact**.

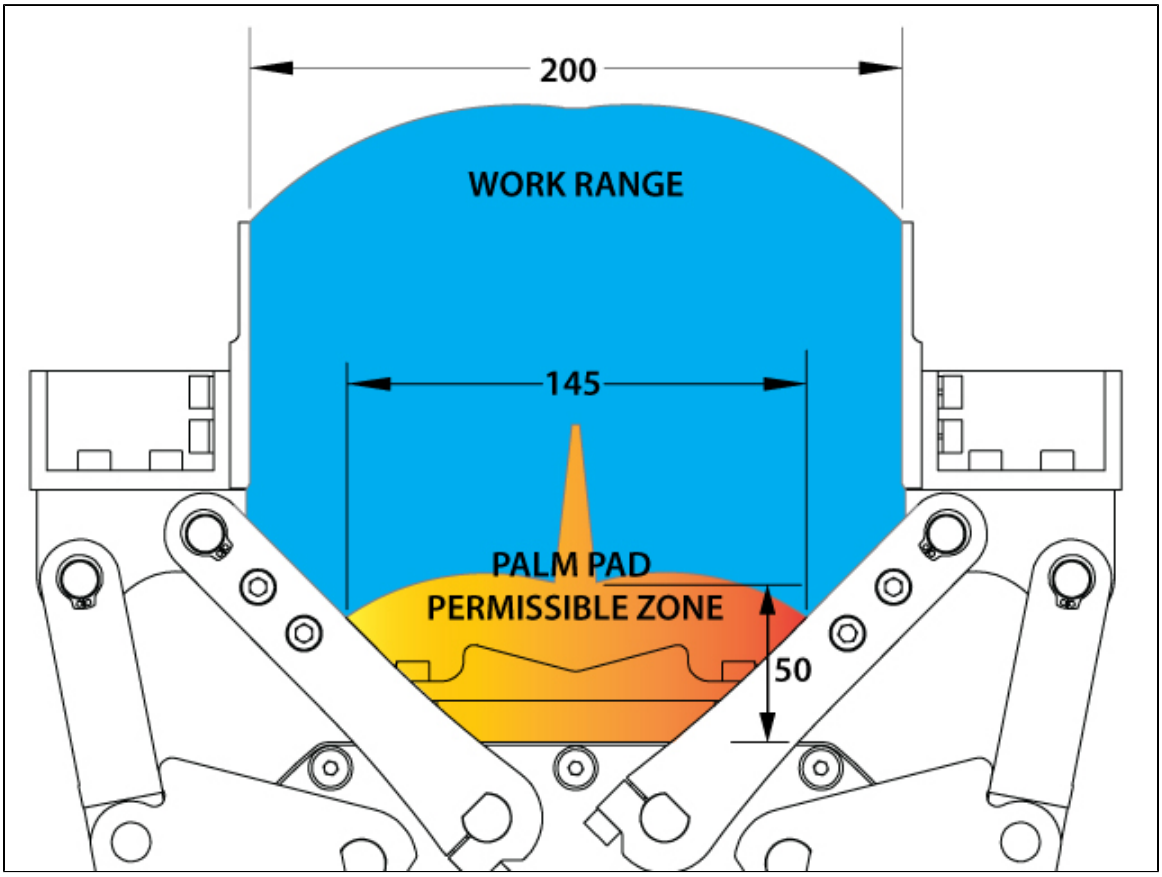


Figure 6.4.3.2 : Working envelope of the Gripper (centered on the Palm Pad).

Modifying the Gripper fingers by any means (drilling holes, adding fixtures, etc.) without Robotiq Engineering Service approval does not respect safety measures and warranty conditions. Never modify the Gripper without consent from Robotiq.

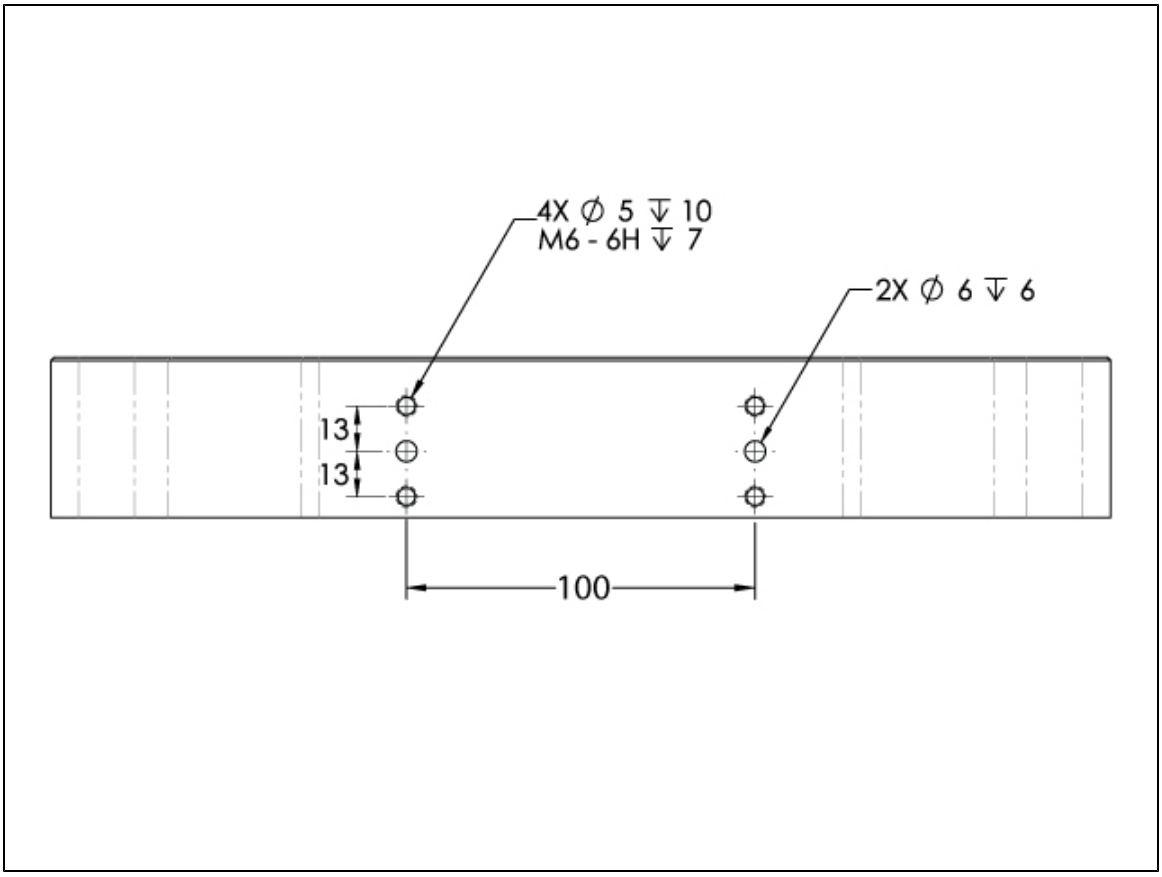


Figure 6.4.3.3 : Palm Pad screw thread patterns.

6.5 Finger movement

Figure 6.5.1 relates the Finger opening (distance between the two Finger Pads) to the corresponding "Go To" position request (from a range of 0 to 255), see section 4.6 Robot output registers & functionalities for details on the position control. See figure 6.5.2 for a representation of Finger movement.

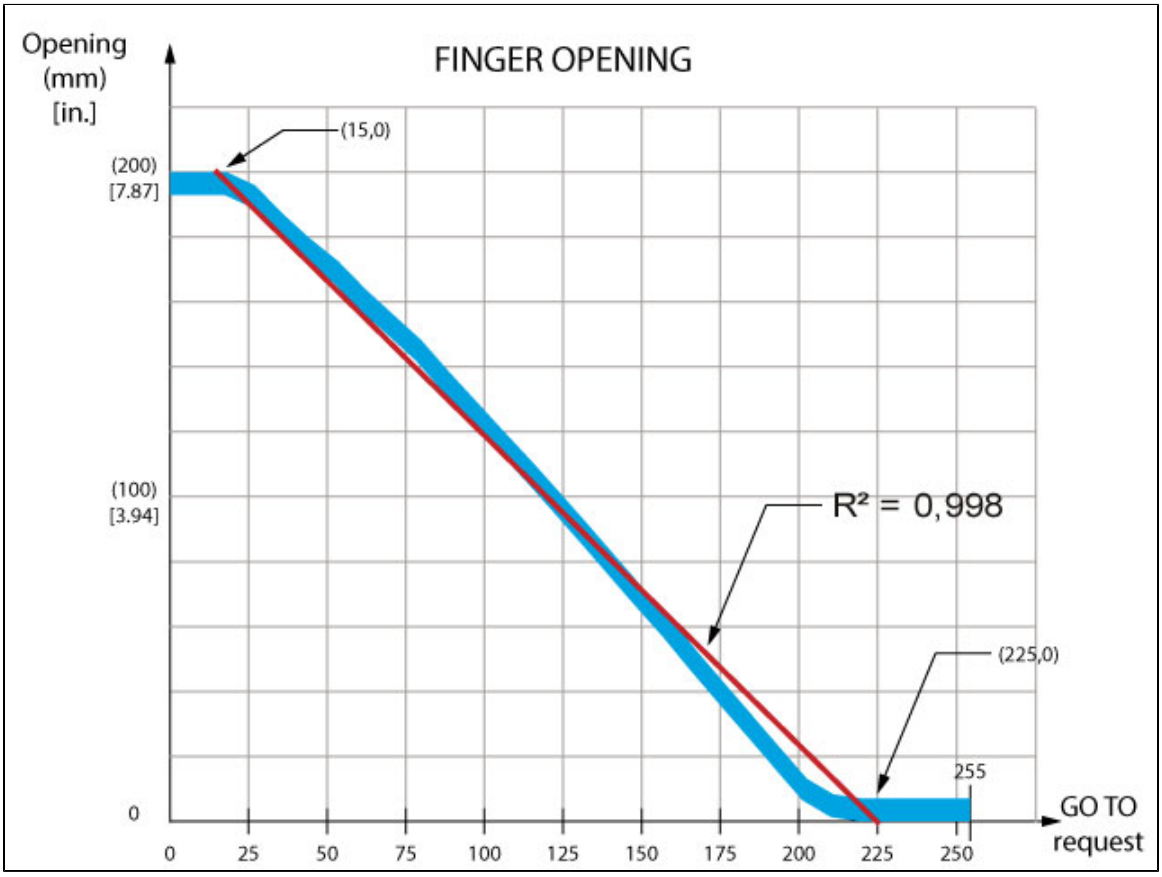


Figure 6.5.1 Finger opening for "Go To" position request.

Info

Finger opening is linear to $R^2 = 0.998$ within the "GO TO" request of 15 to 225. Within this range Finger opening has an approximate value **O = 0.98 mm * (220-GOTO)**.
From the 0 to 15 GO TO mark the Gripper is fully opened, while it is fully closed over 225.

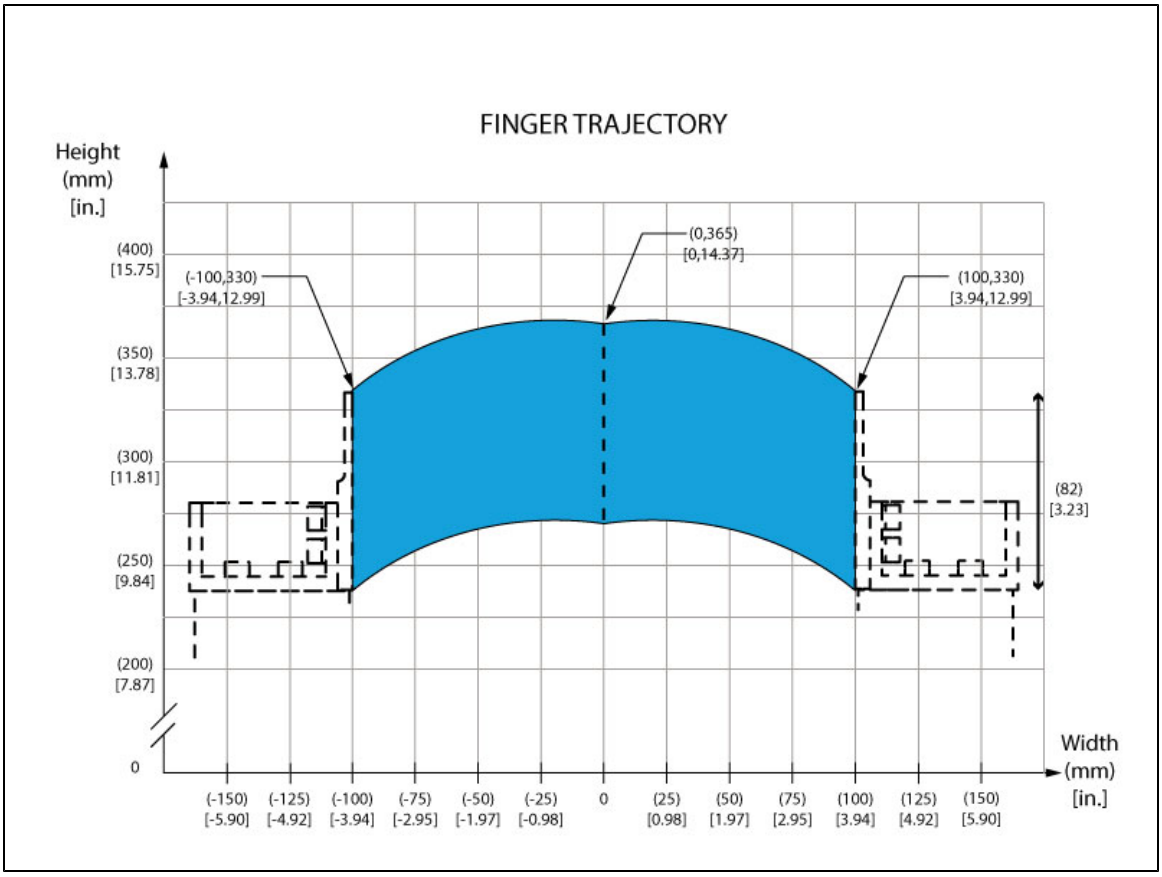


Figure 6.5.2 Finger trajectory

Note

The described finger trajectory is accurate for the standard 2-Finger Adaptive Robot Gripper – 200 Finger Pads (**B-012** part).

6.6 Coupling

The following are available standard Coupling for the 2-Finger Adaptive Robot Gripper – 200, to order see section 8. Spare Parts, Kits and Accessories.

B-061 : M8 Socket Head Cap Screws on 100mm PCD (Pitch Circle Diameter).

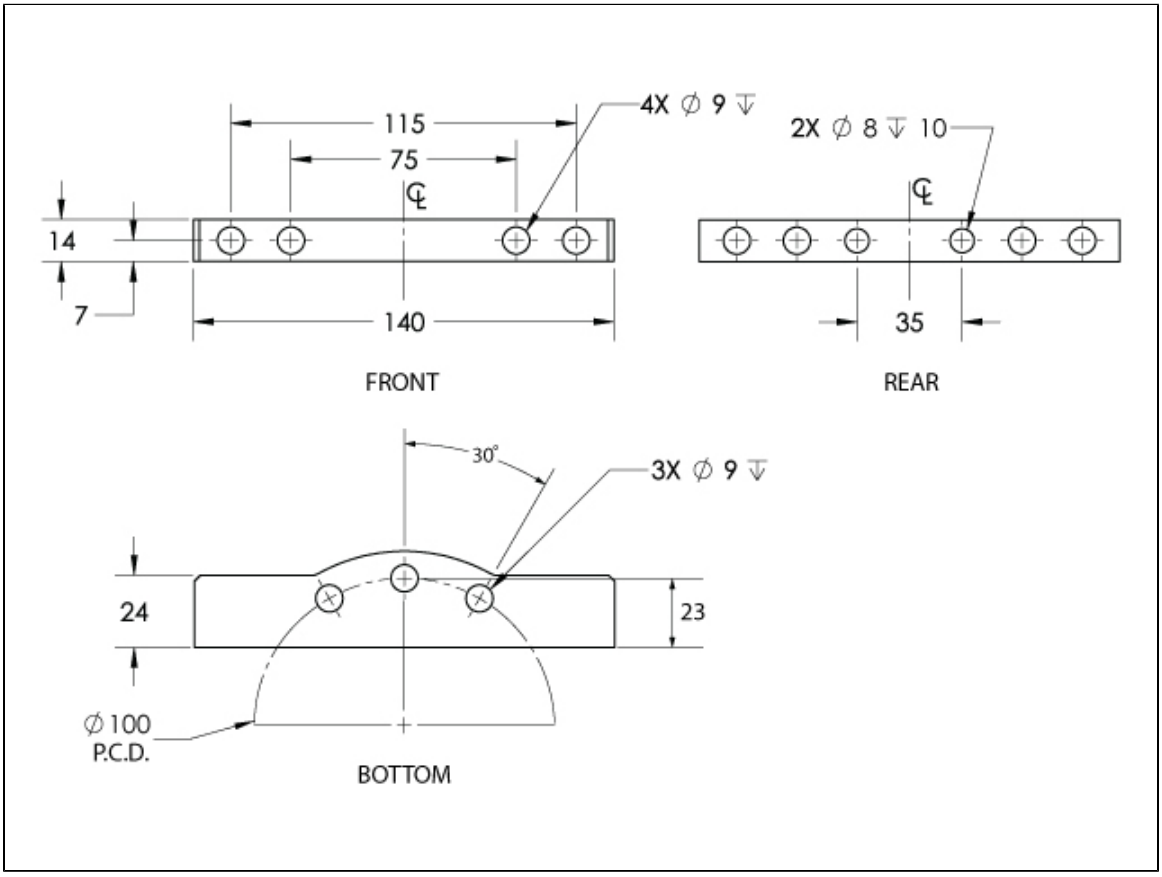


Figure 6.6.1 : B-061 coupling.

B-062 : M10 Socket Head Cap Screw on 125 mm PCD.

> **Info**
> For details on the available threads for Gripper mounting see 3.3.2 Dimensions for custom adapter.

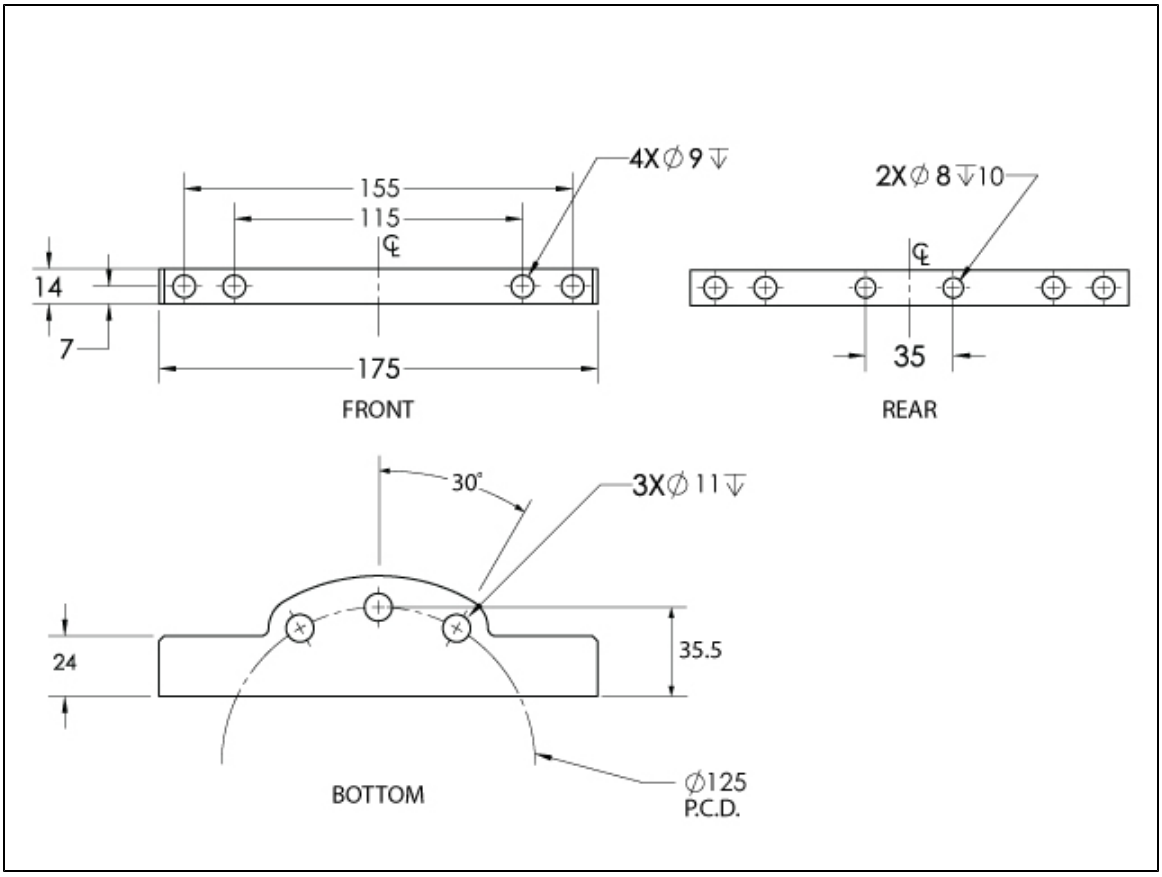


Figure 6.6.2 : B-062 coupling.

7. Maintenance

The Adaptive Gripper requires only external maintenance with limited downtime. Maintenance of the 2-Finger Adaptive Robot Gripper - 200 is required after specified usage, measured in time (normal 40h week) or in cycles (requesting an open and a close movement from the Gripper). Following the maintenance interval will ensure :

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

Please visit support.robotiq.com for details on the maintenance operation.

Warning

Unless specified, any repairs done on the Gripper or its Controller will be done by Robotiq.

Maintenance Intervals :

Operation	Daily	Weekly	Semiannually (or XXX M cycles)	Annually (or XXX M cycles)
Gripper Cleaning	Dirty conditions	Normal conditions		
Periodic Inspection			X	
Finger Pad Replacement[1]			**Test in progress**	**Test in progress**
Overhaul[2]			**Test in progress**	**Test in progress**

[1] Replace pads before if wear is visible.

[2] Overhaul is recommended after XXX M cycles (**Test in progress**) and is done by Robotiq at the user's expense, please contact Robotiq Support.

Visit support.robotiq.com for details on the required maintenance operations.

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

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

7.1 Gripper cleaning

Maintenance interval	Tools you need	Parts you need
Weekly or daily in dirty operating conditions	• Flat head screwdriver • Dry tissue or towel	None

Reminder

The Robotiq 2-Finger Adaptive Robot Gripper - 200 is water resistant, not waterproof, clean the Gripper with a wet towel and then dry with a dry towel.

Note

Always turn off robot and Gripper power supply before doing maintenance operations on the Gripper.

Procedure

1. Remove the protective cap to access the finger opening mechanism.
2. Open the Gripper fingers for better access to the palm and pads using your flat head screwdriver.
3. Clean the Gripper with a wet towel, remove all debris, dirt and dust from the surface of the Gripper.
4. After cleaning the Gripper, dry all parts.
5. Visually inspect the Gripper and pay attention to any visible wear or damage.
6. Put back the protective cap.

7.2 Periodic inspection

Maintenance interval	Tools you need	Parts you need
Monthly	• Flat head screwdriver • Dry tissue or towel	None (unless damage is detected)

Note

Always turn off robot and Gripper power supply before doing maintenance operations on the Gripper.

Procedure

1. Remove the Gripper from the robot following schematics in section 3.3 Mechanical connections.
2. Clean the Gripper following instructions in 7.1 Gripper cleaning.
3. Inspect the Gripper :
    a. Finger movement must be symmetric and fluid:
        i. Test the return movement by pushing open the fingers, the fingers must come back to their initial position on their own.
        ii. Test the general movement of the fingers by actuation via the screwdriver insertion hole in the chassis.
    b. Finger pad wear must not affect gripping, if wear is visible and affects movement, change finger pad(s).
    c. Check for any collision damage, if damage is visible, contact Robotiq Support.
    d. Check for any sign of wear on the Gripper chassis, if wear is present and may affect Gripper performance, contact Robotiq Support.
4. Put protective cap back on the screwdriver hole, put the Gripper back in place, make sure to maintain the initial orientation of your Gripper.

7.3 Finger pad replacement

Maintenance interval	Tools you need	Parts you need
XXX[1] Mio. cycles or when wear is visible	• Flat head screwdriver • Dry tissue or towel	• (2) Robotiq 2-Finger Adaptive Robot Gripper - 200 Finger Pads.

[1]Value currently under evaluation.

See Spare Parts, Kits and Accessories section to order Robotiq 2-Finger Adaptive Robot Gripper - 200 replacement parts.

See Pad design and customization section for details on the creation of custom Finger Pads.

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

Procedure

1. Remove the Gripper from the robot following schematics in section 3.3 Mechanical connections.
2. Clean the Gripper following instructions in 7.1 Gripper cleaning.
3. Remove the Finger Pads as described in section 6.4.1 Finger Pad.
4. Clean the Finger Pad Holders.
5. Fix the new Finger Pads (custom or standard) as illustrated in section 6.4.1 Finger Pad.

7.4 Overhaul

Maintenance interval	Tools you need	Parts you need
XXX[1] Mio. cycles or at warranty expiration	None	None

Gripper overhaul is necessary when the Gripper reaches XXX[1] Mio. cycles or when warranty has expired. Overhaul is done by Robotiq, please contact Robotiq Support Service.

[1] Value currently under evaluation

8. Spare Parts, Kits and Accessories

Spare parts, kits and accessories list :

Item	Description	Ordering Number
B-061	Coupling for 100 mm PCD[1] diameter and M8 screws.	AGB-CPL-061
B-062	Coupling for 125 mm PCD[1] diameter and M10 screws.	AGB-CPL-062
B-071	Adapter Plate for 100 mm PCD[1] diameter, six (6) M8 screws, two (2) 8mm m6 dowel pins. Meant for use with B-061 Coupling.	AGB-APL-071
B-072	Adapter Plate for 56 mm PCD[1] diameter, fifteen (15) M4 screws, one (1) 4 mm m6 dowel pin. Meant for use with B-061 Coupling	AGB-APL-072
B-073	Adapter Plate for 80 mm PCD[1] diameter, six (6) M8 screws, one (1) 8 mm m6 dowel pin. Meant for use with B-062 Coupling	AGB-APL-073
Y-2062	10 m communication cable between 2-Finger Adaptive Gripper – 200 and controller (Gripper Signal Cable).	CBL-COM-Y2062
Y-2057	5 m USB 2.0 cable A-A male. For reconfiguration of the 2-Finger Adaptive Gripper – 200 Controller unit.	CBL-USB-Y2057
Parallel kit	Parallel mechanism locking pins kit, includes : • two (2) B-022 12 mm steel axles. • four (4) Y-945 external retaining rings.	AGB-KIT-B022

Finger Pad	includes : • one (1) B-012 Finger Pad. • four (4) Y-826 M6 x 12mm Socket Head Cap Screws. • four (4) Y-931 DIN 7980 M6 locking rings.	AGB-PAD-B012
Proximal Pad	includes : • one (1) B-011 Proximal Pad. • four (4) Y-826 M6 x 12mm Socket Head Cap Screws.	AGB-PAD-B011
Palm Pad	includes : • one (1) B-010 Palm Pad. • four (4) Y-828 M6 x 25mm Socket Head Cap Screws. • two (2) Y-995 m6 x 24 mm ISO 2338 dowel pins.	AGB-PAD-B010
B-009	One (1) 12.7mm (0.5 in) Palm Pad Spacer model B-009.	AGB-PAD-B009

[1] *Pitch Circle Diameter*

9. Troubleshooting

If your Gripper is not working, check the following :

1. **Check the blue LED on the Gripper :**
    a. It's ON : Check communication LED state (step 2)
    b. It's OFF : Check the blue LED on the controller :
        i. It's ON : Gripper is not powered, but the controller is.
            1. The controller red LED is blinking, emergency stop has been activated or overcurrent was triggered, the system require a software reset (rACT = 0).
            2. The controller red LED is OFF, device may not be detected, check the integrity of the Gripper signal cable (shown in section 3.5).
        ii. It's OFF : Gripper and controller are not supplied, check power supply (see specification in section 3.4).

> ✅ Check Gripper signal cable and controller cable for damage, pay attention to the connectors.

2. **Check the green LED on the Controller :**
    a. It's OFF : No network detected, check communication cables and network infrastructure (see specific protocol in section 3.5.2 and the following).
    b. It's BLINKING : Network detected, no communication established, go to step 5.

> ℹ️ EtherNet family protocol must be connected via RJ45 port, while CanOpen will use DB-9 connector and DeviceNet uses a Combicon connector.

    c. It's ON : Network detected and communication is established, go to step 3.

3. **Check the red LED on the Controller :**
    a. It's OFF : No fault, go to step 6.
    b. It's BLINKING : Major fault occurred, (see section 4.7 for details) reset (activate) the Gripper as stated in point 1 above.
    c. It's ON : Automatic release or booting in process, wait until it's off.

4. **Check the red LED on the Gripper :**
    a. It's OFF : No fault, go to step 6.
    b. It's BLINKING : Automatic release completed, reset (activate) the Gripper.
    c. It's ON : Minor fault occurred (overcurrect triggered), automatic release may be in progress.

a. **Communication & Network issues :**
   i. Only use one connection at a time, either USB or the industrial protocol.
   ii. Ethernet family : Use the proper Ethernet options, Modbus TCP/IP and EtherNet IP require fixed IP, EtherCAT requires DHCP.
   iii. DeviceNet: Requires a separate power supply (see DeviceNet section).

> Master communication device must use the same protocol and the same option settings as the controller for the Gripper.

   iv. After reprogramming communication options, wait for the red led on the controller to turn off before using the Gripper.

b. **Other problems** :
   i. If the system shuts down (blue LED goes off) when the Gripper activates, check the power supply, the power supply must meet the following requirements.
   ii. When attempting to move the Gripper, make sure '' go to requested position'' (rGTO) is active (set to 1), in the User Interface, the Go to Requested Position case must stay checked for the Gripper to move.

10. Warranty

Robotiq warrants the 2-Finger Adaptive Robot Gripper – 200 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 section 3.2 .
- Proper installation of the Gripper specified in section 3 and the following subsections.
- Usage under normal one-shift operation (40h a week).
- Usage respects maintenance specified in section 7.
- Usage respects recommended payload and forces specified in section 6.2.

During the warranty period, Robotiq will repair or replace any defective 2-Finger Adaptive Robot Gripper – 200, 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.
- Warranty sticker has been removed.
- Screws, other than as explained in this guide, have been removed.
- 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 – 200, nor shall Robotiq be responsible for any failure in the performance of other items to which the 2-Finger Adaptive Robot Gripper – 200 is connected or the operation of any system of which the Gripper may be a part.

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

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.

11. Contact

www.robotiq.com

Go to Contact Us

Phone
1-888-ROBOTIQ (762-6847)
1-418-800-0045 (outside US and Canada)

Fax
1-418-800-0046

Technical support and Engineering
1-866-508-1997, X201

Sales US
1-812-220-4578

Sales Canada, Europe and Asia
1-418-800-0045

Head office
Robotiq:
966, chemin Olivier
Suite 325
St-Nicolas, Qc
G7A 2N1
Canada

Translation of original EC declaration of incorporation

ROBOTIQ

Translation of original EC declaration of incorporation

we,

Robotiq inc.
966, Chemin Olivier, suite 325
St-Nicolas, Québec, Canada, G7A 1N1
(supplier)

declare under our sole responsibility that the products:

2-Finger Adaptive Robot Gripper – 200 **(Gripper B)**
Serial B-1001 and onward

to which this declaration relates satisfy the applicable provisions of Directives

2006/42/CE	2006	Revised Machinery Directive

the following requirements have been applied and fulfilled :

- 1.1.2, 1.1.3, 1.1.5, 1.2, 1.3, 1.5.1, 1.5.8, 1.5.9, 1.5.10, 1.6, 1.7

and are in conformity with the following standards or other normative documents:

NF EN ISO 14539	2002	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

The manufacturer agrees to forward on demand the documents specified by Annex VII part B in the required period.
Person responsible for documentation : Mr. Étienne Samson, adress: see the adress of the manufacturer
This partly completed machinery must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive 2006/42/EC.

St-Nicolas, may 2013
(place and date of issue)

Jean-Philippe Jobin
Chief Technical Officer
Robotiq inc.