



# ROBOTIQ PALLETIZING *SOLUTION*

## PE Series

Original Notice

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Robotiq Palletizing Solution - PE Series  
for Universal Robots



Instruction Manual

LEAN   
ROBOTICS

[robotiq.com](http://robotiq.com) | [leanrobotics.org](http://leanrobotics.org)



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# Revisions

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

## 2023/01/31

- AirPick Gripper is replaced by PowerPick Gripper. Sections are modified accordingly
- Multipick feature added in Software section.
- Script "Get Current Box Type" added in Software section.
- Box sensor(s) subsection modified in Installation section.

## 2022/11/22

- Cable management installation improved (Installation section).

## 2022/10/03

- Maximum value for Elbow joint limit changed from 0° to 3°. Minimum and maximum values for Wrist 3 joint limits changed from -270° to -273° and 270° to 273° (Installation section).
- Cable management material and installation modified (Installation section).

## 2022/07/11

- Components image modified in General Presentation section for modification of base covers
- Steps and images modified in Installation section for modification of base covers.

## 2022/04/25

- Added warning note for Moving and Positioning the Solution (Installation section).
- Added an "Avoid collision with conveyor" option in the Palletizer node and the different configurations (Software section).
- Added scripts "Get Pallet State" and "Set Palletizer State" in Software section.

## 2022/03/28

- Updated Electrical Specifications section
- Updated Push Button Enclosure Connection section
- Updated Push Button Enclosure and Teach Pendant Rack section
- Added Robot Limits section





**2022/02/03**

- Updated Physical Clearance and Reachable Area of the Robot section
- Added new option in Copilot Configuration tab
- Added new option in Palletizer node
- Removed Force and Speed Robot Limits section
- Updated Harmonized Standards section

**2022/01/04**

Initial Release





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The information contained in this document is subject to change without notice.





# 1 General Presentation

The terms *Palletizer*, *Palletizing Solution*, *Robotiq Palletizing Solution*, *Solution* and *PE Series* used in this manual all refer to the PE Series Robotiq Palletizing Solution. The PE Robotiq Palletizing Solution is a hardware and software solution already connected and ready to install. It is composed of a base fully integrated with a Robotiq Controller, pallet sensors, a pedestal, and a post with a teach pendant rack and status lights. The Material Handling Copilot software and accessories (e.g., box sensor, anchor kit, cable management system, etc.) are also part of the Solution.

## Info

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

## 11 Palletizing Solution Components

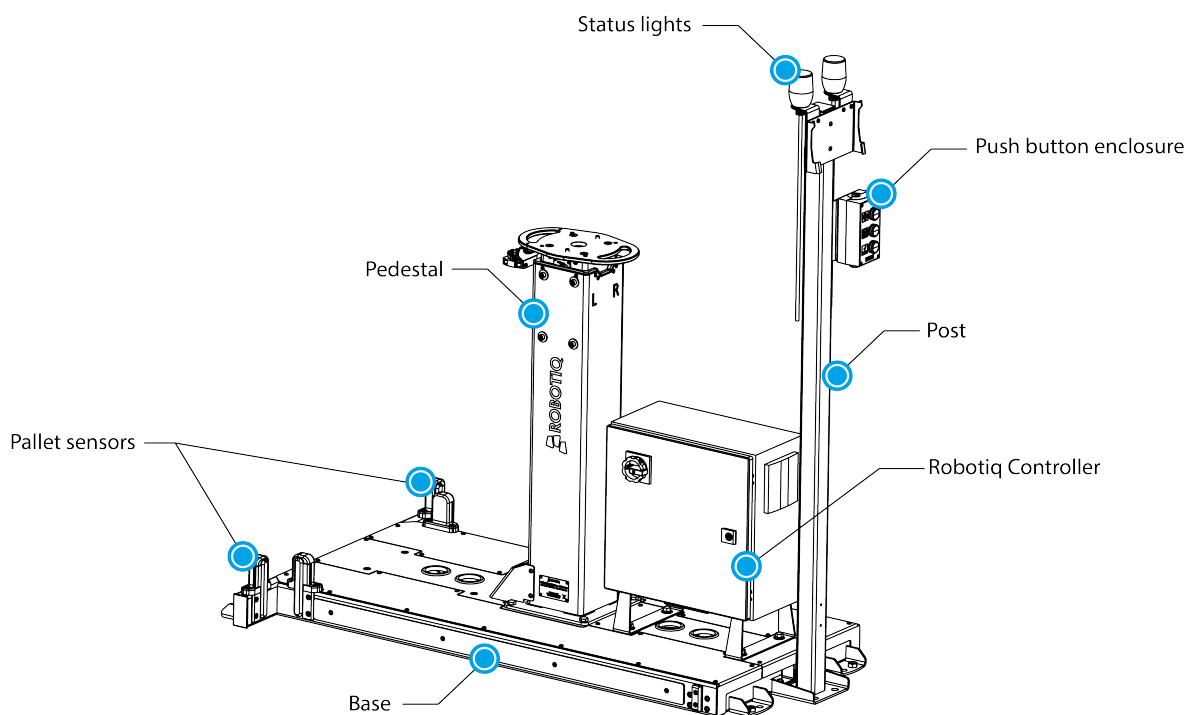


Fig. 1-1: PE Series Robotiq Palletizing Solution

## Info

The following section presents the key features of the Robotiq Palletizing Solution and must not be considered as appropriate to the operation of the Solution. Each feature is detailed in the appropriate section.

### 111 Base, Pedestal and Post

The Robotiq Palletizing Solution is composed of a base, on which a pedestal, pallet sensors and a Robotiq Controller are mounted, and a post, on which a teach pendant rack, a push button enclosure, and status lights are mounted. The inner pedestal section can be adjusted in height (13 different positions) using a plunger latch. The Solution is designed to facilitate the positioning of pallets. The base has to be anchored to the floor. For more details, please refer to the **Installation** section





## 112. Robotiq Controller

All the components of the Solution are integrated and controlled via the Robotiq Controller. It allows for the motion of the robot during a palletizing action, and the control of the pallet sensors and status lights.

## 113. Standalone Post

The Solution also comprises a post to which a push button enclosure, status lights and teach pendant rack are attached. The post can either be mounted to the base or positioned elsewhere, adjacent to the base.

## 114. Pallet Sensors

The Solution is composed of four (4) sensors to detect pallets presence (two per pallet). The sensors will allow the Solution to ensure that the pallets are well positioned on each side of the base to optimize the application process.

## 115. Status Lights

Two (2) status lights are positioned at the top of the post adjacent to the base. Each status light is associated to the nearest pallet. The color of the light gives information on the status of the system or the state of a specific pallet. Please refer to the **Light States** section for more information.

## 116. PowerPick Vacuum Gripper (Optional)

The PowerPick is a Vacuum Gripper that creates a vacuum with a venturi system that uses compressed air as an energy source. It comes with its external controller, is equipped with multiple suction cups and interchangeable components. Its design is optimized (weight, payload capability) for the Palletizing Solution when used with a UR10e robot.



Fig. 1-2: Robotiq PowerPick Gripper and Controller

## 117. Box Detection Sensor

The Solution includes a box sensor that needs to be installed at the end of the conveyor in a way that it is triggered when a box is ready to be picked up.

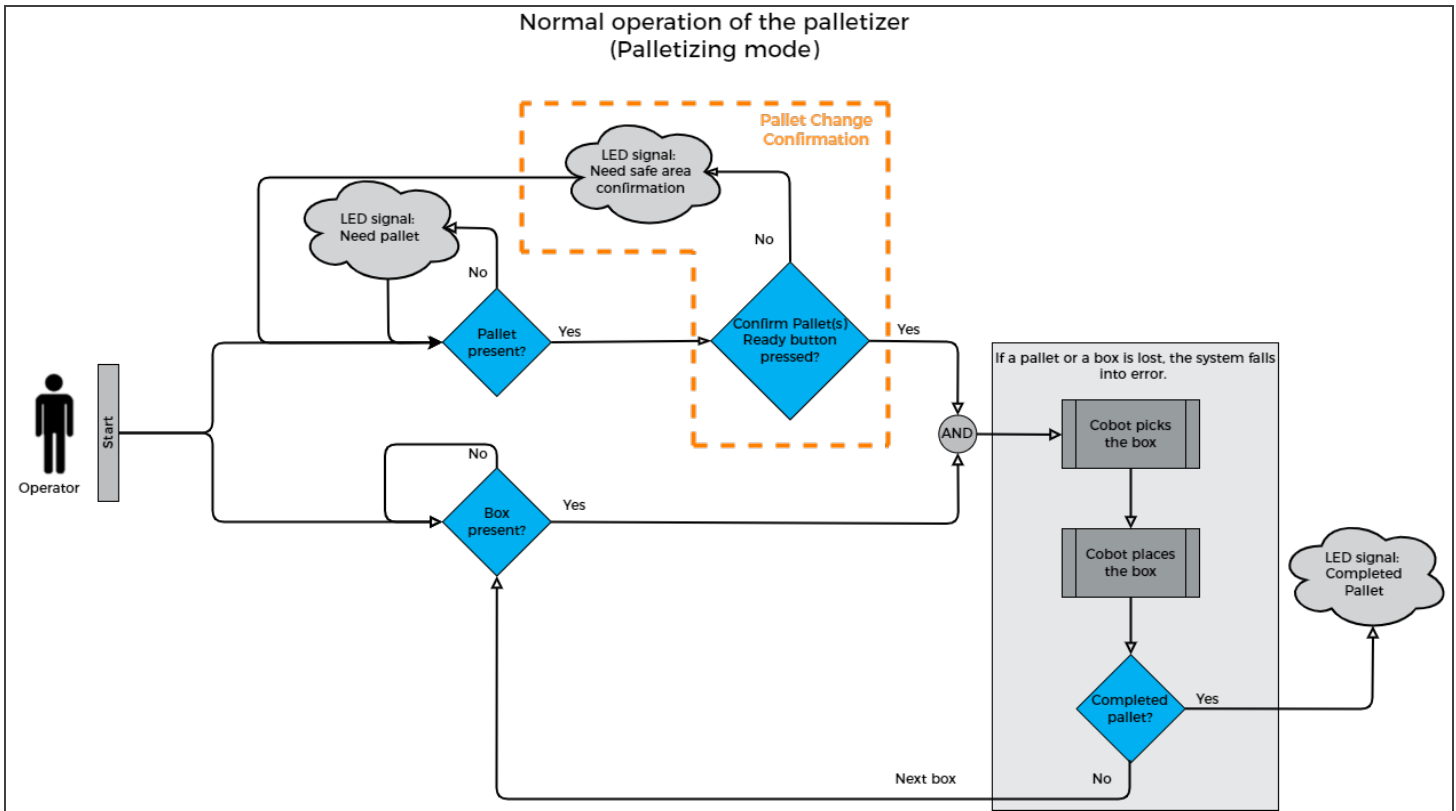


Fig. 1-3: Box Sensor



## 12. Palletizing Operation Diagrams

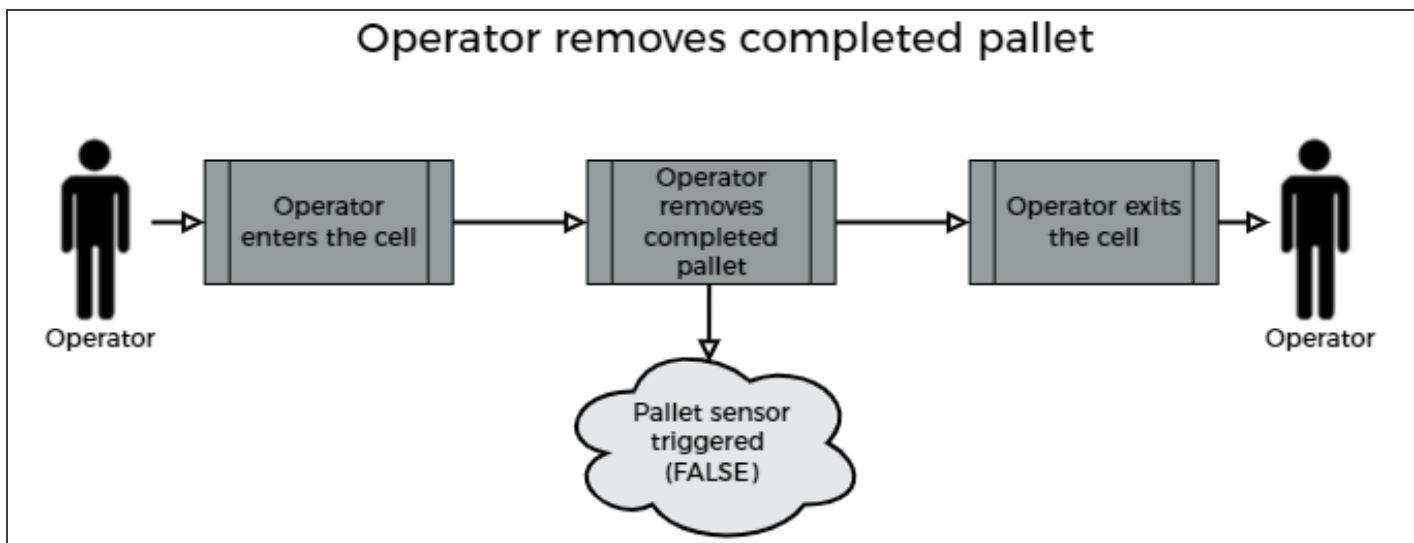
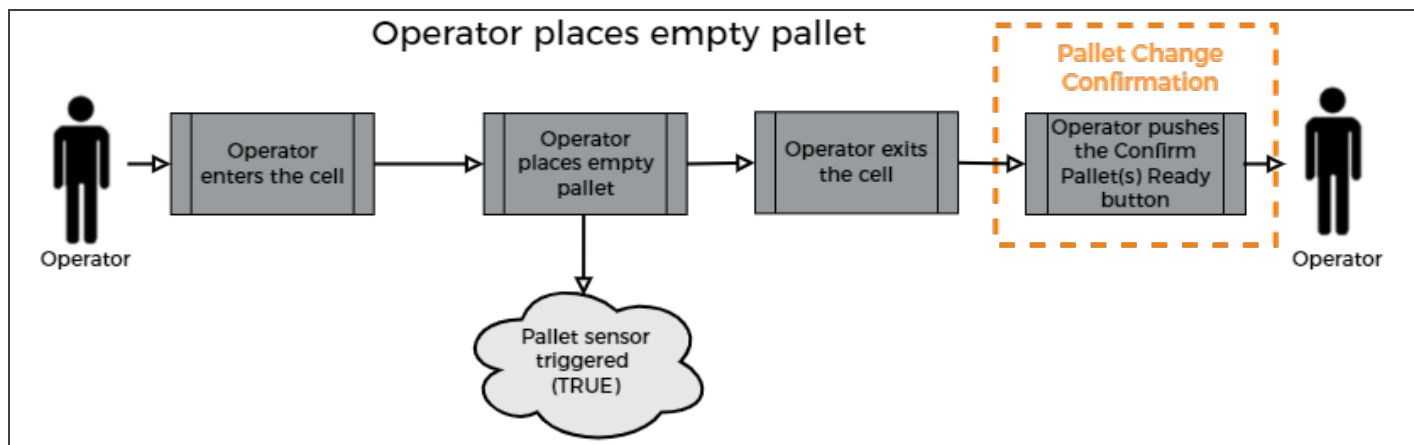
The following diagrams explain the logical operation of the Palletizing Solution based on the operator's actions, as well as responses such as signals, pallet and box sensor behaviors, etc.



Please refer to the Status Lights section for further information about light states.









## 2. Safety

### 2.1 Disclaimer

The intent of this section is to provide general guidelines for safe use of the Robotiq Palletizing Solution, always follow local regulations. The installer is responsible for the safe installation and commissioning of the Palletizing Solution. Robotiq accepts no liability for damage, injury or any legal responsibility incurred directly or indirectly from the use of this product. The user (installer and operator) shall observe safe and lawful practices including but not limited to those set forth in this document.

#### Info

The terms *operator*, *installer*, *commissioning* or *installation* refer to anyone responsible for any of the following operations on the Robotiq Palletizing Solution:

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

The present section is based on the following international standards and technical specifications:

- **ISO 10218-1:2011** : Safety Requirements For Industrial Robots - Robots
- **ISO 10218-2:2011** : Safety Requirements For Industrial Robots - Robots Systems and Integrators
- **IEC 60204-1** : Safety Of Machinery - Electrical Equipment Of Machines
- **ISO/TS 15066:2016** : Robots and robotic devices — Collaborative robots

This manual explains various components of the Robotiq Palletizing Solution and the general operations regarding the whole life-cycle of the product, from installation to operation and decommissioning.

The drawings and photos in this manual are representative examples. However, discrepancies may be observed between the visual supports and the actual product.





## 22. Intended Use

The Robotiq Palletizing Solution is specifically designed for palletization.

### Warning

Only use the application in its original condition without unauthorised modifications.

### Warning

Only use the application if it is in perfect technical condition.

### Warning

The emergency stop function is intended for use in emergency conditions and not for normal condition stop.

### Info

The Solution is intended to be used with a UR10 or UR10e from Universal Robots.

### Info

Always comply with local, state, province and/or federal laws, regulation and directives automation safety and general machine safety.

### Caution

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





## 2.3. Warnings, Risk Assessment and Final Application

### Warning

The operator must have read and understood all of the instructions in the following manual before operating the Robotiq Palletizing Solution.

### Caution

Any use of the Palletizing Solution in non-compliance with these warnings is deemed inappropriate and may cause injury or damage.

The entire cell (i.e., the robot, the PowerPick Vacuum Gripper or any other gripper used, and any other equipment used in the final application) must go through a comprehensive risk assessment process before they can be used.

In order to make the palletizing cell collaborative, several aspects should be taken into consideration. All cells being different, it is important to perform a risk assessment and to enforce the required standards. Please note that the results of the risk assessment depend on the usage and application.

### Caution

It is the installer/operator's responsibility to ensure that all local safety measures and regulations are met.

The following non-exhaustive list presents risks that must be assessed during the integration process:

- Risk of load ejection resulting from loss of vacuum;
- Risk of load dropping resulting from loss of vacuum;
- Risk of pinching any moving component of the Robotiq Palletizing Solution or the robot;
- Risk of damage or breaking if using a custom suction cup bracket that does not meet the technical requirements;

Depending on the application, there may be hazards that require additional protection and/or safety measures. For instance, the workpiece handled by the gripper could be inherently dangerous to the operator.

### Warning

Do not leave any item or object between the boxes and the Palletizing Solution as this could cause collisions.





**Warning**

Depending on the supply sources, when an emergency stop (e-Stop) button is pressed, the following consequences may occur. The robot owner has the responsibility to do a risk assessment and choose the appropriate option.

| Supply sources                            | e-Stop consequences  |
|---|--|
| Robot tool supply<br>(tool connector)     | <p>Power failure to the Vacuum Gripper. The vacuum level will drop to ambient pressure and the object will be lost.</p> <div style="border: 1px solid yellow; padding: 10px; margin: 10px 0;"> <p><b>Caution</b></p> <p>For the Palletizing Solution, it is not recommended to connect the Gripper to the tool connector.</p> </div> |
| Robot controller supply*<br>(Any 24V pin) | <p>Vacuum Gripper powered ON.</p> <ul style="list-style-type: none"> <li>The vacuum level will continue and the object will not be lost.</li> </ul>  |

\*The PowerPick Vacuum Gripper that comes with the Robotiq Palletizing Solution is connected via the robot controller.

**Warning**

Loss of vacuum can occur due to power failure or air supply interruption.

## 2.3.1 Expected System Behavior in Normal Operating Conditions:

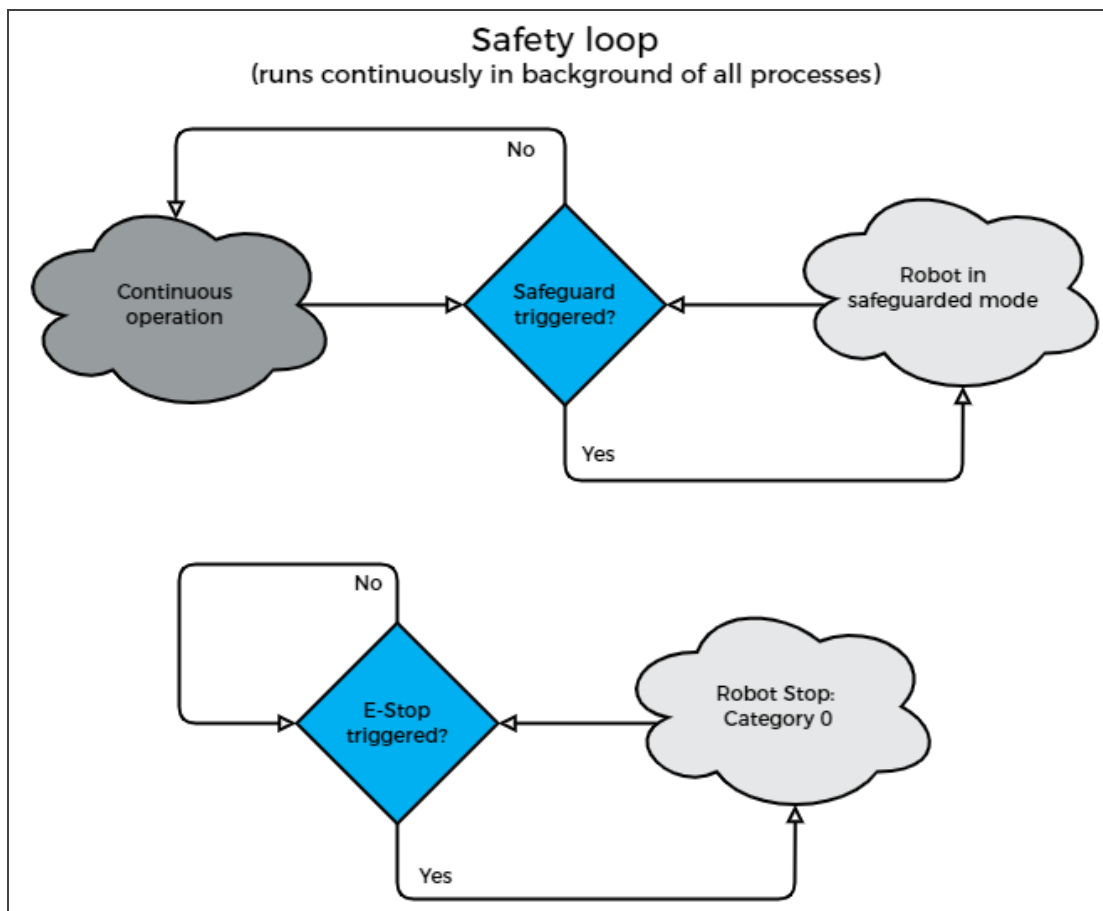
- **Continuous operation:** The palletizer continuously fills pallets when no human operator is within the vicinity of the palletizing cell.
- **Safeguarded operation**
  - **Reduced mode:** The palletizer continuously fills pallets, even when an operator enters the palletizing cell. The operator can safely remove a filled pallet or place a pallet in an empty slot. The system will not start to palletize on an empty pallet unless the operator has pressed the “Confirm pallet(s) ready” button. To obtain this behavior, the “Confirm pallet(s) ready” checkbox in the Installation tab must be ticked. Also, to allow access to the cell to the operator, a complete risk assessment must be performed, and additional parameters must be set (which include, but are not limited to: robot speed, robot force, safety planes, guardrails).
  - **Separation monitoring mode:** The system stops when a human operator enters the vicinity of the palletizing cell to manipulate a filled pallet, place pallets in an empty pallet slot, or troubleshoot the system or any other operations requiring human intervention. In such a state the robot will maintain a Category 2 Stop. When the safeguards are removed, the system will resume operation in Continuous mode.

**Info**

See IEC 60204-1 for definitions of stop categories.







### Warning

In the event of a collision or after an emergency stop, an inspection of the solution must be performed before resuming the use of the machine. Special attention must be given to the pedestal, the cable management system, and the gripper components. Please contact [Robotiq Support](#) if any sign of damage is detected.





## 3. Installation

The following subsections will guide you through the installation and general setup of your Robotiq Palletizing Solution.

Before installing:

- Read and understand the safety instructions related to the Palletizing Solution.
- Verify your package according to the scope of delivery and your order.
- Make sure to have the required parts, equipment and tools listed in Scope of delivery.

### Warning

- When installing:
  - Meet the recommended environmental conditions.
  - Do not operate the Palletizing Solution, or even turn on the power supply, before the device is firmly anchored and the machine area is cleared. Make sure that the air supply is secured.
- Failure to properly secure and install the equipment can result in material damage and bodily injury. In addition, note that in situations where the installation is not compliant, the warranty is void.
- When assembling or moving the Solution, make sure there is enough vertical and horizontal clearance all around so you can avoid material damage and bodily injury.

### Caution

- Make sure to follow all the safety rules and regulations of your workplace while using the Robotiq Palletizing Solution.
- Always wear all recommended personal protective equipment in accordance with your workplace's safety standards, including:
  - Safety glasses;
  - Hearing protection;
  - Hard hats;
  - Steel-toe boots
- Always use proper safety precautions when working with tools that contain sharp edges, pinching surfaces, or generate heat.
- Always lift heavy objects with your legs, not your back. If you can not lift an object alone, ask for help or find another method to move it.





## 3.1 Scope of Delivery

- 1 x PE Series Palletizing Solution base including:
  - 1 x Pedestal
  - 1 x Robotiq Controller
  - 4 x Pallet sensors
  - 1 x Cable management system
- 1 x PE Series Palletizing Solution post including:
  - 2 x Status lights
  - 1 x Teach pendant rack
  - 1 x Push button enclosure
- 10 x 1/2" - 13 concrete anchors
- 1 x Box detection sensor
- 1 x Vacuum Gripper kit (PowerPick, Controller, PowerPick accessories) (Optional)
- 1 x Air Filter Kit (Optional)
- 1 x Material Handling Copilot software license dongle
- 1 x Set of four (4) casters





## 32. Required Tools and Equipment

The following tools are required to install the Palletizing solution.

Included:

- 12.7 mm (1/2 in) concrete drill bit (for use with hammer drill)
- 19 mm (3/4 in) socket, 10 mm (3/8 in) drive size
- 17 mm socket, 10 mm (3/8 in) drive size
- 2 mm hex key
- 3 mm hex key
- 4 mm hex key
- 5 mm hex key
- 6 mm hex key
- 10 mm hex key

Optional:

- 2.5 mm hex key
- 5.5-17 mm double ended wrench
- 20-21 mm double ended wrench

Not included:

- Power screwdriver
- #2 Phillips bit
- 2.5 mm slotted screwdriver
- Utility knife
- Ratcheting socket wrench with 10 mm (3/8 in) drive or adapter
- Torque wrench with 10 mm (3/8 in) drive or adapter, minimum torque range of 15 - 50 Nm (11.0 - 36.9 ft-lb)
- Isopropyl alcohol

Additionally, if you decide to install the anchors provided by Robotiq, you will need the following:

- Hammer drill
- Hammer





## 3.3. Environmental and Operating Conditions

| Conditions                              | Value  |
|---|--|
| Minimum storage/transit temperature     | -20°C [-4°F]   |
| Maximum storage/transit temperature     | 60°C [140°F]   |
| Minimum operating temperature           | 0°C [32°F]   |
| Maximum operating temperature           | 50°C [122°F]   |
| Humidity (non-condensing)               | Palletizing solution:<br>20-80% RH, non-condensing<br><br>PowerPick Gripper :<br>35-85% RH, non-condensing                               |
| Food/ Clean room/ Intrinsic Safety (IS) | No   |
| Dust and water                          | <ul style="list-style-type: none"> <li>• Dust: Affect the time between maintenance</li> <li>• Water : No</li> </ul>                      |
| Other                                   | <ul style="list-style-type: none"> <li>• Free from corrosive liquids or gases</li> <li>• Free from explosive liquids or gases</li> </ul> |

Table 3-1: Environmental and operating conditions of the Robotiq Palletizing Solution

### Caution

Use of the Robotiq Palletizing Solution is not recommended in presence of chemicals in the environment.

### 3.3.1 Air Supply

Compressed air must be supplied to the vacuum gripper according to the technical specifications. For maintenance and other purposes, it is recommended to install a lockout valve before connecting to the product. The air supply tubing must be connected and disconnected to, or from, the inlet port, only when the line is depressurized. When the line is pressurized, the air supply tubing must be securely connected to the PowerPick controller (P-) with the safety clip.

### 3.3.2. Depressurizing the Supply Line

In order to safely depressurize the supply line, the air supply must first be shut off. Then, if no lockout valve is present to depressurize the line, the vacuum gripper can be activated until the pressure is fully released.





## 34. Mounting and Installation

### 34.1 Visual Inspection

The Robotiq Palletizing Solution is shipped on a pallet. A wood crate is protecting the hardware from external elements.

Since the crate weighs 212 kg (465 lb), Robotiq recommends using a pallet truck or forklift truck to move it. The operation of such machinery should be done by qualified and authorized personnel.

#### Caution

Before disassembling the crate, inspect it to make sure there is no damage or defect. If damage or defects are discovered, please contact the [Robotiq support team](#).

### 34.2. Unboxing

#### Tip

A minimum of two people is recommended to perform the following steps.

#### Warning:

The transport, lifting, and moving of the Robotiq Palletizing Solution should be performed by qualified and authorized personnel. Failure to do so may result to material damage, bodily injury or death.

1. Remove the top panel and the four (4) sides of the crate by unscrewing the screws that hold them into place.
2. Remove the supporting wooden frame by unscrewing the screws that hold it into place.
3. Cut all the strapping material that retains the components, and take all cardboard boxes out of the crate.
4. Unscrew the two (2) bolts that retain the pedestal, and take the pedestal out of the crate.
5. Unscrew the two (2) screws that retain the teach pendant rack, and take the teach pendant rack out of the crate.
6. Remove the supporting wooden pieces by unscrewing the screws that hold them into place.
7. Unscrew the four (4) bolts that retain the base into the crate.
8. Take the base out of the crate.
9. Position the pedestal on the base.

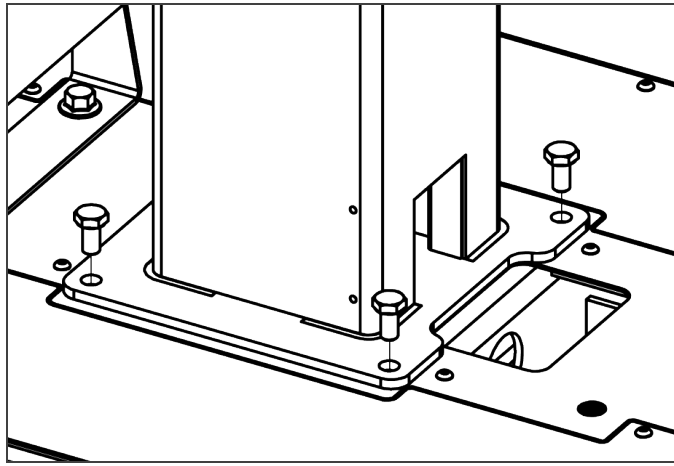
#### Caution

Be careful not to pinch the cables. If necessary, secure them before lifting and placing the pedestal on the base.

10. Secure the pedestal on the base using the four (4) M10 screws provided. Tighten to a torque of 50 Nm.







#### Caution

Make sure to have all components in hand before discarding the crate and packaging.

### 3.4.3. Moving and Positioning the Solution

#### Warning

- Failure to properly secure and install the equipment can result in material damage and bodily injury. In addition, note that the warranty will not cover material damage resulting from an installation that did not comply with the instructions found in this manual.
- The transport, lifting, and moving of the Palletizing Solution should be done by qualified and authorized personnel. Failure to do so may result in machine damage, bodily injury or death.

Although you can assemble the solution at the place of your choice, you will need to move it to its final location afterwards. You can use one of the two following methods to securely move the Solution:

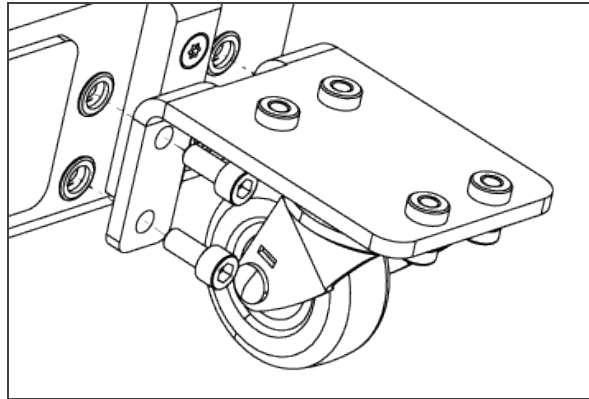
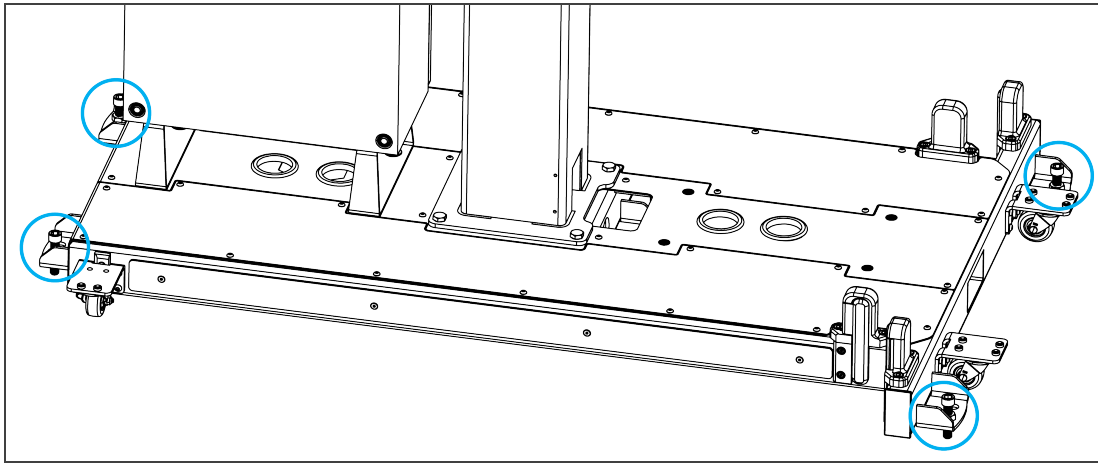
1. Using a forklift. Pay attention to the center of gravity to prevent the equipment from tipping over. Make sure to secure and stabilize the Solution before moving it.
2. Using the set of casters provided with the Solution. To install them, screw the four (4) corner bolts highlighted in the image below to lift the Solution. Screw the four (4) casters into the base. Unscrew the corner bolts to set the solution down on its casters.

#### Caution

- The casters are not designed to support the weight of the whole Solution. Do not install the robot before moving the Solution on its casters.
- Do not use the Solution while it stands on its casters. To make the Solution stand upright, simply screw the four (4) corner bolts, remove the casters and unscrew the corner bolts.









## 3.4.4. Mechanical and Electrical Installation

### Tip

A minimum of two people is recommended to execute these steps.

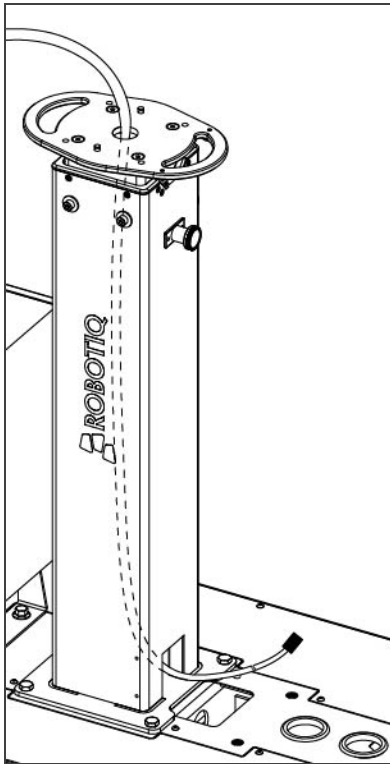
## Robot Installation

### Info

A UR10 or UR10e cobot is required for the installation. The cobot is not included in the Robotiq Palletizing solution.

## For e-Series Universal Robots

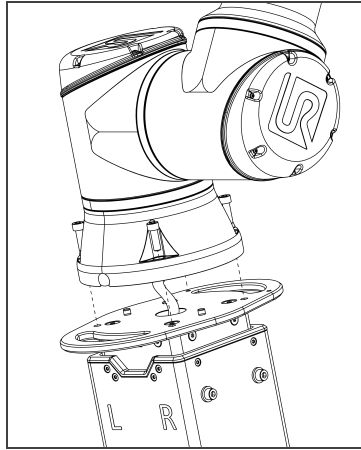
1. Run the cable through the inner pedestal section and pull the cable out at the bottom of the pedestal.





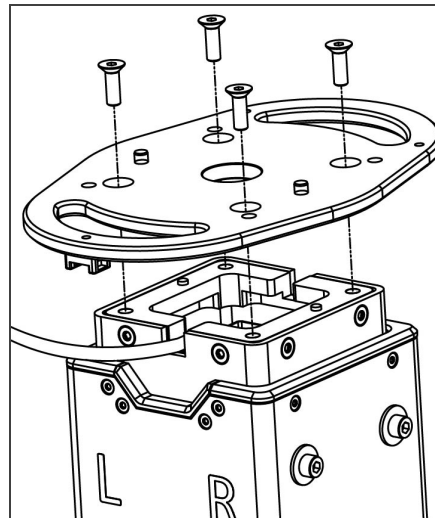
- Place the robot on the robot base plate so that the back of the robot (the side on which is the notch to let the power cable through the robot base) is oriented towards the front of the Solution (towards the Robotiq Controller). Align properly with the two dowel pins (already installed on the robot base), and secure the robot using four (4) M8 x 25 mm screws and Belleville washers.

**The required torque value is 20 Nm.**



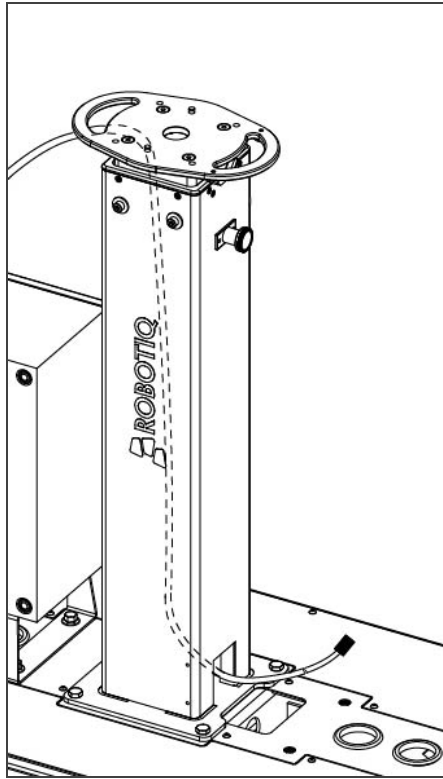
### For CB-Series Universal Robots

- Unscrew the four (4) screws that hold the robot base plate. Then run the robot arm's cable through the opening at the back of the inner pedestal section.



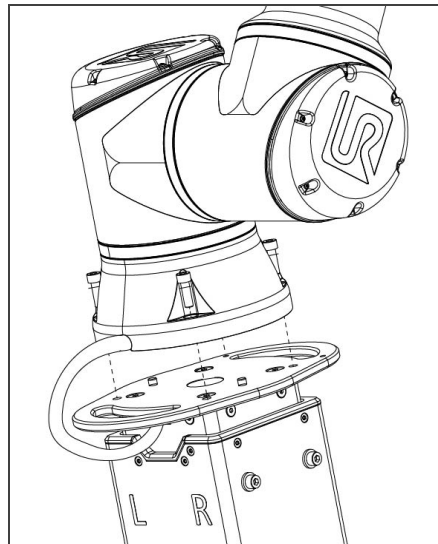


2. Run the cable through to the opening at the bottom of the pedestal.



3. Reposition the robot base plate and secure it with its four (4) screws.
4. Place the robot on the plate so that the back of the robot is oriented towards the Robotiq Controller. Align properly with the two dowel pins (already installed on the robot base), and secure the robot using four (4) M8 x 22 mm screws and Belleville washers.

**The torque value required is 20 Nm.**



#### Caution

Depending on your cobot, make sure to install screws of the right size:

- For e-Series UR: M8 x 25 mm
- For CB-Series UR: M8 x 22 mm





## Adjusting Pedestal Height

The pedestal should be positioned at a height that corresponds to the pallet configuration used in the framework of the application. The possible heights range from 950 to 1550 mm with 50 mm increments.

### Caution

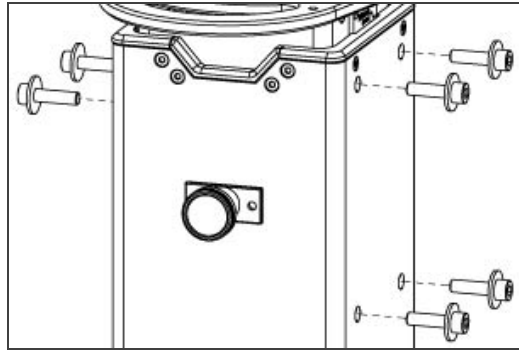
At least two people will be required to perform these installation steps since they consist in lifting material that weighs approximately 50 kg (110 lb).

1. Determine the height required based on your pallet and package configuration. Use the [Robotiq Configurator](#) to simulate your palletizing cell and obtain the exact height required.

### Tip

If you will be using several different configurations, the best practice is to find a height that will correspond to all of them. This will keep you from having to manually change the height of the pedestal during production.

2. Make sure the robot arm is folded in as much as possible.
3. Unscrew the six (6) screws that hold the pedestal in place, starting with the side that has two (2) screws.



4. While holding the inner pedestal section in place using the handles on the robot base plate, pull the plunger latch. Lift the inner pedestal section until it reaches the desired height. Release the plunger latch. The height markers on the left side of the inner pedestal section displays the actual height at which the robot arm stands.
5. Screw the pedestal back in place, starting with the side that has four (4) screws with a 15 Nm torque. Then tighten the two (2) other screws with a 15 Nm torque.





## Push Button Enclosure and Teach Pendant Rack

The post holding the teach pendant rack and push button enclosure is designed to be attached to the Palletizing Solution's base, and anchored to the ground. However, it can be positioned elsewhere, although the final position is dependent on cable length.

Ten-meter cable extensions are available as an option for the push button enclosure and status lights. Please contact [support@robotiq.com](mailto:support@robotiq.com) should you need to add them to your configuration.

1. Screw the post at the front of the base using two (2) M6 x 20 mm screws and washers. Tuck excess cable into the base.
2. Unscrew the screws that hold the status lights into place. Orient the lights so that they stand upright, then tighten the screws.

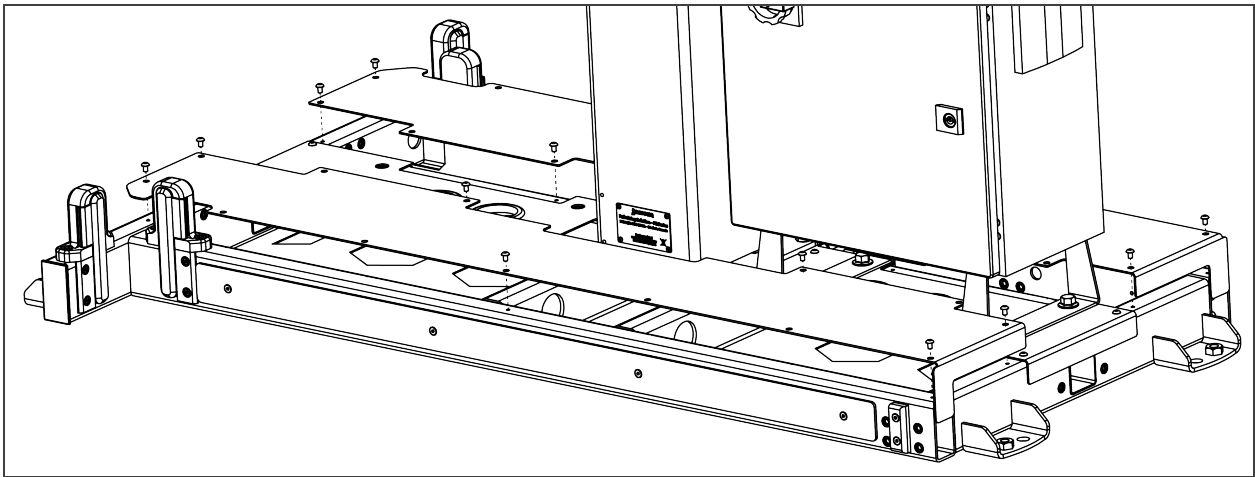
### Caution

Do not invert light order (left/right) since they indicate the status of the pallet that is closest to each of them.

3. Once the Solution is at its final position, anchor it to the ground using the anchors provided. Please refer to the **Anchoring the Solution** section should you need more information on the steps to follow.

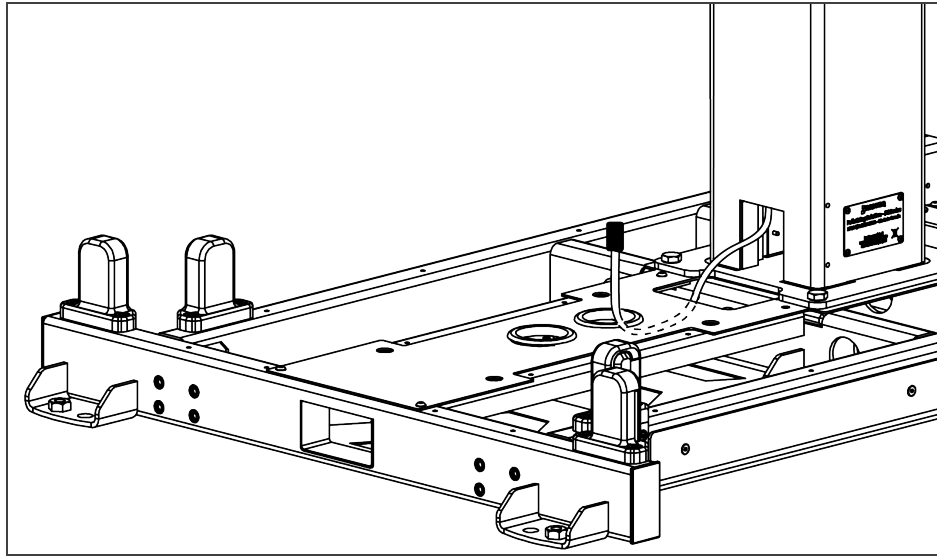
## Cable Routing

1. Remove the cover plates.

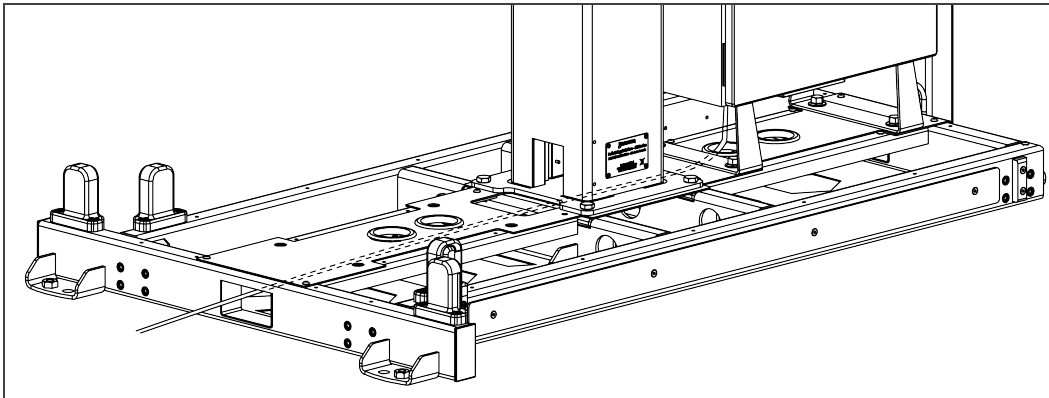




2. Run the robot's power supply cable through the back base plate and pull the connector through the hole that is closest to the pedestal.



3. Pull the Robotiq Controller's power supply cable and Ethernet cable through one of the holes in the front base plate.
4. If required, connect the Teach Pendant's cable to the corresponding socket on the robot controller. Run the cable through the hole at the front of the Solution's base, if needed.
5. Optionally, and depending on your application, the stranded wires of the cable corresponding to the "Restart" and "Pause" buttons of the push button enclosure can be connected to the robot controller.
  - a. In preparation to do so, pull out the cable that is already routed from under the base, through one of the holes of the back base plate.
6. Use the power cable provided with the UR robot to power the Robotiq Controller. Pull the cable through the hole at the very back of the base.



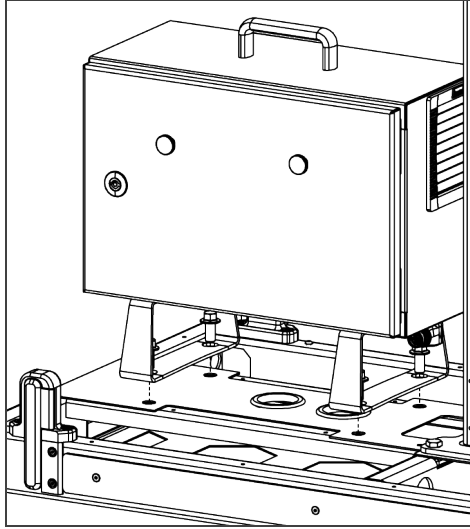
7. Run the box sensor's cable through the opening at the back of the base, and pull it out through one of the holes of the back base plate.





## Controller Installation and Connection

1. Install the UR controller and secure it using the four (4) M12 screws.



2. Connect the power output cable of the Robotiq controller to the UR controller.
3. Connect the robot arm's power output cable to the socket on the UR controller.
4. Open the UR controller. Connect the USB hub to a USB port.
5. Connect the Ethernet/USB converter cable to a USB port.
6. Connect the Ethernet cable to the Ethernet/USB adapter.





## Centering the Solution

This procedure needs to be done before the vacuum gripper installation. It will ensure proper functioning of the solution. The goal is to properly align the column with the base by placing the robot wrist at a specific position at the same time as it touches the side of the base.

1. Connect the power supply cable to a power outlet.
2. Power on the robot.
3. Make sure the six (6) screws that hold the pedestal in place are tight. Torque required: 15 Nm.

### Caution

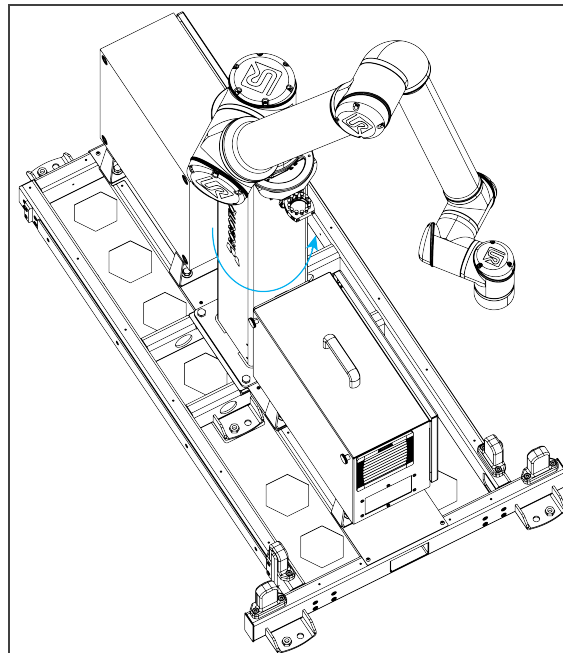
The four (4) screws at the front must be fastened before the two (2) screws at the back.

4. Unscrew half a turn the four (4) screws that secure the column onto the base.

### Warning

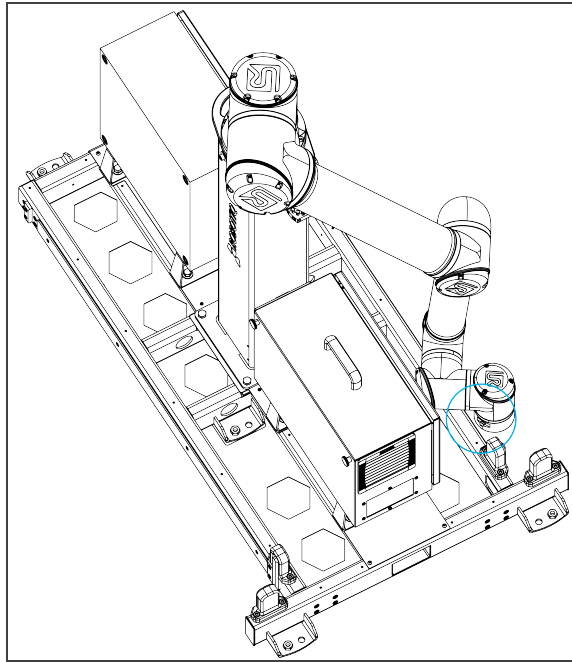
Do not unscrew completely. Unscrew only half a turn to be able to change the orientation of the column. Completely untightening the screws can cause the column to fall and cause bodily injuries and material damages.

5. Rotate the column counterclockwise as much as possible.





6. Position the robot so that the wrist is on the outside left side of the base like shown in the figure below.

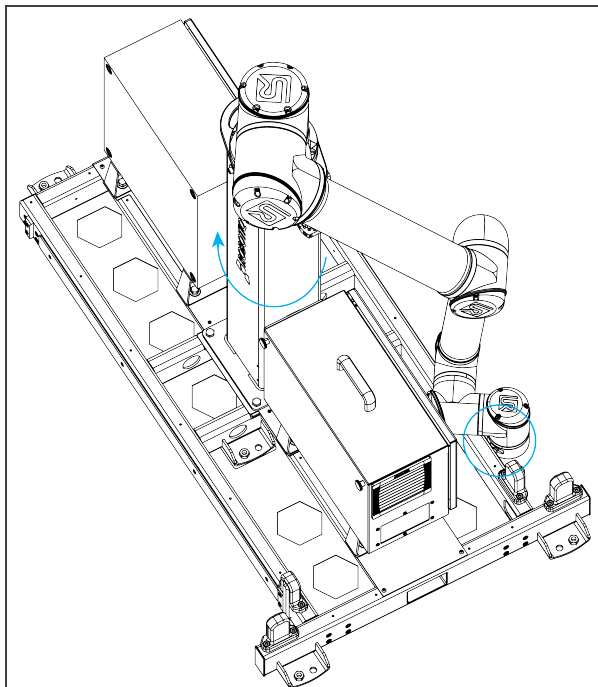


7. Move the robot so the robot tool flange is parallel to the ground: change the feature reference to Base and modify the tool position like the following:  $RX=0^\circ$ ,  $RY=180^\circ$ ,  $RZ=0^\circ$ .
8. Modify the Tool Position X value (base reference) to 333.35 mm (Make sure the TCP is set to 0 (the TCP menu can be found in the Installation tab)).

#### Caution

Move the robot slowly and watch the movement to avoid collisions.

9. Rotate the column clockwise so that the side of the robot wrist touches the side of the base.





10. Tighten the four (4) screws to secure the column onto the base. **Torque must be 50 Nm.**
11. On the teach pendant, validate that the X value is still 333.35 mm.
12. Put the robot back in position of use.

## PowerPick Vacuum Gripper Installation

### PowerPick Gripper

Upon receipt, the PowerPick Gripper is already assembled with the 200 mm offset tube upon receipt. The following instructions explain how to mount this specific configuration. However, you must use the configuration corresponding to your needs. For other configurations installation, please refer to the PowerPick vacuum gripper manual, available at [support.robotiq.com](https://support.robotiq.com)

#### Info

To know which configuration best fits your needs, consult the [Robotiq Configurator](#). If you have more than one setup to comply with, be sure to use a gripper configuration that works for all of them.

1. To be able to mount the PowerPick Gripper and its accessories, power on the robot and rotate the joints as described in the table below. Then shutdown the robot.

| Joint    | Position |
|----------|----------|
| Base     | -180°    |
| Shoulder | -155°    |
| Elbow    | -60°     |
| Wrist 1  | -80°     |
| Wrist 2  | 270°     |
| Wrist 3  | -180°    |

2. Using four (4) M6 screws and tooth lock washers, secure the gripper on the robot tool flange. Align with the dowel pin. **Required torque is 9.5 Nm (7.0 lb ft).**





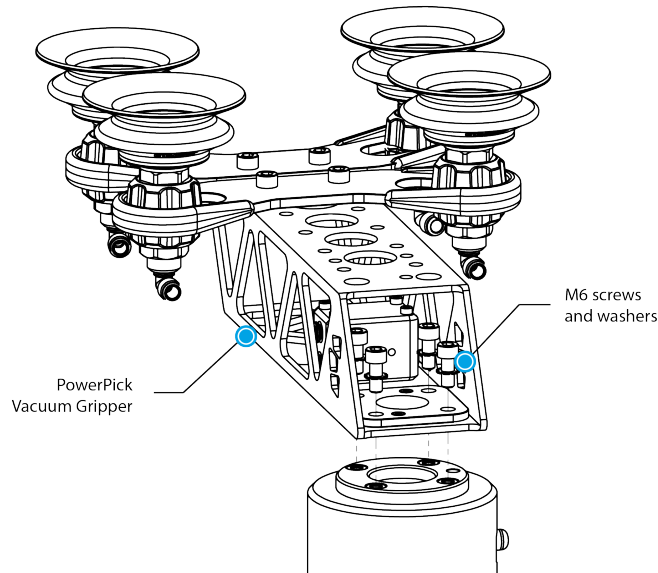


Fig. 3-1: PowerPick Vacuum Gripper Installation

## PowerPick Controller

With Isopropyl alcohol, clean the area where the PowerPick controller will be placed. Remove the protective layers from the double-sided tape. Place the PowerPick Controller on the Robotiq Controller, with pneumatic fittings pointing to the pedestal column. Leave enough space (recommendation of 250 mm (10 in)) between the PowerPick Controller and the pedestal to ensure that the tubing and electrical cable have enough space to connect. Hold the controller 50 seconds to ensure a good grip.

## Cable Routing System

1. To correctly position the cables, change the robot position. Refer to the table below:

| Joint    | Position |
|----------|----------|
| Base     | -180°    |
| Shoulder | -155°    |
| Elbow    | -60°     |
| Wrist 1  | -80°     |
| Wrist 2  | 90°      |
| Wrist 3  | -90°     |

### Info

- Both cable management sleeves are identical (one for the arm, the other for the forearm).
- There are two Hook and Loop (VELCRO®) fasteners on each sleeve: the first is meant to close the sleeve and the second to hold the wires in place.





2. Install the first sleeve:

- Wrap a sleeve around the arm of the robot in a manner that, when facing the teach pendant, the sleeve is closed in a clockwise rotation.
- Tighten the sleeve and close the first Hook and Loop fastener.
- Push the sleeve until it touches the next joint of the robot and then rotate the sleeve so the **first Hook and Loop fastener is facing up**. This will ensure the good positioning of the cables.

3. Install the second sleeve:

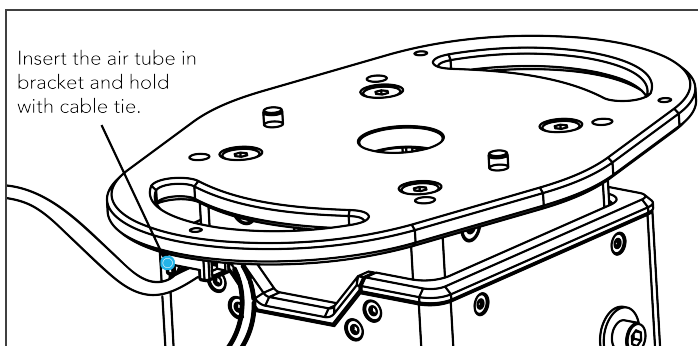
- Wrap the other sleeve around the forearm of the robot in a manner that, when facing the teach pendant, the sleeve is closed in a clockwise rotation.
- Tighten the sleeve and close the first Hook and Loop fastener.
- Push the sleeve until it touches the next joint of the robot and then rotate the sleeve so the **second Hook and Loop fastener is facing up**. This will ensure the good positioning of the cables.

4. Install eight pieces of double sided tape:

- Take two pieces of double sided tape and remove one protective layer from each of them. Inside the first sleeve, in one end of the second Hook and Loop closure (**see the 100 mm marks on the image below**), apply the two pieces of double sided tape side by side. Repeat for the other end. This will prevent the cables from moving inside the sleeve.
- Repeat for the second sleeve.

5. Locate the section of the 10 mm air tube with the white labels. This section will be connected to the gripper.

- Connect the 10 mm air tube to the gripper.
- In the first sleeve, remove the remaining protective layers from the double-sided tape and place the air tube so the white label #1 is at the edge of the sleeve (gripper side).
- Place the air tube along the sleeve and position it on the second double-sided tape portion (see figure below).
- Close the sleeve.
- In the second sleeve, remove the remaining protective layers from the double-sided tape and place the air tube so the white label #2 is at the edge of the sleeve (gripper side).
- Place the air tube along the sleeve and position it on the second double-sided tape portion (see figure below).
- Close the sleeve.
- Using a cable tie, attach the air tube to the bracket just under the robot base plate so the white label #3 is under the bracket.

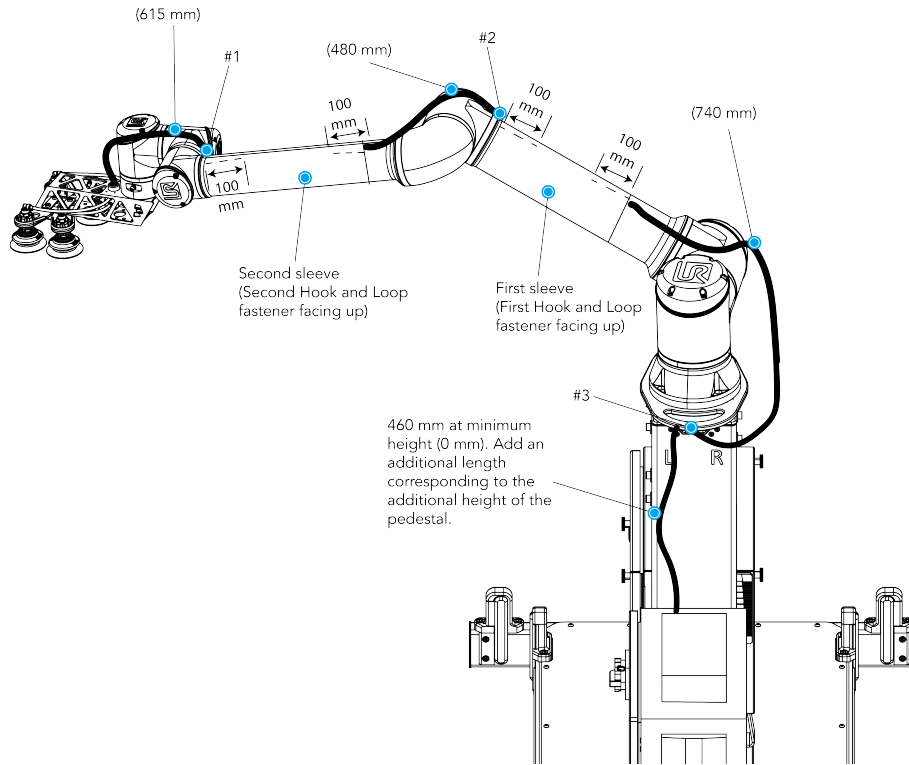




- i. Once the pedestal is at the right height, with a tube cutter cut the air tube at the right length to connect it to the PowerPick controller.

### Caution

To avoid collision / protective stop due to the air tube, ensure that the tube does not go over the sides of the column.



6. Remove the safety clip from the PowerPick Controller (P+ port) and connect one extremity of the 8 mm air tube. Replace the safety clip.
7. Run the air tube through the base via a hole under the Robotiq Controller and make it run through the hole at the back of the base.
8. Connect the 8 mm air tube to the provided filter kit (or the equivalent). The air supplied must comply with the specifications described in the **Environmental and Operating Conditions** section.
9. Connect the filter kit to your local air supply device (air tube not provided).

### Caution

- Use dry and filtered air only. Follow the **ISO 8573-1, class 7.4.4** standard.
- The maximum pressure allowed is 8 bar (115 psi). The optimal pressure for compressed air consumption is 5.5 bar (80 psi). See **PowerPick Vacuum Gripper** section for more details.
- We recommend using a local pressure regulator with a filter and an air dryer. A filter kit is provided with the PowerPick Gripper kit.

10. Shut down the robot and power off the Robotiq Controller.





## PowerPick Gripper and Copilot Connections

1. Connect the Copilot license dongle to the USB hub in the robot controller. It must be connected at all times.
2. Connect the M12 connector of the I/O cable to the PowerPick Controller.
3. Run the cable to the robot controller via the base using holes under the Robotiq Controller and the robot controller.

### Tip

Follow the good practices of the cable management. You can use the plate under the controller and a grommet (not included).

4. Connect the I/O cable to the robot controller according to the table and figure below.

| Color  | Connection          | Function        |
|--------|---------------------|-----------------|
| Blue   | AG (Analog Ground)  | Pressure sensor |
| Yellow | AI (Analog input)   |                 |
| Gray   | 0V                  | Blow off        |
| Pink   | DO (Digital Output) |                 |
| White  | 0V                  | Suction         |
| Brown  | DO (Digital Output) |                 |
| Red    | 24V                 | 24V DC          |
| Green  | GND (Ground)        | Ground          |

Table 3-2: I/O cable connections

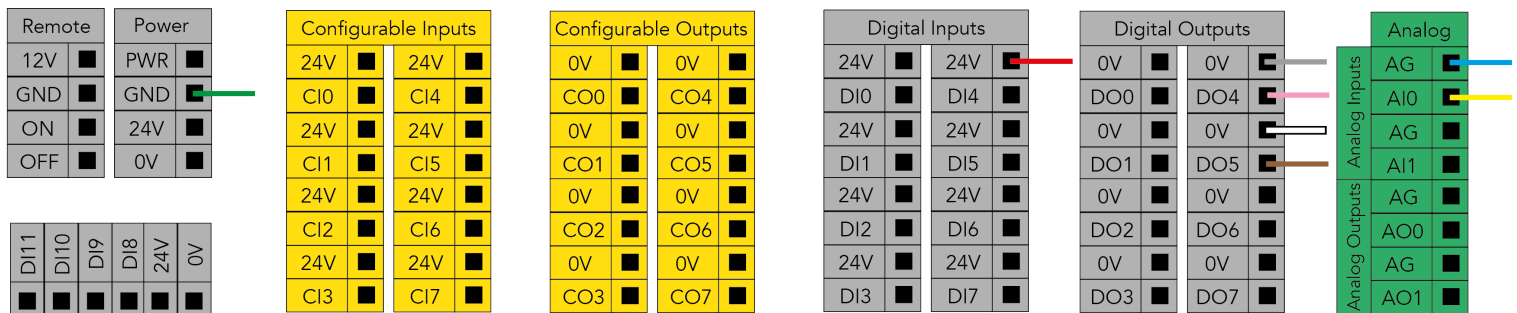


Fig. 3-2: Vacuum Gripper wiring to robot controller





## Push Button Enclosure Connection

1. Optionally, and depending on your application, the stranded wires of the cable corresponding to the **Restart** and **Pause** buttons of the push button enclosure can be connected to the robot controller.
  - a. Run the cable to the robot controller.
  - b. Refer to the diagram in the **Robotiq Controller** section to connect the wires. Depending on the application and the safety devices used, there are alternate ways to wire the buttons to the controller. Adjust accordingly.

### Caution

Button signals are not redundant. Since they are actual Pause and Restart commands, they should not be construed as safeguarding devices.

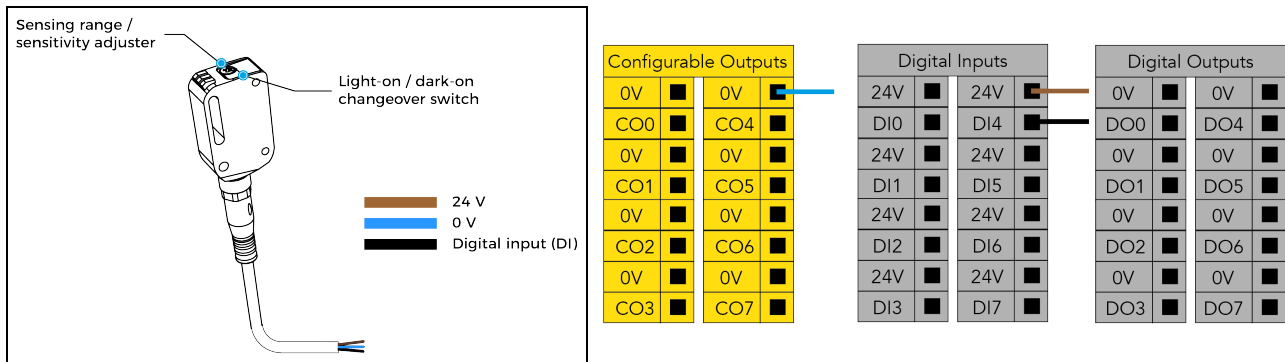
## Box Sensor(s)

1. Run the box sensor(s) cable through a hole under the robot controller. Connect the wires in configurable I/O terminal blocks of the robot controller. Then secure each connection with a terminal block screwdriver (not provided).
  - Brown wire in a 24V terminal block
  - Blue wire in a 0V terminal block
  - Black wire in a DI terminal block (digital input).

### Tip

Follow the good practices of the cable management. You can use the plate under the controller and use a grommet (not included).

2. Install each box sensor on a bracket that suits your setup with the provided screws.
3. Position each box sensor bracket so it can detect the box(es) to be picked.
4. Connect each box sensor M8 connector cable to its sensor.



### Tip

The box sensor(s) must be set properly. Once the system is running, adjust the detection distance with the sensitivity adjuster. To have the sensor(s) providing a high state, when detecting a box, be sure to set it in the light-on switching mode (green light beside "L"). To do it, simply press the light-on / dark-on change-over switch for more than 1 second and less than 4 seconds.





## Anchoring the Solution

### Warning:

The transport, lifting, and moving of the Palletizing Solution should be done by qualified professionals. Failure to do so may result to machine damage, bodily injury or death.

### Caution

- The Solution must only be installed and anchored by qualified staff. If you use the anchors provided with the Solution, it should be installed in 28 MPa [4000 psi] undamaged concrete (minimum).
- If you choose to use other anchors, each anchor should be able to withstand at minimum the following forces (considering that the fasteners rated values are 25% of the ultimate value).

### Warning

It is the responsibility of the end-user to ensure the final anchorage resists for:

| Specifications    | Metric Units | Imperial Units | Comments  |
|-------------------|--------------|----------------|---|
| Pull out strength | 5200 N       | 1180 lbf       | Ultimate value considering rated value with 4:1 safety factor: 20 800 N [4720 lbf]. |
| Shear strength    | 1400 N       | 320 lbf        | Ultimate value considering rated value with 4:1 safety factor: 5600 N [1280 lbf]    |

### Caution

- Make sure to follow all the safety rules and regulations of your workplace while using the Robotiq Palletizing Solution.
- Always wear all recommended personal protective equipment in accordance with your workplace's safety standards, including:
  - Dust mask;
  - Safety glasses;
- Always use proper safety precautions when working with tools that contain sharp edges, pinching surfaces, or generate heat.
- Always lift heavy objects with your legs, not your back. If you can not lift an object alone, ask for help or find another method to move it.
- Use a vacuum cleaner if needed.
- The Solution must be placed on a flat and leveled floor. If it is not the case, use shims to level it.





1. Position the Solution at its final position.

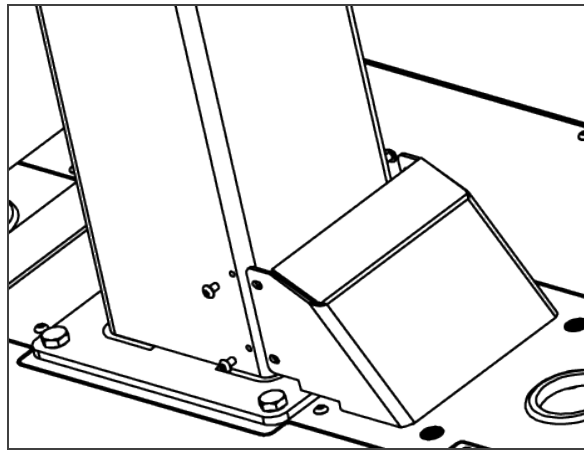
### Caution

Make sure your layout is good and that all distances are respected. See the **Appendix** section.

2. Drill the six (6) holes with the provided drill bit. The minimum installation depth of the anchors provided with the solution is 57 mm [2.25 in].
3. If necessary, level the solution using shims.
4. Place the anchors into the holes and fasten the nuts flush to the screws.
5. Bang the anchors in place.
6. Secure the Solution by screwing the six (6) nuts with a **torque of 54 Nm (40 lb ft)**.

## Finalization and Power On

1. Reinstall the base covers using the 7 provided screws.
2. Install the pedestal cover using the provided screws (4).



3. Connect the power cable to the power outlet.
4. Power on the Robotiq Controller and the robot.

### Caution

Make sure to do a risk assessment before starting to use the Solution. For more details, please refer to the **Safety** section.





## 34.5. Conveyor

The Robotiq Palletizing Solution does not come equipped with a conveyor. However, the palletizing cell, as construed in this instruction manual, includes a conveyor. It is thus important to enforce standard EN 619 (or the equivalent in your region). The conveyor should be positioned as close as possible to the Solution (maximum 100 mm) to prevent anyone from standing between the conveyor and the Solution.

## 34.6. Physical Clearance and Reachable Area of the Robot

The computed trajectories allow the boxes or the robot to overrun the edges of the pallet when the robot moves the boxes to their final position. Mitigation measures can be put in place to prevent a transient or quasi-static impact between a box, or the robot itself, and an operator. Below are some examples:

- Physical assets such as guardrails, bollards, etc. which prevent the operator from accessing the area
- Sensors such as light curtains or area scanners which can detect the presence of a person, and stop the system before that person reaches the danger zone.
- **Add virtual planes around pallet(s)** option available in the Settings tab of the Palletizer node of the Robotiq URCap to contain the overrun within a certain distance of the pallet. Please refer to **Software** section to learn more about this option.

Potential overrun can be determined by the following formulae:

### Front overrun

The potential front overrun is the highest value obtained using the following formula:

Potential front overrun (mm) =  $\max(0.1 \times \text{box height}, 1280 - \text{pallet depth}, 180 + \text{extra bracket reach} + (0.1 \times \text{box height}) - (\text{minimum horizontal box dimension} / 2))$

### Side overrun

Potential side overrun (mm) =  $(\text{box diagonal} / 2) + \text{robot reach} + \text{extra bracket reach} - \text{pallet width} - 295$

Moreover, trajectories are not limited to hovering over the picking position, the base of the Solution, and the pallets. It is thus important to implement physical safeguarding devices that must be put in place next to the picking area, depending on the palletizing cell's layout. The robot's reachable area should be clearly identified and marked on the ground.

### Info

When the robot is palletizing on one side, and no pallet is present on the opposite side, the Palletizing Solution computes trajectories based on the assumption that there are no obstacles on the opposite side. The robot's elbow (joint #2) can therefore extend to the side where no pallet is present. For a UR10, the possible overrun is represented by a cylinder of 705mm radius, aligned with the robot base's Z-axis.



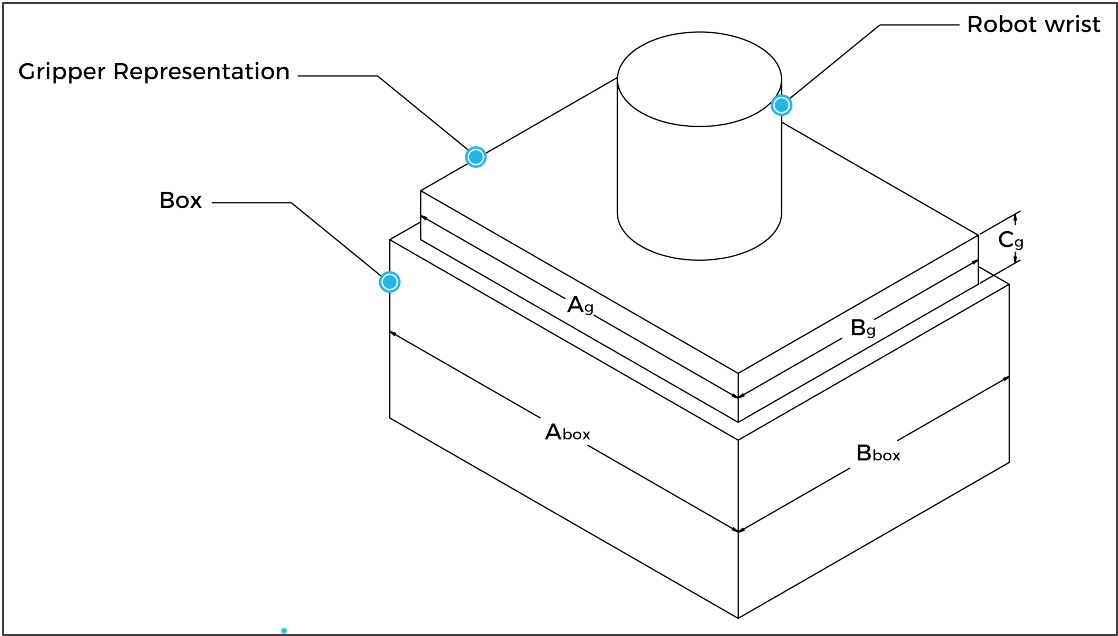


### 35. Other Grippers

It is possible to use a gripper other than the PowerPick Vacuum Gripper. If another gripper is used, it is important to validate that its shape is within the gripper model used for the collision detection algorithm of the software. If your gripper does not fit the following models, it can still work, **but Robotiq does not guarantee that there will be no collision.**

The gripper model is depending on the box dimensions and is obtained according to these criteria:

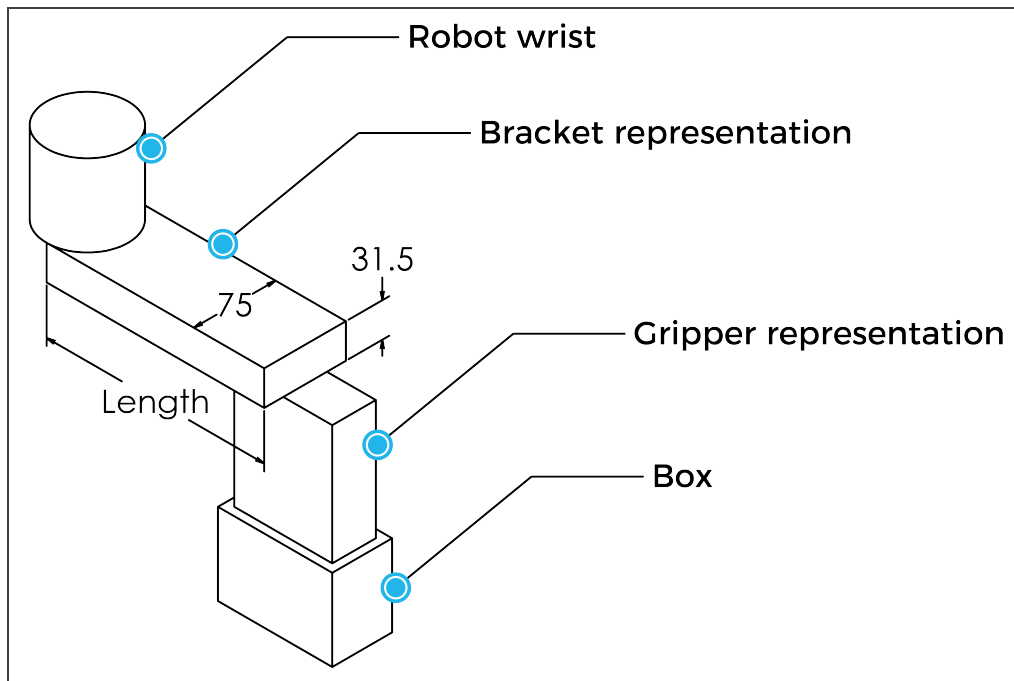
| Box Footprint<br>( $A_{box} \times B_{box}$ )                  | Gripper Footprint<br>( $A_g \times B_g$ )                          | Gripper Height<br>( $C_g$ ) |
|--|--|-----------------------------|
| $A_{box} < 105 \text{ mm}$<br>OR<br>$B_{box} < 55 \text{ mm}$  | $A_g = A_{box} - 1 \text{ mm}$<br>$B_g = B_{box} - 1 \text{ mm}$   | 110 mm                      |
| $A_{box} > 450 \text{ mm}$<br>OR<br>$B_{box} > 350 \text{ mm}$ | $A_g = A_{box} - 40 \text{ mm}$<br>$B_g = B_{box} - 40 \text{ mm}$ | 55 mm                       |
| Otherwise  | $A_g = 200 \text{ mm}$<br>$B_g = 130 \text{ mm}$                   | 110 mm                      |





If a TCP offset is added in the X and/or Y direction, it is considered that an extra reach bracket is used. A rectangular prism is then added at the end of the bracket, according to the rules mentioned above.

| Bracket representation |       |                                  |                                     |
|------------------------|-------|----------------------------------|-------------------------------------|
| Height                 | Width | Length                           | Direction                           |
| 31.5 mm                | 75 mm | Same length as TCP offset (X, Y) | Same direction as TCP offset (X, Y) |





## 3.6. Installation for Universal Robots

The table below shows which Robotiq software to use with your Universal Robots' controller. Please refer to the URCap Package section for the installation of the UR software packages for the Palletizing Solution.

### Info

For CB-Series robots, the controller must have been produced after september 2019 (serial number > 2019301732) to be able to be installed on the Solution.

| Robotiq Software  | CB3.1 Controller | e-Series Controller |
|---|------------------|---------------------|
| Robotiq Grippers URCap Package 1.5.1 and earlier versions | Incompatible     | Incompatible        |
| Robotiq Grippers URCap Package 1.6.0 and later versions   | Compatible       | Compatible          |

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

### Caution

Please refer to the Installing URCap Package section to configure the Palletizing Solution properly before operating and programming the device.

## 3.7. URCap Package

Robotiq provides the user with a Universal Robots URCap package that provides a graphical user interface and enables direct serial communication to your robot controller.

### Info

Browse to the [Palletizing Solution support page](#) to download the URCap package.

### 3.7.1 Installing URCap Package

Make sure the Robotiq Paletizing solution is well installed. Refer to the **Mounting and Installation** section for detailed information.

Before proceeding with the installation of the URCap package, make sure your Universal Robots controller is compatible with the package.

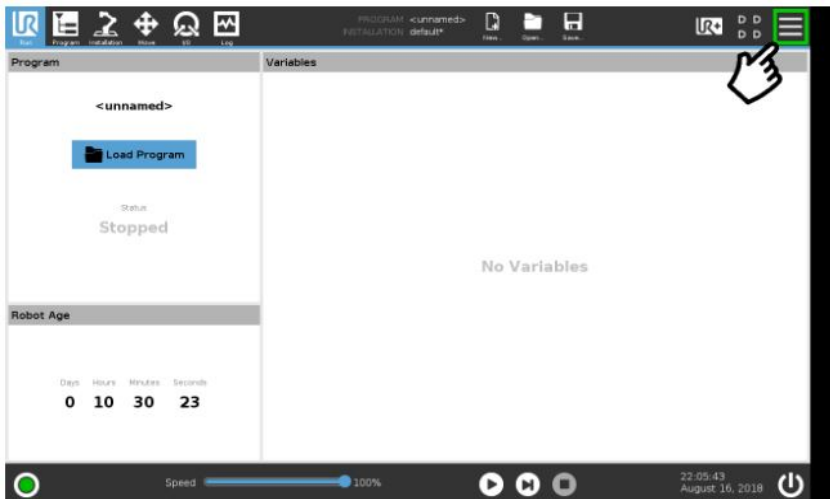
### Tip

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

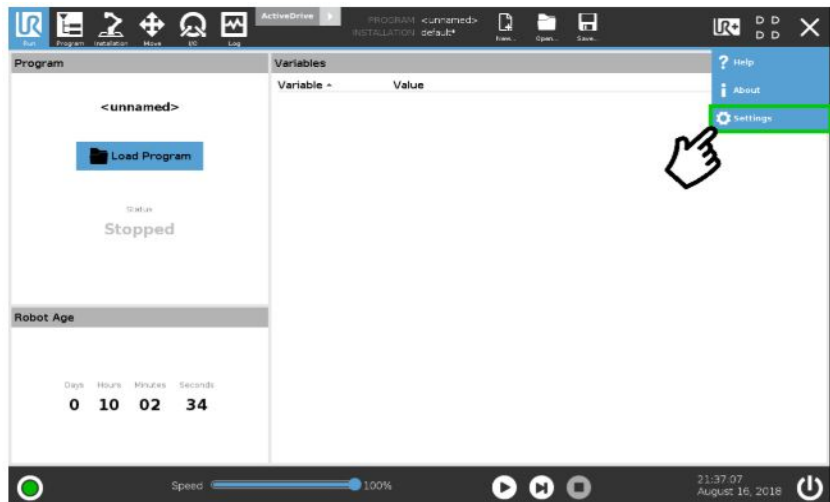




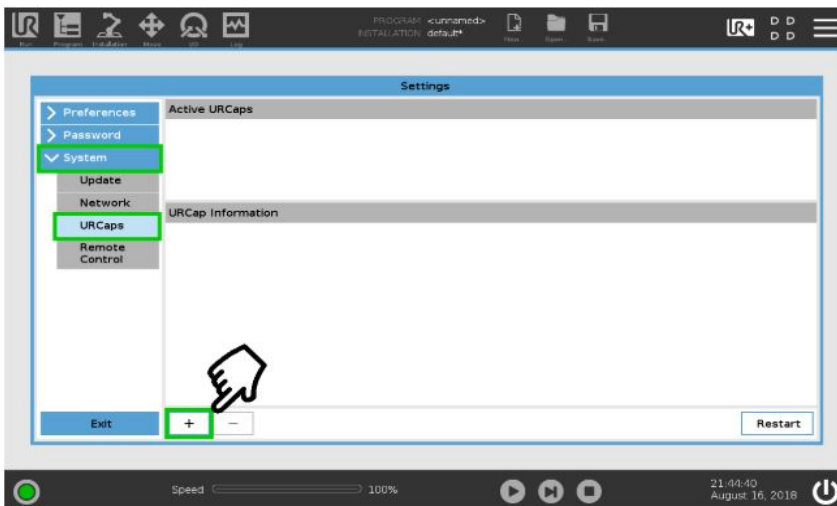
## On e-Series Universal Robots



- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Palletizing solution URCap package.
- Go to [support.robotiq.com](http://support.robotiq.com), and select the Universal Robots brand.
- Select **Palletizing Solution**.
- Click on **Software** → **Palletizing Solution URCap**, download the Copilot URCap and extract it on the root of a blank USB stick.
- Insert the USB stick in the UR teach pendant or controller.
- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.
- Tap **Settings**.



- Tap the **System** button in the navigation pane on the left.
- Tap the **URCaps** button.
- Tap the **plus (+)** button to look for the **.urcap file** in the available drives.
- Select the Copilot URCap (UCS-X.X.X.) to install the URCap.





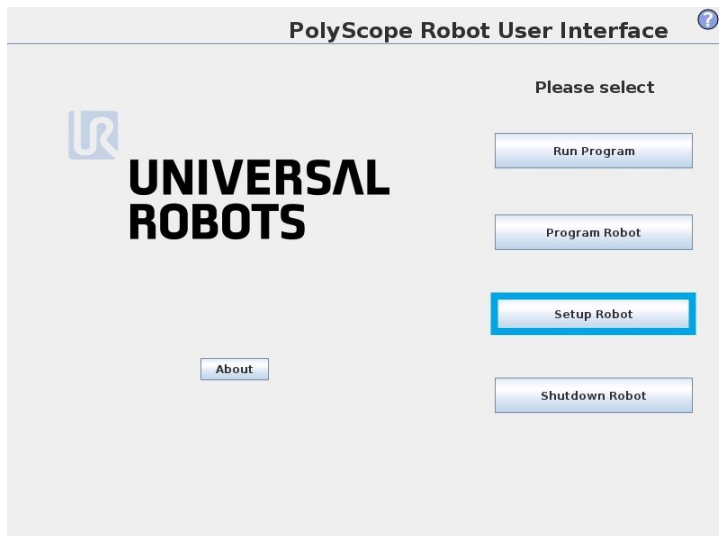


- Once the files are selected, tap the **Open** button.
- Tap the **Restart** button to complete the URCap installation. By doing so, you accept the **license agreement** detailed in the URCap information textbox.

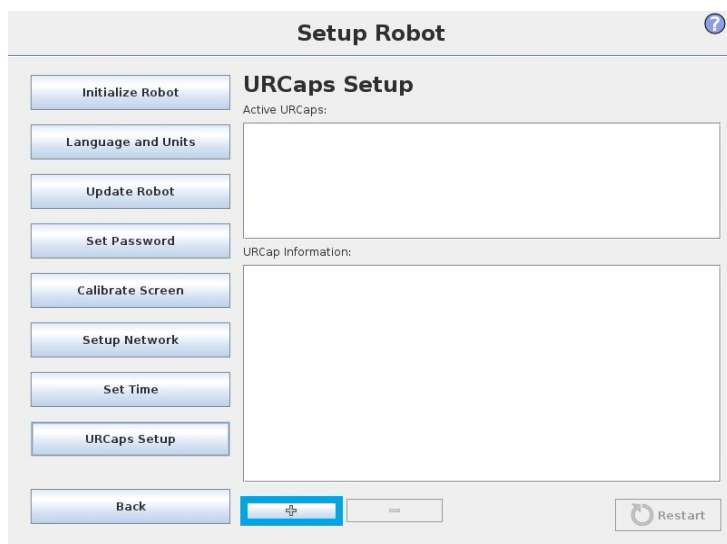
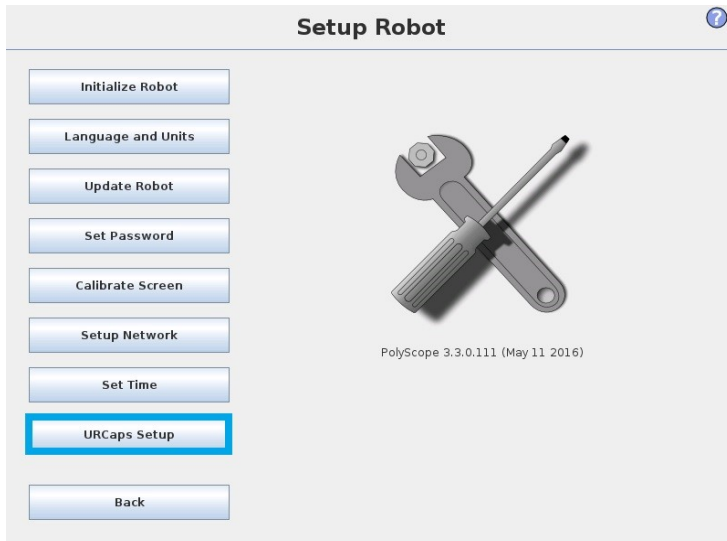




## On CB-Series Universal Robots



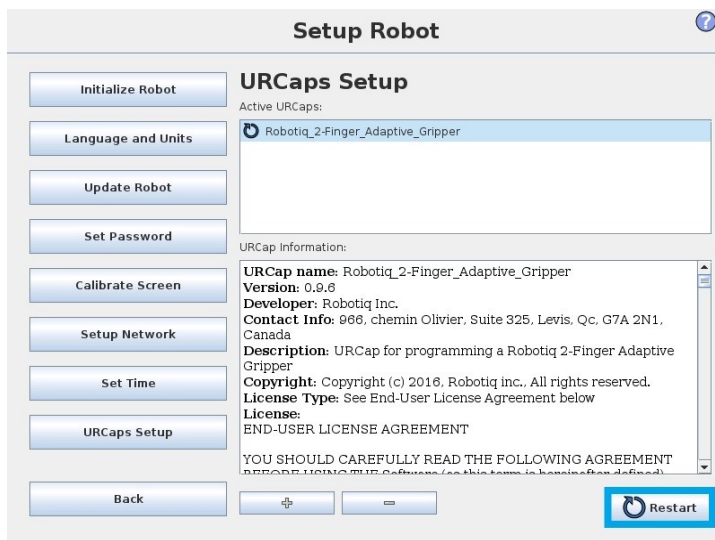
- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Palletizing URCap package.
- Go to [www.support.robotiq.com](http://www.support.robotiq.com), select **Browse by product**.
- Click on your **Robotiq product page** and then **Universal Robots**
- Click on **Software** → **Robotiq URCap** → download the Copilot URCap and extract it on the root of a blank USB stick.
- Insert the USB stick in the UR Teach pendant or controller.
- Go to Setup Robot.
- Tap URCaps Setup.



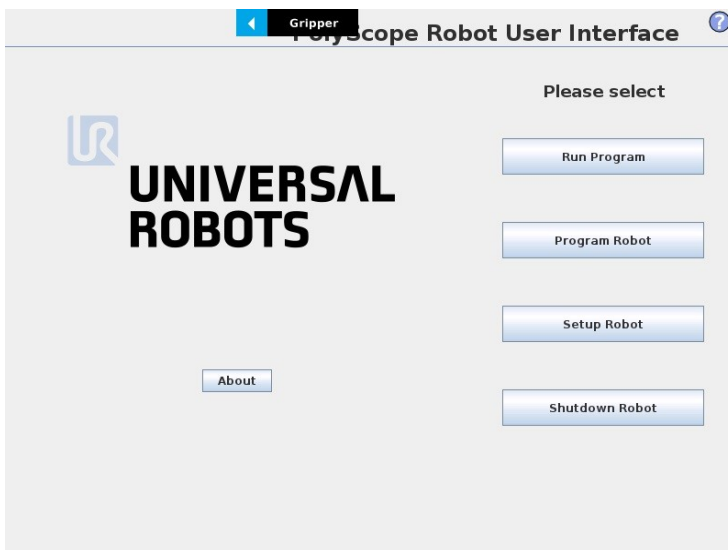
- Tap the plus (+) button to add the URCap.
- Select the Copilot URCap (UCS-X.X.X.) to install the URCap.







- Restart PolyScope to complete the URCap installation. By doing so, you accept the License Agreement that is detailed in the URCap Information text box (see below for the License Agreement).



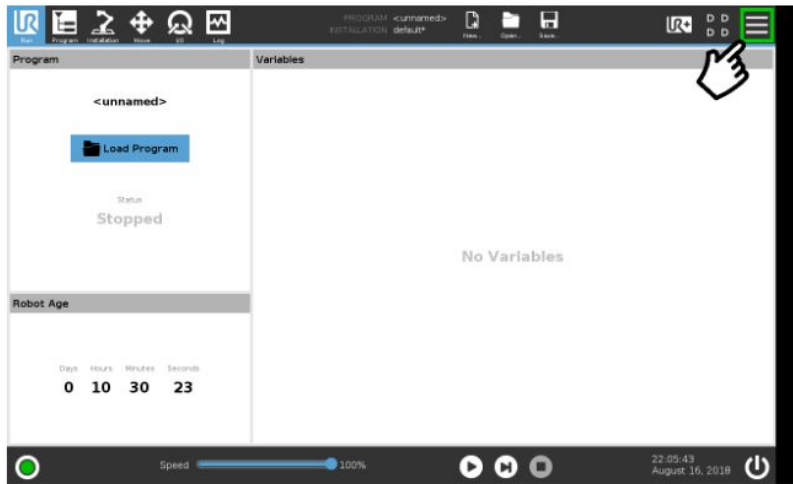
- When PolyScope reopens, the ActiveDrive toolbar will appear on the screen.



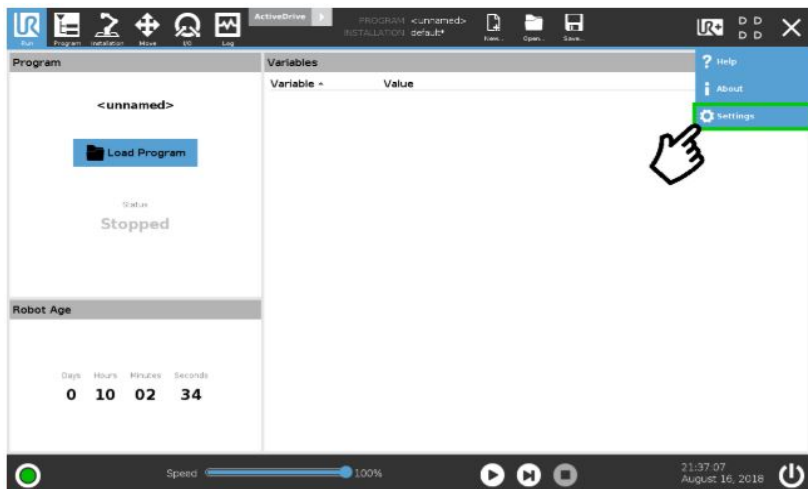


## 3.7.2. Uninstalling URCap Package

### On e-Series Universal Robots



- On the teach pendant, tap the **triple bar icon**.



- Tap **Settings**.

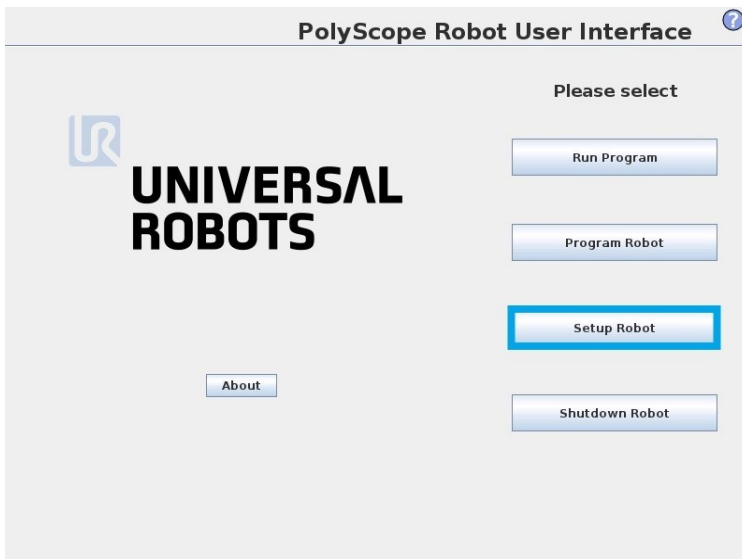


- Select **System** in the navigation pane on the left.
- Select **URCaps**.
- In the **Active URCaps** box, select the URCap to uninstall.
- Tap the **minus (-) button** to uninstall the URCap.
- Restart Polyscope to complete the uninstallation process.

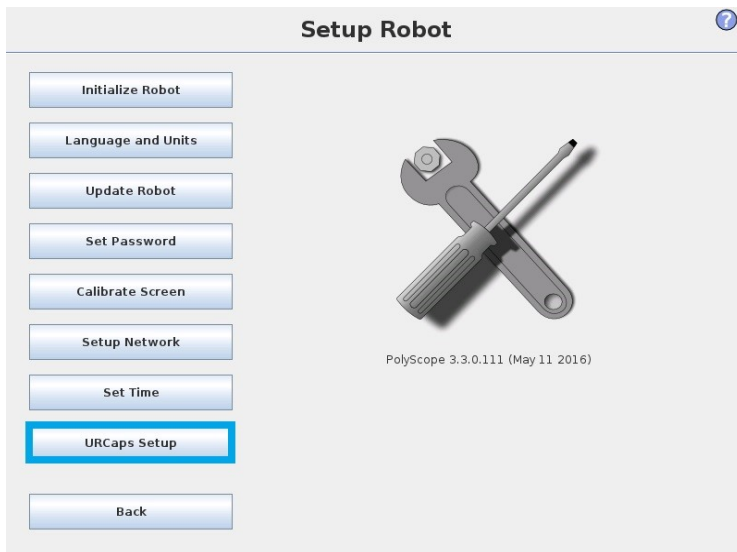




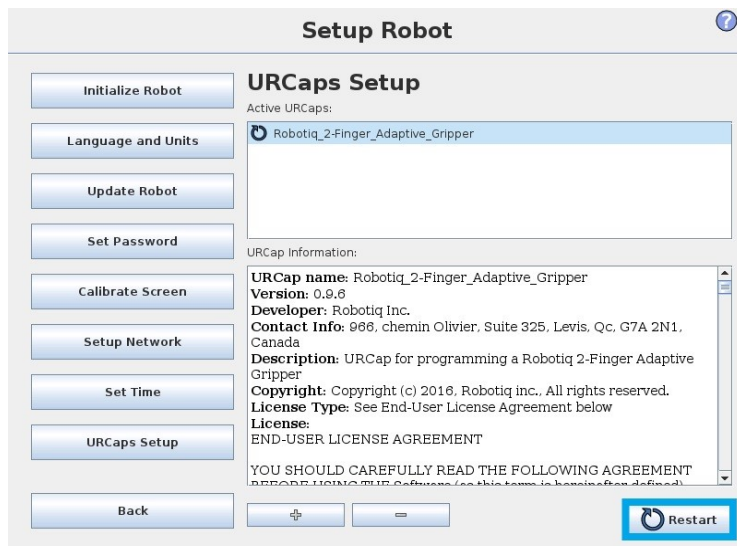
## On CB-Series Universal Robots



- Go to **Setup Robot**.



- Tap **URCaps Setup**.



- In the Active URCaps box, tap the URCap to uninstall.
- Tap the **minus (-) button** to uninstall the URCap.
- Restart PolyScope to complete the uninstallation process.





## 3.8. Robot Configurations

### Info

Some configurations must be done in the Safety section of the Installation tab, to ensure the proper use of the solution.

### 3.8.1 Robot Limits

To ensure the effective operation of the Solution, Robot Limits should stay at the Least Restrictive setting. Tool speed (1) and tool force (2) can be adjusted as required. Please note that adjusting these settings will reduce the Solution's cycle time.

**! DANGER**  
Use of Safety Configuration parameters different from those defined by the risk assessment can result in hazards that are not reasonably eliminated or risks that are not sufficiently reduced.

☐ Factory Presets Most Restricted ————— Least Restricted

☒ Custom

| Limit             | Normal       | Reduced     |
|-------------------|--------------|-------------|
| Power             | 1000 W       | 300 W       |
| Momentum          | 100.0 kg m/s | 25.0 kg m/s |
| Stopping Time     | 1000 ms      | 400 ms      |
| Stopping Distance | 2000 mm      | 500 mm      |
| 1 Tool Speed      | 1000 mm/s    | 1000 mm/s   |
| 2 Tool Force      | 140.0 N      | 150.0 N     |
| Elbow Speed       | 5000 mm/s    | 1500 mm/s   |
| Elbow Force       | 250.0 N      | 150.0 N     |

Safety password

### 3.8.2. Joint Limits

Some joint limits must be configured.

For e-Series:

1. Tap **Installation** → **Safety** → **Joint Limits**
2. Then, unlock the section with the proper password and change the values.
  - The minimum and maximum values for the Elbow will be -167° and 3°.
  - The minimum and maximum values for the Wrist 3 will be -273° and 273°.

PROGRAM: <unnamed>  
INSTALLATION: Thor\_7kg

Run Program Stop Home Back Log

699A 753E

**> General**

**> Safety**

**Robot Limits**

**Joint Limits**

| Joints   | Range        | Normal Mode |         | Reduced Mode |         |             |
|----------|--------------|-------------|---------|--------------|---------|-------------|
|          |              | Minimum     | Maximum | Minimum      | Maximum |             |
| Base     | -363 — 363 ° | -363        | 363     | -363         | 363     | +2 ° / -2 ° |
| Shoulder | -363 — 363 ° | -363        | 363     | -363         | 363     | +2 ° / -2 ° |
| Elbow    | -363 — 363 ° | -167        | 3       | -363         | 363     | +2 ° / -2 ° |
| Wrist 1  | -363 — 363 ° | -363        | 363     | -363         | 363     | +2 ° / -2 ° |
| Wrist 2  | -363 — 363 ° | -363        | 363     | -363         | 363     | +2 ° / -2 ° |
| Wrist 3  | -363 — 363 ° | -273        | 273     | -363         | 363     | +2 ° / -2 ° |

**Maximum speed**

| Joints   | Maximum      | Normal Mode |         | Reduced Mode |         |         |
|----------|--------------|-------------|---------|--------------|---------|---------|
|          |              | Minimum     | Maximum | Minimum      | Maximum |         |
| Base     | max: 131 °/s | 131         | 131     | 131          | 131     | -11 °/s |
| Shoulder | max: 131 °/s | 131         | 131     | 131          | 131     | -11 °/s |
| Elbow    | max: 191 °/s | 191         | 191     | 191          | 191     | -11 °/s |
| Wrist 1  | max: 191 °/s | 191         | 191     | 191          | 191     | -11 °/s |
| Wrist 2  | max: 191 °/s | 191         | 191     | 191          | 191     | -11 °/s |
| Wrist 3  | max: 191 °/s | 191         | 191     | 191          | 191     | -11 °/s |

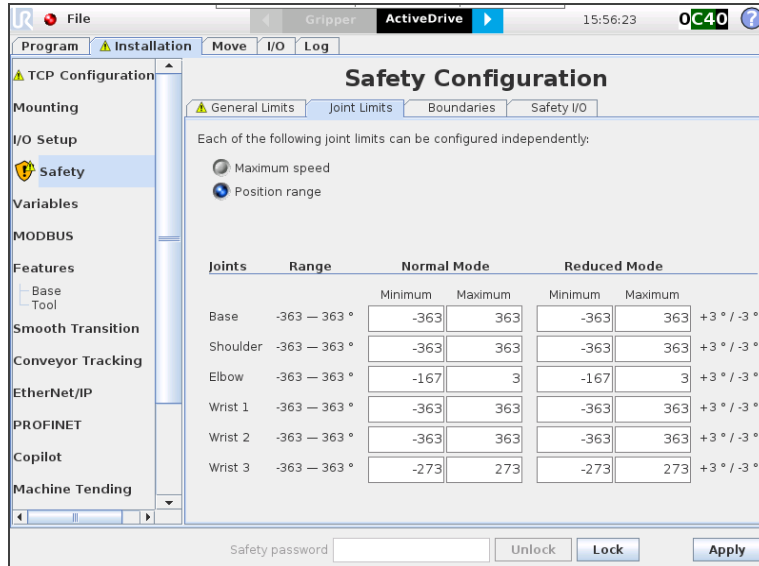
Safety password





### For CB-Series:

1. Tap **Installation** → **Safety** → **Joint Limits** → **Position range**
2. Then, unlock the section with the proper password and change the values.
  - The minimum and maximum values for the Elbow will be -167° and 3°.
  - The minimum and maximum values for the Wrist 3 will be -273° and 273°.



## 3.8.3. Configurable Inputs

Two of the buttons found on the push button enclosure can be configured to trigger “Pause” and “Restart” commands.

### Caution

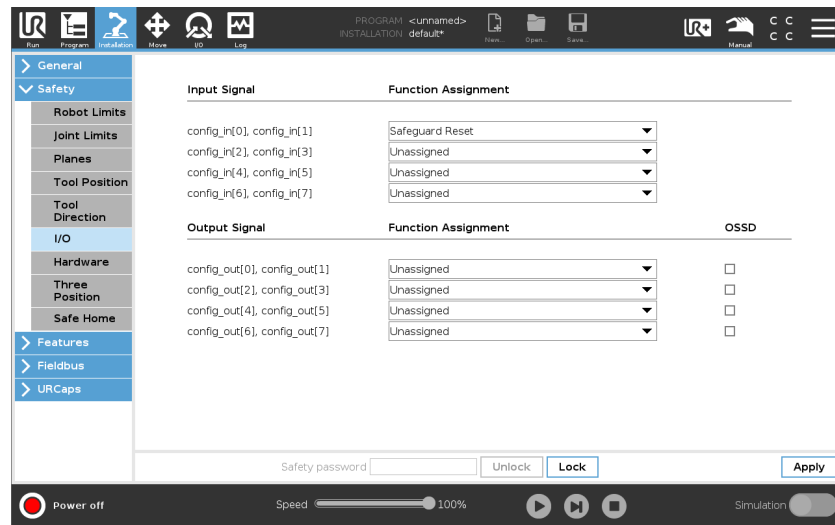
Button signals are not redundant. Since they are actual Pause and Restart commands, they should not be construed as safeguarding devices.

### For e-Series Universal Robots:

1. Tap **Installation** → **Safety** → **I/O**
2. Unlock the section with the proper password and set the Input Signal config\_in[0], config\_in[1] to Safeguard Reset.

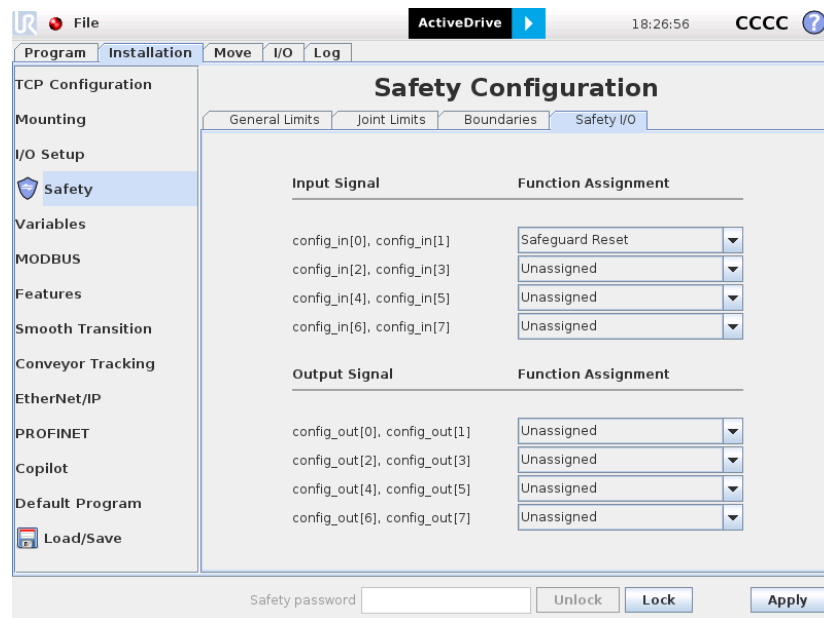






### For CB-Series Universal Robots:

1. Tap **Installation** → **Safety** → **Safety I/O**
2. Unlock the section with the proper password and set the Input Signal config\_in[0], config\_in[1] to Safeguard Reset.



## 3.8.4. Safety Planes

Safety planes, programmable via UR's PolyScope, can be added to the front and sides of pallet zones as safeguarding measures in case of system failure, mainly to prevent the robot from overrunning the edges of the pallet while carrying boxes. Please refer to the instruction manual of the UR robot used for more details in regard to adding and setting up safety planes.

### Info

The trajectories computed in the Palletizer node allow boxes to overrun the edge of the pallet. This should be accounted for when adding and setting up safety planes. Please refer to **Physical Clearance and Reachable Area of the Robot** section for more information. The values can vary depending on your configuration.





## 3.9. License Agreement

### END-USER LICENSE AGREEMENT

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

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  3. *Licensor* means Robotiq inc., a corporation incorporated under the laws of Quebec, having its registered office at 500-966 chemin Olivier, Lévis, Québec, Canada, G7A 2N1, which specializes into the conception, advanced manufacturing and sale of robotic products (the *Licensor's Business*);
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13. **Miscellaneous.**
  1. This Agreement constitutes the entire understanding and agreement between the Licensor and the End-User and replaces any prior agreement relating to the same subject matter.
  2. This Agreement shall be governed and construed in accordance with the laws of the province of Quebec and the federal laws of Canada applicable therein. Any legal action or proceeding between the Licensor and the End-User for any purpose concerning this Agreement or the parties' obligations hereunder shall be brought exclusively in a court of competent jurisdiction sitting in the judicial district of Trois-Rivières, Quebec.
  3. The Licensor's failure to insist upon or enforce strict performance of any provision of this Agreement shall not be construed as a waiver of any provision or right. Neither the course of conduct between the parties nor trade practice shall act to modify any provision of this Agreement.
  4. The Licensor may assign its rights and duties under this Agreement to any party at any time without notice to the End-User. The End-User may not assign this Agreement without the prior written consent of the Licensor.
  5. If any part of this Agreement is null, illegal or non-enforceable, this Agreement shall be interpreted as if this part was never part of this Agreement.
  6. The provisions of this Agreement are for the benefit of the Licensor and its officers, directors, employees, agents, licensors and suppliers. Each of these individuals or entities shall have the right to assert and enforce those provisions directly against the End-User on its own behalf. This Agreement is also for the benefit of, and binds, the End-User and its heirs, successors, legal representatives and permitted assigns.
  7. Any rights not expressly granted herein are reserved.
  8. The parties confirm that they have agreed that this Agreement and all related documents be drafted in English only. Les parties aux présentes confirment qu'elles ont accepté que la présente convention et tous les documents y afférents soient rédigés en anglais seulement.





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## 4. Operation

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### 4.1 Starting Up

After the mechanical and electrical installation, follow these steps:

1. Make sure you have installed the URCap. Please refer to the **Installing URCap Package** section
2. Configure the TCP. Use the proper values depending on the gripper configuration. See **Center of Mass, Tool Center Point (TCP)** section for more details.
3. Test the box sensor and the digital input : Tap the **I/O** tab and place an object in front of the box sensor to validate if the signal changes.
4. Test the Vacuum Gripper: Make sure the compressed air is supplied, then tap the I/O tab and manually activate the DO corresponding to the vacuum of the gripper. Repeat for the DO corresponding to the blow off.





## 4.2. Light States

### Light States Legend

- **Blink fast:** 2 Hz (0.25s ON, 0.25s OFF)
- **Blink slow:** 0.5 Hz (1s ON, 1s OFF)

| Color and signal type | Condition status  | Cause or action needed (troubleshooting for e-Series)  |
|-----------------------|---|--|
| RED<br>Fast blink     | The Robotiq Controller (PLC) is unable to communicate with the robot controller (UR)  | <ul style="list-style-type: none"> <li>• The robot has been started and needs time to boot up (Polyscope has not loaded yet)</li> <li>• Make sure your Ethernet/USB adapter is properly connected: the LED on the Ethernet adapter should be ON.</li> <li>• Make sure the Ethernet cable between the Robotiq Controller and robot controller is properly connected (to the USB adapter) .</li> <li>• Try powering off the system (both the robot and the Robotiq Controller). Wait 1 minute. Power up the system again.</li> </ul> |
| RED<br>Solid          | A Protective or Emergency stop has occurred.  | <ul style="list-style-type: none"> <li>• Follow the procedures required by the system to recover from either a Protective or Emergency stop.</li> </ul>  |
| YELLOW<br>Slow blink  | A Safeguard Stop has occurred.  | Press the safeguard reset button.  |
| BLUE<br>Solid         | <ul style="list-style-type: none"> <li>• The pallet is complete or missing;</li> </ul> <p style="text-align: center;">AND</p> <ul style="list-style-type: none"> <li>• The system is palletizing on the other side.</li> </ul>                  | Place a new pallet   |
| BLUE<br>Fast blink    | <ul style="list-style-type: none"> <li>• The pallet is complete and the system is idle;</li> </ul> <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> <li>• The pallet is not detected and the system is idle.</li> </ul> | Place a new pallet   |
| WHITE<br>Solid        | <ul style="list-style-type: none"> <li>• The Robotiq Controller (PLC) is connected to the robot controller</li> <li>• A program is running without a Palletizer node.</li> </ul>  | N/A  |
| GREEN<br>Solid        | A program with a Palletizer node is running but the pallet present is not completed.  | N/A  |





# 5. Software

## 5.1 Installation

### Caution

To ensure normal operation, make sure the Copilot license dongle remains connected at all times.

1. Connect the license dongle to the USB hub in the UR controller. Go to **Installation > URCaps > Copilot > Dashboard** to ensure your Copilot license is activated.

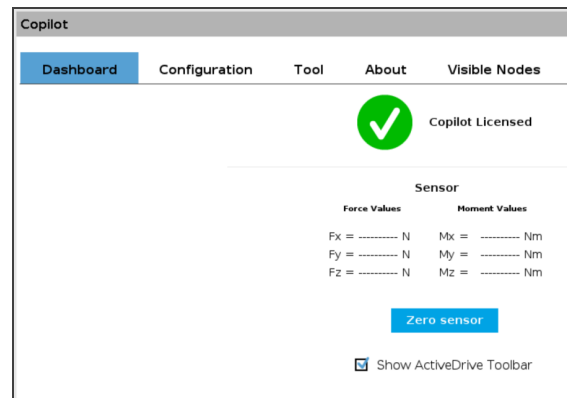


Fig. 5-1: Copilot License

2. Set up the Copilot software based on your configuration and application:

#### For e-Series Universal Robots

Tap Installation > URCaps > Copilot > Configuration

#### For CB-Series Universal Robots

Tap Installation > Copilot > Configuration

Then,

- a. Select the Palletizer model used
  - i. In the Configuration tab, under Palletizing Solution, select Pedestal
  - ii. Select the pedestal height. Use the Robotiq Configurator to simulate your palletizing cell and obtain the exact height. The possible heights range from 950 to 1550 mm with 50 mm increments.
- b. Robotiq recommends to keep the **Copilot** activated at all time. However, when another URCap or a Polyscope option (for example, ProfiNET or Ethernet/IP) needs to control the speed slider, you can deactivate the **Use Copilot to manage a soft speed transition when resuming from a Safeguard stop** option.
- c. If required, select the **Confirm new pallet(s) ready** option. This feature enables the **Confirm new pallet(s) ready** button found on the push button enclosure. When ticked, the **Confirm new pallet(s) ready** option prevents the Palletizer from palletizing on a new pallet detected by the pallet sensors. In order to start the palletization on that new pallet, the operator has to press the **Confirm new pallet(s) ready** button.





- d. If required, select the **Add 25 mm minimum distance between robot arm and base** option. When ticked, this feature ensures a 25 mm clearance between the moving parts and the base of the Solution during trajectory execution.

#### Caution

- When adding moves other than those generated automatically by the Palletizer node, it is the responsibility of the user to observe this distance at all times.
- This option can influence box throughput and the furthest positions reachable by the robot end effector. It should only be used in situations where it is strictly necessary.

- e. If required, activate the **Limit height for Palletizer program node (low ceiling)** option and enter the maximum height that can be reached by the moves automatically generated by the Palletizing solution. Make sure to keep a clearance to prevent a collision with the ceiling.

| Dashboard   | Configuration | Tool | About | Visible Nodes |
|---|---------------|------|-------|---------------|
| <b>General</b>  |               |      |       |               |
| <input checked="" type="checkbox"/> Use Copilot to manage a soft speed transition when resuming from a Safeguard stop   |               |      |       |               |
| <b>Palletizing Solution</b>   |               |      |       |               |
| Model   |               |      |       |               |
| <input type="radio"/> AX Series <input type="checkbox"/> Start linear axis at program start<br><input checked="" type="radio"/> PE Series    Pedestal height <input type="text" value="1500"/> mm |               |      |       |               |
| <input type="checkbox"/> Enable "Confirm new pallet(s) ready" button  |               |      |       |               |
| <input type="checkbox"/> Add 25 mm minimum distance between robot arm and base  |               |      |       |               |
| <input type="checkbox"/> Limit height for Palletizer program node (low ceiling) <input type="text" value="3.5"/> m  |               |      |       |               |
| <b>Force Torque Sensor</b>  |               |      |       |               |
| <input checked="" type="checkbox"/> Show collision detection options  |               |      |       |               |
| Causes a program to stop when the forces and torques monitored by the FT sensor exceed the defined limits.  |               |      |       |               |
| <input type="radio"/> Start monitoring  |               |      |       |               |
| <input checked="" type="radio"/> Stop monitoring  |               |      |       |               |

Fig. 5-2: Configuration tab





## 5.2. Multipick Feature

1. The multipick feature allows to pick multiple boxes at once, using one or more Grippers. In order to make the multipick feature work, you first need to configure the box sensors. See the **Wiring the Multipick Feature** section.
2. The configuration of the multipick feature is explained in the **Parameters Configuration** section and the **Program Tree with Multipick Feature** section.

### Caution

- The boxes picked together are considered as one box. Therefore, when multiple boxes are to be handled:
  - The **boxes must be picked side by side from the same location** (a conveyor for example) **then dropped side by side to the same location** (a pallet for example).
  - The boxes must have the **same dimensions**.
  - The boxes must have the **same payload**.

## 5.3. Program

### 5.3.1 Parameters Configuration

1. Before you start programing, make sure that your Robotiq Palletizing Solution is set this way:

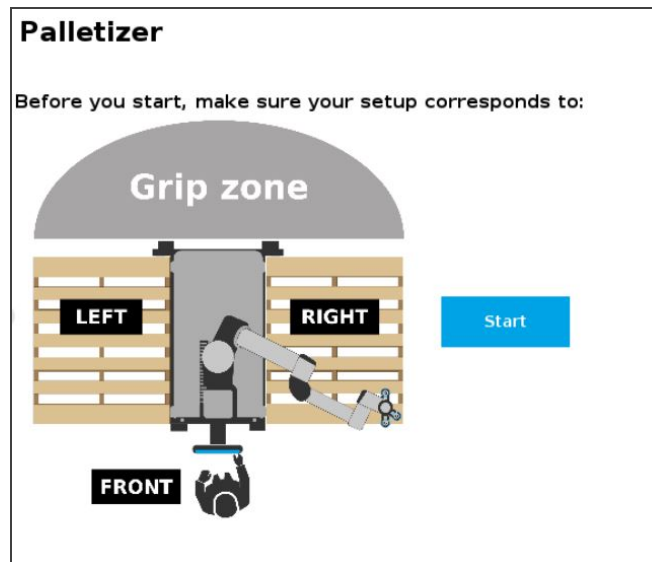


Fig. 5-3: Configuration of Palletizing environment

2. On the Teach Pendant, tap **Program > URCaps**.
3. Tap the **Palletizer** button, then **Start**.
4. You will have to configure four parameters to program your Palletizing Solution: **SETTINGS**, **BOX**, **PALLET** and **PATTERN**.





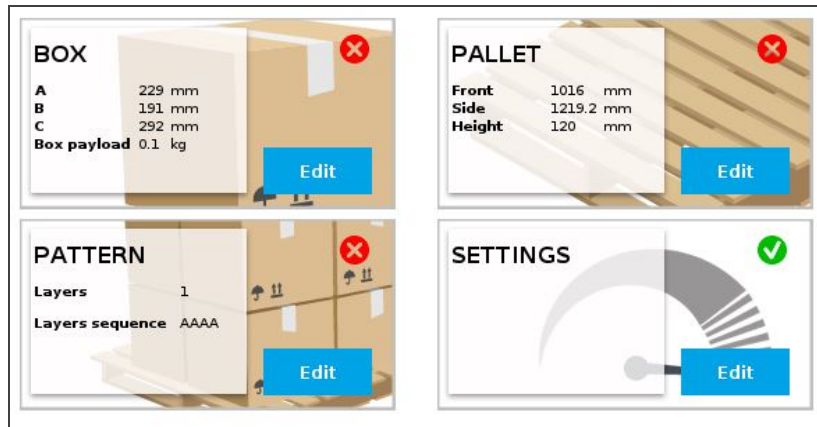


Fig. 5-4: Four parameters to set

## SETTINGS- First Part

Tap **SETTINGS**.

### Info

Here the term **Tool** refers to the Gripper.

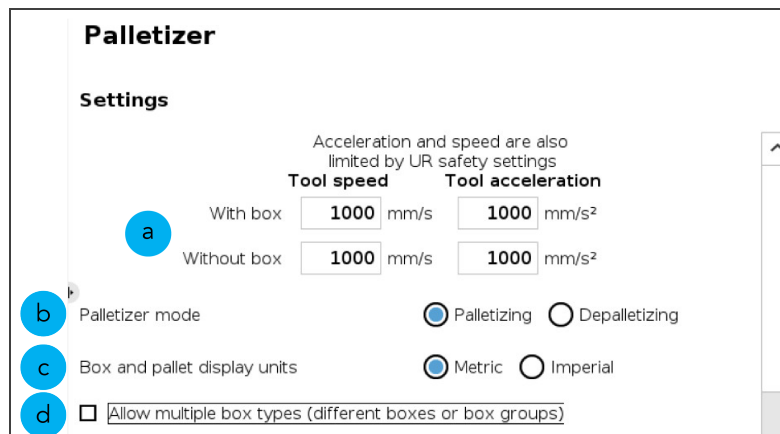


Fig. 5-5: SETTINGS parameter - top screen

- Set **Tool speed** and **Tool acceleration**, **With box** and **Without box**.
- Palletizer mode**: tick **Depalletizing** if you want to depalletize (**Palletizing** is ticked by default).
- Box and pallet display units**: Select the desired display units, **Metric** or **Imperial**.
- If you want to use the multipick feature, tick **Allow multiple box types (different boxes or box groups)** to activate it. Additional fields will be displayed: do not fill them yet.

Go back to the **Palletizer** node by tapping the house icon at the bottom right. The remaining **Settings** will be set later.





## BOX Parameter

1. Tap **BOX**.

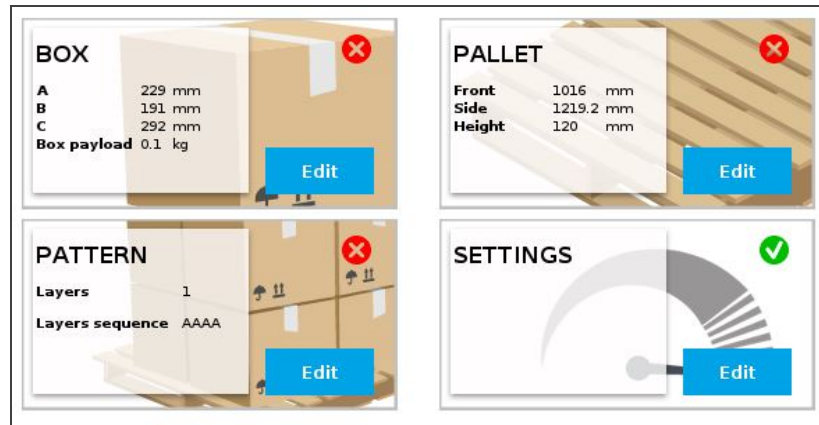


Fig. 5-6: Select the BOX parameter

2. **Only with the multipick feature** (if you do not use the feature, go to next step):
  - a. You must have at least two **Box Types**. Tap **Add Box Type** to create additional **Box Types**. The number of **Box Types** to create depends on the number of boxes to pick together:
    - If you want to pick up to two boxes at once, you need two **Box Types**: one for a **single box** and a second for **two boxes side by side**.
    - If you want to pick up to three boxes at once, you need three **Box Types**: one for a **single box**, a second for **two boxes side by side** and a third for **three boxes side by side**.
  - b. Rename each box type.

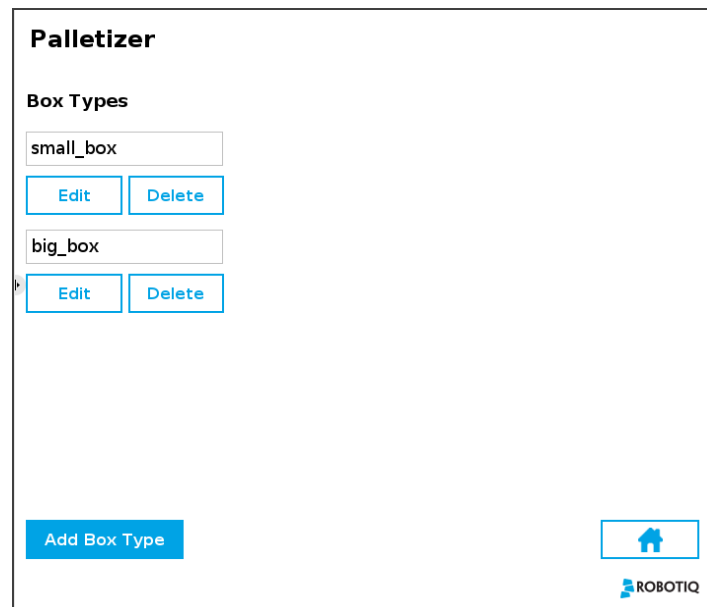


Fig. 5-7: Box Types

### Caution

Do not leave any space in the names of the **Box Types**, as it would not work properly when called in the program tree.





3. Set the **Box attributes**: dimensions **A**, **B** and **C** and **Payload**.

- **With the multipick feature**, you must do the following steps:
  - Tap **Edit** below each box type to configure it. Remember that each multiple box type is a multiple of one single box, therefore:
    - One dimension will double for a double box type, will triple for a triple box type, etc.
    - The payload will double for a double box type, will triple for a triple box type, etc.

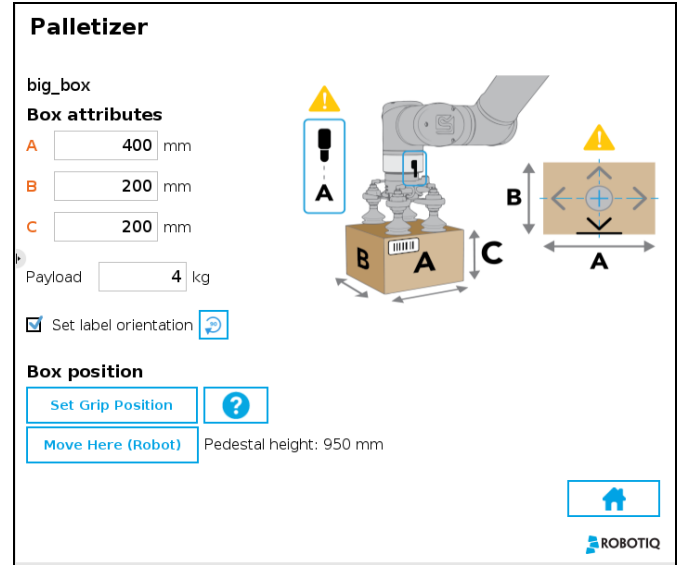
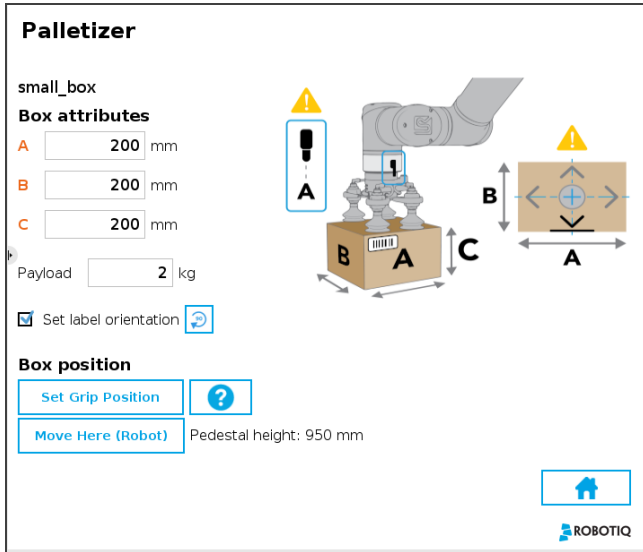


Fig. 5-8: Box attributes - (the images show two Box types with the multipick feature)

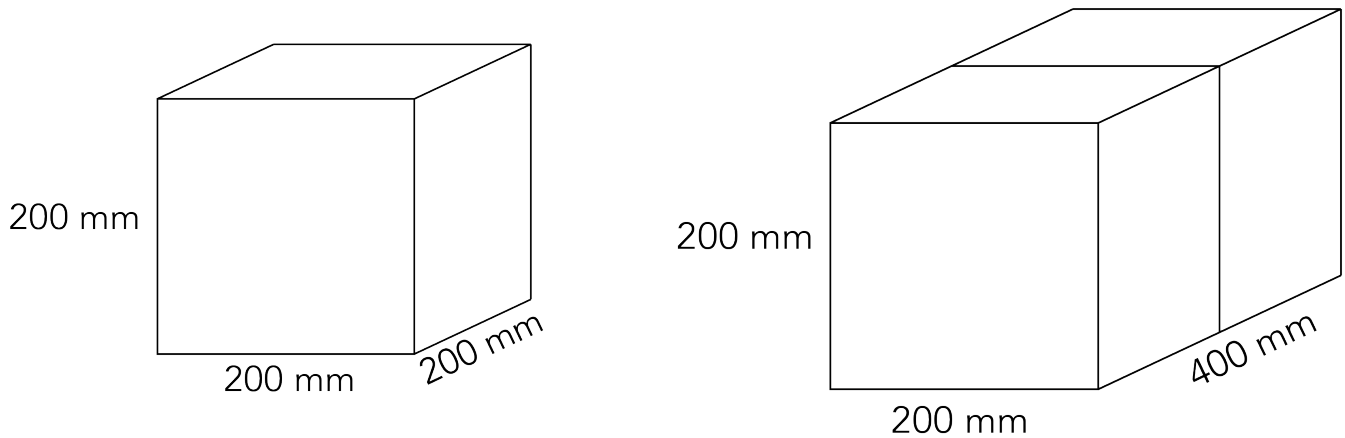



Fig. 5-9: Single box vs double box (with multipick feature)

4. If you have labels on your boxes that need to be oriented on your pallets, tick **Set label orientation**. Choose the side of the box where the label will be displayed by tapping the  button.





5. **Box position:** Tap **Set Grip Position** (palletizing mode) or **Set Drop Position** (depalletizing mode) to determine the **X, Y and Z** coordinates of your robot when gripping or dropping a box (on a conveyor, for example):
  - a. Position the robot tool flange connector on side A, as shown in the image below. Robot joints should be positioned as close as possible to the center of their motion range.
  - b. Align the TCP:
    - **Without the multipick feature:** align the TCP with the center of the box.
    - **With the multipick feature:** the TCP may not be aligned with the center point of the box(es). If so, note the **X** and **Y** distances between the center point of the box(es) and the TCP. Those values will be necessary later in the **SETTINGS - Second Part** section.
  - c. Once you are done, tap **Ok**.

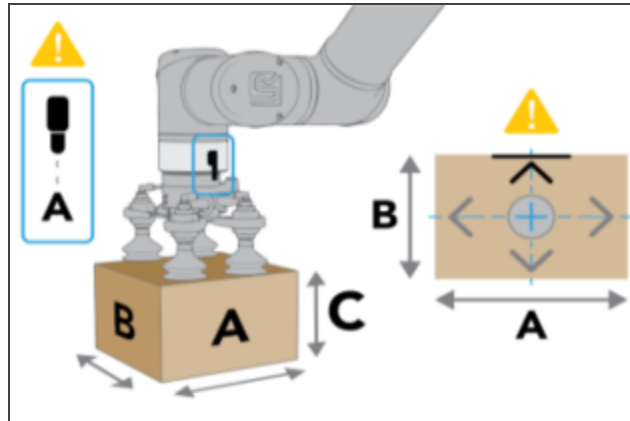


Fig. 5-10: Positioning the robot tool flange

6. The Pedestal height is displayed in the interface, beside the **Move Here (Robot)** button: make sure the value corresponds to the actual height of the pedestal.



Fig. 5-11: Pedestal height

The **BOX** parameter is now completed. Go back to the **Palletizer** node by tapping the house icon at the bottom right.



## SETTINGS - Second Part

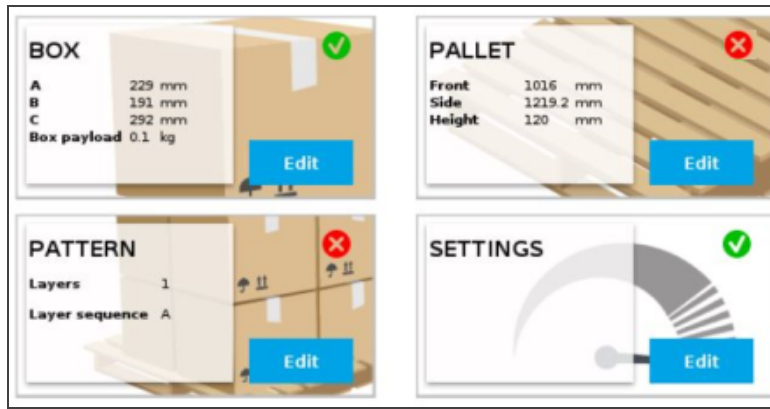


Fig. 5-12: Select **SETTINGS** again

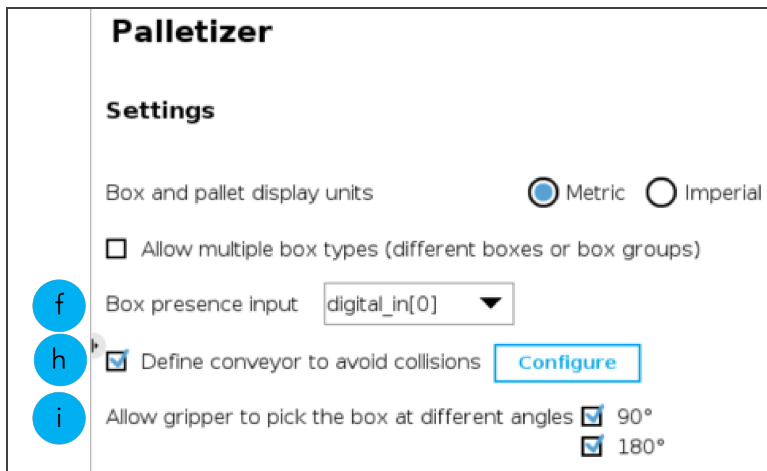


Fig. 5-13: **SETTINGS**parameter - middle screen

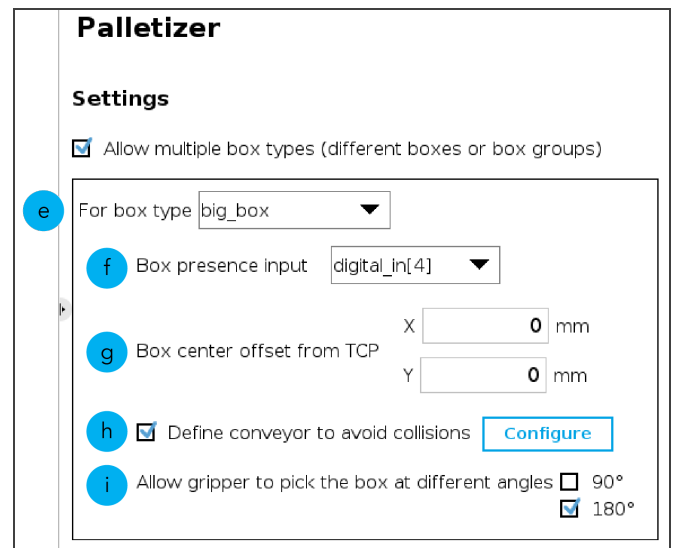


Fig. 5-14: **SETTINGS**parameter - middle screen (with multipick feature)

- e. **For box type (with multipick feature only):** select a box type. Follow steps f to i for each box type.
- f. **Box presence input:** Select the digital input for the box sensor.
  - With the multipick feature only, choose the digital inputs as follow (see the **Wiring the Multipick Feature** section):
    - For the single box, select the digital input linked to your first box sensor.
    - For the multiple box, select the digital input that you have previously connected to a digital output.
  - This example:
    - **digital\_in[0]** for **small\_box**
    - **digital\_in[4]** for **big\_box**
- g. **Box center offset from TCP (with multipick feature only):** when picked, if the center point of the box(es) is not aligned with the gripper TCP, enter the **X** and **Y** distances between the center point of the box(es) and the TCP.
  - These values should have been noted while setting the **BOX** parameter, in the **BOX position** step.





h. To configure a collision avoidance with a conveyor:

- Tick **Define conveyor to avoid collisions**, then tap **Configure**.
- Select your configuration (**Perpendicular**, **Parallel** or **Custom**).
- If the conveyor configuration is **Parallel**, select the **Direction** (**From left** or **From right**).
- Enter the values (see the associated images).

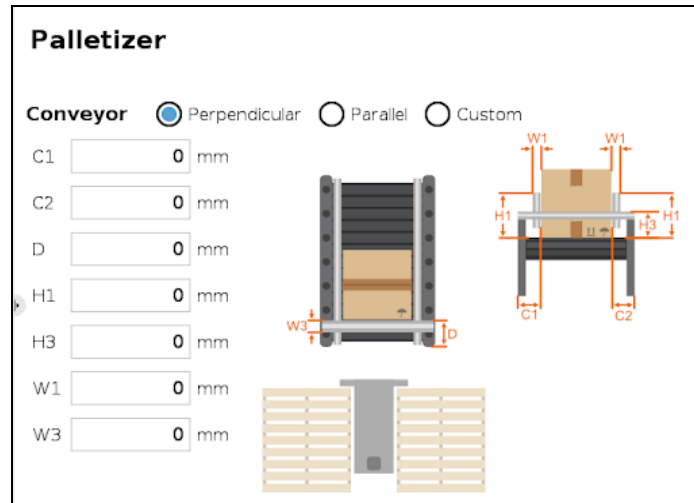


Fig. 5-15: Perpendicular conveyor

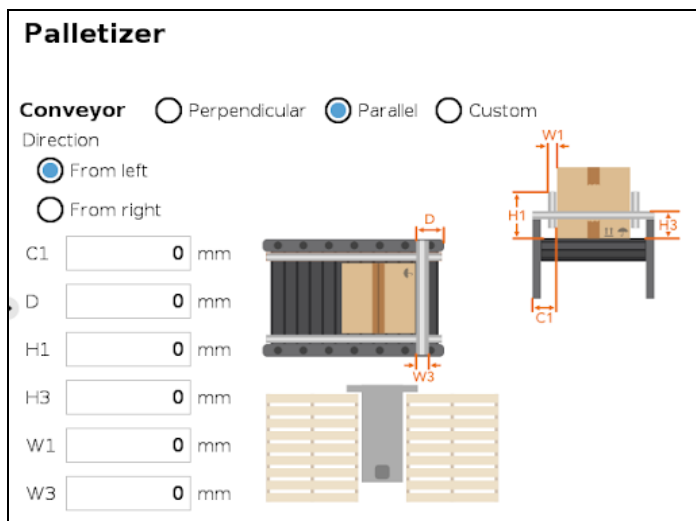


Fig. 5-16: Parallel conveyor - From left

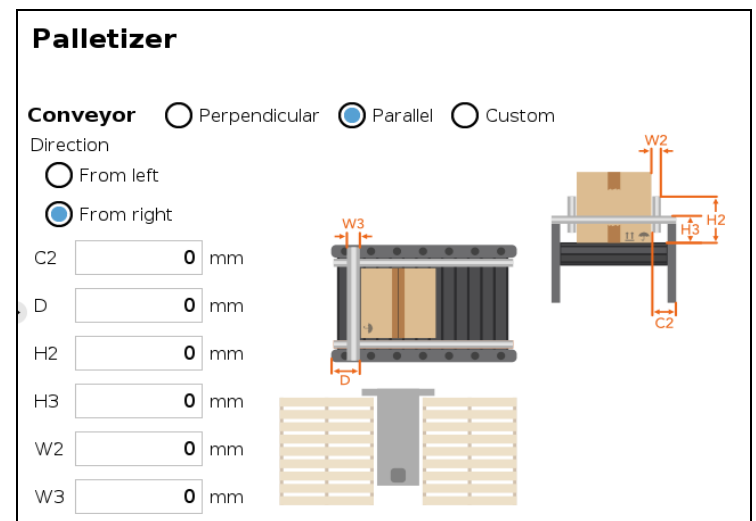


Fig. 5-17: Parallel conveyor - From right





### Palletizer

**Conveyor** ☐ Perpendicular ☐ Parallel ☒ Custom

A  °

C1  mm

C2  mm

D  mm

H1  mm

H2  mm

H3  mm

W1  mm

W2  mm

W3  mm

Fig. 5-18: Custom conveyor

- i. **Allow gripper to pick the box at different angles:** This allows the Gripper to rotate 90° or 180° around the Z-axis for trajectory optimization and more flexibility. It can be unticked if it is impossible for the Gripper to pick the box at 90° or 180° from the originally taught grip position.
- **WITHOUT the multipick feature:** the 90° and 180° checkboxes are ticked by default.
  - **WITH the multipick feature:** only the 180° checkbox is ticked by default (Gripper may be too long in a 90° orientation).

j

k

☒ Validate pallet state at program startup

☐ Add virtual planes around pallet(s)

Distance  mm

Fig. 5-19: SETTINGSparameter - bottom screen

- j. **Validate pallet state at program startup** is ticked by default. If you untick it :
- The first time the program is run, the system will consider that the pallets are empty (palletizing mode) or full (depalletizing mode).
  - If the program is interrupted, the current status (number of boxes processed on each pallet) will be kept.
  - If the program is saved, the status will be saved with it and the next time the program is loaded, it will restart from this status.
  - If you start a program where the checkbox is ticked by default, you can have either one of these pop-up information.





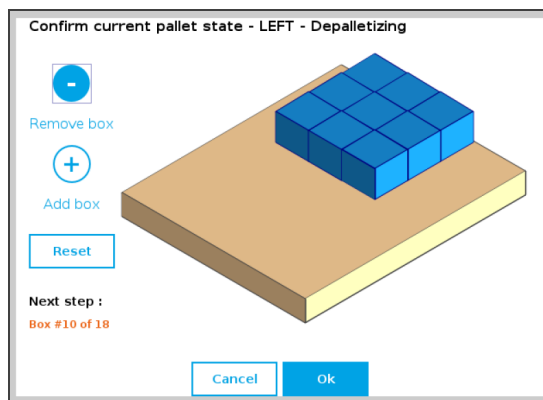


Fig. 5-20: Pallet state - LEFT - Depalletizing

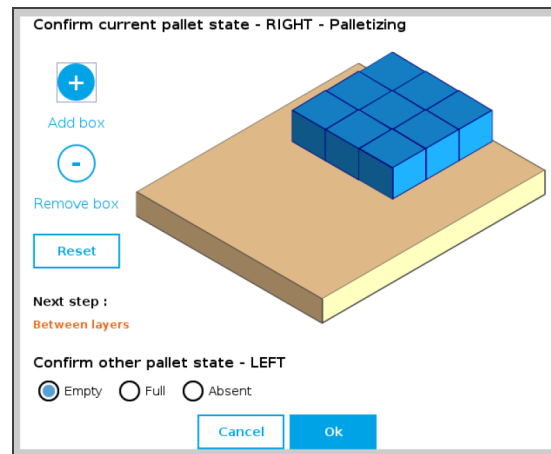
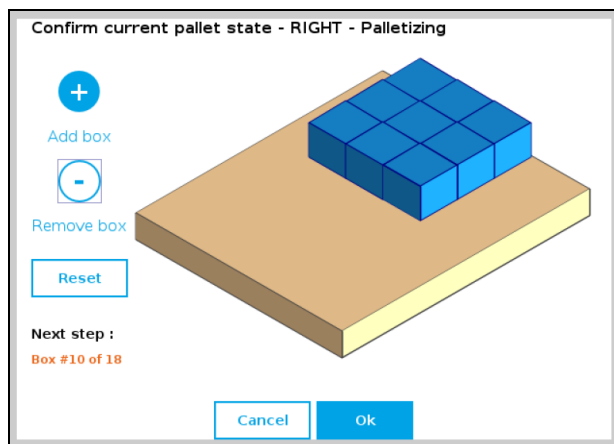


Fig. 5-21: Pallet state - RIGHT - Palletizing

- k. **Add virtual planes around pallet(s)** is unticked by default. Tick it to add virtual planes in order to prevent the boxes and the robot from extending too far beyond the edges of the pallet during approach. To ensure a proper operation of the Solution, a minimum distance of 50 mm is recommended.

The **SETTINGS** are now completed. Go back to the **Palletizer** node by tapping the house icon at the bottom right.





## PALLET Parameter

1. Tap **PALLET**.

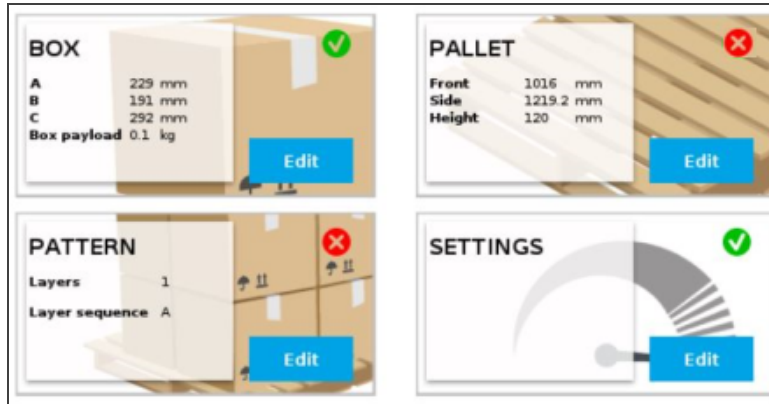


Fig. 5-22: Select the PALLET parameter

2. **Pallet dimensions:** set the **Front**, **Side** and **Height** dimensions.
3. **Pallet selection:** Select **Pallet LEFT** or **Pallet RIGHT**. To use both pallets, tick both.

### Palletizer

#### Pallet dimensions

Front

1016

mm

Side

1219.2

mm

Height

120

mm

The diagram shows two pallets, one labeled 'LEFT' and one labeled 'RIGHT'. The 'LEFT' pallet has dimensions 'SIDE' and 'FRONT' indicated with orange arrows. A person is standing next to the 'LEFT' pallet for scale.

#### Pallet selection \*

☐ Pallet LEFT

☐ Pallet RIGHT

Fig. 5-23: PALLET parameter

The **PALLET** parameter is now completed. Go back to the **Palletizer** node by tapping the house icon at the bottom right.





## PATTERN Parameter

1. Tap **PATTERN**.

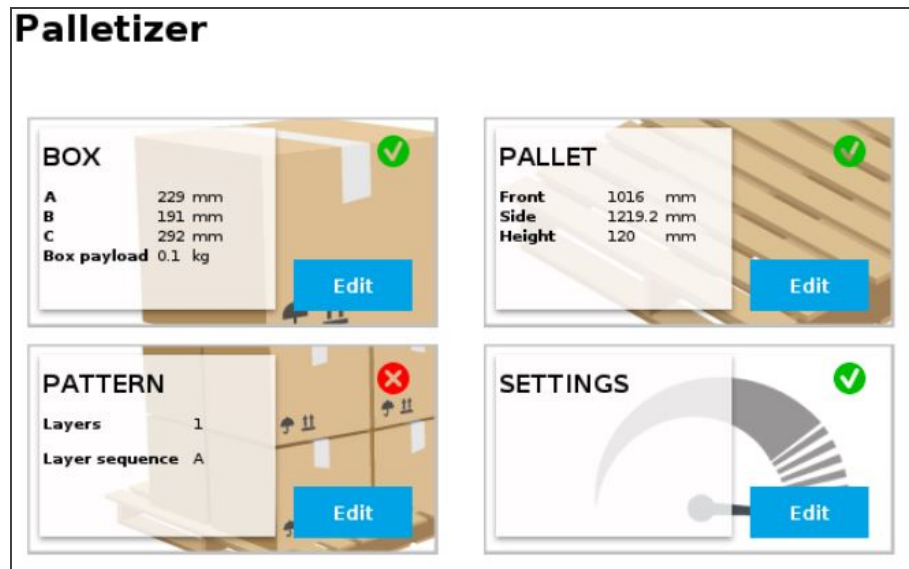


Fig. 5-24: Select the **PATTERN** parameter

2. **Pattern configuration** allows to customize the pattern for picking (depalletizing mode) or dropping (palletizing mode) the boxes. You can create and use a maximum of two patterns: **Pattern A** and **Pattern B**. Tap **Edit** to configure a pattern.

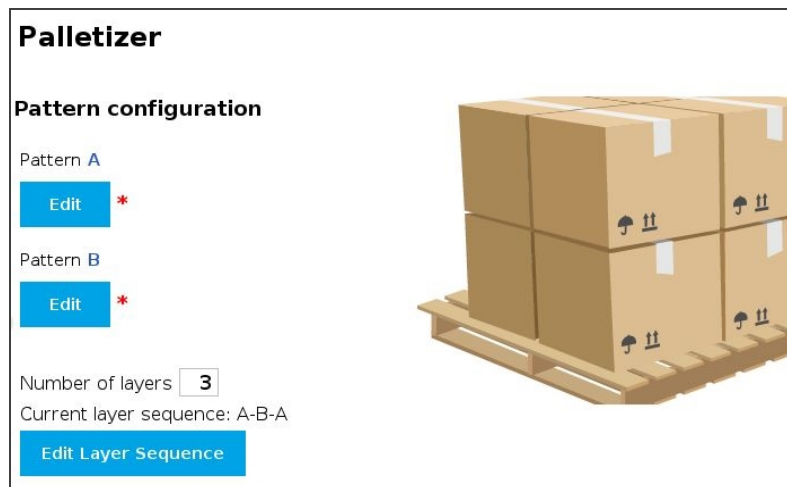


Fig. 5-25: Pattern configuration

3. **With multipick feature only**: choose the box type whose pattern you want to edit.
4. Tap the **+** button to add boxes or the **-** button to remove boxes.
5. Use the arrows to move and position the boxes on the pallet. You can modify the **Movement Step** to move the boxes faster or with more precision.
6. If you have ticked **Set label orientation** in the **BOX** parameters, the side where is the label will be identified by an arrow.





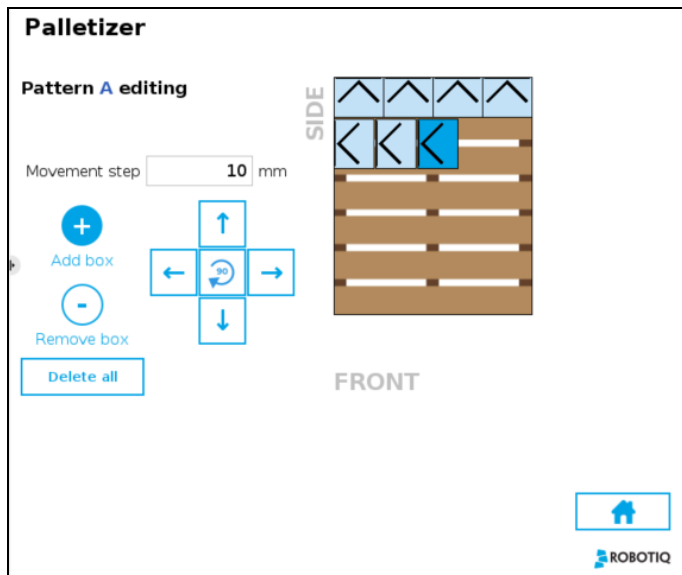


Fig. 5-26: Pattern editing

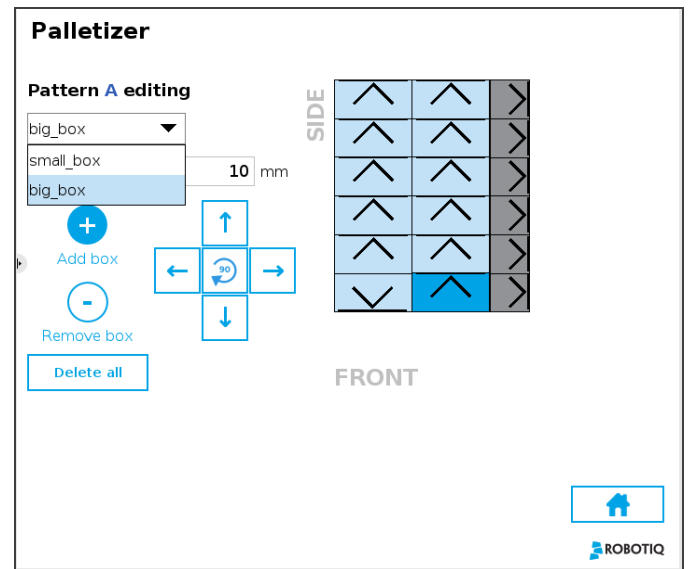


Fig. 5-27: Pattern editing with multipick feature

7. The **Pattern configuration** also allows to customize the layer sequence. Enter the **Number of layers**.

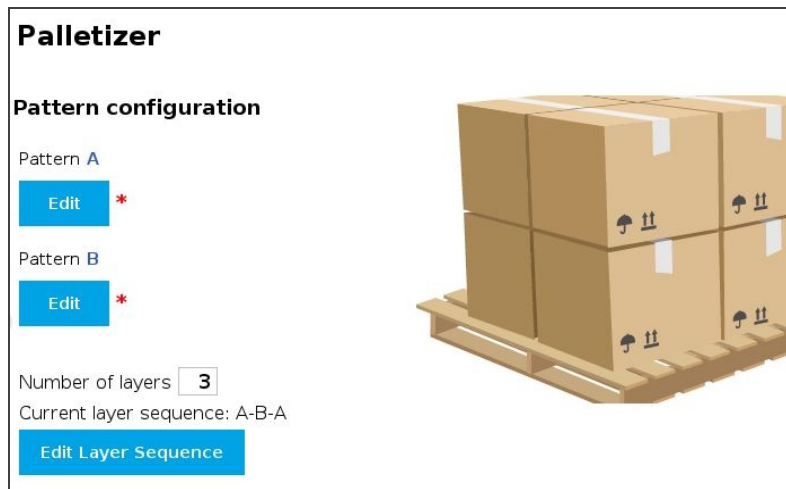


Fig. 5-28: Layers editing

8. If you created multiple patterns, tap **Edit Layer Sequence** to modify the **Layer Sequence**.



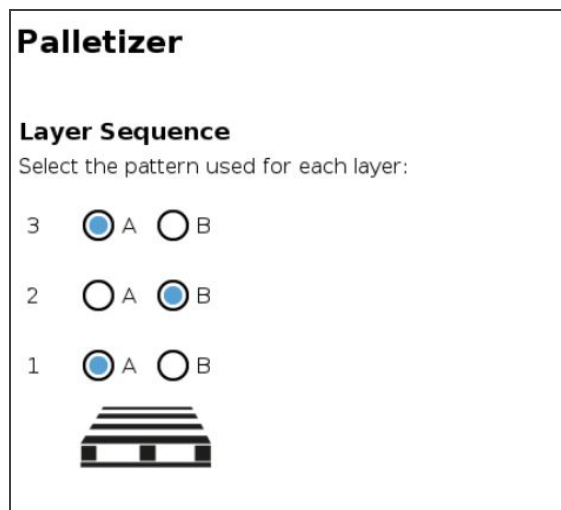


Fig. 5-29: Layer Sequence

All your Palletizer parameters are now configured.

## 5.3.2. Program Tree with Multipick Feature

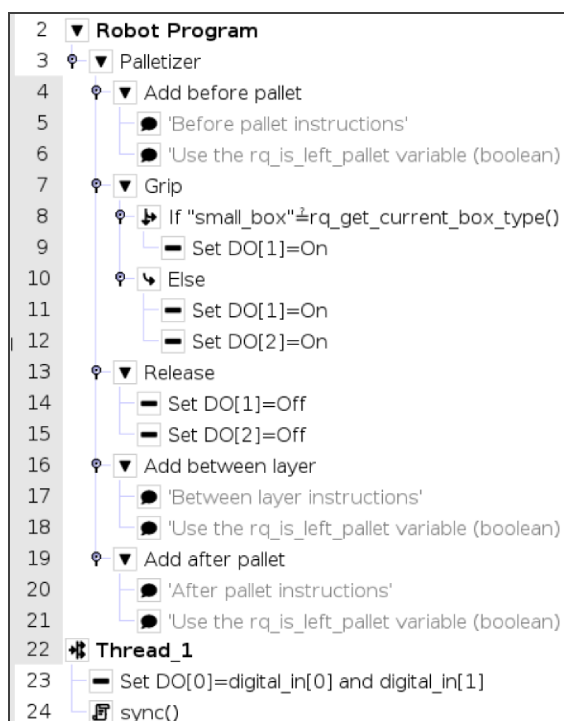


Fig. 5-30: Final program tree





## Multipick Request

When picking for example two boxes at a time using the multipick feature, it is required to validate that two boxes are available and well positioned. This can be done using two box sensors for which the signals are combined in one signal. Then this signal is sent to the robot which can pick two boxes. This section shows an example of how to do this in the robot program through scripts.

Do note that this approach can be used to accommodate special situations, for example, by adding a delay between the sensor signals and the ready-to-palletized signal to ensure that the boxes are well positioned.

1. In the program tree, tap **Robot Program** at the very top. Go to **Program > Advanced** and select **Thread**. At the bottom of the **Thread** node, only **Loops Forever** must be ticked.
  - **Thread** nodes appear at the bottom of the program tree, as they work in parallel of the main program.

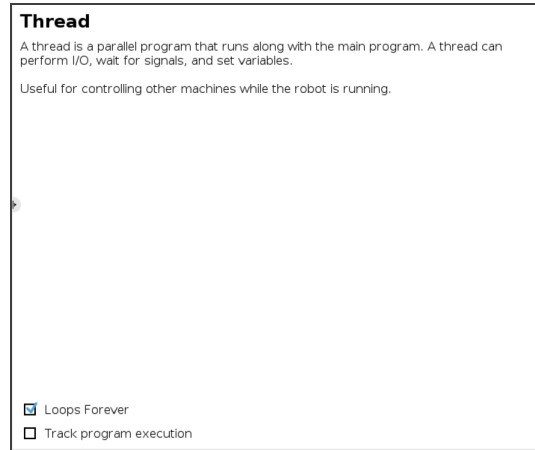


Fig. 5-31: Thread node

2. In the **Thread** node, insert a **Set** node (**Program > Basic**).
3. In the **Set** node, tick the fourth (4th) option from the top, open the scrolling menu and select the **digital output** that you have previously connected to a digital input (see the **Wiring the Multipick Feature** section).
  - This example: **digital\_out[0]**

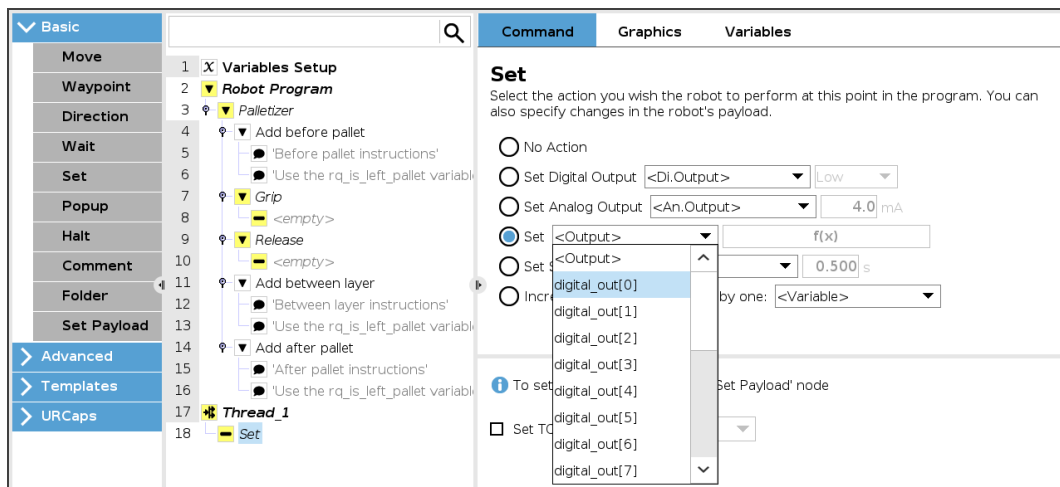


Fig. 5-32: Set node in the Thread node





4. Tap the **f(x)** button beside the scrolling menu you just opened.
5. In the window appearing, using the **Input** scrolling menu and the keyboard, enter the expression shown below (without any space). See the **Wiring the Multipick Feature** section for the digital inputs to enter.
  - **digital\_in[x]** and **digital\_in[xx]**
    - **digital\_in[x]** corresponds to the digital input linked to your first box sensor.
    - **digital\_in[xx]** corresponds to the digital input linked to your second box sensor.
  - This example: **digital\_in[0]** and **digital\_in[1]**

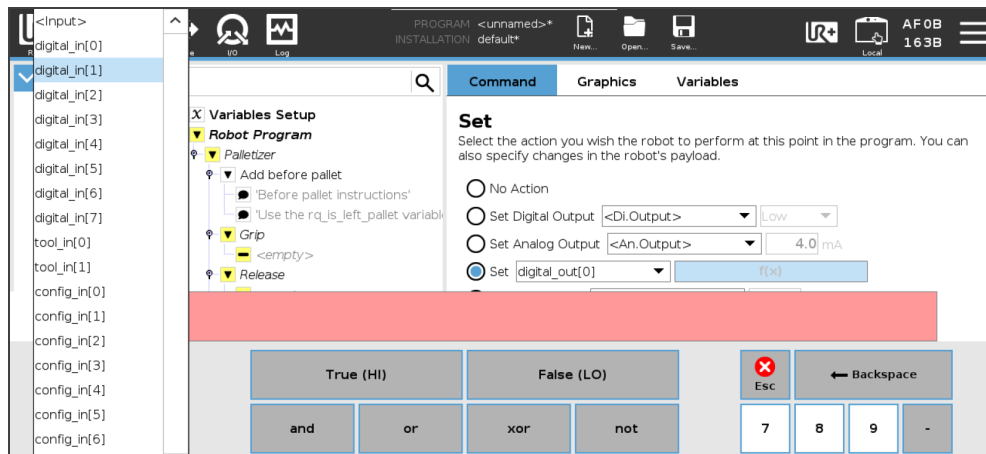


Fig. 5-33: Input scrolling menu in the Set node

6. Go to **Program > Advanced** and select **Script**.
7. In the **Script** node, tap the **f(x)** box.
8. In the dialog box, write **sync()** and tap **Submit**. This command resynchronizes with the main program.

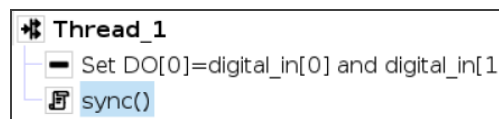


Fig. 5-34: Complete Thread node in program tree





## Gripper(s) Activation

The following steps explain how to activate the right Gripper(s) for each box type.

### Info

- Grippers are linked to digital outputs. In the example presented in this section, there are two grippers: one linked to **digital\_out[1]** and the second to **digital\_out[2]**.
- The association between the box types and the grippers to activate can vary depending of your configuration.

1. In the program tree, tap **<empty>** in the **Grip** node. Then go to **Program > Advanced** and insert a **If** node.
2. In the **If** node, tap the **f(x)** box (leave the box **Check expression continuously** unticked).

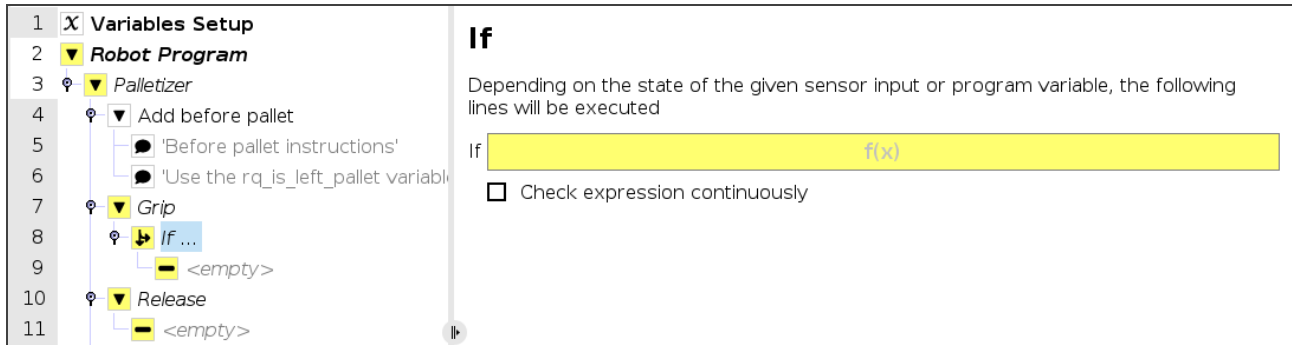


Fig. 5-35: If node in the Grip node

3. In the window appearing:
  - a. Write the name of your first box type between quotation marks.
  - b. Tap **=** on the keyboard (use the **UR** keyboard to have the right character).
  - c. In the **Function** scrolling menu, select **rq\_get\_current\_box\_type()**. Then tap **Submit**.
    - This example: **"small\_box"=rq\_get\_current\_box\_type()**

### Caution

- The name of your first box type must **absolutely be between quotation marks**.
- The character **=** must be selected on the **UR** keyboard.





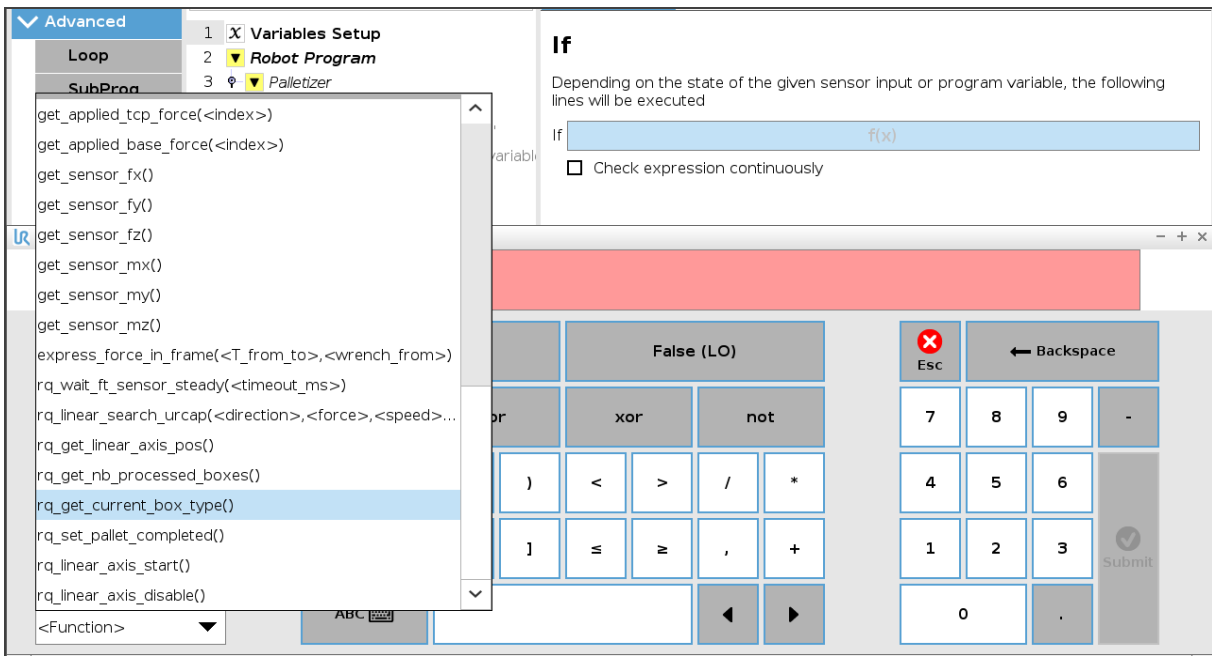


Fig. 5-36: Function scrolling menu in the If node

- In the program tree, tap **<empty>** in the **If** node. Then go to **Program > Basic** and select **Set**.

#### Tip

To be sure how are connected your grippers, you can make tests by activating the various digital outputs. Go to **I/O > Internal** and check the boxes in the **Digital Output** section.

- In the **Set** node, tick **Set Digital Output**, open the scrolling menu and select the digital output linked to the gripper that will pick the box type indicated in the **If** node. Then select **High** in the next scrolling menu.
  - This example: **digital\_out[1]** set to **High**. This activates one gripper when a single box (**small\_box**) is to be picked.

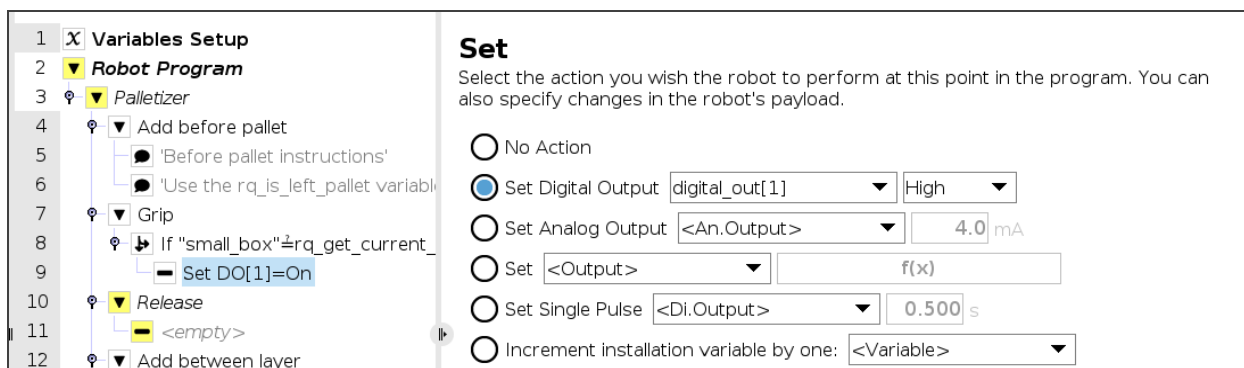


Fig. 5-37: Set node in the If node





6. Go back to the **If** node and tap **Add Else** at the bottom.

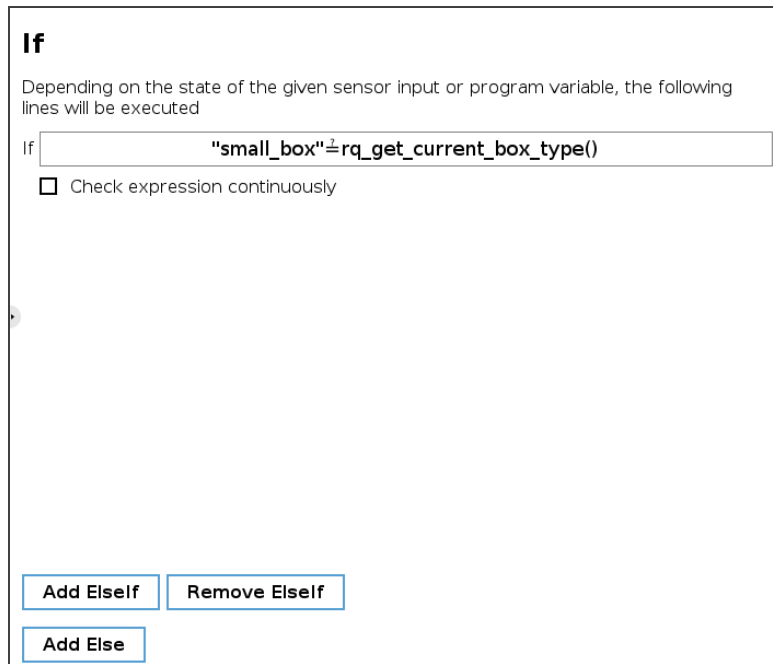


Fig. 5-38: Add Else in the If node

7. In the program tree, tap **<empty>** in the **Else** node. Then go to **Program > Basic** and select **Set**. Select it twice.
8. In one **Set** node, tick **Set Digital Output**, open the scrolling menu and select a digital output linked to one of your gripper. Select **High** in the next scrolling menu. Then repeat for the other **Set** node, but select the output linked to your other gripper.
- This example: **digital\_out[1]** and **digital\_out[2]** set to **High**. This activates both grippers when it is not the single box to be picked (thus the multiple box **big\_box**).

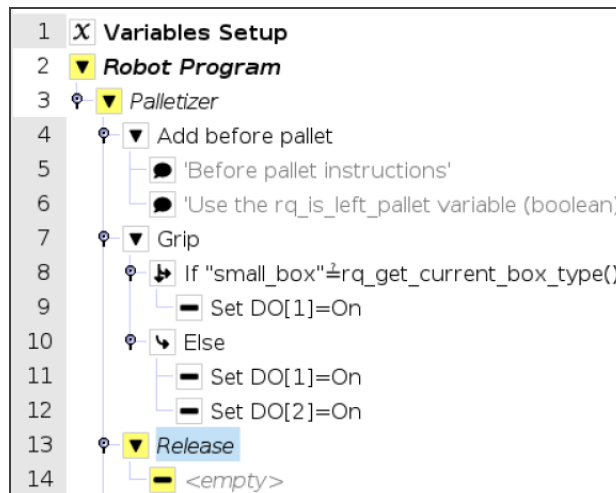


Fig. 5-39: Set nodes in the Else node

9. In the program tree, tap **<empty>** in the **Release** node. Then go to **Program > Basic** and select **Set**. Select it twice.





10. In one **Set** node, tick **Set Digital Output**, open the scrolling menu and select a digital output linked to one of your gripper. Select **Low** in the next scrolling menu. Then repeat for the other **Set** node, but select the output linked to your other gripper. This releases the vacuum in both grippers, even if only one was activated.

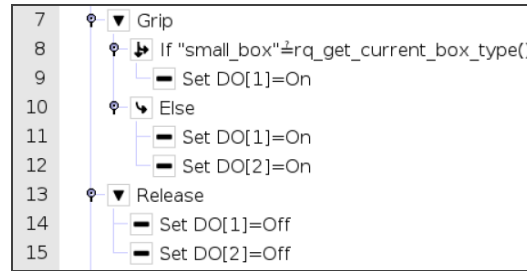


Fig. 5-40: Set nodes in the Release node

You have completed the multipick program.

## 5.4. Wiring the Multipick Feature

### Info

- This section presents a multipick configuration with two box types, and therefore two box sensors. If more than two boxes should be picked, the logic is the same.
- Each box type has its own input signal that can be interpreted as a "product ready to be palletized" signal. When multiple boxes are palletized together, combining box sensor signals is required.
- Robotiq provides only one box sensor with the standard product. Additional sensors can be bought using the part number PAL-BOX-SENS-KIT

- Connect your box sensors as described in the **Box Sensor(s)** section. Note to which digital input is connected each box sensor. In this example (see the image below step 2):
  - The digital input for box sensor #1 is **DI0** (black wire of box sensor #1).
  - The digital input for box sensor #2 is **DI1** (black wire of box sensor #2).
- Then connect a wire between an unused DI terminal block (digital input) and an unused DO terminal block (digital output). In this example (see the green wire on the image below), the digital output **DO0** will activate the digital input **DI4**.

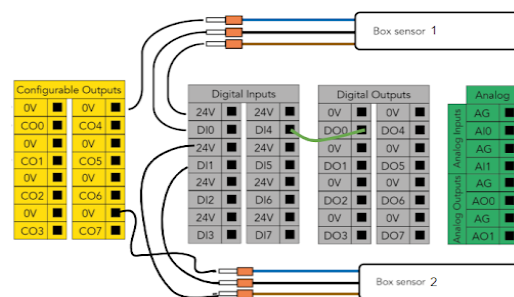


Fig. 5-41: Wiring the box sensors

### Info

Explanation for the DI-DO connection (green wire on the image above): when both box sensors are triggered, the DO (**DO0** on the image) will be activated through the robot program. The DO then needs to be connected to a DI (**DI4** on the image) to be used in the URCap.





## 5.5. Palletizing Script Functions

Palletizing functions are made available in the **Script** drop-down menu.

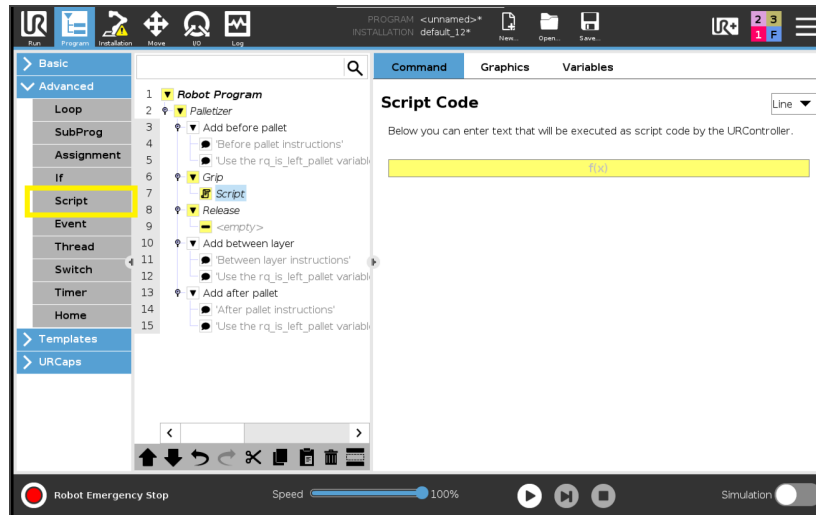


Fig. 5-42: Script node

Tap the Script Code textbox (**f(x)**), then on the drop-down **Function** menu gives access to the script functions list.

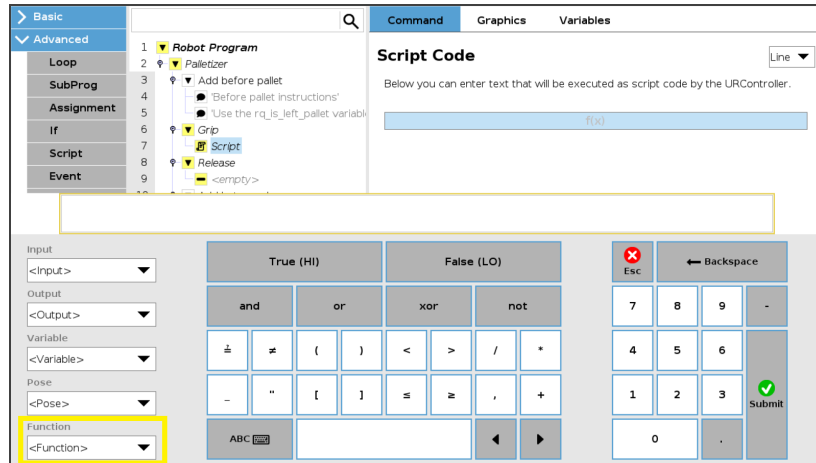


Fig. 5-43: Function menu in Script node





## 5.5.1 Number of Processed Boxes

### Description

This function returns the number of processed boxes. It must be used inside the palletizer node in order to work properly.

### Declaration

```
rq_get_nb_processed_boxes()
```

### Return value

This function returns an integer which expresses the number of processed boxes.

## 5.5.2. Set Pallet Completed

### Description

This function allows to partially fill the pallets. The palletizer will process the current box and go directly to the **Add after pallet** folder. The **Add between layer** folder will not be executed.

Use this function inside a **Grip** or **Release** folder.

### Declaration

```
rq_set_pallet_completed()
```

### Return value

There is no return value with this function.

## 5.5.3. Get Pallet State

### Description

This function returns the state of a pallet. It can be used anywhere in the program.

### Declaration

```
rq_get_pallet_state(is_pallet_left)
```

### Parameters

- Enter **True** to get the state of the **left** pallet.
- Enter **False** to get the state of the **right** pallet.

### Return value

This function returns an integer from 0 to 3 :

- 0 = Waiting, Idle: Solution is waiting for a new pallet or a user confirmation that the pallet is ready.
- 1 = Ready: Pallet is ready to begin the palletizing or depalletizing process.
- 2 = In progress: Palletizing/depalletizing is in progress on the pallet.
- 3 = Completed: Pallet is full (palletizing) or empty (depalletizing).





## 5.5.4. Set Palletizer State

### Description

This function configures the state of a Palletizer node. It must be used outside the palletizer node in order to work properly.

### Declaration

```
rq_set_palletizer_state(palletizer_index, processed_boxes, next_step, other_pallet_state="INACTIVE", current_pallet="CURRENT")
```

### Parameters

- **palletizer\_index**: Palletizer nodes for which the state will be numerically ordered, beginning from 0 (the first node number will be 0, the second node number will be 1 and so on).
- **processed\_boxes**: Number of boxes palletized or depalletized on the current pallet.
- **next\_step**: Next step on the current pallet.
  - "BOX": The robot will place a box on next step.
  - "BEFORE\_PALLET": The robot will execute the **Add before pallet** on next step.
  - "BETWEEN\_LAYERS": The robot will execute the **Add between layer** on next step.
  - "AFTER\_PALLET": The robot will execute the **Add after pallet** on next step.
  - "NEXT\_PALLET": On next step, the robot will start processing the other pallet.
- **other\_pallet\_state**: State of the other pallet (not currently processed).
  - "EMPTY": There is no box on the pallet.
  - "FULL": The pallet is full of boxes.
  - "ABSENT": The pallet is not in place.
  - "INACTIVE": When the Palletizer node does not use the other pallet.
- **current pallet**: The pallet on which the robot is currently working on.
  - "LEFT": The current pallet is the left one.
  - "RIGHT": The current pallet is the right one.
  - "CURRENT": The current pallet is the same as before calling this function.

### Return value

There is no return value with this function.





## 5.5.5. Get Current Box Type

### Description

This function returns the box type being processed when multiple box types are enabled. It must be used inside the palletizer node in order to work properly.

### Declaration

```
rq_get_current_box_type()
```

### Return value

This function returns a string which is the name of the box type currently being processed. The string is case-sensitive





## 6. Specifications

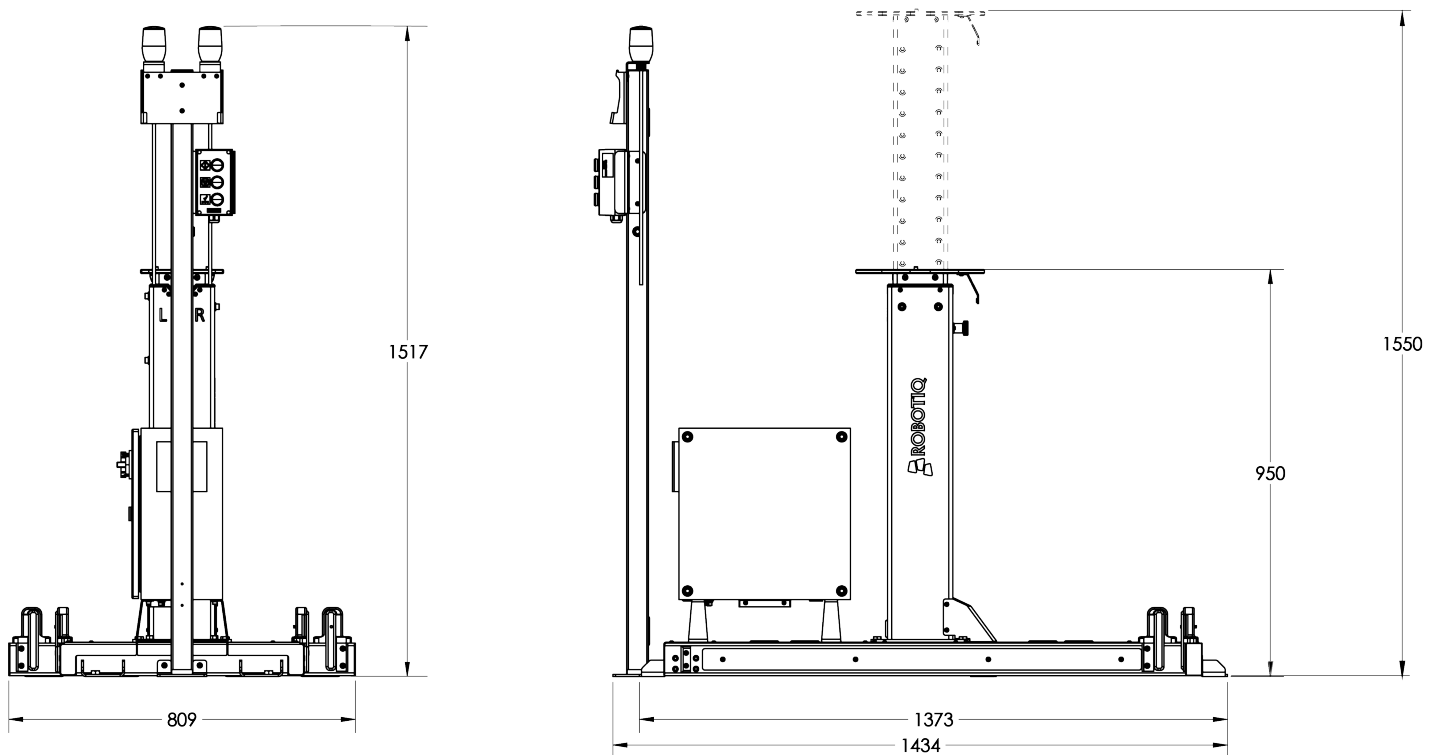
### Caution

This manual uses the metric system, unless specified, **all dimensions are in millimeters.**

The following subsections provide data on the various specifications for the Robotiq Palletizing Solution.

### 6.1 Technical Dimensions

#### 6.11 Base with Pedestal, Robotiq Controller and Post



#### 6.12. PowerPick Vacuum Gripper

For PowerPick Gripper technical dimensions, please refer to its own manual, available at [support.robotiq.com](https://support.robotiq.com)





## 6.2. Mechanical Specifications

### 6.2.1 Palletizing Solution (Without PowerPick Vacuum Gripper)

| Parameter  | Specification                     |                                   |
|--|-----------------------------------|-----------------------------------|
|  | Metric                            | Imperial                          |
| Net product weight (without robot and gripper)         | 99 kg                             | 218 lb                            |
| Base weight  | 62 kg                             | 136 lb                            |
| Pedestal weight  | 37 kg                             | 81 lb                             |
| Maximum box weight <sup>1</sup>                        | Up to 16 kg                       | Up to 35 lb                       |
| Minimum box dimensions <sup>2</sup>                    | See explanations below            |                                   |
| Minimum pallet width and depth                         | 300 mm                            | 12 in                             |
| Maximum pallet dimensions width and depth <sup>3</sup> | See explanations below            |                                   |
| Minimum pallet height (empty)                          | 50 mm                             | 2 in                              |
| Maximum pallet height (filled)                         | 1500 mm                           | 60 in                             |
| Shipping crate dimensions                              | [1500, 950, 810 ] mm<br>(L, W, H) | [59, 37-1/2, 32 ] in<br>(L, W, H) |
| Gross shipping weight                                  | 199 kg                            | 438 lb                            |
| Maximal acceleration in operating conditions           | 2 g                               |                                   |
| Maximum box throughput                                 | Up to 13 boxes/min <sup>4</sup>   |                                   |
| Maximum number of box patterns                         | 2                                 |                                   |
| Energy source  | Electricity                       |                                   |

<sup>1</sup> Maximum box weight depends on the robot model and gripper used.

<sup>2</sup>The minimum box dimensions depend on pallet dimensions. Use the [Robotiq Configurator](#) to validate the combination.

<sup>3</sup>The maximum pallet dimensions depend on your box dimensions. Use the [Robotiq Configurator](#) to validate the combination.

<sup>4</sup>The maximum box throughput depends on box weight, box dimensions, box surface, pallet dimensions, and pallet layout.

*Table 6-1: Mechanical Specifications of the Robotiq Palletizing Solution*





## 6.2.2. PowerPick Vacuum Gripper

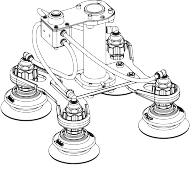
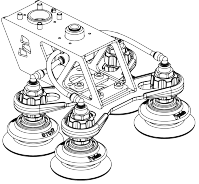
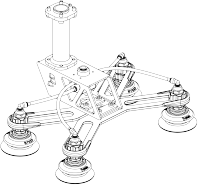
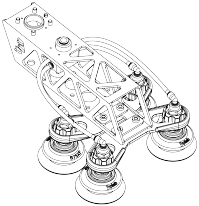
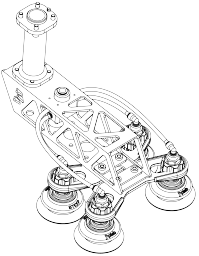
| Specifications                                       | PowerPick Vacuum Gripper       |                 |
|--|--------------------------------|-----------------|
|  | Metric Units                   | Imperial Units  |
| Energy source  | Electricity and compressed air |                 |
| Gripper mass <sup>1</sup>                            | 1030 g                         | 2.27 lb         |
| Minimum feed pressure                                | 3 bar                          | 45 PSI          |
| Optimal feed pressure for low noise (< 80 dBa)       | 4 bar                          | 60 PSI          |
| Optimal feed pressure for compressed air consumption | 5.5 bar                        | 80 PSI          |
| Optimal feed pressure for maximal payload            | 7 bar                          | 100 PSI         |
| Maximum feed pressure                                | 8 bar                          | 115 PSI         |
| Air consumption at low noise pressure                | 161.4 SLPM                     | 42.64 GPM       |
| Air consumption at optimal pressure                  | 221.6 SLPM                     | 58.55 GPM       |
| Air consumption at maximum payload pressure          | 281.7 SLPM                     | 74.43 GPM       |
| Air supply connection type                           | 8 mm OD tube                   | 5/16 in OD tube |
| PowerPick Gripper noise level (at 5.5 bar)           | 82 dBa                         |                 |
| Maximum Vacuum level at 5.5 bar                      | 67%                            |                 |
| Maximum acceleration in operating condition          | 1.5 g                          |                 |
| Contaminants and purity classes                      | ISO 8573-1 class 7.4.4         |                 |

<sup>1</sup> Gripper with the configuration of 200 mm offset tube





## 6.2.3. Center of Mass, Tool Center Point (TCP)

| Configuration  | Offset Tube | Suction Cups Bracket | Wrist Extension | Center of mass (mm) |   |     | TCP (mm) |   |     | Mass (g) |
|--|-------------|----------------------|-----------------|---------------------|---|-----|----------|---|-----|----------|
|  |             |                      |                 | X                   | Y | Z   | X        | Y | Z   |          |
|    | 0 mm        | Small                | Yes             | 5                   | 0 | 108 | 0        | 0 | 183 | 1066     |
|    | 100 mm      | Small                | No              | 85                  | 0 | 57  | 106      | 0 | 122 | 954      |
|   | 100 mm      | Large                | Yes             | 71                  | 0 | 155 | 106      | 0 | 242 | 1289     |
|  | 200 mm      | Small                | No              | 151                 | 0 | 57  | 200      | 0 | 122 | 1020     |
|  | 200 mm      | Small                | Yes             | 151                 | 0 | 154 | 200      | 0 | 242 | 1244     |





## 6.3. Electrical Specifications

### 6.3.1 Robotiq Controller

| Parameter                             | Specification   |
|---------------------------------------|---|
| Operating supply voltage              | 100-240 Vac<br>60/50 Hz   |
| Current consumption (excluding robot) | 2.2 A (100V AC)<br>1.9A (120V AC)<br>1.1 A (230V AC)<br>1.1 A (240V AC) |

*Fig. 6-1: Robotiq Controller electrical specifications*

#### Info

These are the specifications of the Robotiq controller, excluding the robot. The overall voltage consumption will vary depending on the robot used.

#### Warning

The Robotiq controller is CE marked and cCSAus certified. Any modification will void the certification.

The following diagram illustrates the basic connections of the Robotiq Controller. For more information, download the electrical package on the [Robotiq support website](#). Do not modify the wiring unless you can recertify the Robotiq Controller with local authorities.









## 7. Maintenance

Following the maintenance interval will ensure:

- Correct functioning of the equipment;
- Validity of the warranty;
- Proper lifetime of the equipment.

### Caution

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

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

### Caution

Always turn off the Palletizing Solution and depressurize the air supply tube before performing any maintenance operation on it. For more details about the depressurization, please refer to **Depressurizing the Supply Line** section.

### Caution

The Palletizing Solution is not waterproof or water resistant without additional protection. Only clean the equipment with a dry towel.

### Caution

Maintenance operator must be grounded to prevent electrostatic discharge that could damage electronic equipments.





# 7.1 Fasteners

Periodically ensure that the bolts are tightened all over the Solution. If necessary, tight again according to the specified torques represented in the table below.

| Designation | Location  | Tightening Torque |         |
|-------------|---|-------------------|---------|
|             |   | (Nm)              | [lb-ft] |
| M6          | Strengthening brackets of the PowerPick Gripper | 9.5               | 7       |
| M8          | Pallet sensors                                  | 15.0              | 11.1    |
| M10         | Base - Pedestal                                 | 50.0              | 36.9    |
| 1/2" -13    | Wedge anchors                                   | 54.2              | 40.0    |
| M8          | Robot-pedestal link                             | 20.0              | 14.8    |
| M8          | Pedestal height adjustment                      | 15.0              | 11.1    |

Table 7-1: Torque Settings - Palletizing Solution





## 72. PowerPick Vacuum Gripper

The Vacuum Gripper only requires external maintenance with limited downtime. Maintenance is required after specified usage, measured in cycles (workpiece pick-up and release) or use time (hours).

### Warning

Unless specified, any **repairs** done on the Vacuum Gripper will be done by Robotiq.

| Operation           | Daily               | Monthly              | 1 M cycles or<br>1000 hours |
|---------------------|---------------------|----------------------|-----------------------------|
| Gripper Cleaning    | Dirty<br>conditions | Normal<br>conditions |                             |
| Periodic Inspection |                     |                      | X                           |

### 72.1 Air Filter Kit

Regularly inspect the air filter kit. If there is water present, it must be drained.

### Info

For more details about the PowerPick Vacuum Gripper maintenance, please consult its instruction manual available at [support.robotiq.com](https://support.robotiq.com).

## 73. Cleaning

### 73.1 Air Filter Cleaning

Periodically clean the control panel air filters.

### 73.2. Solution Cleaning

Clean the mechanical parts with a soft cloth, as required. Cleaning agents include all non-abrasive media.

## 74. Solution Storage

Ensure short storage times. Choose cool, dry, wellshaded, corrosion-resistant locations.





## 8. Spare Parts, Kits and Accessories

### Info

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

| Item  | Description   | Ordering Number          |
|---|---|--------------------------|
| 52 mm Suction Cups                          | 4 x Suction Cups - Piab 52 mm (1.5 Bellows)   | VAC-CUP-PIAB-52MM-KIT-4  |
| 75 mm Suction Cups                          | 4 x Suction Cups - Piab 75 mm (1.5 Bellows)   | VAC-CUP-PIAB-75MM-KIT-4  |
| 78 mm Suction Cups                          | 4 x Suction Cups - Coval 78 mm (1.5 Bellows)  | VAC-CUP-COVAL-78MM-KIT-4 |
| Status Light for Palletizing Solution       | 1 x Status Light for the Robotiq Palletizing Solution   | PAL-STAT-LIGHT           |
| Type A Pallet sensor - Palletizing Solution | <p>Type A Pallet Sensor Kit for the Robotiq Palletizing Solution</p> <ul style="list-style-type: none"> <li>• 1 x Type A Pallet Sensor</li> <li>• 1 x screw kit</li> </ul> <p>Used for:</p> <ul style="list-style-type: none"> <li>◦ Left pallet, back sensor</li> <li>◦ Right pallet, side sensor</li> </ul> | PAL-SENS-A               |
| Type B Pallet Sensor - Palletizing Solution | <p>Type B Pallet Sensor Kit for the Robotiq Palletizing Solution</p> <ul style="list-style-type: none"> <li>• 1 x Type B Pallet Sensor</li> <li>• 1 x screw kit</li> </ul> <p>Used for:</p> <ul style="list-style-type: none"> <li>◦ Left pallet, side sensor</li> <li>◦ Right pallet, back sensor</li> </ul> | PAL-SENS-B               |





| Item   | Description  | Ordering Number         |
|--|--|-------------------------|
| <b>Box Sensor Kit - Palletizing Solution</b> | <b>Box Sensor Kit for the Robotiq Palletizing Solution</b> <ul style="list-style-type: none"><li>• <b>1 x Box Sensor</b></li><li>• <b>1 x Cable</b></li><li>• <b>1 x Mounting Brackets</b></li></ul> | <b>PAL-BOX-SENS-KIT</b> |





## 9. Troubleshooting

### 9.1 Palletizing Solution (except the PowerPick Gripper)

| Symptom / Issue  | Cause  | Solution  |
|--|--|---|
| The robot was brought to a protective stop after a few layers          | A collision occurred between the gripped box and a box on the pallet. A minor palletizing error carried over from previous layers. | <ul style="list-style-type: none"> <li>• Increase the box height value to compensate for box size discrepancies.</li> <li>• A good practice to determine box height is to measure the height of a full pallet (boxes only), and divide it by the number of layers on the pallet.</li> </ul> |
| The robot started dropping boxes from a great height                   | A minor palletizing error carried over from previous layers.   | Decrease the box height value.  |
|  | The TCP entered is incorrect.  | Confirm that the TCP is located above the box, at the picking position.   |
|  | The pallet height value entered is too low.  | Increase the pallet height value.   |
| The robot entered in collision with a box already placed on the pallet | A collision occurred between the gripped box and a box on the pallet. A minor palletizing error carried over from previous layers. | <ul style="list-style-type: none"> <li>• Increase the box height value to compensate for box size discrepancies.</li> <li>• A good practice to determine box height is to measure the height of a full pallet (boxes only), and divide it by the number of layers on the pallet.</li> </ul> |
|  | One or several faces of the box are rounded.   | Increase the box width and/or box length value.   |
|  | The pallet state in the pallet viewer does not correspond to the actual pallet state.  | Inspect the pallet viewer at program start and confirm that the virtual layout corresponds with the actual layout.  |
|  | The pallet height value entered is too high.   | Decrease the pallet height value.   |





|   |   |  |
|---|---|--|
| The robot triggered a protective stop when placing a box on the first layer                                 | The box height value entered is too high.   | Verify the box height value.   |
|   | The pallet height value entered is too high.  | Verify the pallet height value.  |
|   | The TCP entered is incorrect.   | Confirm that the TCP has been set correctly.   |
| Boxes are not consistently placed straight on the pallet  | The picking position is not stable.   | Make sure your conveyor stop consistently places boxes in the same position. Box position should be consistent in order to ensure a reliable picking.  |
|   | The picking position is incorrect.  | Make sure that the picking position places the vacuum gripper so that it is squared and centered with the box.   |
| Error Message "Collision detected" during trajectory.   | The layout in the pallet viewer does not correspond with the actual layout. The robot detected a collision with an object that is not actually present. | <ul style="list-style-type: none"> <li>Restart the program and select the right box step.</li> <li>Verify the TCP position and orientation values.</li> </ul>  |
| Error Message "Discontinuous path / joint solution impossible detected, please change your starting point." | A singularity was reached on a planned trajectory.  | <ul style="list-style-type: none"> <li>Go to PolyScope's Move tab, and verify if the joints are at the center of their range (0°) when the robot is at the picking position. The algorithm will adjust wrist 3 automatically at program start.</li> <li>If the box position is too close to robot base, discontinuous path issues can occur. Verify that the picking zone is respected.</li> <li>If this situation only occurs with pallets on one side of the Solution, try centering the layer pattern on the pallet.</li> <li>Verify TCP position and orientation values.</li> <li>The robot may have reached a singularity or be closed to reaching a singularity. Move the robot to the Home position and restart the program.</li> <li>Should none of the above steps solve the issue, please contact the <a href="#">Robotiq support department</a>.</li> </ul> |





|   |  |  |
|---|--|--|
| Collisions occur with the pallet sensor on one side, but not on the other   | The pedestal is not centered on the base.  | Execute the centering procedure found in the <b>Installation</b> section.  |
| An actual collision occurred  | The TCP entered is incorrect.  | Confirm that the TCP has been configured correctly   |
|   | The TCP entered is incorrect since it does not account for the bracket used.   | Configure the TCP correctly.   |
|   | The gripper is bigger than the box.  | The size of the surface covered by the gripper or suction device should always be equal or smaller than the size of the face of the box that is being gripped. Please refer to the <b>Other Grippers</b> section for more details.   |
|   | The actual pedestal height does not correspond with the pedestal height value entered in the Installation tab.   | Adjust the pedestal height so that it corresponds to the configuration displayed in the Installation tab.  |
| The robot waits indefinitely over the picking position  | The box presence sensor is misused or not connected.   | <ul style="list-style-type: none"> <li>• Verify that the correct box presence input has been selected.</li> <li>• Verify that the sensor used is active-high if a sensor other than the sensor provided is being used.</li> </ul>  |
| The robot was brought to a protective stop while palletizing  | A joint limit has been exceeded.   | <ul style="list-style-type: none"> <li>• Verify that the joint speed and position limit have been configured correctly. Please refer to the <b>Robot Configurations</b> section for more information.</li> <li>• Decrease the value of the acceleration parameter in the Palletizer node.</li> </ul> |
| The robot does not restart after a pallet has been changed  | The "Confirm pallet(s) ready" feature is enabled.  | Press the "Confirm pallet(s) ready" button after the pallet has been changed.  |
| Error message:<br>"RTDE interface cannot initialize. Make sure that Ethernet/IP adapter and Profinet are disabled, and that no tother URCaps use the RTDE interface." | <p>We employ registers that cannot be used with Ethernet/IP or Profinet at the same time when the following function checkbox is ticked:</p> <p>Installation &gt; URCaps &gt; Copilot &gt; Configuration &gt; General: "Use Copilot to manage a soft speed transition when resuming from a Safeguard stop"</p> | <ul style="list-style-type: none"> <li>• Update to the latest version of the Copilot software.</li> <li>• Untick the "Use Copilot to manage a soft speed transition when resuming from a Safeguard stop" checkbox.</li> </ul>  |





## 9.2. PowerPick Vacuum Gripper

If you are not able to attain the desired vacuum level or if a diminution of the vacuum level occurs, verify:

- The feed pressure level
- The suction cups status
- That the air path is clean and not obstructed (including the manifold)
- If a filter cleaning is necessary





## 10. Warranty

Robotiq warrants the Robotiq Palletizing Solution and all its components 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.

### Warning

Warranty applies under the following conditions:

- Usage respects the operating and storage conditions specified in the Environmental and Operating Conditions section.
- Proper installation of all the components as specified in the Installation section and the following subsections.
- Until one of these condition is reached:
  - 1 year;
  - For PowerPick only : 2 000 000 cycles performed (boxes or objects manipulated). Once one of the components reaches the count, the warranty is not applicable anymore.
- Usage respects maintenance specified in the Maintenance section.
- Usage respects recommended payload, force, acceleration and speed specified in the Mechanical specifications section.

During the warranty period, Robotiq will repair or replace any defective component of the Palletizing Solution, as well as verify and adjust the component free of charge if the equipment should need to be repaired or if the original adjustment is erroneous. If the component is sent back for verification during the warranty period and found to meet all published specifications and work as intended, Robotiq will charge standard verification fees.

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

- The component feedback necessary for the robot program is not accessible.
- If applicable, the component cannot be controlled from the robot teach pendant
- Wear of the components due to direct contact with the workpiece or obstacles is 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.
- 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 Palletizing Solution, nor shall Robotiq be responsible for any failure in the performance of other items to which the Palletizing Solution is connected or the operation of any system of which the Palletizing Solution may be a part.

**Exclusions**

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

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





# 11 Harmonized Standards

## 11.1 Applied Standards

This section describes all applied harmonized standards for the design and production of the Robotiq Palletizing Solution and the PowerPick Vacuum Gripper. For more information on the standards used for each individual product, please refer to their respective declaration of conformity.

### Caution

Compliance of the product is only met if all instructions of the current user manual are followed, which include, but are not limited to, appropriate installation, compliance with safety measures, and normal usage. A risk assessment specific to the user's final application must also be carried out.

The following standards have been applied:

|                             |  |
|-----------------------------|--|
| ISO 12100:2010              | Safety of machinery — General principles for design — Risk assessment and risk reduction       |
| ISO 9409-1:2004             | Manipulating industrial robots – Mechanical interfaces – Part 1: Plates                        |
| ISO 4414:2010               | Pneumatic fluid power – General rules and safety requirements for systems and their components |
| EN 61000-6-2:2016           | Generic standards – Immunity standard for industrial environments                              |
| EN 61000-6-4:2007 + A1:2011 | Generic standards – Emission standard for industrial environments                              |

Moreover, the Robotiq Controller is cCSAus certified according to the CAN/CSA C22.2 n 14-05 and UL 508A standards.





## 112. EC Declaration of Incorporation

### 112.1 Robotiq Palletizing Solution

#### Info

For all information about the EC Declaration of Incorporation for the Robotiq Palletizing Solution, please refer to the [Robotiq support website](#). The declarations are available for download (Robotiq Palletizing Solution > Universal Robots > Documents > Standards, Declarations and Certificates).

### 112.2. PowerPick Vacuum Gripper

#### Info

For all information about the EC Declaration of Incorporation for the PowerPick Vacuum Gripper, please refer to the instruction manual of the device, available on the [Robotiq support website](#). The declarations are available for download (Vacuum Grippers> Universal Robots > Documents > PowerPick Standards, Declarations and Certificates).





## 12. Appendix

### 12.1 Anchoring Pattern

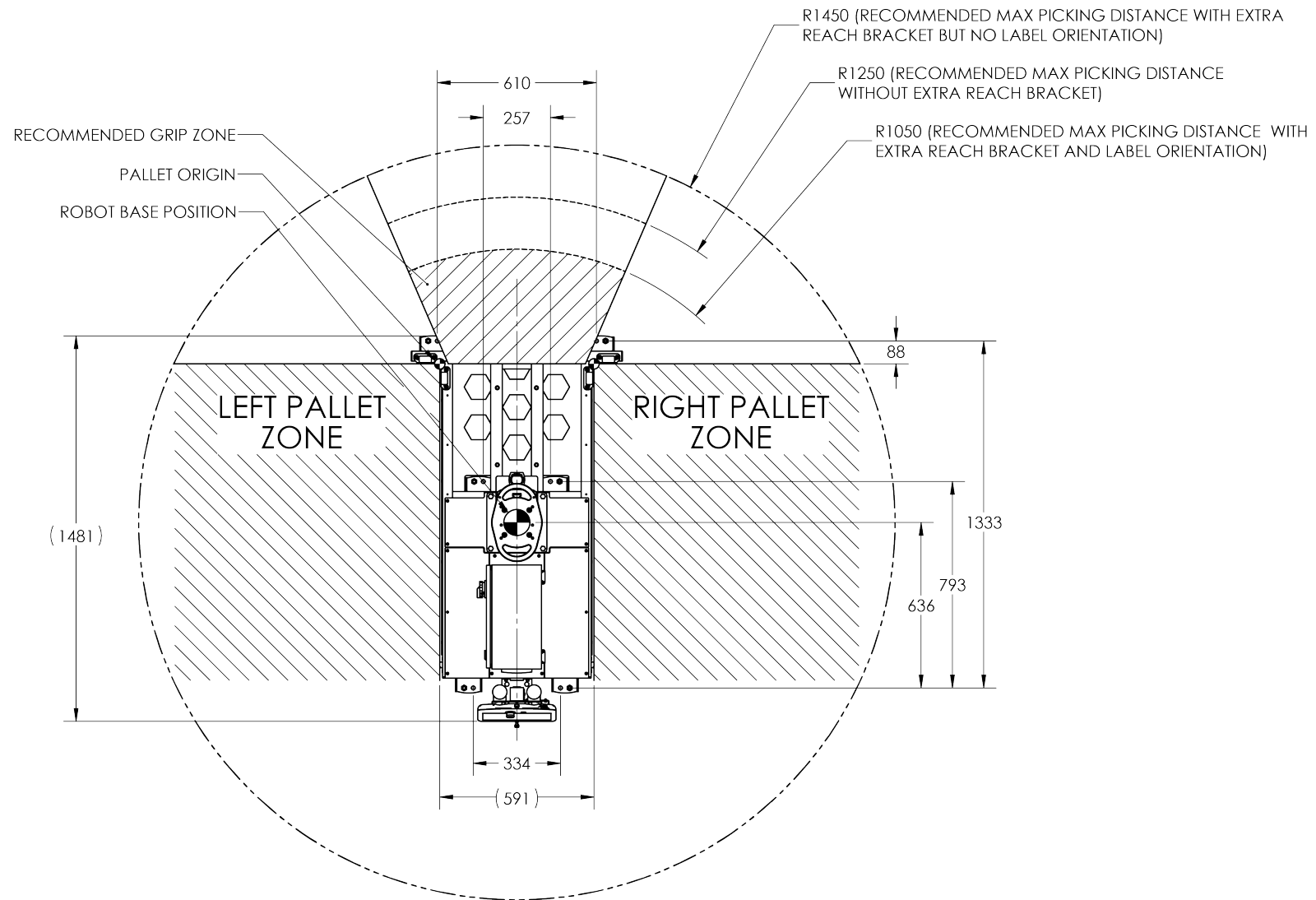


Fig. 12-1: Palletizing Work Zones Schema for UR10





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## 13. Contact

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[www.robotiq.com](http://www.robotiq.com)

### Contact Us

#### Phone

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