



ROBOTIQ PALLETIZING *SOLUTION* AX Series

Original Notice

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Robotiq Palletizing Solution - AX Series
for Universal Robots



Instruction Manual

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Revisions

Robotiq may modify this product without notice, when necessary, due to product improvements, modifications or changes in specifications. If such modification is made, the manual will also be revised, see revision information. See the latest version of this manual online at: 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).
- Link for action associated to red slow blink light modified (Operation section).
- Link for action associated to yellow solid light modified (Operation section).
- Images of Configurable Outputs modified (Installation section).

2022/10/03

- Linear Axis Move images modified (Software section).
- 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).
- Cable management spare parts removed (Spare Parts, Kits and Accessories section).

2022/04/25

- Added warning note for Moving and Positioning the Solution (Installation section).
- Added "Add virtual planes around pallet(s)" option (Installation and Software sections).
- 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

- Added Robot Limits section

2022/02/03

- Added Physical Clearance and Reachable Area of the Robot section
- Updated Safety Connections section



2022/01/04

- Added script functions
- Updated Installation on Universal Robots e-Series section
- The palletizer model is now named AX Series

2021/10/07

- Updated Center of mass, tool center point (TCP) table

2021/09/22

- Updated Safety Connections Appendix
 - Pink wire is now orange
- Updated Safety section to add information regarding Reduced mode
- Updated Software section with more details for the pick position

2021/08/03

- Update of the Software section
 - Added Depalletizing mode to Palletizer node
 - Updated info on the Limit height for Palletizer program node
 - Added section 5.2 (Palletizing script functions)

2021/07/14

- Update of the Specifications section (Center of mass, tool center point table)
- Update of the Appendix section (Safety Connections)
- Update of the Software section
- Update of the Troubleshoot section
- Update of the Warranty section
- Update of the Installation section with new cable management instructions
- Update of Spare Parts, Kits and Accessories section

2021/03/29

- Update of the Software section: label orientation option added.
- Update of the Specifications section
- Update of the Installation section (Robot configurations)

2020/12/16

- Update of the safety section
- Update of the installation section
- Update of the specifications section



2020/11/30

Update of the Installation section.

2020/11/25

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 *AX Series* used in this manual all refer to the AX Series Robotiq Palletizing Solution. The AX 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 linear axis, pallet sensors, 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

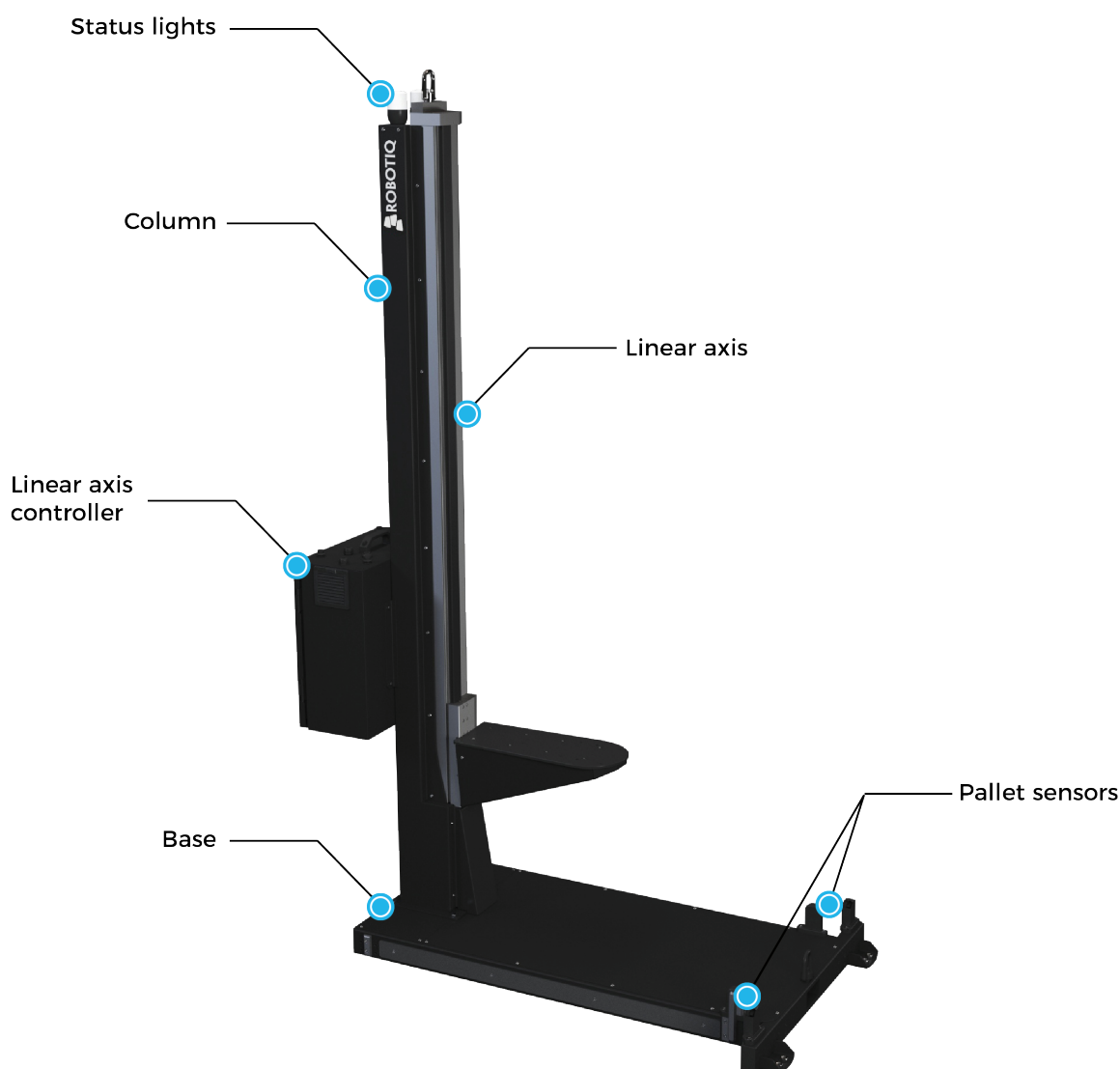


Fig. 1-1: AX Series Robotiq Palletizing Solution



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 and Column

The Robotiq Palletizing Solution is composed of a base and a column on which all the components that are necessary to the good operation of the Solution are attached. 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. Linear Axis

To extend the reach of the robot, a linear axis is installed inside the column. It allows the robot to move vertically in order to build high pallets.

113. Linear Axis Controller

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

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 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

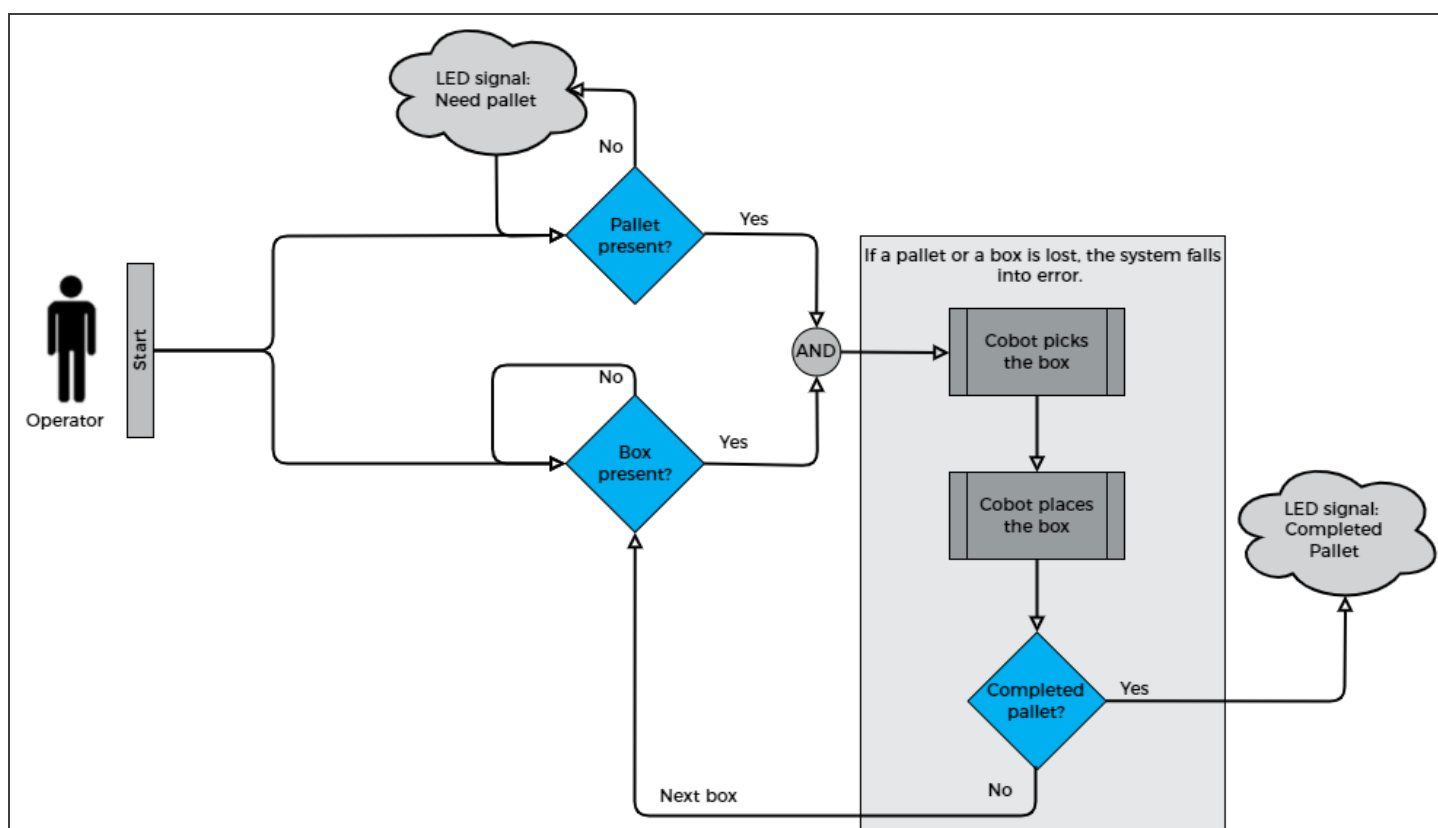
The Solution includes a box sensor that needs to be installed at the end of the conveyor in a way that it is triggered when a box is ready to be picked up.



Fig. 1-3: Box Sensor

12. Palletizing Operation Diagrams

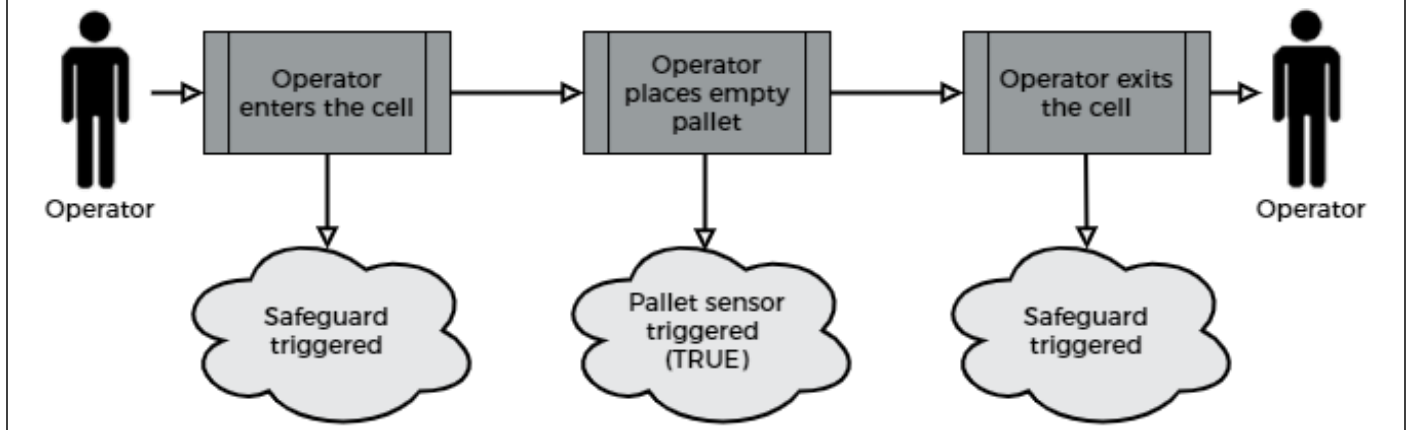
The following diagrams explain the logical operation of the Palletizing Solution based on the operator's actions, as well as responses such as signals, pallet and box sensor behaviors, etc.



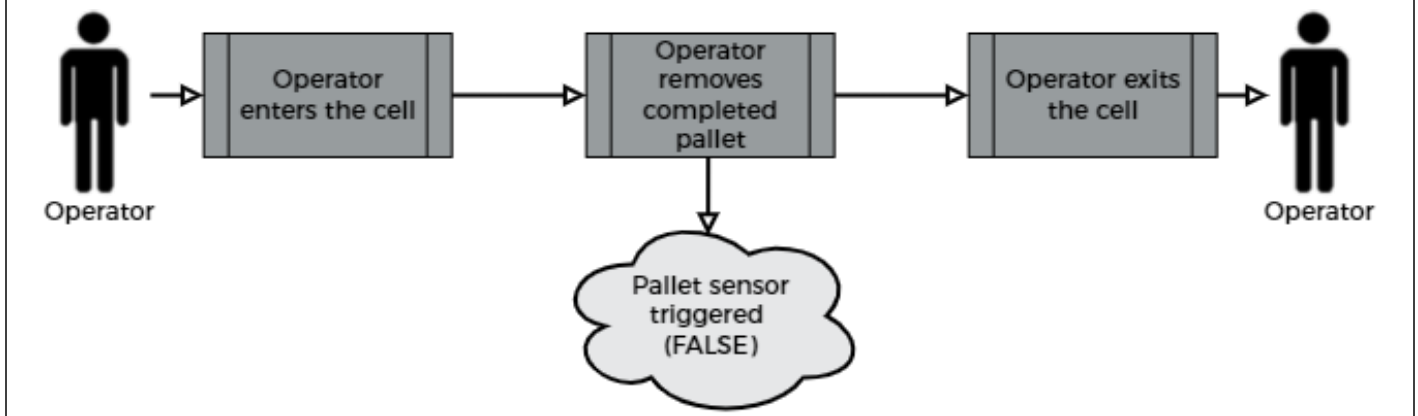
Please refer to the Status Lights section for further information about light states.



Operator places empty pallet



Operator removes completed pallet



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, the linear axis, and any other equipment used in the final application) must go through a comprehensive risk assessment process before they can be used.

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

The linear axis is NOT power and force limited. Pinching or crushing risk must be considered seriously.

Warning

When the robot is not moving, the collaborative collision detection is disabled. If the linear axis moves, it can hurt people with the robot.

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 (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>Caution</p> <p>For the Palletizing Solution, it is not recommended to connect the Gripper to the tool connector.</p> </div>
Robot controller supply* (Any 24V pin)	<p>Vacuum Gripper powered ON.</p> <ul style="list-style-type: none"> The vacuum level will continue and the object will not be lost.

*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:

- Normal mode:** The palletizer continuously fills pallets when no human operator is within the vicinity of the palletizing cell.
- Safeguarded 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 and the linear axis will undergo a Category 1 stop transitioning to a Category 0* stop. When the safeguards are removed, the system will resume operation in normal mode.

Info

See IEC 60204-1 for definitions of stop categories.



Emergency stop mode when the emergency stop button is pressed. All components of the system will undergo stop category 1 transitioning to stop category 0.

Operation mode	Robot			Linear Axis		
	Force (N)	Power (W)	Speed (mm/s)	Force (N)	Power (W)	Speed (mm/s)
Normal mode (Up to safety limits)	up to 250	up to 1000	up to 5000	2400*	690 (nominal)	500
Protective stop	0 (Stop Cat 2)					
Safeguard stop	0 (Stop Cat 2)			N/A (Stop Cat 1 and transition to Cat 0)		
Emergency stop	N/A (Stop Cat 1 and transition to Cat 0)					
Reduced mode	Please refer to the Universal Robots user manual for more details.			The linear axis exhibits the same behavior in Reduced and Normal modes. It is not recommended to use Reduced mode since the linear axis is not safety rated for collaborative applications.		

*Calculated using the following assumptions: static force at peak current with a 90% efficient ball screw and no friction.



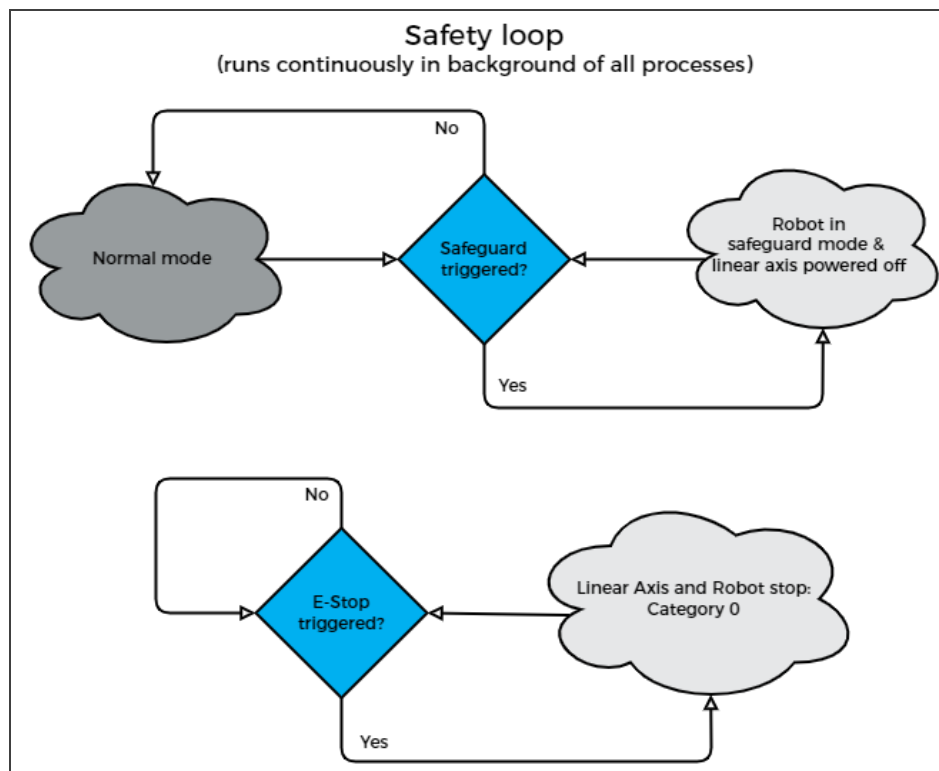


Fig. 2-1: Safety Logical Schema

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 carriage assembly, the linear axis, the cable management system, and the gripper components. Please contact [Robotiq Support](#) if any sign of damage is detected.

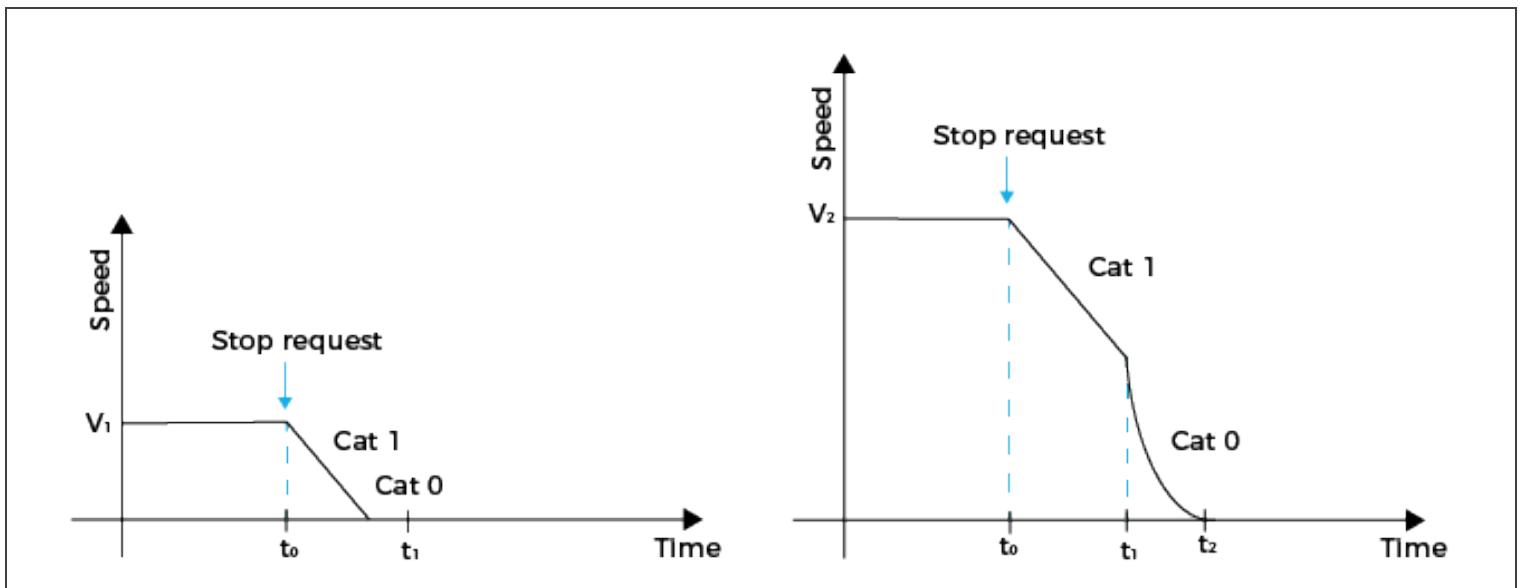
2.3.2. Linear Axis Stop Category 0 and 1

When a stop is required, the robot and the linear axis start the process at the same time, even if they are independent, so the stopping time can differ.

- For robot information, please refer to the Universal Robots documentation.
- For the linear axis:
 - Maximal stopping time for Category 1: 500 ms;
 - Maximal stopping time for Category 0: 100 ms*;
 - Travelled distance when there is a stopping time: 33 mm (1-5/16 in)*

*For cases where the robot is immobile, with a payload of 8 kg and the initial speed of the linear axis is 500 mm/s, which is the maximum allowed speed.





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 AX Series Palletizing Solution base including:
 - 1 x Linear axis (1500 mm stroke)
 - 1 x Motor
 - 1 x Linear axis Controller
 - 4 x Pallet sensors
 - 2 x Status lights
 - 1 x Cable management system
- 6 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 8 mm air tube (already mounted on the column)
- 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:

- Lifting equipment (min. capacity of 200 kg) such as a gantry crane, overhead crane, jib crane, chain block or forklift with a proper lifting hook
- 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 20 - 50 Nm (14.8 - 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: 20-80% RH, non-condensing PowerPick Gripper : 35-85% RH, non-condensing
Food/ Clean room/ Intrinsic Safety (IS)	No
Dust and water	<ul style="list-style-type: none"> • Dust: Affect the time between maintenance • Water : No
Other	<ul style="list-style-type: none"> • Free from corrosive liquids or gases • Free from explosive liquids or gases

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 317 kg (697 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:

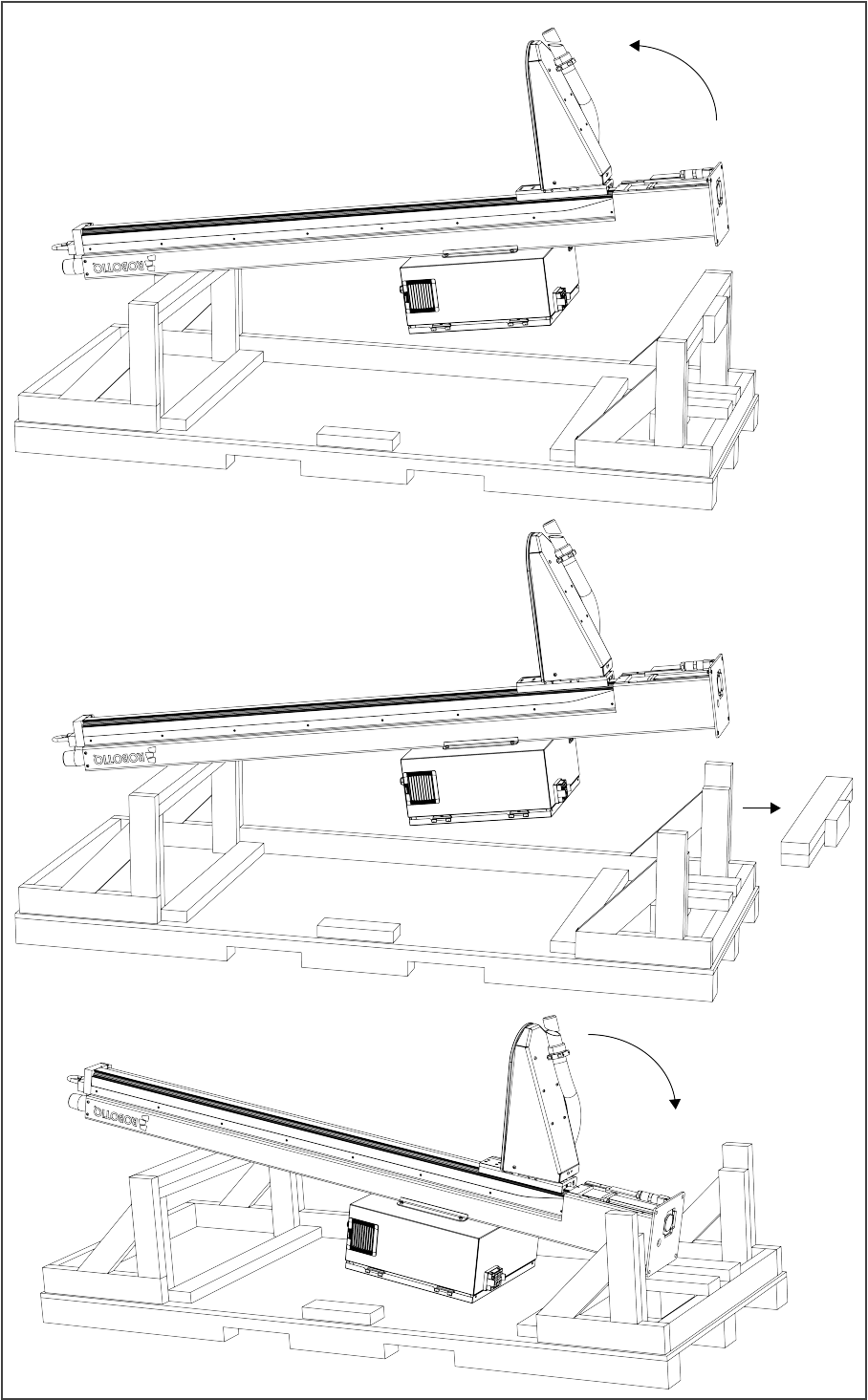
The transport, lifting, and moving of the Robotiq Palletizing Solution should be performed by qualified and authorized personnel. Failure to do so may result to material damage, bodily injury or death.

Warning

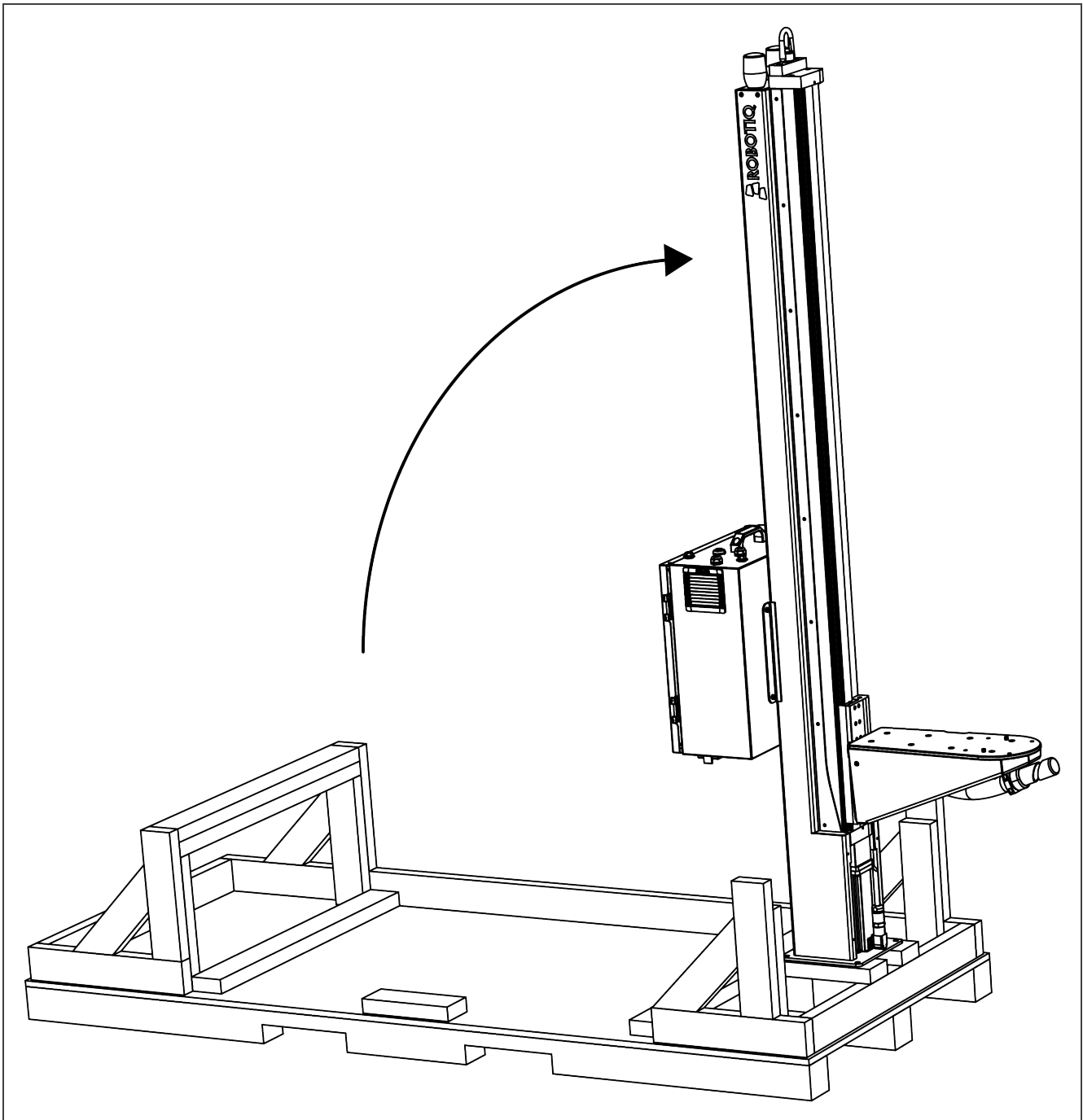
Crush Hazard: Keep your hands and body parts clear when lowering the column onto the base. Failure to do so could result in serious injuries or death.

1. Remove the top panel and the four (4) sides of the crate by unscrewing the screws that hold them into place.
2. Cut all the strapping material that retains the components, and take all cardboard boxes out of the crate.
3. Unscrew the four (4) bolts that retain the base into the crate.
4. Take the base out of the crate.
5. Unscrew the two (2) bolts that retain the column into the crate.
6. Lift the foot base, unscrew the piece of wood under the foot base. Remove the piece of wood and descend the Solution slowly and carefully (see the picture below).





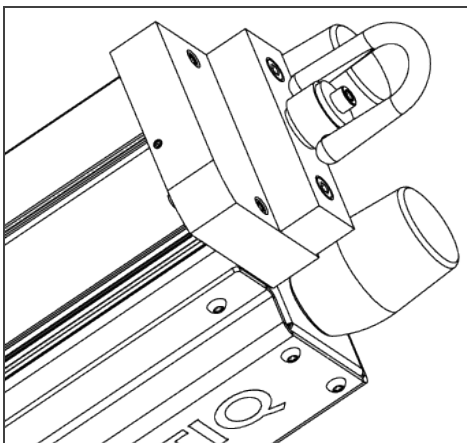
7. Position the column vertically. Use the lift point to rotate the column.

**Caution**

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

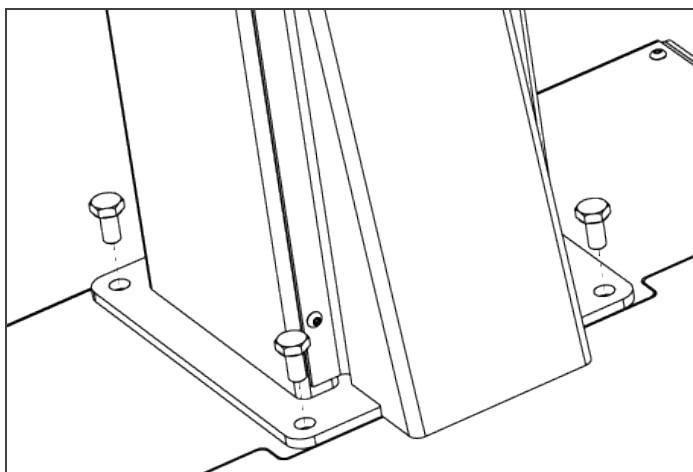


8. Lift and place the column onto the base.

**Info**

A hook is present at the top of the column. Use it to lift the column.

9. Secure the column 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

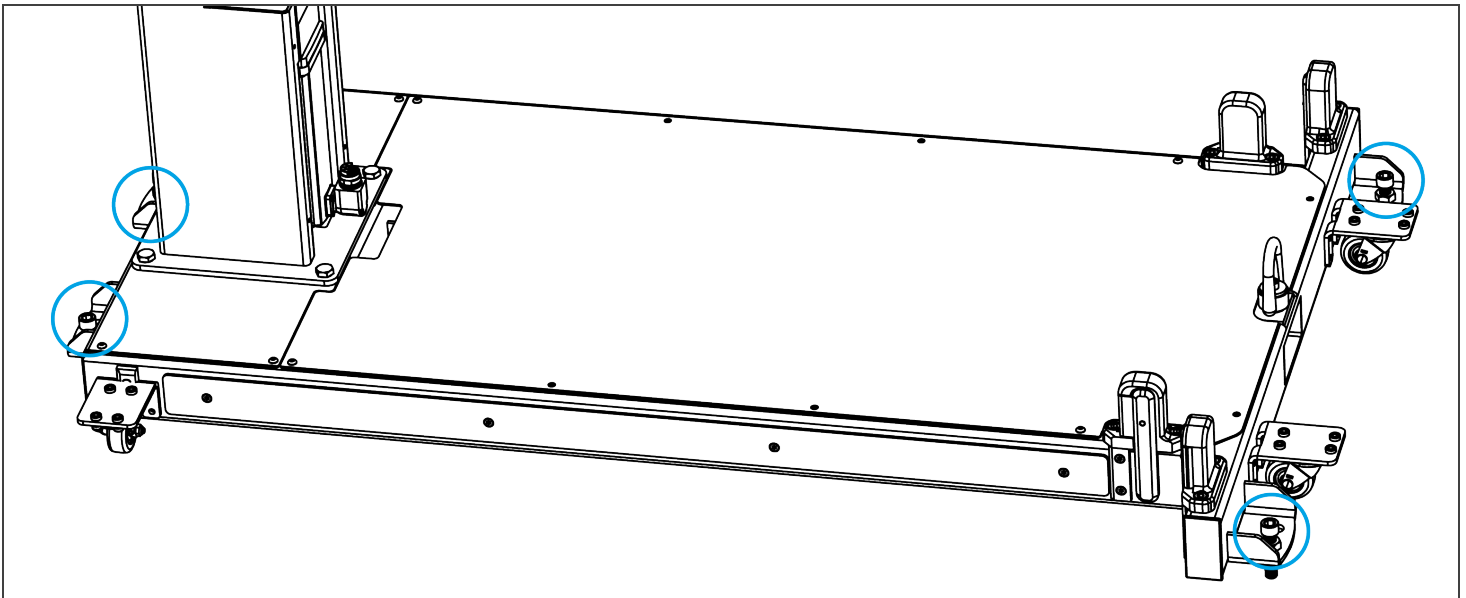
- Failure to properly secure and install the equipment can result in material damage and bodily injury. In addition, note that the warranty will not cover material damage resulting from an installation that did not comply with the instructions found in this manual.
- The transport, lifting, and moving 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.

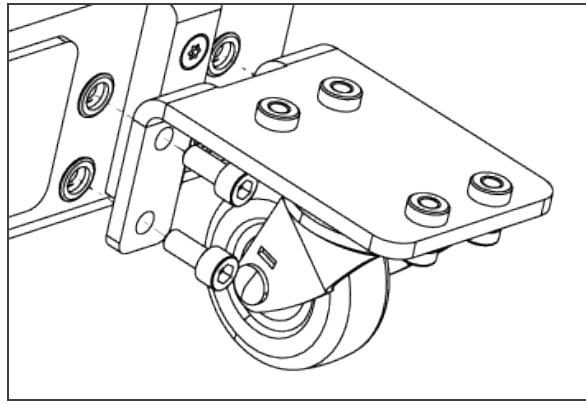
Although you can assemble the solution at the place of your choice, you will need to move it to its final location afterwards. You can use one of the two following methods to securely move the Solution:

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

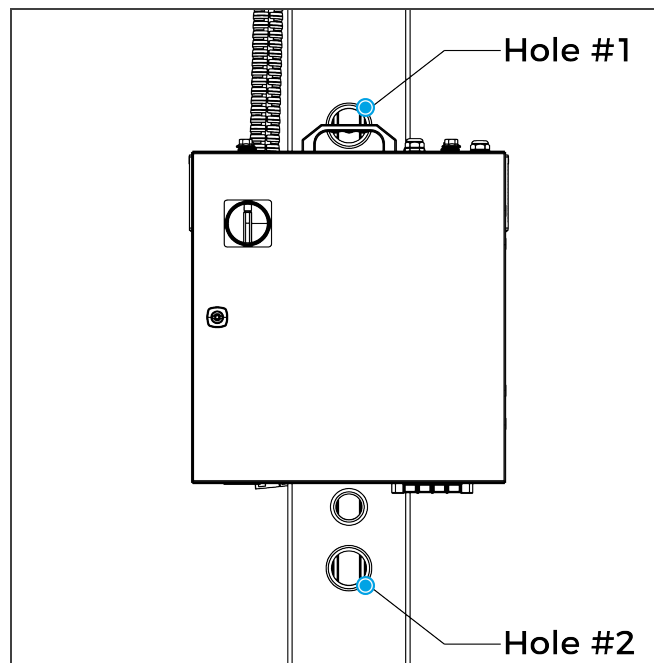
A minimum of two people is recommended to execute these steps.

Robot Installation

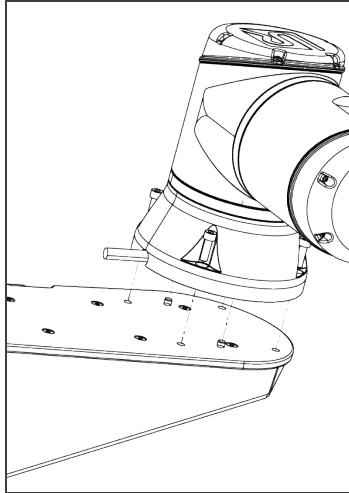
Info

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

For robot installation, few cables need to be wired. The figure below resumes the identification of the column holes.



1. Place the robot on the robot base plate so its power cable is oriented towards the linear axis. Align properly with the two dowel pins (already installed on the robot base), and secure the robot using four (4) M8 screws and Belleville washers.
The required torque value is 20 Nm.

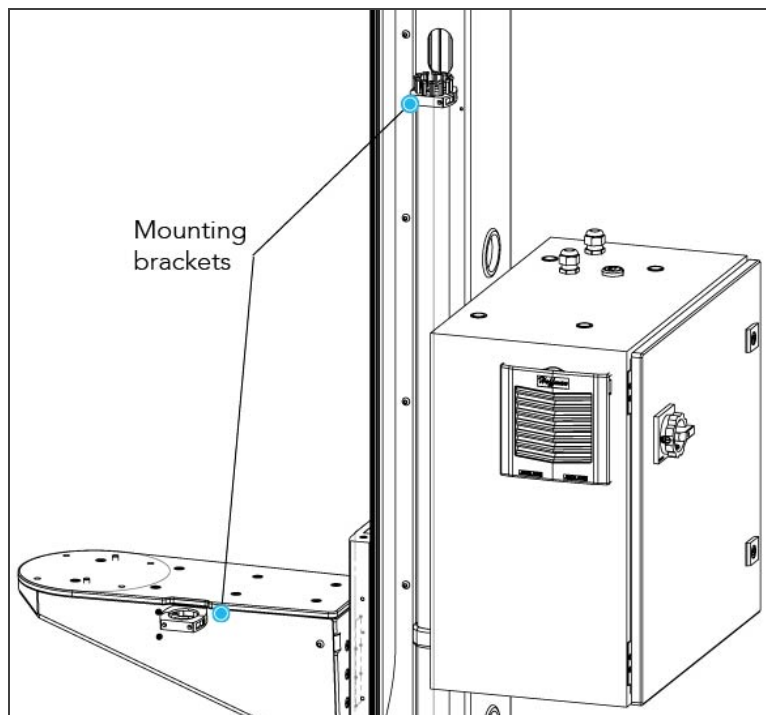


Caution

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

2. Unclip the two (2) mounting brackets of the cable management system: one on the column and one on the carriage.

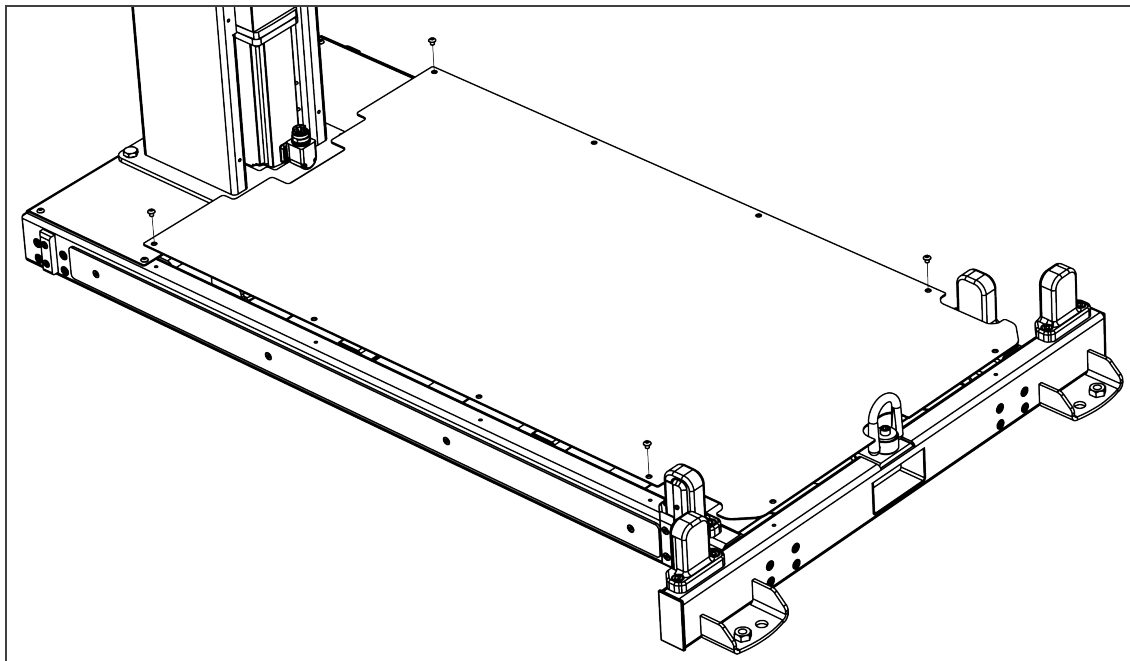


3. Press the robot power cable into the cable carrier up to the column. There are two separate raceways. The robot power cable and the air tube should not use the same section. Push the cable into the column (via the side hole) and bring it out by the hole #1.



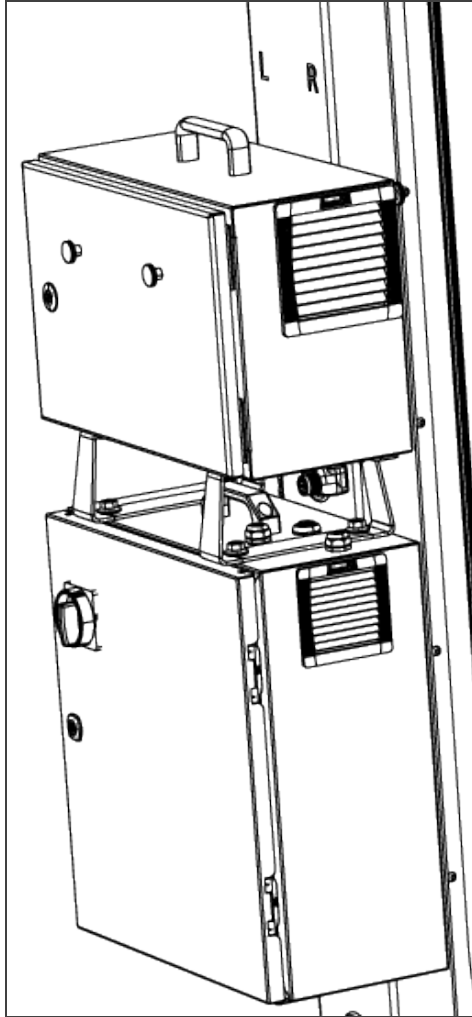
Base Cover Plate

1. Remove the cover plate that will allow the cable management.



Universal Robots Controller Installation

1. Remove the four screws on the top of the linear axis controller.
2. Place the UR controller on top of the linear axis controller and secure it with the four screws you previously removed.



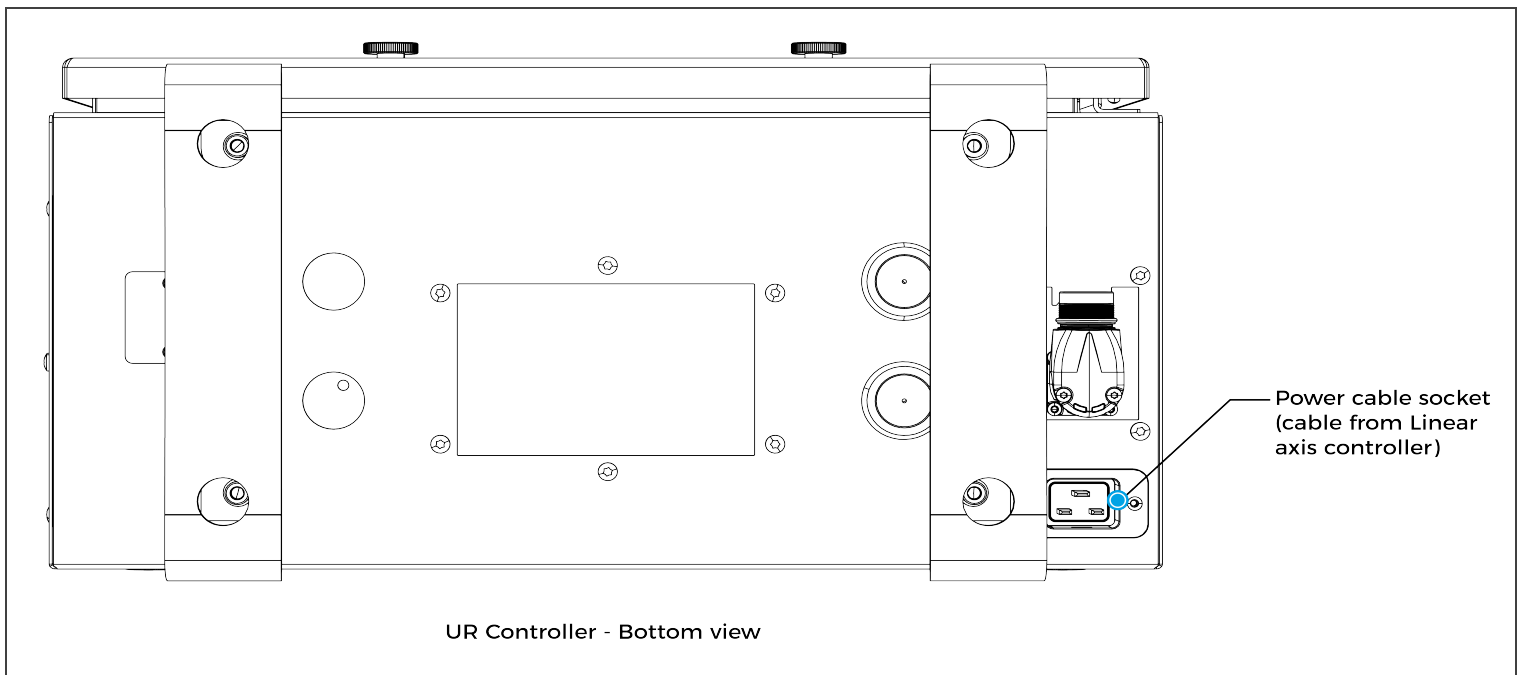
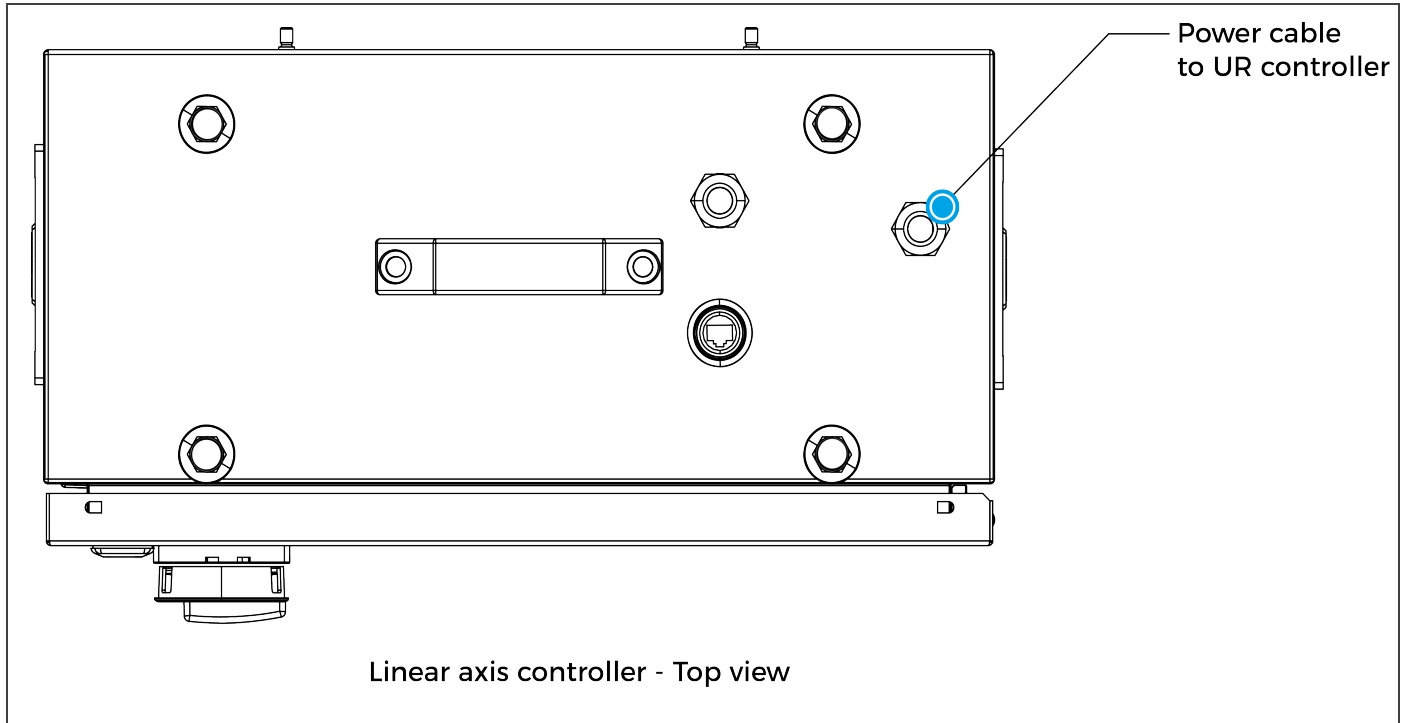
Caution

Do NOT plug the UR controller power cable into UR controller.



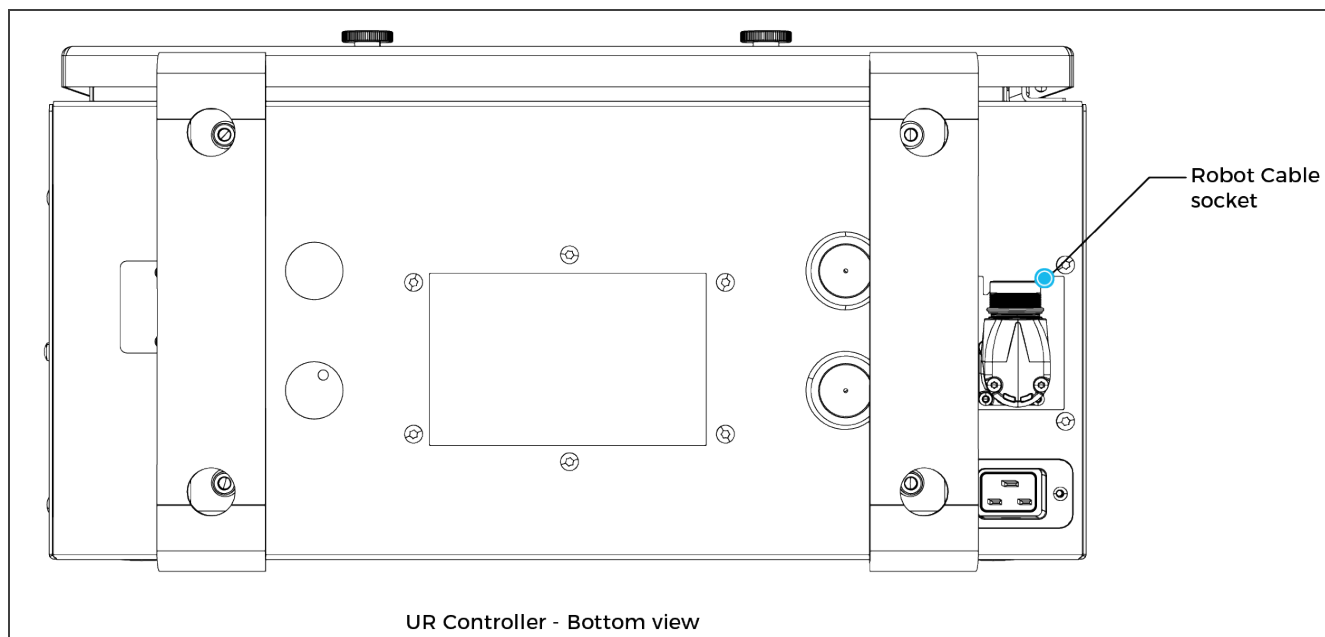
Power Cables Connections

1. Plug the power cable output of the linear axis controller into the UR controller.



2. Plug the robot power cable into the UR controller.
3. Connect the Teach Pendant to the UR controller.

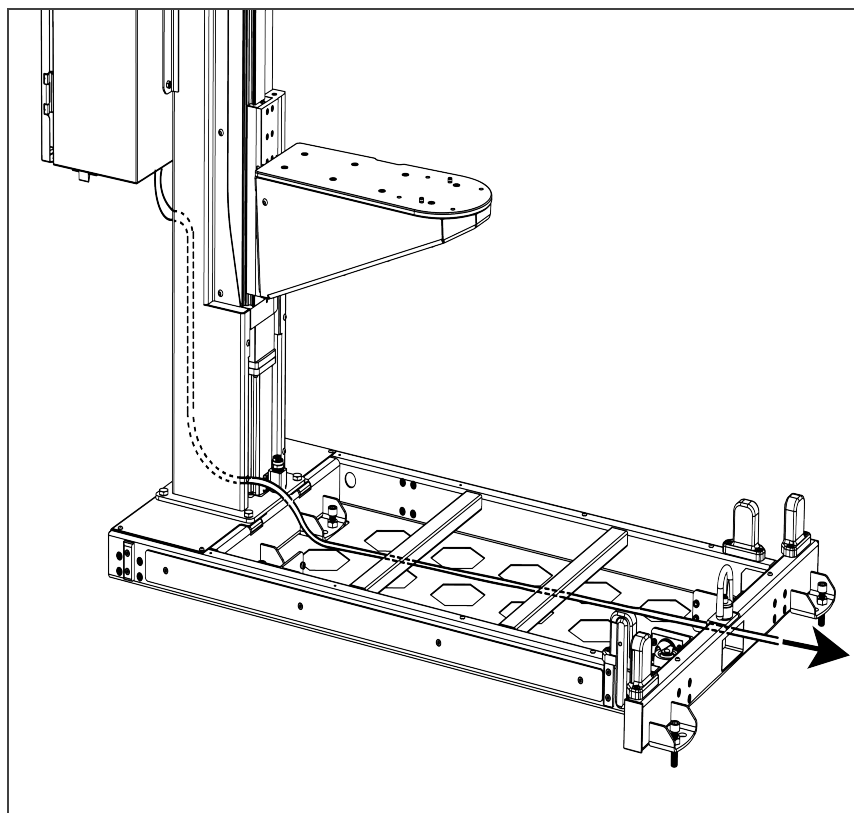




4. Plug the UR controller power cable into the linear axis controller. Pass the cable through the hole #2. Then, continue to channel the cable through the column and the base and bring it out from the other extremity of the base.

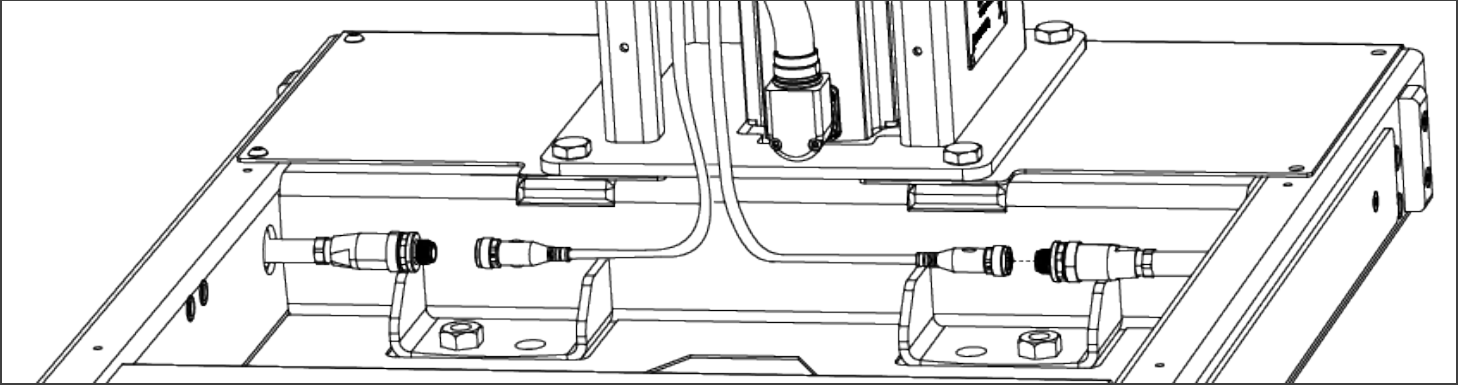
Info

The safety signals wires sticking out of the linear axis controller are inputs only. Therefore, you can power the control box safely even if they are not yet connected.



Pallet Sensors and Base Cables Routing

1. Connect the pallet sensors. The cables are identified for each side. Make sure to connect each pair of cables correctly.



2. Bring out the air tube and the box sensor cable from the bottom of the column and continue to channel it until you bring it out from the other extremity of the base (through the rectangle hole).
3. Plug the power cable into the wall outlet.

Centering the Solution

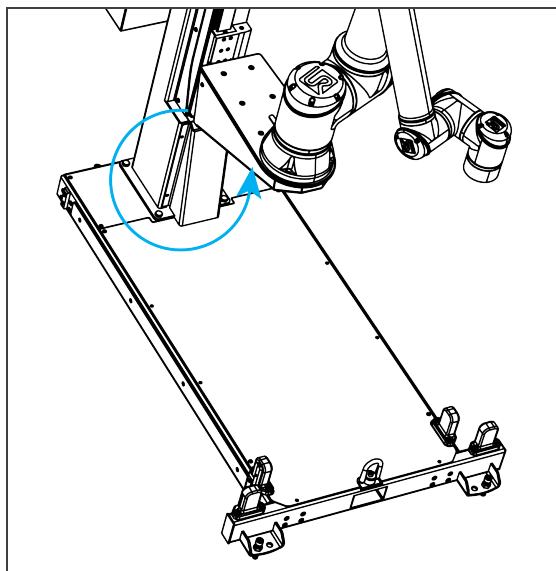
This procedure needs to be done before the vacuum gripper installation. It will ensure proper functioning of the solution. The goal is to properly align the column with the base by placing the robot wrist at a specific position at the same time as it touches the side of the base.

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

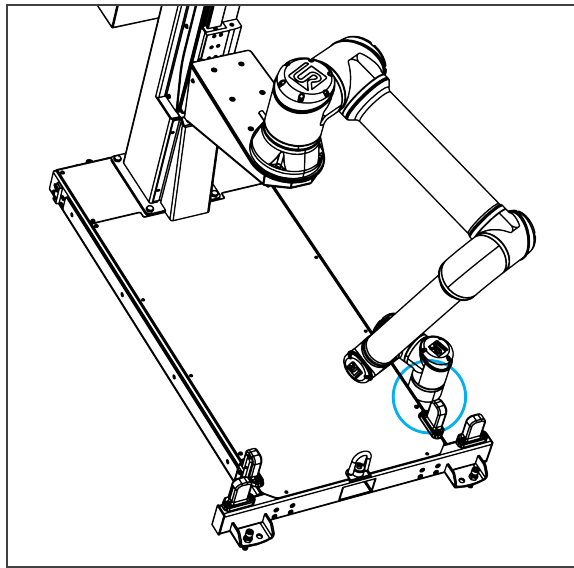
Warning

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.

2. Rotate the column counterclockwise as much as possible.



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

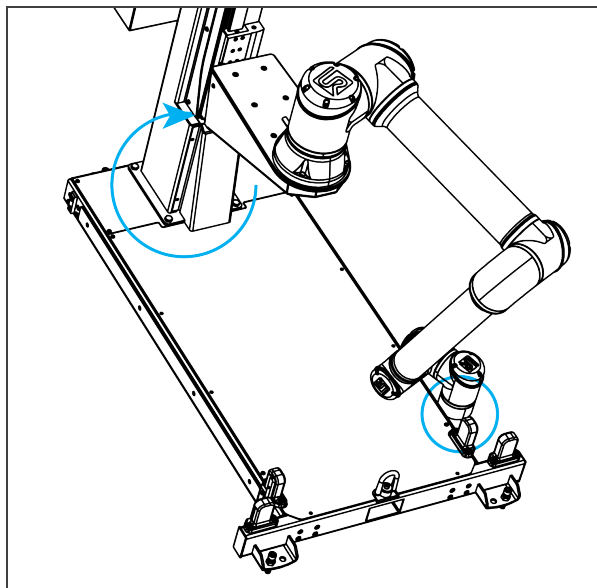


- Move the robot so the robot tool flange is parallel to the ground: change the feature reference to Base and modify the tool position like the following: $RX=0^\circ$, $RY=180^\circ$, $RZ=0^\circ$.
- Modify the Tool Position X value (base reference) to 333.35 mm (Make sure the TCP is set to 0 (the TCP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

Caution

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

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



- Tighten the four (4) screws to secure the column onto the base. **Torque must be 50 Nm.**
- On the teach pendant, validate that the X value is still 333.35 mm.
- 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

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).

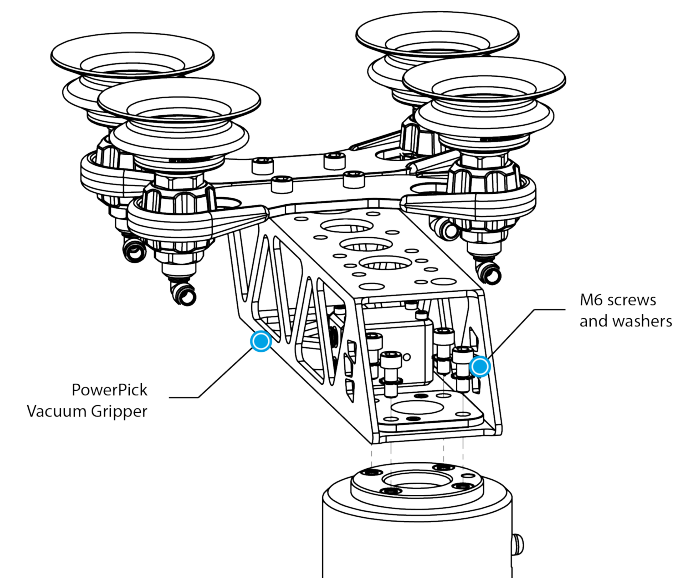


Fig. 3-1: PowerPick Vacuum Gripper Installation



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 linear axis column above the robot controller, with pneumatic fittings pointing downward. Leave enough space (recommendation of 250 mm (10 in)) between the PowerPick Controller and the robot controller 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:
 - a. 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.
 - b. Tighten the sleeve and close the first Hook and Loop fastener.
 - c. 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:
 - a. 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.
 - b. Tighten the sleeve and close the first Hook and Loop fastener.
 - c. 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.

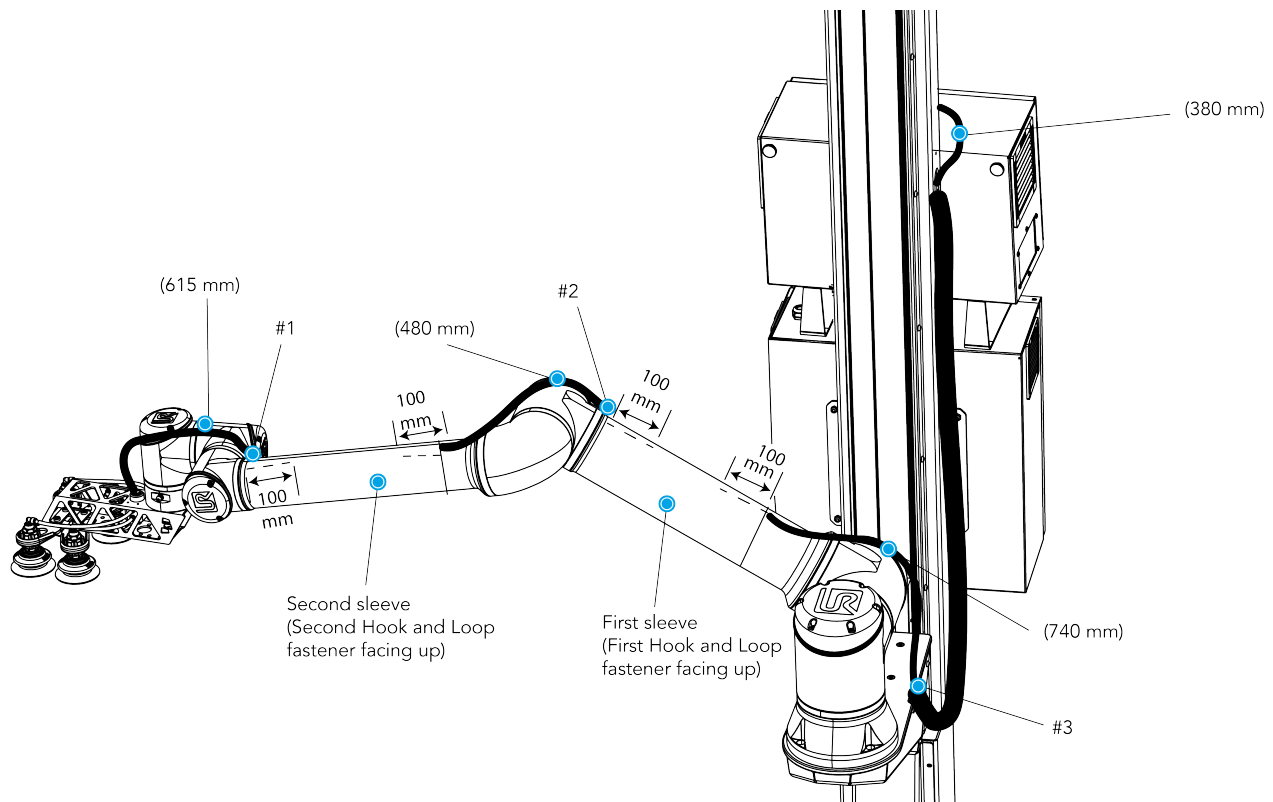


4. Install eight pieces of double sided tape:

- a. 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.
- b. 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.

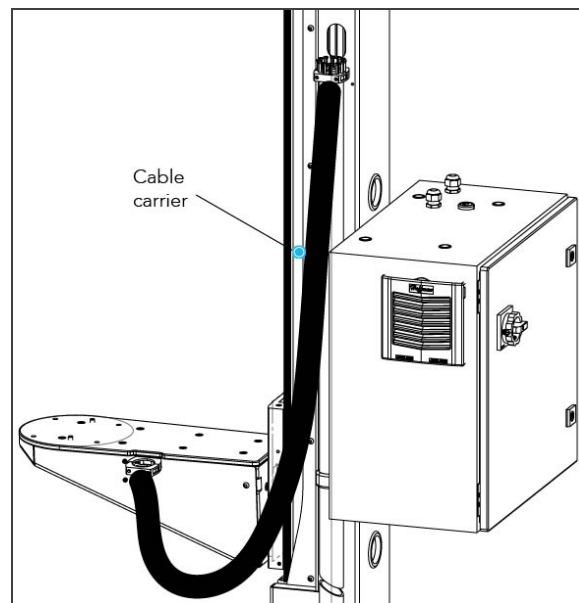
- a. Connect the 10 mm air tube to the gripper.
- b. In the first sleeve, remove the remaining protective layers from the double-sided tape and place the air tube so the white label #1 is at the edge of the sleeve (gripper side).
- c. Place the air tube along the sleeve and position it on the second double-sided tape portion (see figure below).
- d. Close the sleeve.
- e. 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).
- f. Place the air tube along the sleeve and position it on the second double-sided tape portion (see figure below).
- g. Close the sleeve.
- h. Pass the air tube into the cable carrier. The robot power cable and the air tube should not use the same section. Also, the white label #3 should be at the beginning of the cable carrier.
- i. Cut the pneumatic tube to the right length (approximately 380 mm between end of cable carrier and PowerPick Controller) and connect it to the PowerPick Controller (Port P-).



6. Remove the safety clip from the PowerPick Controller (P+ port) and connect the 8 mm air tube coming out of the column hole above the cable carrier. Replace the safety clip.



7. Install an Igus R-Lock at each extremity of the cable carrier.



Info

Refer to the Igus triflex® R Series TRE.40B cable routing system installation instructions for more details.

8. Use cable ties to attach the air tube to the strain relief part of the mounting brackets. Make sure not to crush the air tube with the cable ties.

Caution

Make sure not to pinch the cables with the cable ties.

9. Close both brackets.
10. 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.
11. 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.

12. Shut down the robot and power off the linear axis Controller.

Caution

You have to shut down the robot before making inter-controller and safety signal connections.



Inter-Controller Connections

1. Open the UR controller. Connect the USB hub to a USB port.
2. Connect the Ethernet/USB converter cable to a USB port.
3. Connect the Ethernet cable into the Ethernet socket on the top of the linear axis Controller.
4. Pass the other extremity of the cable through the hole under the UR controller and connect it into the Ethernet/USB converter cable that is already connected.

Tip

Follow cable management good practices. You can either drill a hole in the hole plug or use a grommet (not included).

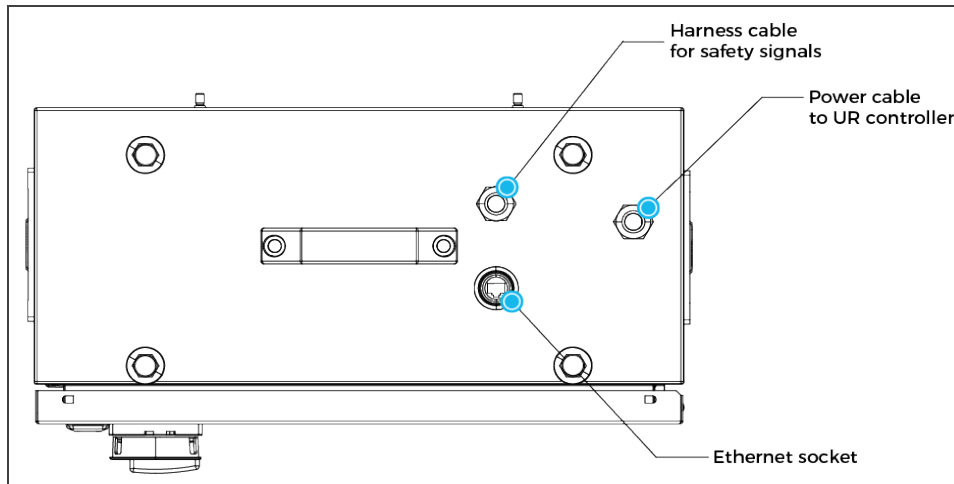


Fig. 3-2: Linear Axis Controller Cable Summary

Safety Signal Connections

1. Take the signal safety cable and pass it through an opening under the UR controller.
2. Wire the cable by following the schema and the table available in the **Appendix** section.

Caution

- Follow the installation guidelines in the UR manual for Emergency stop or Safeguard connections. Use the connector supplied by Robotiq for Safeguard connections.
- If the safeguard is not used, add jumpers between pin 1-2 and 3-4.
- Do not forget to connect the safety reset wire (white color) according to your safety setup. For more details, please refer to the table in the **Safety Connections** section.



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.

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

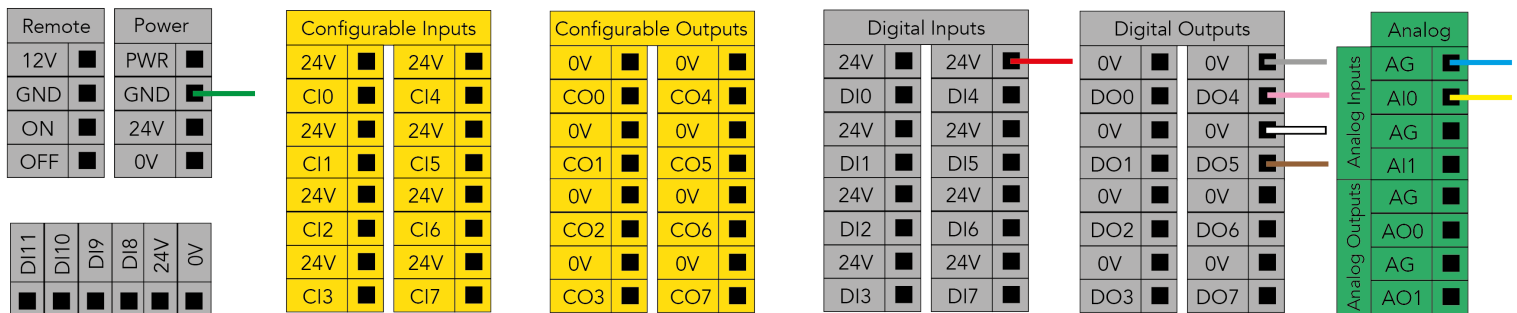


Fig. 3-3: Vacuum Gripper wiring to robot controller



Box Sensor(s)

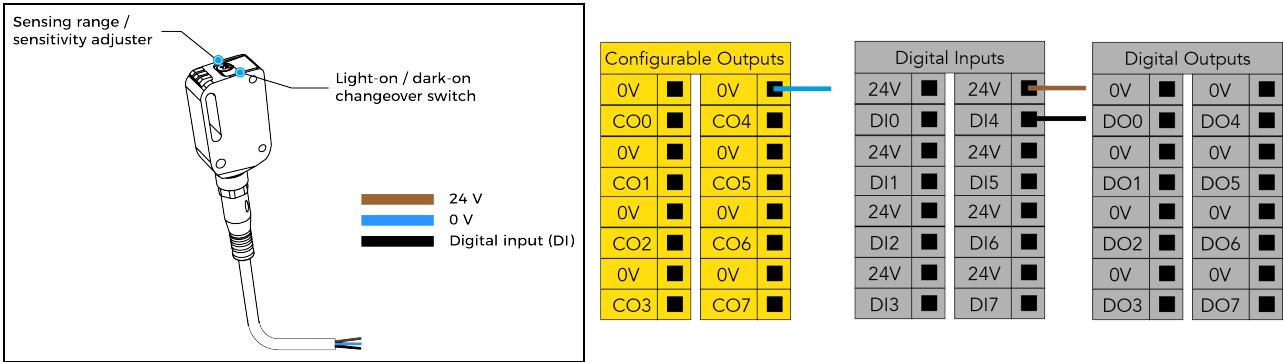
1. Run the box sensor(s) cable through a hole under the robot controller. Connect the wires in configurable I/O terminal blocks of the robot controller. Then secure each connection with a terminal block screwdriver (not provided).
- Brown wire in a 24V terminal block

• 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).



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. Install the box sensor on the bracket that best suits your setup with the provided screws.
2. Position the sensor box's bracket so it can detect the box to be picked.
3. Connect the M8 connector of the box sensor's cable to the sensor.
4. Reinstall the front base cover using the 10 provided screws.
5. Install the column cover using the provided screws (4).
6. Connect the power cable to the power outlet.
7. Power on the linear axis Controller and the robot.

Tip

The box sensor must be set properly. Once the system is running, adjust the detection distance with the sensitivity adjuster. To have the sensor 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.

Warning

The column cover must be properly installed to achieve maximum structure rigidity.

Caution

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

3.4.5. 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) = (box diagonal/2) + robot reach + extra bracket reach - 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.

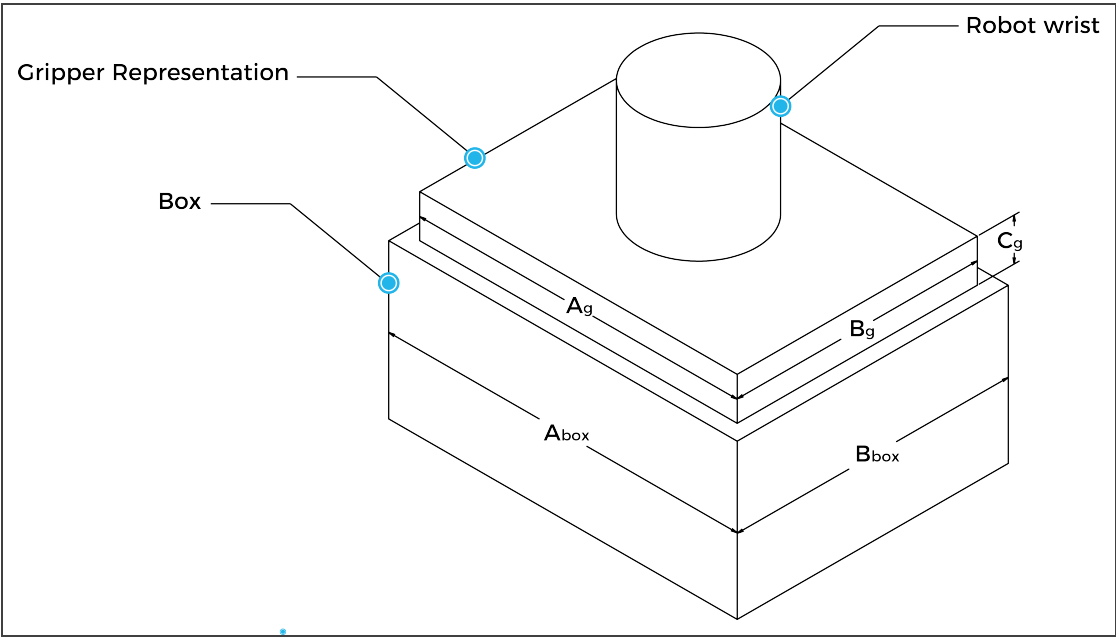
35. Other Grippers

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:

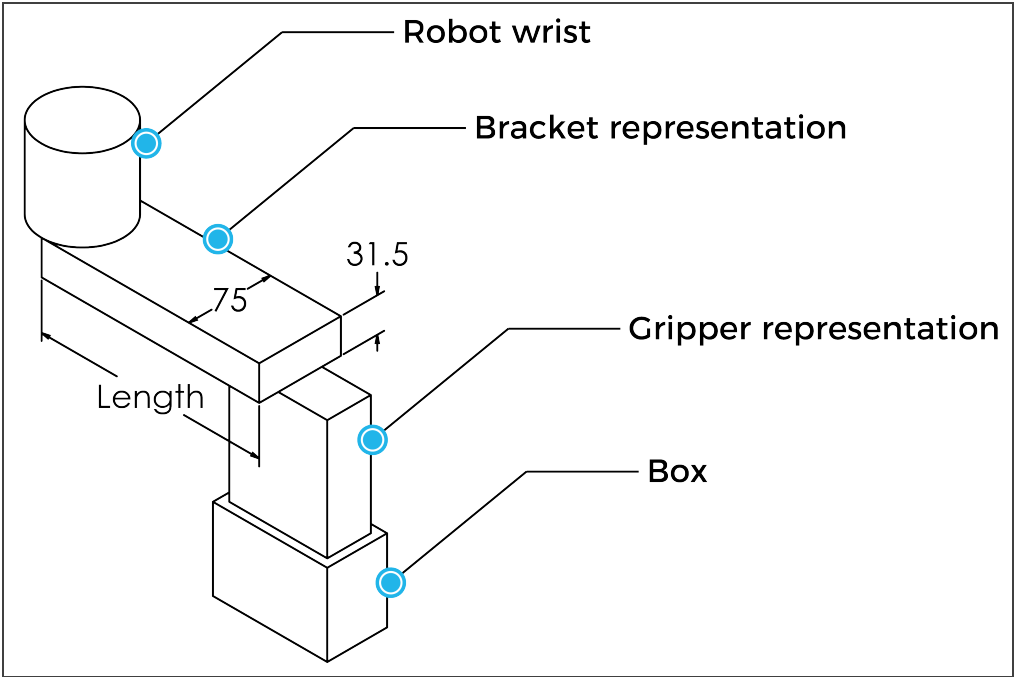
Box Footprint ($A_{box} \times B_{box}$)	Gripper Footprint ($A_g \times B_g$)	Gripper Height (C_g)
$A_{box} < 105 \text{ mm}$ OR $B_{box} < 55 \text{ mm}$	$A_g = A_{box} - 1 \text{ mm}$ $B_g = B_{box} - 1 \text{ mm}$	110 mm
$A_{box} > 450 \text{ mm}$ OR $B_{box} > 350 \text{ mm}$	$A_g = A_{box} - 40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

Info

Upgrading to Copilot version 1.21 and above, an update of the linear axis PLC firmware might be required. A message will show after scanning the linear axis to approve the update.

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 Palletizing solution is well installed. Refer to the **Mounting and Installation** section for detailed information.

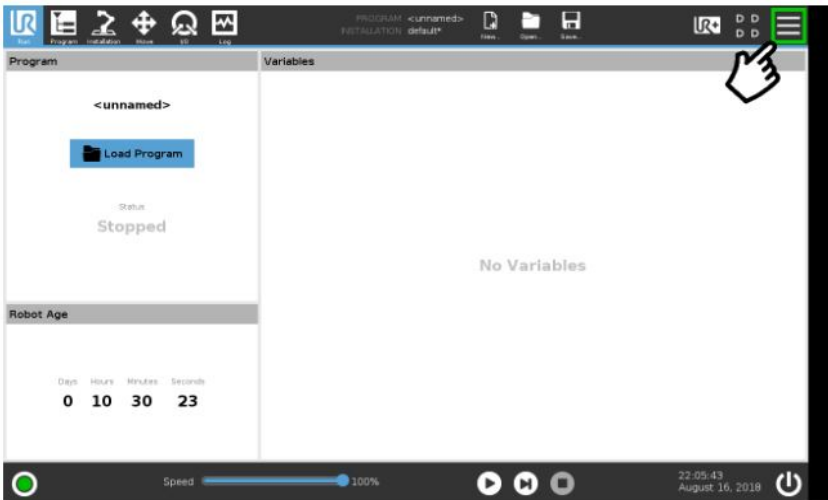
Before proceeding with the installation of the URCap package, make sure your Universal Robots controller is compatible with the package.

Tip

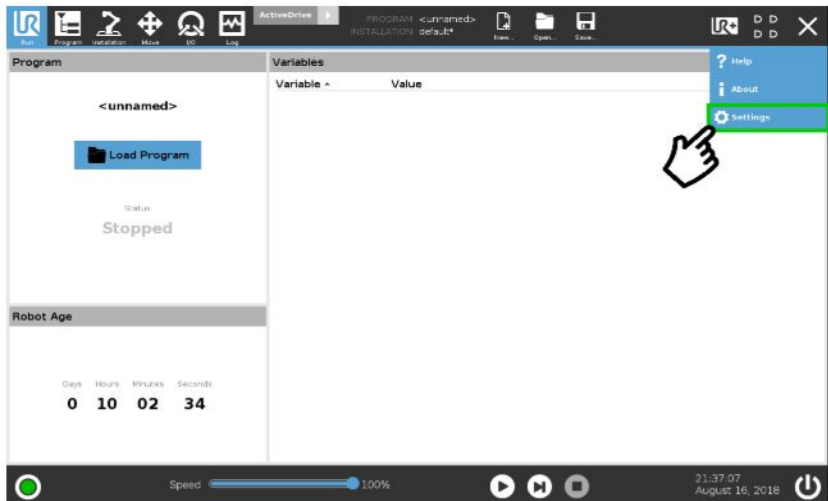
Tap the **triple bar icon** and select the **About** button to view the UR software version.



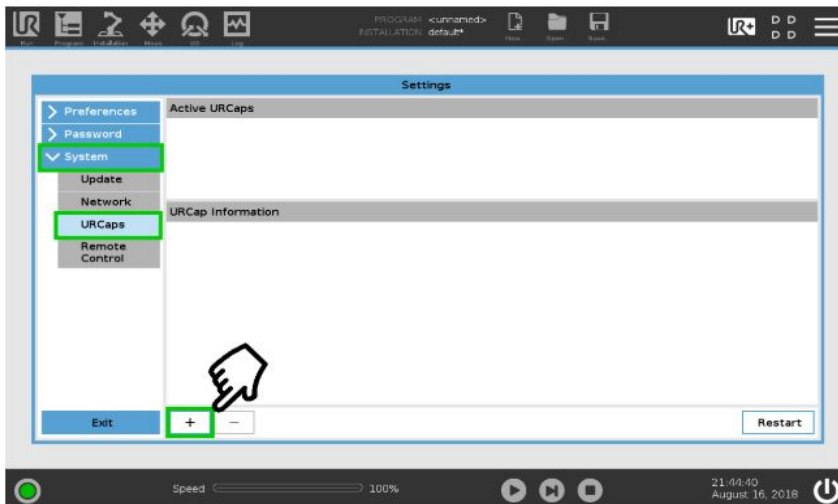
On e-Series Universal Robots

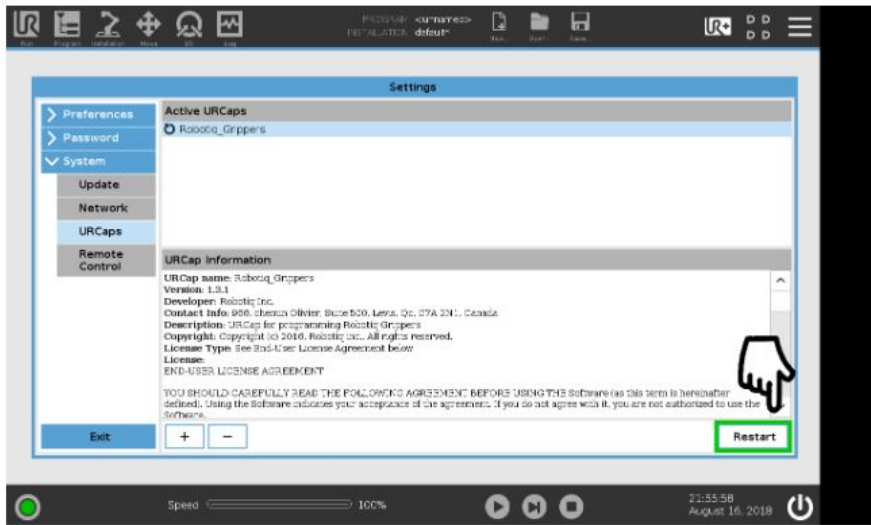


- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Palletizing solution URCap package.
- Go to support.robotiq.com, and select the Universal Robots brand.
- Select **Palletizing Solution**.
- Click on **Software** → **Palletizing Solution 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.

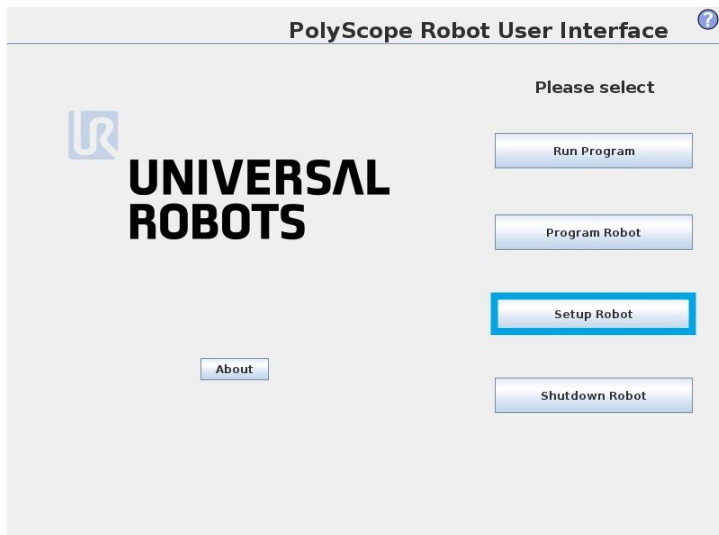




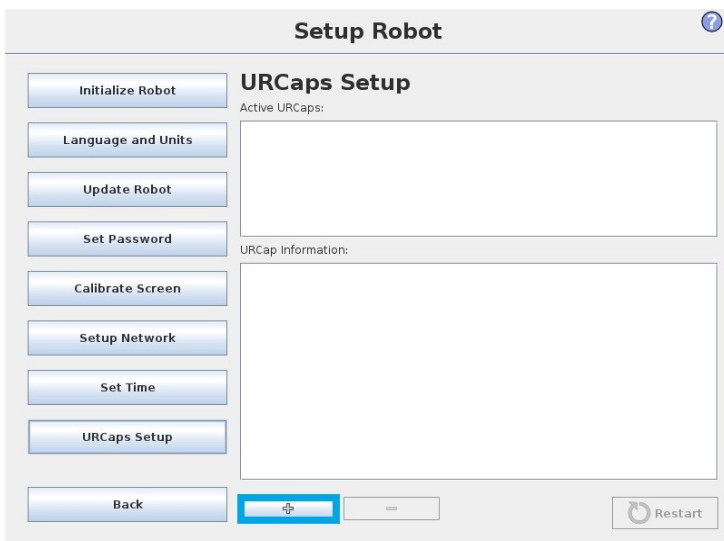
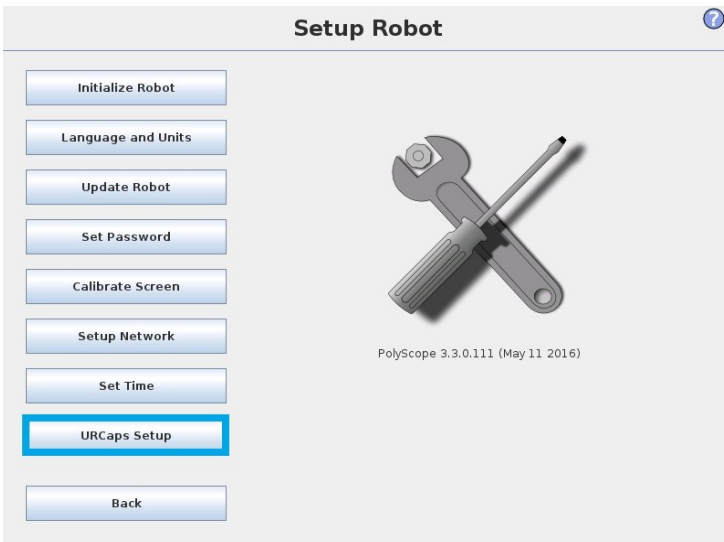
- Once the files are selected, tap the **Open** button.
- Tap the **Restart** button to complete the URCap installation. By doing so, you accept the **license agreement** detailed in the URCap information textbox.



On CB-Series Universal Robots

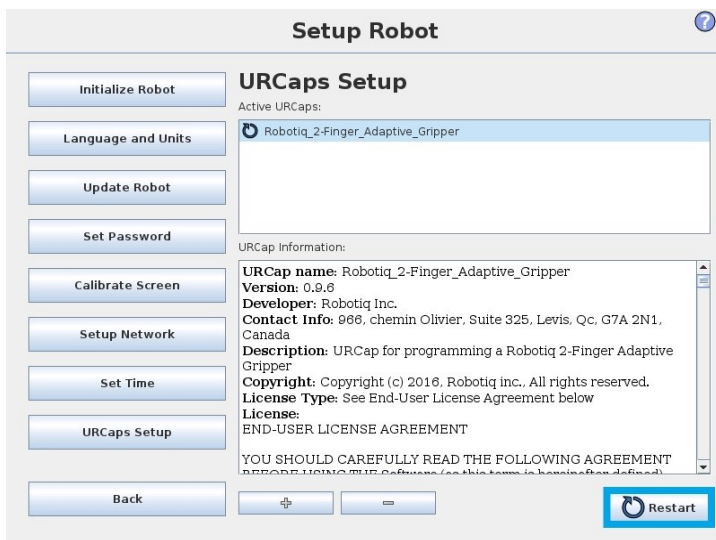


- Make sure that your PolyScope version is up-to-date and that your Universal Robots controller is compatible with the Palletizing URCap package.
- Go to www.support.robotiq.com, select **Browse by product**.
- Click on your **Robotiq product page** and then **Universal Robots**
- Click on **Software** → **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.

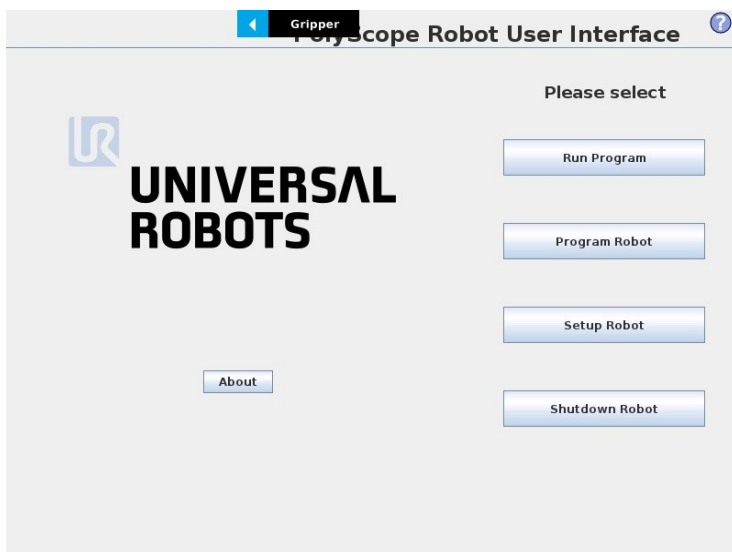


- Tap the plus (+) button to add the URCap.
- Select the Copilot URCap (UCS-X.X.X.) to install the URCap.





- 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).

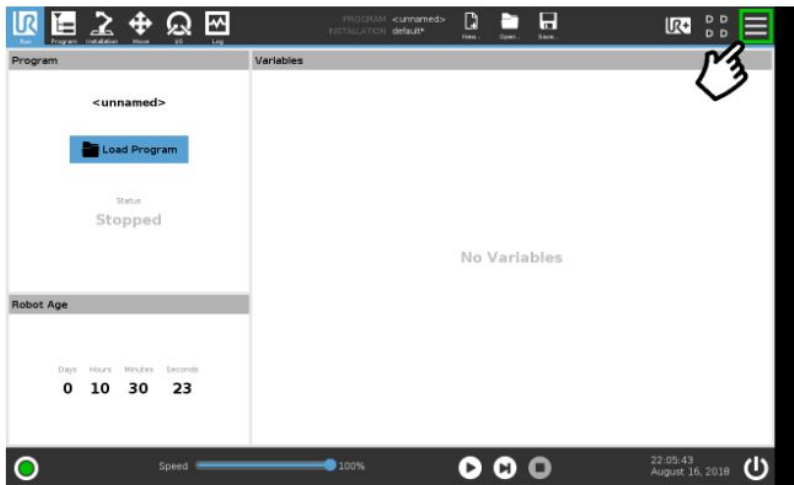


- When PolyScope reopens, the ActiveDrive toolbar will appear on the screen.

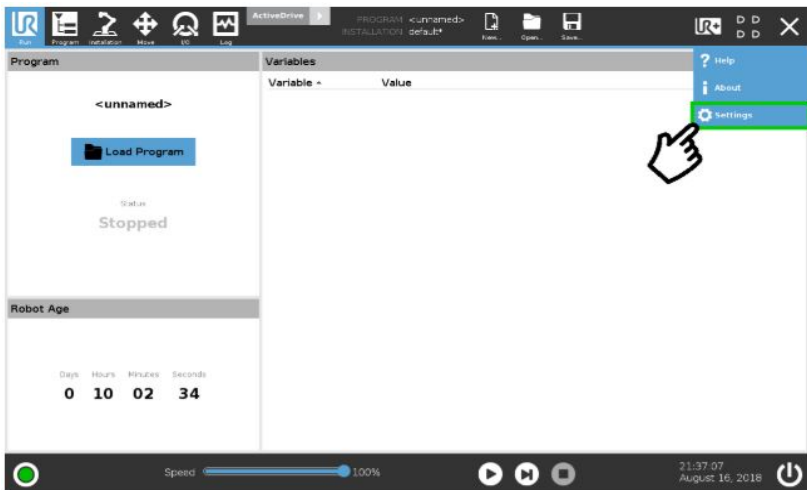


3.7.2. Uninstalling URCap Package

On e-Series Universal Robots



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



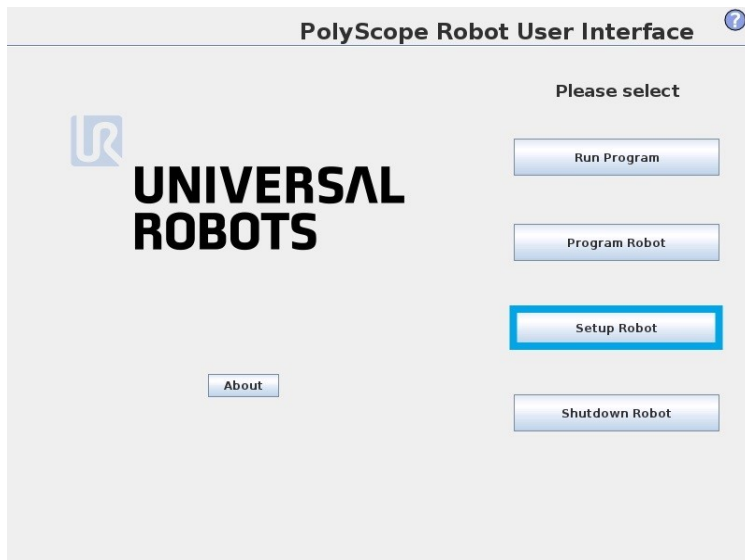
- Tap **Settings**.



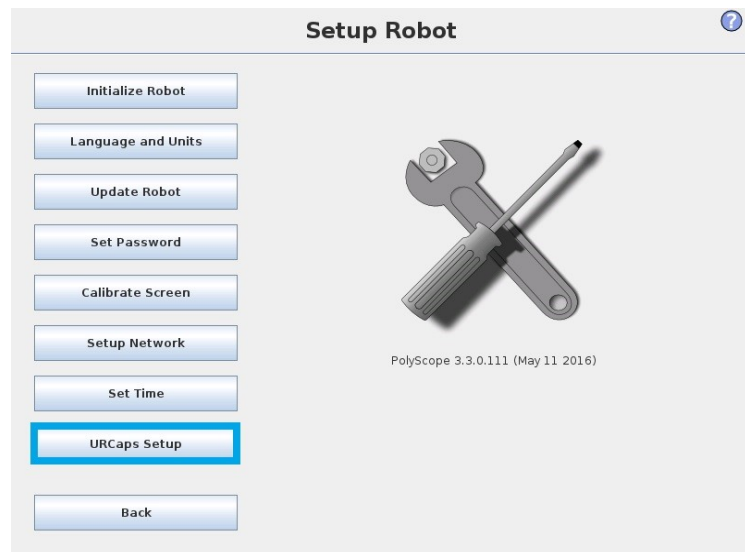
- Select **System** in the navigation pane on the left.
- Select **URCaps**.
- In the **Active URCaps box**, select the URCap to uninstall.
- Tap the **minus (-) button** to uninstall the URCap.
- Restart Polyscope to complete the uninstallation process.



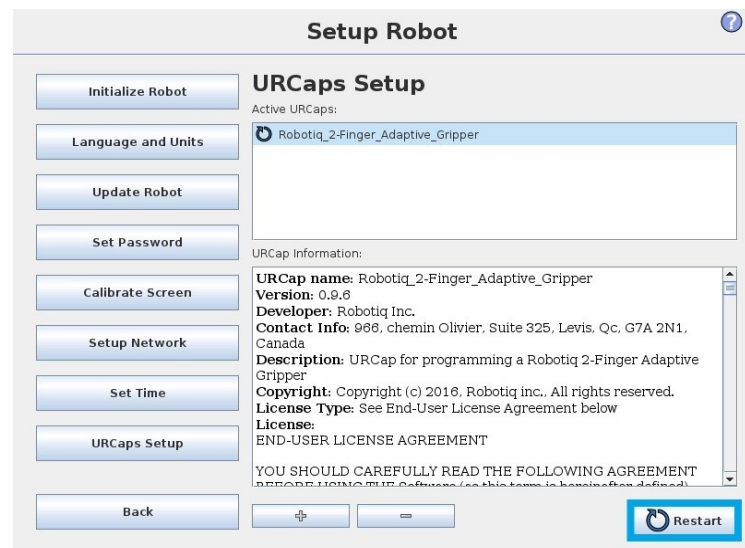
On CB-Series Universal Robots



- 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 Installation Move I/O Log

699A 753E

> General

> Safety

Robot Limits

Joint Limits

Planes

Tool Position

Tool Direction

I/O

Hardware

PROFIsafe

Safe Home

Three Position

> Features

> Fieldbus

> URCaps

Position range

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

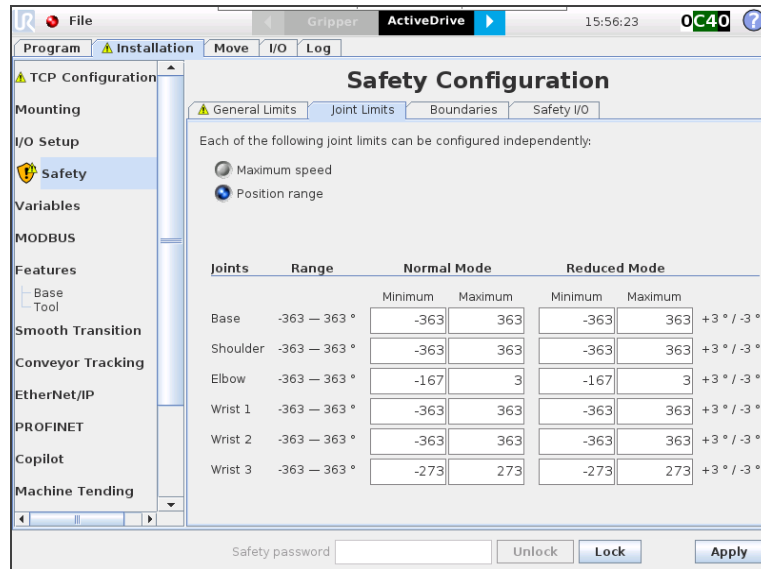
Joints	Maximum	Normal Mode	Reduced Mode
Base	max: 131 °/s	131	-11 °/s
Shoulder	max: 131 °/s	131	-11 °/s
Elbow	max: 191 °/s	191	-11 °/s
Wrist 1	max: 191 °/s	191	-11 °/s
Wrist 2	max: 191 °/s	191	-11 °/s
Wrist 3	max: 191 °/s	191	-11 °/s

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°.

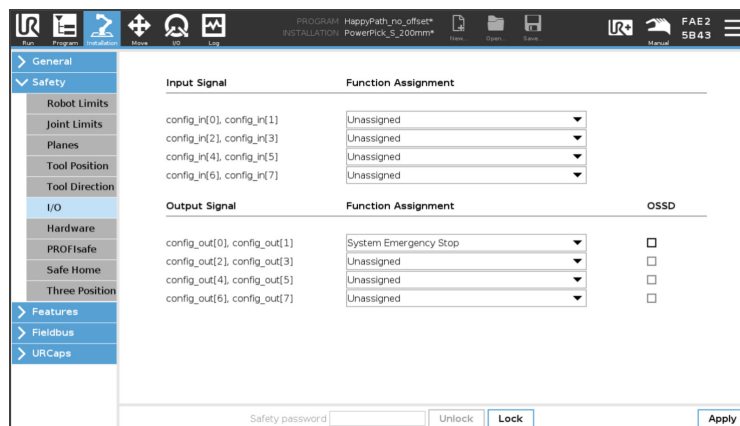


3.8.3. Configurable Outputs

Some configurable outputs must be set.

For e-Series Universal Robots:

1. Tap **Installation** → **Safety** → **I/O**
2. Then, unlock the section with the proper password and set the **Output Signal config_out[0]**, **config_out[1]** at System Emergency Stopped.



For CB-Series Universal Robots:

1. Tap **Installation** → **Safety** → **Safety I/O**
2. Then, unlock the section with the proper password and set the **Output Signal config_out[0], config_out[1]** at System Emergency Stopped.

The screenshot shows the 'Safety Configuration' window with the 'Safety I/O' tab selected. The left sidebar lists various configuration categories, with 'Safety' highlighted. The main area contains two tables for signal configuration.

Input Signal	Function Assignment
config_in[0], config_in[1]	Unassigned
config_in[2], config_in[3]	Unassigned
config_in[4], config_in[5]	Unassigned
config_in[6], config_in[7]	Unassigned

Output Signal	Function Assignment
config_out[0], config_out[1]	System Emergency Stopped
config_out[2], config_out[3]	Unassigned
config_out[4], config_out[5]	Unassigned
config_out[6], config_out[7]	Unassigned

At the bottom, there is a 'Safety password' field with 'Unlock', 'Lock', and 'Apply' buttons.



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 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.



4. Operation

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.
5. Activate and test the linear axis: Tap the **UR+** icon → **ActiveDrive** toolbar→ **Extra Axis**→ **Scan** (you may have to press the **Start** button). Use the arrows to test the linear axis action.

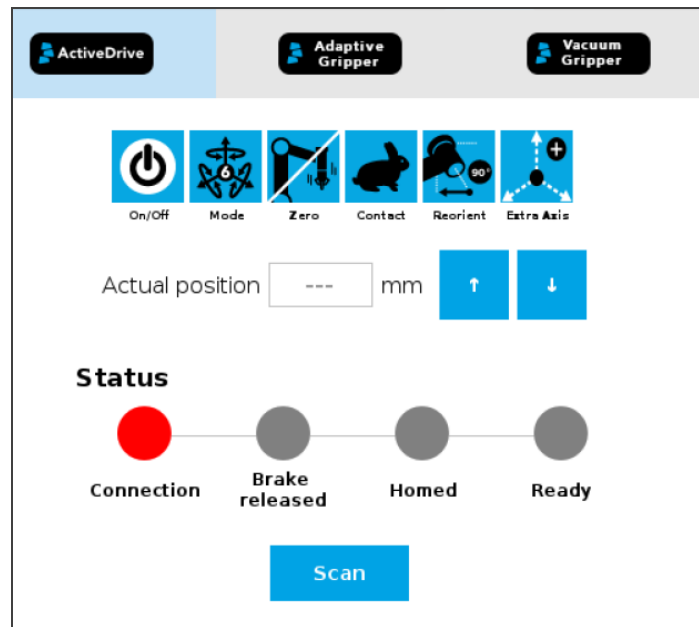


Fig. 4-1: Scan for the linear axis in the ActiveDrive toolbar



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 Fast blink	The linear axis controller (PLC) is unable to communicate with the Robot controller (UR).	<ul style="list-style-type: none"> • The robot has been started and needs time to boot up (Polyscope has not loaded yet) • Make sure your Ethernet/USB adapter is properly connected: the LED on the Ethernet adapter should be ON. • Make sure the Ethernet cable between the PLC and robot controller is properly connected (to the USB adapter) . • Try pressing the Scan button in the installation tab. • Try powering off the system (both the robot and the linear axis Controller). Wait 1 minute. Power up the system again.
RED Slow blink	Communication between the robot and the linear axis controller (PLC) is established, but Copilot has not established the communication yet with the linear axis controller.	<ul style="list-style-type: none"> • Tap UR+ → ActiveDrive → Palletizing, then the Scan button.
RED Solid	An axis error happened.	<ul style="list-style-type: none"> • Tap Installation → URCaps → Copilot → Linear Axis. Then, check the error message and act accordingly.
RED Solid	A Protective or Emergency stop has occurred.	<ul style="list-style-type: none"> • Follow the procedures required by the system to recover from either a Protective or Emergency stop.
YELLOW Solid	<ul style="list-style-type: none"> • When the Scan has succeeded, but the axis brakes are not released (Start not done yet) • A program is running without Palletizer node. 	<ul style="list-style-type: none"> • Tap UR+ → ActiveDrive → Palletizing, then the Start button. You may need to press the safeguard reset button (if you have one in your specific safety setup).
YELLOW Slow blink	A Safeguard Stop has occurred.	Press the safeguard reset button.



Color and signal type	Condition status	Cause or action needed (troubleshooting for e-Series)
BLUE Solid	<ul style="list-style-type: none"> The pallet is complete or missing; <p>AND</p> <ul style="list-style-type: none"> The system is palletizing on the other side. 	Place a new pallet
BLUE Fast blink	<ul style="list-style-type: none"> The pallet is complete and the system is idle; <p>OR</p> <ul style="list-style-type: none"> The pallet is not detected and the system is idle. 	Place a new pallet
WHITE Solid	<ul style="list-style-type: none"> The linear axis is activated and brake is released; The Robotiq Controller (PLC) is connected to the robot controller A program is running without a Palletizer node. 	N/A
GREEN 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.

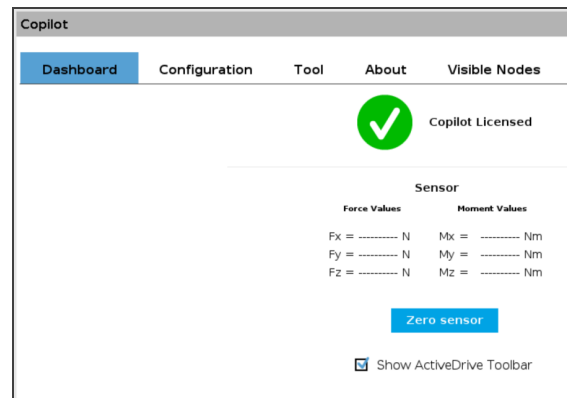


Fig. 5-1: Copilot License

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 Linear Axis
- 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 **Start linear axis at program start (Palletizer, Linear axis move)** option. It will scan and start the linear axis when the program starts.
- d. 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.



Caution

Activating the **Limit height for Palletizer program node** option does not limit the linear axis range outside of the Palletizer node. Therefore, caution must be observed when operating the linear axis with the **ActiveDrive** toolbar or the Linear Axis move node.

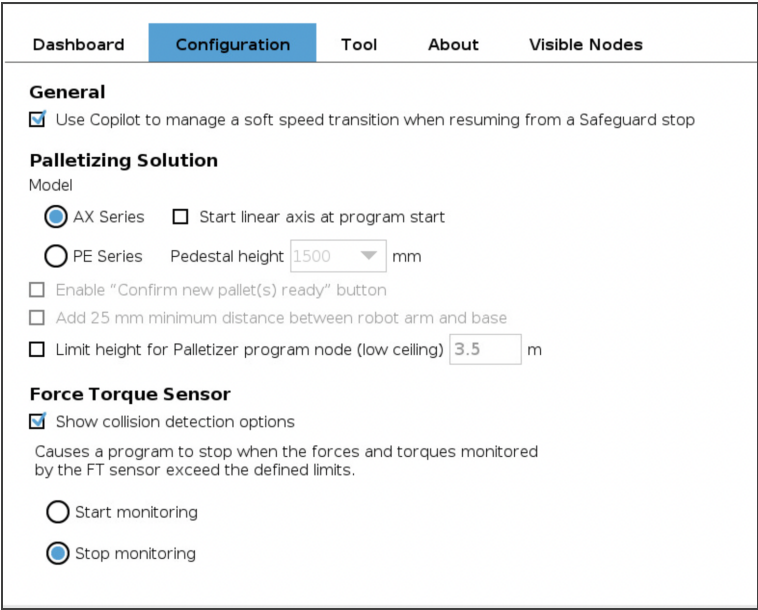


Fig. 5-2: Configuration tab

- 3. In the **ActiveDrive** toolbar, tap **Palletizing**, then **Scan**, and make sure your linear axis is ready.

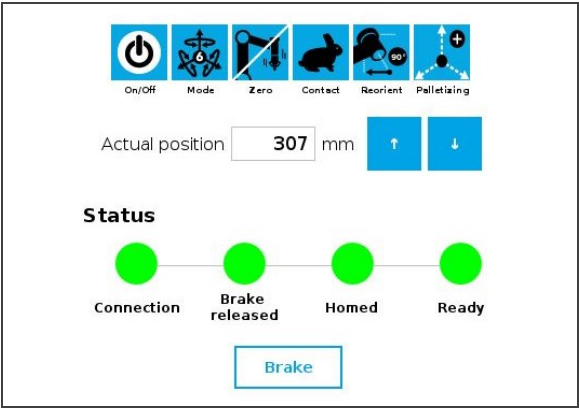


Fig. 5-3: Palletizer ready



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:

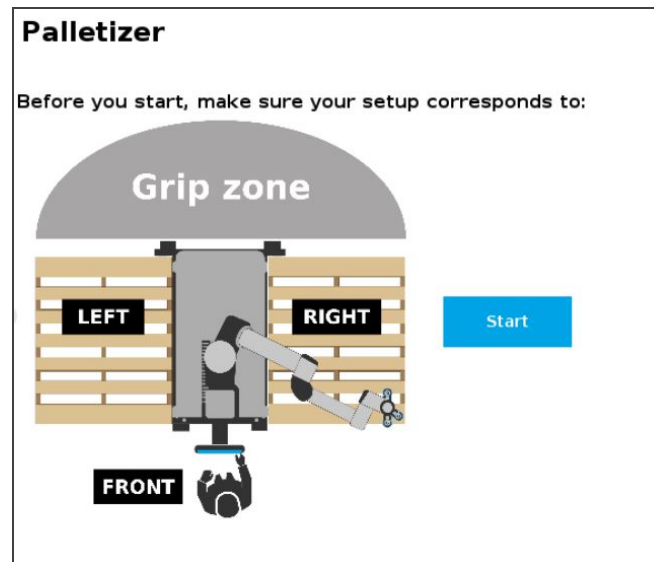


Fig. 5-4: Configuration of Palletizing environment

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**.



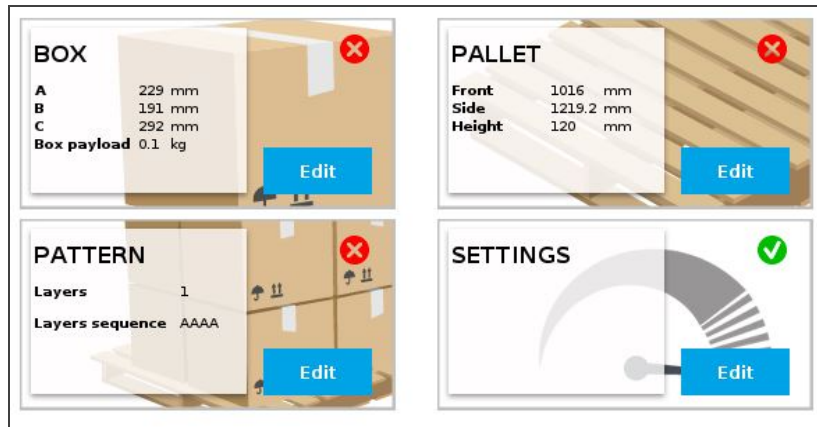


Fig. 5-5: Four parameters to set

SETTINGS- First Part

Tap **SETTINGS**.

Info

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

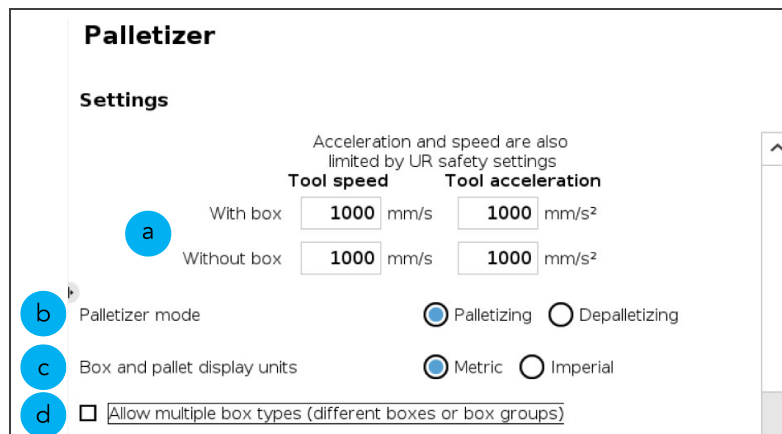


Fig. 5-6: SETTINGS parameter - top screen

- 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**.

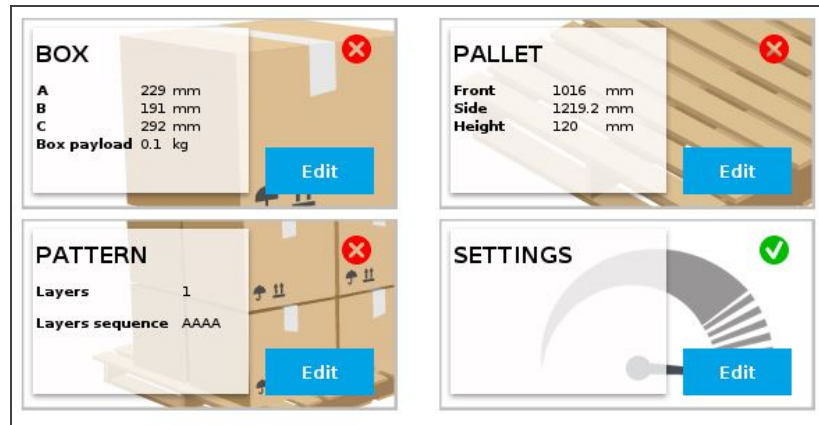


Fig. 5-7: Select the BOX parameter

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.

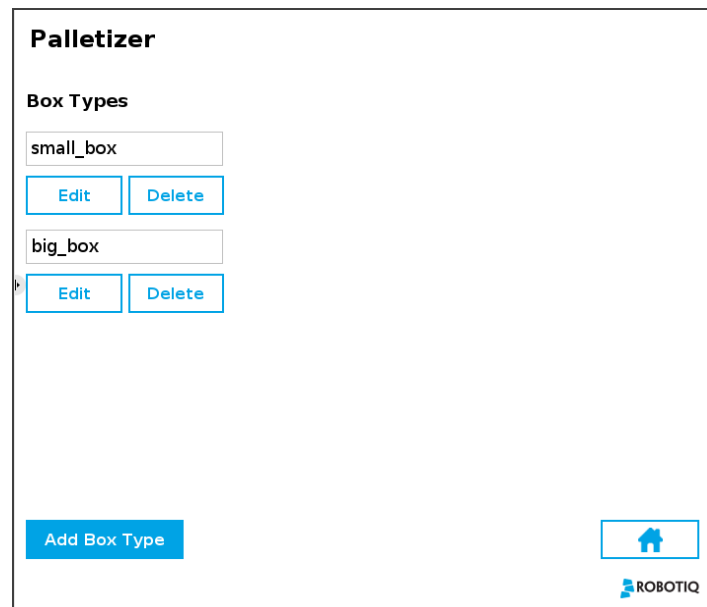


Fig. 5-8: Box Types

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.

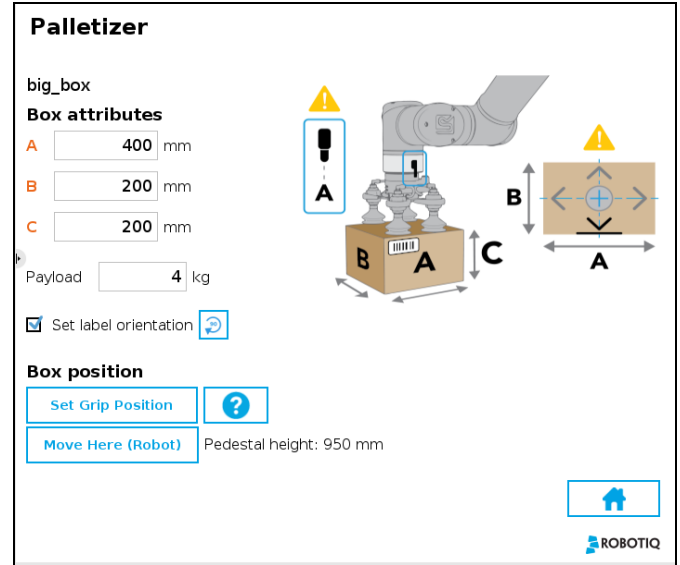
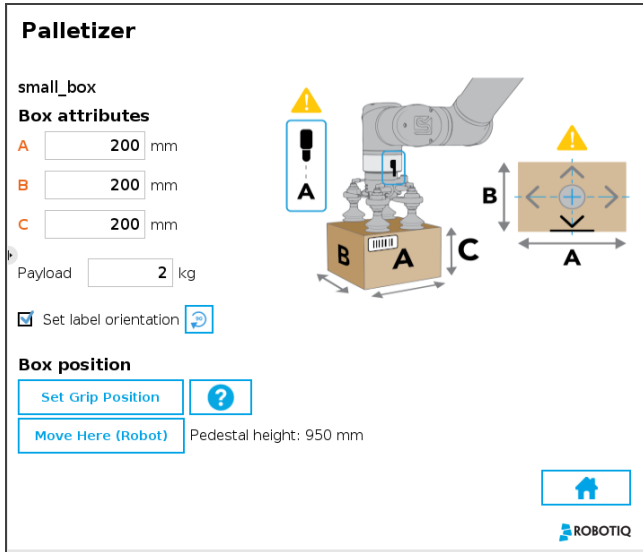


Fig. 5-9: Box attributes - (the images show two Box types with the multipick feature)

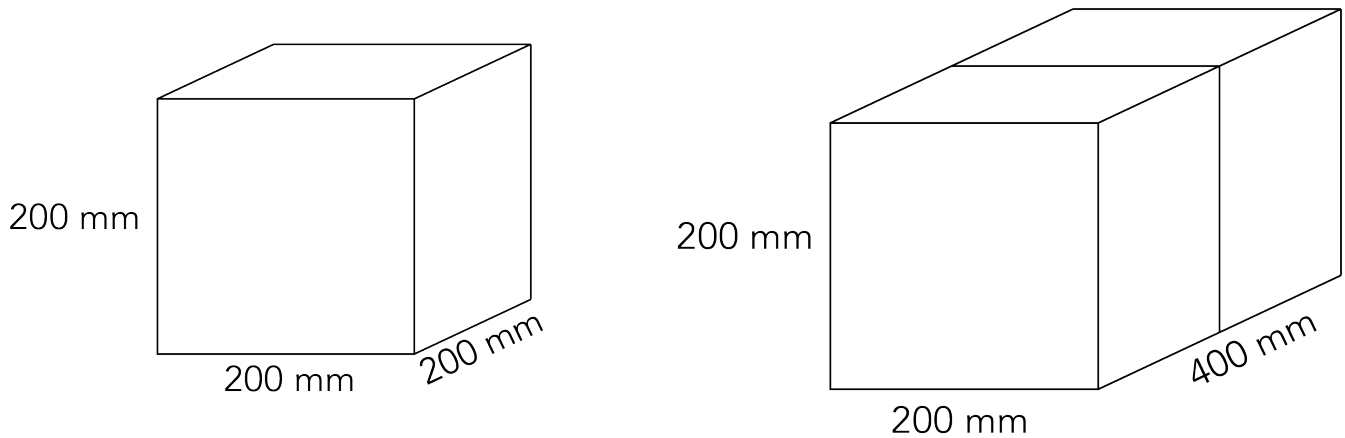



Fig. 5-10: Single box vs double box (with multipick feature)

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**.

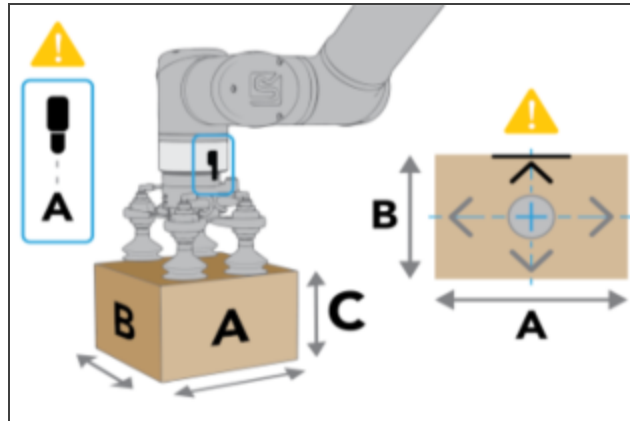


Fig. 5-11: Positioning the robot tool flange

Tip

You can move the linear axis with the ActiveDrive. Go to **ActiveDrive > Palletizing**.

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

SETTINGS - Second Part

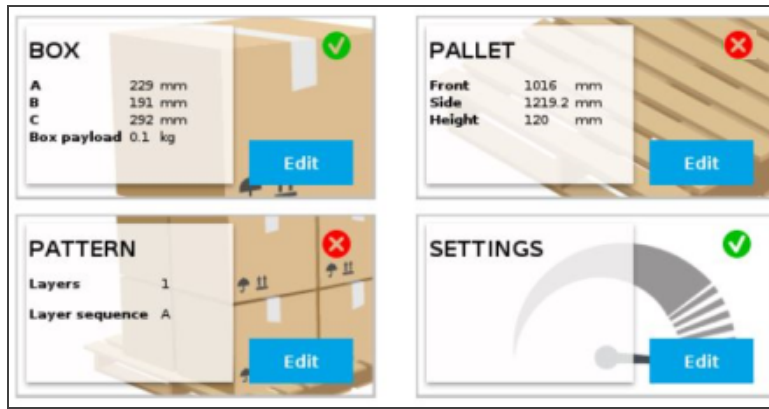


Fig. 5-12: Select **SETTINGS** again

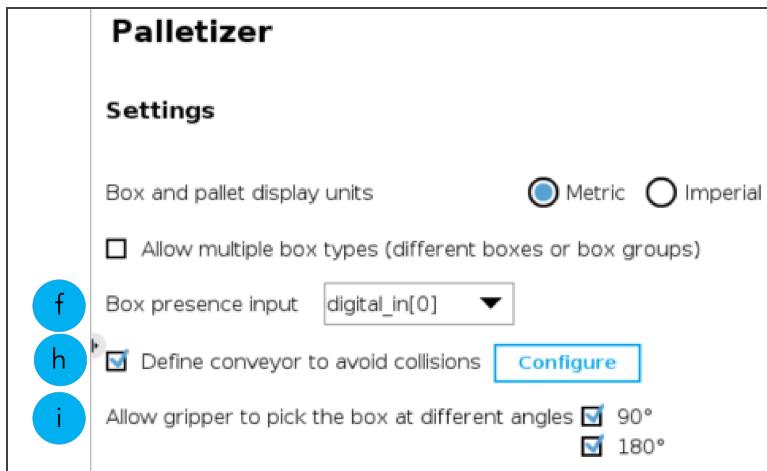


Fig. 5-13: **SETTINGS** parameter - middle screen

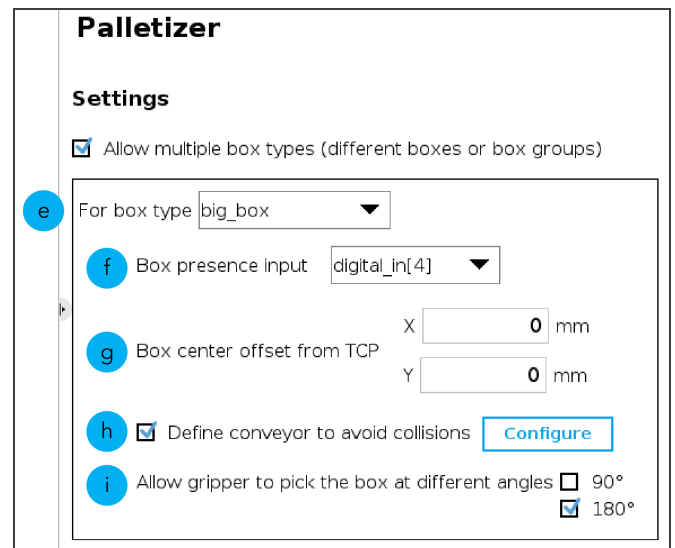


Fig. 5-14: **SETTINGS** parameter - middle screen (with multipick feature)

- 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).

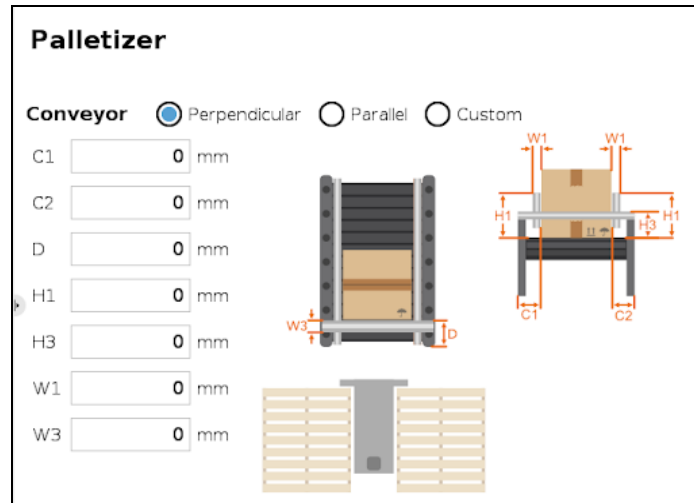


Fig. 5-15: Perpendicular conveyor

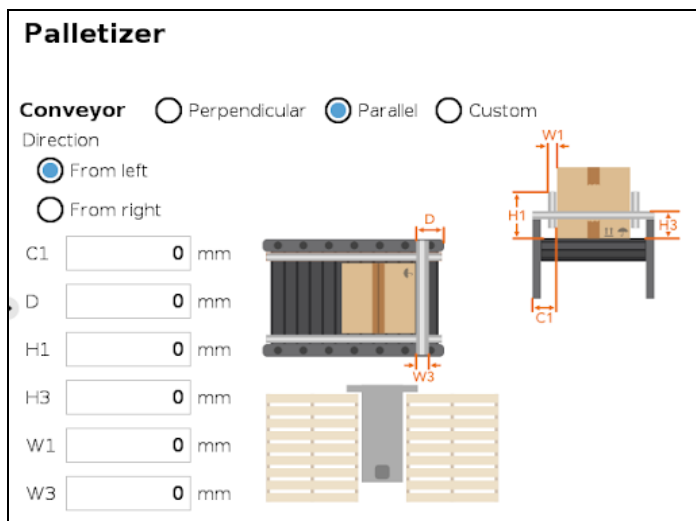


Fig. 5-16: Parallel conveyor - From left

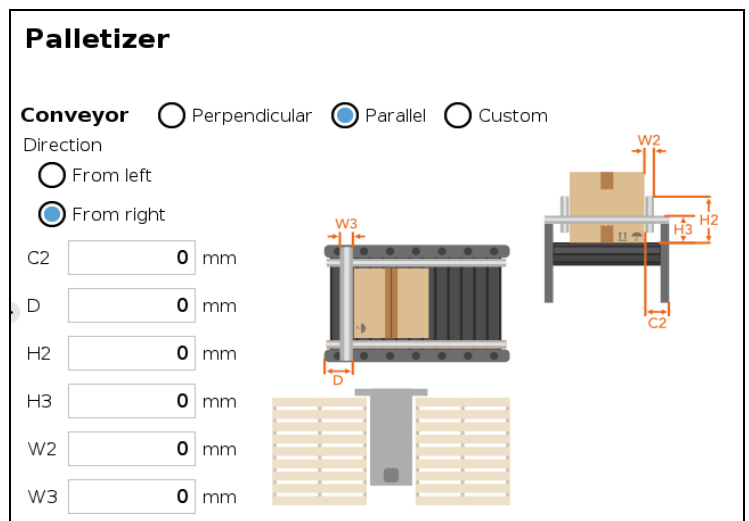


Fig. 5-17: Parallel conveyor - From right



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.



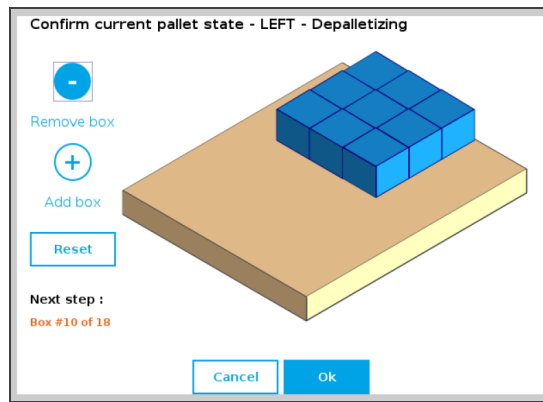


Fig. 5-20: Pallet state - LEFT - Depalletizing

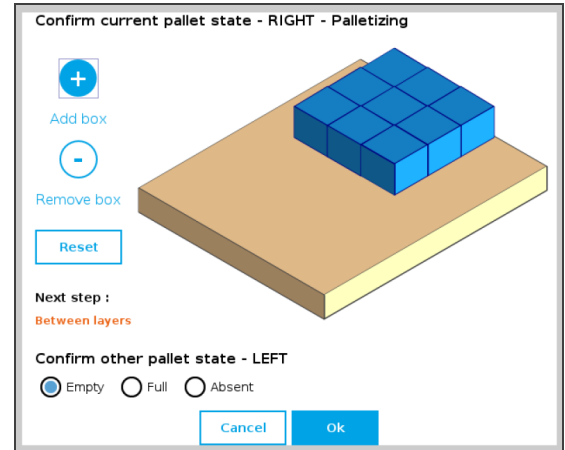
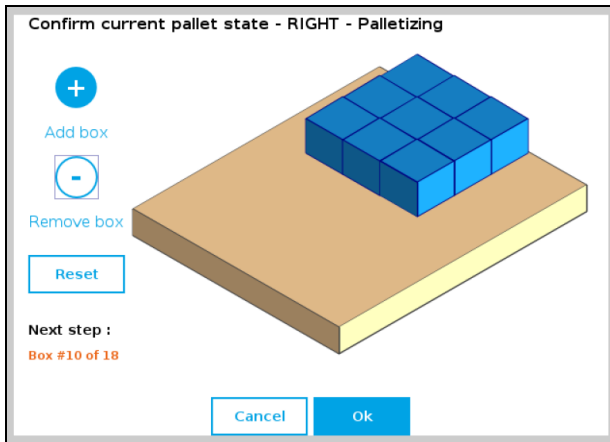


Fig. 5-21: Pallet state - RIGHT - Palletizing

- 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**.

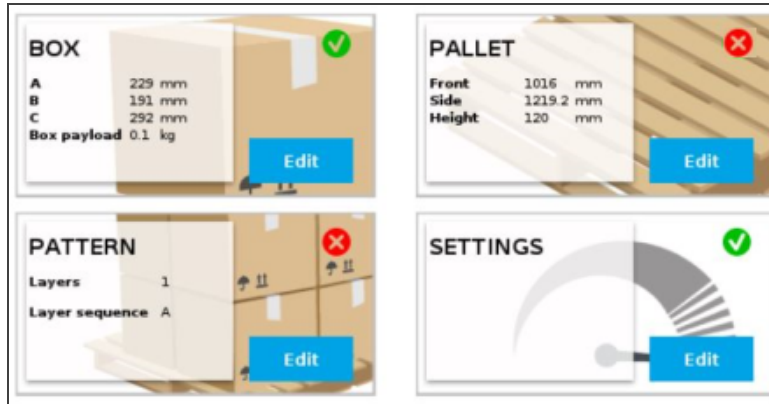


Fig. 5-22: Select the PALLET parameter

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

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**.

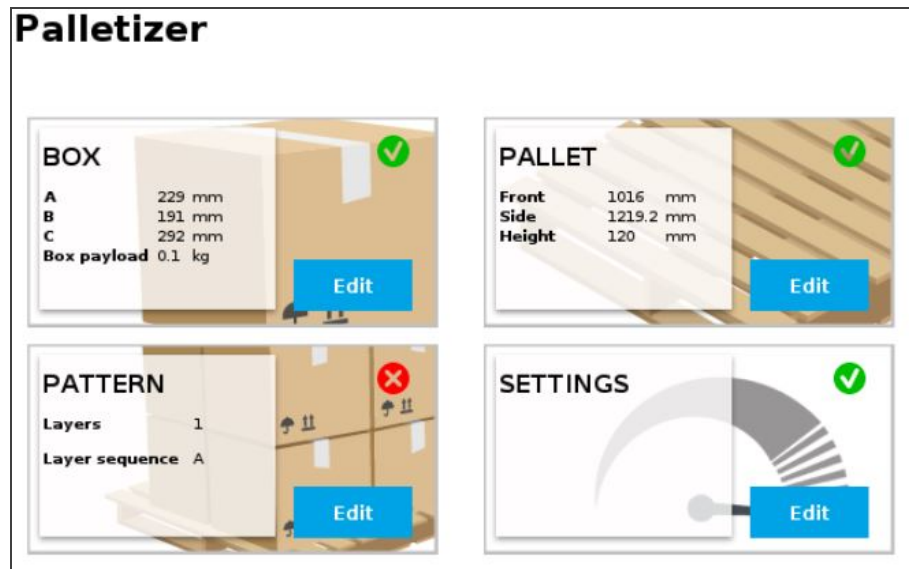


Fig. 5-24: Select the **PATTERN** parameter

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.

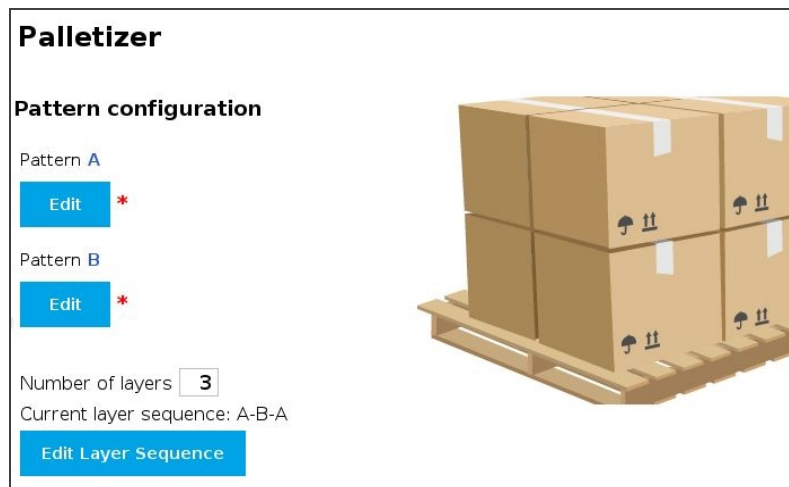


Fig. 5-25: Pattern configuration

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.



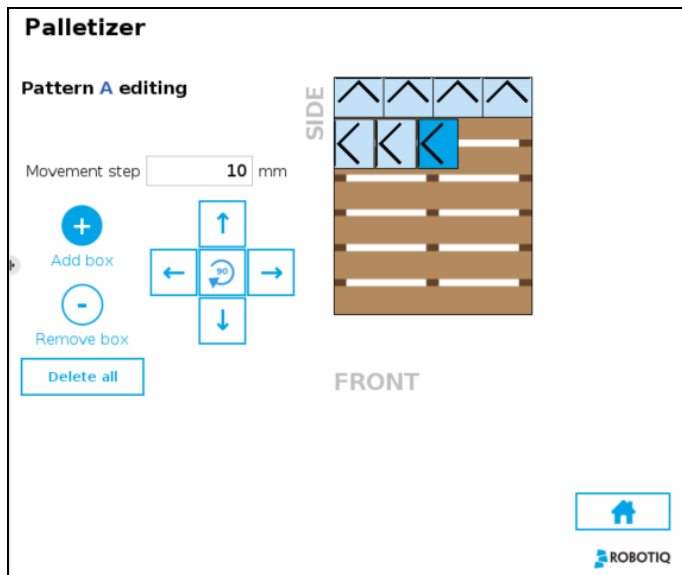


Fig. 5-26: Pattern editing

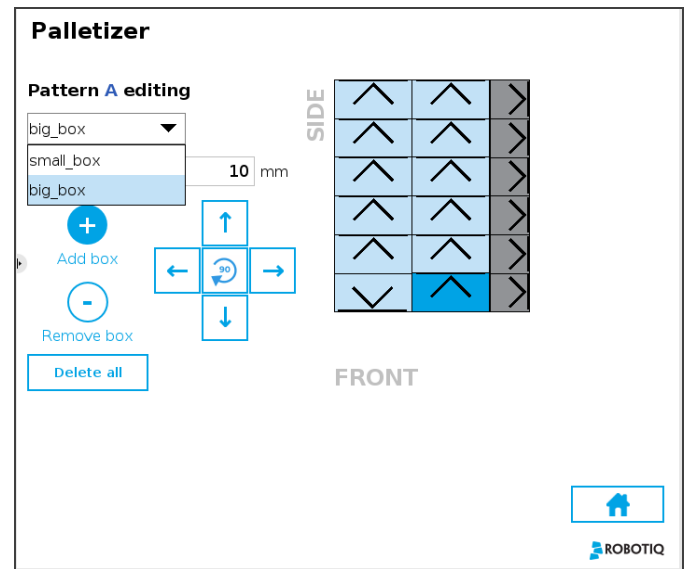


Fig. 5-27: Pattern editing with multipick feature

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

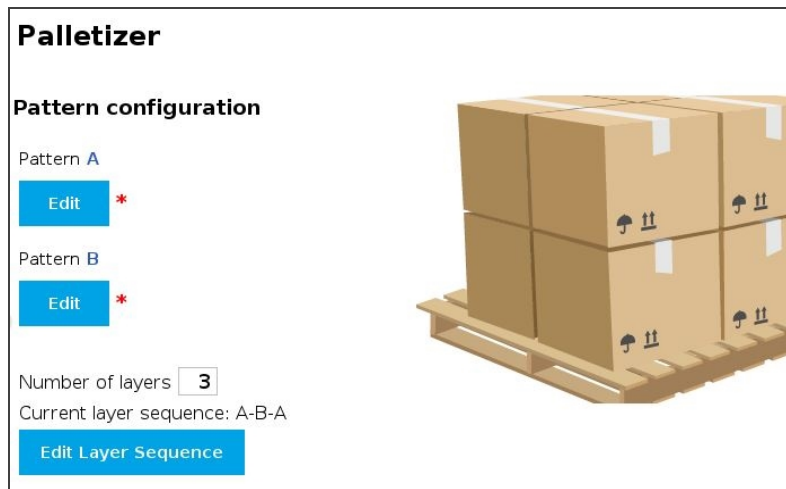


Fig. 5-28: Layers editing

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

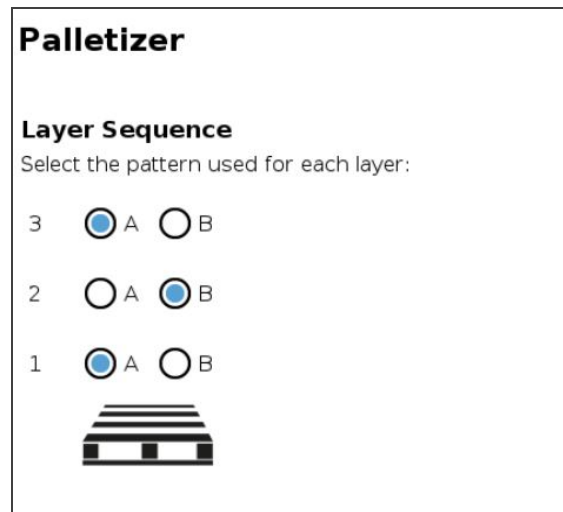


Fig. 5-29: Layer Sequence

All your Palletizer parameters are now configured.

5.3.2. Program Tree with Multipick Feature

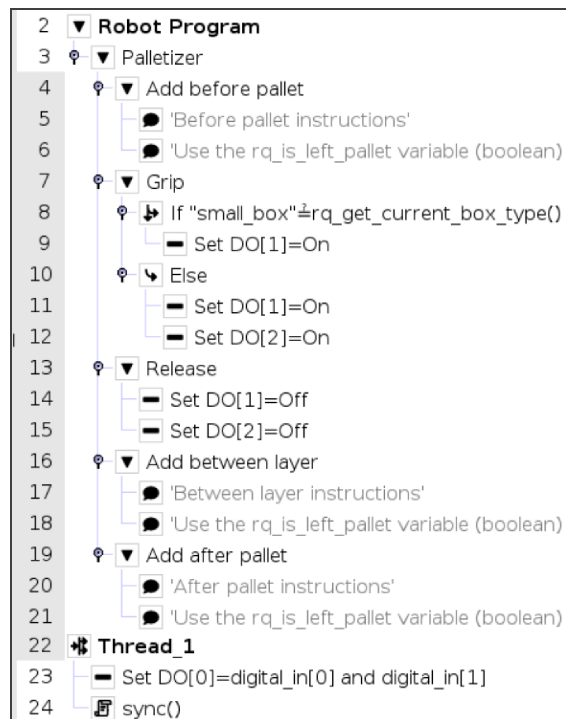


Fig. 5-30: Final program tree



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.

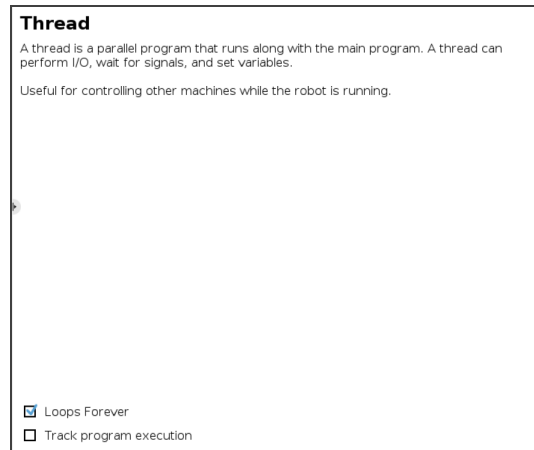


Fig. 5-31: Thread node

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]**

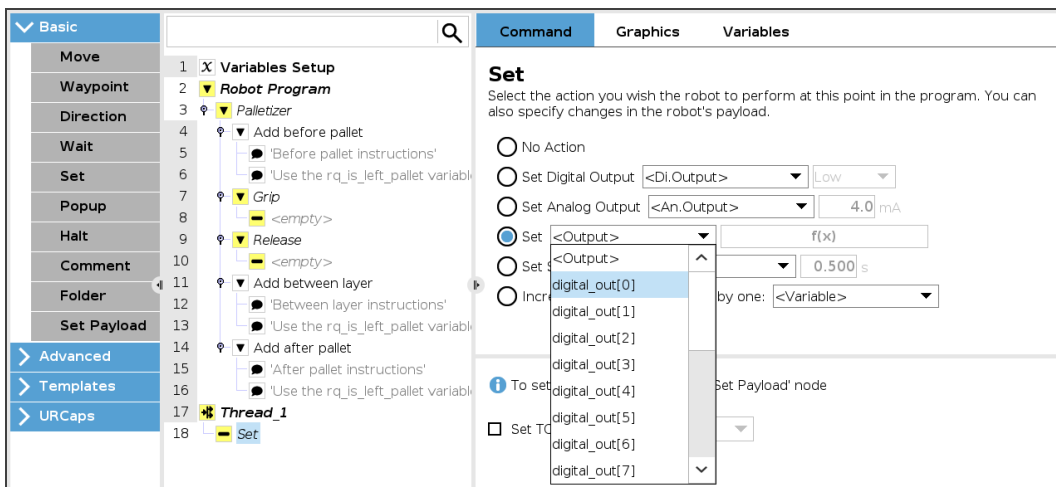


Fig. 5-32: Set node in the Thread node



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]**

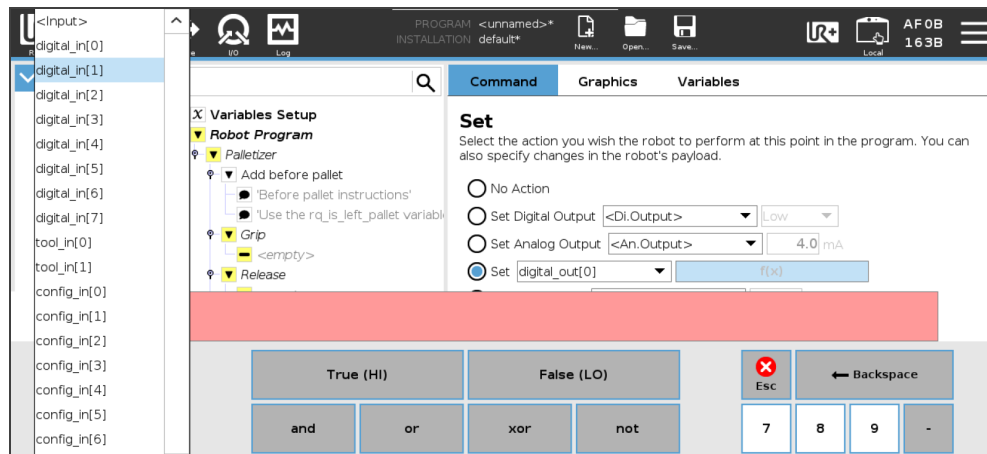


Fig. 5-33: Input scrolling menu in the Set node

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.

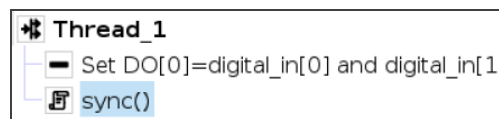


Fig. 5-34: Complete Thread node in program tree



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).

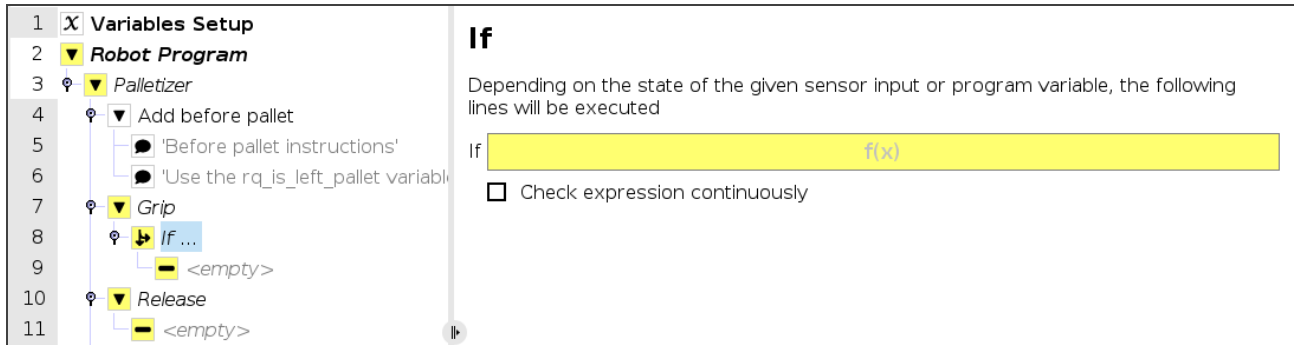


Fig. 5-35: If node in the Grip node

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.



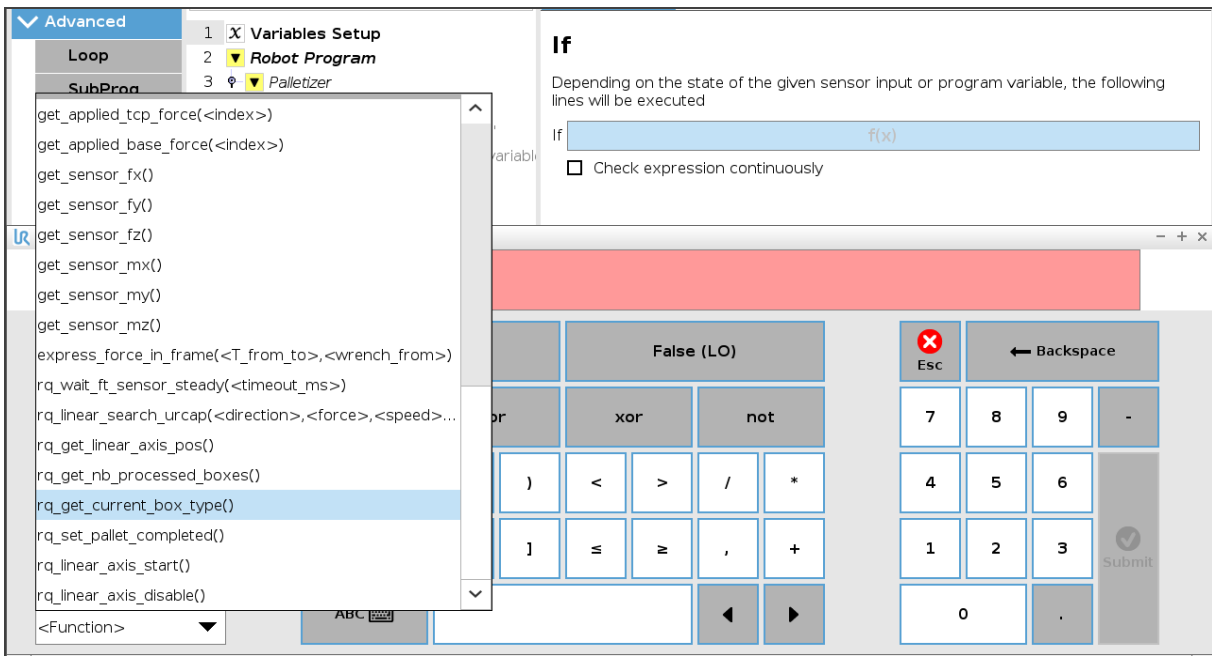


Fig. 5-36: Function scrolling menu in the If node

- 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.

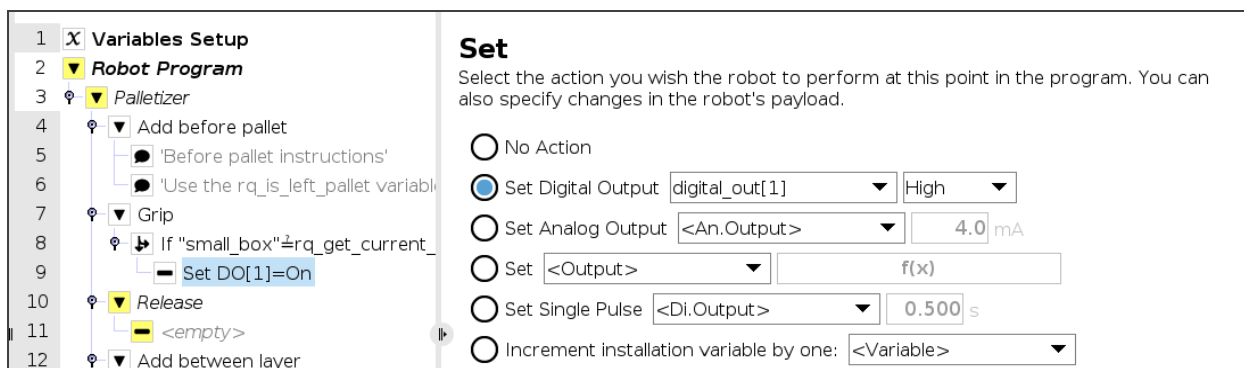


Fig. 5-37: Set node in the If node



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

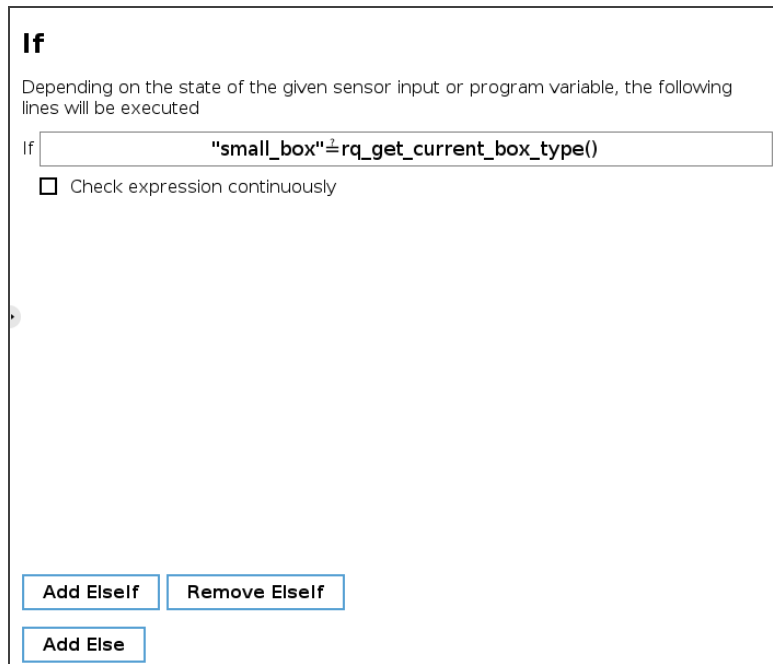


Fig. 5-38: Add Else in the If node

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**).

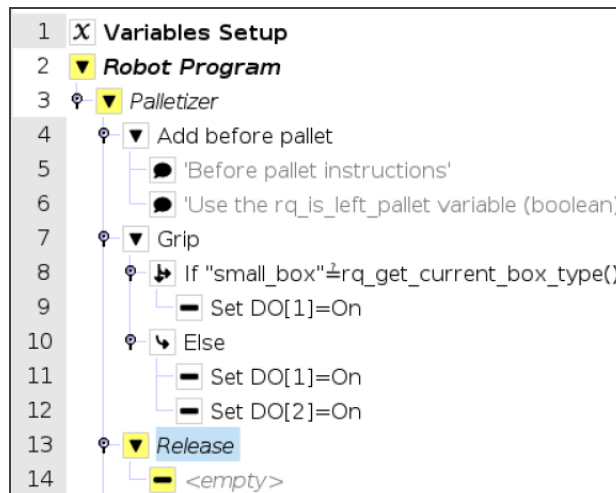


Fig. 5-39: Set nodes in the Else node

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.

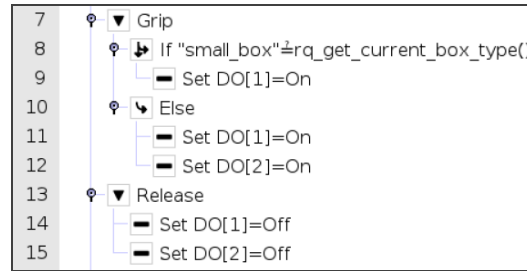


Fig. 5-40: Set nodes in the Release node

You have completed the multipick program.

5.3.3. Linear Axis Move node

- The **Linear axis move** node can be used to move the linear axis to a specific position. It can be used inside or outside the Palletizer node. You can command the axis to move at a:
 - Fixed position**
 - Relative position** : the position is relative to the current position. The entered value can be positive or negative.
 - Variable position**: the position is dictated by a variable (global or local).

Linear axis move

Position

Current position 797 mm

Move Fixed position ▼ 0 mm **Move Here**

Motion

Speed 200 mm/s

Acceleration 1000 mm/s²

☒ Wait for motion completed

☒ Allow robot to trigger protective stop in case of collision

Linear axis move

Position

Current position 797 mm

Move Fixed position ▼ 0 mm **Move Here**

Motion

Speed 200 mm/s

Acceleration 1000 mm/s²

☒ Wait for motion completed

☒ Allow robot to trigger protective stop in case of collision

Fig. 5-41: Linear axis move



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

1. 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).
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**.

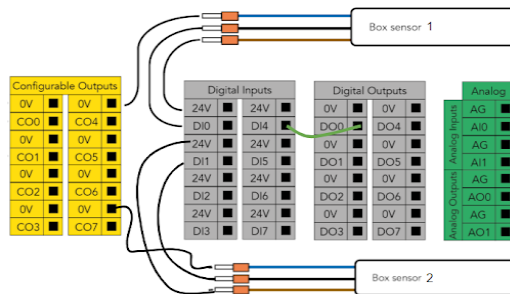


Fig. 5-42: Wiring the box sensors

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.

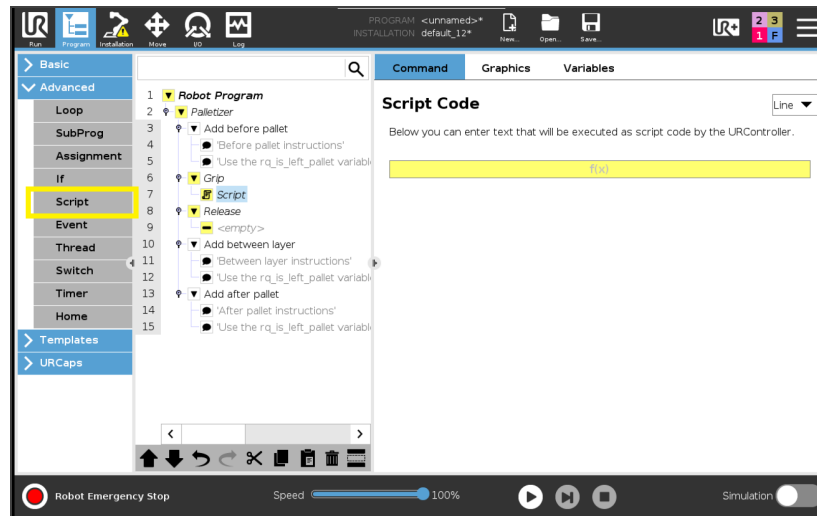


Fig. 5-43: Script node

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

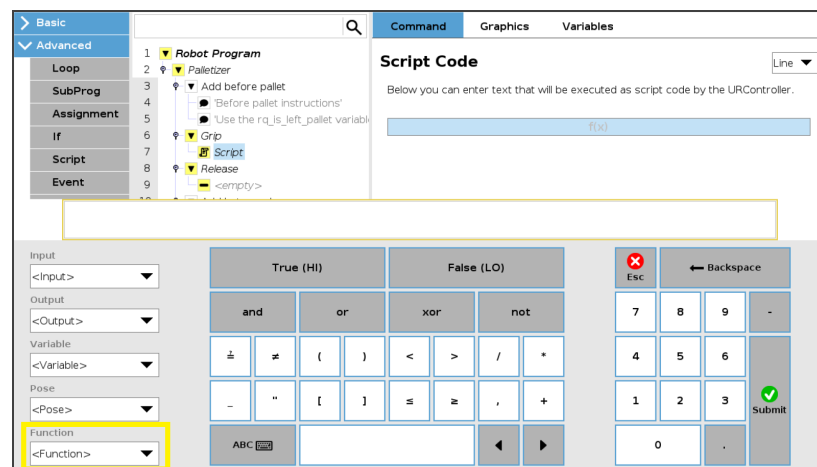


Fig. 5-44: Function menu in Script node

5.5.1 Get Linear Axis Position

Description

This function returns the linear axis position measured from the lowest point of the axis. It can be used anywhere in the program.

Declaration

```
rq_get_linear_axis_pos()
```

Return value

This function returns a float which expresses the linear axis position in meters.



5.5.2. Disable Linear Axis

Description

The linear axis decelerates to a complete stop but remains powered (the brake is not applied). The communication between the robot controller and the linear axis controller remains active.

Declaration

```
rq_linear_axis_disable()
```

Return value

The `rq_linear_axis_disable()` or `rq_linear_axis_disable(True)` function returns True when it succeeds. If the function fails, it returns an error message and the program stops. When the function returns True, the event is recorded in the **UR Log** tab.

The `rq_linear_axis_disable(False)` function returns True when it succeeds, and returns False when it fails (the program is not stopped). The event, whether successful or failed, is recorded in the **UR Log** tab.

5.5.3. Start Linear Axis

Description

This function is the equivalent of the **Start** button. The linear axis brake is released. Use this function before a palletizer or a linear axis move node. The linear axis must be scanned before the use of this function.

Declaration

```
rq_linear_axis_start()
```

Return value

The `rq_linear_axis_start()` or `rq_linear_axis_start(True)` function returns True when it succeeds. If the function fails, it returns an error popup and the program stops. When the function returns True, the event is recorded in the **UR Log** tab.

The `rq_linear_axis_start(False)` function returns True when it succeeds and returns False when it fails (the program is not stopped). The event, whether it is successful or failed, is recorded in the **UR Log** tab.

5.5.4. 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.



55.5. 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.

55.6. 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).



5.5.7. 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.



5.5.8. 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

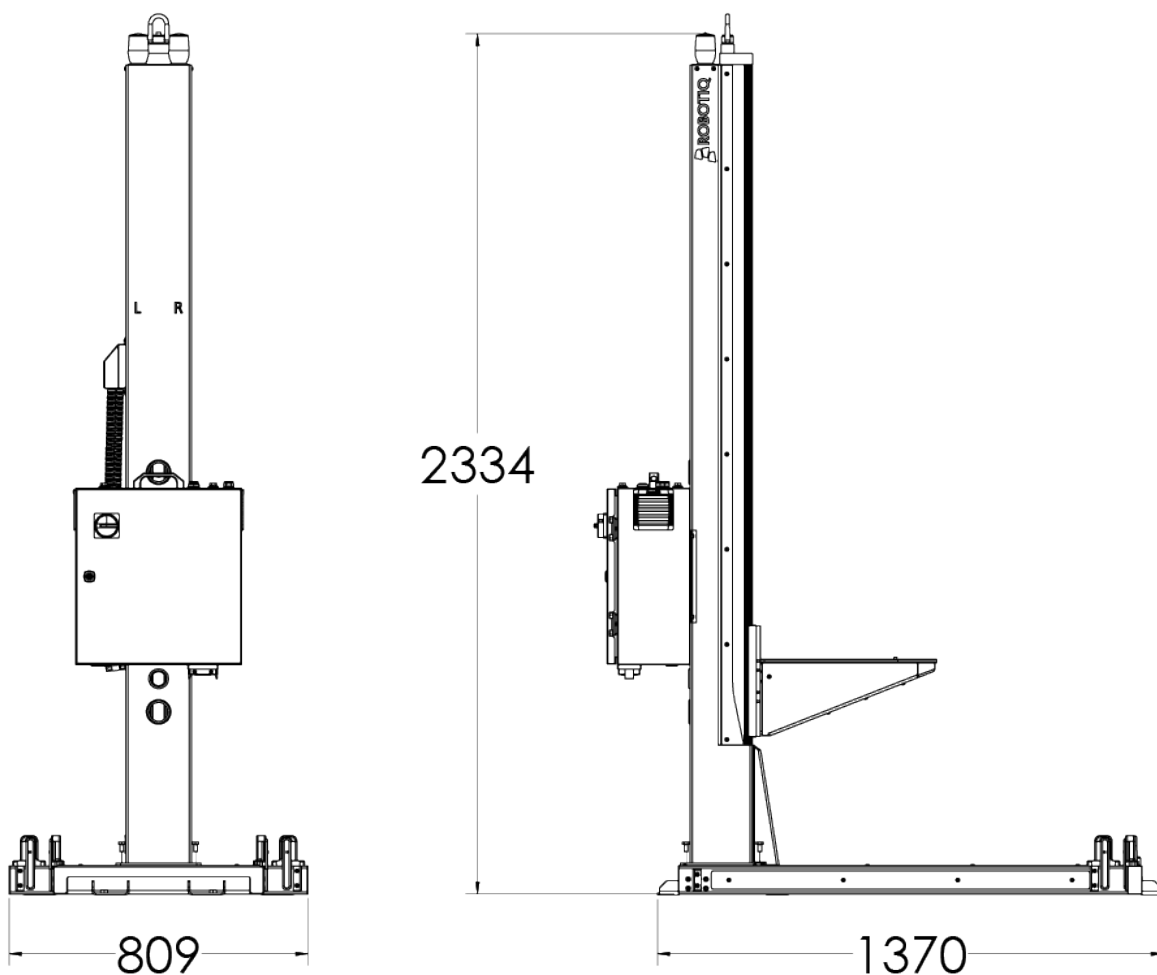
Caution

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 Linear Axis Base with Controller



6.12. PowerPick Vacuum Gripper

For PowerPick Gripper technical dimensions, please refer to its own manual, available at 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)	155 kg	340 lb
Base weight	45 kg	98 lb
Column weight	110 kg	242 lb
Maximum box weight ¹	Up to 16 kg	Up to 35 lb
Minimum box dimensions ²	See explanations below	
Minimum pallet width and depth	300 mm	12 in
Maximum pallet dimensions width and depth ³	See explanations below	
Minimum pallet height (empty)	50 mm	2 in
Maximum pallet height (filled)	Up to 2750 mm	Up to 108 in
Shipping crate dimensions	[2380, 950, 1250] mm (L, W, H)	[93-7/8, 37-3/8, 49-1/16] in (L, W, H)
Gross shipping weight	317 kg	697 lb
Maximal acceleration in operating conditions	2 g	
Maximum box throughput	Up to 13 boxes/min ⁴	
Maximum number of box patterns	2	
Energy source	Electricity	

¹ Maximum box weight depends on the robot model and gripper used.

² The minimum box dimensions depend on pallet dimensions. See section below for more details.

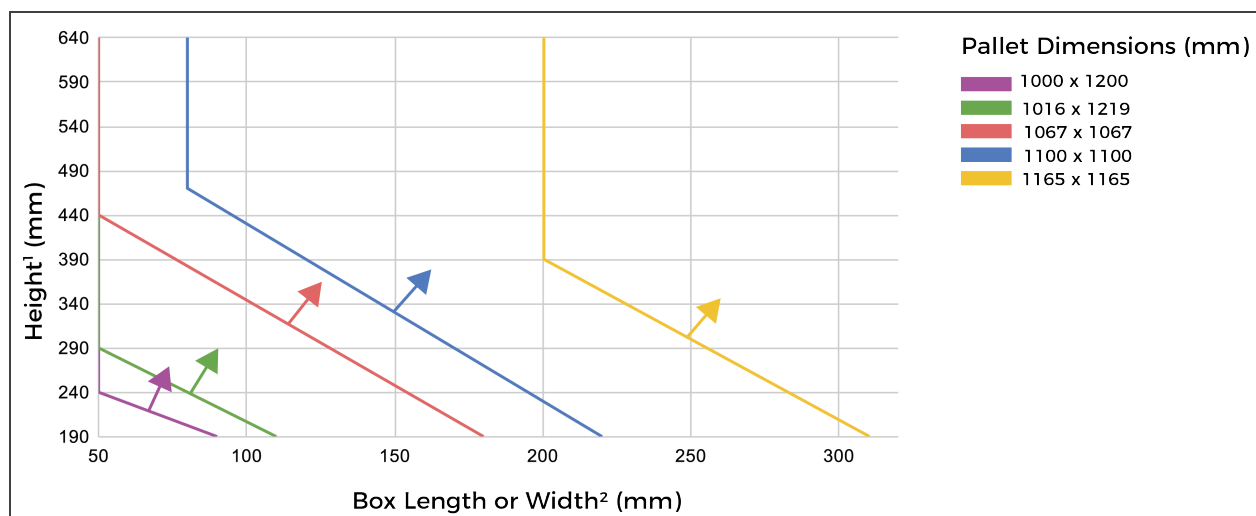
³ The maximum pallet dimensions depend on your box dimensions. See section below for more details.

⁴ 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



- The maximum pallet dimensions and the minimum box dimensions are interdependent. The figure below shows box compatibility for different pallet dimensions when using a TCP offset of 300 mm in the X direction.
- Each color line in the graphic represents pallet dimensions. To figure out if your box dimensions will fit with the pallet dimensions, note that all combinations on the right of each line are available possibilities. For example, if you have a pallet of 1165 x 1165 mm (yellow line) and a total height¹ of 300 mm, all boxes with a length/width ≥ 250 will work.
- The pallet 800 mm x 1200 mm is not represented in the figure, as all box sizes are possible.



¹The sum of the pallet and box heights plus the TCP offset in Z direction.

²Boxes imprint is square. If your box is not, the figure can be used using the smaller dimension.

- Please refer to **Center of Mass, Tool Center Point (TCP)** section to know the TCP offset you have to use, depending on your gripper configuration.
- Here are a few examples of common pallet dimensions while using the PowerPick with the 200 mm offset tube.

Region	Dimensions (mm) ¹ (Width x Depth)	Examples of box dimensions (mm) ²
North America	1016 x 1219	50 x 50 x 50
Australia	1165 x 1165	210 x 210 x 140
Asia	1100 x 1100	150 x 150 x 85
Europe, Asia	1000 x 1200	50 x 50 x 50
North America, Europe, Asia	1067 x 1067	110 x 110 x 85
Europe	800 x 1200	50 x 50 x 50

¹ Height of 100 mm for all pallets

² Possible box dimensions. Any size larger than those listed will work.



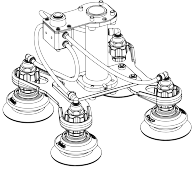
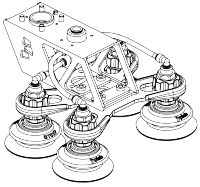
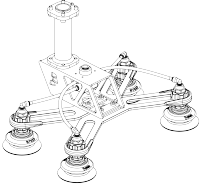
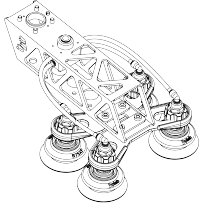
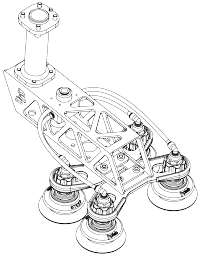
6.2.2. PowerPick Vacuum Gripper

Specifications	PowerPick Vacuum Gripper	
	Metric Units	Imperial Units
Energy source	Electricity and compressed air	
Gripper mass ¹	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	

¹ 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 Linear Axis Controller

Parameter	Specification
Operating supply voltage	100-240 Vac 60/50 Hz
Quiescent power (minimum power consumption)	290 Wmax 205 Wrms
Peak current	12.8A at 120Vac 6.4A at 240Vac

Fig. 6-1: Linear Axis Controller electrical specifications

Info

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

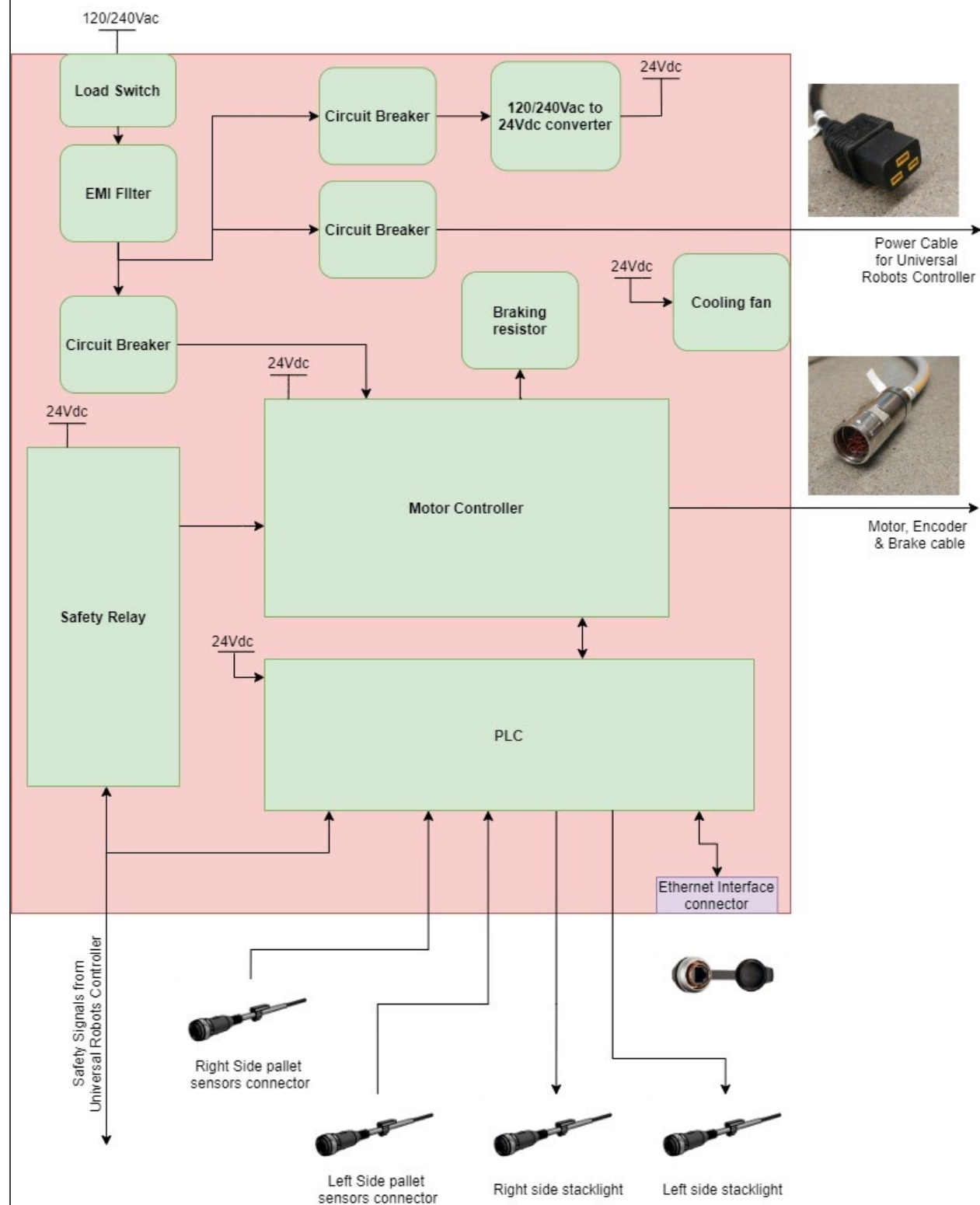
Warning

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

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



Palletizer Control Box Diagram



Info

The complete electrical diagram is available on our the [Robotiq support website](#).



6.3.2. PowerPick Vacuum Gripper

Info

For all information about PowerPick Vacuum Gripper specifications, please consult its instruction manual available on the [Robotiq support website](#).

6.3.3. Universal Robots Controller

Please, refer to the **Installation** section for more details about all connections in the UR controller.



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 Linear Axis

Caution

For every maintenance operation, please verify the axial backlash in the ball screw. If it is greater than 0.2 mm, the linear axis must be replaced.

7.11 Components lubrication

Info

If needed, clean the components before the lubrication.

Info

Recommended lubricant : LUB-KC1.

Ball Screw and Bearing Guide Lubrication

Lubrication of the axis should be done every 2 years considering a typical use of 80h/week. When lubricating, move the carriage all over the axis stroke to distribute the lubricant uniformly.

Cover Strip and Guide Rail Lubrication

Lubrication have to be done if it is needed or when the component doesn't have its grease film anymore.



72. 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
M6	Column-Axis interface	10.5	7.7
M6	Linear axis carriage interface	9.9	7.3
M8	Pallet sensors	15.0	11.1
M10	Base - Column	50.0	36.9
1/2" -13	Wedge anchors	54.2	40.0
M8	Hoist ring	9.5	7.0
M8	Robot-carriage link	20.0	14.8
M8	Lifting bracket - Linear axis link	9.5	7.0
Motor Coupling	Coupling collar	8.0	5.9

Table 7-1: Torque Settings - Palletizing Solution



73. 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 1000 hours
Gripper Cleaning	Dirty conditions	Normal conditions	
Periodic Inspection			X

73.1 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.

74. Cleaning

74.1 Air Filter Cleaning

Periodically clean the control panel air filters.

74.2. Solution Cleaning

Clean the mechanical parts (including the guide rail of the linear axis) with a soft cloth, as required. Cleaning agents include all non-abrasive media.

75. 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	Type A Pallet Sensor Kit for the Robotiq Palletizing Solution <ul style="list-style-type: none">1 x Type A Pallet Sensor1 x screw kit Used for: <ul style="list-style-type: none">Left pallet, back sensorRight pallet, side sensor	PAL-SENS-A
Type B Pallet Sensor - Palletizing Solution	Type B Pallet Sensor Kit for the Robotiq Palletizing Solution <ul style="list-style-type: none">1 x Type B Pallet Sensor1 x screw kit Used for: <ul style="list-style-type: none">Left pallet, side sensorRight pallet, back sensor	PAL-SENS-B



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



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">• Increase the box height value to compensate for box size discrepancies.• 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.
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">• Increase the box height value to compensate for box size discrepancies.• 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.
	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"> • Restart the program and select the right box step. • Verify the TCP position and orientation values.



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"> 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. If the box position is too close to robot base, discontinuous path issues can occur. Verify that the picking zone is respected. If this situation only occurs with pallets on one side of the Solution, try centering the layer pattern on the pallet. Verify TCP position and orientation values. 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. Should none of the above steps solve the issue, please contact the Robotiq support department.
Collisions occur with the pallet sensor on one side, but not on the other	The column is not centered on the base.	Execute the centering procedure found in the Installation 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 Other Grippers section for more details.
The robot waits indefinitely over the picking position	The box presence sensor is misused or not connected.	<ul style="list-style-type: none"> Verify that the correct box presence input has been selected. Verify that the sensor used is active-high if a sensor other than the sensor provided is being used.



Error message: "Please use the Safeguard reset before starting the linear axis"	Multiple causes are possible. Start by power off and power on the Linear Axis Controller.	Power off and power on the Linear Axis Controller.
	The cables of the Linear Axis are not properly connected to the UR controller.	Inspect the connections. Please refer to the Safety Connections section.
	The "Safety configuration" and/or "System Emergency Stopped" functions were not configured correctly.	Verify that the "Safeguard reset" and "System Emergency Stopped" functions are configured correctly. Installation tab > Safety > I/O
	No safeguard measure is being used, but none have been bypassed.	Even if the safeguard function is not used, both the safeguard wire and reset wire from the Linear Axis should be connected to a 24V terminal block in the UR controller (bypass). Please refer to the Safety Connections section for more information.
	A safeguarding OSSD is connected directly to the robot.	OSSD signals are not compatible with the Linear Axis (even if the e-Series UR controller can be compatible). A special relay is required to convert OSSD signals to standard signals.
	The emergency output from the UR controller is set to OSSD signal. (e-Series only)	Verify that the OSSD checkbox for the "System Emergency Stopped" output is unticked. (Installation tab > Safety > I/O) OSSD signals are not compatible with the Linear Axis.
The robot was brought to a protective stop while palletizing	A joint limit has been exceeded.	<ul style="list-style-type: none"> Verify that the joint speed and position limit have been configured correctly. Please refer to the Robot Configurations section for more information. Decrease the value of the acceleration parameter in the Palletizer node.



<p>Error message: " RTDE interface cannot initialize. Make sure that Ethernet/IP adapter and Profinet are disabled, and that no tother URCaps use the RTDE interface."</p>	<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 > URCaps > Copilot > Configuration > General: " Use Copilot to manage a soft speed transition when resuming from a Safeguard stop"</p>	<ul style="list-style-type: none"> • Update to the latest version of the Copilot software. • Untick the " Use Copilot to manage a soft speed transition when resuming from a Safeguard stop" checkbox.
<p>Error message: "org.apache.xmlrpc.CmlRpcException: One parameter is invalid in the fromjson request"</p>	<p>The Linear Axis may be below its home position (0 mm).</p>	<ul style="list-style-type: none"> • Bring the Linear Axis above its home position (0 mm) before starting the program. • Update to the latest version of the Copilot software.

92. 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



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

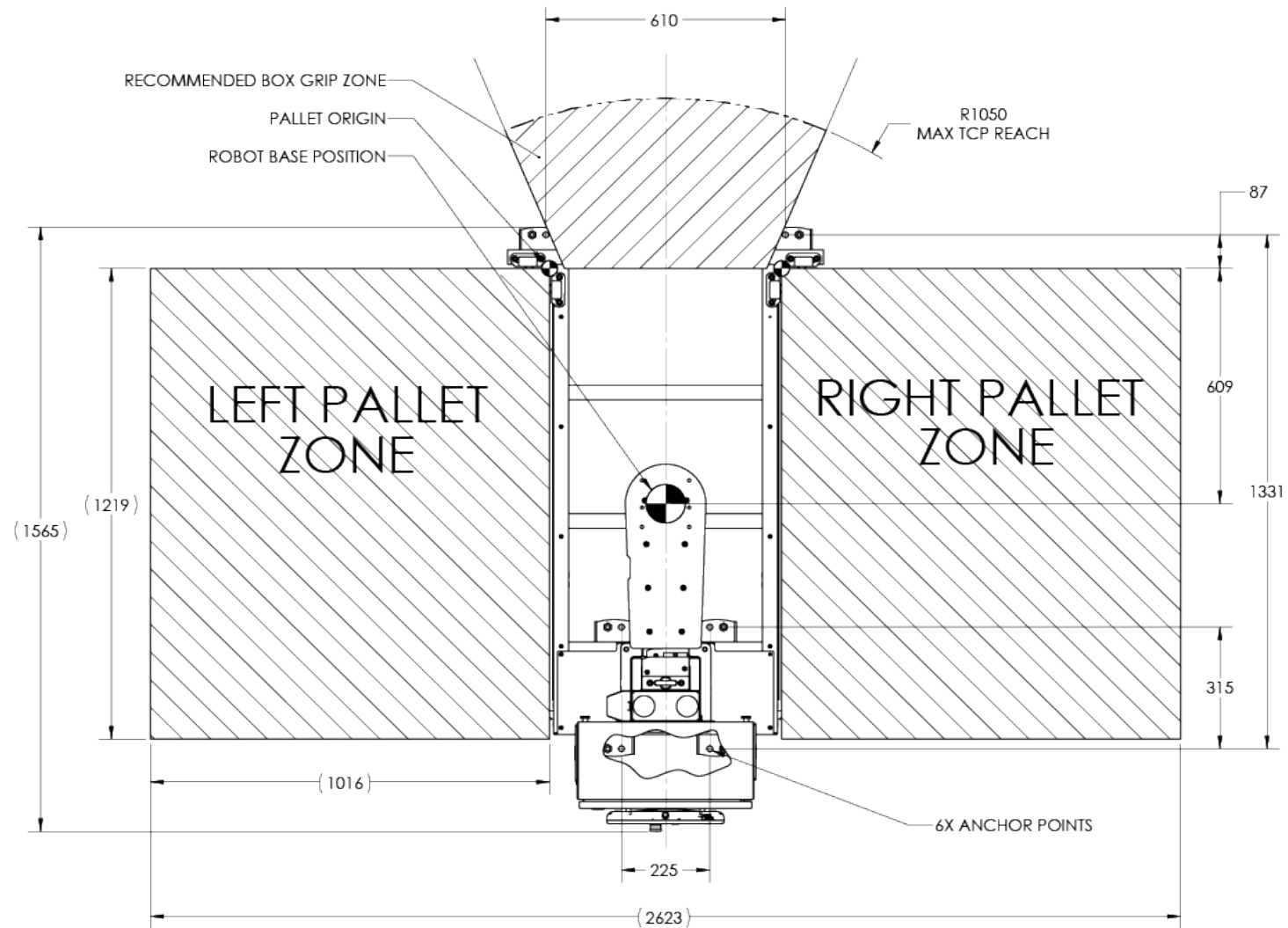


Fig. 12-1: Palletizing Work Zones Schema for UR10



12.2. Safety Connections

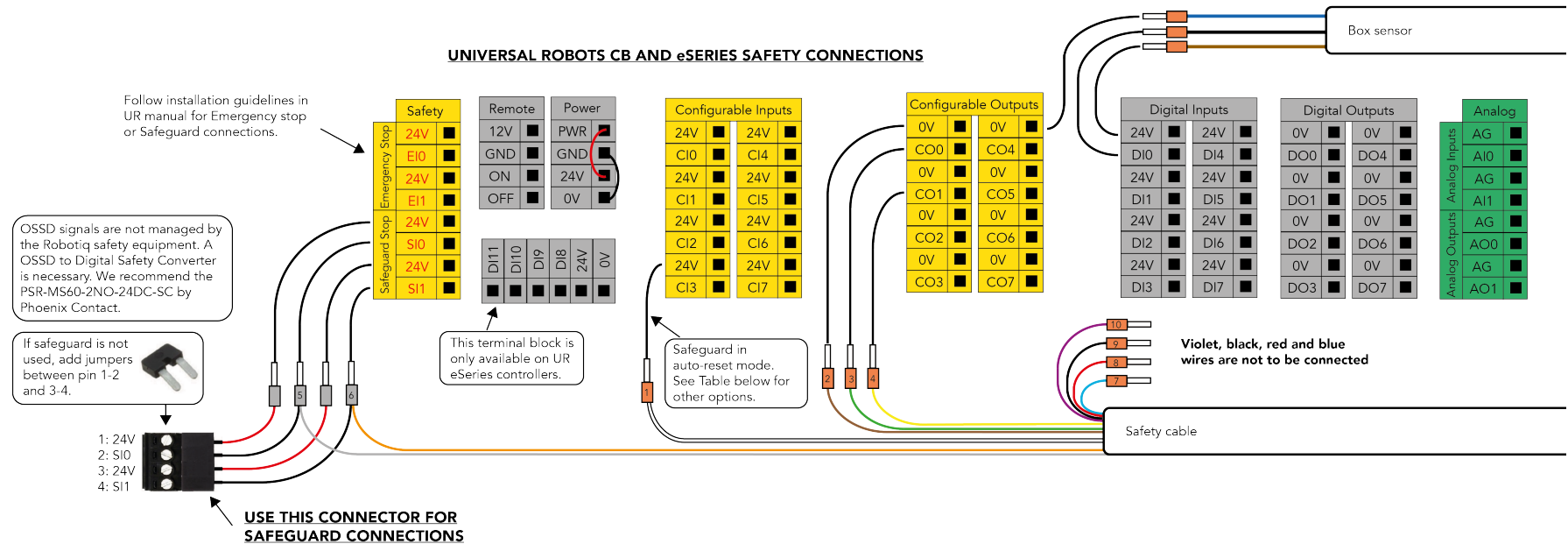


Fig. 12-2: Universal Robots Controller Safety Connections Schema



Wire #	Color	Function	Description
1	White	Safeguard Reset	<p>When using a safeguard reset button, connect wire #1 to the same configurable input as the button.</p> <p>To enable an automatic safeguard reset of the Solution using an area scanner:</p> <ul style="list-style-type: none"> Connect wire #1 to an available 24 V terminal in the UR controller. The system will auto-start when no safeguard signal is triggered.
2	Brown	0V	0V link between both electrical enclosures.
3	Green	UR E-Stop Status 1	E-Stop status signal when an emergency signal is applied to EI0.
4	Yellow	UR E-Stop Status 2	E-Stop status signal when an emergency signal is applied to EI1.
5	Grey	UR Safeguard input 1	UR does not support safeguard statuses in configurable outputs. Connect this pin to the regular safeguard input SI0 for status.
6	Orange	UR Safeguard input 2	UR does not support safeguard statuses in configurable outputs. Connect this pin to the regular safeguard input SI1 for status.

Table 12-1: Safety Wires Description



13. Contact

www.robotiq.com

Contact Us

Phone

1-888-ROBOTIQ (762-6847)
(01) 418-380-2788 Outside US and Canada

Technical support and engineering

option 3

Sales

option 2

Head office

Robotiq:
966, chemin Olivier
Suite 500
St-Nicolas, Québec
G7A 2N1
Canada

