

# BIN PICKING *KIT*

Original Notice

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Robotiq Bin Picking Kit  
for e-Series Universal Robots



Instruction Manual

LEAN   
ROBOTICS

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# Revisions

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

**2020/10/05**

Initial release



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Information provided by Robotiq in this document is believed to be accurate and reliable. However, no responsibility is assumed by Robotiq for its use. There may be some differences between the manual and the product if the product has been modified after the edition date.

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



# 1. General Presentation

The Robotiq Bin Picking kit enables the quick deployment of pick & place and machine tending applications for simple shape parts (such as flat parts and cylinders) that are randomly placed in a bin. It is powered by the Pickit M-HD vision system, the Robotiq EPick gripper with its extension kit and the Machine Tending Copilot Software.

The terms "Gripper" , "EPick Gripper" , "EPick Vacuum Gripper" and "EPick" used in the following manual all refer to the Robotiq EPick Vacuum Gripper. Following the same principle, the term "Pickit Vision System" , "Camera" , "M-HD Camera" and "Pickit Camera" , refer to the Pickit M-HD Camera unless specified.

## Info

The following section presents the key features of the Bin Picking Kit components and must not be considered as appropriate to the operation of the kit. Each feature is detailed in the appropriate section.

## Info

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

## 1.1. Bin Picking Kit components

### 1.1.1. EPick Gripper

The EPick Gripper or EPick Vacuum Gripper is a Vacuum Gripper that generates a vacuum with an electric vacuum pump. This robotic peripheral is designed for industrial applications and generates a vacuum with an electric vacuum pump. Its design makes it a unique robotic end-of-arm tool to quickly pick, place and handle a large range of parts of varying sizes and shapes. The EPick Gripper is compatible with the Robotiq standard coupling interface.

## Info

For more details about the EPick Gripper, please refer to its Instruction manual available on [support.robotiq.com](https://support.robotiq.com)



Fig. 1-1: Robotiq EPick Gripper



## 112. Extension Kit

An Extension Kit is provided with the Bin Picking Kit. It allows the robot to empty the bin without entering the gripper inside, adding reliability and simplifying the configuration of the cell. The kit is composed of three extensions of 200 mm length each, which means you can extend your reach up to 600 mm. An adapter G1/4 to G1/8 is also included to be able to use G1/8 suction cups like the ones included in the kit.

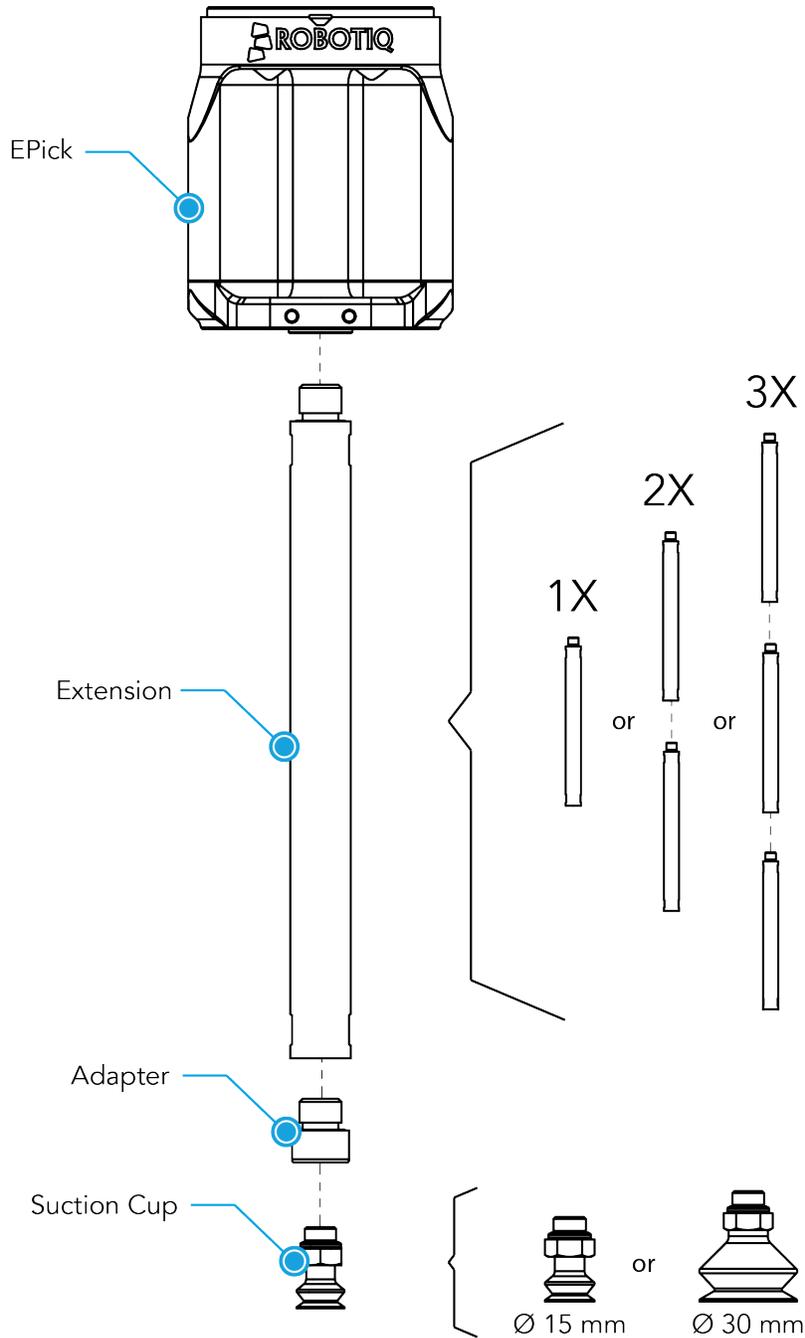


Fig. 1-2: Extension Kit



## 113. Machine Tending Copilot

"Machine Tending Copilot" used in the following manual refer to a Robotiq Copilot license unless otherwise specified. This Robotiq software interface provides force and torque feedback that can be used for robot hand guiding, force control processes, assembly tasks, product testing, and much more. It contains all functionalities to program this application easily.

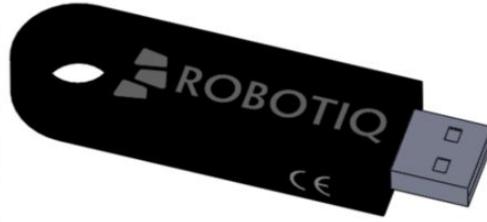


Fig. 1-3: Copilot License Dongle

### Info

For more details about the Copilot Manual , please refer to its Instruction Manual, available on [support.robotiq.com](https://support.robotiq.com).

## 114. Pick it M-HD Camera

Pickit M-HD is a proven 3D vision system that is both powerful and easy to deploy.



Fig. 1-4: Pickit M-HD Camera

### Info

For more details about the M-HD Camera, please refer to its [support documentation](#).



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## 2. Safety

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### Warning

The operator must have read and understood all of the instructions in the following manual before operating the Robotiq Bin Picking Kit.

### Caution

The term "operator" refers to anyone responsible for any of the following operations on the Robotiq Bin Picking Kit:

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

This manual covers the various components of the Robotiq Bin Picking Kit 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.



## 2.1 Warning

### Caution

Any use of the Robotiq Bin Picking Kit in non-compliance with these warnings is deemed inappropriate and may cause injury or damage.

### Warning

- Always use the suction cup system and its components (air nodes, port plug, etc.) with the Robotiq Vacuum Gripper only.
- Never operate the Vacuum Gripper with leaking or worn parts.
- The Vacuum Gripper and the camera need to be properly secured before operating the robot.
- Do not install or operate a Vacuum Gripper or a Camera that is damaged or has lacking parts.
- Never supply the Gripper with an alternating current source.
- Always respect the Camera's electrical and power supply specifications.
- Make sure all cord sets are always secured at both ends—Gripper, Camera and robot.
- Always meet the recommended keying for electrical connections.
- Make sure no individuals or assets are in the vicinity of the robot and/or Gripper prior to initializing the robot.
- Make sure no one is in the Camera field of view before initializing the robot's routine.
- Always meet the Gripper's payload specifications.
- Set your vacuum level based on your application.
- Keep body parts and clothing away from the Gripper while the device is powered on.
- Do not use the Gripper on people or animals.
- Never stand under suspended loads held by the Vacuum Gripper.

### Caution

For other warnings relative to Pickit M-HD camera, please refer to the Safety instructions section on its [documentation website](#).

### 2.1.1 Risk assessment and final application:

The Robotiq EPick Gripper is meant to be used on cobots and industrial robots.

The robot, the Vacuum Gripper, the Pickit M-HD Camera and any other equipment used in the final application must go through a comprehensive risk assessment process before they can be used. Special care must be taken during this step if custom mounting options are used for the suction cups.

### Caution

It is the robot integrator'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 contact between body parts and suction cups during gripping;
- Risk of load ejection resulting from loss of vacuum;
- Risk of load dropping resulting from loss of vacuum;
- Risk of pinching between the EPick Gripper and the part(s) or the environment;
- 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

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)	Power failure to the Vacuum Gripper. The vacuum level will drop to ambient pressure and the object will be lost.
Robot controller supply (Any 24V pin)	Vacuum Gripper powered ON. <ul style="list-style-type: none"> <li>• If an object is detected: the vacuum level will continue to be regulated and the object will not be lost.</li> <li>• If no object is detected: the Vacuum Gripper will go into a standby state 2 seconds after the e-Stop button is pressed.</li> </ul>

### Warning

Loss of vacuum can occur due to power failure.



## 2.2. Intended Use

The EPick Gripper is designed for gripping and temporarily securing or holding objects using the EPick Gripper while the Pickit Vision System is designed for locating objects in a region of interest.

### Caution

The EPick Vacuum Gripper is NOT intended for applying force against objects or surfaces.

The gripper is intended for installation on a robot or other automated machinery and equipment while the camera is intended for installation on top of the workstation, over the bin, so it can visualize all the application.

### Caution

For additional information relative to the intended use of the Pick M-HD camera, please refer to the Safety instructions section on its [documentation website](#).

### Info

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

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



## 3. Installation

The following subsections will guide you through the installation and general setup of your Robotiq Bin Picking Kit.

### Warning

Before installing:

- Read and understand the safety instructions related to the Bin Picking Kit.
- 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 EPick Gripper of the Bin Picking Kit, or even turn on the power supply, before the device is firmly anchored and the machine area is cleared.

### 3.1. Scope of Delivery

Included:

- Pickit M-HD 3D Vision System
- EPick Gripper kit
- Machine Tending Copilot
- Extension kit for Vacuum Grippers

### 3.2. Required Tools and Equipment

To install the EPick Gripper:

- 4 mm hex key to mount the coupling onto the robot
- 4 mm hex key to mount the Vacuum Gripper onto its coupling
- 3 mm hex key to mount the connector protector



## 3.3. Environmental and Operating Conditions

### Caution

Use of the Bin Picking Kit is not recommended in presence of chemicals in the environment.

### 3.3.1. EPick Gripper

Condition	Value
Minimum storage/transit temperature	-30°C [-22°F]
Maximum storage/transit temperature	60°C [140°F]
Minimum operating temperature	5°C [41°F]
Maximum operating temperature	40°C [104°F]
Humidity (non-condensing)	20-80% RH
IP Rating	IP 4X

Table 3-1: Environmental and operating conditions of the EPick Gripper

### 3.3.2. Pickit M-HD Camera

### Caution

For information about the environmental and operating conditions of the Pickit M-HD Camera, please refer to the [support documentation](#).



## 3.4. Mechanical Installation

### 3.4.1 Installing the Camera

Prior the installation of the EPick Gripper, the camera must be installed and calibrated. Make sure to follow the steps described in the [Pickit documentation](#). As a guideline, the field of view, depending on the distance is as follow:

Field of View	Distance
433 x 271 mm	0.62 m
691 x 432 mm	1 m
1330 x 871 mm	2 m

Table 3-2: Field of view depending on the distance.

### 3.4.2. Installing the EPick Gripper onto the robot

For purposes of power and communication, a coupling must be used to attach the EPick Gripper to the robot.

Here are the steps to follow to mount the Gripper on the robot arm (exploded view in figure below).

1. Mount the coupling on the robot wrist using the provided M6 screws and tooth lock washers. Align properly with the dowel pin.
2. Fasten the Gripper to the coupling using the provided M5 screws and tooth lock washers.
3. Plug the coupling's cable into the robot's wrist connector.
4. Cover the connection using the protector and the provided M4 screws.

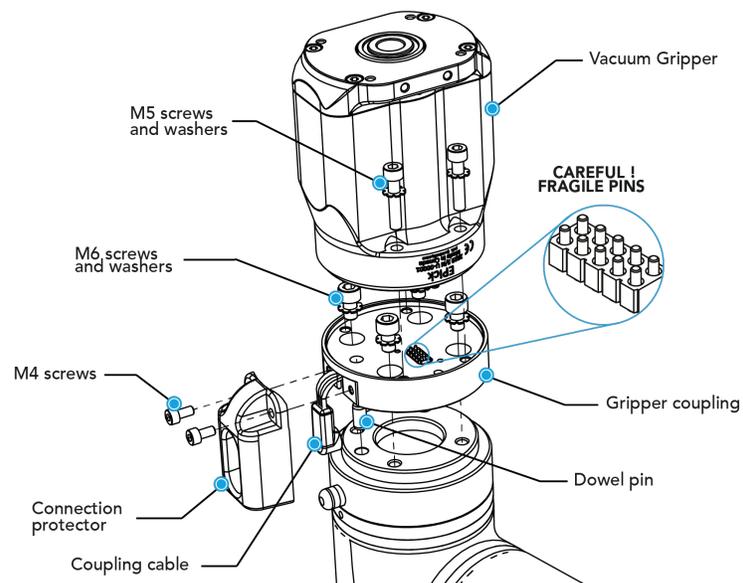


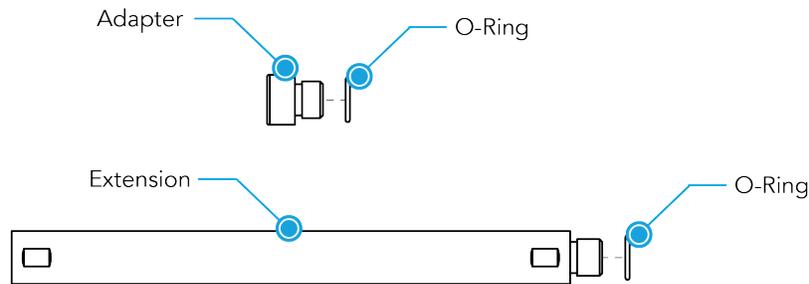
Fig. 3-1: Installing the EPick Gripper onto the robot wrist



### 3.4.3. Installing the Extension Kit (VAC-CUP-KIT-EXT-1)

#### Installing the O-Rings

To ensure the tightness of the assembly, make sure there is an O-Ring at the end of the extension as well as the adapter.



*Fig. 3-2: Installation of the O-Ring on the adapter and the extension.*

#### Installing the Extension Kit on EPick

Here are the steps to follow to mount the Extension Kit on the EPick.

##### Tip

For the assembly of the extensions and the adapter, we recommend you to use a medium strength threadlocker to prevent any loose.

1. Fasten an extension onto the end of the EPick Gripper;
2. If applicable, fasten another, or two other extensions;
3. Fasten the adapter onto the last mounted extension.

##### Caution

Do not exceed a torque of 5 Nm.

4. Select the suction cup that best suit your application and screw it at the end of the adapter.



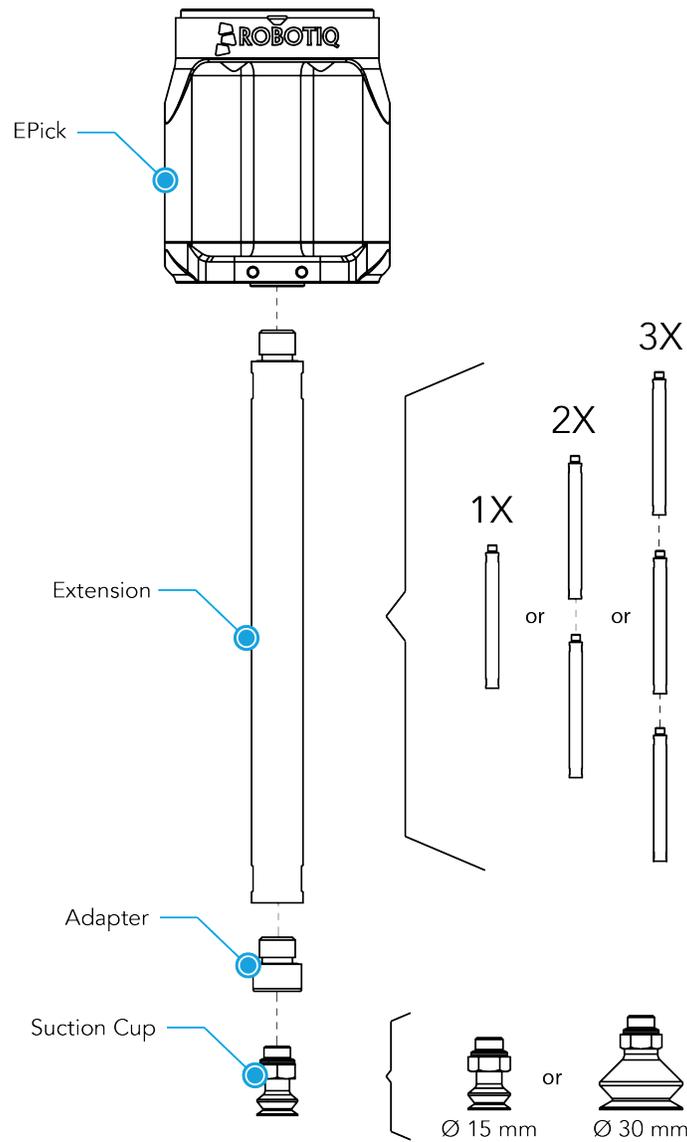


Fig. 3-3: Installation of the Extension Kit onto the EPick Gripper.

## 3.5. Electrical Setup of the EPick Gripper

Power and communication are established with the Gripper via a single device cable. The device cable provides a 24 V power supply and enables serial RS-485 communication to the robot controller.

### Info

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



### 3.5.1 Electrostatic Discharge Safety

The EPick Vacuum Gripper is not ESD safe. If the Vacuum Gripper is installed properly using the toothlock washers, the casing is grounded through the screws that are used to mount the gripper on the coupling. The same thing is true for the coupling. For the EPick Vacuum Gripper, the lower part connected by 4 screws to the casing, as well as the suction cups and the accessories provided, are isolated from the rest of the gripper. Therefore, it is not possible to safely discharge any electrostatic charge that would build up on the part through the gripper.

### 3.5.2. Pinout interface

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

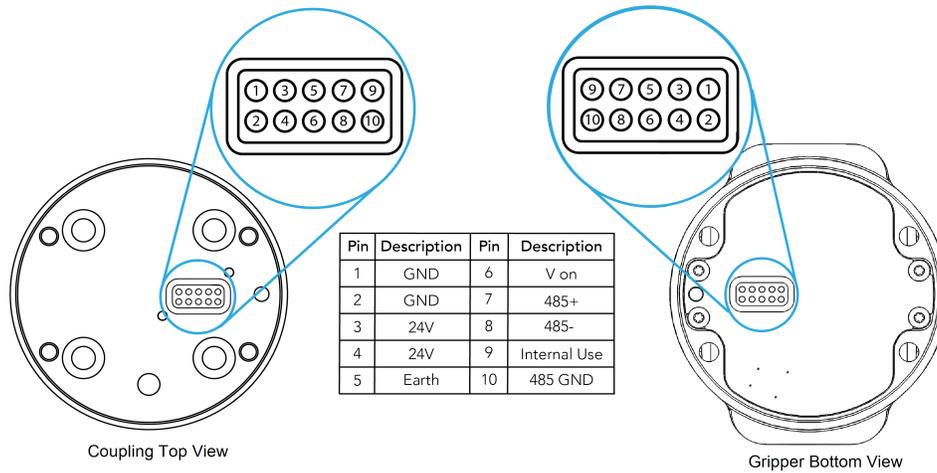


Fig. 3-4: Pinout of the EPick cable-to-wrist coupling.

#### Info

The coupling used in the figure above is used for reference only and corresponds to bolt pattern ISO 9409-1-50-4-M6.



### 3.5.3. Coupling to wrist

The figure below represents the wiring schematic of the Vacuum Gripper with a coupling connecting directly to the robot wrist.

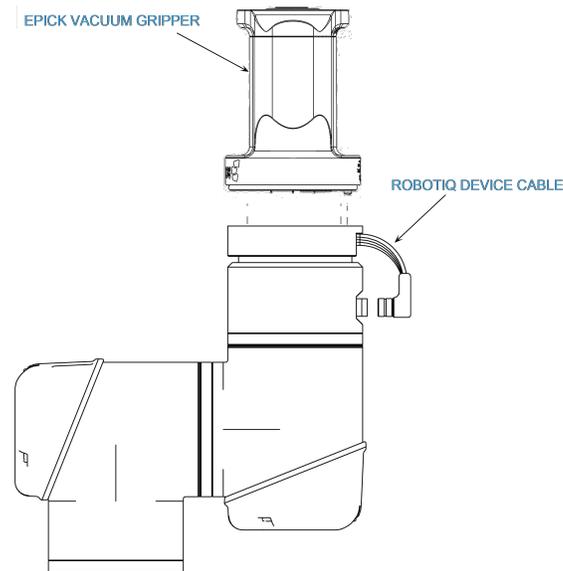


Fig. 3-5: Robotiq EPick Gripper with device cable wiring scheme

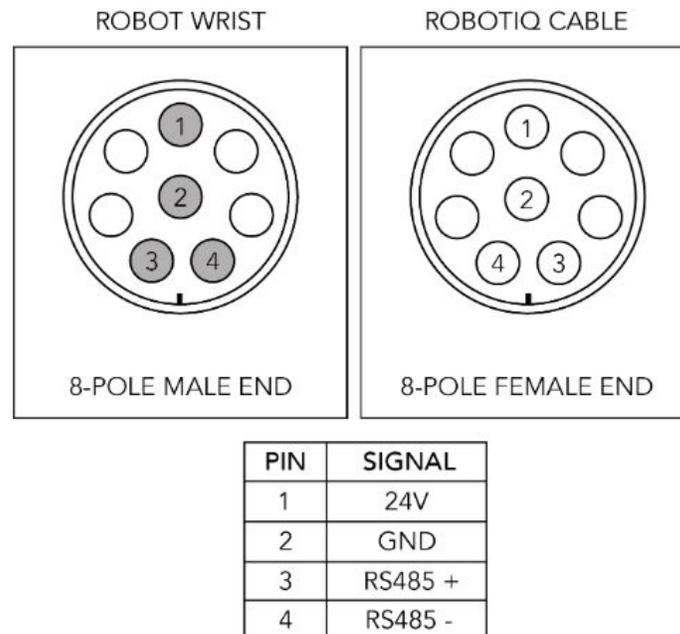


Fig. 3-6: Pinout of the EPick Gripper cable-to-wrist coupling

#### Info

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



## 3.6. Electrical Setup of the Pickit Camera

### Info

For any information regarding the electrical setup of the Pickit Camera, please refer to its [support documentation](#).

## 3.7. 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 package for the Bin Picking Kit.

Robotiq Software	e-Series Controller
Robotiq Grippers URCap Package 1.5.1 and earlier versions	Incompatible
Robotiq Grippers URCap Package 1.6.0 and later versions	Compatible
Robotiq Copilot URCap Package (all versions)	Compatible

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

### Info

For any information regarding the compatibility of the Pickit software, please refer to its [support documentation](#).

### Caution

Prior to use over Universal Robots, adjust the payload and the center of gravity in the Installation tab. Refer to the Mechanical specifications subsections.

### Caution

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



## 3.8. URCap Packages Installation

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

### Info

Browse to the [Bin Picking support page](#) to download the URCap package.

### Info

To use the Camera, Pickit also provides a URCap which can be found and download on [Pickit support website](#).

Make sure the Gripper is properly mounted onto the robot arm. Refer to the **Mechanical 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 (refer to the **Installation for Universal Robots** section).

The Robotiq's URCap package contains:

- The URCap for the Gripper
- The URCap for Machine Tending Copilot
- The Vacuum Gripper toolbar
- The Vacuum node(s)

For details on controlling the Gripper, please refer to the **Software** section.

### Info

Please refer to the **Control over Universal Robots with URCaps Software** section for detailed information on how to program using the URCap package.



## 3.8.1 Robotiq and Pickit URCap packages

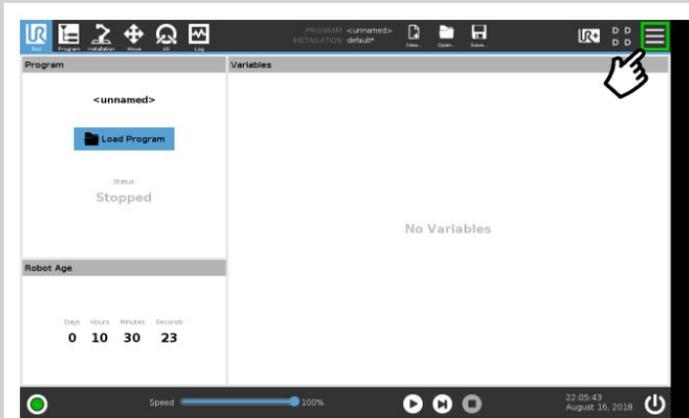
Make sure the Gripper is properly mounted to the robot arm. Refer to the **Mechanical Installation** section for detailed information.

Before proceeding with the installation of the URCap packages, make sure your Universal Robots controller is compatible with the package (refer to the **Installation for Universal Robots** section).

### Info

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

Follow this procedure to install the URCap packages:



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

For Robotiq URCaps

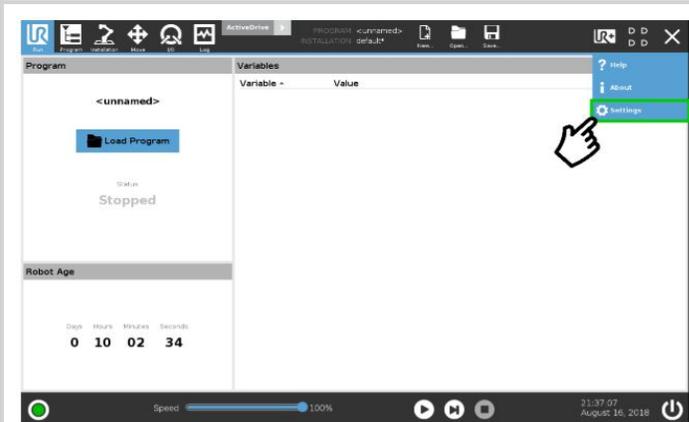
- Go to [support.robotiq.com](http://support.robotiq.com)
- Click on Select product → Bin Picking Kit → Universal Robots
- Click on Software → Bin Picking Software Package → Download ZIP
- Decompress the ZIP archive to the root folder of a USB stick

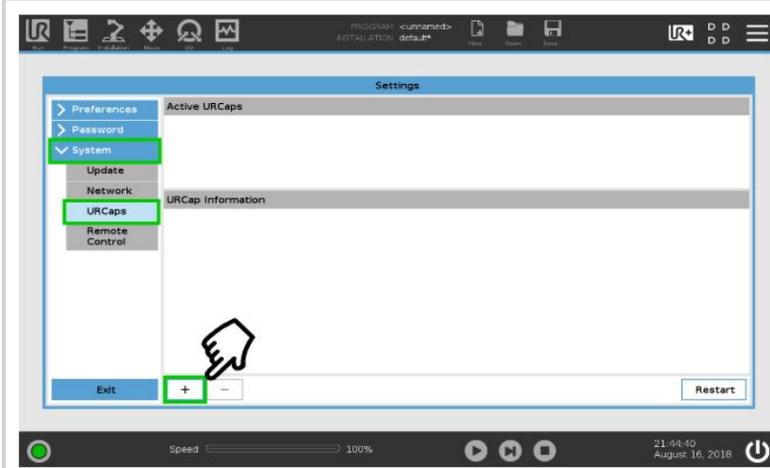
For Pickit URCap

- Please refer to the URCap installation steps described on [Pickit support website](#) and save the file on the **same** USB stick.

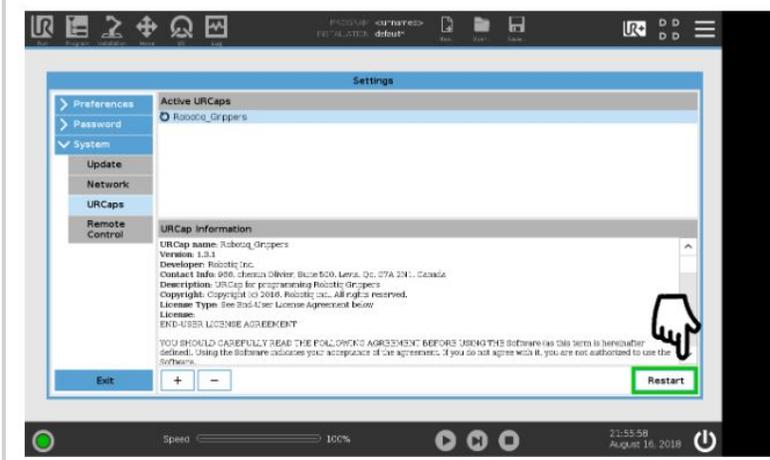
Then,

- Insert the USB stick in the UR teach pendant or controller.
- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.
- Tap **Settings**.





- Tap the **System** button in the navigation pane on the left.
- Select **URCaps** in the dropdown list.
- Press the **plus (+)** button to look for the .urcap files in the available drives.

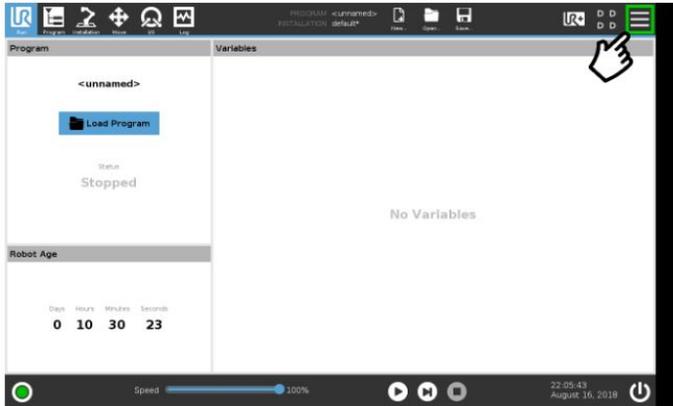


- Select, one at a time the URCap you want to install, then select Open
- Once the file is selected, it will display in the **Active URCaps box**, next to a rounded arrow.
- Repeat the previous steps to install the other URCaps
- Tap the **Restart** button to activate the URCaps.

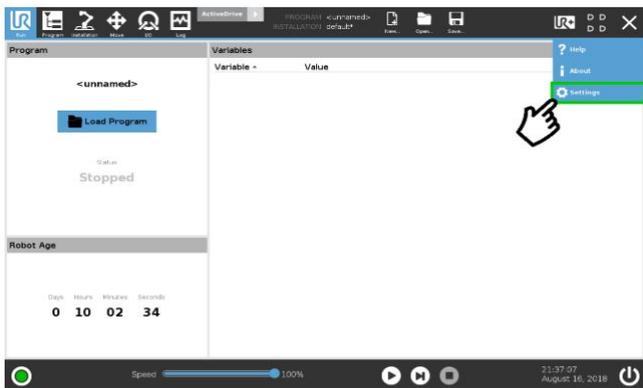


## 3.8.2. Uninstalling a URCap

If you want to uninstall a URCap, follow the procedure below:



- On the teach pendant, tap the **triple bar icon** in the upper right corner of the screen.
- Tap **Settings**.



- Tap the **System** button in the navigation pane on the left.
- Select **URCaps** in the dropdown list.
- Select the URCap you want to uninstall.
- Press the **minus (-)** button to remove the URCap.
- Tap the **Restart** button to deactivate the URCap.

## 3.8.3. Installing License

In order to use the Machine tending Copilot software, connect the Copilot license dongle into a USB port of the Universal Robot controller.

### Warning

Do not disconnect USB license dongle from the robot controller, even after the installation has been completed. It will disable all Copilot functions.



## 3.8.4. License Agreement

### Robotiq Software

#### END-USER LICENSE AGREEMENT

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

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

#### 1. Definition.

1. “ UR” means Universal Robots A/S, a corporation incorporated under the laws of Denmark, having its registered office at Energivej 25, DK-5260 Odense S, which specializes into the conception, advanced manufacturing and sale of robotic products (the “ UR’s Business” );
  2. “ Software” means any of the Licensor’s softwares provided to its customers for the purposes mentioned in Sub-section 1.4 hereof including their modifications and upgrades and their related materials;
  3. “ Licensor” means Robotiq inc., a corporation incorporated under the laws of Quebec, having its registered office at 500-966 chemin Olivier, Lévis, Québec, Canada, G7A 2N1, which specializes into the conception, advanced manufacturing and sale of robotic products (the “ Licensor’s Business” );
  4. “ End-User” means a customer authorized pursuant to this Agreement to install or use the Software in order to make a specific product from the Licensor’s Products compatible and functional with a specific product of the UR’s Product ;;
  5. “ Licensor’s Products” means those products developed by the Licensor in the course of the Licensor’s Business;
  6. “ UR’s Products” means those products developed by UR in the course of the UR’s Business;
  7. “ Licensor’s Authorized Representatives” means and includes the Licensor and Licensor’s authorized vendors, resellers, distributors and licensors;
  8. “ Purchase Agreement” means an agreement between the End-User and the Licensor pursuant to which the End-User purchased one or more of the Licensor’s Products.
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4. Modifications and Upgrades. The Licensor shall be under no obligation to provide any upgrade or modification to the Software. However, the End-User shall be entitled to receive free of charge all modifications and upgrades of the Software provided by the



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

## Pickit Software

For license agreement of Pickit software, please refer to its documentation.



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## 4. Software

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**Info**

For EPick Gripper software information, please refer to the software section of the EPick Instruction manual available on [support.robotiq.com](https://support.robotiq.com).

**Info**

For Copilot software information, please refer to the software section of the Copilot Instruction manual available on [support.robotiq.com](https://support.robotiq.com).

**Info**

For Pickit software information, please refer to the specific section in the [support documentation](#).



# 5. 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 Bin Picking Kit.

- Section 5.1 lists the technical dimensions.
- Section 5.2 presents the mechanical specifications.
- Section 5.3 gives the electrical specifications.

## 5.1. Technical dimensions

### 5.1.1. EPick Gripper

The figure below represents the Gripper's dimensions.

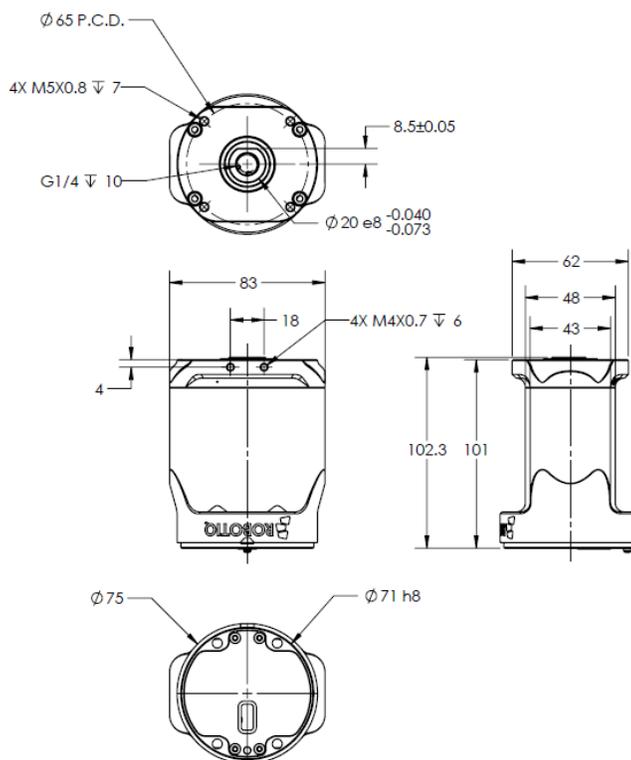


Fig. 5-1: EPick general dimensions



## 5.12. Coupling

Operating the Vacuum Gripper requires a coupling provided by Robotiq. The coupling is mandatory since it integrates electronics and electrical contacts.

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

Bolt pattern for coupling **GRP-ES-CPL-062** is compatible with :

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

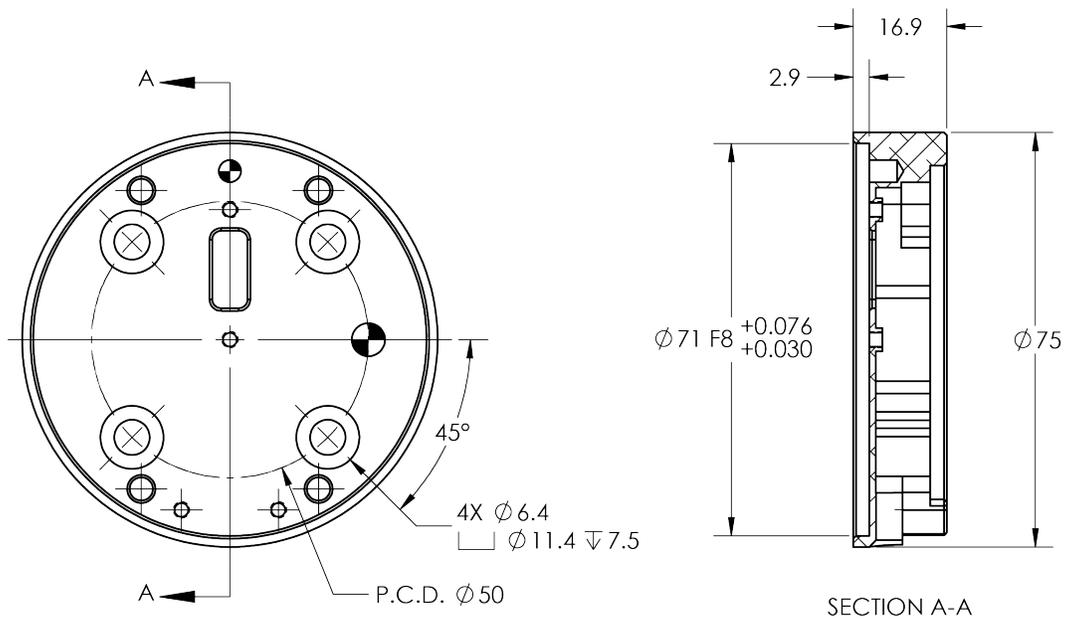


Fig. 5-2: Coupling for ISO 9409-1-50-4-M6.

## 5.13. Pickit Camera

For technical dimensions of the Pickit M-HD camera, please refer to its documentation.



## 5.2. Mechanical specifications

### 5.2.1 EPick Gripper with Extensions

Specifications	Metric Units	Imperial Units
Energy source	Electricity	
Gripper mass (including coupling)	710 g	1.55 lbs
Extension mass	133 g	0.29 lbs
Adapter mass	8 g	~0.02 lbs
Maximum vacuum level	80 %	
Maximum mean flow	12L/min	3.17 gal/min
Payload range <sup>1</sup>	0-16 kg	0-35 lbs
Gripping time <sup>2</sup>	150 ms	
Release time <sup>2</sup>	180 ms	
Noise level	64 dBa	

<sup>1</sup>This payload range is only for a vertical grasp and a negligible robot acceleration. For more details or for information about how to calculate your own payload, please refer to the Payload and force section.

<sup>2</sup> The Gripping and Release time is the time for one suction cup of 40 mm and can vary according to the suction cups configuration and vacuum level.

*Table 5-1: Specifications of the EPick Gripper with extensions*

#### Info

All specifications are measured with coupling **GRP-CPL-062**.



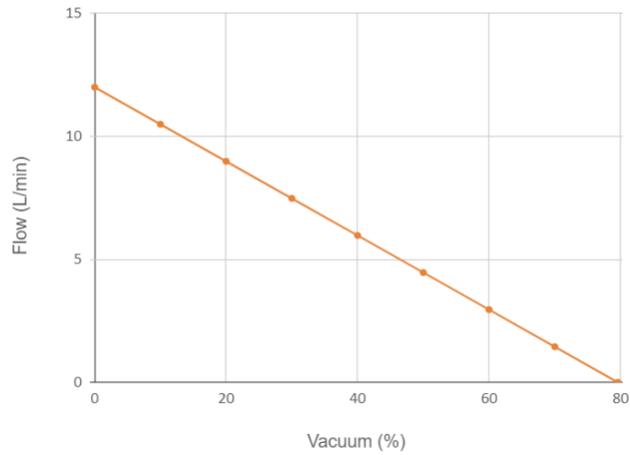


Chart 5-2: Flow (L/min) vs Vacuum (%)

## Payload and force

When a load is to be picked by an EPick Gripper, several factors have to be considered. One of them is the vacuum level percentage selected. This value represents the pressure difference between the inside of the system and the ambient pressure. This table is valid for a nominal atmospheric pressure of 101,3 kPa.

Vacuum level (%)	Pressure difference (kPa)
0	0
10	10.1
20	20.3
30	30.4
40	40.5
50	50.7
60	60.8
70	70.9
80	81.1
90	91.2
100	101.3

Table 5-3: Conversion of absolute pressure to vacuum level



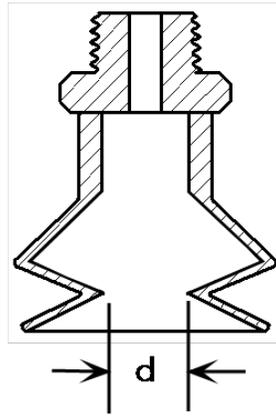


Fig. 5-3: Suction cup with inside diameter

Depending on the selected suction cup, the maximum grip strength can be determined with the following equation:

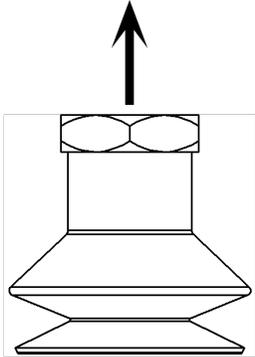
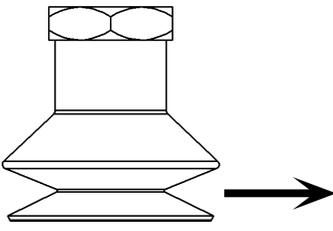
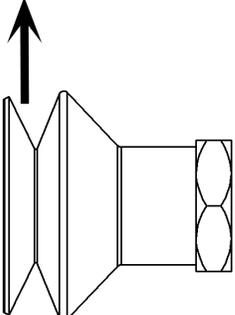
$$F_p(N) = \frac{A \times P \times n}{1000}$$

Where:

- A= Suction cups internal surface (mm<sup>2</sup>)
- P= Vacuum Level (kPa)
- n= Quantity of suction cups to lift-off

For more details, please refer to the specifications provided by the suction cup manufacturer.

The payload is the mass to be lifted according to an acceleration and an applied safety factor. There are three main types of load application that are represented in the following cases. Note that the arrows represent the robot movement.

Case #1	Case #2	Case #3
		
$F_c = m \times (g + a) \times S$	$F_c = m \times \left(g + \frac{a}{\mu}\right) \times S$	$F_c = \frac{m}{\mu} \times (g + a) \times S$



Where:

- $M$  = mass (kg)
- $G$  = gravitational acceleration ( $m/s^2$ )
- $A$  = robot acceleration ( $m/s^2$ )
- $\mu$  = friction coefficient
- $S$  = safety factor

The maximum grip strength of the suction cup must always be bigger than the payload ( $F_p > F_c$ ) to guarantee the good grip of the piece. Robotiq recommends a minimum security factor of 2 in every case. However, a factor 4 is recommended for the next situations:

- Low friction coefficient
- Important robot acceleration
- Non-uniform surface
- Porous surface
- Unequal distribution of the payload in regards to the suction cups

Two categories of material can be lifted by the vacuum gripper: porous and non-porous. A non-porous material is defined as a material where air leakages are negligible and where it is possible to precisely attain a vacuum percentage between 10 and 80%.

### Example 1: Non-porous material

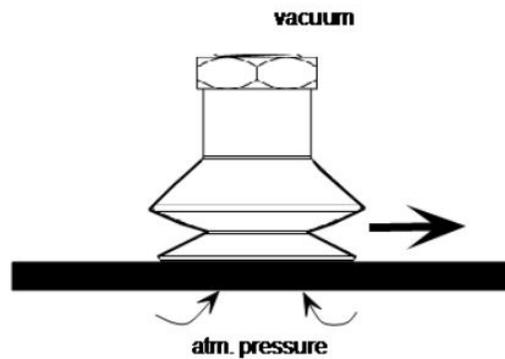


Fig. 5-4: Non-porous material

#### Initial data:

- Material type: non-porous
- Application type: Case #2
- Suction cup diameter ( $d$ ): 40 mm ( $r=20$  mm)
- Percentage of vacuum: 60% (which is equivalent to 60.8 kPa, according to the conversion table above)
- Mass: 2 kg
- Acceleration: 1.2  $m/s^2$
- $n = 4$



$$F_p(N) = \frac{A \times P \times n}{1000}$$

$$A = \pi \times r^2$$

$$A = 1256,6 \text{ mm}^2$$

$$F_p(N) = \frac{1256,6 \times 60,8 \times 4}{1000}$$

$$F_p(N) = 305,6 \text{ N}$$

### Case # 2

- $m = 2 \text{ kg}$
- $g = 9,81 \text{ m/s}^2$
- $a = 1,2 \text{ m/s}^2$
- $S = 4$  (recommended)
- $\mu = 0,5$

$$F_c = m \times \left( g + \frac{a}{\mu} \right) \times S$$

$$F_c = 2 \times \left( 9,81 + \frac{1,2}{0,5} \right) \times 4$$

$$F_c = 97,7 \text{ N}$$

Validation that  $F_p > F_c$  :  $305,6 \text{ N} > 97,7 \text{ N}$

Since  $305,6 \text{ N} > 97,7 \text{ N}$  , the rule is respected and we can ensure the good grip of the part.

The following graph represents the recommended acceleration in function of the payload when the Vacuum Gripper is used with the Robotiq brackets and accessories. Note that the optimal suction cup choice is represented.

#### Info

- Maximum acceleration with Universal Robot:  $150 \text{ m/s}^2$
- Default speed with Universal Robots:  $1,2 \text{ m/s}$
- Maximum acceleration recommended by Universal Robots for an optimistic robot lifetime:  $2,5 \text{ m/s}^2$



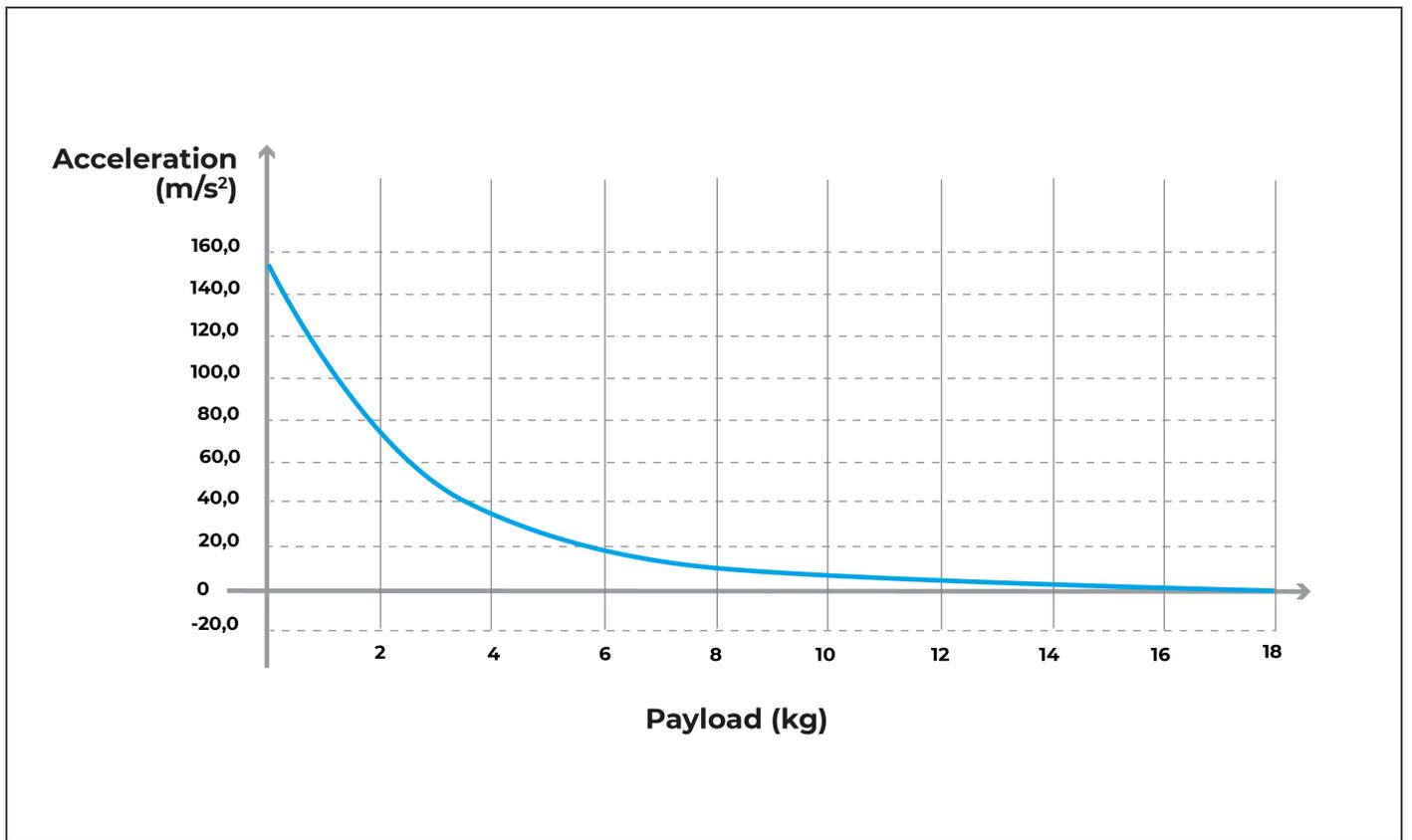


Fig. 5-5: Acceleration of the robot in function of the Vacuum payload

### Example 2: Porous material

For porous material, non-negligible air leakages can be observed. Therefore, the use of the EPick is not recommended. Considering that, the Vacuum Gripper will work in a continuous mode to compensate leakages and the reached vacuum will depend on 4 main factors:

1. Pump flow rate
2. The model of suction cups
3. Porosity of materials
4. Payload to lift



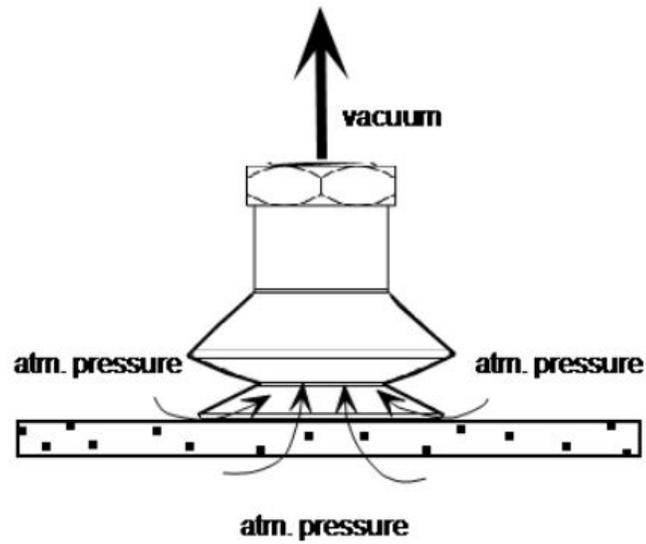
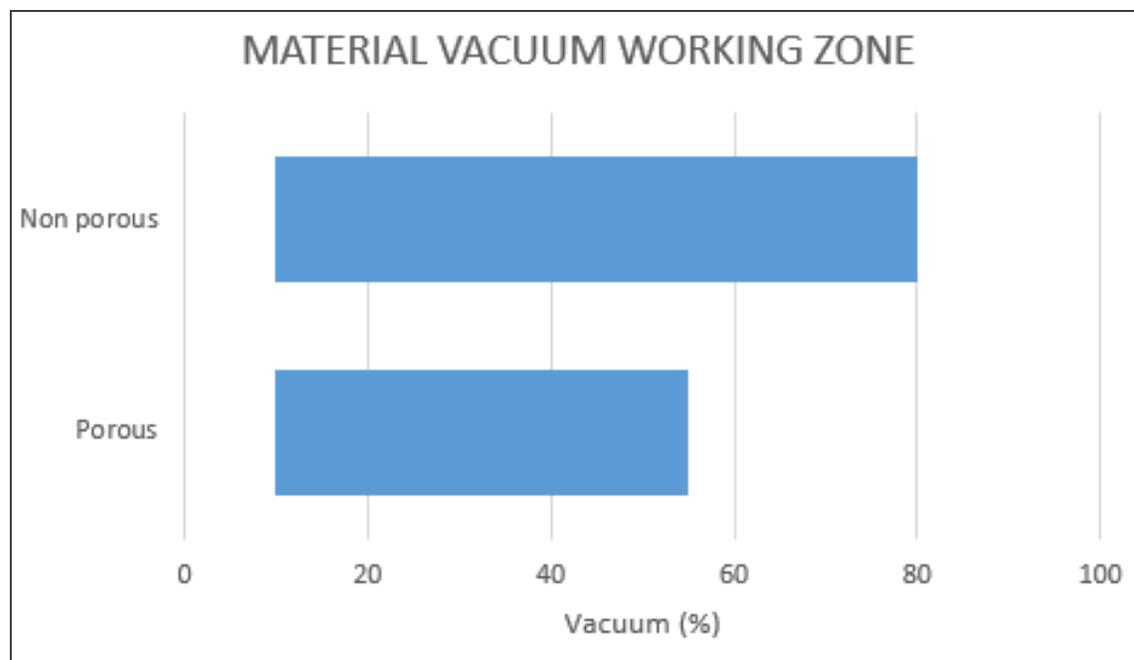


Fig. 5-6: Porous material



#### Info

Robotiq recommends to do some tests to determine the maximum grip strength of the suction cup, depending on the selected material to lift. It is not recommended to operate the robot with vacuum levels lower than 10%.



**Info**

Cardboard material should give percentage vacuum values lower than 15%.

**Initial data:**

- Material type: porous
- Application type: Case #1

**Case # 1**

$$F_c = m \times (g + a) \times S$$

- $m = 0.2 \text{ Kg}$
- $g = 9.81 \text{ m/s}^2$
- $a = 1.2 \text{ m/s}^2$
- $S = 4$  (recommended)

$$F_c = 0,2 \times (9,81 + 1,2) \times 4$$

$$F_c = 8,8 \text{ N}$$

A test has been made with this material and it was statistically possible (without any acceleration) to pick a mass of 1 kg.

$$F_p = 1 \times 9,81 \text{ m/s}^2$$

$$F_p = 9,81 \text{ N}$$

Since,  $F_p > F_c$  ( $9.81 \text{ N} > 8.8 \text{ N}$ ), it is possible to lift a mass of 0.2 kg, as required.



## Center of mass and tool center point

	Combination	Mass (g)	Center of Mass (mm)			Tool Center Point (mm)		
			X	Y	Z	X	Y	Z
EPick + e-Series Coupling	Without any extension or adapter	710	0	0	52	0	0	113
	1 x Extension only	843	0	0	77	0	0	313
	2 x Extensions only	976	0	0	122	0	0	513
	3 x Extensions only	1109	0	0	181	0	0	713
	Adapter only	718	0	0	52	0	0	123
	1 x Extension + adapter	851	0	0	79	0	0	323
	2 x Extensions + adapter	984	0	0	125	0	0	523
	3 x Extensions + adapter	1117	0	0	184	0	0	723
	Extension	-	133	0	0	97	0	0
Adapter	-	8	0	0	2	0	0	10

## Moment Limitation

### Warning

The following limits must be respected at all time. Calculation of maximum moment should include the robot acceleration, total payload and a safety factor.

Parameters	Maximum Value
Total moment	150 Nm

Table 5-4: Moment limitation of the Vacuum Gripper



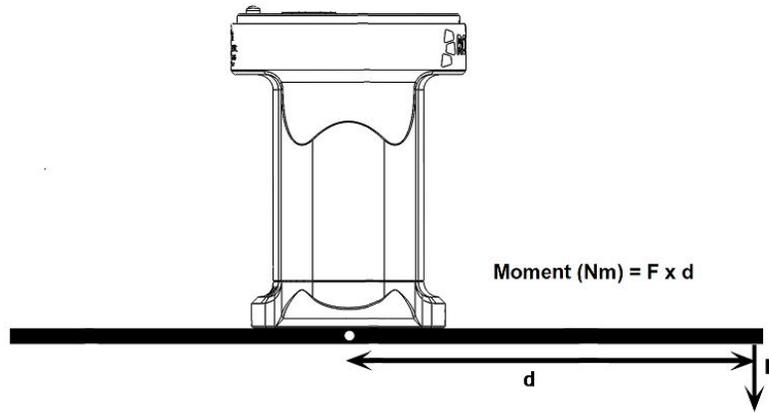


Fig. 5-7: EPick Moment limitation

Parameters		Maximum Value
Total moment		4 Nm
Radial Force	1 extension	20 N
	2 extensions	10 N
	3 extensions	6,6 N

Table 5-5: Moment limitation of the Vacuum Gripper with extension(s)



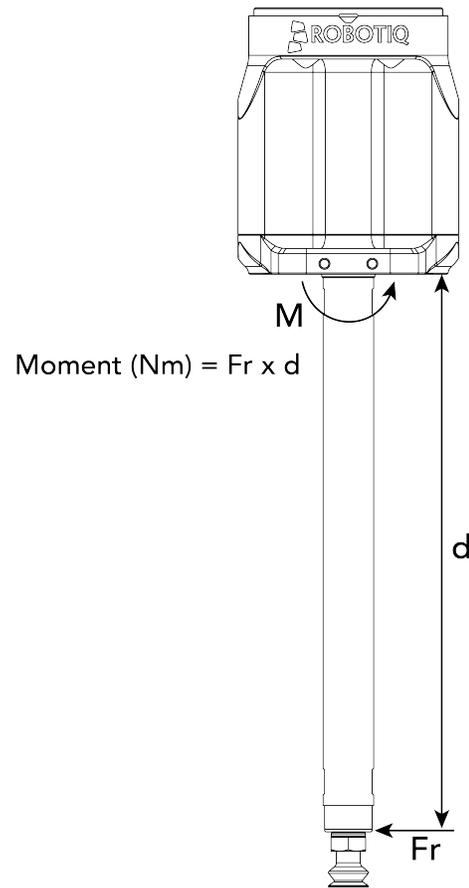


Fig. 5-8: EPick Moment limitation

## 5.2.2. Pickit Camera

For all information about mechanical specifications of the M-HD Pickit camera, please refer to its own documentation on [Pickit website](#).

## 5.3. Electrical specifications

### 5.3.1. EPick Gripper

Specification	Value
Operating supply voltage	24 VDC $\pm$ 10%
Quiescent power (minimum power consumption)	1 W
Peak current	1.8 A for 80 ms when vacuum pump starts
Minimum Peak	600 mA (with current limitations)

Table 5-6: EPick Gripper electrical specifications



## 5.3.2. Pickit Camera

For all information about electrical specifications of the M-HD Pickt camera, please refer to its own documentation on [Pickit website](#).



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## 6. Maintenance

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### Info

For more information about the maintenance of the Bin Picking Kit, please refer to its components: [Pickit support documentation](#) and [EPick Gripper instruction manual](#).



## 7. 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.

For spare parts, kits and accessories relative to the Epick Gripper, please refer to the Spare Parts, Kits and Accessories section of the Epick Gripper manual for e-Series available on [support.robotiq.com](https://support.robotiq.com).

For spare parts, kits and accessories relative to the Pickit M-HD Camera, please contact Robotiq support team at [support@robotiq.com](mailto:support@robotiq.com)

The list below contains spare parts, kits and accessories that are specific to the Bin Picking Kit.

Item	Description	Ordering Number
Extension Kit for EPick / Airpick	<ul style="list-style-type: none"> <li>• 3 x 20 cm G1/4 Extension tubes</li> <li>• 1 x Adapter G1/4 to G1/8</li> <li>• 1 x Vacuum cup (1.5 bellows, 30 mm diameter)</li> <li>• 1 x Vacuum cup (1.5 bellows, 15 mm diameter)</li> </ul>	VAC-CUP-KIT-EXT-1



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## 8. Troubleshooting

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**Info**

Please refer to the Troubleshooting section of the [EPick Gripper instruction manual](#).

**Info**

Please refer to the [Pickit support documentation](#) for more details on troubleshooting of the Pickit M-HD camera.



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## 9. Warranty

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**Info**

For EPick Gripper warranty information, please refer to its instruction manual, available on [support.robotiq.com](https://support.robotiq.com).

**Info**

For Pickit M-HD Camera warranty information, please refer to the [support documentation](#).



# 10. Harmonized Standards, Declarations and Certificates

## 10.1. Original EC declaration of incorporation for EPick Gripper



### EC Declaration of Incorporation (Original)

In accordance with the EC Machinery Directive 2006/42/EC, Annex II, 1., Section B.

We, the manufacturer:

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

hereby declares, under sole responsibility, that the product:

**EPick / EPick Vacuum Gripper**  
All serial number  
(and accessories)

complies with the following essential requirements of the European Directive 2006/42/EC on machinery:

1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.1, 1.5.2, 1.5.4, 1.5.8, 1.5.10, 1.5.11, 1.7.2.

The product is considered as partly completed machinery and has been evaluated in accordance with the following harmonised standards:

- *EN ISO 12100:2010*

**The product must not be put into service until the final machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive 2006/42/EC, including amendments.**

The manufacturer declares that the product complies with the following European Directives and harmonised standards:

- **2014/30/EU (EMC Directive)**
  - *EN 61000-6-2:2016*
  - *EN 61000-6-4:2007 + A1:2011*
- **2011/65/EU + 2015/863 (RoHS Directive)**
  - *EN 50581:2012*
- **2012/19/EU (WEEE Directive)**
  - *EN 50419:2005.*

The manufacturer also declares the use of these other technical standards, as far as applicable:

*ISO 9409-1:2004.*

Name and address of the person authorised to compile the relevant technical documentation:

Nicolas Tremblay, CEP, see manufacturer address.

The relevant technical documentation is compiled in accordance with part B of Annex VII of Directive 2006/42/EC and will be presented electronically by the manufacturer to competent national authorities, if required with a substantiated reason.

Signed in Lévis on November 7<sup>th</sup>, 2019

Louis-Alexis Allen Demers, ing., Eng., Ph. D.  
Hardware Director



## 10.2. EC declaration of incorporation for Pickit M-HD Camera

For EC declaration of incorporation for Pickit M-HD Camera, please refer to [Pickit support website](#).

## 10.3. Applied standards

This section describes all applied harmonized standards for the design and production of the EPick Vacuum Gripper. Conformity of the product is only met if all instructions of the current user manual are followed. Among others; proper installation, safety measures and normal usage must be respected. A risk assessment specific to the user's final application must also be carried out.

### Info

For information about Pickit M-HD Camera applied standards, please refer to its documentation on [Pickit website](#).

### Caution

Conformity of the product is only met if all instructions of the following manual are followed. Among others; installation, safety measure and normal usage must be respected.

The following standards have been applied:

<b>ISO 12100</b>	<b>2010</b>	Safety of machinery — General principles for design — Risk assessment and risk reduction
<b>ISO 9409-1</b>	<b>2004</b>	Manipulating industrial robots – Mechanical interfaces – Part 1: Plates
<b>IEC 61000-6-2</b>	<b>2016</b>	Generic standards – Immunity standard for industrial environments
<b>IEC 61000-6-4</b>	<b>2007 + A1: 2011</b>	Generic standards – Emission standard for industrial environments
<b>EN 50581</b>	<b>2012</b>	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
<b>EN 50419</b>	<b>2005</b>	Marking of electrical and electronic equipment



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# 11. Contact

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

## Contact Us

### Phone

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

### Technical support and engineering

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### Sales

option 2

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