ROBOTIQ

ROBOTIQ SCREWDRIVING SOLUTION

Original Notice

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**Robotiq Screwdriving Solution
for Universal Robots**

Instruction Manual

LEAN ROBOTICS

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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.

Revision 2023/04/05

- Updated Mechanical Specifications section:
  - Screwdriver torque specifications (torque load, torque tolerance).

- Updated the script functions in the Software section and Script Functions appendix.

- Updated the Screw Feeder Behavior in the Troubleshooting section.

Revision 2022/08/01

- Updated Mechanical Specifications section (for units with firmware DL1-1.1.X or later):
  - Screwdriver torque specifications.

  - Maximum RPM specifications.

Revision 2022/05/10

- Updated Advanced Screwdriving Functions (Software section), now refers to Scripts section in Appendix.

- Added torque tolerance and updated No load speed in Mechanical specifications table (Specifications section).

- Updated Robotiq Screwdriver table in Troubleshooting section.

- Added Appendix (detailed advanced screwdriving functions).

Revision 2022/02/09

- Added Input Air Pressure Validation section

- Updated Screwdriver Vacuum Sleeve Selection section

- Updated Advanced Screwdriving Functions section

Revision 2021/09/29

- Updated Specifications section

- Updated Environmental and Operating Conditions section

Revision 2021/08/30

- Initial release

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1. General Presentation

The terms "Screwdriving Solution," "Robotiq Screwdriving Solution," "Screwdriver," "Robotiq Screwdriver," "SD-100," "Screw Feeder," "Robotiq Screw Feeder" and "SF-300" used in the following manual all refer to the Robotiq Screwdriving Solution and pertaining components. The Robotiq Screwdriving Solution, composed of the Robotiq Screwdriver and Robotiq Screw Feeder, is a robotic peripheral designed for industrial applications. Its design makes it a unique tool for fastening components together in an autonomous manner. The Screw Feeder delivers screws individually at a picking area. The Screwdriver then collects them using vacuum technology and proceeds to the actual screwdriving task.

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

> **Info**
>
> The following section presents the key features of the Robotiq Screwdriving Solution; each feature is detailed in the appropriate section of the manual. Safety guidelines must be read and understood before any operation is attempted with the Screwdriver and/or Screw Feeder.

1.1. Screwdriving Solution Nomenclature

The Robotiq Screwdriving Solution comprises two main components: the SD-100 Robotiq Screwdriver, and SF-300 Robotiq Screw Feeder.

Fig. 1-1: Screwdriver and Screw Feeder

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

1.1.1. Screw Feeder Nomenclature

The Robotiq Screw Feeder is an electrical device used to take in screws, bring them individually to a picking area with a rail, and send a signal to the robot for the Robotiq Screwdriver to pick them up for screwdriving tasks and applications.
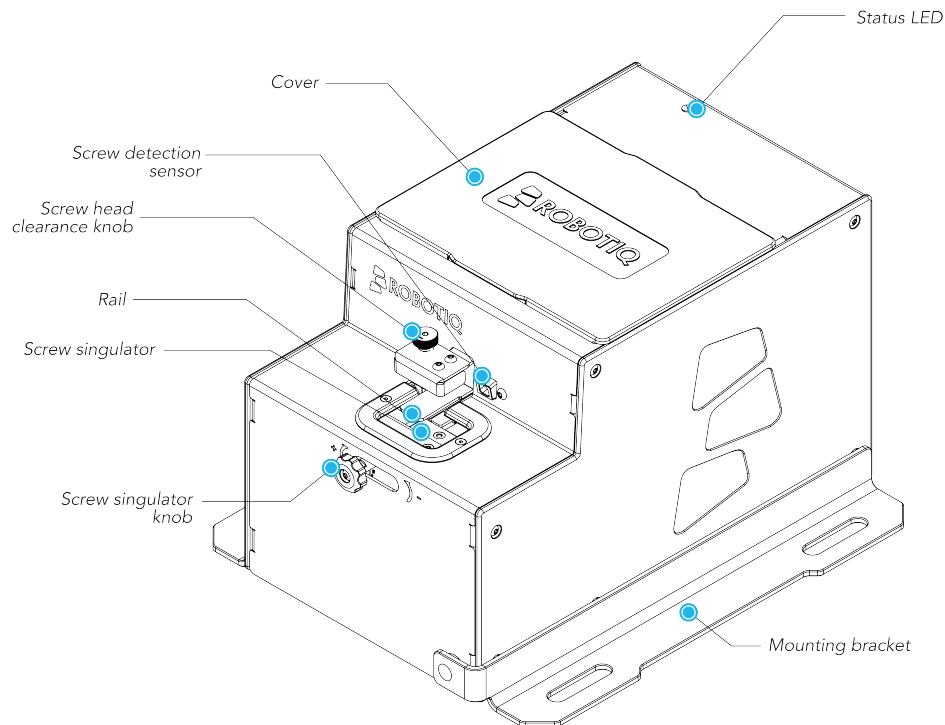
Fig. 1-2: Screw Feeder Nomenclature (Front)

Power switch

USB type-B port

Signal output and
ground connector

NPN configuration
PNP configuration

Power input

Rail knob

Protective earth
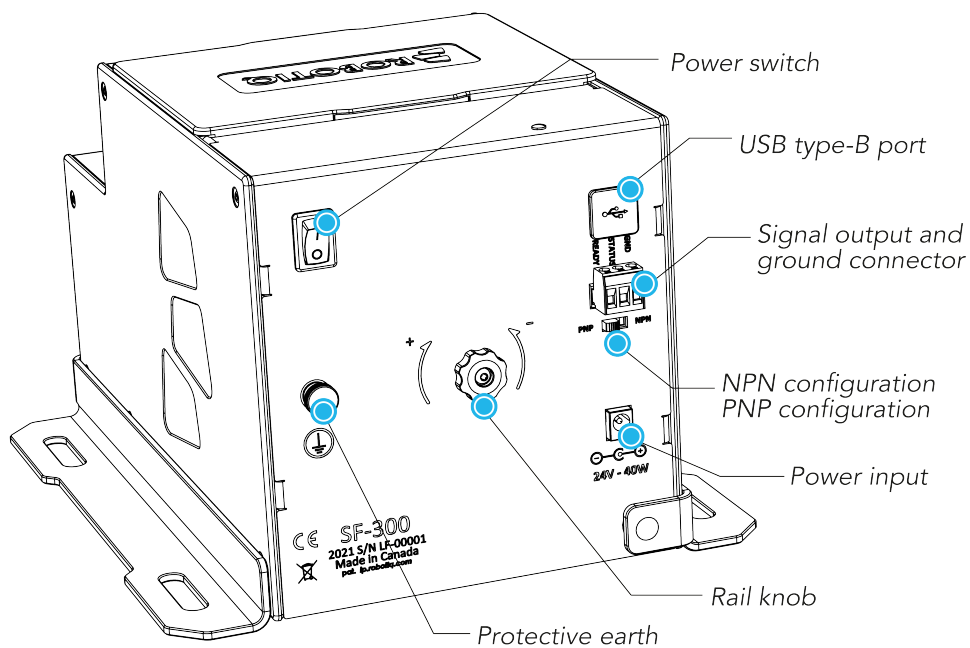
Fig. 1-3: Screw Feeder Nomenclature (Back)

Brush

Brush knob

Wheel blade

Screw chamber
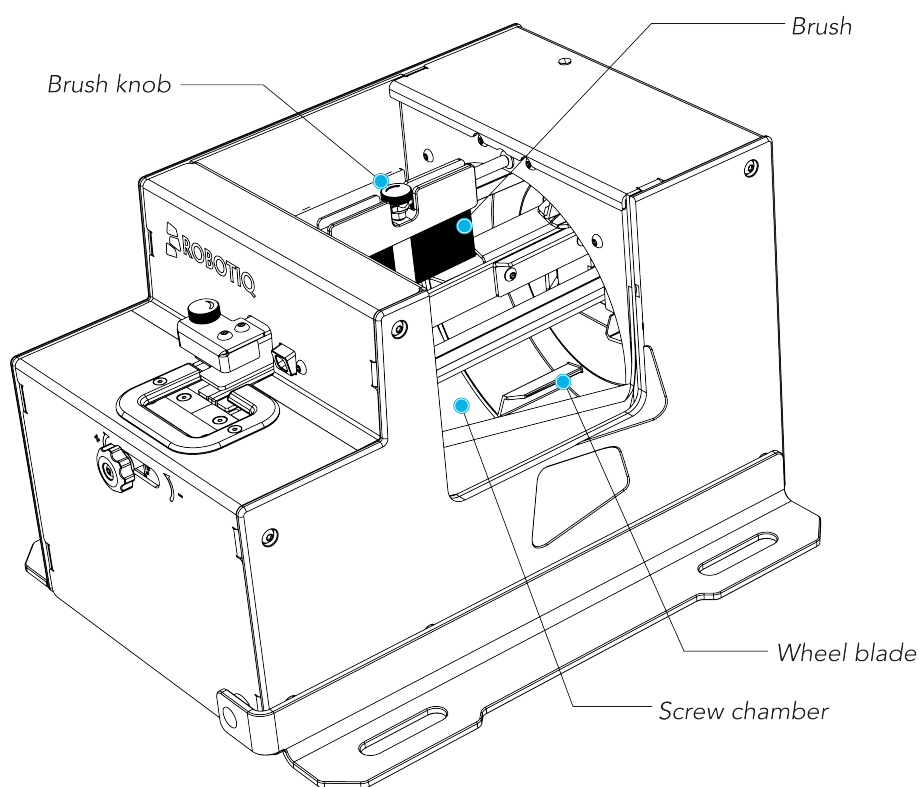
Fig. 1-4: Screw Feeder Nomenclature (Internal Components)

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

1.1.2. Screwdriver Nomenclature

The Robotiq Screwdriver is an end-of-arm robotic tool used to pick up screws from the Screw Feeder's picking area using vacuum technology, and to carry out screwdriving tasks.
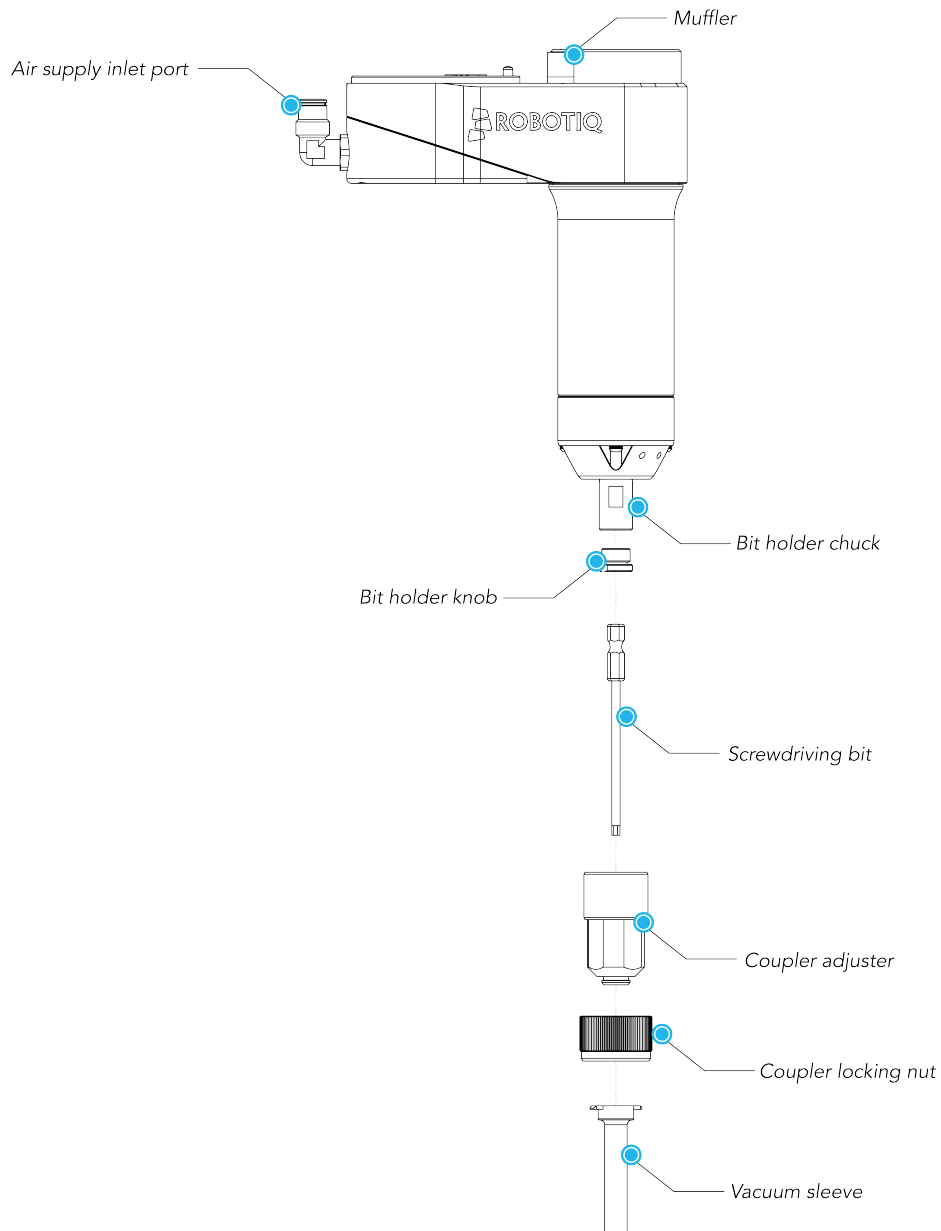
Fig. 1-5: Screwdriver Nomenclature

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

> **Tip**
>
> Even though the Screwdriving Solution is delivered with various types of screwdriving bits and vacuum sleeves to meet the needs of numerous applications, it is possible to order specific types of bits and sleeves according to your needs.

Robotiq Screwdriving Solution - Instruction Manual
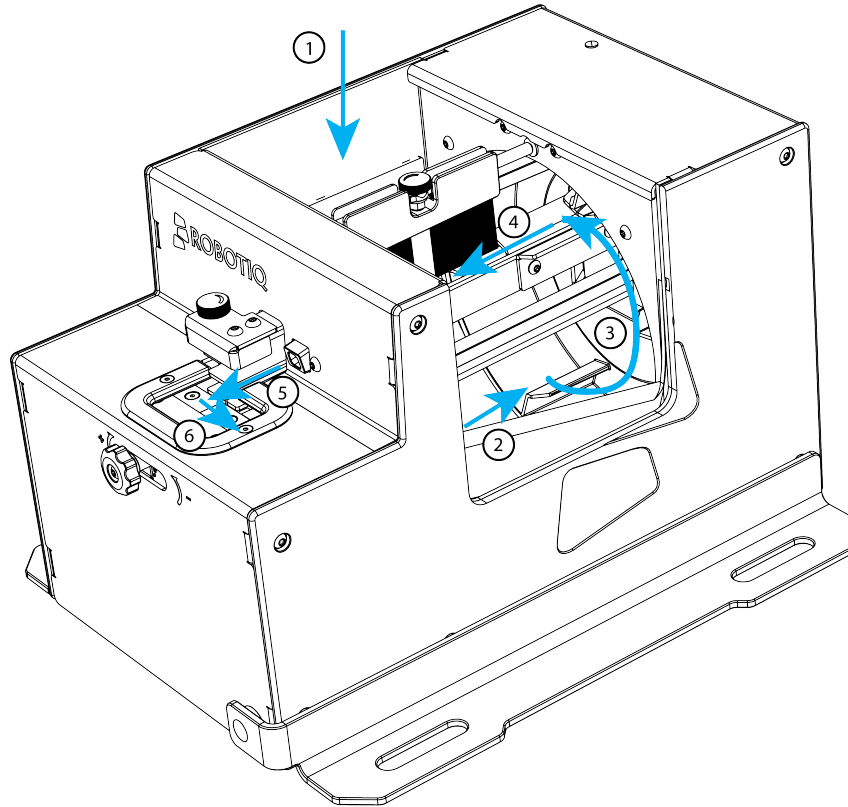
1.2. Screw Feeding

Fig. 1-6: Screw Feeding Cycle

1. Screws are dropped in the screw chamber manually or via an automated device.

2. Screws in the chamber move toward the reclaiming wheel.

3. The wheel blades of the reclaiming wheel pick up screws and bring them up to the rail.

4. The rail directs the screws to the front of the Screw Feeder; the rail brush oscillates and pushes misplaced screws back in the screw chamber.

5. At the end of the rail, screws are individually directed to the screw singulator

6. The screw singulator brings a screw in front of the screw detection sensor, which sends a Ready signal to the robot controller.

> **Warning**
>
> Make sure not to fill the screw chamber of the Screw Feeder above the max line.
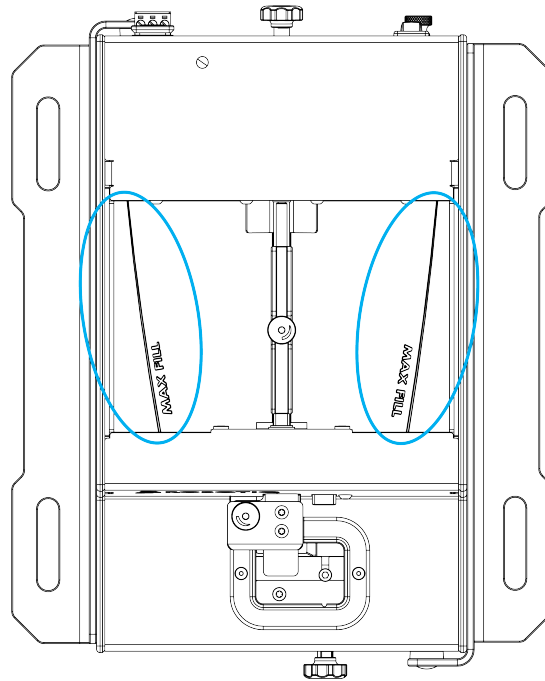
Fig. 1-7: Max Line of the Screw Chamber.

1.3. Screw Picking and Fastening

In a typical screwdriving application, the Robotiq Screwdriver collects, via vacuum action, a screw dispensed by the Robotiq Screw Feeder. The robot arm then moves to the workpiece within reach and executes a screwdriving action based on the parameters set by the user in the software interface.
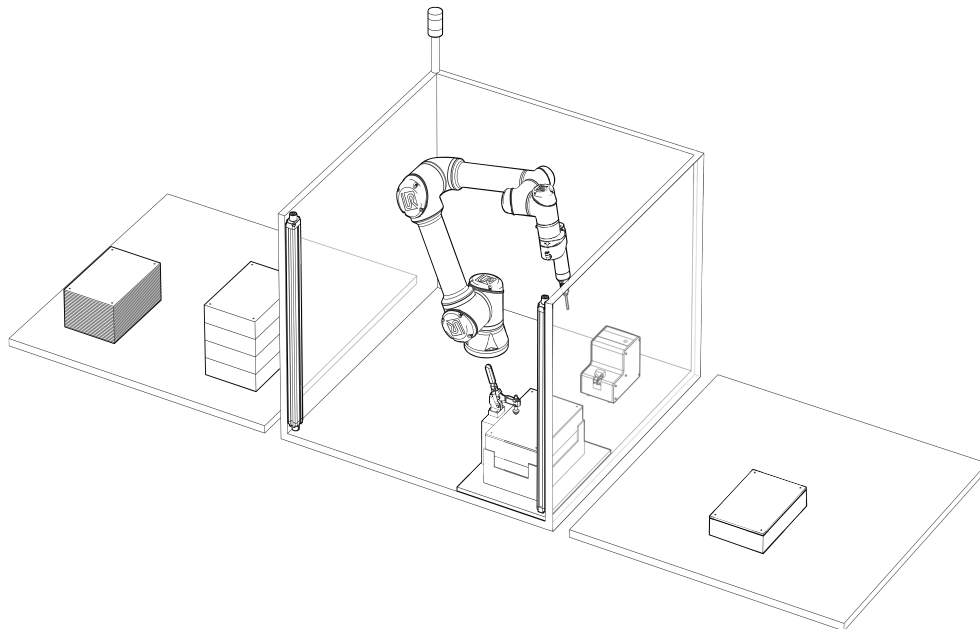
Fig. 1-8: Typical Screwdriving Cell with the Robotiq Screwdriver and Screw Feeder.

2. Safety

> **Info**
>
> The term " operator" refers to anyone responsible for any of the following operations on the Robotiq Screwdriving Solution:
>
> - Installation
> - Control
> - Maintenance
> - Inspection
> - Calibration
> - Programming
> - Decommissioning

> **Warning**
>
> The operator must have read and understood all of the instructions in the following manual before handling the Robotiq Screwdriver and Screw Feeder.

2.1. Disclaimer

The intent of this section is to provide general guidelines for the safe use and operation of the Robotiq Screwdriving Solution. Always follow local regulations.

This documentation explains the various components of the Robotiq Screwdriving Solution and general operations regarding the whole lifecycle of the product from installation to operation and decommissioning.

Robotiq accepts no liability for damage, injury or any legal responsibility incurred directly or indirectly from the use of this product.

The operator shall observe safe and lawful practices including but not limited to those set forth in this document.

The drawings and photos in this documentation are representative examples; nonetheless, discrepancies may be observed between those and the delivered product.

2.2. Warnings, Risk Assessment and Final Application

> **Caution**
>
> Any use of the Screwdriving Solution in non-compliance of these warnings is inappropriate and may cause injury or damage.

> **Caution**
>
> It is the robot integrator's duty to ensure that all local safety measures and regulations are met.

> **Warning**
>
> - Air supply must be dry and filtered according to ISO 8573-1 class 3.4.3.
> - Air supply pressure should be set between 6.2 bar and 7 bar (90 psi and 100 psi) at the tool with an optimal pressure set at 7 bar (100 psi).
> - The tubing should be properly secured before pressurizing the Screwdriver.
> - Always bring the air pressure down to 0 psi before disconnecting or removing any tubing.
> - Never operate the Screwdriver with leaking or worn tubing.
> - The Screwdriver needs to be properly secured before operating the robot.
> - Do not install or operate a Robotiq Screwdriver or Screw Feeder that is damaged or lacking parts.
> - Never supply the Screwdriver with an alternative current source.
> - Make sure all cord sets are always secured at both ends, the Screwdriver's and the robot's.
> - Always meet the recommended keying for electrical connections.
> - Make sure no one is in the robot's or Screwdriver's vicinity before initializing the robot's routine.
> - Keep body parts and garments away from the Screwdriver while the device is powered on.
> - Do not use the Screwdriver on people or animals.

The Robotiq Screwdriver has to be equipped with either one of the 79 dB or 85 dB mufflers.

Given the noise levels generated by the mufflers, please enforce the appropriate workplace, local, state or federal regulations in terms of hearing PPE.

> **Info**
>
> The 85 dB muffler is installed by default on the Screwdriver.

> **Tip**
>
> For environments requiring the limitation of noise levels, consider installing the 79 dB muffler onto the Robotiq Screwdriver.

The Robotiq Screwdriver is meant to be used on Universal Robots collaborative robots. The robot, Screwdriver, Screw Feeder, and any other equipment used in the final application must be evaluated via a thorough risk assessment.

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

- Risk of pinching between the Screwdriver and the processed objects or the surrounding environment.

- Risk of pinching between the moving and stationary parts of the screw singulator of the Screw Feeder.

- Risk of damage to material or bodily injury caused by contact with a screwdriving bit, or with a screw held in place by the screwdriving bit and vacuum sleeve.

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

> **Warning**
>
> Loss of vacuum can occur due to power failure or air supply stoppage.

2.3. Intended Use

The Screwdriver is designed for reclaiming a screw from the screw detection position on the Screw Feeder, holding that screw in order to move it from the detection position to a fastening or screwing location, and fastening or screwing said screw.

2.3.1. Typical Applications

The Robotiq Screwdriving Solution was developed and designed to meet the requirements of particular applications, namely in the packaging and assembly of electronic components, and in the assembly of certain types of manufactured goods that fall within the general industry sector.

Such applications include:

- Securing the lid of plastic and/or sheet metal containers for mechanical components

- Assembling plastic and/or metal enclosures for mechanical components

- Joining electronic components together

- Securing the lid of plastic and/or sheet metal containers for electronic components

- Assembling plastic and/or metal enclosures for electronic components

2.3.2. Supported Fasteners

In order to meet the safety requirements of operating the Screwdriving Solution, Robotiq deemed appropriate to indicate the length, types and diameters that correspond to the specifications of the Solution.

> **Caution**
>
> Please refer to the **Screwdriver Vacuum Sleeve Selection** section to view the possible combinations between screw type, screw diameter, screw head, screw drive, screwdriving bit and vacuum sleeve.

Fastener Length Supported

- Maximum length of 25 mm (1 in)

- Minimum length of 6 mm (1/4 in), or 10 mm (3/8 in) for socket head screws

Fastener Types Supported

The Screwdriving Solution supports two main types of screws:

- Machine screws
    - Uniform diameter with flat tip
    - Mainly used for assembly and installation

- Self-tapping screws
    - Require a pilot/pre-drilled hole
    - In their smaller versions, they are mainly used for plastic and sheet metal enclosures and lids for electronic components

Fastener Diameters Supported

For the safe and normal use of the Robotiq Screwdriving Solution, Robotiq limits the supported diameters to:

- Imperial
    - #3 gauge (0.0984 in / 2.5 mm)
    - #4 gauge (0.1181 in / 3 mm)
    - #5 gauge (0.125 in / 3.2 mm)
    - #6 gauge (0.1378 in / 3.5 mm)
    - #8 gauge (0.164 in / 4.16 mm)

- Metric
    - M2.5 to M4

> **Info**
>
> For fastener diameters over M4 or #8, please validate your use case by contacting Robotiq.

3. Installation

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

> **Warning**
>
> Before installing the product:
>
> - Read and understand the safety instructions related to the Robotiq Screwdriving Solution.
>
> - Verify your package based on the scope of delivery and on your order.
>
> - Have the required parts, equipment and tools listed in the requirements readily available.

> **Warning**
>
> When installing the product:
>
> - Meet the recommended environmental conditions.
>
> - Do not operate the components of the Robotiq Screwdriving Solution or turn on the power supply before they are firmly anchored or mounted, and the danger zone is clear.

> **Warning**
>
> Failure to properly secure and install the equipment can result in material damage and serious bodily injuries. In addition, note that in situations where the installation is not compliant, the warranty is void.

3.1. Scope of Delivery

3.1.1. Screwdriver Standard Kit

> **Installation on CB-Series Universal Robots**
>
> Installation on CB-Series robots requires the FT 300-S Force Torque Sensor and its corresponding hardware and tools.
>
> Please refer to the Quickstart Guide of the FT 300-S Force Torque Sensor provided in the kit.
>
> Otherwise, for further information, you can also refer to the user manual of the FT 300-S Force Torque available at support.robotiq.com.

- Robotiq SD-100 Screwdriver Basic Kit
    - Robotiq SD-100 Screwdriver
    - Vacuum sleeve kit
    - 8-meter pneumatic hose
    - Robotiq device coupling
    - RS-485 to USB signal converter
    - 10-meter High-flex device cable
    - 79 dB muffler
    - Pressure gauge with push-to-connect tube fitting
    - Hardware and tools

> **Info**
>
> The O-ring found in the hardware is for replacement purposes only. You do not need to install it upon first use of the Robotiq Screwdriver.

- One (1) screwdriving bit kit among:
    - Phillips starting kit (PH1, PH2)
    - Torx® starting kit (T8, T10, T15, T20)
    - Metric hex socket starting kit (2 mm, 2.5 mm, 3 mm)
    - Imperial hex socket starting kit (5/64 in, 7/64 in, 3/32 in)
- FT 300-S Standard Kit (CB-Series only)
- Robotiq Force Copilot license dongle (e-Series only)

3.1.2. Screw Feeder Standard Kit

- Robotiq SF-300 Screw Feeder

- Screw Feeder mounting brackets

- Screw Feeder cable for I/O signals and ground

- Protective earth cable

- USB A-Male to USB B-Male cable

- Power supply and international power adapter kit

- Screw Feeder power supply cable

- Hardware and tool

> **Caution**
>
> The following are not included in the standard delivery:
>
> - Hardware required for options.
>
> - Additional accessories or fixtures for the Robotiq Screwdriver, unless specified.

3.2. Required Tools and Equipment

3.2.1. Robotiq Screwdriver

> **Installation on CB-Series Universal Robots**
>
> Installation on CB-Series robots requires the FT 300-S Force Torque Sensor and its corresponding hardware and tools.
>
> Please refer to the Quickstart Guide of the FT 300-S Force Torque Sensor provided in the kit.
>
> Otherwise, for further information, you can also refer to the user manual of the FT 300-S Force Torque available at support.robotiq.com.

- 4 mm hex key to mount the Screwdriver onto its coupling.

- 1/2 inch wrenches to secure the screwdriving bit by tightening the bit holder knob and bit holder chuck.

- 2.5 mm slotted screwdriver to attach the wires of the High-flex device cable to the RS-485 to USB signal converter, and then to the robot controller (not included).

- 8-mm (5/16-in) fitting to connect the tubing to the compressed air source (not included).

3.2.2. Robotiq Screw Feeder

- 4 screws to mount the Screw Feeder brackets on the work surface (not included).

- Metric or imperial key corresponding to the fasteners used to mount the Screw Feeder on your work surface (not included).

- 2.5 mm slotted screwdriver to attach the wires of the I/O signal and ground cable to the robot controller (not included).

- 10 mm wrench to fasten the earthing nut on the robot cabinet (not included).

3.3. Environmental and Operating Conditions

3.3.1. Robotiq Screwdriver

CONDITION	VALUE
Storage / transit temperature range	-20°C to 60°C
Operating ambient temperature range	0°C to 50°C
Humidity	20-80% RH, non-condensing
IP rating	IP4X
Other	Dust accumulation may affect performance and shorten the time between maintenance actions. Free from soot or fluids. Free from corrosive liquids or gases. Free from explosive liquids or gases. Refer to IP rating.

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

Air Supply

Compressed air must be supplied to the Screwdriver 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 safety clip must be at all times installed on the inlet port. To protect against whipping hazards, the air supply tubing must be securely attached to the robot arm. An air fuse should also be installed.

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 Screwdriver can be activated until the pressure is fully released.

3.3.2. Robotiq Screw Feeder

CONDITION	VALUE
Storage / transit temperature range	-20°C to 50°C
Operating ambient temperature range	0°C to 50°C
Humidity	20-80% RH, non-condensing
IP rating	IP20
Other	Free from dust, soot or fluids. Free from corrosive liquids or gases. Free from explosive liquids or gases. Free from powerful electromagnetic interference. Refer to IP rating.

Table 3 - 2: Environmental and operating conditions of the Robotiq Screw Feeder

3.4. Mechanical Installation

3.4.1. Robotiq Screwdriver

Vacuum sleeve
(To select and mount)

Coupler locking nut
(Already mounted on
the screwdriver)

Coupler adjuster
(Already mounted on the
screwdriver)

Screwdriving bit
(To select and mount)

Bit holder knob
(Already mounted
on the screwdriver)

Bit holder chuck
(Already mounted on
the screwdriver)

Screwdriver body

M5 screws
and washers

Air supply
inlet port

Muffler

M6 screws
and washers

Robotiq device
coupling

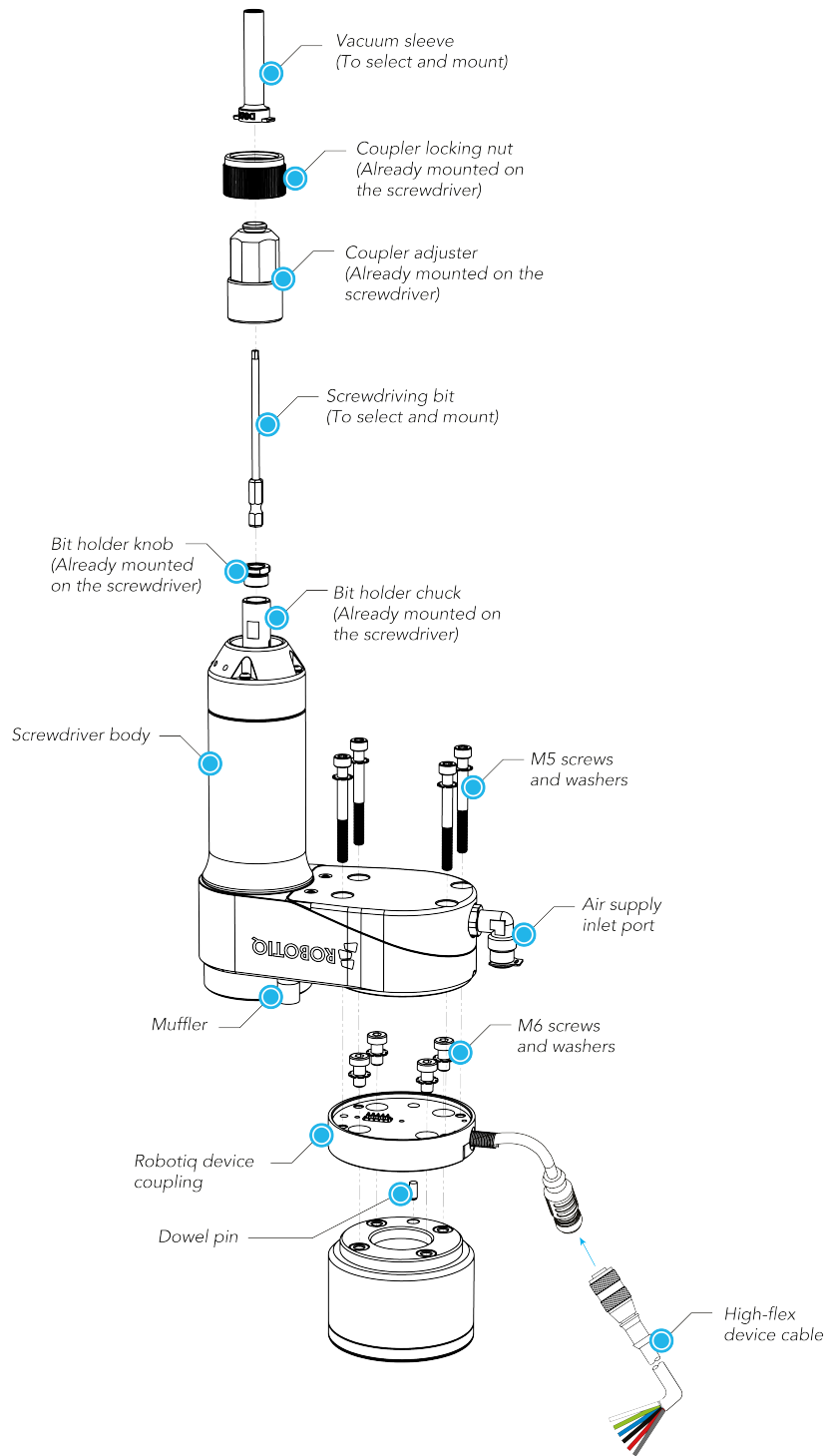Dowel pin

High-flex
device cable

Fig. 3-1: Mechanical Installation of the Robotiq Screwdriver.

Below are the steps to mount the Screwdriver onto the robot.

> **Installation on CB-Series Universal Robots**
>
> Installation on CB-Series robots requires the FT 300-S Force Torque Sensor and its corresponding hardware and tools.
>
> Please refer to [the Quickstart Guide of the FT 300-S Force Torque Sensor](#) provided in the kit.
>
> Otherwise, you can also refer to the user manual of the FT 300-S Force Torque Sensor for further technical information.

1. Mount the coupling onto the robot arm.
   - Align properly with the dowel pin provided in the hardware kit.
   - Secure using M6 screws and corresponding tooth lock washers
   - Connect the coupling cable to the provided High-flex cable.

2. Mount the Screwdriver onto the coupling.
   - Align properly with the dowel pin.
   - Secure using M5 screws and corresponding tooth lock washers.

3. Wire the pneumatics.
   - Connect the pneumatic hose to the air supply inlet port (quick-connect).
   - Verify the connection by pulling on the tubing.
   - Run the tubing along the robot arm and to the compressed air source.
   - Limit tubes and piping length to a minium while leaving enough excess tubing to allow full robot movement.
   - Cut off excess tubing when installation is complete. Avoid coiling the excess tubing (8mm) into a bundle.
   - Supply the Robotiq Screwdriver with compressed air.

> **Caution**
>
> Air supply must be dry and filtered according to ISO 8573-1 class 3.4.3. We recommend using a local pressure regulator with a filter and air dryer.

> **Info**
>
> Air supply pressure should be set between 6.2 bar and 7 bar (90 psi and 100 psi) at the tool with an optimal pressure set at 7 bar (100 psi). Having the correct air pressure at the tool is important. Please refer to the **Input Air Pressure Validation** section to read the procedure and validate the input air pressure that corresponds to your configuration.

4. Select the screwdriving bit that corresponds to your application.
   - Unscrew the coupler locking nut.
   - Unscrew the coupler adjuster.
   - Unscrew the bit holder knob using the provided 1/2 wrenches on the flats of the bit holder knob and bit holder chuck.
   - Insert the bit into the bit holder chuck until it reaches the bottom of the chuck; you may need to rotate the bit to make sure the flats of the hex shank are aligned (the O-ring of the chuck might show resistance).
   - Apply 0.5 Nm to 1 Nm of torque on the flats of the bit holder knob and bit holder chuck to secure the screwdriving bit.

> **Tip**
>
> An alternative way to proceed in the absence of a torque wrench or torque meter is to manually tighten the assembly until it no longer turns, and to unscrew half a turn.

- Screw the coupler adjuster and coupler locking nut back on. Please refer to the **Vacuum Coupler Adjustment** section to adjust the bit holder assembly in order to ensure proper screw detection.

5. Attach the vacuum sleeve to the coupler.

> **Info**
>
> Please refer to the **Screwdriver Vacuum Sleeve Selection** section to select the vacuum sleeve that corresponds to the screws and screwdriving bit that will be used in the framework of your application.

- Install the vacuum sleeve onto the coupler.

> **Info**
>
> Should the user need to replace or change the muffler, simply unscrew the muffler by hand.
>
> Screw the replacement or new muffler back on.

3.4.2. Robotiq Screw Feeder

Below are the steps to mount the Robotiq Screw Feeder

- Place the Screw Feeder on a flat work surface.
- Make sure the device stands on its shoes (rounded rubber pads) on the work surface.
- Make sure the device is level, horizontally.
- Make the provided mounting brackets close in on both sides of the Screw Feeder to secure its position.

> **Info**
>
> Should you decide to fasten the mounting brackets to the work surface (e.g., T-slot extrusions), preferably use 5/16 inch or M8-diameter fasteners to secure the Feeder onto the work surface. The use of washers is optional, but recommended.

3.5. Electrical Setup

3.5.1. Electrostatic Discharge Safety

The Robotiq Screwdriver is ESD safe. If installed properly using the toothed lock washers, the casing and internal mechanism are grounded through the screws used to mount the screwdriver on the coupling. The same is true for the coupling.

The Robotiq Screw Feeder is ESD safe. If installed properly with the earth cable related to the controller, the casing and internal mechanism internal mechanism are grounded through the protective earth cable.

3.5.2. Robotiq Screwdriver

Installation on CB-Series Universal Robots

Installation on CB-Series robots requires the FT 300-S Force Torque Sensor and its corresponding hardware and tools.

Please refer to the Quickstart Guide of the FT 300-S Force Torque Sensor provided in the kit.

Otherwise, you can also refer to the user manual of the FT 300-S Force Torque Sensor for further technical information.

Caution

Leave enough excess cable to allow full robot movement.

1. Route the High-flex cable to the robot controller using a cable management method that corresponds to the work environment and to the application at hand.

2. At the robot controller end of the High-flex cable, connect the red wire to a 24 V Configurable Input in one of the robot controller's terminal blocks.

3. At the robot controller end of the High-flex cable, connect the black and gray wires to a 0 V Configurable Output in one of the robot controller's terminal blocks.
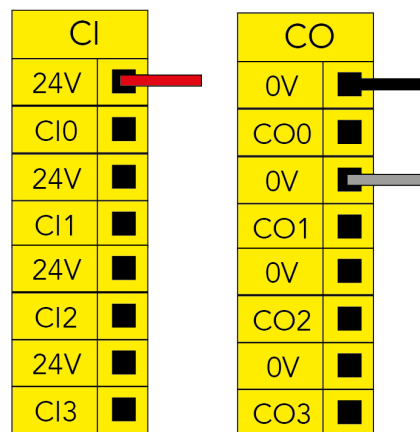

Fig. 3-2: Power Supply Wiring

4. Connect the communication wires to the RS-485 to USB converter.

485+ (pin #1)
485- (pin #2)
485 GND (pin #3)

USB - 2.0

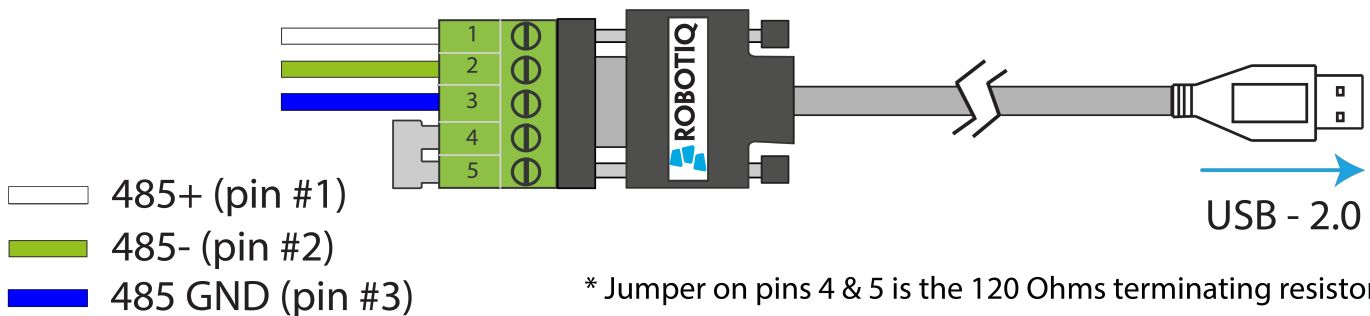* Jumper on pins 4 & 5 is the 120 Ohms terminating resistor.

Fig. 3-3: Communication Wiring.

5. Connect the RS-485 to USB converter to a USB port of the robot controller.

The figure below illustrates the Screwdriver's pigtail connector from the coupling (ACC-CPL-008), the device cable on the robot side (CBL-COM-2065-10-HF) and their associated pinout.
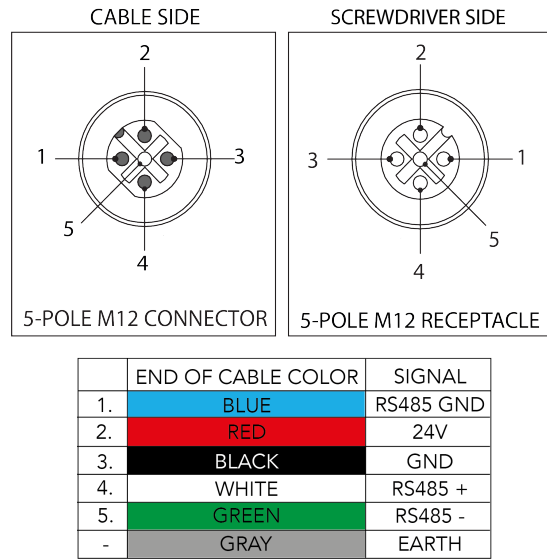

	END OF CABLE COLOR	SIGNAL
1.	BLUE	RS485 GND
2.	RED	24V
3.	BLACK	GND
4.	WHITE	RS485 +
5.	GREEN	RS485 -
-	GRAY	EARTH

Fig. 3-4: Pinout of the Screwdriver pigtail and device cable.

3.5.3. Robotiq Screw Feeder

> **Info**
>
> For the following steps, please refer to the **Screw Feeder Nomenclature** section for a detailed view of the back of the device.

1. Connect the device end of the power supply cable to the power input at the back of the Screw Feeder.

2. Connect the other end of the power supply cable to a 100 V - 240 V electrical outlet.

3. Set the configuration toggle switch to PNP.

4. Connect the wires at the end of the I/O signals cable to available digital I/O terminal blocks in the robot controller:
   - Black wire (ground): 0 V Digital Output
   - Brown wire (status signal): Digital Input 0, 1, 2 or 3
   - Blue wire (ready signal): Digital Input 0, 1, 2 or 3 (different from brown wire)

> **Caution**
>
> Do not connect the wires in configurable I/O terminal blocks: the signals will not be made available in the programming interface.

5. Secure each connection using a 2.5 mm slotted screwdriver.

> **Caution**
>
> The assignment of Digital Input numbers to their corresponding signal wire should be duly noted as they will be required for configuring the communication between the Screw Feeder, the robot controller and the Screwdriver.
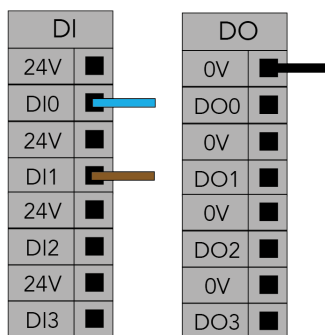
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DI		DO	
24V	■	0V	■
DI0	▪	DO0	■
24V	■	0V	■
DI1	▪	DO1	■
24V	■	0V	■
DI2	■	DO2	■
24V	■	0V	■
DI3	■	DO3	■

Fig. 3-5: Example of Digital Input/Output terminal assignment for the Screw Feeder.

6. Connect the protective earth cable (green) to the protective earth ring terminal at the back of the feeder on one end, and to the screw connection marked with earth symbols (protective earth for application) inside the robot controller on the other end. The nut for the screw connection on the robot side is included in the provided kit.
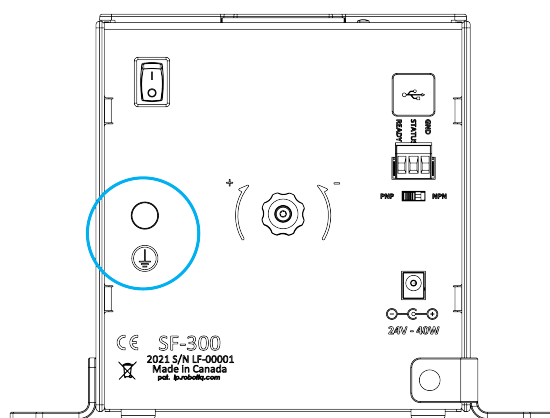

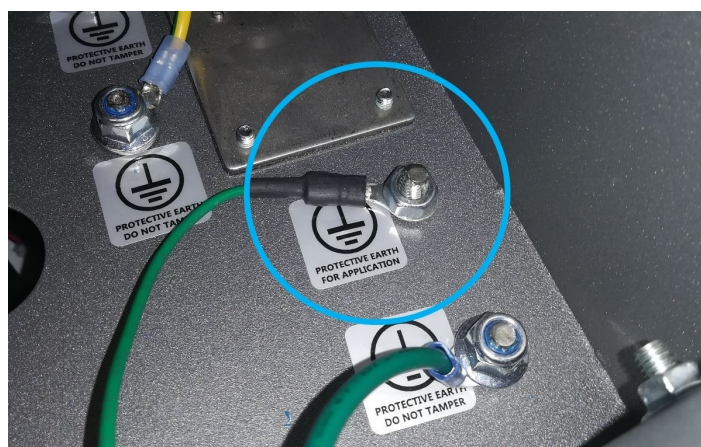*Fig. 3-6: Earth Screw Connection at the Back of the Screw Feeder.*

Fig. 3-7: Screw Feeder Earth Screw Connection in Robot Controller.

Info

The USB type-B female connector at the back of the Screw Feeder and the provided USB cable should only be used in case a firmware update is required. If such a situation occurs, please contact the Robotiq support department for assistance.

3.6. URCap Package

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

> **Info**
>
> Make sure you are using the most up-to-date versions of the Robotiq Copilot and Robotiq Screwdriving URCap packages, which can be found on the Robotiq support website.

3.6.1. URCap Package Installation

Make sure the components of the Robotiq Screwdriving Solution (Screwdriver and Screw Feeder) are properly installed and secured. Refer to the **Mechanical Installation** section should you need guidelines and detailed information.

> **Info**
>
> This manual takes into account that you are using the latest version of PolyScope based on the robot model you are using, and that you downloaded the latest version of the Robotiq URCaps pertaining to this product.
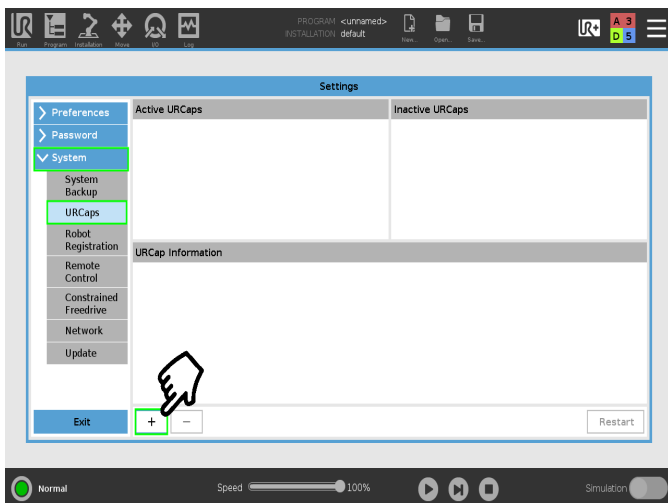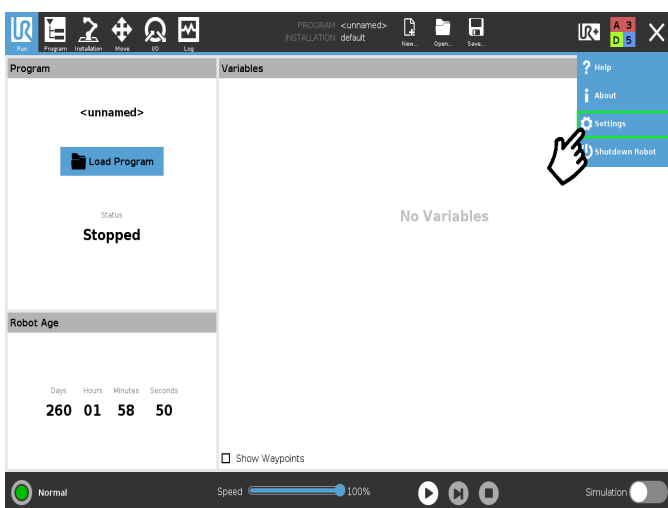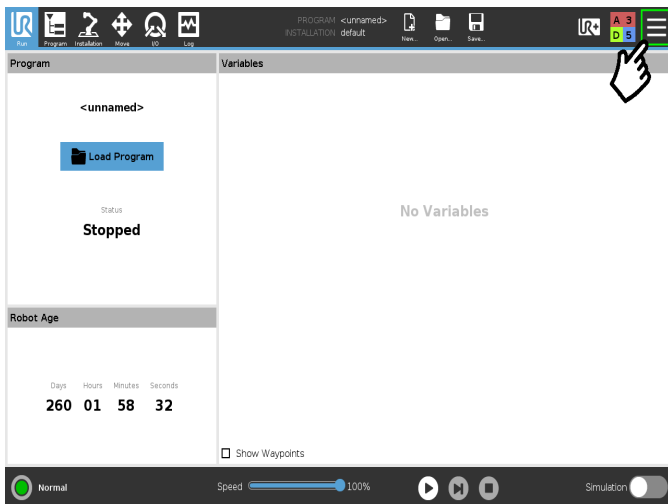
> **Tip**
>
> To view the PolyScope software version:
>
> **CB-Series**: On the PolyScope homepage, tap the **About** button.
>
> **e-Series**: Tap the triple bar icon and tap on the **About** button.
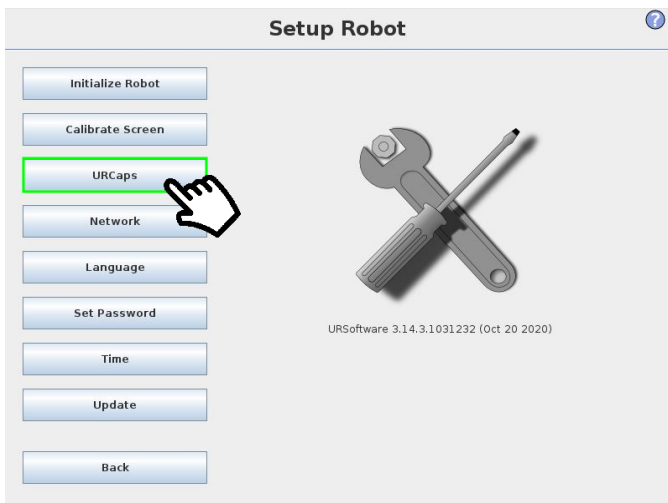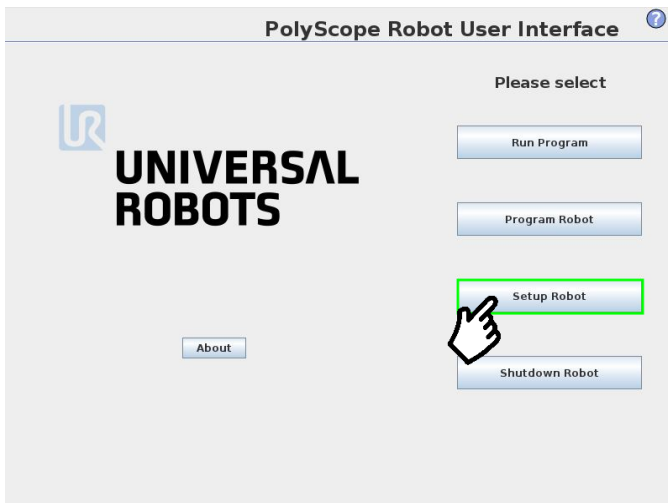
On e-Series Robots

- Make sure that the version of your PolyScope software is up-to-date and that your Universal Robots controller is compatible with the Screwdriving Solution URCap package.

- Go to support.robotiq.com, and select the Universal Robots brand.

- Select **Robotiq Screwdriving Solution** > **Software** > **Robotiq URCap**s.

- Download the **Screwdriving** and **Copilot** zip files.

- Extract the files at 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 on **Settings**.

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

- Select the Screwdriving Solution URCap (UCT-X.X.X) to install it on the robot controller.

- Tap the **plus (+)** button to locate the **.urcap files** in the available drives.

- Select the Copilot URCap (UCS-X.X.X) to install it on the robot controller.

- Tap the **plus (+)** button to locate the **.urcap files** in the available drives.

- Once the file is selected, tap the **Open** button.

- Tap the **Restart** button to complete the URCap installation. By doing so, you accept the **license agreement** that is detailed in the **URCap Information** text box (text also available in the **License Agreement** section).

On CB-Series Robots

- Make sure that the version of your PolyScope software is up-to-date and that your Universal Robots controller is compatible with the Screwdriving Solution URCap package.

- Go to support.robotiq.com, and select the Universal Robots brand.

- Select **Robotiq Screwdriving Solution > Software** > **Robotiq URCaps**.

- Download the **Screwdriving** and **Copilot** zip files.

- Extract the files at the root of a blank USB stick.

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

- On the PolyScope homepage, tap **Setup Robot**.

- Tap **URCaps**.

Setup Robot

URCaps

Active URCaps

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

URCap Information
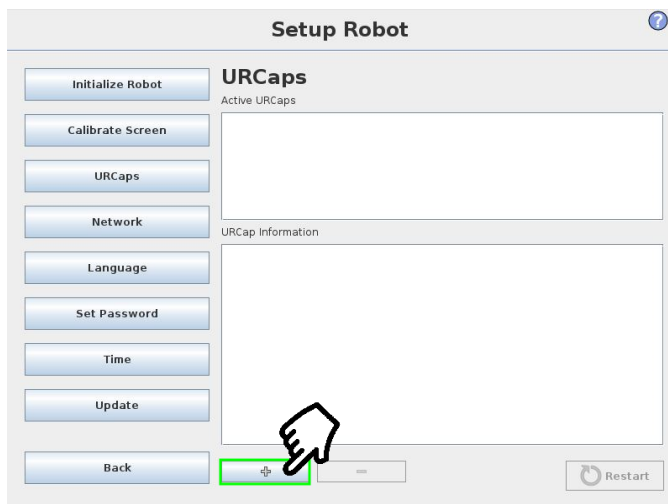
Restart

- Tap the **plus (+)** button to add the Screwdriving Solution URCap package.

- Open Robotiq_UCT-X.X.X.urcap from the USB storage device.

- Tap the **plus (+)** button to add the Force Copilot URCap package.

- Open Robotiq_UCS-X.X.X.urcap from the USB storage device.

Setup Robot

URCaps

Active URCaps

Robotiq_Copilot
Robotiq_Screwdriving

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

URCap Information

URCap name: Robotiq_Screwdriving
Version: 1.0.6
Developer: Robotiq Inc.
Contact Info: 966, chemin Olivier, Suite 500, Levis, Qc, G7A 2N1, Canada
Description: URCap for programming Robotiq Screwdrivers
Copyright: Copyright (c) 2021, Robotiq inc., All rights reserved.
License Type: See End-User License Agreement below
License:
END-USER LICENSE AGREEMENT

YOU SHOULD CAREFULLY READ THE FOLLOWING AGREEMENT
BEFORE USING THE Software (as this term is hereinafter defined)

Restart

Restart PolyScope to complete the installation of the URCaps. By doing so, you accept the License Agreement that is detailed in the **URCap Information** text box (text also available in the **License Agreement** section).
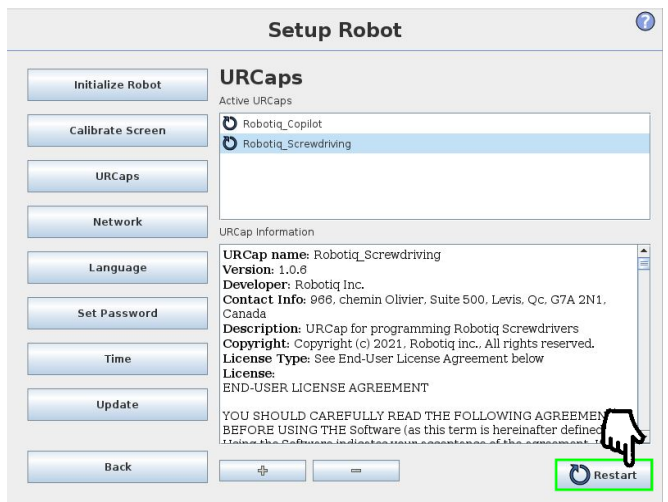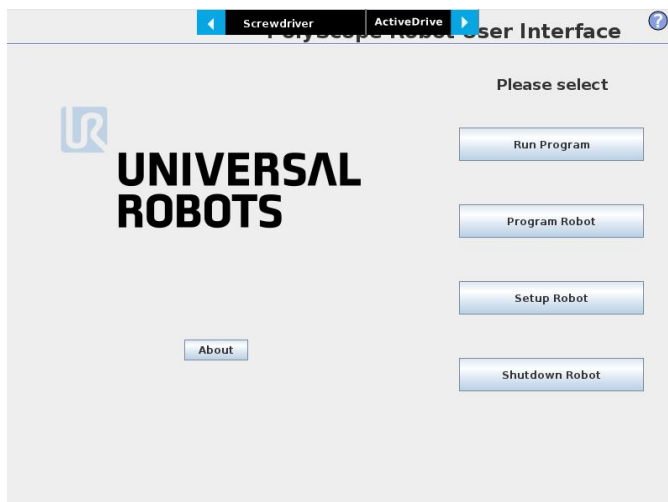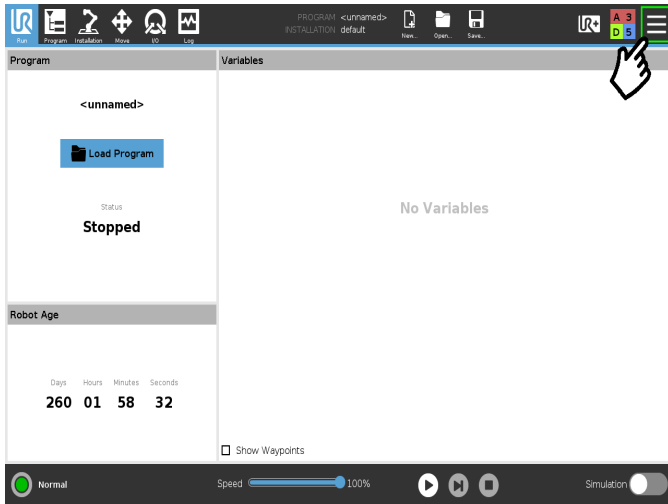
PolyScope Robot User Interface

Screwdriver   ActiveDrive

Please select

UNIVERSAL
ROBOTS

Run Program

Program Robot

Setup Robot

About

Shutdown Robot

After PolyScope restarts, the Screwdriver Toolbar will be displayed.

3.6.2. URCap Package Uninstallation

On e-Series Robots
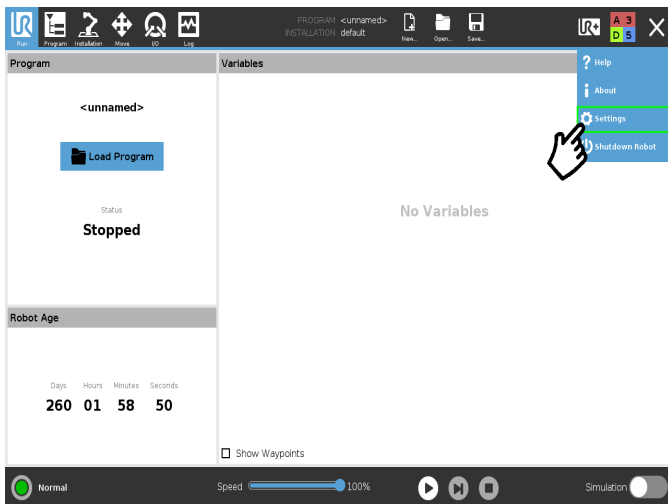
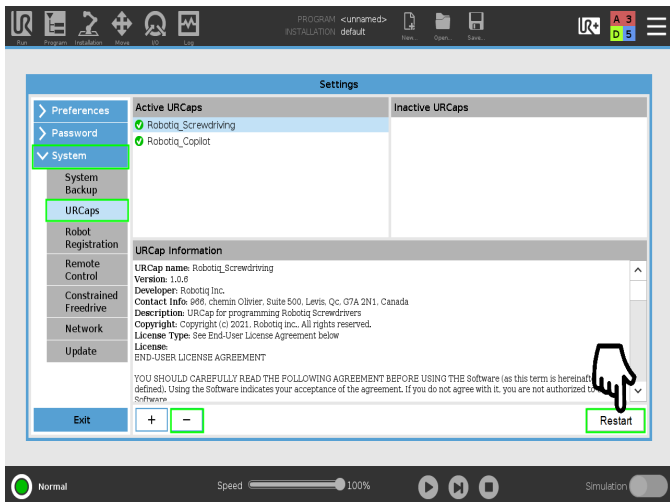|	
	On the teach pendant, tap the **triple bar ico**n.
	Tap **Settings**.
	- Select **System** in the navigation pane on the left. - Select **URCaps**. - In the Active URCaps box, select the URCap you wish to uninstall. - Tap the **minus (-)** button to uninstall the URCap. - Restart PolyScope to complete the uninstallation process.

On CB-Series Robots
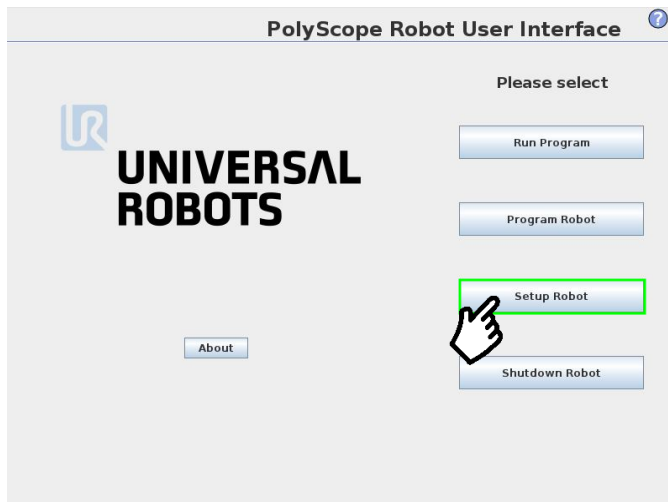
Go to **Setup Robot**.
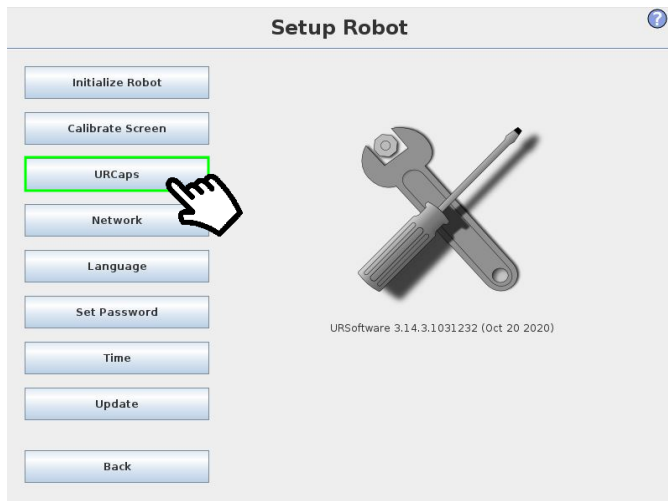
Tap **URCaps Setup**.

- In the Active URCaps box, tap the URCap you wish to uninstall.

- Tap the **minus (-)** button to uninstall the URCap.

- Restart PolyScope to complete the uninstallation process.

3.6.3. License Agreement

END-USER LICENSE AGREEMENT

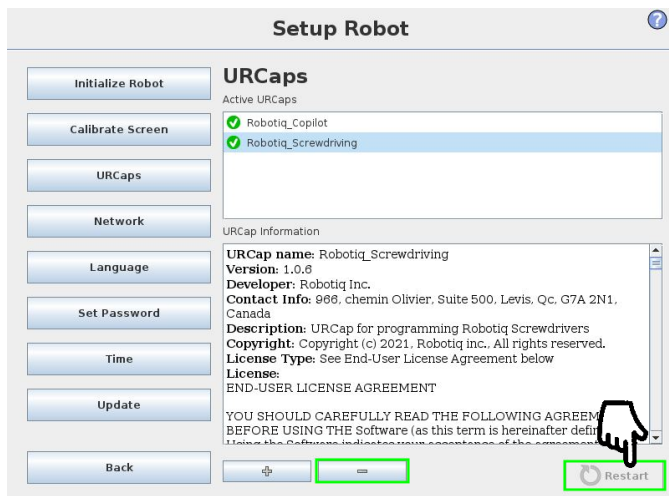YOU SHOULD CAREFULLY READ THE FOLLOWING AGREEMENT BEFORE USING THE Software (as this term is hereinafter defined). Using the Software indicates your acceptance of the agreement. If you do not agree with it, you are not authorized to use the Software.

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

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Software shall not be covered by this Section 4 but shall require that a new End-User Software License Agreement be entered into between the Licensor and the EndUser.

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

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11. Training, Maintenance and Support. There is no entitlement to training, maintenance and support under this license unless otherwise specified in the Purchase Agreement or any other written agreement between the End-User and the Licensor. The End-User may provide the Licensor with details regarding any bug, defect or failure in the Software promptly and with no delay from such event; the End-User shall comply with the Licensor's request for information regarding bugs, defects or failures and furnish him with information, screenshots and try to reproduce such bugs, defects or failures upon Licensor's demand.

12. Expiration and Termination. The Licensor may terminate this Agreement for default by the End-User. This Agreement will also be automatically terminated upon the election of such by the Licensor or the official launch of the Software, whichever event comes first. Upon termination of this Agreement for any reason, the End-User shall promptly uninstall the Software on any UR's Products and Licensor's Products, computer, or server on which it has been installed, deliver to the Licensor all CDs, DVDs, magnetic tapes, cards, and other tangible items and materials embodying the Software, and return to the Licensor all copies thereof or destroy such copies and warrant in writing that all copies thereof have been destroyed. In the event of termination of this Agreement, all obligations of the parties under this Agreement due for performance on the date of termination shall survive the termination, and the party terminating shall not be liable to the other party for any damages arising out of the termination.

13. Miscellaneous.

    1. This Agreement constitutes the entire understanding and agreement between the Licensor and the End-User and replaces any prior agreement relating to the same subject matter.

    2. This Agreement shall be governed and construed in accordance with the laws of the province of Quebec and the federal laws of Canada applicable therein. Any legal action or proceeding between the Licensor and the End-User for any purpose concerning this Agreement or the parties' obligations hereunder shall be brought exclusively in a court of competent jurisdiction sitting in the judicial district of Trois-Rivières, Quebec.

    3. The Licensor's failure to insist upon or enforce strict performance of any provision of this Agreement shall not be construed as a waiver of any provision or right. Neither the course of conduct between the parties nor trade practice shall act to modify any provision of this Agreement.

    4. The Licensor may assign its rights and duties under this Agreement to any party at any time without notice to the EndUser. 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 unenforceable, 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.

4. Operation

4.1. Calibrating the FT 300-S Force Torque Sensor (CB-Series Only)

Operating the Screwdriver on CB-Series Universal Robots requires the use of the Robotiq FT 300-S Force Torque Sensor. If you are not familiar with the calibration procedure of the Sensor, **please refer to the Force Copilot User Manual**.

Once the FT 300-S Force Torque Sensor has been mounted and calibrated, the user can benefit from the features of the Force Copilot software features, essential in operating the Robotiq Screwdriver.

4.2. Force Copilot License Dongle (e-Series)

Operating the Screwdriver on e-Series Universal Robots requires the use of the Force Copilot software.

> **Caution**
>
> The License Dongle should stay connected to ensure the continuous functioning of the force features.

- Connect your Force Copilot License Dongle to a USB port of the Universal Robots controller.

- Make sure your Copilot license is activated.
  - Tap the **Installation** button in the top ribbon.

  - Select **URCaps** > **Copilot**.

  - On the **Dashboard** sub-menu, the Copilot License activation will display.
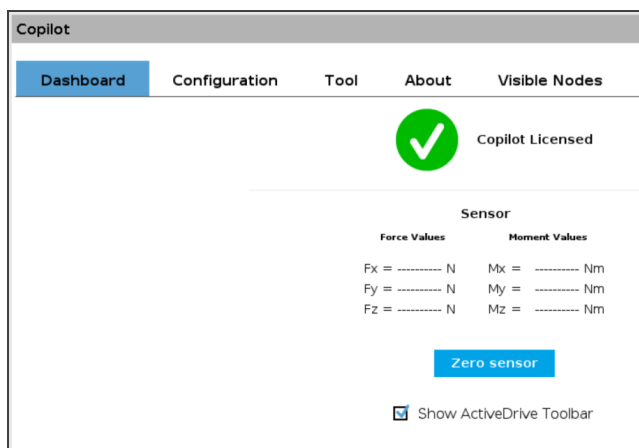
4.3. Screw Feeder Signals

In order for the Robotiq Screw Feeder to communicate with the robot controller and interface with the Robotiq Screwdriver, the user needs to configure the proper input signals in the PolyScope interface.

> **Info**
>
> Should you have omitted to note which Digital Input numbers correspond to the signal wires of the Screw Feeder, please refer to the **Robotiq Screw Feeder** section, or look at the terminal blocks of the robot controller.

4.3.1. On CB-Series Robots

- In the PolyScope interface, tap the **Installation** tab.

- Select **I/O Setup** in the navigation pane on the left.

- In the **Input** section, select the Digital Input that corresponds to the terminal in which you inserted the **Status** signal wire.

> **Tip**
>
> For the automatic detection of the I/O signal by the URCap, rename the signal to **feeder_status**.

- Select the Digital Input that corresponds to the terminal in which you inserted the **Ready** signal wire.

> **Tip**
>
> For the automatic detection of the I/O signal by the URCap, rename the signal to **screw_ready**.

- Optionally, while you are in the I/O Setup menu, you can select the Digital Output that corresponds to the terminal in which you inserted the Ground signal wire, and rename it to something meaningful (e.g., feeder_ground).

- Make sure that the configuration switch is set to the correct position (PNP).

4.3.2. On e-Series Robots

- In the PolyScope interface, tap the Installation tab.

- Expand the General menu in the navigation pane on the left

- Select I/O Setup.

- In the Input section, select the Digital Input that corresponds to the terminal in which you inserted the Status signal wire.

> **Tip**
>
> For the automatic detection of the I/O signal by the URCap, rename the signal to **feeder_status**.

- Select the Digital Input that corresponds to the terminal in which you inserted the Ready signal wire.

> **Tip**
>
> For the automatic detection of the I/O signal by the URCap, rename the signal to **screw_ready**.

- Optionally, while you are in the I/O Setup menu, you can select the Digital Output that corresponds to the terminal in which you inserted the Ground signal wire, and rename it to something meaningful (e.g., feeder_ground).

- Make sure that the configuration switch is set to the correct position for the cobot (PNP or NPN).

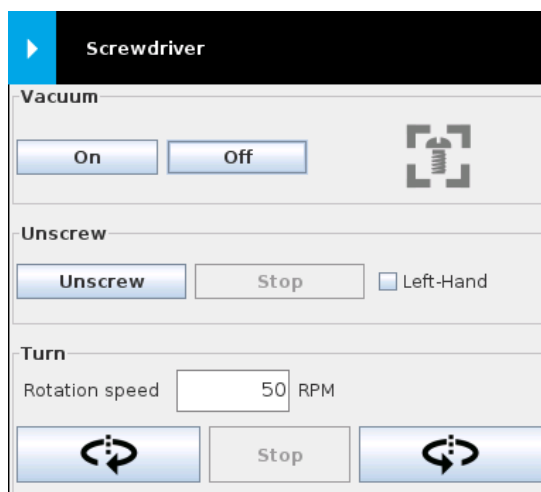# 4.4. Introduction to the Screwdriver Toolbar
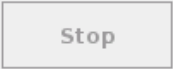
Fig. 4-1: Screwdriver Toolbar.

Vacuum Section		
Visual Support	**Name**	**Description**
On	On Button	Activates vacuum function
Off	Off Button	Stops vacuum function
[Screw Detection Indicator icon]	Screw Detection Indicator	Depending on the vacuum level reached and the positioning of the screw at the tip of the screwdriving bit/vacuum sleeve, displays either: • The "No screw detected" icon (in gray) OR • The "Screw detected" icon (in green)
Unscrew Section		
Visual Support	**Name**	**Description**
Unscrew	Unscrew Button	Instructs the Screwdriver to perform an unscrewing action. Grayed out when the Screwdriver is performing the action.

Visual Support	Name	Description
Stop	Stop Button	Tapping the Stop button while the Screwdriver is performing an unscrewing action will stop that action. Grayed out by default and after the unscrewing action has stopped.
☐ Left-Hand	Left-Hand Checkbox	Instructs the Screwdriver, when tapping the Unscrew button, to perform an inverted unscrewing action, for screws with left-hand threads.
Turn Section		
Visual Support	**Name**	**Description**
Rotation speed 50 RPM	Rotation Speed Field	User-defined value (expressed in revolutions per minute, or RPM) to jog the screwdriving action. Default value is 50 RPM.
⟳	Turn CW Button	Jogs the screwdriving action clockwise (facing downwards on the tool's Z axis) at the speed defined in the Rotation Speed Field.
Stop	Stop Button	Stops the screwdriving action after either the Turn CW or Turn CCW has been pressed. Grayed out by default and after the screwdriving action has been stopped.
⟲	Turn CCW Button	Jogs the screwdriving action counterclockwise (facing downwards on the tool's Z axis) at the speed defined in the Rotation Speed Field.

4.5. Input Air Pressure Validation

Having the correct input air pressure at the tool is important. Follow these steps to validate or adjust the input air pressure.

1. Switch off the air supply at the tool.

2. Disconnect the air tube at the tool (remove the safety clip from the inlet port).

3. Connect the push-to-connect tube fitting provided to the Screwdriver.

4. Re-install the safety clip on the inlet port.

5. Connect the pressure gauge at the other end of the tube.

6. Connect the tube that has been previously disconnected to the other end of the pressure gauge.

7. Switch on the air supply.

8. Using a pressure regulator (not provided), adjust the pressure to 7 bar (100 psi).

9. Start the vacuum system using the Screwdriver Toolbar.

10. Monitor the pressure on the pressure gauge. The pressure value displayed should be around 0.7 MPa (7 bar / 100 psi)*. If that is not the case, adjust the pressure regulator so that the pressure gauge displays a value closer to 0.7 MPa when the vacuum system is activated.

*0.7 MPa is the optimal, recommended pressure, but it can be set between 0.62 MPa (6.2 bar / 90 psi) and 0.7 MPa (7 bar / 100 psi).

> **Info**
>
> Too much air loss in the system might prevent the system from reaching 7 bar (100 psi).

11. Once the pressure is correctly adjusted, switch off the vacuum system.

12. Switch off the air supply at the tool, and remove the pressure gauge assembly.

13. Reconnect the air tube to the Screwdriver.

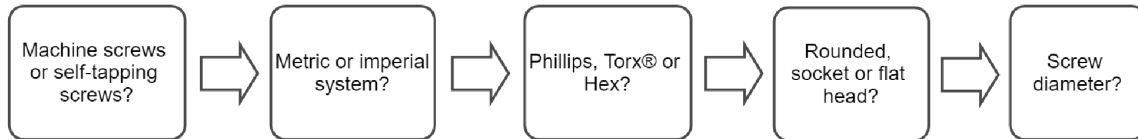14. Re-install the safety clip on the inlet port.
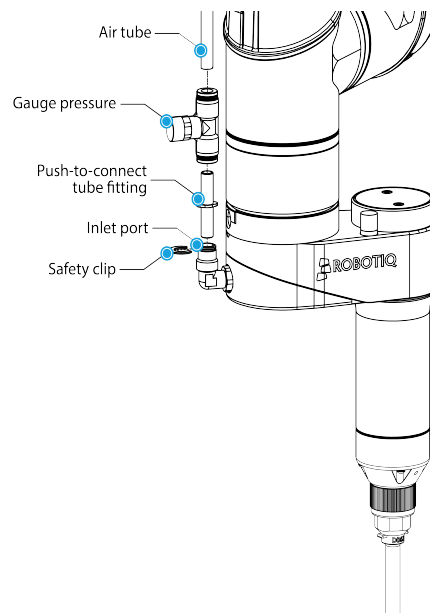
4.6. Screwdriver Vacuum Sleeve Selection

The correct screwdriver bit and vacuum sleeve combination must be selected to get proper results.

> **Info**
>
> The following charts only show the maximum bit gauge size for a given sleeve.
>
> Select the bit according to the screw specifications.

Machine screws or self-tapping screws? ⇒ Metric or imperial system? ⇒ Phillips, Torx® or Hex? ⇒ Rounded, socket or flat head? ⇒ Screw diameter?

4.6.1. Self-Tapping Screws

SELF-TAPPING SCREWS

METRIC SCREWS

Screw type	Phillips		Torx®	
	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve
Rounded head				
M2.5	PH1	C052		
			T8	A052
M2.9	PH1	C062		
M3	PH1	C062		
M3.12			T10	A062
	PH2	C072		
M3.63			T15	A072
M3.9	PH2	C085		
M4	PH2	C085		
Flat head				
M2.9	PH1	D061		
M3.5	PH2	D070		
M3.9	PH2	D082		

IMPERIAL SCREWS

Screw type	Phillips		Torx®	
	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve
Rounded head				
#4	PH1	C062	T8	A062
#6			T10	A062
	PH2	C072	T15	A072
#8	PH2	C085	T20	A083
Flat head				
#4	PH1	D061	T8	B061
#6	PH2	D070	T10	B072
#8	PH2	D082	T15	B082
			T20	B095

4.6.2. Machine Screws

MACHINE SCREWS

METRIC SCREWS

Screw type	Phillips		Torx®		Hex	
	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve
Rounded head						
M2.5	PH1	C052	T8	A052		
M3	PH1	C062	T10	A062	2	A062
M4	PH2	C085	T20	A083	2.5	A083
Socket head						
M2.5			T8	E050	2	E050
M3			T10	E061	2.5	E061
M4			T20	E072	3	E072
Flat head						
M2.5	PH1	D050	T8	B050		
M3	PH1	D061	T8	B072	2	B061
M3			T10	B061		
M4	PH2	D082	T20	B095	2.5	B082

IMPERIAL SCREWS

Screw type	Phillips		Torx®		Hex	
	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve	Max. bit size*	# Vacuum sleeve
Rounded head						
#3	PH1	C052				
#4	PH1	C062	T8	A062		
#4			T10	A062		
#5	PH1	C085			5/64	A062
#5	PH2	C072				
#6	PH2	C072	T10	A072	5/64	A072
#6			T15	A072		
#8	PH2	C085	T15	A083	3/32	A083
#8			T20	A083		
Socket head						
#3					5/64	E045
#4					3/32	E050
#5			T10	E061	3/32	E061
#6			T15	E061	7/64	E061
#8			T25	E072	9/64	E072
Flat head						
#3	PH1	D050				
#4	PH1	D061	T8	B072		
#5	PH1	D061	T10	B072	5/64	B072
#5	PH2	D061				
#6	PH2	D070	T10	B072	5/64	B082
#8	PH2	D082	T15	B082	3/32	B095
#8			T20	B095		

4.7. Vacuum Coupler Adjustment

At this point, the Screwdriver should be equipped with a screwdriving bit and its corresponding vacuum sleeve. Please refer to the **Mechanical Installation** sectionn should you need further instructions on this matter.

1. To adjust the protruding length of the screwdriving bit, start by screwing or unscrewing the coupler adjuster so that the tip of the screwdriving protrudes slightly past the lower end of the vacuum sleeve.
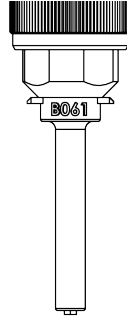
Fig. 4-2: Drawing of a Screwdriving Bit Protruding Slightly Past the Lower End of the Vacuum Sleeve.

2. In the Screwdriver Toolbar, tap the On button to activate the vacuum action (a gray icon will display, indicating that the Screwdriver cannot detect a screw).
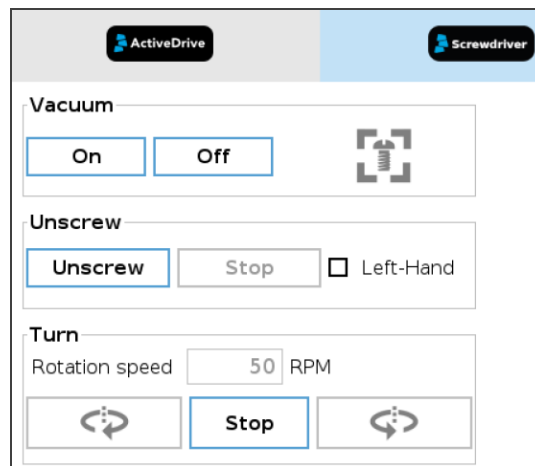
Fig. 4-3: Screwdriver Toolbar Showing No Screw Has Been Detected.

3. Hold a screw corresponding to your application at the tip of the screwdriving bit.

4. Lower the coupler adjuster until the screw icon of the Screwdriver Toolbar becomes green. The screwdriving bit should be inserted into the screw's drive with the screw head resting against the end of the vacuum sleeve.
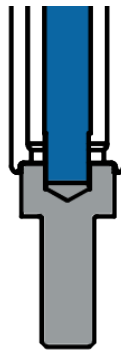
Fig. 4-4: Drawing of Screwdriving Bit (in Blue) Inserted Into Screw's Drive with Screw Head Resting Against Vacuum Sleeve.
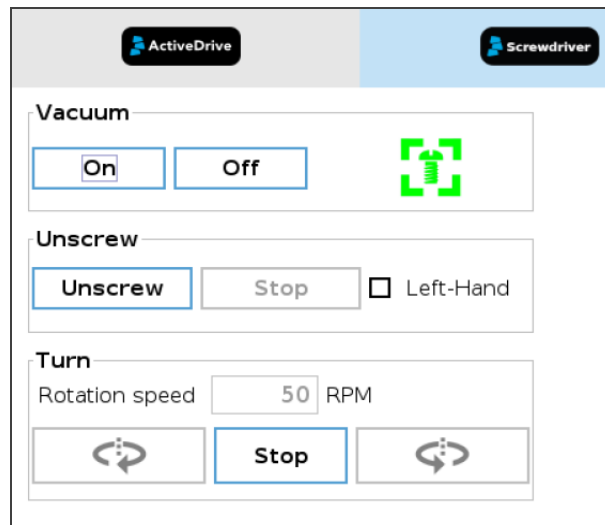
Fig. 4-5: Screwdriver Toolbar Showing a Screw Has Been Detected.

> **Warning**
>
> The screw icon going from gray to green should be noticeable when looking at the Screwdriver Toolbar.
>
> If you keep lowering the vacuum sleeve after the screw has been detected, this may lead to the screwdriving bit disengaging from the screw's drive.

5. Slightly tighten the coupler locking nut by hand to secure the adjustment.

4.8. Screw Feeder Adjustment

4.8.1. Screw Singulator Knob

The screw singulator knob can be found at the front of the Screw Feeder, more specifically at the center of the front panel, aligned with the screw singulator assembly.
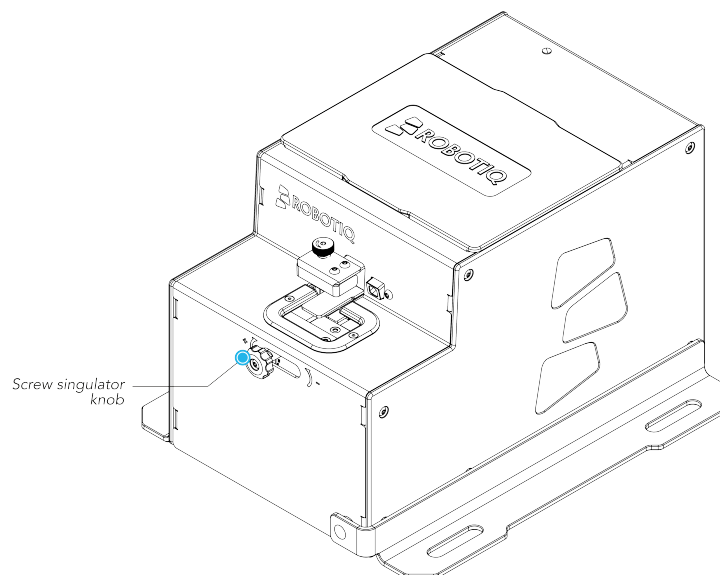
Fig. 4-6: Location of the Screw Singulator Knob at the Front of the Screw Feeder.

It allows adjusting the opening of the screw singulator plates, which pick up the screws at the end of the rail and bring them in front of the screw detection sensor.

- Turning the screw singulator knob clockwise widens the gap between the two singulator plates, to accommodate larger diameter screws.

- Turning the screw singulator knob counterclockwise narrows the gap between the two singulator plates, to accommodate smaller diameter screws.

Best practice for adjusting screw singulator plates:

- Turn off the Screw Feeder.

- Adjust the screw singulator according to the size of your screws; make sure it can be picked up effortlessly by the Screwdriver using vacuum action.

> **Tip**
>
> When closing the screw singulator plates around the threaded portion of the screw, make sure to leave minimal play to facilitate the release of the screw when it is picked up by the Screwdriver.

4.8.2. Rail Knob

The rail knob can be found at the back of the Screw Feeder, more specifically at the center of the back panel. It allows adjusting the width of the rail which transports the screws, head up, from the reclaiming wheel to the screw singulator.
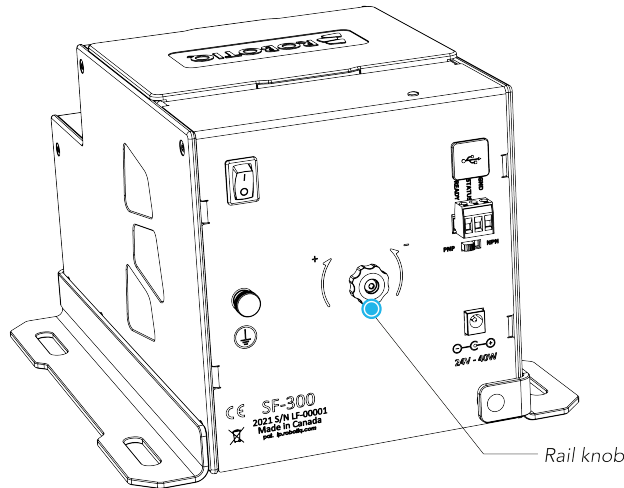
Fig. 4-7: Location of the Rail Knob at the Back of the Screw Feeder.

- Turning the rail knob clockwise widens the gap between the two rail sides, to accommodate larger diameter screws.

- Turning the rail knob counterclockwise narrows the gap between the two rail sides, to accommodate smaller diameter screws.

- Adjust the rail so that the screws should be able to travel freely along the rail.

> **Tip**
>
> When closing the rail sides around the threaded portion of the screw, make sure to leave a certain play so that the screws can be transported freely through vibration during runtime.

4.8.3. Brush Knob

The brush knob can be found at the top of the Screw Feeder, more specifically on the shaft holding the brush. The shaft oscillates thus allowing the brush to clear incorrectly positioned screws traveling across the rail, from the reclaiming wheel to the screw singulator.
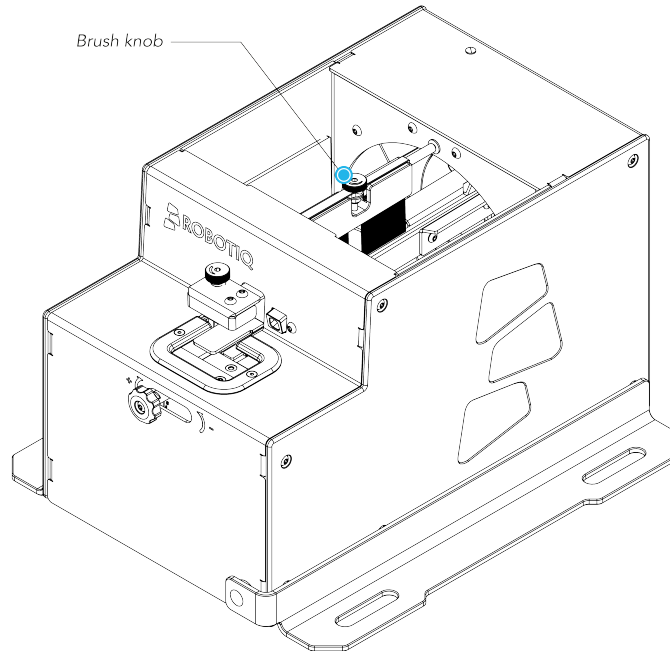
Fig. 4-8: Location of the Rail Knob at the Top of the Screw Feeder.

- Turning the brush knob clockwise increases the gap between the brush and the rails, to accommodate higher head screws.

- Turning the brush knob counterclockwise decreases the gap between the brush and the rails, to accommodate lower head screws.

Best practice for adjusting brush height:

- Turn off the Screw Feeder.

- Set the brush height using the brush knob so that the bristles barely come into contact with the top of the screw head.

- Adjust the brush height if incorrectly positioned screws are still traveling along the rail.

> **Tip**
>
> When bringing the brush assembly closer to the rail, make sure to leave a certain play to prevent the brush from pushing correctly positioned screws into the screw chamber.
>
> The brush is often stopped at an angle when the Screw Feeder is stopped. The user can rotate it freely to align it with the rail.

4.8.4. Screw Head Clearance Knob

The screw head clearance knob can be found at the front of the Screw Feeder, more specifically above the end of the rail. It allows adjusting the height of the screw head clearance plate to prevent screws from overlapping, or to separate screws that become overlapped while travelling on the rail (e.g., countersunk head screws).
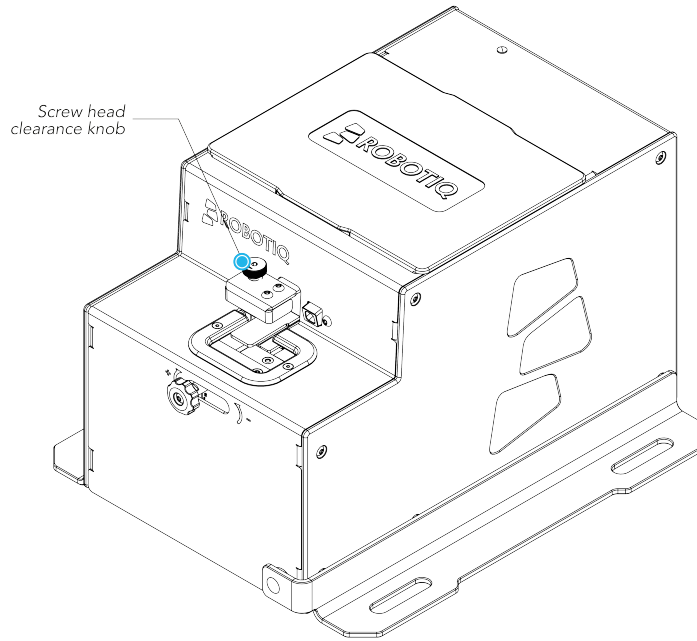
Fig. 4-9: Location of the Screw Head Clearance Knob at the Front of the Screw Feeder.

- Turning the screw head clearance knob clockwise raises the screw head clearance plate.

- Turning the screw head clearance knob counterclockwise lowers the screw head clearance plate.

Best practice for adjusting screw head clearance:

- Turn the screw head clearance knob counterclockwise so as to raise the screw head clearance plate.

- Place one or several screws in the rail; refer to the **Rail Knob** section and/or **Brush Knob** section should you need to adjust the width of the rail and/or height of the brush assembly, respectively.

- Lower the screw head clearance plate enough so that no screw can go through.

- Slowly raise the screw head clearance plate until screws can travel freely underneath it with minimal play.

4.9. Screw Feeding Test

Once all Screw Feeder adjustments have been made, you can **test the screw feeding process** (refer to the **Rail Knob**, **Brush Knob**, **Screw Head Clearance Knob** or **Screw Singulator Knob** sections for indications on how to perform the adjustment of the Screw Feeder components):

> **Warning**
>
> Before powering on the Screw Feeder, make sure not to fill the screw chamber above the max line.
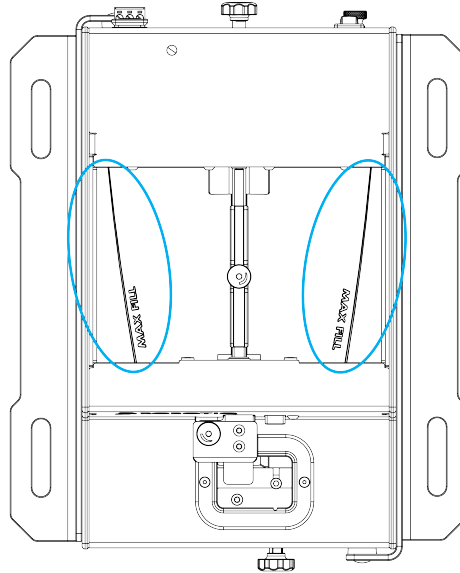
Fig. 4-10: Max Line of the Screw Chamber.

- Pour a certain number of screws in the screw chamber.

- Turn on the Screw Feeder; the device will go through the steps referred to in the **Screw Feeding** section.

- Monitor the screw feeding process to identify any issue (e.g., the screw gets stuck or friction seems to slow down its travel).

- The Screw Feeder will automatically stop when a screw reaches the screw detection position.

- Remove screws from the singulator as they reach the screw detection position.

- Repeat until the rail is filled with screws.

- The test can be considered successful when:
    1. a few screws go through the whole feeding process, from the screw chamber to the screw detection position.
    2. once the rail is filled, the Screw Feeder feeds approximately 1 screw per 3 seconds.

5. Software

5.1. Overview

The URCap package contains several features to program and control the Robotiq Screwdriver:

- Screwdriver Toolbar
    - Automatically made available by installing the Screwdriving URCap package
    - Allows jogging the Screwdriver
        - Vacuum ON/OFF
        - Right-hand/left-hand unscrewing
        - Testing the rotation clockwise and counterclockwise

- Pick Screw node
    - Sets the picking position
    - Assigns the Screw Feeder's digital inputs
    - Tests the picking sequence in Teach mode
    - Executes the picking sequence at runtime

- Drive Screw node
    - Allows inserting a screwdriving command with features such as:
        - Using a stop condition
        - Adjusting the tool speed
        - Applying force on the screw
        - Teaching the action
        - Testing the command.
        - Advanced features include:
            - Auto-detection of faulty screwdriving sequences based on error conditions
            - Option to retry the screwdriving sequence on failure

5.2. Installation Menu

Getting to the Installation menu:

- **CB-Series**
    a. From the PolyScope homepage, tap **Program Robot**.
    b. Tap the **Installation** tab.
    c. Select **Screwdriving** from the navigation pane on the left.

- **e-Series**
    a. In the PolyScope interface, tap the **Installation** button in the top ribbon.
    b. Expand the **URCaps** dropdown menu in the navigation pane on the left.
    c. Select **Screwdriving**.

5.2.1. Tools Tab
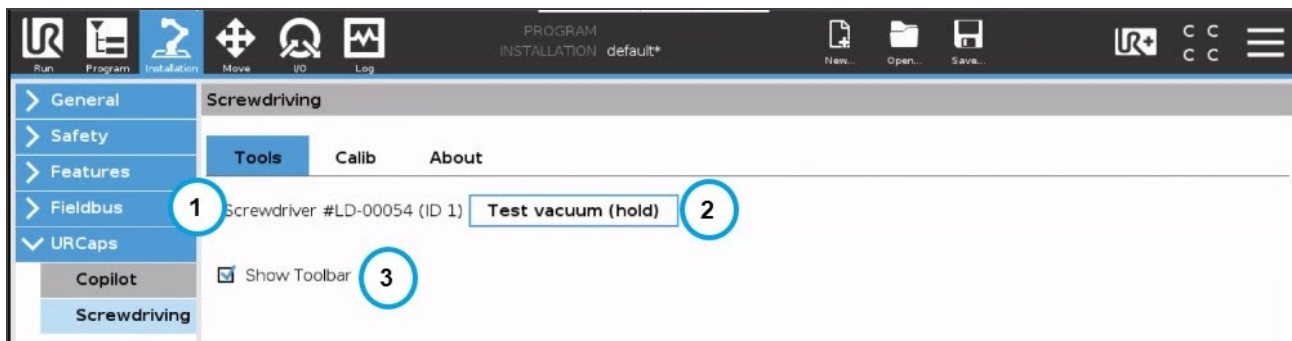
1. **Screwdriver serial number**
    - Displays the serial number of the activated Screwdriver.

2. **Test vacuum (hold)** button
    - Hold the button to enable vacuum action.

3. **Show Toolbar** checkbox
    - Tick to enable/display the Screwdriver Toolbar
    - Untick to disable/hide the Screwdriver Toolbar

Info

Should the Tools tab not be displaying a Screwdriver, please open the Screwdriver Toolbar and tap on the **Activate** button.

5.2.2. Calib Tab

Info

This subsection is only used to list the elements of the Calibration user interface.

Please refer to the **Calibration Procedure** section for specific guidelines on how to calibrate or refine the calibration of the Robotiq Screwdriver.

Info

Should the Calib tab not be displaying a Screwdriver, please open the Screwdriver Toolbar and tap on the **Activate** button.

---
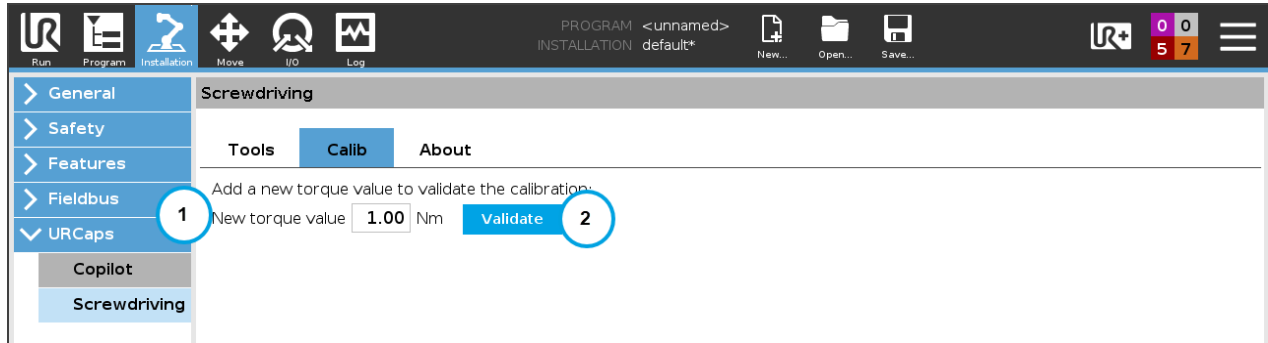
1. **New torque value** field
   - Enter torque value requested, corresponding to your application.

2. **Validate** button
   - Tapping this button will display the validation interface, allowing you to carry on with the torque testing procedure.
   - If one or several torque values are listed lower in the interface, you can directly tap the **Validate** button next to each.
   - Tapping the **Delete** button will remove the torque value.
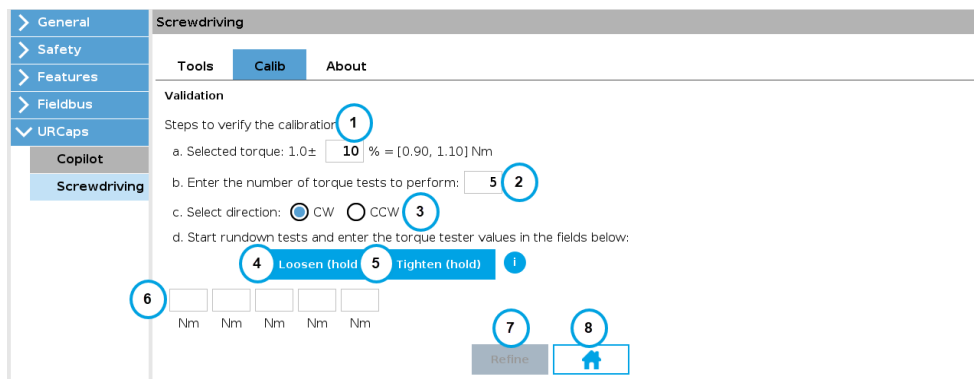
1. **Torque value tolerance** field
   - Enter the tolerance in percentage; the interface will surround out-of-range values with a red border, and within-range values with a green border.

2. **Number of tests to perform** field
   - Enter the number of rundown tests to perform using a torque tester and rundown adapter.

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3. **Select direction** radio buttons
   - Tapping the **CW** button will instruct the Screwdriver to rotate in the clockwise direction during rundown tests.
   - Tapping the **CCW** button will instruct the Screwdriver to rotate in the counterclockwise direction during rundown tests.

4. **Loosen (hold)** button
   - Tap and hold the button to release torque stress applied on the rundown adapter during rundown tests.

5. **Tighten (hold)** button
   - Tap and hold the button to apply torque stress on the rundown adapter during rundown tests.

6. **Torque values read** fields
   - Enter values displayed on the torque tester after each rundown test.

7. **Refine** button
   - Tap this button to refine the calibration corresponding to the torque value requested.

8. **Home** button
   - Tap this button to go back to the initial Calib screen.

> **Info**
>
> The refinement interface is similar to that of the validation, and only displays if the user requests a calibration refinement.

5.2.3. About Tab
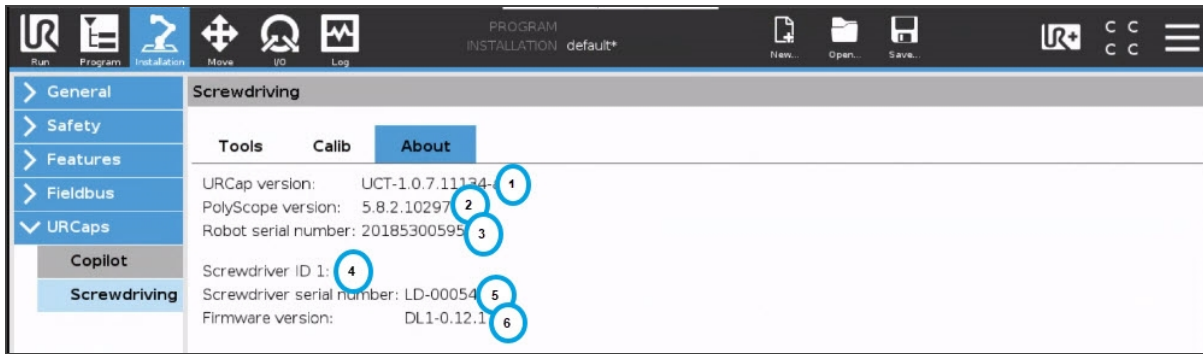
1. **URCap version**
   - Displays current UR software package version for the Robotiq Screwdriver.

2. **PolyScope version**
   - Displays current UR robot software version.

3. **Robot serial number**
   - Displays the serial number of the robot on which the Screwdriver is installed.

4. **Screwdriver ID**
   - Displays Screwdriver ID (assigned by default upon activation).

5. **Screwdriver serial number**
   - Displays the serial number of the activated Screwdriver.

6. **Firmware version**
   - Displays the current version of the Screwdriver firmware.

5.3. Command Window

5.3.1. Pick Screw Node

- **CB-Series**
   a. From the PolyScope homepage, tap **Program Robot**.
   b. Open an empty program or load an existing program.
   c. Go to the **Structure** tab.
   d. Tap the **URCaps** submenu.
   e. Tap the **Pick Screw** button to add a Pick Screw node to the program tree.
   f. Go to the **Command** tab to edit the Pick Screw node inserted in the program tree.

- **e-Series**

  a. In the PolyScope interface, tap the **New** icon to create a program, or the **Open** icon to load an existing program.

  b. Tap the **Program** button in the top ribbon.

  c. Select the **URCaps** dropdown menu in the navigation pane on the left.

  d. Tap the **Pick Screw** button to add the node to the program tree.

  e. Select the node in the program tree to edit it.

1. **Feeder status** indicator
   - Displays Screw Feeder status
     - Green = Screw Feeder is working properly.
     - Red = Screw Feeder is off or is experiencing an issue.

> **Caution**
>
> If needed, please refer to the **Screw Feeder Signals** section to properly configure the corresponding digital inputs. Then, if the signals have been named as recommended, they should automatically be selected by the system.

2. **Screw ready** indicator
   - Indicates if a screw is at the screw detection position in the Screw Feeder.
     - Green = The screw is in front of the screw detection sensor, ready to be picked.
     - Gray = The screw detection sensor of the Screw Feeder cannot detect a screw.

> **Caution**
>
> If needed, please refer to the **Screw Feeder Signals** section to properly configure the corresponding digital inputs.

3. **Retry on failure** checkbox
    - Tick to ask the robot to re-execute the Pick Screw node should it fail.
    - Untick to prevent the robot from re-executing the Pick Screw node should it fail.

4. **Set pick position** button
    - Sets the position at which the screwdriving bit is considered to be in proper contact with the drive of the screw.

5. **Move to pick pos** button
    - Instructs the robot to go to the screw picking position set at step #4.

6. **Pick position** indicator
    - Visual element that tells the user how to properly position the Screwdriver is considered at the screw picking position, and in proper contact with the drive of the screw.

7. **Move to approach** button
    - Instructs the robot to go to a position which by default is set 10 mm away from the screw picking position set at step #4.

8. **Test** button
    - Tapping this button will run a Pick Screw test based on the parameters set in the previous steps.

5.3.2. Drive Screw Node

- **CB-Series**
    - From the PolyScope homepage, tap **Program Robot**.
    - Open an empty program or load an existing program.
    - Go to the **Structure** tab.
    - Tap the **URCaps** submenu.
    - Tap the **Drive Screw** button to add a Drive Screw node to the program tree.
    - Go to the **Command** tab to edit the Drive Screw node inserted in the program tree.

- **e-Series**
    - In the PolyScope interface, tap the **New** icon to create a program, or the **Open** icon to load an existing program.
    - Tap the **Program** button in the top ribbon.
    - Select the **URCaps** dropdown menu in the navigation pane on the left.
    - Tap the **Drive Screw** button to add the node to the program tree.
    - Select the node in the program tree to edit it.

Drive Screw
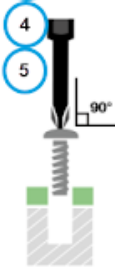
1. **Stop Condition** dropdown menu
   - Expand to select which of the stop conditions will be used to trigger the end of the screwdriving sequence: torque value reach (metric), torque value reached (imperial), or number of turns.

2. **Stop condition** value field
   - Expressed in either newton-meters (Nm), pound-force feet (lbf·ft) or angle (deg)
   - Enter value to set the Screwdriver stop condition.

   > **Caution**
   >
   > A message box will appear when a torque between 0.25Nm (0.185 lbf·ft) and 0.499Nm (0.368 lbf·ft) is requested (valid for firmware version ≥ 1.1).
   >
   >
   >
   > **Unsupported Torque Value Requested**
   >
   > Requested torque value is under 0.5Nm, which is not within the supported range. Repeatability might exceed ±10% and we recommend torque validation.
   > Refer to the calibration module in the Installation tab.
   >
   > Would you like to proceed?
   >
   > [Yes]   [No]
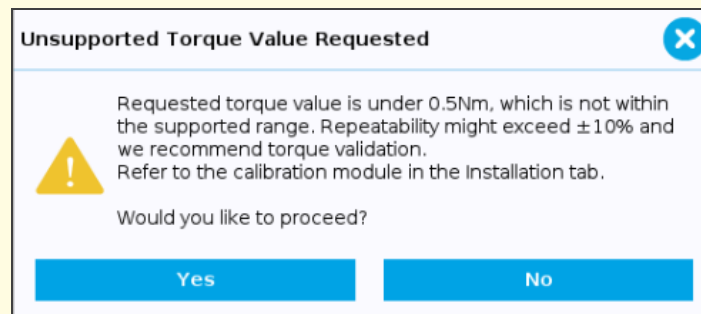
3. **Tool speed** field
   - Expressed in revolutions per minute (RPM)
   - Enter value to set the speed at which the Screwdriver will be rotating.

4. **Force applied on screw** field
   - Expressed in newtons (N)
   - Enter value to set the force that the Screwdriver will apply in the tool's Z axis when performing the screwdriving action.

5. **Start Teach position** indicator
   - Visual element that tells the user where to position the Screwdriver before pressing the **Teach** button.

6. **Teach** button
   - Tap to teach the screwdriving cycle. A program will perform a screwing sequence followed by an unscrewing sequence based on the parameters set in the previous steps, and will collect the additional parameters needed to reproduce the sequence at runtime.

7. **Test** button
   - Tap to test the screwdriving action based on the parameters set in the previous steps.

8. **Advanced settings** checkbox
   - Tick the box to expand the advanced settings section.
   - Untick the box to hide the advanced settings section.

9. **Angle before ramp down** field
   - Expressed in degrees (deg)
   - The value displayed corresponds to the parameter collected during the teaching sequence.
   - Refine the value to adjust the total angle of rotation that the Screwdriver will cover during the screwdriving action prior to decelerating.

10. **Left-hand threads** checkbox
    - Tick the box to engage the Screwdriver in an inverted (counterclockwise) rotational motion for left-hand thread screws.
    - Left the box unchecked to leave the rotational motion of the Screwdriver in the clockwise direction (right-hand threads).

11. **Retry on failure** error condition checkbox
    - Tick the box to retry the screwdriving sequence once the robot has finished handling the failure.
    - Untick the box to prevent the robot from re-executing the Drive Screw node should it fail.

12. **Distance tolerance** error condition checkbox
    - Tick this box to ask the system to execute a user-defined command should the value entered be exceeded.

13. **Distance tolerance** value field
    - Expressed in millimeters (mm)
    - Grayed out if the **Distance tolerance error condition** checkbox is unticked.
    - Should the TCP find itself away from the target position on the Z-axis (based on the stop condition), for a distance equivalent or greater than the value entered, this will instruct the system to execute a user-defined command.

14. **Timeout** error condition checkbox
    - Tick this box to ask the system to execute a user-defined command should the value entered be exceeded.

15. **Timeout** value field
    - Expressed in second (s)
    - Grayed out if the **Timeout error condition** checkbox is unticked.

- ○ Enter a value, acting as a threshold, that will prompt an error message resulting from the screwdriver executing the screwdriving action over a period of time corresponding to the value entered, without reaching its target destination or target torque value.

5.4. Pick and Screw Sequence

> **Caution**
>
> Prior to engaging a pick and screw sequence, make sure that the Screwdriver is equipped with the appropriate screwdriving bit and vacuum sleeve, and that the coupler assembly is correctly adjusted to ensure a successful screw detection and picking sequence.

5.4.1. Picking Screw

1. Insert a Pick screw node in the program tree. Please refer to the **Command Window** section should you need instructions on how to do so.

2. If not automatically selected, select the digital inputs of the Screw Feeder. Please refer to the **Screw Feeder Signals** section should you need to rename the inputs according to the signal they are transferring.

3. Remove the vacuum sleeve covering the screwdriving bit.

> **Caution**
>
> Make sure the tool is perpendicular to the Screw Feeder's Surface.
>
> You can use the ActiveDrive feature to reorient the tool at 90 degrees and lock the motion in 4 degrees of freedom.
>
>
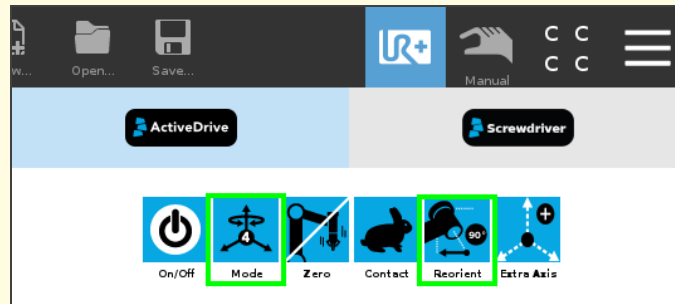
4. Using the ActiveDrive feature, move the tool to bring the screwdriving bit as close as possible to the screw head.

> **Tip**
>
> Use the Contact mode of the ActiveDrive feature to move the tool slowly and precisely.

> **Tip**
>
> Reduce the speed of the robot to the minimum using the slider in the PolyScope interface.
>
> You will need to stop the ActiveDrive feature to do so.
>
> The user can also rotate the Screwdriver's body above the screw drive for the screwdriving bit to be as centered as possible; screwdriving bits are often not perfectly straight.

5. Slowly bring the screwdriving bit as close as possible to the screw head; Robotiq recommends placing the very tip of the screwdriving bit flush with the top of the screw head. This optimizes the vacuum action for a straight screw picking.

> **Caution**
>
> The screwdriving bit must not reach and apply pressure at the bottom of the screw head drive.

> **Info**
>
> The depth at which the screwdriving bit should be inserted depends on your situation (screw type, screw head, drive type, etc.). Make sure to adjust accordingly.

6. Tap the Set pick position button in the Command window.

7. Confirm by tapping the OK button.

8. Move the robot away from the picking position.

9. Reinstall the vacuum sleeve around the screwdriving bit.

10. In the PolyScope interface, set the speed slider at the desired speed.

> **Info**
>
> You can test the picking sequence by tapping the **Test** button.
>
> 1. The robot goes to the approach point.
>
> 2. Once a screw is ready to be picked, the Screwdriver starts and the vacuum action is enabled.
>
> 3. The robot goes to the picking position.
>
> 4. The vacuum action pulls the screw.
>
> 5. Once the system detects the screw, the robot goes to the retracting position.
>
> - A successful test will bring up a confirmation pop-up window. Follow the instructions on screen.
>
> - A failed test will bring up an error message. You can refine your pick position or refer to the Troubleshooting section to apply corrective actions. Test again until the program successfully cycles through the picking sequence.

5.4.2. Screwdriving

> **Caution**
>
> Prior to engaging a screwdriving sequence, make sure the Screwdriver holds a screw.
>
> If the Screwdriver does not hold a screw, you can use the pick test from the Pick node (refer to the **Picking Screw** section) to pick up a screw.
>
> Alternatively, open the Screwdriver Toolbar, activate the vacuum action by tapping the ON button, place a screw manually at the tip of the screwdriving bit. Please note that the automatic picking sequence is more representative of actual operating conditions.

1. Insert a Move node in the program tree.

2. To define the waypoint within the Move node, move the Screwdriver holding the screw right above the hole in which the screw will be inserted.

3. Record the position as the waypoint inserted at step #2; make sure the screw is aligned with the hole before confirming the position.

> **Caution**
>
> Make sure the tool is perpendicular to the workpiece.
>
> You can use the ActiveDrive feature to reorient the tool at 90 degrees and lock the motion in 4 degrees of freedom.

> **Info**
>
> The screw should be concentric with the hole.
>
> The shorter the distance, the shorter the cycle time when performing the actual screwdriving sequence.

> **Tip**
>
> Use the Contact mode of the ActiveDrive feature to move the tool slowly and precisely.

> **Tip**
>
> Reduce the speed of the robot to the minimum using the slider in the PolyScope interface.
>
> You will need to stop the ActiveDrive feature to do so.
>
> The user can also rotate the Screwdriver's body above the hole for the screwdriving bit to be as centered as possible; screwdriving bits are often not perfectly straight.

4. Insert a Drive Screw node within the Move node.


```
1   ▼ Robot Program
2   ⦿ ✛ MoveJ
3      ⊙ screw_1
4   ⦿ ▼ Drive Screw
5      ⦿ ▼ If success
6         ● 'Insert If Success Instruction
7         ⦿ ✛ MoveL
8            ⦿ ▼ Direction: Tool Z-
9               ➟ Until distance: 5 mm
```
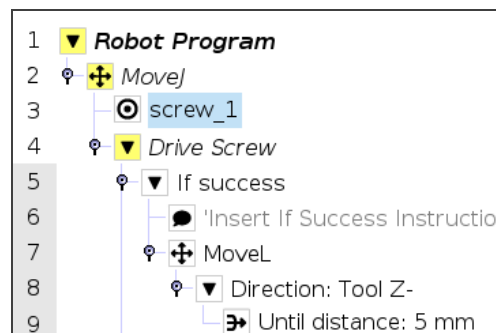
5. Set the stop condition that corresponds to your assembly requirements.

6. Adjust the tool speed based on your application (default is 500 RPM).

7. Adjust the force applied on the screw (default is 10 N).

8. In the PolyScope interface, make sure the speed slider is set at 100%.

9. Press the **Teach** button.

10. Confirm the screw has reached its final position.

> **Info**
>
> 1. The Screwdriver will perform a screw sequence until the predefined stop condition is reached.
>
> 2. Once the stop condition is reached, the user will be prompted to confirm whether or not the screw has reached its final position.
>
> 3. The Screwdriver will perform an unscrewing sequence and record the parameters for successful screwdriving sequence.

11. To test the Drive Screw sequence, you first need to go back to the waypoint that corresponds to the start of your teaching sequence.

12. Place the screw and start the vacuum action.

13. Tap the **Test** button.

14. Confirm whether or not the screwdriving sequence has executed correctly.

15. You can use the **Unscrew** function of the Screwdriver Toolbar to remove the screw.

Tip

Make sure to insert enough waypoints when retracting from the screwdriving position in order to avoid collisions with assets, material or workers.

Tip

Reduce the robot speed when executing the pick and screw sequence for the first few times.

5.5. Advanced Script Functions

The use of the Screwdriving URCap unlocks several advanced script functions that can be inserted into the robot program. For more details click on the scripts below and see the Scripts section in the **Appendix**.

SCRIPT	SHORT DESCRIPTION
rq_auto_unscrew()	Performs a full unscrew action until the screw threads are disengaged from the hole.
rq_is_blocked_at_start_cause()	Use under the "Unhandled errors" node to display the cause of the error.
rq_is_communication_lost_cause()	
rq_is_contact_not_found_cause()	
rq_is_feeder_screw_ready()	Validates if a screw is ready to be picked from the Screw Feeder.
rq_is_feeder_status_ok()	Validates if the feeder is on and ready.
rq_is_restricted_before_angle_cause()	Use under the "Unhandled errors" node to display the cause of the error.

rq_is_screw_detected()	Validates the presence of a screw at the end of the screwdriver via vacuum action.
rq_is_screwdriver_wrong_echo_cause()	Use under the " Unhandled errors" node to display the cause of the error.
rq_pick_screw()	Picks a screw from the Robotiq Screw Feeder.
rq_screw_activate()	Activates the Screwdriver once it is powered on.
rq_screw_stop()	Stops the rotation of the screwdriver.
rq_screw_turn()	Turns the bit of the Screwdriver around by a number of degrees or until a specific torque value is reached.
rq_screw_vacuum_off()	Stops the vacuum action on the Screwdriver.
rq_screw_vacuum_on()	Starts the vacuum action on the Screwdriver.
rq_get_screw_status()	Retrieves the current activation status of the Screwdriver.
rq_get_vacuum_pressure_kpa()	Retrieves the current vacuum level in the vacuum sleeve.

6. Screwdriver Calibration

> **Caution**
>
> In order for the calibration to be reliable in your production environment, use the Screwdriver in the same environmental conditions in which the calibration was performed.

6.1. Material Required

- Torque tester (not included)

- 1/4-inch rundown adapter (not included, length of 15 mm minimum for insertion in the Robotiq Screwdriver's bit holder)

6.2. Calibration Procedure

1. In the PolyScope interface, go to **Installation** > **Screwdriving** > **Calib** tab.
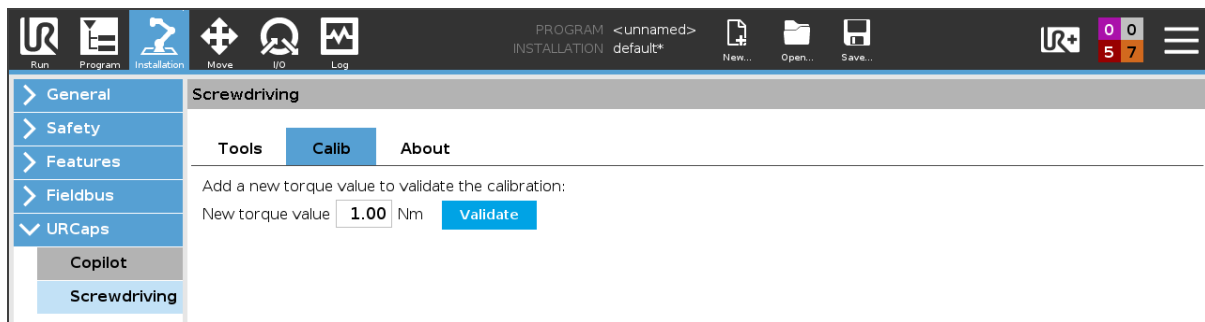
2. Enter the torque value you need to reach in the framework of your application.

3. Tap the **Validate** button to carry on with the torque testing procedure.

4. If one or several torque values are listed lower in the interface, you can directly tap the **Validate** button next to each.

> **Tip**
>
> Unscrewing the rundown adapter completely prior to the insertion in the Screwdriver's bit holder will ensure the adapter is not constrained at an angle.

5. Remove the Screwdriver's coupler locking nut and coupler adjuster to reveal the bit holder.

6. Unscrew the bit holder knob for an easier insertion. Use the provided 1/2-inch wrenches if needed.

> **Tip**
>
> Use Robotiq's Mode feature in the ActiveDrive Toolbar to limit robot motion to 3 degrees of freedom.
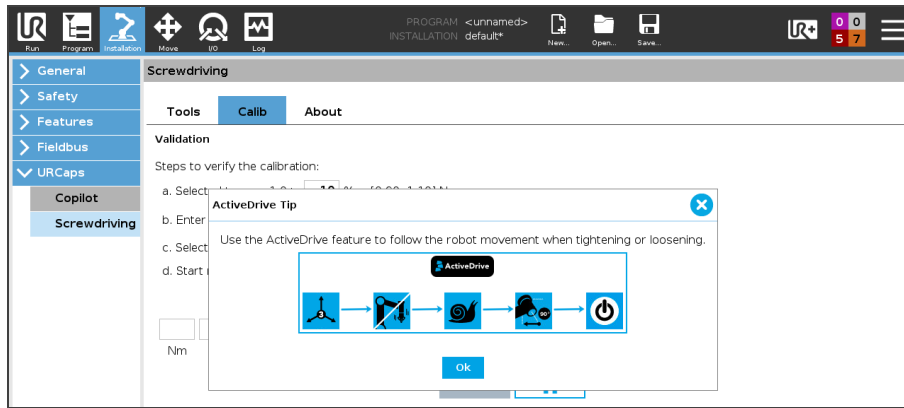
7. Tap the **Zero** button in Robotiq's ActiveDrive Toolbar to zero the force and torque values.

8. Tap the **Contact** button in Robotiq's ActiveDrive Toolbar to go into ''Snail'' contact mode; this will allow for a precise insertion.

9. Make sure the Screwdriver's bit holder is aligned with the rundown adapter.

10. In the **Calib** tab, next to **Selected torque**, adjust the tolerance value according to the requirements of your application. The default value is 10% (according to ISO 5393 standards).
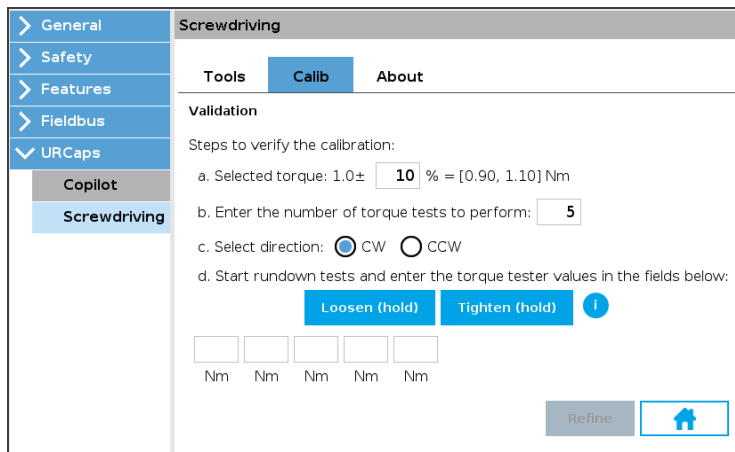
Info

The tolerance value is only used for user interface friendliness purposes. It will not be used for the actual calibration process. The refinement process will remain as much as possible within the Screwdriver's tolerance specifications.

---

11. Align the Screwdriver's bit holder with the rundown adapter so that the male and female hexagonal patterns correspond to each other.

12. Slip the Screwriver's bit holder on the rundown adapter. Make sure it is completely inserted. You should be able to rotate the bit holder freely.

Info

If the robot appears to be struggling or vibrating, the alignment of the bit holder and torque tester adapter might be slightly off. Try zeroing the force and torque values.

---

13. Define the number of tests you need to perform according to your calibration requirements. The default value is 5.

14. Select the rotational screwing direction. The default value is clockwise (CW).

15. Start the **Validation** rundown tests:

> **Info**
>
> Turn on the ActiveDrive feature and keep it active since you will be guiding the ScrewDriver by hand.

   a. Hold the **Loosen (hold)** button to release any torque stress applied on the rundown adapter.

   b. Hold the **Tighten (hold)** button until the popup window displays, indicating the requested torque has been reached.
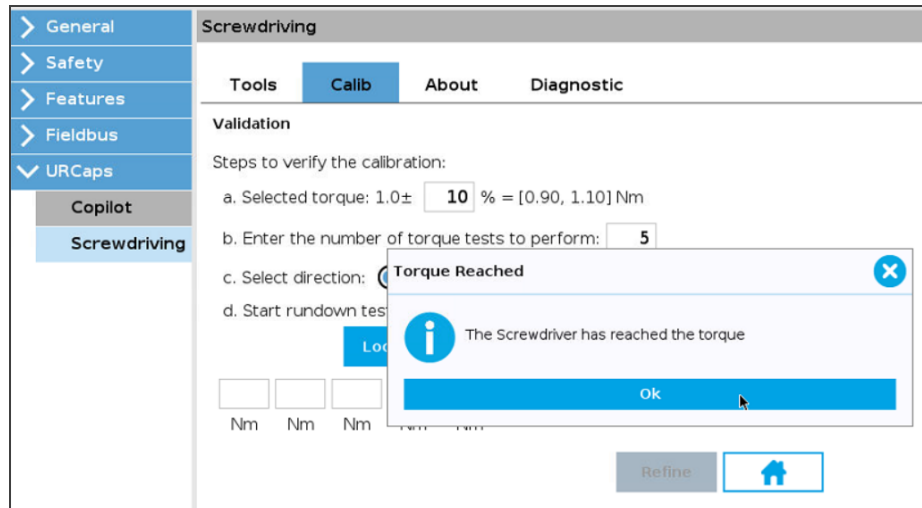
   c. Read the torque value.

   d. In the **Calib** tab of the URCap, enter the value in the first field.

   e. Repeat until you have populated all fields in the Calib tab, in accordance with your calibration requirements.

16. The interface will display test results for the concerned torque value:

   a. Test results: Within range. Refinement not required.
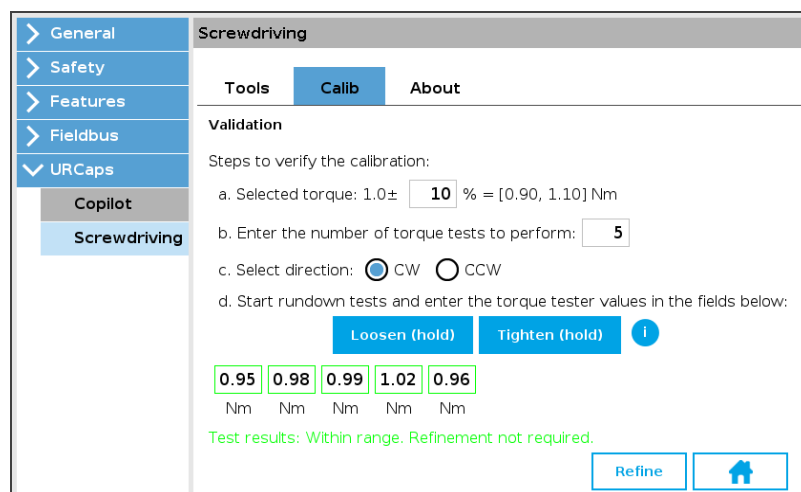
   b. Test results: Out of range. Refinement required.

17. If the test results indicate "Out of range," tap the **Refine** button.

18. If the test results indicate "Within range," you can also tap the **Refine** button should you want to potentially achieve better results.

> **Info**
>
> Once the **Refine** button is tapped, the mean value of the entered values will be used to refine the calibration results.
>
> The refinement interface/process is similar to that of the actual validation, although the refinement interface/process will not indicate if the the values are within or out of range.

> **Info**
>
> During the rundown tests for the refinement of the calibration, the Screwdriver firmware will send torque values that are slightly lower or higher than the requested torque value depending on the mean value from the **Validation** rundown tests..

19. Start the **Adjustment** rundown tests:

   a. Hold the **Loosen (hold)** button to release any torque stress applied on the rundown adapter.

   b. Hold the **Tighten (hold)** button until the popup window displays, indicating that the requested torque has been reached.

   c. Read the torque value.

    d. In the **Calib** tab of the URCap, enter the value in the first field.

    e. Repeat until you have populated all fields in the Calib tab.

20. Tap the **Validate** button to complete the refinement process. The system will use interpolation on the discrete torque data generated during both series of rundown tests to predict the torque values that should be within the requested range.

21. Start the **Validation of adjustment** rundown tests:

    a. Hold the **Loosen (hold)** button to release any torque stress applied on the rundown adapter.

    b. Hold the **Tighten (hold)** button until the popup window displays, indicating that the requested torque has been reached.

    c. Read the torque value.

    d. In the **Calib** tab of the URCap, enter the value in the first field.

    e. Repeat until you have populated all fields in the Calib tab.

    f. Once all fields are populated, tap the **Continue** button.

22. Follow a course of action based on these factors:

    a. If all fields are green, a popup window displays, asking whether or not the user wishes to add the refined torque value to the Screwdriver calibration.

      i. Tapping **No** will prevent the refinement process from collecting the data; the data will then be lost.

     ii. Tapping **Yes** will instruct the refinement process to write the calibrated value to the Screwdriver calibration.

b. If at least one field is red, a popup window displays, asking whether or not the user wishes to perform another refinement.

      i. Tapping **Cancel** will prevent the refinement process from collecting the data; the data will then be lost.

     ii. Tapping the **Refine point** button will instruct the refinement process to use the mean torque value from the third rundown test. Steps 19 to 21 will have to be performed again.

    iii. Tapping the **Add point** button instructs the refinement process to write the refined torque value to the Screwdriver calibration as is.

Info

During the rundown tests for the refinement of the calibration, the Screwdriver firmware will send torque values that are slightly lower or higher than the requested torque value depending on the mean value from the **Validation of adjustment** rundown tests.

---

23. The user will be brought back to **the home screen** of the **Calib** tab, where the newly added torque value will display.

7. Specifications

7.1. Technical Dimensions

7.1.1. Screwdriver
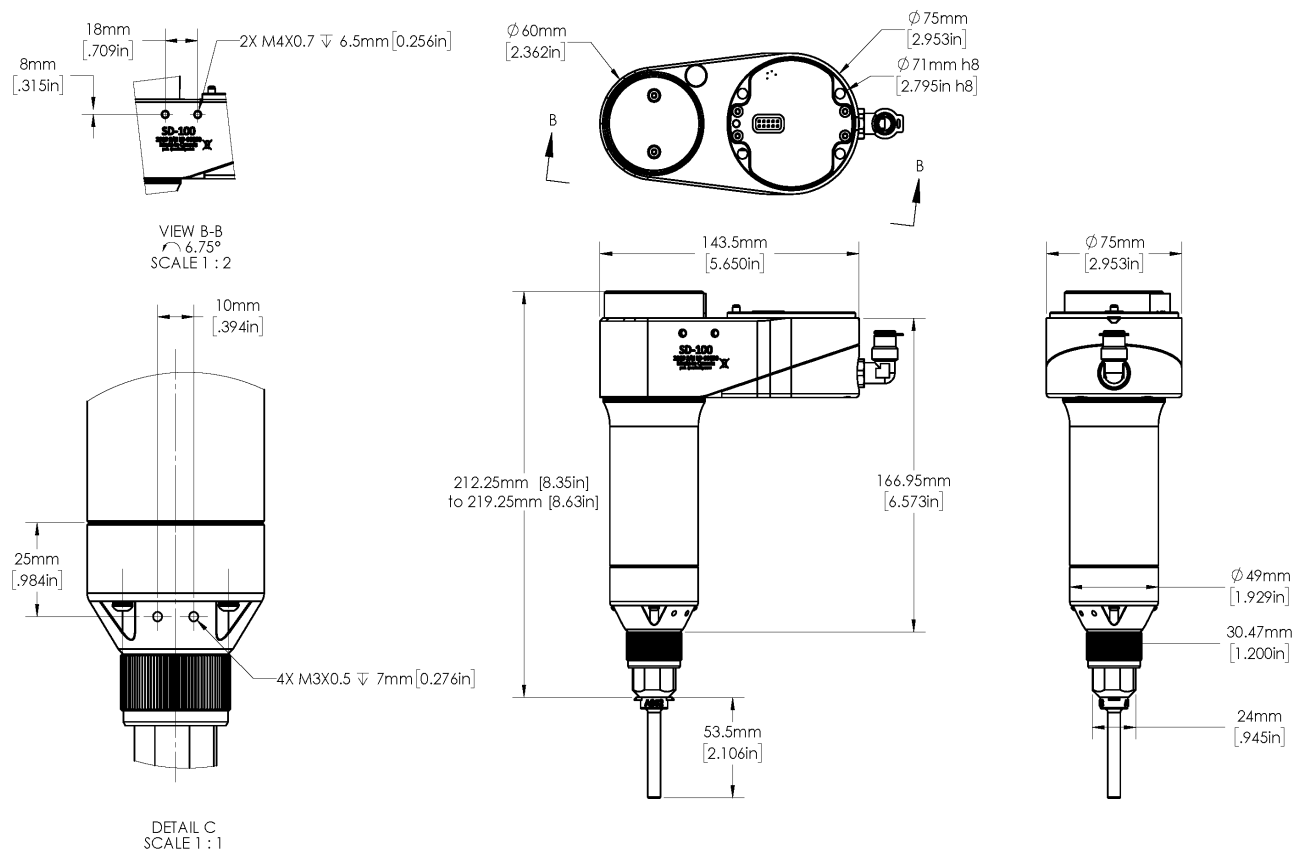
Fig. 7-1: Dimensions of the Screwdriver.

7.1.2. Screw Feeder
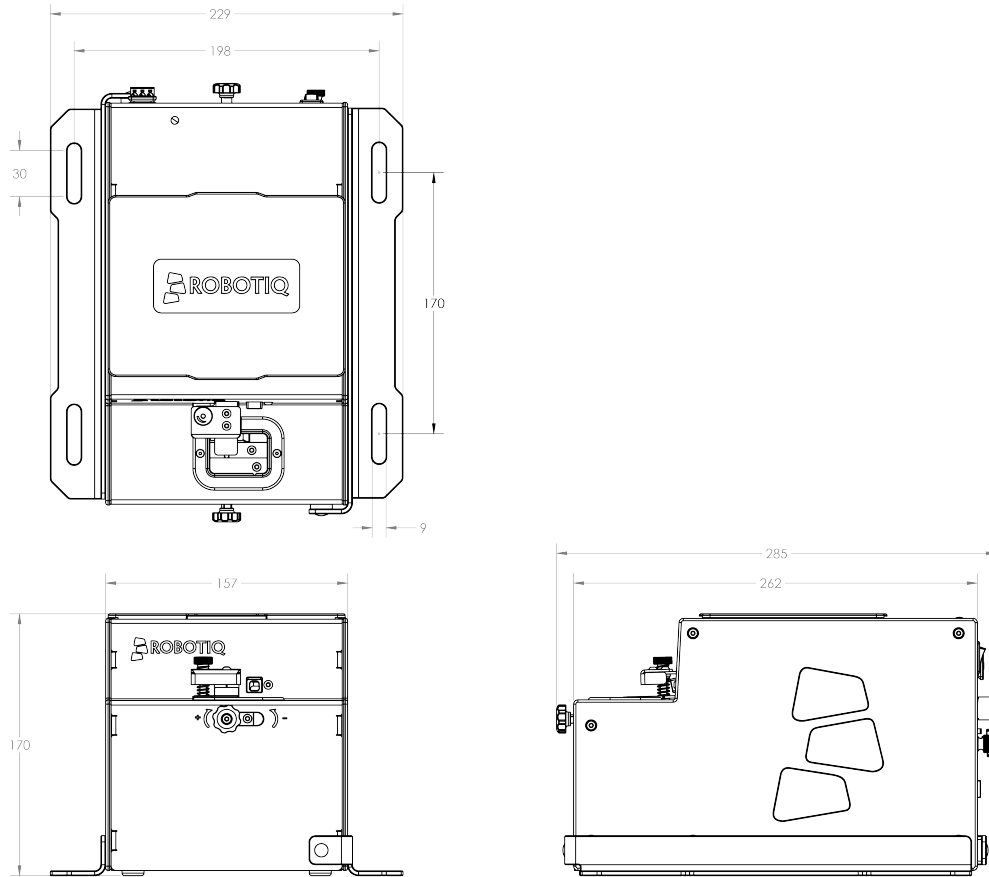
Fig. 7-2: Dimensions of the Screw Feeder.

7.1.3. Coupling

Operating the Screwdriver requires a coupling provided by Robotiq.

The coupling is mandatory since it integrates electronics and electrical contacts.
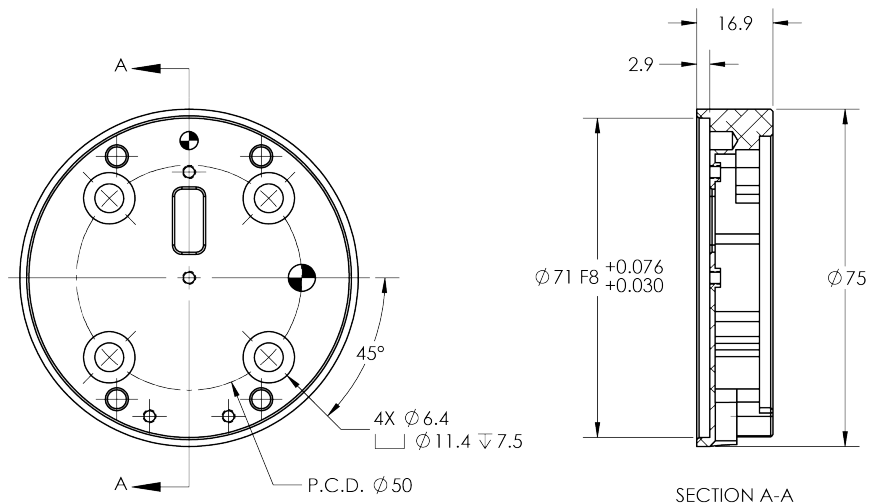
Fig. 7-3: Dimensions of the Robotiq Coupling for Installation of the Screwdriver.

7.2. Mechanical Specifications

7.2.1. Robotiq Screwdriver

MECHANICAL SPECIFICATION		VALUE	
		MIN	MAX
Energy source		Electricity and compressed air	
Screw diameter range		M2.5 (#3)	M4 (#8)
Screw length		6 mm (¼ in)	25 mm (1 in)
Torque	DL1-1.1.X and later versions	RANGE A: 0.5 Nm (4.425 in-lb) to 4.0 Nm (35.402 in-lb) | TOLERANCE: ±10%[1]	
		RANGE B: 0.3 Nm (2.655 in-lb) to 0.5 Nm (4.425 in-lb) | TOLERANCE: ±15%[1]	
		RANGE C: 0.25 Nm (2.213 in-lb) to 0.30 Nm (2.655 in-lb) | TOLERANCE: based on installation	
Torque	DL1-1.0.X and earlier versions	0.5 Nm (4.425 in-lb) to 4.0 Nm (35.402 in-lb) | TOLERANCE: ±10%[1]	
No load speed	DL1-1.1.X and later versions	1 RPM	600 RPM
No load speed	DL1-1.0.X and earlier versions	1 RPM	500 RPM
Air supply connection type		8 mm (5/16 in) OD Tube	
Feed pressure at the tool		6.2 bar (90 psi)	7 bar (100 psi)
Optimal feed pressure		7 bar (100 psi)	
Air consumption at optimal pressure		65 L/min (17 gpm)	
Maximum acceleration under normal operating conditions		2 g	
Noise level		79 dB	85 dB
Screwdriver mass		1.5 kg (3.30 lb)	

Media (compressed air)	ISO 8573-1 class 3.4.3 (dry and filtered air that complies with standard ISO 8573-1 class 3.4.3)

[1] According to the ISO 5393 standard.

Center of Mass and Tool Center Point

Prior to using the Robotiq Screwdriver over Universal Robots, adjust the payload and tool center point (TCP).

Setting the payload and TCP values can be done using the following values

> **Info**
>
> If you use other equipment and configurations that best correspond to your application (e.g., dual configuration, Wrist Camera), the payload and TCP values will differ from the following values.
>
> Make sure you take all parameters, dimensions and measurements into account when setting a different payload and TCP.

On CB-Series Robots

- In the PolyScope interface, go to the **Installation** tab.

- Tap **TCP Configuration** in the navigation pane on the left.
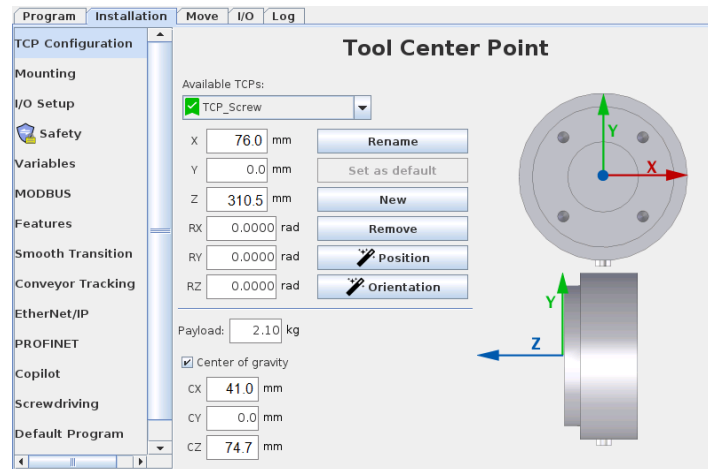
Fig. 7-4: TCP Menu in the PolyScope Interface for CB-Series.

> **Info**
>
> The tool center point on the Z axis includes the 3.5 screwdriving bit length.

Configuration	TCP (mm) - at tip of 3.5-in screwdriving bit			Center of gravity (mm)			Payload (g)
	X	Y	Z	CX	CY	CZ	
FT 300-S + Screwdriver	76	0	310.5	41	0	74.7	2115

On e-Series Robots

- In the PolyScope interface, tap the **Installation** button in the top ribbon.

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

- Select **TCP** from the dropdown menu.
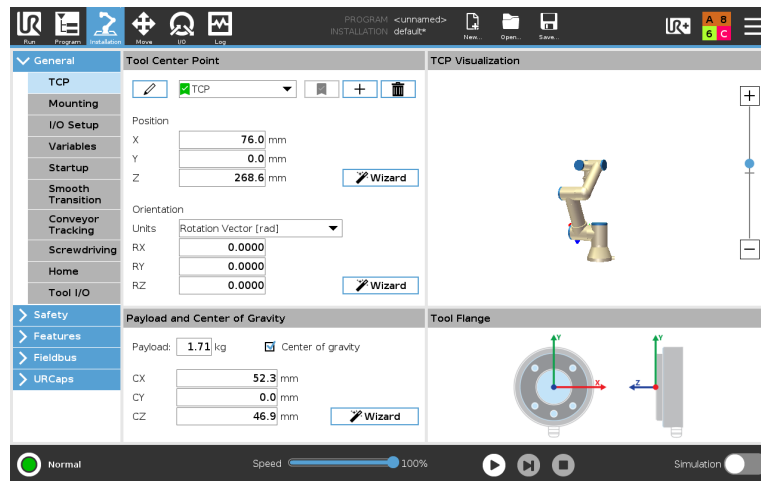
Fig. 7-5: TCP Menu in the PolyScope Interface for e-Series.

> **Info**
>
> The tool center point on the Z axis includes the 3.5 screwdriving bit length.

Configuration	TCP (mm) - at tip of 3.5-in screwdriving bit			Center of gravity (mm)			Payload (g)
	X	Y	Z	CX	CY	CZ	
Screwdriver	76	0	268.6	52.3	0	46.9	1711

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7.2.2. Robotiq Screw Feeder

MECHANICAL SPECIFICATION	VALUE	
	MIN	MAX
Screw diameter range[1]	M2.5 (#3)	M5 (#10)[1]
Screw length[2]	6 mm (¼ in)	25 mm (1 in)
Screw head height	-	5 mm (3/16 in)
Screw head diameter	-	10 mm (3/8 in)
Typical feed rate	20 screws / minute	
Screw chamber volume	300 CC	
Gross weight	5.2 kg (11.4 lb)	
Dimensions (W x D x H)	157 mm x 286 mm x 171 mm (6.18 x 11.25 x 6.73 in)	
Energy Source	Electricity	

[1] For screws over M4 or #8, validate your use case with Robotiq's support department.

[2] For socket head screws, the minimum screw length is 10 mm. Please validate with Robotiq's support department for shorter socket head screws.

7.3. Electrical Specifications

7.3.1. Robotiq Screwdriver

ELECTRICAL SPECIFICATION	VALUE
Nominal supply voltage	24 VDC ±10%
Quiescent power (minimum power consumption)	1.2 W (50 mA)
Peak current (at maximum force)	2.3 A
Hot swappable	Yes
Type of source	DC
Suggested power supply output current	2.5 A (minimum)
Suggested power supply overcurrent protection	2.9 A (maximum)
ESD safe	Yes (for robotic applications)

7.3.2. Robotiq Screw Feeder

ELECTRICAL SPECIFICATION	VALUE
Operating voltage	120/220 VAC to 24 VDC
Nominal Power consumption	12 W (500 mA)
Quiescent power (minimum power consumption)	1.2 W (50 mA)
ESD safe	Yes (for robotic applications)

8. Maintenance

Maintenance is required after specified usage, measured in cycles or use time (hours).

Following the maintenance interval will ensure:

- Correct functioning of the Screwdriver and Screw Feeder.

- Validity of the warranty.

- Proper lifetime of the Screwdriver and Screw Feeder.

> **Warning**
>
> Unless specified, any repairs done on the Screwdriver and/or Screw Feeder will be performed by Robotiq.

> **Caution**
>
> Maintenance operations are for the average normal usage of the Screwdriver and Screw Feeder, 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)

8.1. Robotiq Screwdriver

> **Caution**
>
> Maintenance operator must be grounded to prevent electrostatic discharge, which could damage the Screwdriver's electronic components.

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

8.1.1. Cleaning

OPERATION	WEEKLY	MONTHLY
Inlet filter cleaning	Dirty conditions	Normal conditions
Muffler cleaning	Dirty conditions	Normal conditions

> **Caution**
>
> Without additional protection, the Screwdriver is not waterproof or water resistant. Therefore, clean the Screwdriver using a dry towel.

> **Caution**
>
> Make sure to depressurize the air supply before you start removing the Screwdriver from its coupling or before performing any cleaning actions.

Inlet Filters

MAINTENANCE INTERVAL	REQUIRED TOOLS	REQUIRED PARTS
• Weekly (normal operating conditions) • Daily (heavy dirt/dust-filled environments)	• Dry or slightly damp lint-free cloth • Flat head screwdriver	Replacement filter (if applicable)

1. Remove the nozzle by removing the four screws and Belleville washer

2. Remove the inlet filter covers with a flat head screwdriver

3. Clean dirt, dust, debris and other contaminants from the four filter using a dry or slightly damp lint-free cloth

> **Info**
>
> Replace any damaged filter to ensure efficient Screwdriver operation.
>
> Please refer to the **Spare Parts, Kits and Accessories** section for replacement filters reference.

4. Put the filters and their covers back on

5. Put the nozzle back in place, and secure using the four screws and Belleville washer (convex side upwards)
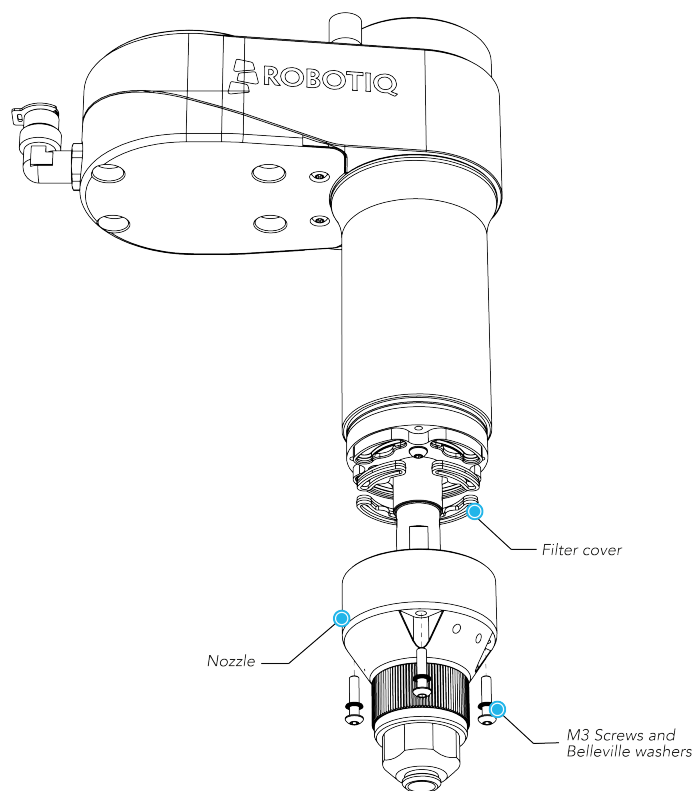
Fig. 8-1: Accessing the Inlet Filters of the Robotiq Screwdriver.

Muffler

MAINTENANCE INTERVAL	REQUIRED TOOLS	REQUIRED PARTS
• Monthly (normal operating conditions) • Weekly (heavy dirt/dust-filled environments)	Cotton swabs	None

1. Unscrew the muffler and verify if there is any dirt, dust, debris or other contaminants.

2. If needed, clean the inside of the muffler with a cotton swab.

3. Put the muffler back in place. Screw it by hand.

8.1.2. Bit Holder O-ring Replacement

MAINTENANCE INTERVAL	REQUIRED TOOLS	REQUIRED PARTS
As needed (visual inspection performed at every changeover)	Tweezers	O-RING 3 X 6.5 BUNA-N A70

1. Use a pair of tweezers to remove the damaged O-ring.

2. Insert the new O-ring and make sure it is positioned correctly.

8.2. Robotiq Screw Feeder

> **Caution**
>
> Always turn off the Screw Feeder and unplug the power cord from the outlet before performing any maintenance operation.

> **Caution**
>
> Maintenance operator must be grounded to prevent electrostatic discharge, which could damage the Screw Feeder's electronic components.

OPERATION	WEEKLY	MONTHLY
Cleaning	Dirty conditions	Normal conditions
Lubrication	-	X

8.2.1. Cleaning

MAINTENANCE INTERVAL	REQUIRED TOOLS	REQUIRED PARTS
• Monthly (normal operating conditions) • Weekly (heavy dirt/dust-filled environments)	Dry or slightly damp lint-free cloth	None

> **Caution**
>
> Do not spray water or other liquids directly on or in the product.

1. Using a dry or slightly damp lint-free cloth, clean all exterior surfaces and all chamber surfaces; in order to remove all dust, dirt and debris, it may be necessary to empty the Screw Feeder's chamber and rail, following the changeover procedure in the **Emptying the Screw Feeder** section.

2. Inspect the Screw Feeder and pay attention to visible damage or excessive wear.

3. Check the proper reliability and function of the adjustment knobs; if necessary add lubricant according to the **Lubrication** section.

8.2.2. Lubrication

MAINTENANCE INTERVAL	REQUIRED TOOLS	REQUIRED PARTS
Monthly	• Non-curing silicone-based lubricant • T10 Torx® screwdriver	None

> **Caution**
>
> Do not use petroleum-based products for lubricating the Screw Feeder parts.
>
> Only use silicone-based lubricants.

1. Using a T10 Torx® screwdriver, remove the two top screws from the head clearance plate assembly.
2. Remove the whole assembly by sliding the plate forward and then upward.
3. Holding the assembly upside down, add a drop of non-curing silicone-based lubricant at the base of the pivot (behind the flat washer).
4. Work the adjustment knob to spread the lubricant evenly.
5. Wipe off the excess lubricant before reassembling the head clearance plate.
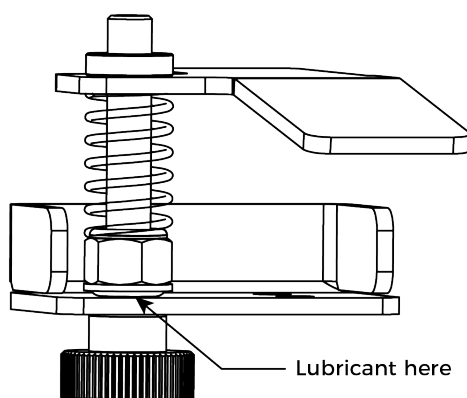
Fig. 8-2: Head Clearance Plate Lubrication.

6. Open the Screw Feeder's cover.
7. Push the brush assembly horizontally; doing so will reveal the adjustment screw mechanism.
8. Add a drop of lubricant between the flat washer and the main brush shaft.
9. Work the adjustment knob to spread the lubricant evenly
10. Wipe off the excess lubricant.
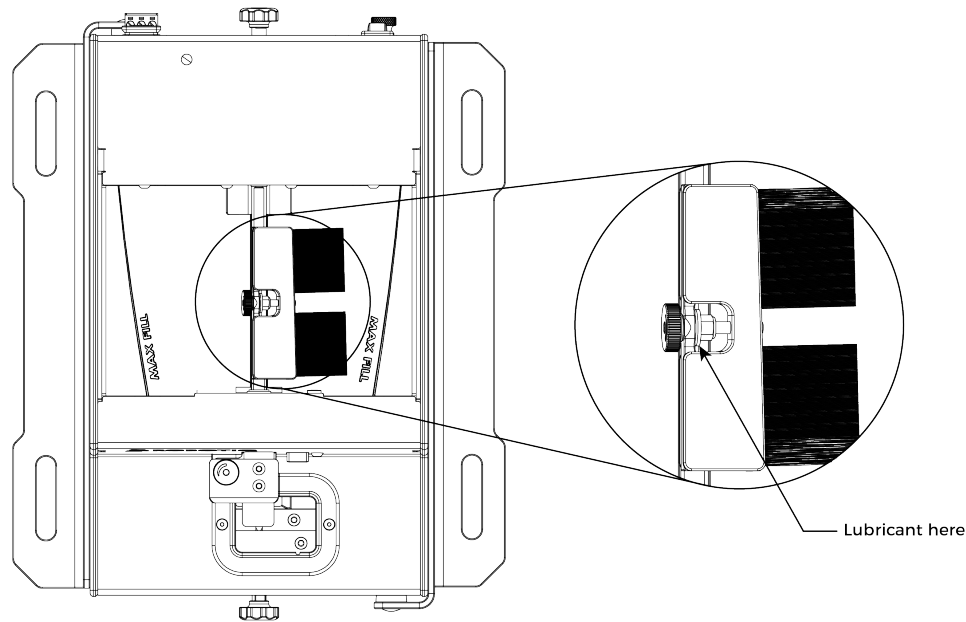
Fig. 8-3: Brush Assembly Lubrication.

8.2.3. Emptying the Screw Feeder

1. Make sure the device is turned off and that the power cord is unplugged from the outlet.

2. Remove the screws from the rail by picking them by hand, and return them to the screw chamber. Smaller screws such as M2.5 and M3 can be returned to the chamber by opening the rail using the rail adjustment knob. The screws should fall through the rails. Tilting the device backwards and then forward will allow all the screws to fall properly in the chamber. Make sure no screws are left in the rail. Use a tool such as a manual screwdriver to help free remaining screws.

3. Once all screws are in the chamber, use one of the front corners of the chamber as a funnel to empty the Screw Feeder's chamber.

9. Spare Parts, Kits and Accessories

9.1. Robotiq Screwdriver

Item	Description	Ordering Number
Torx® bit starting kit	1x Torx® T8 bit (89 mm (3.5 in) length) 1x Torx® T10 bit (89 mm (3.5 in) length) 1x Torx® T15 bit (89 mm (3.5 in) length) 1x Torx® T20 bit (89 mm (3.5 in) length) 1x replacement O-ring for bit holder	SOL-SDS-BIT-T
Phillips bit starting kit	1x Phillips #1 bit (89 mm (3.5 in) length) 1x Phillips #2 bit (89 mm (3.5 in) length) 1x replacement O-ring for bit holder	SOL-SDS-BIT-P
Metric hex bit starting kit	1x 2 mm metric hex bit (89 mm (3.5 in) length) 1x 2.5 mm metric hex bit (89 mm (3.5 in) length) 1x 3 mm metric hex bit (89 mm (3.5 in) length) 1x replacement O-ring for bit holder	SOL-SDS-BIT-MH
Imperial hex bit starting kit	1x 5/64 in imperial hex bit (89 mm (3.5 in) length) 1x 7/64 in imperial hex bit (89 mm (3.5 in) length) 1x 3/32 in imperial hex bit (89 mm (3.5 in) length) 1x replacement O-ring for bit holder	SOL-SDS-BIT-IH
Torx® T8 bit kit	5x Torx® T8 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-17
Torx® T10 bit kit	5x Torx® T10 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-18
Torx® T15 bit kit	5x Torx® T15 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-19
Torx® T20 bit kit	5x Torx® T20 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-20
Phillips #1 bit kit	5x Phillips #1 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-21
Phillips #2 bit kit	5x Phillips #2 bits (89 mm (3.5 in) length)	SOL-SDS-BIT-22

Metric hex bit kit (2 mm)	5x 2 mm metric hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-23
Metric hex bit kit (2.5 mm)	5x 2.5 mm metric hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-24
Metric hex bit kit (3 mm)	5x 3 mm metric hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-25
Imperial hex bit kit (5/64 in)	5x 5/64 in imperial hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-26
Imperial hex bit kit (7/64 in)	5x 7/64 in imperial hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-27
Imperial hex bit kit (3/32 in)	5x 3/32 in imperial hex bits (89 mm (3.5 in) length)	SOL-SDS-BIT-28
Vacuum sleeve starting kit	22x differently sized vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-SDS-VACSLE-KIT
A052 vacuum sleeve kit	5x A052 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-041-A052
A062 vacuum sleeve kit	5x A062 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-042-A062
A072 vacuum sleeve kit	5x A072 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-043-A072
A083 vacuum sleeve kit	5x A083 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-044-A083
B045 vacuum sleeve kit	5x B045 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-045-B045
B050 vacuum sleeve kit	5x B050 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-046-B050
B061 vacuum sleeve kit	5x B061 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-047-B061
B072 vacuum sleeve kit	5x B072 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-048-B072
B082 vacuum sleeve kit	5x B082 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-049-B082
B095 vacuum sleeve kit	5x B095 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-050-B095
C052 vacuum sleeve kit	5x C052 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-051-C052
D050 vacuum sleeve kit	5x D050 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-053-D050
D061 vacuum sleeve kit	5x D061 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-054-D061
D070 vacuum sleeve kit	5x D070 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-055-D070

D082 vacuum sleeve kit	5x D082 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-056-D082
C062 vacuum sleeve kit	5x C062 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-058-C062
C072 vacuum sleeve kit	5x C072 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-059-C072
C085 vacuum sleeve kit	5x C085 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-060-C085
E045 vacuum sleeve kit	5x E045 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-061-E045
E050 vacuum sleeve kit	5x E050 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-062-E050
E061 vacuum sleeve kit	5x E061 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-063-E061
E072 vacuum sleeve kit	5x E072 vacuum sleeves (fits 89 mm (3.5 in) long bits)	SOL-L-064-E072
SD-100 maintenance kit	4x inlet filters 1x 79 dB muffler 1x 85 dB muffler 1x Screwdriver screw kit 2x replacement O-rings for bit holder 1x safety clip 1x bit holder knob	SOL-SDS-D1-MAINT-KIT
Screwdriver inlet filters	12x inlet filters	SOL-L-008
Screwdriver screw kit	4x SHCS M5-0.8 x 45 4x M5 washers	SOL-SDS-SCREW-KIT
RS-485 to USB adapter	RS-485 to USB adapter	ACC-ADT-USB-RS485
End effector coupling kit	- ISO 9409-1-50-4-M6 coupling - Hardware and tools 1-meter pigtail cable	ACC-CPL-008
Device cable	10-meter Robotiq device cable for power and communication (straight, M12, 5 pins, female on one side, single ended on the other, shielded)	CBL-COM-2073-10-HF

9.2. Robotiq Screw Feeder

Item	Description	Ordering Number
SF-300 spare parts kit	USB kit: • 1x USB A-male to B-male cable • 1x USB rubber protector Protective earth kit: • 1x protective earth cable • 1x protect earth screw • 1x M6 flanged nut I/O kit: • 1x I/O signals and ground cable • 1x I/O terminal block 2x replacement brushes	SOL-SDS-F3-SPARE-KIT

10. Troubleshooting

10.1. Screwdriver Behavior

The Screwdriver goes up and down before a successful pick

This indicates that the screw detection via vacuum action is not optimal.
Please refer to the **Vacuum Coupler Adjustment** section and optimize the adjustment of the vacuum coupler accordingly.

Screws are not picked properly and/or consistently

- Make sure you are using the right screwdriving bit.

- Make sure you are using the vacuum sleeve that corresponds to the screwdriving bit. You can use a different sleeve if it appears to be more suitable for your application.

- Make sure the adjustment of the vacuum coupler allows for the appropriate holding of the screw against the vacuum sleeve. Please refer to the **Vacuum Coupler Adjustment** section and optimize the adjustment of the vacuum coupler accordingly.

- Make sure the picking position defined is aligned and at a perfect 90-degree angle perpendicular to the Screwdriver and screwdriving bit. Please refer to the **Picking Screw** section to orient the device using the ActiveDrive feature.

10.2. Screw Feeder Behavior

The Screw Feeder uses a periodic, equally timed, 6-pulse Red (R) and Blue (B) code to indicate its operating state. In normal operating conditions, the Screw Feeder's status LED is solid blue and it turns green when communicating via USB. Other statuses and faults are detailed in the following table:

STATUS LED						DESCRIPTION	POSSIBLE CAUSE	SOLUTION
1	2	3	4	5	6			
SOLID BLUE AND RED (PURPLE)						Booting	- The device is going through its power on sequence (no more than 2 seconds). - The device cannot load the firmware program.	Upgrade the Screwdriver's firmware (contact the Robotiq support department for assistance). If the problem persists, call Robotiq's support department.
SOLID BLUE						No fault	Normal operation	-

						Fault type	Cause	Solution
-	-	-	R	R	R	Minor application fault	Wheel, brush, and/or singulator motor blockage	1. Check for screw blockage around the reclaiming wheel and singulator; the screws may have fallen in unwanted positions. 2. Too many screws in the Screw Feeder can cause motor blockage. 3. Review the adjustments of the Screw Feeder; for instance, a brush adjustment set too low can cause motor blockage.
B	B	B	R	R	-	Major general fault	Undervoltage	Make sure the Screw Feeder is powered with the appropriate power supply. If the fault persists, call Robotiq support.
-	-	-	-	R	R	Minor general fault	Overheating	If the ambient temperature is above 50°C, turn off the device and wait for it to cool down. Adjust the ambient temperature to make sure it is equal or inferior to 50°C. Once cooled down, turn on the device and operate it.
B	B	B	R	R	R	Major application fault	Internal major problem	Contact the Robotiq support department.

Refer to the **Error Management** section for more troubleshooting guidance.

10.3. Error Management

10.3.1. Robotiq Screwdriver

ERROR	DESCRIPTION	POTENTIAL CAUSE	POTENTIAL RECOVERY
Screw not detected	The Screwdriver is at the retract position after going to the pick position.	A screw is not detected at the end of the vacuum sleeve, either because it is missing or misaligned.	Adjust pick position. Adjust vacuum sleeve. Make sure you have proper pressure going in the screwdriver. Perform the picking action again.
Screw dropped	After picking a screw, the Screwdriver stops just before performing a fastening action.	A screw is not detected at the end of the vacuum sleeve, either because it is misaligned or was dropped between the picking action and the fastening action.	Retrieve the dropped screw. Adjust pick position. Adjust vacuum sleeve. Make sure you have proper pressure going in the screwdriver. If applicable, perform the picking action again and continue the program.
Screwdriving failed	The Screwdriver stops after attempting to fasten a screw longer than allowed time (usually 10 seconds).	The fastening action could not be completed because the torque value was not reached due to stripped threads, screw failure, or screw manufacturing defect.	In most cases, solving the issue will require human intervention (e.g., integration). Stop the program and wait for an operator to inspect the parts and screws for any defect.

Unhandled Error : Restrictions before angle	The torque specified during teaching has been reached earlier than expected while fastening.	The Screwdriver is not perpendicular to the hole.	Use the Reorient feature on the Active Drive before teaching the Drive Screw node.
		The screw or the hole is cross-threaded or has a manufacturing defect.	Change the screw or the hole you are screwing in.
		The screw is smaller in length than the one used when teaching the Drive Screw node.	Fasten with the same type and length of screw you used when teaching the Drive Screw node.
		The feature **Distance tolerance** is improperly used.	See **Drive Screw Node** section for more details.
		If none of the above applies to your situation and torque accuracy is required :	Reduce the **Angle before ramp down** parameter by 60° to 360° (cycle time affected) in the **Advanced settings** of the Drive Screw node.
		If none of the above applies to your situation and torque accuracy is NOT required :	Increase the torque target

OR

Remove the error pop-up in the " If fail > Unhandled errors" tree of the Drive Screw node. |

10.3.2. Robotiq Screw Feeder

> **Caution**
>
> Always turn off the Screw Feeder and unplug the power cord from the outlet before performing any troubleshooting operation.

> **Caution**
>
> Should the user experience a blockage with the Screw Feeder, make sure to turn off the device, clear the blockage, and turn the device back on.

ERROR	DESCRIPTION	POTENTIAL RECOVERY
Feeder not ready	The Screw Feeder is either off or experiencing a fault.	• Power on the Screw Feeder or refer to the **Screw Feeder Behavior** section. • Make sure that the configuration is set at PNP.
No screw ready	Automatically triggered after a hard-coded timeout. The Screw Feeder detects no screw at the screw detection position.	1. Refill the Screw Feeder; the quantity of screws may be insufficient to ensure a proper feeding. 2. Review the Screw feeder adjustments; an overtightened rail, singulator plate or head clearance plate can prevent the screws from traveling appropriately. 3. Make sure that the PNP / NPN configuration is correct.
Singulator cannot pick up screws from the rail	The screws can circulate on the rail, but are not coming out from the front of the machine.	1. Review the Screw Feeder's adjustments; an overtightened rail, singulator plate or head clearance plate can prevent the screw from traveling appropriately. 2. Make sure that the Screw Feeder is level and sits on all four shoes (rubber pads).
Singulator goes back and forth even when there is a screw present between the singulator plates	The screw presence sensor cannot detect the screw in the singulator.	1. Check if the top and bottom sensors (aligned with the singulator plates) are obstructed or need to be cleaned. 2. Check for sensor error using the LED error codes (refer to the **Screw Feeder Behavior** section). 3. Validate if the singulator stops at the screw picking position when the bottom sensor is obstructed. If so, screw head height may be out of the device's range.
Singulator does not go to the screw picking position or to the rail position	The singulator moves but does not complete the full movement between the rail and the screw picking position. The LED indicator flashes red.	1. Check for blockages, and screws that might have fallen in unwanted positions. 2. Check the head clearance adjustment. A loose head clearance plate can cause the screw to tilt into the singulator without fully engaging.

Screws cannot board the rail	The screws are circulating through the reclaiming wheel, but are not traveling forward on the rail.	1. Check the rail width adjustment; a rail gap that is too narrow can prevent screws from entering.Check for blockage; a screw blocked on the rail can result in accumulation at the reclaiming wheel unloading area, preventing screws from moving forward. 2. Make sure the device is level. 3. Make sure the screws are within the required specifications.
Screws cannot board the reclaiming wheel	There are screws in the chamber but they are not going up the reclaiming wheel.	1. Make sure the machine is level. 2. Add screws in the Screw Feeder's chamber. Most of the time, the difficulty for screws to go in the reclaiming wheel results from an insufficient number of screws in the chamber.
Screws cannot move forward on the rail or move slowly	There are screws getting in the rail and the reclaiming wheel is operating normally, but the screws are not moving down the rail, or are moving very slowly.	1. Check for blockage; a screw blocked on the rail can alter or stop the vibration. 2. Make sure the machine is level and resting on all four shoes (rubber pads). 3. Review the Screw Feeder's adjustments; an overtightened rail, singulator plate or head clearance plate can prevent the screws from traveling appropriately. 4. Check that the chamber is correctly filled; too many screws (over the max fill line) can prevent the rail from vibrating properly. 5. Verify that the rail knob is clear from any interference, such as a wall or a vertical surface; since this component vibrates along with the rail, an external impediment can prevent the screws from moving forward.
Incorrect screws are coming out of the rail system	Incorrectly positioned screws are not sorted by the Screw Feeder and are fed to the singulator.	1. Verify the Screw Feeder's adjustments. A too low or too high brush or head clearance plate can cause incorrectly positioned screws to travel to the singulator. 2. Verify that your screw is within the specified range.
Reclaiming wheel is not moving or moving abnormally	The reclaiming is not feeding screws to the rail and the LED flashes red.	1. Check for blockage along the blades of the wheel. In this situation, it is normal for the wheel to move back and forth in order to try and free the blockage. 2. Check if the < Ready > I/O is raised. This would mean that an obstruction likely triggered the front sensor as if there were a screw ready to be picked, and prevents the normal operation of the Screw Feeder. 3. Check the amount of screws in the chamber. Too many screws in the chamber can prevent the wheel from rotating properly.

The I/O signals on the Screw Feeder do not function properly	The I/O cable is connected to the Screw Feeder and robot controller, but does not display Low and High states correctly.	1. Make sure the cable, including the ground port (GRN) is correctly plugged in. 2. Make sure you use the correct PNP / NPN setting. For Universal Robots, the switch should be toggled to PNP.
The rail or singulator adjustment knob is stuck	The rail or singulator plates cannot be closed or opened, because the knob cannot be turned easily.	<u>DO NOT APPLY EXCESSIVE FORCE TO THE ADJUSTMENT KNOBS; THIS MAY RESULT IN PERMANENT DAMAGE.</u> Most likely a screw fell in between moving parts of the adjustment mechanism, thus preventing its normal operation. First, empty the rail manually and try to locate the blockage. Blockages in this situation happen mostly at the very back or the very front of the rail. Second, try opening the rail or singulator at its maximum. Then, holding the feeder firmly in your hands, tilt and shake the machine so that the screw falls in the reservoir. In certain situations, a long tool, such as a screwdriver, can be used to reach the blockage and help clear the screws.

11. Warranty

Robotiq warrants the Screwdriver and Screw Feeder 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 the Screwdriver and Screw Feeder specified in the **Installation** section and the following subsections.
>
> - Until one of these conditions is reached:
>   - 1 year
>   - 2 000 000 cycle counts[1]
>
> - Usage respects maintenance specified in the Maintenance section.
>
> - Usage respects recommended torque and force values specified in the **Mechanical Specifications** section.

[1]For the Robotiq Screwdriver, one (1) cycle count is defined as the completion of a screwdriving operation or the detection of an error (starts when requesting a screwdriving action, and ends whether when the success condition is met or when an error occurs. Each cycle count is accounted for in the internal memory of the Screwdriver.

For the Robotiq Screw Feeder, one (1) cycle count is accounted for each time a screw is detected by the screw detection sensor (at screw detection position) and leaves the screw detection position.

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

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

- The Screwdriver or Screw Feeder feedback necessary for the robot program is not accessible.

- Wear of the Screwdriver or Screw Feeder 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 Screwdriver or Screw Feeder, nor shall Robotiq be responsible for any failure in the performance of other items to which the Screwdriver or Screw Feeder is connected or the operation of any system of which the Screwdriver or Screw Feeder 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 Screwdriver, Screw Feeder or other factors beyond Robotiq's control. It also excludes all consumable parts, such as vacuum sleeves, 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.

12. Harmonized Standards and Declarations

The standards listed in the table below were followed, as far as applicable, for the design and production of the Robotiq Screwdriving Solution. The declarations are available for download on Robotiq's support department website (Robotiq Screwdriving Solution > Universal Robots > Documents > Standards, Declarations and Certificates).

ISO 12100:2010	Safety of machinery — General principles for design — Risk assessment and risk reduction
ISO 4414:2010	Pneumatic fluid power — General rules and safety requirements for systems and their components
ISO 9409-1:2004	Manipulating industrial robots — Mechanical interfaces — Part 1: Plates
EN 61000-6-2:2016	Generic Standards – Immunity for industrial environments
EN 61000-6-4:2007 + A1:2011	Generic Standards – Emission for industrial environments
ANSI/ESD SP10.1-2016	ESD Association Standard Practice for the Protection of Electrostatic Discharge Susceptible Items – Automated Handling Equipment (AHE)

13. Appendix

13.1. Script Functions

13.1.1. rq_auto_unscrew()

Description

With the screwdriving bit in or just above the screw drive, performs a full unscrew action until the screw threads are disengaged from the hole.

Declaration

rq_auto_unscrew(direction, rotation_speed)

Parameters

direction	(type: bool)
	FALSE = RQ_DIRECTION_CCW (default) for a counter-clockwise rotation of the Screwdriver
	TRUE = RQ_DIRECTION_CW for a clockwise rotation of the Screwdriver
rotation speed	(type: integer) (unit: RPM)
	Desired rotation speed of the Screwdriver. Must be between 1 and 500 RPM.

Returned value

No value is returned.

Example

```
1  ▼ Robot Program
2    ● 'Unscrewing sequence'
3    🗟 rq_screw_vacuum_on()
4    🗟 rq_auto_unscrew( False ,250)
```

13.1.2. rq_is_blocked_at_start_cause()

Description

The Screwdriver started fastening a screw on which torque has already been applied.

Use this script under the "Unhandled errors" node to display the cause of the error.

Returned value

(type: bool)

TRUE = The cause of the "Unhandled errors" is "Blocked at start".

13.1.3. rq_is_communication_lost_cause()

Description

The communication between the Screwdriver and the robot controller has been lost.

Use this script under the "Unhandled errors" node to display the cause of the error.

Returned value

(type: bool)

TRUE = The cause of the "Unhandled errors" is "Communication lost".

13.1.4. rq_is_contact_not_found_cause()

Description

The Screwdriver did not find contact with the surface.

Use this script under the "Unhandled errors" node to display the cause of the error.

Returned value

(type: bool)

TRUE = The cause of the "Unhandled errors" is "Contact not found".

13.1.5. rq_is_feeder_screw_ready()

Description

Validates if a screw is ready to be picked at the screw detection position of the Screw Feeder.

Declaration

rq_is_feeder_screw_ready(inputNumber)

Parameters

inputNumber	(type: integer) Integer associated with the "Screw ready" digital input. e.g., Screw ready digital_in[0] ▼ ● Note: If the input name has been changed (e.g., "screw_ready"), use the default input number.

Returned value

(type: bool)

TRUE = A screw is detected by the screw detection sensor of the Screw Feeder.

Example

```
1  ▼ Robot Program
2    ⌛ Wait rq_is_feeder_screw_ready(0)
3  ⊕ ✛ MoveL
4        ⊙ app_feeder
```

13.1.6. rq_is_feeder_status_ok()

Description

Validates if the Screw Feeder is on and ready.

Declaration

rq_is_feeder_status_ok(inputNumber)

Parameters

inputNumber	(type: integer) Integer associated with the digital input of "Feeder status". e.g., Feeder status digital_in[1] ▼ ● Note : If the input's name has been changed (ex.: "feeder_status"), the default input number must be used.

Returned value

(type: bool)

TRUE = The Screw Feeder is turned on and detects no errors.

Example

```
1  ▼ Robot Program
2    ─ ⊠ Wait rq_is_feeder_status_ok(1)
3  ● ✛ MoveL
4       ─ ⊙ app_feeder
```

13.1.7. rq_is_restricted_before_angle_cause()

Description

The torque value defined at the teaching step has been reached earlier than expected.

Use this script under the "Unhandled errors" node to display the cause of the error.

Returned value

(type: bool)

TRUE = The cause of the "Unhandled errors" is "Restriction before angle".

13.1.8. rq_is_screw_detected()

Description

Validates the presence of a screw at the end of the screwdriver via vacuum action. The vacuum needs to be turned on for the system to be able to detect the screw.

Returned value

(type: bool)

TRUE = A screw is detected at the end of the vacuum sleeve.

13.1.9. rq_is_screwdriver_wrong_echo_cause()

Description

There is a discrepancy between the command sent to the Screwdriver and the action performed by the Screwdriver. Cross threading may have caused this issue.

Use this script under the "Unhandled errors" node to display the cause of the error.

Returned value

(type: bool)

TRUE = The cause of the "Unhandled errors" is "Wrong echo".

13.1.10. rq_pick_screw()

Description

Picks a screw from the Robotiq Screw Feeder.

Declaration

rq_pick_screw(screw_pose, status_input, ready_input, test_in_action,approach_dist, rotation_speed, pick_speed, timeout, retract_speed, direction, slave_id)

Parameters

screw_pose	(type: point) Position where the robot will be picking the screw. Defined in Installation under Features.
status_input	(type: integer) Digital input used for "Feeder status" input. e.g., Feeder status digital_in[1] ▼ ● Note: If the input name has been changed (e.g., "feeder_status"), use the default input number.
ready_input	(type: integer) Digital input used for "Screw ready" input. e.g., Screw ready digital_in[0] ▼ ● Note: If the input name has been changed (e.g., "screw_ready"), use the default input number.
test_in_action	(type: bool) TRUE = The robot stops after picking a screw. FALSE = The robot moves on to the next line in the program after picking a screw.
approach_dist	(type: integer) (unit: mm) Distance between the approach point and the screw_pose point
rotation_speed	(type: integer) (unit: RPM) Desired rotation speed of the Screwdriver. Must be between 1 and 500 RPM.

pick_speed	(type: integer)(unit: mm/s) Movement speed between the approach point and the screw_pose point.
timeout	(type: integer) (unit: sec) Time after which the robot will stop trying to pick a screw if the previous pick was unsuccessful.
retract_speed	(type: integer) (unit: mm/s) Movement speed between the screw_pose point and the retract point. Note: The robot will retract as long as a screw is detected by the Screw Feeder's sensor. The retract distance is therefore dependent on screw length, and cannot be changed.
direction	(type: bool) FALSE = RQ_DIRECTION_CCW (default) for a counter-clockwise rotation of the Screwdriver. TRUE = RQ_DIRECTION_CW for a clockwise rotation of the Screwdriver.
slave_id	(type: integer) Only slave ID 9 is supported by the Screwdriver.

Returned value

No value is returned.

Example

```
1  ▼ Robot Program
2  ⊕ ✛ MoveL
3      ◉ app_feeder
4      ▣ rq_pick_screw(scew_pose,1,0, False ,20,10,25,10,40, False ,9)
```

13.1.11. rq_screw_activate()

Description

Activates the Screwdriver once it is powered on.

To ensure the consistent activation of the Screwdriver at the start of the program, it is recommended to insert a rq_screw_activate () script function in the BeforeStart sequence of the program.

Returned value

No value is returned.

13.1.12. rq_screw_stop()

Description

Stops the rotation of the screwdriver.

Returned value

No value is returned.

13.1.13. rq_screw_turn()

Description

Turns the bit of the Screwdriver around by a number of degrees or until a specific torque value is reached. Accuracy of the final torque value may vary from standard tolerances.

> **Caution**
>
> The speed ramp down before reaching the final torque value is not included in this script. With machine screws, it is preferable to operate the Screwdriver at lower speeds (50 RPM or less) when using torque as a stop condition.

Declaration

rq_screw_turn(regulation_mode, torque_Nm, rotation_angle, rotation_speed_rpm, direction, slave_id)

Parameters

regulation_mode	(type: integer) 1 = RQ_ REGULATION_MODE_ANGLE to turn until a specific number of turns is achieved. 3 = RQ_REGULATION_MODE_SPEED to turn until a specific torque value is reached.
torque_Nm	(type: float) (unit:Nm) The torque value at which the Screwdriver will stop turning. Must be between 1 and 4 Nm. Only read when RQ_REGULATION_MODE_SPEED is used.
rotation_angle	(type: integer) (unit: degrees (°)) The number of degrees by which to turn before the Screwdriver stops. Only read when RQ_ REGULATION_MODE_ANGLE is used. Note: Use " 0" for rotation_angle in case it is not required.
rotation_speed_rpm	(type: integer) (unit: RPM) Desired rotation speed of the screwdriver. Must be between 1 and 500 RPM.
direction	(type: bool) FALSE = RQ_DIRECTION_CCW (default) for a counter-clockwise rotation of the Screwdriver. TRUE = RQ_DIRECTION_CW for a clockwise rotation of the Screwdriver.
slave_id	(type: integer) Only slave ID 9 is supported by the Screwdriver.

Returned value

No value is returned.

Example

```
1  ▼ Robot Program
2  ⚲─✛ MoveL
3      ⊙ HOME
4      ⊙ app_workpiece
5      ⊙ above_threads
6      ▣ rq_screw_turn(3,1,0,250, True ,9)
```

13.1.14. rq_screw_vacuum_off()

Description

Stops the vacuum action on the Screwdriver.

Returned value

No value is returned.

13.1.15. rq_screw_vacuum_on()

Description

Starts the vacuum action on the Screwdriver. This is required for the system to be able to detect a screw.

Returned value

No value is returned.

13.1.16. rq_get_screw_status()

Description

Retrieves the current activation status of the Screwdriver.

Returned value

(type: integer)

3 = Activated

2 = (Not used)

1 = Activation in progress

0 = Else

13.1.17. rq_get_vacuum_pressure_kpa()

Description

Retrieves the current vacuum level in the vacuum sleeve.

Returned value

(type: number)

Current vacuum level in the vacuum sleeve in kPa.

Example

Without screw	Vacuum must be equal or superior to -16 kPa
With screw	Vacuum must be equal or inferior to -30 kPa

Program

    BeforeStart

        rq_screw_activate()

    Robot Program

        rq_screw_vacuum_on()

        vacuum_pressure:=rq_get_vacuum_pressure_kpa()

14. Contact

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
Lévis, Québec
G7A 2N1
Canada

ROBOTIQ eLearning

elearning.robotiq.com