

USER MANUAL

FOR UR ROBOTS

v1.11.0

Original Instructions

Contents

1. Introduction 7
1.1. Important Safety Notice 7
1.2. Scope of the Manual 7
1.2.1. Eyes 7
1.2.2. VGC10 7
1.2.3. HEX-E/H QC 7
1.2.4. Software and Firmware 8
1.2.4.1. URCap Software 8
1.2.4.2. Eyes Firmware 8
1.2.4.3. Eye Box Software 8
1.3. Naming Convention 8
1.3.1. Compute Box/Eye Box 8
1.3.2. HEX-E QC/HEX-H QC 8
1.4. Copyright 8

2. Safety 10
2.1. Intended Use 10
2.2. General Safety Instructions 10
2.3. Risk Assessment 12
2.4. Environmental Safety 12
2.5. Certification Statement 13

3. HW Installation 14
3.1. Overview 14
3.2. Robot Mount 14
3.2.1. HEX-E/H QC 14
3.2.2. Tools 15
3.2.2.1. VGC10 15
3.3. External Mount 15
3.4. Eyes Lighting Kit Mount 15
3.4.1. Eyes Lighting Kit – Camera Mount 16
3.4.2. Eyes Lighting Kit – External Mount 16
3.4.3. Optional – Diffuser Mount 16
3.5. Wiring 17
3.5.1. USB Cable 17
3.5.2. Optional – Light Cable 18
3.5.3. Tool Data Cable 19
3.5.3.1. Cable to HEX-E/H QC 19
3.5.3.2. Cable to VGC10 20
3.5.3.3. Cable to Eye Box 20
3.5.4. Ethernet Cable to Robot 21

3.5.5. Ethernet Cable to Computer 21
3.5.6. Eye Box DIP Switch Settings 22
3.5.7. Power Supply 22
3.6. Best practices - HEX-E/H QC 23

4. SW Installation 24
4.1. Robot Software Setup 24
4.1.1. Install URCap 24
4.1.2. Uninstall Software 25
4.1.3. URCap Setup 26
4.1.3.1. Device Info 26
4.1.3.2. Eyes 30
4.1.3.3. HEX 31
4.1.3.4. VGC10 35
4.2. Eyes Software Settings 39
4.2.1. Robot Mount Settings 39
4.2.2. External Mount Settings 42

5. Operation 45
5.1. URCap Commands 45
5.1.1. Eyes 45
5.1.1.1. Eyes General Overview 45
5.1.1.2. Eyes Locate 45
5.1.1.3. Eyes Inspect 68
5.1.1.4. Eyes Get Workpiece 88
5.1.1.5. Eyes Pick 92
5.1.1.6. Eyes Landmark 94
5.1.2. Best Practices – Eyes 97
5.1.2.1. Check Detection on the Full Workspace 97
5.1.2.2. Sort Objects Using Part Location by Workpiece's Inner Features 97
5.1.2.3. Set Parameters on Inspection by Using Workpiece's Inner Features 98
5.1.2.4. Set Inner Region of Interest when Using Inspection by Using Workpiece's Inner Features 99
5.1.3. Best Practices – Eyes Lighting Kit 99
5.1.3.1. Light Reflections 99
5.1.3.2. Use the Diffuser 101
5.1.3.3. Enhance Surface Features and Edges 101
5.1.4. HEX-E/H QC 101
5.1.4.1. HEX-Zero 101
5.1.4.2. HEX-Insert Part 102
5.1.4.3. HEX-Force Control 106
5.1.4.4. HEX-Search 109
5.1.4.5. OnWaypoint 111

5.1.4.6. Trajectory 112
5.1.4.7. Path from Hand Guide 116
5.1.4.8. Path from OnWaypoints 119
5.1.4.9. Path from Shape 123
5.1.4.10. TCP 127
5.1.5. VG10/VGC10 128
5.2. URCap Toolbar 132
5.2.1. Eyes 134
5.2.2. HEX-E/H QC 135
5.2.3. VG10 / VGC10 137
5.3. URScript Commands 138
5.3.1. Eyes 138
5.3.2. VG10/VGC10 140
5.4. Feedback Variables 142
5.4.1. Eyes 142
5.4.2. HEX-E/H QC 143
5.4.3. VG10 / VGC10 144

6. Additional Software Options 145
6.1. Compute Box/Eye Box 145
6.1.1. Ethernet Interface Setup 145
6.1.2. Web Client 147
6.1.3. Web Client: Devices Menu 148
6.1.3.1. Eyes 149
6.1.3.2. HEX-E/H QC 151
6.1.3.3. VG10 / VGC10 154
6.1.4. Web Client: Configuration Menu 156
6.1.5. Web Client: Weblogic Menu 157
6.1.6. Web Client: Path Menu 157
6.1.7. Web Client: Update Menu 158
6.1.8. Web Client: TCP/COG 159
6.1.9. Web Client: Account Settings 161
6.1.10. Web Client: Inspection Monitoring 163

7. Hardware Specification 165
7.1. Technical Sheets 165
7.1.1. Eyes 165
7.1.2. HEX-E QC 168
7.1.3. HEX-H QC 169
7.1.4. HEX-E QC and HEX-H QC Comparison 171
7.1.5. VGC10 172
7.2. Mechanical Drawings 185
7.2.1. Adapter Plate 185

7.2.2. Mountings....185
7.2.2.1. HEX-E/H QC....185
7.2.2.2. Eyes - Robot Mount....186
7.2.2.3. Eyes - External Mount....186
7.2.2.4. Eyes Lighting Kit Mount....187
7.2.2.5. Eye Box....188
7.2.3. Tools....188
7.2.3.1. VGC10....188
7.3. TCP, COG....189
7.3.1. Eyes....190
7.3.2. HEX-E/H QC....191
7.3.3. VGC10....191

8. Maintenance....192
8.1. Eyes....192
8.2. VG10/VGC10....192

9. Troubleshooting....194
9.1. Robot Has Not Obtained an IP Address....194
9.2. Error During Operation....194
9.3. Changing the DIP Switch Does Not Take Effect....194
9.4. URCap Operation....194
9.5. Tool Functions Are Not Available....195
9.6. URCap Pop-Up Messages....195
9.6.1. HEX-E/H QC....195
9.6.1.1. Force Overload Protection....195
9.6.1.2. Auto-calibration Warning....196
9.7. Web Client Pop-Up Messages....196
9.7.1. HEX-E/H QC....196
9.7.1.1. Error 128....196
9.7.1.2. Error 4096....197

10. Warranties....198
10.1. Patents....198
10.2. Product Warranty....198
10.3. Disclaimer....198

11. Certifications....199
11.1. EMC....200
11.2. Eyes - Environment....201
11.3. Eyes Lighting Kit - Environment....202
11.4. Declaration of Incorporation....203
11.4.1. Eyes....203
11.4.2. HEX-E....204

11.4.3. HEX-H..... 205
11.4.4. VGC10..... 206

1. Introduction

1.1. Important Safety Notice



DANGER:

You must read, understand, and follow all safety information in this manual, and the robot manual and all associated equipment before initiating robot motion. Failure to comply with safety information could result in death or serious injury.

1.2. Scope of the Manual

The manual covers the following OnRobot products and their components:

1.2.1. Eyes

Components	Version
Eyes (camera)	v2.0
Eye Box	v1.4
Eyes Lighting Kit	v1.0

1.2.2. VGC10

Tool	Version
VGC10	v1

1.2.3. HEX-E/H QC

Sensors	Version
HEX-E QC	v3
HEX-H QC	v3



NOTE:

Generally, the products without the Quick Changer v2 interface, are not in the scope of this manual.

1.2.4. Software and Firmware

1.2.4.1. URCap Software

The manual covers the following software versions:

Software	Version
URCap	v5.11.0

1.2.4.2. Eyes Firmware

Firmware	Version
Eye Box	v1.3.19

1.2.4.3. Eye Box Software

The manual covers the following Eye Box software version:

Software	Version
Eye Box	v5.11.0

NOTE:

When the used Eye Box has lower software/firmware version, update the Eye Box. For detailed instructions, see **Web Client: Update Menu**.

The Eye Box extends the functionality of the existing OnRobot Compute Box.

Products that can be used with the Compute Box are also supported by the Eye Box.

1.3. Naming Convention

1.3.1. Compute Box/Eye Box

Eye Box and Compute Box are used interchangeably.

1.3.2. HEX-E QC/HEX-H QC

The HEX-E QC and HEX-H QC names as model variants are used separately or together as HEX-E/H QC if the information is relevant for both variants.

1.4. Copyright

The information contained herein is property of OnRobot A/S and shall not be reproduced in whole or in part without prior written approval of OnRobot A/S. The information herein is

subject to change without notice and should not be construed as a commitment by OnRobot A/S. This manual is periodically reviewed and revised.

OnRobot A/S assumes no responsibility for any errors or omissions in this document.

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2. Safety

The robot integrators are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that any significant hazards in the complete robot application are eliminated. This includes, but is not limited to:

- Performing a risk assessment for the complete robot system
- Interfacing other machines and additional safety devices if defined by the risk assessment
- Setting up the appropriate safety settings in the robot software
- Ensuring that the user will not modify any safety measures
- Validating that the total robot system is designed and installed correctly
- Specifying instructions for use
- Marking the robot installation with relevant signs and contact information of the integrator
- Collecting all documentation in a technical file; including the risk assessment and this manual

2.1. Intended Use

OnRobot tools are intended to be used on collaborative robots and light industrial robots with different payloads depending on the end-of-arm tooling specifications. OnRobot tools are normally use in pick-and-place, palletizing, machine tending, assembly, quality testing and inspection and surface finishing applications.

The end-of-arm tooling should only operate under conditions noted in 7.1. Technical Sheets section.

Any use or application deviating from intended use is deemed to be impermissible misuse. This includes, but is not limited to:

- Use in potentially explosive atmospheres
- Use in medical and life critical applications
- Use before performing a risk assessment
- Use outside the permissible operational conditions and specifications
- Use close to a human's head, face and eye area
- Use as a climbing aid

2.2. General Safety Instructions

Generally, all national regulations, legislations and laws in the country of installation must be observed. Integration and use of the product must be done in compliance with precautions in this manual. Particular attention must be paid to the following warnings:

DANGER:

You must read, understand, and follow all safety information in this manual, and the robot manual and all associated equipment before initiating robot motion. Failure to comply with safety information could result in death or serious injury.

The information in this manual does not cover designing, installing, and operating a complete robot application, nor does it cover other peripheral equipment that can influence the safety of the complete system. The complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

Any safety information provided in this manual must not be construed as a warranty, by OnRobot A/S, that the robot application will not cause injury or damage, even if robot application complies with all safety instructions.

OnRobot A/S disclaims any and all liability if any of OnRobot tools tooling are damaged, changed or modified in any way. OnRobot A/S cannot be held responsible for any damages caused to any of OnRobot tools tooling, the robot, or any other equipment due to programming errors or malfunctioning of any of OnRobot tools.

WARNING:

OnRobot tools are not allowed to be exposed to condensing conditions when power is on or when connected to a robot. If condensing conditions appear during transport or storage, the product must be placed between 20 and 40 Celsius degrees for 24 hours before power is applied or before connected to a robot.

It is recommended that OnRobot tools are integrated in compliance with the following guides and standards:

- ISO 10218-2
- ISO 12100
- ISO/TR 20218-1
- ISO/TS 15066



WARNING:

- The tools have to be properly secured before operating the robot.
- Keep fingers, clothes and hair away from the tool while the power is on.
- Always use protective glasses when working with sharp objects.
- Always ensure complete shutdown of the robot when working on the system for maintenance or inspection.
- Do not use the tools on people or animals.
- Do not perform any modification to the tooling.
- If the robot supports a bounded workspace/ speed/ force limit, make sure to use those features.
- Select robot trajectories that minimize risks of internal clamping between robot joints and tooling.

2.3. Risk Assessment

The robot integrator must perform a risk assessment on the complete robot application. OnRobot tools are only components in a robot application and therefore they can be only safely operated if the integrator has considered the safety aspects of the whole application. OnRobot tools are designed with relatively smooth and round design with a limited amount of sharp edges and pinch points

In collaborative applications, the trajectory of the robot can play a significant safety role. The integrator must consider the angle of contact with a human body, e.g. orientate OnRobot tools and workpieces so that the contact surface in the direction of movement is as large as possible. It is recommended that the tool connectors are pointed in the direction opposite to the movement.

OnRobot A/S have identified the potential hazards listed below as significant hazards that must be considered by the integrator:

- Objects flying from OnRobot tools due to loss of grip
- Objects falling down from OnRobot tools due to loss of grip
- Injuries due to collisions between humans and workpieces, OnRobot tools tooling, robot or other obstacles
- Consequences due to loosen of bolts
- Consequences if OnRobot tools cable gets stuck to something
- Workpiece itself represents a hazard

2.4. Environmental Safety

OnRobot A/S products must be disposed of in accordance with the applicable national laws, regulations and standards.

The product is produced with restricted use of hazardous substances to protect the environment; as defined by the EU RoHS Directive 2011/65/EU. These substances include mercury, cadmium, lead, chromium VI, polybrominated biphenyls and polybrominated diphenyl ethers.

Observe national **registration** requirements for importers according to EU WEEE Directive 2012/19/EU.







2.5. Certification Statement

This product is classified as Class 1 Laser Product under the EN/IEC 60825-1, Edition 3 (2014) internationally and IEC60825-1, Edition 2 (2007) in the US.

This product complies with US FDA performance standards under 21 CFR 1040.10 for laser products except for deviations pursuant to Laser Notice No. 50 dated June 24, 2007.

3. HW Installation

3.1. Overview

For a successful installation the following steps will be required:

- Mount the components

NOTE:

The Eyes can be mounted either using Robot Mount or External Mount.
The Robot Mount allows the camera to be mounted on the robot's tool flange.
The External Mount allows the camera to be mounted externally.

- Wire the cables
- Setup the Eye Box
- Setup the Eyes software
- Setup the robot software

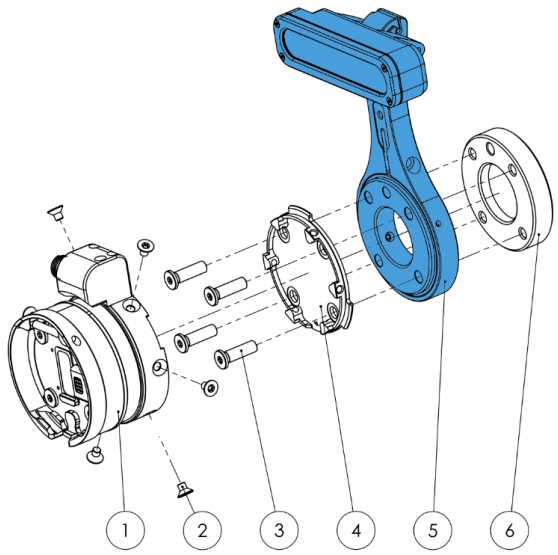
In the following sections, these installation steps will be described.

3.2. Robot Mount

1. Mount the robot-specific adapter (if applicable)
2. Mount any optional accessories
3. Mount the Quick Changer option
4. Mount the tool(s) (if applicable)

3.2.1. HEX-E/H QC

The robot mount is attached together with the OnRobot Quick Changer mounting options.



HEX-E/H QC

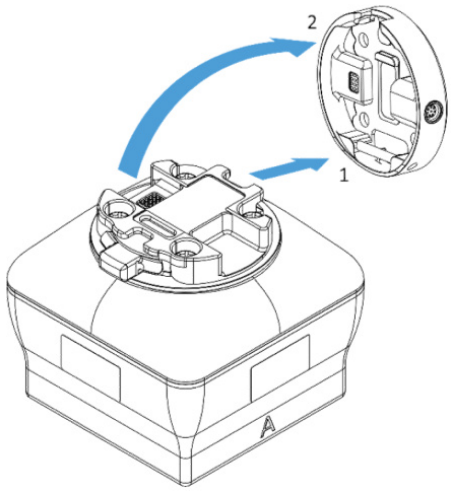
1. HEX-E/H QC sensor
2. M4x6mm (ISO14581 A4-70)
3. M6x20mm (DIN7984LT A2)
4. HEX-E/H QC adapter
5. Eyes Robot Mount
6. Adapter/ Robot tool flange (ISO 9409-1-50-4-M6)

Use 1.5 Nm tightening torque for M4x6mm.

Use 3.8 Nm tightening torque for M6x8mm.

3.2.2. Tools

3.2.2.1. VGC10



Step 1:

Move the tool close to the Quick Changer as illustrated.

The hook mechanism (rod and hook tongue) will keep the lower part locked once mounted.

Step 2:

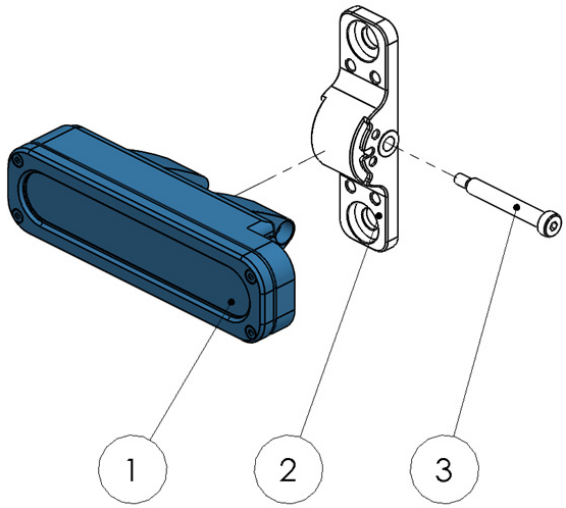
Flip the tool until it is fully mated, and you hear a clicking sound.

To unmount the tool, press the aluminum button on the Quick Changer and repeat the steps in the reverse order.

3.3. External Mount

The External Mount allows the Eyes to be mounted externally to the robot. Here, the mounting option is left for the user to decide. A calibration step needs to be performed for the Eyes to find the spatial relation between robot and Eyes.

To ease mounting the Eyes externally, OnRobot provides an External Mount piece. It can be mounted, for example, on a wall, ceiling or a fixed location available in the workspace.



External Mount

1. Eyes Camera HEAD
2. External Mount
3. SMSB 4.5-30

Use 3.5 Nm tightening torque for SMSB 4.5-30.

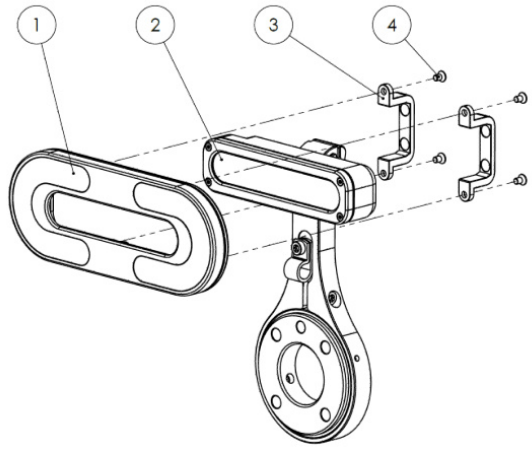
3.4. Eyes Lighting Kit Mount

Optionally, use the Eyes Lighting Kit to achieve more accurate detection and inspection results with Eyes.

You can mount the Eyes Light on the camera or you can use it externally with the provided mount.

3.4.1. Eyes Lighting Kit – Camera Mount

Mount the Eyes Lighting Kit on the camera as follows:

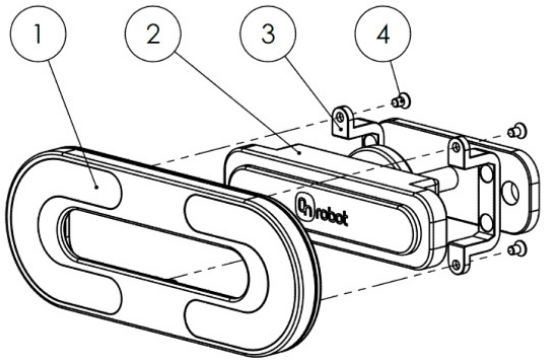


Eyes Lighting Kit Camera Mount

1. Eyes Light
2. Eyes Robot Mount
3. Eyes Light attachment brackets
4. M3x5mm (BN20039 A4-70)

Use 0.5 Nm tightening torque.

3.4.2. Eyes Lighting Kit – External Mount



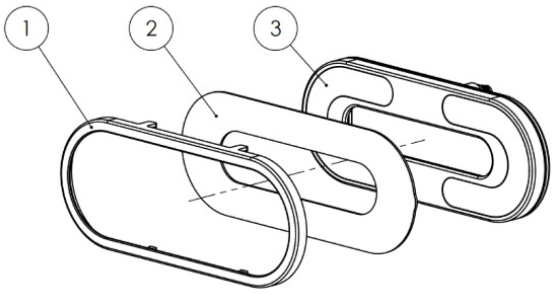
Eyes Lighting Kit External Mount

1. Eyes Light
2. Eyes Light wall mount
3. Eyes Light attachment brackets
4. M3x5mm (BN20039 A4-70)

Use 0.5 Nm tightening torque.

3.4.3. Optional – Diffuser Mount

Optionally, mount the diffuser as follows:



Diffuser

1. Diffuser cover
2. Diffuser
3. Eyes Light

3.5. Wiring

DANGER:

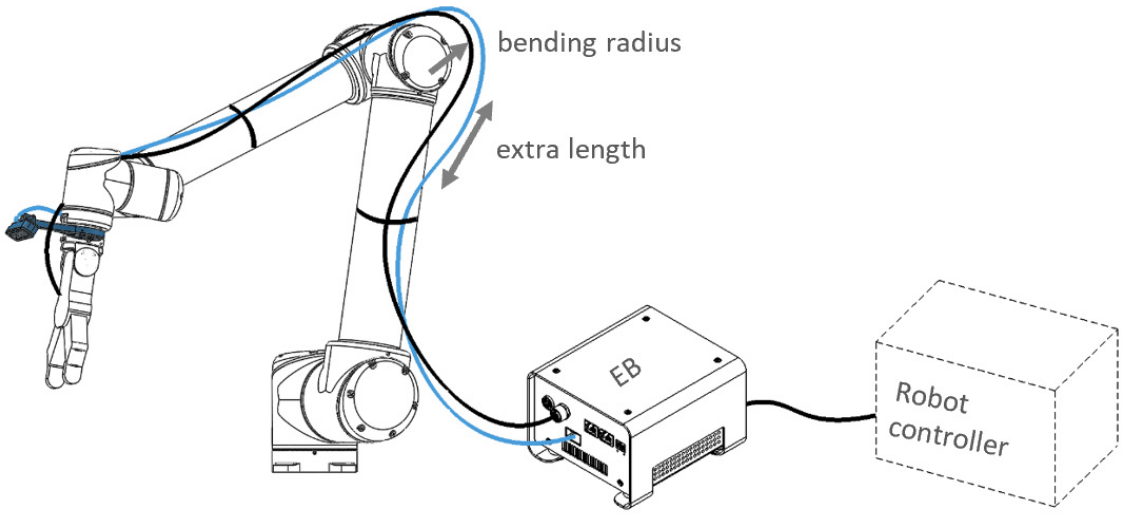
Use only original OnRobot tool data cables.

NOTE:

The Eye Box extends the functionality of the existing OnRobot Compute Box. Products that can be used with the Compute Box are also supported by the Eye Box.

Connect the following cables to wire the system:

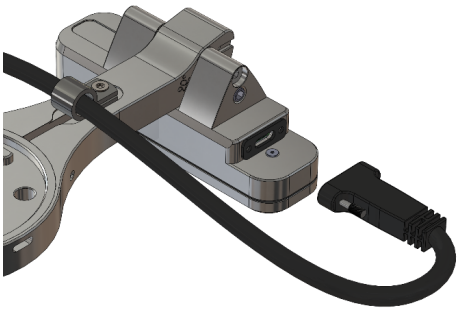
- USB cable between the Eyes and the Eye Box
- Optionally, Light cable between the Eyes and the Eye Box
- Tool data cable between the Tool(s) and Eye Box
- Ethernet cable between the robot controller and the Eye Box
- Ethernet cable between a computer and the Eye Box (only for configuration)
- Power supply of the Eye Box



3.5.1. USB Cable

First connect the USB cable to the Eyes.

Use the cable holder as illustrated on the left.



CAUTION:

Ensure the locking screws on the Eyes end connector are fastened. Use a maximum tightening torque of 0.2 Nm.

CAUTION:

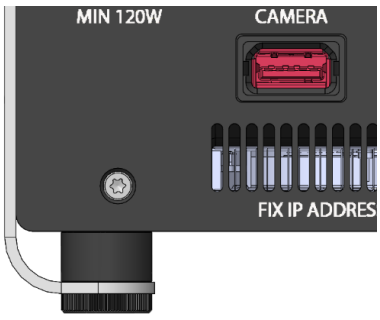
Make sure to use the supplied cable holder to prevent any excessive strain on the USB connector caused by the rotation of the cable.

Then route the USB cable to the Eye Box (EB) and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Finally, connect the other end of the USB cable to the Eye Box's CAMERA connector.



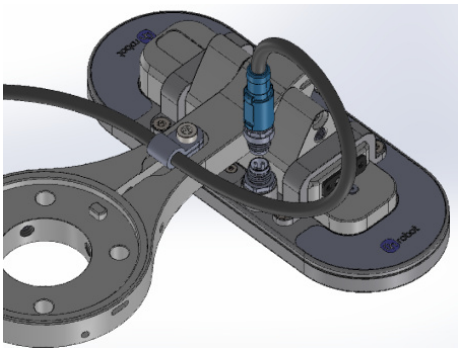
CAUTION:

Use only original OnRobot USB3 cables. Do not cut or extend these cables.

3.5.2. Optional – Light Cable

Connect the Light cable to the Eyes.

Use one of the cable holders on the Eyes. One cable holder is placed on top and another one at the bottom.



CAUTION:

Ensure that the locking screws on the Eyes end connector are fastened. Use a maximum tightening torque of 0.2 Nm.

CAUTION:

Make sure to use the supplied cable holder to prevent any excessive strain on the connector caused by the rotation of the cable.

Then route the Light cable to the Eye Box and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Connect the other end of the Light cable to the Eye Box's Light 1 or Light 2 connectors.



CAUTION:

Use only original OnRobot cables. Do not cut or extend these cables.

3.5.3. Tool Data Cable

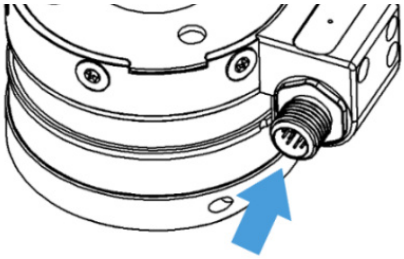
NOTE:

This step is only applicable when the Eyes is used with another OnRobot tool.

The data cable enables the Eye Box to be used with other OnRobot products.

3.5.3.1. Cable to HEX-E/H QC

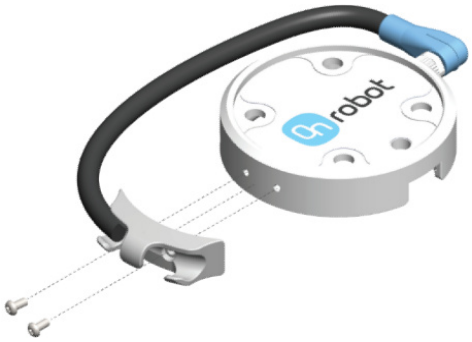
First connect the data cable to the tool.



Use the marked M12-12pin connector on the HEX-E/H QC.

3.5.3.2. Cable to VGC10

First connect the data cable to the tool.



Use the M8-8pin connector on the Quick Changer or on the Dual Quick Changer.

Use the cable holder as illustrated on the left.

CAUTION:

Make sure to use the supplied cable holder to prevent any excessive strain on the 90-degree M8 connector caused by the rotation of the cable.

3.5.3.3. Cable to Eye Box

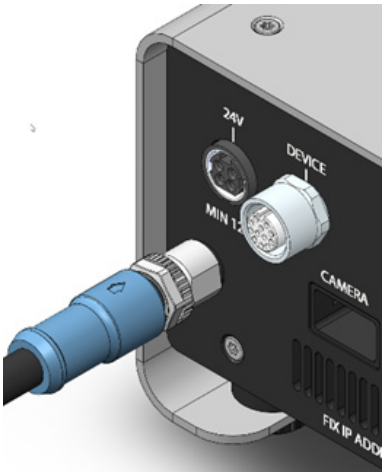
Then route the Tool data cable to the Eye Box (EB) and use the supplied Velcro tape (black) to fix it.

NOTE:

Make sure that during the routing some extra length is used at the joints so that cable is not pulled when the robot moves.

Also make sure that the cable bending radius is minimum 40mm (for the HEX-E/H QC it is 70mm).

Finally, connect the other end of the Tool data cable to the Eye Box's DEVICE connector.



CAUTION:

Use only original OnRobot tool data cables. Do not cut or extend these cables.

CAUTION:

Quick Changer and Dual Quick Changer can only be used to power OnRobot tools.

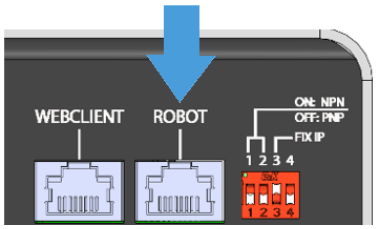
3.5.4. Ethernet Cable to Robot

Connect one end of the supplied Ethernet (UTP) cable to the robot controller's Ethernet (LAN) port.

NOTE:

If the robot controller's Ethernet port is in use, use a standard 4-port Ethernet switch to be able to use two network devices at the same time.

Connect the other end of the supplied cable to the Eye Box's ROBOT connector.



CAUTION:

Use only shielded, maximum 3m long Ethernet cables.

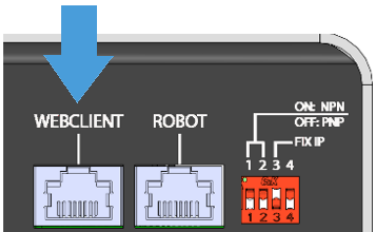
WARNING:

Check and make sure that the Eye Box enclosure (metal) and the robot controller enclosure (metal) are not connected (no galvanic connection between the two).

3.5.5. Ethernet Cable to Computer

Connect one end of the supplied Ethernet (UTP) cable to a computer's Ethernet (LAN) port.

Connect the other end of the supplied cable to the Eye Box's WEBCLIENT connector.



CAUTION:

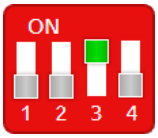
Use only shielded, maximum 3m long Ethernet cables.

NOTE:

The Ethernet cable to computer is only necessary during configuration of the Eyes and during operation is not needed.

3.5.6. Eye Box DIP Switch Settings

Set the DIP switches of the Eye Box as follows:



Set the DIP switch 3 to ON and the DIP switch 4 to OFF position.

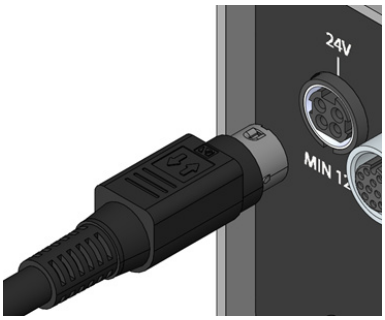
For more information about the Ethernet interface settings, see 6.1.1. Ethernet Interface Setup.

3.5.7. Power Supply

Power supply vs device compatibility table.

Power Supply	1.5A	5A	6.25A
Eyes alone	X	✓	✓
Eyes with other OnRobot device	X	✓	✓
Eyes with OnRobot Screwdriver or VGP20	X	X	✓

Connect the supplied power supply to the Eye Box 24V connector.



NOTE:

To disconnect the power connector, make sure to pull the connector housing (where the arrows are shown) and not the cable.

CAUTION:

Use only original OnRobot power supplies. The Eye Box requires minimum 120W.

Finally, power up the power supply that will power the Eye Box and the connected Tool(s).

3.6. Best practices - HEX-E/H QC

Best practices to maintain the calibrated device:

- Power off the HEX sensor when it is not used for a longer period of time.
- Remove any dead weight from the sensor when it is not used for a longer period of time.

4. SW Installation

4.1. Robot Software Setup

4.1.1. Install URCap

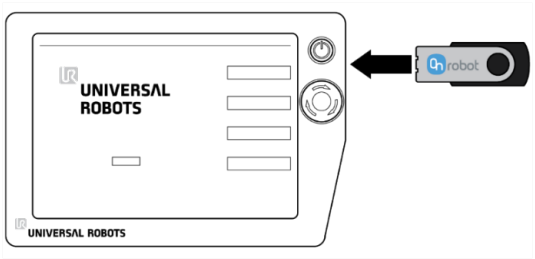
UR CB3

NOTE:

The minimum UR PolyScope version is **3.11**. Please remove all previous OnRobot URCap version(s) before the installation. The controller version must be CB3.1.

For the HEX-E/H QC products the **3.12** is not recommended.

1. Insert the OnRobot USB drive in the USB slot on the right side of the Teach Pendant.



2. Select the **Setup Robot** option from the main menu, then the **URCaps** option.

3. Tap on the + sign to browse for the OnRobot URCap file. It can be found in the usbdisk/UR/URCAP folder. Tap on **Open**.

UR e-Series

NOTE:

The minimum UR PolyScope version is **5.5**. Please remove all previous OnRobot URCap version(s) before the installation.

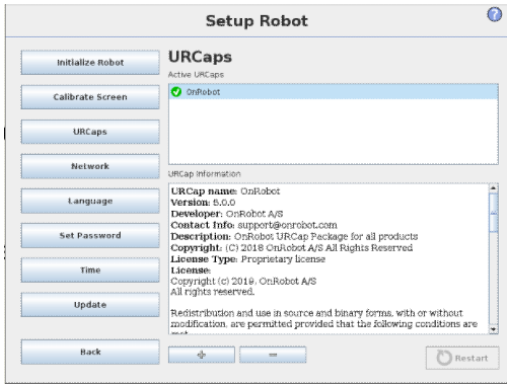
For the HEX-E/H QC products the **5.6** is not recommended, instead please use the **5.7**.

1. Insert the OnRobot USB drive in the USB slot on the top right side of the Teach Pendant.



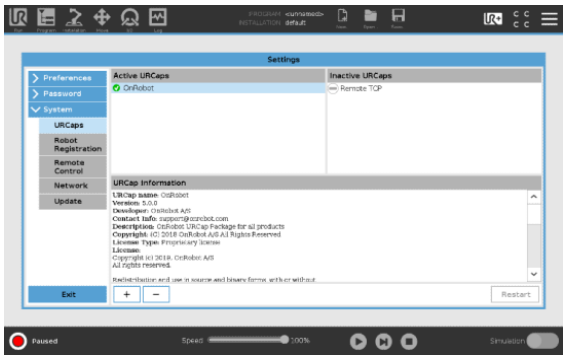
2. Then tap on the menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.
3. Tap on the + sign to browse for the OnRobot URCap file. It can be found in the usbdisk/UR/URCAP folder. Tap on **Open**.

4. The system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



5. Initialize the robot.

4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



5. Initialize the robot.

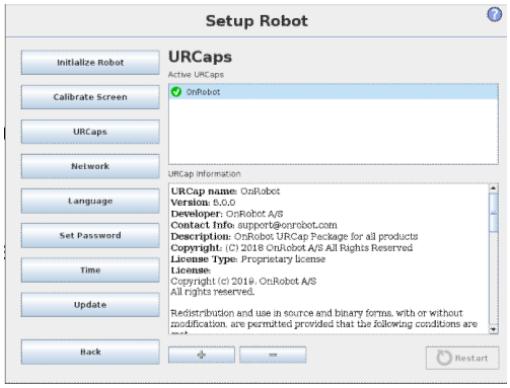
NOTE:

For more information on the URCap installation please refer to UR documentation.

4.1.2. Uninstall Software

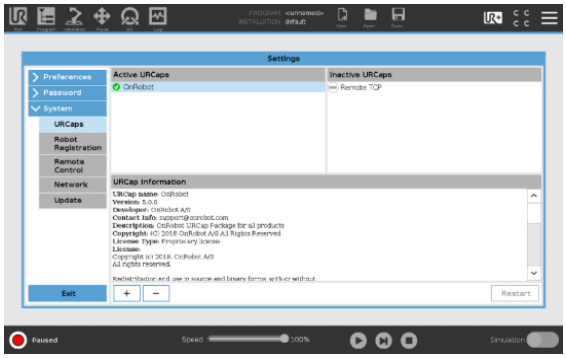
UR CB3

1. Select the **Setup Robot** option from the main menu, then the **URCaps** option.
2. Select the OnRobot URCap file.
3. Tap on the - sign.
4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



UR e-Series

1. Tap on the ☰ menu (top right corner of the screen), then from the **System** section tap on the **URCaps** menu.
2. Select the OnRobot URCap file.
3. Tap on the - sign.
4. Then the system needs to be restarted for the changes to take effect. Tap on the **Restart** button and then wait for the system to be restarted.



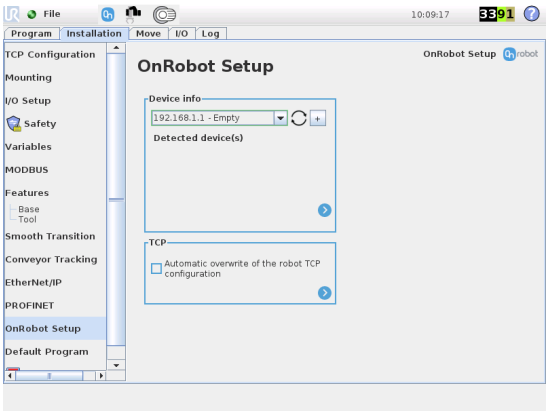
5. Initialize the robot.

5. Initialize the robot.

4.1.3. URCap Setup

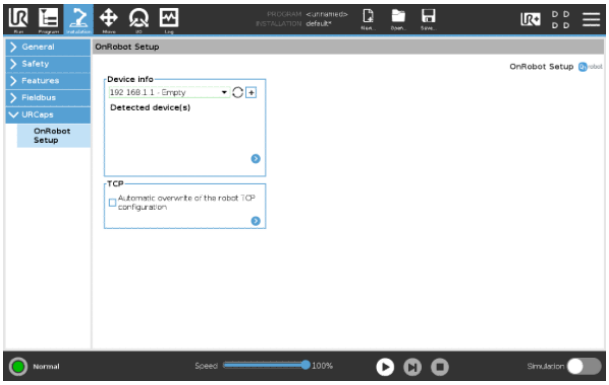
UR CB3

Select the **Installation** tab, then select **OnRobot Setup**. The following screen is shown:



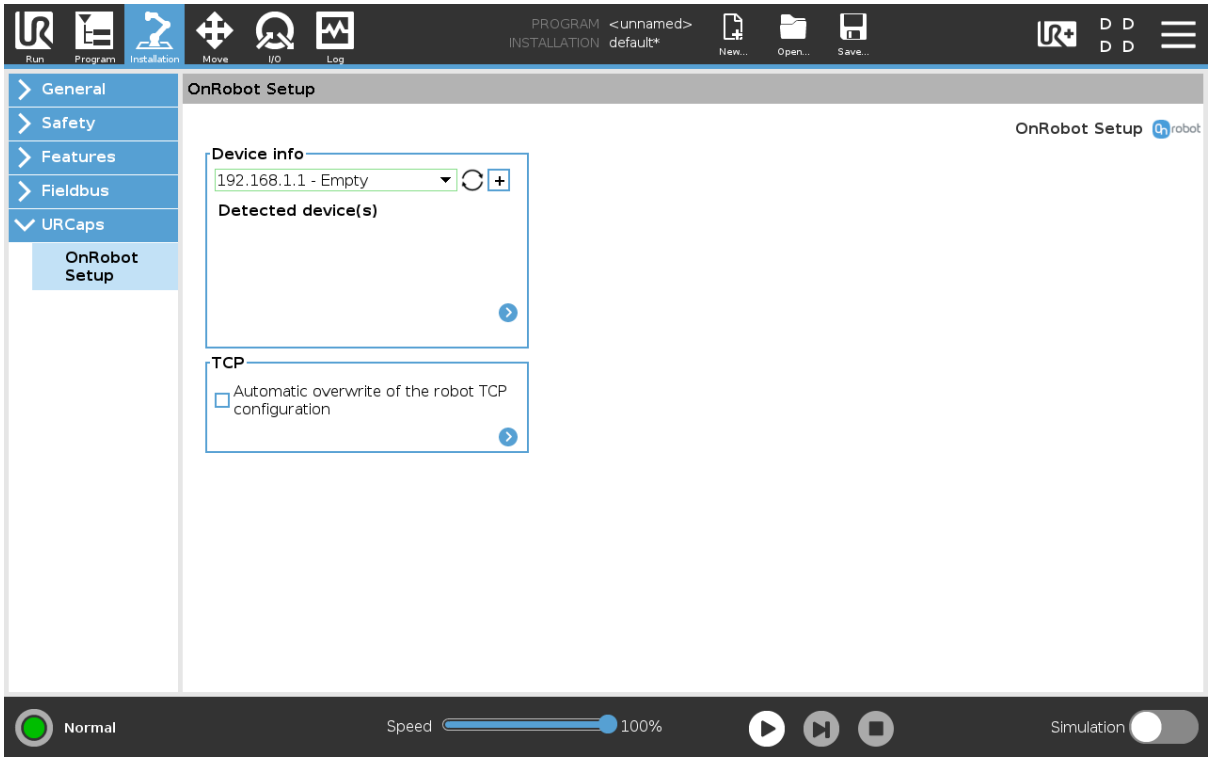
UR e-Series

Tap on the **Installation** tab in the top menu. Then tap on the **URCaps**.



4.1.3.1. Device Info

In the normal view of the panel, the available functions are shown below:



Device info

Dropdown menu to select a device-robot communication channel: Discover the connected devices.

Use the reload button to find new available devices.

NOTE:

After setting up the device the changes need to be saved to be part of the current installation.

For the e-Series UR robots tap on the **Save** button (from the top menu and use the **Save Installation** button.

For the CB3 UR robots use the **Save** button.

NOTE:

To use the newly discovered devices you might need to restart PolyScope. To do that simply press the **Restart now** button. Remember to save it before, if there are any unsaved changes in your program or settings.

OnRobot products are checked after the robot is restarted and the saved settings are restored while loading a program. That check could take up to 5 seconds via the Quick Changer for I/O. Therefore make sure to wait at least 5 seconds before you start your program. To make sure that the device is connected check the **Device info**.

If the connected OnRobot product is changed, always go to the **Device info** to check if the change was successful.

CAUTION:

After any error message is shown that is related to the connection to our devices, please go to the **Device info** to make sure that the right settings (e.g.: TCP) are used.

No connection: If you want to use OnRobot URCap and there are no connected devices, select **No connection** from the dropdown menu and no error message will show up.

Load multiple devices: The automatically loads the selected devices to the UR environment, even if the device is not connected to the robot. When you change between loaded devices, the robot does not require a restart but you should press the reload button to refresh the detected devices.

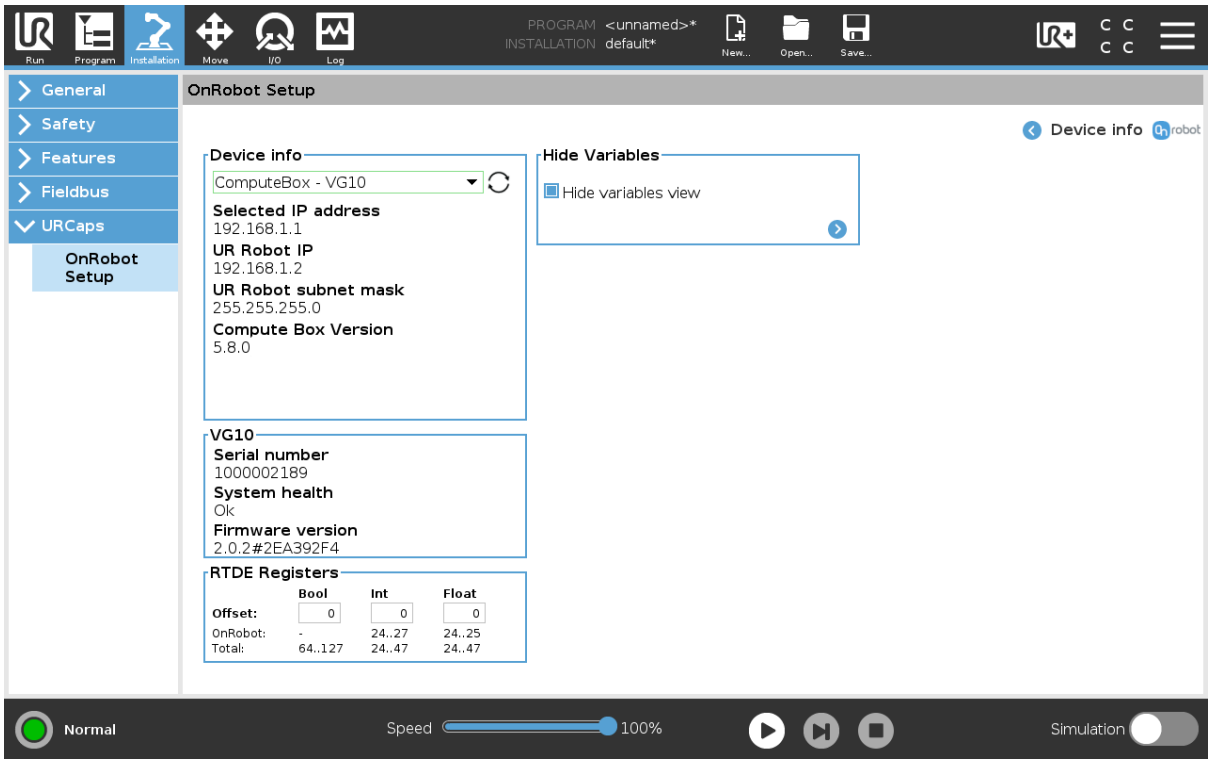
WARNING:

When multiple devices are activated, you may experience slow URCap operation. In this case, activate only the devices that you use. It is recommended to activate up to two devices at the same time.

For each loaded device, the appropriate URCaps commands and Toolbar will be visible, hence load only the devices that you will change frequently.

Detailed parameters of the Device Info

To get more information about the devices press on and the following screen will show:



Device info

The **Selected IP address**, **Compute Box Version**, **UR Robot IP** and **UR Robot subnet mask** are shown.

Errors

This displays information about the errors if there is any.

Device name

The **Serial number**, **System health** and **Firmware version** are shown.
Update: this will update the firmware if an update is available.

Depending on the selected devices, different panels will become available to configure the devices.

RTDE Registers

OnRobot uses RTDE registers to communicate with UR. Real-Time Data Exchange (RTDE) is an interface that can be used to send data for the robots through registers. For more information about RTDE registers, see UR's **Real-Time Data Exchange (RTDE) Guide**.

You need this option if you use OnRobot devices with other vendors' devices and OnRobot registers might overlap other vendors' registers.

OnRobot uses three different types of registers: **Bool**, **Int** and **Float**.

Offset: Offsets the registers by the amount that is written in the certain field.

OnRobot: Shows the number of registers that OnRobot uses of the certain type.

Total: Shows the maximum number of registers of the certain type that is available in UR.

Check other vendors' registers to make sure that the registers that you are using are not used by other vendors. If your registers overlap other vendors' registers, offset them by writing a certain value in the **Offset** fields. If the offset value is too high, the number of OnRobot registers can exceed the number of **Total** registers. In this case the values will turn red in the **OnRobot** row.

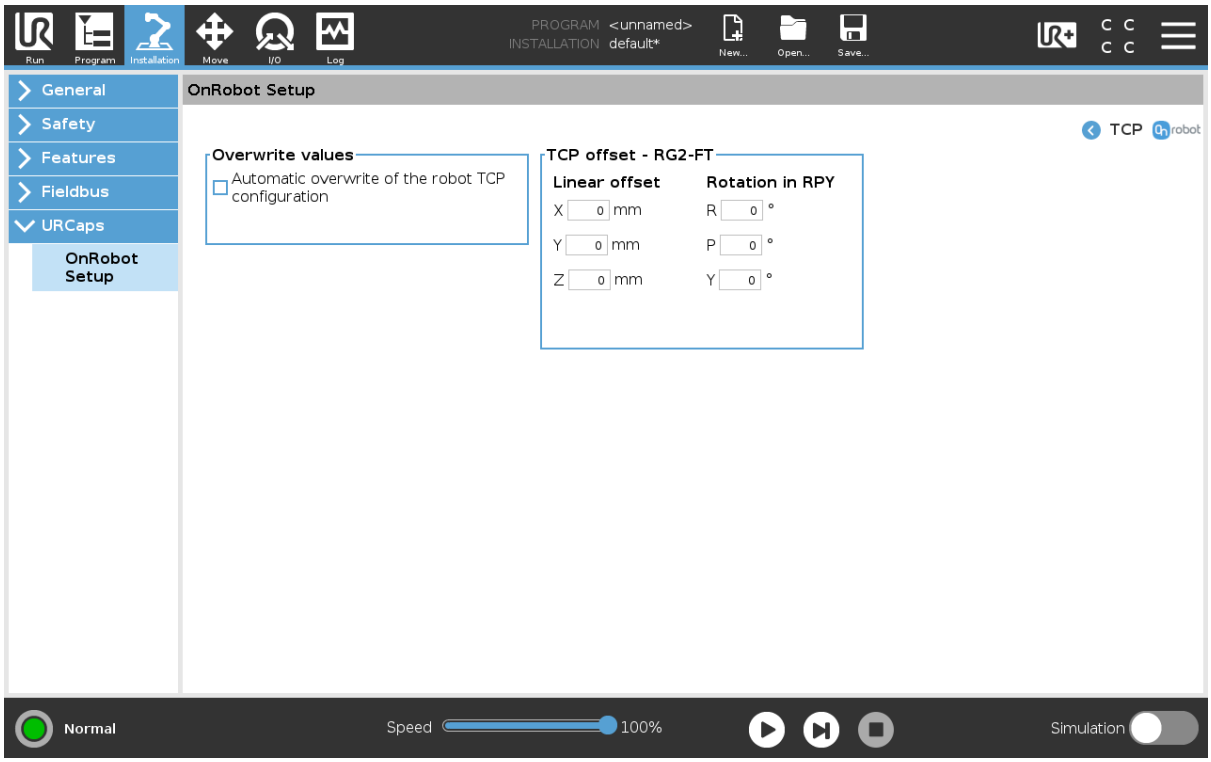
Hide Variables

A list of selectable variables. When a variable is selected to hide, it will not appear on the configuration panel.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

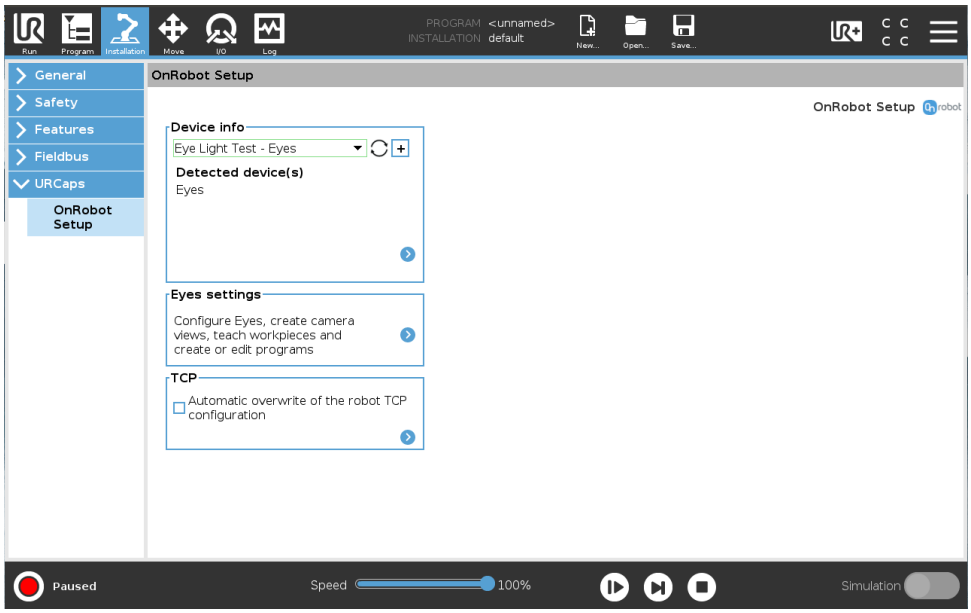
For further information and best practices on the TCP setting see TCP Configuration section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

4.1.3.2. Eyes

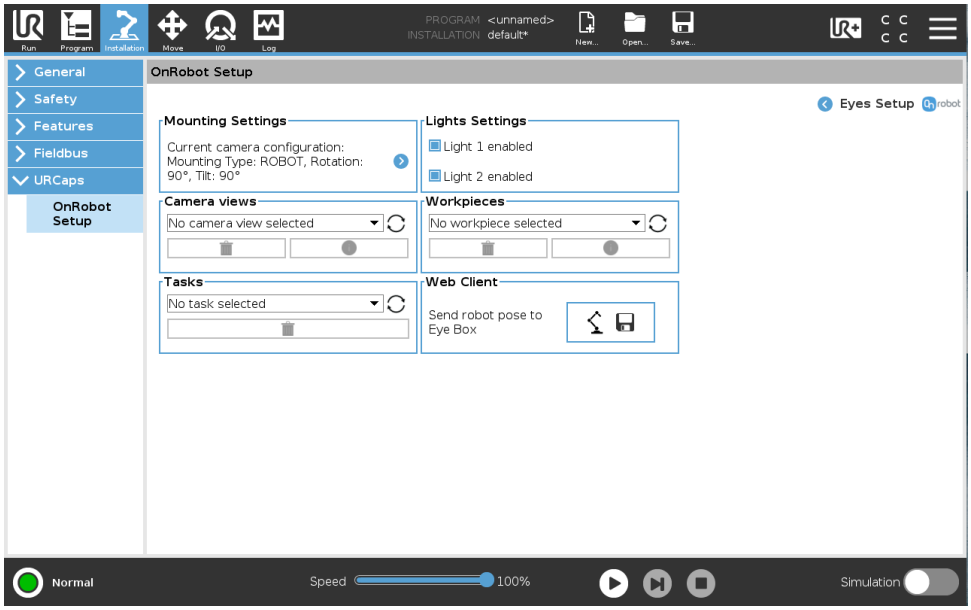
Use the following configuration panels for the Eyes:



Eyes settings

Use this menu to configure the Eyes.

Press  to go to the **Eyes Setup** page.



Mounting Settings

Use this menu to select the camera mount.

Press  to go to the **Mounting Type** settings page.

Lights Settings

Use this menu to enable the Lights on Eyes.

Camera views

Use this menu to select a camera view.

To delete a camera view, press .

To see more information about a camera view, press .

Workpieces

Use this menu to select a workpiece.

To delete a workpiece, press .

To see more information about a workpiece, press .

Tasks

Use this menu to select a task.

To delete a workpiece, press .

Web interface

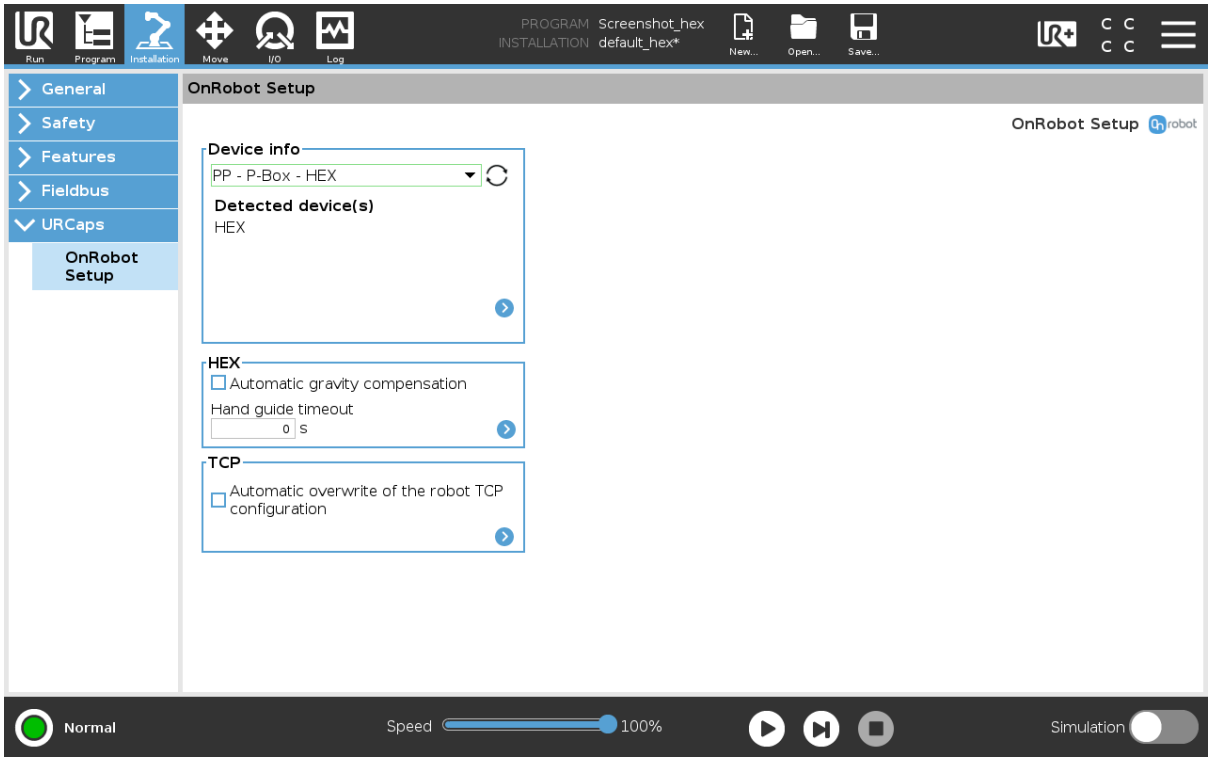
Use this menu only when configuring the Eyes via Web Client.

Send robot pose to Eye Box: Press this button in the following cases:

- When creating a new camera view.
  The screen prompts you to save the current robot pose to be used later on. At this time, press the button.
- When calibrating an externally mounted Eyes with the robot.
  When selecting External Mount in the Eyes' Web Client settings, the screen prompts you to send the robot's pose from the robot. At this time, press the button.

4.1.3.3. HEX

The configuration panels for the HEX are shown in the image below:



HEX

Automatic gravity compensation: If enabled, the weight of the tool and the part will be compensated while the robot orientation is changed.
Make sure that the weight and the Center of Gravity is set correctly.
Gravity compensation is only available for the following operations:

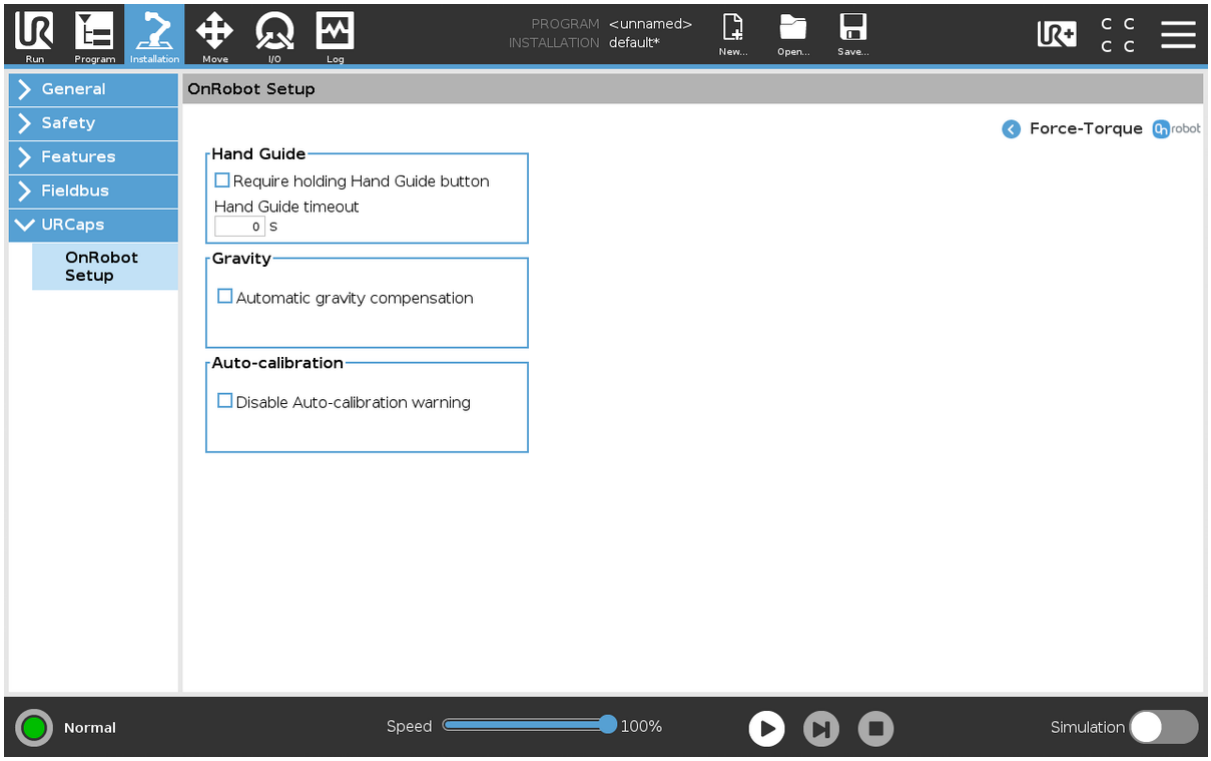
- Force Control
- Pin insertion
- Hand Guiding
- Sanding

WARNING:

The robot cannot be tilted when you use gravity compensation.

Timeout: After the set timeout value, the hand guiding will be stopped automatically. The default value is 0 that sets the timeout to infinite.

Press to see more options:



Hand Guide

Require holding Hand Guide button: If checked (recommended), press the Hand Guide enable button constantly during the hand guiding. If unchecked, you can start the hand guiding by pressing the enable button and can stop it by pressing the enable button again.

Timeout: After the set timeout value, the hand guiding will be stopped automatically. The default value is 0 that sets the timeout to infinite.

Gravity

Automatic gravity compensation: If enabled, the weight of the tool and the part will be compensated while the robot orientation is changed.
Make sure that the weight and the Center of Gravity is set correctly.
Gravity compensation is only available for the following operations:

- Force Control
- Pin insertion
- Hand Guiding
- Sanding

WARNING:

The robot cannot be tilted when you use gravity compensation.

Auto-calibration

Disable Auto-calibration warning: When selected, the Auto-calibration warning pop-up will be disabled. The need for Auto-calibration will appear as a log entry. For further information on Auto-calibration, see the 6.1.3.2. Web Client: Devices Menu section.

WARNING:

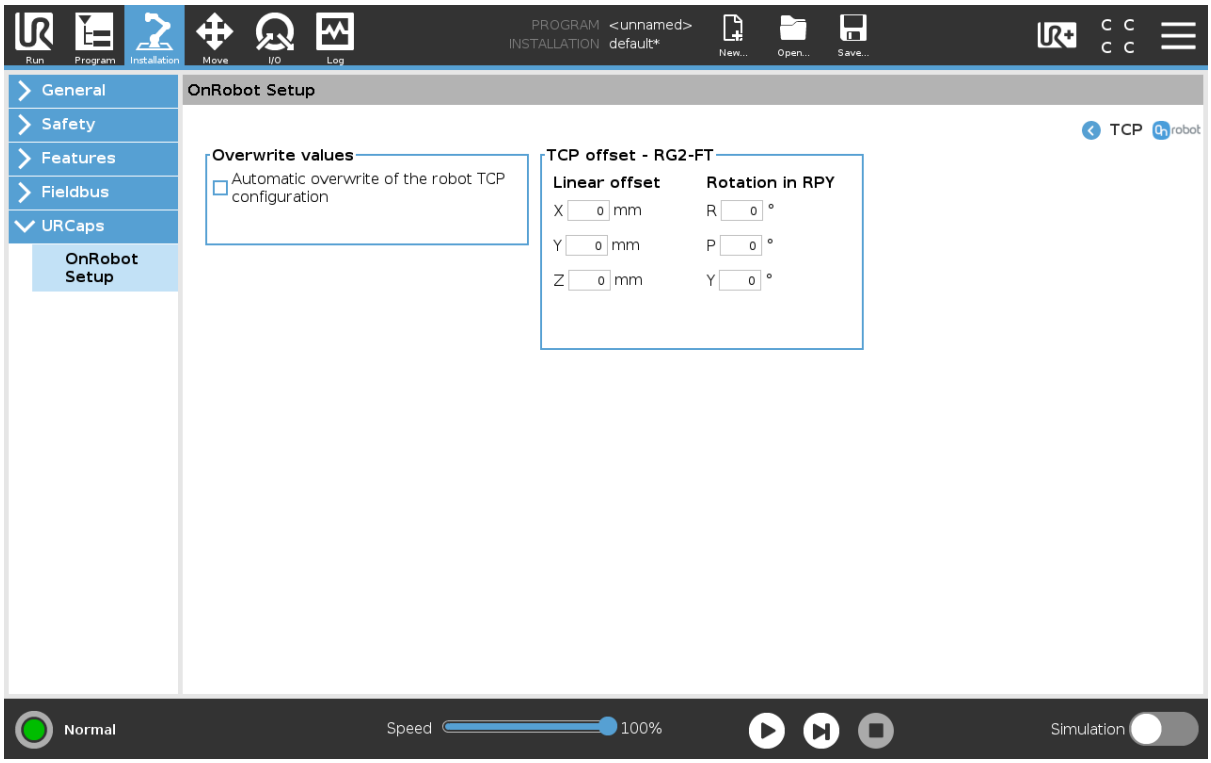
It is recommended to perform the Auto-calibration process when instructed. If the Auto-calibration process is not possible, schedule your sensor to be sent back to the OnRobot factory for a re-calibration. If the Auto-calibration warning pop-up is disabled, the following statements must be taken into consideration:

- The sensor is not reliable in the overload range.
- The overload protection will be less precise.
- The Force overload protection is only reliable if the `HEX-Zero` command is used properly.

TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

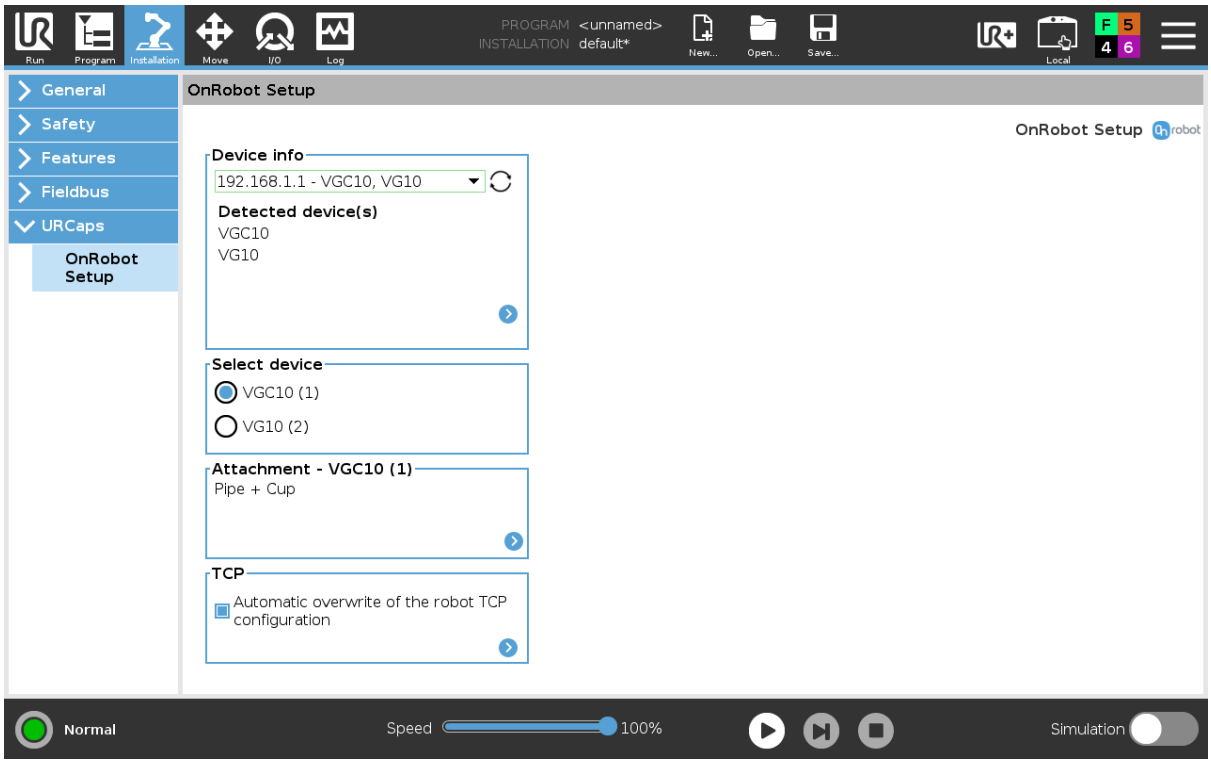
For further information and best practices on the TCP setting see TCP Configuration section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

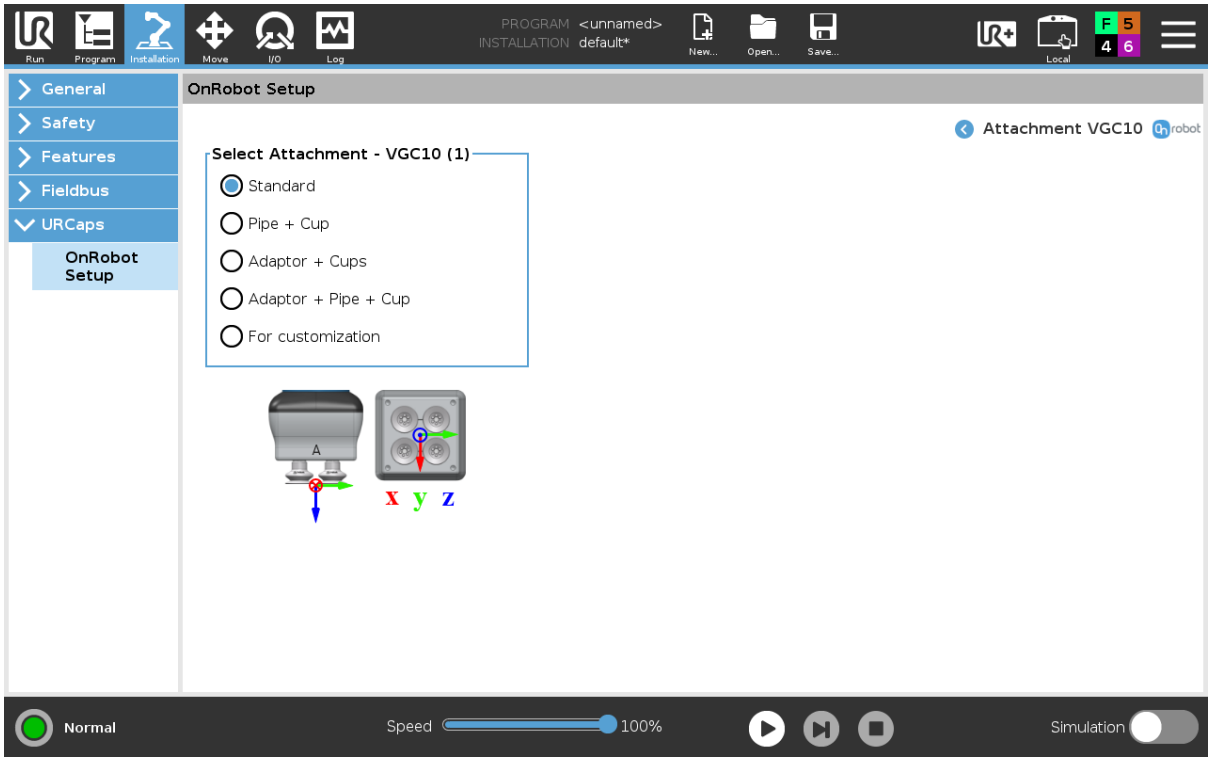
4.1.3.4. VGC10

The configuration panels for the VGC10 are shown in the image below:



Attachment

In the normal view of the panel, the selected attachment types such as **Standard**, **Pipe + Cup**, **Adaptor + Cups**, **Adaptor + Pipe + Cup** and **For customization** are mentioned. This configuration panel is used to set the TCP in the right position as well as to move the Center of Gravity of the workpiece to the new TCP. To select a different attachment configuration press on .

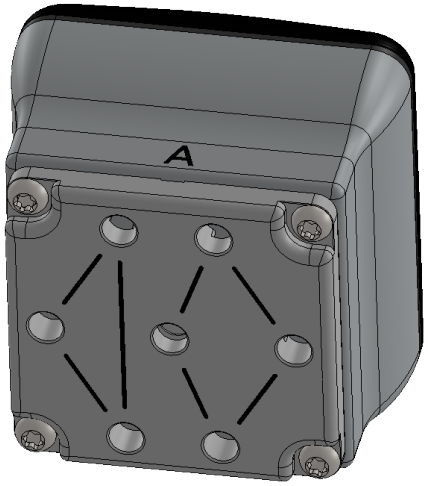


Here the actual mounting can be selected to set up the TCP correctly. The different options are:

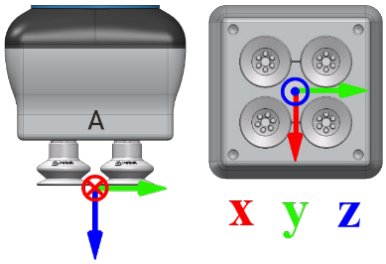
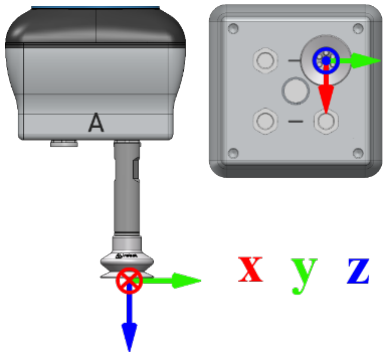
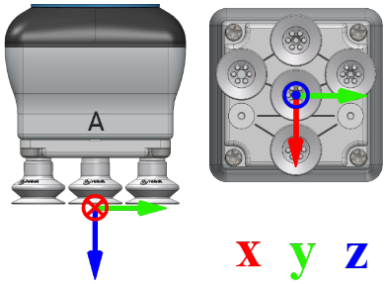
- **Standard**: Device with only four cups attached to it. This selection will set the TCP at the center of the end side of the cups (see table below).
- **Pipe + Cup**: Device with the extension pipe with a cup placed in the right side using the letter A as reference. This selection will set the TCP at the end of the cup placed on the extension pipe (see table below).
- **Adaptor + Cups**: Device with the adaptor with cups. This adaptor allows to create several configurations. This selection will set the TCP at the center of the end side of the cups, considering also the adaptor height (see table below).
- **Adaptor + Pipe + Cup**: Device with the adaptor with the extension pipe in the middle with a cup. This selection will set the TCP at the end of the cup placed on the extension pipe (see table below).
- **For customization**: Device with no attachments on. This selection will set the TCP at the center of the bottom side of the device (see table below). This option is useful when the user utilizes a customized configuration and, to edit the offset of the TCP, wants to start by having a reference at the end of the device with no attachments on.

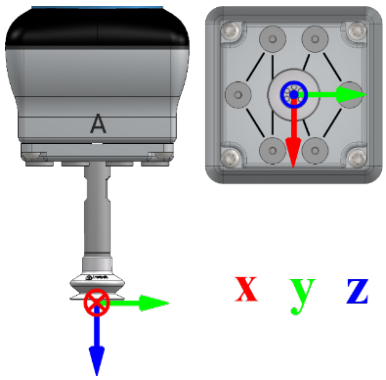
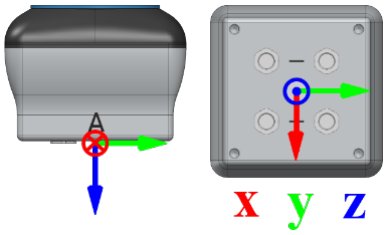
NOTE:

A higher flow can be achieved, by combining both channels, if the adaptor place is mounted 90° rotated as shown in the picture below. See more info in subsection **Adaptor Plate**.

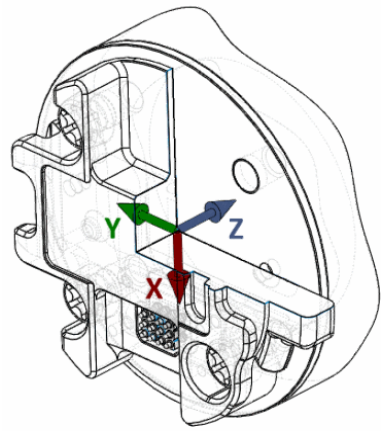


The table below provides an overview of the different attachment combinations, the TCP values that will be set in the robot and an image with a visual representation of the TCP location.

Attachment	TCP (x, y, z) [mm]	Image
Standard	(0, 0, 100)	
Pipe + Cup	(-17, 17, 150)	
Adaptor + Cups	(0, 0, 110)	

Attachment	TCP (x, y, z) [mm]	Image
Adaptor + Pipe + Cup	(0, 0, 160)	
For customization	(0, 0, 75)	

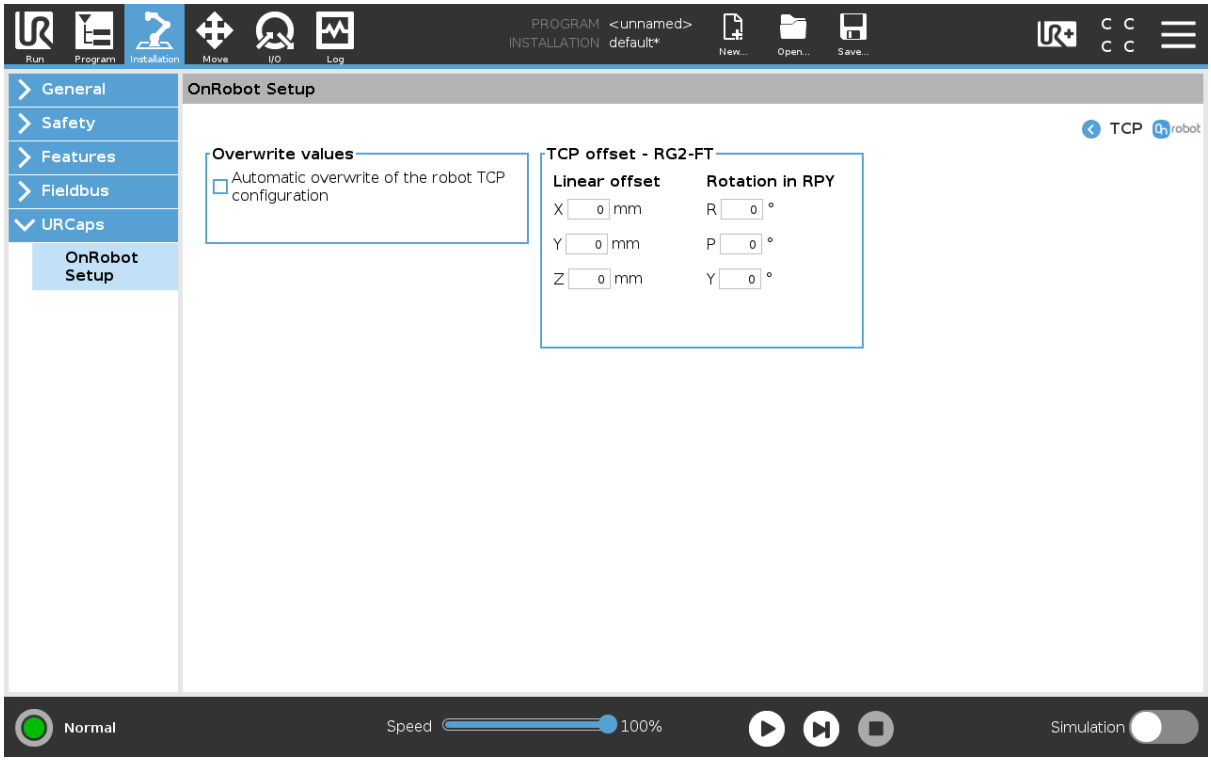
The TCP values have their origin in the top part of the gripper as shown in the image below.



TCP

In the normal view of the panel the TCP of the robot can be overwritten by the TCP of the tool by pressing the **Automatic overwrite of the robot TCP configuration** checkbox.

To see more options press on and the following screen will show:



Overwrite values

Automatic overwrite of the robot TCP configuration: when checked, the UR's TCP configuration is automatically overwritten (Dynamic TCP mode). When unchecked the TCP is left unchanged (Static TCP mode).

For further information and best practices on the TCP setting see **TCP Configuration** section.

TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

4.2. Eyes Software Settings

Configure the Eyes software settings as follows:

- Go to the **Eyes Setup** page. Under **Mounting Settings**, press .
- Select the camera mount:
  - ROBOT - The Eyes is attached to the tool flange of the robot. This is the default option.
  - EXTERNAL - The Eyes is mounted externally.

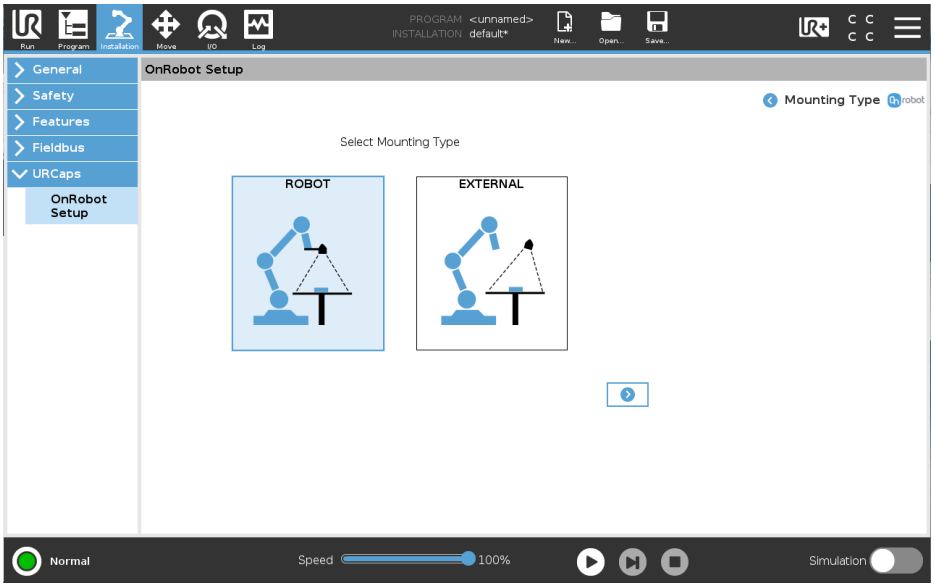
4.2.1. Robot Mount Settings

By default, the camera mount is robot mount. The robot mount option supports multiple hardware configurations using rotation and tilt adjustments.

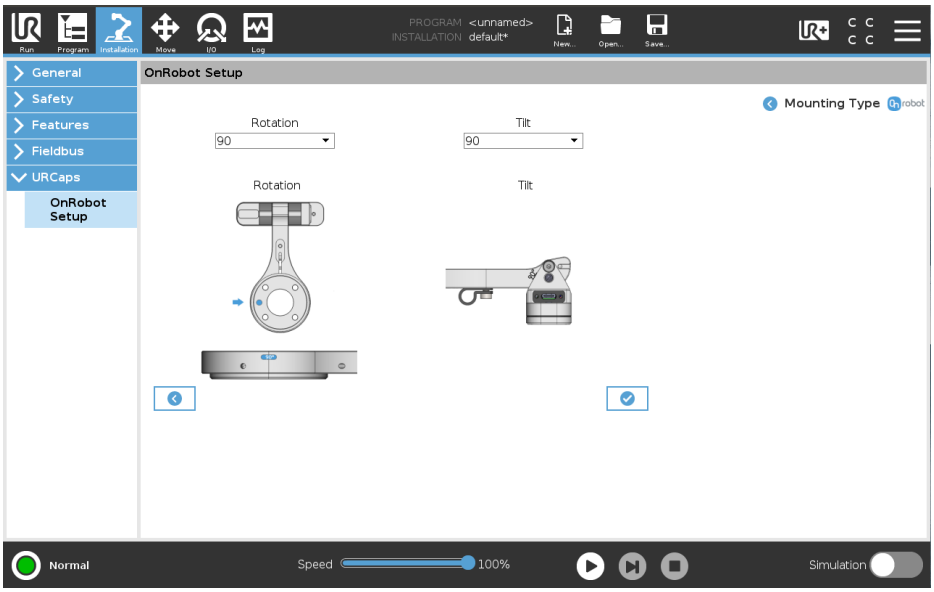
Set the robot mount settings as follows:

- Go to the **Eyes Setup** page. Under **Mounting Settings**, press .

- Select ROBOT camera mount.



- Press .
- Select the **Rotation** and the **Tilt** parameters from the drop-down lists, respectively.

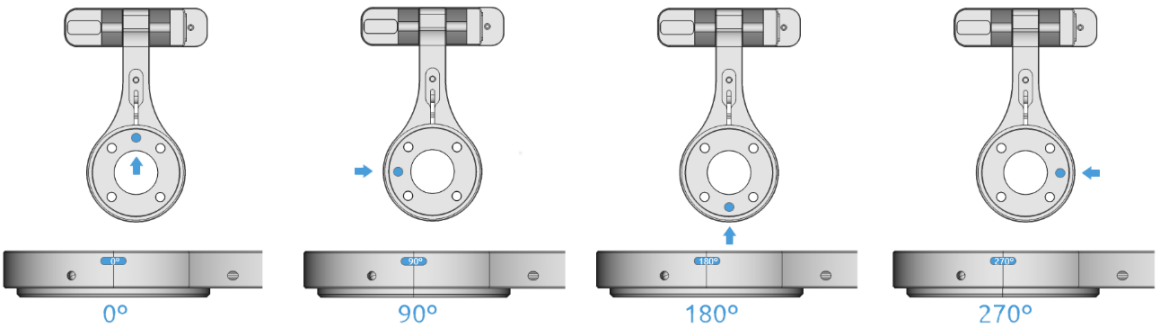


- Press .

Rotation (°)

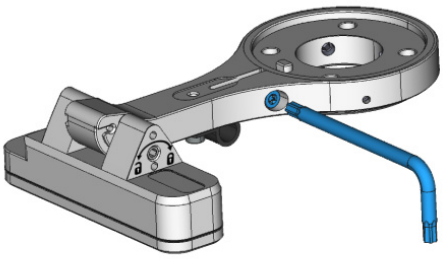
The rotation parameter specifies the orientation of the camera around the robot's tool flange. You can adjust the rotation of the robot mount by rotating the arm of the mount once it has been mounted to the robot's tool flange. The rotation angle is specified on the side of the mount, and can be one of the following values:

- 0 degree
- 90 degrees
- 180 degrees
- 270 degrees



NOTE:

Make sure that the mount is in one of the supported positions. Do not use intermediate positions. Secure the structure with the provided supporting screw (labeled as “Screw for Camera lock” - M4x16mm). Tighten the screw with 1 Nm torque.



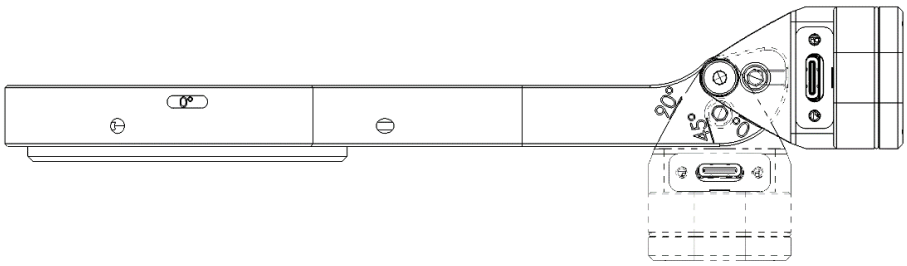
CAUTION:

Make sure that the supporting screws are not tightened when you change the angle of the robot mount.

Tilt (°)

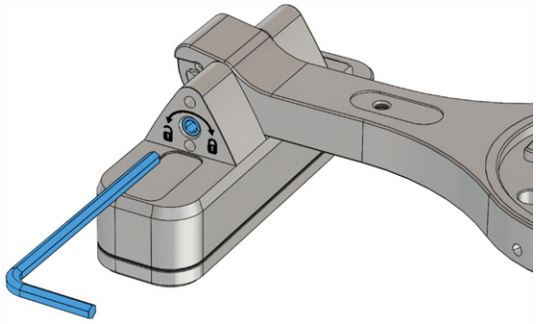
The tilt parameter specifies the orientation of the robot mount’s head, which holds the camera. Adjust the tilt of the mount by rotating its head. The angle can be seen on the side of the mount head and it can be one of the following values:

- 0 degree
- 45 degrees
- 90 degrees



NOTE:

Make sure that the mount is in one of the supported positions. Do not use intermediate positions. Once a position is decided, secure the mount using the tightening screw. Tighten the screw with 0.4 Nm torque.



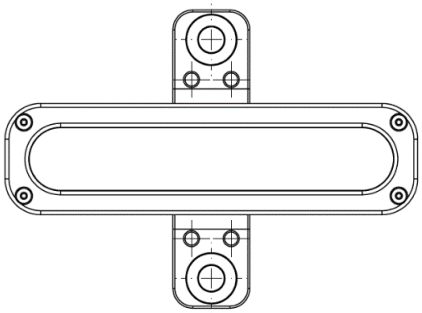
CAUTION:

Make sure that the supporting screws are not tightened when you cahnge the angle of the robot mount.

4.2.2. External Mount Settings

To use external mount, detach the camera component from the robot mount as follows:

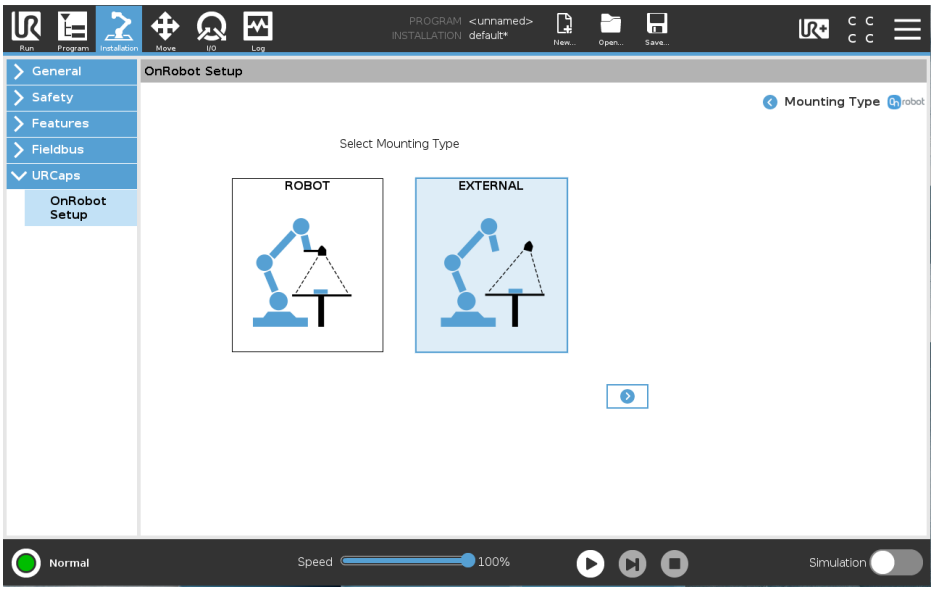
- Unscrew the SMSB 4.5-30 screw on the side of the camera component.
- Detach the camera from the robot mount.
- Attach the camera to the external mount.



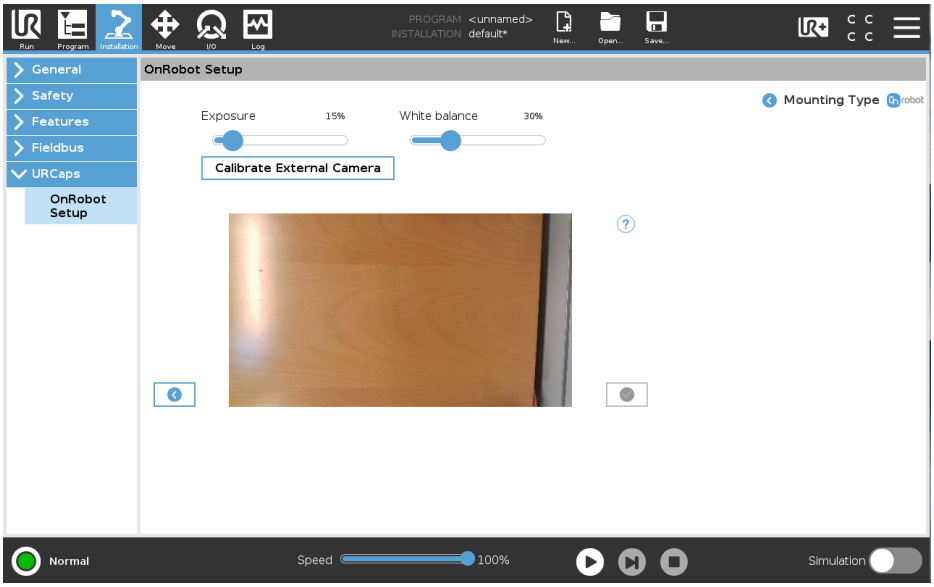
- Attach the support piece to a fixture using one of the multiple holes present on it.

Set the external mount settings as follows:

- Go to the **Eyes Setup** page. Under **Mounting Settings**, press .
- Select EXTERNAL camera mount.



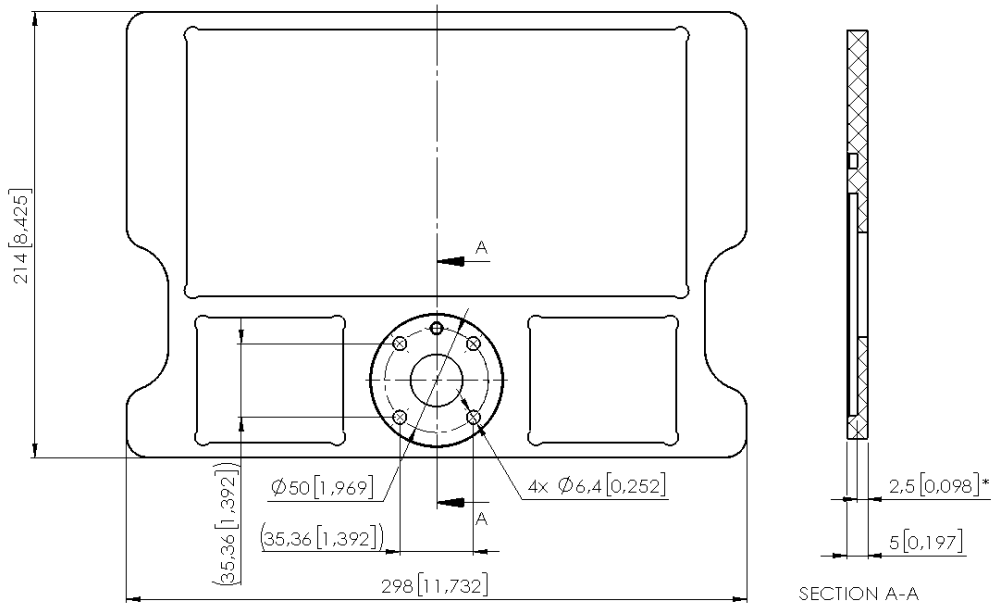
- Press .
- Adjust the image using the **Exposure** and the **White balance** parameters, if needed. Use the sliders to change the parameters.
  Under **Camera feed**, you can see the current camera image.



Use the **Calibrate External Camera** button to calibrate the Eyes. With the calibration process, the Eyes gets the relative pose of itself with respect to the robot.

Calibrate the Eyes as follows:

- Attach the calibration plate to the robot tool flange using the provided M6x12 screws.



- Move the robot so the calibration plate sits on the workspace within the camera view and the inner corners of the pattern are marked in green.
- Press the **Calibrate External Camera** button.

NOTE:

If the external camera is moved at any time with respect to the robot, a new calibration is required.

- Press .

5. Operation

NOTE:

It is assumed that the Installation has finished successfully. If not, first do the installation steps in the previous section.

5.1. URCap Commands

URCap commands provide an easy way to program an application.

5.1.1. Eyes

5.1.1.1. Eyes General Overview

OnRobot Eyes supports the following applications:

- **Part Location** - This application can be used to locate workpieces laid out on a flat surface, providing information about the workpieces' position and the workpieces' type.
- **Inspection** - This application can be used to inspect the outer contour and color of workpieces laid out on a flat surface. The workpieces' quality and position are provided to the robotic application. Additionally, OnRobot WebLogic can be used to operate the Eyes Inspection, see *User Manual for Using WebLogic*.
- **Landmark** - This application can be used to create applications where the robot and part of its workspace are not fixed to each other. The Eyes detect the provided landmark object to recalibrate the robot with its workspace.
  It does not require configuration and can be used directly in the robot program.

Configure the **Part Location** and **Inspection** applications as follows:

- **Part Location** - To setup the camera view, define what type of workpieces the Eyes will detect. Configure the Eyes Locate URCap command.
- **Eyes Inspect** - To setup the camera view, define what type of workpieces the Eyes will inspect. Configure the Eyes Inspect URCap command.

To operate the system in any of the supported applications, run the Eyes application from the robot.

NOTE:

For more information about saving the configuration of the Eyes, go to the 6.1.3.1. Eyes Backup section.

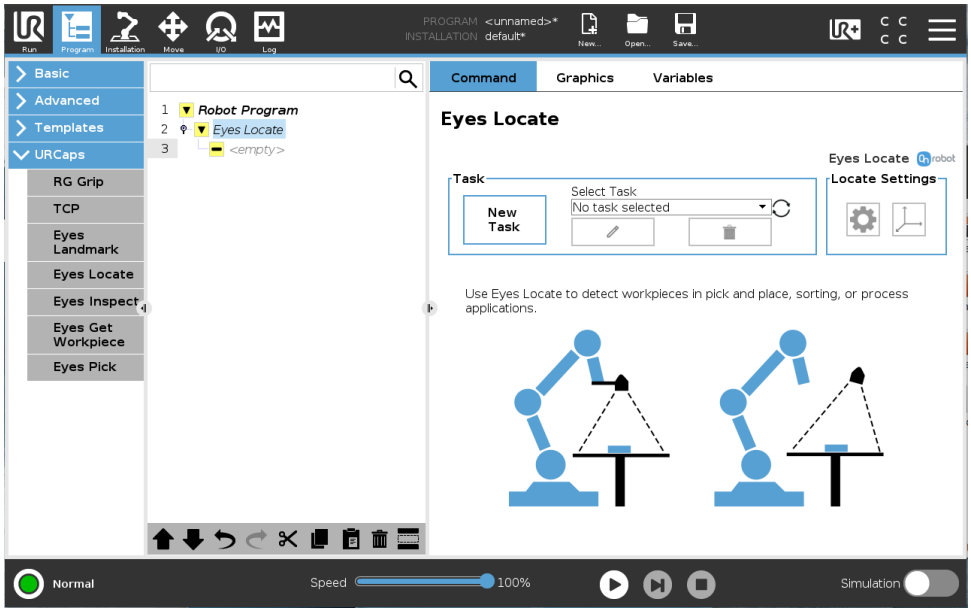
5.1.1.2. Eyes Locate

Configure the Eyes Part Location Application

I. Select an Existing Eyes Task

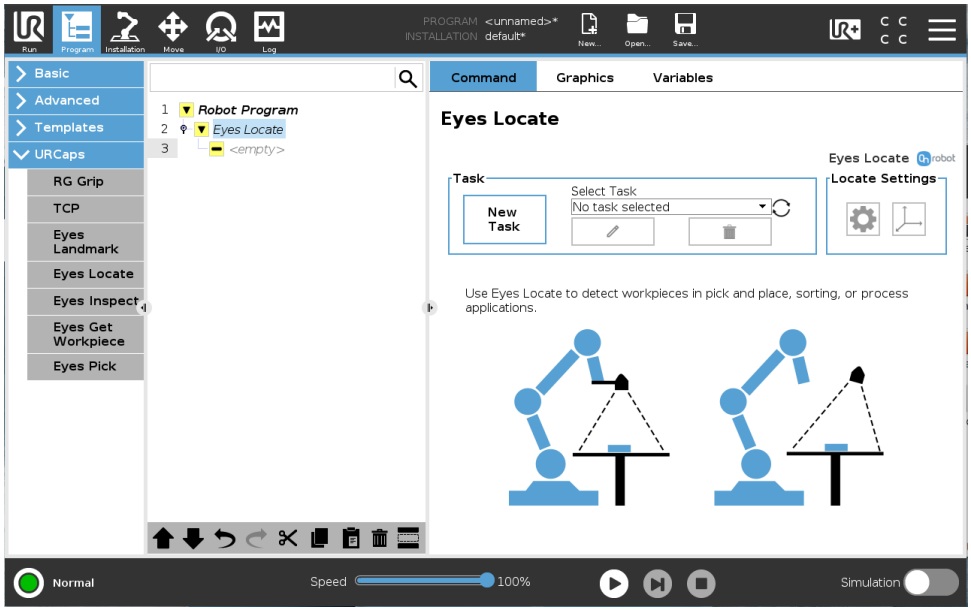
Under **Task**, select an already existing Eyes task from the drop-down list.

If you want to edit the Eyes task, press . To delete an Eyes task, press .



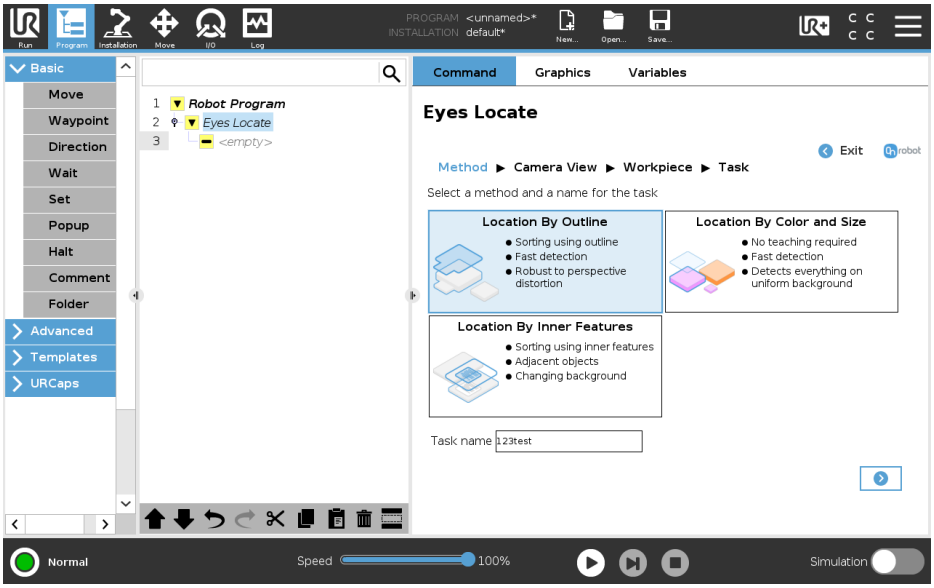
II. Create a New Eyes Task

Under **Task**, press **New Task** to create a new Eyes task.



II/1. Method

- Enter a name for the task to the **Task name** field and then select a location method.



You can select one of the following location methods:

- Location by workpiece's outline
  This detection method uses the selected workpiece's outline to locate and sort the objects in the scene. Color can be used as a sorting variable in case of objects with identical outer shape.
- Location by workpiece's inner features
  This detection method uses the selected workpiece's inner features like holes, edges, and similar features to locate and sort the objects in the scene. Color can optionally be used as a sorting variable. Adjacent and touching objects can be identified as well.
- Location by color and size
  This detection method is intended for fast deployment. It does not require teaching and the parts are identified based on the color and the size boundaries you set. The following table gives an overview of the Part Location methods.

Method	Strengths	Limitations
Workpiece's outline	• Guarantees OneShot detection • Requires few parameters to adjust • Provides fast cycle time	• Cannot distinguish the inner features of the object • Cannot handle adjacent or touching objects
Workpiece's inner features	• Can identify adjacent or touching objects • Background does not need to remain constant during the operation	• Perspective distortion on tall objects could lead to false negative results • Does not guarantee the detection of all objects when using OneShot • Provides variable cycle time

Method	Strengths	Limitations
Color and size	• Does not require teaching • Identifies different parts in the same task as long as they are different from the background • Provides fast cycle time	• Does not support sorting

NOTE:

When you use Part Location by Workpiece's inner features, position the camera parallel to the surface on which the objects are placed.

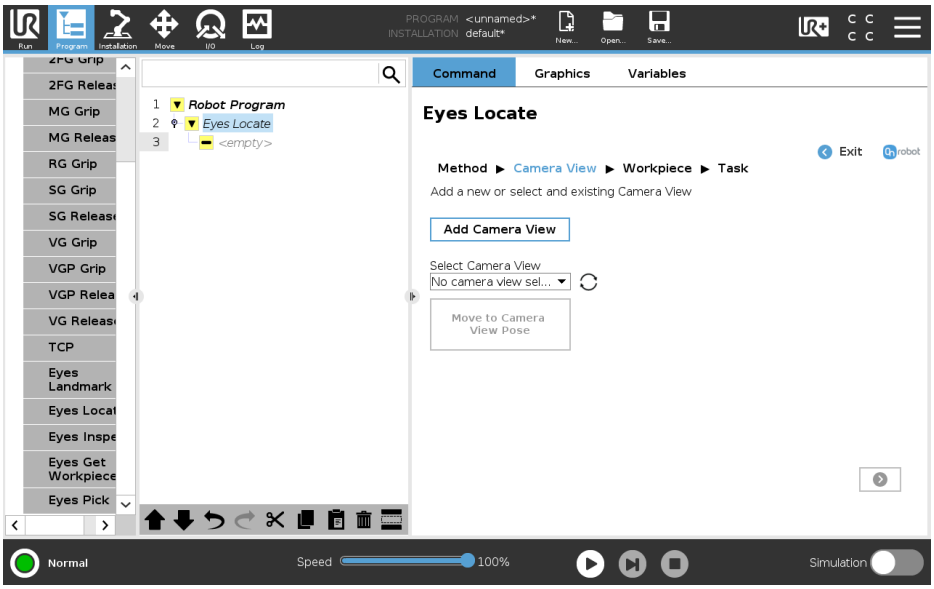
- Press .

II/2. Camera View

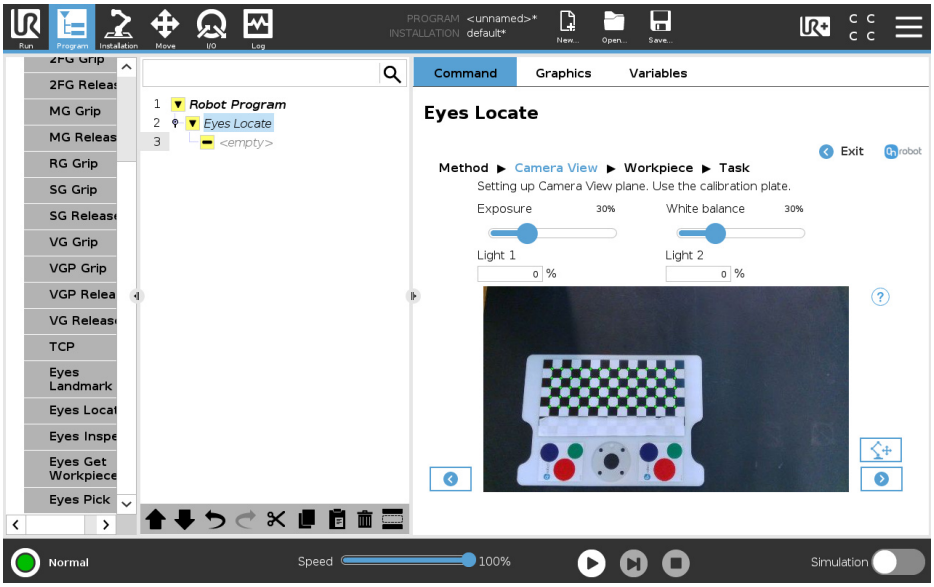
The camera view is an area which the Eyes will look at to detect workpieces. The area should be a flat surface and its background's color should be distinctly different to color of the workpieces to be detected. Eyes is robust to light changes, but it is advisable to limit lighting changes, changing shadows or strong reflections in the camera's view.

Position the camera as parallel to the surface as possible, at a distance between 400 mm – 1000 mm. The smaller the distance, the higher the accuracy. The larger the distance, the larger region of the surface objects are detected in.

- To use an existing camera view, select it from the dropdown list and press .
  To create a new camera view, press **Add Camera View**.



- Place the calibration plate on the surface, such that it can be seen in the camera feed. The procedure is the same independently of the height of the objects to be detected. The inner corners of the pattern should be marked in green if the pattern is correctly detected. The working area of the Eyes is not limited to area covered by the calibration plate.



You can adjust the image using the **Exposure** and the **White balance** parameters, if needed. For example, the pattern is not detected or the color of the image does not reflect what is seen. Use the input fields to change the parameters.

- Set the **Exposure** and the **White balance** parameters, and observe the effects on the camera feed.
- Set the **Exposure** parameter so the image is neither saturated nor underexposed (non-white objects do not appear white, non-black objects do not appear black) and the brightness of the background and the calibration plate roughly reflects how it is seen.
- Set the **White balance** parameter so the colors look similar in the image as in reality.

If you use the **Eyes Lighting Kit**, the intensity of the two lights can be adjusted independently to improve the illumination conditions in the application. Use **Light 1** and **Light 2** parameters to adjust the intensity of the lights.

NOTE:

To avoid drawing excessive power from the Eye Box, the combined intensity of the two lights is limited to 100%. If the intensity of one light exceeds the maximum level, the intensity of the other light will be lowered automatically.

Using the **Eyes Lighting Kit** for location can provide the following:

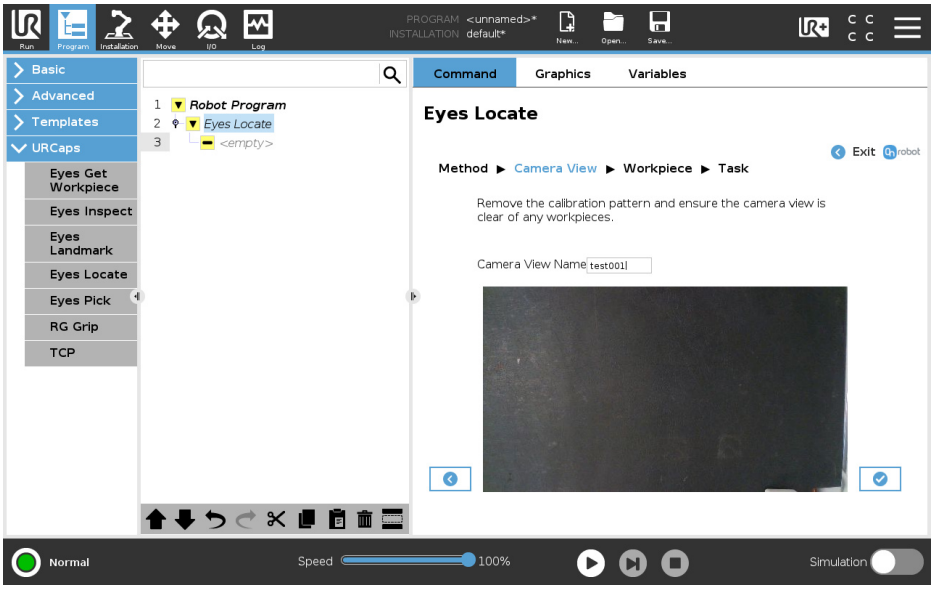
- Reducing dependency on ambient light sources.
- Eliminating shadows casted by the operators or by the objects.

NOTE:

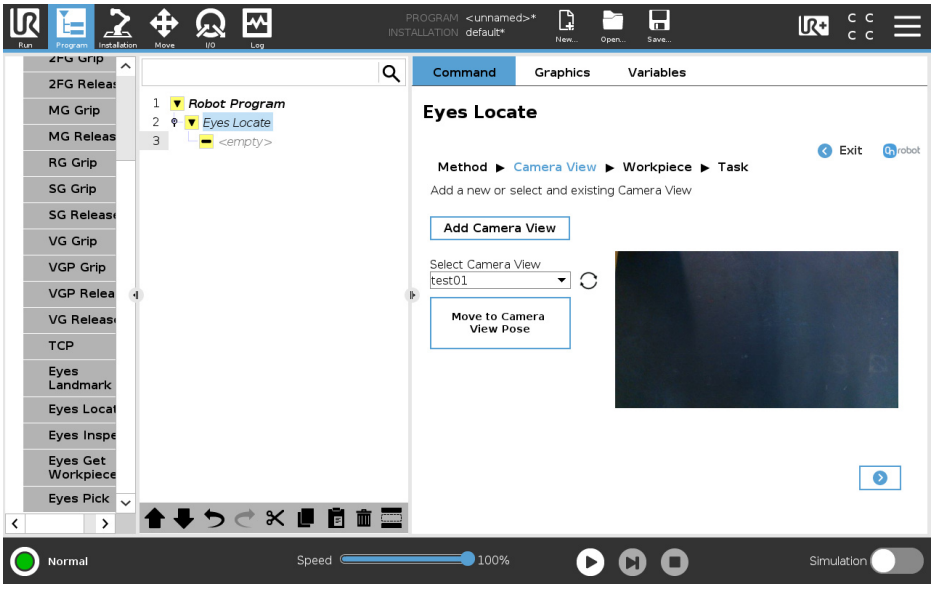
When working with shiny objects or background, it is recommended to mount the light externally to the camera.

You might need to readjust the **Exposure** and **White balance** after you changed the intensity of the lights. **Exposure** values can get very low for strong light intensities.

- Press .
- Remove the calibration plate and ensure that the camera view is clear of any objects. Avoid shadows that do not belong in the scene.



- Press .
- The image shows the newly created camera view. The task will automatically use this camera view.



- Press .
  If the selected method is by color and size, go to **Task Using Detection by Color and Size**.

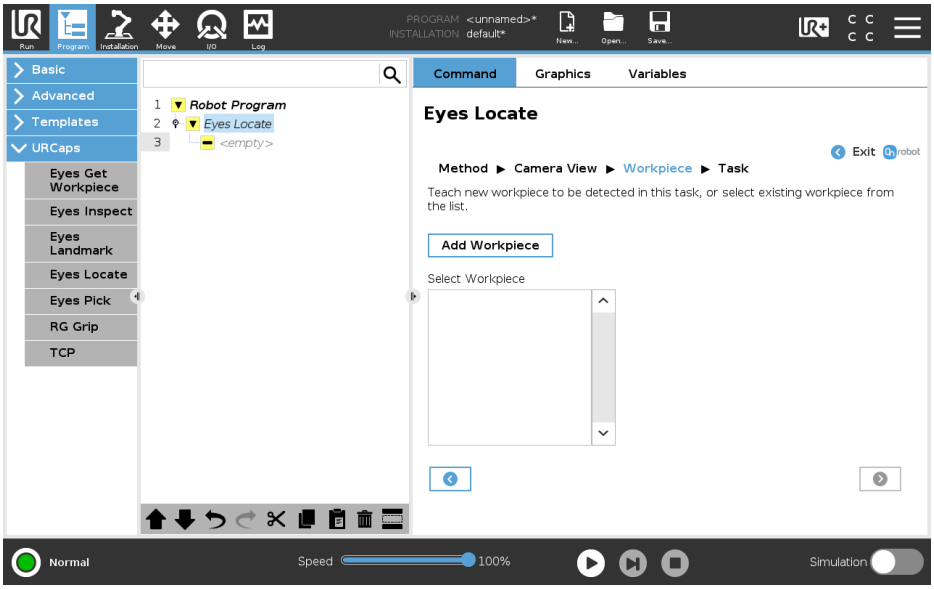
II/3. Workpiece

A workpiece is a representation of one side of an object.

NOTE:

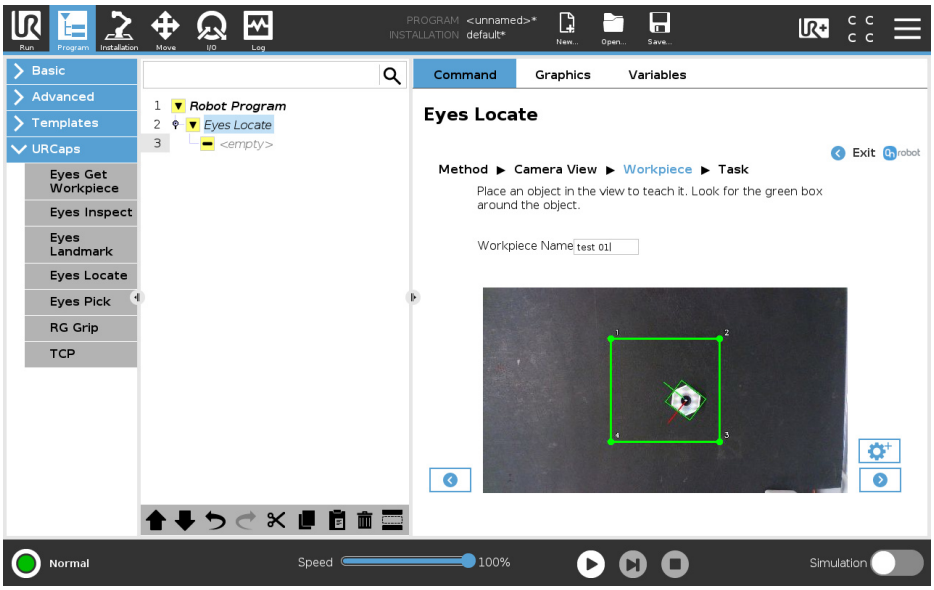
In most applications, handling workpieces lying on the same side is enough. If the application should detect an object on different sides, create several workpiece representations for the object, one for each unique side. For example, a cuboid can have six different models, but only three unique ones. A cylinder can only have two unique models. In most applications, only one workpiece configuration for each physical workpiece is necessary.

- To use previously taught workpieces, select them from the list and press .
  To teach new workpieces and to add them to the list, press **Add Workpiece**.



- Enter a name for the workpiece in the **Workpiece Name** field.

  Place the object inside the region of interest.
  The current image is shown on the page.

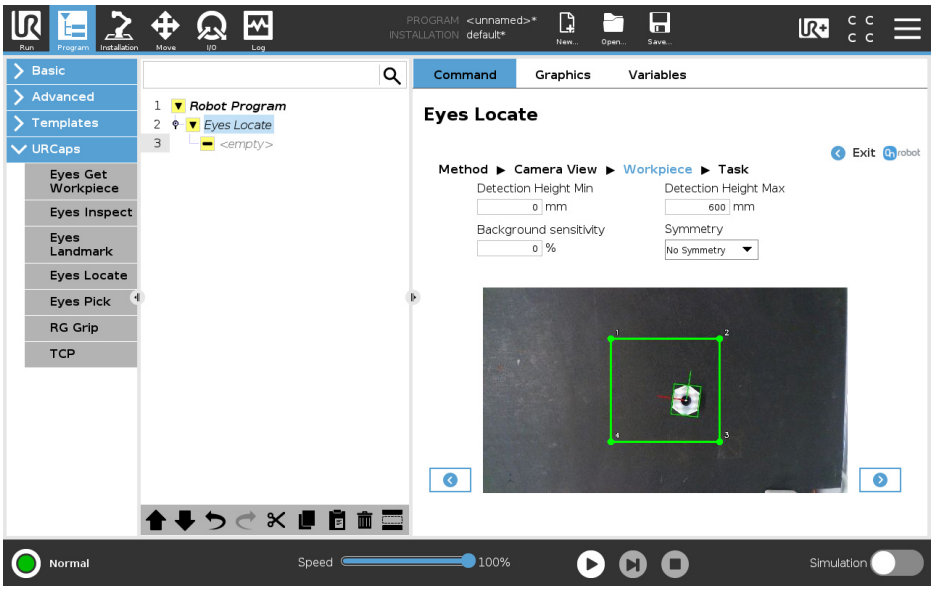


When the camera recognizes the object, a green bounding box will appear on the image. Red boxes can appear due to extra objects present on the image. In this case, remove the extra objects until the camera sees only one object.

If more than one object is still detected, adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.

If the object is recognized properly (the moving pattern covers the entire object), press to save the workpiece.
Otherwise the detection can be adjusted by using advanced parameters.

- Press to go to the advanced settings.
- Adjust the detection by setting the **Detection height min**, **Detection height max**, **Background sensitivity**, and **Symmetry** parameters.



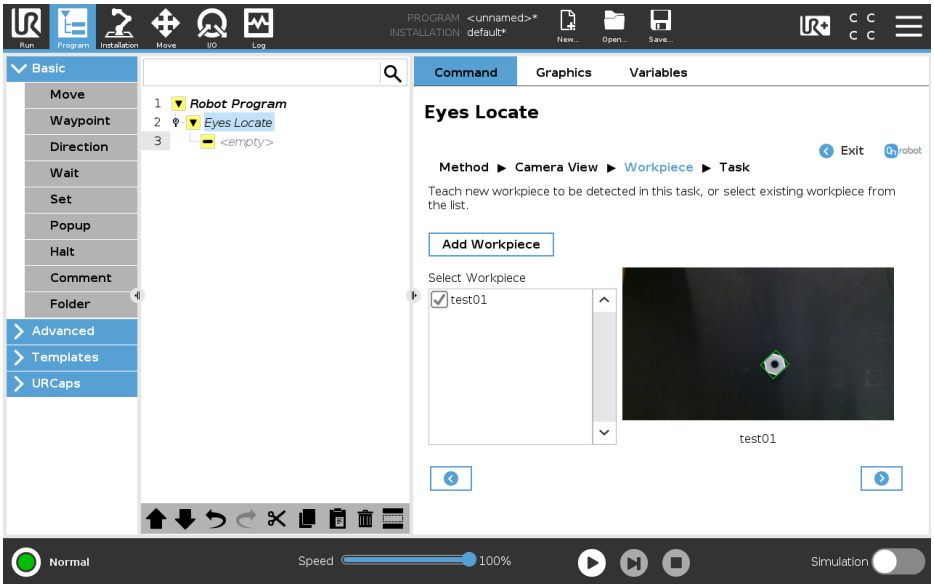
- **Background sensitivity**: This parameter makes the task detect the workpieces that are more similar in color to the background. Use the parameter with care as the greater its value is, the less robust the detection is to lighting changes and shadows. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Detection Height**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- Select the rotational symmetry of the workpiece from the drop-down list.
  The rotational symmetry specifies the number of distinct orientations in which the workpiece's outline looks the same. For example, select Rectangular Symmetry when working with a rectangle or an ellipse and select Squared Symmetry when working with a square or four-vertex star. The following table shows some examples.

Types of Symmetry	Good Examples	Bad Examples
No symmetry		
Circular symmetry		
Rectangular symmetry		
Triangular symmetry		
Square symmetry		
Pentagonal symmetry		
Hexagonal symmetry		

NOTE:

The rotational symmetry defines the amount of unique picking orientations of an object. It is different from other types of symmetry. Items having lines of symmetry do not necessarily have any kind of rotational symmetry.

- Press .
- The image shows the workpiece.



The process can be repeated to teach more workpieces.

- Press .
  If the selected method is by workpiece's inner features, go to **Task Using Detection by the Workpiece's Inner Features**.

If the selected method is by workpiece's outline, go to **Task Using Detection by the Workpiece's Outline**.

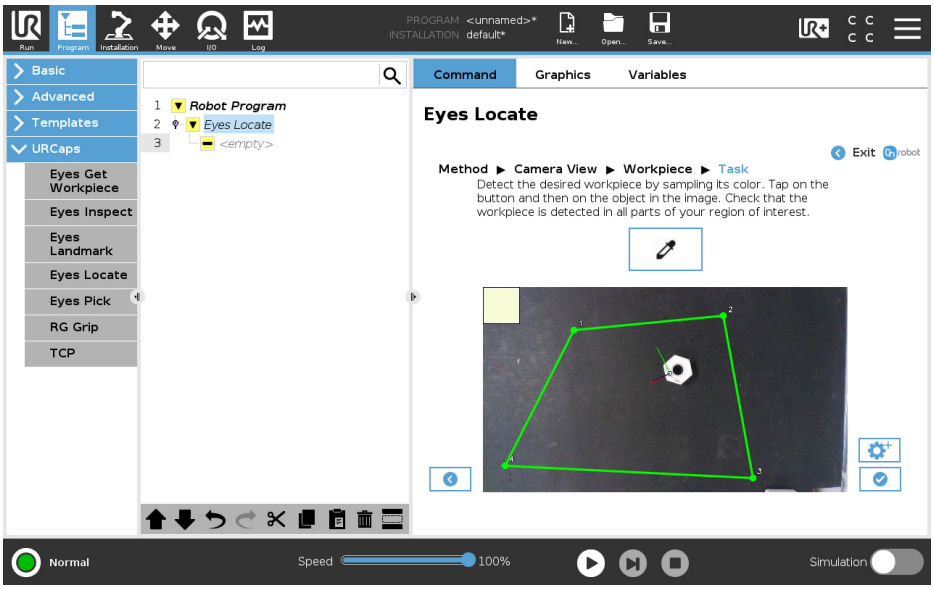
II/4. Task

The task can be set up to detect one or several types of workpieces.

II/4.1 Task Using Detection by Color and Size

- You can see the detected workpieces with their respective picking coordinate frame in the camera feed.

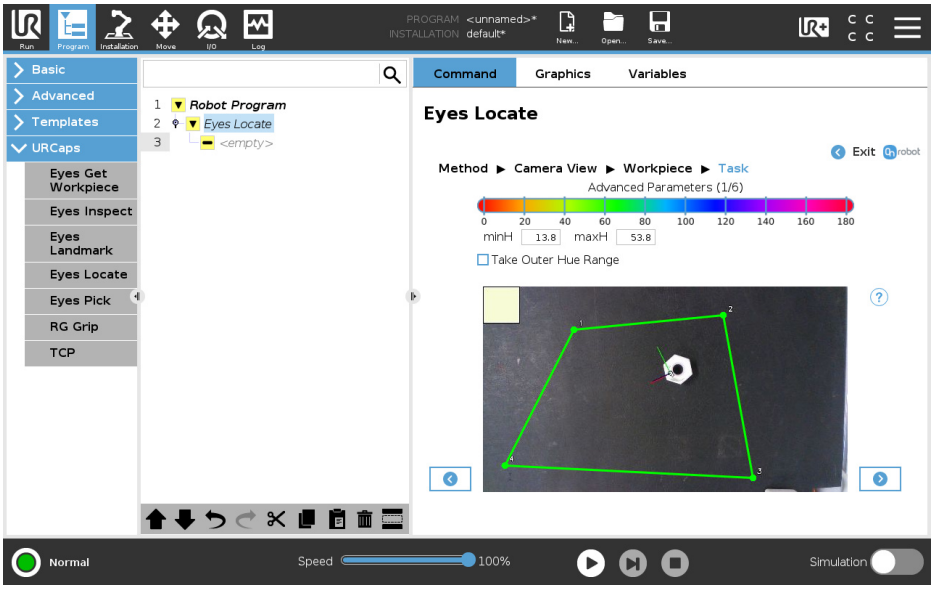
  Press  to sample the color of the workpiece and then tap the item on the image that you want to be detected.



  The  button automatically adjusts the Hue, Saturation, and Lightness parameters to your objects.
  Slightly adjust the Hue, Saturation, and Lightness ranges manually under advanced settings if the sampling feature did not provide optimal results.

  You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.

- If the workpiece is detected in all parts of the region of interest, press  and go to **Finish Configuration**.
- Optionally, you can adjust the detection by using advanced parameters. Press  to go to the advanced settings.
- Adjust the Hue, Saturation, and Lightness parameters.

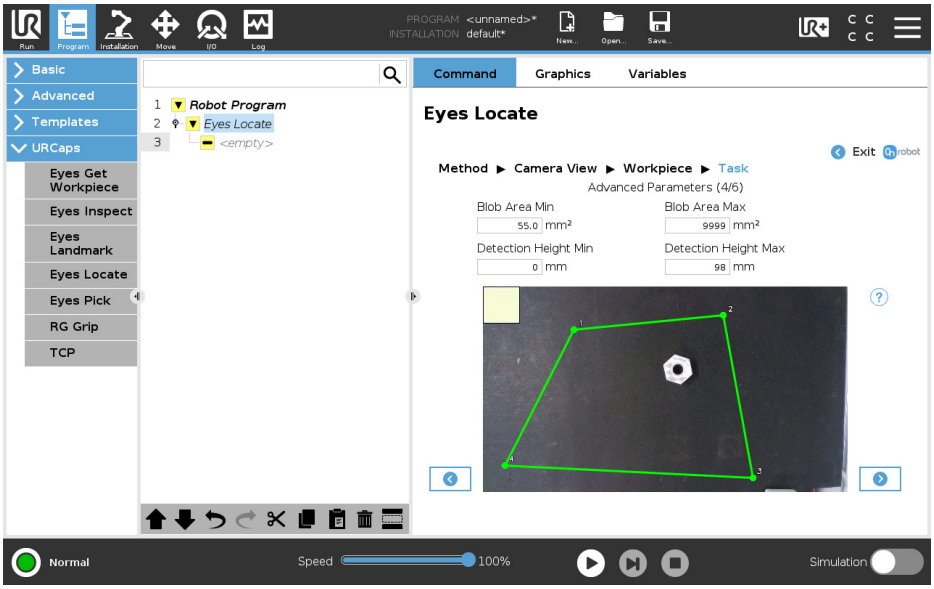


The Hue, Saturation, and Lightness parameters defines which objects are going to be detected in the Eyes task:

- **minH** and **maxH**: Represents which range of colors are going to be considered part of the foreground. Use the **Take outer hue range** option if you want to select the outer range of colors.
- **minS** and **maxS**: Represents how vivid the colors of the workpiece need to be to be considered foreground. The higher the saturation, the more vivid the color is. For example, pure red color has higher saturation than pink.
- **minL** and **maxL**: Represents the brightness of each pixel in the image. Higher lightness indicates white and bright colors. Black and dark colors have low lightness values. This parameter can be used to distinguish objects with no color, meaning black, white, and different shades of gray.

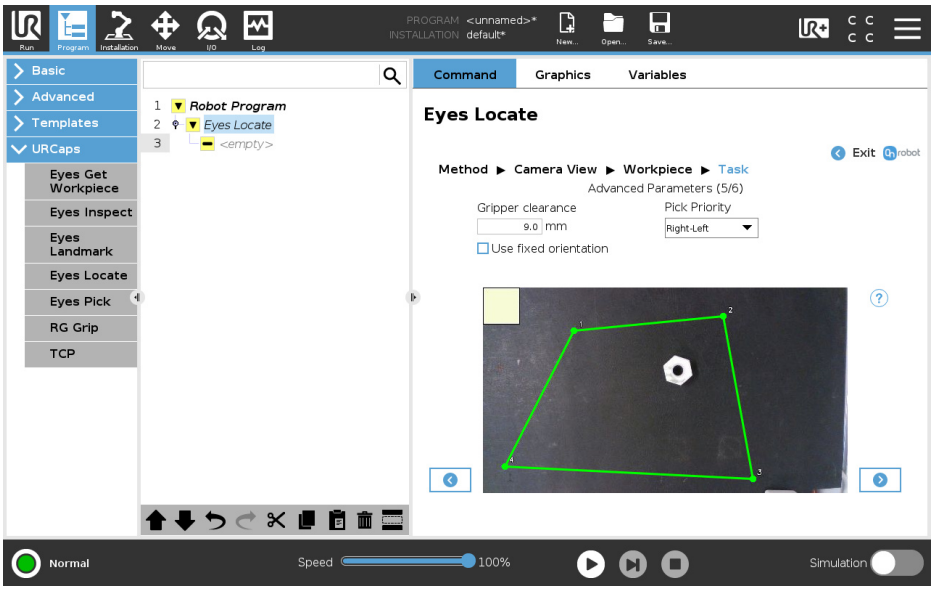
  Negate: Switches between the foreground and the background in the image. You can detect different objects on a uniform background, just set the previous parameters considering the background as the object, then use the negate parameter and all objects in the background will be detected.

- Press .
- Adjust the detection by setting the **Blob area min**, **Blob area max**, **Detection height min**, and **Detection height max** parameters.



- **Blob Area**: Selects a size range of the objects detected in squared millimeters.
- **Detection Height**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.

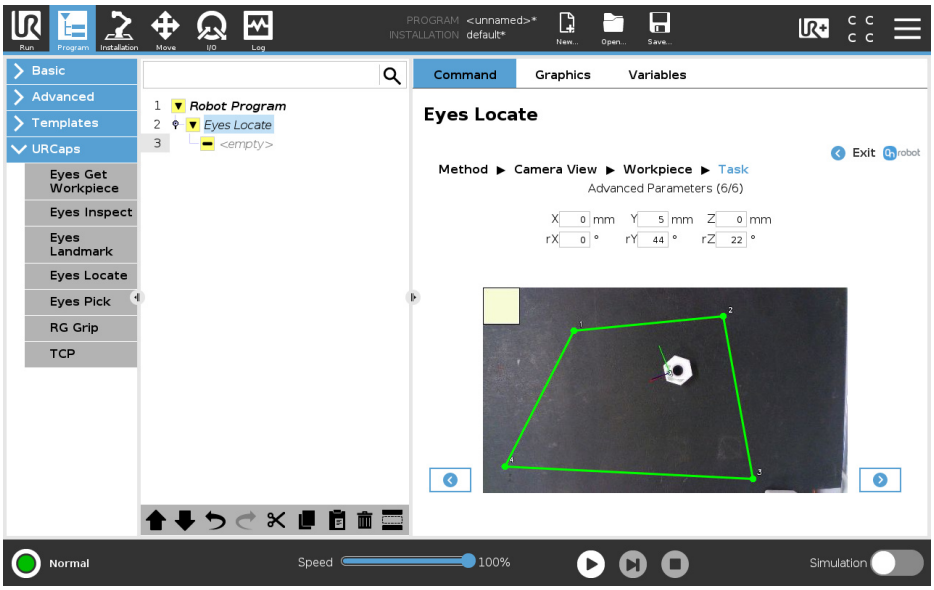
- Press .
- Adjust the detection by setting the **Gripper clearance**, **Pick priority**, and **Use fixed orientation** parameters.



- **Gripper clearance**: Distance of the free space around an object in [mm], which is required for the detection. This parameter can be used to guarantee that the gripper will be able to grip the object.

- **Pick priority**: This option defines in which order the workpieces will be picked, based on their position in the image. The first workpiece is marked with white in the image.
- **Use fixed orientation**: If enabled, the orientation of the detected items will be fixed to the selected camera view plane. This can be used to avoid unnecessary rotations of the gripper when the objects can be picked with any orientation.

- Press .
- Adjust the picking offset and the rotation for all workpieces. If the workpieces are placed inside the region of interest, the picking position and the orientation are visualized in the image feed. Axes X, Y, Z are represented by red, green, and blue lines, respectively. If parts of the axis are covered by the workpiece in the 3D space, the color of that part of the axis will be darker.



NOTE:

The offsets are applied in the original frame of the detected workpieces. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.

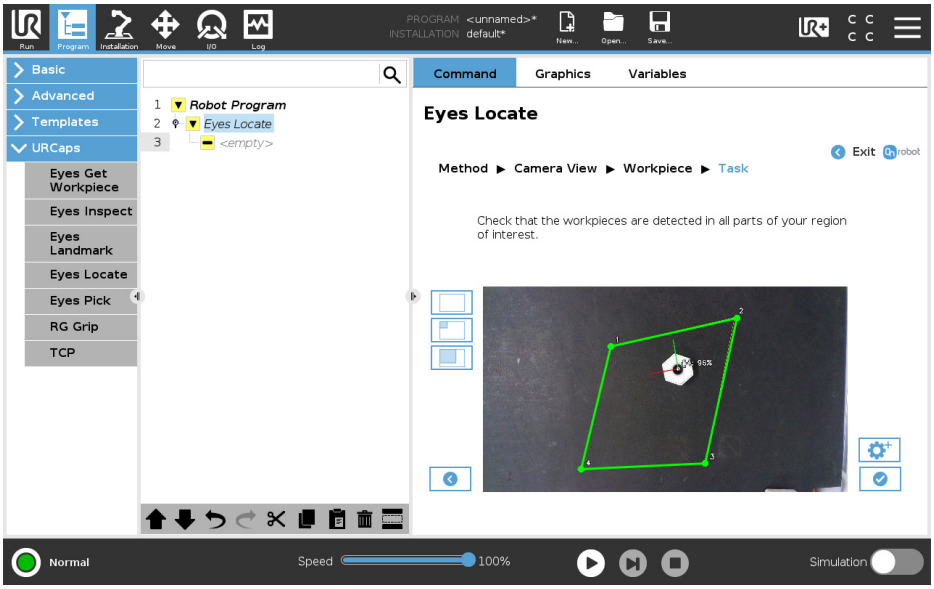
It is recommended to test the task on the whole workspace by moving the workpiece inside the region of interest and checking that it is correctly detected and sorted in all positions.

- Press and go to first page of Task Using Detection by Color and Size.

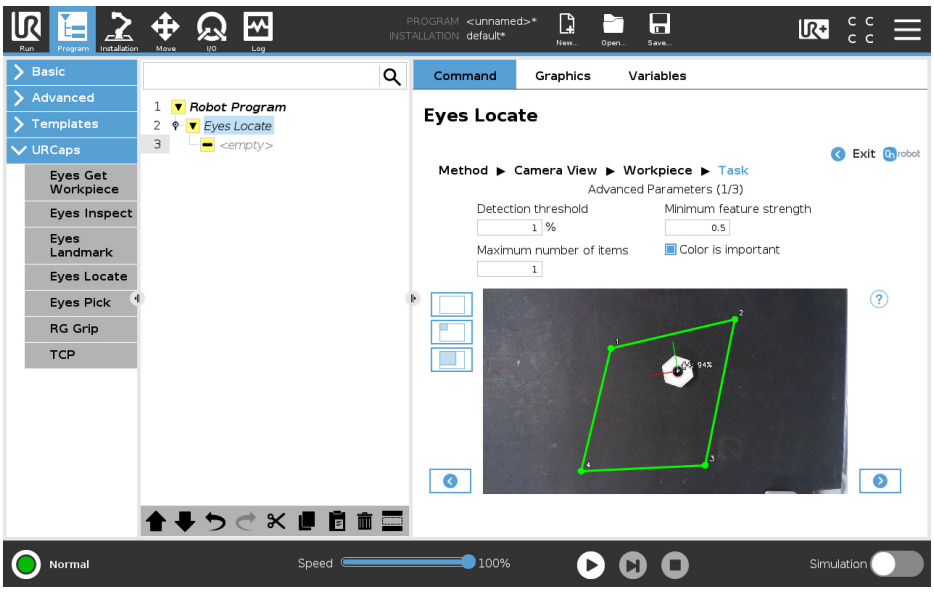
II/4.2 Task Using Detection by the Workpiece's Inner Features

- You can see the detected workpieces with axes and the workpiece number in the camera feed.

Check that the workpiece is detected in all parts of the region of interest. If so, press  and go to **Finish Configuration**.



- Optionally, you can adjust the detection by using advanced parameters. Press  to go to the advanced settings.
- Adjust the detection by setting the **Detection threshold**, **Minimum feature strength**, **Maximum number of items**, and **Color is important** parameters.

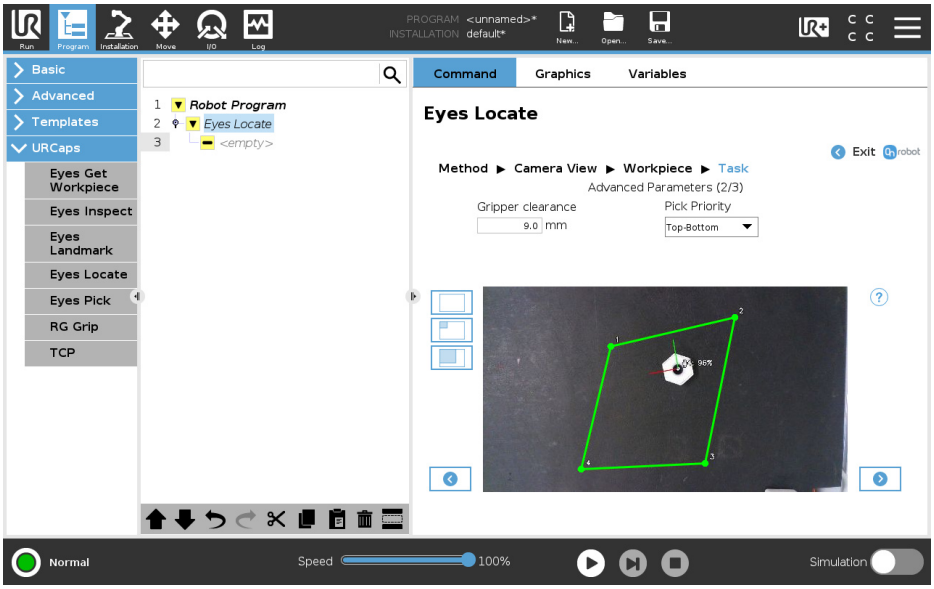


- **Detection threshold**: Defines the similarity value required for the detected objects to be accepted as a valid detection. If it is set to the maximum, only exactly matching objects will be detected by the Eyes. If it is set to the minimum, false positive results can occur.
- **Minimum feature strength**: Defines the extent to which the Eyes considers the object edges. Low values can lead to include nonexistent features coming from image noise. High values can lead to false negative results as some of the object features are disregarded. See the following example to see insufficient features, good level features, and excessive/noisy features.

Good	Excessive	Insufficient
		

- **Maximum number of items**: This parameter specifies the maximum number of objects expected in a single detection. Lower values reduce the processing time.
- **Color is important** (Useful for workpieces with similar shapes): Select it if the task is meant to distinguish between workpieces that have the same outer shape but different colors (the detection method does not change, only the sorting criteria).

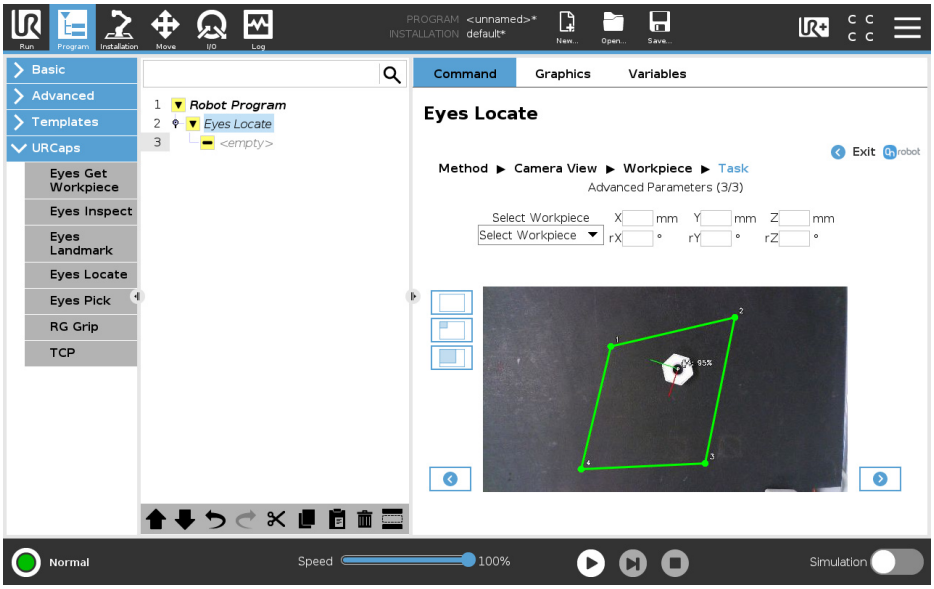
- Press .
- Adjust the detection by setting the **Pick priority** and the **Gripper clearance** parameters.



- **Pick priority** (Workpiece marked in white will be picked first): This option defines in which order the workpieces will be picked, based on their position in the image. The first workpiece is marked in white in the image.
- **Gripper clearance** (mm): Distance in millimeters of free space required around an object for it to be detected. This parameter is useful to guarantee that the gripper will be able to grip the object.

- Press .
- Adjust the picking offset and the rotation for each workpiece. Select a workpiece from the drop-down list, and set the parameters for that workpiece.

  If the picking position of the workpiece is placed inside the region of interest, the picking position and the axes are visualized in the overlay. Axes X, Y, Z are represented by red, green, and blue lines, respectively. If parts of the axis are covered by the workpiece or the surface, the color of that part of the axis will be darker.



NOTE:

The offsets are applied in the non-rotated frame of the detected workpiece. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.

NOTE:

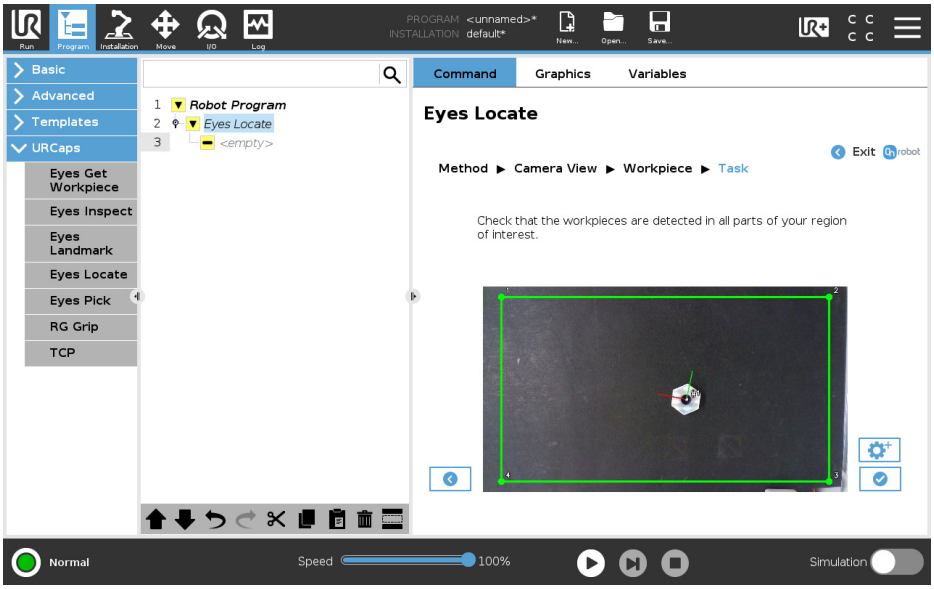
Each workpiece is stored with the camera view that was used to define it. Sorting can only be done between workpieces with the same camera view.

- Press and go to the first page of **Task Using Detection by the Workpiece's Inner Features**.

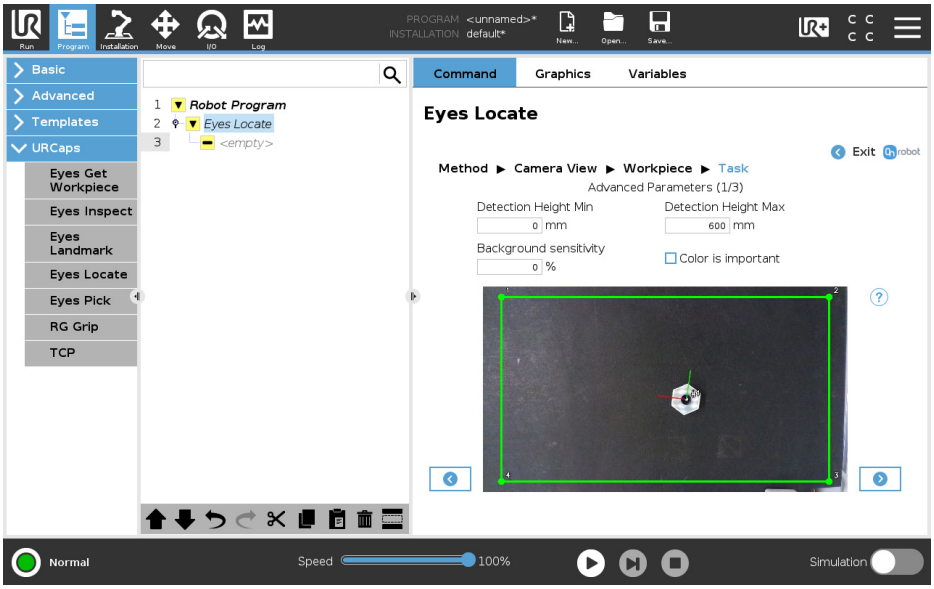
II/4.3 Task Using Detection by the Workpiece's Outline

- You can see the detected workpieces with axes and the workpiece number in the camera feed.

  Check that the workpiece is detected in all parts of the region of interest. If so, press and go to **Finish Configuration**.



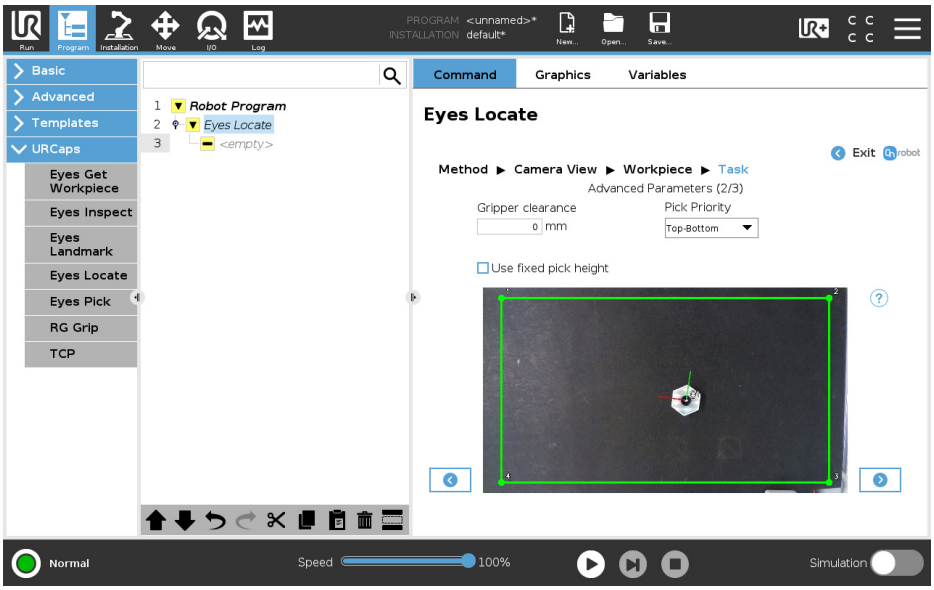
- Optionally, you can adjust the detection by using advanced parameters. Press  to go to the advanced settings.
- Adjust the detection by using the **Detection height min**, **Detection height max**, **Background sensitivity**, and **Color is important** parameters.



- **Background sensitivity**: This parameter makes the task detect the workpieces that are more similar in color to the background. Use the parameter with care as the greater its value is, the less robust the detection is to lighting changes and shadows. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Detection Height**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.

- **Color is important**: Select this check box if the task is meant to distinguish between workpieces that have the same outer shape but different colors (the detection method does not change, only the sorting criteria).

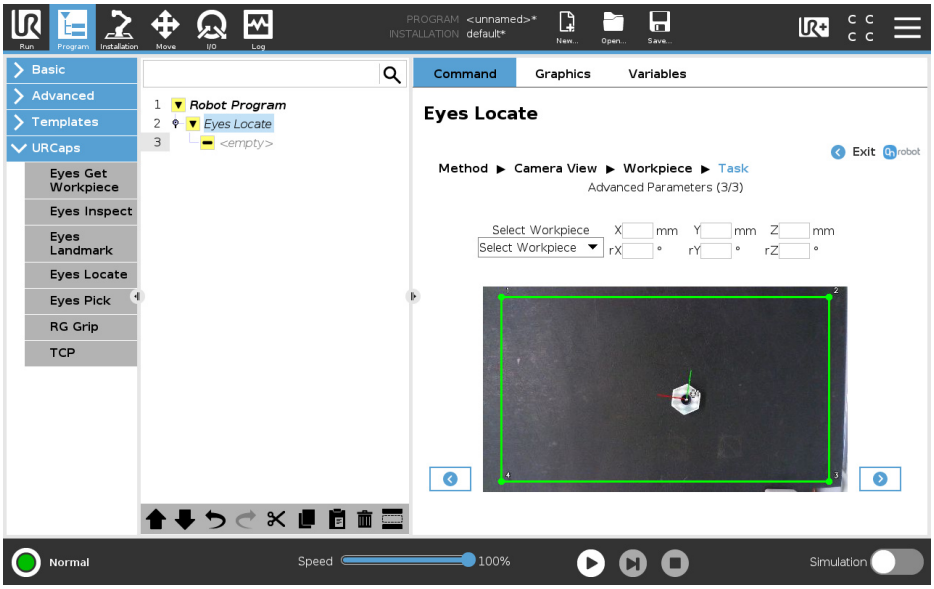
- Press .
- Adjust the detection by setting the **Use fixed pick height**, **Pick priority**, and **Gripper clearance** parameters.



- **Use fixed pick height**: If selected, the height of the workpiece will be considered 0 mm and the position will be given in the camera view plane.
- **Pick priority**: Defines in which order the workpieces will be picked, based on their position in the image. The first workpiece is marked with white in the image.
- **Gripper clearance**: Distance of the free space around an object in [mm], which is required for the detection. This parameter can be used to guarantee that the gripper will be able to grip the object.

- Press .
- Adjust the picking offset and the rotation for each workpiece. Select a workpiece from the drop-down list, and set the parameters for that workpiece.

  If the picking position of the workpiece is placed inside the region of interest, the picking position and the axes are visualized in the overlay. Axes X, Y, Z are represented by red, green, and blue lines, respectively. If parts of the axis are covered by the workpiece or the surface, the color of that part of the axis will be darker.



NOTE:

The offsets are applied in the non-rotated frame of the detected workpiece. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, you have to adjust each corner of it. Select a corner with the buttons next to the camera feed and click on the image to mark the new position of the corner.

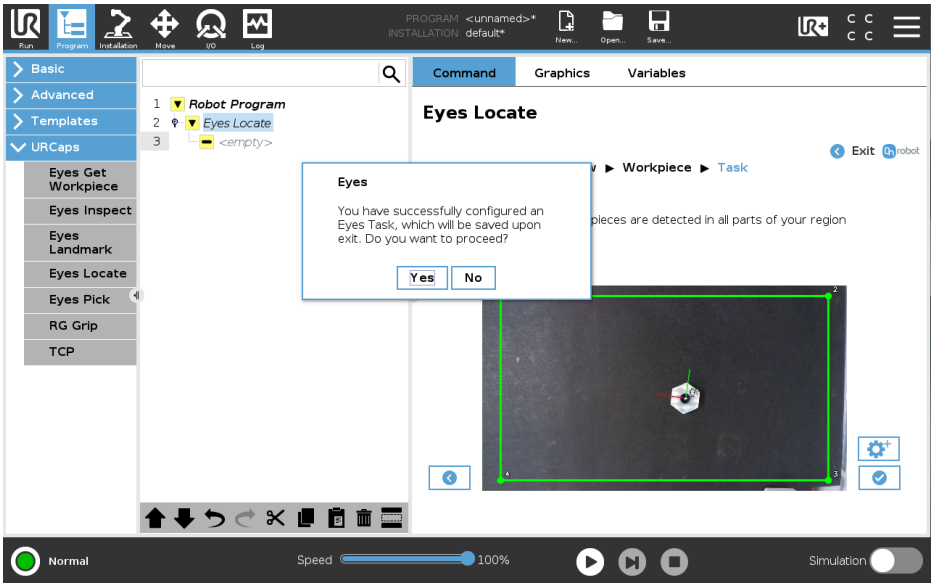
NOTE:

Each workpiece is stored with the camera view that was used to define it. Sorting can only be done between workpieces with the same camera view.

- Press and go to the first page of **Task Using Detection by the Workpiece's Outline**.

II/5. Finish Configuration

- Eyes Part Location configuration is finished.



- Press **Yes** to save and exit the Task configuration.

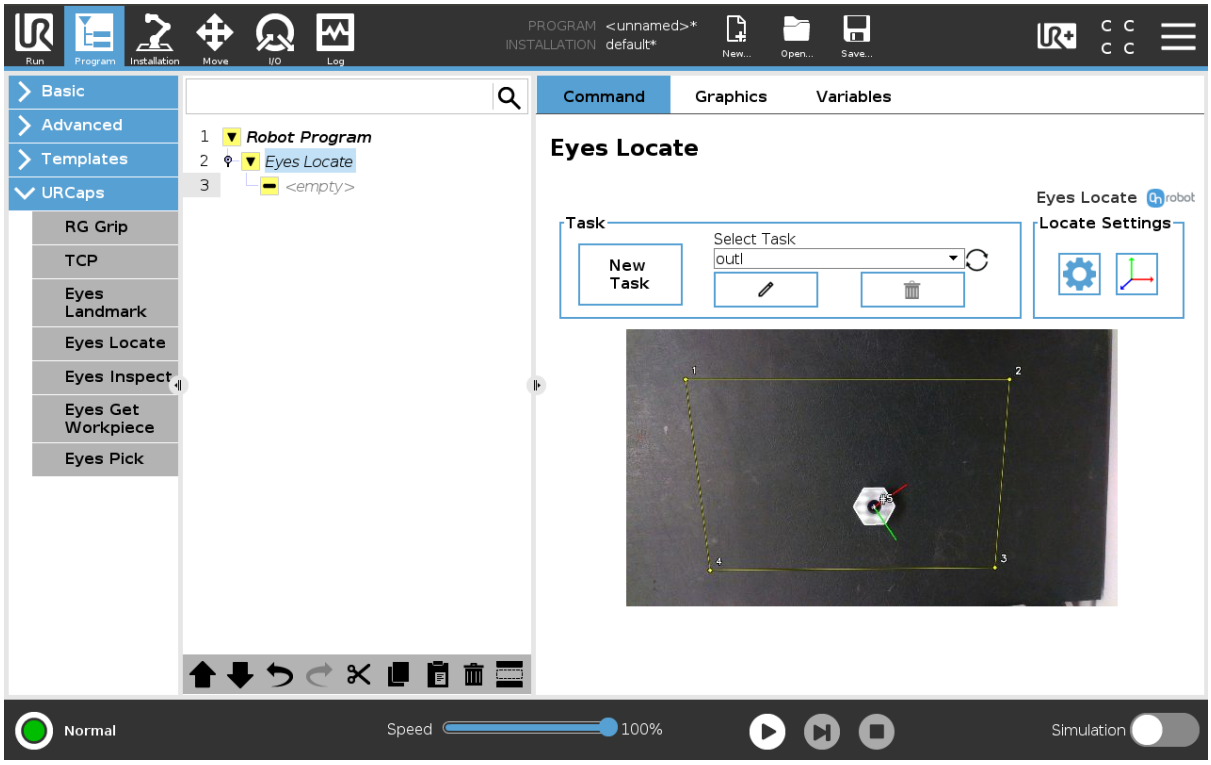
Configure Eyes in the Robot Program

The `Eyes Locate` command is used to run an Eyes task to detect workpieces. This command is normally used together with the `Eyes Get Workpiece` command, using the latter as a child command.

NOTE:

If the camera is attached to the robot wrist, the camera view is linked to the robot pose. Before using the `Eyes Locate` it is required to move the robot to the saved robot pose for the appropriate camera view. In the case of an external mount is used, ensure the camera is not obstructed by the robot.

When the `Eyes Locate` command is executed, the Eyes will attempt to identify workpieces defined by the chosen Eyes task. The different functions are explained below.



Select Eyes task

The user can select an Eyes task from the drop-down selection. When there is no task selected the drop-down menu will be bordered in red and the `Eyes Locate` command will be incomplete, as shown below.

 `Eyes Locate`

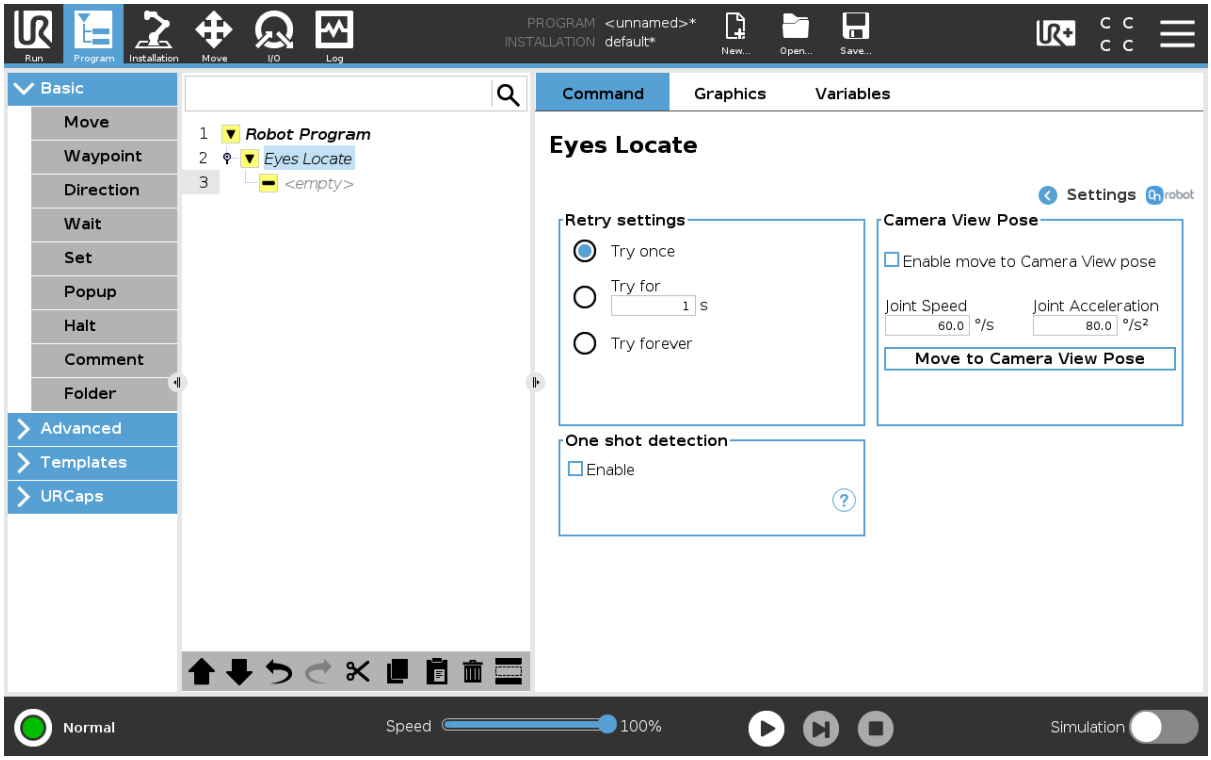
Once a task is selected the drop-down menu will be bordered green, the `Eyes Locate` node will be complete and the **Camera feed** from the camera will be shown.

Camera feed

Here the live video feed of the Eyes will be shown. Detected workpieces from the selected task will be shown in the live feed.

Settings

A new page with the program setting will be shown by pressing on .



Retry settings

The user can select how long the Eyes Locate command will try to locate workpieces. The options are:

- **Try once**: The Eyes Locate command will try only one time.
- **Try for (s)**: The user can input how long in seconds the Eyes Locate command will try to locate workpieces.
- **Try forever**: The Eyes Locate command will never stop trying to locate workpieces.

One shot detection

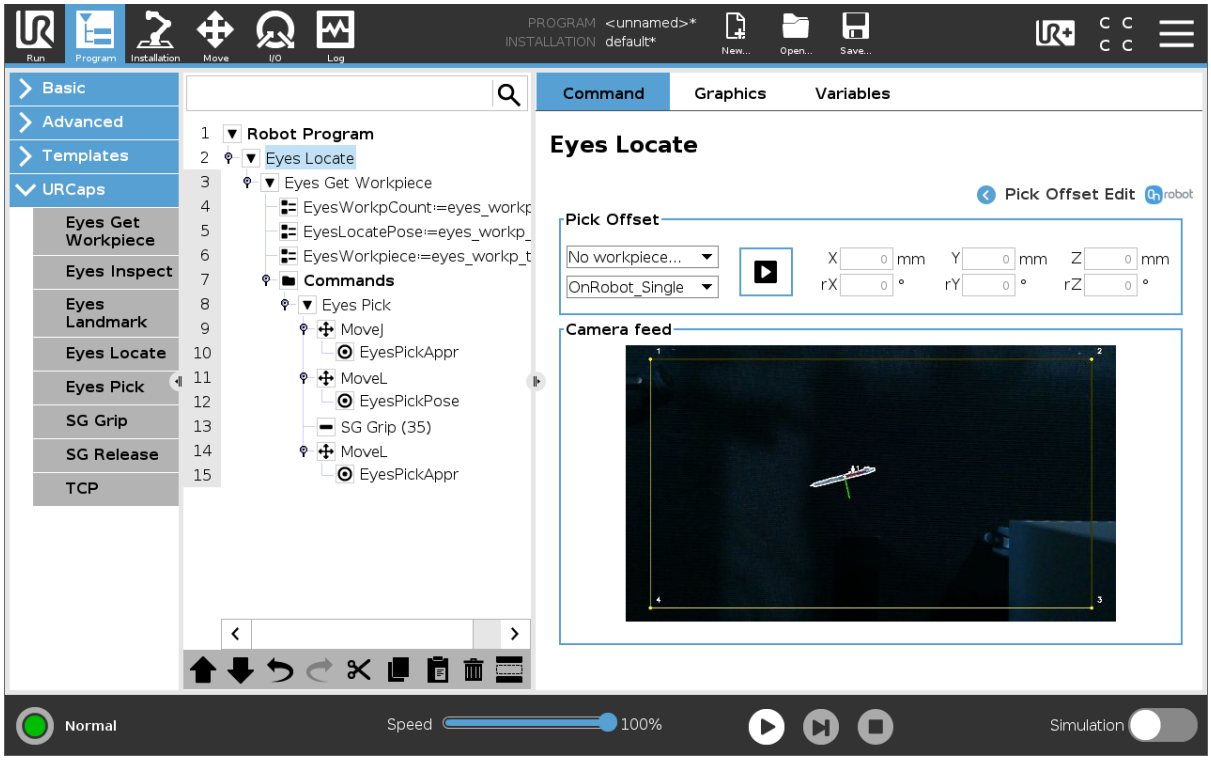
If enabled, the Eyes will attempt to identify all target workpieces at once saving their pose and type. The section of the program inside the Eyes Locate node will execute as many times as workpieces were detected by the Eyes. In this way, it is possible to handle all workpieces without acquiring more images and thus, reducing cycle time.

Camera View Pose

If enabled, Eyes Locate will move the robot to the associated camera view pose of the selected task. This camera view pose is saved while creating the camera view for the application. The move applied is a joint move. Joint Speed and Joint Acceleration can be adjusted.

Pick Offset Edit

A new page with the Pick Offset setting will be shown by pressing on  .



Pick Offset

In the first dropdown menu, the user can select which workpiece's pick offsets and rotation will be edited. If the picking position of the workpiece is placed inside the region of interest, picking position and axes are visualized in the camera image. Axes X, Y, Z are represented by lines colored red, green and blue, respectively. If sections of the axis are covered by the workpiece/surface, the color of that section of the axis will be shown darker.

NOTE:

The offsets are applied in the non-rotated frame of the detected workpiece. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

These pick offsets can also be modified from Web Client and affect only the selected workpiece type in the selected task.

WARNING:

Pressing  will simulate the picking operation by moving the robot to the detected part.

This can be used to validate that the picking offsets are correct for the application. In the second dropdown menu, the TCP for this move can be selected. Use OnRobot_Single, when working with 1 OnRobot gripper, use OnRobot_Dual_1 or OnRobot_Dual_2 when working with Dual Quick Changer.

The contributions for the values of the different axes X, Y and Z and their rotations rX, rY and rZ can be edited by pressing on the input field and selecting a new value. The changes will automatically be seen in the camera feed.

5.1.1.3. Eyes Inspect

Configure the Eyes Inspection Application

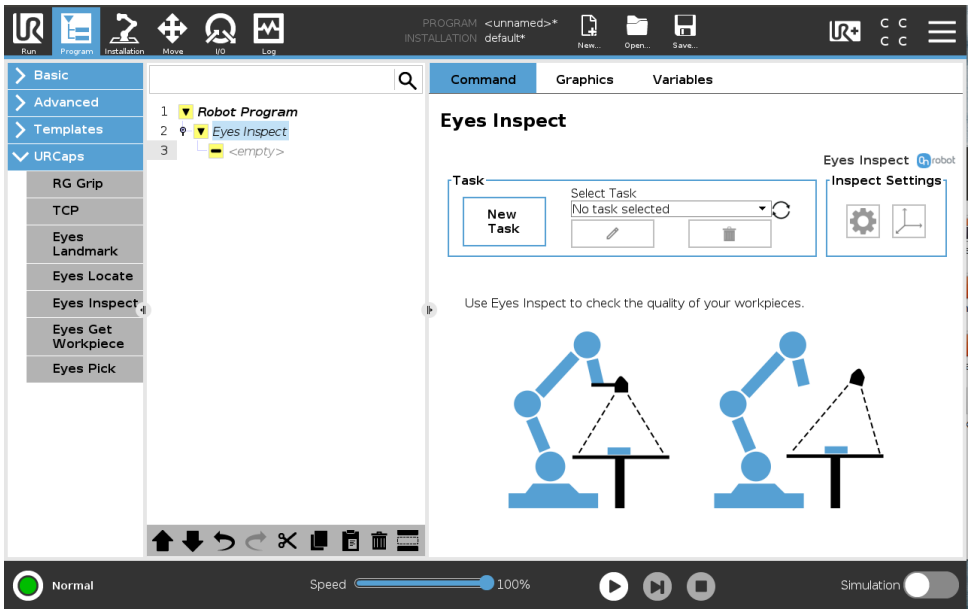
NOTE:

Each workpiece is stored with the camera view used to define it.

I. Select an Existing Eyes Task

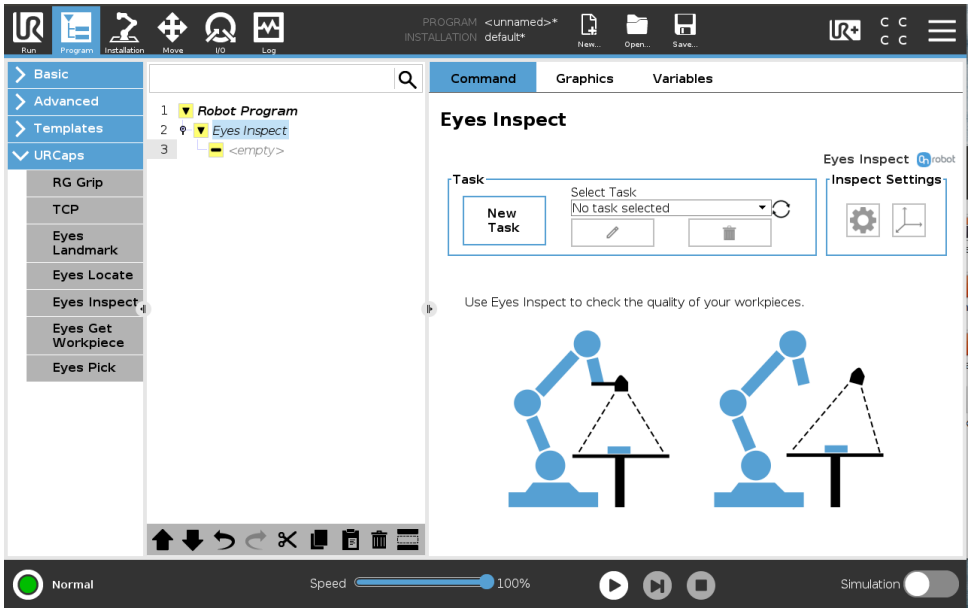
Under **Task**, select an already existing Eyes task from the drop-down list.

If you want to edit the Eyes task, press . To delete an Eyes task, press .



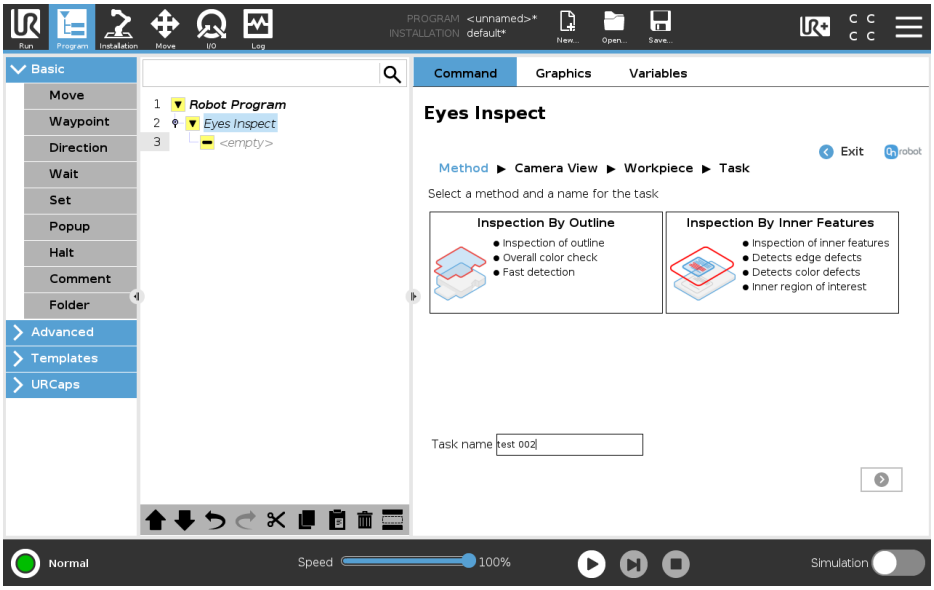
II. Create a New Eyes Task

Under **Task**, press **New Task** to create a new Eyes task.



II/1. Method

- Enter a name for the task to the **Task name** field.



You can select one of the following inspection methods:

- Inspection by workpiece's outline
  This method can inspect the workpiece's outer contour and overall color.
- Inspection by workpiece's inner features
  This method uses the selected workpiece's color and inner features like holes, edges, and similar features. You can add an internal region of interest to specify where the inspection task should focus on.

The following table gives an overview of the Inspection methods.

Method	Strengths	Limitations
Workpiece's outline	• Requires few parameters to adjust • Provides fast cycle time	• Cannot inspect the inner features of the object • Cannot handle adjacent or touching objects
Workpiece's inner features	• Inner region of interest is available • Can inspect workpieces with inner defects • Color check is done pixel by pixel	• Perspective distortion on tall objects could affect the outcome of the inspection • Cannot handle adjacent or touching objects • Provides variable cycle time

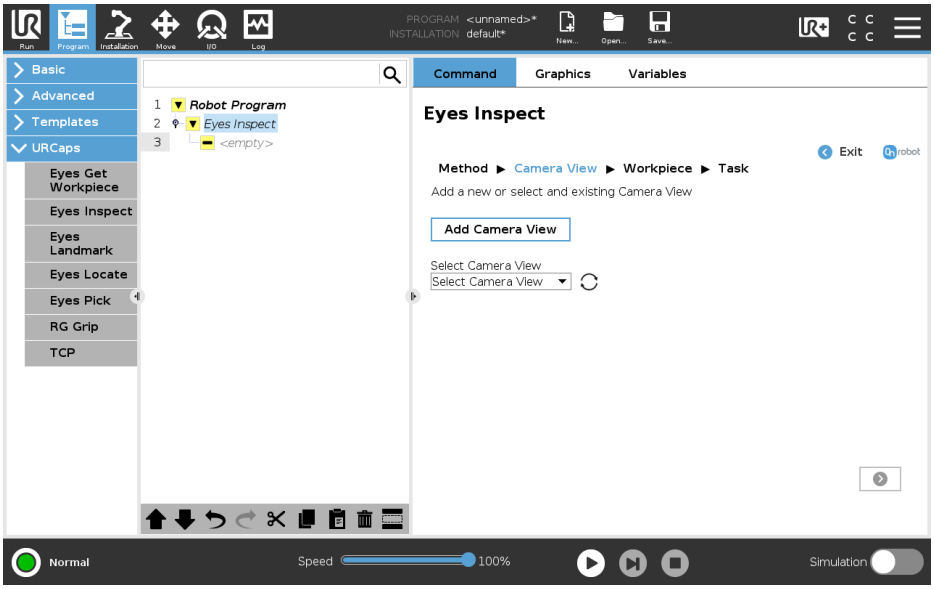
- If no camera view is selected, press .

II/2. Camera View

The Camera View is an area which the Eyes will look at to detect workpieces. The area should be a flat surface and its background's color should be distinctly different to color of the workpieces to be detected. Eyes is robust to light changes, but it is advisable to limit lighting changes, changing shadows or strong reflections in the camera's view.

Position the camera as parallel to the surface as possible.

- To use an existing camera view, select it from the dropdown list and press .
  To create a new camera view, press **Add Camera View**.



- Select the camera view type.

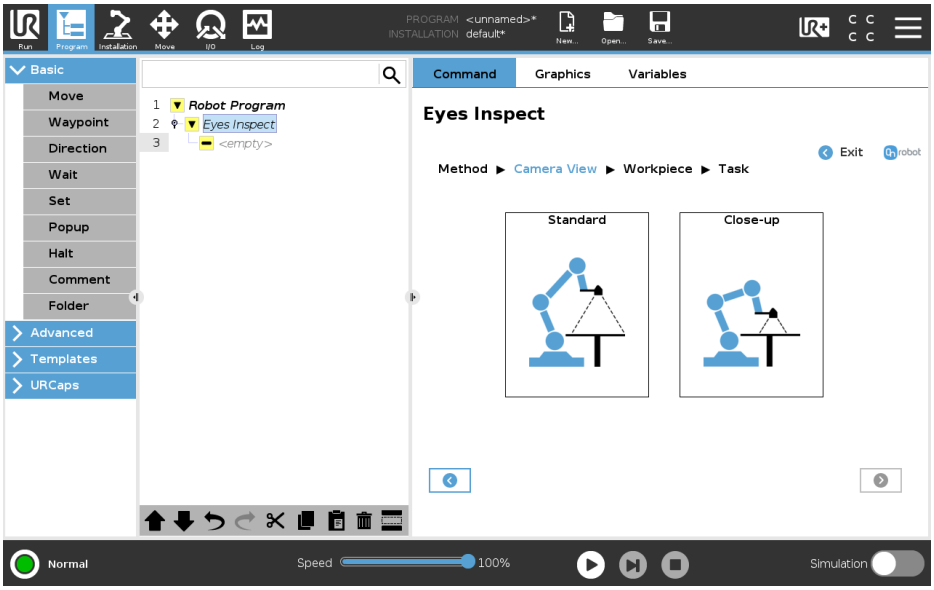
  For inspection applications, Eyes supports two types of camera views depending on the distance between the objects and the camera.

  - Standard Camera View: The camera should be placed between 400 mm and 1000 mm from the objects. When using this type of inspection, the 3D position of the object will be available, however, the level of details to be inspected is larger.
  - Close-up Camera View: The camera cannot be placed closer than 50 mm to the object. The 50 mm distance between the object and the camera allows the inspection

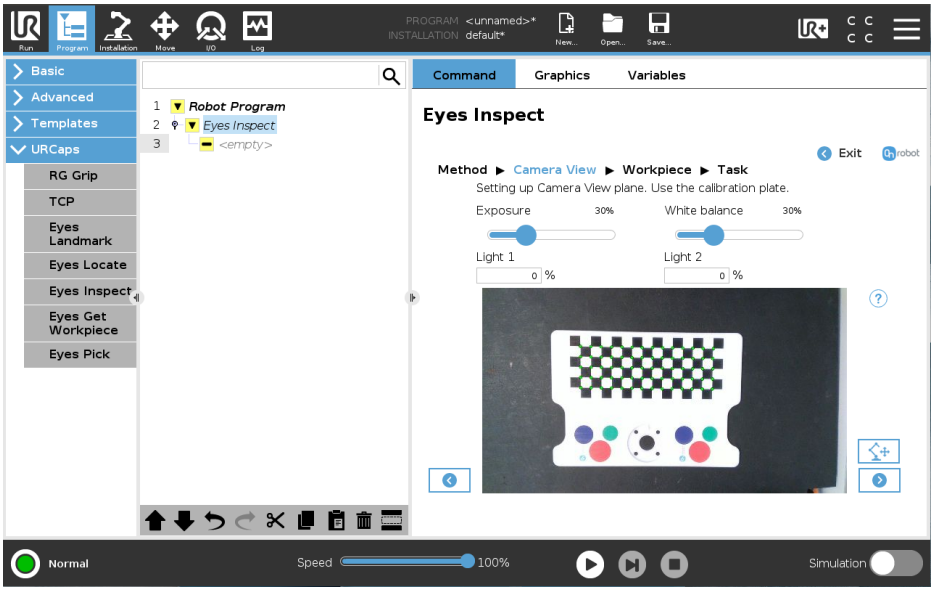
of the finer details. However, depth information cannot be generated at this distance and the position of the inspected item will not contain information about the height of the workpiece.

NOTE:

Standard camera views can be used for Part Location applications. Similarly, Part location camera views can be used as Standard camera views for an inspection application.



- Press .
- The current camera image will be shown on the page.
  The inner corners of the pattern should be marked in green if the pattern is correctly detected. The working area of the Eyes is not limited to the area covered by the calibration plate.



You can adjust the image using the **Exposure** and the **White balance** parameters, if needed. For example, the pattern is not detected or the color of the image does not reflect what is seen. Use the input fields to change the parameters.

- Set the **Exposure** and the **White balance** parameters, and observe the effects on the Camera feed.
- Set the **Exposure** parameter so the image is neither saturated nor underexposed (non-white objects do not appear white, non-black objects do not appear black) and the brightness of the background and the calibration plate roughly reflects how it is seen.
- Set the **White balance** parameter so the colors look similar in the image as in reality.

If you use the **Eyes Lighting Kit**, the intensity of the two lights can be adjusted independently to improve the illumination conditions in the application. Use **Light 1** and **Light 2** parameters to adjust the intensity of the lights.

NOTE:

To avoid drawing excessive power from the Eye Box, the combined intensity of the two lights is limited to 100%. If the intensity of one light exceeds the maximum level, the intensity of the other light will be lowered automatically.

Using the **Eyes Lighting Kit** for inspection can provide the following:

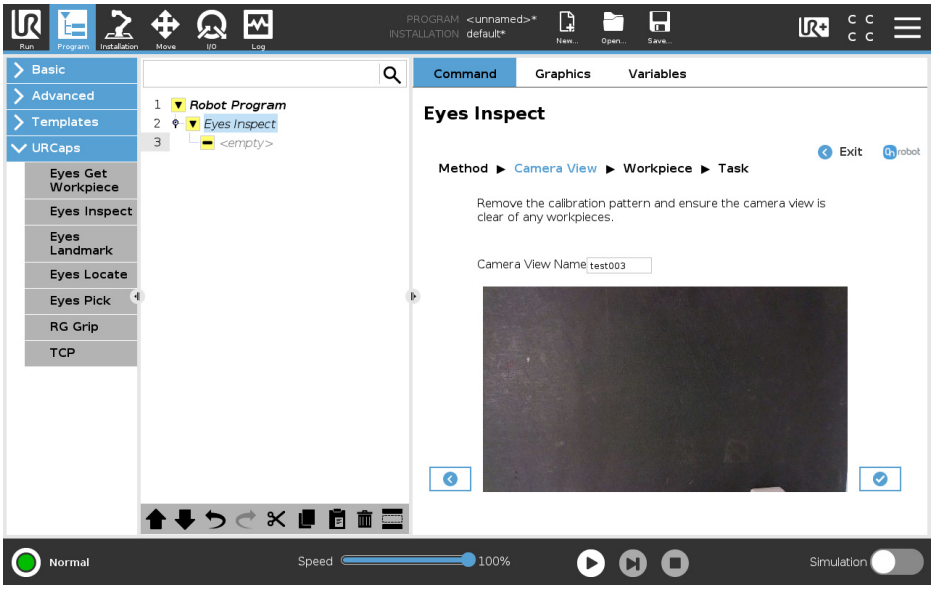
- Reducing dependency on ambient light sources.
- Eliminating shadows casted by the operators or by the objects.

NOTE:

When working with shiny objects or background, it is recommended to mount the light externally to the camera.

You might need to readjust the **Exposure** and **White balance** after you changed the intensity of the lights. **Exposure** values can get very low for strong light intensities.

- Press .
- Remove the calibration plate and ensure that the camera view is clear of any objects. Avoid shadows that do not belong in the scene.



- Press .

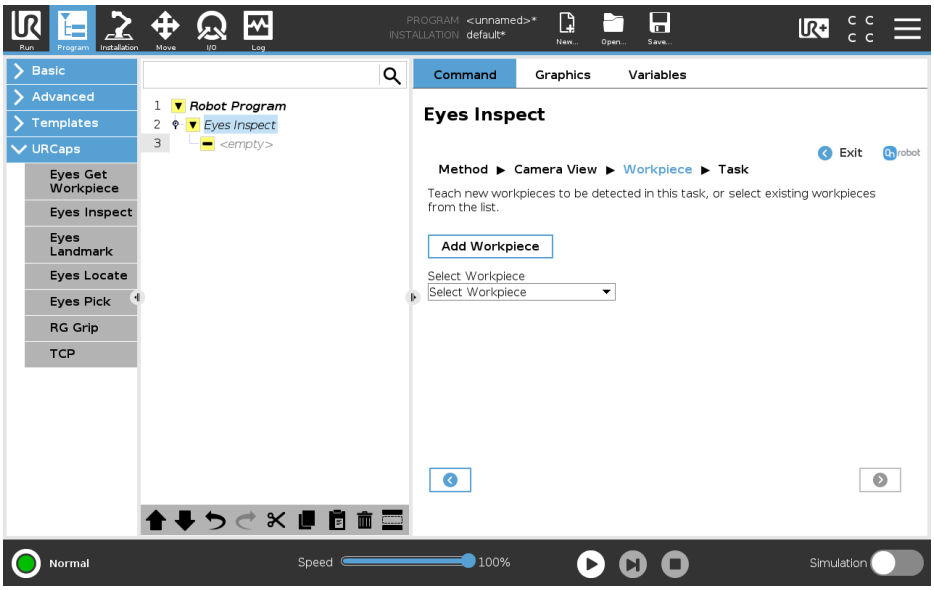
II/3. Workpiece

A workpiece is a representation of one side of an object.

NOTE:

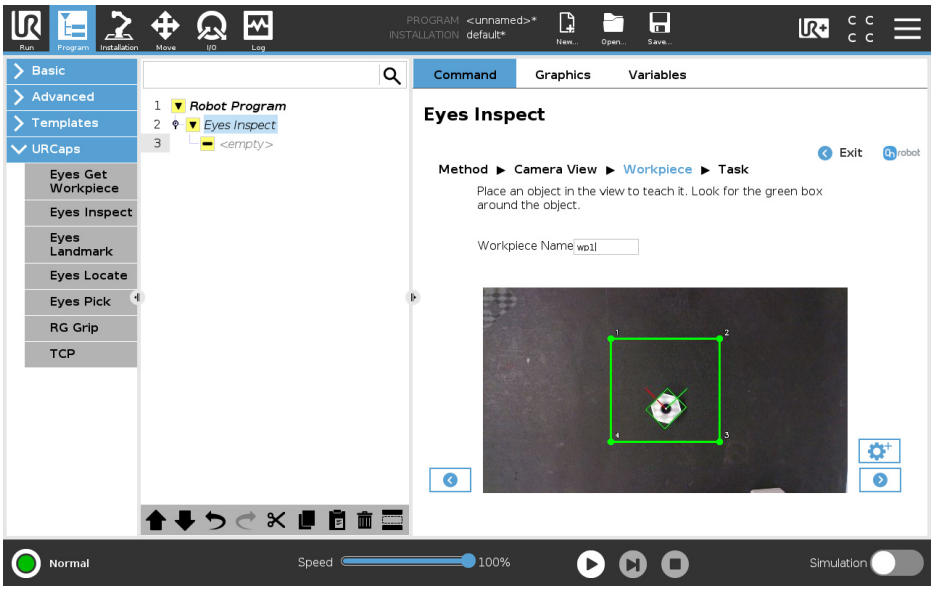
In most applications, handling workpieces lying on the same side is enough. If the application should detect an object on different sides, create several workpiece representations for the object, one for each unique side. For example, a cuboid can have six different models, but only three unique ones. A cylinder can only have two unique models. In most applications, only one workpiece configuration for each physical workpiece is necessary.

- To use previously taught workpieces, select them from the list and press .
  To teach new workpieces and to add them to the list, press **Add Workpiece**.



- Enter a name for the workpiece to the **Workpiece Name** field.

  Place the object inside the region of interest.
  The current camera image is shown on the page.

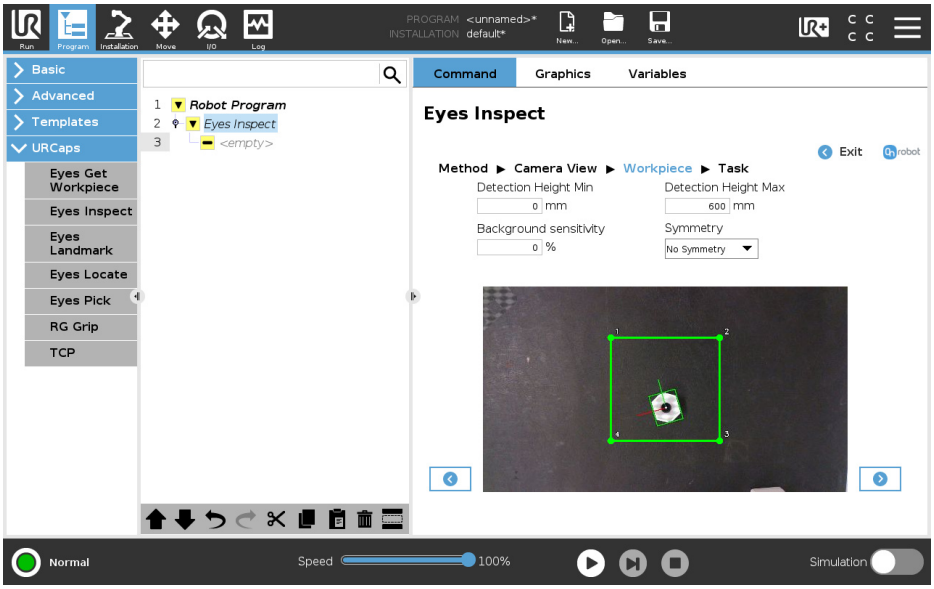


  When the camera recognizes the object, a green bounding box will appear on the image. Red boxes can appear due to extra objects present on the image. In this case, remove the extra objects until the camera sees only one object.

  If more than one object is still detected, adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.

  If the object is recognized properly (the moving pattern covers the entire object), press to save the workpiece.
  Otherwise the detection can be adjusted by using advanced parameters.

- Press to go to the advanced settings.
- Adjust the detection by setting the **Detection height min**, **Detection height max**, **Background sensitivity**, and **Symmetry** parameters if the camera does not recognize the object properly (the moving pattern does not cover the entire object).



Select the rotational symmetry of the workpiece from the drop-down list.
The rotational symmetry specifies the number of distinct orientations in which the workpiece's outline looks the same. For example, select Rectangular Symmetry when working with a rectangle or an ellipse and select Squared Symmetry when working with a square or four-vertex star. The following table shows some examples.

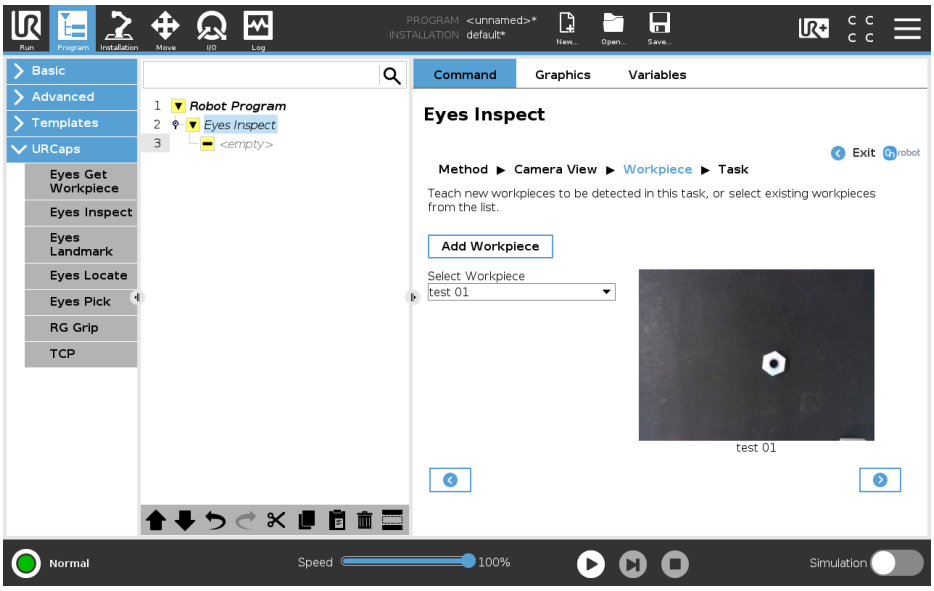
Types of Symmetry	Good Examples	Bad Examples
No symmetry		
Circular symmetry		
Rectangular symmetry		
Triangular symmetry		
Square symmetry		
Pentagonal symmetry		
Hexagonal symmetry		

NOTE:

The rotational symmetry defines the amount of unique picking orientations of an object. It is different from other types of symmetry. Items having lines of symmetry do not necessarily have any kind of rotational symmetry.

- **Background sensitivity**: This parameter makes the task detect the workpieces that are more similar in color to the background. Use the parameter with care as the greater its value is, the less robust the detection is to lighting changes and shadows. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Detection Height**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.

- Press .
- The workpiece and its settings are shown on the page.



The process can be repeated to teach more workpieces.

- Press .
  If the selected method is by workpiece's inner features, go to **Task Using Inspection by the Workpiece's Inner Features**.
  If the selected method is by workpiece's outline, go to step **Task Using Inspection by the Workpiece's Outline**.

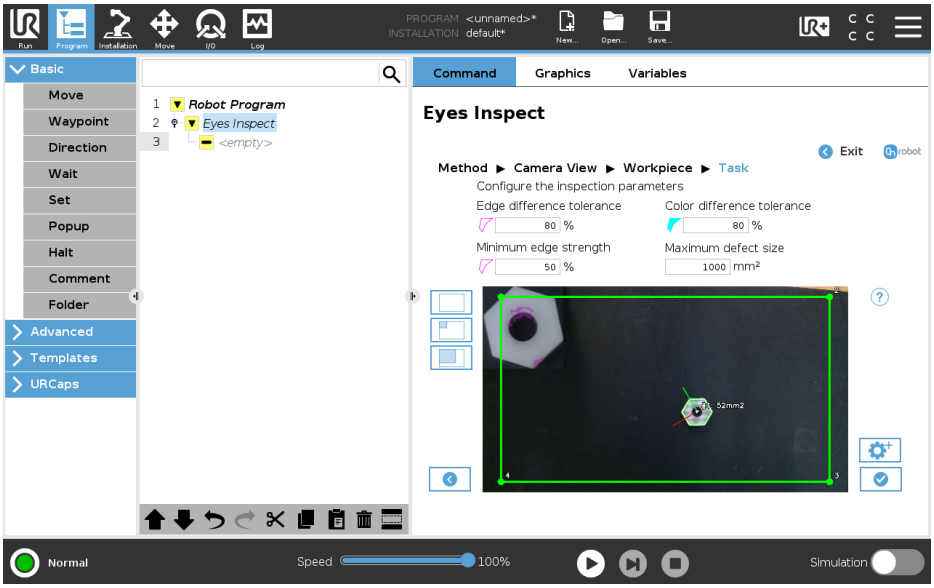
II/4. Task

The task can be set up to detect one or several types of workpieces.

II/4.1 Task Using Inspection by the Workpiece's Inner Features

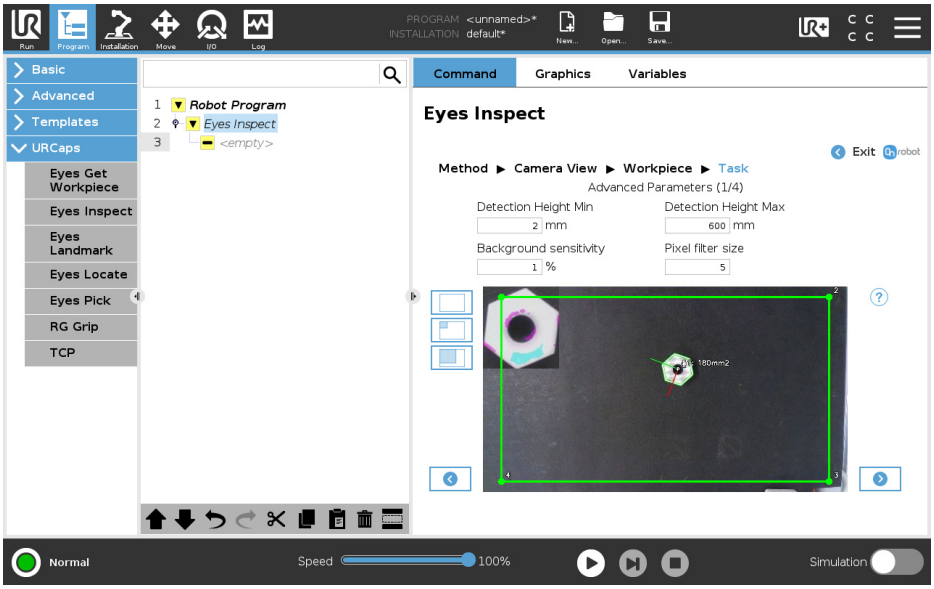
- You can see the detected workpieces in the image view with their axes.
  Check that the inspected workpiece is inside the region of interest and set **Edge difference tolerance**, **Color difference tolerance**, **Minimum edge strength**, and **Maximum defect size** parameters.

You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.



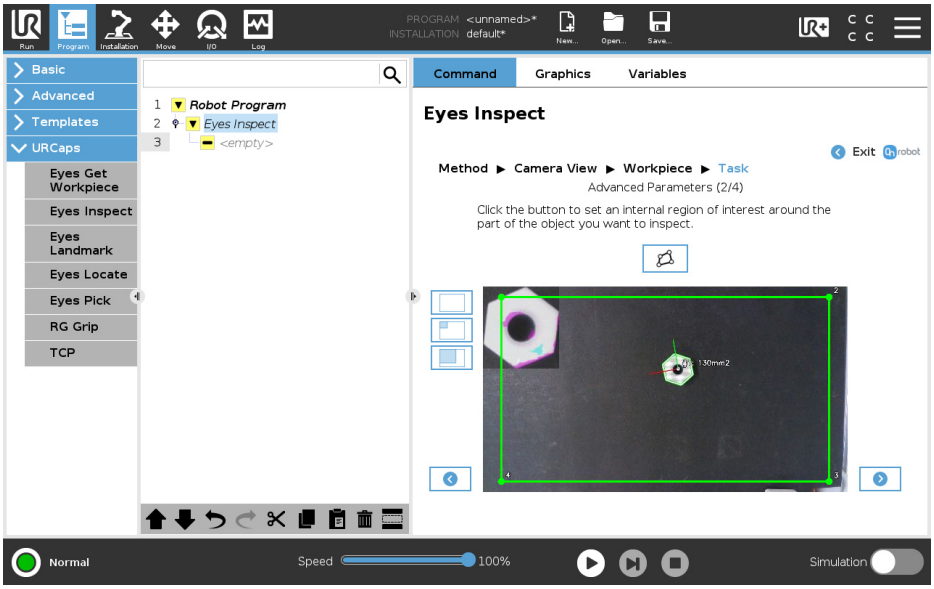
- **Edge difference tolerance**: Specifies how different in orientation the considered edges can be for a specific edge point to be classified as correct. Edge orientation is defined as the direction in which the color changes (creating the edge).
- **Color difference tolerance**: Defines how much the color of the workpiece can vary for a pixel to be considered as a defect. Setting the parameter to 100% means that the color is not considered when the task inspects the object.
- **Minimum edge strength**: Specifies how strong edges are considered when calculating the **Edge Difference**. The strength of an edge is related to the difference of colors in both sides of the edge. For example, a transition from black to white is a strong edge, while transition from orange to red is a weaker edge.
- **Maximum defect size** (mm2): Specifies how much area the defective pixels of the workpiece may cover before the workpiece fails the inspection. Pixels are considered defective based on the **Edge difference tolerance** and the **Color difference tolerance**.

- Press  and go to **Finish Configuration**.
- Optionally, press  to go to the advanced settings.
- Adjust the inspection by setting the **Detection height min**, **Detection height max**, **Background sensitivity**, and **Pixel filter size** parameters.

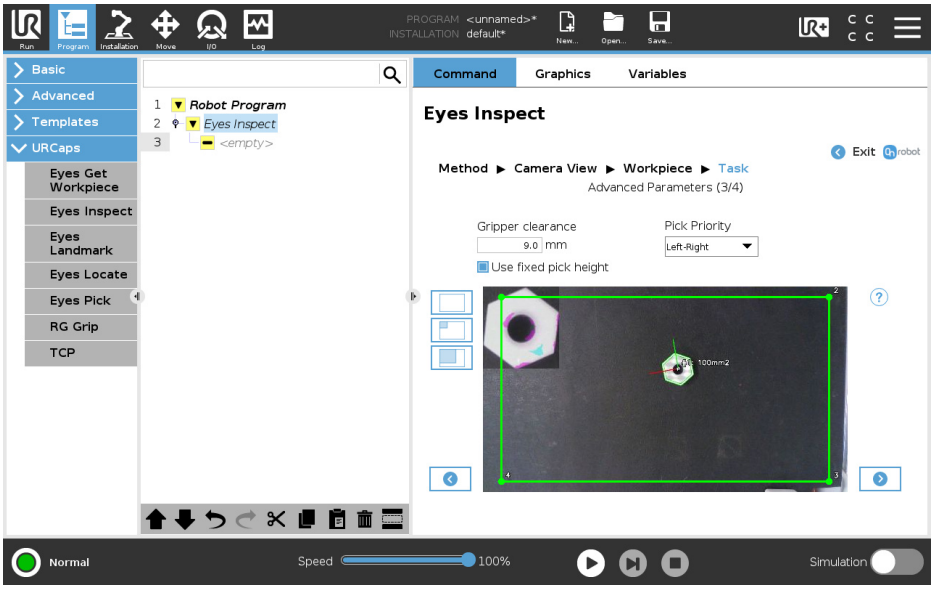


- **Detection height range**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Background sensitivity**: This parameter makes the task detect the workpieces that are more similar in color to the background. Use the parameter with care as the greater its value is, the less robust the detection is to lighting changes and shadows. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Pixel filter size**: Defines the size of the filter which is used to reduce the noise in the image. High values will eliminate small details to focus on the bigger defects. Low values can lead to image noise that affects the outcome of the inspection. For most applications, you do not need to adjust this parameter.

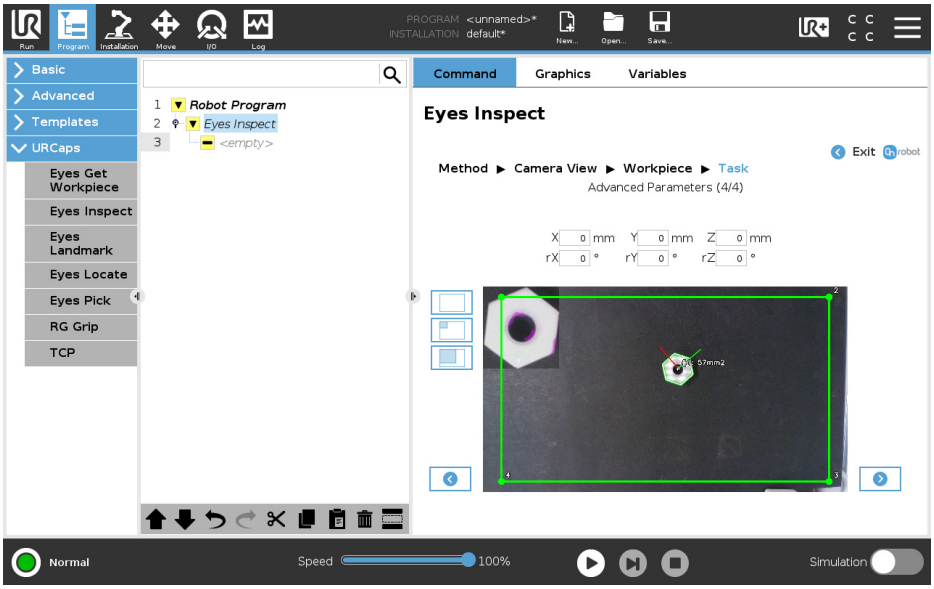
- Press .
- Adjust an inner region of interest. This region specifies which areas should be considered when performing the inspection. Defects outside of the inner region of interest will not affect the outcome of the inspection. To modify the inner region of interest, click the button. Adjust this region similarly to the main region of interest.



- Press .
- Adjust the inspection by setting the **Pick priority**, **Gripper clearance**, and **Use fixed pick height** parameters.



  - **Gripper clearance** (mm): Sets the distance in [mm] of the required free space around an object to be detected. This parameter guarantees that the gripper will be able to grip the object.
  - **Pick priority** (Workpiece marked in white will be picked first): Defines in which order the workpieces will be picked, based on their position in the image.
  - **Use fixed pick height**: If selected, the height of the workpiece will be considered 0 mm and the position will be given in the camera view plane.
- Press .
- Adjust the picking offset and the rotation. If the workpieces are placed inside the region of interest, the picking position and the orientation are visualized in the image feed. Axes X, Y, Z are represented by red, green, and blue lines, respectively. If parts of the axis are covered by the workpiece in the 3D space, the color of that part of the axis will be darker.



NOTE:

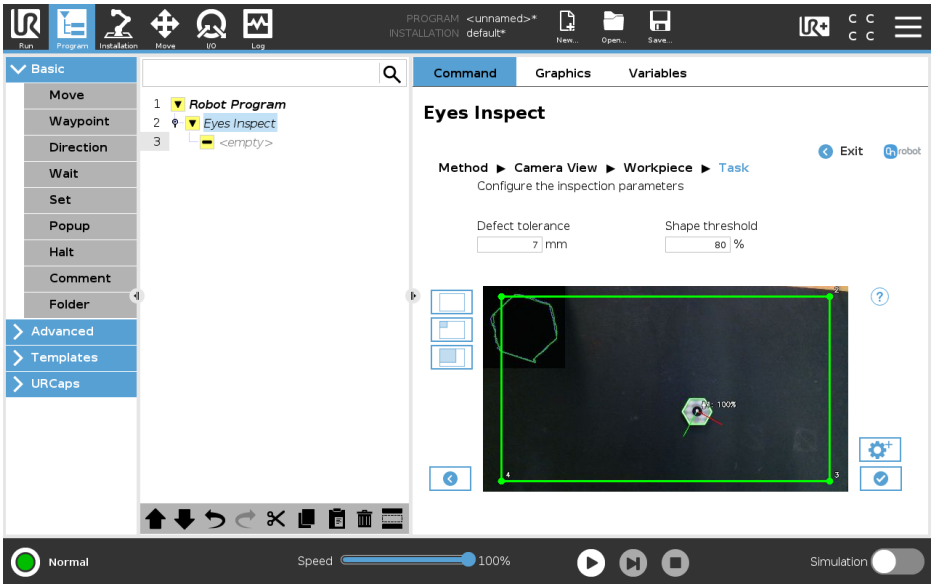
The offsets are applied in the original frame of the detected workpieces. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

- Press and go to the first page of **Task Using Detection by the Workpiece's Inner Features**.

II/4.2 Task Using Inspection by the Workpiece's Outline

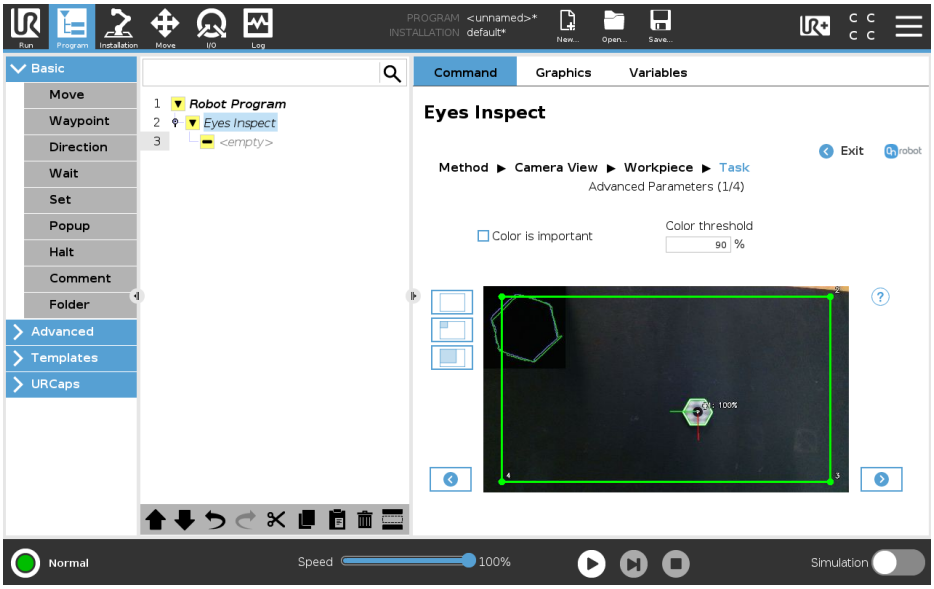
- The detected workpieces are seen in the camera feed with their axes.
  Only one workpiece can be inspected per task.
  Check that the detected workpiece is inside the region of interest and set the **Defect tolerance**, **Shape threshold**, and **Color threshold** parameters.

  You can adjust the region of interest, which is marked by a yellow rectangle in the image. To change the region of interest, adjust the corners by clicking and dragging each of the points to its new position. The green region moves first, then the yellow follows, indicating that you successfully changed the region of interest.



- **Defect tolerance**: Defines the allowed size of outer shape defects on workpieces. It is used to decide whether each contour point of the inspected workpiece is within tolerance. It will be so if its distance to the contour of the taught workpiece is lower than the Defect Tolerance.
- **Shape threshold**: Threshold in percentage defining how much of a workpiece's contour needs to be within tolerance for the workpiece to pass inspection.

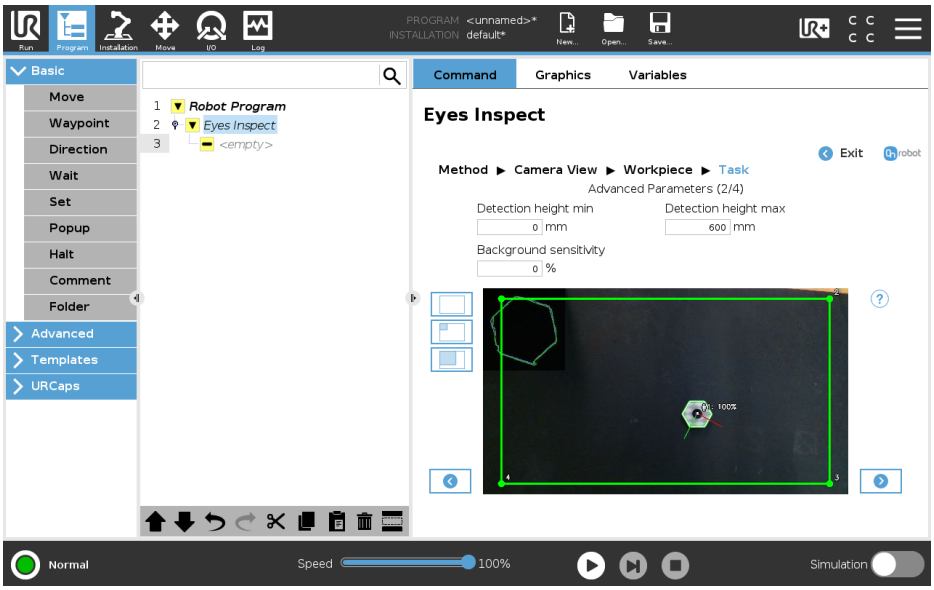
- Press  and go to **Finish Configuration**.
- Optionally, press  to go to the advanced settings.
- Adjust the inspection by setting the **Color threshold** and **Color is important** parameters.



- **Color threshold**: Threshold in percentage defining how different the color of inspected and taught workpiece are allowed to be for the detected workpiece to pass. The actual match is calculated as a measure of the effort to move from the taught workpiece color histogram to the detected workpiece color histogram. The histogram is calculated using the HSV color space.

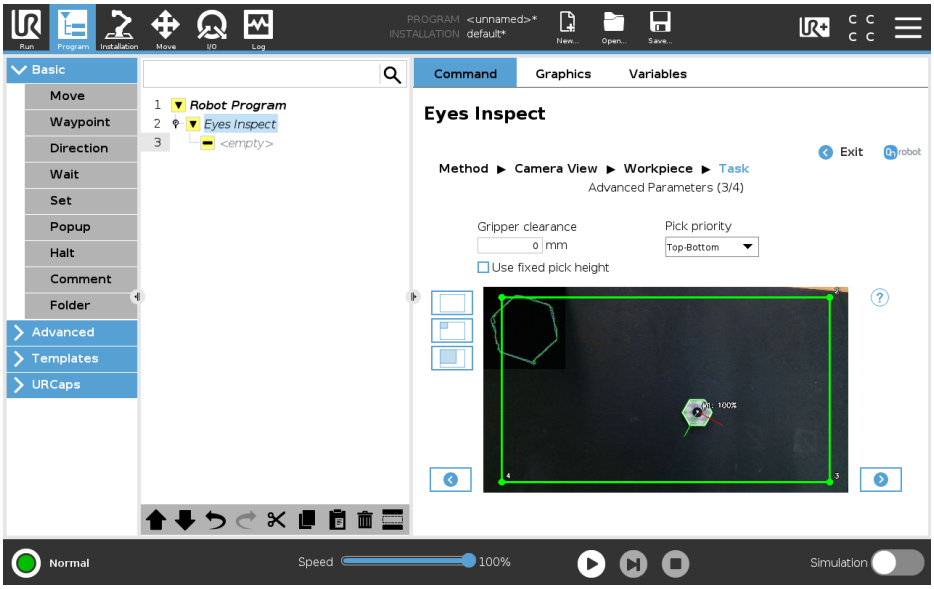
- **Color is important** (Useful for workpieces with similar shapes): Select it if the task is meant to inspect the color of workpieces. If selected **Color threshold** is used to decide whether a workpiece passes or fails the inspection task.

- Press .
- Adjust the inspection by setting the **Detection height min**, **Detection height max**, and **Background sensitivity** parameters.



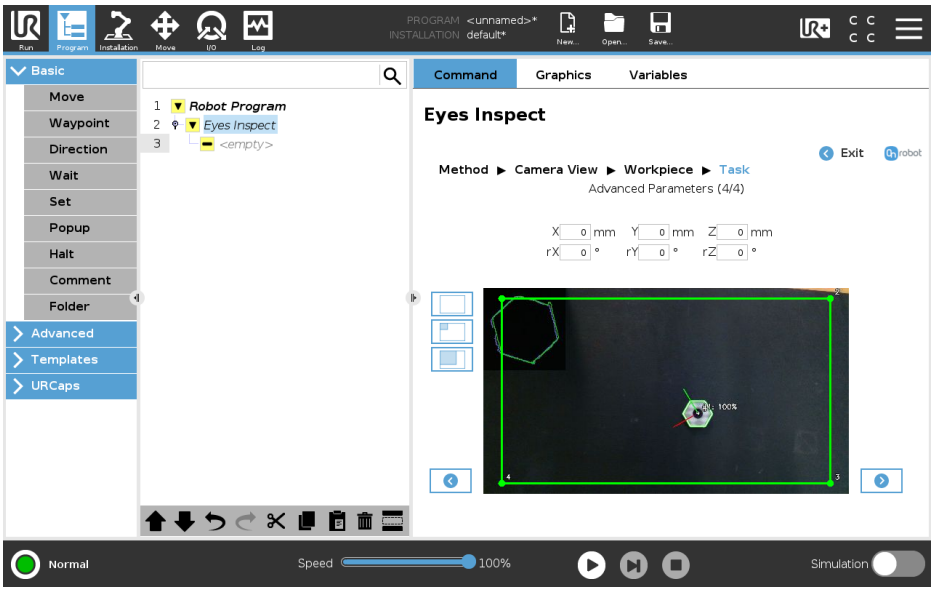
- **Detection Height**: This parameter ensures that only objects inside of a given height range from the camera view plane will be detected as possible workpieces. Use the parameter when detecting tall workpieces, so that only the top part is used to compute the position of the workpiece. Increase the robustness to disturbances like shadows or reflections, as these usually appear at camera view plane level. It is recommended to have a range large enough to allow variations in the height of the workpieces. The effect can be seen in the textured zone in the image feed, which indicates the foreground.
- **Background sensitivity**: This parameter makes the task detect the workpieces that are more similar in color to the background. Use the parameter with care as the greater its value is, the less robust the detection is to lighting changes and shadows. The effect can be seen in the textured zone in the image feed, which indicates the foreground.

- Press .
- Adjust the inspection by setting the **Use fixed pick height**, **Pick priority**, and **Gripper clearance** parameters.



- **Gripper clearance** (mm): Distance in millimeters of free space required around an object for it to be detected. This parameter is useful to guarantee that the gripper will be able to grip the object.
- **Pick priority** (Workpiece marked in white will be picked first): This option defines in which order the workpieces will be picked, based on their position in the image. Only available when using Standard camera view.
- **Use fixed pick height**: If selected, the height of the workpiece will be considered 0 mm and the position will be given in the camera view plane.

- Press .
- Adjust the picking offset and the rotation. If the workpieces are placed inside the region of interest, the picking position and the orientation are visualized in the image feed. Axes X, Y, Z are represented by red, green, and blue lines, respectively. If parts of the axis are covered by the workpiece in the 3D space, the color of that part of the axis will be darker.



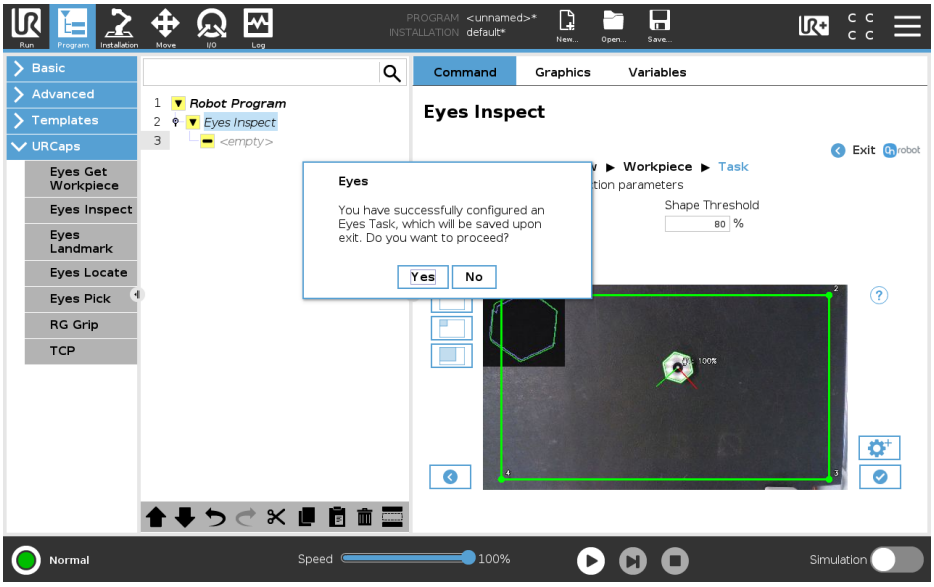
NOTE:

The offsets are applied in the original frame of the detected workpieces. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

- Press and go to the first page of **Task Using Detection by the Workpiece's Outline**.

II/5. Finish Configuration

- Eyes Inspection configuration is finished.



- Press **Yes** to save and exit the Task configuration.

Configure Eyes in the Robot Program

The `Eyes Inspect` command is used to run an Eyes task to inspect workpieces. This command is used together with the `Eyes Get Workpiece` command, using the latter as a child command.

NOTE:

If the camera is attached to the robot wrist, the camera view is linked to the robot pose. Before using the `Eyes Inspect` it is required to move the robot to the saved robot pose for the appropriate camera view. In the case of an external mount is used, ensure the camera is not obstructed by the robot.

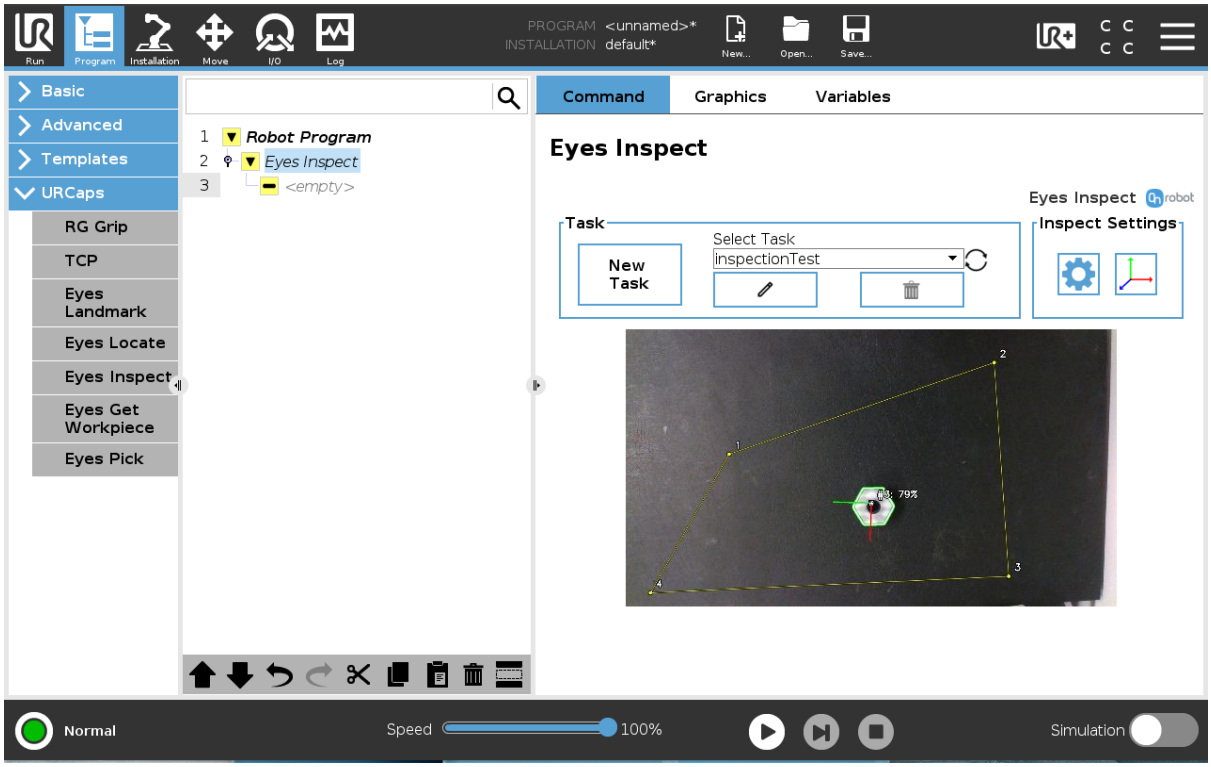
When the `Eyes Inspect` command is executed, the Eyes will attempt to identify workpieces defined by the chosen Eyes task. The different functions are explained below.

Select Eyes task

The user can select an Eyes task from the drop-down selection. When there is no task selected the drop-down menu will be bordered in red and the `Eyes Inspect` command will be incomplete, as shown below.

Eyes Inspect

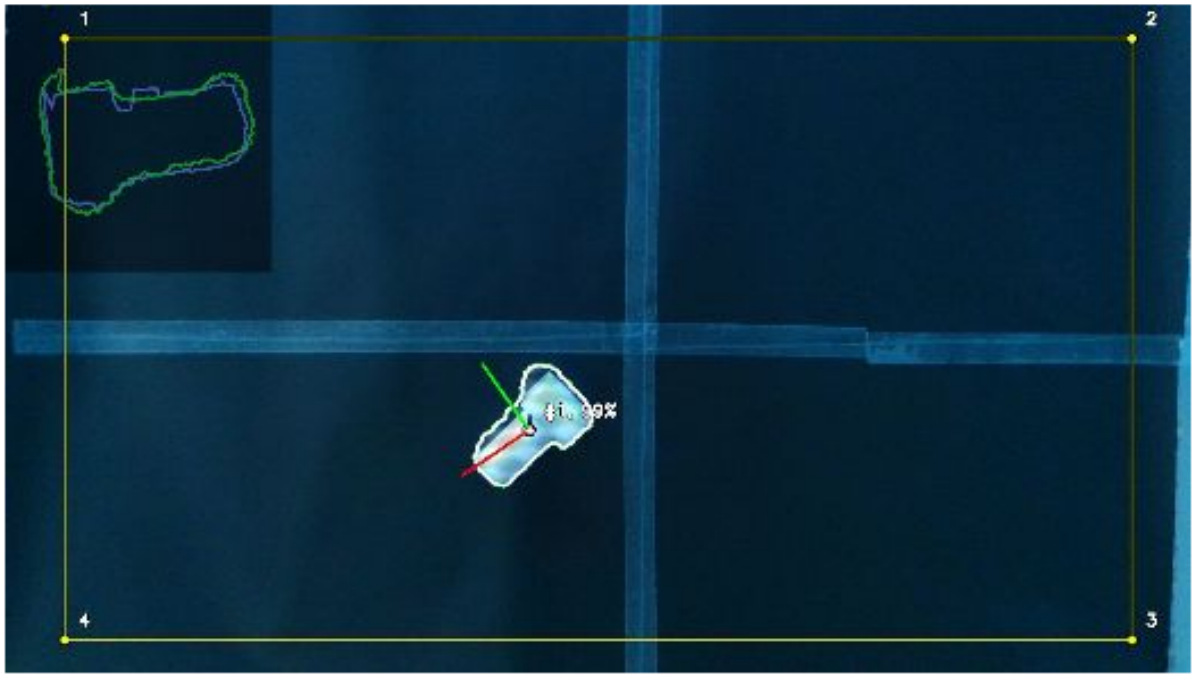
Once a task is selected the drop-down menu will be bordered green, the Eyes Inspect command will be complete and the **Camera feed** from the camera will be shown.



Camera feed

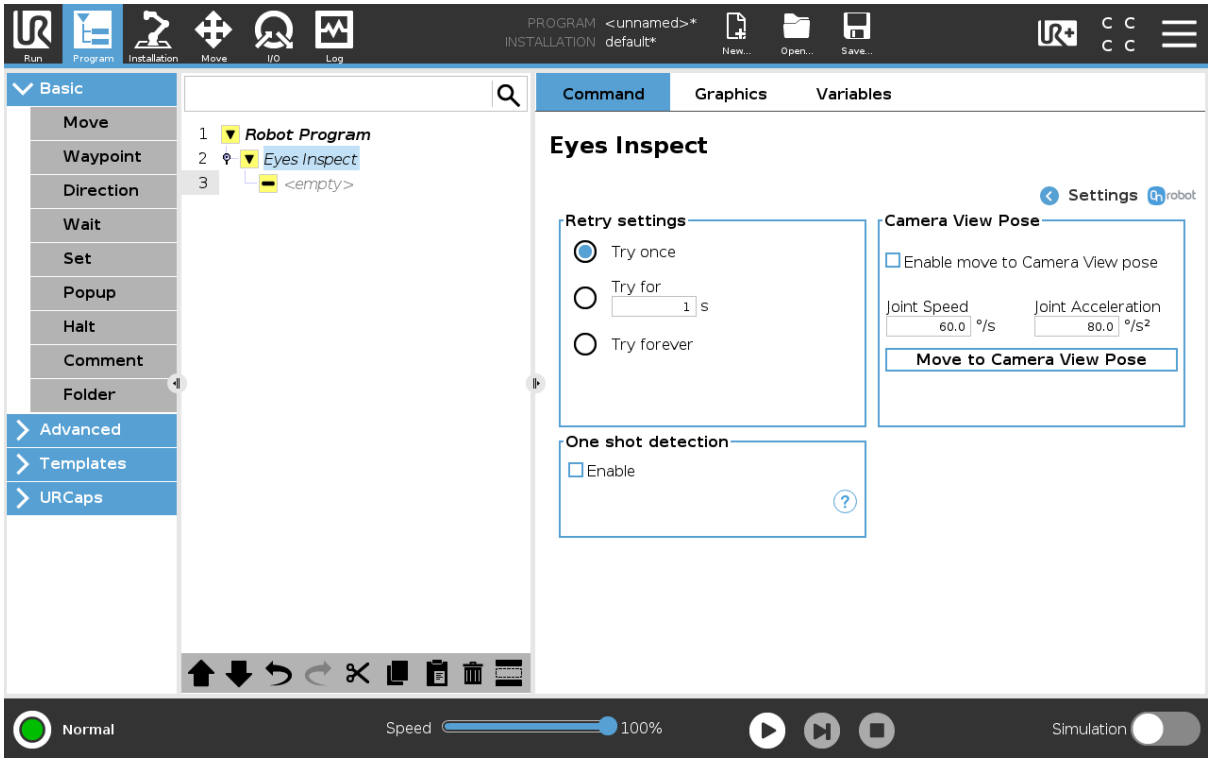
Here the live video feed of the Eyes will be shown. Detected workpieces from the selected task will be shown in the live feed. These workpieces will have 2 numbers. #1 indicates the workpiece number in the Eyes program and the 99% indicates the Match percentage.

Additionally, on the top left corner, the taught workpiece contour is shown in blue and the read current workpiece contour is shown in green.



Settings

A new page with the **Inspect Settings** will be shown by pressing on .



Retry settings

The user can select how long the Eyes Inspect command will try to locate workpieces. The options are:

- **Try once**: The Eyes Inspect command will try only one time.
- **Try for (s)**: The user can input how long in seconds the Eyes Inspect command will try to locate workpieces.
- **Try forever**: The Eyes Inspect command will never stop trying to locate workpieces.

One shot detection

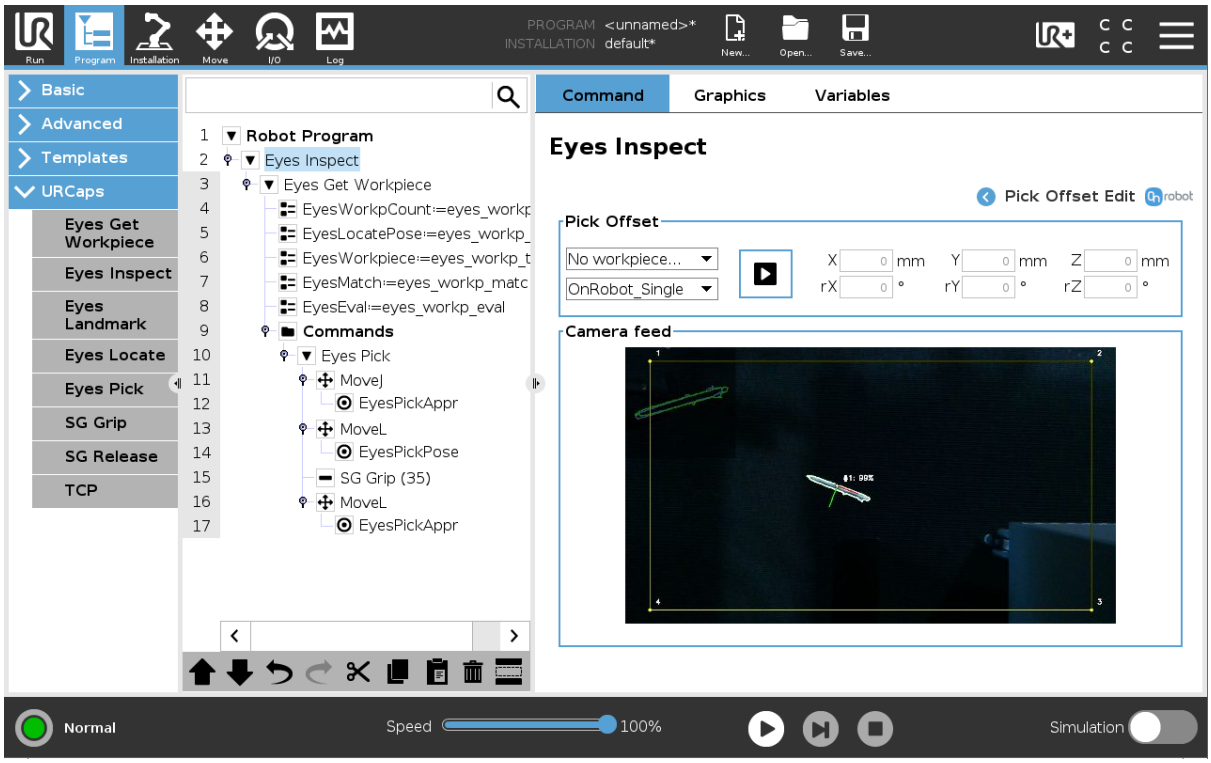
If enabled, the Eyes will attempt to identify all target workpieces at once saving their pose and type. The section of the task inside the Eyes Locate node will execute as many times as workpieces were detected by the Eyes. In this way, it is possible to handle all workpieces without acquiring more images and thus, reducing cycle time.

Camera View Pose

If enabled, `Eyes Locate` will move the robot to the associated camera view pose of the selected task. This camera view pose is saved while creating the camera view for the application. The move applied is a joint move. Joint Speed and Joint Acceleration can be adjusted.

Pick Offset Edit

A new page with the Pick Offset setting will be shown by pressing on .



Pick Offset

In the first dropdown menu, the user can select which workpiece's pick offsets and rotation will be edited. If the picking position of the workpiece is placed inside the region of interest, picking position and axes are visualized in the overlay. Axes X, Y, Z are represented by lines

colored red, green and blue, respectively. If sections of the axis are covered by the workpiece/surface, the color of that section of the axis will be shown darker.

NOTE:

The offsets are applied in the non-rotated frame of the detected workpiece. For this reason, it is more intuitive to adjust the picking offsets first, and the picking orientation afterwards.

These pick offsets can also be modified from WebClient and affect only the selected workpiece type in the selected task.

WARNING:

Pressing  will simulate the picking operation by moving the robot to the detected part.

This can be used to validate that the picking offsets are correct for the application. In the second dropdown menu, the TCP for this move can be selected. Use OnRobot_Single, when working with 1 OnRobot gripper, use OnRobot_Dual_1 or OnRobot_Dual_2 when working with Dual Quick Changer.

 when pressed, the robot will move to the defined Pick Offset. This feature can be used to validate the selected settings.

The contributions for the values of the different axes X, Y and Z and their rotations rX, rY and rZ can be edited by pressing on the input field and selecting a new value. The changes will automatically be seen in the camera feed.

5.1.1.4. Eyes Get Workpiece

The `Eyes Get Workpiece` command is used to create and assign values to certain variables.

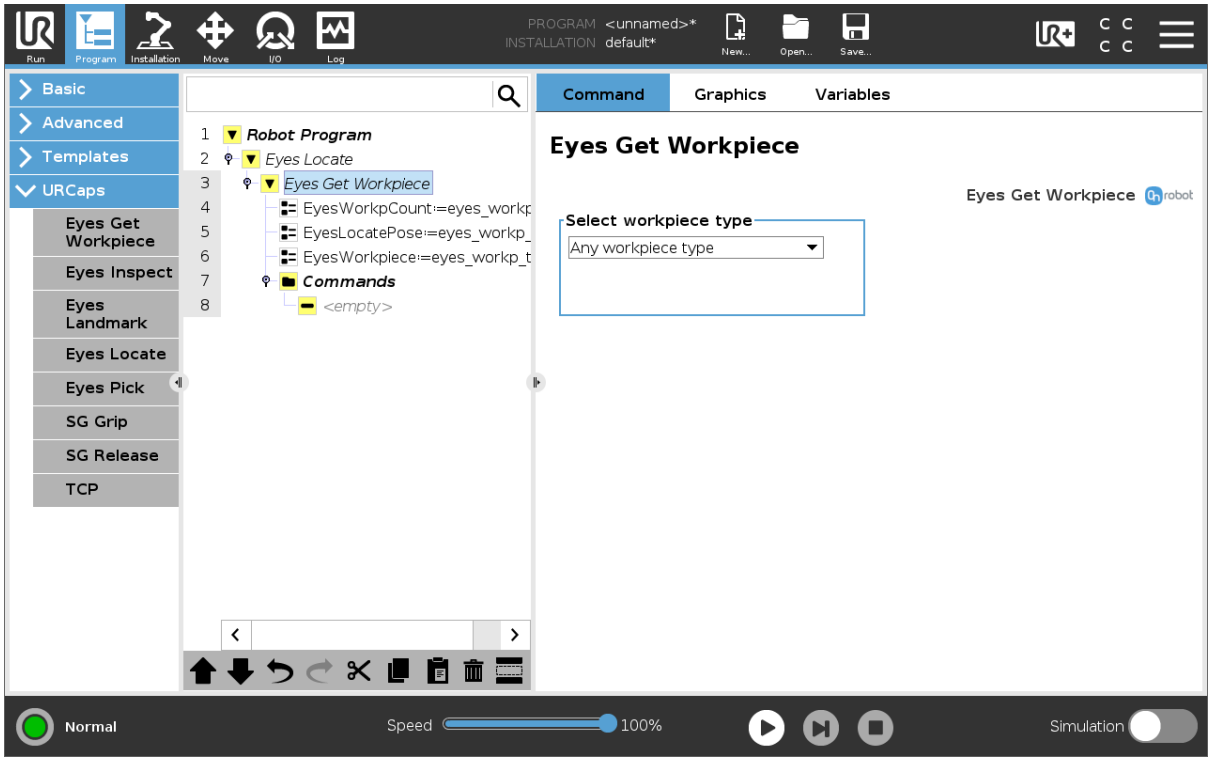
This command is used with the `Eyes Locate` or `Eyes Inspect` (standard and close up) commands and needs to be inserted as a child command.

Below, three sections are found:

- Eyes Get Workpiece for Eyes Locate command.
- Eyes Get Workpiece for Eyes Inspect (close up camera view) command.
- Eyes Get Workpiece for Eyes Inspect command.

In these sections, the created variables are explained.

Eyes Get Workpiece for Eyes Locate command



In the robot program, the created variables and their assignments can be seen. These variables are explained below:

`EyesWorkpCount`: this variable assigns the number of detected workpieces located by the Eyes Location Task.

`EyesLocatePose`: this variable assigns the detected workpiece's pose when the Eyes Locate command is executed.

NOTE:

The detected workpiece's pose is given to the robot using the robot's Base frame as reference.

`EyesWorkpiece`: this variable assigns the detected workpiece's type as defined in the Eyes Location Task.

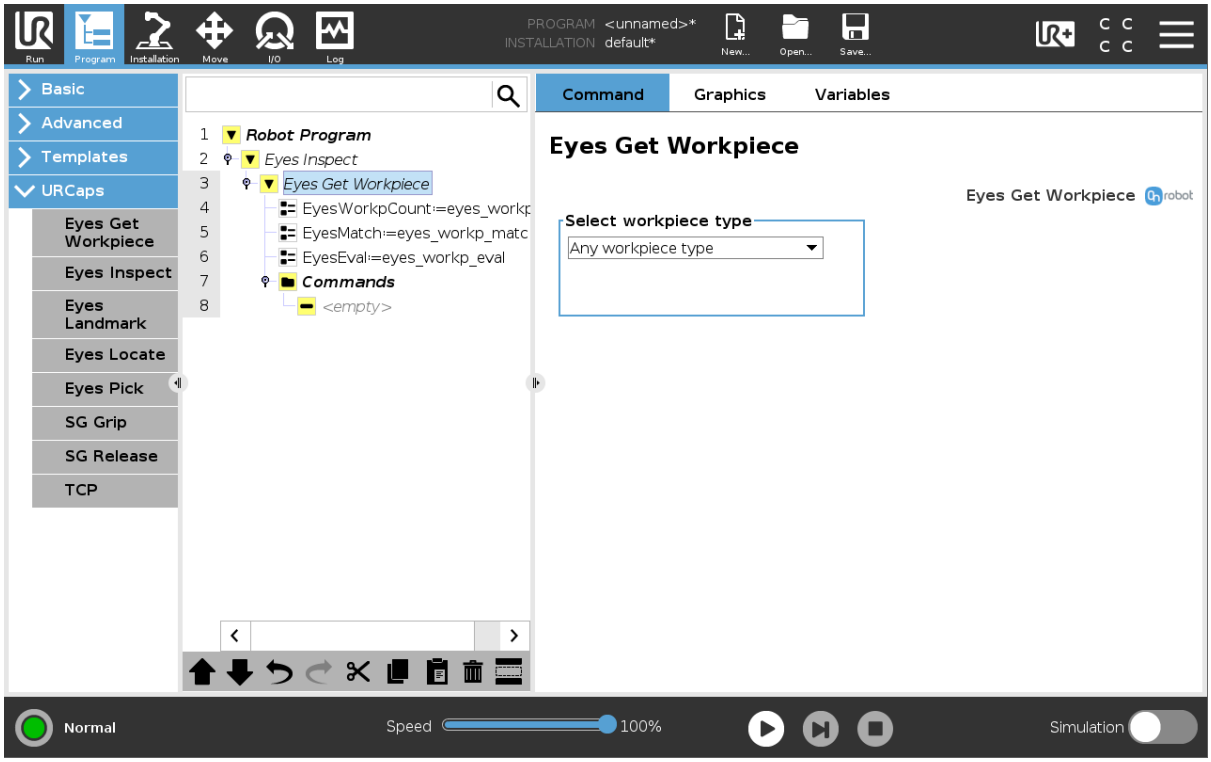
NOTE:

Changing the variable names or expression in the variable assignment nodes will result in unwanted behavior from the Robot Program.

Select workpiece type

The user can select what workpiece information will be return in the assignments for this command. When selecting **Any workpiece type**, the picking priority configured in Eyes task configuration is used to select which workpiece is returned.

Eyes Get Workpiece for Eyes Inspect (close up camera view) command



In the robot program, the created variables and their assignments can be seen. These variables are explained below:

`EyesWorkpCount`: this variable assigns the number of detected workpieces located by the Eyes Inspection Task.

`EyesMatch`: this variable assigns the match percentage between the workpiece's model and the one in used as defined in the Eyes Inspection Task.

- If the color is taken into consideration in the task, this match % will be the average between the color match and the shape match.
- If the color is not taken into consideration in the task, this match will only be the shape match.

`EyesInspectEval`: this variable assigns true if the match % is higher than the one defined in the Eyes Inspection Task. If the match % is lower, then it assigns false.

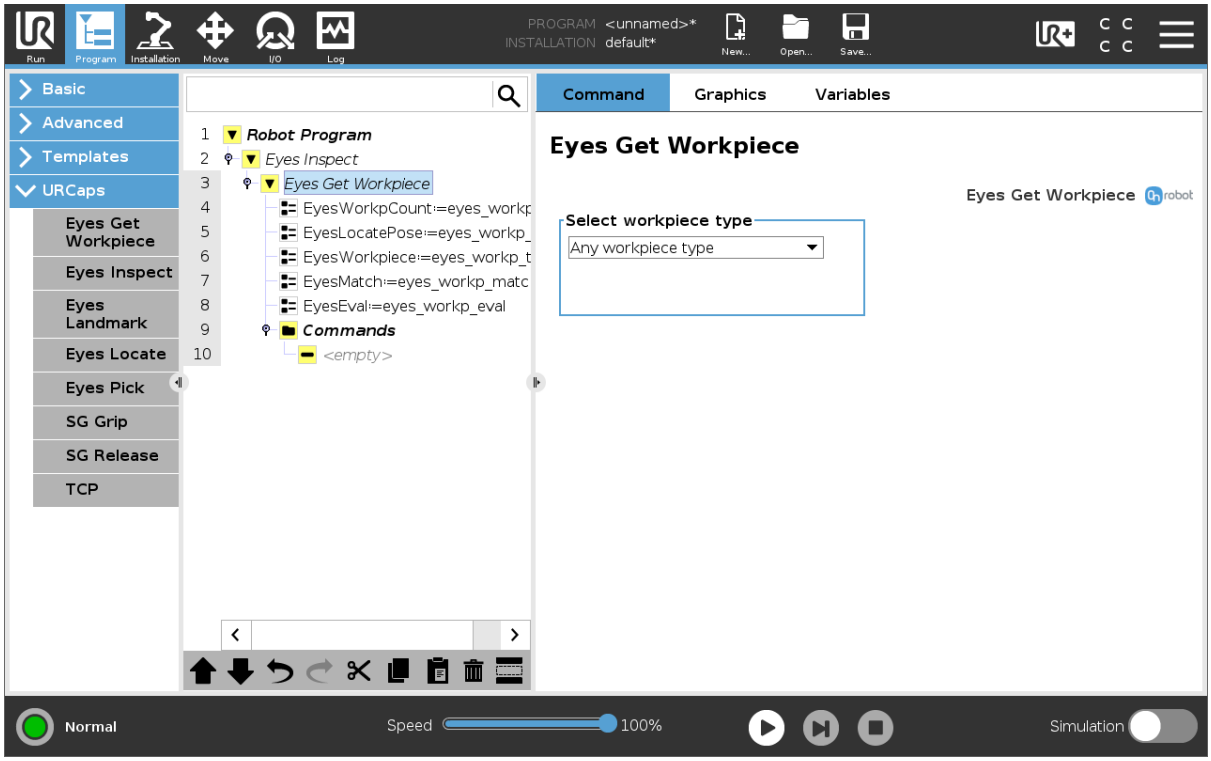
NOTE:

Changing the variable names or expression in the variable assignment nodes will result in unwanted behavior from the Robot Program.

Select workpiece type

The user can select what workpiece information will be return in the assignments for this command. When selecting **Any workpiece type**, the picking priority configured in Eyes task configuration is used to select which workpiece is returned.

Eyes Get Workpiece for Eyes Inspect command



In the robot program, the created variables and their assignments can be seen. These variables are explained below:

`EyesWorkpCount`: this variable assigns the number of detected workpieces located by the Eyes Inspection Task.

`EyesLocatePose`: this variable assigns the detected workpiece's pose when the Eyes Inspect command is executed.

NOTE:

The detected workpiece's pose is given to the robot using the robot's Base frame as reference.

`EyesWorkpiece`: this variable assigns the detected workpiece's type as defined in the Eyes Inspection Task.

`EyesMatch`: this variable assigns the match percentage between the workpiece's model and the one in used as defined in the Eyes Inspection Task.

- If the color is taken into consideration in the task, this match % will be the average between the color match and the shape match.
- If the color is not taken into consideration in the task, this match will only be the shape match.

`EyesInspectEval`: this variable assigns true if the match % is higher than the one defined in the Eyes Inspection Task. If the match % is lower, then it assigns false.

NOTE:

Changing the variable names or expression in the variable assignment nodes will result in unwanted behavior from the Robot Program.

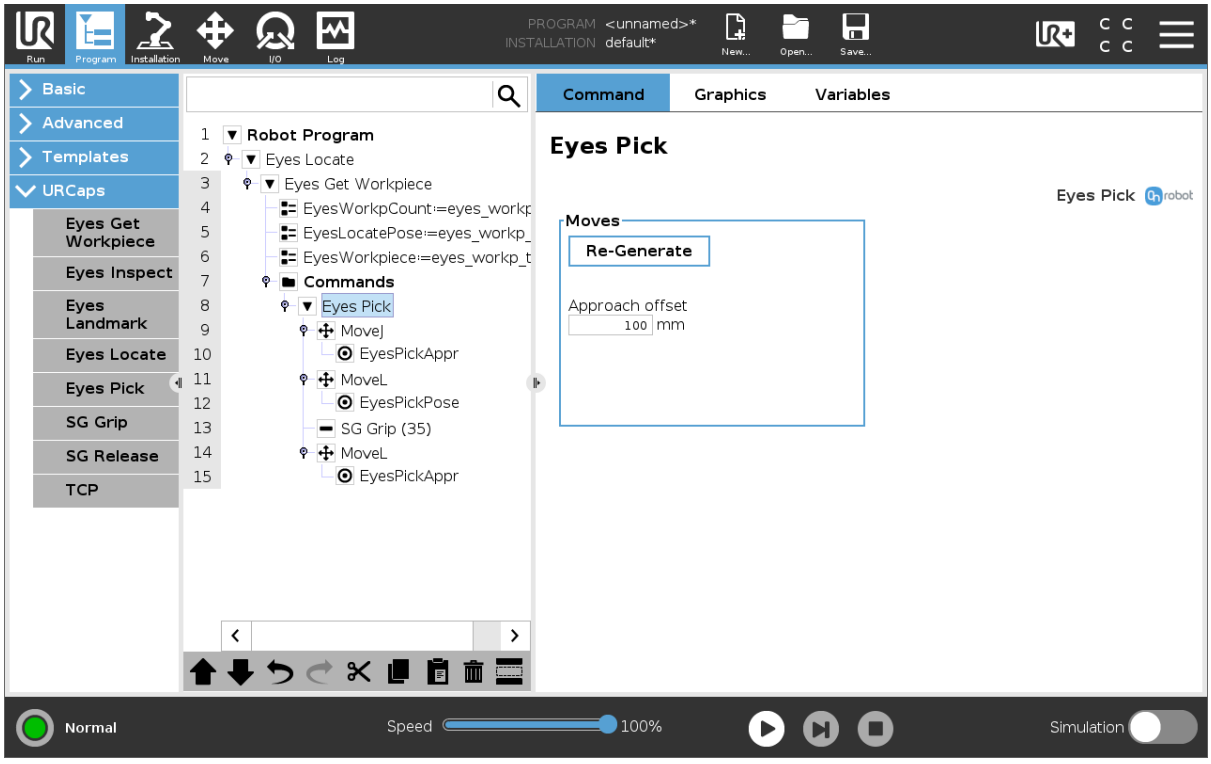
Select workpiece type

The user can select what workpiece information will be return in the assignments for this command. When selecting **Any workpiece type**, the picking priority configured in Eyes task configuration is used to select which workpiece is returned.

5.1.1.5. Eyes Pick

The `Eyes Pick` command is an optional helper function that can be used after an `Eyes Locate` or `Eyes Inspect` and the `Eyes Get Workpiece` are executed. The command enables a user to quickly setup a generic motion to pick a detected workpiece. The Eyes Pick motion will perform a **MoveJ** until an approach offset pose set by the user, a **MoveL** to the workpiece's gripping position and finally a **MoveL** back to the offset pose.

This command needs to be inserted as a child command of the `Eyes Get Workpiece` command.



Moves

Generate: When this button is pressed, the program structure will be completed with the Move commands. If this program structure has already been generated, the **Generate** button is transformed into a **Re-Generate** button. Pressing the latter, will overwrite the program structure with the default one.

NOTE:

If an OnRobot gripper is connected, the Eyes Move will add the given gripper's grip command to the program.

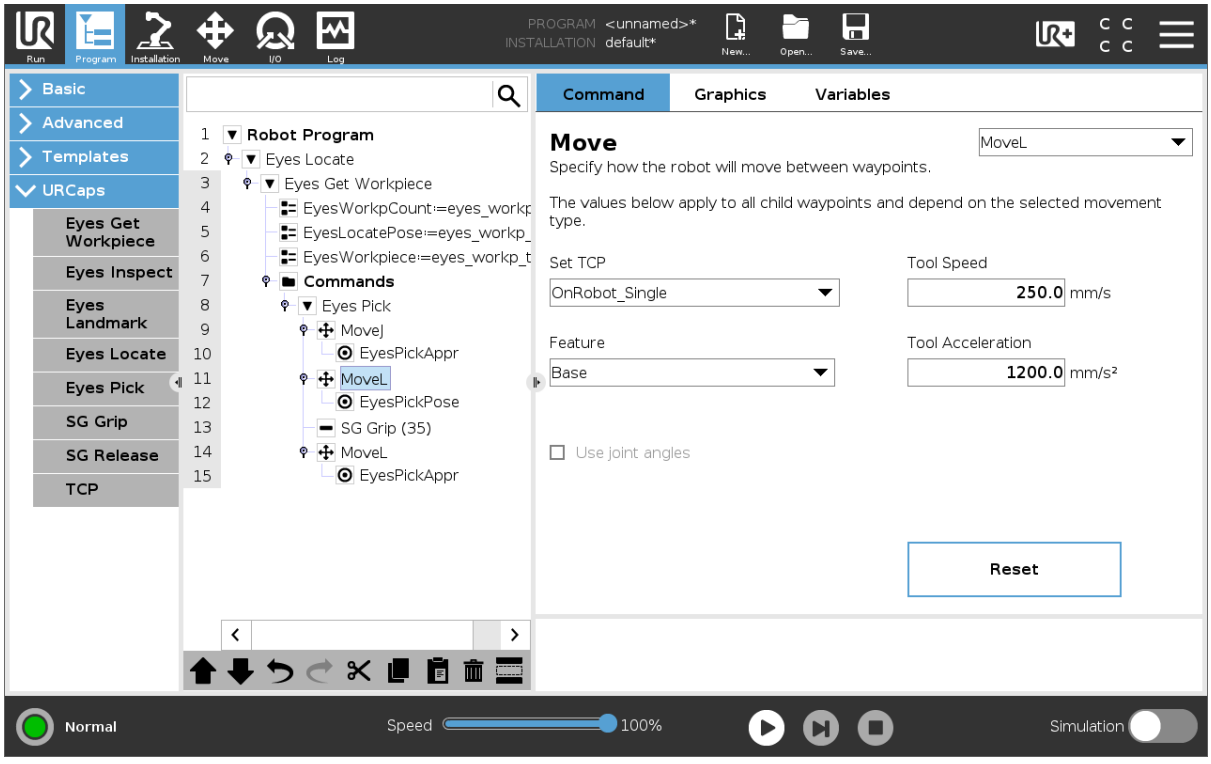
Approach offset: This distance will determine the waypoint where the robot will move to in the first MoveJ.

Select device

When two grippers are used, the radio buttons with the gripper's name will appear. These buttons will select which one of the two grippers should be used when creating the program structure for the `Eyes Pick`.

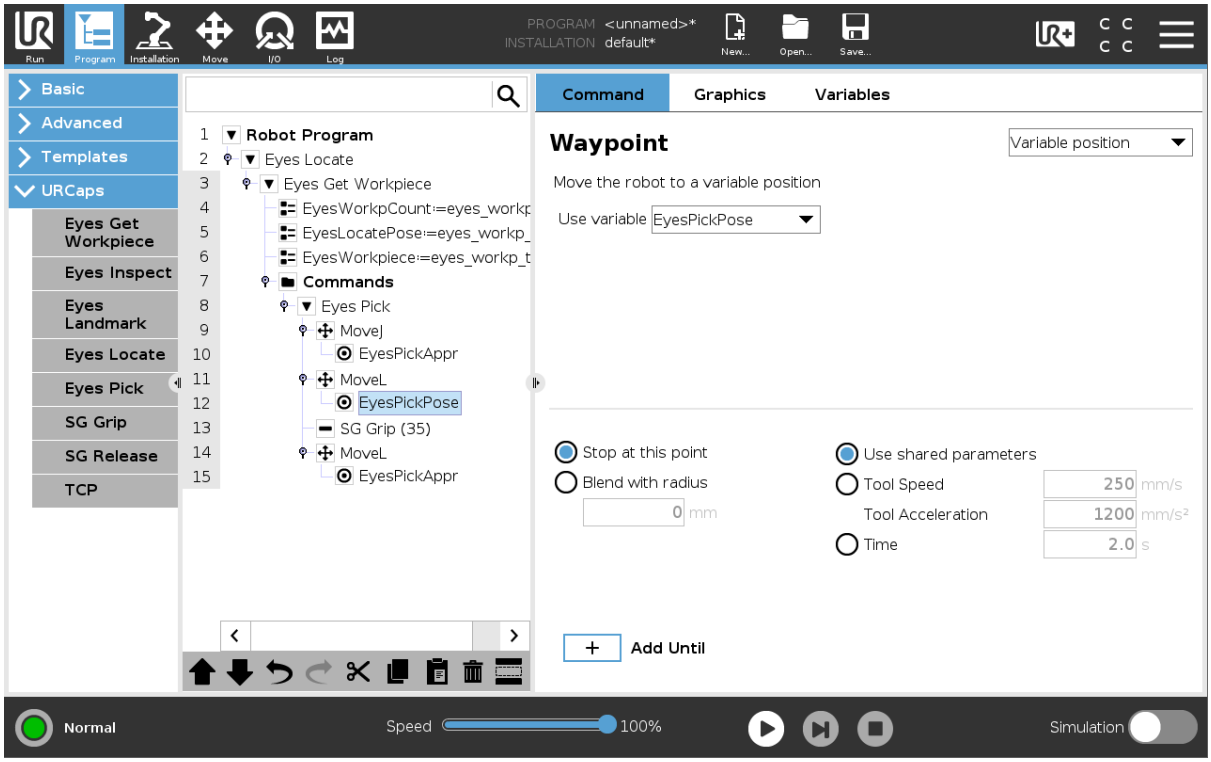
Inserted Move commands:

The inserted move commands will use the OnRobot TCP to make the motion. If the Dual QC is used, the selected gripper option will define which TCP is chosen for the commands.



The above is an example of the default Move that is set by the `Eyes Pick`. The `OnRobot_Dual_1` TCP has been chosen.

The Waypoint shown below uses the variable `EyesPickPose`.



NOTE:

In some cases, the robot may not be able to find a viable path from the chosen locate pose to the object pose. In these cases, it is recommended to add waypoints closer to the physical area of where the objects are located.

5.1.1.6. Eyes Landmark

The `Eyes Landmark` command is used to locate the OnRobot landmark and, using a feature point as reference in the moves, will reorient the robot position based on the position of the landmark. The Landmark is detected using a dual capture approach.

This feature/command is very useful in the following cases:

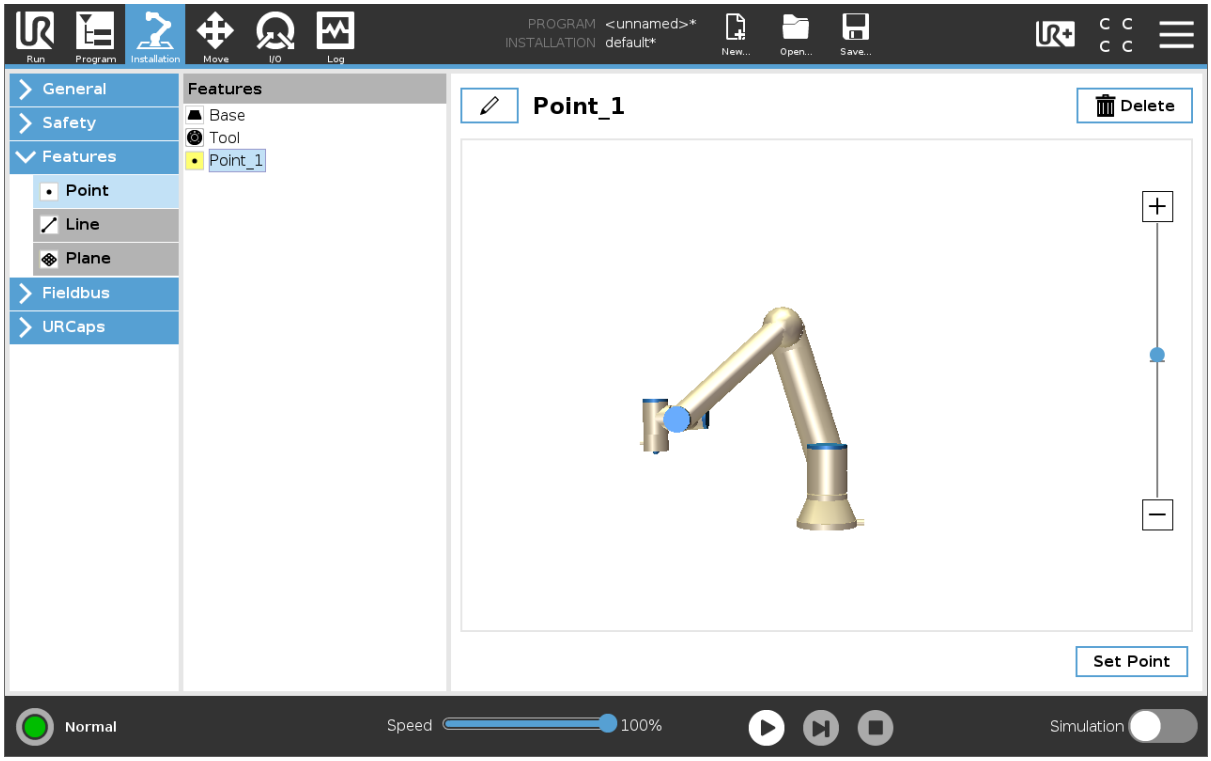
- When the robot is transported to the workstation and it is not always placed in the very exact position.
- When the workpiece is brought to the robot in a tray, trolley or the like and it is not always placed in the same position.

The following steps will guide the user to create a robot program using the `Eyes Landmark` command:

1. Go to the **Installation** tab, **Features** dropdown, press **point** to create it (on a CB3, tick this as **Variable**) and press **Set point**.

NOTE:

The landmark command will change its value when executed, therefore this point must not be used for anything else.



2. Go to the **Program** tab and add an `Eyes Landmark` command. The different functions are explained below.

Select feature point

Select the desired feature point.

Save landmark

Place the landmark so that the camera can see it at 300 mm distance.

Then press the  button. This performs two actions:

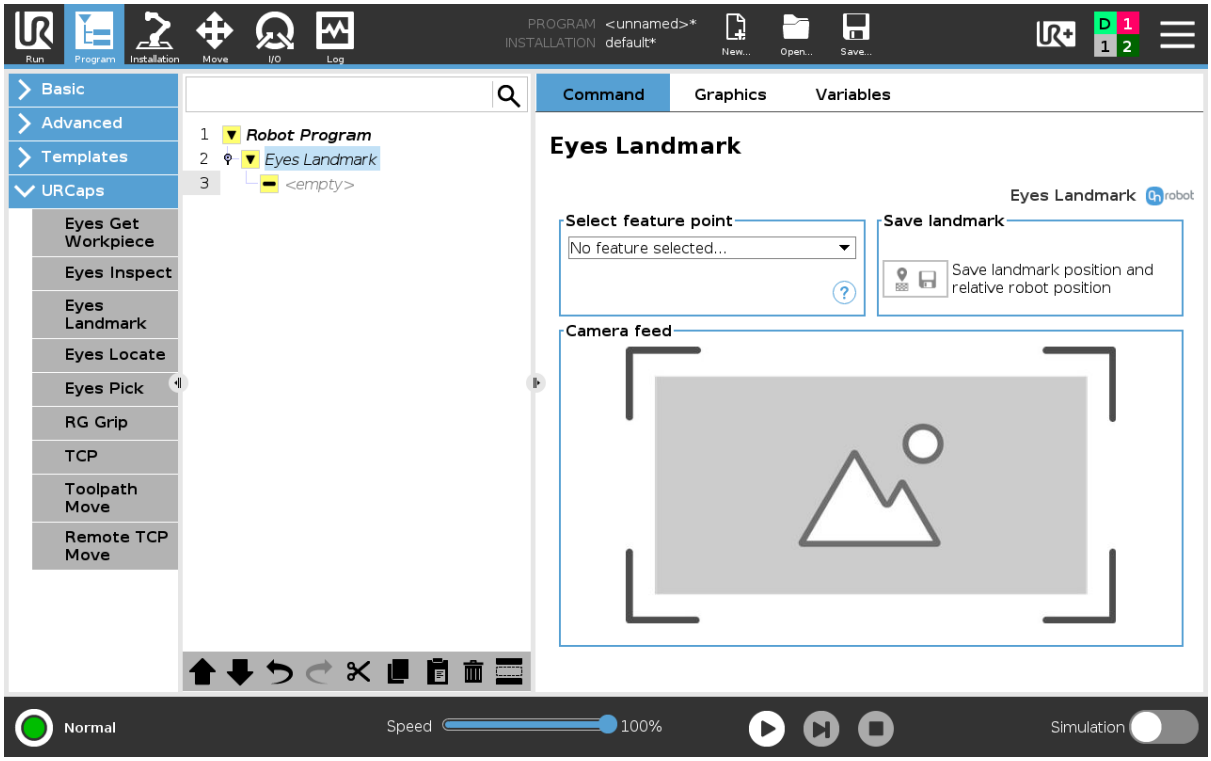
- Save the original landmark position.
- Save the robot position relative to the landmark. The robot will move to the saved relative position when executing the `Eyes Landmark` command in the robot program.

NOTE:

The TCP of the robot is set to **Use tool flange** on eSeries or **Ignore Active TCP** on CB3 when teaching the Landmark.

NOTE:

Do not move the landmark until the whole program is set up.



NOTE:

The `Eyes Landmark` command can be place in the BeforeStart sequence if it is only required to run once on each program.

3. Outside the `Eyes Landmark` command, place a Move command.

- Select a move type that allows you to set a **Feature point** (eSeries any move will allow you, CB3 only MoveL and MoveP will allow you).
- Set a TCP to use.
- Select the feature point that was created at the beginning.

4. Go to the **Waypoint** and teach it. Add more waypoints if needed.
5. Repeat steps 3 and 4 if more moves are needed.

NOTE:

Any Move that is relative to the landmark must be placed after and outside the `Eyes Landmark`.

No other nodes should modify the feature point.

If the original landmark needs to be re- taught, the waypoints that are using the current feature point will require a reteach.

Each time the `Eyes Landmark` command is executed, the pose of the feature point will be updated, and the `Move` command that uses the feature point will be modified accordingly.

In the robot program, the created variables and their assignations can be seen. These variables are explained below:

`EyesLndmrkDet`: Latest detected Landmark pose with respect to robot base frame.

`EyesLndmrkFeat`: Pose of the feature point associated to Landmark.

`EyesLndmrkOrig`: Original Landmark pose with respect to robot base frame.

5.1.2. Best Practices – Eyes

This section describes general and specific advices how to improve the performance of Eyes during configuration.

5.1.2.1. Check Detection on the Full Workspace

Good practice:

Check that the part location and the inspection tasks give the expected results before you finish the configuration.

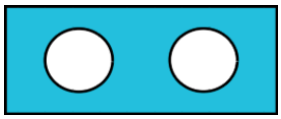
- Check all corners of the selected region of interest.
- Check several orientations of the workpieces that Eyes will detect.

5.1.2.2. Sort Objects Using Part Location by Workpiece's Inner Features

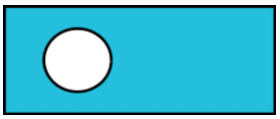
Part location method using workpiece's inner features has effective sorting features. It can sort adjacent objects and partially occluded objects. However, these features can lead to unexpected sorting behavior when the features of one of the sorted items are also present on the other item.

Example

You want to pick and sort two workpieces. The taught workpieces are the following and both of them are selected in the Eyes task configuration:

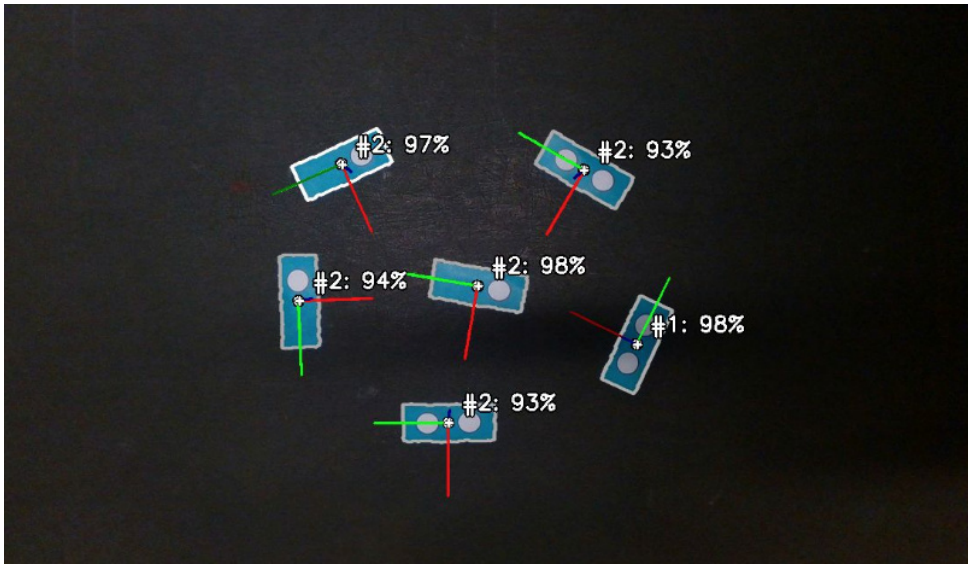


Workpiece 1



Workpiece 2

In this case, Eyes might incorrectly classify Workpiece 1 as Workpiece 2.
However, Eyes will always correctly identify Workpiece 2, see below:



If such an application is required, it can still be solved with Eyes as follows:

1. Create two different Eyes tasks:
   - Associate the first task with the workpiece with more features (Workpiece 1 in the Example).
   - Associate the second task with the workpiece with less features (Workpiece 2 in the Example).

   Each task locates only one of the workpieces.
2. In the robot program, do the following:
   - Locate and pick the items using the Eyes task, which is associated with the workpiece with more features (Workpiece 1 in the Example).
   - Repeat the process using the second Eyes task, which is associated with the workpiece with less features (Workpiece 2 in the Example).
3. All pieces are correctly classified and picked.

5.1.2.3. Set Parameters on Inspection by Using Workpiece's Inner Features

The goal of an inspection task is to differentiate between correct and defected workpieces. Set the parameters so Eyes correctly identifies which parts of the object are defected.

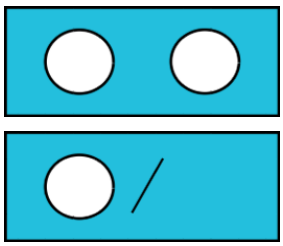
Two types of defects can be identified:

- Defected areas due to color changing, displayed in cyan blue.
- Defected edges or lines due to differences in edges, displayed in magenta.

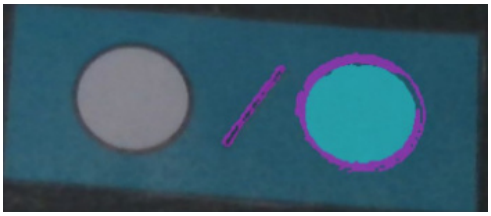
Good practice:

- Initially try to detect the defect on the workpiece with only one of the above types of defects. Start from the one that fits better the expected defects on your workpiece.
- Use both types of defect detection when the expected defects of your workpiece cannot be detected by either of the above types.

  The two types of defects are correctly displayed in the detailed view when the **Color difference tolerance**, the **Minimum edge strength**, and the **Edge difference tolerance** parameters are correctly adjusted.



Taught workpiece and defected item



Result

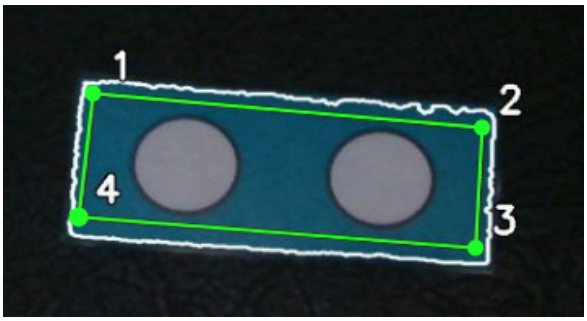
- Set the **Defect size threshold** to differentiate between correct and defected items.

5.1.2.4. Set Inner Region of Interest when Using Inspection by Using Workpiece's Inner Features

Good practice:

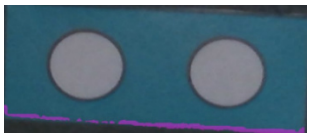
- Set the inner region of interest  around the feature that Eyes will inspect. Setting the inner region of interest will generate more robust results and a more consistent output.

  It is highly recommended to set the inner region of interest when looking for edge defects and if only the inner details of the object are being inspected. Set the inner region of interest as follows:

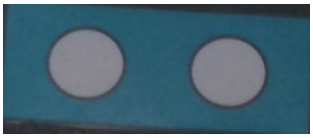


- With this setting Eyes avoids detecting extra defects due to the workpiece orientation not being perfectly matched to the taught workpiece.

  The following example shows an item that has no defects.



Region of interest is not set



Region of interest is set as recommended

5.1.3. Best Practices – Eyes Lighting Kit

This section describes some recommendations how to use the Eyes Lighting Kit.

5.1.3.1. Light Reflections

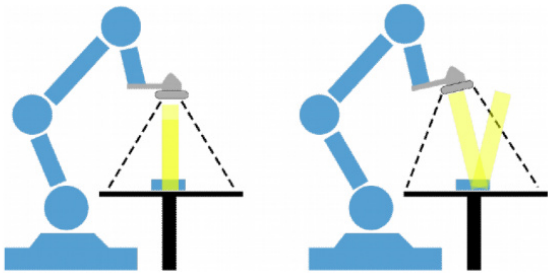
Using artificial lighting in your setup can create reflections depending on how the light, the object, and the camera are placed with respect to each other.

When the light is mounted on the camera and on the robot, it can cause a brighter spotlight in the center of the image.

If this is a problem in your application, mitigate it in one of the following ways:

Tilt the camera

When you tilt the camera, the light will not be reflected directly into the camera, thus the spotlight in the image will be reduced. It is recommended to use a tilt of 5 degrees.



Place some objects on a reflective background and see the effect of this technique on these objects. When the camera is parallel to the picking table, the light gradient appears from the center of the image, covering most of the usable workspace.

On the other side, when you tilt the camera, the spotlight does not affect the center of the workspace, and thus the illumination is more uniform in that area.



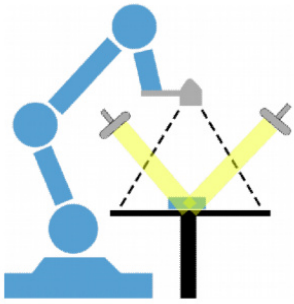
Not tilted



Tilted

Use externally mounted light

Place the external light to avoid the light being reflected directly into the camera.



With this approach, you can get rid of the spotlight altogether as you can move the reflection point out of the view of the camera.

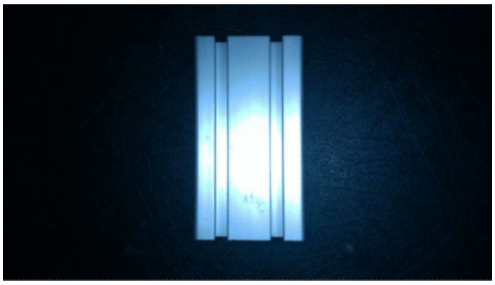


The following limitation apply when you use externally mounted light:

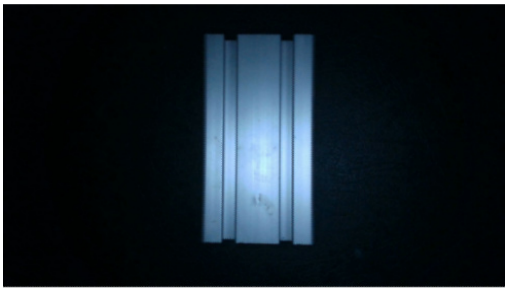
- It is easy to cast undesirable shadows on the background as the light is not on the same axis as the camera.
- The application will require a larger space as the light needs to be mounted externally.

5.1.3.2. Use the Diffuser

Diffused light can be used to illuminate the workpieces in a more uniform way. It works best when the camera is close to the workpiece and the light intensity is set to a low level.
See the following examples:



No diffuser

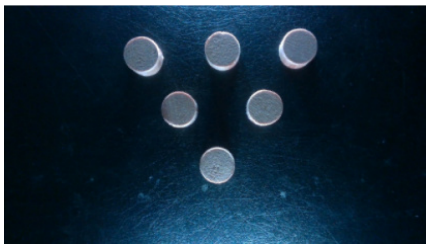


Diffuser

Using the diffuser will not eliminate reflections on reflective objects and/or backgrounds. It only distributes the light in a slightly more uniform way.

5.1.3.3. Enhance Surface Features and Edges

Use this approach when inspecting surface defects on objects as the approach enhances the features of the object.
The approach is represented in the figures below. The light is directed at a heavy angle, so it is only reflected on the edges and other surface features of the objects.
See an example as follows:



Light from the sides



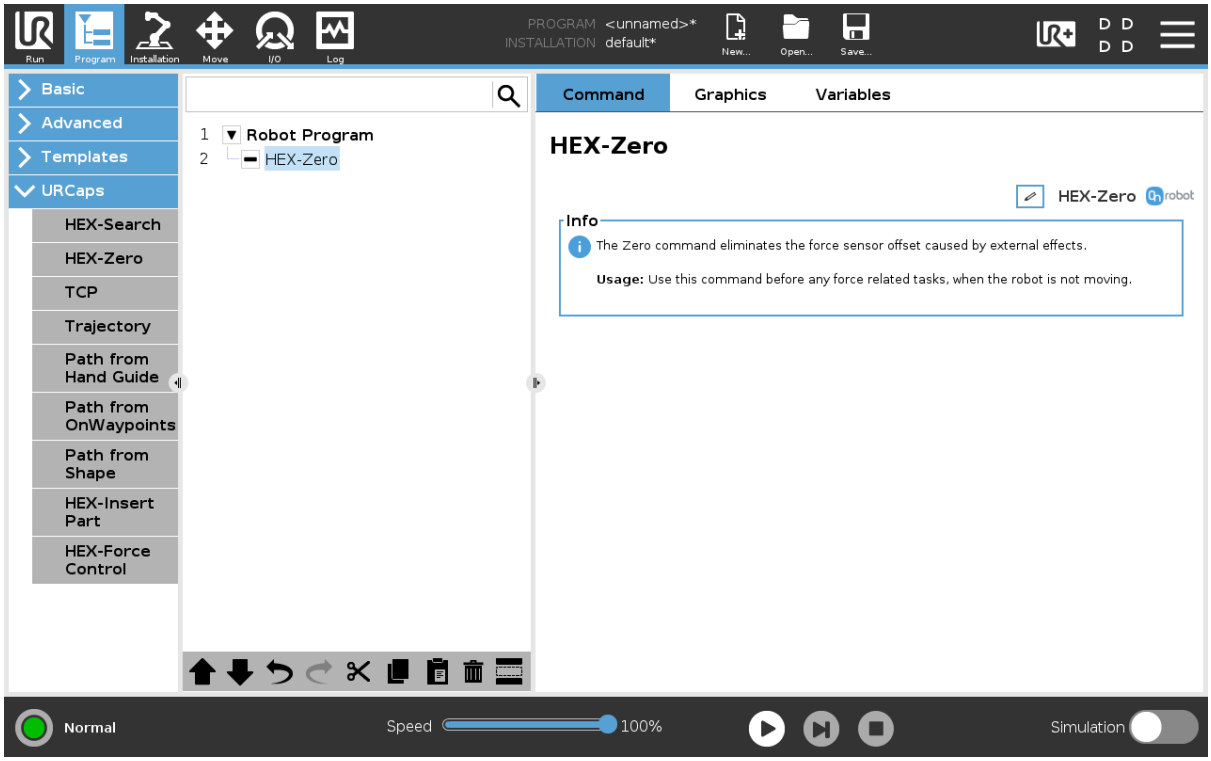
Light from the top

5.1.4. HEX-E/H QC

5.1.4.1. HEX-Zero

The `HEX-Zero` command eleminates the HEX sensor offset caused by external effects.

This command needs to be used when the robot is not moving and before executing any force related tasks.



5.1.4.2. HEX-Insert Part

The `HEX-Insert Part` command can be used to insert a part into a hole.

The part needs to be pointing in the right direction and needs to be close to the hole entrance. You can choose between two hole entrance finding methods. Then the robot tries to insert the part with the predefined force limit. The final position and orientation will be corrected by the `HEX-Insert Part` command.

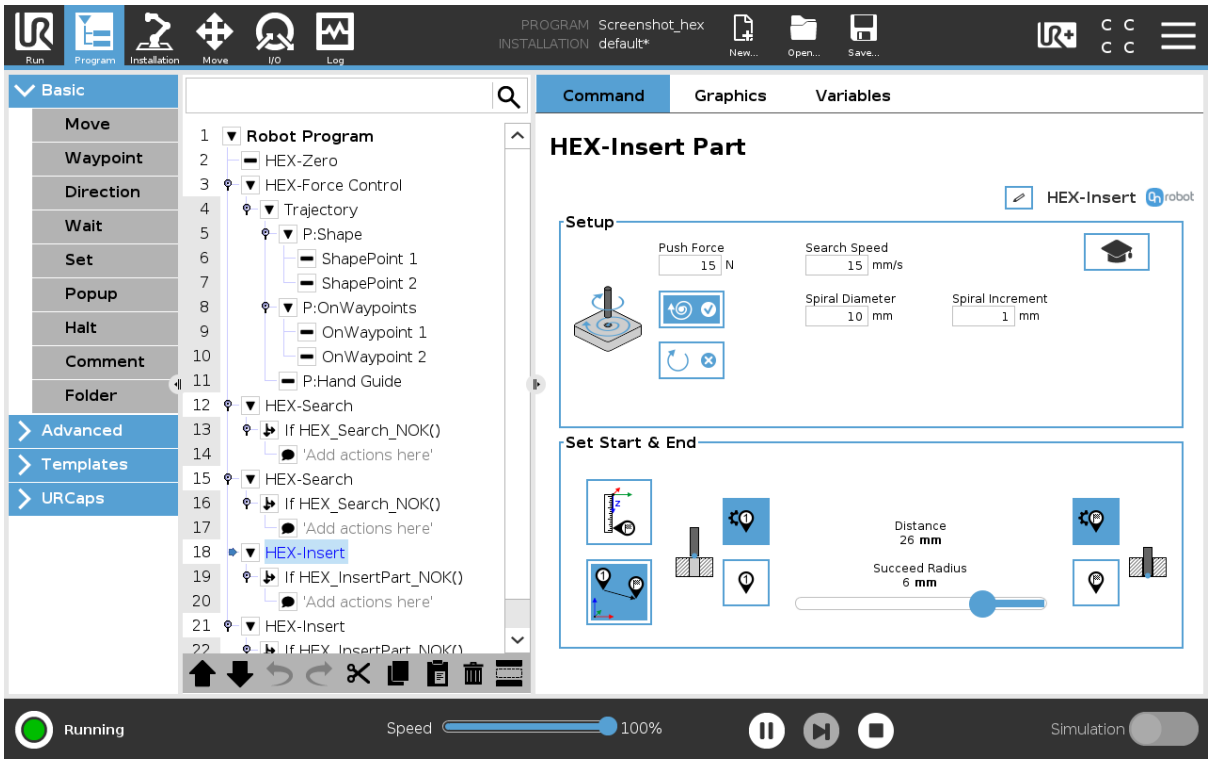
NOTE:

Make sure that the tool is not in contact with any object before starting the program.

Setup the `HEX-Insert Part` command:

1. Choose a hole entrance finding method - optional
2. Set the part insertion parameters

1. Set the hole entrance finding method



Setup

These settings are applicable for both absolute and relative movements.

Push Force: The force target value, which defines how big force can be used during the insertion. It is also used during the hole entrance finding to limit the contact force. The force is measured along the Tool Z axis.

Search Speed: The movement speed of the tool, during the hole entrance finding.

Hole entrance finding method:

None, one or both method can be enabled.

- **None** - The robot is already in position, no need to find the hole entrance or the right orientation. **Spiral** and **Rotate** options needs to be disabled.
- **Spiral**  - The robot approaches the surface and starts a spiral motion to find the hole entrance. The maximum **Spiral Diameter** and the **Spiral Increment** can be set. If the maximum **Spiral Diameter** is reached, the insertion is unsuccessful.
- **Rotate**  - The tool rotates the part to fit it into the hole. The rotation angle and the torque value can be set. The rotation direction uses the right-hand rule. This can be used, for example when inserting gears. If the maximum **Angle** is reached, the insertion is unsuccessful.



2. Set the part insertion parameters

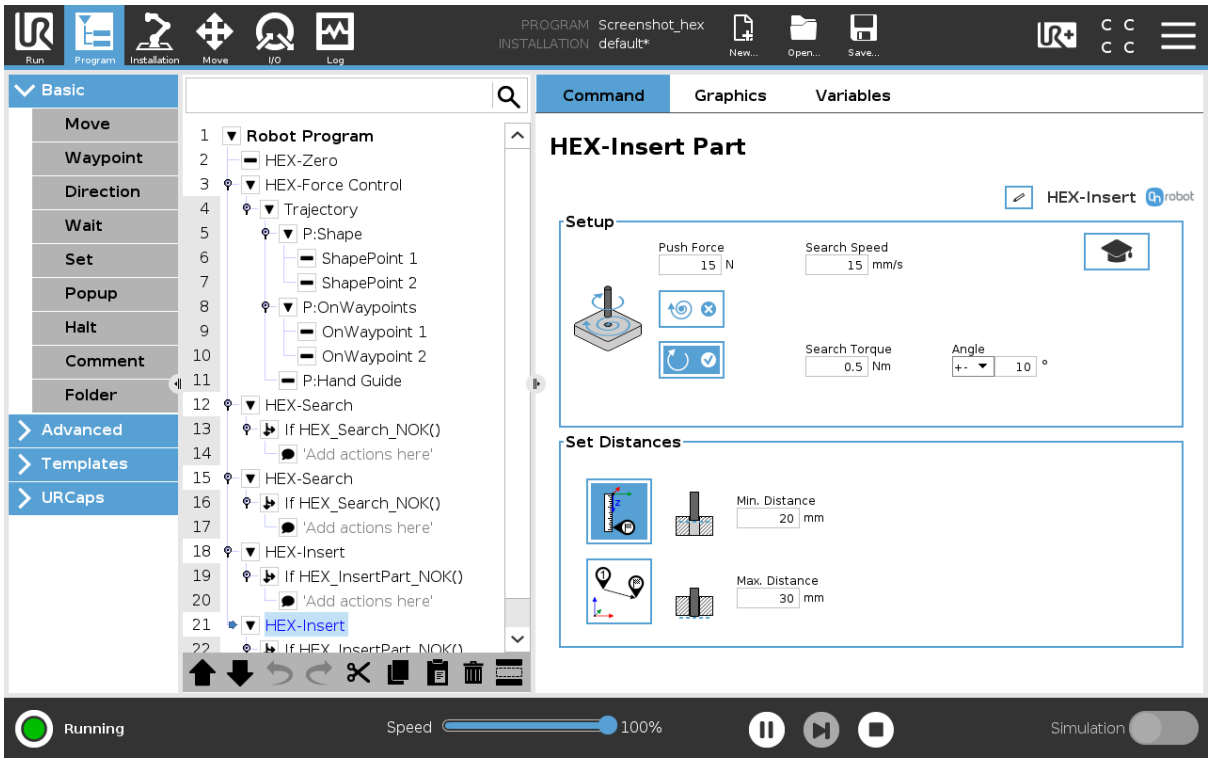
Select the image to use either **Absolute**  or **Relative**  movement for the part insertion.
By default, **Absolute** movement is selected.

Set Start & End

These settings are applicable for absolute movement.

Set the start  and the end  positions of the operation. The start position will be approached with the **Approach Speed** and the hole entrance finding (if selected) is started from that position.

The  and  buttons move the robot to the saved start and end points, respectively. In some cases the exact end position cannot be given. In this case, define a range around the end position using the **Succeed Radius** slider. When the robot reaches this radius, the operation is considered successful.



Set Distances

These settings are applicable for relative movement.

The robot starts the insertion process (and the optional hole entrance finding) from its actual position.

Min. Distance: The minimum distance of the insertion. The insertion is successful, if the **Push Force** is reached and this distance is reached.

Max. Distance: The maximum distance of the insertion. The insertion is successful, if this distance is reached.

Advanced Settings

Pressing the advanced settings icon  displays additional options.

Gain of Force: The proportional gain parameter of the force control for the pushing force, and the side forces.

Gain of Torque: The proportional gain parameter of the torque control.



NOTE:

High gain values can result in vibration and protective stop. Higher mass and bigger distance can be vibrating more easily.

Approach Speed: The speed of the movement with which the robot approaches the start position. Only applicable for absolute movement.

Timeout: The time of the whole insertion operation. If it is set to zero, this exit criterium is neglected.

Exit conditions

The `HEX-Insert Part` command is successful, if one of the following statements are true:

- The robot reaches the end position (absolute movement) or the maximum distance (relative movement).
- After the robot reached or passed the radius (absolute movement) or the minimum distance (relative movement) and the contact force reached the **Push Force** defined in **Setup**.

The `HEX-Insert Part` command is unsuccessful, if one of the following statements are true:

- The time defined in **Timeout** is elapsed.
- The robot is not moving for a second while the contact force reaches the **Push Force** defined in **Setup**.
- The maximum **Spiral Diameter** is reached during Spiral movement (hole entrance finding).
- The maximum **Angle** is reached during Rotation movement (hole entrance finding).

If the command is unsuccessful it enters into the `If HEX_InsertPart_NOK()` node of the program.

5.1.4.3. HEX-Force Control

Applications such as deburring, sanding or grinding may require holding constant force/ torque to a defined direction during movements.

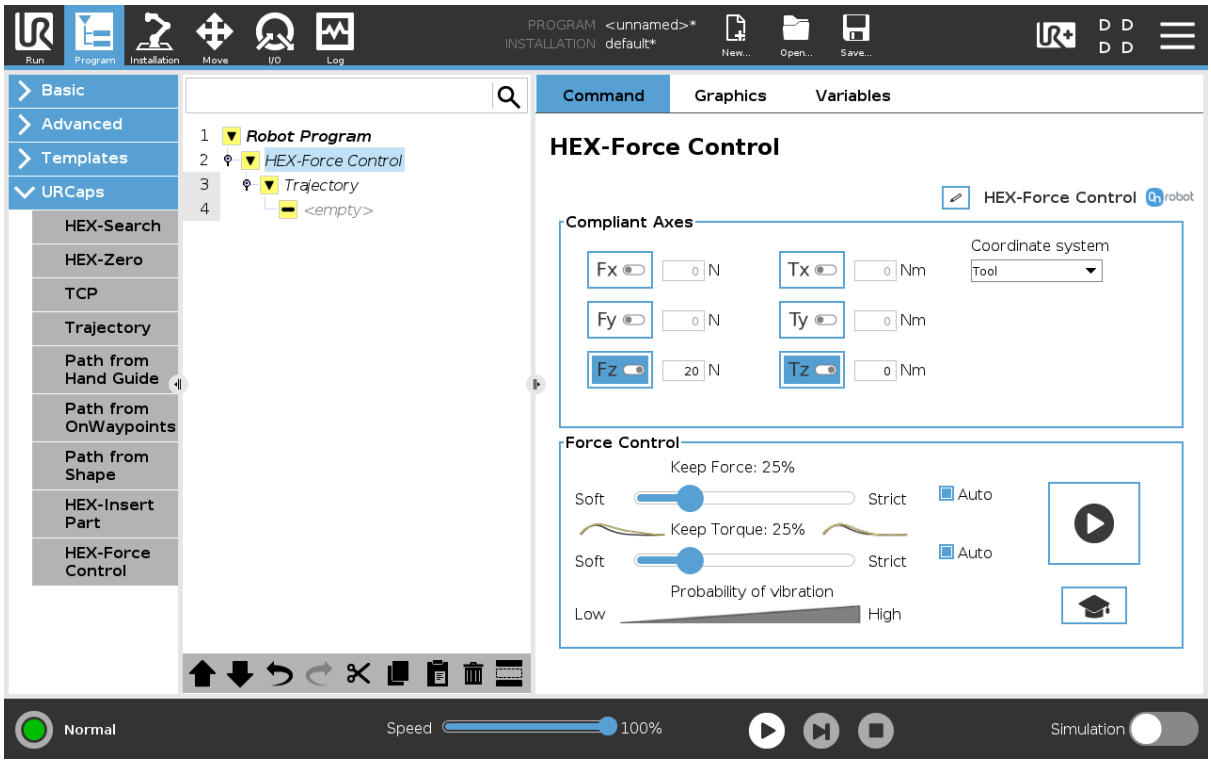
The `HEX-Force Control` command alters the trajectory of its child nodes in order to keep the force and torque values constant along the selected axis. The `HEX-Force Control` command does not control forces in the direction that the tool is moving using the `Trajectory`, and the `HEX-Search` commands.

The following commands can be used as child nodes:

- `HEX-Search`
- `Trajectory`

NOTE:

To cancel any force or torque offset, execute a `HEX-Zero` command at the beginning of the `HEX-Force Control` command.



: shows the name of the node. It can be edited and saved.

Compliant Axes

Fx, Fy, Fz, Tx, Ty, Tz axis selection. If an axis is enabled (compliant) the movement along that axis is force and torque controlled. The enabled axis is controlled to keep the set force and torque value constant.

Coordinate system: The coordinate system used for the movement. It can be set to Base or Tool.

Force Control

Keep Force: sets the percentage of the force value for the tool to keep during operation.

Press the  button to test the set value.
At a higher percentage value the tool can follow the object more precisely.
Setting the slider to 0 (OFF position) deactivates the force control.

Keep Torque: sets the percentage of the torque value for the tool to keep during operation.

Press the  button to test the set value.
At a higher percentage value the tool can follow the object more precisely.
Setting the slider to 0 (OFF position) deactivates the torque control.

Auto checkbox: enables the system to slightly modify the **Keep Force** and **Keep Torque** parameters during operation to minimize the vibration but maintain the required force and torque value.
By default, the checkboxes are selected.

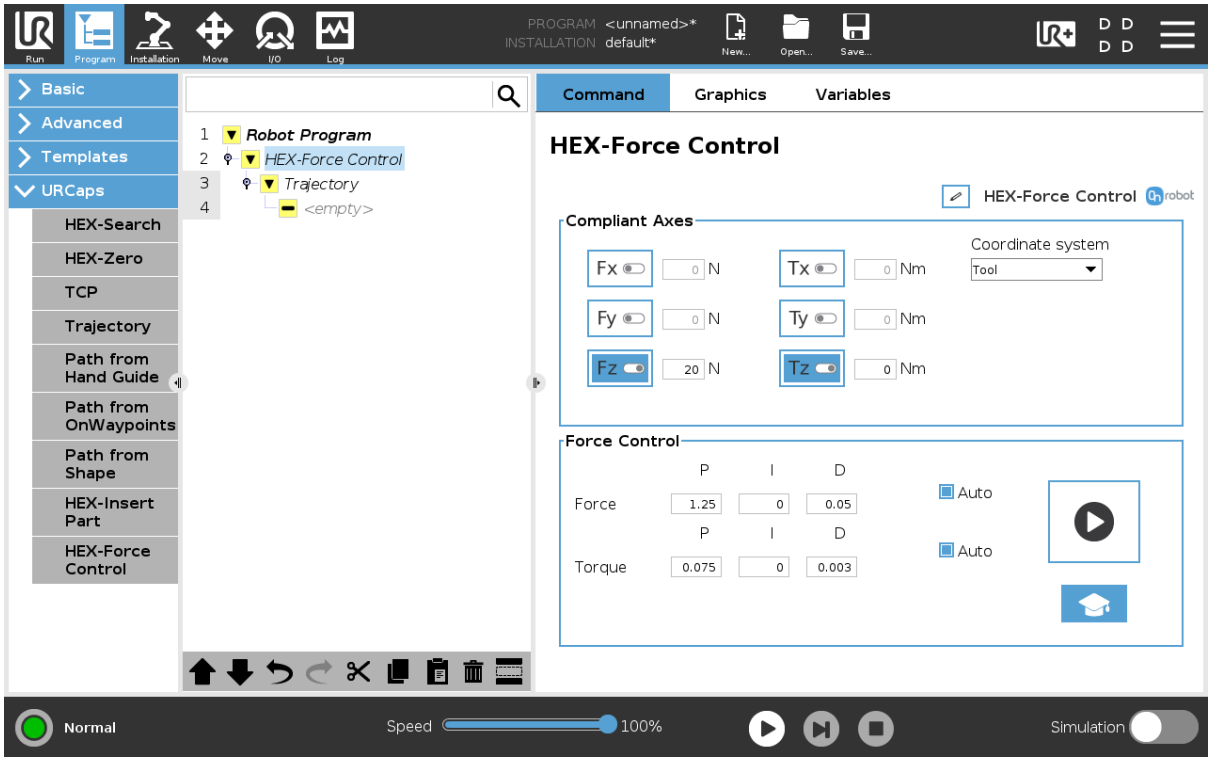
Force Control Advanced Settings

Pressing the advanced settings icon  displays additional options and allows fine-tuning the force and torque settings.

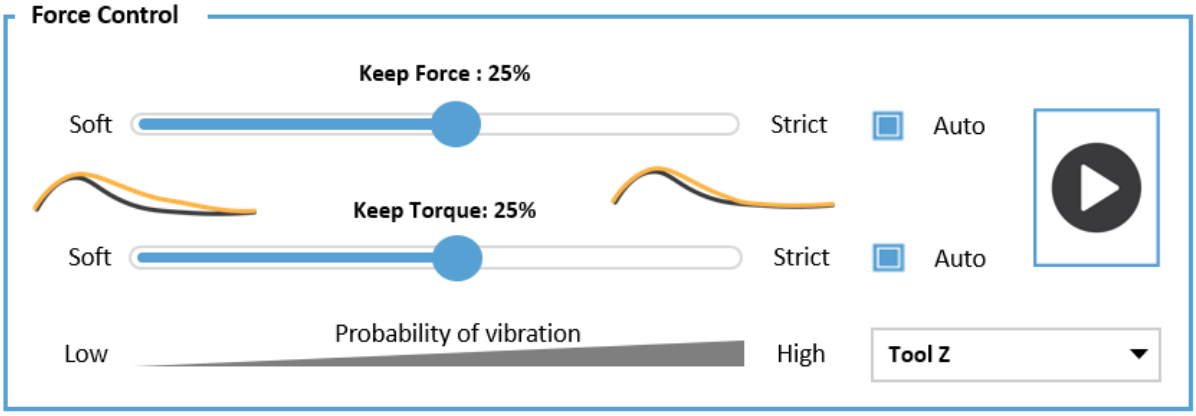
P: The force and torque controller can be tuned with this proportional gain parameter. If any overshoots or vibrations occur, try lowering the gain value (For example: 0.5).

I: The force and torque controller can be tuned with this integral gain parameter. If any overshoots or vibrations occur, try lowering the gain value.

D: The force and torque controller can be tuned with this derivative gain parameter. If any overshoots or vibrations occur, try lowering the gain value.



Setup the Keep Force and Keep Torque Parameters



To obtain the best result the robot path must be well defined. **Force Control** should only adjust for small deviation on the parts, but advanced control can overcome greater deviations. The closer the given path to the actual part is, the better surface finishing can be achieved.

Always verify the path on the workpiece before adjusting the **Force Control**.

In order to obtain the best **Keep Force** and **Keep Torque** parameter settings, follow these guidelines.

Path definition tips

- The path should be close to and at an even distance from the part. High and uneven path distance might result in an uneven result, since at some points the **Force Control** needs to compensate for higher distances.

- The tool should always be perpendicular to the surface. High angular deviation at given points demands higher rotational compensation from the **Force Control**.



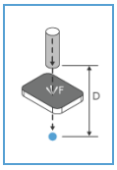
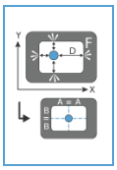
- Verify your path on the workpiece. Before adjusting the **Force Control** parameters, check if the recorded path covers the workpiece as required, and the robot follows the part surface as planned.

Force Control setup tips

- Try playing the path with disabled Force Control and verify that the workpiece is followed by the tool correctly. For this both the **Keep Force** and **Keep Torque** parameters should be 0% (OFF).
- Gradually increase the **Keep Force** parameter in 5-10% increments. The value of 25% should be suitable in most applications.
- If the **Keep Force** parameter is set and the path is well defined, the **Keep Torque** parameter can be 0% (OFF) in most cases. If it is required to apply torque, for example, when the torque is reduced by the workpiece deviation, the **Keep Torque** parameter should also be gradually increased and checked for result.
- It can happen that the tool overturns. In this case check if the tool slides well on the surface or decrease the **T(Torque)** level and/or the **Keep Torque** value.

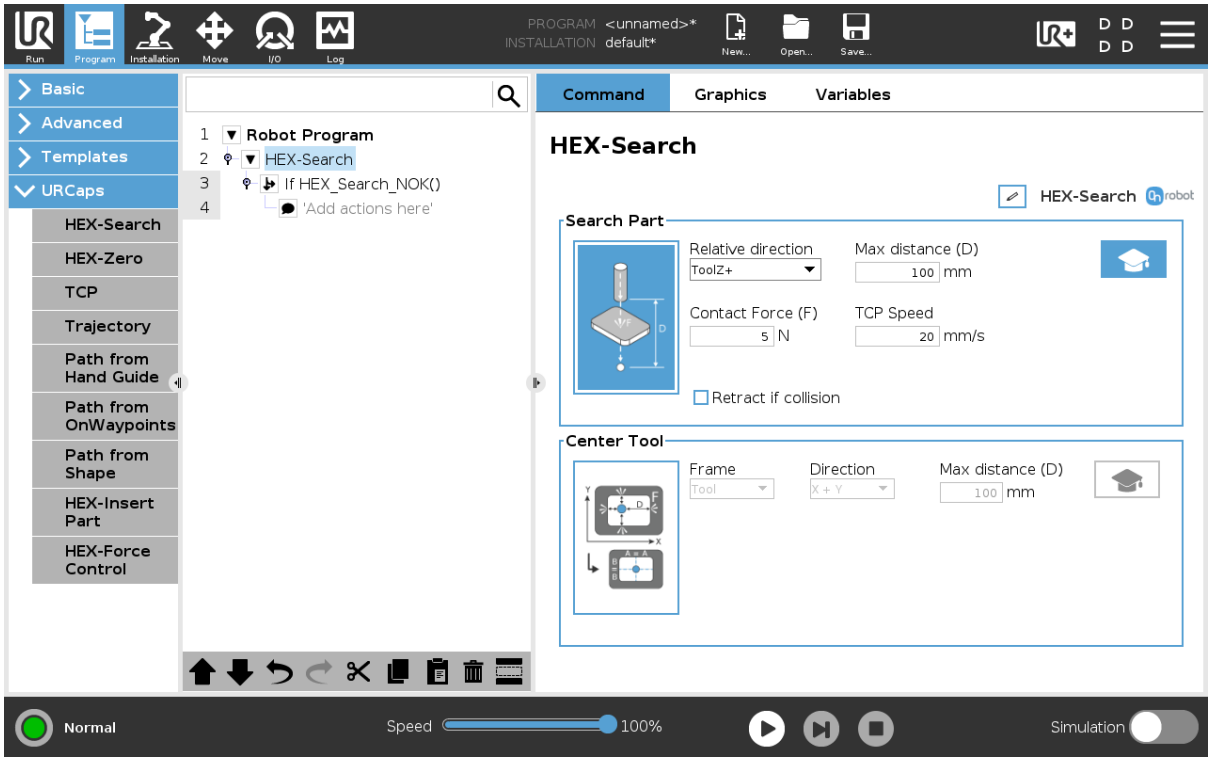
5.1.4.4. HEX-Search

The `HEX-Search` command is used to move the robot along a route and detect contact with an object. If the movement reaches the defined maximum distance, rotation, or moves all the way along the set trajectory without any contact, the search is not successful (the object is not found).

Select the image to use either the **Search Part**  or the **Center Tool**  options.

Search Part

The **Search Part** option can be used, for exapmle to find and remove the top object from a stack. If no more objects are found the stack is empty, therefore the search is unsucessful.



: shows the name of the node. It can be edited and saved.

This option searches in a specified direction, distance, rotation or along a trajectory for an object.

Relative direction: The direction in which the search is carried out. This can be set in a direction relative to the tool, to the base or on a trajectory.

NOTE:

If this setting is changed back from Trajectory to a different setting, the Trajectory node is deleted from the program and the data is lost.

Max distance (D): The maximum distance that the tool is going to move during the search operation.

Max rotation: The maximum rotation that the tool is going to execute during the search operation. The rotation direction uses the right-hand rule.

Search Part Advanced Settings

Pressing the advanced settings icon displays additional options.

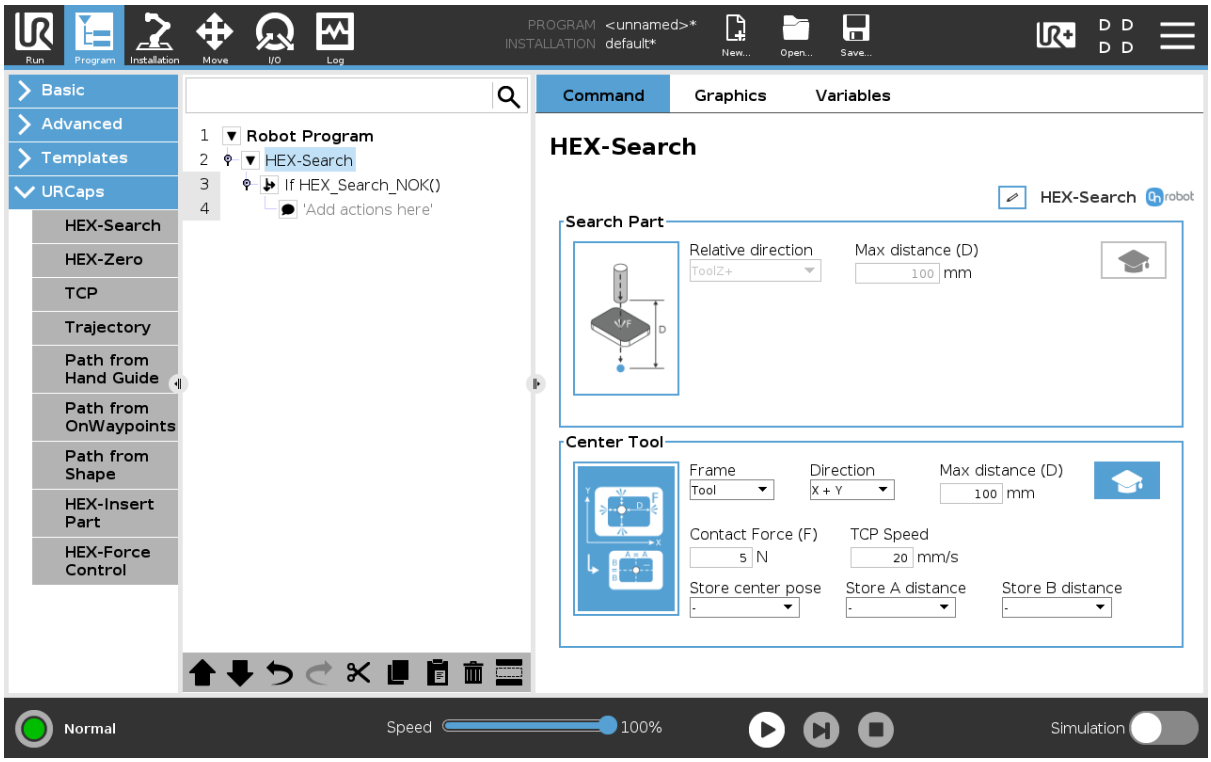
Contact Force (F): The force value that needs to be reached to detect a target object.

TCP Speed: The movement speed while searching for an object.

Retract if collision: If this option is checked, the tool retracts after collision with the object.

Center Tool

The **Center Tool** option can, for example find a center of a hole (various shapes) with a small object.



This option searches in set directions for the perimeters within a set distance, then moves the robot or base to the relative center of the boundaries that have been found.

Frame: Set the Tool or Base.

Direction: The directions in which the search is carried out.

Max distance (D): The maximum distance that the tool is going to move during the search operation. If the range is reached, the detection is unsuccesful.

Max rotation: The maximum rotation that the tool is going to execute during the search operation. The rotation direction uses the right-hand rule.

Center Tool Advanced Settings

Pressing the advanced settings icon  displays additional options.

Contact Force (F): The force value that needs to be reached to detect a target object.

TCP Speed: The movement speed while searching for an object.

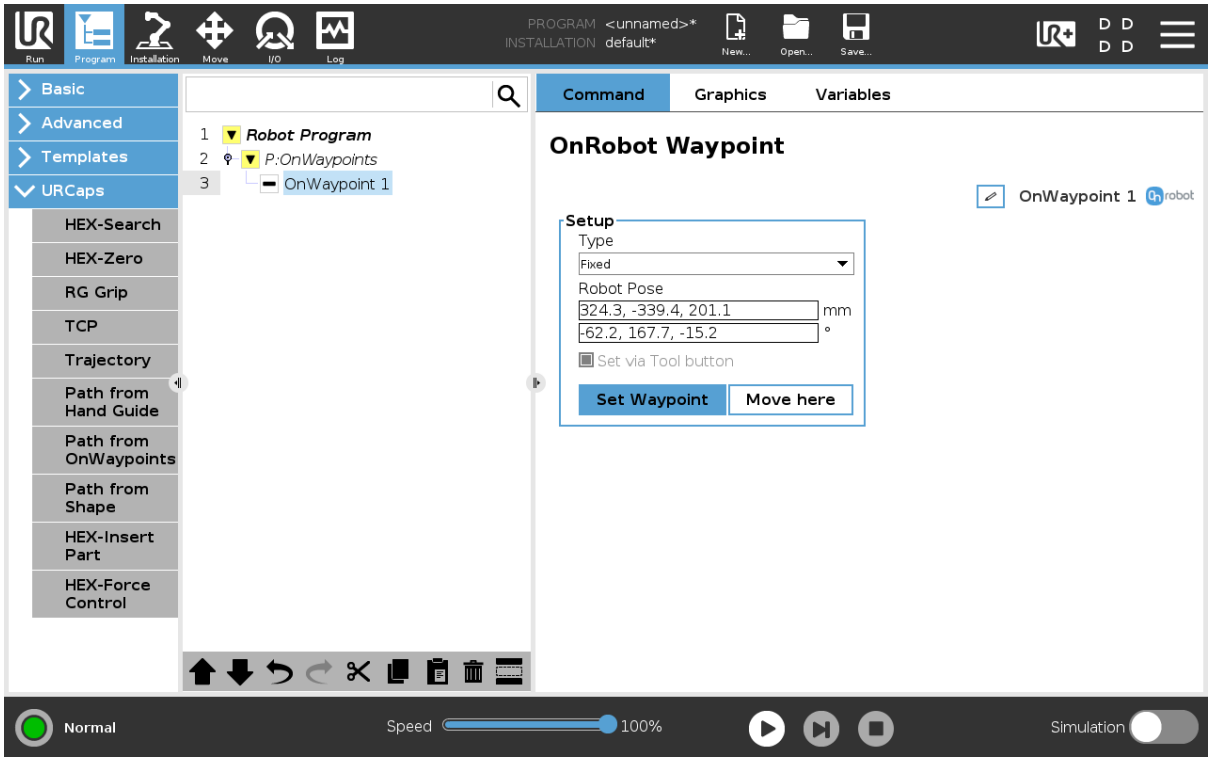
Store center pose: Stores the center position value into a list.

Store A distance: Stores the A relative distance value into a list.

Store B distance: Stores the B relative distance value into a list.

5.1.4.5. OnWaypoint

The `OnWaypoint` command is used to set a position for the robot.



Type: The type of the waypoint. It can be set to Fixed.

Robot Pose: Coordinate and rotation values for the waypoint.

Set via Tool button: This checkbox allows the command to automatically get the **Robot Pose** values when pressing the tool button. In this case, the LED of the Tool button turns to steady green.

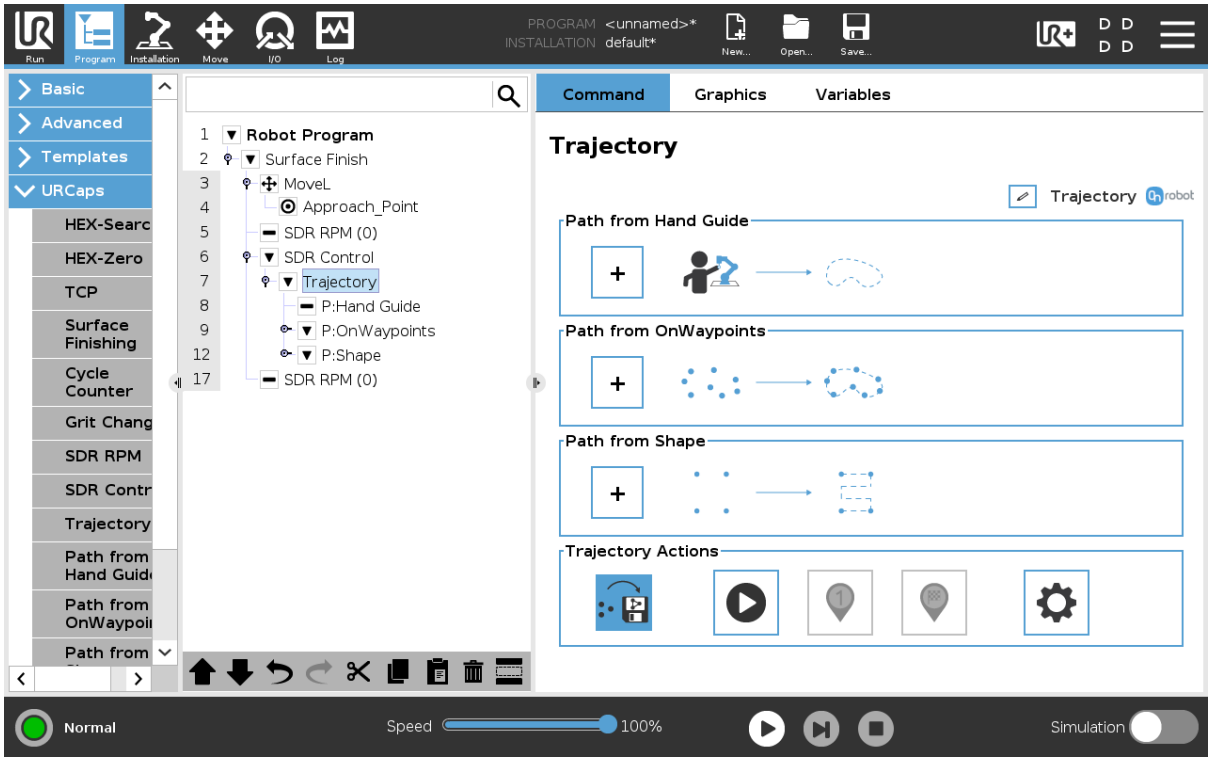
5.1.4.6. Trajectory

The `Trajectory` command specifies the trajectory for the Sander, which is used to follow the object.

The parameters that are set on this page affect the robot motion properties, such as **Speed**, **Acceleration**, and so on.

A complete trajectory can be composed of several paths obtained from a hand guide learning, specified independent waypoints or shapes, or a combination of these.

The generated trajectory is stored on the Compute Box.



: shows the name of the node. It can be edited and saved.

Path from Hand Guide

: inserts a new **Path from Hand Guide** child node.

Path from OnWaypoints

: inserts a new **Path from OnWaypoints** child node.

Path from Shape

: inserts a new **Path from Shape** child node. Automatically adds waypoints depending on the selected shape.

Trajectory Actions

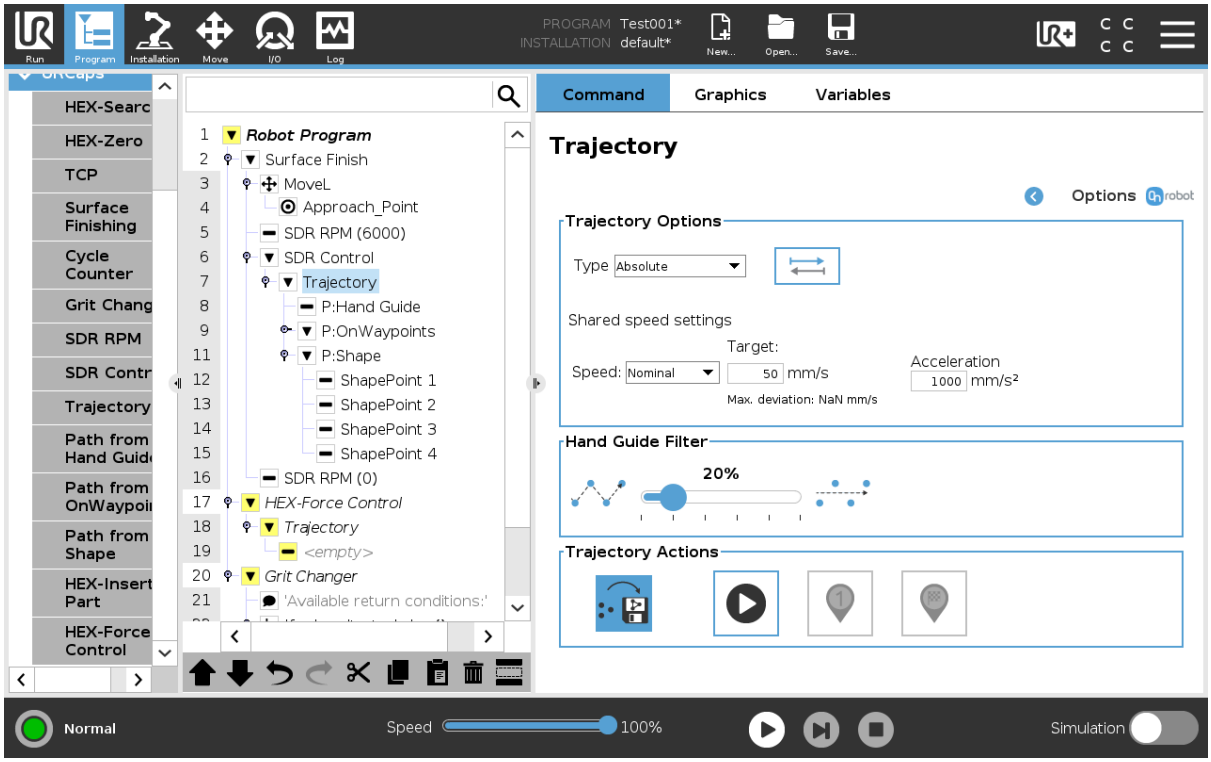
: generates a trajectory from the previously set paths. The generated trajectory is stored on the Compute Box.
When the button is pressed again, the system regenerates only the changed paths.


: starts playing the generated trajectory.


: jumps to the starting point of the trajectory.


: jumps to the endpoint of the trajectory.


: opens the **Trajectory Options** page.



Trajectory Options

Type: sets the trajectory type. The following values can be selected:

- **Relative**: the trajectory is started from the actual position of the TCP.

  It is recommended to use **Relative** mode as trajectory type because the height of the object can vary. When **Relative** mode is selected, the defined `Trajectory` is executed with respect to the first contact point where the sanding will start. Consequently, the OR-Sander will follow the surface of the object more accurately.

- **Absolute**: the Sander moves to the original starting point and the trajectory is started from there.
  When you change the **Type**, a pop-up window informs you that the change affects all child nodes.

: when checked, the system reverses the direction of the trajectory.

Shared speed settings: these settings are got from the preset values, set on the **Surface Finishing** page. You can also define the settings on this page.

Speed: sets the speed type of the trajectory. The following values can be selected:

- **Nominal**: use this option is you want to have even TCP speed but can accept speed changes in some cases, for example, in the corners of the object.
- **Constant**: use this option if you want to keep exactly the same speed on the whole surface.
- **As recorded**
  When you specify only hand guide paths, the speed can only be **As recorded**.

Target: sets the target speed value.

Max. deviation: when the **Speed** type is set to **Nominal**, it shows the maximum deviation value which can occur during playback.

Calc. maximum: when the **Speed** type is set to **Constant**, it shows the maximum suggested speed for the trajectory which the robot can execute.

Acceleration: sets the target acceleration value.

Hand Guide Filter

Filter Slider: sets the smoothness of the hand guide path.

Remove pauses: removes unwanted pauses (parts where the robot motion is less than 1 mm) from the path where the robot does not move. The following values can be selected:

- **None**: does not remove any pauses from the path.
- **All**: removes all unwanted pauses from the path.
- **Start**: removes unwanted pauses from the beginning of the path.
- **End**: removes unwanted pauses from the end of the path.
- **Start & End**: removes unwanted pauses from beginning and from the end of the path.

Only visible when **Speed** is set to **As recorded**.

Trajectory Actions


: generates a trajectory from the previously set paths. The generated trajectory is stored on the Compute Box.
When the button is pressed again, the system regenerates only the changed paths.


: starts playing the generated trajectory.

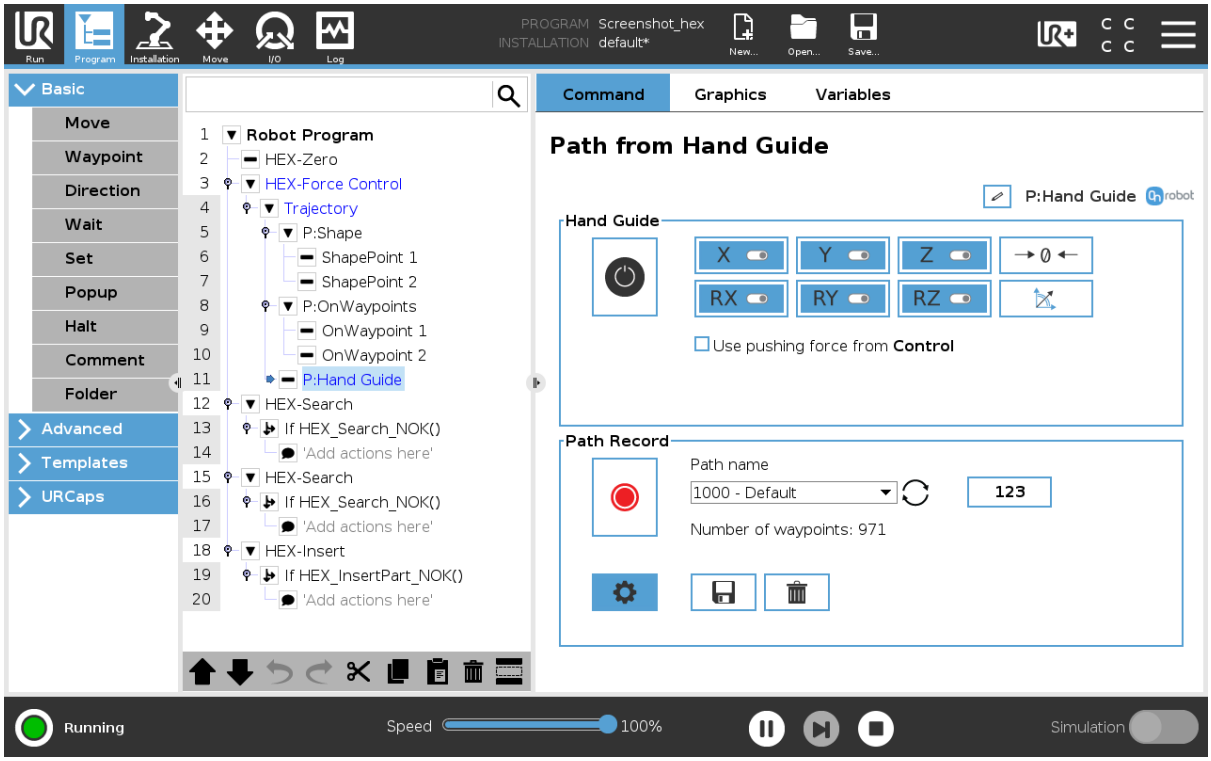

: jumps to the starting point of the trajectory.

: jumps to the endpoint of the trajectory.

5.1.4.7. Path from Hand Guide

The `Path from Hand Guide` command generates a path using hand guide.

The color of the node is yellow until the path is saved.



: shows the name of the node. It can be edited and saved.

Hand Guide

: enables or disables hand guiding.

Use pushing force from **SDR Control**: uses the **Push Force (F)** value set for the **SDR Control** node, see **SDR Control**.
Only visible if an **SDR Control** node exists.

The **Hand Guide** shows which axes are enabled for movement, the zero button  and the snap to axes button .

To toggle on or off on an axis, tap the button. An axis is enabled if it turns from white to blue and enables movement along the axis.

In the following example, the X, Y, Z, RX, RY, RZ items are selected:



NOTE:

The used coordinate system is the Tool.

It is possible to activate or deactivate axes during hand guiding.

To start hand guiding the UR robot, make sure that you do not touch the tool and then press and hold the enable button . Wait until the enable button turns blue and drive the robot by hand with the help of the OnRobot sensor.

NOTE:

Make sure that you do not touch the tool before the hand guiding is activated, otherwise the robot can behave abnormally (e.g..: the robot could move without any external force exerted). In this case, press the zero  button, while you are not touching the tool.

Make sure that you do not use the zero  button while touching the tool.

To stop hand guiding the UR Robot, tap the enable button .

The zero  button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

The snap to axes button  rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

NOTE:

If you are experiencing vibration, grab and guide the tool at the Center of Gravity (roughly it is at the center).

Path Record

: starts the recording of the waypoints.

Path name: selects a path from the drop-down list.

: reloads the list of saved paths.

Number of waypoints: shows the number of waypoints.
When you add a new waypoint, the number increases.

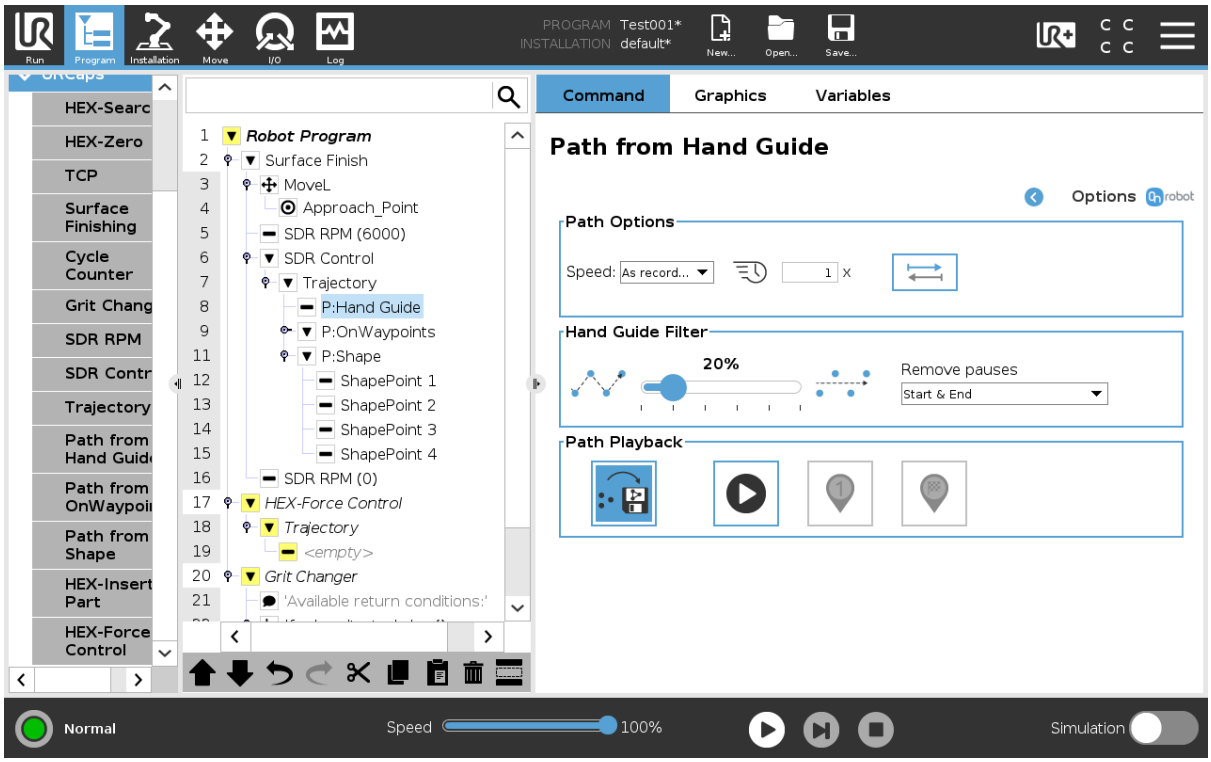
123/ABC : changes the order of the path name list. The order can be numeric or alphabetical.

Not saved: indicates that the path is not saved and it is not empty.

: saves the path.

: deletes the opened path.

: opens the **Path Options** page.



Path Options

By default, the **Speed** settings are marked with gray (disabled) and got from the preset values, set on the **5.1.4.6. Trajectory** page. By selecting another speed type, the fields are enabled and can be edited.

Speed: sets the speed type of the movement. The following values can be selected:

- **Nominal**: use this option is you want to have even TCP speed but can accept speed changes in some cases, for example, in the corners of the object.
- **Constant**: use this option if you want to keep exactly the same speed on the whole surface.
- **As recorded**
  When you specify only hand guide paths, the speed can only be **As recorded**.

: use this option to speed up or slow down the recorded path.

: when checked, the system reverses the direction of the path.

Acceleration: sets the target acceleration value.

Hand Guide Filter

Filter Slider: sets the smoothness of the hand guide path.

Remove pauses: removes unwanted pauses (parts where the robot motion is less than 1 mm) from the path where the robot does not move. The following values can be selected:

- **None**: does not remove any pauses from the path.
- **All**: removes all unwanted pauses from the path.
- **Start**: removes unwanted pauses from the beginning of the path.
- **End**: removes unwanted pauses from the end of the path.
- **Start & End**: removes unwanted pauses from beginning and from the end of the path.

Only visible when **Speed** is set to **As recorded**.

Path Playback

: generates a trajectory from the previously set paths. The generated trajectory is stored on the Compute Box.
When the button is pressed again, the system regenerates only the changed paths.

: starts playing the hand guide path.

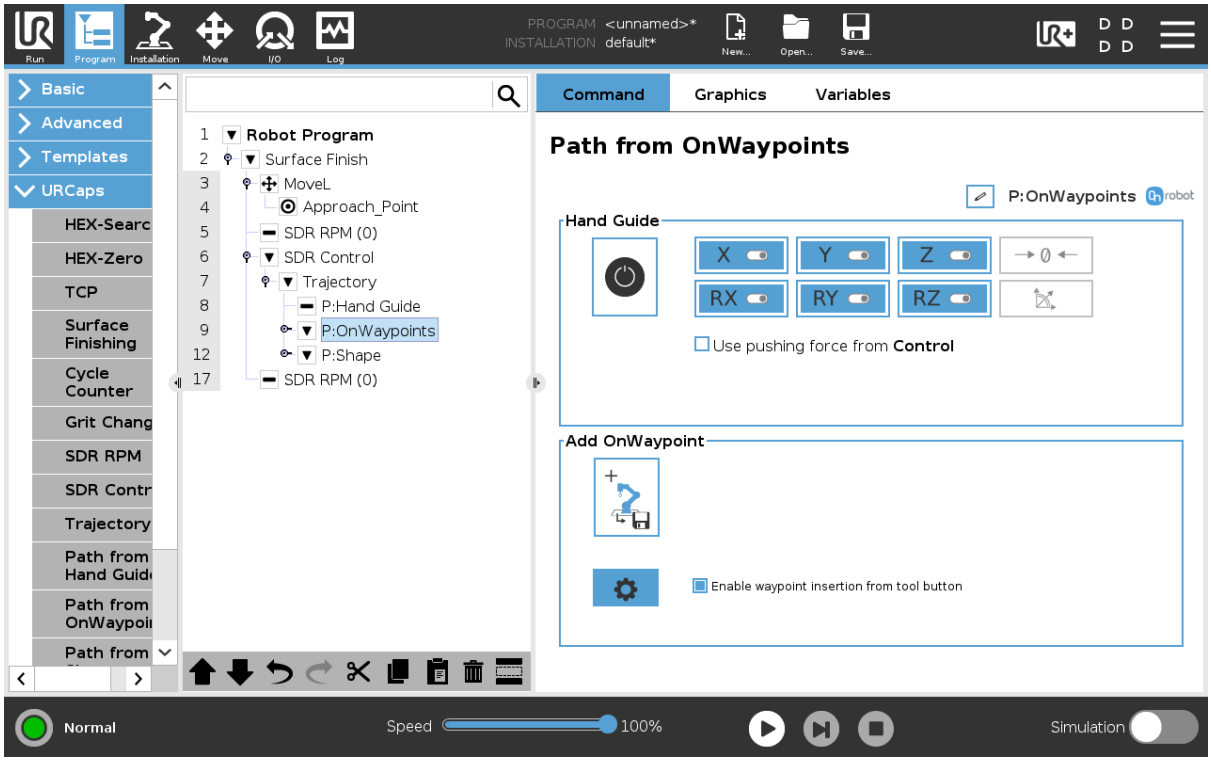
: jumps to the first element of the path.

: jumps to the last element of the path.

5.1.4.8. Path from OnWaypoints

The `Path from OnWaypoints` command generates a path using specified waypoints.

The color of the node is yellow until the path is saved.



: shows the name of the node. It can be edited and saved.

Hand Guide

: enables or disables hand guiding.

Use pushing force from **SDR Control**: uses the **Push Force (F)** value set for the **SDR Control** node, see **SDR Control**.
Only visible if an **SDR Control** node exists.

The **Hand Guide** shows which axes are enabled for movement, the zero button and the snap to axes button .

To toggle on or off on an axis, tap the button. An axis is enabled if it turns from white to blue and enables movement along the axis.

In the following example, the X, Y, Z, RX, RY, RZ items are selected:



NOTE:

The used coordinate system is the Tool.

It is possible to activate or deactivate axes during hand guiding.

To start hand guiding the UR robot, make sure that you do not touch the tool and then press and hold the enable button . Wait until the enable button turns blue and drive the robot by hand with the help of the OnRobot sensor.

NOTE:

Make sure that you do not touch the tool before the hand guiding is activated, otherwise the robot can behave abnormally (e.g..: the robot could move without any external force exerted). In this case, press the zero button, while you are not touching the tool.

Make sure that you do not use the zero button while touching the tool.

To stop hand guiding the UR Robot, tap the enable button .

The zero button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

The snap to axes button rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

NOTE:

If you are experiencing vibration, grab and guide the tool at the Center of Gravity (roughly it is at the center).

Add OnWaypoint

: when the hand guide is not started, press the button to add new OnWaypoint nodes to the program.

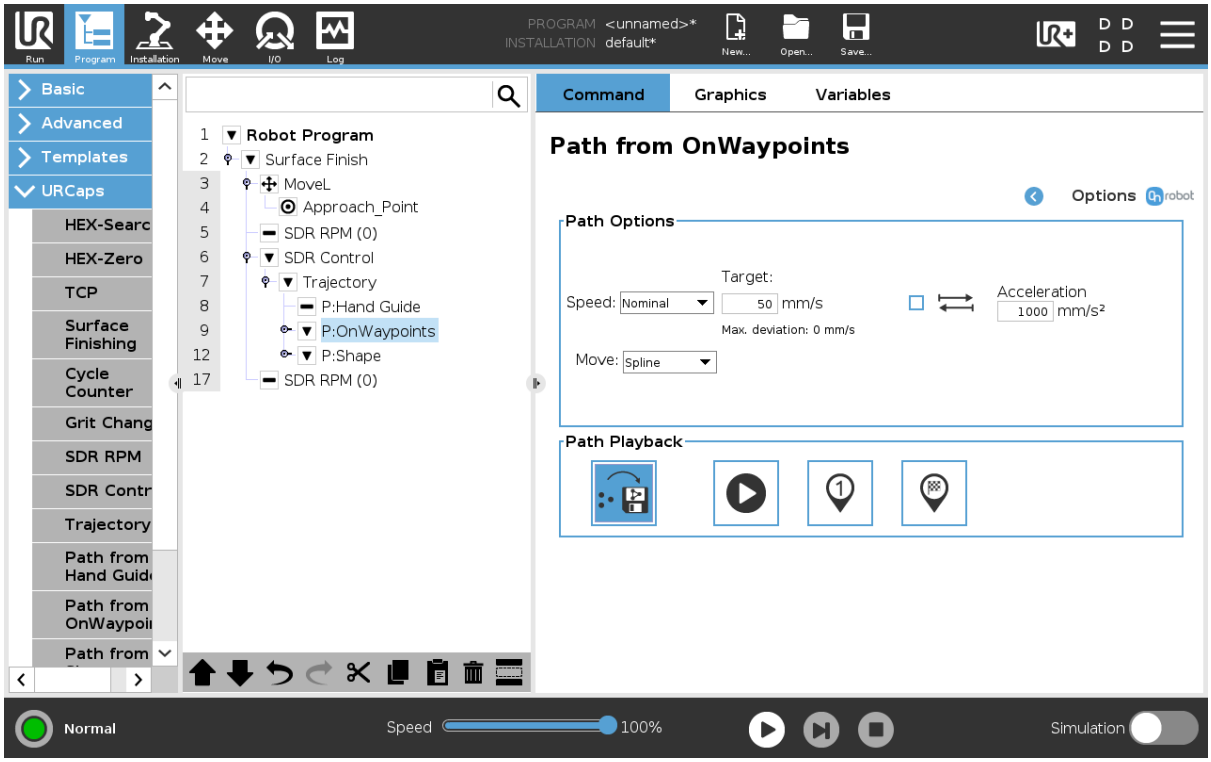
: when the hand guide is started, press the button to save the actual position of the actual TCP.
When the hand guide is stopped, the OnWaypoint nodes are automatically added to the program.

List of the last waypoints: shows the last waypoints added to the program.

Only visible when the  button is pressed.

Enable waypoint insertion from tool button: when checked, a new **OnWaypoint** node can be added by pressing the button on the Sander. In this case, the LED of the Tool button turns to steady green.

: opens the **Path Options** page.



Path Options

By default, the **Speed** settings are marked with gray (disabled) and got from the preset values, set on the 5.1.4.6. Trajectory page. By selecting another speed type, the fields are enabled and can be edited.

Speed: sets the speed type of the movement. The following values can be selected:

- **Nominal**: use this option is you want to have even TCP speed but can accept speed changes in some cases, for example, in the corners of the object.
- **Constant**: use this option if you want to keep exactly the same speed on the whole surface.
- **As recorded**
  When you specify only hand guide paths, the speed can only be **As recorded**.

Target: sets the target speed value.

Max. deviation: when the **Speed** type is set to **Nominal**, it shows the maximum deviation value.

: when checked, the system reverses the direction of the path.

Acceleration: sets the target acceleration value.

Move: sets the type of the movement. The following values can be selected:

- **Spline**: the path points are connected with a spline. It ensures a faster path.
- **Linear**: the path points are connected with linear lines using the **Blend** parameter as the minimum radius. It ensures a more accurate path.

Blend: sets the blending value, only in case of **Linear** movement.

Path Playback

: generates a trajectory from the previously set paths. The generated trajectory is stored on the Compute Box.
When the button is pressed again, the system regenerates only the changed paths.

: starts playing the waypoint path.

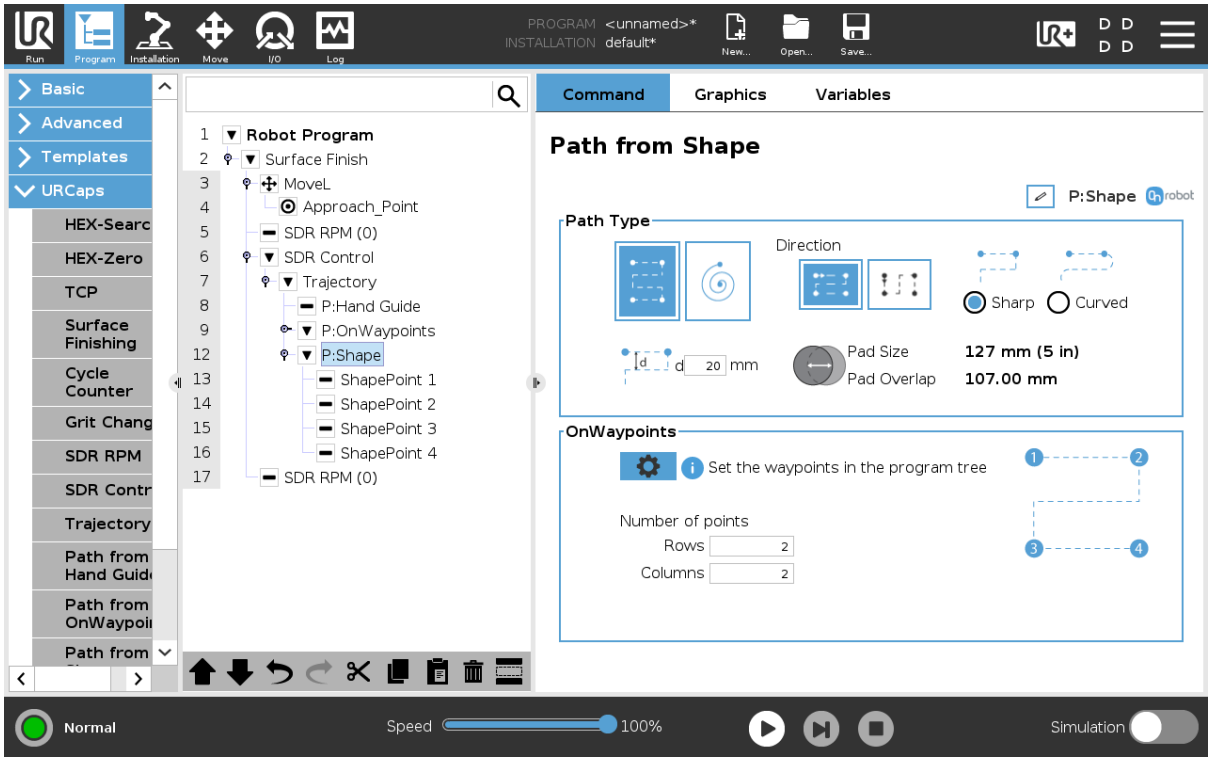
: jumps to the first element of the path.

: jumps to the last element of the path.

5.1.4.9. Path from Shape

The `Path from Shape` command generates a path using different corner point of the part.

The color of the node is yellow until the path is saved.



: shows the name of the node. It can be edited and saved.

Path Type

: select this option to use a squared path.

d: sets the overlap distance between two parallel running of the Sander.

Direction

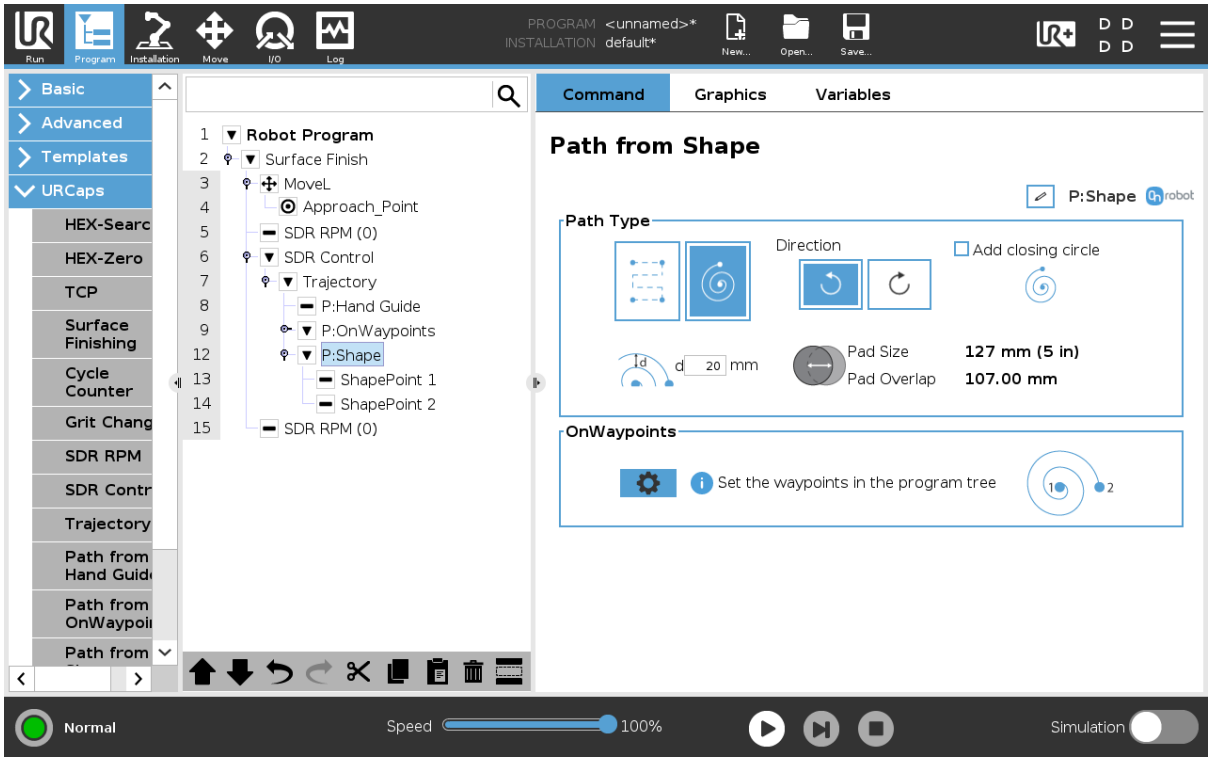
: sets the direction of the path.

Sharp: when checked, the path follows sharp edges.

Curved: when checked, the path follows curved edges.

Pad Size: shows the size of the pad.

Pad Overlap: shows the overlap distance during pad movement.



Path Type

: select this option to use a spiral path.

d: sets the overlap distance between two parallel running of the Sander.

Direction

: sets the direction of the path clockwise or counterclockwise.

Add closing circle: when checked, the spiral path is closed.

Pad Size: shows the size of the pad.

Pad Overlap: shows the overlap distance during pad movement.

OnWaypoints

Displays the point that you set on the path. The number of points is added automatically based on the selected shape type.

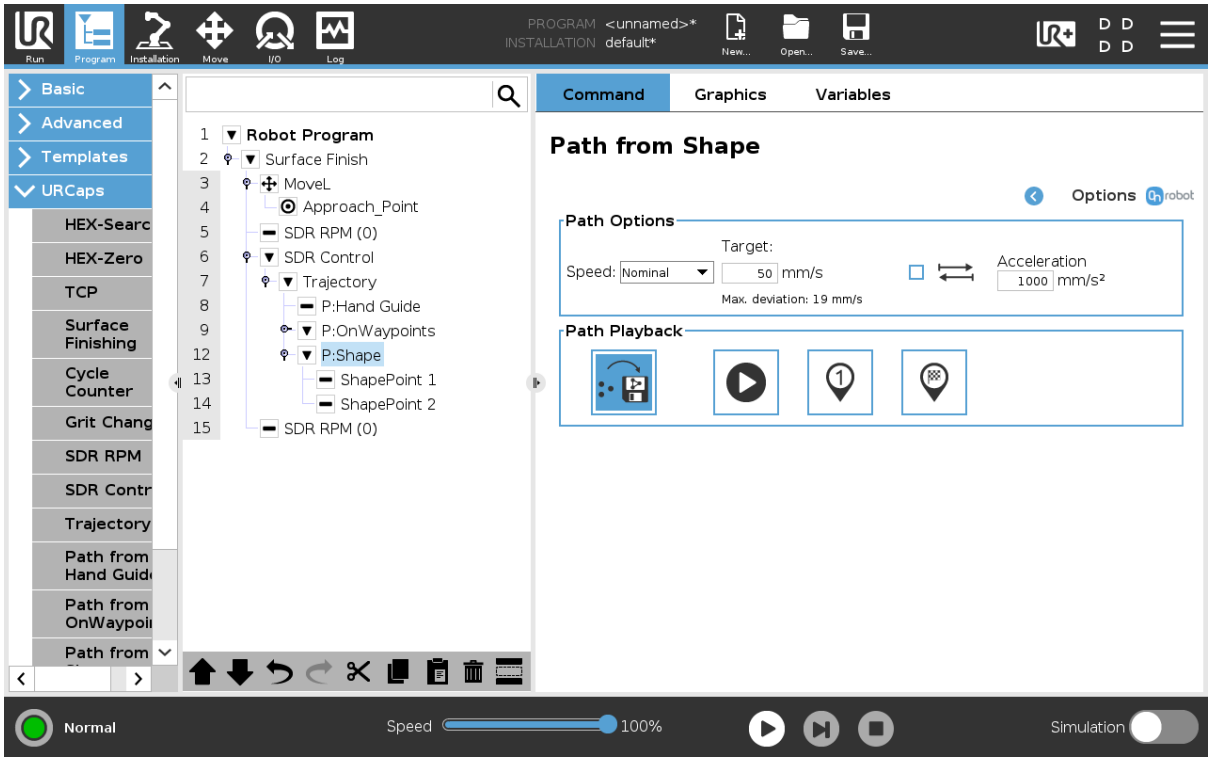
: opens the **Path Options** page.

Number of points
This option is only displayed when squared path is selected.

NOTE:

Minimum 2x2, maximum 3x5 points can be configured.

- **Rows**: sets the number of rows in the shape.
- **Columns**: sets the number of columns in the shape.



Path Options

By default, the **Speed** settings are marked with gray (disabled) and got from the preset values, set on the **5.1.4.6. Trajectory** page. By selecting another speed type, the fields are enabled and can be edited.

Speed: sets the speed type of the movement. The following values can be selected:

- **Nominal**: use this option is you want to have even TCP speed but can accept speed changes in some cases, for example, in the corners of the object.
- **Constant**: use this option if you want to keep exactly the same speed on the whole surface.
- **As recorded**
  When you specify only hand guide paths, the speed can only be **As recorded**.

Target: sets the target speed value.

Max. deviation: when the **Speed** type is set to **Nominal**, it shows the maximum deviation value.

: when checked, the system reverses the direction of the path.

Acceleration: sets the target acceleration value.

Path Playback

: generates a trajectory from the previously set paths. The generated trajectory is stored on the Compute Box.
When the button is pressed again, the system regenerates only the changed paths.

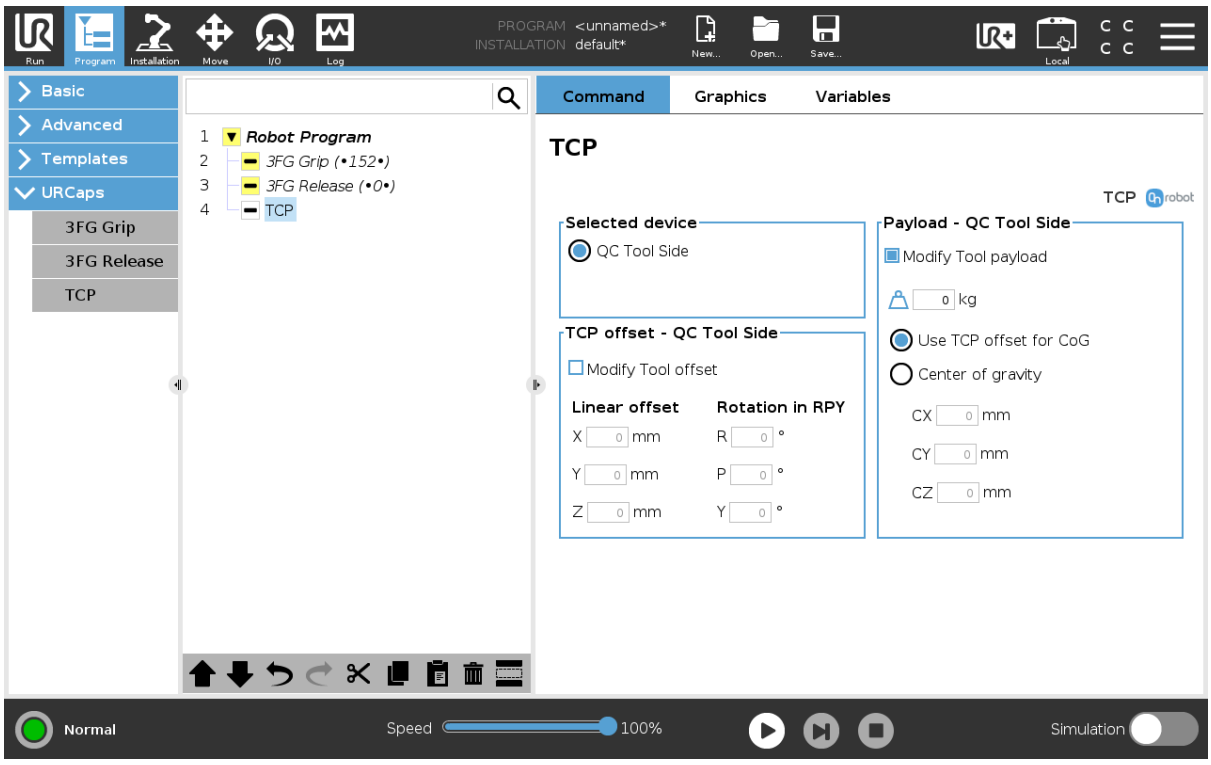
: starts playing the shape path.

: jumps to the first element of the path.

: jumps to the last element of the path.

5.1.4.10. TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

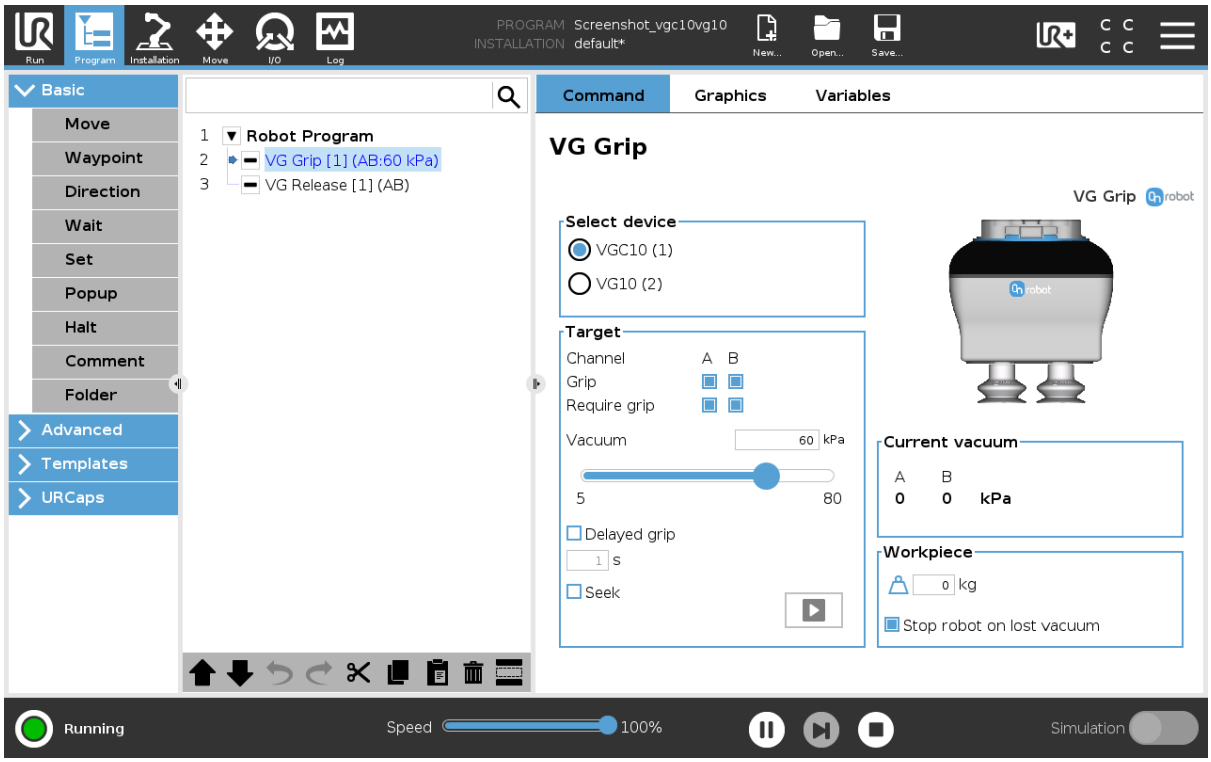
Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

5.1.5. VG10/VGC10

VG Grip

This command is used to activate the pump and generate vacuum to grip a workpiece.



Select device

When two grippers are used, you can select which gripper performs the action.

Target

Channel(s): Select which channel performs the action. It is possible to select channel A, B or both. To see which one is channel A and B, for VG10 see stickers under the arms and for VGC10 see the letters on the sides on the housing.

Grip: Select which channels will turn on the vacuum. Each selected channel will try to achieve the target vacuum. You can select any combination of channels A, B, or you can select all channels at once. At least one channel must be selected.

Require grip: Select which of the above selected channels must achieve the target vacuum. If the target vacuum is not achieved within 3 seconds, the channel will go to a grip error state and an error popup will be displayed.
If you select a channel in the **Require grip** row, that channel will automatically be selected in the **Grip** row.

If you select a channel in the **Grip** row and you do not select **Require grip** for it, the channel will try to achieve the target vacuum but no errors will be reported for the channel if the target vacuum is not achieved. The vacuum pump will continue to run whether something is gripped or not in this case.

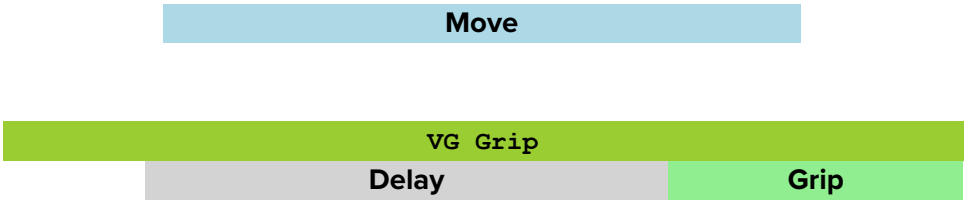
Vacuum: The higher the vacuum is set (up to 80 kPa) the more the lifting power is.

Delayed grip: Using this option, you can save cycle time.

When the **Delayed grip** option is not used, the robot moves to a certain point and then grips the workpiece. The cycle consists of the length of the **Move** command and the length of the **Grip** command.



When the **Delayed grip** option is used, you start the `VG Grip` command before the **Move** command and you delay it. This way the vacuum can build up gradually while the robot is still moving. The cycle time becomes shorter this way.



Make sure you always set the delay time to a smaller value than the length of the **Move** command. Otherwise the **Delayed grip** option will not save any time.

The delay value should be the legth of the **Move** command minus 0.5 s.

: Executes the command.

When any of the VG grippers is used in combination with a HEX-E/H QC the following extra option becomes available:

Seek and auto level: when checked, the gripper will be moved by the robot in the +Z direction (in Tool coordinate system) until it reaches a surface (this is the seek part) with both channels. This feature is only useful if both channels are going to do the grip at the same time. During the motion the gripper's orientation is automatically adjusted to be parallel to the surface (this is the auto level part).



NOTE:

In order to help the Auto-level part to function, make sure to use the same suction caps for A and B channels and set the arms to be symmetrical.

When any of the VG grippers is used without a HEX-E/H QC but used on an E-series controller the following extra option becomes available:

Seek: when checked, the same seeking action will happen as above. Since the auto leveling part is not used the VG grippers need to be parallel to the surface.

NOTE:

Setting a lower vacuum gives a faster grip with less wear on the vacuum cups. It also reduces the risk of leaving suction marks on delicate workpieces.

It can take a few seconds when pressing **Play** or **Test** before the robot program starts. This is normal.

When the two channels are set to different vacuum percentages the VG grippers automatically release air into the channel with lower pressure. This feature is activated when the pressure is more than 20% vacuum over the setting. Releasing air generates a characteristic rumbling sound and change in pumping speed.

Current vacuum

Displays the current vacuum level for each channel.

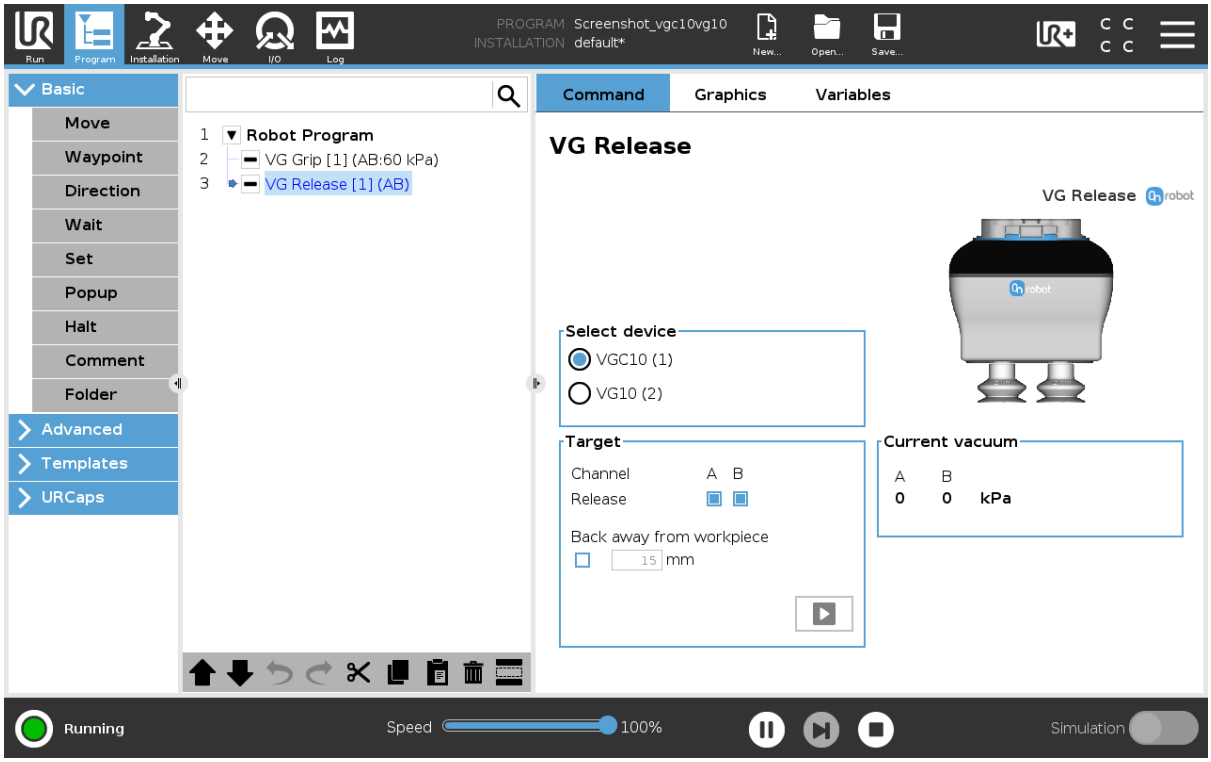
Workpiece

: Enter the workpiece weight. Then the URCap software calculates the resulting payload mass considering the gripper, the Quick Changer, and the workpiece mass.

Stop robot on lost vacuum: When this option is selected, the vacuum is monitored continuously. If the vacuum disappears unexpectedly, the robot will stop the movement and displays a popup window.

VG Release

This command is used to release the grip of the workpiece by removing vacuum.



Select device

When two grippers are used, you can select which gripper performs the action.

Target

Channel(s): Select which channel performs the action. It is possible to select channel A, B or both. To see which one is channel A and B, for VG10 see stickers under the arms and for VGC10 see the letters on the sides on the housing.

Release: Select which channels will turn off the vacuum. You can select any combination of channels A, B, or you can select all channels at once. At least one channel must be selected.

Back away from workpiece: When the workpiece is released, the robot will travel away 15 mm.

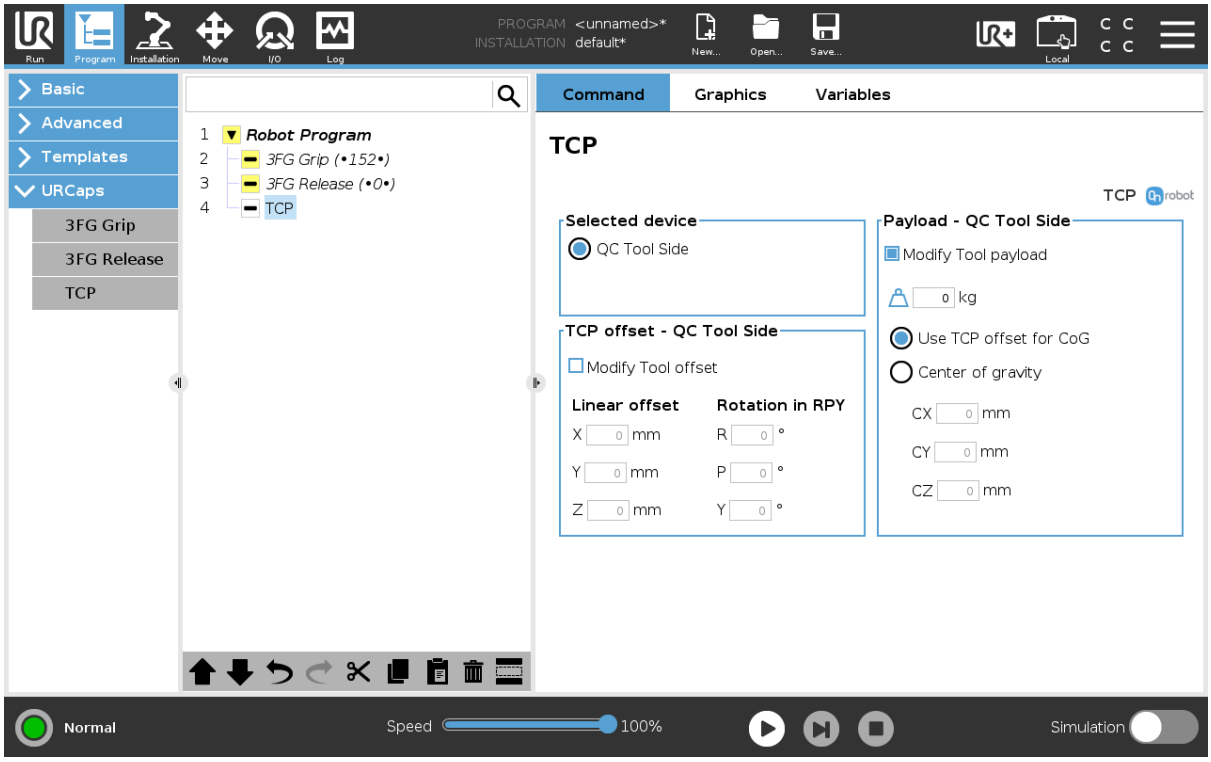
: Executes the command.

Current vacuum

Displays the current vacuum level for each channel.

TCP

The `TCP` command is used to set the current TCP and/or payload for the robot.



TCP offset

Set the **Linear offset** (X,Y,Z) and the **Rotation in RPY** (Roll-Pitch-Yaw) values to adjust the OnRobot device dependent calculated TCP.

Payload

Modify Tool payload: If enabled the UR's payload will be overwritten.

enter the workpiece mass that is attached to the device. The device own mass is added automatically.

Use TCP offset for CoG: set the center of gravity of the workpiece at the active TCP position.

Center of gravity CX, CY, CZ: set the location of the center of gravity of the workpiece.

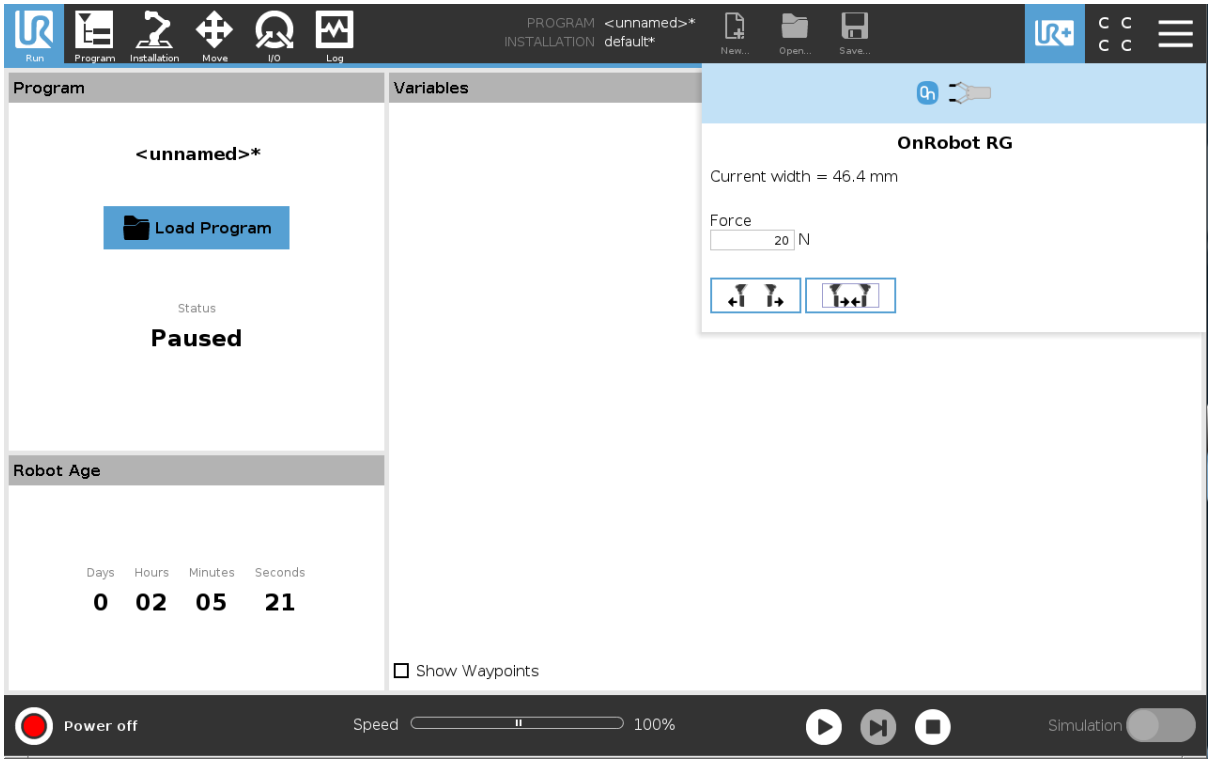
5.2. URCap Toolbar

The Toolbar makes it simple to operate the tools while you are programming or during runtime.

How to Access the Toolbar

The way how the toolbar can be accessed is different on the e-Series and the CB3 UR robots, but the functionality is the same.

To open up the toolbar in the e-Series, press on the UR+ icon on the top right side. Then press on the OnRobot icon .

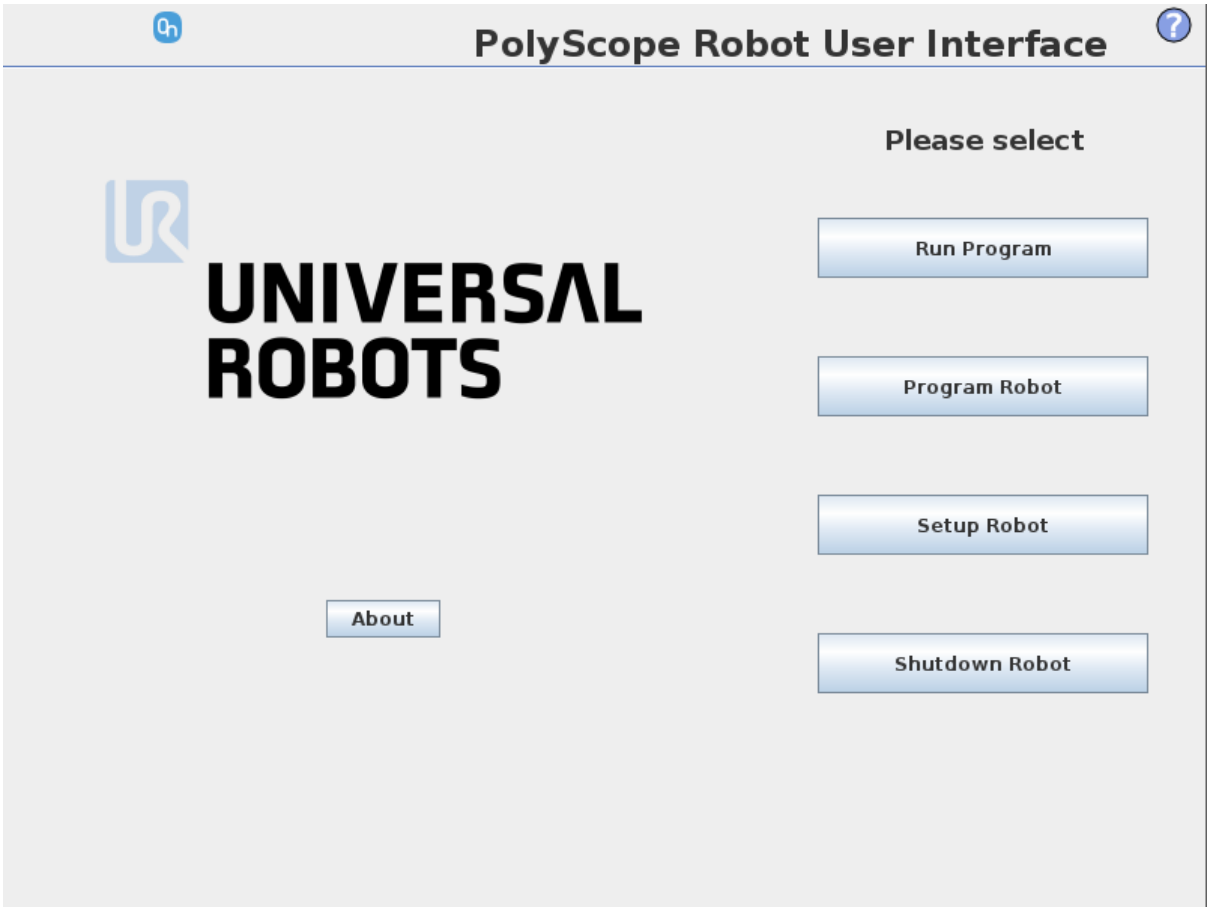


Each OnRobot End of Arm Tooling has its own functionality and that is explained in the sections below.

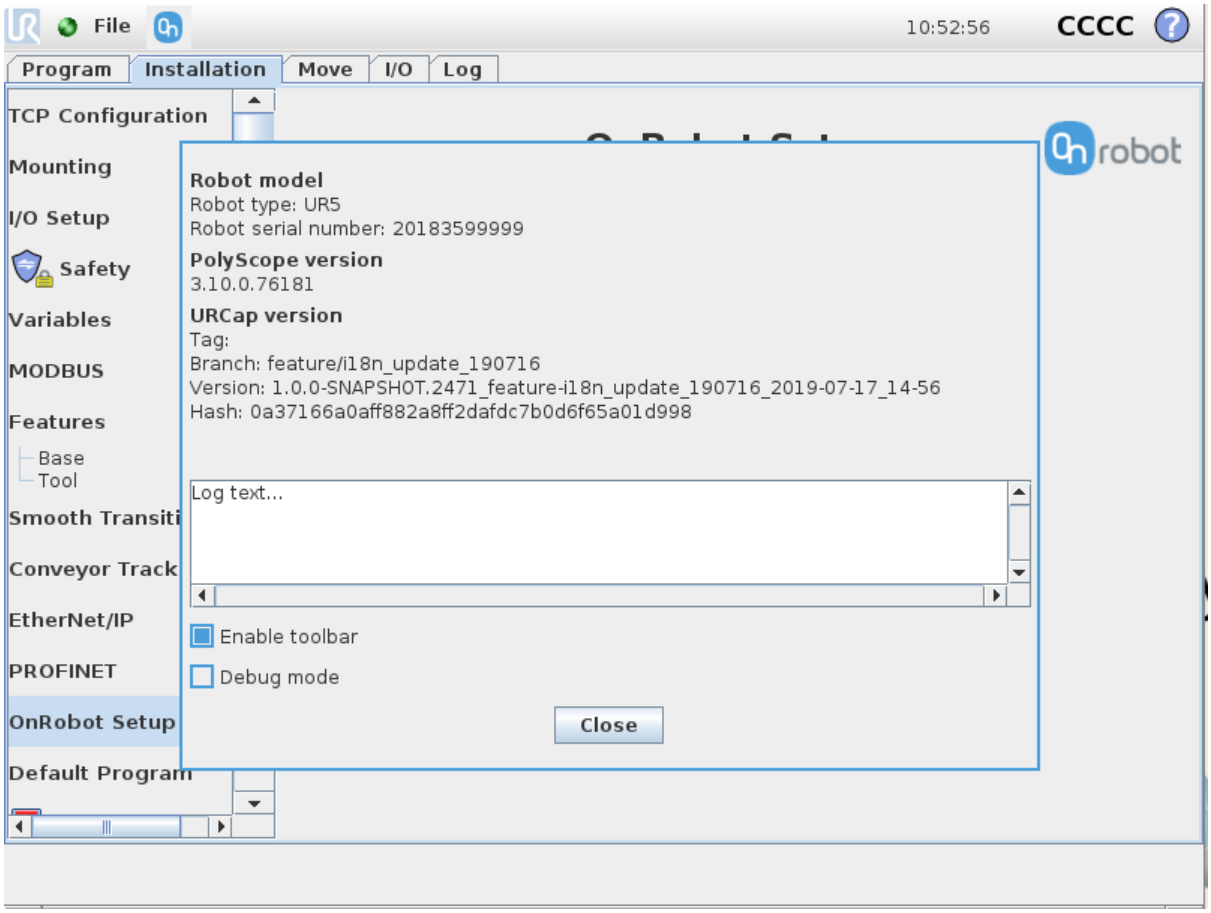
To open up the toolbar in the CB3, press on the OnRobot icon on the top left side. The icon might take around 20 seconds to appear after robot power up.

NOTE:

All toolbars are disabled while any robot program is running. Some toolbars are also disabled and cannot be used while the robot is not initialized.



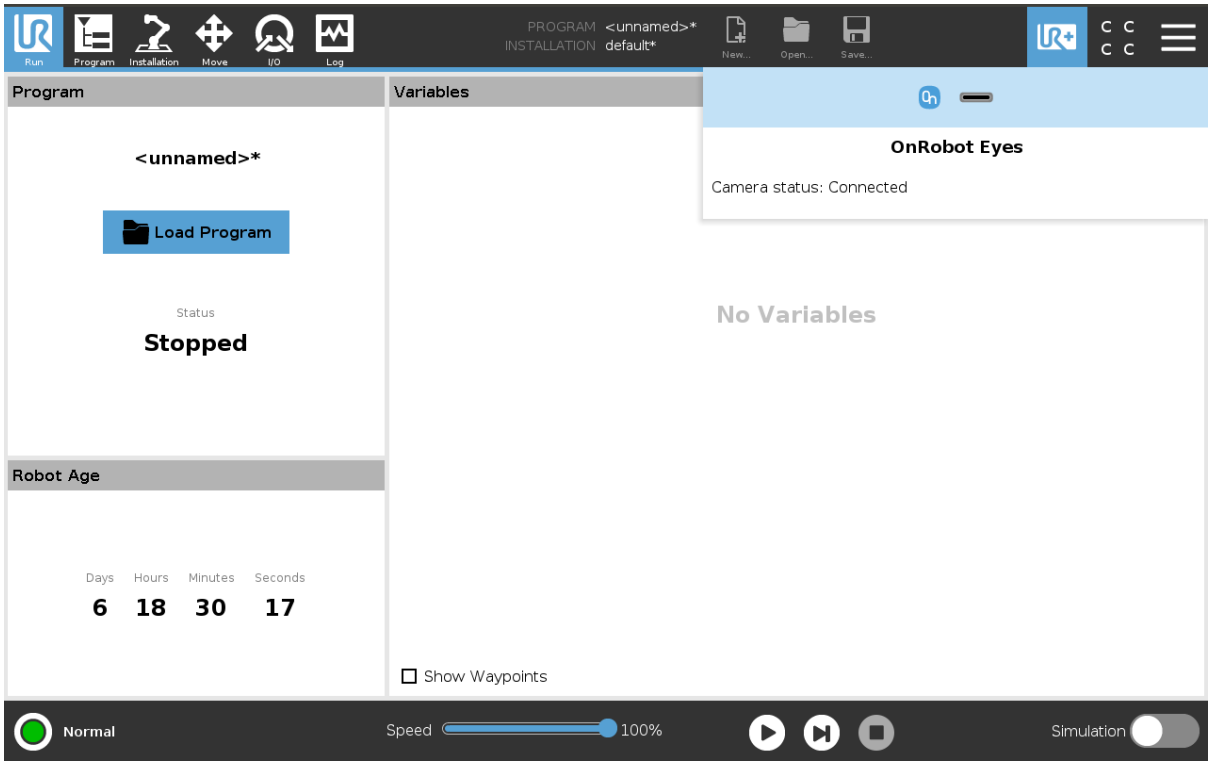
To enable/disable the toolbar, press on the OnRobot logo on the top right corner and check/uncheck the **Enable toolbar** checkbox.



5.2.1. Eyes

To open up the toolbar, follow the instructions under **How to Access the Toolbar** in the **5.2. URCap Toolbar** section.

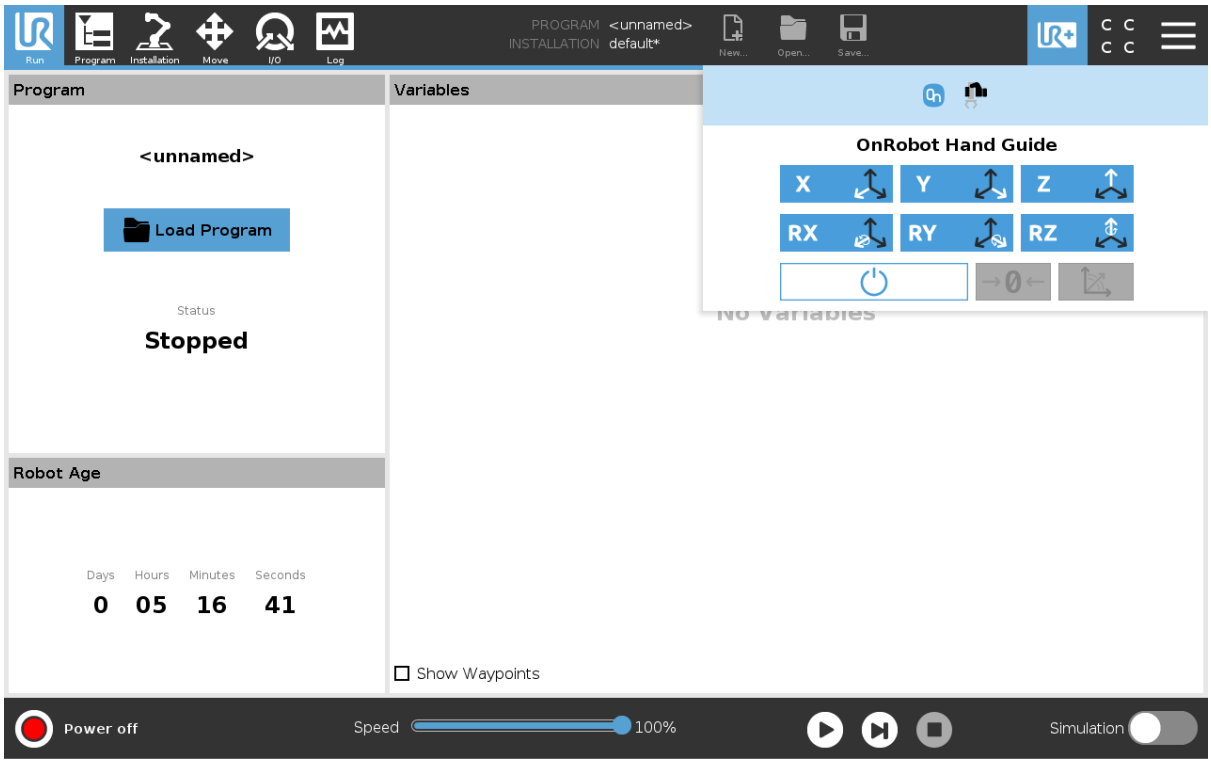
The toolbar for the Eyes is shown below. The toolbar shows the status of the camera.



5.2.2. HEX-E/H QC

To open up the toolbar, follow the instructions under **How to Access the Toolbar** in the **5.2. URCap Toolbar** section.

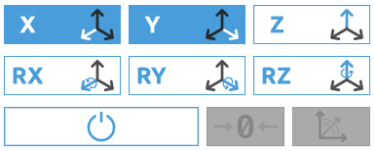
The toolbar for the HEX is called Hand Guide and it is shown below. This toolbar is used to hand guide the robot by holding the End of Arm Tooling with your hand. It is possible to lock some of the axes to reduce the degrees of freedom.



The toolbar contains the available axes, the enable button , the zero button and the snap to axes button .

To select an axis, tap on the appropriate item. An axis is selected if it turns from white to blue .

In the following example, the X and the Y items are selected to limit the movement along the X and Y axis (planar):



NOTE:

The used coordinate system is the Tool.

To deactivate any axis that has been selected, tap on the item again.

NOTE:

It is possible to activate or deactivate axes during hand guiding.

To start hand guiding the UR robot, first make sure that you do not touch the tool and then press and hold the enable button . The button turns to an hourglass icon while the hand guiding is being initiated. Wait until the enable button turns blue and drive the robot by hand with the help of the OnRobot sensor.

NOTE:

Make sure that you do not touch the tool before the hand guiding is activated (enable button turned to blue), otherwise the robot can behave abnormally (e.g..: the robot could move without any external force exerted). In this case, press the zero button, while you are not touching the tool.

Make sure that you do not use the zero button while touching the tool.

To stop hand guiding the UR Robot, press the enable button .

NOTE:

The hand guiding could be configured (in the OnRobot installation page) to be enabled with a single tap on the enable button  (instead of holding) and stopped with a second tap. However, the holding behavior is recommended for increased safety.

NOTE:

Please always set the speed slider of the robot to 100% while using the hand guiding to have an optimal user experience.

The zero  button is intended to be used when the tool orientation is changed during hand guiding, so that the effects of gravity or changes in the load of the robot can be neutralized.

The snap to axes button  rotates the axes of the tool coordinate system to align with the closest axes of the base coordinate system, disregarding negative or positive directions. This allows the user to set the tool to face precisely horizontally, or vertically, after guiding by hand.

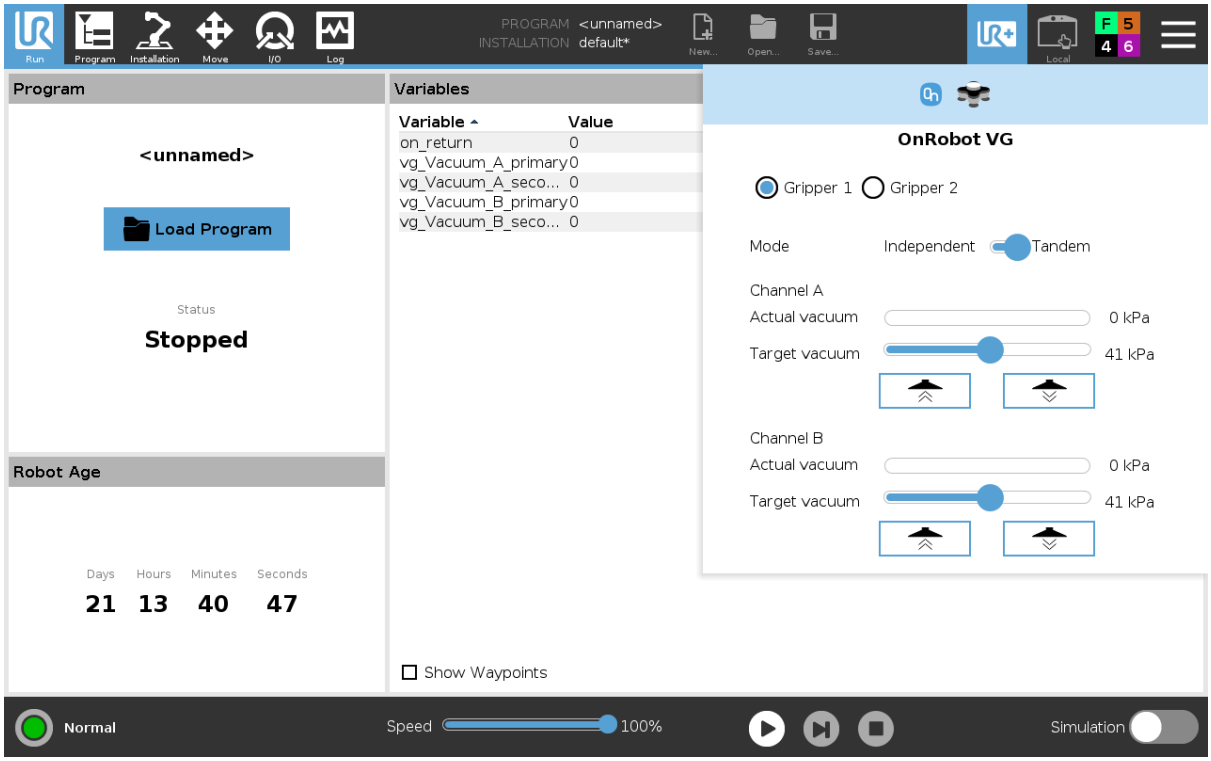
NOTE:

If you are experiencing vibration, grab and guide the tool at the Center of Gravity (roughly it is at the center).

5.2.3. VG10 / VGC10

To open up the toolbar, follow the instructions under **How to Access the Toolbar** in the **5.2. URCap Toolbar** section.

The toolbar for the VG grippers is shown below.



Gripper 1 and **Gripper 2**: In case of using 2 VG grippers you can select which one performs the action.

Mode: Select **Independent** (actuate a channel individually) or **Tandem** (actuate both channels together).

Actual vacuum: shows the current vacuum in each channel.

Target vacuum: defines target vacuum in each channel.

 (Grip button): when pressed, the pump will start to generate vacuum at the selected level on the selected channel(s).

 (Release button): when pressed, the test-grip will terminate and release any workpieces that may be held by the selected channel.

5.3. URScript Commands

URScript commands can be used alongside other scripts.

5.3.1. Eyes

When the OnRobot URCap is enabled, there will be defined script functions for Eyes:

```
get_eyes_workp_pose()
```

This function will retrieve the pose of the last detected workpiece from the Eye Box.

```
get_eyes_workp_type()
```

This function will retrieve the type of the last detected workpiece from the Eye Box.

```
get_eyes_workp_cnt()
```

This function will retrieve the amount of last detected workpiece from the Eye Box that are left.

```
get_eyes_lmk_ok()
```

This function will retrieve True if the latest detection of the Landmark application was successful, False otherwise.

```
eyes_sendrobotpose()
```

This function can be used to send the robot's current pose to the Eye Box. This is only necessary for calibrating the External Mount.

```
eyes_locate(task_id, locate_limit)
```

`task_id`: Is the task_id to be executed by Eyes.

`locate_limit`: Configures the trial behavior of the command. - 1 means try once, 0 is used to try forever, and a value bigger than 0 represents the number of seconds the command should execute for.

```
eyes_getworkpiecepose()
```

This function will send the pose of the last detected workpiece to the Eye Box.

```
eyes_getworkpiececount()
```

This function will send the amount of last detected workpiece to the Eye Box that are left.

```
eyes_inspect(task_id, inspect_limit)
```

`task_id`: Is the task_id from the Eyes device.

`locate_limit`: Configures the trial behavior of the command. - 1 means try once, 0 is used to try forever, and a value bigger than 0 represents the amount of seconds the command should execute for.

```
eyes_getworkpiecematch()
```

Match percentage from latest inspection execution

```
eyes_getworkpieceeval()
```

Evaluation from latest inspection execution. 1 indicates passed and 2 indicates failed.

```
eyes_landmarkdetect()
```

Command to detect the position of the landmark.

5.3.2. VG10/VGC10

When the OnRobot URCap is enabled, there will be several VG script functions available:

```
vg10_grip (channel, vacuum, timeout, alert, tool_index)
```

Commands the VG10 to perform a grip.

`channel`: Tells which channel to be gripped with.

- `0 = Channel A`
- `1 = Channel B`
- `2 = Channel A and Channel B`

  If not set, this parameter defaults to 2 (A and B).

`vacuum`: Tells how hard to grasp in the range of 0% to 80 % vacuum.

- `60 = 60% vacuum`. A typical firm grip.
- `30 = 30% vacuum`. A typical soft grip.

  If not set, this parameter defaults to 60%.

`timeout`: Tells how long to wait for commanded vacuum to be achieved. If vacuum is not achieved, an air leakage at the workpiece or vacuum cups is reported in a popup and the robot program stops.

- 0 = The function will not wait for vacuum, but return immediately after the command is sent
- >0 = Waiting time [s]. Floating point numbers can be used. E.g. 0.6 = 600 ms.

  If not set, this parameter defaults to 5 seconds.

`alert`: Whether the grip should be monitored after vacuum (grip) is established. If vacuum is lost while handling a workpiece, a popup warning is shown, and the robot program stops. This setting cannot be used without a proper timeout setting, see above.

- `False` = Vacuum is not monitored.
- `True` = Vacuum is continuously monitored. Popup warning enabled.

  If not set, this parameter defaults to True.

If only one VG10 gripper is attached, use:

```
    tool_index=vg_index_get()
```

If two VG10 grippers are attached, use:

For primary:

```
    tool_index=1
```

For secondary:

```
    tool_index=2
```

```
vg10_release(channel, timeout, autoidle, tool_index)
```

Commands the VG10 to perform a release.

`channel`: Tells which channel to be released.

- `0 = Channel A`
- `1 = Channel B`
- `2 = Channel A and Channel B`

If not set, this parameter defaults to 2 (A and B).

`timeout`: Tells how long to wait for vacuum to be removed.

- 0 = The function will not wait, but return immediately after the command is sent
- >0 = Waiting time [s]. Floating point numbers can be used. E.g. 0.6 = 600ms.

If not set, this parameter defaults to 5 seconds.

`autoidle`: Tells if the release valve should automatically be turned off when the release is completed and the robot has moved 5 cm away from the release position.

If not set, this parameter defaults to True.

If only one VG10 gripper is attached, use:

```
    tool_index=vg_index_get()
```

If two VG10 grippers attached, use:

For primary:

```
    tool_index=1
```

For secondary:

```
    tool_index=2
```

```
vg10_vacuum_A or vg10_vacuum_B
```

Returns current vacuum in the selected channel.

If two grippers are attached use _primary or _secondary.

Example:

```
    vg10_vacuum_A_secondary
```

```
vg10_idle(channel, tool_index)
```

Commands the VG10 to idle the selected channel. When a channel is in idle, the power consumption is slightly lower, but parts may 'stick' to the suction cup as the air return channel is closed.

`channel`: Tells which channel to be in idle.

- `0 = Channel A`
- `1 = Channel B`
- `2 = Channel A and Channel B`

If only one VG10 gripper is attached, use:

```
tool_index=vg_index_get()
```

If two VG10 grippers are attached, use:

For primary:

```
tool_index=1
```

For secondary:

```
tool_index=2
```

5.4. Feedback Variables

5.4.1. Eyes

Feedback Variable	Unit	Description
EyeLndmarkDet	p[x,y,z,rx,ry,rz]	Latest detected Landmark pose with respect to robot base frame.
EyesInspectEval	-	The evaluation result is one of the following: 0 - indicates that an error occurred during the inspection. 1 - indicates that the inspection has passed (match % is higher than the one defined in the Eyes Inspection Task). 2 - indicates that the insepection has failed.
EyesLndmrkFeat	p[x,y,z,rx,ry,rz]	Pose of the feature point associated to Landmark.
EyesLndmrkOrig	p[x,y,z,rx,ry,rz]	Original Landmark pose with respect to robot base frame.
EyesLocatePose	p[x,y,z,rx,ry,rz]	Coordinates of the position where the located workpiece is placed.
EyesMatch	%	Match percentage between the workpiece's model and the one in used as defined in the Eyes Inspection Task.
EyesWorkpCount	-	Number of detected workpieces located by the Eyes Part Location or the Eyes Inspection Tasks. It is only updated after the EyesGetWorkpiece command is executed.

Feedback Variable	Unit	Description
EyesWorkpiece	-	Detected workpiece's type as defined in the Eyes Part Location or Eyes Inspection Tasks.
eyes_lmk_pose	p[x,y,z,rx,ry,rz]	Latest detected landmark pose.
eyes_workp_cnt	-	Number of detected workpieces located by the Eyes Part Location or the Eyes Inspection Tasks. It is only updated after the EyesGetWorkpiece command is executed.
eyes_workp_pose	p[x,y,z,rx,ry,rz]	Pose of latest detected workpiece.
eyes_workp_type	-	Type of the latest detected workpiece.
eyes_lmk_ok	True/False	True if the latest detection of the Landmark application was successful, False otherwise.
eyes_cnt	-	Total number of detected workpieces located by the Eyes Part Location or the Eyes Inspection Tasks. It is updated after the Eyes Locate or the Eyes Inspect commands are executed.

5.4.2. HEX-E/H QC

Feedback Variable	Unit	Description
on_return		The return value for the OnRobot commands
F3D	[N]	Length of the 3D force vector $F3D = \sqrt{Fx^2 + Fy^2 + Fz^2}$
HEX_Average_F3D	[N]	Low-pass filtered (1Hz) F3D that can be used to have a noise-free signal.
FT_Base	[3xN,3xNm]	Force and torque values calculated in the Base Coordinate system, in an array
FT_Tool	[3xN,3xNm]	Force and torque values calculated in the Tool Coordinate system, in an array
Fx	[N]	Force value along the X axis
Fy	[N]	Force value along the Y axis
Fz	[N]	Force value along the Z axis
T3D	[Nm]	Length of the 3D torque vector $T3D = \sqrt{Tx^2 + Ty^2 + Tz^2}$
Tx	[Nm]	Torque value about the X axis

Feedback Variable	Unit	Description
Ty	[Nm]	Torque value about the Y axis
Tz	[Nm]	Torque value about the Z axis

5.4.3. VG10 / VGC10

Feedback Variable	Unit	Description
on_return	0	The return value for the OnRobot commands
vg_Vacuum_A	%Vacuum	Returns the %Vacuum achieved on channel A
vg_Vacuum_B	%Vacuum	Returns the %Vacuum achieved on channel B

6. Additional Software Options

6.1. Compute Box/Eye Box

6.1.1. Ethernet Interface Setup

A proper IP address must be set for the Compute Box/Eye Box and the robot/computer to be able to use the Ethernet interface. The IP address can be configured using DIP switches 3 and 4.

WARNING:

Stop the robot program before you change any Ethernet interface settings.

NOTE:

Configuring DIP switch 3 will remove any previously set static IP address.

To change between modes, first change the DIP switches and then cycle the Compute Box/Eye Box power so the changes will take effect.

DIP 3 - sets the Compute Box / Eye Box IP address

- **ON**: Fixed IP (192.168.1.1)
- **OFF**: Dynamic or Static IP *(can be configured via the Web Client)*

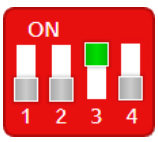
DIP 4 - sets whether the connected robot or laptop will receive IP address from the Compute Box / Eye Box

- **ON**: DHCP server is disabled
- **OFF**:DHCP server is enabled

We recommend to set the DIP switches according to either of the two options below:

- **Fix IP/Auto mode** - in simple installations (no external network and/or no PLC connected)
- **Advanced mode** - in more complex installations (external network and/or PLC are used)

Fix IP/Auto mode (factory default)

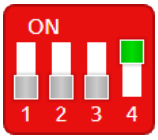


Set the DIP switch 3 to ON and the DIP switch 4 to OFF position and cycle the power so the changes will take effect.

IP Address of the Compute Box/Eye Box	IP Address of the Robot/Computer
The IP address of the Compute Box/Eye Box is fixed 192.168.1.1. This IP address cannot be changed.	The Compute Box/Eye Box will automatically assign an IP address to the connected robot/computer if it was configured to obtain an IP address automatically. **NOTE:** The assigned IP address range is 192.168.1.100-105 (with subnet mask 255.255.255.0). If the Compute Box/Eye Box is used in a company network where a DHCP server is already in use, it is recommended to use Advanced mode.

In this mode, the DHCP server of the Compute Box/Eye Box is enabled.

Advanced mode (any static or dynamic IP/subnet mask)



Set the DIP switch 3 to OFF and the DIP switch 4 to ON position and cycle the power so the changes will take effect.

IP Address of the Compute Box/Eye box	IP Address of the Robot/Computer
Case 1: Static IP address The IP address 192.168.1.1 is already in use in your network or a different subnet needs to be configured.	The Compute Box/Eye Box will not assign an IP address to the robot/computer. Set the IP address of the robot/computer manually. Make sure to have a matching IP setting to your robot/computer network for a proper communication. Use the same subnet but different IP address.
Case 2: Dynamic IP address *	The IP address of the robot/computer is set dynamically. An external DHCP server assigns the IP address to the robot/computer.

* By default, the IP address of the Compute Box/Eye Box is set to Dynamic IP.

The IP address of the Compute Box/Eye Box can be set to any value by using the Web Client. For more details, see section Web Client: Configuration Menu. Under **Network settings**, set the **Network mode** to either **Static IP** or **Dynamic IP**.

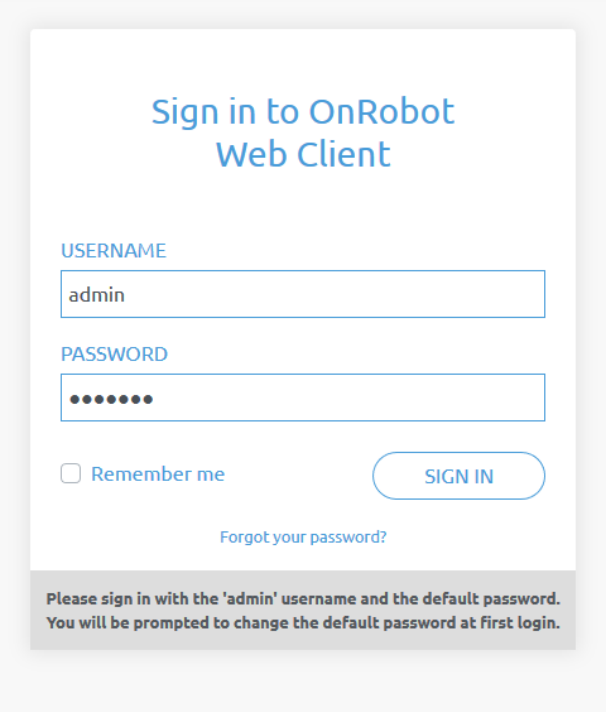
In this mode, the DHCP server of the Compute Box/Eye Box is disabled.

6.1.2. Web Client

OnRobot's Web Client is used to configure an Eyes application. To access it on your computer first the Ethernet interface needs to be set up to have a proper communication between your computer and the Eye Box. It is recommended to use the factory default DIP switch settings (DIP 3 On and DIP 4 Off).

Then do the following steps:

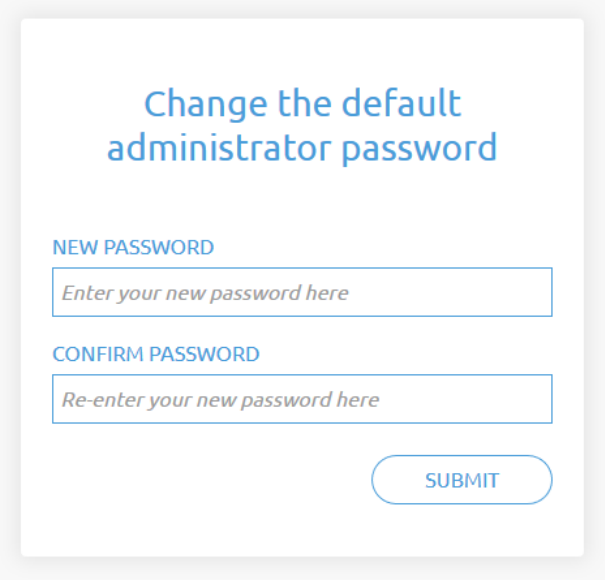
- Connect the Eye Box to your computer with the supplied UTP cable.
- Power the Eye Box with the supplied power supply (if it is not powered).
- Wait one minute for the Eye Box LED to turn from blue to green.
- Open a web browser on your computer and type in the IP address of the Eye Box (factory default is 192.168.1.1).
- The Sign-in page opens:



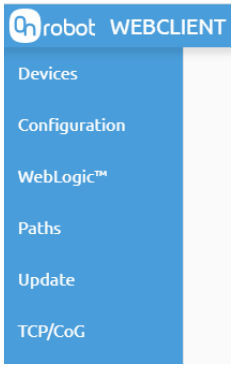
The factory default administrator login is:

Username: admin
Password: OnRobot

For the first login a new password needs to be entered: (password must be at least 8 characters long)



Once signed in the following menus will appear on the left side of the screen:



- **Devices** - Monitor and control the connected devices (e.g.: grippers)
- **Configuration** - Change the Compute Box's settings
- **WebLogic**™ - Program the Digital I/O interface through OnRobot WebLogic™
- **Paths** - Import/export the recorded Paths (not available to all robots)
- **Update** - Update the Compute Box and the devices
- **TCP/CoG** - Calculate the TCP (Tool Center Point) and CoG (Center of Gravity) values for your OnRobot product combination.

The following menus will appear in the top right corner of the screen:



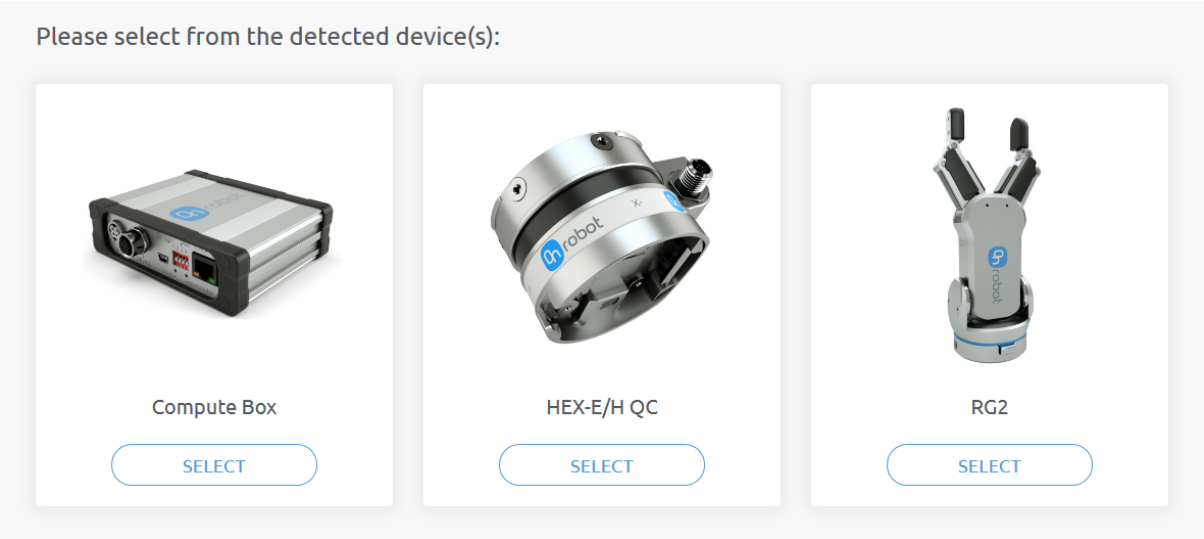
- 

Select the language of the Web Client
- 
Account settings (e.g.: change password, add new user)

In the following, these menus will be described.

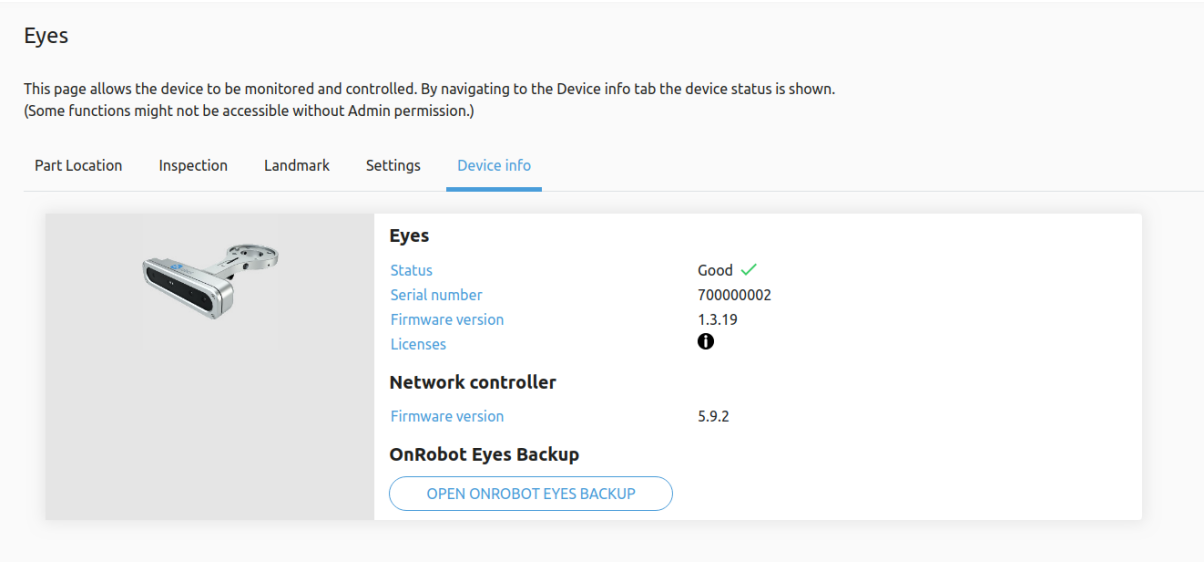
6.1.3. Web Client: Devices Menu

To control/monitor a device click on the **Select** button.



6.1.3.1. Eyes

Device info



Eyes

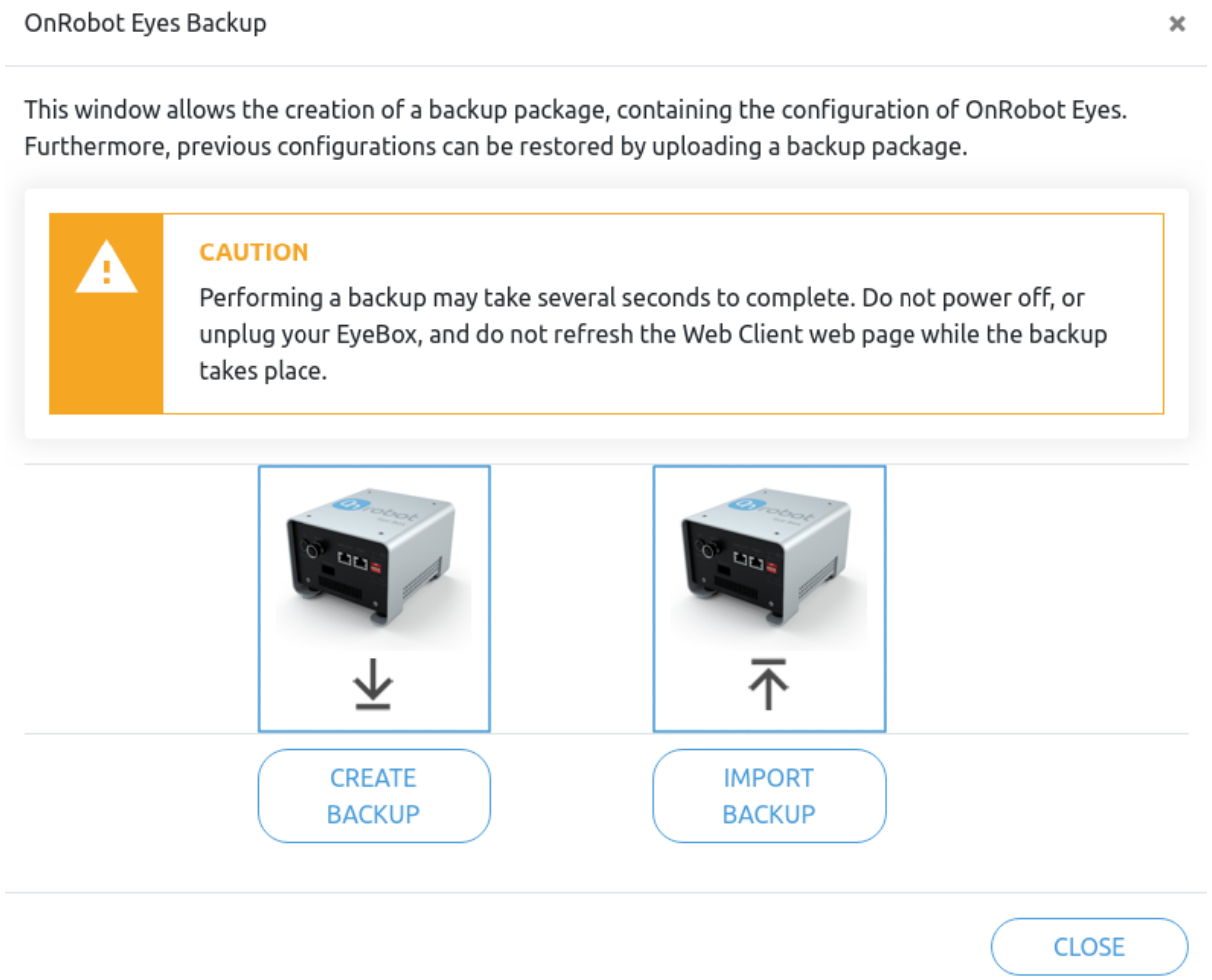
This section displays information about the device's **Status**, **Serial number**, **Firmware version** and **Licenses**.

Network controller

This section displays information about the **Firmware version** of the Network controller.

OnRobot Eyes Backup

Click on **Open OnRobot Eyes Backup** and the following screen will appear.

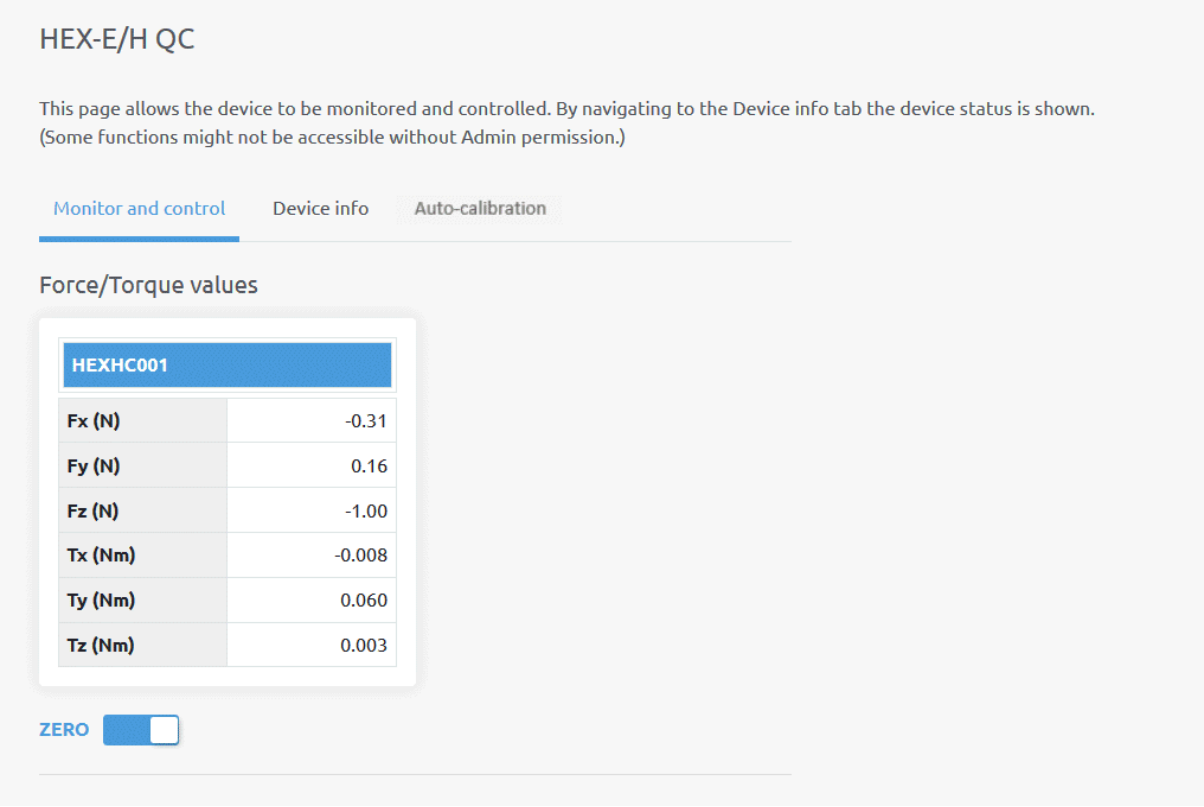


Click on **Create backup** to download a backup package that contains the configuration of the OnRobot Eyes.

Click on **Import backup** to upload the OnRobot Eyes configuration to the Eye Box. The successfully uploaded configuration will overwrite any configuration on the Eye Box.

6.1.3.2. HEX-E/H QC

Monitor and control



The force and torque values (**Fx,Fy,Fz** and **Tx,Ty,Tz**) are shown in N/Nm.

The **Zero** toggle switch can be used to zero the force and torque reading.

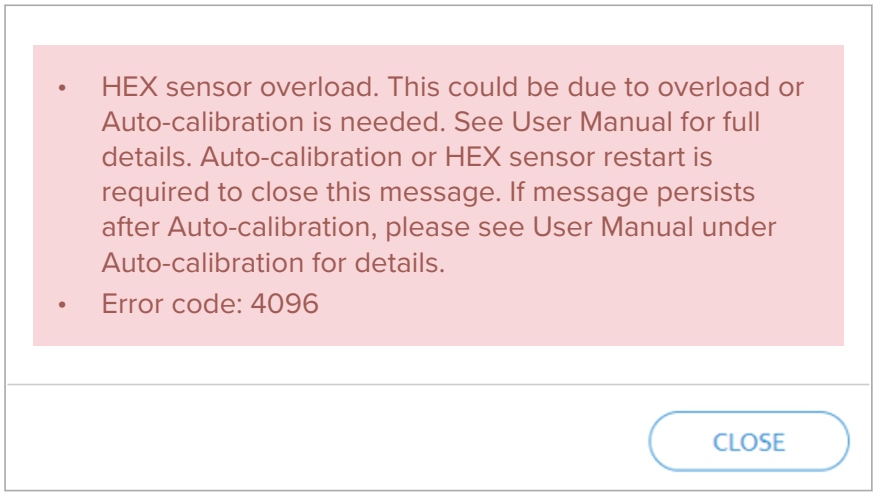
NOTE:

Zero value set on this page is not stored permanently and are restored to the default values on power reset.

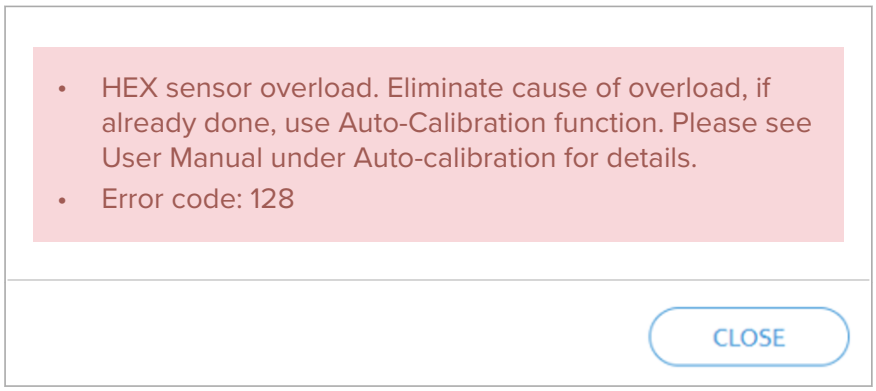
Device info

When you use the HEX-E/H QC for a longer period of time, the force can be drifting in the **Fz** direction.

On the **Device info** tab, the firmware gives **Faulty** sensor if the drift is too high and displays the following message:



or this message, if no Auto-Calibration has been performed yet:



To eliminate the **Faulty** sensor status, initiate an auto-calibration.

Auto-calibration

Auto-calibration is an option to prolong the time the sensor is in service before it is sent back for OnRobot factory re-calibration. Auto-calibration can be done onsite, and it takes only a couple of minutes.

NOTE:

Auto-calibration tab does not appear if the firmware version of the HEX sensor is lower than 2.15. If your firmware version is higher than 2.09 please go to the **6.1.7. Web Client: Update Menu** and update your firmware. For firmware versions lower than 2.09 please contact your distributor.

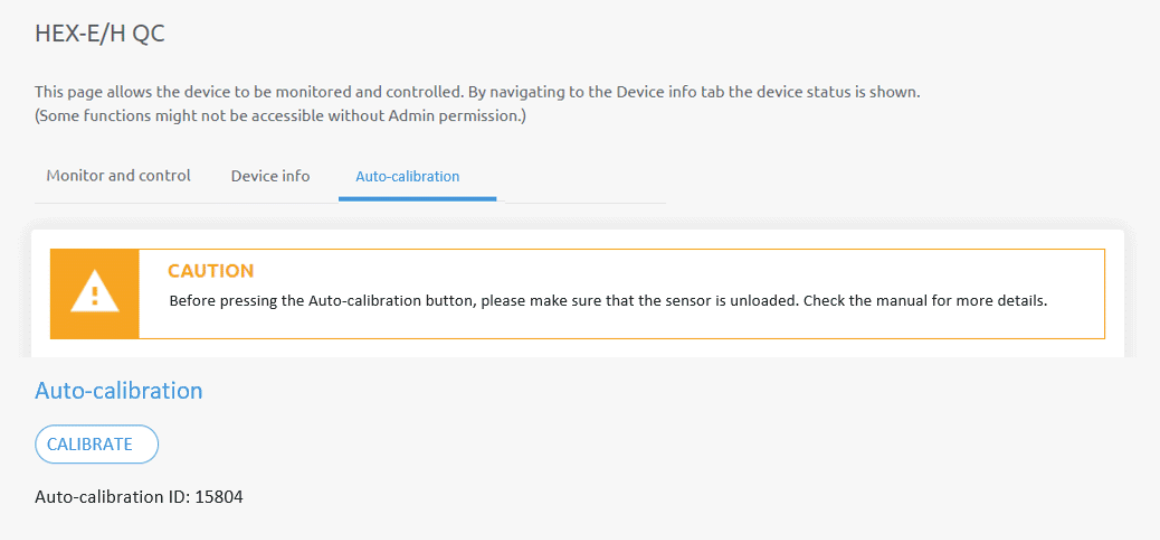
Required steps to do an auto-calibration:

1. Stop the robot.

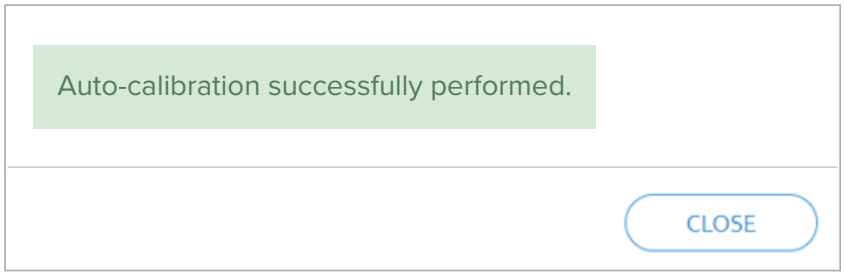
NOTE:

Make sure that the HEX is mounted on the robot during the auto-calibration. The measured offset value can differ when the HEX is not mounted on the robot.

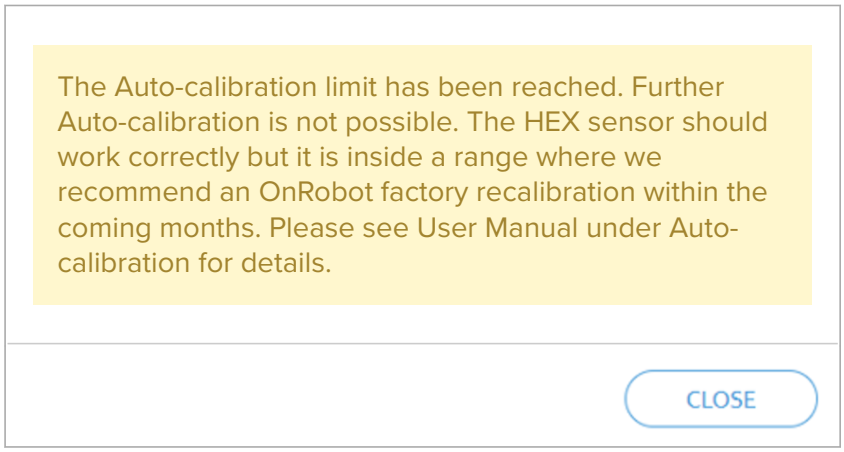
2. The sensor's tool side should face upward (robot side facing downward) to get the most accurate result.
3. Note how the tool(s) are connected to the sensor. After the calibration, the tools need to be re-attached to the sensor the same way to prevent any disturbance in your application (for example re-teaching waypoints)
4. Detach any tool connected to the sensor and put it aside, it must be completely unloaded during the auto-calibration.
5. On the **Auto-calibration** tab, press **Calibrate**.



6. Confirm the process in the popup window.
7. If the auto-calibration was successful, the following message is shown:



If the auto-calibration was carried out but the result indicates that a recalibration at the OnRobot factory is recommended, then the following message is shown:

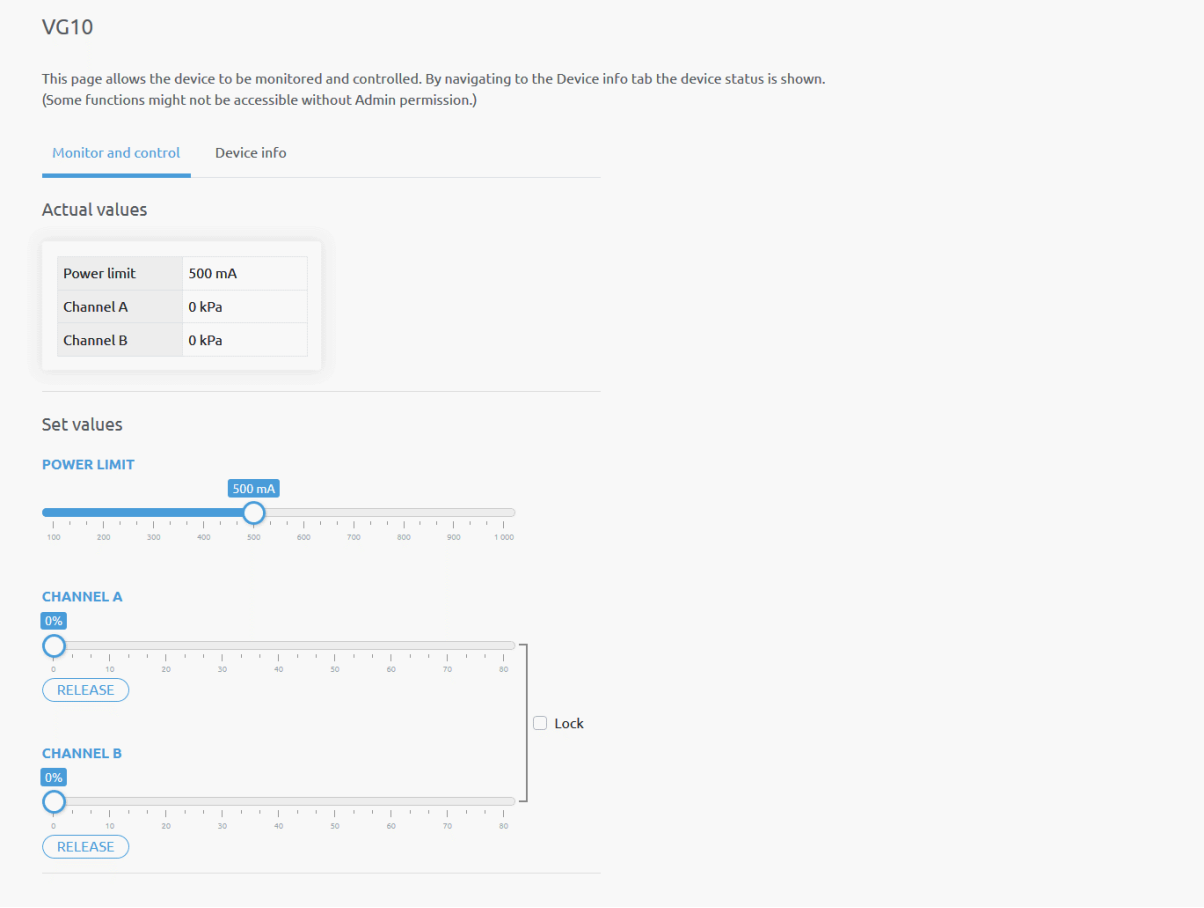


8. Re-attach the tool(s) to the sensor the same way as it was.
9. Start your robot and validate your application.
10. Auto-calibration is finished.

Considerations for the auto-calibration:

- It is recommended to make an auto-calibration every 2-3 months.
- If the auto-calibration process detects that an OnRobot factory re-calibration is needed, schedule your sensor to be sent back to the OnRobot factory for a re-calibration within the coming months.

6.1.3.3. VG10 / VGC10



The actual vacuum level for **Channel A** and **Channel B** can be seen in percentage (in the range of 0...80 kPa vacuum). The actual value of the **Power limit** is shown in mA.

The **Power limit** can be adjusted in the range of 0...1000mA with the slider.

NOTE:

The power limit set in this page is not stored permanently and always restored to the default value on power reset.

Higher power limit value means the required vacuum level is reached faster (higher airflow), but if it is set too fast overshoot may occur.

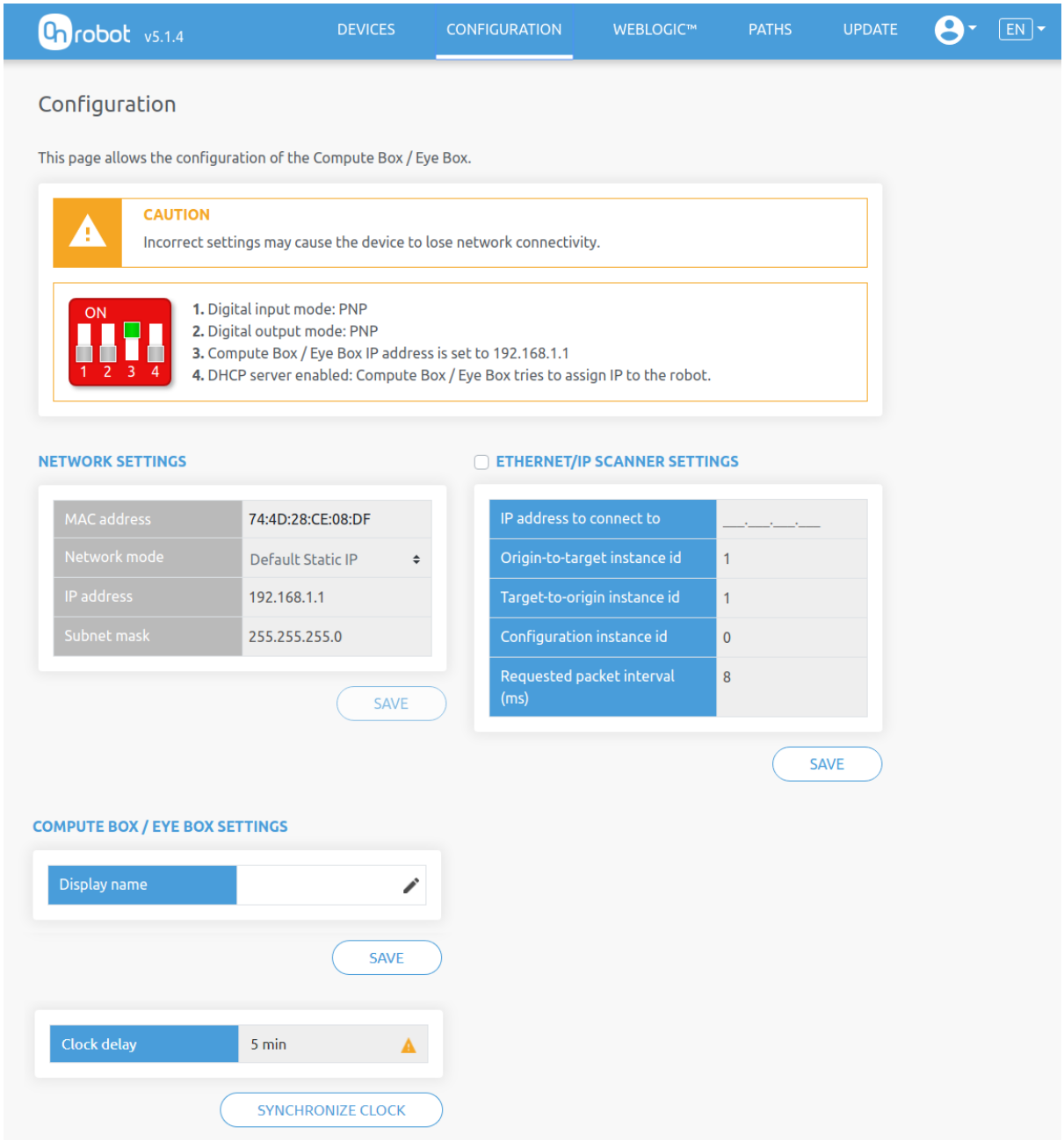
Low power limit may not be enough for higher percentage of vacuum and the target vacuum level may not be reached.

The **Channel A** and **Channel B** vacuum level can be set individually or in tandem by checking the **Lock** checkbox.

Make sure to set high enough vacuum before you grip and lift any object.

To release the gripped object, click on the **Release** button.

6.1.4. Web Client: Configuration Menu



The factory default DIP switch settings set the IP address of the Eyes Box to a fixed 192.168.1.1 (subnet mask 255.255.255.0). If the IP address needs to be changed the first the DIP switch 3 needs to be set to Off and the Eye Box power needs to be reset.

Then the following option will be available to change the IP address.

Network settings:

The **MAC address** is a world-wide unique identifier that is fixed for the device.

The **Network mode** drop-down menu can be used to decide if the Eye Box will have a static or a dynamic IP address:

- If it is set to **Dynamic IP**, the Eye Box expects an IP address from a DHCP server. If the network that the device is connected to has no DHCP server.
- If it is set to **Static IP**, then a fixed IP address and subnet mask must be set.

- If it is set to **Default Static IP**, the fixed IP revert to the factory default and cannot be changed. This is triggered by setting the DIP switch 3 to On and doing a power reset.

After all parameters are set, click on the **Save** button to store the new values permanently. Wait 1 minute and reconnect to the device using the new settings.

Compute Box / Eye Box settings:

In case, more than one Eye Box is used within the same network, for identification purpose any user specific name can be entered to the **Display name**.

If the **Clock delay** field shows a difference, click **Synchronize clock** to synchronize the Compute Box's time with your computer.

EtherNet/IP scanner settings:

This is a special option of the EtherNet/IP connection for some robots. For these robots as part of the installation the required values will be given and instructed to set.

6.1.5. Web Client: Weblogic Menu

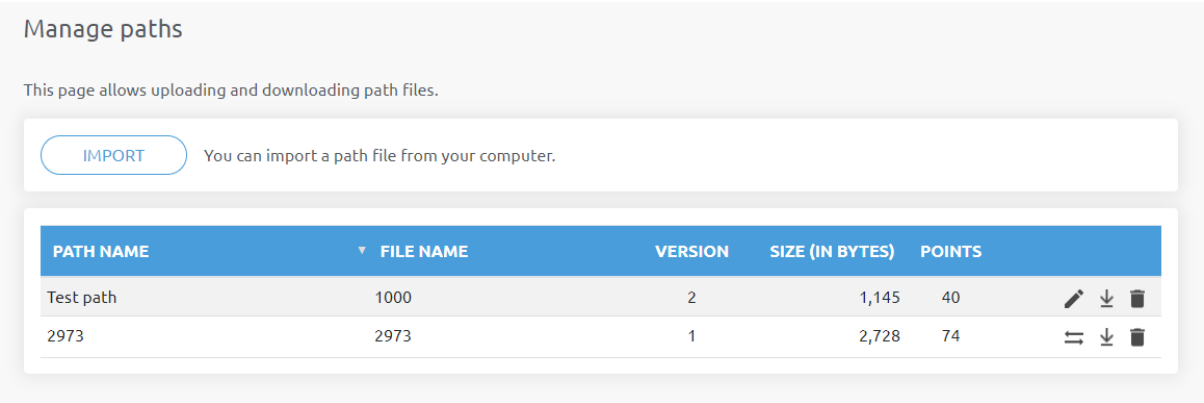
For information how to operate Eyes via WebLogic, see *User Manual for Using WebLogic™*.

6.1.6. Web Client: Path Menu

NOTE:

The Path feature may not be available to your robot type.

This page can be used to import, export, and delete the previously recorded paths. In this way a Path can be copied to a different Compute Box.



The paths are recorded as .orp files.

Previously recorded paths with .ofp extension must be converted to .orp files. Use the path converter button ⇆ to convert the files.

To change the name of a path, use the ✎ icon.

To import a previously exported path, click on **Import** and browse for the file.

The available paths are listed at the end of the page. Any paths can be exported and downloaded as an .orp file or permanently deleted to free up the list if a path is not needed anymore.

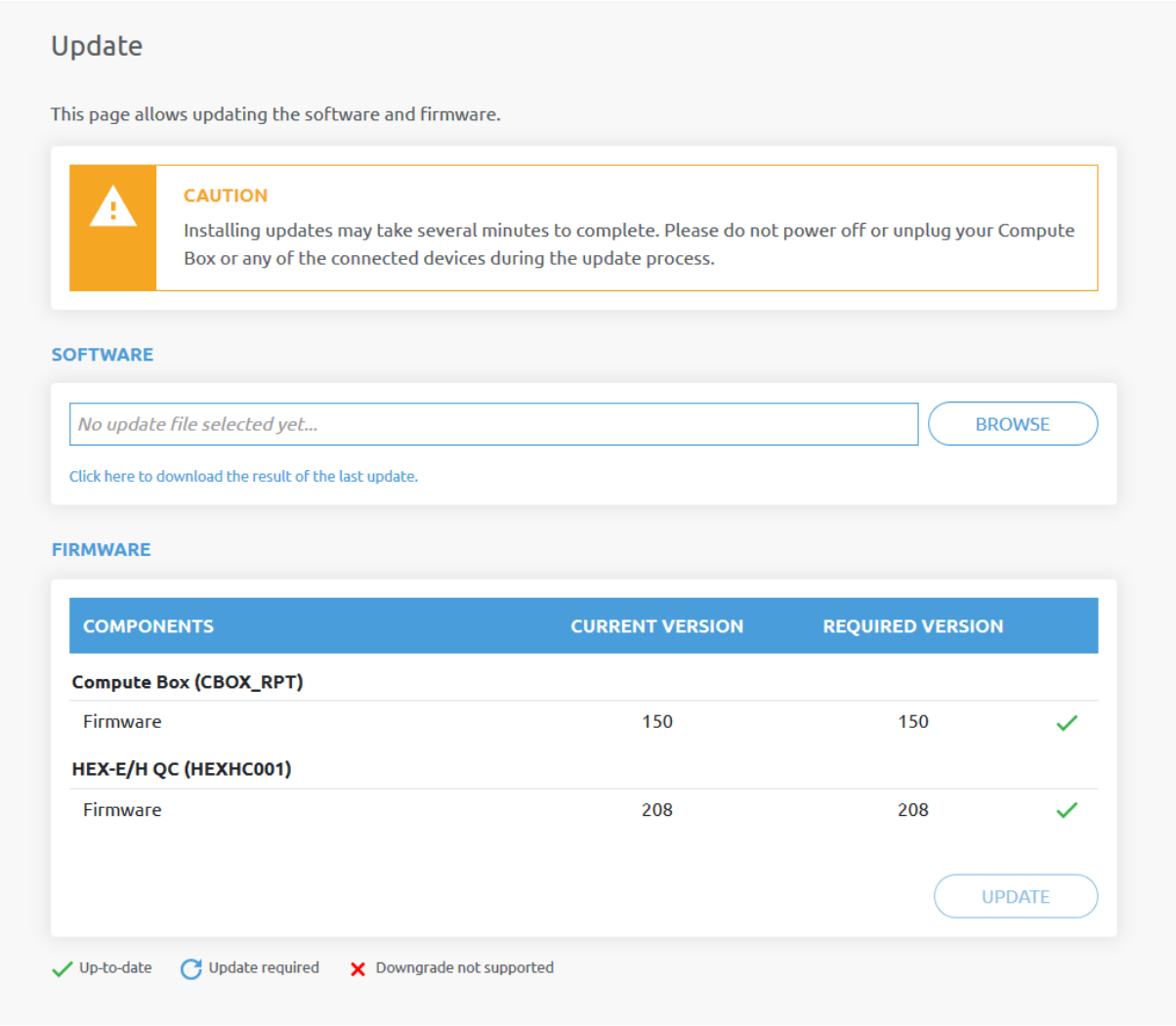
NOTE:

Always make sure that you do not delete any path that is currently in use in any of your robot programs. Otherwise the path will need to be re-recorded, since the delete operation cannot be undone.

The Compute Box can store up to 100 Mbytes of paths that is roughly equal to 1000 hours of recordings.

6.1.7. Web Client: Update Menu

This page can be used to update the software on the Compute Box and the firmware on the devices.



CAUTION:

During the update process (takes about 5-10 minutes) DO NOT unplug any device or close the browser window. Otherwise the updated device could be damaged.

The loading screens during the update process are the same for the software and the firmware updates.

Software Update

Click on **Browse** to search for the `.cbu` software update file. The **Browse** button will turn to **Update**.

Click on **Update** to start the software update process.

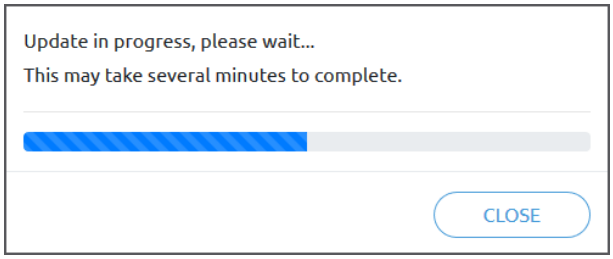
If the update is finished and was successful, the message below is shown.

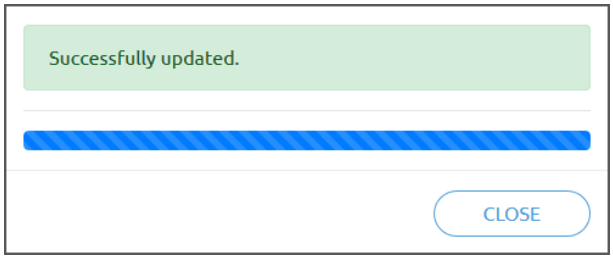
Firmware Update

Update required: A firmware update is required because one of the components is out of date.

Click on **Update** in the firmware section of the page to start the firmware update process.

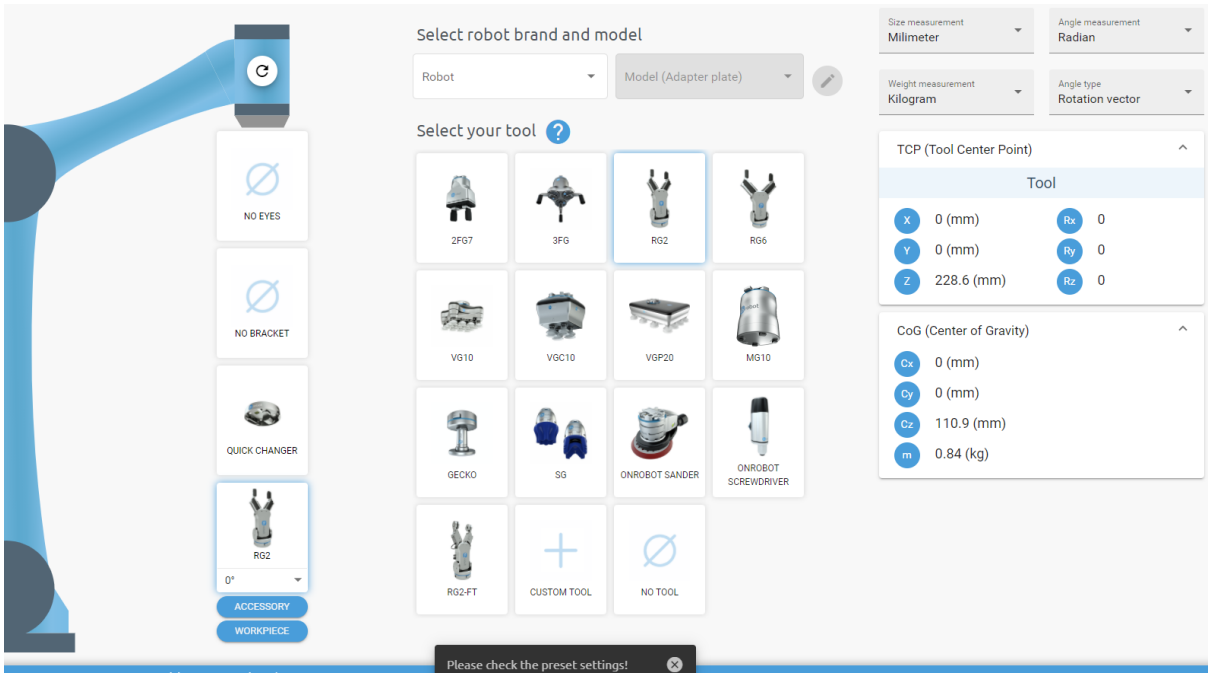
If the update is finished and was successful, the message below is shown.





6.1.8. Web Client: TCP/COG

Use the TCP/COG calculator to calculate the TCP (Tool Center Point) and COG (Center of Gravity) values for your OnRobot product combination.



The TCP/COG calculator will show the automatically detected settings.

NOTE:

Make sure to check the preset settings before calculating the TCP and COG values.

1. Select the robot brand and the model you are using from the **Robot** and **Model (Adapter plate)** dropdown menus.

   Click on  to set custom Adapter plate settings.
2. Click on the **No eyes** card to modify the Eyes preset settings.
3. Click on the **No bracket** card to modify the Angle Bracket preset settings.
4. Select mounting type.
5. Select tool.

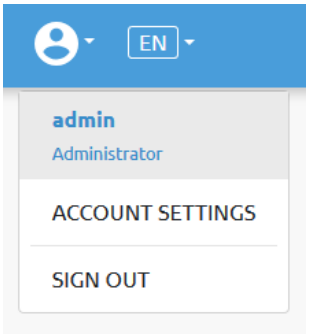
   Click on  to get help about how to enter the values.
6. Click on **Accessory** to select any OnRobot accessories.
7. Click on **Workpiece** to enter the workpiece weight. Then the calculator calculates the resulting payload mass considering the gripper, the mounting, and the workpiece mass.
8. Choose the unit of measure for the values you want to enter from the **Size measurement**, **Angle measurement**, **Weight measurement** and **Angle type** dropdown menus.

The calculator calculates the values which you can see in the **TCP (Tool Center Point)** and **CoG (Center of Gravity)** boxes. These values can be entered into the robot.

6.1.9. Web Client: Account Settings

This menu can be used to:

- See the currently sign-id user
- Go to **Account settings**
- Sign-out

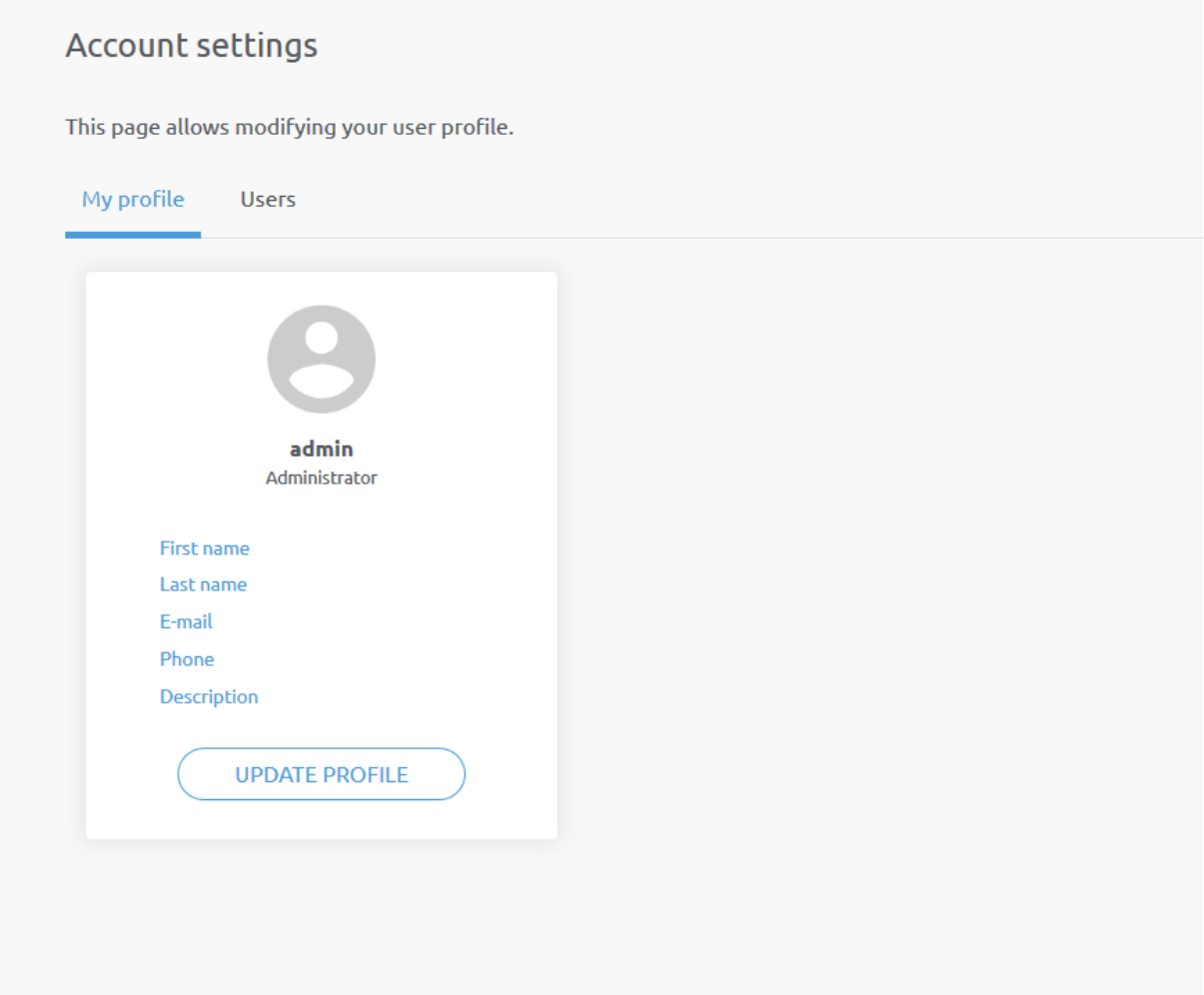


Account settings:

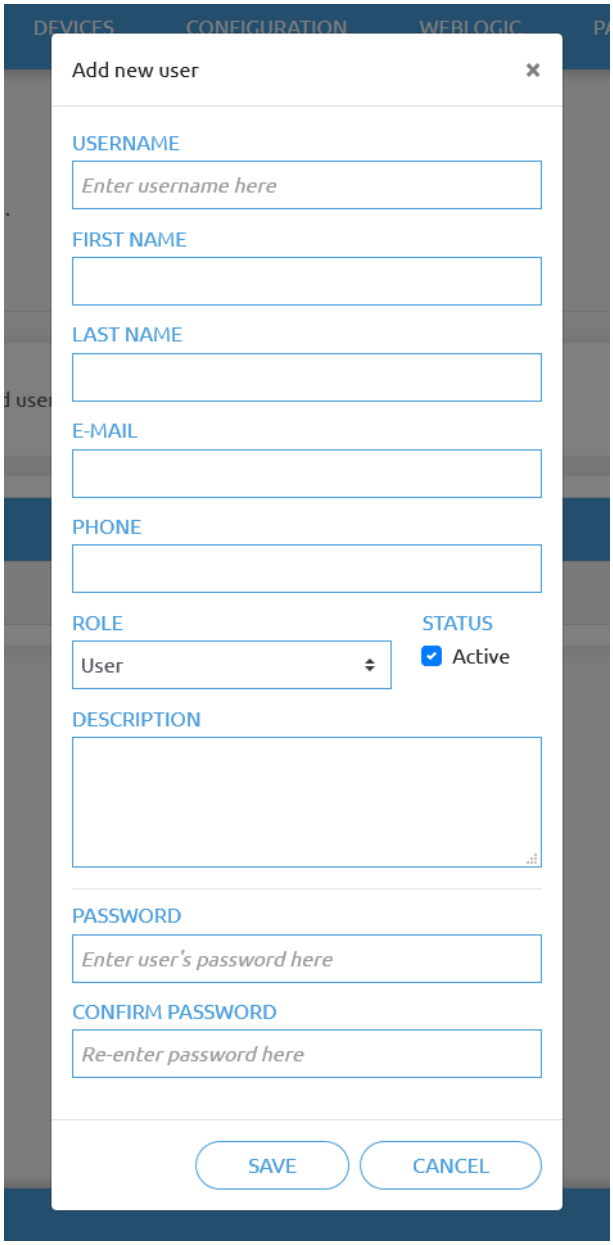
This page has two tabs:

- **My profile** - to see and update the currently logged in users' profile (e.g.: change password)
- **Users** - to manage users (e.g.: add/remove/edit)

On the **My profile** tab to change any profile data (e.g.: password) click on the **Update profile** button.



On the **Users** tab click on the **Add new user** button to add more users:

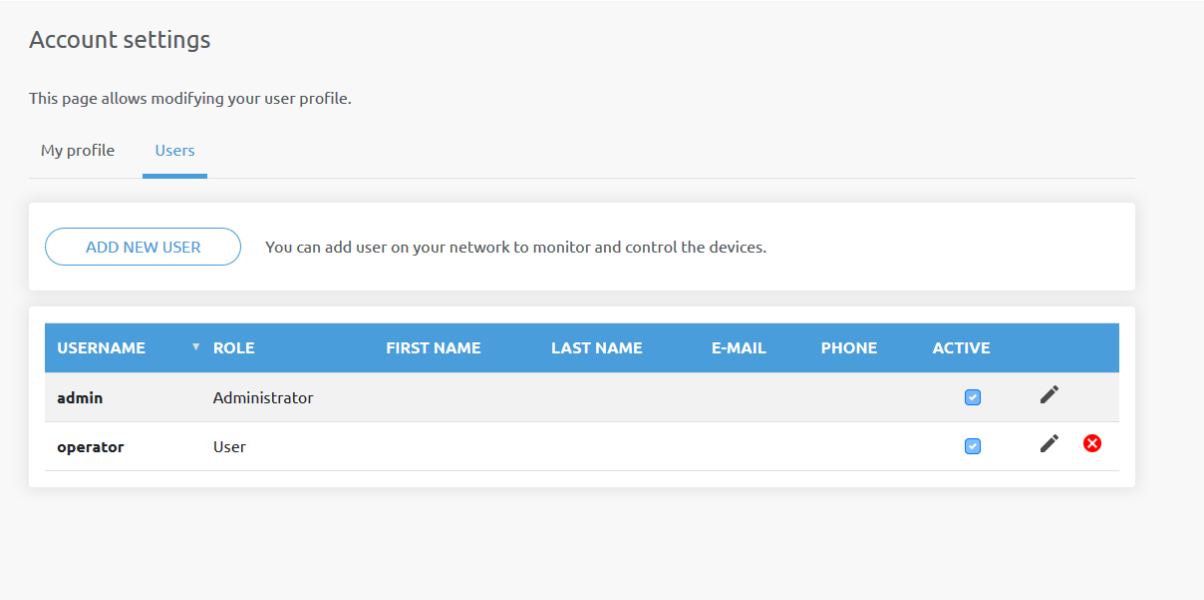


There are three user levels:

- Administrator
- Operator
- User

Fill in the user information and click **Save**.

Later on to change any user information just click on the edit icon.



To prevent a user to sign-in either could be:

- deactivated by changing its **Active** status in the edit mode
- or removed by clicking the delete icon.

6.1.10. Web Client: Inspection Monitoring

OnRobot Eyes inspection can be executed and monitored from the Web Client. This is useful to monitor the decisions taken by Eyes and test the inspection tasks created.

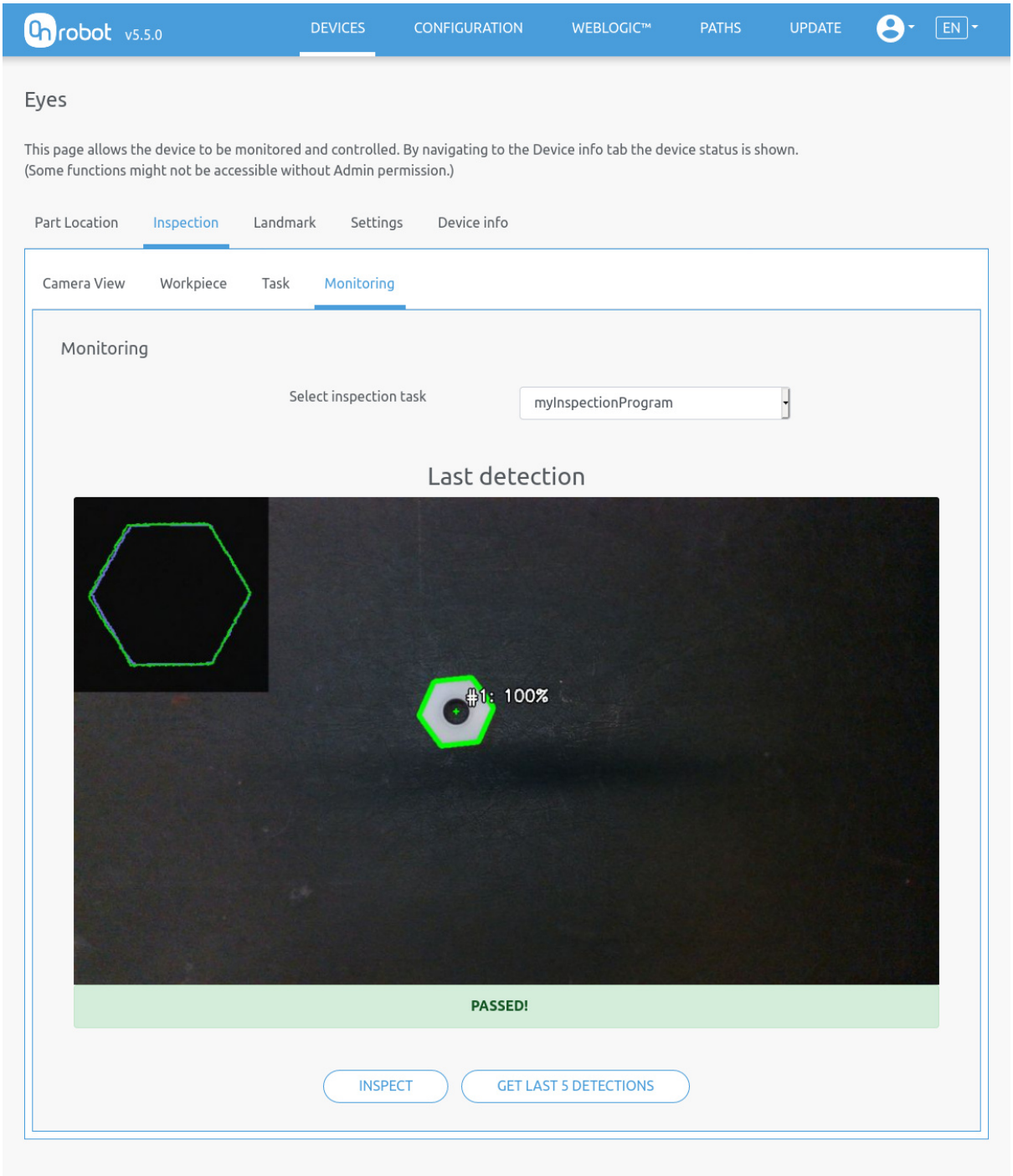
To access the monitoring functionality, in the **Devices** menu, click on the Eyes tool and navigate to **Inspection** and then **Monitoring**.

In order to monitor or test an inspection task, select it from the dropdown. An image showing the latest inspection execution of the selected task will be shown. It will be updated when the inspection task is executed again.

To test the program, click INSPECT, this will trigger an execution of the selected inspection task.

WARNING:

Executing an inspection task from the Monitoring tab might cause unexpected behavior if another Eyes task is being executed from another source (robot program, WebLogic). Stop execution from these sources before using this functionality.



Additionally, it is possible to see the latest 5 inspection results by clicking **Get last 5 detections**.

7. Hardware Specification

7.1. Technical Sheets

7.1.1. Eyes

Eyes

Camera Characteristics			Unit
Interface		USB-C 3.x	
Image Sensor Technology		Rolling Shutter. Size 1.4 x 1.4	[µm px]
RGB Camera Field of View (FOV)		69.4 x 42.5 x 77 (+/- 3)	[°]
RGB Camera Resolution	Standard	1280x720	[px]
	Close-up	1920x1080	[px]
Depth Technology		Active IR Stereo	
Depth FOV		65±2 x 40±1 x 72±2	[°]
Depth Output Resolution		1280 x 720	[px]
Working Distance		400-1000 15.75 - 39.37	[mm] [inch]
Operating Temperature		0 – 35 32 – 95	[°C] [°F]
IP Rating		IP 54	
Weight		0.260 0.57	[kg] [lb]
Calculated operation life		30 000	[h]

Eyes Features			Unit
Type of vision system	2.5 D		
Minimum workpiece size	10x10 or 15 diameter 0.39x0.39 or 0.59 diameter		[mm] [inch]
Applications Supported	Detection, Sorting, Inspection, Landmark		
Mounting options supported	Robot and External		
Reconfigurability when Robot mounted	12 configurations (4 x 3)		
	Around robot's flange	Tilt orientations	
	0 - 90 - 180 - 270	0 - 45 - 90	[degrees]
	Processing time	Typical: 0.5 s	

Eyes Features					Unit
Detection Repeatability	< 2 < 0.078				[mm] [inch]
Detection Accuracy (typical) measured at 500 mm	External Mount		Robot Mount		
	2 0.078		2 0.078		[mm] [inch]
Minimum Inspection Defect Size	Standard		Close-up		
	5 0.197		3 0.118		[mm] [inch]
Landmark accuracy**	Waypoint distance from Landmark	Minimum error	Typical error	Maximum error	
	200 7.874	0.2635 0.0104	0.6596 0.0260	0.9500 0.0374	[mm] [inch]
	500 19.68	0.6586 0.0259	1.6490 0.0649	2.3750 0.0935	[mm] [inch]
	1000 39.37	1.3173 0.0519	3.2981 0.1298	4.7500 0.1870	[mm] [inch]

** Depending on the distance from the waypoint (picking point) to Landmark. Obtained using dual capture approach with the camera being 300 mm (11.81 in) above the Landmark.

Application and set-up recommendations	
Lighting conditions	No drastic, instant changes
Reflections and focused light spots	Keep minimal
Characteristics of objects	Different from background
Camera with respect to workspace table	Looking straight to it

Eyes Lighting Kit

Eyes Lighting Kit Features		Unit
Input voltage	24	[V]
Maximum current	1	[A]
Connection	3-pin M8 connector	
Operating temperature	0–50 32–122	[°C] [°F]
IP rating	IP54	
Weight	0.131 0.288	[kg] [lb]

Eyes Lighting Kit Features		Unit
Calculated operation life	30 000	[h]

Eye Box

Eye Box	
Weight	1.01 kg 2.23 lb
Required power supply	24V (6.25A)
Calculated operation life	30 000 h

Power Supply (6.25A/150W)	Min	Typical	Max	Units
Input voltage (AC)	100	-	240	[V]
Input current	-	-	2.1	[A]
Output voltage	-	24	-	[V]
Output current	-	6.25		[A]

Power input (24V connector)	Min	Typical	Max	Units
Supply voltage	-	24	25	[V]
Supply current	-	6.25	-	[A]

Power output (Device connector)	Min	Typical	Max	Units
Output voltage	-	24	25	[V]
Output current (EB HW v1.2)	-	4.5	4.5*	[A]

*Peak currents

Eye Box I/O interface:

Power Reference (24V, GND)	Min	Typical	Max	Units
Reference output voltage	-	24	25	[V]
Reference output current	-	-	100	[mA]

Digital Output (DO1-DO8)	Min	Typical	Max	Units
Output current - altogether	-	-	100	[mA]
Output resistance (active state)	-	24	-	[Ω]

Digital Input (DI1-DI8) as PNP	Min	Typical	Max	Units
Voltage level - TRUE	18	24	30	[V]

Digital Input (DI1-DI8) as PNP	Min	Typical	Max	Units
Voltage level - FALSE	-0.5	0	2.5	[V]
Input current	-	-	6	[mA]
Input resistance	-	5	-	[kΩ]

Digital Input (DI1-DI8) as NPN	Min	Typical	Max	Units
Voltage level - TRUE	-0.5	0	5	[V]
Voltage level - FALSE	18	24	30	[V]
Input current	-	-	6	[mA]
Input resistance	-	5	-	[kΩ]

7.1.2. HEX-E QC

General Properties	6-Axis Force/Torque Sensor				Unit
	Fxy	**Fz**	**Txy**	**Tz**	
Nominal Capacity (N.C)	200	200	10	6.5	[N] [Nm]
Single axis deformation at N.C (typical)	± 1.7 ± 0.067	± 0.3 ± 0.011	± 2.5 ± 2.5	± 5 ± 5	[mm] [°] [inch] [°]
Single axis overload	500	500	500	500	[%]
Signal noise* (typical)	0.035	0.15	0.002	0.001	[N] [Nm]
Noise-free resolution (typical)	0.2	0.8	0.01	0.002	[N] [Nm]
Full scale nonlinearity	< 2	< 2	< 2	< 2	[%]
Hysteresis (measured on Fz axis , typical)	< 2	< 2	< 2	< 2	[%]
Crosstalk (typical)	< 5	< 5	< 5	< 5	[%]
IP Classification	67				
Dimensions (H x W x L)	50 x 71 x 93 1.97 x 2.79 x 3.66				[mm] [inch]
Weight (with built-in adapter plates)	0.347 0.76				[kg] [lb]

* Signal noise is defined as the standard deviation (1 σ) of a typical one second no-load signal.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated operation life	30 000	-	-	[Hours]

Operating Conditions	Minimum	Typical	Maximum	Unit
Re-calibration period*	-	15 000**	-	[Hours]

*Notification is provided when factory re-calibration is recommended.

**Based on energized hours.

Best practice for maintaining your calibrated device:

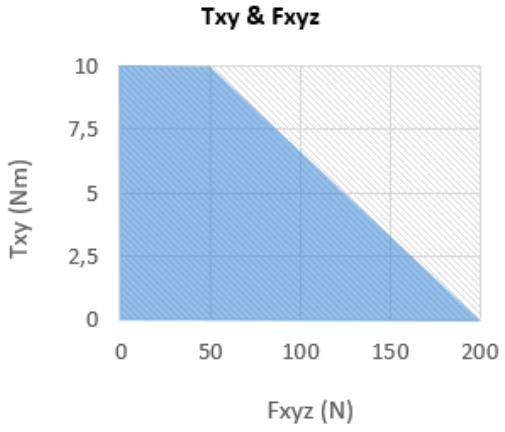
- Turn off the HEX sensor when not in use for a longer period.
- Offload the HEX sensor when not used for a longer period.
- The Auto-calibration software feature is recommended every 2-3 month or when needed.

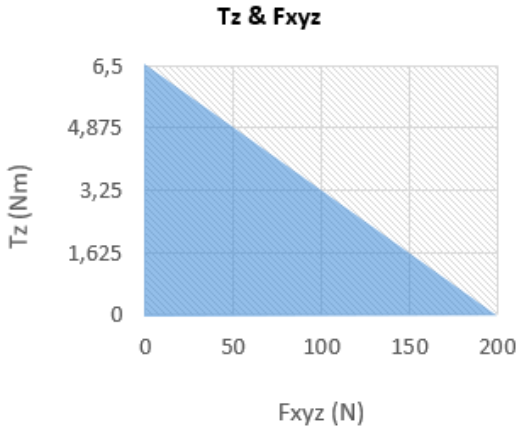
Complex Loading

During single-axis loading, the sensor can be operated up to its nominal capacity. Above the nominal capacity the reading is inaccurate and invalid.

During complex loading (when more than one axis is loaded) the nominal capacities are reduced. The following diagrams show the complex loading scenarios.

The sensor cannot be operated outside of the Normal Operating Area (marked with blue on the diagrams below).





7.1.3. HEX-H QC

General Properties	6-Axis Force/Torque Sensor				Unit
	Fxy	Fz	Txy	Tz	
Nominal Capacity (N.C)	200	200	20	13	[N] [Nm]
Single axis deformation at N.C (typical)	± 0.6 ± 0.023	± 0.25 ± 0.009	± 2 ± 2	± 3.5 ± 3.5	[mm] [°] [inch] [°]
Single axis overload	500	400	300	300	[%]
Signal noise* (typical)	0.1	0.2	0.006	0.002	[N] [Nm]
Noise-free resolution (typical)	0.5	1	0.036	0.008	[N] [Nm]

General Properties	6-Axis Force/Torque Sensor				Unit
Full scale nonlinearity	< 2	< 2	< 2	< 2	[%]
Hysteresis (measured on Fz axis , typical)	< 2	< 2	< 2	< 2	[%]
Crosstalk (typical)	< 5	< 5	< 5	< 5	[%]
IP Classification	67				
Dimensions (H x W x L)	50 x 71 x 93 1.97 x 2.79 x 3.66				[mm] [inch]
Weight (with built-in adapter plates)	0.35 0.77				[kg] [lb]

* Signal noise is defined as the standard deviation (1 σ) of a typical one second no-load signal.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	7	-	24	[V]
Power consumption	-	-	0.8	[W]
Operating temperature	0 32	- -	55 131	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated operation life	30 000	-	-	[Hours]
Re-calibration period*	-	7 500**	-	[Hours]

*Notification is provided when factory re-calibration is recommended.

**Based on energized hours.

Best practice for maintaining your calibrated device:

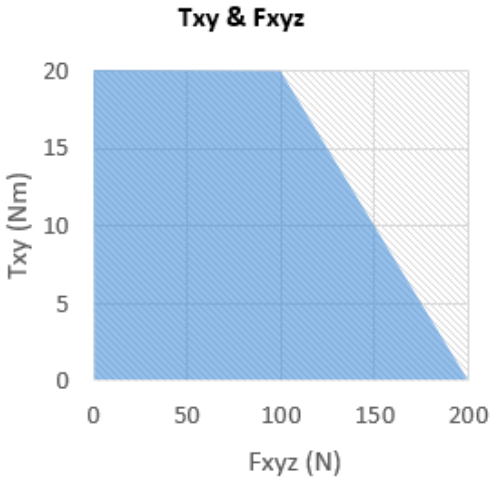
- Turn off the HEX sensor when not in use for a longer period.
- Offload the HEX sensor when not used for a longer period.
- The Auto-calibration software feature is recommended every 2-3 month or when needed.

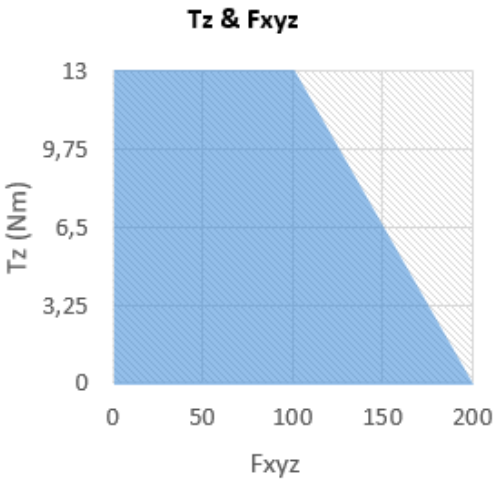
Complex Loading

During single-axis loading, the sensor can be operated up to its nominal capacity. Above the nominal capacity the reading is inaccurate and invalid.

During complex loading (when more than one axis is loaded) the nominal capacities are reduced. The following diagrams show the complex loading scenarios.

The sensor cannot be operated outside of the Normal Operating Area (marked with blue on the diagrams below).



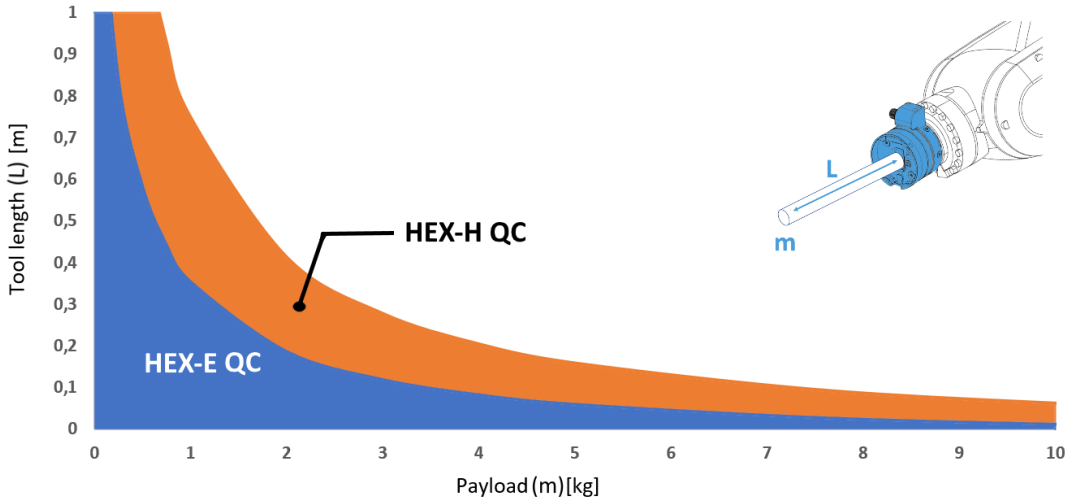


7.1.4. HEX-E QC and HEX-H QC Comparison

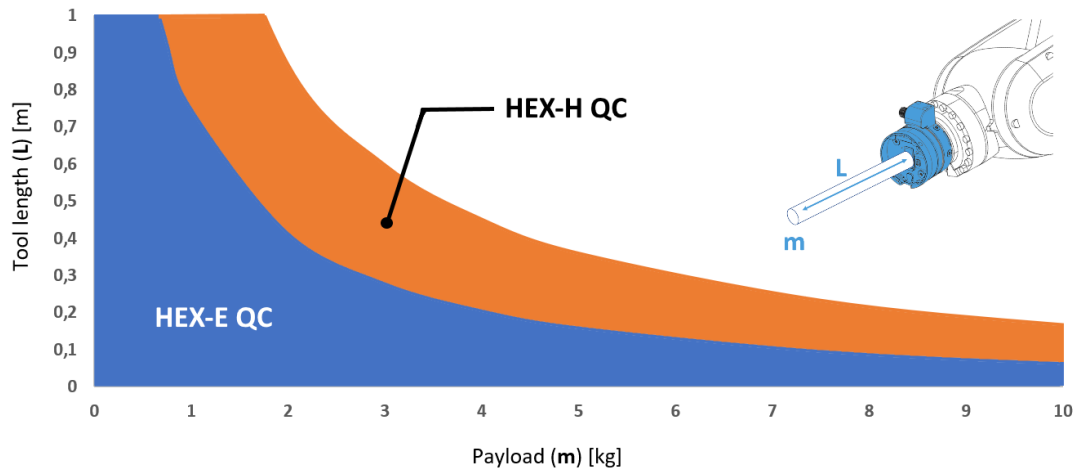
When the sensor is used in applications where higher sensitivity is needed HEX-E QC is recommended, where higher payload or tool length is needed HEX-H QC is recommended.

The following graphs show the extent of the payload and the tool length that you can use together with the HEX-E and the HEX-H sensors in case of applications requiring high or moderate precision.

Applications requiring high precision (e.g.: force control based applications like Sanding and Pin Insertion)



Other applications (e.g.: part detection, force monitoring)



In the blue region it is recommened to use only the HEX-E QC.

7.1.5. VGC10

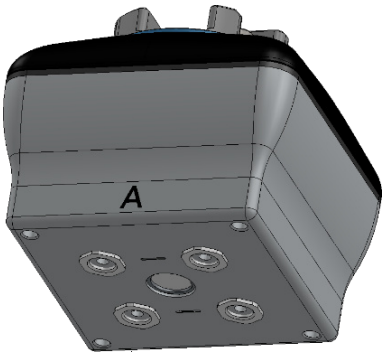
General Properties		Minimum	Typical	Maximum	Unit
Vacuum		5 % -0.05 1.5	- - -	80 % -0.810 24	[Vacuum] [Bar] [inHg]
Air flow		0	-	12	[L/min]
Payload	With default attachments	- -	- -	6 * 13.2 *	[kg] [lb]
	With customized attachments	- -	10 20	15 33.1	[kg] [lb]
Vacuum cups		1	-	7	[pcs.]
Gripping time		-	0.35	-	[s]
Releasing time		-	0.20	-	[s]
Vacuum pump		Integrated, electric BLDC			
Dust filters		Integrated 50µm, field replaceable			
IP Classification		IP54			
Dimensions		101 x 100 x 100 3.97 x 3.94 x 3.94			[mm] [inch]
Weight		0.814 1.79			[kg] [lb]

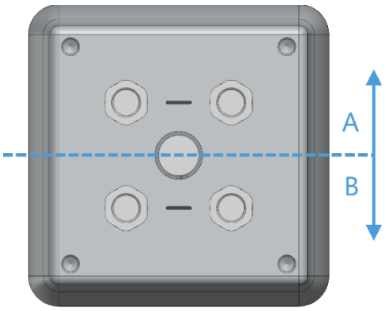
* By using three 40mm cups. More info in the table **Number of Cups needed for non-porous materials depending on payload and vacuum**.

Operating Conditions	Minimum	Typical	Maximum	Unit
Power supply	20.4	24	28.8	[V]
Current consumption	50	600	1500	[mA]
Operating temperature	0 32	- -	50 122	[°C] [°F]
Relative humidity (non-condensing)	0	-	95	[%]
Calculated operation life	30 000	-	-	[Hours]

2 Channels

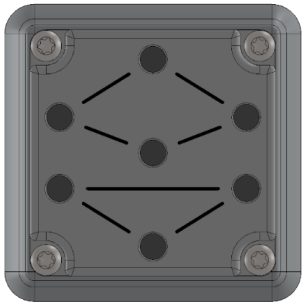
The VGC10 has 4 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channels A and B independently for vacuum.



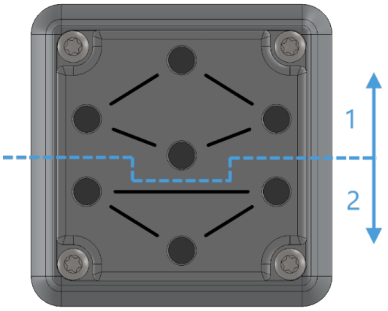


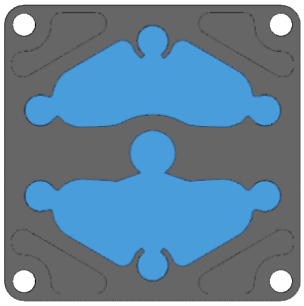
Adaptor Plate

The VGC10 comes with an Adaptor Plate which provides extra flexibility to locate the vacuum cups in different configurations.

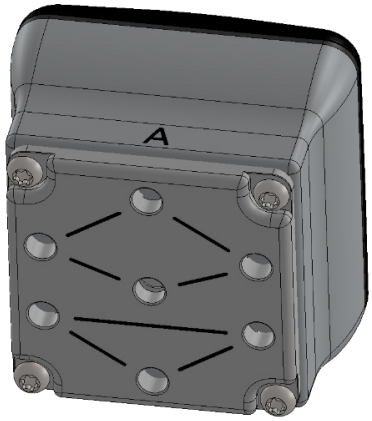


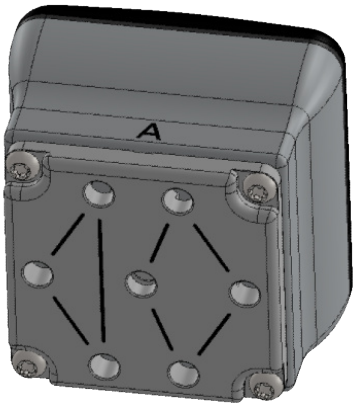
The Adaptor Plate has 7 holes to use fittings with vacuum cups or blinding screws as needed. It also has lines which show the holes that are communicated together. This is useful when using channel A and B independently for vacuum.



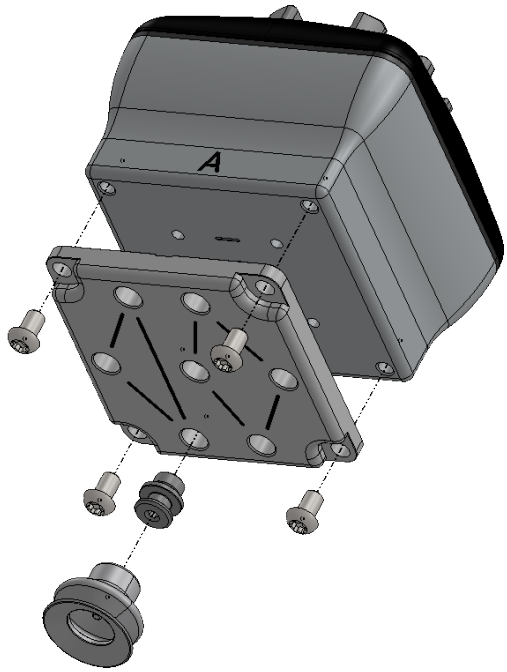


The Adaptor Plate can be placed in different positions by rotating it 90º. Having as reference the letters A and B written on the gripper housing, the Adaptor Plate can be placed to separate both channels or to communicate them. If the Adaptor Plate is placed as in picture below on the left, both channels will be separated, and they can be used independently or combined. If the Adaptor Plate is placed as in picture below on the right, both channels will be communicated and a higher air flow can be achieved, although both channels will have to be used combined.





To mount the Adaptor Plate simply remove the 4 fittings or blinding screws from the gripper, place the Adaptor Plate by choosing the right angle according to the desired configuration, and tighten the 4 screws with 4 Nm tighten torque.



NOTE:

Please, note that the O-Ring in the Adaptor Plate is not glued therefore it can be pulled out. If that happens simply put it back in place and the gripper will work as before.

Extension Pipe

The Extension Pipe provides an extra length of 50 mm to reach narrow spaces.

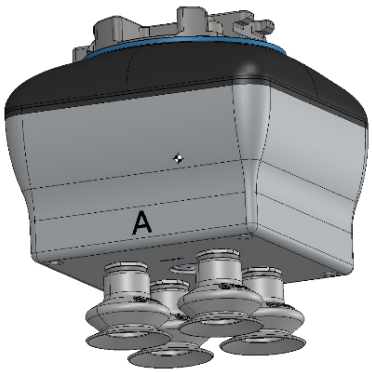
NOTE:

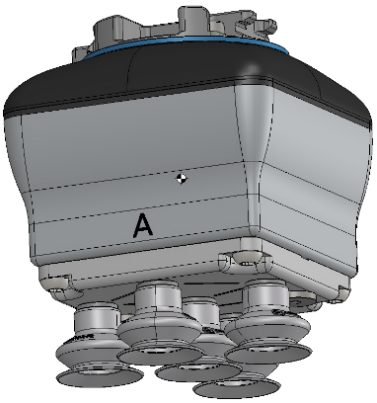
Remember to use the Adaptor Plate rotated to achieve a higher air flow when using both channels together.

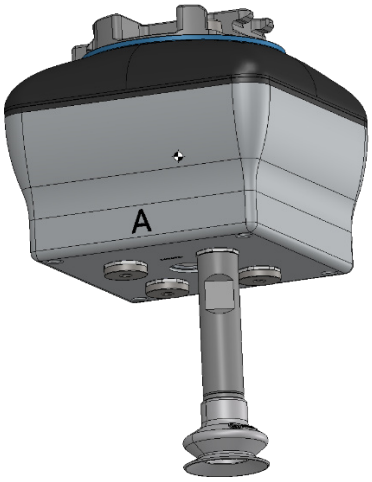
The Extension Pipe can be mounted in any of the holes by simply screwing it in and adding a fitting on top as shown in the image below.

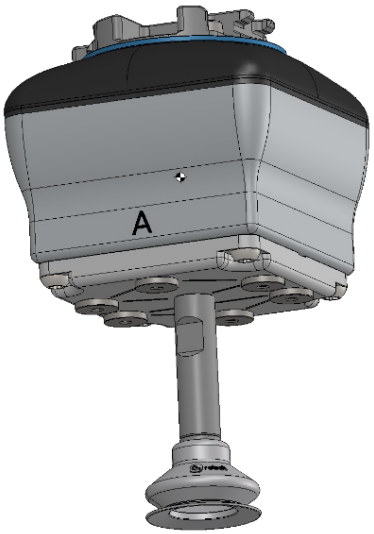


Below different mounting configurations with the provided attachments are shown.



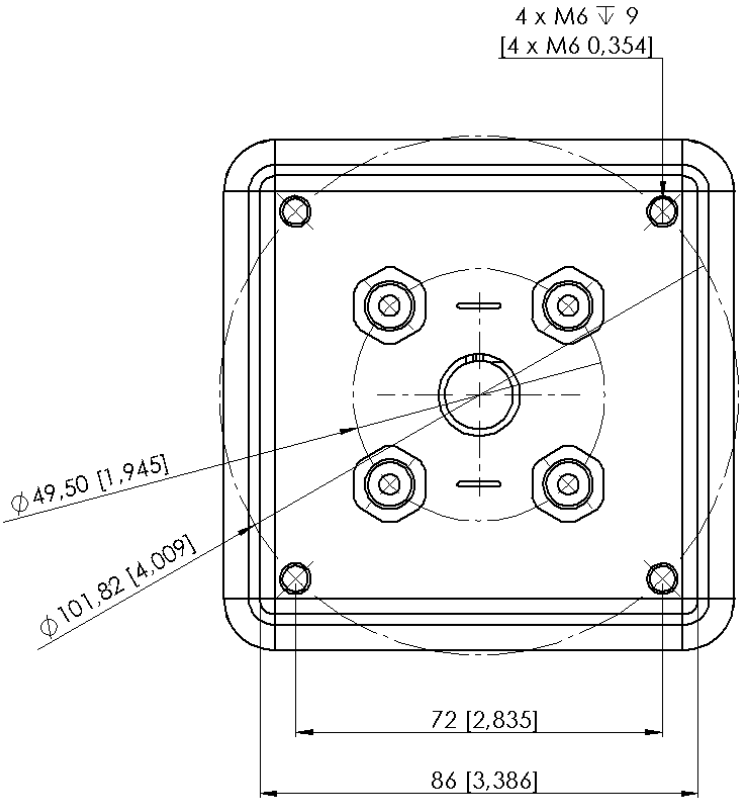




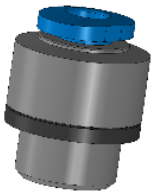


Customized Adaptor Plates and Push-in Fittings

The design of the VGC10 is meant to facilitate the users to make their own adaptor plates to create different kinds of configurations. The dimensions needed to create a customized adaptor plate are shown in the image below.

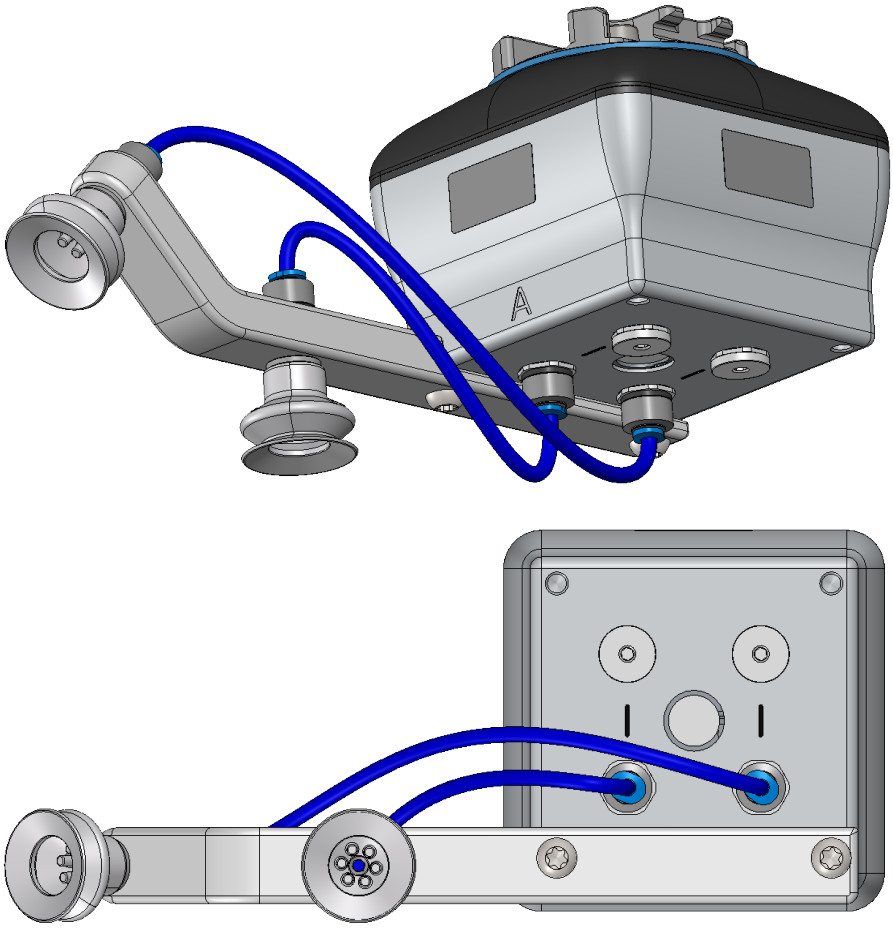


The Push-in Fittings are used to attach 4 mm vacuum tubes to create customized configuration that required remote vacuum. In most cases, this size is enough for generating the needed vacuum from the pump in the gripper.

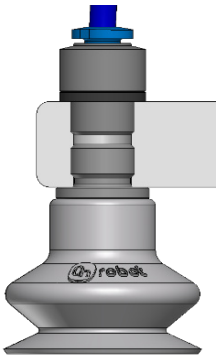


The commercial name of the Push-in Fittings is Fitting QSM-G1/8-4-I-R in case some more units need to be purchased.

An example of a customized configuration with a homemade adaptor plate and remote vacuum is shown below.



The image below shows how the push-in fittings and the normal fittings are communicated.



Payload

The lifting capacity of the VG grippers depends primarily on the following parameters:

- Vacuum cups
- Vacuum
- Air flow

Vacuum Cups

Choosing the right vacuum cups for your application is essential. The VG grippers come with common 15, 30 and 40 mm silicone vacuum cups (see table below) which are good for hard

and flat surfaces, but not good for uneven surfaces and it might leave microscopic traces of silicone on the workpiece which can cause issues with some types of painting processes afterwards.

Image	External Diameter [mm]	Internal Diameter [mm]	Gripping Area [mm2]
	15	6	29
	30	16	200
	40	24	450

For non-porous materials, the OnRobot suction cups are highly recommended. Some of the most common non-porous materials are listed below:

- Composites
- Glass
- High density cardboard
- High density paper
- Metals
- Plastic
- Porous materials with a sealed surface
- Varnished wood

In an ideal case, working with non-porous material workpieces where there are no air flow going through the workpiece, the table below shows the number of cups and the cup size needed depending on the payload (workpiece mass) and the vacuum used.

Number of Cups needed for non-porous materials depending on payload and vacuum :

	 15 mm				 30 mm				 40 mm			
Payload (kg)	**Vacuum (kPa)**				**Vacuum (kPa)**				**Vacuum (kPa)**			
	20	**40**	**60**	**75**	**20**	**40**	**60**	**75**	**20**	**40**	**60**	**75**
0.1	3	2	1	1	1	1	1	1	1	1	1	1
0.5	13	7	5	4	2	1	1	1	1	1	1	1
1	-	13	9	7	4	2	2	1	2	1	1	1
2	-	-	-	14	8	4	3	2	4	2	2	1
3	-	-	-	-	12	6	4	3	5	3	2	2
4	-	-	-	-	15	8	5	4	7	4	3	2
5	-	-	-	-	-	10	7	5	9	5	3	3
6	-	-	-	-	-	12	8	6	10	5	4	3
7	-	-	-	-	-	13	9	7	12	6	4	4
8	-	-	-	-	-	15	10	8	14	7	5	4
9	-	-	-	-	-	-	12	9	15	8	5	4
10	-	-	-	-	-	-	13	10	-	9	6	5
11	-	-	-	-	-	-	14	11	-	9	6	5
12	-	-	-	-	-	-	15	12	-	10	7	6
13	-	-	-	-	-	-	16	13	-	11	8	6
14	-	-	-	-	-	-	-	14	-	12	8	7
15	-	-	-	-	-	-	-	15	-	13	9	7

NOTE:

To use more than 7 (15mm), 4 (30mm) or 3 (40mm) vacuum cups with the VGC10 a customized adaptor plate is needed.

The table above is created with the following formula that equalizes the lifting force with the payload considering 1.5G of acceleration.

$$Amount_{Cups} * Area_{Cup}[mm] = 14700 \frac{Payload\ [kg]}{Vacuum\ [kPa]}$$

It is often a good idea to use more vacuum cups than needed, to accommodate for vibrations, leaks and other unexpected conditions. However, the more vacuum cups, the more air leakage (air flow) is expected and the more air is moved in a grip resulting in longer gripping times.

When using porous materials, the vacuum that can be achieve by using the OnRobot suction cups will depend on the material itself and will be between the range stated in the specifications. Some of the most common non-porous materials are listed below:

- Fabrics
- Foam
- Foam with open cells
- Low density cardboard
- Low density paper
- Perforated materials
- Untreated wood

See the table below with general recommendations, in case other suction cups are needed for specific materials.

Workpiece surface	Vacuum cup shape	Vacuum cup material
Hard and flat	Normal or dual lip	Silicone or NBR
Soft plastic or plastic bag	Special plastic bag type	Special plastic bag type
Hard but curved or uneven	Thin dual lip	Silicone or soft NBR
To be painted afterwards	Any type	NBR only
Varying heights	1.5 or more bevels	Any type

NOTE:

It is recommended to consult a vacuum cup specialist to find the optimal vacuum cup where the standard types are insufficient.

Suction Cups for Foil and Bags Ø25

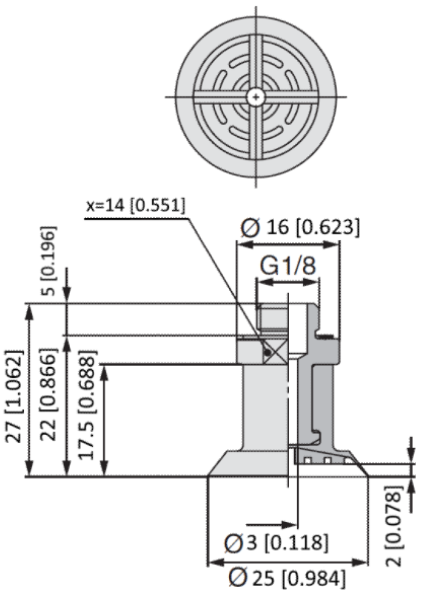
This suction cup improves the vacuum gripper's ability to pick and place workpieces with surface of foil, thin paper, and plastic bags during irregular and angular arm movement.

	 25 mm			
Number of Cups	**1**	**2**	**3**	**4**
Surface	**kg**			
Foil	0.83	1.07	1.43	1.57
Thin paper	1.08	1.71	2.23	3.21
Foil - round shape	1.28	2.32	3.32	4.25
Plastic bag	0.32	0.54	0.63	0.74

The vacuum cup is silicone rubber compliant with the USA Food and Drug Administration (FDA).

Using this vacuum cup reduces the wrinkles made on thin workpieces (film, vinyl, and so on) during absorption:  .





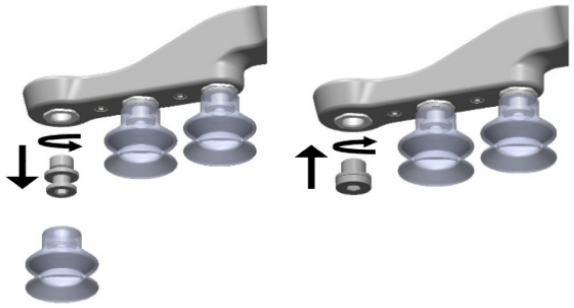
This vacuum cup is an accessory and need to be purchased separately. To purchase the vacuum cup, contact the vendor from where the VGx gripper has been purchased.

- Suction Cups for foil and bags Ø25 - PN 105922

Fittings and Blind Screws

It is possible to change suction cups simply by pulling them off the fittings. It might be a bit challenging to remove the 15 mm Diameter vacuum cups. As suggestion try to stretch the silicon to one of the sides and then pull it out.

Unused holes can be blinded using a blind screw, and each fitting can be changed to a different type to match the desired suction cup. The fittings and the blinding screws are mounted or dismounted by screwing (2Nm tightening torque) or unscrewing them with the provided 3 mm Allen key.



The thread size is the commonly used G1/8”; allowing for standard fittings, blinders and extenders to be fitted directly to the VG grippers.

Vacuum

Vacuum is defined as the percentage of absolute vacuum achieved relative to atmospheric pressure, i.e.:

% vacuum	Bar	kPa	inHg	Typically used for
0%	0.00rel. 1.01 abs.	0.00rel. 101.3 abs.	0.0rel. 29.9 abs.	No vacuum / No lifting capacity
20%	0.20rel. 0.81 abs.	20.3rel. 81.1 abs.	6.0rel. 23.9 abs.	Cardboard and thin plastics
40%	0.41rel. 0.61 abs.	40.5rel. 60.8 abs.	12.0rel. 18.0 abs.	Light workpieces and long suction cup life span
60%	0.61rel. 0.41 abs.	60.8rel. 40.5 abs.	18.0rel. 12.0 abs.	Heavy workpieces and strongly secured grips
80%	0.81rel. 0.20 abs.	81.1rel. 20.3 abs.	23.9rel. 6.0 abs.	Max. vacuum. Not recommended

The vacuum in kPa setting is the target vacuum. The pump will run at full speed until the target vacuum is achieved, and then run at a lower speed necessary to maintain the target vacuum.

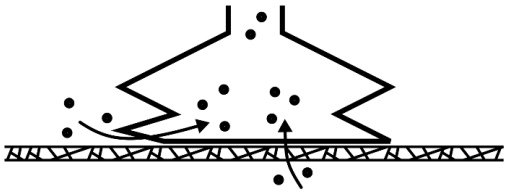
The pressure in the atmosphere varies with weather, temperature and altitude. The VG grippers automatically compensate for altitudes up to 2km, where the pressure is about 80% of sea level.

Air Flow

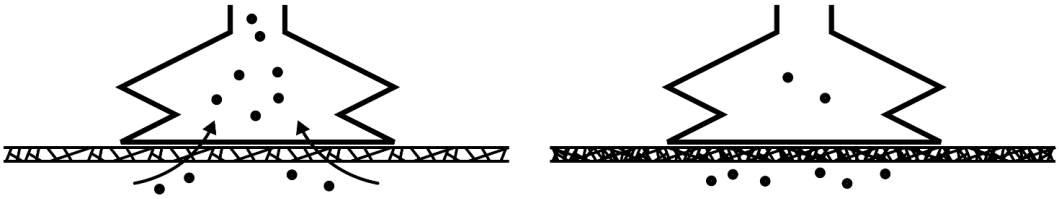
Air flow is the amount of air that must be pumped to maintain the target vacuum. A completely tight system will not have any air flow, whereas real life applications have some smaller air leakages from two different sources:

- Leaking vacuum cup lips
- Leaking workpieces

The smallest leak under a vacuum cup can be hard to find (see picture below).



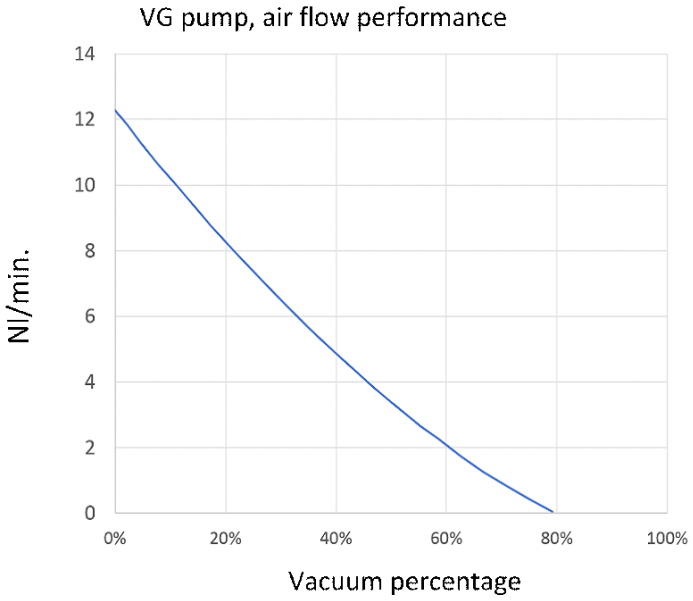
Leaking workpieces can be even harder to identify. Things that look completely tight might not be tight at all. A typical example is coarse cardboard boxes. The thin outer layer is often requiring a lot of air flow to create a pressure difference over it (see figure below).



Therefore, the users must be aware of the following:

- VG grippers are not suitable for most uncoated, coarse cardboard boxes.
- Extra attention must be paid to leakages, e.g. vacuum cup shape and surface roughness

The air flow capability of a VG grippers is shown in the graph below:



NOTE:

The easiest way to check if a cardboard box is sufficiently tight is simply to test it using the VG grippers.

A high vacuum percentage setting does not give a higher lifting capacity on corrugated cardboard. In fact, a lower setting is recommended, e.g. 20%.

A low vacuum setting results in less air flow and less friction below the vacuum cups. This means VG gripper filters and vacuum cups will last longer.

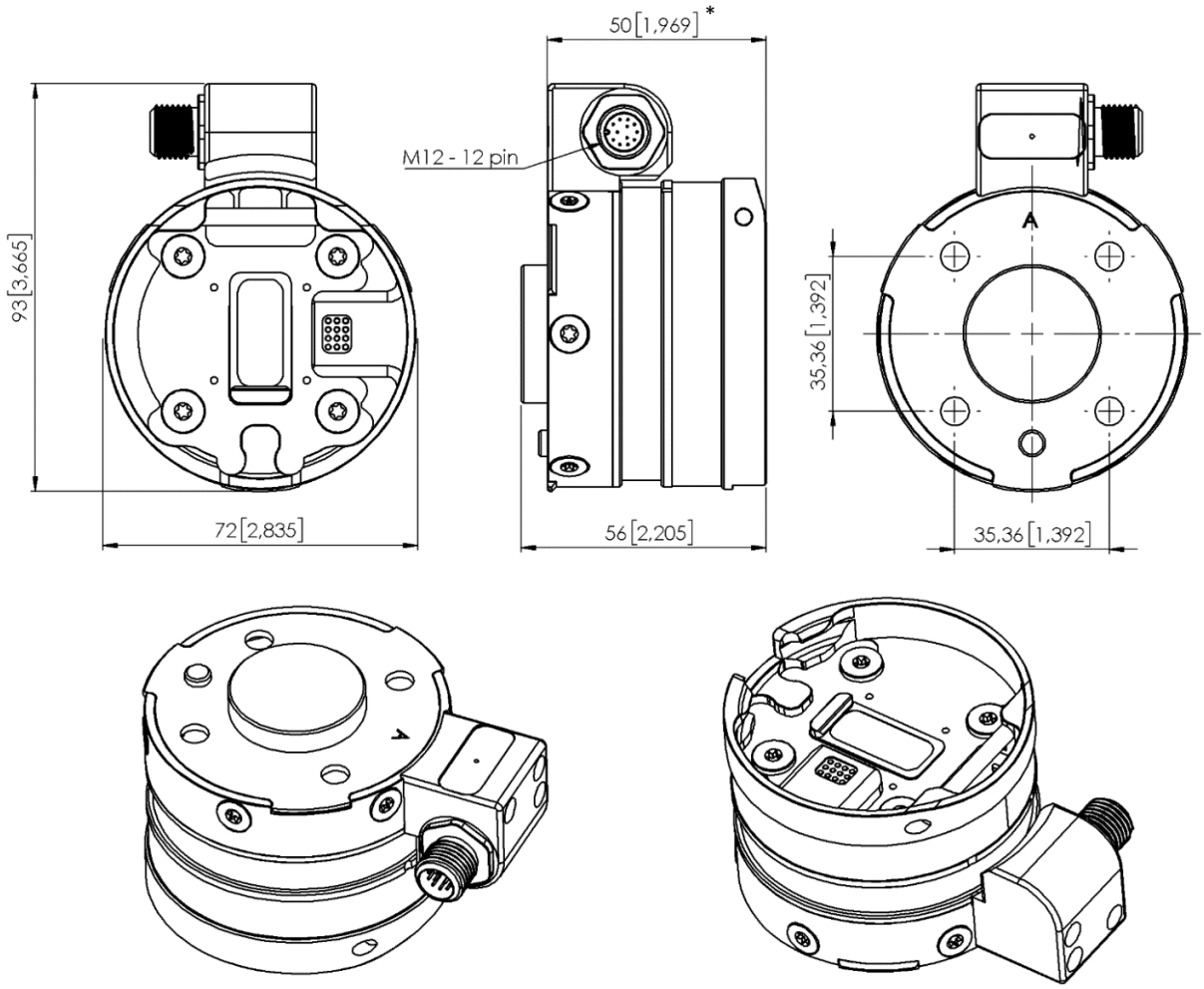
7.2. Mechanical Drawings

7.2.1. Adapter Plate

No adapter plate is required.

7.2.2. Mountings

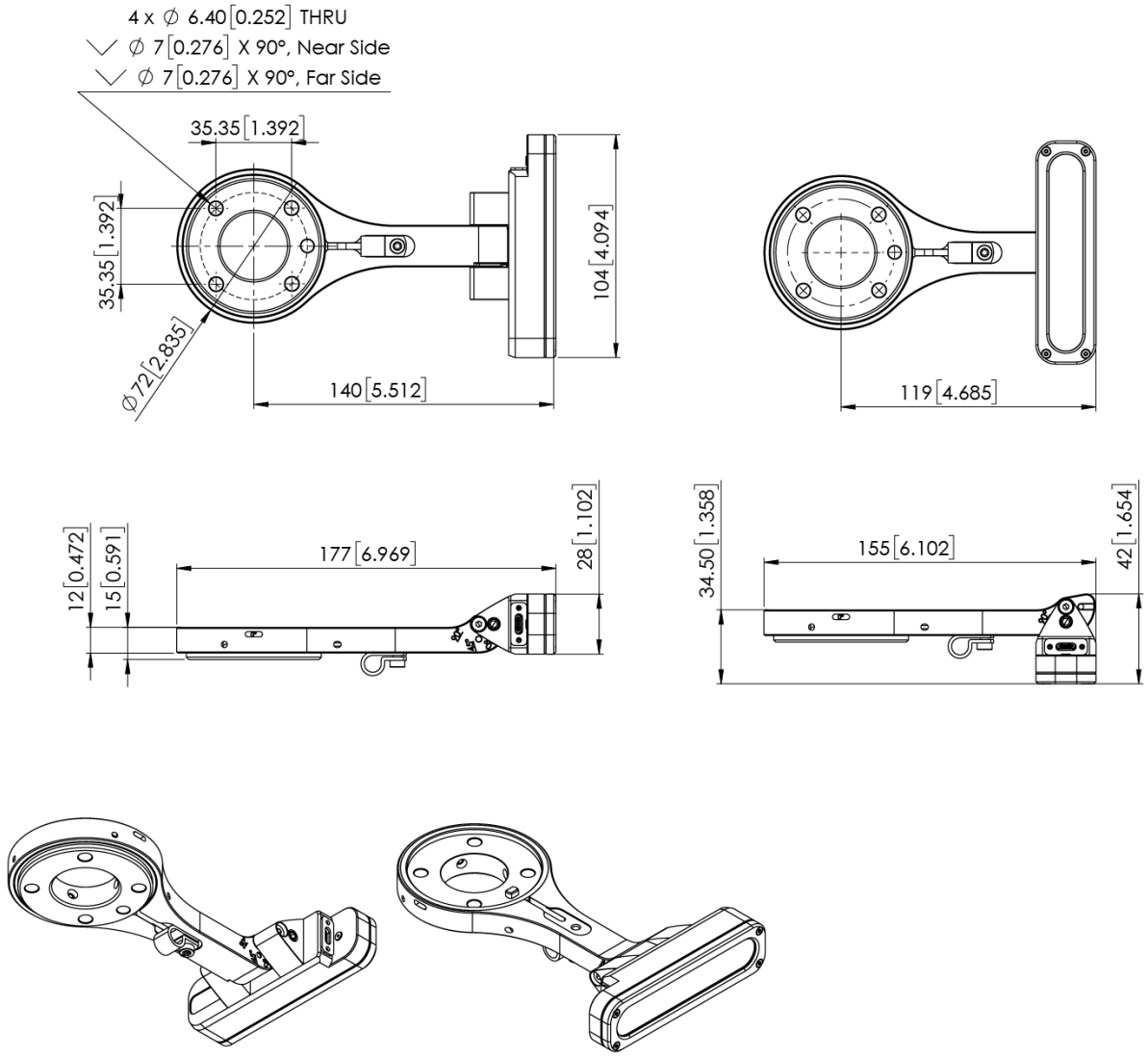
7.2.2.1. HEX-E/H QC



* Distance from Robot flange interface to OnRobot tool

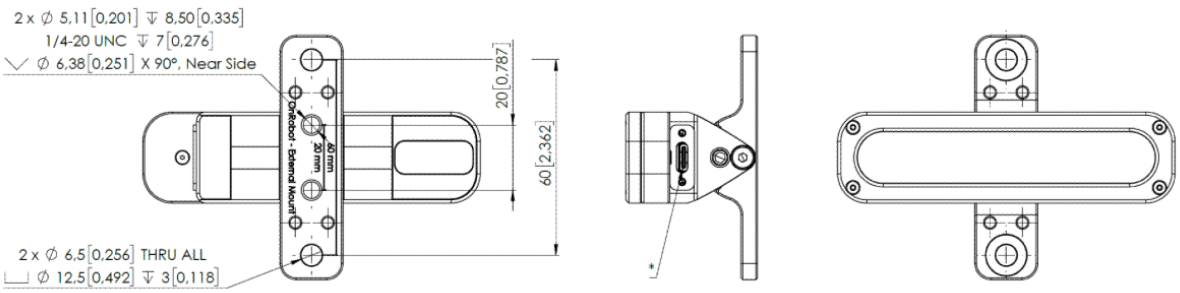
All dimensions are in mm and [inches].

7.2.2.2. Eyes - Robot Mount



All dimensions are in mm and [inches].

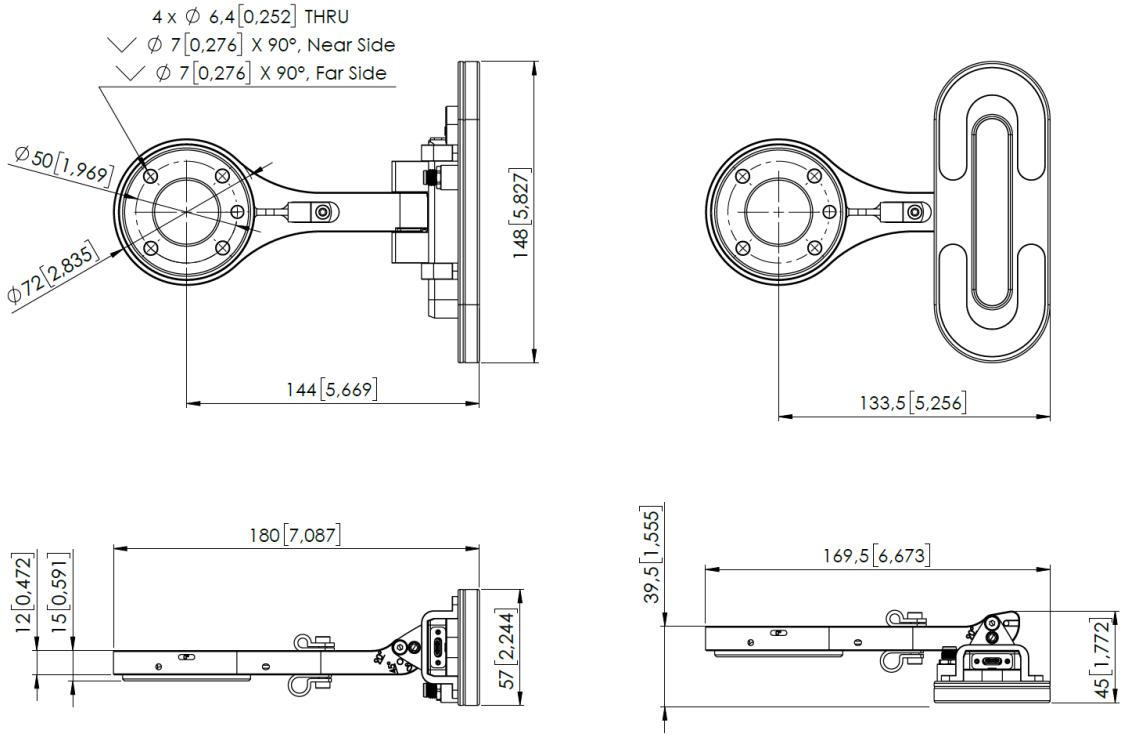
7.2.2.3. Eyes - External Mount



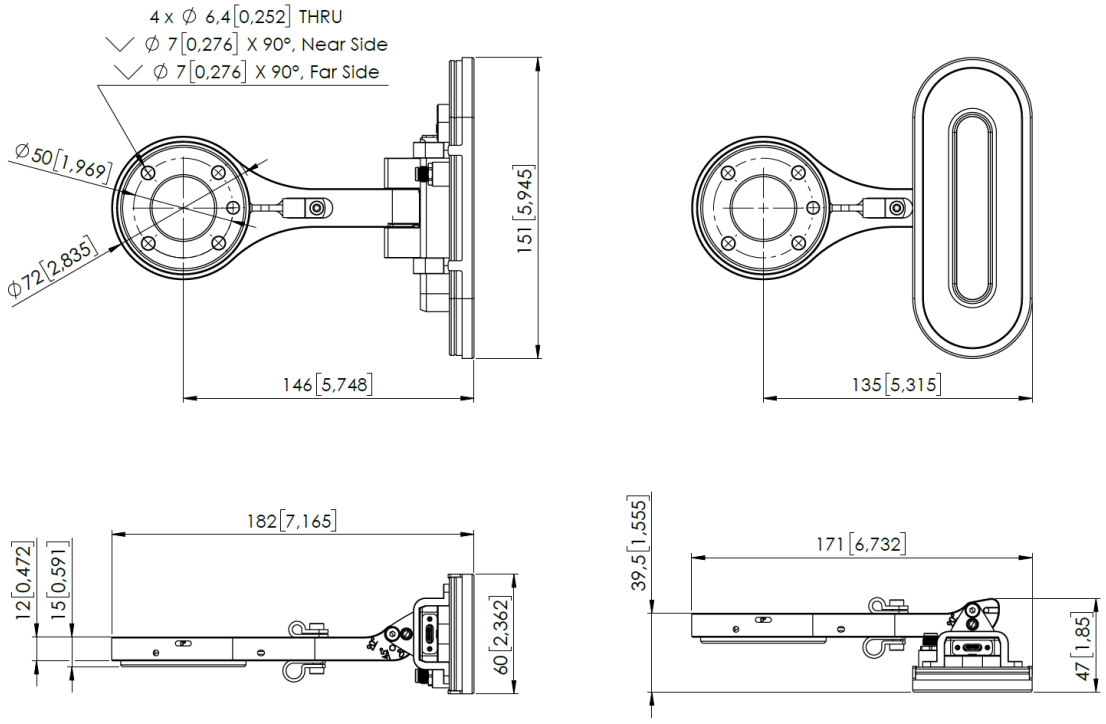
All dimensions are in mm and [inches].

7.2.2.4. Eyes Lighting Kit Mount

Eyes with Light

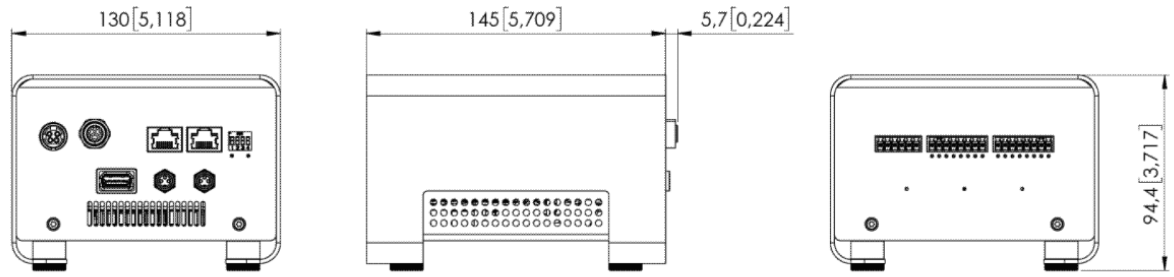


Eyes with Light and Diffuser



All dimensions are in mm and [inches].

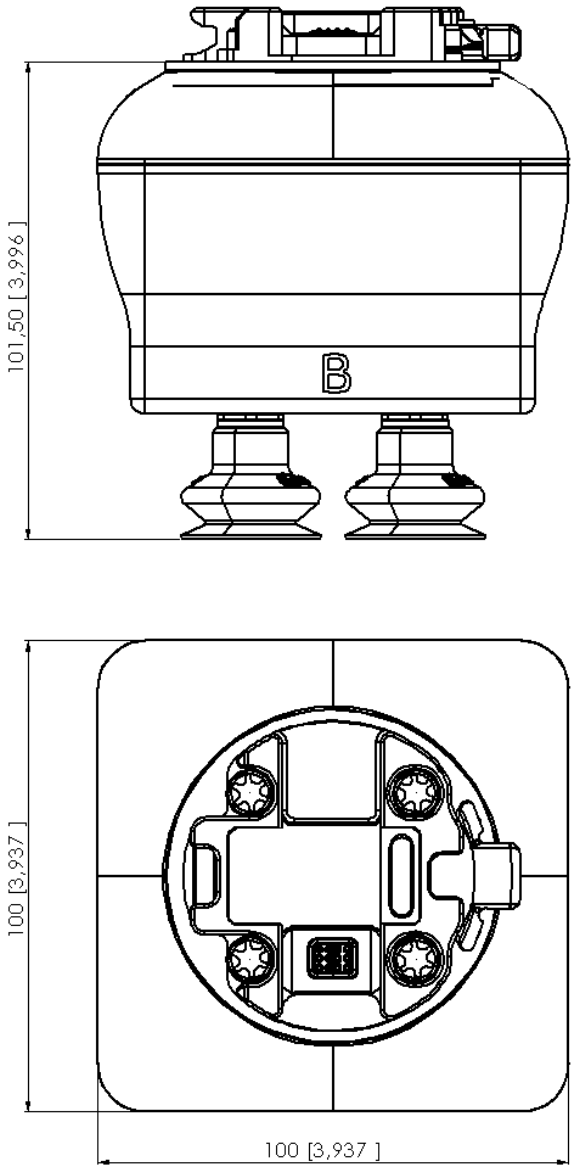
7.2.2.5. Eye Box



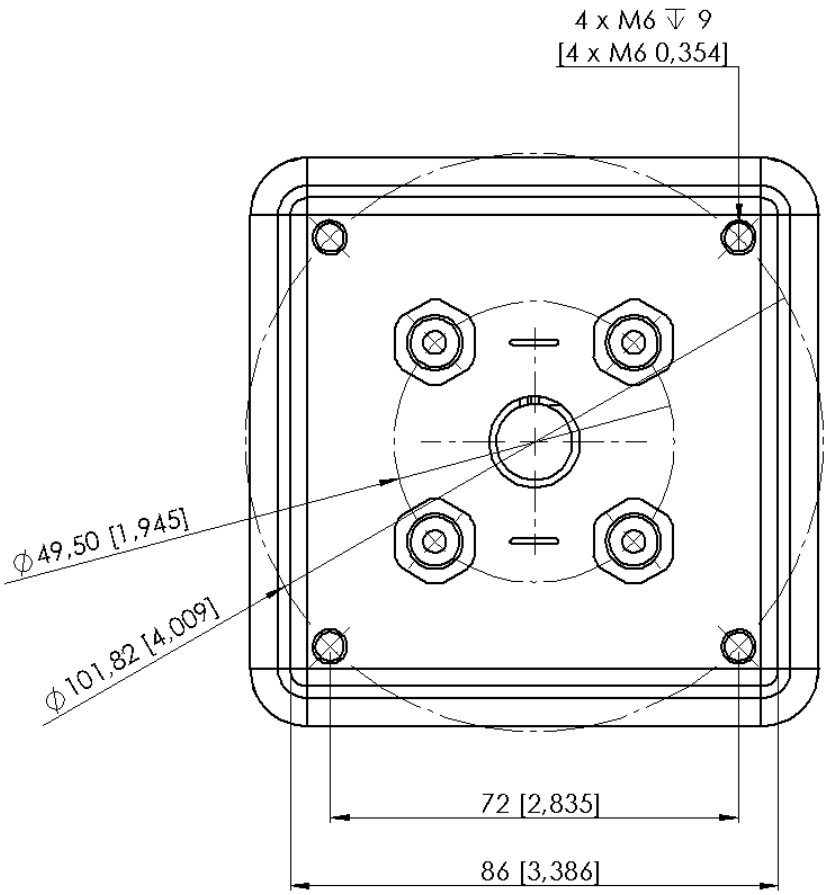
All dimensions are in mm and [inches].

7.2.3. Tools

7.2.3.1. VGC10



All dimensions are in mm and [inches].



All dimensions are in mm and [inches].

7.3. TCP, COG

Using Tool Connection

Use the TCP/COG calculator to calculate the TCP and COG values for your OnRobot product combination.

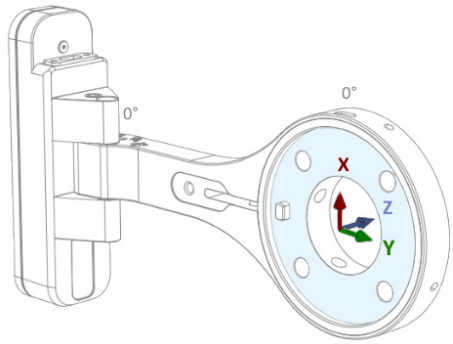
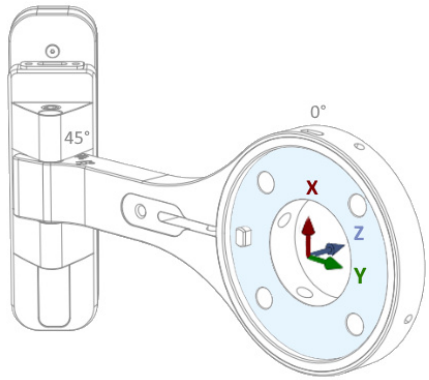
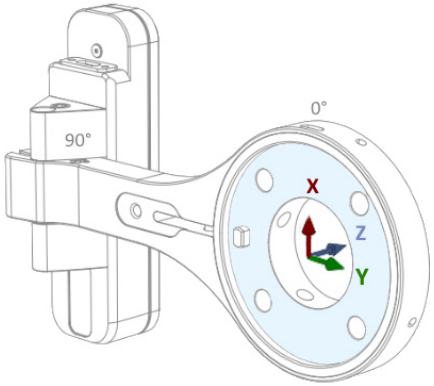
The TCP/COG calculator can be downloaded from **www.onrobot.com/downloads**.

Using Compute Box/Eye Box

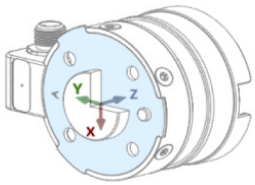
For more information, see the **6.1.8. Web Client: TCP, COG** section.

TCP, COG, and weight parameters of the single devices (without any mounting/adapter):

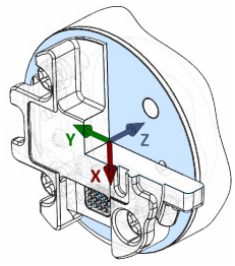
7.3.1. Eyes

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
Tilt: 0° 	X = 0 Y = 0 Z = 12	cX = -0.19 cY = 68.18 cZ = 0.48	0.282 kg 0.622 lb
Tilt: 45° 	X = 0 Y = 0 Z = 12	cX = -0.19 cY = 65.81 cZ = 6.16	0.282 kg 0.622 lb
Tilt: 90° 	X = 0 Y = 0 Z = 12	cX = -0.19 cY = 60.12 cZ = 8.50	0.282 kg 0.622 lb

7.3.2. HEX-E/H QC

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=50	cX=0 cY=5 cZ=20	0.35 kg 0.77 lb

7.3.3. VGC10

Coordinate system	TCP [mm]	Center of Gravity [mm]	Weight
	X=0 Y=0 Z=75	cX=-1 cY=-1 cZ=37	0.814 kg 1.79 lb

* With no attachments

8. Maintenance



WARNING:

An overall inspection of the OnRobot's End of Arm Tooling must be performed regularly and at least once every 6 months. This inspection must include but is not limited to check for defective material and clean gripping surfaces.

Use original spare parts, and original service instructions for the OnRobot's End of Arm Tooling and the robot. Failure to comply with this precaution can cause unexpected risks, resulting in severe injury.

If you have questions regarding spare parts and repair, please visit our website **www.onrobot.com** to contact us.

8.1. Eyes

Eyes Camera

Clean the lenses (front surface) of the Eyes regularly with the supplied micro-fiber cloth. For stronger contamination, use isopropyl alcohol with a soft cotton swab to keep it clean.

Eyes Lighting Kit

Clean the Lights with a soft sponge or cloth made from 100% cotton. Use lukewarm water and a mild dish washing detergent. Avoid using alcohol in the cleaning process.

8.2. VG10/VGC10

The VG grippers are equipped with one filter for each suction cup socket, and one filter for the exhaust. How often the filters need to be changed depends on the nature of the work piece and the working environment. The VG grippers automatically de-dust the filters every time a grip is released. However, particles can eventually get stuck and build up inside the filter, lowering the VG grippers performance.

A filter service kit is available, which include both new filters and tools needed.

- Filter service kit for VG10, PN 100064
- Filter service kit for VGC10, PN 103757

Neither use nor power on the VG grippers without filters. Dust, hair and larger particles can get stuck in pump membranes and valve seats, causing permanent damage to the VG grippers.



DANGER:

Identify how often the filters need service and schedule maintenance with a fixed period short enough to ensure a firm grip at all times.

An overall inspection of the VG grippers must be performed regularly and at least once every 6 months.

Never power the VG grippers without filters or with filters mounted incorrectly. Failure to comply with this precaution can cause irreversible failure of pump or valves.

9. Troubleshooting

9.1. Robot Has Not Obtained an IP Address

If the Compute Box has not assigned an IP address to the robot, do the following:

Assign a static IP address to the robot that matches your current IP settings on your Compute Box. The default IP address of the Compute Box is 192.168.1.1.

NOTE:

Change the last number in the IP address (if using 255.255.255.0 subnet mask) to avoid an IP conflict with the Compute Box.

Example

If the default fixed (192.168.1.1) IP address is used on the Compute Box, then use the following values:

- IP address: 192.168.1.2
- Subnet Mask: 255.255.255.0

9.2. Error During Operation

If an error occurs during operation, try the following:

1. Restart the robot and check the functionality.
2. If the error is still present, contact the distributor from where the product has been purchased.

9.3. Changing the DIP Switch Does Not Take Effect

To change the DIP switch network settings, first change the DIP switches and then cycle the Compute Box/Eye Box power so the changes will take effect.

If the changes still do not take effect, wait one minute and then cycle the Compute Box/Eye Box power once again.

9.4. URCap Operation

CAUTION:

Installed URCaps from different vendors may affect the OnRobot URCaps operation.

If you experience slow GUI response, performance issue, slow program start, error pop-ups, or function loss, make sure that only the OnRobot URCap is installed on the robot.

9.5. Tool Functions Are Not Available

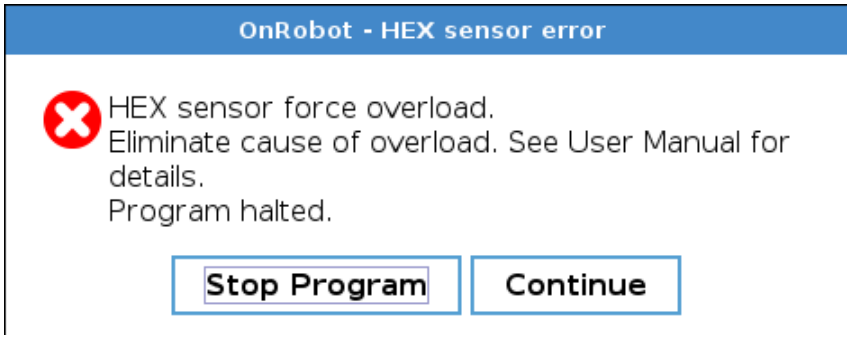
If the tool functions are not available (grayed out) in the program, return to the **Installation** tab > **URCaps** > **Device info** and then back to the program.

9.6. URCap Pop-Up Messages

9.6.1. HEX-E/H QC

9.6.1.1. Force Overload Protection

Displayed pop-up message



Error code (on the Web Client): 128

Description: The HEX sensor is overloaded because of:

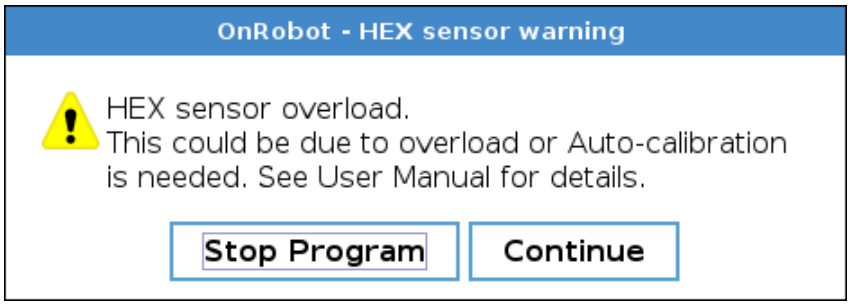
- **Case 1.** Too much payload has been put on the robot.
  or
- **Case 2.** The payload on the robot is within limit and high force drifting occurs in the Fz direction.

How to solve and clear the error:

	Solution	Error Clearance
Case 1.	Remove the payload from the robot.	Acknowledge the message in the pop-up dialog. Removing the payload will clear the error message.
Case 2.	Use the Auto-calibration function. See 6.1.3.2. HEX-E/H QC section.	Acknowledge the message in the pop-up dialog. Using Auto-calibration will clear the error message.

9.6.1.2. Auto-calibration Warning

Displayed pop-up message



Error code (on the Web Client): 4096

Description: The HEX sensor requires Auto-calibration.

How to solve and clear the error:

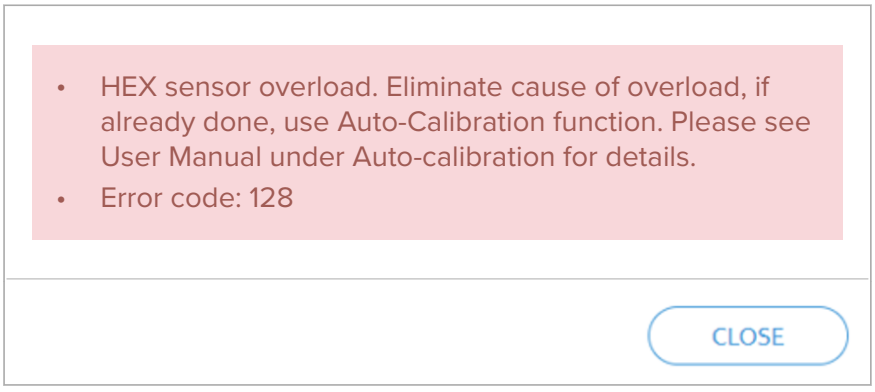
Solution	Error Clearance
Use the Auto-calibration function. See **HEX-E/H QC** section.	Acknowledge the message in the pop-up dialog. Perform the Auto-calibration process if possible. If the Auto-calibration process cannot be performed, go to the **Auto-calibration** part of the **4.1.3.3. URCap Setup - HEX** section to supress future warnings.

9.7. Web Client Pop-Up Messages

9.7.1. HEX-E/H QC

9.7.1.1. Error 128

Displayed pop-up message



Error code: 128

Description: The HEX sensor is overloaded because of:

- **Case 1.** Too much payload has been put on the robot.
  or

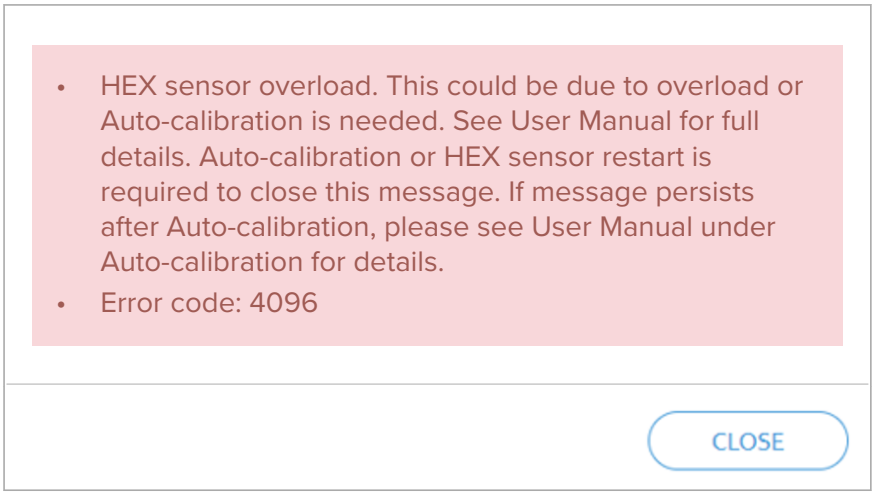
- **Case 2.** The payload on the robot is within limit and high force drifting occurs in the Fz direction.

How to solve and clear the error:

	Solution	Error Clearance
Case 1.	Remove the payload from the robot.	Click **Close**. Removing the payload will clear the error message.
Case 2.	Use the Auto-calibration function. See **6.1.3.2. HEX-E/H QC** section.	Click **Close**. Using Auto-calibration will clear the error message.

9.7.1.2. Error 4096

Displayed pop-up message



Error code: 4096

Description: The HEX sensor requires Auto-calibration.

How to solve and clear the error:

Solution	Error Clearance
Use the Auto-calibration function. See **HEX-E/H QC** section.	Click **Close**. Using Auto-calibration or restarting the HEX sensor will clear the error message.

10. Warranties

10.1. Patents

Products of OnRobot A/S are protected by several patents; some still in global publication process (Patents pending). All manufacturers of copies and similar products violating any patent claims will be prosecuted.

10.2. Product Warranty

Without prejudice to any claim the user (customer) may have in relation to the dealer or retailer, the customer shall be granted a manufacturer's warranty under the conditions set out below:

In the case of new devices and their components exhibiting defects resulting from manufacturing and/or material faults within 12 months of entry into service (maximum of 15 months from shipment), OnRobot A/S shall provide the necessary spare parts, while the customer (user) shall provide working hours to replace the spare parts, either replace the part with another part reflecting the current state of the art, or repair the said part. This warranty shall be invalid if the device defect is attributable to improper treatment and/or failure to comply with information contained in the user guides. This warranty shall not apply to or extend to services performed by the authorized dealer or the customer themselves (e.g. installation, configuration, software downloads). The purchase receipt, together with the date of purchase, shall be required as evidence for invoking the warranty. Claims under the warranty must be submitted within two months of the warranty default becoming evident. Ownership of devices or components replaced by and returned to OnRobot A/S shall vest in OnRobot A/S. Any other claims resulting out of or in connection with the device shall be excluded from this warranty. Nothing in this warranty shall attempt to limit or exclude a customer's statutory rights nor the manufacturer's liability for death or personal injury resulting from its negligence. The duration of the warranty shall not be extended by services rendered under the terms of the warranty. Insofar as no warranty default exists, OnRobot A/S reserves the right to charge the customer for replacement or repair. The above provisions do not imply a change in the burden of proof to the detriment of the customer. In case of a device exhibiting defects, OnRobot A/S shall not be liable for any indirect, incidental, special or consequential damages, including but not limited to, lost profits, loss of use, loss of production or damage to other production equipment.

In case of a device exhibiting defects, OnRobot A/S shall not cover any consequential damage or loss, such as loss of production or damage to other production equipment.

10.3. Disclaimer

OnRobot A/S continues to improve reliability and performance of its products, and therefore reserves the right to upgrade the product without prior warning. OnRobot A/S ensures that the content of this manual is precise and correct but takes no responsibility for any errors or missing information.

11. Certifications

intertek
Total Quality. Assured.

CERTIFICATE OF REGISTRATION

This is to certify that the management system of:

OnRobot A/S

Main Site: Teglværksvej 47 H, 5220 Odense SØ, Denmark
Chamber of Commerce: 36492449

Additional Site: OnRobot A/S, Cikorievej 44, 5220 Odense SØ, Denmark

has been registered by Intertek as conforming to the requirements of

ISO 9001:2015

The management system is applicable to:

Development and sales of End-of-Arms tools for industrial customers worldwide.

Certificate Number:
0096721

Initial Certification Date:
26 November 2019

Date of Certification Decision:
26 November 2019

Issuing Date:
26 November 2019

Valid Until:
25 November 2022

ISO 9001:2015 CERTIFICATION ™
Intertek

SWEDAC ACKREDITERING
Accred. no. 1639
Certification of Management Systems
ISO/IEC 17021-1

Carl-Johan von Plomgren
MD, Business Assurance Nordics

Intertek Certification AB
P.O. Box 1103, SE-164 22 Kista, Sweden

In the issuance of this certificate, Intertek assumes no liability to any party other than to the Client, and then only in accordance with the agreed upon Certification Agreement. This certificate's validity is subject to the organization maintaining their system in accordance with Intertek's requirements for systems certification. Validity may be confirmed via email at certificate.validation@intertek.com or by scanning the code to the right with a smartphone.

The certificate remains the property of Intertek, to whom it must be returned upon request.

11.1. EMC

Attestation of Conformity no. 120-35088-A1

FORCE Technology has performed compliance testing on electrical products since 1967. FORCE Technology is an accredited test house according to EN17025 and participates in international standardization with organizations such as CEN/CENELEC, IEC/CISPR and ETSI. This attestation of conformity with the below mentioned standards and/or normative documents is based on accredited tests and/or technical assessments carried out at FORCE Technology.

Attestation holder
OnRobot A/S, Teglværksvej 47H, 5220 Odense SØ, Denmark

Product identification - Name (Part no.)
Power Supplies: PSU (104788), VER36U240-JA, VES120PS24, VES150PS24.
Controllers: UR Kit with Compute Box (102344), Doosan Robot kit (102345), Techman/OMRON TM Robot Kit (102359), KUKA-A Robot kit (102360), KUKA-B Robot kit (102361), FANUC Robot kit (102362), Kawasaki-B Robot kit (102363), Kawasaki-C Robot kit (102364), Kawasaki-D Robot kit (102365), Kawasaki-E Robot kit (102366), Yaskawa-F Robot kit (102367), Yaskawa-G Robot kit (102368), Yaskawa-H Robot kit (102369), NACHI-I Robot kit (102370), NACHI-J Robot kit (102371), Hanwha Robot Kit (103208), Eye Box (103707).
Mountings: Dual Quick Changer (101788), Quick Changer Robot side (102037), HEX-E QC (102111), Quick Changer Kit (102277), HEX-H QC (102376), Quick Changer Robot side 4,5A (104277), Dual Quick Changer 4,5A (104293), Quick Changer Kit 4,5A (104388).
Tools: 2FG7 (106376), 3FG15 (103666), Eyes Lighting Kit (107080), MG10 (105202), OnRobot Eyes (103903), RG2 (102012), RG2-FT (102075), RG6 (102021), Sander (106376), Screwdriver (103961), SG Base Part (103546), VG10 (101661), VGC10 (102844), VGP20 (107242).

Manufacturer
OnRobot A/S

Technical documentation
FORCE Technology Assessment no. 120-35088-A1

Standards/Normative documents

IEC 61000-3-2:2018	EMC Directive 2014/30/EU, Article 6
IEC 61000-3-3:2013/AMD1:2017	EN 61000-3-2:2014
IEC 61000-6-2:2016	EN IEC 61000-3-2:2019
IEC 61000-6-4:2018	EN 61000-3-3:2013/A1:2019
	EN 61000-6-2:2005/AC:2005
	EN IEC 61000-6-2:2019
	EN 61000-6-4:2007/A1:2011
	EN IEC 61000-6-4:2019

Additionally, for RG2 (102012) and RG6 (102021):
IEC 61326-3-1:2017, Industry locations, SIL 2

The product identified above has been assessed and complies with the specified standards/normative documents. The attestation does not include any market surveillance. It is the responsibility of the manufacturer that mass-produced apparatus have the same properties and quality. This attestation does not contain any statements pertaining to the requirements pursuant to other standards, directives or laws other than the above mentioned.

Signature
Knud A. Baltsen
Digitally signed by Knud A. Baltsen
Date: 2021.05.27 16:58:51 +02'00'
Signed by: Knud A. Baltsen, Senior Specialist, Product Compliance

FORCE Technology
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2970 Hørsholm, Denmark
+45 43 25 14 00
+45 43 25 00 10
info@forcetechnology.dk

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Nye Vakås vei 32
1395 Hvalstad, Norway
+47 64 00 35 00
+47 64 00 35 01
info@forcetechnology.no

FORCE Technology
Park Allé 345
2605 Brøndby, Denmark
+45 43 25 00 00
+45 43 25 00 10
info@forcetechnology.dk

11.2. Eyes - Environment

Attestation of Conformity no. 120-23503

Assessment holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

OnRobot Camera Eyes

FORCE Technology test reports

Environmental tests of Camera, project no.: 120-23503, report no.: 120-23503-1 dated 22 April 2020

Other technical documentation

Conclusion

The Camera Eyes have been tested according to the standards listed below. The test results are given in the Force report listed above. All tests were carried out as specified in the relevant specifications including special test criteria's stated by the client.

IEC 60529:2013	IP5X
IEC 60529:2013	IPX4

Signature

11.3. Eyes Lighting Kit - Environment

Attestation of Conformity no. 121-23120

Assessment holder

OnRobot A/S
Teglværksvej 47H
5220 Odense SØ
Denmark

Product identification

Eyes Lightning

FORCE Technology test reports

Environmental tests of Eyes Lightning, project no.: 121-23120, report no.: 121-23120-1 dated 4 April 2020

Other technical documentation

Conclusion

The Eyes Lightning have been tested according to the standards listed below. The test results are given in the Force report listed above. All tests were carried out as specified in the relevant specifications including special test criteria's stated by the client.

IEC 60529:2013	IP5X - Dust protection
IEC 60529:2013	IPX4 – Enclosure protection

Nordborg 2021-04-04

Signature

11.4. Declaration of Incorporation

11.4.1. Eyes

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Vision System
Model:	Eyes
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. The following essential requirements of Directive 2006/42/EC are fulfilled: 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.10, 1.5.11, 1.5.12, 1.6.1. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, May 4th, 2021

Group Management

Beskid Vilmos

Vilmos Beskid
CTO

11.4.2. HEX-E

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-E QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. The following essential requirements of Directive 2006/42/EC are fulfilled: 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.10, 1.5.11, 1.5.12, 1.6.1. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

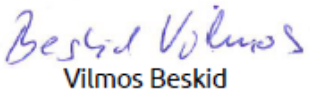
Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, November 11th, 2020

Group Management



Vilmos Beskid
CTO

11.4.3. HEX-H

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type:	Industrial Force/Torque Sensor
Model:	HEX-H QC
Generation:	V3
Serial:	1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. The following essential requirements of Directive 2006/42/EC are fulfilled: 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.10, 1.5.11, 1.5.12, 1.6.1. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

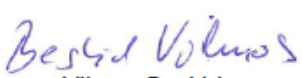
Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, November 11th, 2020

Group Management



Vilmos Beskid
CTO

11.4.4. VGC10

CE/EU Declaration of Incorporation (Original)

According to European Machinery Directive 2006/42/EC annex II 1.B.

The manufacturer:

OnRobot A/S
Teglværskvej 47H
DK-5220, Odense SØ
DENMARK

declares that the product:

Type: Industrial Robot Gripper
Model: VGC10
Generation: V1
Serial: 1000000000-1009999999

may not be put into service before the machinery in which it will be incorporated is declared in conformity with the provisions of Directive 2006/42/EC, including amendments, and with the regulations transposing it into national law.

The product is prepared for compliance with all essential requirements of Directive 2006/42/EC under the correct incorporation conditions, see instructions and guidance in this manual. The following essential requirements of Directive 2006/42/EC are fulfilled: 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4, 1.5.1, 1.5.2, 1.5.4, 1.5.5, 1.5.10, 1.5.11, 1.5.12, 1.6.1. Compliance with all essential requirements of Directive 2006/42/EC relies on the specific robot installation and the final risk assessment.

Technical documentation is compiled according to Directive 2006/42/EC annex VII part B and available in electronic form to national authorities upon legitimate request. Undersigned is based on the manufacturer address and authorized to compile this documentation.

Additionally, the product declares in conformity with the following directives, according to which the product is CE marked:

2014/30/EU — Electromagnetic Compatibility Directive (EMC)
2011/65/EU — Restriction of the use of certain hazardous substances (RoHS)

Relevant essential health and safety requirements of the following EU directives are also applied:

2014/35/EU — Low Voltage Directive (LVD)
2012/19/EU — Waste of Electrical and Electronic Equipment (WEEE)

A list of applied harmonized standards, including associated specifications, is provided in this manual.

Budapest, November 11th, 2020

Group Management

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