



Q.VITEC

Erkennen, was möglich ist



V.Qnect+ User manual



Vision Q.400



V.Qnect+

**UNIVERSAL
ROBOTS**

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1.1 Explanation of symbols



Product safety



Personal safety



Notes with useful information

1.2 Introduction

Our motivation as a company is to help customers optimize their workflows and make the quality of work easier and gentler for the workers directly at the machines. With our popular, and in the digital image processing established, software Vision Q.400 we were in the past often able to make even the most complex, industrial routes more productive and cost saving.

With the cooperation between Universal Robots and V.Qnect+, you too will be able to program and configure complex robot sequences and robot commands in a user friendly way. You will also benefit from the many advantages that Vision Q.400 offers. These include the live image, the possibility to create multiple sequence groups, to connect multiple cameras and to access results from the spreadsheet.

Some features	Description
V.Qnect+	Interface between Universal Robots and Vision Q.400
Liveimage	Perfect alignment of the camera with the help of the live image
Read out spreadsheet	From the spreadsheet, you can easily and knowledgeably read the results.
Execute Executiongroups	You can execute the Executionsgroups from Vision Q.400 easily.
Multiple cameras	You can connect multiple cameras (moving or stationary).

With the complete package* we offer you, you have the possibility to use all checkers from the Vision Q.400 software and to adapt them exactly according to your ideas or application. It is aimed at both end users and system houses for industrial image processing who want to quickly and easily implement inspection solutions at the highest level without programming knowledge. For example, V.Qnect+ in combination with Universal Robots can be used in the tasks of completeness checks, measuring tasks, object recognition, contour checks and positioning. In addition, the rich feature set can be extended with individual algorithms.

*Total package: Universal Robot, V.Qnect+ and Vision Q.400 from Q.VITEC.



V.Qnect+ is compatible and tested with Vision Q.400, but not with Vision Q.400 [plus].

**This documentation assumes the basic knowledge of a
Universal Robots!
Please read the documentation of your Universal Robot first!**



**To get more detailed information about UR robot.
Please refer to the associated documentation.**



<https://www.universal-robots.com/download/>



**To obtain more detailed information about your Vision Q.400.
Please refer to the associated documentation.**



<https://qvitec.de/de/downloads/handbuecher/>

1.3 What's in the Box

Before starting the assembly, please make sure that all components you have ordered are included in your package:

- URCap, V.Qnect+ - 1.0.0
- Electrical Kit (Q.400SD-R02 with Vision Q.400, 24V DC Power)
- GigE Vision Camera
- Ring Light
- Camera Mounter (Direct, Extension or Stationary)
- Cables set
- Screws set

If one or more parts are not enclosed with your order, please report this to your clerk or report this to Q.VITEC headquarters.

1.4 V.Qnect+ Compatibility

API versions and PolyScope version

V.Qnect+ was developed with URCap API 1.10.0 version. As you can see on the version table, V.Qnect+ supports Polyscope e-series versions 5.8 and higher / cb-series 3.13 and higher. Thanks to URCaps upward compatibility, you can use V.Qnect+ with all newer versions. If you have an older Polyscope version installed, please upgrade the robot.

URCap API Version	Minimum Polyscope Version (e-series)	Minimum Polyscope Version (cb-series)
1.3.55	5.0	3.6
1.4.4	5.1	3.7
1.5.0	5.2	3.8
1.6.1	5.3	3.9
1.7.0	5.4	3.10
1.8.0	5.5	3.11
1.9.0	5.6	3.12
1.10.0	5.8	3.13
1.11.0	5.9	3.14
1.12.0 (latest)	5.10	3.15

The URCap (V.Qnect+) has been tested and are compatible with the following versions of Polyscope:

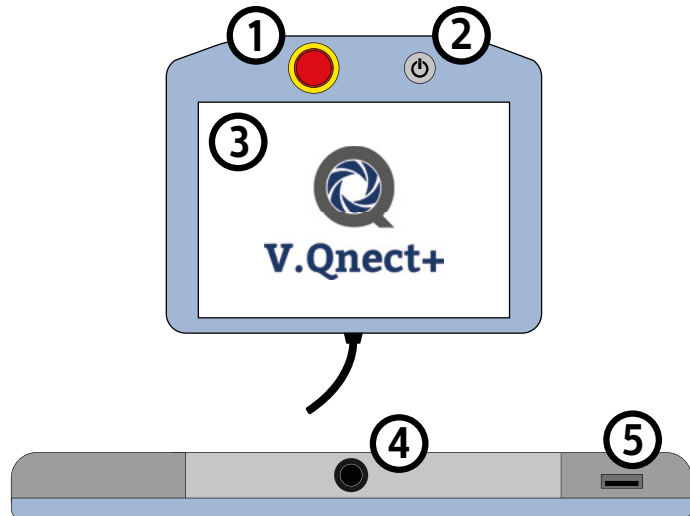
Polyscope (e-series)	Polyscope (cb-series)
5.8	3.13
5.9	3.14
5.10	3.15

2. UR and V.Qnect+ Icons








2.1 UR Teach Pendant

In the below figure, you can see the Teach Pendant supplied by UR. With this, you operate and configure the robot and V.Qnect+.

1	Emergency off
2	On/Off
3	Polyscope
4	Freedrive
5	USB



2.2 V.Qnect+ Icons

	No camera was found		No Connection with Vision Q.400
	Camera found		Connected with Vision Q.400
	Refresh (Button)		Empty table (Button)
	Error		

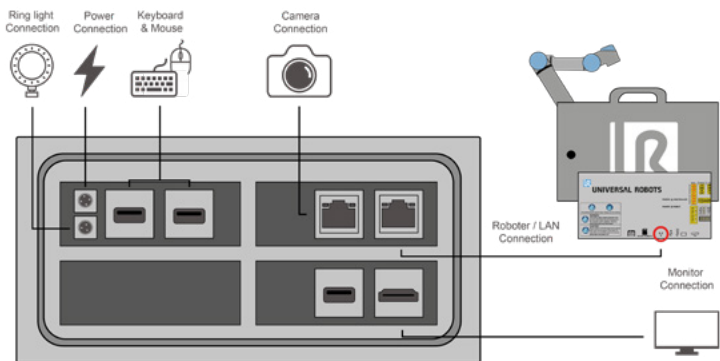
3. V.Qnect+ Electrical Kit

The V.Qnect+ Electrical Kit, which was included with the V.Qnect+ URCap, contains a 24V DC power supply and the Q.400SD-R02 PC. All important connections for your robot can be found in this kit.

3.1 Installation

Please make sure to atleast connect a LAN, Cam, license dongle and power source to make use of V.Qnect+ successfully.

1. LAN
2. Cam
3. Ring light
4. HDMI
5. external keyboard
6. external mouse
7. Vision Q.400 & V.Qnect+ License Dongle
8. Power source



LAN

For connection to the Universal Robot Controller.

Camera

Port for camera connection for Vision Q.400.

Ring light

If you want to use a ring light in your application, it has to be connected at (3).

Vision Q.400 & V.Qnect+ License Dongle

The dongle is needed to use your V.Qnect+. (Chapter 5)

3.2 24V DC Power supply

The power supply converts the 230V AC voltage from the mains into a 24V DC voltage to operate the Q.400-R02 PC.

3.3 Q.400SD-R02

In the latest version of the Q.400SD series, high reliability is combined with flexible configuration. The controller has integrated a powerful 64-bit 4-core X86 CPU, which can run user-designed applications and image processing algorithms. The controller can work constantly under different temperature, from -40°C to $+80^{\circ}\text{C}$, the controller provides very stable performance.

Compared to Q.400SD R01: 50% faster CPU performance (same power consumption), 3.5x DDR bandwidth increase, 4.5x GPU performance (deep learning algorithm acceleration).



On our data sheet you will find more information about the Q.400SD-R02




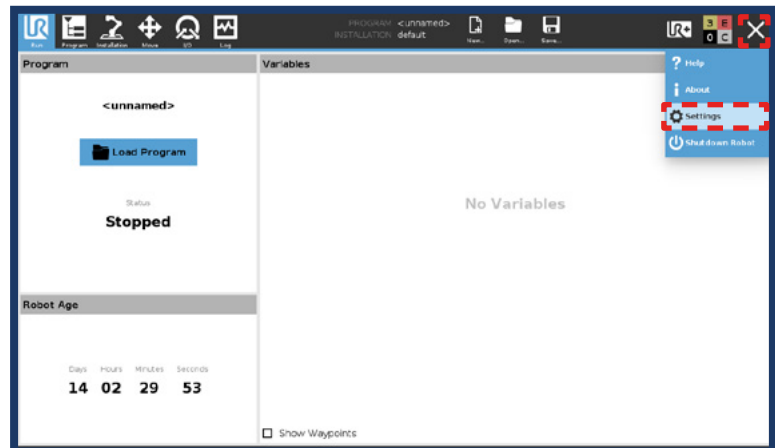
<https://qvitec.de/de/downloads/imagechecker-datenblaetter/>

4. V.Qnect+ Installation

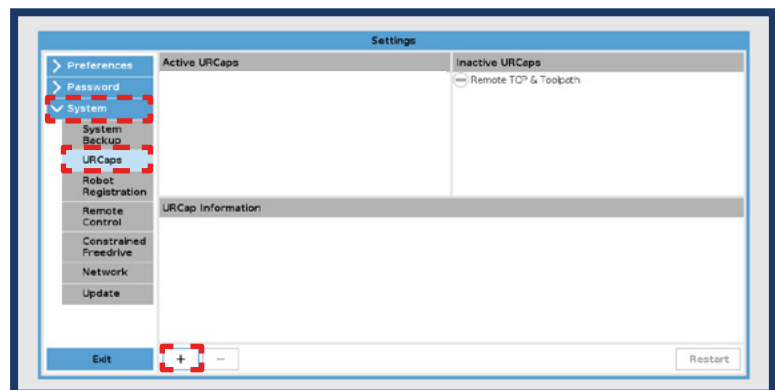
In the following steps, the installation and configuration of the URCap (V.Qnect+), hardware and electronics steps will be explained to you. Follow the instructions as described. Make sure the Universal Robot is properly configured and ready to use.

Please insert the V.Qnect+ activation USB stick into the UR Teach Pendant (No. 6 on the UR Controller picture).

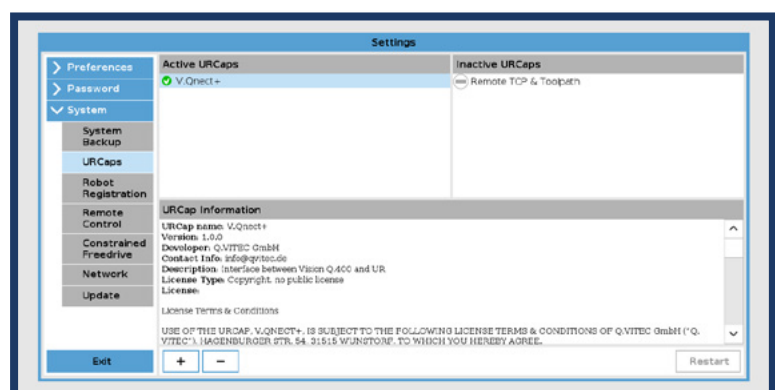
On the upper right side you will find the icon  please press this.
A small drop-down menu will open where you can select **settings** next.




A settings window opens. The **System** tab on the left takes you to **URCaps**. On this page you can press the „+“ at the bottom to see data from the inserted USB stick.



Select the file with „**urcap**“ extension. After you import V.Qnect+ please make sure to restart the robot to complete the installation process.



If you go to  -> Settings -> System -> URCaps again after the installation, you will see a green tick next to the V.Qnect+ software. This means the software is successfully installed and is compatible with the polyscope version.

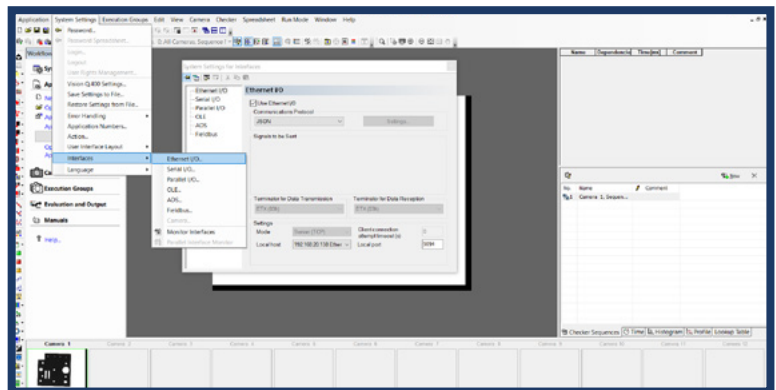
5. Installation Tab

5.1 Determine IP address & port in Vision Q.400

Connect a HDMI cable to the Imagechecker and to your monitor. ([See 3.2 Example: Q.400SD-R02](#))

Vision Q.400 must be in setup mode, only then you can find the IP address and the port under: **System Settings -> Interfaces -> Ethernet I/O**.

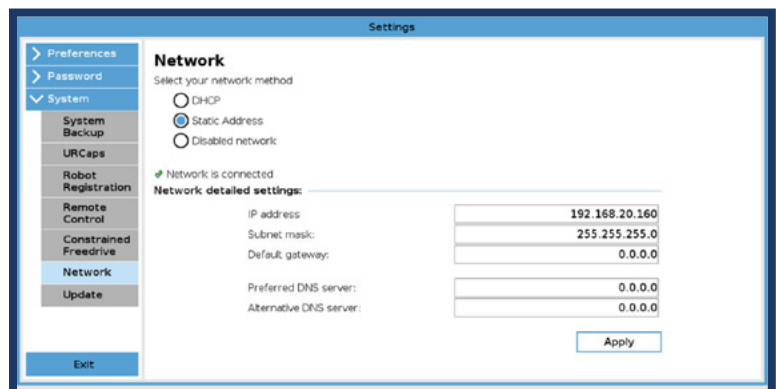
A popup window opens, check **Ethernet I/O** and select **JSON** in the **Communication Protocol** dropdown. In **Local host** dropdown, select the appropriate IP address. If you wish to change the port number, you can do that in the **Local port** text field.



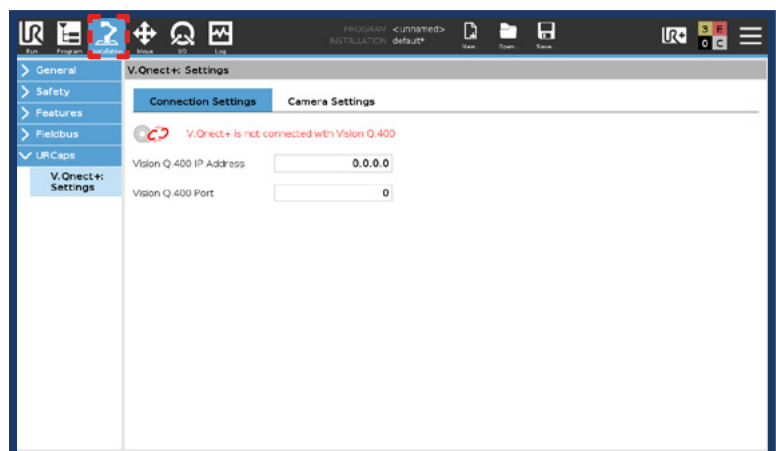
5.2 Connection Settings

Make sure to complete 6.1 before going further.

Connect the robot to network.
You can check your network status under **Settings -> System -> Network**.



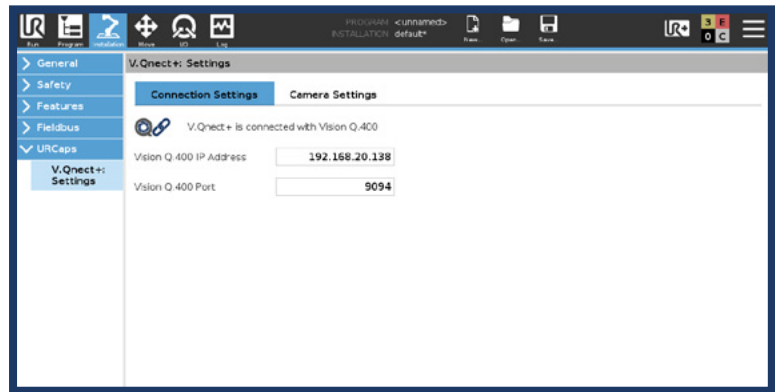
Select the **Installation** tab in the upper area. After you have installed V.Qnect+ you will see a new tab under URCaps „**V.Qnect+: Settings**“. A new window will open with 2 new tabs. In **connection settings** tab, you can see two text fields where you can enter the **IP address** and **port** of the Vision Q.400. Upon entering the correct inputs, V.Qnect+ connects with Vision Q.400 for further data transmission.



Default values: IP address: 0.0.0.0; Port : 0.

For more information, see Vision Q.400 manual, chapter 5.4.7.3, on how to change this. ([see chapter 1.2](#))

After you have entered the IP address and port. You will see the icon „V.Qnect+ is connected with Vision Q.400“ in the upper area.



- A connection to Vision Q.400 will be established automatically with correct IP address and Port.
- The user can see if V.Qnect+ is connected to Vision Q.400 by the connected / disconnected icons.



Make sure that all necessary requirements of V.Qnect+ are satisfied. Otherwise start errors like the following will occur:

- The daemon that connects and communicates with Vision Q.400 could not be started.
- Check the network status under: **Settings** -> **System** -> **Network**
- Vision Q.400 was opened without Application or Cameras



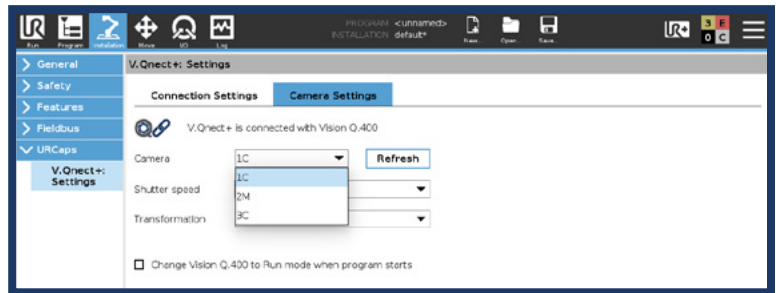
You can visualize the connection status of V.Qnect+ with Vision Q.400 by the icons shown below.

	Connected with Vision Q.400		Not connected with Vision Q.400
--	-----------------------------	--	---------------------------------

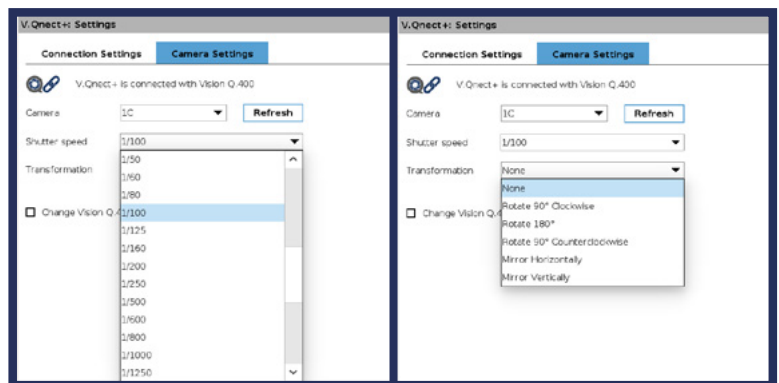
5.3 Camera Settings: URc

Make sure to complete 6.2 before going further.
Camera settings are disabled when there is no connection to Vision Q.400.

Select the tab „**Installation**“ in the upper area to get to „**URCaps** -> **V.Qnect+: Settings**“.
You can see the number of cameras that Vision Q.400 consists of in Cameras drop-down menu (**C = Color, M = Mono**).
If you connect a camera while Vision Q.400 is running, press the „**Refresh**“ button to refresh the cameras.



You can adjust the **Shutter speed** (changes the brightness of the image) of the selected camera within shutter speed drop-down menu. You can also rotate the live image with the help of „**Transformation**“ drop-down menu.



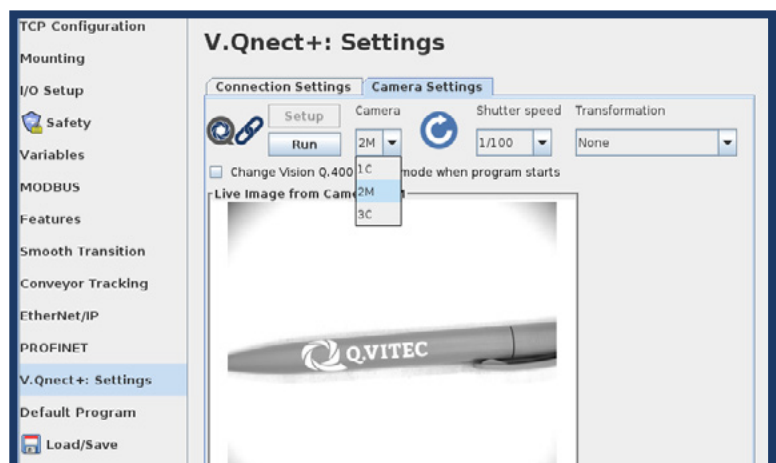
For more information on camera settings & shutter speed, refer to the Vision Q.400 manual, chapter 9. ([siehe Kapitel 1.2](#))

5.4 Camera setting: URcb

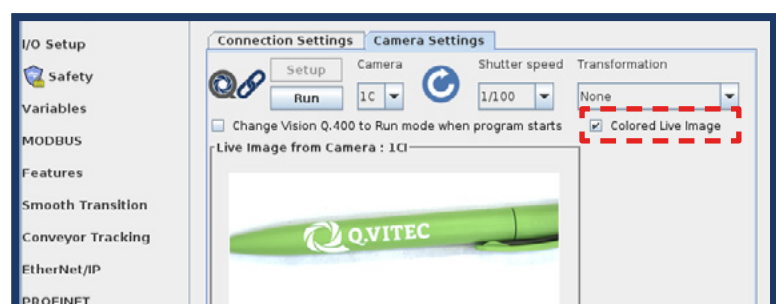
The camera settings in the cb-Series are similar to the settings of the e-Series. ([see chapter 6.2](#))

In e-Series, the live image and mode selection are in the toolbar. ([see chapter 7](#))
Since the cb-Series does not support a toolbar, you can find the **live image display** and the **mode selection** in the camera settings tab.

The Icon (⌂), can be used as a button, to refresh the cameras drop-down menu.



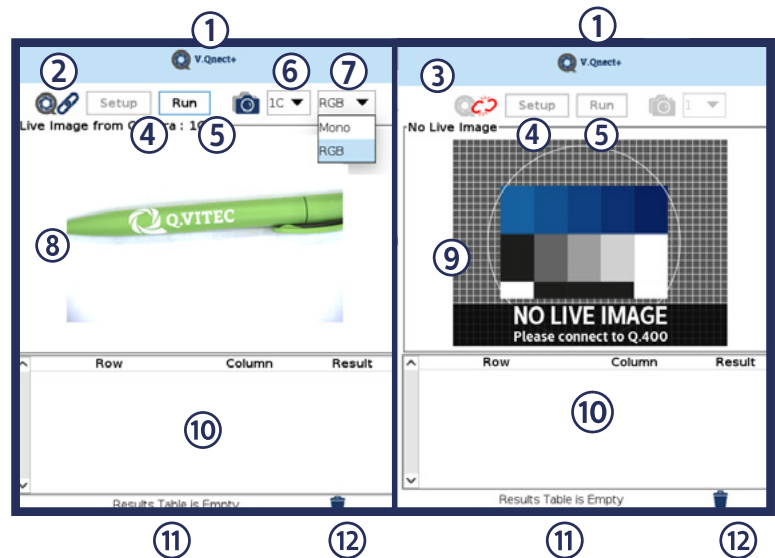
When you select a color camera in the „camera dropdown menu“, you can see a checkbox with label „Colored Live Image“.



6. Toolbar

In the Toolbar you have the perfect overview. For example, you can see if the connection status, live image and the last 20 results of V.Qnect+ Spreadsheet logging. If there are multiple URCaps with Toolbars installed, please click on V.Qnect+ logo to see the Toolbar of V.Qnect+ URCap.

1. V.Qnect+ Logo
2. V.Qnect+ is connected to Vision Q.400
3. V.Qnect+ is not connected to Vision Q.400
4. Changing to Setup mode
5. Changing to Run mode
6. Camera drop down
7. RGB / Mono Drop Down
8. Live image from selected camera
9. Standby Screen
10. Spreadsheet logging
11. Time of the last logging
12. Clear logging results table - button



V.Qnect+ Connection Status

The V.Qnect+ connects automatically to Vision Q.400 with correct IP Address and Port.

If V.Qnect+ does **not** connect automatically:

- check whether the IP address and the port have been entered correctly. ([see chapter 6](#))
- check if Vision Q.400 is open.
- check if the license dongle with a valid license is connected to the V.Qnect+ electrical kit.
- check if the robot is connected to the network. ([see chapter 3](#))
- check if your Vision Q.400 and the robot network are in the same subnet. ([see chapter 6.2](#))
- check if the daemon of V.Qnect+ is started successfully and if not, please restart the Robot. ([see chapter 6.2](#))

Camera selection

In the dropdown menu you can select which camera you want to access. You can connect a maximum of 3 cameras to Vision Q.400 with the V.Qnect+ electrical kit that the user purchased. (**C** = Color Camera, **M** = Mono Camera)

Color / Mono Drop Down

You can use this dropdown, if a color-camera is selected to display between **RGB** and **Mono**. This option is not available for a mono-camera and when Vision Q.400 is connected.

Live Image

The live image from the selected camera is only possible if:

- Vision Q.400 is installed and configured on the PC.
- Atleast one camera is connected.
- A functional application is open in Vision Q.400.
- V.Qnect+ is installed on the robot.
- V.Qnect+ is connected to Vision Q.400.
- V.Qnect+ is in Setup mode.

Standby Screen

Toolbar shows „No Live Image“ screen in the following 4 cases:

- No connection to Vision Q.400
- No connection to camera
- Vision Q.400 is in run mode
- Open an application with min. one camera

Spreadsheet Logging

When a robot program is running, you can view the updated spreadsheet logging here. This table is updated every second while the robot program is running and can display a maximum of 20 rows. With the trash button (bottom right) you can remove all logging from the table. In addition, you can see the date and time of the last logging in the lower area. The table columns (**Row**, **Column** and **Result**) can be moved by drag and drop.

7. Program Nodes

V.Qnect+ consists of 2 program nodes:

- A **sequence group** is a group of one or more checker sequences. Sequence groups offers you the possibility to subdivide your application into meaningful subtasks.
- The **Spadsheet** is a central interface with which you can display e.g. checker results and static values.



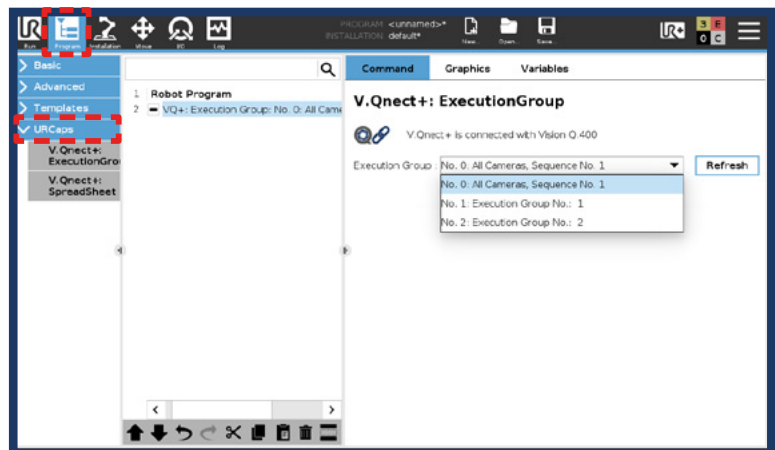
The URcap „V.Qnect+“ uses 9090 as the XML-RPC port on the local host.

7.1 Sequence groups

Under the „**Program**“ tab, you can access the „**V.Qnect+: Sequence Groups**“ via „**URCaps**“. You can insert the Vision Q.400 sequence groups into the robot program.

On the right side in the drop-down menu you can choose one from the created groups. These sequence groups are taken directly from Vision Q.400.

If you have created a new group in Vision Q.400, press „Refresh“ button to add it to the list.



- „Refresh“ button is disabled if there is no connection to Vision Q.400.

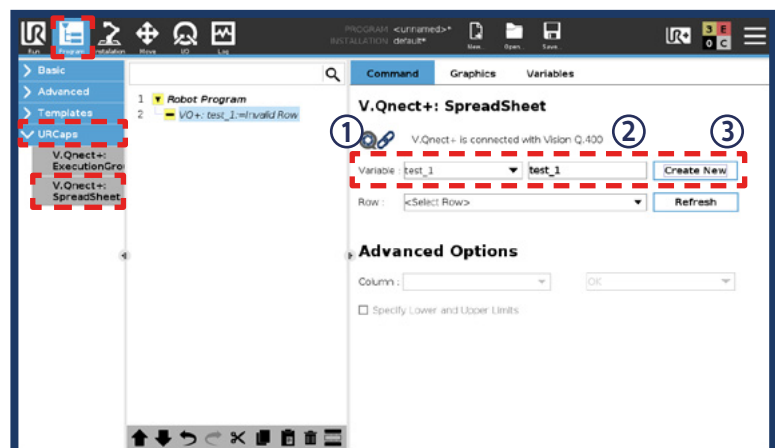
7.2 Spreadsheet

Under the „**Program**“ tab, you can access the „**V.Qnect+: Spreadsheet**“ via „**URCaps**“



- **Spreadsheets must be created in Vision Q.400 beforehand in order to be able to read them directly on the UR Teach Pendant.**
- For more information on the spreadsheet, see Vision Q.400 manual, Chapter 9. ([see chapter 1.2](#))

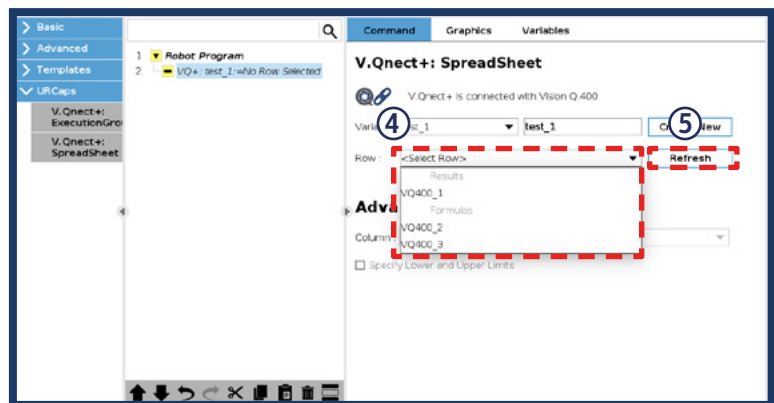
The first step is to create a **variable** (1). To the right of the drop down, there is a text field, you have to **name the variable** (2). If you want to create the variable press the button „**Create New**“ (3).





It is not possible to create execution groups and spreadsheet rows in V.Qnect+.

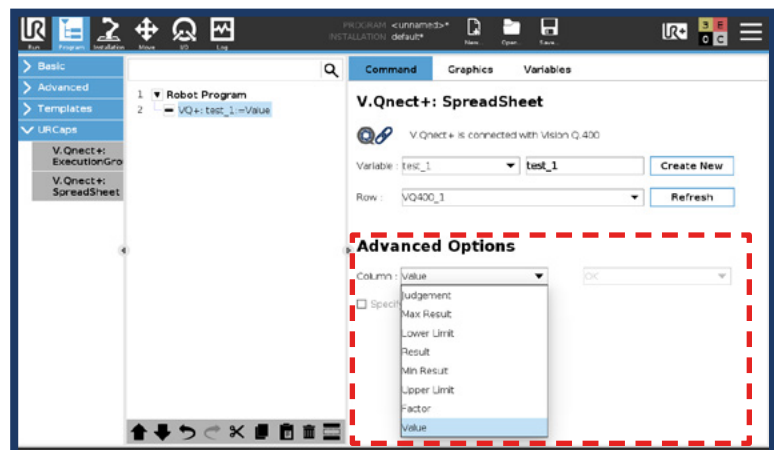
Once you have created the variable, you can next select the **row** (4) that you want to access. To add a new row created in Vision Q.400 to V.Qnect+ please press the **Refresh** button (5).



7.2.1 Spreadsheet - Advanced Options

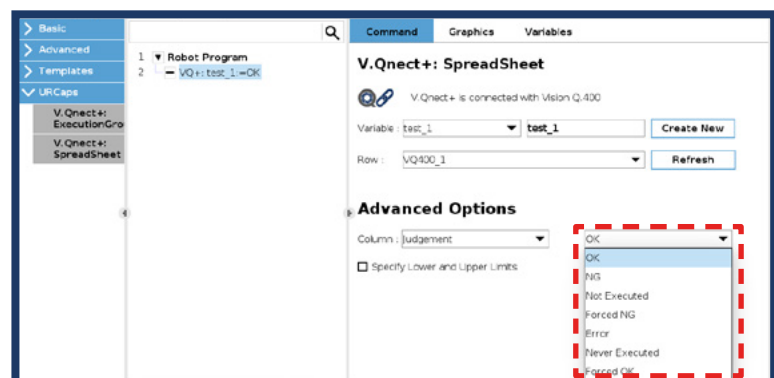
If you have defined the variable and row in the upper part of the selection menu, you can select a column in the advanced options.

On the right side in the drop-down menu you can choose from the existing columns. These columns are taken directly from Vision Q.400 spreadsheet and are fixed. If you wish to use a column that is not existing, please ask Q.VITEC as a feature request.



If you select the „**Judgement**“ field, a second drop-down menu will be enabled. There you can select the type of „**Judgement**“ that you want to compare.

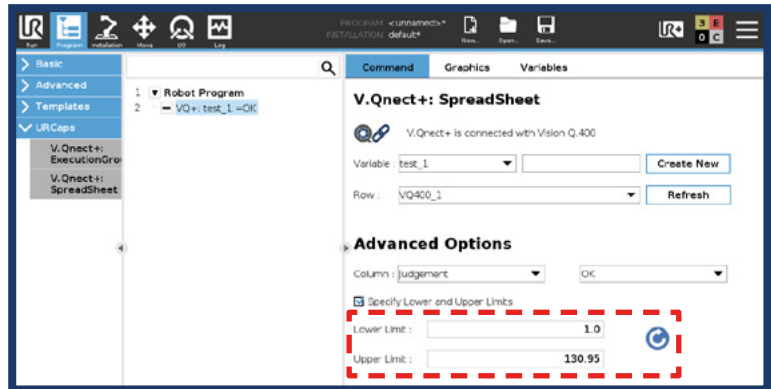
For example: If the judgement of the selected row in Vision Q.400 and V.Qnect+ are same, then the output is „True“ otherwise it is „False“



The URCap, V.Qnect+ uses 9090 as the XML-RPC port on the local host.

If you select the „**Judgement**“ column, the checkbox that says „Specify lower and upper limits“ is enabled. When you check the checkbox, two textfields appear with the current **lower and upper limits** of the selected row.

You can change the limits in Vision Q.400 with the help of those textfields or if you prefer to change the limits directly in Vision Q.400 then click „Refresh Icon“ to update the limits in V.Qnect+.



If there is no connection to Vision Q.400, the following options are disabled:

- **Refresh button** to update the spreadsheet rows
- **Lower and upper limits textfields**
- **Refresh button** to update lower and upper limits

7.2.2 Spreadsheet - Explanation of terms



Types of Columns:

- **Value:** The value of a row in the spreadsheet is the result calculated either by a checker or a mathematical formula.
- **Factor:** A freely selectable constant which, when multiplied by the value, gives the result (calibrated). For example, a value in pixels can be converted to millimeters.
- **Assessment:** Indicates whether the result of a formula is between the lower limit and the upper limit. If yes, the judgement is „OK“, if not it is „NG“.
- **Minimum and Maximum:** Indicate the minimum and maximum numerical value that the result has ever taken over all starts/calculations.



Types of Judgements:

- **Never Executed:** Provided that the test sequence („sequence group“) in vision Q.400 to which the formula belongs has never not been executed.
- **Not executed:** If the formula was not contained in the last started checker sequence, but in another one, which was therefore „Not Executed“ at that moment.
- **Error:** If the formula or the checker could not be executed correctly due to a problem (e.g. because no object was recognized).
- **Forced NG or Forced OK:** appear when a formula uses the result of another spreadsheet line (e.g. from a checker), but the checker cannot display a result due to a problem (see „Error“). By default, the formula will then switch to „Forced NG“ (=I don't have all the values available that I need for my calculation). However, this can also be changed to „Forced OK“ if this seems to make more sense in the respective application.

8.2 Direct selection - Spreadsheet

Make sure to complete the first step in this chapter before going further.

Select „**VQnectSpreadsheet(<row>, <column>, <judgement>)**“ from „<Funktion>“ Drop-Down Menu.

Now instead of „<row>“ enter your desired row from the spreadsheet (e.g. VQ_454_partFinder). For „<column>“ enter the desired column from your spreadsheet (e.g. **judgement**, **value**, etc) and the type of „**judgement**“.

The text field turns white to indicate that your input is correct.

If you use a column other than „**judgement**“, enter an empty string (“”). See image.



It is necessary to pay attention to the exact spelling and to add the quotation marks.

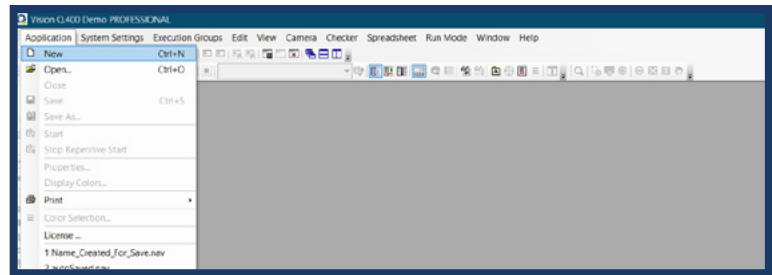
9. Example Application

In this chapter we show you how to create a sample application in Vision Q.400 and to use it in V.Qnect+.


9.1 Create Sample Application in Vision Q.400


Start Vision Q.400 and open a new application under „**Applications** -> **New**“.
Create an application with minimum one camera.

For further information: Vision Q.400 manual, chapter 5.4.7.3. [\(see chapter 1.2\)](#)



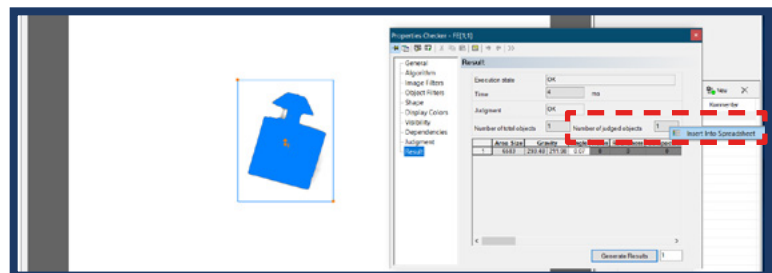
- When you start Vision Q.400 for the first time, you need to connect the camera.
- Vision Q.400 manual, chapter 5.4.7 [\(see chapter 1.2\)](#) to get more details on camera configuration

Next, select the „**Feature extraction**“ checker () on the left side and mark the object with the rectangle tool. After you have released the mouse button, the pop-up window „**Checker Properties**“ opens.

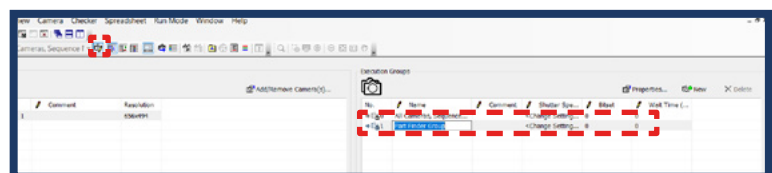
Change the default setting (128) of the „**Maximum number of objects**“ to 1. To evaluate the checker press „**Execute checker**“ () or the **F8** key.


For further information: Vision Q.400 manual, chapter 10.8 [\(see chapter 1.2\)](#)

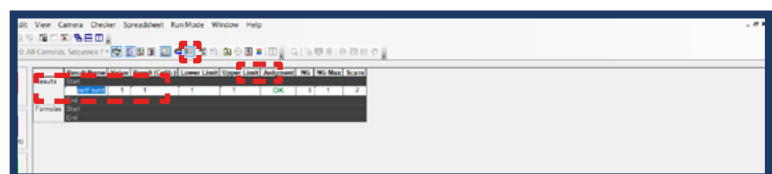
After executing the checker, the „**Checker Properties**“ window will automatically show you the **Results** tab. There you can insert the result into the spreadsheet with a right click on „**Number of calculated objects**“.




Open the **sequence group** () and rename the name of group 1 to „**Part Finder Group**“.



Open the **Spreadsheet** () and rename the row, to „**PartFound**“.
Change the spreadsheet column „**Lower limit**“ to 1.



Press **F5** or  to evaluate your checker with object and without object in the camera view.

For more information: Vision Q.400 manual, chapter 11 [\(see Chapter 1.2\)](#)

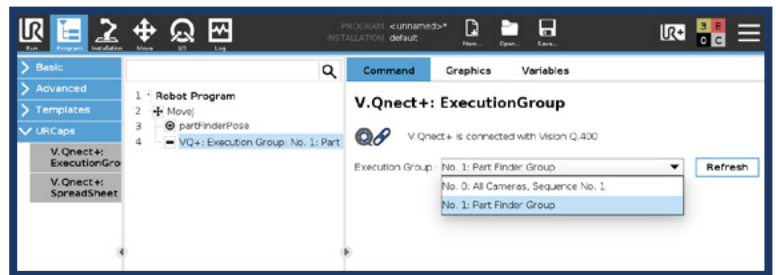
9.2 Presence Check

The presence check checks if an object is present / not present.

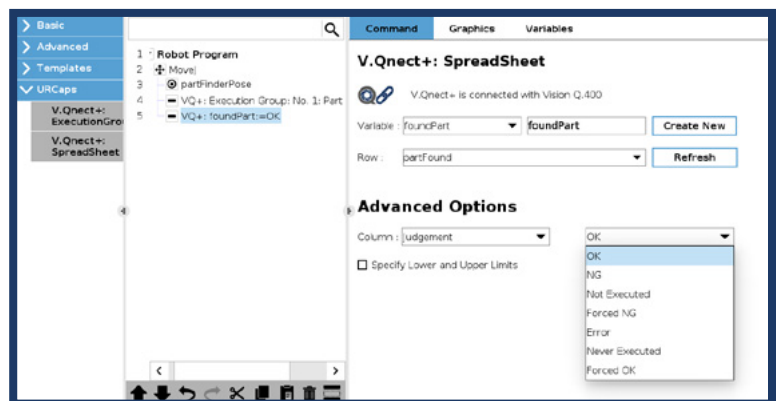
Set the first waypoint of the robot with the camera over the object. Pay attention to the exposure and sharpness of the object. Save the waypoint.



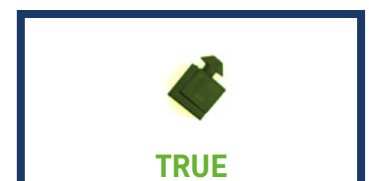
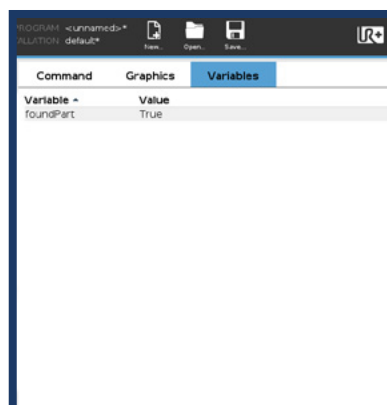
Add to the robot program a sequence group (**Program -> URCaps -> V.Qnect+: Sequence Groups**) that you have previously created in Vision Q.400.



In order for the V.Qnect+ to process the result, a Spreadsheet node must be inserted into the robot program. To do this, click **Program -> URCaps -> V.Qnect+: Spreadsheet**. Select the row „part-Found“ and column „Judgement“ and „OK“ for this application. Start the robot program.



After you have started the program, you can read the results under „**Variables**“. If the result is „**True**“, the object was found, if the result is „**False**“, no object or an unknown object was found by the camera.



(example)



(example)

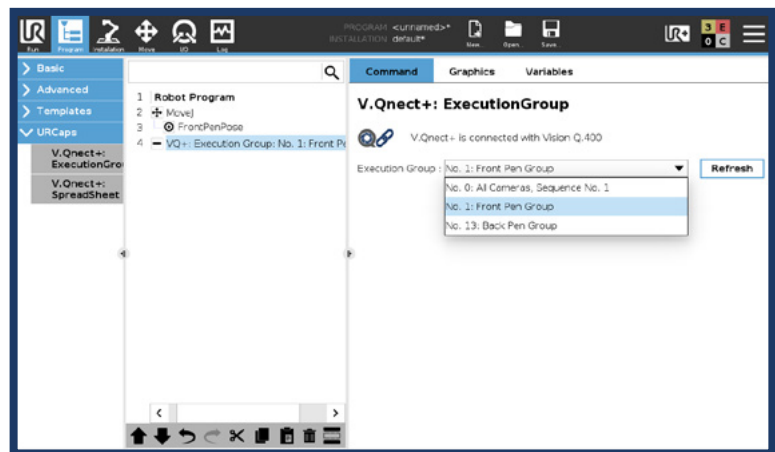
9.3 Measurement

In this test, a commercially available pen is measured.

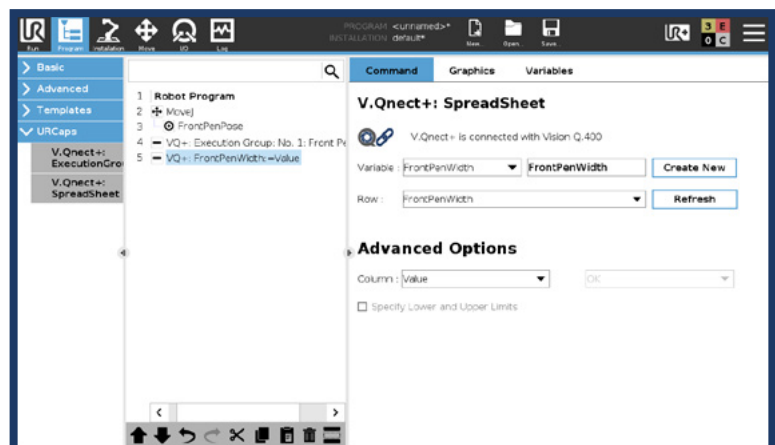
Set the first **waypoint** of the robot with the camera slowly over the object. Pay attention to the exposure and sharpness of the object. Save the waypoint.



In the Sequence Groups area (**Program -> URCaps -> V.Qnect+: Sequence Groups**), select the sequence group previously created in Vision Q.400.



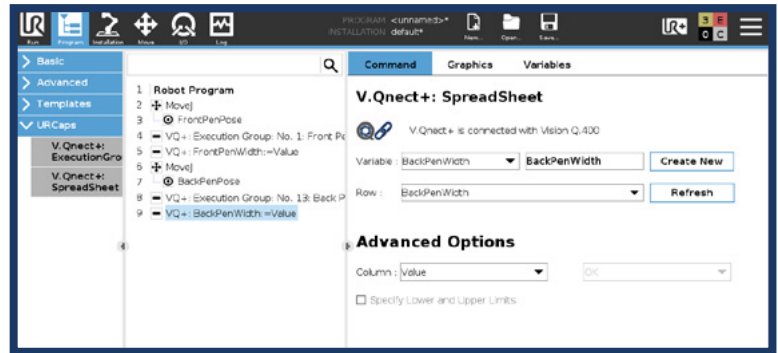
After you have determined the first position and the sequence group, you need to add a Spreadsheet node there, go to **Program -> URCaps -> V.Qnect+: Spreadsheet** and select the row and column.



Move the robot with the camera to the **second waypoint** you want to measure. Save this in the robot program



After the second waypoint, select the next sequence group (**Program -> URCaps -> V.Qnect+: Sequence Groups**) and the next spreadsheet (**Program -> URCaps -> V.Qnect+: Spreadsheet**).



After you have started the program, you can read the results under „**Variables**“.

