



**NORDBO**  
ROBOTICS



NRS-6 for Universal Robots

# User Manual

Ver. 1.6

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**NORDBO**  
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## Glossary

The following table explains the terms used throughout the manual.

<b>TERMS</b>	<b>EXPLANATION</b>
NRS-6	General product name of Nordbo Robotics' range of force and torque sensors measuring force and torque in 6-axis
FT sensor / sensor	Used when referring to the NRS-6 sensor
NRC-ETH	CAN to Ethernet converter module – reads data from NRS-6 and outputs it through analogue outputs or Ethernet. Serves as a user interface of the NRS-6
Signal converter or converter	Used when referring to the NRC-ETH
UR	Short for "Universal Robots"
Application	A "System" designed for solving the problem of automating an action or process
Cobot	Short for "Collaborative Robot" – a robot that has been approved for working side-by-side with human workers
Sensor-/robot side interface plates	A plate with hole pattern fitting either the robot's tool flange or the NRS-6. Are needed to attach the sensor to a robot.
Node	Program blocks of the URcap

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## 1. Introduction

### 1.1. Intended use

This document serves as a guide for integrating Nordbo Robotics' NRS-6 force and torque sensor in an application using a Universal Robots manipulator.

### 1.2. Prerequisites

It is recommended that the person executing the instructions of this installation guide has basic knowledge and skill in using Universal Robots' PolyScope, and that the user has a basic understanding of the risks related to working with a robot. It is also recommended reader should also have basic knowledge in using a computer and altering its network settings. It is required that the person executing the guide's instructions have made a risk assessment of the application in which the product is integrated before using this manual.

### 1.3. Safety Warnings

Following instructions must be read thoroughly by anyone intending to use this product.



**Warning! This symbol indicates that potentially hazardous, dangerous or unwanted situations can arise from not following the instructions correctly. If safety instructions are not followed properly it may result in death, personnel injury or equipment damage.**

Before attempting to mount the NRS-6 on the robot, it is important to ensure that the robot cannot move. The robot must therefore be powered off before attempting to attach the sensor on the robot.

The robot must always be **powered off** before attempting to connect wires to the robot's controller, or when connecting cables between any of Nordbo Robotics' products.

The product may be damaged if dropped on hard surfaces. Be aware that wire connectors of both the sensor and the converter can break if the user overtighten the cables' screw.

The NRS-6 is water and dust resistant according to IP67 test standards.

The sensor can be used within the specified measurement range. Using the sensor outside of its range is considered misuse. Nordbo Robotics is not liable for any damage or injury resulting from misuse.

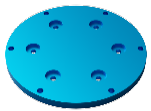
## 2. Product information

### 2.1. NRS-6 UR Bundle

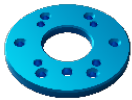
The UR bundle consists of the items listed below.



1x Interface plate (Cobot-to-flange)



1x Interface plate (Flange-to-sensor)



1x Interface plate (Sensor-to-tool)



1x NRS-6XXX-D80



1x NRC-ETH - CAN to Ethernet converter



1x NRC-ETH 2 m power cable



1x NRC-ETH 3 m sensor cable



12x M4x10 mm ISO 7380



4x M6x8 mm ISO 7380



6x M4x12 mm DIN 7991



1x USB key with relevant manuals and software

## 2.2. Technical specifications

Model	NRS-6050-D80	NRS-6200-D80	
<b>Compatibility</b>	Windows, Linux, UR & Codesys	Windows, Linux, UR & Codesys	
<b>Diameter, Ø</b>	80 mm	80 mm	
<b>Height, H</b>	22 mm	22 mm	
<b>Weight</b>	300 g	300 g	
<b>Operating conditions, temperature</b>	0° to 50°	0° to 50°	
<b>Operating conditions, humidity</b>	< 85%	< 85%	
<b>Hysteresis</b>	< 0,2 %	< 0,2 %	
<b>Crosstalk</b>	< 5 %	< 5 %	
<b>Power requirement (CAN)</b>	5 VDC @ 250 mA	5 VDC @ 250 mA	
<b>Power requirement (Ethernet)</b>	6-40 VDC @ 1000 mA	6-40 VDC @ 1000 mA	
<b>Sample rate</b>	< 1000 Hz	< 1000 Hz	
Fx Fy	<b>Max force</b>	± 500 N	± 2000 N
	<b>Resolution*</b>	0,015 N	0,005 N
	<b>Overload</b>	700 N	± 2700 N
	<b>Signal noise**</b>	0,025 N	0,056 N
	<b>Noise-free resolution</b>	0,1 N	0,25 N
	<b>Full scale non-linearity</b>	< 4%	< 4%
	<b>Axis deformation</b>	30 µm	30 µm
Fz	<b>Max force</b>	± 500 N	± 2000 N
	<b>Resolution*</b>	0,015 N	0,005 N
	<b>Overload</b>	1200 N	± 4700 N
	<b>Signal noise**</b>	0,032 N	0,085 N
	<b>Noise-free resolution</b>	0,15 N	0,35 N
	<b>Full scale non-linearity</b>	< 4%	< 4%
	<b>Axis deformation</b>	27 µm	27 µm
Tx Ty	<b>Max torque</b>	± 10 Nm	± 40 Nm
	<b>Resolution*</b>	0,32*10 <sup>-3</sup> Nm	1,2*10 <sup>-3</sup> Nm
	<b>Overload</b>	15 Nm	55 Nm
	<b>Signal noise**</b>	0,35*10 <sup>-3</sup> Nm	0,8*10 <sup>-3</sup> Nm
	<b>Noise-free resolution</b>	1,5*10 <sup>-3</sup> Nm	3,0*10 <sup>-3</sup> Nm
	<b>Axis deformation</b>	0,2°	0,2°
Tz	<b>Max torque</b>	± 5 Nm	± 30 Nm
	<b>Resolution*</b>	0,25*10 <sup>-3</sup> Nm	0,95*10 <sup>-3</sup> Nm
	<b>Overload</b>	15 Nm	± 55 Nm
	<b>Signal noise**</b>	0,4*10 <sup>-3</sup> Nm	0,95*10 <sup>-3</sup> Nm
	<b>Noise-free resolution</b>	0,002 Nm	3,5*10 <sup>-3</sup> Nm
	<b>Axis deformation</b>	0,05°	0,05°

\*The resolution describes the minimal increment of the different axis. The range and resolution of the sensor may vary depending on factory calibration. It can be expected that a calibrated sensor has a measuring deviation below 3% but is depending on the temperature and humidity of the environment.

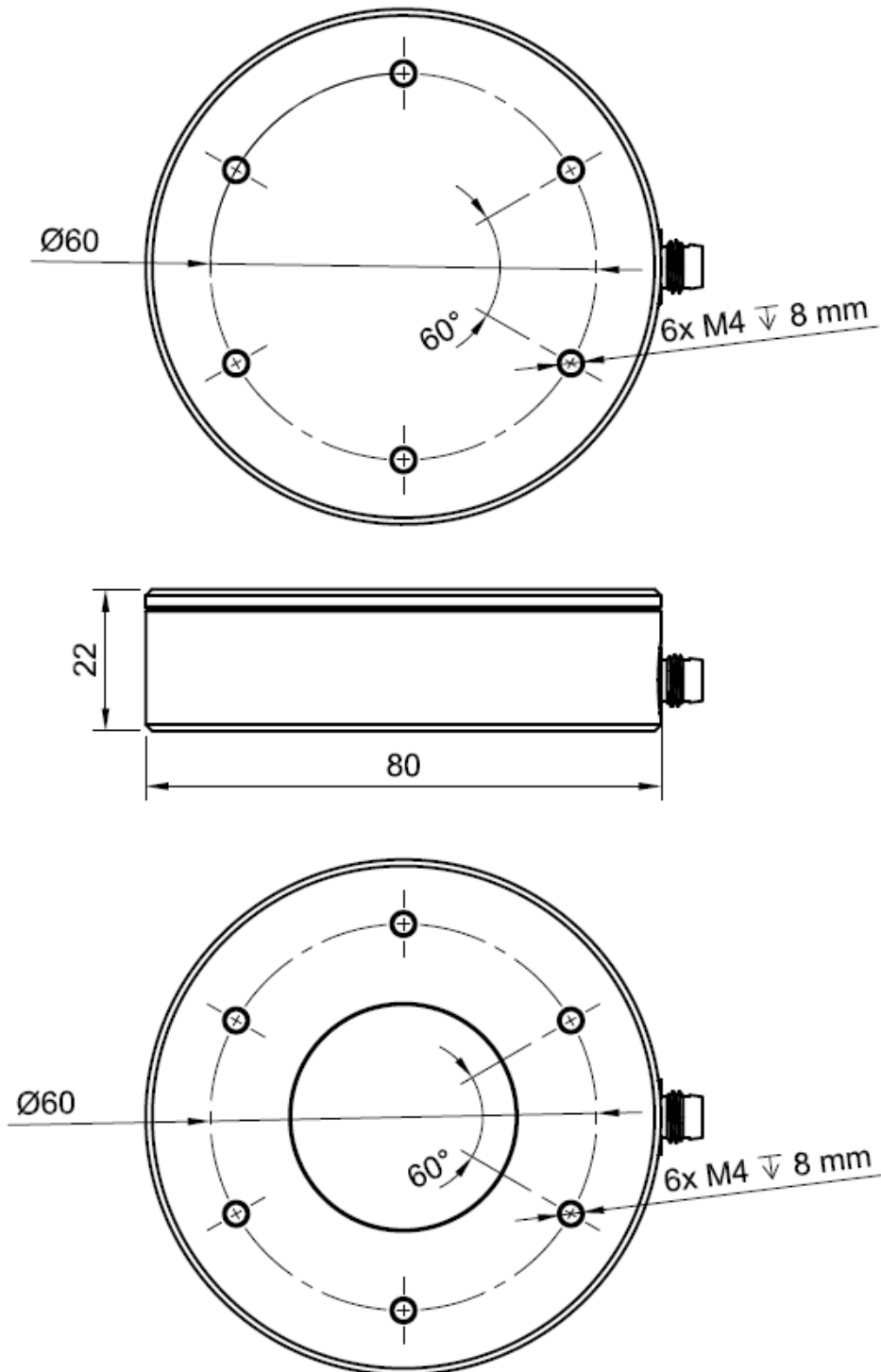
\*\*Signal noise is defined as the standard deviation of a one second signal without load

## Converter – Technical Specifications

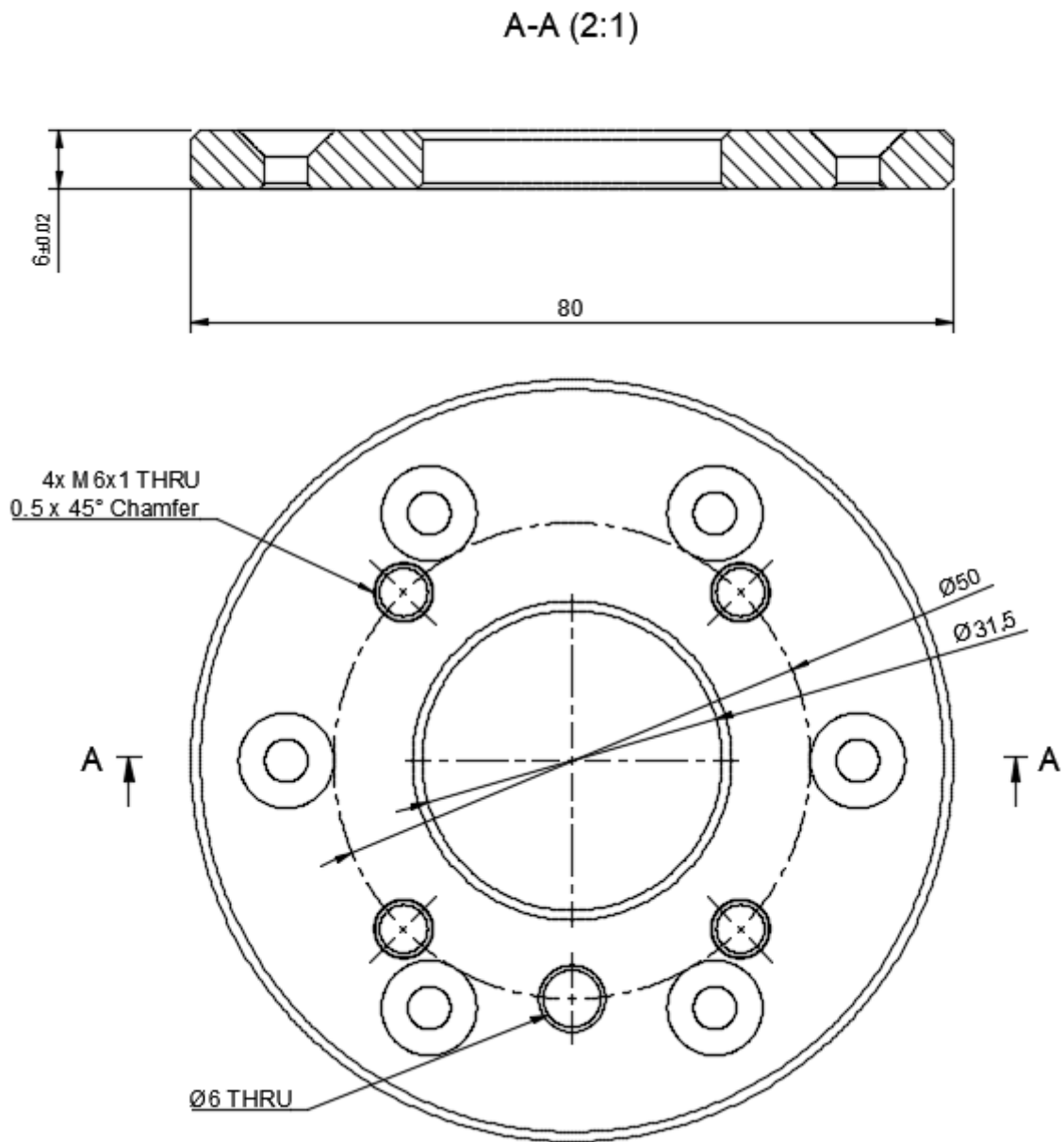
<b>Model</b>	NRS-ETH
<b>Compatibility</b>	Windows, Linux, UR & Codesys
<b>Width, W</b>	55 mm
<b>Length, L</b>	91 mm (incl. connectors)
<b>Height, H</b>	39 mm
<b>Weight</b>	115 g
<b>Operating temperature</b>	0° to 50°
<b>Operating humidity</b>	< 85 %
<b>Power requirement (CAN)</b>	5 VDC @ 100 mA
<b>Power requirement (Ethernet)</b>	6-40 VDC @ 500 mA



### 2.3. Mechanical specifications: NRS-6XXX-D80



## 2.4. Mechanical specifications: Cobot interface plate



## 3. Installing the NRS-6 on UR

The following section describes the procedure for installing the sensor on an UR3, UR5 or UR10 robot, and how to use the software tools created for it. The process for installing the FT sensor on the UR is as follows:

- **3.1 Mounting the NRS-6 on the robot**
- **3.2 Setting up the NRC-ETH for the application**
- **3.3. Connecting to the robot**
- **3.4 Creating a program using nodes**
- **3.5 Using raw sensor data**

### 3.1. Mounting the NRS-6 on the robot

To mount the sensor to the robot's flange the user will need the supplied bolts and interface plates. One interface plate will be mounted to the robot, the other interface plate to the sensor before coupling the two interface plates together.

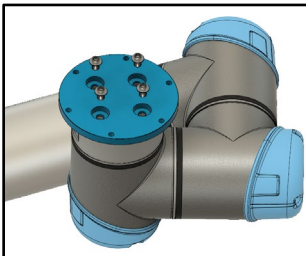


**Warning! The user must make sure that the robot cannot move during this step. Unintended robot movement may cause harm to personnel working with the robot.**



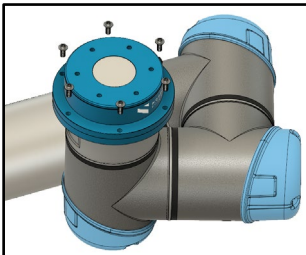
#### Step 1

Mount the interface plate (Flange-to-Sensor) on the sensor using 6x M4 10 mm bolts.



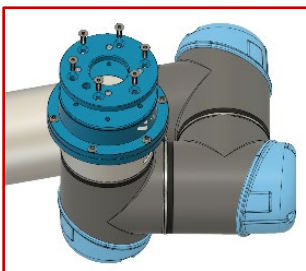
#### Step 2

Mount the interface plate on robot (Cobot-to-Flange) using the supplied M6 8 mm bolts.



#### Step 3

Use the supplied M4 10 mm bolts to attach the two plates to each other. Mount the bolts from the sensor's side into the threaded holes of the opposite plate.



#### Step 4 (Optional)

Use the supplied M4 12 mm countersunk bolts to attach the cobot interface plate (Cobot-to-EOAT) to the sensor.



#### Step 4

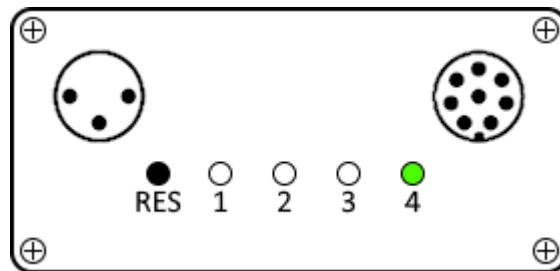
Use the supplied NRC-ETH sensor cable to connect the sensor to the signal converter. It is recommended to supply the signal converter with the 24-volts output from the UR controller.

Red wire: connect to 24 v

Black wire: connect to ground

### 3.2. Setting up the NRC-ETH for the application

The NRC-ETH signal converter has 4 LEDs displaying its operating status, and a button for resetting the firmware without connecting the device. The LEDs are numbered 1-4, and the reset button marked "RES".



ID	Description	Functionality
RES	Reset Button	Restores device to factory settings. Press and hold the reset button until all LEDs have turned on and off again. Doing so will delete all user-defined settings on the device permanently and reset the IP address to default!
1	White LED	Blinks when the firmware of the converter is running correctly
2	White LED	Turned on when the FT SENSOR is connected to the converter and is running without errors
3	White LED	Blinks when an Ethernet data stream has been started externally and is running
4	Green LED	Turned on when power is on

## Step 1

- Plug the converter into a pc using an Ethernet cable
  - OPTIONAL: If no switch or router is available, connect converter and computer directly using an Ethernet cable.
- Plug a computer into the same switch or router using another Ethernet cable.
- Configure the computer with static IP-address in the range of the converter.



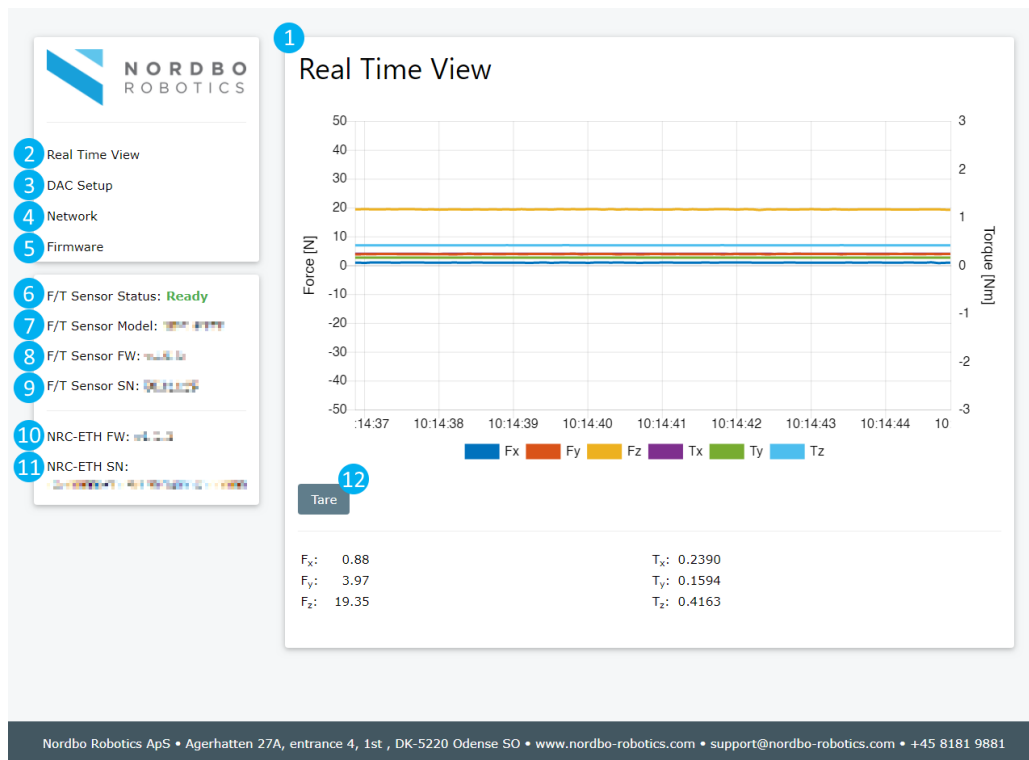
## Step 2

It may be necessary for the user to manually setup the signal converter for the application. Several changes can be made through the convert's web interface which can be accessed by connecting to the NRCs IP address using an internet browser.

- Access the converters web interface through any browser by typing in the signal converter's IP address in the browser's address bar (By default, the IP address is "192.168.0.100").

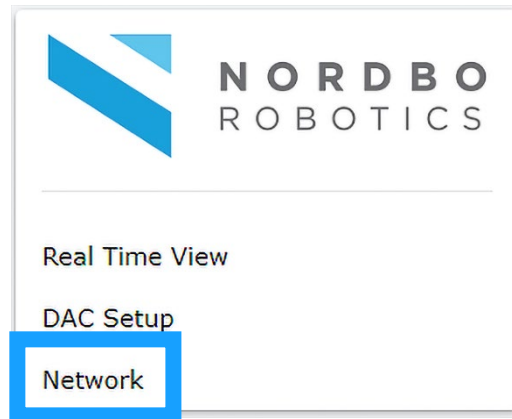


When entering the web interface of the converter, it will show the layout as seen on the figure below.



No.	Description
1	Real Time View screen where the user can see the FT sensors force and torque outputs in real time
2	Button that navigates to the Real Time View menu
3	Button that navigates to the DAC Setup menu
4	Button that navigates to the Network menu
5	Button that navigates to the Firmware menu
6	Indicates if FT sensor is connected and is ready to operate
7	Indicates which sensor model that is currently connected to the converter
8	Displays which firmware version that is currently active on the connected FT sensor
9	Displays the serial number of the FT sensor that is currently connected
10	Displays the firmware version of the converter that is online
11	Displays serial number of the converter that the user is currently connected to
12	Clicking "Tare" will set all force and torque measurements to 0.0 N/Nm

When inside the web interface, select "Network" in the interface's navigation menu to the left



### Step 3

- Select if application should use a DHCP-server and the signal converter's hostname for the connection
- Select or deselect feature by clicking the box
- Change the signal converter's IP address to an IP address in the robot's local network (E.g. Robot: "192.168.1.10", NRC-ETH: "192.168.1.11")
- Change the NRC-ETH's subnet mask to match the subnet mask of the robot's network (E.g. Both: IP address "192.168.1.X", subnet mask: "255.255.255.0")
- Default gateway (E.g. "192.168.1.1")
- Hostname (E.g. NordboFT)

## Network

Enable DHCP

IP address

Subnet mask

Default gateway

Hostname

When data has been assigned, press "Save" to store it on the NRC-ETH. If the NRC-ETH's address was changed the user will have to re-access the NRC-ETH's web interface by entering the new IP address to make any further settings. Pressing "Update" will replace any assigned values with the values that are currently stored and active on the NRC-ETH.



### 3.3. Connecting to the robot

By the beginning of this step it is assumed that the user has completed the instructions of the section 3.2. Setting up the NRC-ETH for the application.

#### Step 4

- Connect the NRC-ETH to the Universal Robots controller using an Ethernet switch and a RJ45 cable. The controller's Ethernet port is on the bottom side of the cabinet.

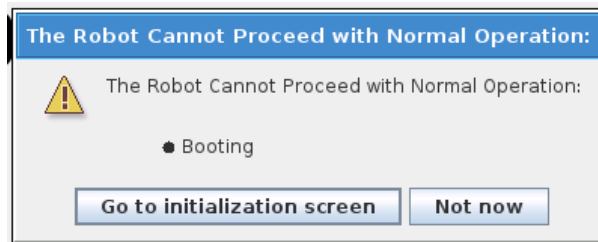
**Obs.:** It is recommended to connect the robot and NRC-ETH through an Ethernet switch, but the robot and NRC-ETH can be connected directly.



## Step 5

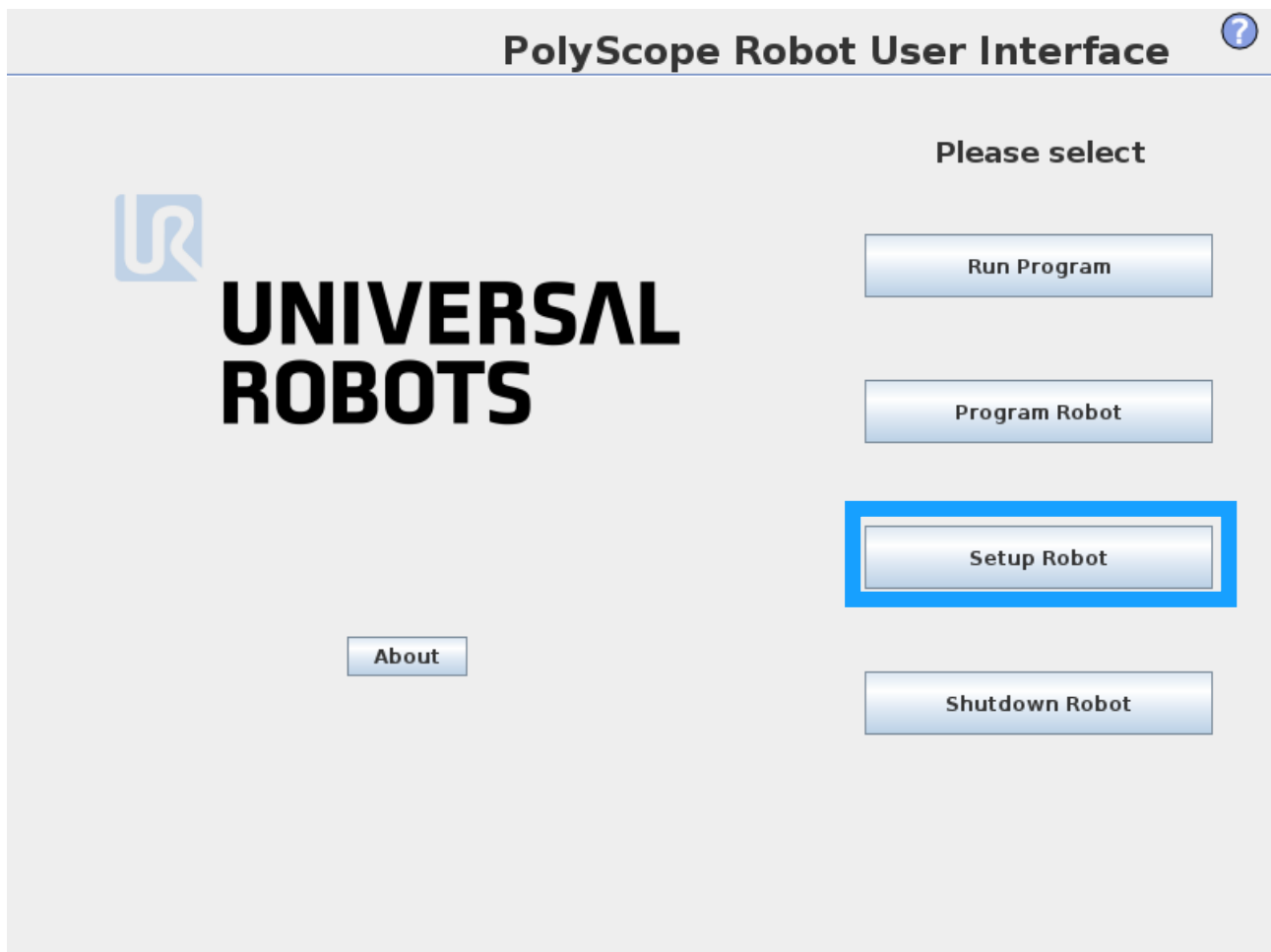
To setup the robot for communicating with the NRC-ETH, the user must change the robot's IP address and subnet mask to be in the application's local network. Assigning the default gateway is optional but recommended.

**Obs.:** If the experiencing the pop-up "The robot Cannot Proceed with Normal Operations" choose "Not now"



When the robot has been booted and initialized, the user will see the Welcome screen. First the robot's IP address must be changed to be in the application's local network

- Go to "Setup Robot"



- Go to Network menu and select "Static Address"
- Assign an IP address, Subnet mask and default gateway that reside in the application's local network.
- Click Apply to store settings

?

## Setup Robot

Initialize Robot

Language

Time

Calibrate Screen

URCaps

Network

Set Password

Update

Back

### Network

Select your network method

DHCP

Static Address

Disabled network

✘ Not connected to network!

**Network detailed settings:** \_\_\_\_\_

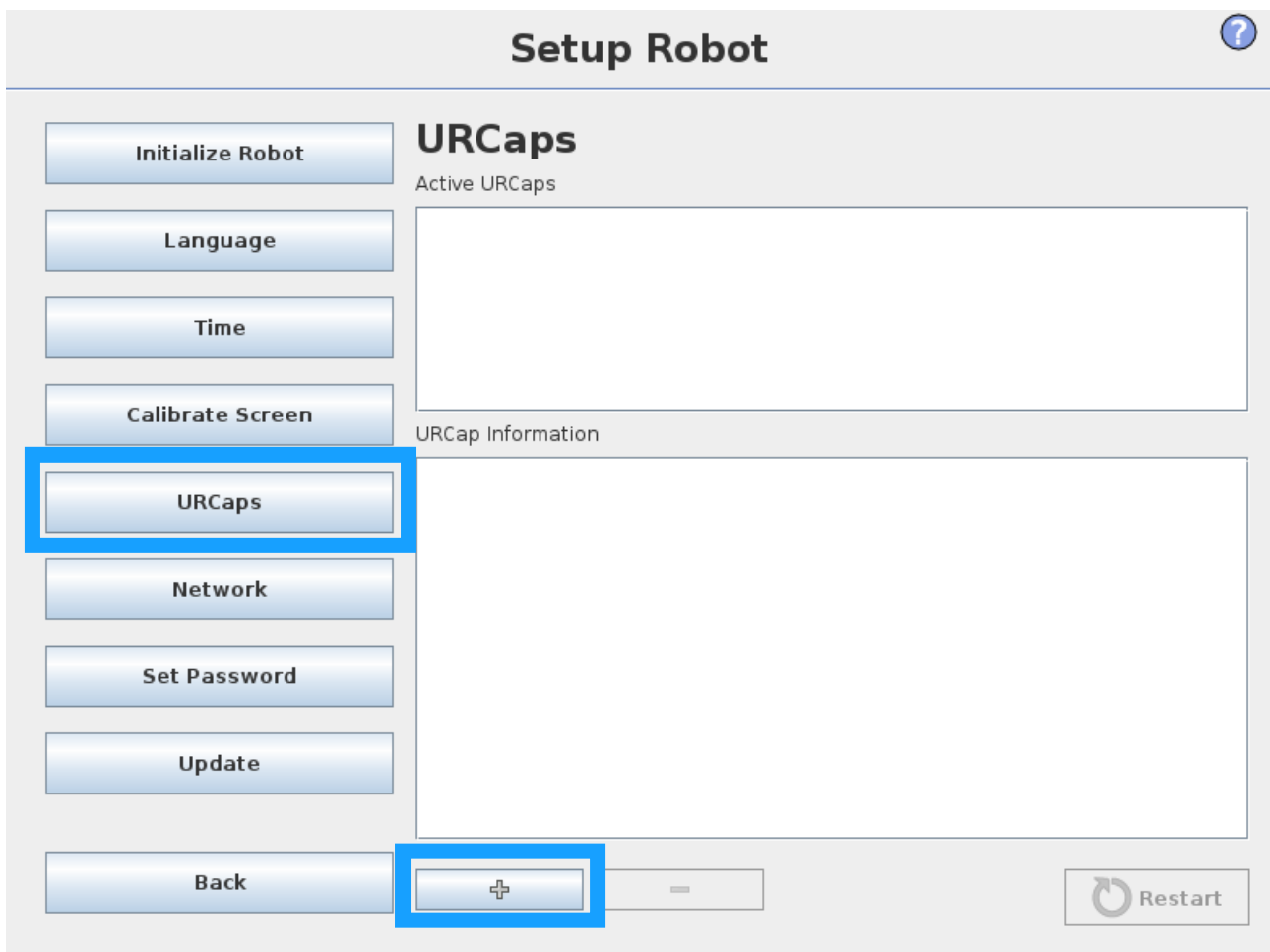
IP address	192.168.0.154
Subnet mask:	255.255.255.0
Default gateway:	192.168.0.1
Preferred DNS server:	192.168.0.1
Alternative DNS server:	0.0.0.0

Apply

## Step 6

To use the sensor the user must have installed the URCap.

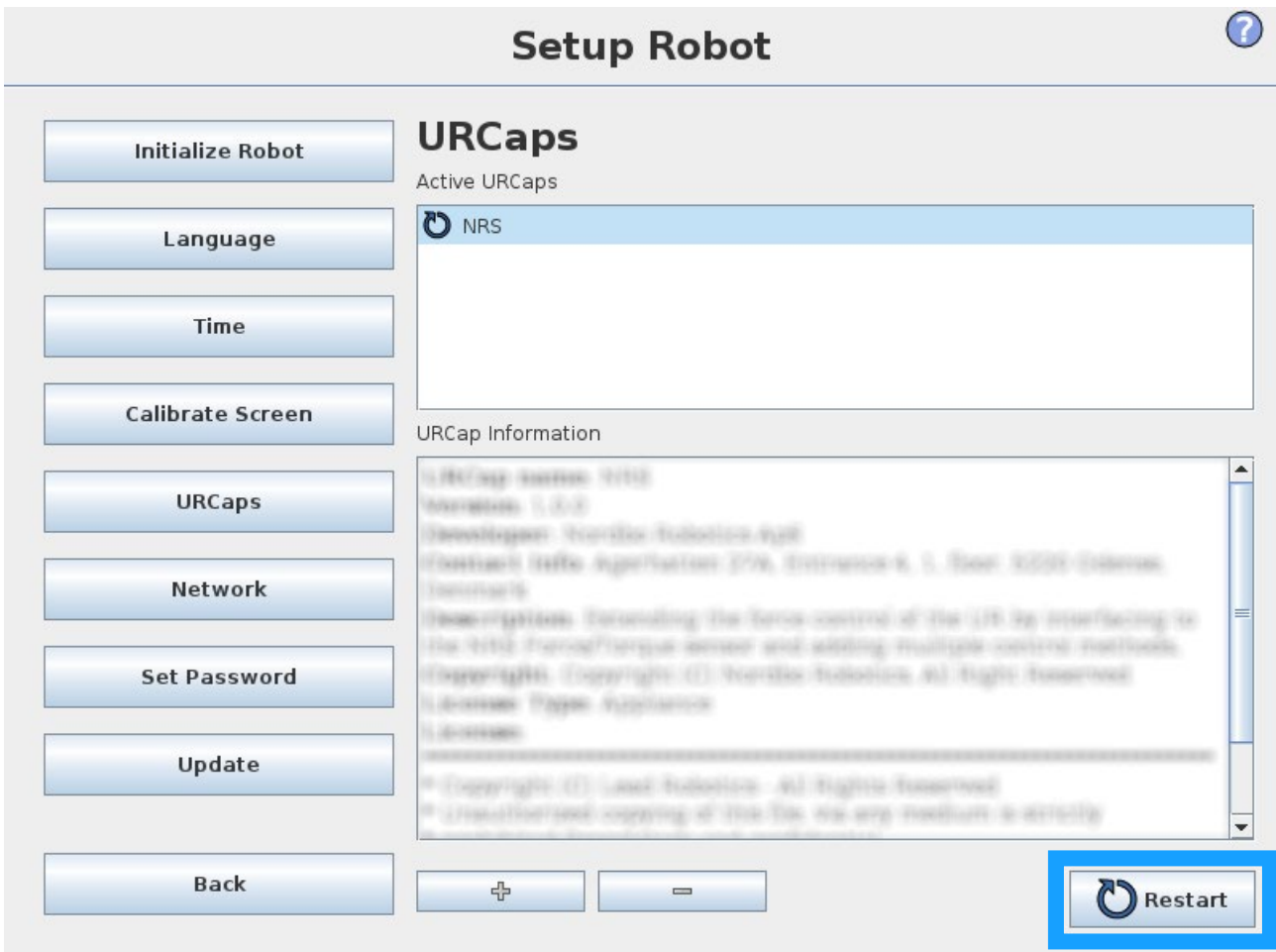
- Insert the supplied USB flash drive into the screen's USB slot
- In the left menu, click the button URCaps
- Click the button marked with a plus (+)
- Locate the URCap file on the flash drive.
- Select the URCap file and click "Open"



## Step 7

The robot now requires a reboot

- Click the “Restart button” in the bottom right corner, that is now no longer greyed out
- Wait for robot to restart



**Setup Robot** ?

**Initialize Robot**

**Language**

**Time**

**Calibrate Screen**

**URCaps**

**Network**

**Set Password**

**Update**

**Back**

**URCaps**

Active URCaps

- 🔄 NRS

URCap Information

```

URCap Name: NRS
Version: 1.0.0
Developer: Nordbo Robotics ApS
Contact Info: ApSvejlsvej 276, Esbjerg S, DK-6700 Esbjerg, Denmark
Description: Providing the basic control of the UR by interfacing to the UR's Force/Torque sensor and adding multiple control methods.
Copyright: Copyright (C) Nordbo Robotics. All Rights Reserved.
License Type: License
License:
.....
* Copyright (C) Nordbo Robotics. All Rights Reserved.
* Unrestricted copying of this file via any medium is strictly
  
```

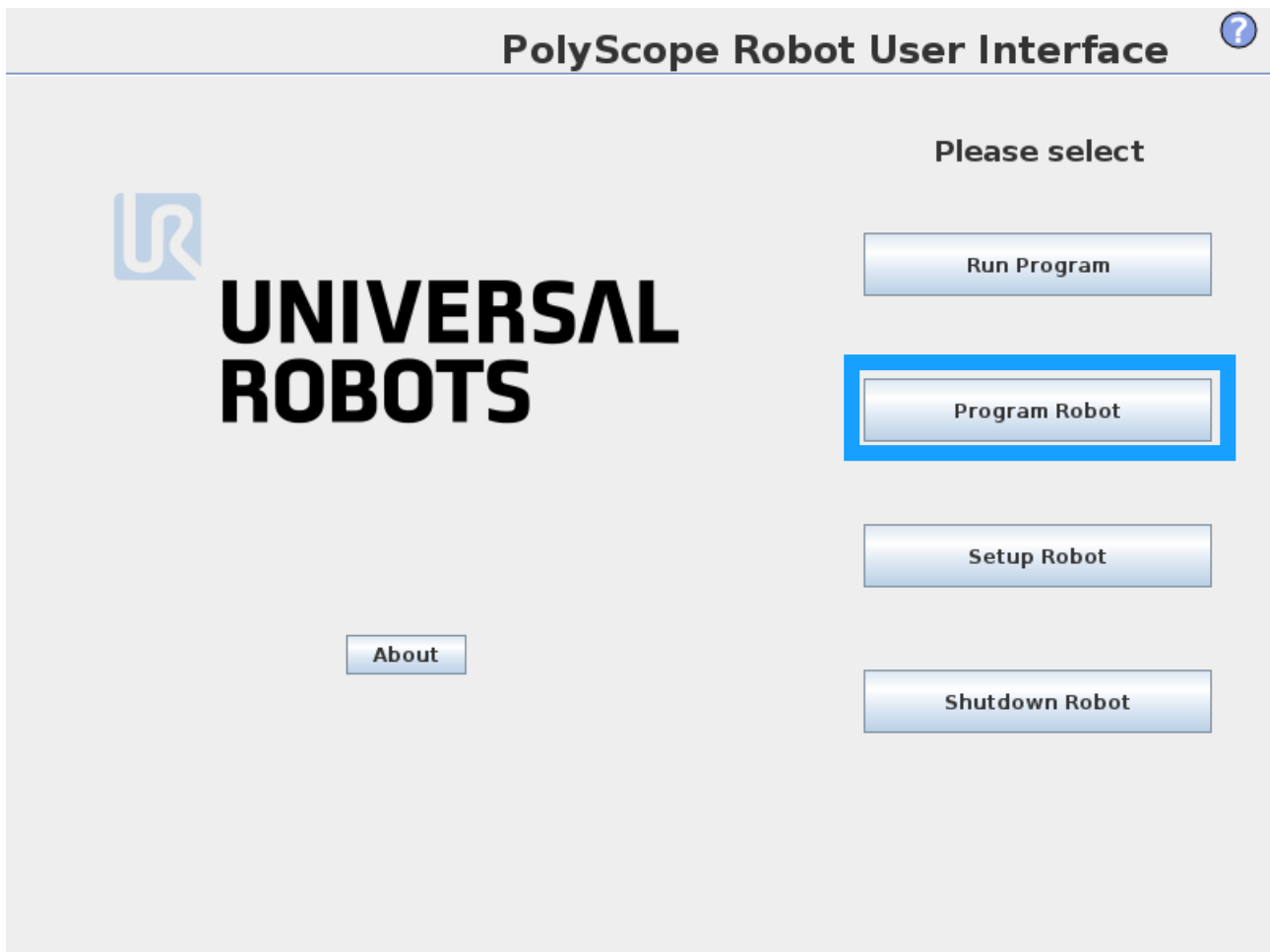
+   -

**Restart**

## Step 8

When the NRC-ETH's IP address and the robot's IP address are within the same network, and the URcap is installed and ready on the robot, it is now possible to establish connection to the sensor from the robot.

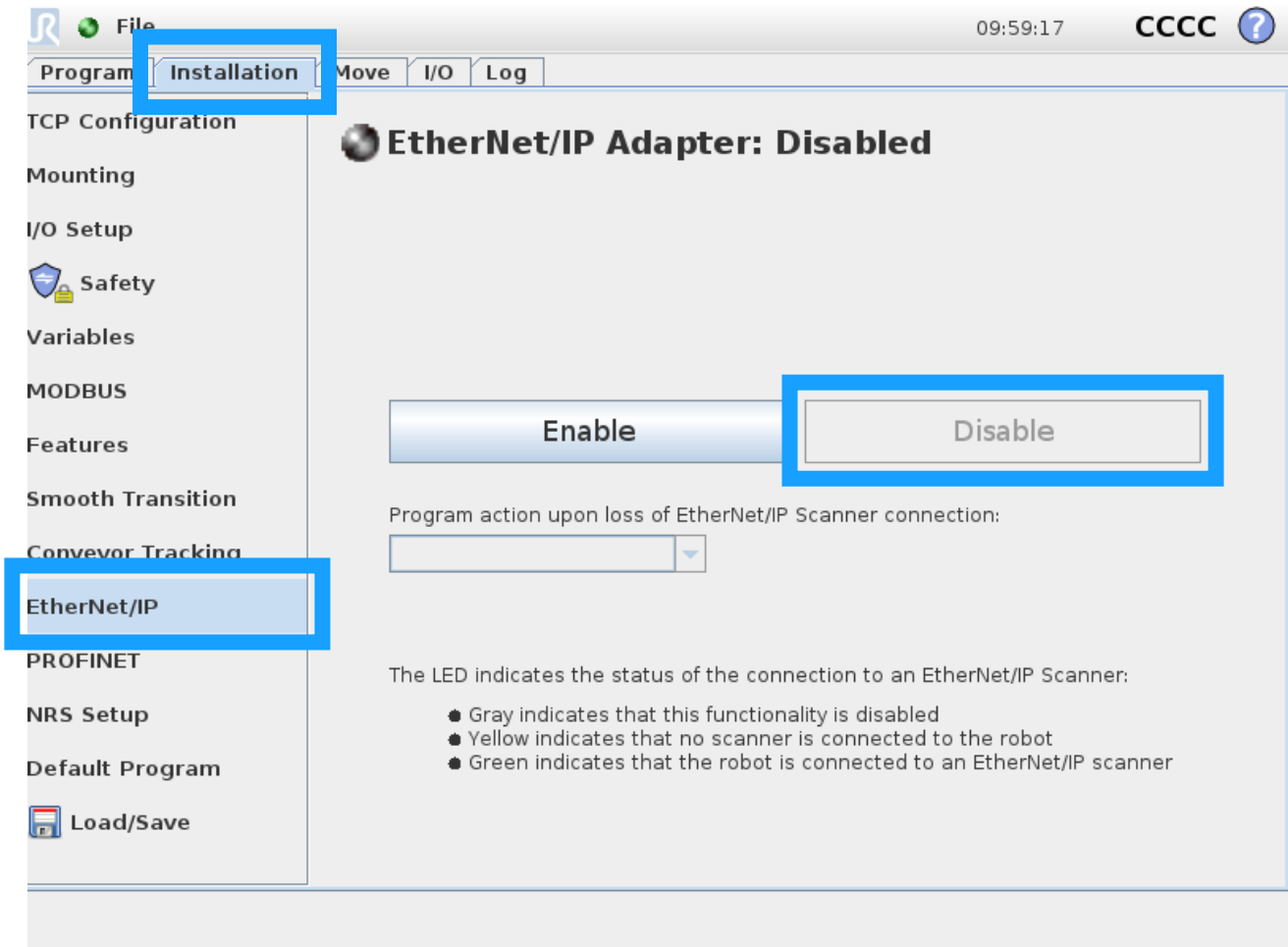
- Go to Program Robot to setup the robot's installation file



## Step 9

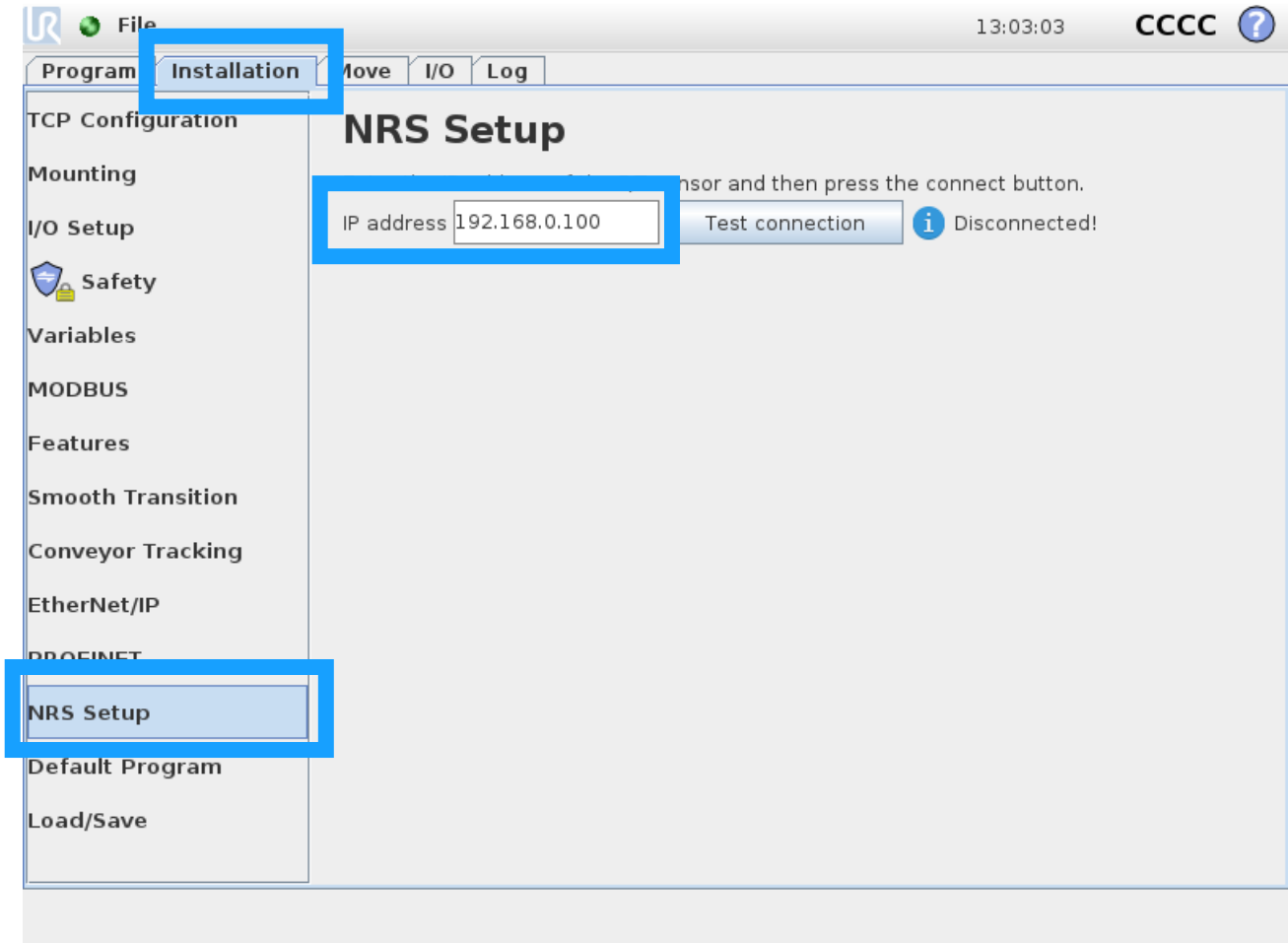
For the URCap to properly work, the robot's Ethernet/IP scanner must be disabled first.

- Go to the installation tab
- Find the menu point called "Ethernet/IP" and click it
- If Ethernet/IP scanner is enabled, disable it by clicking the button "Disable"



## Step 10

- Go to the Installation tab
- If it is necessary, scroll down – find the menu point called “NRS Setup”
- Assign the same IP address as assigned to the NRC-ETH in Step 3 in the field “IP address”

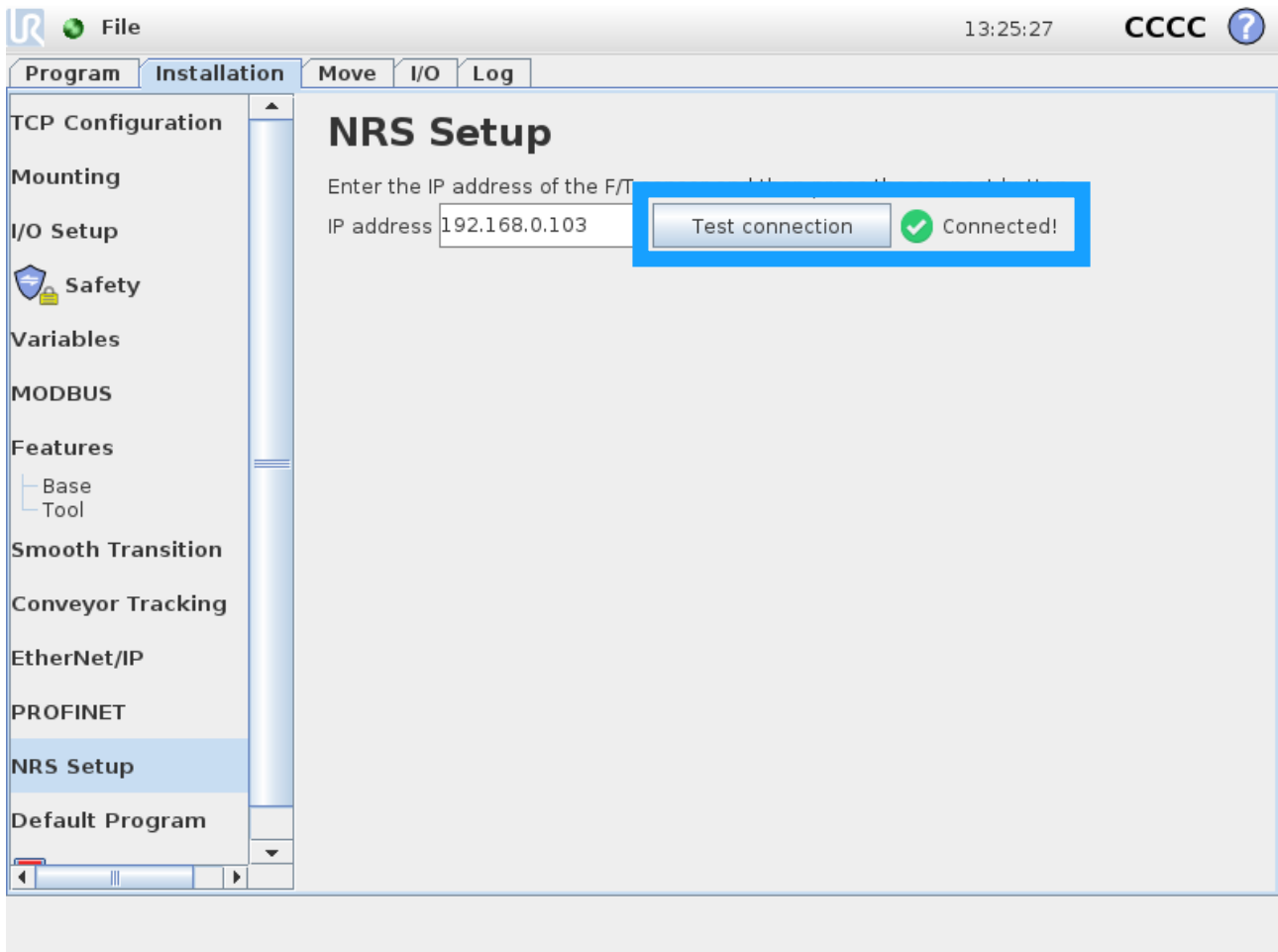




## Step 11

To check if the connection is correctly set up, click "Test connection"

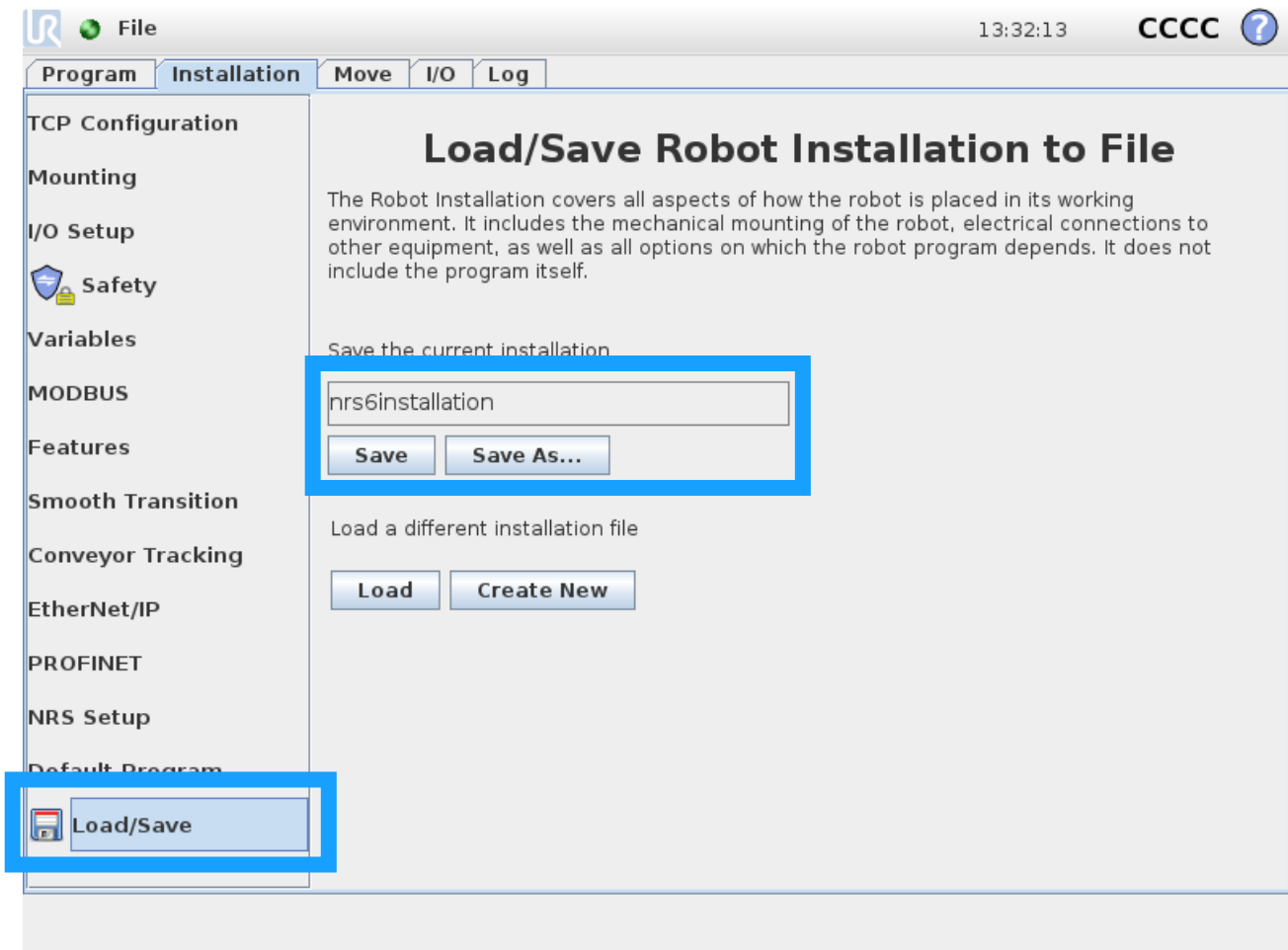
- After a brief delay the text to the right of the "Test connection" button should change to either "Connected" or to an error description



## Step 12

When the sensor has been connected and the connection is tested the setup must be saved

- Go to the menu point "Load/Save"
- Click "Save" or "Save As..." in the Load/Save menu to save the settings made above
  - "Save" will replace configuration of currently active Installation
  - "Save As..." will save a new Installation



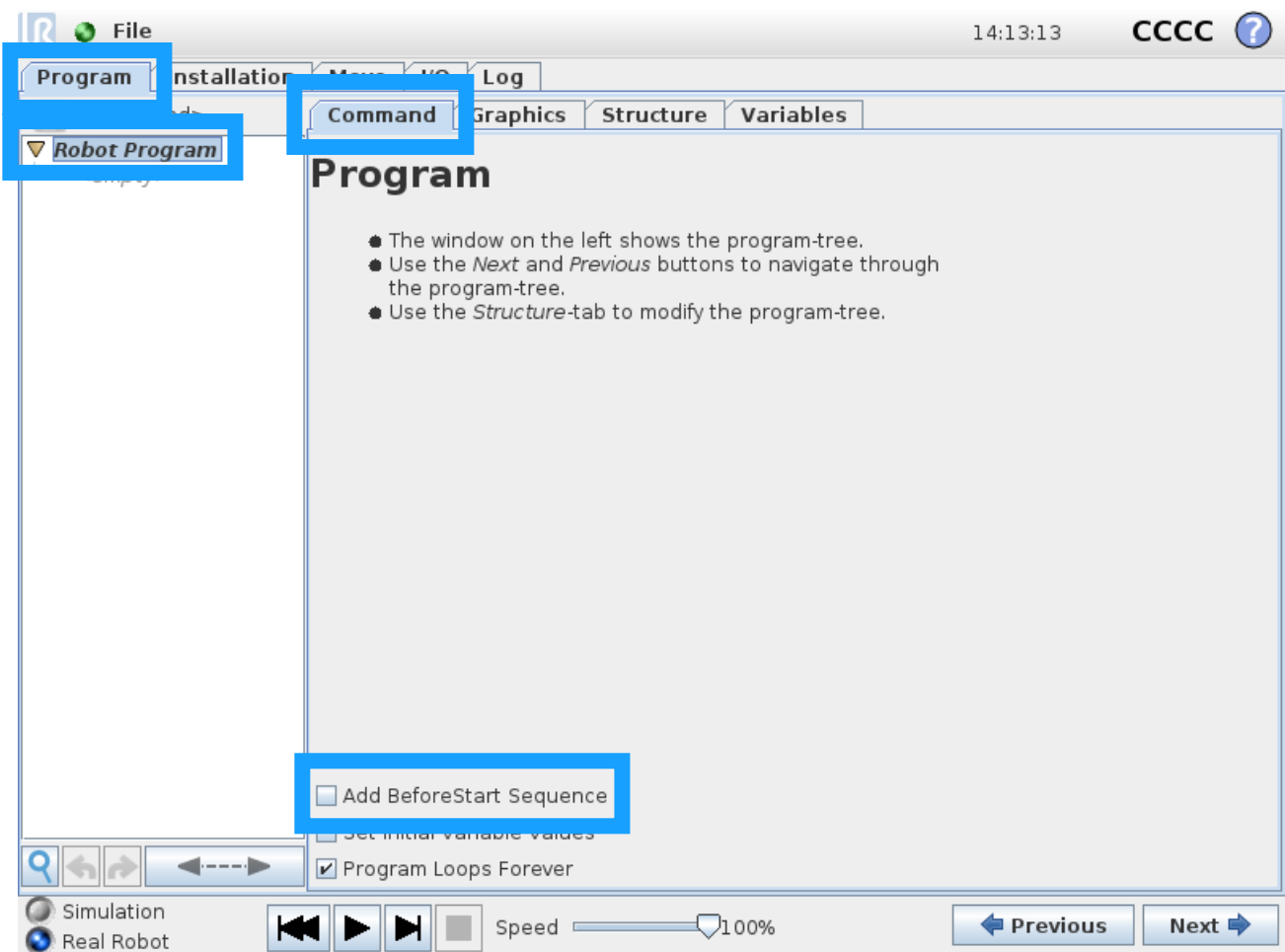
### 3.4. Creating a program using nodes

In this section the nodes of the URcap are described individually. For all applications the “Initialize sensor” step must be fulfilled. It is recommended to run the “Tare sensor” command once every cycle, before exposing the robot to the forces or torques that it is going to measure, to ensure the highest accuracy.

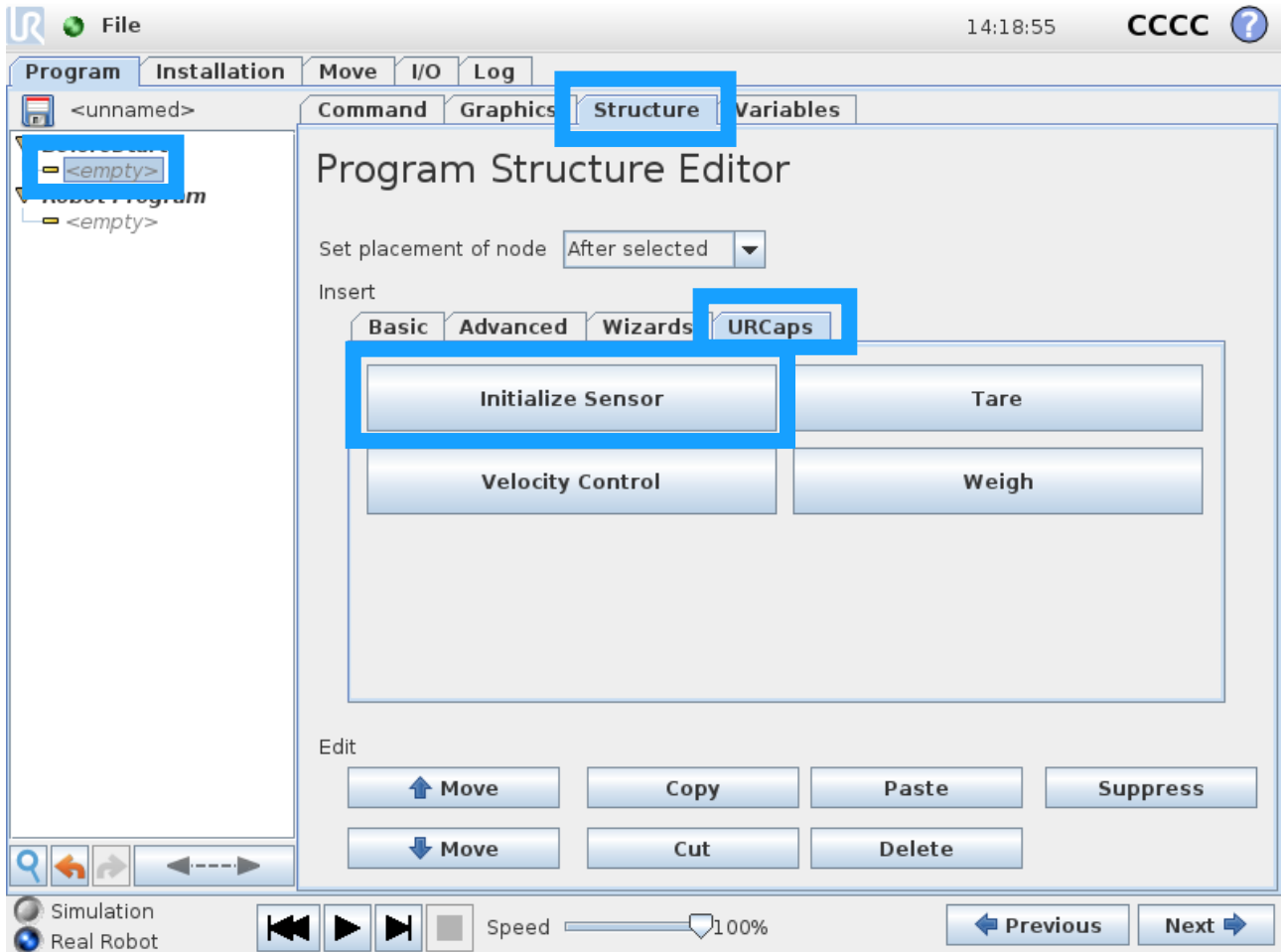
#### Step 1: Initialize Sensor

The node “Initialize Sensor” will start the data flow from the NRC-ETH to the robot. Initializing the sensor is necessary in all applications that use the force and torque data from the sensor. It is highly recommended to run this command in a “BeforeSequence” scope.

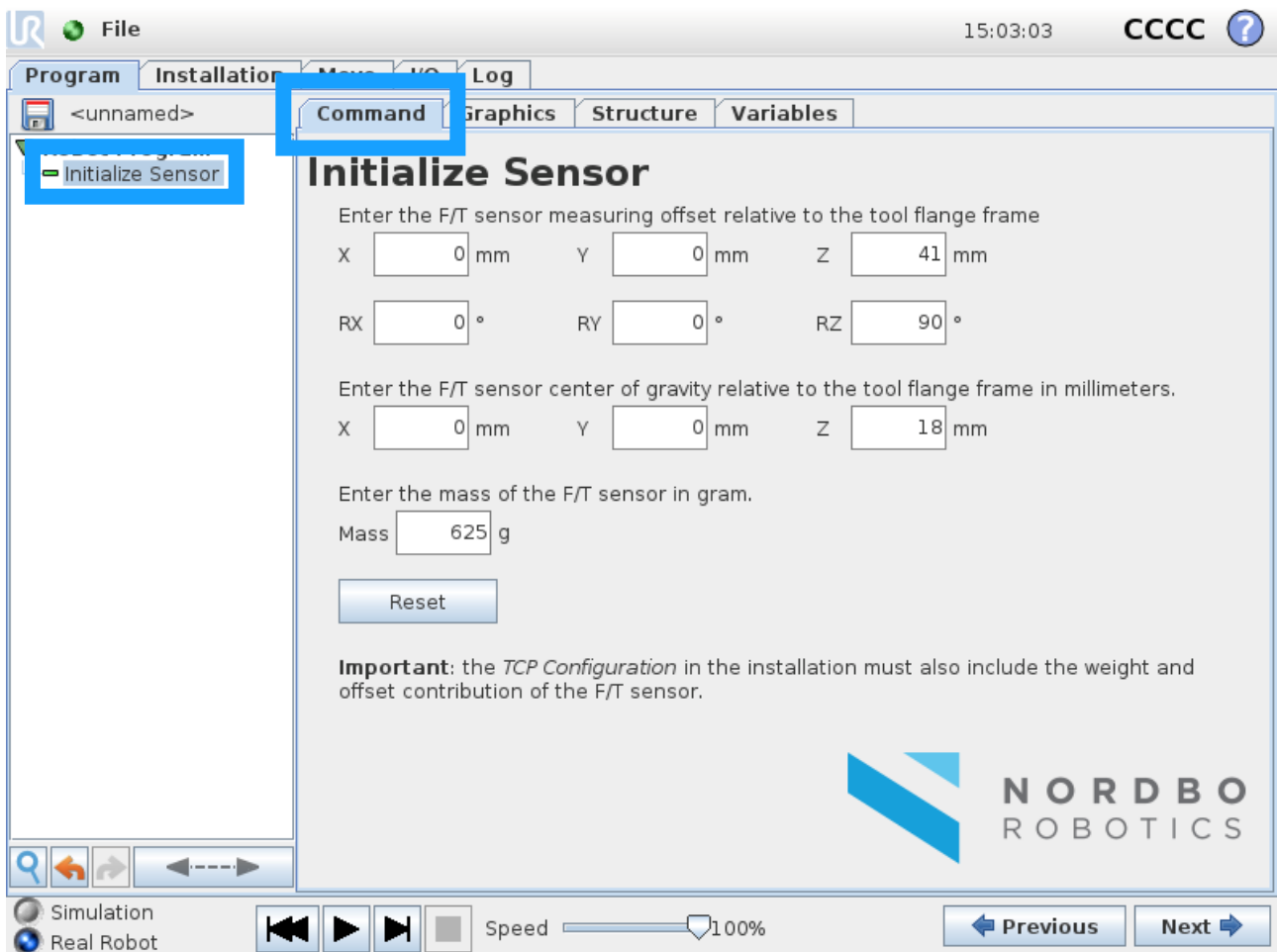
- Click the “Program” tab to go to the programming menu of the robot’s PolyScope
- In the programming menu go to the tab “Command”
- Click and select the scope “Robot Program”
- Click the box saying “Add BeforeStart Sequence” to enable it



- Select the "<empty>" line in the BeforeStart sequence
- Go to the tab "Structure"
- Select the tab "URCaps" in the Structure menu
- Click the node "Initialize sensor" to insert it in the BeforeStart sequence



- Select “Initialize Sensor” that should now appear below “BeforeStart” in the program tree and go to the “Command” tab
- In the first row enter the sensor’s offset in millimeters from the robot’s tool flange, relative to the robot’s original tool center point
  - **Note:** This specifies the point of force measurement relative to the robot TCP of the sensor for more accurate measurements.
- In the second row enter the sensor’s rotational offset in degrees from the robot’s tool flange, relative to the robot’s original tool center point
- In the third row enter the position of the sensor’s center of gravity in millimeters relative to the robot’s tool flange frame.
  - **Note:** The default 18 mm is the distance from the robot TCP to the sensors center of gravity.
- In the last block enter the sensor’s own weight plus the weight of the interface plates
  - **Note:** The default 625 g is the combined weight of the sensor and the three supplied interface plates and bolts.

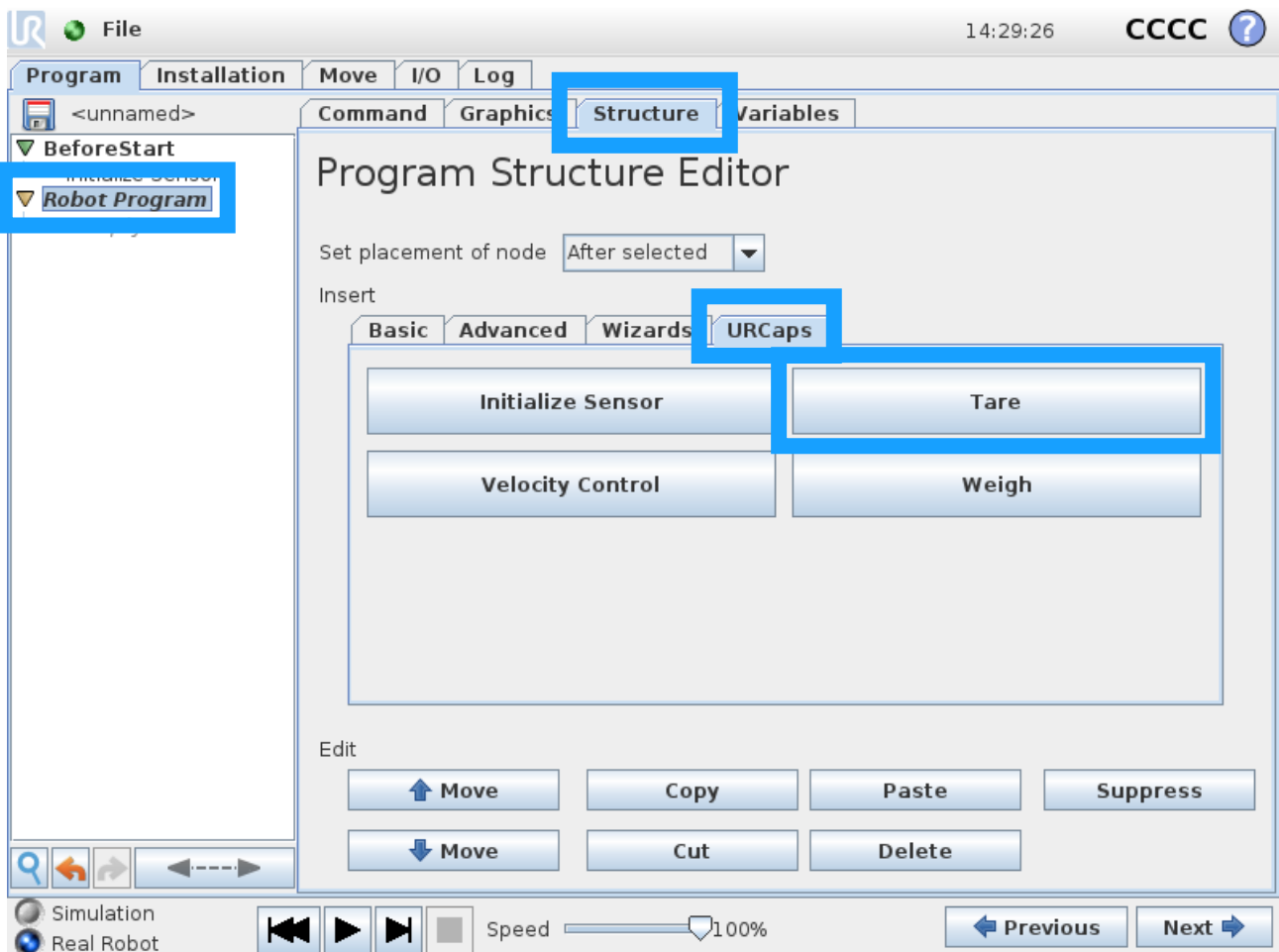


The sensor will now initialize the connection and data stream before the program starts. Clicking Reset will set all values to the URcap's default values.

## Step 2: Tare

The node "Tare" will use the current load, that the sensor is exposed to, as reference values for force and torque, from the point where the node is called and onwards. This means that all values will turn to 0.0 N/Nm, even if the sensor is exposed to any load when the node is called. This node is typically called once every cycle, or once per new action performed. It is highly recommended to call this node when the robot is not moving to get the most accurate result.

**Example:** The sensor is placed on a table and a bottle weighing 1 kg is placed on the sensor. The sensor will display that 1 kg of force is applied to the Z-axis. Calling the node Tare Sensor will set the output values to 0.0, and thus removing the bottle will cause the output value to be -1 kg.



- Select the scope "Robot Program" in the project tree on the left side of the robot's PolyScope
- Go to the tab Structure
- In the Structure menu, go to the tab URCaps
- Insert "Tare"

All sensor values will use the current load applied to it as reference values after this node is done, and thus all force and torque values will be 0.0 N/Nm. It is recommended to insert a "Wait" node with a 0.5 seconds delay after the tare for more accurate results.

### **Step 3: Velocity control**

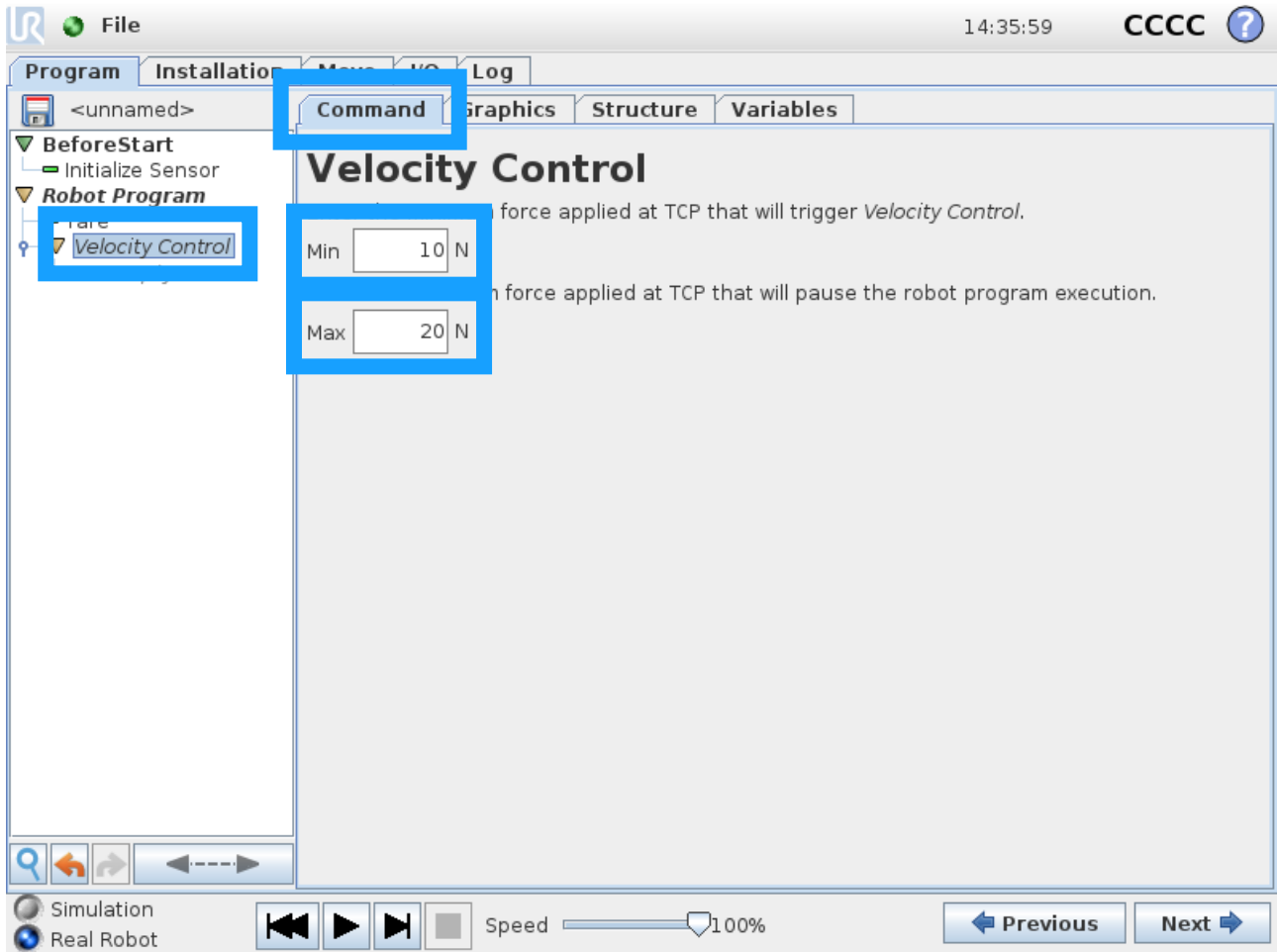
The node Velocity Control will regulate the robot's velocity in a given path, based on the force resultant that the sensor is exposed to. The velocity of the robot will be regulated between 0-100% of reference velocity, based on a span that is defined by the user.

The force that the sensor is exposed to is independent of direction – all values are absolute, and the "force" is a resultant of the total force of all axes.

E.g.: Minimum force before speed is slowed: 10 Newton. Maximum force where robot will have 0% velocity left: 20 Newton.

In this example:

- The robot will move at 100% of reference speed when the force that the sensor is exposed to is less than 10 Newton
- Between 10 and 20 Newton the force will be linearly scaled between 100%-0% (for example 15 Newton will result in 50% velocity)
- At above 20 Newton the robot will stop entirely, and not continue its movement until the force is less than 20 Newton



To use this node the user will need to insert a Move node inside the Velocity Control node.

- Click an object in the scope Robot program, or click the scope Robot program to insert the node in the first line
- Go to the Structure tab
- In the Structure tab, select URCaps
- Insert the Velocity Control node
- When the command has been inserted, click the Velocity Control node in the program tree
- Go to the tab Command
- Assign a "Min" value
  - Min is the force value where a reduction of the robot's velocity will begin
- Assign a "Max" value

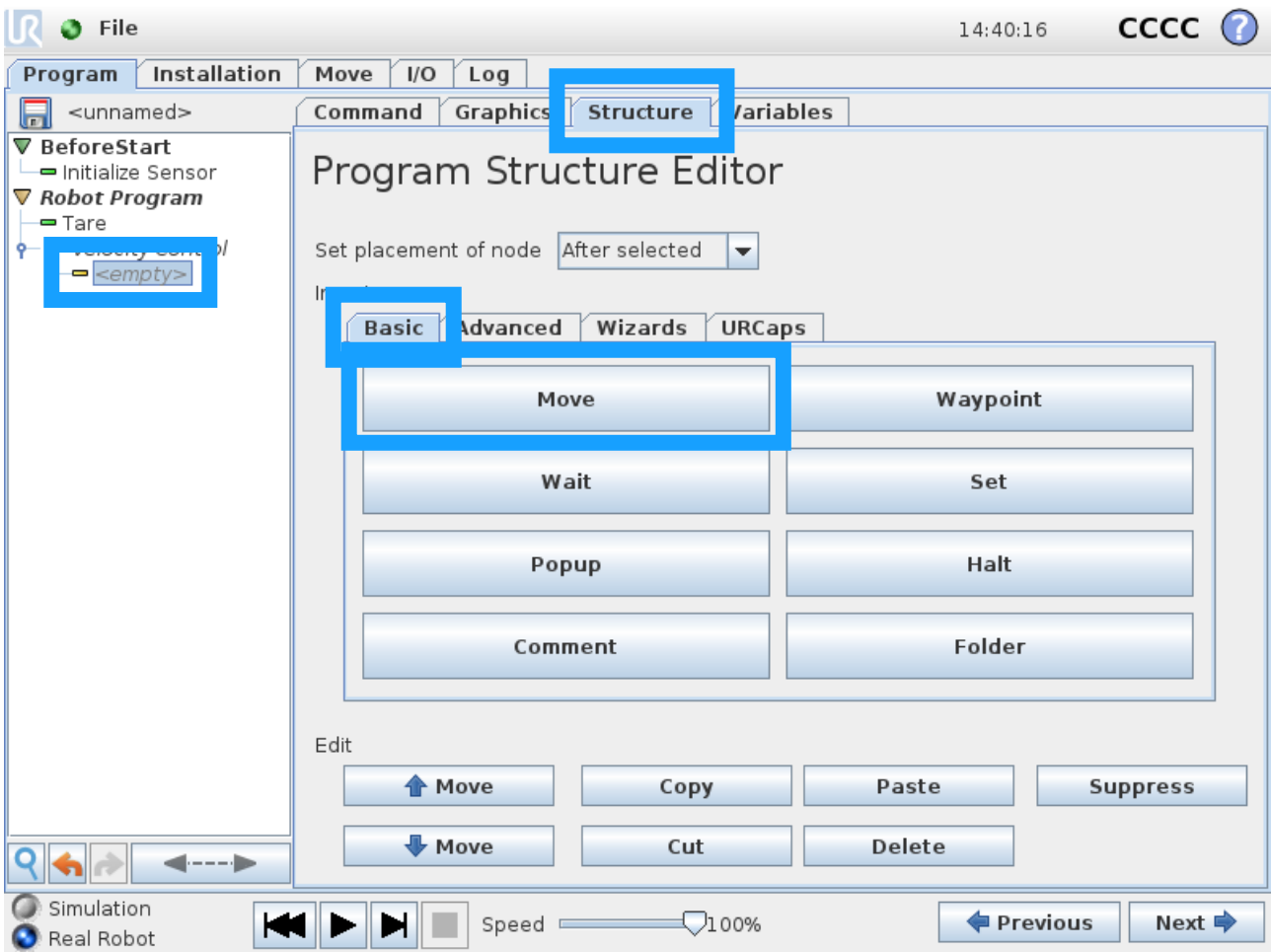


- Max is the force value where the robot's velocity will fall to 0%

The Velocity Control node is now ready to be run. The Velocity Control node only influences Move nodes.

#### Step 4: Move

- When the Velocity Control node has been properly setup, click the "<empty>" field inside the node
- Go to the Structure tab
- Go to the tab Basic in the Structure menu
- Insert the node "Move" inside the Velocity Control node
  - Velocity Control alters the velocity of movements that the robot performs inside the Velocity Control node
  - All Move nodes inside Velocity Control will be affected by this



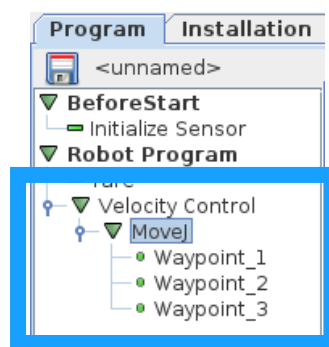
When the Move node has been inserted, the user will need to add Waypoints to the Move node.

- Add the desired waypoints. Refer to Universal Robots' support for help on programming using the Universal Robots PolyScope

The robot will now follow the path given in the Move node inside the Velocity Control node. If the total force measured exceeds the Min value, the robot will reduce its velocity.

If the total force measured exceeds the Max value the robot will stop until the force value no longer exceeds the Max value.

Between the Min and Max total force values the velocity will be scaled between 100%-0% of the reference speed assigned in the Move-node.



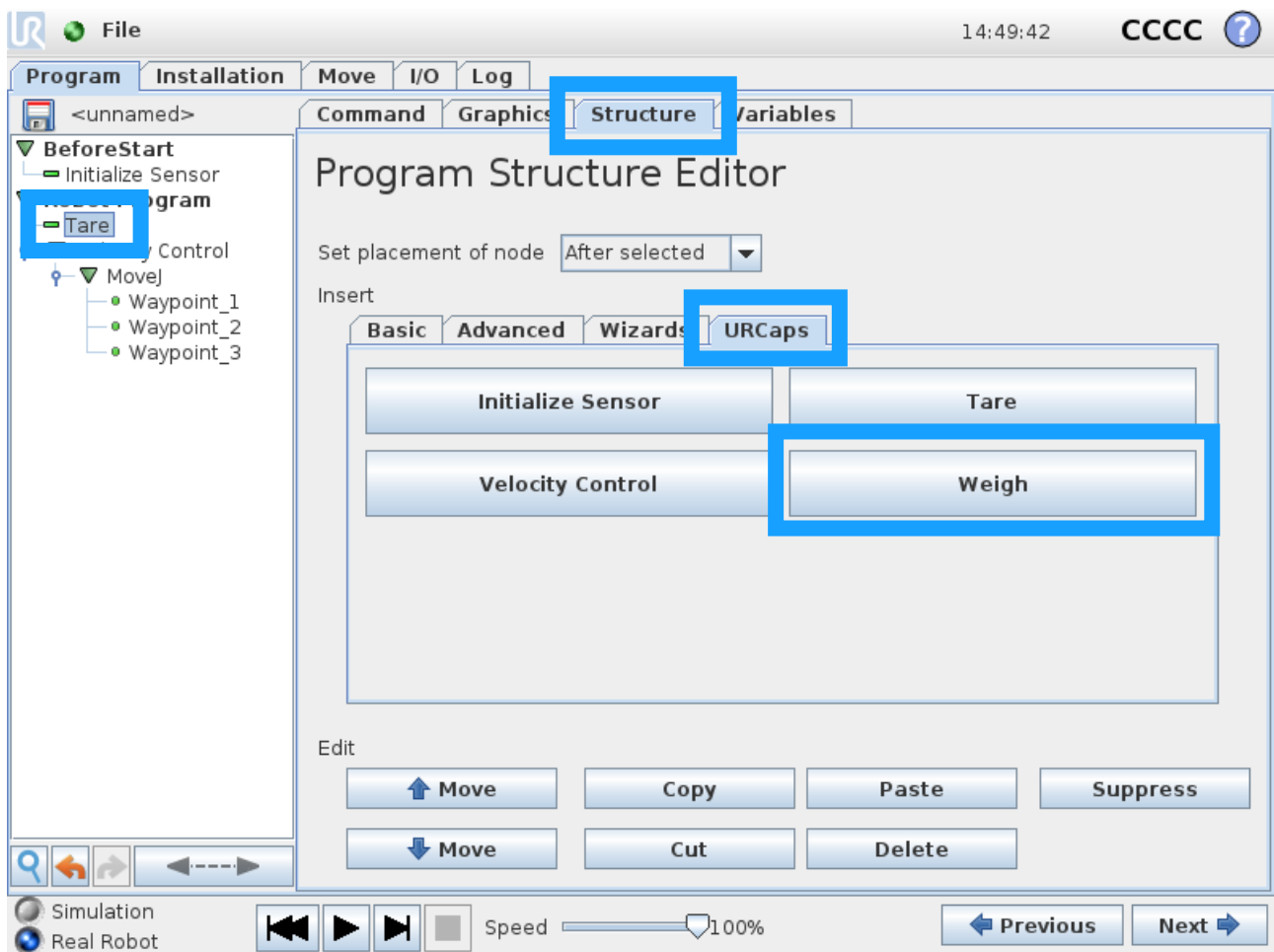
## Step 5: Weigh

The node Weigh will use the data from the SENSOR to estimate the weight of an object while the object is moved by the robot. To use this node the user will need to insert a Move node inside the Weigh node.

A Tare-node should always be called before the Weigh node is used. The Tare node should be called while the tool has the orientation that it will be weighing the object from.

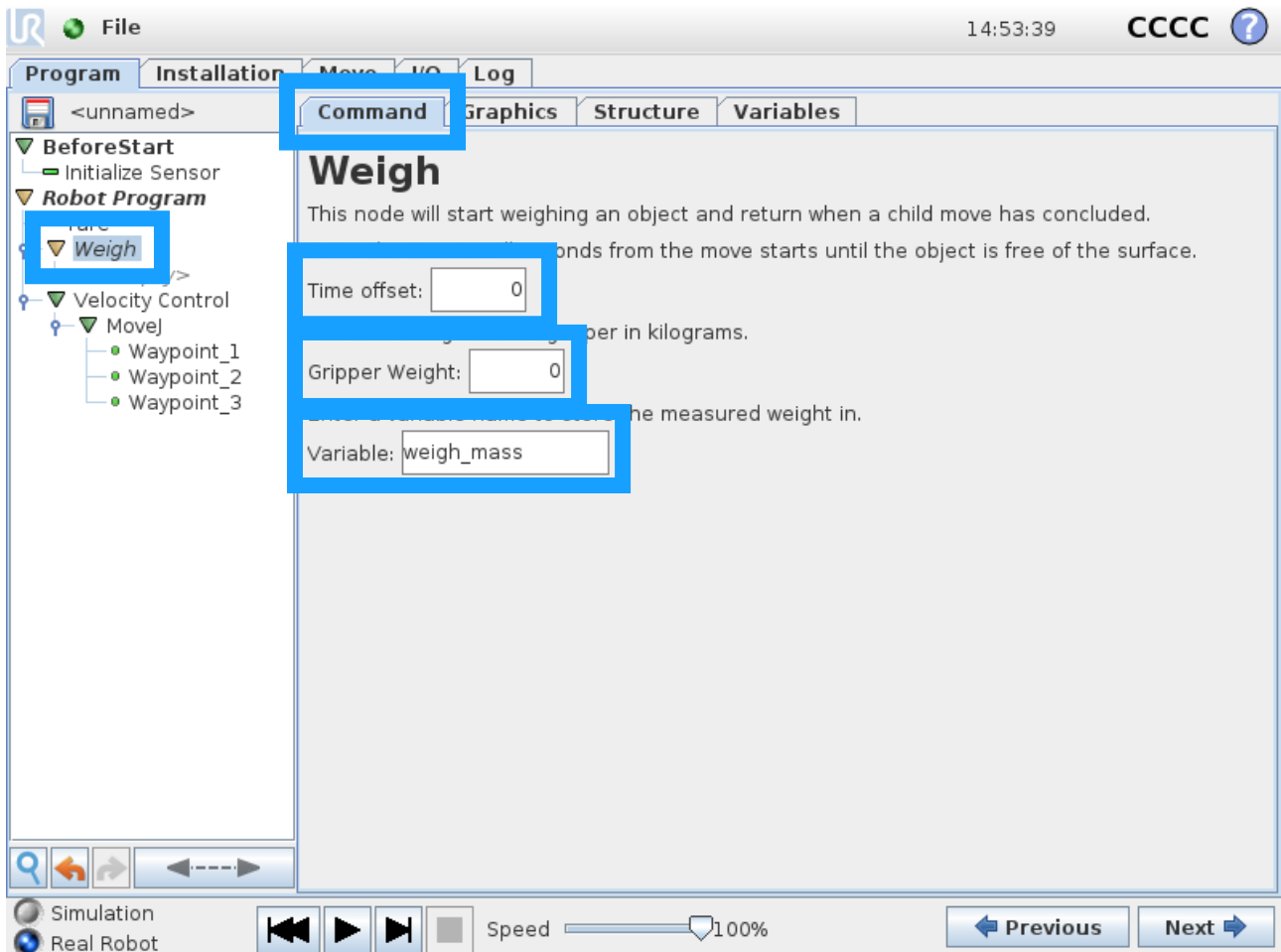
E.g. if the user is going to pick an object from a table, the robot should be straight above the object, pointing towards it with the gripper.

- Select the scope "Robot Program", or an object inside the scope, in the project tree on the left side of the robot's PolyScope
- Go to the tab Structure
- In the Structure menu, go to the tab URCaps
- Insert Weigh node



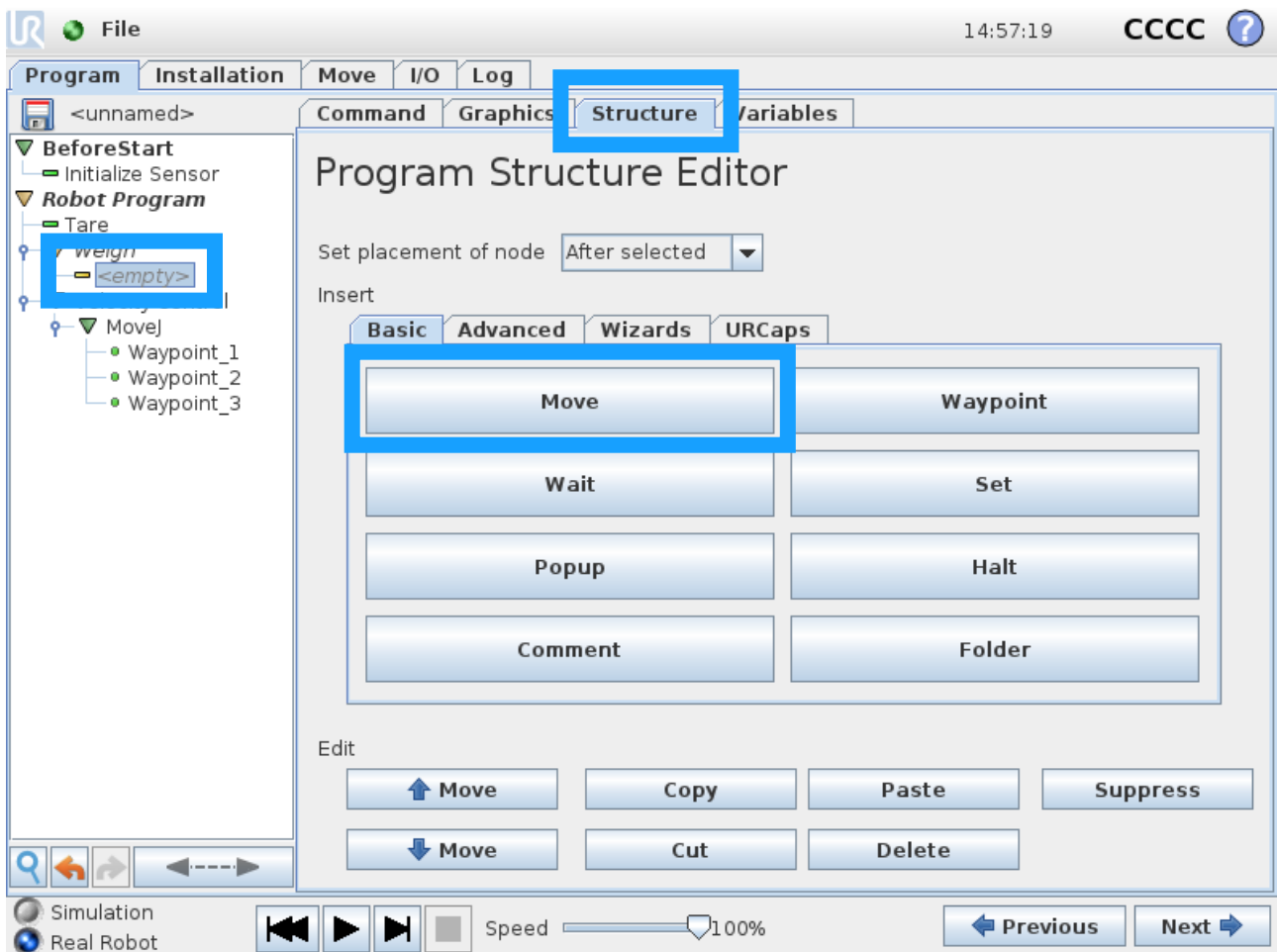
- Click the Weigh node that should now appear in the program tree
- Go to the Command tab
- In the “Time offset” assign the number of milliseconds that the movement takes to lift the object free of the surface it is being picked from
- In the “Gripper weight” assign the robot’s gripper’s weight
  - Only enter the weight of tools attached after/on the SENSOR!
- In the “Variable” field enter a name of the variable where the resulting weight will be stored after the Weigh node is finished
  - If the user does not change this the variable containing the weight will be named “weigh\_mass”

The Weigh node will now start measuring the weight from the point where the time in “Time offset” has expired, and until the final waypoint in the move command has been finished. The weight will be stored in a variable named “weigh\_mass” unless another name is assigned.



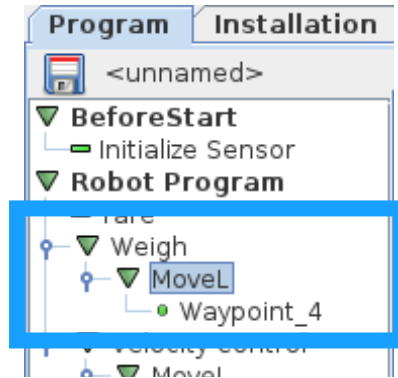
## Step 6: Weigh in motion

- When the Weigh node has been properly setup, click the "<empty>" field inside the node
- Go to the Structure tab
- Insert any node inside the Weigh node
  - Weigh will estimate the weight of the object carried by the robot using several force measurements taken over the time scope of the commands assigned inside the Weigh node
    - E.g. Use "Move" to move while estimating weight, or "Wait" to weigh an object more accurately for a specified amount of time
  - It is recommended to use MoveL in a straight Z-direction (vertical) for this node if any movements are performed while weighing the carried object



If a Move node is used, the user will need to add waypoints in the Move node.

- Add the desired waypoints. Refer to Universal Robots' support for help on programming using the Universal Robots PolyScope

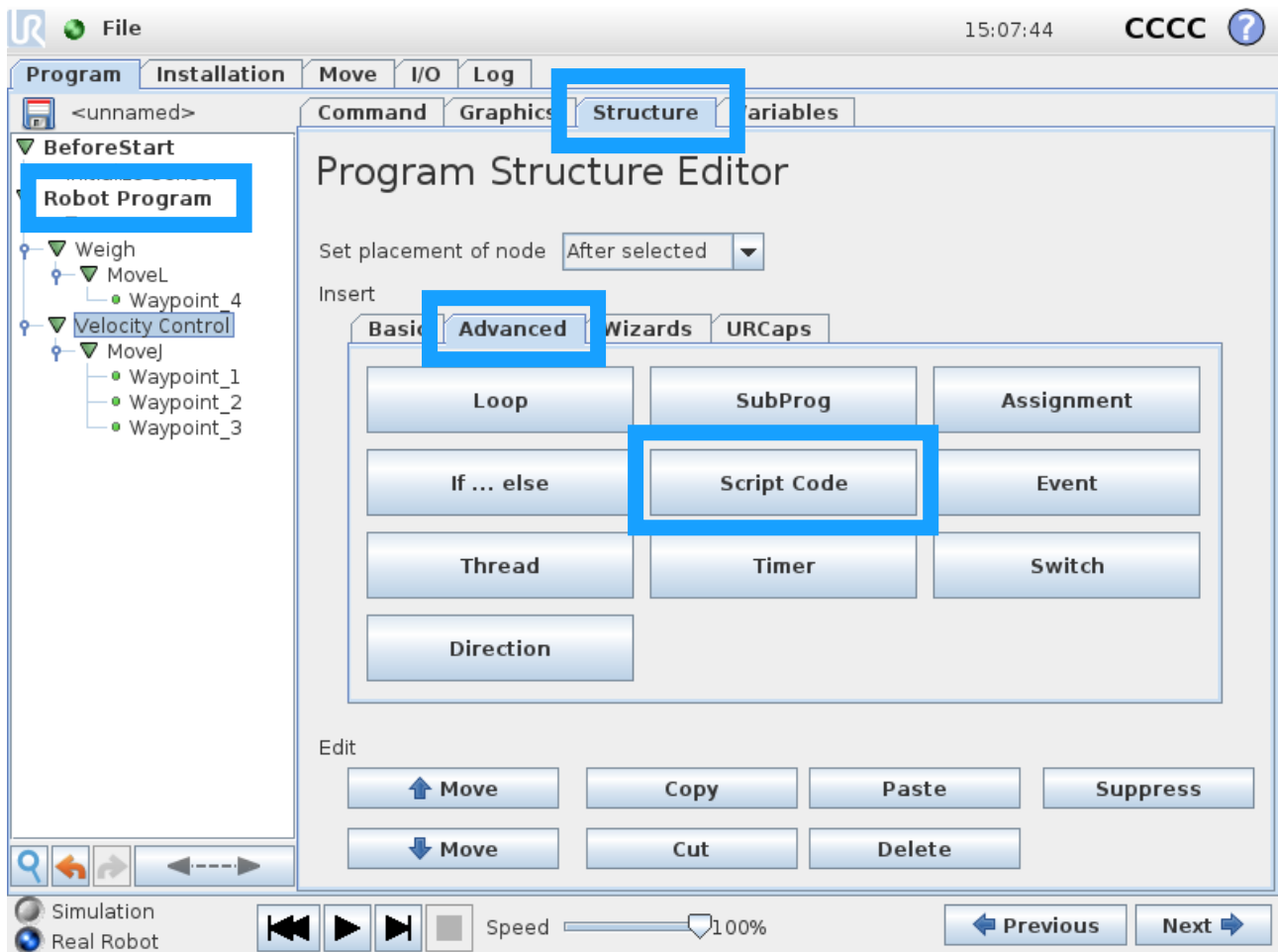


### 3.5. Using raw sensor data

Using the URCap to control the SENSOR and NRC-ETH, the robot will replace its own tool centre point force measurements with those of the SENSOR's. This means that the raw force and torque values can be acquired using Universal Robots' own script command "get\_tcp\_force()" – the values must be stored in a variable.

#### Step 1

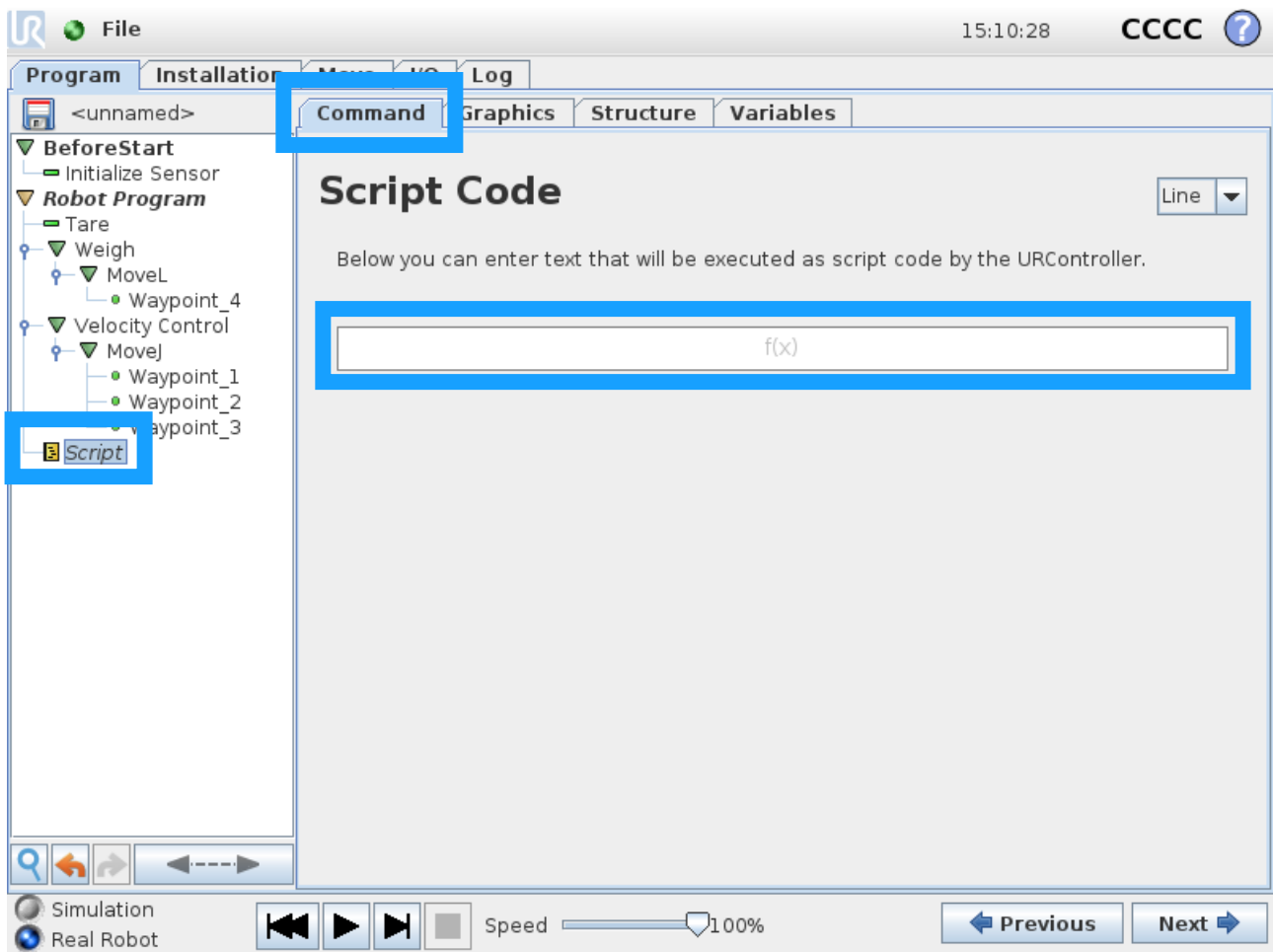
- Select the scope "Robot Program", or an object inside the scope, in the project tree on the left side of the robot's PolyScope
- Go to the tab Structure
- In the Structure menu, go to the tab Advanced
- Insert a script code by clicking the "Script Code" button in the structure menu





## Step 2

- Click the node "Script" that should now be available in the program tree
  - To be able to store the data, the user will need to create a variable to store the data in prior to the following steps (it is recommended to create variables in an "Init Variables" scope or as Installation Variable in the tab "Installation", menu point Variables)
  - Variable must be initialized with a value of the type "list of 6 floating point value"
    - Initialize as `myVar = p[0.0,0.0,0.0,0.0,0.0,0.0]`
    - `myVar[0]`:Force X, `myVar[1]`:Force Y, `myVar[2]`:Force Z, `myVar[3]`:Torque X, `myVar[4]`:Torque Y, `myVar[5]`:Torque Z
    - `myVar[0]` will return Force X, `myVar[1]` will return Force Y etc.
- Go to the Command tab
- Click the empty field to start programming a script

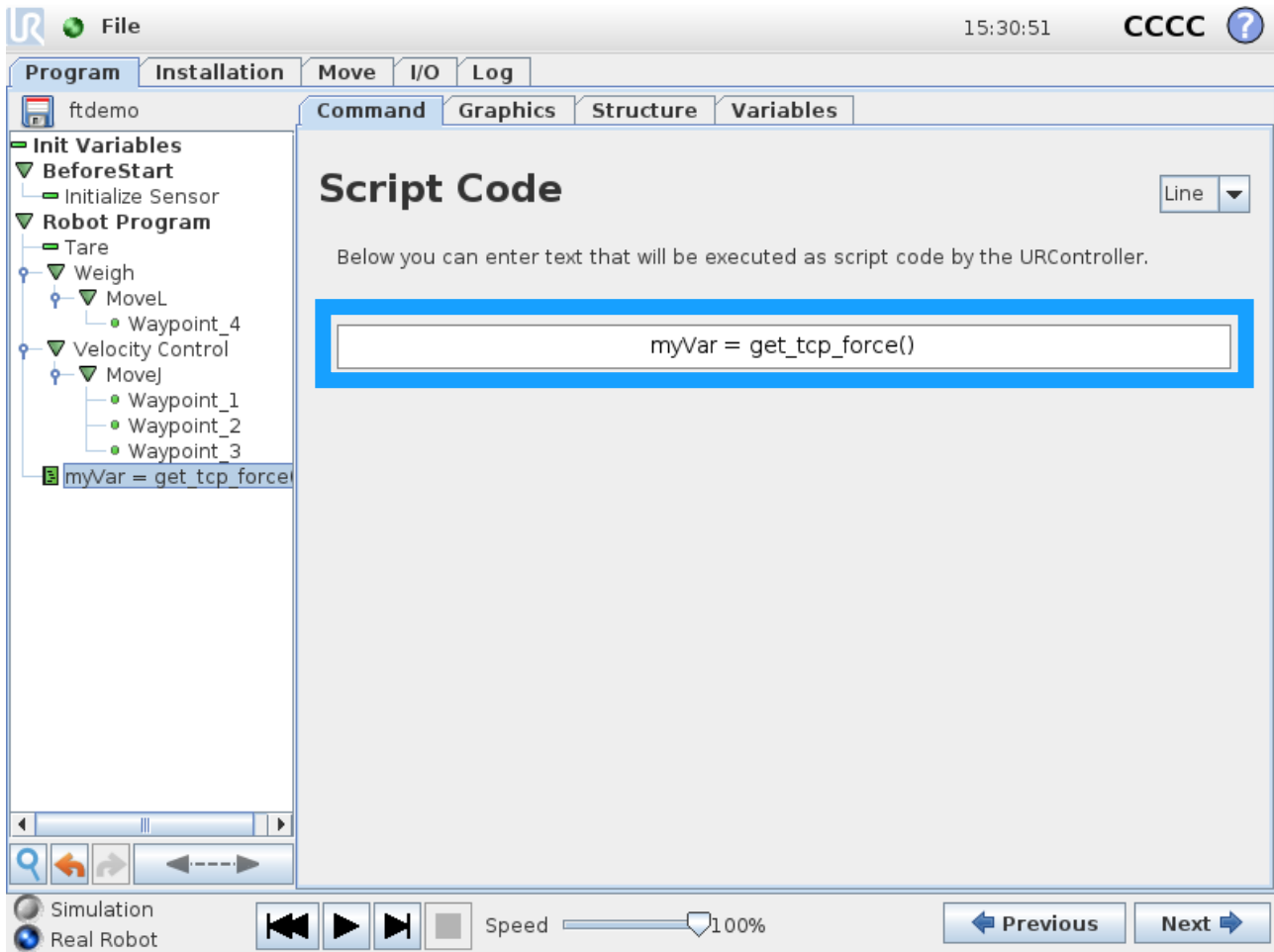


- Type in the following in the script:

- `myVar = get_tcp_force()`

Now the robot will store the SENSOR's data in the variable `myVar`, in the cycle when it passes the Script Code node.

**Obs.:** Node that the script code is case sensitive, and that the command "`get_tcp_force()`" must be written with non-capital letters. To use the variable in a different place than the script that stores the data, the name of the variable must be written exactly as it is written in the assignment.

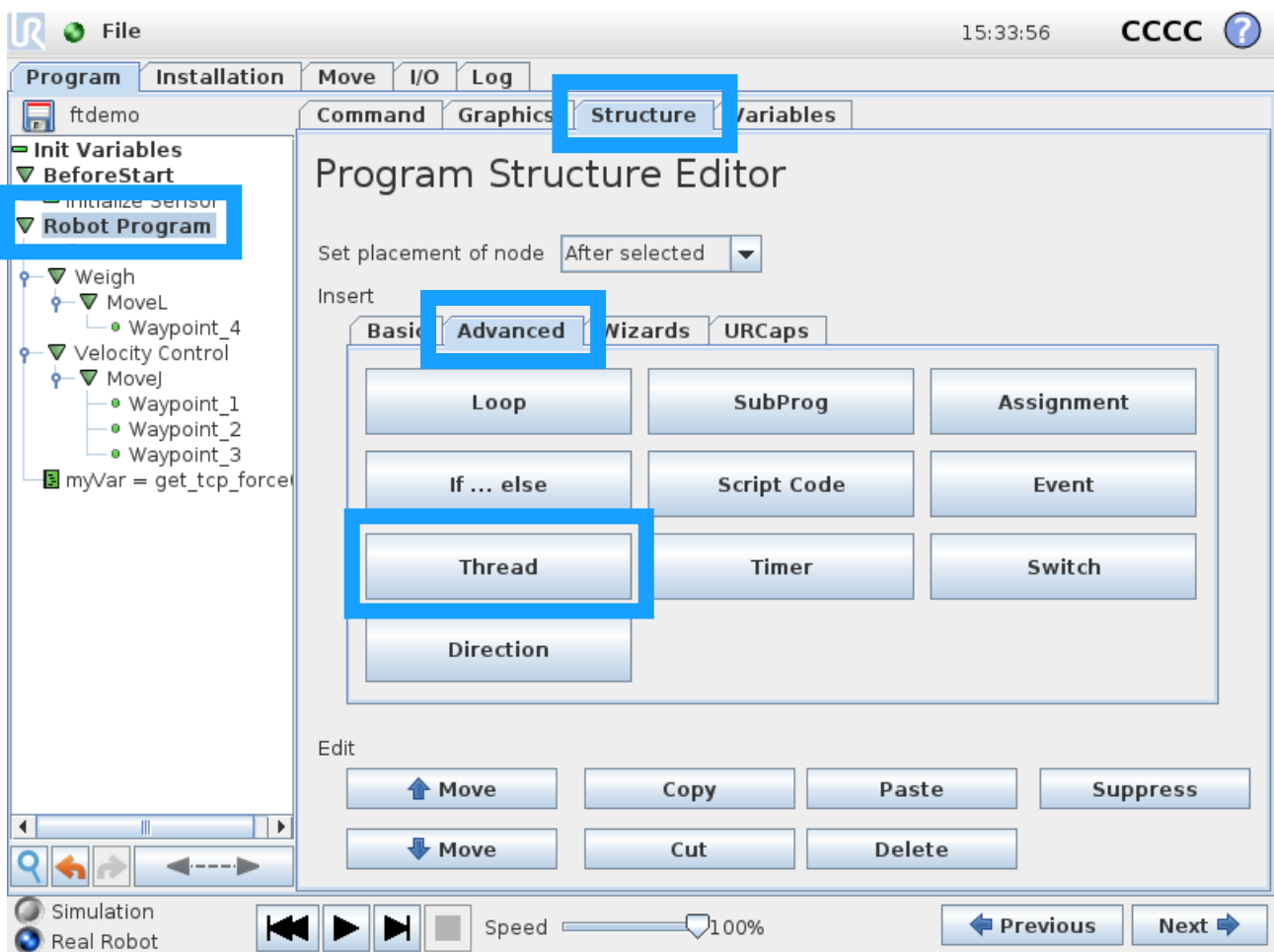


### Step 3

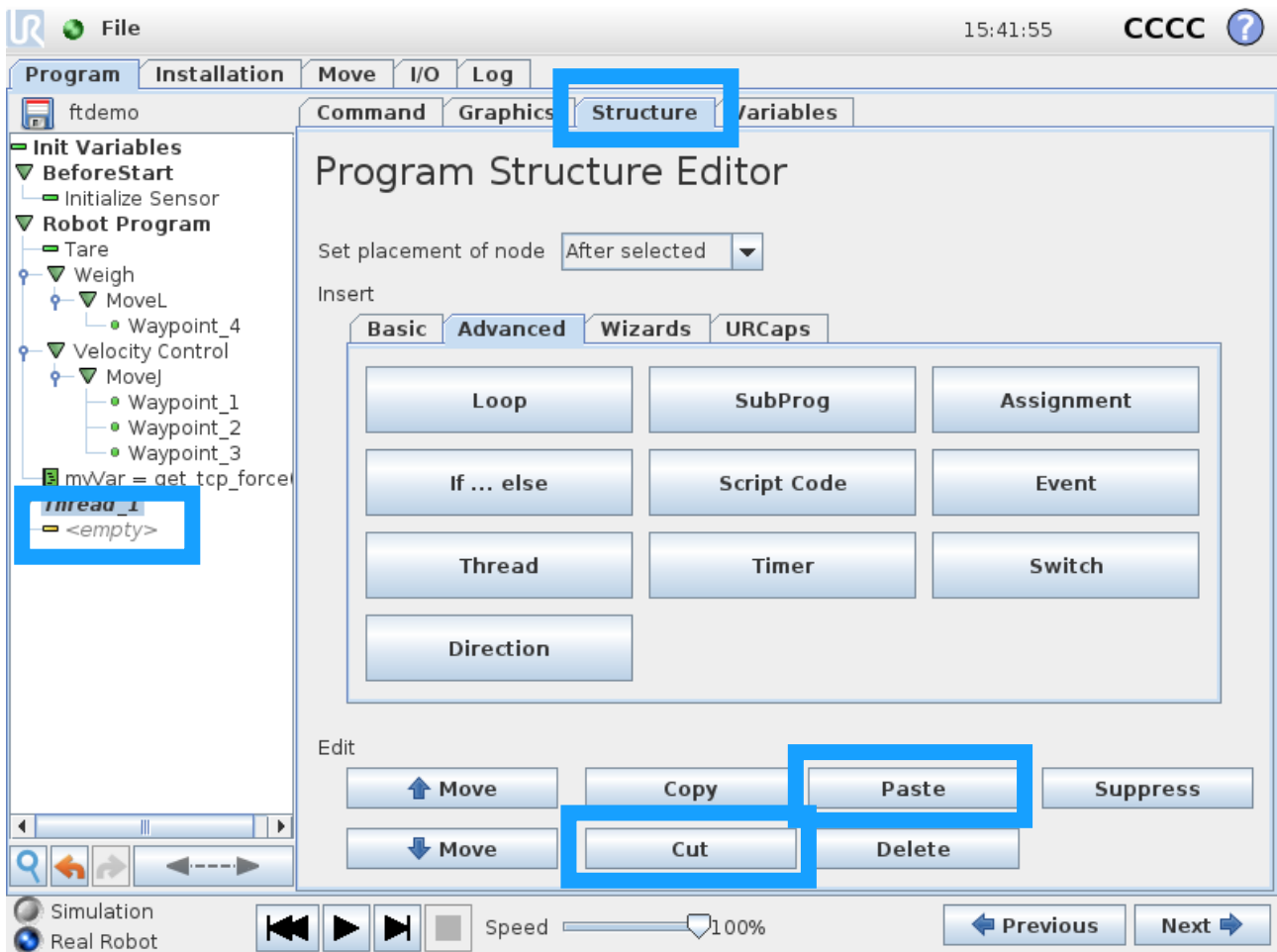
For acquiring force and torque data cyclically, call the function "get\_tcp\_force()" in a separate thread, followed by a script with the sync() command if necessary. A thread will run in parallel with the main robot program and will allow the user to make a program which updates the stored force and torque values for every program cycle (8 milliseconds interval).

Updating the force and torque values may, for example, be used to exit a while loop and interrupting a move-node at a given force value – this can be used for a variety of things such as tightening bolts to a given torque value, or pushing objects until a given force value is reached.

- Click the scope Robot Program
- Go to the Structure tab
- In the Structure menu, go to the Advanced tab
- Insert a new Thread scope by clicking the button "Thread"
  - This will only work if the scope Robot Program is selected



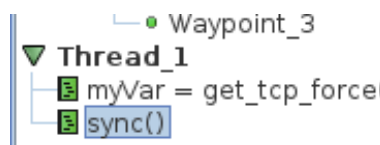
- Move the script that was made in the previous steps to the "<empty>" field in the new thread, or create a new similar script in the new thread
  - Select the script by clicking it in the program tree
  - Go to the Structure tab
  - Click "Cut"
  - Select the "<empty>" field in the new thread
  - Click "Paste"



## Step 4

When the script that acquires the force/torque data has been moved to the new thread, the user will need to add another script that synchronizes the thread with the robot's cycle time.

- Add a new script in the thread, below the script that reads the force/torque data
  - Script must call following function:
    - `sync()`
    - Assigning the TCP force to the variable `myVar` takes less than 8 milliseconds, which is why the "`sync()`" is needed to wait out the remaining cycle time
  - Type the text "`sync()`" into the script line as previously described (see step 33)
    - Note that the script code is case sensitive, and "`sync`" must be written with non-capital letters



When this is done, the variable "`myVar`" will acquire the sensor's force and torque data with an 8 milliseconds delay (once per controller cycle). Note that adding more threads may increase this delay to (number of threads) multiplied by 8 milliseconds for some robot versions.

## 4. Troubleshooting

### 4.1. RTDE-errors – connection to sensor failed

This error can be recognized if the abbreviation “RTDE” is displayed in the error message on the robot, when attempting to run a program containing any of the URCap nodes of the SENSOR.

This error presumably happens when the connection between the sensor and the robot is not closed correctly upon a crash or a similar event. It is fixed by rebooting the robot entirely and powering off the sensor entirely as well.

Upon starting the robot and the application again, the sensor and the robot should now be able to connect.

This error can further occur if the NRC-ETH has been damaged. If there is any suspicion that this is the case, do NOT open the NRC-ETH, as it will remove any warranty of the product. Contact Nordbo Robotics’ support to resolve this issue.

### 4.2. Hard reset of NRC-ETH

If network settings have been setup invalidly on the NRC-ETH using the device’s web interface, the module can be hard reset. On the NRC-ETH’s side with the LEDs and the DAC connector (DAC connector may only be there on devices purchased with DAC module add-on), there is a button next to the 4 LEDs.

Pressing the button will soft reset the device. No settings will be changed, but the firmware will reset.

To perform a hard reset, the user must press and hold the reset button for 6 seconds. The button must be hold down until all 4 LEDs have turned on and off again. Afterwards the hard reset has been performed and the firmware is reset to use default values.

After performing a hard reset the device can be found on the network address 192.168.0.100.

## 5. Declarations and Certificates

### CE/EU Declaration of Incorporation, original

According to the European Machinery Directive 2006/42/EC Annex II, part 3.

We, the manufacturer:

Nordbo Robotics A/S  
Agerhatten 27A, Entrance 4  
DK-5220 Odense, Denmark

Hereby declare that the following product:

**Type:** Industrial 6-axis Force & Torque sensor  
**Model:** NRS-6050-D80 and NRS-6200-D80  
**Serial number form:** YMM001 (Ex. 1908001)

Meets the requirements of the Machinery Directive 2006/42/EC as partly completed machinery.

The product must not be put to use before the complete machine in which the product is installed is in full compliance with all requirements of the European Machinery Directive 2006/42/EC.

A comprehensive risk assessment must be performed for each application to ensure that all essential requirements are being met.

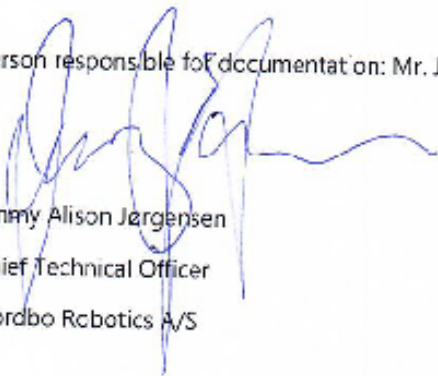
Technical documentation specified by Annex VII part B is available to national authorities upon request.

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)

Person responsible for documentation: Mr. Jimmy Alison Jørgensen



Jimmy Alison Jørgensen  
Chief Technical Officer  
Nordbo Robotics A/S

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