

# WireTank TCP Calibration Station

**User Manual: Version 3.1**

**URCap: Version 4.7**

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## Overview

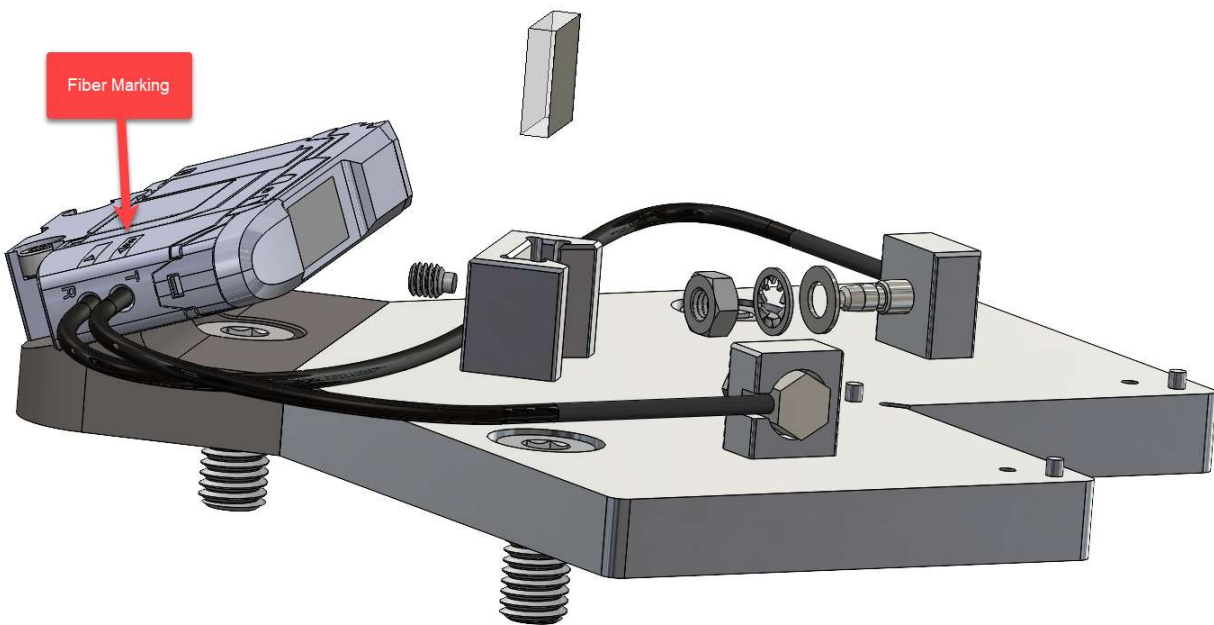
The challenge with robotic dispensing applications that require a high level of precision, is that the “Tool Center Point (TCP)” of the robot will change every time the syringe or tip is changed. This can result in offsets of over 1mm in each of the x, y, and z TCP translation directions.

The TCP calibration station relies on the principle that a well created TCP will be used to define all the station planes to be used in the application including the calibration plane of the TCP calibration station.

After a tip change, the TCP could be manually recalibrated by moving the tip visually to the origin of the calibration plane and changing the TCP position offsets so that the position of the robot relative to the plane is all zeros.

This is what the TCP calibration routine automates by first measuring the offsets of the original TCP to the sensor limits with the original tip and then creating a new TCP after a tip change so that the offsets of the new TCP cancel out any translation that has occurred as the result of the different tip.

## Mechanical Installation



*Figure 1 – Mechanical Assembly*

**Note:** You may cut the fibers to the desired length using the fiber cutter provided to ensure a flat cut. Please note the fiber marking at the fiber base should match the marking on the fiber!

- 1) Lock down the TCP calibration station using the two provided M8 screws.
- 2) Lock down the fiber optic sensor using the provided M8 screw.
- 3) Install mirror into mirror support feature by first loosening the set screw, inserting mirror, and then slightly tighten the set screw making sure not to overtighten.
- 4) Open the screen protector on the fiber optic sensor and press the grey lever down to allow insertion of the fiber unit thrubeams.
- 5) Insert fiber unit thrubeam into mounting feature using the washer, lock washer and nut. One of the units is marked with a sequence of dots along the unit. This needs to be connected to the hole with the dots marking on top of the fiber optic sensor.
- 6) Once both thrubeams are inserted, press down on the grey lever to lock and close screen protector.
- 7) Install FS-N41C Fiber Optic Sensor onto mounting bracket

## Electrical Installation

The flying leads of the connector coming from the sensor will have the colors listed below:

1. Brown - 24V
2. Blue - Ground
3. Black - Signal 1 - Connect at desired digital input
4. White - Signal 2 - Not Used

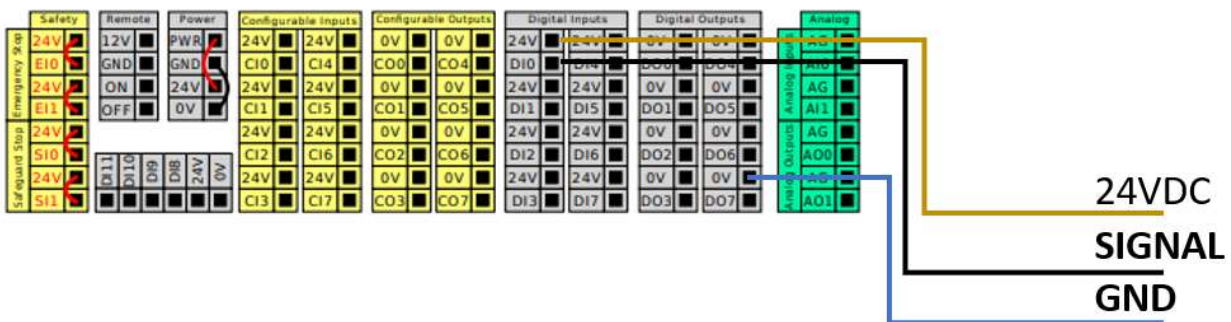


Figure 2 – Sample Electrical Connections

These can be connected at the digital input of the robot, using the ground and 24V from the robot's IO.

Note: In order to identify the digital input used for the sensor, it is possible to rename the IO as shown in the figure below.

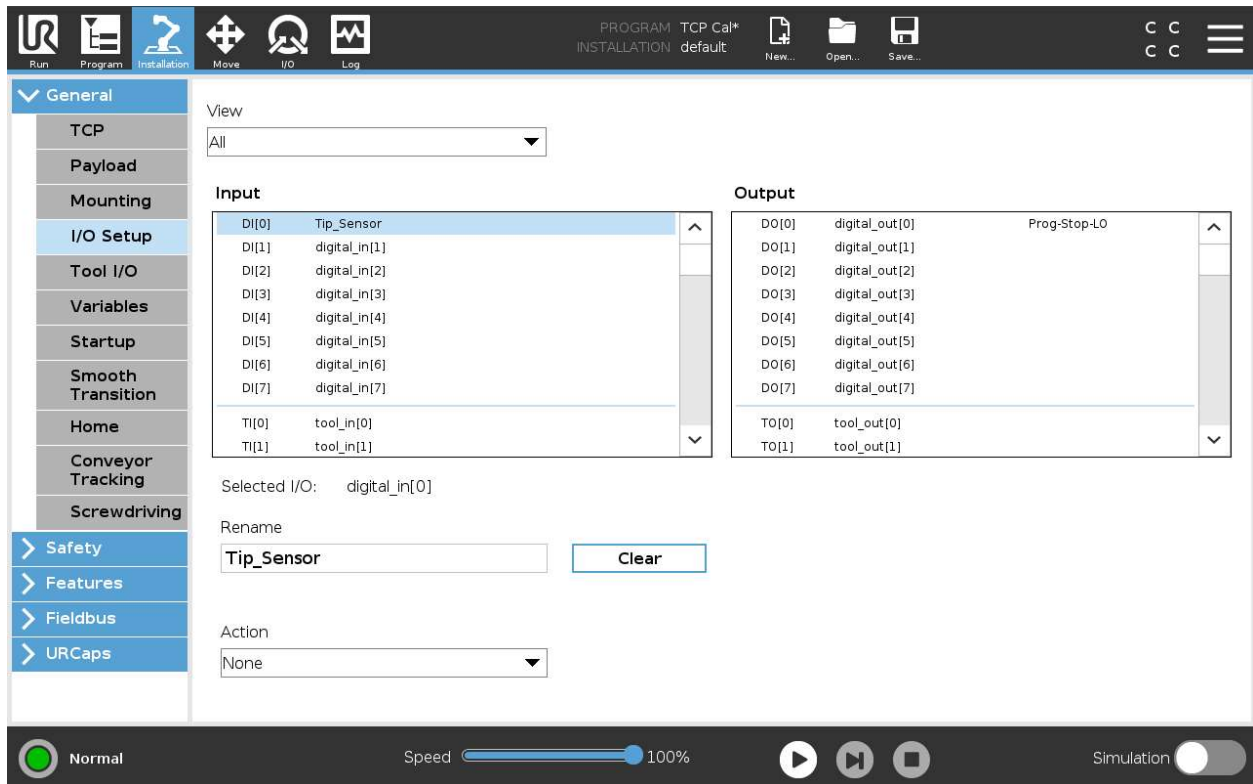


Figure 3 – IO Setup screen

## Polyscope Installation Setup – TCP and Calibration Plane Definition

- 1) Create a TCP and define its position (X,Y,Z) offsets using the position “Measure” wizard and the 4 point method using Polyscope’s TCP definition page as shown in Figure 4. You may refer to the Polyscope user manual for further details on how to teach a TCP.
  - a. You do not yet need to define an orientation
- 2) Set the TCP created in the previous step as the active TCP and define the calibration plane as per Figure 6 below and save the plane as CalPlane. The origin, X+ and Y+ should match the callouts on Figure 6.
  - a. This can be done using Polyscope’s plane definition wizard as show in Figure 5.
  - b. Adding a plane is done by clicking on “Plane” under the Feature sub-menu within the installation tab. An origin point, an X+ point and a Y+ direction is then chosen.
  - c. **NOTE:** The plane should be defined using the extruded cylinders and not the holes in the TCP calibration station.
- 3) Move to the origin of the plane, using the desired orientation and use the TCP “Measure” wizard to set the orientation based on the CalPlane
- 4) After following the steps above, it is now possible to select the feature and press “Move Here”. The TCP of the robot should now be aligned with the origin of the calibration plane.

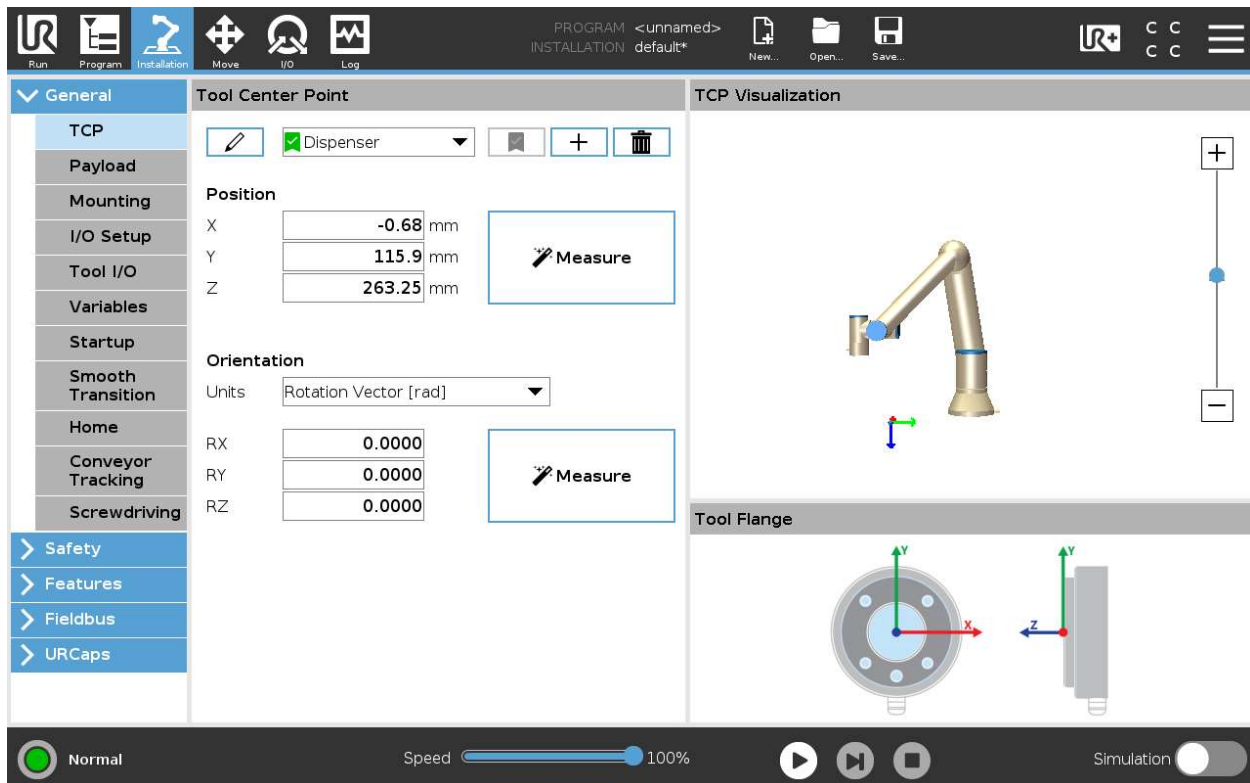


Figure 4 – TCP Definition

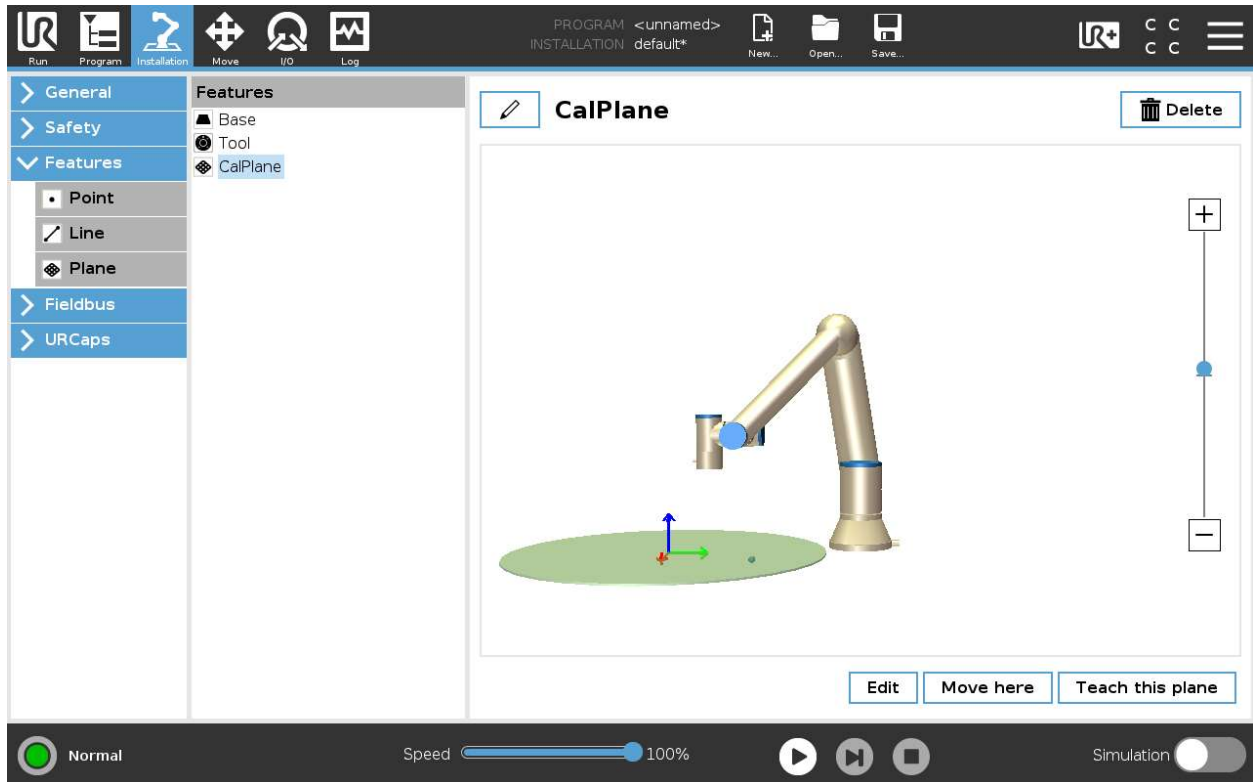


Figure 5 – Plane Definition

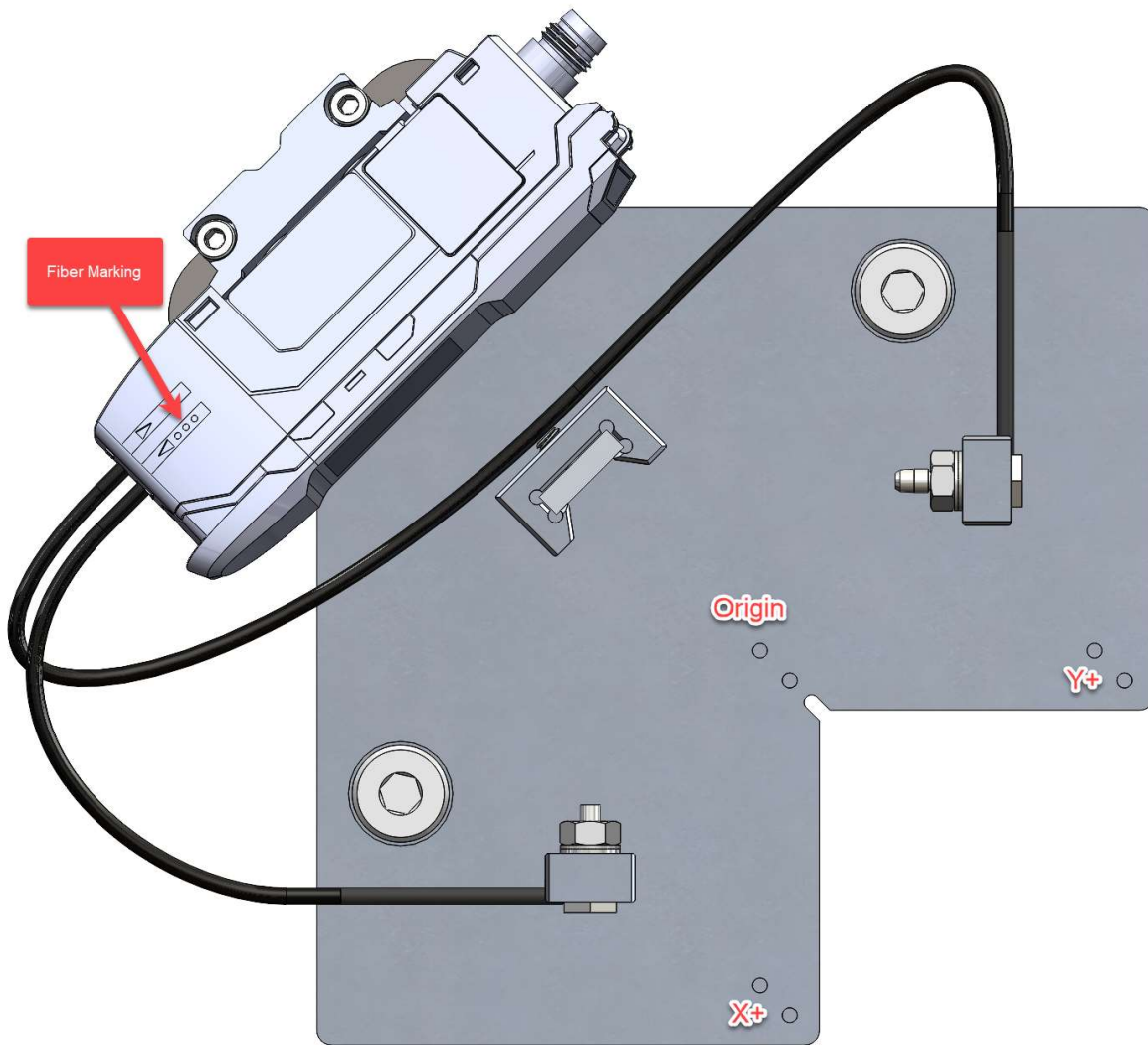


Figure 6 – CalPlane definition

## URCap Setup

- 1) Select the calibration plane by choosing it from the drop down
- 2) Select the TCP by choosing it from the drop down
- 3) Select the Sensor IO by choosing it from the drop down
- 4) Position the robot so that it's safe to approach the calibration plane and press "Measure Offsets". This will automatically read the x, y, and z offsets of the TCP to the sensor IO.
- 5) Define the rest of the needed planes and save the installation

The "Sensor Height" setting defines the height at which the robot's TCP crosses the sensor beam. The default setting of 3.5 mm should work for most application, however, in the case of tapered tips, it may be desired to increase this number so that the offsets are measured as close to the tip of the TCP as



possible. If the number is too large, there is a risk that the TCP will not trigger the sensor which will result in a calibration error display message.

The “Approach Height” will set the height the tip will initially start to search for the surface and it will also determine how far the search will go below the defined plane before exiting with an error. This should be set to the maximum expected difference between the tips in either direction.

At this point you may place a different tip, and perform the “Calibrate TCP” routine.

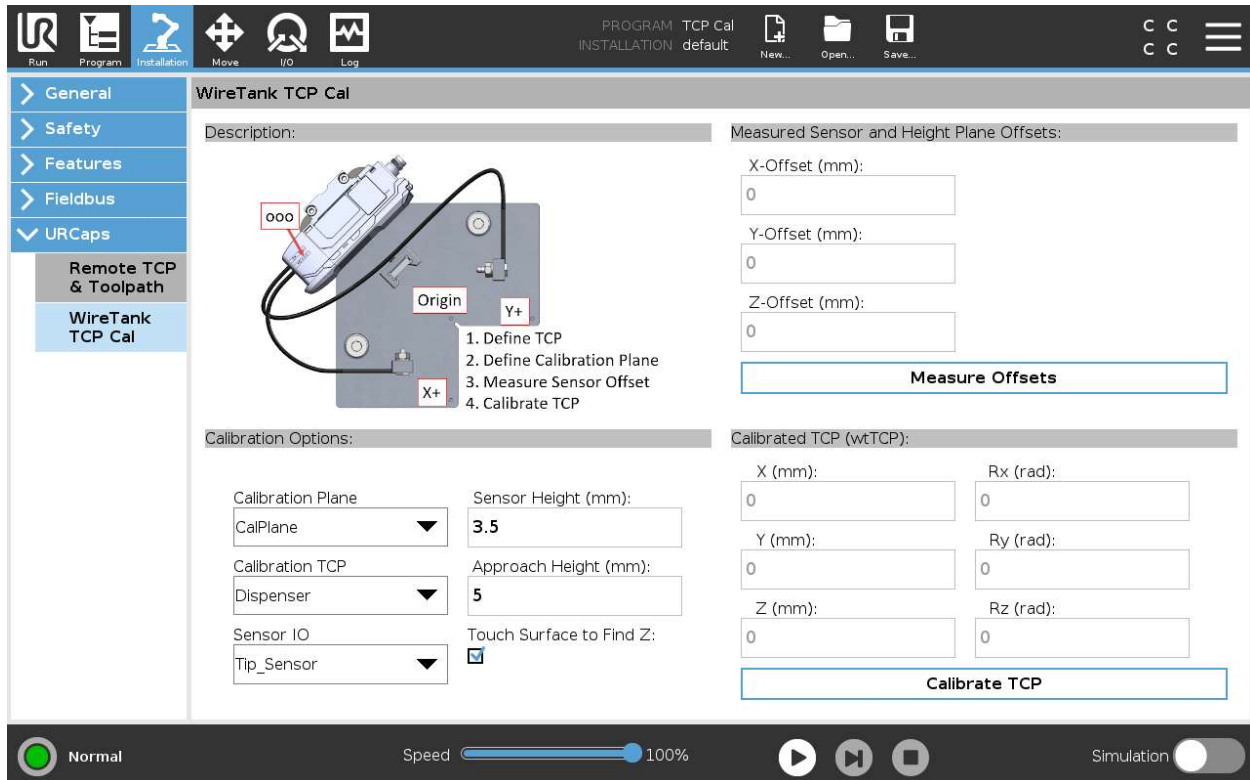
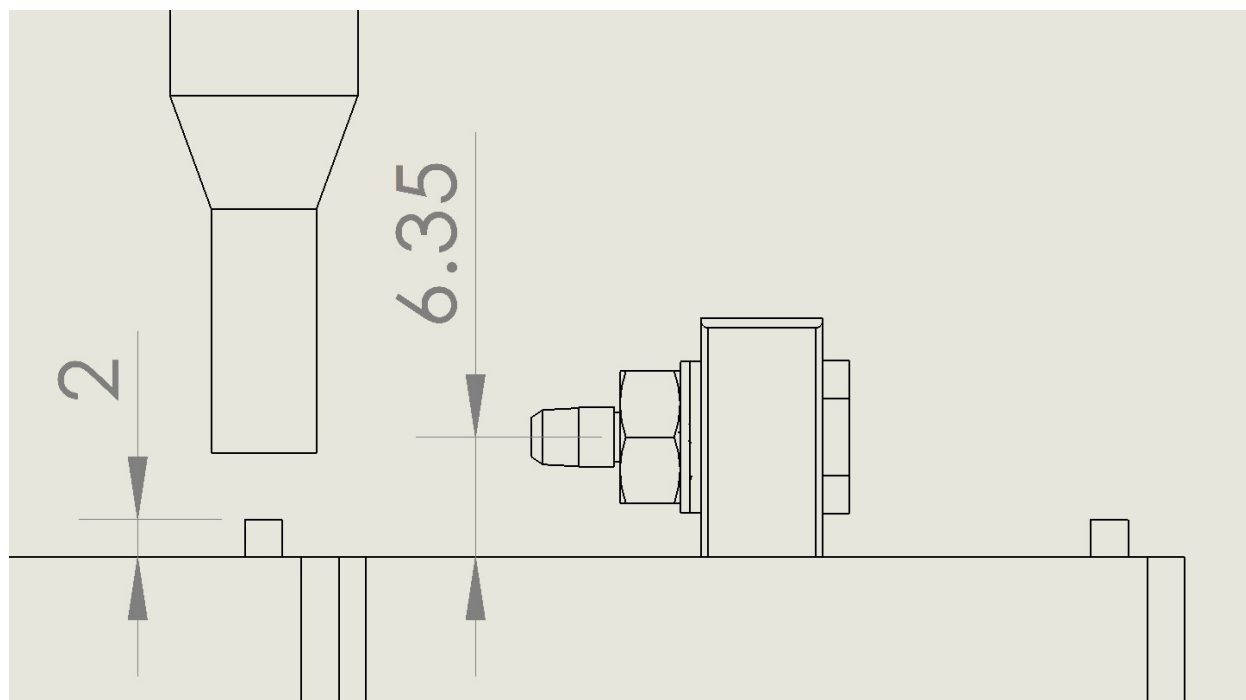


Figure 7 – WireTank TCP Calibration URCap – Installation Node



*Figure 8 – Mechanical Drawing Dimensions*

Once the “Calibrate TCP” routine has completed, a new TCP will be displayed in the TCP definition page as shown in the figure below. This TCP cannot be edited manually.

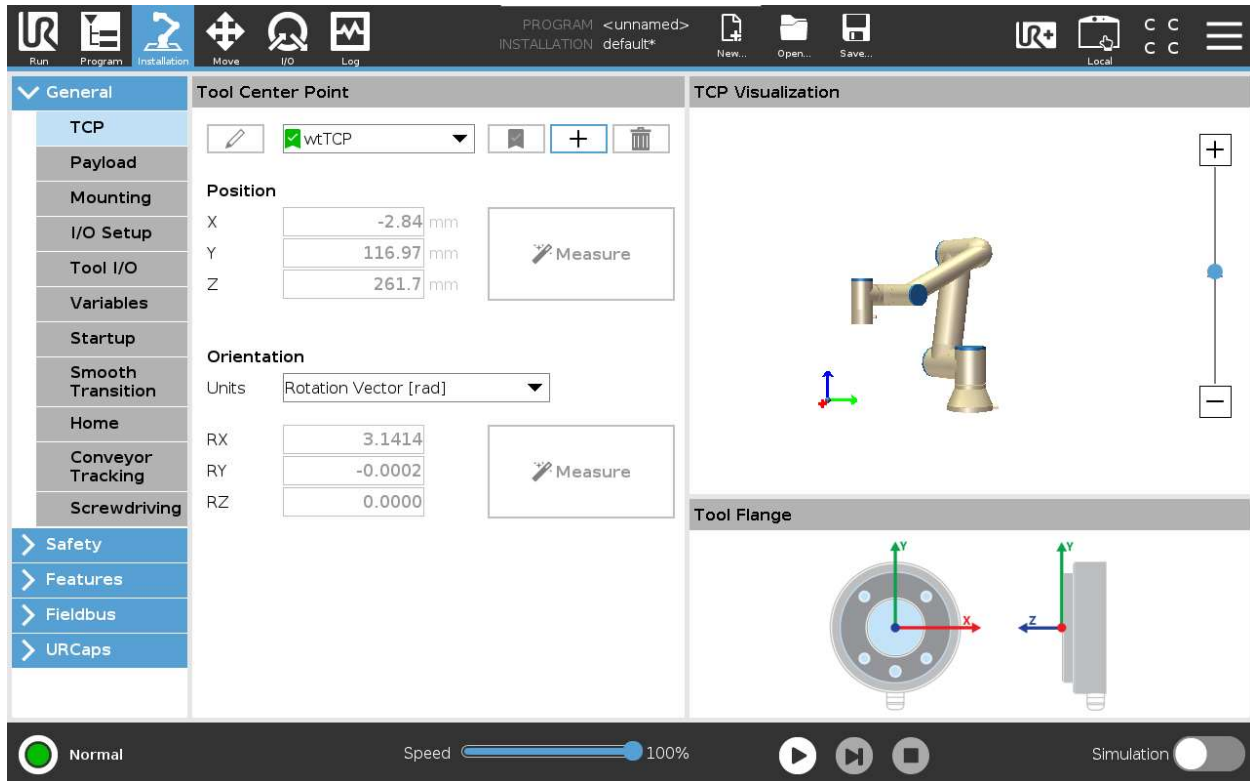


Figure 9 – URCap TCP

**NOTE :**

After running the “Measure Offsets” or the “Calibrate TCP” routines, the TCP will be set to the TCP selected in the “Calibration Options” dropdown in the background. Therefore, if you want to use the TCP selected in Polyscope by choosing a default TCP, you need to select a different TCP and then reselect it.

## Polyscope Program Nodes

The URCap includes the following node:

- 1) WireTank Calibrate TCP
  - a. This program node will perform the automatic TCP calibration
  - b. It can define an error handling routine
  - c. It will set the active TCP to the calibrated TCP
  - d. Allow the user to store the TCP in a user defined variable

The image below shows a sample program, where the calibration of the TCP is done automatically. The program will move the robot to an approach point 20mm above the calibration plane, perform the TCP calibration routine, and then set that as the active TCP of the robot.

You may also select to include an error handling routine as shown that displays an error popup and halts the program.

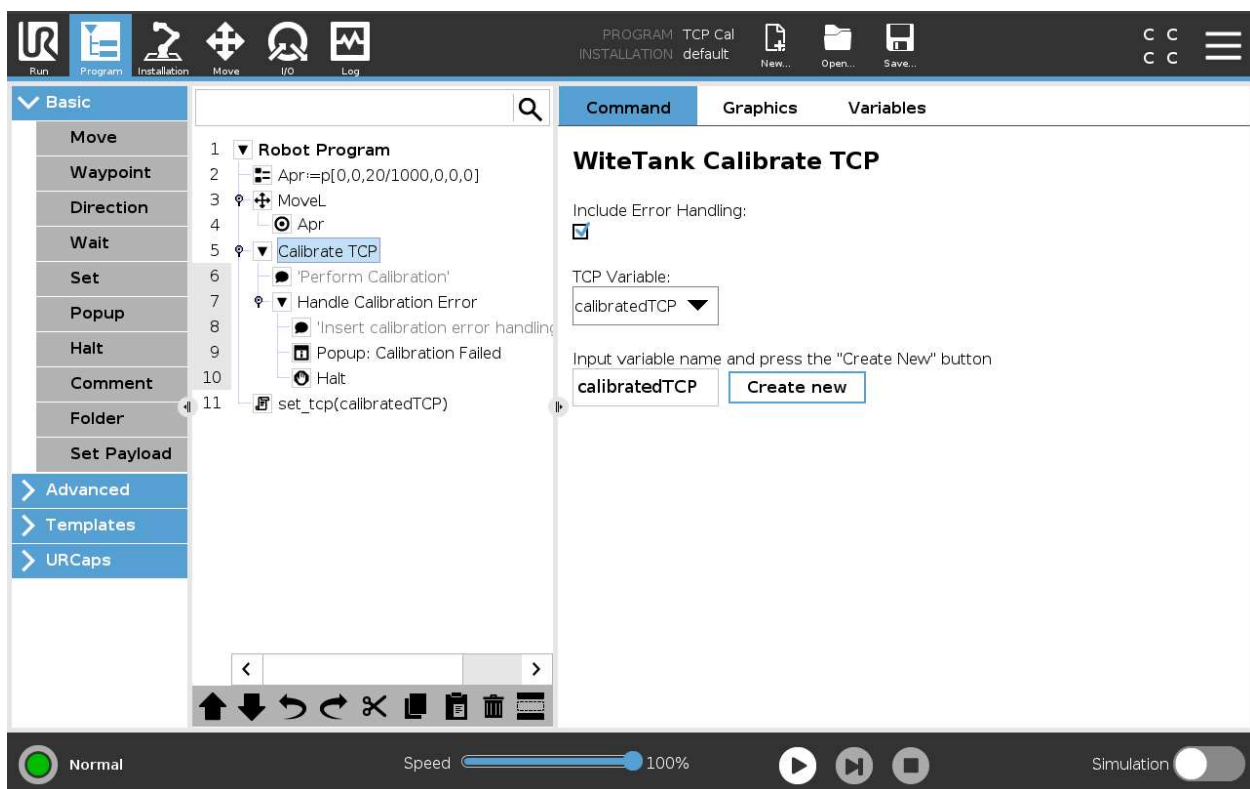


Figure 10 – Sample program

### NOTE:

**Running the calibration within a program will not update the installation node TCP or the TCP provided by the URCap, therefore calibrations performed within a program only affect the variable TCP within the program.**