VERSA BUILT ROBOTICS

Robot2CNC - Basic Edition
Universal Robots - Okuma Mill
Installation and Operation

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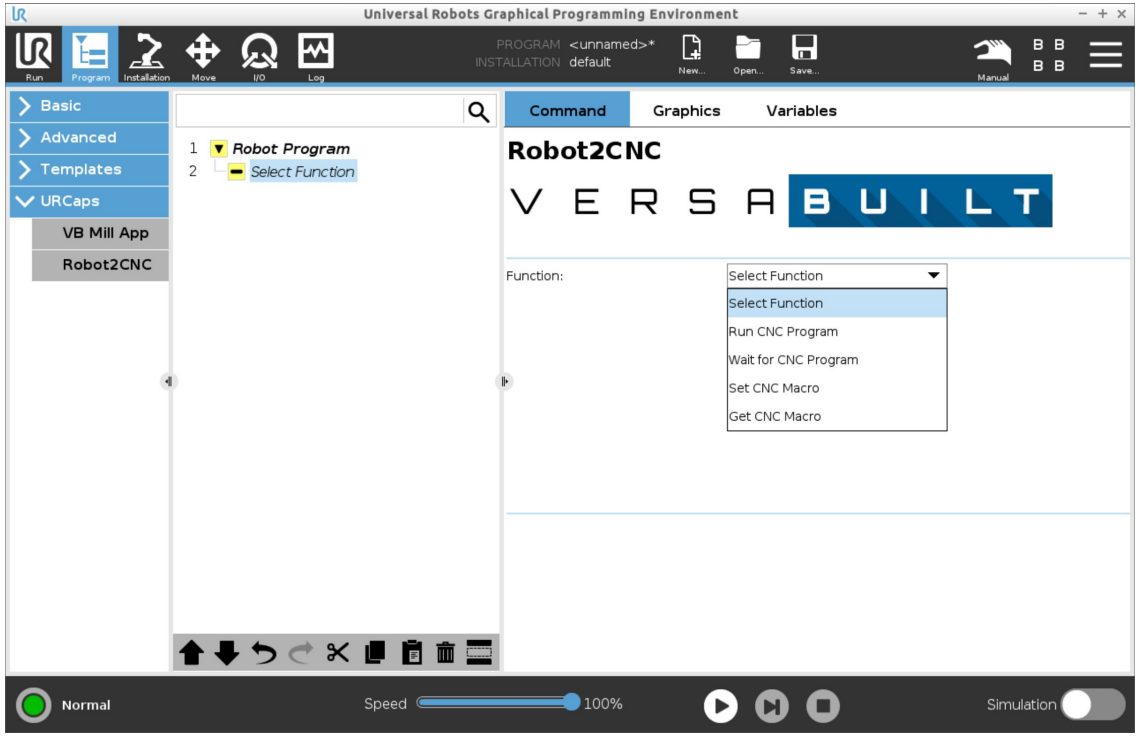
Safety Warnings

DANGER: The Robot2CNC is an industrial control product designed to be operated by trained personnel only. The Robot2CNC is capable of starting the CNC, actuating clamping devices and making changes to the CNC's operating parameters. Before deploying the Robot2CNC, a safety risk assessment must be completed in accordance to local, state and/or federal requirements. When using the Robot2CNC all CNC safety interlocks must be maintained. Additional safety measures may be required to ensure the Robot2CNC device does not create a safety hazard when deployed.

The Robot2CNC should only be used by trained operators.

How it Works

Robot2CNC communicates with an Okuma CNC Mill using by communicating over the CNC's Ethernet port using a VersaBuilt ThinkAPI application. The VersaBuilt ThinkAPI allows the Robot2CNC to read and write macro variables on the CNC. Values in the macro variables are used to communicate information and commands between the Robot and the CNC machine. When used with the provided VersaBuilt CNC dispatcher program, the Robot2CNC allows the robot to select and run any program stored on the CNC and be notified when the program completes.

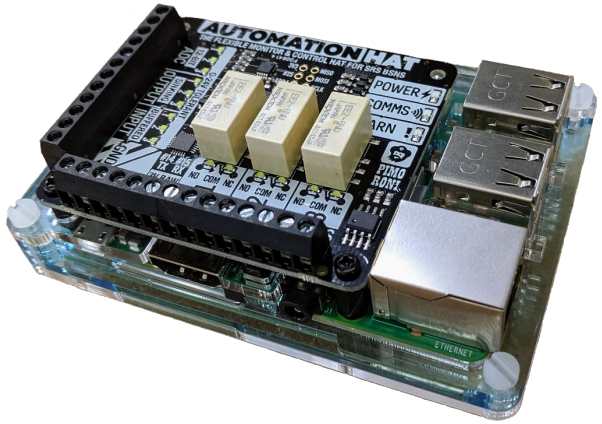


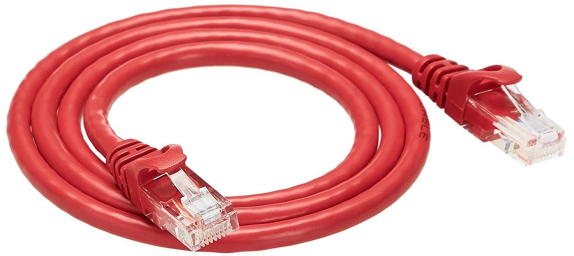
In the Robot2CNC Basic edition, the following commands are available:

1. Run CNC Program (CNC Program Number)
2. Wait for CNC Program
3. Set CNC Macro Variable
4. Get CNC Macro Variable

In the Box

- Robot2CNC Computer
- VersaBuilt USB drive
- 2 x Long Ethernet cables
- 1 x Short Ethernet cable
- 1 x 5-port Ethernet switch
- Cycle Start Wiring





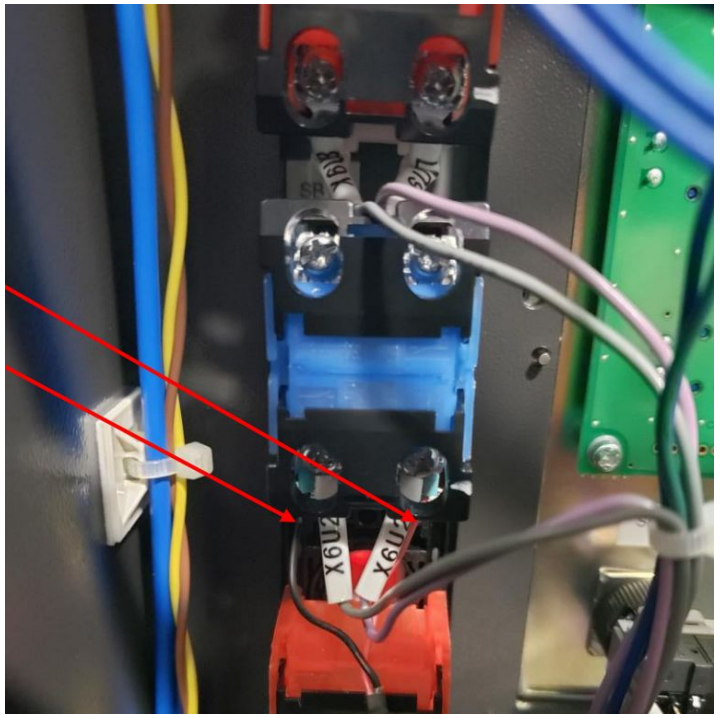
Installation Steps

1. Install Cycle Start Wires to CNC
2. Mount Robot2CNC Computer and the 5-port Hub in the CNC Cabinet
3. Connect Cycle Start Wires to Robot2CNC
4. Connect Ethernet Cable to CNC
5. Connect Ethernet Cable to Robot
6. Configure CNC Settings
7. Install VersaBuilt software on CNC
8. Configure UR Robot Settings
9. Install UR Robot Software
10. Install Script File and Validate Robot2CNC

Step 1: Install Cycle Start Wires to CNC

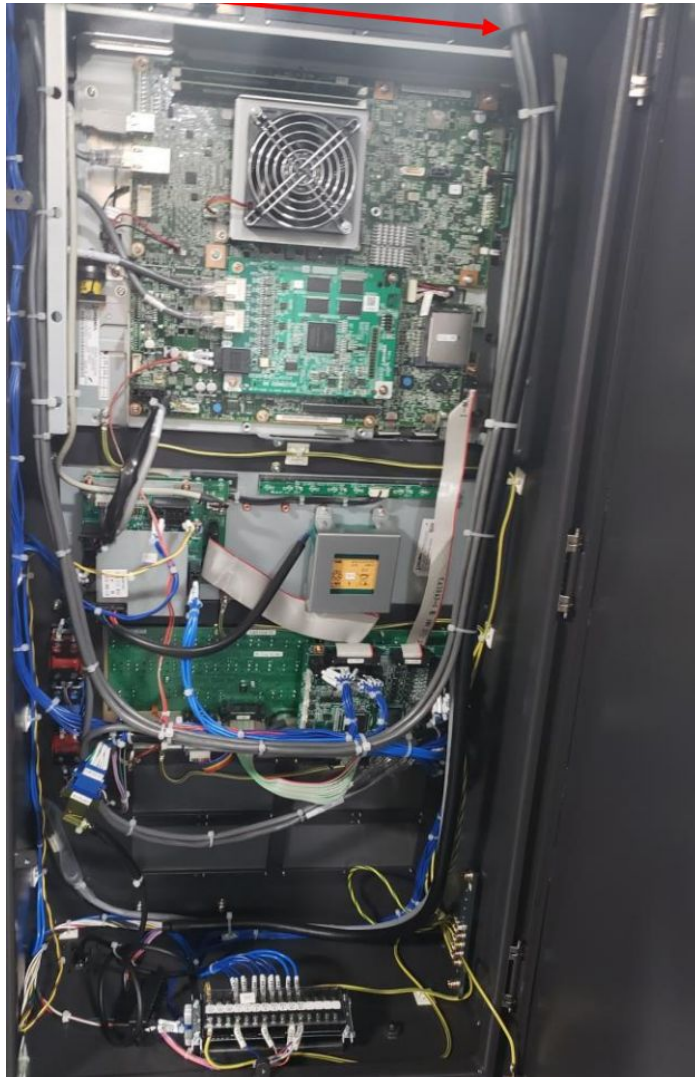
1. Make sure CNC is powered off at main breaker
2. Rotate Okuma Control Panel to show back of panel
3. Remove the back cover panel by unscrewing the 4 fasteners

Step 1: Install Cycle Start Wires to CNC



1. Locate the back of cycle start button*
2. Connect the Cycle Start Wires wire kit to the terminals on the cycle start button. Polarity does not matter. Either wire can go to either terminal.
3. Route the wire kit cable through the cable pass through hole on the Haas Control Panel
4. Route the cable to the Robot2CNC
5. Put back sheet metal cover panel and fasten the 4 screws with a Phillips screwdriver or M4 Allen wrench

**Note: Some Okuma machines installed with a factory auto door will have two cycle start buttons. If your Okuma has two cycle start buttons, you will need to make another set of Cycle Start Wires and piggyback the second set of Cycle Start Wires from the first cycle start button to the second cycle start button.*



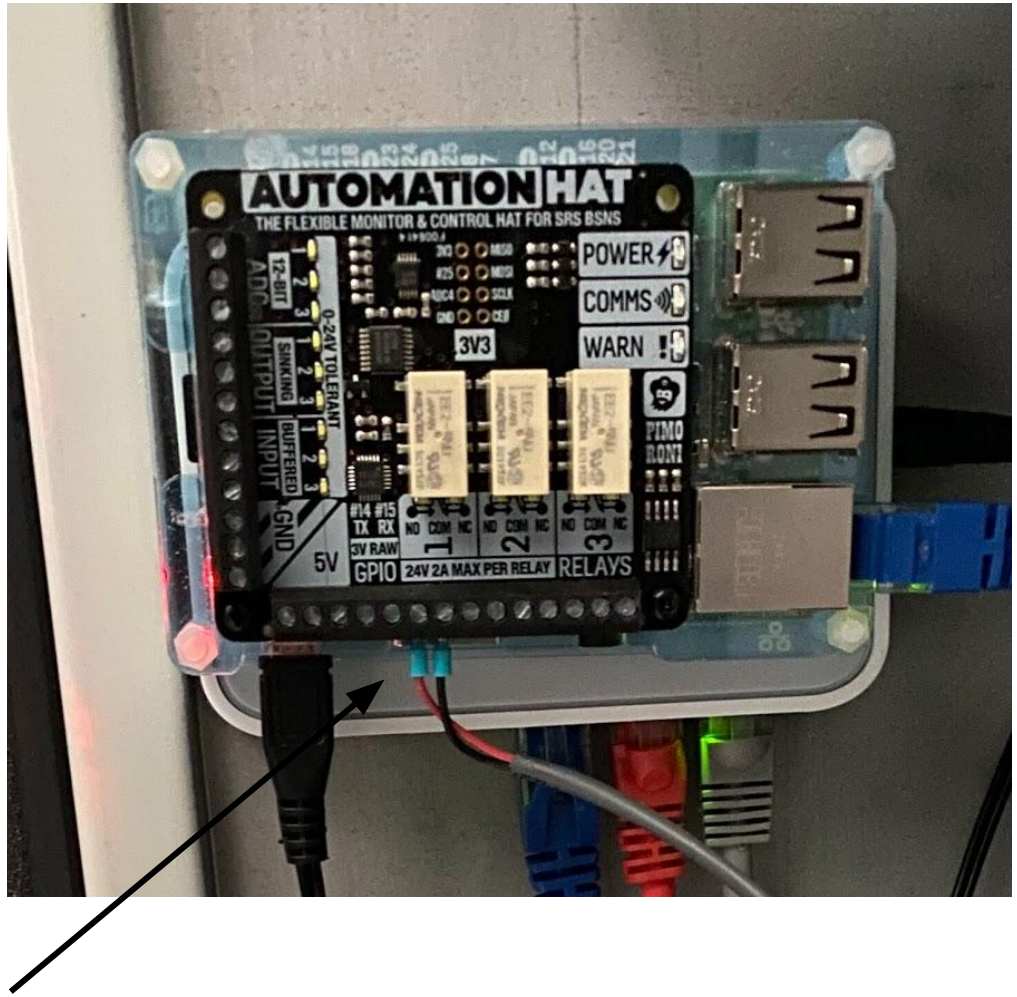
Step 2: Mount Robot2CNC Computer

1. Turn-off power at the breaker to the CNC
2. Open CNC cabinet doors
3. Place Robot2CNC and Network Hub on the bottom shelf of the CNC cabinet away from exposed electrical wires
4. Optionally bond Robot2CNC and Network Hub with included double-sided tape
5. Connect power supplies to Robot2CNC and Network Hub
6. Connect 1-foot long Ethernet cable between Robot2CNC and 5-port Ethernet switch

Step 3: Connect Cycle Start Wires to Robot2CNC

Tools Needed: 1/16” flathead screwdriver

1. Route wires down to the Robot2CNC Computer in the CNC cabinet
2. Locate relay 1 on the Robot2CNC
3. Using the flathead screwdriver, loosen the terminal marked NO and connect the red wire and tighten it down
4. Repeat the process for the black wire in the terminal marked COM

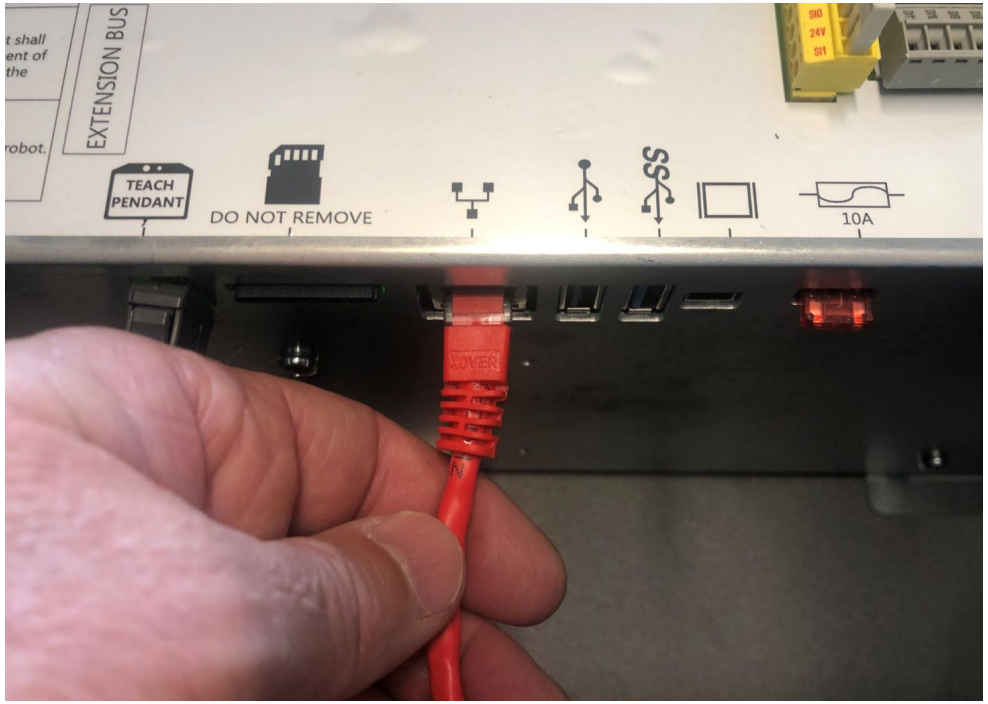


Step 4: Connect Ethernet Cable to CNC

- Plug the Ethneret cable into the CNC's Ethernet port and route the other end of the Ethernet cable to the Robot2CNC computer
- Plug the Ethernet cable from the CNC into the 5-port Ethernet switch

Step 5: Connect Ethernet Cable to Robot

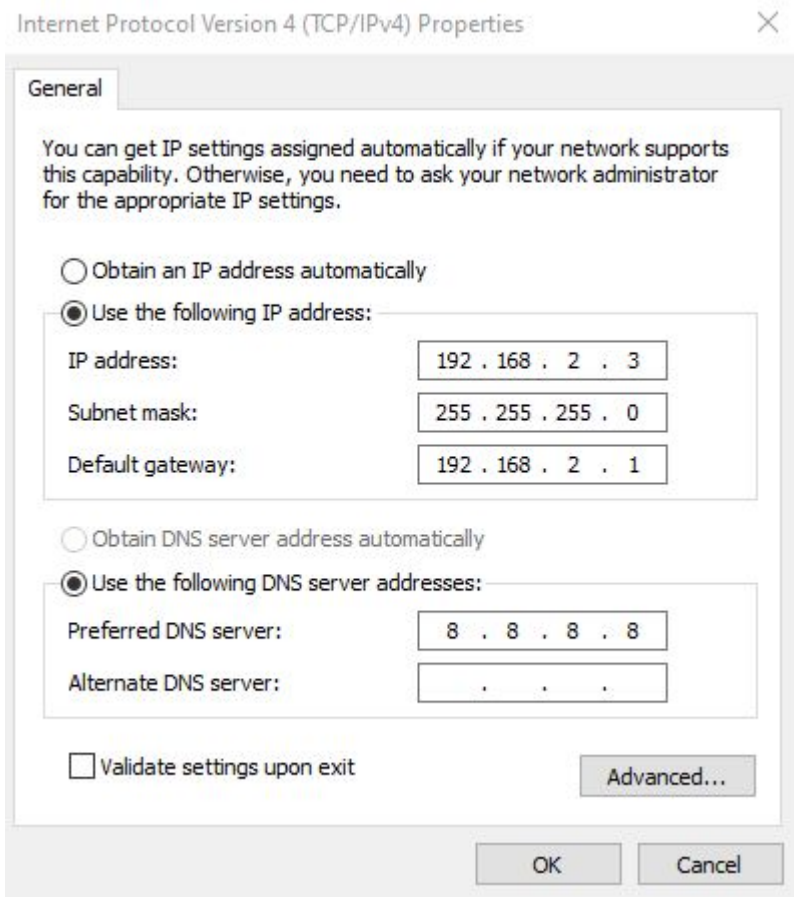
1. Lay the UR Controller on it’s back, remove a round access hole plug from the bottom of the controller
2. Route one end of the Ethernet cable through the access hole and into the UR controller
3. Plug the Ethernet cable into the Ethernet port of the UR controller
4. Route the other end of the Ethernet cable into the CNC cabinet
5. Plug the Ethernet cable into the 5-port Ethernet switch



Step 6: Configure CNC Settings

Setup a static TCP/IP address configuration on the Okuma CNC using the built-in Windows network setup:

IP Address	192.168.2.3
Subnet Mask	255.255.255.0
Gateway	192.168.2.1
Preferred DNS Server	8.8.8.8

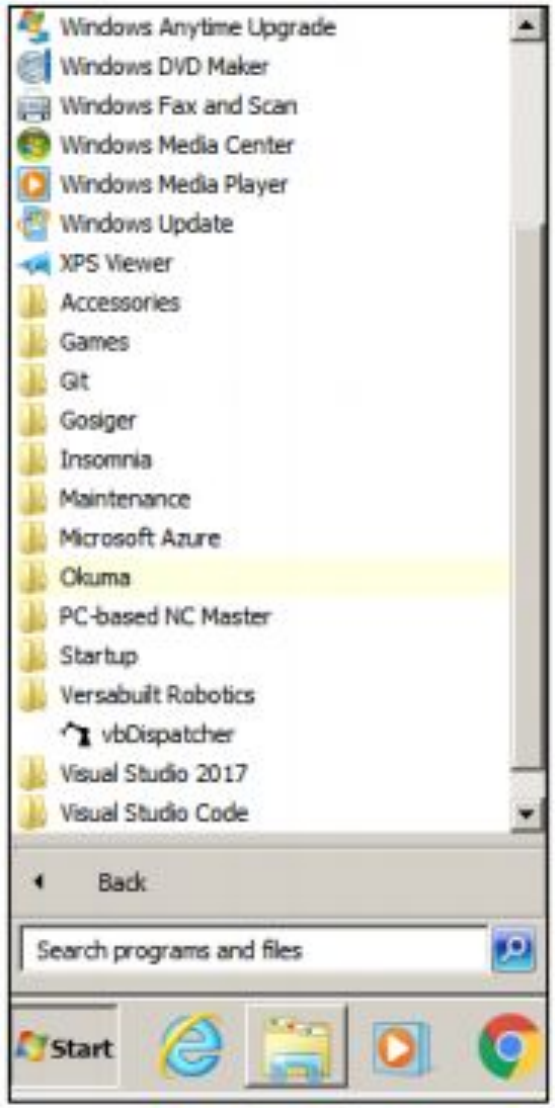


Step 7: Install VersaBuilt Dispatcher Program

1. Insert VersaBuilt USB drive into the Okuma USB port
2. Navigate to the Okuma directory on the VersaBuilt USB drive
3. Double-click on the setup.exe program
4. Follow the on-screen instructions
5. Click Yes to override User Account Control if prompted

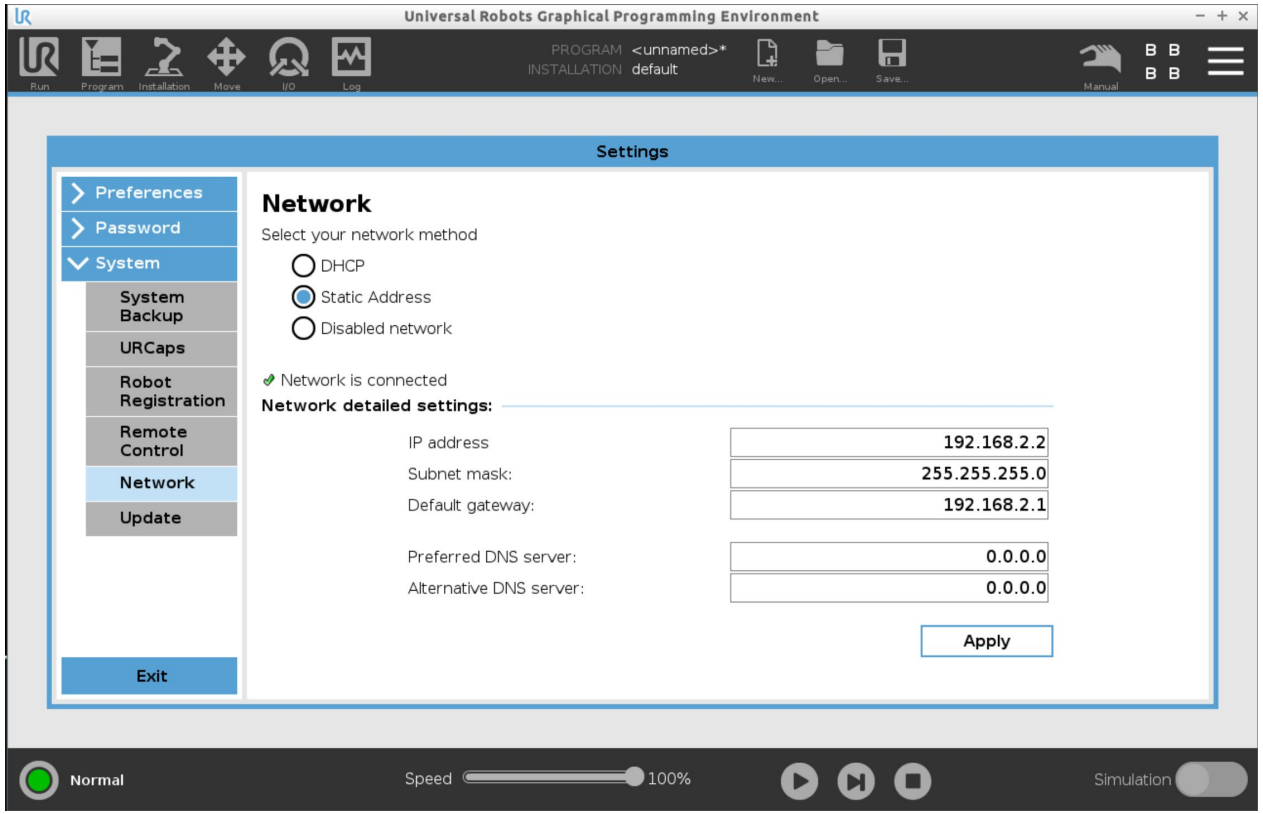
Step 7: Install VersaBuilt Dispatcher Program

The vbDispatcher program must be running for the Robot2CNC to work properly. The vbDispatcher program can be started from the Start menu manually or can be started automatically every time the CNC boots by adding a short cut of the vbDispatcher program to the Windows Startup folder



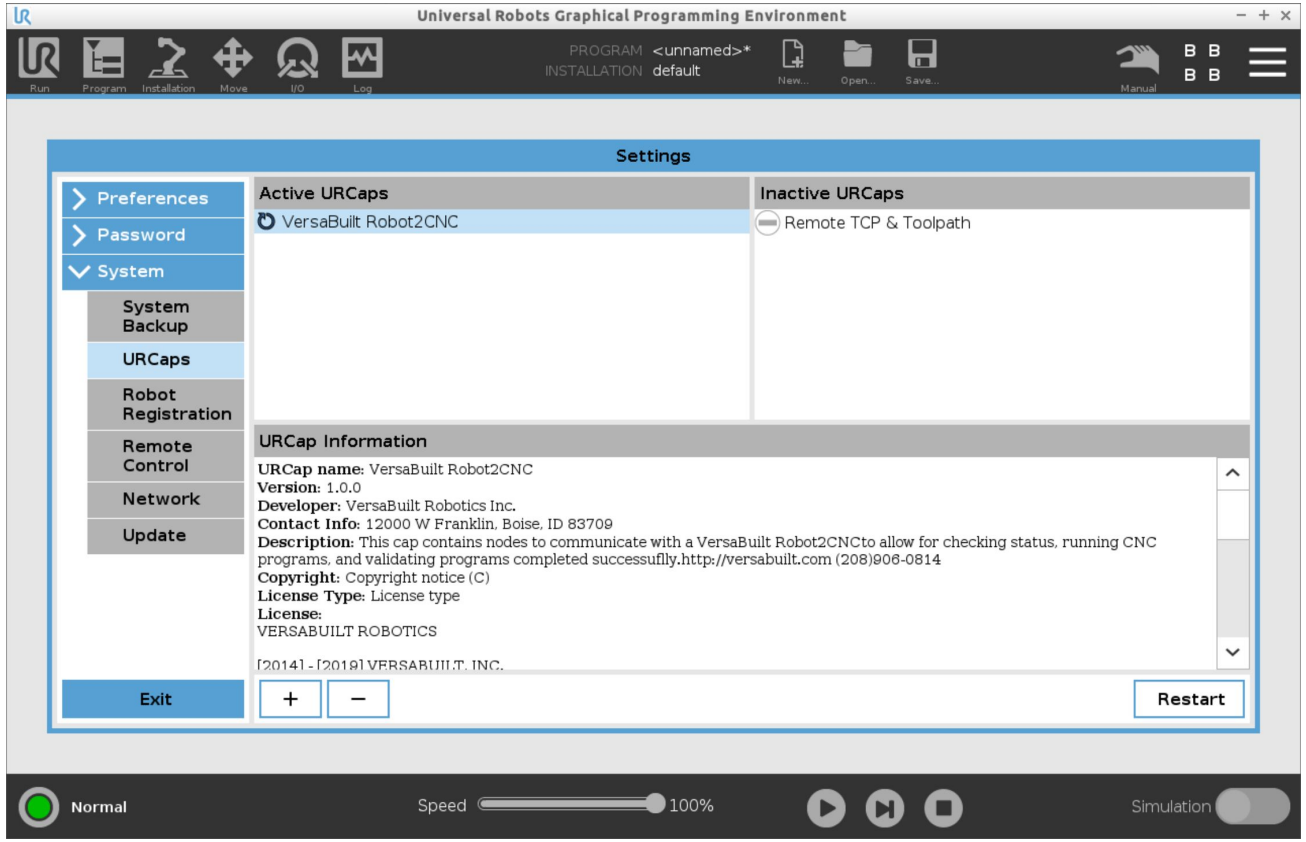
Step 8: Configure UR Robot Settings

1. Click on the 3 horizontal bars in the upper right-hand corner of the UR teach pendant and select Settings
2. On the Settings page, select System -> Network
3. Select Static Address
4. Enter the Network detailed settings as shown



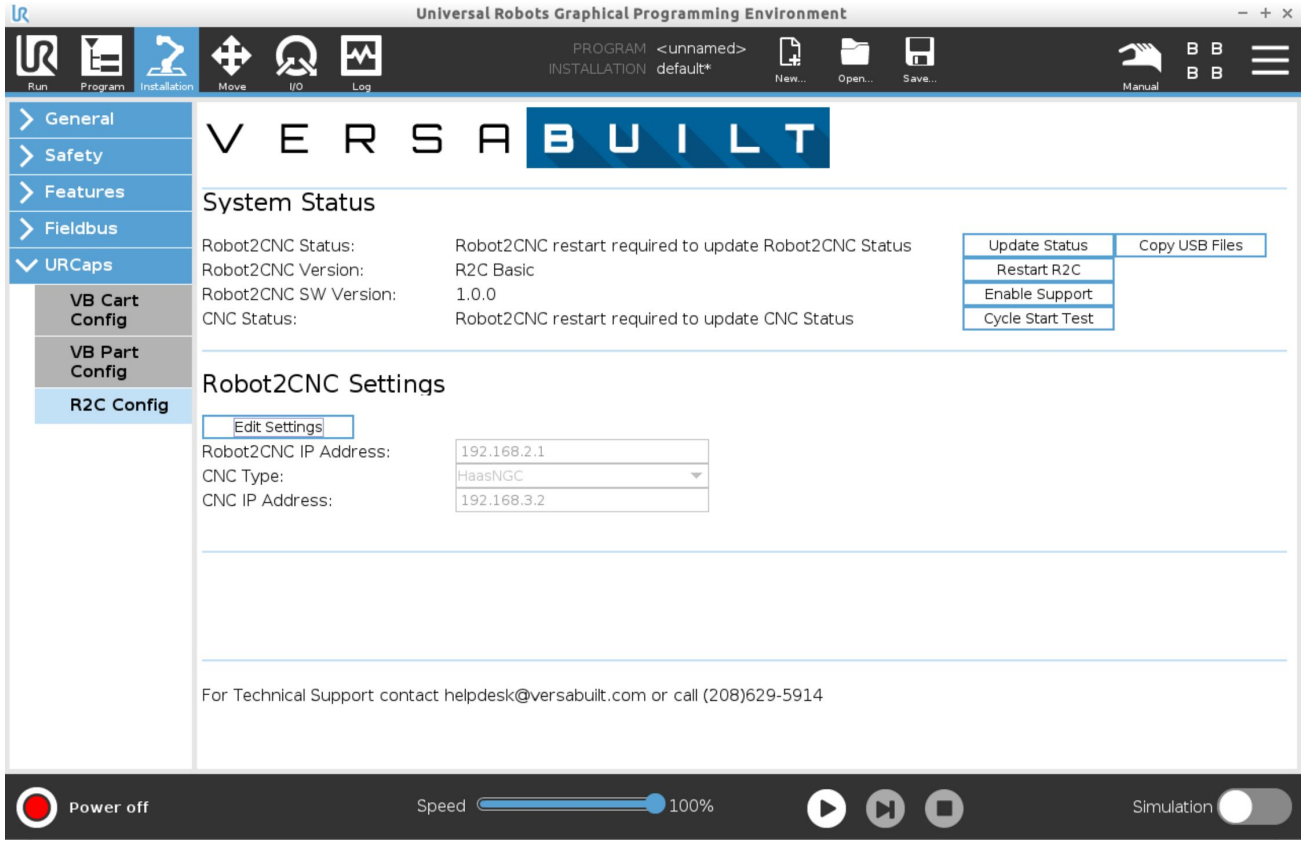
Step 9: Install UR Robot Software

1. Insert the VersaBuilt USB drive into the UR Teach Pendant
2. Click on the 3 horizontal bars in the upper right-hand corner of the UR teach pendant and select Settings
3. On the Settings page, select System -> URCaps
4. Press the + button in the lower left of the Settings page to add a URCap
5. Navigate to the usbdisk and select the robot2cnc-2.0.urcap file (note: file name may be different)
6. Press the Restart button in the lower right corner of the Settings page



Step 10: Install Script File and Validate Robot2CNC

1. Insert the VersaBuilt USB drive into the UR Teach Pendant
2. On CNC, select program 9000, place CNC in memory mode and close CNC door
3. Click on the Installation icon near the top left of the UR teach pendant then select URCaps -> R2C Config
4. Click on the Copy USB Files button
5. Confirm Robot2CNC Settings are as follows:
   a. Robot2CNC IP Address 192.168.2.1
   b. CNC Type: Focas
   c. CNC IP Address 192.168.3.2
6. Press the Restart R2C button
7. After 30 seconds, press the Update Status button
8. Confirm Robot2CNC Status: UP
9. Confirm CNC Status: IDLE
10. Press Cycle Start Test button
11. Confirm CNC Status: CNC Cycle Start Test Passed

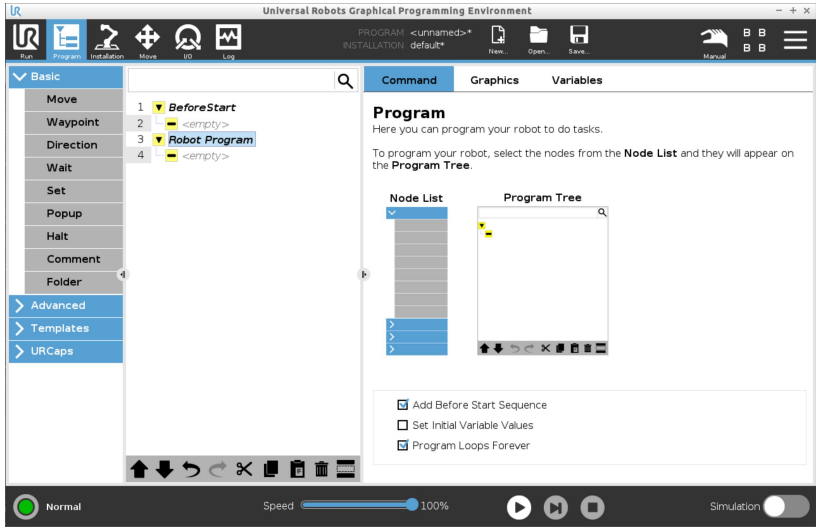


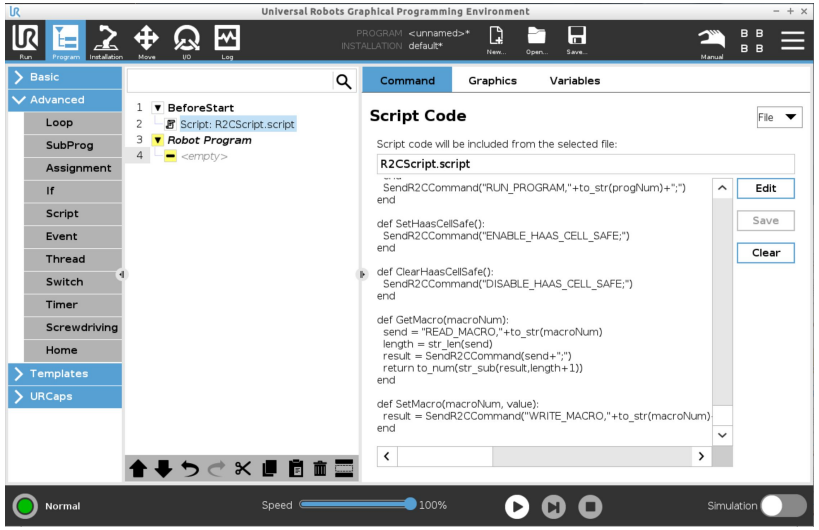
Note: if any test fails, see Appendix A Troubleshooting

Programming with the Robot2CNC

Before using Robot2CNC in a UR Polyscope program, the R2CScript.script file must be added to the Before Start Sequence:

1. From the Program page, click on the ***Robot Program***
2. Click on the Add Before Start Sequence checkbox
3. Click on the line marked <empty> below the ***BeforeStart***
4. Click > Advanced -> Script
5. In the upper right, select File
6. Click on the Edit button
7. Click the Open button then navigate to the VersaBuilt folder and select R2CScript.script and press the Open button
8. Click the Exit button

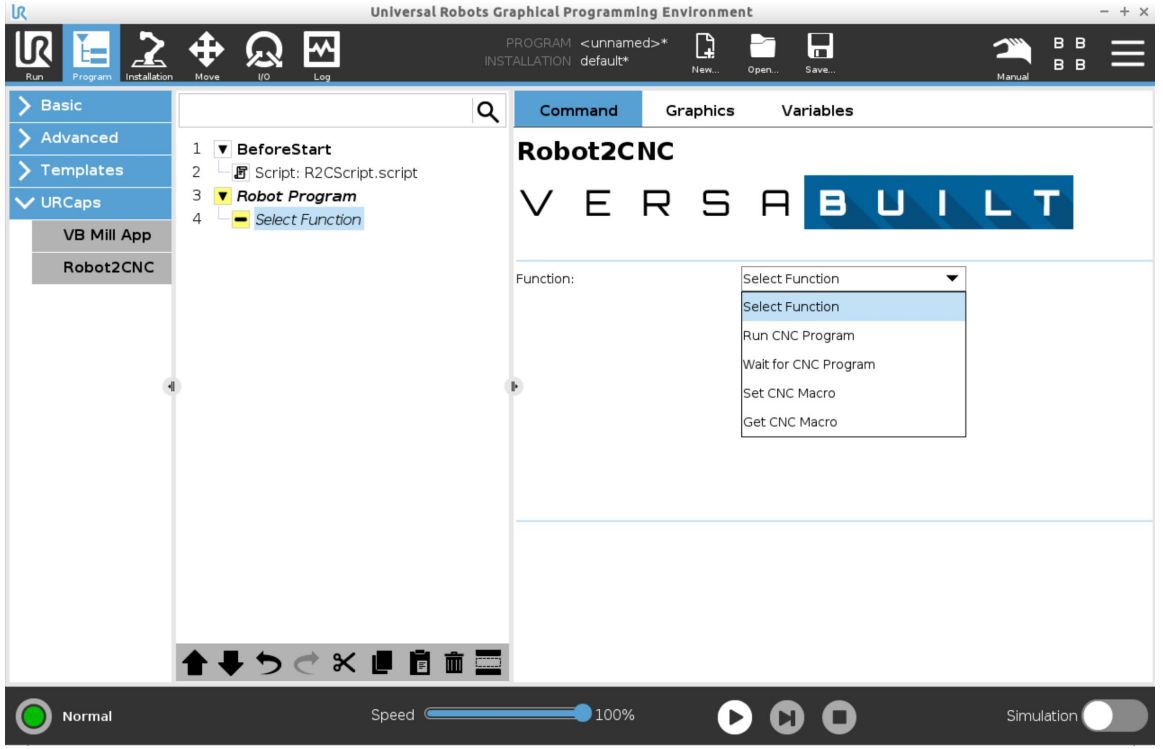




Programming with Robot2CNC

Robot2CNC commands can be added into the Polyscope programming tree via the Robot2CNC program node accessible in the URCaps section. To add a Robot2CNC command to a program do the following:

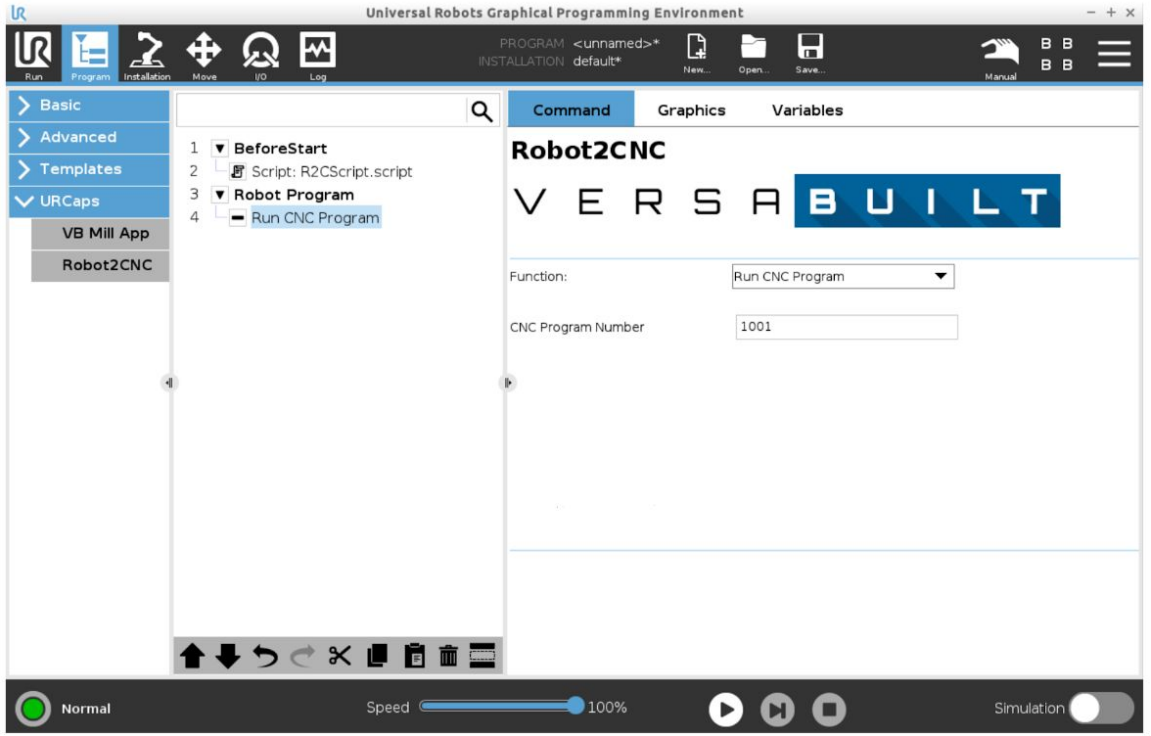
1. Click in the program tree where the Robot2CNC command is required
2. Select > URCaps -> Robot2CNC
3. Click Select Function
4. Select the required function from the list



Robot2CNC Commands

Run CNC Program

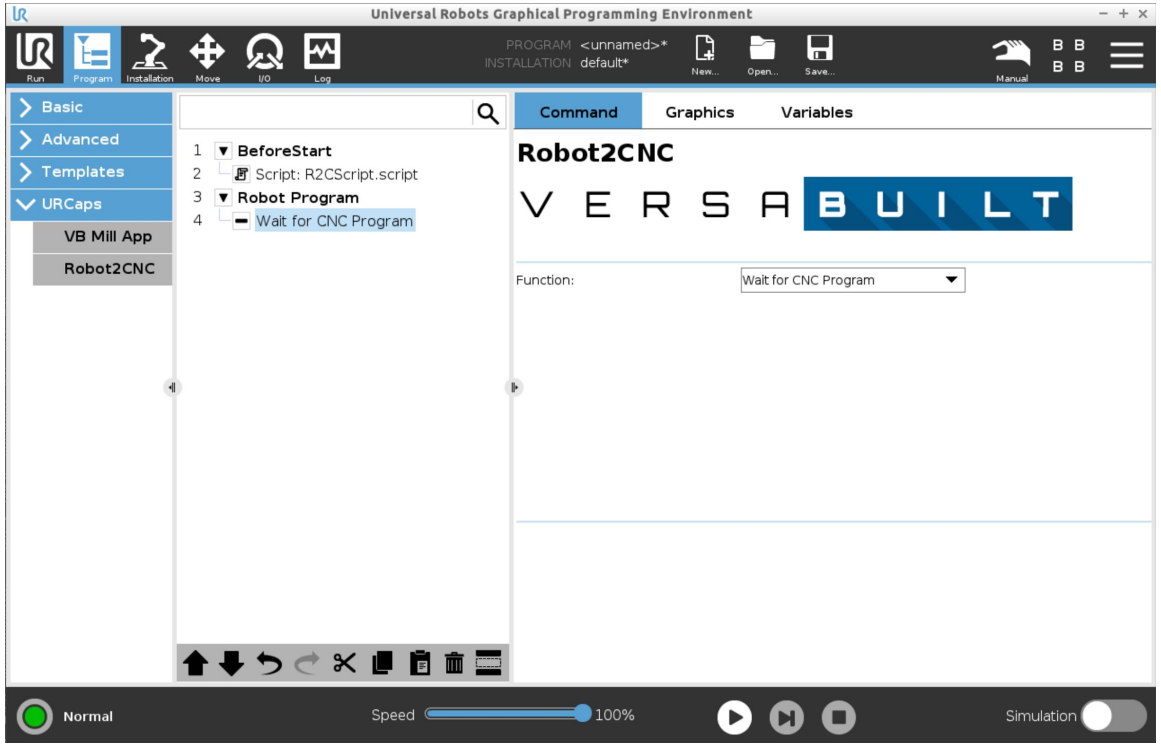
Runs the CNC program number entered in the CNC Program Number field. CNC program number must be in the CNC memory and the CNC must be in memory mode with the CNC door closed. CNC program completion can be detected with the Wait for CNC Program command.



Robot2CNC Commands

Wait for CNC Program

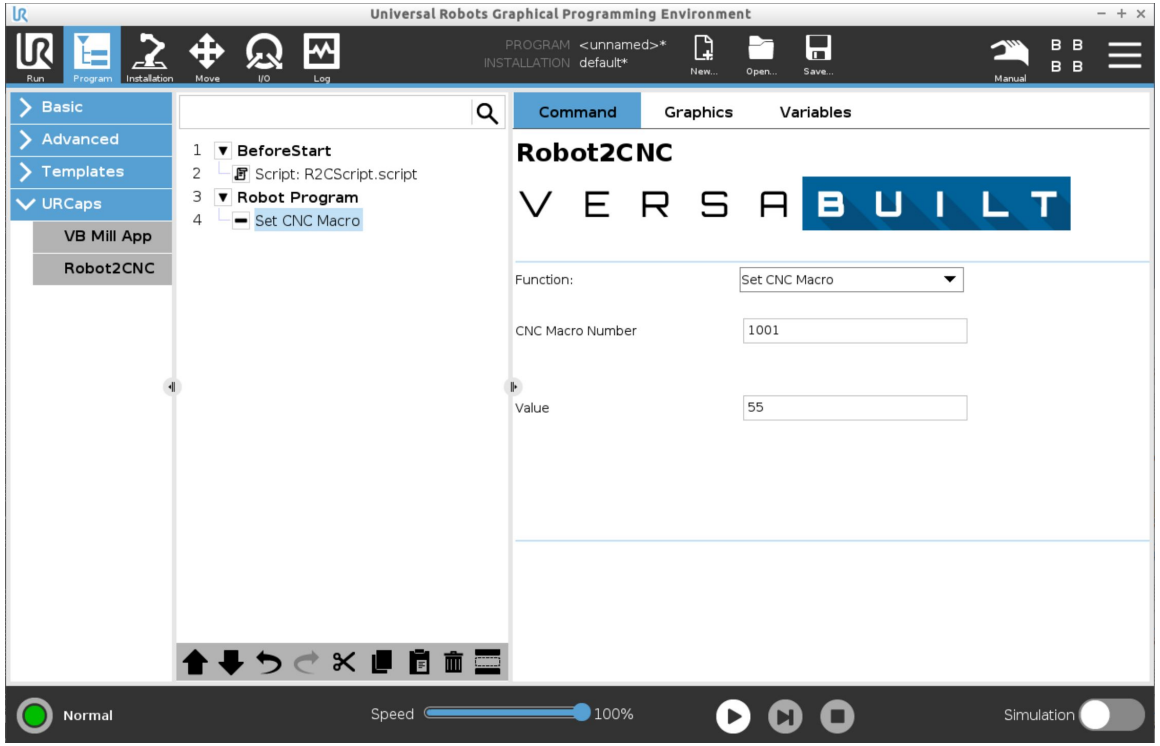
Waits for the currently executing CNC program to complete. If the CNC program completes successfully, Polyscope program execution continues. If an error occurs in the CNC program, a popup message is displayed with information about the error and allowing the operator to stop or continue processing.



Robot2CNC Commands

Set CNC Macro

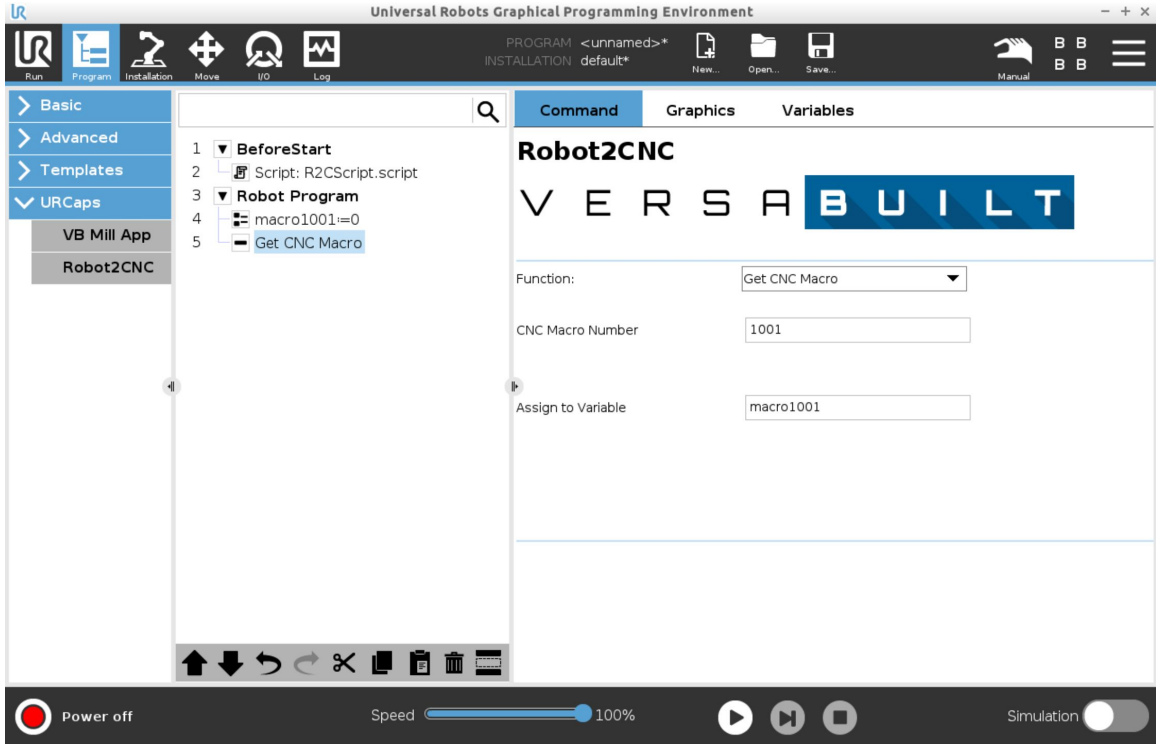
Sets the CNC Macro Number entered to the Value entered. The CNC Macro Number parameter must be a valid macro variable number on the Haas CNC control.



Robot2CNC Commands

Get CNC Macro

Gets the CNC Macro variable specified by the CNC Macro Number parameter and stores it in the Polyscope variable entered in the Assign to Variable parameter. The Assign to Variable must be a valid Polyscope variable, typically created with a Polyscope Assignment program node



Modifying CNC Programs for Robot2CNC

- Robot2CNC requires a hand-shake signal from the CNC
- The hand-shake signal is done through the Okuma variable VC190, this variable is reserved by Robot2CNC and should not be used for any other purpose
- All programs that will be run by the Robot2CNC must include VC190=2 just before the program ends
- The VC190=2 line is safe to use, even when the CNC program is not being executed by the Robot2CNC
  - Tip: place the VC190=2 line in your CAM post processor

```
…
…
VC190=2
M02
```

Appendix A: Troubleshooting

Robot2CNC Status: ERROR, Unable to Connect

The UR robot cannot communicate with the Robot2CNC over the Ethernet network. Check the following:

1. Ethernet cable is connected between the UR robot and the Robot2CNC
2. The Robot2CNC Ethernet port LED is yellow or flashing yellow
3. The IP Address of the robot is set to according to the Step 8 in this manual
4. Connect to the Robot2CNC using a portable computer or smart phone and verify Robot2CNC network settings (see Appendix C)

CNC Status: ERROR, Unable to Connect

The Robot2CNC computer cannot communicate with the CNC over the Ethernet network. Check the following:

1. Make sure the Robot2CNC Status: Up; CNC Status is not valid until Robot2CNC Status: Up
2. Ethernet cable is connected between the Robot2CNC and the CBC
3. The Robot2CNC USB-to-Ethernet adapter port LED is yellow or flashing yellow
4. The IP Address of the CNC is set to according to the Step 7 in this manual
5. Connect to the Robot2CNC using a portable computer or smart phone and verify Robot2CNC network settings (see Appendix C)

Appendix A: Troubleshooting

CNC Status: Refused

The Robot2CNC is able to communicate with the CNC but setting 143 is not properly configured

1. Make sure setting 143 Machine Data Collection is set to 9000

CNC Status: CNC State must be IDLE for Cycle Start Test

The CNC is not in a state that allows it to be cycle started. Check the following and try again:

1. CNC Door is closed
2. CNC is in memory mode, program 9000 is selected and CNC is not alarmed
3. Press the reset button

Appendix A: Troubleshooting

CNC Status: CNC Cycle Start Test failed

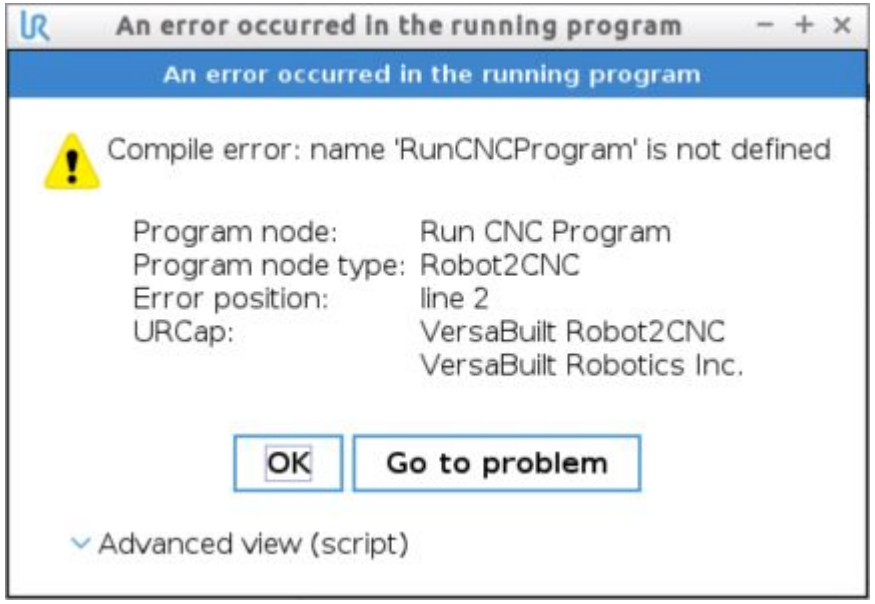
Likely causes to the failure:

1. The CNC is not in memory mode; verify CNC is in memory mode, retry Cycle Start Test
2. 9000 program is not selected; select 9000 program then retry Cycle Start Test
3. CNC door is not closed; make sure the CNC door is closed then retry Cycle Start Test
4. Cycle Start Wiring problem
    a. To confirm wiring problem, press the Cycle Start Test button on the R2C Confing URCap page of the teach pendant, then press the Cycle Start button on the CNC within 15 seconds; if the test passes, the wiring problem is confirmed
    b. Confirm the Cycle Start Relay wires are secure
    c. Put an ohmmeter across the the Cycle Start relay contacts on the Robot2CNC, the contacts should be open
    d. While monitoring the Cycle Start Relay contacts with the ohm meter, have a partner press the Cycle Start Test button, the ohmmeter should show a momentary closing of the contacts; if it does not, contact VersaBuilt for warranty exchange of the Robot2CNC
    e. Put an ohmmeter across the the Cycle Start relay contacts at the Cycle Start button in the back of the CNC, the contacts should be open
    f. While monitoring the Cycle Start Relay button with the ohm meter, have a partner press the Cycle Start Test button, the ohmmeter should show a momentary closing of the contacts; if it does not, contact VersaBuilt for warranty exchange of the Cycle Start Relay wires

Appendix A: Troubleshooting

Compile error when running program with Robot2CNC URCap

- The R2CScript.script file has not been added to the Before Start sequence of the UR Polyscope program
- See Section 5 of this manual for instructions on how to add the R2CScript.script file to your program



Appendix B: Robot2CNC Web Configuration Interface

The Robot2CNC includes an advanced interface that allows advanced settings to be configured and allows the Robot2CNC to connect to the Internet for remote support or to download software updates. To connect to the Robot2CNC Web Configuration Interface do the following:

1. Using a laptop computer or a smartphone with wi-fi, goto wifi settings and connect to a network titled vbrXXXXX (where XXXXX is the serial number of the Robot2CNC)
2. Password: versabuilt
3. Open a web browser and enter the address: 192.168.4.1:9001