VERSA BUILT ROBOTICS

UR CNC Mill Application Kit Installation Guide

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Safety Warnings

Section 1

Safety Warnings

Validity and Responsibility

The information in this manual does not cover all equipment that can influence the safety of the complete system. The complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the system is installed. The integrator of VersaBuilt products are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that any significant hazards in the complete application are eliminated. This includes, but is not limited to:

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

**Before implementation and use of system, read and understand the Universal Robot manuals.*

Limitation of Liability

Any safety information provided in this manual must not be construed as a warranty, by VersaBuilt, that the system will not cause injury or damage, even if the system complies with all safety instructions.

Safety Warnings

DANGER: The VersaBuilt UR Mill Application Kit is an industrial machine tool designed to be operated by trained personnel only. Devices within the UR Mill Application Kit may move suddenly and without warning. Serious or fatal crushing injuries can occur from contact with the robot, gripper or vises.

Before deploying the VersaBuilt UR Mill Application Kit, a safety risk assessment must be completed in accordance with local, state and/or federal requirements.

The UR Mill Application Kit should only be used by trained operators.

Specifications

MultiGrip FJ Gripper, Clamping Force

Air Pressure (psi)	Gripper Clamp Force (lbf)	Gripper Clamp Force (Newtons)
20	33	145
30	49	218
40	65	291
50	82	364
60	98	437
70	115	509
80	131	582
90	147	655
100	164	728
110	180	801
120	196	844

Specifications

MultiGrip FJ Vise, Clamping Force

Air Pressure (psi)	Gripper Clamp Force (lbf)	Gripper Clamp Force (Newtons)
20	707	3143
30	1060	4715
40	1413	6287
50	1767	7859
60	2120	9430
70	2473	11002
80	2827	12573
90	3180	14145
100	3533	15717
110	3887	17289
120	4240	18861

**The clamping force shown in the table above is the arithmetic sum of the individual forces, per industry norms*

Risk Mitigation

Robot2CNC Mill Edition

- The Robot2CNC Mill Edition includes electronically actuated pneumatic valves for controlling vises, in-CNC air blow-off and optionally a pneumatic door. The Robot2CNC Mill Edition IOs are not safety rated and may actuate pneumatics unexpectedly. A pneumatic supply valve with lockout provision is provided to remove pneumatic energy from the Robot2CNC Mill Edition.

MutliGrip FJ Gripper

- UR Mill Application Kit software applications include pre-programmed sequences such that when gripping outside CNC, the default programming commands the gripper to close, then open, then close again to pick up parts. This close/open/close sequence may allow the operator to escape if accidentally clamped by the MultiGrip FJ Gripper. The MultiGrip FJ Gripper is controlled by the UR Robot IO signals. The pneumatic configuration of the Mill Application Kit includes an option to remove pneumatic energy from the gripper using the Robot2CNC Mill Edition pneumatic supply valve.

MultiGrip FJ Vise

- In “Automatic Mode”, the MultiGrip FJ Vises are controlled by the Robot2CNC Mill Edition. During manual operation of vises, for handloading, the Diverter Valve can be switched to “Manual Mode”, diverting air from the supply to the Robot2CNC Mill Panel to the Vise Hand Valves mounted to the CNC table. In this configuration, vises can only open or close by way of direct operator access to the hand valves.

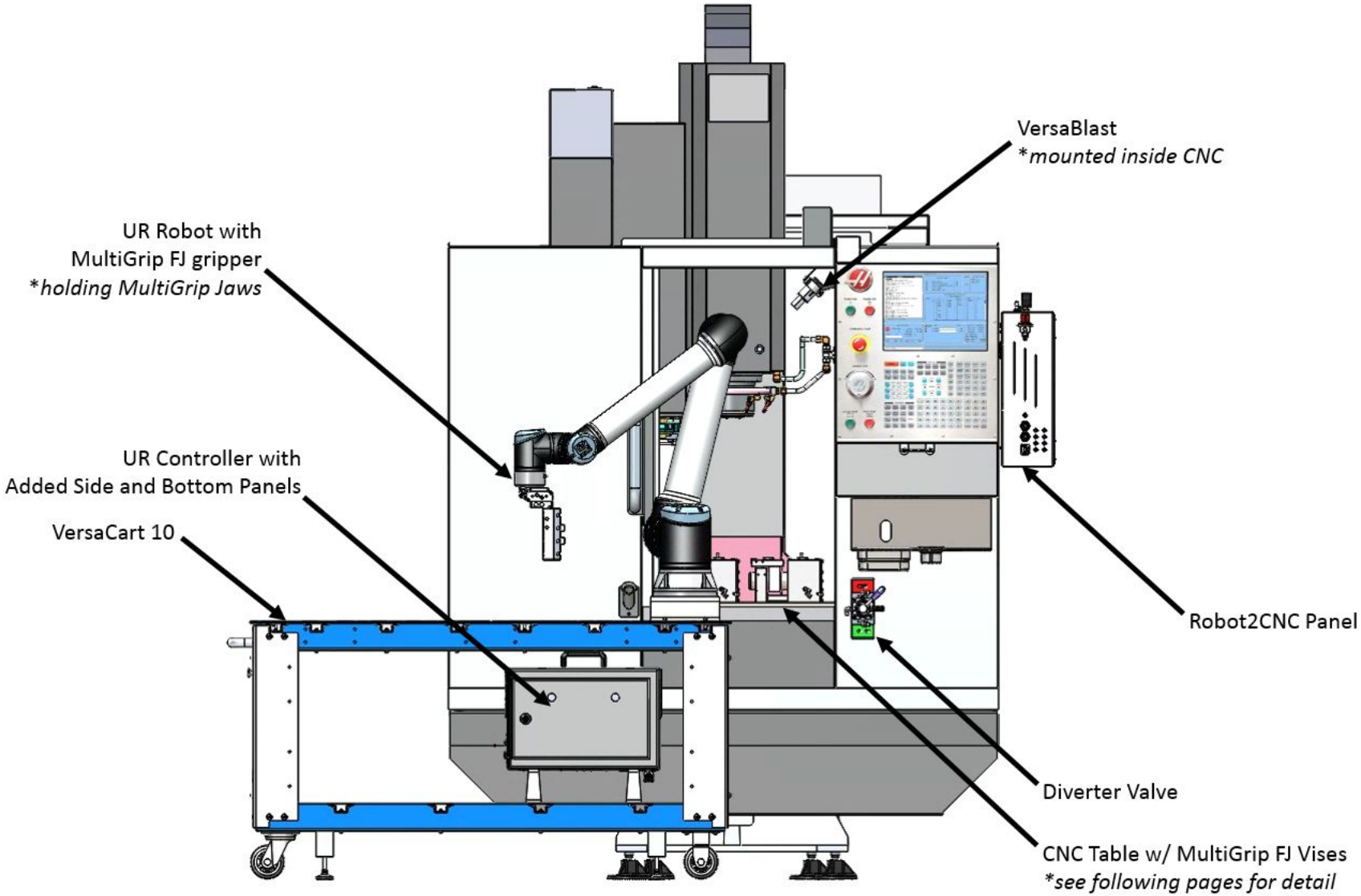
Mill Application Kit Contents

Section 2

Mill Application Kit Contents

1. **VersaCart 10**
2. **UR Controller Panel Mill Kit**
3. **MultiGrip FJ Gripper**
4. **Robot2CNC Mill Panel**
5. **MultiGrip FJ Vises**
6. **MultiGrip FJ Vise Sensor Kit**
7. **Hand Valves Kit**
8. **VersaBlast Assembly**
9. **VersaBlast Valve Assembly**
10. **MultiGrip Calibration Plate**
11. **MultiGrip Jaws**
12. **Tubing Kit**

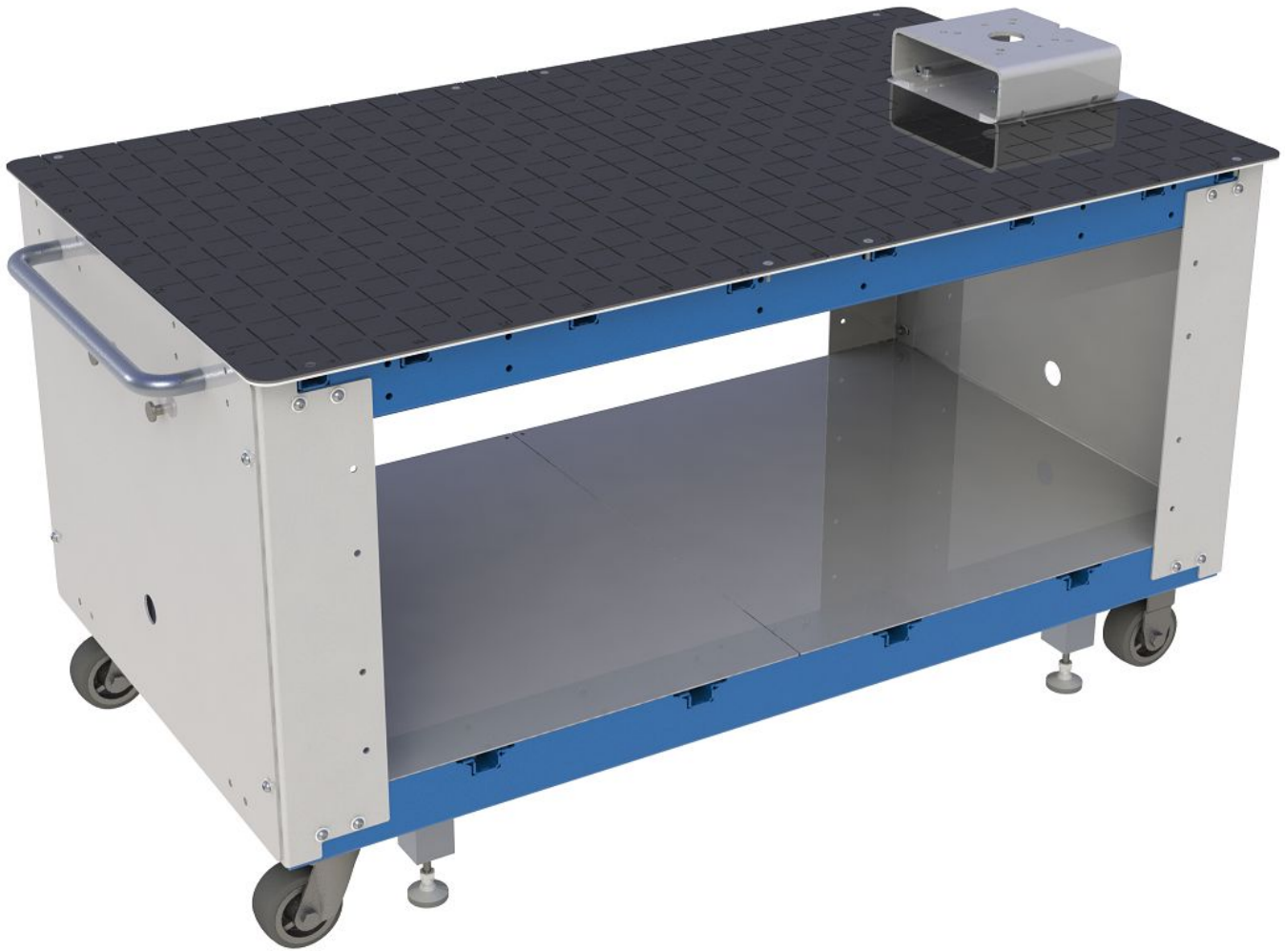
Mill Application Kit Overview



VersaCart 10

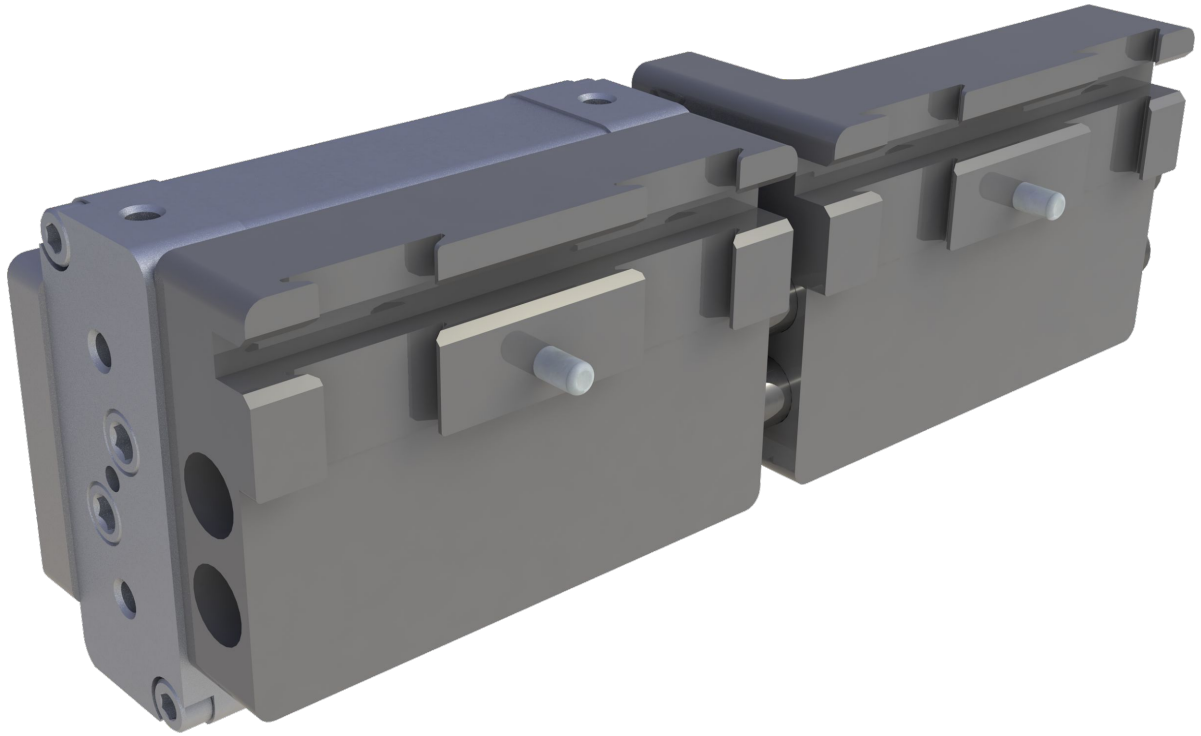
VersaCart 10:

- 32” W x 55” L x 30” H Cart
- Visual infeed for robot pick and place
- Robot pedestal for UR Robots
- Casters for easy transport
- Foot pads to lock cart in place



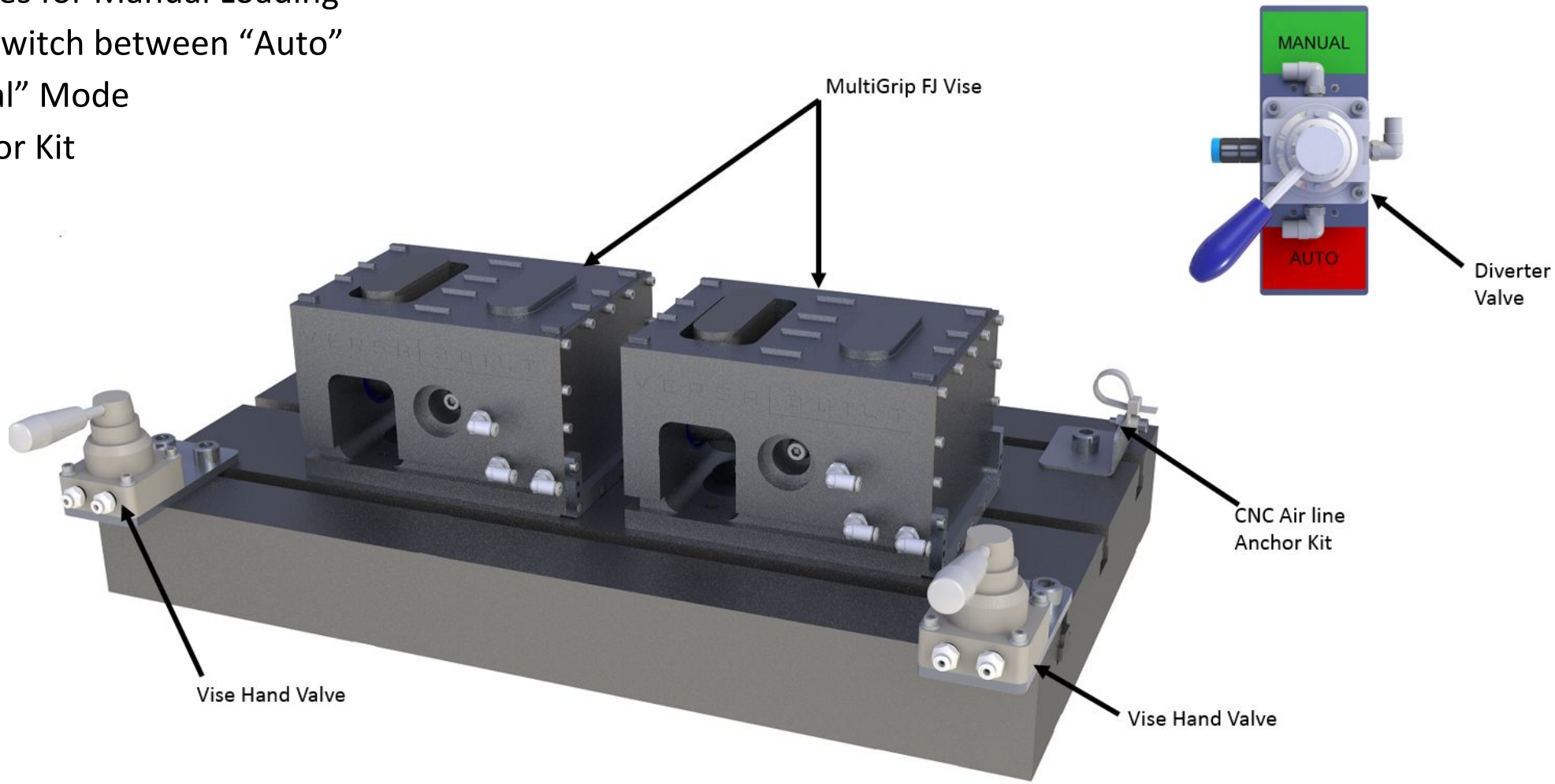
MultiGrip FJ Gripper

- 2 x Gripper Fingers with features to pick and place MultiGrip Jaws
- Adapter Plate to attach to Universal Robot
- 5/32” Tubing to connect to UR Controller Panel
- Speed control fittings to adjust gripper open and close speeds
- Zip Ties for tube routing on UR Robot arm



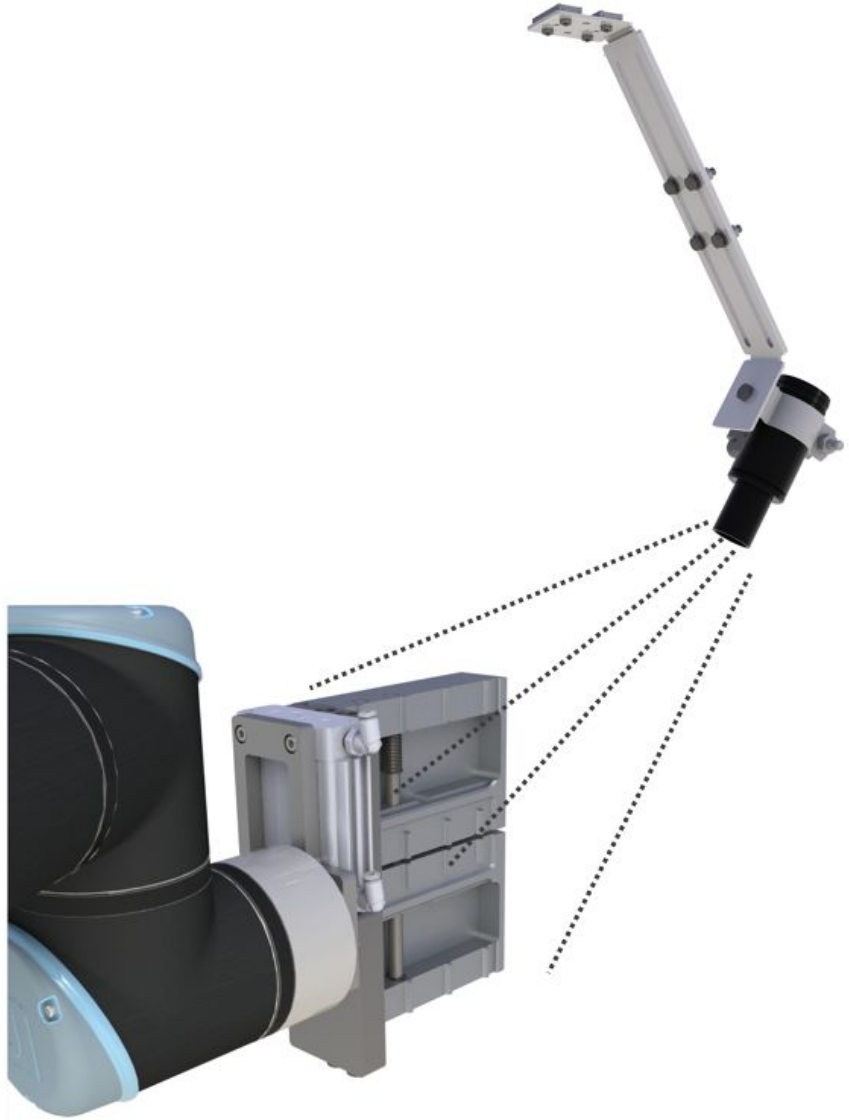
MultiGrip FJ Vises and Valves

- 2 x MultiGrip FJ Vises
- 2 x Vise Hand Valves for Manual Loading
- Diverter Valve to switch between “Auto” mode and “Manual” Mode
- CNC Air Line Anchor Kit
- Vise Sensor Kit



VersaBlast

- Air Amplifier/Booster supplying jet of air to blow chips and debris off of MultiGrip Jaws before and after machining
- Adjustable bracket assembly, with option to flip bottom bracket for flexible assembly to accommodate variety of CNC configurations
- Strong magnet mount
- Air Pilot valve to maximize air flow to Air Amplifier/Booster

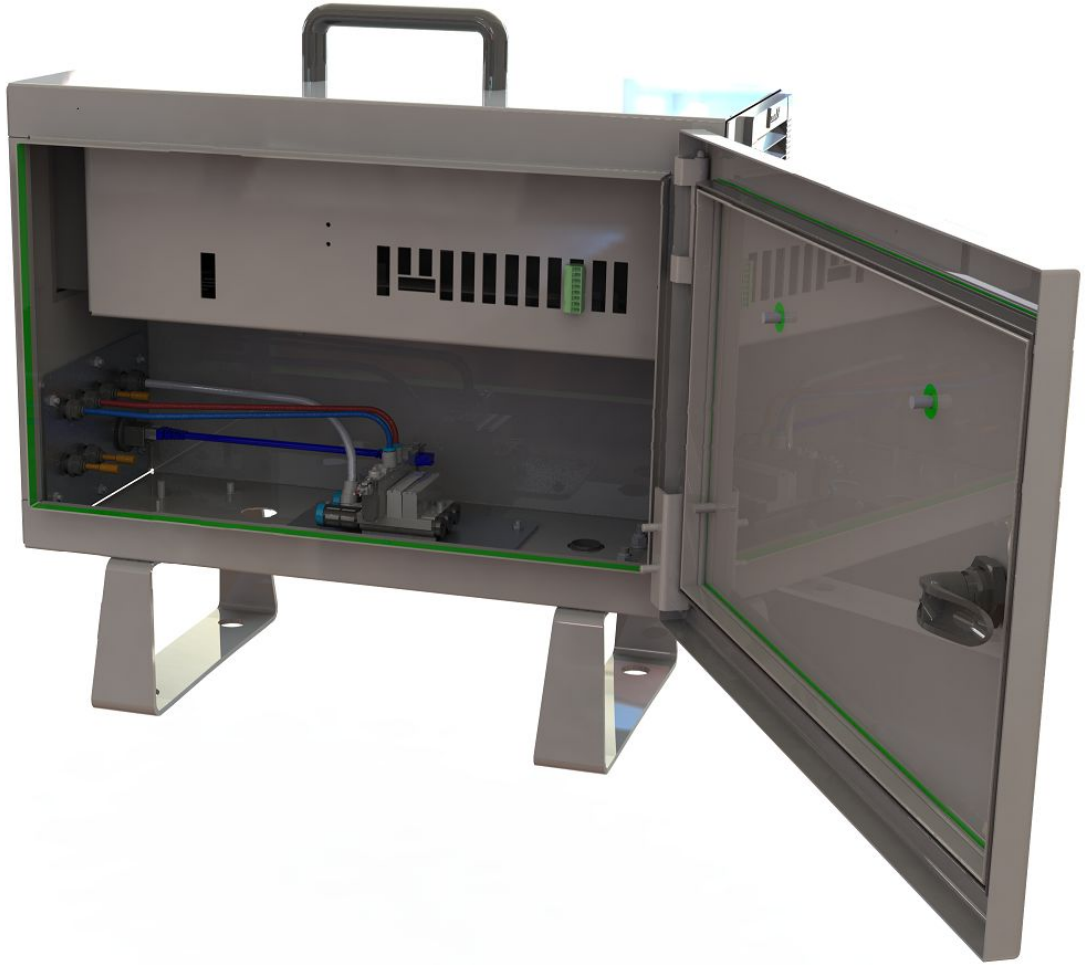


Robot2CNC Mill Panel

- Robot2CNC Mill Panel with Pneumatic and Electrical connections
- Pneumatic signals to Vises, VersaBlast, and optional VersaDoor
- Ethernet connection to 5-Port Ethernet Switch, facilitating communication between Robot and CNC
- Digital Output Connection to CNC Cycle Start
- Digital Input connection to MultiGrip FJ Vise and VersaDoor sensors
- RS232 DB9 connection to CNC for Haas Legacy controls

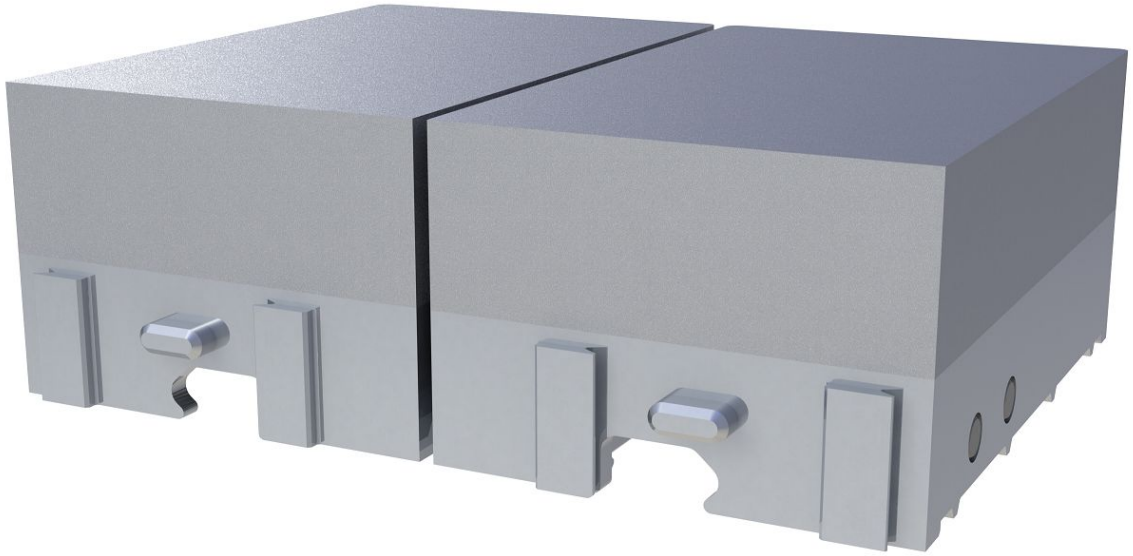
UR Controller Panel

- Provides bulk-head connections for pneumatic and Ethernet connections
- Side and Bottom panels replacing existing blank panels
- Ethernet cable connection inside controller
- Pneumatic Valve for MultiGrip FJ Gripper control
- Pre-wired Digital Output Connection for valve control

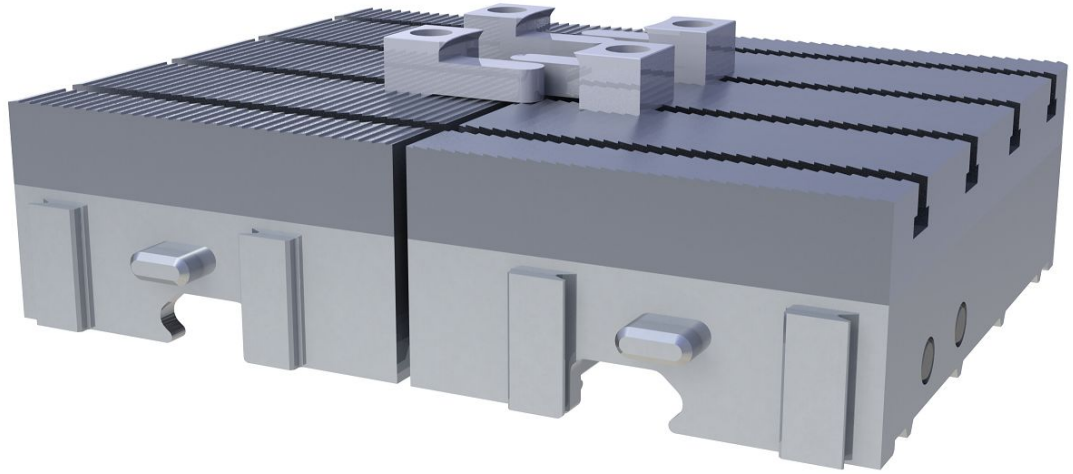


MultiGrip Jaws

- 2 x MultiGrip OD Jaw Bases
- 2 x MultiGrip OD Top Plates (1.5” Height)
- 1 x Universal OP 1 Jaws



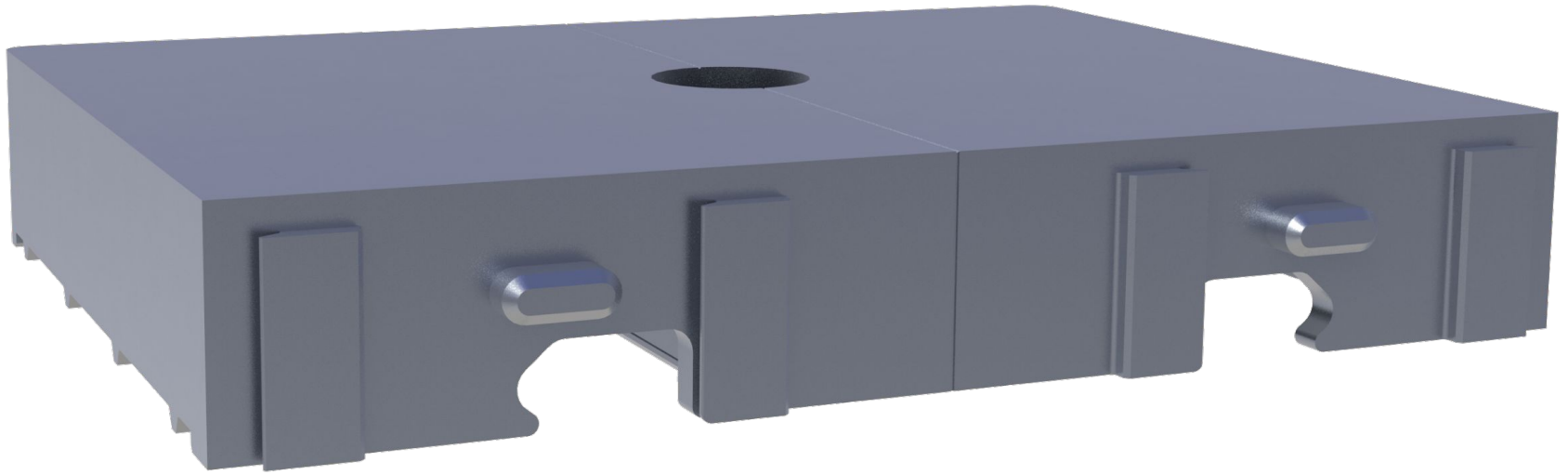
OD Jaw Base shown with one set of Top Plates attached



OD Jaw Base shown with Universal OP 1 Jaws attached

Calibration Plate

- Calibration Plate are used during the Cart and Vise calibration process
- Calibration Plate include features for vise clamping, and alignment with cart edges



Tubing and Fittings

- 0.50” tubing:
  - 15-ft Connecting from Plant Supply to VersaBlast air pilot valve
  - 10-ft Connecting VersaBlast air pilot valve to VersaBlast blower
  - 3-ft Connecting ¼” quick disconnect and ½” tee fitting with reducer to ¼” to connect supply to Diverter Valve and Robot Controller (for robot gripper)
- 0.25” tubing:
  - 25-ft white tubing - Connecting from Plant Supply to Diverter Valve
  - 25-ft blue tubing - Connecting from Plant Supply to Robot Controller
  - 25-ft black tubing - Connecting from Diverter Valve to Manual Valves in CNC
  - 25-ft red tubing - Connecting from Diverter Valve to Robot2CNC Mill Panel
  - 15-ft blue tubing - Connecting Robot2CNC to VersaBlast air pilot valve
- 5/32” tubing:
  - 25-ft red tubing - Connecting from Robot2CNC Mill Panel to Vise 1 Close
  - 25-ft blue tubing - Connecting from Robot2CNC Mill Panel to Vise 1 Open
  - 25-ft clear or black tubing - Connecting from Robot2CNC Mill Panel to Vise 2 Close
  - 25-ft white tubing - Connecting from Robot2CNC Mill Panel to Vise 2 Open
  - 15-ft black tubing - MG Vise exhaust to exit CNC from tee fitting
  - 2x 3-ft black tubing - MG Vise exhaust from vises to tee fitting

**Refer to Appendix A for a pneumatic schematic*

Tubing and Fittings

- Fittings:
  - QTY: 1 Tee Fitting for 1/4” tubing - Plant supply to UR Controller (Robot Gripper) and Diverter Valve
  - QTY: 1 Tee Fitting for 5/32” tubing - From exhaust on MultiGrip Vises to outside CNC
  - QTY: 1 Silencer and Fitting - Vise exhaust line connection to end of tubing on top of CNC (connected to 15 ft 5/32” tubing)
  - QTY: 7 Magnets with Loop - to aid routing of tubing in, on, and around CNC

**Refer to Appendix A for a pneumatic schematic*

Required Tools

- Hex Keys:
  - 1/4-inch
  - 3/8-inch
  - 3mm
  - 4mm
  - 5mm
  - 6mm
- Wrenches:
  - 9/16-inch open end wrench
  - 7/8-inch open end wrench
  - 8mm open-end wrench (QTY: 2)
  - 10mm open-end wrench
  - 13mm deep socket wrench
  - 13mm open-end wrench
  - 15mm open-end wrench
  - 17mm open-end wrench
  - Adjustable wrench (Crescent)
  - Ratchet for Deep Socket Wrench
- Torx Driver
- Hand Drill
- Drill Bits:
  - 0.22-inch (7/32”) or equivalent
  - 0.31-inch (5/16”) or equivalent
- Tube cutters
- Side cutting pliers
- Lineman’s Pliers (QTY: 2)
- Level
- Tape Measure
- Steel Square (or equivalent)
- Rubber mallet
- Ball Peen Hammer
- Flat Head Screwdriver (3.0 x 50mm or equivalent)
- Bench top vise
- Medium strength threadlocker (e.g., Loctite 243 blue)
- Spindle mount dial indicator 1/10,000” (0.0001”)

VersaCart Assembly

Section 3

Install UR Robot and Add Components to UR Controller

1. Final Assembly of VersaCart
    - Robot Pedestal
    - Casters
    - Foot Pads
2. Installation of Robot to Cart *<u>*requires 2 people*</u>
    - Route robot cable
    - Attach robot to pedestal
3. Installation of Teach Pendant on VersaCart
    - Route teach pendant cable
    - Install teach pendant on cart hangers
4. Installation of UR Controller Mill Panels
    - Attach bottom and side panels with existing bolts (replacing existing panels)
    - Connect Ethernet and digital output connector inside controller
5. Connect power and signal cables

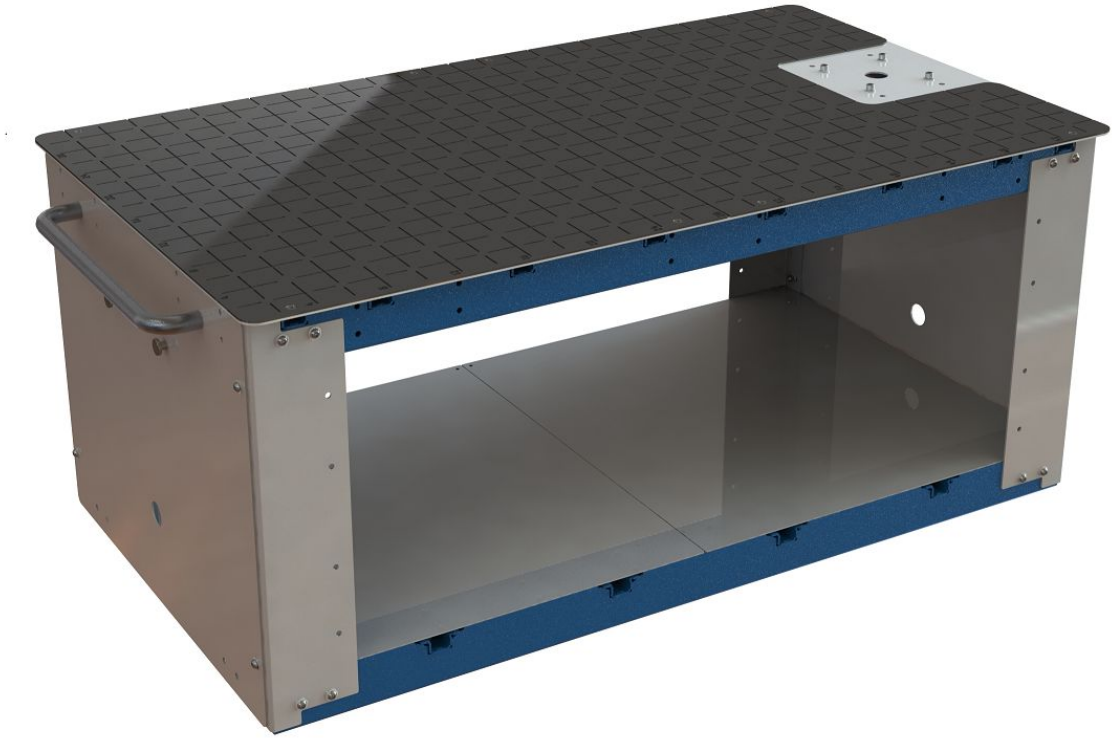
Install Robot Pedestal, Casters and Foot Pads

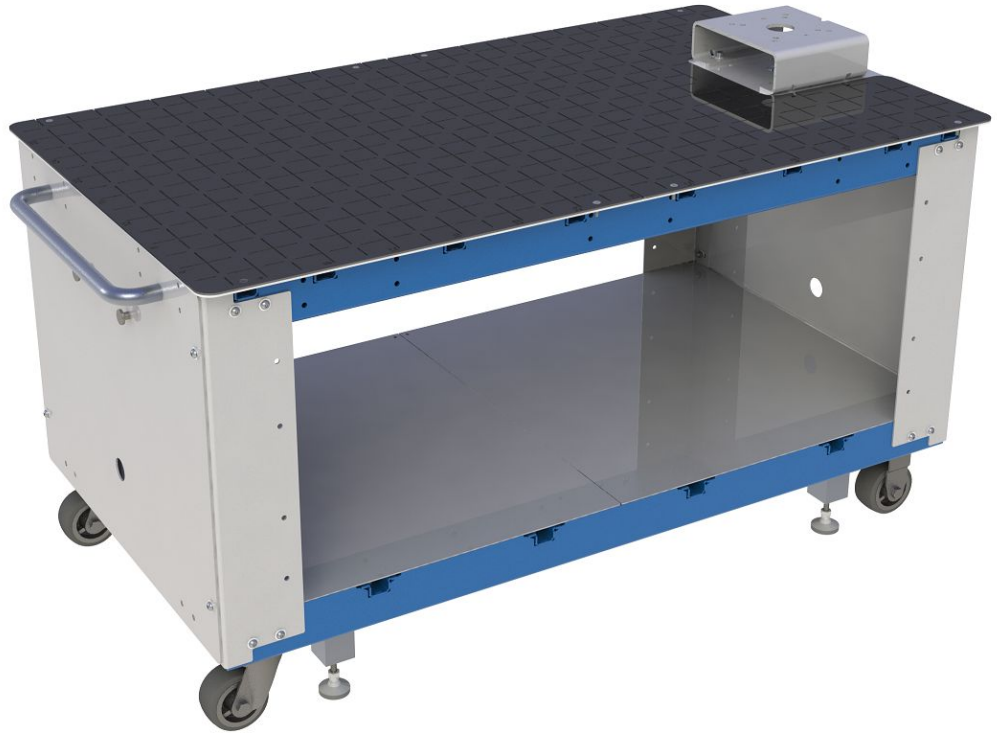
Tools:

- 5mm hex key
- 6mm hex key
- 15mm open-ended wrench
- 17mm open-ended wrench
- Medium Strength Threadlocker (e.g., Loctite)

Parts:

- Robot Pedestal with 4 x M8 Socket Head Screws x 45mm L and washers
- 4 x Casters with 16 x M8 Button Head Screws x 20mm L and washers
- 4 x Foot Pad assembly with 16 x M6 Socket Head Screws x 80mm L

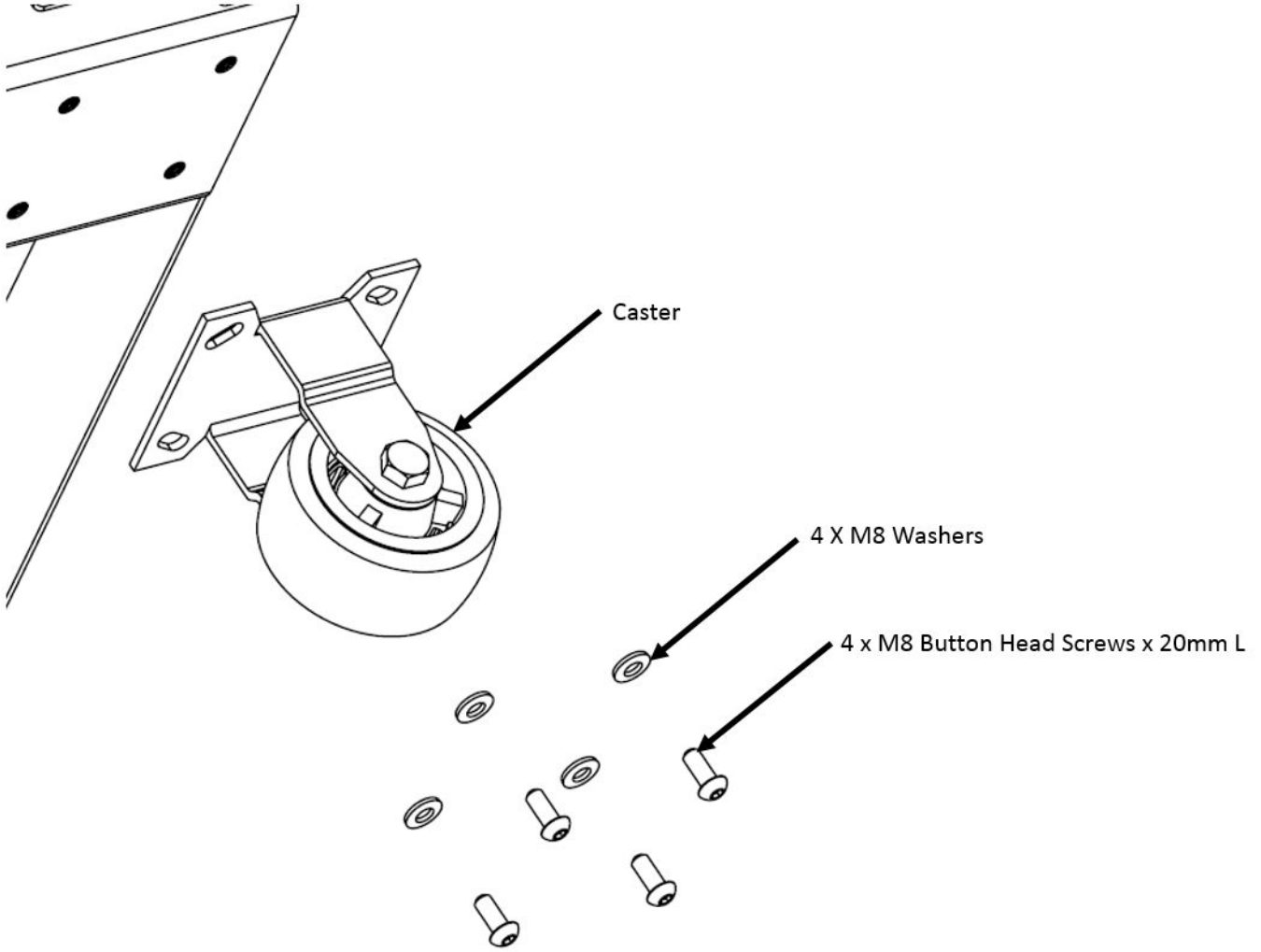




Install Casters

Steps:

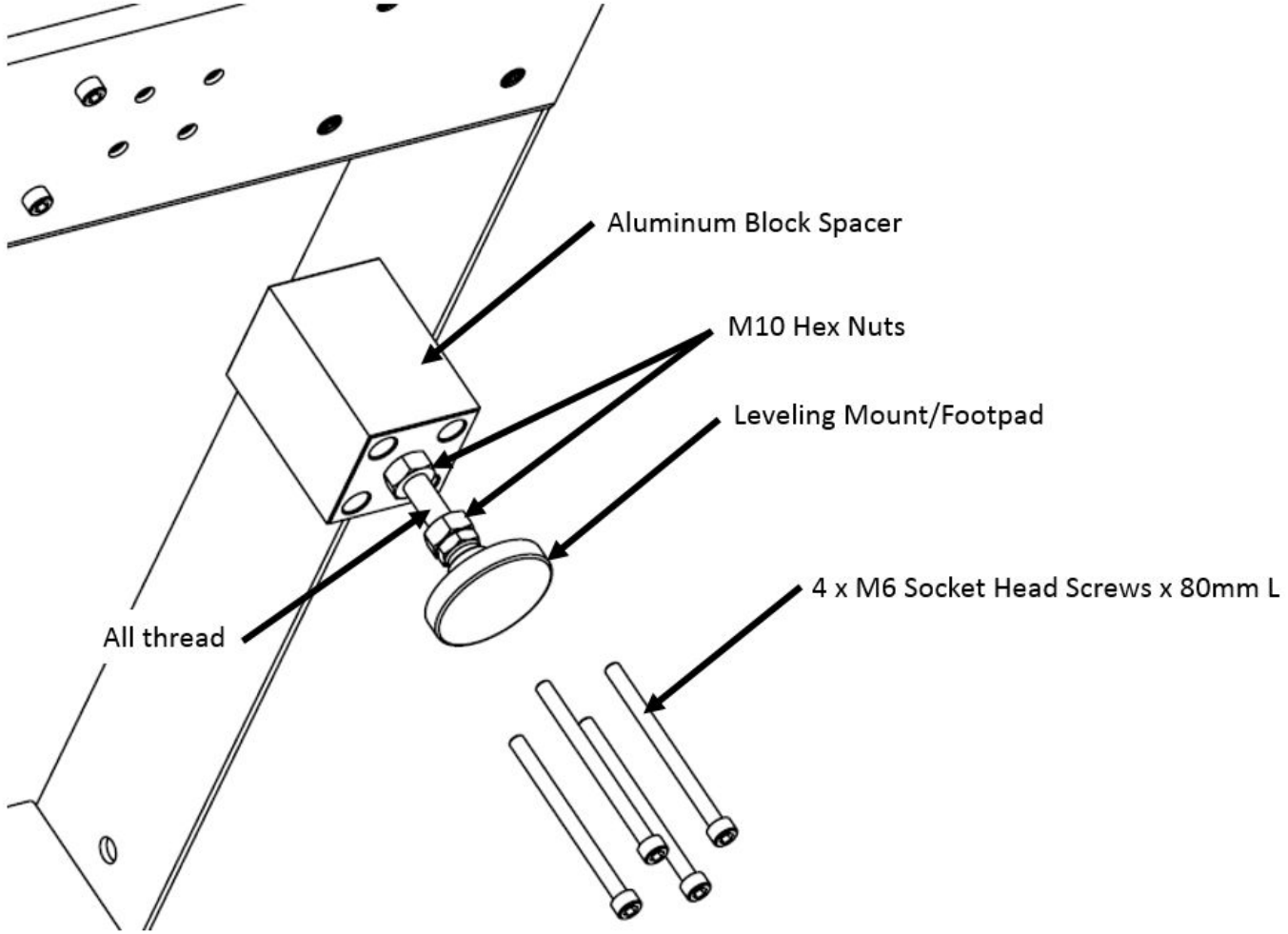
1. Position cart with access to bottom for caster and footpad installation, via one of the following methods
   - VersaCart on side
   - Lift VersaCart with pallet jack or forklift
2. Assemble 4 x Casters, noting the orientation:
   - Swivel casters on handle side of cart
   - Fixed casters on robot side of cart
   - Each caster is fastened with 4 x M8x1.25 BHCS x 20mm L and 4 x M8 washers



Install Foot Pads

Steps:

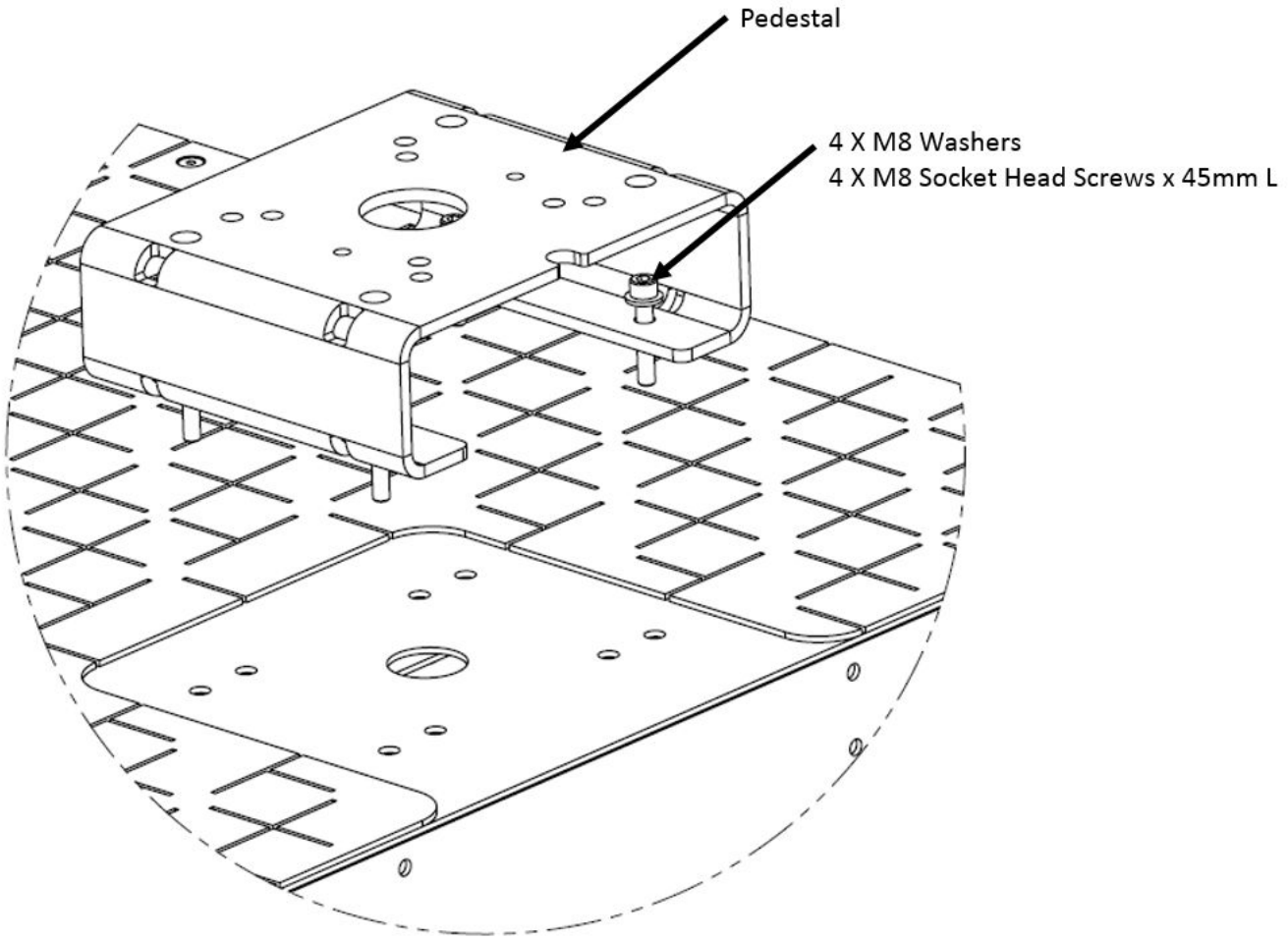
3. Assemble 4 x Footpads
   - Footpad assembly includes:
     - Aluminum block spacer with 4 x thru holes and M10 thread thru center
     - M10 all-thread
     - Leveling Mount/Footpad with M10 thread
     - 2 x M10 Hex Nuts
   - Each footpad is fastened with 4 x M6x1.00 SHCS x 80mm L
   - Adjust footpads such that the when placed on the ground, the weight of the cart is on the casters



Install Pedestal

Steps:

4. Position cart resting on 4 casters
5. Assemble Robot Pedestal to Cart top
    - Locate pedestal in open space on top of cart
    - Fasten with 4 x M8x1.25 SHCS x 45mm (with threadlocker) and 4 x M8 washers

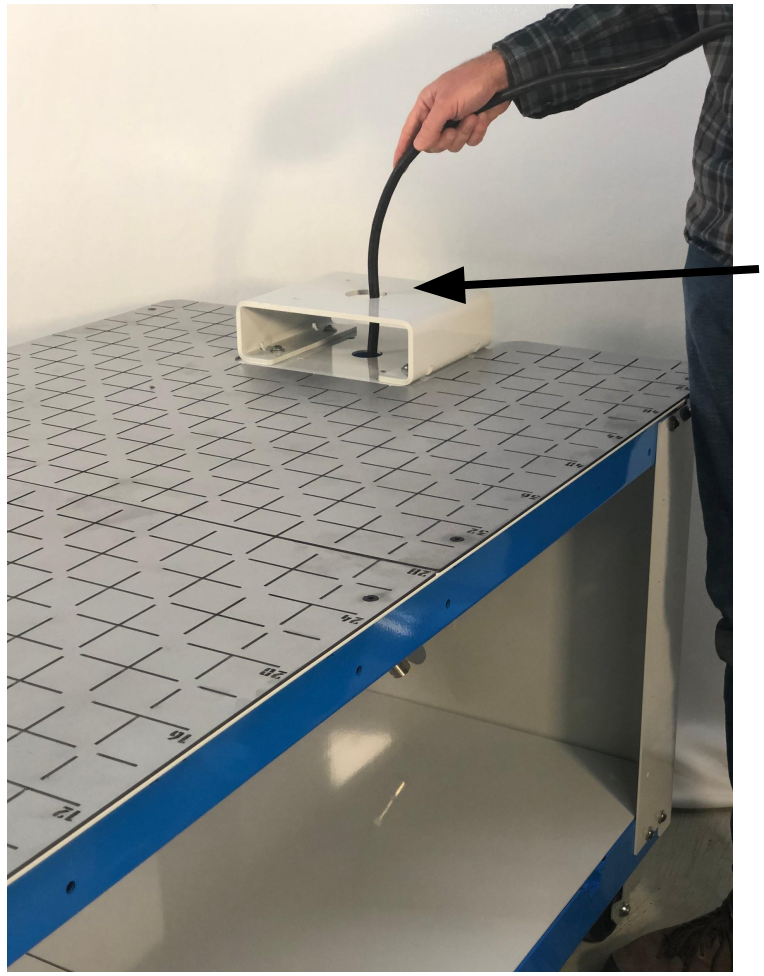


Install UR10e Robot on VersaCart 10

- Tools:
  - 6mm hex key
  - 13mm open-ended wrench

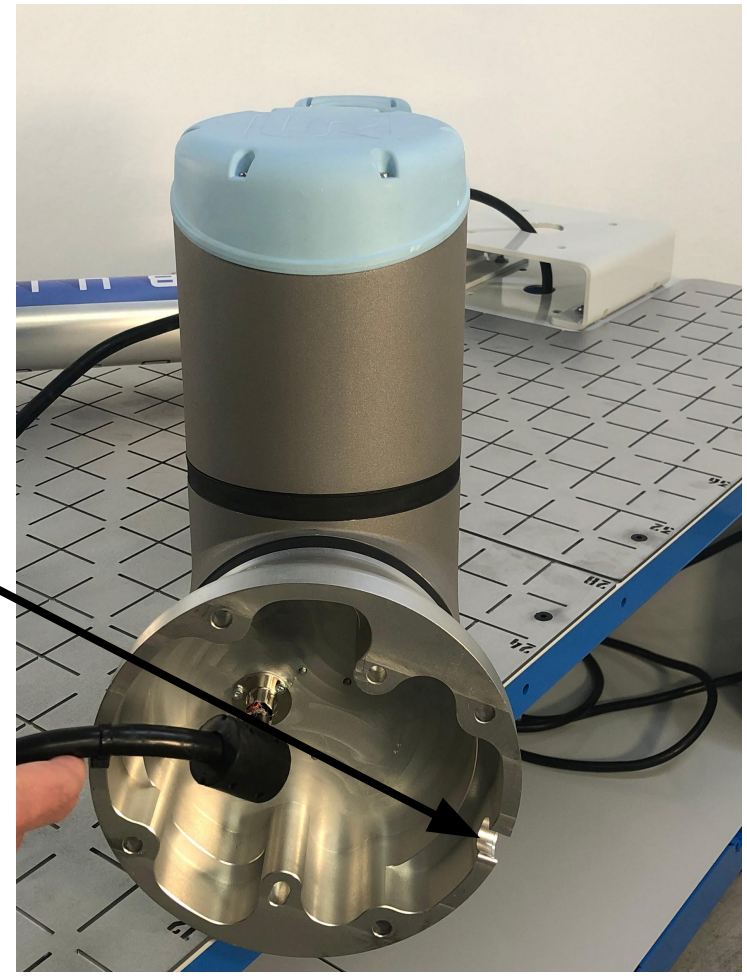
- Parts:
  - UR10e Robot
  - VersaCart 10
  - 4 x M8 Socket Head Screws x 30mm L
  - 4 x M8 Hex Nuts

Route UR10e Cable



ROBOT POWER DISCONNECTED

- Place robot on VersaCart table top
- Route robot cable through hole in VersaCart robot stand and table top
- Pull robot cable out of slot in UR robot base so the cable can pass through the bottom of the robot

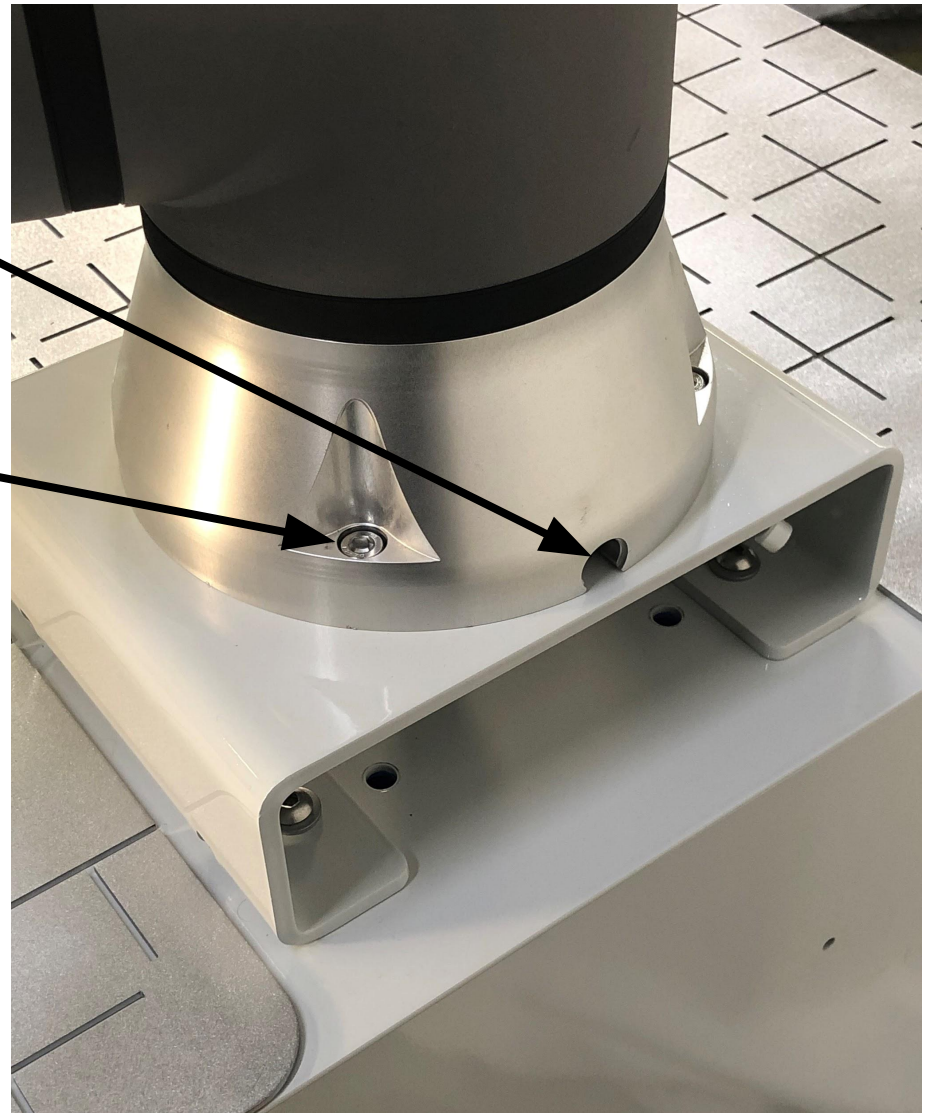


Locate and Secure UR10e Robot on VersaCart 10

- Position UR10e robot on VersaCart pedestal, with the robot's cable slot in the base positioned to the back of the VersaCart

- Secure the UR10e robot to the VersaCart robot pedestal with 4 x M8 Socket Head Screw x 30mm Length - Apply a small drop of medium strength threadlocker to each fastener

Note: *Screws are attached with captive hex nuts press-fit into the bottom side of the pedestal. If necessary, use a 13mm wrench on the captive hex nut while tighten screw into place.*

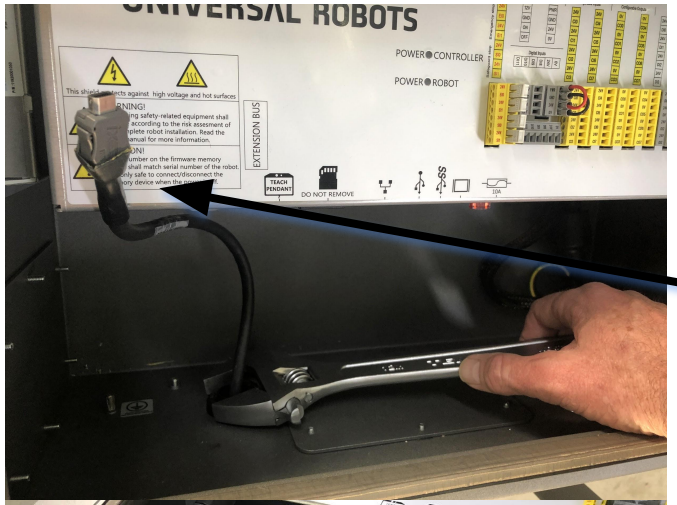


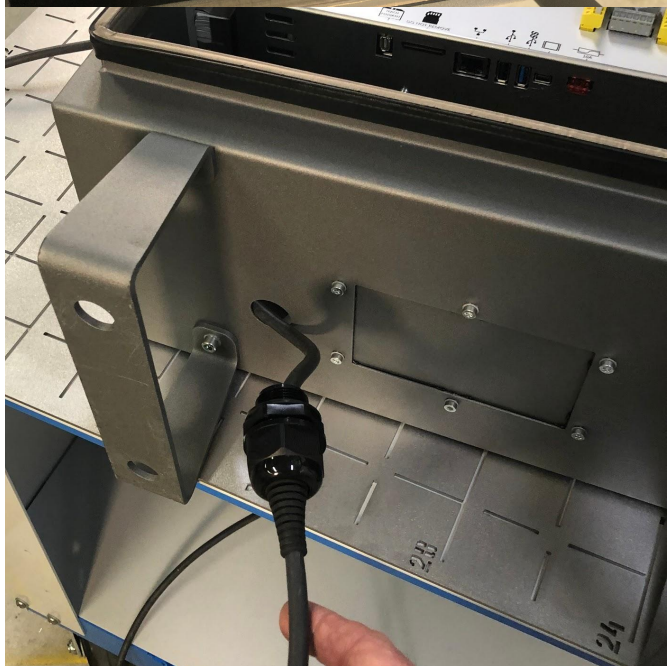
Route UR Teach Pendant Cable

- Tools:
  - Adjustable wrench

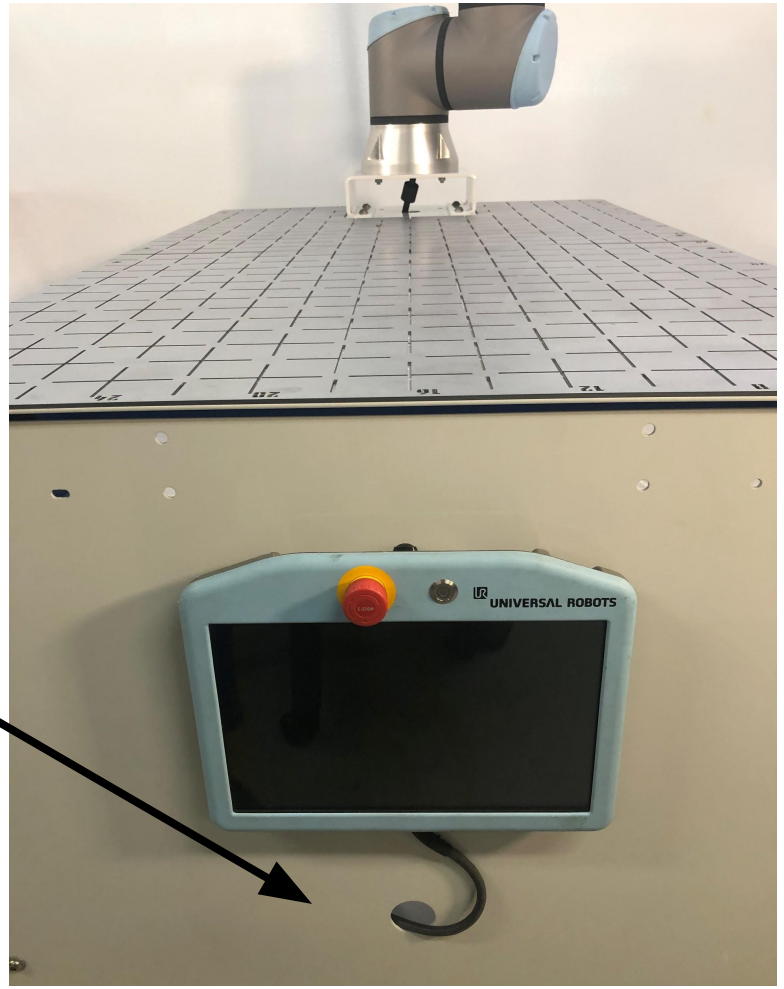
- Parts:
  - UR Controller
  - Teach Pendant

Route UR Teach Pendant Cable





- Lay the UR controller on the top of the cart and open the access door
- Disconnect the teach pendant connector by pressing the sides and pulling down
- With adjustable wrench, loosen and remove the teach pendant bulkhead fitting at the bottom of the UR controller
- Route the teach pendant cable through the hole in the VersaCart and hang the teach pendant as shown
- Reinstall the teach pendant bulkhead fitting and plug in the teach pendant connector in the UR controller

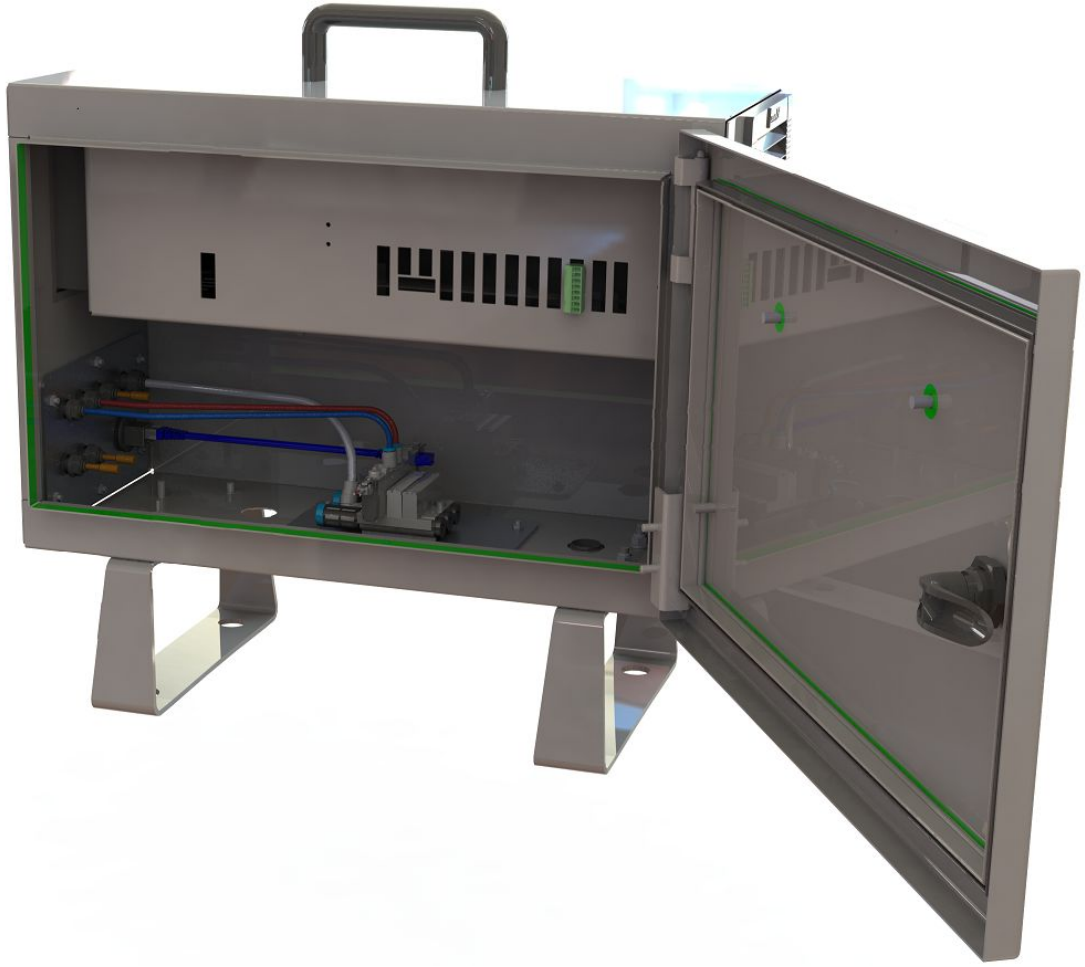


Install UR Controller Panel

- Tools:
  - Torx Driver

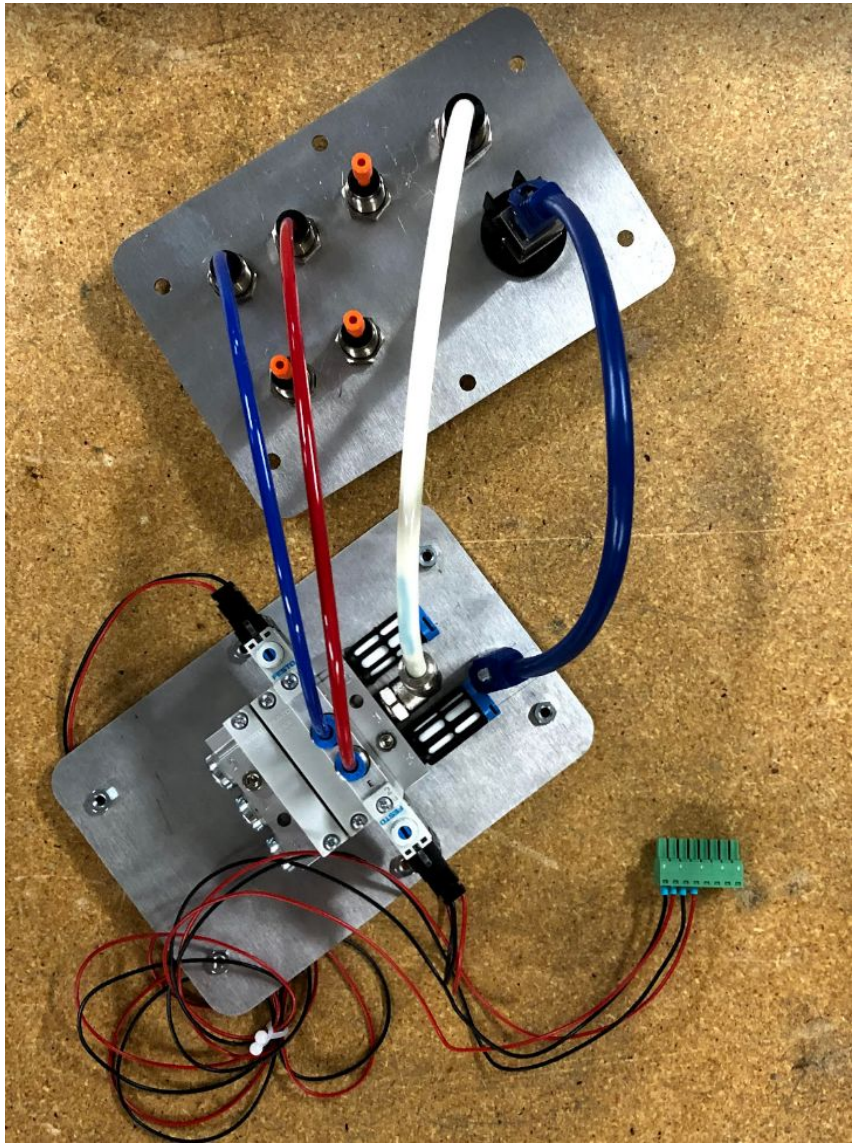
- Parts:
  - UR Controller Panel - Side Panel with bulkhead fittings and panel mount Ethernet connector
  - UR Controller Panel - Bottom Panel with pneumatic valve assembly
  - Tubing is pre-routed between panels
  - Ethernet cable
  - Digital output connector, pre-wired to pneumatic valve

*Panels replace existing panels on UR controller, using same hardware to re-attach

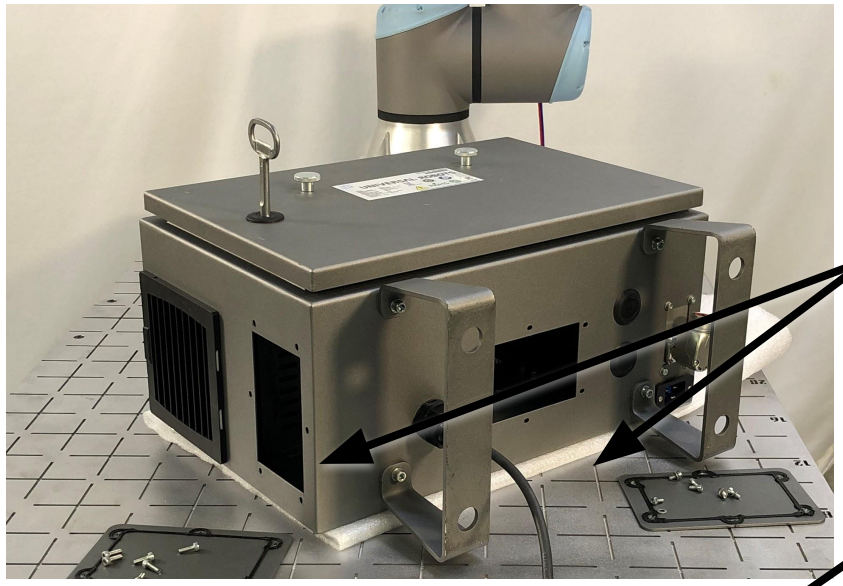


Install UR Controller Panel

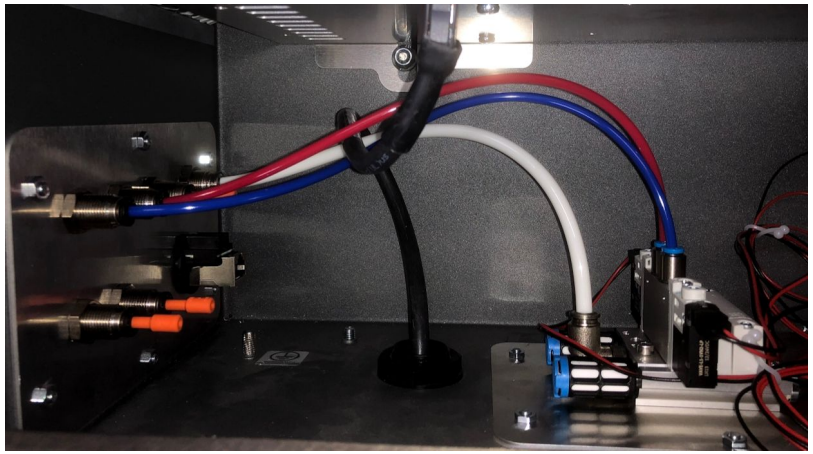
The image to the right shows the UR Controller Panels as packaged, ready for installation



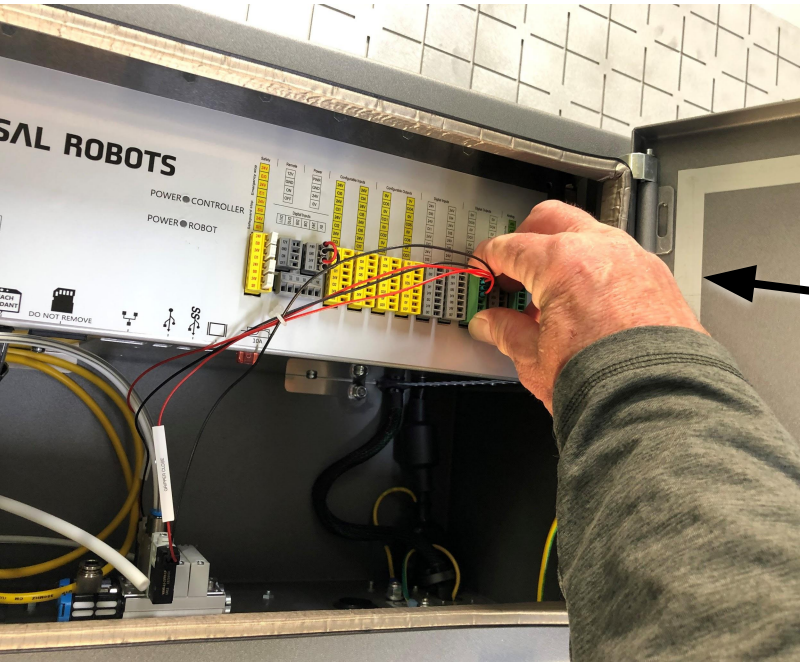
Install UR Controller Panel



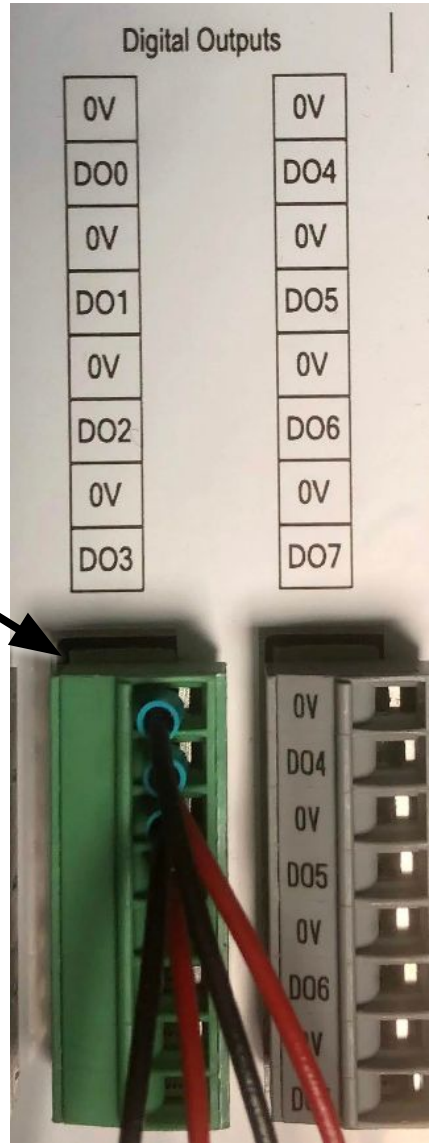
- Remove existing cover plates on side and bottom of controller with Torx driver (keep Torx screws for next step)
- Attach the UR Controller Side and Bottom Panels to the UR robot controller, using existing bolts
- Tubing connecting the panels is pre-installed. 1/4” tubing is supply air, and 5/32” tubing is gripper open/close.



InstallUR Controller Panel



- Remove the IO plug for **DO0-DO3** and install the supplied Gripper IO plug connected to the Gripper valve manifold into the UR robot controller as shown
- Connect 12-inch **Ethernet cable** from the side panel panel mount Ethernet connector to the UR internal Ethernet connection



Connect Robot Power and Signal Cables

- Attach the UR robot cable to the UR robot controller
- Position UR robot controller in the VersaCart underneath the robot as shown
- **Do not power-up the robot yet**

MultiGrip FJ Gripper Installation

Section 4

Install MultiGrip FJ Gripper

- Tools:
  - 4mm hex key
  - 5mm hex key
  - 2 x Lineman's Pliers
  - Side cutting pliers
  - Medium Strength Threadlocker

- Parts:
  - MultiGrip FJ Gripper assembly
  - 4 x M6x1.0 SHCS x 12mm L
  - 1 x 15-foot length of Red 5/32" tubing
  - 1 x 15-foot length of Blue 5/32" tubing
  - 8 x 16" Long Cable Ties (Zip ties)

Install MultiGrip FJ Gripper

1. **Power up the robot** and position the end of arm in a convenient location for Gripper assembly

Base	**+10°**
Shoulder	**-80°**
Elbow	**+90°**
Wrist 1	**-10°**
Wrist 2	**+90°**
Wrist 3	**-180°**

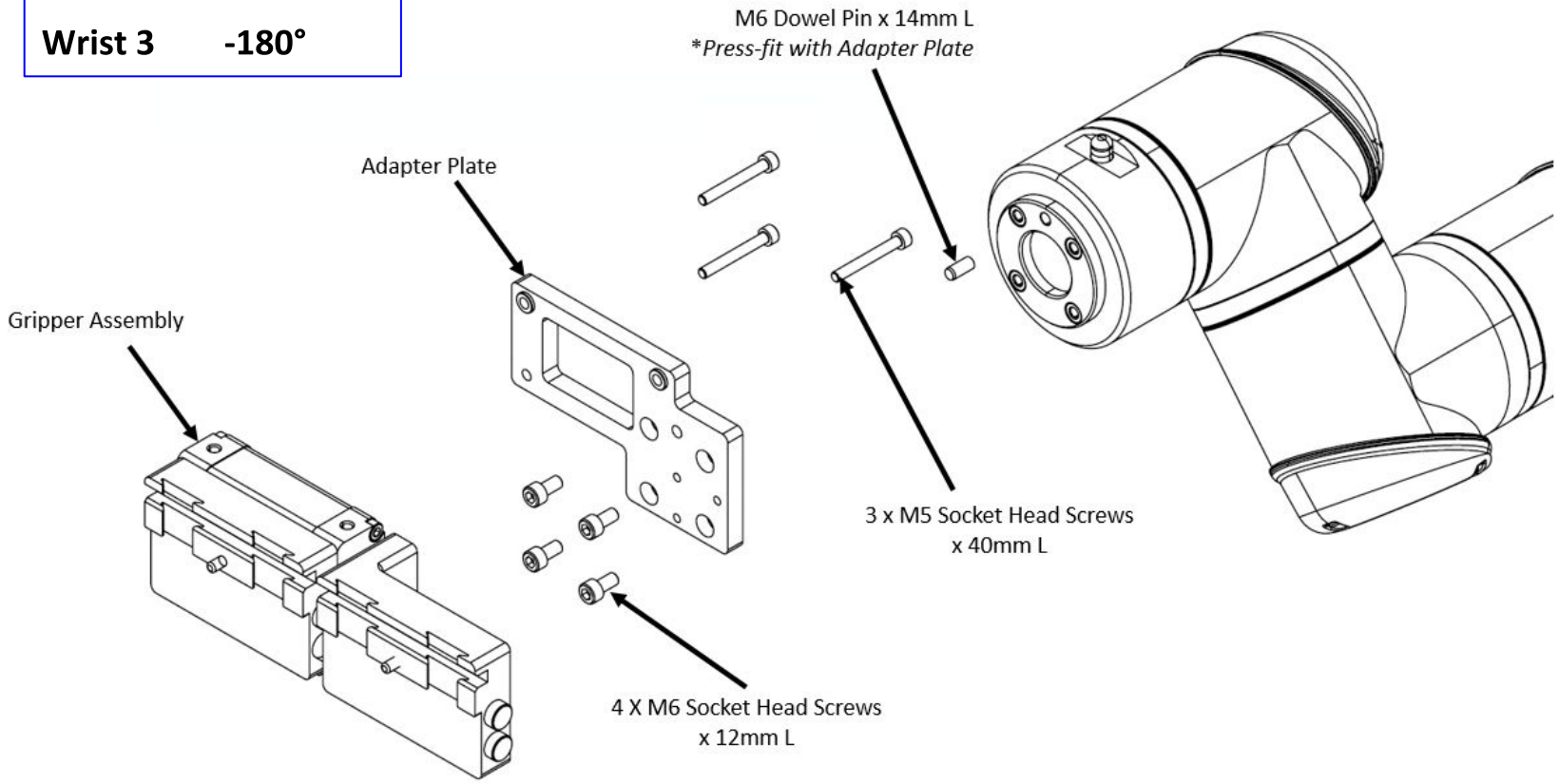
2. Place a small drop of thread locker onto each bolt in the MultiGrip FJ Gripper Fasteners package

3. Attach the Adapter Plate to the robot:

   Align the Adapter Plate with the M6 dowel pin to mating features on the robot end of arm

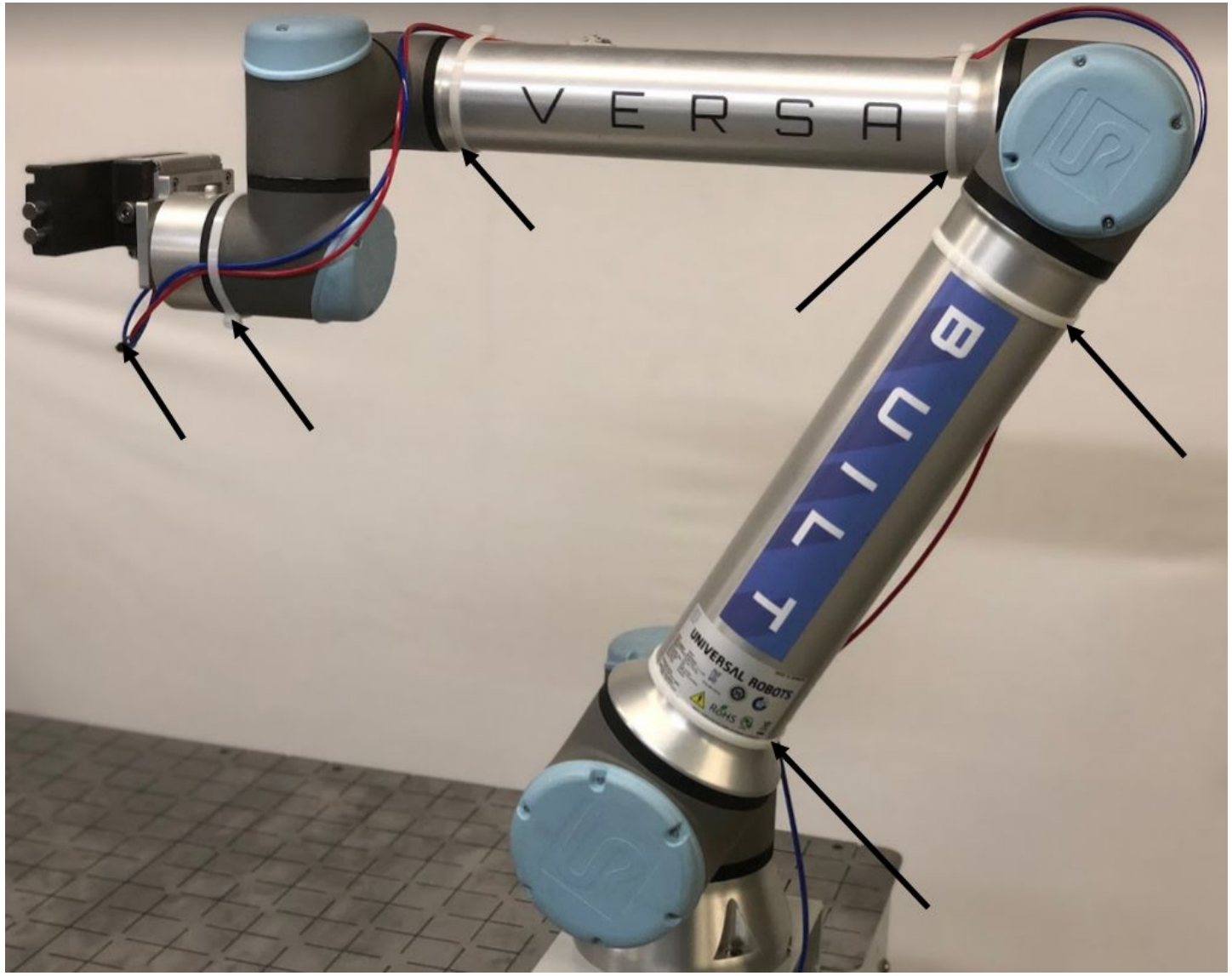
   Secure the Adapter plate with 4 x M6 Socket Head Screws x 12mm L

4. Attach the Gripper Assembly to the Adapter Plate with 3 x M5 Socket Head Screws x 40mm L



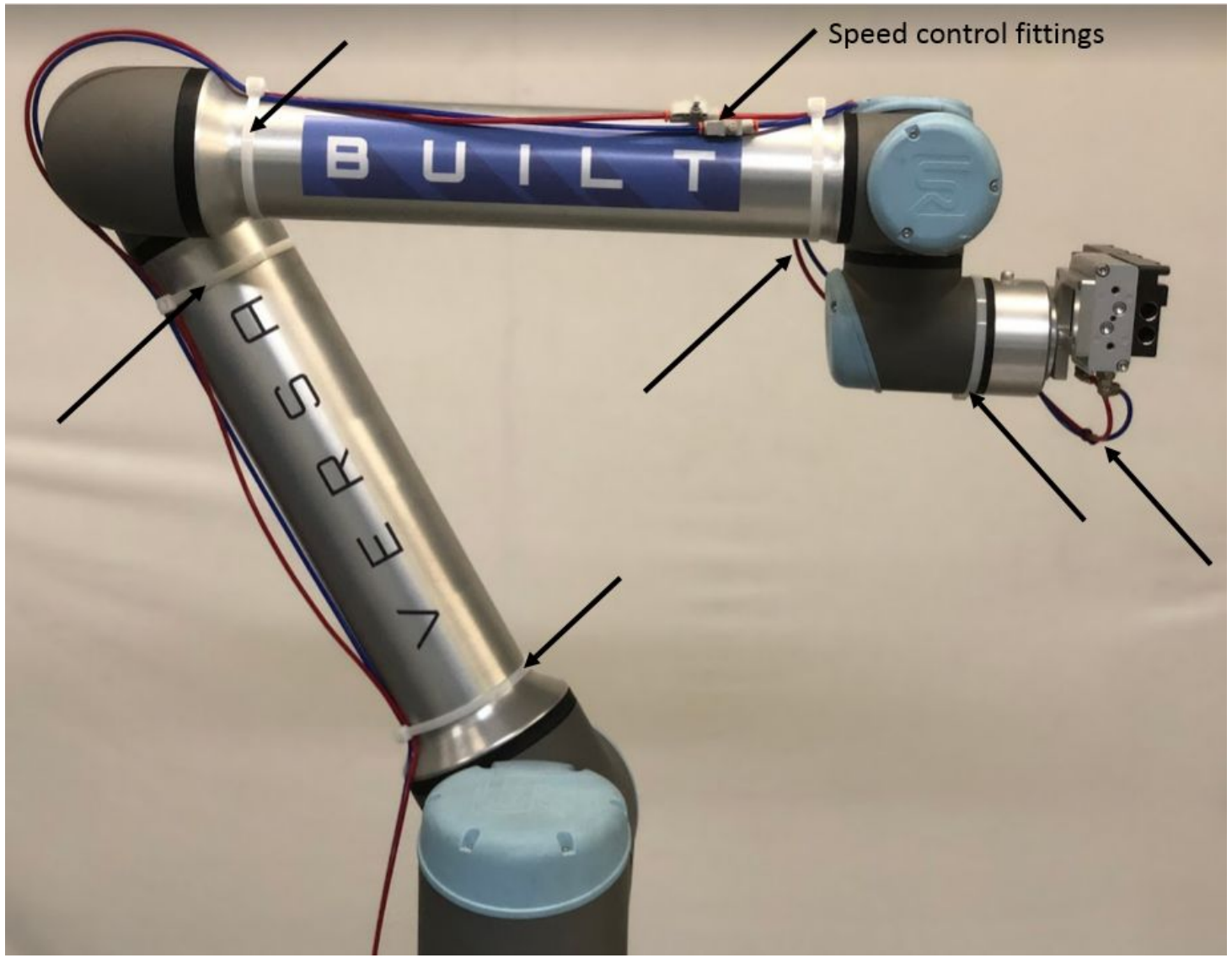
Route MultiGrip FJ Gripper Air Lines

- Insert the Gripper Air Lines into the gripper air fittings as shown
  - Blue tubing is Gripper Open
  - Red tubing is Gripper Close
- Using 1 x 18” cable ties, loosely secure the airline on the lower and upper aluminum arms (*arrows in image to the right show cable tie location*)
- Allow for a loop of airline length between the last anchor point on the upper arm and the gripper as shown
- Route air lines behind rear side of robot, then thru hole below pedestal and attach to the UR Controller Panel, as shown on the following pages



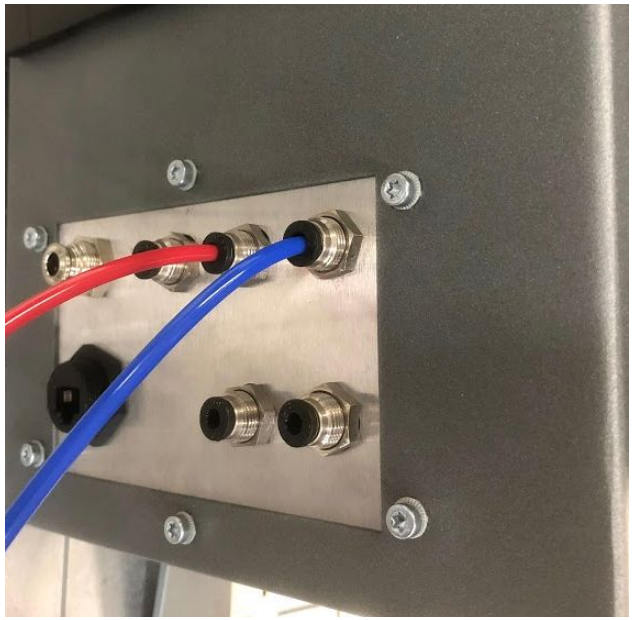
Route MultiGrip FJ Gripper Air Lines

- Note the location of the Speed Control Fittings, with the control direction pointed toward the gripper. The fittings are controlling flow into the gripper, while allowing free-flow of air out of the gripper.
- The speed fittings purpose is to slow down the gripper opening and closing speed
- Gripper open to close and close to open cycles should be between ¼ and ½ of a second
- For speed adjustment, tighten the screw on the fitting. Once set to proper speed, tight the nut on the fitting.



Route MultiGrip FJ Gripper Air Lines

- Using two sets of pliers, tighten each cable tie by pulling on the end of the cable tie with one pair of pliers while pushing on the locking mechanism with the other pliers
- The air lines should be slightly compressed by the cable ties
- Connect air lines to the UR Controller Panel, as shown below



Robot2CNC Mill Edition Installation

Section 5

Robot2CNC Mill Edition Parts and Tools

Parts:

- Robot2CNC Mill Panel
- 5 Port Ethernet Switch
- 110 VAC to 24VDC Power Cable
- Cycle Start Cable
- 3-Foot Ethernet Cable
- 2 x 25-foot Ethernet Cables
- Shut-off valve assembly
- Pressure Gauge
- DIN Rail with mounting hardware
- Adhesive-back Rubber Pad
- 4 x 1/4” to 5/32” reducer fittings

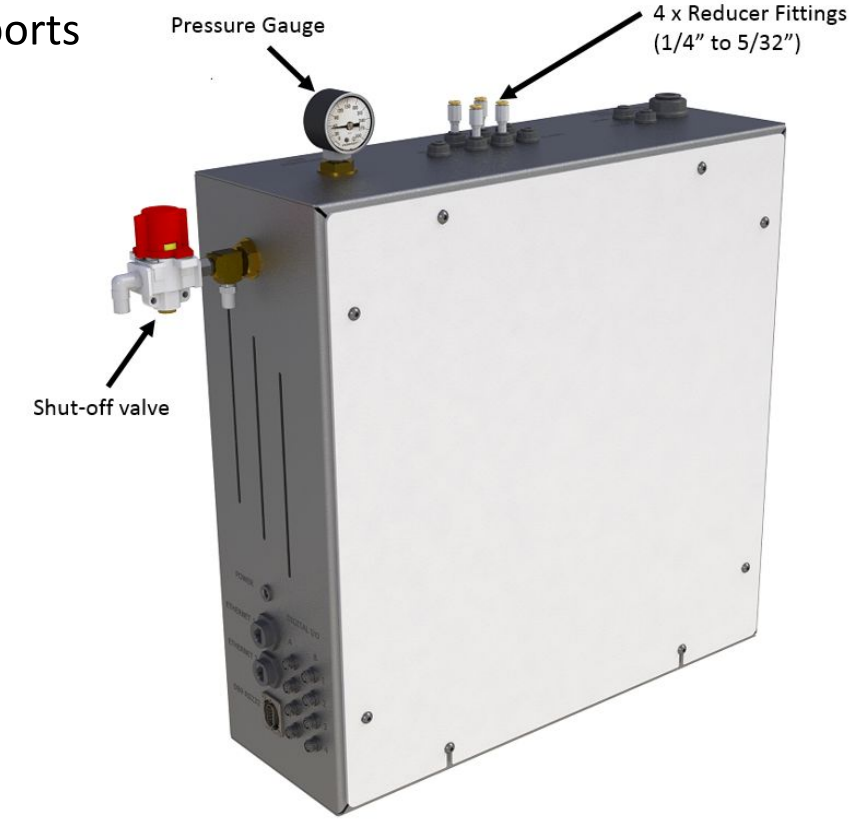
Tools:

- Tape Measure
- Level
- Hand Drill
- 0.22” (7/32”) or equivalent drill bit
- 3mm Hex Allen Key
- 8mm open-end wrench
- 9/16” open-end wrench
- 7/8” open-end wrench

Assemble Robot2CNC Mill Edition

Steps:

1. Assemble components to panel
    - Shut-off valve assembly
    - Pressure Gauge
    - Insert 4 x 5/32” to ¼” reducer fittings in Vise 1 & 2, Open/Close ports



Position and Mount Robot2CNC Mill Edition

Steps:

2. Determine Mounting locator for panel
    - Side of CNC
    - Top of CNC
    - Wall or Racks near CNC

    *Optimal location is near the right side of the CNC within 10 feet of front of CNC

    *Power cable requires 110 VAC outlet

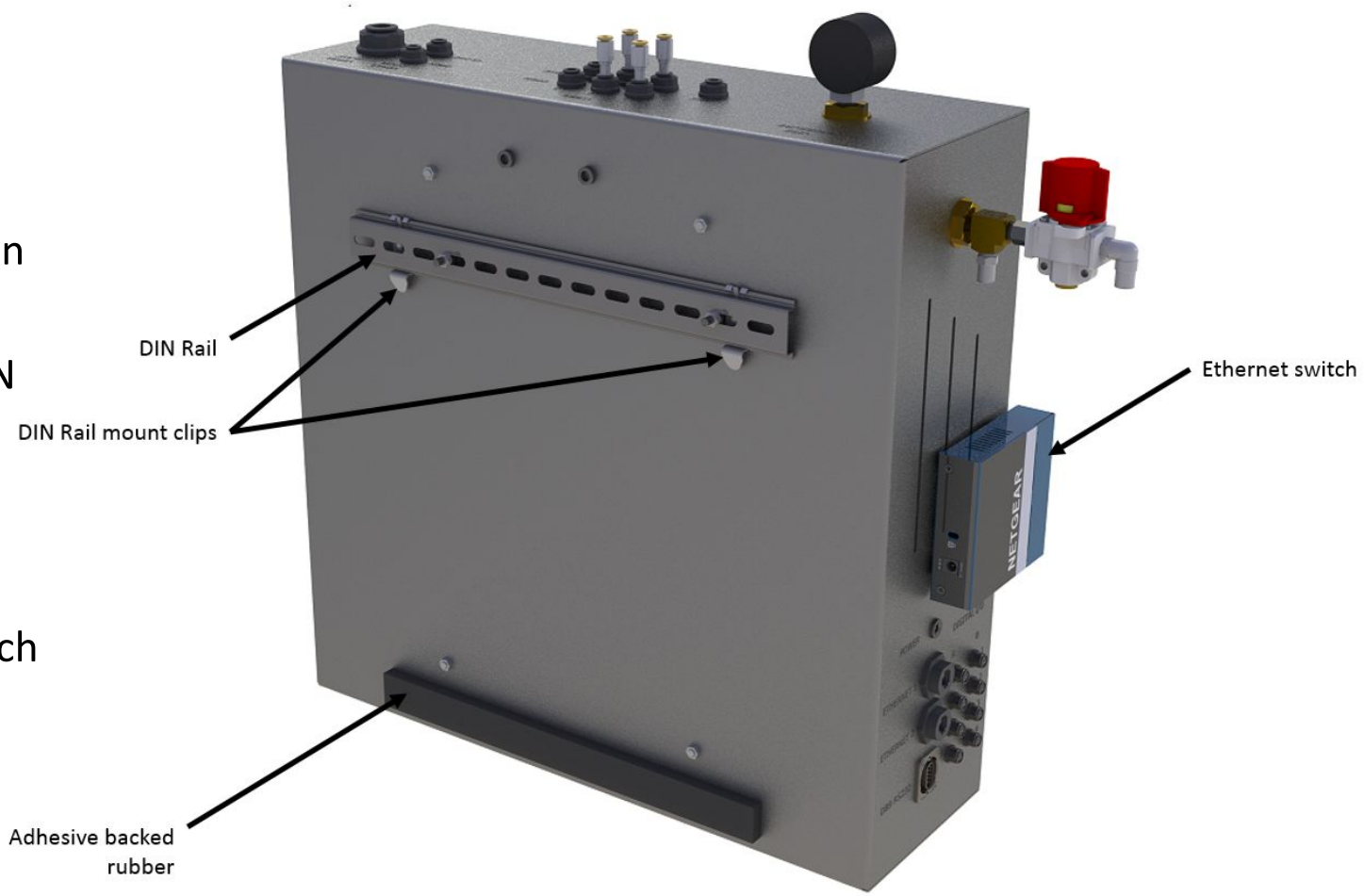
    *5 Port Ethernet switch connects to Robot2CNC Mill Edition with 3-foot Ethernet cable

Position and Mount Robot2CNC Mill Edition

Steps:

3. Install DIN rail with supplied M5 screws or with traditional fasteners (not included) thru clearance slots, 0.23” wide
4. Attach adhesive backed rubber, with most common location shown in image to the right
5. Secure Robot2CNC Mill Edition to DIN Rail with DIN Rail Clips pre-installed on panel

   Attach Robot2CNC Mill Edition to DIN Rail **verify solid attachment*
6. With adhesive backed velcro, attach Ethernet switch
7. Connect supplied Ethernet cable (3-ft length) from Ethernet Port 1 to Ethernet Switch
8. Connect power supply



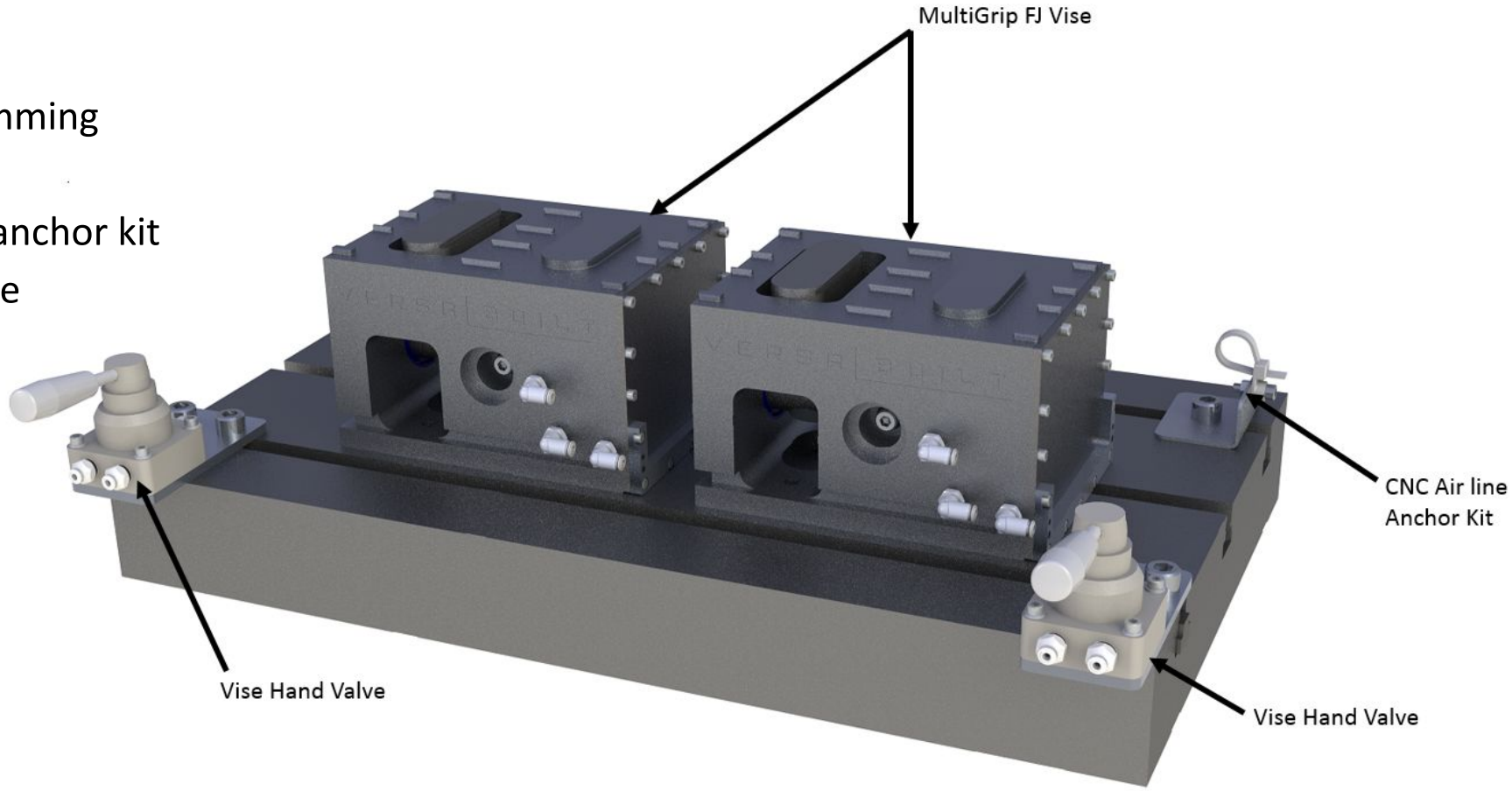
MultiGrip FJ Vise Installation

Section 6

MultiGrip Vises and CNC Components

Steps:

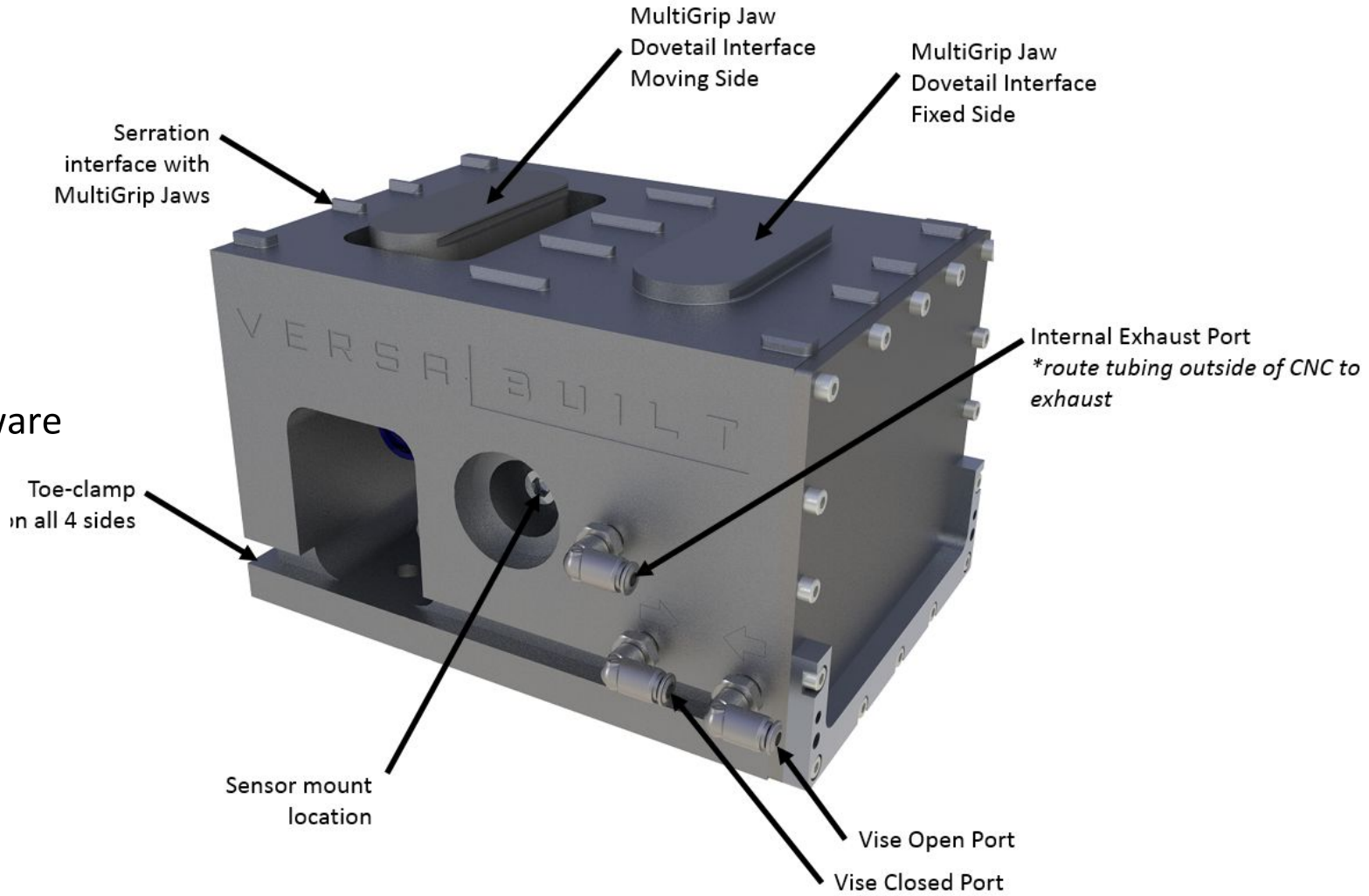
1. Install Vise Sensors
2. Install Vises in CNC
3. Alignment and Tramming
4. Install Hand Valves
5. Install CNC Air line anchor kit
6. Install Diverter Valve



MultiGrip FJ Vise Overview

The MultiGrip FJ Vise includes the following features:

- ⅛ NPT ports, 3 per side
  - Plug un-used side
  - Vise Open
  - Vise Closed
  - Internal Exhaust Port
- Sensor mount, front and back available
  - Only 1 sensor required
  - Plug un-used side with supplied hardware
- Toe-clamp feature around vise
- MultiGrip Jaw interface features
  - Fixed dovetail
  - Moving Side dovetail
  - Serrations
- Clamp with both OD and ID MultiGrip Jaws



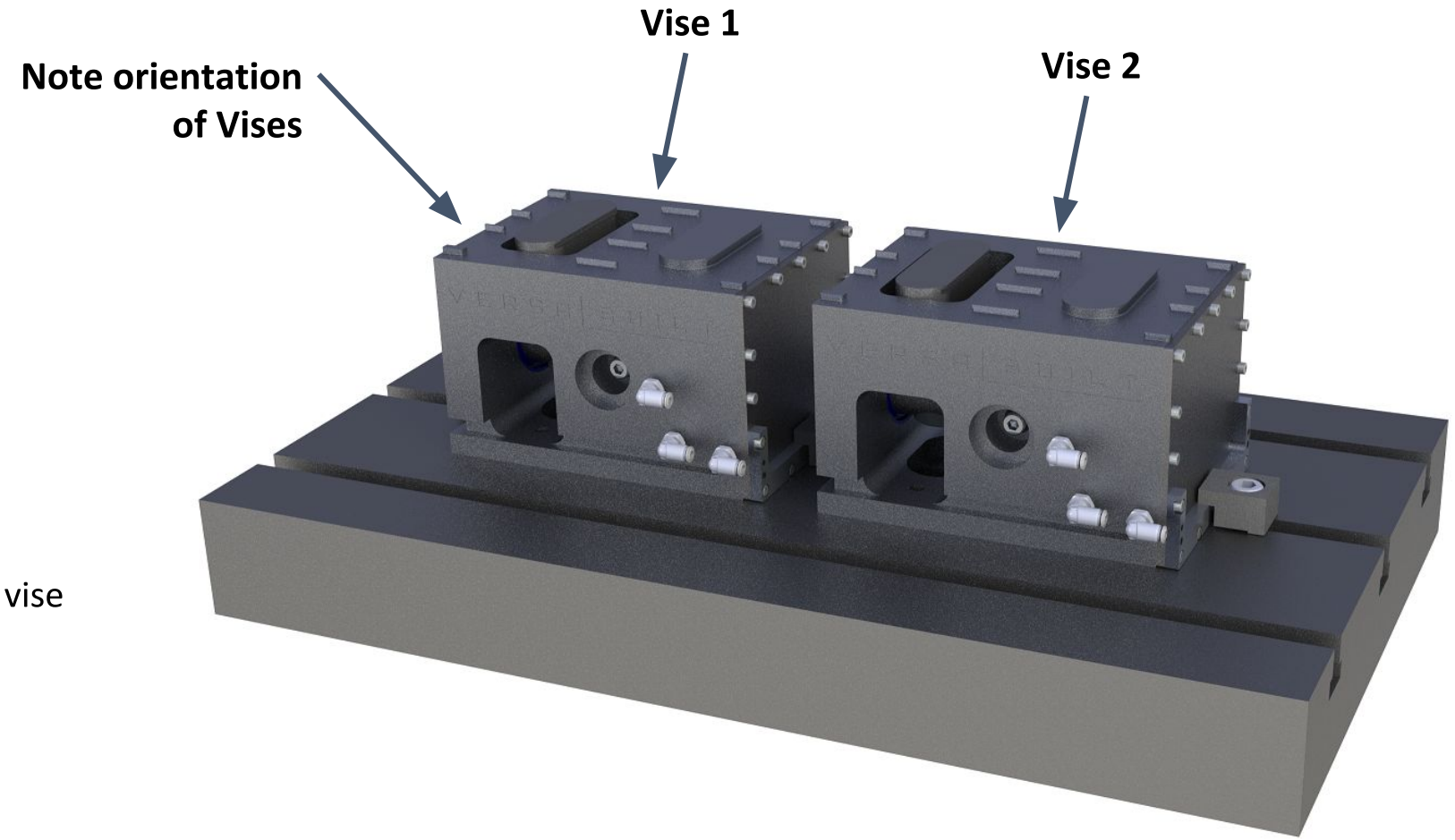
MultiGrip FJ Vise Installation

Tools:

- 13mm wrench
- 3/8” Hex Key
- Torque wrench
- Tape Measure
- Spindle mount dial indicator

Parts:

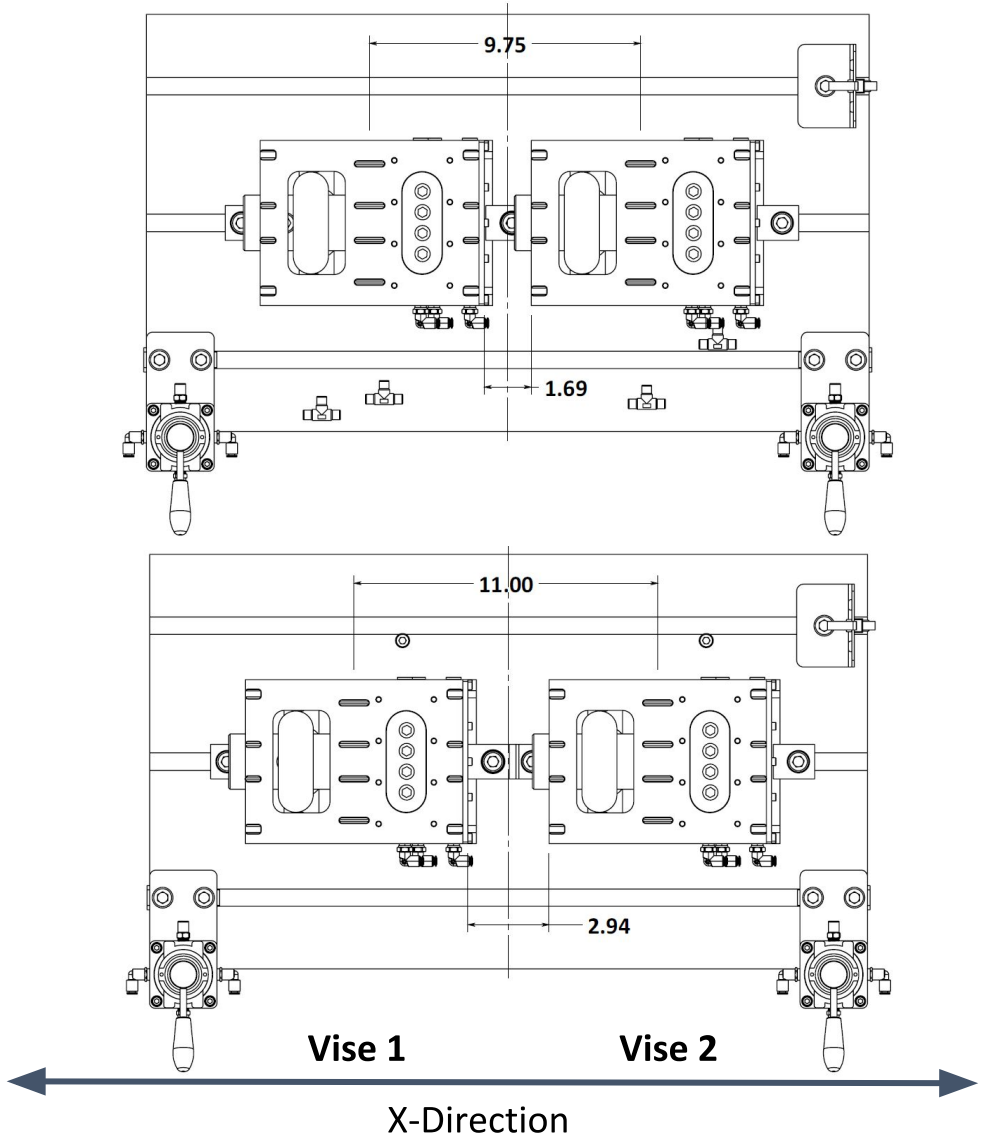
- 2 x MultiGrip FJ Vises
- 2 x L-Mount Clamps
- 1 x T-Mount Clamp
- 2 x 0.50-13 Socket Head Screw x 1.25” L per vise
- 2 x 0.50-13 T-Nut per vise
- 3 x 5/32” x 1/8 NPT fittings per vise



MultiGrip FJ Vise Installation

Vise installation & tramming steps:

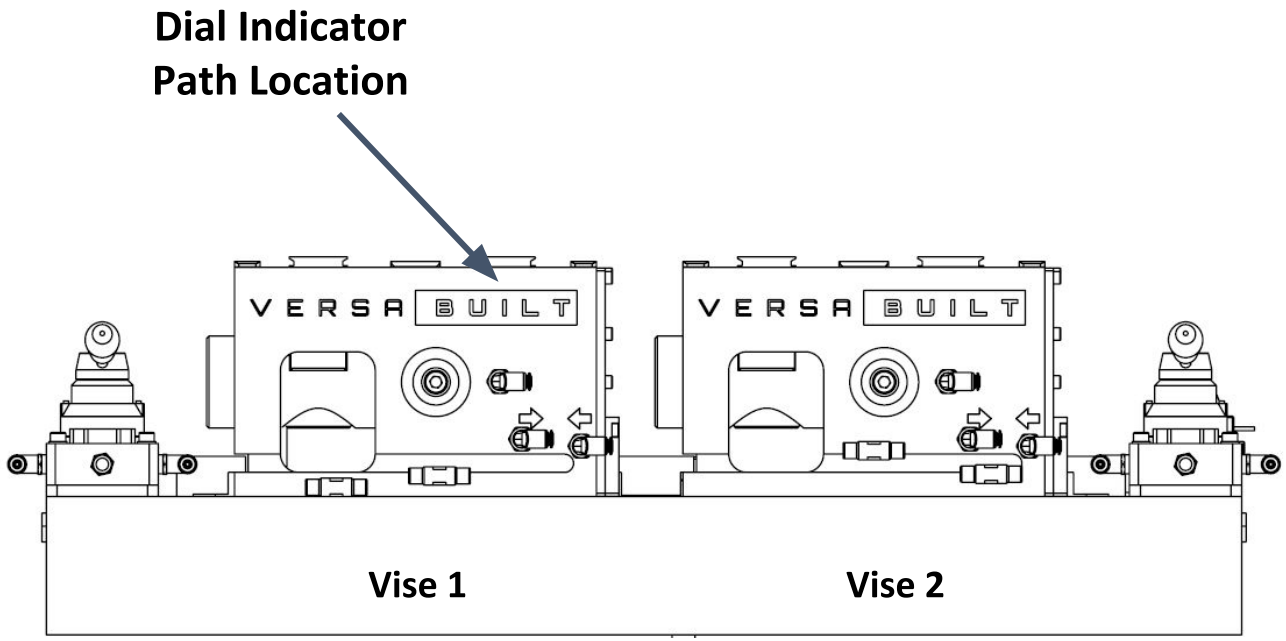
1. Attach 5/32” fittings with 13mm wrench
2. Wipe down CNC table, clean and free of debris
3. Wipe down bottom side of vise, clean and free of debris
4. Measure CNC table center and mark
5. Vise Spacing:
   a. For CNCs with X travel less than 22”: Center of vises are spaced 9.75” on center or with 1.69” gap, as shown in upper drawing
   b. For CNC with X travel greater than 22”: Center of vises are spaced 11” on center or a 2.94” gap, as shown in lower drawing
6. Place Vise 1 on Table
7. Place center clamps in T-Slots
   a. For CNCs with X travel less than 22”, insert T-Clamp, with 0.5” bolt and t-nut
   b. For CNCs with X travel greater than 22”, insert 2 x side clamps, with 0.5” bolt and t-nut
8. Place Vise 2 on Table
9. Insert Side-Clamps on sides of vises
10. Loosely clamp vises in place



MultiGrip FJ Vise Tramming

Vise installation & tramming steps:

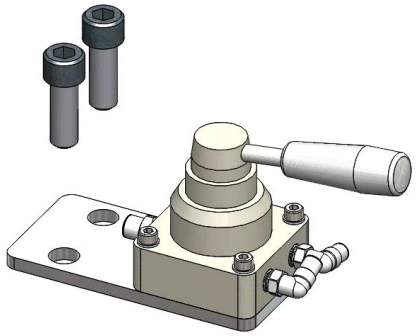
11. Install spindle mount dial indicator
12. Engage dial indicator with vises on the front surface, above the engraved VersaBuilt logo
13. Move Table/Spindle relative to each other in the X-direction, aligning the front of each vise with the X-axis of the machine
14. Adjust position of vises as needed and re-measure with dial indicator
15. Lock down position of vises with clamps, with T-nuts and 0.50-13 Socket Head Screws, **tightening to 118 ft-lbs of torque**

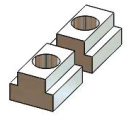


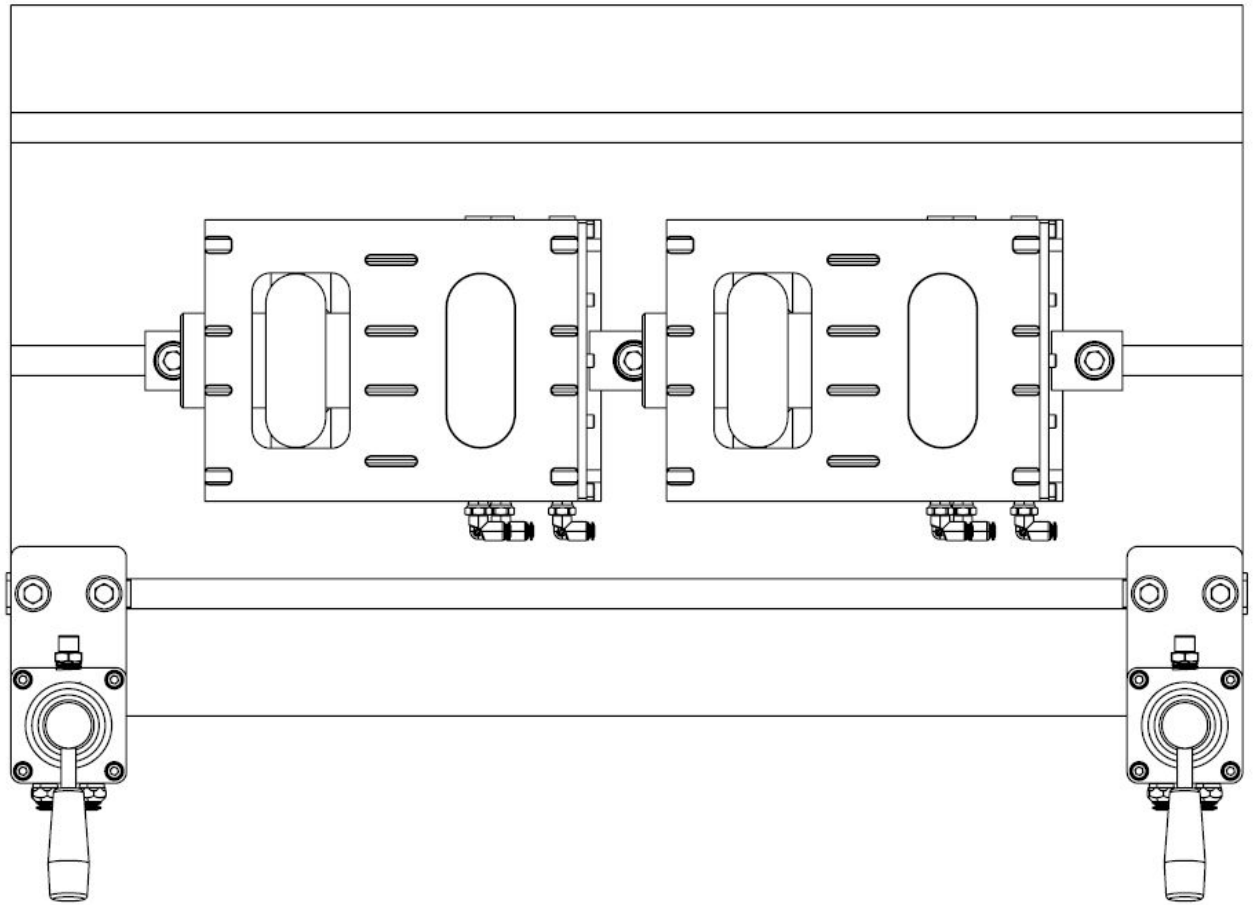
Attach Hand Valves to CNC table

- Each hand valve includes the following hardware:
  - 2 x 0.50” Socket Head Screw x 1-3/8” L
  - 2 x 0.50” T-Nuts
  - Valve mounted to base plate

- The image to the right shows a convenient location for attaching the hand valves to the CNC table **Routing and connecting air lines is shown in Section 9*





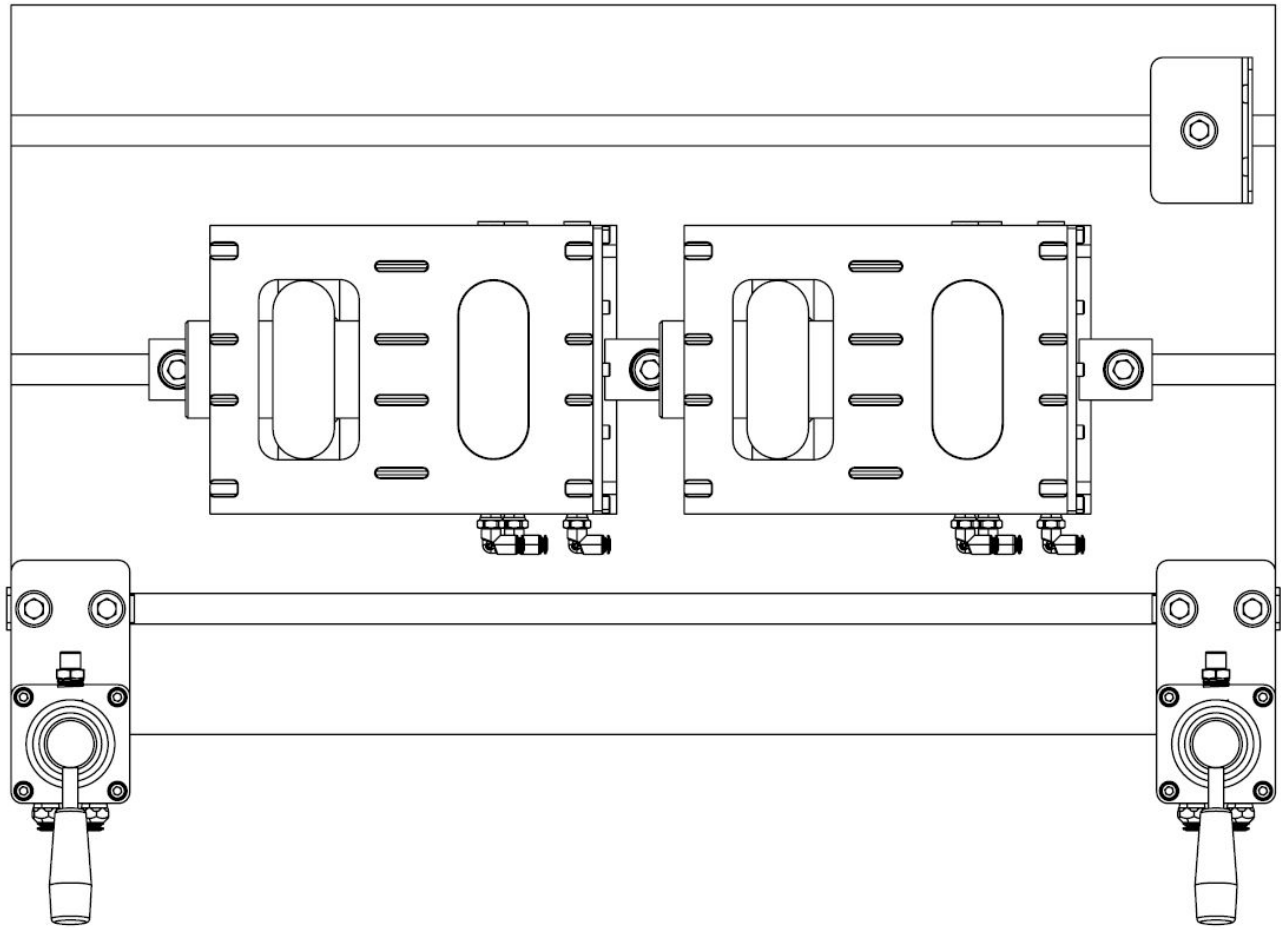


Attach CNC Air Line Anchor kit to CNC table

- The purpose of the CNC Air Line Anchor Kit is to provide a routing anchor and strain relief for pneumatic tubing and signal cables

- Each CNC Air Line Anchor kit includes the following hardware:
  - 1 x 0.50” Socket Head Screw x 1-3/8” L
  - 1 x 0.50” T-Nuts
  - Mount bracket
  - 3 x screw mount cable ties
  - 3 x M6 Socket Head Screws x 20mm L
  - 3 x M6 Hex Nuts

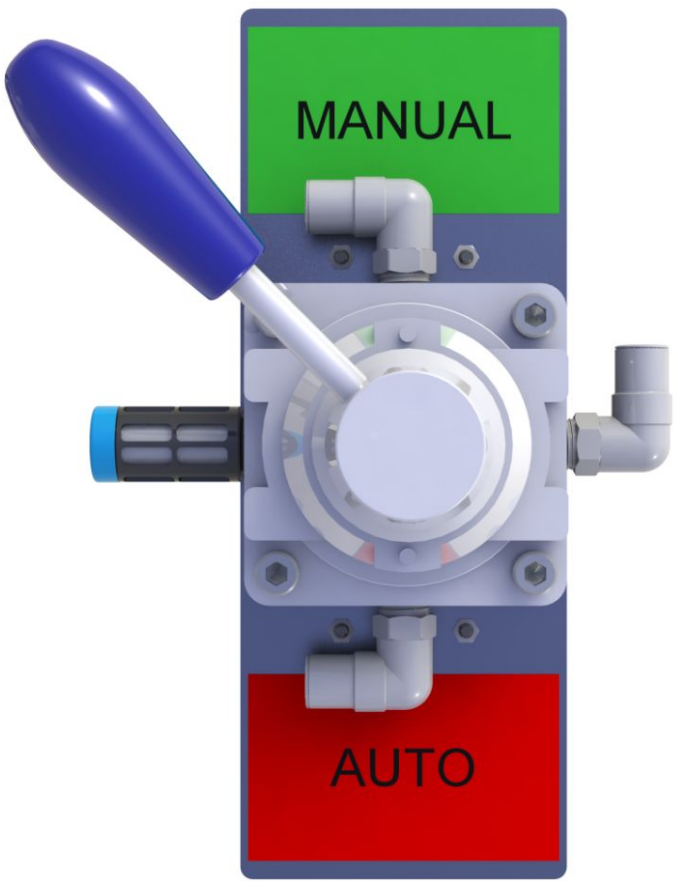
- The image to the right shows a convenient location for the anchor kit (back right corner)



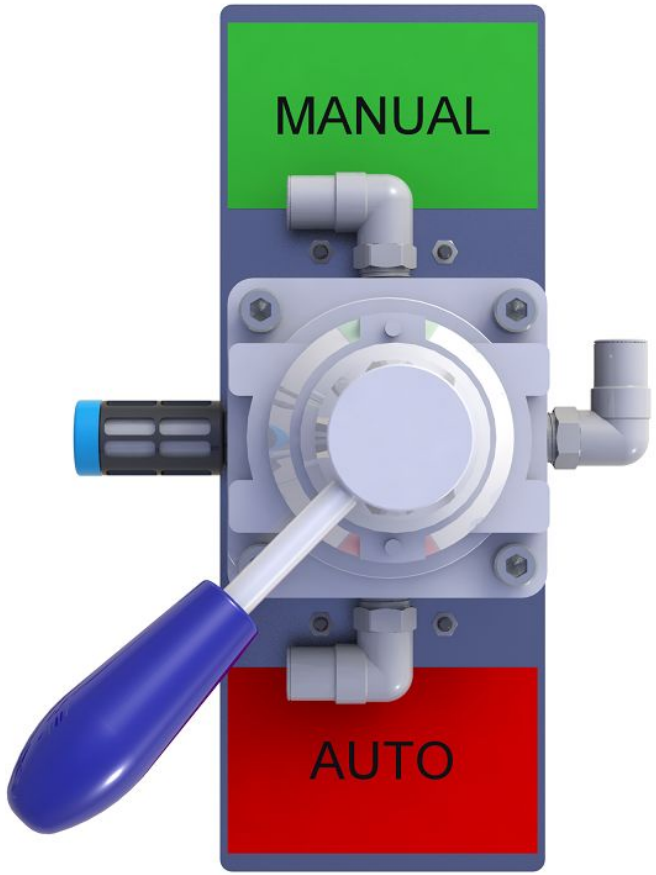
Install Diverter Valve

- The purpose of the Diverter Valve is to switch the pneumatic system to supply air to either the Manual Valves or the inlet to the Robot2CNC Mill Panel. When in Auto Mode, air to the manual valves is exhausted. When in Manual Mode, air to the Robot2CNC Mill Panel is exhausted.

- The Diverter Valve is mounted on an aluminum plate with 2 x Magnets. Find a convenient operator accessible location for the Diverter Valve, typically on the front of the CNC to the right of the door frame below the CNC controller.



Manual Mode



Auto-Mode

VersaBlast Installation

Section 7

Position and Secure VersaBlast in CNC

Installation Steps:

1. Find mounting location for VersaBlast inside CNC
2. Locate VersaBlast Air Pilot Valve Assembly on top or side of CNC
3. Adjust or orient brackets to position VersaBlast within reach of robot
4. Lock brackets in position with 4 x bolts
5. Adjust & lock angle of VersaBlast blower with bolt and nut attachment
6. Secure assembly in CNC with magnets or 2 x 0.1875” rivets

**During Robot Calibration, the position of the VersaBlast will be tested and may require repositioning*

***After connecting tubing, VersaBlast may require nozzle adjustment to maximize flow*

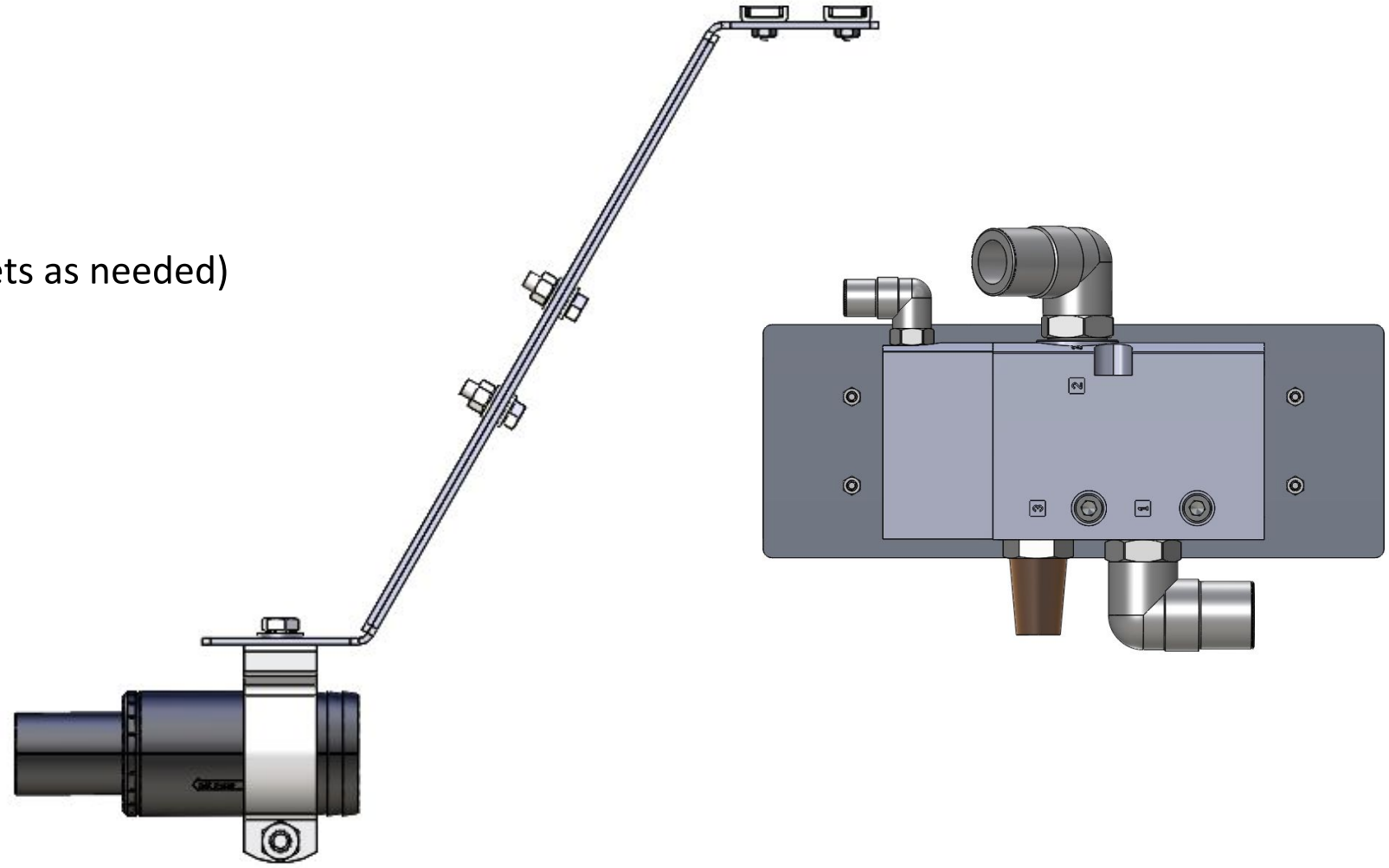
Position and Secure VersaBlast in CNC

Tools:

- 2 x 8mm Wrenches
- 1 x 10mm Wrench
- 0.25” Hex Key
- Bench top vise (to bend brackets as needed)

Parts:

- VersaBlast Kit
- VersaBlast Valve Assembly

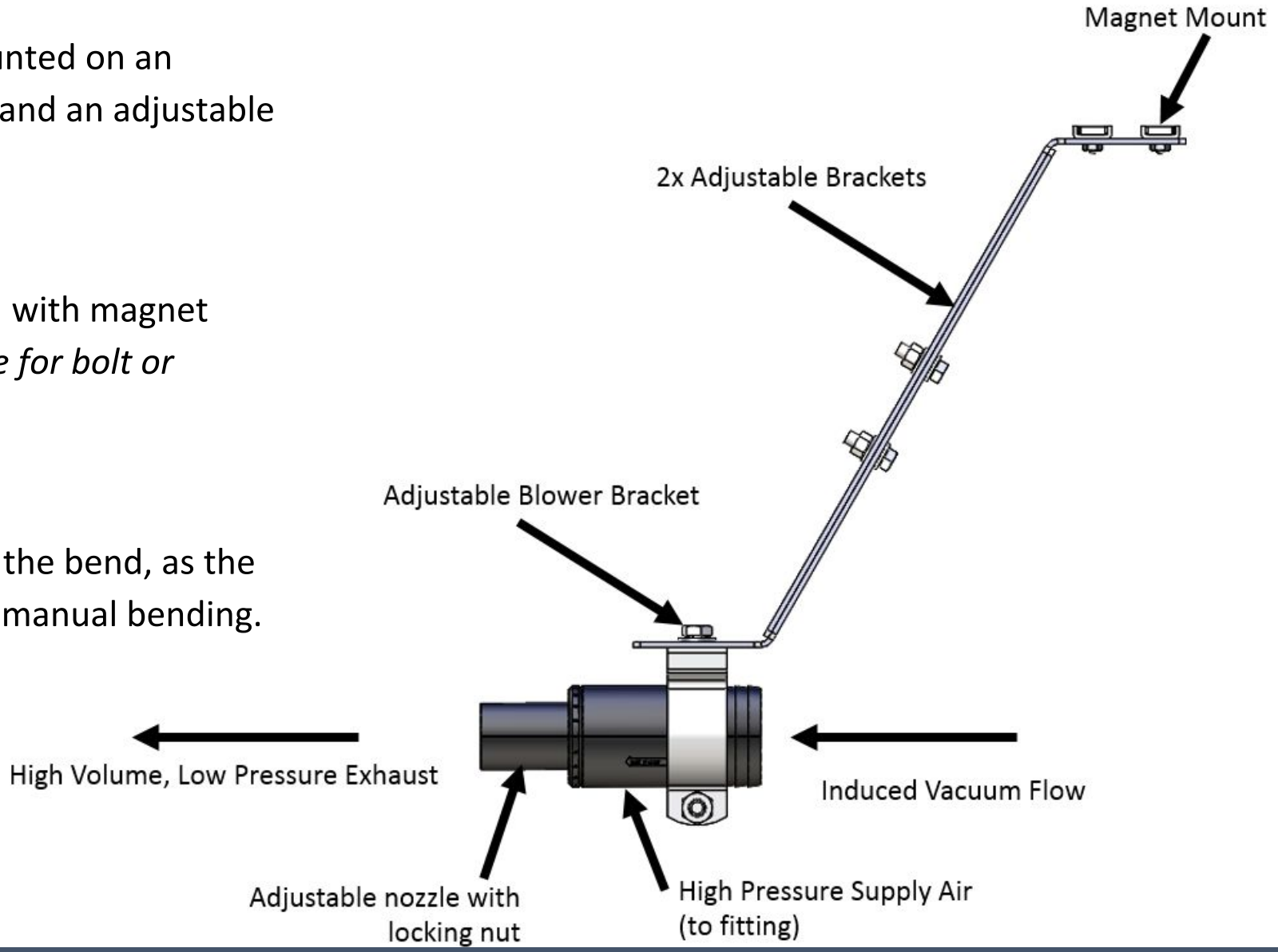


Position and Secure VersaBlast in CNC

- The VersaBlast air amplifier is mounted on an assembly of 2 adjustable brackets and an adjustable blower bracket.

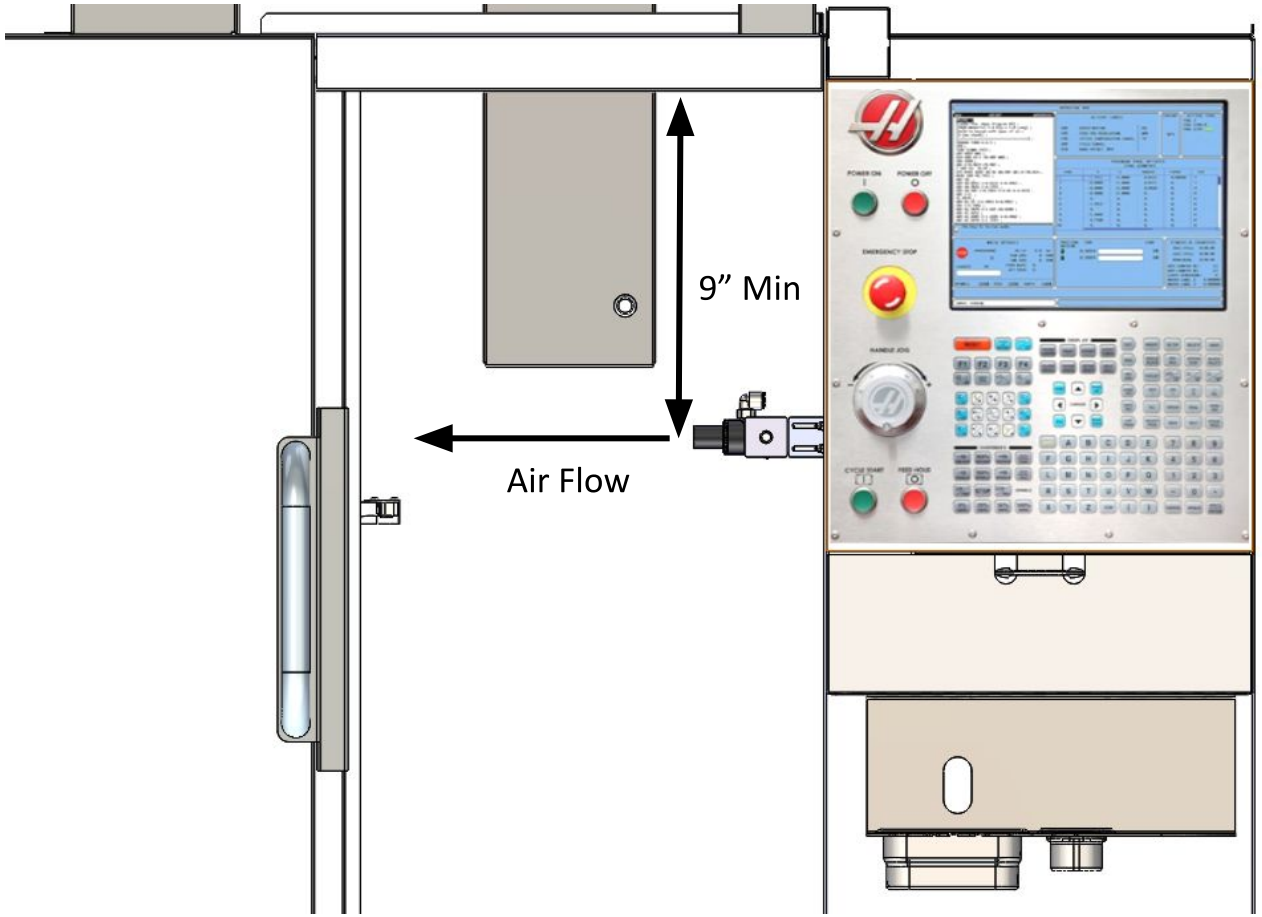
- By default, the assembly is located with magnet mounting. *Holes are also available for bolt or riveting (0.1875” clearance holes)*

- The angle is adjustable by revising the bend, as the bracket has bend relief cuts to aid manual bending.



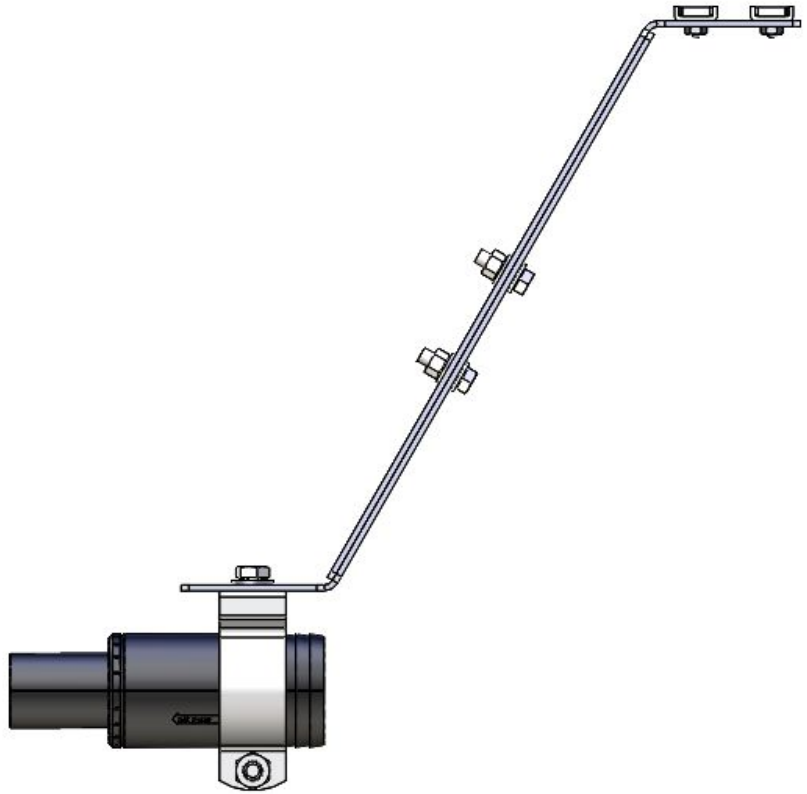
Position and Secure VersaBlast in CNC

- VersaBuilt recommends securing the VersaBlast using the provided magnets
  - Outline mounting location with permanent marker to ease repositioning if knocked out of place
- Optionally, VersaBlast can be mounted with rivets or bolts (not included) with 2x 0.1875” clearance holes.
  - Do not finalize installation location until robot reach is determined
- Position VersaBlast within robot reach and pointing into CNC
  - For single door CNCs, adjacent to the door opening is a typical location
  - For double door CNCs, the ceiling is a typical location
- Final VersaBlast location will be determined during calibration
- To avoid robot collisions with CNC, position nozzle a minimum of 9-inches from ceiling or top of door frame.

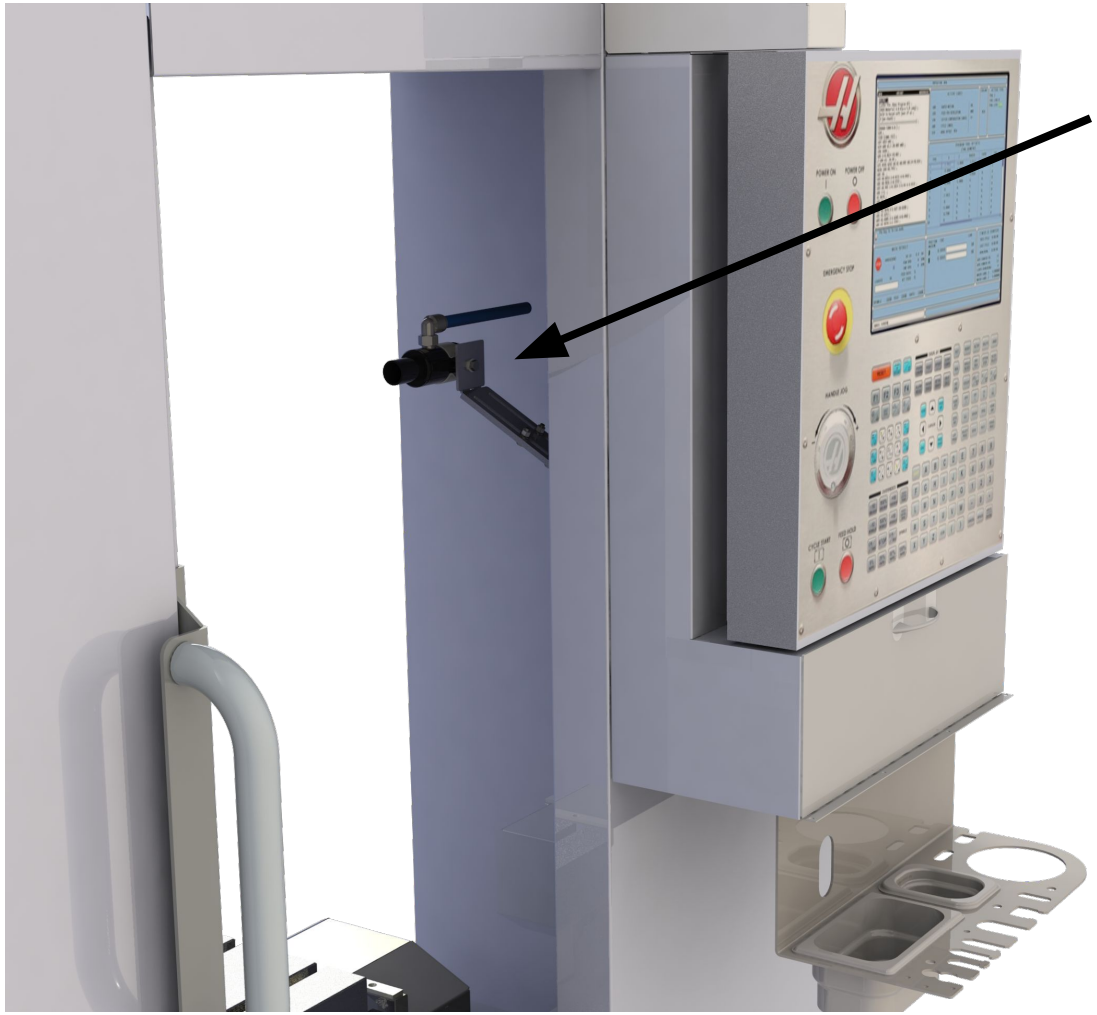


Position and Secure VersaBlast in CNC

- Adjustments and modifications to the bracket assembly are available
  - Brackets include reliefs in the bends to aid bend modifications, as needed
  - Rotate the clamp hanger holding the VersaBlast blower, as needed
- Position the blower as close to a horizontal position as possible to maximize air blast impact on jaws. See image to the right, showing the blower in the horizontal position.



Haas DT Series Example

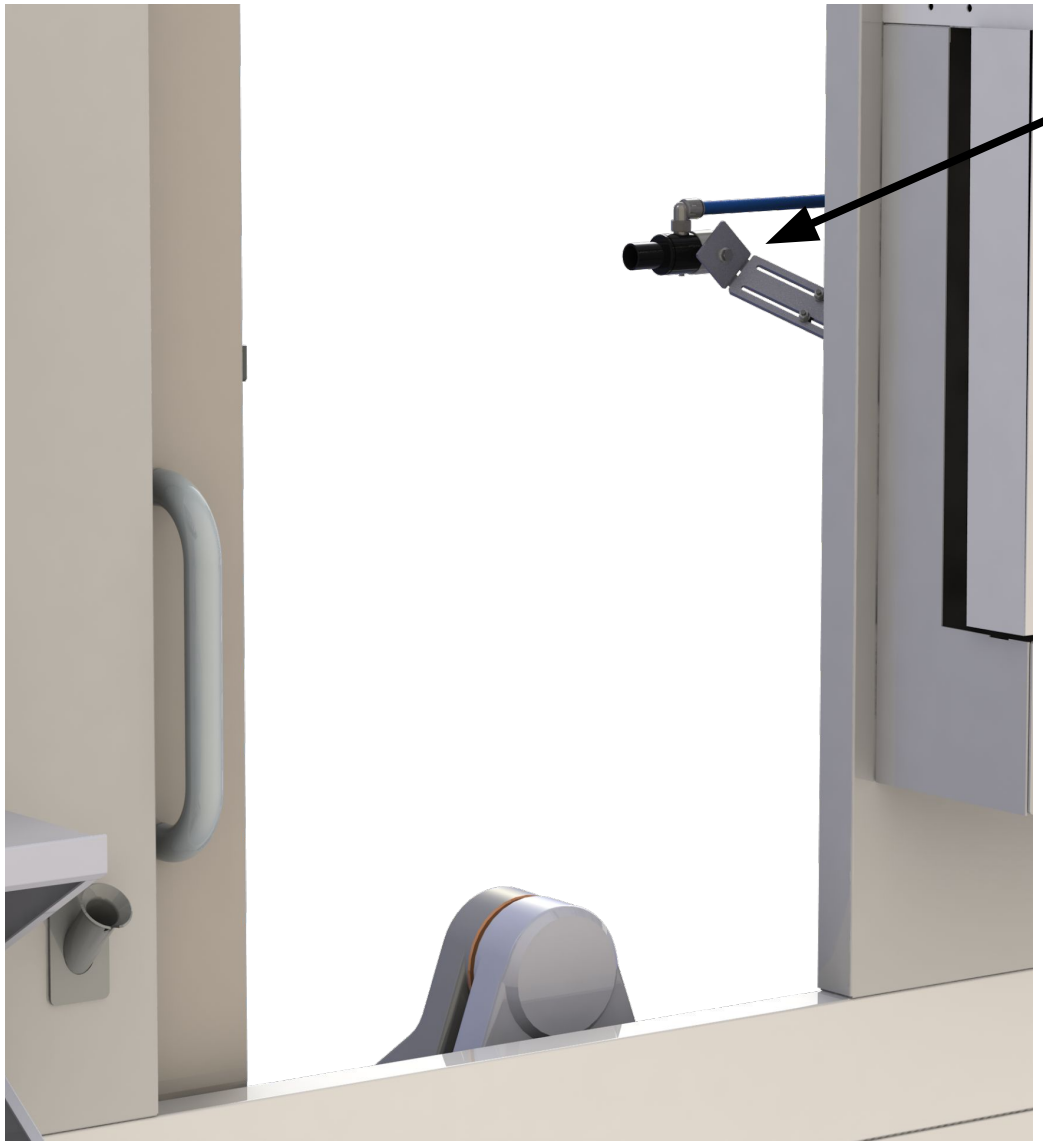


Position bracket in approximate position and adjusted length, as shown

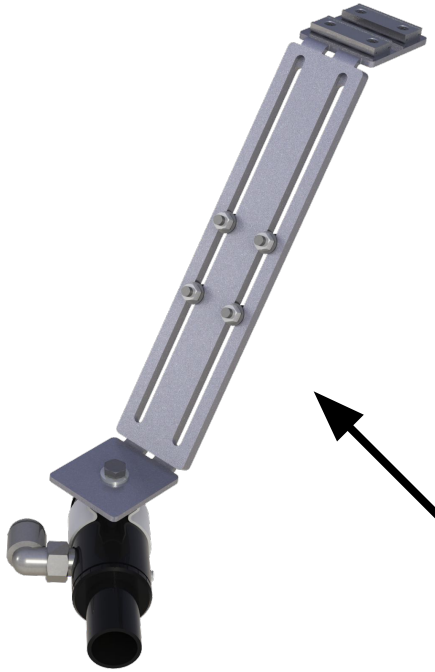
Assembly orientation

View of VersaBlast Assembly inside CNC

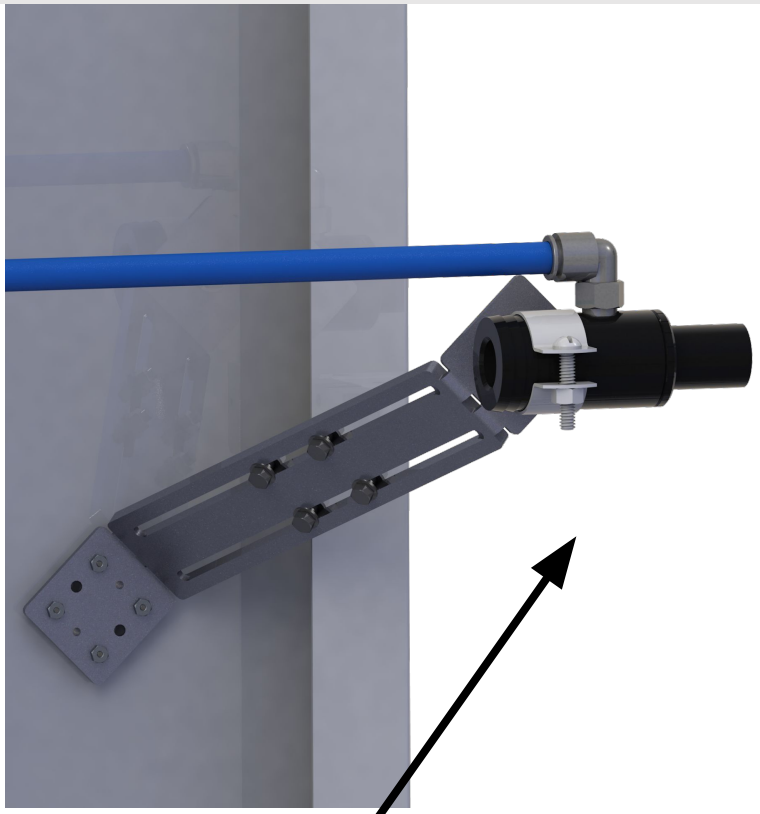
Haas UMC Series Example



Position bracket in approximate position and adjusted length, as shown

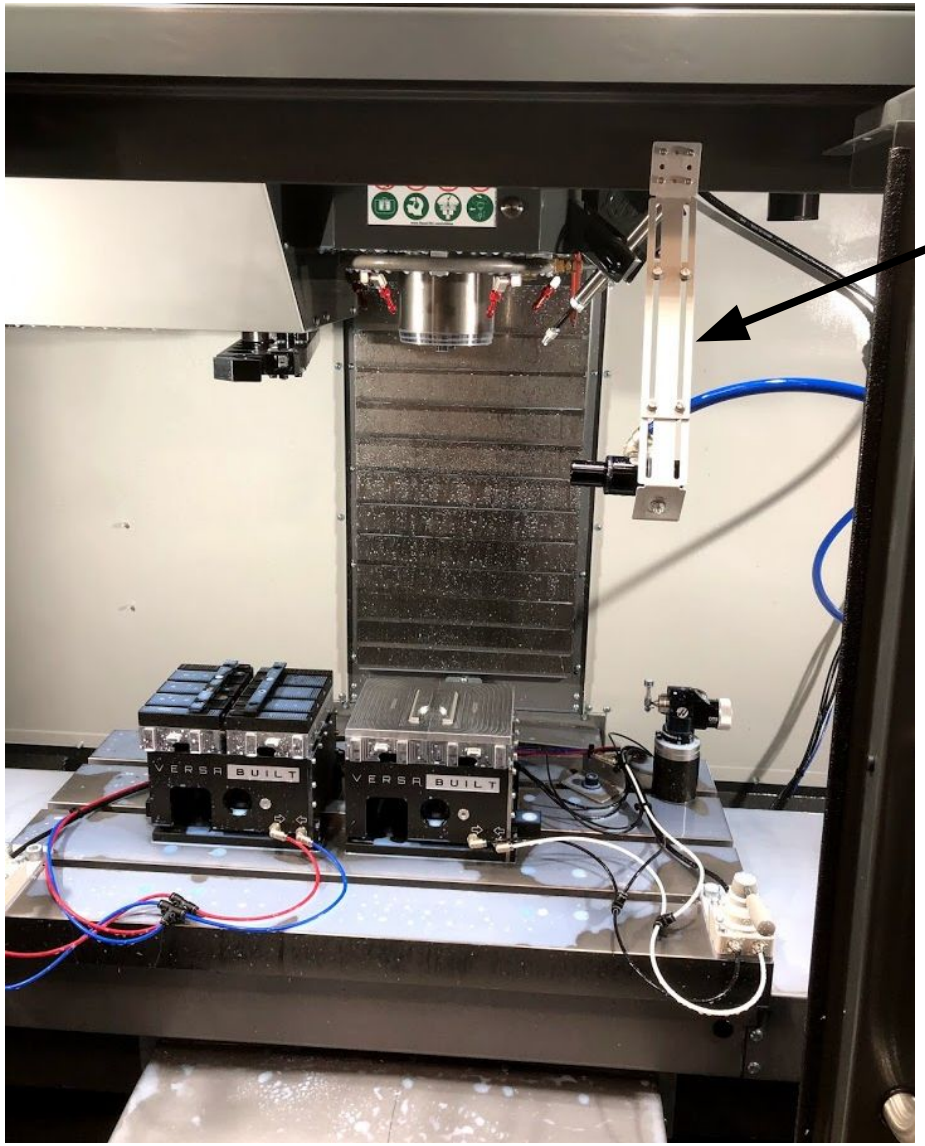


Assembly orientation



View of VersaBlast Assembly inside CNC

Haas VF Series Example



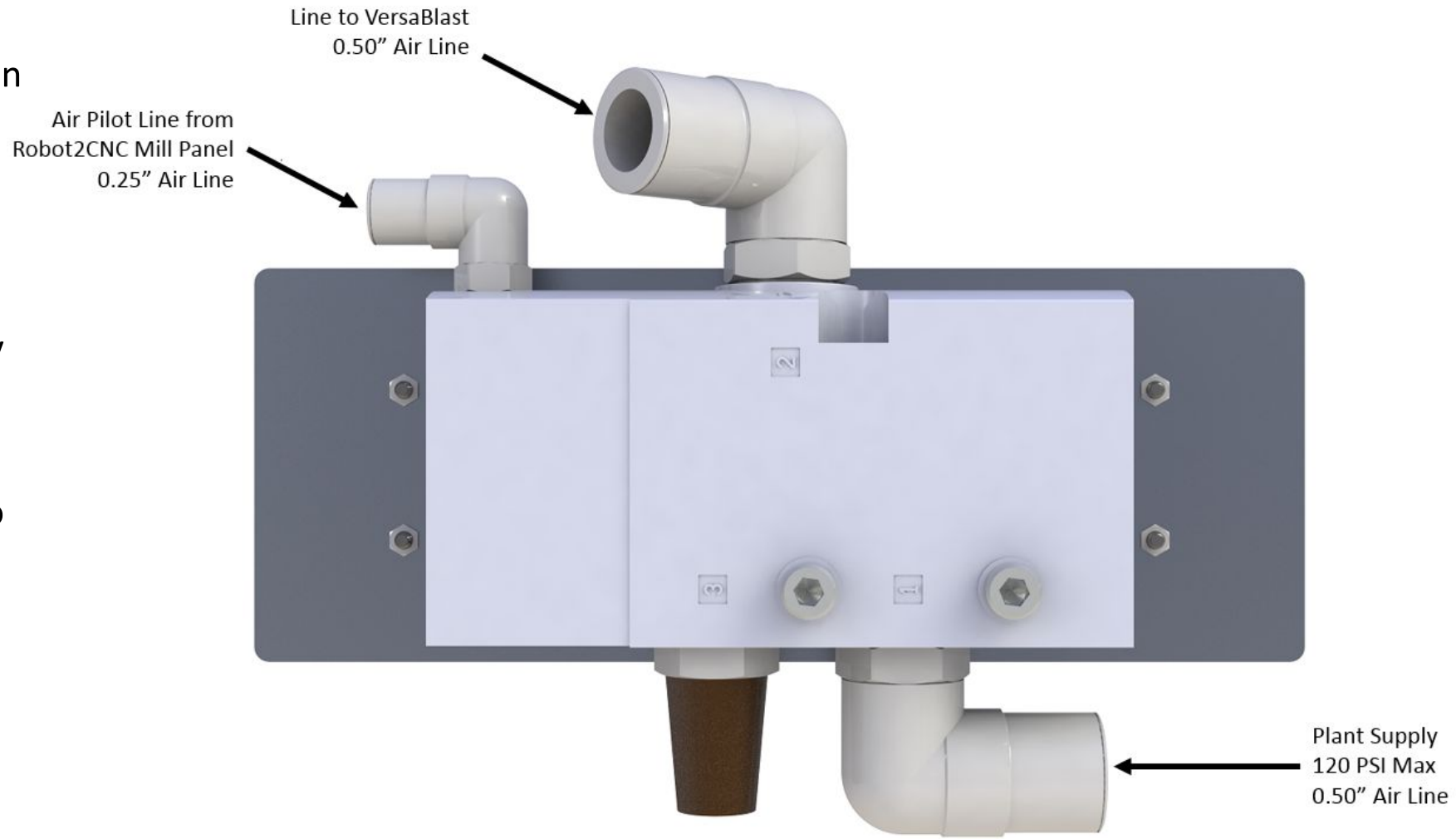
Position bracket in approximate position and adjusted length, as shown

Bend bracket to prevent assembly from interfering with CNC door on VF2 series

VersaBlast Air Pilot Valve

Air Pilot Valve Assembly:

- Place valve assembly on side or on top of CNC
- Refer to Section 10 for tube routing information, with the following tubing required:
  - 0.50” Line from Plant Supply to #1 Port
  - 0.25” Line from Robot2CNC Mill Panel VersaBlast port to Air Pilot Port
  - 0.50” Line from Port #2 to VersaBlast



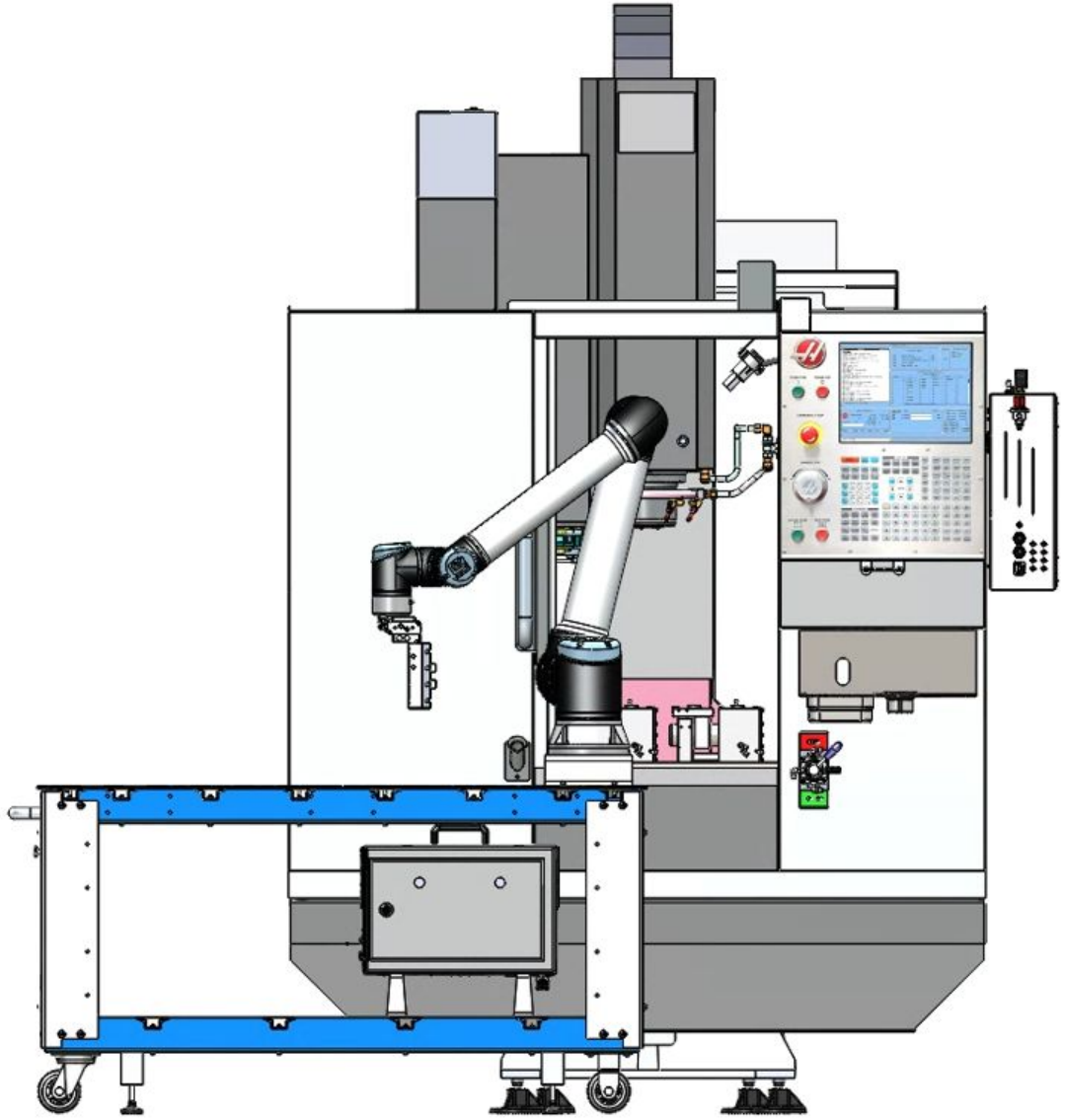
VersaCart to CNC Installation

Section 8

Position VersaCart in front of CNC

Tools:

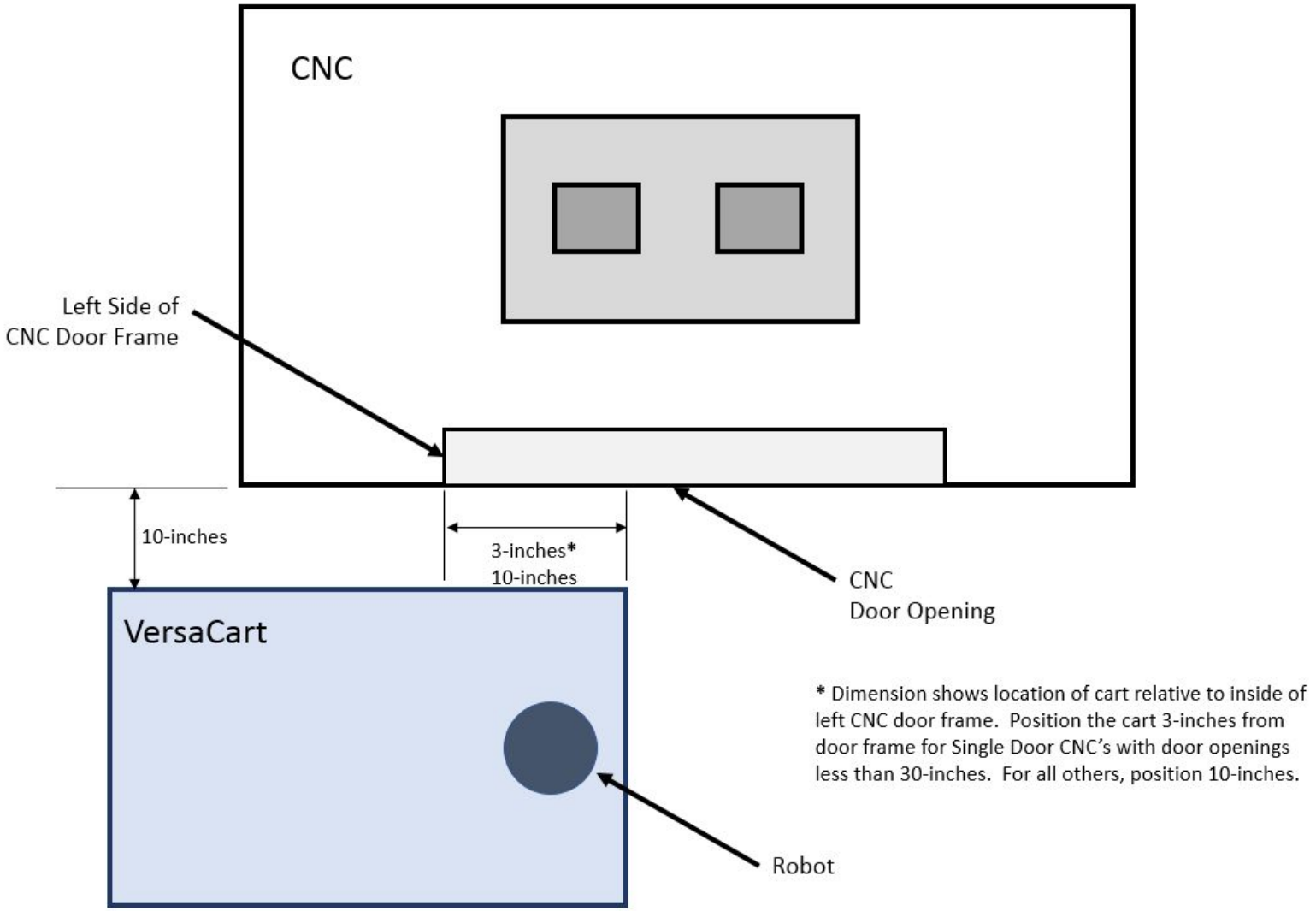
- 15mm Wrench
- 17mm Wrench
- Level
- Tape Measure
- Steel Square or equivalent



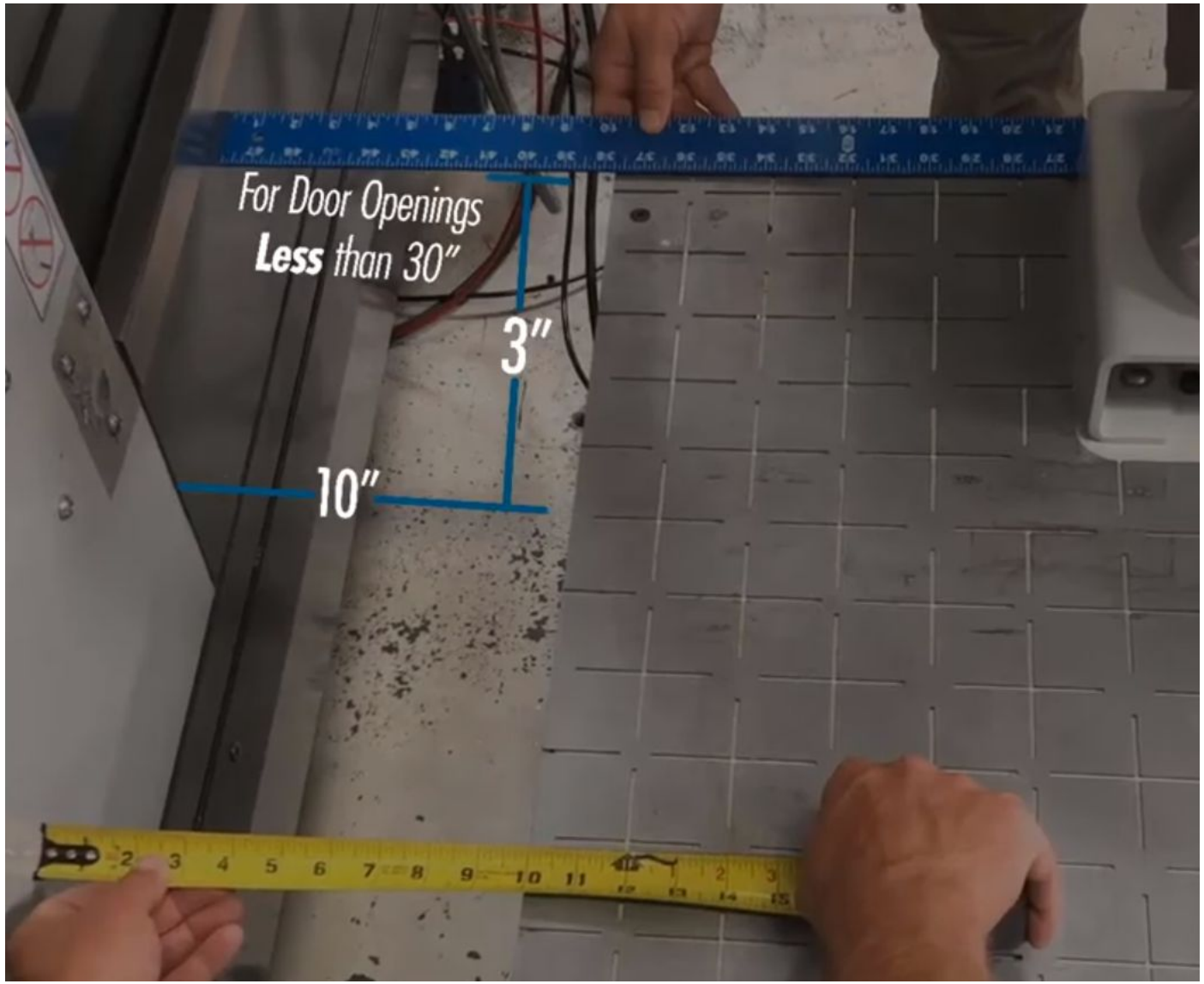
Position VersaCart in front of CNC

Steps:

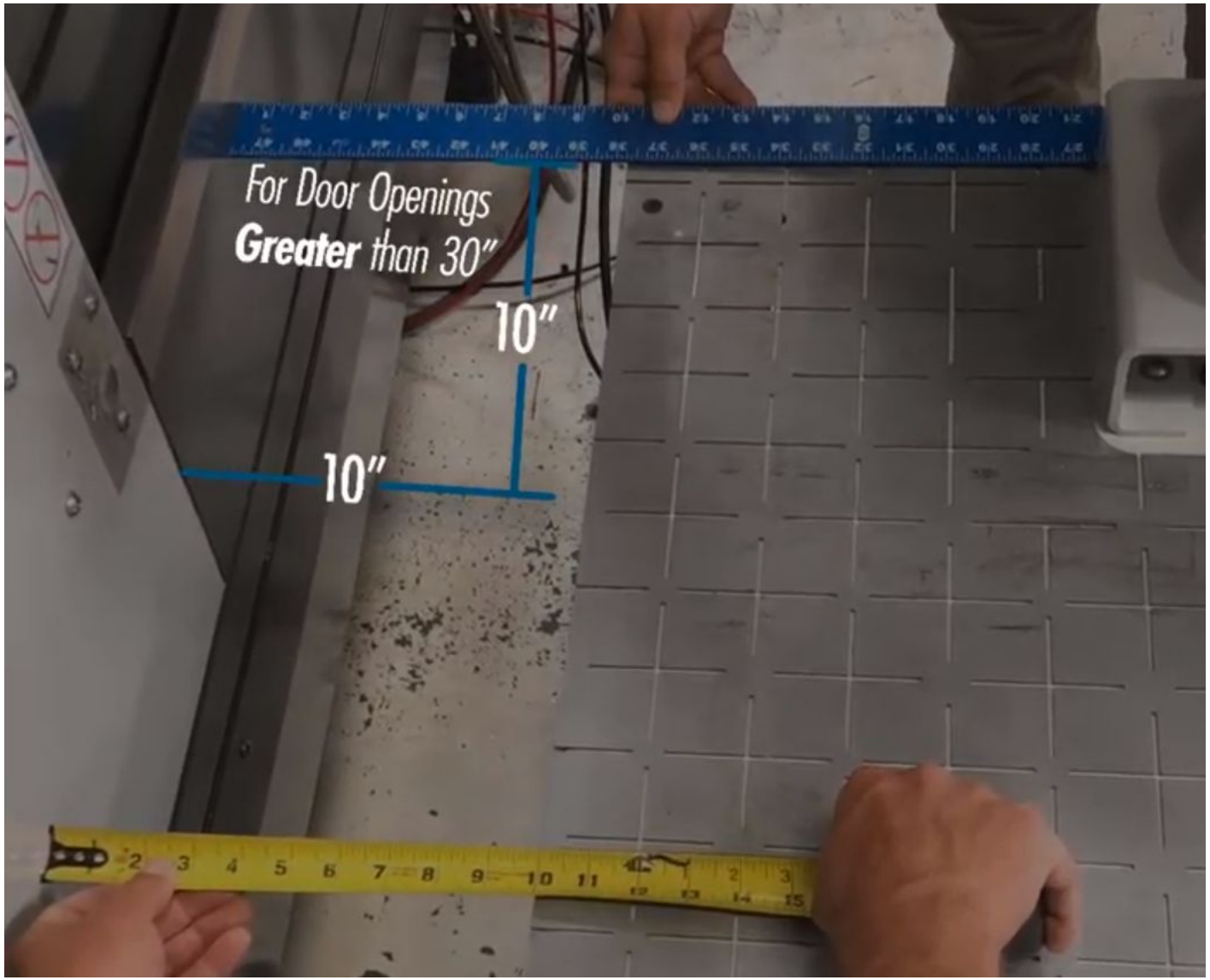
- Position VersaCart in front of CNC as shown on the right and following pages
- Using an 15mm open end wrench, turn each of the leveling feet until the nearest castering wheel is raised off the ground at least ⅛”
- Place the level on the top of the VersaCart
- Adjust the leveling feet until the VersaCart is level front-to-back and side-to-side
- Lock leveling feet in place with 2 x Hex nuts using 17mm open ended wrench



Position VersaCart in front of CNC



Position VersaCart in front of CNC



Position VersaCart in front of CNC

Connect and Route Tubing and Cabling

Section 9

Tubing

The Mill Application Kit includes a tubing kit with the following:

- 0.50” tubing:
  - 15-ft Connecting from Plant Supply to VersaBlast air pilot valve
  - 10-ft Connecting VersaBlast air pilot valve to VersaBlast blower
- 0.25” tubing:
  - 25-ft white tubing - Connecting from Plant Supply to Diverter Valve
  - 25-ft blue tubing - Connecting from Plant Supply to Robot Controller
  - 25-ft black tubing - Connecting from Diverter Valve to Manual Valves in CNC
  - 25-ft red tubing - Connecting from Diverter Valve to Robot2CNC Mill Panel
  - 15-ft blue tubing - Connecting Robot2CNC to VersaBlast air pilot valve
- 5/32” tubing:
  - 25-ft red tubing - Connecting from Robot2CNC Mill Panel to Vise 1 Closed
  - 25-ft blue tubing - Connecting from Robot2CNC Mill Panel to Vise 1 Open
  - 25-ft clear or black tubing - Connecting from Robot2CNC Mill Panel to Vise 2 Closed
  - 25-ft white tubing - Connecting from Robot2CNC Mill Panel to Vise 2 Open

**All air fittings are “push-to-connect” (PTC), allowing quick and easy connectivity*

***Incoming Air is the main air supply and should be conditioned air that meets ISO 8573-1:2010 [7:4:4] standard*

****Refer to Appendix A for complete Pneumatics Schematics*

Supply Plant Air

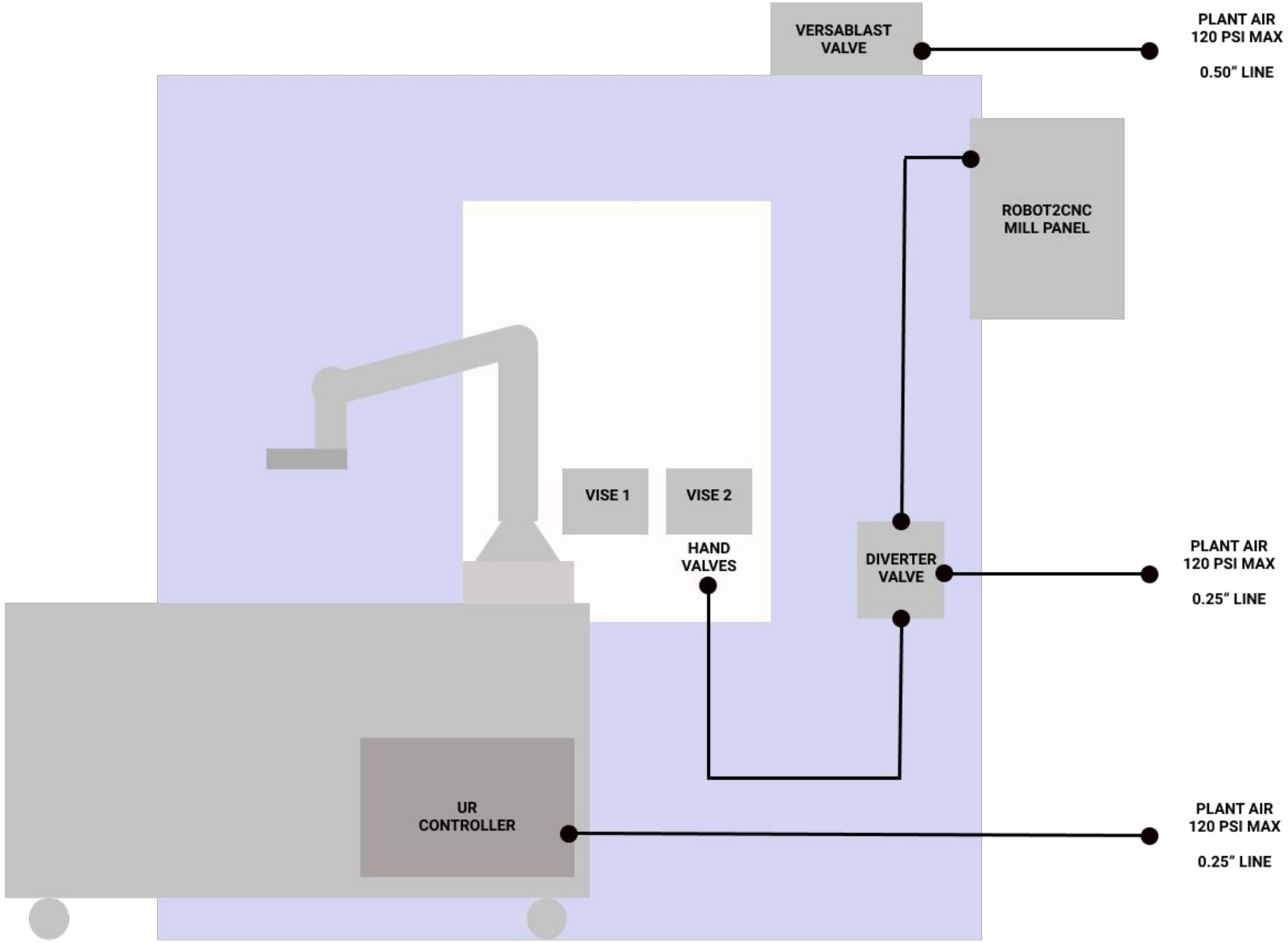
The figure to the right shows supply air to devices in the Mill Application Kit

- ½” Tubing to the VersaBlast Valve
- ¼” Tubing to the Diverter Valve
  - ¼” line to Hand Valves inside CNC**
  - ¼” line to Robot2CNC Mill Panel
- ¼” Tubing to the UR Controller Panel

½” supply lines can be Tee’d from a single source or from 3 different sources

***Line to Hand Valves from Diverter Valve is routed thru the top of the CNC.*

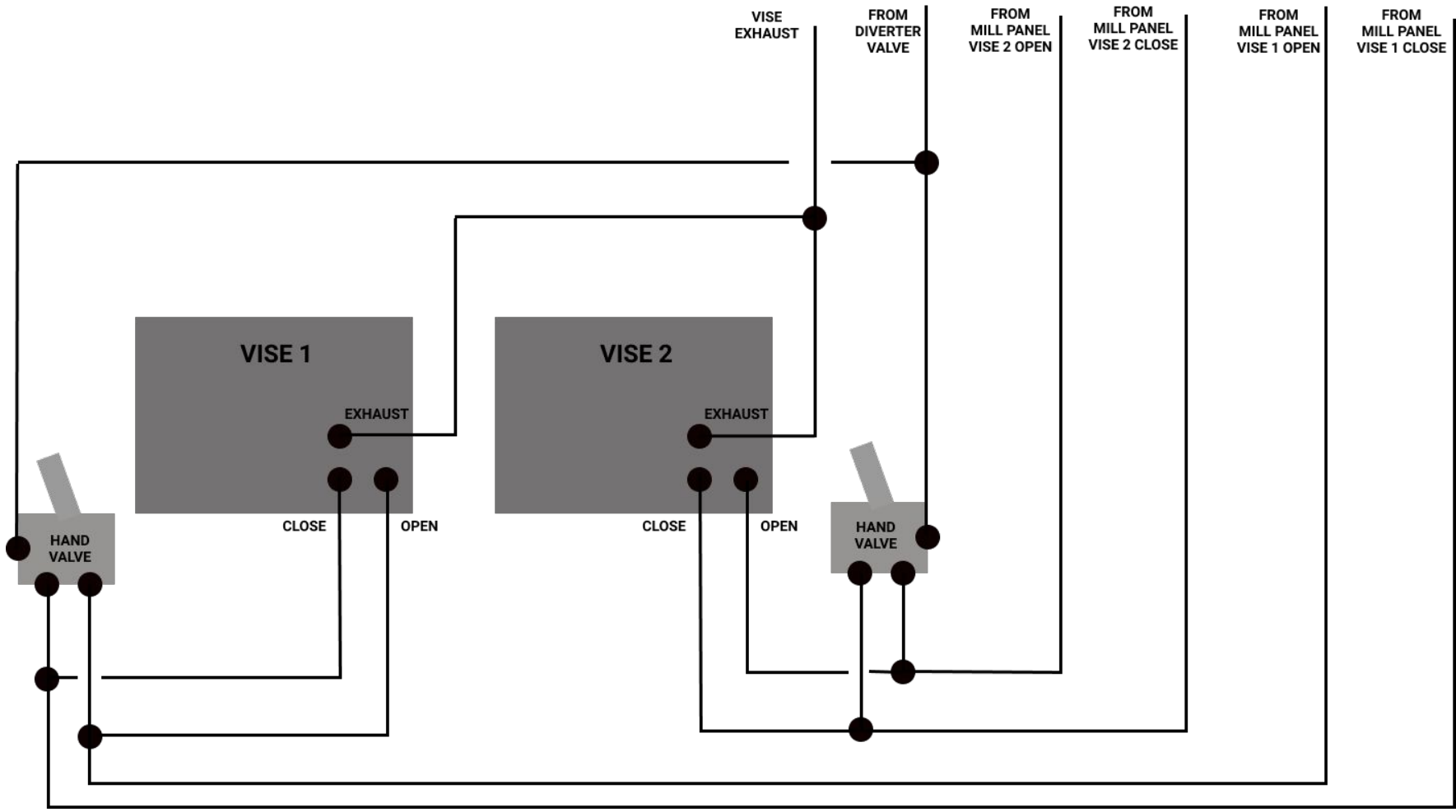
Connect Supply Air after all devices are connected, then check for leaks or poor connections



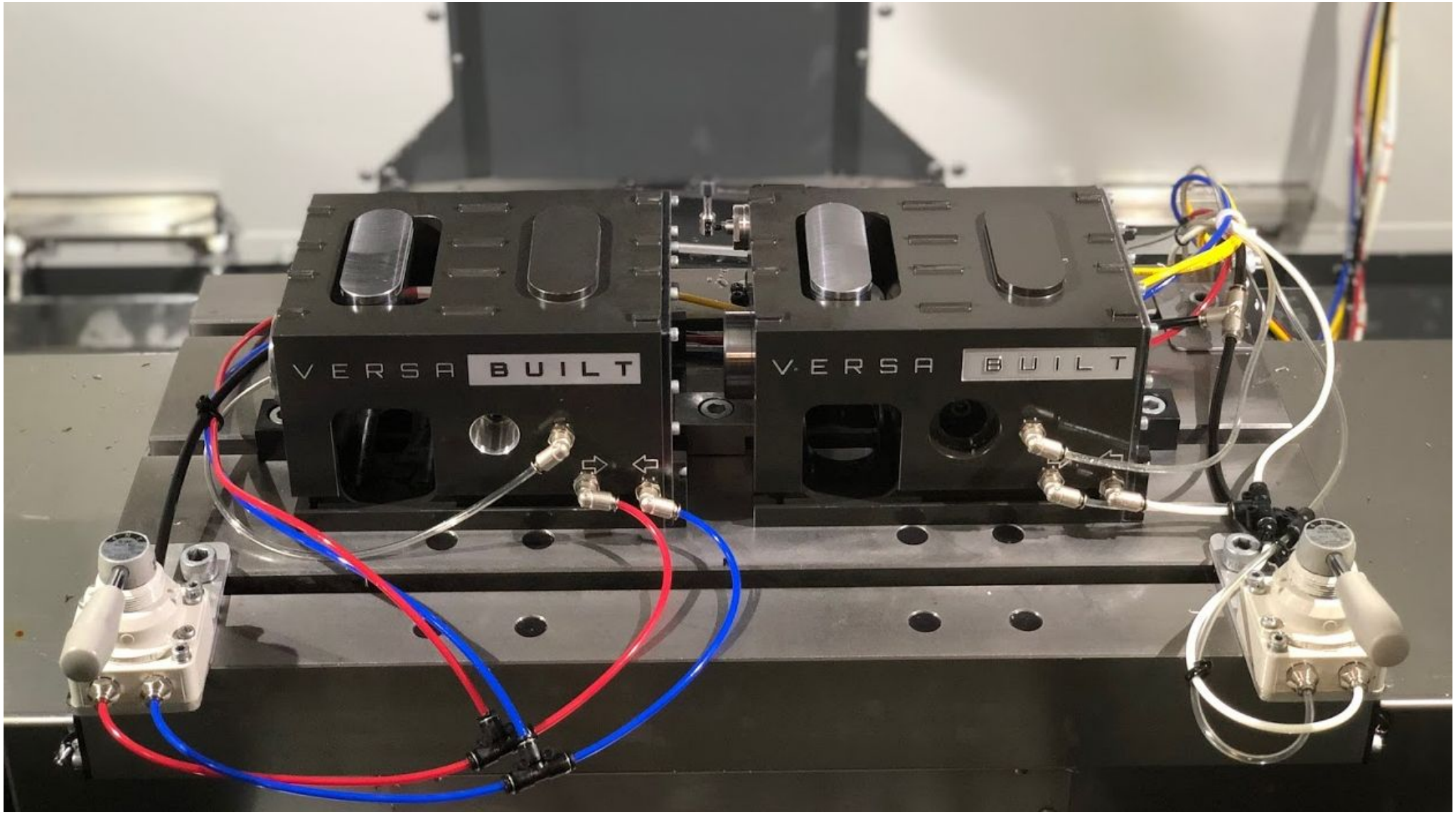
Vise Air Routing In/Out of CNC

The figure on the right shows routing of lines to MultiGrip Vises in the CNC

- 1/4” tubing is provided to the 2 x Hand Valves from the Diverter Valve
- 5/32” (4mm) tubing is supplied from the Robot2CNC Mill Panel for Vise 1 and Vise 2 Open and Close
- 5/32” (4mm) tubing and Tee-fittings connect the Robot2CNC and Hand Valves air lines to the Open and Close fittings on the Vises
- TUBING COLORS:
  - 1/4” TUBING = BLACK
  - VISE 1 OPEN = BLUE
  - VISE 1 CLOSE = RED
  - VISE 2 OPEN = WHITE
  - VISE 2 CLOSE = CLEAR OR BLACK



Vise Air Routing In/Out of CNC



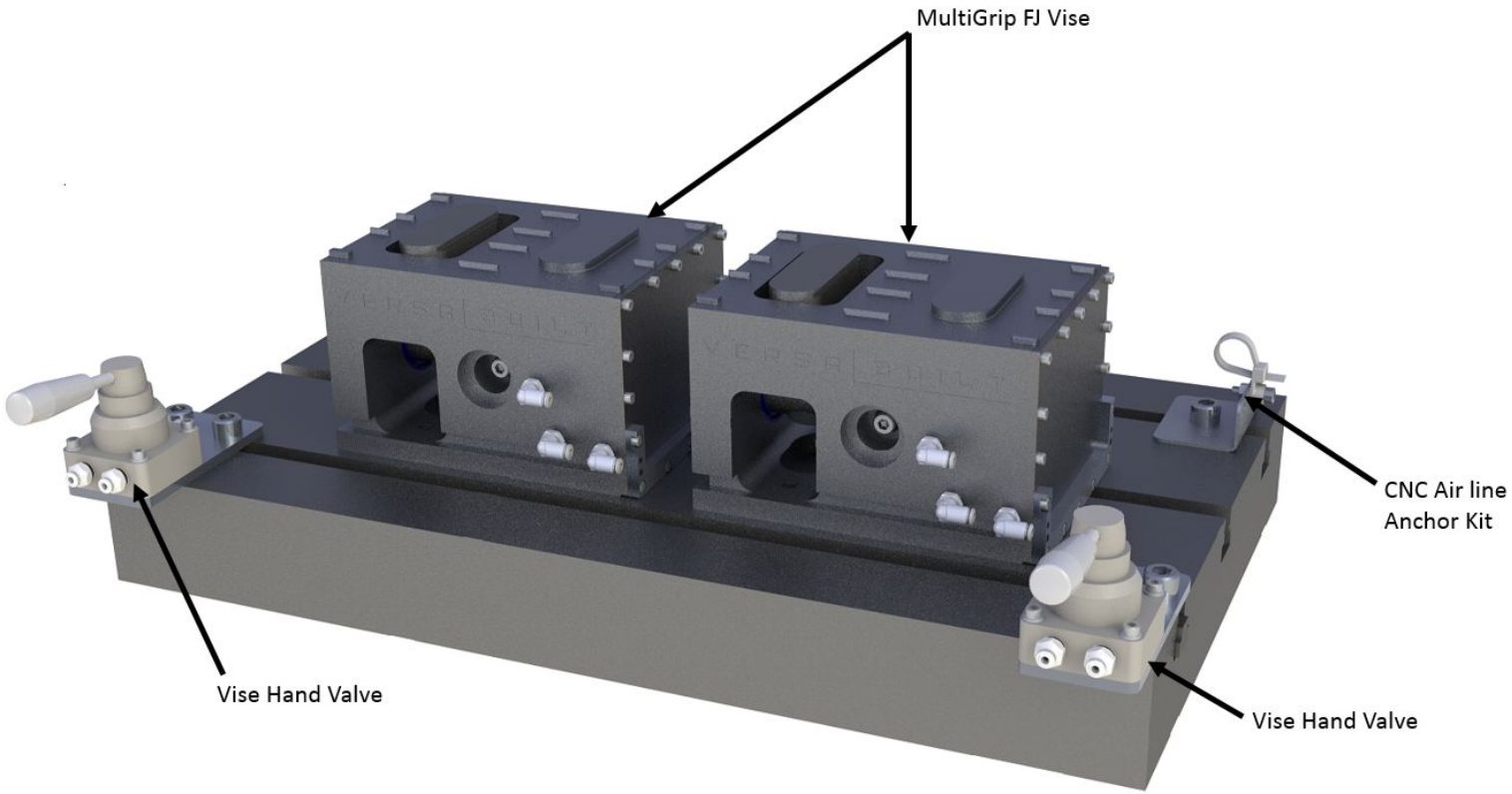
Vise Air Routing In/Out of CNC

- Tee together the exhaust lines from both vises, routing the combined line out of the CNC with a fittings and silencer combination shown in the image to the right

Connecting, Routing and Securing Air Lines

- Air lines that attach to the CNC table should be long enough to allow full travel of the CNC table without strain on the air lines
- Anchoring the CNC table air lines to the corner of the CNC table will help prevent damage from strain - use the included CNC Air Line Anchor kit
- Use included cable-ties to anchor air lines to prevent rubbing or chafing
- Delay trimming and and final securing of air lines that go to the CNC Table until all air lines have been routed and strain has been verified by positioning CNC table to its extents

Do not close cable tie on anchor line kit until after connecting cables to Vise Sensors and connecting all tubing to vises and hand valves

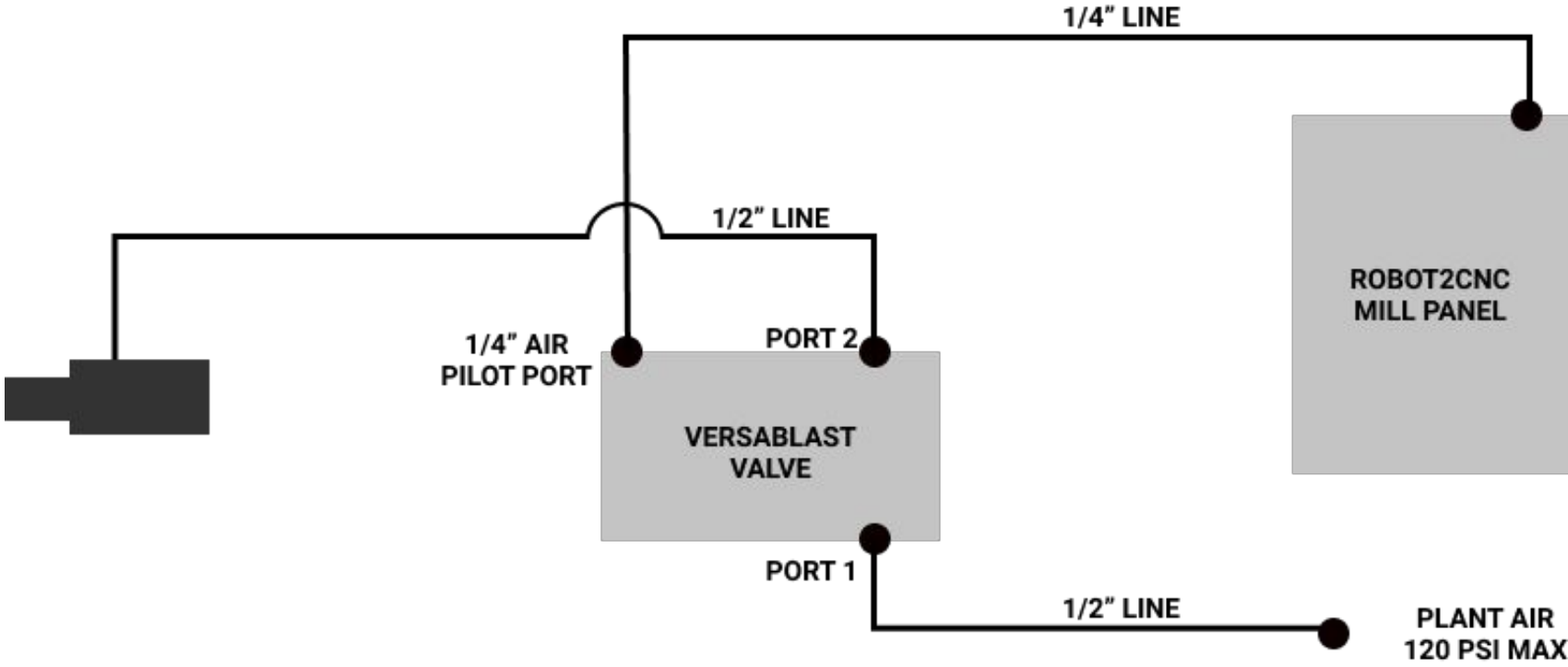


VersaBlast Air Routing

Connect the following tubing to VersaBlast:

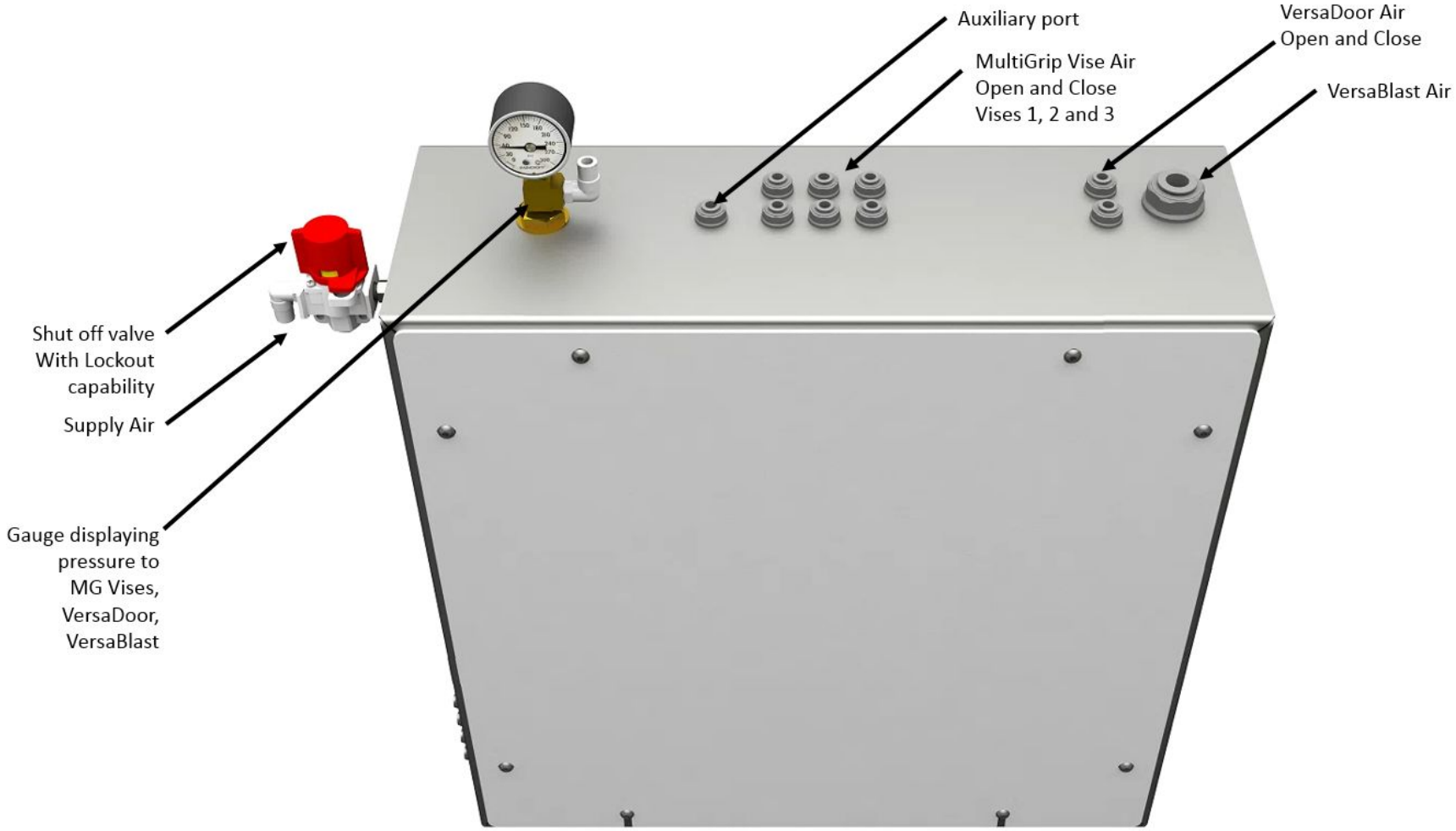
- 1/4” tubing from the Robot2CNC Mill Panel to the 1/4” air pilot fitting on the VersaBuilt Valve
- 1/2” tubing from Plant Air to port 1 of the VersaBlast Valve
- 1/2” tubing from port 2 of the VersaBlast Valve to the VersaBlast blower

Note: minimize tube lengths to the VersaBlast blower to maximize air flow



Diverter Valve and Shut-off Valve

- The Diverter Valve provides the user with the ability to shut off air to the 24VDC solenoid valves, used in automatic operation, diverting air to manual valves in the CNC for hand loading
- To switch between Auto and Manual modes, depress the button on the valve handle and position to the labeled ends of the valve assembly
- When in Manual mode, the air gauge on the Robot2CNC should be at 0 psi, with all pressure on the automatic side relieved.
- To lock out or prevent supply of air to Robot2CNC components, the air to the Robot2CNC Mill Panel can shut off with the Red Shut-off Valve

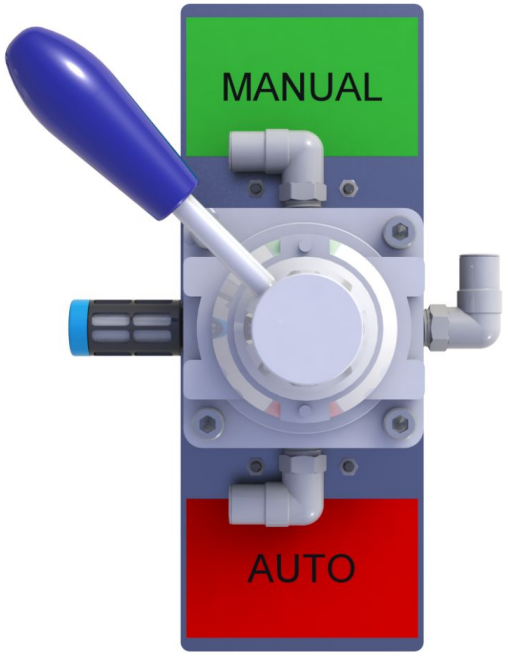


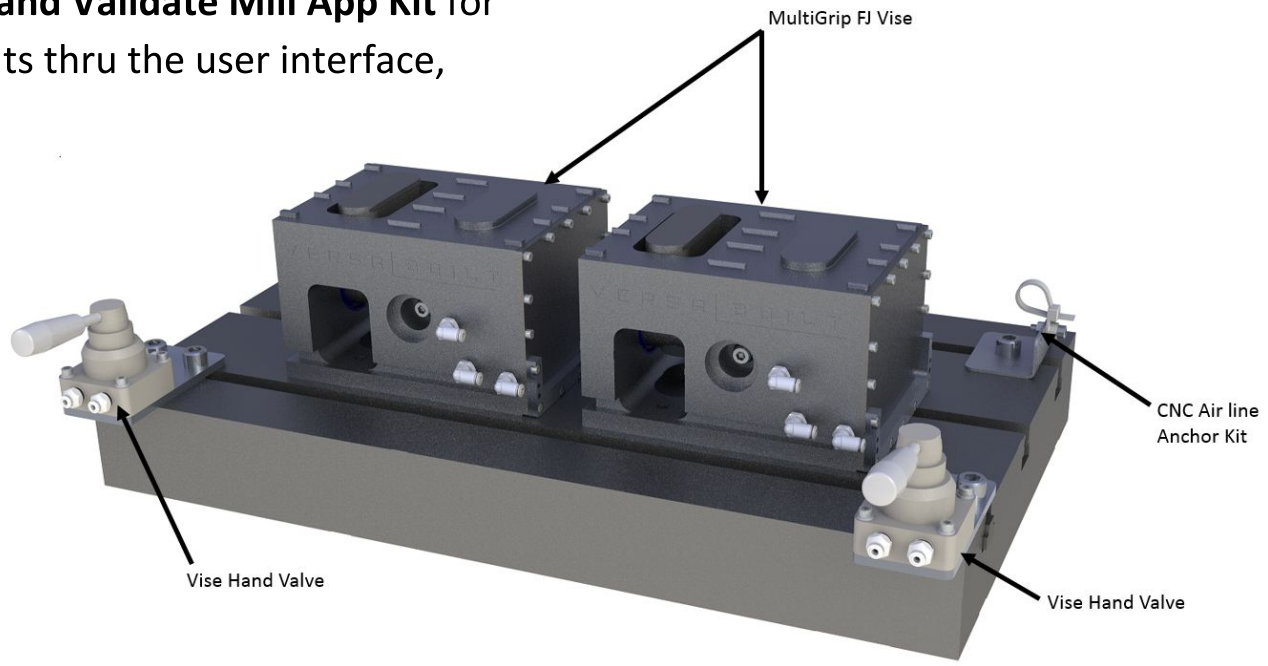
Connect Supply Air and Test

- Before connecting air, make sure no person is in contact with the MultiGrip FJ Gripper, MultiGrip Vises, or VersaDoor as it may close suddenly during this step.
- Ensure the Diverter Valve is set to the Green Manual position, the CNC door is closed and that no person will come in contact with the MultiGrip vises
- Connect Supply Air to 3 x ½” Air Lines, as shown in the diagram on previous pages
- Check for leaks, loose connections and fix as needed

Connect Supply Air and Test

- With Diverter Valve in Manual Position, Test operation of Hand Valves inside CNC:
  - Verify plant air supply to the diverter valve is connected
  - Toggle the Hand Valves in the CNC and verify open/close
  - Return the Hand Valves to the Center Position
- Refer to **Section 13: Calibrate and Validate Mill App Kit** for complete testing of components thru the user interface, after loading software





Cable Installation

The Mill Application Kit includes the following cables:

- Ethernet Cables, connecting:
  - CNC
  - Robot Controller
  - Robot2CNC
  - Optional: Company Network
- DB9 to DB25 Serial Cable (for legacy CNC's without Ethernet connectivity)
- Cycle Start Cable, connecting Robot2CNC Mill Panel to CNC
- Vise Sensor Cables, connecting sensor installed on each MultiGrip Vise to the Robot2CNC Mill Panel

**All air fittings are "push-to-connect" (PTC), allowing quick and easy connectivity*

***Incoming Air is the main air supply and should be conditioned air that meets ISO 8573-1:2010 [7:4:4] standard*

****Refer to Appendix A for complete Pneumatics Schematics*

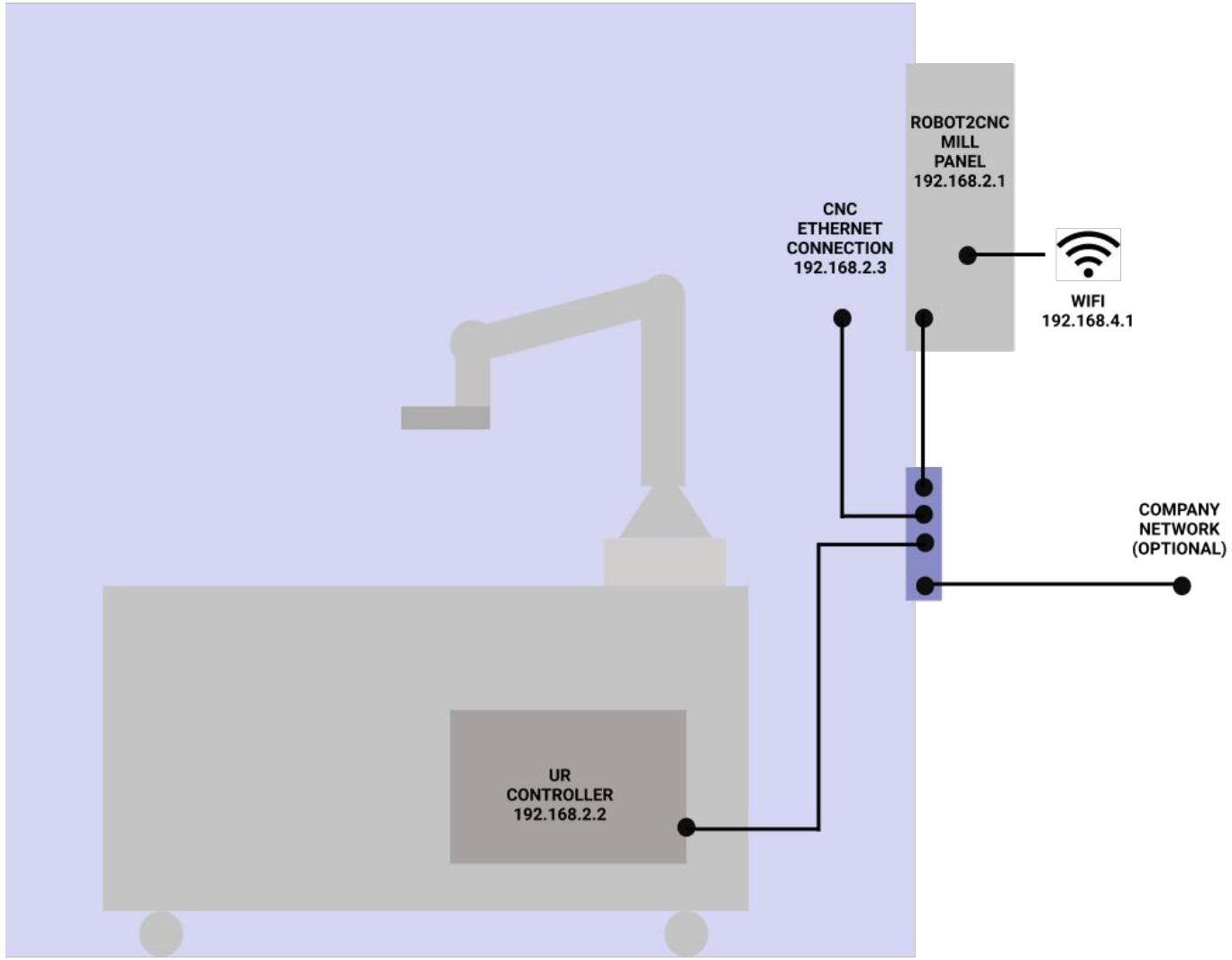
Connect Ethernet Cables

The figure to the right shows Ethernet connections to the provided Ethernet Switch

- CNC - Default address 192.168.2.3
- UR Controller - Default address 192.168.2.2
- Robot2CNC Mill Panel - Default address 192.168.2.1
    - Wifi Connect 192.168.4.1

**For CNC's with Serial Port communication (without Ethernet), connect the DB9 to DB25 Serial Cable provided with the Robot2CNC Mill Panel directly from Robot2CNC Mill Panel to the CNC's Serial Port.*

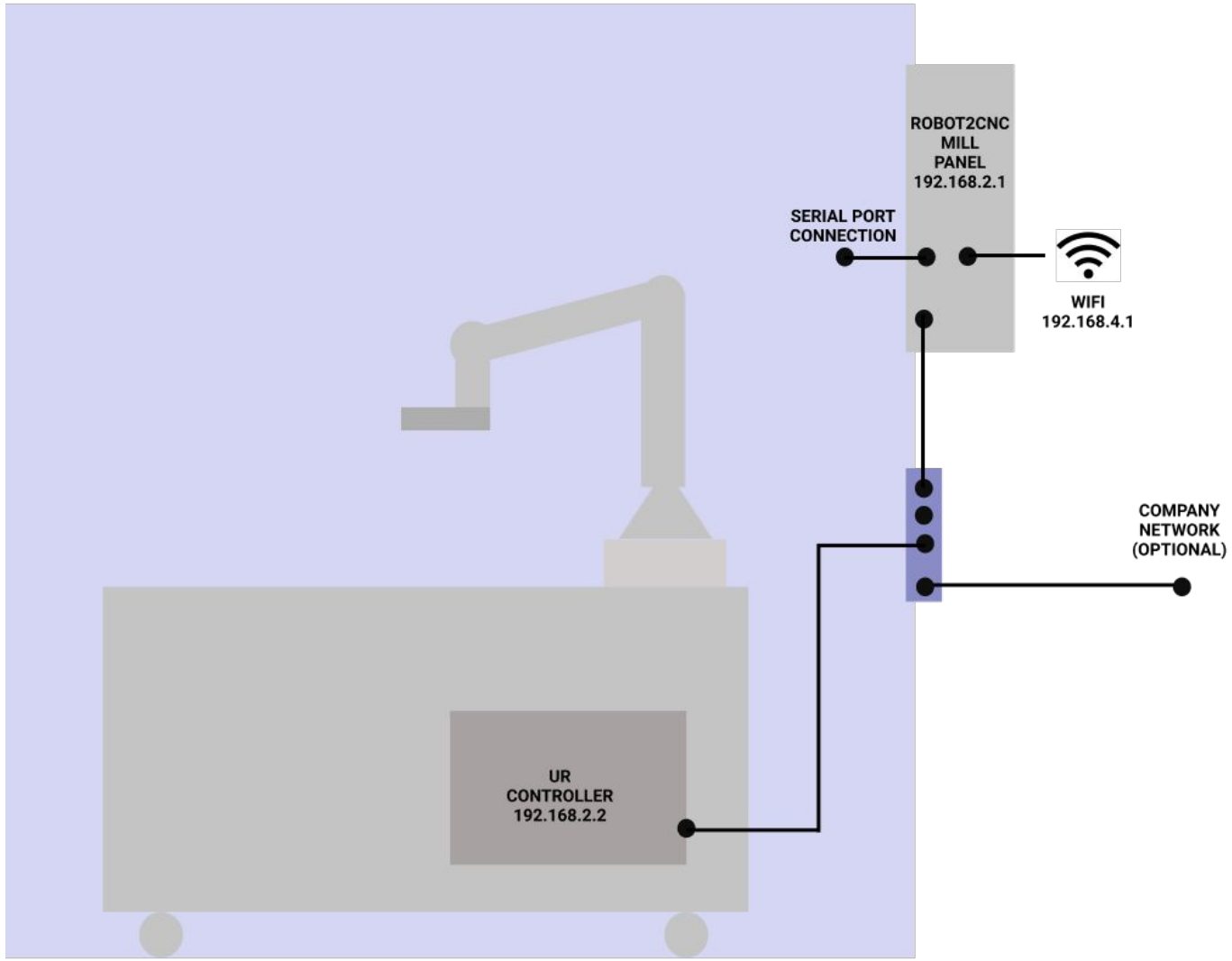
***Route cables so they are protected from coolant and chips, anchor as needed using included cable-ties*



Serial Cable Connection to CNC

For CNC's without an ethernet connection, the Robot2CNC Mill Panel will connect via the RS232 Port on CNC.

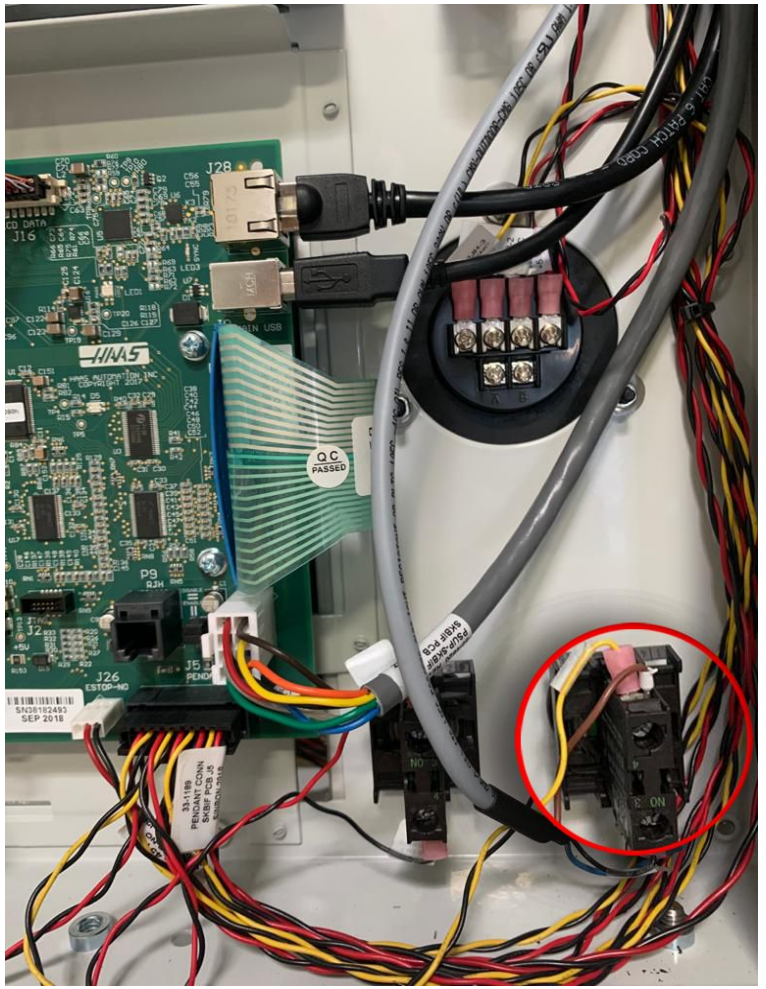
***Route cables so they are protected from coolant and chips, anchor as needed using included cable-ties*



Install Cycle Start Cable

Installation instructions for Cycle Start wiring is CNC make/model/year dependent, with the following instructions provided as a guideline only

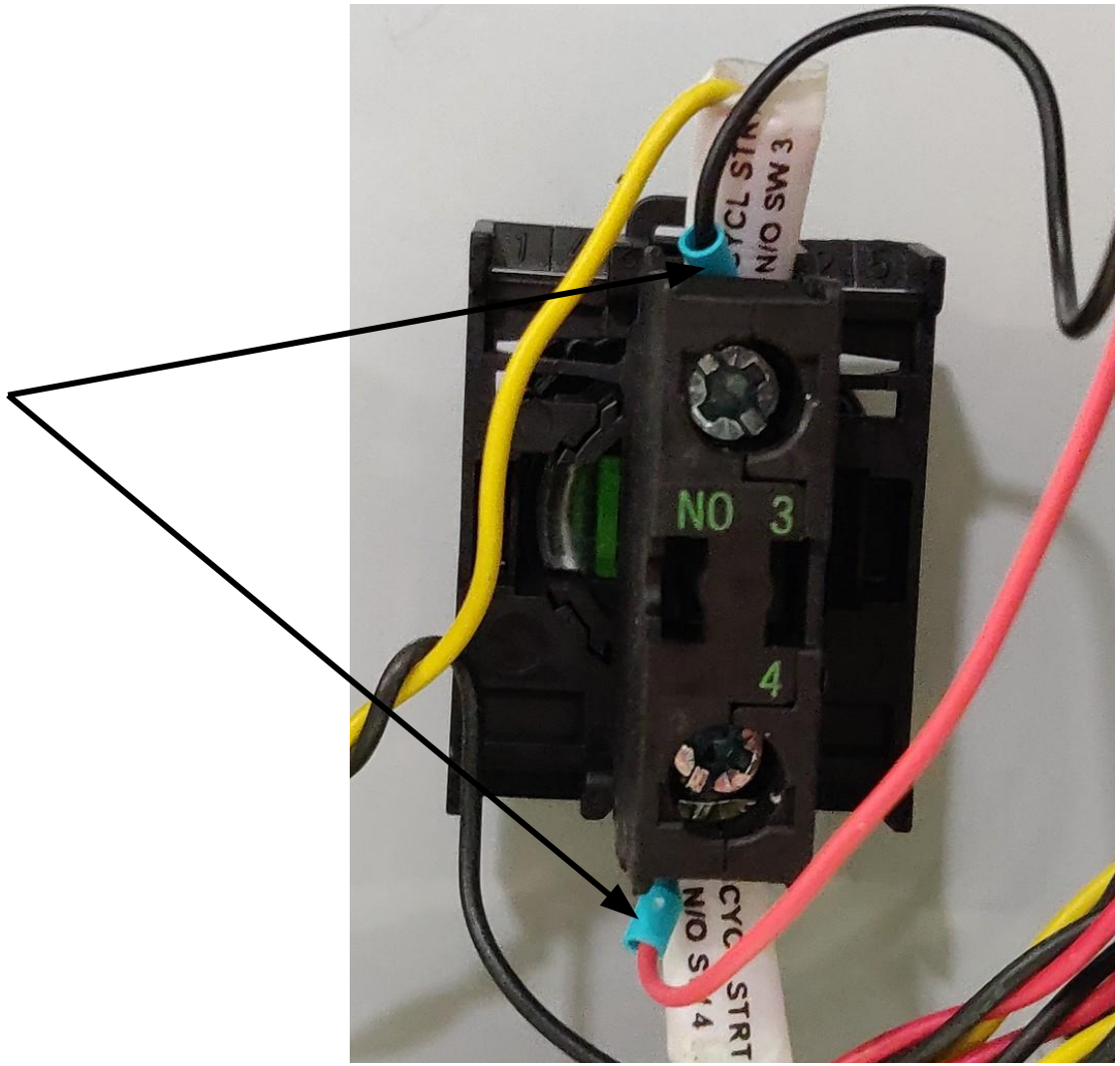
- Verify proper Cycle Start wiring installation carefully, consult with a properly trained CNC repair technician if necessary
- Connecting directly to the CNC Cycle Start button is typically the easiest way to connect the Cycle Start wiring
- Some CNCs provide terminals in the CNC control cabinet dedicated to remote cycle start connection



Back of Cycle Start Button

Install Cycle Start Cabling

- The Cycle Start Cable includes two wires that must be attached to the Cycle Start terminals
- The Cycle Start button should have two terminals, loosen the terminal screw and attach one of the Cycle Start Cable wires to each terminal
- Polarity of the wires does not matter
- Route the M8 connector side of the Cycle Start Cabling through the CNC's wire chase and back to the Robot2CNC
- Plug the M8 connector into the Digital I/O **B1** on the Robot2CNC



MultiGrip Vise Sensor Installation

Tools:

- 6mm Hex Key
- 13mm Deep Socket Wrench
- Ratchet for Deep Socket Wrench

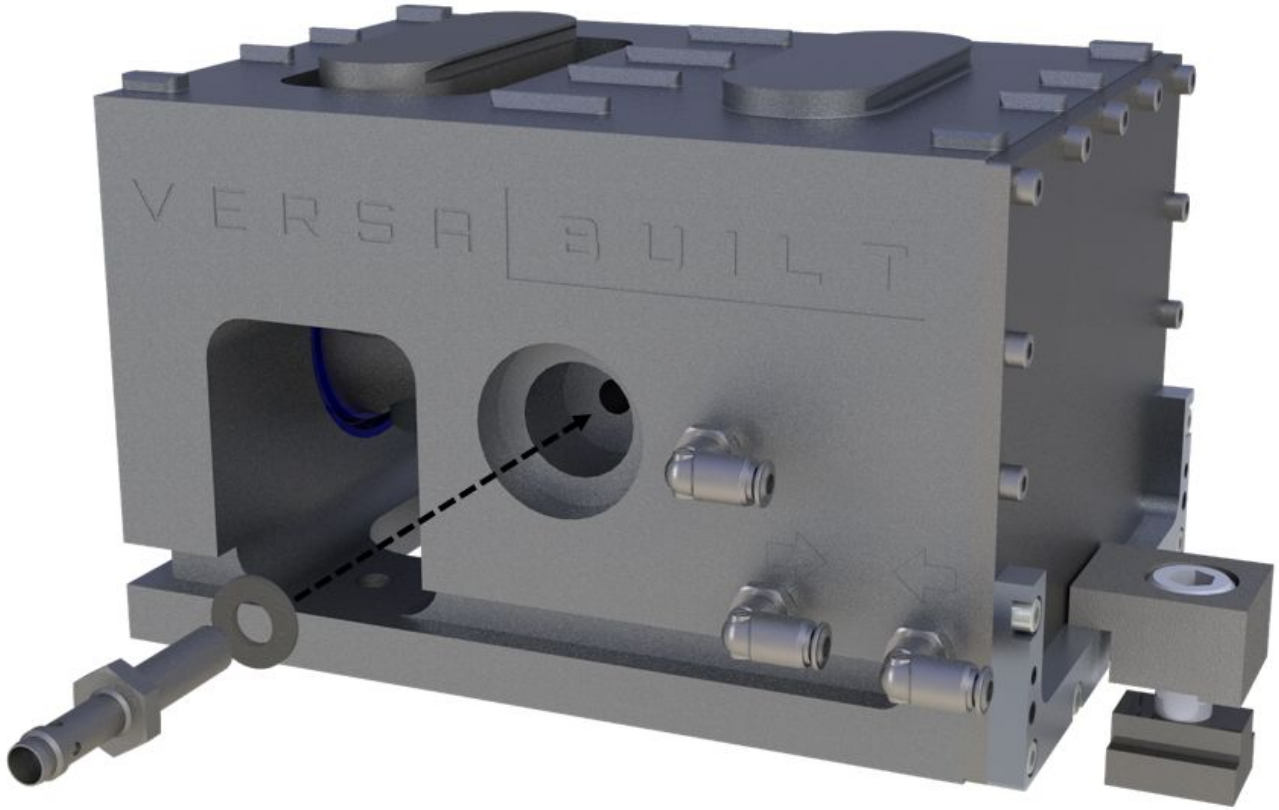
Parts:

- MultiGrip FJ Vise
- MultiGrip Vise Sensor Kit
  - 2 x M8 Proximity Sensors
  - M8 Y-Cable, 3-pin to 4-pin
  - M8 Cable, 4-pin, 15-feet

MultiGrip FJ Vise Sensor Installation

Caution

Sensors can be crushed by actuated vise, if installation steps are not properly followed.



MultiGrip FJ Vise Sensor Installation

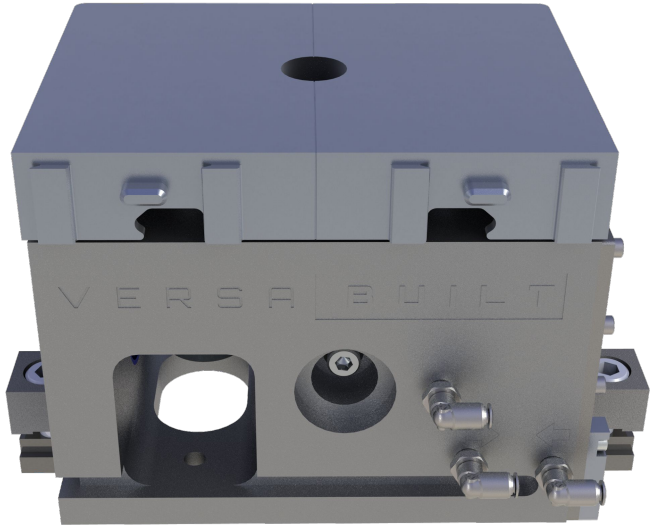
Vise Sensor Installation Steps:

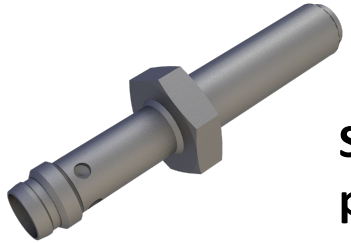
1. Place Diverter Valve in Manual Position
2. Verify Open and Close of each visePlace Calibration Jaws on Vise
3. Place vise in **OPEN** position
4. Close Vise to clamp on Calibration Jaws

   Setting sensor in vise fully open or fully closed position can result in crushed vise sensor
5. Remove M8 Socket Head Screw and M8 Washer from front side of the vise (using 6mm hex key)
6. Place nut on sensor body, near the back of the sensor body (at least 1” from the ***threaded*** end of the sensor)
7. Reuse M8 washer, placing on sensor body
8. Thread sensor into vise body, by hand until sensor bottoms out on shaft inside vise
9. Using 13mm Deep Socket Wrench, hand tighten sensor nut

Vise Open

Vise with Calibration Jaws



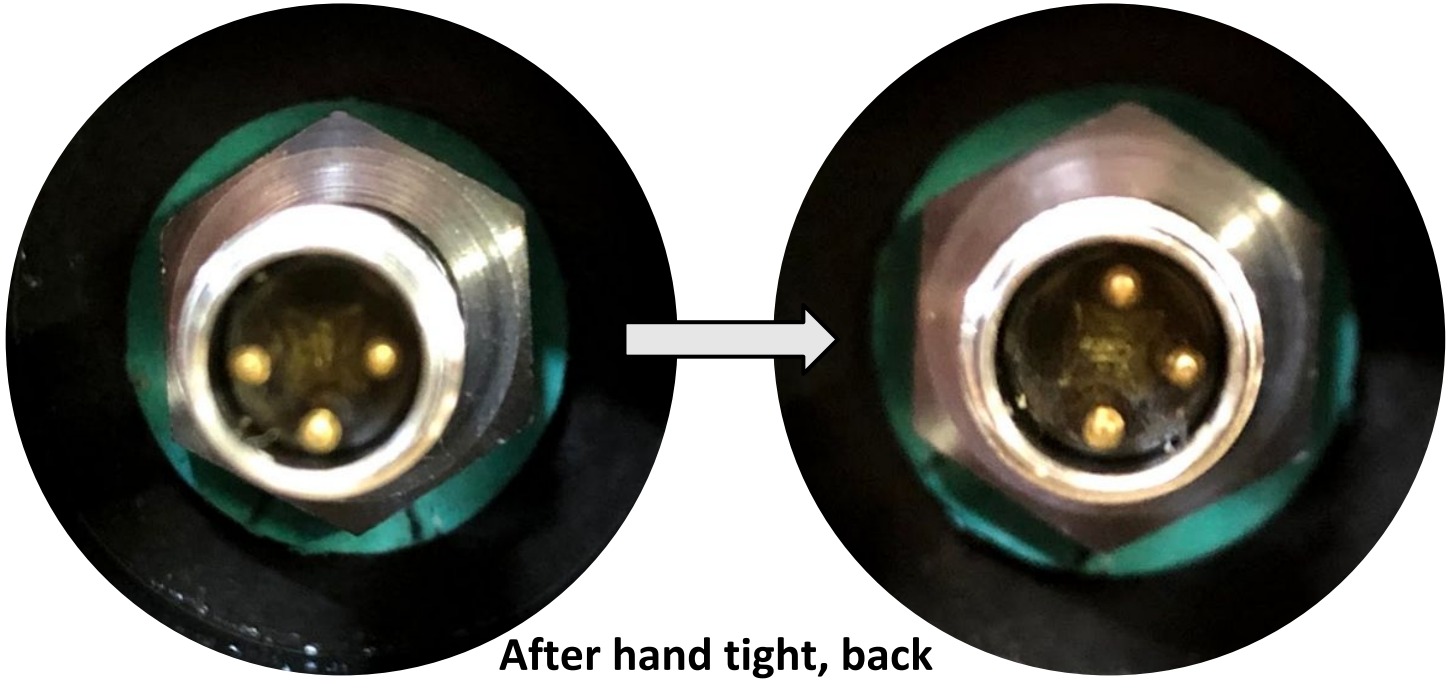


Sensor with nut in pre-install position

MultiGrip FJ Vise Sensor Installation

Vise Sensor Installation Steps, continued:

7. Note position of sensor in the fully inserted position
8. Loosen sensor nut (½ turn counter-clockwise)
9. Loosen sensor ¼ counter-clockwise turn, as shown on the right
10. Tighten sensor nut again (verify sensor is in same position before tightening (¼ counter-clockwise turn position)
11. Repeat process until the sensor is roughly ¼ turn from fully seated position
12. Tighten nut with deep socket wrench and ratchet
13. **Repeat process on 2nd Vise**



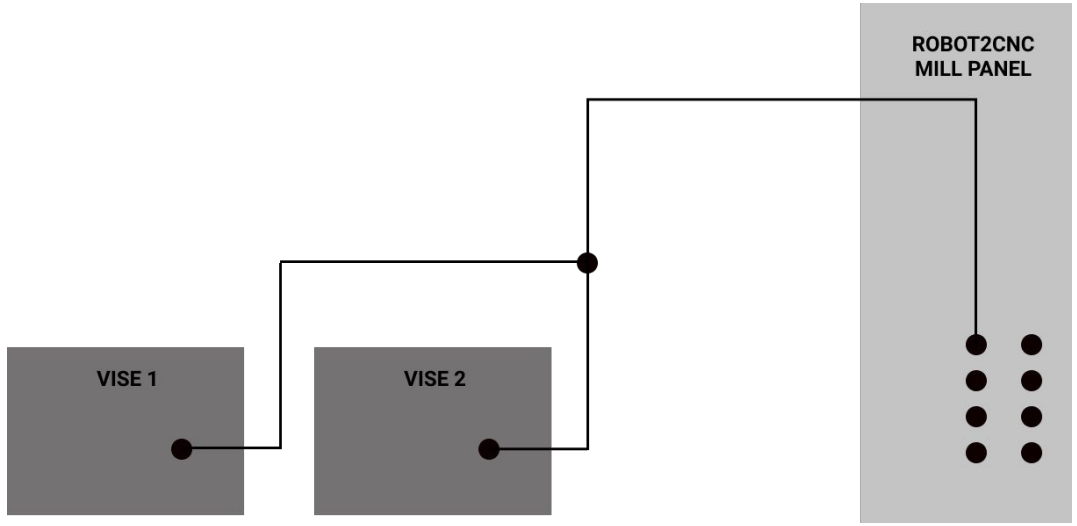
After hand tight, back up sensor ¼ turn

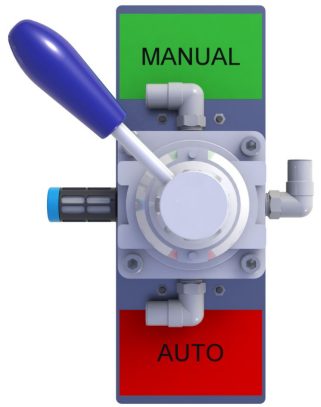
MultiGrip FJ Vise Sensor Installation

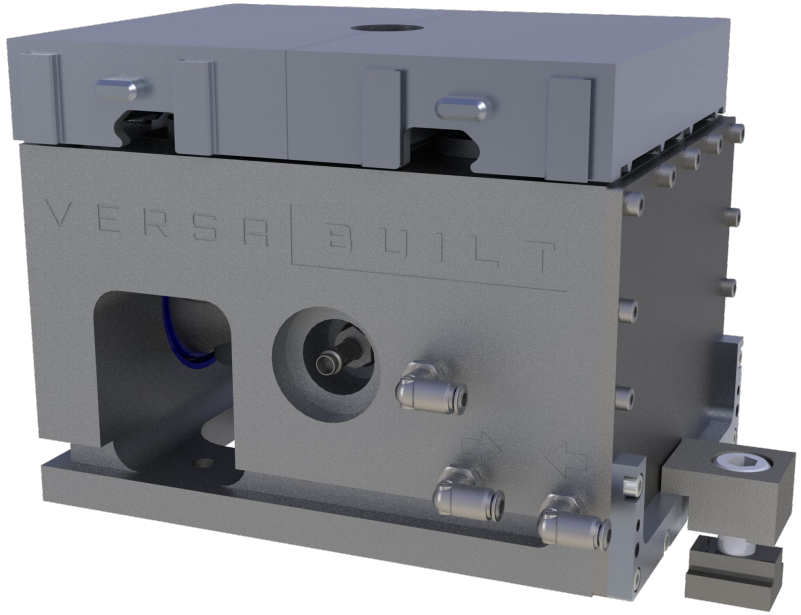
Connect Vise Sensor Cables and Test:

14. Connect Sensor Cables to Robot2CNC Mill Panel
    a. 3-Pin cables to each sensor
    b. 3-Pin cables to 4-pin cable
    c. 4-pin cable to Robot2CNC Mill Panel
    d. Route out of CNC, anchored for stress-relief with the Air Line Anchor Kit, to the Robot2CNC Mill Panel (Digital I/O A1).
15. Connect power cable to the Robot2CNC Mill Panel
16. Note a light on the sensor body will illuminate in the middle of the vise stroke, then turn off at the ends of the stroke (Open and Closed)
17. For each vise and each sensor:
    a. Open Vise, light should is OFF
    b. Close Vise to clamp on Calibration Jaws, light should be ON
    c. Open Vise, remove Calibration Jaws, then Close Vise, light should be OFF

    If sensor light is not working as noted, restart sensor installation process *verify sensor is not damaged and/or power is connected to Mill Panel*







Routing cables and tubing

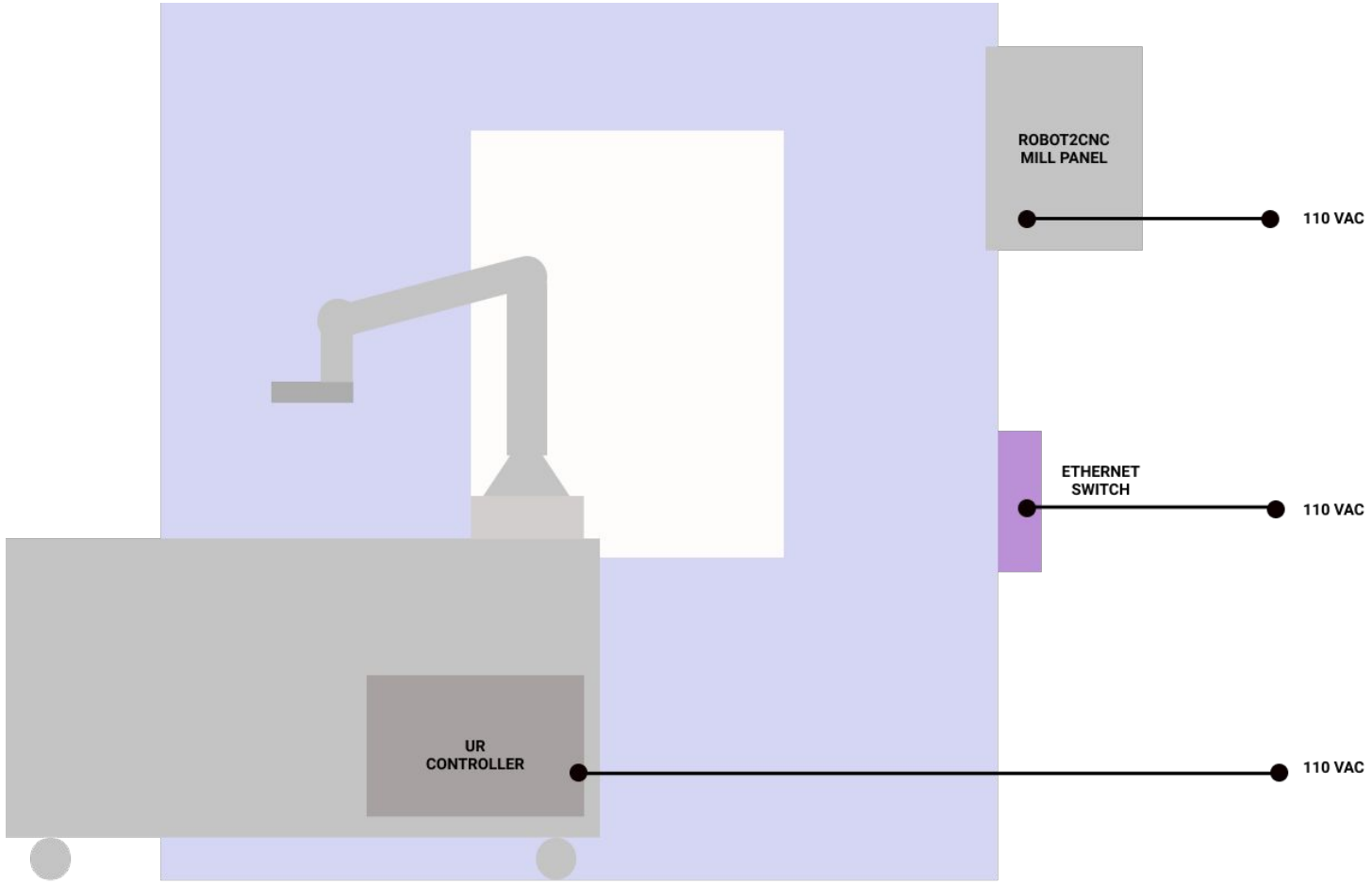
- Secure cables and tubing to Air Line Anchor Kit, leaving slack in all lines to prevent strain and undue stress during table movements
- Bundle lines together with cable ties and route lines out of the top of the CNC thru an access hole
- Test tube and cable length by moving the CNC table to the furthest and closest table positions relative to the access hole
- Adjust lengths to avoid tight lines at the furthest position and snags on the shortest position

Routing cables and tubing

- Included with the Tubing Kit are Magnets with anchoring loops
- Use cable ties and magnets to organize and route cables and tubing on, in, and around the CNC

Connect Electrical Power

- Before connecting electrical power to the system, make sure no person within 6 feet of the robot, gripper, vises, door opener or any other mechanism capable of movement or actuation.
- Connect power cable to Robot2CNC Mill Panel to 110 VAC outlet
- Connect power cable to UR Robot Controller to 110 VAC outlet
- Connect power cable to Ethernet switch to 110 VAC outlet

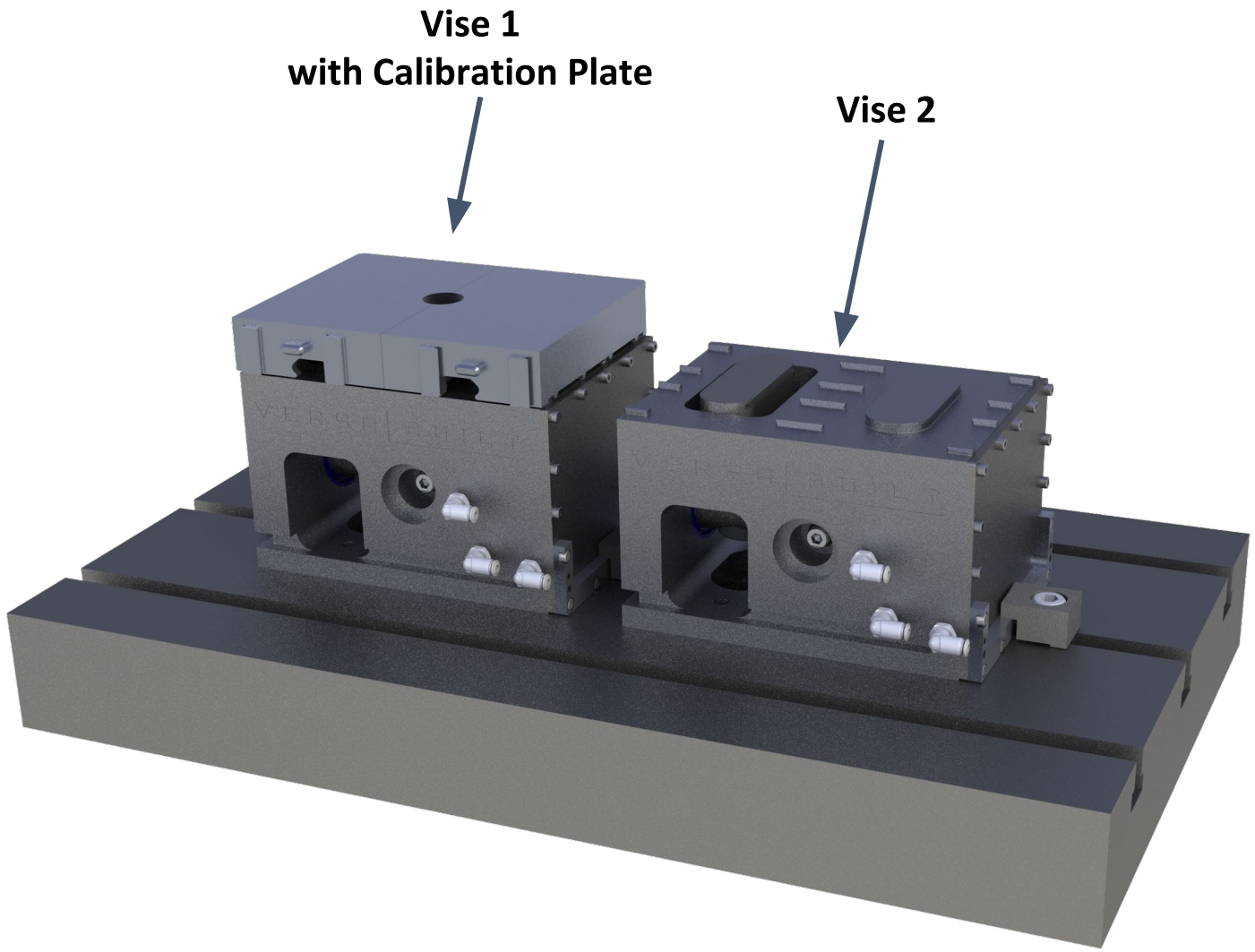


Find and Store CNC Vise Locations

Section 11

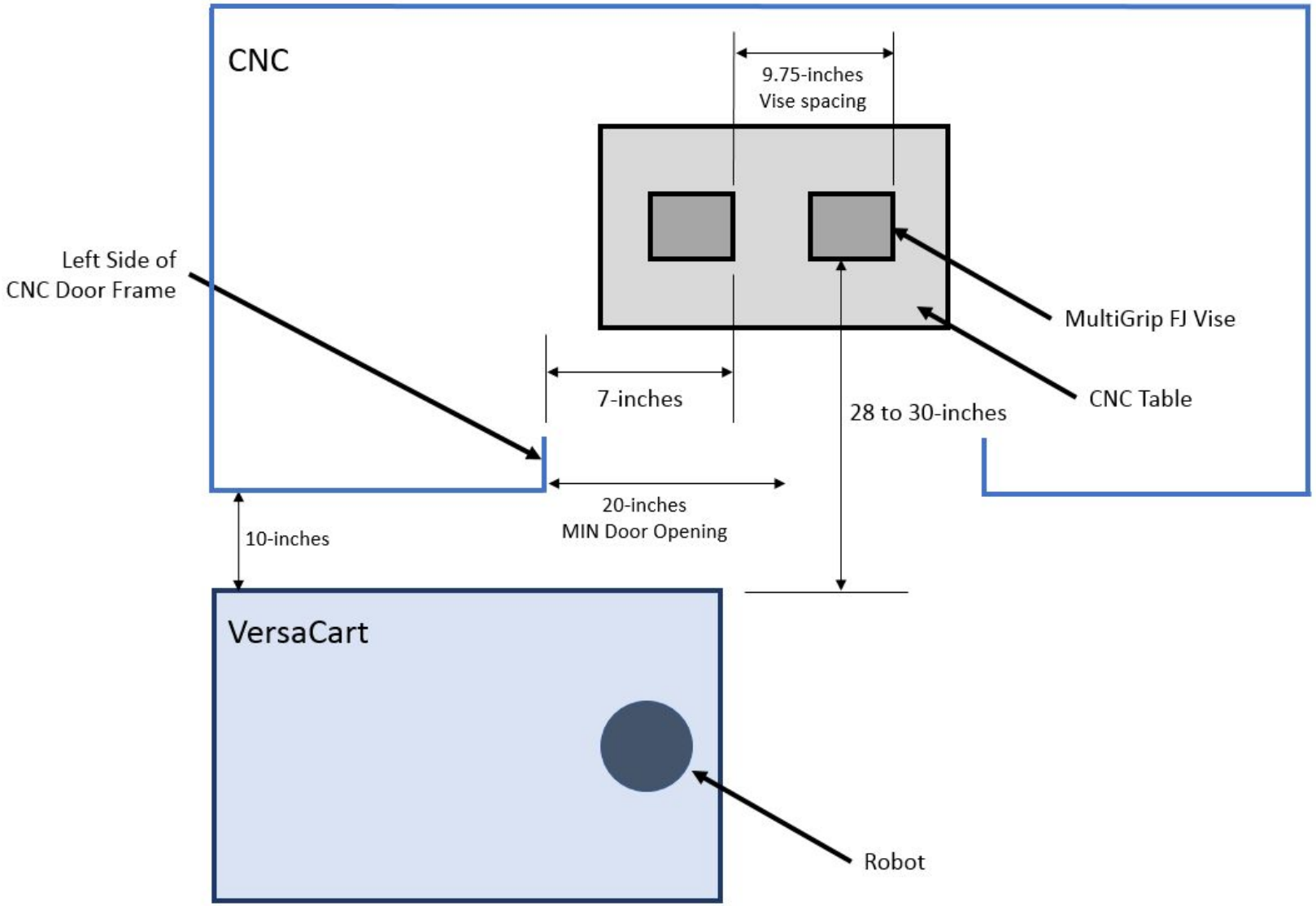
Find and Store Vise Home Locations

- Place Calibration Plate on Vise:
  - With vises open, place the Calibration Plate onto Vise #1 and use the hand valve to close the vise and secure the Calibration Plate
  - Verify the Calibration Plate is fully seated on the Vise Serrations
- Use a spindle probe or indicator to find the center of the hole for XY
- Repeat the process for the second vise
- Store each vise home location in the CNC control
- The vise home locations will be used in the Vise Wash program in Section 12



Set CNC Table Load Position

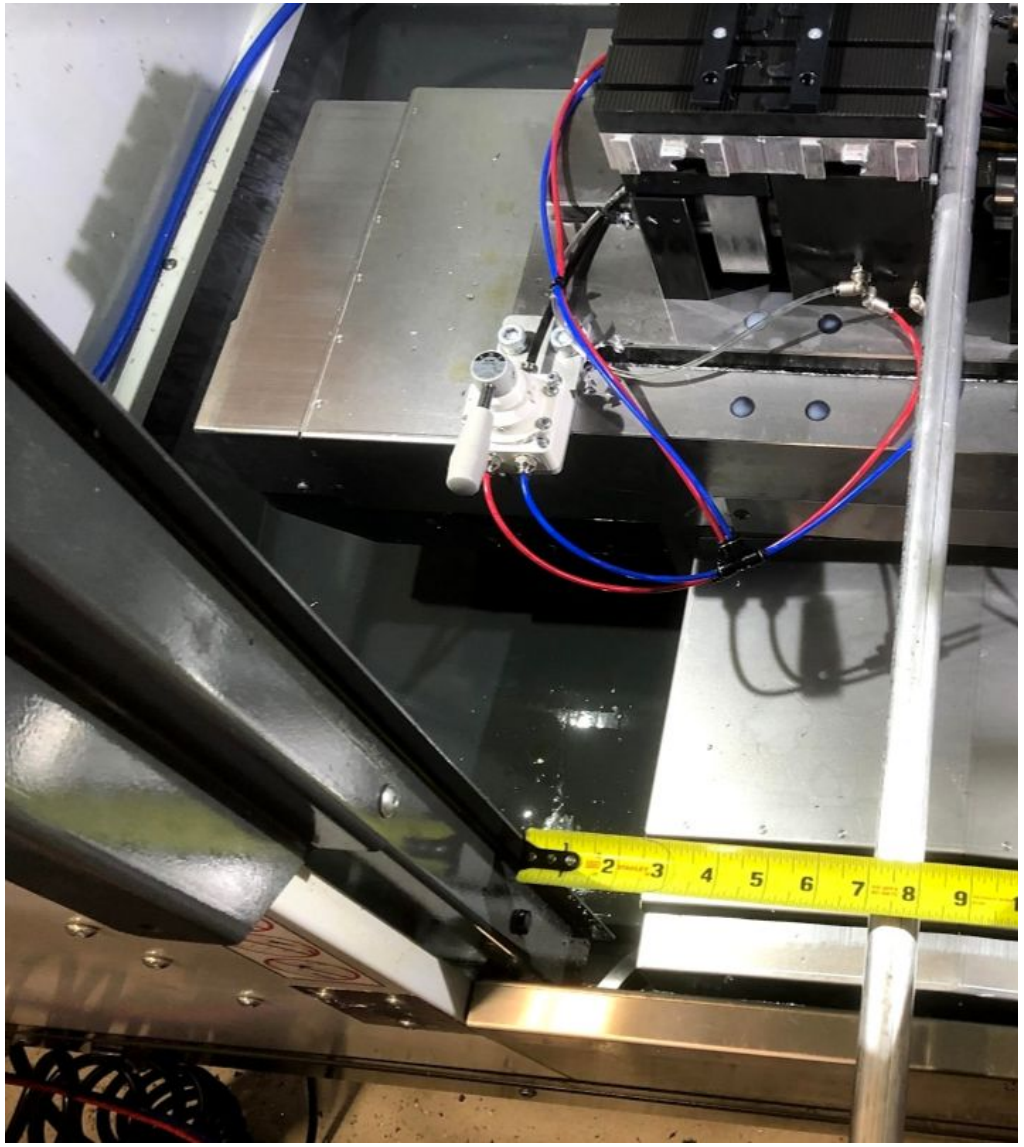
- Open the CNC Door and move the CNC table to a the table load position according to the diagram at the right
- Save the Table Load Position as a CNC home location in the CNC control, VersaBuilt recommends using G53 for the Table Load Position
- The Table Load position will be used in Section 12 when editing the table load program



Set CNC Table Load Position

To set position of CNC Table, relative to doorway:

- Open CNC Door
- Place bar across side of Vise #1
- Measure from inside edge of the door or door frame to the inside of the bar
- The Table Load position needs to be 7-inches, as shown in the image to the right

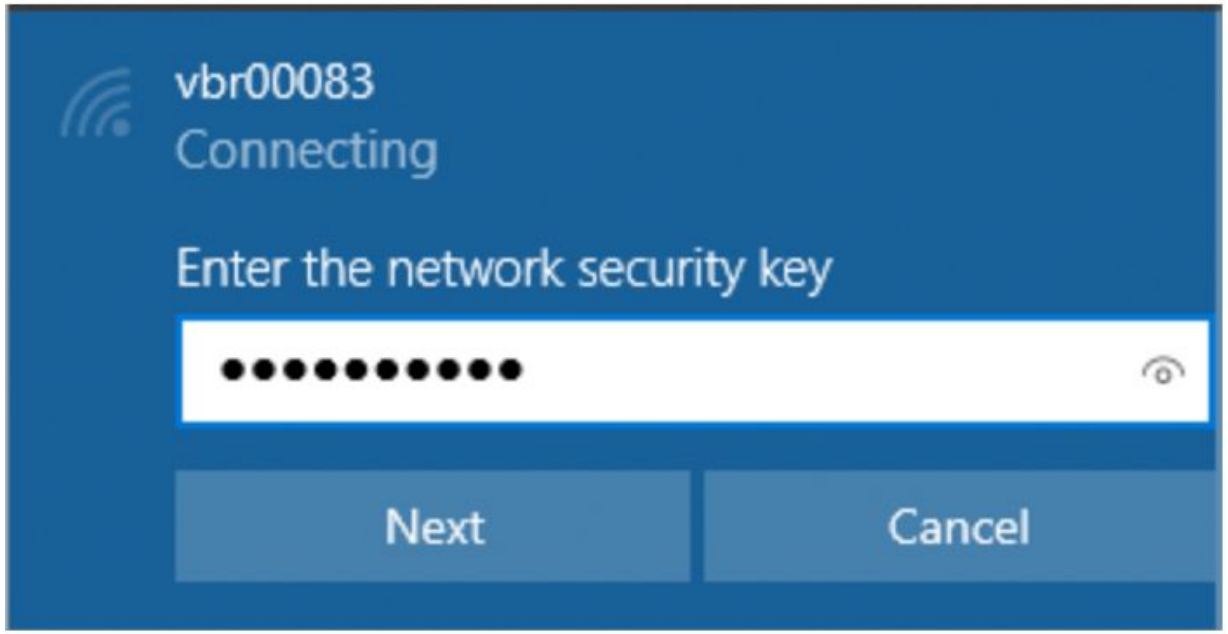


Configure CNC and Robot and Install UR Mill App Software

Section 12

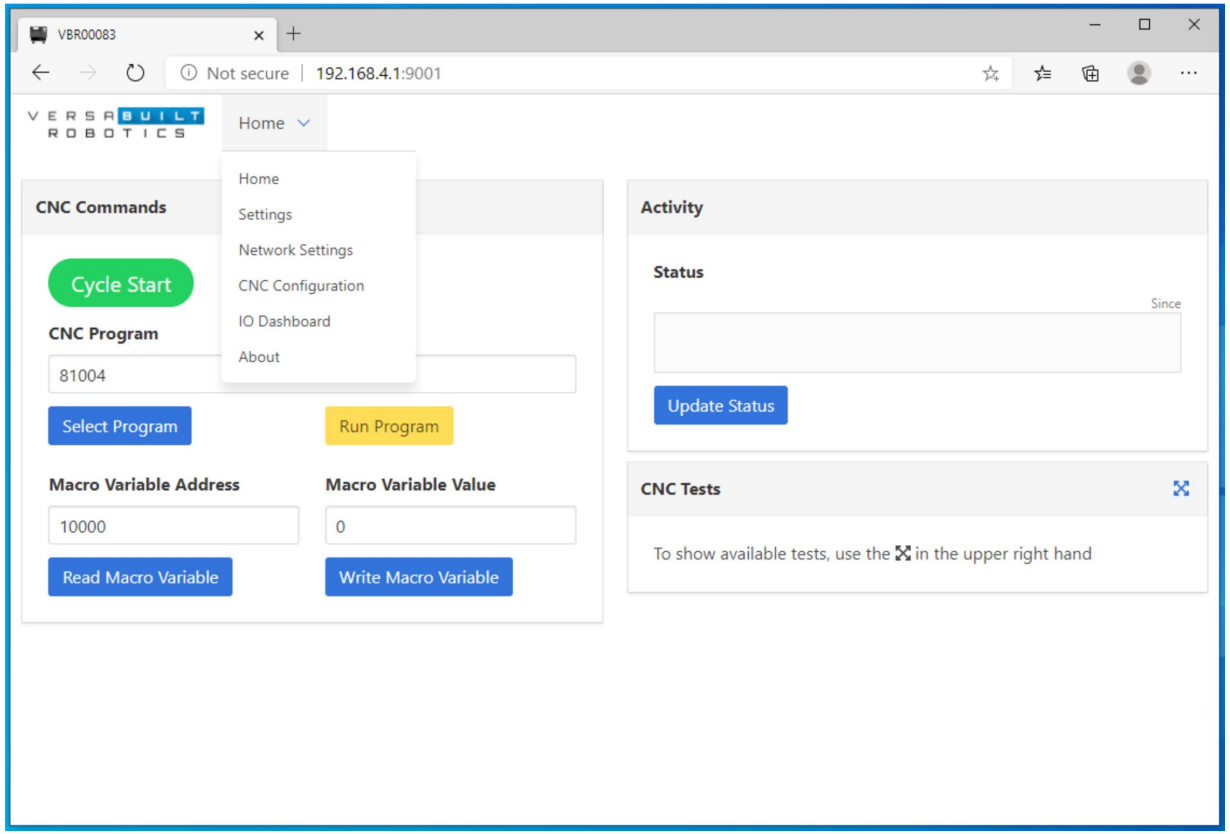
Connect to and Configure Robot2CNC Mill Edition

- For this step you will need to use a computer, tablet or phone to connect to the Robot2CNC's Wifi
- Open the WiFi settings of your device and look for the vbrXXXXX network, where XXXXX is the serial number of your Robot2CNC
- Enter the Robot2CNC default WiFi password: versabuilt



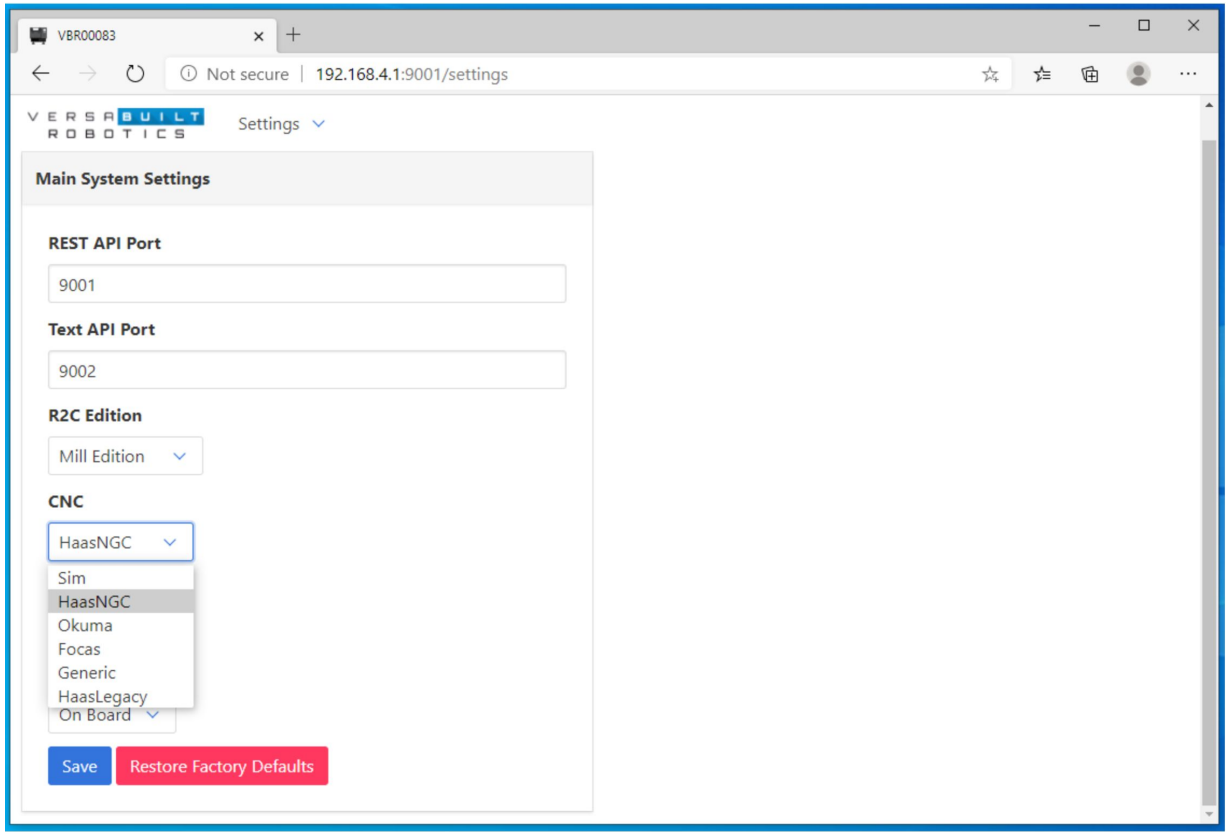
Connect to and Configure Robot2CNC Mill Edition

- Once connected to the Robot2CNC Wifi network, open a web browser and enter the following in the address bar of the browser: **192.168.4.1:9001**
- Click on the drop down menu in the upper left portion of the screen and select Settings



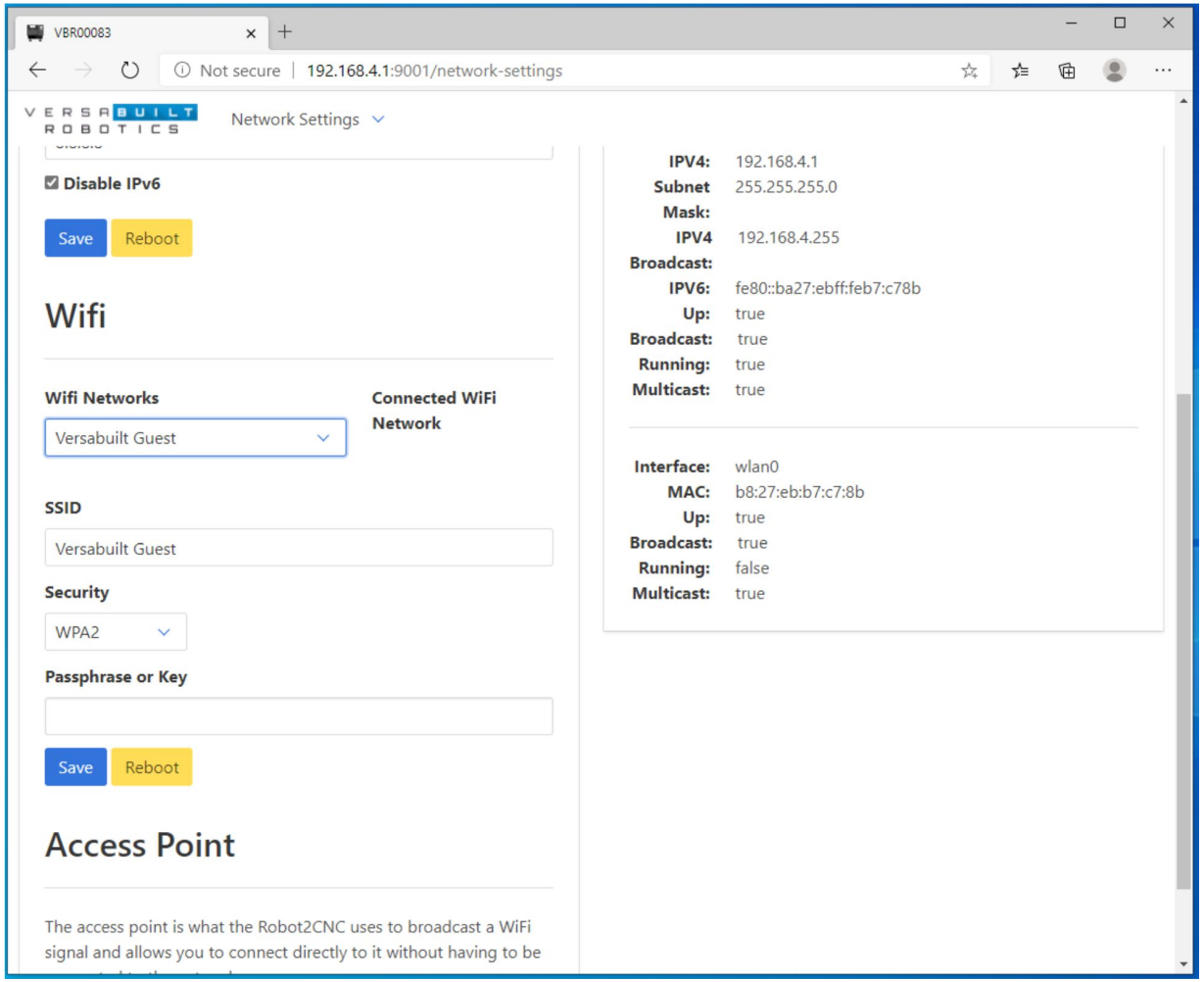
Connect to and Configure Robot2CNC Mill Edition

- Click on the drop-down menu under CNC and select the type of your CNC from the list:
  - Sim - only used for testing
  - HaasNGC - newer Haas controls
  - Okuma - Okuma OSP-300 controls
  - Focas - Fanuc controls
  - Generic - generic interface using hand-shake signals
  - HaasLegacy - older Haas controls
- Press the Save button, Robot2CNC will restart and update the screen after about 15 seconds



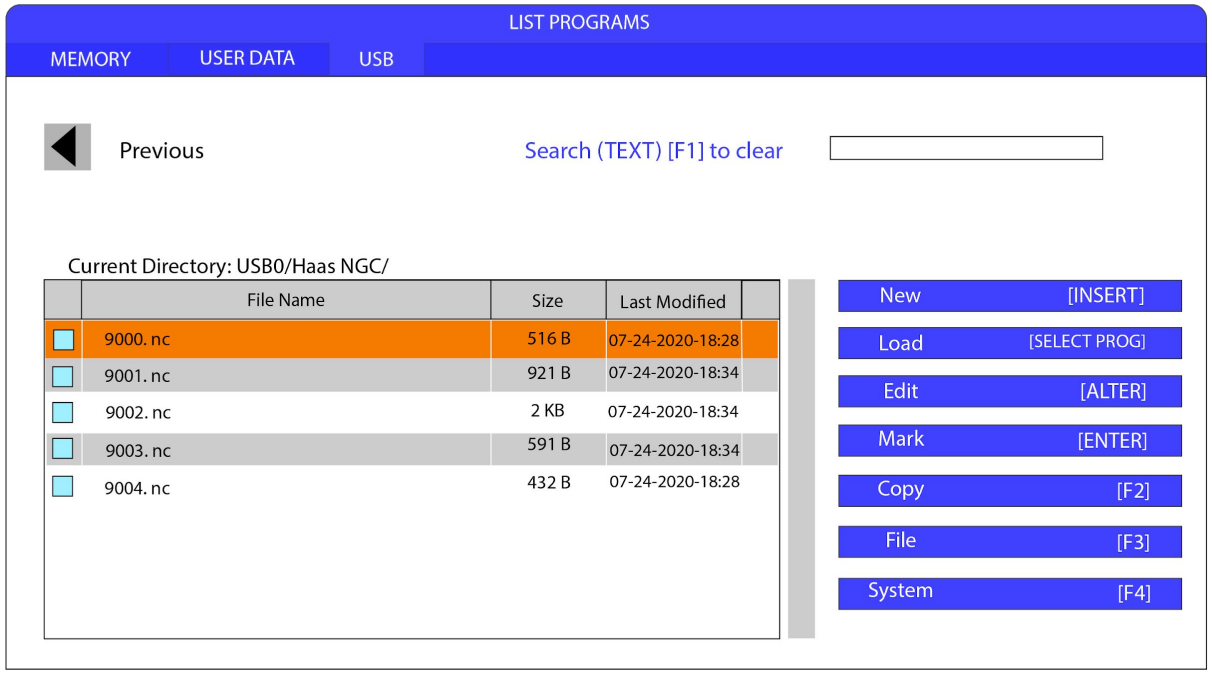
Optional: Configure Robot2CNC Mill Edition Internet Access

- Configuring for Internet Access will allow VersaBuilt to access the Robot2CNC for remote support
- The Robot2CNC will only connect to the Internet and allow VersaBuilt access when Remote Support is enabled from the Robot2CNC URCap
- Internet access is most easily accomplished by configuring the Robot2CNC to connect to a local Wifi network from the Network Settings page
- Alternatively, the Robot2CNC, Robot and CNC can be connected to the LAN, consult an IT specialist for LAN configuration



Install Robot2CNC Gcode Files on CNC

- Insert the VersaBuilt USB Drive into the CNC control
- Navigate to the folder on the USB drive that matches the CNC brand
- Copy all gcode files from the folder onto the CNC control
- See Appendix E for additional software installation instructions for Okuma CNC controllers



Edit CNC Table Load Program

- Edit the 8000 CNC Table Load Program to reference the Table Load position found in Section 11
- Note that the program is generic gcode and should be carefully reviewed and edited before running on your CNC

```
%
O8000(DEFAULT TABLE LOAD POSITION)
#3000=1(LOAD POSITION NOT SET)
(DELETE ALARM LINE WHEN SET AND TESTED)
G0G91G49G40G28Z0 (MAKE SURE Z AXIS IS
HOME)
G0G90G53X0.0Y0.0 (SET TABLE LOAD POSITION)
M98 P9004 (ROBOT2CNC HANDSHAKE)
M30
%
```

CNC Table Load Program positions the CNC table for robot exchange of parts and MultiGrip Jaws

Edit/Test Vise Wash Program

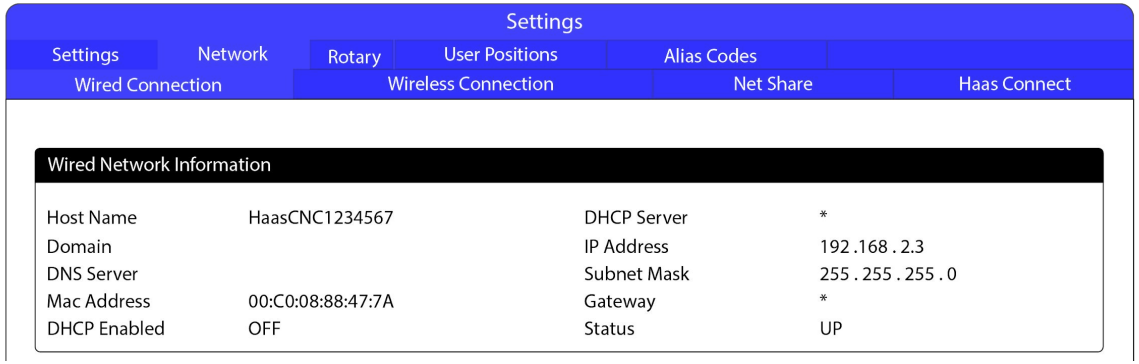
- Edit the 8001 CNC Table Wash Program to reference the vise home locations found in Section 11
- Note that the program is generic gcode and should be carefully reviewed and edited before running on your CNC
- Select a specific tool to be called when the CNC Table Wash Program runs, should be a short tool that won't collide with parts on the vise
- Test the CNC Table Wash Program to ensure all chips will be adequately flushed from the vises

```
%
O8001(VISE WASH)
(----------ZIG ZAG PATTERN----------)
#3000=1(WASH ROUTINE NOT SET)
(DELETE ALARM LINE WHEN SET AND TESTED)
G0G91G49G40G28Z0(MAKE SURE Z AXIS IS HOME)
T20 M06 (ADJUST PER WASH TOOL LOCATION IN TOOL TURRET)
G90
G54(ADJUST WORK COORDINATE TO MATCH VISE 1)
M08
G00 X-3.0Y3.0
G01X-3.0Y-3.0F400.
X-1.5Y3.0
X-1.5Y-3.0
X0.0Y3.0
X0.0Y-3.0
X1.5Y3.0
X1.5Y-3.0
X3.0Y3.0
X3.0Y-3.0
G55(ADJUST WORK COORDINATE TO MATCH VISE 2)
G00 X-3.0Y3.0
G01X-3.0Y-3.0F400.
X-1.5Y3.0
X-1.5Y-3.0
X0.0Y3.0
X0.0Y-3.0
X1.5Y3.0
X1.5Y-3.0
X3.0Y3.0
X3.0Y-3.0
M09
M98 P9004 (ROBOT2CNC HANDSHAKE)
M30
%
```

CNC Wash Program cleans vises of debris/chips between operations

Configure CNC Settings

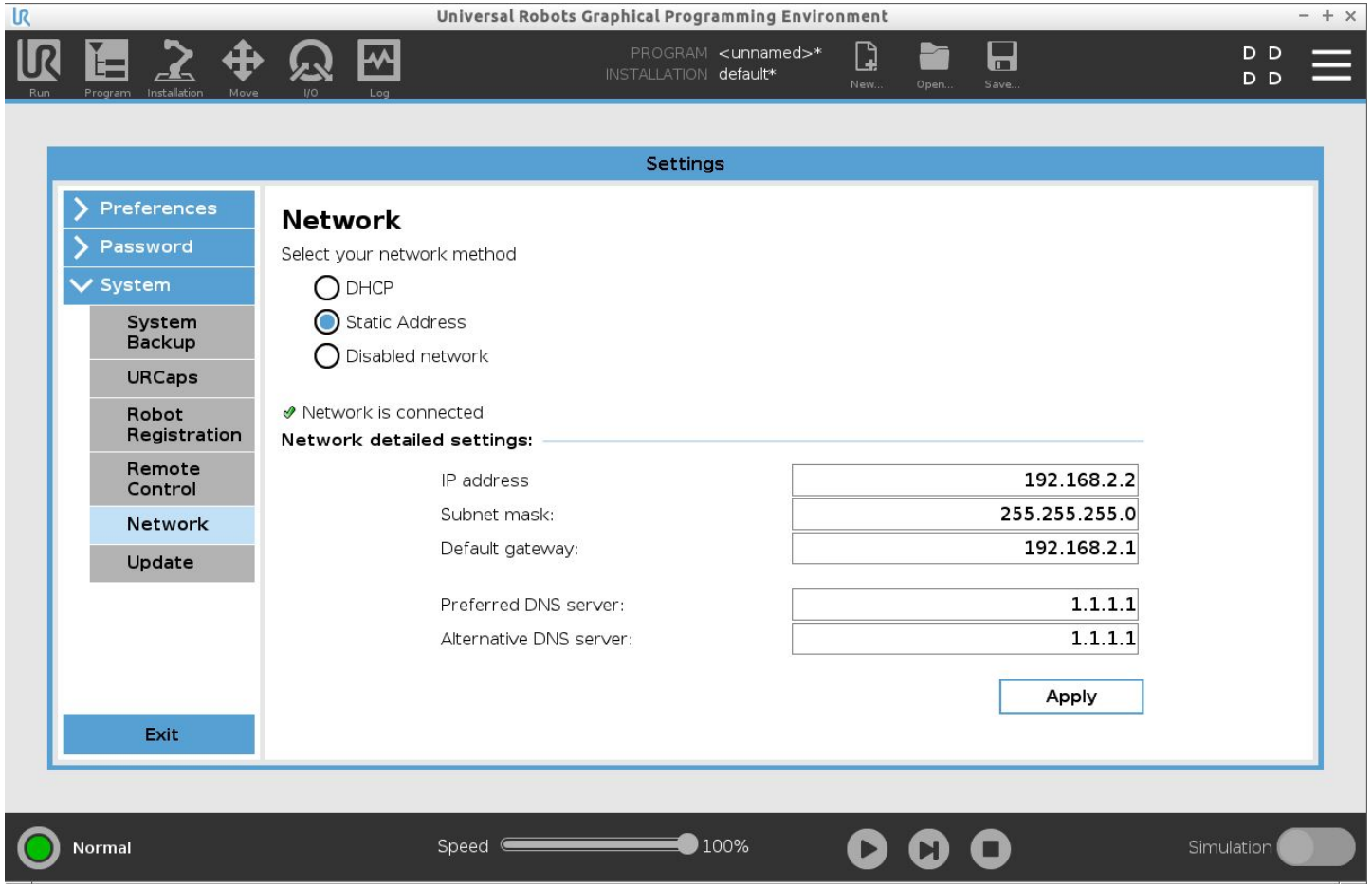
- Configuration settings for the CNC are make and model dependent
- Refer to Appendix E for CNC configuration instruction by CNC make



Configure UR Robot Network Settings

UR teach pendant Settings -> System -> Network set the following:

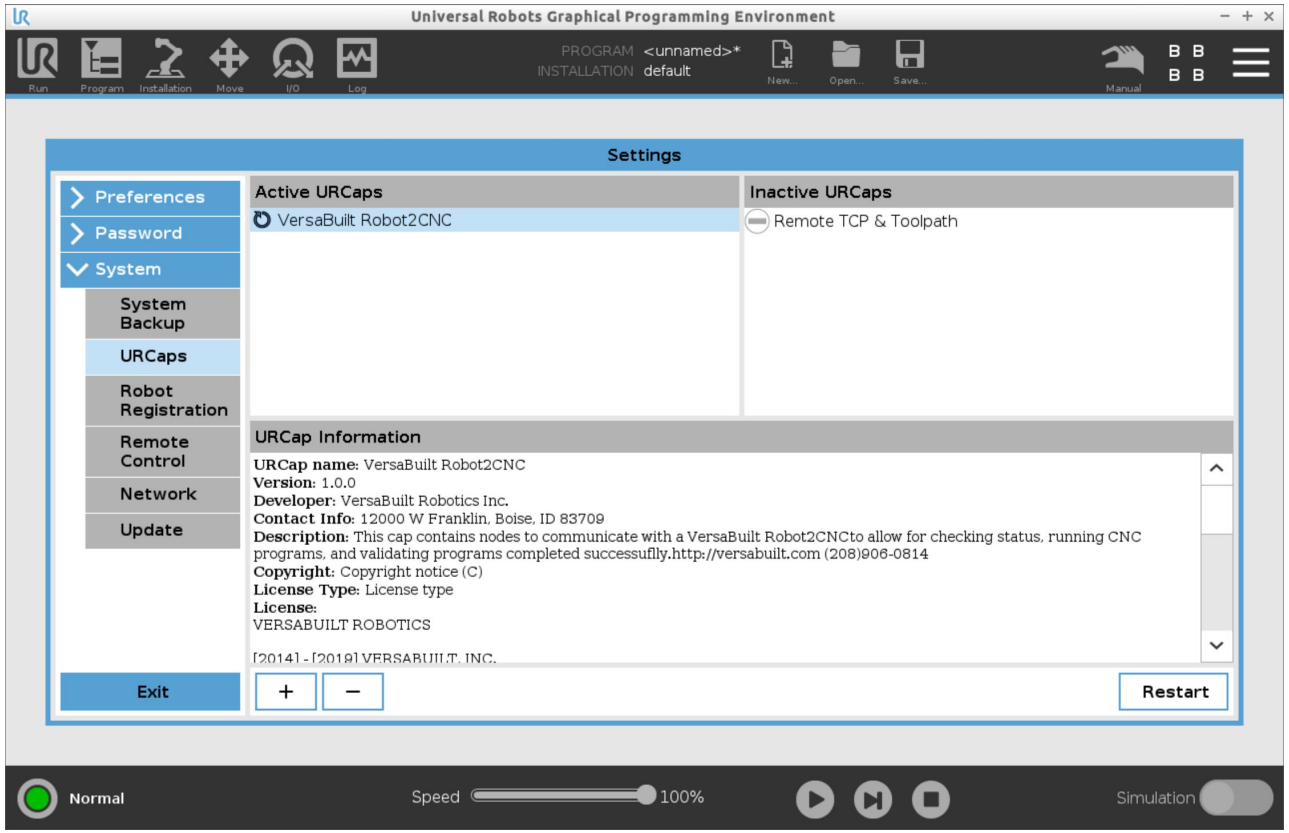
- Network Method: Static Address
- IP address: 192.168.2.2
- Subnet mask: 255.255.255.0
- Default gateway: 192.168.2.1
- Preferred DNS server: 1.1.1.1
- Alternate DNS server: 1.1.1.1



Install Mill App Software on UR Robot

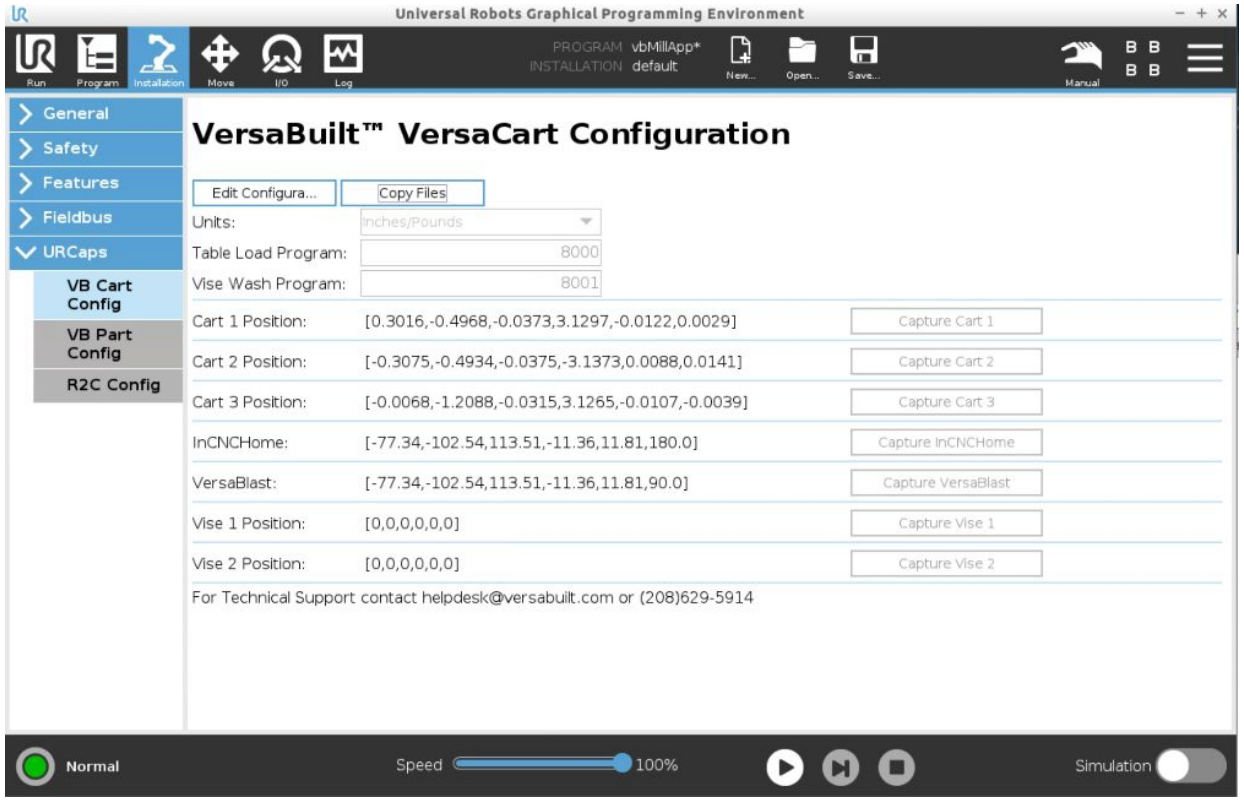
- Put the VersaBuilt USB Drive into the USB slot of the UR Teach Pendant
- Click on the 3 horizontal bars in the upper right-hand corner of the UR Teach Pendant and select Settings -> System -> URCaps
- Press the + button
- Navigate to the root folder of the usbdisk and Select the robot2cnc.urcap* file
- **NOTE:** the UR Teach Pendant will prompt to restart after the URCap file is selected, do not restart yet
- Press the + button
- Navigate to the root folder of the usbdisk and Select the VersaBuiltMillApp.urcap* file
- Press the Restart button

*actual file name may be different



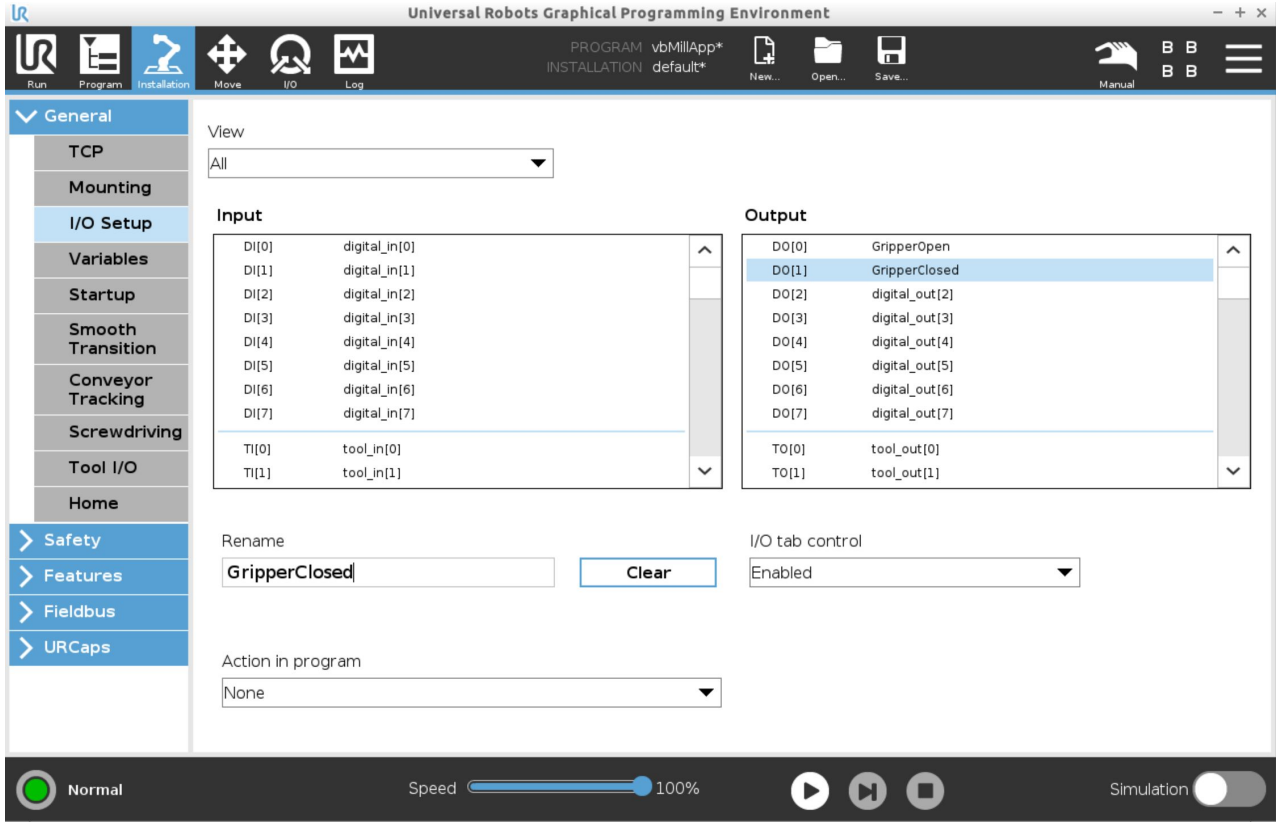
Install Mill App Software on UR Robot

- Put the VersaBuilt USB Drive into the USB slot of the UR Teach Pendant
- Click on the Installation Tab of the UR Teach Pendant and select URCaps -> VB Cart Config
- Press the Copy Files button
- Click on the Installation Tab of the UR Teach Pendant and select URCaps -> VB Cart Config
- Press the Copy USB Files button



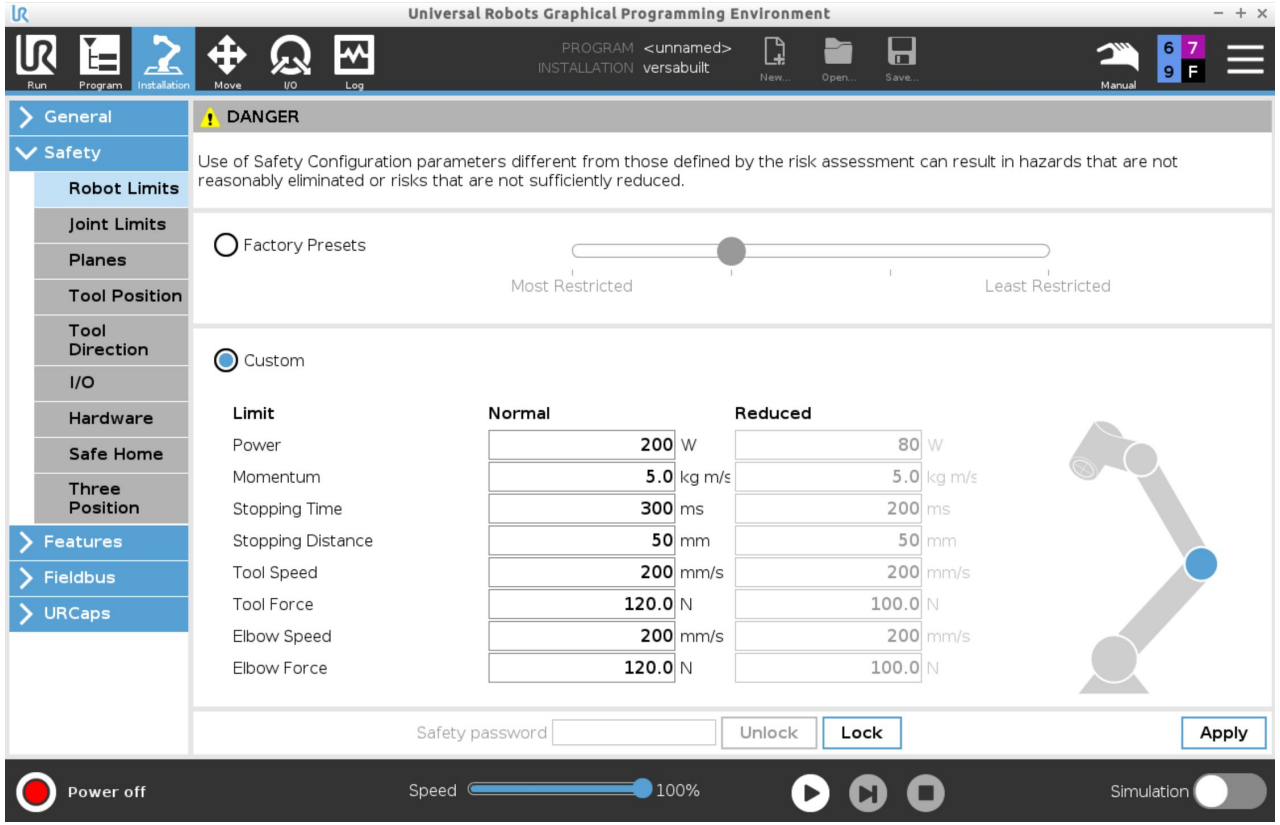
Name UR Robot Gripper IOs

- Put the VersaBuilt USB Drive into the USB slot of the UR Teach Pendant
- Click on the Installation Tab of the UR Teach Pendant and select General -> I/O Setup
- Click on the Output DO[0]
- Click in the Rename text box and enter GripperOpen
- Click on the Output DO[1]
- Click in the Rename text box and enter GripperClosed



Configure UR Robot Safety

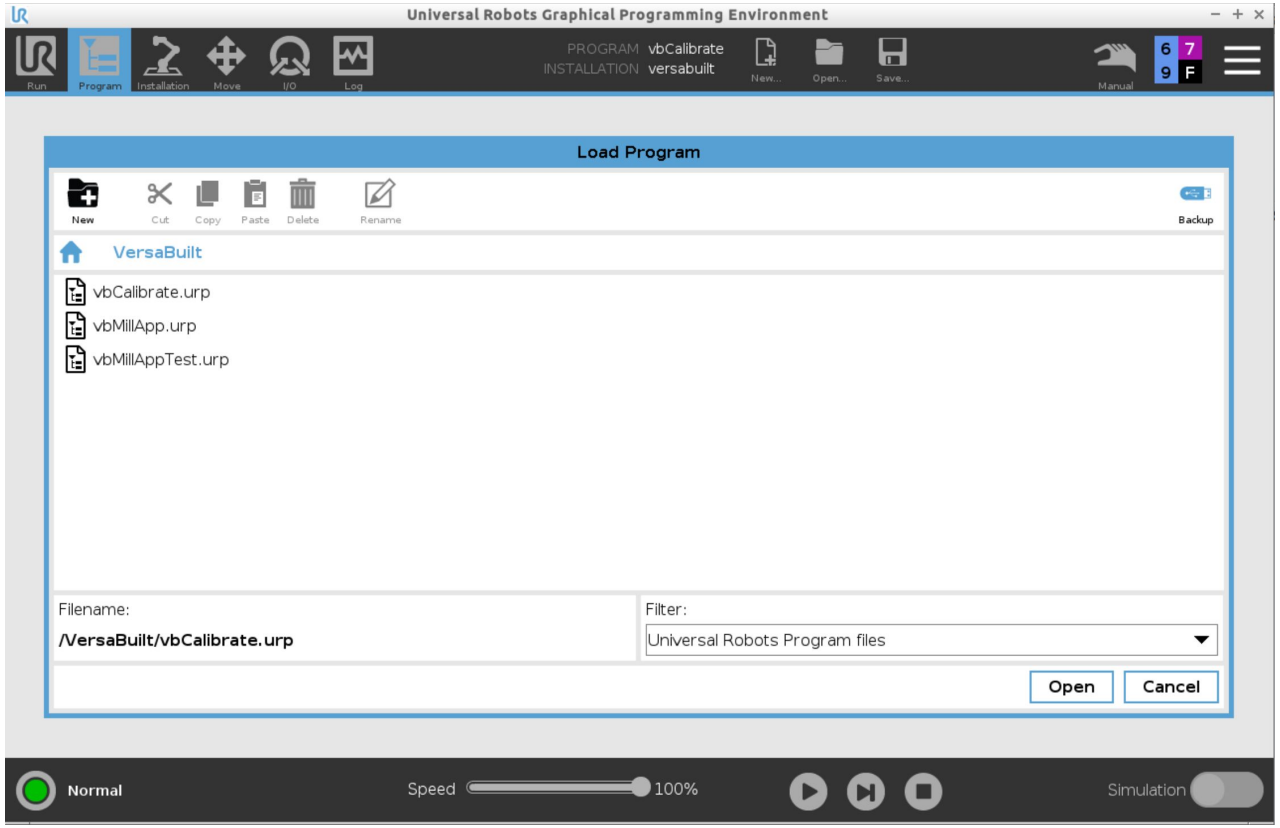
- Perform risk assessment prior to this step
- Configure UR Robot Safety settings according to the risk assessment
- After safety configuration is complete, save the Installation using the Save… icon near the top of the screen
- Name the installation file: versabuilt.installation



Associate VersaBuilt Programs with Safety Configuration

- Press the Open… icon near the top of the screen, navigate to the VersaBuilt folder, open the vbCalibrate.urp program
- The UR Teach Pendant will prompt you to confirm that the safety configuration has changed, confirm the change
- After the program loads, verify the safety checksum has not changed from the previous step
- The safety checksum is in the upper right of the teach pendant and is a quadrant of numbers, letters and colors:

- Save the program
- Perform the same steps for the vbMillApp.urp and vbMillAppTest.urp programs

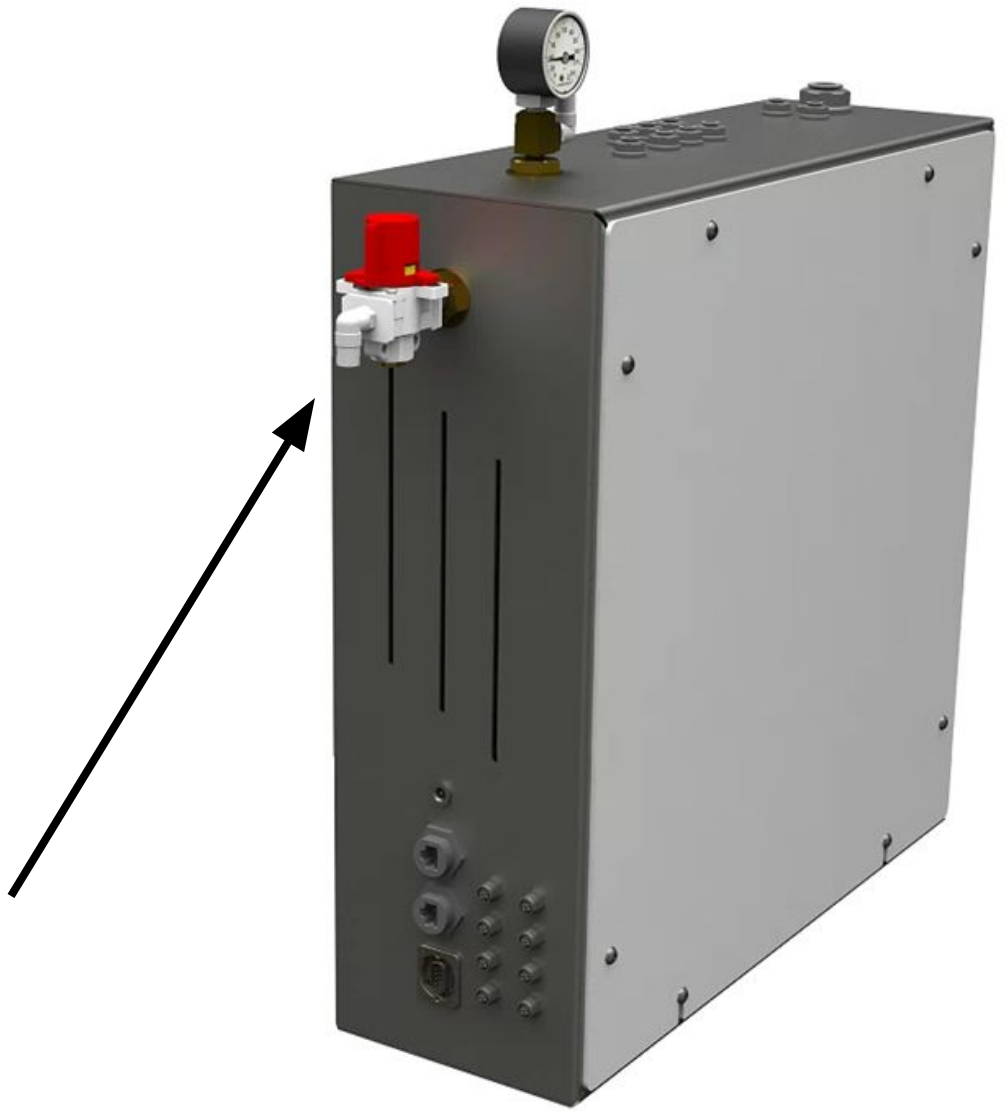


Calibrate and Validate Mill App Kit

Section 13

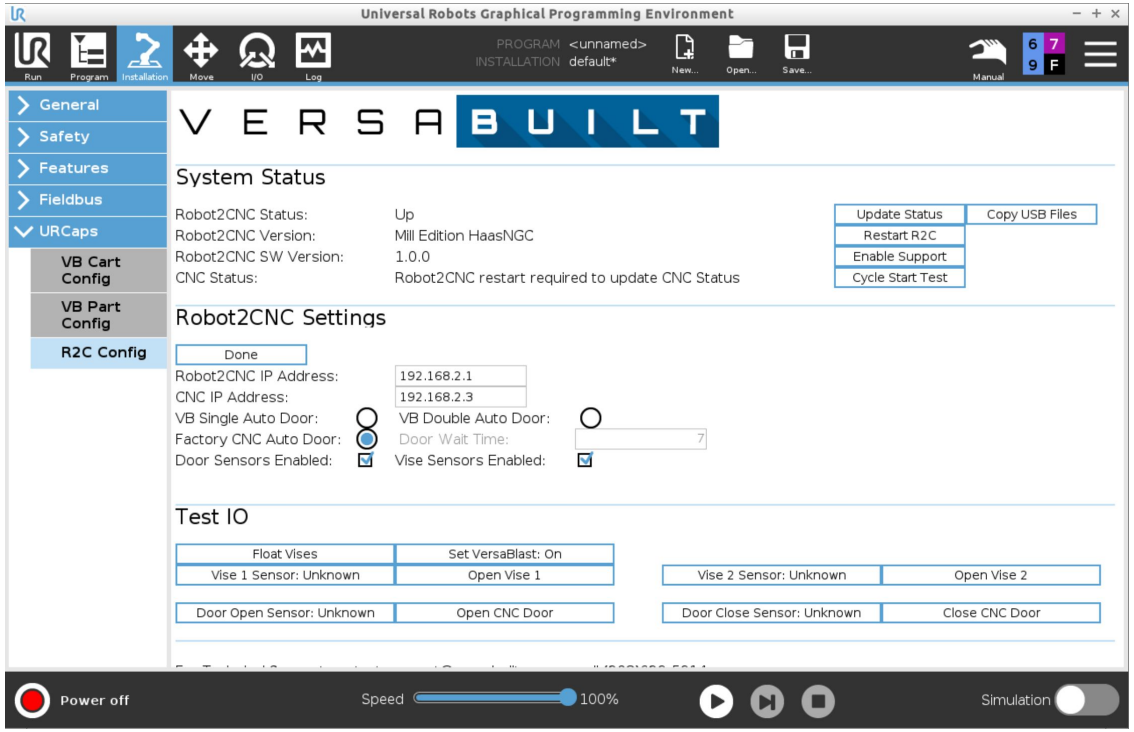
Configure and Validate Robot2CNC Mill Panel

- WARNING: this step opens and closes the vises, grippers and door. Keep all body parts away from the vises, grippers and door
- If an air line needs to be swapped, remove pneumatic energy to the system by turning the red air relief valve on the Robot2CNC Mill Panel



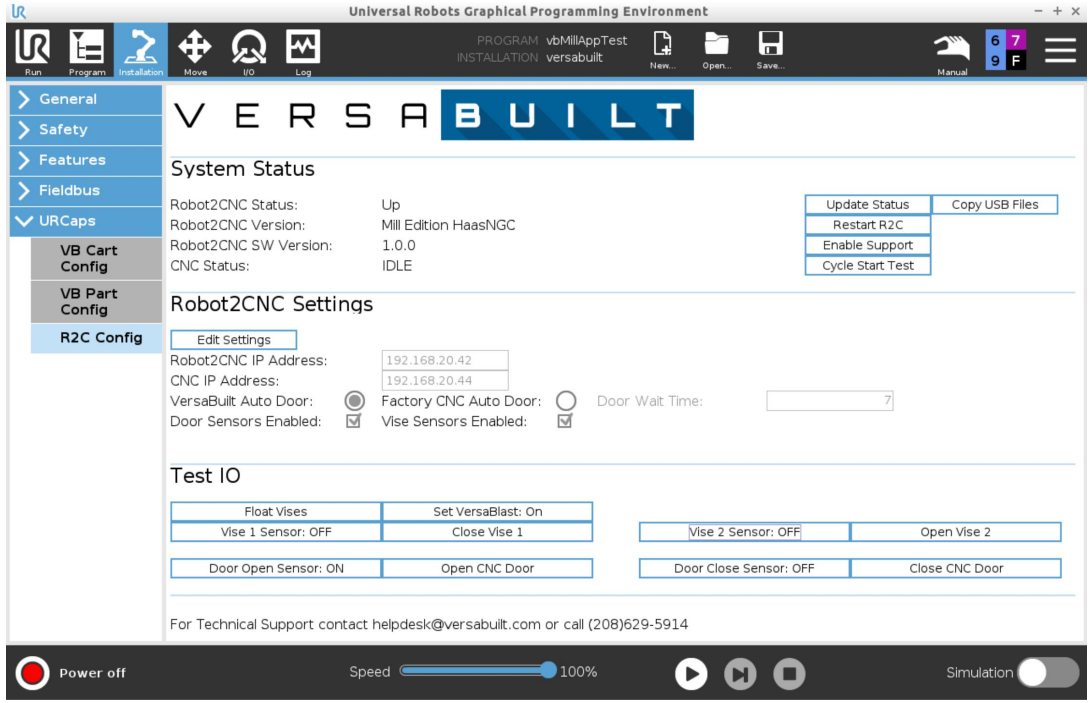
Validate Robot2CNC Mill Panel

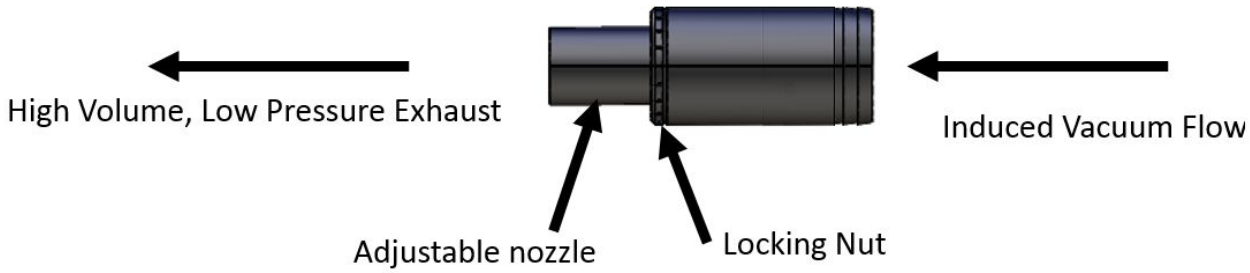
- Make sure the UR Robot, the Robot2CNC and the CNC are all powered on
- Make sure the CNC is in memory mode, **program 9000** is selected and the CNC door is closed
- On the UR Teach Pendant, press **Installation Tab -> URCaps -> R2C Config**
- Check to ensure the **Robot2CNC Status: Up** and the **CNC Status: IDLE**
- Press the **Cycle Start Test button**, ensure **CNC Status: CNC Cycle Start Test passed**



Validate Robot2CNC Mill Panel

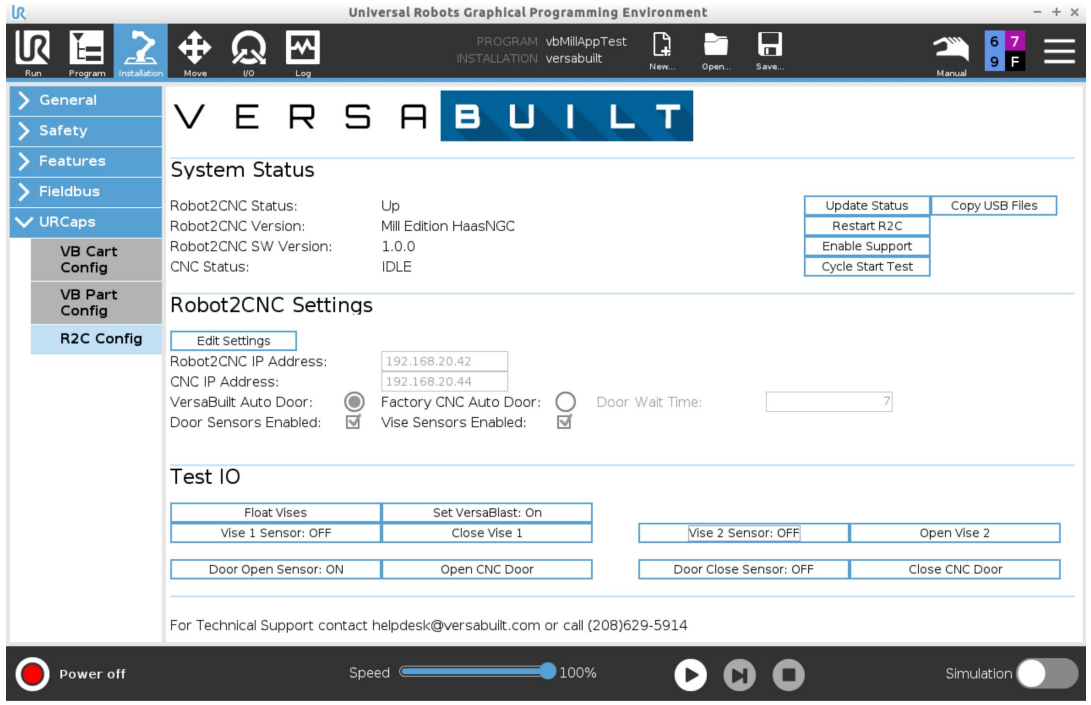
- Each of the following tasks may require more than one button push for the URCap and the Robot2CNC to synchronize
- Make sure all people are clear of the vises, VersaBlast and CNC door during these tests
- **VersaBlast - Test and Set:**
  - Press **Set VersaBlast: On** button, make sure the VersaBlast is blowing air
  - Adjust nozzle to maximize air velocity, and lock nut
  - Press the **Set VersaBlast: Off** to turn off the VersaBlast





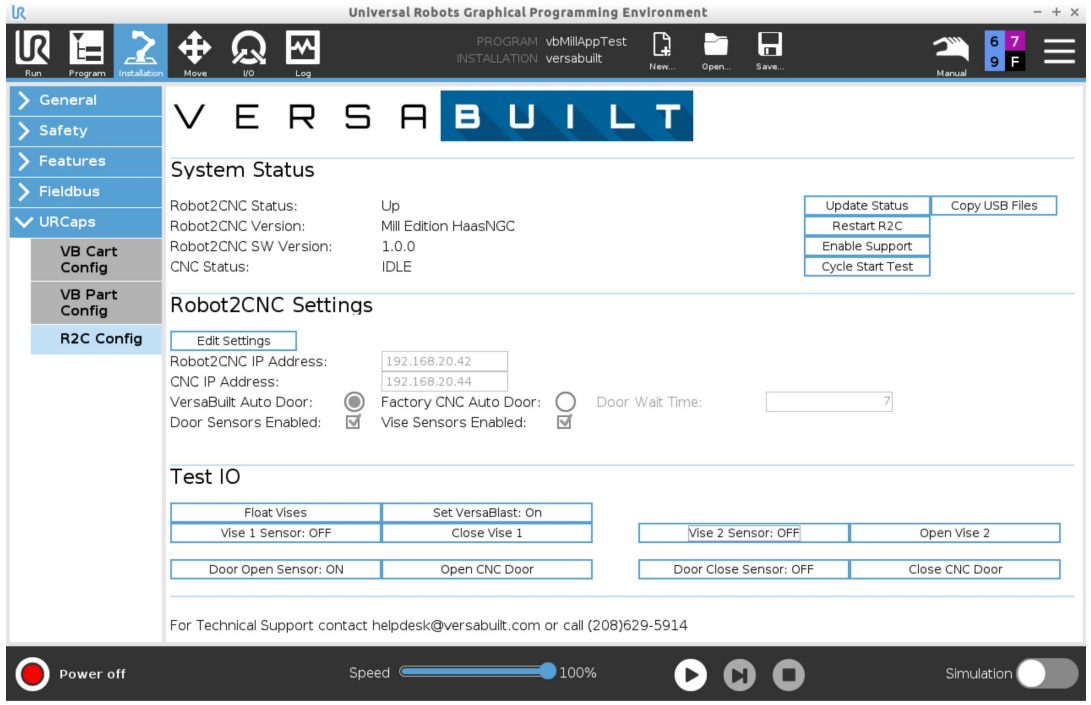
Validate Robot2CNC Mill Panel

- **Vise Open/Close Testing:**
  - Press the **Open Vise 1** button, ensure the vise opens
  - Press the **Close Vise 1** button, ensure the vise closes
  - Repeat the process for **Vise 2**
  - *If necessary, swap airlines to get correct open/close order*



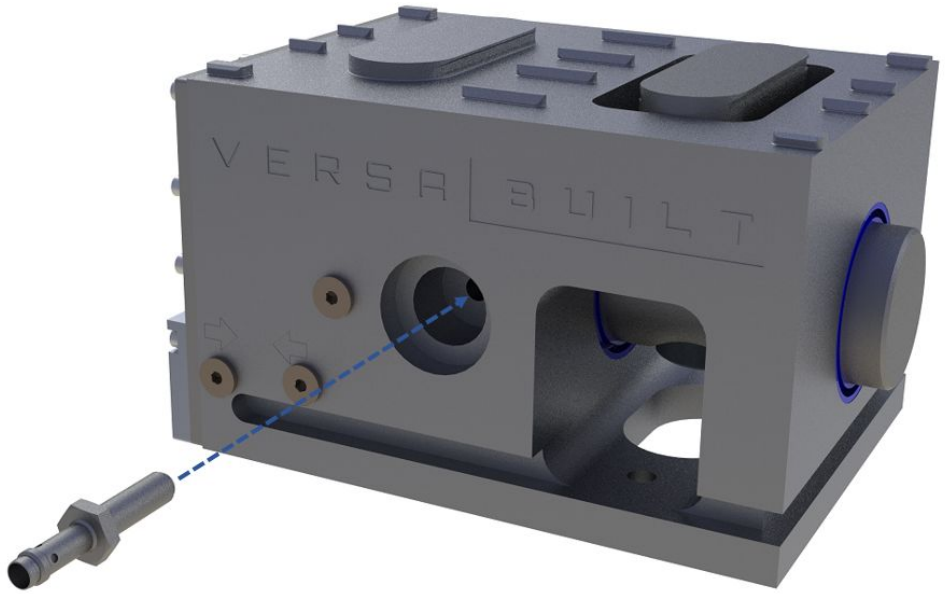
Validate Robot2CNC Mill Panel

- **Vise Sensor Testing:**
  - With Vise 1 Closed, check that the Vise 1 Sensor is “Off”
  - With Vise 1 Open, check that the Vise 1 Sensor is “Off”
  - With Vise 1 Open, place the Calibration Plate onto Vise 1 and press the Close Vise 1 button
  - Ensure the Vise 1 Sensor: “On”
  - Repeat the vise sensor testing process for Vise 2



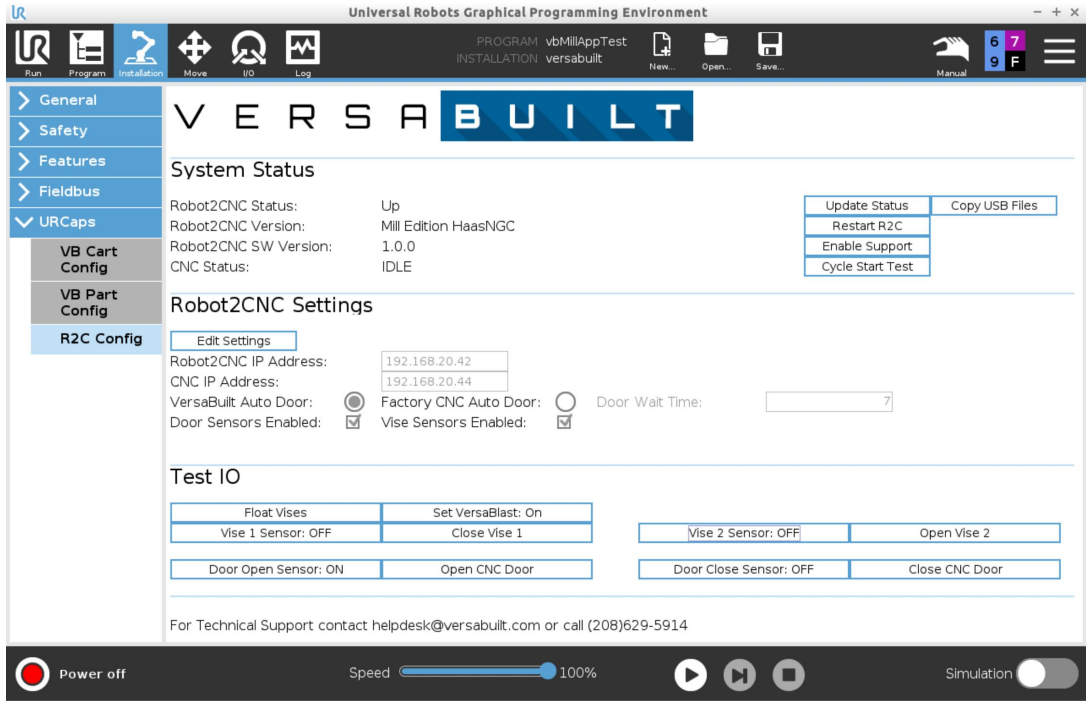
Validate Robot2CNC Mill Panel

- **Sensor Adjustment:**
  - The proper setup of sensors determine ID or OD MultiGrip Jaws in the MultiGrip FJ Vise, clamping on material. When clamping on material , OD Jaws have a nominal 0.125” gap between left and right jaw, and ID Jaws have a nominal 0.39” gap between left and right jaw.
  - Vise sensors can be adjusted in or out to achieve the necessary behavior. To adjust, remove sensor cable, loosen nut on sensor body with 13mm Deep Socket Wrench. If the Sensor is On in the Fully Open or Fully Closed state, rotate sensor counter-clockwise to loosen. If the Sensor is Off when clamping on the Calibration Plate, rotate the sensor clockwise to tighten. Secure the nut, reattach the cable and test again. Repeat as necessary.



Validate Robot2CNC Mill Panel

- If the CNC has a Factory Auto Door:
  - Ensure the CNC is configured to close the door on Cycle Start and to open the door on Cycle End
  - Press Edit Settings and select Factory CNC Auto Door and de-select Door Sensors Enabled and set the Door Wait Time to the longer of the measured door open or door close time plus 2 seconds
- If the CNC is configured with a VersaBuilt Auto Door:
  - With the door closed, press the Open CNC Door Button, *if necessary swap the airlines to get the correct door open behavior*
  - Make sure the Door Open Sensor turns on and remains on after the door open is complete
    - Adjust the door sensor as necessary so the door sensor remains on when the door cylinder is pressurized then released
    - Repeat the same steps for the Door Close and Door Close Sensor

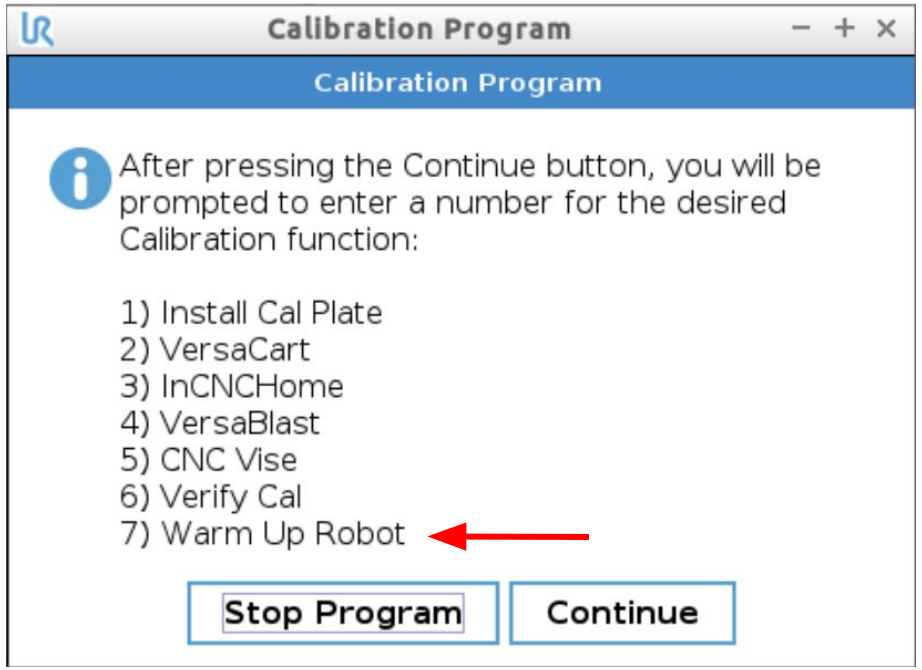


Refer to VersaDoor and VersaDoor Sensor Kit Manuals as needed

Calibration

Calibration of the UR Mill Application Kit requires 4 steps:

1. VersaCart Calibration
   - Calibrate the robot in 3 VersaCart Positions
2. InCNC Calibration
   - Calibrate the position where the robot enters the CNC doorway
3. VersaBlast Calibration
   - Calibrate the position of the robot are during VersaBlast operation
4. Vise Calibration
   - Calibrate Vise 1 and Vise 2 positions

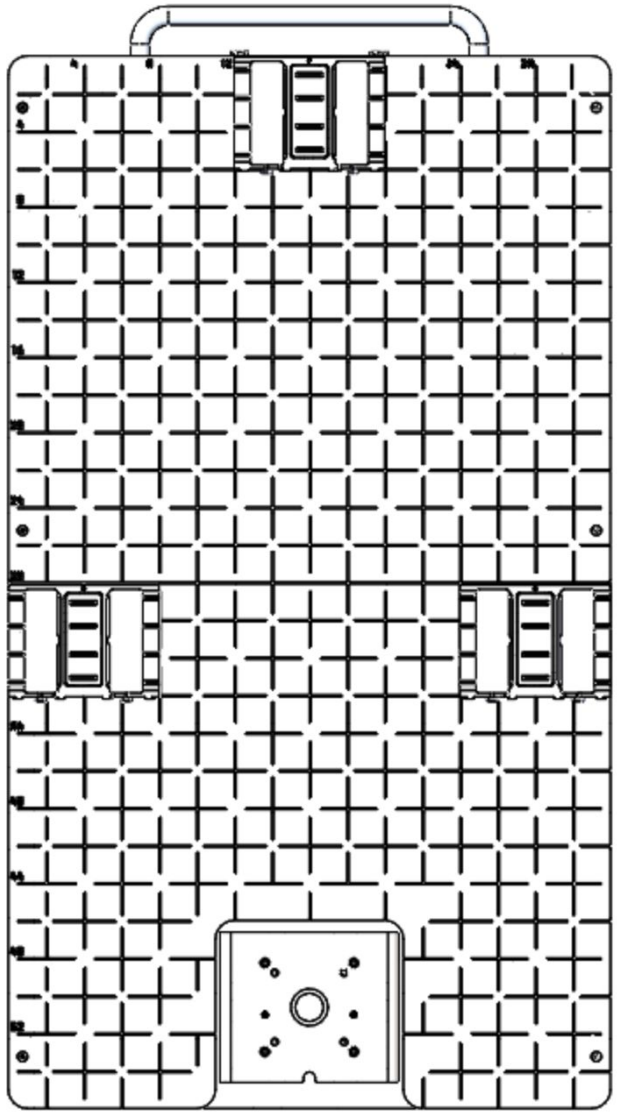


Important: Before starting the calibration procedure, make sure to warm up the UR robot. Load and run the **vbCalibrate** program then **select Warm Up Robot**.

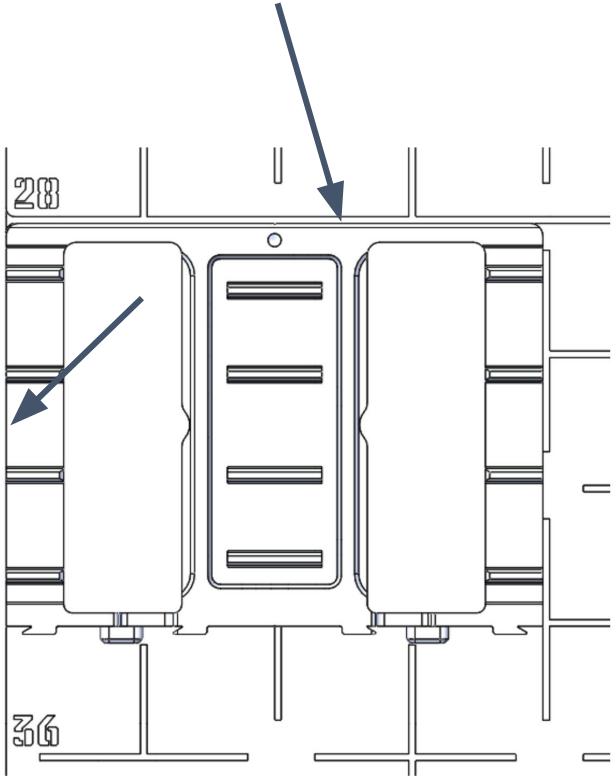
Note: Each step requires the **Calibration Plate** to be clamped in the robot gripper. The Calibration Plate installation step is included during the VersaCart Calibration step.

Calibrate VersaCart

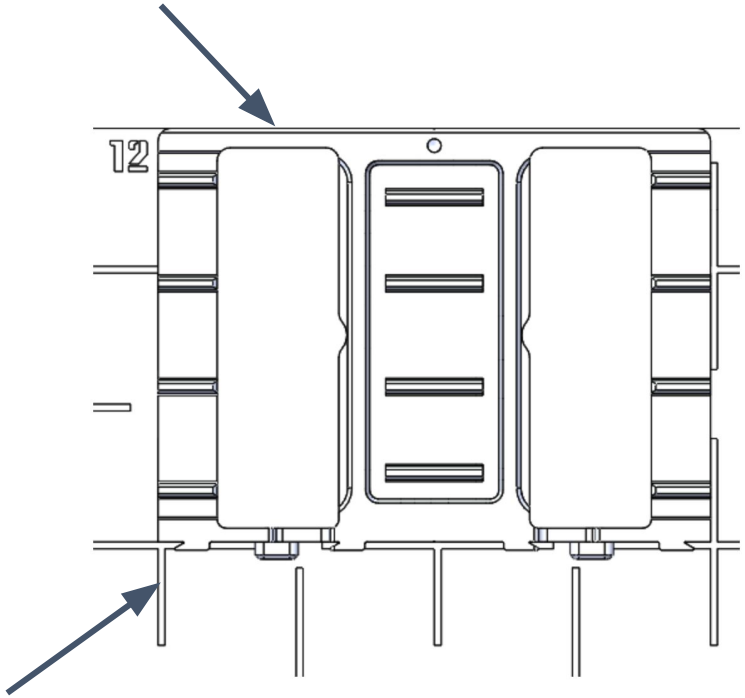
- Load the **vbCalibrate** program on the UR teach pendant and then press the play button on the UR Teach Pendant, follow the on-screen instructions
- Choose "I**nstall Calibration Plate**" and follow the instructions on screen to load the calibration plate
- Next choose **VersaCart** to begin the VersaCart calibration process
- You will be prompted to move the Calibration Plate into **3 positions** on the VersaCart
    - The robot will move approximately to each of the positions as shown
    - The program will float the robot, allowing the Calibration Plate to be moved precisely into position



Calibrate VersaCart



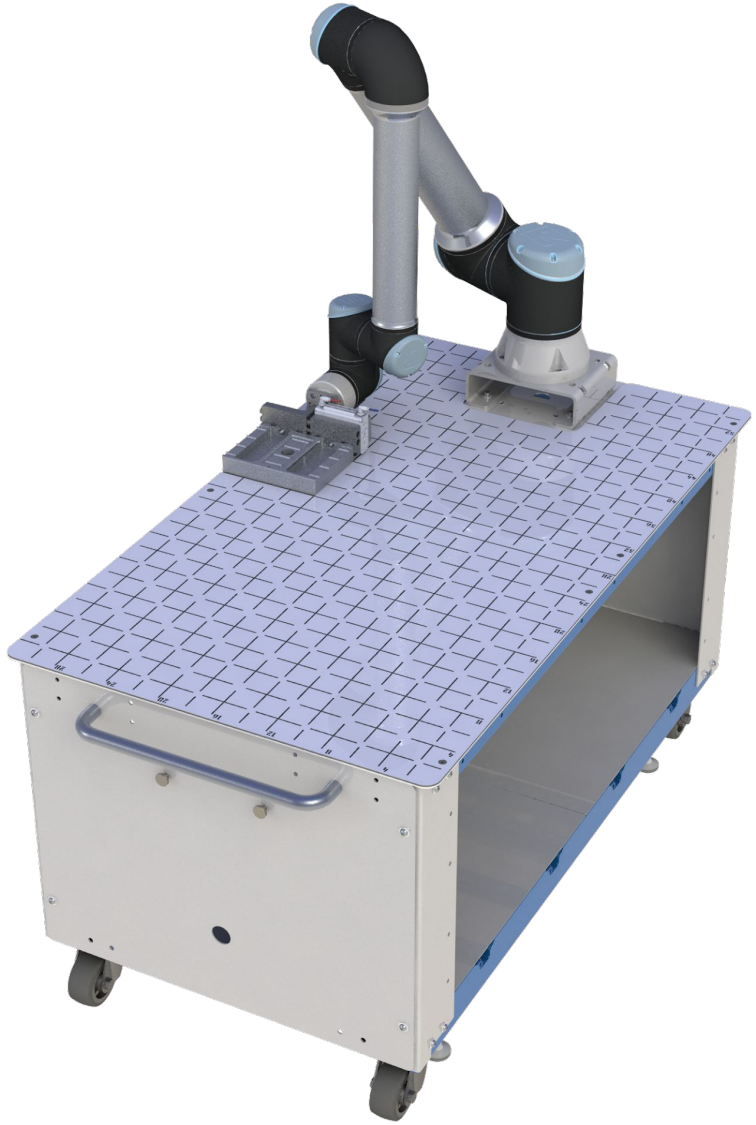
- Precise alignment of the Calibration Plate is critical to the calibration process
- The Calibration Plate top and left edges are aligned with the VersaCart
- The top edge of the Calibration Plate must be aligned with the top edge of each Visual Infeed plate
- The left edge of the Calibration Plate is aligned with the left edge of the Visual Infeed plate for position 1
- For positions 2 and 3, the left edge of the Calibration Plate must be aligned with the left edge of the cut-out of the alignment mark



**Refer to the following pages for images showing the calibration locations*

Calibrate VersaCart

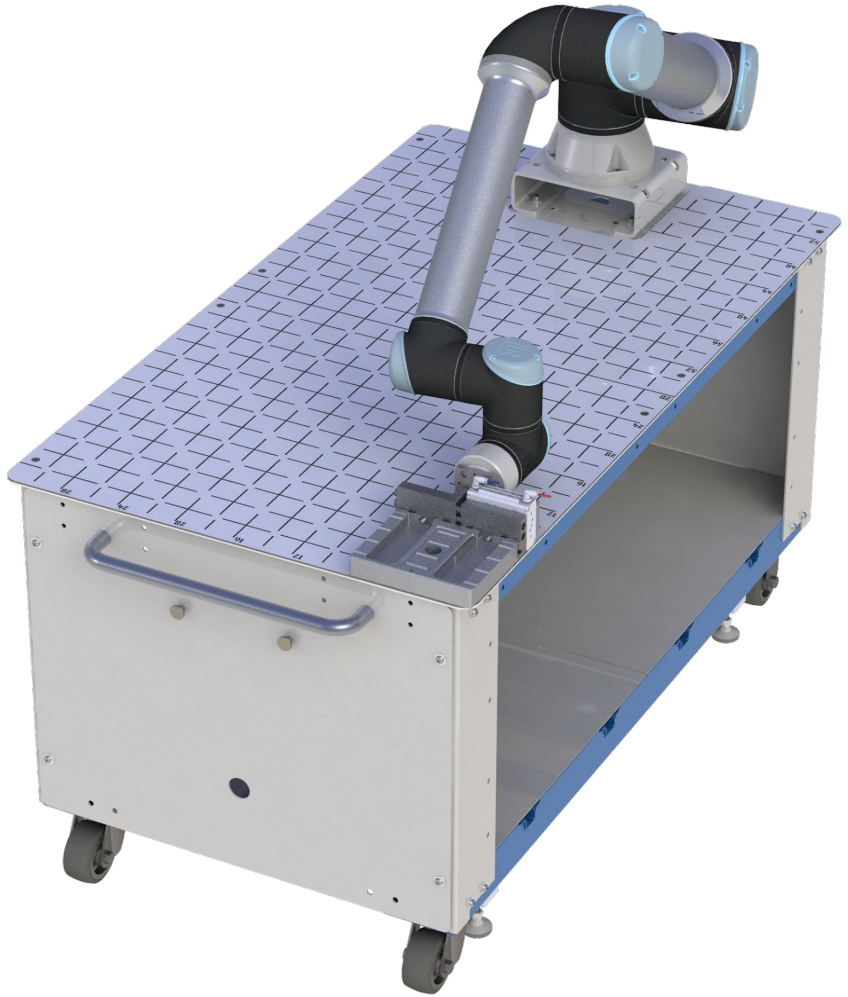
Position #1



Position #2

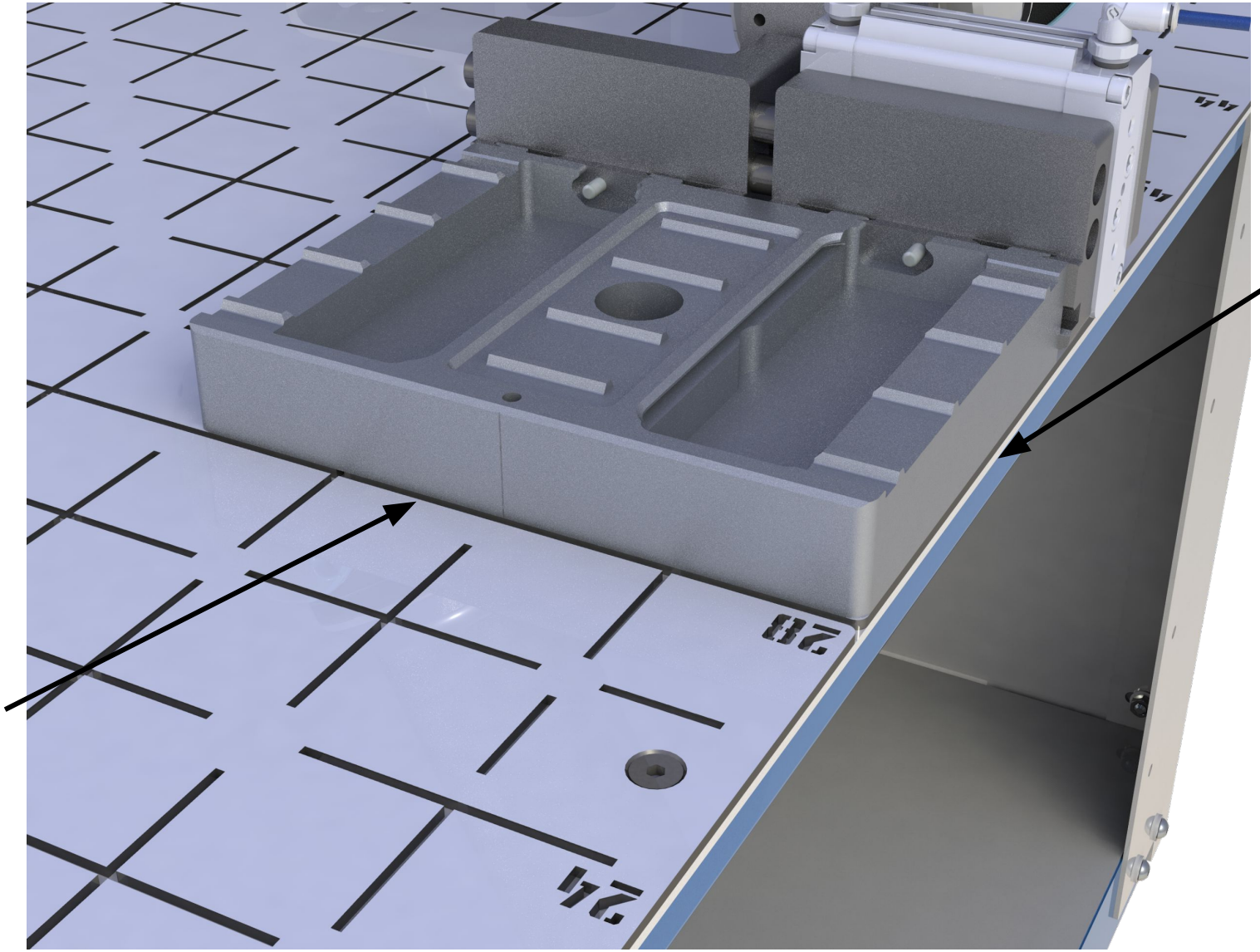
Position #3

Calibrate VersaCart



Verify Calibration Position

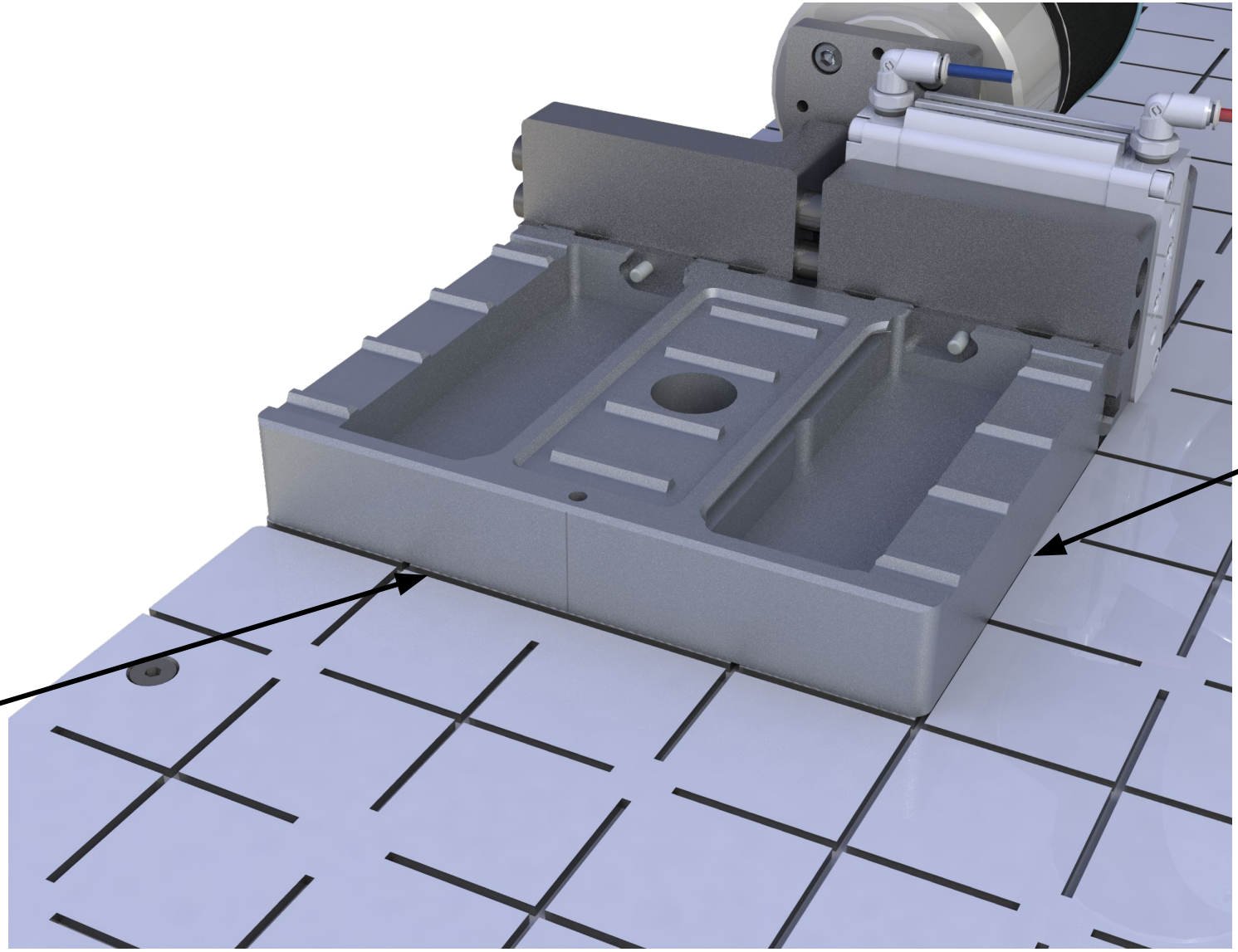
Calibrate VersaCart - Position #1



Align left side of Calibration Plate with edge of Visual Infeed, at location shown

Align top edge of Calibration Plate edge of Visual Infeed, at location shown, with gap between plates visible

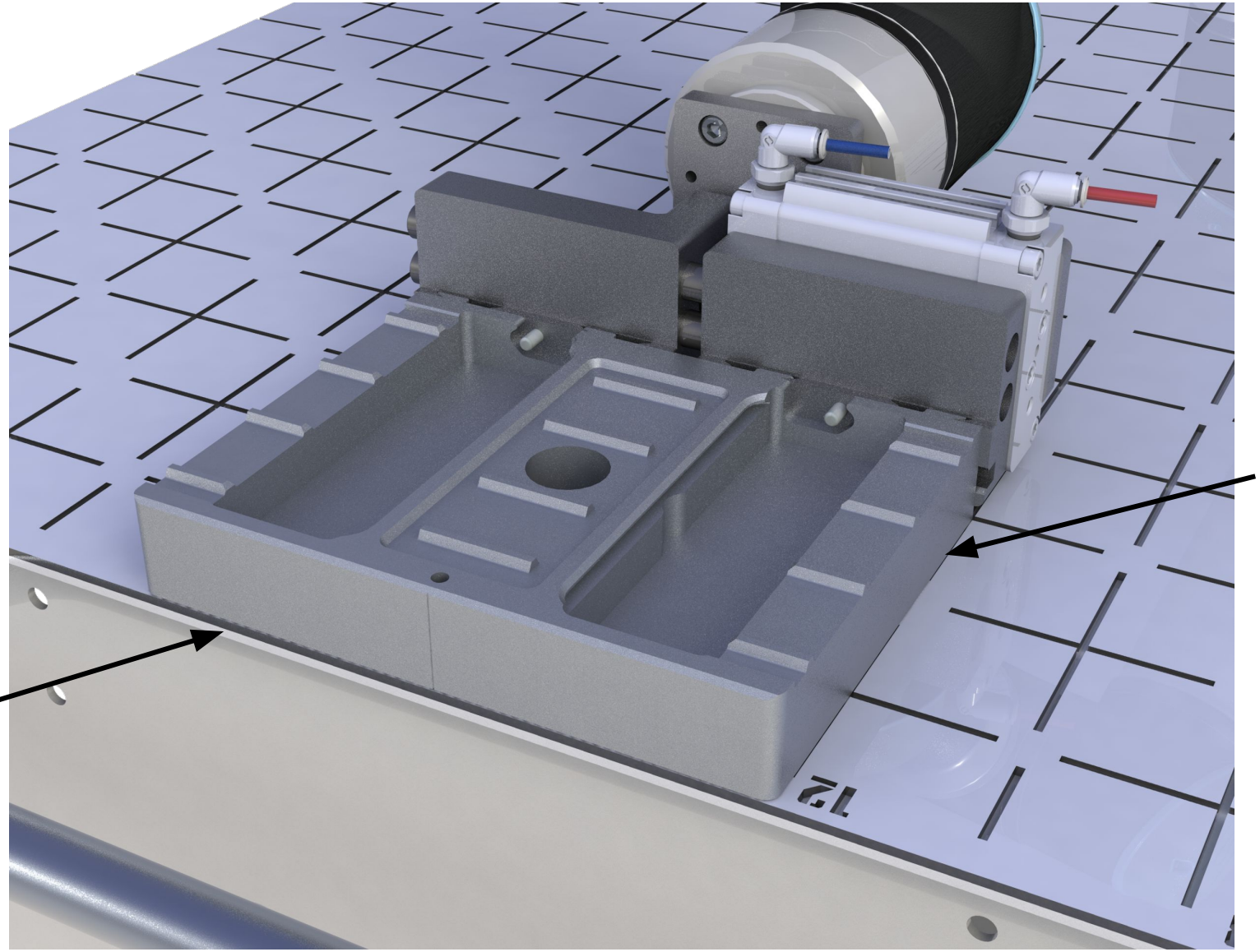
Calibrate VersaCart - Position #2



Align top edge of Calibration Plate edge of Visual Infeed, at location shown, with gap between plates visible

Align left side of Calibration Plate with edge of grid on Visual Infeed, at location shown, covering width of marking

Calibrate VersaCart - Position #3

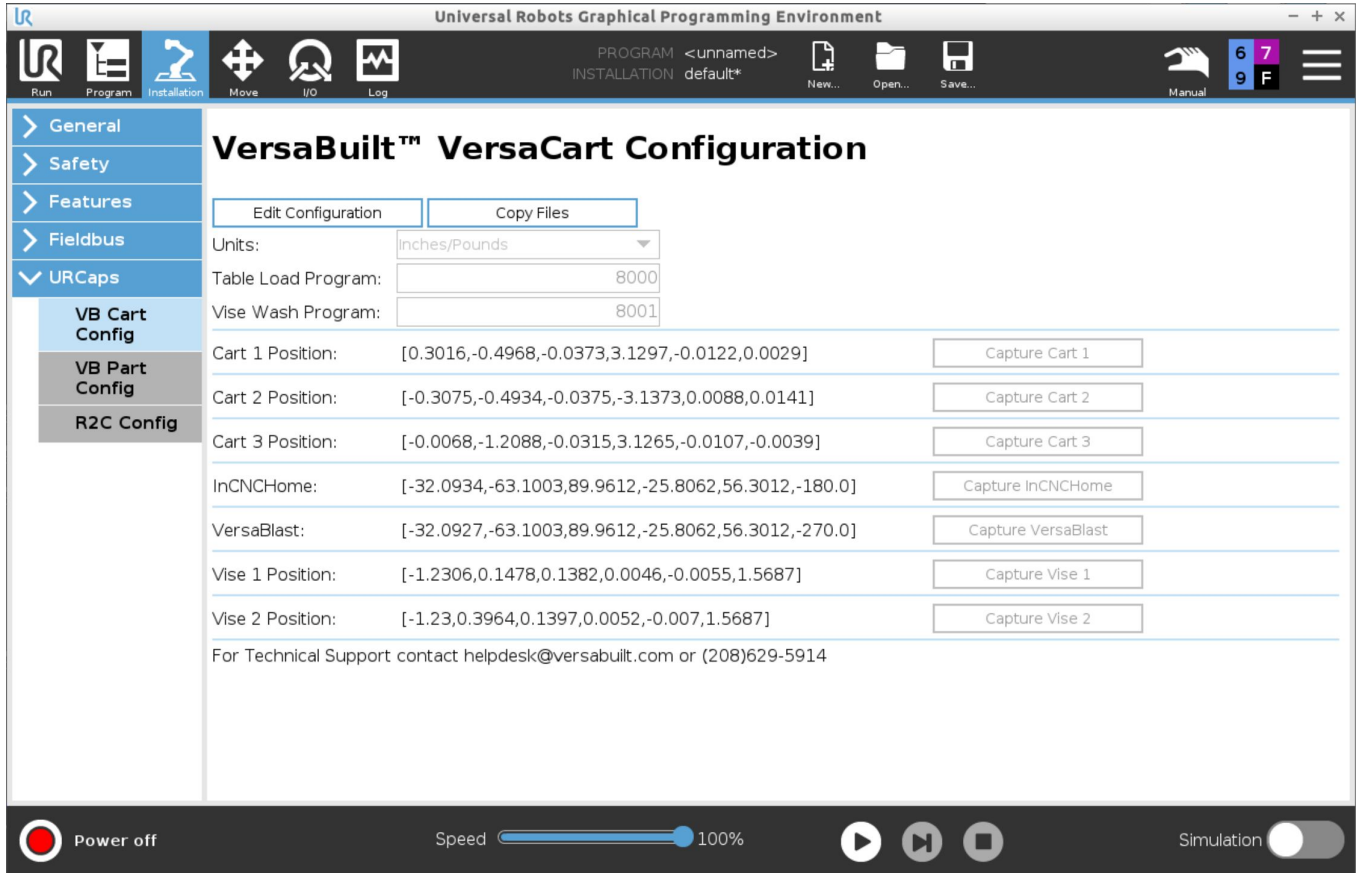


Align top edge of Calibration Plate edge of top of Visual Infeed, at location shown

Align left side of Calibration Plate with edge of grid on Visual Infeed, at location shown, covering width of marking

Calibrate VersaCart

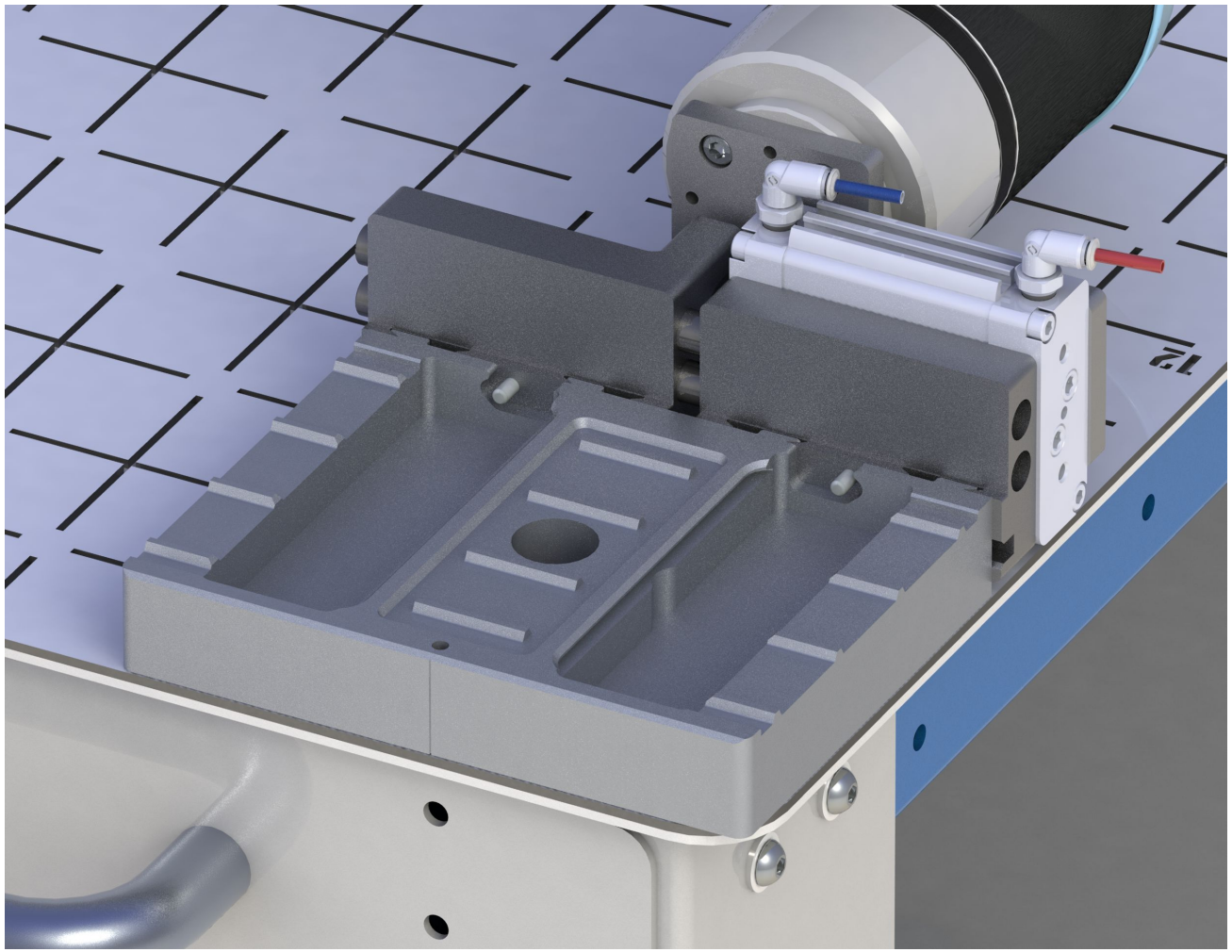
- During each VersaCart calibration step, the robot will automatically move into a position close to the precise calibration position (position 1, 2 or 3).
- The robot will pause and enter a “float” state allowing the user to **move the robot into the proper position**. Refer to the previous pages and carefully align the Calibration along the edges, as shown, with the plate flat against the cart surface.
- When the Calibration Plate is in position, press **Stop program,** as prompted, then go to the **Installation Tab -> UR Caps -> VB Cart Config**
- Press the **Edit Configuration** button then press the “**Capture Cart 1**” button
- Press Save Configuration and then **repeat** the process for Cart Positions 2 and 3



NOTE: The robot may fault when moving back to the Table Home location after each calibration step; it may be necessary to jog the robot up manually

Verify VersaCart Calibration

- After all three cart positions are calibrated, select the **Verify Cal** option in the calibrate program then select “Verify Cart Cal”
- The robot will move the calibration to the left corner of the table
- Make sure the Calibration plate is flat on the table and aligned with the top and sides of the cart as shown
- If necessary, recalibrate the VersaCart

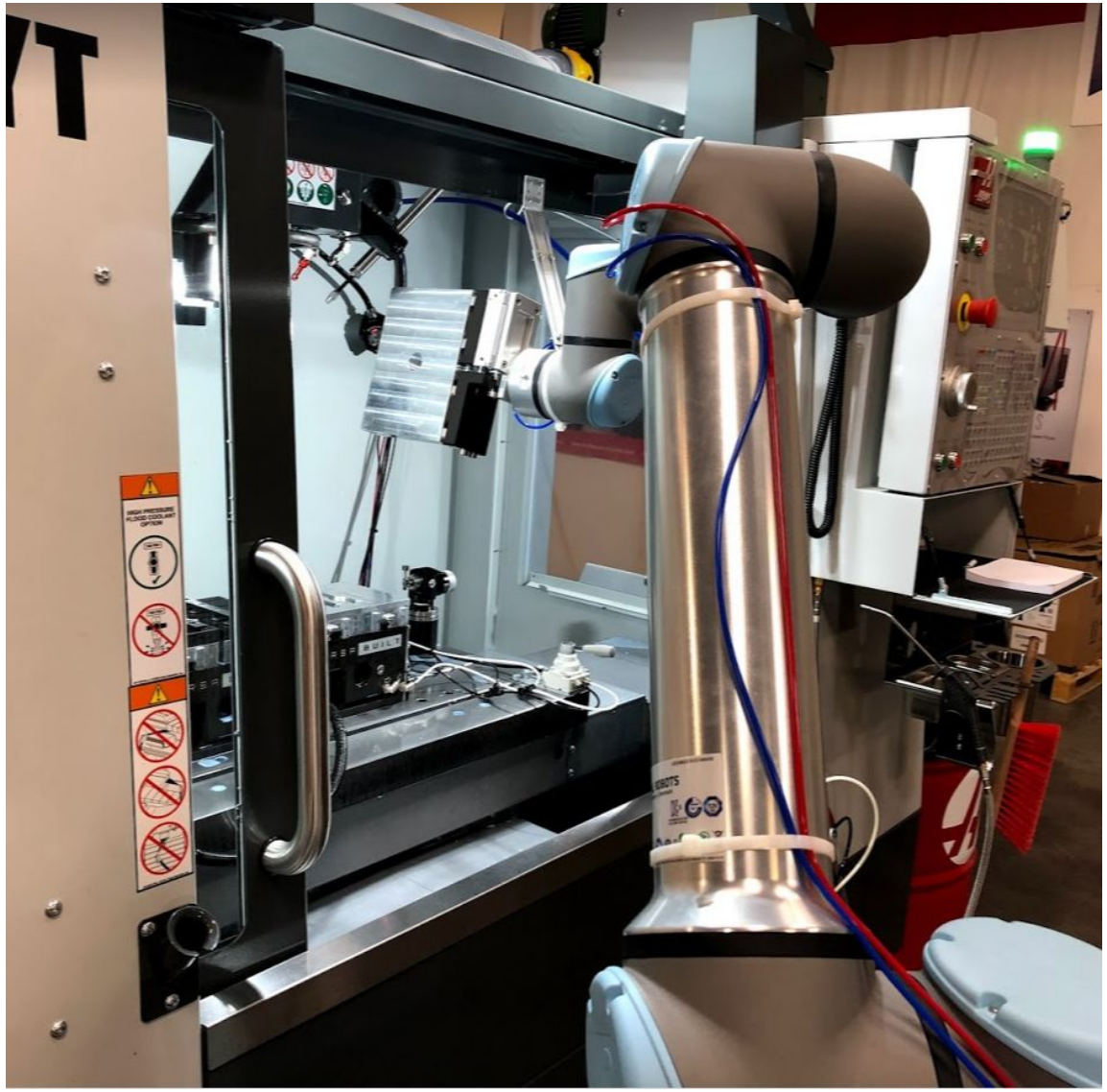


Calibrate InCNCHome Position

- With the Calibration Plate in the Gripper, load the **vbCalibrate** program on the UR teach pendant and then press the play button on the UR Teach Pendant and follow the on-screen instructions
- Select **InCNCHome calibration**
- Once the robot is in position, inside the CNC, press the Stop Program button and select the **Move tab** on the UR Teach Pendant to move the robot in X Y and Z
- The ideal robot position is halfway between the two vises in X, 8 to 10 inches (200-250mm) above the vises in Z and back in Y so that the front of the calibration plate is 1 to 2 inches (25-50mm) from the front of the vises
- Once the robot is properly positioned, go to the **Installation Tab -> UR Caps -> VB Cart Config**
- Press the **Edit Configuration** button, then press the **Capture InCNCHome position**, then press the **Save Configuration** button

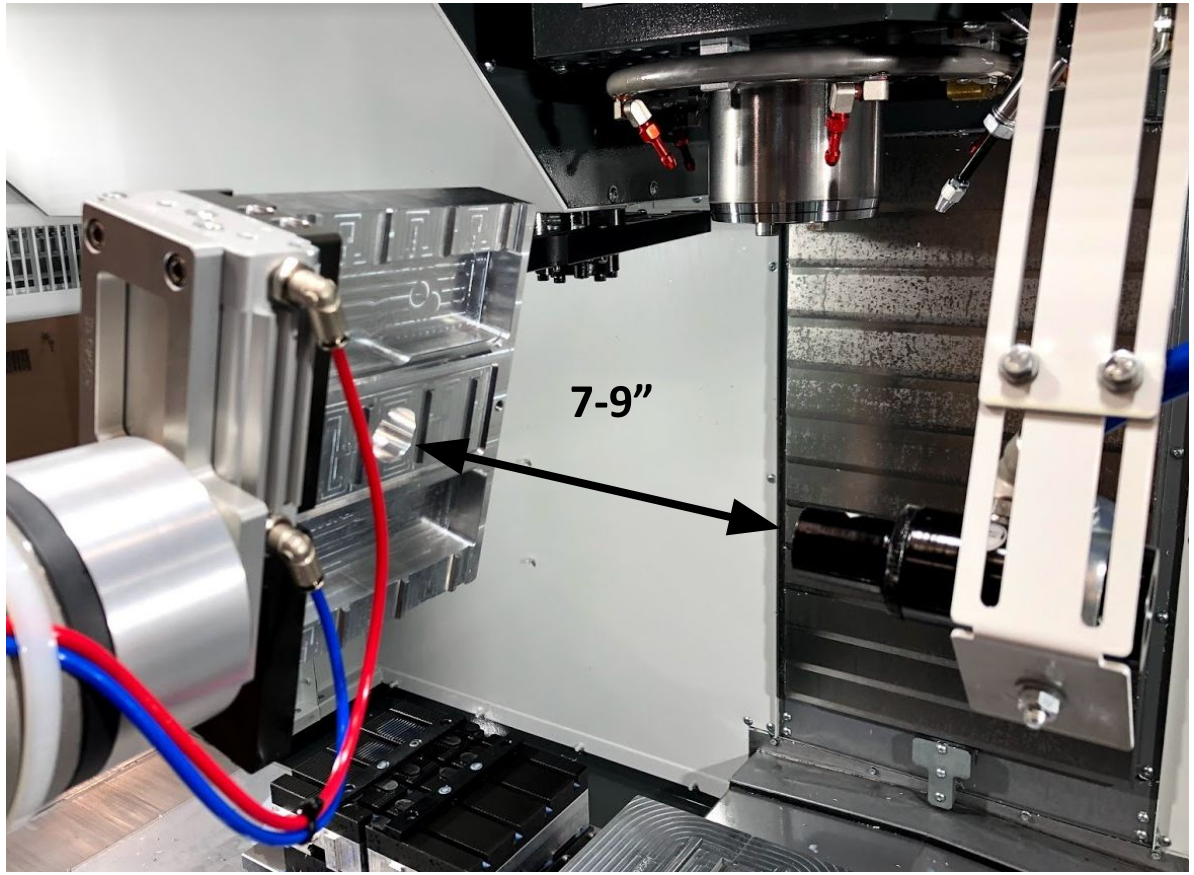
Calibrate VersaBlast Position

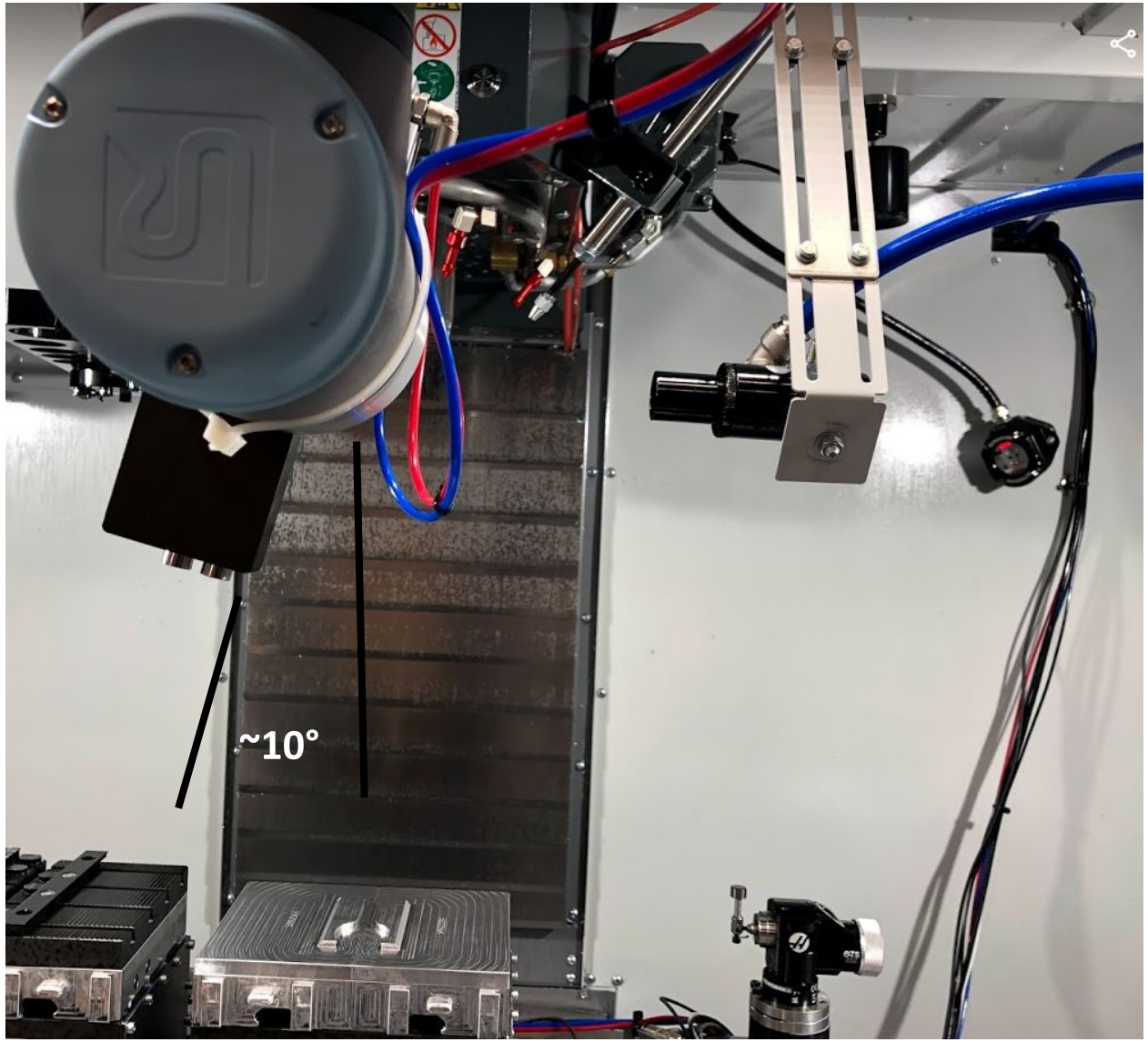
- Load the **vbCalibrate** program on the UR teach pendant and then press the play button on the UR Teach Pendant, follow the on-screen instructions
- Select **VersaBlast calibration**
- Once the robot is in position inside the CNC, press the Stop Program button and select the **Move tab** on the UR Teach Pendant to move the robot in X Y and Z
- The bottom of the Calibration Plate should face the VersaBlast nozzle and the VersaBlast nozzle air blast should be centered on the bottom of the Calibration Plate 7” to 9” away, where air can blow thru the hole in the Calibration Plate (see images on the following page)
- Once the Calibration Plate is properly positioned, go to the **Installation Tab -> UR Caps -> VB Cart Config**
- Press the **Edit Configuration** button, then press the **Capture VersaBlast position**, then press the **Save Configuration** button
- To verify the VersaBlast calibration, run the vbCalibrate program, select Verify Cal, then Verify VersaBlast Calibration



Calibrate VersaBlast Position

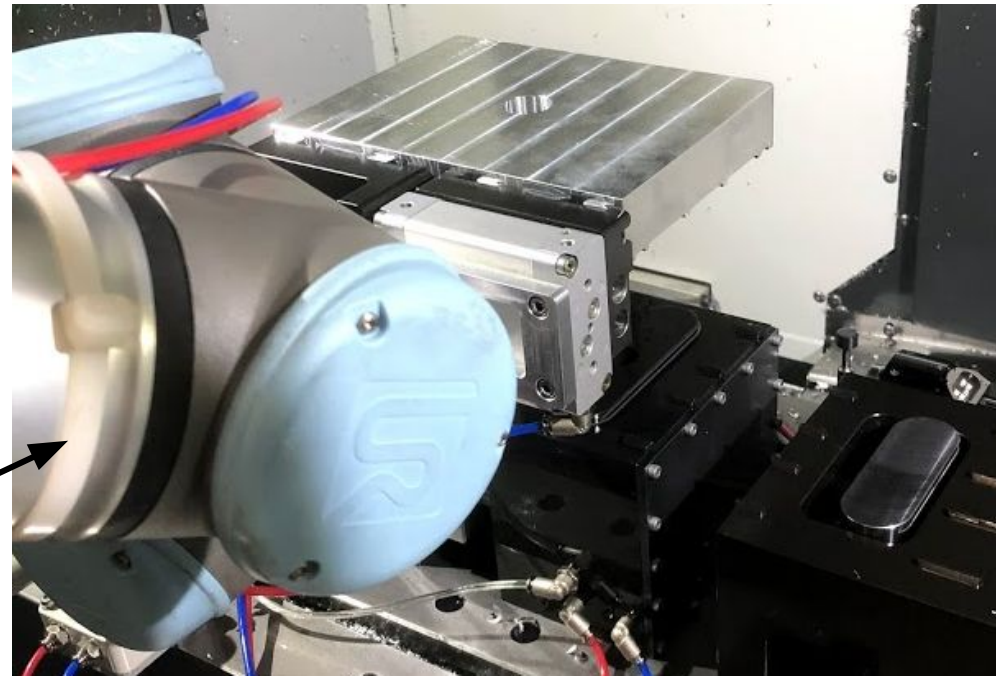
- Position face of Calibration Jaws at a 10-degree angle, as shown (image to the right)
- Position bottom of calibration jaws 7-9” inches from end of VersaBlast nozzle, as shown below

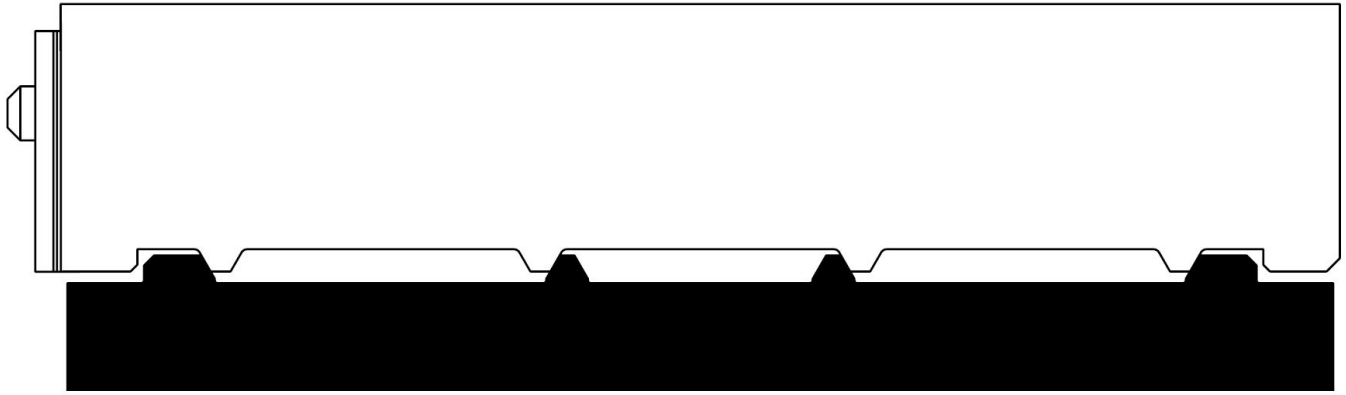




Calibrate Vises

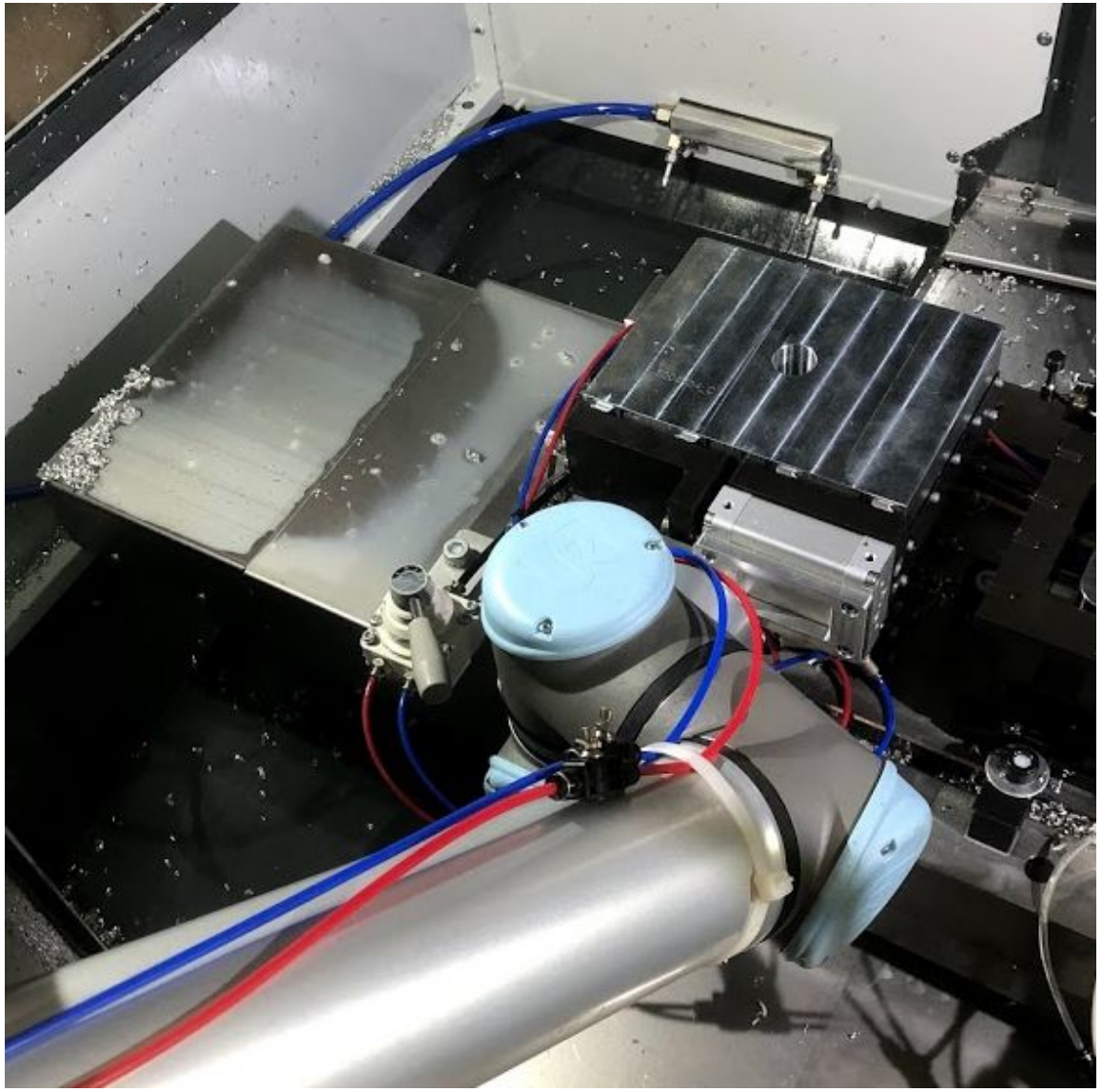
- Remove any MultiGrip Jaws loaded on the MultiGrip FJ Vises in the CNC
- Load the **vbCalibrate** program on the UR teach pendant and then press the play button on the UR Teach Pendant, follow the on-screen instructions
- Select **CNC Vise** calibration and follow the instructions on screen, start by calibrating Vise 1 (the vise on the left)
- Per on-screen instructions, switch Diverter Valve to Manual Position
- Open vise 1 using the Vise Hand Valve
- The robot will pause in a position inside the CNC and float so it can be pushed into position
- **Manually position the Calibration Plate** onto the Vise by grabbing the Calibration Plate and moving it onto the vise





Calibrate Vises

- Once the calibration plate is engaged with the vise (as shown in the image on previous page), using the Vise Hand Valve, close the Vise to clamp the Calibration Plate onto the vise
- Once the robot is in position and the Calibration Plate is clamped onto the vise, stop the program and go to the Installation **Tab -> UR Caps -> VB Cart Config**
- Press the **Edit Configuration** button, then press the **Capture Vise 1** position, then press the **Save Configuration** button
- Open Vise with Hand Valve
- Remove calibration plate and robot from vise by pressing free-drive button on teach pendant and manually positioning robot
- Repeat the process to calibrate Vise 2

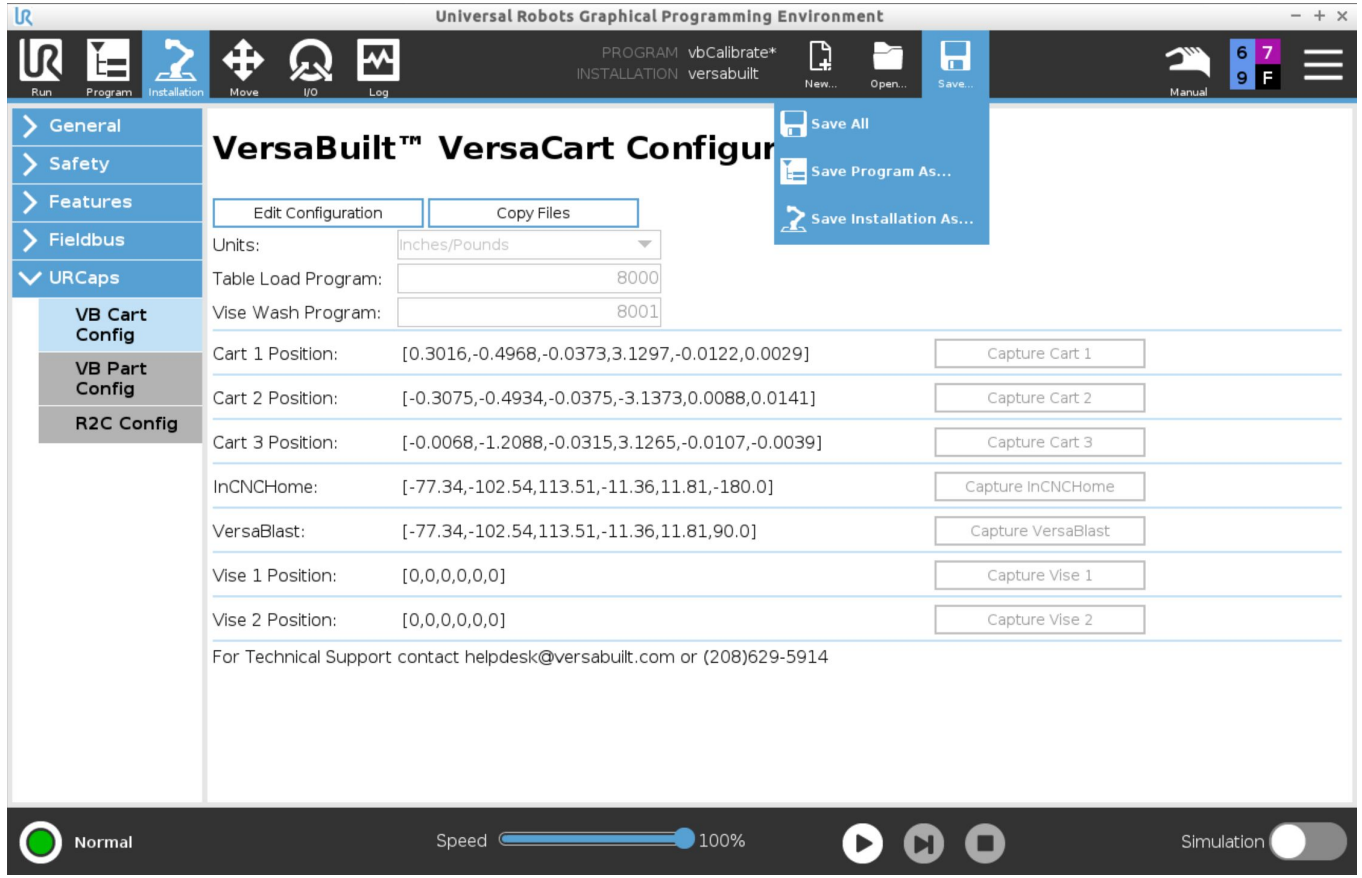


Verify Vise Calibration

- Before attempting automatic loading of MultiGrip jaws onto the MultiGrip FJ Vise, perform vise calibration verification
- Load the **vbCalibrate** program and select Verify Cal
- Select Verify Vise 1 Cal
- The robot will position the calibration plate onto vise 1 without clamping the vise
- Carefully review the position of the calibration plate with respect to vise
- If necessary, re-calibrate one or both vises
- **Note:** poor vise calibration can cause damage to the MultiGrip Jaws or MultiGrip FJ Vise

Save the Installation File

- **VERY IMPORTANT STEP**
- None of the calibration data will be saved unless the Installation
- Press the Save icon on the UR Teach Pendant
- Press the Save All button
- VersaBuilt also recommends performing a System Backup
- **REMEMBER: ALWAYS PRESS SAVE ALL WHEN CHANGES ARE MADE**
  - The UR Robot will not always remind you to save changes when needed



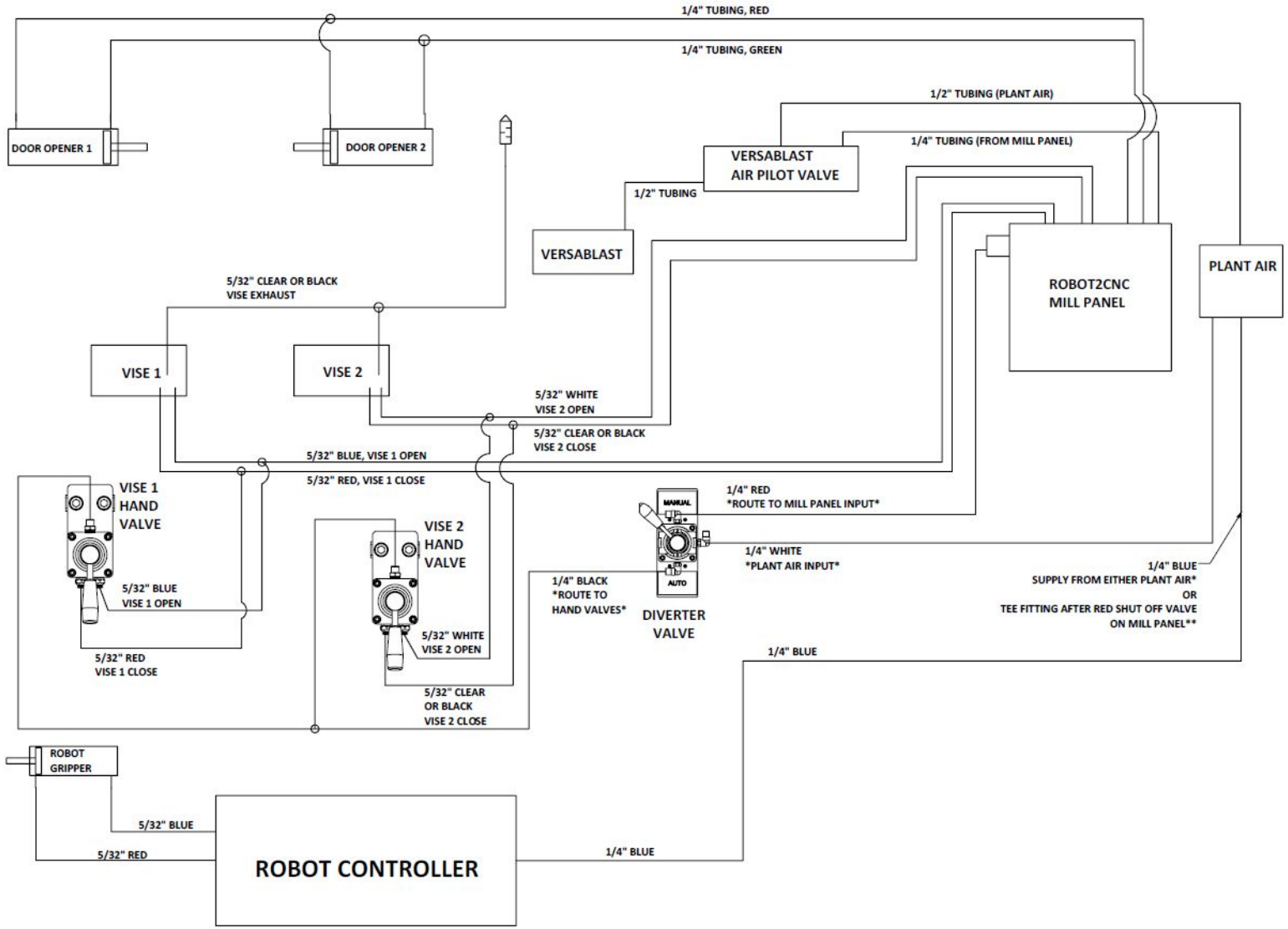
Appendices

Pneumatic Schematics

Block diagram of Mill Kit Pneumatics:

- Supply air to Diverter Valve
- Diverter Valve toggles system between “Manual Mode” with air supplied to Manual Valves and “Auto Mode” with air supplied to the Robot2CNC Mill Panel.
- Robot2CNC Mill Panel controls air to Door Opener(s), VersaBlast and MultiGrip Vises.
- Robot Controller contains 24VDC solenoid valve to control MultiGrip FJ Gripper Open and Close.
- The following pages show detailed schematics of each device and block shown.

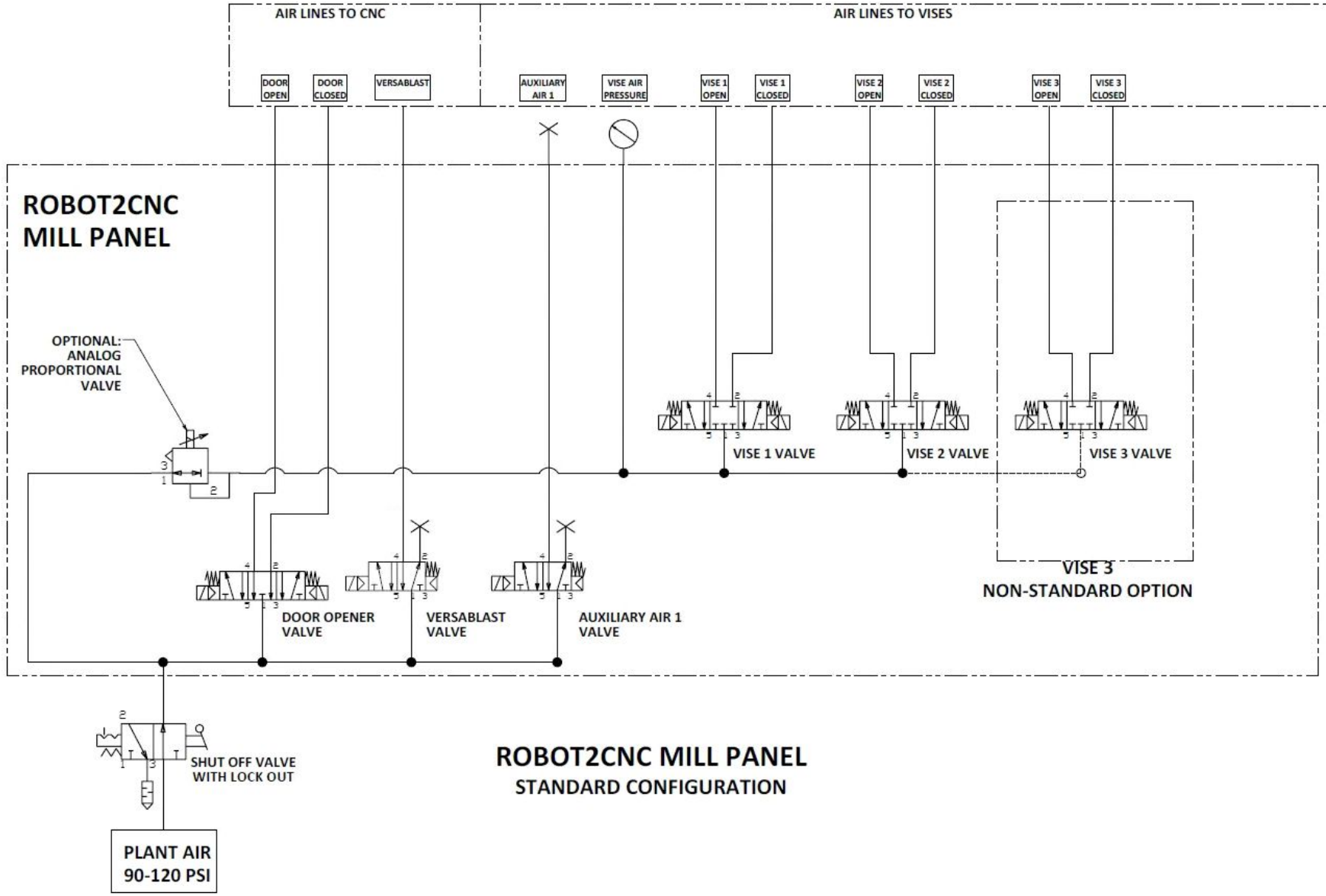
*Note: when in “Auto Mode”, manual valves need to be in center-position. When in “Manual Mode” vise valves need to be in center position, without power to either side of the solenoid valve



Pneumatic Schematics

Schematic shows inside detail of Robot2CNC Mill Panel, including:

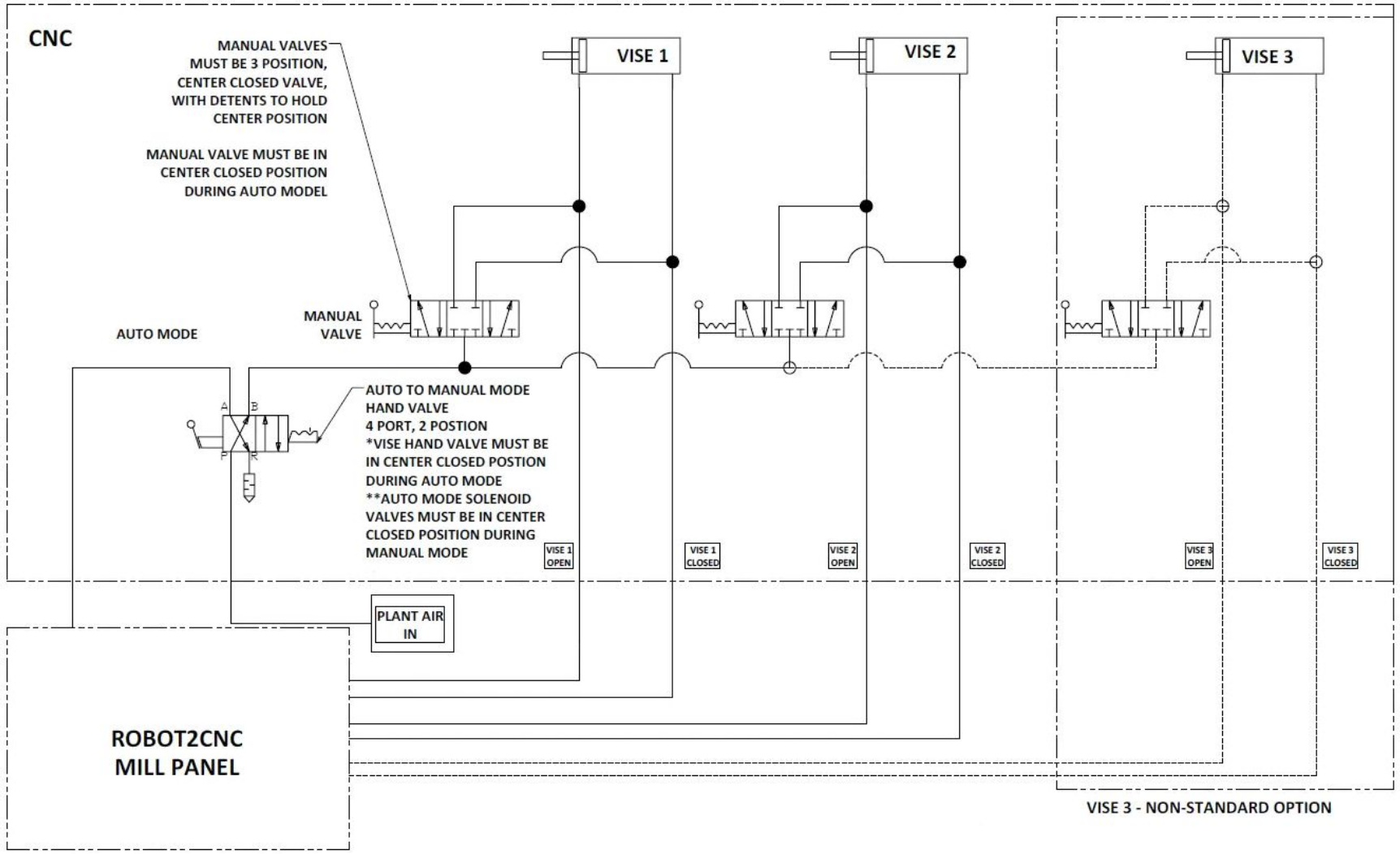
- 24VDC solenoid valves
- Vise valves are 5 port, 3 position, center closed
- Door valve is 5 port, 3 position, center exhaust
- VersaBlast and Vise Exhaust valves are 5 port, 2 position
- Optional Analog Proportional Valve for Vises to control pressure from 0 PSI up to the supplied plant pressure.
- Optional 3rd Vise control
- Vise Exhaust for Booster Panel **if not used, this line can be used as a supply to air piloted valve*
- Regulated Plant Air is a branch of the vise pressure for use with the Booster Panel or other customized application.



Pneumatic Schematics

Schematic shows detail of routing air with Auto-Mode/Manual-Mode Switch Valve:

- The Diverter valve is a 2 position valve that will relieve downstream air on the unused side of the valve (when in manual mode, air to the Robot2CNC panel is exhausted, and when in auto mode, air to the manual valve is exhausted).
- A manual valve is used for each vise, with lines tee'd into the vise lines from the Robot2CNC Mill panel
- Manual valves are 3 position, center closed valve - this valve must be in the center position during Auto Mode
- The Robot2CNC vise valves are 3 position, center closed valves - these valves must be powered off (in the center position) during Manual Mode

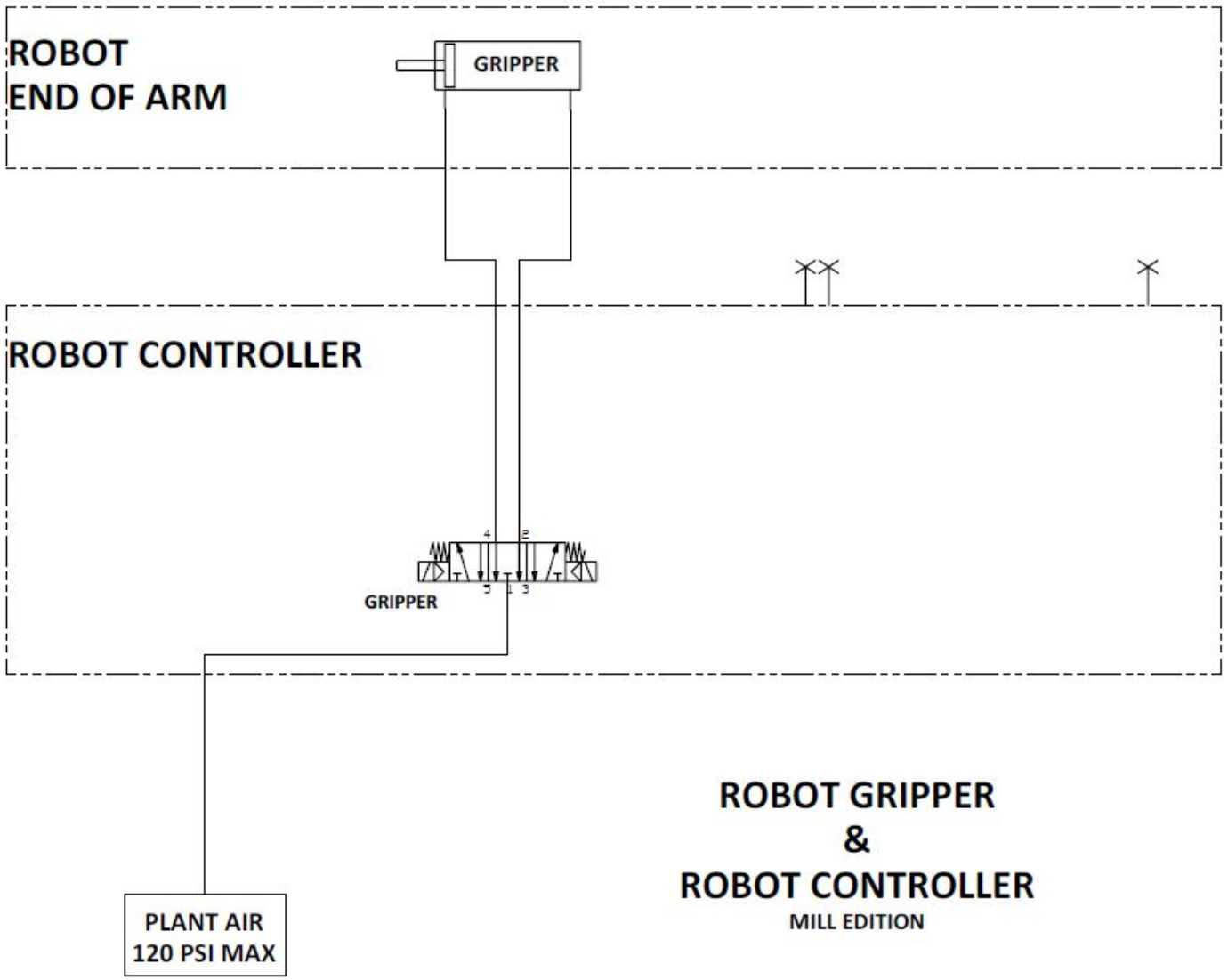


AIR INPUT - AUTO/MANUAL MODE

Pneumatic Schematics

Schematic shows detail of routing air to robot end of arm with MultiGrip Gripper

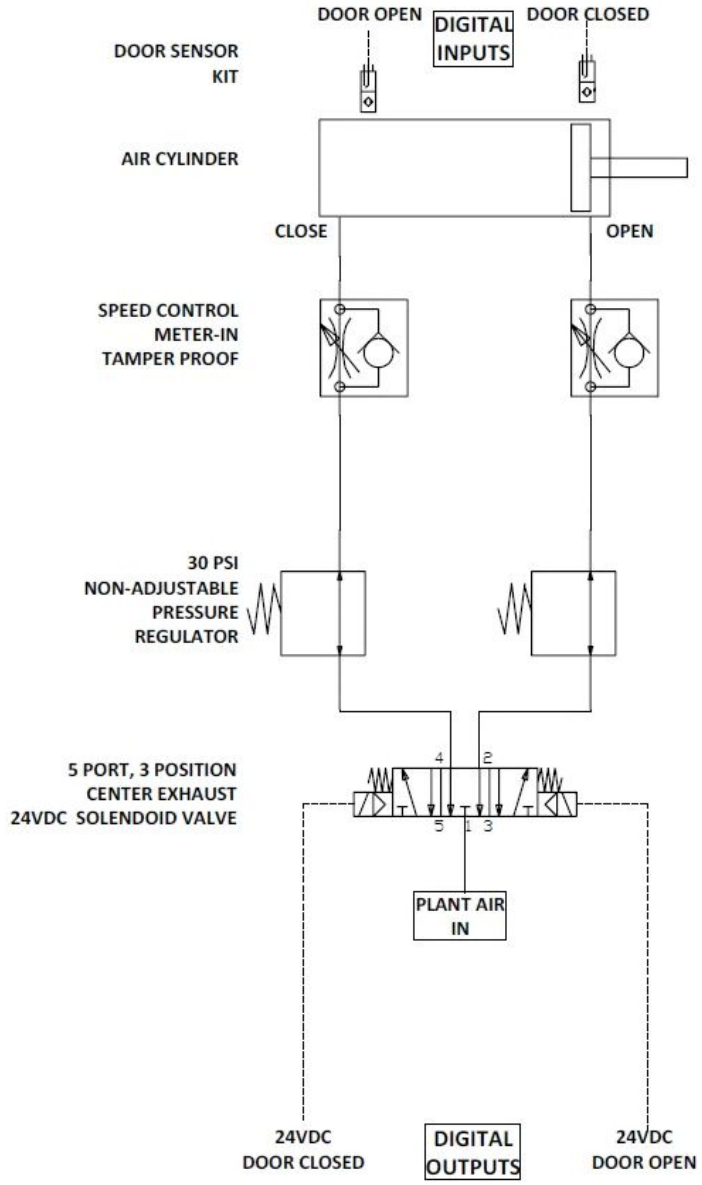
- Plant Air is routed to a 5 port, 3 position, Center Exhaust, 24VDC solenoid valve. Center Exhaust allows the gripper to “float” or move freely, when power is removed from the valve.
- Robot controller panel includes 3 unused ports, shown with plug symbols: 2 are for second gripper and 1 is used for wrist blow-off. These are reserved for Lathe applications.



Pneumatic Schematics

Schematic shows detail of routing air to VersaDoor (single door application)

- Plant Air is routed to a 5 port, 3 position, Center Exhaust, 24VDC solenoid valve. Center Exhaust allows the door to “float” or move freely, when power is removed from the valve.
- Robot controller panel includes 3 unused ports, shown with plug symbols: 2 are for second gripper and 1 is used for wrist blow-off. These are reserved for Lathe applications.
- Schematic shown to the right includes notes and symbols for Digital Outputs (24VDC) and Digital Inputs (Door Sensors). The required Digital Inputs and Outputs are supplied by the Robot2CNC Mill Panel.

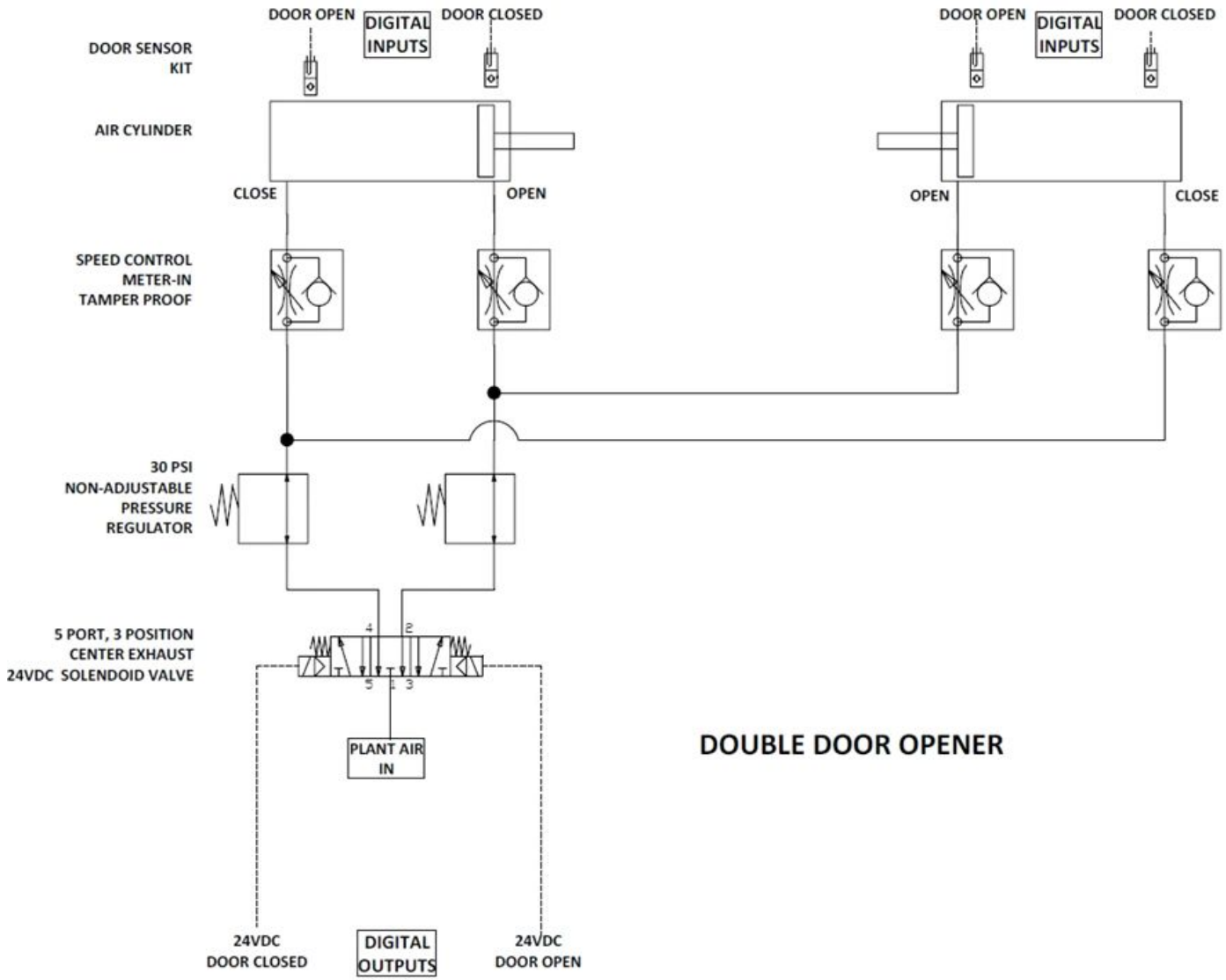


SINGLE DOOR OPENER

Pneumatic Schematics

Schematic shows detail of routing air to VersaDoor (double door application)

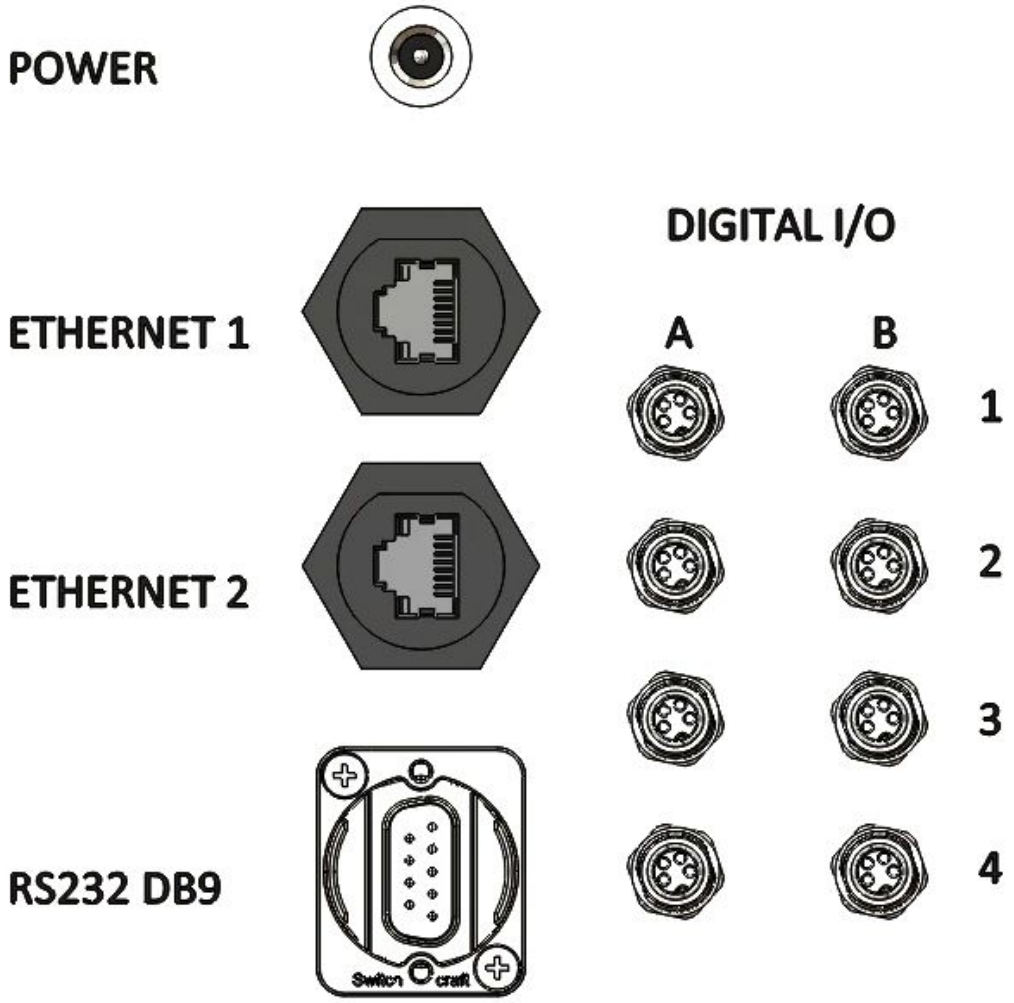
- Double door application is nearly equivalent to single door application, with exception of additional door actuator, 2x 30 PSI regulators, 2x door sensors, and 2x tee fittings to connect second door actuator with open/close signals.



Robot2CNC Mill Edition Panel Connections

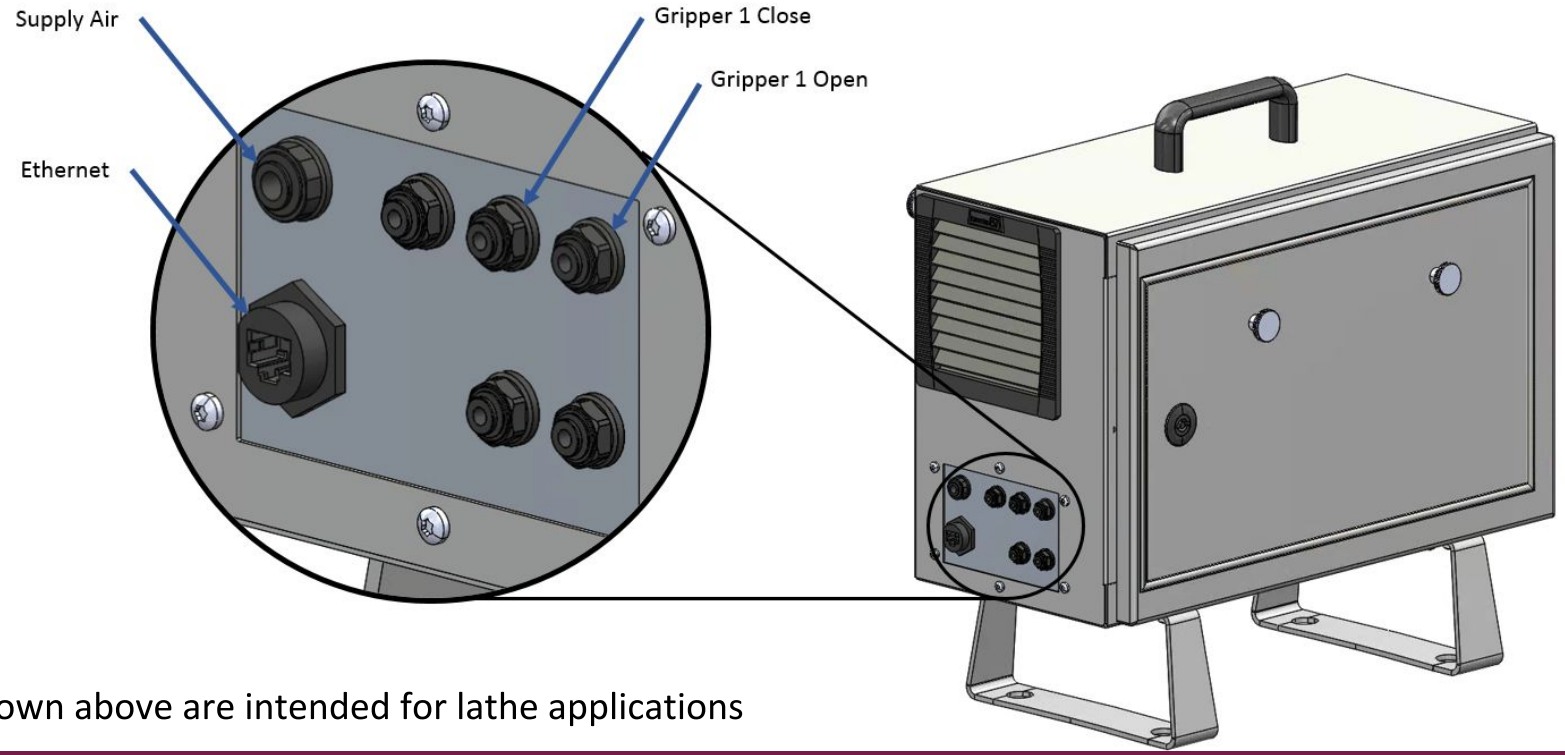
- **Power = 110VAC to 24VDC cord provided with Robot2CNC Panel**
- **Ethernet 1 = Robot2CNC Communication to Ethernet Switch**
- **Ethernet 2 = Open**
- **RS232 DB9 = Connection to CNC if Ethernet is not available**

- **A1 = Vise Sensor, Vise 1 and Vise 2**
- **A2 = Vise Sensor, Vise 3**
- **A3 = VersaDoor Sensor, Single Door**
- **A4 = VersaDoor Sensor, 2nd Door (double door application)**
- **B1 = Cycle Start Relay Connector**
- **B2 = Open**
- **B3 = Open**
- **B4 = Open**



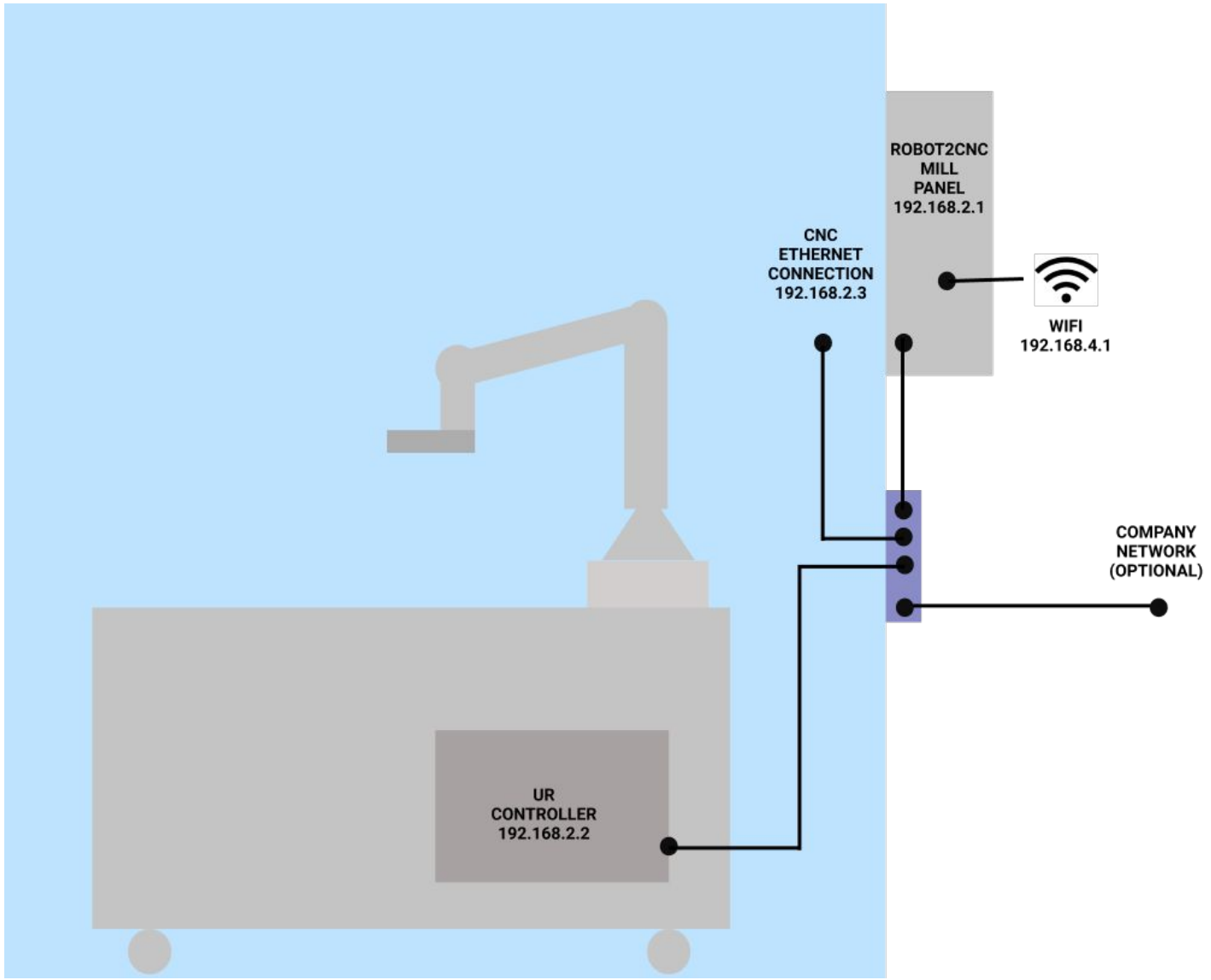
UR Controller Panel Connections

- **Ethernet = Connecting Robot2CNC Mill Panel to UR Controller**
- **Supply Air = Air from Robot2CNC Mill Panel (line after red shut off valve)**
- **Gripper 1 Close = Red Line to Gripper**
- **Gripper 2 Open = Blue Line to Gripper**



Note: Unlabeled bulkhead fittings shown above are intended for lathe applications

Network Diagram



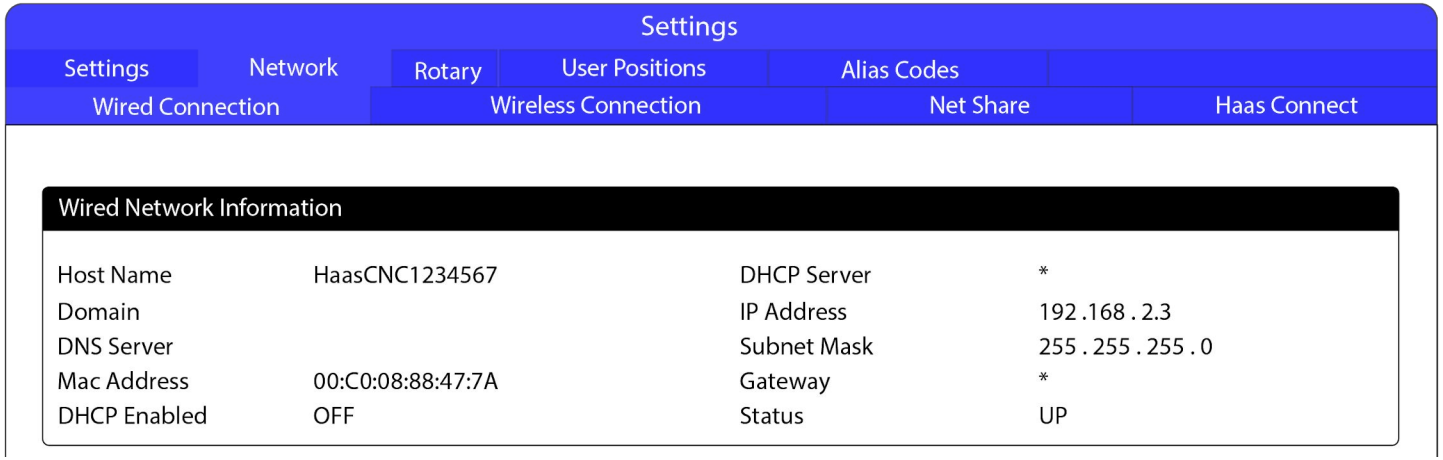
Haas NGC CNC Settings

Settings: Network Tab

Wired Network Enabled	On
Obtain Address Automatically	Off
IP Address	192.168.2.3
Subnet Mask	255.255.255.0

Settings: Settings Tab

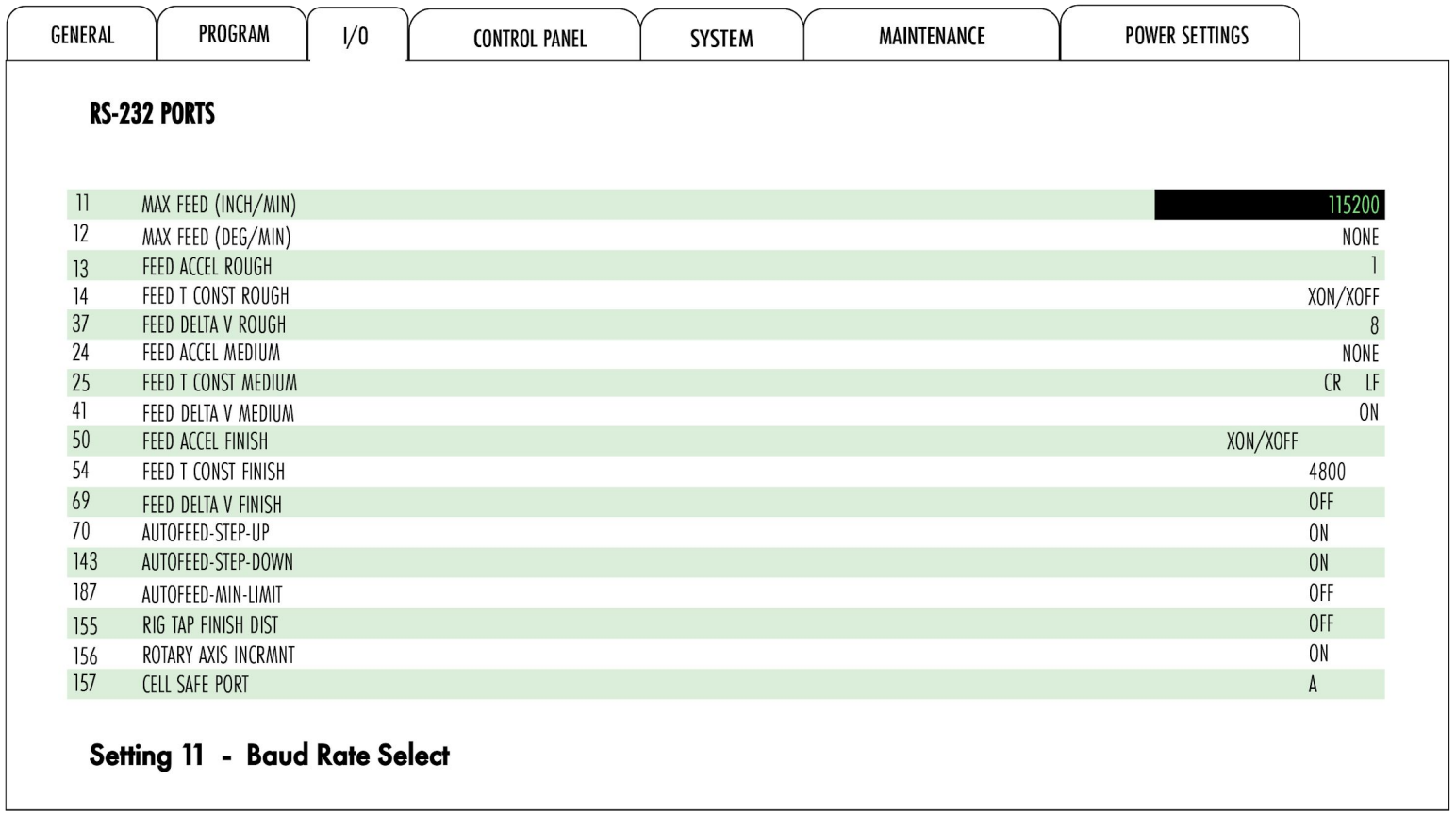
143 Machine Data Collection	9000



Haas Legacy CNC Settings

Settings: IO Tab

11	Baud Rate:	115,200
12	Parity Select:	NONE
13	Stop Bit:	1
14	Synchronization:	XON/XOFF
37	RS-232 Data Bits	8
41	Add Spaces RS232	ON
69	DPRNT Leading Sp	OFF
143	Machine Data Col	ON



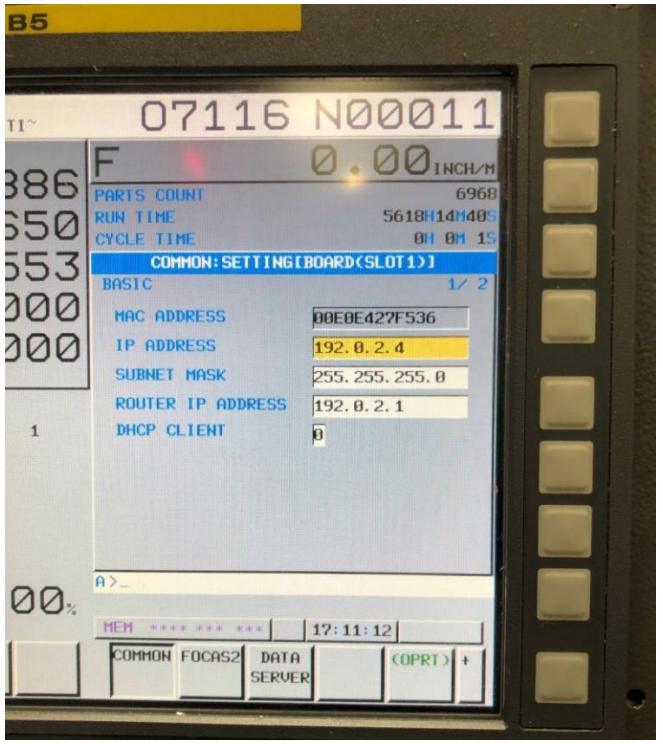
Fanuc Focas CNC Settings

Focas2 Settings:

Port Number (TCP)	8193

CNC Network settings:

IP Address	192.168.2.3
Subnet Mask	255.255.255.0
Router IP Address	192.168.2.3
DHCP Client	0



Okuma CNC Settings

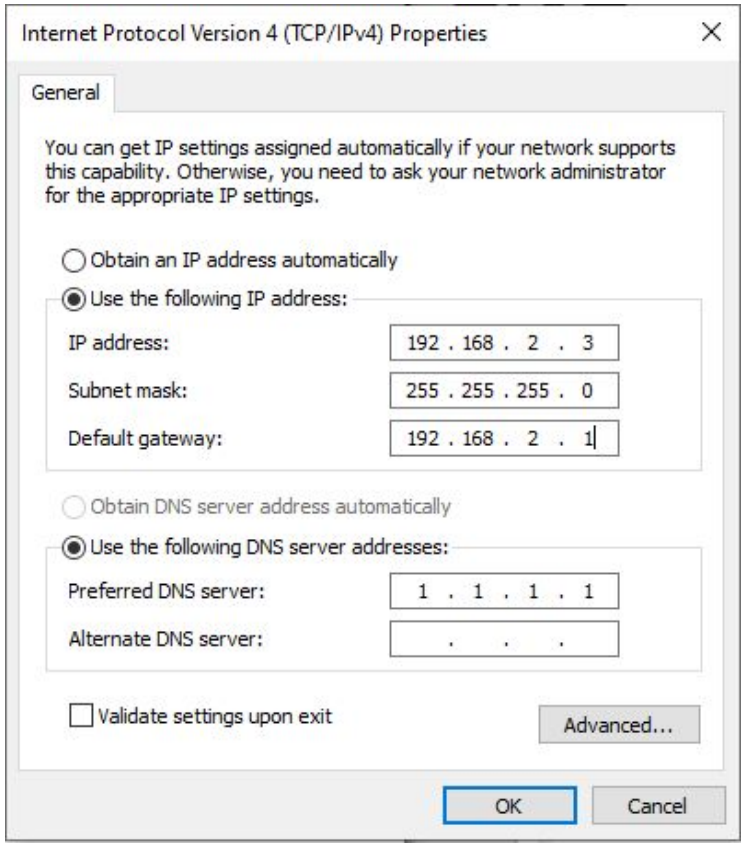
Windows Network Adapter Settings:

- Use the following IP address:

IP Address	192.168.2.3
Subnet Mask	255.255.255.0
Router IP Address	192.168.2.1

- Use the following DNS server address

Prefered DNS server	1.1.1.1



Okuma CNC vbxDispatcher Install

- Plug VersaBuilt USB Drive into the CNC Controller
- On the CNC enter the Windows portion of the CNC OS and open the folder for the USB Drive
- Rune the setup.exe file in the Okuma folder of the VersaBuilt USB Drive
- In the Select Installation Folder screen, select Everyone
- Add the vbxDispatcher.exe program to the Windows startup folder to ensure the vbxDispatcher will be started after reboot