VERSA BUILT ROBOTICS

Lathe Automation System Installation Manual

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Safety Warnings

DANGER: VersaBuilt makes industrial machine tool automation components designed to be operated by trained personnel only. Machine tool automation components may move suddenly and without warning. Serious or fatal crushing injuries can occur from contact with the robot, gripper or vises.

Before deploying VersaBuilt industrial machine tool automation components, a safety risk assessment must be completed in accordance with local, state and/or federal requirements.

VersaBuilt industrial machine tool automation components should only be used by trained operators.

Read and understand the VersaBuilt Lathe Automation System Safety Manual before proceeding

Lathe Automation System Contents

Section 2

Lathe Automation System Overview

Double Headed gripper
*Configurable for Shaft or Puck Picking

VersaCart 1300
*56” L x 32” W x 30” H
Grid Top for Part/Puck Infeed
Shown with optional Shaft Infeed

Connect to VSC interface with laptop, computer, tablet or smartphone via Wi-Fi or Ethernet

VersaBuilt System Controller for Lathes (VSC for Lathes)

VSC Enable Button

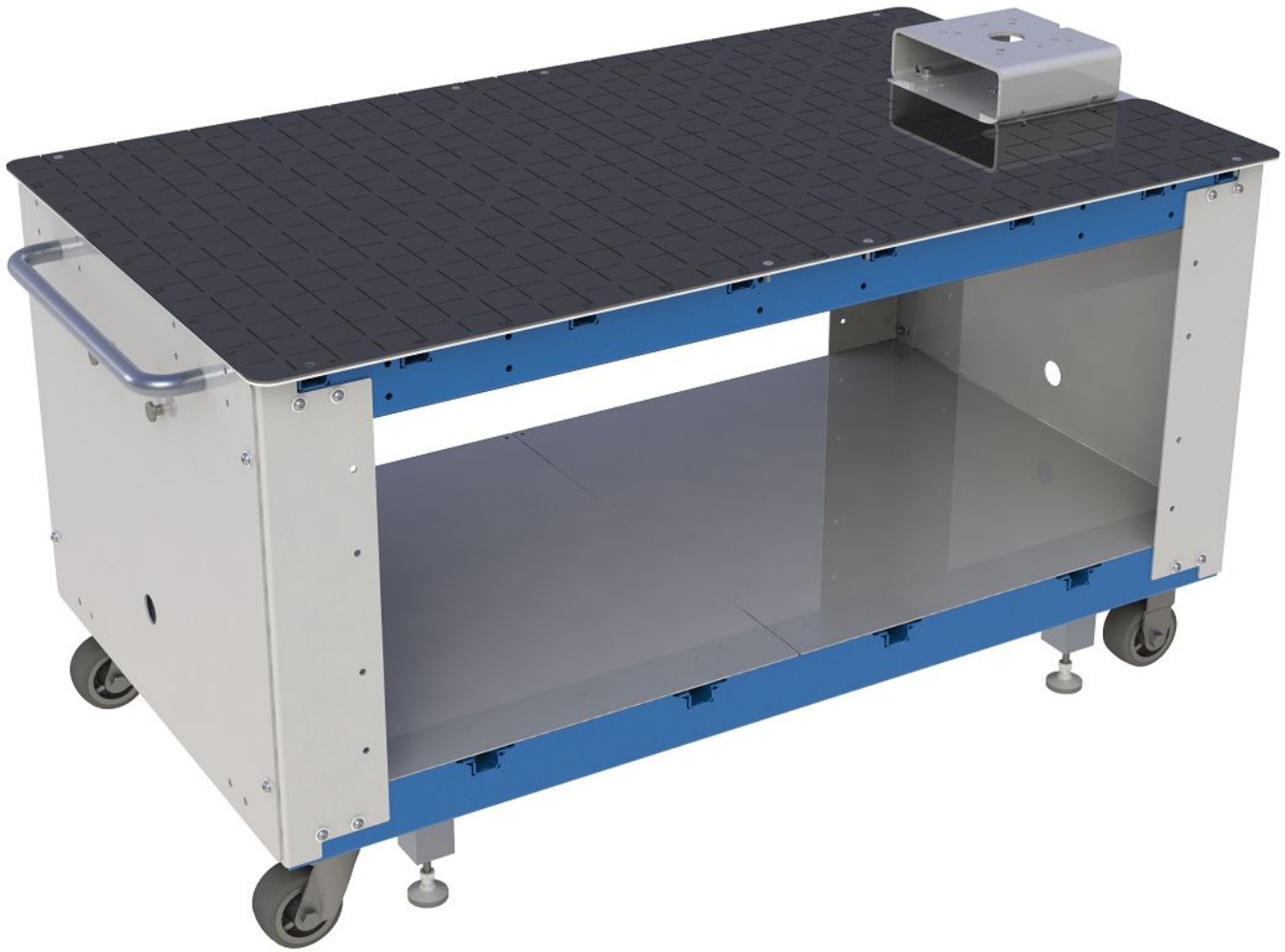
Lathe Automation System Overview

Parts shown in Puck configuration

VersaCart 1300

VersaCart 1300:

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



VersaCart 1300 - Puck Infeed

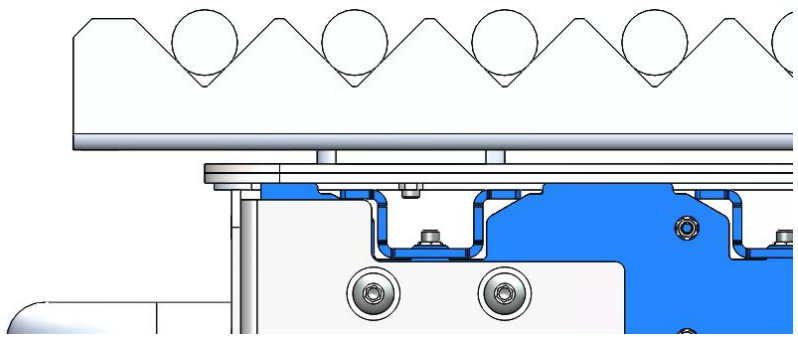
VersaCart 1300 shaft Infeed:

- Parts lay flat on VersaCart table
- Parts are located on visual infeed
- Refer to VSC interface to show layout of parts, after part configuration is complete (with length/width = diameter)

VersaCart 1300 - Shaft Infeed *optional accessory

VersaCart 1300 Shaft Infeed:

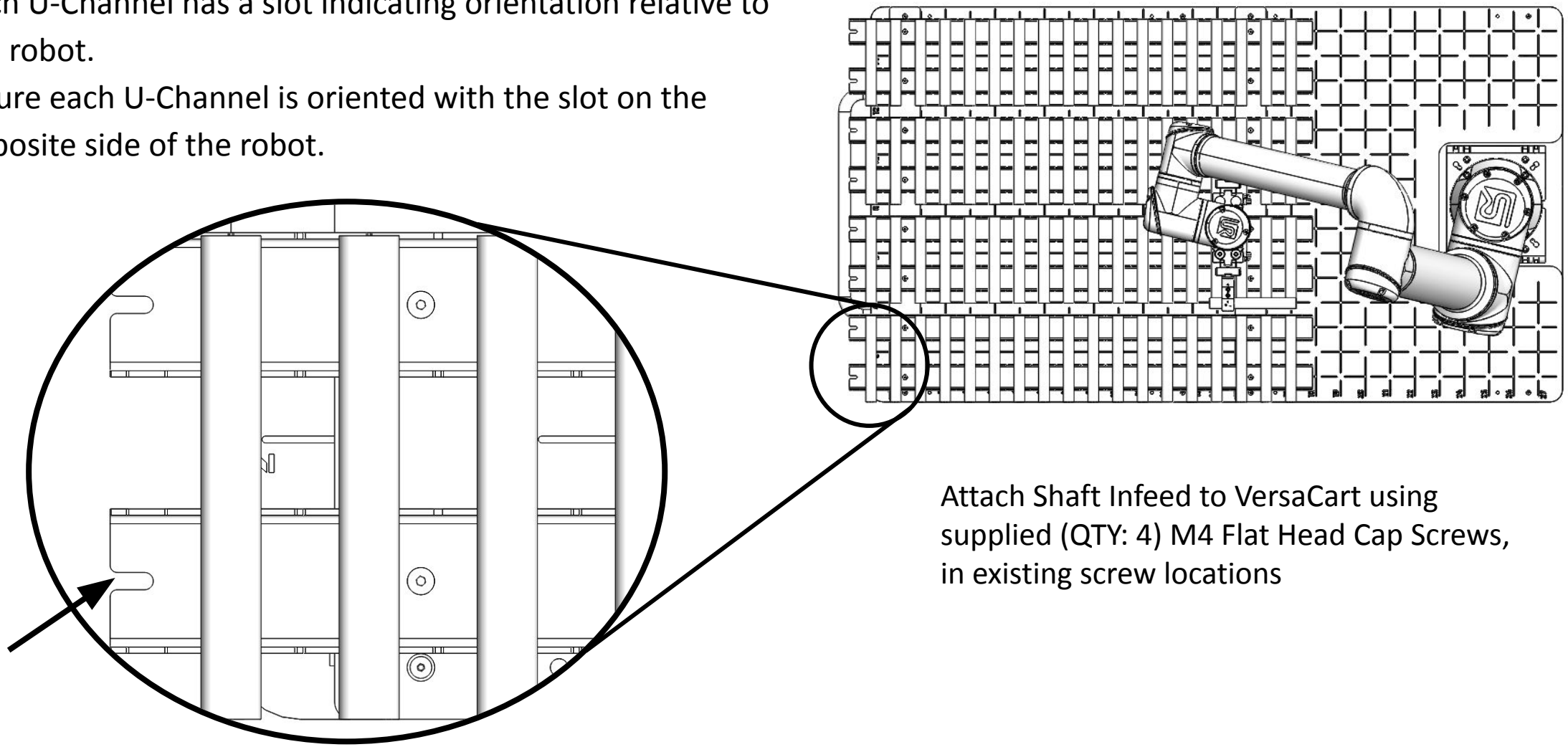
- Fasten to visual infeed
- 8x U-Channels with V profile for locating round shafts/shafts
- Locate shafts from 0.25” to 3” diameter
- Refer to Machinist Manual for guidance and VSC interface to show layout of parts, after part configuration is complete



VersaCart 1300 - Shaft Infeed *optional accessory

VersaCart 1300 Shaft Infeed Orientation:

- Each U-Channel has a slot indicating orientation relative to the robot.
- Insure each U-Channel is oriented with the slot on the opposite side of the robot.



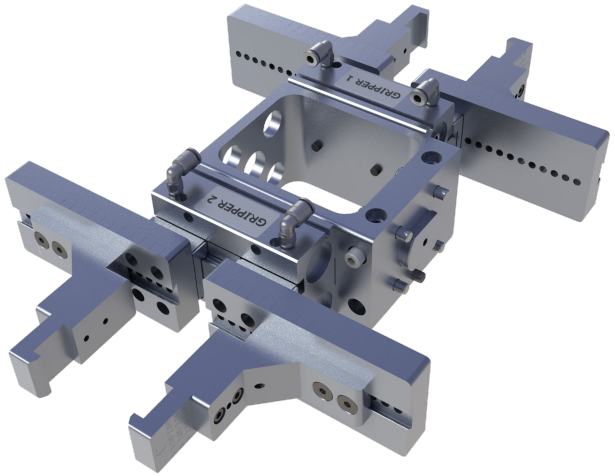
Attach Shaft Infeed to VersaCart using supplied (QTY: 4) M4 Flat Head Cap Screws, in existing screw locations

DuoGrip Gripper

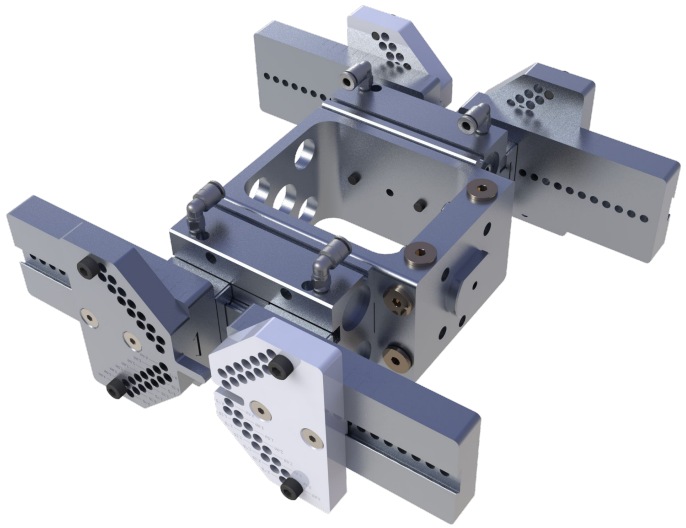
- 2x Pneumatic Grippers mounted 180° apart, with hardware for shaft picking* and puck picking**
- Adapter Plate to attach to Robot conforming to ISO 9409-1-50-4-M6
- 5/32” Tubing to connect to supply from gripper valve in VSC
- Zip Ties for tube routing on Robot arm

*shaft picking for parts with length much greater than diameter (shaft, shaft, etc) - picked and placed from the side. shaft fingers for diameter ranges 0.25 to 3.0” available.

**Puck picking for round parts that can stand up. Diameter ranges from 0.50” to 4” standard and optional up to 8”



Shaft Picking Setup



Puck Picking Setup

Lathe VersaBuilt System Controller (Lathe VSC)

- VersaBuilt System Controller (VSC) with Pneumatic and Electrical connections
- Pneumatic signals to Gripper, and optional VersaDoor
- Ethernet connection to 5-Port Ethernet Switch, facilitating communication between Robot and CNC
- Digital Output Connection to CNC Cycle Start
- Digital Output Connection(s) to CNC for chuck actuation
- Digital Input connection to VersaDoor sensors
- VSC Enable Button with magnetic attachment, connecting to Digital Input
- RS232 DB9 connection to CNC for Haas Legacy controls

Tubing and Fittings

- 0.25” tubing:
  - 25-ft white tubing - Connecting from Plant Supply to VSC

- 5/32” tubing:
  - 25-ft red tubing - Connecting from VSC to Gripper 1 Close
  - 25-ft blue tubing - Connecting from VSC to Gripper 1 Open
  - 25-ft clear or black tubing - Connecting VSC to Gripper 2 Close
  - 25-ft white tubing - Connecting from VSC to Gripper 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. System air consumption is 15-20 SCFM during VersaBlast operation.

Refer to Appendix A for complete Pneumatics Schematics

Required Tools

- Hex Keys:
  - 1/4-inch
  - 3/8-inch
  - 3mm
  - 4mm
  - 5mm
  - 6mm
- Wrenches:
  - 8mm open-end wrench (QTY: 2)
  - 10mm open-end wrench
  - 13mm open-end wrench
  - 15mm open-end wrench
  - 17mm open-end wrench
  - Adjustable wrench (Crescent)
- Tube cutters
- Side cutting pliers
- Lineman’s Pliers (QTY: 2)
- Level
- Tape Measure
- Medium strength threadlocker (e.g., Loctite 243 blue)

Robot & Gripper Installation

Section 3

Install Robot & Gripper

Installation steps for Robot, Double Headed Gripper, routing gripper tubing along robot body are found in the Lathe Automation System UR10e Robot & Gripper Installation, Configuration and Operation Manual

VersaBuilt System Controller (VSC) Installation & Configuration

Section 4

VSC Parts and Tools

Hardware:

- VersaBuilt System Controller (VSC)
- 110 VAC to 24VDC Power Cable
- Cycle Start Cable
- 5 Port Ethernet Switch
- 3-Foot Ethernet Cable
- 2 x 25-foot Ethernet Cables
- VSC Enable Button
- Chuck Open/Close Cable
- DIN Rail with mounting hardware
- Adhesive-back Rubber Pad

Pneumatics:

- Shut-off valve assembly
- Pressure Gauge
- 1/4” to 5/32” reducer fittings & plugs

Tools:

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

Find Mounting Location for VSC

Steps:

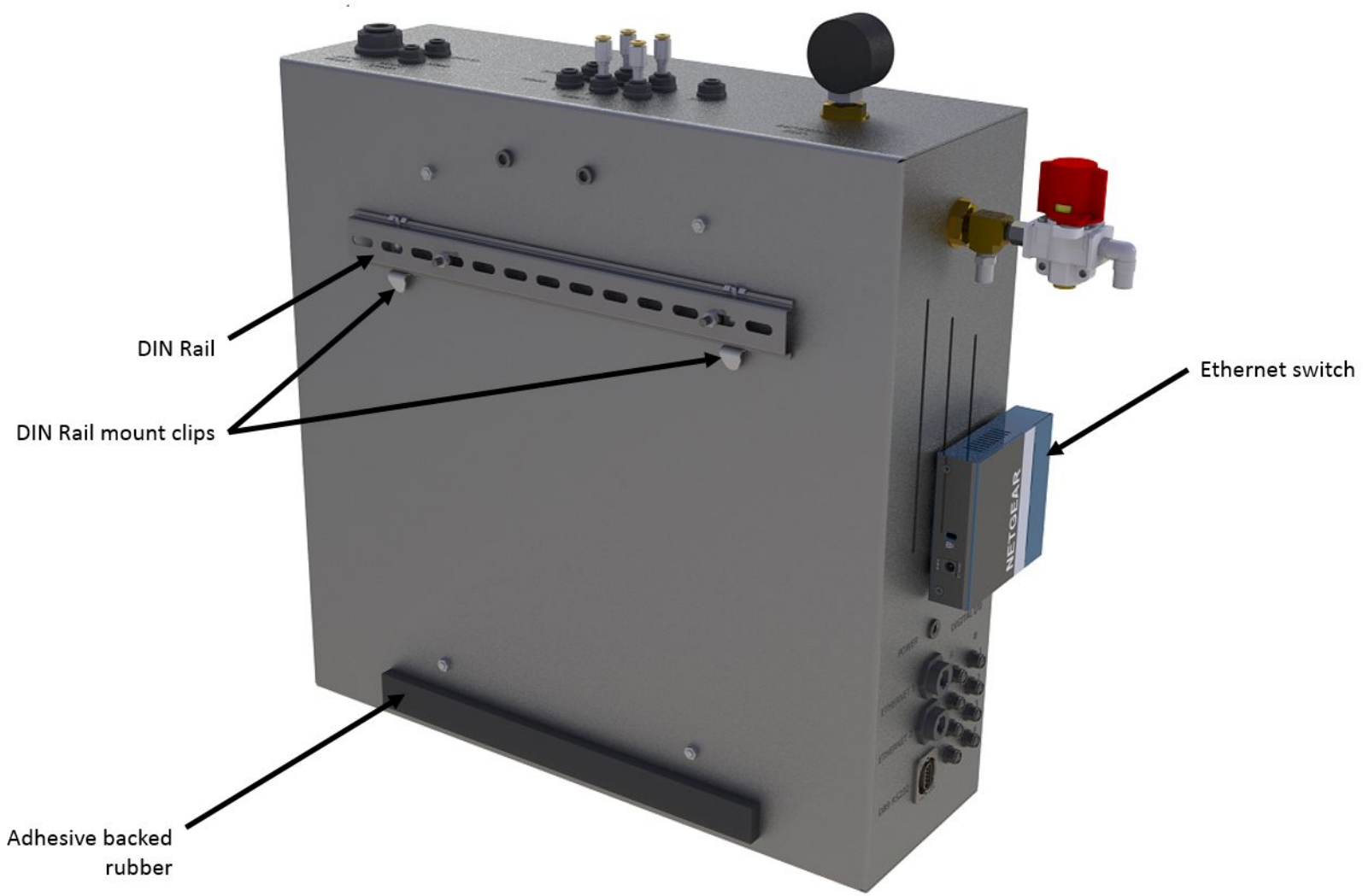
1. Determine Mounting locator for panel
   - Side of CNC
   - Top of CNC
   - Wall or Racks near CNC
   - Bottom shelf of Versacart

   *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 VersaBuilt System Controller with 3-foot Ethernet cable
2. Install DIN rail with supplied fasteners thru clearance slots, 0.23” wide
3. Attach adhesive backed rubber, with most common location shown in image on the following page
4. Secure VSC to DIN Rail with DIN Rail Clips pre-installed on panel
5. With adhesive backed velcro, attach Ethernet switch
6. Connect supplied Ethernet cable (3-ft length) from Ethernet Port 1 to Ethernet Switch
7. Connect power supply
8. Connect VSC Enable Button cable to Digital I/O connection B2

Position and Mount VersaBuilt System Controller

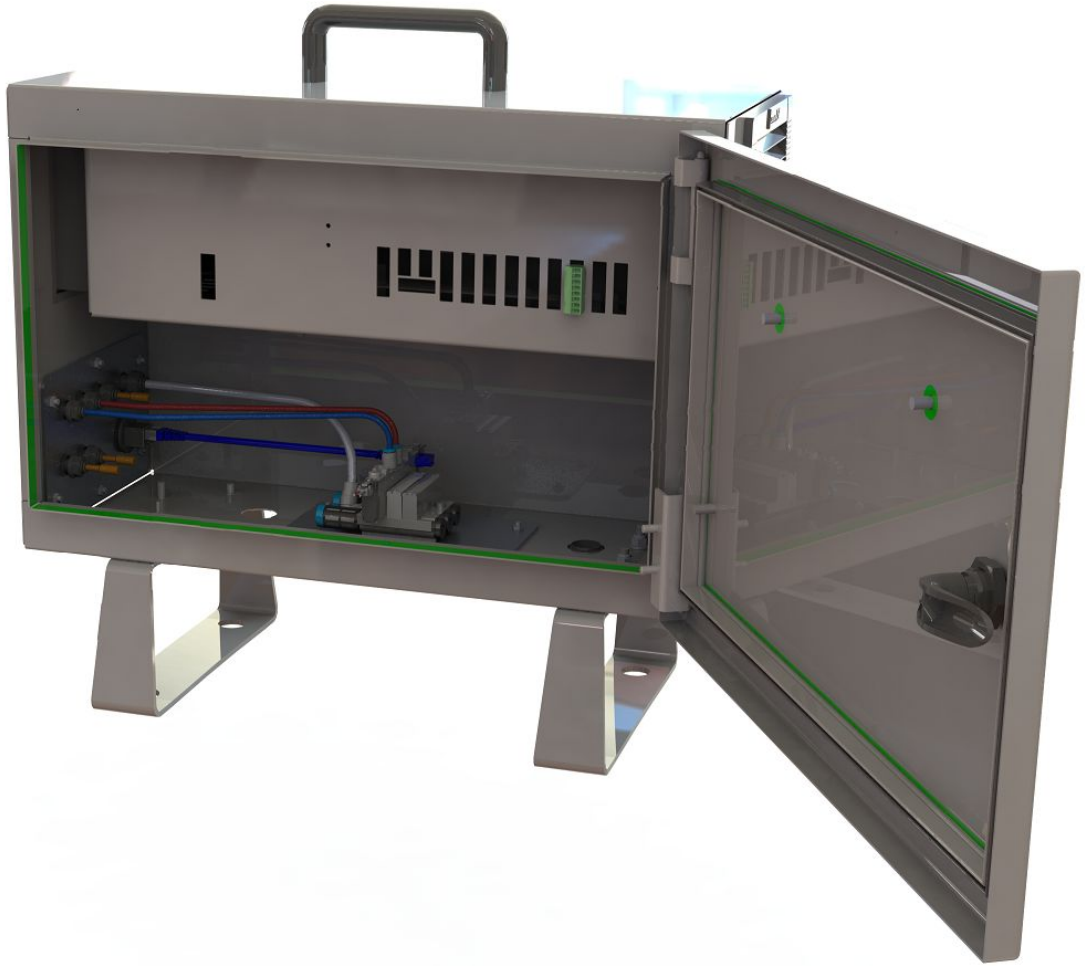


Install UR Controller Panel

- Tools:
  - Torx Driver for M4 bolts connecting UR factory supplied cover panels on the side and bottom of the controller, then reconnecting VersaBuilt cover panels.

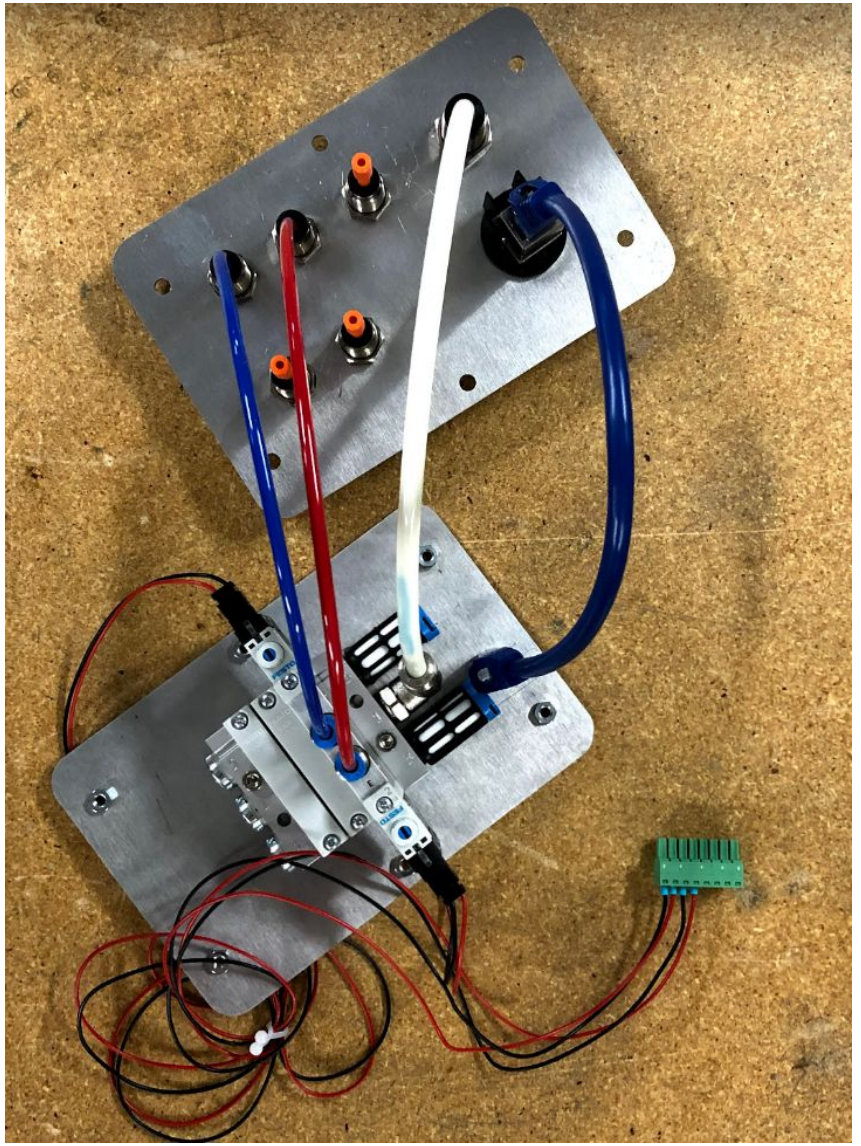
- Parts:
  - UR Controller Panel - Side Panel with bulkhead fittings and panel mount Ethernet connector
  - UR Controller Panel - Bottom Panel with pneumatic valve assembly
  - Tubing is pre-routed between panels
  - Ethernet cable
  - Digital output connector, pre-wired to pneumatic valve

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

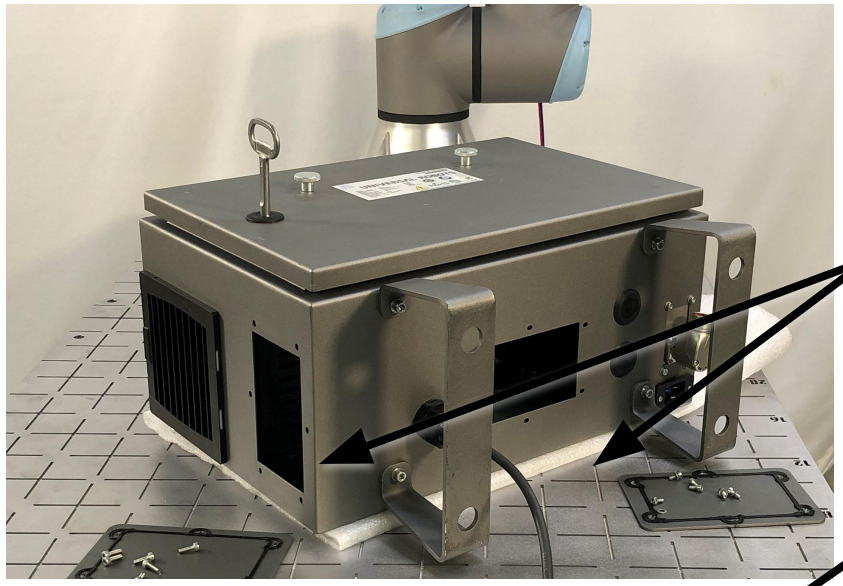


Install UR Controller Panel

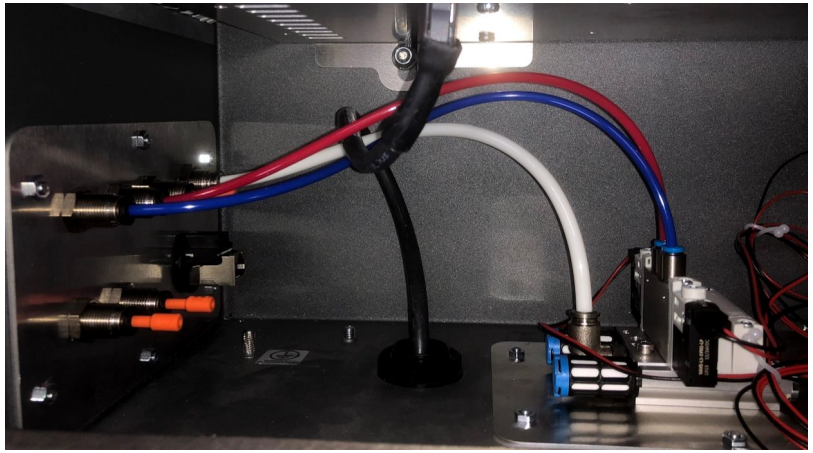
The image to the right shows the UR Controller Panels as packaged, ready for installation



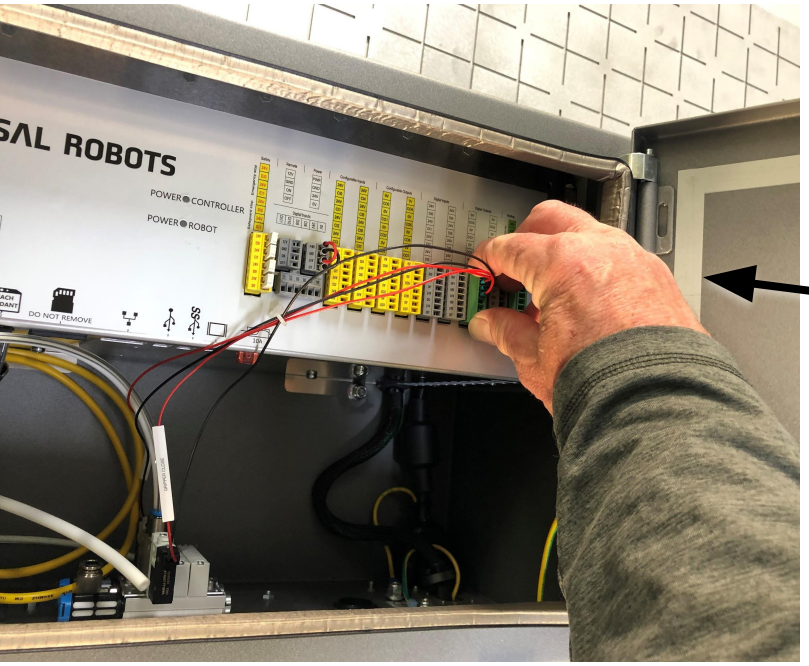
Install UR Controller Panel



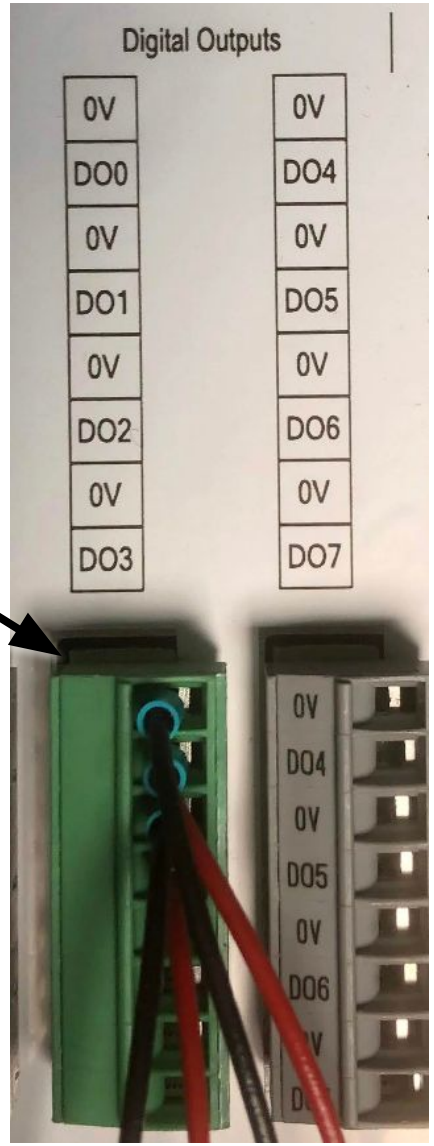
- Remove existing cover plates on side and bottom of controller with Torx driver (keep Torx screws for next step)
- Attach the UR Controller Side and Bottom Panels to the UR robot controller, using existing bolts
- Tubing connecting the panels is pre-installed. 1/4” tubing is supply air, and 5/32” tubing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

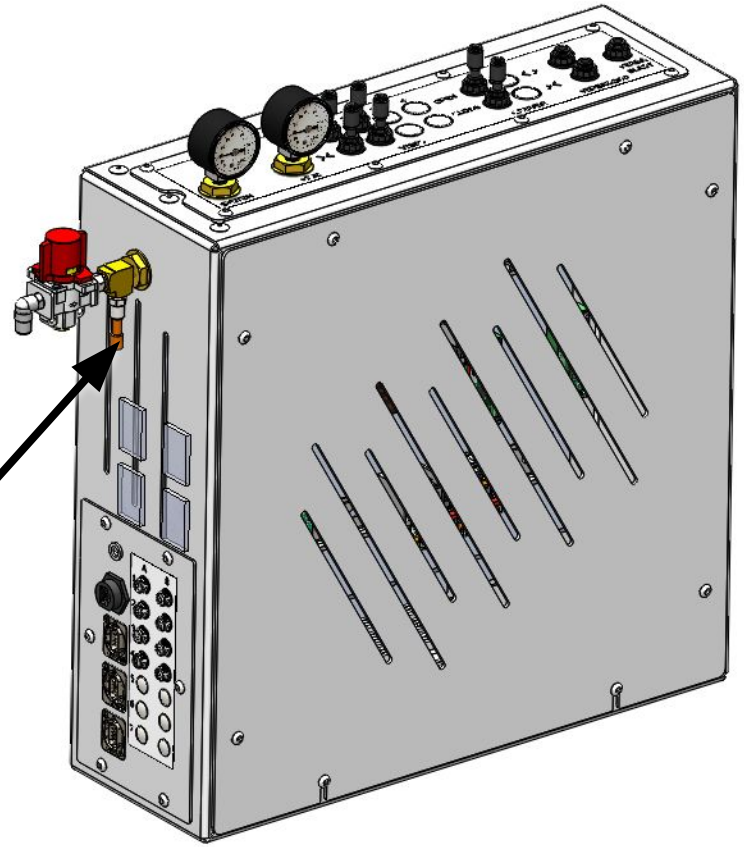


Install UR Controller Panel

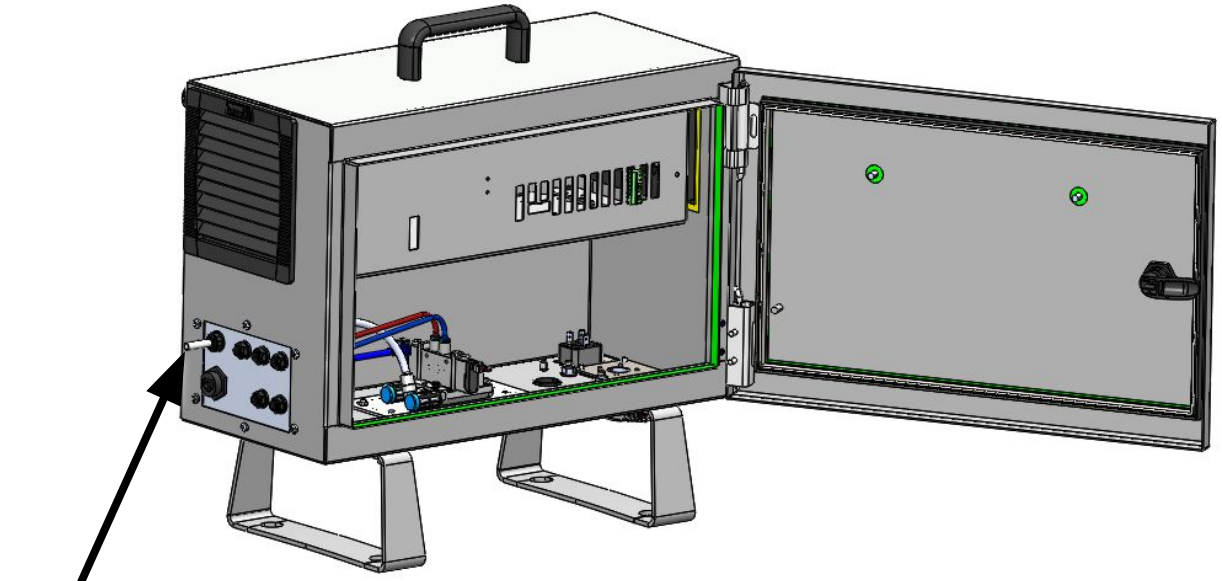
Connect 0.25” tubing from port after Red Shut-off Valve on VSC

to

Air Input on UR Controller



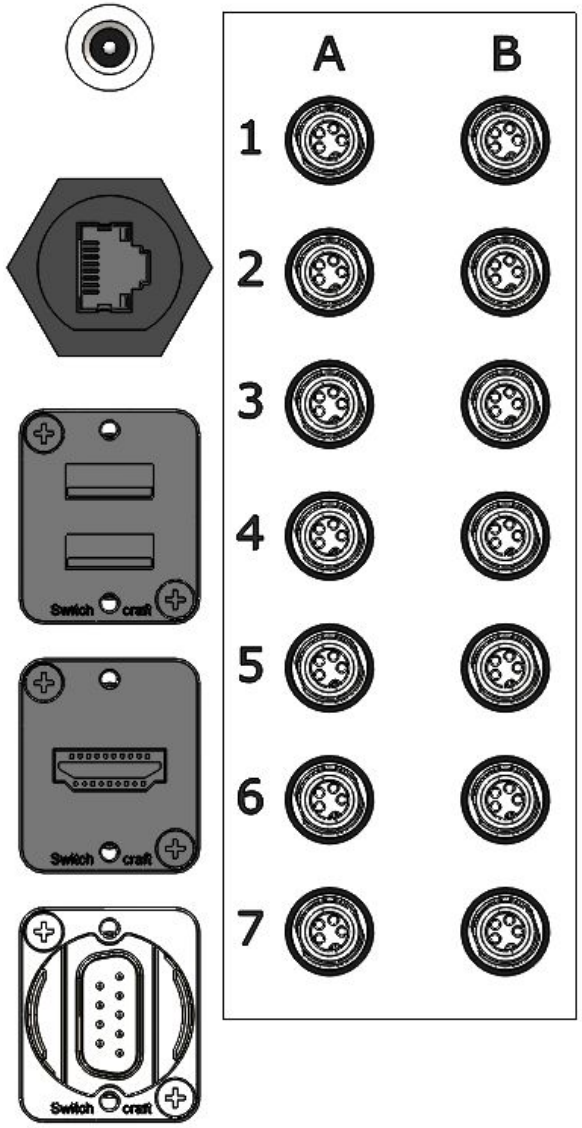
Port after Red Shut-off



Air Input

VSC Cable Connections

- Power = 110VAC to 24VDC cord provided with VSC Panel
- Ethernet 1 = VSC Communication to Ethernet Switch
- USB ports 1 and 2 (keyboard, mouse, backup)
- HDMI port (monitor)
- RS232 DB9 = Connection to CNC if Ethernet is not available
- A1 = Vise Sensor, Vise 1 and Vise 2 (MAS)
- A2 = Vise Sensor, Vise 3 and Vise 4 (MAS)
- A3 = VersaDoor Sensor, Single Door
- A4 = VersaDoor Sensor, 2nd Door
- A5 = VersaWash XT
- A6 = Dual CNC Communication - Robot Lock (Output)
- A7 = Chuck #1 Control (LAS)
- B1 = Cycle Start Cable
- B2 = VSC Enable
- B3 = Door Operator Panel (Door Open/Door Close)
- B4 = Cycle End Command (Generic Driver input)
- B5 = Open
- B6 = Dual CNC Communication - Robot Lock (Input)
- B7 = Chuck #2 Control (LAS)



*A2 was wired for Cycle End Command and Vise 3 Sensor on serial numbers VSC00100 thru VSC00107, and VBR serial numbers

*Legacy LAS - A1 and A2 wired for Chuck 1 and 2 control where A7 and B7 are unused

User Interface Connection to the VSC

Configure Robot for VSC (robot dependent)

Some robots require a VersaBuilt program to be run on the robot's teach pendant or the robot to be put in a special mode for the VSC to be able to control the robot.

Check the **VersaBuilt Robot Installation, Configuration and Operation** manual that matches your robot make and model for additional steps required to enable operation with the VSC.

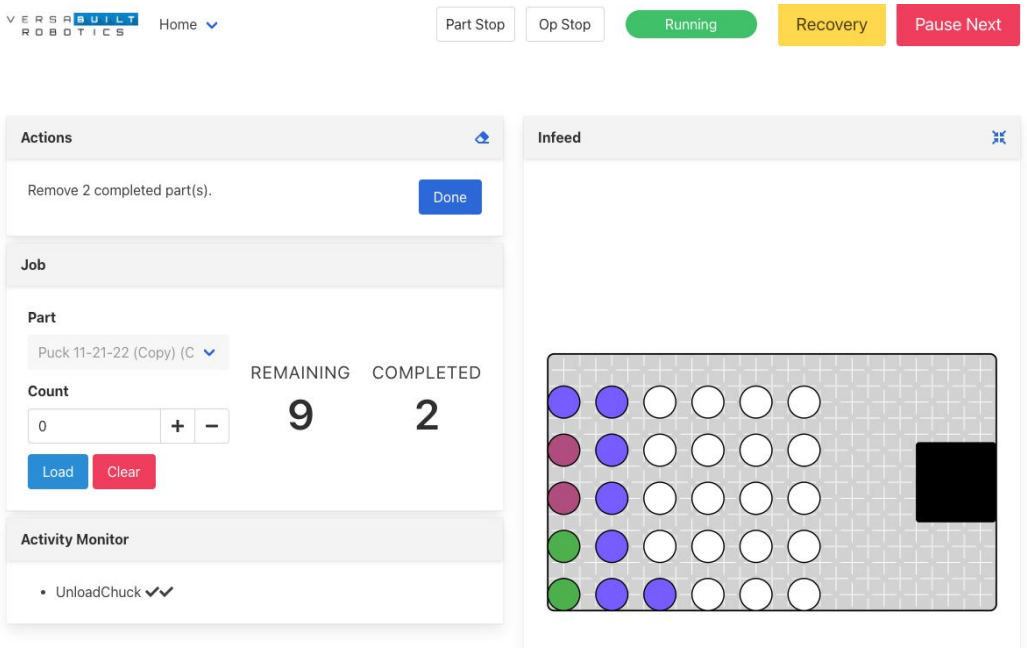
Open the VSC Home Page

The VSC is accessed by a phone, tablet or computer.

Using a phone, tablet or computer, open the VSC web page using the following address:

192.168.4.1:9000 for Wi-Fi connected devices
192.168.2.1:9000 for Ethernet connected devices

*For more information on how to configure the device networking to access the VSC, see the VSC Lathe Operators Manual.

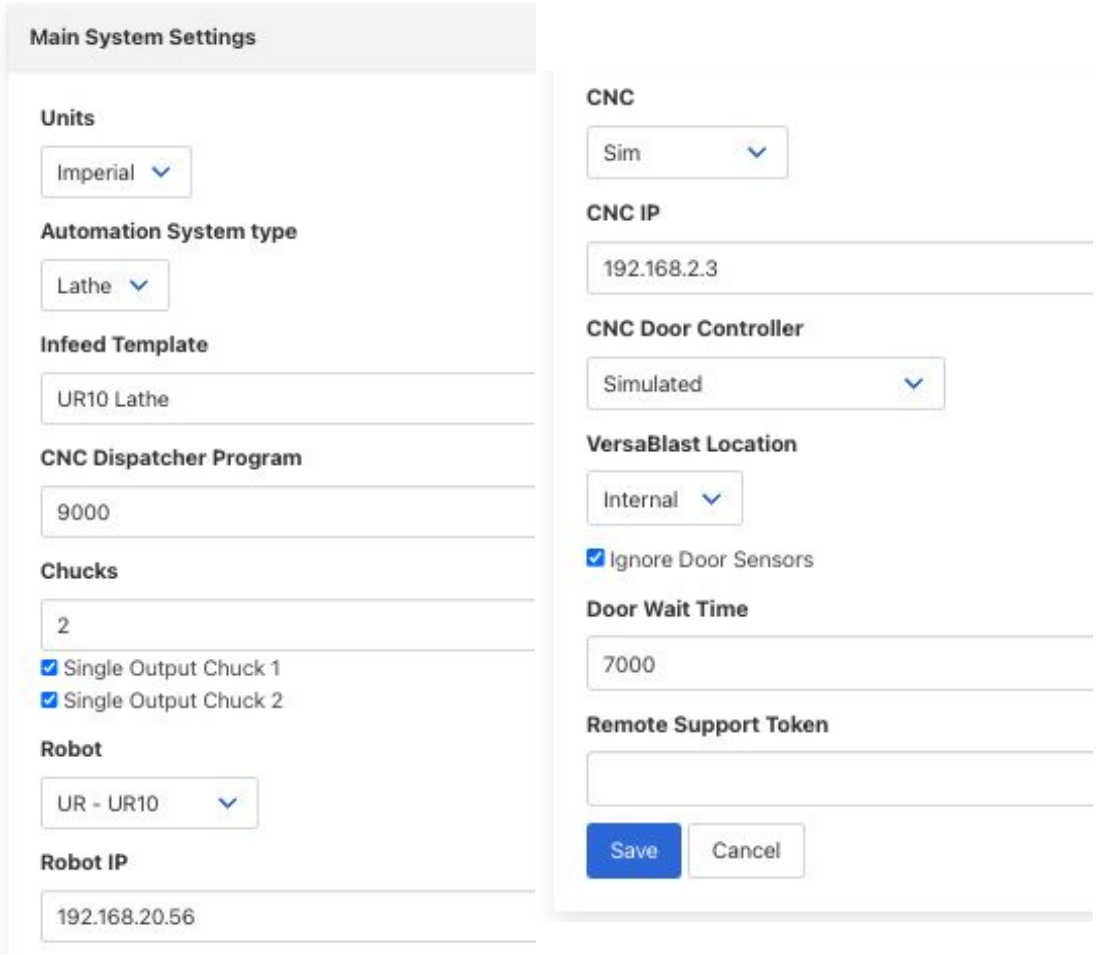


Wi-Fi connection is vsc + serial number (e.g., vsc00125)
Wi-Fi password = **versabuilt**

Configure VSC System Settings

Navigate to the Settings Page

Click on the Navigation down arrow and select Settings. Press the Edit System Settings button at the bottom of the page. Edit the System Settings to match the configuration of your system (see following pages for descriptions of each setting).



VSC Main System Settings

Units: Choose imperial or metric units to be used in the VSC

Automation System Type = Lathe (Default is Mill)

Infeed Template = UR10 Lathe

Default CNC Wash Program: Default CNC program number for a wash program to clean the chuck(s) of chips

Chucks - user can specify have 1 or 2 chucks (2 chucks for sub-spindle lathe or tailstock)

Single Output Chuck - If your lathe has a single foot pedal per chuck, select Single Output Chuck for each chuck

CNC Dispatcher Program: CNC Dispatcher program number, 9000 by default (Haas and Fanuc CNC controls only)

Robot: UR - UR10

Robot IP: IP address of the robot, 192.168.2.2 by default

CNC: Select the type of CNC control the VSC is connected to

CNC IP: IP Address of the CNC (not applicable for Haas Legacy or Generic), 192.168.2.3 by default

CNC Door Controller: Select one of VSC Controlled Autodoor or CNC Controlled Autodoor

NOTE: a CNC Controlled Autodoor must be configured to automatically close on CNC Cycle Start and Open on CNC Cycle End

VSC Main System Settings

Ignore Door Sensors: set to true if VersaBuilt door sensors are not installed

Door Wait Time: For CNC Controlled Autodoor:

If Ignore Door Sensors is true, the amount of time the VSC will wait after the Cycle End signal is received before proceeding

Door Wait Time: For VSC Controlled Autodoor:

If Ignore Door Sensors is selected, the amount of time the VSC will wait after commanding a door open or door close before proceeding

If Ignore Door Sensors is not selected, the amount of time the VSC will wait after commanding a door open or door close before generating an error

NOTE: without door sensors, the robot will try to move into the CNC, sending a signal to open the door then waiting the prescribed “door wait time”. The robot will move to enter the CNC even if the CNC door did not open successfully

Configure the VSC Network Settings

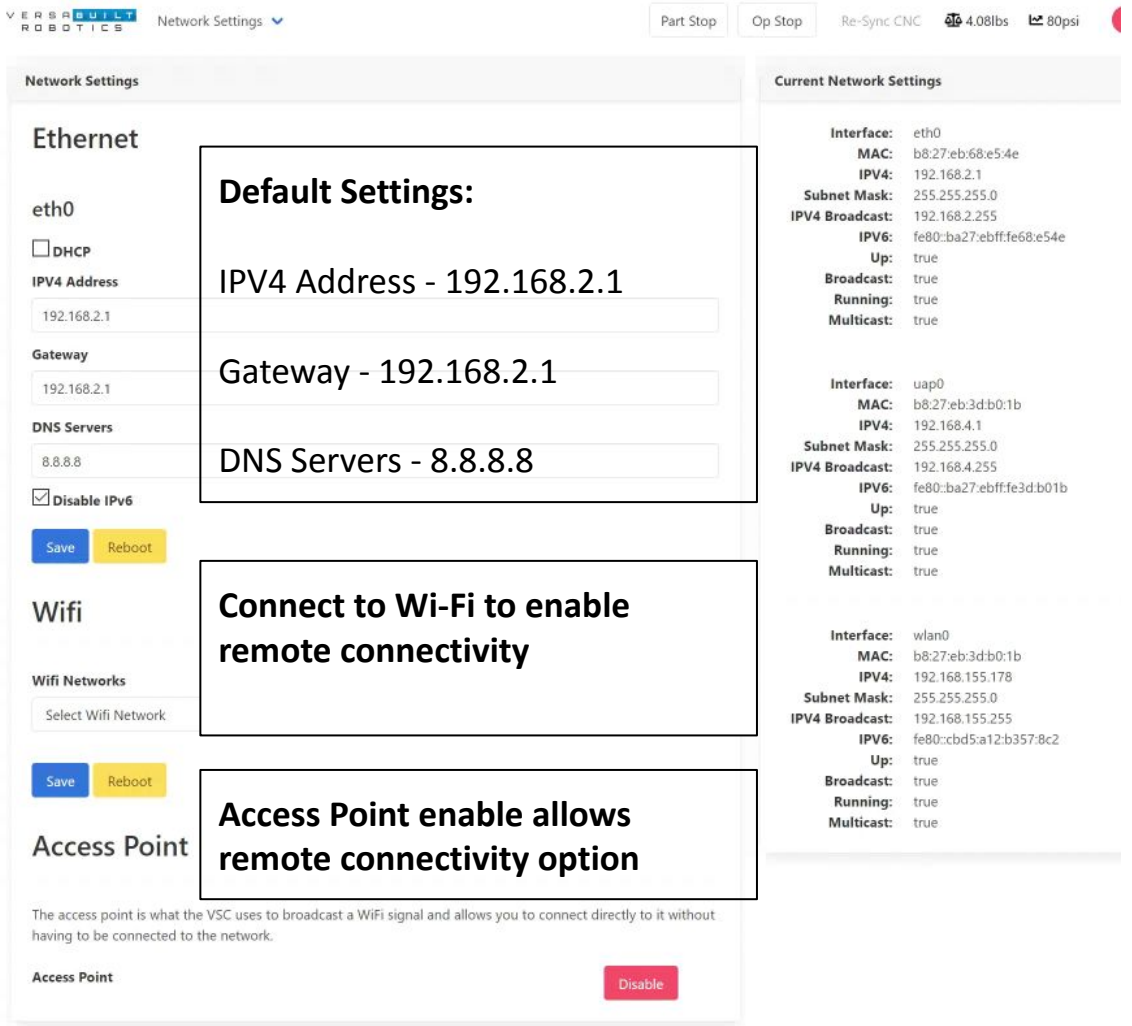
Navigate to the Network Settings Page

Click on the Navigation down arrow and select Network Settings.

Network Settings Overview

VersaBuilt recommends keeping the default Ethernet settings, setup to access the Internet via a local Wi-Fi network, and Access Point enabled. VSC Internet access is optional, allowing VersaBuilt technical support to access the VSC remotely when the Remote Support option is enabled from the About page of the VSC.

Alternatively, the VSC may be connected to the corporate network. In this configuration, the VSC, CNC and Robot should all be assigned IP addresses that will not change and the Gateway parameter should be set to the corporate Internet router IP address. Consult an IT specialist familiar with the corporate network for proper custom network configuration.



VersaBuilt System Controller CNC Installation

VSC Installation instructions can be found in the “VersaBuilt System Controller CNC Installation and Programming Manual”

Note: when referencing this manual, there are independent instructions for Mill applications and Lathe applications.

VersaCart to CNC Installation

Section 5

Position VersaCart in front of CNC

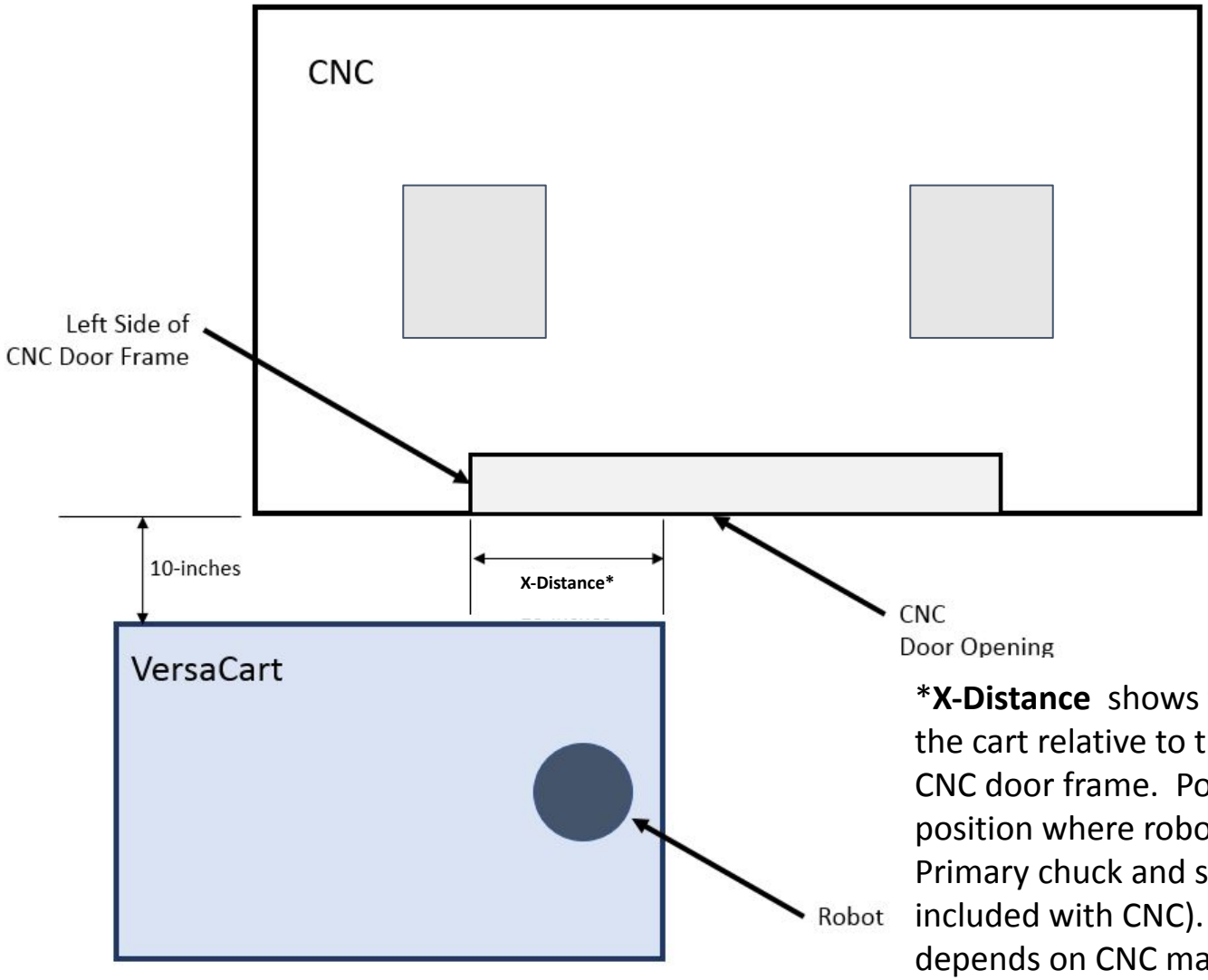
Tools:

- 15mm Wrench
- 17mm Wrench
- Level
- Tape Measure

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



***X-Distance** shows the location of the cart relative to the inside of left CNC door frame. Position the cart in position where robot can reach Primary chuck and sub-spindle (if included with CNC). Dimension depends on CNC make and model.
For most CNC’s X = 10-inches

Position VersaCart in front of CNC

- Use a wrench to turn the nuts closest to the footpad to lower the foot pad and raise the VersaCart
- Make sure each wheel of the VersaCart is off the ground, the VersaCart is level and all 4 foot pads are firmly on the ground
- Tighten the lock nuts against the aluminum block to keep the foot pads in place

Connect and Route Tubing and Cabling

Section 6

Tubing

The Lathe Automation System includes a tubing kit with the following:

- 0.25” tubing:
  - 25-ft white tubing - Connecting from Plant Supply to VSC (connected to Red Shut-off valve)

- 5/32” tubing:
  - 25-ft red tubing - Connecting from VSC to Gripper 1 Closed
  - 25-ft blue tubing - Connecting from VSC to Gripper 1 Open
  - 25-ft black tubing - Connecting from VSC to Gripper 2 Closed
  - 25-ft white or clear tubing - Connecting from VSC to Gripper 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***

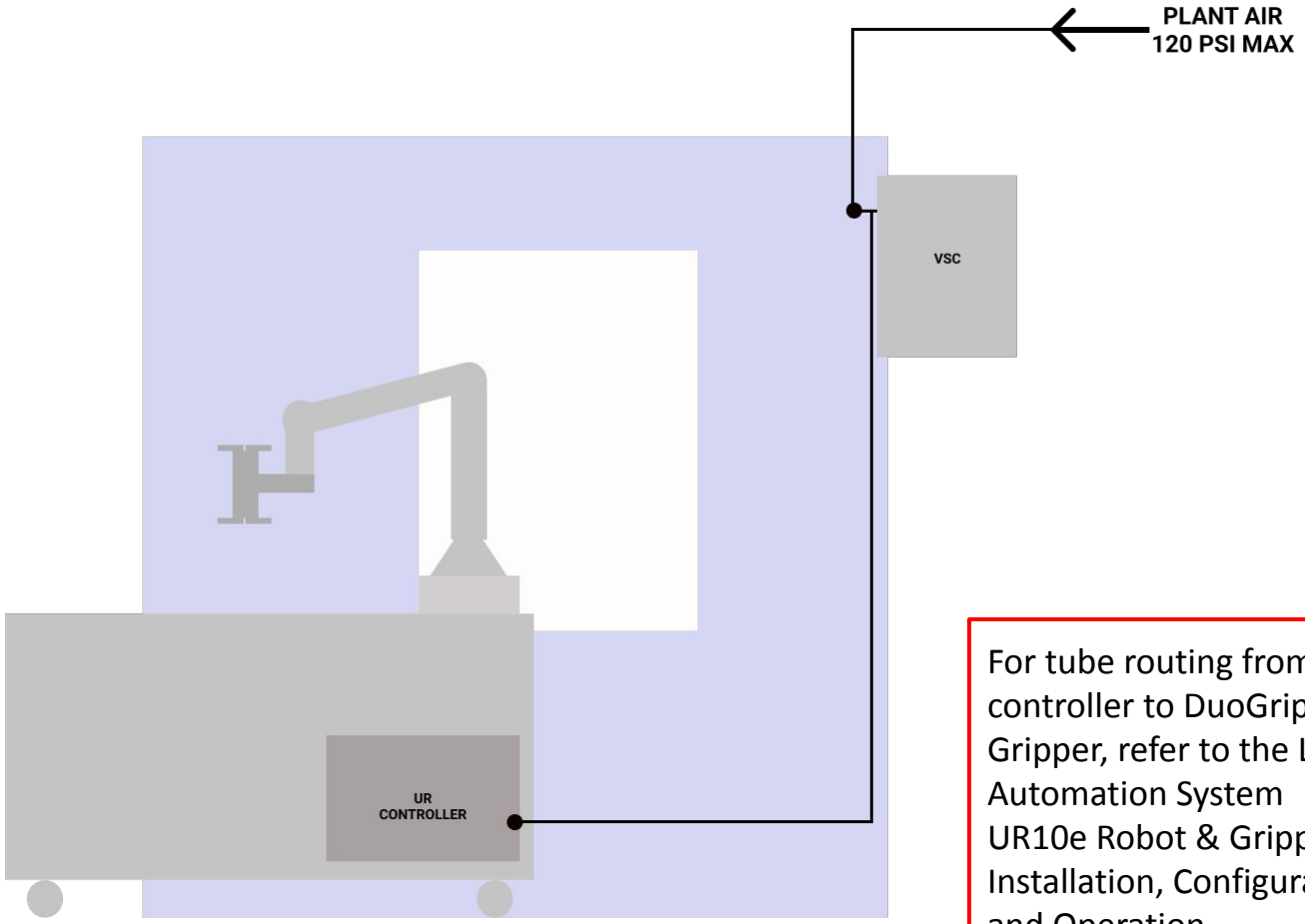
****Refer to the following page for the pneumatic schematics*

Route air to Automation Equipment

The figure to the right shows supply air to devices in the Lathe Automation System

- 1/4” tubing from Plant Air to VSC Input (Red shut off valve)
- 1/4” Tubing to tee-fitting after Red shut off valve to UR Controller
- 5/32” air lines out of the UR controller to the DuoGrip Gripper

**supply lines can be Tee’d from a single source or from different sources*



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

For tube routing from UR controller to DuoGrip Gripper, refer to the Lathe Automation System UR10e Robot & Gripper Installation, Configuration and Operation

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

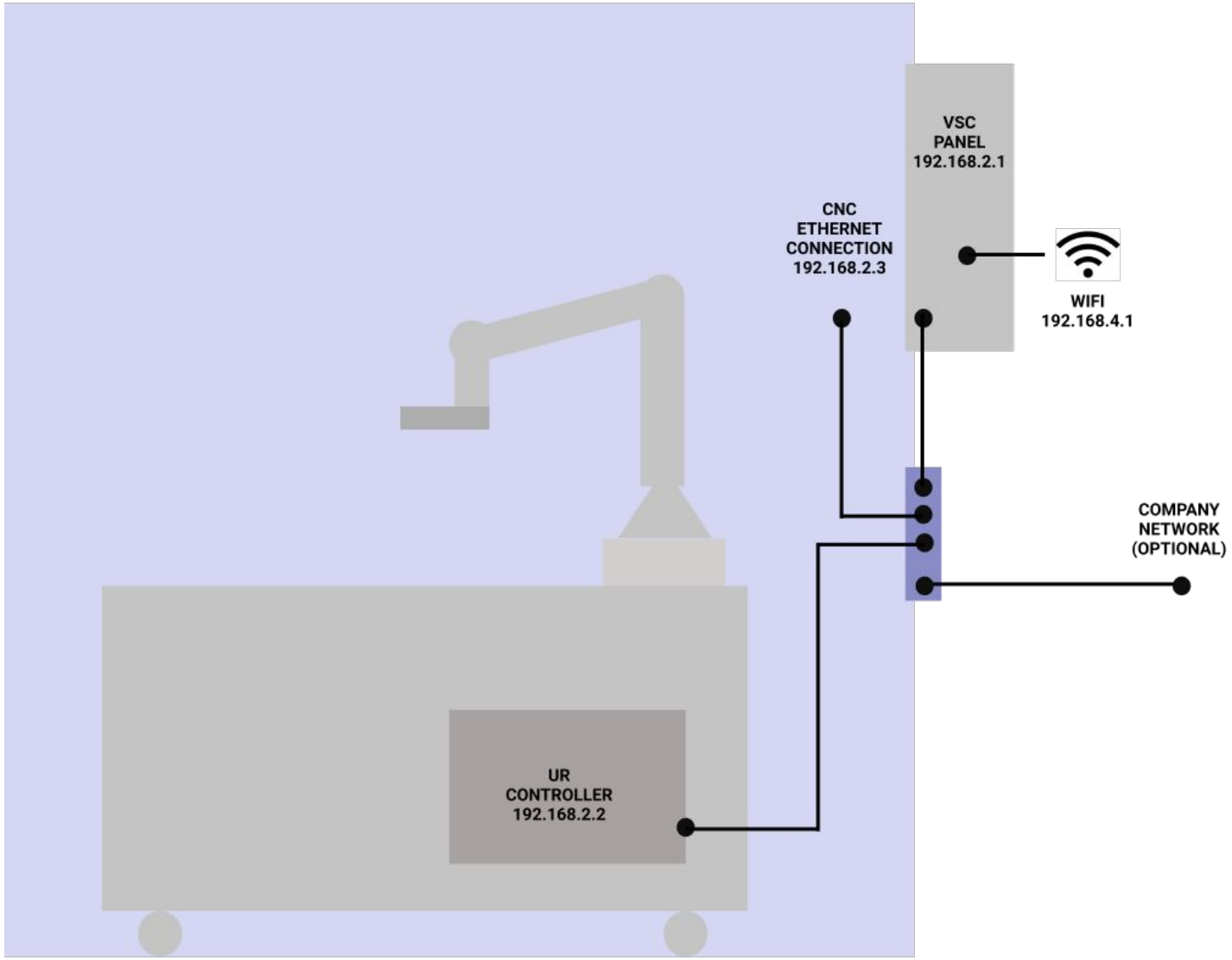
VSC Enable Button Installation

Installation of VSC Enable Button:

- VSC Enable Button enables control of moveable peripherals of the automation system, confirming user control of the system. The VSC Enable Button is utilized in system recovery and the start of a new job.
- The VSC Enable Button is magnetically mounted on the CNC or any ferrous surface. Place in a convenient location for operator reach.
- Connect the VSC Enable Cable to Digital I/O **B2** on the VSC Panel.

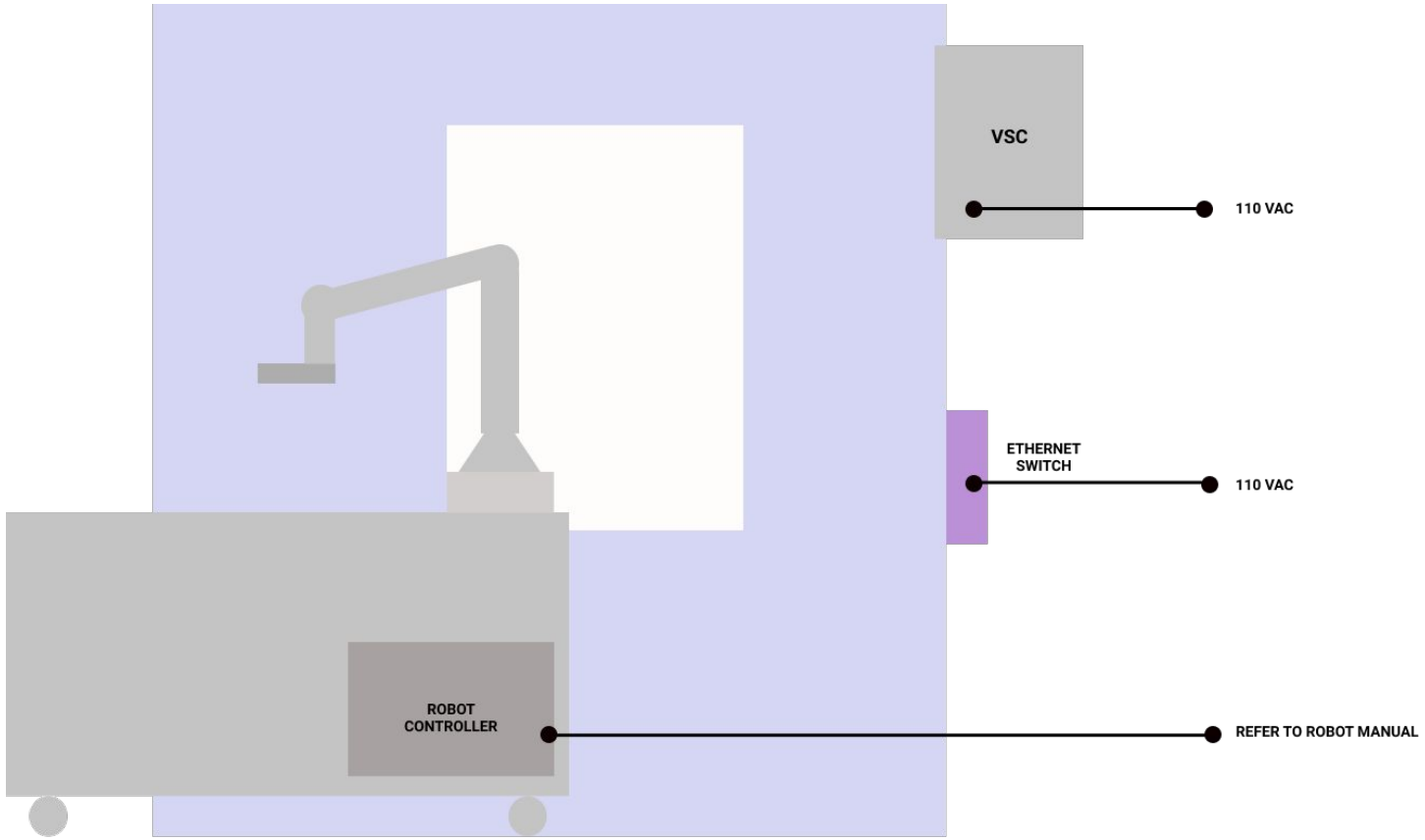
Make Ethernet Connections

- Mount the provided 5-port switch to the VSC or another convenient location
- Use the supplied Ethernet cables to connect the VSC, CNC and robot to the Ethernet switch



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 for VersaBuilt System Controller (VSC) to 110 VAC outlet
- Connect power cable for Ethernet switch to 110 VAC outlet
- Connect power cable for Robot Controller to power specified in robot specification

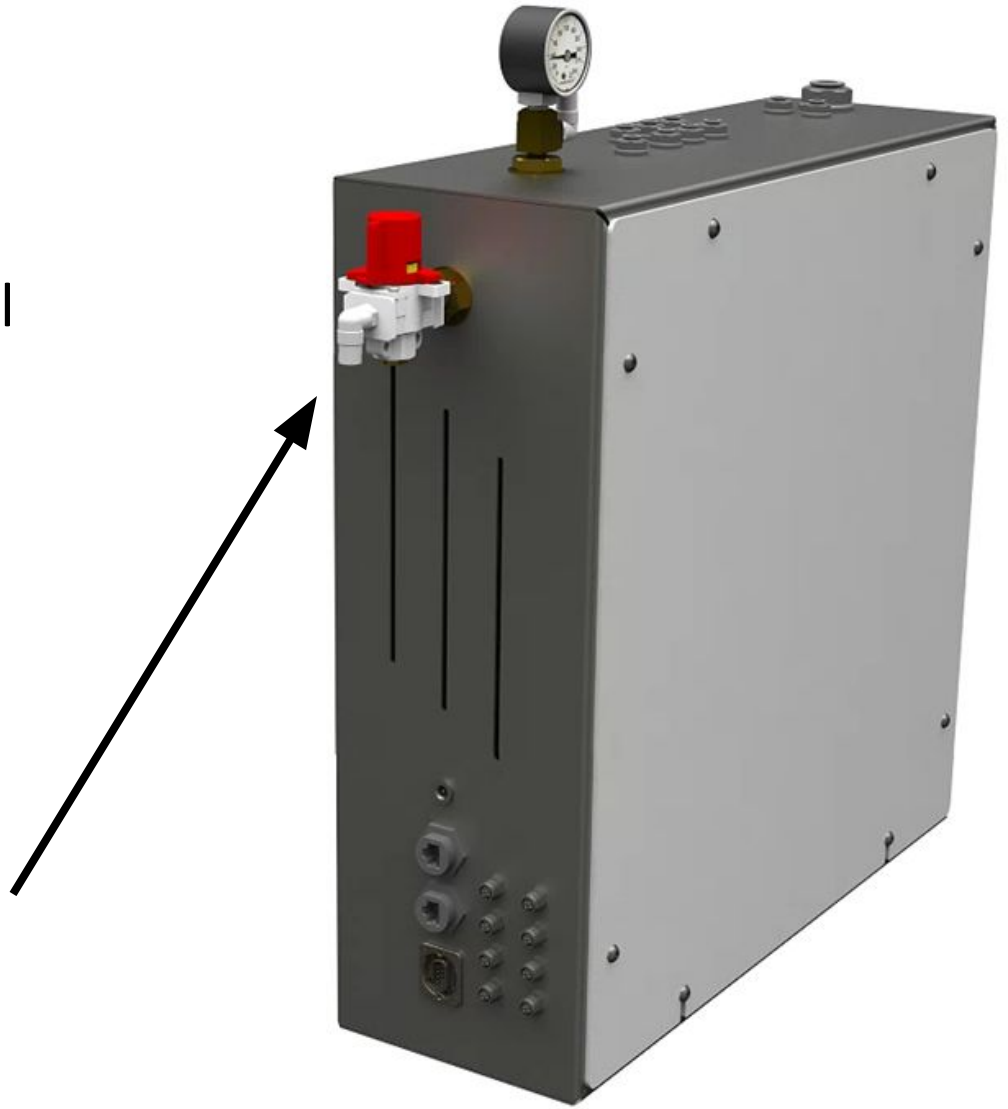


Validate Lathe System & Calibrate

Section 7

Configure and Validate VersaBuilt System Controller

- WARNING: this step opens and closes the chucks, grippers and door. Keep all body parts away from the chucks, grippers and door
- If an airline needs to be swapped, remove pneumatic energy to the system by turning the red air relief valve on the VersaBuilt System Controller



Familiarization with VSC Recovery Panel

Review the Lathe Automation System Operator's Manual

Before beginning the calibration process, take time to review the VersaBuilt System Controller Lathe Operator's Manual. In particular, carefully review Section 7: Recovery Panel.

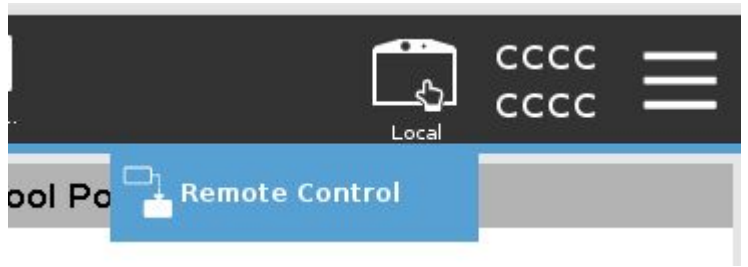
Review the VersaBuilt Robot Installation, Configuration and Operation Manual

Before beginning the calibration process, take time to review the Robot Installation, Configuration and Operation manual that matches the make and model of your robot. In particular, review and configuration required to allow the VSC to control the robot and steps required to properly use the Freedrive mode of the robot.

Validate VersaBuilt System Controller Configuration

Configure Robot for VSC

Place the UR Robot in Remote Mode. On the teach pendant, in the upper-right of the screen, press on the Local button. Select Remote.



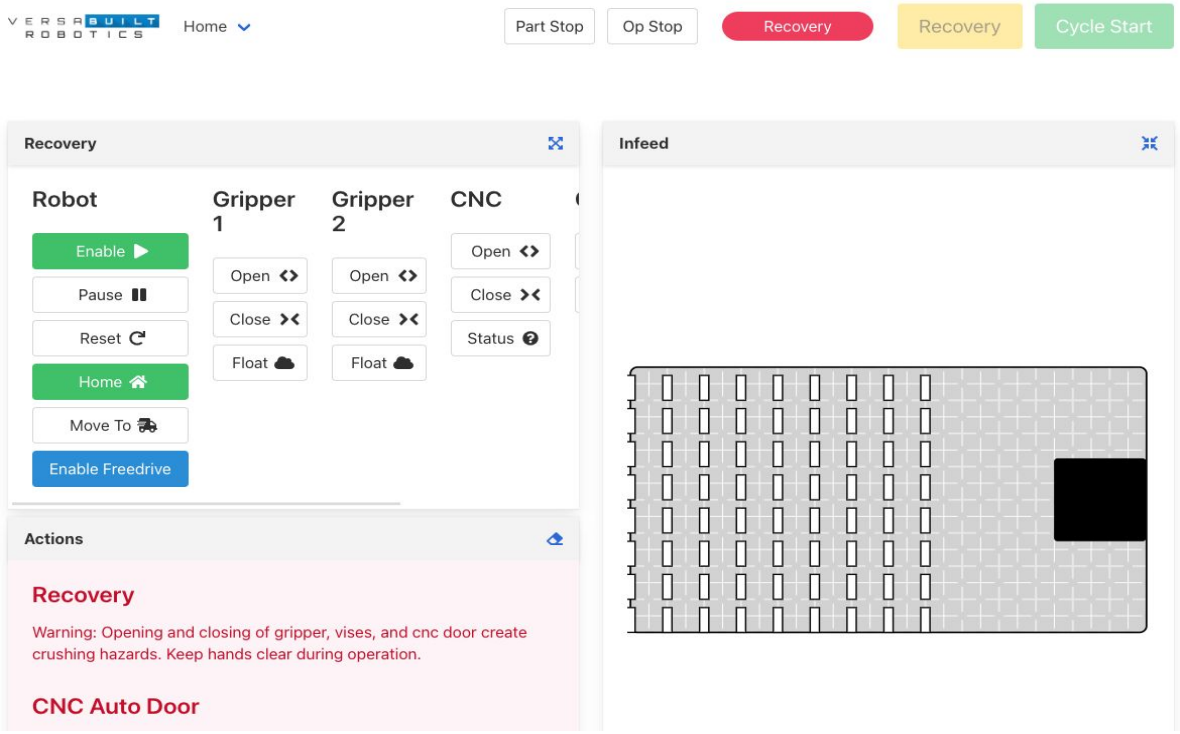
Open the VSC Home Page

The VSC is accessed by a phone, tablet or computer.

Using a phone, tablet or computer, open the VSC web page using the following address:

192.168.4.1:9000 for Wi-Fi connected devices
(Wi-Fi vsc00xxx - password: versabuilt)
192.168.2.1:9000 for Ethernet connected devices

*For more information on how to configure the device networking to access the VSC, see the VSC Mill Operators Manual.

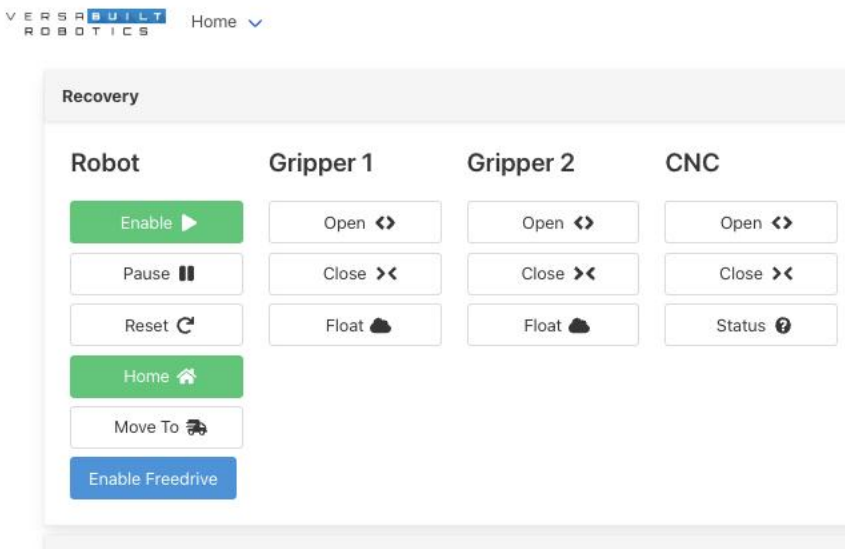


Validate Gripper

Gripper Open/Close Validation:

Navigate to the Home page and press the yellow Recovery button in the upper right hand section of the page. Make sure system is in Auto mode.

- Press the **Open** button for each gripper, ensure the grippers open
- Press the **Close** button for each gripper, ensure the grippers close
- *If necessary, remove air to the VSC and swap airlines to get correct open/close order*

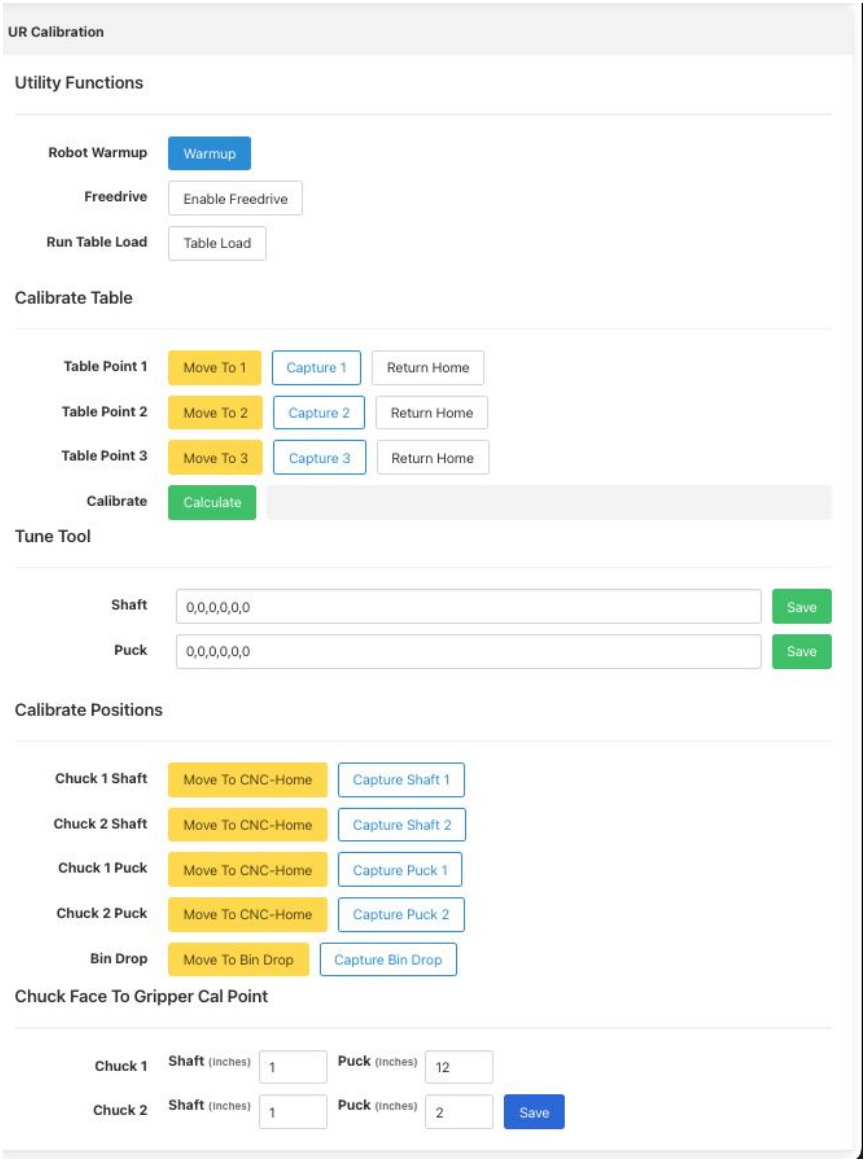


Calibration Overview

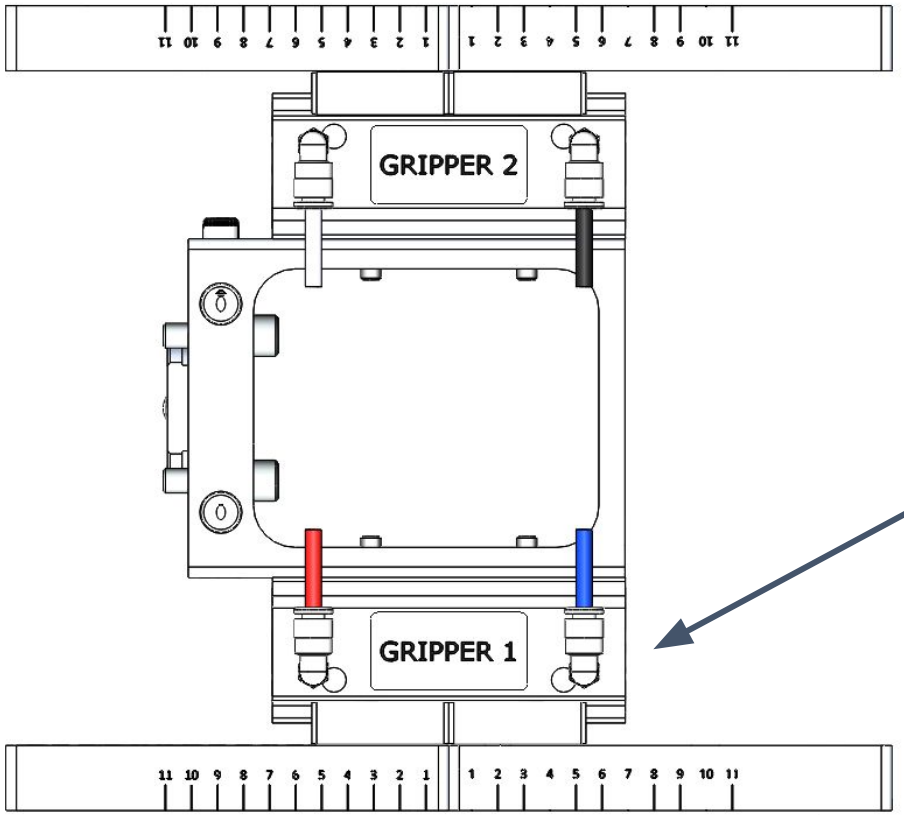
Calibration of the Lathe Automation System requires the following steps:

1. VersaCart Calibration:
   - Remove Shaft or Puck Fingers on Gripper 1
   - Select Gripper Close
   - Calibrate the robot in 3 VersaCart Positions (see following pages)
2. Bin Drop Calibration: optional position for dropping off parts in a bin location (bin, bucket, ramp, etc), rather than placing back on VersaCart
3. Lathe Chuck Calibration and Tuning: calibrate the centerline of the chuck for puck and shaft (see following pages)

Important: Before starting the calibration procedure VersaBuilt recommends warming up the robot by pressing the **Warmup** button in the Calibration page. *Warmup requires the robot to be in a known “Home” position. If the Warmup routine errors out, select the “Move to” command and position the robot to Table Home Gripper 1.



VersaCart Calibration

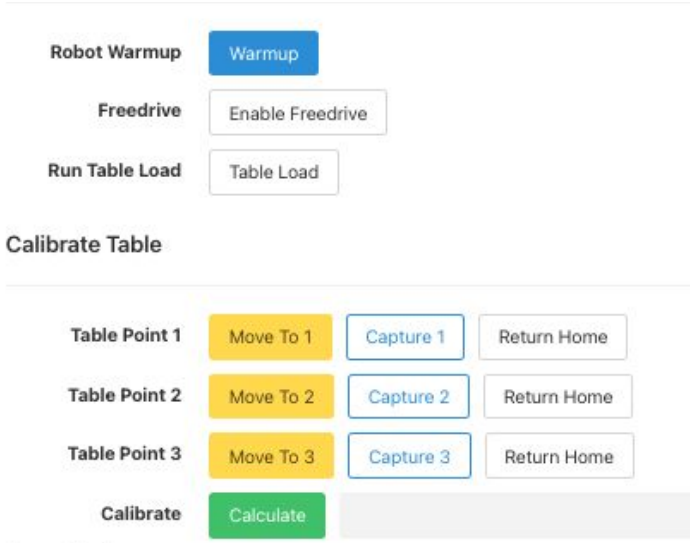


Gripper 1 and 2 shown with Shaft and Puck Fingers **removed** & in the **Gripper Close** position

Gripper 1 is used to calibrate VersaCart

Gripper 1 Base Finger face is used to calibrate the plane of the VersaCart

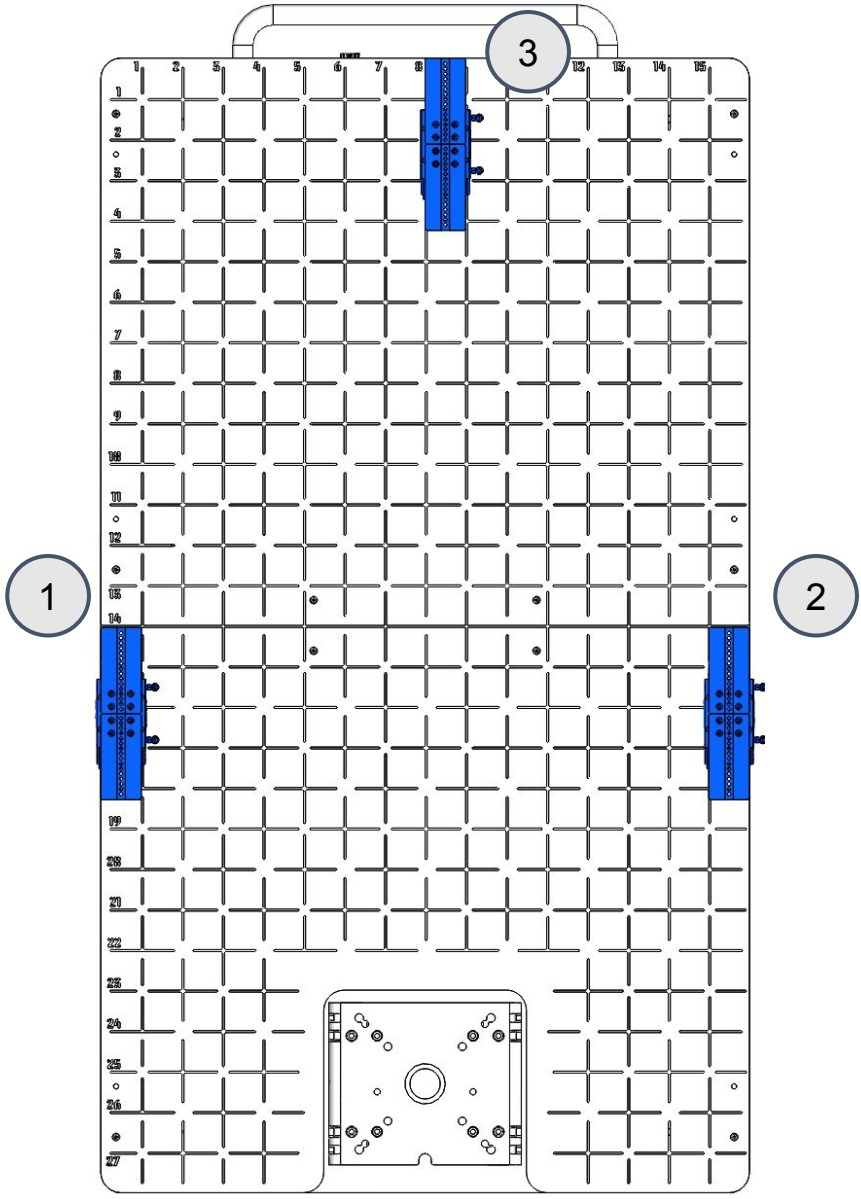
VersaCart Calibration



Calibration Steps are shown on the following pages

VersaCart Calibration Prep

- Refer to the images and detailed steps on the following pages
- Remove Puck or Shaft Gripper Fingers
- Move Robot to Table Home Gripper 1
- Navigate to the Calibration Page on the user interface
- On the calibration page, the following buttons will be used:
  - Warmup
  - Enable Freedrive
  - Move to…
  - Capture
  - Return Home
  - Calculate
- <u>Steps</u>:
  - Warmup Robot
  - Capture Table Point 1
  - Capture Table Point 2
  - Capture Table Point 3
  - Click “Calculate” to save the calibration



VersaCart Calibration

Calibration Steps are shown on the following pages

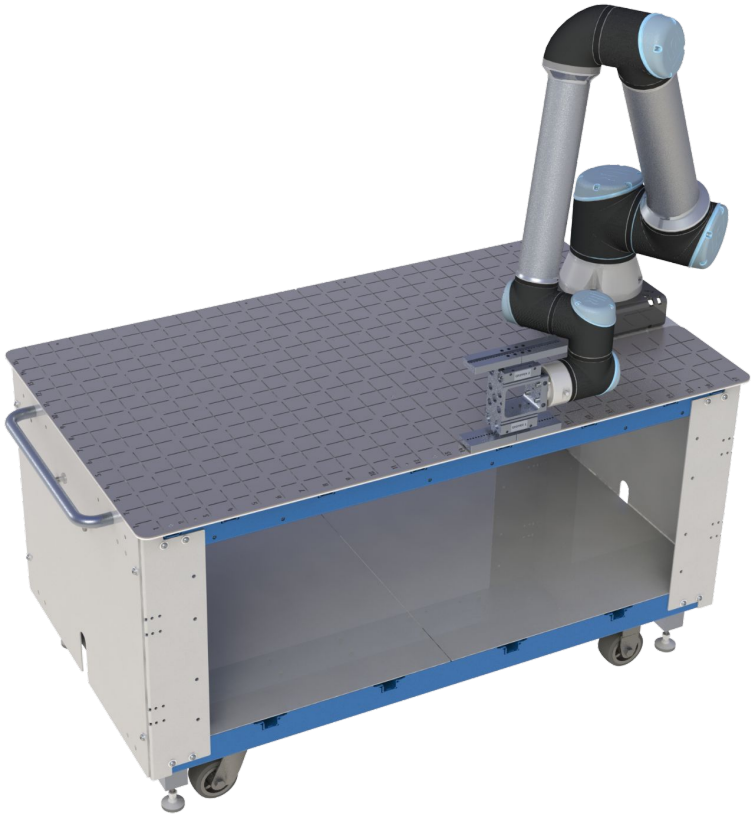


Table Point 1

Table Point 2

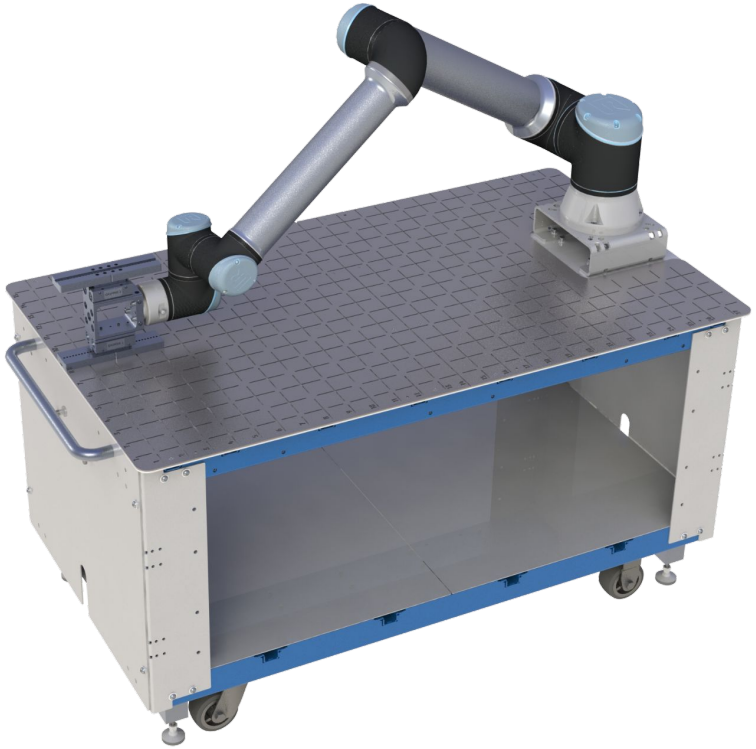


Table Point 3

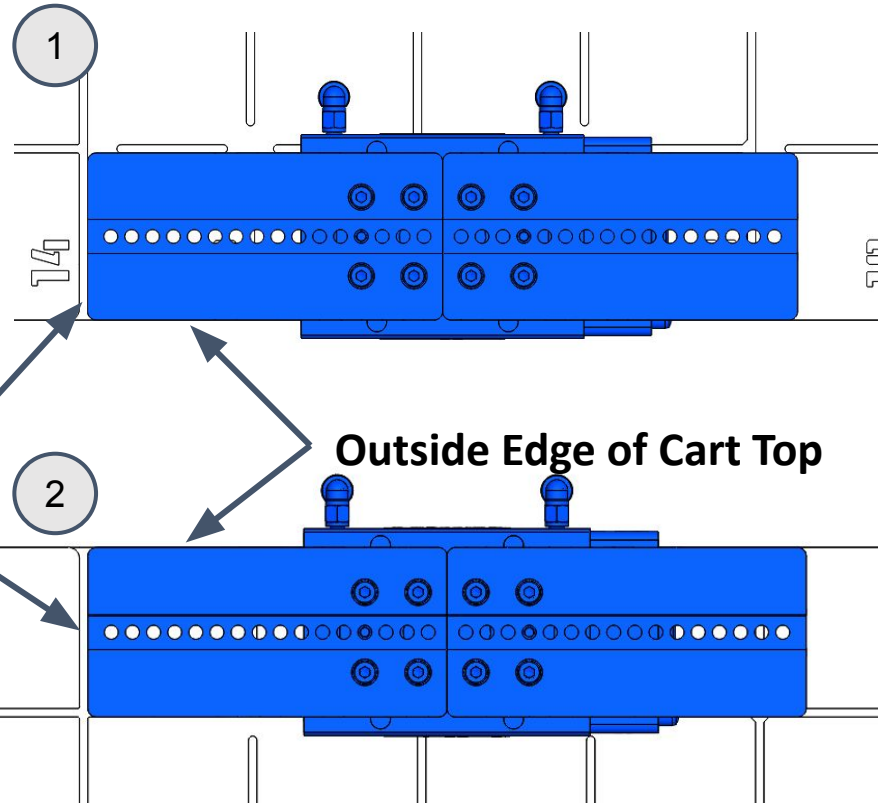
Calibrate VersaCart

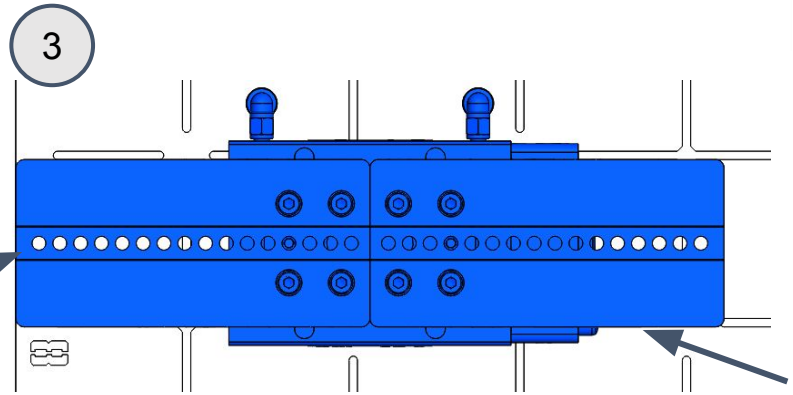
- Precise alignment of the Gripper Base Fingers on the table top is critical to the calibration process
- The side and end of the Base Fingers are aligned with the VersaCart
- Positions 1 and 2 are aligned on edge next to #14, with side of Base Fingers aligned with the outside edge of the cart
- Position 3 is next to mark #8 with the end of the Base Finger aligned with the end of the cart

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

Calibration Steps are shown on the following pages

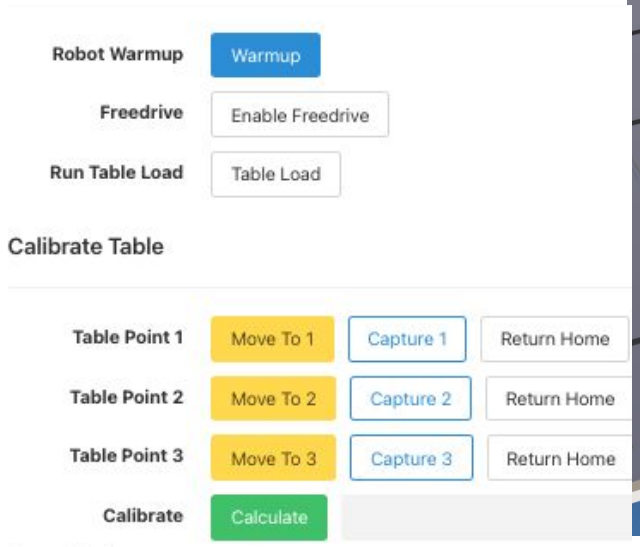
Gripper 1 is pushed down with Base Fingers touching the surface of the VersaCart

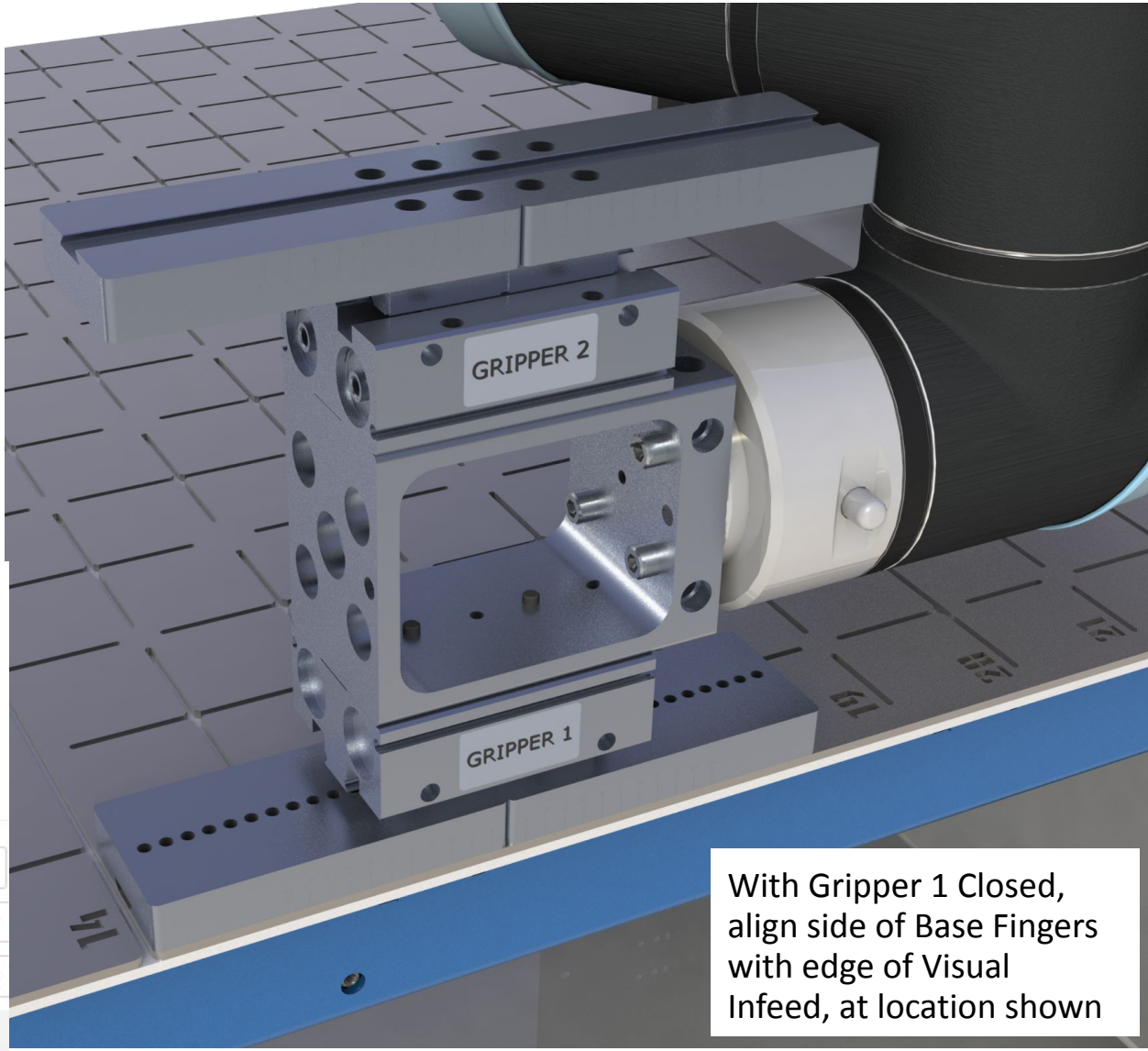




Calibrate VersaCart Table Point 1

1. **With Robot at Table Home Gripper 1, Select “Warmup “**
2. **Calibrate Table Point 1:**
   a. Select “Move to 1” **this will position robot above Table Point 1*
   b. Select Enable Freedrive (select Empty Gripper, then Enable Freedrive) **this allows the user to drag-to-teach*
   c. By hand, gently move the robot into the Table Point 1 position, with Gripper 1 Base Fingers pushed against the VersaCart surface.
   d. With Gripper 1 Closed, align the side of Base Fingers with edge of Visual Infeed, at location shown (line below #14)
   e. Select “Stop Program” on the UR Teach Pendant **this disables Freedrive*
   f. Select “Capture 1”
   g. Select “Return Home”



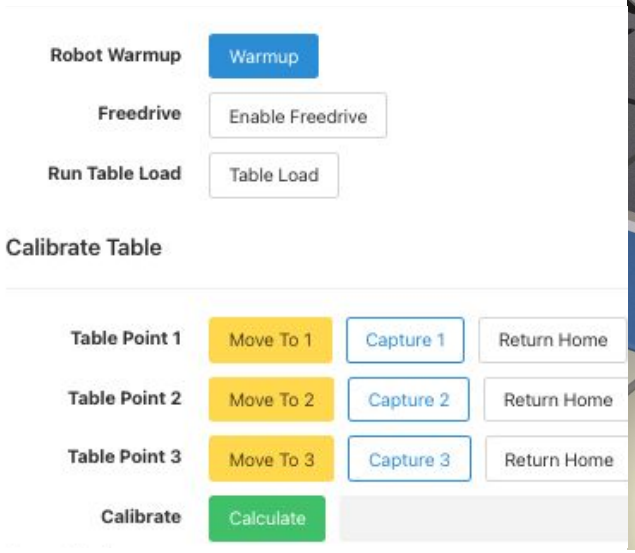


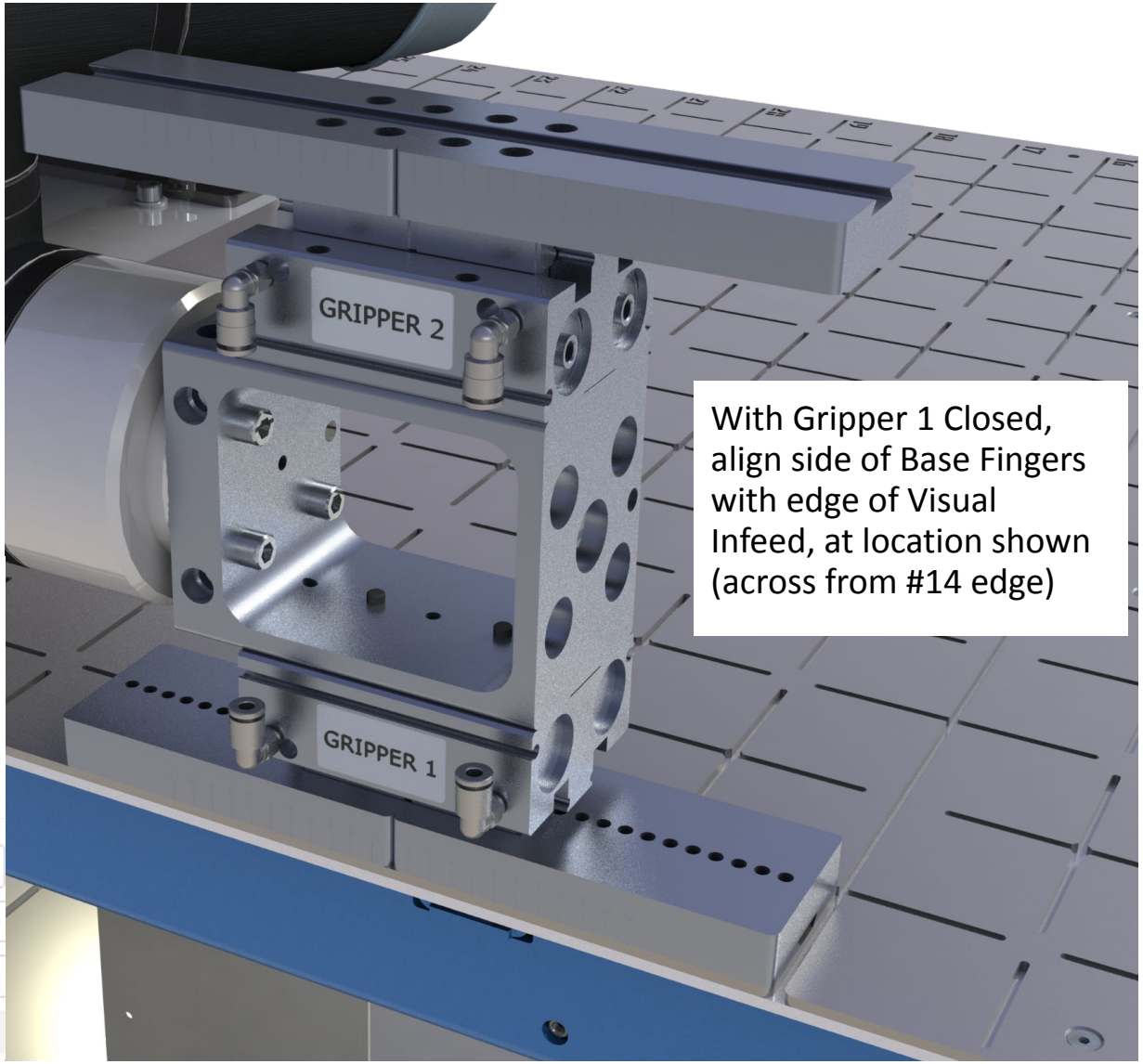
With Gripper 1 Closed, align side of Base Fingers with edge of Visual Infeed, at location shown

Calibrate VersaCart Table Point 2

2. Calibrate Table Point 2:

a. Select “Move to 2” **this will position robot above Table Point 2*
b. Select Enable Freedrive (select Empty Gripper, then Enable Freedrive)
c. By hand, gently move the robot into the Table Point 2 position, with Gripper 1 Base Fingers pushed against the VersaCart surface.
d. With Gripper 1 Closed, align the side of Base Fingers with edge of Visual Infeed, at location shown (line below #14) **on the opposite side of the table from Table Point 1*
e. Select “Stop Program” on the UR Teach Pendant **this disables Freedrive*
f. Select “Capture 2”
g. Select “Return Home”





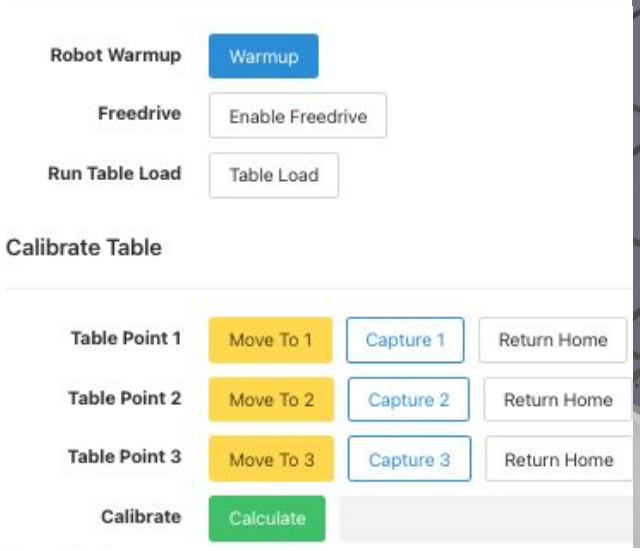
With Gripper 1 Closed, align side of Base Fingers with edge of Visual Infeed, at location shown (across from #14 edge)

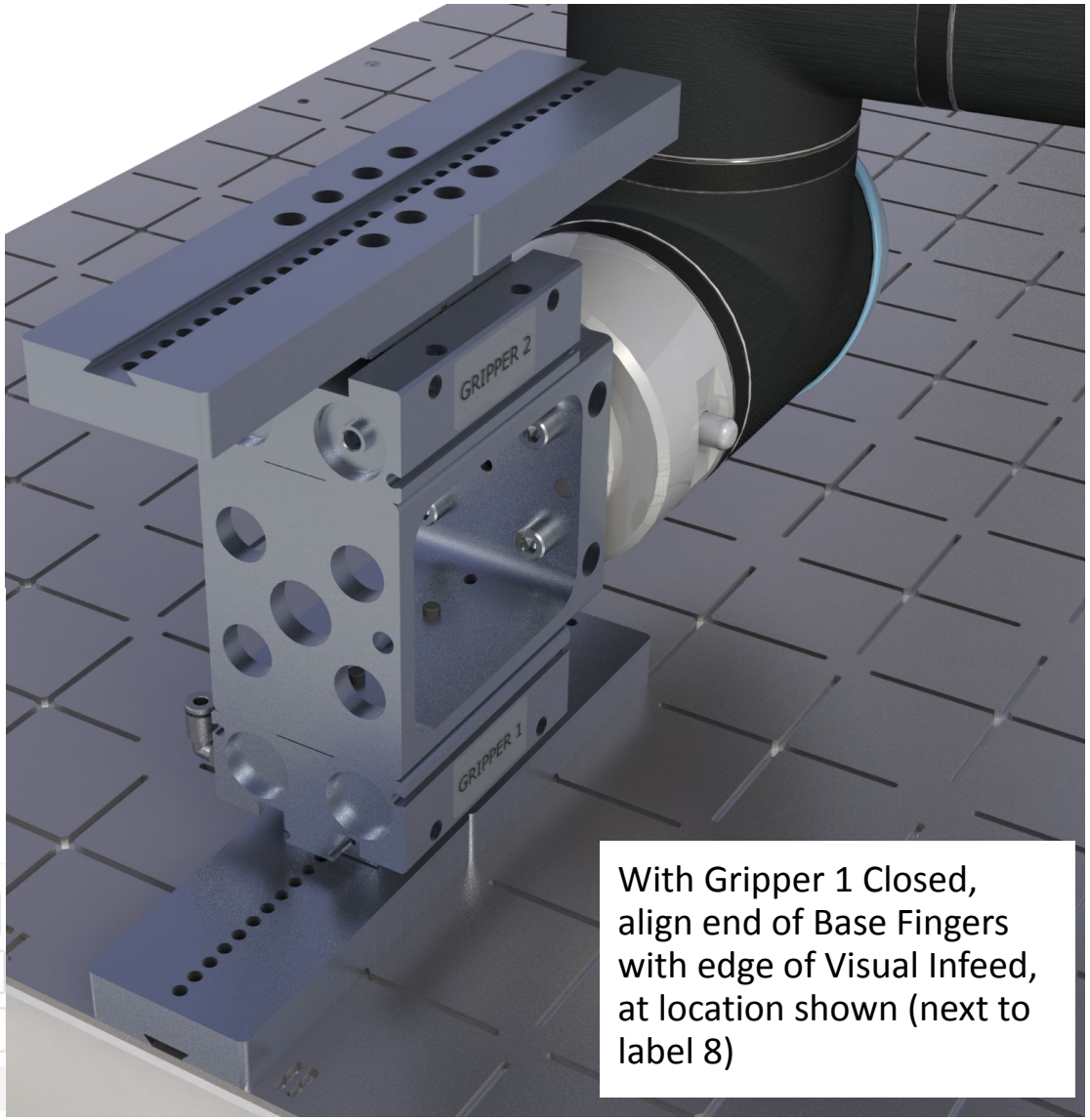
Calibrate VersaCart Table Point 3

3. Calibrate Table Point 3:

a. Select “Move to 3” **this will position robot above Table Point 3*
b. Select Enable Freedrive (select Empty Gripper, then Enable Freedrive)
c. By hand, gently move the robot into the Table Point 3 position, with Gripper 1 Base Fingers pushed against the VersaCart surface.
d. With Gripper 1 Closed, align the side of Base Fingers with edge of line next to #8.
e. Select “Stop Program” on the UR Teach Pendant **this disables Freedrive*
f. Select “Capture 3”
g. Select “Return Home”

4. Save Calibration - Select “Calculate”

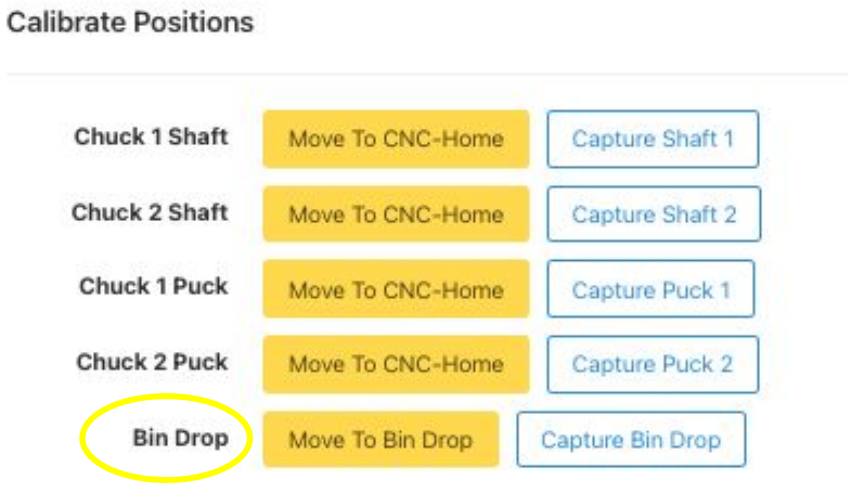


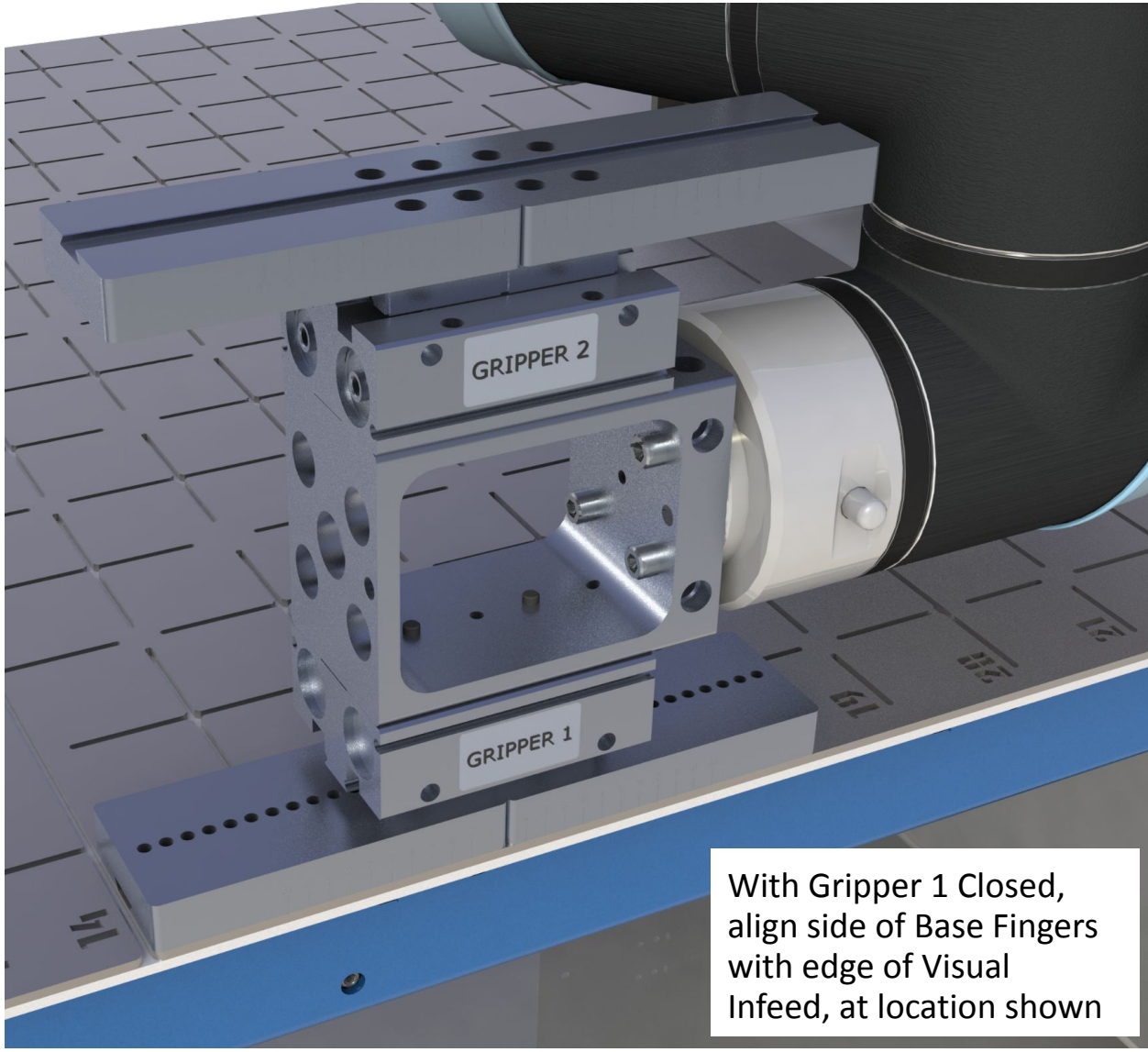


With Gripper 1 Closed, align end of Base Fingers with edge of Visual Infeed, at location shown (next to label 8)

Calibrate Bin Drop

1. Select “Move to Table Home Gripper 1
2. Select “Move to Bin Drop” **this will position robot at the Factory Default Bin Drop Position*
3. Select Enable Freedrive (select Empty Gripper, then Enable Freedrive) **this allows the user to drag-to-teach*
4. By hand, gently move the robot to the preferred position for dropping parts at a Bin, Bucket, Ramp, Conveyor, etc.
5. Select “Stop Program” on the UR Teach Pendant **this disables Freedrive*
6. Select “Capture Bin Drop”
7. Select “Return Home”

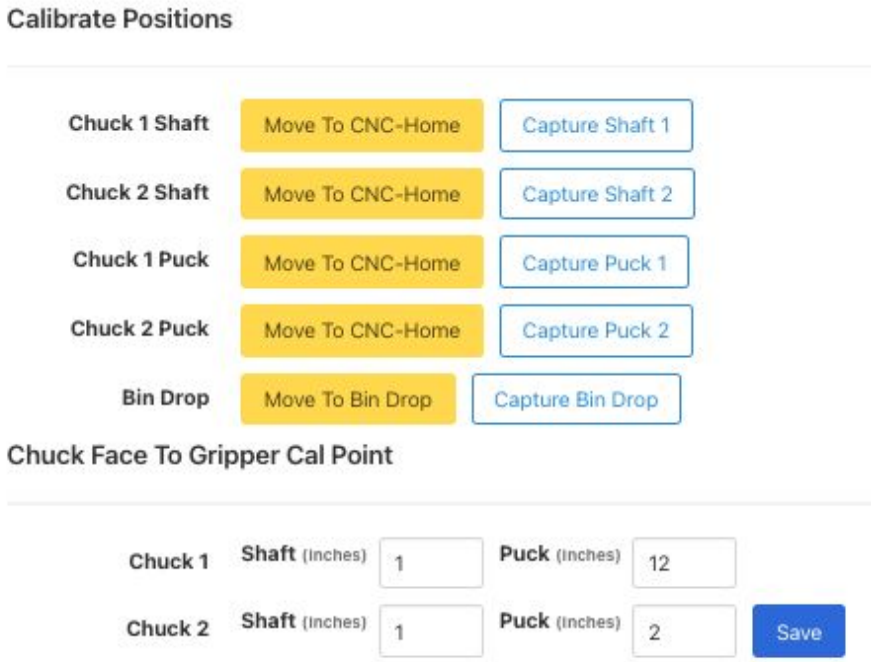




With Gripper 1 Closed, align side of Base Fingers with edge of Visual Infeed, at location shown

Calibrate Puck & Shaft Centerline

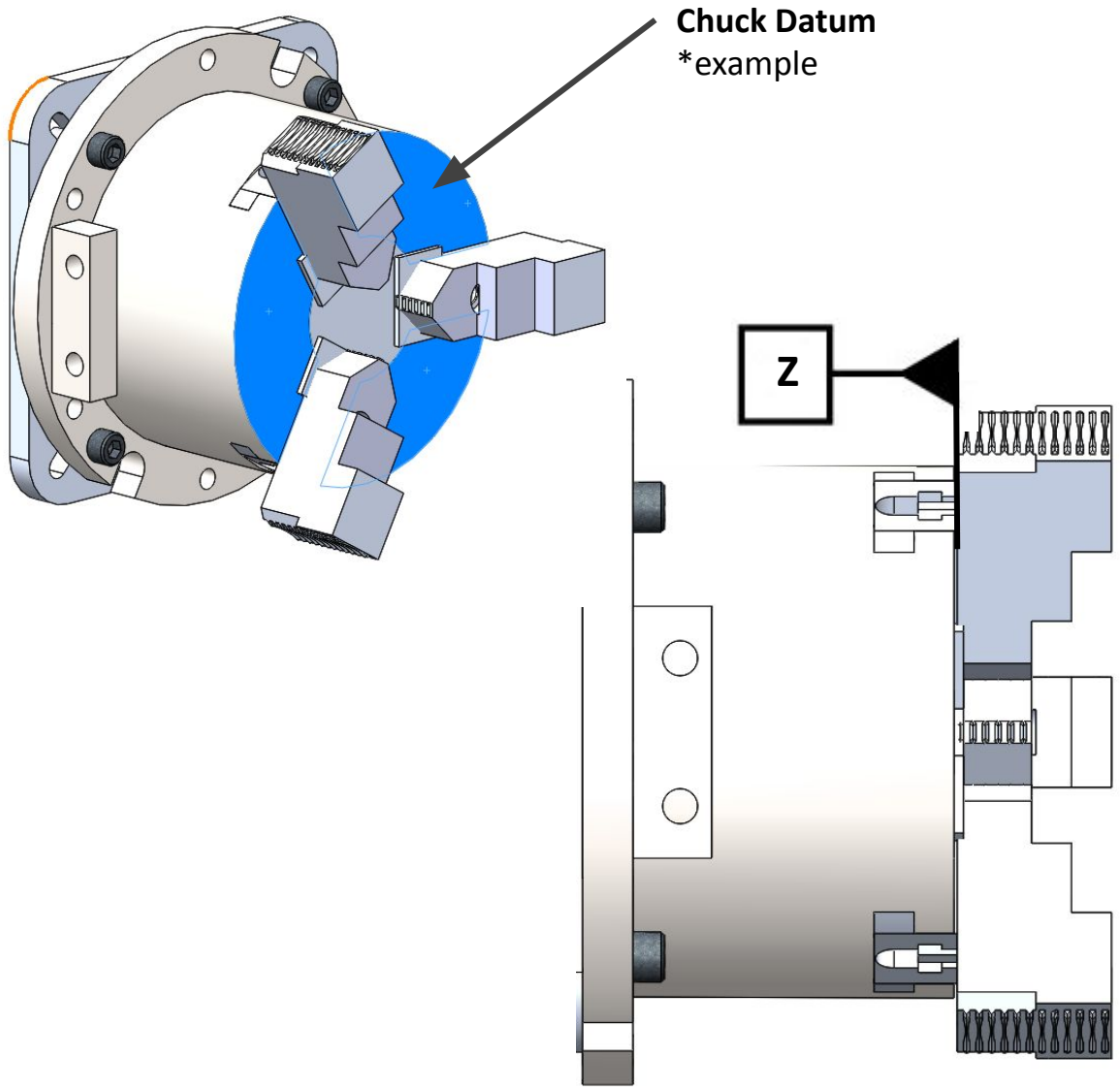
- The following pages detail the process to calibrate the general centerline (z-axis) of the primary and sub-spindle relative to the robot gripper
- Part specific size (part height/length), workholding (jaw depth), and location of the part relative to the gripper are entered in the part specific configuration.
- Chuck 1 & Chuck 2 are calibrated with Gripper 1, from the Move To CNC-Home position rotate the gripper as needed towards Chuck 1 or Chuck 2
- Puck specific note:
  - Puck Pick and Place to/from the VersaCart Visual Infeed Grid is calibrated in the process above (VersaCart Calibration).
  - Puck load and unload to/from the Chuck(s) requires fields to be entered in each part configuration.
- Shaft specific note:
  - Shaft Pick and Place to/from the VersaCart is calibrated on a per part basis, during Part Configuration, with the Shaft Infeed secured to the VersaCart **refer to the Machinist Manual for details*



Calibrate Puck Centerline

Items required for Puck Calibration:

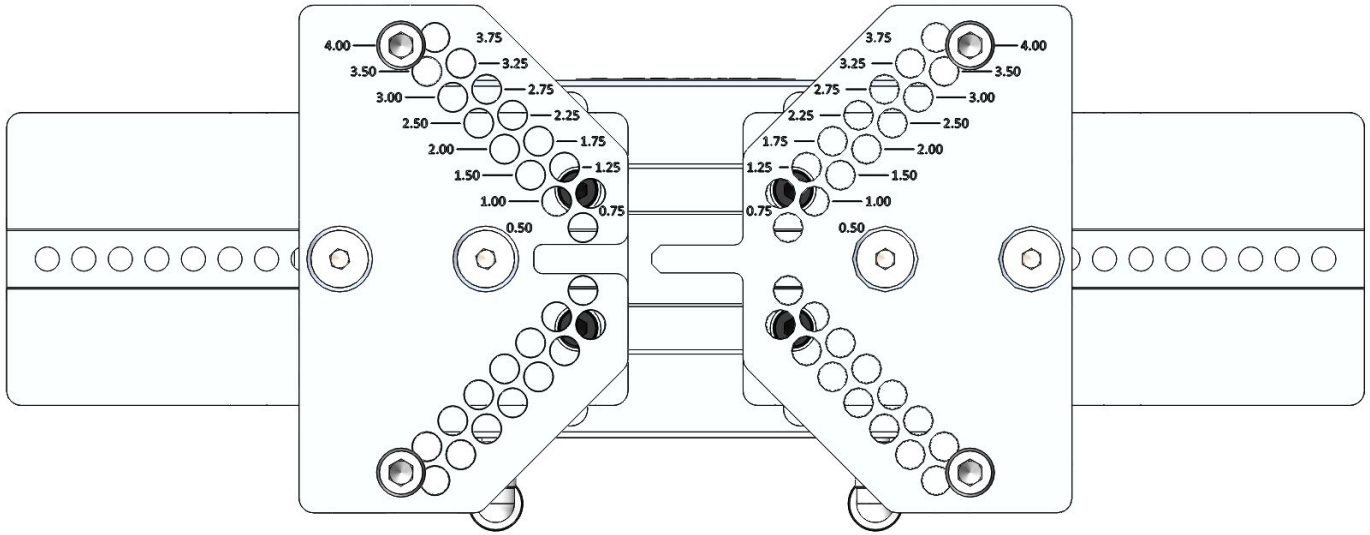
- Connection to VSC interface, on Calibration Page
- Tape Measure and/or Calibers
- Level
- Calibration Part **use representative part for process*
- **Define a Datum** on the Chuck that can be used as a measuring zero location.
  - This datum needs to be a constant, available to measure regardless of the workholding in the machine.
  - For the purposes of this manual, the images to the right show a 3-Jaw Chuck with the highlighted surface as the Datum.



Calibrate Puck Centerline

Calibration Steps

1. **Choose a part to be used for Puck Calibration**
   a. Calibrate with a part that has been faced, such that the surface is perpendicular to z-axis (rather than saw cut material)
2. **Install the Puck Gripper Fingers**
   a. Attach fingers on Gripper 1 and Gripper 2
   b. Attach Socket Head Cap Screws or Headless Screws in a position for holding a part for calibration purposes
   c. Refer to the Machinist Manual for position of screws for material size ranges. The image below shows Socket Head Cap Screws in Position 4, for material 4.0” to 4.25”

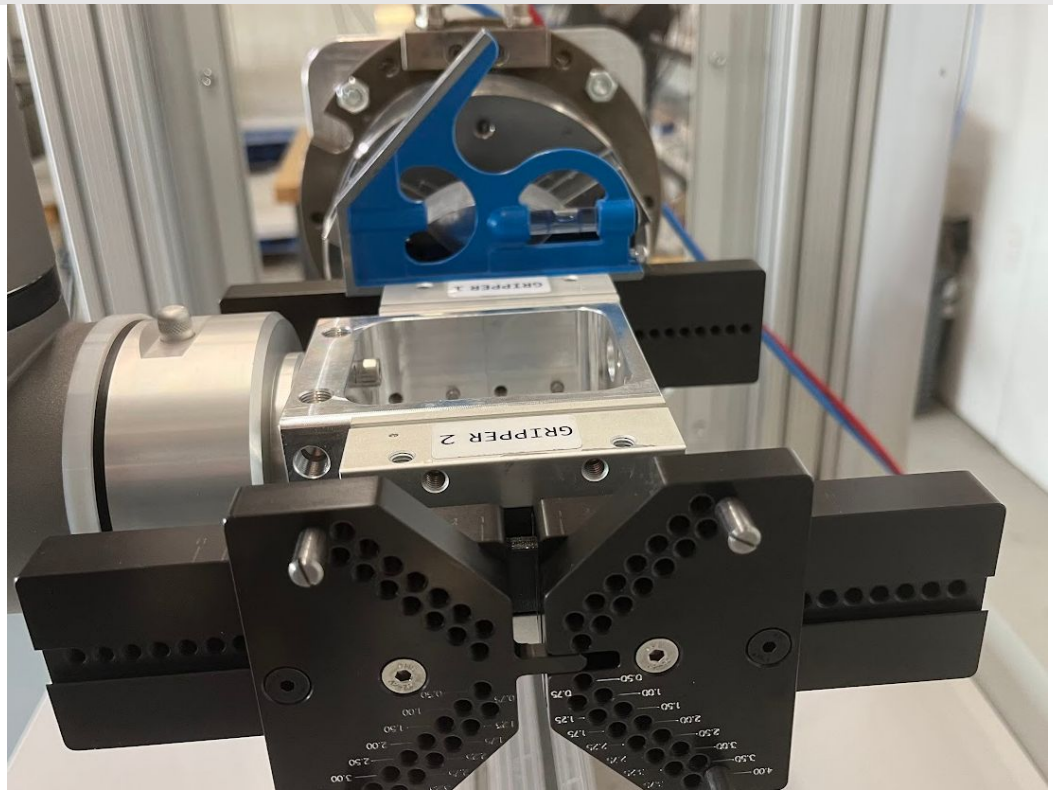


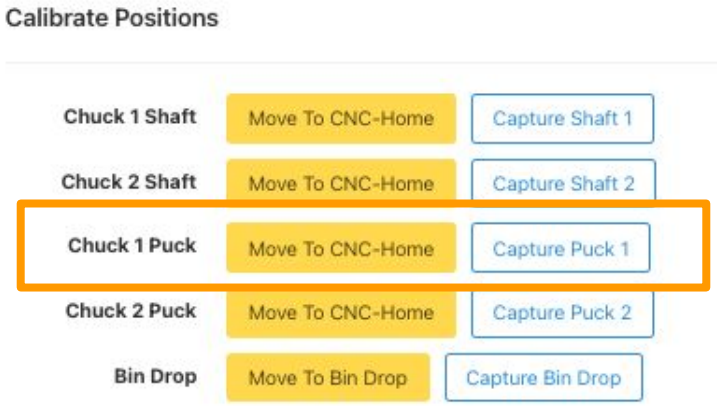
Calibrate Puck Centerline

3. Calibrate Chuck 1 Puck Position

a. Clamp part in Chuck 1 (fully seat part in Z, if there is a z-stop)
b. Float Gripper 1
c. Select “Move To CNC-Home”, on “Chuck 1 Puck”
d. Select Enable Freedrive *(Empty Gripper > Enable Freedrive)*
e. Gently move robot engaging Gripper 1 Puck Fingers with the part in the Chuck
f. Position the gripper *at a level position*, pushing on gripper such that the fingers are coplanar with the material, hand clamping on the part with the gripper floating
g. Close Freedrive pop-up window & select “Stop Program” on Teach Pendant
h. Close Gripper 1
i. Select Enable Freedrive & close Freedrive pop-up window**robot may move slightly as a result of gripper close alignment*
j. Readjust to level and push against part
k. Close Freedrive pop-up window & select “Stop Program” on Teach Pendant
l. Select “Capture Puck 1”

For best results - Part used for calibration should be faced on both sides, with faces perpendicular to the spindle axis



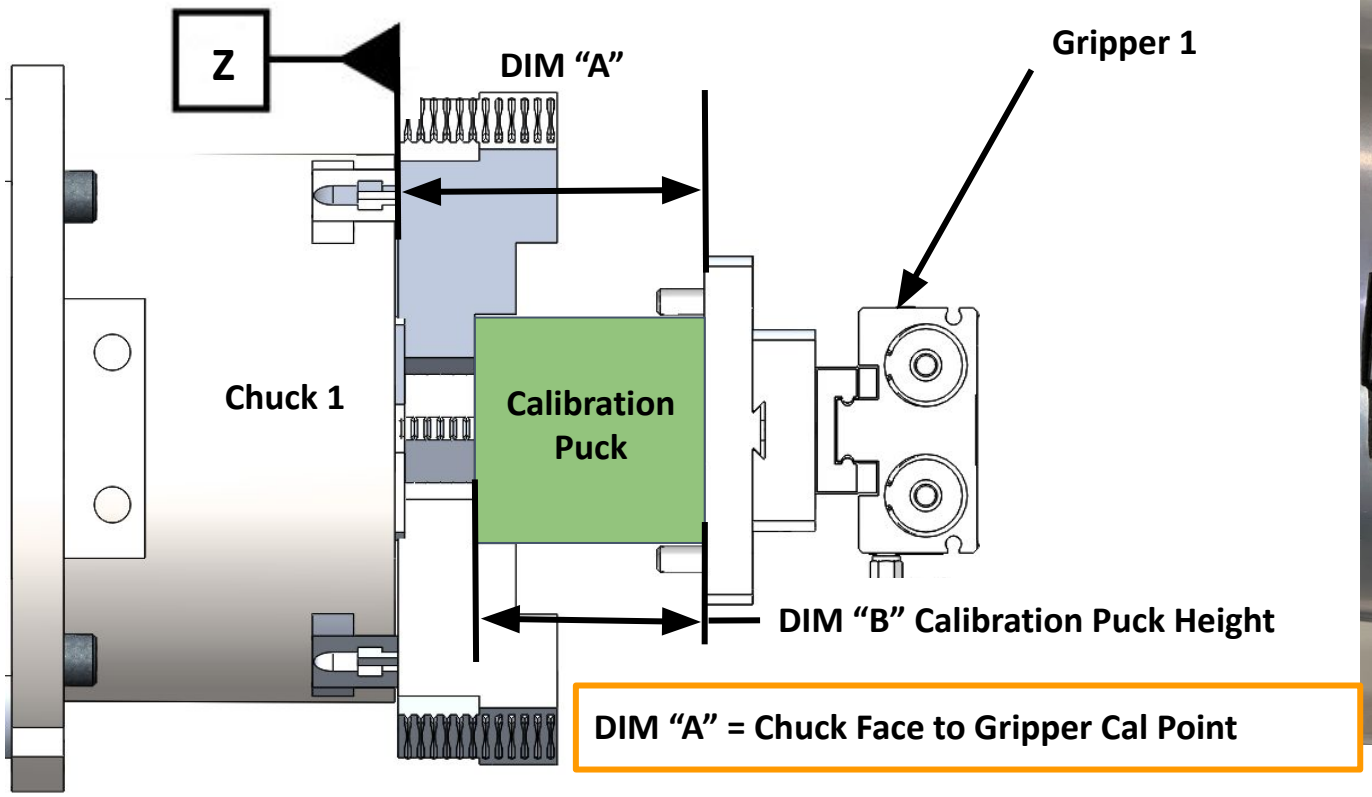


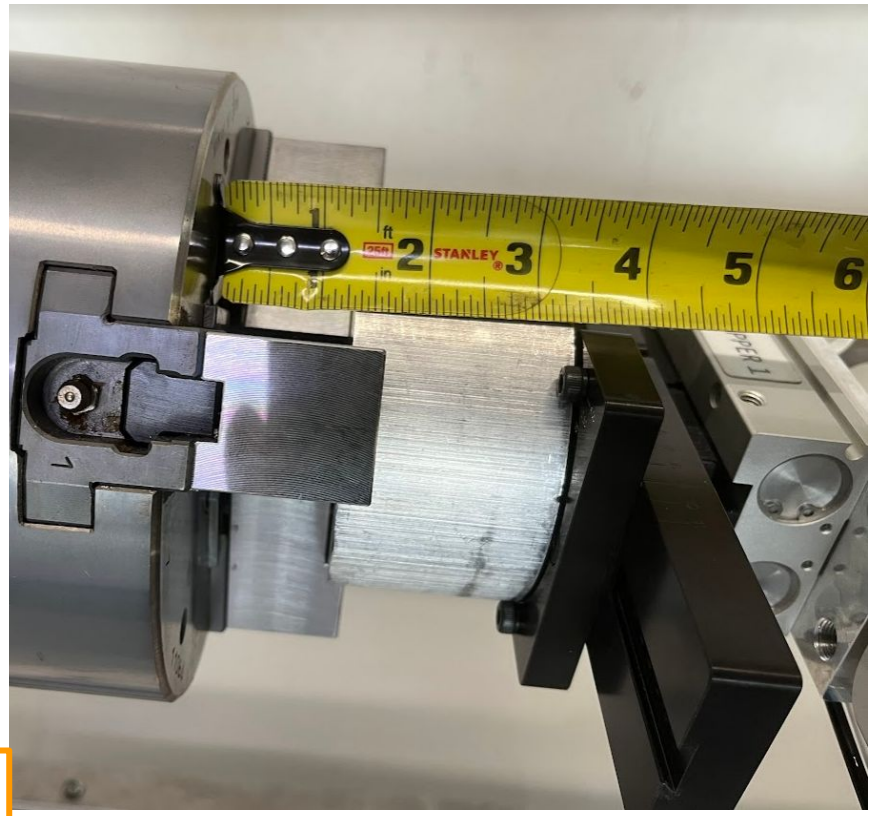
Calibrate Puck Centerline

4. Define Chuck Face to Gripper Cal Point

a. Measure distance from defined Datum on the chuck to the face of the gripper fingers and enter into Chuck 1 Puck field in the “Chuck Face to Gripper Cal Point” section

b. Take note of the Calibration Puck Height **used during part configuration*





Calibrate Puck Centerline

5. **Move Robot Home**
   a. Open Gripper
   b. Enable Freedrive
   c. Gently move robot away from Chuck
   d. Select Stop Program on Teach Pendant
   e. Move robot to CNC Home Gripper 1 Puck
   f. Move robot to Table Home Gripper 1
6. **To Test**
   a. This calibration location can be tested by configuring a part, then selecting “Load Chuck” or “Unload Chuck” while the configured part is the selected part on the Home Page
7. **Calibrate Chuck 2 Position** *(if sub-spindle is included with CNC)*
   a. Repeat steps described for Chuck 1, but with Chuck 2 and Gripper 2

*Gripper 1 always loads the Chuck and Gripper 2 unloads the Chuck

**For single Chuck applications, the finished part is removed from the Chuck with Gripper 2. Gripper 2 pick position is calculated from the Gripper 1 to Chuck 1 calibration

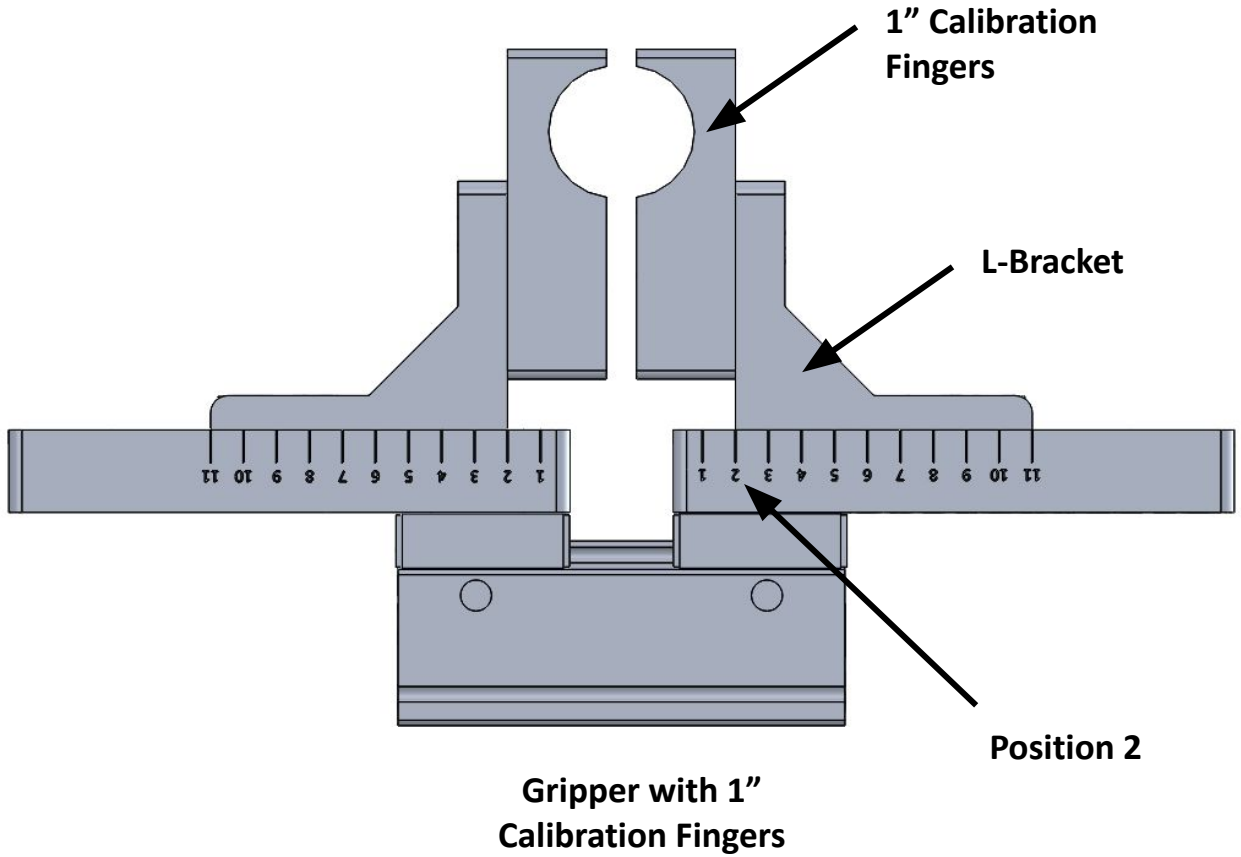
Calibrate Shaft Centerline

Items required for Shaft Calibration:

- Connection to VSC interface, on Calibration Page
- Tape Measure
- Level
- Calibration Part **1" Diameter shaft provided by VersaBuilt*
- 1" Calibration Gripper Fingers
- Find a Datum on the Chuck that can be used as a measuring zero location

Calibration Steps

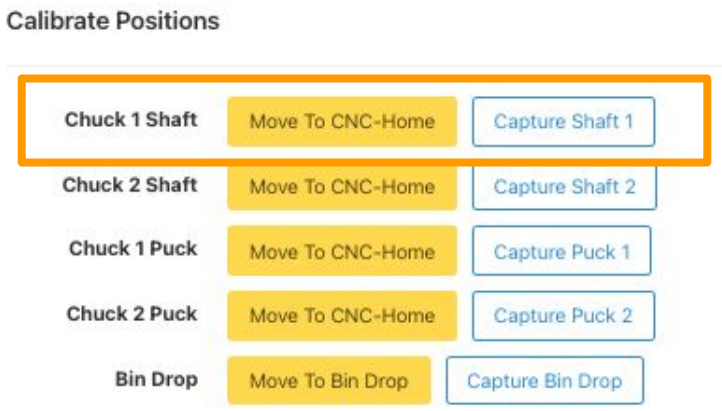
1. **Install the Shaft Gripper Fingers**
   a. Attach Shaft L-Brackets with 1" Calibration Fingers on Gripper 1 at Position 2

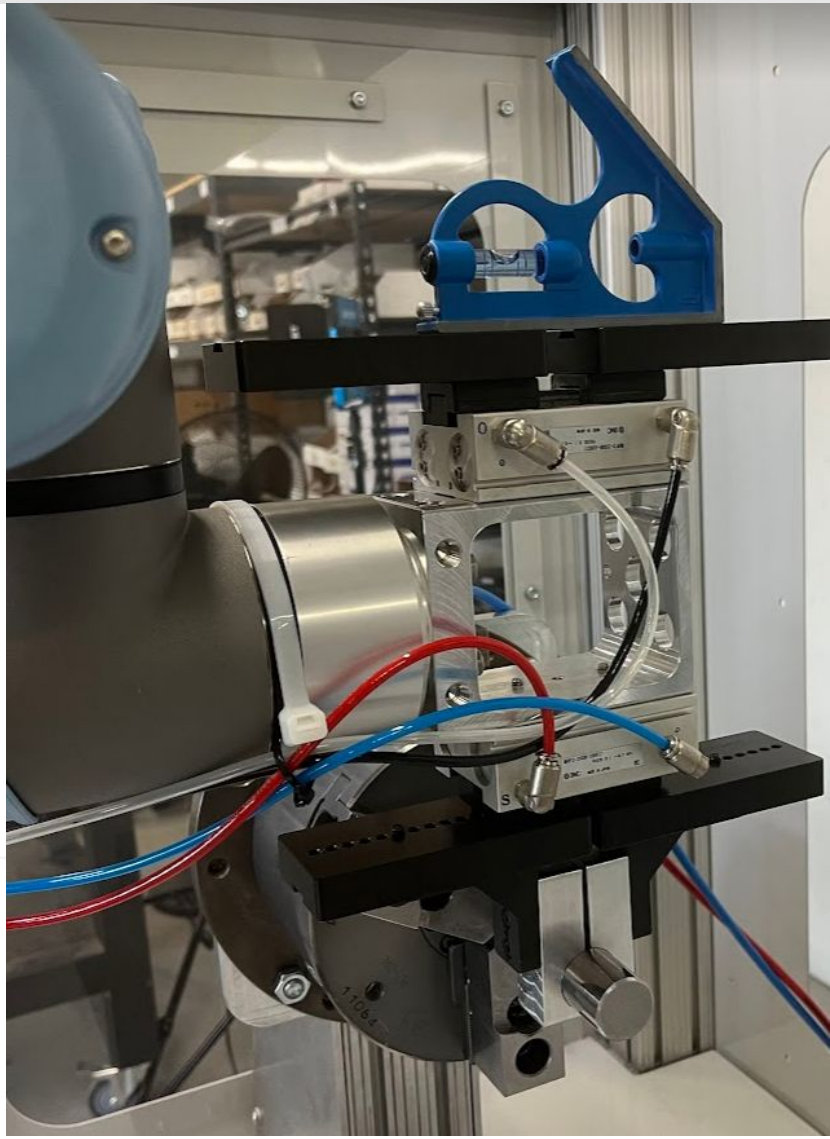


Calibrate Shaft Centerline

2. Calibrate Chuck 1 Shaft Position

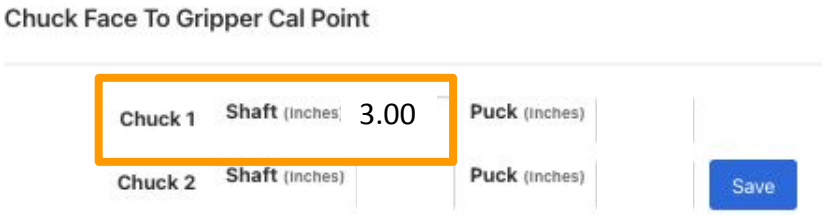
a. Place 1-inch Calibration Part in Chuck 1 & Float Gripper 1
b. Select “Move To CNC-Home”, on “Chuck 1 Shaft” row
c. Select Enable Freedrive *(Empty Gripper > Enable Freedrive)*
d. Gently move robot engaging Gripper 1 Shaft Fingers with the part in the Chuck
e. Position the gripper at a level position, with 1” shaft fitting thru mating hole in the gripper fingers, then hand clamp on part with floating gripper
f. Close Freedrive window, select Stop Program on Teach Pendant
g. Close Gripper 1
h. Select Enable Freedrive **robot may move slightly as a result of gripper closing forces acting on robot while in FreeDrive*
i. Readjust to level as needed
j. Close Freedrive window, select Stop Program on Teach Pendant
k. Select “Capture Shaft 1”

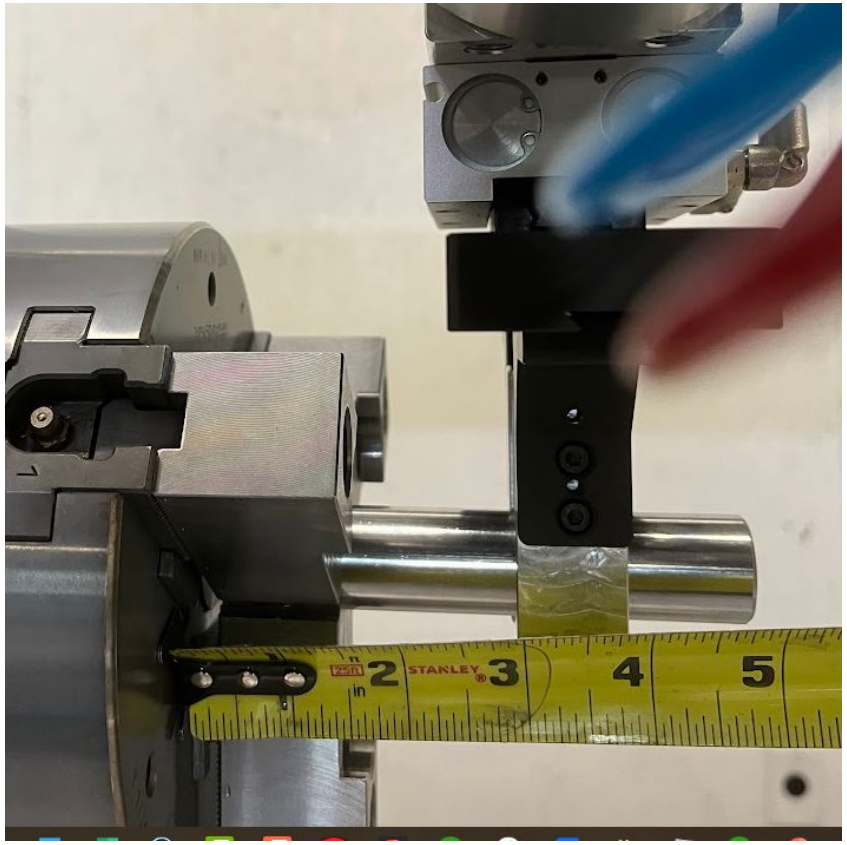




Calibrate Shaft Centerline

3. **Define Chuck Face to Gripper Cal Point**
   a. Measure distance from static face or feature (datum) on the chuck to the side of the gripper fingers and enter into Chuck 1 Shaft field in the “Chuck Face to Gripper Cal Point” section
4. **Move Robot Home**
   a. Open Gripper
   b. Enable Freedrive
   c. Gently move robot away from Chuck
   d. Stop Program
   e. Move robot to CNC Home Gripper 1 Shaft
5. **Test Calibration**
   a. This calibration location can be tested by configuring a part, then selecting “Load Chuck” or “Unload Chuck” while the configured part is the selected part on the Home Page
6. **Calibrate Chuck 2 Position** *(if sub-spindle is included with CNC)*
   a. Repeat steps described above for Chuck 2 and Gripper 2





*Gripper 1 always loads the Chuck and Gripper 2 unloads the Chuck

**For single Chuck applications, the finished part is removed from the Chuck with Gripper 2. Gripper 2 pick position is calculated from the Gripper 1 to Chuck 1 calibration

Part Specific Calibration

Further detail on Calibration can be found in the Machinists Manual, where individual part configuration is detailed.

For Pucks

The calibration steps on the previous pages will enable pick and place from the VersaCart. With part size information, the system will calculate proper feed and placement to/from the Chuck(s).

For Shafts

The calibration steps on the previous pages give the system a chuck centerline used to load and unload from the chuck. In the part configuration, the user will:

- Calibrate Part Load and Unload positions to/from VersaCart Shaft Infeed, based on the relative positions of the part to the fingers when loaded or unloaded to/from the Chucks

VersaBlast Installation

Section 8

VersaBlast Installation

Overview:

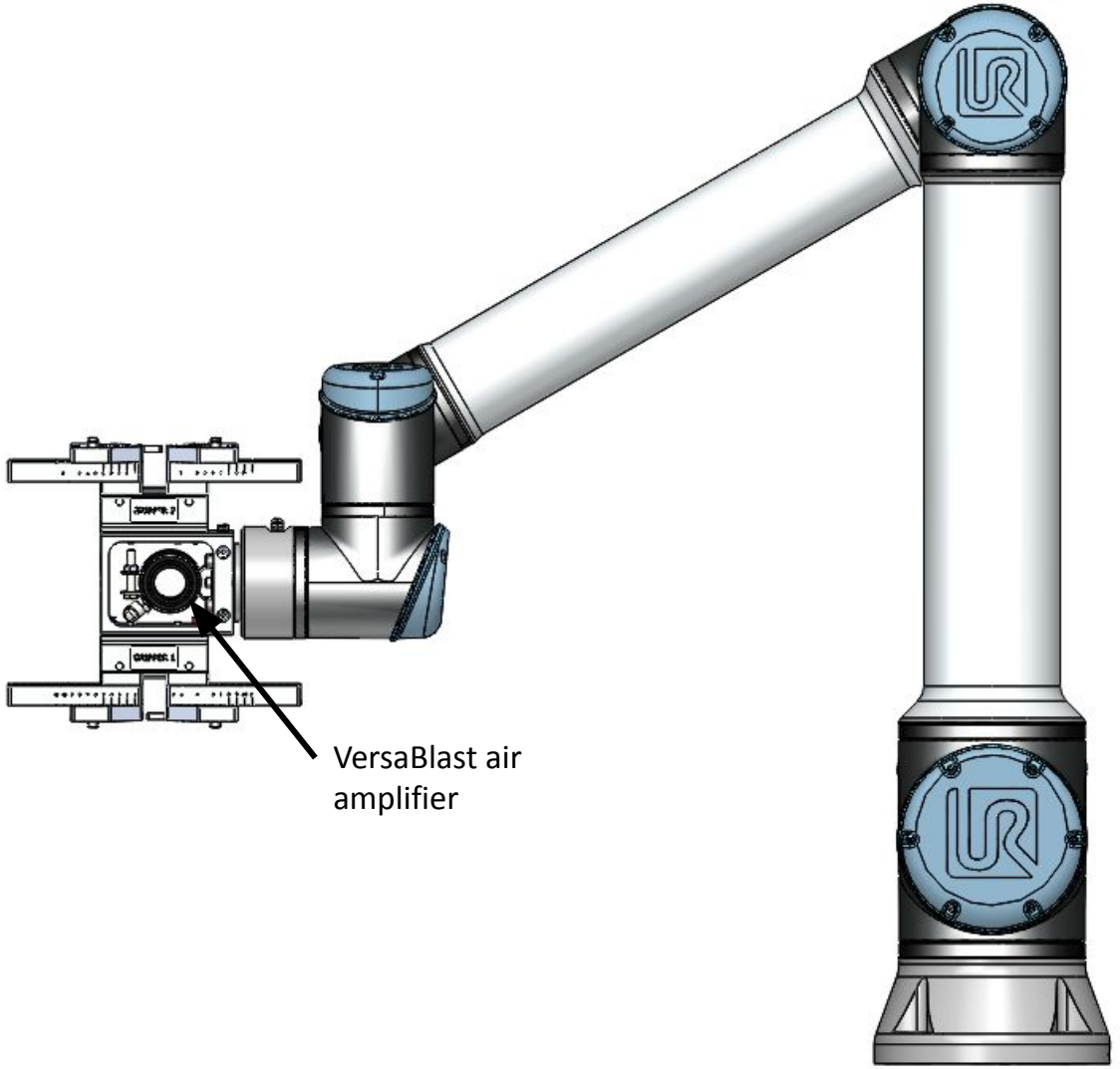
VersaBlast for Lathes is an air amplifier, mounted to the inside/middle of the DuoGrip Gripper bracket. Air is supplied to the air amplifier via 2 valves:

- VersaBlast A/P Valve - A high flow valve with 0.5” air lines on the input and output side. The valve is normally closed and opened by an air signal via the 0.25” air line from the VSC VersaBlast air line. This valve mounts on the VersaCart with a magnetic mount plate.
- VSC signal valve - Inside the VSC is a 2 position solenoid valve providing air to the VersaBlast A/P valve when VersaBlast operation is triggered

0.5” air lines are routed from the VersaBlast A/P valve output along the robot arm, to a connecting union at the 4th axis of the robot to reduce the air line from 0.5” to 0.25”. The 0.25” line is routed from the 4th axis to the fitting on the Air Amplifier.

After installation, test air flow. To maximize air flow (jet force), shorten the distance of tubing and adjust the nut on the amplifier.

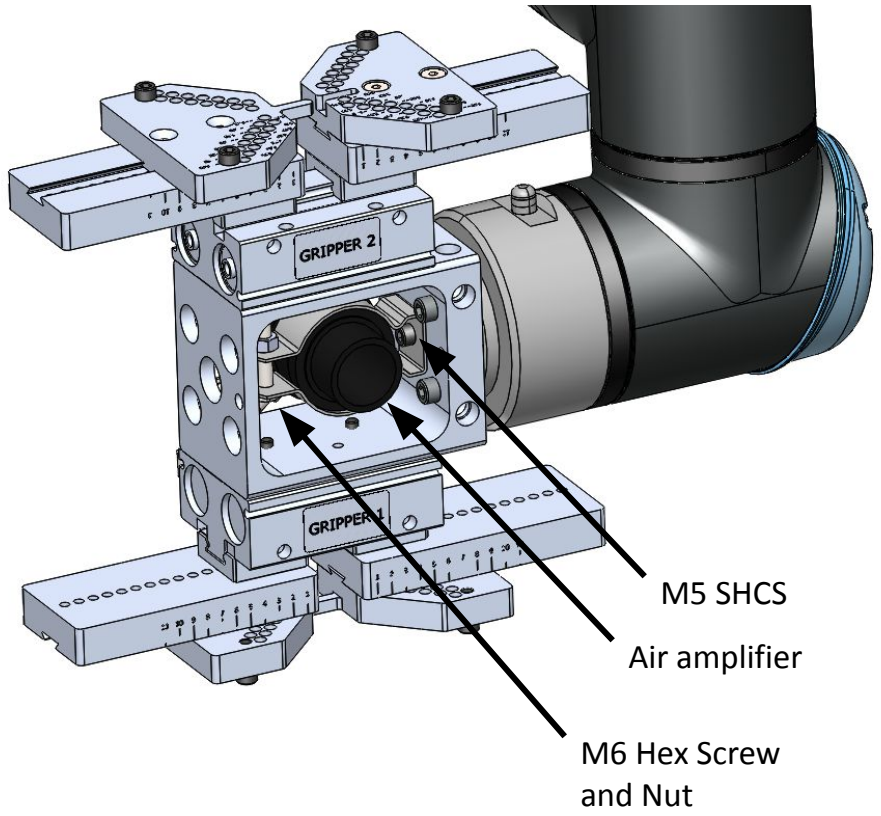
During automatic operation, the robot will move in a preprogrammed pattern based on the calibrated centerline and part configuration parameters.



VersaBlast Installation

Parts Included:

- VersaBlast A/P valve assembly (on magnet mount)
- VersaBlast for DuoGrip Gripper:
  - Air Amplifier
  - Threaded Rod Hanger (c-clamp to mount amplifier)
  - M5x0.8 Socket Head Cap Screw x 12mm L (QTY: 1)
  - M6x1.0 Hex Head Cap Screw x 35mm L (QTY: 1)
  - M6x1.0 Hex Nut (QTY: 1)
  - Fitting, L, Swivel, 0.25” tube x ¼ NPT (QTY: 1)
  - Fitting, Union, 0.25” to 0.50” tubing (QTY: 1) - connecting 0.25” tubing to 0.50” tubing on robot arm
  - 0.25” tubing (QTY: 3 ft) - connecting from amplifier to 0.5” tubing on robot arm
  - 0.25” tubing (QTY: 6 ft) - connecting from VersaBlast A/P valve to VSC (VersaBlast port)
  - 0.50” tubing (QTY: 10 ft) - connecting from 0.25” tubing on robot arm to output side of VersaBlast A/P valve
  - 0.50” tubing (QTY: 15 ft) - connecting from shop air to input side of VersaBlast A/P valve
  - 0.25” Quick Disconnect Plug (QTY: 1) - connecting 0.50” tubing to shop air supply



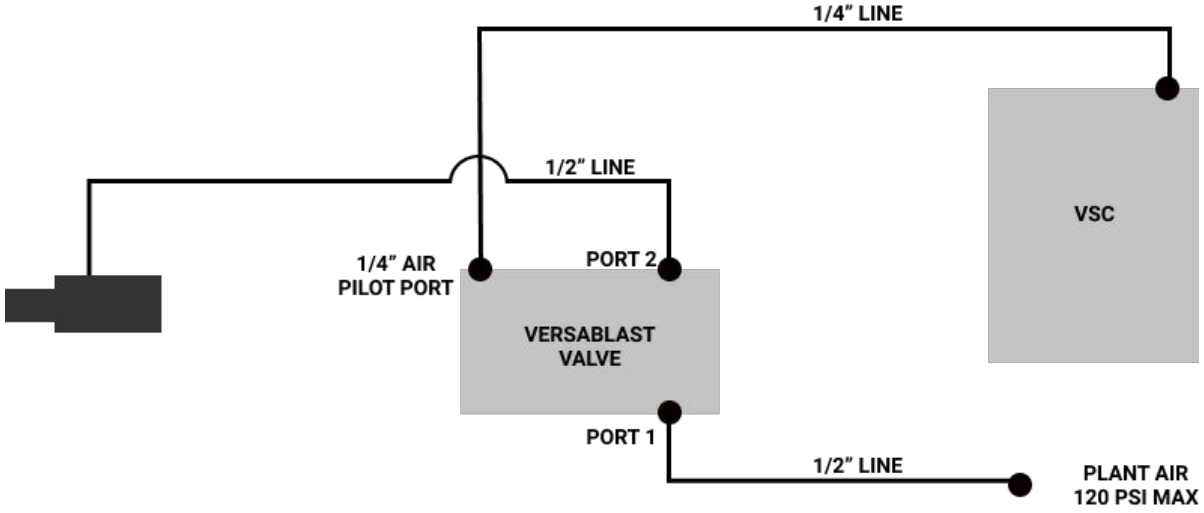
VersaBlast Installation

Installation Steps:

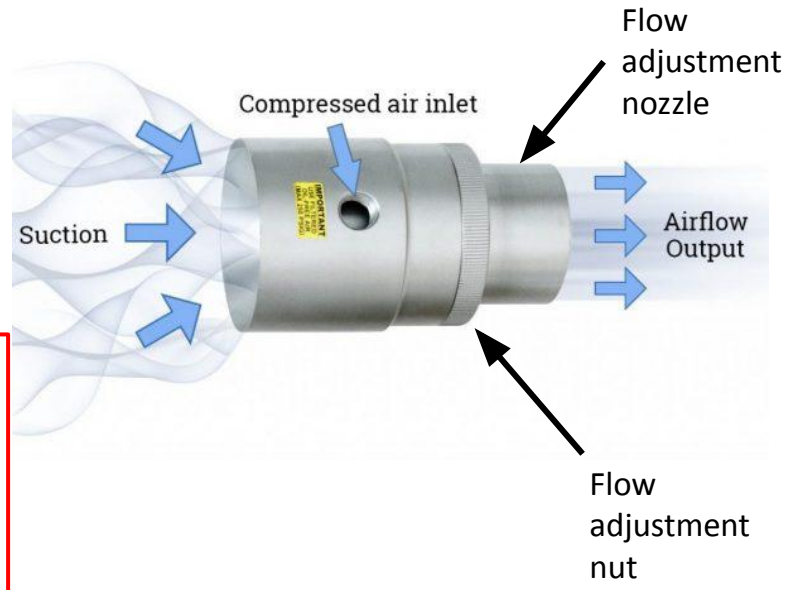
- Connect air lines to devices
  - Connect 0.25” line to fitting on Air Amplifier
  - Connect 0.25” line to 0.50” line with Union fitting
  - Connect 0.50” to VersaBlast A/P valve output
  - Connect 0.25” line from VSC to VersaBlast A/P valve
  - Connect 0.50” line from Shop supply to VersaBlast A/P valve input
- Test & Maximize air Flow
  - Adjust nozzle on amplifier to maximize air flow
  - Set adjustment with nut
- Attach Air Amplifier to DuoGrip Gripper
  - Attach Threaded Rod Hanger with M5 Socket Head Cap Screw to DuoGrip Gripper with 4mm Hex Key
  - Secure Air Amplifier with 0.25” tube fitting into position with Threaded Rod Hanger by tightening M6 Screw and Nut with 10mm Hex Wrench **note orientation - large side of air amplifier faces tubing/fitting side of grippers*
- Route air lines from Air Amplifier along robot arm to VersaBlast A/P valve output
  - Route 0.25” line with 5/32” lines routed to grippers
  - Connect 0.25” line to 0.50” line with Union fitting at Axis #4
  - Route 0.50” line with 5/32” lines thru the robot base
- Mount A/P Valve assembly on or inside VersaCart

VersaBlast Installation

1. Connect air lines to devices
   - Connect 0.25” line to fitting on Air Amplifier
   - Connect 0.25” line to 0.50” line with Union fitting
   - Connect 0.50” to VersaBlast A/P valve output
   - Connect 0.25” line from VSC to VersaBlast A/P valve
   - Connect 0.50” line from Shop supply to VersaBlast A/P valve input



2. Test & Maximize air Flow
   - To activate flow on the Air Amplifier, go to the I/O panel screen on the VSC interface. In the Digital Outputs section, scroll down to VersaBlast and select “Set High”
   - Loosen nut Flow Adjustment nut and turn Flow Adjustment nozzle to position that maximizes air flow
   - In the I/O panel screen, select “Set Low” to turn off the VersaBlast valve *

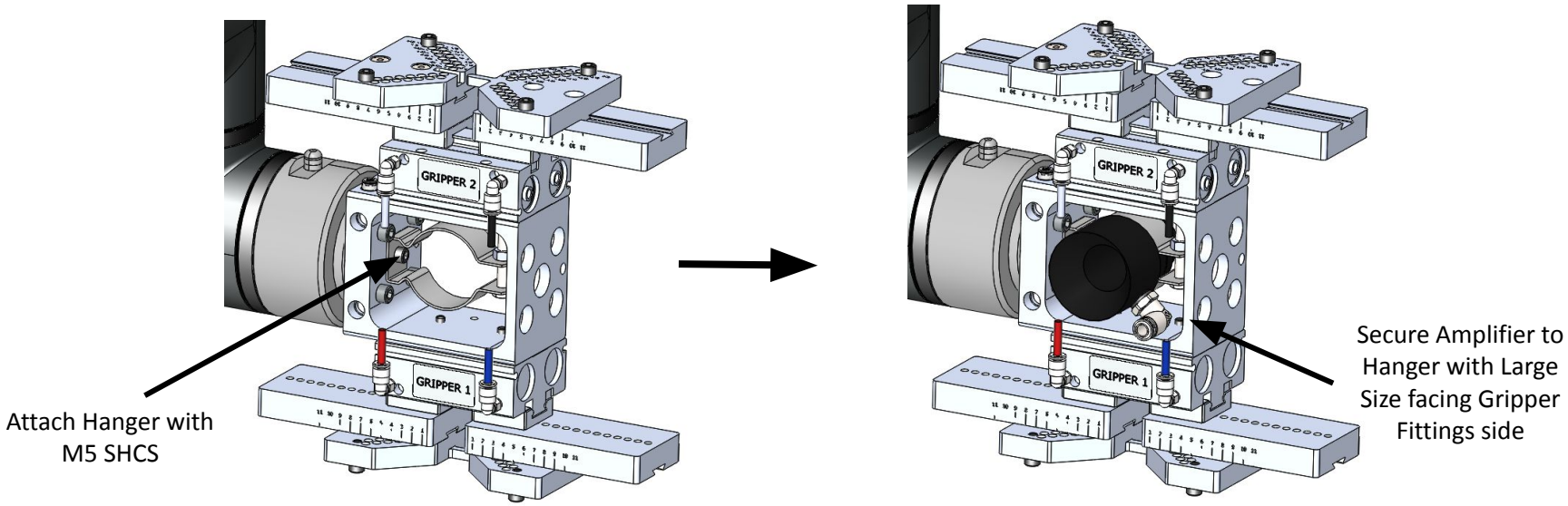


*If the “Set High” function does not turn on the VersaBlast, check the internal tube routing to verify an air line is routed from the VersaBlast valve to the VersaBlast Port

Refer to the appendix for a picture of the VSC internal tube routing

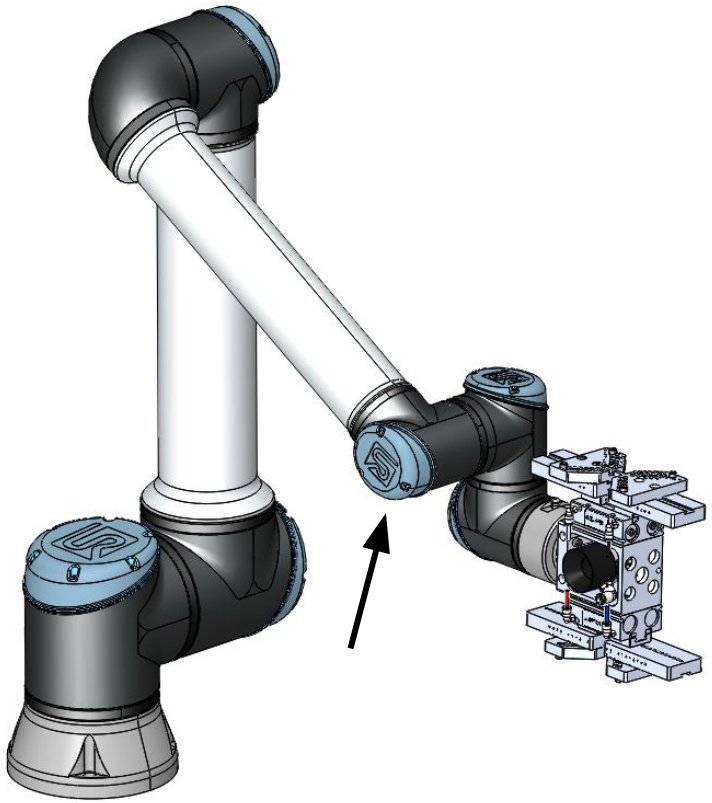
VersaBlast Installation

3. Attach Air Amplifier to DuoGrip Gripper
   - Attach Threaded Rod Hanger with M5 Socket Head Cap Screw to DuoGrip Gripper with 4mm Hex Key
   - Secure Air Amplifier with 0.25” tube fitting into position with Threaded Rod Hanger by tightening M6 Screw and Nut with 10mm Hex Wrench **note orientation - large side of air amplifier faces tubing/fitting side of grippers (air flows away from fittings)*

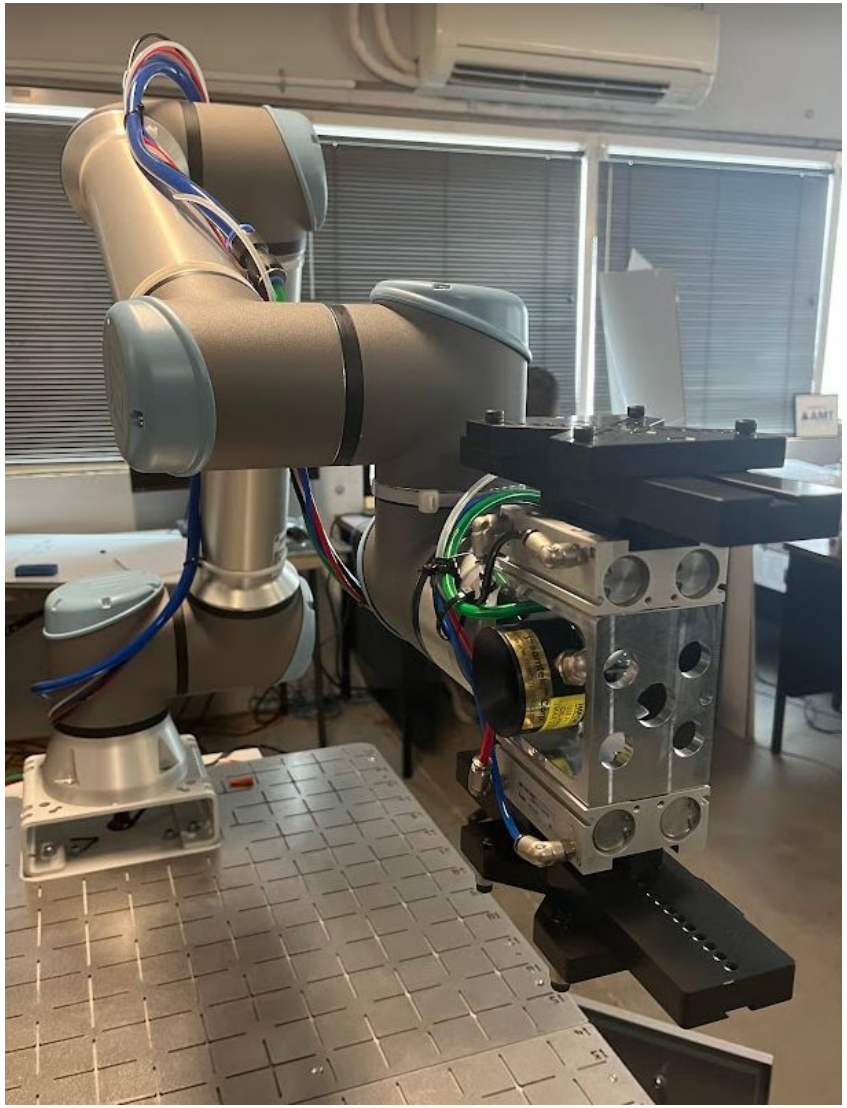


VersaBlast Installation

4. Route air lines from Air Amplifier along robot arm to VersaBlast A/P valve output
   a. Route 0.25” line with 5/32” lines routed to grippers
   b. Connect 0.25” line to 0.50” line with Union fitting at Axis #4 (shorten 0.25” line if needed)
   c. Route 0.50” line with 5/32” lines thru the robot base



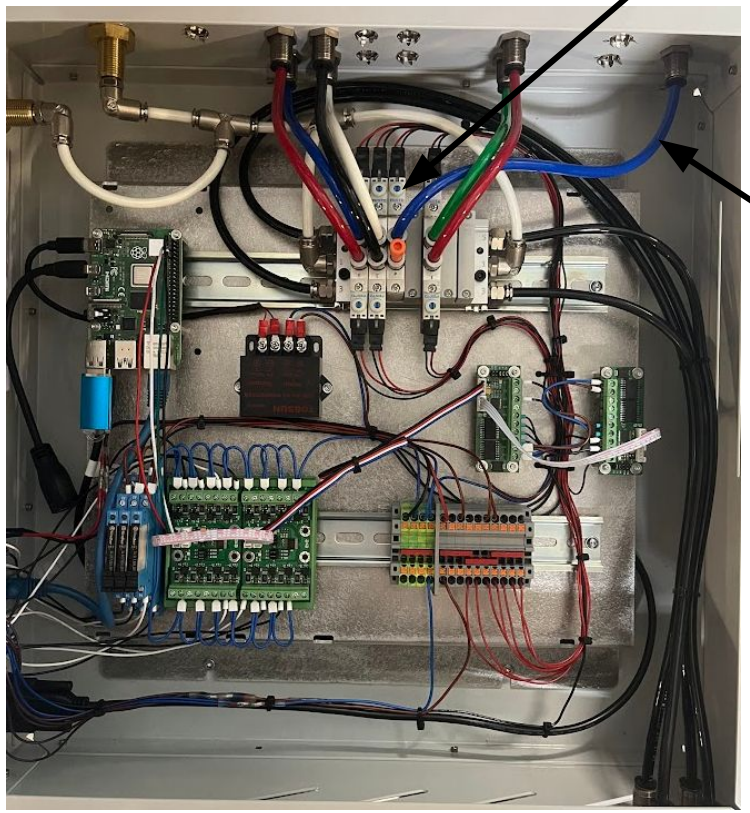
VersaBlast Installation



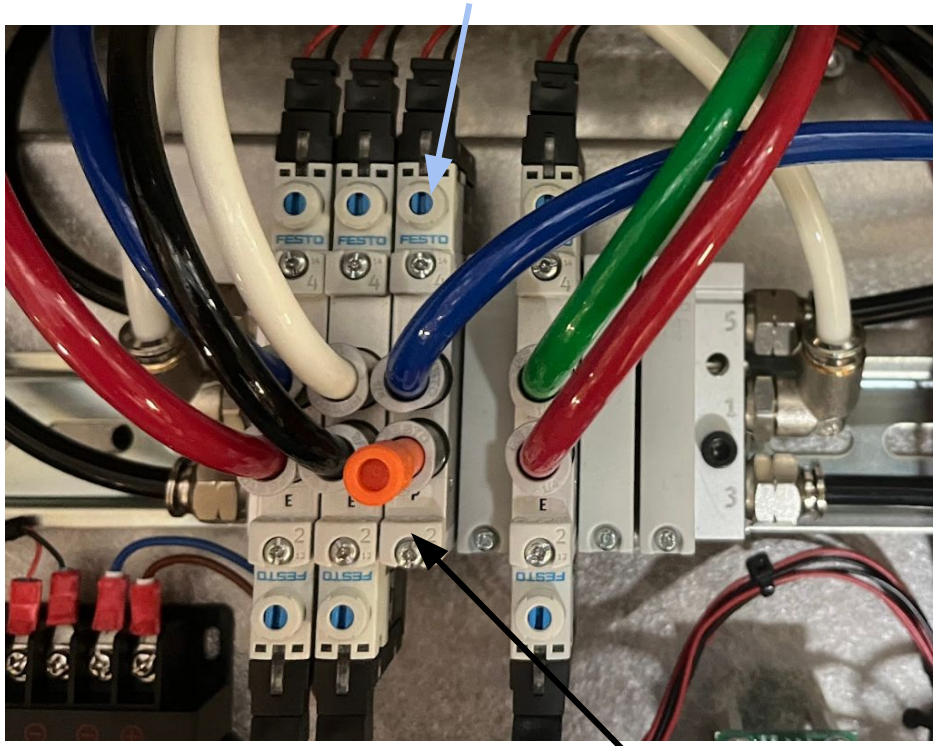
VersaBlast Installation

5. Mount A/P Valve assembly on or inside VersaCart
    a. Determine convenient location to mount VersaBlast A/P valve assembly

VersaBlast Installation



Manual Override switch
Turn with small screwdriver
vertical = auto position, horizontal = manual override



VersaWash Installation

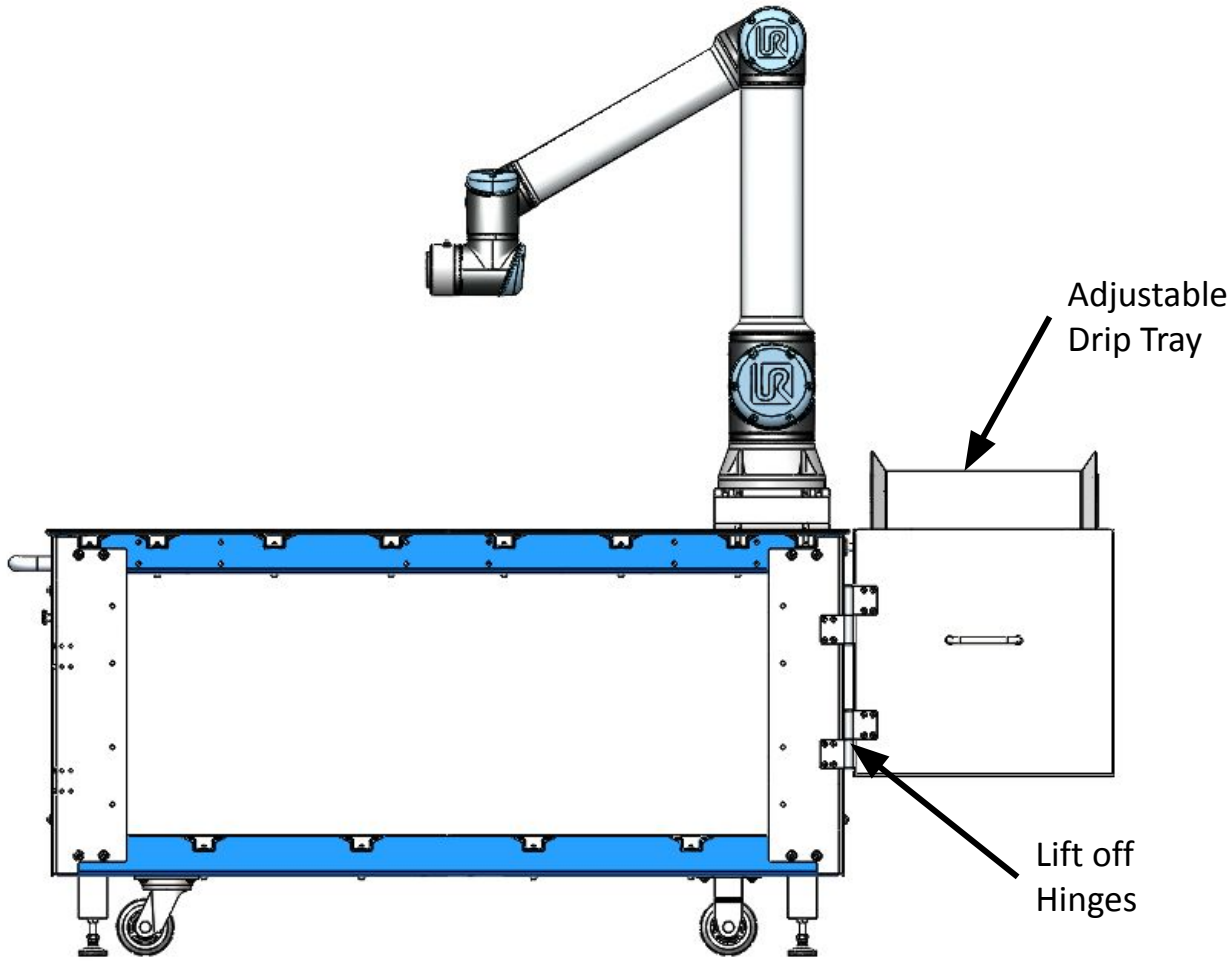
Section 9

VersaWash Installation

Installation Steps:

1. Install VersaWash bucket on pre-installed hinges
2. Connect power from Pump to Power Switch mounted inside VersaCart
3. Connect M8 cable from Power Switch to A5 on VersaBuilt System Controller
4. Connect Power Switch to 110 VAC
5. Fill with Water
6. Test

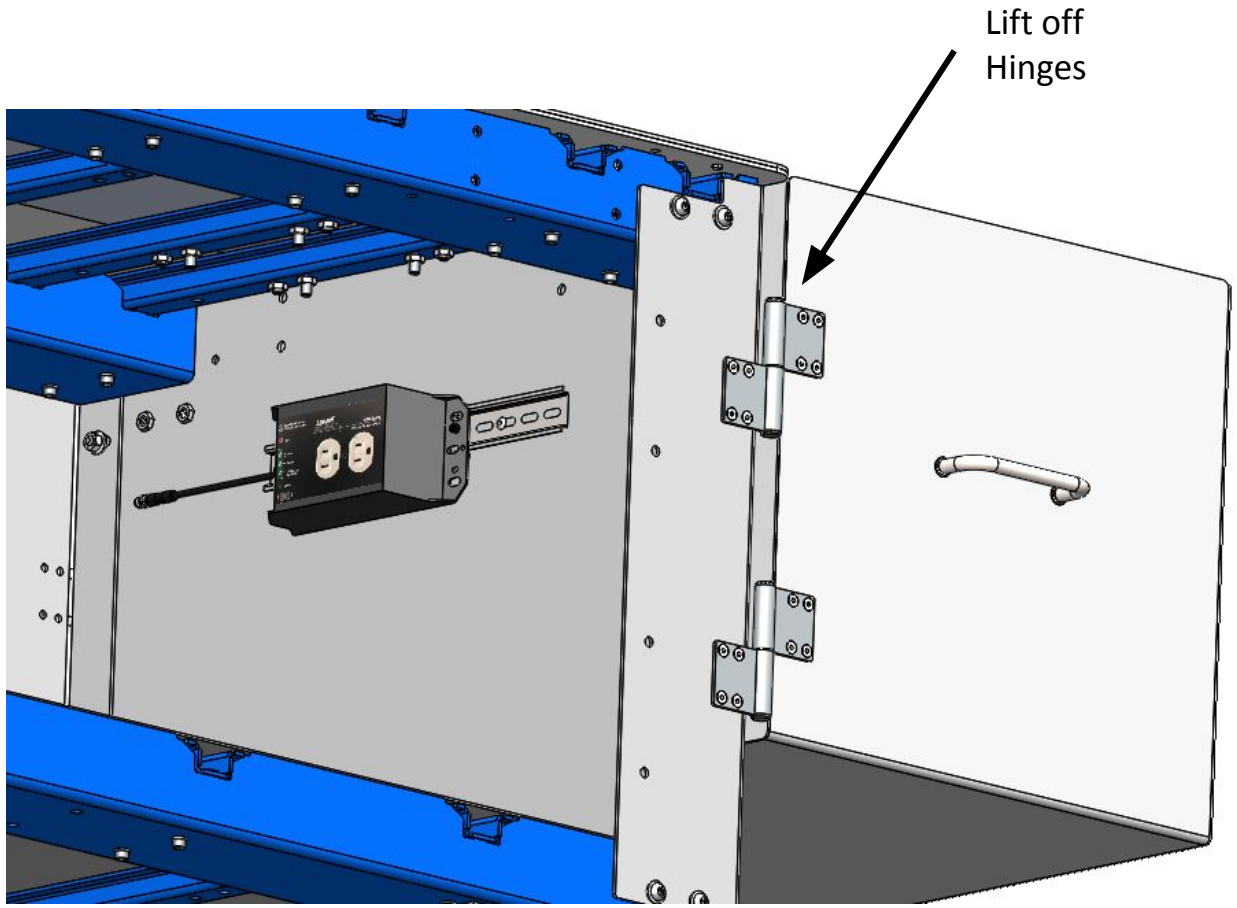
**During Robot Calibration, VersaWash function and robot motion is tested*



VersaWash Installation

Install Bucket:

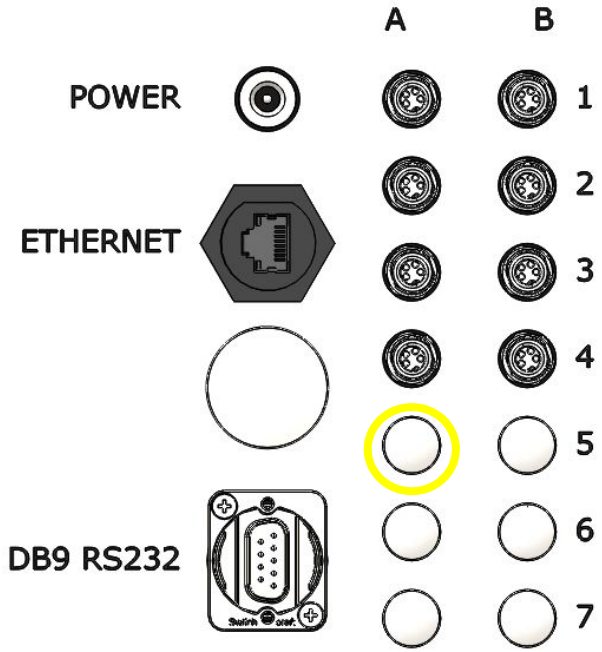
- Loosen bolts connecting hinges to VersaCart
- Slide connecting members of lift-off hinge into place
- Tighten fasteners on hinges
- Test pivoting and magnet attachment to Cart when closed
- Set drip trap to lay against CNC or on lip of door opening (without interfering with the door)

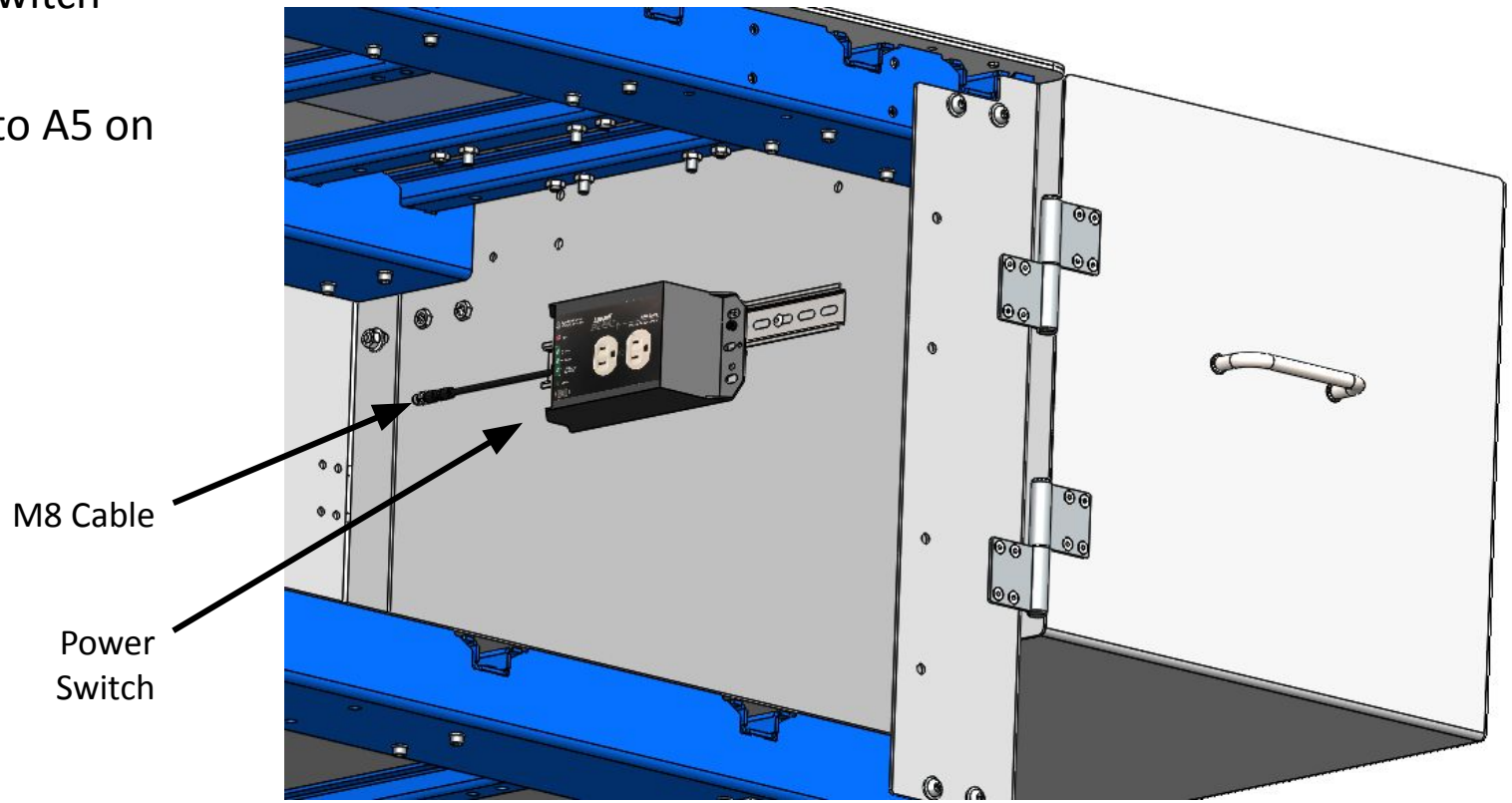


VersaWash Installation

Connect Power:

- Connect power from Pump to Power Switch mounted inside VersaCart
- Connect M8 cable from Power Switch to A5 on VersaBuilt System Controller
- Connect Power Switch to 110 VAC





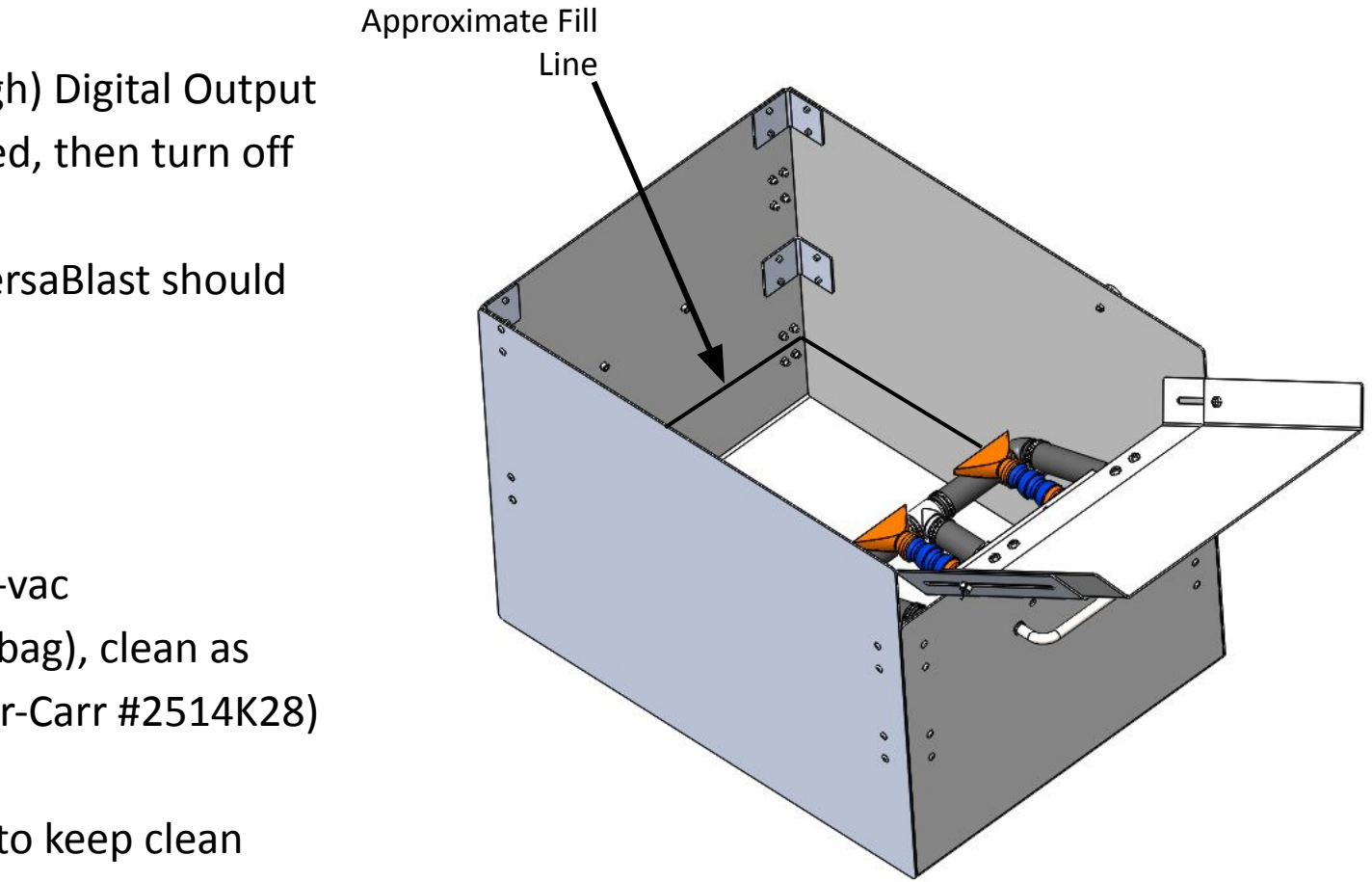
VersaWash Installation

Fill and Test:

- Add 5 Gallons of Water
- Go to I/O Panel screen, turn on (set high) Digital Output for VersaWash, adjust nozzles as needed, then turn off (set low)
- Verify settings - Go to settings page, VersaBlast should be set to “External”

Maintenance:

- Clean once per day, during daily use
- Remove water, chips, debris with shop-vac
- Monitor pump filter (600 micron filter bag), clean as needed. Replace as needed (McMaster-Carr #2514K28)
- Refill with 5 Gallons
- Add Dawn Soap or antibacterial agent to keep clean



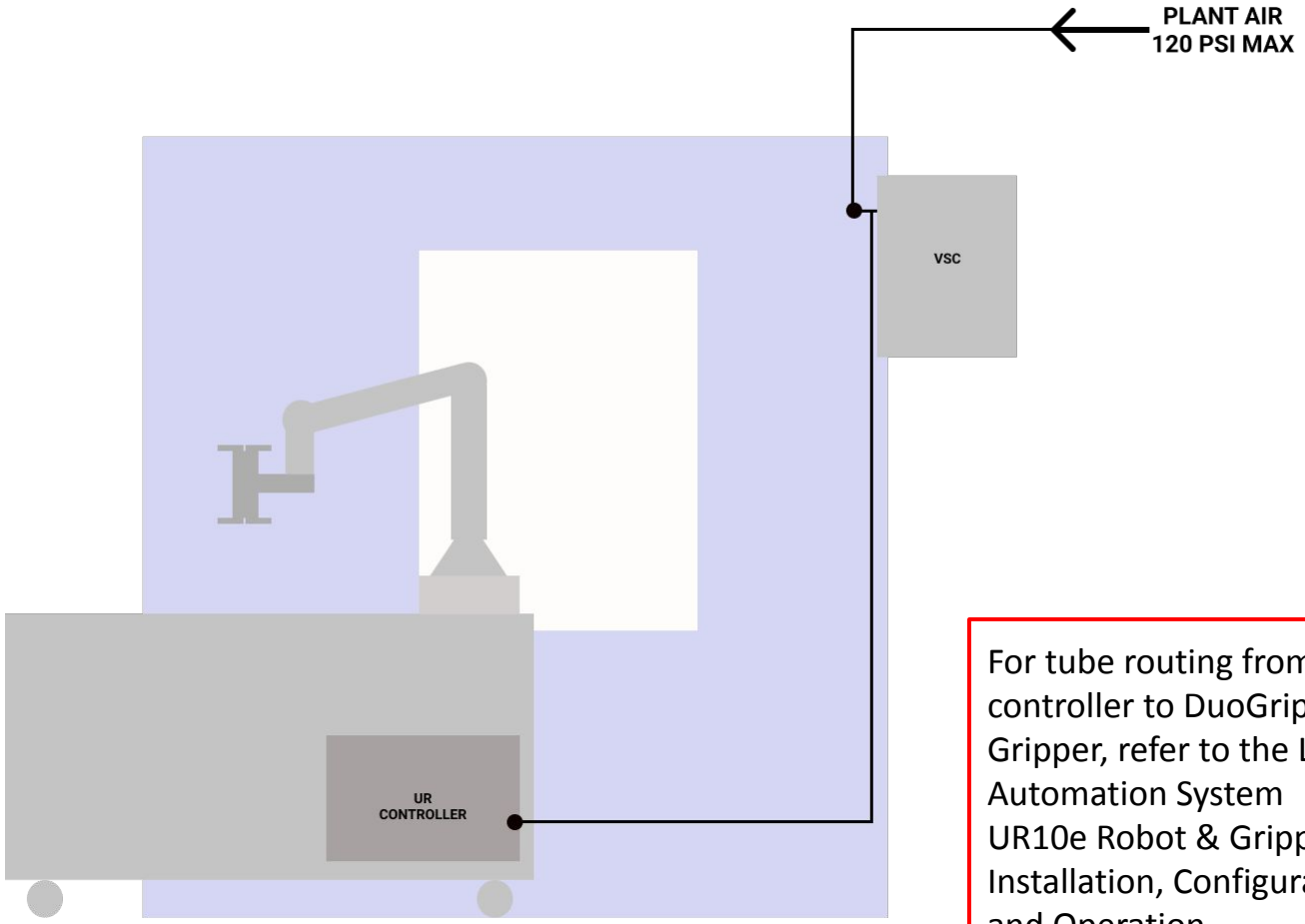
Appendices

Air Routing - Supply

The figure to the right shows supply air to devices in the Lathe Automation System

- 1/4” tubing from Plant Air to VSC Input (Red shut off valve)
- 1/4” Tubing to tee-fitting after Red shut off valve to UR Controller
- 5/32” air lines out of the UR controller to the DuoGrip Gripper

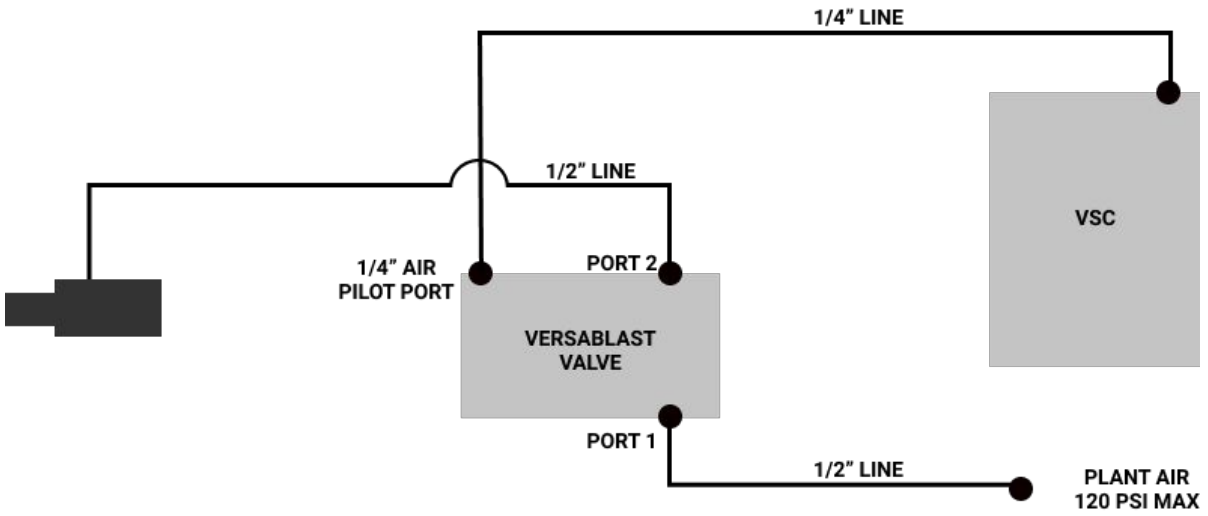
**supply lines can be Tee’d from a single source or from different sources*



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

For tube routing from UR controller to DuoGrip Gripper, refer to the Lathe Automation System UR10e Robot & Gripper Installation, Configuration and Operation

Air Routing - VersaBlast

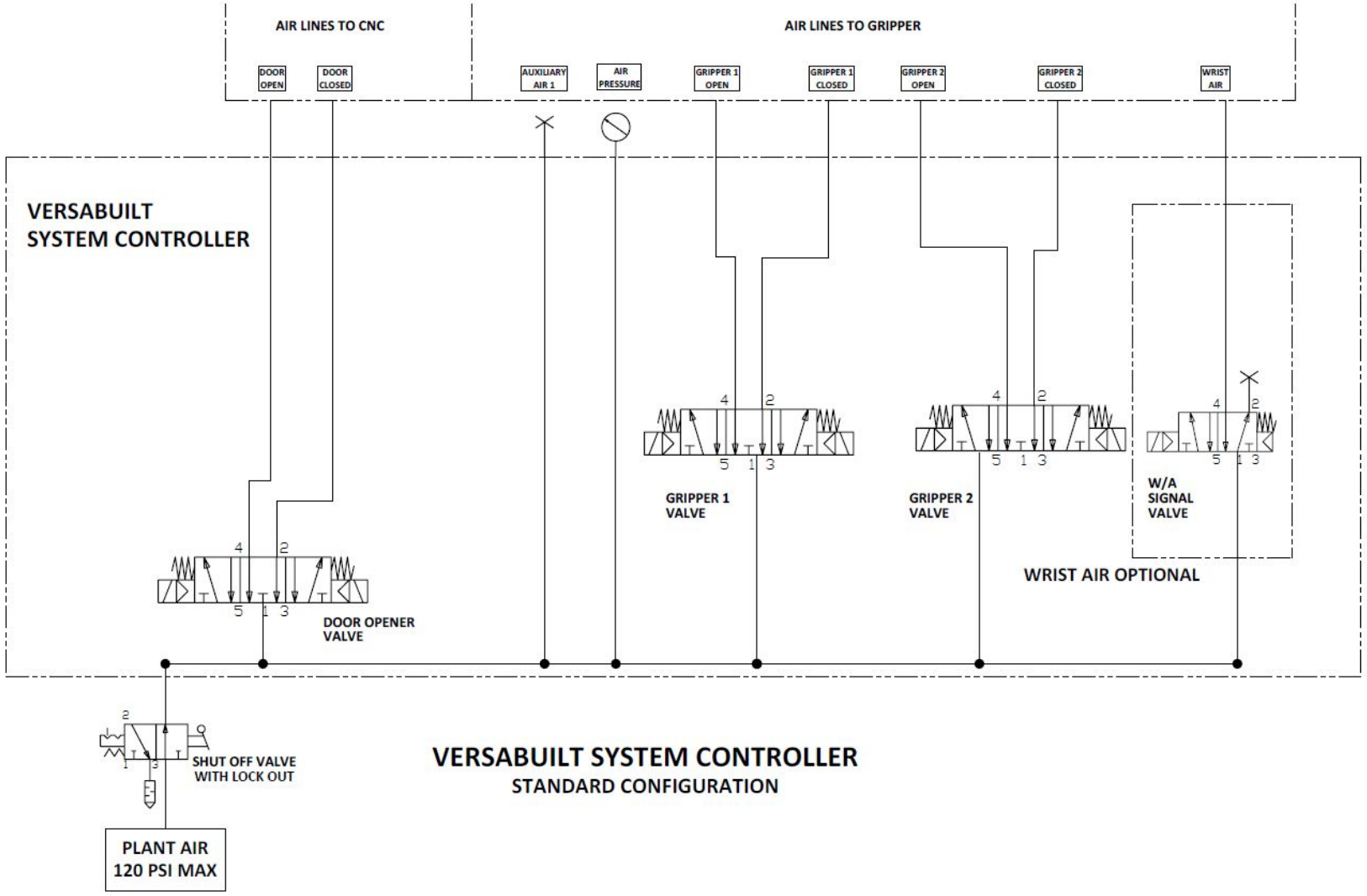


Pneumatic Schematics

Schematic shows inside detail of VersaBuilt System Controller, including:

- 24VDC solenoid valves
- Gripper valves are 5 port, 3 position, center exhaust
- Door valve is 5 port, 3 position, center exhaust

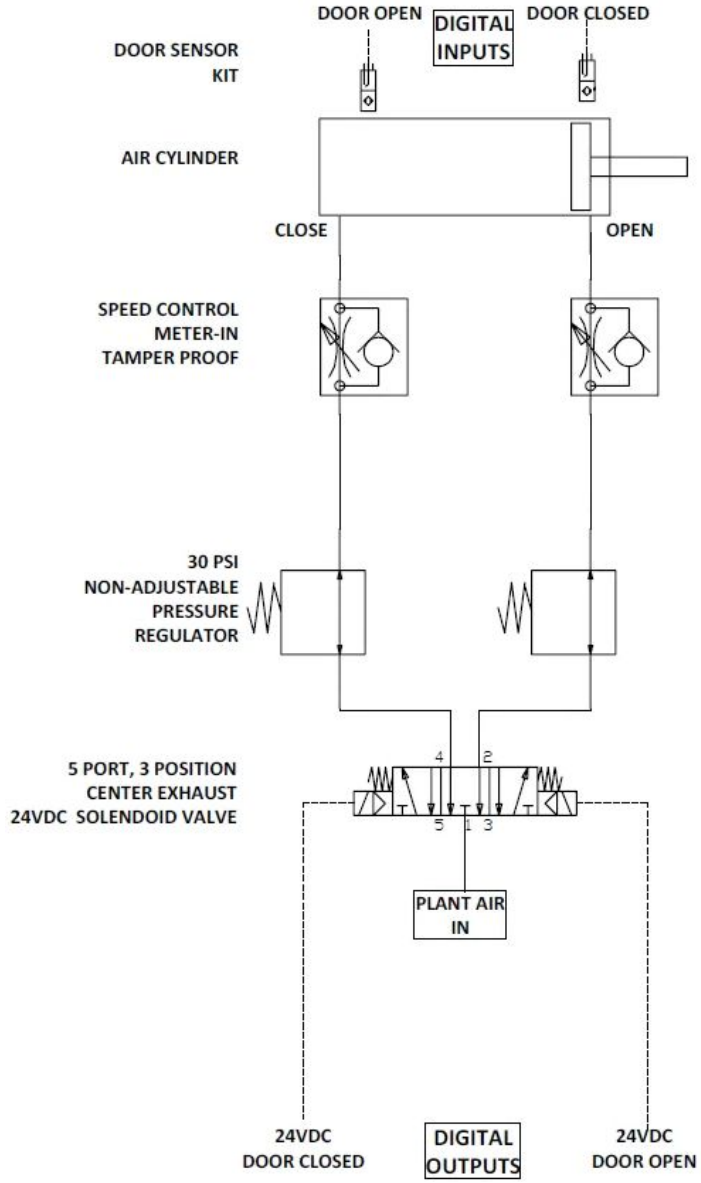
- Optional:
  - *Wrist air 5 port, 2 position*



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 VersaBuilt System Controller.

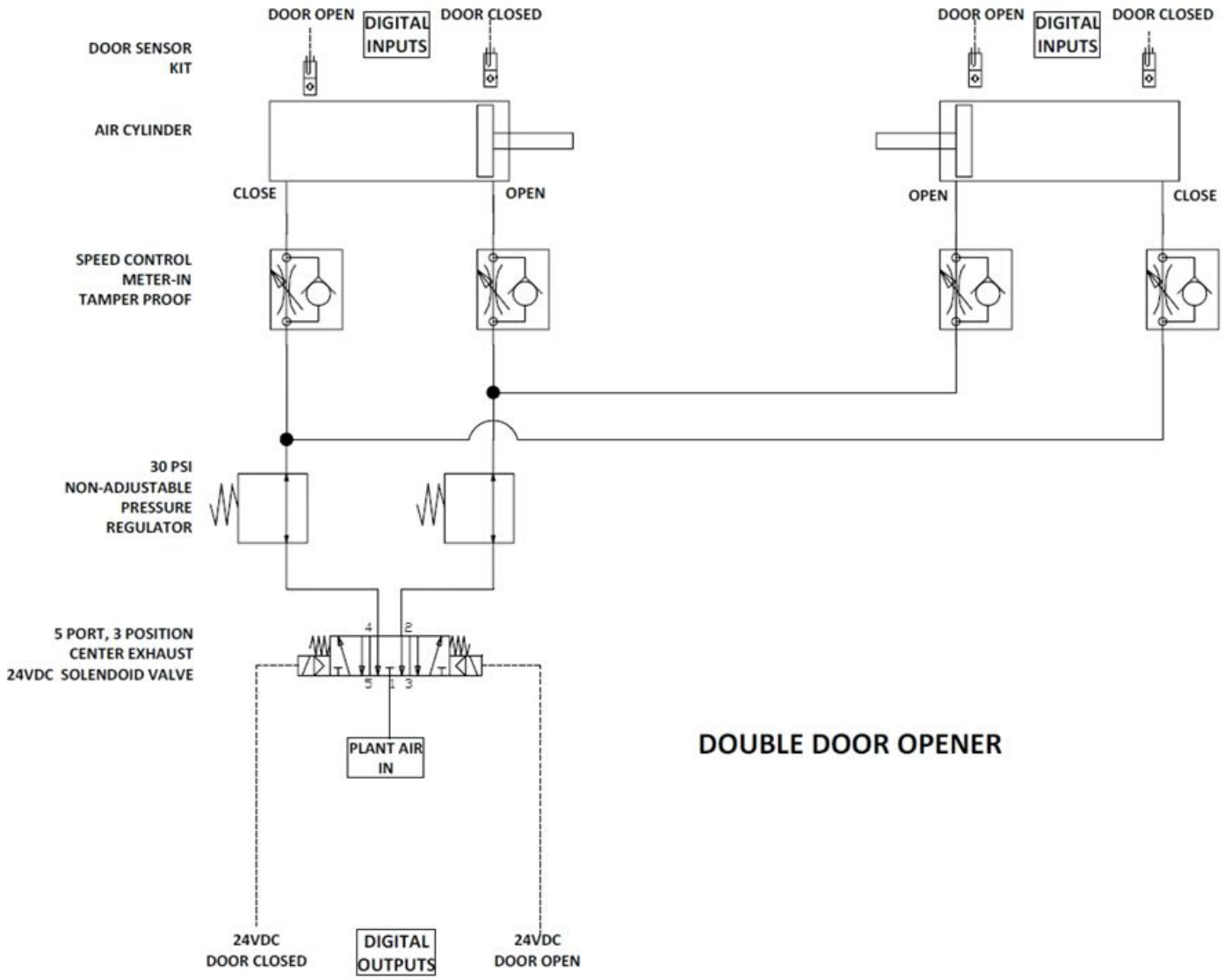


SINGLE DOOR OPENER

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.

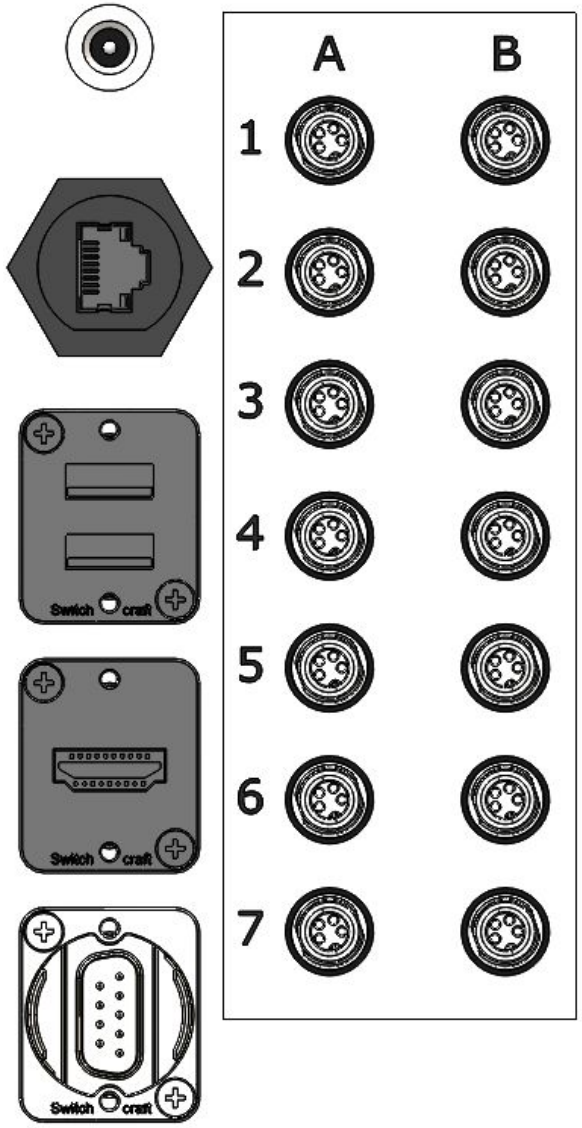


VSC Lathe Connections

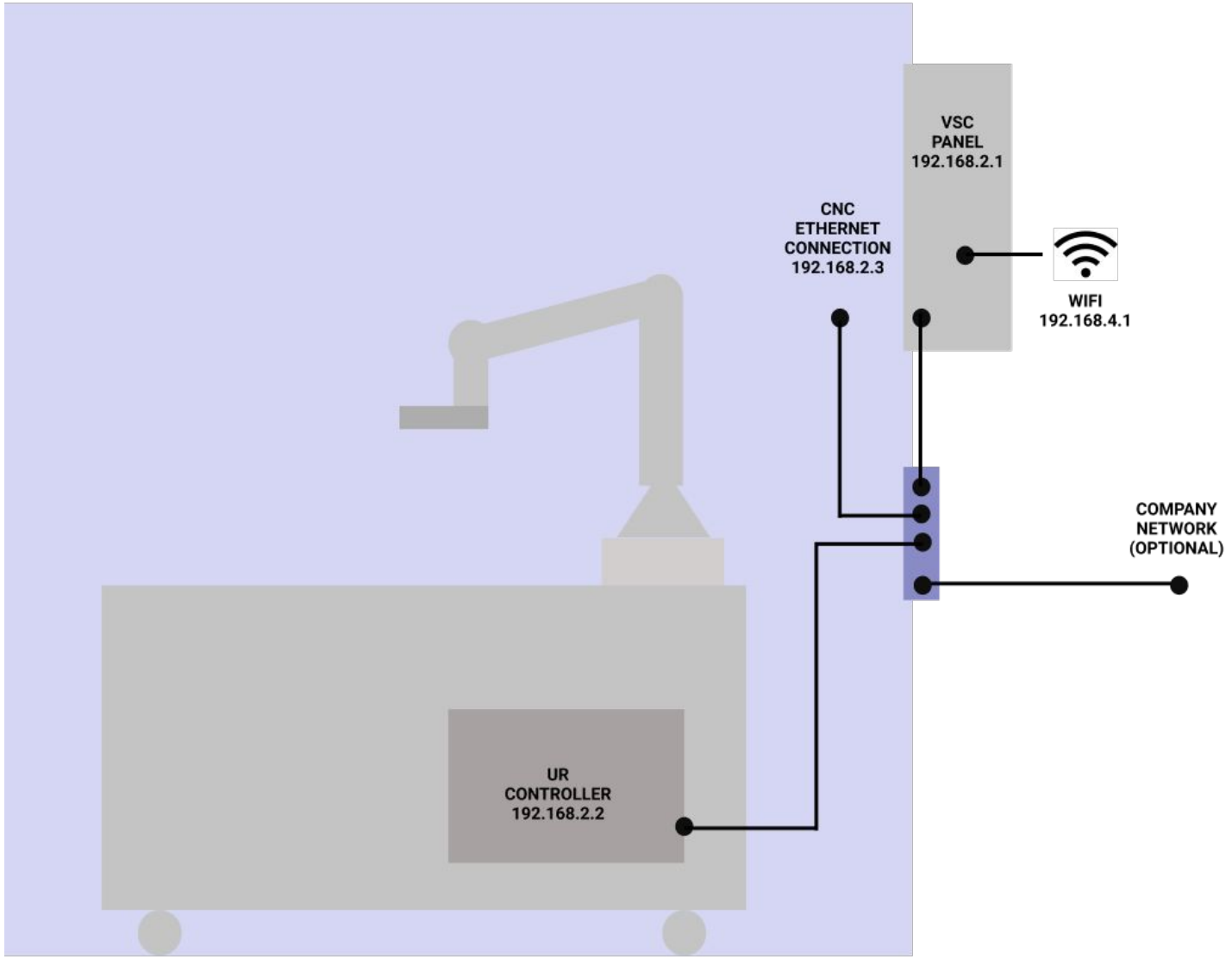
- **Power = 110VAC to 24VDC cord provided with VSC Panel**
- **Ethernet 1 = VSC Communication to Ethernet Switch**
- **USB ports 1 and 2 (keyboard, mouse, backup)**
- **HDMI port (monitor)**
- **RS232 DB9 = Connection to CNC if Ethernet is not available**
- **A1 = Vise Sensor, Vise 1 and Vise 2 (MAS)**
- **A2 = Vise Sensor, Vise 3 and Vise 4 (MAS)**
- **A3 = VersaDoor Sensor, Single Door**
- **A4 = VersaDoor Sensor, 2nd Door**
- **A5 = VersaWash XT**
- **A6 = Dual CNC Communication - Robot Lock (Output)**
- **A7 = Chuck #1 Control (LAS)**
- **B1 = Cycle Start Cable**
- **B2 = VSC Enable**
- **B3 = Door Operator Panel (Door Open/Door Close)**
- **B4 = Cycle End Command (Generic Driver input)**
- **B5 = Open**
- **B6 = Dual CNC Communication - Robot Lock (Input)**
- **B7 = Chuck #2 Control (LAS)**

***A2 was wired for Cycle End Command and Vise 3 Sensor on serial numbers VSC00100 thru VSC00107, and VBR serial numbers**

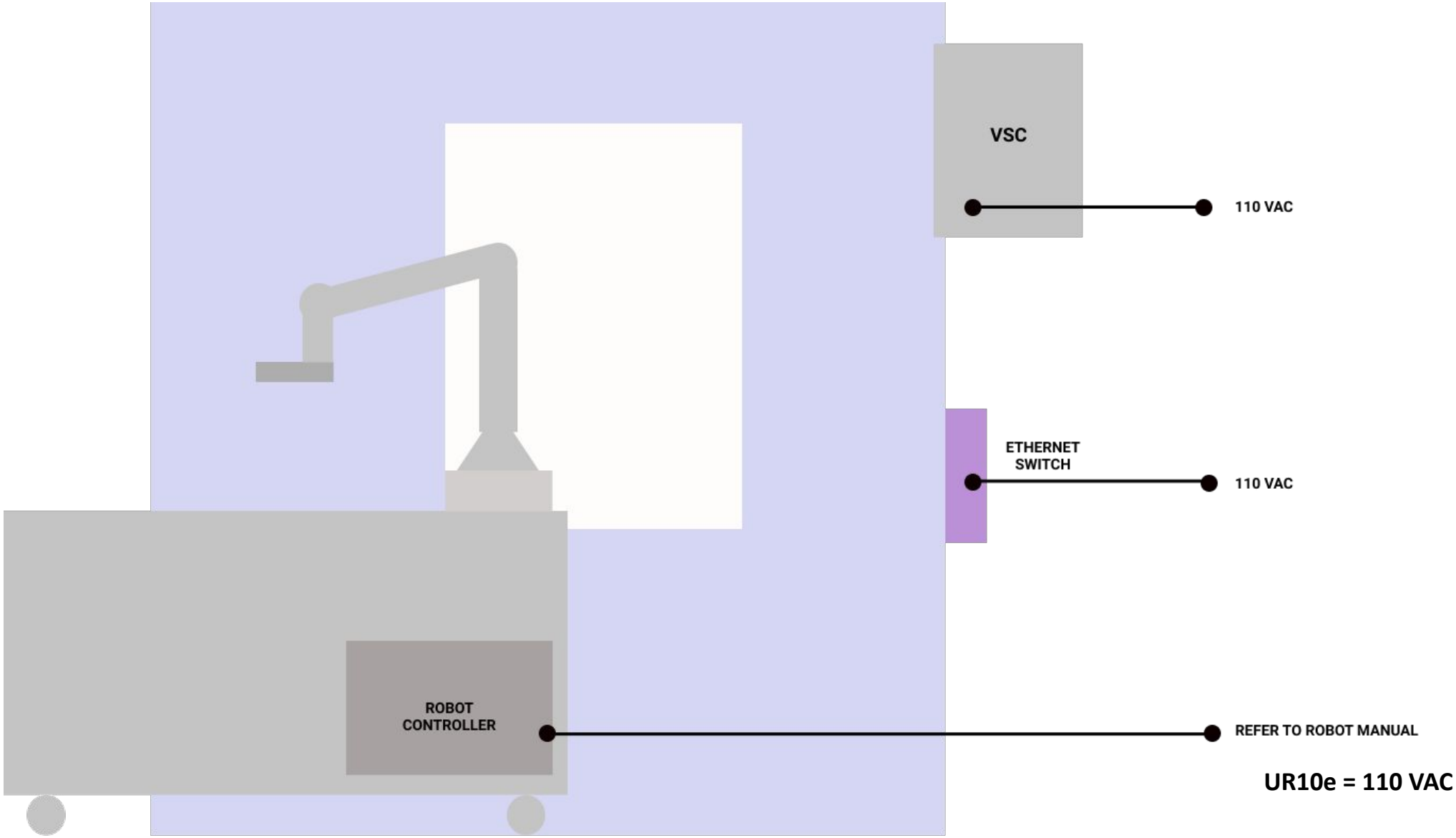
***Legacy LAS - A1 and A2 wired for Chuck 1 and 2 control where A7 and B7 are unused**



Network Diagram



Electrical Power



UR10e = 110 VAC

Spare parts

Robot (P/N 5010050):

- UR 10e #110312

VersaCart (P/N 5008242)

DuoGrip Gripper (P/N 5009899):

- P/N 5009895 - DuoGrip Gripper Base Finger (QTY: 4)
- P/N 5009897 - DuoGrip Gripper Mount Block (QTY: 1)
- P/N 5010537 - DuoGrip Gripper Puck Finger, Male (QTY: 2)
- P/N 5010538 - DuoGrip Gripper Puck Finger, Female (QTY: 2)
- P/N 5000645 - Gripper, 20mm centering stroke (QTY: 2)
- 5/32” (4mm) Polyurethane Tubing, Durometer 95A (Red, Blue, Black, White/Clear)
- Fitting, L, 5/32” push-to-connect tube x 10-32 male thread (QTY: 4)

Spare parts

Shaft Fingers & Shaft Infeed (P/N 5011159):

- P/N 5010371 - Lathe Shaft Infeed
- P/N 5009986 - Lathe Shaft Infeed U-Channel
- P/N 5010341 - Lathe Shaft Infeed Channel Mount
- P/N 5011157 - Lathe Finger Set for DuoGrip Gripper
- P/N 5008318 - Shaft Finger L-Bracket
- P/N 5011182 - Shaft 1” Calibration Finger
- P/N 5011187 - Shaft 1” Calibration Part
- P/N 5011204 - Shaft Finger A
- P/N 5011205 - Shaft Finger B
- P/N 5011206 - Shaft Finger C

Spare parts

VSC (P/N 5009955):

- DIRECTIONAL CONTROL VALVE, DOUBLE SOLENOID, SIZE 10, 5 PORT, 3 POSITION, CENTER EXHAUST M7 AIR CONNECTION, H2 ELECTRICAL CONNECTION, 24VDC, MANUAL OVERRIDE PUSH-IN/DETENTING, LED DISPLAY - FESTO 564212 (VUVG-L10-P53E-T-M7-H2L)
- DIRECTIONAL CONTROL VALVE, 5 PORT 2 POSITION, VALVE SIZE 10, M52 5/2 Way M7 Air Connection, H2 Electrical Connection, Internal Pilot 24VDC, Manual Override Push In / Detenting, LED Display - FESTO 577333 (VUVG-L10-M52-RT-M7-1H2L)
- MANIFOLD COVER PLATE - FESTO VABB-L1-10-S
- SEAL KIT, VABD, VUVG VALVES - FESTO VABD-L1-10X-S-M7 #566673
- VALVE MANIFOLD, 7 POS - FESTO 566563 (VABM-L1-10S-G18-7)
- FINDER RELAY BLUE, 24VDC, 1 SLICE (QTY: 1) - Beyond Components 38.51.7.024.0050
- RASPBERRY PI 4, MODEL B 2019, QUAD CORE 64 BIT WIFI BLUETOOTH (4GB)
- DIGITAL INPUT MODULE, I2C OPTO 15-30V PCF8574 - ERE I2C-IN830M0
- DIGITAL OUTPUT MODULE, OPEN COLLECTOR, I2C OC PCF8574A - ERE I2C-OC805SA
- 24V TO 5V DC-DC CONVERTER - AMAZON B01M03288J
- 1/4” Polyurethane Tubing, Durometer 95A (Red, Blue, Black, White/Clear, Yellow, Green)
- 5/32” (4mm) Polyurethane Tubing, Durometer 95A (Red, Blue, Black, White/Clear)
- Fitting, L, 1/4” push-to-connect tube x ⅛” NPT (QTY: 6)
- Fitting, Straight, 1/4” push-to-connect tube x ⅛” NPT (QTY: 1)
- Fitting, Straight, 1/4” push-to-connect tube x 1/4” Swift-Fit (QTY: 1)

Spare parts

Door Opener:

- P/N 5007494 - VersaDoor, 24”
- P/N 5006080 - VersaDoor, 30”
- P/N 5006549 - VersaDoor, 40”
- P/N 5007619 - VersaDoor, 24” Double
- P/N 5007621 - VersaDoor, 30” Double
- P/N 5010762 - VersaDoor, 40” Double
- P/N 5007633 - VersaDoor Sensor Kit, M8 Cables
- P/N 5006175 - VersaDoor L-Bracket
- 1/4” Polyurethane Tubing, Durometer 95A
- Fitting, Straight, ¼” push-to-connect tube x 1/8 Universal Thread/Swift-Fit (QTY: 2)

Vendors:

- The fittings are purchased from a distributor of AIGNEP fittings
- The tubing is purchased from Freelin-Wade, Festo, McMaster-Carr

Any questions or if items are not listed above, please contact VersaBuilt via sales@versabuilt.com

VERSA BUILT
ROBOTICS

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