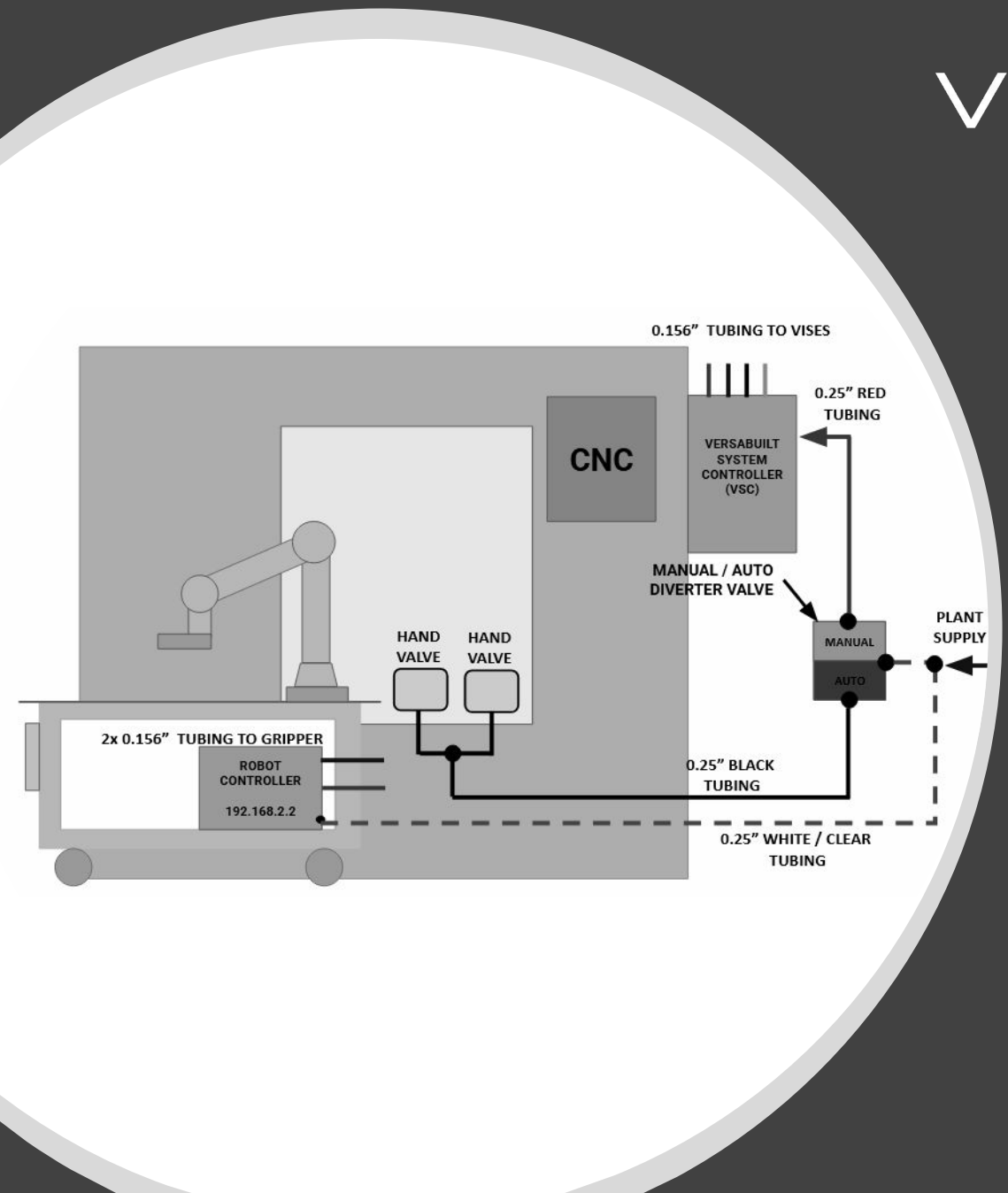


The diagram illustrates the hydraulic or pneumatic system for a robotic setup. Key components and connections include:

- CNC Machine:** The central component, connected to the Robot Controller.
- Versabuilt System Controller (VSC):** Receives input from the CNC and controls the diverter valve.
- Manual / Auto Diverter Valve:** A valve that can be switched between Manual and Auto modes. It is connected to the VSC and the Plant Supply.
- Robot Controller:** Labeled with the IP address 192.168.2.2, it controls the robot gripper.
- Tubing:**
 - 0.156" Tubing to Vises:** Connects the VSC to the vises.
 - 0.25" Red Tubing:** Connects the VSC to the Manual/Auto Diverter Valve.
 - 0.25" Black Tubing:** Connects the Manual/Auto Diverter Valve to the Robot Controller.
 - 0.25" White / Clear Tubing:** Connects the Plant Supply to the Manual/Auto Diverter Valve.
- Plant Supply:** The source of the fluid for the system.
- Hand Valves:** Two hand valves are shown, connected to the system for manual operation.



Automation System Pneumatics Manual vsc 1.0

Energizing the Pneumatics

- Before connecting to Supply Air
 - Make sure no person is in contact with the Gripper, Vises, or VersaDoor as it may move suddenly when energized.
 - Verify connections match provided diagrams and schematics in this manual
 - Refer to the Safety Manual for completion of your Risk Assessment
 - **Verify air prep:** The main air supply should be less than 115 psi and conditioned air that meets ISO 8573-1:2010 [7:4:4] standard. Note: Maximum system air consumption is 15-20 SCFM. * *Air Prep equipment (Filter, Moisture Separator, Regulator) is sold separately from systems.*
- Automation System check:
 - All air fittings are “push-to-connect” (PTC), allowing quick and easy connectivity
 - If a VersaBuilt AutoDoor is included, close the CNC door
 - Keep hands/body clear of any actuator (Gripper, Vise/Chuck/Workholding, VersaDoor, VersaBlast, etc.)
 - Start by connecting the Diverter Valve in the Green “Manual” position
 - Connect Supply Air to the system
 - Use hand valves to actuate the vises
 - Check for leaks, loose connections and fix as needed
 - When ready to test automatic tools, switch the Diverter Valve to the Red “Auto” position.
 - Tests device pneumatics with the I/O Panel or Recovery panels

Air Routing for Automation Systems

- Connect Supply Air to:
 - Diverter Valve or VSC
 - Systems with vises include a Diverter Valve (Mill Systems), to enable or disable the use of Manual Valves.
 - Systems without pneumatic vises (e.g., Lathe Chucks, Vacuum Chucks), do not include Diverter Valves by default.
 - Robot Controller w/ Gripper Valves
- Diverter Valve:
 - MultiGrip Systems route supply air to the Diverter Valve, then to the VSC and Hand Valves
 - DuoGrip Systems route supply air to the VSC (Diverter Valves and Vise Air Routing with Hand Valves is optional)
- VSC supplies air to:
 - Vises
 - Door Opener
 - VersaBlast (air pilot signal)
 - T-fitting available to route air after the shutoff valve to robot controller or other devices, if preferred
- Robot Controller w/ Gripper Valves supplies air to:
 - Gripper 1 (for Duogrip Gripper 1, or MultiGrip Gripper)
 - Gripper 2 (for DuoGrip Gripper 2)

Tubing and Fittings

- 0.50" tubing:
 - 3-ft Connecting ¼" quick disconnect and ½" tee fitting with reducer to ¼" to connect supply to Diverter Valve
 - 15-ft + 10-ft blue tubing for VersaBlast for DuoGrip connecting supply to A/P valve, then A/P valve to robot arm**
- 0.25" tubing:
 - 25-ft white tubing - Connecting from Plant Supply to Diverter Valve
 - 25-ft black tubing - Connecting from Diverter Valve to Manual Valves in CNC
 - 25-ft red tubing - Connecting from Diverter Valve to VersaBuilt System Controller (VSC)
 - 25-ft white tubing - Connecting t-fitting before Diverter Valve to UR Controller for Gripper operation
 - 25-ft blue tubing - Connecting from VSC VersaBlast port to A/P valve**
 - 3-ft blue tubing - Connecting from ½" tubing routed on robot to air amplifier on DuoGrip**

***For Mill Systems with MultiGrip only**

****For Systems with DuoGrip only**

Tubing and Fittings

- 5/32" tubing:
 - 25-ft red tubing - Connecting from VSC to Vise 1 Close*
 - 25-ft blue tubing - Connecting from VSC to Vise 1 Open*
 - 25-ft clear or black tubing - Connecting VSC to Vise 2 Close*
 - 25-ft white tubing - Connecting from VSC to Vise 2 Open*
 - 15-ft red tubing - Connecting from VSC to Gripper 1 Close
 - 15-ft blue tubing - Connecting from VSC to Gripper 1 Open
 - 15-ft clear or black tubing - Connecting VSC to Gripper 2 Close*
 - 15-ft white tubing - Connecting from VSC to Gripper 2 Open*
 - 5-ft red tubing - Connecting UR Controller to Gripper Close tubing
 - 5-ft blue tubing - Connecting UR Controller to Gripper Open tubing
 - 5-ft black tubing - Connecting UR Controller to Gripper Close tubing**
 - 5-ft white/clear tubing - Connecting UR Controller to Gripper Open tubing**
 - 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*

***For Mill Systems with MultiGrip only**

****For Systems with DuoGrip only**

**Refer to Appendix A for a pneumatic schematic*

Tubing and Fittings

- Fittings:
 - 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*

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

Incoming Air is the main air supply and should be less than 115 psi and conditioned air that meets ISO 8573-1:2010 [7:4:4] standard.

Maximum system air consumption is 15-20 SCFM.

Refer to Appendix A for complete Pneumatics Schematics

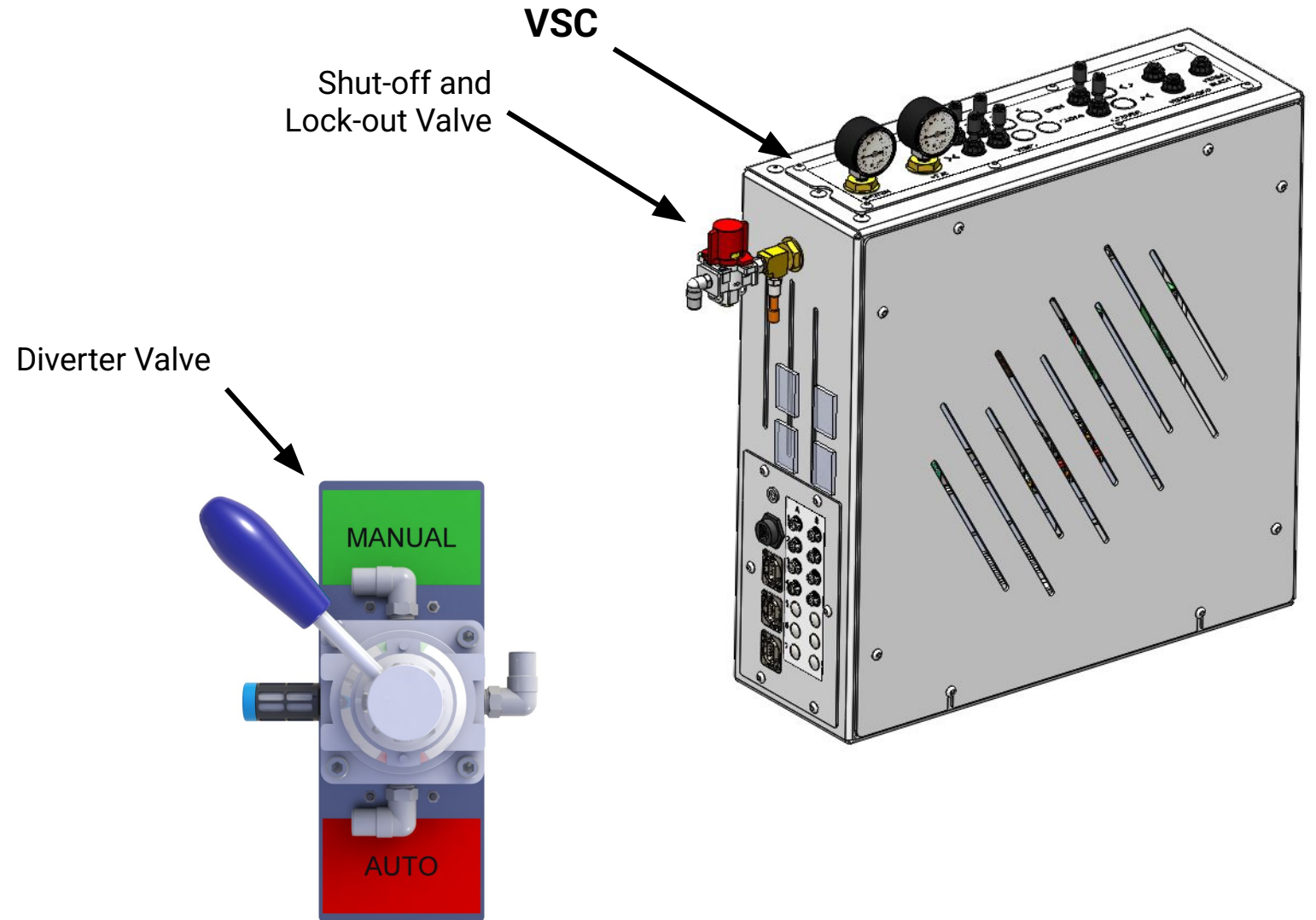
Connect Supply Air after all devices are connected,
then check for leaks or poor connections

***For Mill Systems with MultiGrip only**

****For Systems with DuoGrip only**

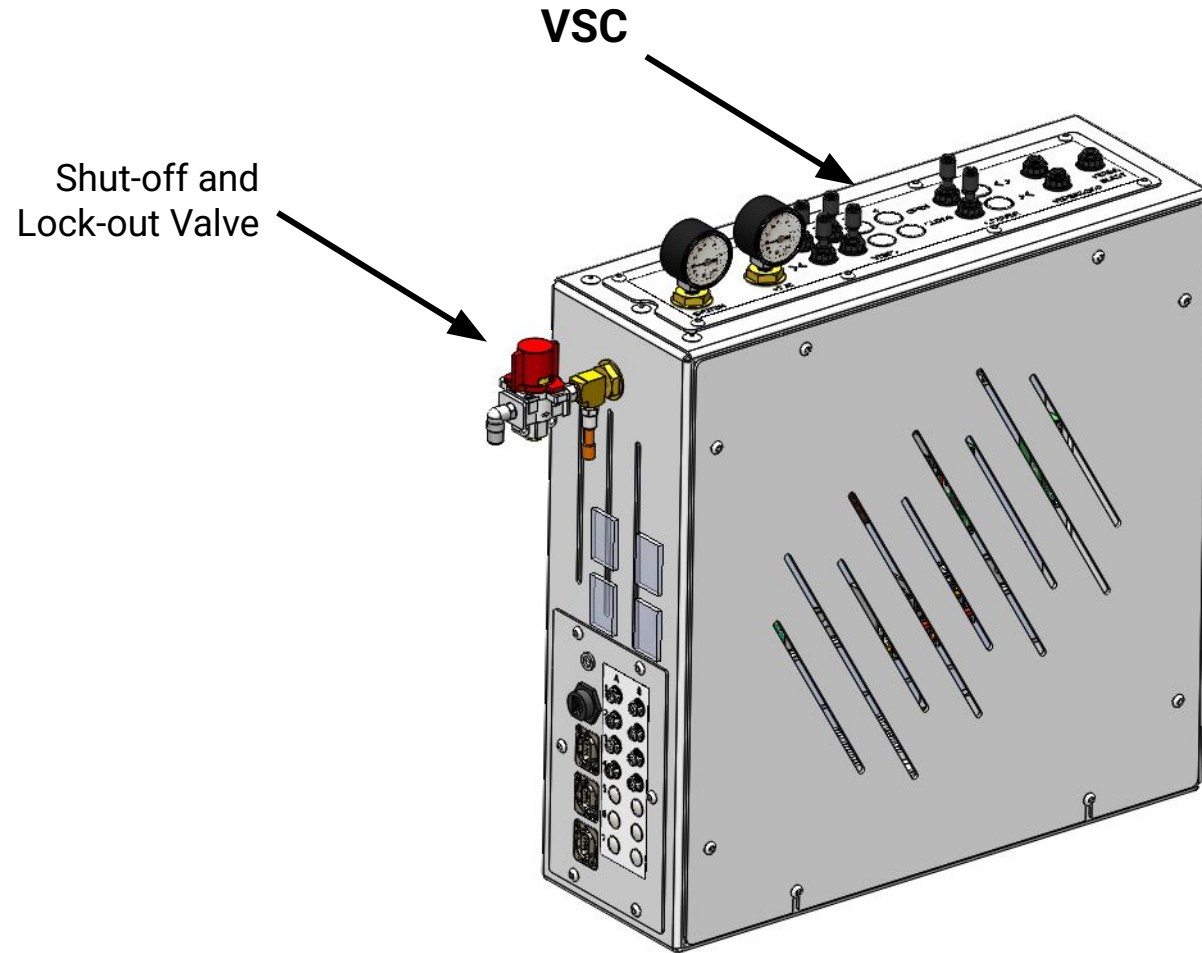
Diverter Valve and Shut-off Valve

- The Diverter (Manual/Auto) Valve provides the user with the ability to shut off air to the 24VDC vise, door and VersaBlast signal valves, used in automatic operation in the VSC, 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 VSC should be at 0 psi, after one or two manual actuations of devices, with all pressure on the automatic side relieved.
- To lock out or prevent supply of air to components, exhaust, test, verify pressure removal, and lock-out with the Red Shut-off Valve



Systems w/o Hand Valves - Shut-off Valve

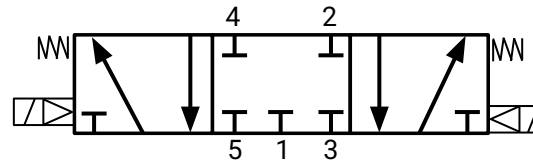
- Systems without workholding hand valves (e.g., Lathe Systems) do not include Diverter Valves, as the manual operation of workholding is done through the foot pedal, or CNC controller command.
- To lock out or prevent supply of air to components, exhaust, test, verify pressure removal, and lock-out with the Red Shut-off Valve



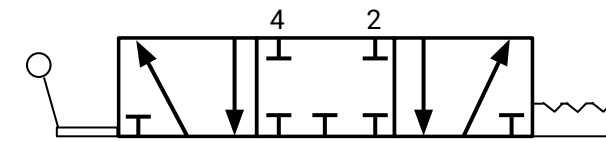
VSC Pneumatics - Valve Types

Valve Types:

1. Vise Valves



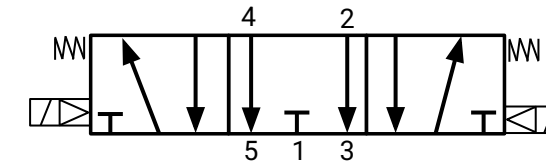
5 Port, 3 Position, Center Closed
Dual 24VDC Solenoid Valves



5 Port, 3 Position, Center Closed
Hand Valves

Air is held / trapped with
valve in Center position
(w/o 24VDC signals or
center handle position)

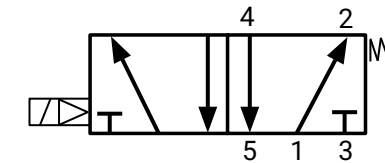
2. Gripper & VersaDoor Valves



5 Port, 3 Position, Center Exhaust
Dual 24VDC Solenoid Valve

Air is exhausted w/o
24VDC signals

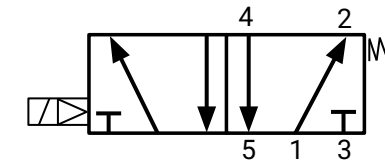
3. Vise Exhaust Valve



5 Port, 2 Position, Spring Return
Single 24VDC Solenoid Valve

Configured for Normally
Open supply air to vise
valves

4. VersaBlast Signal Valve



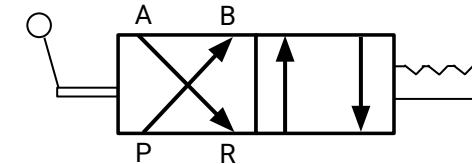
5 Port, 2 Position, Spring Return
Single 24VDC Solenoid Valve

Configured for Normally
Closed, signalling
VersaBlast on with Air
Pilot Signal to High Flow
Valve

VSC Pneumatics - Valve Types

Valve Types:

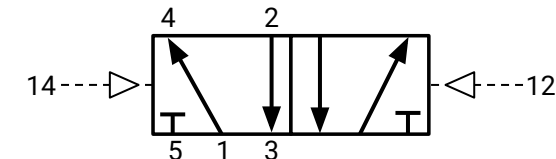
5. Diverter Valve



4 Port, 2 Position
Hand Valve

Switch between "AUTO"
and "MANUAL" model

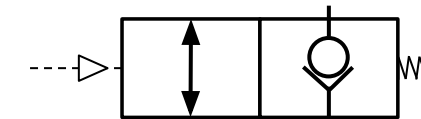
6. Air Pilot Valves



5 Port, 2 Position
Air Piloted Valve

Enables high pressure or
hold position w/o 24VDC
Signal

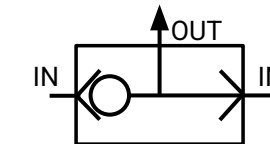
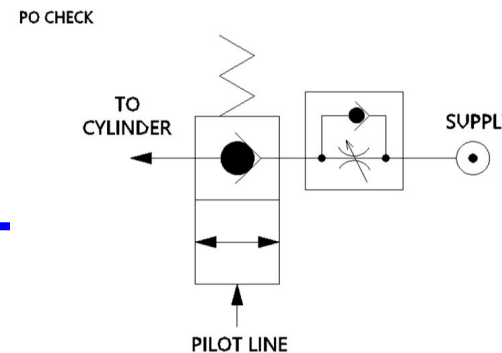
7. Pilot Operated Check Valves



Pilot Operated Check Valve

Holds pressure in device
without pilot air

8. Shuttle Valves



Shuttle Valve

Two Input lines, supplying
the greater of the two
pressures to the output

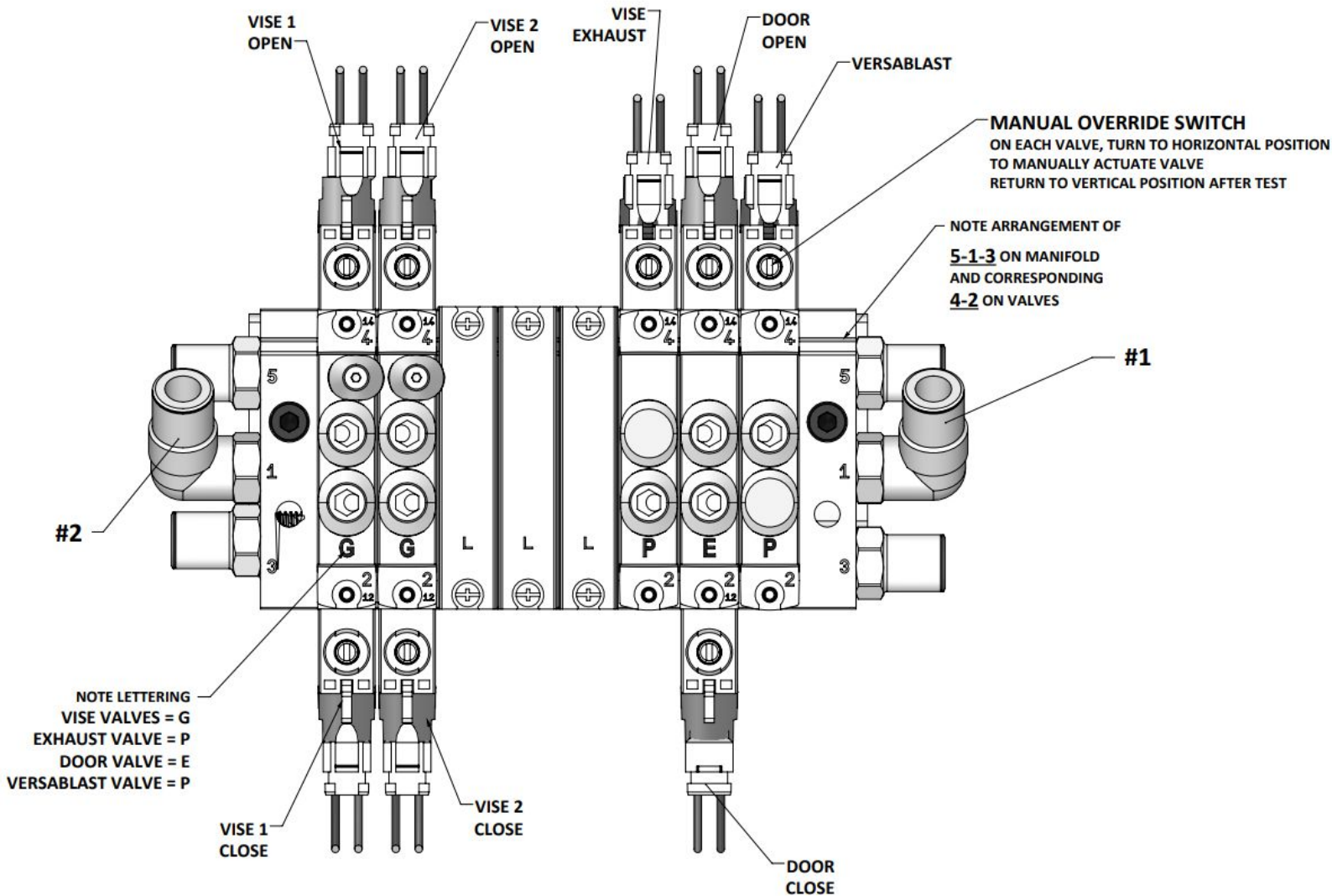
VSC Pneumatics

Inside the VSC, supply air is routed to fitting #1 for:

- **Vise Exhaust Valve**
 - 5 Port 2 Position Solenoid Valve
 - Configured as a 2-position “Normally Open” valve, exhausting air when energized in the “Closed” position.
- **VersaDoor Valve**
 - 5 Port 3 Position Center Exhaust Solenoid Valve
 - Exhausts air to atmosphere when de-energized
- **VersaBlast Valve**
 - 5 Port 2 Position Solenoid Valve
 - Configured as a 2-position “Normally Closed” valve, supplying air when energized in the “Open” position.
- **Note:** systems with Gripper Valves inside the VSC are on the #1 side of the supply air and are equivalent to VersaDoor Valves

Vise Air is routed from the Vise Exhaust valve “Normally Open” port to fitting #2, with a T-Fitting routing air to the Vise Pressure Gauge.

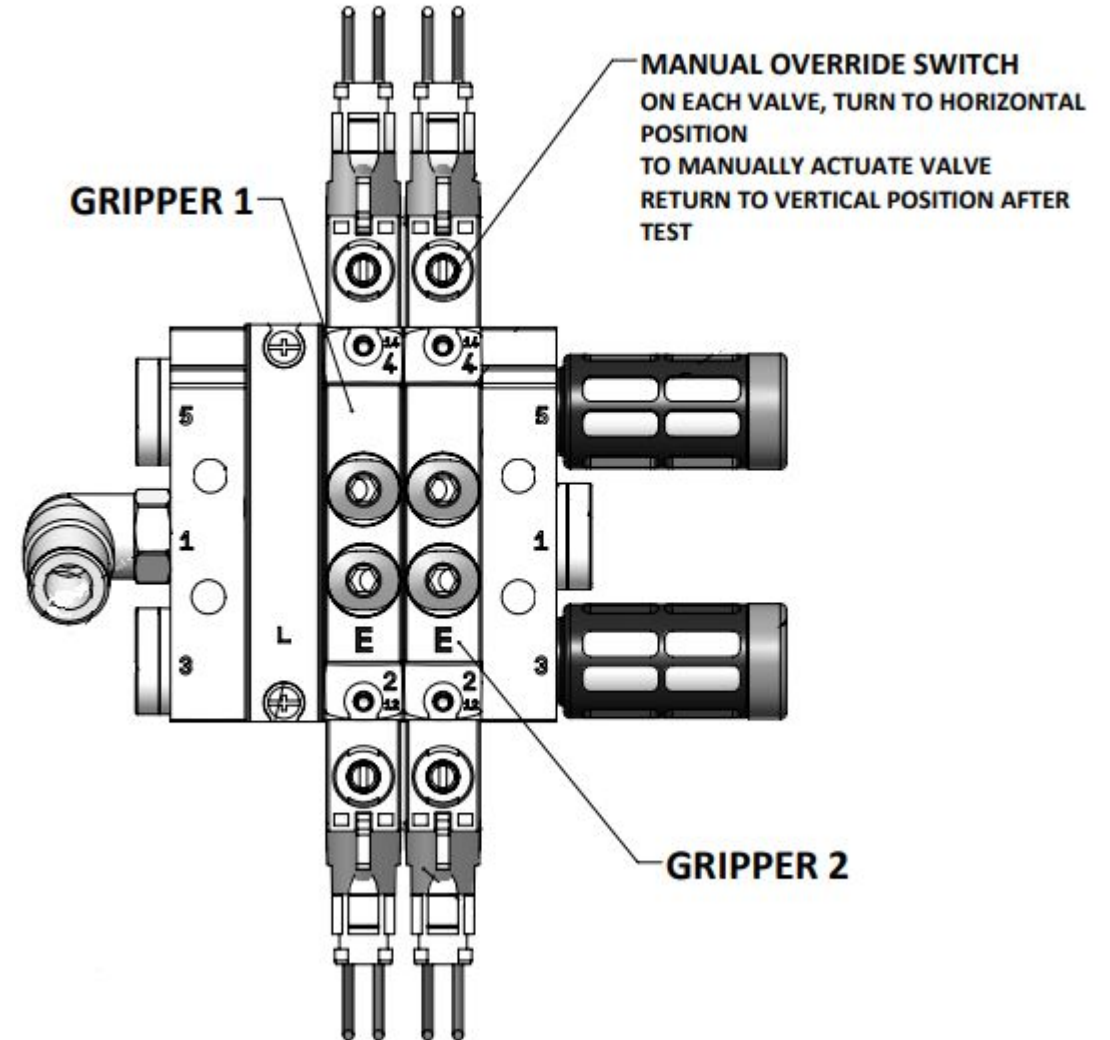
- **Vise Valves**
 - 5 Port 3 Position Center Closed Solenoid Valve
 - Blocks air in and out when de-energized
 - Center closed allows for parallel plumbing with equivalent 3 position center closed hand valve
 - When the Vise Exhaust Valve is activated, pressure to the vises is exhausted and open to atmosphere



Gripper Manifold - Inside Robot Controller

For systems with the Gripper Manifold inside the robot controller, using Robot I/O, supply air is routed to port 1 supply:

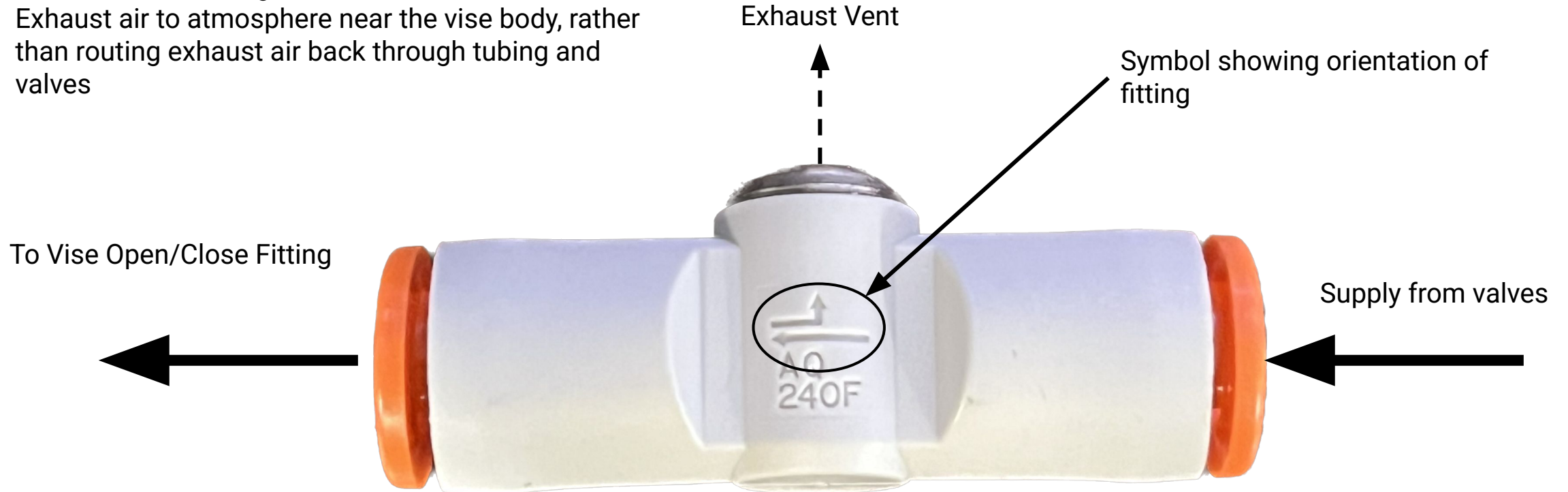
- Gripper Valves
 - 5 Port 3 Position Center Exhaust Solenoid Valve
 - Exhausts air to atmosphere when de-energized
- Note: Refer to the VSC Manifold for systems with Gripper Valves inside the VSC rather than inside the robot controller



Quick-Exhaust Fittings

Quick-Exhaust Fitting:

Exhaust air to atmosphere near the vise body, rather than routing exhaust air back through tubing and valves

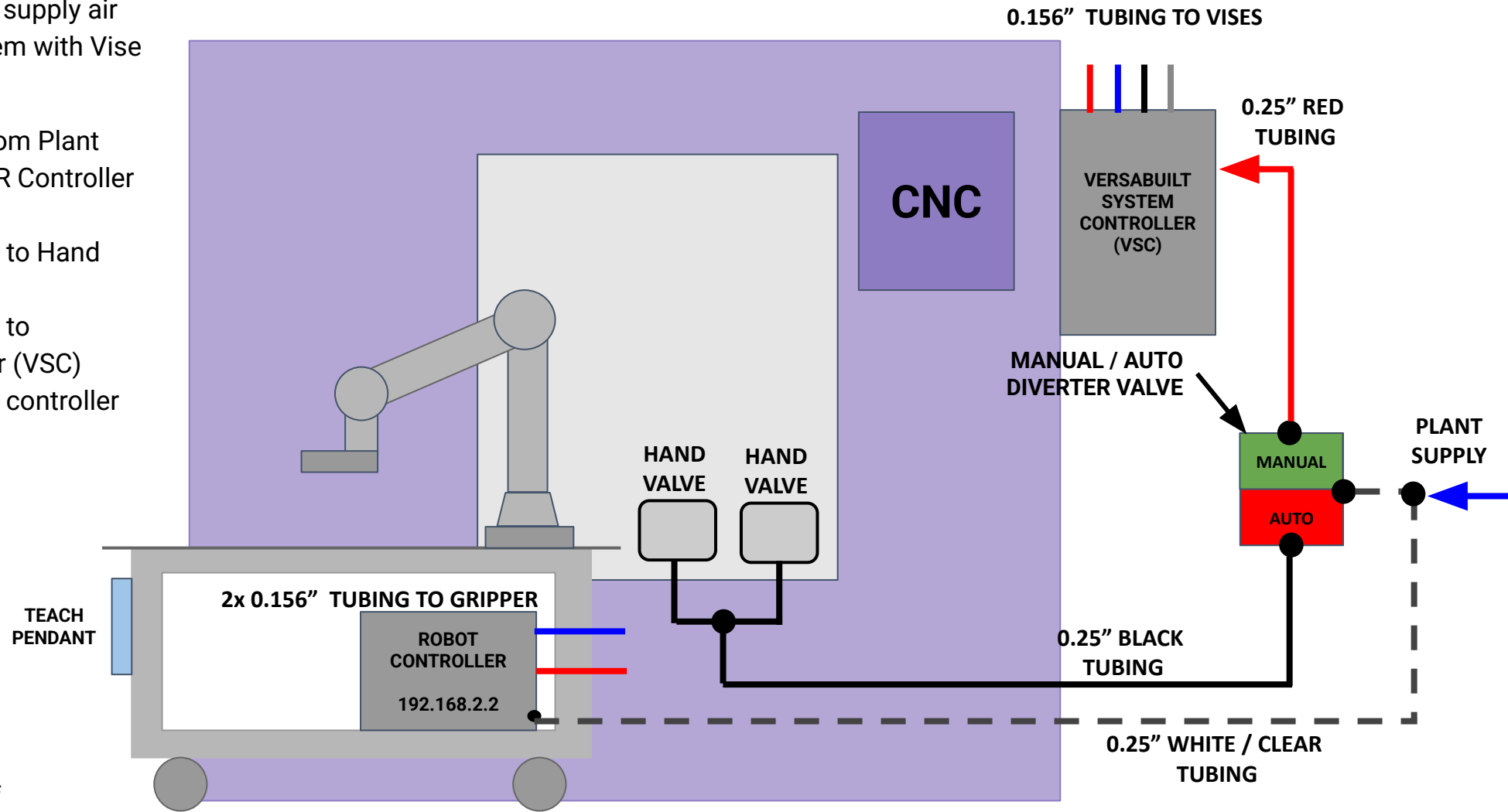


Quick-exhaust increases the speed of vise actuation and reduces complexity of exhaust air routing through devices

MultiGrip Mill System Pneumatics

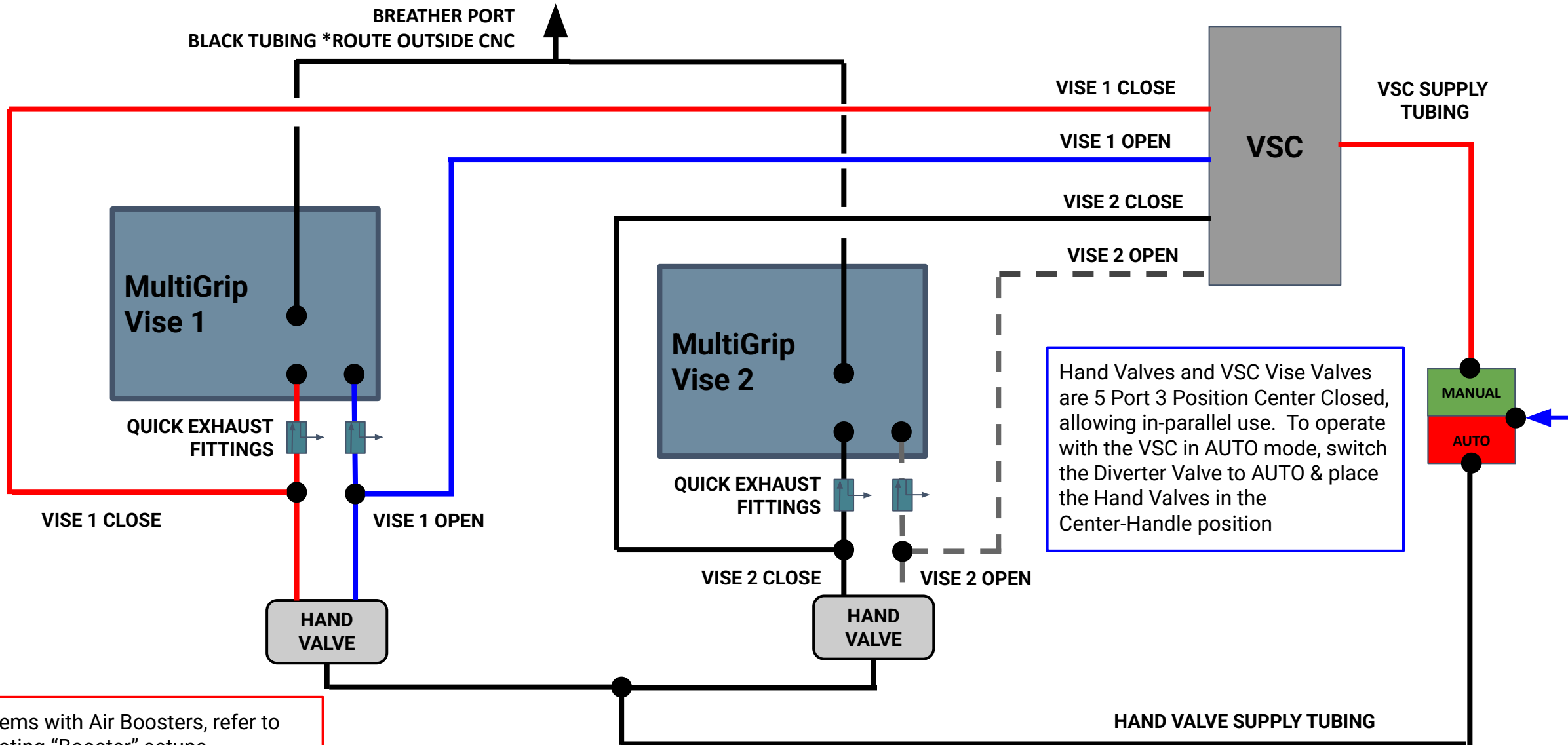
The figure to the right page shows supply air to devices in the Automation System with Vise Hand Valves

- 1/2" tubing to 1/4" tubing from Plant Supply to Diverter Valve & UR Controller for Gripper Valve supply
- 1/4" line from Diverter Valve to Hand Valves inside CNC*
- 1/4" line from Diverter Valve to VersaBuilt System Controller (VSC)
- 2x 5/32" air lines from robot controller to MultiGrip Gripper

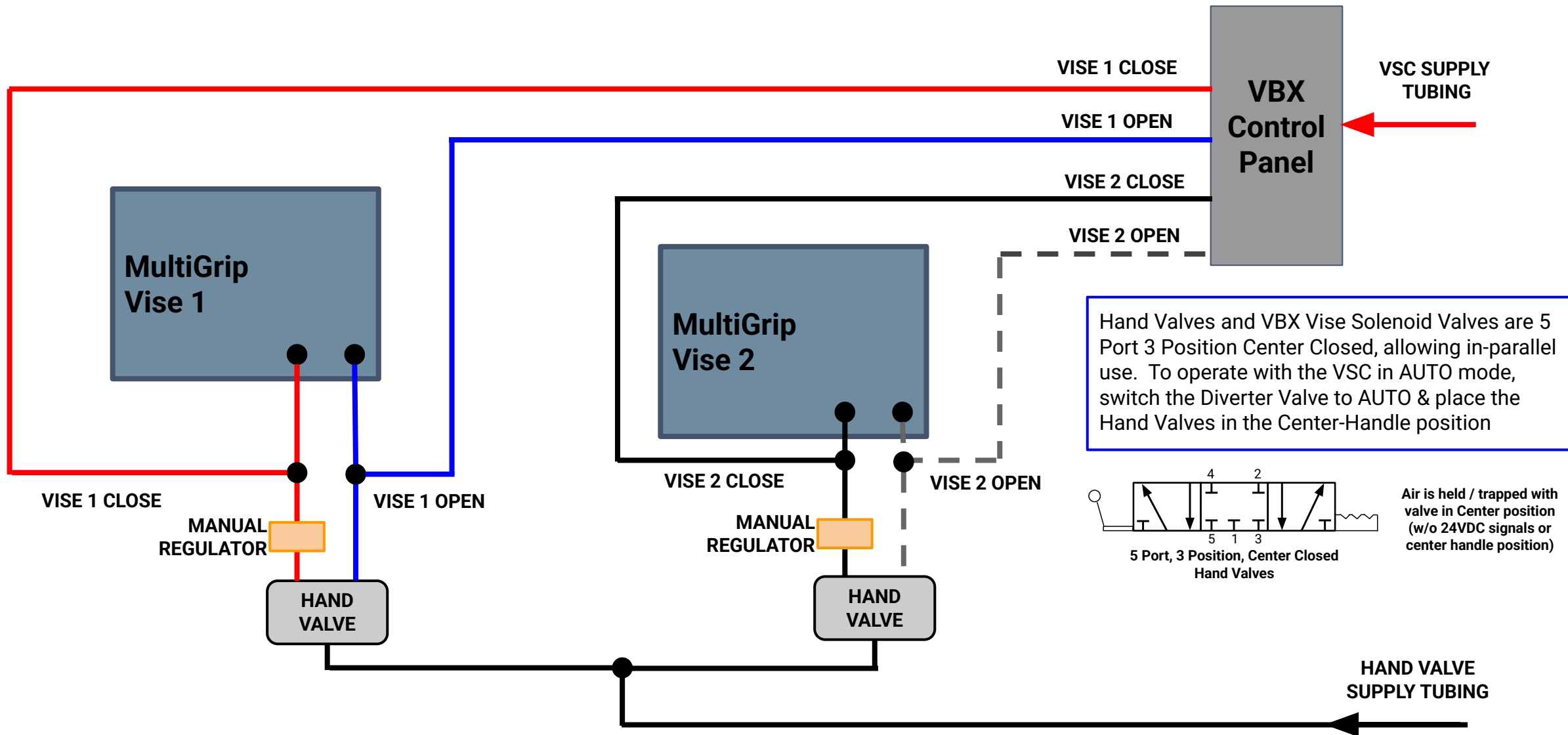


*Air line from Diverter Valve to Hand Valves is typically routed thru the top of the CNC, and tee'd to each vise hand valve.

MultiGrip Vise Tube Routing - 2x Vises



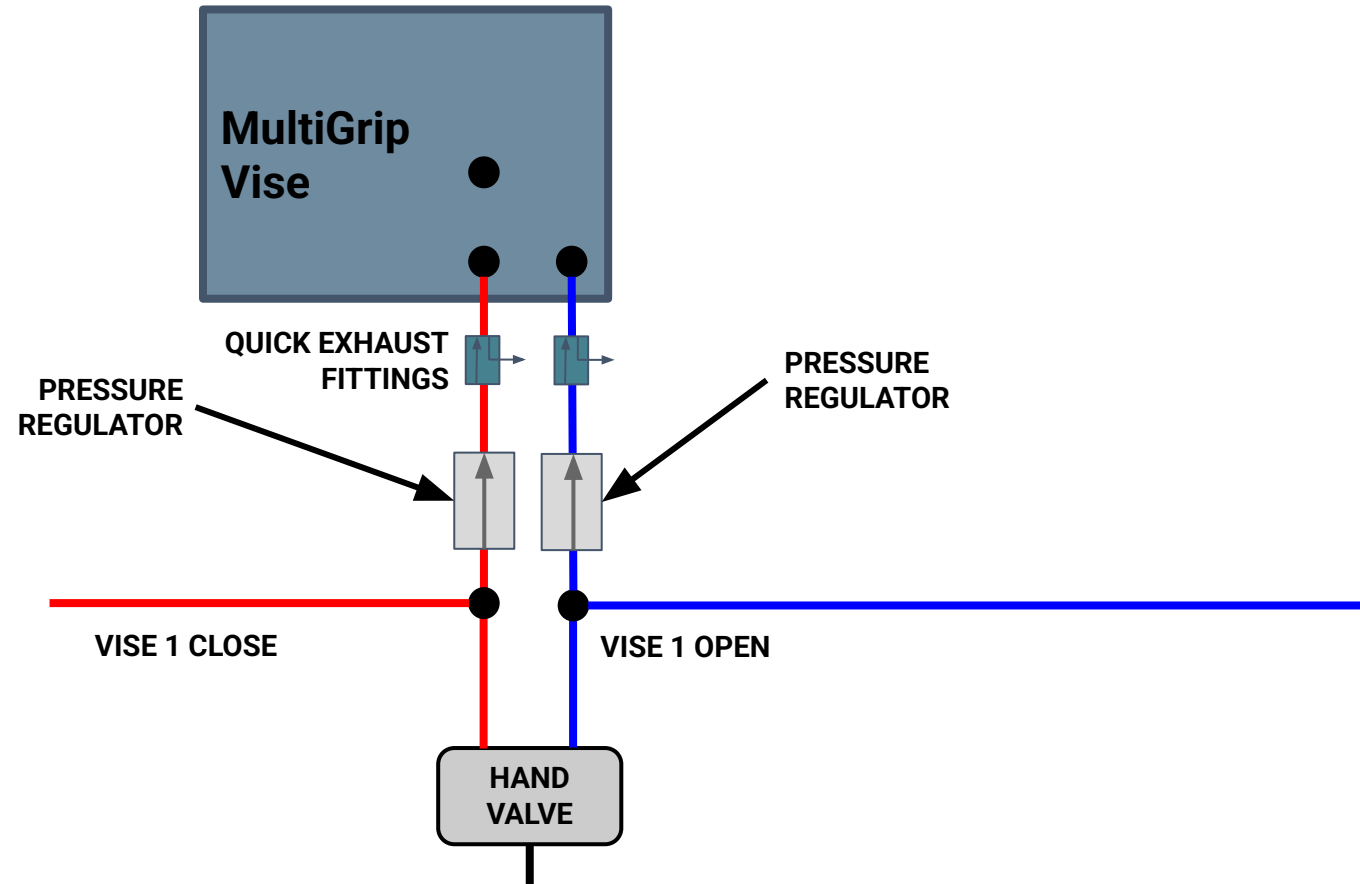
MultiGrip Vise Tube Routing - 2x Vises (Legacy VBX)



Vises - Adding Manual Pressure Regulators

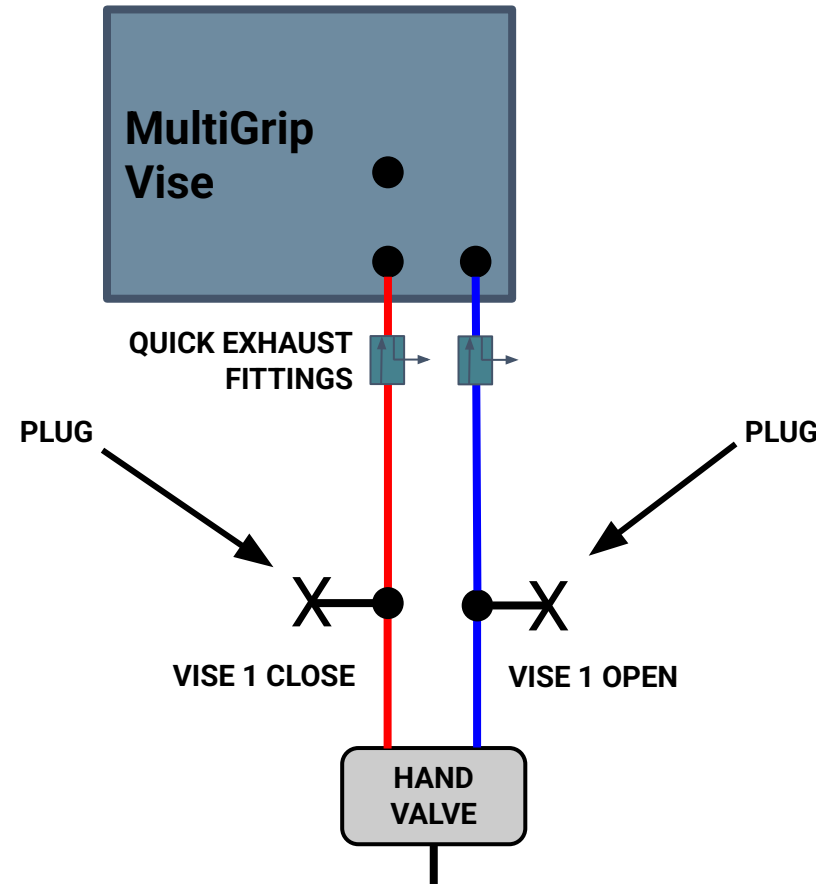
When adding a Manual Pressure Regulator, insert device between:

- T-Fitting connecting air lines from the VSC & the Hand Valve
- AND
- Quick Exhaust Fittings



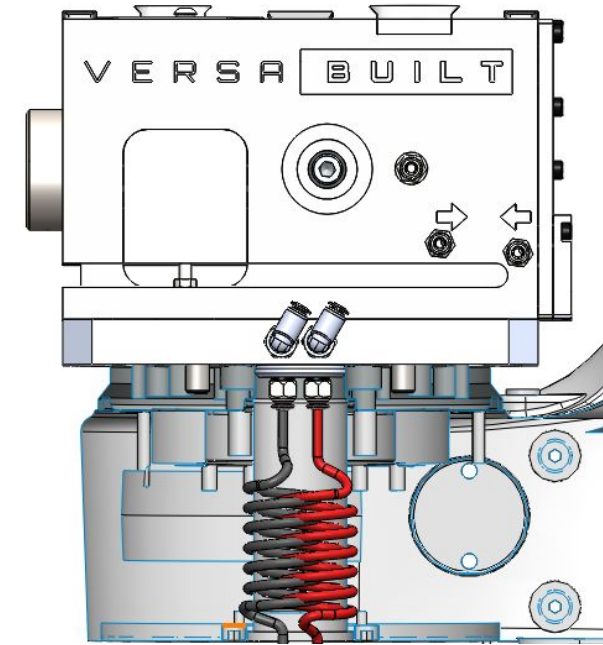
Vises - Manual Operation before VSC installation

When setting up for manual prove-out, without the VSC air-lines connected, add or keep the provided push-to-connect plug on the VSC side of the T-Fitting between the hand valve and the Quick Exhaust Fittings



4th and 5th Axis Rotary - Tube Routing

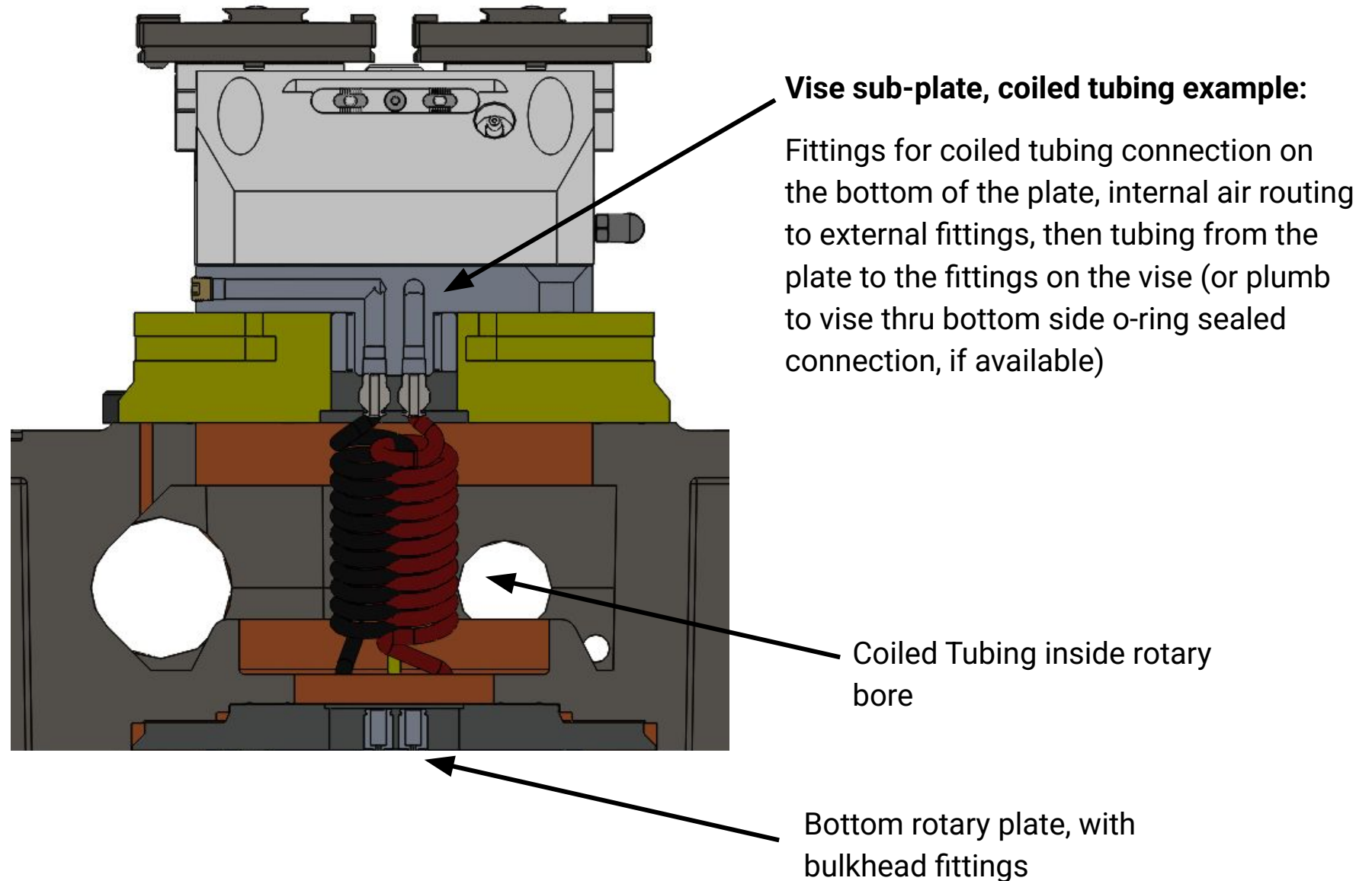
- There are 2 options for vise tube routing with 4th and 5th Axis Rotary setups
 - Rotary Union
 - Coiled Tubing with Axes Limits
- Rotary Union:
 - If available or standard with the rotary, a 2 port rotary union can make the routing of air to the vise simple. Minimum of 2 ports are needed for MultiGrip Vises. A rotary union also allows for continuous axes rotation.
 - Typically, a custom vise adapter plate from the vise to the platter, with tubing connections is required.
- Coiled Tubing:
 - With a bottom rotary plate, with bulkhead fittings and vise adapter to the platter, coiled tubing can be connected inside the rotary bore and accommodate non-continuous rotation.
 - Revise the CNC settings to limit the axes to 720° of rotation.



Coiled Tubing Example

Haas CNC Settings - [312 – Min User Travel Limit C](#)

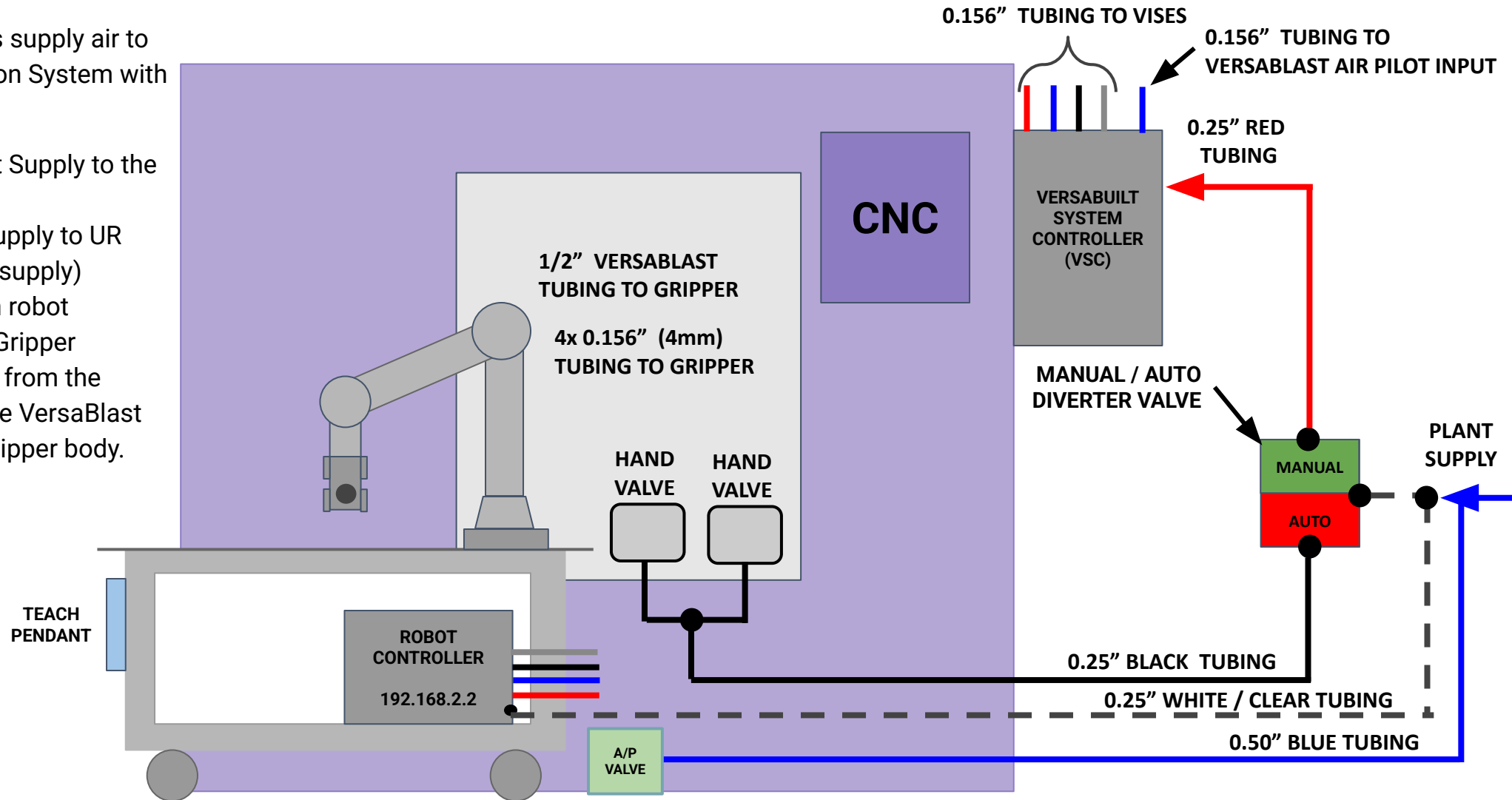
4th and 5th Axis Rotary - Coiled Tubing Example



DuoGrip Mill System Pneumatics

The figure to the right shows supply air to devices in the Mill Automation System with DuoGrip.

- 1/4" tubing from Plant Supply to the VSC
- 1/4" line from Plant Supply to UR Controller (gripper air supply)
- 4x 5/32" air lines from robot controller to DuoGrip Gripper
- 1x 1/2" to 1/4" air line from the VersaBlast Valve to the VersaBlast Air Amplifier on the Gripper body.



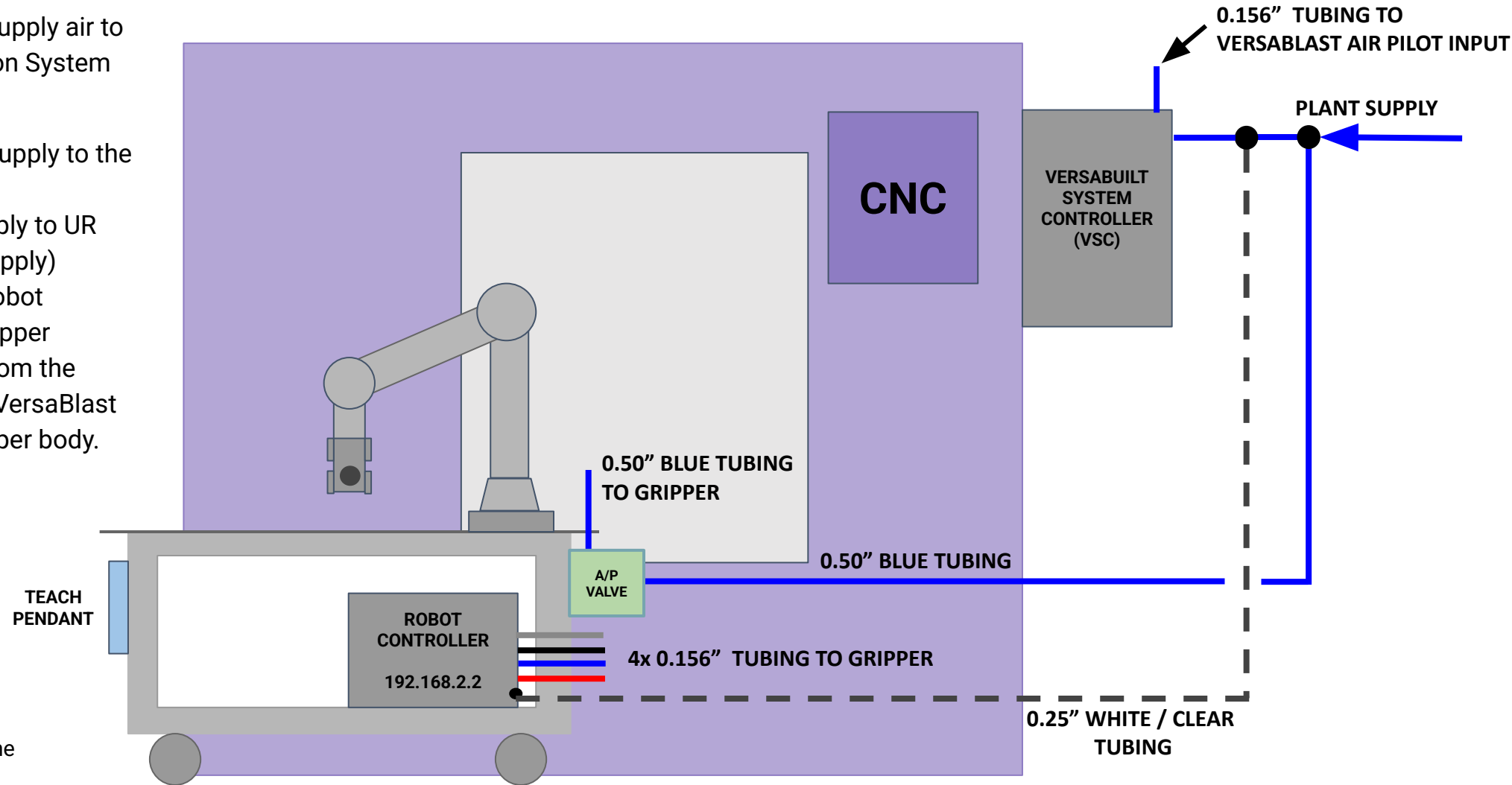
Notes:

- Vises and hand valves sold separately
- VersaBlast diagram shown on the following pages

DuoGrip Lathe System Pneumatics

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

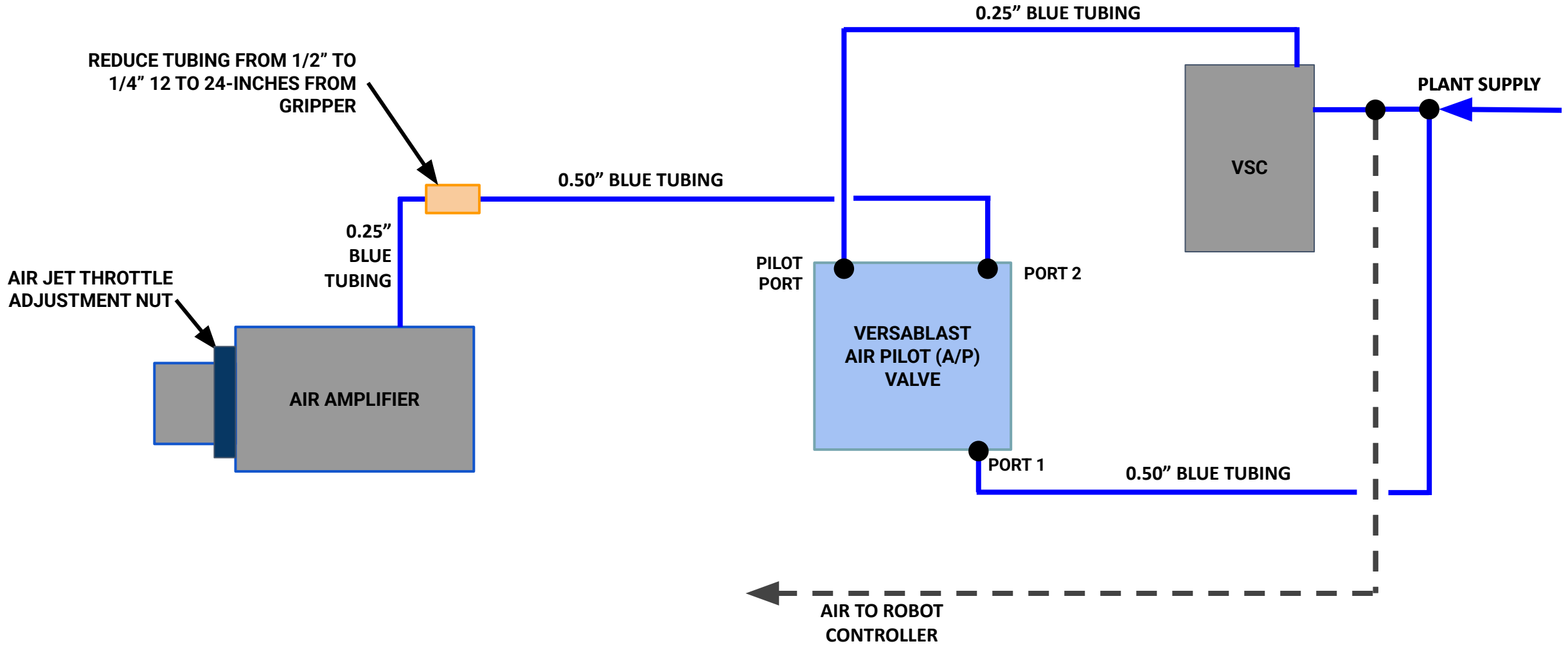
- 1/4" tubing from Plant Supply to the VSC
- 1/4" line from Plant Supply to UR Controller (gripper air supply)
- 4x 5/32" air lines from robot controller to DuoGrip Gripper
- 1x 1/2" to 1/4" air line from the VersaBlast Valve to the VersaBlast Air Amplifier on the Gripper body.



Notes:

- VersaBlast diagram shown on the following pages

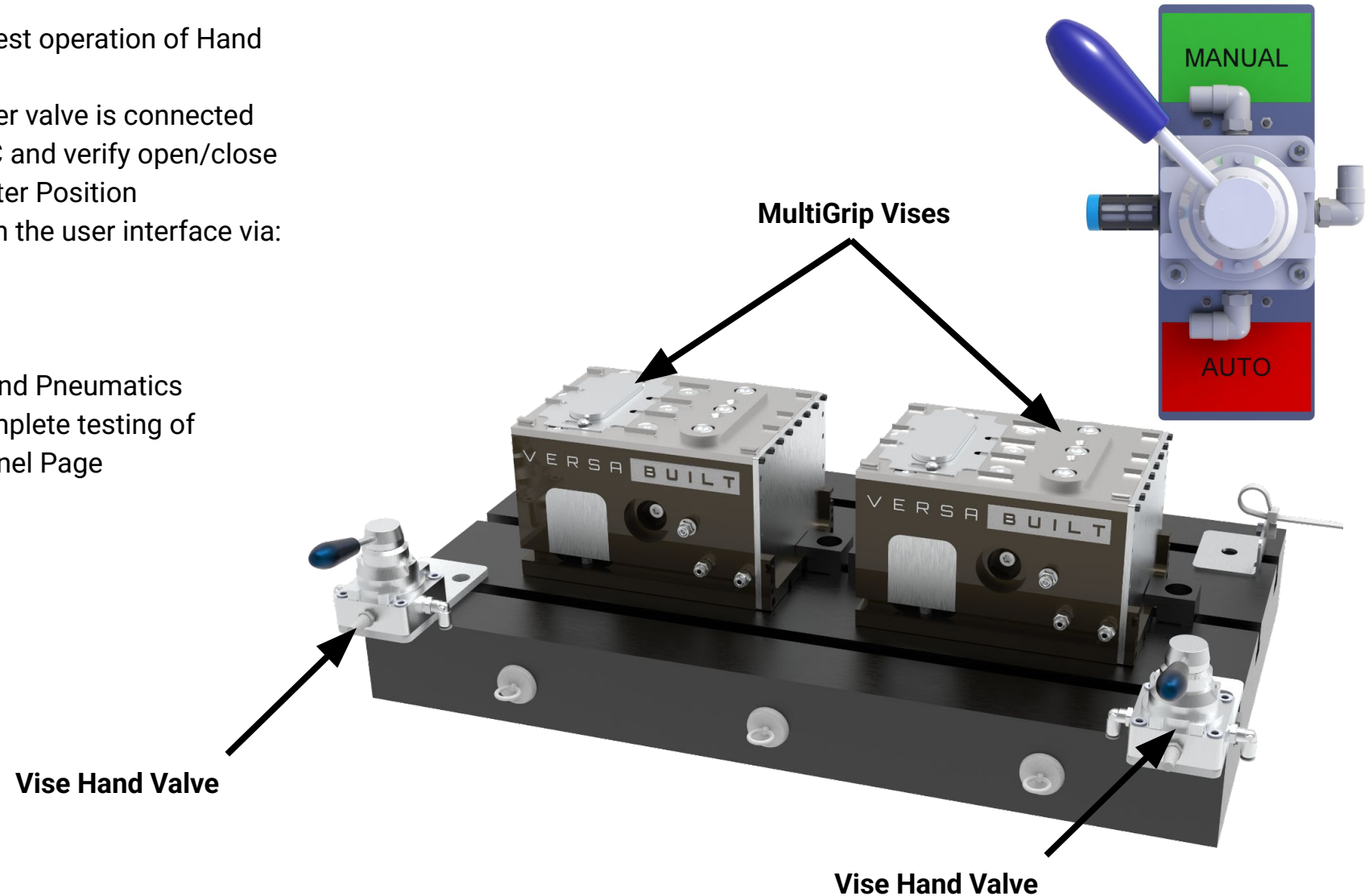
VersaBlast Pneumatics



Mill System - 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
- Testing of devices can be completed with the user interface via:
 - Home Page - Recovery Panel
 - Calibration Page - Recovery Panel
 - I/O Panel Page
 - Refer to the "Electrical, I/O and Pneumatics Manual" for guidance of complete testing of components with the I/O Panel Page

Hand Valves and VSC Vise Valves are 5 Port 3 Position Center Closed, allowing in-parallel use. To operate with the VSC in AUTO mode, switch the Diverter Valve to AUTO & place the Hand Valves in the Center-Handle position



Vise Air & Cable Routing In/Out of CNC

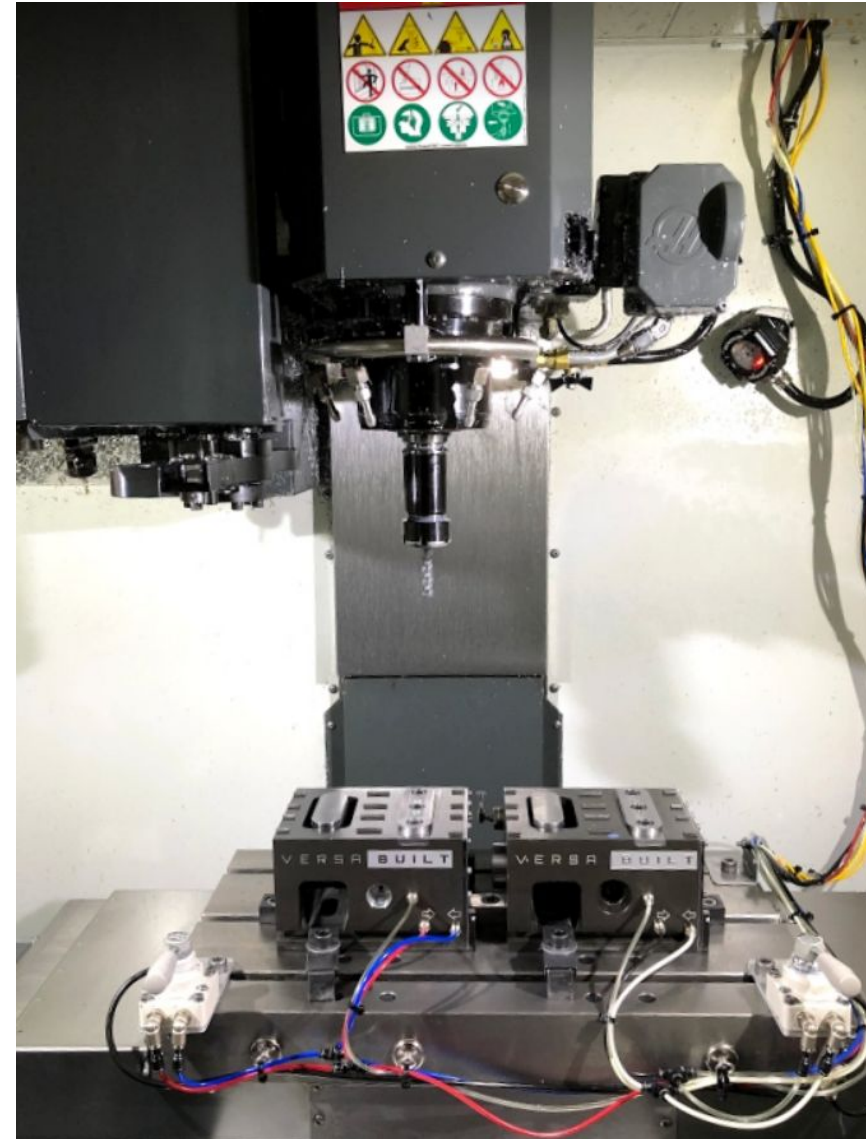
- Secure cables and tubing to Air Line Anchor Kit (for MultiGrip Vise applications), leaving slack in all lines to prevent strain and undue stress during table movements
- Bundle lines together with cable ties and route lines out of the top of the CNC thru an access hole
- Test tube and cable length 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



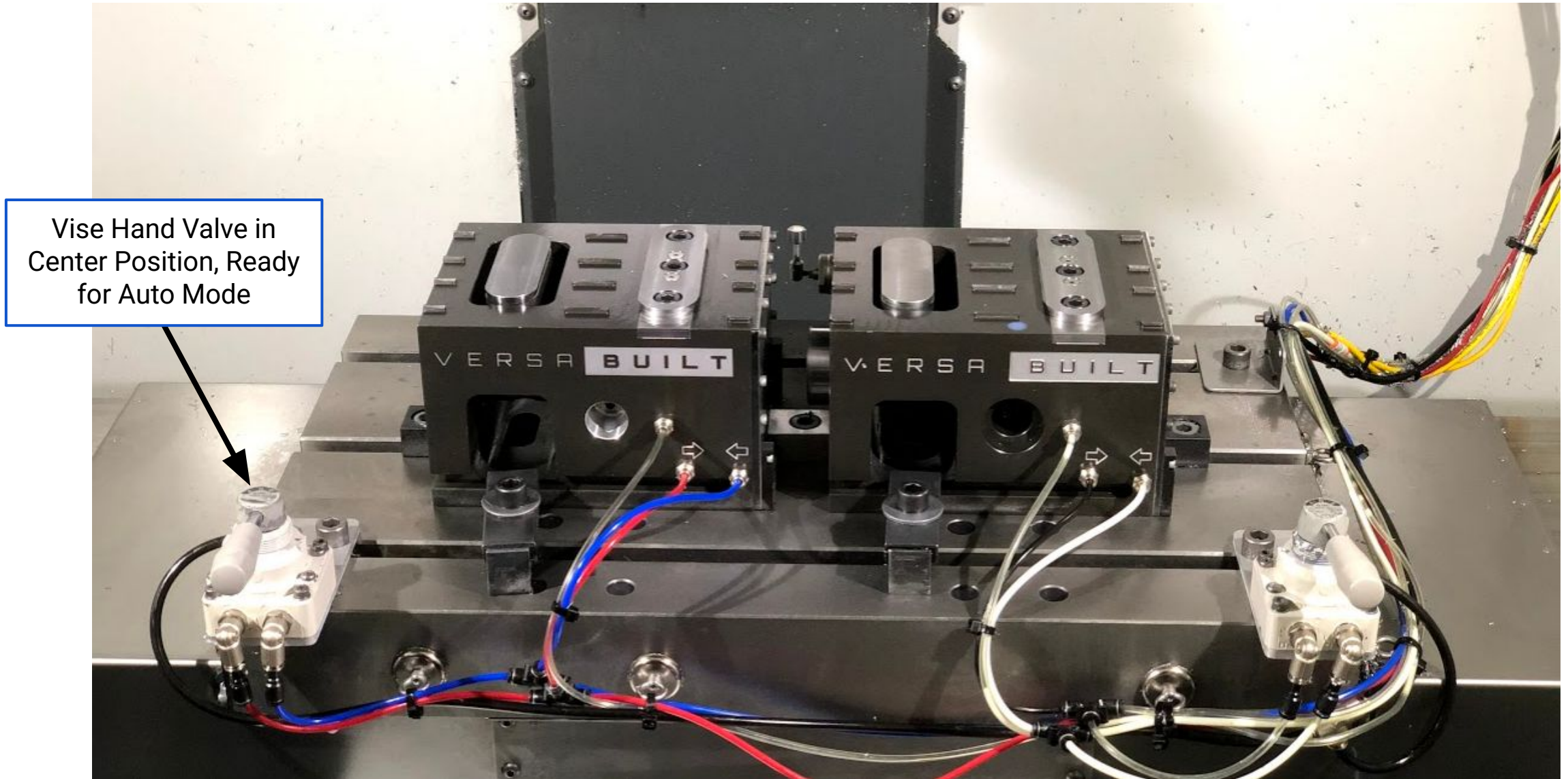
Vise Air & Cable Routing In/Out of CNC

Refer to the image to the right and on the following page for guidance on tube and cable routing inside the CNC.

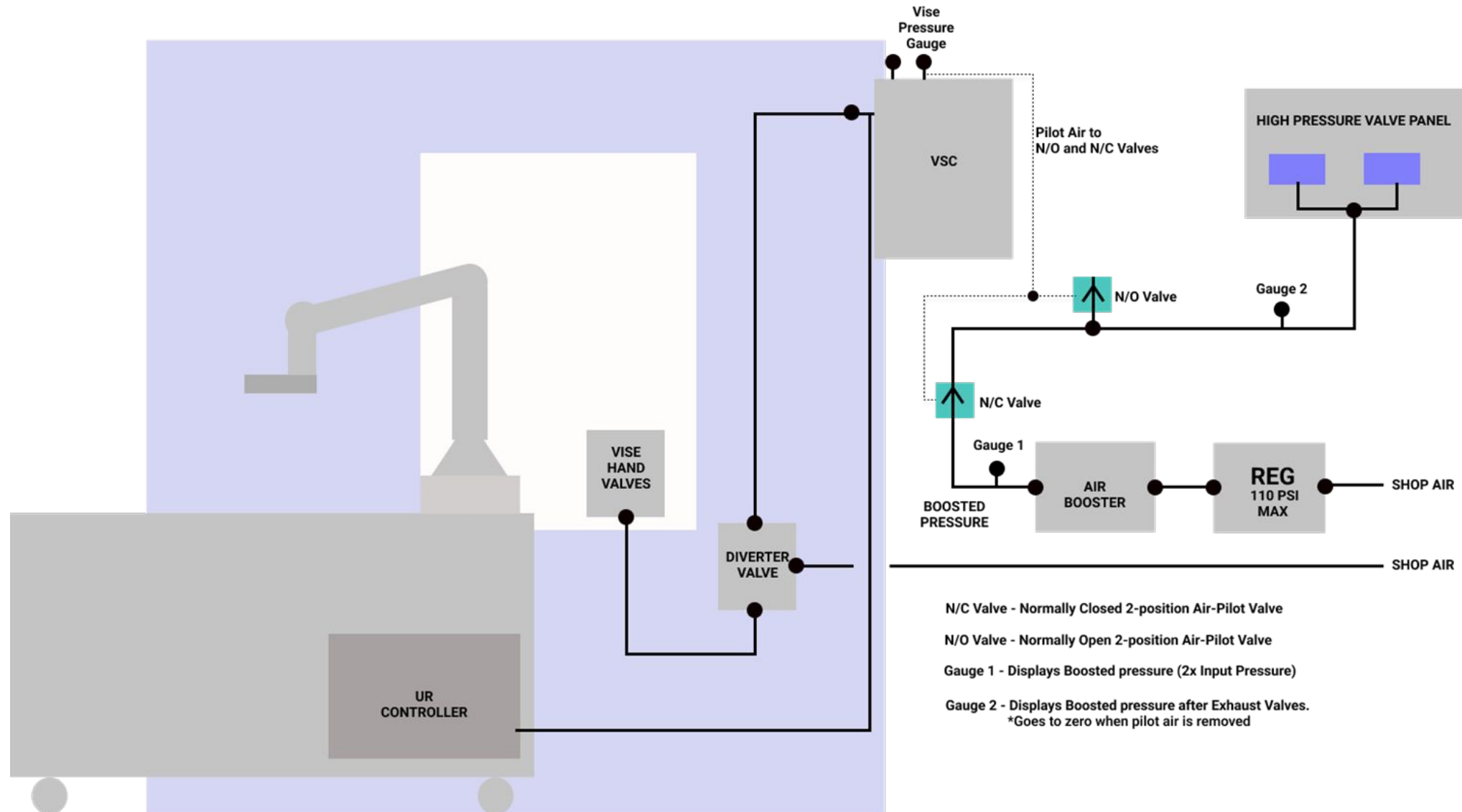
- Use provided magnets with loops and cable-ties to route air-lines along the front and side of the CNC table.
- Anchor tubing and cables on the back corner of the table with the provided CNC Air Line Anchor Kit (aluminum angle, fasteners and cable-ties).
- Route air and cable lines out the top of the CNC, with lines and cables bundled and held together with cable-ties.



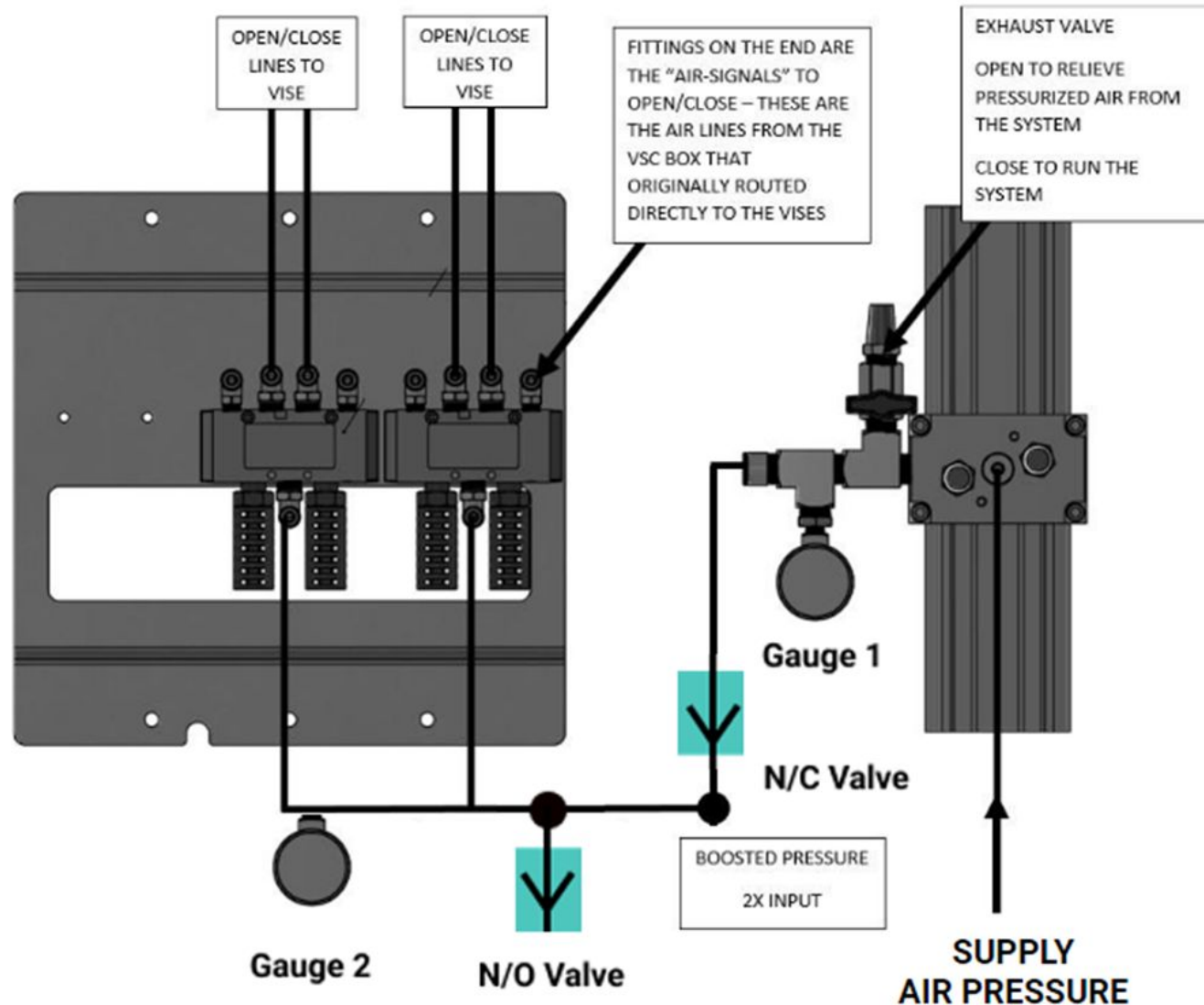
Vise Air & Cable Routing In/Out of CNC



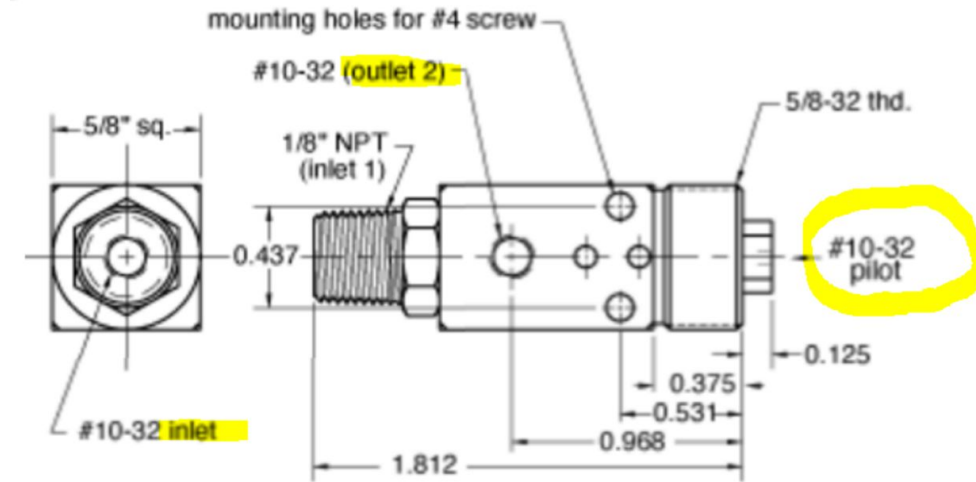
Automation Setup: 2x Vises with Air Booster



Automation Setup: 2x Vises with Air Booster

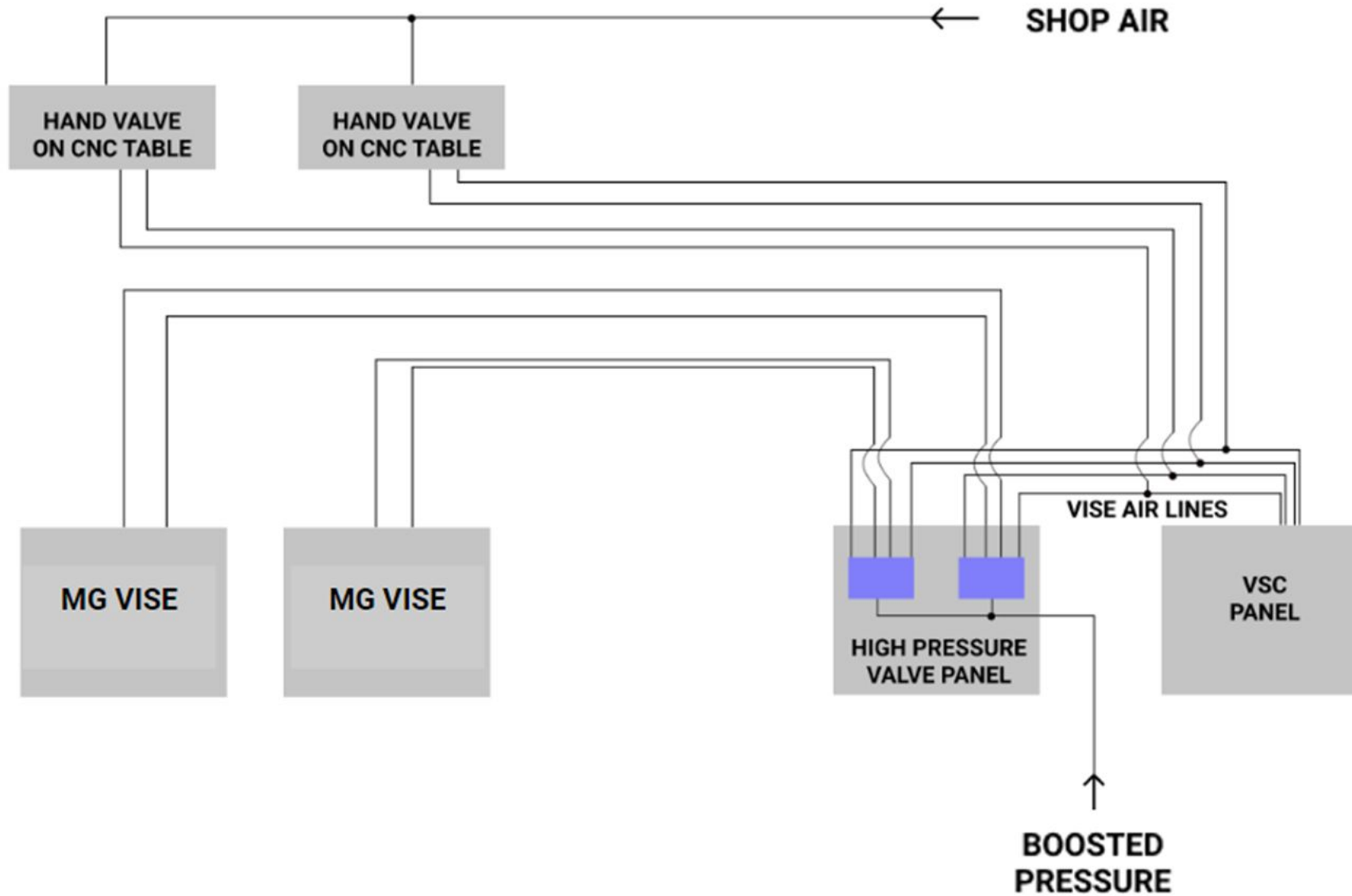


N/C and NO valve



- Gauge 1 shows the boosted pressure value (2x supply to the booster)
- Gauge 2 shows the vise pressure (when exhausted, this & the VSC vise gauge should be zero, when pressurized it should match Gauge 1)
- N/O valves are "Normally Open" valves – without pilot air, the valve is open
- N/C valves are "Normally Closed" valves – without pilot air, the valve is closed
- Note the Inlet, Outlet & Pilot port locations on the NO & NC valves

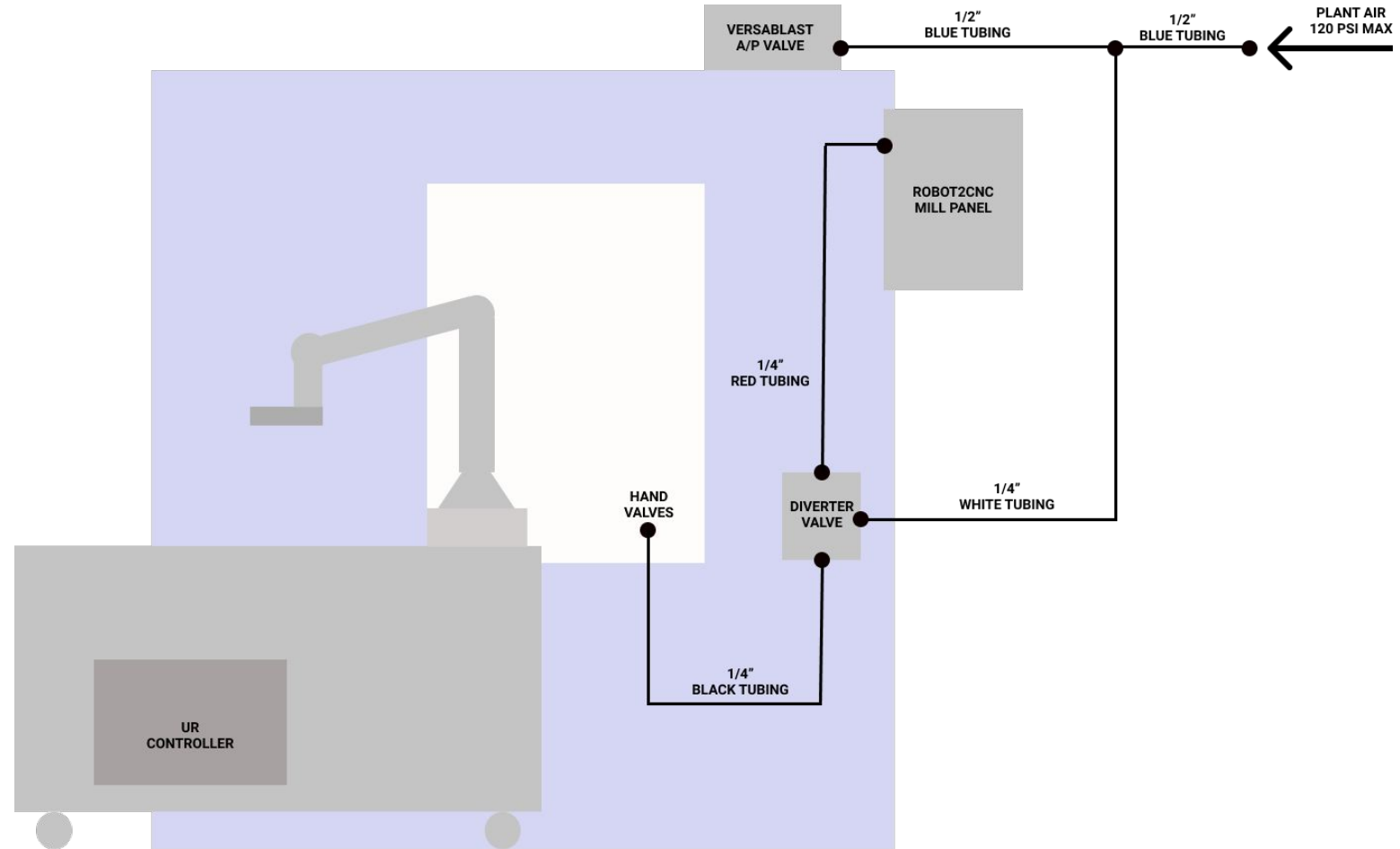
Automation Setup: 2x Vises with Air Booster



*Gripper valves inside VSC

For Systems shipped prior to April 2023

*April 2023 and after systems include
Gripper Valves inside the UR Controller



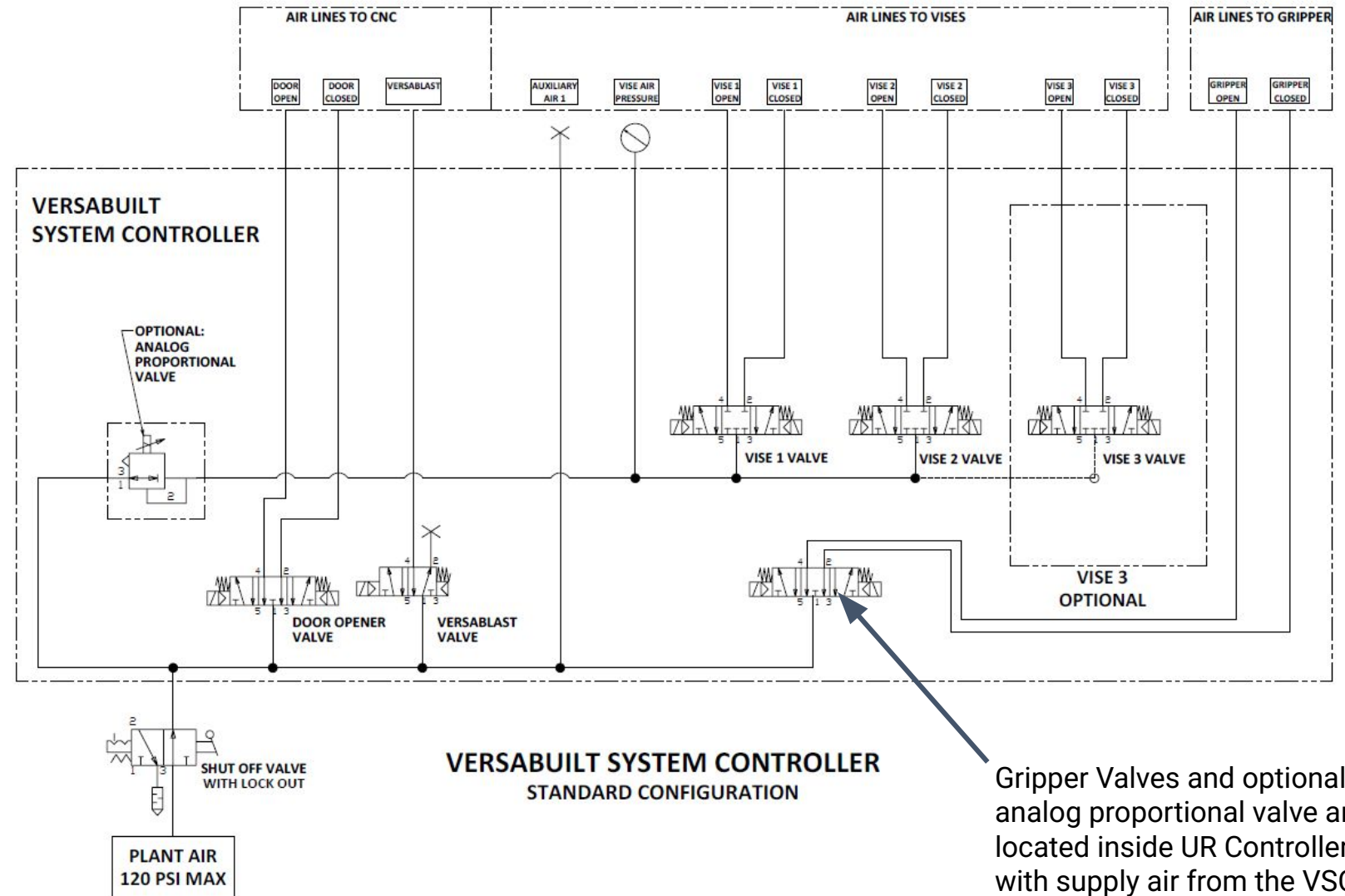
Pneumatic Schematics - VSC

Schematic shows inside detail of
VersaBuilt System Controller, including:

- 24VDC solenoid valves
- Vise valves are 5 port, 3 position, center closed
- Gripper valves are 5 port, 3 position, center exhaust*
- Door valve is 5 port, 3 position, center exhaust
- VersaBlast signal valve is 5 port, 2 position
- Optional:
 - Vise 3 Valve
 - Vise 4 Valve

*Gripper valves are located inside UR controller

*Not shown is Vise exhaust valve, which exhausts all pressure to vises when signal is provided to the valve

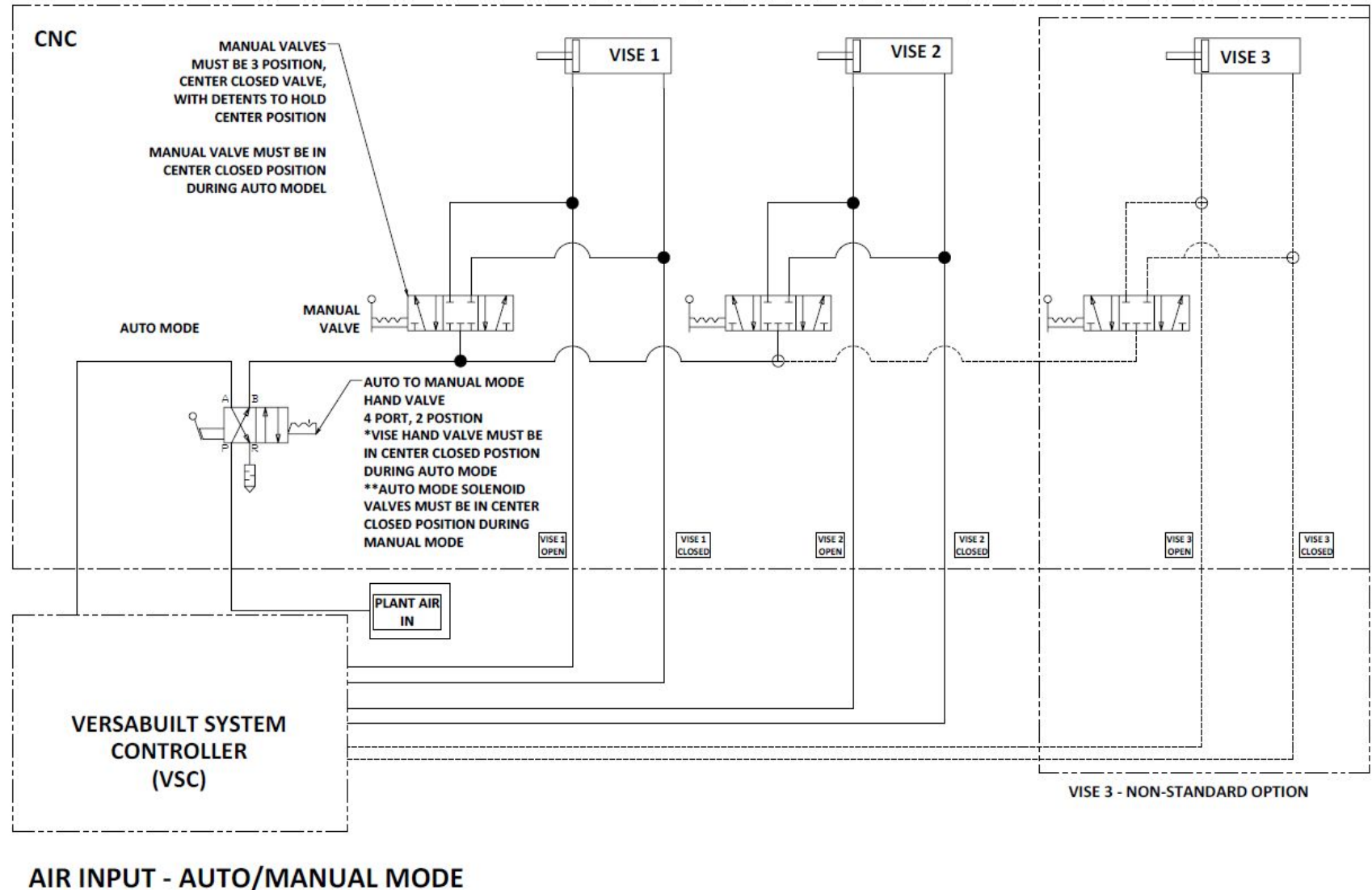


Gripper Valves and optional analog proportional valve are located inside UR Controller, with supply air from the VSC

Pneumatic Schematics - Auto/Manual Switch

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

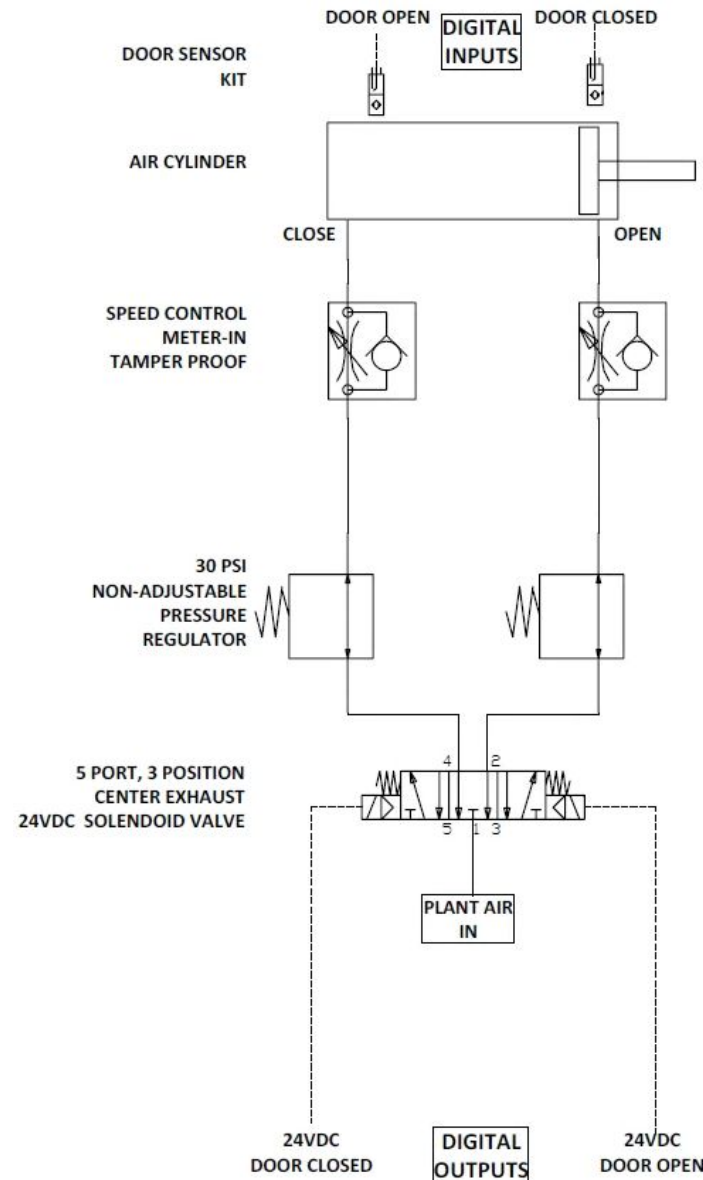
- The Diverter valve is a 2 position valve that will relieve downstream air on the unused side of the valve (when in manual mode, air to the VSC panel is exhausted, and when in auto mode, air to the manual valve is exhausted).
- A manual valve is used for each vise, with lines tee'd into the vise lines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



Pneumatic Schematics - VersaDoor (single)

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.

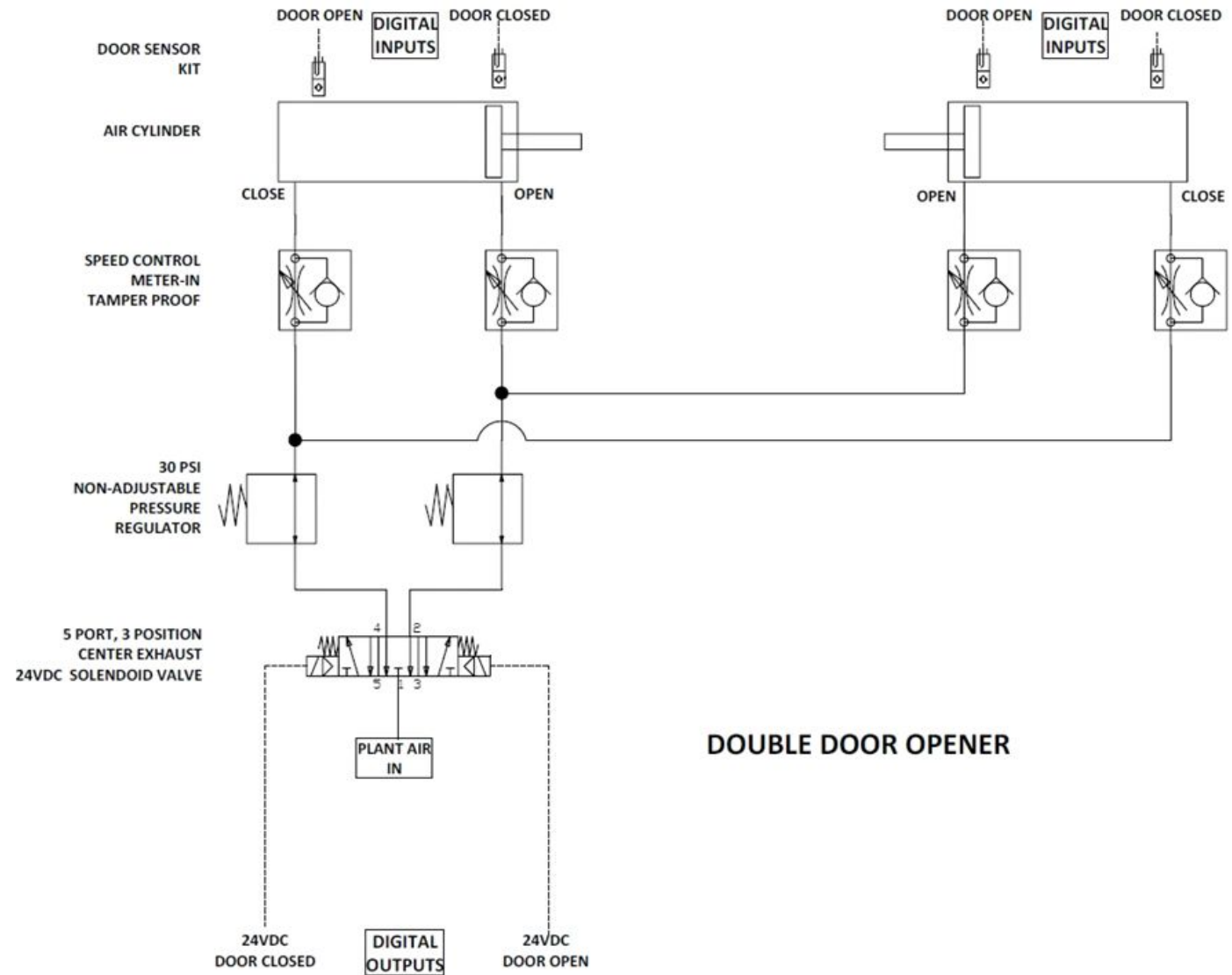


SINGLE DOOR OPENER

Pneumatic Schematics - VersaDoor (double)

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

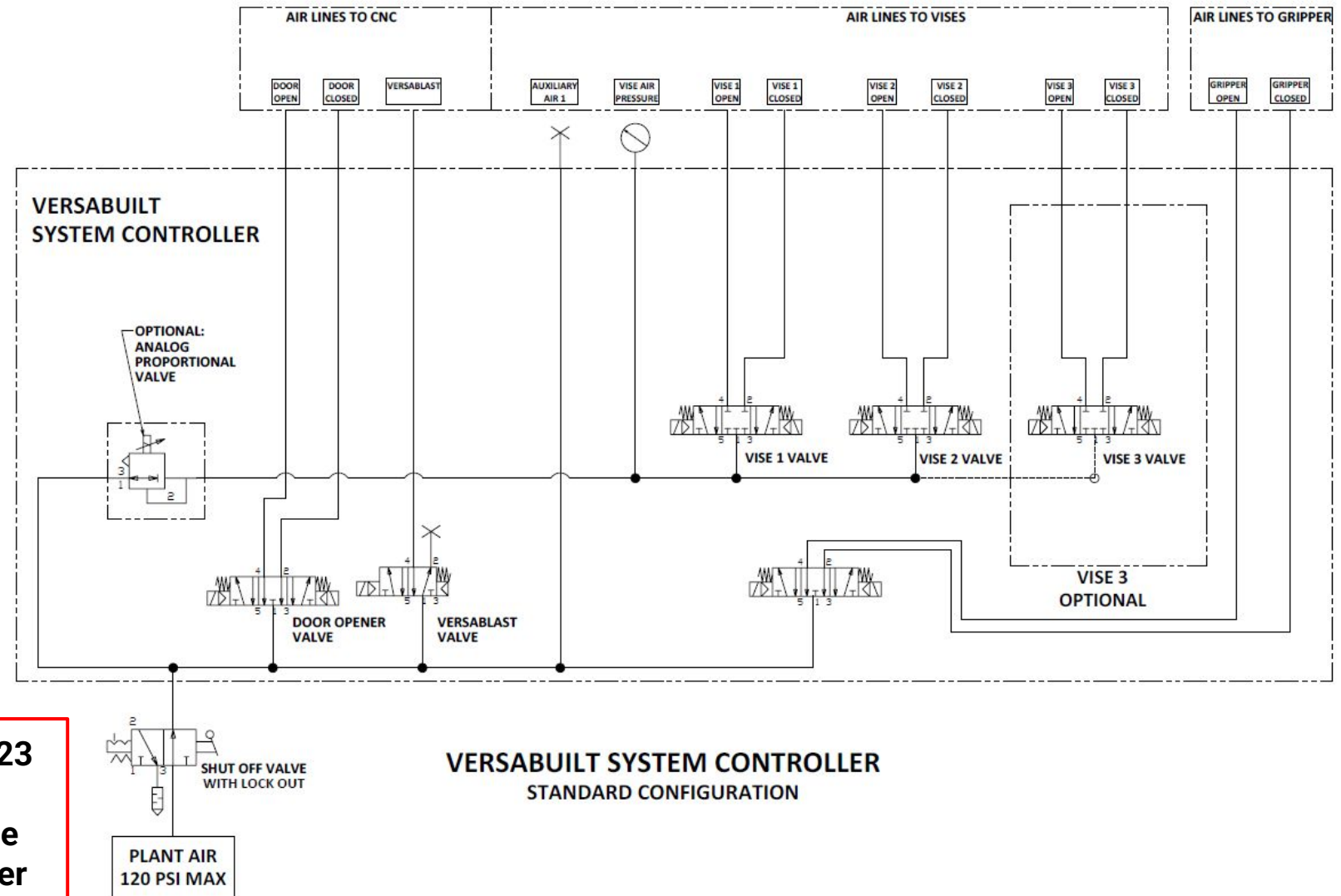
- Double door application is nearly equivalent to single door application, with exception of additional door actuator, 2x 30 PSI regulators, 2x door sensors, and 2x tee fittings to connect second door actuator with open/close signals.



Pneumatic Schematics - VSC (Gripper Valves in VSC)

Schematic shows inside detail of
VersaBuilt System Controller, including:

- 24VDC solenoid valves
- Vise valves are 5 port, 3 position, center closed
- Gripper valve is 5 port, 3 position, center exhaust
- Door valve is 5 port, 3 position, center exhaust
- VersaBlast is 5 port, 2 position
- Optional:
 - *Analog Proportional Valve for Vises to control pressure from 0 PSI up to the supplied plant pressure*
 - Vise 3 Valve



For Systems shipped prior to April 2023

***April 2023 and after systems include
Gripper Valves inside the UR Controller**

VERSABUILT ROBOTICS