



VBX Series Operator's Manual

Use and Applications

Revised July 2021

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VBX-160 Safety

Section 1

VBX-160 Safety

1. Safety Warnings
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3. Lockout/Tagout
4. Pneumatic Lockout/Tagout
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6. Testing Safety Interlocks

Safety Warnings

Safety Warnings:

DANGER: The VBX-160 operates on high voltage. Working with high voltage equipments entails a possible lethal hazard. To avoid injuries or death, read, understand and follow all safety instructions included with the VBX-160 including this manual and the Robot manufacture manuals included with the VBX-160

DANGER: The VBX-160 uses a high-speed 6-axis industrial robot. The robot can move suddenly, quickly and with force sufficient to cause serious or fatal injuries. Before operation, ensure that all VBX-160 and CNC safety systems are performing properly and that guarding sufficient to prevent any part of an operator's body from entering into the path of the robot's movement are securely in place.

VBX-160 Safety Warnings

Safety Warnings:

DANGER: The VBX-160 uses a compressed air supply to operate an air knife, the robot gripper and the CNC vises. When performing maintenance on the VBX-160 or inside the CNC, or anytime an operator can gain access to the inside of the VBX-160 or the CNC, pneumatic energy should be released. See the Lockout Tagout procedure below.

DANGER: Pinch points that could cause a serious injury may exist at the VBX-160 doors, between the CNC door and the VBX-160 and when the VBX-160 is pivoted away from or towards the CNC. Use caution when opening or closing the VBX-160 doors, when the VBX-160 is operating in automatic mode, or pivoting the VBX-160 away from or towards the CNC to prevent a pinching injury.

VBX-160 Safety Warnings

Safety Warnings:

DANGER: When operating the VBX-160 vises in manual machining mode using the hand valves, a crushing hazard exists. Travel of the vise jaws from the open to the closed position is 16mm allowing a finger or other body part to get trapped and then crushed when the vise is actuated. Manual machining mode and operation of the vises using the hand valves should only be done by trained operators, according to the procedures in this manual. Never actuate a vise with any body part touching any part of the vise or any object on the vise.

Safety Practices

- When the VBX-160 and CNC are not in use, secure the VBX-160 to the gate post, turn off power and pneumatic supply to the VBX-160
- If manual operation of the CNC is necessary, the pneumatic supply to the VBX-160 PLC must be Locked Out and Tagged Out (see Lockout Tagout procedure below)
 - See Section 7.6 for instructions on enabling Manual Machining Mode
- Never override any safety interlocks on the VBX-160 or the CNC
- Never operate the VBX-160 if any safety panels are missing; it should not be possible for a person to put any part of their body in a position in which any part of the robot or what the robot is holding could contact a person
- Only trained and authorized personnel should

Lockout Tagout

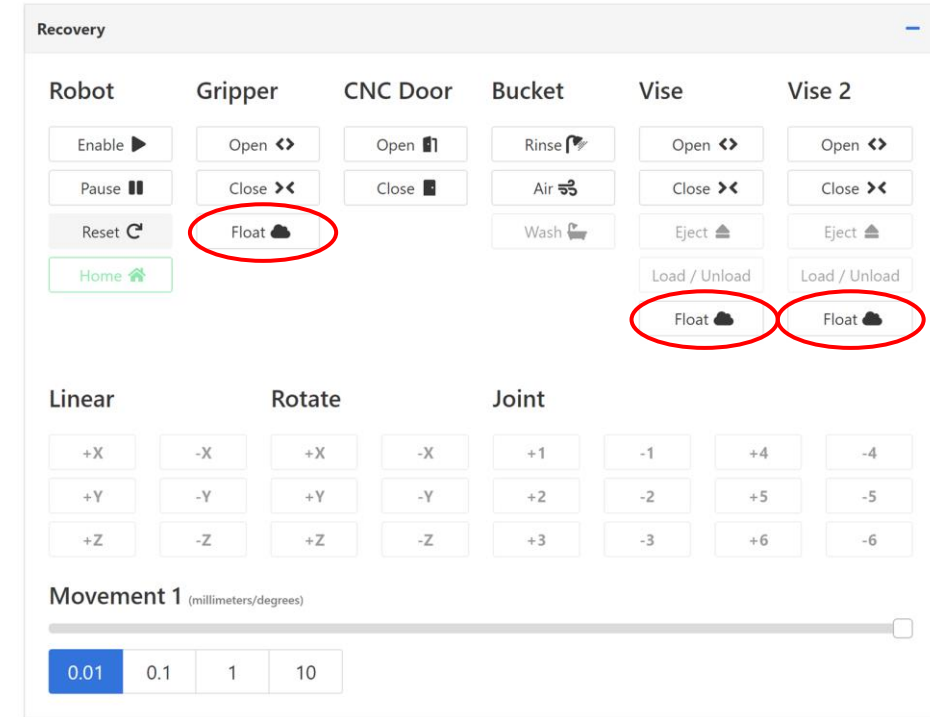
- AWR recommends the guidelines presented in this procedure to perform Lockout-Tagout when servicing or maintaining the VBX-160.
- Please reference the OSHA standard for “The Control of Hazardous Energy (Lockout/Tagout) (29 CFR 1910.147)”
- VBX-160 Sources of Energy:
 - Air pressure supply
 - Typical pressure 120psi
 - Affected devices:
 - Robot Gripper
 - Vises
 - Chucks
 - Door Opener (optional)

Lockout/Tagout

- VBX-160 Sources of Energy (continued):
 - Electrical
 - 230 VAC, 1 phase
 - Affected devices:
 - Robot
 - Water pump
 - Computer Monitor
 - Computer
 - Power Disconnect
 - Power Distribution
 - PLC
 - Network switch
 - 24VDC peripheral devices

Pneumatic Lockout/Tagout

- VBX-160 Pneumatic Lockout/Tagout
 - Make sure the VBXC and the CNC are idle
 - Enter Recovery mode on the VBXC
 - Press the Float button on the Gripper and all Vises
 - Release the red pneumatic shut-off valve located on the air-electrical panel and using approved devices, lockout/tagout the pneumatic shut-off valve
 - Test that energy has been removed by attempting to actuate the gripper and vises



Pneumatic
Shut-Off Valve

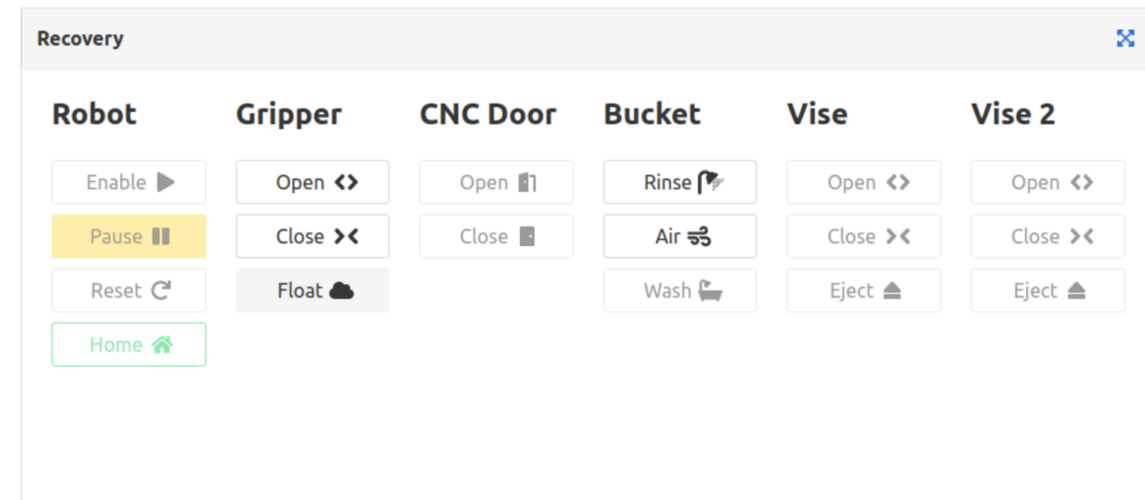
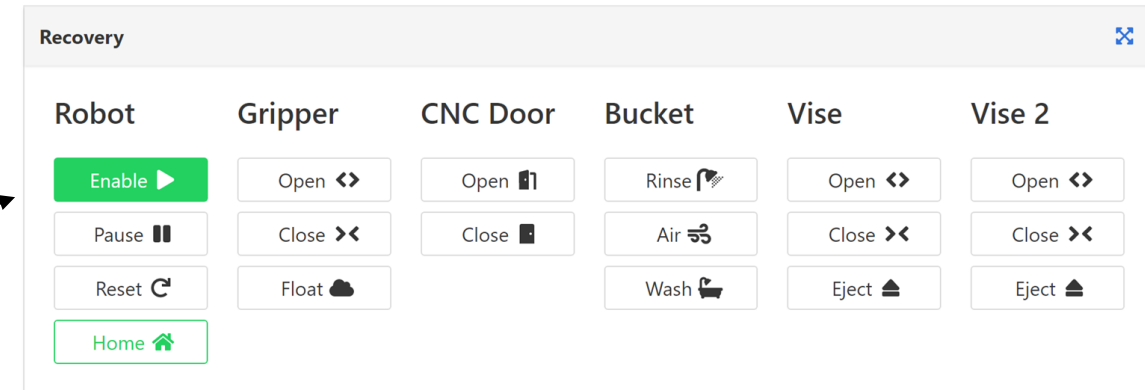
Electrical Lockout/Tagout

- VBX-160 Electrical Lockout/Tagout
 - Make sure the VBXC and the CNC are idle
 - Perform the Pneumatic Lockout/Tagout procedure
 - Press the blue VBXC power button below the VBXC monitor, wait 30 seconds for the VBXC to shut down
 - Turn off the power at the Electrical Panel by moving the lever down and using approved lockout/tagout devices, lock and tag the lever
 - Unplug the Electrical Panel's power receptacle and lock the power receptacle in an approved Lockout/Tagout clamshell
 - Test that electrical power is removed by verifying that there are no LEDs lighted on the PLC



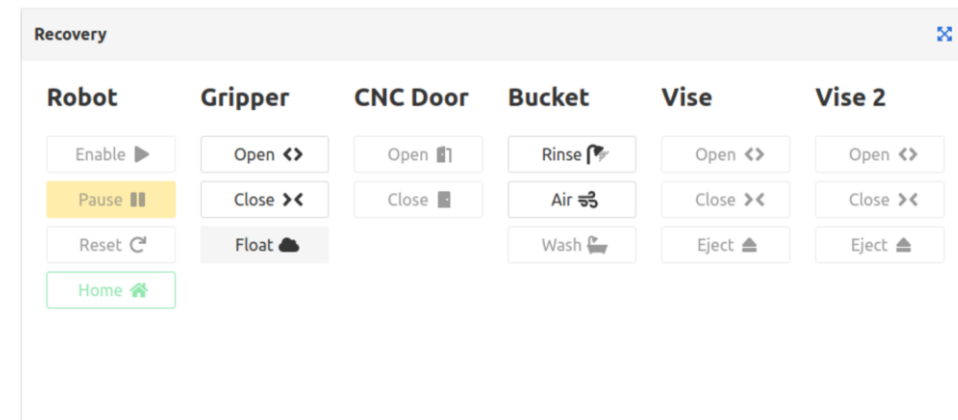
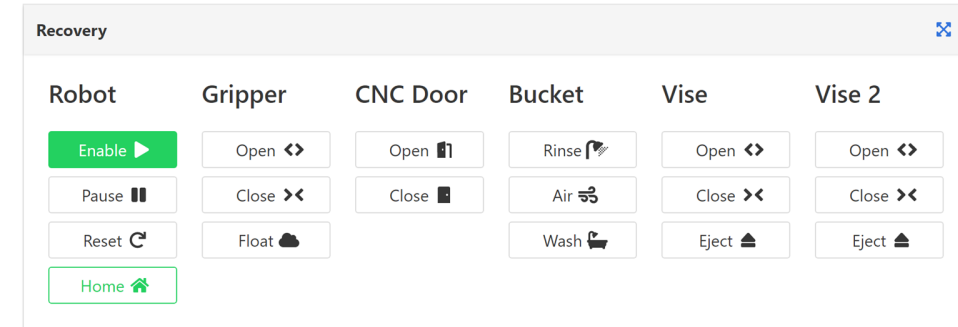
Testing Safety Interlocks

1. With VBX-160 pivoted to the CNC and the VBXC and CNC at idle, enter Recovery mode in the VBXC
2. Press the Enable button, verify the Enable button turns green
3. Open a VBX-160 door
4. Verify the Enable button turns, white, the border is grayed and pressing the enable button does not turn it green again
5. Close the VBX-160 door
6. Repeat steps 2 through 5 until all VBX-160 doors have been checked
7. Repeat steps 2 through 5 but at step 3, pivot the VBX-160 away from the CNC



Testing Safety Interlocks

1. With VBX-160 pivoted to the CNC and the VBXC and CNC at idle, enter Recovery mode in the VBXC
2. Press the Enable button, verify the Enable button turns green
3. Press the blue expansion icon in the upper right corner of the Recovery Panel
4. Set the robot speed to 1% in the upper right corner of the VBXC screen
5. In the Recovery Panel, set Movement to 30mm by clicking the 10 button and adjusting the slide to 30
6. Press the Z+ button and as soon as the robot begins to move up, open one of the VBX-160 doors
7. The robot should stop immediately
8. Close the door and press the Enable button; the robot should finish moving up
9. If the robot does not behave as described, discontinue use and contact AWR for service
10. Restore robot speed to 100%, Enable and Home the robot



Quick Start Guide

Section 2

Quick Start Guide

To add a new job to run on the VBX-160:

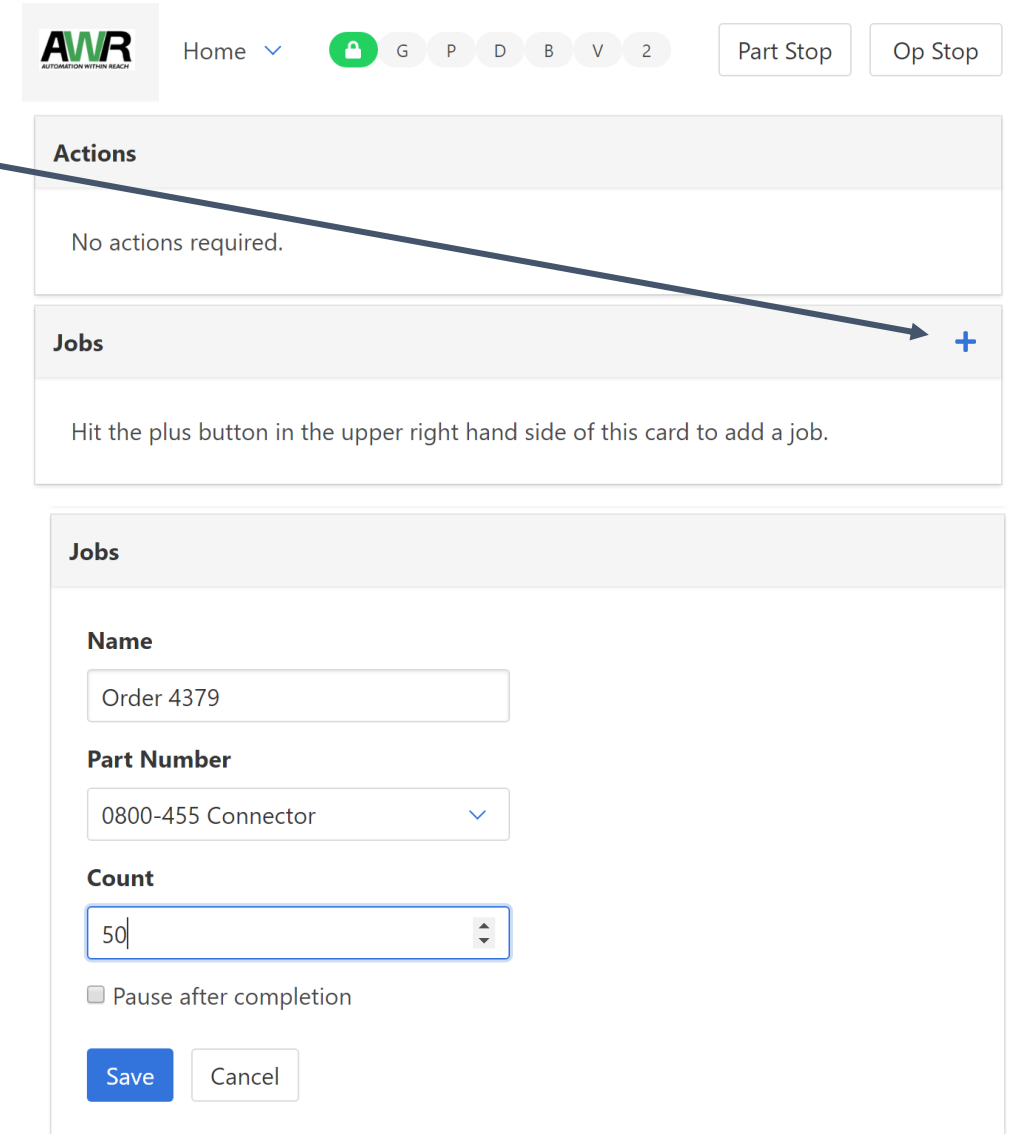
1. Make sure the CNC is ready
2. Add the Job to the VBXC Home Page
3. Complete the Actions listed in the VBXC Actions Panel
4. Press the Cycle Start button on the VBXC

CNC Ready

- CNC has the cutting tools loaded and measured for the job
- Tool life settings have been checked and are sufficient to complete the job
- Inside of CNC is clear of chips
- Door opens and closes smoothly
- Chip bins have sufficient capacity to complete job
- CNC is setup to communicate with VBXC (see the VBX-160 CNC Communications Manual included with your VBX-160)

Add Job to VBXC

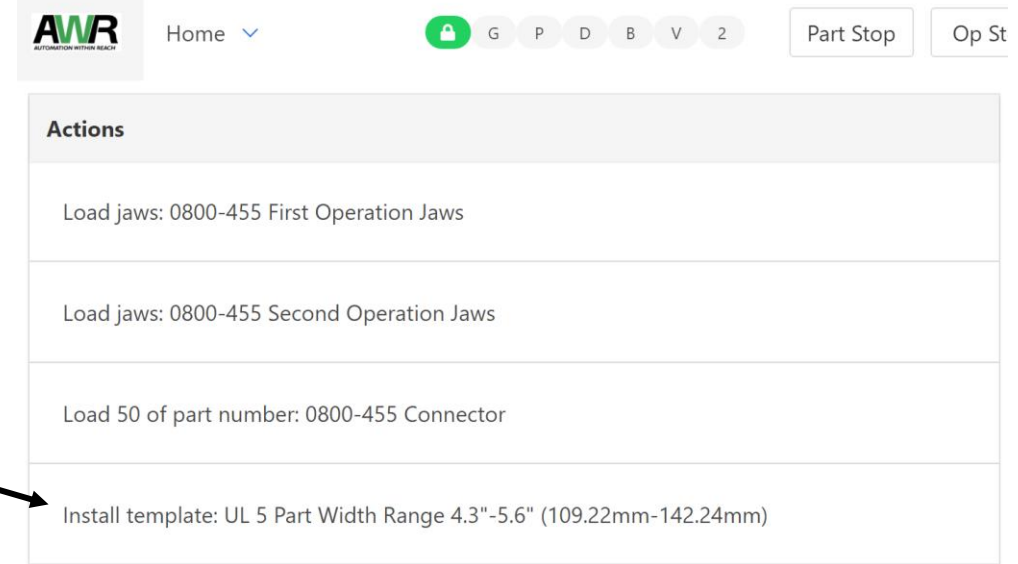
- From the VBXC Home Page, press the + button in the upper right hand corner of the Jobs panel
- Enter a name for the order, select the Part Number of the job to be processed and the count of parts to be processed
- Press Save to continue



The screenshot shows the VBXC Home Page interface. At the top, there is a navigation bar with the AWR logo, a 'Home' dropdown, a user profile icon, and a series of buttons labeled G, P, D, B, V, and 2. To the right of these are 'Part Stop' and 'Op Stop' buttons. Below the navigation bar, there are two main panels. The first panel, titled 'Actions', contains the text 'No actions required.' The second panel, titled 'Jobs', contains the text 'Hit the plus button in the upper right hand side of this card to add a job.' and a blue plus button in the top right corner. An arrow points from the text 'press the + button' to this plus button. Below the 'Jobs' panel, there is a form titled 'Jobs' with the following fields: 'Name' (text input with 'Order 4379'), 'Part Number' (dropdown menu with '0800-455 Connector'), and 'Count' (text input with '50'). There is also a checkbox labeled 'Pause after completion' and two buttons at the bottom: 'Save' and 'Cancel'.

Complete the Actions in the Actions Panel

- The Actions panel lists everything that needs to be done before the job can be started
- If there are no shelves with the correct Universal Part Locator configured, there will be a message to “Install template”

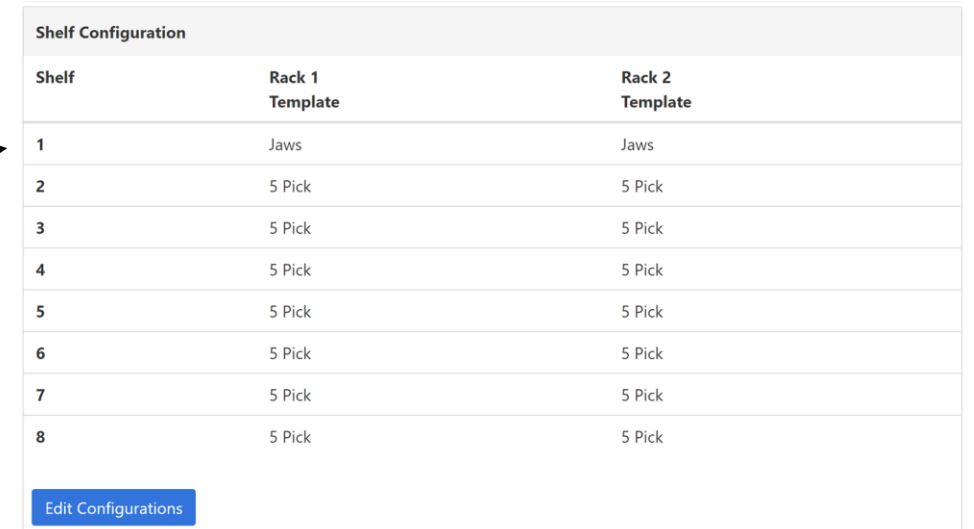


The screenshot shows the AWR (Automation Within Reach) interface. At the top, there is a navigation bar with the AWR logo, a 'Home' link, and a series of buttons labeled G, P, D, B, V, and 2. To the right of these buttons are two buttons: 'Part Stop' and 'Op St'. Below the navigation bar is the 'Actions' panel, which contains a list of tasks:

- Load jaws: 0800-455 First Operation Jaws
- Load jaws: 0800-455 Second Operation Jaws
- Load 50 of part number: 0800-455 Connector
- Install template: UL 5 Part Width Range 4.3"-5.6" (109.22mm-142.24mm)

An arrow points from the text "Install template" in the list to the fourth item in the Actions panel.


- First, go to the VBXC Settings page to edit the Shelf Configurations - select at least one shelf for the required configuration
- Next, for the selected shelves, configure the Universal Part Locator to match the selected configuration

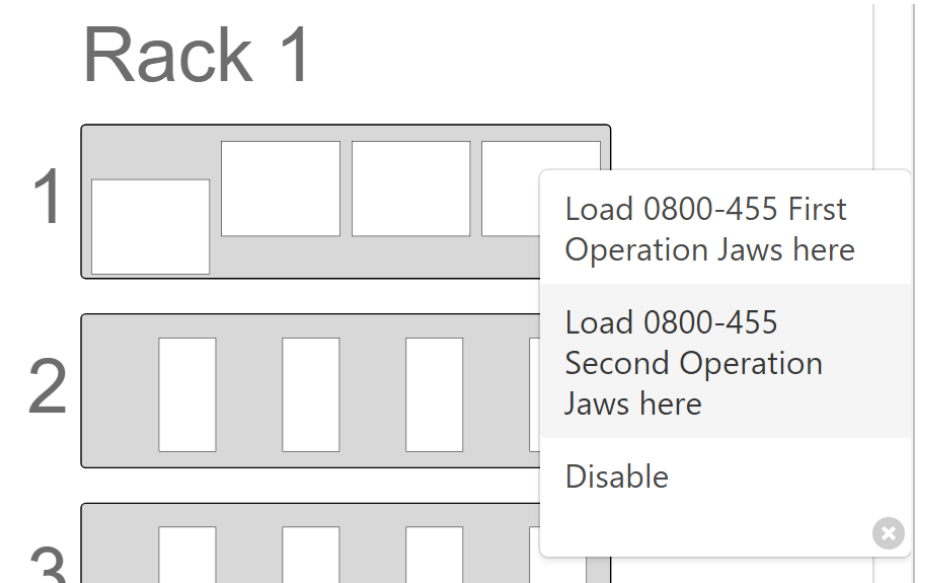
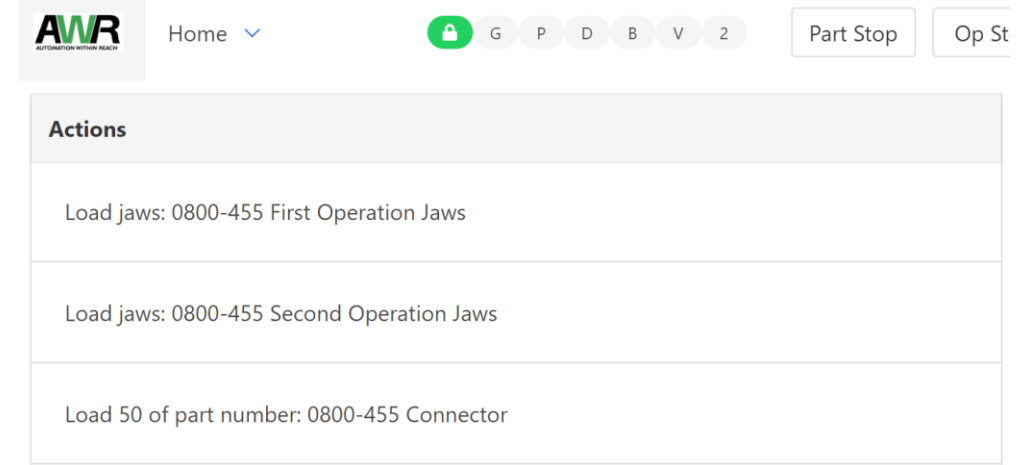


The screenshot shows the 'Shelf Configuration' table. The table has three columns: 'Shelf', 'Rack 1 Template', and 'Rack 2 Template'. There are 8 rows of data. The first row shows 'Jaws' for both Rack 1 and Rack 2. The remaining 7 rows show '5 Pick' for both Rack 1 and Rack 2. At the bottom of the table is a blue button labeled 'Edit Configurations'.

Shelf	Rack 1 Template	Rack 2 Template
1	Jaws	Jaws
2	5 Pick	5 Pick
3	5 Pick	5 Pick
4	5 Pick	5 Pick
5	5 Pick	5 Pick
6	5 Pick	5 Pick
7	5 Pick	5 Pick
8	5 Pick	5 Pick

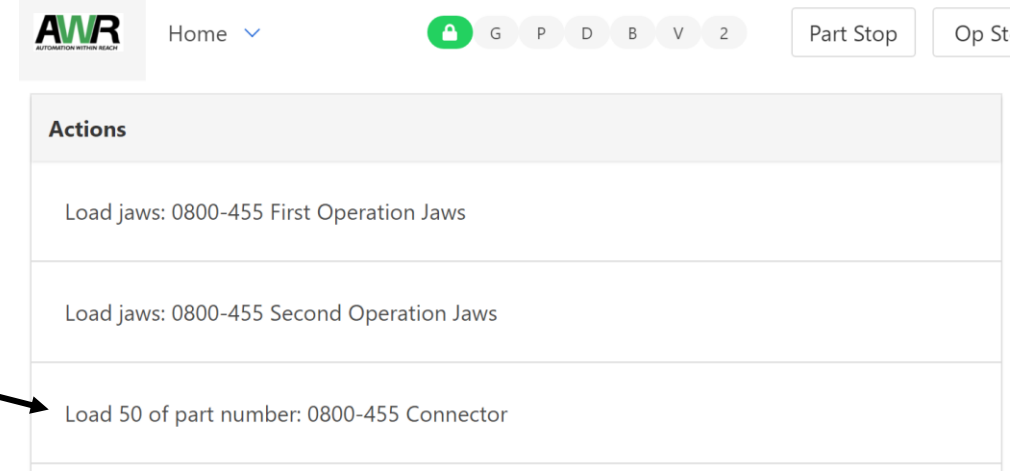
Complete the Actions in the Actions Panel

- Next, load the required jaws for the job onto an available Jaw Storage Plates 
- Confirm the selected Jaw Storage Location position in the VBXC by right-clicking on the matching Jaw Storage Location and selecting the proper jaw loaded in that location

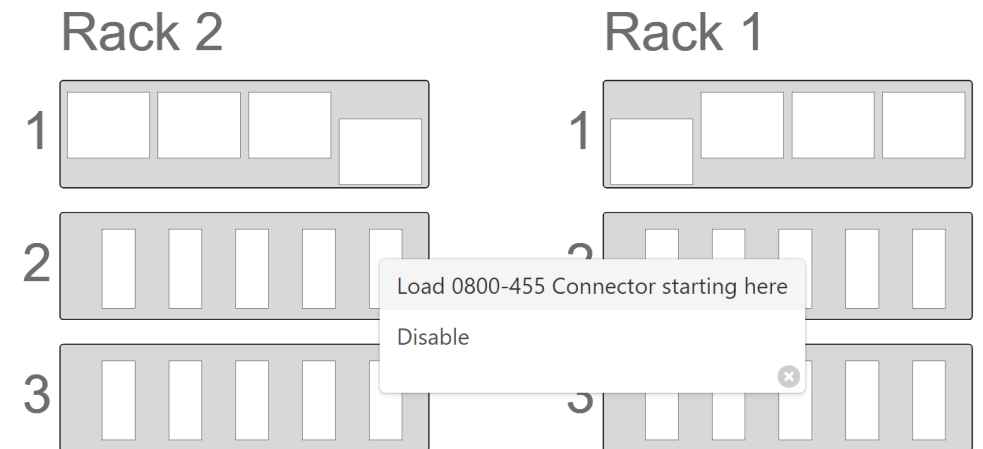


Complete the Actions in the Actions Panel

- Next, load the required parts for the job into available part slots of the VBXC



- Right-click on an available starting slot that matches the Universal Part Locator pick templates and select Load from the pop-up menu
- Note: the VBXC allocates parts to available locations moving from right to left and top to bottom of available slots



Press Cycle Start Button

- When the VBXC is ready to process the job, the Home Page should look similar to this and the Cycle Start button should be bright green
- Press the green Cycle Start button to start the job

The screenshot displays the AWR Home Page interface. At the top, there is a navigation bar with the AWR logo, a 'Home' dropdown, a status bar with icons (G, P, D, B, V, 2), and buttons for 'Part Stop', 'Op Stop', '100%' utilization, '0psi', and a status indicator set to 'Idle'. To the right of the status bar are two buttons: 'Recovery' (yellow) and 'Cycle Start' (bright green).

The main content area is divided into three sections:

- Actions:** A section with the text 'No actions required.'
- Jobs:** A table with columns 'Name', 'Part Number', 'Progress', 'Edit', and 'Cancel'. It contains one job entry: 'Order 4379' with 'Part Number' '0800-455 Connector' and 'Progress' '0 / 50'. There are 'Edit' and 'Cancel' buttons for this job.
- Activity:** A section containing a 'System Utilization' bar chart showing 100% utilization, a 'Parts Completed' line chart showing progress over time, and a 'Status' dropdown menu currently set to 'Idle'. A 'Reset' button is located at the bottom right of the Activity section.

On the right side of the interface, there is a 'Cell' section with an 'In/Out' toggle switch. Below this, there are two racks, 'Rack 2' and 'Rack 1', each with 8 slots. The slots are represented by colored bars: white for idle, blue for running, yellow for paused, and red for recovery. In Rack 2, slots 2 through 4 are blue. In Rack 1, slots 1 through 8 are blue.

VBX-160 Overview

Section 3

VBX-160 Major Components

1. Racks and Shelves
2. Universal Part Locators
3. MultiGrip Gripper
4. MutliGrip Jaws
5. MultiGrip Vises
6. Jaw Storage Plates
7. Gate Posts
8. Rinse and Dry Tank
9. Robot Controller and Air/Electrical Panel
- 10.VBXC Controller
- 11.Safety Interlock



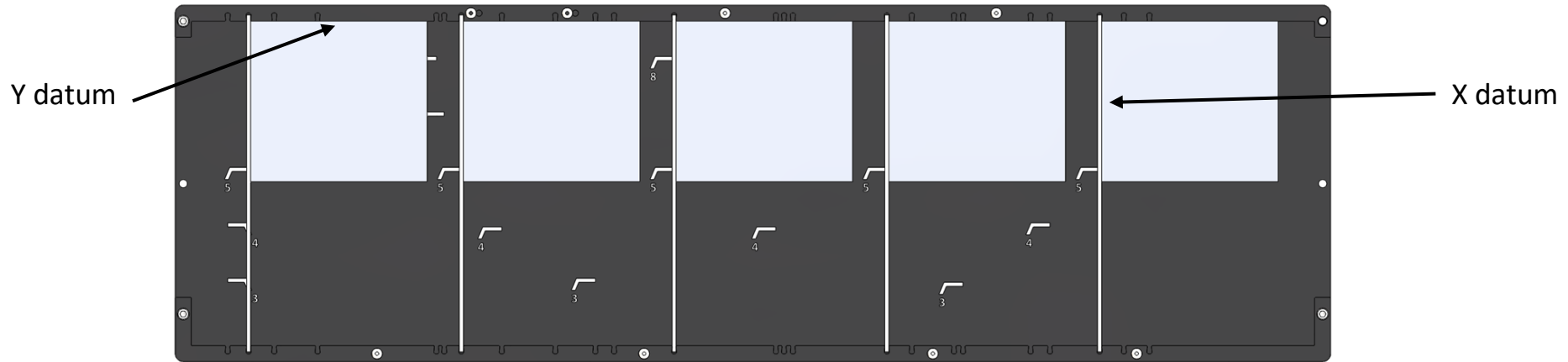
Racks and Shelves

- Two racks with 8 shelves per rack
- Top most shelves reserved for MultiGrip Jaws
- Shelves 2 through 8 reserved for part storage
- Each part shelf holds a Universal Part Locator
- Universal Part Locators are easily configurable to optimally store parts depending on part width



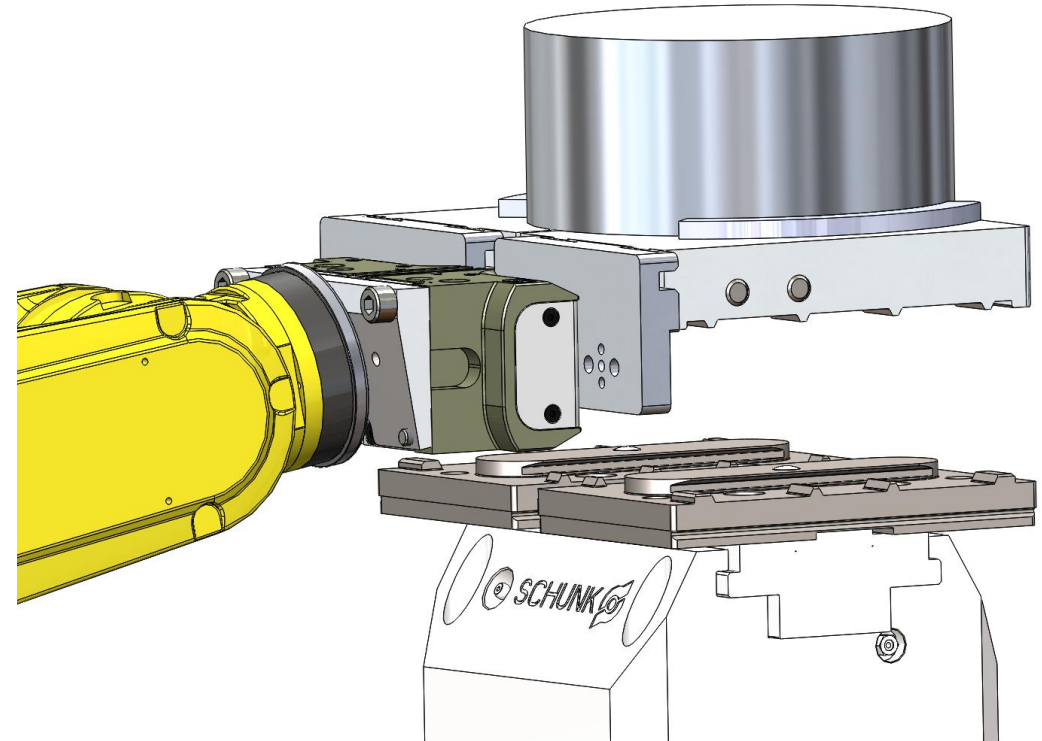
Universal Part Locators

- Part locator system
- Aligns the part in X and Y for robot pickup
- Optimizes VBX-160 infeed capacity based upon part width
- Flexible, quick and easy to setup
- Works with rounds and rectangles and any part that can be properly located with a single X and Y datum



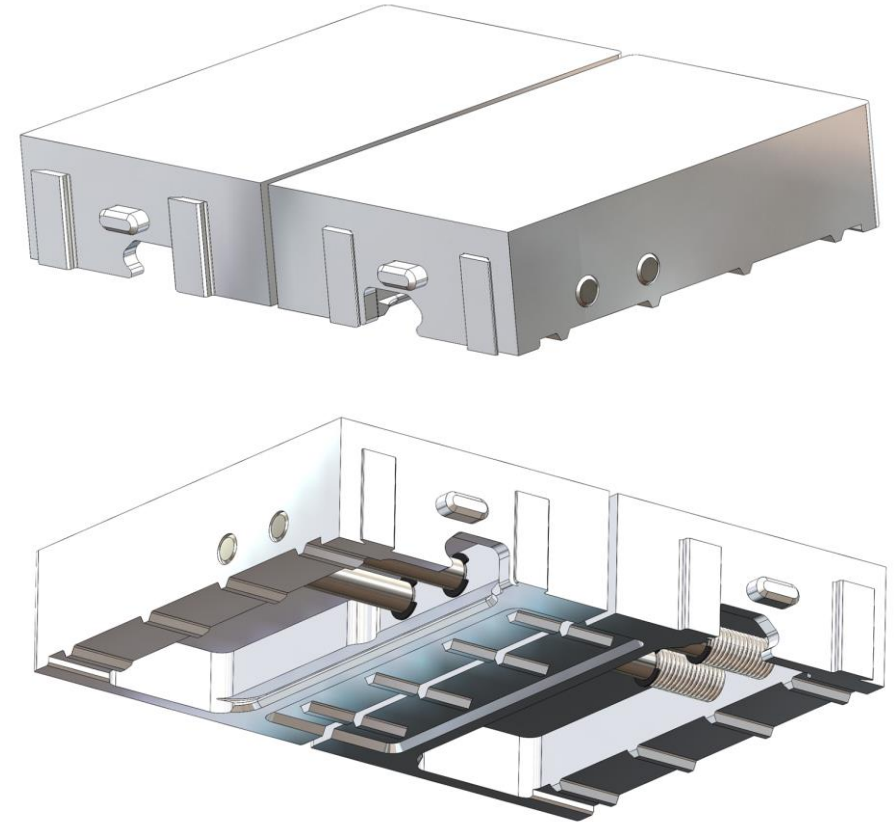
MultiGrip Gripper

- Pneumatic centering gripper with MultiGrip Jaw interface
- Built-In tool changer configured to pick or place MultiGrip Jaws from Jaw Storage Plates or MultiGrip Vise
- MultiGrip Gripper with MultiGrip Jaws attached can pick and place parts



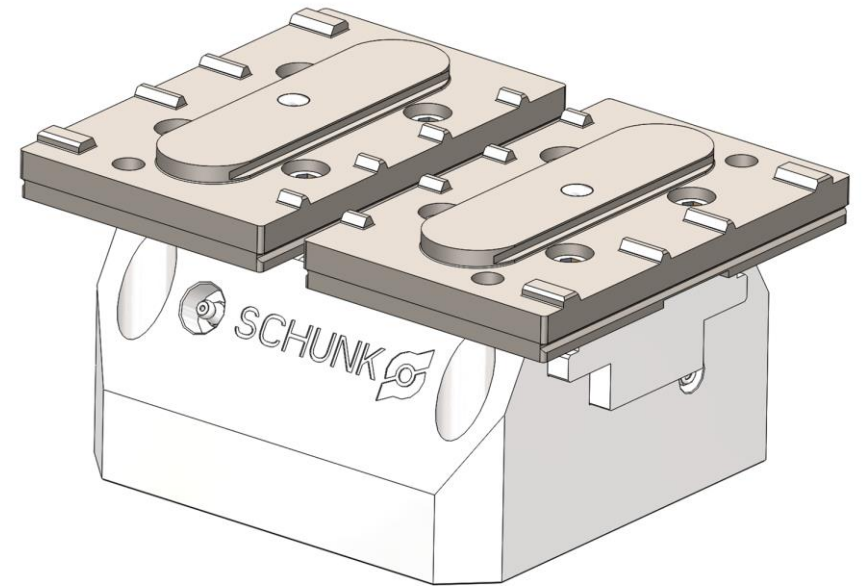
MultiGrip Jaws

- Machinable soft jaw system that works with MultiGrip Gripper and MultiGrip Vise
- Available in OD and ID clamping styles
- Options available to suit a wide variety of CNC machine tending requirements



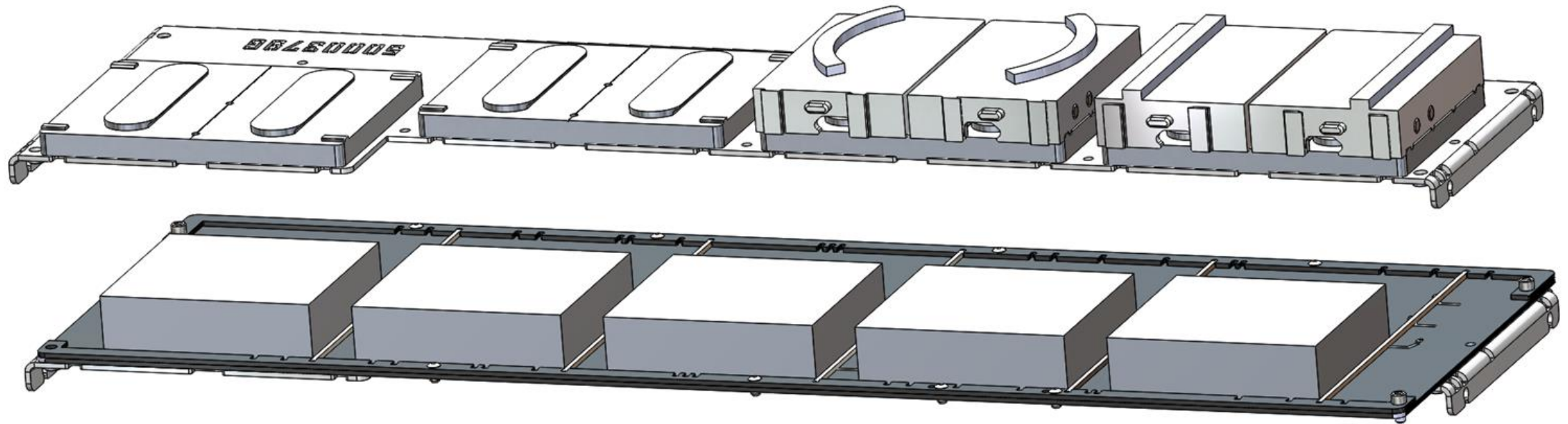
MultiGrip Vise

- High-force centering pneumatic vise
- Repeatability of less than 0.0008"
- MultiGrip intermediate jaw interface for engaging and disengaging MultiGrip jaws
- May be robot loaded using MultiGrip Gripper or hand loaded by operator



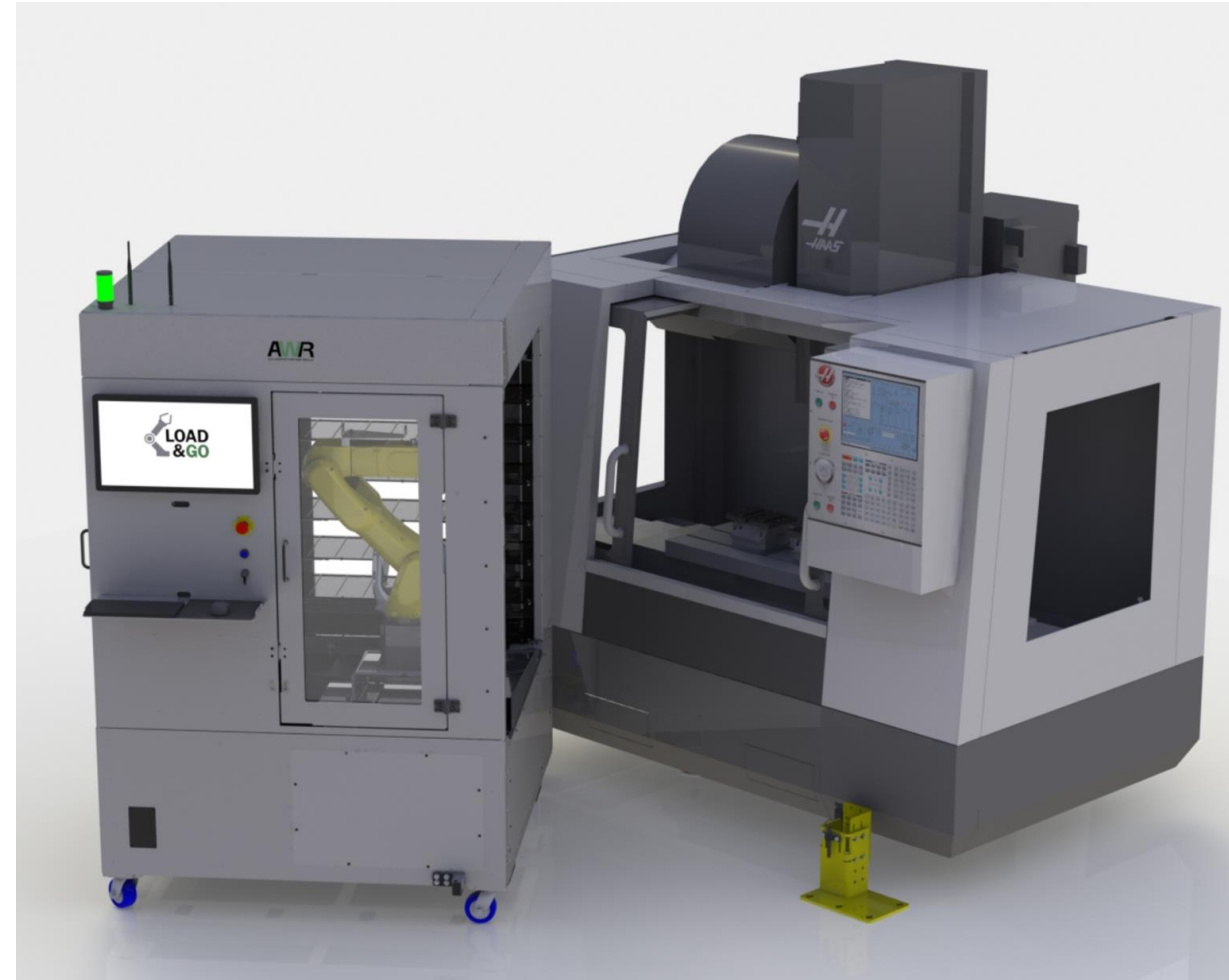
Jaw Storage Plates

- Holds MultiGrip Jaws for use by the robot during part processing
- Operator loads MultiGrip Jaws onto Jaw Storage Plates during job setup
- VBX-160 includes 8 Jaw Storage Plates allowing for multiple jobs to be setup and processing simultaneously



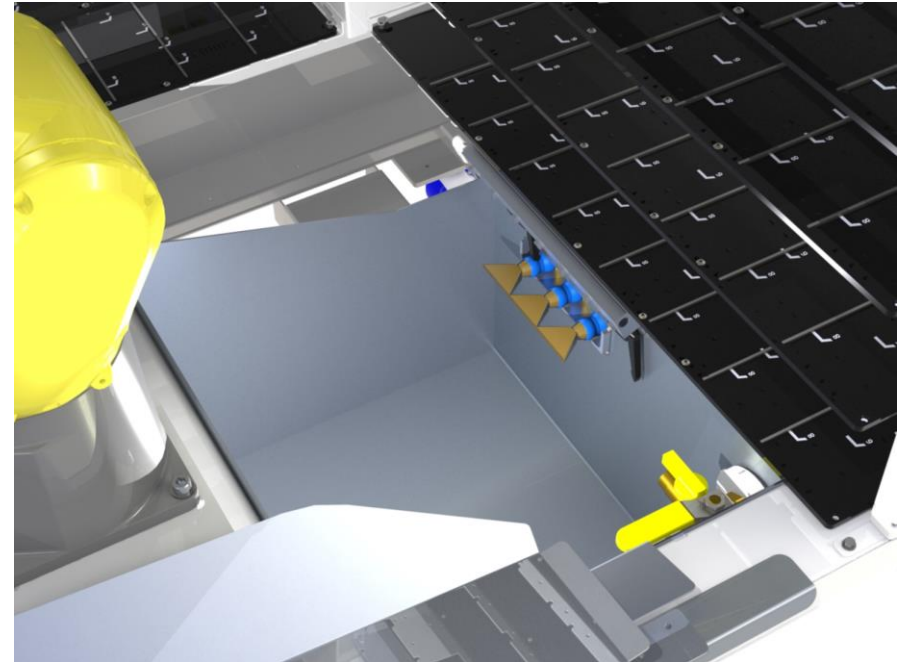
Gate Posts

- Anchored to the shop floor to provide a rigid mount for the VBX-160 in front of the CNC
- Includes a pivot post and gate post
- Gate post includes a quick-pull lock-pin that when pulled allows the VBX-160 to be pivoted away from CNC by the operator in seconds
- Operator can pivot the VBX-160 back into position and lock the VBX-160 into place with the lock-pin in seconds

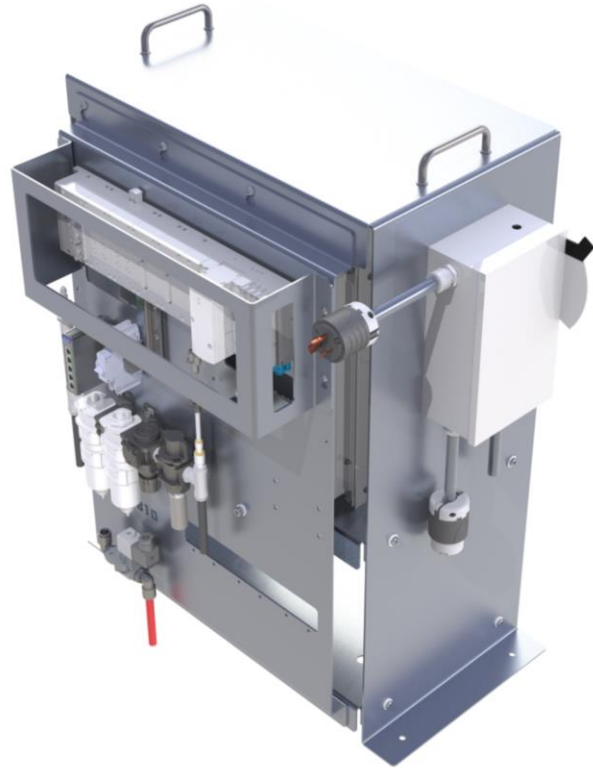


Rinse and Dry Tank

- Tank in VBX-160 used to rinse coolant and chips away from MultiGrip Jaws
- Air-knife uses compressed air to blow excess water after rinse
- Built-in pump includes diverter valve and standard garden hose bib to ease removal of dirty rinse water



Robot Controller and Air/Electrical Panel

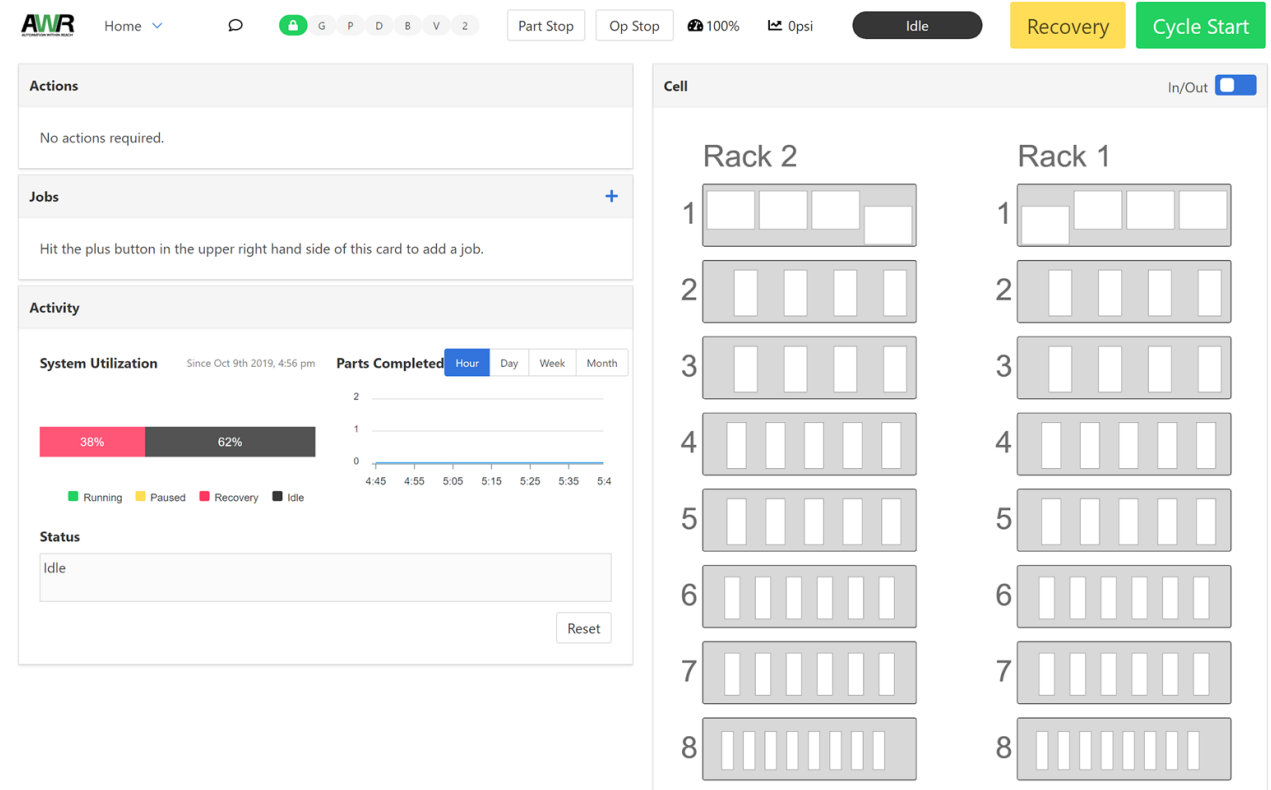


- IP-54 rated robot controller cabinet suitable for use in machine shop environment
- Robot controller is typically set to the side of the CNC
- Air/Electrical panel mounted on the robot controller controls pneumatic and electrical signals used by the VBX-160



VBXC Controller

- Controls the robot and the CNC
- Intuitive interface is simple to use but powerful
- Stores all automation part configuration related information
- Operator selects part number and quantity and the VBXC prompts the operator to setup the job
- Multiple jobs can be scheduled and processed simultaneously
- Recovery Panel helps operator restart the system after an error occurs



Safety Interlock

- VBX-160 doors and gate post include dual-channel safety switches
- If a VBX-160 door or gate post is open, the robot stops immediately
- E-stop switch below the VBXC screen immediately stops the robot

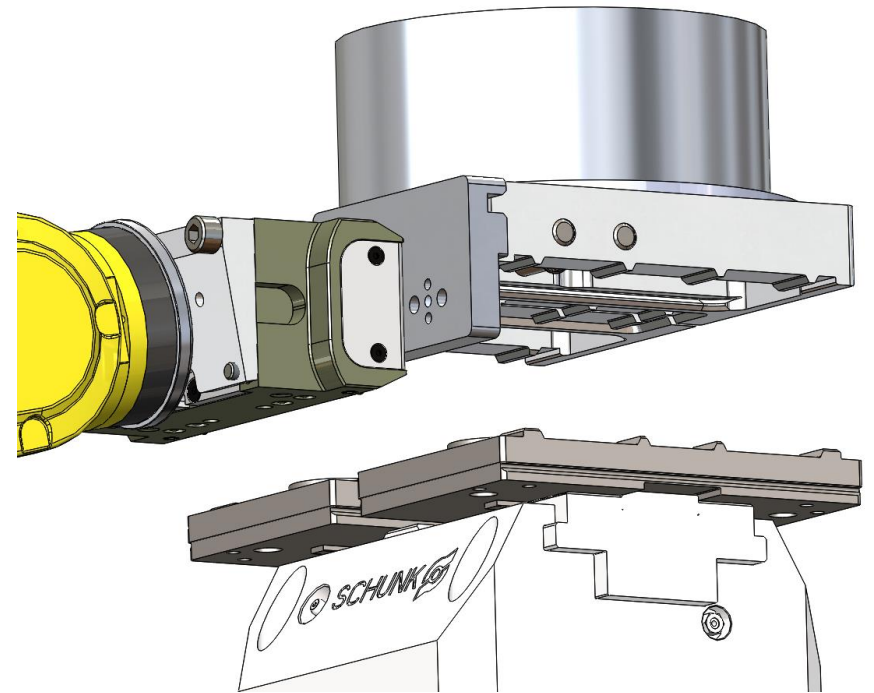


MultiGrip Overview

Section 4

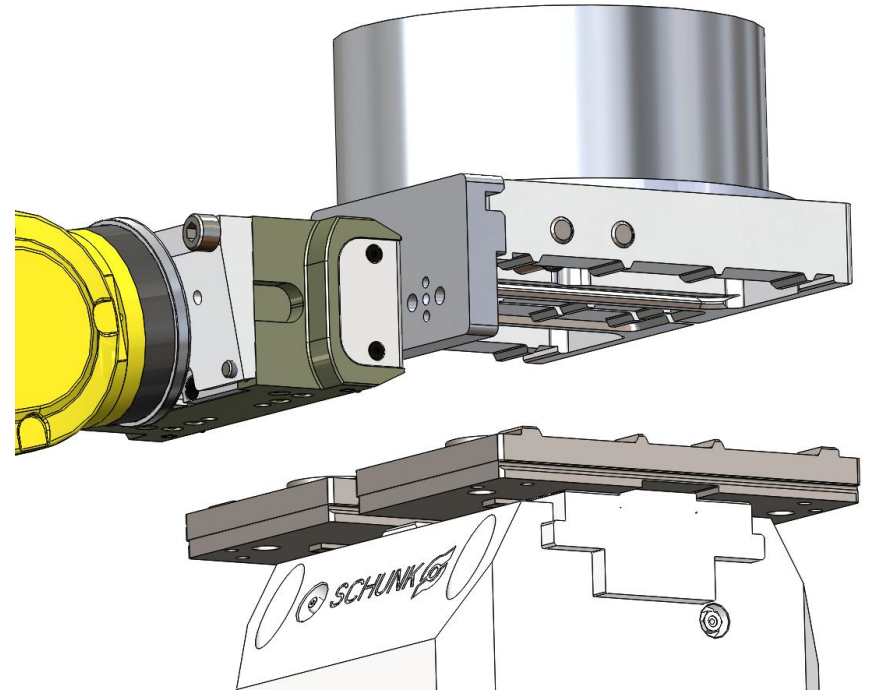
MultiGrip Overview

1. Uses and Applications
2. MultiGrip Jaw Details
3. MultiGrip Gripper Interface
4. MutliGrip Vise Interface
5. MultiGrip Part Interface
6. MultiGrip Jaw Reference Orientation
7. MultiGrip Jaw Types
8. MultiGrip Top Jaws and Base Jaws
9. MultiGrip Fixed Jaws
10. MultiGrip Jaws and Repeatability
11. Dry Machining with MultiGrip



Uses and Applications

- Automation-Enabled CNC Workholding System
- Highly Repeatable, Quick-Change Jaw System
 - Manual tending
 - Robot Tending
- Complete MultiGrip System Includes:
 - MultiGrip Gripper
 - MultiGrip Jaws
 - MultiGrip Vise



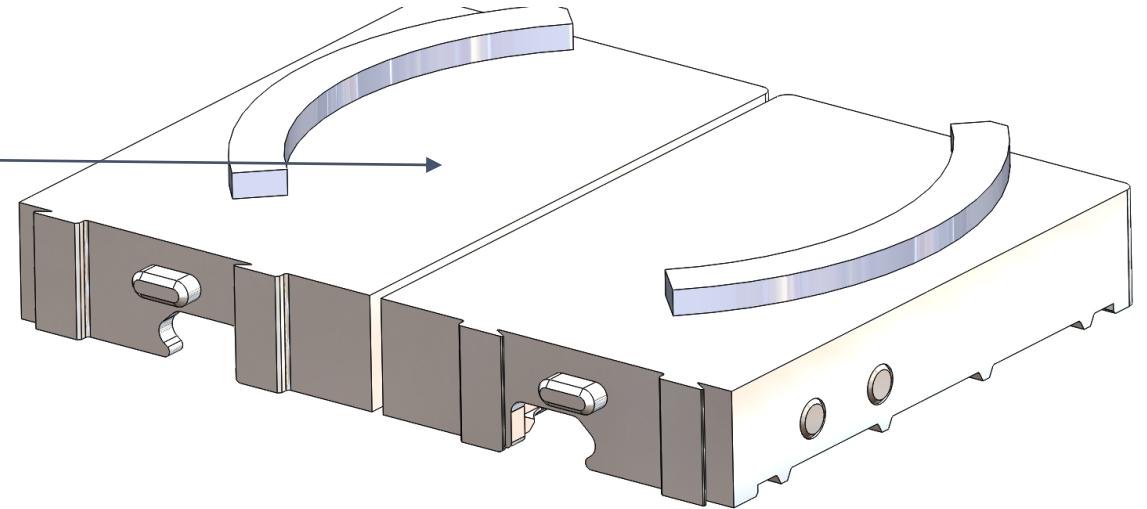
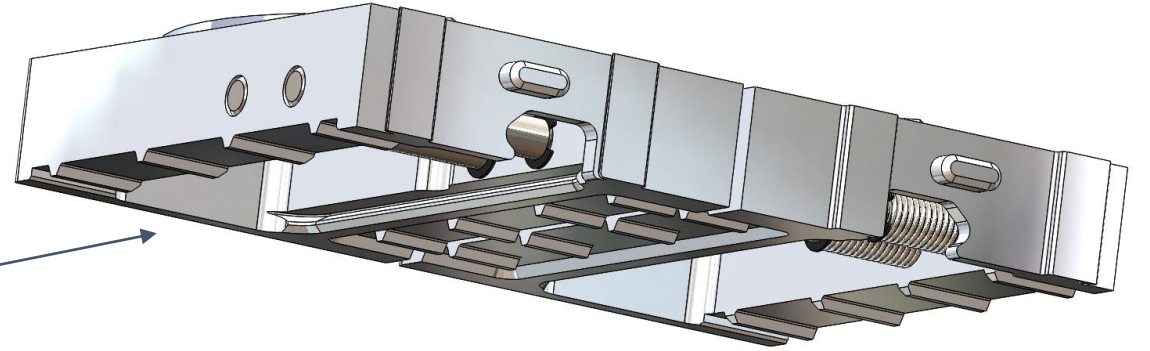
Uses and Applications

- MultiGrip Jaws may be used for the following:
 - Picking parts from the VBX-160 shelves
 - Holding parts in a MultiGrip vise
 - Placing parts in a chuck or non-MultiGrip vise
 - Performing a first operation to second operation transfer
 - Placing completed parts to the VBX-160 shelves
- Each type of use has unique requirements for successful automation
- Understand how your MultiGrip jaws will be used and ensure that all design considerations are met for the use

MultiGrip Jaw Details

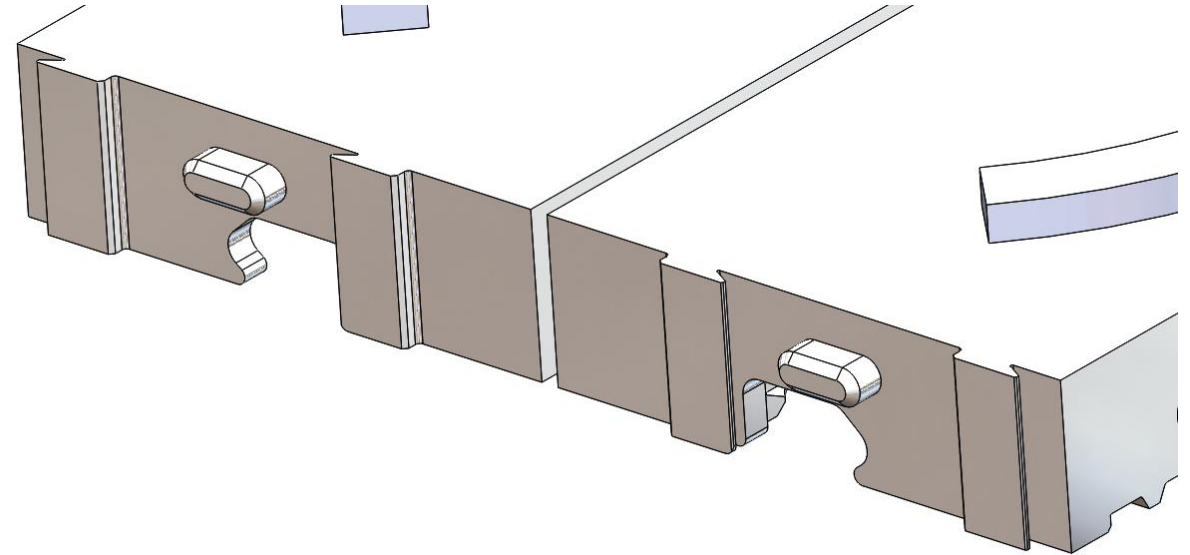
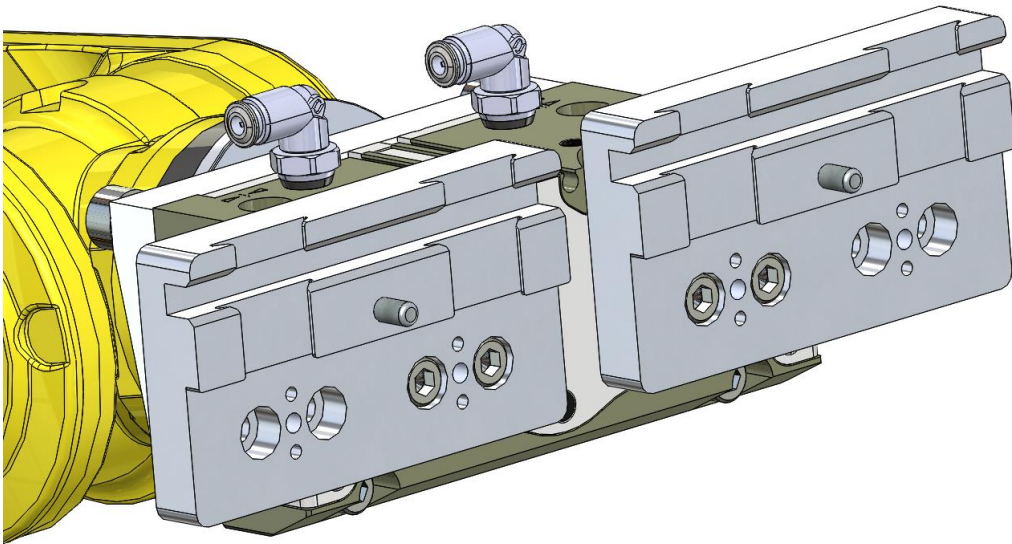
Three interfaces:

- Vise Interface
- Part Interface
- Gripper Interface



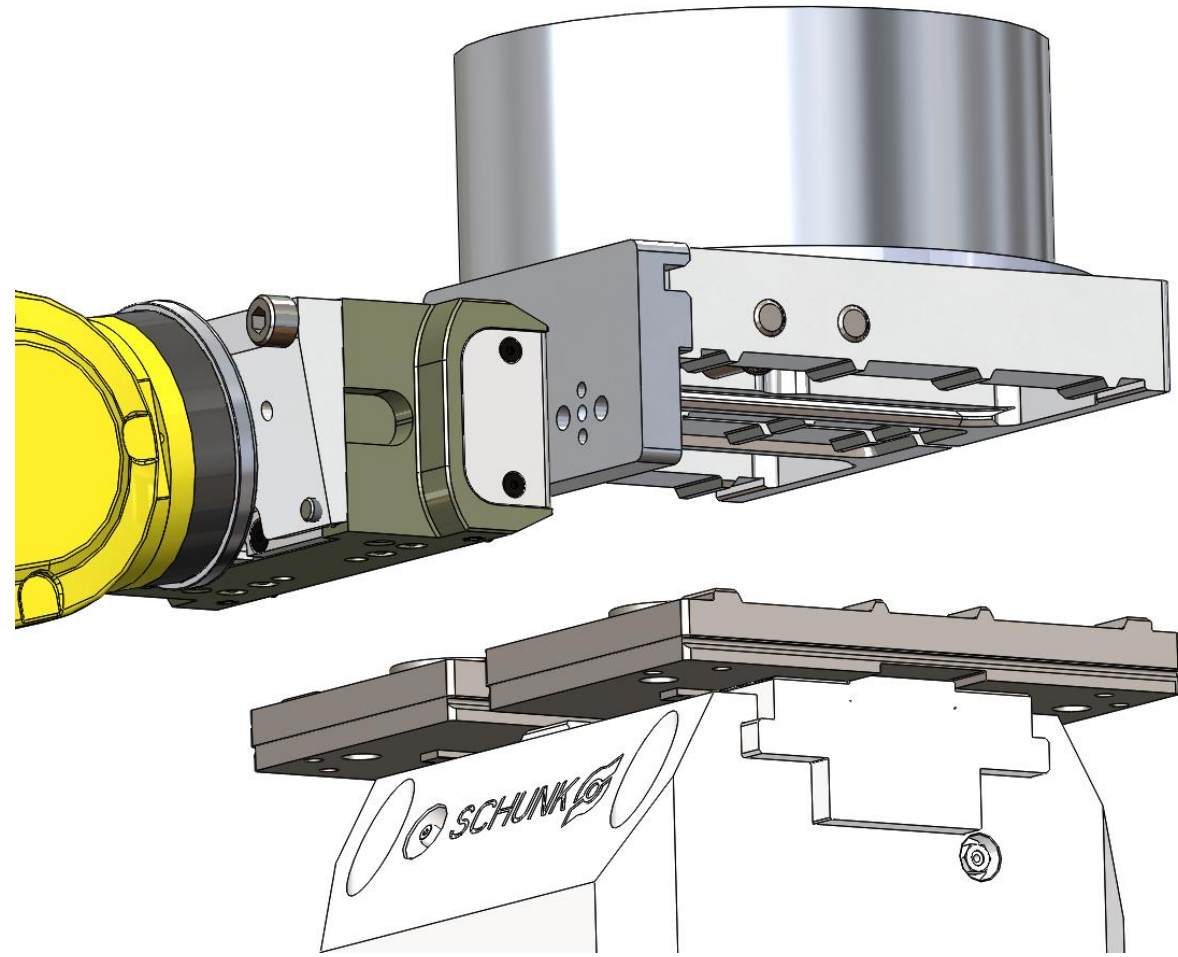
MultiGrip Gripper Interface

Gripper interface allows
robot to pick and place jaws



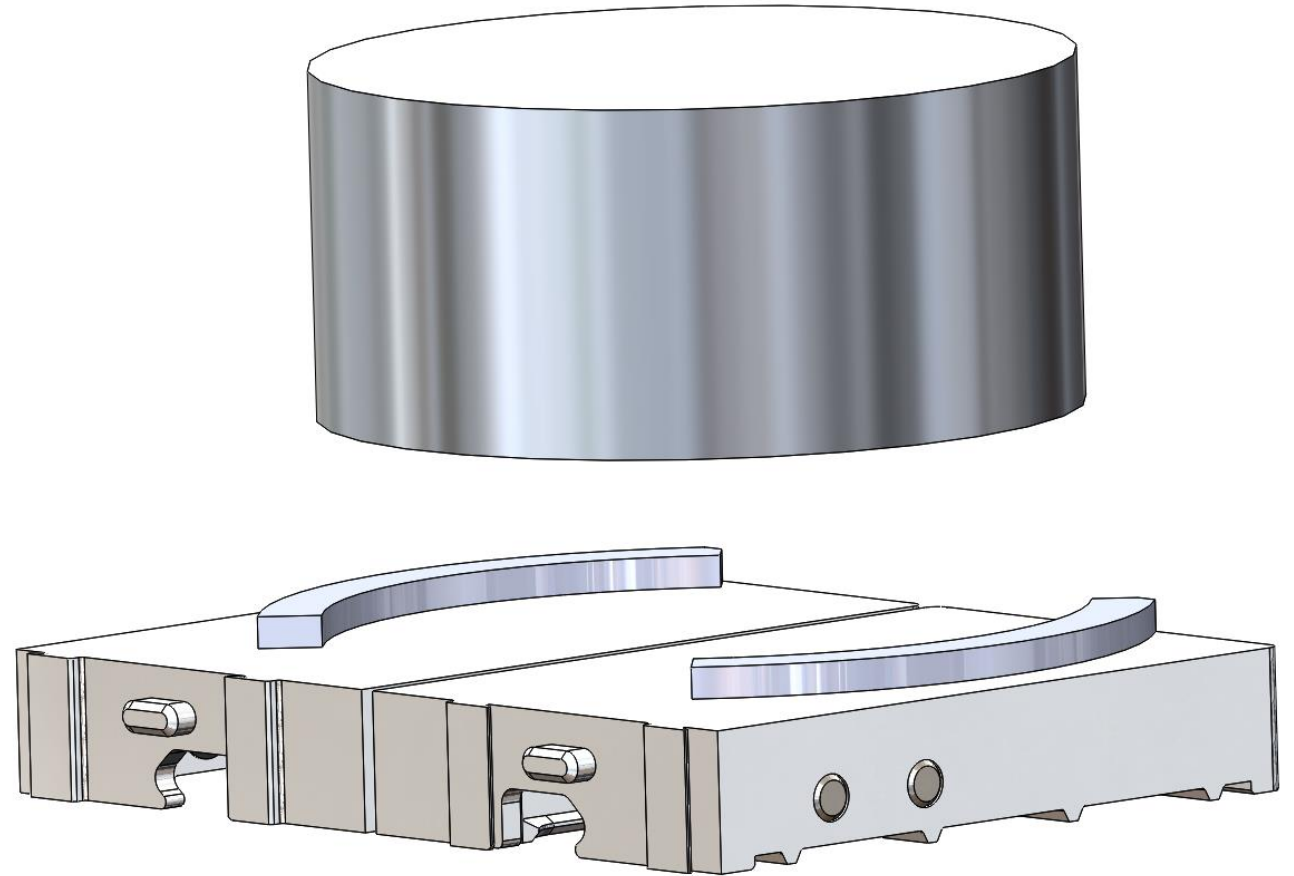
MultiGrip Vise Interface

Vise interface allows vise to secure part and jaws for processing



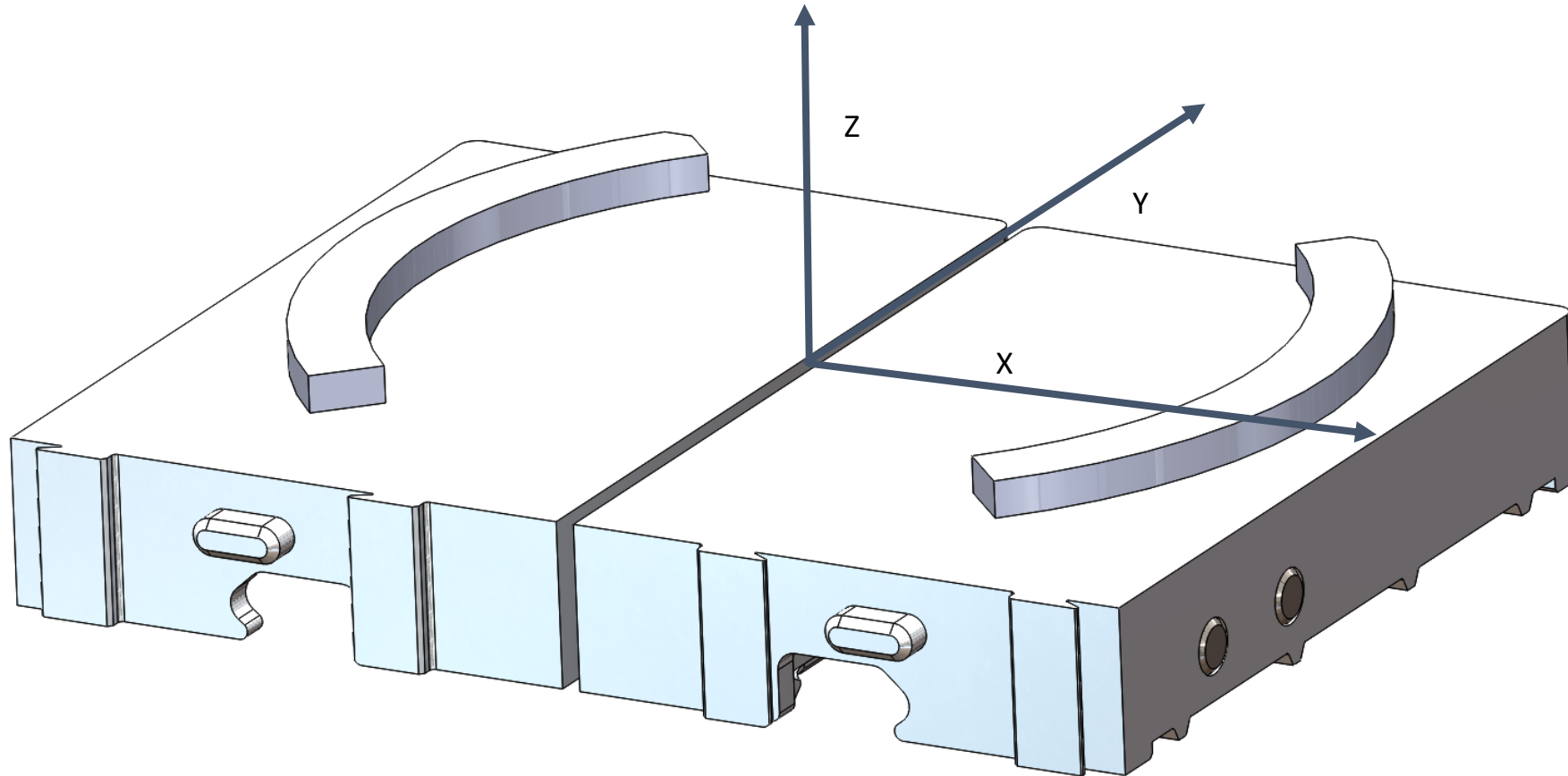
MultiGrip Part Interface

Part interface: machineable
surface for holding part



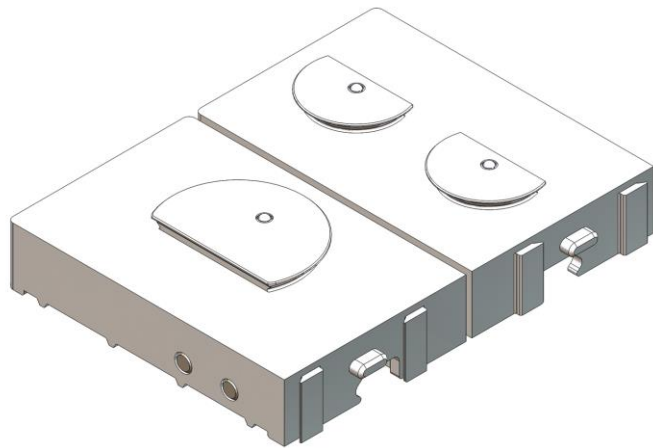
MultiGrip Jaw Reference Orientation

XYZ axis aligned with typical CNC axis

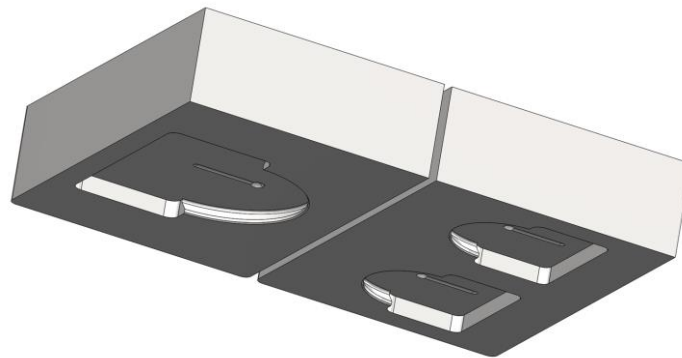


MultiGrip Jaw Types

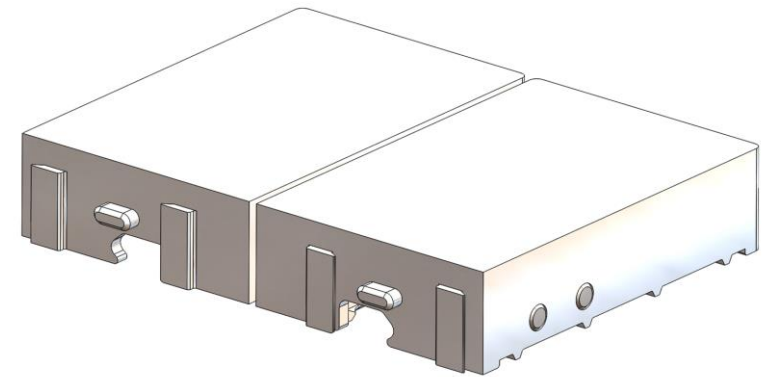
MultiGrip Base Jaws



MultiGrip Top Jaws

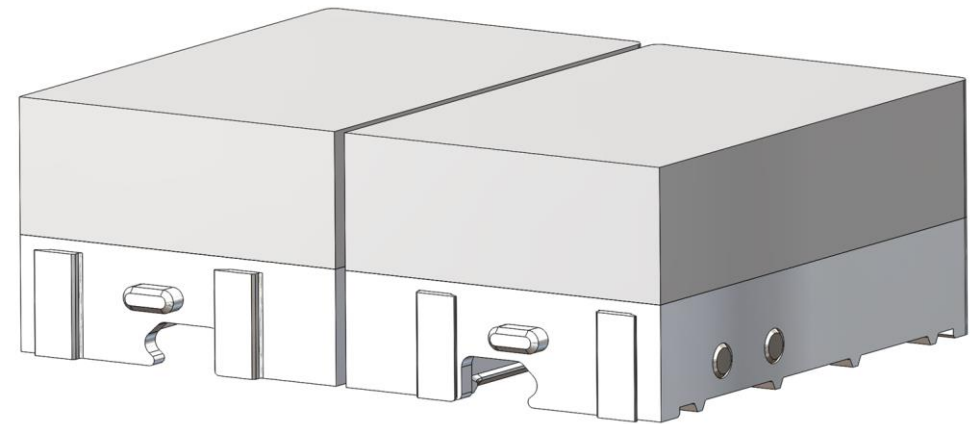


MultiGrip Fixed Jaws



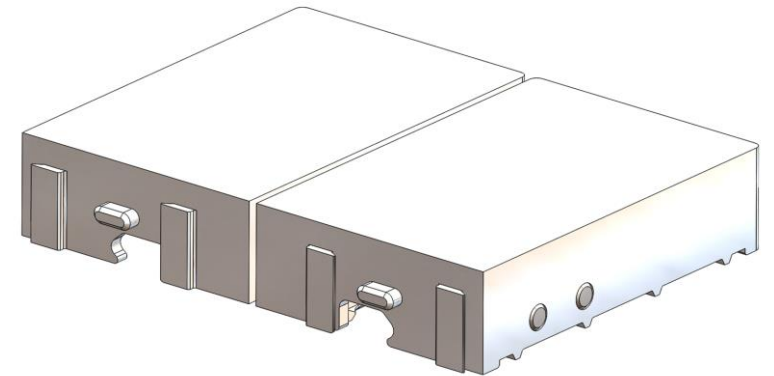
MultiGrip Top Jaws and Base Jaws

- Part pocket machined into low-cost exchangeable Top Jaws
- Top Jaws snap into place on MultiGrip Base Jaws in seconds
- One fixed Top Jaw, one swivel Top Jaw
- Swivel Top Jaw allows jaws to conform better, increases gripping force on part
- Slightly heavier and slightly taller than MultiGrip Fixed Jaws
- Top Jaws are available in standard and over-sized versions, ID and OD clamping styles, with thickness of 1", 1.5" and 2"



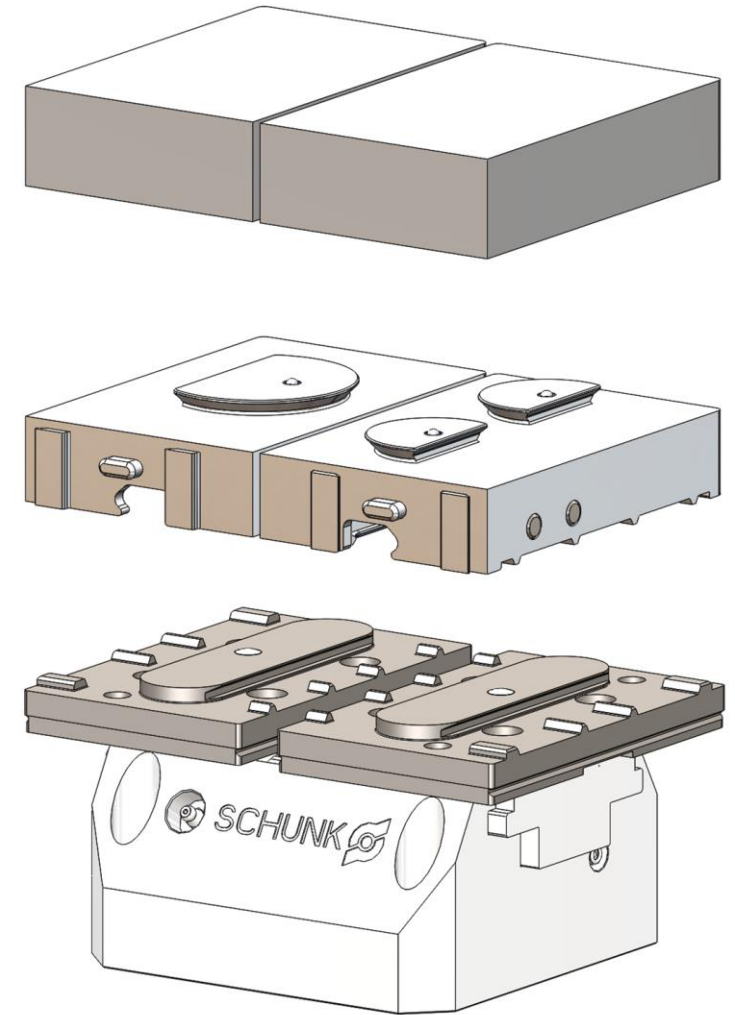
MultiGrip Fixed Jaws

- Solid top surface to machine part pocket
- Typically single part use
- Used when low overall jaw height or low jaw weight is required
- Minimum overall height of 1.125"
- Available in ID and OD clamping styles
- Considerations must be made to accomodate jaw deflection during gripper pick of rectangular parts (See section on part picking below for more information)



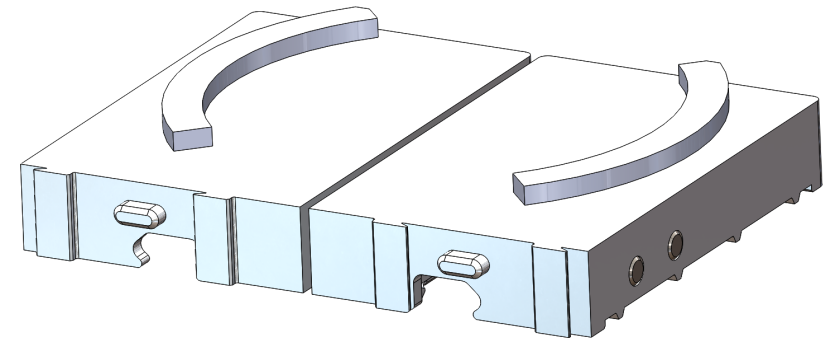
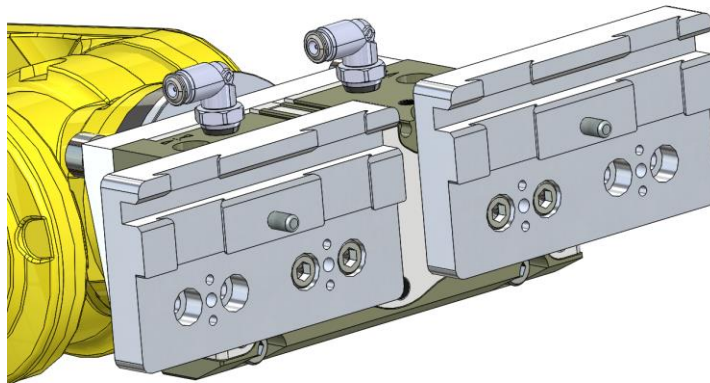
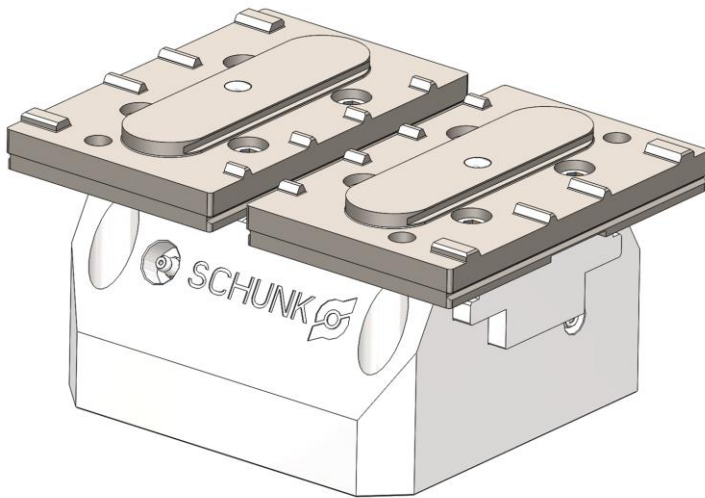
MultiGrip Jaws and Repeatability

- Best repeatability is achieved when MultiGrip Jaws are paired with the MultiGrip vise they were originally machined on
- For MultiGrip Top Jaws, best repeatability is achieved when the machined Top Jaws are paired with the MultiGrip Base Jaws and the MultiGrip vise they were originally machined on
- When Top Jaws are moved onto a different set of MultiGrip Base Jaws or any MultiGrip Jaw is moved to a different vise, confirm location of XYZ pocket
 - Generally, there will be less error in XY and more error in Z when moving Jaws



Dry Machining with MultiGrip

- MultiGrip relies on CNC coolant to lubricate the vise interface, the gripper interface and the Jaws
- When dry machining use of a dry lubricant is required to be applied at least daily to the vise interface, gripper interface of the jaws, cross-pins of the jaws, and the gripper face





VBXC Controller


Section 5

VBXC Controller



1. VBXC Home Page
2. Status Bar
3. Actions Panel
4. Jobs Panel
5. Cell Panel
6. Activity Panel
7. Recovery Panel
8. VBXC Configuration Page
9. VBXC Settings Page
10. VBXC Calibration Page
11. VBXC About Page

VBXC Home Page

 Home 

 G P D B V 2

Part Stop Op Stop

 100%  50psi


Idle


Recovery

Cycle Start

Actions

No actions required.

Jobs 

Name	Part Number	Progress	Edit	Cancel
Order 4379	0800-455 Connector	0 / 50		Cancel

Activity

System Utilization

Since Oct 11th 2019, 4:52 pm

Parts Completed

Hour Day Week Month

100%

Running

Paused

Recovery

Idle

8:00

8:10

8:20

8:30


8:40

8:50

Status

Idle

Reset

Cell 

Rack 2

1

2

3

4

5

6

7

8

Rack 1

1

2

3

4

5

6

7

8

Status Bar

Navigation Menu



Home ▾

Optional Stops

Part Stop

Op Stop

Speed

100%

Vise Pressure

50psi

Processing Mode

Recovery

Control Buttons

Recovery

Cycle Start

- Navigation Menu - allows navigation between the available VBXC Pages
- Optional Stops
 - Part Stop will complete the current running part, place the part back on the shelf and then pause processing
 - Op Stop will complete the current CNC operation and then pause processing
- Speed - controls the speed of the robot between 1% and 120%; 100% is normal speed
- Vise Pressure - controls the air pressure of the vises; note that if a job is running, the vise pressure should not be changed
- Processing Mode - the processing mode of the VBXC system; one of Running, Paused, Recovery or Idle
- Control Buttons - The Control Buttons available depend on the Processing Status:
 - **Cycle Start** Begins robot processing if there are no pending Action Panel items that require completion; Cycle Start is only available when the robot cell doors and pivot post are closed
 - **Feed Hold** Pauses robot processing; does not pause CNC processing
 - **Recovery** Forces the VBXC into recovery mode; the current processing part will be reset

Actions Panel

- The Actions Panel lists actions for the operator to complete
- Actions may include loading or unloading jaws or parts, configuring shelves or clearing parts or jaws from the vise or gripper during a recovery process
- All actions are acknowledgements by the operator that a physical task has been performed such as loading parts on the shelf
- Some actions clear automatically such as the acknowledgement of loading jaws in the Cell Panel
- Some actions cannot be recognized by the VBXC and are instructions for the operator to perform before processing continues; in this case a Clear button is provided to clear the action
- Note: only actions that the VBXC requires to begin the job are listed, the CNC must also be configured to run the job

Actions
Load jaws: 0800-455 First Operation Jaws
Load jaws: 0800-455 Second Operation Jaws
Load 50 of part number: 0800-455 Connector

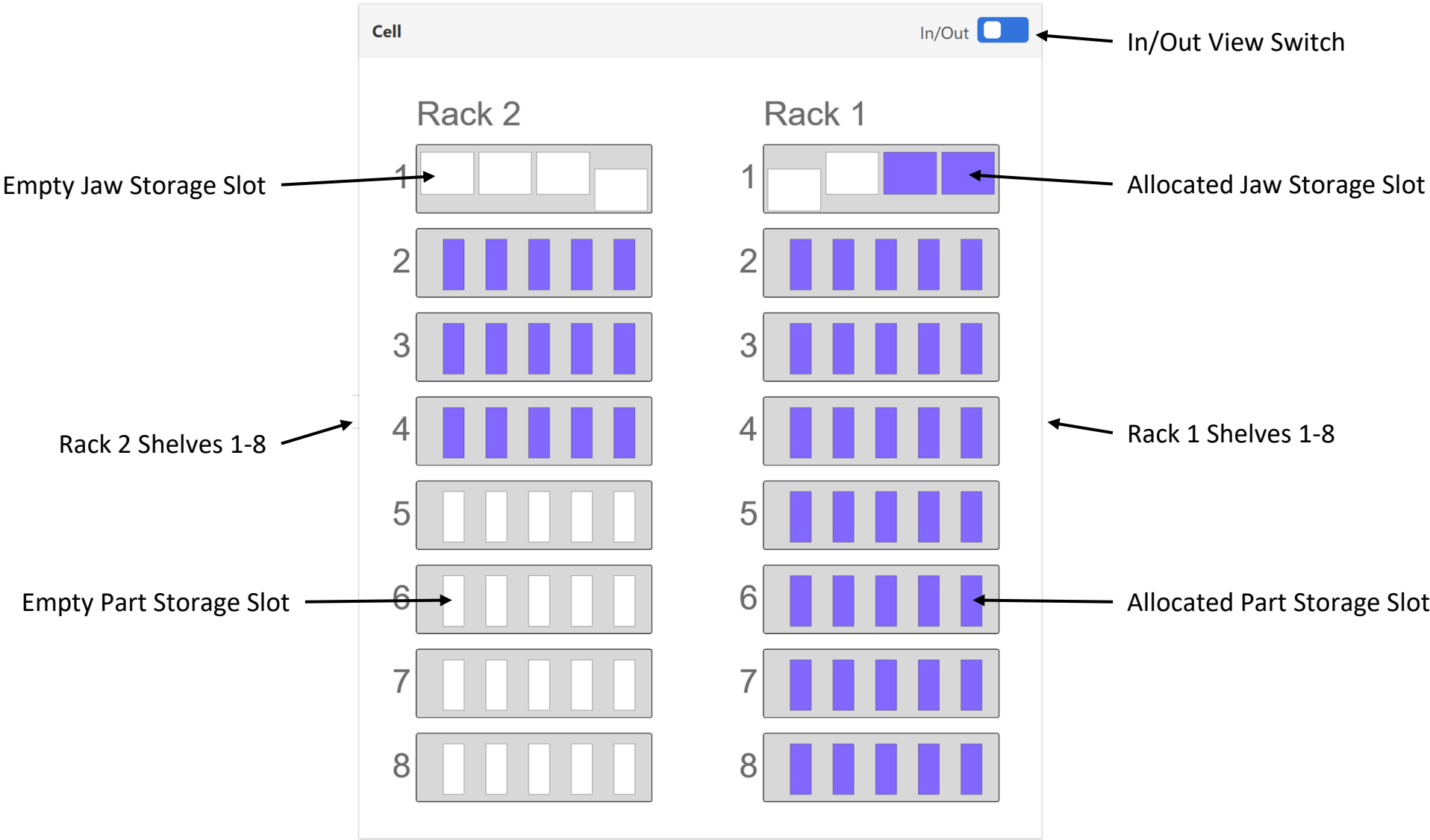
Jobs Panel

- The Jobs Panel allows new jobs to be entered, edited or cancelled
- Before a new job can be entered, at least one Part Number must be configured in the VBXC Configurations Screen
- To enter a new job, hit the + button in the upper right hand corner of the Jobs panel
- Enter a Name for the order, select a Part Number and enter a Count
- Press Save to begin the job setup, the Actions Panel will list the steps required to start the job
- Note: Only actions required for the VBXC will be listed in the Actions Panel; the CNC must be configured to machine the part in the job and the CNC must be setup to communicate with the VBXC - See the VBXC CNC Manual for more information on CNC Communication Setup

The screenshot displays the 'Jobs' panel interface. At the top, there is a header bar with the title 'Jobs' and a blue plus button in the upper right corner. Below the header, a message states: 'Hit the plus button in the upper right hand side of this card to add a job.' The main form area is titled 'Jobs' and contains the following fields:

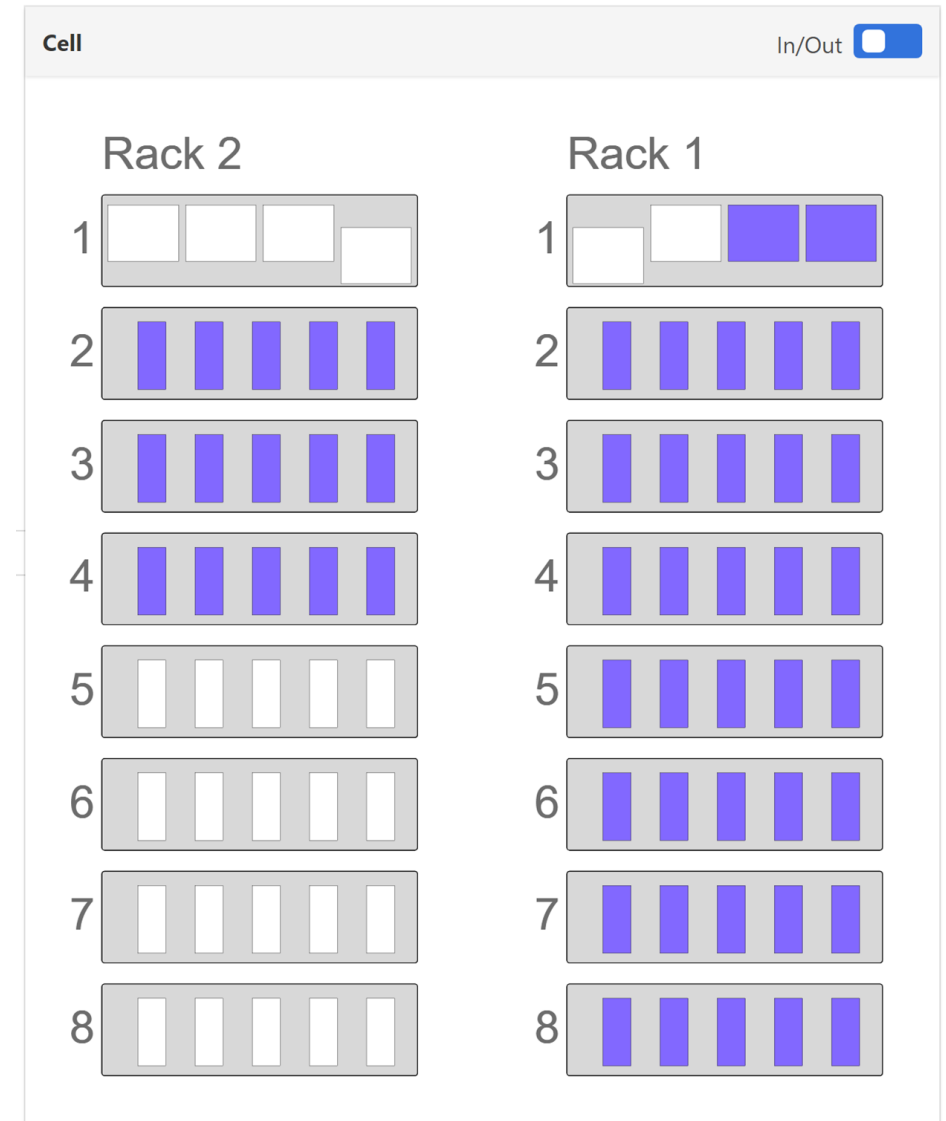
- Name:** A text input field containing 'Order 4379'.
- Part Number:** A dropdown menu showing '0800-455 Connector' with a blue downward arrow.
- Count:** A numeric input field with '50' entered and a spinner control on the right.
- ☐ Pause after completion
- Buttons:** A blue 'Save' button and a white 'Cancel' button.

Cell Panel



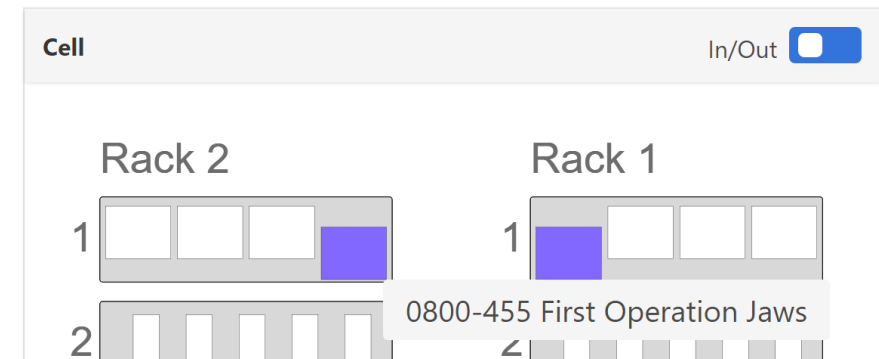
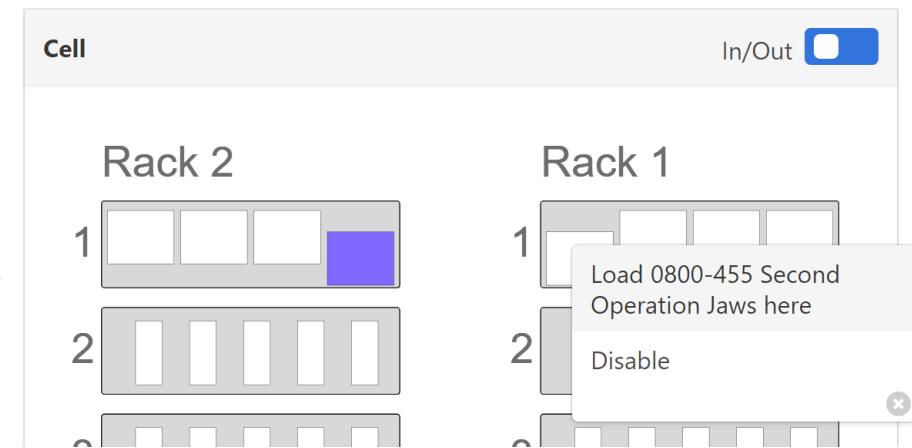
Cell Panel

- The Cell Panel allows the operator to specify and confirm the location of where parts and jaws are stored in the VBXC
- In the upper-right corner of the Cell panel, the In/Out switch changes the view of the Cell panel
 - **In** is a simulated view displaying the racks and shelves looking from the inside of the VBX-160
 - **Out** is a simulated view displaying the racks and shelves looking from the outside of the VBX-160
- Shelf 1 on Racks 1 and 2 hold MultiGrip jaws and cannot be configured any other way
- Shelves 2 through 8 hold Universal Part Locators and can be configured for 3, 4, 5, 6 or 8 picks per shelf in the Settings Page (see Section 5.9)



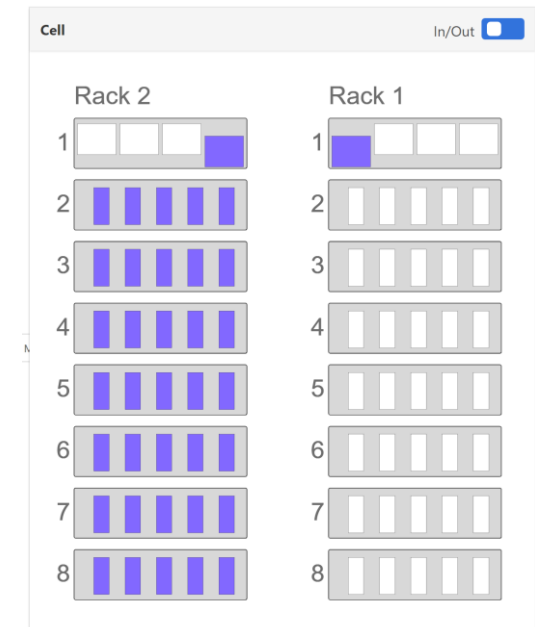
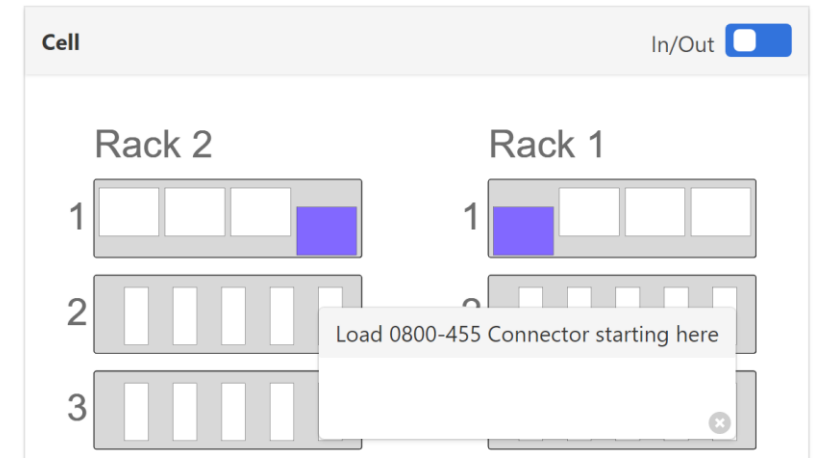
Cell Panel

- When a new job is added through the Job Panel and there are Action Panel Jaw and Part items to complete, the operator must select where in the cell the jaws and the parts will be located
- In this state, a right-click menu is available to tell the VBXC where the jaws and parts will be stored
- If the Action panel includes a Load Jaws action item, then right-clicking on a Jaw Slot on shelf 1 of Rack 1 or Rack 2 will bring up a menu to allocate a jaw to that Jaw Slot
- The VBXC acknowledges the jaw has been allocated to that Jaw Slot by displaying the rectangle in a purple color
- Hovering the mouse over a purple rectangle will pop-up a message displaying what jaws are allocated to that Slot



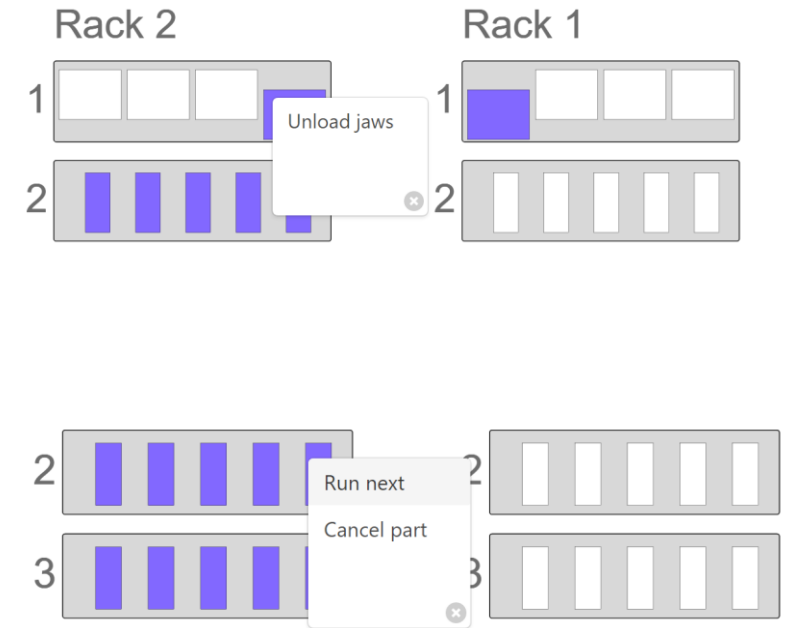
Cell Panel

- If the Action panel includes a Load Parts action item, then right-clicking on a Part Slot anywhere in Rack 1 or Rack 2 will bring up a menu to allocate parts beginning at that Part Slot
- Parts are allocated from right to left across shelves and top to bottom across racks until the end of Rack 2 has been reached
- The VBXC acknowledges that a part has been allocated to Slot by displaying the rectangle in a purple color
- Hovering the mouse over a purple slot will pop-up a message displaying what Part Number is allocated to that slot








Cell Panel

- When jaws or parts are allocated to a slot, right clicking on the jaw or part will bring up a menu for that part
- Right clicking on an allocated Jaw Slot will allow the jaw to be unloaded (to be allocated to a different slot)
- Right clicking on an allocated Part Slot will bring up a menu to allow the part to be the next part Run or the part to be canceled

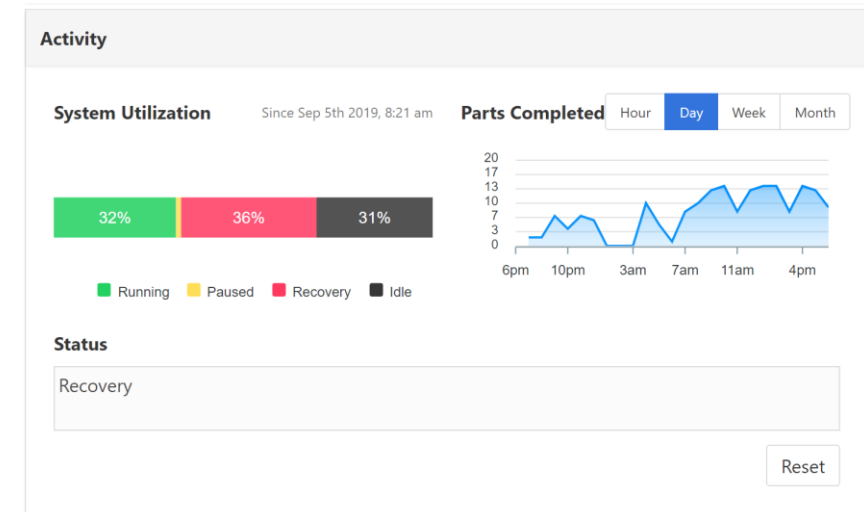


Cell Panel

- Color represents the status of the slot:
 -  Green - Part Complete
 -  Dark Purple - Waiting for processing
 -  Light Purple - Processing
 -  Red - Error
 -  White - Empty

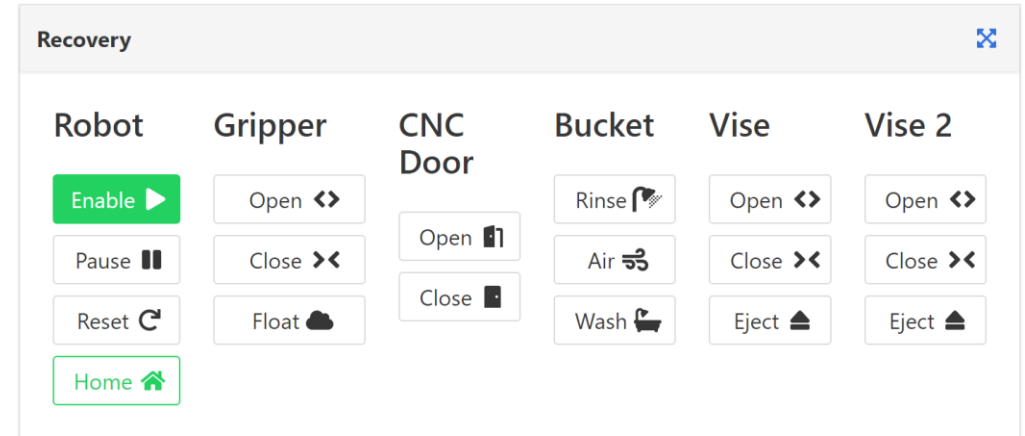
Activity Panel

- The Activity Panel shows activity of the VBX-160 for the trailing 30 days or since the Activity Panel has been Reset
- System Utilization shows the percentage of time spent in each processing state
- Parts Completed graphs the number of parts completed over the selected time period



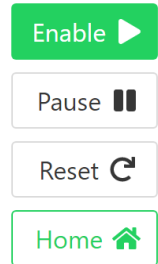
Recovery Panel

- The Recovery Panel can be accessed at any time by pressing Recovery button in the top right of the screen
- The VBXC will enter the Recovery state whenever a processing error is encountered
- When in Recovery with an active job, the Recovery Panel can be used to get the VBX-160 and CNC in state where the job can be resumed
- When in Recovery without a job active, the Recovery panel and the Cell Panel can be used perform individual robot actions useful for validating new part processes



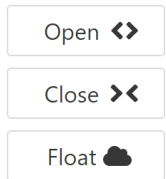
Recovery Panel

Robot



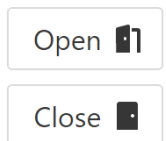
- Robot allows the robot to be Enabled for movement, Paused, Reset or Moved to the Home Position
- The Reset button clears the robot's memory of its current action
- The Home button can be used to get the robot to a safe Home position from almost anywhere (The robot must be at the Home position to exit the Recovery Panel)

Gripper



- Gripper buttons allow the MultiGrip Gripper to be opened, closed or floated
- The Float button removes open or closing pressure from the gripper

CNC Door




- CNC Door allows the operator to open or close the CNC Door

Recovery Panel

Bucket

Rinse 


Air 

Wash 

- Rinse button turns on the water pump in the Rinse Bucket
- Air button turns on the air knife in the Rinse Bucket
- Pressing the Wash button runs the robot through a rinse and dry cycle for the Multigrip jaws held by the robot

Vise

Open 

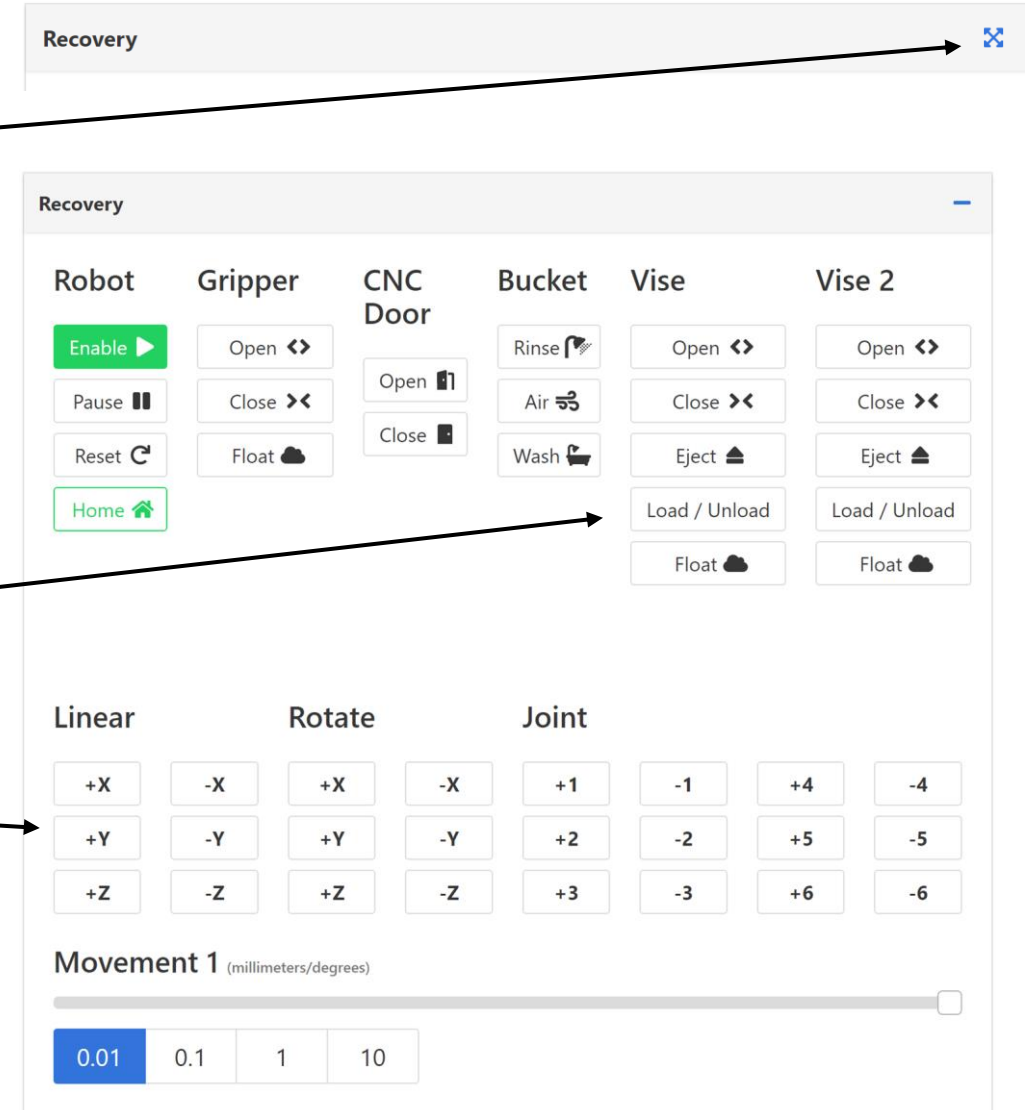
Close 

Eject 

- Vise Open button opens the vise
- Vise Close button closes the vise
- Eject button uses the robot to unload MultiGrip Jaws and place the Jaws back onto a Jaw Storage Plate (note: do not eject Jaws in a vise that are holding a part, remove the part first by opening the vise)

Recovery Panel

- Extended Functions can be accessed in the Recovery Panel by pressing the expand button in the upper right corner of the Recovery Panel
- The Extended Recovery Panel adds Advanced Vise Load/Unload buttons to the Vises
- and Robot Motion commands



Recovery Panel

- Robot motion commands should only be used in specific error conditions (see Section 5.3)
- Generally, only Linear motions should be necessary to recover from error conditions
- The movement scale adjusts how far the robot moves in millimeters or degrees; always start with movements of 1mm or less until you are confident in the direction of motion
- Linear motion moves the MultiGrip jaws the robot is holding according to the view shown
- Rotate motion rotates the MultiGrip jaws the robot is holding according to the view shown
- Joint motion moves the robot specified robot joint
- Joint 1 is the robot base up, joints increase numerically up to joint 6, the robot wrist

The Recovery Panel interface includes three columns of motion command buttons: Linear, Rotate, and Joint. The Linear column contains buttons for +X, -X, +Y, -Y, +Z, and -Z. The Rotate column contains buttons for +X, -X, +Y, -Y, +Z, and -Z. The Joint column contains buttons for +1, -1, +2, -2, +3, -3, +4, -4, +5, -5, +6, and -6. Below these buttons is a section labeled 'Movement 1 (millimeters/degrees)' which includes a horizontal slider and a set of four buttons: 0.01, 0.1, 1, and 10. The 0.01 button is currently selected and highlighted in blue. An arrow points from the text 'always start with movements of 1mm or less' to the 0.01 button, and another arrow points from the text 'Linear motion moves the MultiGrip jaws the robot is holding' to the Linear column of buttons.

Linear		Rotate		Joint			
+X	-X	+X	-X	+1	-1	+4	-4
+Y	-Y	+Y	-Y	+2	-2	+5	-5
+Z	-Z	+Z	-Z	+3	-3	+6	-6

Movement 1 (millimeters/degrees)

0.01 0.1 1 10

Recovery Panel

- Advanced Vise Loading and Unloading allows the robot to load or unload MultiGrip Jaws to or from the vise or Load or Unload parts to MultiGrip Jaws
- These functions are most useful for proving out a new part

Advanced Vise Loading & Unloading Operations

Vise 1

Vise Clamp

☒ OD ☐ ID

☐ Dump Coolant (Unload Operations Only)

☐ Do Not Fumble WARNING: Do Not Check If Vise Sensors Are Already Disabled

Load / Unload

☐ Jaws ☒ Part

Part Load/Unload Options

Part Clamp

☒ OD ☐ ID

Height (Z) (Inches)

X-offset (Inches)

Y-offset (Inches)

5

0

0

Special Movement Options

Z-Up (Inches)

Y-Back (Inches)

0

0

Warning: This recovery operation will not run table load or open cnc door.

Load

Unload

Cancel

Recovery Panel



- The robot motion commands should only be used under the guidance of a trained technician
- Using the robot motion commands can put the robot in a position that cannot be recovered from using the Home button





Linear		Rotate		Joint			
+X	-X	+X	-X	+1	-1	+4	-4
+Y	-Y	+Y	-Y	+2	-2	+5	-5
+Z	-Z	+Z	-Z	+3	-3	+6	-6

Movement 1 (millimeters/degrees)

0.01	0.1	1	10
------	-----	---	----

VBXC Configuration Page

Jaws +			
Name	Description	Clamp	Edit
0800-455 First Operation Jaws	First operation jaw for 0800-455 on CNC #37 Vise 1	OD	
0800-455 Second Operation Jaws	Second operation jaw for 0800-455 on CNC #37 Vise 2	OD	

Parts +		
Part Number	Description	Edit
0800-455 Connector	0800-455 Connector on Machine #37	
5003269	VersaBuilt Rectangle - with wash as milling	
5003269A	VersaBuilt Rectangle - TestAllSlots	
5003269B	VersaBuilt Rectangle - Two Op Two Vise Test	

- The VBXC Configuration Page includes Jaws configuration and Parts configuration
- Jaw and Part Configuration is documented in the VBX-160 Machinists Manual


VBXC Settings Page


- The VBXC Settings Page allows for configuration of the VBX-160 system and is typically used during initial setup of the VBX-160 and should only be changed by a trained technician
- VBXC Setting Page includes Panels for the following:
 - Main System Settings - select default units (inch vs metric), default robot shelf entry height and default programs for positioning the CNC table and CNC wash program
 - Processes - allows editing of the process scripts used by the Part Configurations to process parts
 - Initializer Settings - includes VBX-160 configuration settings particular to the installation

Main System Settings

Setting	Value
Units	Imperial
Default Entry Height	127
Default Table Load Program	81016
Default CNC Wash Program	81004

Edit System Settings

Processes 

To show available processes, uses the  in the upper right hand

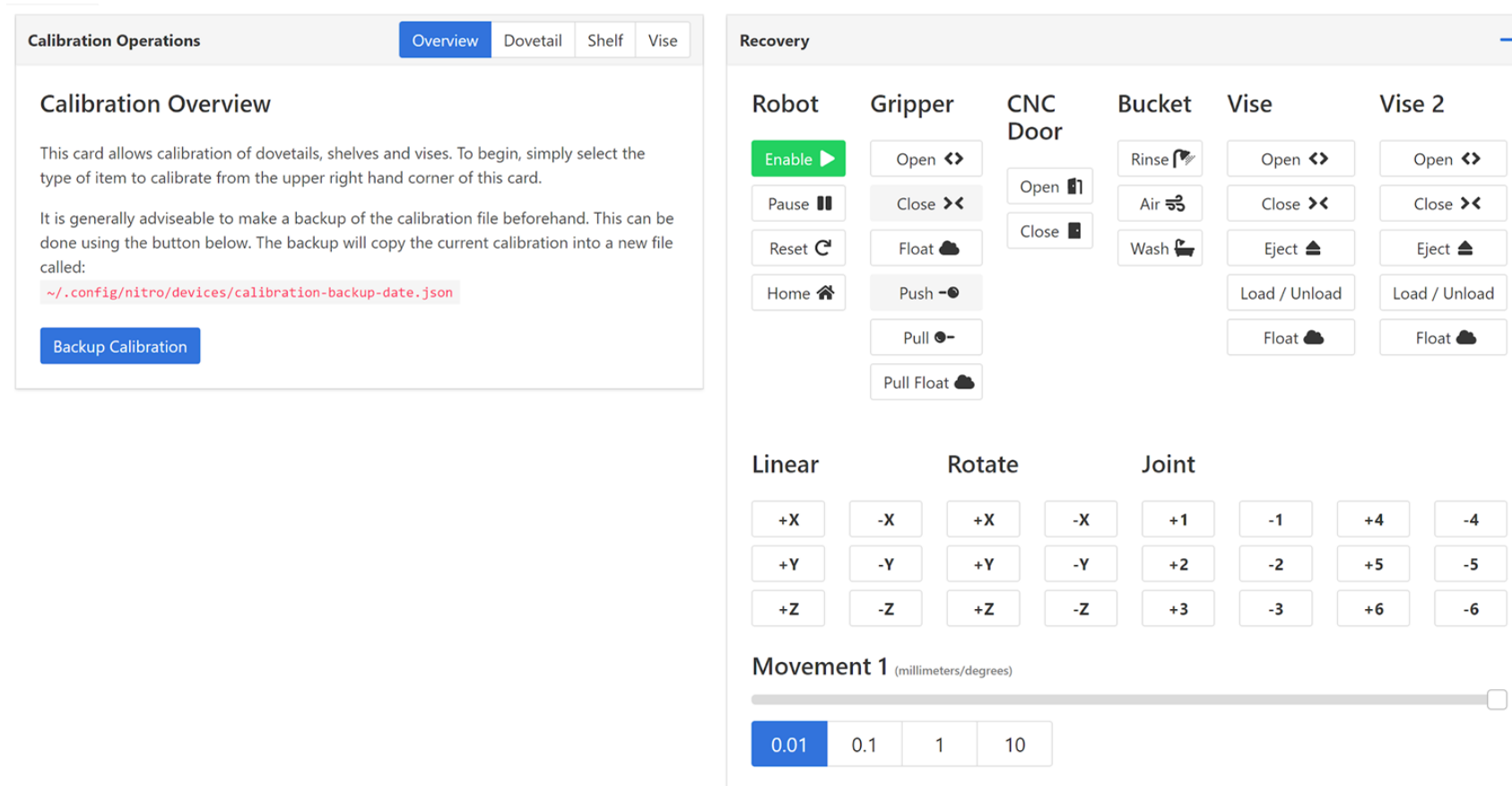
Initializer Settings

Name	Value
Robot	LR Mate 200iD/7L
Robot IP Address	192.168.20.69
Gripper IO Mechanism	Robot
CNC	Sim
CNC IP Address	192.0.2.4
IO	Sim
Door (May be overridden by CNC)	Sim
Vise Controller	Sim
Motion	Regular
Vises	2
Grippers	1

Edit Settings

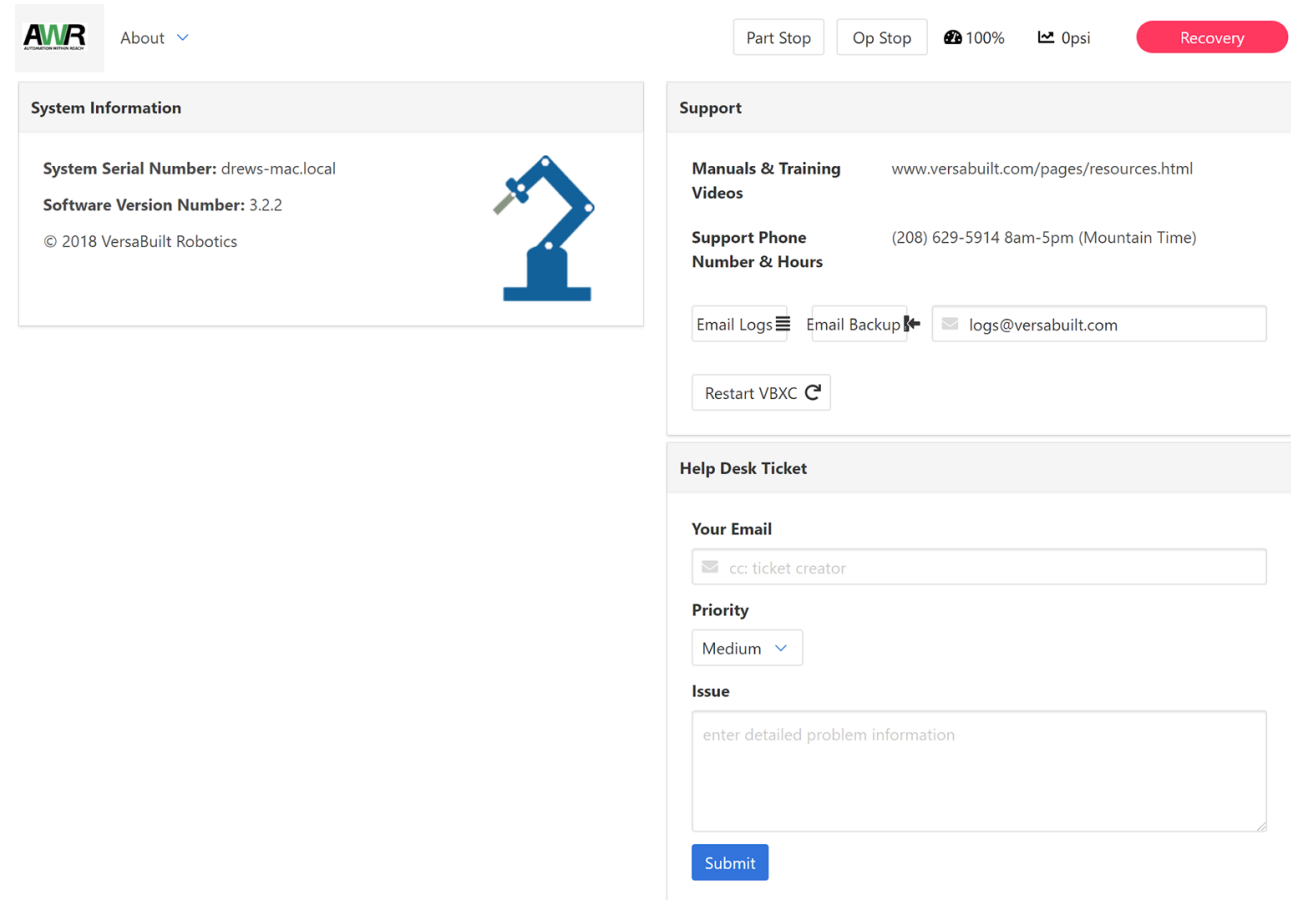
VBXC Calibration Page

- The VBXC Calibration Page is used to calibrate Jaw Storage Plates, Shelves and Vises
- Calibration is typically done by a technician as part of installation
- The VBXC Calibration page is documented in the VBX-160 Installation Manual



VBXC About Page

- The VBXC About Page includes information that is useful for AWR to support you if you have problems
- The System Information Panel includes the serial number of the VBX-160 and the software version
- The Support Panel includes information about how to get support, emailing logs or backup information to AWR and a button to Restart the VBXC
- The Help Desk Ticket Panel allows you to enter a help desk ticket directly to AWR



The screenshot displays the VBXC About Page interface. At the top left is the AWR logo and an 'About' dropdown menu. The main content area is divided into two panels. The 'System Information' panel on the left contains the following text: 'System Serial Number: drews-mac.local', 'Software Version Number: 3.2.2', and '© 2018 VersaBuilt Robotics'. To the right of this text is a blue icon of a robotic arm. The 'Support' panel on the right includes links for 'Manuals & Training Videos' (www.versabuilt.com/pages/resources.html) and 'Support Phone Number & Hours' ((208) 629-5914 8am-5pm (Mountain Time)). It also features input fields for 'Email Logs' and 'Email Backup' with a 'logs@versabuilt.com' email address, and a 'Restart VBXC' button with a refresh icon. Below the support panel is a 'Help Desk Ticket' section with fields for 'Your Email' (cc: ticket creator), 'Priority' (Medium), and 'Issue' (enter detailed problem information), followed by a 'Submit' button. At the top right of the interface are status buttons: 'Part Stop', 'Op Stop', '100%', '0psi', and a red 'Recovery' button.

Universal Part Locators

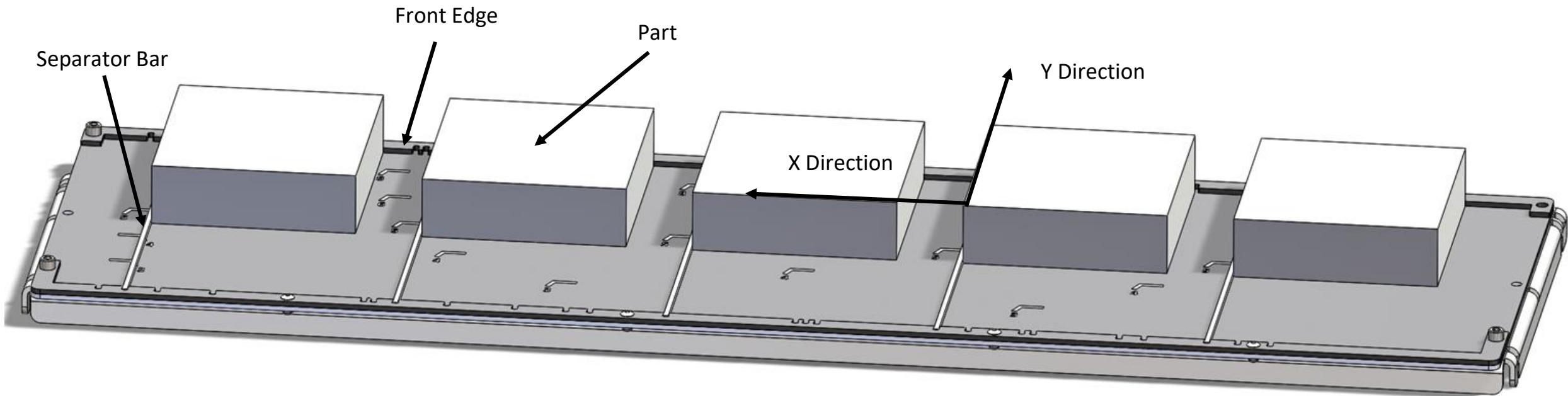
Section 6

Universal Part Locators

1. Universal Part Locators Overview
2. Configuring Universal Part Locators
3. Aligning parts in Universal Part Locators
4. Configuring the VBXC for Universal Part Locators

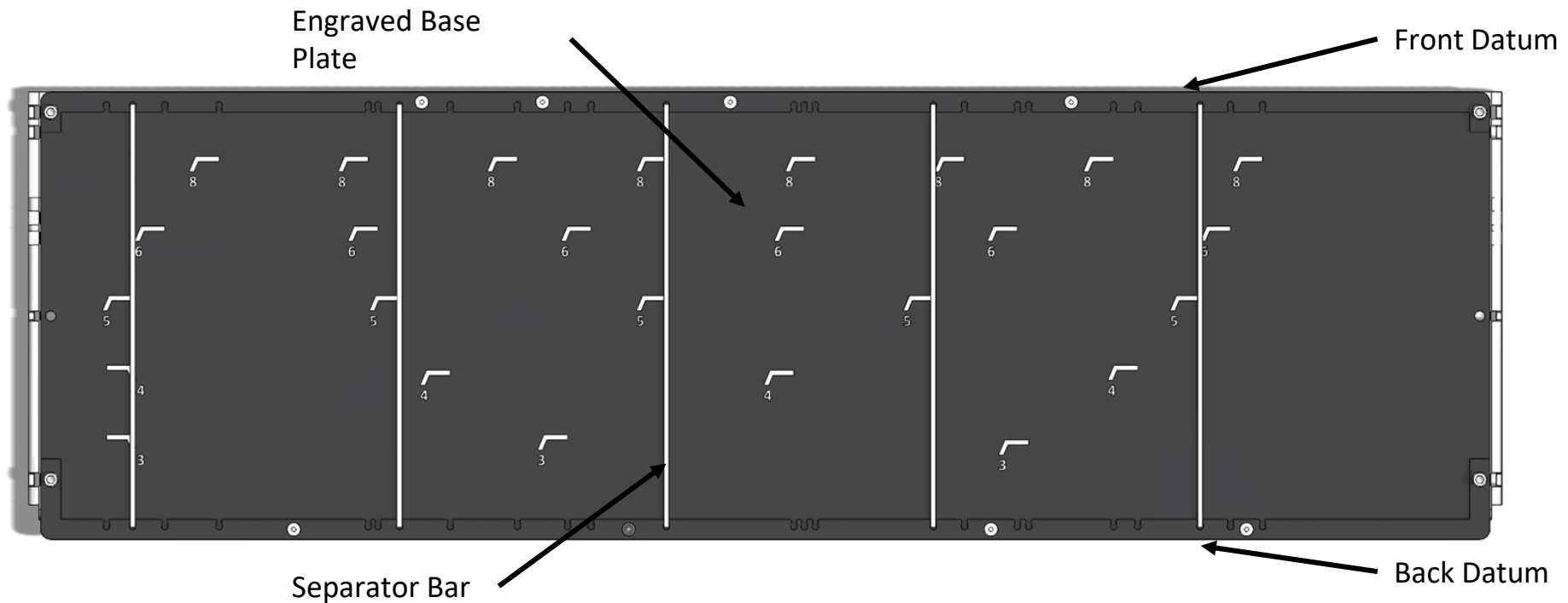
Universal Part Locator Overview

- Universal Part Locators are used to position parts on the shelf for the robot to pick up
- Parts are located against the front edge of the locator in the Y direction and against a separator bar in the X direction



Universal Part Locator Overview

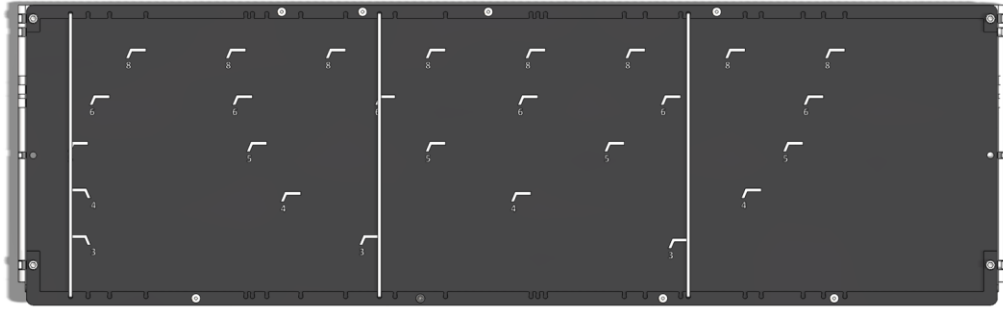
- Universal Part Locators include an engraved base plate, front and back datums and separator bars
- Pick templates are selected by aligning separator bars into the slots in the front and back datums aligned with the tip of the selected pick template engraving



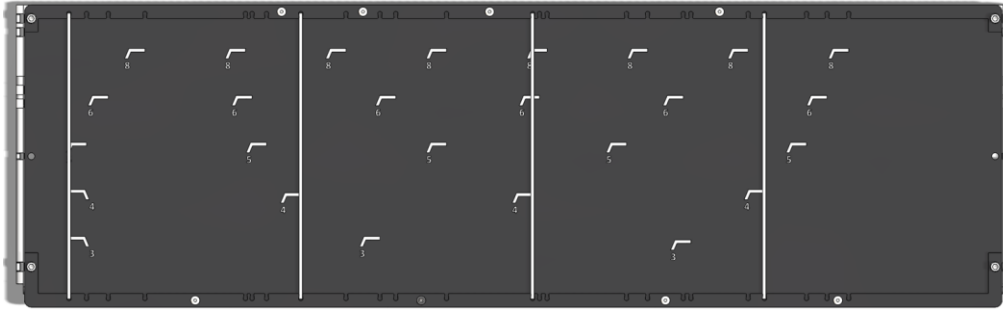
Universal Part Locator Overview

- Universal Part Locators can be configured for 3-picks, 4-picks, 5-picks, 6-picks or 8-picks per shelf
- The VBXC shelf configuration must match the configuration of the Universal Part Locators in the VBX-160
- The required configuration is part width dependent and stored with the part configuration
- When adding a new job for processing, the VBXC will prompt the operator to edit the shelf configuration if there are no shelves configured for the part to be processed
- Note: to run a job, at least one shelf must be configured with the required Universal Part Locator shelf configuration

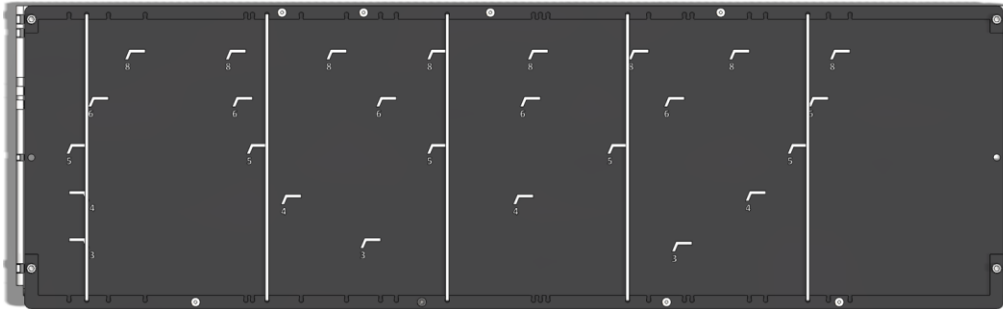
Configuring Universal Part Locators



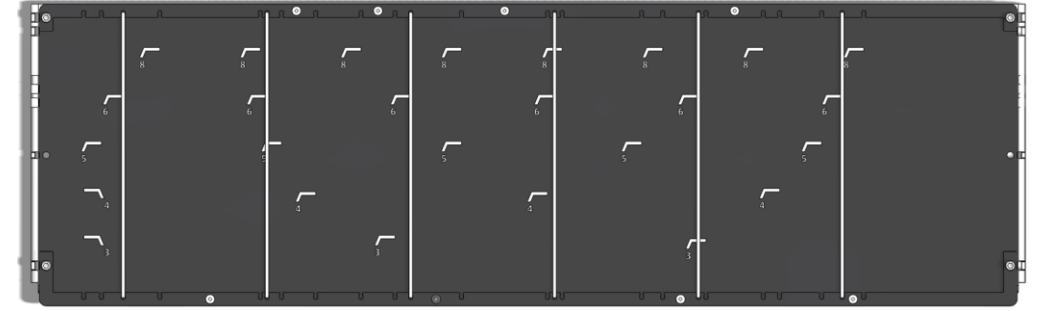
3-Pick



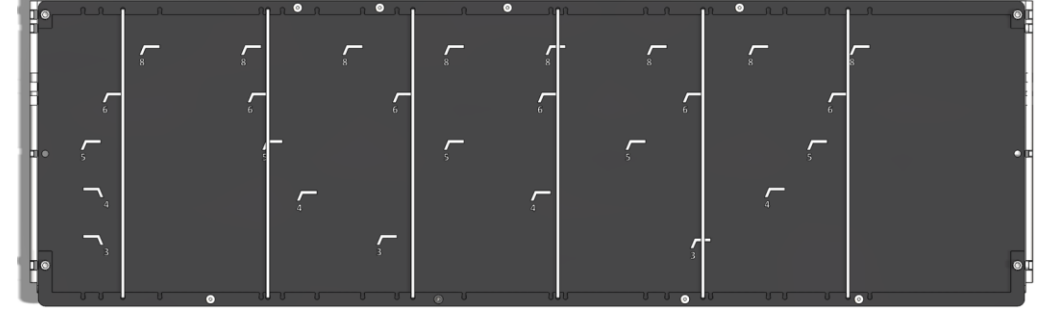
4-Pick



5-Pick

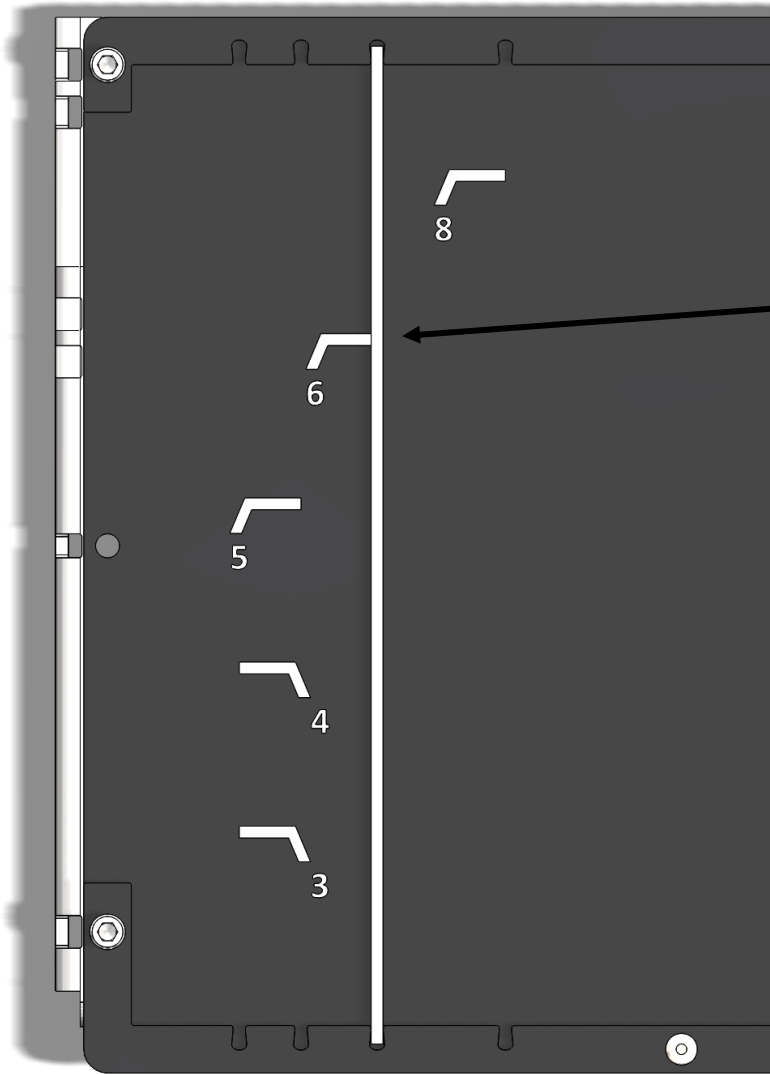


6-Pick



8-Pick

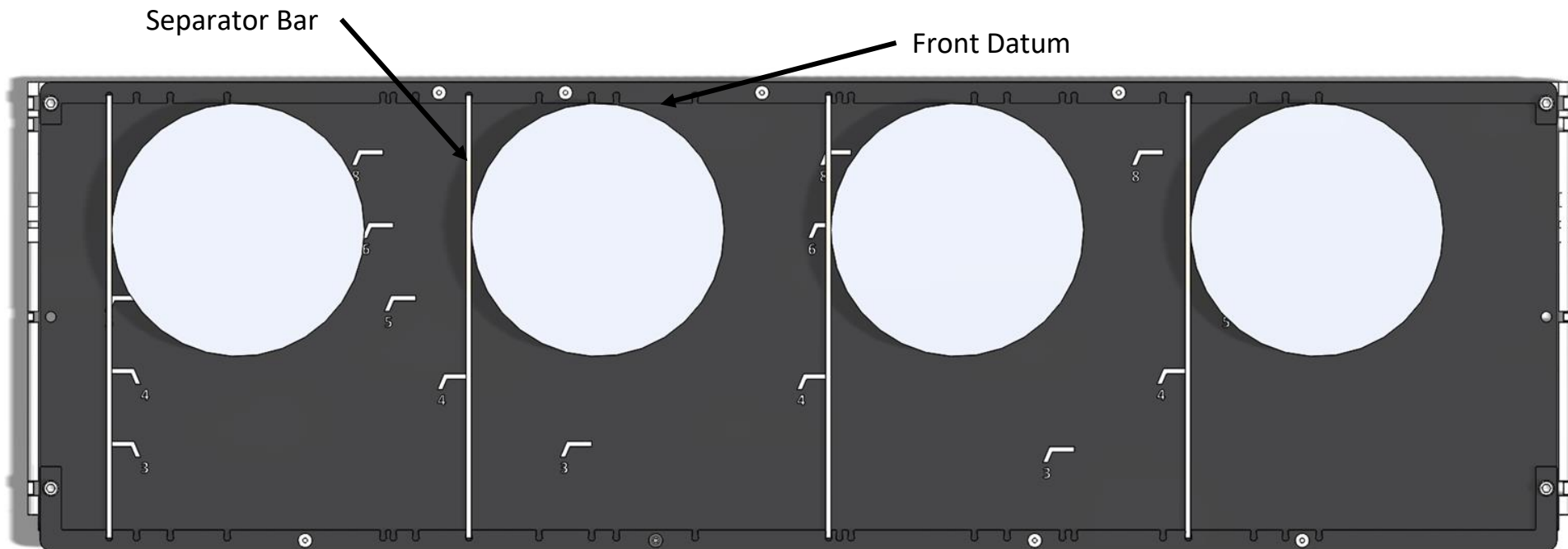
Configuring Universal Part Locators



- Separator bars are aligned in the slots of the Front Datum and Back Datum so the separator bar covers the tip of desired engraving leader

Aligning Parts in Universal Part Locators

- Parts should be pushed against the Front Datum and to the Separator Bar to the left of the part
- Note: the part should just contact the Separator Bar; make sure the part is not deflecting the Separator Bar



Configuring the VBXC for Universal Part Locators

- Shelf configuration in the VBXC is done from the Settings page of the VBXC
- To get to the Settings Page, click the down arrow in the upper left part of the screen and select Settings
- In the bottom right corner of the Settings page is the Shelf Configuration Panel
- Click on the Edit Configurations button to edit the Shelf Configuration

The screenshot displays the VBXC interface. At the top left, the 'AWR' logo is visible. A navigation menu is open, showing options: Home, Configurations, Settings, Calibration, and About. An arrow points from the 'Settings' option in the list to the 'Settings' page. The 'Settings' page has a header with a lock icon and user initials 'G P D B V'. Below the header is a table with columns: Name, Part Number, Progress, Edit, and Cancel. The first row shows 'Order 4379' with '0800-455 Connector' and '0 / 50' progress. Below this table is the 'Shelf Configuration' panel. It has a table with columns: Shelf, Rack 1 Template, and Rack 2 Template. The table contains 8 rows. The first row has '1' in the Shelf column, 'Jaws' in the Rack 1 Template column, and 'Jaws' in the Rack 2 Template column. The remaining 7 rows have '2' through '8' in the Shelf column and 'Universal Five Pick' in both the Rack 1 and Rack 2 Template columns. At the bottom right of the Shelf Configuration panel is a blue button labeled 'Edit Configurations'. An arrow points from the 'Edit Configurations' button in the text to this button.

Shelf	Rack 1 Template	Rack 2 Template
1	Jaws	Jaws
2	Universal Five Pick	Universal Five Pick
3	Universal Five Pick	Universal Five Pick
4	Universal Five Pick	Universal Five Pick
5	Universal Five Pick	Universal Five Pick
6	Universal Five Pick	Universal Five Pick
7	Universal Five Pick	Universal Five Pick
8	Universal Five Pick	Universal Five Pick

Edit Configurations

Configuring the VBXC for Universal Part Locators

- In Shelf Configuration edit mode, each Shelf template can be selected to the desired configuration
- After making changes, press Save to save the new configuration

The screenshot displays the 'Shelf Configuration' interface, which is divided into two columns for 'Rack 1' and 'Rack 2'. Each rack contains a list of shelf templates, each with a dropdown menu for selection. At the bottom of each column are 'Save' and 'Cancel' buttons.

Rack 1	Rack 2
Shelf 1 Template Jaws	Shelf 1 Template Jaws
Shelf 2 Template Universal Four Pick	Shelf 2 Template Universal Four Pick
Shelf 3 Template Universal Four Pick	Shelf 3 Template Universal Four Pick
Shelf 4 Template Universal Four Pick	Shelf 4 Template Universal Four Pick
Shelf 5 Template Universal Four Pick	Shelf 5 Template Universal Four Pick
Shelf 6 Template Universal Four Pick	Shelf 6 Template Universal Four Pick
Shelf 7 Template Universal Four Pick	Shelf 7 Template Universal Four Pick
Shelf 8 Template Universal Four Pick	Shelf 8 Template Universal Four Pick

Error Recovery

Section 7

Error Recovery

1. Types of Errors
2. Recovering from CNC Errors
3. Recovering from Robot Errors
4. Improving the Automation Process

Types of Errors

CNC Errors

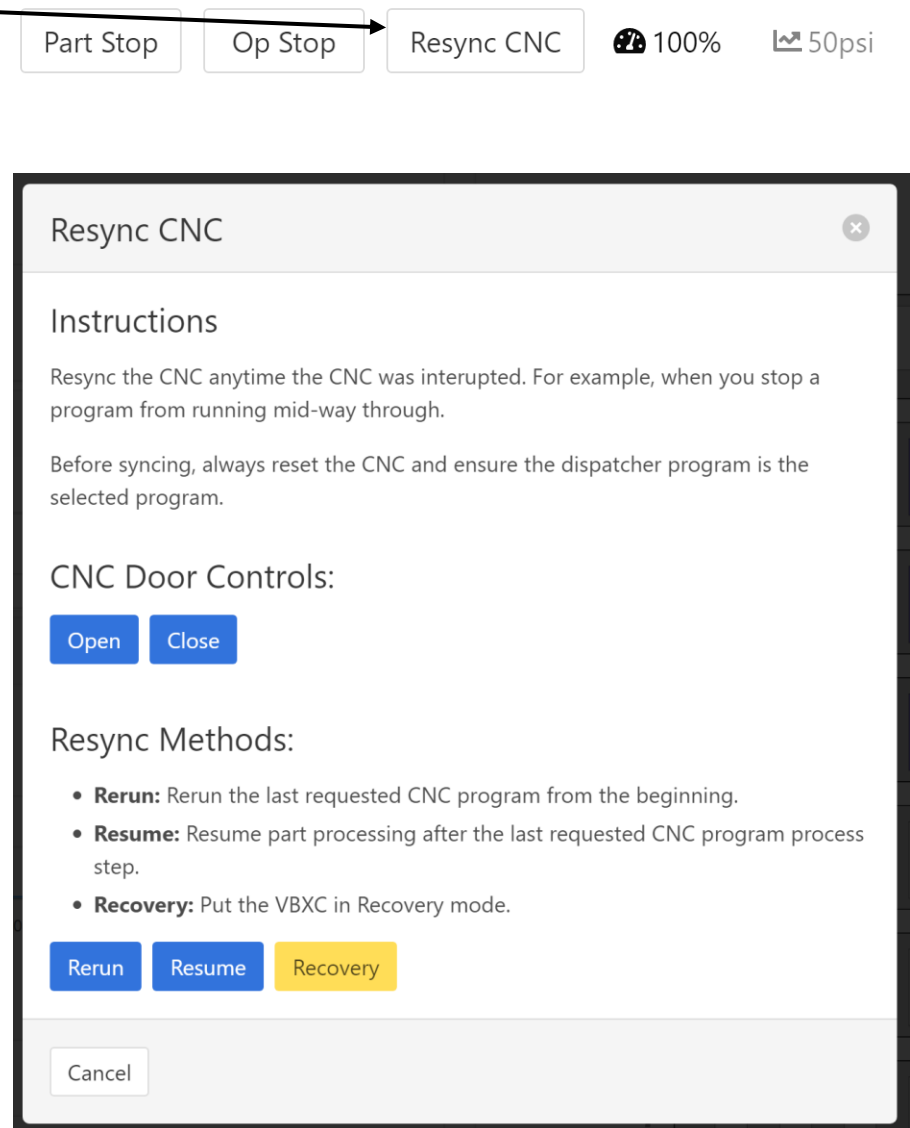
- CNC Errors are errors that disrupt the normal CNC operation processing and require the operator to intervene to resume normal CNC processing
- CNC Errors may include part probe faults, tool breakage detection, tool life expiration, CNC alarms that stop the CNC process

Robot Errors

- Robot Errors are errors that disrupt the normal robot processing and require the operator to intervene to resume normal VBX-160 processing
- Robot Errors may include collision errors, fumble errors (part falling out of jaws), CNC door opener errors, robot vise or gripper sensor errors

Recovering From CNC Errors

- While the VBXC is in the Running state and the CNC is machining, a Resync CNC button appears in the status bar
- If a CNC error occurs that requires the CNC to be restarted, you will need to Resync the CNC
- For VBX-160s that include an Auto Door controlled by the VBX-160, the Resync CNC dialog includes controls to Open and Close the CNC door
- There are three methods for Resync:
 - Rerun should be used when it is safe for the VBXC to rerun the CNC machining operation from the beginning
 - Resume should be used if the current machining operation was completed by the operator and the CNC and part are ready to move onto the to the next step
 - Recovery should be used when the best course of action is to remove the currently processing part from the CNC and continue processing with the next part
 - Note: All MultiGrip jaws must be removed from the CNC and placed back on the shelves before exiting recovery



Recovering from Robot Errors

- If the VBXC detects an unrecoverable error, it will automatically enter the Recovery state
- To complete the Recovery process the following general steps must be taken:
 - All MultiGrip jaws used in the job must be placed back on Jaw Storage Plates and the location of the Jaws must be acknowledged to the VBXC using the right-click menu in the Cell Panel (see Section 4.4)
 - The robot must be moved to the Home location by enabling the robot and pressing the Home button in the Recovery Panel
- **Important Notes:**
 - If possible, start the Recovery process by moving the robot to Home

Recovering from Robot Errors

- **Important Notes (continued):**
 - If the robot or a vise is holding MultiGrip jaws and a part when in Recovery, the part will need to be removed before the MultiGrip jaws can be placed on the Jaw Storage Plates
 - If the part is in the vise, use the recovery panel to open the vise, then pivot the VBX-160 away and open the CNC door to remove the part
 - If the robot is holding the part, press the Float button under the Gripper, then remove the part from the Gripper
 - Note: the part may drop when the gripper is floated, the part can be held by one person while another person floats the gripper

Recovering from Robot Errors

- **Important Notes (continued):**
 - If the robot is stopped in a shelf while picking or placing a part, you will need to do the following:
 - The robot must be clear of any part; by pressing the Home button, the robot will back the MultiGrip jaws straight back out of the shelf and could damage the part or the Universal Part Locator
 - If a part is interfering with the robot moving directly back out of the shelf, the part must be removed or the robot must be moved up from the part in Z+ enough to clear the part
 - If the MultiGrip jaws are pressing directly on the shelf , the robot must be moved up from the shelf in Z+ enough to clear the Universal Part Locator
 - If the robot immediately generates another collision error, try using very small increments to release the pressure of the collision before using larger increments; if a collision error persists even with small increments, you will need to power-cycle the VBX-160 to help release the collision pressure before continuing

Improving the Automation Process

- Every error in the automation or CNC process is an opportunity to improve that process
- Before fixing the error, take time to understand what caused the error and what corrective action can be taken in the future to prevent the error
- Most errors are caused by an uncontrolled part of the automation or CNC process or variability within those processes that was outside the range of what the process could tolerate
- Take proactive measures to improve the process or better control the variability in the process
- Work with the machinist or engineer that developed the process to improve the process
- Keep in mind that it is very difficult to control all process variability and that not all process errors will be worth fixing

Operating the VBX-160

Section 8

Operating the VBX-160

1. Powering-Up the VBX-160
2. Powering-Down the VBX-160
3. VBX-160 Doors
4. Pivoting the VBX-160 Away from the CNC
5. Maintaining the Rinse Tank
6. Manual Machining Mode

Powering-Up the VBX-160

There are 3 power switches on the VBX-160:

- Electrical Panel power lever
 - Mounted on side of Robot Controller and Air/Electrical Panel
- Robot controller power switch
 - Mounted on front of Robot Controller
- VBXC power button
 - Blue button mounted below VBXC Monitor



Power-up Sequence:

1. Move the Electrical Panel power lever to the up position
2. Turn the robot controller power switch to the on position
3. Press the VBXC power button so the blue light illuminates



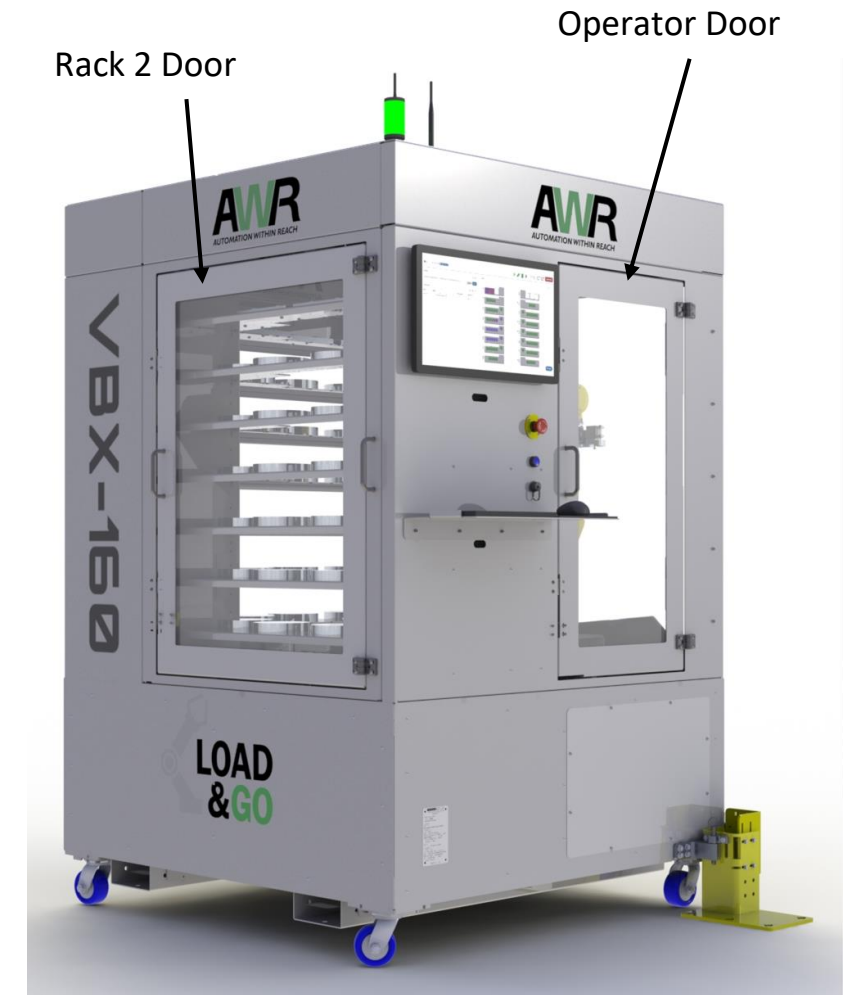
Powering-Down the VBX-160

Power-Down Sequence:

1. Press the VBXC power button
 - a. wait until the blue light goes off before continuing
2. Turn the robot controller power switch to the off position
3. Move the Electrical Panel power lever to the down position

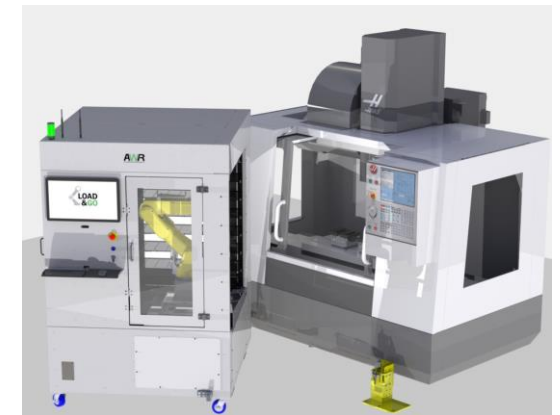
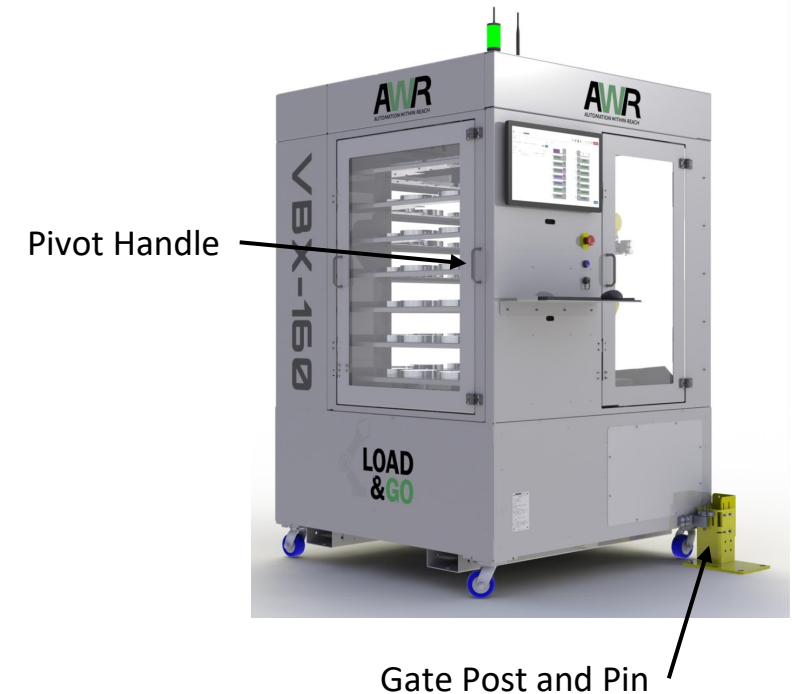
VBX-160 Doors

- VBX-160 has Three Doors:
 - Operator Door just to the right of the VBXC
 - Rack 1 Door in front of Rack 1
 - Rack 2 Door in front of Rack 2
- Door safety interlocks
 - Each door has a safety interlock switch
 - Safety interlock switch mounts to the door and to the VBX-160 chassis
 - When closed, a green LED will illuminate on the door interlock
 - When the door is open, the green LED is not illuminated and the robot will not be able to move
 - If the safety interlock does not function as described, contact AWR for service



Pivoting the VBX-160 Away from the CNC

- VBX-160 is secured in place using a Pivot Post and a Gate Post
- The Pivot and Gate Posts are secured to the concrete floor and the VBX-160 is secured to the posts using a steel pin
- To pivot the VBX-160 away from the CNC, pull the steel pin at the Gate Post adjacent to the VBX-160 Operator Door
- Make sure there are no people or objects in the way and then use only the Pivot Handle to pivot the VBX-160 away from the CNC taking care to avoid pinch hazards
- When pivoting the VBX-160 back to the CNC, use only the Pivot Handle to push the VBX-160 back into position taking care to avoid pinch hazards
- Push the steel pin back into place to secure the VBX-160 to the Gate Post



Maintaining the Rinse Tank

- VBX-160 uses a Rinse Tank to wash chips and coolant from the parts and jaws
- Removing chips is critical for maintaining a reliable automation process
- The Rinse Tank should be checked daily, adjusted as necessary and cleaned on a regular schedule to ensure a reliable automation process
- Water level should be maintained between the Min and Max fill lines
- Fill with clean water or water with a anti-corrosion inhibitor or with CNC machine coolant
- The Wash Nozzles and Air Knife are both adjustable and should be set in a position that cleans the jaws and parts adequately without excess water escaping the rinse tank; the
- Flow Valve can be used to adjust flow through the Wash Nozzles
- The Filter Bag should be checked for tears and cleaned of chip build-up using a wet vac



Maintaining the Rinse Tank

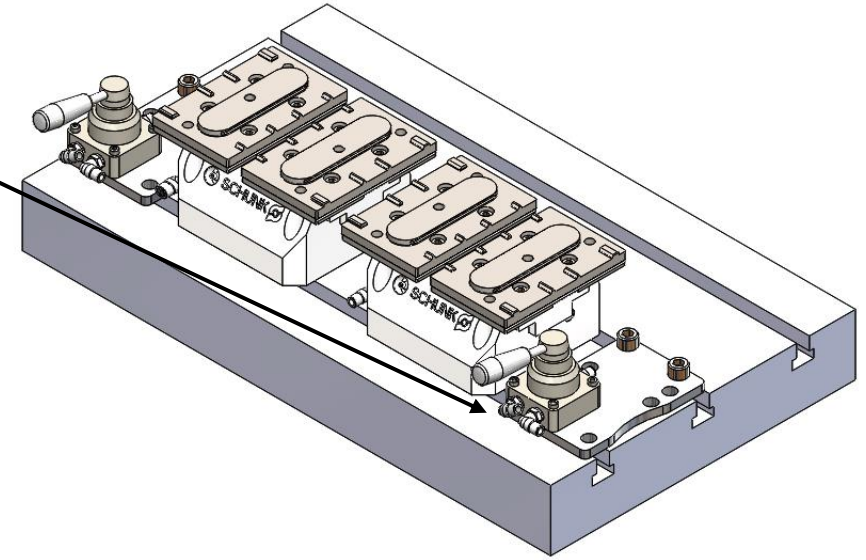
- The Hose Bib and Diverter Valve can be used to empty the tank
- Remove the cap on the Hose Bib and attach a short garden hose to the the the Hose Bib
- Turn the Diverter Valve so that it is in the position shown
- Put the other end of the hose into a suitable container
- From the VBXC Recovery Panel, press the Rinse button
- The pump will turn on and empty most of the Rinse tank
- Press the Rinse button again when the pump starts to suck air to shut off the pum
- The remaining fluid and chips in the Rinse Tank can be removed with a wet vac



Hose Bib

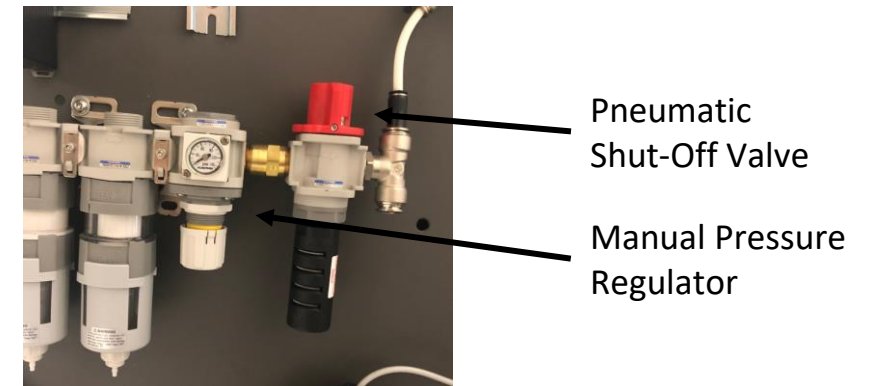
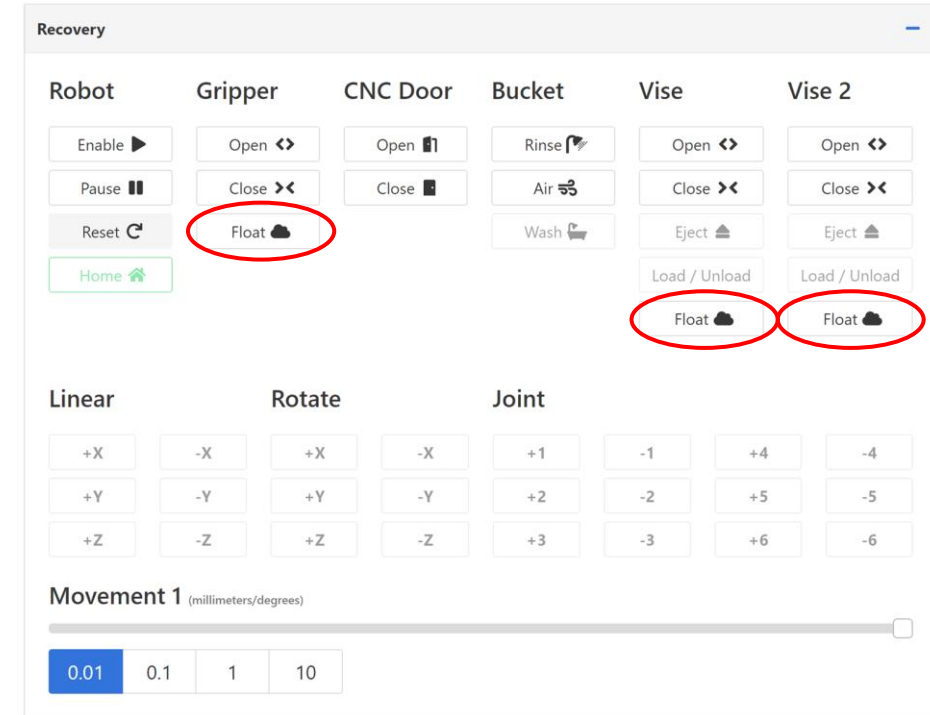
Manual Machining Mode

- The VBX-160 includes hand valves, mounted on the CNC table, that can be used for manual machining
- **SAFETY WARNING:** actuating a vise can cause a serious permanent injury, review Section 1 VBX-160 Safety
- Use extreme caution when manually actuating the vises with the hand valves - keep fingers and all other body parts away from the vises



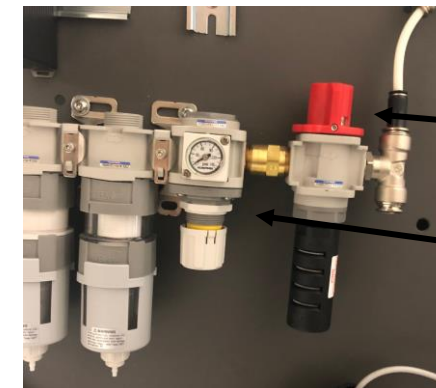
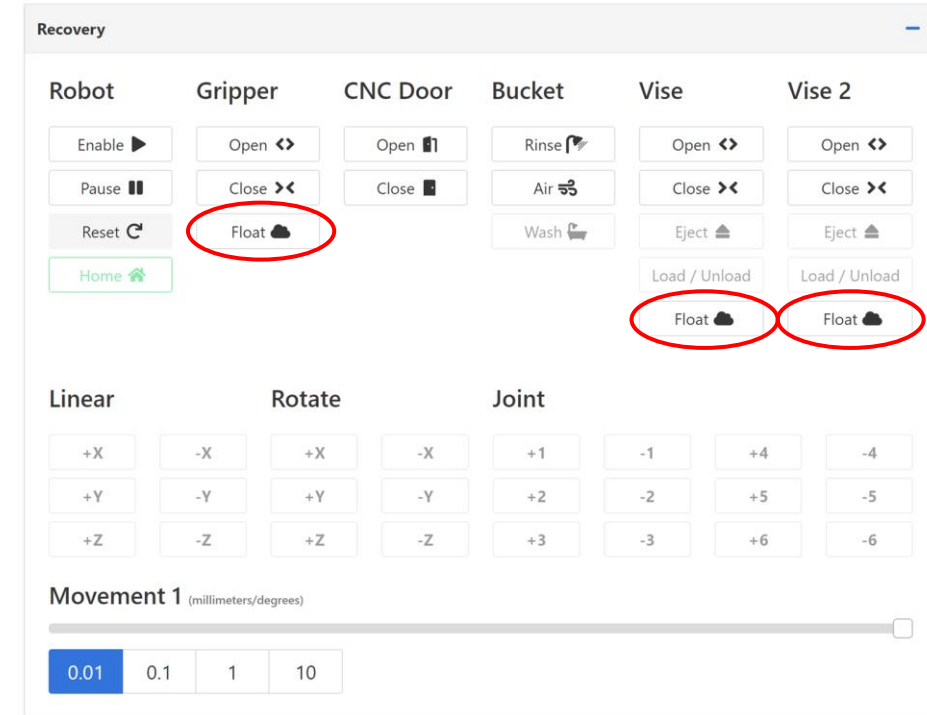
Manual Machining Mode

- The following steps are required to enable the hand valves for manual machining:
 - Make sure the VBXC and the CNC are idle
 - Enter Recovery mode on the VBXC
 - Press the Float button on all Vises
 - Release the red pneumatic shut-off valve located on the air-electrical panel and using approved devices, lockout/tagout the pneumatic shut-off valve
 - Test that energy has been removed by attempting to actuate the grippers and vises
- Test that the vises can be opened/closed using the hand valves
- Adjust vise pressure to the desired value using the manual pressure regulator



Manual Machining Mode

- The following steps are required to re-enable VBX-160 control of the vises for automation processing
 - Put each hand-valve into the center position
 - Pivot the VBX-160 to the CNC and close all of the VBX-160 doors
 - Actuate the red pneumatic shut-off valve located on the air-electrical panel
 - Enter Recovery mode on the VBXC
 - Test that the vises can be opened/closed using the buttons in the Recovery Panel
- Adjust PLC input pressure to the desired value using the manual pressure regulator (typically maximum shop air pressure)



Pneumatic
Shut-Off Valve

Manual Pressure
Regulator