VERSA BUILT ROBOTICS

UR Mill Application Kit
Machinist Manual

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Safety Warnings

Section 1

Safety Warnings

Validity and Responsibility

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

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

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

Limitation of Liability

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

Safety Warnings

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

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

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

Specifications

MultiGrip FJ Gripper, Clamping Force

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

Specifications

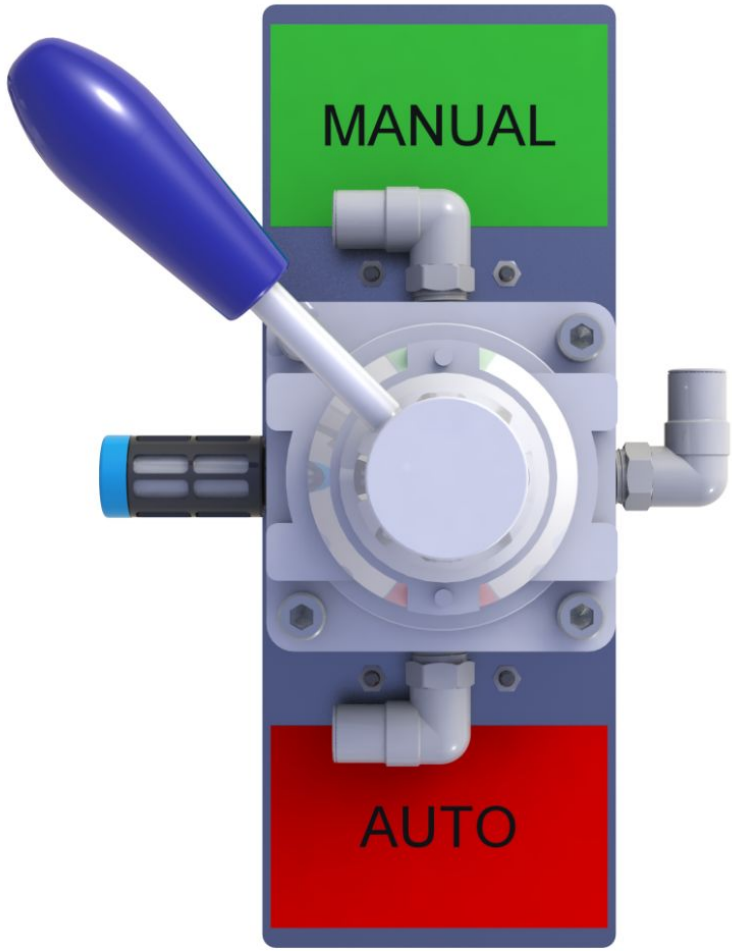
MultiGrip FJ Vise, Clamping Force

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

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

Safety Warnings

When the UR Mill Application Kit is not in use, remove the power to the Robot2CNC and switch the diverter valve to manual mode to prevent accidental automatic actuation of a MultiGrip FJ Vise.

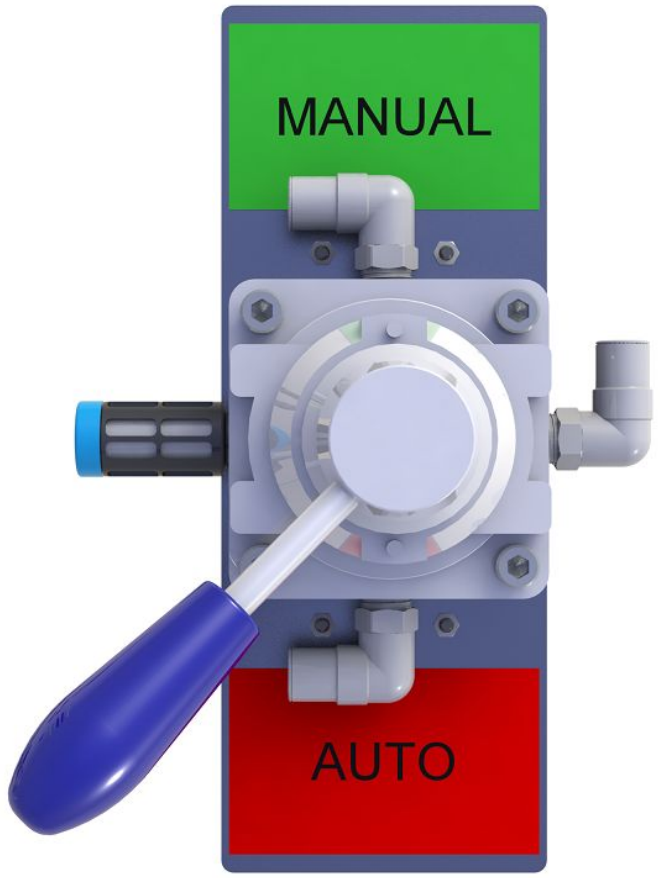


Selecting Automatic vs Manual Mode

Section 2

Selecting Automatic vs Manual Mode

- The UR Mill Application Kit has 2 modes:
  Auto and Manual
  - Auto mode is for running parts in the CNC with robotic tending
  - Manual mode is for running parts in the CNC via hand loading
- When the system is in Auto Mode, air to the hand valves on the CNC table is blocked.
- When the system is in Manual Mode, air to the Mill Panel and **optionally**[1] the Robot Controller (for gripper) is blocked, disabling automatic functionality.
- Switching between these 2 modes is done by way of the Diverter Valve and the Vise Hand Valves[2]



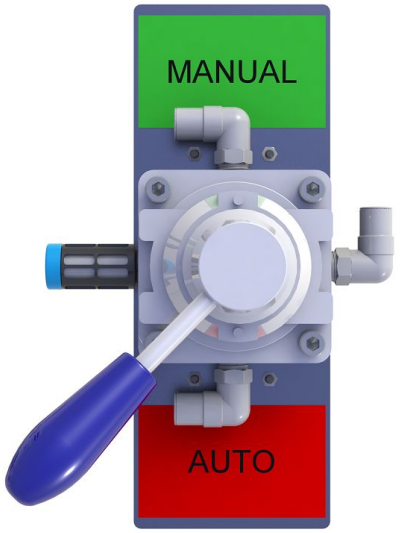
Diverter Valve shown in “Auto-Mode”

Notes:

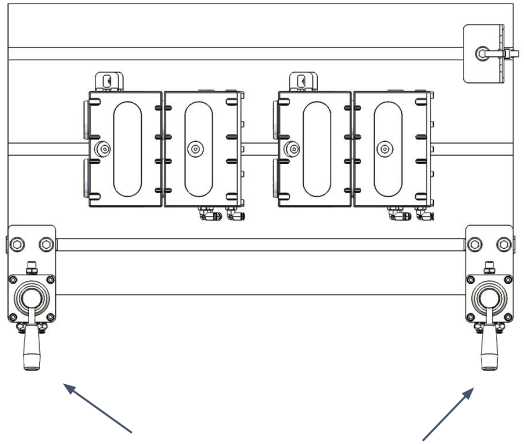
1) The UR Mill Application Kit - Installation Guide allows the Robot Controller pneumatics to be supplied by the Diverter Valve or be independent of the Diverter Valve; be sure to understand how the system is configured and what the diverter valve controls and doesn to control
2) Always test for proper pneumatic functionality when switching between Auto and Manual modes

Selecting Automatic vs Manual Mode

- Setting Automatic Mode:
  1. Be prepared for sudden movement of the vises, gripper, door opener and/or VersaBlast
  2. Set each Vise Hand Valve to the center position
  3. Ensure all persons are clear of the vises, gripper, door opener and VersaBlast
  4. Move the Diverter Valve handle to the AUTO position
  5. On the UR Teach Pendant -> Installation -> URCaps -> R2C Config validate vise, door and VersaBlast operation are working correctly



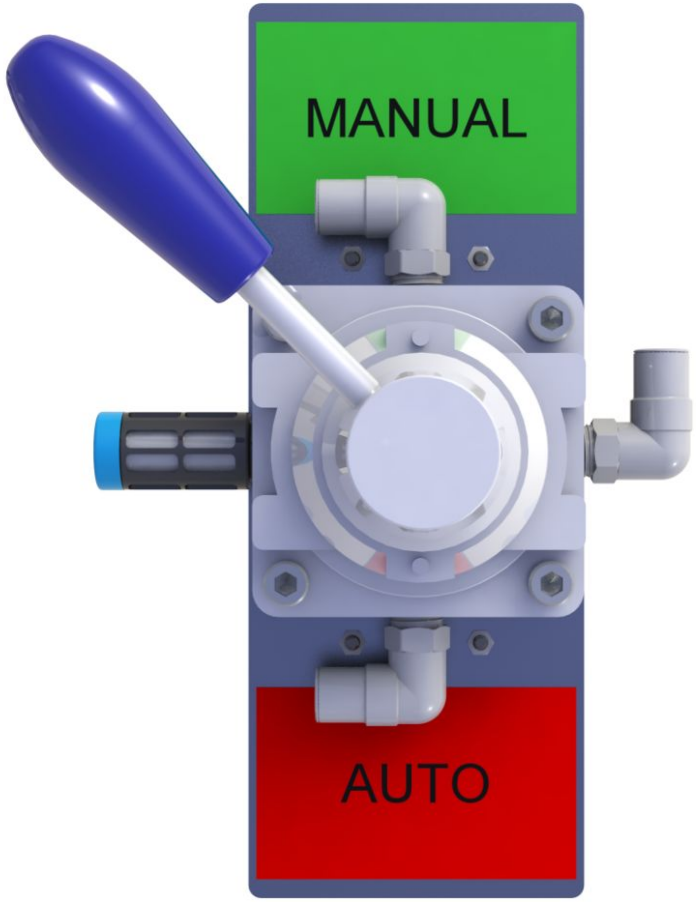
Diverter Valve shown in "Auto-Mode"



Vise Hand Valves shown in center position

Selecting Automatic vs Manual Mode

- Setting Manual Mode:
  1. Be prepared for sudden movement of the vises, gripper, door opener and/or VersaBlast
  2. Ensure all persons are clear of the vises, gripper, door opener and VersaBlast
  3. On the UR Teach Pendant -> Installation -> URCaps -> R2C Config press the Float Vises button
  4. Move the Diverter Valve handle to the MANUAL position
  5. With ALL body parts clear of each vise, set each Vise Hand Valve away from the center position



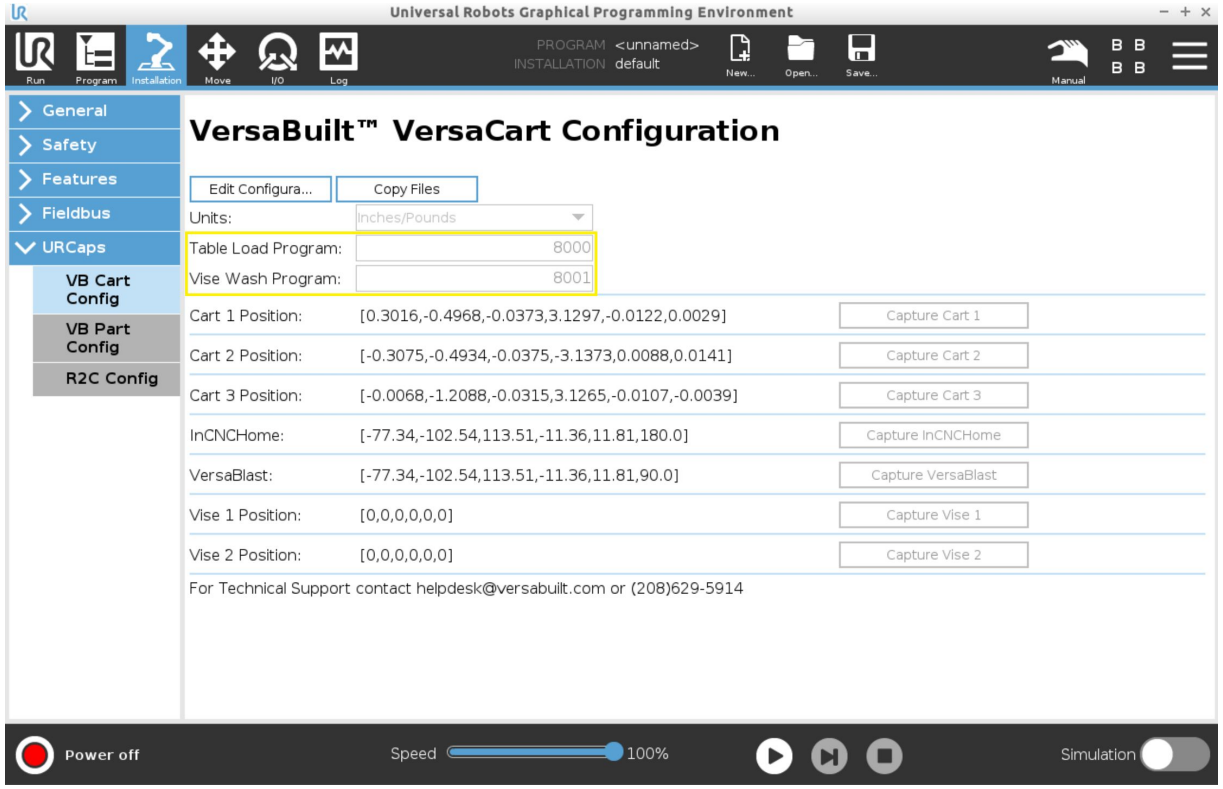
Diverter Valve shown in "Manual-Mode"

CNC Program Requirements

Section 3

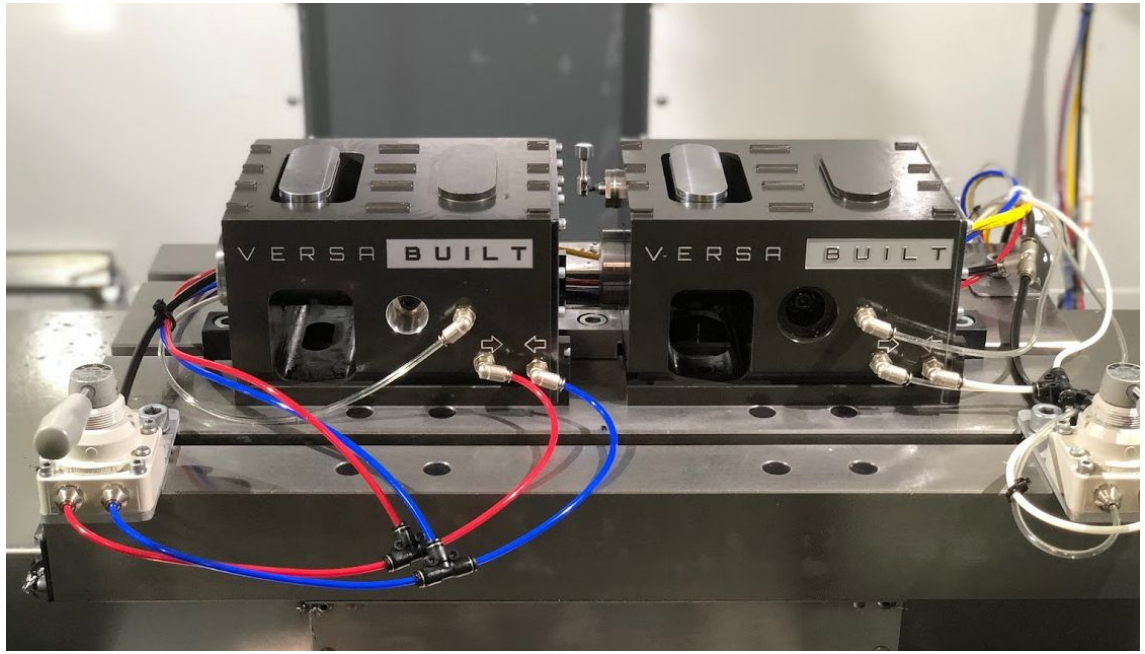
CNC Program Requirements

- During the installation process, a Table Load program and Vise Wash program should have been created and the program number stored in the VB Cart Config URCap
- The CNC Table Load program moves the CNC table to the location so the robot can load and unload the vises, the Vise Wash program washes the vise of chips
- The CNC Table Load program is called directly by the URMillApp program at the start of the automation process, the Vise Wash program is called at the end of the automation process before the jaw are put away on the vise



Vise Wash and Table Load Programs

- The CNC Vise Wash Program uses CNC coolant and optionally a chip fan to clean the vises before loading or unloading
- Main purpose of the Vise Wash program is to remove any chips that may be on a part ready for transfer or an empty vise that is about to be loaded
- Create a Vise Wash program that works well for your CNC vise configuration and test it thoroughly
- The Vise Wash program can be implemented as a subprogram and called just before the end of the milling program
- **NOTE:** All milling programs used in automation ***must*** end with cleaning the vises and positioning the CNC table to the table load position



End of Milling Program Requirements

- VB Mill App program requires the vises to be washed before the end of the program and the CNC table to be in the Table Load Position
- Robot2CNC requires the program to end an M98 P9004 to positively acknowledge the milling program is about to end

TIP: Add the following lines to your CAM Post right before the M30

```
M98 P8001     (Vise Wash)
M98 P8000     (Table Load Position)
M98 P9004     (Robot2CNC ack)
M30
%
```

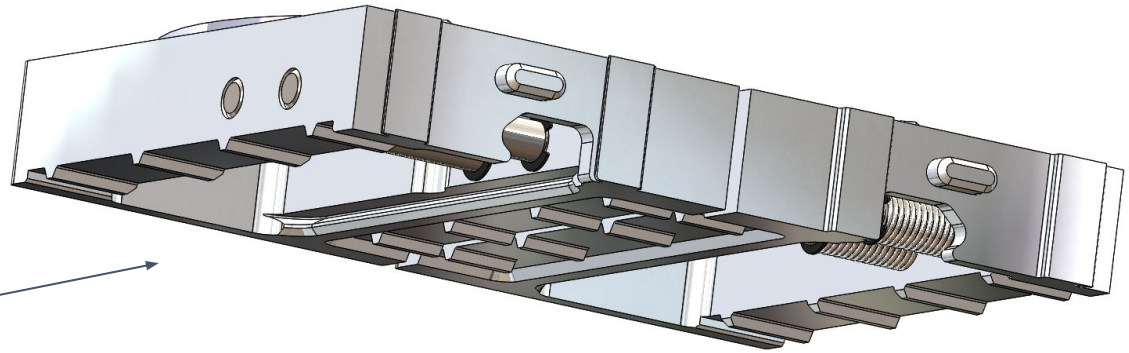
Introduction to MultiGrip Jaws

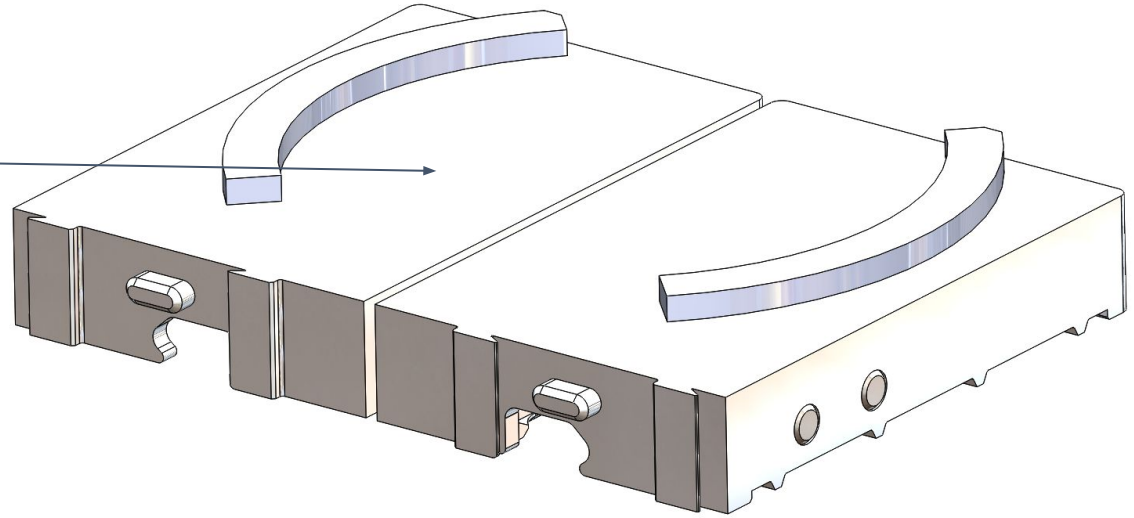
Section 4

MultiGrip Jaw Details

Three interfaces to MultiGrip Jaws:

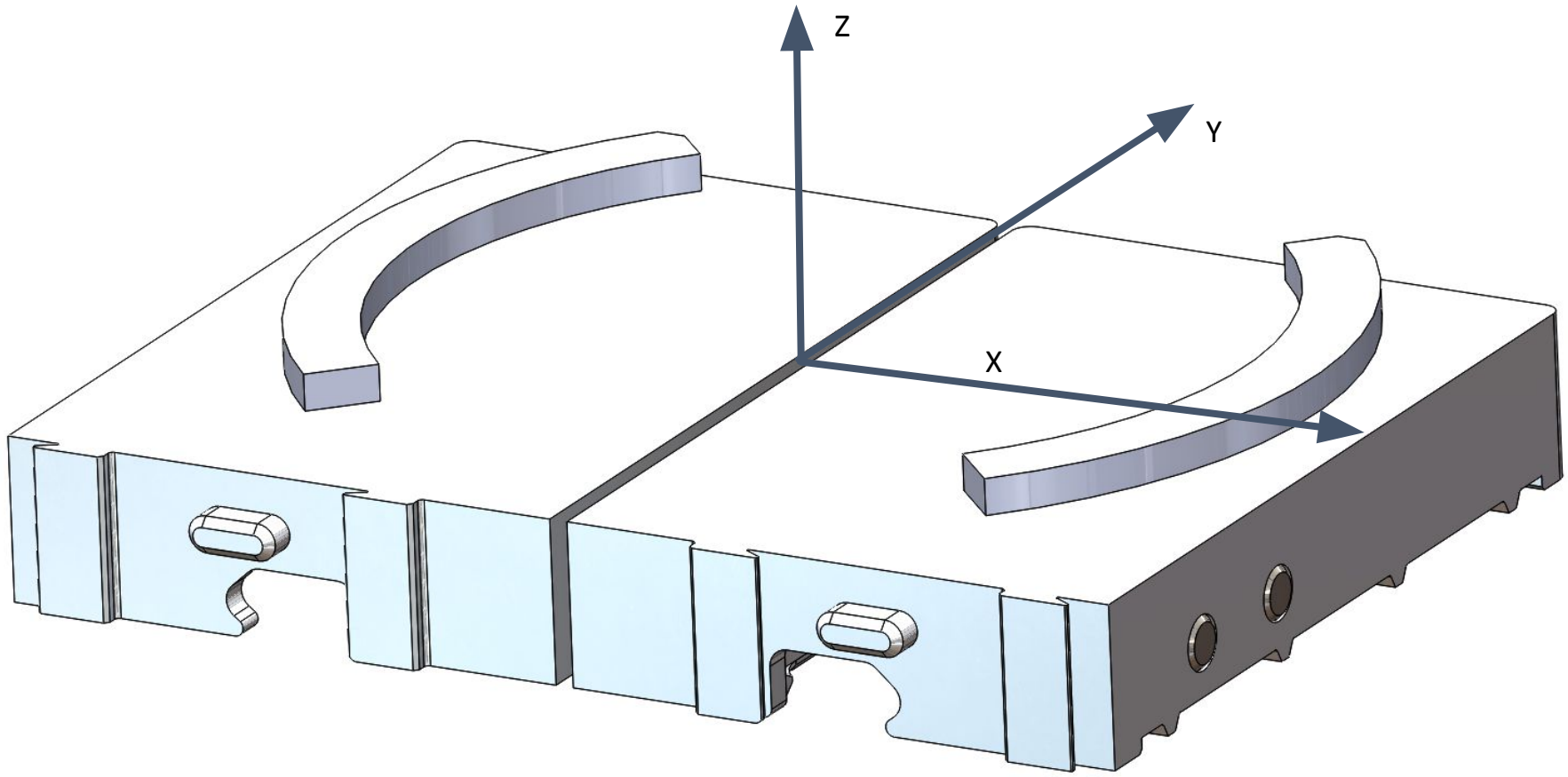
- Vise Interface
- Machinable Part Interface
- Gripper Interface





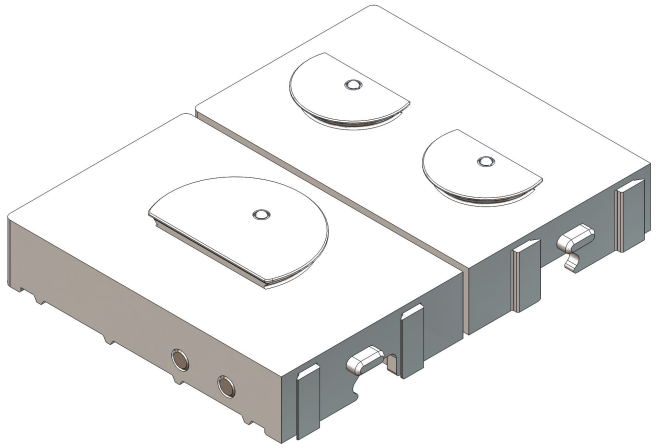
MultiGrip Axis Nomenclature

XYZ axis aligned with typical CNC axis

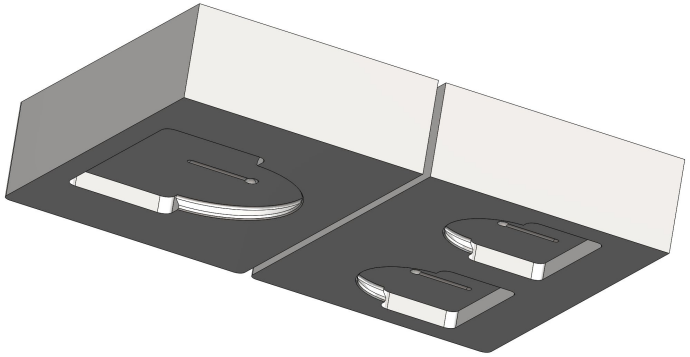


MultiGrip Jaw Types

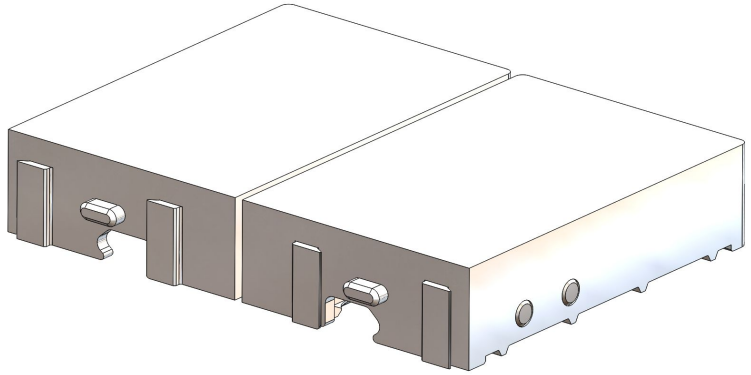
MultiGrip Base Jaws



MultiGrip Top Jaws

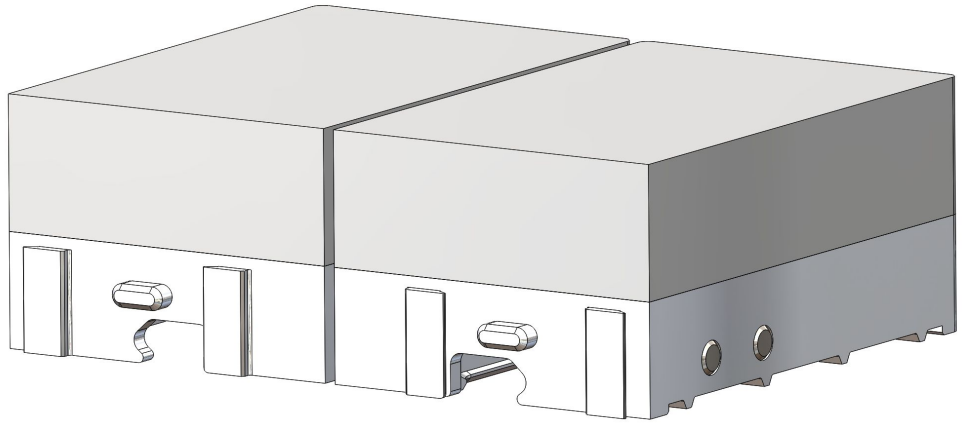


MultiGrip Fixed Jaws



MultiGrip Top Jaws

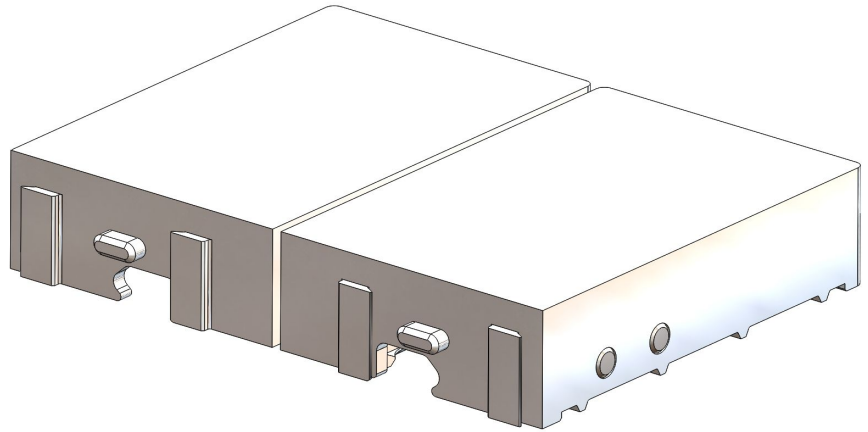
- Part pocket machined into low-cost exchangeable Top Jaws
- MultiGrip Top Jaws snap into place on MultiGrip Base Jaws in seconds
- One fixed Top Jaw, one swivel Top Jaw
- Swivel Top Jaw allows jaws to conform to part, increases gripping force on part
- Slightly heavier and slightly taller than MultiGrip 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 Top Jaws Mounted on MultiGrip Base Jaws

MultiGrip Fixed Jaws

- Solid top surface to machine part pocket
- Typically single part use
- Used when low overall jaw height or lowest jaw weight is required
- Minimum overall height of 1.125”
- Available in ID and OD clamping styles
- Available in 1.5” and 2.0” heights
- Considerations must be made to accomodate jaw deflection during gripper pick of rectangular parts (See section Designing MultiGrip Jaws for Picking and Placing for more information)

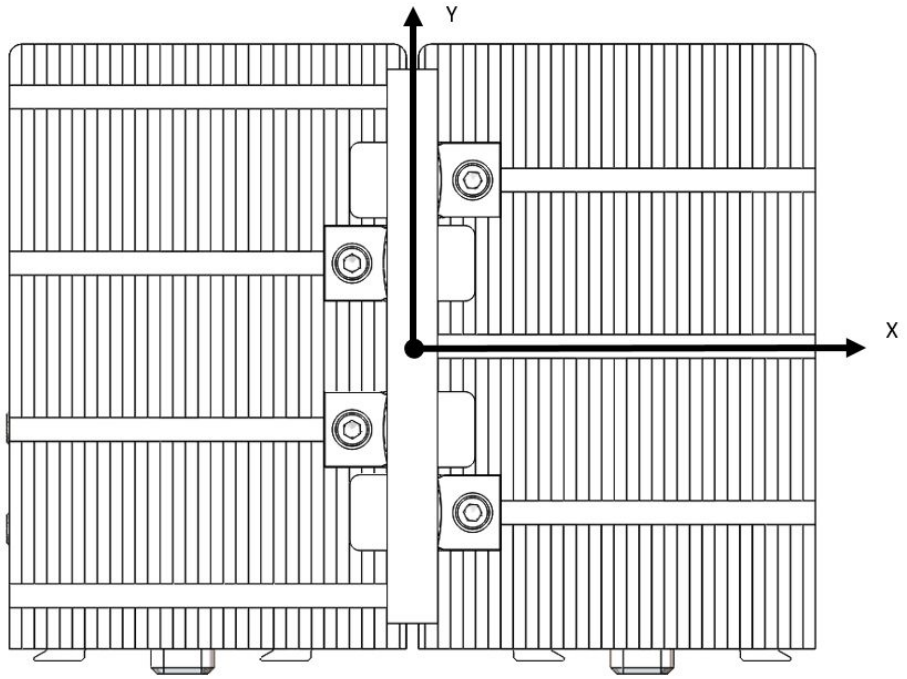


MultiGrip Jaw Repeatability

- Best repeatability of the MultiGrip workholding system is achieved when MultiGrip Top Jaws are paired with the MultiGrip Base Jaws and the MultiGrip Vise they were originally machined on
  - A good practice is to dedicate at least one set of MultiGrip Base Jaws to each vise
  - Engrave an identifier on each Base Jaw that encodes the CNC machine and vise the Base Jaw is dedicated too
  - When machining Top Jaws, engrave both a part number for the Top Jaws and the identifying number of the Base Jaw it was machined on to make it easy for operators to match the correct Top Jaw and Base Jaw together
- Variability of the position of the MultiGrip jaws between clamping cycles occurs primarily along the X axis
  - The position of the fixed jaw (right jaw) will vary a small amount based upon the clamping pressure applied and the friction between the MultiGrip Jaws and MultiGrip Vise

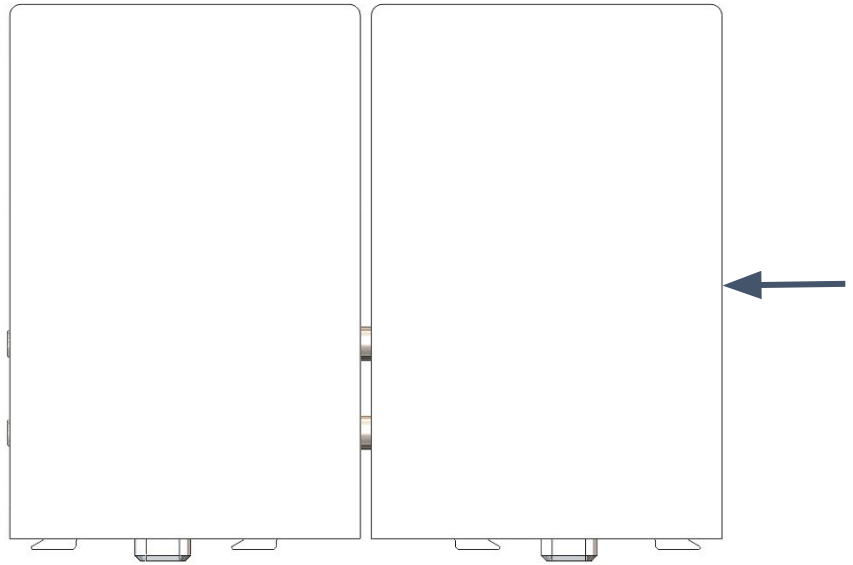
Best Practices: Setting the Machining Coordinate System

- When machining raw stock in the first operation, the requirements of the absolute position of the machined part relative to the raw stock are typically low
  - In this case, it is generally safe to use assumed center position of the vise found from the calibration plate in the installation process
- When machining the second operation or any operation in which critical dimensions must be maintained between how the part is held in the jaws and how it is finished
  - In this case best practice is to set the Machining Coordinate system by indicating the fixed (right) MultiGrip Jaw



Best Practices: Indicating MultiGrip Jaws

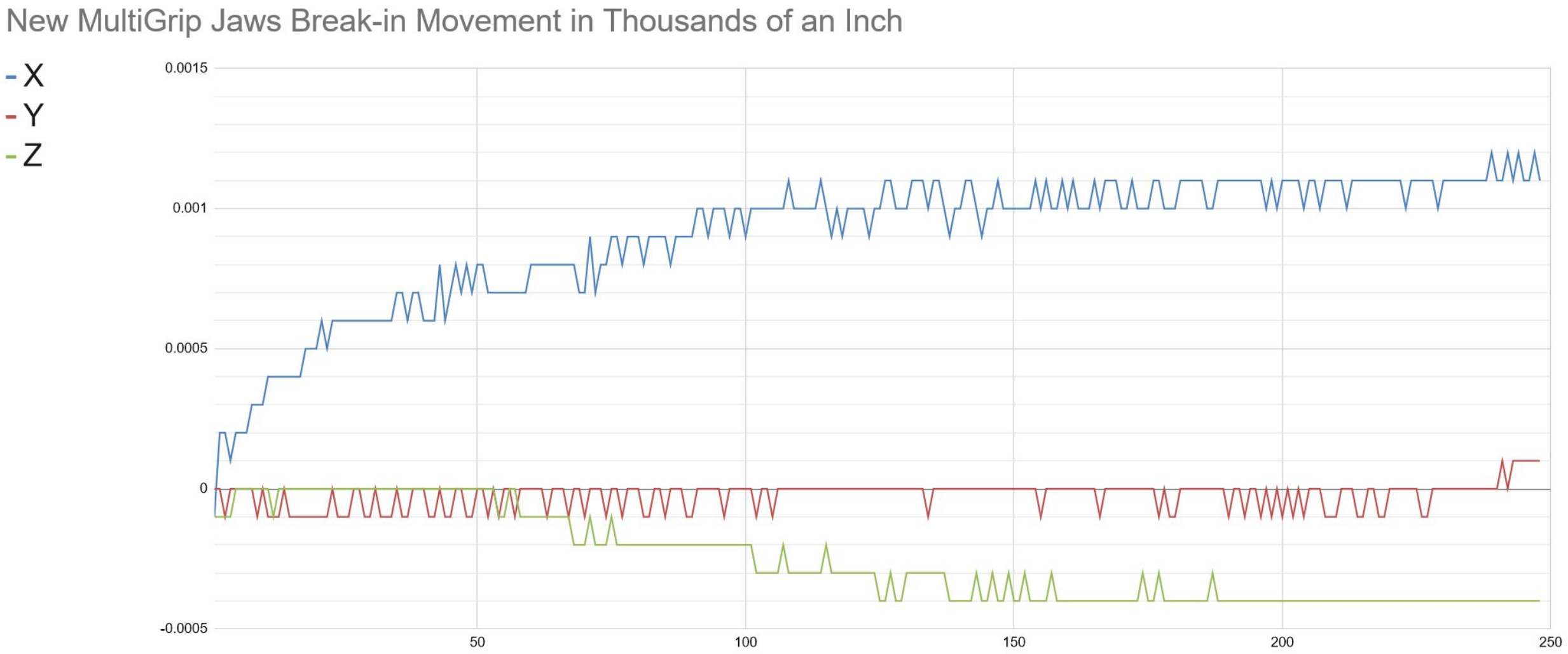
- Indicating MultiGrip Jaws in preparation for cutting new MultiGrip soft jaws:
  - Start with the vise home position found during vise setup and installation (see installation manual)
  - Set the the vise air pressure to the clamping pressure that will be used during the machining process
  - Turn on CNC coolant so the MultiGrip vise is covered in coolant
  - Place the jaws on the MultiGrip vise and clamp the vise with the 1/8” machineable spacer installed
  - Indicate the X position of the Machining Coordinate System from the right Top Plate or MultiGrip Jaw as shown
  - If you prefer to set the CAM coordinate system to the center of the jaws, shift the measured X value 4” to the left
  - Generally, variability in Y is minimal and does not require a change from the vise home position



Best Practices: New MultiGrip Jaw Break-in

- New MultiGrip Fixed Jaws or MultiGrip Base Jaws have a break-in period
- During the break-in period the position of the jaws after each clamping cycle will move more than after the break-in period
- After the break-in period, MultiGrip Jaws will generally repeat to position within 0.0005” between clamping cycles
- Most of the break-in movement takes place in the first 100 open/close cycles when the jaws will move primarily in X
- Jaws can be broken in by hand by first soaking the vise with coolant and then clamping empty jaws in the vise, using a dead blow to move the right jaw off the dovetail after each open
- Alternatively, indicate the position of the jaws with a spindle probe before each machining cycle
- See next page for chart details

Best Practices: New MultiGrip Jaw Break-in



Dry Machining with MultiGrip

- MultiGrip relies on CNC coolant to lubricate the vise interface, the gripper interface and the jaws
- If possible, run a vise wash program with coolant after the dry machining is completed to wash away chips and lubricate the vise, gripper and jaws
- If no coolant is available, 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 face of the gripper

MultiGrip Jaw Design and Machining

Section 5

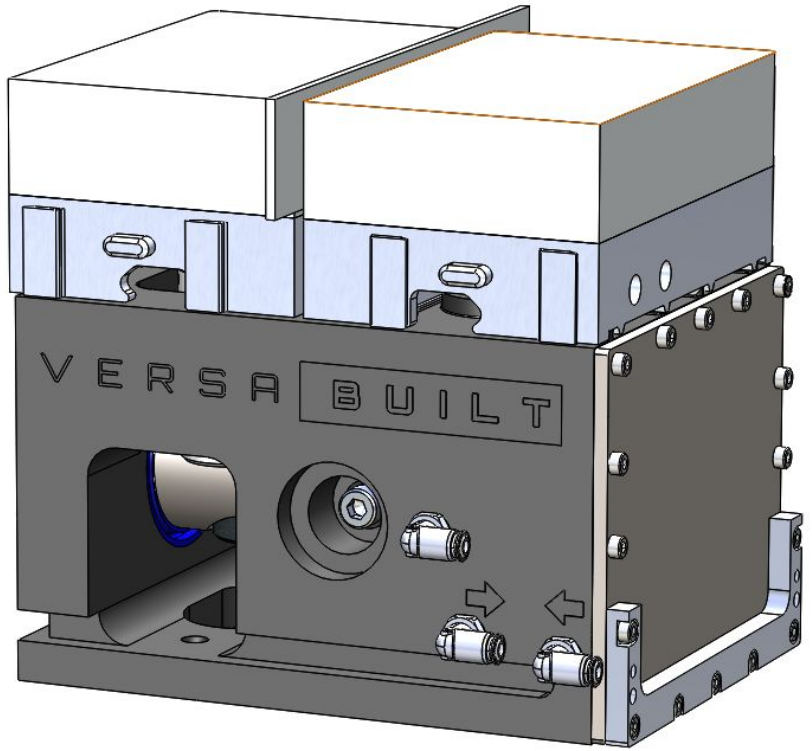
MultiGrip Jaw Design and Machining

Designing and cutting MultiGrip Jaws should follow the same best practices used with any other vise soft jaw and the guidelines in this section.

Design MultiGrip Jaws that will be rigid enough for the intended machining operations and capable of reliably picking, transfering or placing parts.

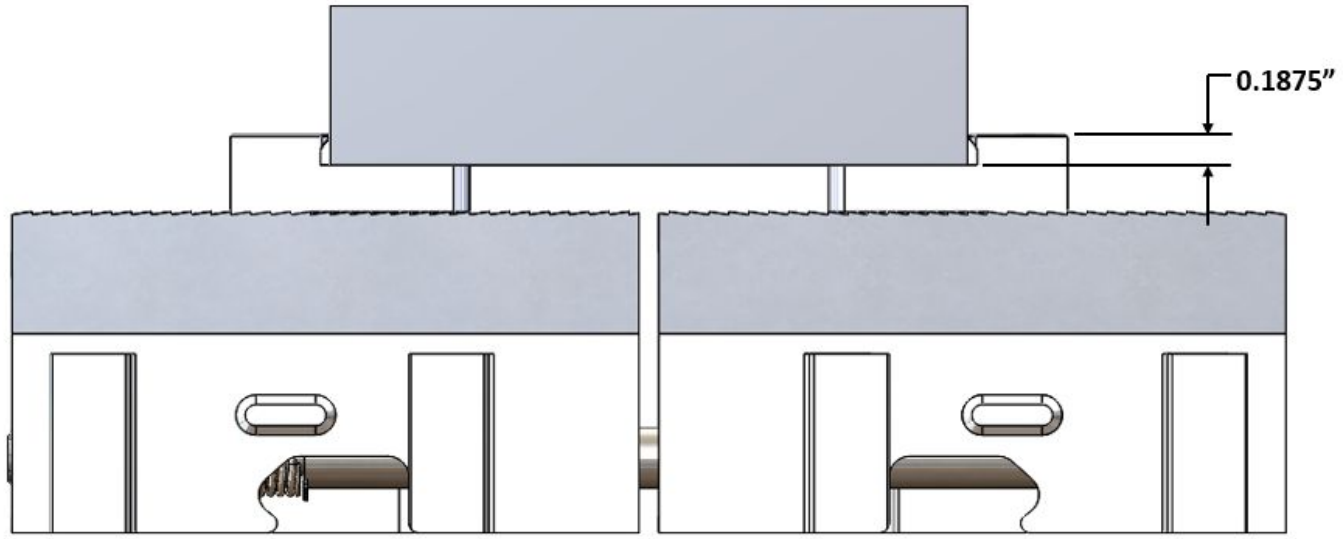
Cutting MultiGrip Jaws

- Before cutting MultiGrip jaws, with fresh coolant on the vise, load the empty jaws into vise and cycle the jaws open and closed several times
- Position the included 0.125” wide machinable jaw spacer in the jaws so that the bottom of the jaw spacer is between 0.125” and 0.250” below the lowest part of the jaw pocket to be cut
- Before machining the jaw pocket, set the vise clamping pressure to the intended clamping pressure during automated processing or the maximum clamping pressure of the vise



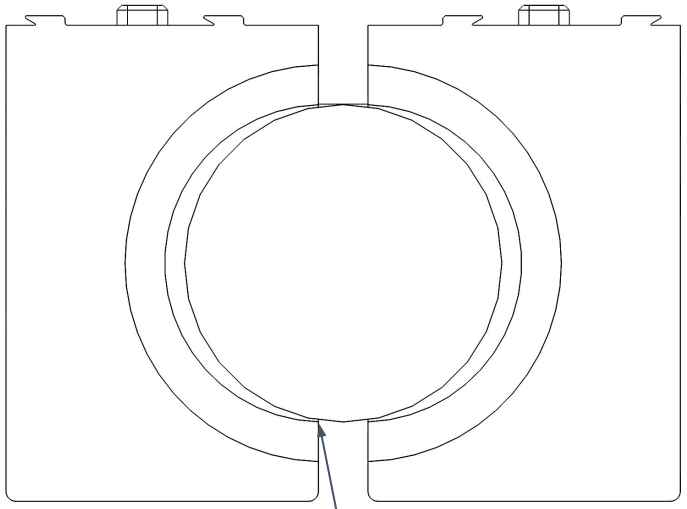
Jaw Pocket Depth

- For OP1 jaws that will pick the part from infeed, we recommend a minimum pocket depth of 0.1875” (4.75mm)
- For OP2 jaws that will be used to transfer the part from OP1, we recommend a minimum pocket depth of 0.100” (2.5mm)

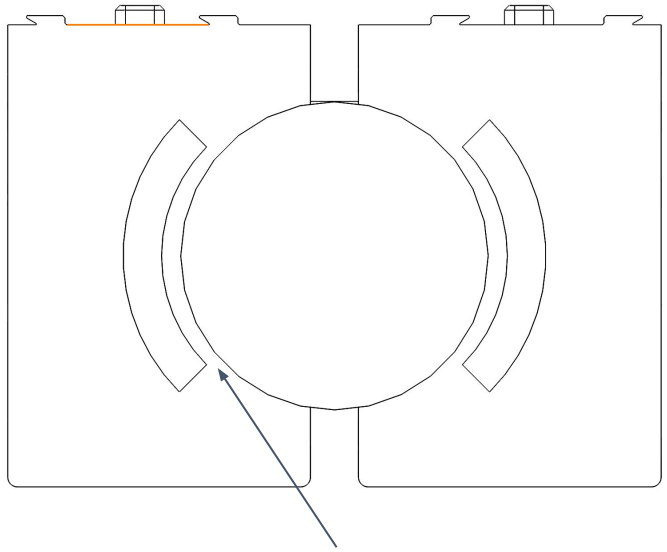


Clearance Between Jaw Pocket and Part During Pick

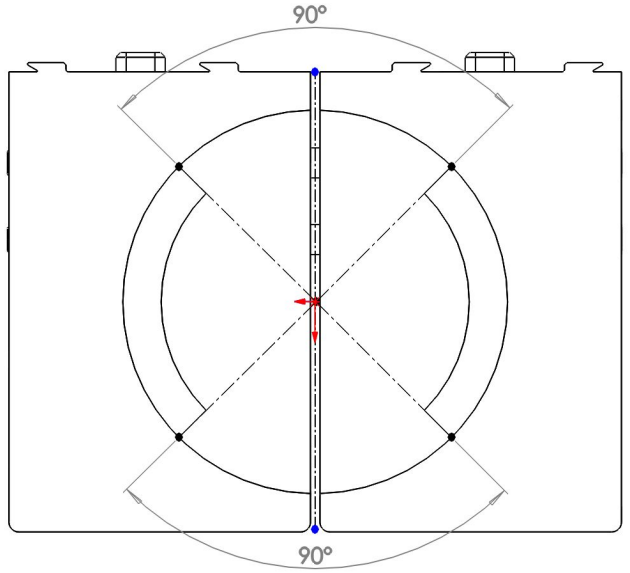
- Design the part pocket so that when the jaws are fully open, there is adequate clearance between the the part and pocket
- Avoid pocket features that approach parallelism with the X plane of the jaws
- For round parts we recommend a 90 degree clearance cut along both sides of Y axis



Not enough clearance between part and jaws during pick



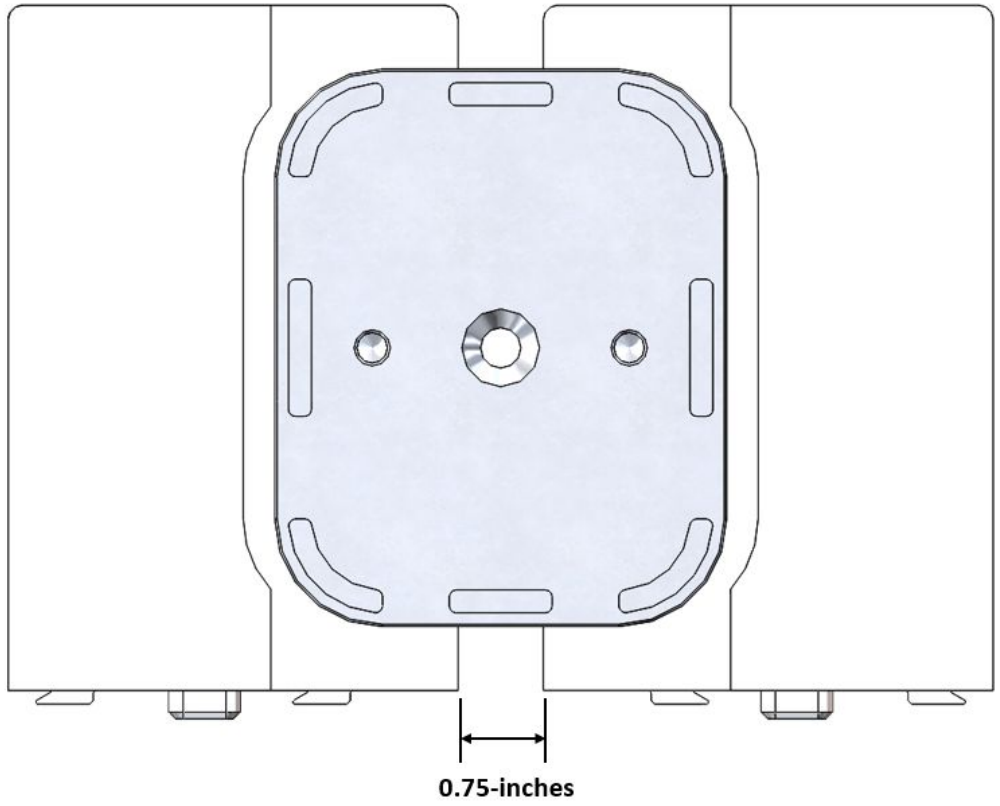
Enough clearance between part and jaws during pick

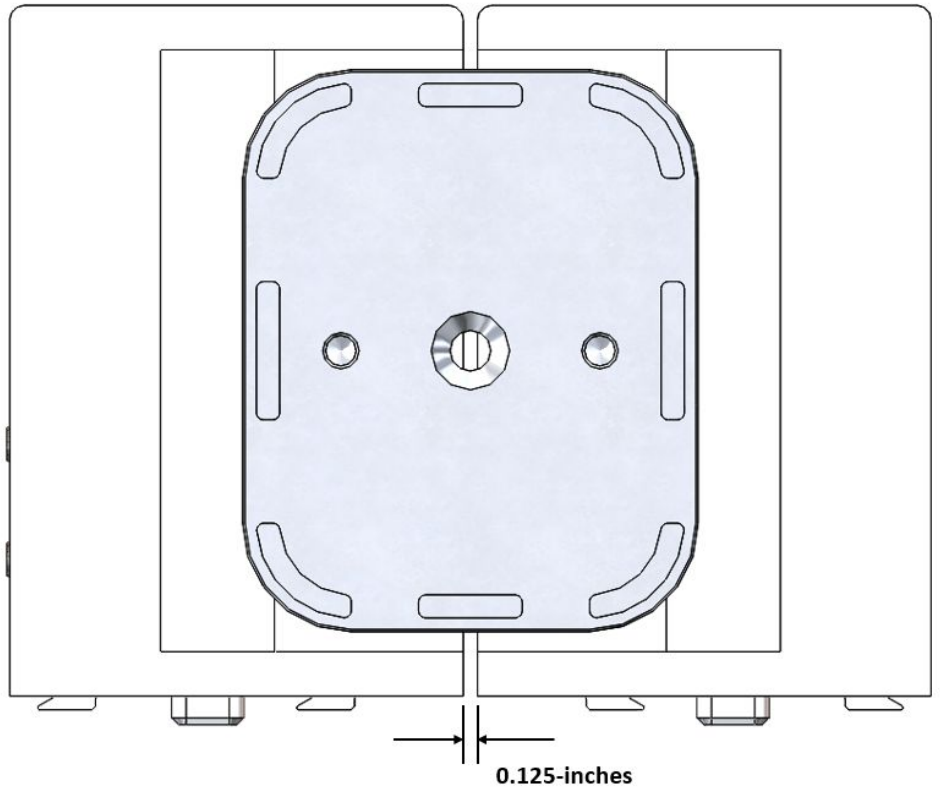


90 degree cut along Y axis for part clearance

Clearance Between Jaw Pocket and Part During Pick & Place

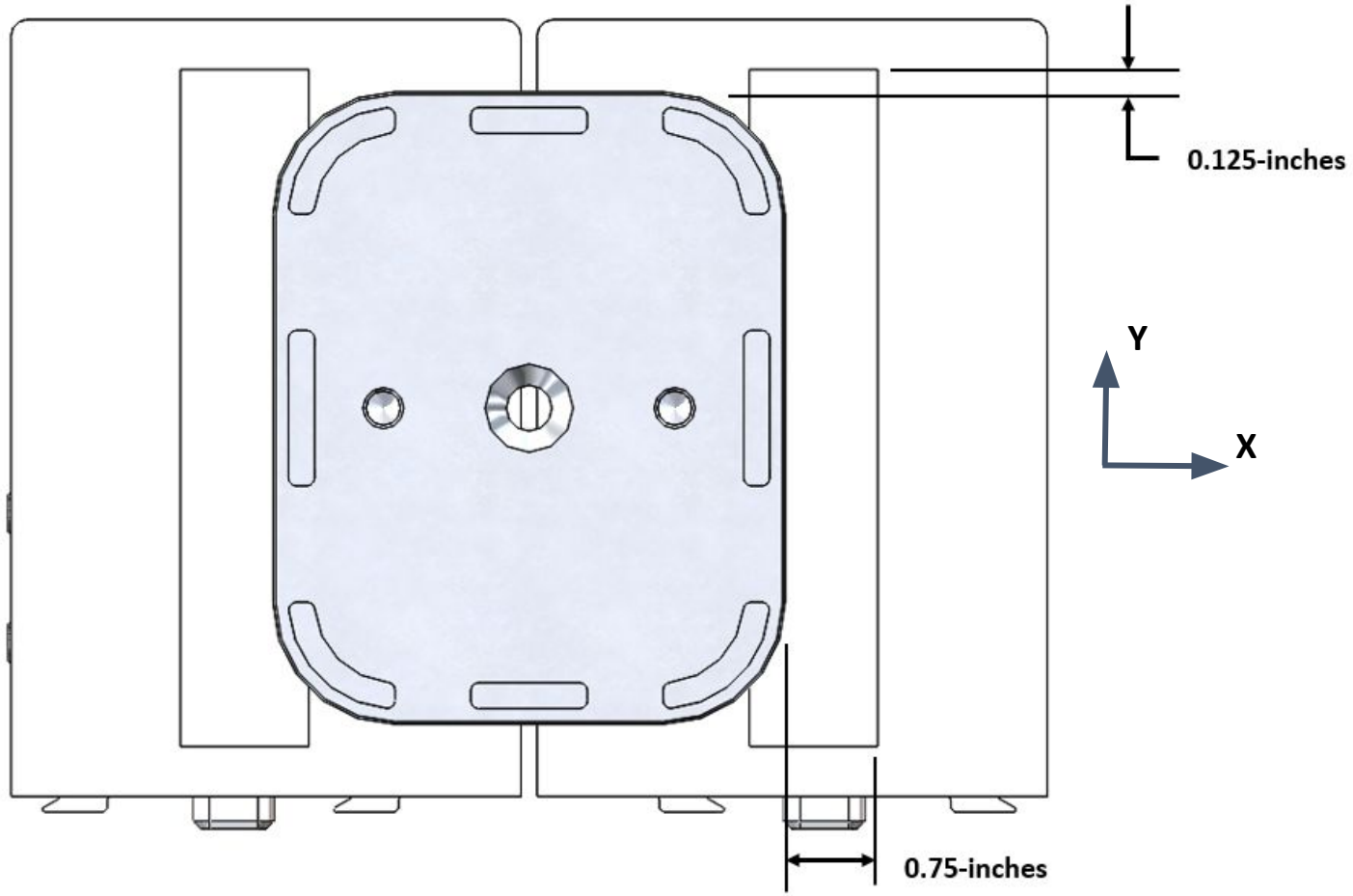
- Consider the jaw stroke and nominal clamp positions during pick
- OD jaws max opening = 0.75” (~20mm), nominal vise clamp = 0.125”
- ID jaws min closing = 0.0”, nominal clamp = 0.394” (10mm)





Clearance Between Jaw Pocket and Part During Pick & Place

- Maximum X-direction sidewall = 0.75-inches
- Maximum Y-direction sidewall = 0.125-inches



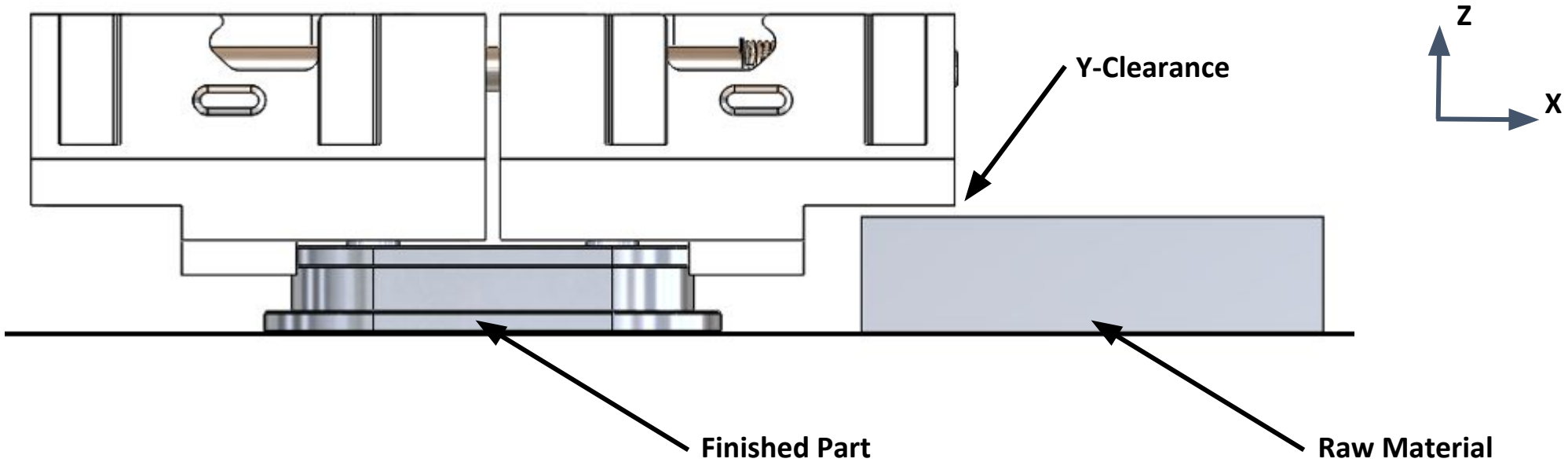
Default layout of parts on the VersaCart are arranged for maximum density, assuming the sidewall dimensions shown.

If you cannot design your jaws with minimized sidewalls, the layout of parts on the VersaCart will change to a lower density to clear the full jaw size.

On the UR Teach Pendant go to: UR Part Configuration> Advanced Configuration, select "Guarantee Jaw Clearance" to be <u>True</u>

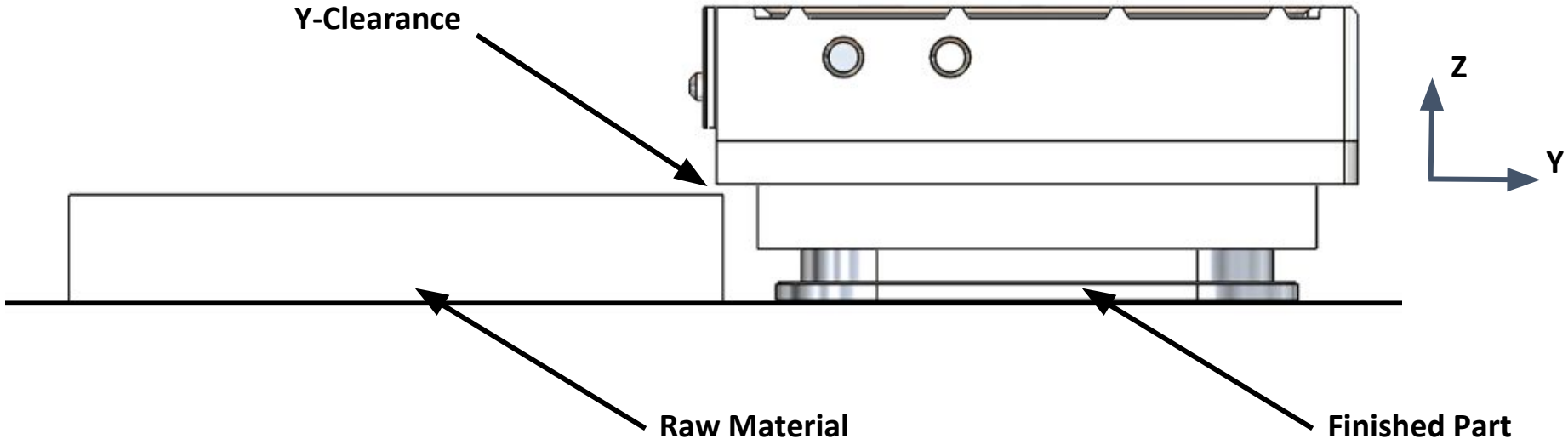
Clearance Between Jaw Pocket and Part During Pick & Place

- Include Z-clearance between the jaw and adjacent parts on the VersaCart during picking of raw material and place of finished parts
- Clearance needs to be in X and Y Directions
- The image below shows placing a finished part on the VersaCart, with X-Clearance to clear adjacent raw material



Clearance Between Jaw Pocket and Part During Pick & Place

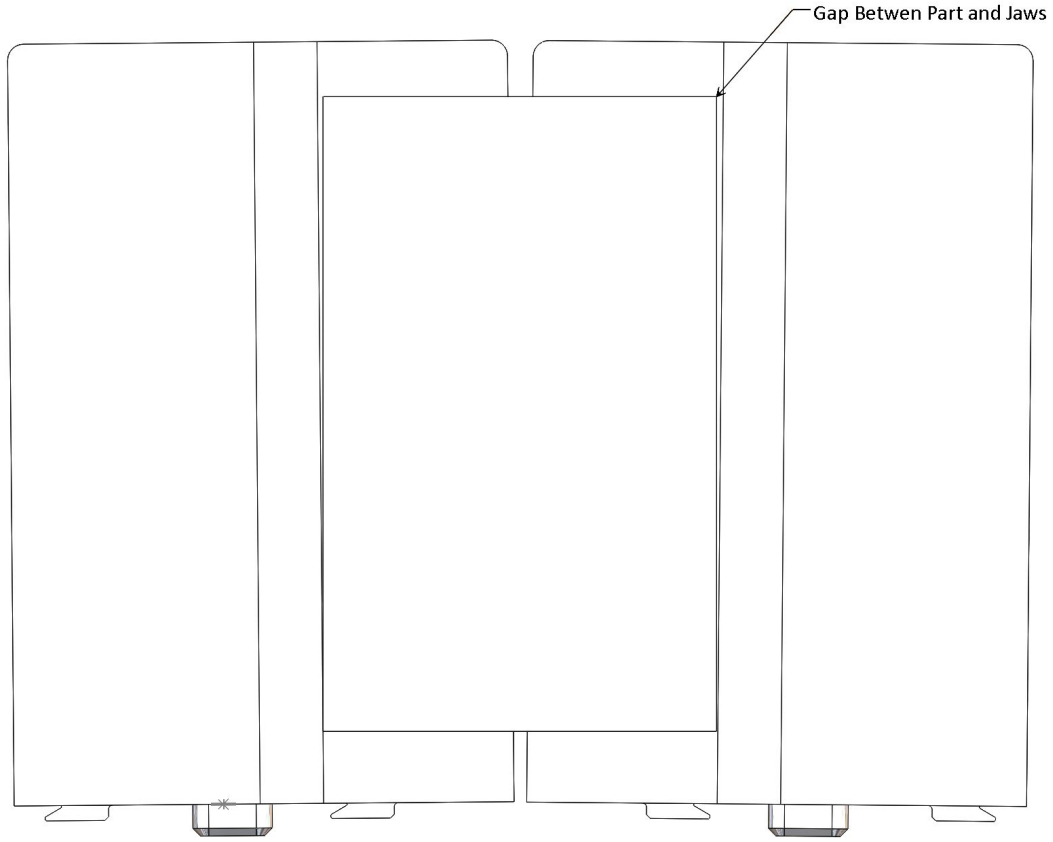
- The image below shows placing a finished part on the VersaCart, with Y-Clearance to clear adjacent raw material



MultiGrip Fixed Jaws Deflection During Pick

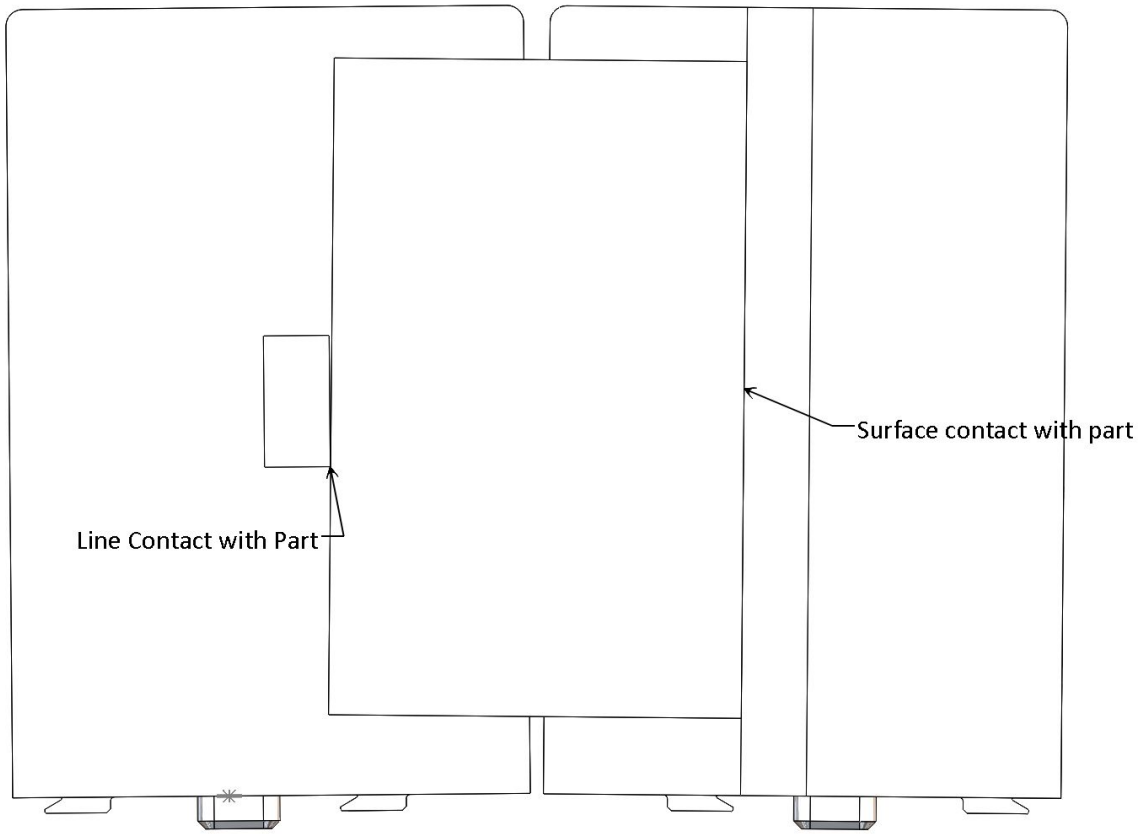
- MultiGrip ***Fixed Jaws*** will deflect a small amount during part grip*
- MultiGrip Top Jaws include a fixed jaw and a swivel jaw; the swivel jaw is designed to rotate to ensure full part contact with the part during part pick as the jaw deflects
- MultiGrip Fixed Jaws do not have a swivel jaw and will not be able to pick some part shapes without additional considerations

* This type of jaw deflection does not occur when MultiGrip Jaws are loaded into a MultiGrip Vise. MultiGrip Base Jaws with Top Jaws accommodate jaw deflection and generally no changes for jaw deflection are required.



MultiGrip Fixed Jaw Deflection During Pick

- When using MultiGrip Fixed Jaws with rectangular parts, triangulation of the jaw pocket will typically provide good results during pick
- Triangulation of the of the jaw pocket is not necessary for round parts using MultiGrip Fixed Jaws

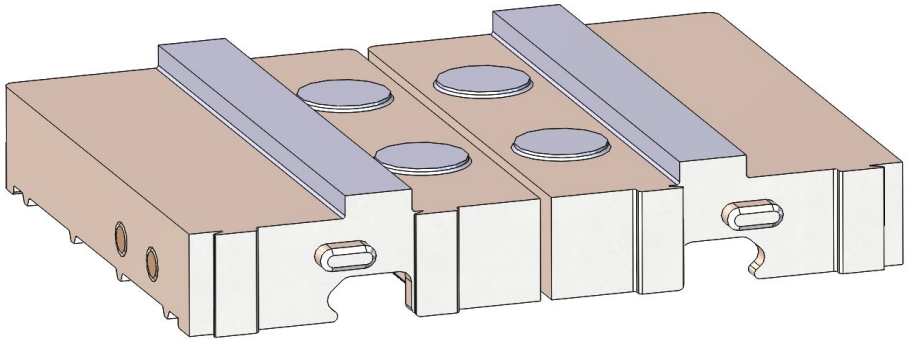


Part Settling

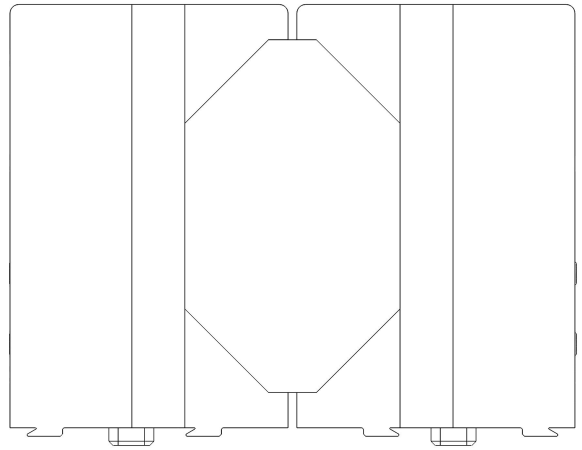
- Part settling is the term used to accurately position a part in the MultiGrip jaw pocket for CNC processing
- Accuracy and repeatability of the workpiece in the workholding can be affected by the part geometry, part weight and the jaw pocket design
- Almost any part can be accurately positioned in MultiGrip Jaws for automated processing using the right combination of tools for the part being settled:
  - Sound jaw pocket design
  - Opening and closing the vise after loading to settle part in Z
  - CNC settling programs and part settling tools
  - CNC spindle probes

Part Settling

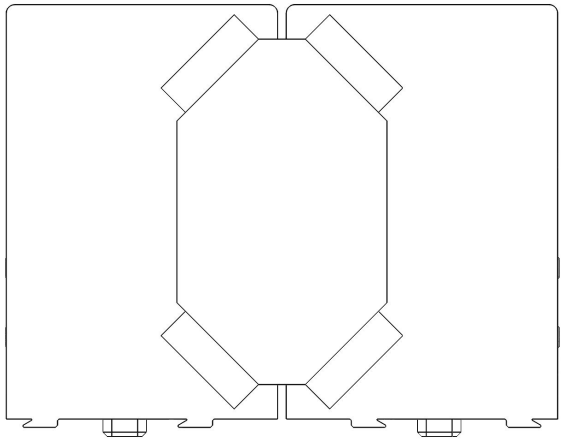
- To prevent part lift in Z during clamp, avoid a radiused corner between the Z locating surface of the jaws and the jaw pocket wall
  - Pads on the floor of the jaw pocket are a simple solution
- When possible, use the shape of the part to locate the part in Y and if required, rotation about Z



Pads on floor of Jaw Pocket



Jaw Pocket does not locate part in Y



Jaw Pocket locates part in Y

Pick Settle and Vise Settle

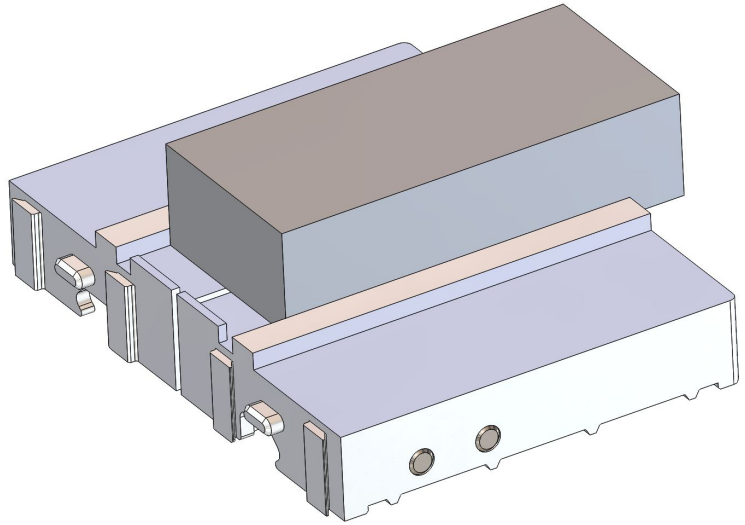
- After picking a part from infeed or the OP 1 vise, the part will not be settled fully in Z
- By default, the UR Mill App Kit will open and close the gripper after the pick to make sure the part is held securely
  - Settling the part in the gripper does not ensure the part is full seated in Z after the jaws are loaded into the vise
- By default, the UR Mill App Kit will open and close the vise after load to ensure the part is settled in Z using the force of gravity
  - If gripper settle and vise settle options are not adequate, contact VersaBuilt support for additional options for your application

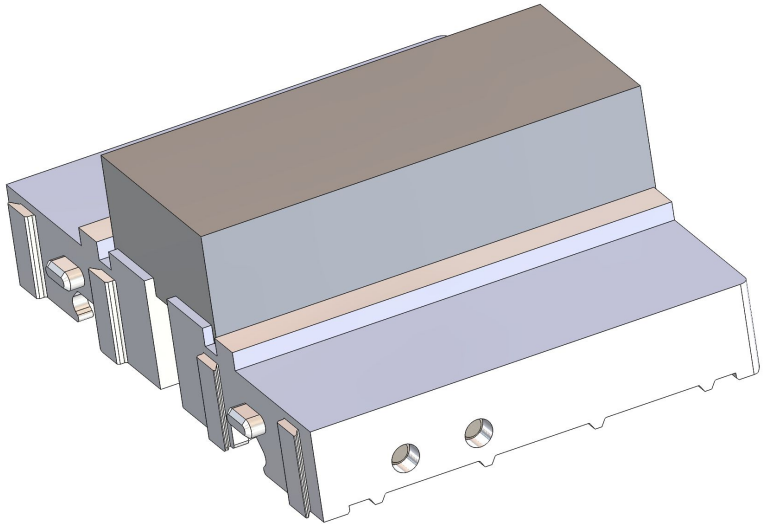
OP 1: Locating Rectangular Parts in Y

- Rectangular part shapes can shift along the Y axis when picked from infeed
- Operators typically cannot locate the part accurately enough to ensure the machining operation is successful
- There are two options for locating rectangular parts in Y:
  - Building a Y datum into the MultiGrip Jaws and using the Pick Settle option with a Pick Settle Angle
  - Using the OP 1 Y Push option to allow the robot to push the part to a datum after the vise is loaded
- OP 1 Y Push is generally accurate enough for first operations and works well with the Versabuilt Universal OP 1 Jaws

OP 1 Pick Settle with Y Datum in MultiGrip Jaws

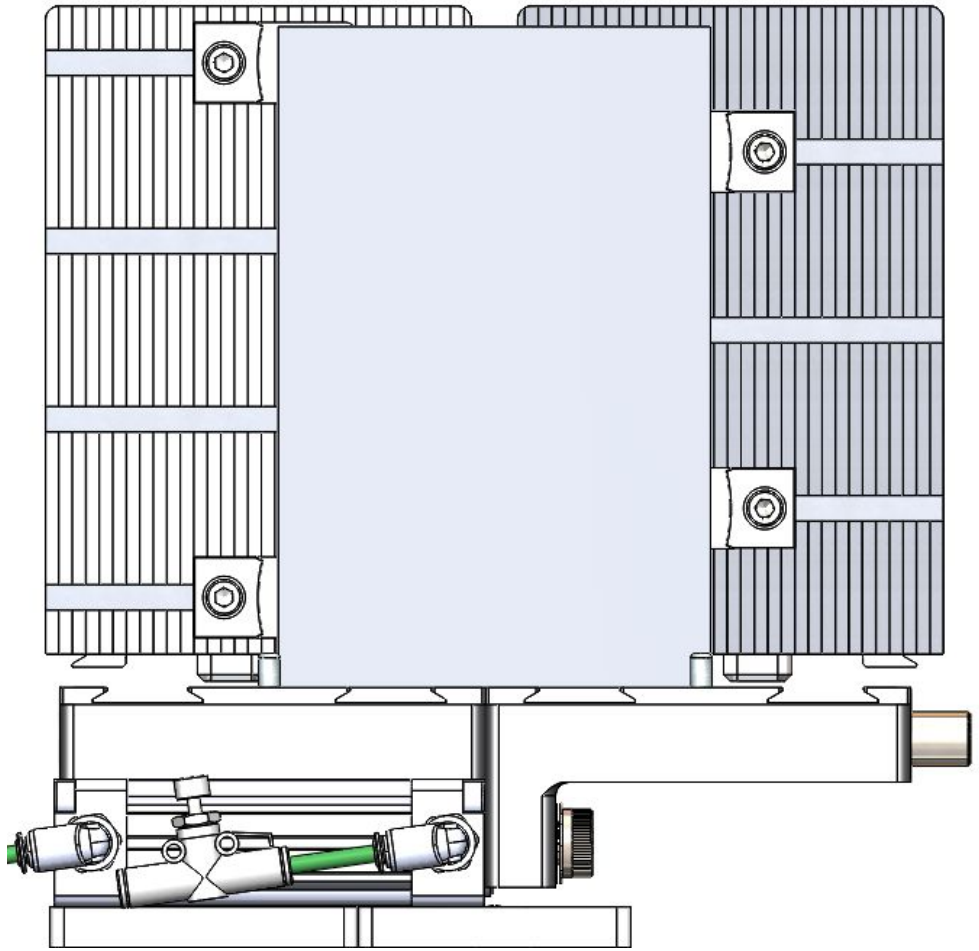
- To use Gripper Settle to locate a part in Y, the jaws should be designed with a datum in Y, generally near the negative Y edge of the jaws
- The datum should be positioned so the part is centered in the jaws if the part is less than 5.5” in length; for longer parts, the datum should be at the front edge of the jaws and the part will overhang the jaws in the positive Y direction
- In the Part Configuration, under Advanced Configuration, a Pick Settle Angle can be specified
- For a Y datum nearest the gripper interface, use a positive Pick Settle Angle





OP 1 Y Push

- OP 1 Y Push, using the robot gripper, can be used to push the part into position. In the Part Configuration, select **OP 1 Y Push = True**
- By default, the robot will use the gripper to push the part to the center of the vise based upon the part length entered
- Optionally, under the **Show Advanced Configuration** the height offset the gripper pushes the part can be set
- The **OP 1 Y Push Height Offs** is an offset from the top of the part loaded in the vise the the gripper will push from
    - Default value is -0.100” (2.5mm) or 0.100” below the top of the part; positive values would be above the part
    - Top of the part is calculated from the **Pick Height**

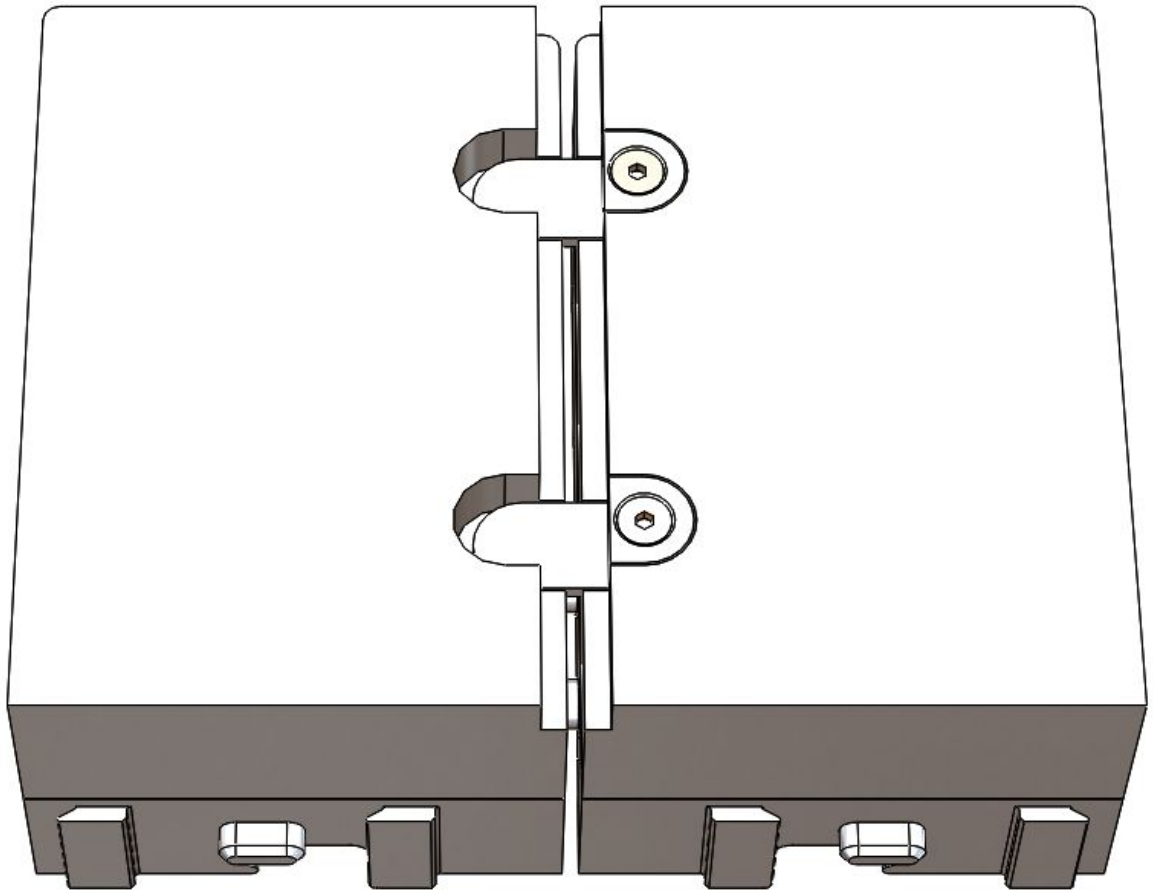


OP 2: Locating Rectangular Parts in Y

- When the shape of the part and the OP 2 jaws cannot adequately locate the part in Y during clamping, additional measures are needed
- There are two options available for locating rectangular parts in Y:
  - Building a Y datum into the OP 2 MultiGrip Jaws and using the Transfer Settle and Transfer Settle Angle options under the Advanced Configuration Options
  - Using a CNC probe to set the OP 2 CNC home location in Y
    - Requires a valid datum for the CNC probe to reach
    - Typically a through hole feature from OP 1 the probe can reach or a side profile that was machined in OP 1

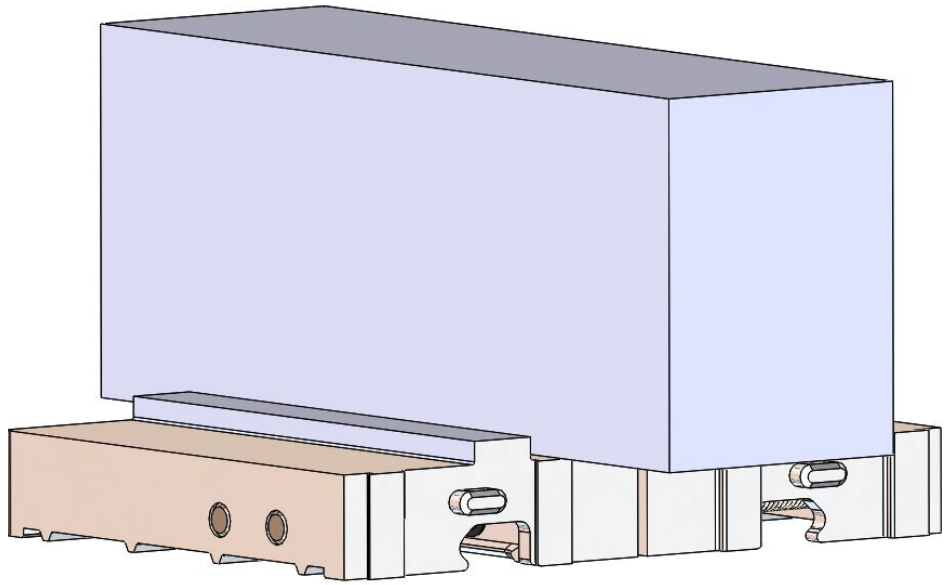
Narrow Parts and Gripper or Vise Settle

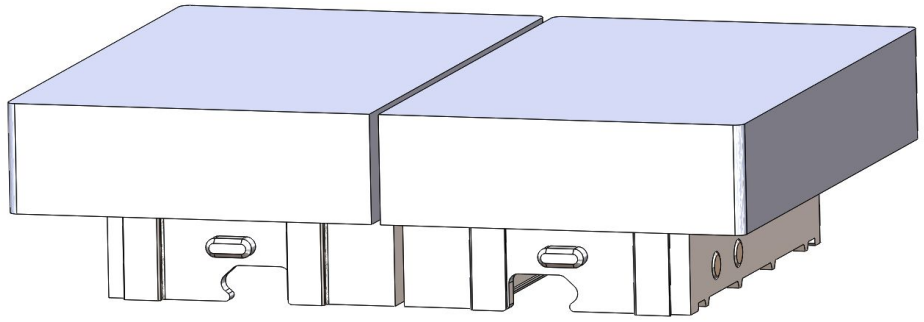
- Generally, parts less than 1.625” wide cannot be settled using Gripper or Vise Settle with standard MultiGrip Jaws
- When the gripper opens, the gap between the jaws is 0.80” and the part may fall into the gap
- Adding an overlapping bridge into your MultiGrip Jaws prevents the part from falling into the open gap during a settle operation
- The example to the right shows 2 bridges bolted into place, then machined for clamping a 0.50” part



Accommodating Large Diameter and Long Parts

- Parts may overhang the front or back of the jaws
- Without a Y datum to locate against, the part will need to locate the Y datum using a Y-push
- Alternatively, oversized Top Plates can be used to better support larger parts





Using a CNC Probe

- A CNC spindle probe is a very useful tool for validating the automation process and can be used for the following purposes:
  - Automatically measure parts and perform tool wear offsets to keep parts in tight tolerance
  - Validate the positional accuracy of the part or MultiGrip jaws in the CNC machine before machining
  - Offset home position due to thermal changes or part load position for rectangular parts (generally OP 2 only, see next pages)
- Refer to CNC spindle probe documentation included with your machine for more information
- Remember that spindle probes require regular calibration to maintain high accuracy

Using a CNC Probe to Offset OP 1 in Y

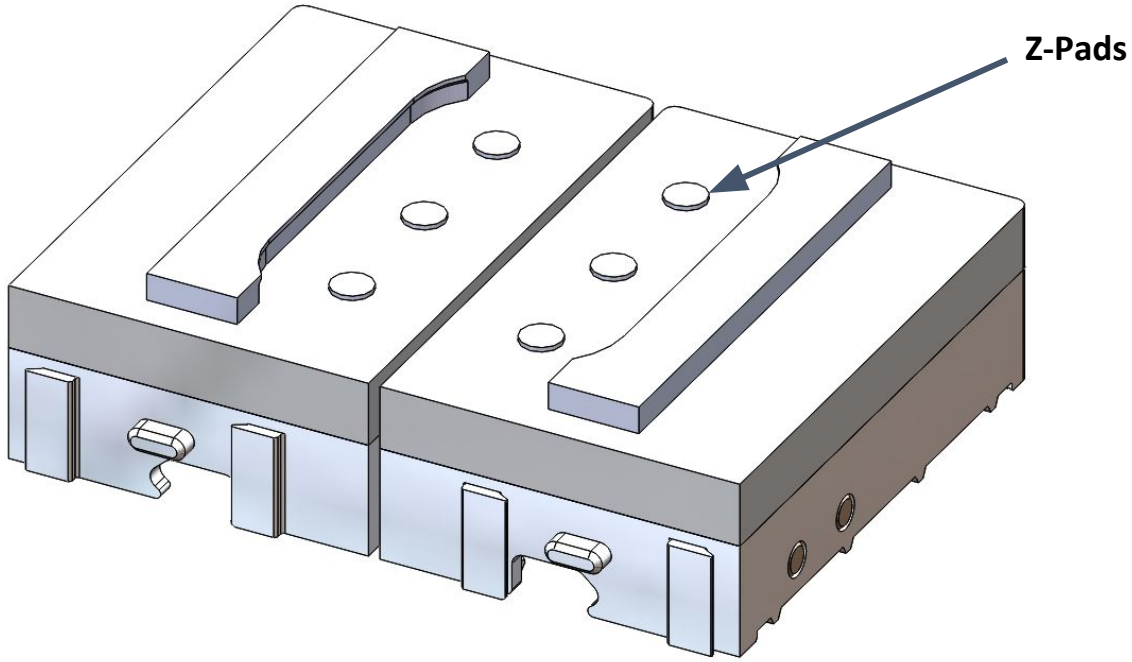
- In general, do not use a CNC Spindle Probe to offset the home location of a rectangular part in Y for OP 1
  - If the part is offset in Y and the OP 2 MultiGrip jaws locate the part along the Y axis (non-rectangular part), the robot may not be able to pick the offset part after OP 1 is complete because the part is shifted from the robot's center of pick
  - If the OP 2 jaws do not locate the part in Y, the part may be offset in Y using a probe in OP 1
- For raw stock that is cut very closely to nominal length, combining an OP 1 Y Push with a probe **is typically OK** because the true position of the part is only offset a very small amount

Jaw Durability

- MultiGrip jaw components are made from 6061-T6 aluminum for a good balance between low weight and durability
- When machining harder materials, additional considerations may be required for long jaw life:
  - Will the jaw pocket walls deform from hard part materials under vise clamping pressure?
    - If the clamping surfaces of the part are smooth and total vertical wall clamping surface area of the jaw pocket is greater than 1” squared, bare aluminum will generally suffice
    - Otherwise, we recommend a jaw pocket be made from hardened steel and bolted to the jaws as an insert
  - Will chips from the cutting process strike critical portions of the jaws with enough force to wear the jaws?
    - Hard anodizing the MultiGrip Top Jaws or the use of a hardened steel insert will generally manage wear issues

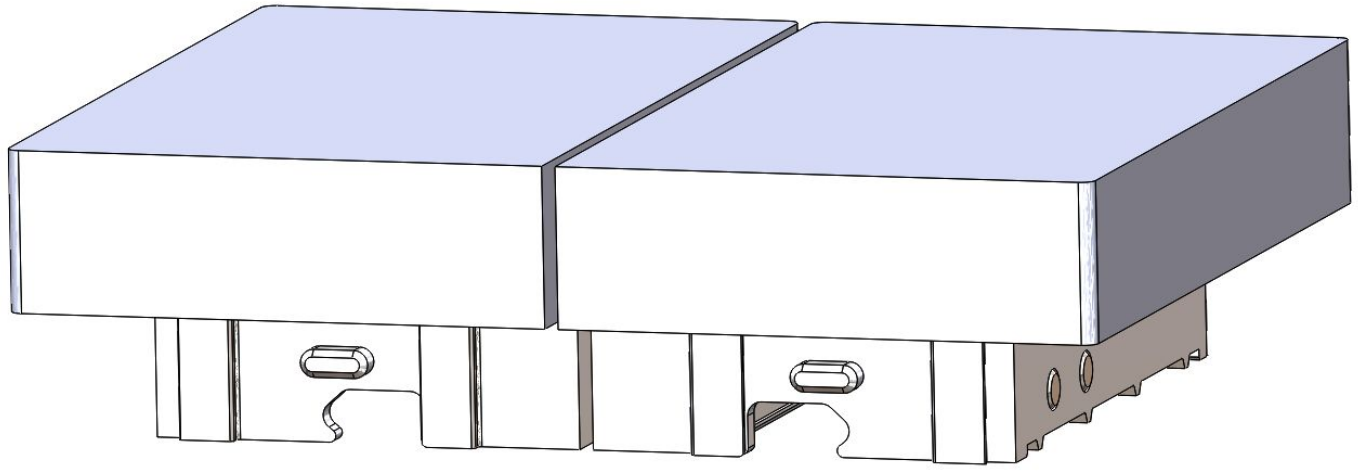
Part Release During Place to Outfeed

- Lighter parts with lots of surface area between the part and jaws in a machining environment that uses coolant may not release from the jaws during place
- When machining lighter parts with large surface areas, minimize surface contact between part and jaws
- Use “pads” in Z and X clamping surfaces as necessary to reduce surface area:



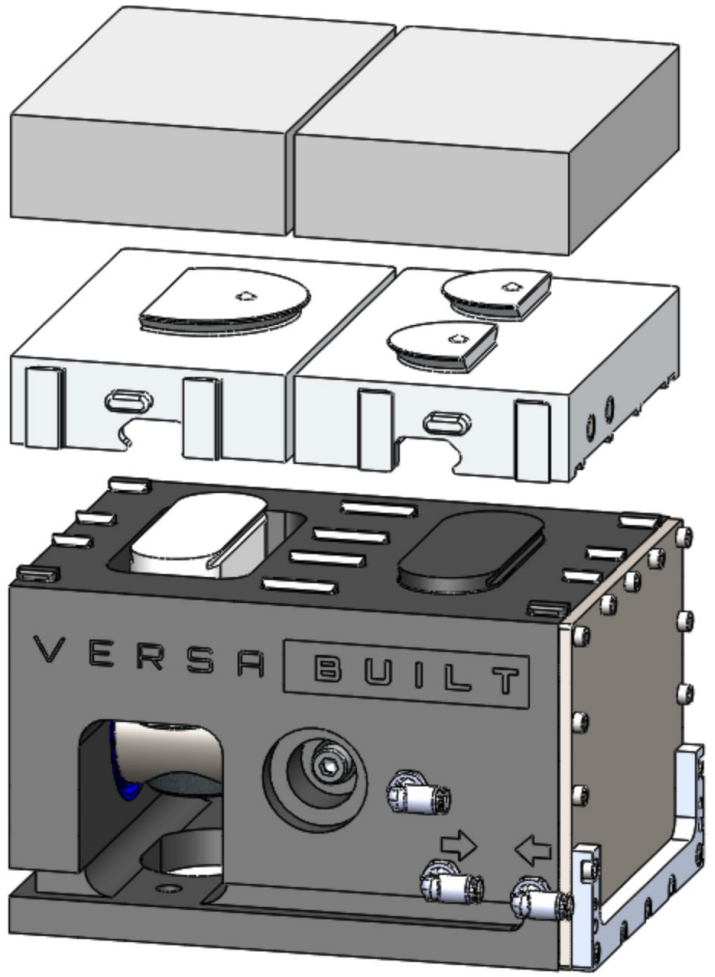
Using Over-Sized Top Jaws

- Oversized Top Jaws are two inches wider and two inches longer than standard Top Jaws
- Can be used to better support larger parts during the CNC machining process
- Available from your dealer or VersaBuilt direct



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 pocket XYZ location
- A good practice is to dedicate at least one set of MultiGrip Base Jaws to each vise
- Engrave an identifier on each Base Jaw that encodes the CNC machine and vise the Base Jaw is dedicated too
- When machining Top Jaws, engrave both a part number for the Top Jaws and the identifying number of the Base Jaw it was machined on to make it easy for operators to match the correct Top Jaw and Base Jaw together



Preparing to Automate a New Part

Section 7

Preparing to Automate a New Part

Steps to automate a new part:

1. Prove out machining of the part by hand loading
2. Determine pick, transfer and place heights from CAD or physically measure
3. Weigh jaws and parts
4. Configure Part in URCap
5. Run VBMillApp program

Prove out Machining

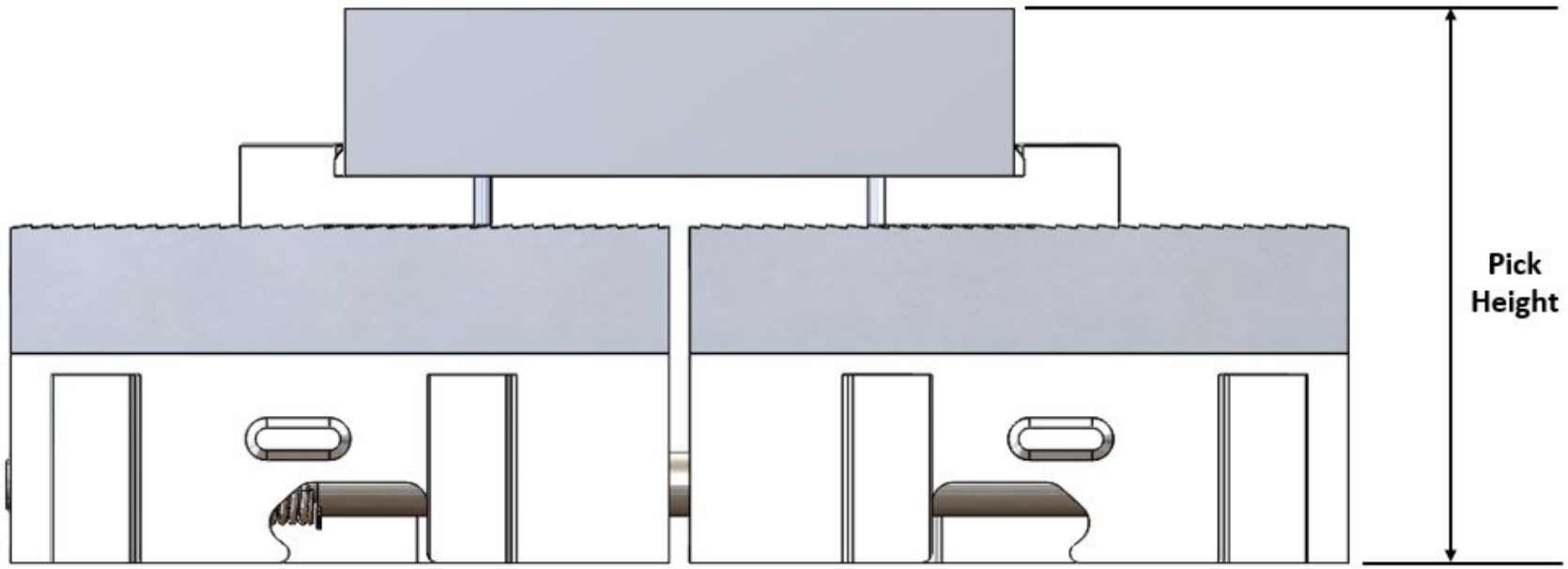
- Design first op and second op jaws according to the MultiGrip Machinist's Manual
- Validate CNC process is functioning as expected by hand loading parts into jaws
- After first operation is complete, weigh and record half-completed part for next step
- After second operation is complete, weigh and record completed part for next step

Determine Pick Height

- Measure Pick Height from CAD

  **Optionally, jaws and parts can physically be measured with a height gauge*

- Pick height is measured from the bottom of the MultiGrip Jaw to the top of the raw material

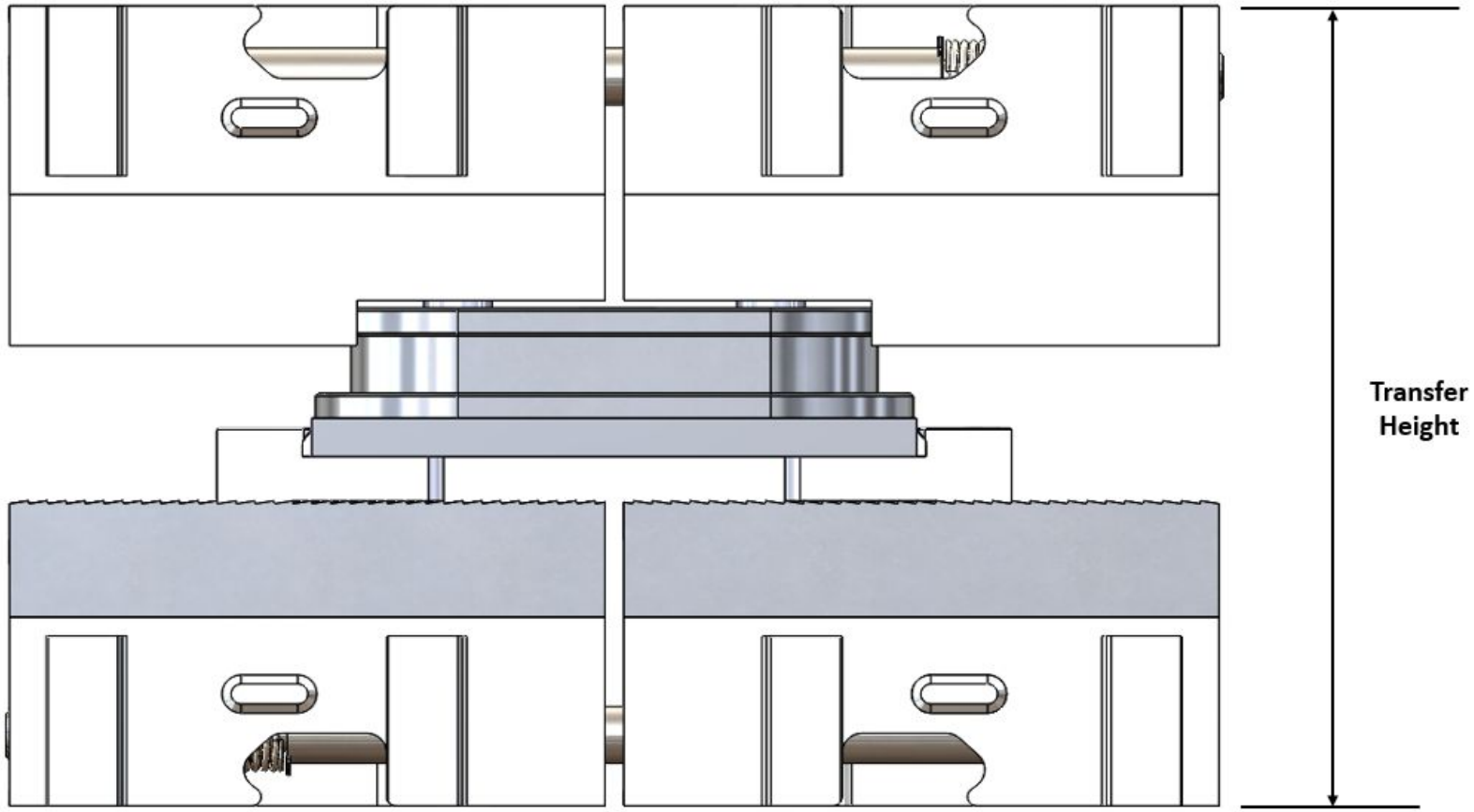


Determine Transfer Height

- Measure Transfer Height from CAD

  Optionally, jaws and parts can physically be measured with a height gauge

- Transfer height is measured from the bottom of the first op jaw to the bottom of the second op jaws with the after first op part (½ complete part) coincident with the Z locating surface of the second op jaws

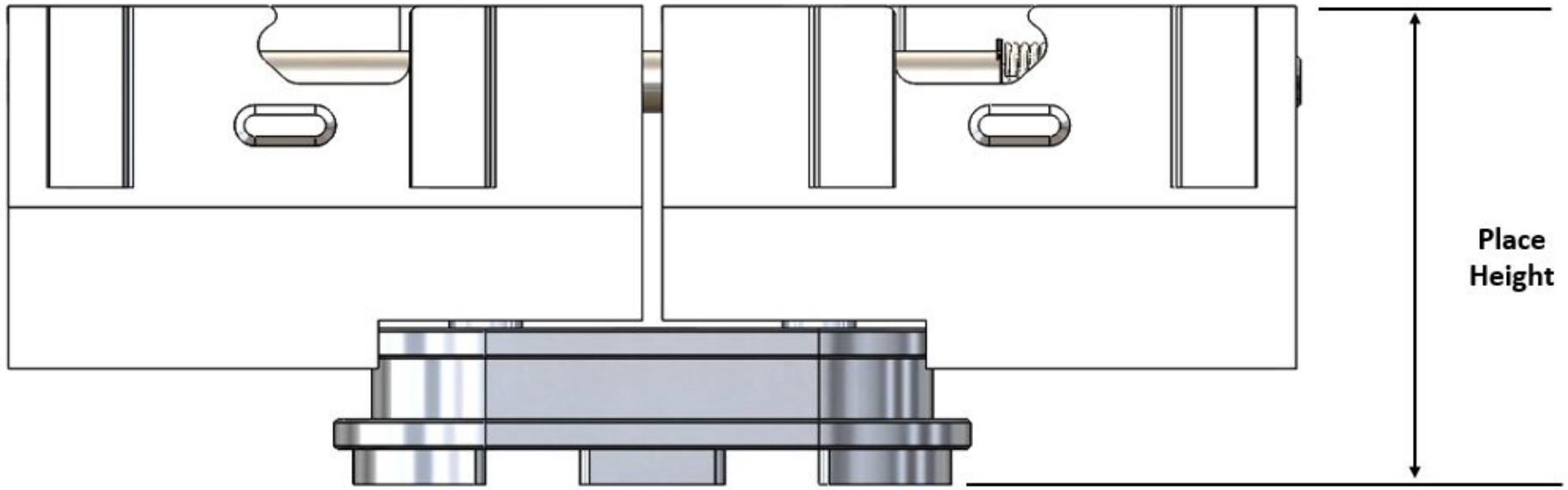


Determine Place Height

- Measure Place height from CAD

  Optionally, jaws and parts can physically be measured with a height gauge

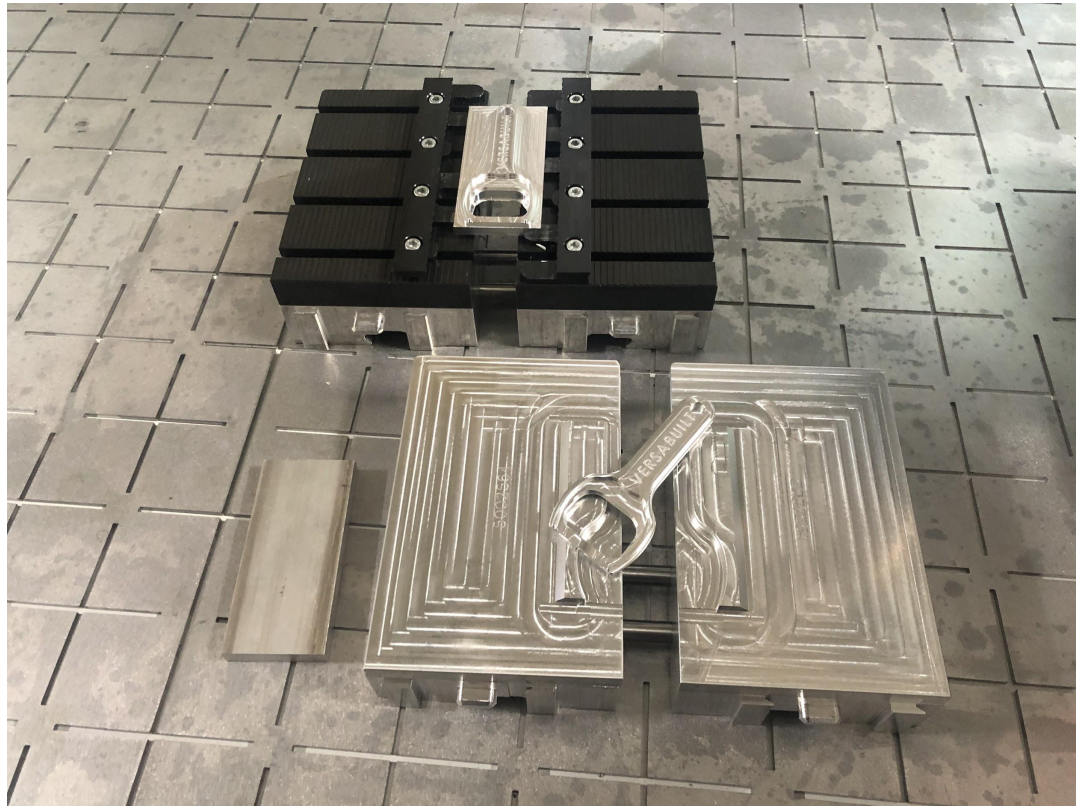
- Place height is measured from the bottom of the second op jaw to the top of the completed part



Preparing to Automate a New Part

Gather Jaw and Part weight information:

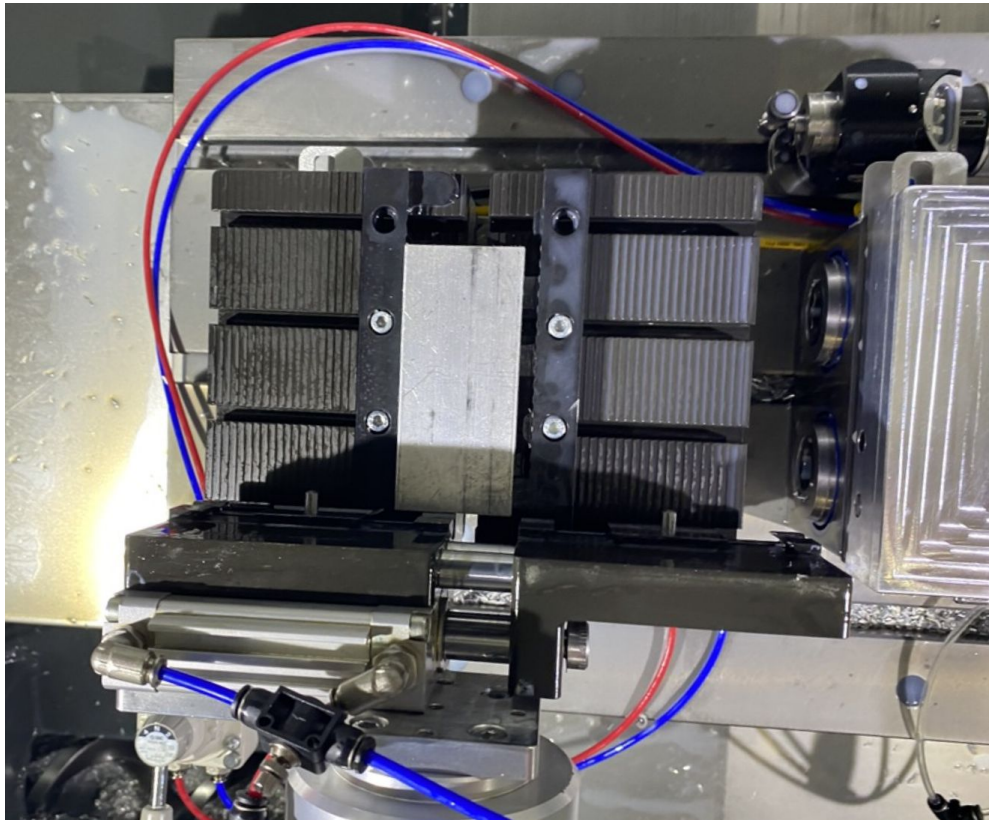
- First Op MultiGrip jaws weight
- Second Op MultiGrip jaws weight
- Weight of raw material before machining
- Weight of part after first operation machining is complete
- Weight of completed part



Preparing to Automate a New Part

OP 1/2 Part Y Locating Strategy:

- Generally only required for rectangular parts
- If part will require Y Locating after OP 1 or OP 2 load, determine whether the process will be best served by a Y push or a datum in the jaws and a pick settle angle

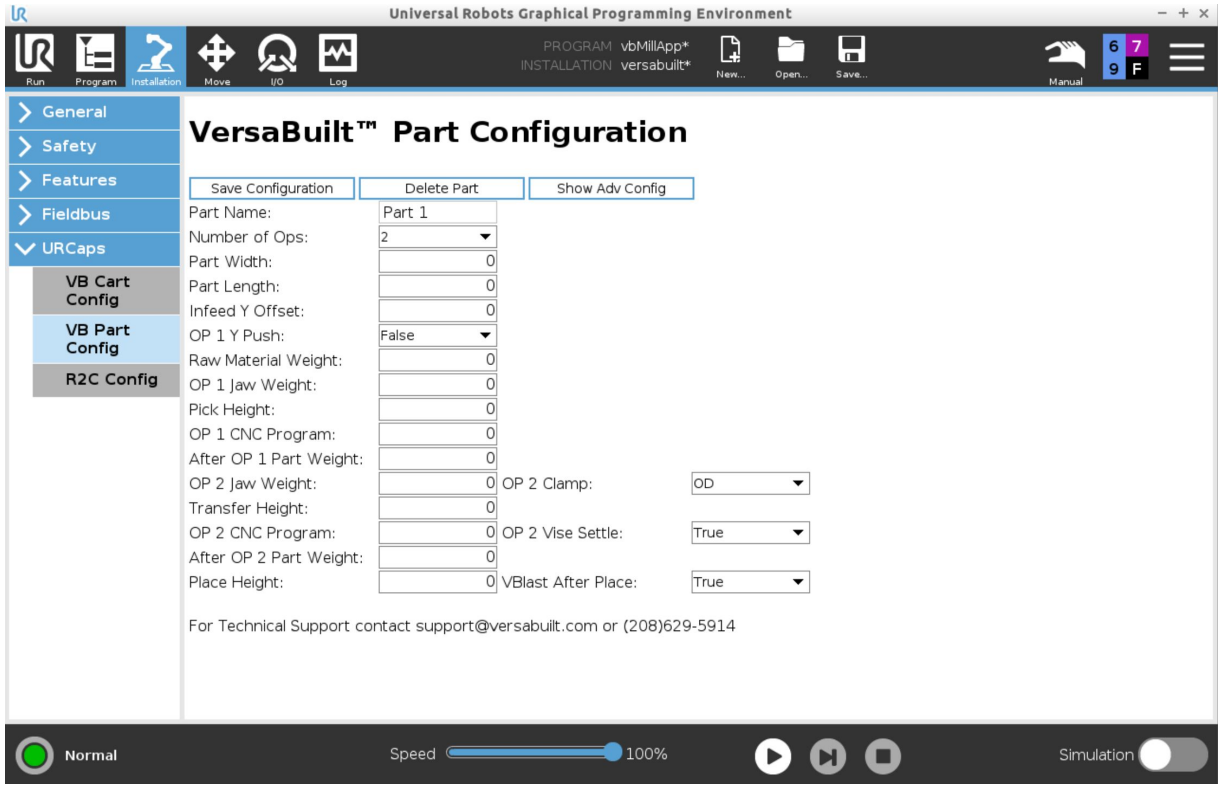


Creating Part Configurations

Section 8

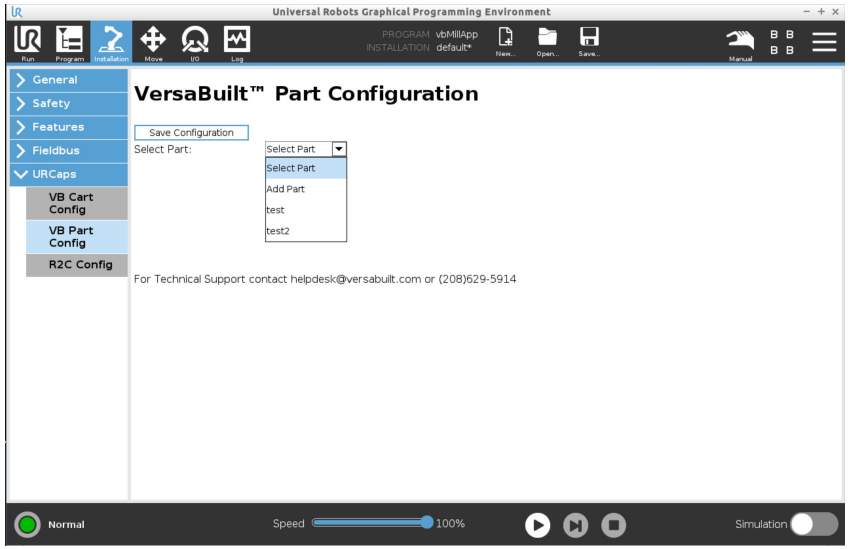
VB Part Config UR Cap

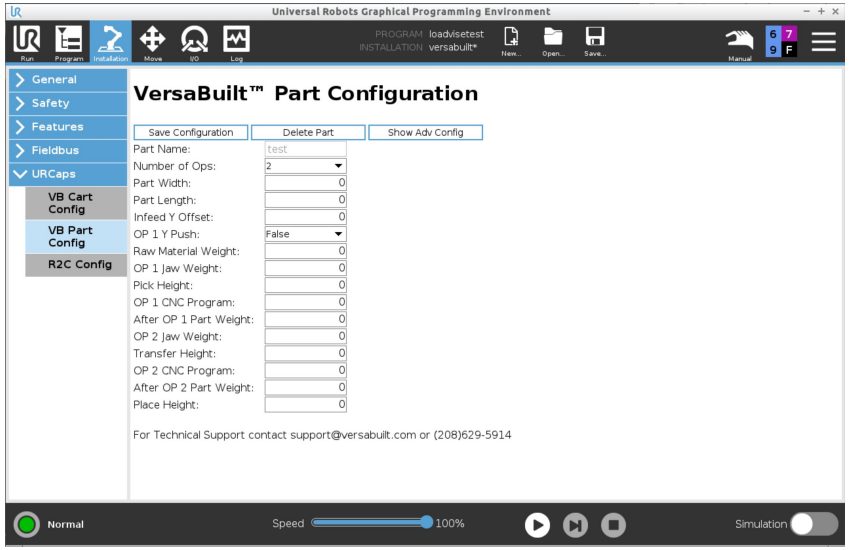
- Part configurations are created and stored in the VB Part Config URCap in the Installation tab of the UR Teach Pendant
- Multiple part configurations can be created and stored on the UR teach pendant for later use without the need to re-enter the part configuration information
- Part configurations can be created, edited or deleted using the buttons on screen



Adding/Editing/Deleting Part Configurations

- To Begin, click on the Edit Configuration button
- The Select Part drop-down list is shown
- Select a part to edit or select Add Part to add a new part to the system
    - When Add Part is selected, the system will prompt for a Part Name then show the part configuration screen
- To delete a part, select the part name to delete then press the Delete Part button when the configuration is shown





NOTE: Whenever making a change to the VB Part Config, save the UR Installation file to save the changes permanently; backup installation file frequently!

Part Configuration Parameters

- **Part Name**: Identifier for the part, used by operator to select the part to process
- **Number of Operations**: number of CNC milling operations, 1 or 2
- **Part Width**: the width of the part
- **Part Length**: the length of the part
- **Infeed Y Offset:** pick offset used to set the part off-center initially so that the part can be centered using an OP1 Y Push or a Pick Settle operation; negative values will load the part offset towards the gripper interface of the jaws, positive values load the part offset away from the gripper (*negative values are used with OP 1 Y Push*)
- **OP 1 Y Push:** enable or disable Y push function after vise load; VersaBuilt recommends using -0.25” (-6mm) Infeed Y Offset when using OP 1 Y Push
- **Raw Material Weight**: weight of the part before any machining

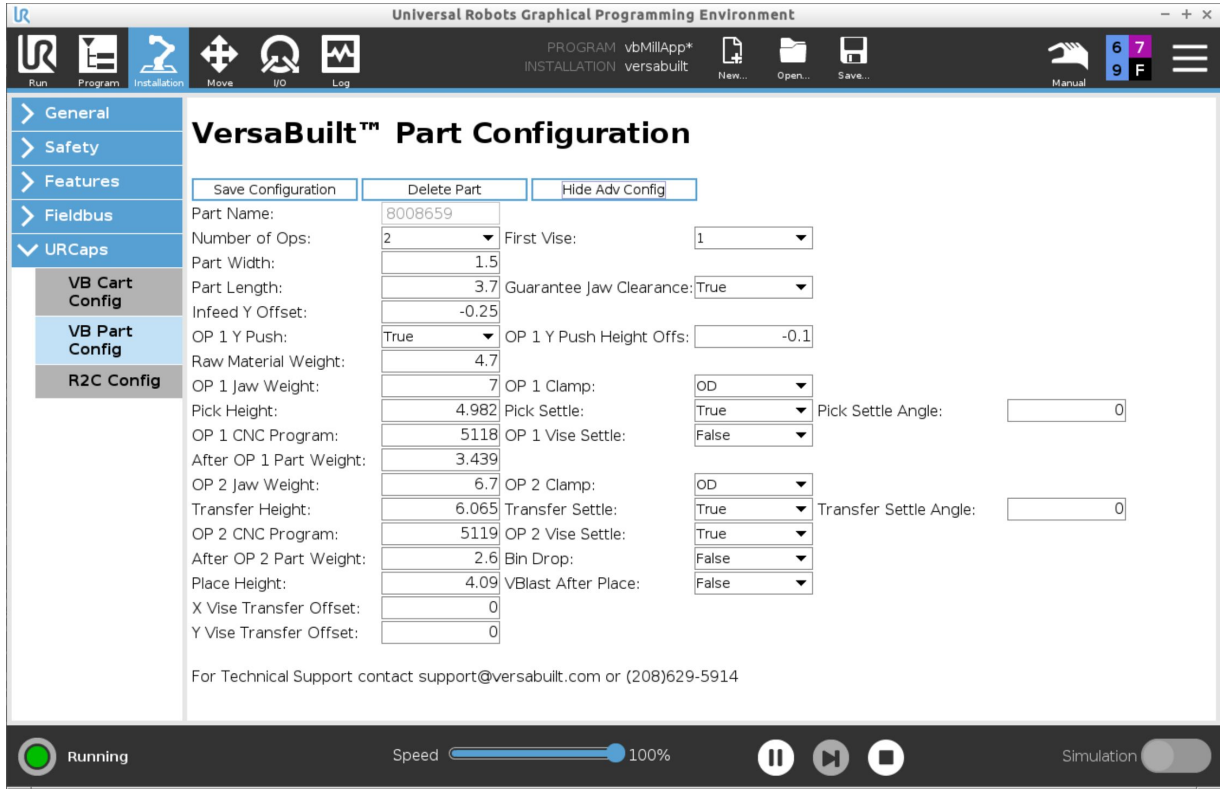
Part Configuration Parameters (continued)

Part Configuration Parameters (continued):

- **OP 1 Jaw Weight**: weight of the first operation MultiGrip jaws
- **Pick Height**: height, from bottom of first op jaws to the table top, the robot will move to pick the part from infeed
- **OP 1 CNC Program**: CNC program number for first milling operation
- **After OP 1 Part Weight**: weight of the part after the first milling operation is complete
- **OP 2 Jaw Weight**: weight of the second operation MultiGrip jaws
- **Transfer Height**: height from bottom of first operation jaws to bottom of second operation jaws during the operation transfer process
- **OP 2 CNC Program**: CNC program number for second milling operation
- **After OP 2 Part Weight**: weight of the part after the second milling operation is complete
- **Place Height**: height, from bottom of second operation jaws to the table top, the robot will move to place the part back into the infeed

Advanced Part Configuration Parameters

- Advanced Part Configuration options are useful in some applications
- Advanced Part Configuration Options can be shown by clicking on the Show Adv Config button



Advanced Part Configuration Parameters

- **First Vise**: which is the first vise that should be loaded, 1 or 2; First Vise = 1 by default
- **Guarantee Jaw Clearance**: Selecting True will generate part column spacing of 5 and row spacing of 4, guaranteeing that the MultiGrip jaws will not collide with adjacent parts during pick and place, False by default
    - **Note:** this option could also be called, “I didn’t read and understand Section 5 of this manual before I made my jaws”
- **OP 1 Y Push Height Offs:** adjust the default OP 1 Y Push Height Offset from -0.100 to some other value
- **OP 1 Clamp:** option to set the clamping of each operation to OD clamping (outer diameter, close to clamp) or ID clamping (inner diameter, open to clamp); OD clamping is default
- **Pick Settle**: option to enable the robot to open and close the jaws to allow the part to settle into the jaws; Pick Settle is True by default
    - **Settle Angle**: optional angle to tilt the jaws during the **Pick Settle** so the part can settle against a datum in the jaws; angle can be positive (end of jaws up) or negative (end of jaws down); settle angle is 0 by default

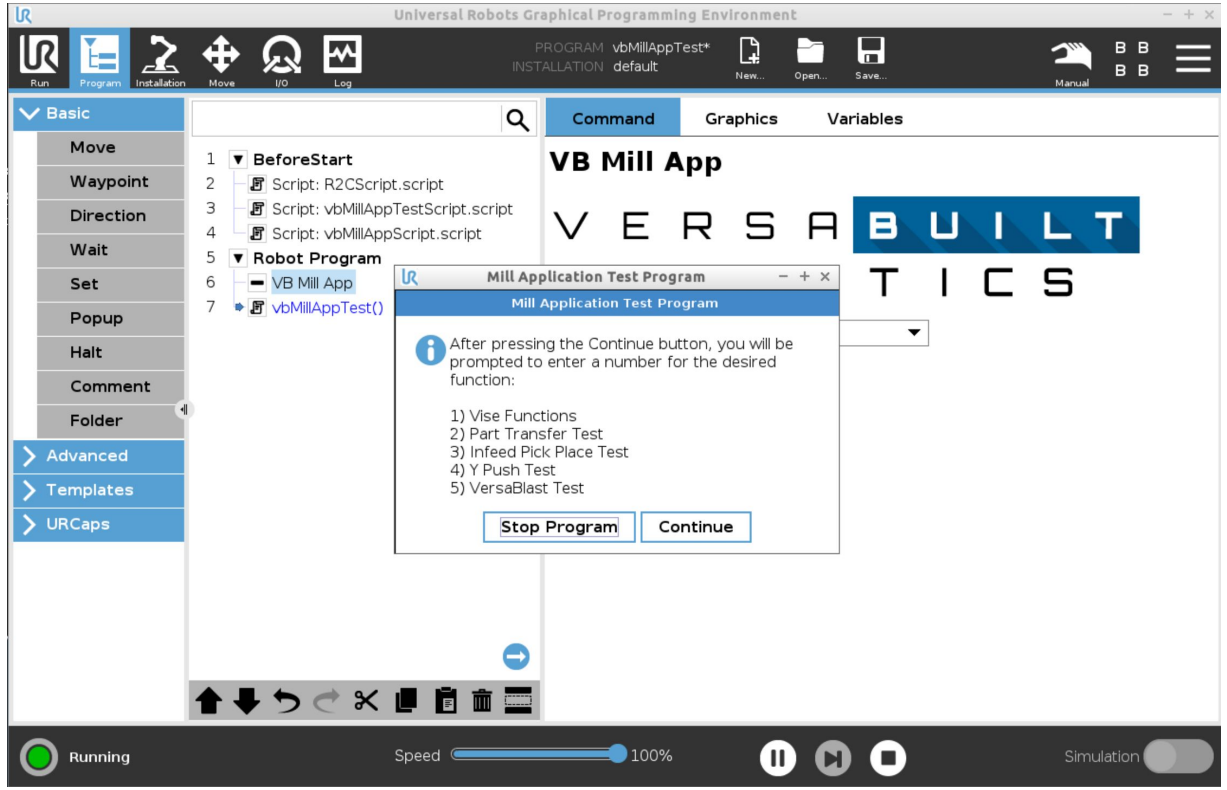
Advanced Part Configuration Parameters

- **OP 1 Vise Settle**: option for vise to open and close after load to settle part in jaws; OP 1 Vise Settle is True by default
- **Transfer Settle**: option to enable the robot to open and close the jaws to allow the part to settle into the jaws during transfer from OP 1 to OP 2; Transfer Settle is True by default
  - **Transfer Settle Angle**: optional angle to tilt the jaws during the **Transfer Settle** so the part can settle against a datum in the jaws; angle can be positive (end of jaws up) or negative (end of jaws down); settle angle is 0 by default
- **OP 2 Vise Settle**: option for vise to open and close after load to settle part in jaws; OP 2 Vise Settle is True by default
- **Bin Drop**: option to have the robot drop the part in a bin or bucket after the part is complete **see appendix for Bin Drop Location*
- **VBlast After Place:** option to have the robot use the VersaBlast cleaning cycle on the OP 2 jaws after a finished part is placed and before the next part transfer; VBlast After Place is True by default
  - VBlast After Place is useful if the OP 2 machining process leaves chips between the part and the jaws

Appendices

Using the VBMillAppTest Program

- The VBMillAppTest program allows a new part configuration to be tested without running an automation cycle
- To use VBMillAppTest, first configure the part to be tested in the VB Part Config URCap in the Installation tab of the UR Teach Pendant
- Open the VBMillAppTest program in the VersaBuilt directory of the Robot Teach Pendant
- Follow the on-screen menus, to test pick, place, load vise, unload vise, part transfer and VersaBlast



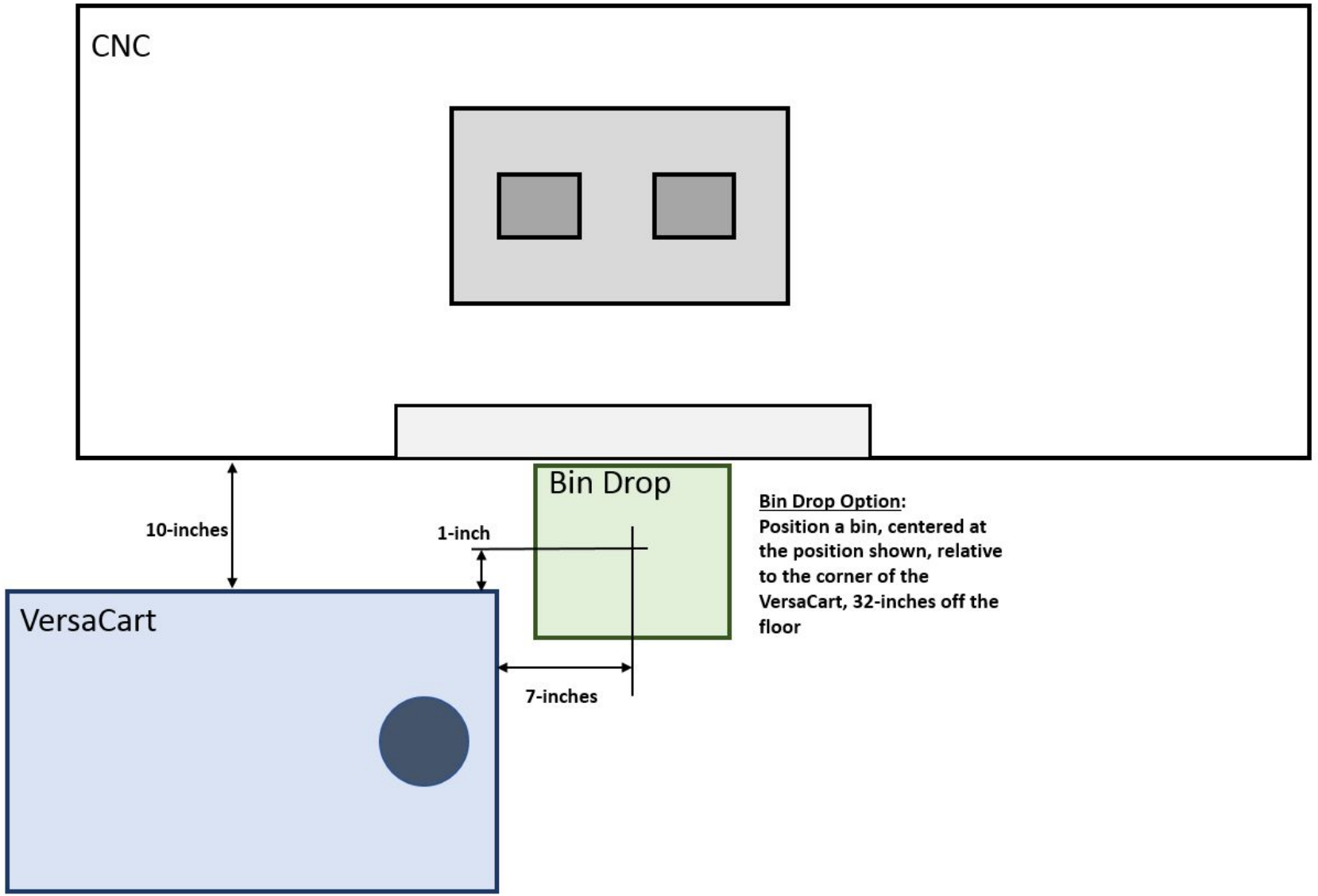
New Part Configuration Worksheet

Part Name:					
Number of Ops:		First Vise:			
Part Width:					
Part Length:					
Infeed Y Offset:					
OP 1 Y Push:		OP 1 Y Push Height Offs:			
Raw Material Weight:					
OP 1 Jaw Weight:		OP 1 Clamp:			
Pick Height:		Pick Settle:		Pick Settle Angle:	
OP 1 CNC Program:		OP 1 Vise Settle:			
After OP 1 Part Weight:					
OP 2 Jaw Weight:		OP 2 Clamp:			
Transfer Height:		Transfer Settle:		Transfer Settle Angle:	
OP 2 CNC Program:		OP 2 Vise Settle:			
After OP 2 Part Weight:		Bin Drop:			
Place Height:		VBlast After Place:			
X Vise Transfer Offset:					
Y Vise Transfer Offset:					

Bold = Standard Config, No Bold = Advanced Config

Bin Drop Option

- Place bucket or bin at location shown
- Protect parts with foam, water or other means



CNC Vise Control

- Each of the MutliGrip FJ Vises can be opened or closed from within a CNC program using the included CNC programs
- 9002 program is used for vise control
- Call the 9002 program using the G65 command and using D and C parameters:
  - D01. selects vise 1
  - D02. selects vise 2
  - C02. closes the vise
  - C03. opens the vise
- Recommend dwelling 1 second to allow vise to actuate:
  - G04 P1.

EXAMPLES:

- Close Vise 1: G65 P9002 D01. C02.
- Open Vise 1: G65 P9002 D01. C03.
- Close Vise 2: G65 P9002 D02. C02.
- Open Vise 2: G65 P9002 D02. C03.