VERSABUILT ROBOTICS

Lathe Automation System Machinist Manual

Table of Contents

Safety Warnings

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

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

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

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

Accessing VSC Lathe Home Screen

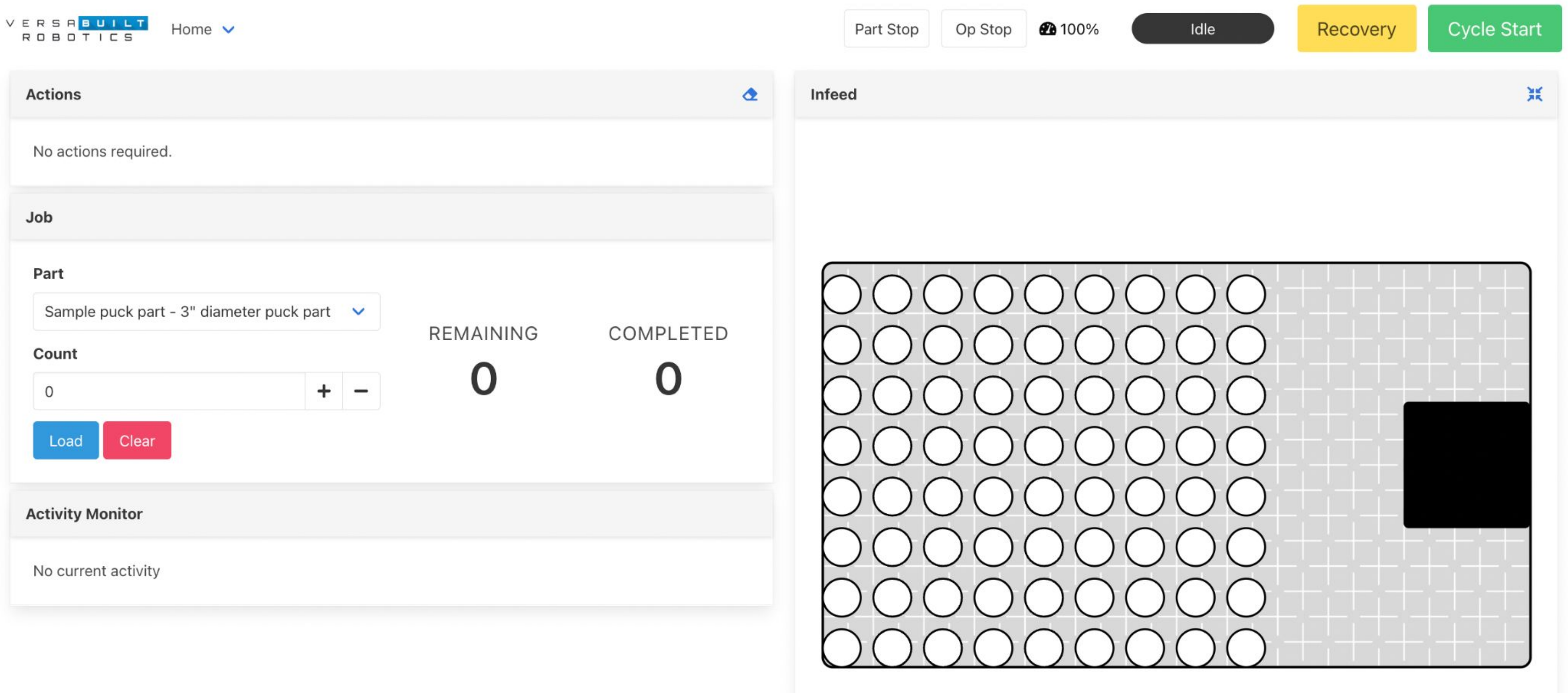
Section 2

Accessing the VSC Lathe

The VSC can be accessed by any computer, tablet or phone with Wi-Fi or Ethernet using a web browser such as Google Chrome.

VersaBuilt recommends dedicating a laptop computer or a full-sized tablet (10” or greater) such as an IPad.

The VSC can be accessed via a smartphone or small tablet, with some changes to how the user interface is displayed.



Accessing the VSC Lathe - Ethernet

Connecting to the VSC via Ethernet

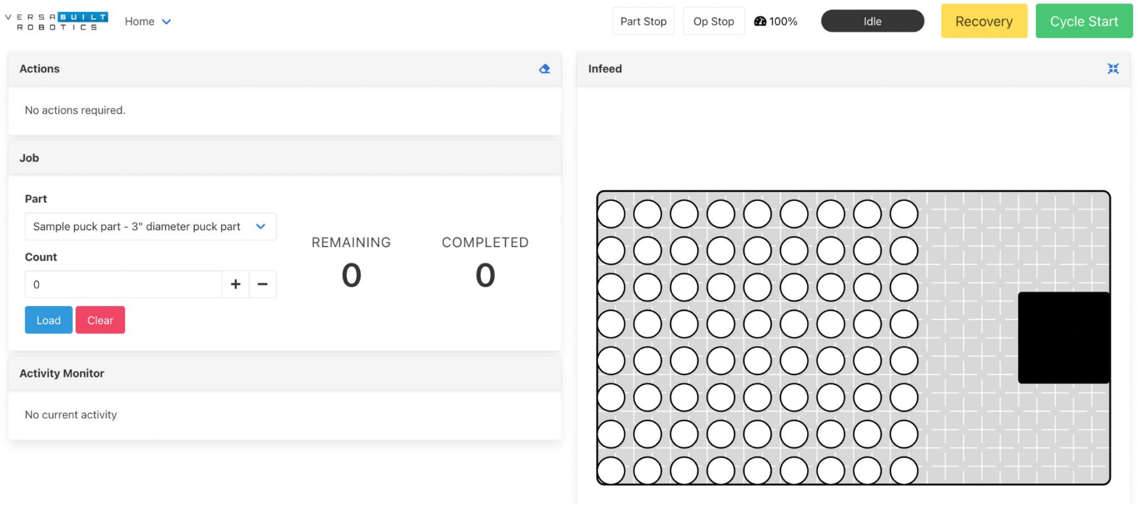
For an Ethernet device such as a laptop:

1. Plug the device into an available port on the Ethernet switch connected to the VSC. For most computers, the ethernet port will be automatically configured to access the VSC.

2. Open a web browser and enter the following into the address bar: **192.168.2.1:9000**

3. The VSC home page should appear. If the VSC home page does not appear, go to the computer's Ethernet settings and configure the Ethernet port for:

   DHCP: Obtain an IP Address Automatically



Accessing the VSC Lathe - Wi-Fi

Connecting to VSC via VSC Wi-Fi Access Point

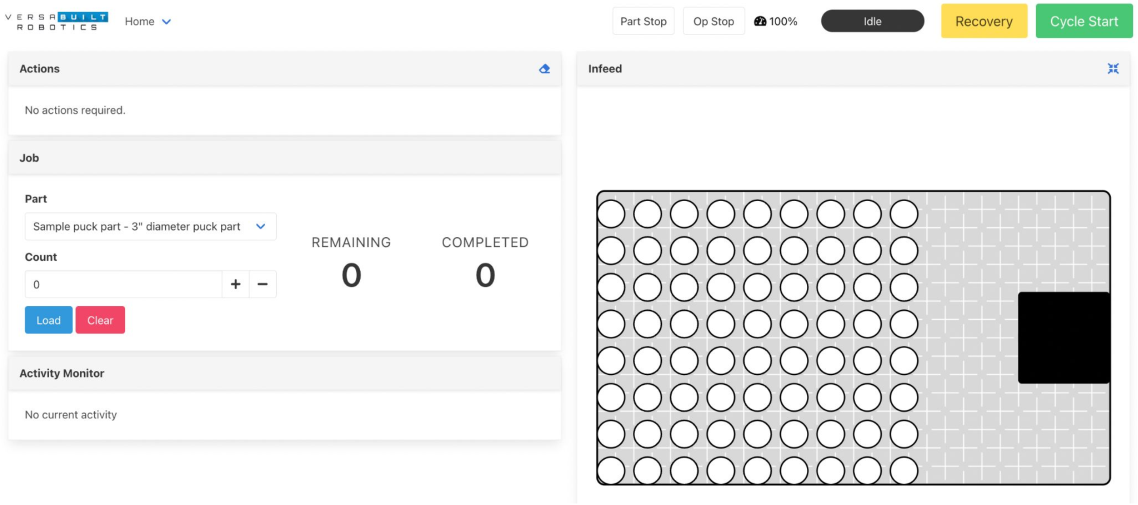
For a Wi-Fi connected device such as an IPad, device network settings will be automatic:

1. Open your device's Wi-Fi settings and search for a network named vscXXXXX where the XXXXX is the serial number of your VSC (e.g., vsc00125).

2. Connect to the VSC Access Point, using the password: **versabuilt** (all lower case).

3. Once connected to the access point, open a web browser and enter the following address: **192.68.4.1:9000**

   The VSC home page should appear



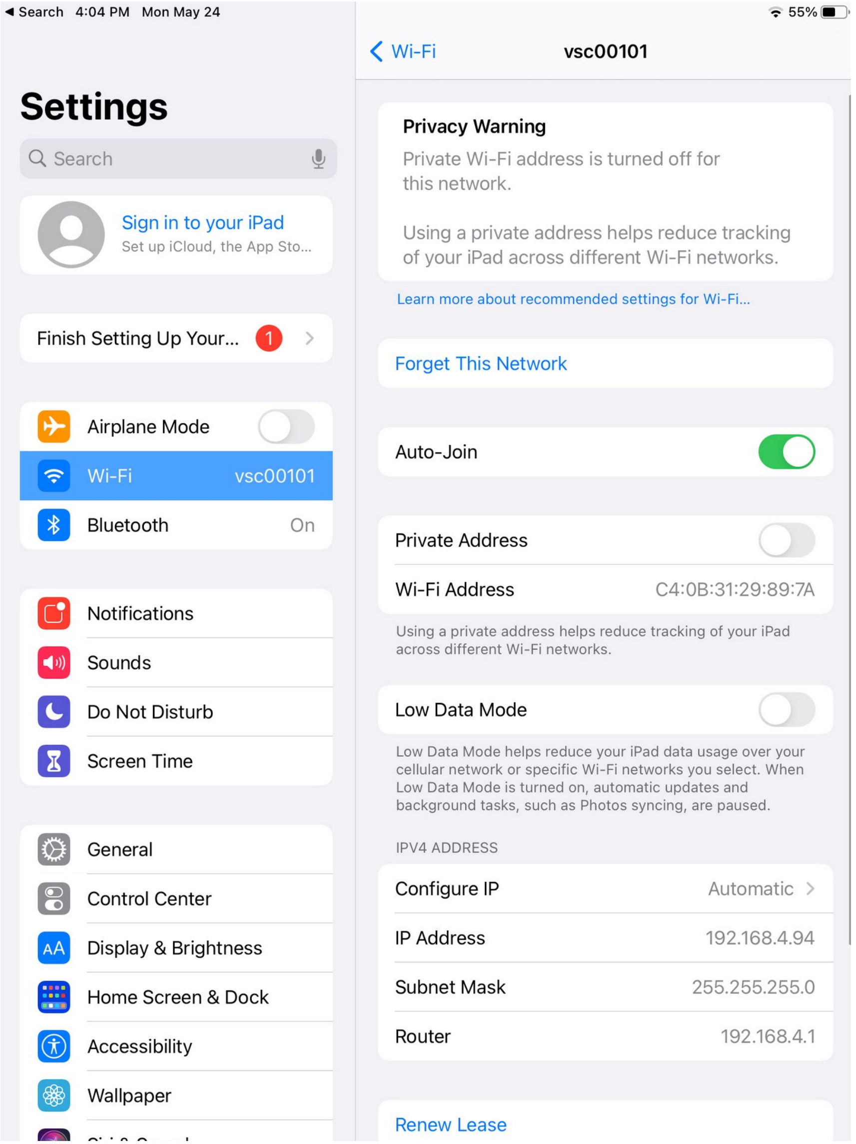
Accessing the VSC Lathe

Configuring Wi-Fi settings for the VSC

Because the VSC does not have an Internet connection, your device may try to automatically connect to another Wi-Fi access point. To prevent this, do two things:

1. Select Auto-Join on the VSC Wi-Fi network

2. If the device has previously connected to any other Wi-Fi network, modify the settings for that Wi-Fi network to “forget” the settings



Chuck Considerations

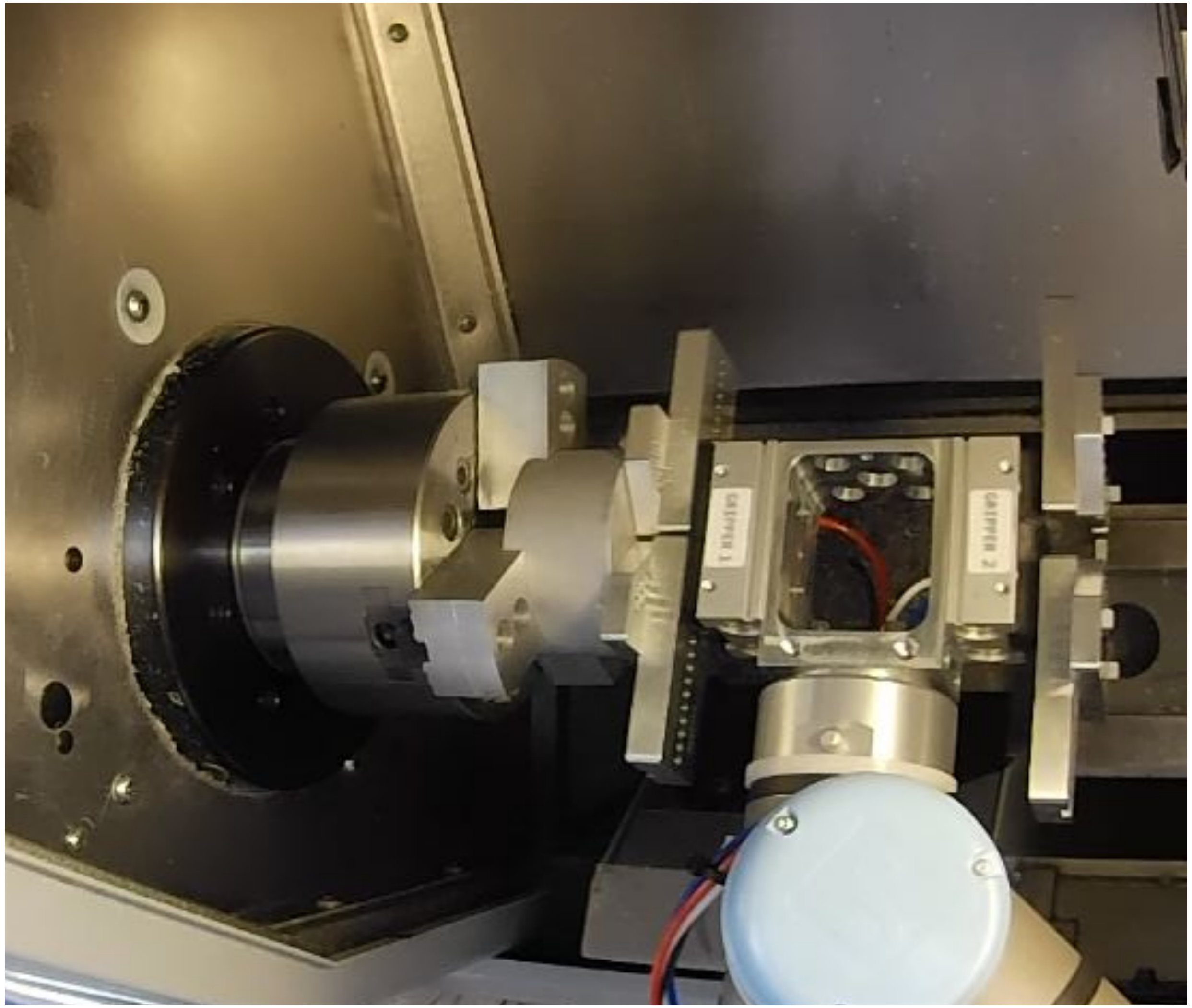
Section 3

Chuck Calibration Position and Part Configuration Options

During the installation process, calibration of the robot to the lathe chuck(s) is performed, *ideally using parts that have been turned and faced*. The calibration process stores an accurate centerline to the chuck(s) and establishes a reference position between the face of the chuck and the robot gripper.

Unless overridden by the part configuration options, the calibrated centerline and reference position to the face of the chuck are used to establish the robot's initial move inside of the CNC and the centerline the robot moves along to load the chucks.

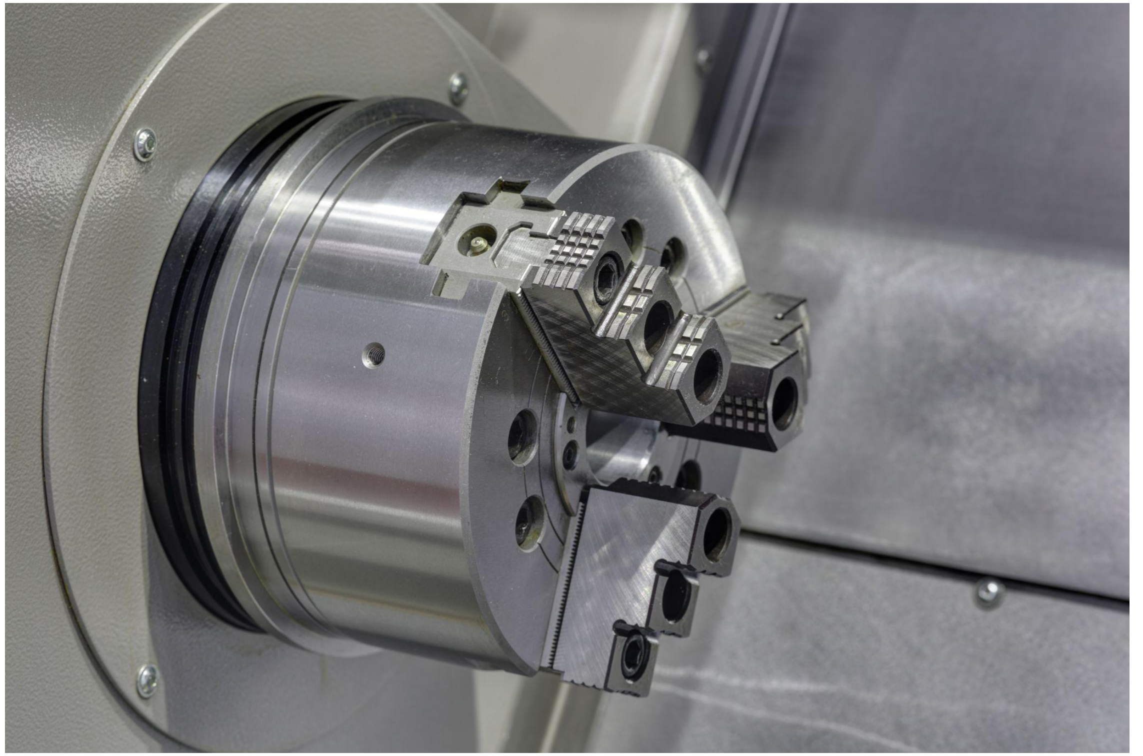
Establishing an accurate centerline is particularly important when using collet chucks due to the limited radial clearance between the part and the collet.



3-Jaw Universal Chuck Considerations

3-Jaw Universal Chucks are common on CNC lathes and are relatively easy to load with the Lathe Automation System. They have longer jaw stroke, providing more clearance during the loading process, and remain stationary in Z during clamping. The primary consideration when loading a 3-Jaw chuck is how the part is positioned in the Z axis of the chuck:

- If there is no Z surface in the chuck jaws or the Z surface is too deep for the part to seat against, the robot can load the part to an absolute (unique) calibrated load position (shafts) or to a Z offset from the face of the chuck (pucks) established during calibration
- If there is a Z surface the part must be seated against, consider using the robot option "**Apply Force During Chuck Clamp**" or using the **VersaBuilt Lathe Part Seating Tool**
  - The Apply Force During Chuck Clamp uses the robot's force capabilities to apply a force along the Z axis while the chuck is being clamped; this option has some limitations due to the capabilities of the robot
  - The Lathe Part Seating Tool will generally be more accurate at seating the part but takes additional CNC programming and cycle time to implement



Collet Chuck Considerations

<u>Collet Chucks</u>

Collet Chucks can be more challenging to load with the Lathe Automation System. This is due to the small radial clearance between the part and the collet. Accurate calibration is critical for successful loading. Additionally, consider providing a **lead-in chamfer of 0.030” or more** to help align parts into the collet.

Some collet chucks pull the collet back during clamp and push the collet out during unclamp. This may change the position of the part during load.

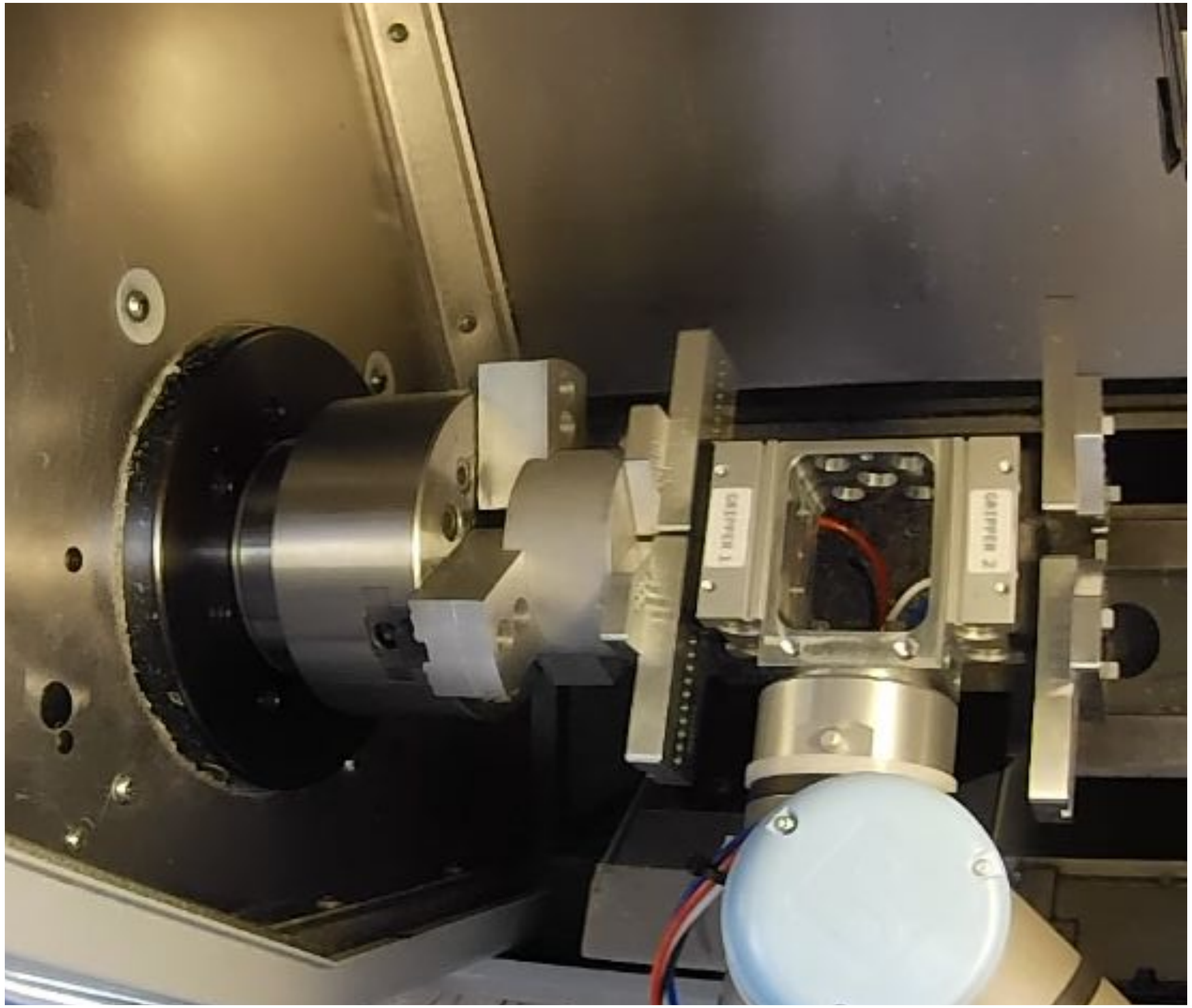
If the collet chuck has a Z stop, consider using the robot option **Apply Force During Chuck Clamp** or using the **VersaBuilt Lathe Part Seating Too**l.

Chuck Calibration Position and Part Configuration Options

Refer to the “VersaBuilt System Controller - CNC Installation and Programming Manual” in the section titled “Install CNC Files and Edit Table Load and Table Wash Programs”.

For sub-spindle Lathes, before calibrating the sub-spindle, set the position of the sub-spindle to a “load” position; the position the robot will load/unload from. Record this position and make sure that all CNC turning programs end with the sub-spindle in the “load” position.

Verify the wash program adequately washes the chuck for reliable processing.

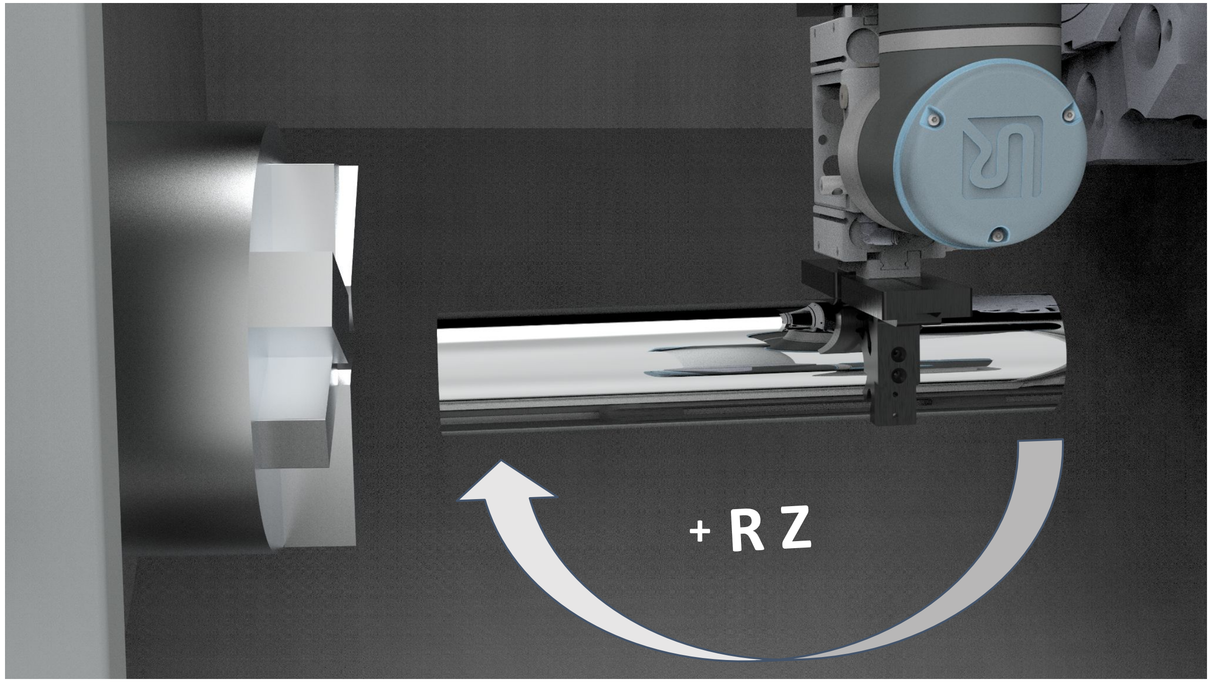


Chuck Load Tuning Adjustments

Under the Chuck Load Options of the part configuration is the **Load Tuning Adjustment (X,Y,Z,rX,rY,rZ)** option. This option can be used to fine tune the how the robot load the part into the chuck. It is most commonly used for heavier parts that may “droop” slightly in the gripper during the chuck loading process.

The adjustment is defined as 6 numbers separated by commas. Adjustments in X, Y, and Z are in inches or millimeters (depending on the configured units of the system). Adjustments in rotation, rX, rY, and rZ are in degrees.

Although the Load Tuning Adjustment allows for adjustment in all six degrees of freedom, typically only the last digit, rotation about Z or rZ, is used to account for part droop in either puck or shaft configuration. Adjustment for rotation about Z is shown.



Washing Chips from the Chuck

The Lathe Automation System relies on the CNC coolant to remove chips that could interfere with the CNC process or automation process. Flood coolant is a more reliable method of removing chips than compressed air.

Best practice is to add part specific CNC motion to flood the face and side of the chuck while the chuck spins slowly. Finishing the cycle with the chuck spinning at a high-speed can help remove remaining chips and coolant.

Some parts will allow all chips to be removed with the part in the chuck and the wash cycle at the end of the program. Other parts will not allow all chips to be removed in the wash cycle with the part in the chuck. In this case, use the “Wash Chuck after Unload” option is set in the part configuration. This option allows the machinist to specify a unique wash program for each part. After the finished part is unloaded, the robot will retract, close the door and run the wash program before loading the next part.

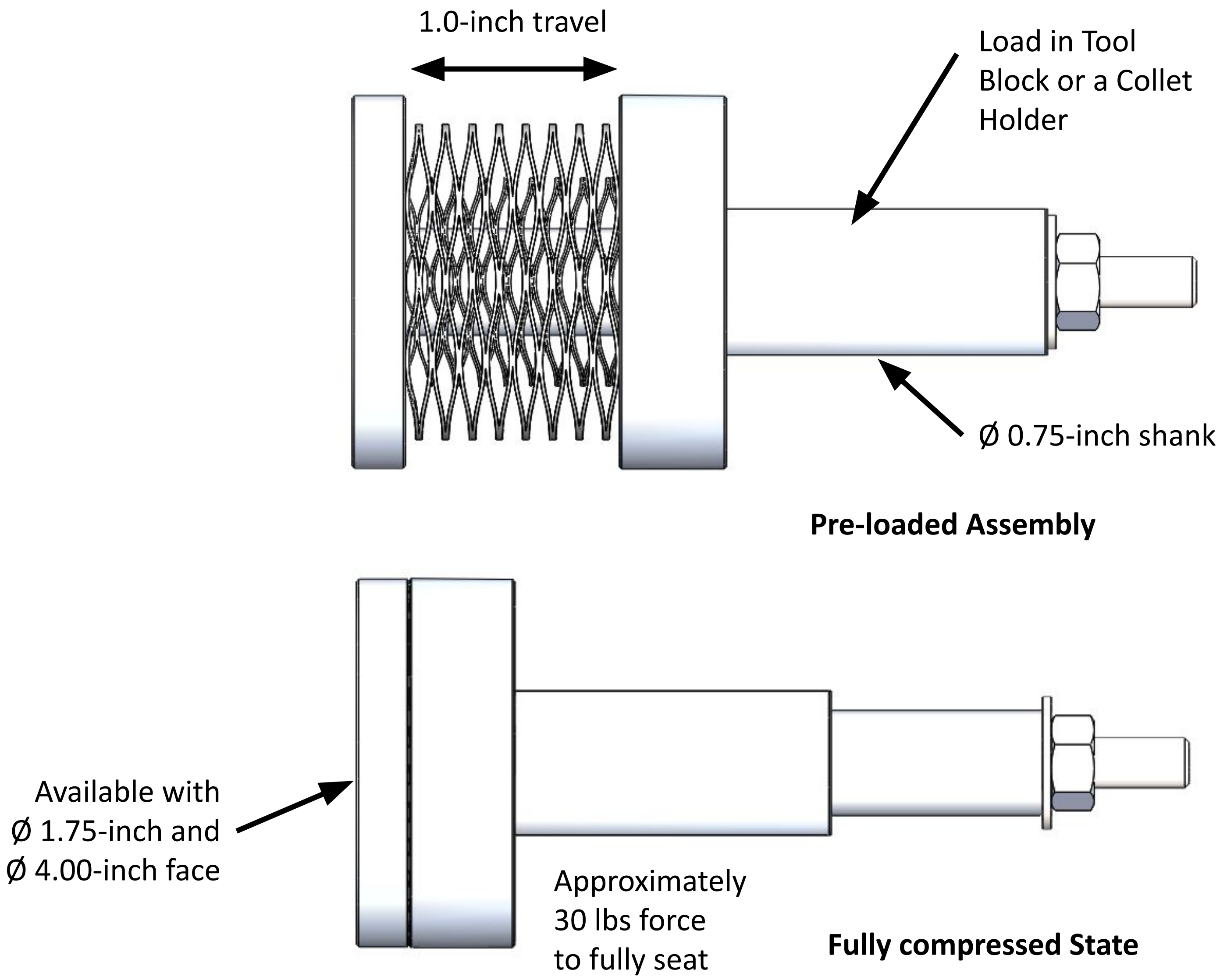
VersaBuilt Lathe Part Seating Tool

VersaBuilt Lathe Part Seating Tool is an available option for Lathe Automation, to aid seating the part to a z-stop in the chuck.

The tool has a pre-loaded spring and includes 1-inch of travel to accommodate overtravel and insuring a fully seated part.

Visit www.versabuilt.com/resources for CAD downloads.

Insert tool into CNC turret for z-push part seating.



DuoGrip Gripper

Section 4

DuoGrip Gripper Overview

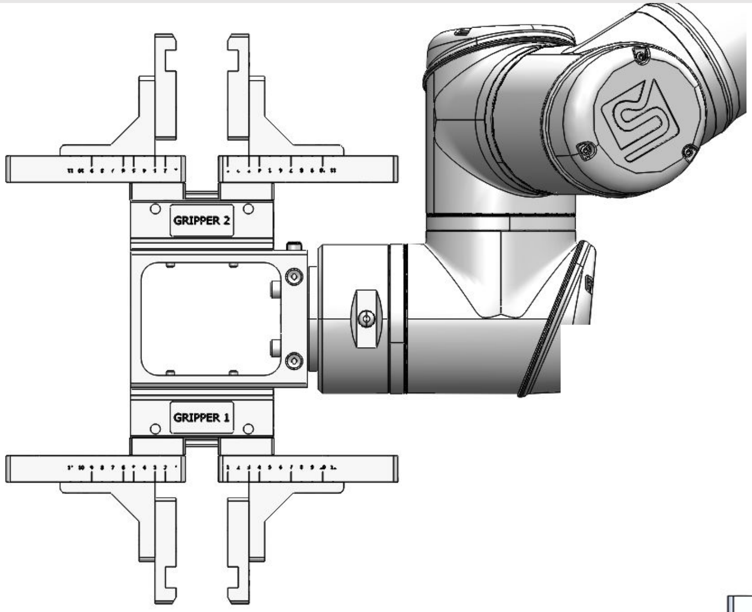
The VersaBuilt DuoGrip Gripper is a double-headed center actuating gripper configurable for pick and place of parts in infeed orientations for Pucks and Shafts.

Pucks are placed on the Versacart visual grid with the flat side down.

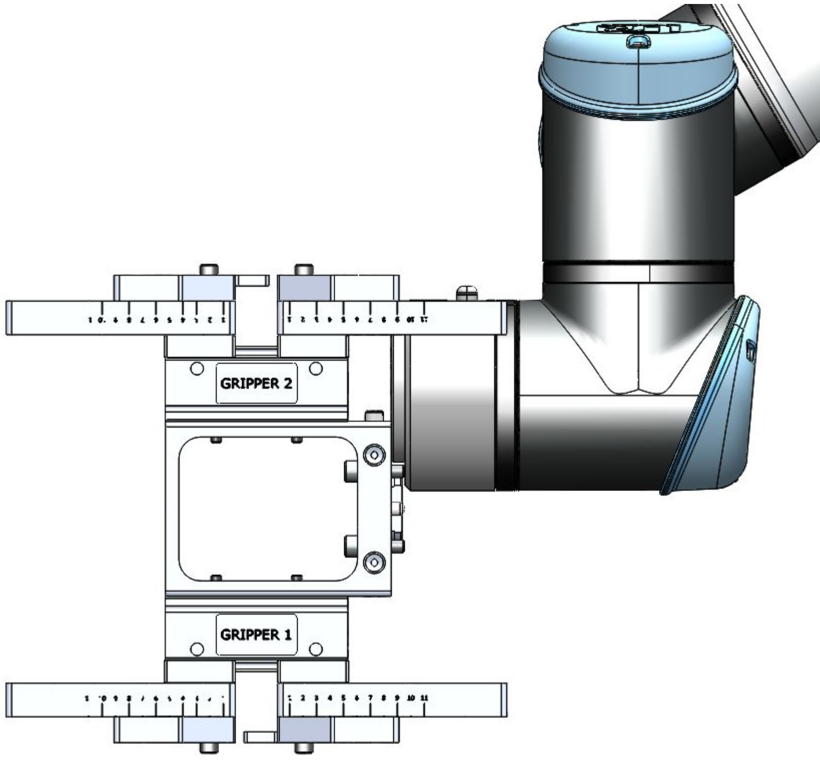
Shafts are placed on the Versacart Shaft Infeed, with the flat side perpendicular to the to the table top.

Gripper 1 is always used to pick parts from the infeed and load parts into the lathe chuck.

Gripper 2 is always used to unload completed parts from the lathe chuck and place parts in the outfeed.



Gripper with Shaft Fingers



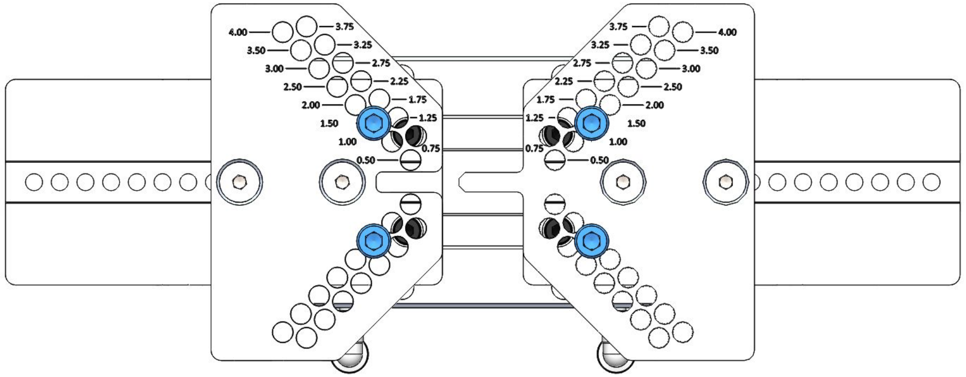
Gripper with Puck Fingers

Gripper Finger Overview

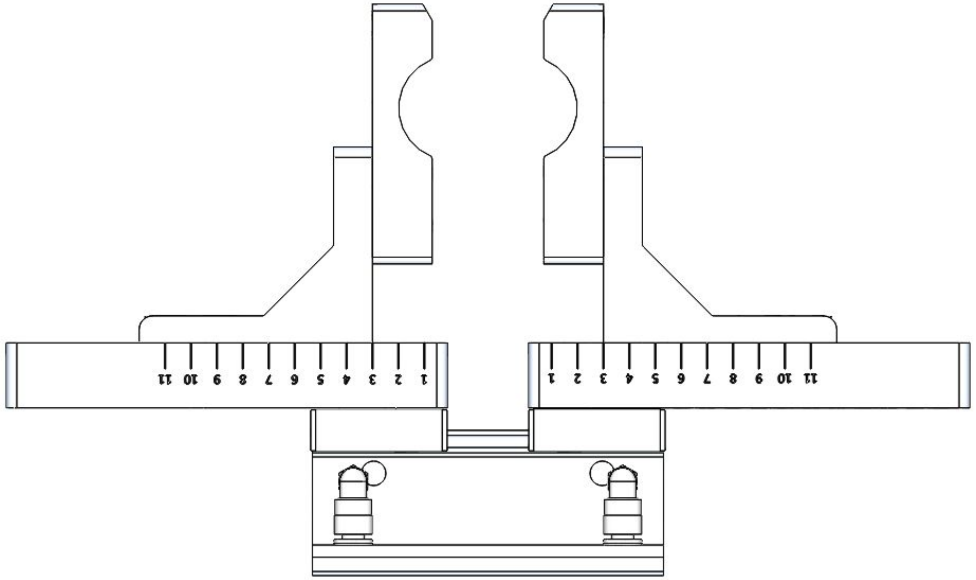
Puck Fingers included with the Lathe Automation System can support material diameters of 0.5” to 4.0”. Engraving on the fingers show the locations to place gripper screws for each material size. The optional Large Puck Fingers support material diameters up to 8”

Shaft Fingers can be adjusted to support material diameters of 0.25” to 3.00”. Refer to the following pages for Shaft Finger configuration options. For maximum gripping accuracy, custom shaft finger diameters may be ordered from VersaBuilt. Fingers are custom cut to the part diameter for maximum gripping strength and accuracy.

Custom Fingers - In addition to supporting round parts, both the Puck Fingers and the Shaft Fingers can accept custom gripper finger tips to reliably process non-round shapes. Custom gripper finger tips may be 3D printed. Download a 3D model of the DuoGripper from the Resources page of the www.versabuilt.com.



Gripper with Puck Fingers in 1.00” position for 1.00 to 1.24” rounds

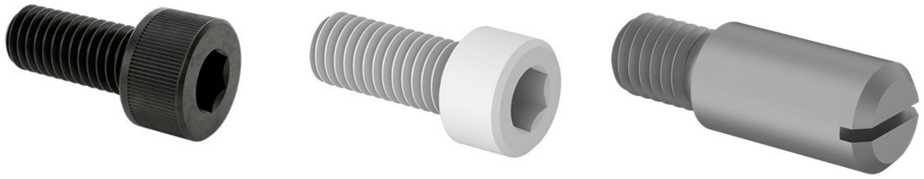


Gripper with 1” Custom Shaft Fingers w/ Bracket in Position #3

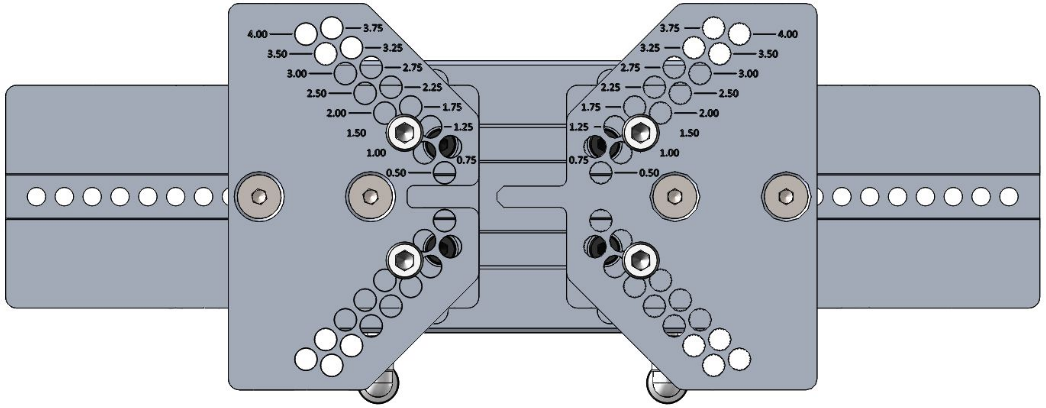
Puck Finger Configuration

DuoGripper Puck Fingers use M5 threaded holes to accept different types of screws to grip the part. Three types of screws are provided in the kit:

- M5 x 12mm head length Headless Shoulder Bolts
- M5 x 12mm length Steel Socket Head Cap Screws
- M5 x 12mm length Plastic Socket Head Cap Screws

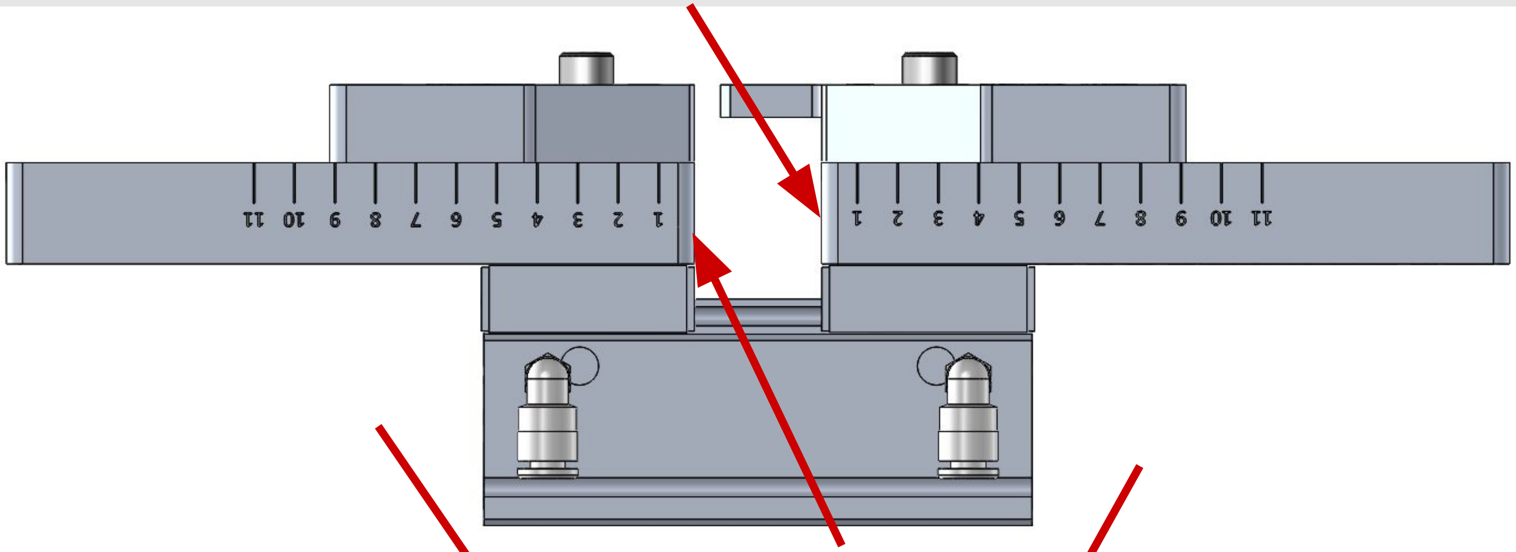


Headless Shoulder Bolts are recommended for most applications. For applications that require a lower profile grip, the Socket Head Cap Screws are recommended. With Steel Screws for most applications and Plastic Screws when steel could damage the part.

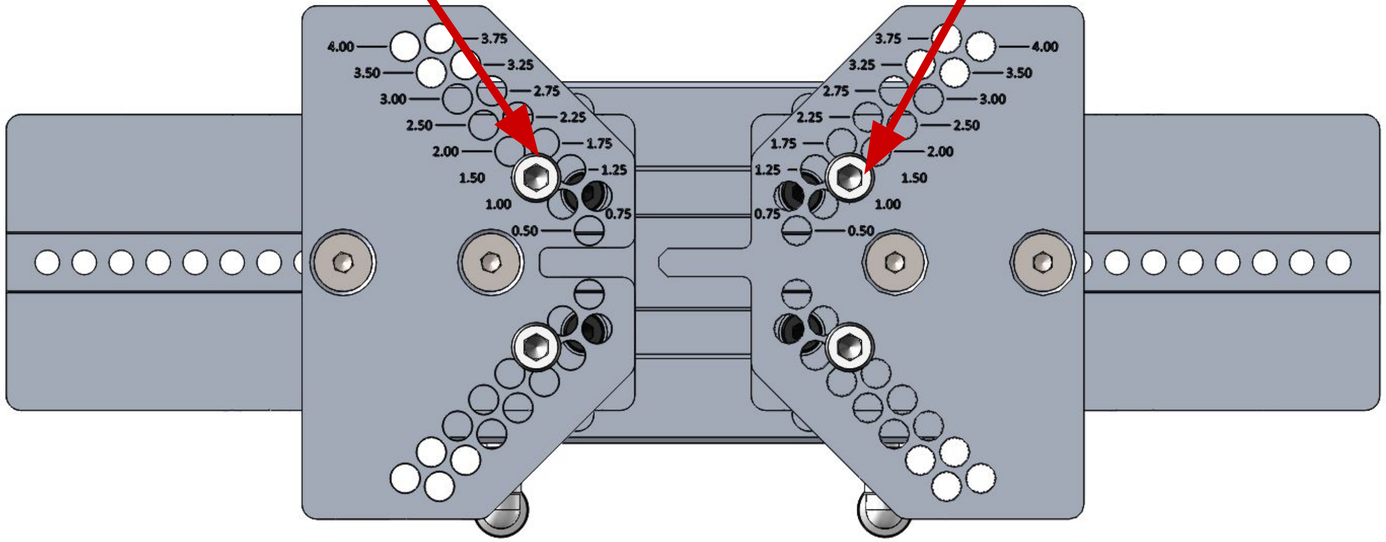


Puck Finger Configuration

Install the Puck Fingers onto the Duo Gripper so the front edge of the Puck Fingers align with the front edge of the gripper fingers as shown



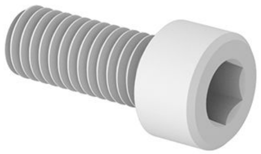
Insert the screws into the holes corresponding to the diameter of the puck to be picked/placed.

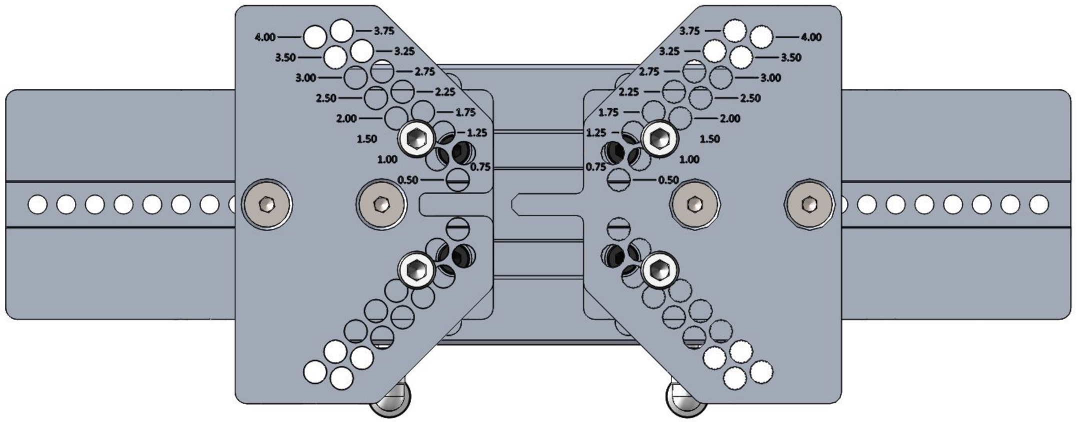


Puck Finger Configuration - Socket Head Cap Screws

Refer to the table below for location of the Socket Head Cap Screws on the Puck Gripper Fingers, depending on the size of part to be clamped.

The image below shows the gripper with Headless Shoulder Bolts in the 1.50 engraved position for clamping diameters from 1.50 to 1.745”



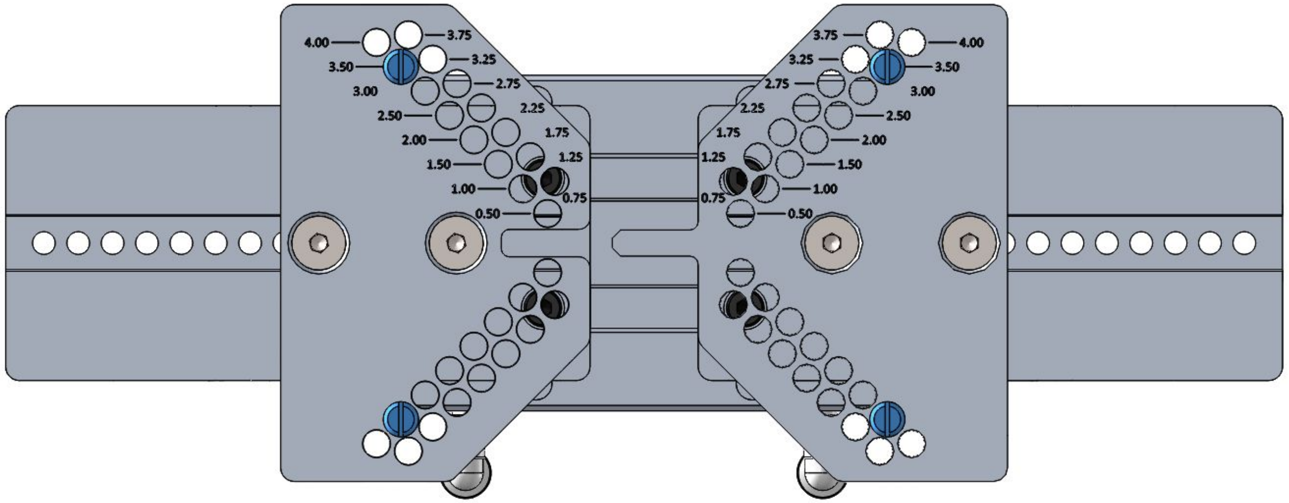


BOLT POSITION	MIN PUCK	MAX PUCK
0.50 engrave	0.500	0.745
0.75 engrave	0.750	0.995
1.00 engrave	1.000	1.245
1.25 engrave	1.250	1.495
1.50 engrave	1.500	1.745
1.75 engrave	1.750	1.995
2.00 engrave	2.000	2.245
2.25 engrave	2.250	2.495
2.50 engrave	2.500	2.745
2.75 engrave	2.750	2.995
3.00 engrave	3.000	3.245
3.25 engrave	3.250	3.495
3.50 engrave	3.500	3.745
3.75 engrave	3.750	3.995
4.00 engrave	4.000	4.245

Puck Finger Configuration - Headless Shoulder Bolts

Refer to the table below for location of the Headless Shoulder Bolt on the Puck Gripper Fingers, depending on the size of part to be clamped.

The image below shows the gripper with Headless Shoulder Bolts in the 3.50 engraved position for clamping diameters from 3.59 to 3.84-inches.



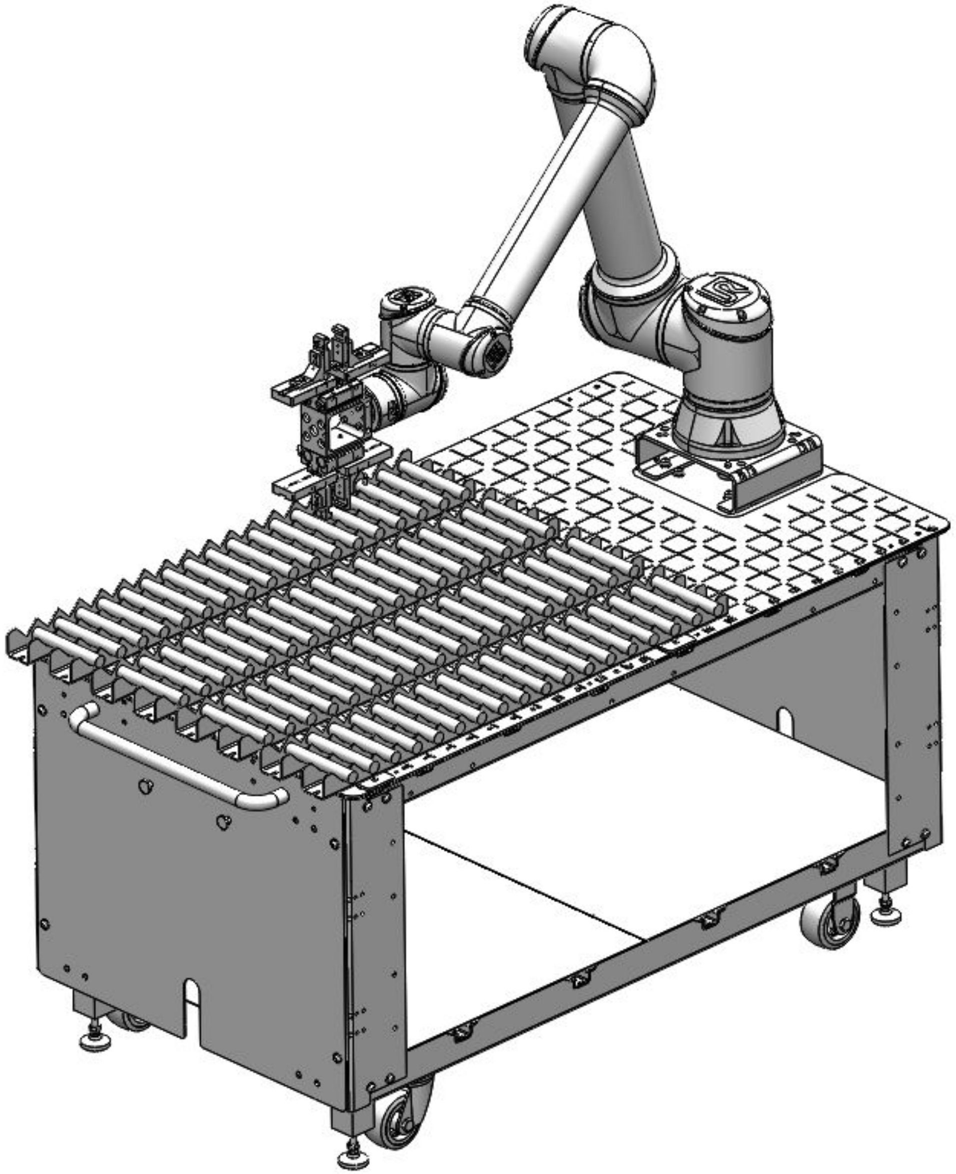
BOLT POSITION	MIN PUCK	MAX PUCK
0.50 engrave	0.58	0.87
0.75 engrave	0.87	1.09
1.00 engrave	1.09	1.36
1.25 engrave	1.36	1.59
1.50 engrave	1.59	1.86
1.75 engrave	1.86	2.09
2.00 engrave	2.09	2.35
2.25 engrave	2.35	2.59
2.50 engrave	2.59	2.85
2.75 engrave	2.85	3.09
3.00 engrave	3.09	3.35
3.25 engrave	3.35	3.59
3.50 engrave	3.59	3.84
3.75 engrave	3.84	4.10
4.00 engrave	4.10	4.38

Shaft Fingers and Shaft Infeed

Shaft processing requires 2 assemblies for setup:

- Shaft Fingers
- Shaft Infeed

The following pages detail assembly of the Shaft Fingers to the DuoGripper and the Shaft Infeed to the VersaCart.

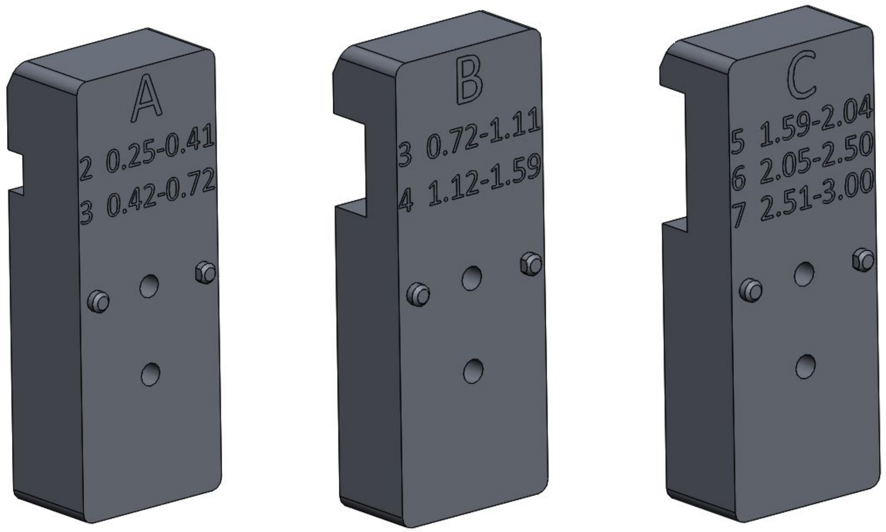


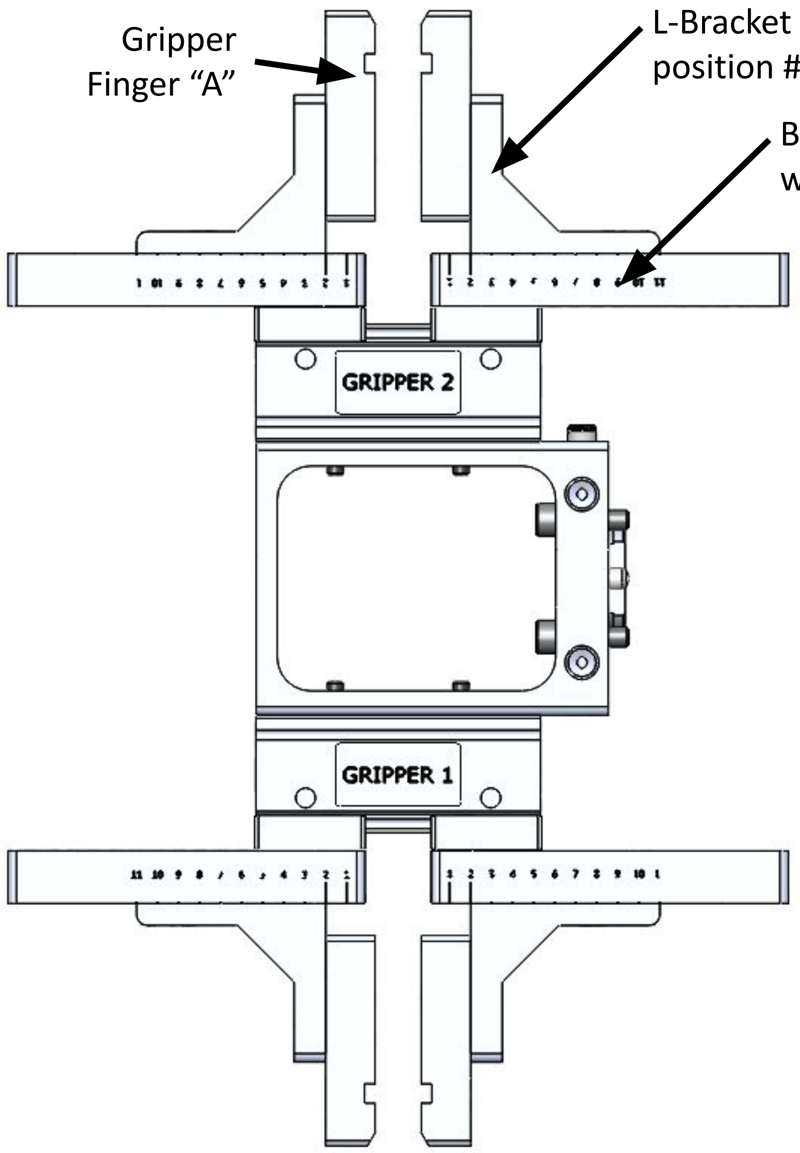
Shaft Finger Configuration

DuoGripper Shaft Fingers use L-Brackets, bolting to the Base Fingers in multiple locations, with A, B or C Shaft Fingers or custom fingers attached to the L-Brackets.

A, B & C Fingers (shown below) include engraving on the back side to indicate the size range and L-Bracket location.

L-Bracket locations are set with the inside face aligned with an engraved number on the Base Fingers

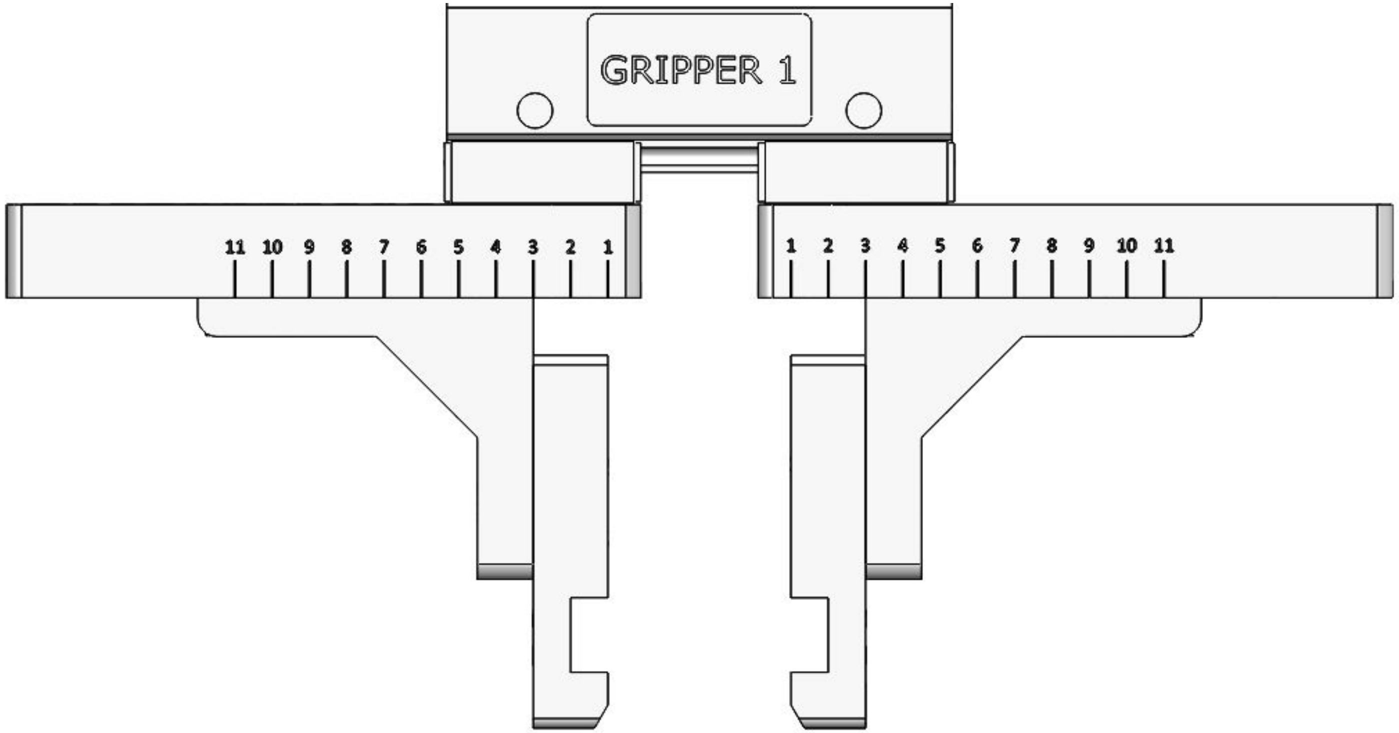




Shaft Finger Size Configuration

Gripper Finger Type and L-Bracket Location for shaft sizes from 0.25-inch to 3.00-inch are shown in the table to the right

The image below show Gripper Finger “B” in with L-Bracket in Position #3. This clamps shafts from 0.72 to 1.12-inches.



FINGER	POSITION	MIN SHAFT	MAX SHAFT
A	2	0.25	0.41
A	3	0.41	0.72
B	3	0.72	1.12
B	4	1.12	1.59
C	5	1.59	2.04
C	6	2.04	2.51
C	7	2.51	3.00

Gripper 1 Fingers
Size of “raw material” loaded into Chuck

Gripper 2 Fingers
Size of “finished material” unloaded from Chuck

Shaft Infeed - Assembly to VersaCart

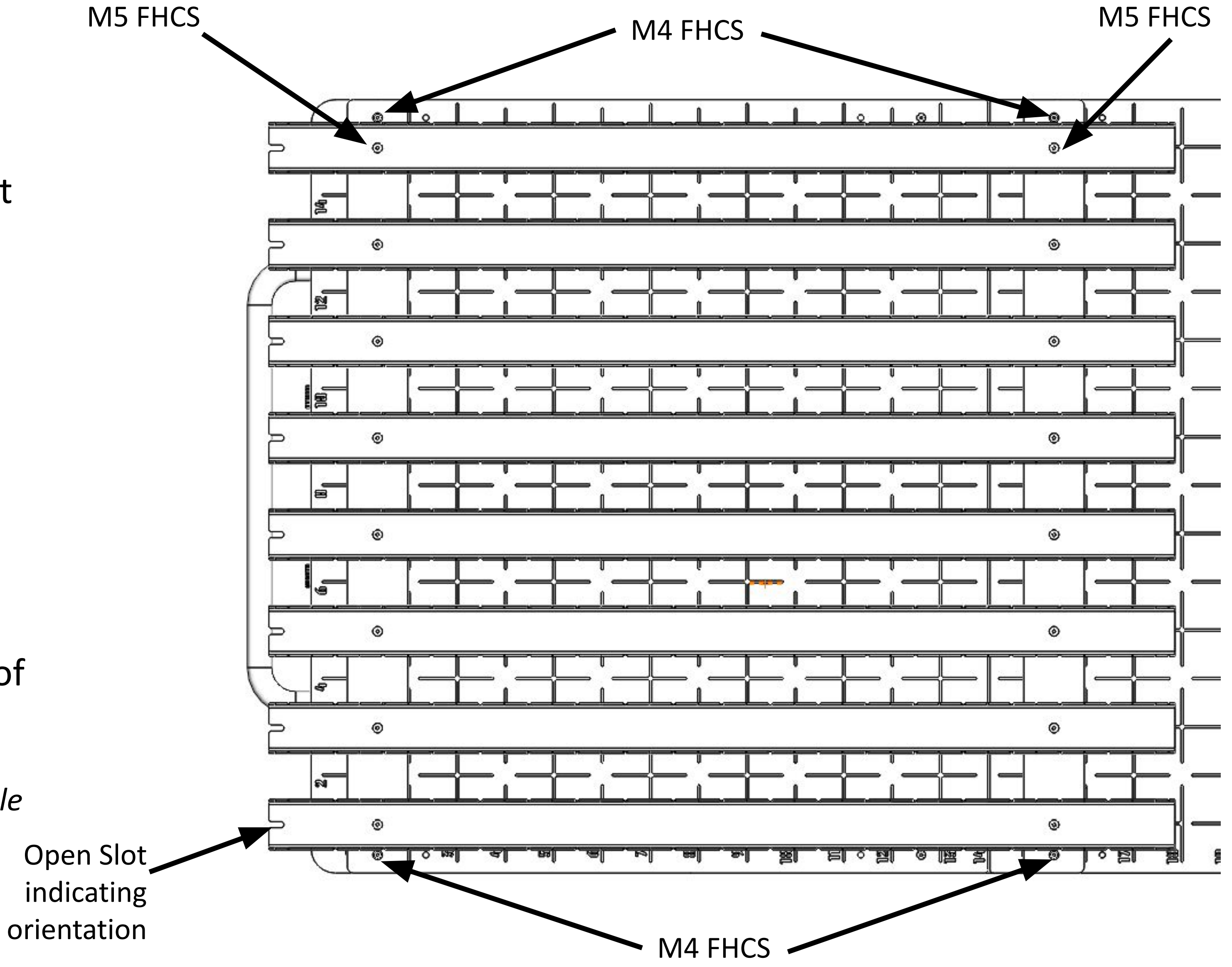
Shaft Infeed consists of 2x crossbars and 8x U-channels.

The crossbars are bolted to the top of the VersaCart visual infeed, with 4x M4 Flat Head Cap Screws (FHCS), in 4 locations used to bolt the visual infeed to the cart structure.

The u-channels are bolted to the crossbars with 2x M5 Flat Head Cap Screws (FHCS) per u-channel (16 total).

The u-channel has a specific orientation, with an open slot located on the side of the cart, opposite of the robot.

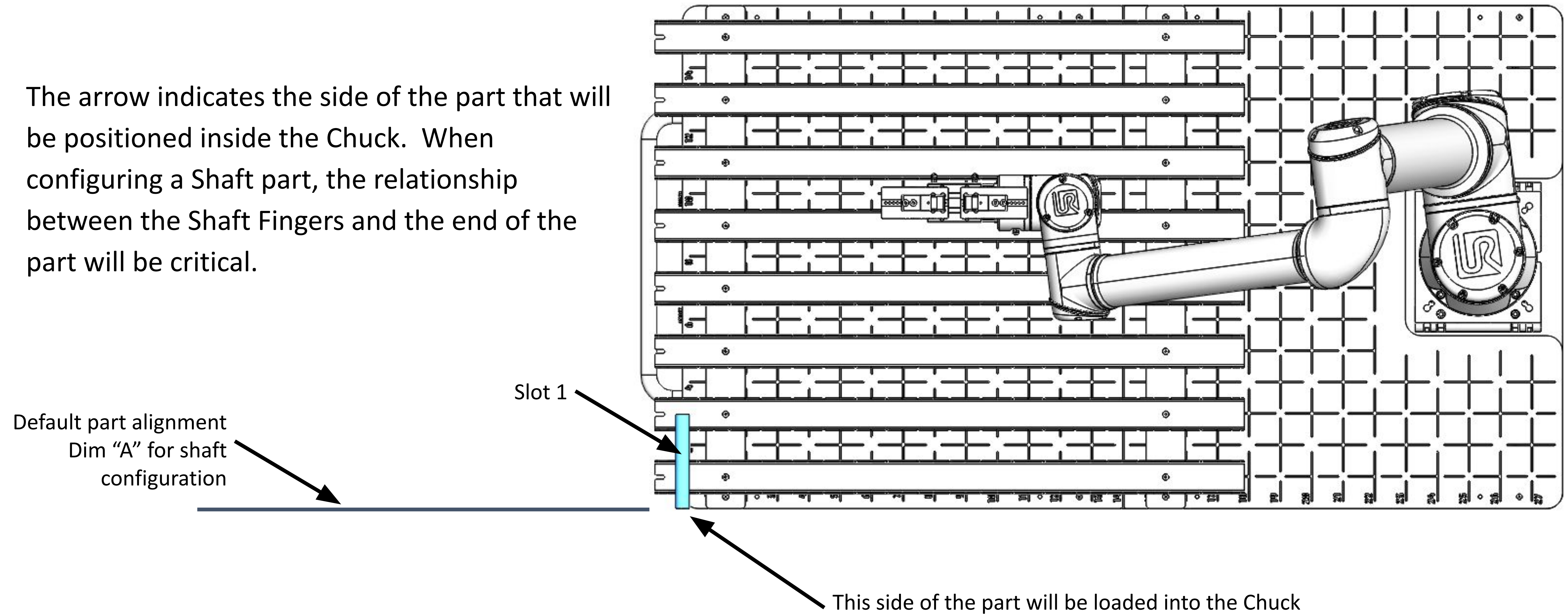
**When securing the crossbars and u-channels, lightly assemble each Flat Head Cap Screw, verify they are aligned and square. U-Channels shall alight with the Visual Infeed Grid. After alignment, tighten down.*



Shaft Infeed - Part Orientation & Position

The image to the right shows part loaded into Shaft Infeed “Slot 1”.

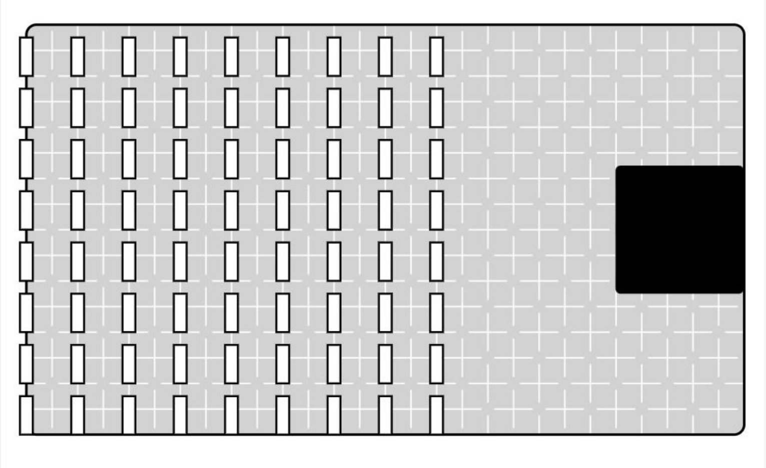
The arrow indicates the side of the part that will be positioned inside the Chuck. When configuring a Shaft part, the relationship between the Shaft Fingers and the end of the part will be critical.



Shaft Infeed Overview

The minimum recommended shaft length is 2.5”. Although a 2” length is possible to support, it may be difficult to keep parts from falling into the infeed channels. The maximum shaft length is 28” (limited by robot motion). The maximum shaft diameter supported is 3”.

Parts are automatically allocated in the infeed by the part configuration parameters of diameter and length. Parts on the VSC display will be shown as aligned with the vertical grid line nearest the left side of the part (robot’s perspective).



Part Configuration: Puck

Section 5

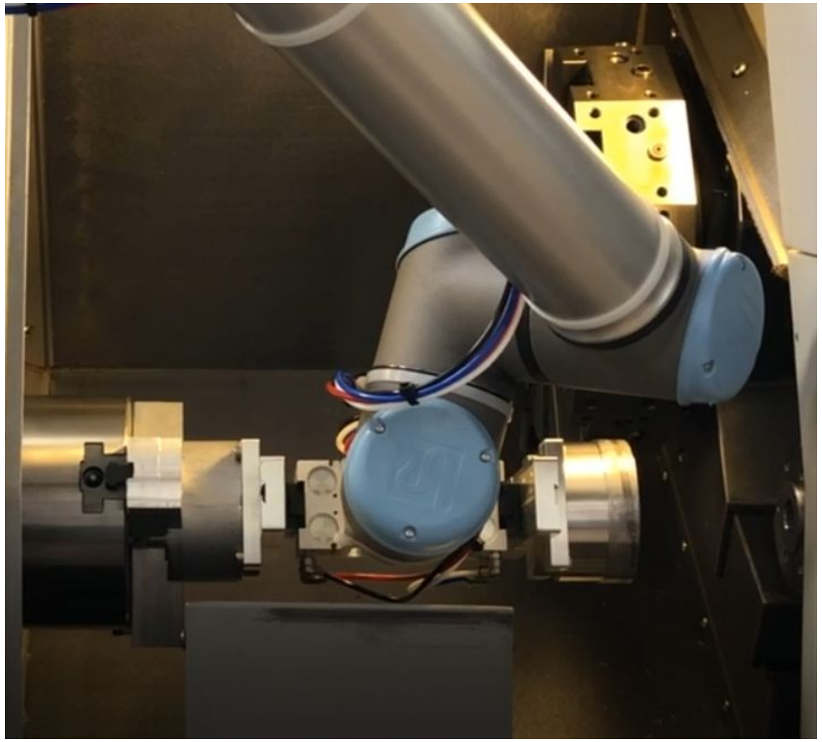
Step 1- Prove Out CNC Process

- Prior to automating a new part, prove out the CNC process using hand-loading
- Validate that after the part is removed from the CNC, that no chips will interfere with the next part loaded into the chuck
  - If chips are present that would interfere with the next load, improve the wash motion at the end of the cycle
  - If the wash program can't remove all of the chips, develop a separate wash program to wash the chuck after the part is removed; verify the program adequately removes all the chips from the critical chuck surfaces
  - The separate program will be used in conjunction with the "Wash Chuck after Unload" option in the part configuration

Puck Process Overview

The puck process is designed to maximize efficiency by using the dual gripper to minimize the time spent exchanging parts. The process works as follows:

1. Robot picks part from infeed using gripper 1
2. Robot loads part into chuck
3. Robot closes CNC door and begins CNC turning cycle
4. Robot moves back to infeed and picks another part with gripper 1
5. When CNC turning cycle completes, the robot unloads the completed part with gripper 2 and loads the new part with gripper 1
6. Robot closes the CNC door and begins CNC turning cycle
7. Robot places the completed part in the infeed with gripper 2
8. Robot picks another part from the infeed using gripper 1
9. System goes back to step 5 and repeats until all parts are complete



Puck Process Measurements

There are a handful of measurements required to process each part with the Lathe Automation System. These measurements are described below and shown in images on the following page.

- **Raw Material**
  - Raw Material Diameter
  - Raw Material Height
  - Raw Material Weight
- **Finished Part**
  - Finished Part Height
  - Finished Part Weight
- **Chuck Measurements**
  - Distance from Face of Chuck* to the Face of Jaws
  - Distance from Face of Chuck* to the End of Raw Material
  - Distance from Face of Chuck* to the End of Finished Part
  - Distance from Load Position to Apply Force

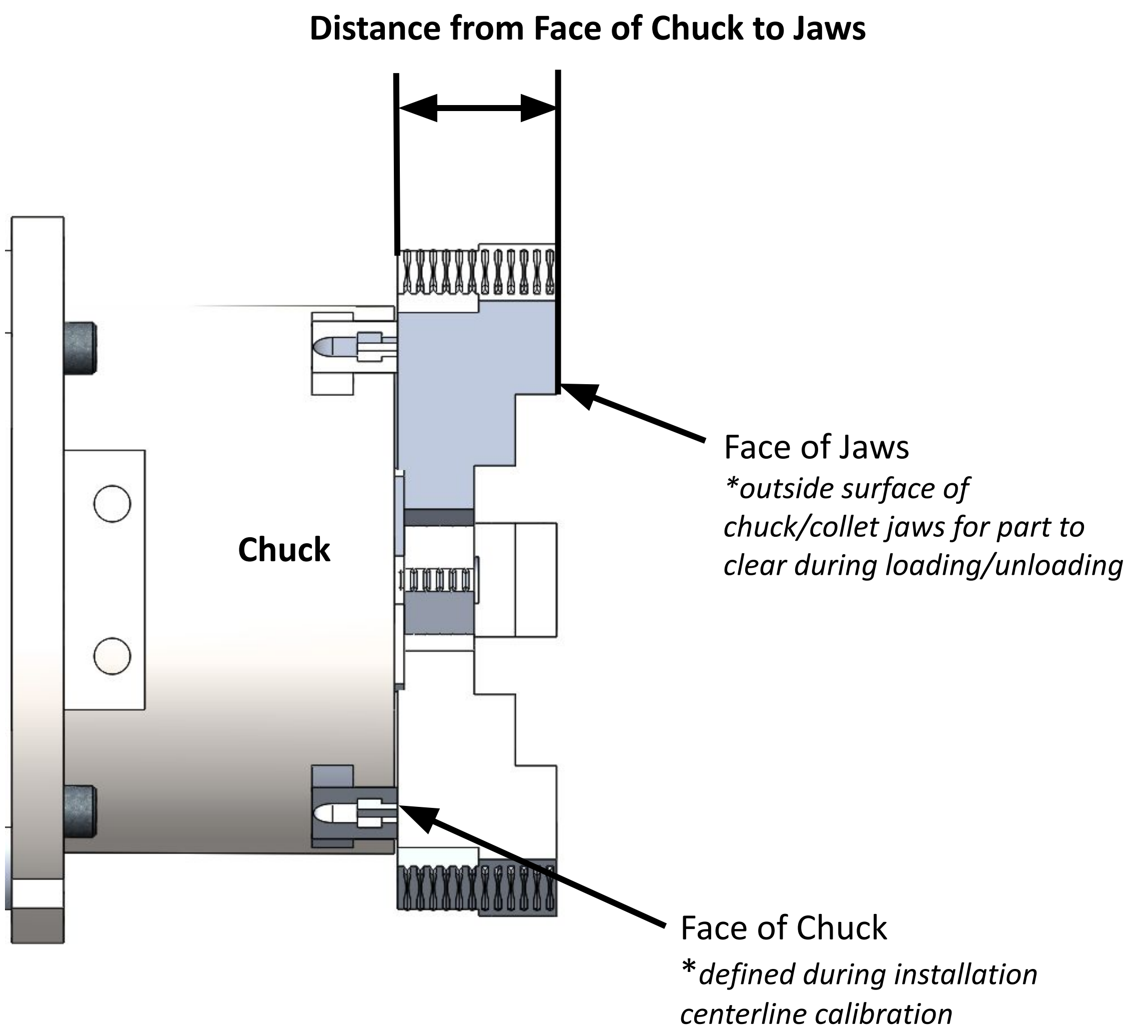
Chuck Measurements

Distance from Face of Chuck to Jaws
Measure the distance from the Face of the Chuck to the Face of the Jaws.

The part configuration requires this dimensions for the **Load Chuck Options** and the **Unload Chuck Options** sections to account for differences between jaws on a main spindle and a sub-spindle. If there is no sub spindle, the same dimension will be entered for the **Load Chuck Options** and the **Unload Chuck Options** sections of the part configuration.

Face of Chuck is a z-datum feature that can be used to measure jaw and part position.

The Face of Chuck should be consistent across setups (jaw change, collet change) to prevent the need for recalibration or re-setup on a per part basis

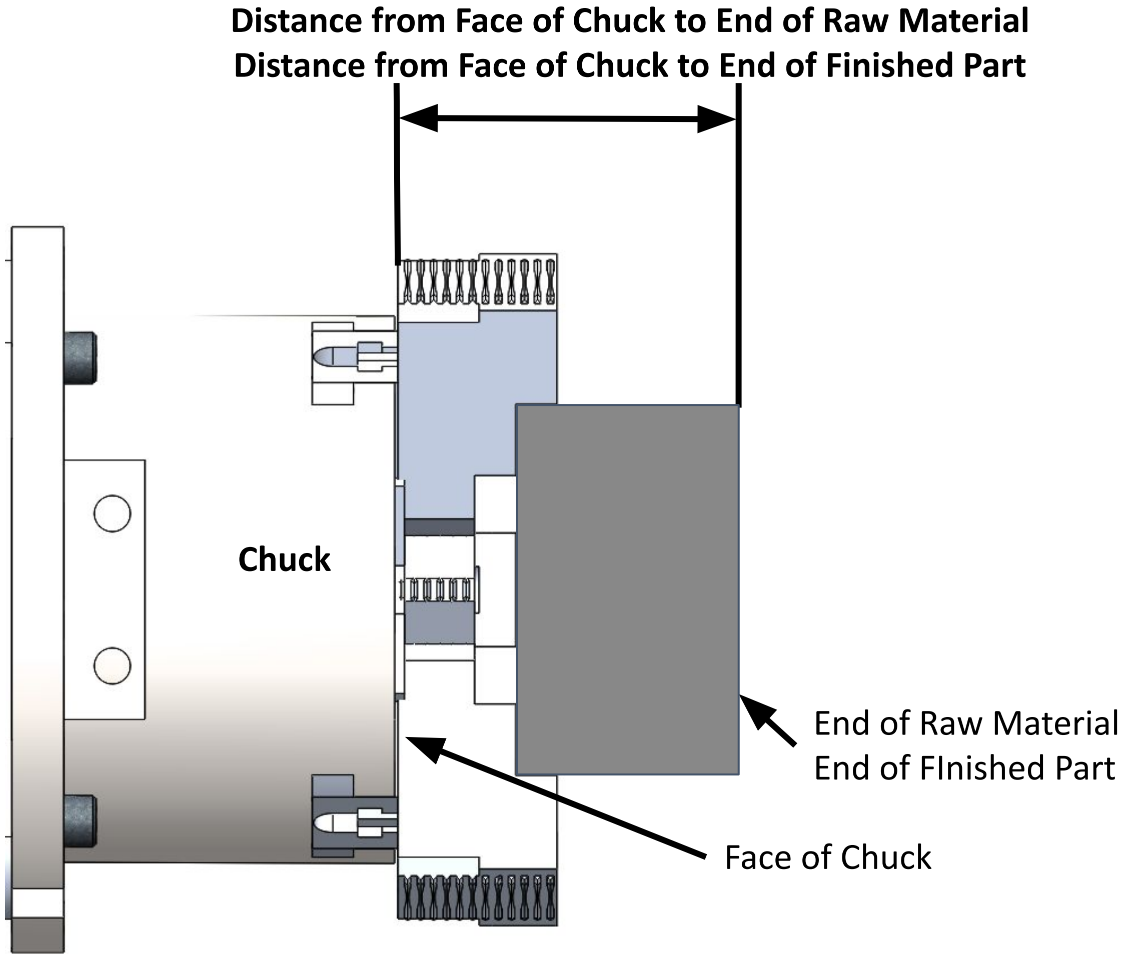


Chuck Measurements

Distance from Face of Chuck to End of Raw Material
Load a piece of raw material into the chuck, make sure it is seated on the Z locating surface of the chuck jaws. If there is no Z surface, position the Raw Material to the desired depth in the chuck. Clamp the chuck.

Measure the distance from the Face of the Chuck (determined during calibration) to the end of the Raw Material. Enter this measurement inthe **Chuck Load Options** section of the part configuration form.

Distance from Face of Chuck to End of Finished Part
Machine a piece of raw material into a finished part. Measure the distance from the Face of the Chuck (determined during calibration) to the end of the Finished Part. Enter this measurement inthe **Chuck Unload Options** section of the part configuration form.



Part Configuration: Puck

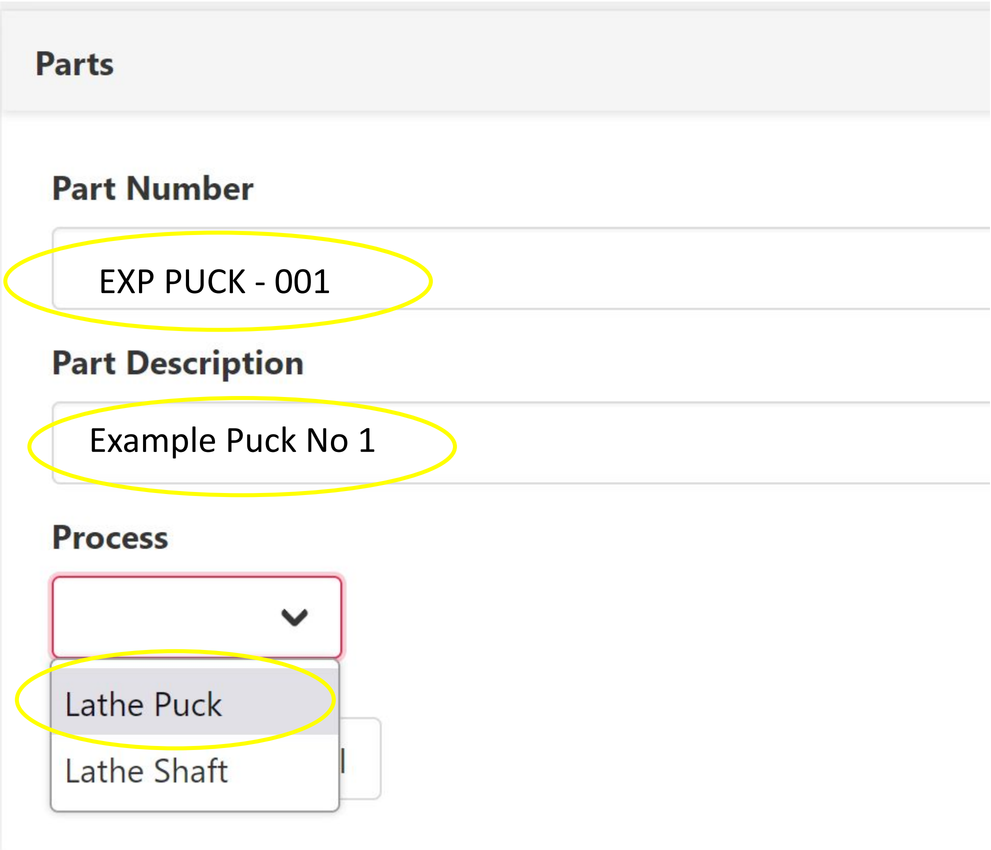
On VSC Interface, go to the "Configuration" page

VSC interface default page is "Home"

1. Click on pulldown menu in the upper left corner of the screen and select Configuration
2. On the configuration page, click on the + symbol in the upper right of the screen to add a part

Part Information

1. Part Number - Enter identifiable internal part number
2. Part Description - Enter a description of the part
3. Select Process
   - Lathe Puck
4. Enter part and process specific data described on the following pages



Puck Configuration Form

Process Options

☐ Override COG

☐ Bin Drop

☐ Transfer in CNC

CNC Turning Program

0

Raw Material Definition

☑ OD Clamp on Raw Material Pick

☑ Find Part on Pick

☑ Settle Part after Pick

Raw Material Diameter (Inches)	**Raw Material Height** (Inches)	**Raw Material Weight** (Pounds)
0	0	0

Finished Part Definition

☑ OD Clamp on Finished Part Place

☑ Find Part on Place

Finished Part Height (Inches)	**Finished Part Weight** (Pounds)
0	0

Puck Configuration Form (continued)

Chuck Load Options

- [x] OD Clamp on Load Chuck
- [x] Find Chuck on Load
- [x] Apply Force During Chuck Clamp

Load Chuck Number

1

Distance from Face of Chuck to Face of Jaws (Inches)

0

Distance from Face of Chuck to End of Raw Material (Inches)

0

Chuck Jaw Z Clearance Distance (Inches)

1

Offset from Calibrated Chuck Position (Inches)

0

Load Tuning Adjustment (X,Y,Z,rX,rY,rZ)

0,0,0,0,0,0

Distance from Load Position to Apply Force (Inches)

0.5

Applied Force (Newtons)

10

Time to Apply Force (seconds)

3

Max Load Position Error using Apply Force (Inches)

0.05

Puck Configuration Form (continued)

Chuck Unload Options

- [x] OD Clamp on Unload Chuck
- [x] Find Chuck on Unload
- [ ] Wash Chuck after Unload
- [x] Dump Coolant on Unload

Unload Chuck Number

1

Dump Coolant Drip Time

1

Op 1 Wash Program Number

8001

Distance from Face of Chuck to Face of Jaws (Inches)

0

Distance from Face of Chuck to End of Finished Part (Inches)

0

Offset from Calibrated Chuck Position (Inches)

0

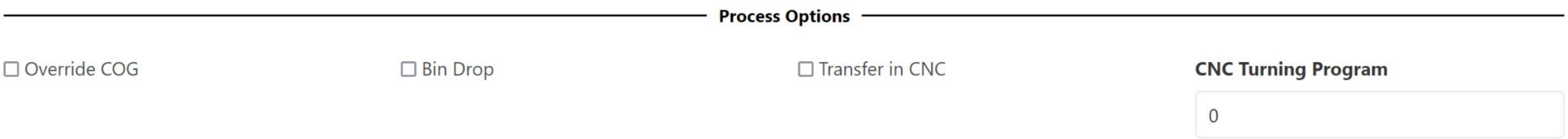
VersaBlast and VersaWash Options

- [ ] VersaBlast Before Unload
- [ ] VersaBlast After Unload
- [ ] VersaWash Before Place

End Part Configuration

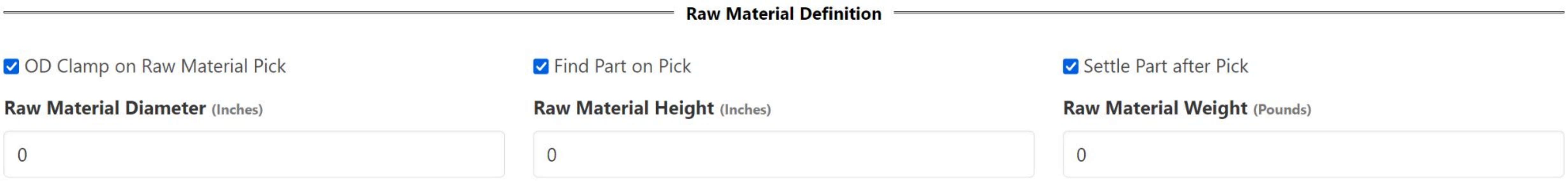
Save Cancel

Puck Configuration Parameters - Process Options



- **Override COG (Center of Gravity)**
  - By default, the center of gravity (COG) for each part is calculated assuming a uniform distribution of mass along the length of the part, at the different states of operation. If needed, the COG definition for each process step can be entered manually.
  - COG definition can be calculated via UR Robot process (see UR manual) or via CAD
  - COG is needed for Part in Gripper 1 only, Part in Gripper 2 only, and Part in both Grippers
- **Bin Drop**
  - When selected, the system will drop the part in the calibrated Bin Drop location instead of placing the part back on the VersaCart table
  - Bin Drop location is pre-calibrated, but can be repositioned in the Calibration process, shown in the Installation Manual
- **Transfer in CNC**
  - If equipped with a sub-spindle, the LAS will move directly from the main spindle to the sub-spindle, without exiting to the CNC Home position during load/unload process
- **CNC Turning Program**
  - The CNC Program to machine the part during the automation process

Puck Configuration Parameters - Raw Material Definition



- **OD Clamp on Raw Material Pick**
  - If selected, the Gripper will OD clamp on raw material pick from cart, otherwise the Gripper will ID clamp

- **Find Part on Pick**
  - If selected, the Robot will move towards VersaCart table until the puck fingers touch the part
  - If not selected, the gripper will attempt to pick the Raw Material based on the Raw Material Height entered

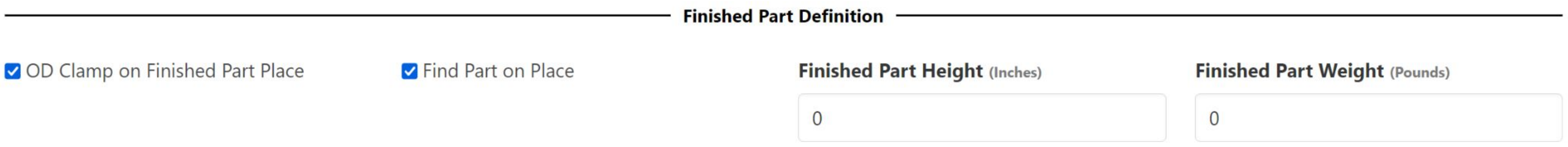
- **Settle Part after Pick**
  - If selected, the robot will flip the gripper after picking the part, so part is facing up, then open and close the gripper to settle the part in the gripper.

- **Raw Material Diameter**
  - Diameter of the raw material before processing

- **Raw Material Height**
  - Height of the raw material before processing

- **Raw Material Weight**
  - Weight of the raw material before processing

Puck Configuration Parameters - Finished Part Definition



- **OD Clamp on Finished Part Place**
  - If selected, the Gripper will OD clamp when unloading the part from the chuck and when placing the part on the cart
  - If unselected, the Gripper place with ID clamp logic
- **Find Part on Place**
  - If selected, the Robot, holding a part in the gripper, will move towards VersaCart table until the part in the puck fingers touch the table,hen the gripper will release the part
  - If not selected, the gripper will attempt to place the Finished Part based on the entered Finished Part Height

- **Finished Part Height**
  - Height of the finished part

- **Finished Part Weight**
  - Weight of the finished part

Puck Configuration Parameters - Chuck Load Options

OD Clamp on Load Chuck

When selected, the part is OD clamped in the chuck, otherwise part is ID clamped in the chuck

Find Chuck on Load/Unload

When selected, robot will use its force sensor to determine when the Z surface of the chuck is reached

Apply Force During Chuck Clamp

Use the robot's force sensor to apply a force during chuck clamp. If the Load Position (Distance from Face of Chuck to End of Raw Material) is not found, the system will retry up to 5 times and uses circular motion to find the load position

Load Chuck Number

To load main spindle, enter 1; to load sub-spindle, enter 2

Distance from Face of Chuck to Face of Jaws

See previous pages for picture and description

Distance from Face of Chuck to End of Raw Material

See previous pages for picture and description

Chuck Jaw Z Clearance Distance

Distance from end of Raw Material to Face of Jaws during approach

Offset from Calibrated Chuck Position

Offset from the calibrated position of the chuck in Z. Useful for sub-spindles that need to be positioned differently than the calibration position during load

Distance from Load Position to Apply Force

If attempting to get in a collet with limited clearance, increase this distance so the robot begins to apply force outside of the collet, otherwise set to 0

Applied Force

Force in newtons to apply (approximately 4.5 Newtons to a pound)

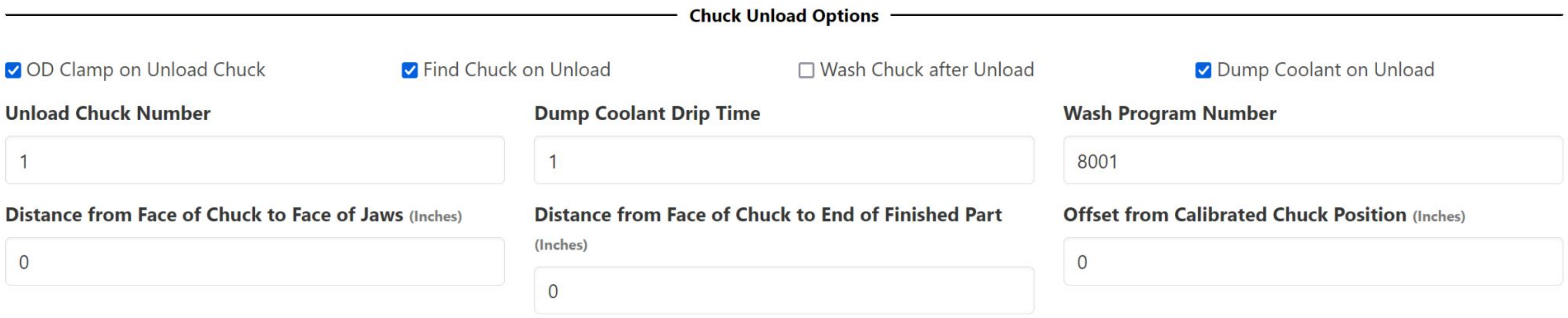
Time to Apply Force

Amount of time to Apply Force before clamping the chuck. While the chuck is being clamped, force will also be applied

Max Load Position Error using Apply Force

After applying force, the system will check to see if it reached the load position, this field sets the threshold for max position error

Puck Configuration Parameters - Chuck Unload Options



OD Clamp on Unload Chuck

When selected, the part is OD clamped in the chuck, otherwise part is ID clamped in the chuck

Find Chuck on Unload

When selected, robot will use its force sensor to determine when the Z surface of the chuck is reached

Wash Chuck After Unload

If selected, will run the CNC program in the **Wash Program** field after unloading parts to clear chips from the chuck

Dump Coolant on Unload

If selected, gripper will rotate down to dump coolant trapped in the part and allow it to drip dry

Unload Chuck Number

To unload from main spindle, enter 1; to unload from sub-spindle, enter 2

Dump Coolant Drip Time

Time spent in CNC allowing coolant to drip off part during Dump Coolant

Distance from Face of Chuck to Face of Jaws

See previous section for picture and description

Distance from Face of Chuck to End of Finished Part

See previous section for picture and description

Offset from Calibrated Chuck Position

Offset from the calibrated position of the chuck in Z. Useful for sub-spindles that need to be positioned differently than the calibration position during unload

Puck Configuration Parameters - Chuck Unload Options

VersaBlast and VersaWash Options

☐ VersaBlast Before Unload ☐ VersaBlast After Unload ☐ VersaWash Before Place

- **Override COG (Center of Gravity)**
  - By default, the center of gravity (COG) for each part is calculated assuming a uniform distribution of mass along the length of the part, at the different states of operation. If needed, the COG definition for each process step can be entered manually.
  - COG definition can be calculated via UR Robot process (see UR manual) or via CAD
  - COG is needed for Part in Gripper 1 only, Part in Gripper 2 only, and Part in both Grippers
- **Bin Drop**
  - When selected, the system will drop the part in the calibrated Bin Drop location instead of placing the part back on the VersaCart table
  - Bin Drop location is pre-calibrated, but can be repositioned in the Calibration process, shown in the Installation Manual
- **Transfer in CNC**
  - If equipped with a sub-spindle, the LAS will move directly from the main spindle to the sub-spindle, without exiting to the CNC Home position during load/unload process
- **CNC Turning Program**
  - The CNC Program to machine the part during the automation process

Puck Configuration Worksheet

Part Name:	
CNC Program:	
Chuck Load (chuck 1 or 2)	
Chuck Unload (chuck 1 or 2)	

Dimension	**Measured Value**
Raw Material Diameter	
Raw Material Height	
Raw Material Weight	
Finished Part Height	
Finished Part Weight	

Dimension	**Measured Value**
Face of Chuck 1 to End of Raw Material	
Face of Chuck 1 to End of Finished Part	
Face of Chuck 1 to Face of Jaws	
Face of Chuck 2 to End of Raw Material	
Face of Chuck 2 to End of Finished Part	
Face of Chuck 2 to Face of Jaws	

Chuck 2 measurements are used for CNC's with a sub-spindle

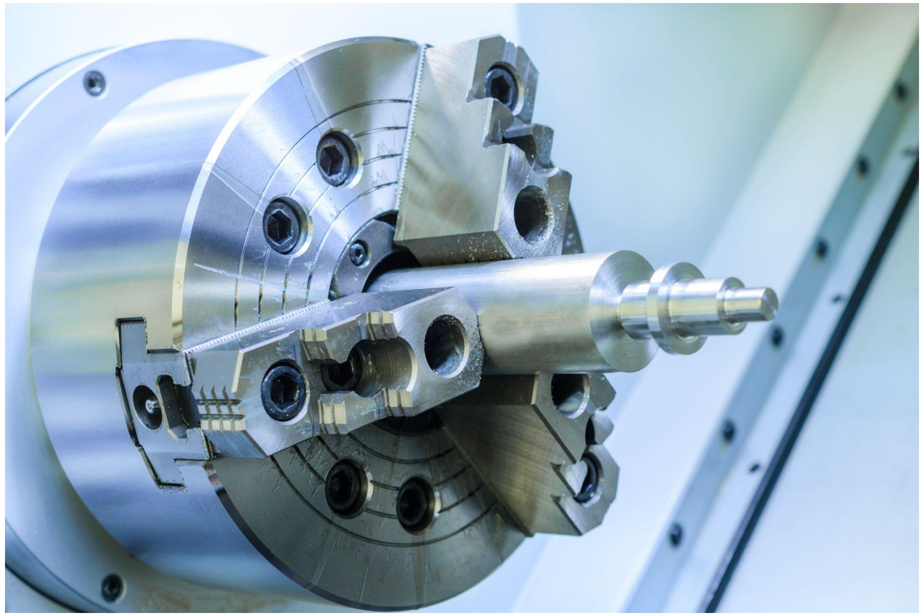
Options	**Option (yes/no)**
Bin Drop *calibrate Bin drop position	
Transfer in CNC **option with sub-spindle Lathes*	
Find Part on Pick	
Settle Part after Pick	
OD Clamp on Chuck Unload **if unselected, the part will be unloaded via ID hold*	
Find Chuck on Load	
Apply Force During Chuck Clamp	
Find Chuck on Unload	
Dump Coolant on Unload	
Wash Chuck on Unload **calls 8001 program, unless otherwise specified*	
VersaBlast Before Unload *optional equipment	
VersaBlast After Unload *optional equipment	
VersaWash Before Place *optional equipment	

Part Configuration: Shaft

Section 6

Prove Out The CNC Process First

- Prior to automating a new part, prove out the CNC process using hand-loading
- Validate that after the part is removed from the CNC, that no chips will interfere with the next part loaded into the chuck
    - If chips are present that would interfere with the next load, add or improve the wash motion at the end of the cycle
    - If the wash program can't remove all of the chips, develop a separate wash program to wash the chuck after the part is removed; verify the program adequately removes all the chips from the critical chuck surfaces
    - The separate program will be used in for the "Wash Chuck after Unload" option in the part configuration
    - If an air nozzle blast of compressed air is required to free the chips, use the VersaBlast option in the configuration *(if the Lathe Automation System is equipped with the optional VersaBlast components)*



Shaft Process Overview

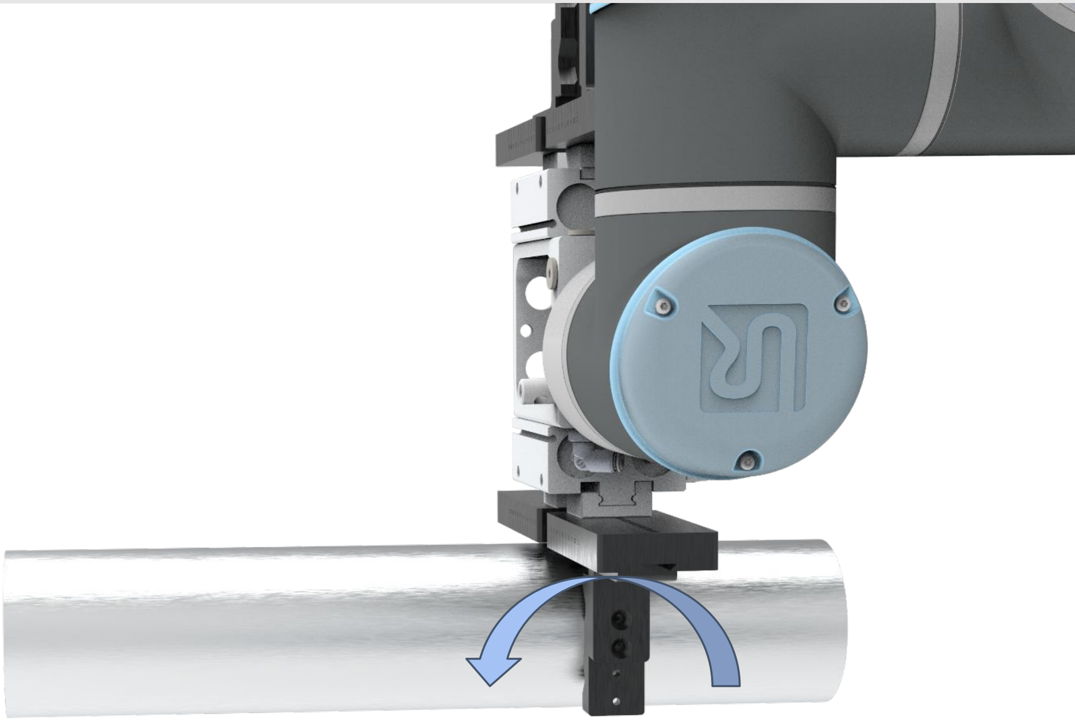
The shaft process is designed to maximize efficiency by using the Duo Grip Gripper to minimize the time spent exchanging parts. The process works as follows:

1. Robot picks part from infeed using Gripper 1
2. Robot loads part into chuck
3. Robot closes CNC door and begins CNC turning cycle
4. Robot moves back to infeed and picks the next part with Gripper 1
5. When CNC turning cycle completes, the robot unloads the completed part with Gripper 2 and loads the new part with Gripper 1
6. Robot closes the CNC door and begins CNC turning cycle
7. Robot places the completed part in the infeed with Gripper 2
8. Robot picks the next part from the infeed using Gripper 1
9. System goes back to step 5 and repeats until all parts are complete

Shaft Part Configuration - Pick Positions

Picking on the Center of the Part

Using the standard gripper fingers, designed for a range of sizes, VersaBuilt recommends picking the shaft near the center of the part; especially for parts weighing more than 1 pound and/or parts longer than 6”. A part that is off center places a rational load on the gripper fingers. If the part is heavy enough and off-center enough, the load could cause the part to droop, and cause premature wear on the gripper fingers. Optionally the use of a custom gripper fingers with a diameter matching that of the part, can handle significantly more offset load. Contact VersaBuilt for the details of your application.



Why Pick Off-Center?

Off-center picking in the infeed may be necessary if the shaft needs to be pushed deep into the chuck during load. Off-center picking of the shaft during chuck unload may be necessary if the part is buried deep in the chuck.

Shaft Infeed - Part Layout

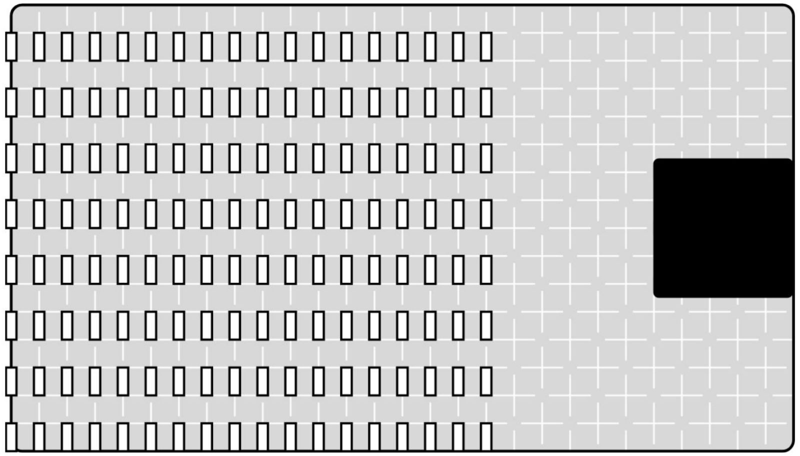
Although pattern shown on the VSC display is the recommended alignment in the infeed, it is not required to precisely align the parts as shown by the VSC. In fact, for some shaft shapes and sizes, the infeed layout allocated by the VSC will not work.

Because the pick and place locations are calibrated, the robot will move through the infeed by the spacing shown on the infeed but starting at the calibrated pick and place locations.

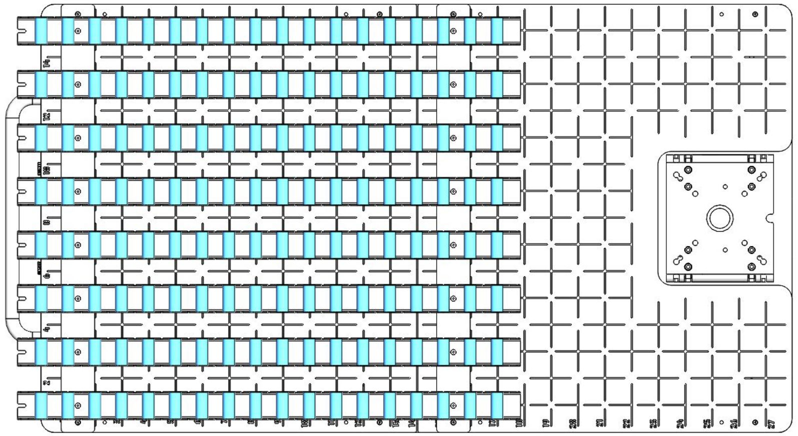
If it is not convenient to align the parts in the infeed as shown on the VSC, align the first part in the infeed near the allocated position, but aligned as required by the shaft geometry or to make it easy for the operator to align the parts in the infeed. The remaining parts will need to be spaced the same distance apart as shown on the screen.

In the example shown, a 2” long part is aligned by the VSC starting at the left edge of the table but the machinist chose to align the part so that it is centered over the channel, the remaining parts spaced the same distance apart, 4” from the left edge of one part to another part.

Note: be sure to document exactly where the parts must be aligned in the infeed in the setup sheet for the operator



VSC Shaft Allocation



Actual Shaft Allocation

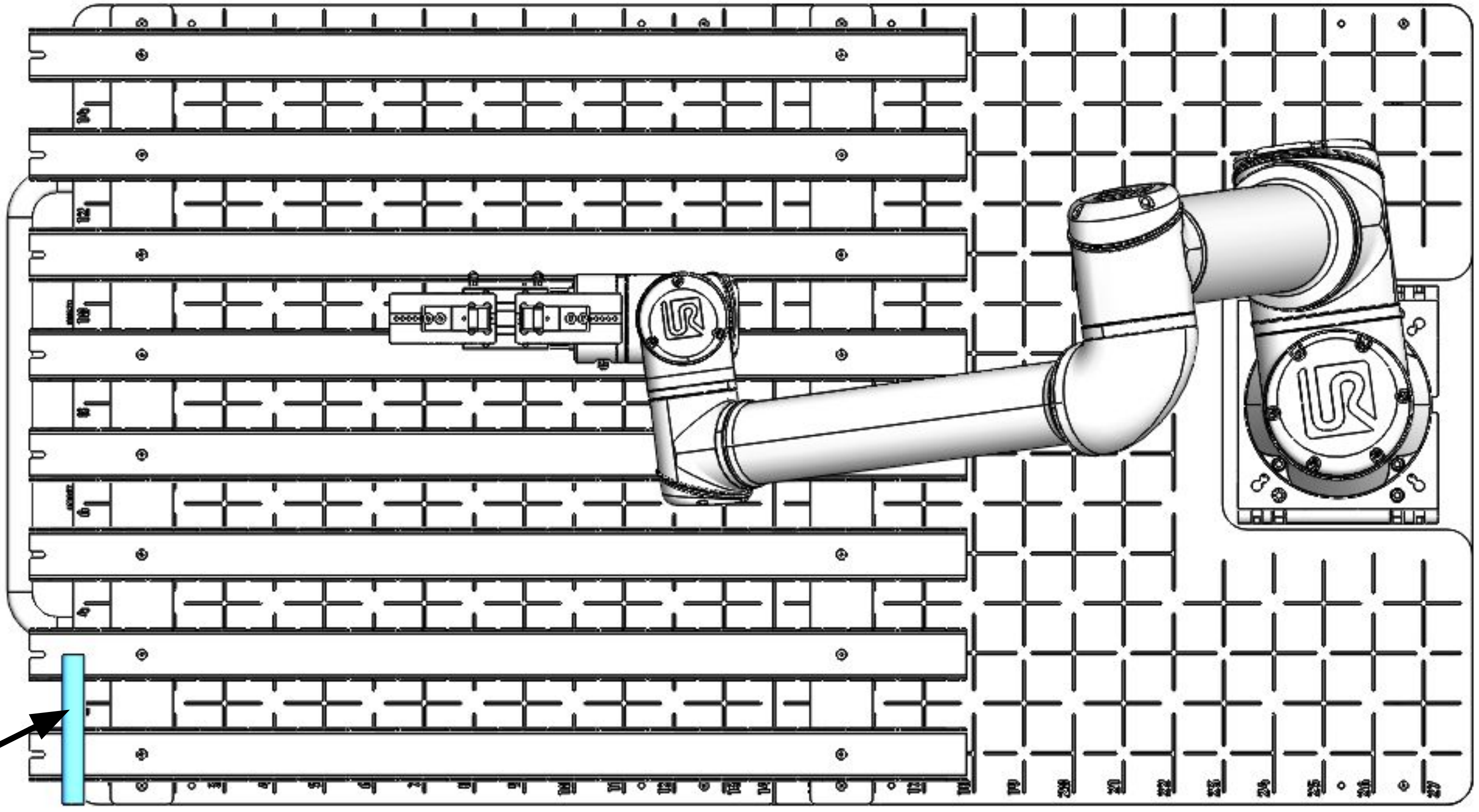
Shaft Infeed - Part Layout

Configuring Shafts requires two positions to be calibrated

1. Pick from Infeed
2. Place to Outfeed

Start process by loading raw material in “Slot 1” of the Shaft Infeed (slot shown in the image to the right).

This position selected should support the part, allow the robot to grip the part in a position that allows the part to be pushed into the chuck, and should be a repeatable position for an operator to locate the part in the infeed.



Slot 1

This side of the part will be loaded into the Chuck

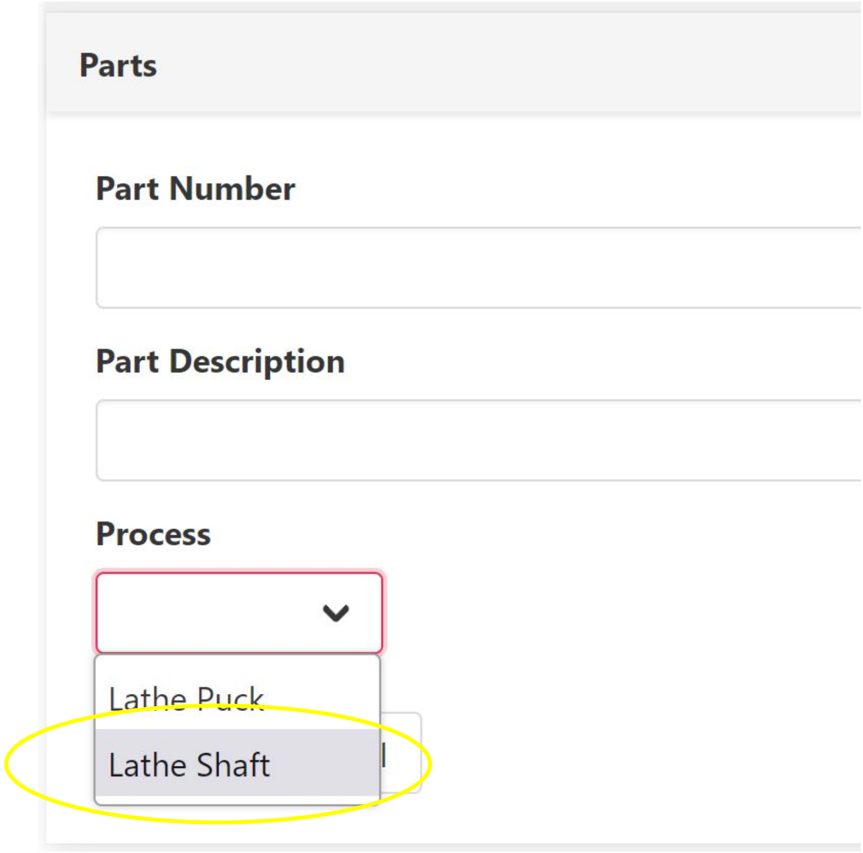
Part Configuration - Shaft

To Configure a Part, go to the VSC "Configuration" page

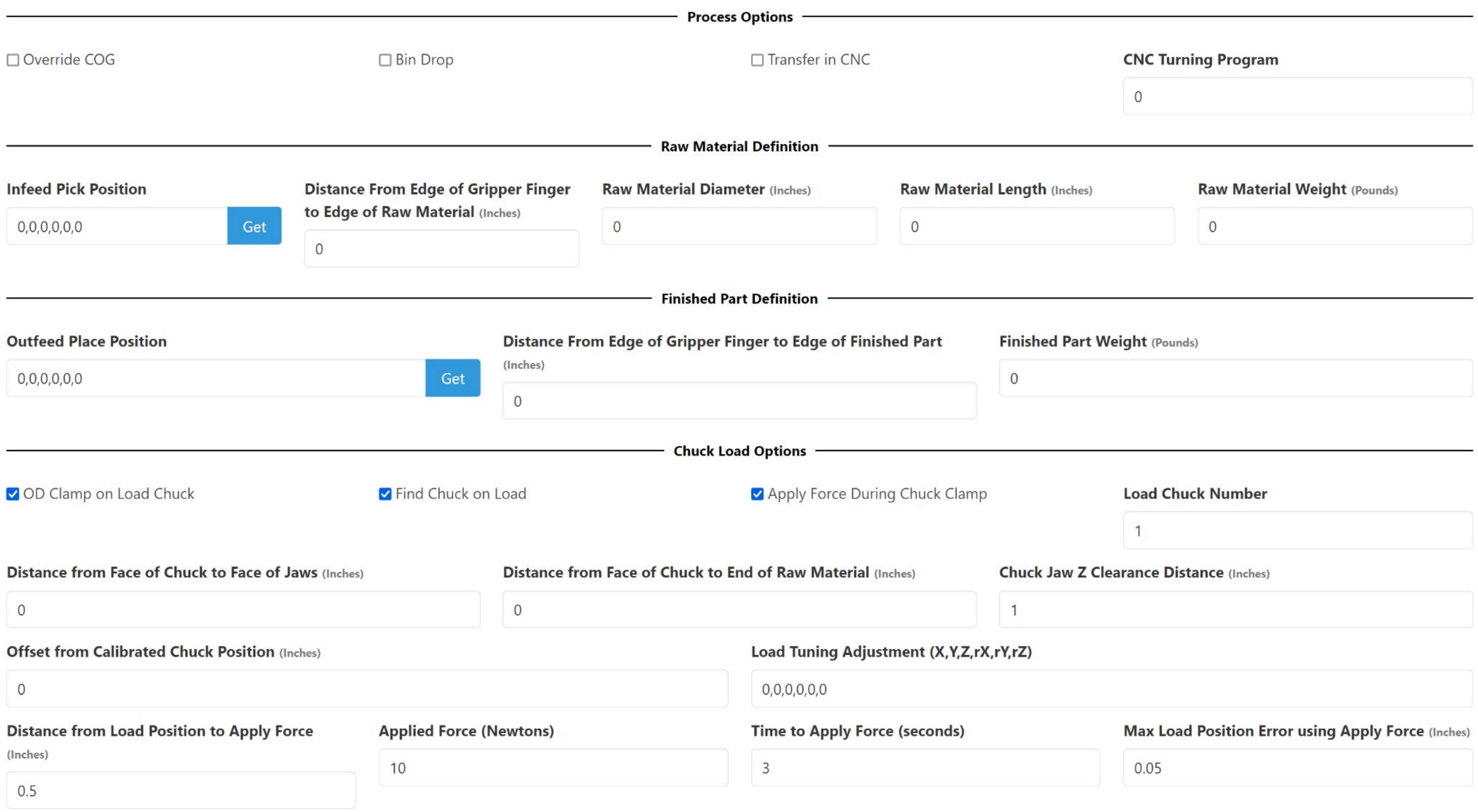
- VSC default page is "Home"
- Click on pulldown menu in the upper left corner of the screen and select Configuration
- On the configuration page, click on the + symbol in the upper right of the screen to add a part

Part Information

- Part Number - Enter identifiable internal part number
- Part Description - Enter a description of the part
- Select Process
  - Lathe Shaft
- Enter part and process specific data described on the following pages



Part Configuration - Shaft



Part Configuration - Shaft (cont'd)

Chuck Unload Options

- [x] OD Clamp on Unload Chuck
- [x] Find Chuck on Unload
- [ ] Wash Chuck after Unload

Unload Chuck Number

1

Wash Program Number

8001

Distance from Face of Chuck to Face of Jaws (Inches)

0

Distance from Face of Chuck to End of Finished Part (Inches)

0

Offset from Calibrated Chuck Position (Inches)

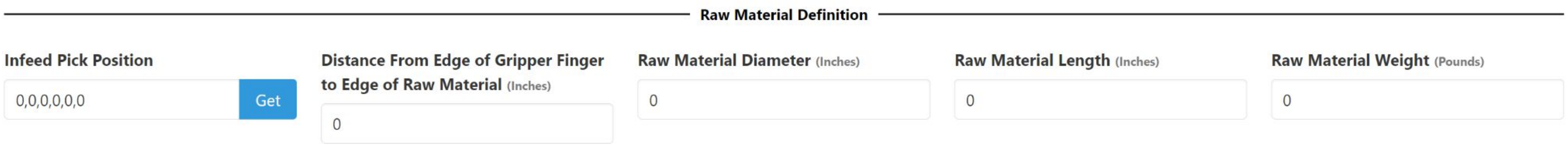
0

VersaBlast and VersaWash Options

- [ ] VersaBlast Before Unload
- [ ] VersaBlast After Unload
- [ ] VersaWash Before Place

End Part Configuration

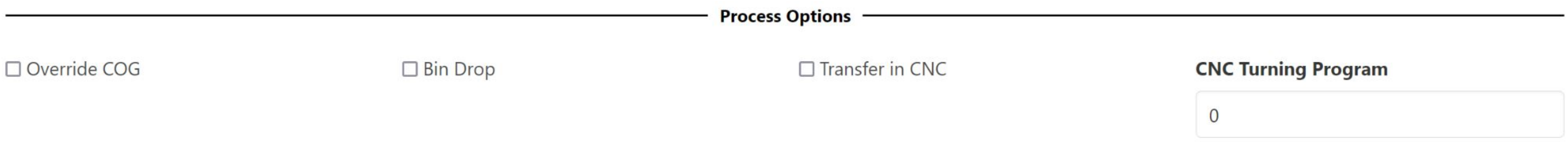
Shaft Configuration Parameters - Raw Material Definition



- **Infeed Pick Position**
  - Load a piece of raw material into the first slot as described in the Shaft Infeed - Part Layout in this section of the manual. Use the Recovery panel at the top of the configuration page to Float the gripper and Freedrive the robot. Drag the robot over the part and use the Recovery panel to clamp the gripper on the part. Making any fine adjustments to the pick position then ***end Freedrive mode by pressing the Continue button on the UR Teach Pendant*** and then press the Get button to record the calibrated position.
- **Distance From Edge of Gripper Finger to Edge of Raw Material**
  - While the robot is still in the calibrated Infeed Pick Position
- **Find Part on Pick**
  - If selected, the Robot will move towards VersaCart table until the puck fingers touch the part
  - If not selected, the gripper will attempt to pick the Raw Material based on the Raw Material Height entered

- **Settle Part after Pick**
  - If selected, the robot will flip the gripper after picking the part, so part is facing up, then open and close the gripper to settle the part in the gripper.

Shaft Configuration Parameters - Process Options



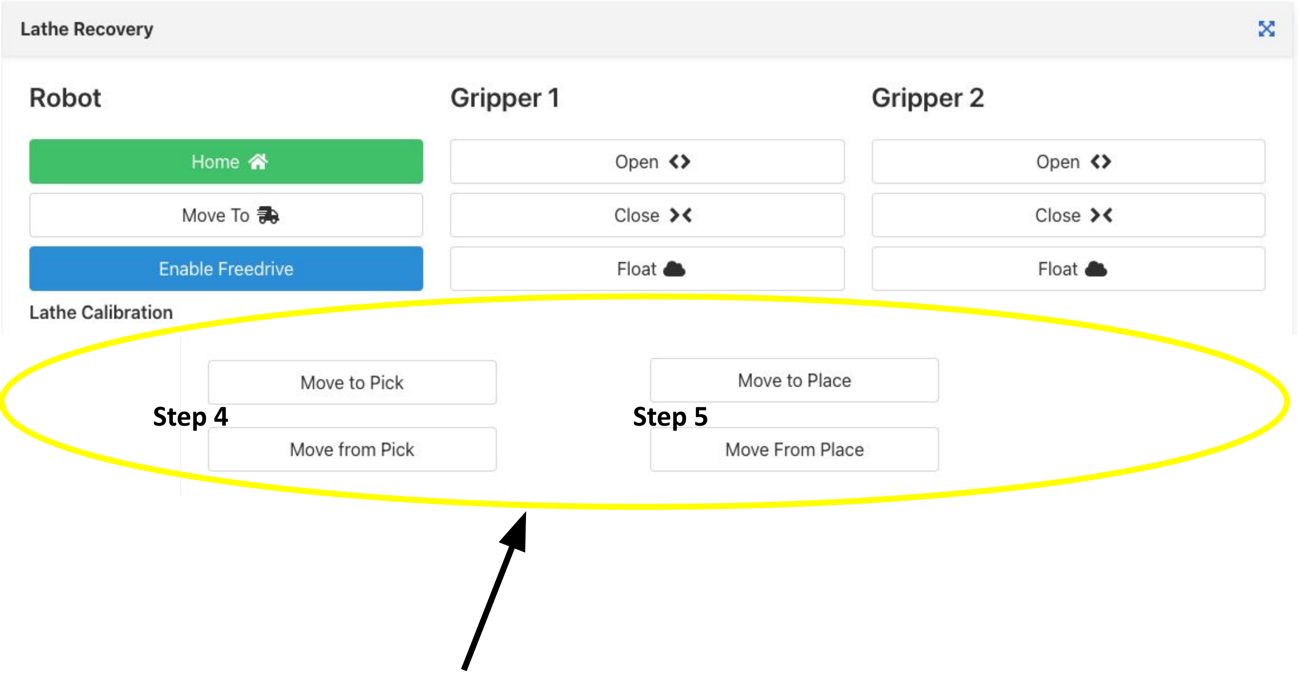
- **Override COG (Center of Gravity)**
  - By default, the center of gravity (COG) for each part is calculated assuming a uniform distribution of mass along the length of the part, at the different states of operation. If needed, the COG definition for each process step can be entered manually.
  - COG definition can be calculated via UR Robot process (see UR manual) or via CAD
  - COG is needed for Part in Gripper 1 only, Part in Gripper 2 only, and Part in both Grippers
- **Bin Drop**
  - When selected, the system will drop the part in the calibrated Bin Drop location instead of placing the part back on the VersaCart table
  - Bin Drop location is pre-calibrated, but can be repositioned in the Calibration process, shown in the Installation Manual
- **Transfer in CNC**
  - If equipped with a sub-spindle, the LAS will move directly from the main spindle to the sub-spindle, without exiting to the CNC Home position during load/unload process (note: there must be room in the CNC for the gripper to flip over between the main spindle and sub-spindle)
- **CNC Turning Program**
  - The CNC Program to machine the part during the automation process

Shaft Configuration Overview

At the top of the Configuration page, a Lathe Recovery panel is provided to help move the robot through the following calibration steps:

- Select "**Move to …**" button to move the robot to a starting position near each calibration location. When the robot gets to the calibration position, *it will be in Freedrive mode.*
- Drag the robot to the calibration position, clamp the gripper on the part, make final adjustments, **then press the Continue button on the robot teach pendant**.
- Select the "Get" button on the VSC part configuration page corresponding to the calibration location in the part configuration to save the position. Make sure the value in the field changes; if it doesn not, make sure the Continue button on the robot teach pendant was pressed.
- Press the corresponding "Move from…", the robot will release the part and move back to the nearest home location

Note: When using the "Move to …" buttons, the gripper should be empty and the part to be calibrated to should be in the desired position in the infeed or the chuck.

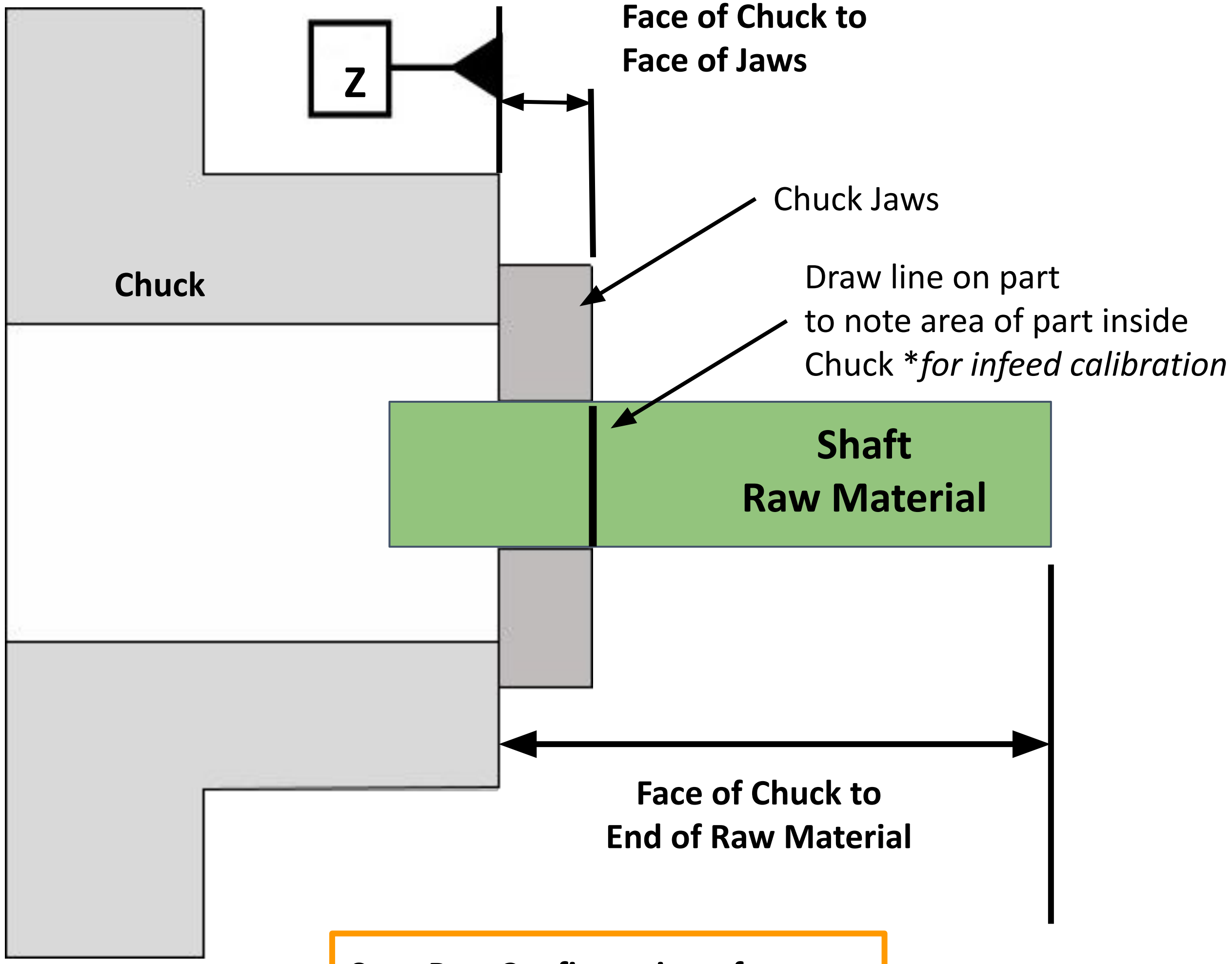


"Move to" buttons aiding the Shaft Calibration steps for each Shaft configuration

Shaft Part Configuration - Chuck Load Dimensions

Step 1: Measure Raw Material in Chuck

1. Place Raw Material in Chuck, as intended for loading part for machining
2. Draw line on part to note dept of part in chuck (to aid pick and place gripper location)
3. Measure and note the following dimensions, shown in the image to the right (referencing Chuck Datum found in Shaft Centerline Calibration):
   a. Distance from Face of Chuck to End of Part (Load)
   b. Distance from Face of Chuck to Face of Jaws (Load)
4. Enter Values for B & C in the Part configuration for part in the "**Chuck Load Options**" section.



Save Part Configuration often

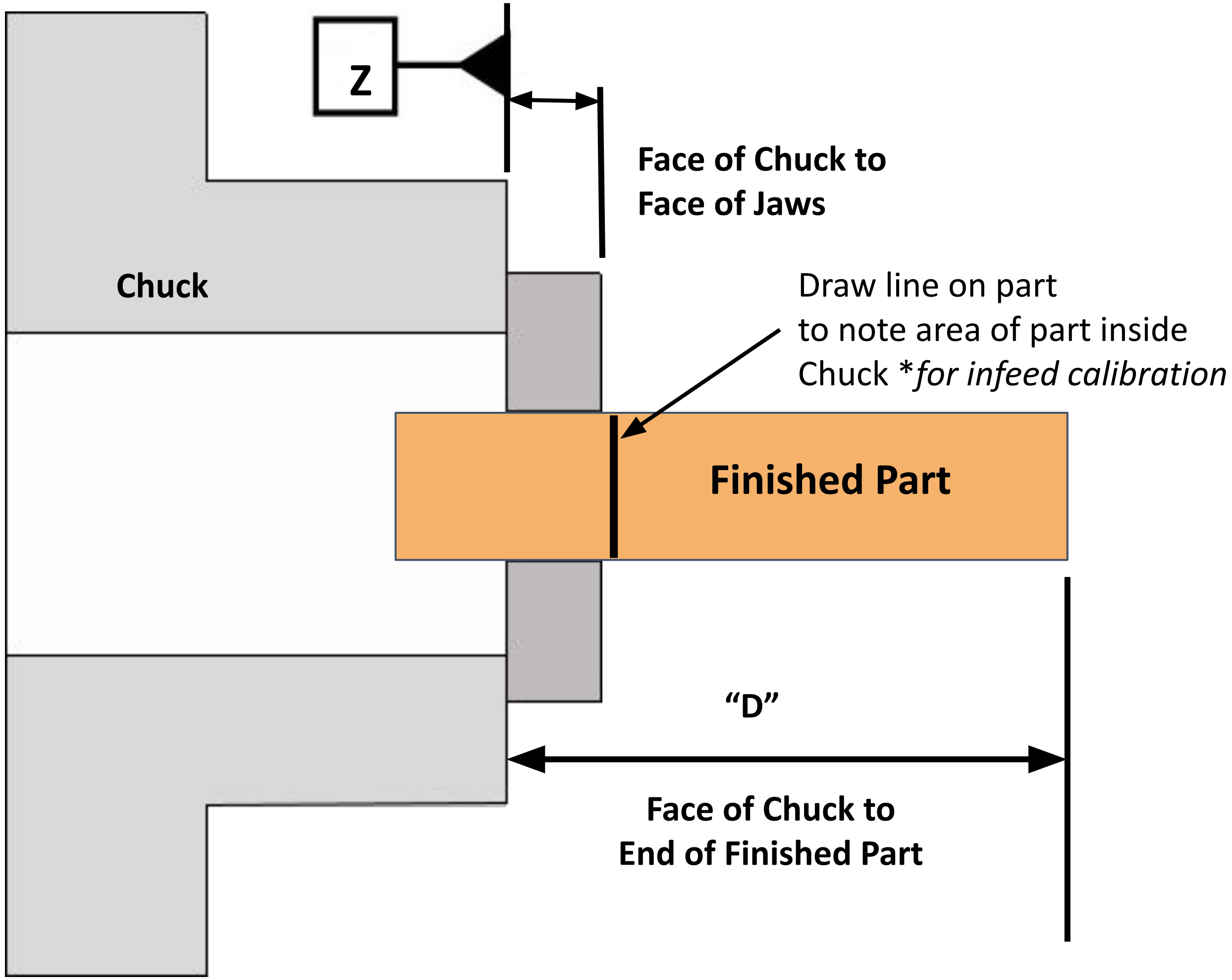
Shaft Part Configuration - Chuck Unload Dimensions

Step 2: Measure Finished Part in Chuck

1. Place Finished Part in Chuck, as it would be completed following the final operation
2. Draw line on part to note dept of part in chuck (to aid pick and place gripper location)
3. Measure and note the following dimensions, shown in the image to the right (referencing Chuck Datum defined in Shaft Centerline Calibration):
   a. Distance from Face of Chuck to End of Part
   b. Distance from Face of Chuck to Face of Jaws
4. Enter Values in the Part configuration for part in the "**Chuck Unload Options**" section
5. **Save the Part Configuration** to avoid losing changes

Distance from Face of Chuck to Face of Jaws (Inches)

Distance from Face of Chuck to End of Raw Material (Inches)



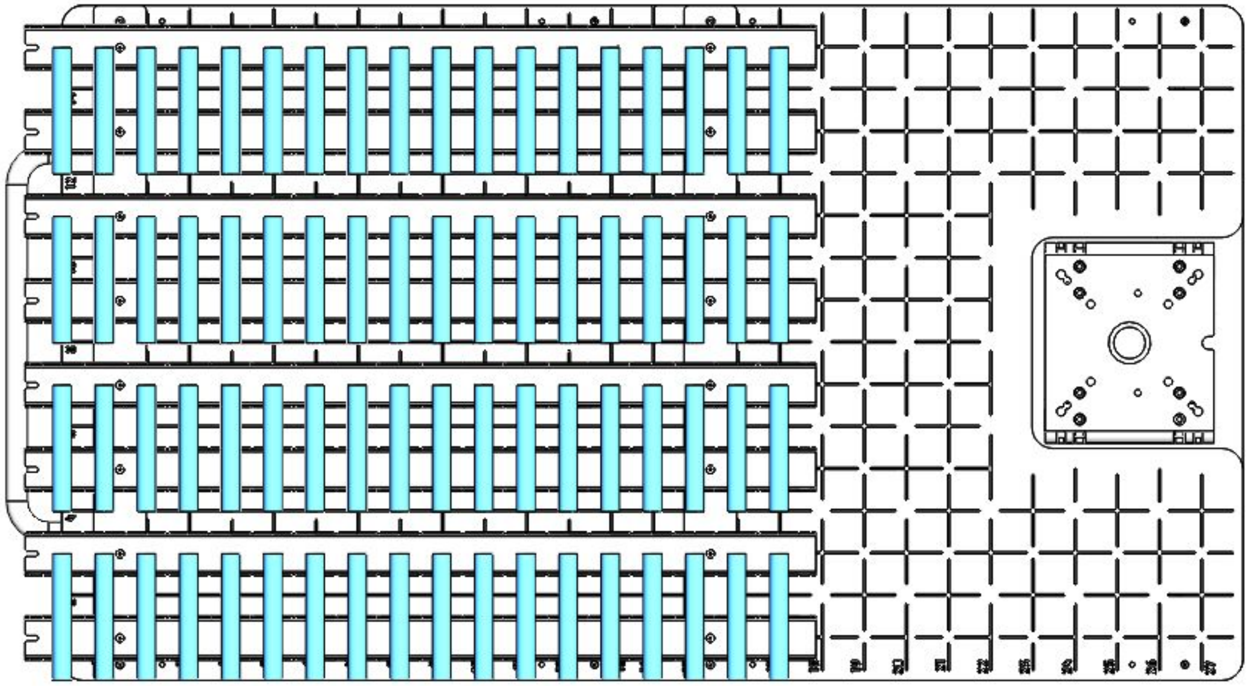
Shaft Part Configuration - Infeed Alignment

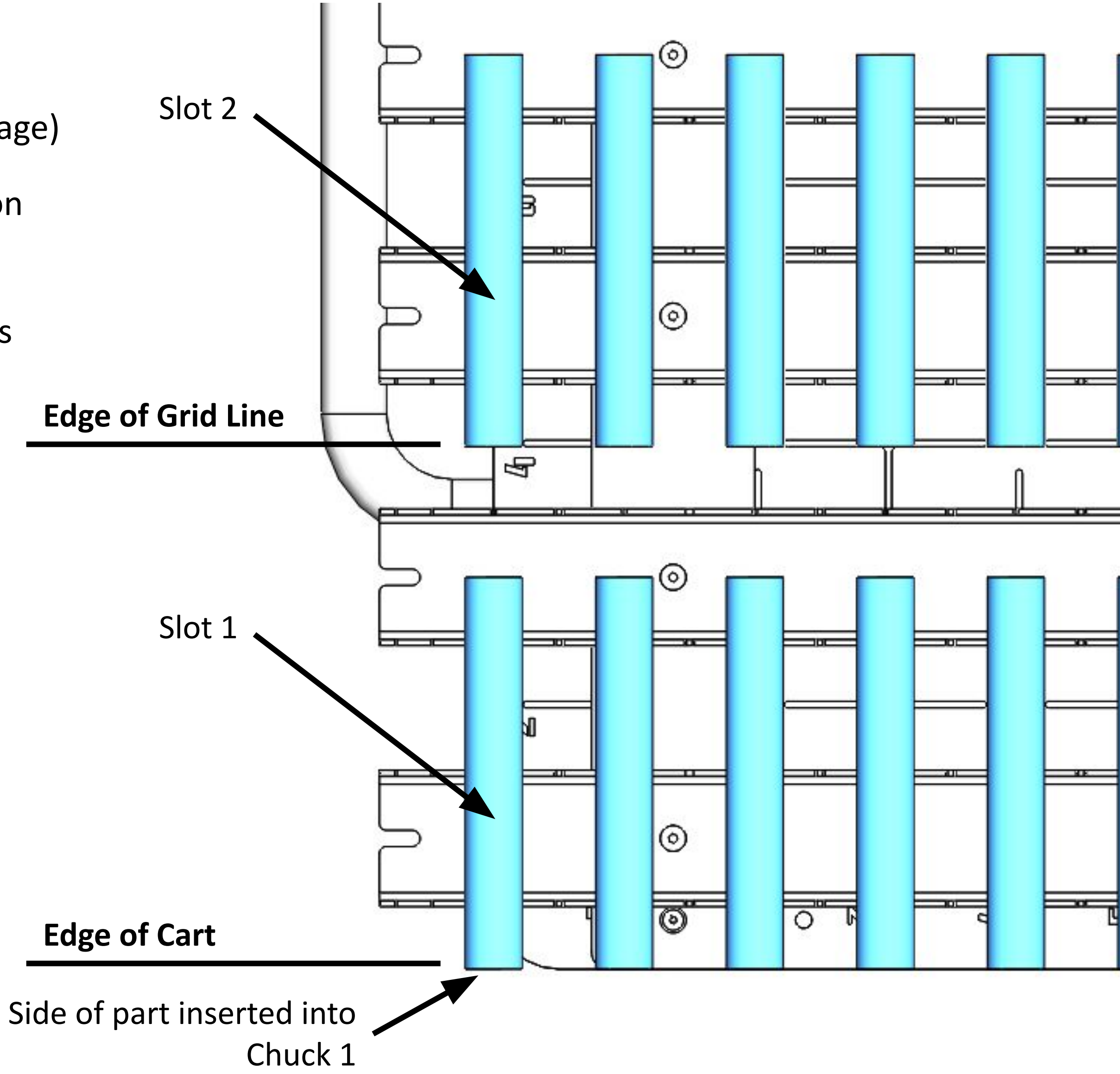
Step 3: Determine Infeed Alignment

Parts are aligned with the edge of the table or the edge of a grid line on the Visual Infeed (there are exceptions to this rule, described on the following page)

This alignment is shown when a part is configured and a quantity is loaded on the Home page of the VSC.

An example shown below and to the right, shows 6-inch long part, with parts placed in the default position.



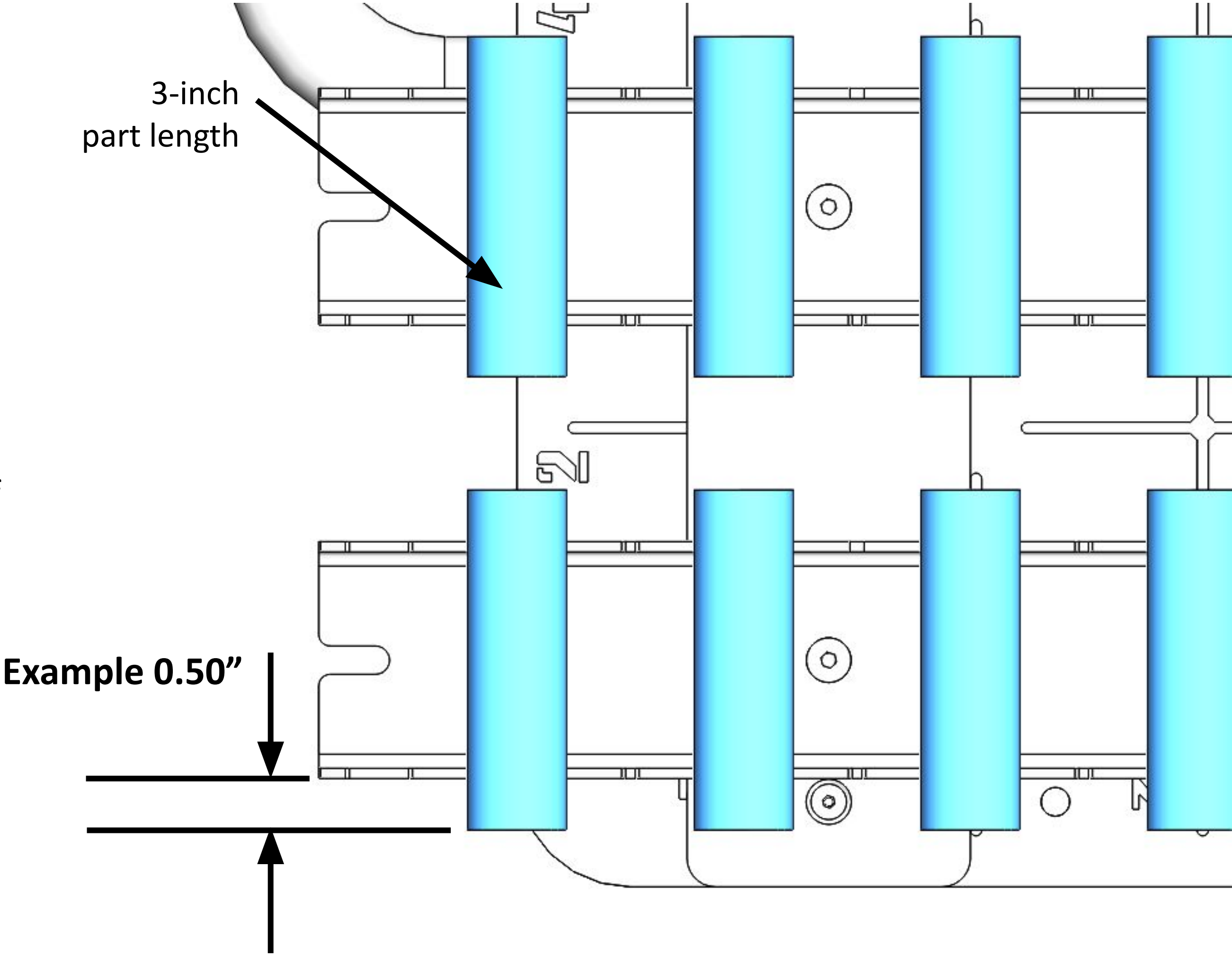


Step 4: Determine Infeed Alignment (continued)

Exceptions to the rule:

- Parts may need to be a aligned on the infeed in a non-standard way (not aligned with the cart edge or grid lines) Example situations are:
  - Part length is less than 3-inches
  - Non-uniform part (for example, Op2 part setup)
- Note the part alignment for Operator setup (e.g., setup sheet, picture).
- **An example** shown to the right is a 3-inch part, centered over the U-channel with 0.50" of the part hanging over the outside of the U-channel (inside channel width = 2.0")

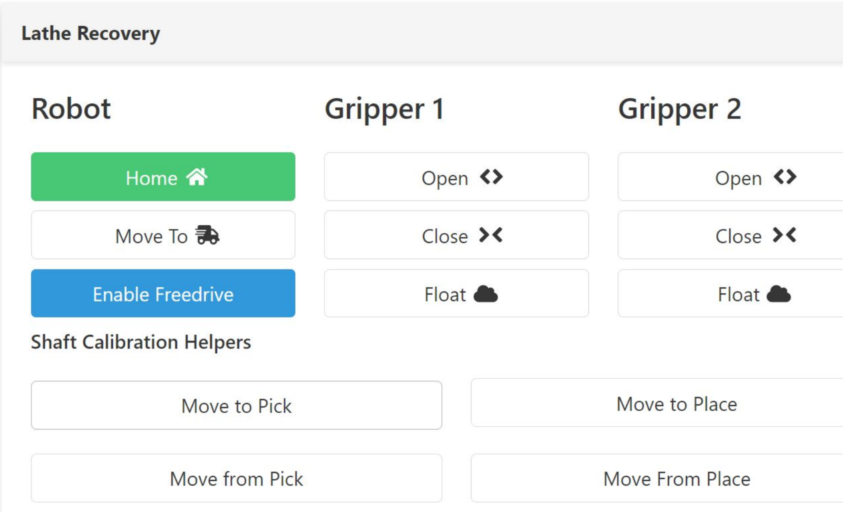
Note: The actual infeed alignment is not stored in the VSC, rather it must be documented in the part setup sheet so the operator can load the parts in the infeed as required by the configuration.



Shaft Part Configuration - Calibrate Infeed Pick

Step 5: Calibrate Infeed Pick
(Note: these steps are for loading main spindle, see next page for loading sub-spindle)

1. Place Raw Material in Shaft Infeed in Slot 1, in a preferred loading position, noting setup relative to infeed channels and how deep the raw material is to be loaded into the chuck. **See images on previous 2 pages and on the following pages for reference.**
2. Verify proper Shaft Fingers on DuoGrip Gripper #1 corresponding to the raw material diameter
3. Navigate to the "Configuration Page"
4. Add or Edit part configuration
5. Select "Move to Pick" button in the Lathe Recovery panel at the top of the Configuration page - *robot automatically enters Freedrive with Gripper 1 Open*
6. With robot in Freedrive, gently drag robot near to the position for picking the raw material from the infeed, with fingers inside or between the U-channels, and positioned so that the part can be loaded into the chuck **the gripper should be in a vertical position*
7. Select "Stop Program" on Teach Pendant to Exit FreeDrive
8. Close Gripper 1 from the recovery panel at the top of the page **this will clamp on the part*
9. Select Freedrive **with empty gripper*
10. Gently reposition Robot such that the clamped part is resting on the "V" grooves of the Shaft Infeed and aligned in the infeed as required
11. Select "Stop Program" on Teach Pendant to Exit FreeDrive
12. In the Part Configuration:
    a. Press the **"Get"** button for the Infeed Pick Position
    b. Enter **Distance From Edge of Gripper Finger to Edge of Raw Material** in the **"Raw Material Definition"** section **refer to images on following pages.*
13. Save Configuration **Make note of the required position of the part for a part setup sheet*
14. Select Grippe 1 Open and "Move from Pick" - gripper will release part and move home

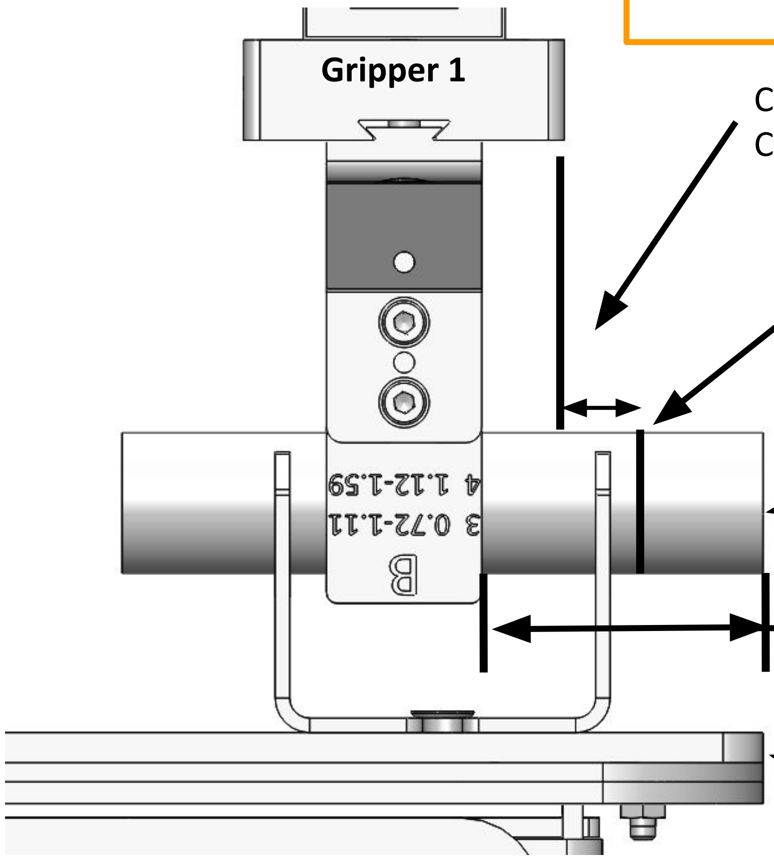


Save Part Configuration often

Shaft Part Configuration - Calibrate Infeed Pick - Main Spindle

Calibrating Gripper 1
Infeed Pick, for loading Chuck 1
(main spindle)

To clear the chuck, Gripper fingers need to be on the outside of the line drawn on the part during raw material load chuck measurements



Clearance between Gripper Base Fingers and Chuck Jaws (recommended > 0.25-inches)

Line drawn on part to note area of part inside Chuck

End of part to be inserted into Chuck 1

Distance from Edge of Gripper to Edge of Raw Material

Outside edge of VersaCart

Gripper Finger location at Infeed Calibration can be inside U-channels or between U-channels

Shaft Part Configuration - Calibrate Infeed Pick - Loading Sub-spindle

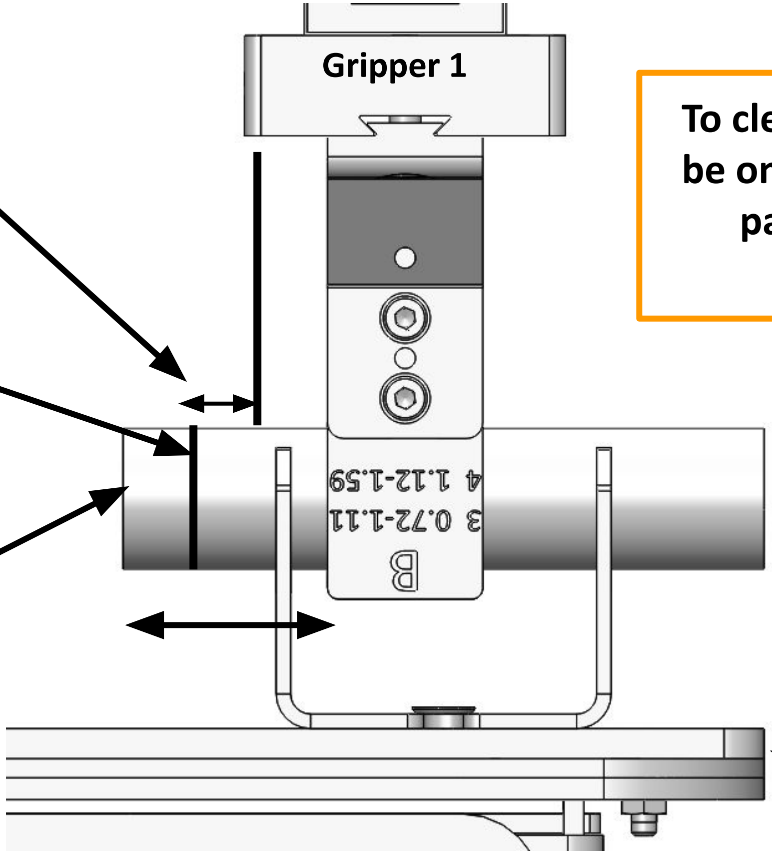
Calibrating Gripper 1
Infeed Pick, for loading Chuck 2
(sub-spindle)

Raw material is loaded into
Chuck 2 (sub-spindle)

Clearance between Gripper Base Fingers and Chuck Jaws (recommended > 0.25-inches)

Line drawn on part
to note area of part inside
Chuck

End of part
inserted into
Chuck 2



Outside edge of VersaCart

To clear the chuck, Gripper fingers need to be on the outside of the line drawn on the part during raw material load chuck measurements

NOTE: Only reference this drawing when loading raw material into the sub-spindle

Gripper Finger location at Infeed Calibration can be inside U-channels or between U-channels

Shaft Part Configuration - Calibrate Outfeed Place

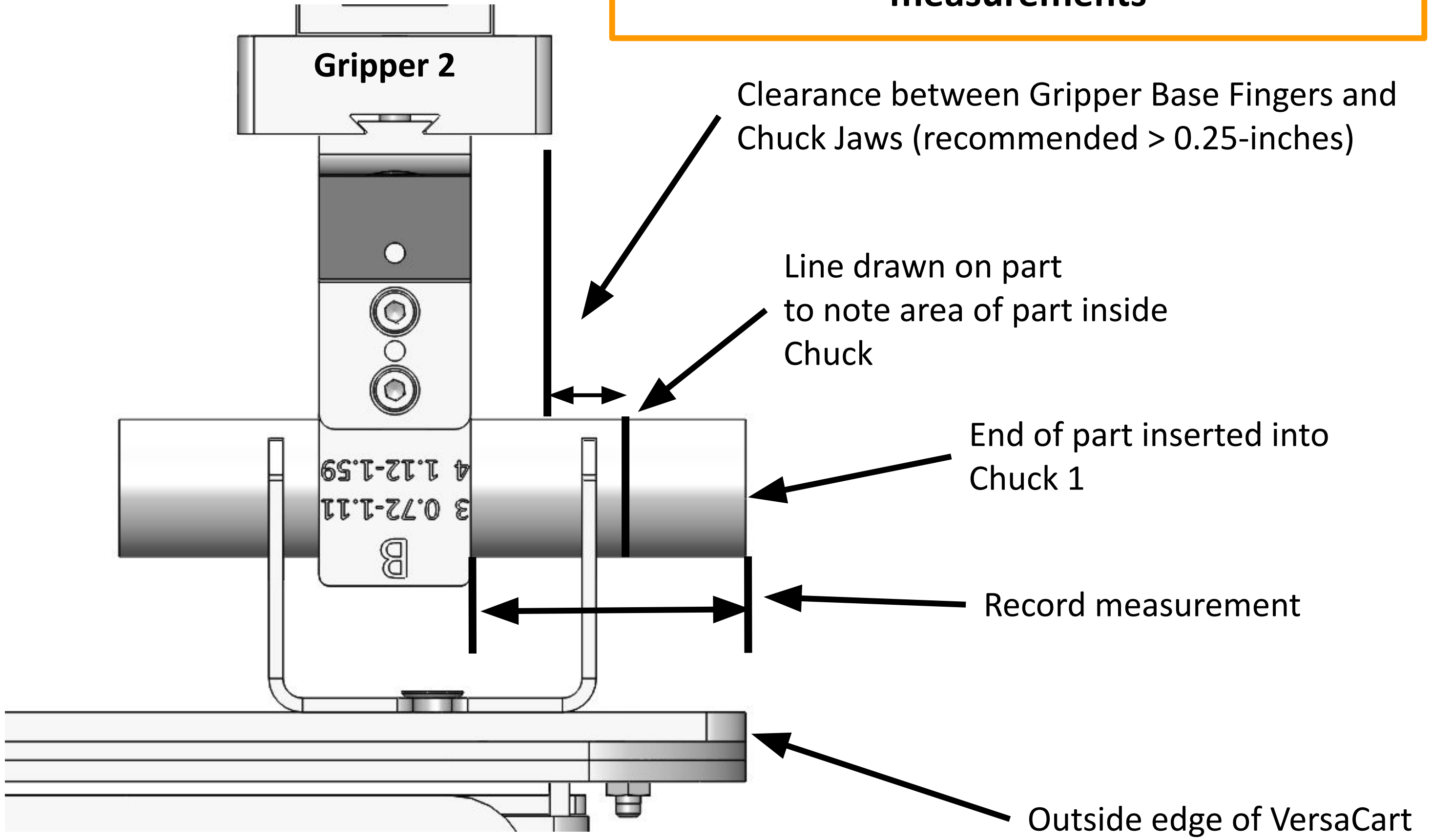
Step 5: Calibrate Outfeed Place

1. Place the Finished Part in infeed slot 1 outfeed location, positioning the part so it will not interfere with adjacent parts in the outfeed (next slot is raw material loaded as shown in Step #1 and the gripper will not interfere with the U-channels when it is clamped on the part). **See images on following 2 pages.**
2. Verify proper Shaft Fingers on DuoGrip Gripper #2 corresponding to the finished material diameter
3. Navigate to the “Configuration Page”
4. Add or Edit part Configuration
5. Select “Move to Place” - *robot automatically enters Freedrive with Gripper 2 Open*
6. With robot in Freedrive, drag robot to a position for placing the finished part in slot 1
7. Select “Stop Program” on Teach Pendant to Exit FreeDrive
8. Close Gripper 1 from the recovery panel at the top of the page **this will clamp on the part*
9. Select Freedrive **with empty gripper*
10. Gently reposition Robot such that the clamped part is resting on the “V” grooves of the Shaft Infeed and aligned as needed to not interfere with adjacent parts
11. Select “Stop Program” on Teach Pendant to Exit FreeDrive
12. In the Part Configuration:
    a. Press the **“Get”** button for the Outfeed Place Position
    b. Enter **Distance From Edge of Gripper Finger to Edge of Finished** in the **“Finished Part Definition”** section **refer to images on following pages.*
13. Save Configuration
14. Select Grippe 2 Open and “Move from Place” - gripper will release part and move home

Shaft Part Configuration - Calibrate Outfeed Place - Main Spindle

To clear the chuck, Gripper fingers need to be on the outside of the line drawn on the part during raw material load chuck measurements

Main Spindle (Chuck 1) Unload



Gripper Finger location at Infeed Calibration can be inside U-channels or between U-channels

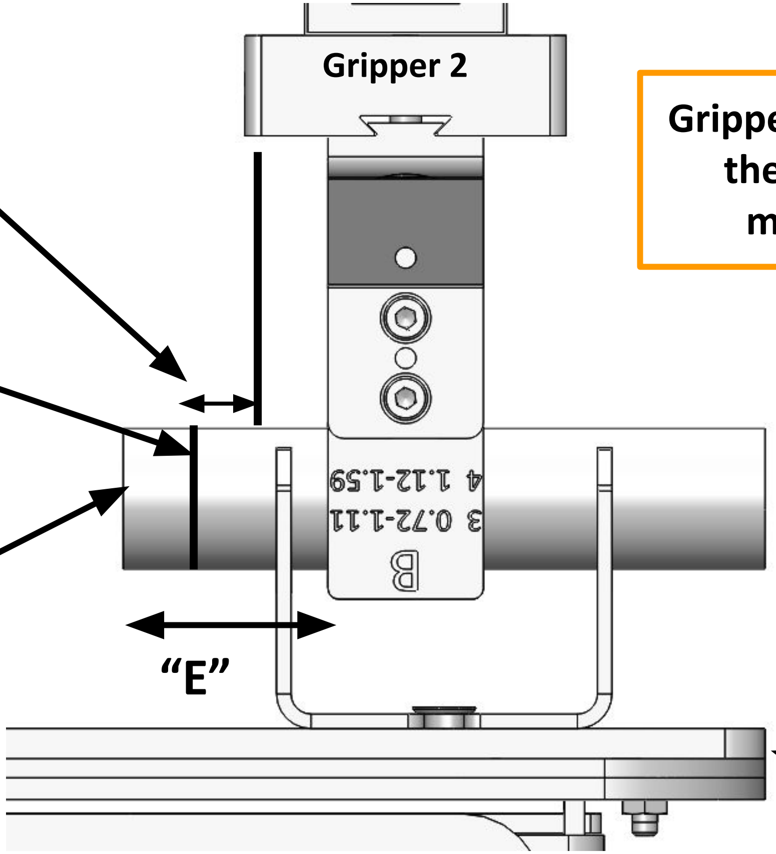
Sub-Spindle (Chuck 2) Unload

Finished part is unloaded from Chuck 2 (sub-spindle)

Clearance between Gripper Base Fingers and Chuck Jaws (recommended > 0.25-inches)

Line drawn on part to note area of part inside Chuck

End of part inserted into Chuck 2



Gripper fingers need to be on the outside of the line drawn on the part during raw material load chuck measurements

Outside edge of VersaCart

NOTE: Only reference this drawing when unloading finished part from the sub-spindle

Gripper Finger location at Outfeed Calibration can be inside U-channels or between U-channels

Shaft Configuration Worksheet

Part Name:	
CNC Program:	
Chuck Load (chuck 1 or 2)	
Chuck Unload (chuck 1 or 2)	
Dimension	**Measured Value**
Raw Material Diameter	
Raw Material Length	
Raw Material Weight	
Distance from Edge of Gripper Finger to Edge of Raw Material	
Distance from Edge of Gripper Finger to Edge of Finished Part	
Finished Part Weight	

Dimension	**Measured Value**
Face of Chuck 1 to End of Raw Material	
Face of Chuck 1 to End of Finished Part	
Face of Chuck 1 to Face of Jaws	
Face of Chuck 2 to End of Raw Material	
Face of Chuck 2 to End of Finished Part	
Face of Chuck 2 to Face of Jaws	

Chuck 2 measurements are used for CNC's with a sub-spindle

Options	**Option (yes/no)**
Bin Drop *calibrate Bin drop position	
Transfer in CNC **option with sub-spindle Lathes*	
Find Chuck on Load	
Apply Force During Chuck Clamp	
OD Clamp on Chuck Unload **if unselected, the part will be unloaded via ID hold*	
Find Chuck on Unload	
Wash Chuck on Unload **calls 8001 program, unless otherwise specified*	
VersaBlast Before Unload *optional equipment	
VersaBlast After Unload *optional equipment	
VersaWash Before Place *optional equipment	

Fundamentals of Successful Automation

Section 7

CNC Process vs Automation Process

The CNC process and the automation process rely on each other for success. The CNC process requires the automation process to:

- Control the automation steps and command robot movements, gripper, chucks, CNC doors and execution of CNC programs
- Load the parts into the CNC chucks

The automation process requires the CNC process to:

- Wash the chuck, jaws and parts of all chips
- Keep the CNC door mechanism free of chips or other debris that could prevent the door from opening or closing
- Remove chips as required to prevent the CNC process from stopping

Automation Process Errors vs CNC Process Errors

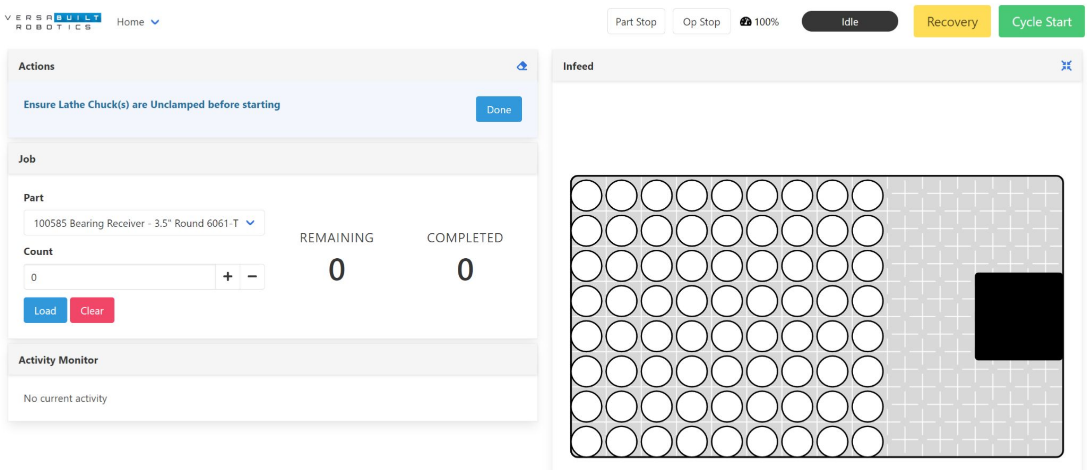
Automation Process Errors and Typical Causes

- Missed robot pick or missed robot place of a part
  - Part not properly located in the infeed
  - Part dimensional variability (e.g., part shorter than expected)
  - Poor robot calibration or accuracy
  - Change in air pressure to gripper or vise
- Failure to load or unload a chuck
  - Poor calibration
  - Robot cart or CNC moved since robot was calibrated
  - Robot that is cold and doesn't accurately move to the expected position
- Failure to properly locate a part in chuck
  - Damaged jaws
  - Poor jaw design
  - Chuck not designed for robot loading
  - Variability in part dimensions or other variables
- Robot stop
  - Unexpected collision
  - Actual robot payload significantly different than programmed payload

CNC Process Errors and Typical Causes

- CNC door fails to open or close
  - Chips not adequately washed away from critical door components
  - Inadequate maintenance
- Unexpected chips or coolant on the floor
  - Inadequate maintenance
  - Lack of understanding in maintenance intervals
- Broken cutting tools
  - Lack of understanding tool life
  - Inadequate coolant system maintenance
  - Parts not loaded "true" in chuck
- Parts that fail to meet dimensional tolerances
  - Tool life management problems
  - Irregular z-location of part in chuck

Validating the Automation Processes



The Lathe Automation System basic functions should have been validated as part of the installation process. This includes validating all IO and the calibration of the system.

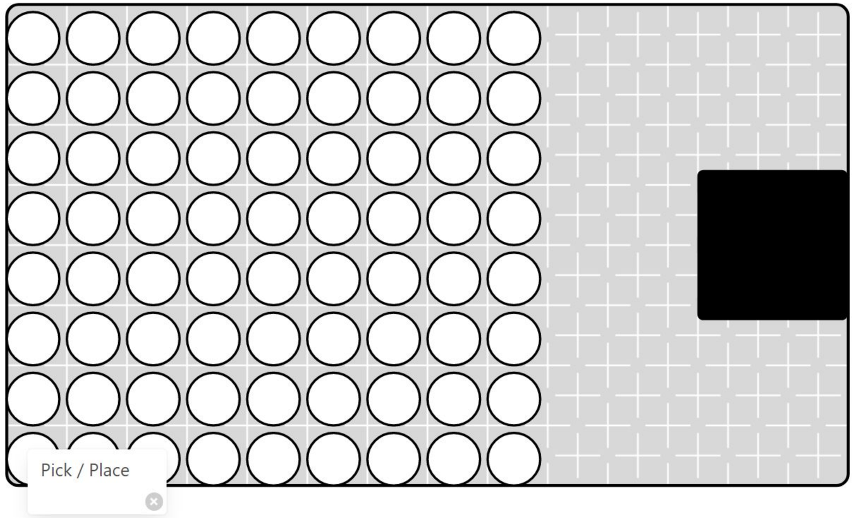
Additional validation tools are available that allow the automation process to be validated on a per part basis. VersaBuilt recommends using these tools as the first parts are automated to gain confidence in the automation process.

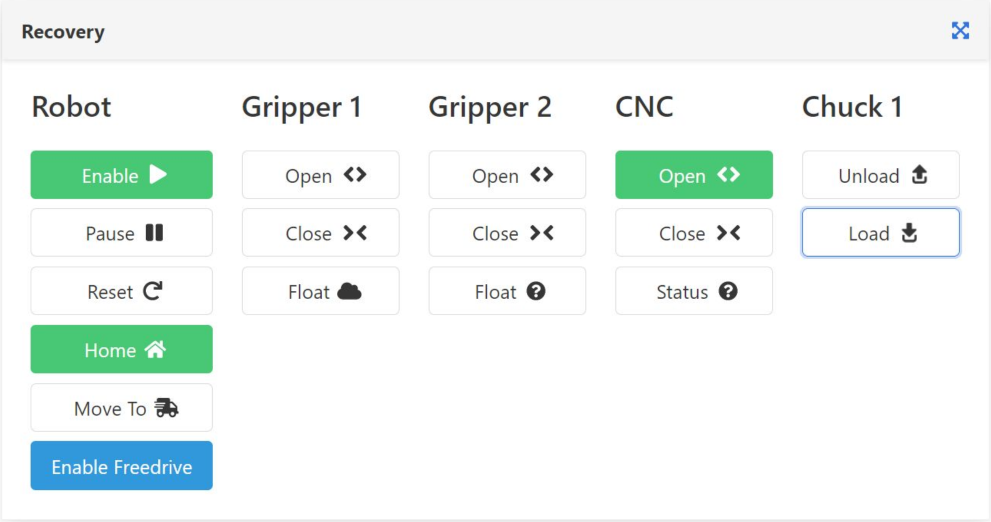
Validating the Automation Processes

Pick Part, Load Chuck, Unload Chuck, Place Part

Before attempting to run in auto, validate pick from table, load chuck (raw material) and unload chuck (finished part).

- Start by entering Recovery mode, selecting the part configuration to be tested from the Job panel, and unclamping the chuck
- Place a piece of raw material in the infeed and click on the location in the Infeed panel
- Select the Pick/Place pop-up menu, a modal will appear with the option to Pick or Place a part, select Pick Lathe Part
- When the part has been successfully picked, press the Load button under Chuck 1 in the Recovery panel
- Once the part has been successfully loaded in the chuck, unload the chuck and replace the raw material with a completed part
- Press the Unload button under Chuck 1 in the Recovery panel
- Select the Pick/Place pop-up menu, a modal will appear with the option to Pick or Place a part, select Place Lathe Part to validate placement of the part back in the infeed





Validate the CNC Processes - Operator Maintenance Intervals

All CNCs require operator maintenance to prevent “unexpected events”. If operators perform CNC maintenance primarily by reacting to what they observe, “unexpected events” are much more likely to occur when automation is implemented. When automation is implemented, operators spend less time interacting with the CNC process making them less likely to observe a problem. If lights-out manufacturing is implemented, scheduled maintenance becomes even more critical.

Operator maintenance includes tasks like:

- Adding coolant and check coolant concentrations
- Emptying chip bins
- Cleaning coolant sump and filters
- Cleaning coolant lines of chips
- Washing down chips in the CNC cabinet and CNC door mechanisms
- Way and spindle lubrication

VersaBuilt recommends instituting maintenance intervals with a sign-off sheet. Make sure the automation does not run past any maintenance interval to avoid “unexpected events”.

Validate the CNC Processes - Machining Process

Like CNC maintenance, the machining process has limits to how long it can continue without operator intervention. Tool life management is the primary factor influencing how long the machining process can operate without intervention. An entire book could be devoted to tool life management.

Tool life management generally falls into one of two categories: operator observation or process-driven proactive management. Process-driven proactive tool management takes time to develop and increases in difficulty in high-mix manufacturing environments. If proactive tool life management is used in conjunction with a CNC’s built-in tool expiration (the CNC alarms when a tool expires), the CNC will prevent the automation process from continuing when tool life expires.

If tool life is managed by operator observation, the operator must decide how many parts can run before further operator inspection is required.

Successful Lights-Out Manufacturing

Many companies purchase CNC automation for “lights-out” manufacturing. Before venturing into “lights-out” manufacturing, validate your automation and CNC processes and measure and understand how long your automation can run successfully without an operator present. Hope and automation are two things that don’t go well together.

Although “lights-out” manufacturing may be the goal, understand that CNC automation can provide a great return on investment even if it only works when operators are present to monitor it. CNC automation is primarily a tool that increases the productivity of operators.

In motorcycle racing, you sometimes hear the phrase, “You need to slow down to go faster”. The same can be said for CNC automation. Machinists are typically taught to optimize the speed of the machining process. In high-mix automation, it is more important to optimize the length of time the machining process can run without operator intervention. In addition to making choices about tool and spindle probing, machinists can sometimes make choices in machining and workholding strategies that improve process reliability over process speed. Best to find a balance between speed and reliability with a strong emphasis on reliability.

VERSABUILT ROBOTICS