ALL THE TOOLS YOU'LL NEED TO
FABRICATE DEVICES IN-HOUSE.

Carver PRO-S™

Operation Manual

Revision B

PVA Med
Six Corporate Drive
Halfmoon, NY 12065

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Table of Contents

1. Introduction

Before you operate this system, read the operation and setup manual. This will help you to become familiar with the product and ensure successful operation.

If any questions or problems arise, contact PVA's Technical Support department.

1.1 PVA Contact Information

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1.2 Document History

Revision	Revision Date	Reason for Changes
REV B	September 2022	Workflow Replaced with Mandrel Template Workflow
REV A	June 2022	Initial Release

Note: All photographs and CAD model representations in this document are a "general representation" of the system and its components. The actual appearance of the system and its components can differ based upon customer specific configuration.

1.3 Safety

Certain warning symbols are affixed to the machine and correspond to notations in this manual. Before operating the system, identify these warning labels and read the notices described below. Not all labels may be used on any specific system.

Always wear approved safety glasses when you operate or work near the workcell.

Before you operate the system, read and understand the manuals provided with the unit.

Never put hands or tools in areas with this symbol when the machine is in operation. A dangerous condition may exist.

Read and understand the manuals provided with the unit before any repairs or maintenance is done. Only a qualified individual should do service.

Use caution when there are pressurized vessels. Find and repair any leaks immediately. Always wear appropriate safety equipment when you work with pressurized vessels or vessels that contain chemicals

Shear hazard from moving parts. Avoid contact.

Do not remove protective guarding.

In situations where inattention could cause either personal injury or damage to equipment, a warning notice is used.

Do not smoke near the machine. Always have a fire extinguisher available for emergency use.

Before performing any repairs or maintenance to the system, turn off power and lock out the power disconnect switch.

Warning notices are used to emphasize that hazardous voltages, current, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use. Only qualified personnel should enter areas designated with this symbol.

Laser light source present. Do not stare directly into the beam. Do not use in the presence of highly reflective surfaces

Pinch hazard from moving parts. Avoid contact.

Hot surface. Avoid contact.

Warning, Ultraviolet (UV) light hazard. Do not look directly at the UV light source.

This product meets EU standards for health, safety, and environmental protection.

Warning, no open flames.

Electrostatic sensitive device warning. Observe precautions for handling.

2. Getting Started

2.1 Unboxing

1. Remove the packaging straps from the shipping crate.
2. Open the shipping crate by first taking the lid off and then removing the sides.
3. Remove the plastic wrapping around the metal ramp and any additional items.

Figure 1: Remove Plastic Wrapping

4. Remove the waste bin access key tied to the handle on the front. Open the waste bin access doors on the front of the machine and remove the lag screws in the four metal brackets that are holding the carver in place around its wheels on the pallet.

Figure 2: Metal Brackets Inside Access Doors

5. Secure the metal ramp to the wooden pallet on the side of the carver with the lag screws from the previous step.

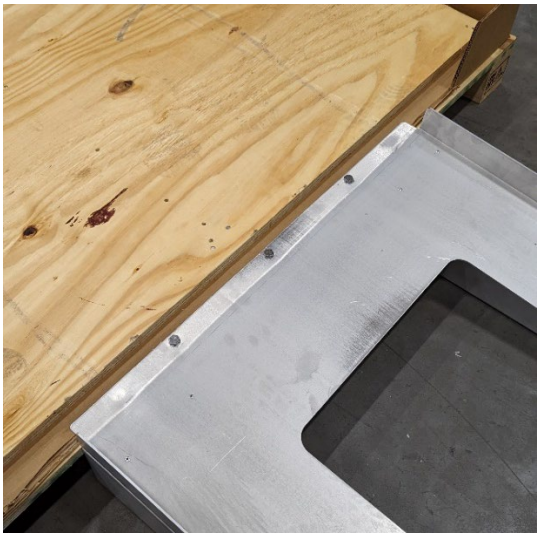

Figure 3: Metal Ramp Secured to the Wooden Pallet

6. Unload the carver using the metal ramp with at least two people – one person in front of the machine and one person behind the machine.

Figure 4: Unloading the Carver Using the Metal Ramp

7. Move the carver to its desired location and position the machine on level ground.

8. To level the carver, lower the feet by turning the red knob on each leg to stabilize it. Turning the knob to the left lowers the foot and turning the knob to the right raises the foot.

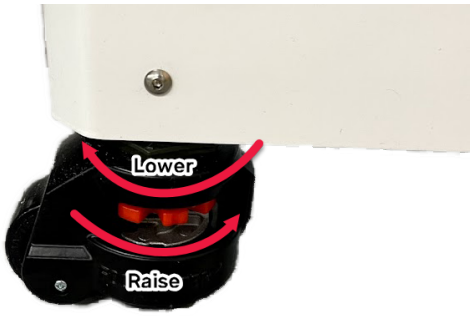

Figure 5: Raise and Lower the Feet

2.2 Initial Setup

2.2.1 Tool Kit

Before starting the setup process, locate the Tool Kit that has been provided with your Carver PRO-S™. The following items are included and shown below.

Figure 6: Carver Tool Kit

1. Toolbox
2. Square Chuck Key
3. Crescent Wrench
4. Collet Wrench
5. Mallet
6. microSD Card and Converter
7. Cleaning Brush

2.2.2 Mandrels

One long through mandrel and one short mandrel are included with the Carver PRO-S™. Dimensions for both mandrels are as follows:

- Length of long mandrel: 91.2 cm (35.9 in) in
- Length of short mandrel: 26.8 cm (10.5 in) in
- Diameter for both mandrels: 2.5 cm (1 in)

Figure 7: Long Mandrel and Short Mandrel

Refer to Section 7.2 for more information on the PVA Med mandrels.

2.2.3 Waste Bin Liners

One (1) roll of clear plastic waste bin liners has been included with the Carver PRO-S™. For more information on accessing and emptying the waste bin, refer to Section 5.3.

Figure 8: Roll of Waste Bin Liners

2.2.4 Plugging into Ethernet and Power Connections

1. Plug one end of the ethernet cable into a wall supply and the other end of the cable into the back of the Carver PRO-S™.

Figure 9: Connecting the Ethernet Cable

2. Connect the supplied power cord into the 120/220V wall power supply. Refer to the machine serial tag for more information.

Figure 10: Supplied Power Cord End

Note: The unit power is specified at time of purchase depending on outlet country. The plug at the end of the cord will reflect these changes.

3. Connect the other end of the power cord to the back of the carver. The power connection is located directly below the ethernet connection.

Figure 11: Connected Power Cord on Carver PRO-S™

4. Turn the main power switch on the side of the carver clockwise to the **ON** position.

Figure 12: Main Power Switch

2.2.5 Connecting to the Network

1. Upon powering up, the machine will be assigned an IP address by the user's in-house router.

2. To view the IP address, select the **Setup** tab on the bottom right corner of the HMI screen.

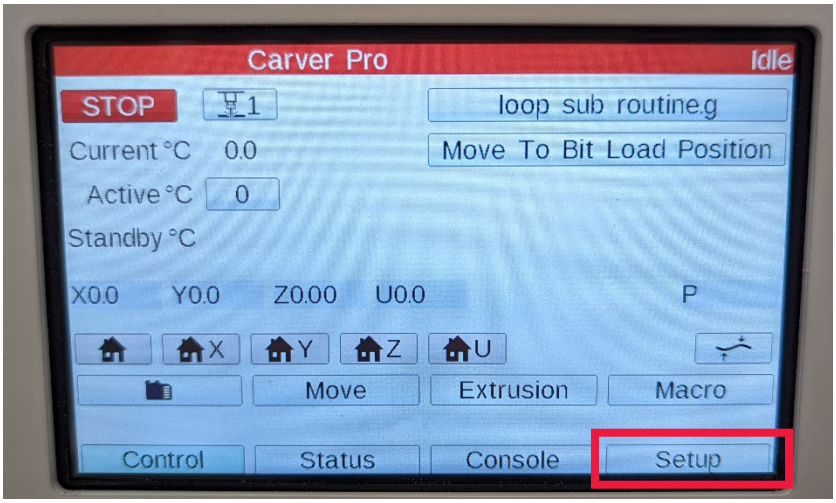

Figure 13: IP Setup Tab Location on the HMI

3. On the bottom left corner in the **Setup** screen, the IP address that the network has assigned to the machine will be shown.

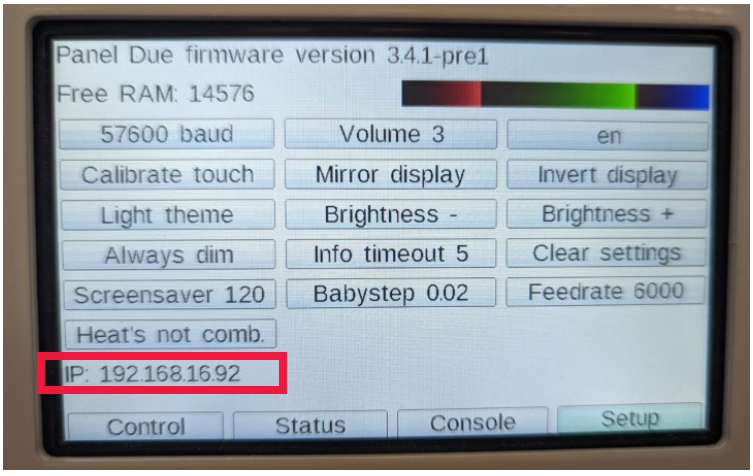

Figure 14: IP Address Location

4. This IP address can be entered into an internet browser to access the web interface of the carver. Refer to Section 4.2.2 for more information on this interface.

5. On a new power cycle, the user's network may assign an alternate IP address based on the other devices connected. It is advised to assign a preset static IP address to the Carver PRO-S™ to make the connection process easier. Consult any appropriate router manual and/or IT group to assign an IP based on the unique MAC address for the Carver PRO-S™.

6. To find the Carver PRO-S™ MAC address, select the **Console** tab. Enter **M540** in the terminal and the machine's MAC address will be displayed.

Note: If the IP address is displaying as 000.000.00.00, ensure that the front door is closed, and the E-stop is disengaged.

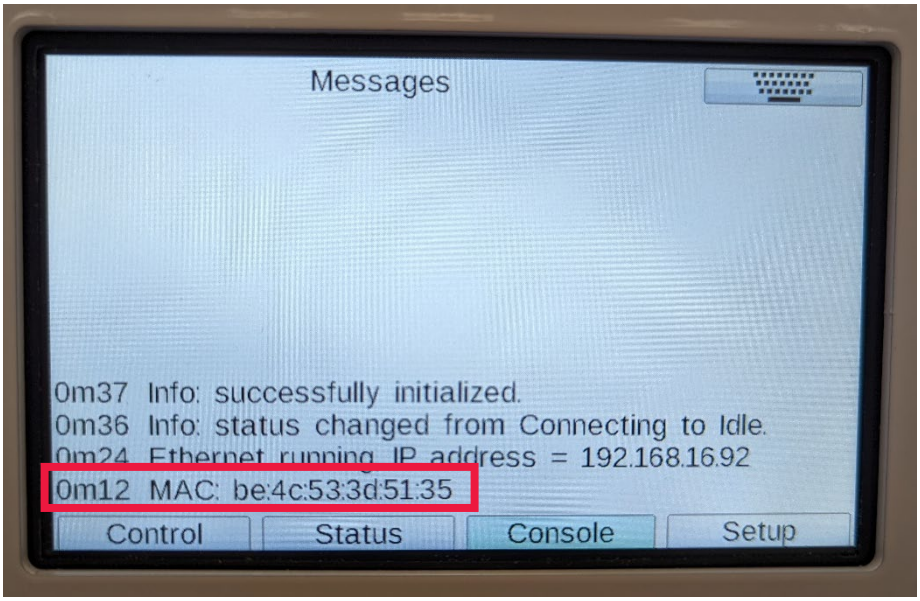

Figure 15: MAC Address Location

2.2.6 Cutting Bit Installation

To install a cutting bit for the first time, or in the event that the cutting bit is damaged, worn, or at the incorrect height and needs to be replaced with a new bit, perform the following steps:

1. Place a crescent wrench on the spindle flats, as seen in Figure 16.

Figure 16: Crescent Wrench Holding the Spindle Flats

2. With the other hand, place a collet wrench on the collet nut, as seen in Figure 17.

Figure 17: Collet Wrench on the Collet Nut

3. To prevent the spindle from rotating with the crescent wrench, turn the collet nut to the left to loosen the collet until the bit can be fully removed from the collet.

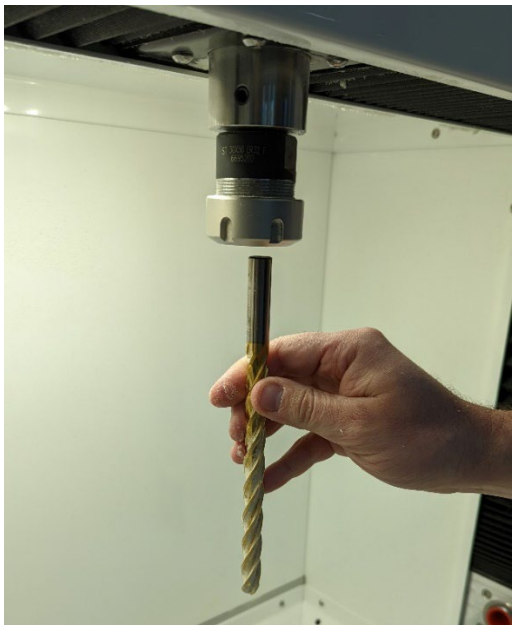

Figure 18: Cutting Bit Removed from Collet

Note: If loosened too much, the bit may fall into the waste bin.

4. On the HMI, select the **Move To Bit Load Position** button.

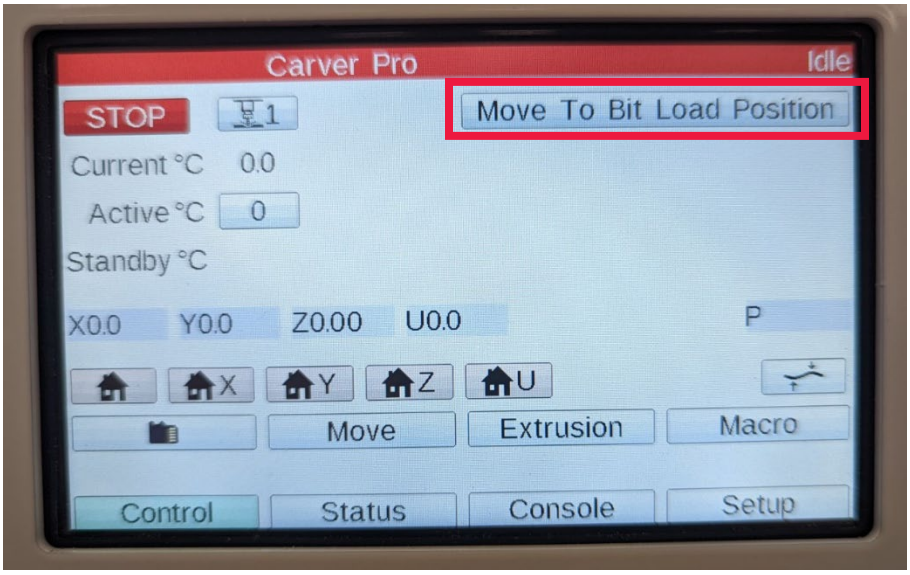

Figure 19: Move to Bit Load Position

5. The **REMOVE BIT** prompt will display. If a bit was previously installed, ensure it has been removed and press the **OK** button to continue.

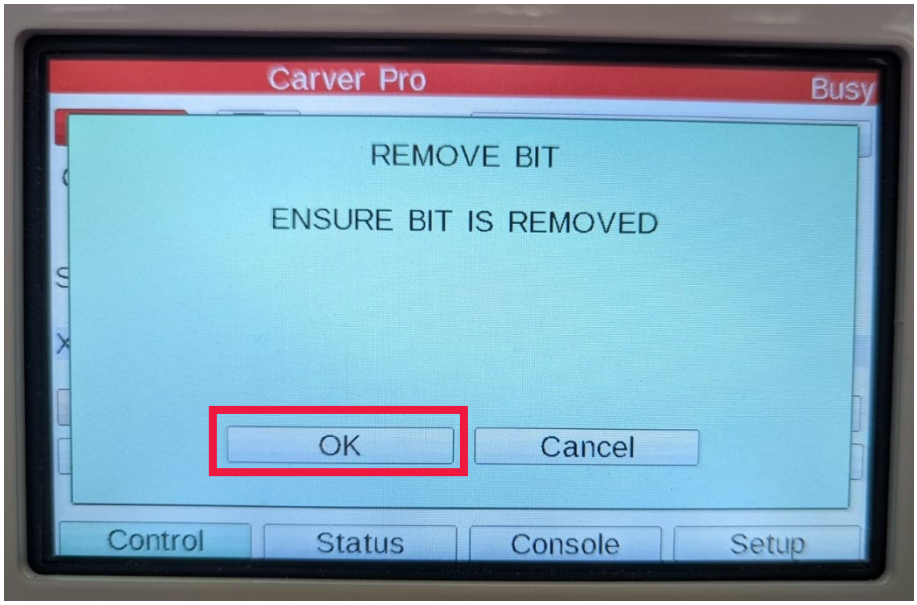

Figure 20: Remove Bit Prompt

6. The carver will then home and move to the preset position.

7. A prompt will display indicating to manually install the bit and slide the spindle over the mandrel by hand.

Figure 21: Install Bit Prompt

8. Place the bit in the collet and manually slide it over to the right side of the mandrel. Allow the end of the bit to rest on the mandrel, as seen in Figure 22.

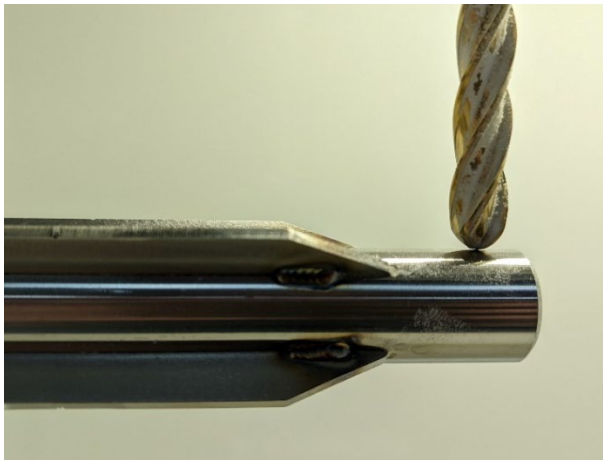

Figure 22: Bit Resting on the Mandrel

9. Secure the spindle with a crescent wrench, tightening the collet with the collet wrench until snug.

10. Once properly tightened, there will be a slight gap between the end of the bit and the top of mandrel, as seen in Figure 23.

Figure 23: Gap Between Bit and Mandrel

11. The end of the bit is now at the correct position to run a test carve to confirm dimensional accuracy.

3. DeskProto®

3.1 Installation and Setup

1. DeskProto® can be installed by running the DeskProto® Setup program. Users can download this setup program (**DeskProto71.exe** for Windows, **DeskProto71.dmg** for Mac, or **DeskProto71.AppImage** for Linux) from the download page on the DeskProto® website. If installing via a CD, the program is named **Setup.exe**.

Figure 24: DeskProto® Software Download Page

2. To begin an installation, open DeskProto® 7.1.
3. On the startup screen, users should select the following:
    a. **Machine**: ISO plain G-codes – mm
    b. **Measurement Unit**: mm
    c. **Default Project Type**: Geometry – most of my files will use 3D files (STL/DXF)

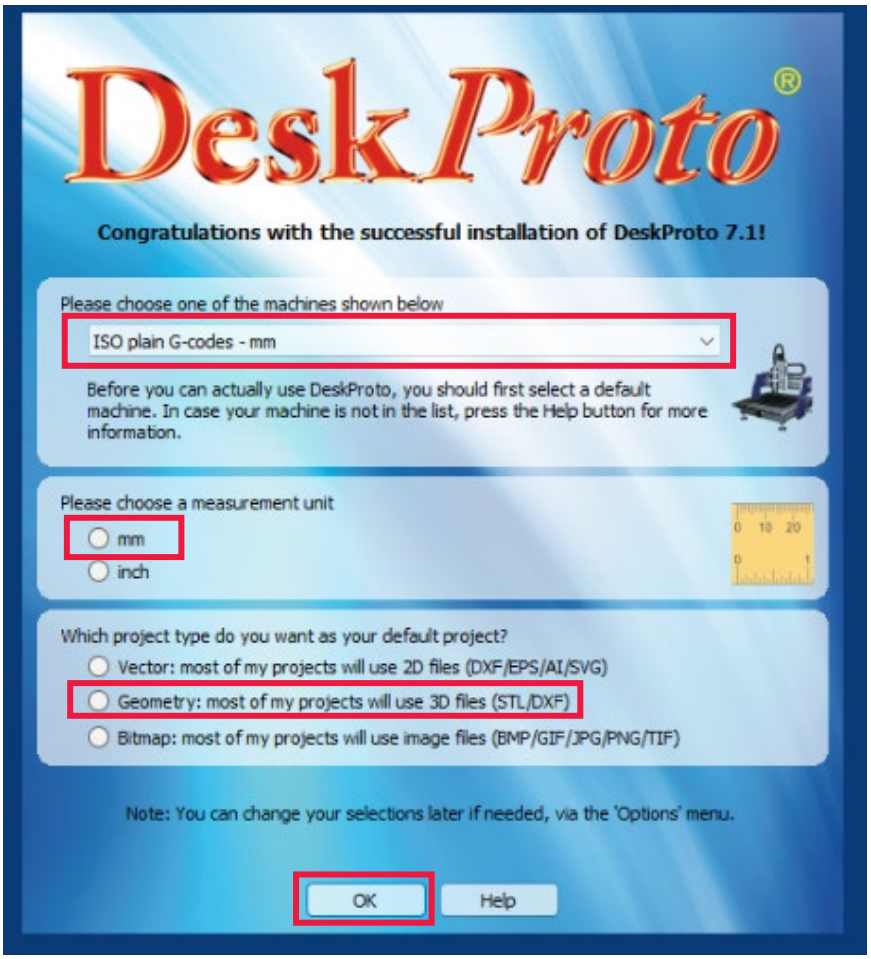

Figure 25: DeskProto® Startup Screen

4. Click the **OK** button to apply the selections.

3.1.1 Activating a DeskProto® License

1. Following the settings startup screen, select the **Activate** button to begin entering the information for a DeskProto® license.

Figure 26: Activating a Current DeskProto® License

2. Copy the company name and key from the license file provided with the machine.

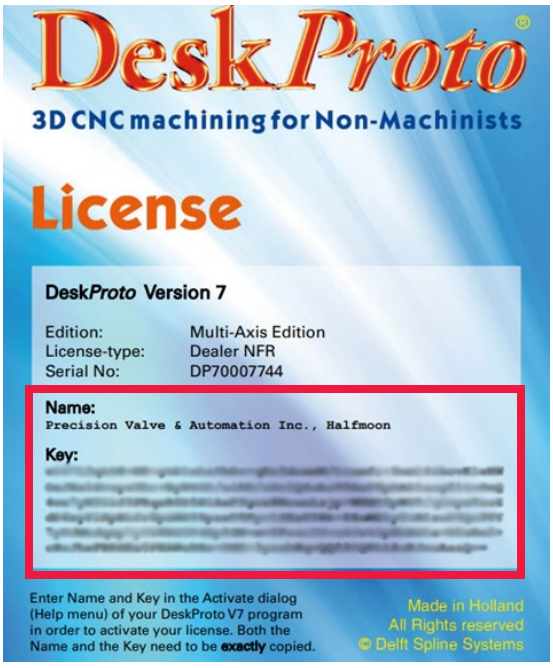

Figure 27: DeskProto® License File

3. In the license details section of the activation window, paste the previously copied company name in the **Name** box and the license key in the **Key** box.

4. Click the **Activate** button to activate the license.

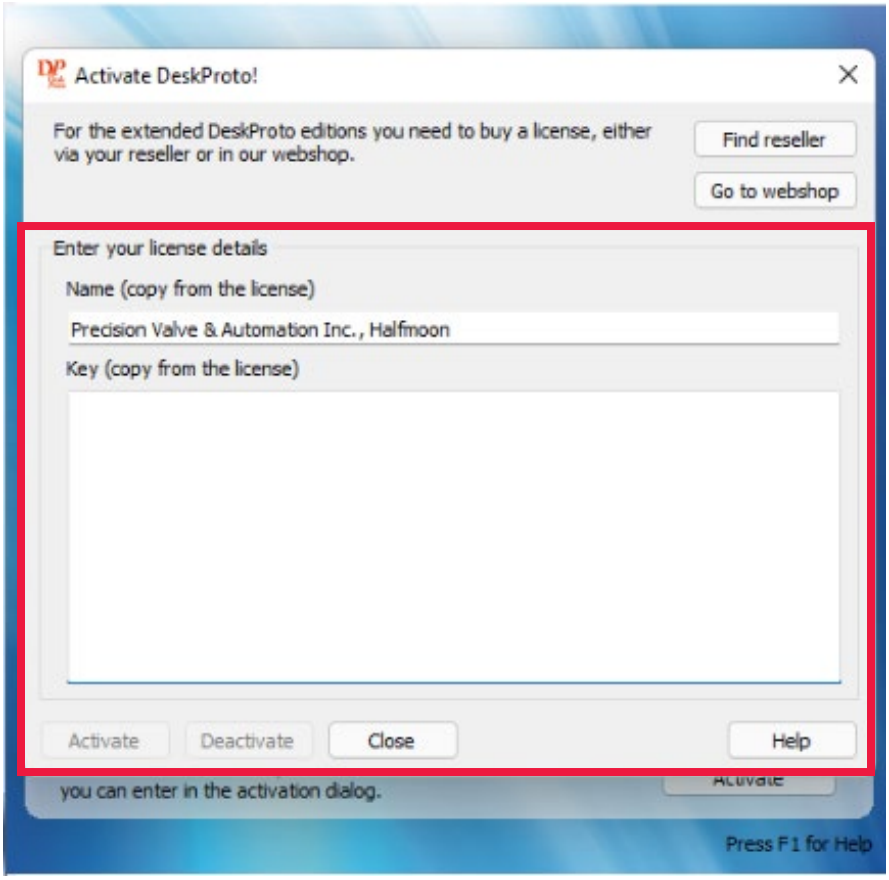

Figure 28: Entering a DeskProto® Key to Activate a License

5. Once license activation is complete, the user will be returned to the DeskProto® startup screen.

6. To avoid DeskProto® from displaying the startup screen each time the application is opened, uncheck the **Show this start screen on startup** box. Click the red "**X**" in the upper right-hand corner of the window to apply the change.

Figure 29: Turning Off Startup Screen

3.1.2 Importing Machine Settings

1. In DeskProto®, navigate to **Options -> Library of Machines**.

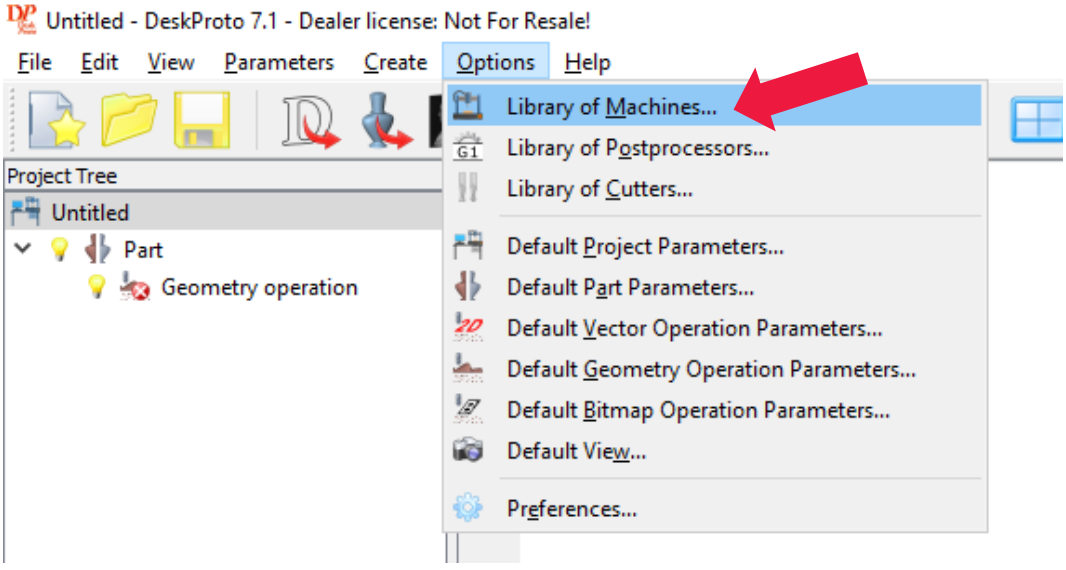

Figure 30: Options Tab

2. Click the **OK** button on the warning screen. Uncheck the **Always show this message** box to avoid the message from showing again.

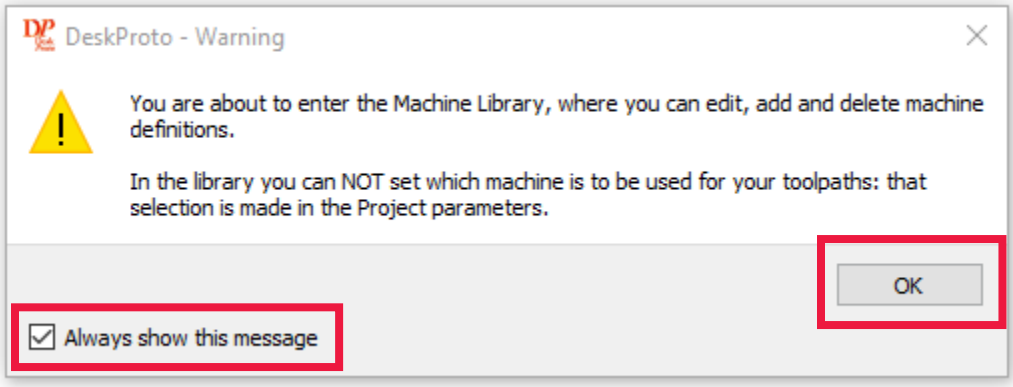

Figure 31: Machine Library Warning Screen

3. In the **Machines Library** window, select the **Open location** button to open a new Windows Explorer window.

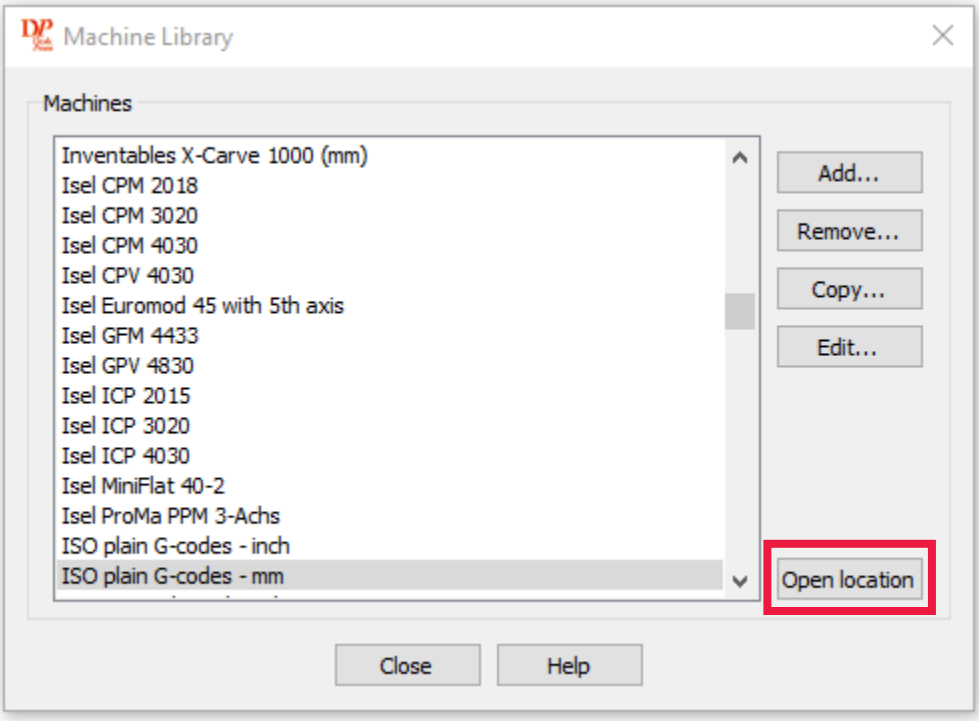

Figure 32: Open Location in Machine Library

4. Upon selecting **Open location**, a Windows Explorer window will open to the location where the DeskProto® machine information was installed and is currently stored. The files (**deskproto_7-1_settings V1.1**, **PVA Bit 6in.ctr**, **PVA CARVER PRO.ppr**, and **PVA CARVER PRO-S.mch**) seen in Figure 33 will be copied to this location.

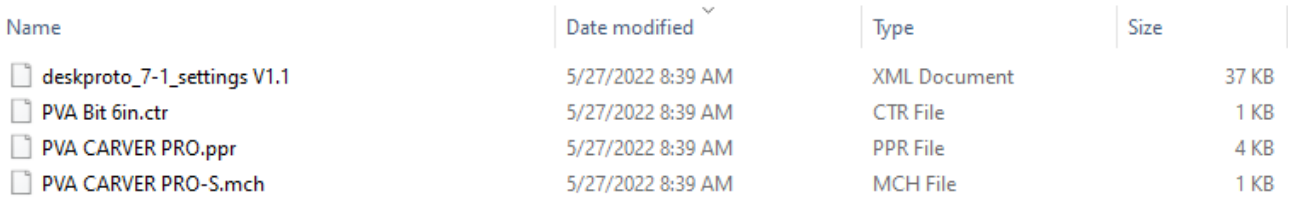

Figure 33: Machine Library Files

Note: These files have been provided with the Carver PRO-S™ license file. They can also be downloaded as a zip folder from the PVA Med website on the Carver PRO-S™ product page.

5. Close the Windows Explorer window.

6. In the DeskProto® software, navigate to **Options -> Preferences**.

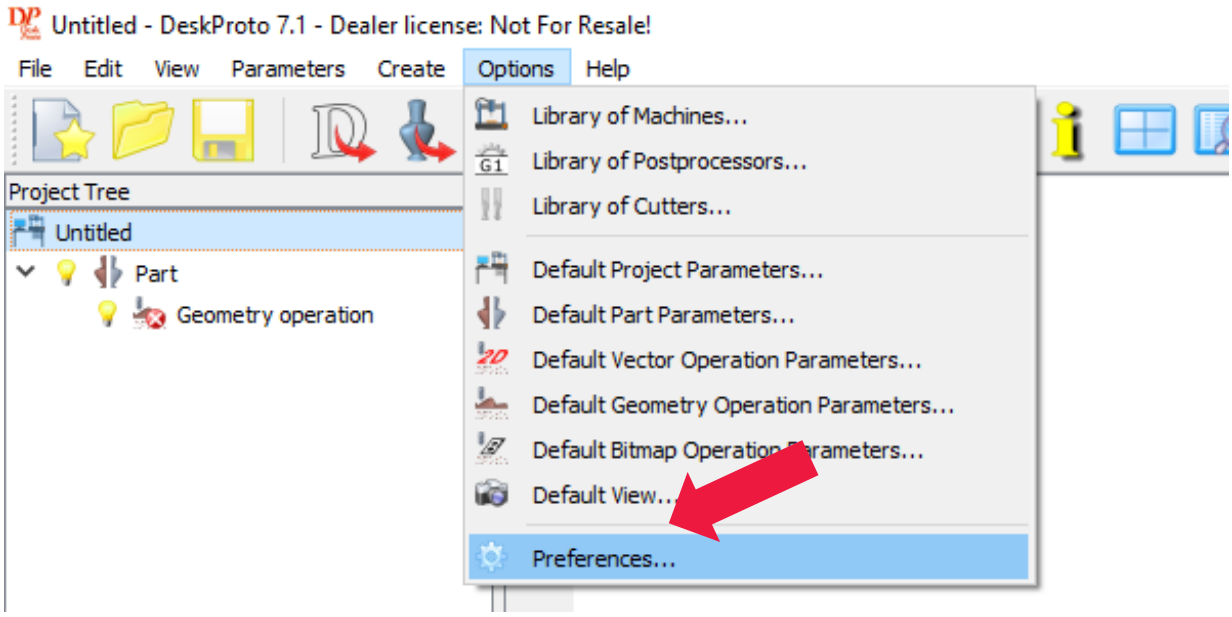

Figure 34: Preferences in the Options Tab

7. In the Preferences window, navigate to **Advanced -> Settings**.

8. Select the **Import Settings** button.

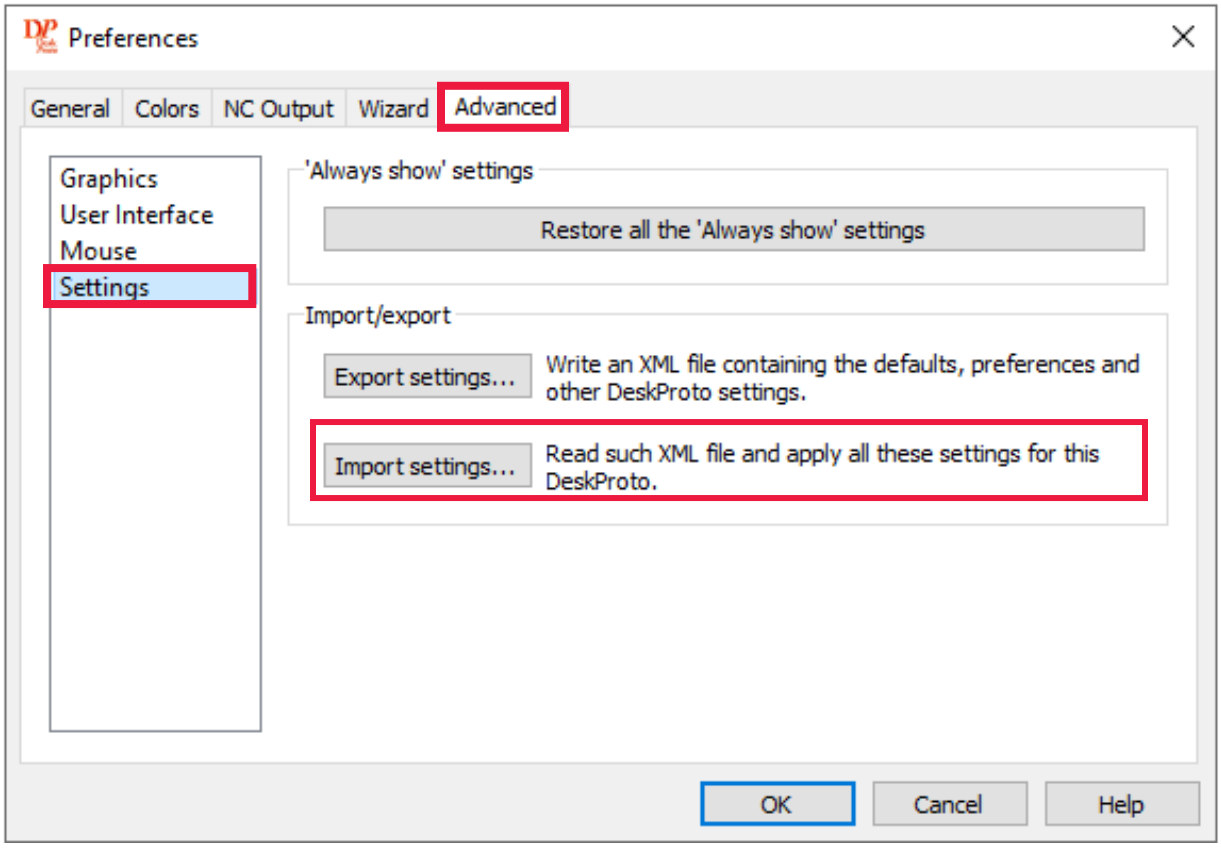

Figure 35: Advanced Settings Tab

9. Click the **YES** button on the warning screen to close the project and apply the changes.

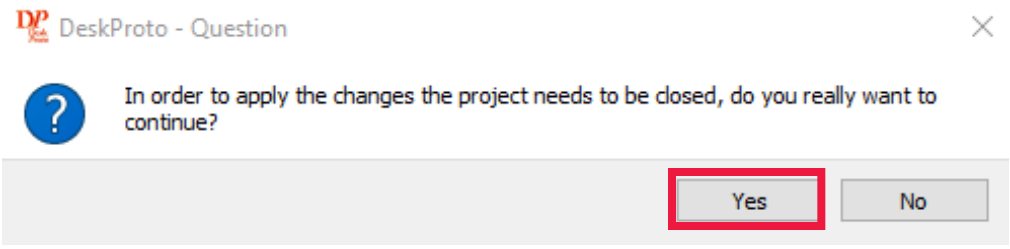

Figure 36: Import Settings Warning Screen

10. Browse to and select the settings file named **deskproto_7-1_settings V1.0.xml**. Click the **Open** button to import the file into DeskProto®.

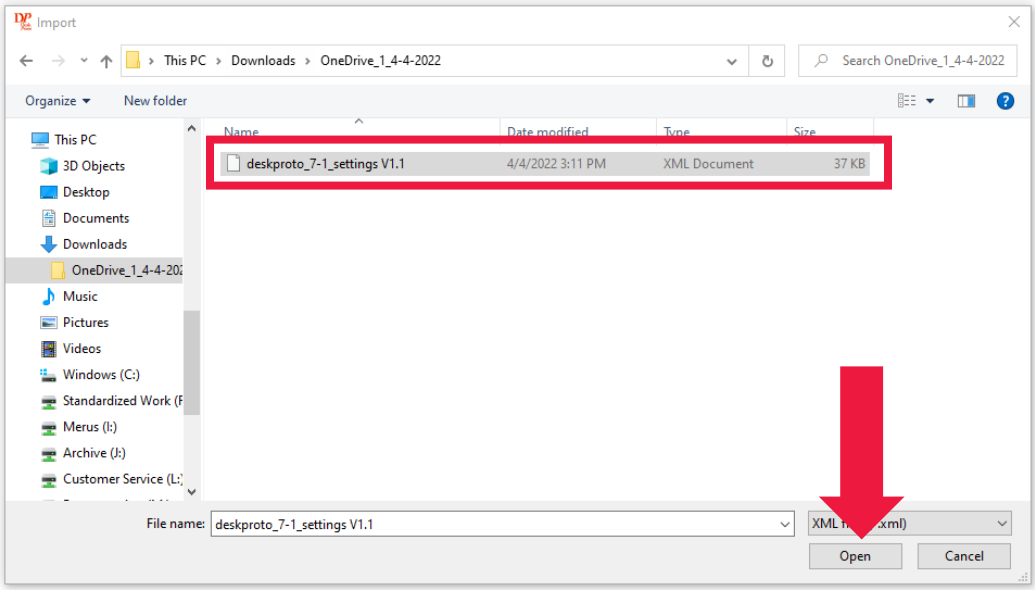

Figure 37: Browse to a Settings File

11. A success message will be displayed to confirm that DeskProto® has enabled the new settings from the chosen file and the project is properly configured for use. Click **OK** to close the window.

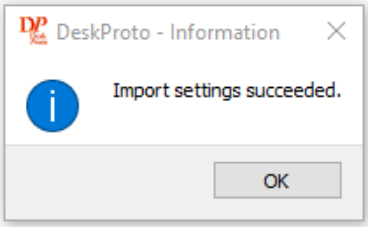

Figure 38: Settings Import Success Message

3.2 Workflow Template for Long and Short Mandrels

3.2.1 Importing the Template Model

1. In DeskProto®, open the workflow template by selecting **File** -> **Open Project**.

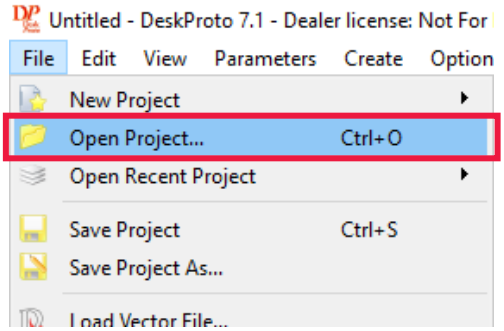

Figure 39: Opening a Project in DeskProto®

2. In the explorer window, browse to the template you would like to import and select the **Open** button.

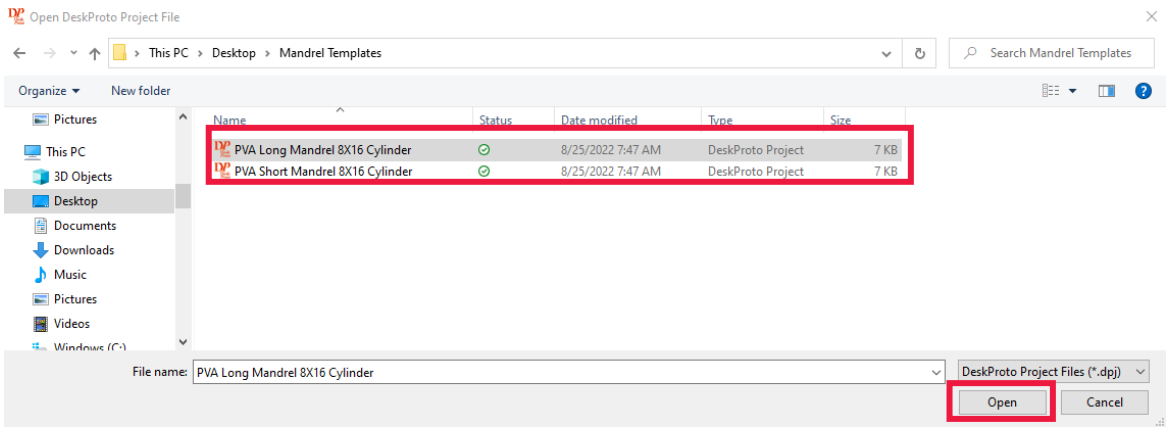

Figure 40: Choosing a STL file in DeskProto®

3. After the template opens, a second explorer window will open where you will be able to select the desired STL file.

4. To avoid overwriting the template, rename the STL file by selecting **File** -> **Save Project As...** and entering the desired name. The Project Tree will update the file to reflect the new file name.

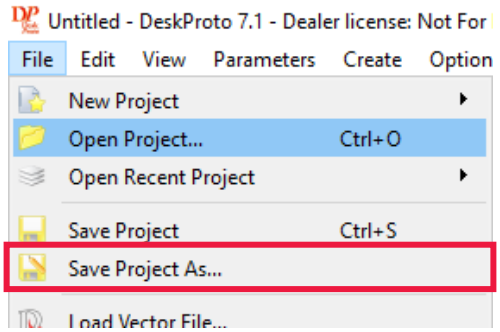

Figure 41: Changing the Name of a Project

3.2.2 Orienting the Model

1. After import, the user will see the STL file and a representation of the mandrel.

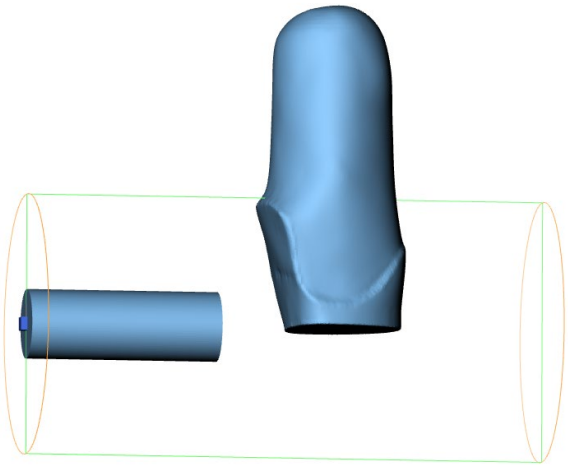

Figure 42: STL File and Mandrel Representation

2. To orient the model, double-click on the **Project Name** within the **Project Tree**.

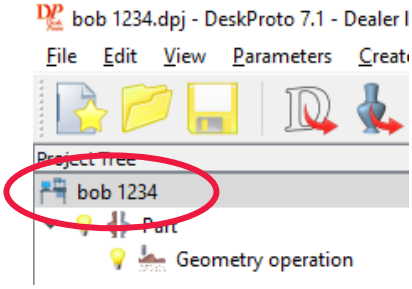

Figure 43: Project Name Within the Project Tree

3. Within the **Project Parameters** popup, navigate to the **Geometry** tab. On the **Geometry** tab, select the **Transform** button.

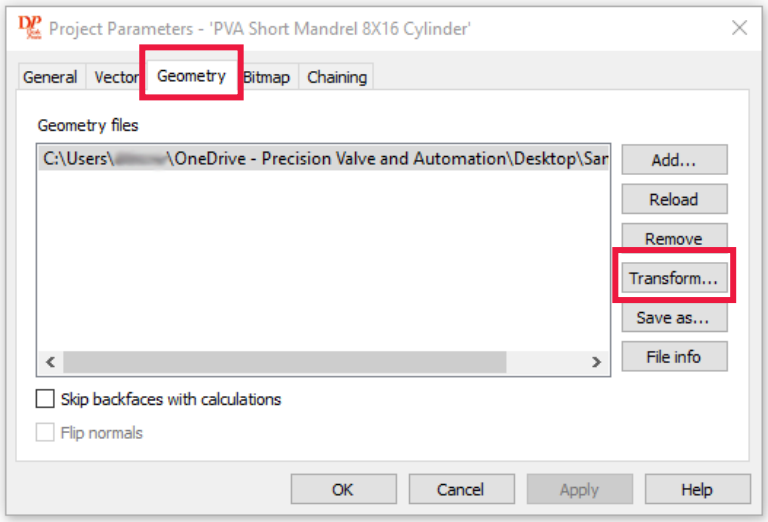

Figure 44: Geometry Tab in Project Parameters

4. The model will need to be oriented about the X axis. To achieve this, rotate the model by 90° or 270° about the Y axis. Select **Preview** to view changes as they are entered.

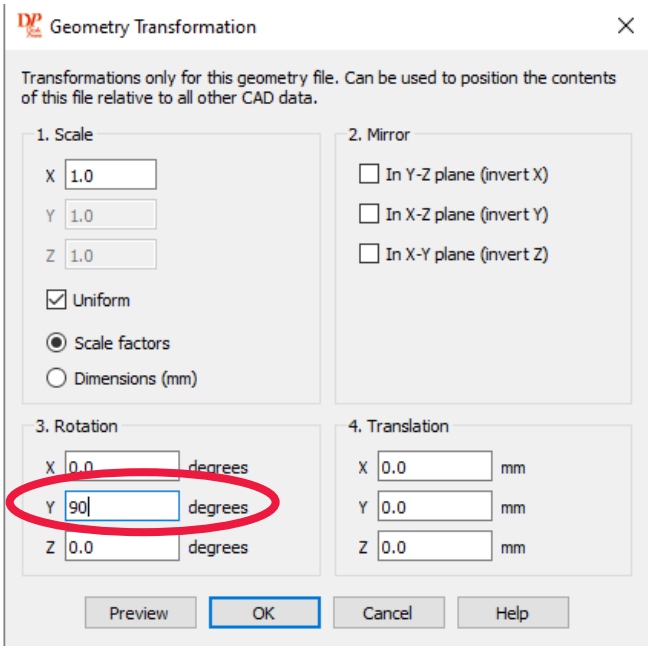

Figure 45: Geometry Transformation Window

5. Use the **Translation** tool to change the location of the object in mm for X, Y, and Z so it is positioned on the mandrel. Use the **Preview** button to view changes as the values are entered.

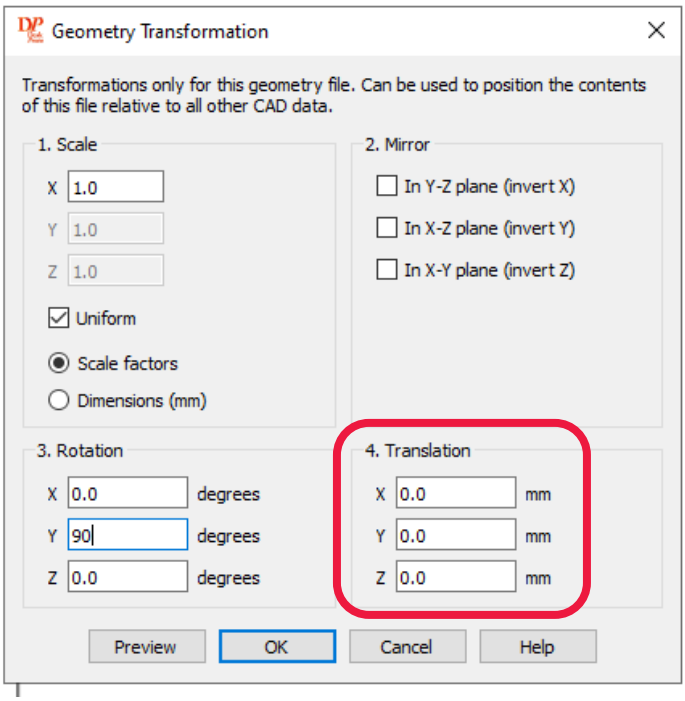

Figure 46: Translation Tool

6. Before translation and after translation examples are shown below.

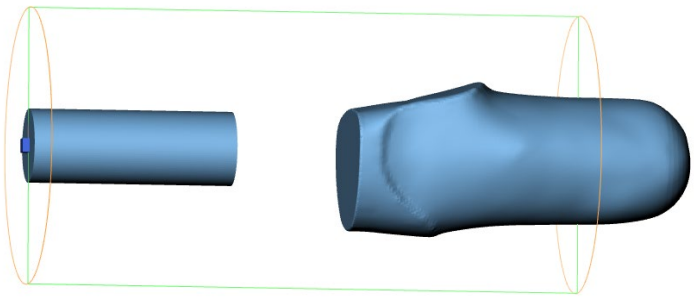

Figure 47: Model Before Translation

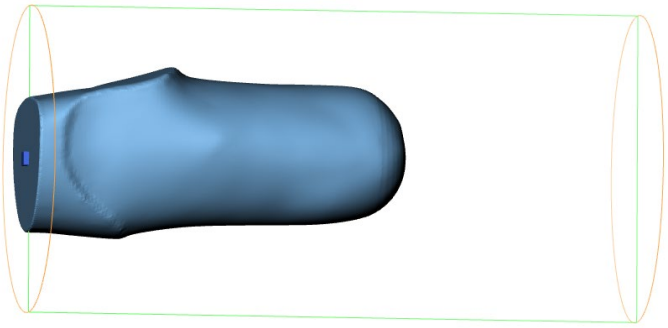

Figure 48: Model After Translation

7. Once positioned, select the **OK** button in the **Geometry Transformation** window.
8. Select OK in the Project Paramater window.

3.2.3 Define Material Block

1. To define parameters for the material block, double-click on the part in the **Project Tree**.

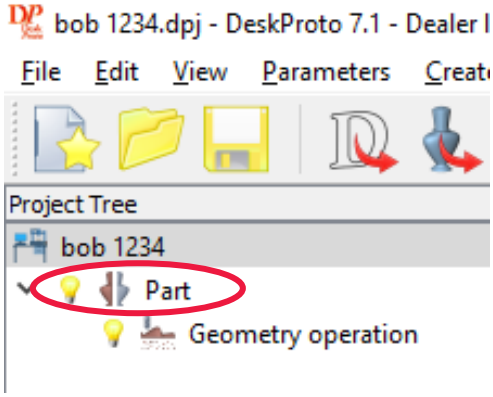

Figure 49: Selecting the Part in the Project Tree

2. In the **Part Parameters** window, navigate to the **Material** tab. A default material size is already set in the template. To modify this size, select the **Set Graphically** button.

Note: If using a rectangular block, uncheck the "Use cylindrical material block" checkbox before proceeding.

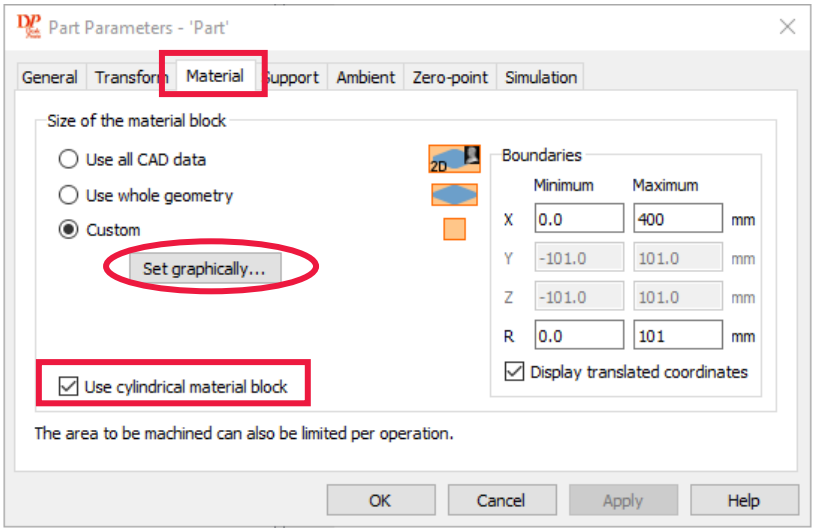

Figure 50: Material Tab in the Part Parameters Window

3. In the pop-up window, the size of the CAD model will be displayed in **Boundaries of CAD data** section. The size of the material block will be displayed in the **Material block of current part** section.

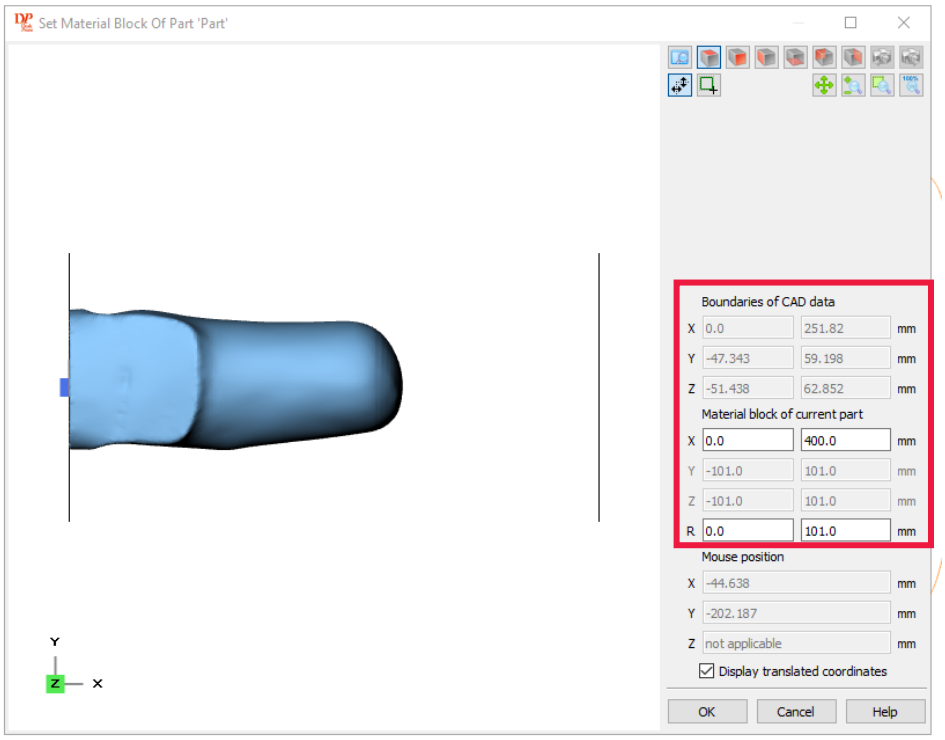

Figure 51: Setting Material Block Size

4. Modify the material block X value so it is the same size or just slightly longer than the length of the model displayed as the X value in the **Boundaries of CAD data** section.

Note: If this value remains at full length, excess time will be spent cutting the right side of the material blank rather than parting it off.

5. If desired, the diameter for a cylindrical block can also be modified in this window by entering new values for the XY coordinates.

6. Width changes for a rectangular block can also be applied in this window by entering new values in the Y and Z maximum fields (short mandrel) or X maximum field (long mandrel) for the size of the material block. Selecting the **Apply** button will create an appropriately sized rectangle around the part.

Note: When using a rectangular foam blank, it is important that the Y and Z values are entered into the appropriate fields to ensure the material is oriented correctly relative to the model. The R field and radius will be automatically calculated. Ensure that this number is less than the maximum work area of the Carver PRO-S™.

7. Select the **OK** button when finished with changes. Select the **OK** button in the **Part Parameter** window to return to the main screen.

3.2.4 Material Block Size Error

If a material block size is entered that is larger than the work area of the machine, DeskProto® will produce a **Part Size Error** message when selecting the **OK** button in the **Material** tab of the **Part Parameters** window. To dismiss this message and return to the previous screen to enter new values, select the **OK** button.

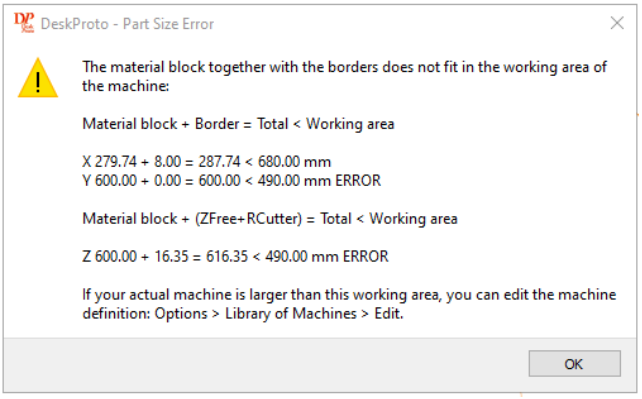

Figure 52: Material Block Size Error

3.2.5 Configuring Cutting Profiles

1. To configure cutting profiles, double-click on **Geometry operation** in the **Project Tree**.

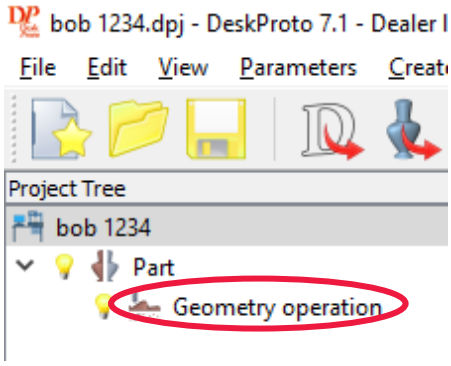

Figure 53: Geometry operation in the Project Tree

2. In the **Geometry operation** window, select the **General** tab. In the **Precision** section, enter in mm the desired distance between tool paths. The default pitch is set to 2.0 mm for the Carver PRO-S™.

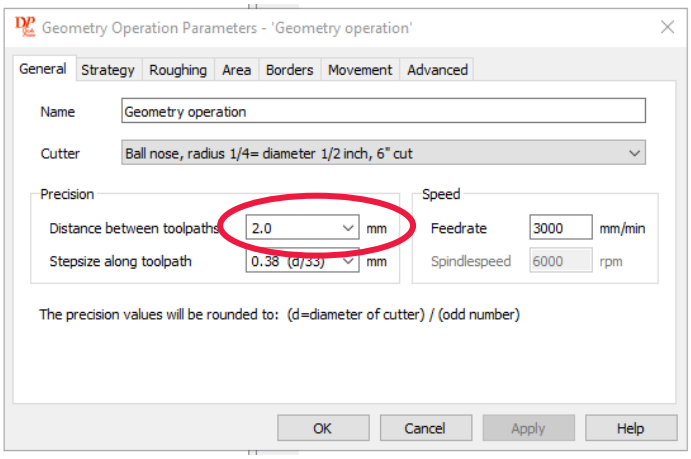

Figure 54: Adjusting the Distance Between Toolpaths

Note: A smaller distance will create a better finish and finer detail but will result in a longer carve. A larger value will create a coarse finish and reduce detail but result in a faster carve.

3. Navigate to the **Area** tab. Set **Area to be machined** to **Use material block above rotation axis**. Select the OK button to commit the changes.

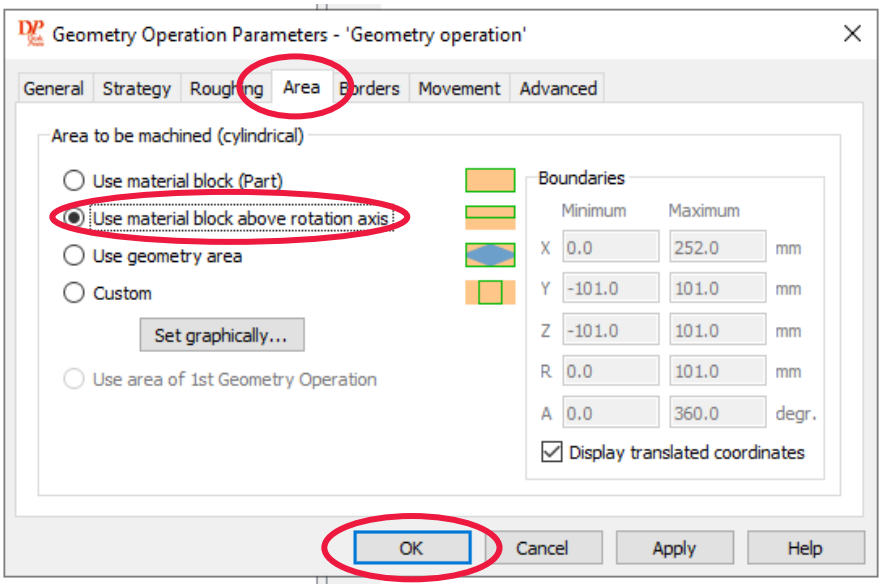

Figure 55: Use Material Block Above Rotation Axis Selection

Note: If this step is not performed, a Move Outside of Machine Limits error will be displayed when the distal end is carved.

3.2.6 Calculating a Toolpath

1. Select the **Calculate Toolpaths** icon.

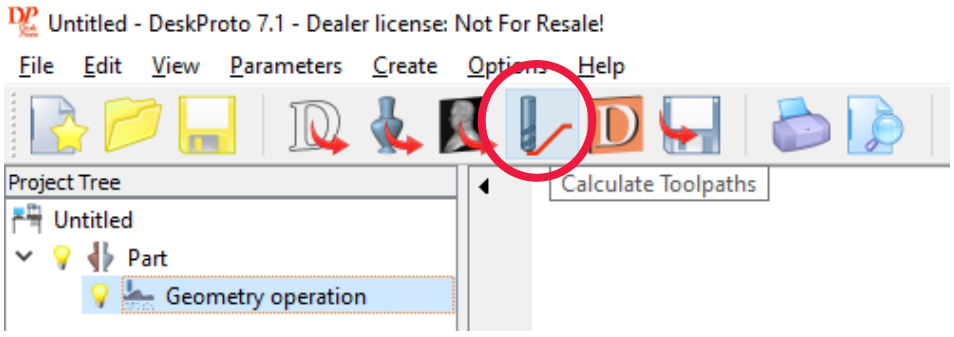

Figure 56: Calculate Toolpaths Location

2. Once the toolpaths are created, the red lines added in the **Model View** on the DeskProto® home screen will represent the cutting path of the carver. The purple

lines shown in the **Model View** will represent the starting point and the lead in process of the carve.

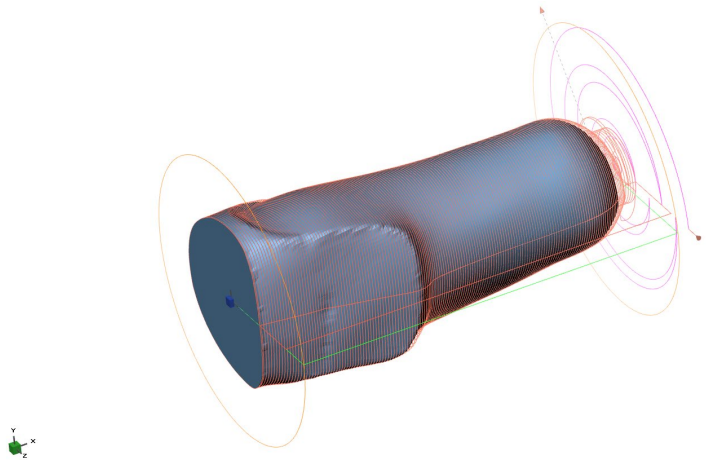

Figure 57: Model View Showing Cutting Path, Starting Point, and Lead In Process

3. Select **OK** to close the window.

3.2.7 Saving a G-code

Once finished creating all the necessary toolpaths, select the **Write NC-program File** button to save the G-code to the desired location.

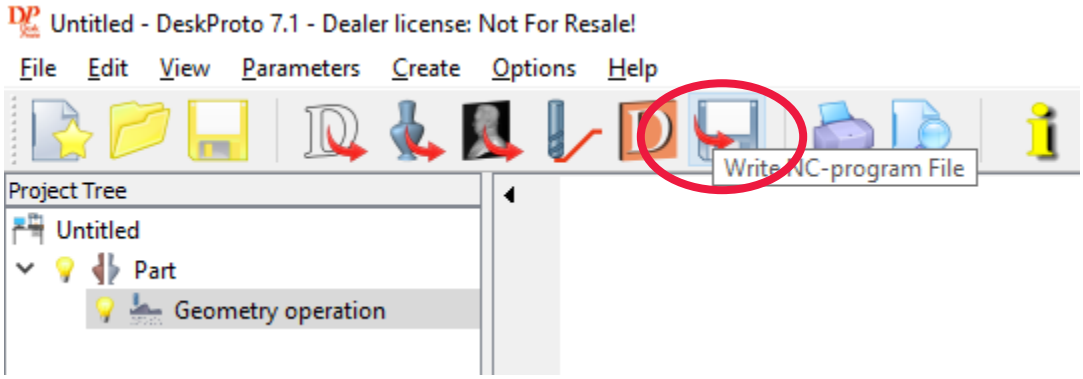

Figure 58: Writing a NC-program File

4. Operation

4.1 Preparing for a Carve

When preparing the Carver PRO-S™ for a carve, the foam blank being used can be either inserted onto a pre-installed mandrel or slid onto the mandrel before it is installed into the chuck of the machine.

Below is a list of cylindrical foam blanks options available that are compatible with the Carver PRO-S™.

	Foam Size (in)		Foam Size (mm)		DeskProto® Model (mm)	
Cylinder	**X (diam)**	**Y (height)**	**X (diam)**	**Y (height)**	**R (radius)**	**X (length)**
ISO3.5-612C, 3.5 lb, 6x12	6	12	152	305	76	305
ISO3.5-812C, 3.5 lb, 8x12	8	12	203	305	102	305
ISO3.5-816C, 3.5 lb, 8x16*	8	16	203	406	102	406
ISO3.5-1016C, 3.5 lb, 10x16	10	16	254	406	127	406
ISO3.5-1018C, 3.5 lb, 10x18	10	18	254	457	127	457
ISO3.5-1218C, 3.5 lb, 12x18	12	18	305	457	152	457
ISO3.5-1220C, 3.5 lb, 12x20	12	20	305	508	152	508
ISO3.5-1224C, 3.5 lb, 12x24	12	24	305	610	152	610
ISO3.5-1424C, 3.5 lb, 14x24	14	24	356	610	178	610
ISO3.5-1426C, 3.5lb, 14x26	14	26	356	660	178	660
ISO3.5-1624C, 3.5 lb, 16x24	16	24	406	610	203	610
ISO3.5-1626C, 3.5 lb, 16x26	16	26	406	660	203	660
ISO3.5-1824C, 3.5 lb, 18x24	18	24	457	610	229	610
ISO3.5-1826C, 3.5lb, 18x26	18	26	457	660	229	660
Carver PRO-S™ Maximum Work Area						
	19	26	483	660	241	660

Figure 59: Cylinder Foam Blanks Available

***Note: One (1) box of ISO3.5-816C, 3.5 lb, 8x16 cylinder foam is included with each Carver PRO-S™.**

4.1.1 Adding a Foam Blank onto a Pre-Installed Mandrel

1. Align the foam blank's pilot hole with the end of the pre-inserted mandrel.

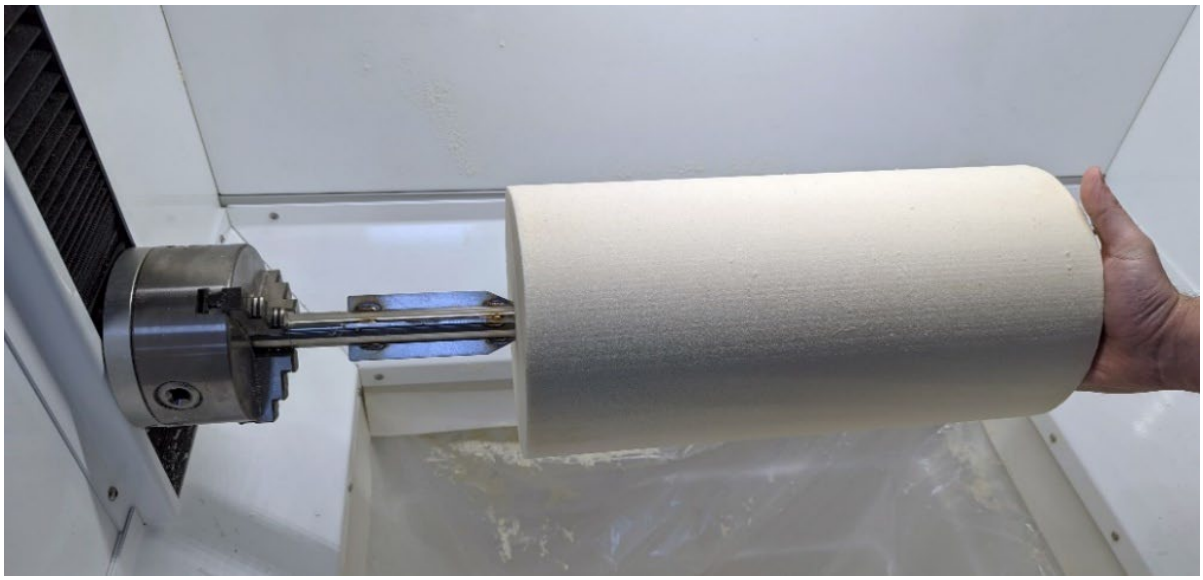

Figure 60: Inserting the Mandrel into a Foam Blank

2. Gently tap end of the foam blank with the mallet from the supplied kit or by hand until the mandrel is fully inserted.

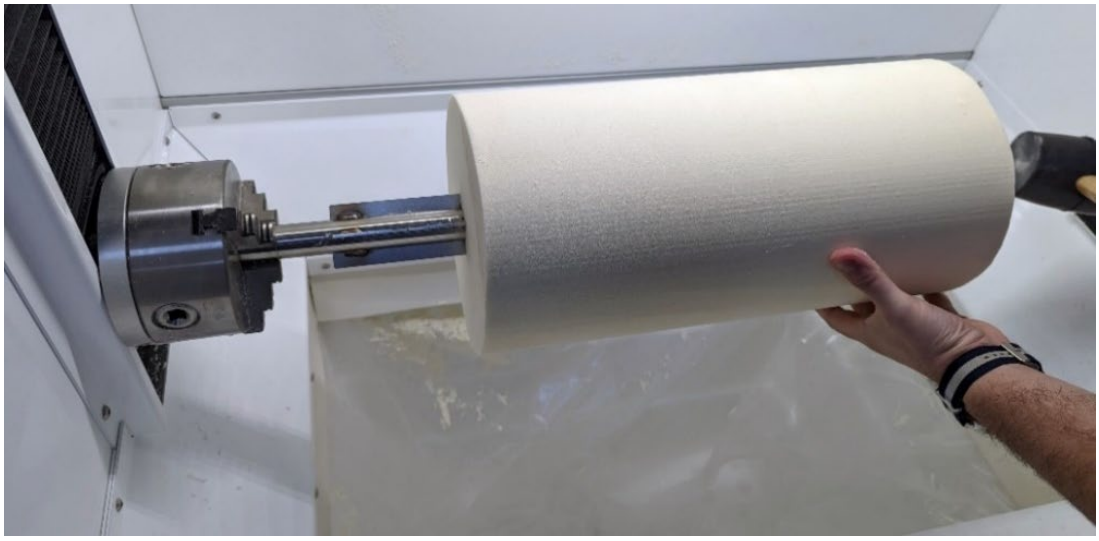

Figure 61: Tapping the Foam Blank with a Mallet

3. When fully and properly inserted, the fins on the mandrel should be flush with the end of the foam blank. Refer to Figure 68.

4. Ensure the mandrel is properly installed by confirming the engraved line at the left side of the mandrel is flush with the end of the chuck, as seen in Figure 68. To avoid movement on the rotation axis, confirm the mandrel has been installed straight.

Figure 62: Properly Inserted Foam Blank and Mandrel

5. Tighten the chuck with the supplied square chuck key. Once the chuck is fully tightened, ensure the square key is removed from machine before operation.

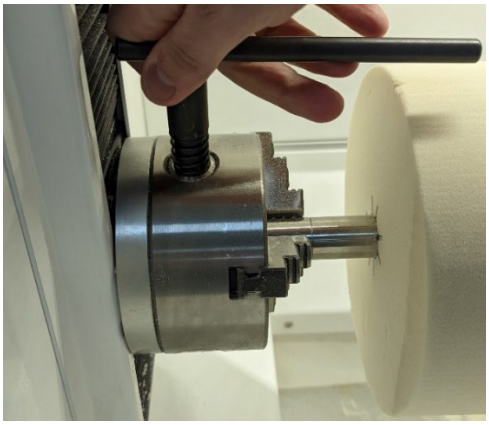

Figure 63: Tightening the Chuck

6. Close the door of the Carver PRO-S™.

4.1.2 Adding a Foam Blank to a Mandrel Before Installation

1. To ensure the foam blank is slid to the end of the mandrel and fully seated, the user can tap the end of the foam blank by hand or with a mallet.

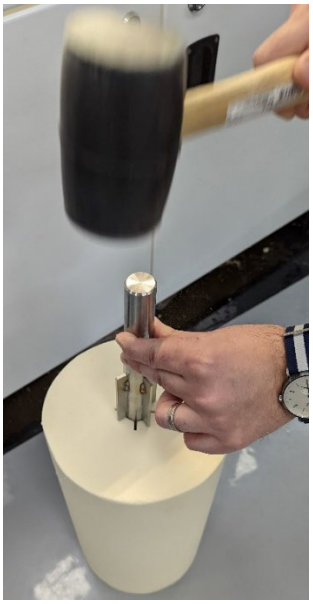

Figure 64: Inserting the Mandrel into a Foam Blank with a Mallet

2. Install the mandrel with the pre-inserted foam blank into the chuck of the Carver PRO-S™. The mandrel is properly installed when the engraved line at the left side of the mandrel is flush with the end of the chuck. Refer to Figure 71.

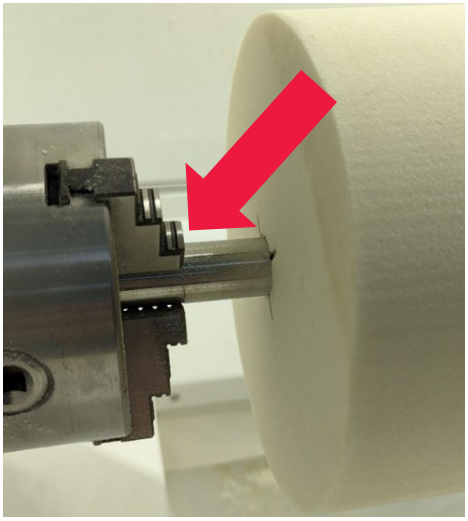

Figure 65: Proper Installation of the Mandrel in the Chuck

3. Tighten the chuck with the supplied square chuck key. Once the chuck is fully tightened, ensure the square key is removed from machine before operation.

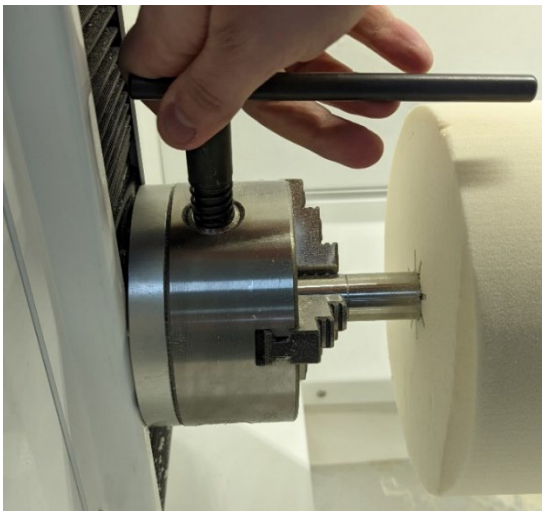

Figure 66: Tightening the Chuck with Square Key

4. Close the door of the Carver PRO-S™.

4.2 Using G-code Files

Once a user has acquired their desired G-code, the Carver PRO-S™ allows for G-codes to be loaded through either a microSD card or a network upload.

4.2.1 Loading a G-code File from a microSD Card

1. The user will need to copy the desired G-code file from their PC to a microSD card.
2. To do this, the microSD card may need to be inserted into an adapter. Upon insertion, the microSD card will typically show up on the user's PC as drive D.

Figure 67: microSD Card

3. Once the file is successfully copied, the user should remove the microSD card from the PC and insert it into the SD card reader located on the front left of the Carver PRO-S™.

Note: The microSD card must be inserted with the metallic contacts facing the center of the Carver PRO-S™.

Figure 68: Inserting the MicroSD Card

4. Once the card is loaded, press the microSD card button on the home page of the carver's HMI control screen, as seen in Figure 75.

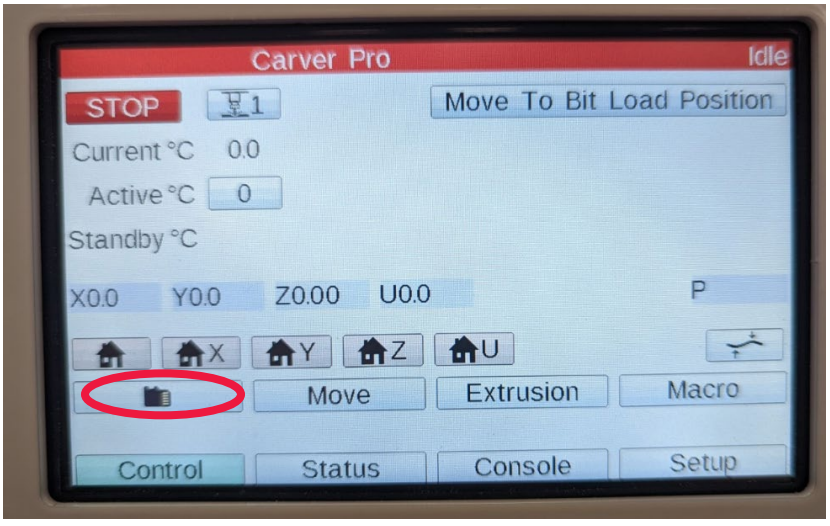

Figure 69: MicroSD Card Button

5. In the microSD options screen, press the microSD card icon to switch between the onboard SD card (Card 0) and the secondary SD card on the top of the machine (Card 1).

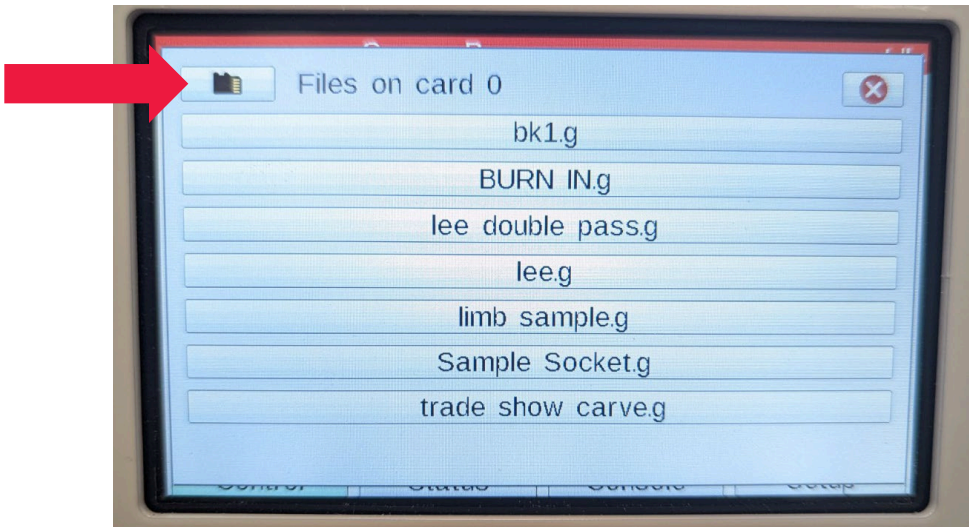

Figure 70: MicroSD Options Screen

6. Once the correct microSD card is selected, choose the desired G-code to run from the list.

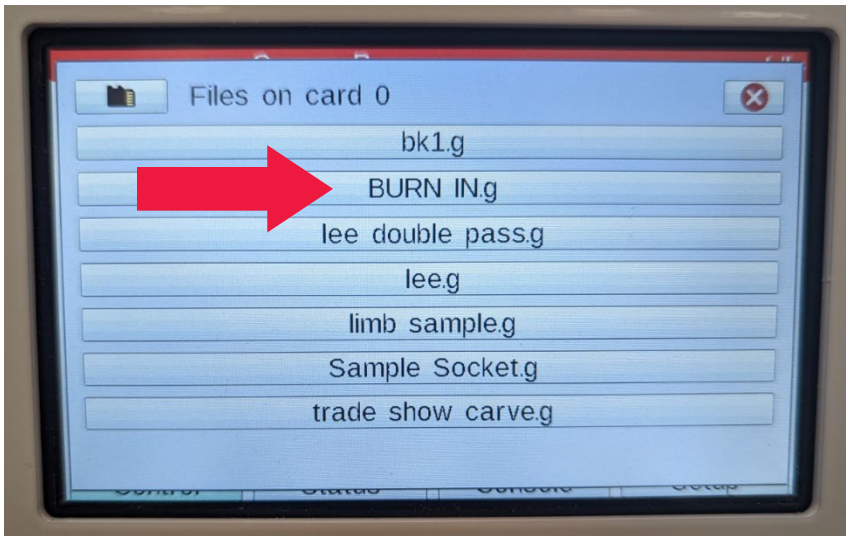

Figure 71: Select G-code

7. Select the **Print** button to run the G-code and begin the carve.

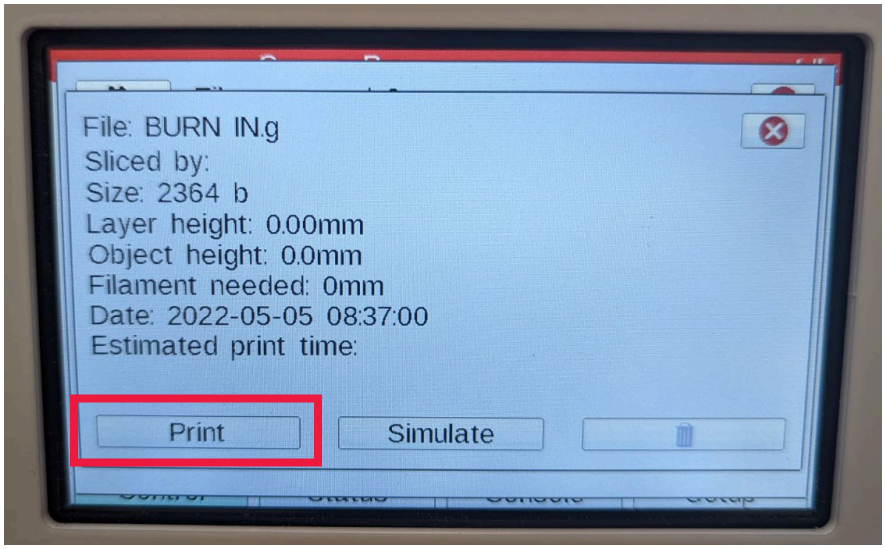

Figure 72: Print Screen for MicroSD Card

4.2.2 Loading a G-code File from an Internet Upload

1. Connect to the Carver PRO-S ™ via the web interface, as seen in Figure 79, by typing the carver's IP address into a web browser.

2. To upload a new file to the web interface, click the **Upload & Start** button in the upper right-hand corner of the web interface home screen.

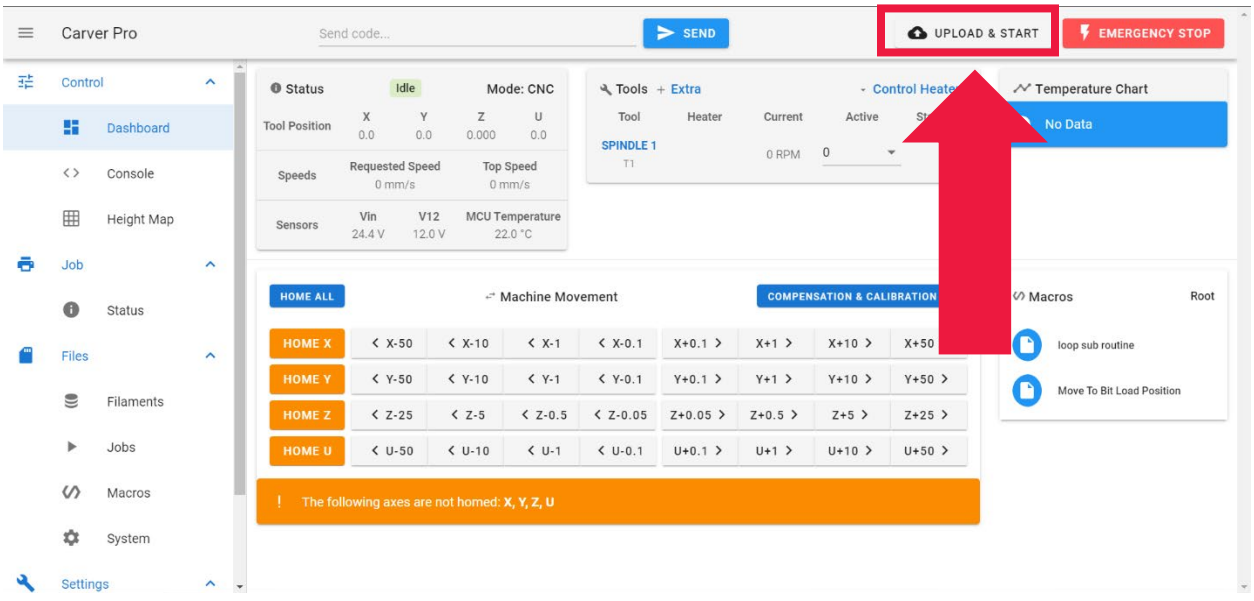

Figure 73: Carver PRO-S™ Web Interface Home Screen

3. When prompted, select the desired G-code to print and click the **Open** button.

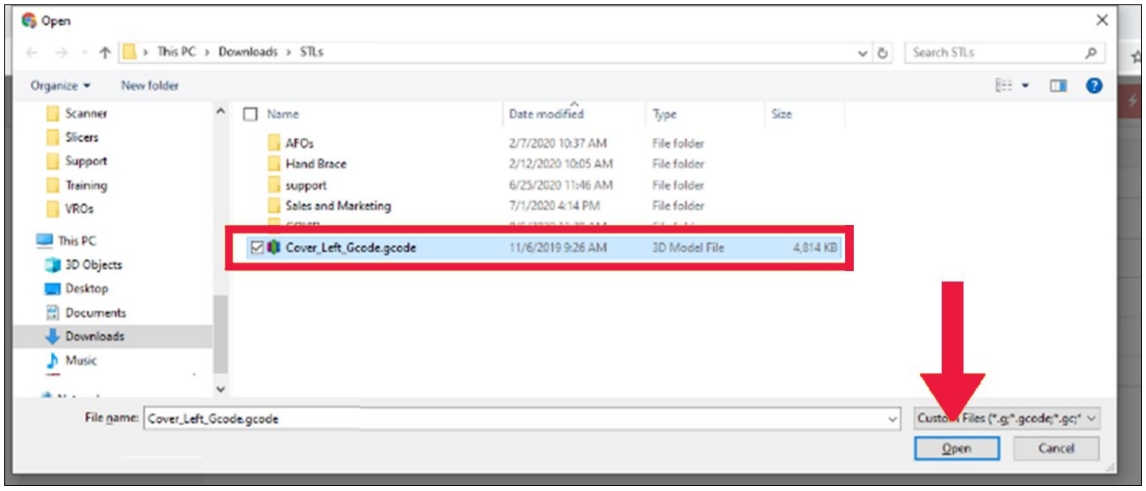

Figure 74: Select G-code and Open

4. Once selected, the interface will begin uploading the G-code file and a status bar will show its progress as it is being transmitted over the network to the carver. This file will be saved on Card 0, which is the onboard SD card.

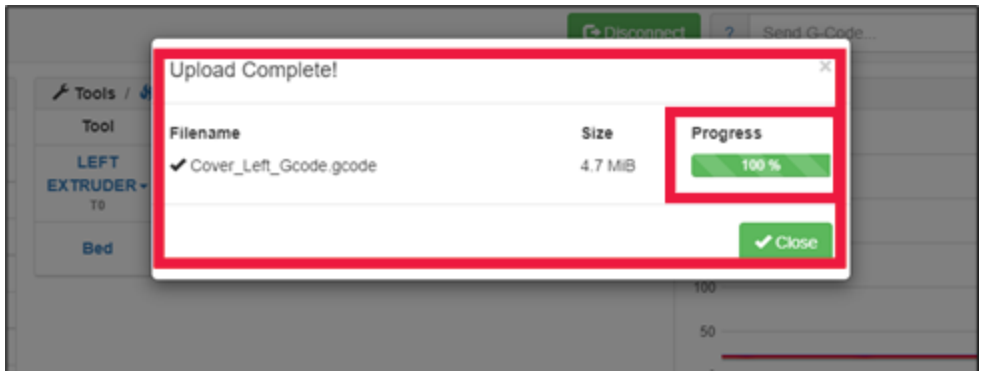

Figure 75: Upload Complete

5. After being successfully uploaded, the carver will begin the carving sequence for the selected G-code file.

4.2.3 Accessing G-Code Files from the Web Interface

Accessing G-code files via the web interface in a web browser allows for files to be uploaded, downloaded, deleted, and sorted into sub directories.

Files can be uploaded by browsing for them or by dragging and dropping them onto the **Upload G Code Files(s)** button.

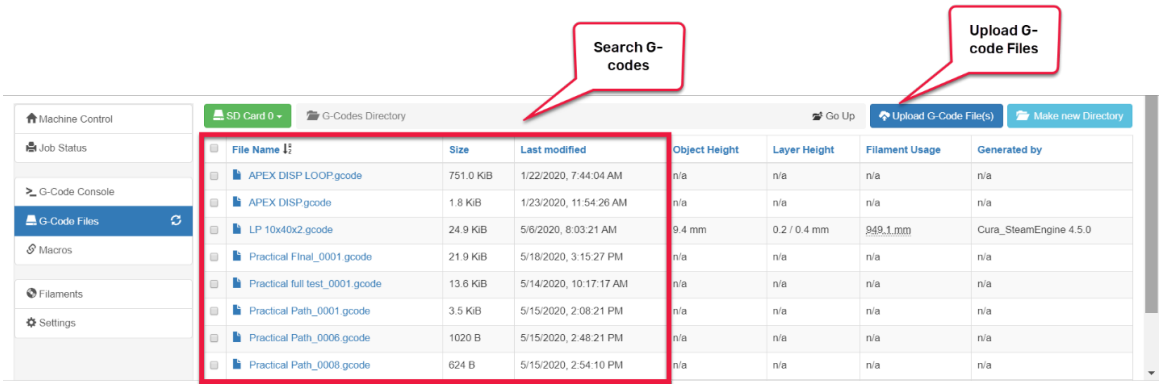

Figure 76: G-code Files in the Web Interface

To display a list of options for each G-code file that is currently uploaded to the web interface:

1. Right-click on the desired G-code file.
2. From this window, the user can choose to carve the part (**Print File**), estimate the carve path time (**Simulate File**), or download the G-code file (**Download**).
3. Users can also **Rename**, **Delete**, or **Edit** the selected G-code file in this section.

Figure 77: Right Click Options for G-codes in the Web Interface

Note: The file upload functionality in the web interface cannot be used while the Carver PRO-S™ is running.

4.3 Starting a Carve

1. After opening the file, the carver will automatically home all axes.
2. Once the homing process is complete, the spindle will move to the left side of the carver with Z axis fully retracted.

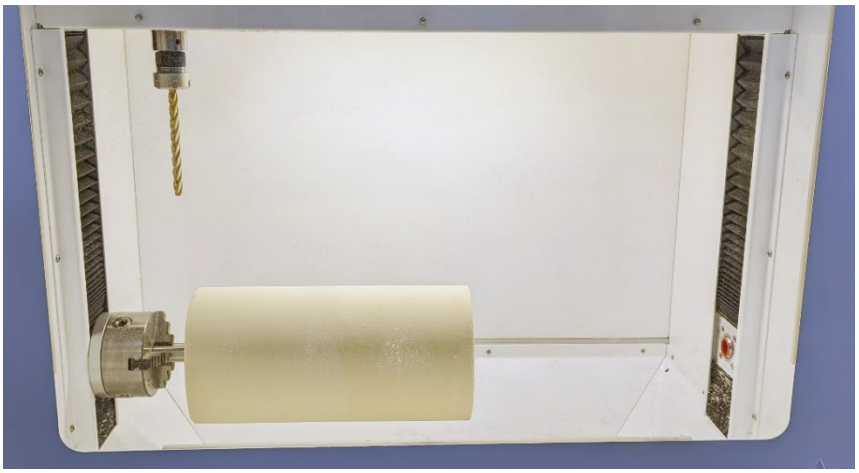

Figure 78: Homing Process Completed with Z Axis Fully Retracted

3. A **DEFINE THE ORIGIN** message will be displayed on the HMI asking the user to define the 0 point of the X and U axis. The axis that is currently selected will display as an underlined letter in the middle of jogging distances.

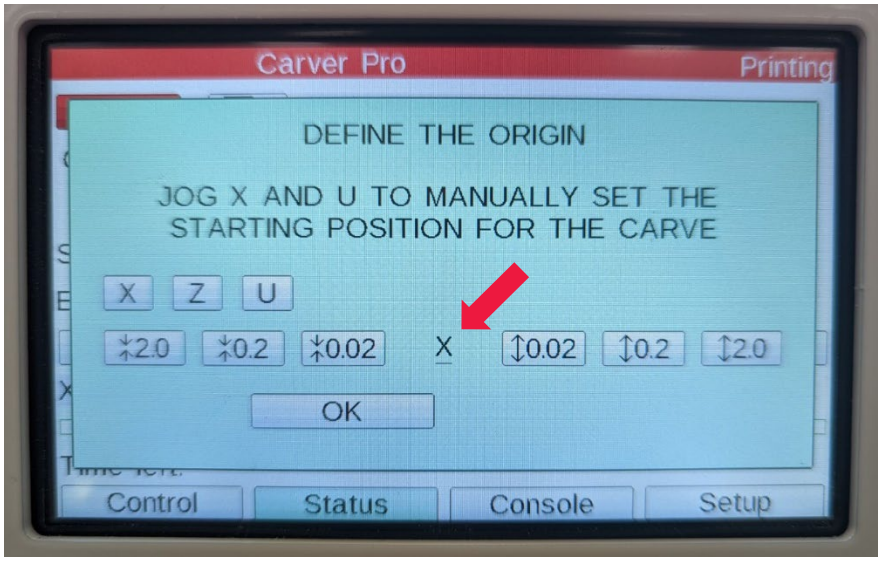

Figure 79: User Message to Define 0 Point of X and U Axis

4. Using the buttons on the HMI or the web interface, users can jog the axis to move the spindle to the starting point for the X and the U axes.

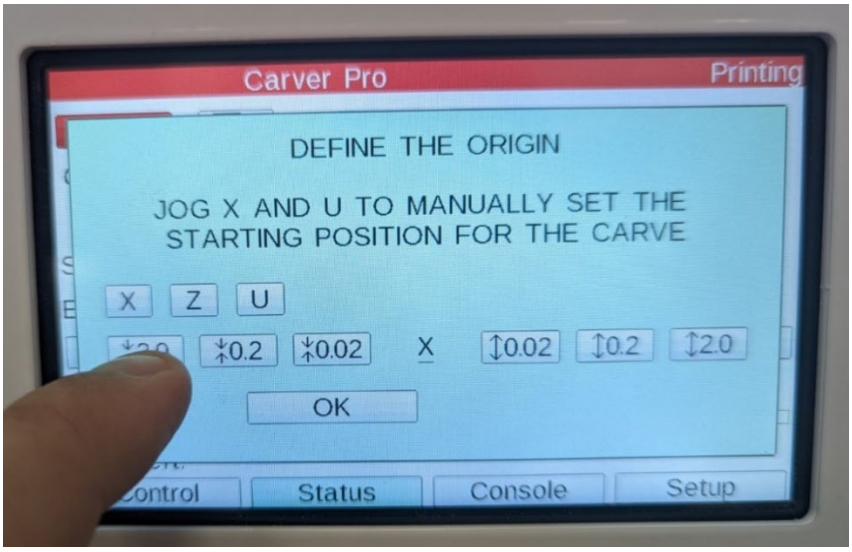

Figure 80: Jogging the X and U Axes on the HMI

5. The spindle should typically be centered over the left most edge of the foam blank.

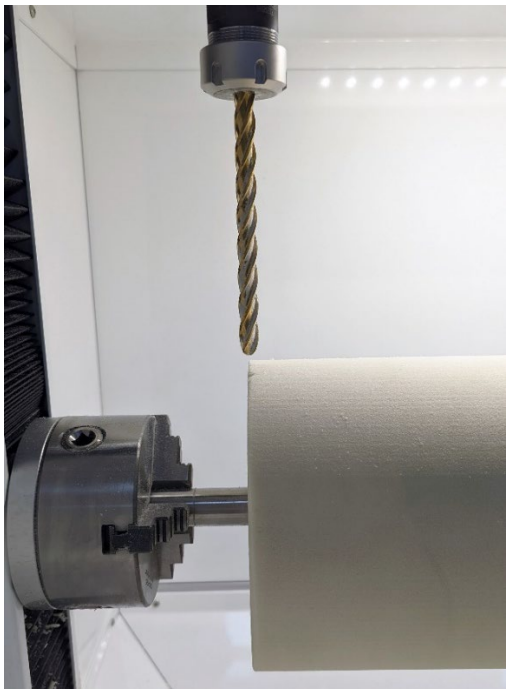

Figure 81: Spindle Centered Over Left Most Edge

Note: If the spindle is biased to the left edge of the foam, the material finished part will be short. If the spindle is biased to the right edge of the foam, there will be uncut material at the left side of the foam blank.

6. If using a rectangular blank, it will be important to rotate the X and the U axes, so the foam blank matches the orientation used in DeskProto®. Only the X and the U axis will be offset during this process. If the Z axis is moved, it will not be overwritten.

7. Do not open the door during this process or the current carve will be aborted.

8. To ensure the carver is moving in the desired direction, consider the following and refer to Figure 88:

    a. **X axis** – the icons would indicate the increment the user is moving closer to or further from the left edge of the machine.

    b. **Z axis** – the icons would indicate the increment the user is moving closer to or further from the end of the bit.

    c. **U axis** – the icons would indicate the increment the user is moving closer to or further from the current 0 point.

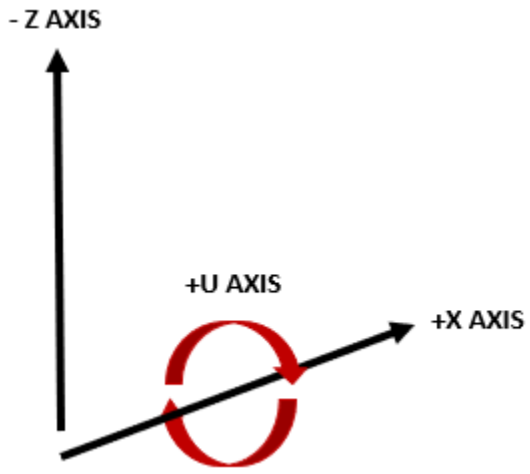

Figure 82: Axes Diagram

9. After defining the 0 point for X and U axis, select the **OK** button. The carve will begin using the new X and U axis zero point.

10. After the sample carve is completed, the spindle will be turned off, the Z axis will lower, and the spindle will move to the right side of the machine.

Figure 83: Spindle and Z Axis Locations After a Finished Carve

11. A completion message will be displayed on the HMI that includes the file name and total carving time in hours and minutes.

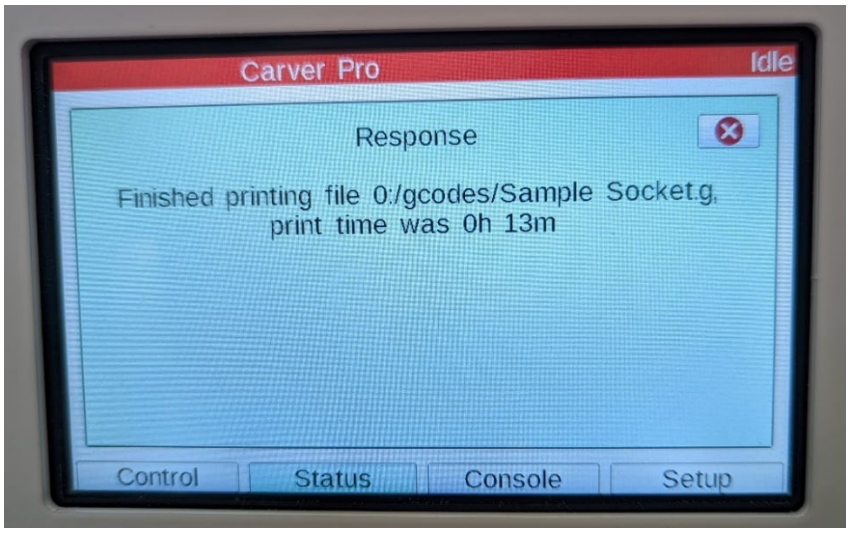

Figure 84: Sample Print Completion Message

12. The door of the Carver PRO-S™ can now be opened and the finished carve can be removed from the mandrel.

Figure 85: Removing Finished Part from Mandrel

13. Alternatively, the mandrel can be removed with the finished part still attached by opening the chuck with the square key.

Figure 86: Removing Finished Part and Mandrel

14. Upon completion, the cylindrical extension on the left end of the sample carve should measure 75 mm (2.95 in), as seen in Figure 93.

Figure 87: Finished Cylindrical Extension Sample Carve Tolerance

Note: This measurement may fluctuate slightly if the foam becomes compressed.

5. Cleaning and Maintenance

5.1 Ball Screw and Linear Guides

The ball screw and linear guides should be greased along with the fitting on the carriage every 100KM or approximately once a month, whichever comes first.

- Before applying grease, clean any buildup that forms on the ball screw and seals.
- A lithium-type, soap base, grease (JIS Type 2) should be used.

Note: Not all carver models have ball screw and linear guides with grease fittings. If a grease fitting is not present, apply a small amount of grease to the ball screw and linear guide, and move back and forth to distribute the lubricant.

5.2 Cables and Drive Belt

The cables in the flexible cable carrier and the spindle drive belt should be examined quarterly for wear. If either the cables or the drive belt have become worn, replace as necessary.

5.3 Waste Bin

Each Carver PRO-S™ includes a waste bin and a box of replacement waste bags for the bin. A key is provided to lock and unlock the enclosure doors to access the waste bin, as seen in Figure 94.

Figure 88: Accessing the Waste Bin

When the waste bin has reached capacity:

1. Unlock the doors using the provided key and slide the waste bin out of the enclosure.

Figure 89: Removing the Waste Bin From its Enclosure

2. Remove the used bag and replace with a new bag.
3. Roll the waste bin back into its enclosure.
4. Close and lock both enclosure doors.

Note: For safety purposes, ensure the waste bin enclosure doors are always locked when not actively accessing the bin.

5.4 Best Practices

- Do not wear loose clothes or jewelry when operating the carver.
- Do not touch the cutting bit while it is moving.
- Immediately engage the Emergency Stop button if personnel is in danger.
- Locate and define all safety labels on and around the carver before turning the machine on.
- Dispose of all used parts and materials in accordance with local laws and regulations.

Safety is a joint responsibility between the OEM and the end-user. All precautions and practices should be in accordance with local regulations.

Do Not: Use incompatible tools, remove door interlocks or bypass safety devices, make custom mechanics, or change material from the original design.

6. Appendix A

6.1 Carving Terminology

Carve Rate	The volume of foam carved per unit of time.
G-code	The file type that the carver will use to carve the model. This file contains all the settings and model information needed to create a carve.
Carve Speed	Defines at which speed (in millimeters/second) the bit moves while carving.
Profile	The saved settings applied to the model when carving in DeskProto® software.
DeskProto®	DeskProto® is a 3D CAM program. It can import STL files from any 3D CAD program, calculate CNC toolpaths, and then write NC program files.
Rapid Plaster®	PVA Med's exclusive modification software designed specifically for lower extremity prosthetics.
STL	A file type common for 3D models. Has the file extension ".stl".

7. Appendix B

7.1 Carver PRO-S™ Dimensions

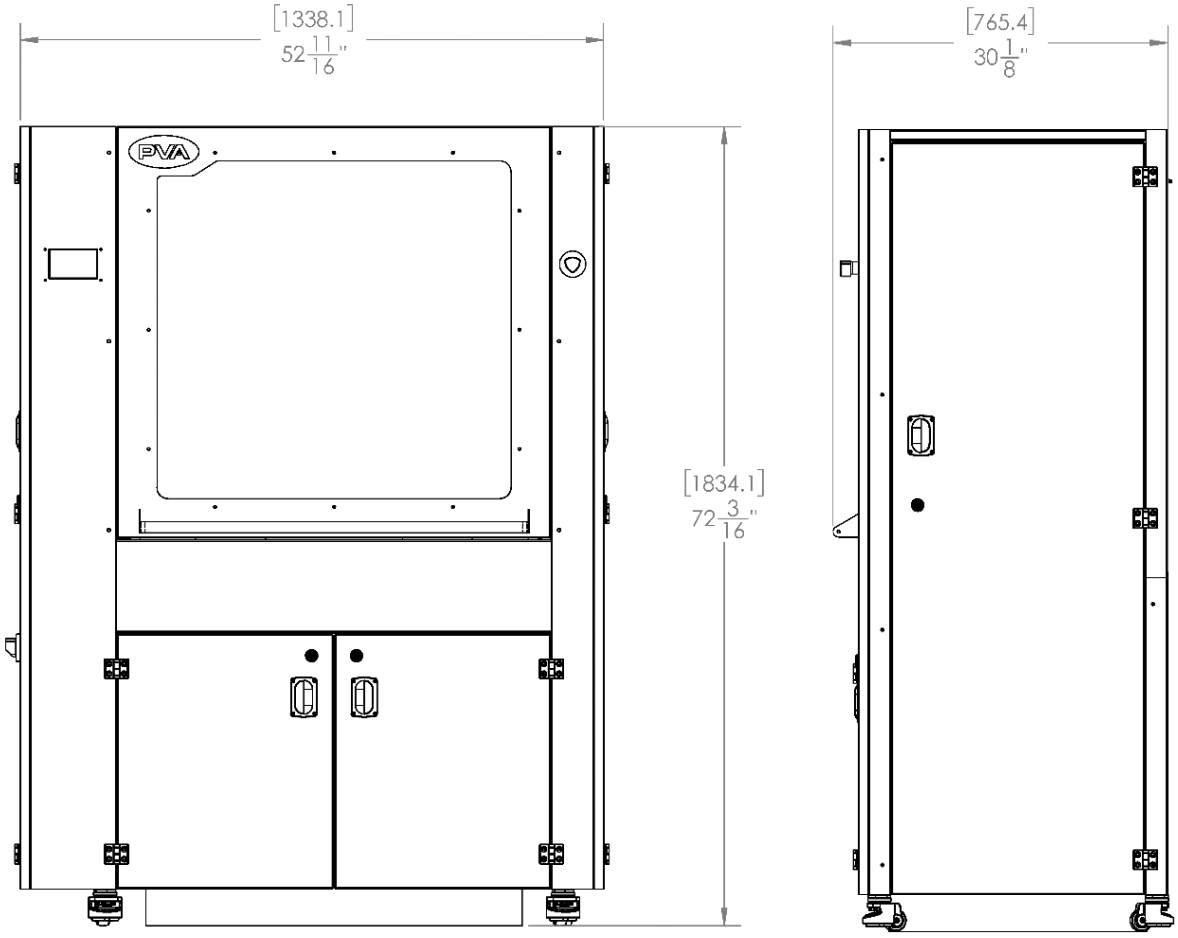

Figure 90: Carver PRO-S™ Dimensions

7.2 PVA Med Mandrel Dimensions

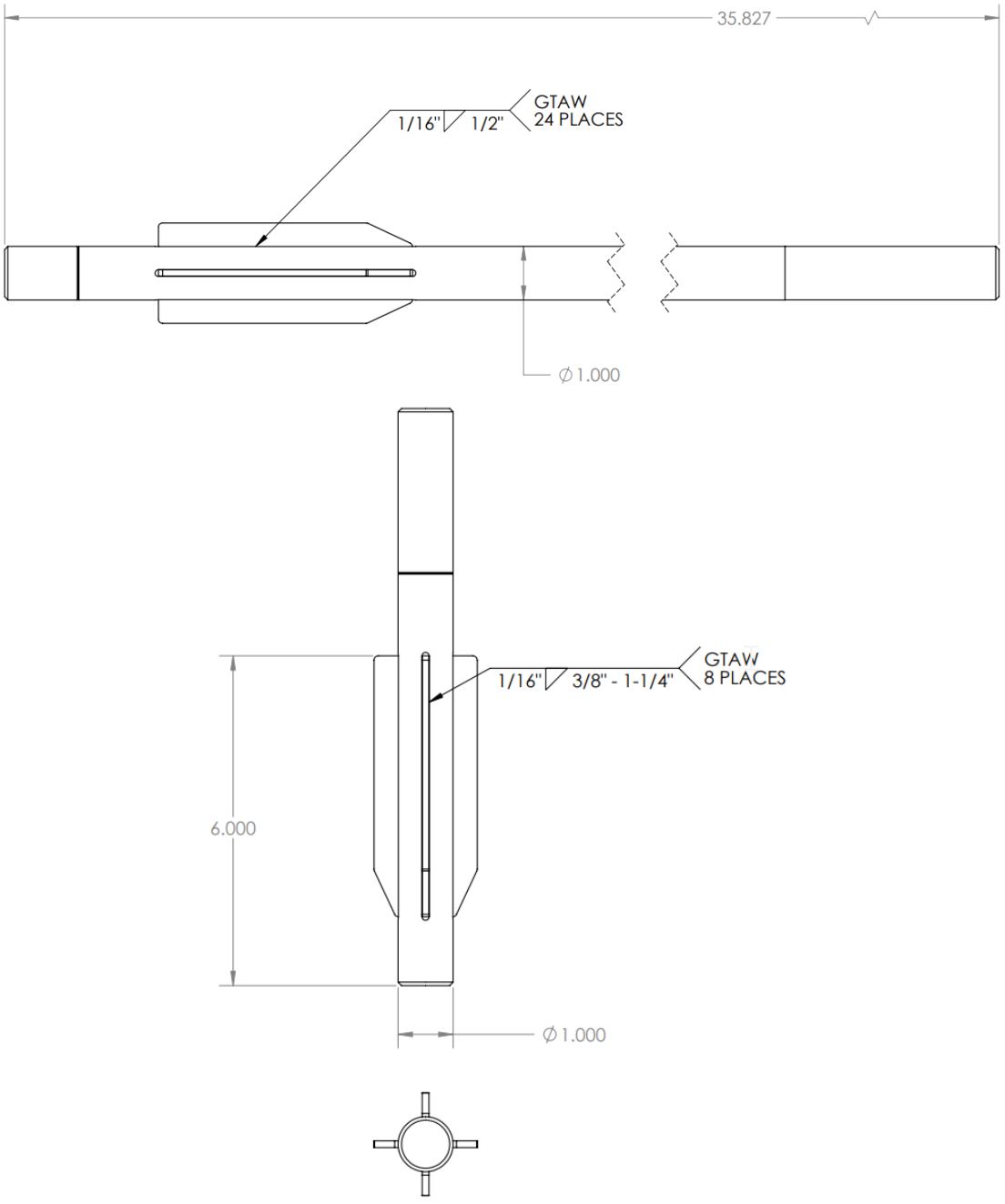

Figure 91: PVA Med Mandrel Dimensions

7.3 Spare Parts Kit

Item	Description	Quantity
1	Contactor	1
2	Timing Belt, 150 TH, 15 mm	1
3	Relay	1
4	Fuse ATDR-12	1
5	Fuse ATDR-15	1
6	Sensor, Prox 2mm, Range, NPN	1
7	GMC 3A Fuse	1
8	GMD 1A Fuse	1
9	End Mill, Ball End, 6 LOC, 8 OL	1
10	Stepper Motor	1

Figure 92: Spare Parts Kit

7.4 Technical Specifications and Warnings

- Do not use the Carver PRO-S™ if wires are frayed, connections are loose, or if unusual conditions are detected that could indicate a short.
- This machine is made of machined metal which may retain sharp edges. Improper handling may result in property damage or personal injury.
- Supervise any children who are near or using this product.

8. Table of Figures

9. Notes

10. Warranty

PVA Warranty Policy

PVA warrants the enclosed product against defects in material or workmanship on all components for one year from the date of shipment.

The warranty does not extend to components damaged due to misuse, negligence, or installation and operation that are not in accordance with the recommended factory instructions. Unauthorized repair or modification of the enclosed product, and/or the use of spare parts not directly obtained from PVA (or from factory authorized dealers) will void all warranties.

All PVA warranties extend only to the original purchaser. Third party warranty claims will not be honored at any time.

Prior to returning a product for a warranty claim, a return authorization must be obtained from PVA's Technical Support department. Authorization will be issued either via the telephone, facsimile, or in writing upon your request.

To qualify as a valid warranty claim, the defective product must be returned to the factory during the warranty period. Upon return, PVA will repair (or replace) all components found to be defective in material or workmanship.

(Retain this for your records)

Product Information:

PRODUCT: _____

SERIAL NUMBER: _____

DATE OF PURCHASE: _____