

# CALIBRATION & OPERATION

After the frame is built and the M2 is assembled, you are ready to use your new CNC!

**Drew's Note:** To better understand CNC, we recommend reading through this whole section before beginning the calibration process of the M2. This guide is for using standard bit diameters and does not cover V-bit usage.

## EXPERIENCED MASLOW USERS

This section will be covering calibration with Makerverse 1.1.2.

Check out [this](#) video on calibration!

You will have to set your Z Step Per Rotation to 472.5 for Easel, by inputting  $102=472.5$  in the console. Follow the steps in the calibration process to calibrate your M2!

## BEGINNER TUTORIAL

To use your M2, you will need a digital file, CAM (computer-aided manufacturing) software to create the Gcode program the M2 will follow, and a machine control application to send the Gcode to the M2. Part 2 will explain how to make a cut in Easel a Gcode generator. This tutorial will also show you how to use Makerverse, a machine control software, with a digital .SVG file.

## OPERATION & CALIBRATION PART 1: GET A DIGITAL .SVG FILE

### 1. Digital file:

You must have a digital file to CNC with the M2. We suggest a black and white SVG file. There are many files available online and tutorials on how to create them on YouTube!

### 2. Create a file:

You can download an SVG file or create one yourself using [Inkscape](#), found on your flash drive.

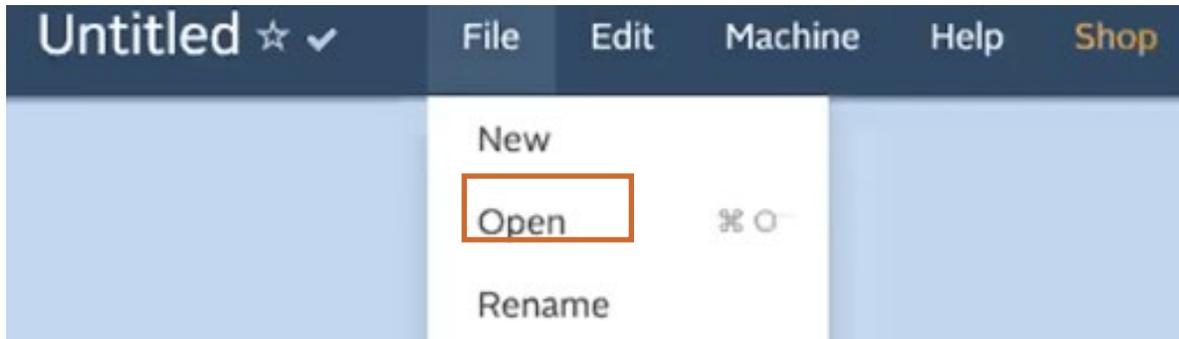
## OPERATION & CALIBRATION PART 2: USING CAM SOFTWARE

### 1. CAM software:

We suggest using the CAM program Easel to create your Gcode. Create a free Inventables account and login [here](#) to use it and here is a link to our [EASEL Playlist!](#)

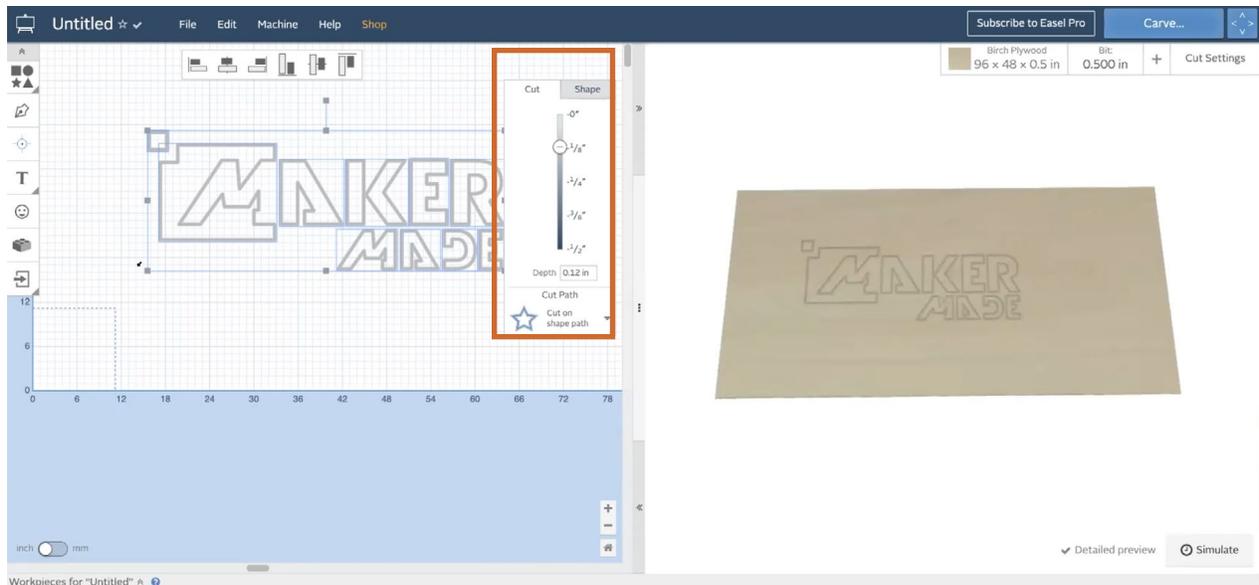
## 2. Open file:

Once you login, load your design by clicking “File” > “Open” and selecting your .SVG file.



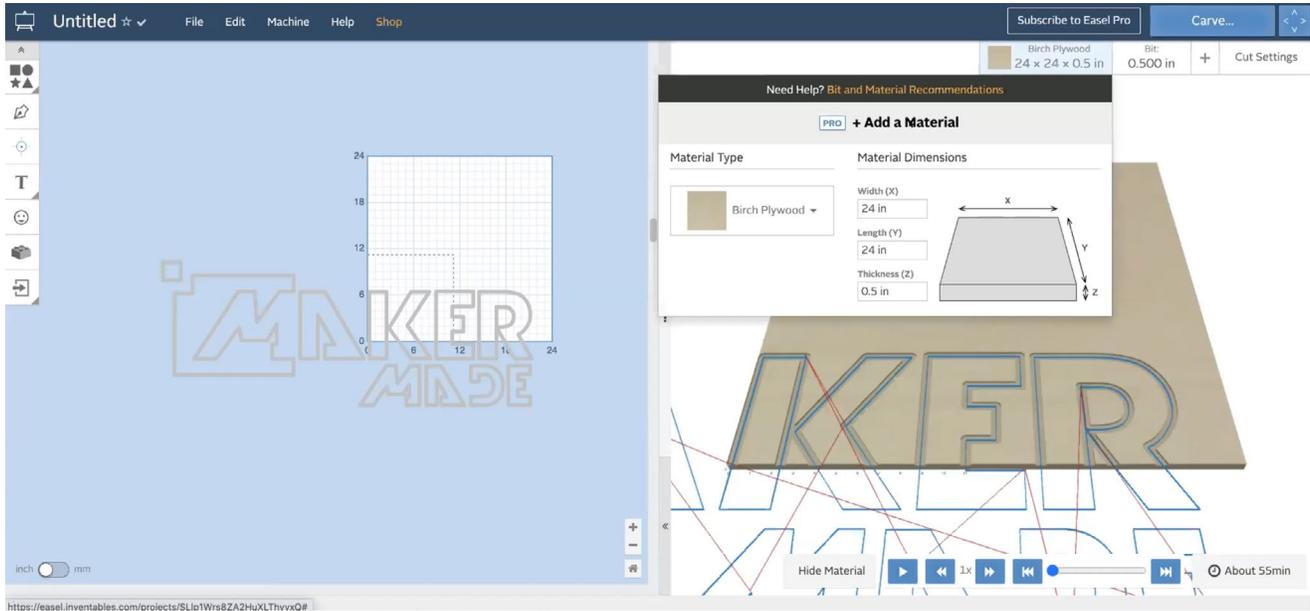
## 3. Choose depth:

Click on your file and “cut” tab in the dialog box to choose how deep the M2 will cut. If your SVG is split into multiple parts or isolatable, you can select different parts of your file to cut different depths.



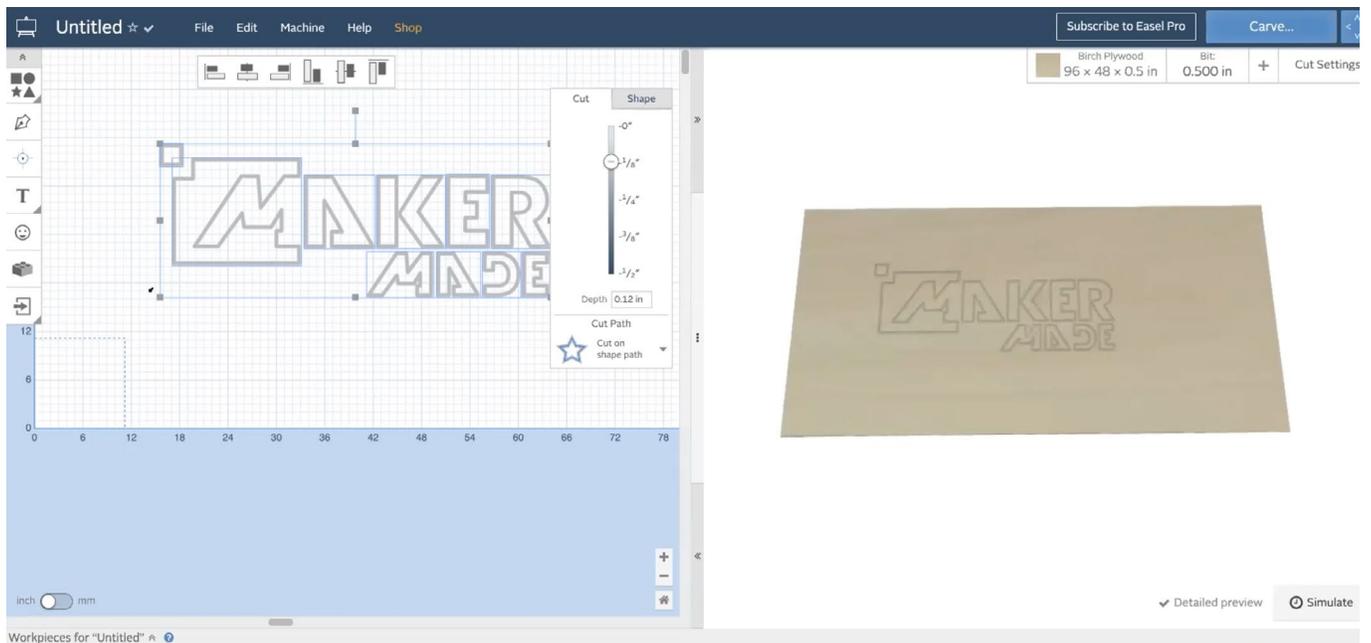
#### 4. Material dimensions:

You can change material dimensions by clicking the “material” tab. Select the material you are cutting and the size to save it in the Gcode.



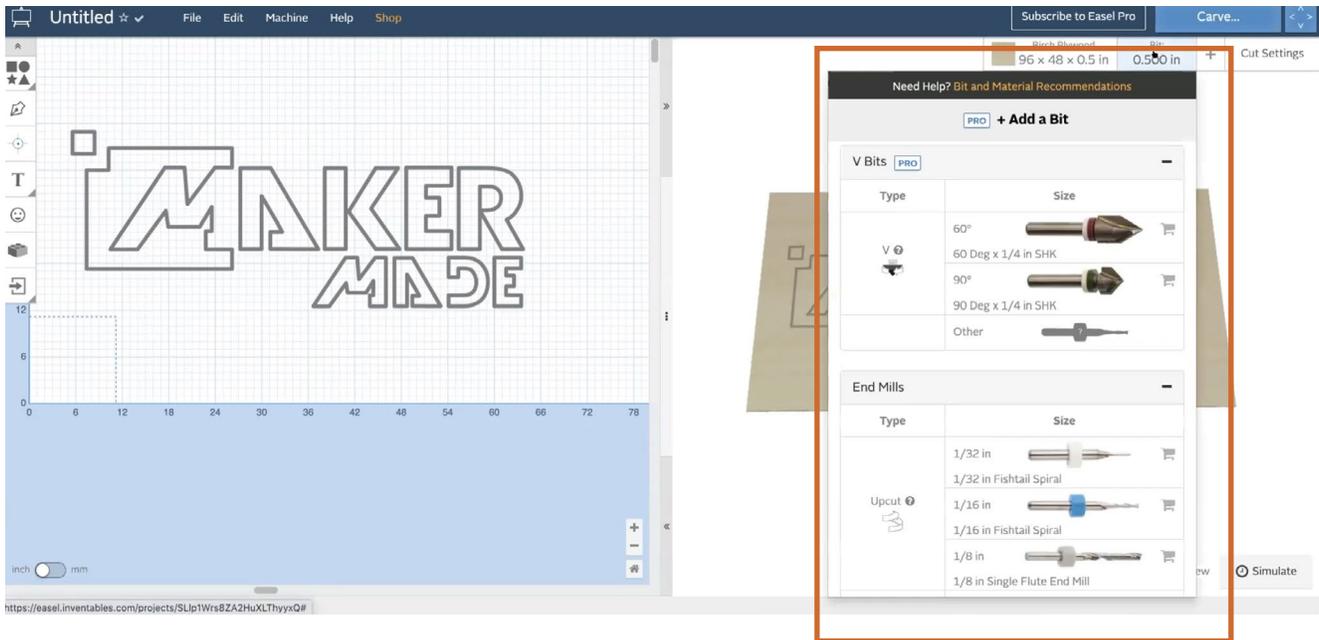
#### 5. Resize/move:

Once your model is selected, you can also resize it by dragging the small gray boxes around your file. See section 8 for instructions on homing your file to (0,0).

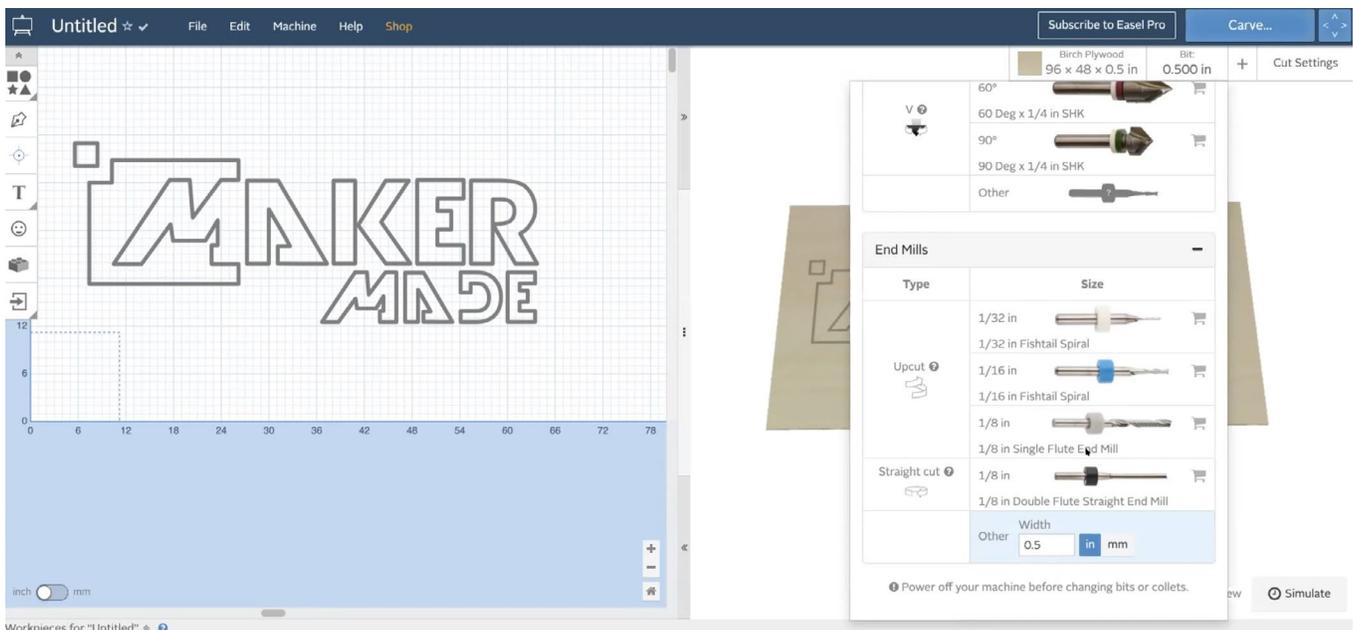


## 6. Change Bit

Change the bit settings to the same bit that is on your router. Click the “bit” tab and select your bit.

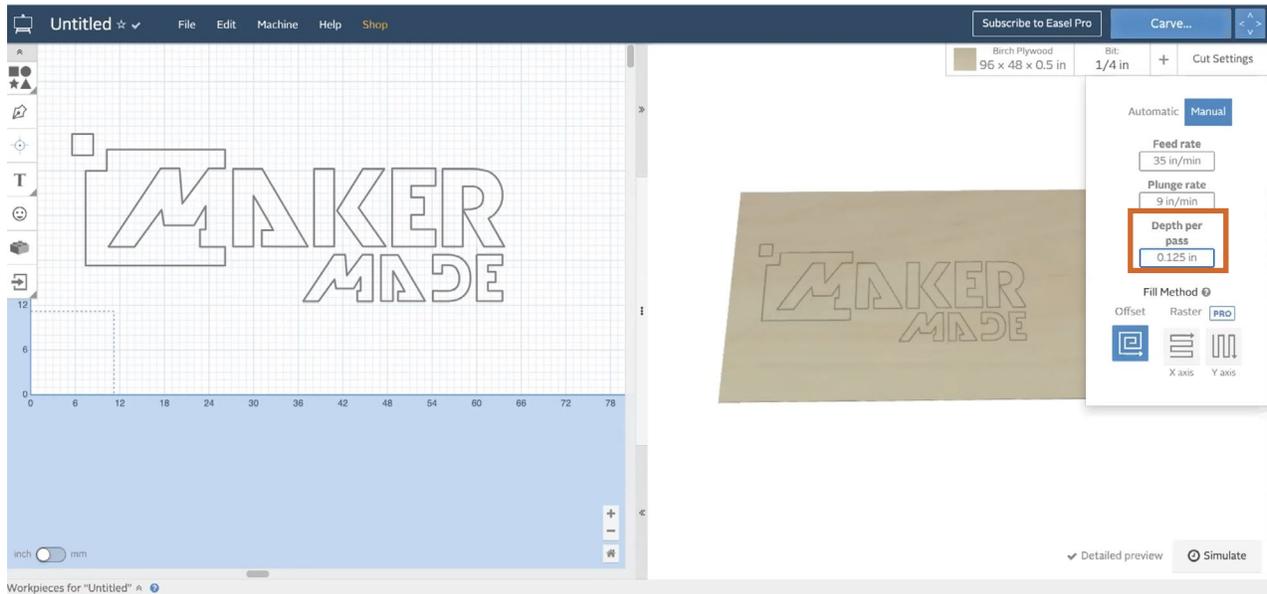


There are preset bits for the X-carve, but the best way to change it for the M2 is to scroll to the bottom of the tab and manually type in your bit size.



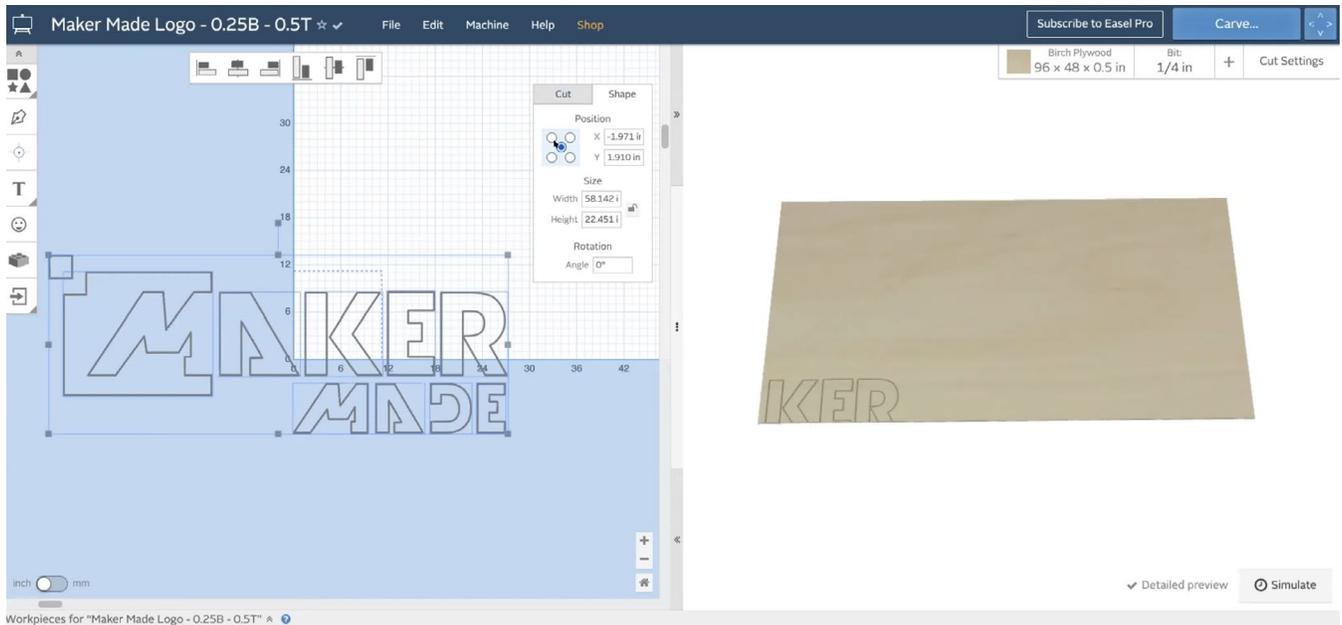
## 7. Change depth per pass

The safest and cleanest way to have a clean cut is to change your depth per pass to half of your bit diameter. Here, we have a 1/4in bit, so we changed our Depth per pass to 0.125 inches. You can leave the other values as they are for now.



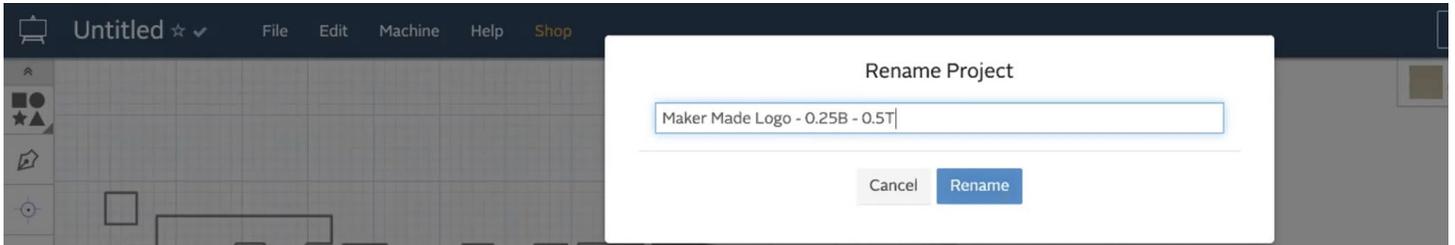
## 8. Arrange:

When you create your Gcode, your M2 will start cutting your file based on where X,Y both equal zero millimeters (0,0). You can arrange your file to start based on where you home your M2. Either select and move all the parts of your file or click the “shape” tab in the dialog box after selecting your model. Click the bubble in the five part matrix to choose where your M2 will start. The bottom corner of the grid is (0,0), and will correspond with where you set (0,0) home in your Machine Control Application for your M2.



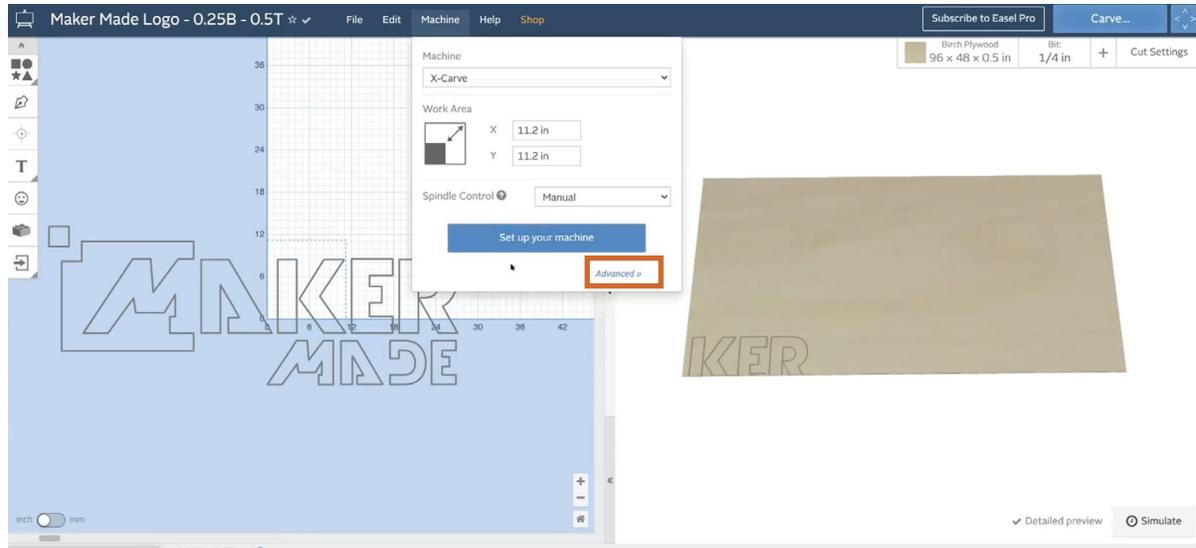
## 9. File management:

To keep track of the Gcode files you create to use them again, we suggest naming the file with the bit size and thickness of the material. Click “untitled” in the menu bar to change the name.

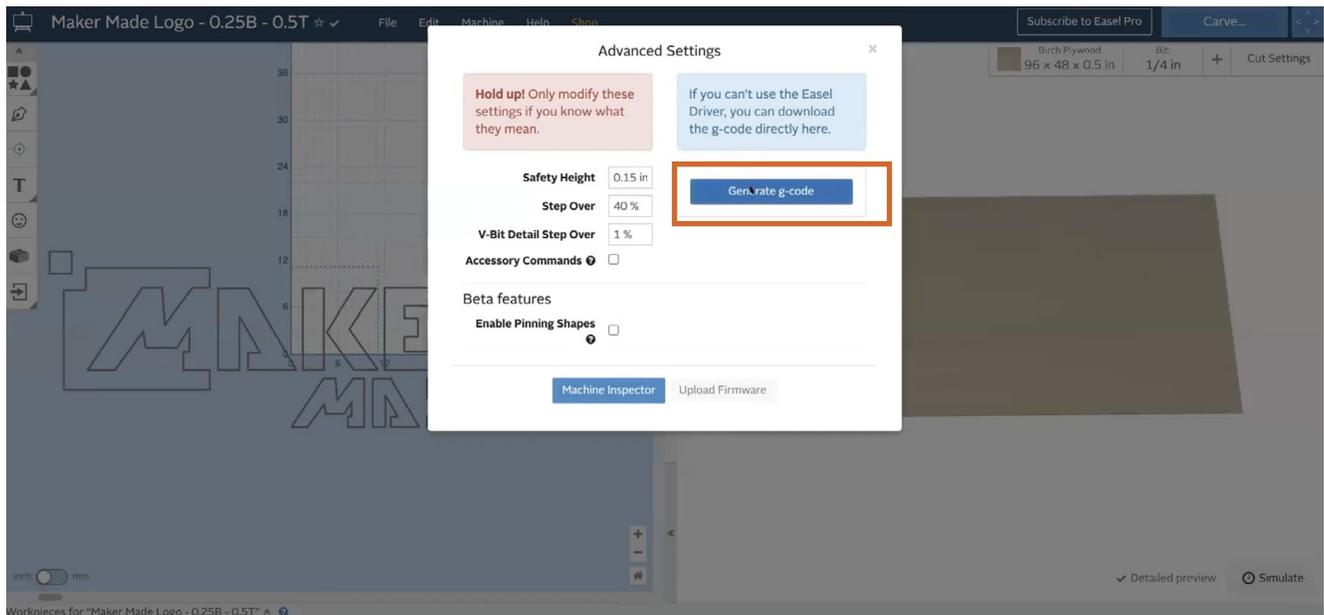


## 10. Generate Gcode:

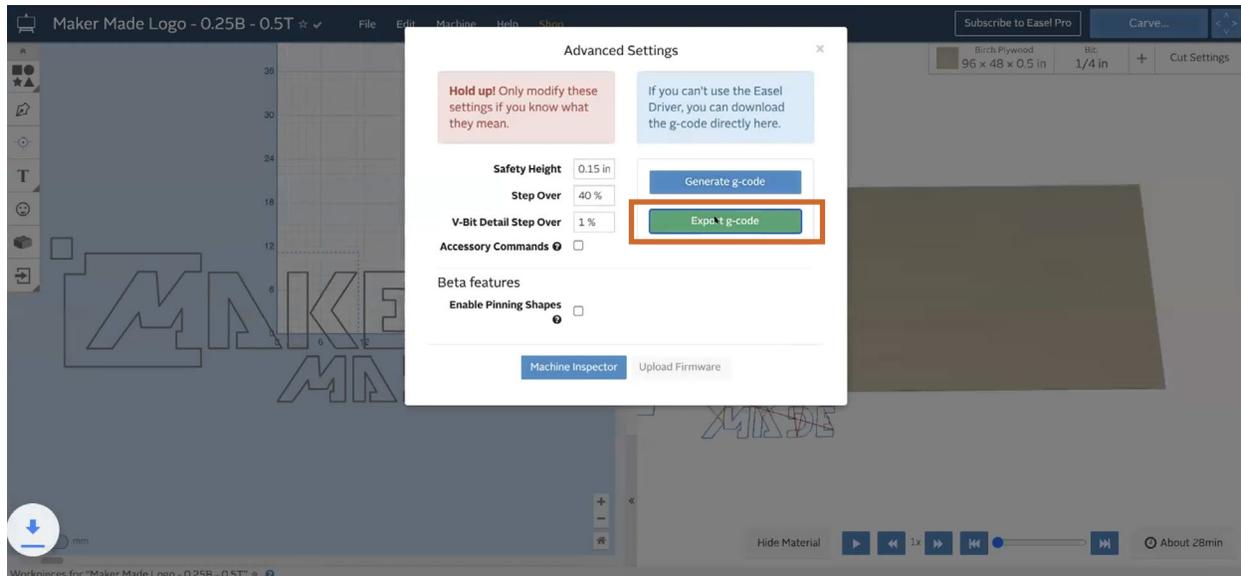
To generate your Gcode to cut, click “Machine” > “Advanced” to bring up the Gcode menu.



Then click “Generate g-code”.



Then “Export g-code” to save the Gcode. You will upload this Gcode into the Machine Control Application. You can leave the other default setting alone until you become more comfortable with your M2.



You finished exporting and are ready for the next stage!

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## OPERATION & CALIBRATION PART 3: CALIBRATION AND HOW TO USE THE MACHINE CONTROL APPLICATION MAKERVERSE

### 1. DOWNLOAD:

You need a machine control application (also known as a Gcode sender). We suggest our Makerverse for your M2 and many other CNC machines. It's based off the open source CNCjs software. Coming soon to the Windows and Apple Stores, you can download it for your Windows, Mac, or Linux computer here: <http://www.makerverse.com/>

**Drew's Note:** If using a version of Makerverse before 1.1.2, you must uninstall it from your computer and reboot for version 1.1.2 to work correctly. You will also need to update your firmware. Instructions can be found [here](#).

### 2. OPEN MAKERVERSE:

Click "allow program" to open. It is pending release in the Windows and Mac App Stores. An account is not required, but you may set one up later.

### 3. LOGIN:

To use Makerverse, you must create an account. Create an account and verify your email address. You can login to your makerverse account from any device!

### 4. CREATE A WORKSPACE FOR YOUR M2:

A workspace holds a connection to a single machine. It knows how to communicate with the machine (what port the machine uses, for example). It will run your cuts and generally be the home of your machine.

A workspace does not store machine settings. In almost every case, your machine itself stores things like the calibration settings. This means that you can detach the machine from the USB port and safely connect it to a different computer (running Makerverse, or any other program compatible with your machine) and the machine will continue to function.

Click "Connect to a New Machine" and then choose "Maslow M2" to get started.

New Workspace

Connect to a Machine CNC

**Maslow (Due)**  
*Maslow built with the Arduino Due ('M2', or similar).* Select

**Maslow (M2)**  
*The official MakerMade M2.* Select

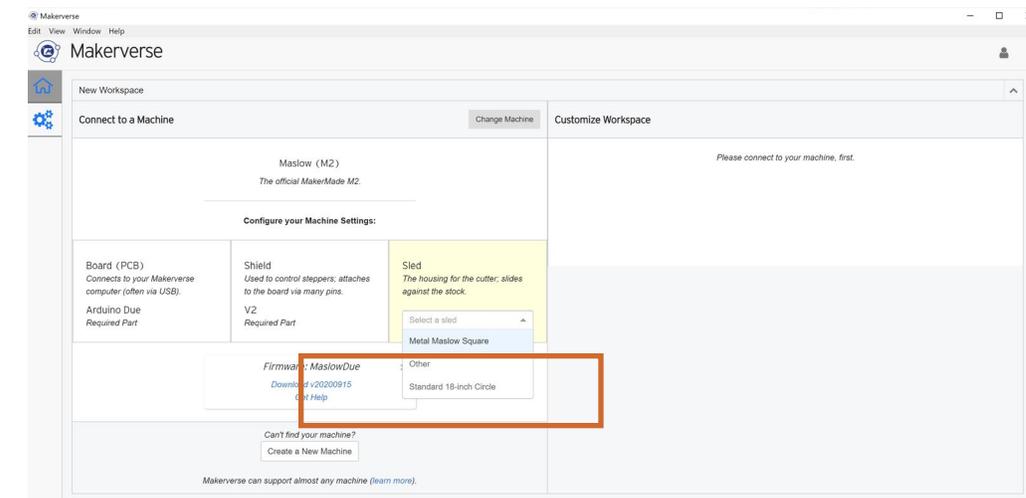
**Maslow (Mega)**  
*The original Maslow, built with the Arduino Mega ('Classic' or 'JumpStart' kits).* Select

Can't find your machine?

Makerverse can support almost any machine ([learn more](#)).

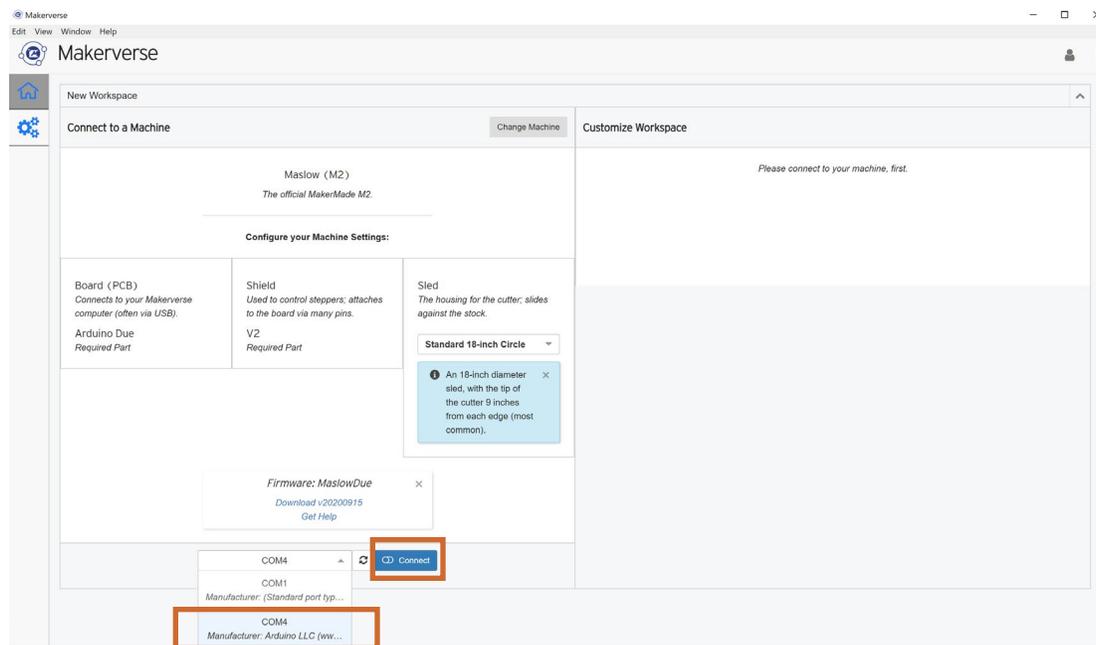
## 5. CHOOSE SLED:

Choose the “Standard 18-inch Circle” for your M2.



## 6. CONNECT YOUR M2:

Plug your M2 USB into your computer and the power plug into the socket. Click the drop down menu and choose the port that reads “Arduino LLC” and click connect!



**Drew's Note:** If you don't see your M2 right away, click the refresh button next to connect.

You will see data fill the screen when it connects.

## 7. VERIFY CONNECTION AND FIRMWARE

You will know your M2 is connected when you see the information about your machine fill out around the connection screen.

Verify that your firmware on the bottom tab is the same as the link: v20200915. If it is a lower number, follow [this link](#) to flash your board to the current version, or your M2 will not connect.

The screenshot shows the Makerverse software interface. On the left, under 'Connect to a Machine', the 'Maslow (M2)' machine is selected. Below this, 'Configure your Machine Settings' includes sections for 'Board (PCB)' (Arduino Due), 'Shield' (V2), and 'Sled' (Standard 18-inch Circle). A notification states: 'An 18-inch diameter sled, with the tip of the cutter 9 inches from each edge (most common)'. The 'Firmware: MaslowDue' section is highlighted with a red box, showing 'Download v20200915' and 'Get Help'. Below that, a 'Confirmed Protocol: Maslow' notification is shown, and the 'Response Protocol: Grbl v1.1g' and 'Firmware: MaslowDue v20200915' are also highlighted with a red box. On the right, the 'Customize Workspace' panel is visible, showing axis settings (X, Y, Z) and a 'Create Workspace' button.

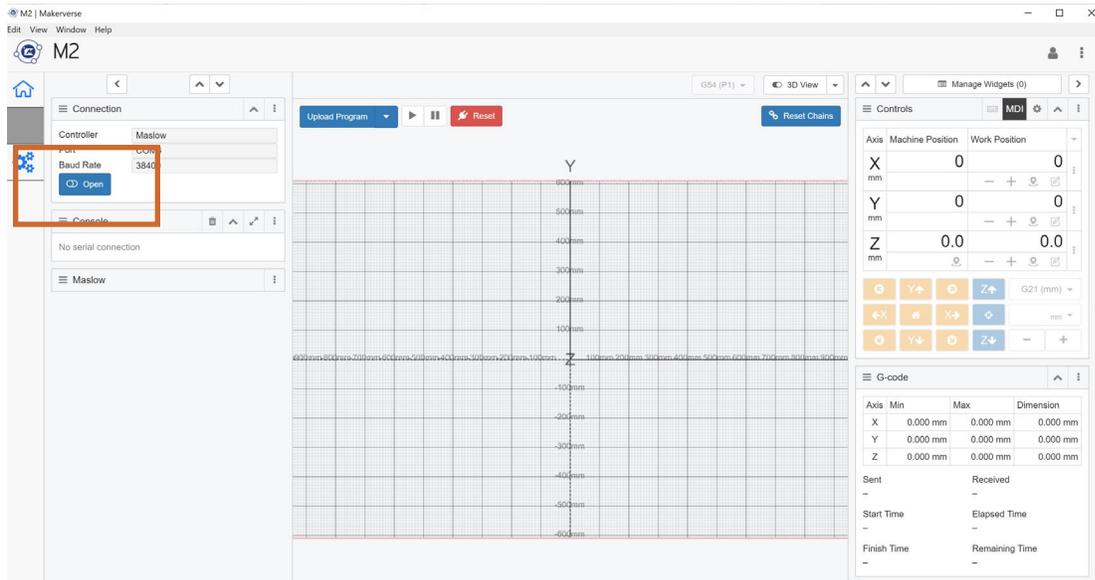
## 8. CREATE WORKSPACE:

You can name your machine's workspace and click "Create Workspace". Icons and background customization will be in available in a future update.

This image shows a close-up of the 'Create Workspace' form. The 'Name' field is highlighted with a red box and contains the text 'M2'. Below it, the 'Icon' field is labeled 'Choose an icon' and the 'Background Color' field is a color picker. There are also two checkboxes: 'Connect automatically' and 'Prefer inches?'. At the bottom, a blue button labeled 'Create Workspace' with the subtitle 'Your machine's new home.' is highlighted with a red box.

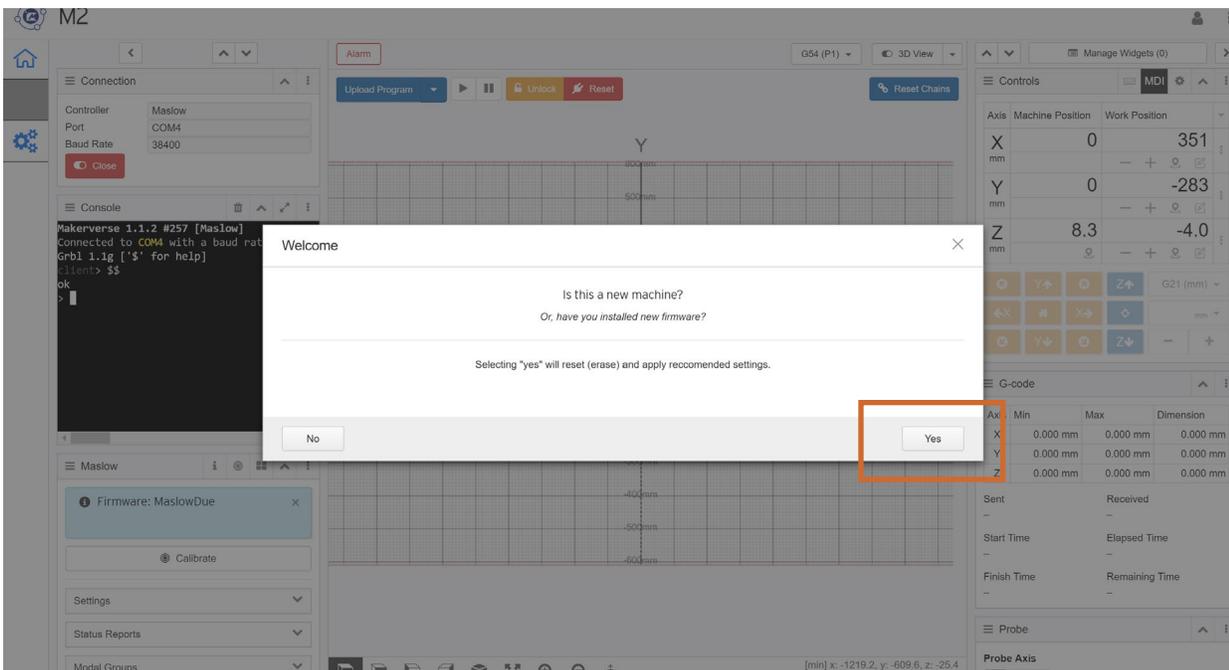
## 9. CONNECT M2 TO WORKSPACE

You are now in your M2 Workspace! Click “Open” to connect your M2.



## 10. CALIBRATE

When you connect a new machine, you need to calibrate it to your frame. Click “Yes” to start the calibration and follow the onscreen steps!



**Drew's Note:** When connecting your M2 for the first time, be sure to be close to a power source to unplug if anything does not go as planned.

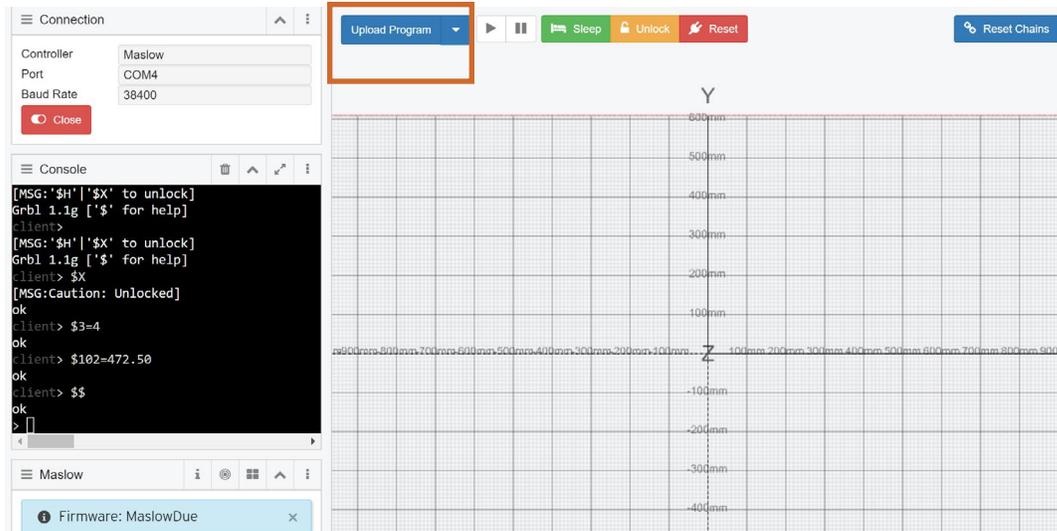
If the X, Y, and Z motors are not plugged in completely to the motors and Arduino DUE Board, the M2 will not follow your commands and will act wonky (like continuing to move when you only told it to move 1 inch).

## OPERATION AND YOUR FIRST CUT

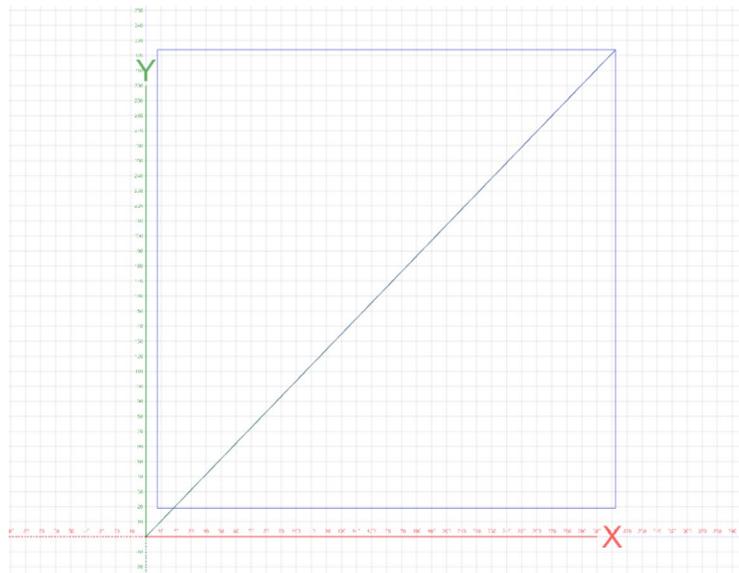
After calibration, you are ready to cut! Here are the instructions over how to cut with your M2.

### 1. UPLOAD GCODE:

Click “Upload Program” and select the Gcode file you created in Easel.



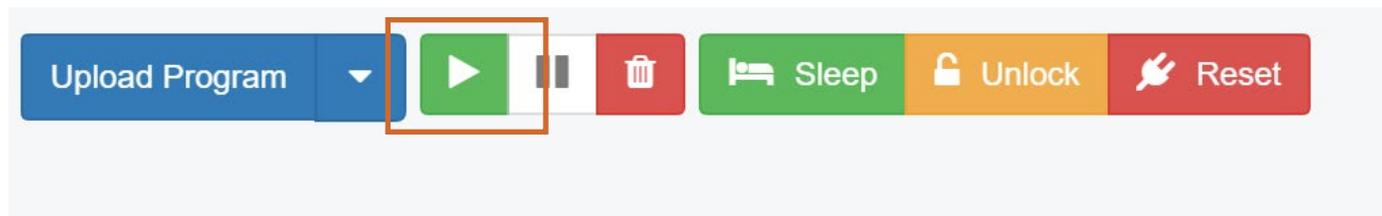
You'll know your Gcode loaded correctly when Makerverse displays the path of the Gcode you loaded! You already set the dimensions and depths in Easel for the M2, so it's ready to start! We recommend a one foot or one meter square as your first test cut for calibration, set to cut outside the shape path.



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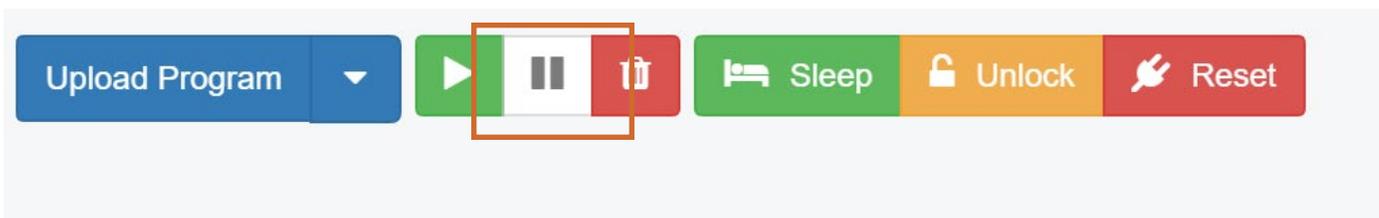
## 2. START:

Before you cut, raise the Z-Height 3mm above your print surface (so it doesn't start touching your material). Put on safety goggles, set your router RPM to the recommended cut speed for the material, manually turn on your router so your bit is spinning, and click the green "Run" button to begin cutting out your project! **We recommend running the first cut with the**



## 3. PAUSE/STOP

To pause or stop the M2, click the "Pause" button on the top bar. Once the M2 is paused, you will be able to stop the project by clicking the "Stop" button next to it. It must be paused before you can stop the project!



**Drew's Note:** When your M2 is cutting for the first time, be close to the power source to stop all operation if something goes awry. After your first cut, you should measure and compare the real values of your square cut to the values of your Gcode for scaling. Be sure that you set easel's cut path around the outside of your square, so you can have the correct measurement from the inside edge to inside edge.

#### 4. WORK POSITION:

When working on projects, setting and changing your Work Position Home will make using your M2 more fun and efficient.

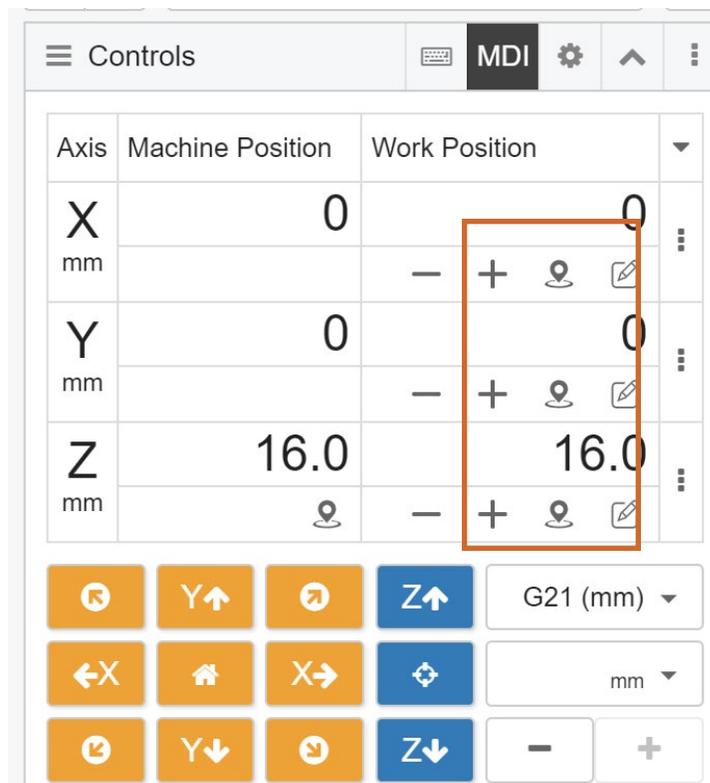
Once you home your M2 out of the box, we recommend changing your Work Position (0,0) for projects, instead of resetting home every time you are cutting a new project. This will save time and calibration headaches!

For example, to use every part of your 4'x8' material you can set different work positions each time you cut with your M2. Then you could cut the same project out of different sections of your material!

To set the work position, jog the M2 to the position on your material where you want to begin. Then click the “Zero Out Machine” locator icons for X and Y under Work Position to set your new Work Home.

Now when you run your M2, you can begin from where you set your temporary home position! We recommend cutting 3 or 4 times and measuring until your cuts are near exact to your Gcode.

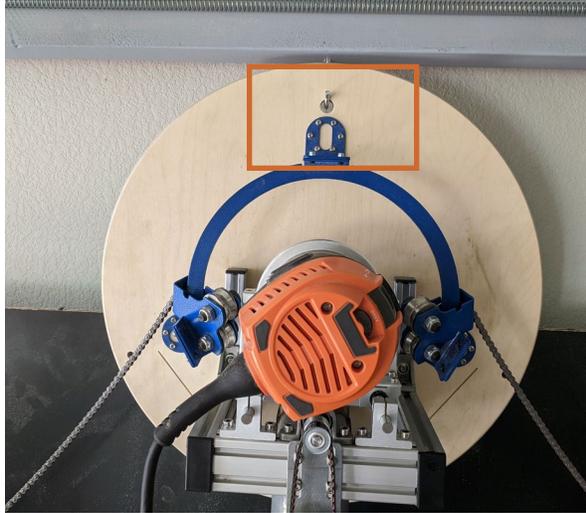
You now know how to start making projects on the M2. Happy making!



# APPENDIX 1 - TIPS

[Click here to check out updates on our FAQ section!](#)

**We recommend attaching a hook to the Top Beam to hold the M2 when not in operation. This can reduce stress on your chains and spring, and give the M2 a safe place to park.**



**Always wear safety goggles.**

**Always clamp the material you're cutting to the Wasteboard Stud Mounts so it doesn't move during operation. You can also securely attach it to the Wasteboard using screws.**

**Always raise the Z-Height to 3mm above your print surface before you turn on your router and run your M2.**

**Never leave your M2 unattended while in operation.**

**Makerverse does not control your router, it only controls your M2. You must manually turn your router on and off.**

**In case of an error always turn off your router before you turn off your M2.**

**Always remember to turn on your router before clicking "Run" in Makerverse and turn off your router after the M2 is paused, stopped, or has completed the project.**

**It's a good idea to make sure you're behind the waste board when you declamp materials, as they can fall to the ground on your foot. Nobody wants that.**

**When installing the frame, we recommend a friend help connect the spring and each person wear safety goggles during stretching. The chain can snap back causing damage to self and surroundings.**

# APPENDIX 2 - TROUBLESHOOTING

## Frame / Mechanical Issues

If your M2 is slanting up or down, check these parts of your frame build:

1. The bottom of your wasteboard should be 12" from the bottom of your footers.
2. The wasteboard should be clamped or screwed onto the stud mounts, to maintain a 15 degree angle.
3. The target distance of the motor offset (from the top of the chain to the top of the wasteboard, should be at least 18" for a 4'x8' frame.
4. Make sure your wasteboard is as flat as possible.
5. Your frame must be square. Ensure that the stud mount and top beam measurements are symmetrical.
6. Make sure all of the T-nuts, bolts, and screws are tight on your M2 and frame.
7. If your M2 is slanting on different materials, increase the RPM of your router and decrease your cut per pass depth. Your bit can pull the M2 sled in different directions based on the depth, bit, and RPM.

## Calibration / Digital Issues

If your M2 is not accurate or slanting, check these calibration settings:

1. Don't round measurements. If you measure 25.478mm, then input that into Makerverse.
2. Measure the exact size of your wasteboard by hand and set your home in the middle. Input your wasteboard size into Makerverse.
3. When you change a value, the Makerverse UI might not immediately show the change. You can disconnect and reconnect the port to see your changes.
4. Always set your home in the center of your wasteboard and use work offset home. If you constantly change the position of home, your M2 will not be calculate properly.
5. The most important measurements are the distance between motors, motor offset (from chain to top of wasteboard, and the exact size of your wasteboard.

# APPENDIX 3 - LINKS

[Click here to check out updates on our FAQ section!](#)

Easel: <https://www.inventables.com/technologies/easel>

Inkscape: <https://inkscape.org/>

M2 Resources: <https://makermade.com/m2-resources/>

Makerverse: <https://makermade.com/resources/>

Makerverse Calibration Video: <https://youtu.be/HsnEQgeWrml>

Marketplace: <https://makermade.com/marketplace/>

Router Guide: <https://makermade.com/m2-resources/>

Weekly Beginner Training Link: <https://makermade.com/resources/>

YouTube Playlists: <https://www.youtube.com/c/MakerMadeCNC>