2020 DrawBot
Installation and Use

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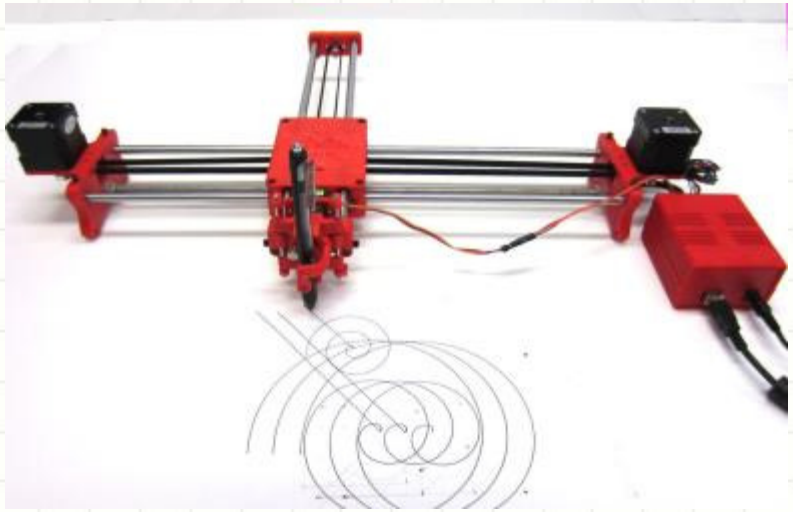
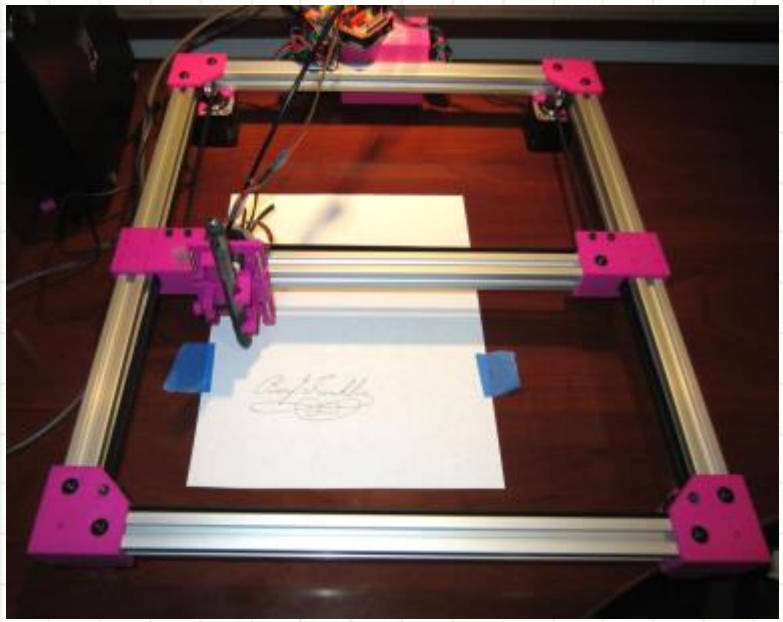
2020 DrawBot Software

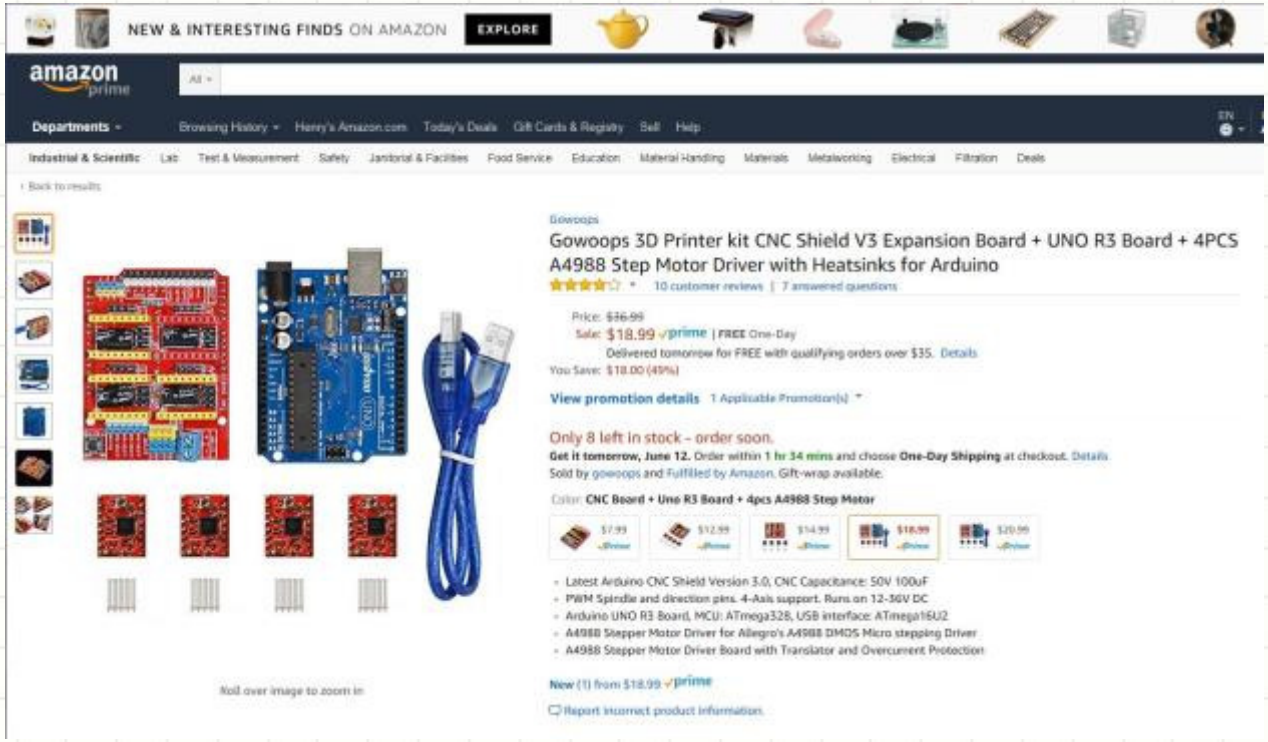
If you are viewing this document, you probably just finished assembling your 2020 DrawBot. In order to use your DrawBot you will need to install software on your computer. This document explains how to install the software, how to use your DrawBot, and how to do basic operations with Inkscape. These instructions will work with both the open beam style Drawing Robot and the 2020 DrawBot closed frame style.





2020 DrawBot Software

Both of these drawing robots use an Arduino as the computer and an extra module called a CNC Shield. This computer should have already been programmed with the firmware and configured with parameters. If it hasn't, you need to refer back to the original instructions for building either of these drawing robots.



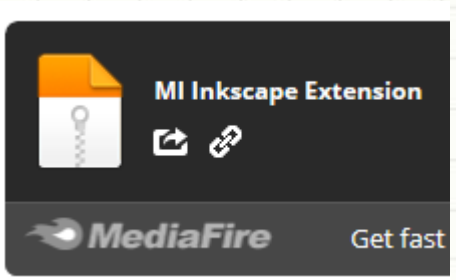
2020 DrawBot Software Installation

2020 DrawBot Software

You will need to install three pieces of software to make your DrawBot work.

- **Inkscape** – Graphics creation program that can create and also import graphics from other sources and then prepare the output file needed for the DrawBot to draw.
- **Inkscape MI GRBL Extension** – This software knows how to convert the vector graphics file into G-Code which the DrawBot uses to draw the graphic.

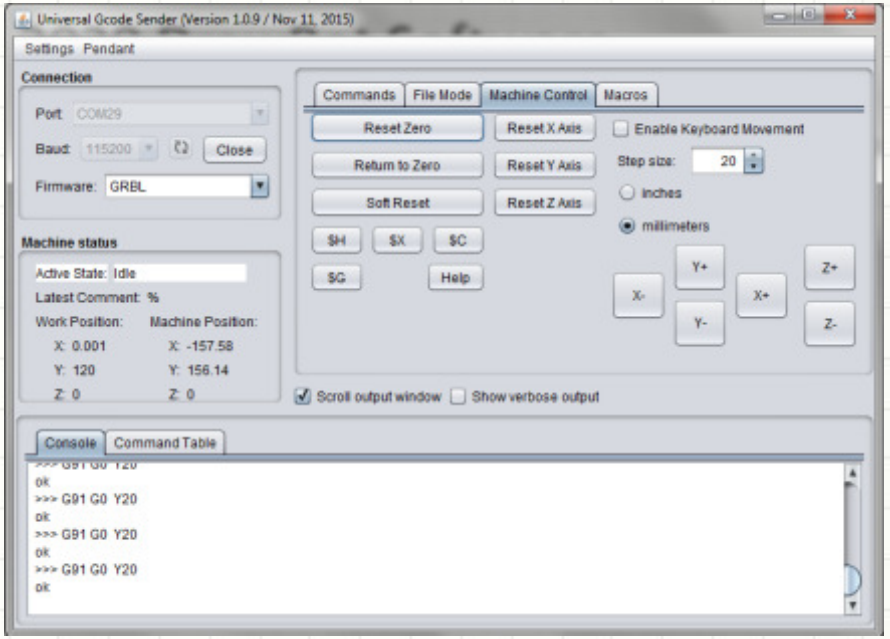
Inkscape



2020 DrawBot Software

Once Inkscape and the Inkscape MI GRBL Extension have created the G-Code file needed to draw the graphic, you need a program to send the G-Code to the DrawBot through a USB port. This program is called the Universal G-Code Sender.

- **Universal G-Code Sender** – This program also acts as a front panel to the DrawBot. It gives you control over the DrawBot motions, allows you to reset the DrawBot, and it allows you to send G-Code files to the DrawBot.



NOTE: Your computer must have a Java Runtime Environment installed in order to run the UGS. Do a Google search on how to add the JRE.

Why so many Software Pieces?

Here's the deal:

- Inkscape is a drawing program much like Photoshop or GIMP. It can create graphic objects. It has the capability for programmers to add additional features such as converting drawings into special formats such as G-Code. These features are called extensions.
- The MI Extension is a special piece of code that Inkscape uses to convert a drawing to G-Code.
- G-Code is a special format of drawing file that includes the actual motions need to guide the DrawBot into drawing your picture. Most of the format contains move instructions for the X and Y axis and Z axis commands to raise and lower the pen.
- Once you have a G-Code file, you need a way to get the DrawBot ready and to then send the G-Code file through the USB port to the DrawBot. The Universal G-Code Sender program takes care of that. It also allows you to manually move the different axis of the robot. Remember that the UGS needs a Java Run time environment in order to run

Installing Inkscape

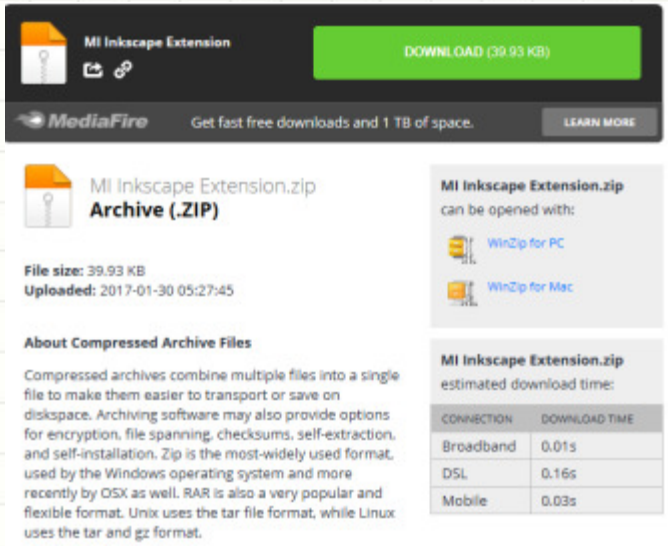
Install Inkscape version 0.92. Other versions may work but we know that the G-Code extension works with this version.

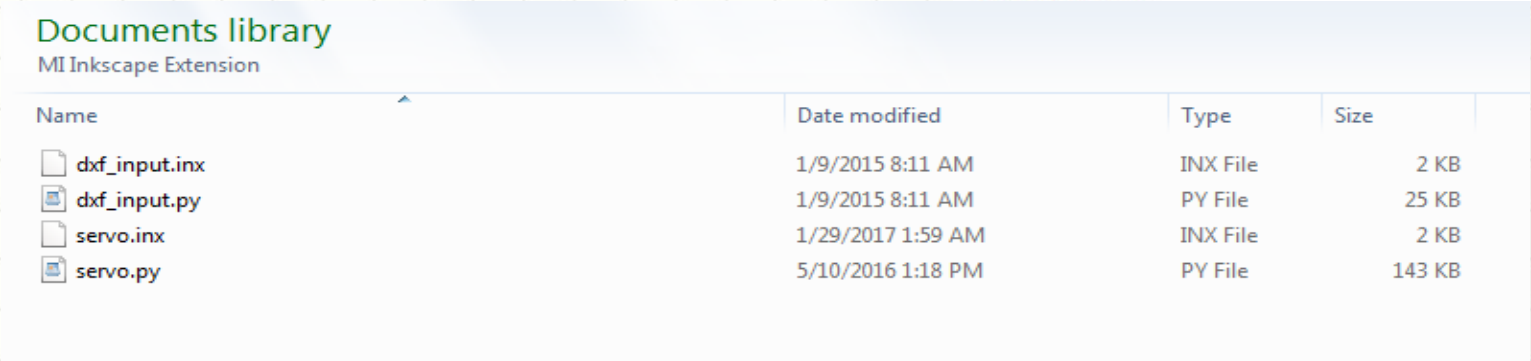
- Download the latest version of Inkscape for your computer here: **https://inkscape.org/en/**
- You may also use the copy of Inkscape found on the flash drive that was provided to you.
- Follow the directions after executing the installation script.

Install the Inkscape MI GRBL Extension

Install the Inkscape MI GRBL Extension. You must copy the MI Extension directory contents to the c:\\Program Files\Inkscape\share\extensions directory.

- Download the Inkscape MI Extension from here: **http://www.mediafire.com/file/ae0wquqornzc3o2/MI+Inkscape+Extension.zip**
- You may also use the copy of MI GRBL Extension from the flash drive that was provided to you.
- Copy the MI Extension files shown below to c:\\Program Files\Inkscape\share\extensions

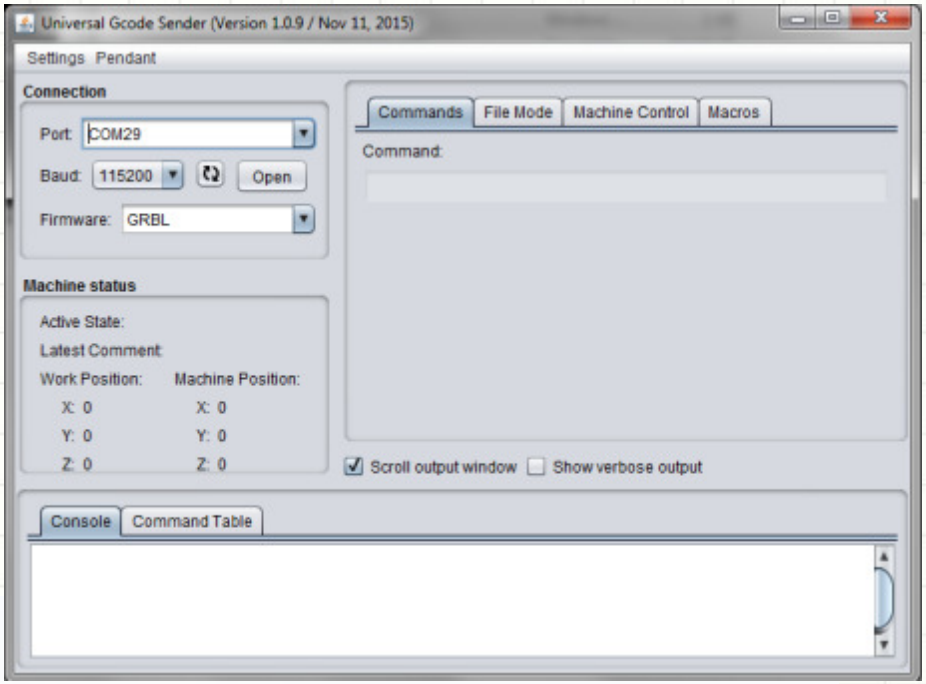


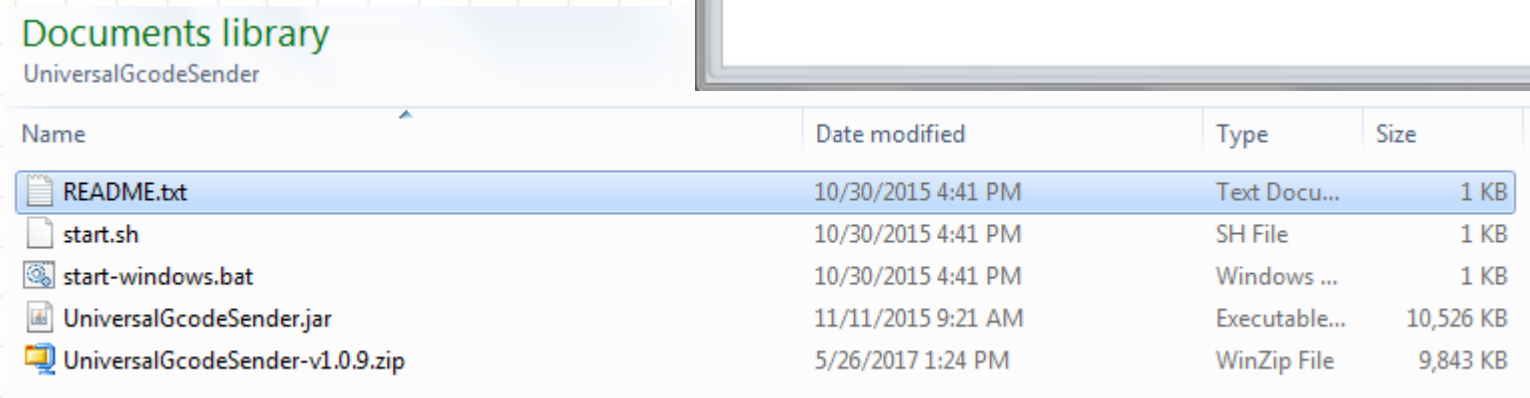


Install the Universal G-Code Sender

Make a directory for your copy of the Universal G-Code Sender UGS

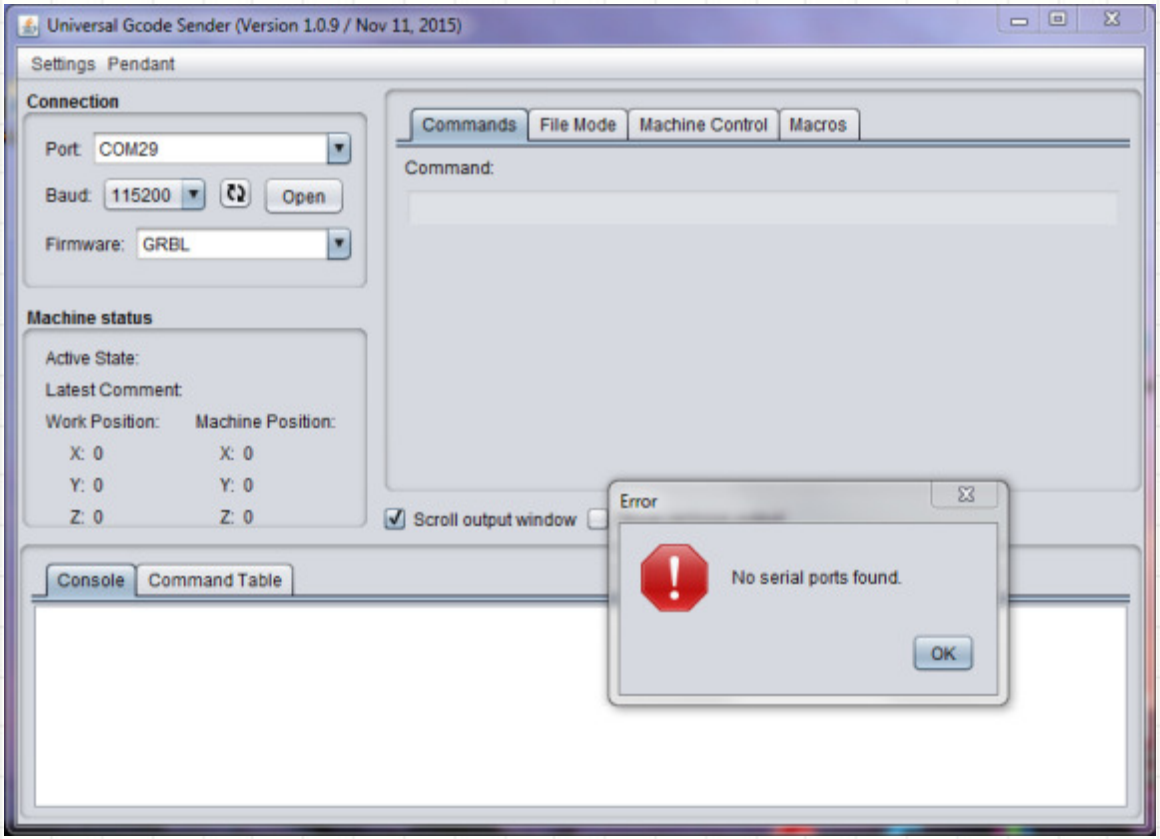
- Get the Universal G-Code Sender from here: https://winder.github.io/ugs_website/download/
- Copy the files from the flash drive or unzip them into your new directory.
- To execute the UGS, execute the "*start-windows.bat file*".





Install the Universal G-Code Sender

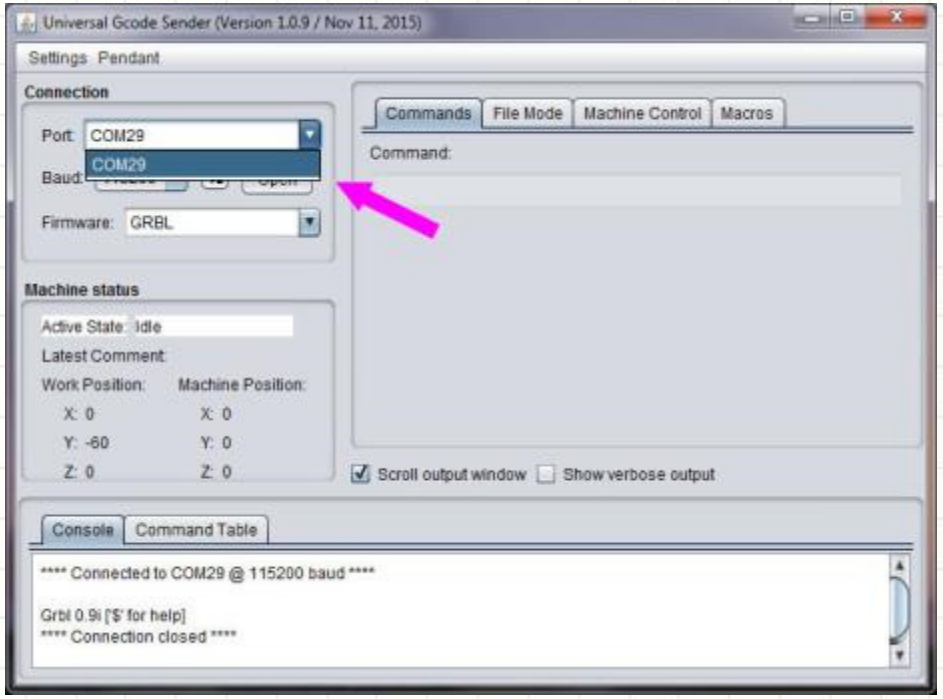
If you start the UGS and it does not find your DrawBot, you will get an error message as shown here. You will need to install a USB driver to make the DrawBot visible to your USB port. The next slide explains how. If the UGS won't start, you probably need to install a Java JRE.



If Your Computer doesn't see the DrawBot

If your computer does not recognize your 2020 DrawBot, you may need to manually install the USB drivers. This is similar to when you install a printer or a mouse. If you did not get an error message, skip these instructions.

- Follow the USB driver installation instructions here: https://learn.sparkfun.com/tutorials/how-to-install-ftdi-drivers/windows---quick-and-easy
  Reboot your computer and try plugging the DrawBot into a USB port.
- When you start the Universal G-Code Sender, it should report that it found the serial port by listing the COMXX port. It probably won't be 29 as shown. It can be an number between 02 and 32.

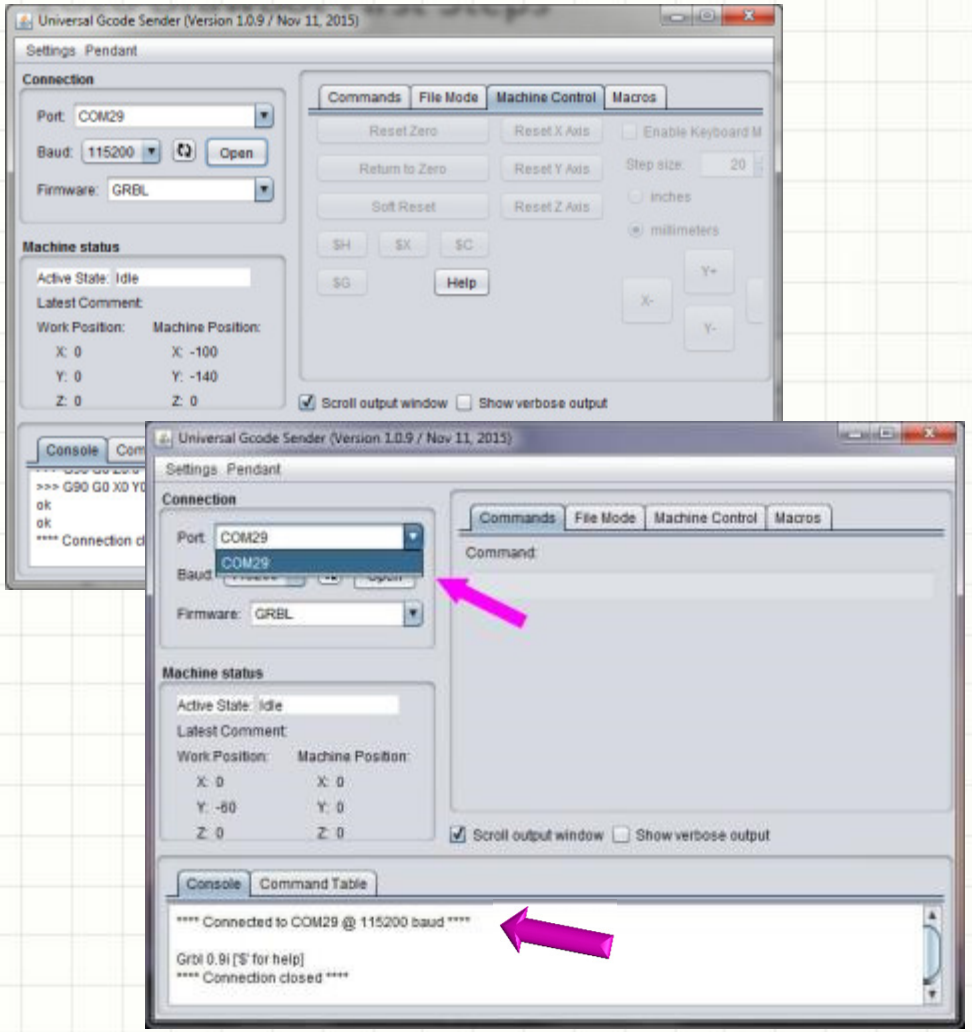


2020 DrawBot First Test

2020 DrawBot First Test – Step 1

Before we create custom drawings and convert them to G-Code, we will test the DrawBot by sending an existing G-Code file using the Universal G-Code Sender (UGS). This is a good first step to testing a DrawBot.

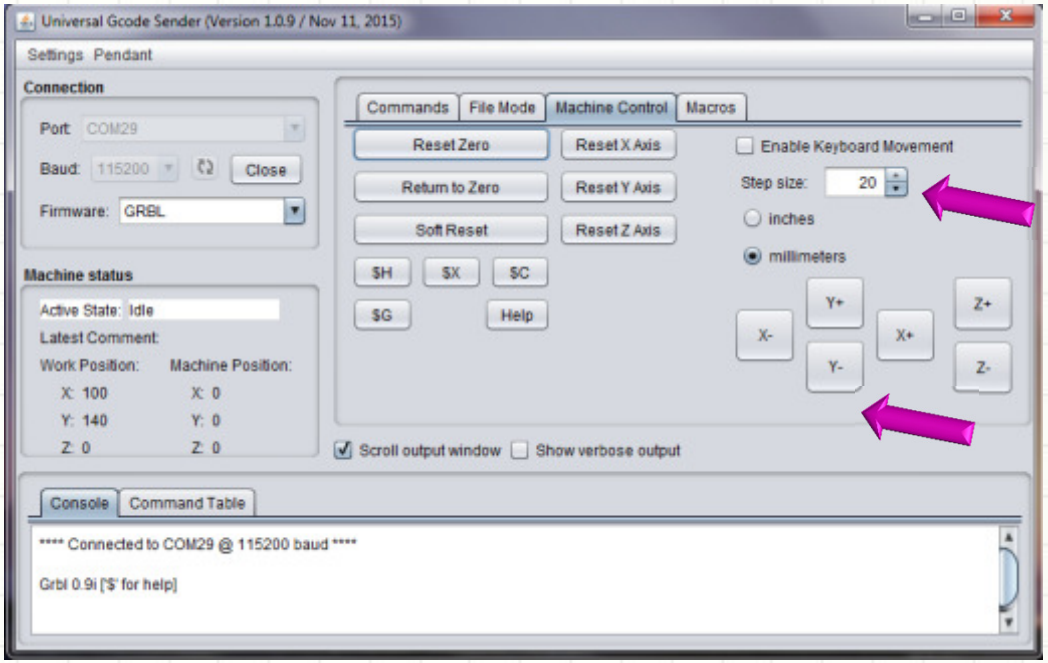
- Start the UGS by executing the *"start-windows.bat"* file in your Universal G-Code Sender directory.
- The UGS should start up and show an available COM port.
- Make sure the COMXX port is selected and then press "Open"
- You should see a message in the Console stating that UGS was able to connect to COMXX like shown in the lower screen shot.



2020 DrawBot First Test – Step 2

If you were able to open the connection to your DrawBot, you should be able to test the motion. Make sure the DrawBot pen carriage is somewhere in the middle of the frame. You may gently move it with your hand.

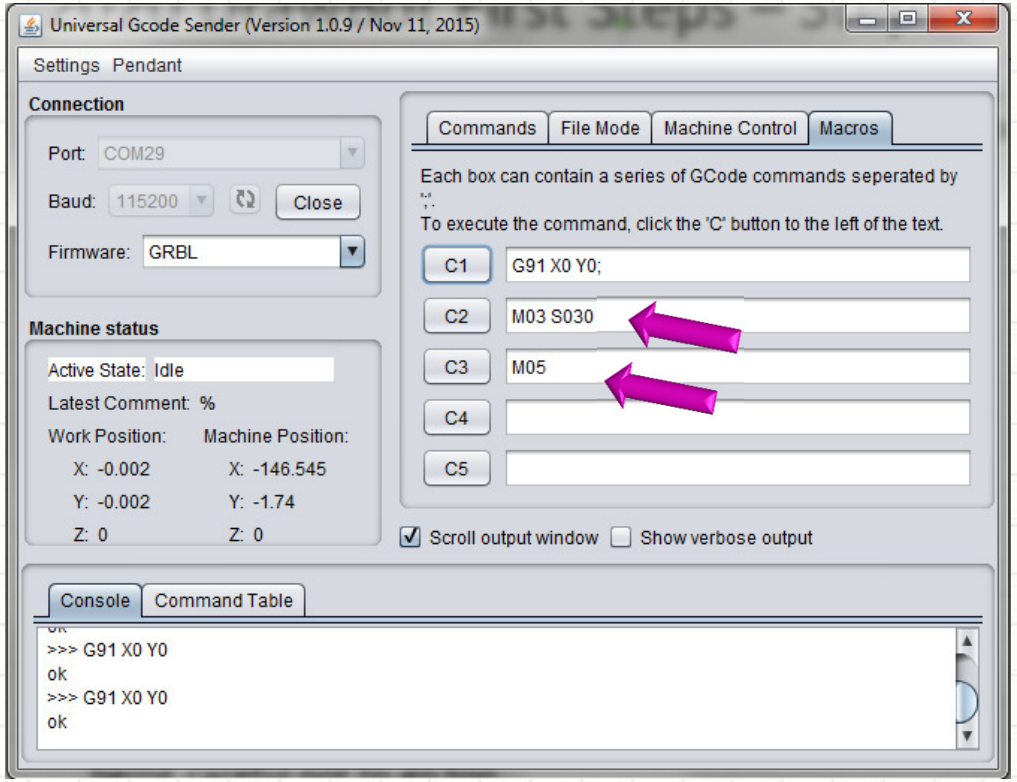
- Select the Machine Control Tab. The buttons should be enabled.
- Change the “Step size” to either 10 or 20.
- Try pressing either +Y or +X. The carriage should move by 20 mm in the direction you select for each push of the button.
- Play around with moving the carriage being careful not to go too far once the carriage is near the end of its travel. If you go too far, the motors will buzz.



2020 DrawBot First Test – Step 3

In order to move the pen up and down in the Z direction, you will need to enter what are called macros. Macros are like a nickname for a set of instructions. We want to create macros for Z up and Z down of the pen

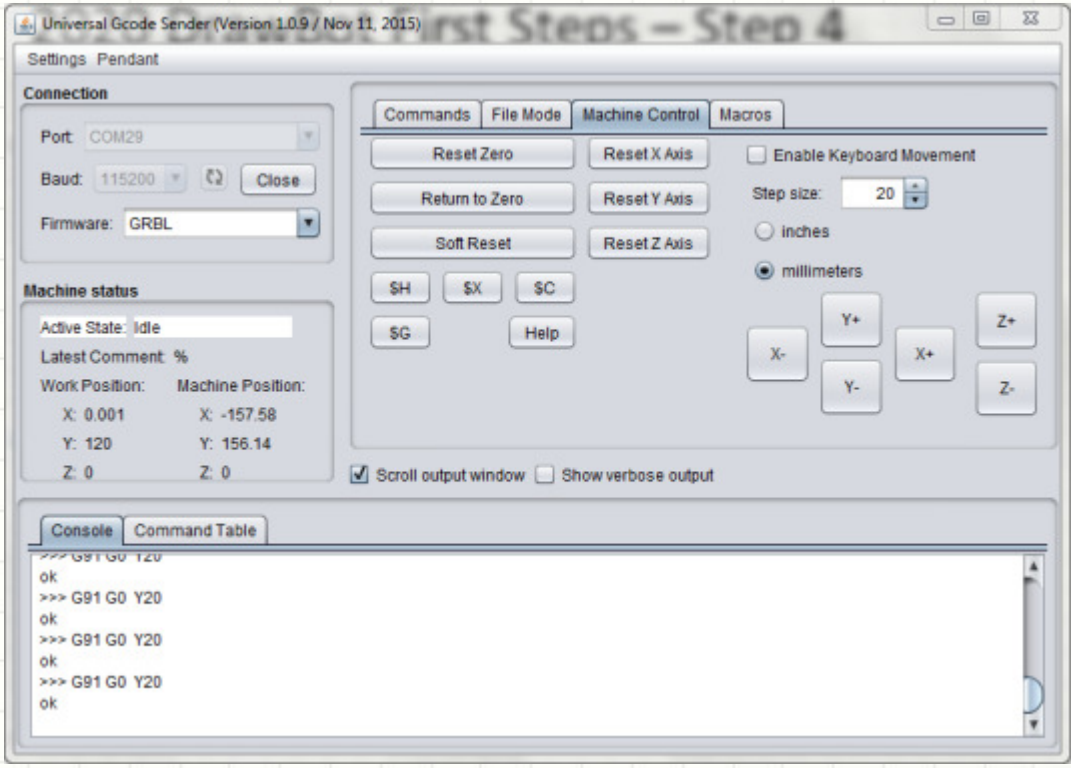
- Select the Macros Tab.
- Add the C2 Macro
  M03 S030 which is Z down
- Add the C3 Macro
  M05 which is Z up
- Test these Macros by pressing the C2 and C3 buttons. Your pen should go down and then back up.
- These macros only need to be entered one time. The UGS will store them for future use.



2020 DrawBot First Test – Step 4

You are now ready to test your DrawBot making its first drawing.

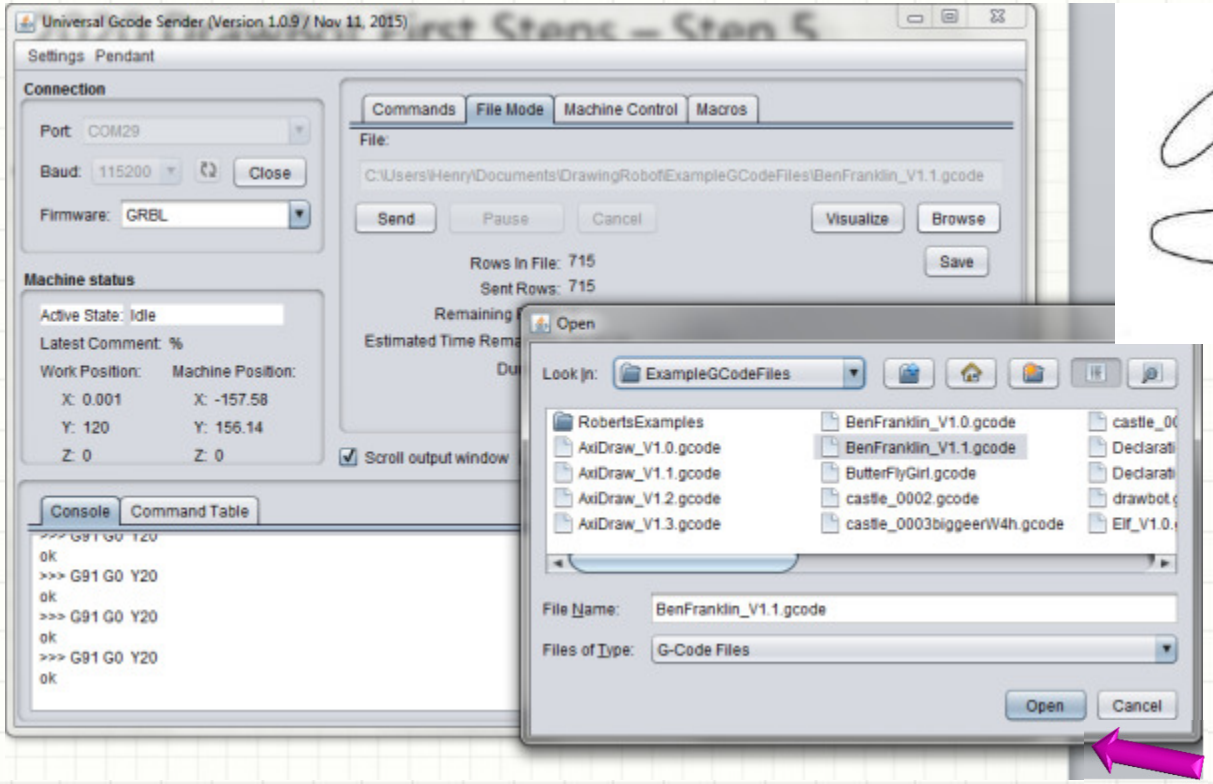
- Load a pen by placing it in the holder and tighten the set screw. Make sure that with the Macro command C2 (down) that the pen is on the paper and with the macro C3 (up) that the pen is off the paper.
- Move the carriage to your 0,0 (X,Y) corner using the motion commands.
- Select “Reset Zero” to set this as the origin.
- Select the “File Mode” Tab



2020 DrawBot First Test – Step 5

Load and draw your first file.

- From the File Mode Tab select “Browse”. A pop up will allow you to navigate to a sample file. Your flash drive will have a file called “BenFranklin_v1.1.gcode”. Select that file and “Open”.
- Select “Send” and your DrawBot should start drawing the file.
- If anything goes wrong, select “Cancel”.
- Otherwise you should get a plot like Ben Franklin’s signature.

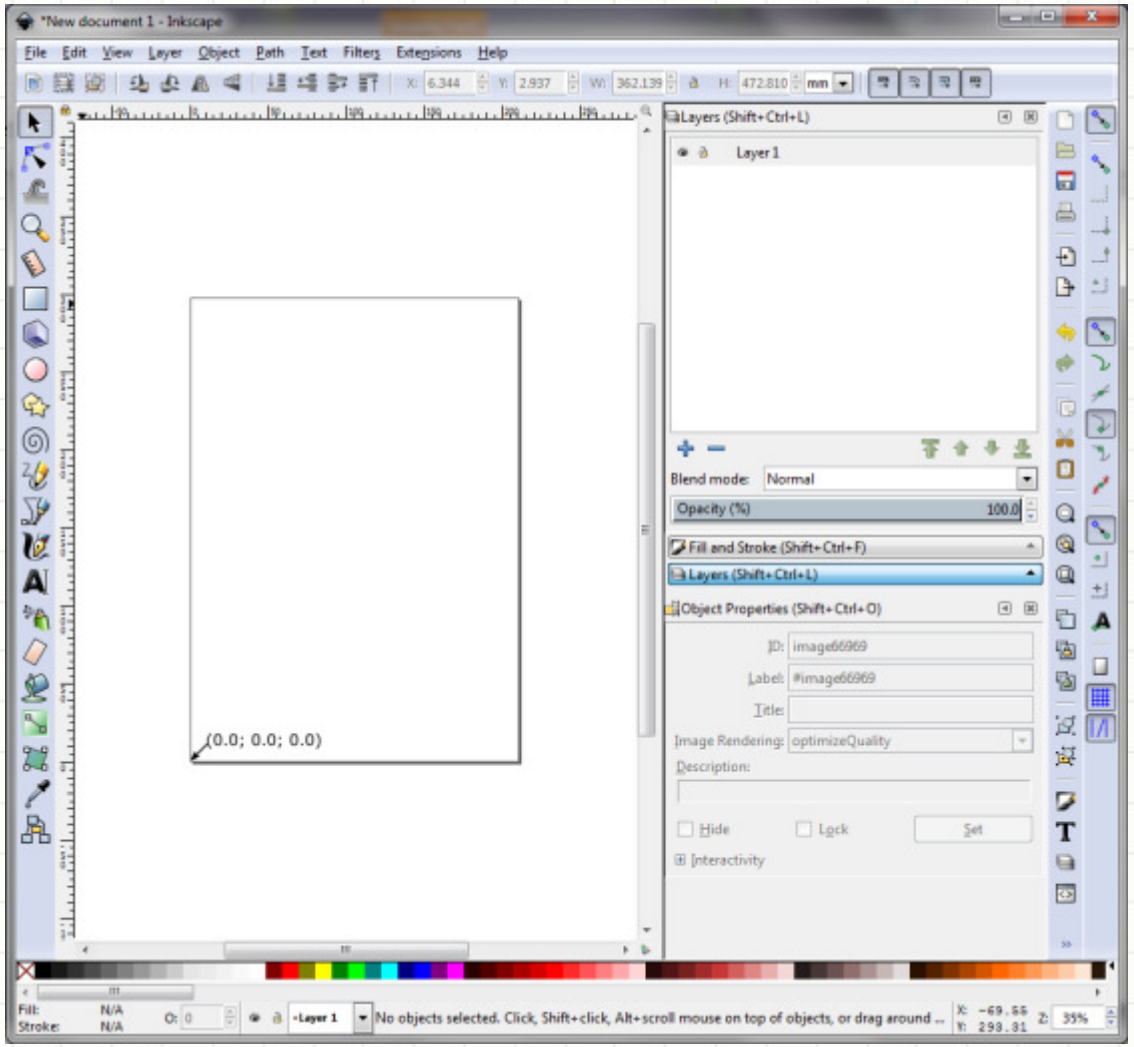


Creating an Inkscape Drawing & Sending it to the DrawBot

Using Inkscape – Step 1

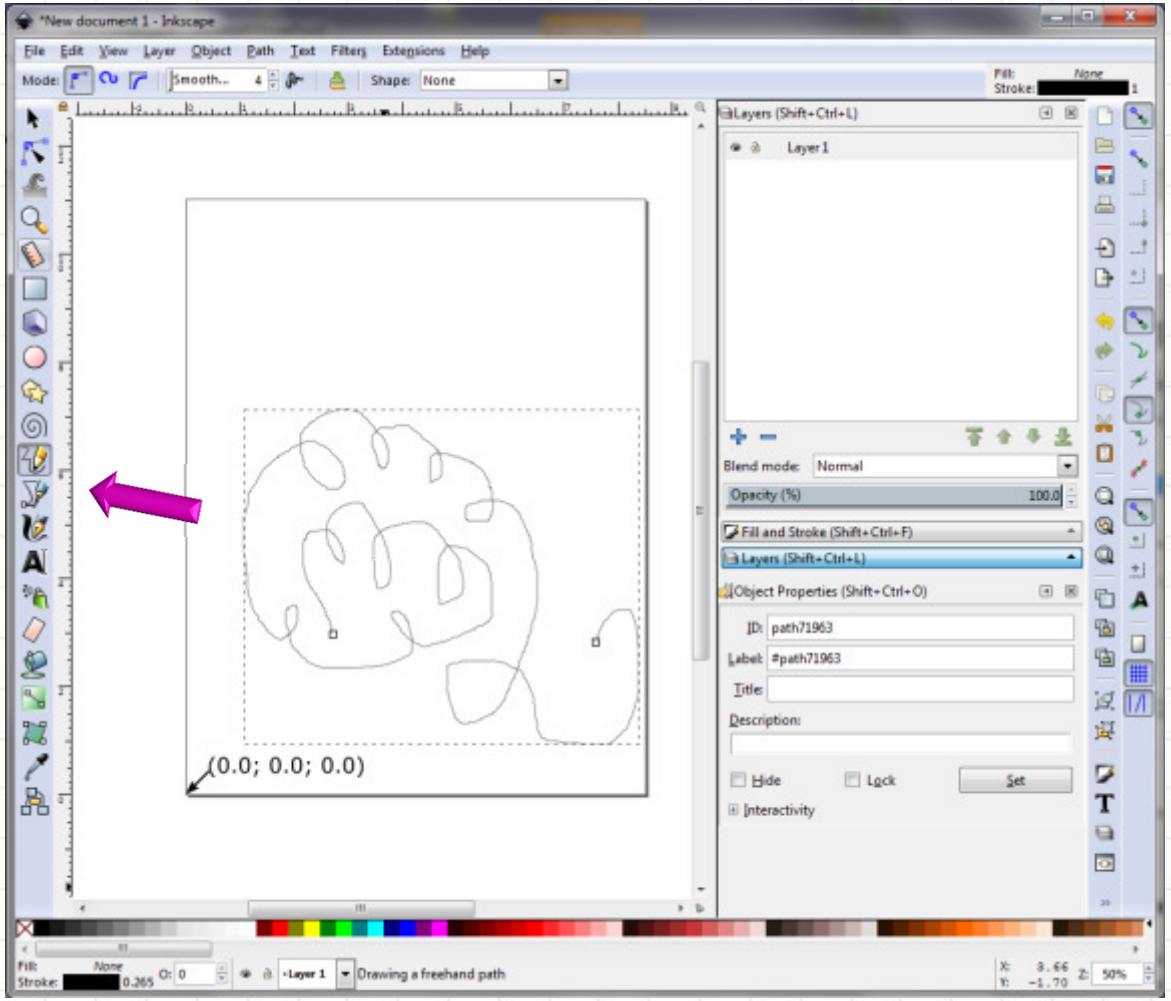
You will now create a simple drawing in Inkscape, generate G-Code, and then send it to the DrawBot.

- Open Inkscape. It usually takes a little while for it to open and be ready for use.



Using Inkscape – Step 2

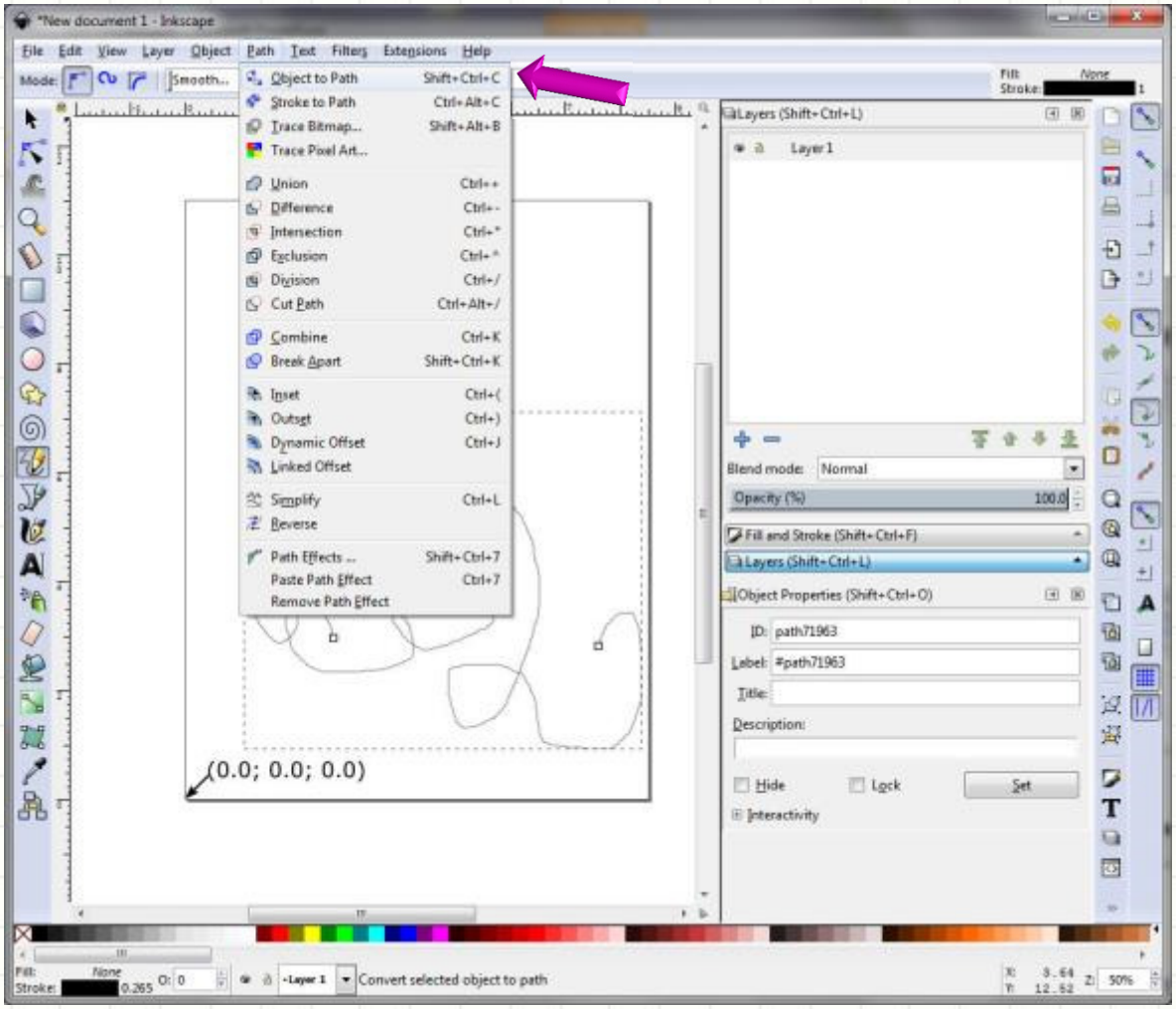
- Select the “Draw Freehand” tool which looks like a pencil. You may use other drawing tools if you like.
- Drawing anything you like such as a squiggle or something more if you are artistic.
- Make sure your drawing is selected by using the selection arrow and drawing a box around it.



Using Inkscape – Step 3

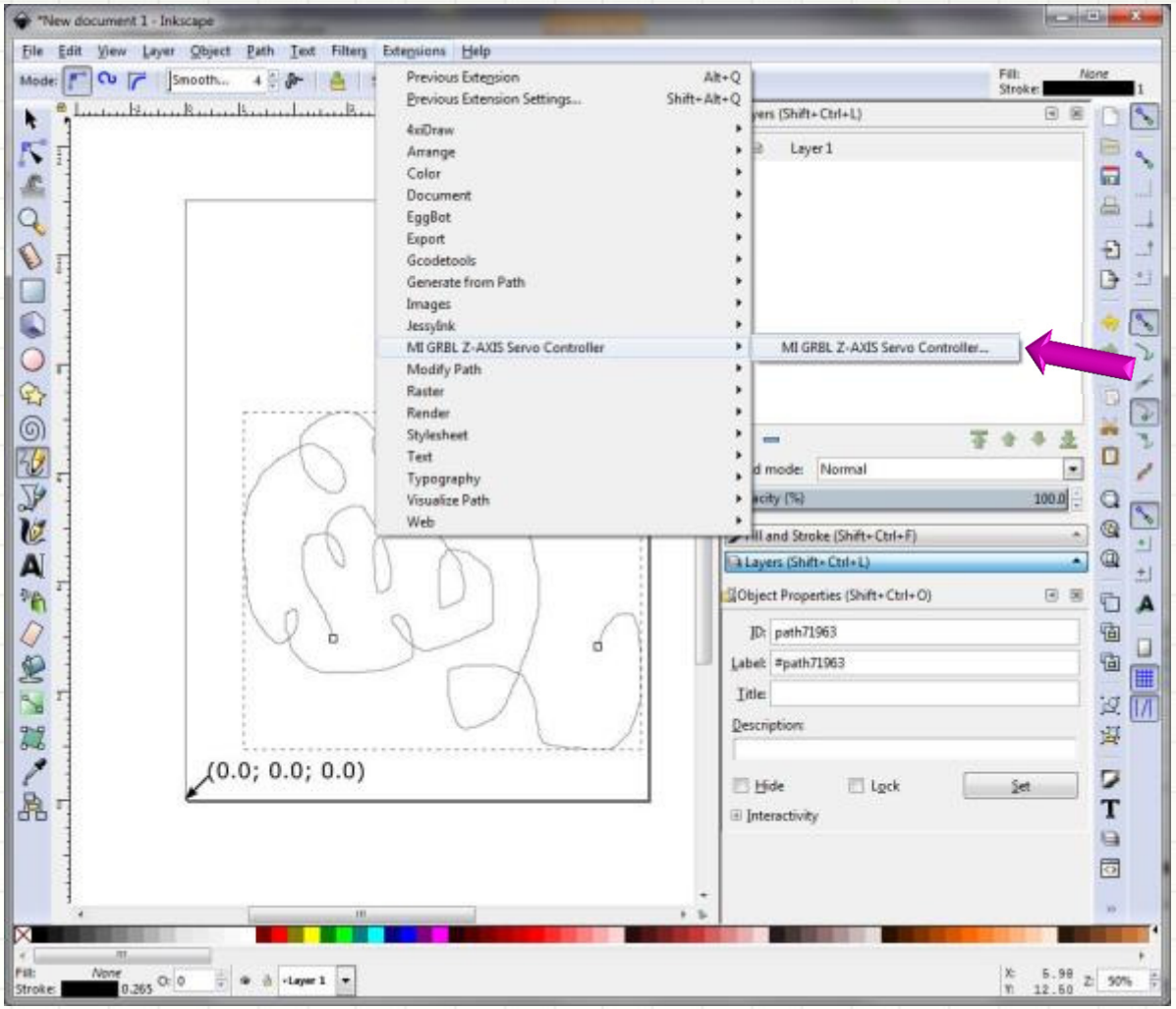
- Select the “Path” pull down and then “Object to Path”

  This allows Inkscape to interpret the drawing as line paths



Using Inkscape – Step 4

- Select the pull down “Extensions” and then “MI GRBL Z Axis Servo Controller” and “MI GRBL Z Axis Servo Controller”



Using Inkscape – Step 5

The extension pop up will appear. It is very important that you fill in the fields as shown.

Servo Up M3

Servo Down M5

X axis Speed 3000

Y axis Speed 3000

Angle for Servo 30

Delay 0.1

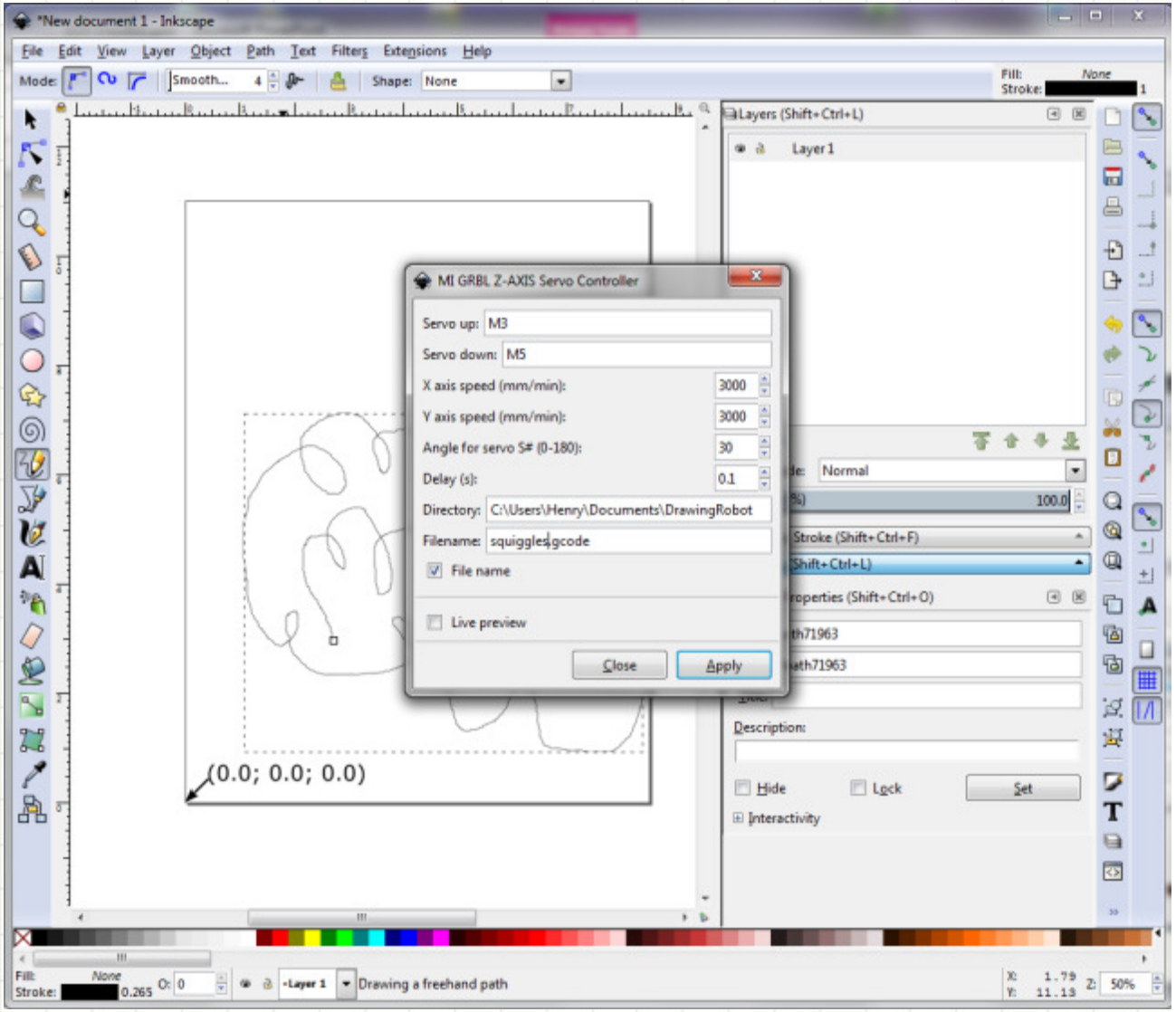
Directory

<your choice>

Filename

<your choice>

Filename Box checked



These fields will be saved for future use.

Select “Apply”

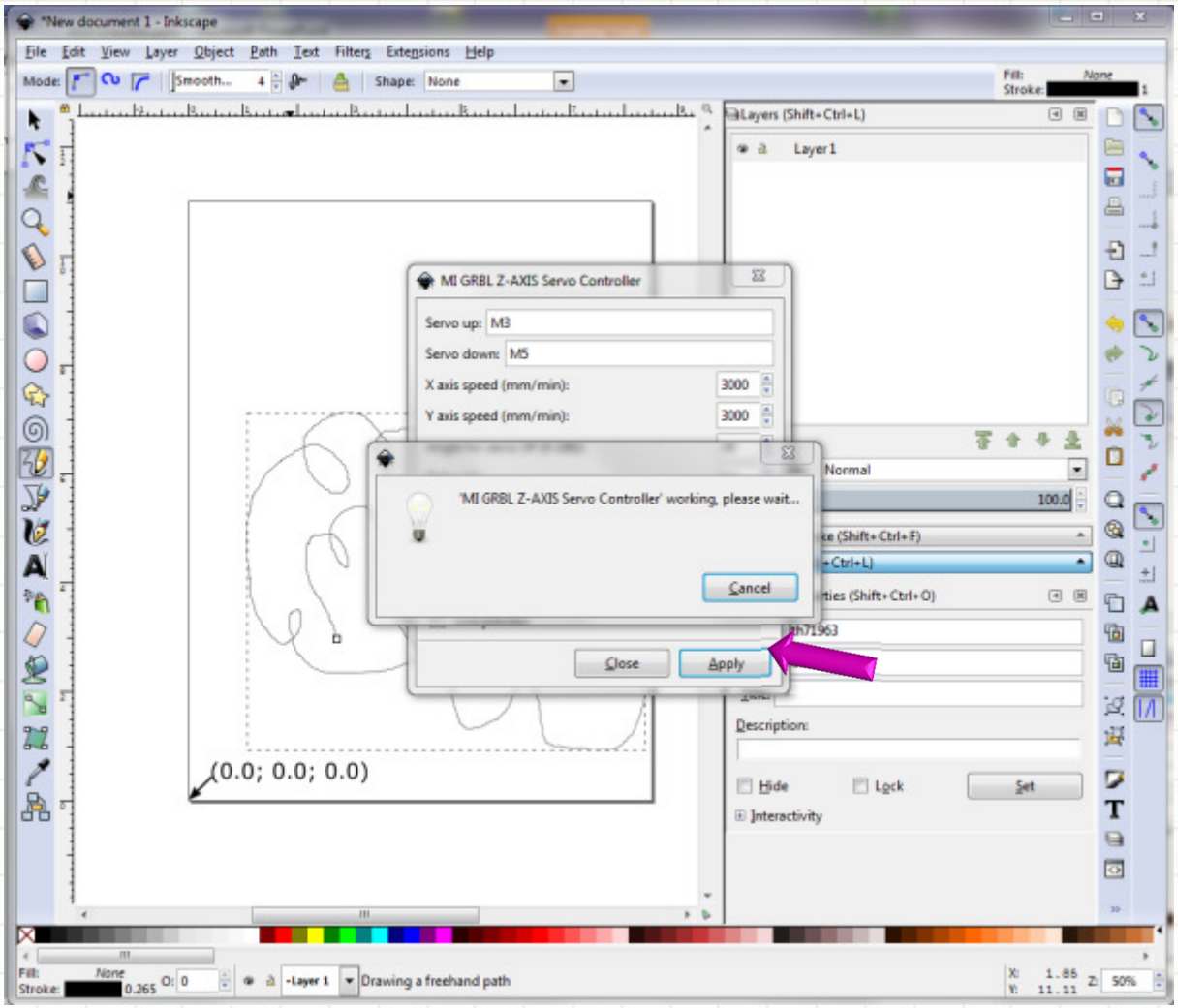
Using Inkscape – Step 6

You should see a “Working, please wait” pop up like the one shown while the Extension processes your drawing. When the Pop up disappears, your G-Code will be in the directory that you selected.

Select “Close”

After the Cancel

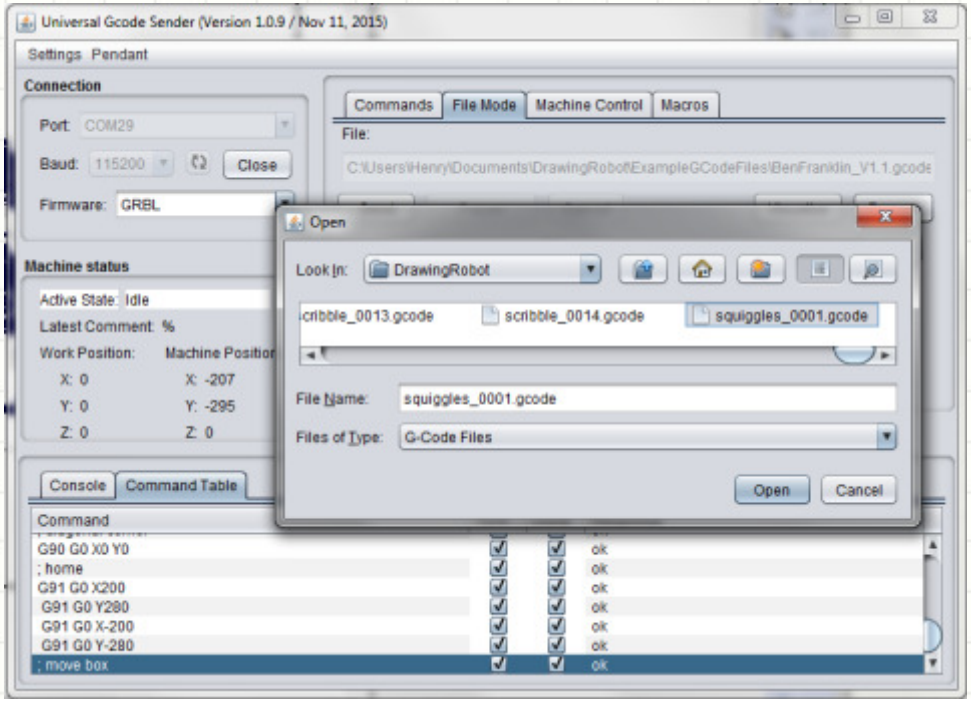
Box disappears

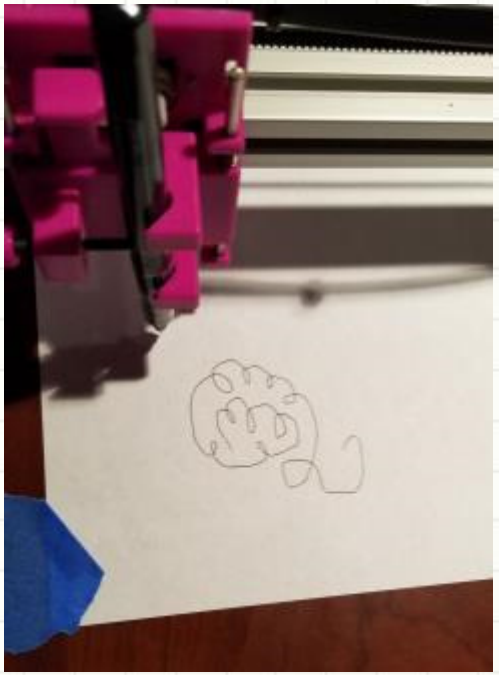


Using Inkscape – Step 7

Now load your file using the Universal G-Code Sender (UGS).

- From the “File Mode” Tab select “Browse”. A pop up will allow you to navigate to your file. Our example filename was “squiggles” and Inkscape added a _0001.gcode to the name. The file is squiggles_0001.gcode. It will appear in the directory you selected.
- Make sure you have your DrawBot set at the zero location and that the pen is ready.
- Select “Send” and your DrawBot should start drawing the file.
- If anything goes wrong, select “Cancel”.
- Otherwise you should get a plot that looks like what you drew.



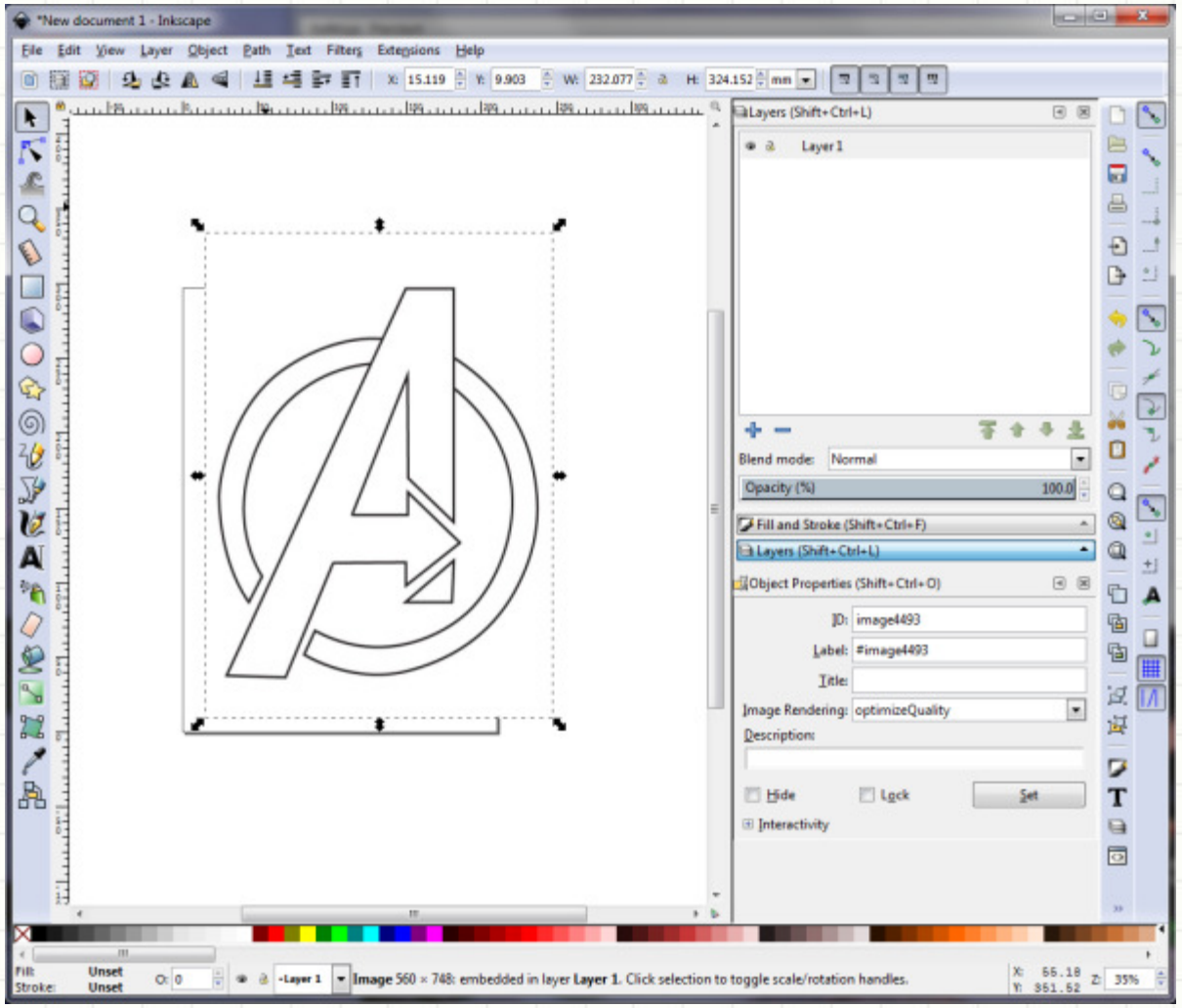


Importing a Drawing Into Inkscape and Drawing it

Using Inkscape with Imported Graphics – Step 1

Sometimes you may want to plot something that already exists as a JPG or GIF graphic. The following slides explain how to import a graphic into Inkscape and prepare it to be drawn by your DrawBot.

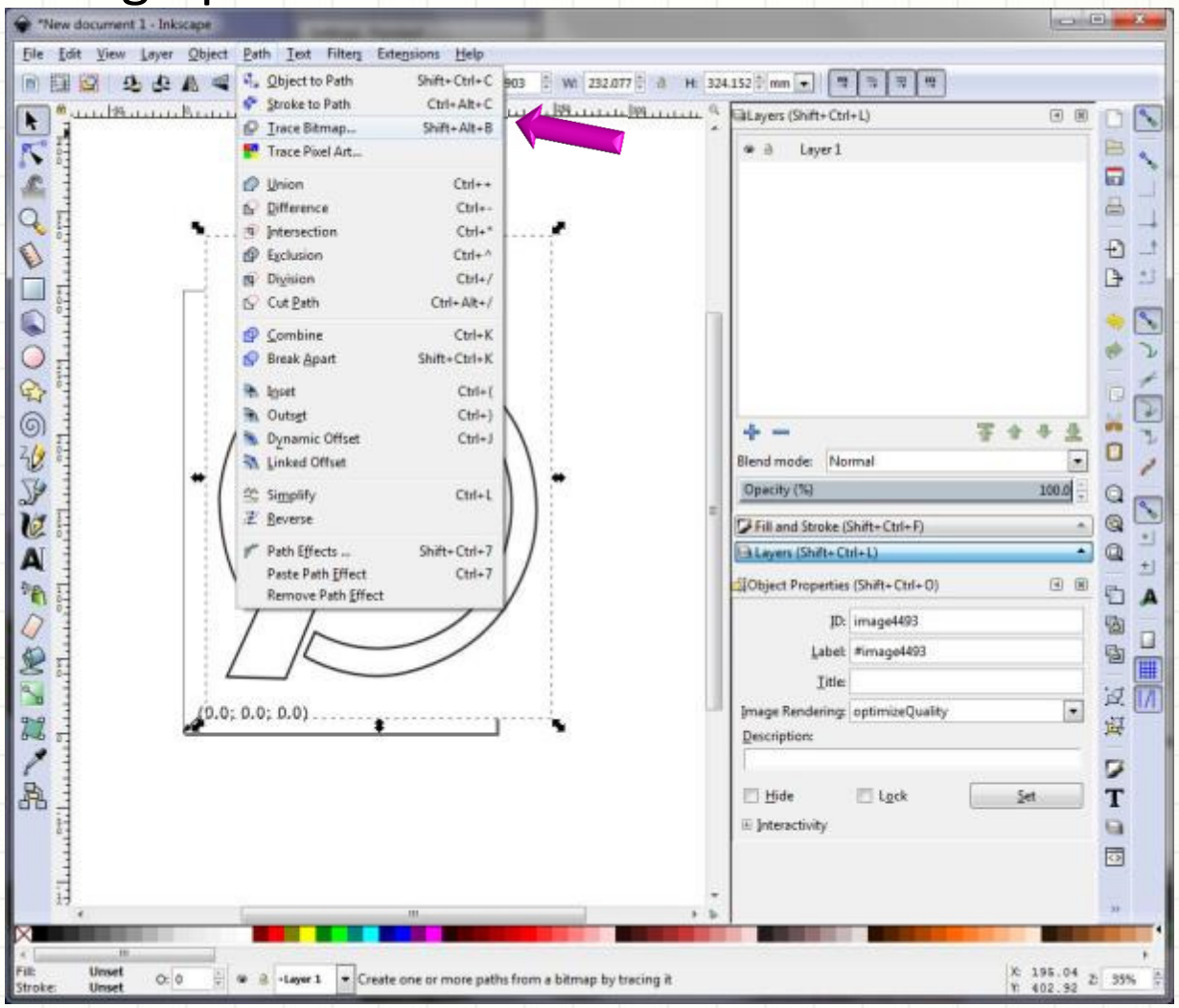
- Open Inkscape.
- Select “File” and then “Import”
- Select the graphic you would like to import.
- Size and move the graphic to the size and location you want.



Using Inkscape with Imported Graphics – Step 2

The current drawing is a bitmap. We need Inkscape to be able to find the edges of the graphic to create lines to draw

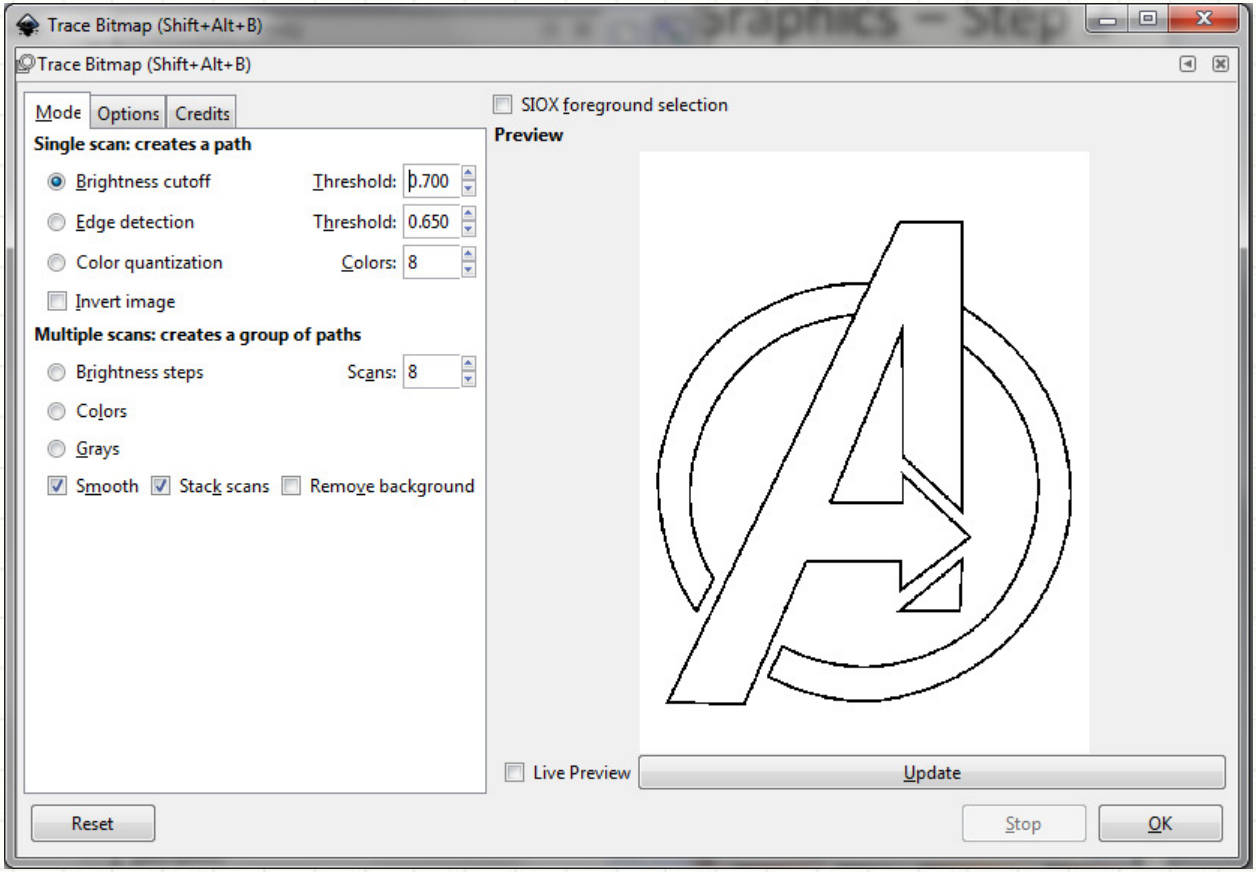
- Select the pull down “Path” and then select “Trace Bitmap”
- A popup will appear which is explained in the next slide.



Using Inkscape with Imported Graphics – Step 3

The “Trace Bitmap” feature allows Inkscape to find the lines in your graphic. I use “Brightness Cutoff” but “Edge Detection” also works. Play with the thresholds until you get a result that looks sharp and has well defined lines.

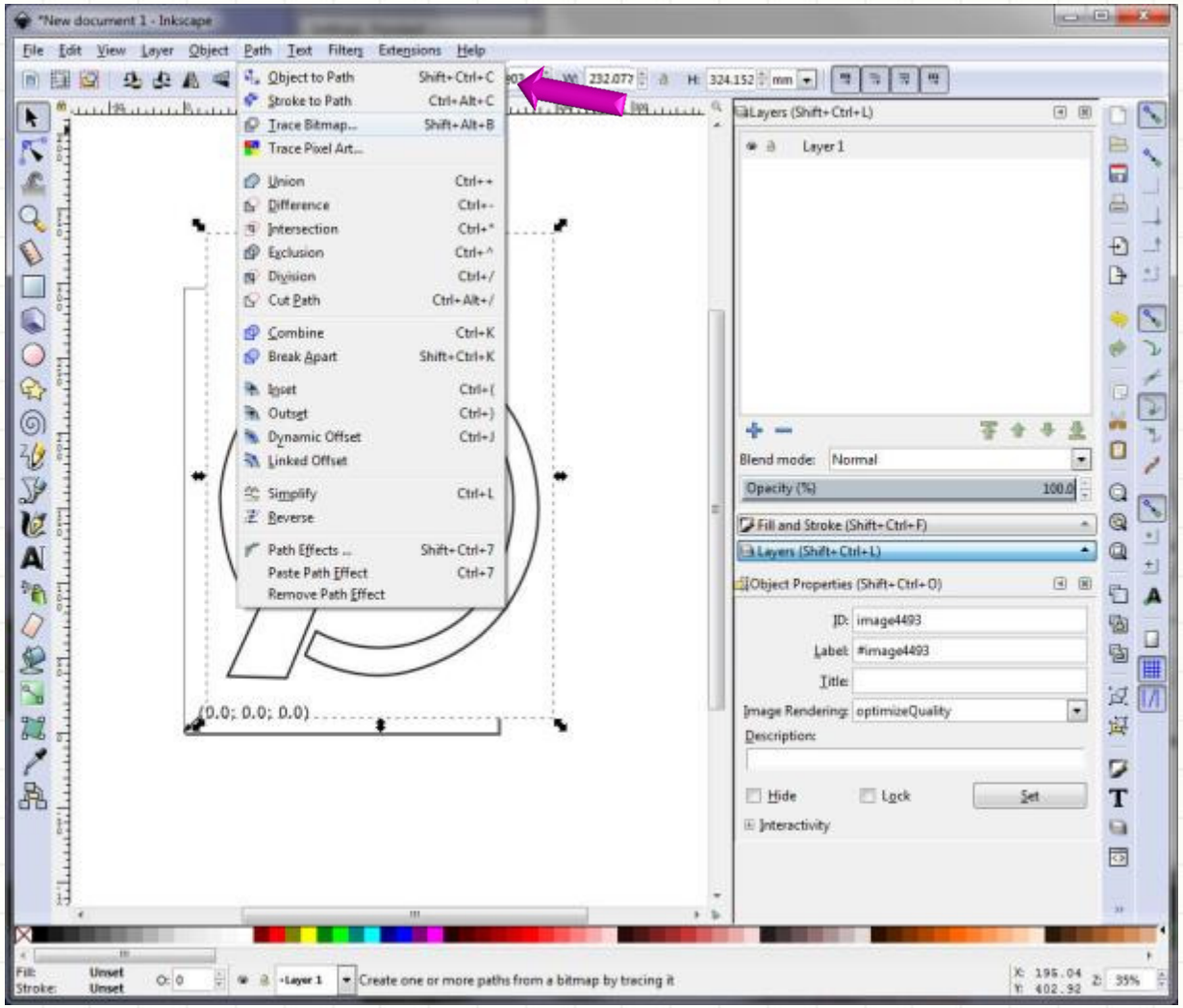
- To see the result as you work, either press “Update” or click the “Live Preview” box
- Once you are satisfied, click OK and then the upper right X to close the window.



Using Inkscape with Imported Graphics – Step 4

Inkscape now knows where the edges are in your graphic. We now want Inkscape to select line paths for drawing our graphic.

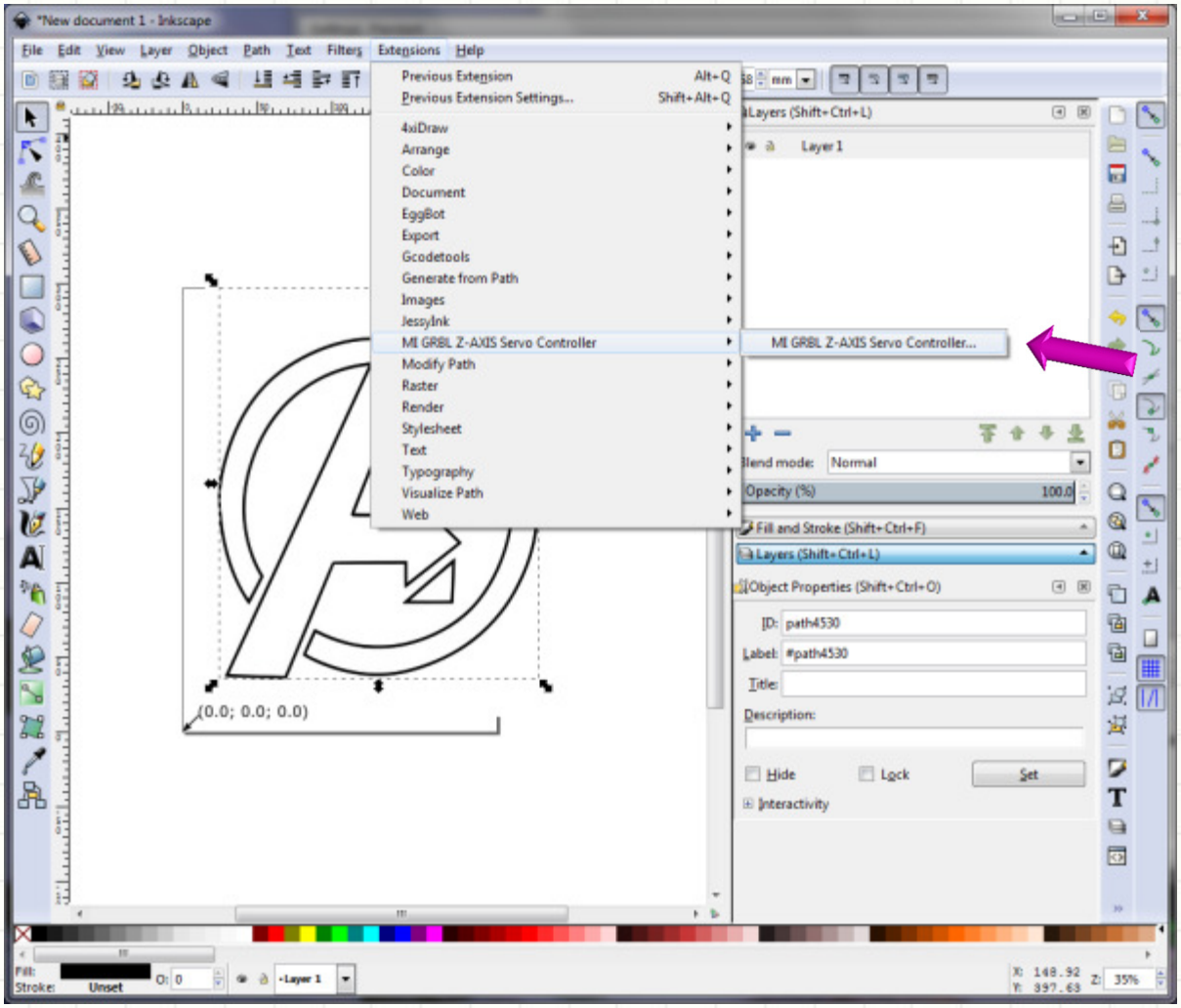
- Select the pull down “Path” and then select “Object to Path”
- There is no pop up on this feature. The action happens behind the scenes.



Using Inkscape with Imported Graphics – Step 5

We now have a drawing where defined edges were turned into line paths we want to draw. We now need to turn the line paths into G-Code which the DrawBot can use to draw the graphic.

- Select “Extensions” and then “MI GRBL…” and “MI GRBL Z Axis Servo Controller”



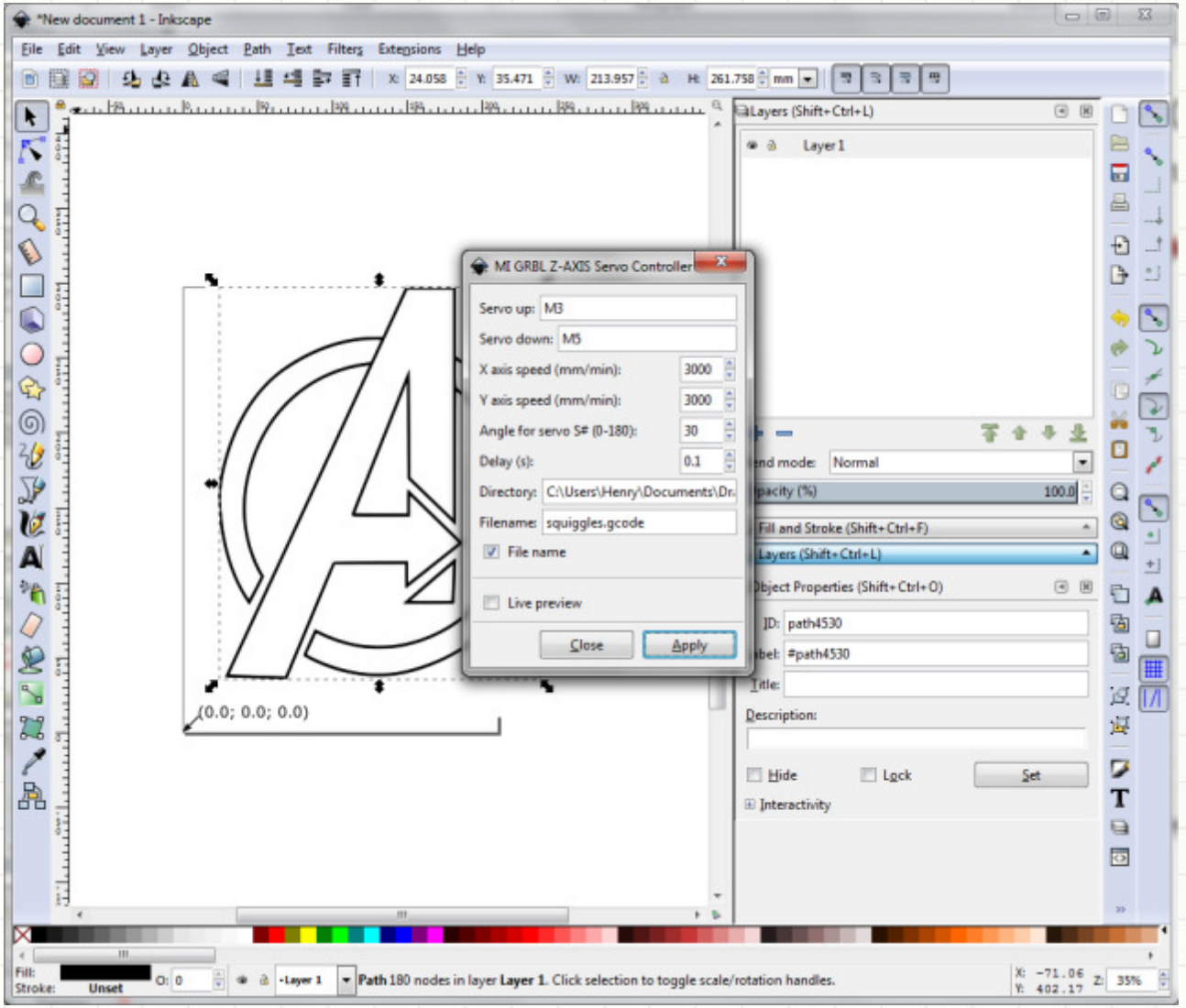
Using Inkscape with Imported Graphics – Step 6

The MI extension pop up will appear. It is very important that the fields are as shown.

Servo Up	M3
Servo Down	M5
X axis Speed	3000
Y axis Speed	3000
Angle for Servo	30
Delay	0.1
Directory	<you choose>
File name checked	

These fields will be saved for future uses.

Select "Apply"



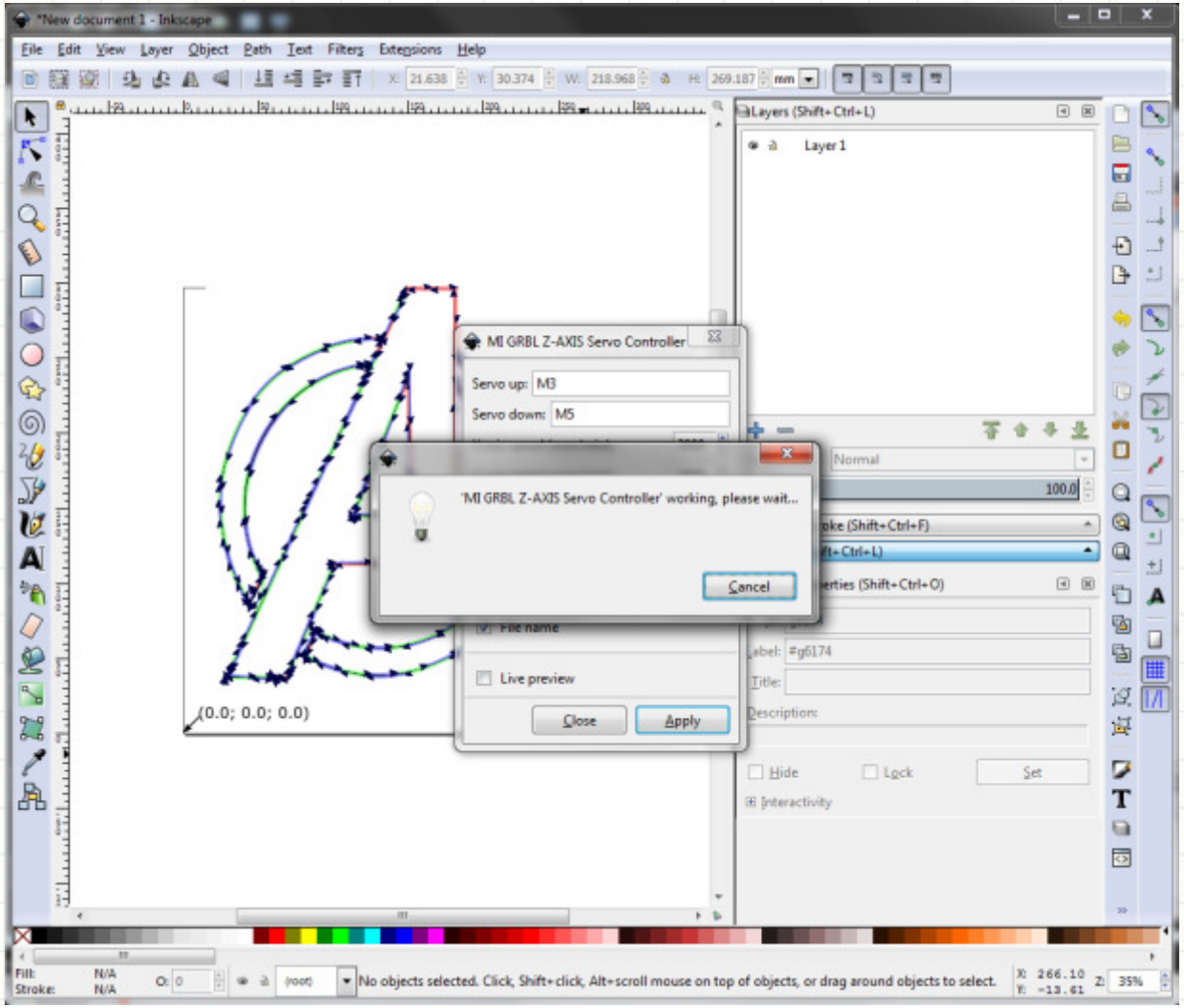
Using Inkscape with Imported Graphics – Step 7

You should see a pop up like the one shown while the Extension processes your drawing. When the Pop up disappears, your G-Code will be in the directory that you selected.

Select “Close”

After the Cancel

Box disappears



Using Inkscape with Imported Graphics – Step 8

Now load your file using the Universal G-Code Sender (UGS). If you don't remember how to do that, refer back to the previous example.

- Make sure you have your DrawBot set at the zero location and that the pen is ready.
- Select "Send"
- You should get a plot that looks like the imported graphic.

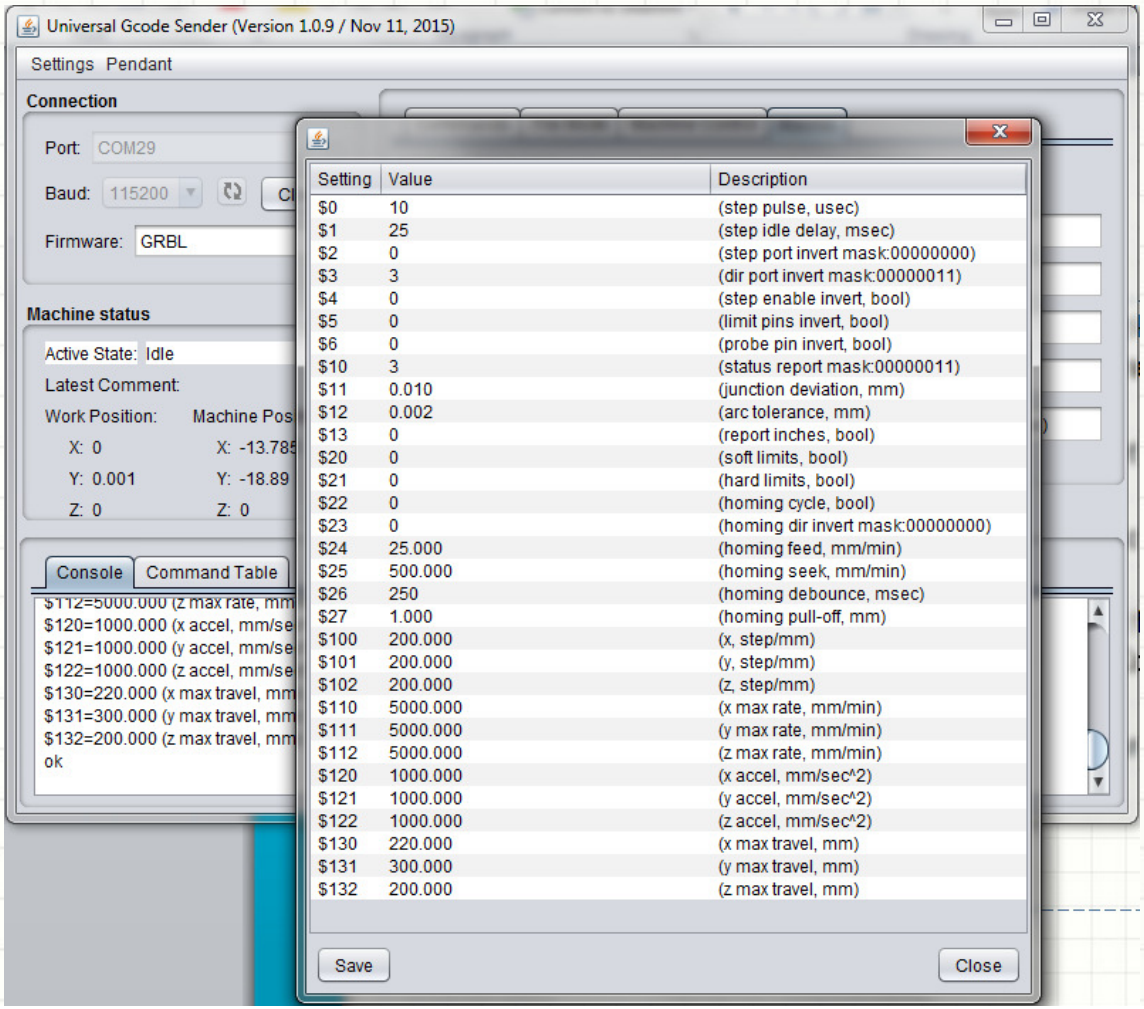
Extra Stuff for the Curious

2020 DrawBot Tips

- Be sure to use the “Reset to Zero” to let the DrawBot know where you want your origin to be. Erratic behavior can be caused by the DrawBot starting from an unknown origin.
- If you have problems, don’t hesitate to try “Soft Reset” from the UGS or a hard reset which is to power the DrawBot off then back on.
- Make sure your pen touches the paper on the C2 macro and that it lifts clearly off the paper on a C3 macro.
- The UGS “Console” shows the commands being used for each motion. You can learn a little about G-Code commands by looking at the “Console” or “Command Table” windows.
- If you have a tricky problem with a G-Code file, try turning “Verbose” mode on by checking that box.
- If you are having strange problems, check your GRBL parameters as explained on the next slide.

2020 DrawBot GRBL Parameters

If you are having problems with your DrawBot, check the GRBL parameters by selecting “Settings”, “Firmware Settings”, and “GRBL”. Check your settings against the ones shown. If you change any settings, select “Save” before “Close”.



Software for the 2020 DrawBot

- Inkscape
  https://inkscape.org/en/
- Inkscape MI Extension for creating G-Code
  http://www.mediafire.com/file/ae0wquqornzc3o2/MI+Inkscape+Extension.zip
- Universal G-Code Sender Ver 1.0.9
  https://winder.github.io/ugs_website/download/
- USB Drivers if needed
  https://www.arduino.cc/en/Guide/DriverInstallation

For those that want to tinker with the DrawBot firmware

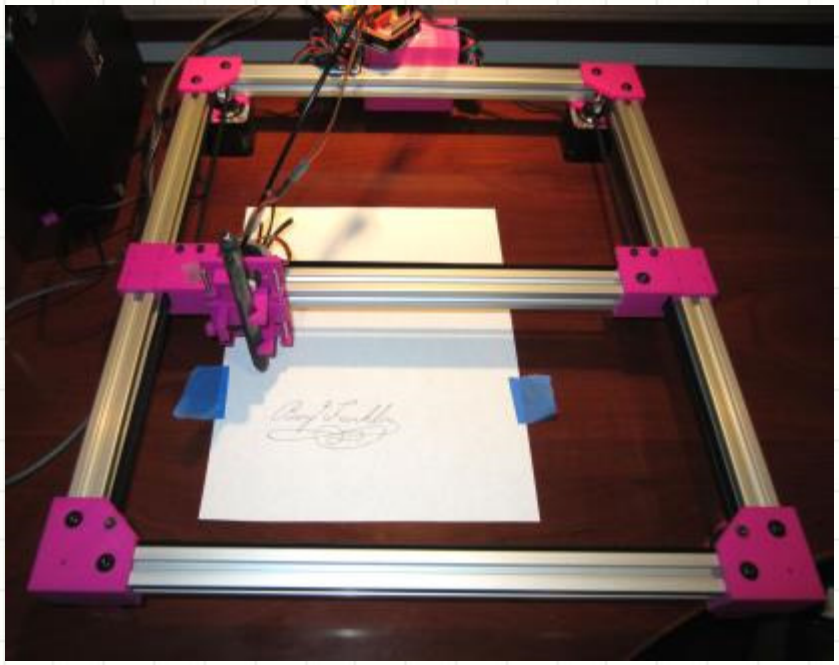
- GRBL – Arduino firmware that makes the DrawBot go.
  https://github.com/robottini/grbl-servo
- Arduino Development Software
  https://www.arduino.cc/en/Guide/HomePage

Drawing Robot Thingiverse Pages

Everything you need to build a drawing robot from scratch.

2020 DrawBot

https://www.thingiverse.com/thing:2374238



Drawing Robot

https://www.thingiverse.com/thing:2349232