Printrbot CNC Operation Manual

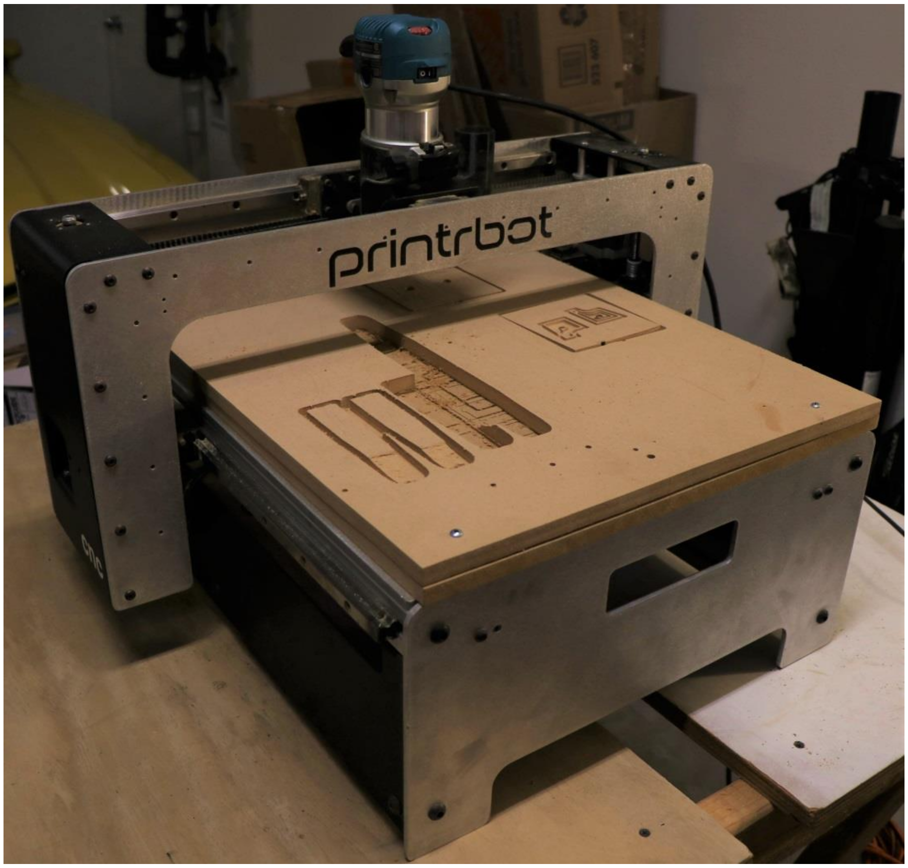


Table of Contents

Introduction

The CNC router that will be used in this manual is a limited run (only 19 made) CNC created by the now out of business company known as Printrbot. While there is a lot of information on the internet about Printrbot and their machines, much knowledge was lost when the company and their website were shut down. This manual is a collection of information about this particular machine that was either found on the internet or put together during the machine's operation with Professor Simon Penny.

In this manual, we will discuss the *Technical Specifications* of the Printrbot CNC, *Regular Operation* of the machine and compatible software, and various different *Troubleshooting* methods that have been proven to solve issues relating to this particular machine and its software. There will also be a *Revision History* page that will act as a record of all changes made to this document. If you are interested in updating this document, please fill out a row on the *Revision History* table when you have completed the necessary changes, save the updated word document, and replace the current PDF version in the CNC folder.

Because this machine was built in such a small quantity, there may be issues that have not been discovered or do not have a solution yet, but this manual will hopefully be able to assist in both the operation and troubleshooting process.

Technical Specifications

The Printrbot CNC features the following:

Item	Quantity
NEMA 23 stepper motors	5 [1 x-axis, 2 y-axis, 2 z-axis]
TinyGv9 Board	1
Stepper motor Limit Switch	5 [2 x-axis, 2 y-axis, 1 z-axis]
USB 2.0 A to USB 2.0 B Cable	1
100-240V AC to 24V DC XP Power Adapter	1
Stepper Belt Drive	4 [2 x-axis, 2 y-axis]
Stepper Linear Rail	4 [2 x-axis, 2 y-axis]
Stepper Lead Screws	2 [2 z-axis]

Regular Operation

Software Required

In order to run the CNC, we will need some software downloaded first. The following is a list of the required software:

- A program to create the gcode for our part
- Software to connect to the tinyg v9 board on the Printrbot (serial-port-json-server.exe)
- A program to interpret the gcode (in our case, we will use a website: chillipeppr.com/tinyg)

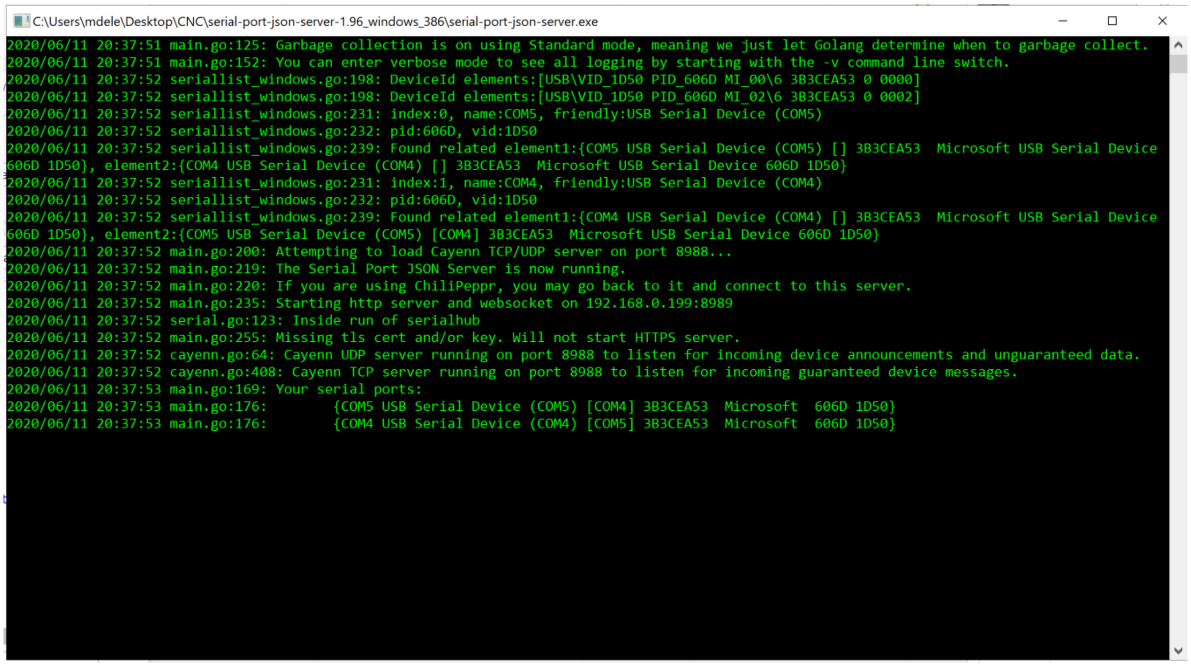
All listed software is free to download or use and will be simple to operate once we have a basic understanding on how each program works.

Software Operation

Gcode Software

Serial Port JSON Server

Now that the part is ready, we need to send it to the CNC to print. The first things that need to be checked are that the USB cable that connects the computer to the CNC is plugged in and the CNC is powered on. When powered on, the Printrbot CNC will temporarily power all motors (an audible noise will come from the motors but they should not move) and the TinyGv9 board will power on (indicated by blue and blinking red LED lights on the TinyG board located underneath the CNC). If both of these are true, we are ready to connect to the TinyGv9 on the CNC. In the included CNC folder, open the program called *serial-port-json-server.exe*. The program will then run for around 3 to 5 seconds before it has completed searching for the connected USB cable. If the program is able to find the USB cable and connect to the TinyG board, the following will be shown:

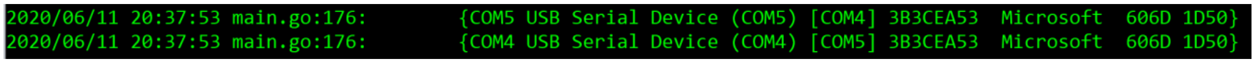


C:\Users\mdele\Desktop\CNC\serial-port-json-server-1.96_windows_386\serial-port-json-server.exe

```
2020/06/11 20:37:51 main.go:125: Garbage collection is on using Standard mode, meaning we just let Golang determine when to garbage collect.
2020/06/11 20:37:51 main.go:152: You can enter verbose mode to see all logging by starting with the -v command line switch.
2020/06/11 20:37:52 seriallist_windows.go:198: DeviceId elements:[USB\VID_1D50 PID_606D MI_00\6 3B3CEA53 0 0000]
2020/06/11 20:37:52 seriallist_windows.go:198: DeviceId elements:[USB\VID_1D50 PID_606D MI_02\6 3B3CEA53 0 0002]
2020/06/11 20:37:52 seriallist_windows.go:231: index:0, name:COM5, friendly:USB Serial Device (COM5)
2020/06/11 20:37:52 seriallist_windows.go:232: pid:606D, vid:1D50
2020/06/11 20:37:52 seriallist_windows.go:239: Found related element1:{COM5 USB Serial Device (COM5) [] 3B3CEA53  Microsoft USB Serial Device
606D 1D50}, element2:{COM4 USB Serial Device (COM4) [] 3B3CEA53  Microsoft USB Serial Device 606D 1D50}
2020/06/11 20:37:52 seriallist_windows.go:231: index:1, name:COM4, friendly:USB Serial Device (COM4)
2020/06/11 20:37:52 seriallist_windows.go:232: pid:606D, vid:1D50
2020/06/11 20:37:52 seriallist_windows.go:239: Found related element1:{COM4 USB Serial Device (COM4) [] 3B3CEA53  Microsoft USB Serial Device
606D 1D50}, element2:{COM5 USB Serial Device (COM5) [COM4] 3B3CEA53  Microsoft USB Serial Device 606D 1D50}
2020/06/11 20:37:52 main.go:200: Attempting to load Cayenn TCP/UDP server on port 8988...
2020/06/11 20:37:52 main.go:219: The Serial Port JSON Server is now running.
2020/06/11 20:37:52 main.go:220: If you are using ChiliPeppr, you may go back to it and connect to this server.
2020/06/11 20:37:52 main.go:235: Starting http server and websocket on 192.168.0.199:8989
2020/06/11 20:37:52 serial.go:123: Inside run of serialhub
2020/06/11 20:37:52 main.go:255: Missing tls cert and/or key. Will not start HTTPS server.
2020/06/11 20:37:52 cayenn.go:64: Cayenn UDP server running on port 8988 to listen for incoming device announcements and unguaranteed data.
2020/06/11 20:37:52 cayenn.go:408: Cayenn TCP server running on port 8988 to listen for incoming guaranteed device messages.
2020/06/11 20:37:53 main.go:169: Your serial ports:
2020/06/11 20:37:53 main.go:176:        {COM5 USB Serial Device (COM5) [COM4] 3B3CEA53  Microsoft  606D 1D50}
2020/06/11 20:37:53 main.go:176:        {COM4 USB Serial Device (COM4) [COM5] 3B3CEA53  Microsoft  606D 1D50}
```

Note that the date visible on each line on the left side of the screen will match the current calendar date and time that the program is run.

The most important lines needed in order to continue are the last two:



```
2020/06/11 20:37:53 main.go:176:        {COM5 USB Serial Device (COM5) [COM4] 3B3CEA53  Microsoft  606D 1D50}
2020/06/11 20:37:53 main.go:176:        {COM4 USB Serial Device (COM4) [COM5] 3B3CEA53  Microsoft  606D 1D50}
```

COM4 and COM5 indicate that the USB cable is connected and functioning properly. If these lines are not showing, see *Troubleshooting* for JSON. If these lines are showing, we can proceed to Chillipeppr. Note: Do not close JSON while operating the CNC.

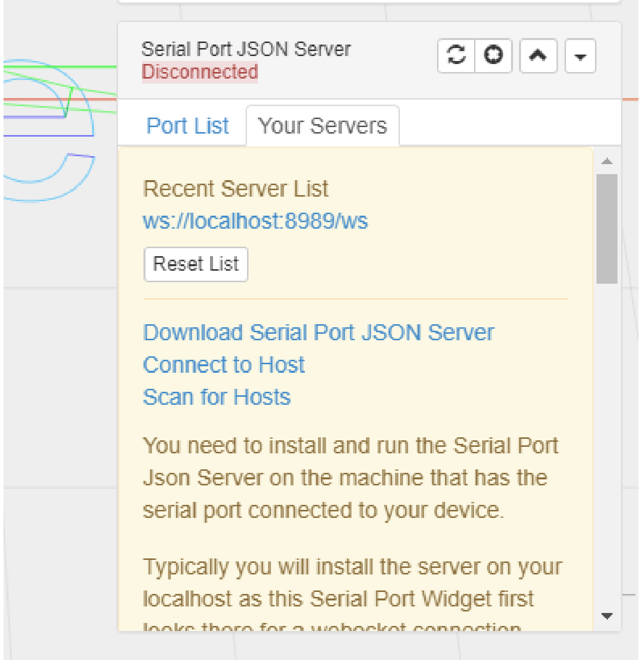
Chillipeppr.com

Now that we have a gcode part and are connected to the TinyG board with JSON, we can proceed to chillipeppr.com/tinyg

Software Installation Steps

Setting up Chilipeppr:

Step 1: Download the Serial Port JSON Server



Recent Server List

ws://localhost:8989/ws

Download Serial Port JSON Server

Connect to Host

Scan for Hosts

You need to install and run the Serial Port Json Server on the machine that has the serial port connected to your device.

Typically you will install the server on your localhost as this Serial Port Widget first looks there for a websocket connection

Step 2: Extract the zip file and open up the folder

* We tested the latest version already (Jul 27th, 2019), but be sure the boards.txt file has the string "tinyg" in it and that a bossac folder exists

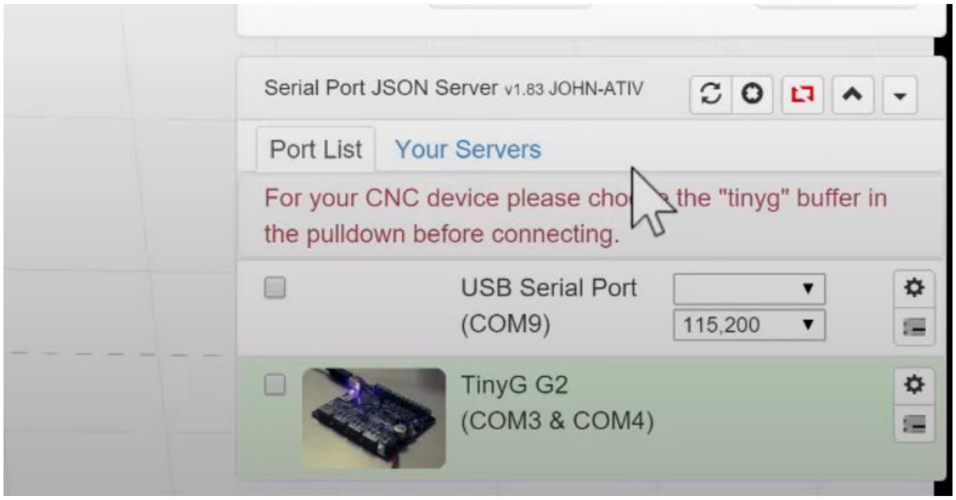
Step 3: Run the Serial Port.exe; Be sure to allow it through your firewall

*You should see in the command line window that popped up COM# showing up; that means your ports are available to be used!

Step 4: Go to Your Servers, and Proceed to Connect to localhost.

The TinyG board should be detected by now

Step 5: Head to Port List; Check off the TinyG G2 Board (it'll have a PNG)



Serial Port JSON Server v1.83 JOHN-ATIV

Port List | Your Servers

For your CNC device please choose the "tinyg" buffer in the pulldown before connecting.

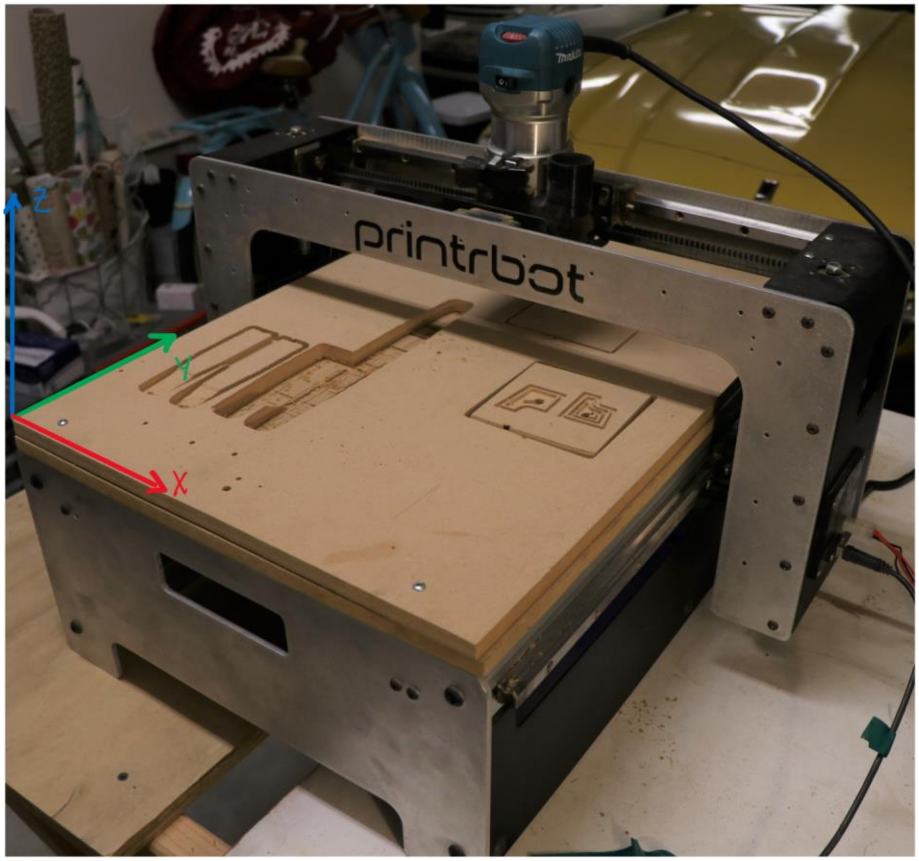
☐ USB Serial Port (COM9) — 115,200

☐ TinyG G2 (COM3 & COM4)

Step 6: Drag in your gcode into the browser, and start!

Hardware Operation

After our software changes in Chillipeppr, the XYZ coordinate system will look like the following (Note the corner with respect to the location of the wiring):



Troubleshooting

Chillipeppr

TinyG Not Showing on Port List:

If the TinyG is not showing on the port list, the USB COM 4 and COM 5 may not be registering. Try disconnecting and reconnecting the USB cable from the computer and restarting the JSON software

Serial Port JSON

COM 4 and COM 5 are not registering on the JSON software:

Both COMs may not show on the JSON software when the program is run. Make sure that the TinyG board is powered on.

Try disconnecting and reconnecting the USB cable from the computer and restarting the JSON software.

If this does not work, try hitting the manual reset button on the TinyGv9 board. This is a small red button located underneath the Printrbot on the TinyG board. This will reset the TinyG board and may reset any settings that have been modified

NEMA 23 Stepper Motors

Stepper Motor Limit Switches

Motor Limit Switches Not Stopping the Motors When Pressed:

The limit switches may not always function as desired. When pressed on a surface, they will send a signal to the TinyG board to stop the motor from moving. This, however, has been known to fail. One possible problem is that the limit switch may be disabled in the software settings on Chillipeppr. This can be checked by typing the following into the *Console*:

```
$lim
```

If the Limit Switch is enabled, the *Console* will then show the following:

```
[lim] limit switch enable         1 [0=disable,1=enable]
```

If a 0 is shown instead of a 1, type the following into the *Console*:

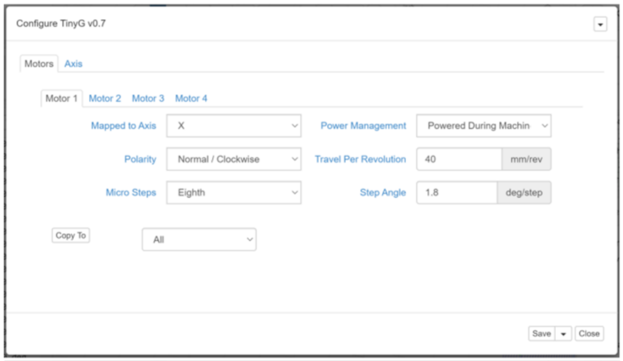
```
$lim=1
```

When pressed, there should be an audible *click* sound.   If there is no sound, the switch mechanical button may be broken and will not send a signal to the TinyG board to stop the motor. The switch can be tested by jogging the motor in Chillipeppr while holding the limit switch corresponding with that axis down (e.g. Jog the x-axis motor and hold the x-axis limit switch). If the motor moves while the switch is pressed, this likely means that the switch is no longer working properly.

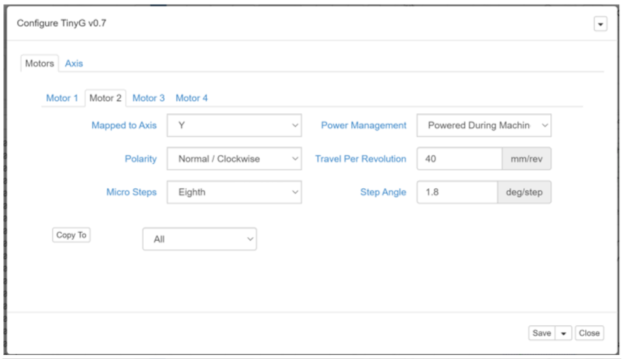
TinyGv9

TinyG Motor Configuration

Original Settings



Mapped to Axis: X
Polarity: Normal / Clockwise
Micro Steps: Eighth
Power Management: Powered During Machin
Travel Per Revolution: 40 mm/rev
Step Angle: 1.8 deg/step
Copy To: All



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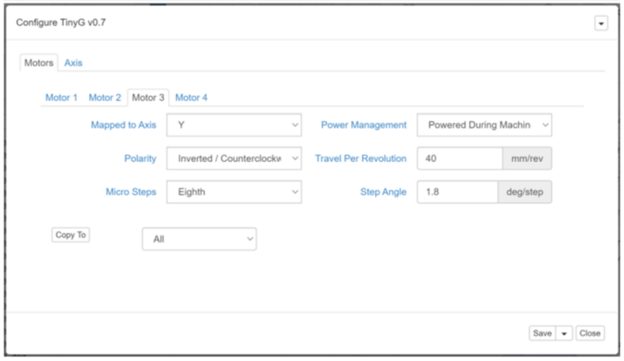

Mapped to Axis: Y
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Micro Steps: Eighth
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Travel Per Revolution: 40 mm/rev
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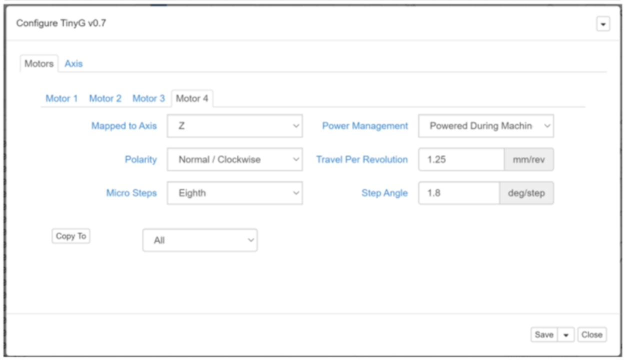
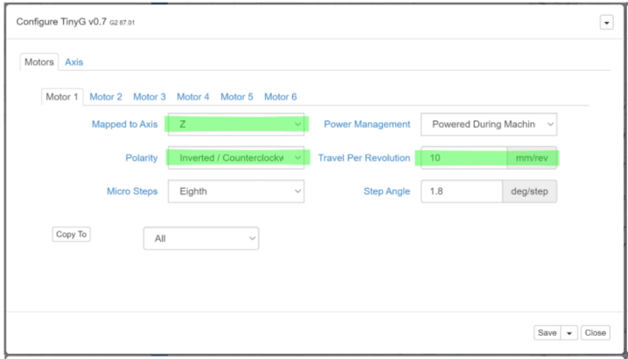
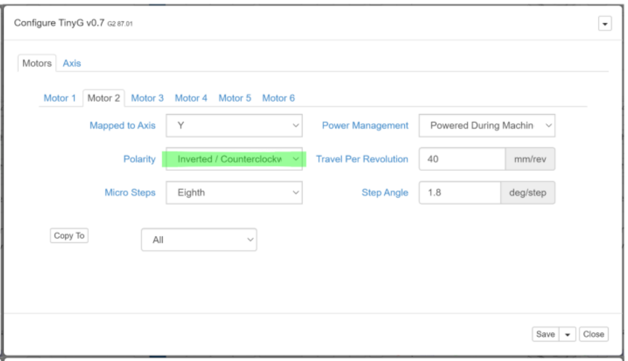


Mapped to Axis: Z
Polarity: Normal / Clockwise
Micro Steps: Eighth
Power Management: Powered During Machin
Travel Per Revolution: 1.25 mm/rev
Step Angle: 1.8 deg/step
Copy To: All

Updated Settings *Changes Highlighted in Green*



Mapped to Axis: Z
Polarity: Inverted / Counterclockw
Micro Steps: Eighth
Power Management: Powered During Machin
Travel Per Revolution: 10 mm/rev
Step Angle: 1.8 deg/step
Copy To: All



Mapped to Axis: Y
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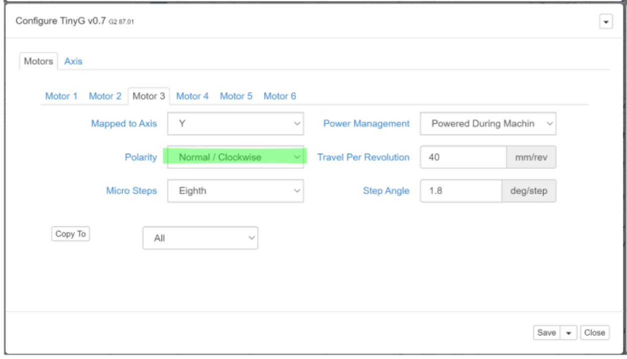
Micro Steps: Eighth
Power Management: Powered During Machin
Travel Per Revolution: 40 mm/rev
Step Angle: 1.8 deg/step
Copy To: All



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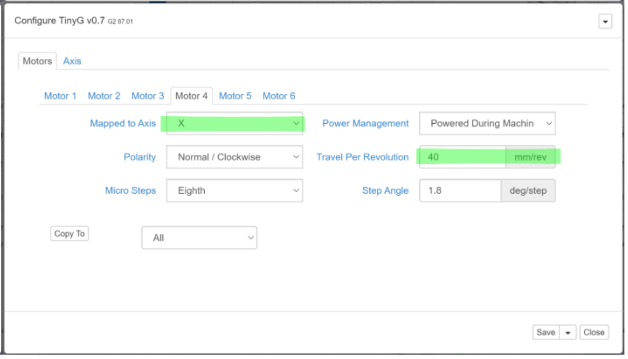

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Polarity: Normal / Clockwise
Micro Steps: Eighth
Power Management: Powered During Machin
Travel Per Revolution: 40 mm/rev
Step Angle: 1.8 deg/step
Copy To: All

Revision History

Name	Date	Changes made
Michael DeLessio	6/1/2020	Creation of Manual
Adrien Sanding	6/11/2020	Creation of Manual

References

Brook Drumm (Founder of Pritrbot) Discussing this CNC