

Wiring a Z Table and Rotary: Step-by-Step Instructions

Using external stepper drivers with a Cohesion3D Mini board is recommended for driving a z-table or a rotary. External stepper drivers are ideal for larger motors and more powerful applications. An external stepper driver adapter is used in place of the A4988 stepper driver.

The following steps are the same for either a z-table or a rotary setup. If you are installing both, repeat each step for each stepper driver.

What you will need for each setup:

- An external stepper driver such as a TB6600
[<http://cohesion3d.com/tb6600/>]
- An external stepper driver adapter
[<http://cohesion3d.com/external-stepper-driver-adapter-for-pololu-style-socket/>]
- Some length of 20-22AWG wires in various colors
- It is also highly recommended to get a separate 24V/6A power supply to connect the stepper motors to.

Requires tools:

- Wire cutter and wire stripper
- Precision screw drivers
- (Digital) Multimeter with continuity tester
- (Optionally) A crimper if you are putting terminal lugs on the power cables going to the 24V power supply

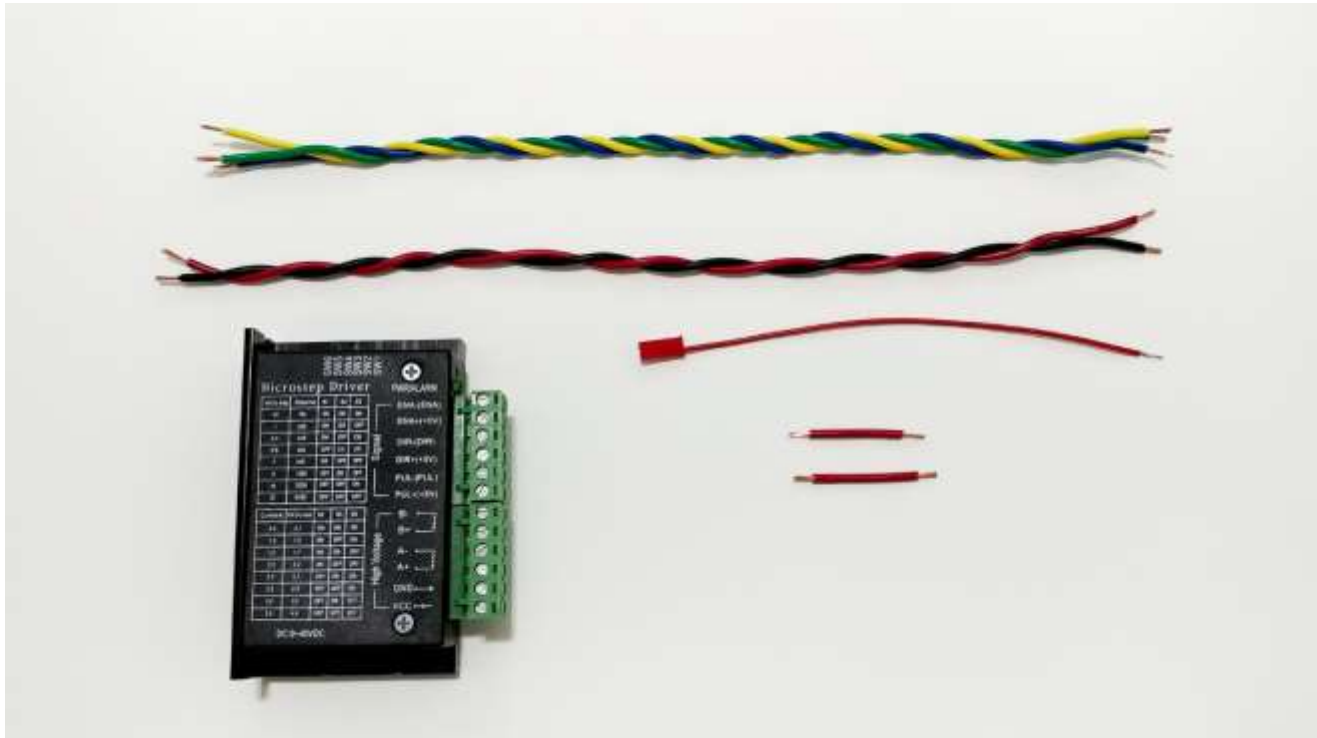


Let's start by setting the TB6600 to the proper settings of 16 micro steps and 1 Amp current output. Use a small flat precision screw driver to flip the switches. For the micro steps value, switches **S1**, **S2**, and **S3** should be set to **OFF**, **OFF**, and **ON** respectively. And for the 1 Amp current, the switches **S4**, **S5**, and **S6** should be set to **ON**, **OFF**, and **ON** respectively. The switches should look like this when done:

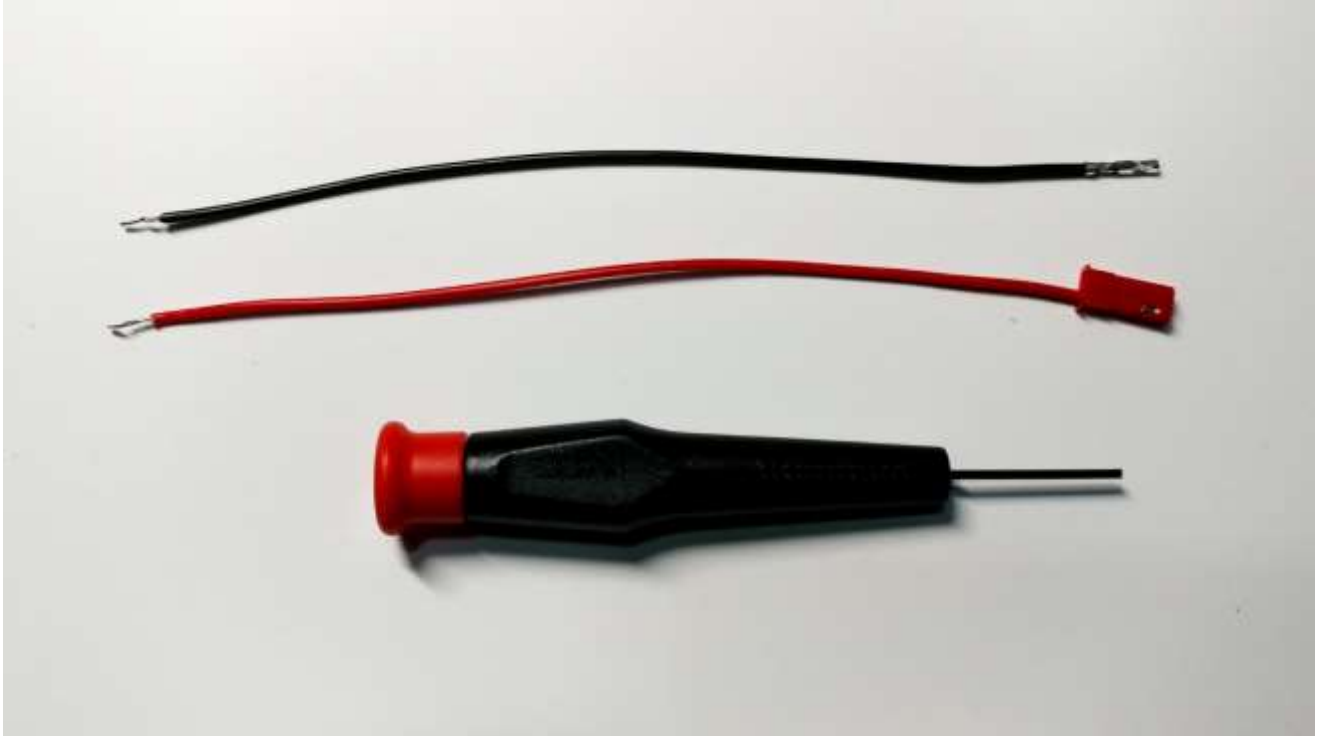


Now let's move on to preparing the various wire pieces. Wire colors aren't important as long as you can easily identify them. Traditionally a black and red pair is used for power connections, and other colors for other kinds of connections. Wire lengths will be dependent on where the stepper drivers are located within the laser cutter, where the 24V PSU is, and where the Cohesion3D Mini board is. Arrange your wire bundles in the following manner:

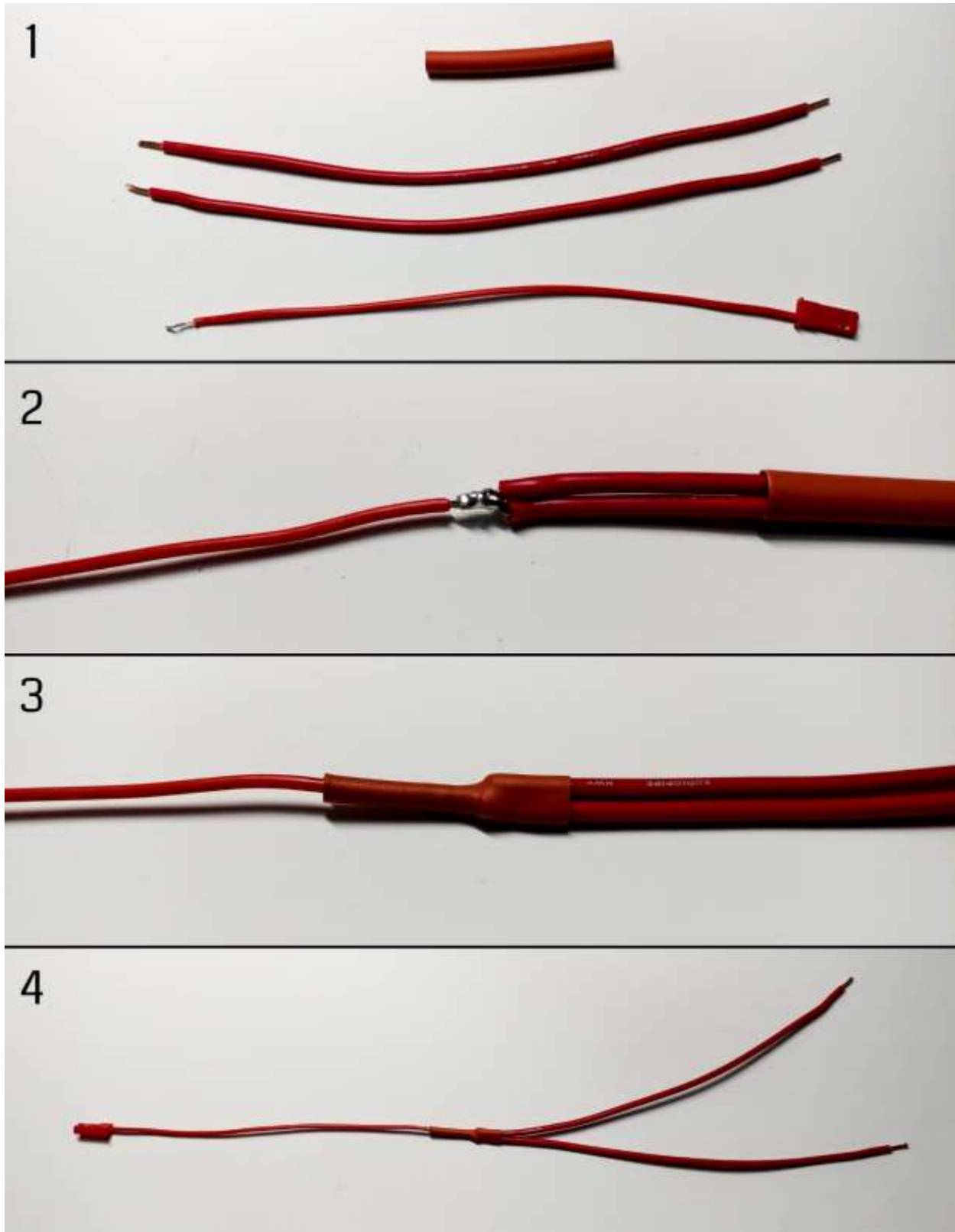
- two (2) short red wires (about 1.5" to 2" long), these will be used as "shunts"
- three (3) wires (different colors) to connect the adapter to the stepper driver
- one (1) red/black pair for the 24V power connection from the PSU to the stepper driver
- one (1) single red wire used for the 5V connection to the Cohesion3D board



For this document, a battery power cable pair was used with the black wire removed. Use a small tip screw driver to push on the metal clip in the header and slide the wire out of the housing.



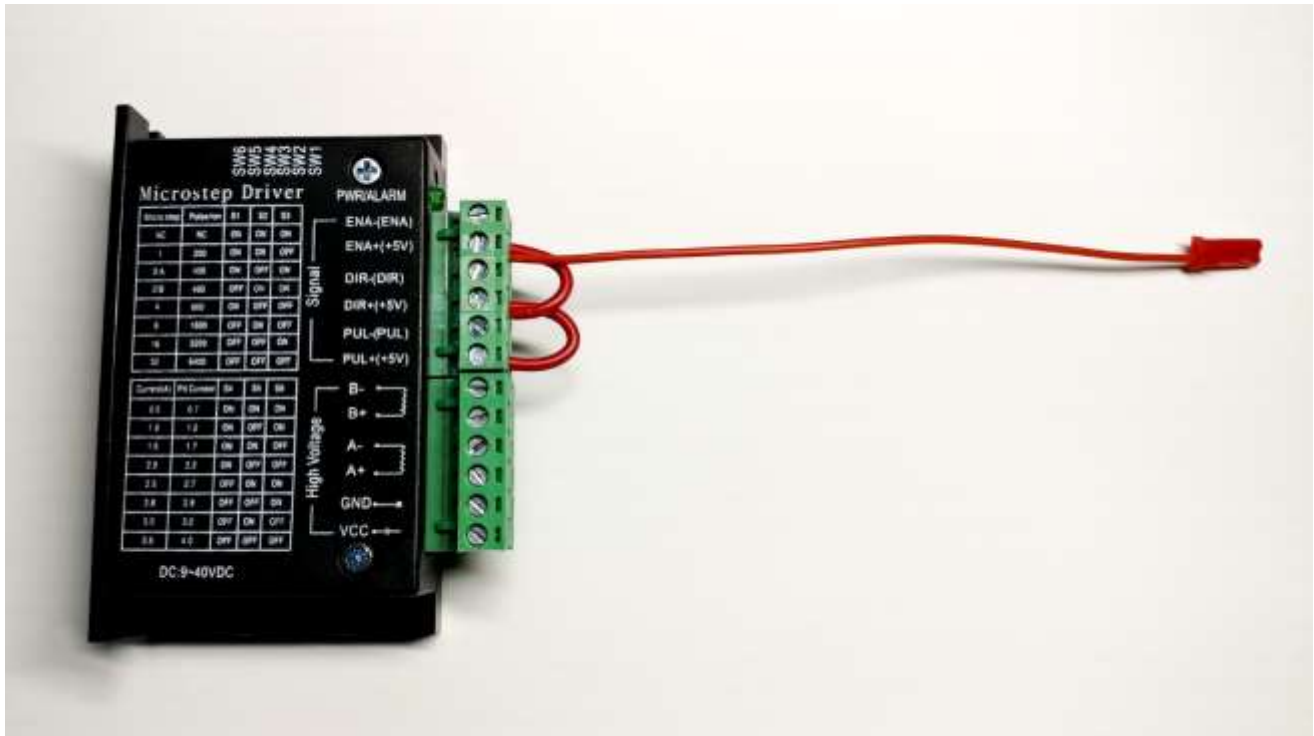
NOTE: If you are installing both a z-table and a rotary, this wire will need to be made into a Y-split cable with each leg going to each stepper drivers. Cut two lengths of wire and solder them together to the single one with the header. Use a heat shrink sleeve to protect the joint.



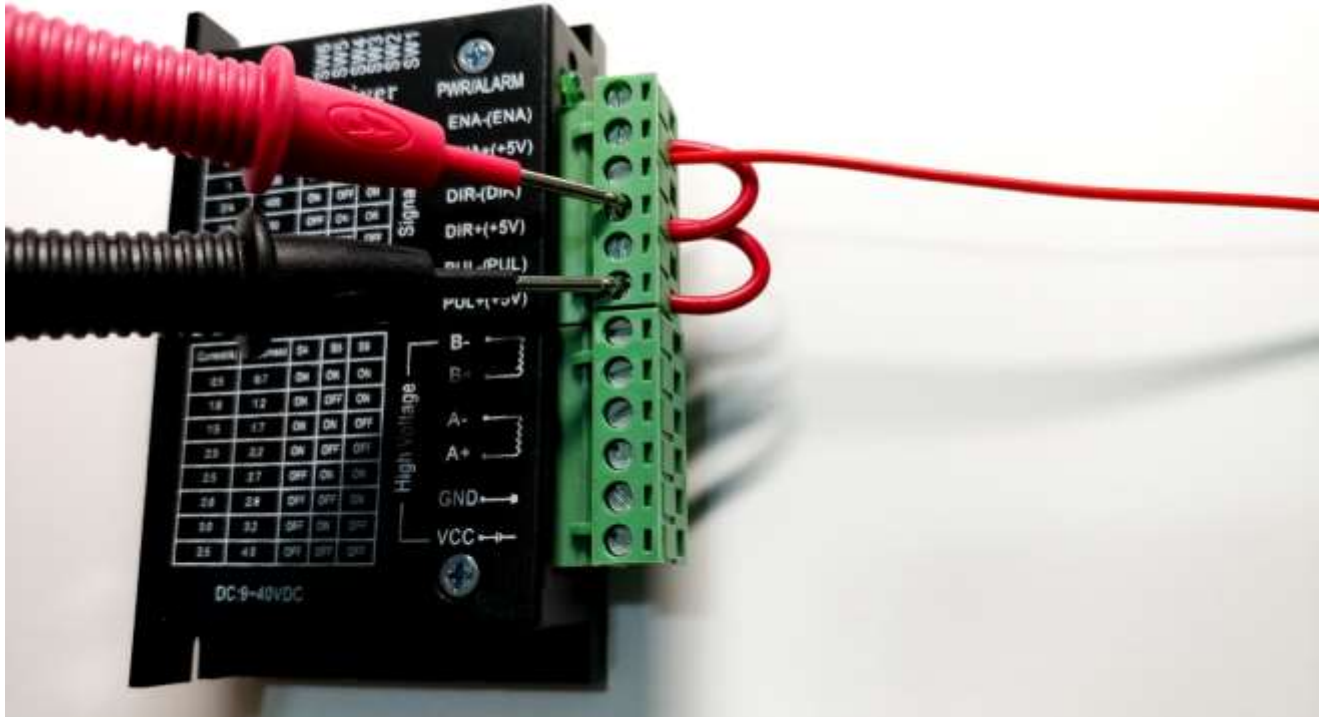
Step 1:

Start by identifying the (+) terminals on the stepper driver. They are **ENA(+)**, **DIR(+)**, and **PUL(+)**. Using the two short red wires, connect these together. Use one wire to connect **ENA(+)** to **DIR(+)**, then use the other wire to connect **DIR(+)** to **PUL(+)**. Look at the wiring schematic [<https://cohesion3d.freshdesk.com/support/solutions/articles/5000739904-wiring-a-z-table-and-rotary-with-external-stepper-drivers>] to see how this is done.

Connect the single red wire (or the Y-split you made) to the **ENA(+)** terminal as well. This wire will later connect to the 5V header on the Cohesion3D Mini board. Ideally this wire will have a header on one end to plug it in the header on the board. It's a 2-pin female Dupont style header. You'll only be using one of the two pins.

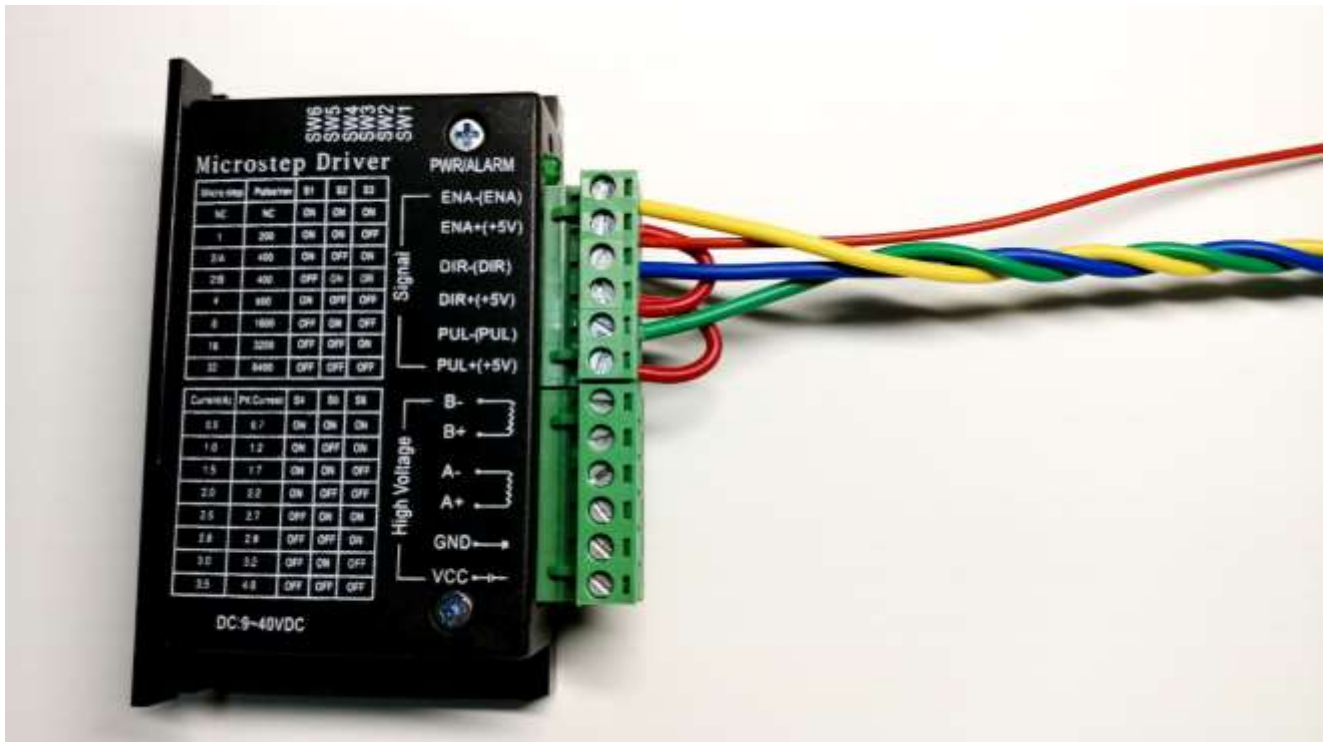


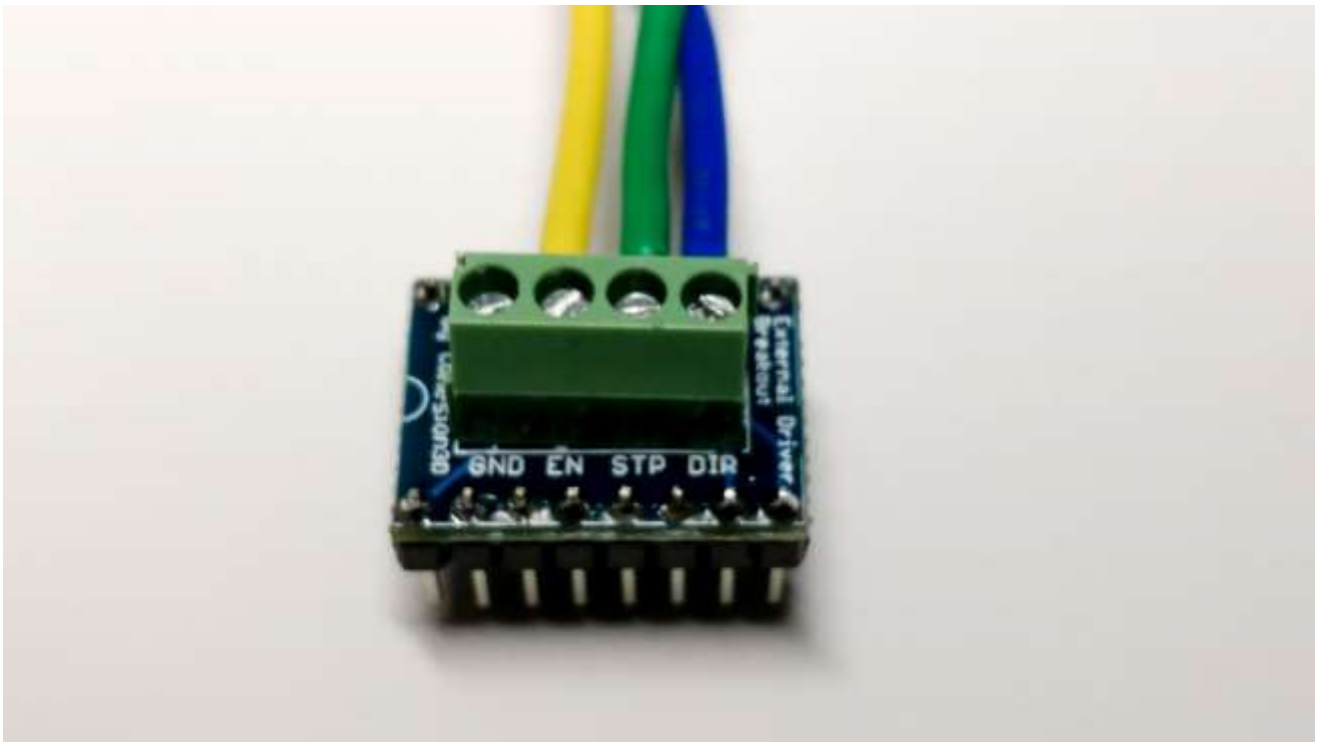
You can check for proper connections by using a multimeter set to continuity. Put the probes on the (+) terminals and it should beep if there's a good connection. Do this with all three (+) terminals.



Step 2:

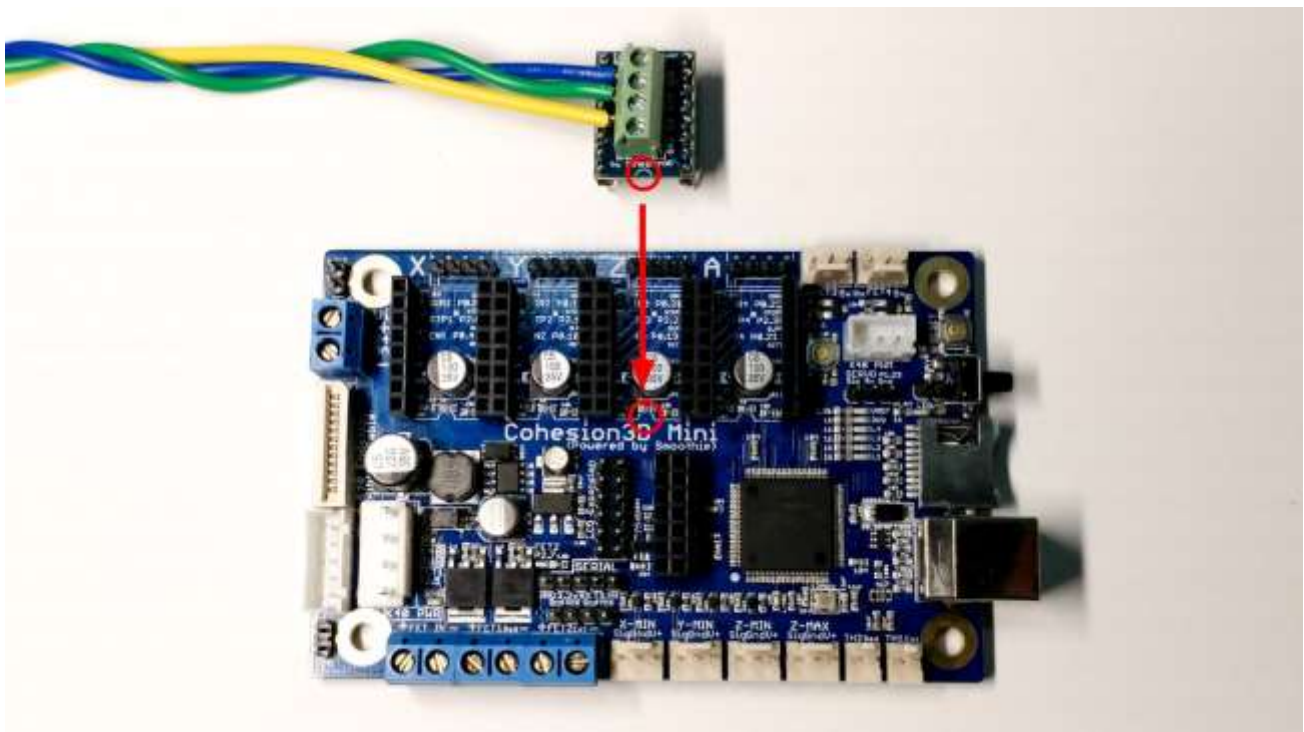
Identify the three (-) terminals on the stepper driver. They are **ENA(-)**, **DIR(-)**, and **PUL(-)**. Using three wires of different colors, connect those to the matching terminals on the external stepper driver adapter: **ENA(-)** to **EN**, **DIR(-)** to **DIR**, and **PUL(-)** to **STP**.





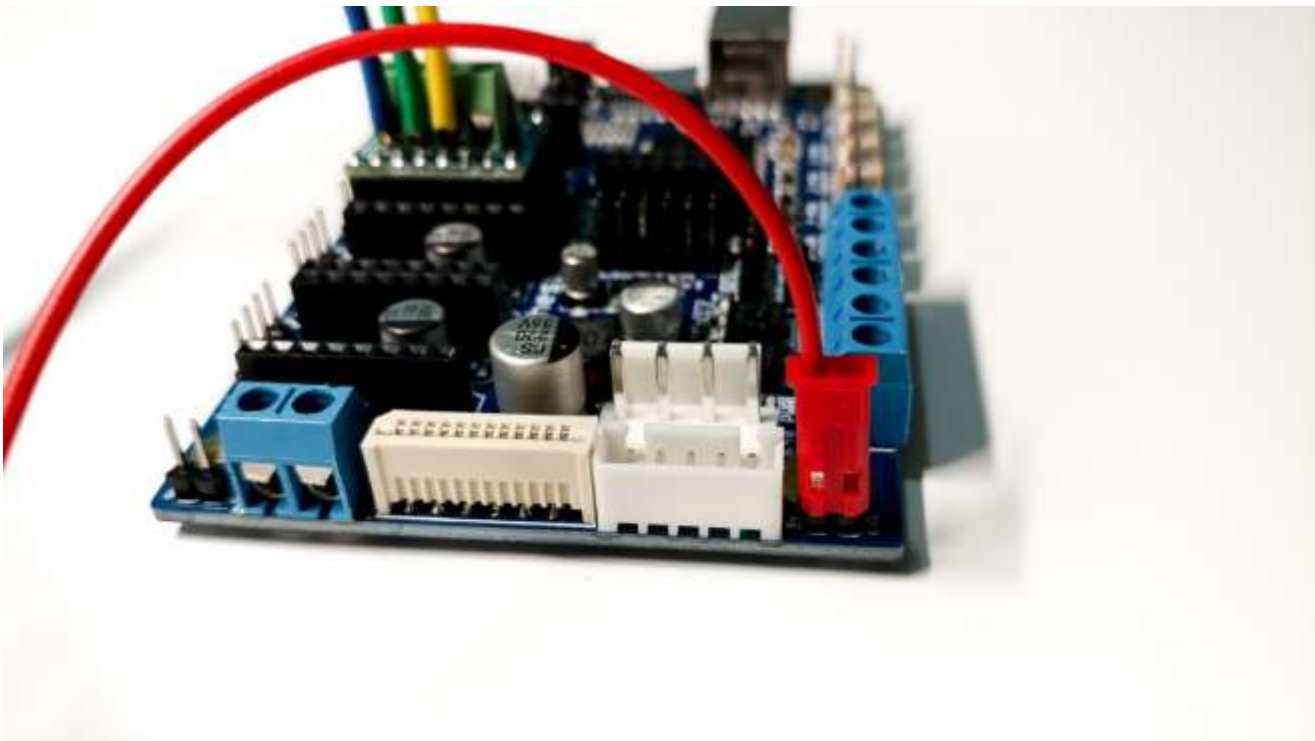
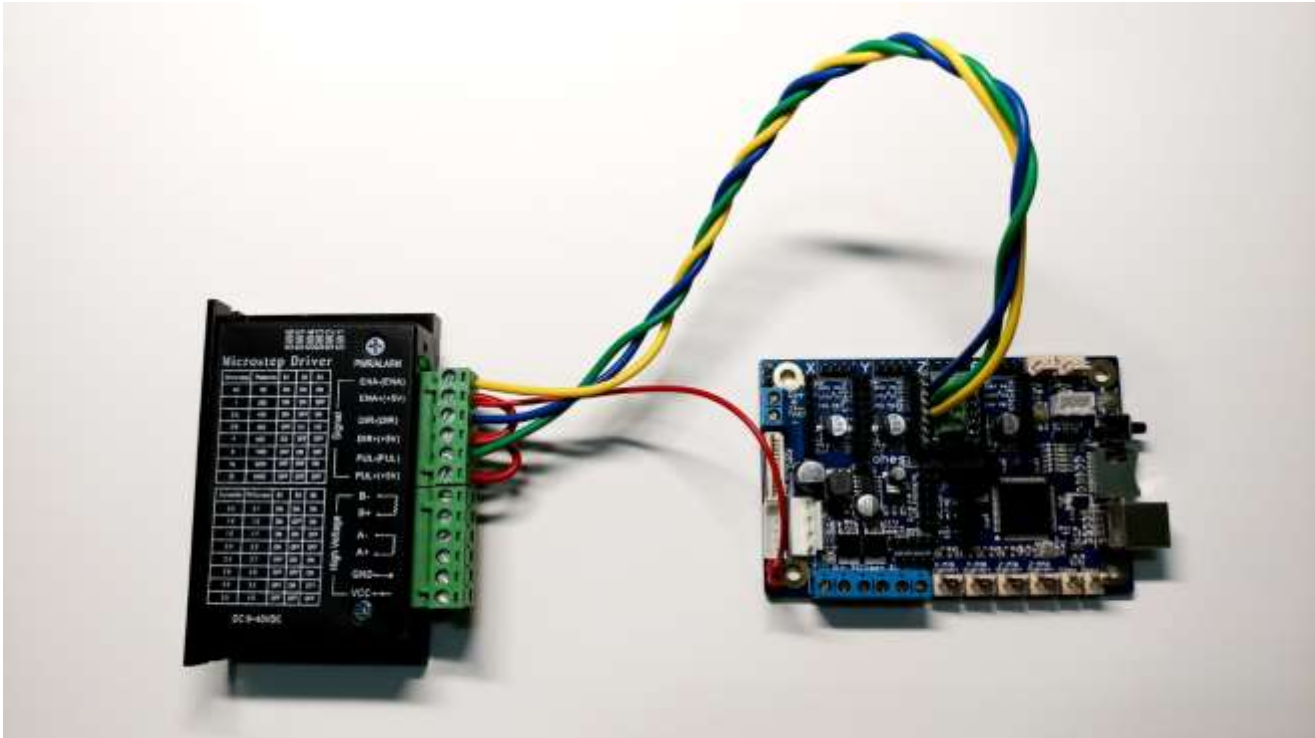
Step 3:

The external stepper driver adapter board has a half moon indicator on one edge. Match it up with the same half moon indicator on the Cohesion3D Mini board and plug it in to the port you intend to use, Z (z-table) or A (rotary). Make sure you match up the pins with the header correctly. A misalignment can potentially damage your board.



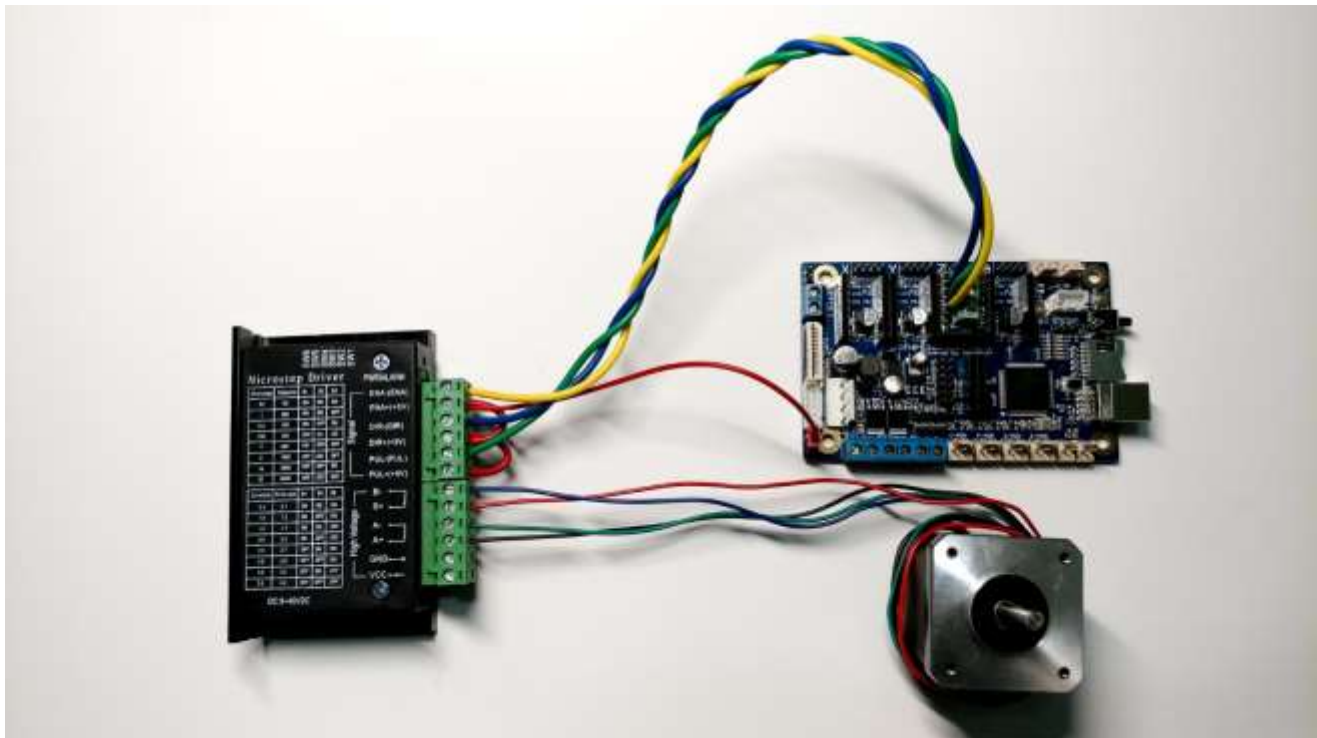
Step 4:

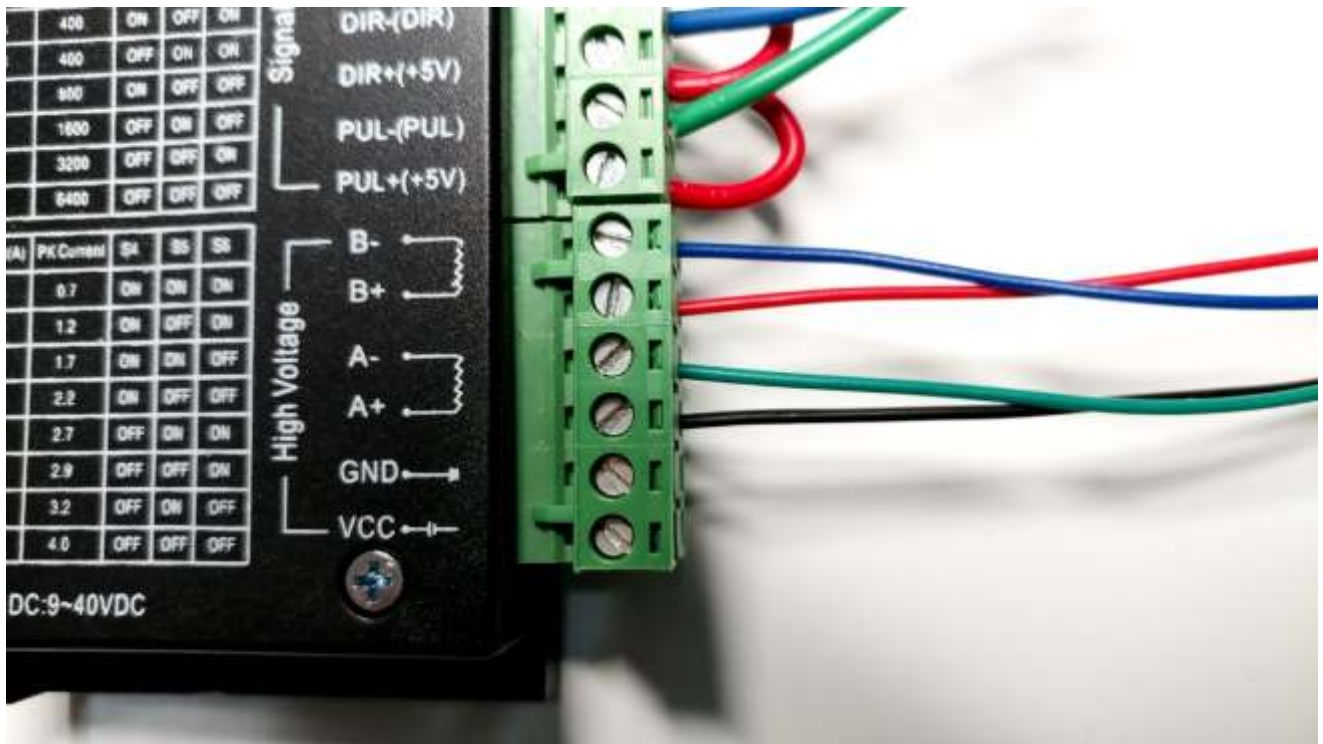
Connect the 5V red wire from Step 1 to the 5V header on the Cohesion3D board. While holding the Cohesion3D Mini board with the name right side up, the header is in the lower left corner. This a 2-pin header, however only the 5V pin will be used. The 5V pin is the upper of the two.



Step 5:

Following the manufacturer's pin-out instructions for the stepper motor, connect the stepper motor wires to the stepper driver A+/A- and B+/B- terminals. (Most manufacturers or vendors will indicate what the wire pairs are.)

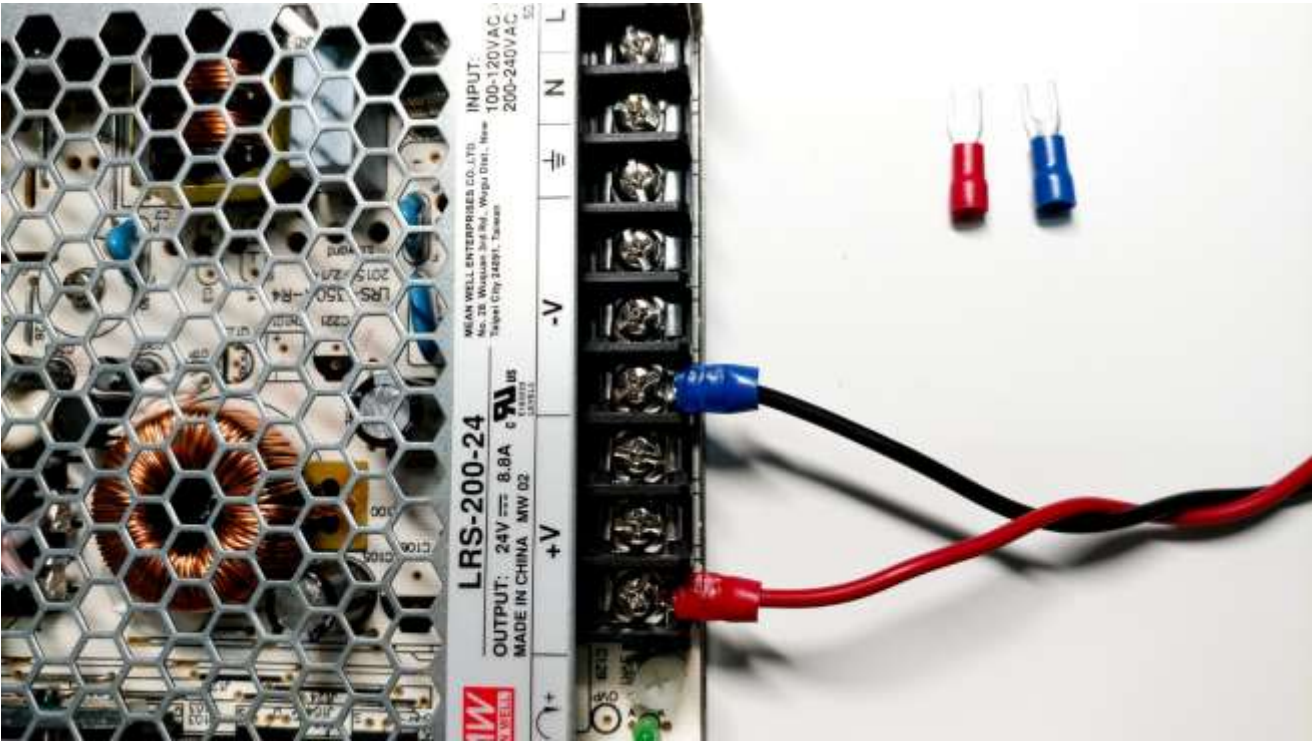
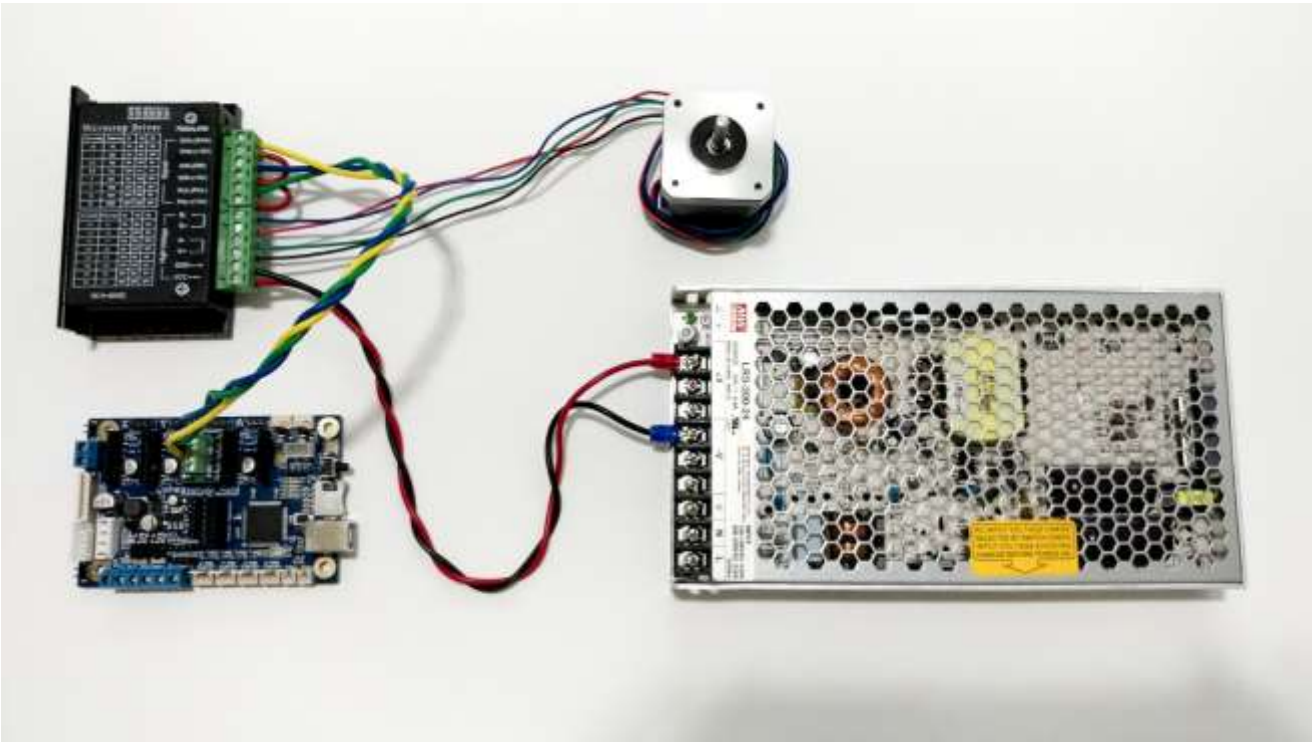




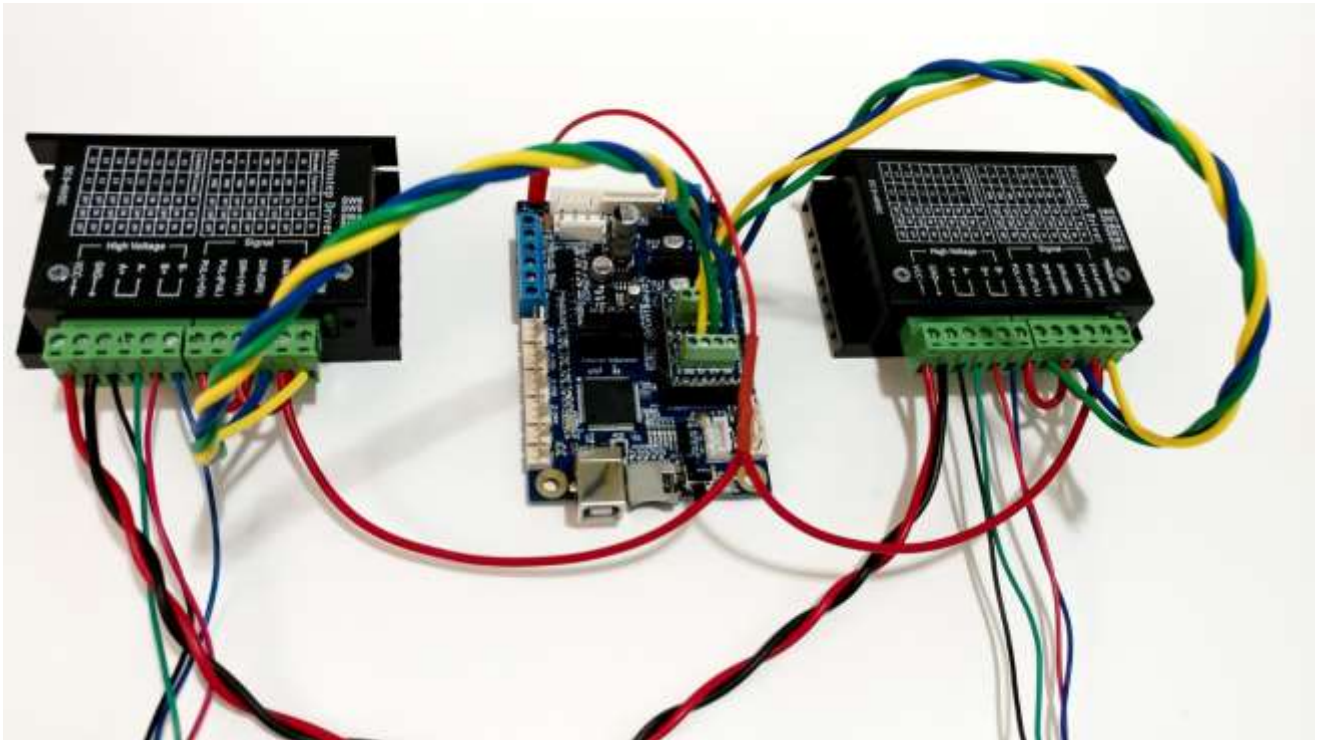
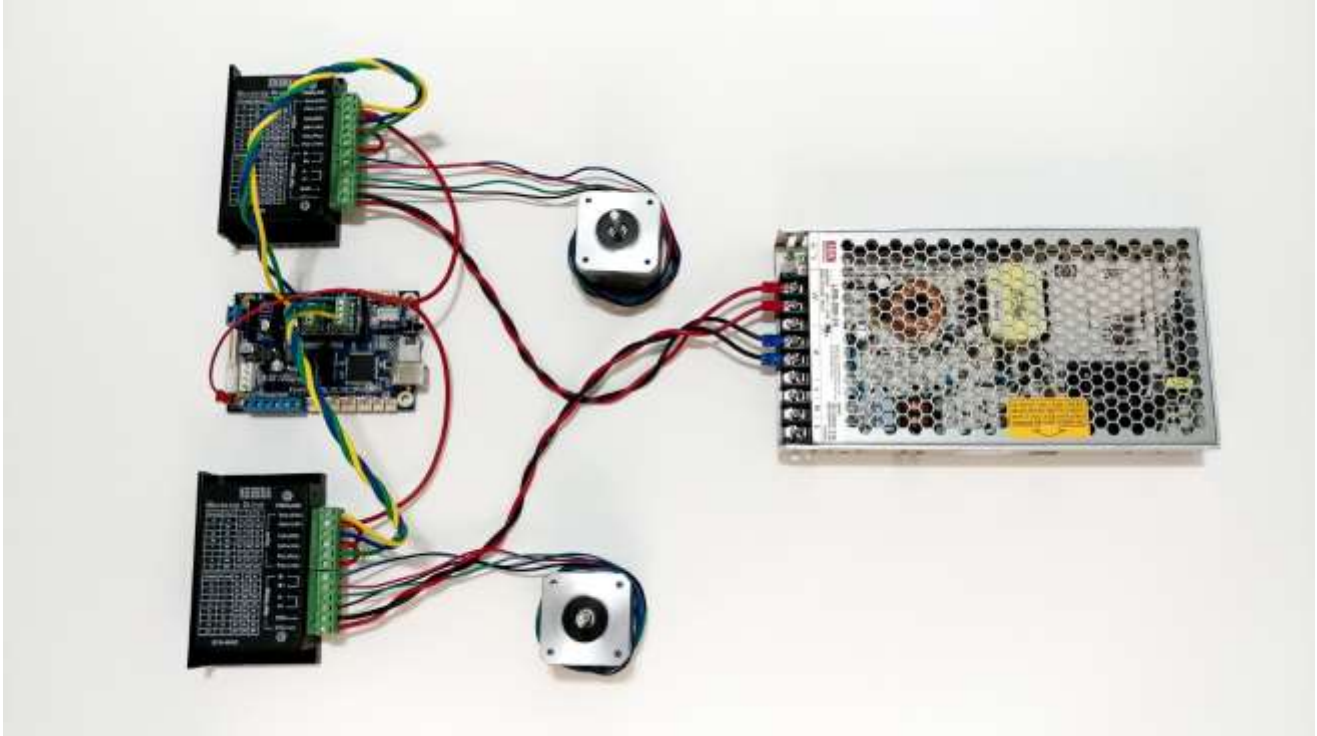
Step 6:

Finally, connect the red/black wire pair from the 24V terminals on the stepper driver to the 24V PSU.





If you are connecting both a z-table and rotary, repeat all the steps for the second device, using the Y-split cable you created for the 5V header, and wire both stepper drivers to the 24V power supply.





After verifying that all the wiring is correct and the screw terminals are screwed tight, you can move on to configuring the `config.txt` file.

IF YOU ARE ONLY ADDING A Z-TABLE (on port Z):

Open the `config.txt` file and change the settings on the 'gamma' stepper module to the following:

```
gamma_step_pin      2.2!o    # Note the '!o' appended - that's the letter 'o'
gamma_dir_pin       0.20!o    # Note the '!o' appended - that's the letter 'o'
gamma_en_pin        0.19!o    # Note the '!o' appended - that's the letter 'o'
gamma_current       1.5
gamma_max_rate      300.0
```

Save the file back onto the SD card, and power up the machine. If all went well, in LaserWeb4, switch to the Settings tab and open the Machine section. Scroll down and enable the '**MACHINE Z STAGE**'.

IF YOU ARE ADDING BOTH A Z-TABLE (on port Z) AND A ROTARY (on port A):

You will need an updated firmware that enables 4 axis. Please follow the instructions outlined on the Smoothie web site <http://smoothieware.org/compiling-smoothie> to compile a new firmware.

Change the compile command from 'make clean all' into two separate ones:

```
make clean
make AXIS=4 CNC=1
```

Once the compile finishes, there should be a `main.bin` file in a folder titled `LPC1768`. Rename the file to `firmware.bin` and copy it onto the SD card of the Cohesion3D Mini. Open the `config.txt` file and make the same changes to the 'gamma' stepper module as described above.

Then, below that section, add the following settings for the rotary (port A):

```
# A axis
delta_steps_per_mm  100      # may be steps per degree for example
delta_step_pin      2.3!o    # Pin for delta stepper step signal
delta_dir_pin       0.22!o    # Pin for delta stepper direction
delta_en_pin        0.21!o    # Pin for delta enable
delta_current       1.5      # Z stepper motor current
delta_max_rate      3000.0    # mm/min
delta_acceleration   500.0    # mm/sec2
```

Save the file back onto the SD card. Insert it into the Cohesion3D Mini and power it up. If everything went well, you should see the LEDs on the board count in a binary fashion, then go into its idle state (two constant LEDs and 2 rapidly flashing LEDs.) Watch a short video demonstration on YouTube: <https://www.youtube.com/watch?v=KsNRvsvl8vc>

In LaserWeb4, switch to the Settings tab and open the Machine section. Scroll down a bit and enable the '**MACHINE Z STAGE**' and '**MACHINE A STAGE**'.

Laserweb 4.0.989

Files

Comms

Control

Settings

About

Machine

DIMENSIONS

MACHINE WIDTH 300 MM

MACHINE HEIGHT 200 MM

ORIGIN OFFSETS

SHOW MACHINE ☒

MACHINE LEFT X 0 MM

MACHINE BOTTOM Y 0 MM

TOOL HEAD

BEAM Ø 0.1 MM

PROBE TOOL

X/Y PROBE OFFSET 0 MM

Z PROBE OFFSET 0 MM

▼ MACHINE FEED RANGES

MACHINE Z STAGE ☒

TOOL OFFSET

0 MM

DEFAULT START HEIGHT

MM

MACHINE A STAGE ☒

AIR ASSIST ☐

File Settings

Gcode

Application

If you don't want your Z-table to also go through a homing sequence, you can change the command in LaserWeb to 'G28.2 X Y' which will only home the X and Y movements.

Laserweb 4.0.989

Files

Comms

Control

Settings

About

Machine

File Settings

Gcode

GCODE START

```
G21 ; Set units to mm
G90 ; Absolute positioning
M3 ; Turn on laser
```

GCODE END

```
M5 ; Switch tool offEnd
M2 ; End
```

GCODE HOMING

```
G28.2 X Y
```

TOOL ON

TOOL OFF

PWM MAX S VALUE	1	
CHECK-SIZE POWER	0	%
TOOL TEST POWER	20	%
TOOL TEST DURATION	500	MS