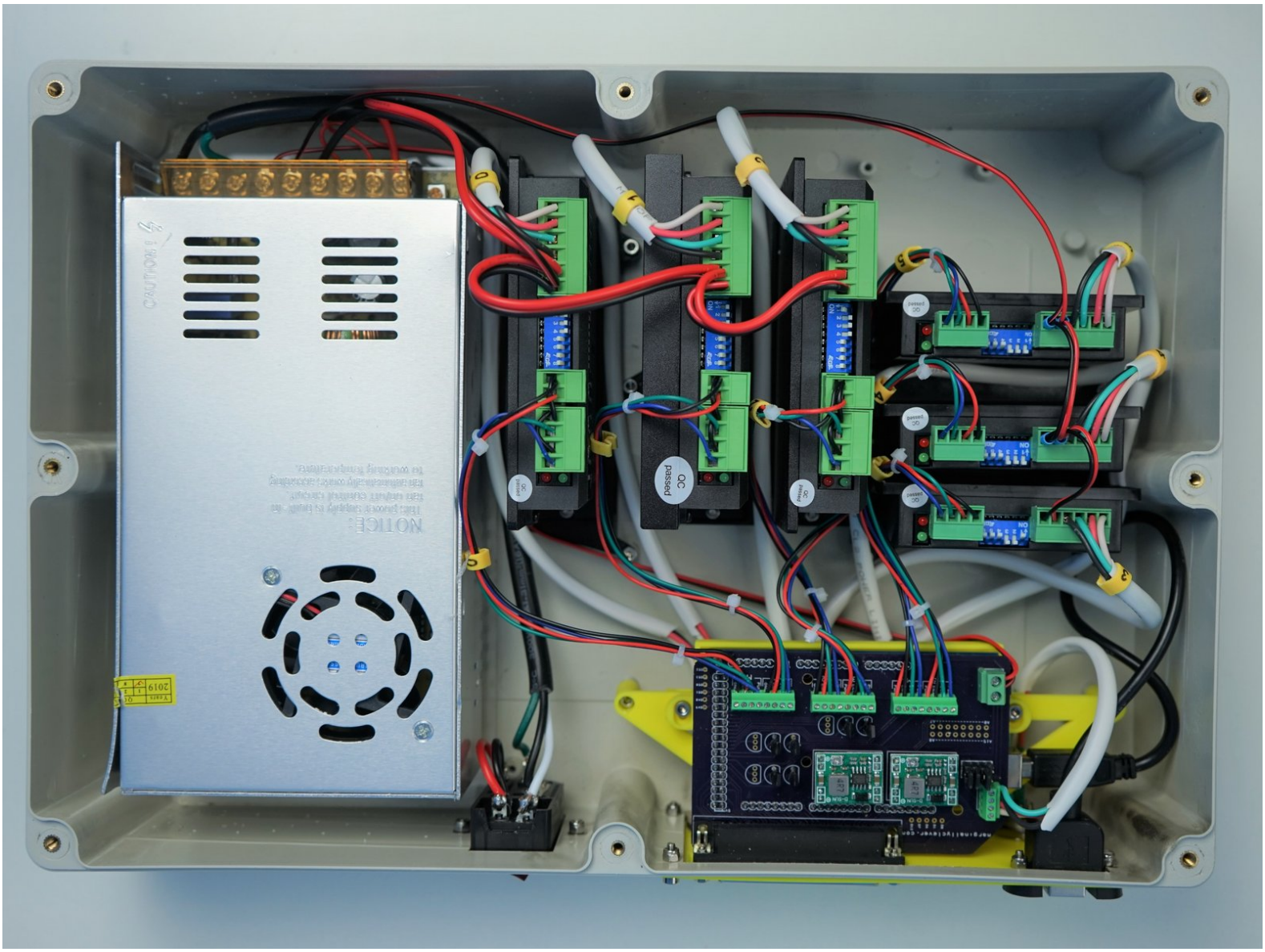
mcr

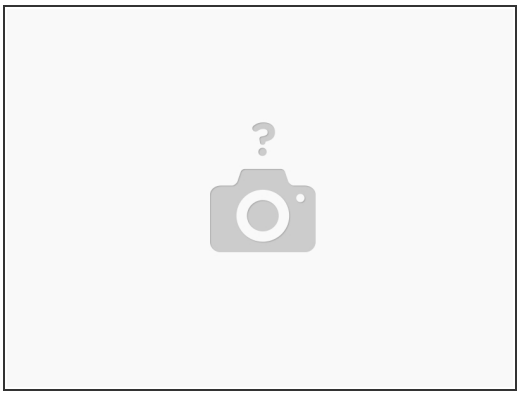
1. Electronic Case Assembly

This guide will assemble the Sixi robot's brain box.

Written By: Dan Royer

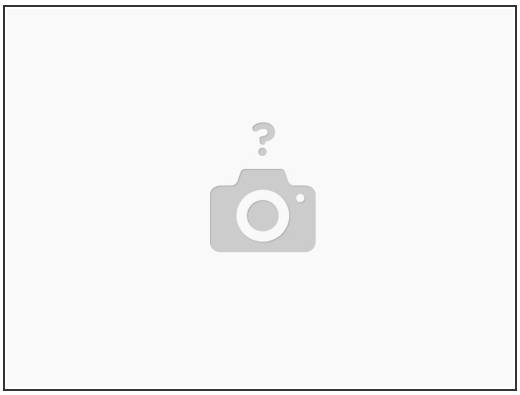


Step 1 — Tools Required



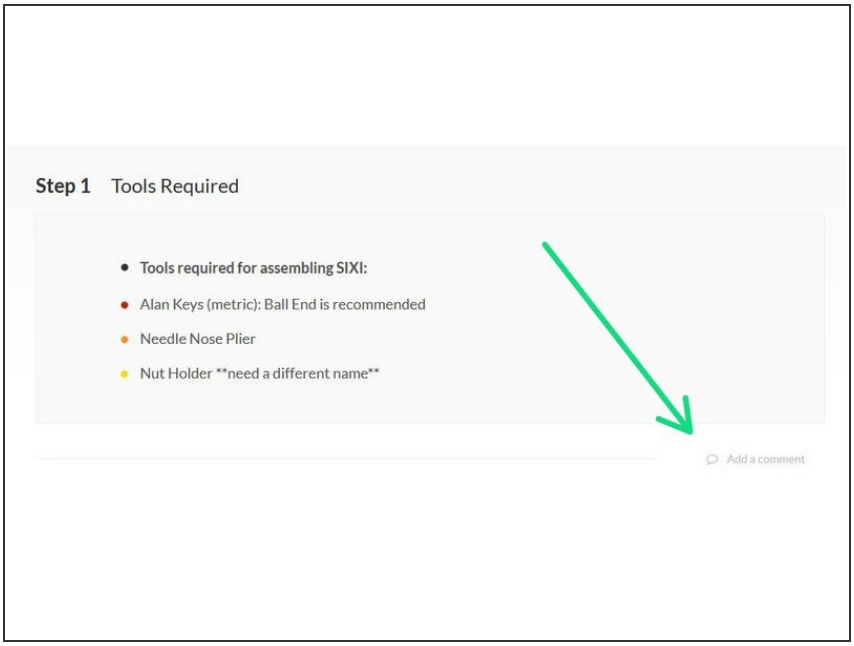
- **Tools required for assembling SIXI:**
- Alan Keys (metric): Ball End is recommended
- 5mm Hex Nut Driver
- Needle Nose Plier

Step 2 — Label and Version Guide



Most 3D printed parts are labelled to verify the package and versions.

Step 3 — How to be successful



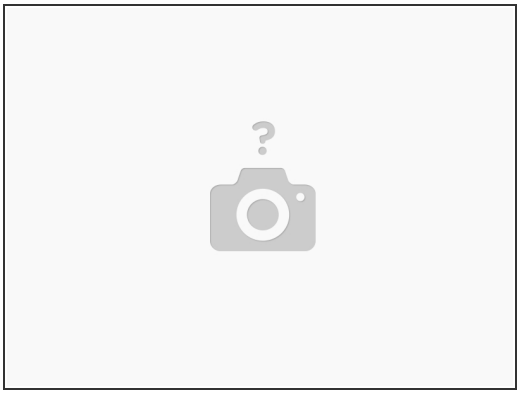
Read each chapter before you start work. Catch confusing things early!

Always follow every step in order.

- If a step is unclear, use the comment section below it to let us know.

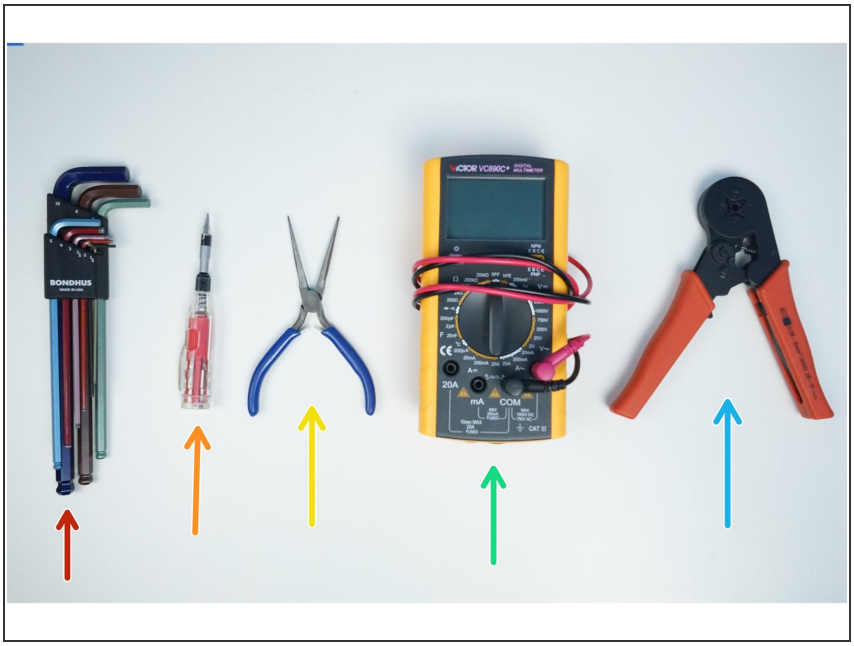
Steps may be color coded and have matching colored symbols on the pictures. A single picture could have more than one symbol.

Step 4 — 3D printing



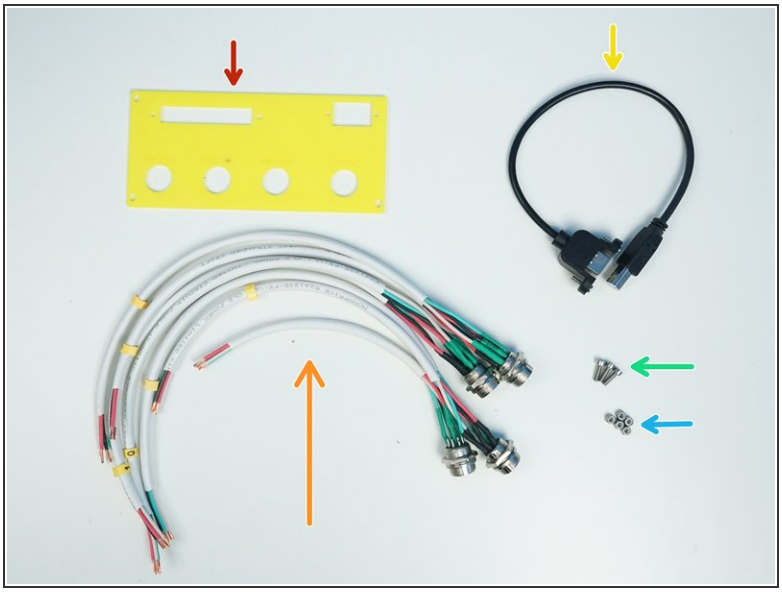
- If you are 3D printing parts yourself, make sure to calibrate your printer! Bad tolerances will make gearboxes either (A) sloppy or (B) so tight they don't move.

Step 5 — Tools and Parts Required for This Chapter



- [3D] Electronic Case Package
- Robot Electronics
- Alan Keys
- Flat Screw Driver
- Needle Nose Pliers
- Multimeter
- Ferrule Crimper (optional)

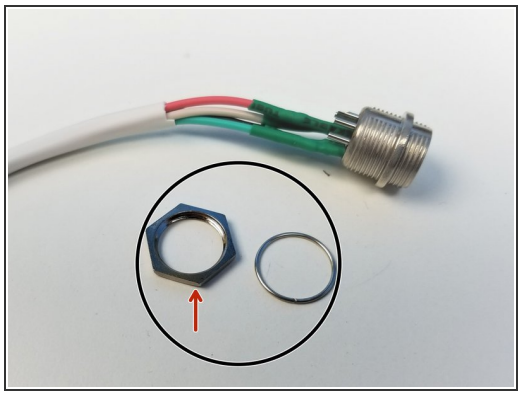
Step 6 — Case Wall Mount - Parts

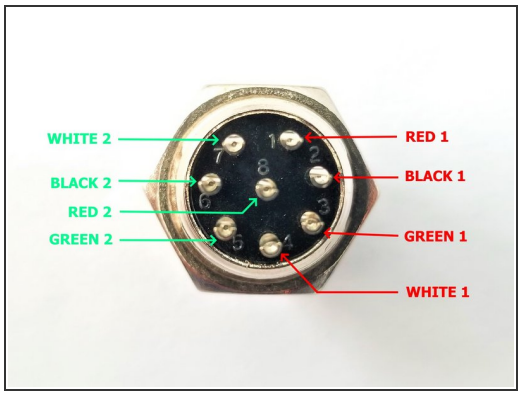


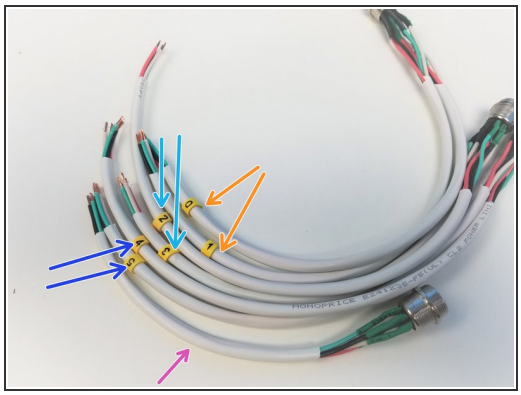
Prepare the following components:

- ABS Junction Box {380x260x105mm}
- [3D] - 7E-plug wall adapter
- Aviation GX16-8p Cable M/O (wire assembled and numbered)
- USB-B M/F Panel Mount Extension
- M3x10mm Screws (x3)
- M3 Nylock Nuts (x5)

Step 7 — Case Wall Mount - GX16 Aviation Connectors 1







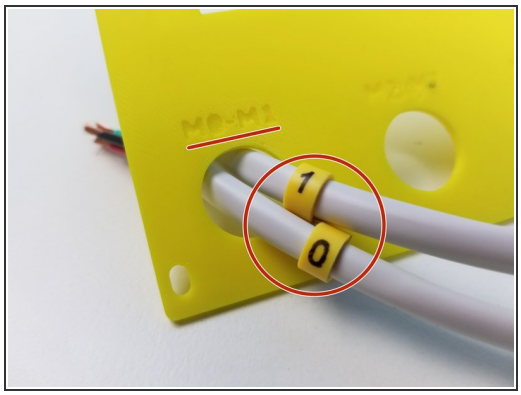
- Unscrew the **Wall Mount Nuts** from each connectors

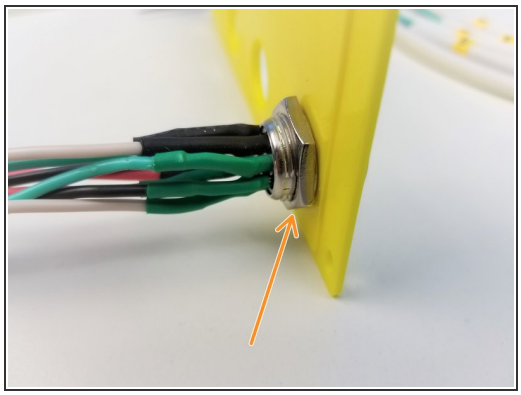
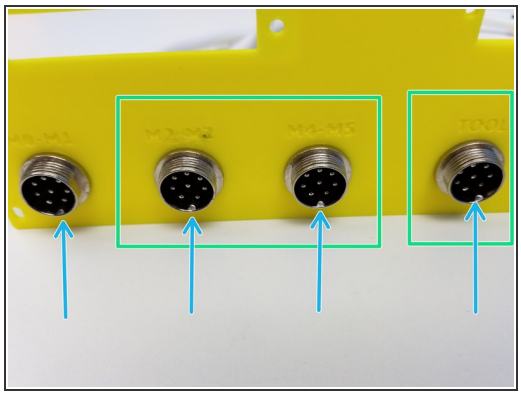
Each Connectors have **2 sets of 4pin wires soldered** in this specific manner

The wires are cut to length as follows:

- 0 & 1 = **370mm & 370mm** respectively
- 2 & 3 = **370mm & 270mm** respectively
- 4 & 5 = **340mm & 310mm** respectively
- Not Labelled = Tool --> **190mm**

Step 8 — Case Wall Mount - GX16 Aviation Connectors 2

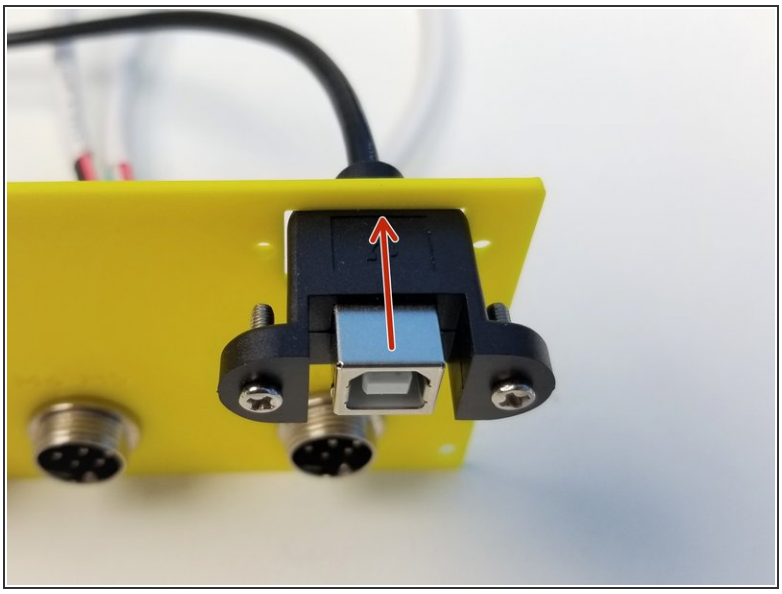


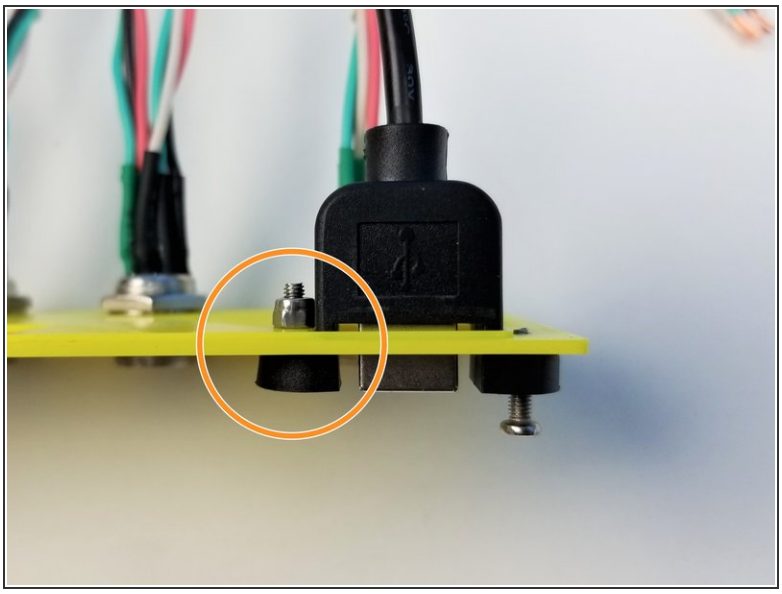



Familiarize yourself with the panel. The back side has a lip and the front side is labelled with each connector.

- Feed the **Cables** through the Wall Adapter as labelled. Make sure the long end of the cable ends up on the *back* side of the panel.
- Tighten the **Mounting Nut** that was unscrewed from the previous step
- **Repeat** the same process with the rest of the connectors
- Be sure the **alignment mark** on the plug to be in the bottom center

Step 9 — Case Wall Mount - USB Extension Cable



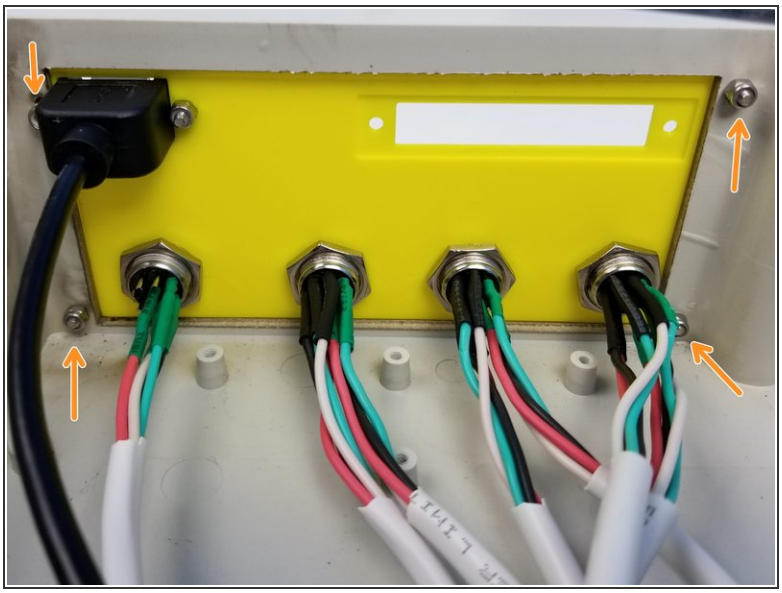


USB Extension Cable comes with *M3x10mm Philip Head Screws*

- Feed the **USB Cable** through the Case Wall Adapter
- Use **M3 Nylock Nut** to secure USB Extension Cable in place

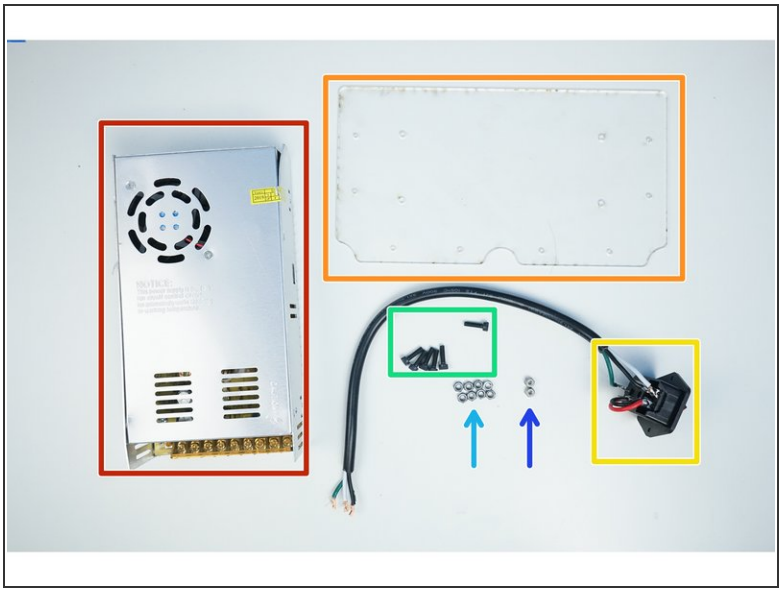
⚠ Only tighten the side furthest from the edge

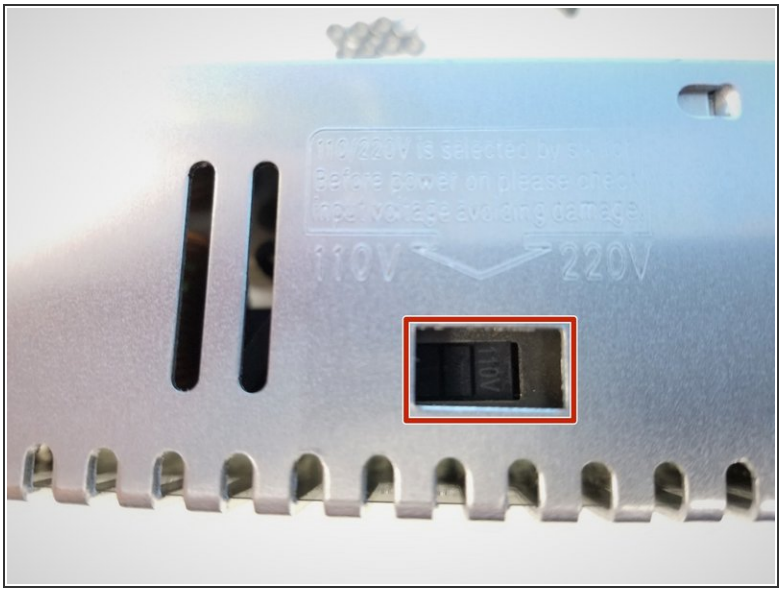
Step 10 — Case Wall Mount - Installation



- Insert the Case Wall Adapter into the Case and secure its place using the **M3x10mm Screws**.
- Use the **M3 Nylock Nuts** on the inside of the case but don't tighten it too much. *Case wall Adapter should be able to slide along the wall*

Step 11 — Power Supply Installation - Parts



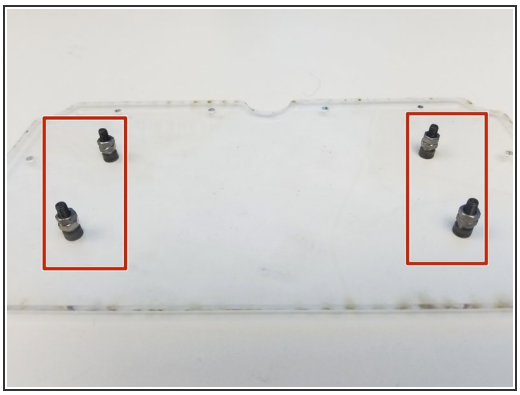
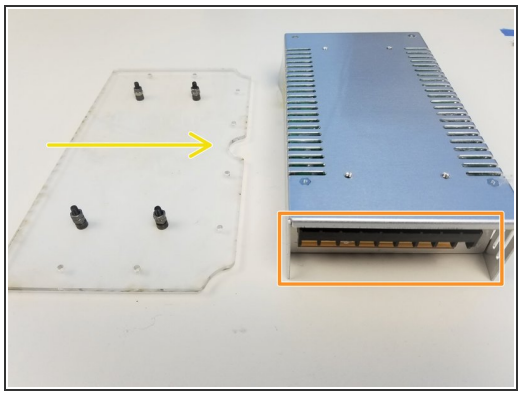
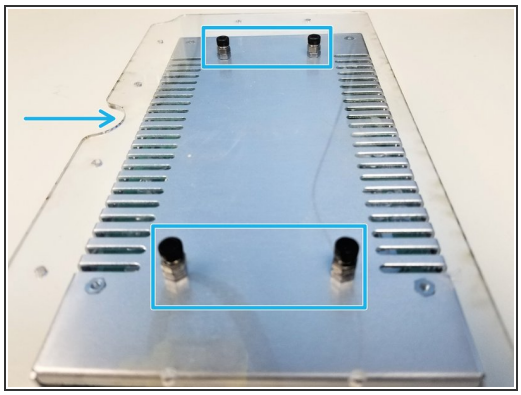


Prepare the following components:

- Power Supply 24V-20A
- Acrylic PSU Mounting Plate
- Rocker Switch
- M4x14mm Screws (x6)
- M4 Hex Nuts (x8)
- M4 Nylock Nuts (x2)

⚠ Make sure the **Power Supply is set to the correct voltage**, in Canada, we use 110V

Step 12 — Power Supply Installation - PSU Mounting Plate

- Use **two M4 Hex nuts per M4x14mm Screws** as *spacer on the Acrylic Mounting Plate*

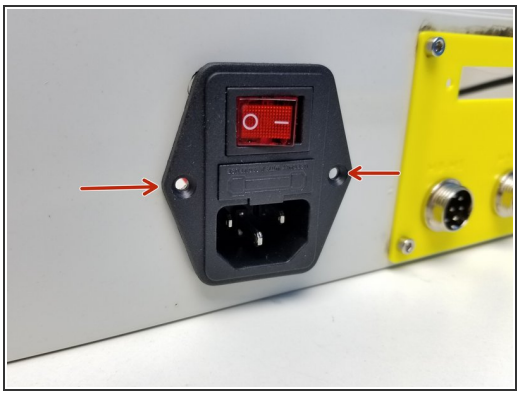
ⓘ Align the PSU and the Acrylic Mounting Plate as shown in the figure exactly

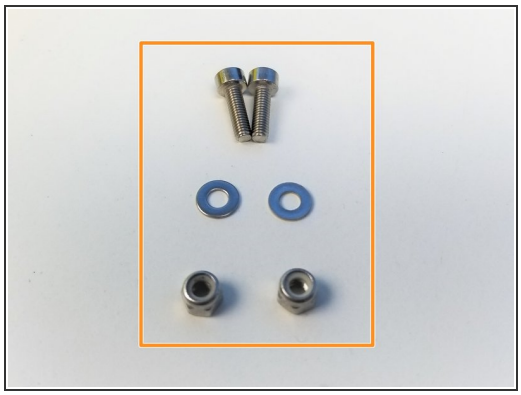
- Take a closer look on the Screw Terminal of PSU
- Take a closer look on the "Half Moon" cut on the Plate

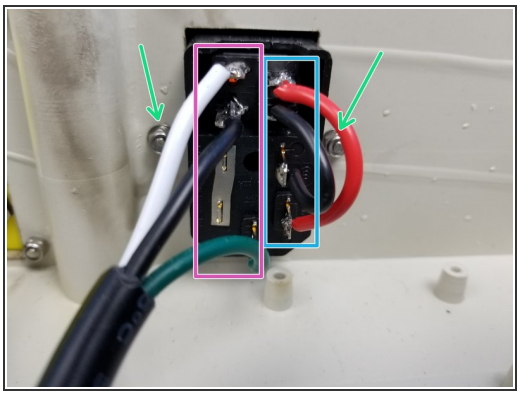
- Flip the **Acrylic Mounting Plate** on to the PSU

⚠ DON'T tighten 1 screw all the way at a time, this will cause the plate to flex and cause it break

Step 13 — Power Supply Installation - Rocker Switch Installation







- Insert the **Rocker Switch** into the Machined Case.

⚠ Some version of Rocker Switch has smaller mounting holes

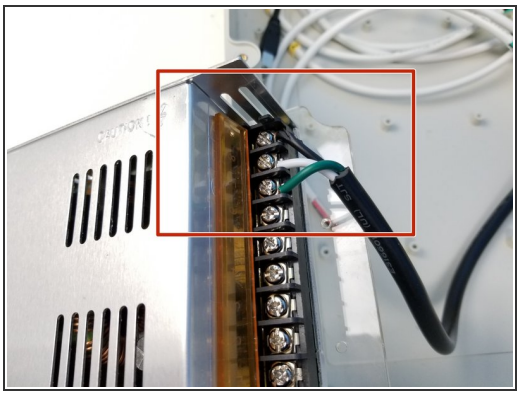
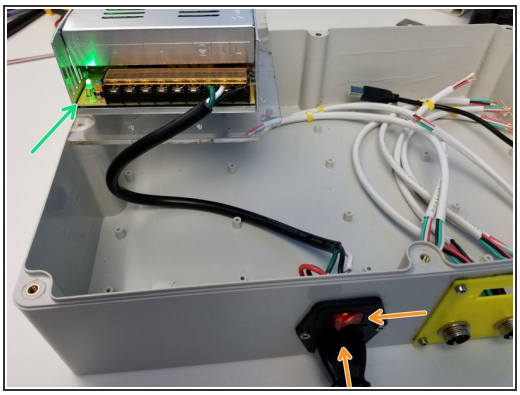
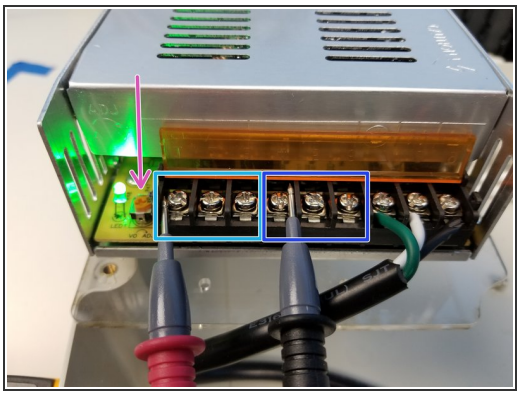
- if this is the case, use the **M3x10mm Screws, Washers and Nylock Nuts**
- If not, use **M4x14mm Screws and M4 Nylock Nuts**

- Secure the **Rocker Switch** with the fasteners

ⓘ Notice the Soldering Patterns AND Length

- 18AWG Power Wires **65mm** long
- 3 Wire Power Cable **365mm** long

Step 14 — Power Supply Installation - Rocker Switch Test

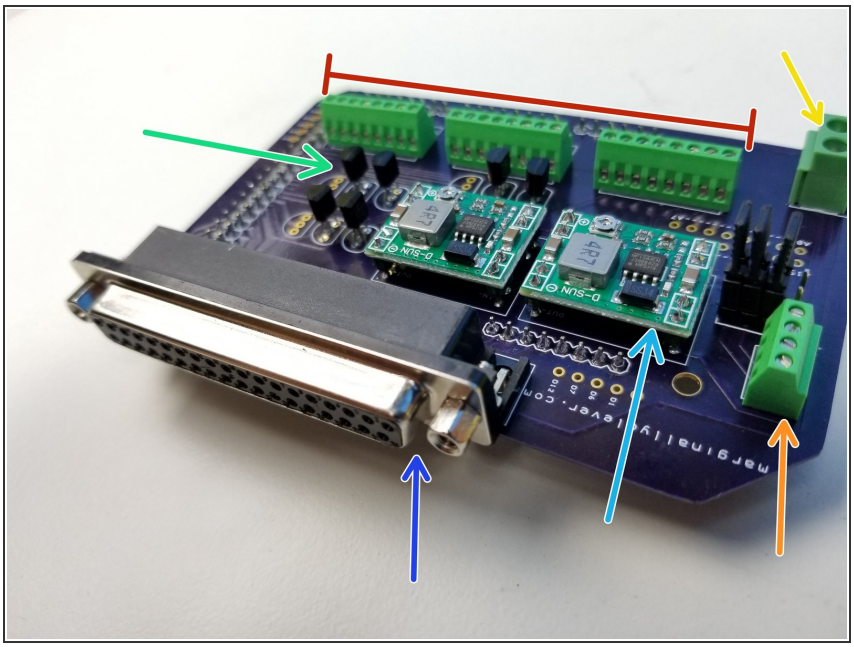
- Secure the **Power Cable** to the PSU Screw Terminals
- Test the Rocker Switch and PSU by connecting the Power Plug and turning the Switch ON

⚠ Be careful to NOT touch the screw terminals with your bare hands.

- If the Green LED light turns on, it's a good sign

- Use the Multimeter to make sure the output voltage is **approximately 24V**, adjust using the Philip Head Screw
  - Left 3 terminals are Positive Output
  - Middle 3 terminals are Ground/Negative Output
- Once test is successful, **Turn off** the Power using the Switch and **unplug** the Power Plug

Step 15 — Arduino Mega Shield Introduction

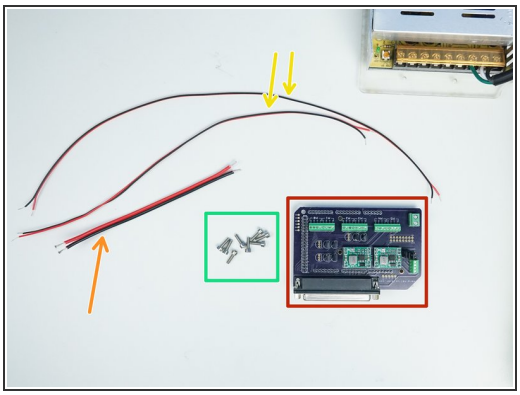


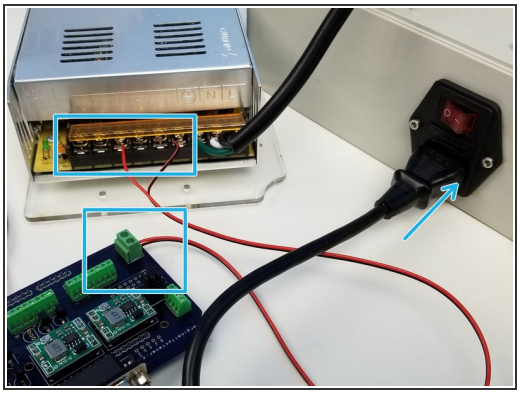
This custom Arduino Mega Shield can be ordered directly and contains the following parts:

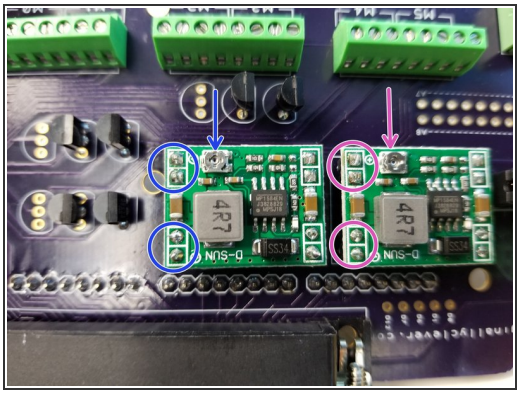
- Screw Terminal 8p - 2.54mm (x3)
- Screw Terminal 4p - 2.54mm (x1)
- Screw Terminal 2p - 3.5mm (x1)
- NPN Transistor 2N2222A (x6-9)
- Voltage Regulator MP1584EN (x2)
- D-SUB F-Conn right-angle 37p

⚠ The voltages in the MP1584EN **must** be adjusted *before* we connect this to the Arduino Mega. Incorrect voltage could damage the electronics.

Step 16 — Power Supply Installation - Arduino Mega Shield Test





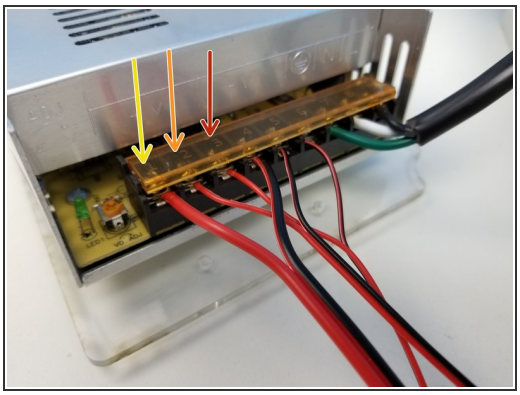
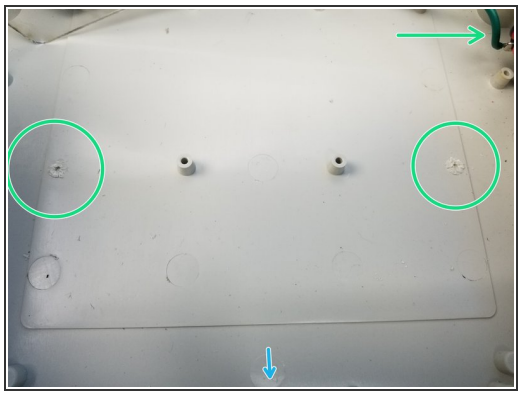
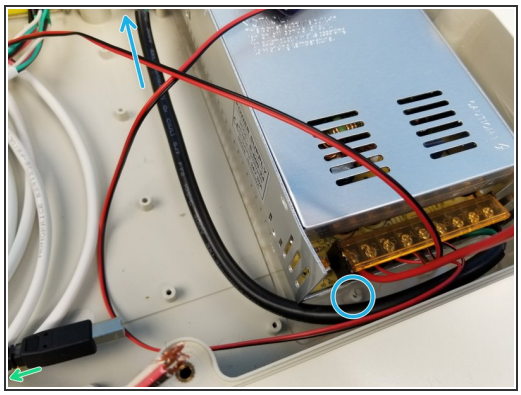


Prepare the following components:

- Arduino Mega Shield
- 2-Wire Power Cable 18AWG - [**160mm**]
- 2-Wire Power Cable 22AWG - [**335mm** & **420mm**]
- M3x8mm Screws (x8)

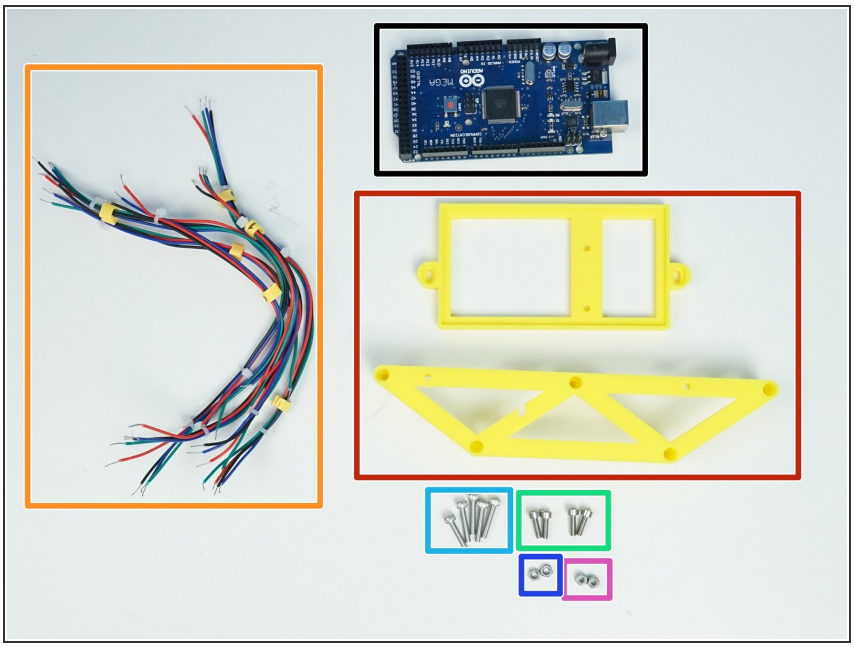
- Connect the PSU and Mega Shield using the **22AWG 420mm** long wires. Connect the plug to the Switch and turn the power ON
- Test the LEFT MP1584EN output voltage to be **6V or whichever voltage your gripper servo needs**, adjust using the potentiometer
- Test the RIGHT MP1584EN output voltage to be **10 -12V for powering Arduino Mega** .

Step 17 — Power Supply Installation - Final Installation

- Connect the rest of the power Wires
  - Small Stepper Driver Wires (**22AWG 335mm** long)
  - Big Stepper Driver Wires (**18AWG 160mm** long)
- Using a wire cutter to **snip two pegs** positioned with respect to the Rocker Switch on the top right corner of the picture.
- Align the Half Moon slot and secure the mounting plate to the Case using **M3x8mm Screws** in the available spots around PSU.

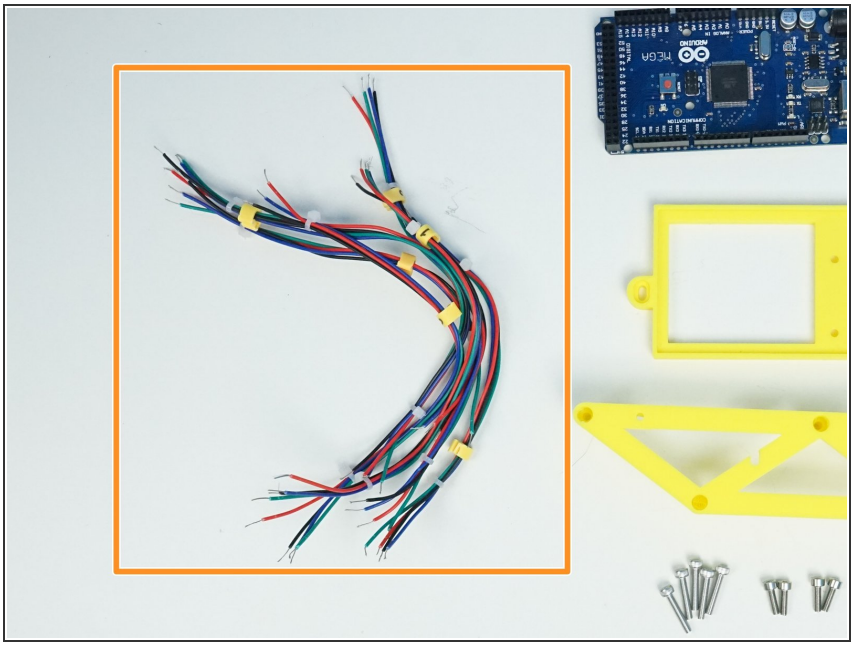
Step 18 — Arduino Installation - Parts



Prepare the following components:

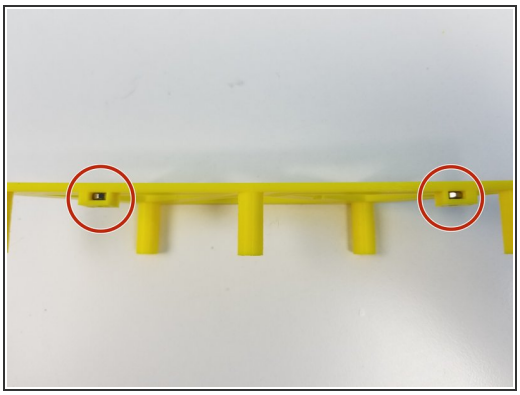
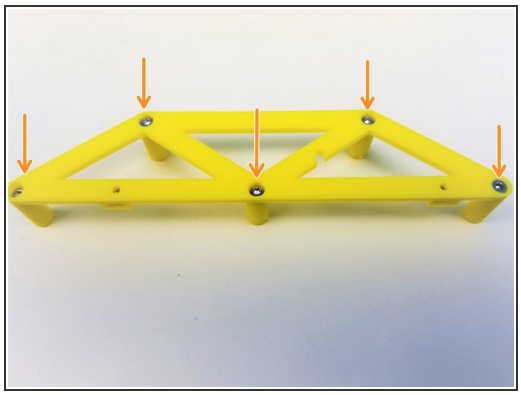
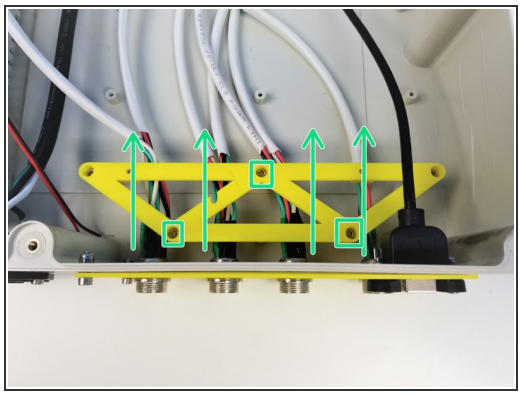
- Arduino Mega 2650
- [3D] Arduino Tray and Standoffs
- 4-Wire Signal Cable 22AWG {for Motor}
- M3x10mm Screws (x4)
- M3x16mm Screws (x5)
- M3 Hex Nuts (x2)
- M3 Nylock Nuts (x2)

Step 19 — Arduino Installation - Signal Cable Lengths



- **Length of each *4-pin 22AWG* wires are listed as below:**
  - 0 -> 210mm
  - 1 -> 210mm
  - 2 -> 200mm
  - 3 -> 165mm
  - 4 -> 185mm
  - 5 -> 225mm

Step 20 — Arduino Installation - Standoff

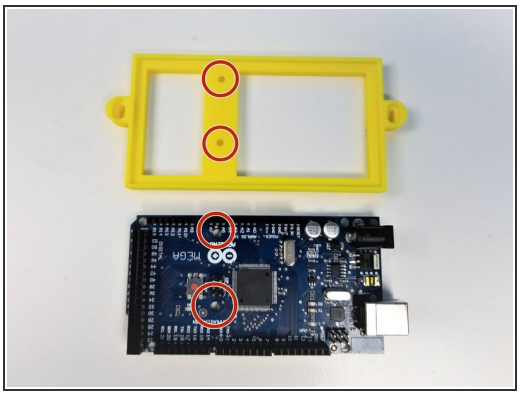
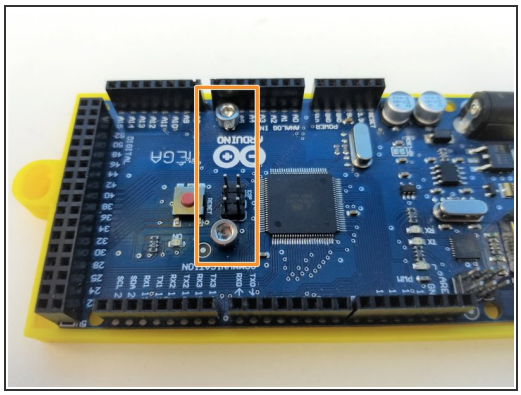
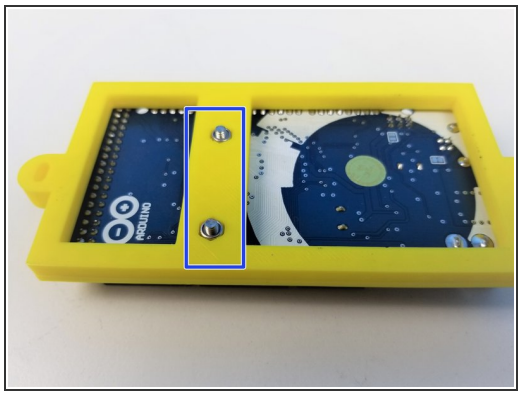




- Insert **M3 Hex Nuts** in the side slot of the Arduino Standoff
- Partially screw in **M3x16mm Screws** for easier assembly

ⓘ Secure the **Standoff to the Case** by tightening the Screws in place.

- Notice the Orientation of the Standoff as well as the position of the cables relative to the pegs of the Standoff

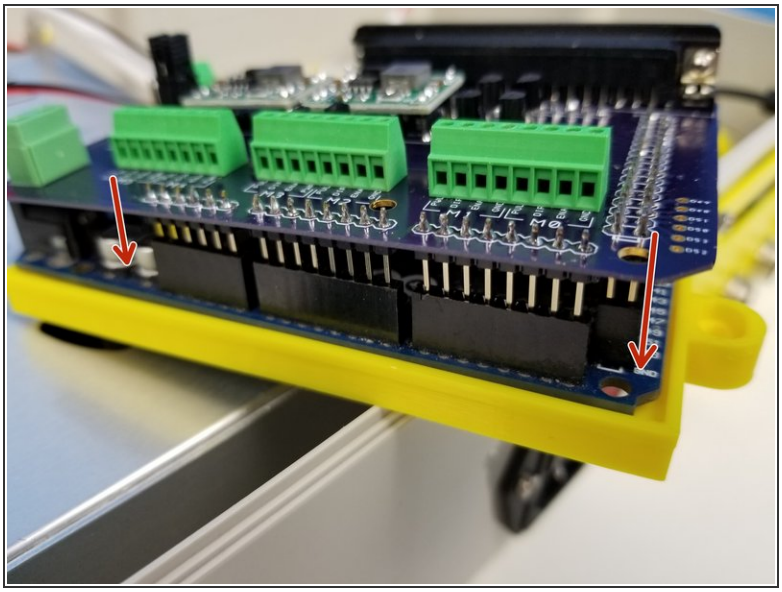
Step 21 — Arduino Installation - Tray Preparation

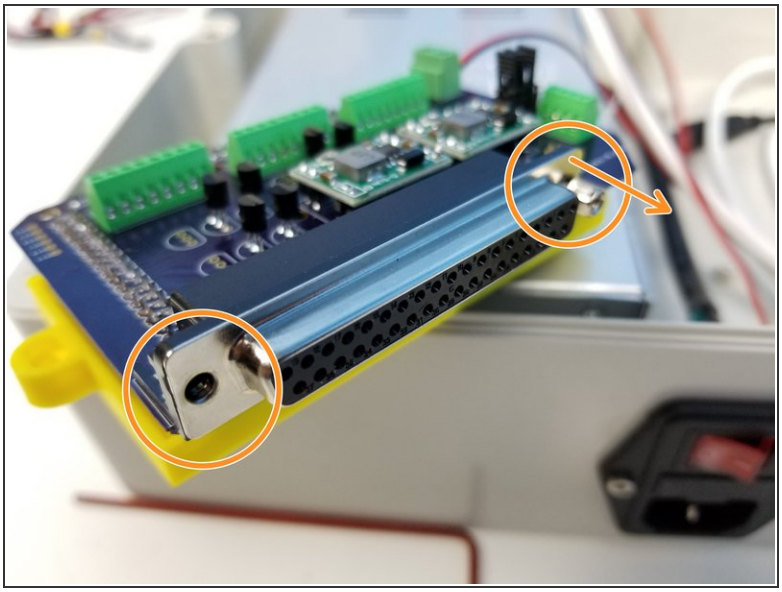




- Align the Holes on the Tray and the Arduino Mega
- Use the **M3x10mm Screws** and **M3 Nylock Nuts** to secure the Arduino to the Tray

⚠ Make sure to tighten the screws just enough to hold them together, No more, since **over-tightening the screws can damage the board**.

Step 22 — Arduino Installation - Arduino Mega Shield



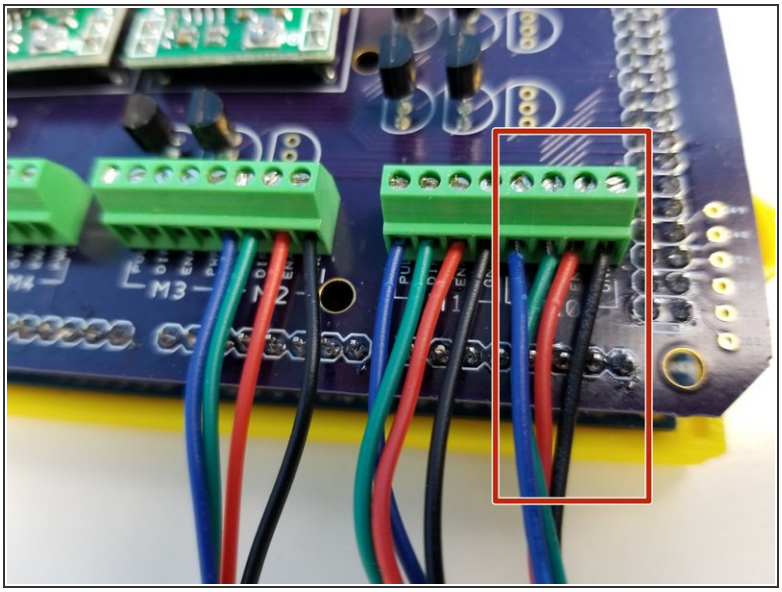


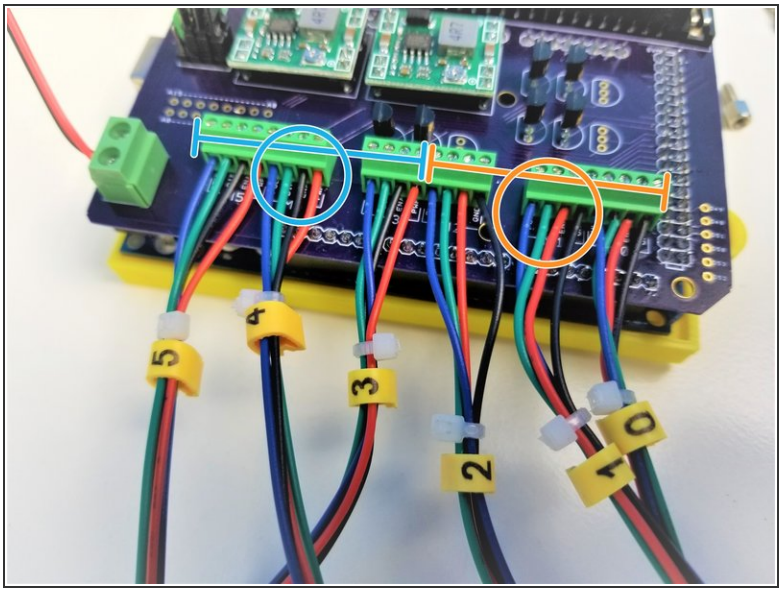
- Insert the **Mega Shield** to the Arduino Mega

  ⚠ Make sure you have set the voltage regulator in **Step 11** before going forward

- Remove the hex head screw from the **Right Angle D-Sub Connector**

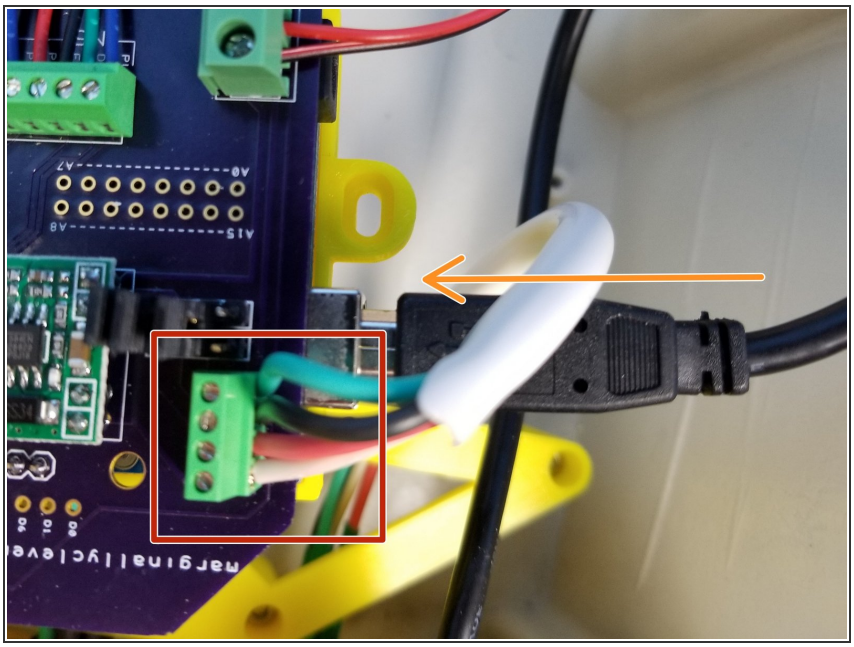
Step 23 — Arduino Installation - Motor Signal Cables





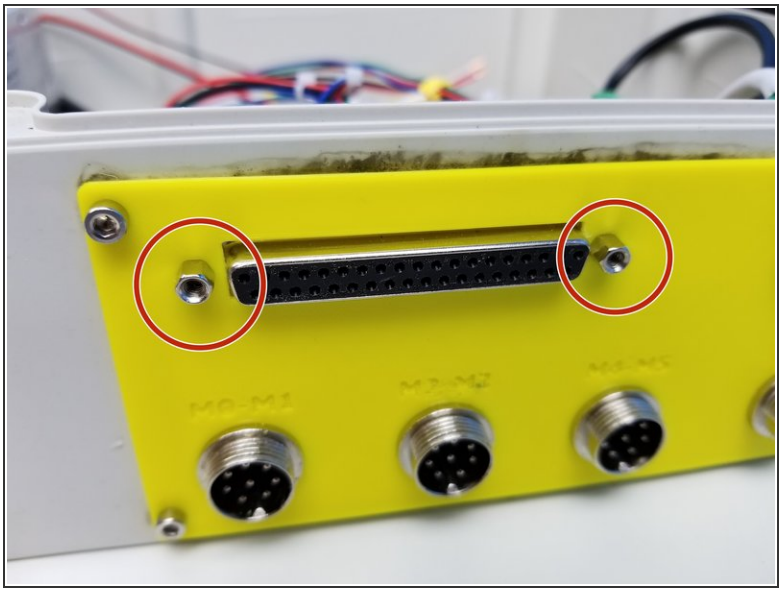
- Start with **Motor 0 signal cable** to the Right most connector labelled "M0"
- **M0, M1 and M2** follows the same color pattern
  - from the right, Black, Red, Green, Blue
- **M3, M4, M5** follows a different color pattern from M0-M2,
  - from the right, Red, Black, Green, Blue

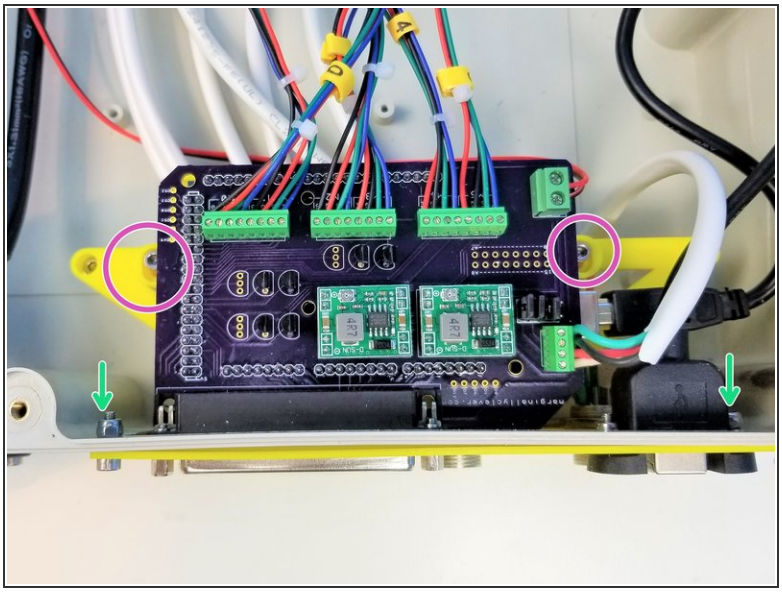
Step 24 — Arduino Installation - Tool and USB



- Insert the **"TOOL" Cable** in the specific order:
  - from the top, Green, Black, Red, White
- Insert the **USB Extension Cable** in the Arduino

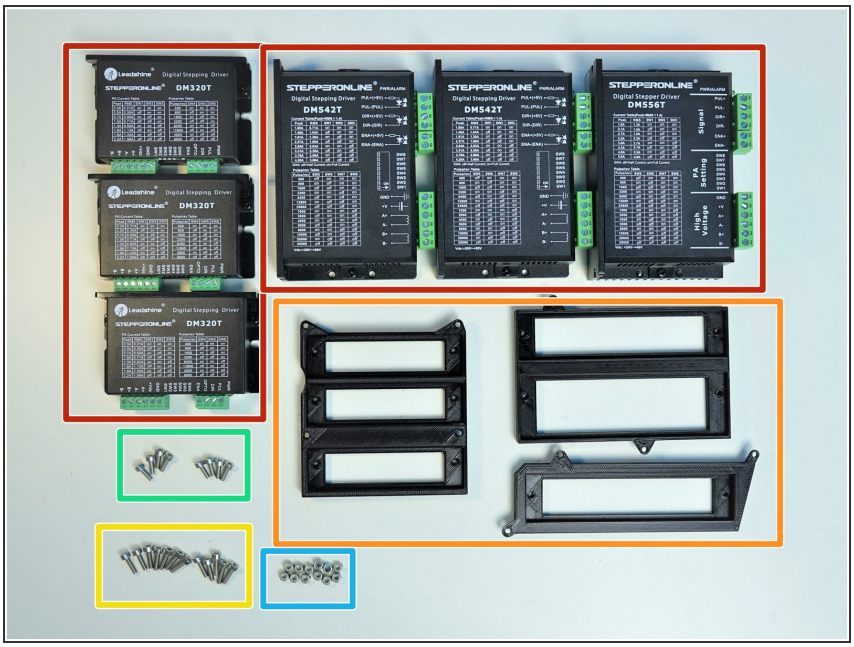
Step 25 — Arduino Installation - Tray Mounting





- Secure the **Right Angle D-Sub Connector** to the Case Wall Adapter slot using the Hex Head Screws
- Align the Tray to the Standoff and secure it using the **M3x10mm Screws**
- Once everything is aligned, secure this alignment by tightening the screw and the nut on the **Case Wall Adapter**

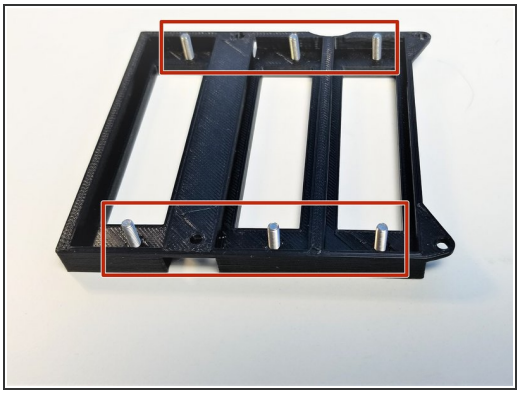
Step 26 — Stepper Drivers Installation - Parts

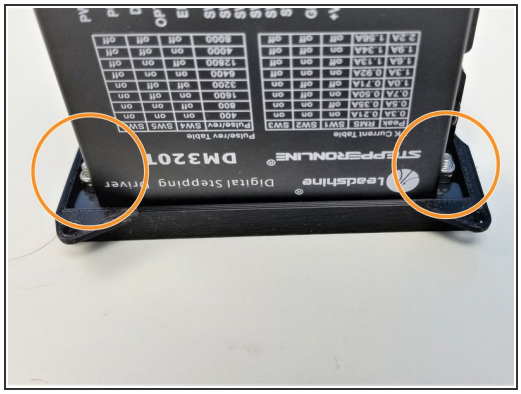


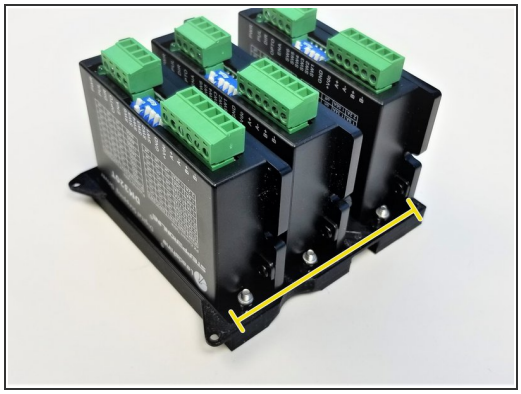
Prepare the following components:

- Stepper Drivers [**DM320T** & **DM542T** & **DM556T**]
- [3D] Stepper Driver Adapters
- M3x10mm Screws (x12)
- M3x8mm Screws (x9)
- M3 Nylock Nuts (x12)

Step 27 — Stepper Drivers Installation - DM320T

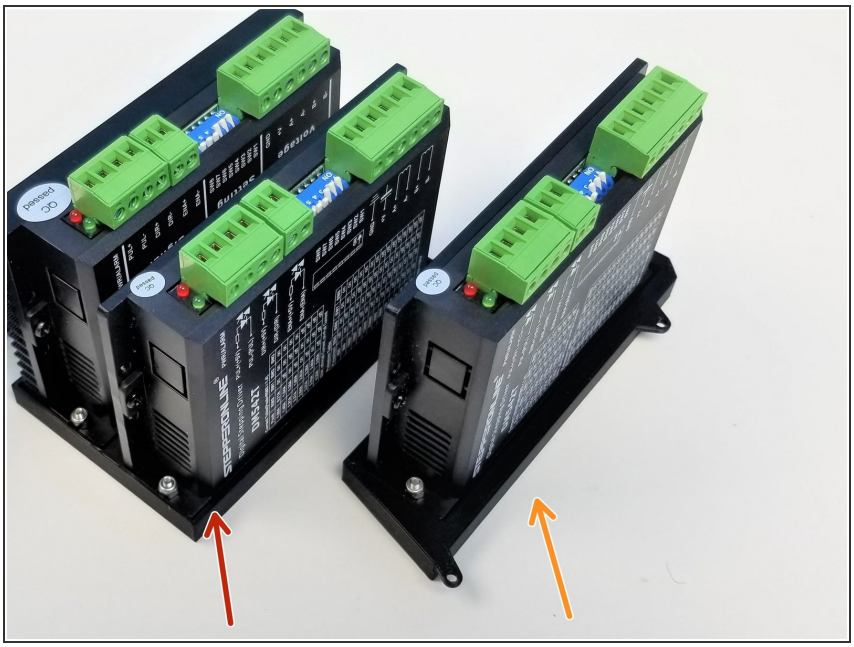






- Starting with the Smaller "DM320T" Drivers, screw in **M3x10mm Screws** in the Adapter with 3 small slots
- One driver at a time, secure the drivers to the adapter using **M3 Nylock Nuts**, use Needle Nose Plier to hold the nuts.
- Repeat the process for the rest of the DM320T Drivers

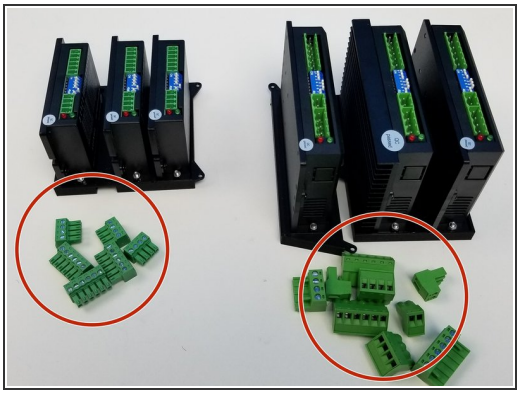
Step 28 — Stepper Drivers Installation - DM542T and DM556T

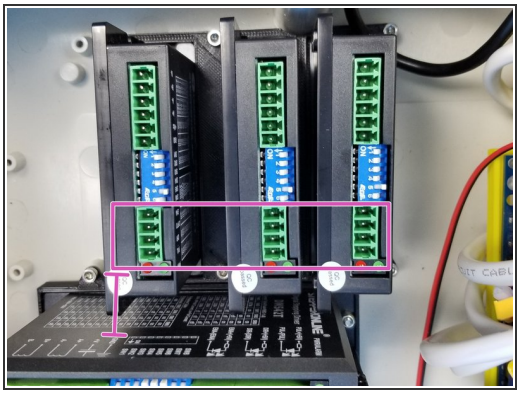


There are two DM542T Drivers and one DM556T Driver, DM556T Driver is the one with a big Heat Sink in the back

- **Repeat the same process as previous step:**
  - Adapter with 2 Slots, fits each **DM542T and DM556T**
  - Adapter with a single slot fits one **DM542T Driver**

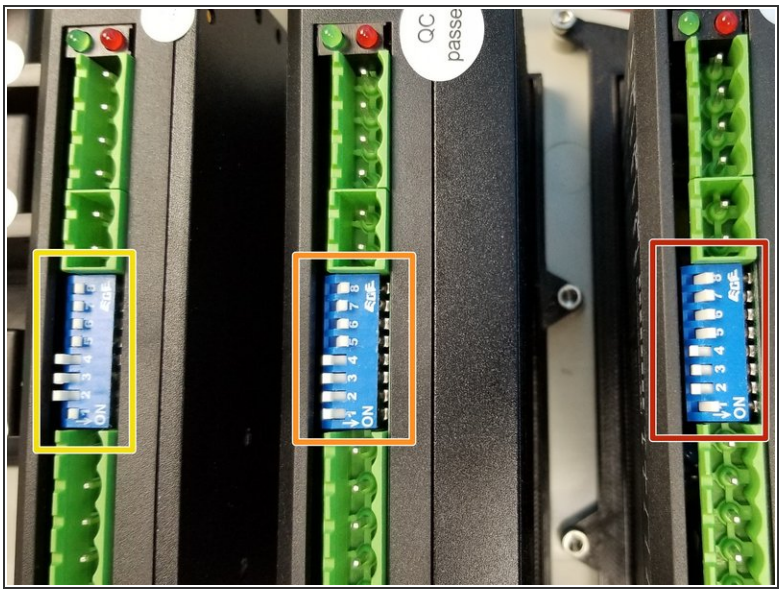
Step 29 — Stepper Drivers Installation - Driver Adapters Mounting

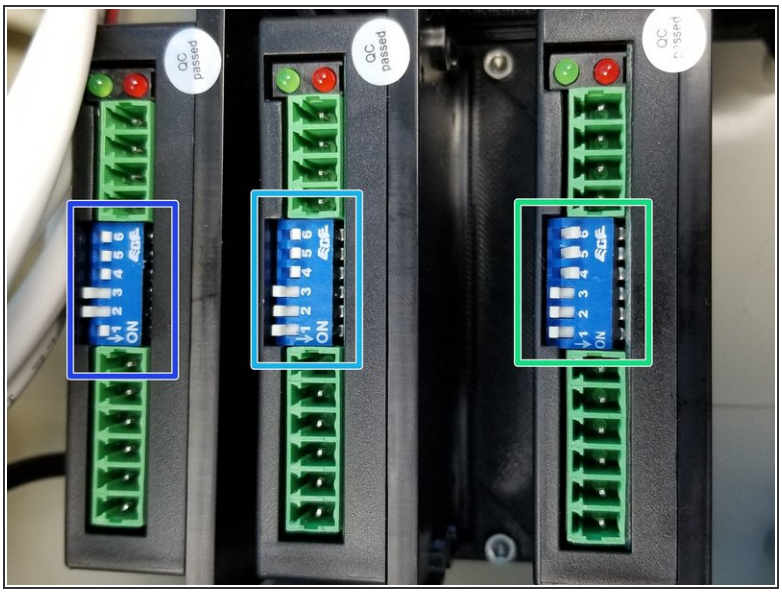




- Pull all the **Screw Terminal Blocks off** from the Drivers
- Starting with a single DM542T Driver Adapter, secure each drivers to the Case
  - Make sure the adapters are aligned as shown in the picture, Label on the DM542T and DM556T Drivers are facing away from the PSU
  - For DM320T Drivers, **4 pin side is closer to the Label of DM542T Driver**

Step 30 — Stepper Drivers Installation - Driver Switch Modes

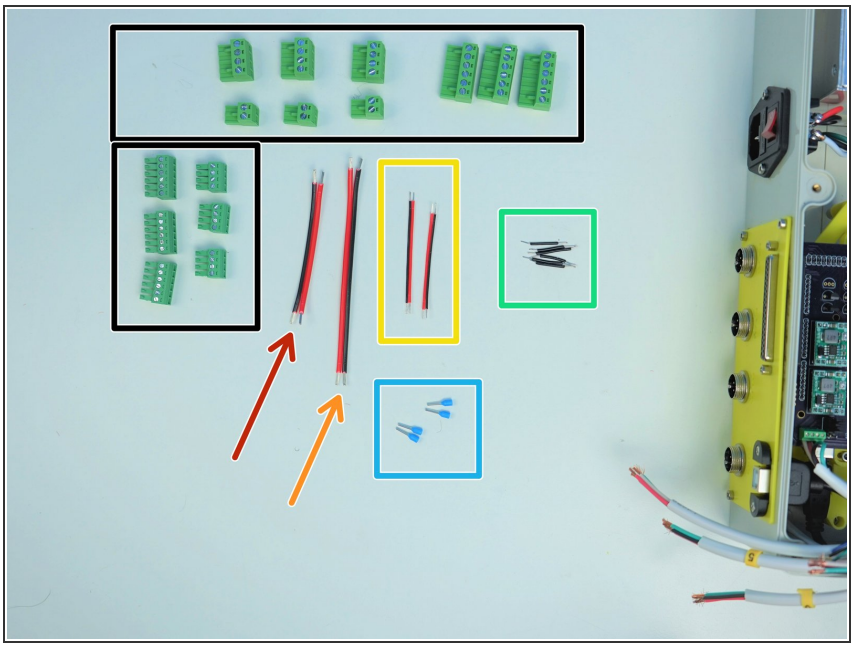




Set the switch to the following mode, it'll follow the Binary scheme, 1 = On, 0 = Off, starting from switch 1 in ascending order

- DM542T -> 10001111
- DM556T -> 00001111
- DM542T -> 10001111
- DM320T-Right -> 000111
- DM320T-Middle -> 000111
- DM320T- Left -> 100111

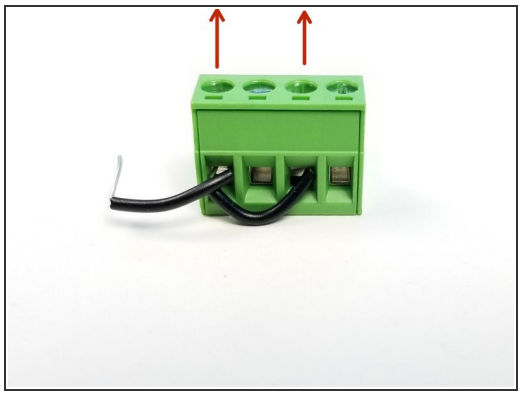
Step 31 — Final Cable Assembly - Parts

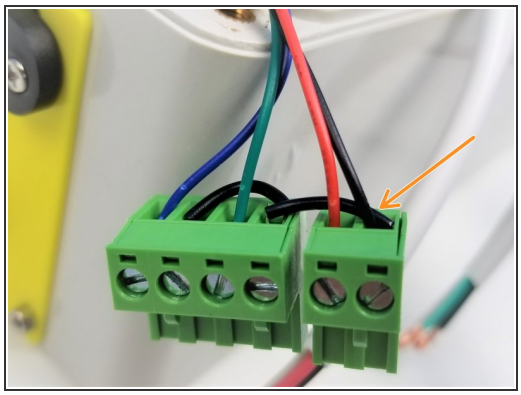


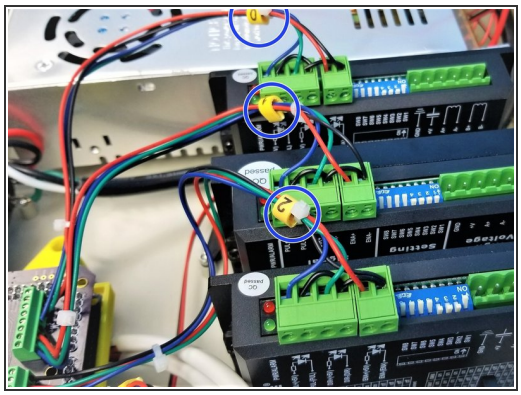
Prepare the following components:

- Screw Terminal Blocks from the Drivers
- 2-pin Power Wires **18AWG 90mm**
- 2 pin Power Wires **18AWG 130mm**
- 2 pin Power Wires **22AWG 65mm** (x2)
- 22 AWG solid Wires Black **30mm** (x6)
- [Opt] - Ferrule Crimp Pins (x4)

Step 32 — Final Cable Assembly - DM542T & DM556T Signal Wiring



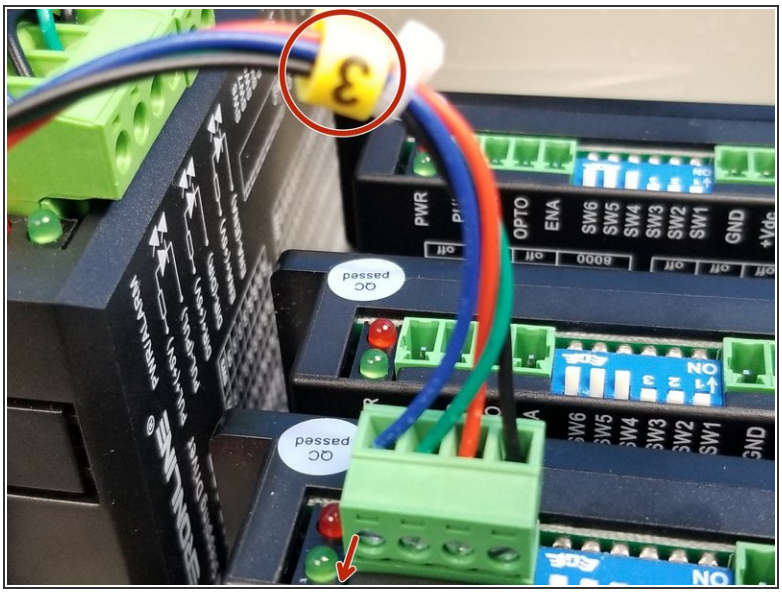


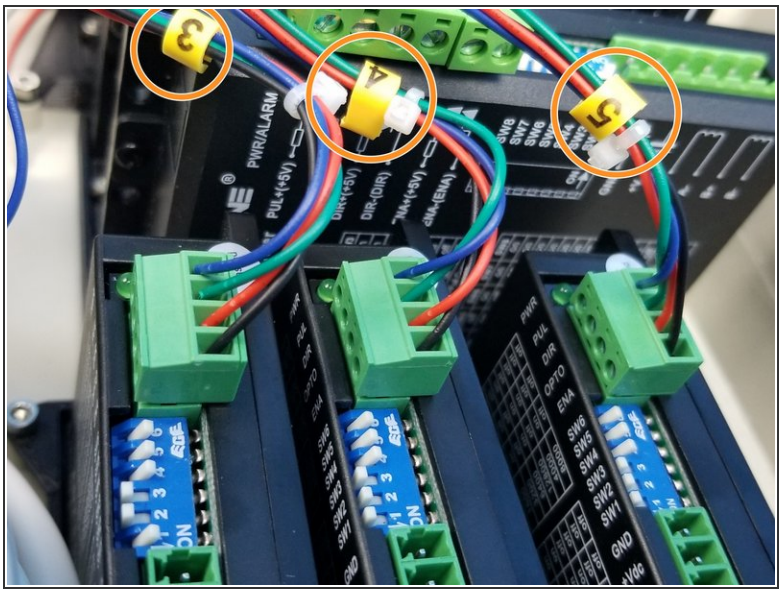


- Grab one of the Bigger Driver's 4-pin Screw Terminal and wire it as shown in the first picture, **Screw Head is pointing UP**
- Starting with M0 Cables that's already attached to **Arduino Mega Shield**, secure the wire as shown in the second picture.

  ⚠ notice there are 2 black solid wires in the right most pin of the 2-pin connector
- Repeat the same process for the M1 and M2 Drivers, and plug them as shown in the third picture.

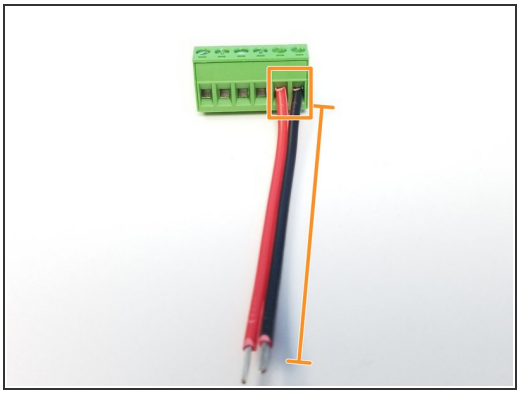
Step 33 — Final Cable Assembly - DM320T Signal Wiring

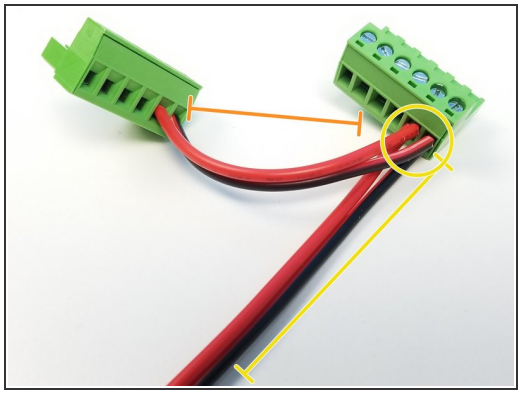


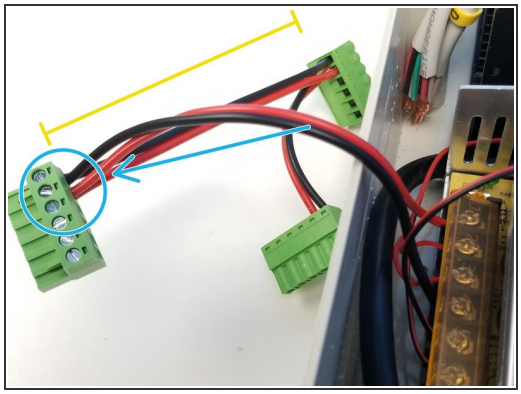


- Starting with the **M3 signal cable**, attach them and plug them in the corresponding driver as shown in the first picture,
- Repeat the process for M4 and M5 drivers, **notice the labels**

Step 34 — Final Cable Assembly - DM542T & DM556T Power Wiring

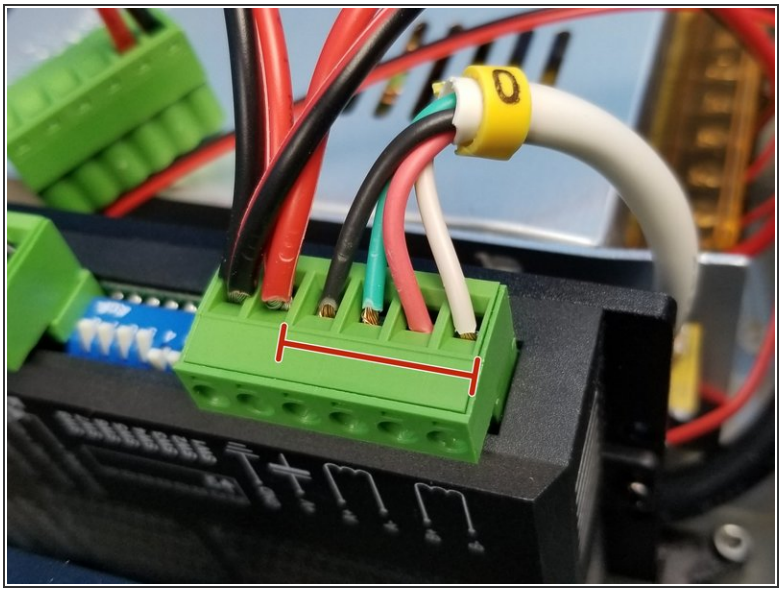


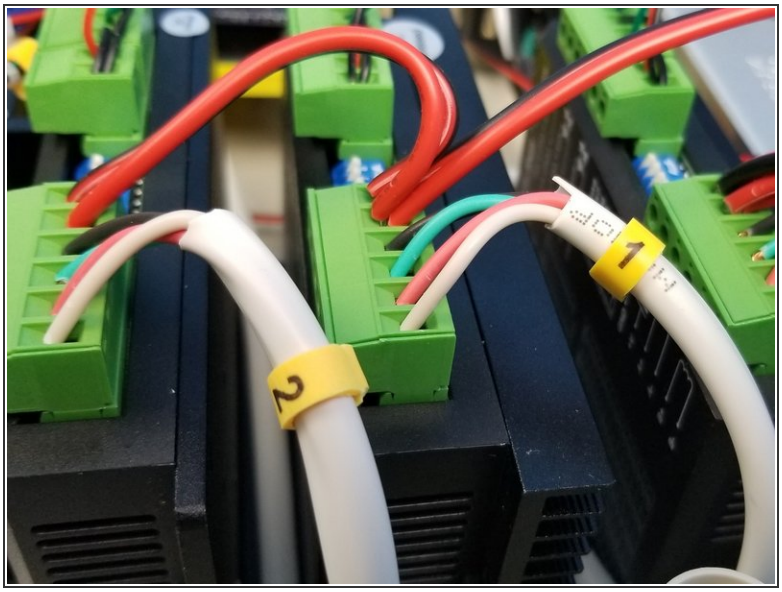




- Use the **shorter 18AWG** 2-pin power cable and attach it to big 6-pin screw terminal
- Attach the other end of the shorter 18AWG cable and one end of the **longer 18AWG** to another 6-pin screw terminal
- Now repeat the second step with the longer 18AWG cable and the 18AWG cable that's already in the PSU with the last 6-pin screw terminal

Step 35 — Final Cable Assembly - M0-2 Power Cable



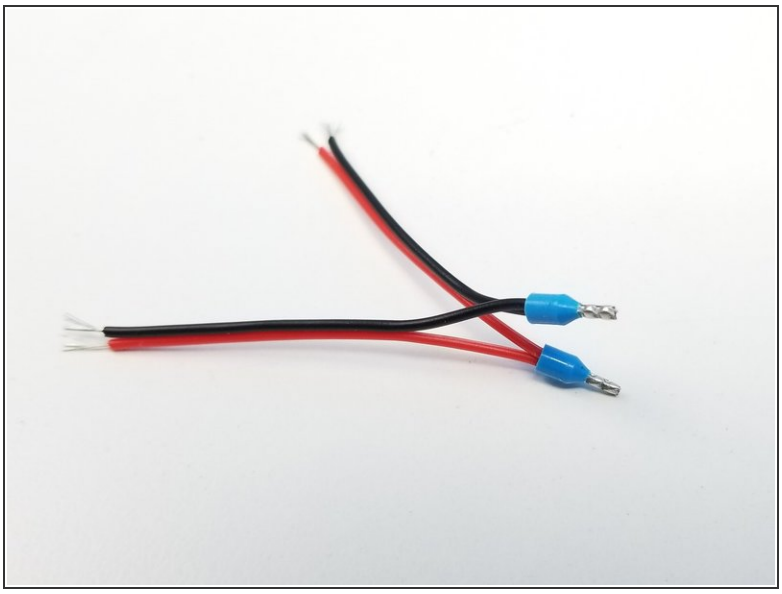


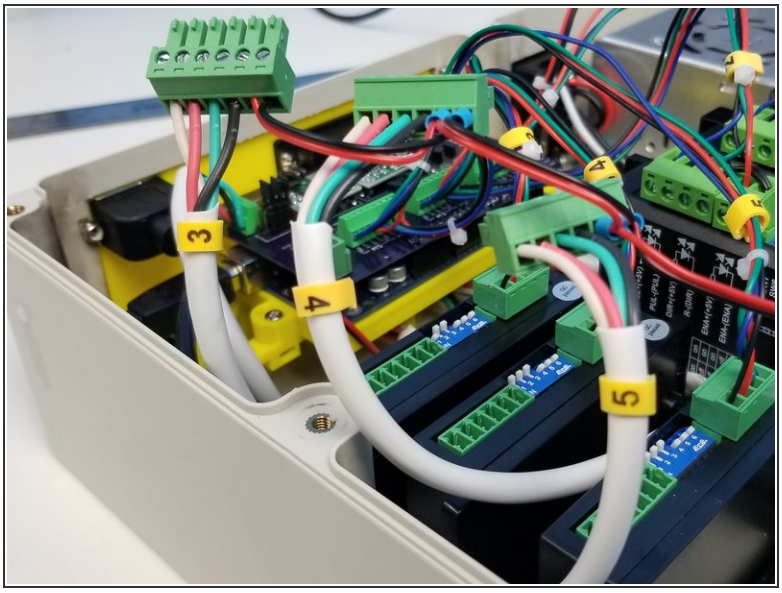
- Start with **M0 cables** from the GX16 Aviation Plug and the screw terminal that's directly connected to PSU.

  ⓘ Start with Black, Green, Red, White

- Repeat the same process for M1 and M2 as shown in the second picture.

Step 36 — Final Cable Assembly - DM320T Power Wiring



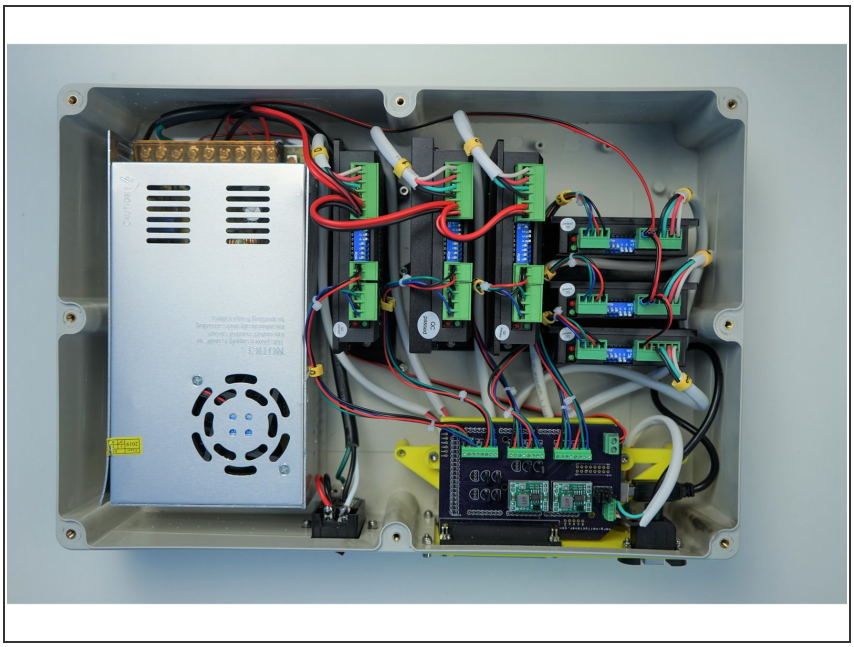


Optional Step:

- Use the **Ferrule Crimp Pins** to connect 22AWG power wires as shown in the first picture, do this for cable from PSU as well.

- The same color code as bigger drivers applies to DM320T, just repeat step 30 with M3-5 Motor Wires

Step 37 — FINISHED!



- Congratulation! you've successfully finished assembling the Electronic Case! Go You!