Edgerton Assembly Manual

Description

This is a complete assembly manual for Edgerton, the High-Speed LED Flash. Some soldering and 3D printing skills are required. Please note that the photographs below may show components that differ somewhat from the most recent models available. The assembly photos were taken during development of the flash and the design has changed since.

For a complete overview, please visit https://td0g.ca.

Tools Required

- 3D printer with 200mm x 200mm bed
- Soldering Iron & Solder
- Small Side Cutters
- Hot Glue Gun
- Allen Wrenches
- Dupont Crimper Kit (Optional but Recommended)

3D Printing the First Parts

1. Download the latest .STL files from https://github.com/td0g/high_speed_flash.
2. 3D print the Template.STL (using a cheap filament – this part will not be used in the final assembly) and 8x copies of the LED Clamp.STL (ABS or PETG)
3. Begin 3D printing the Front.STL and Back.STL. This will take many hours and you can proceed to the next steps while these parts are printing.

LED Bank Assembly

4. Take 3x LED's and lay them out on the template. Make sure the orientation is the same (anodes on one side, cathodes on the other).

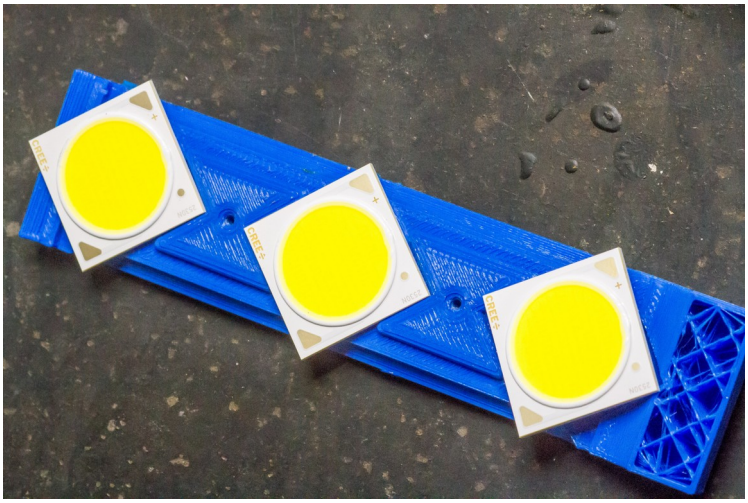

Figure 1: Anodes on top, cathodes on bottom

5. Flip the LED’s face-down and clamp them down using the LED Clamps and M2 screws.

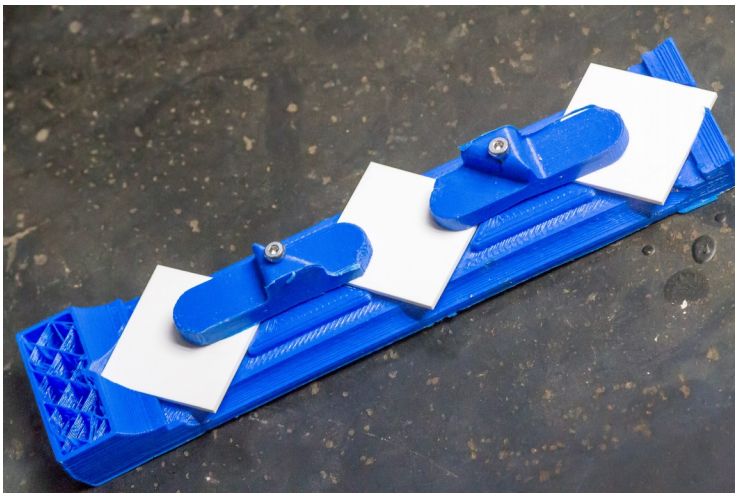

Figure 2: Do not mix up LED orientation when flipping LED's

6. Take a 9cm long section of 22AWG wire and strip the insulation. Twist the conductors so that there are no loose strands.

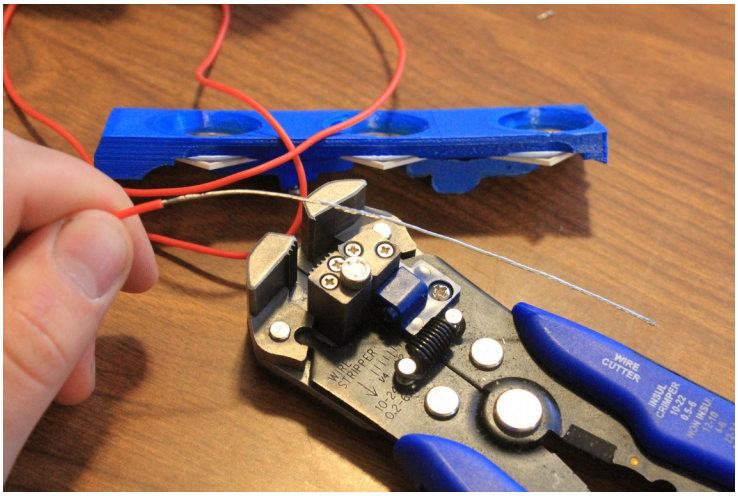

Figure 3: Removing insulation from 22AWG wire

7. Solder the bared wires onto the LED cathodes (negative). Don't make the wire too tight or too loose.

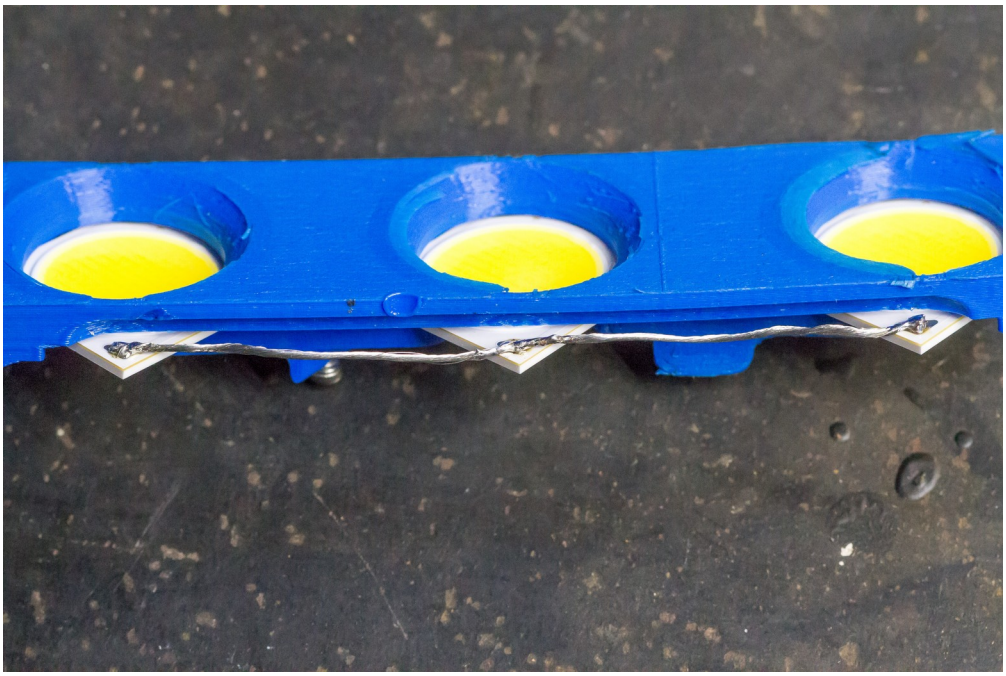

Figure 4: 22AWG wire soldered to LED cathodes

8. Solder the 2-ohm resistors onto the LED anodes (positive) as shown in figure 5.

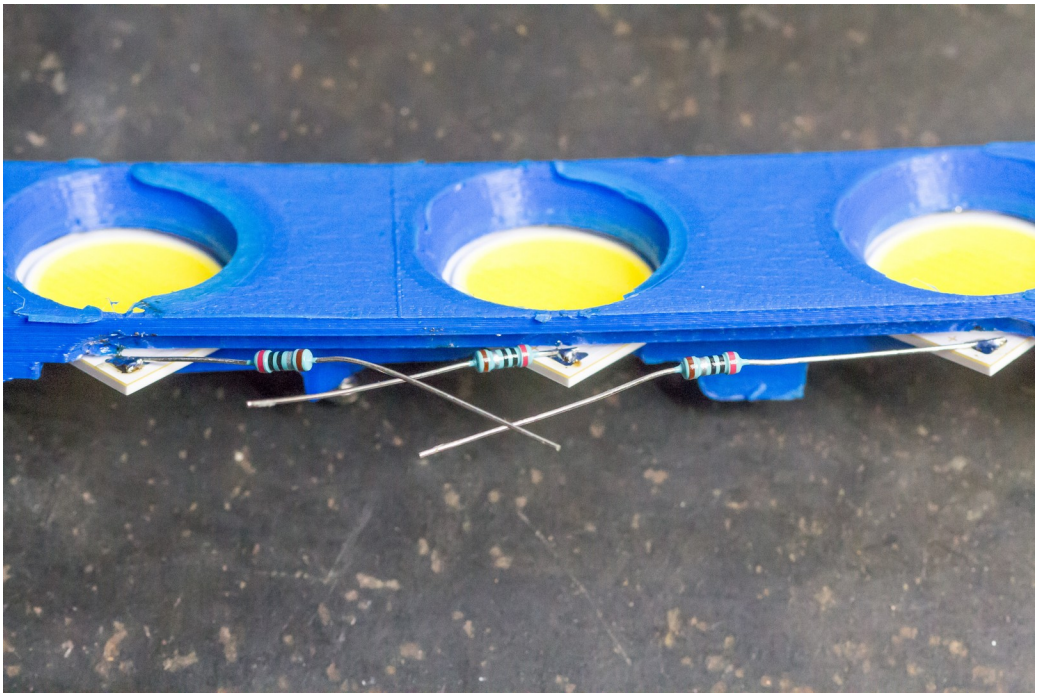

Figure 5: 2-ohm series resistors

9. Take a film capacitor and solder the MOSFET source pin as shown (Polarity of the film capacitor doesn't matter). Don't connect the middle pin yet.

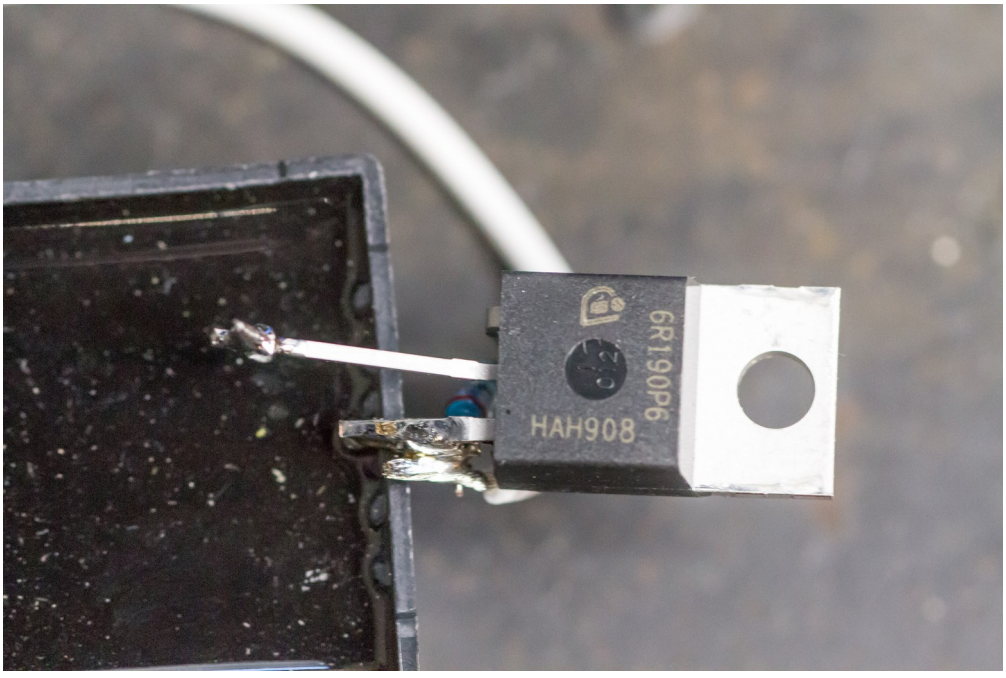

Figure 6: MOSFET Drain on bottom, Source in middle, and Gate on top

10. Solder 22AWG wire onto the MOSFET Source / Capacitor cathode.

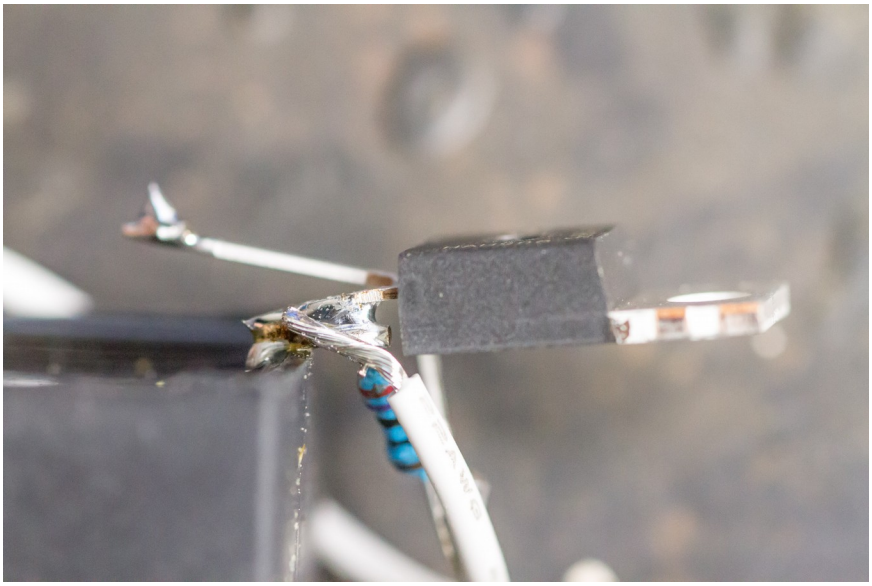

Figure 7: Ground wire soldered to MOSFET Source / Capacitor cathode

11. Solder a 200-ohm resistor from the MOSFET Gate to the Source.

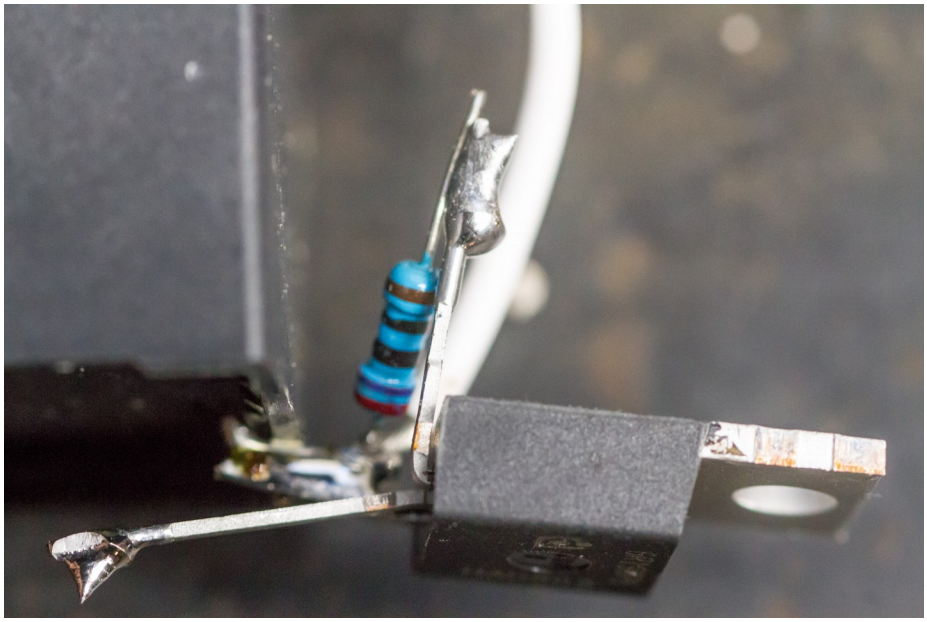

Figure 8: 1/4W resistor from MOSFET Gate to Source

12. Solder the ferrite bead onto the MOSFET Gate

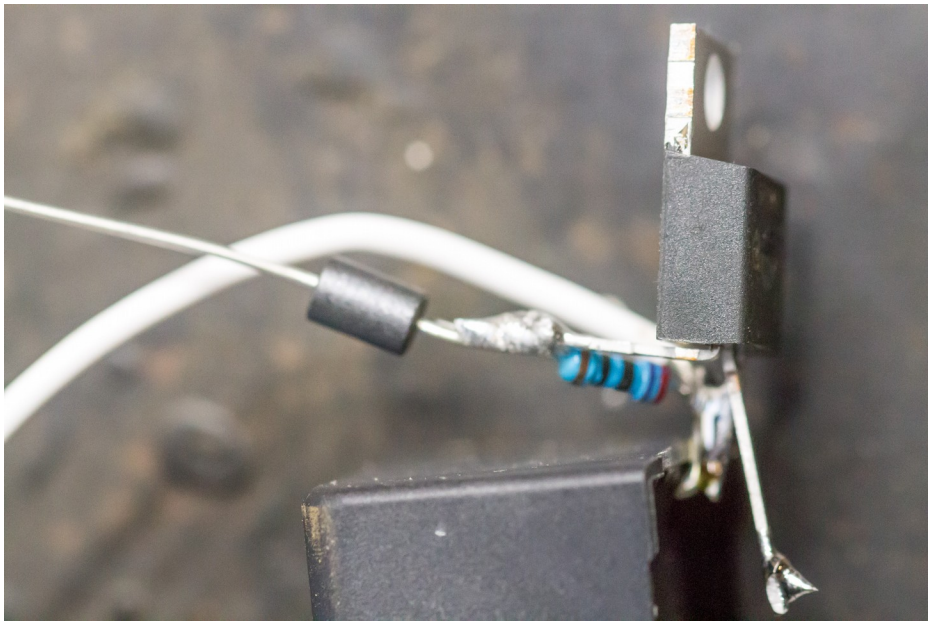

Figure 9: Short distance from ferrite bead to MOSFET

13. Lay the capacitor upside down and place the LED template on top. Solder the MOSFET Drain (middle pin) to the LED cathode rail.

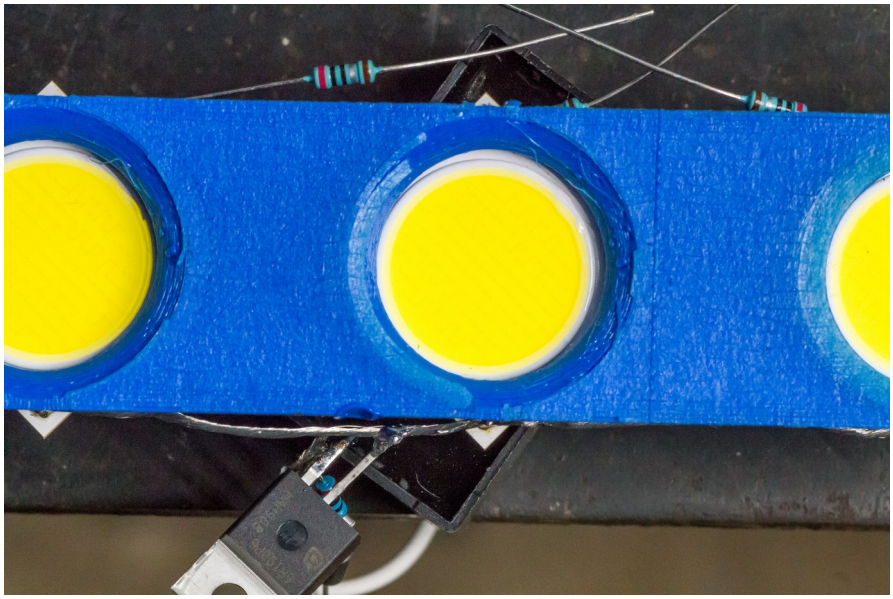

Figure 10: MOSFET Drain (middle) to LED cathode rail

14. Solder the capacitor's anode to the LED series resistors. Clip the excess leads from the resistors. Note how the rightmost resistor lead is routed on the opposite side from the LED Anode pad so that they don't touch.

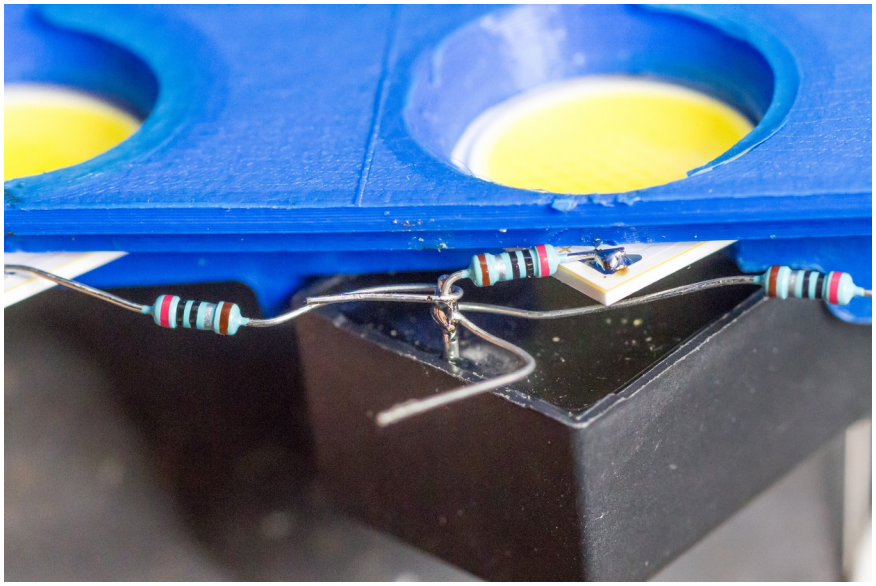

Figure 11: Careful routing of resistor leads

15. Solder a 22AWG wire to the capacitor's anode.

Figure 12: High-Voltage Supply Line on capacitor Anode

16. Repeat steps 4 – 15 three more times.

Control Board

17. There are multiple options available:
    - Assemble your own control board on a 5 x 7 cm perfboard using the Circuit Diagram and Perfboard Layout available at https://github.com/td0g/high_speed_flash.
    - Etch your own control board using the Eagle files available at https://github.com/td0g/high_speed_flash.
    - Purchase a ready-to-use control board – TO BE UPDATED WITH STORE ADDRESS
18. Flash the ATMega328P with the latest firmware available at https://github.com/td0g/high_speed_flash. There are multiple ways to do this, but I personally recommend burning a Lilypad Arduino bootloader, installing the microcontroller on the control board, then using an FTDI adapter and the Arduino IDE to upload the firmware. Nick Gammon has a good guide for this process, please visit http://www.gammon.com.au/breadboard.
19. Mount the control board onto the body of the flash.
20. Connect the control board. See the following image. The Capacitor and MOSFET connections are all connected in parellel. NOTE: It is recommended to solder the Capacitor Gnd and Gate connections onto the male headers.

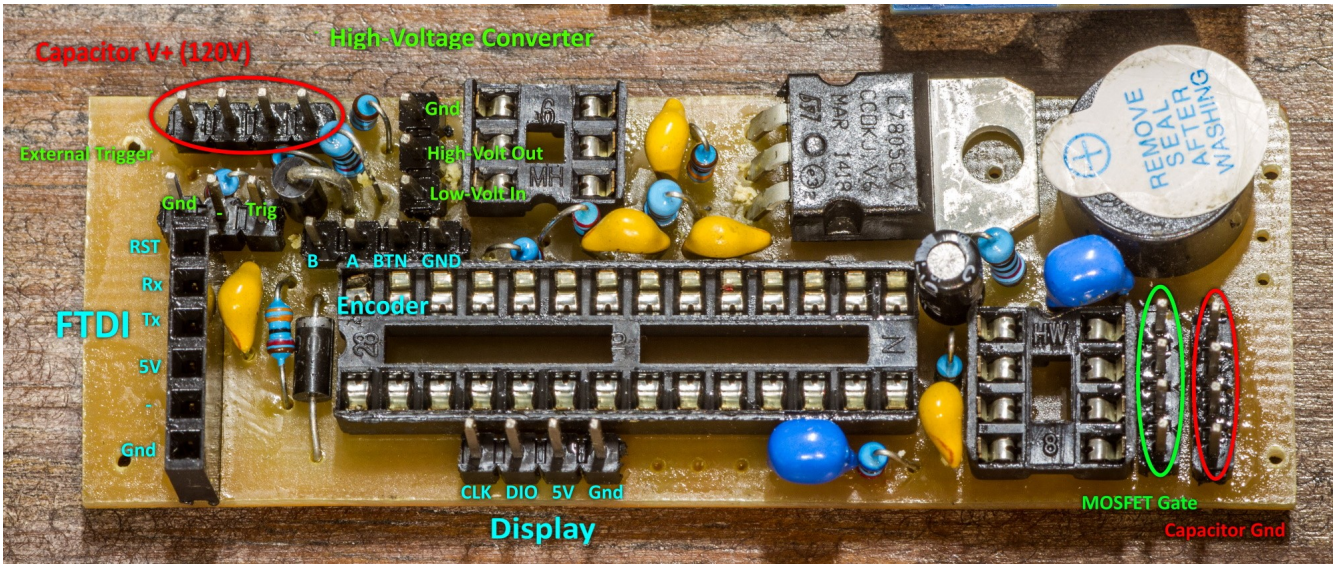

Figure 13: Control Board Hookup Guide (Rev1)

Complete Assembly

21. Begin printing the Encoder Knob.STL(ABS or PETG).
22. Slice the LED Cover.STL (ABS or PETG). This component has a built-in magnet. You will need to determine the layer at which the magnet hole is covered and modify the gcode to pause at that point. You might be able to use M226, but I believe most firmware doesn't support this gcode. I simply split the gcode into two files, with the first ending when it's finished the top layer of hte magnet hole (and adding G0 X0 Y190 F3000 to move the print head out of the way) and the next file continuing after that. This way, I can leave the printer running, install the magnets when the printer finishes the first file, then continue by running the second file.
23. Begin printing the LED Cover (ABS or PETG).
24. Install the LED banks into the front as shown. Alternate the anode/cathode direction so that there is never an anode and cathode adjacent to each other.

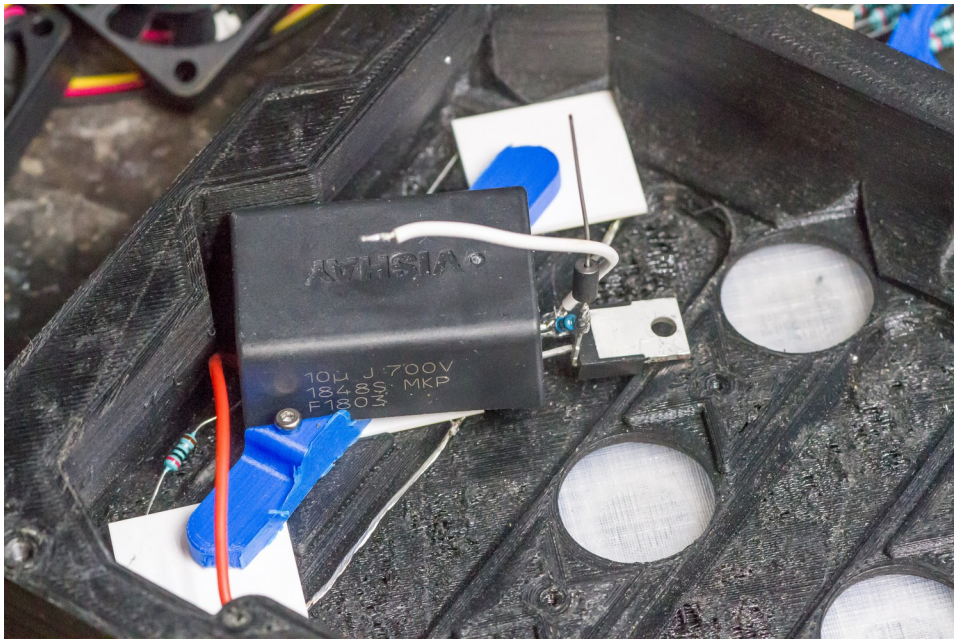

Figure 14: LED bank installed in case front

25. Install the control board onto the front using 2x M2 screws.
26. Install the Arca-Swiss QR plate onto the Back using M5 screws and nuts. You may need to drill holes into the QR plate for this purpose.

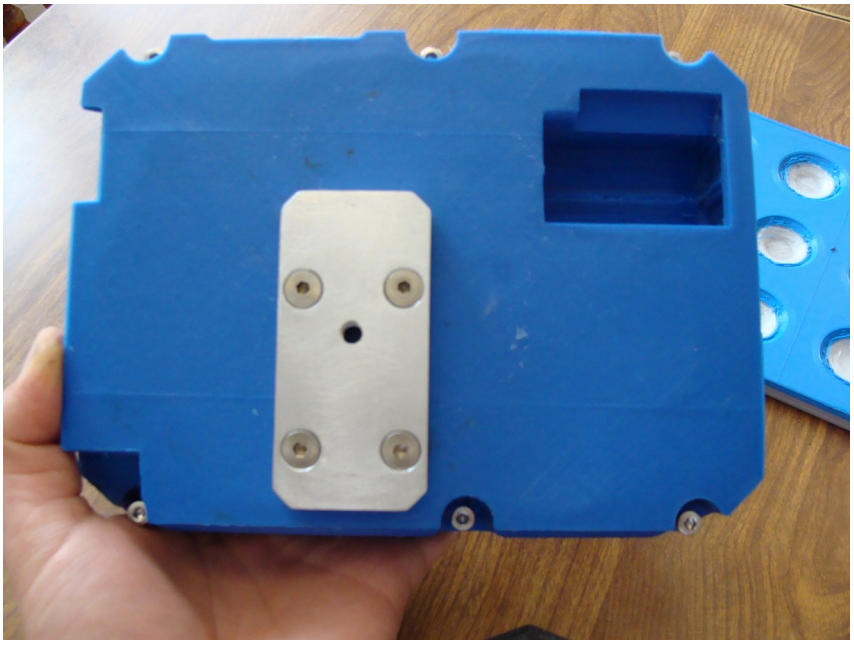

Figure 15: Arca-Swiss QR plate

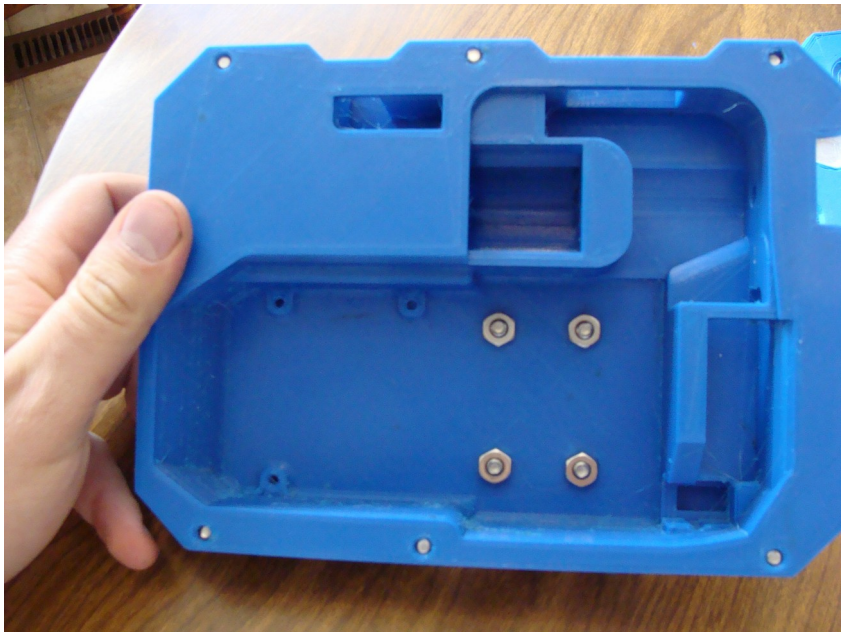

Figure 16: Case interior view, M5 nuts securing Arca-Swiss QR plate

27. Install the high-voltage boost regulator onto the back using 3x M3 screws.
28. Screw the encoder into the hole in the back. You may need to tap the hole first if it is difficult to thread in.
29. Slide the TM1637 Display into the hole in the back.
30. Slide the 3.5mm jack into the small hole in the back. Solder wires to all three pins then secure the jack with hot glue.
31. Install the AA Battery contacts onto the back using hot glue.
32. Solder a wire from the battery output positive and run it to the power switch hole. Solder the other end onto the power switch, and run another wire through the hole to the power switch.

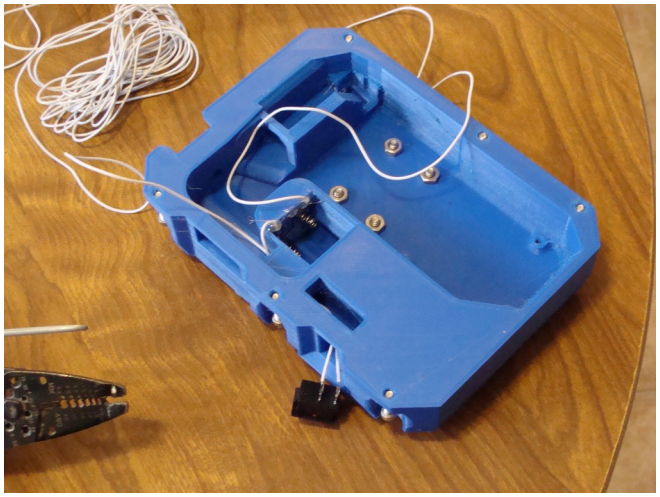

Figure 17: Wiring to power switch installed, proceed to slide power switch into case

33. Slide the power switch into the hole in the back.
34. Run the output wire from the power switch to the high-voltage boost control board, then continue it to the input pad on the control board
35. Run a wire from the battery ground to the ground on the high-voltage boost control board, then the high-voltage negative pins, and finally to the control board ground pad.
36. Connect the 3.5mm jack, encoder, and TM1637 display to the control board. I used Dupont connectors and headers on the control board, but if you don't have a crimper tool then you can solder the wires directly onto the control board.

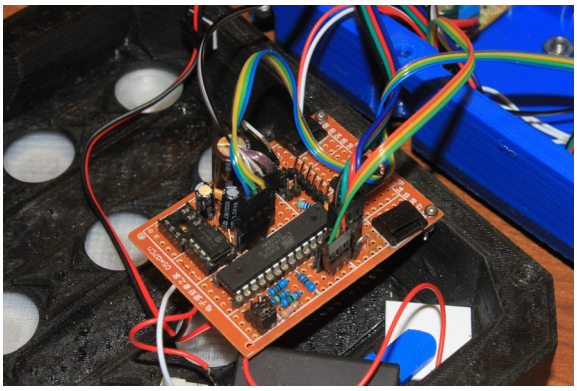

Figure 18: Control Board connected

Firmware Setup

37. The setup routine can be run by holding the button for several seconds while the flash is turned on. The screen will remain blank until the setup routine begins, at which point you may release the button.

38. Measure the input voltage at the batteries as shown in figure 18. Using the encoder wheel, adjust the voltage displayed to match the input voltage.

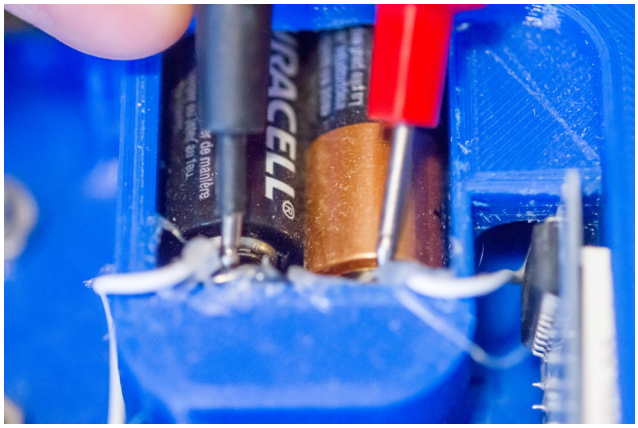

Figure 19: Input (battery) voltage measurement

39. Press the button to proceed to the next step.

40. The high-voltage converter will turn on. **CAREFULLY** measure the output voltage as shown in figure 19 while adjusting the potentiometer on the converter. Adjust the voltage to the desired LED drive voltage (120 V recommended).

41. Using the encoder wheel, adjust the voltage display to match the output voltage.

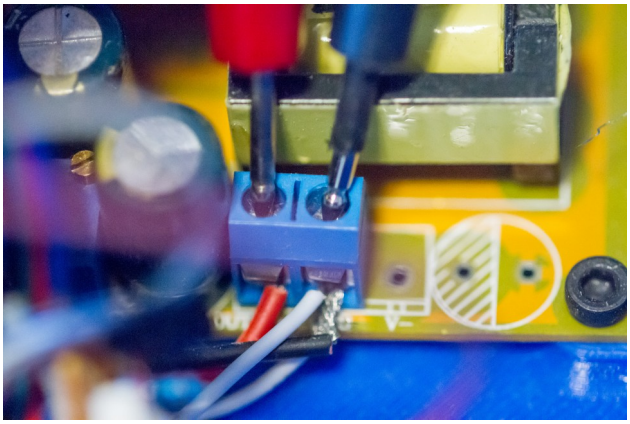

Figure 20: Output voltage from boost converter

42. Press the button again to save the settings to memory and resume normal operation.

DONE!