

E2-A Assembly Manual

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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>.



Warnings – PLEASE READ

This assembly manual is a first draft. If you follow the instructions, please contact me at tyler@td0g.ca if you find any errors.

The greatest advantage of an LED flash over an air-gap flash is safety, **but there are still dangerous voltages in this LED flash!** The capacitor charger, if set correctly, will supply 120V to several capacitors. Be careful, try to keep the case closed, and do not touch any circuitry when the capacitor charger is on!

This strobe pushes the capabilities of the LED's. I have worked hard to find the safest limitations of the LED's, but **complete failure of the LED's is still possible**. That means the expensive components can be accidentally destroyed and require replacing. I've taken many precautions in the design to prevent this, but please consider building a strobe at your own financial risk.

The LED's are not as powerful as a Xenon flashtube, and they do not turn on as long as a typical camera strobe. **Expect to crank up the ISO by several (4 or more) stops** in order to capture usable images.

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)
- Thread taps (M3 x 0.5mm, M7 x 1.0mm, 3/8" UNC)
- 12mm Wrench

3D Printing

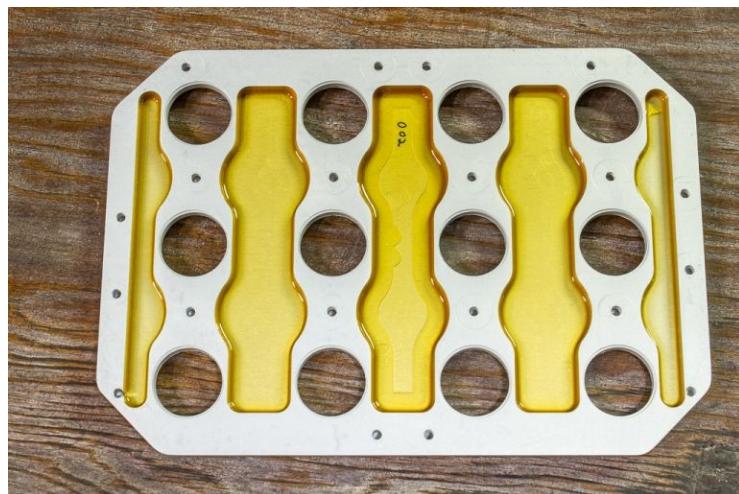
1. Download the latest .STL files from https://github.com/td0g/high_speed_flash/tree/master/MK2/E2-A/STL.
2. 3D print the **Template.STL** and 2x **Template_Clamps.STL** (using a cheap filament – this part will not be used in the final assembly)
3. Begin 3D printing the **Mid_Section.STL** and **Back_Cover.STL**. This will take many hours and you can proceed to the next steps while these parts are printing.
4. Finally, print the **Battery Holder.STL**, **Dial.STL** and 8x copies of the **LED_Clamp.STL** (ABS or PETG). The Battery Holder requires supports.

Faceplate

5. Source a 7.5" long piece of 1/4" x 5" Aluminium 6061 T6 stock
6. Cut the faceplate design
7. Anodize the faceplate
8. Tap all 20x holes with an M3 x 0.5mm
9. Prepare a level surface (I use a tripod ball head and level it with a construction level)

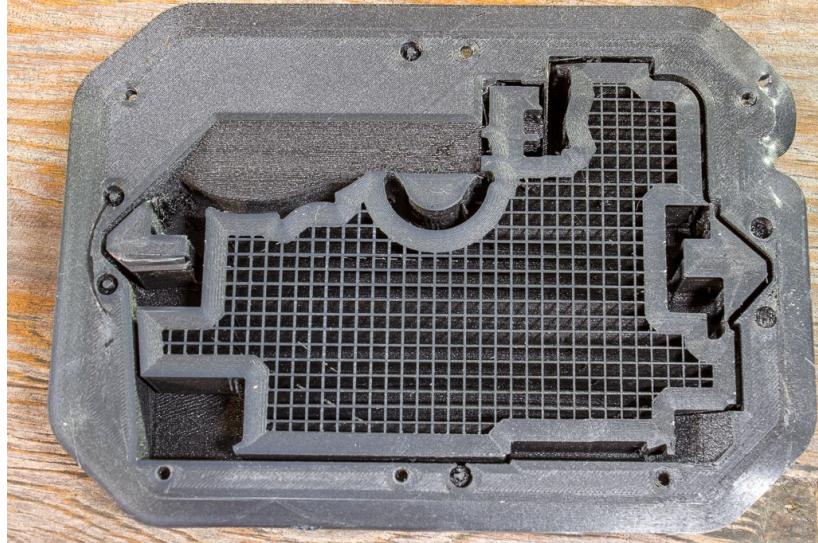


10. Apply a liberal coat of polyurethane to the recesses in the faceplate. Allow the polyurethane to set for at least 24 hours.

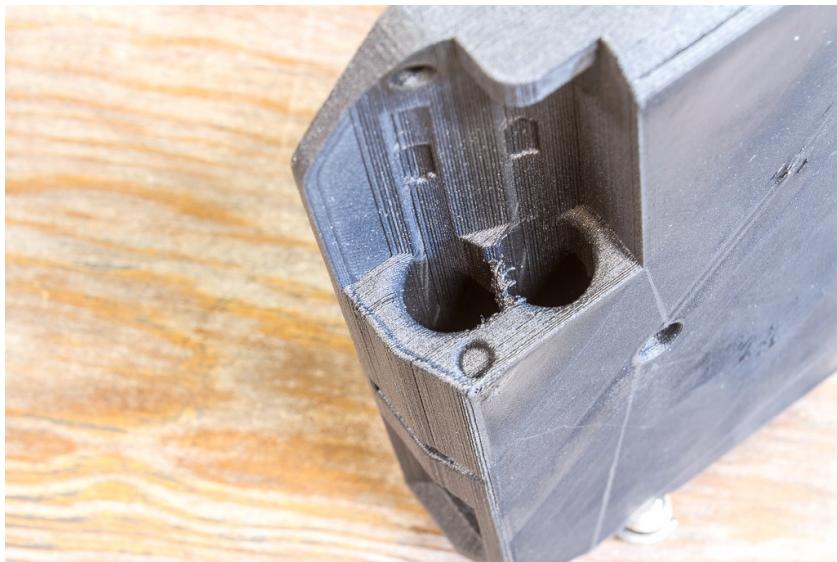


Back Cover

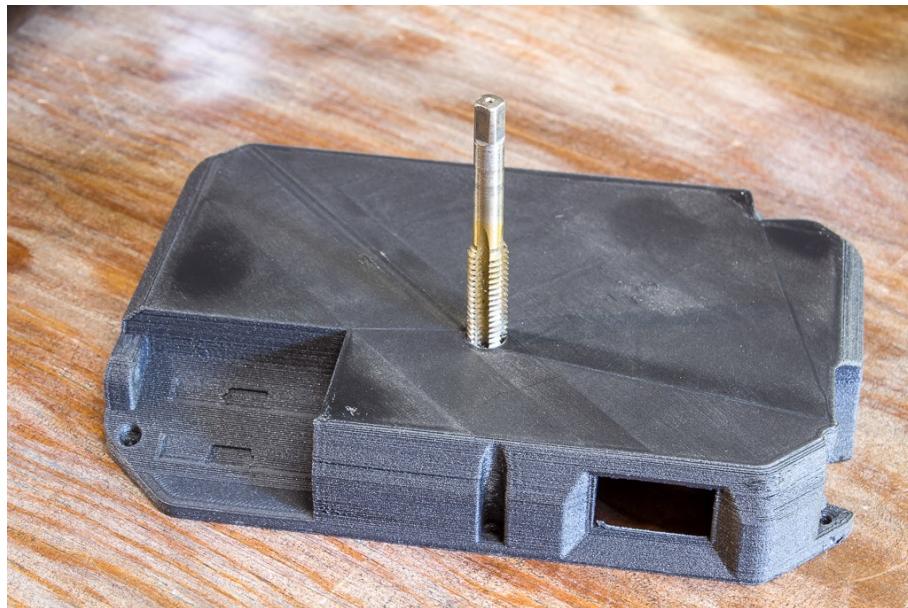
11. Remove the supports and bed adhesion from the back cover.



12. Remove the battery holder support, power switch support, and display support pieces. Confirm that AA batteries slide easily into the battery holder. Sand the holes if batteries do not slide in easily.



13. Tap the hole on the top of the back cover with a 3/8" UNC tap



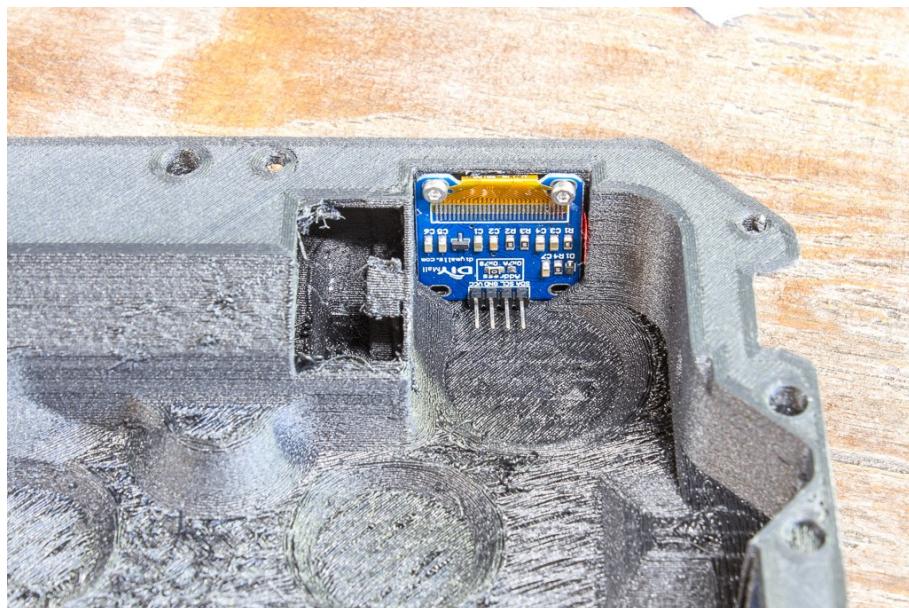
14. Install the 1/4" - 3/8" adapter in the tapped hole



15. Trim the headers on the OLED displayed



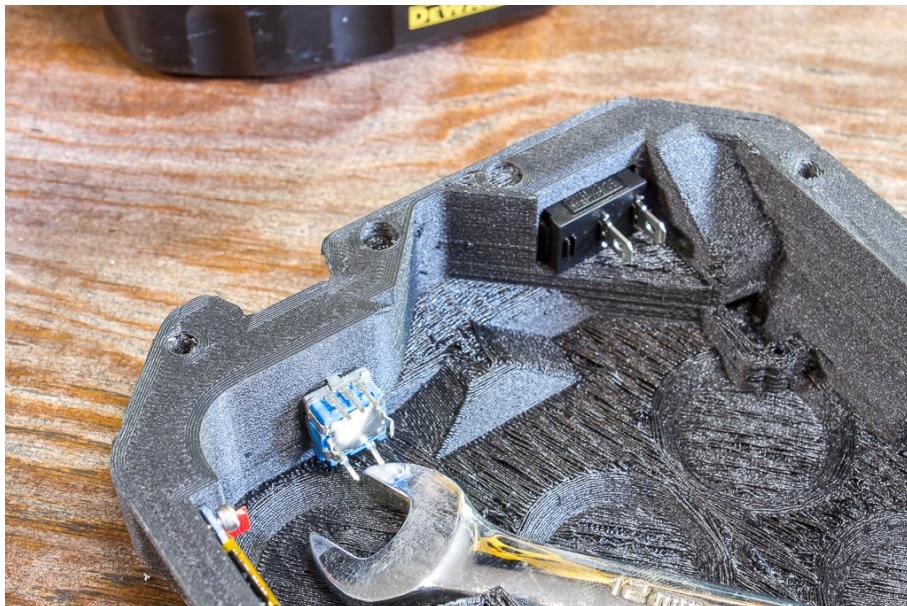
16. Install display with 2x 4mm M2 screws



17. Tap encoder hole with M7x1 tap



18. Install the EC11 encoder. It will be easy to start, but use a 12mm wrench to finish screwing it in.

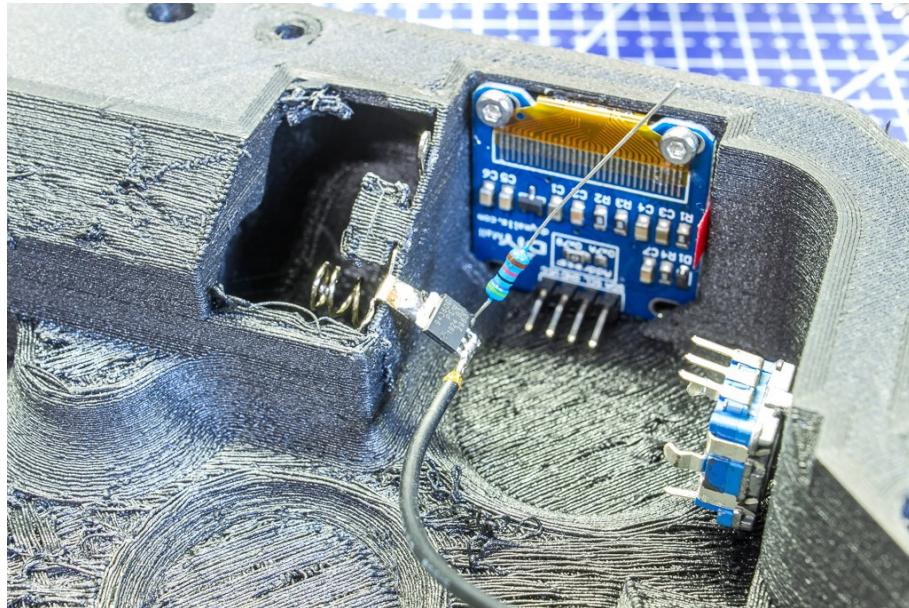


19. Install the KCD1-101 power switch as shown in the figure above.

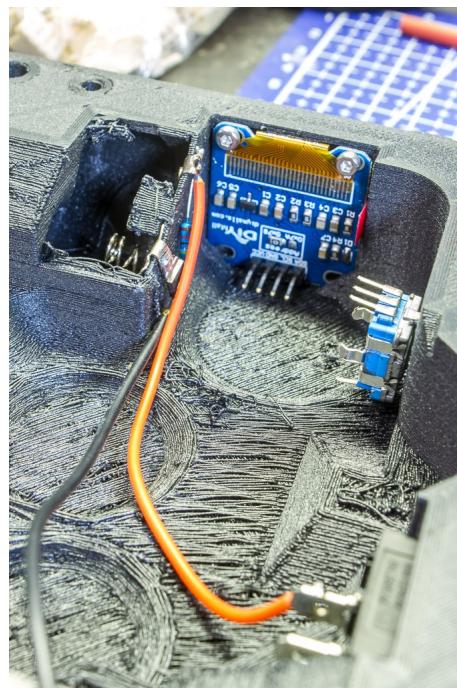
20. Install battery contacts. Slide batteries in to confirm alignment.



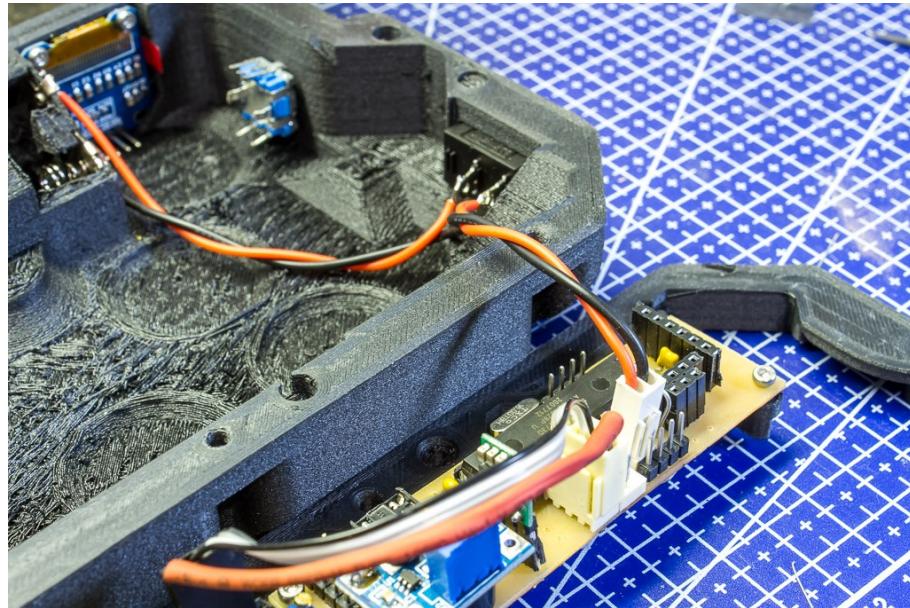
21. Solder the BUK9Y43 MOSFET tab to battery negative contact (with spring), solder a 47K 1/8W through-hole resistor to rightmost pin on MOSFET, solder remaining pins to 17 cm long negative wire



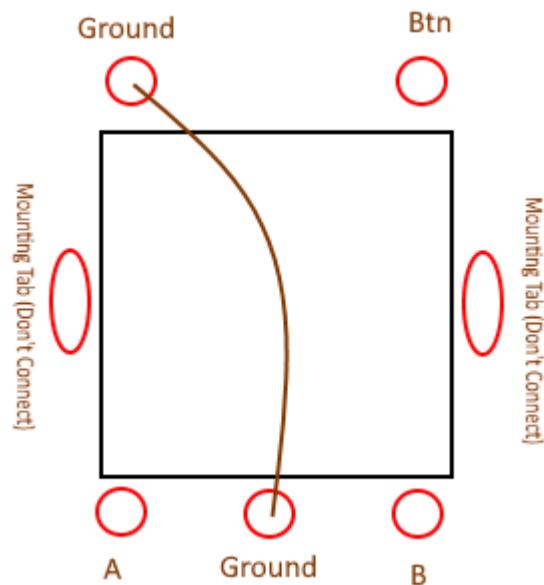
22. Solder the 47K resistor to battery positive contact (no spring) and solder 11cm long wire from battery positive contact to power switch



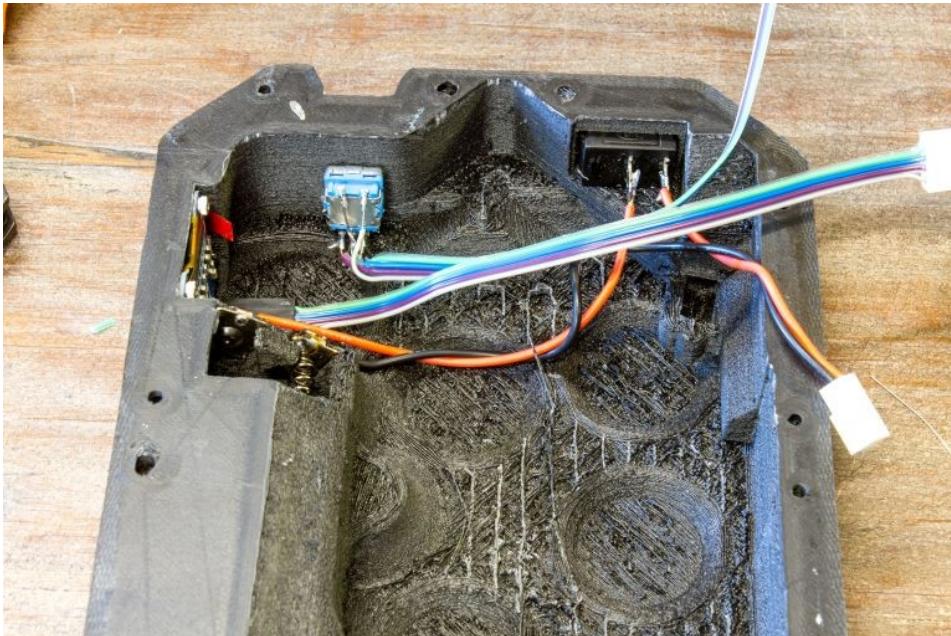
23. Solder 8cm long wire to other side of power switch. End the positive and negative wires in a female dupont connector and connect to the EMCB1 board.

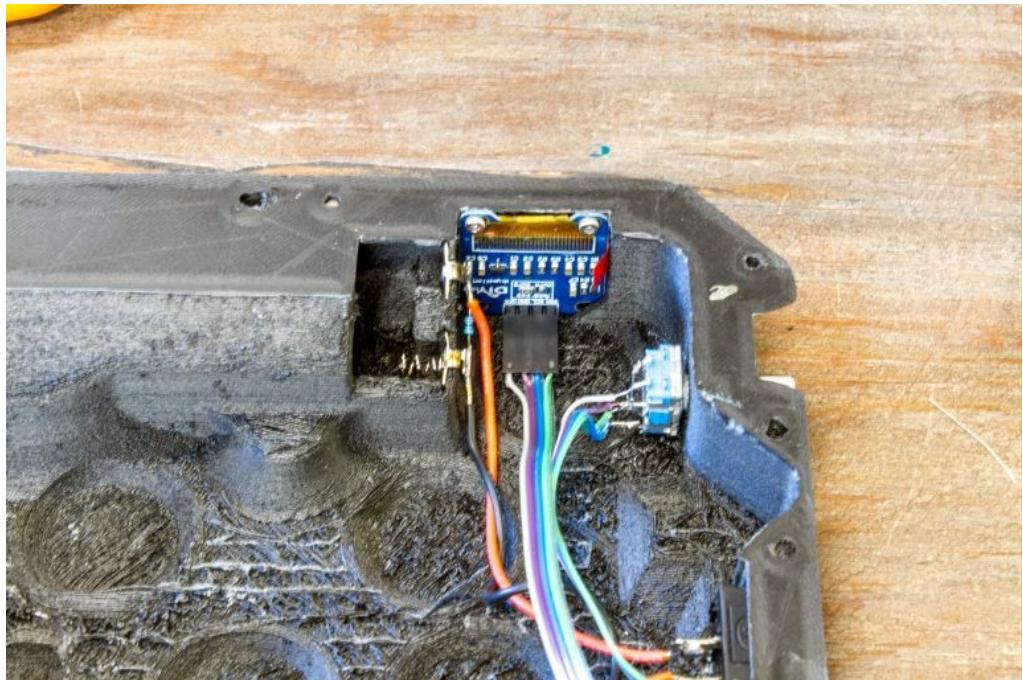


24. Solder a 15cm long 4-wire ribbon onto the encoder as shown.



25. Connect the display using a 15cm long 4-wire ribbon

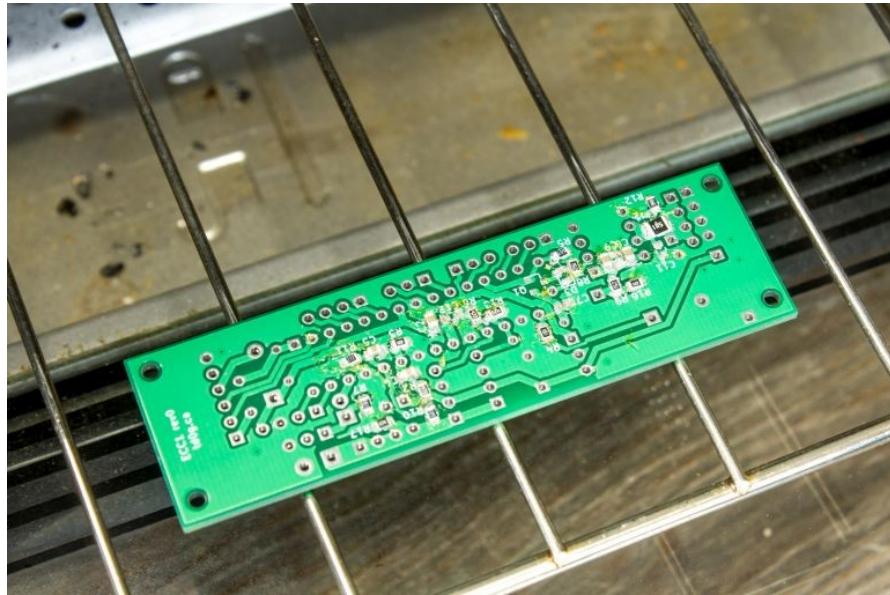




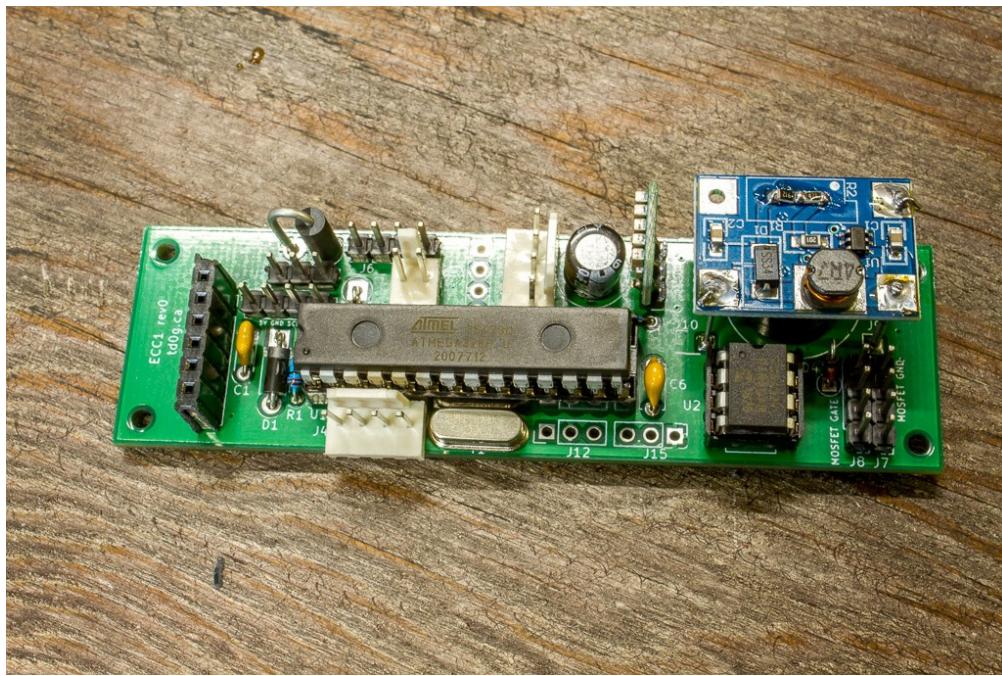
EMCB1 Assembly



26. Solder surface mount components to EMCB1 control board

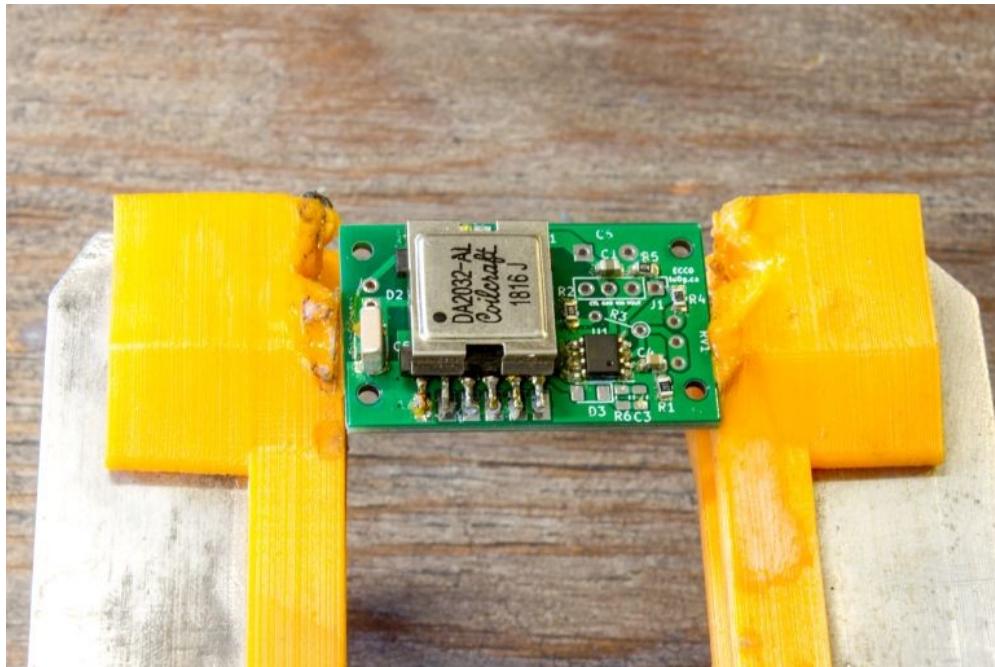


27. Solder through-hole components onto board. Install ATMEGA328P and TC4452 IC's onto board.

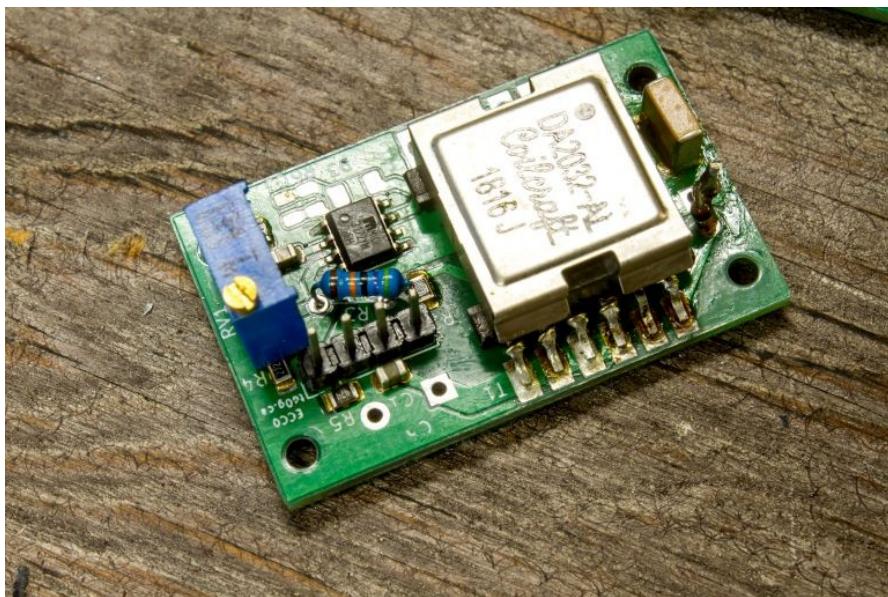


ECC0 Assembly

28. Solder surface mount components onto board



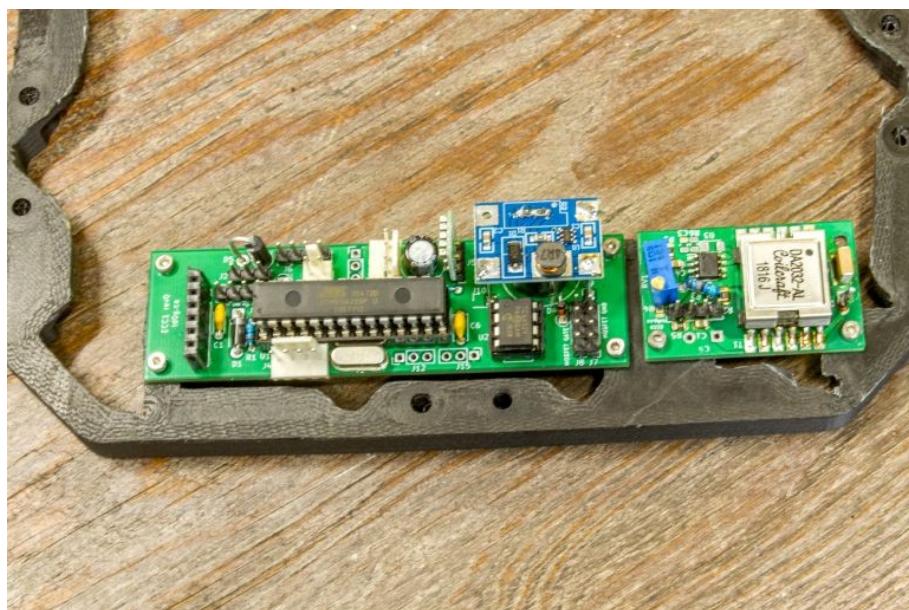
29. Solder through-hole components onto board



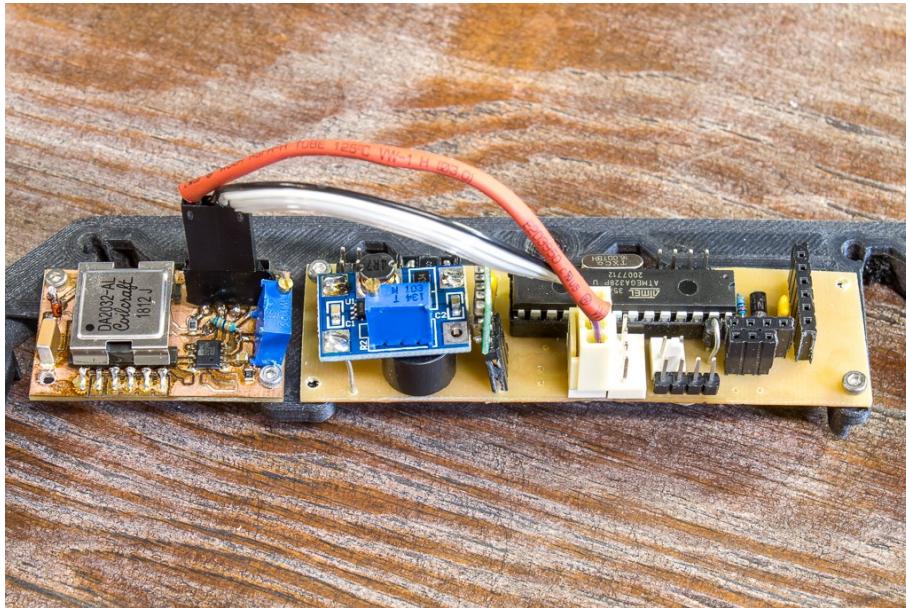
Mid Section



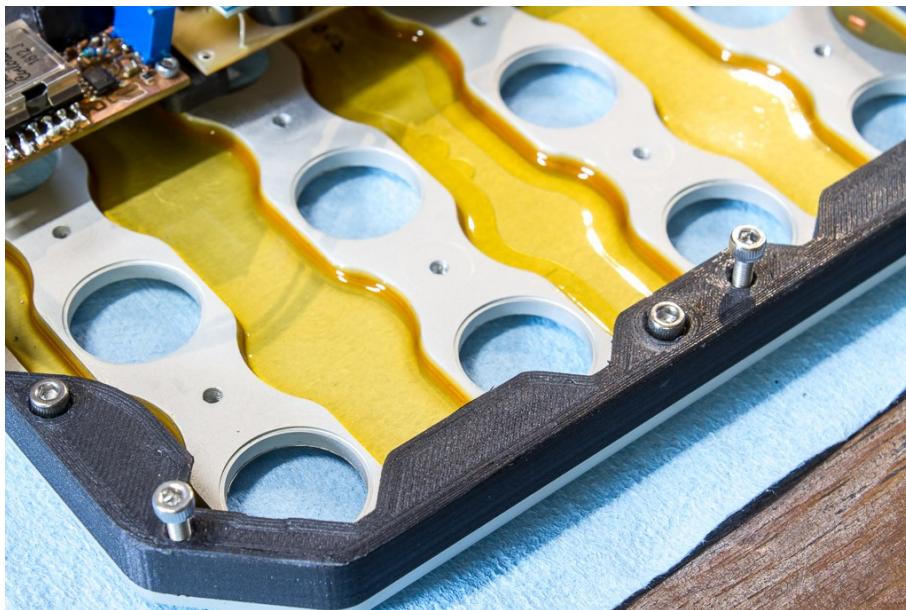
30. Remove bed adhesion from mid section
31. Install ECB1 board with 4x 6mm M2 screws
32. Install the ECC1 board with 3x 4mm M2 screws



33. Connect the ECB1 and ECC0 with a 4-wire 10-cm long ribbon. Keep the high-voltage wire separated from the other wires and protect it with heat shrink tubing

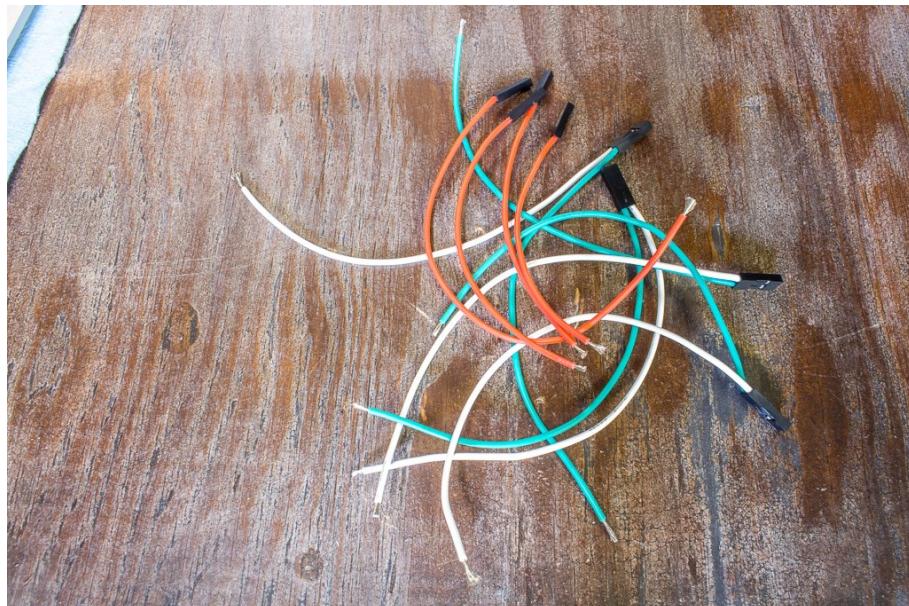


34. Mount the mid section to the aluminium faceplate with 6x 12mm M3 screws



LED Bank Assembly

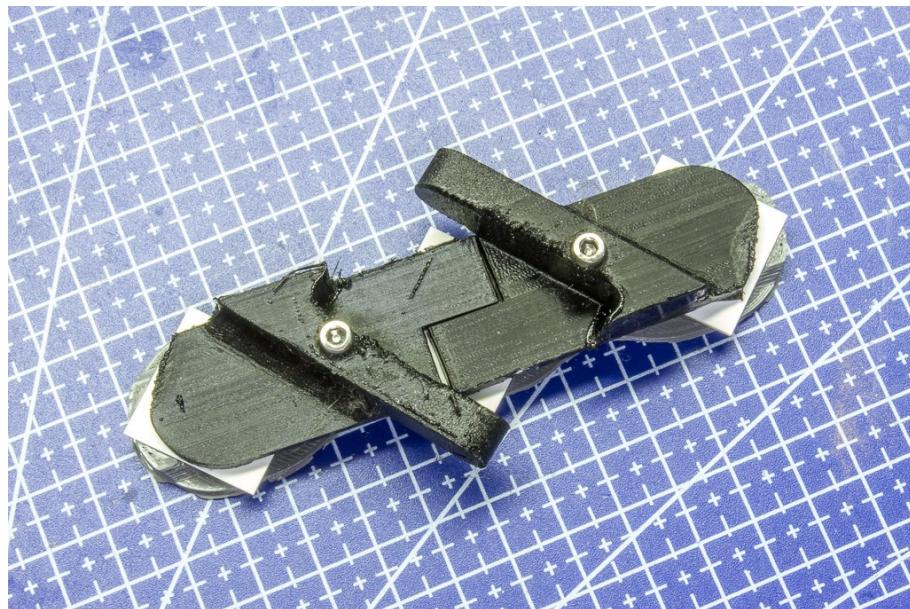
30. Prepare 12 wires: 4x ground wires (15cm long) 4x gate wires (13cm long), and 4x capacitor anode wires (9cm, 10cm, 11cm, 17cm long). Add female dupont connectors to the ends. Put the ground and gate wires in pairs. Put the capacitor anode wires alone. In the figure below, the ground wires are white, gate wires are green, and capacitor anode wires are red.



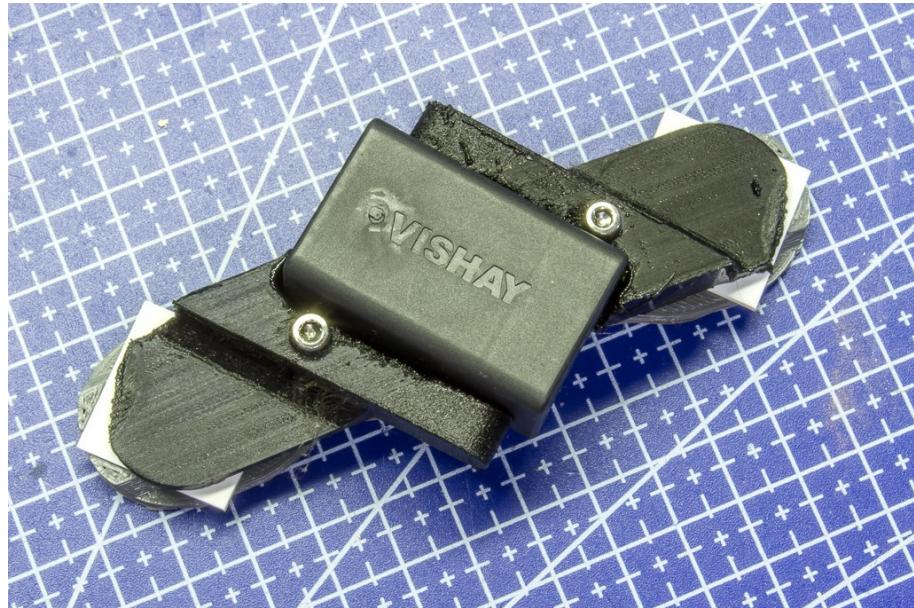
31. 3D print the Template and Template Clamps



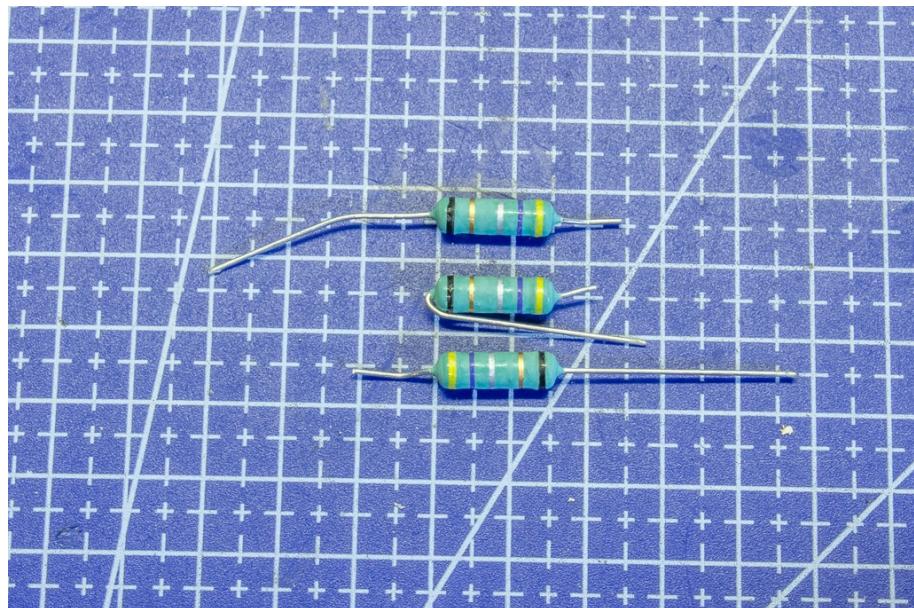
32. Take 3x LED's and lay them out on the template. Make sure the orientation is the same (anodes on one side, cathodes on the other).



33. Place the film capacitor in the template



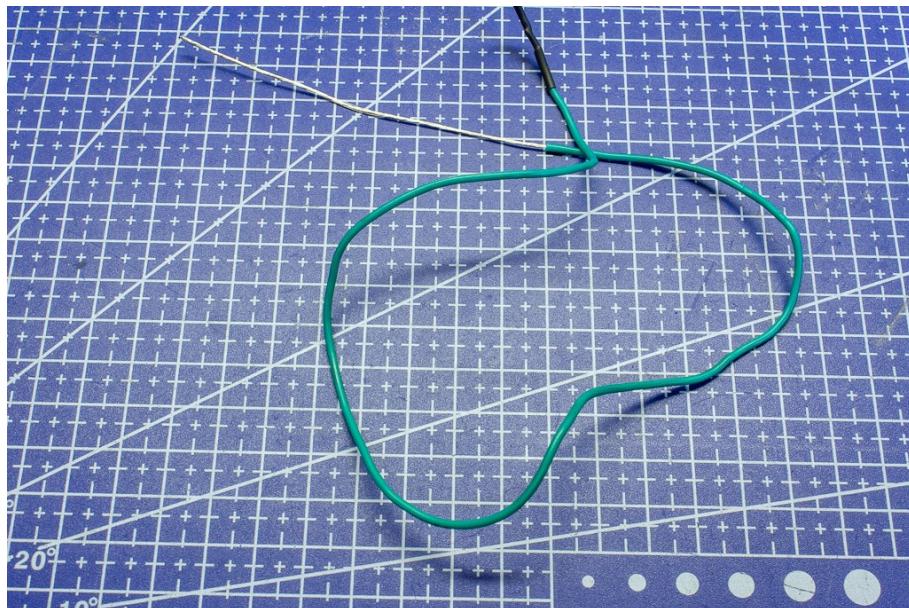
34. Prepare three 0.47 ohm resistors as shown



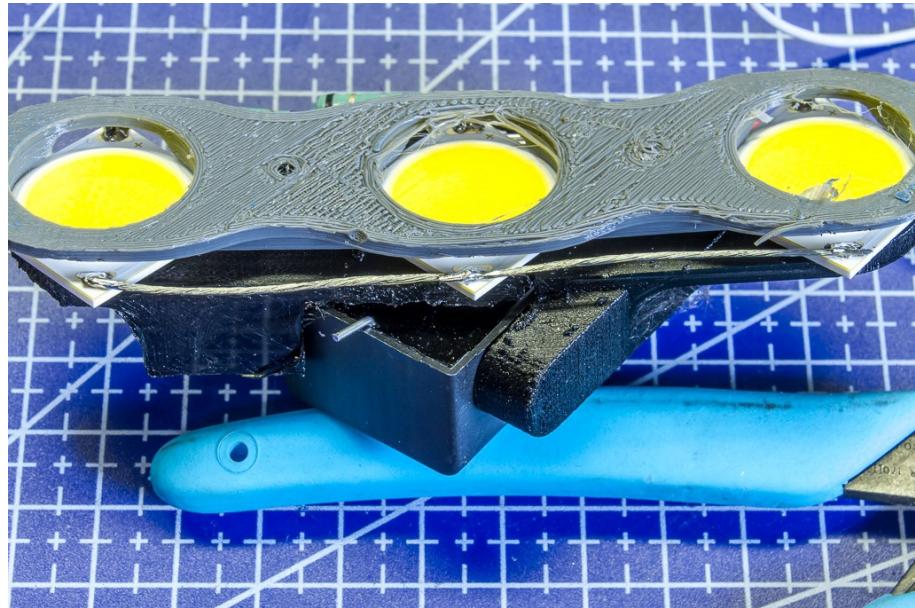
35. Solder the resistors between the LED anodes and the capacitor anode as shown. Solder the red wire as shown.



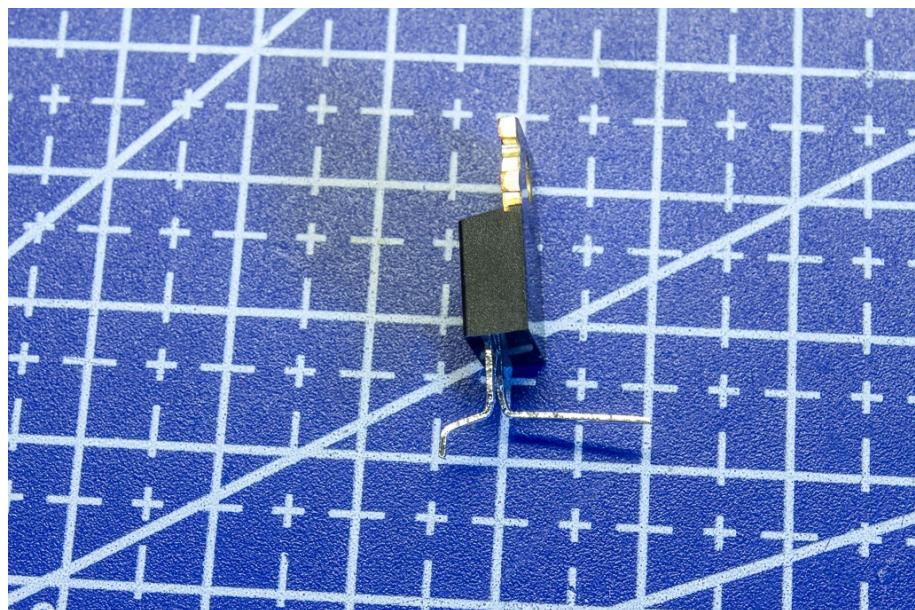
36. Strip a 9-cm long section of silicone wire as shown.

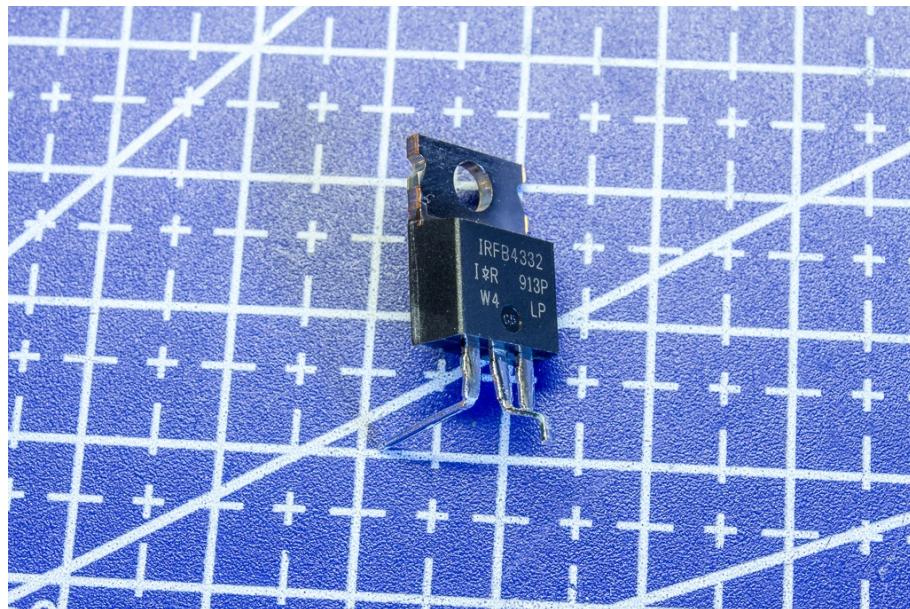
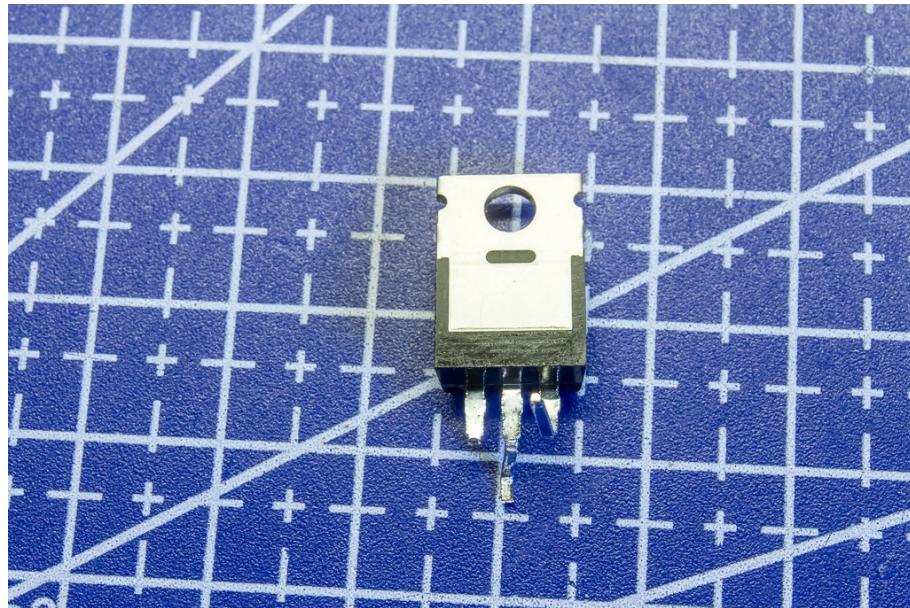


37. Solder the wire to the LED cathodes. The template is designed such that the wires should be soldered without excess length.

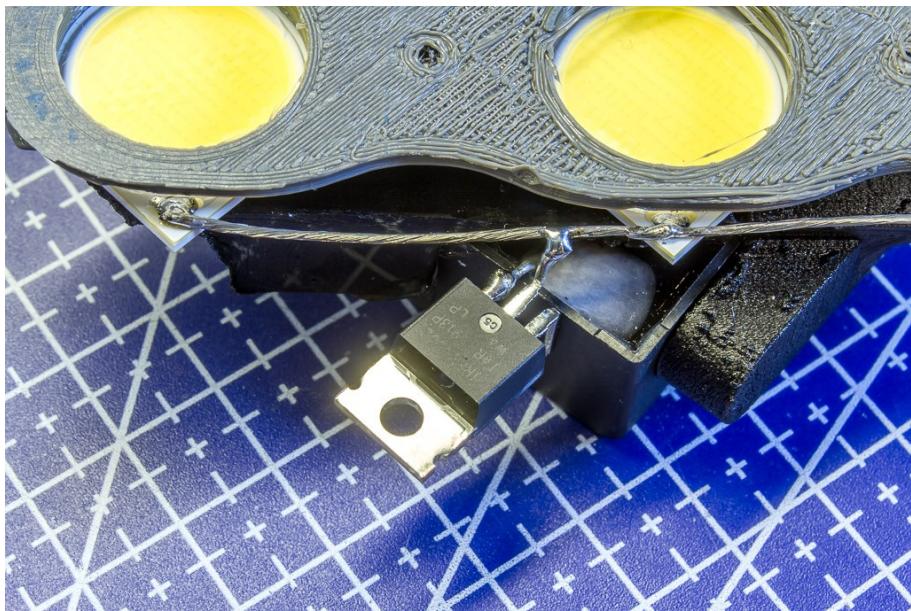
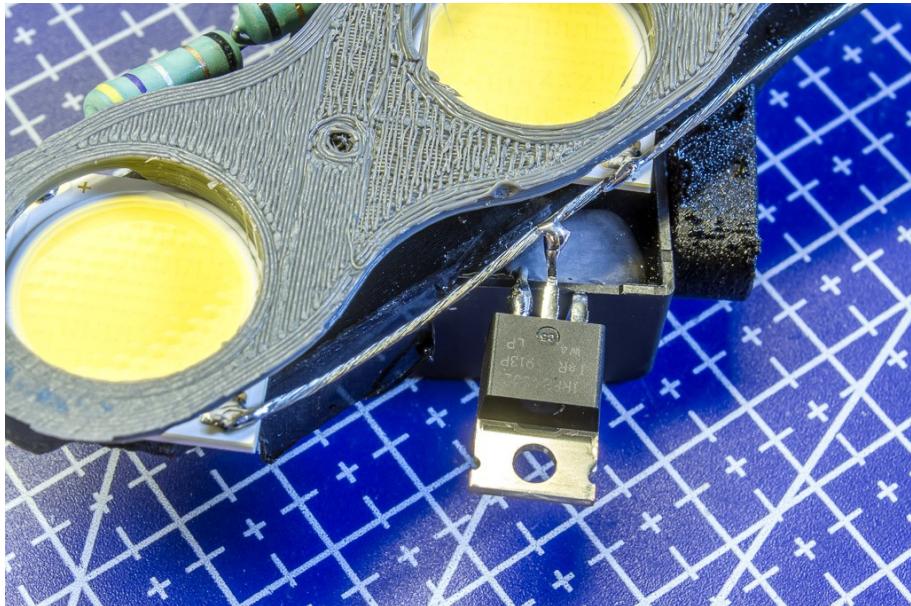


38. Prepare the IRFB4332 MOSFET as shown

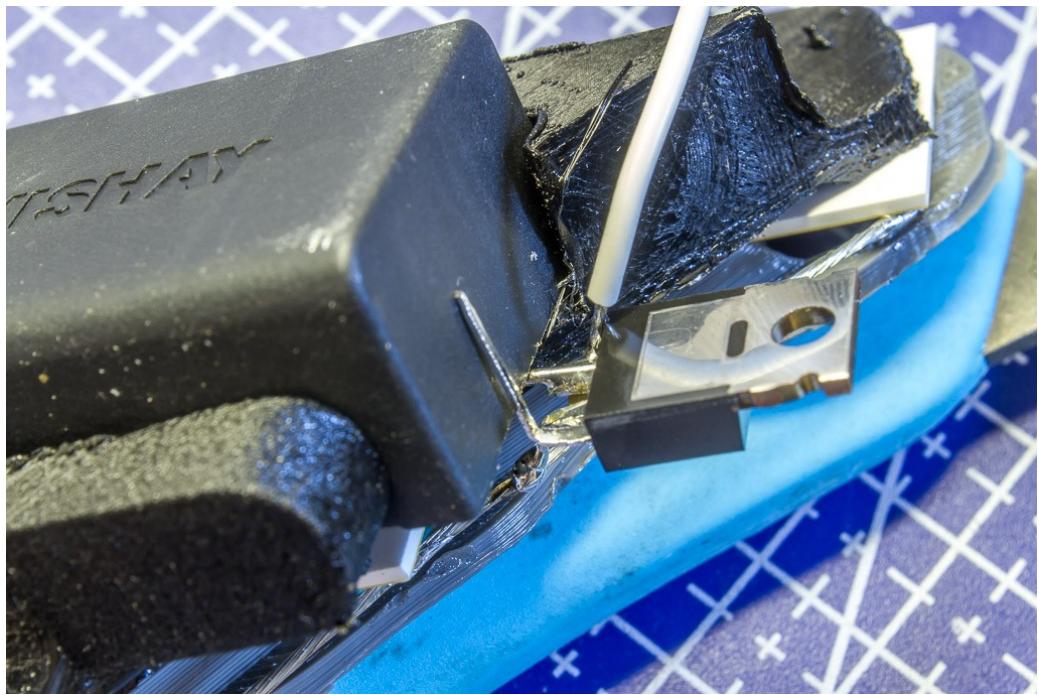
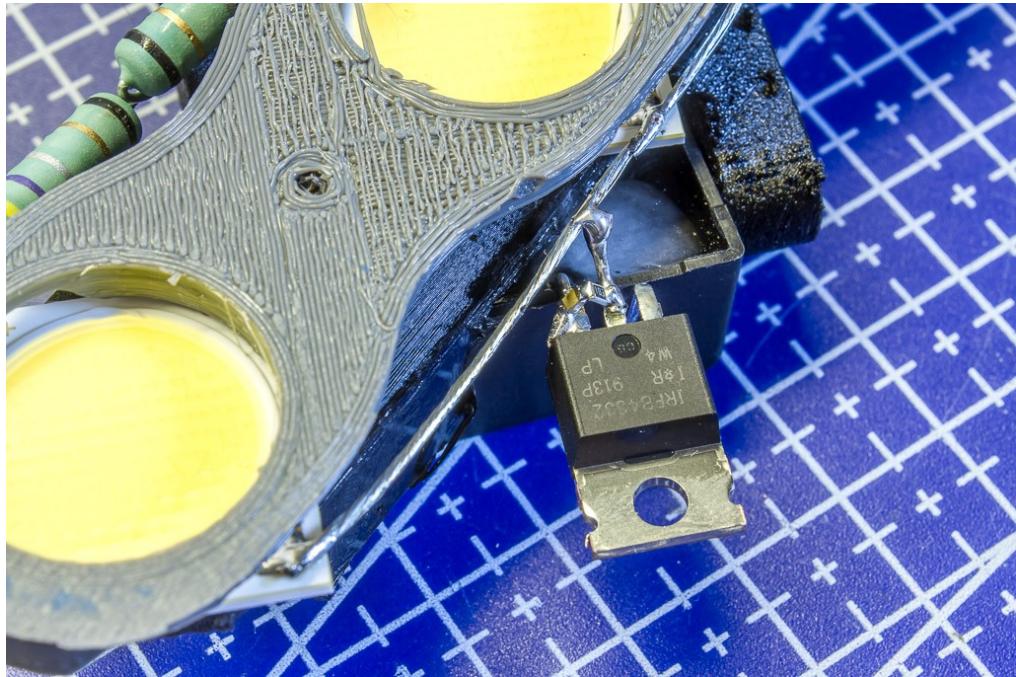




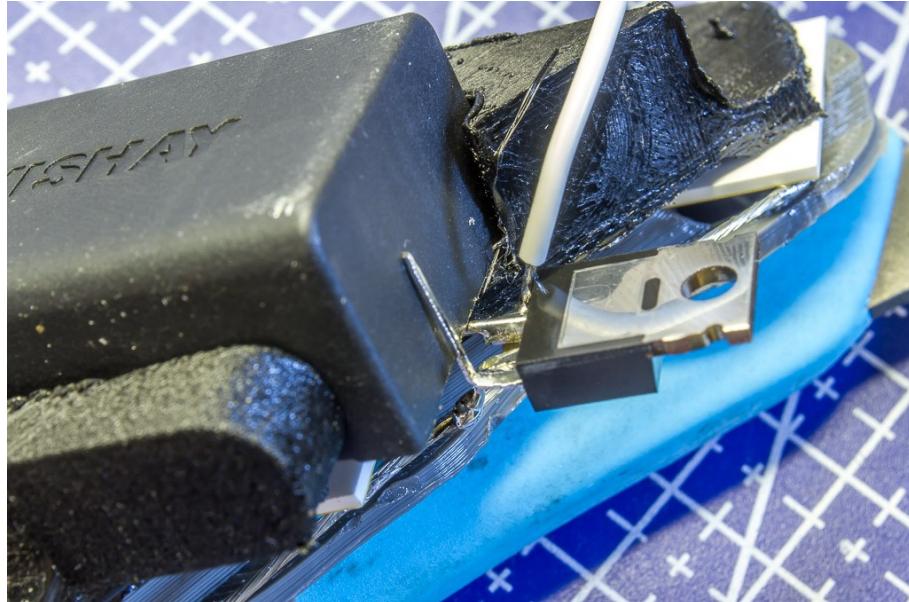
39. Solder the MOSFET onto the capacitor cathode and stripped wire as shown



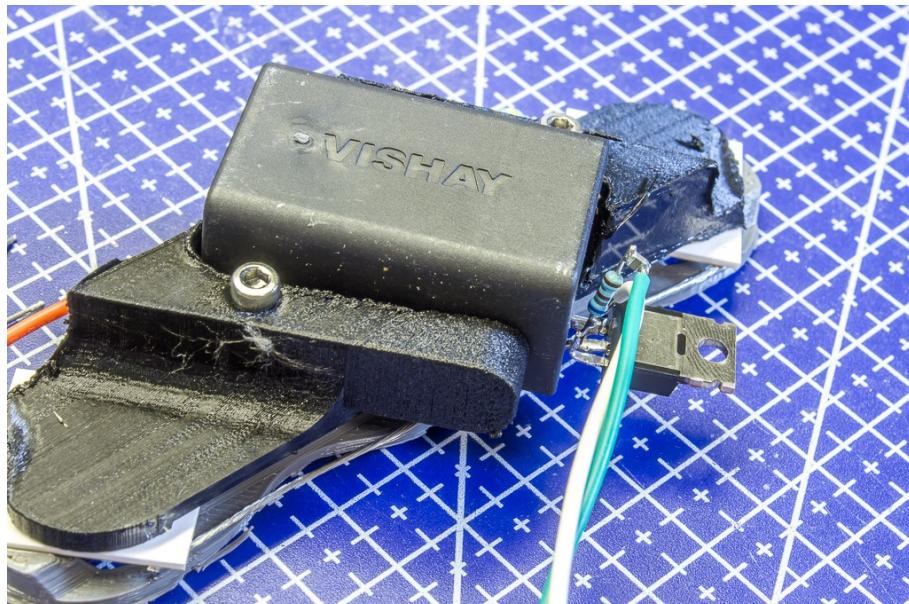
40. Solder the snubber circuit between the MOSFET's drain and source pins as shown



41. Solder the ground wire onto the MOSFET as shown



42. Solder the 6.81-ohm resistor and ferrite bead onto the MOSFET gate pin as shown



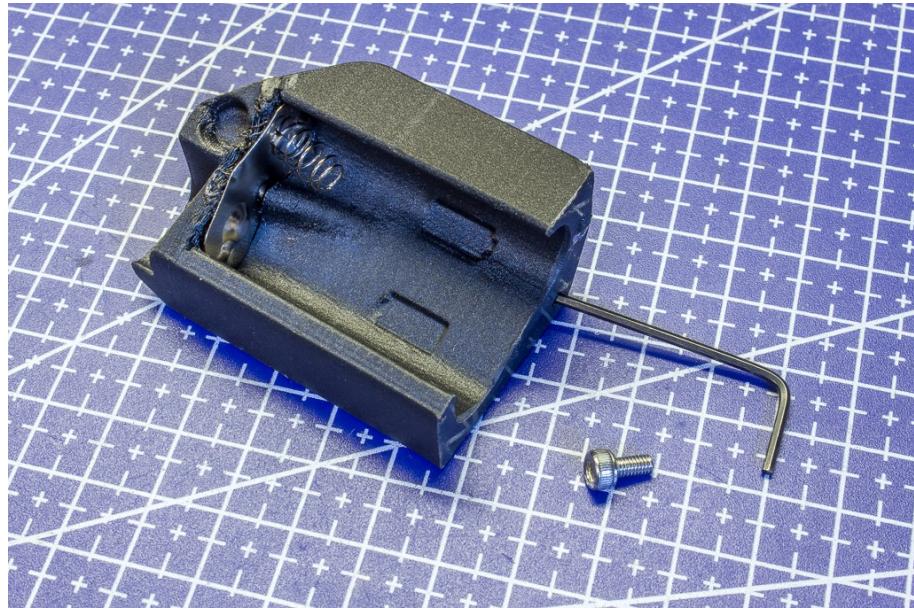
43. Repeat three more times

Battery Holder

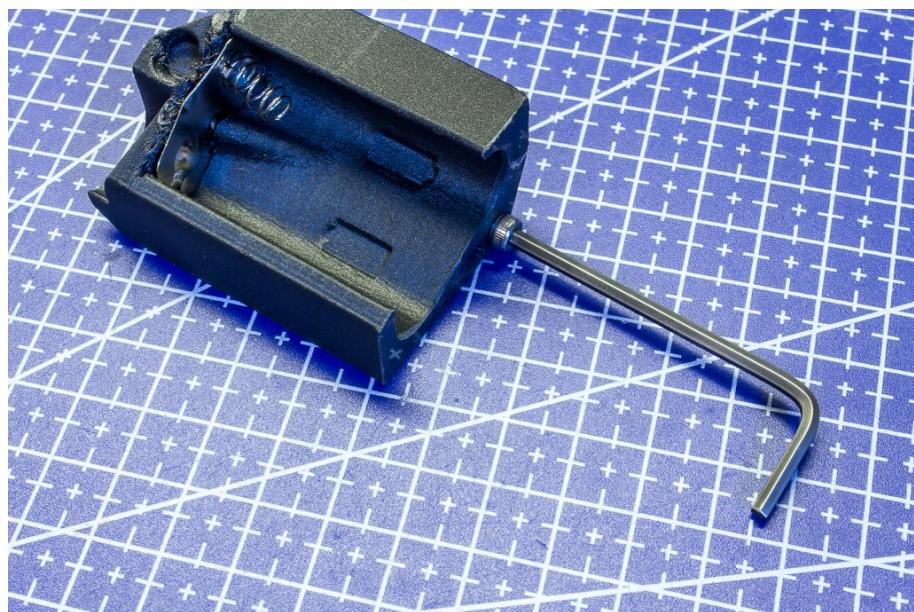
44. Remove the support and bed adhesion from the Battery Holder
45. Slide the battery contacts into the battery holder. Depending on the quality of the print, the battery holder may need to be trimmed in order to allow the contacts to enter.



46. Secure the battery contacts with a short M3 grub screw. Use a long allen wrench to install the grub screw.

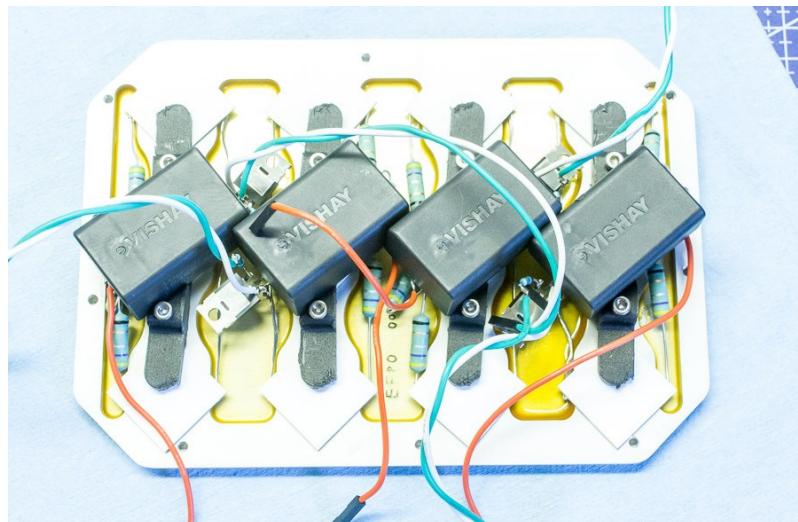


47. Install a 6mm M3 screw in the hole.

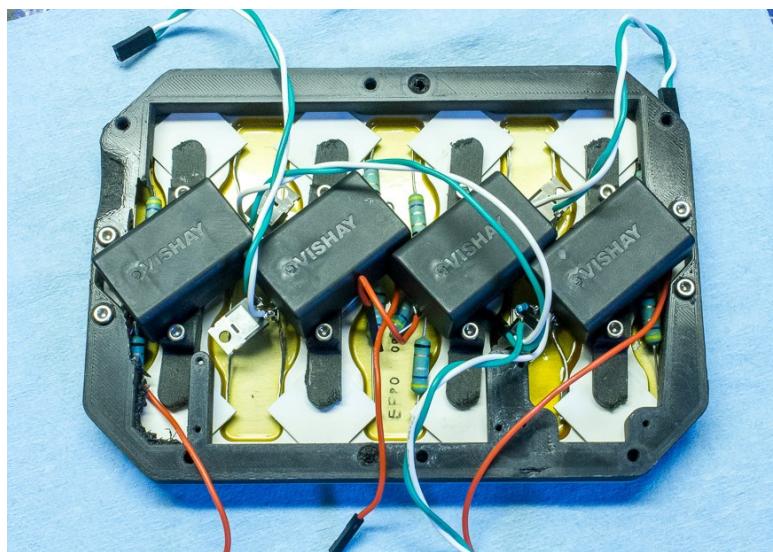


Complete Assembly

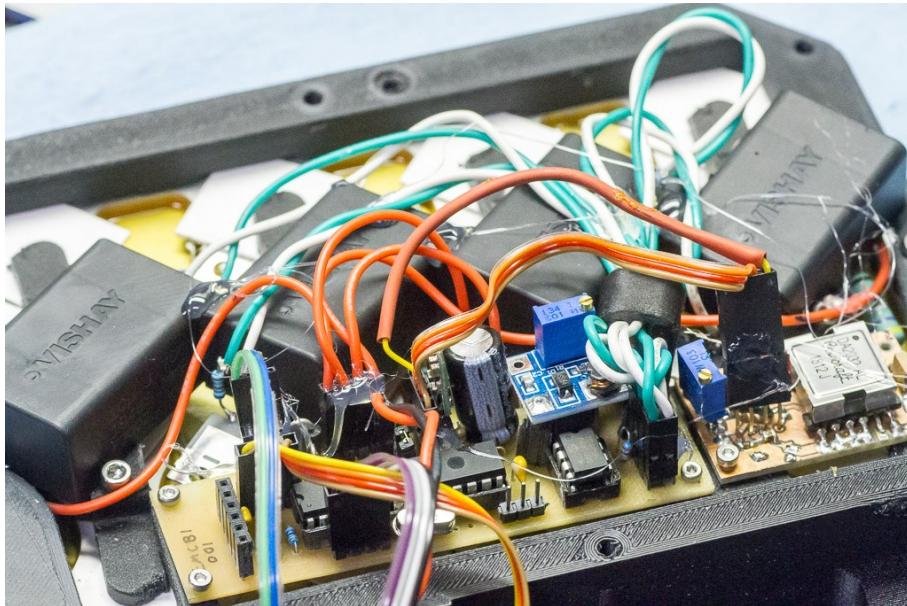
48. Remove the support and bed adhesion from the Dial. Install the Dial onto the encoder. It will just slip on.
49. Remove the mid section from the faceplate.
50. Install all four LED banks onto the faceplate using 14mm M3 screws. The orientation of the banks will alternate as shown.



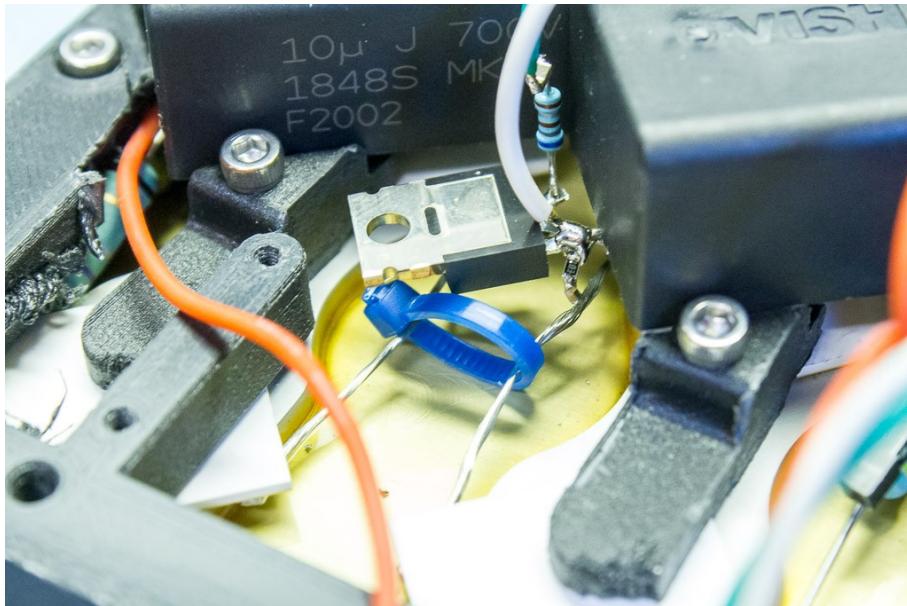
51. Re-attach the mid section to the faceplate



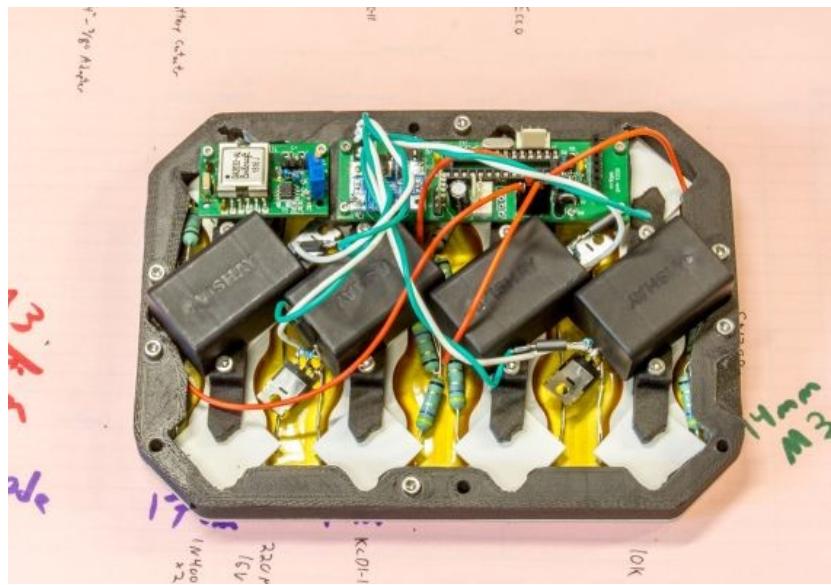
52. Connect the LED bank wires to the EMCB1 board.



53. Wrap the bare LED cathode wires in pairs using zip-ties and apply light tension to the wires. Do not tighten the zip-ties. This will prevent the wires from touching the aluminum faceplate.



54. Install the Back Cover onto the Mid Section using 4x 18mm M3 screws, 1x 20mm M3 screw, and 1x 16mm M3 screw (on the side near the batteries).
 55. Insert 4x AA batteries and turn the unit on. Turn on the ECC0 capacitor charger by entering the Ready To Arm state. Adjust the ECC0 output voltage to 120V.
 56. Perform the QC procedure as outlined in the E2A Testing Protocol.pdf checklist.



Changelog

2020-09-16 VTG Initial draft