Stern Star Trek
Nebula Backboard Upgrade

The following document walk you through the installation of Pinball-Mods.com's Nebula mod for the Backboard of the Stern Star Trek Pro, Premium, and Limited Edition Pinball Machines. This upgrade is a bolt-on modification which requires no irreversible changes to your pinball machine; however, you may need to solder the power wires to your GI circuits.

Please **note**: The Author of this document is not responsible for any damage you do to yourself or your property.

Tools/Materials Needed:

- Philips Screw driver
- Wire Cutters
- A soldering iron
- Some solder
- Some hookup wire to connect the boards to each other and to your machine. Suggestions:
  - Red & Black 22AWG stranded wire for GI power.
  - Red, Black, & Blue Kynar™ Wire for Remote LED connection.
- Heat Shrink Suggestion: Adhesive Lined Heat Shrink
- Black Electrical tape Suggestion: 3M 88 Electrical Tape

NOTE: The pictures in this document may swap between the prototype Purple PBAs and the production White PBAs as much of this document was written prior to receiving the production PCBs. The color of the PBA doesn't matter; only the connections / instructions in the document.

Overview / Introduction:

The process to install these boards is fairly simple and should only take a couple of hours to complete. Two of the three Printed circuit Board Assemblies (PBAs) has an independent constant current source intended to drive its own "local" LEDs and it provides two or more remote led ports (J1, J1A, J2A, J2B, J2C). The third board (labeled -94b) is the remote LED which connects to the remote led port.

These PBAs mount between the backboard plastics and the standoffs for said plastics with the electronics (LEDs) facing the backboard wall with the graphics. The backs of the PCBs are component free; so the plastics can sit flush against the PBAs. Each PBA set is labeled with a -65, -67, or -94b corresponding to the plastic they fit behind. In the case of the Pro pinball machine; the -94b PBA fits behind the -64 plastic. The shape of the PBAs is such that they will only fit behind their plastic so they cannot be seen by the Player of the game.

The PBAs are designed to be powered from the GI circuit of your pinball machine. On the pro; use the 6.3VAC GI circuit. On the Premium/LE; tie these to a GI socket or to the unused GIO2 circuit on the main RGB insert board (#520-6812-00 [see page Y24 in the manual]).

On the Author's machine; he connected the Nebula boards to his GI Dimmer via GIO4 with the following Settings:

Normal - 24%
Klingon MultiBall – 7%

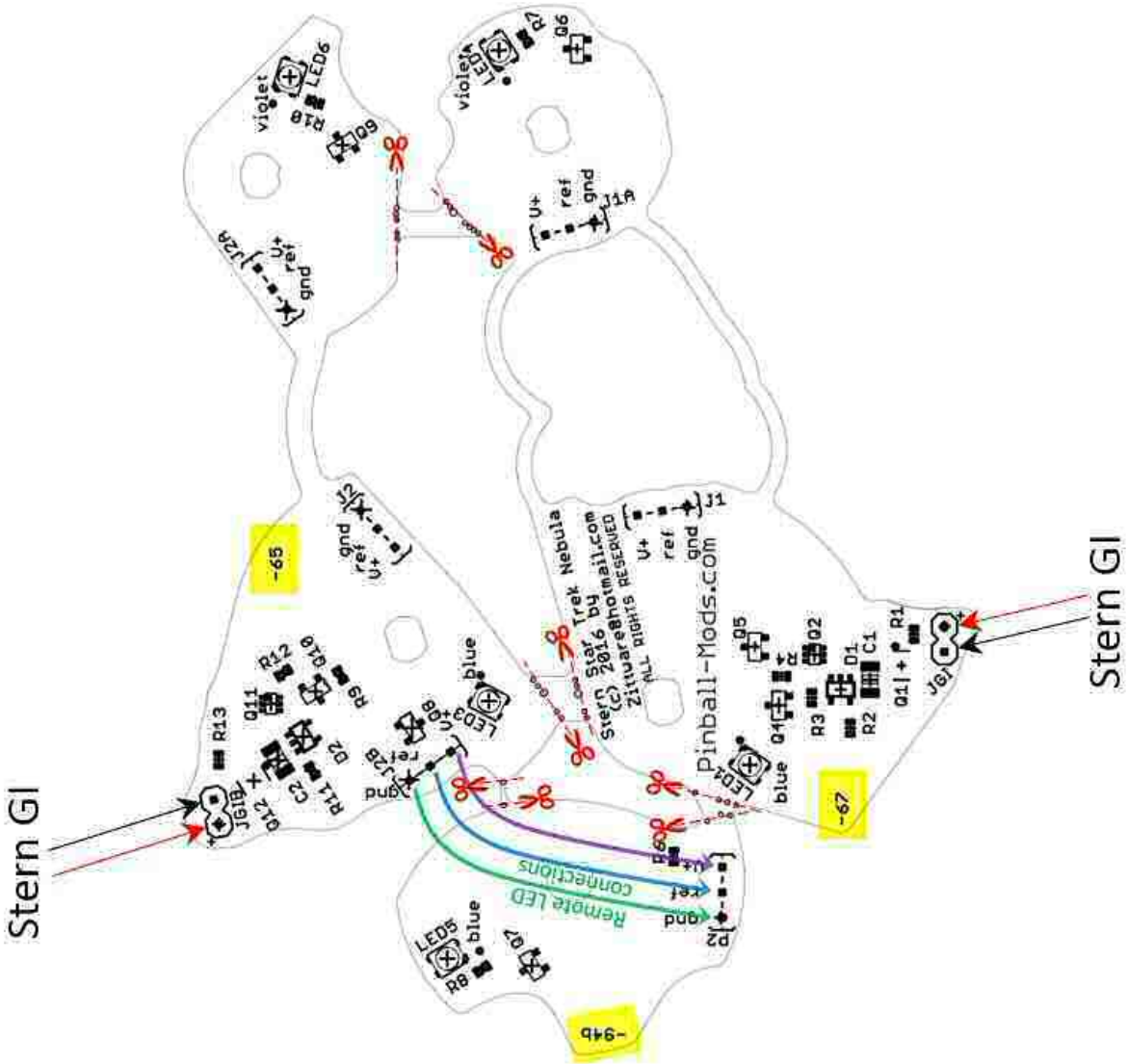


Figure 1 PBA Connections

Installation (Step-By-Step):

1) Begin by carefully snapping apart the three PBAs using the provided drill holes.

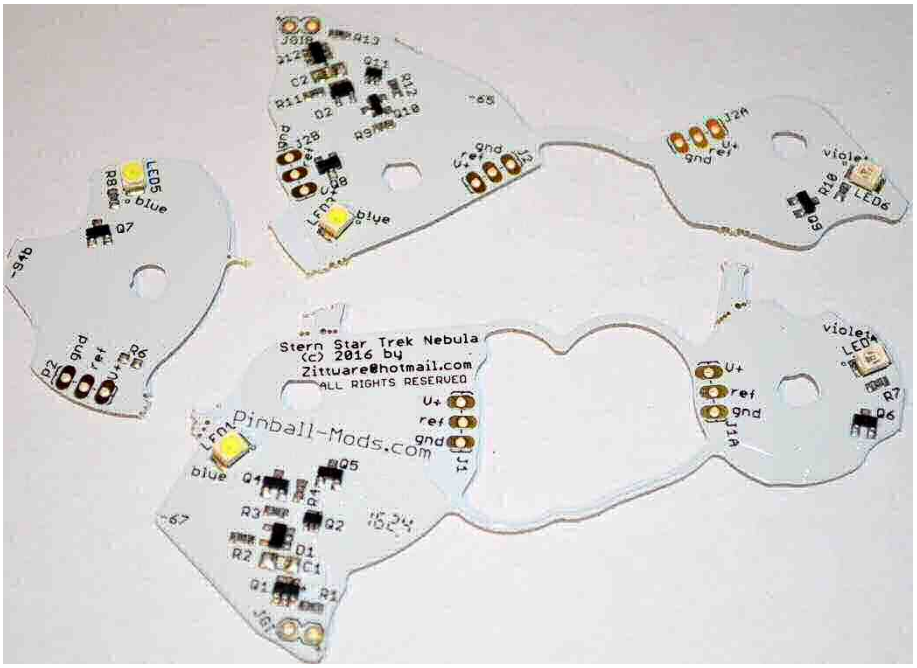


Figure 2 Snap boards apart using drill holes

2) Remove the connecting spurs and for best results trim the mouse bites from the PBAs so they won't be seen when installed.

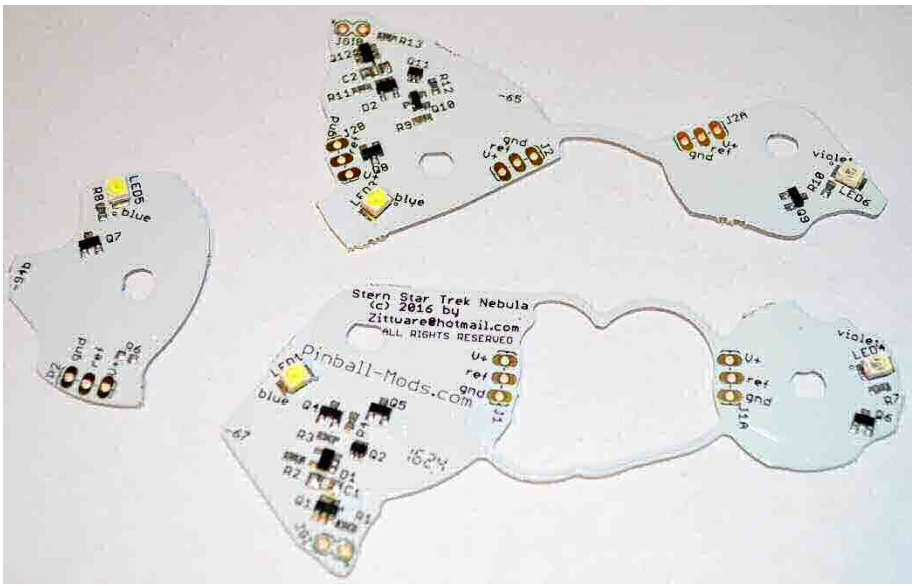


Figure 3 Remove connecting spurs and mouse bites

3) At your work bench; Select two different colors to represent positive and negative GI power leads. The Author picked white for hot; and green for ground. The color isn't critical; you can use any color you want. Looking at the -65 and -67 PBAs; you'll see a tiny plus which indicates the positive rail. On the Pro, 6.3VAC is used; so the polarity isn't needed. On

Figure 4 Solder GI wires to JGI and JGIB

Premium/LE machines the polarity matters for best results, but we are getting ahead of ourselves at the moment. On each machine; you'll want about 6-8inches of power leads soldered to the JGI (-67) and JGIB (-65) connections from the component side of the PCB. Jot down your color selections here so you can reference it the later steps.

+ = _____ GND= _____

4) Trim the soldered wire flush with the -67 and -65 boards as pictured. **NOTE:** This is important to prevent the sharp edges of the wire from scratching the art off of your plastics.

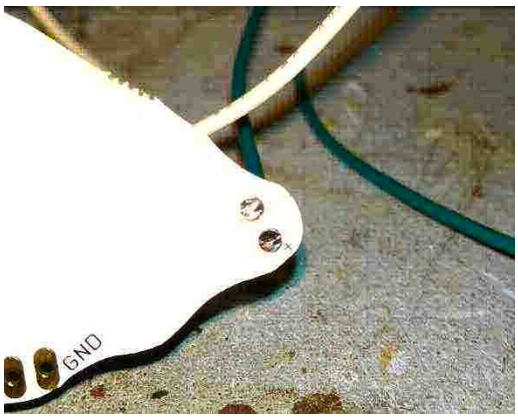


Figure 5 Install Electrical tape to protect art

Once you've trimmed the wire flush with the back of the PBAs; cover the connection with some black electrical tape as an added preventive measure for your plastics.

Figure 6 Trim wire/solder flush with PBA

5) Now select 3 different colors for the remote LED connections. You can reuse the colors above or select new ones. The author used red, green, and black Kynar™ rework wire. You'll want about 3-4inches of wire … preferably some small gauge solid wire so it can be easily hidden between the plastics. Solder one side of the wire to the connection at J2B on -65's PBA. The Author used Red for positive (V+), Black for ground (GND), and green for ref.

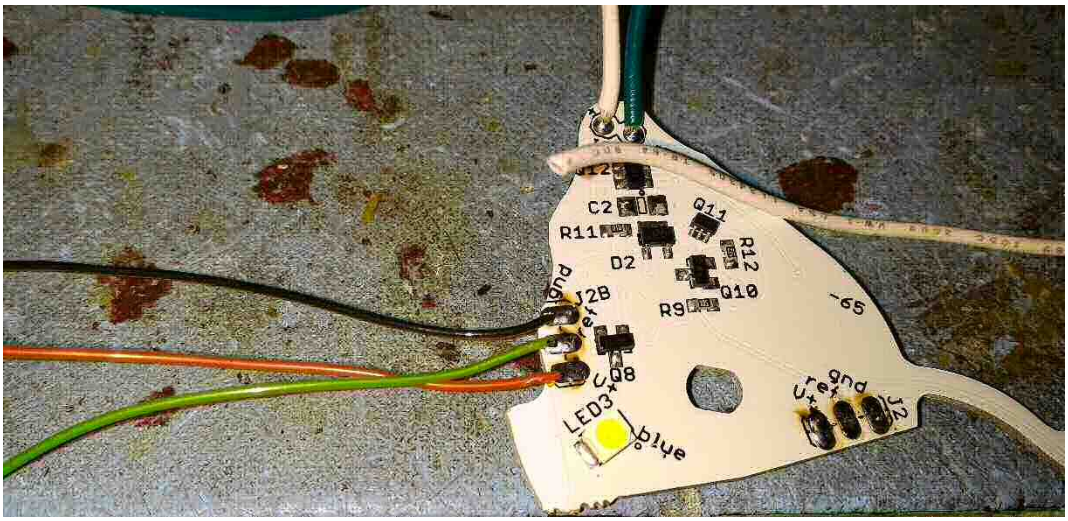


Figure 7 Solder J2B connection

Jot down your color selections here so you can reference it the later steps.
V+ = _____ ref = _____ GND= _____

6) Again trim the solder connections flush with the board

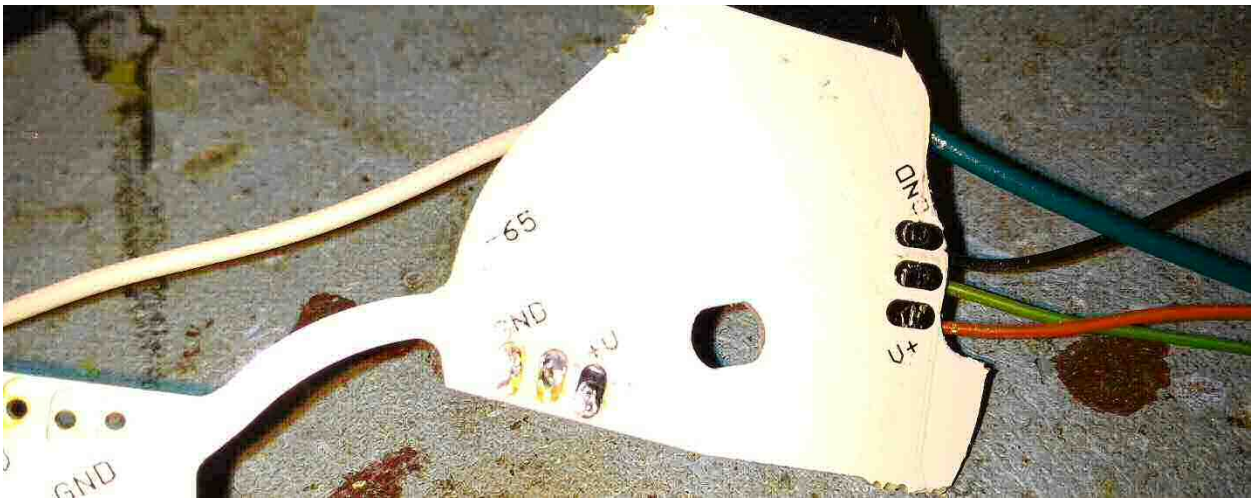


Figure 8 Trim J2B flush w/ PBA

and cover with black electrical tape to prevent damage to the plastics art.

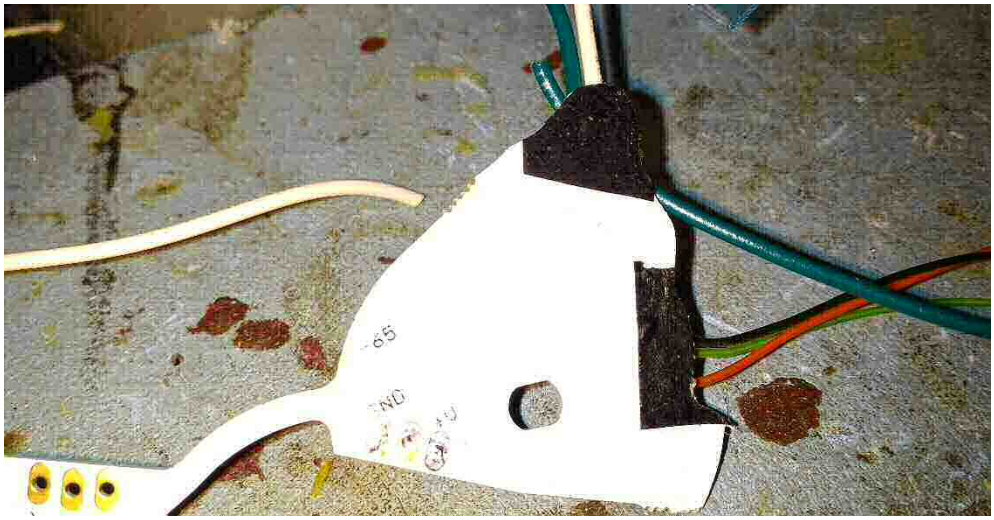


Figure 9 Cover J2B w/ Electrical Tape

7) Now it's time to move to your machine… in the following pictures; the Author is installing on a LE machine… but the installation should be nearly identical on the Pro. For best results carefully remove the -94 (LE/Premium) or -64 (pro) plastic. This plastic is the foremost plastic on the backboard and is in-front of the -65 and -67 plastics. Begin by removing the two Philips wood screws holding the plastic to the backboard. Note the Black Standoffs are not secured with anything other than the woodscrew. Be careful to not lose the screw, washer, or standoff when removing it. Note: The Black Standoffs go with the -94/-64 plastic. They are longer then the next set of standoffs which allows this plastic to sit in front of the others.

8) Now you should be free to remove the -65 and -67 plastics being careful not to lose any of the mounting hardware deep in your machine. Note: On the LE/Premium these standoffs are grey in color and are about 1/8" shorter than their black counterparts.

9) Each board is shaped specifically for their matching plastics; so refer to this installation guide. If you look closely you can make out the outline of the boards behind their plastics. We've identified them here for you so you know where each board goes.

Figure 10 Nebula PCB Placement

10) Let's start with the -67 PBA, Feed the wire under the -66 plastic between the warp ramp and the backboard cutout with the components facing up.

Figure 11 Thread -67 JGI into warp ramp slot but over the warp ramp

The wires should be above the warp ramp.

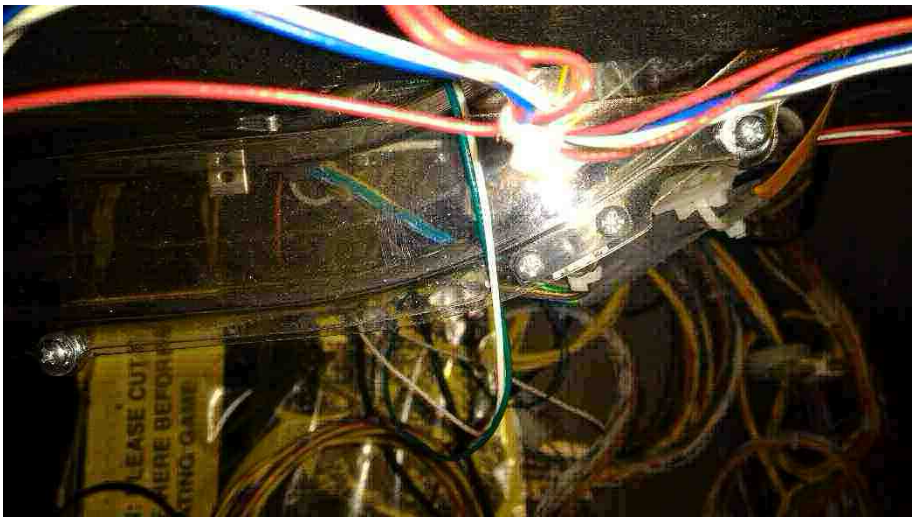


Figure 12 Thread -67 JGI into warp ramp slot but over the warp ramp

11) At this point; go ahead and reinstall the -67 plastic with the two grey standoffs, washers, and PBA. You want to sandwich the PBA on the backside (white side) of the plastic. The washer goes in front like it originally did. The PBA goes between the plastic and the grey standoff. This can be a little frustrating; so it's best if you have the Playfield pulled all the way out into full service position. I find it easier to get one screw started but loose; then rotate the whole stack into position with the other hole. After getting both screws started tighten both screws making sure to adjust the -67 PBA into its final hidden position as you tighten the screws.

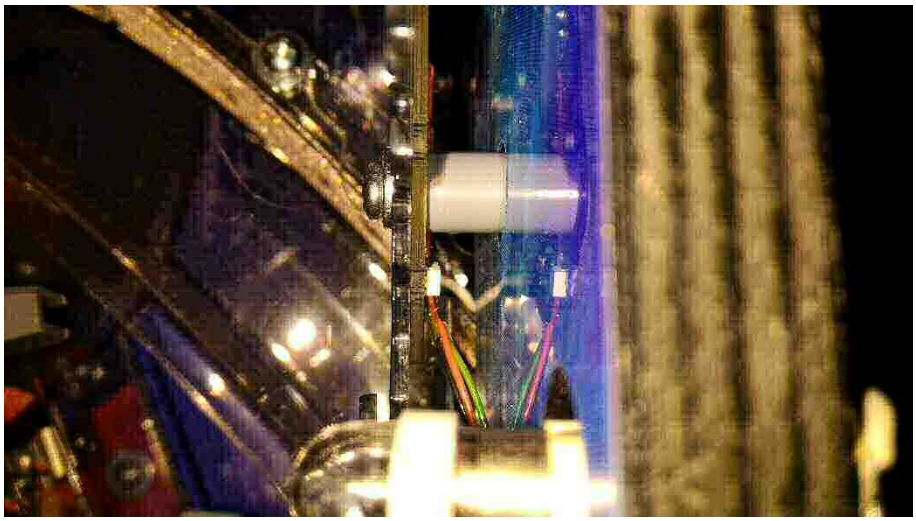


Figure 13 Sandwich PCB between plastic and standoffs

12) Now you want to repeat that procedure for the -65 plastic. Feed the JGIB wires thru the hole of the -66 plastic in the extreme upper right side of the warp ramp hole. It may help to loosen one or both of the screws if you are having trouble.

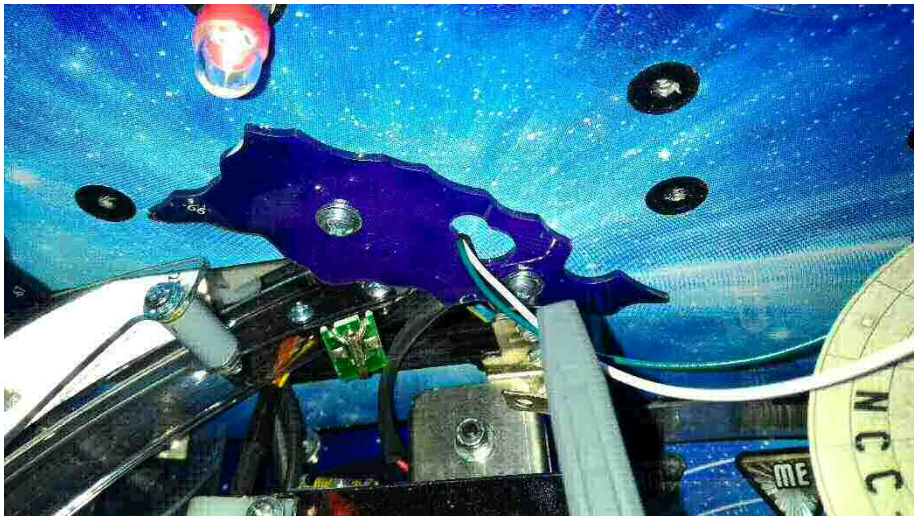


Figure 14 Thread JGIB wires in the -66 hole

13) Now it's time to install the -94 (-64 Pro) remote LED PBA behind the bird-like shape. This will probably be the most frustrating part of this mod because if you are like me; you have big clumsy fingers and a fear of melting solder onto some part of the machine. At this point; you need to stop, take a deep breath, and carefully read this: ***WARNING:*** You are about to solder some wires inside your machine … Go get a towel, some newspaper, or some other protective device to drape over your playfield, plastics, ramps, Vengeance…. Everything. *Do not sit the hot soldering iron on your PF, plastics, ramps, etc as you know darn well it WILL melt something.* Take this preventive measure now; so you won't regret it later – You've been warned.

At this point you want to solder the V+, ref, GND wires from J2B on -65 to the remote LED board -94b at P2. Remembering which colors you jotted down in step 4) above.

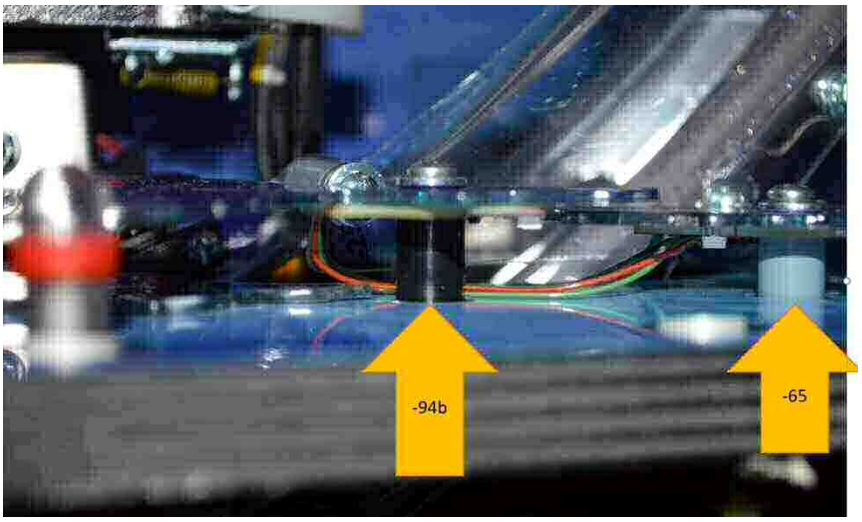


Figure 15 Connect -94b to -65 using the 3 wires from step 4.

Keep the wire a short as possible but leave enough length so you can adjust the wire and maybe make a new connection if the wire breaks during the final steps.

14) Like before trim the solder connections flush with the board and cover with black electrical tape to prevent damage to the plastics art.

15) You want to sandwich this PBA behind the bird like shape just over the left side of the vengeance. Like the others; place the PBA behind the plastic and between the black standoff. Make any final adjustments to hide the remote wires and the pcb behind the plastic(s).

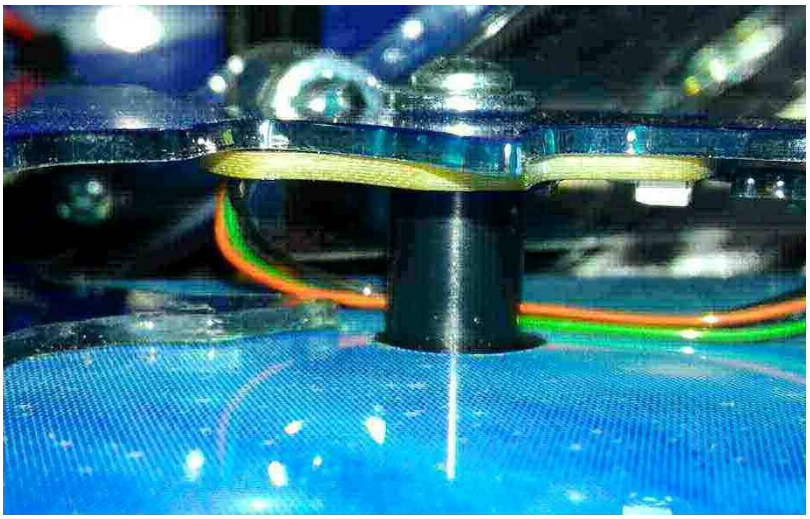


Figure 16 Install -94b PCB

16) At this point; it's time to merge the two JGI connection from -65 and -67 together. The author soldered these together under the playfield. Just make sure you solder the positives to each other and the grounds/negatives to each other so that you have a single JGI connection to attach to a single point on your machine. Use Heatshrink or Electrical tape to cover your solder connections.

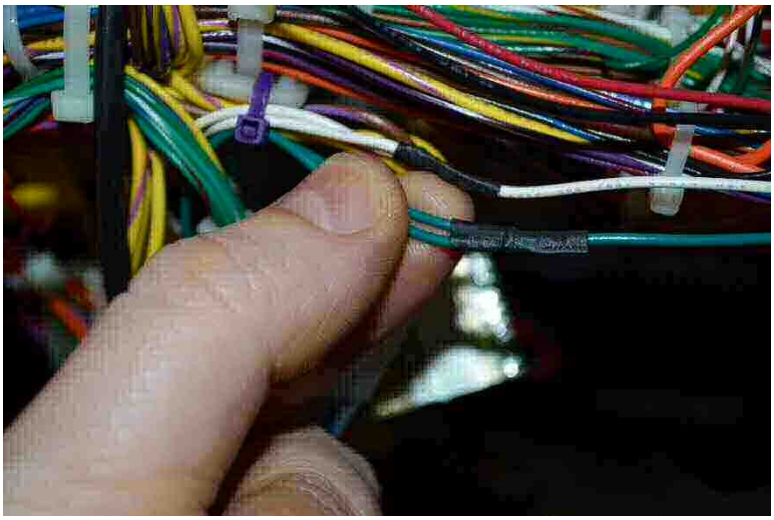


Figure 17 Merge JGI & JGIB connections into one.

17) The final step is to connect the merged JGI connection to your machine's General Illumination circuit. There are three recommended locations to connect depending on the configuration of your machine.

a. If you have an LE or Premium with our GI Dimmer; we suggest connecting directly to the Dimmer's J5 (Aux) connection using GIO channel 4 so that you can dim the nebula LEDs to your desired level in both normal and Klingon

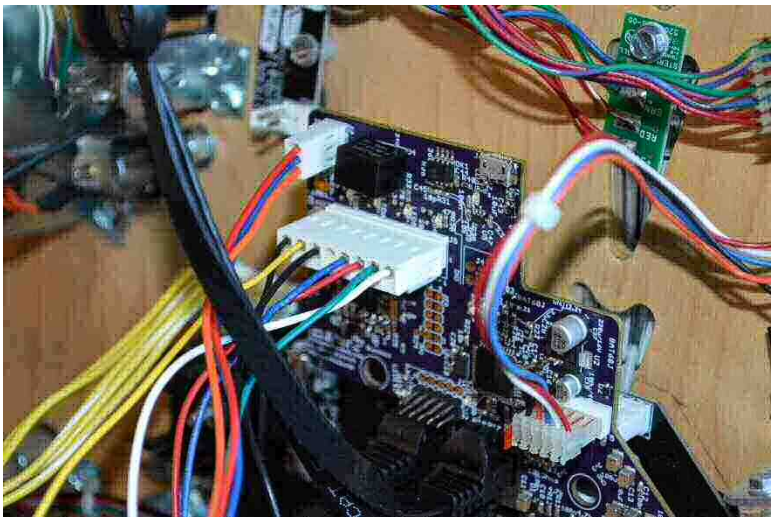


Figure 18 **Premium/LE w/ GI Dimmer:** Use GIO4 in J5 (AUX)

multiball. J5 Pin1 is the positive rail (white) while J5 Pin2 is the PWM negative rail (green) in this picture.

b. For best results on a Stock Premium/LE; ensure you connect the positive to the positive rail of your GI on the Premium/LE. Our suggestion is to use the Empty GIO2 connection on the main RGB LED board if it's not already being used by another mod.

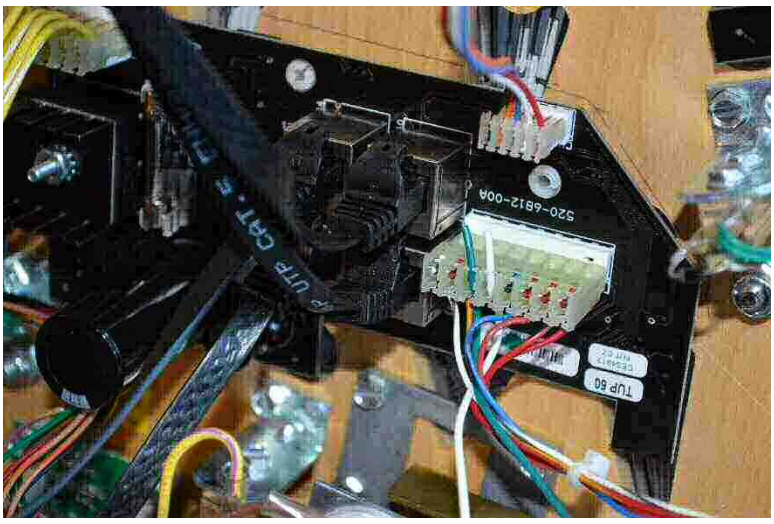


Figure 19 **Stock Premium/LE:** Use GIO2

If you've already used the GIO2 connection; any other JGI should work. Consider duplicating the Pro configuration below.

c. For the Star Trek Pro; It's easiest to connect the JGI to one of the LED bulbs on the backboard. Here the author soldered to the back of a white bulb near the center of the backboard:

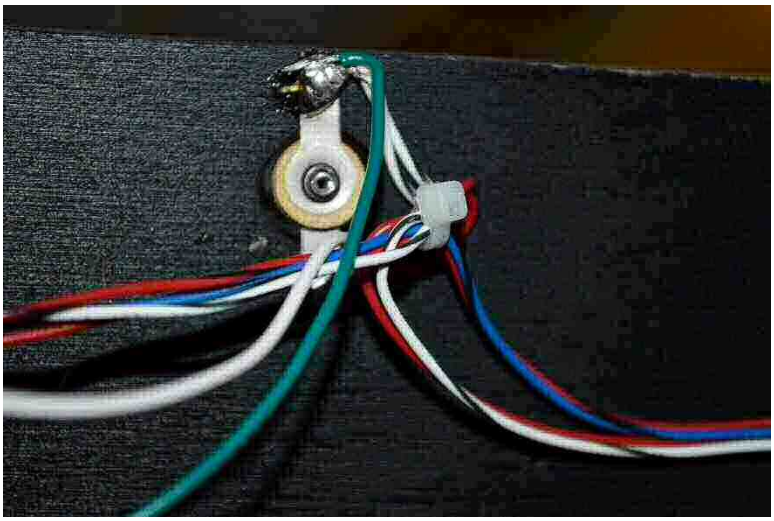


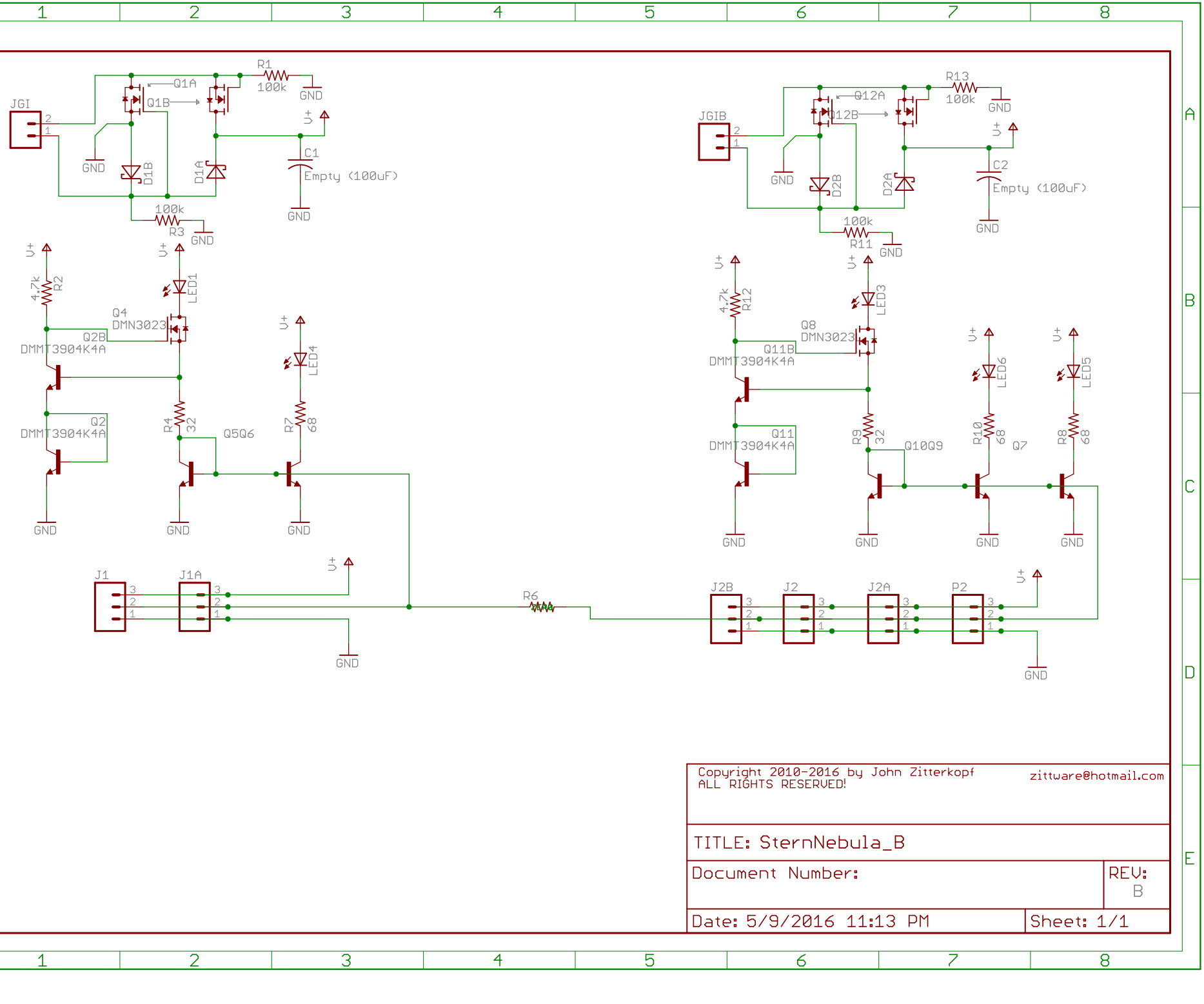
Figure 20 **Pro:** Solder to a Backboard Lamp

18) At this point; you will want to double check your connections and once you are sure you've installed the product correctly – power up your machine and verify it's operating correctly. Here's the author's example as installed in a LE machine:

Figure 21 Completed Example installation

Appendix A: Nebula Schematics

These Schematics are provided for the sole purpose of enabling custom modifications of the PCB or as an understanding of what each connector does. Providing these schematics comes with no warranty and is **NOT a license to duplicate this work** of art for *any purpose*. You must obtain written consent from the Author to duplicate the work. Modification of the PCB voids any warranty.


JGI
Q1A
Q1B
R1
100k
GND
D1B
D1A
C1
Empty (100uF)
R3
100k
V+
4.7k
R2
LED1
Q4
DMN3023
Q2B
DMMT3904K4A
Q2
R4
32
Q5Q6
LED4
R7
68
J1
J1A
R6
JGIB
Q12A
Q12B
R13
D2B
D2A
C2
R11
R12
LED3
Q8
Q11B
Q11
R9
Q10Q9
LED6
R10
Q7
LED5
R8
J2B
J2
J2A
P2
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