

RapidLED BioCube 14 Retrofit

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Overview

As with any type of lighting retrofit, there are many dangers, difficulties, and pitfalls that may occur. The Bio Cube 14 retrofit should be attempted by people familiar with electronics, LEDs, LED Drivers, series circuits, and be comfortable with the fact that this retrofit will require complete disassembly and removal of all contents of the original Bio Cube hood. If you are uncomfortable with or inexperienced at any of the prerequisites required for this retrofit, you should not attempt this retrofit.

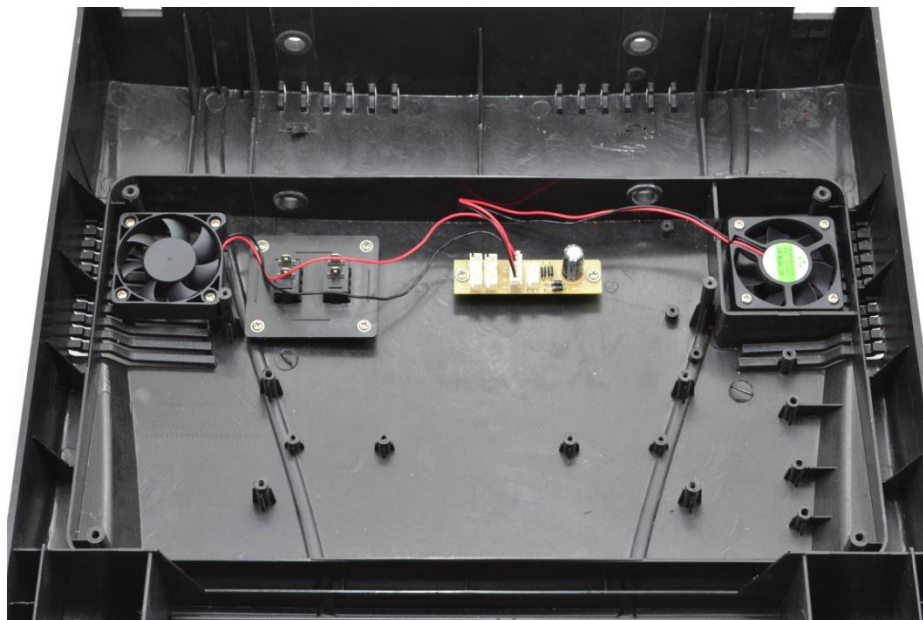
Hood Preparation

Everything must be unplugged and disconnected before beginning. We will only keep the original fans, so the goal in this step is to remove everything from your current Bio Cube 14 hood except the original fans.

Start:



Finish: Note you should also remove the PCB that the fans are plugged in to in this photo. We will not use it.



Fan Installation

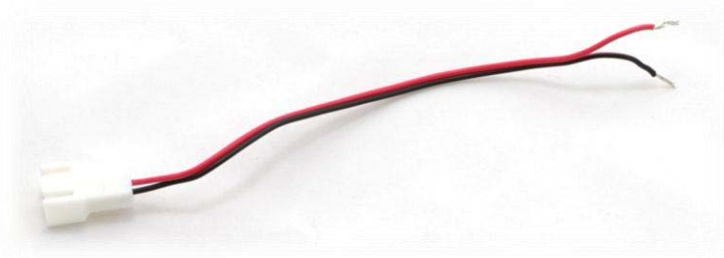
As a note before you get started with the fans, we have been getting reports that some BC14 fans will not power up using our AC adapter, usually with fans that are a few years old. We did not experience this issue with our BC14 with new fans. If your fans are not spinning up, we recommend

using the included 60mm Vantec fan to blow across the heatsink fins. It is all that is necessary to cool 12 LEDs. If possible, use the Vantec fan and one exhaust fan on the opposite side of the hood. Running one or two fans is enough to keep the LEDs cool.

We will utilize the fans included with the BC14 and an additional 60mm Vantec Stealth fan to ensure proper airflow over the heatsink. We will wire in the included 12V AC adapter such that it powers all three fans in the hood. This requires us to use wire nuts to connect all positive (+) red fan wires and all negative (-) black fan wires together.

Step 1: Cut the white connector off of the end of each original fan. Strip a little bit of wire from each end of each red and black fan wire.

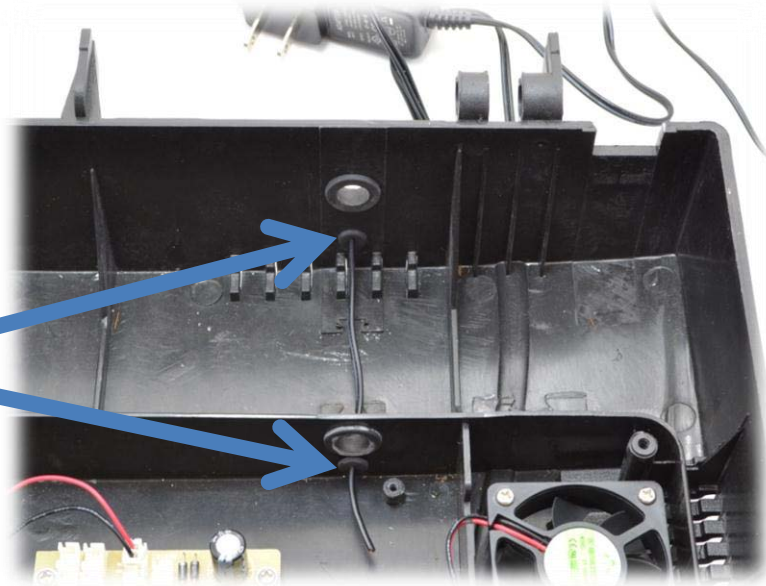
Step 2: The Vantec fan includes an adapter. Cut the end off of it and strip a little bit of wire off of each end. The red wire is positive (+), the black wire is negative (-).



Step 3: Cut the end off of the AC adapter (don't strip it yet).

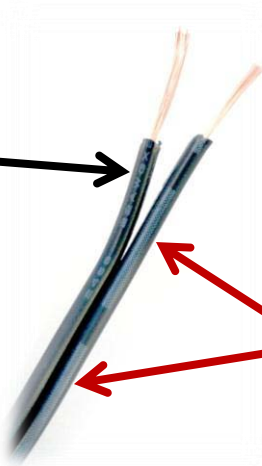


Step 4: Route the AC adapter wire through the rubber grommets which the original AC adapter wire ran.



Route AC Adapter wire through original AC Adapter grommets

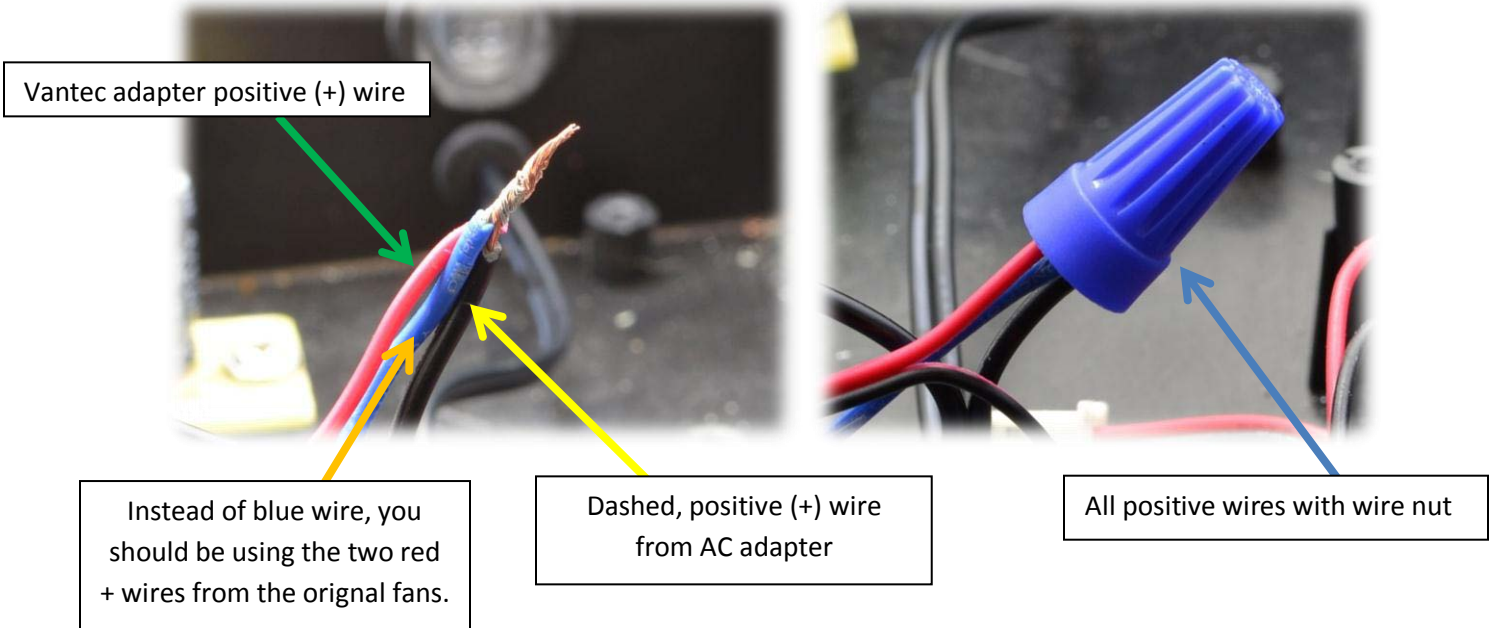
Step 5: Strip a little bit of wire off of the end of the AC adapter wire. Note which wire is positive on the AC adapter and which wire is negative.



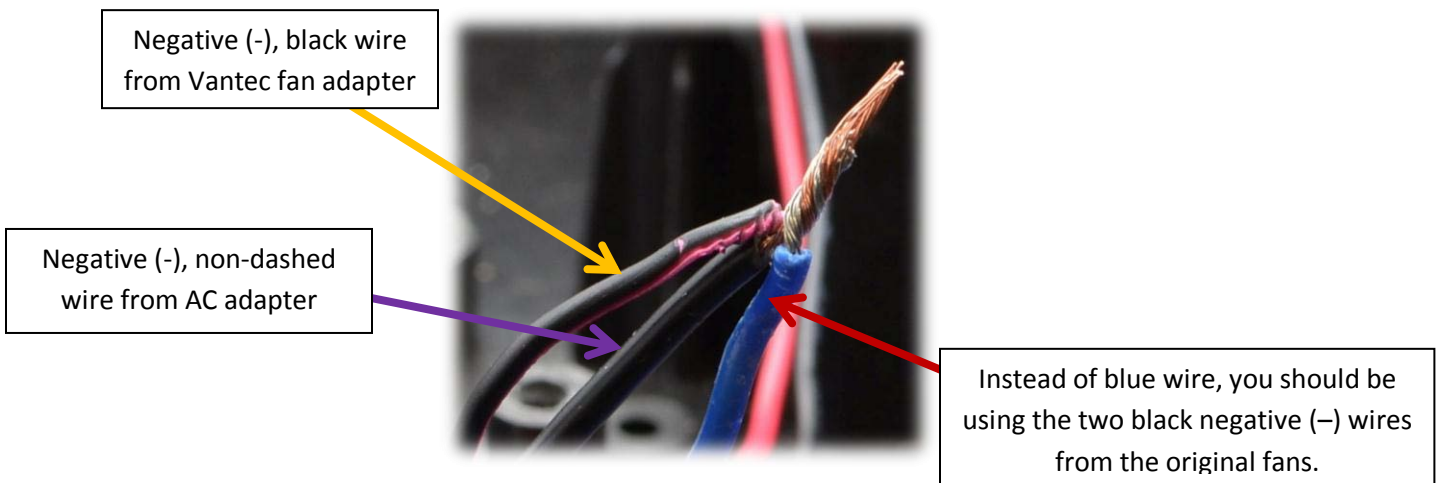
No dashes indicate negative (-) AC adapter wire

White dashes indicate positive (+) AC adapter wire

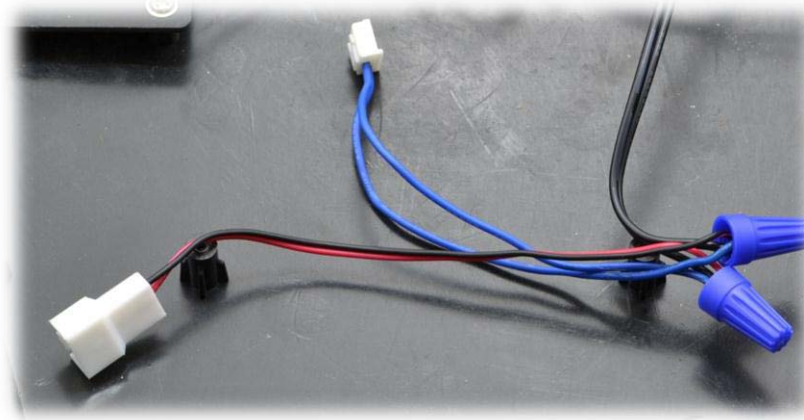
Step 6: Now we wire the fan cables together. Take one of the included (non-moisture resistant) wire nuts and wire all red, positive (+) fan wires (3) to the positive (+) AC adapter wire. The wires are: 1) AC adapter positive, 2) original fan positive wires, which would be the two red wires coming from the original fans, and 3) the positive red wire from Vantec fan adapter.



After wiring the positive wires, we wire the negative ones in the same fashion with a non-moisture resistant wire nut. There are four negative wires also. They are: 1) AC adapter negative, 2) the two black negative wires from the original fans, and 3) negative black wire from Vantec fan adapter.



Completed fan wiring harness: note, your picture will differ. The blue wire will be replaced by 4 wires from the original fans, two red, positive (+) fan wires and two negative (-) black wires.



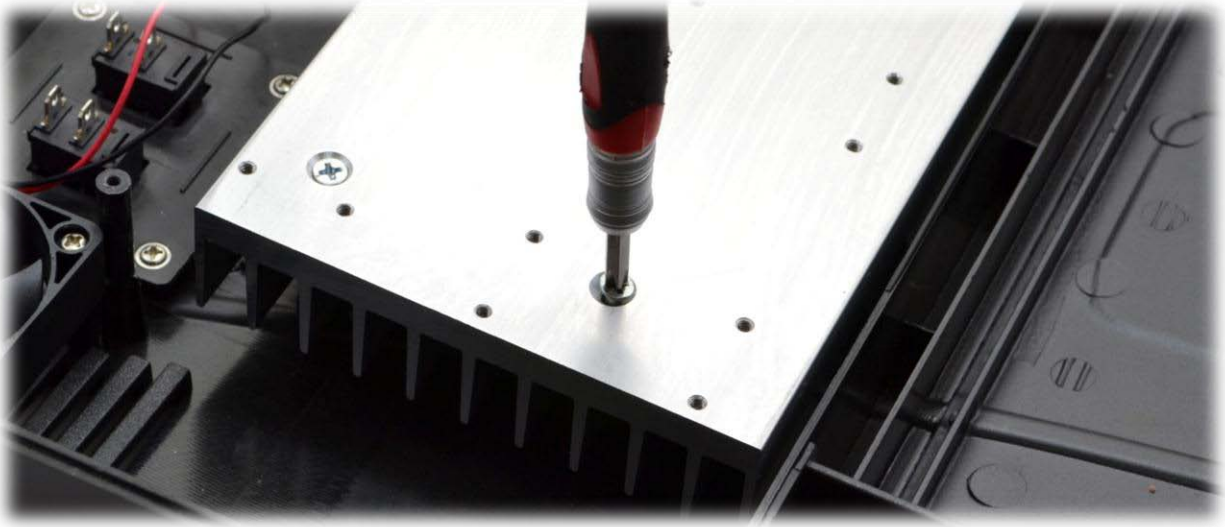
Step 7: Connect the Vantec fan to the Vantec fan adapter.



The 60mm Vantec fan will sit loose in the case on the left side of the heatsink as can be seen two photos below this paragraph. If you desire, you can use some double stick tape to secure it to the hood.

Heatsink Installation

The heatsink attaches to the plastic posts already in the hood via 4 screws. The screws are the large screws included with the kit. Tighten gently until heatsink is snug. In this particular retrofit, the screws should only be tightened 2-3 turns. Tightening them more than this may strip out the screw bosses at which point you will have fill the stripped bosses with a hard glue or epoxy and drill them back out (7/64 drill bit) so the screw will grip again or find some other solution. Over tightening may also snap the screw bosses from the hood, in which case, you will have to attempt repair with super glue.



Note, in the picture above, you should not have the brown PCB. It should be removed. All + (red) fan wires should be securely fastened to the AC adapter positive wire with a wire nut and all – (black) fan wires should be securely fastened to the AC adapter negative wire with a wire nut.

Attaching LEDs to the Heatsink

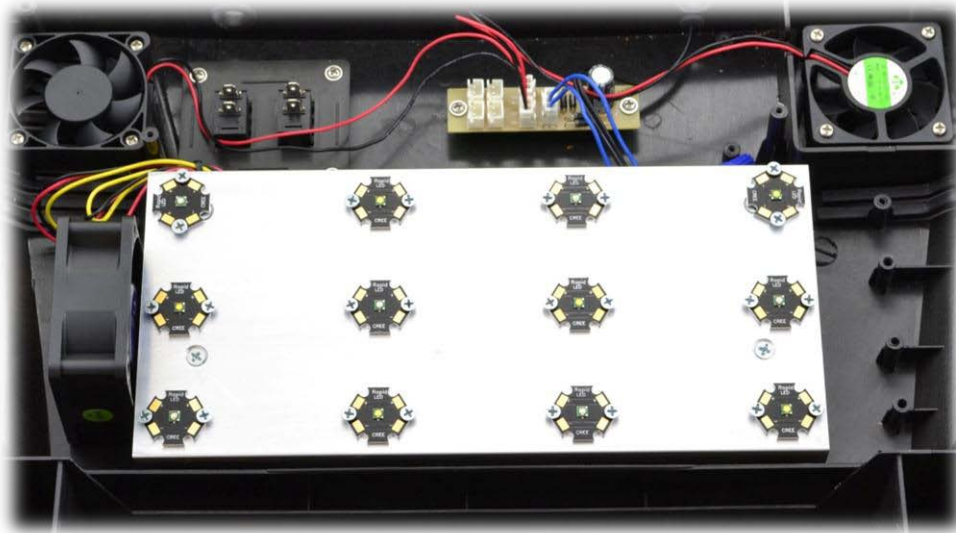
The heatsink has many little holes in it. Two little holes are used to secure 1 LED to the heatsink – one at each end of each LED.

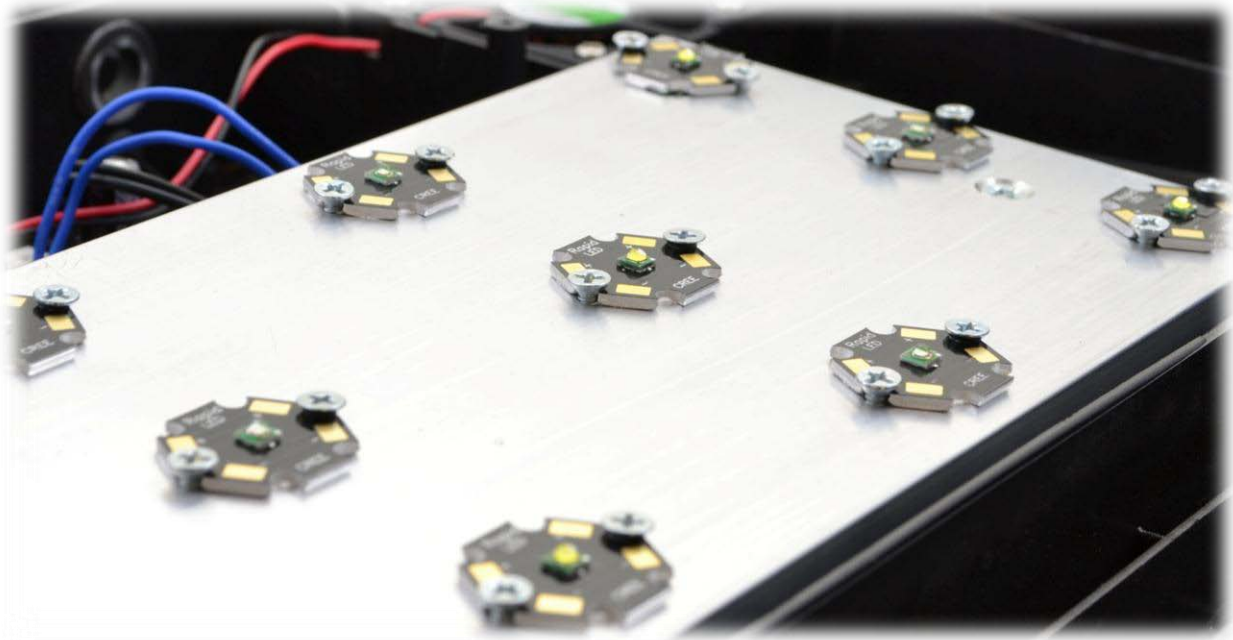
The easiest way to arrange the LEDs on this heatsink for easy wiring are to have one row upside (180°) down from the adjacent row. This can be seen in the 1st picture under “Wiring Your LEDs.”

We need to apply thermal grease to the back of each LED and screw it to the heatsink. Thermal grease ensures proper thermal conductivity of heat away from the LED into the heatsink. A very small dab of grease on the back of each LED is all that is necessary. More is NOT necessarily better. Too little will lower conductivity and too much will create a mess. A thin layer works best. The photo below is about how much you should use.



After the thermal grease has been applied to the star, screw it into the heatsink with two little screws, adjusting the height of the two fastening screws to center the LED between them. Once again, do not over tighten. The screws should be snug but not tight. When screwing down the LEDs, ensure the screw is not touching any solder or solder pads. This will ground the string at that point and cause strange behavior and possibly, damage.





Soldering Notes

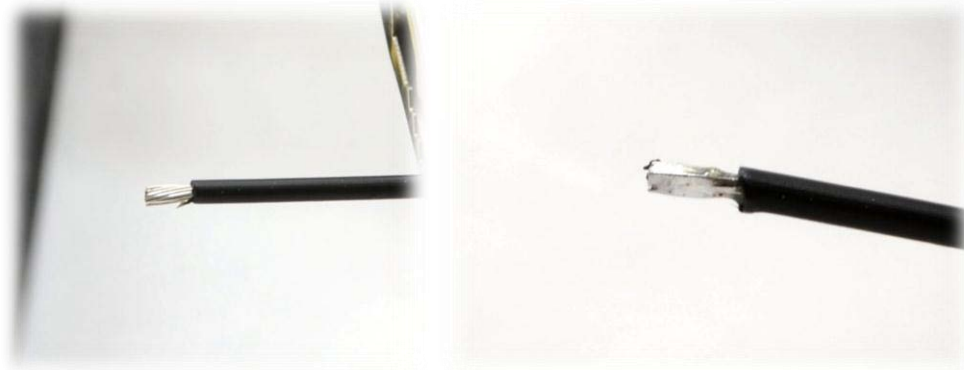
Now that the LEDs are securely attached to the heatsink with thermal grease, any heat applied to the solder pads (the little gold pads) of the LEDs will be quickly conducted away into the heatsink. When soldering, this will be a problem if your soldering iron does not have a clean tip (new is best) or does not have enough power – we recommend at least a 50 watt soldering iron. An iron that does not produce enough heat will fail to melt the solder properly when you wire up your LED string. Your iron should at most take 1-2 seconds to complete each solder joint. Leaving the iron touching a solder pad for longer than 1-2 seconds is not advised.

Tinning Wire

Tinning is the process of pre-coating the wire, or solder pad, in the case of an LED, with solder. Tinned wire and solder pads are more easily soldered together than non-tinned components. This step is to save headache and trouble later.

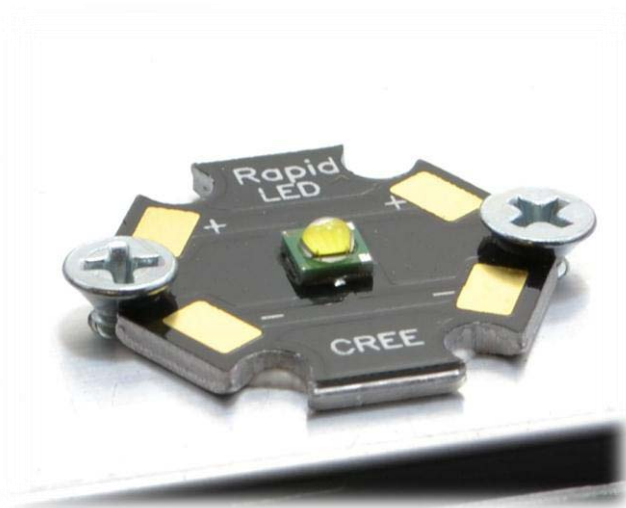
To tin wire, heat the wire with the tip of a clean soldering iron for a few seconds. After the wire is heated, apply solder to the wire (not the tip of the iron). Since solder flows towards heat sources, it should melt on to and flow through the strands of the wire, coating them evenly.

There are two photos below. The left is of untinned wire, the right is of the same wire tinned.



Tinning LEDs

LEDs are tinned similarly to the wire above. Press the tip of the soldering iron to the LED solder pad and apply solder near the tip of the iron. You do not need too much solder. You can tin all of the solder pad or only the ones you will use. The top photo below is an untinned LED. The photo below it has the bottom left solder pad tinned.



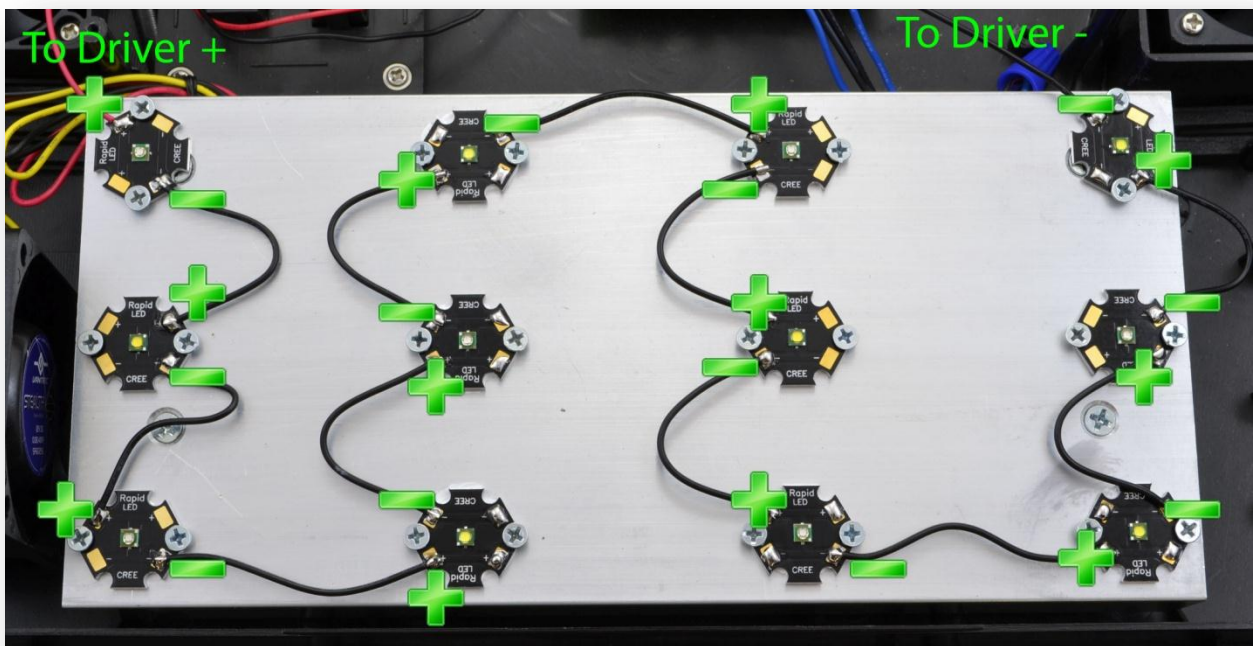
Wiring the LEDs

*****NEVER APPLY POWER TO THE LED DRIVER BEFORE ALL WIRING IS COMPLETE *****

Wiring the LEDs is done as a string in series. The string is a series circuit wired + to – (or – to +, depending on where you start) starting from one wire on the driver, from LED to LED, to the other wire on the driver.

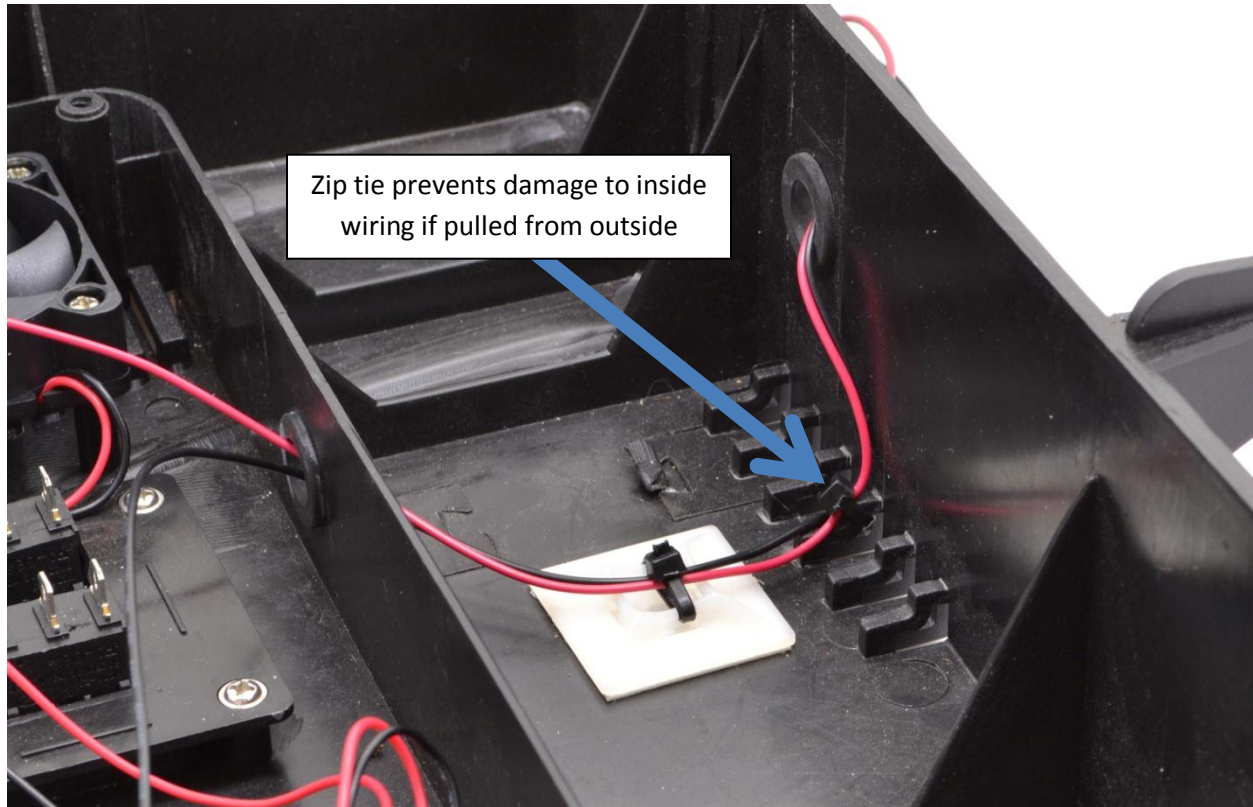
The V+ wire from the driver connects to a positive (+) solder pad on the first LED of the string and the V- wire from the driver connects to a negative (-) solder pad on the last LED of the string as noted below. You will likely be using jumper wire included with the kit to complete this step

Below is a photograph of completed of all 12 LEDs wired to the driver, + to – all the way around. Again, do NOT power the driver until the wiring is complete. You risk burning out your LEDs, a very expensive mistake.



Wire Strain Relief

You will want to use the included zip ties to zip tie the wire from the LEDs so that if they are pulled, they will not be ripped off of the LEDs. This can be accomplished many ways. In the photo below, you can see that if the wire is pulled from the outside of the hood, all strain on the wire will be dealt with by the zip tie – the wiring inside on the heatsink and LEDs is safe from external strain.



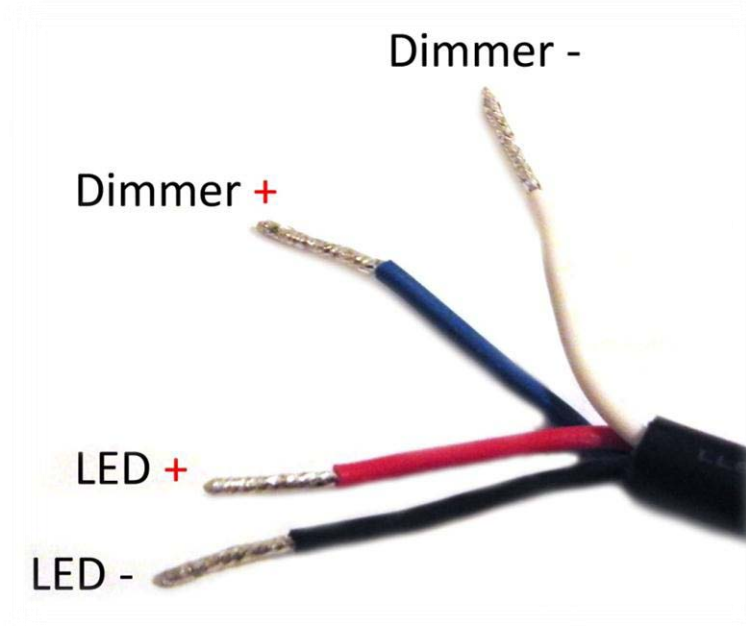
Wiring the Driver to AC Power

The AC Line and Neutral, or ACL and ACN wires, which are brown and blue, connect to the power cord included in our kits. Strip the white and black wires of the power cord (green is ground and unused) and attach them to the blue and brown wires on the driver with the included moisture resistant wire nuts. Order is not important because AC current alternates. Obviously, this step is dangerous because you are working with 120VAC. Make sure nothing is plugged in and have a licensed electrician assist you with this step.



Using a Dimmable Driver (Skip to “Finishing Up” for Constant Current Drivers)

Wiring the Driver Dimmer Wires

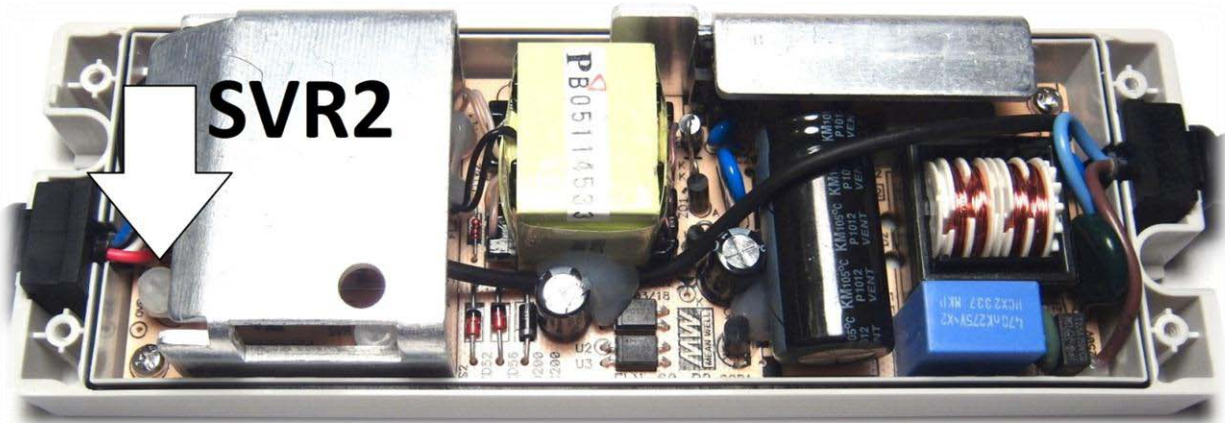


There are 4 output wires on a dimmable driver as in the above photo. The dimming wires, DIM + (blue), and DIM – (white), simply hook up to the respective ports on your controller or dimmer. Dimmable drivers must have the dimmer wires hooked up to a controller or dimmer or the LEDs will not light up. No dimming signal = 0% brightness.

If you do not have a dimming circuit or controller, you can test by applying a voltage to the Dimmer + and Dimmer – wires on the driver. This voltage can range from 1-10V. Do NOT exceed 10V or you risk damaging the dimming circuitry. A 1V reference voltage will light the LEDs to 10% brightness, whereas a 10V reference voltage will light the LEDs to 100% brightness. You likely have something around your house that can supply a reference voltage. A “wall wart,” 9V battery, or even a AA battery can be used for testing. Be sure to test the actual output voltage of your wall wart with a multimeter before use – unregulated wall warts will output much greater than the output voltage on the label when used with small loads.

Adjusting Driver Current – Do this before applying power to non XP-G LEDs

To adjust the driver output current, open the driver by removing the 4 screws and very gently rotate SVR2 counter-clockwise until it stops. Counter-clockwise rotation lowers output current and clockwise rotation raises output current. We have just set current to the minimum. The maximum output current of the ELN-60-48 D and P model drivers is 1.3A. **1.3A is the factory default setting and can burn out LEDs that cannot accept this much current (XR-E, XP-E, Osram, moonlight).**



Adjusting Driver Current with a Multimeter

To adjust the driver output to a specific value, you must first wire a multimeter into your LED string and second, you must ensure the DIM+ and DIM- wires are connected to a dimmer. The dimmer should be set to full brightness.

The multimeter should be wired into your LED string exactly the same as an LED, + to -, in fact, if you just pretend it is an LED, you will have no problem measuring current. If you wire the multimeter in backwards, it will still work, but your measurements will be negative instead of positive.

To set your multimeter up for measuring current, move the RED probe plug to the 10A socket and rotate the knob to the 10A position. Multimeters can differ in operation. Please consult your multimeter manual for model specific operating instructions.

As in the photo below on the right, have a friend firmly hold the probes in a gap in the LED string. We had to remove a wire in an existing setup for this example. If either probe loses contact with a solder pad on either LED, do NOT re-touch it to the LED until power has been removed from the driver for a few minutes, and then start over from the beginning.



The following should be complete before applying power to the driver:

- SVR2 has been gently rotated counter-clockwise until it stops (set to minimum current)
- DIM+ and DIM- wires on driver are connected to a dimmer
- Dimmer is set to 100% brightness (10VDC MAX)
- Multimeter is turned on and set up to measure current
- Multimeter is wired into LED string as if it were an LED

Once all of the above have been completed, power the driver and rotate SVR2 clockwise until the readout on the multimeter displays the desired output current for 100% brightness. In the below photos, the current begins at .25A, or 250mA. SVR2 was rotated clockwise until the desired maximum current, .75A, or 750mA. In our example, we wired our probes backwards, thus the – sign. When measuring current, you can ignore the – sign because we are only interested in the absolute amount of current flowing through the LED string. Switching the multimeter leads around would have flipped the sign around to +(no sign) in this example.



Now that you have set the current on your driver by rotating SVR2, un-plug the driver, replace the cover, and re-wire your LED string.

Finishing Up

After all of your wiring is complete, re-attach the plastic cover, power it up and enjoy!

