RapidLED NanoCube 24 Retrofit

Contents

Overview

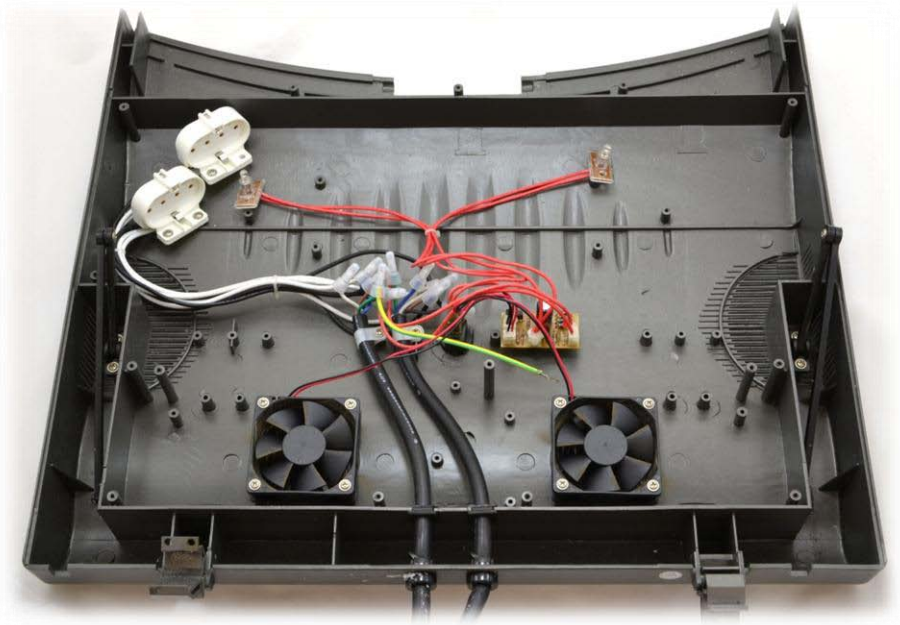
As with any type of lighting retrofit, there are many dangers, difficulties, and pitfalls that may occur. The Nano Cube 24 retrofit should be attempted by people familiar with AC power and wiring, electronics, LEDs, LED Drivers, series circuits, and be comfortable with the fact that this retrofit will require complete disassembly and removal of all contents of the original 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

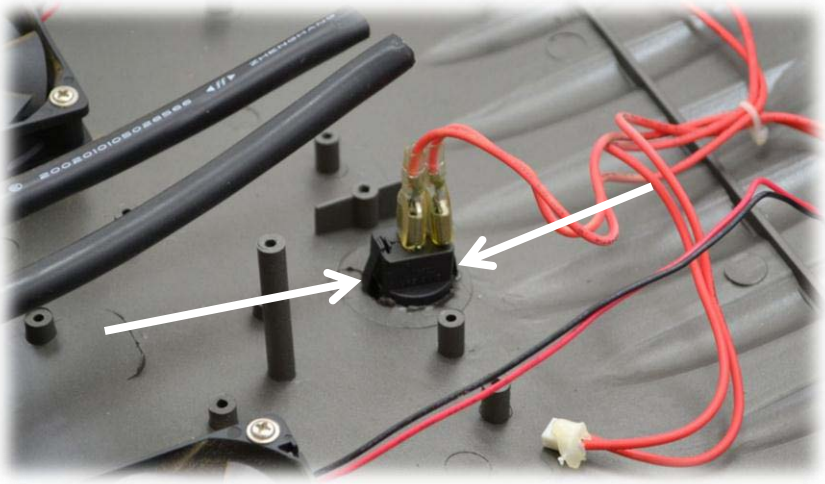
Any and all power wires must be unplugged and disconnected before beginning. We will keep the original fans and the two large wires coming out of the rear of the hood. Everything else will be removed.

Start:

Reflectors Removed:

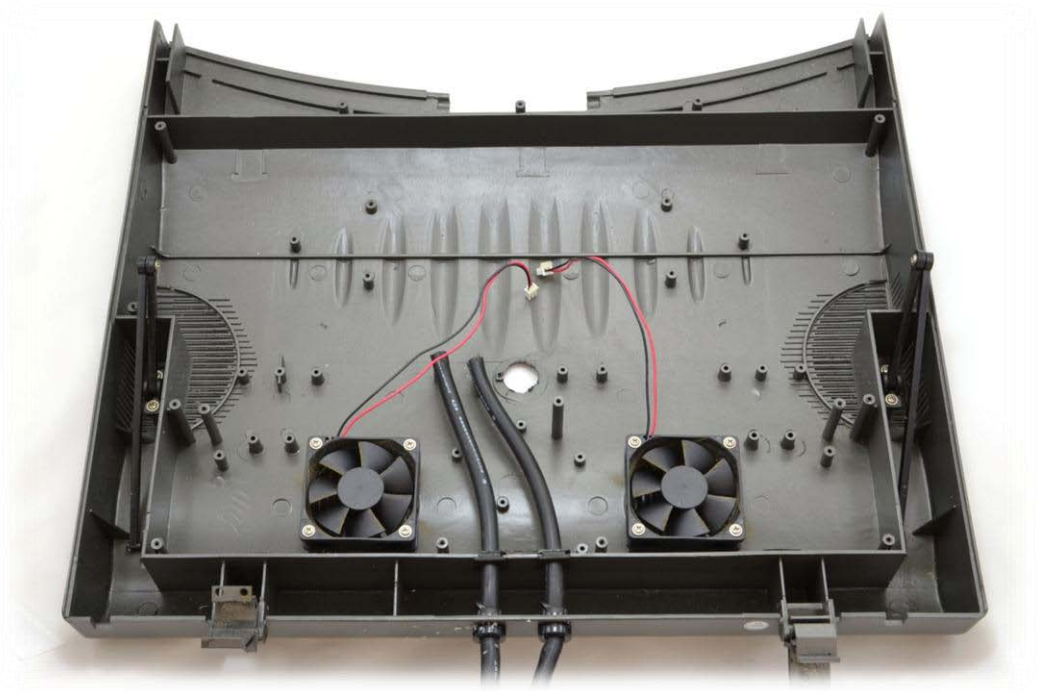


Switch Removal:



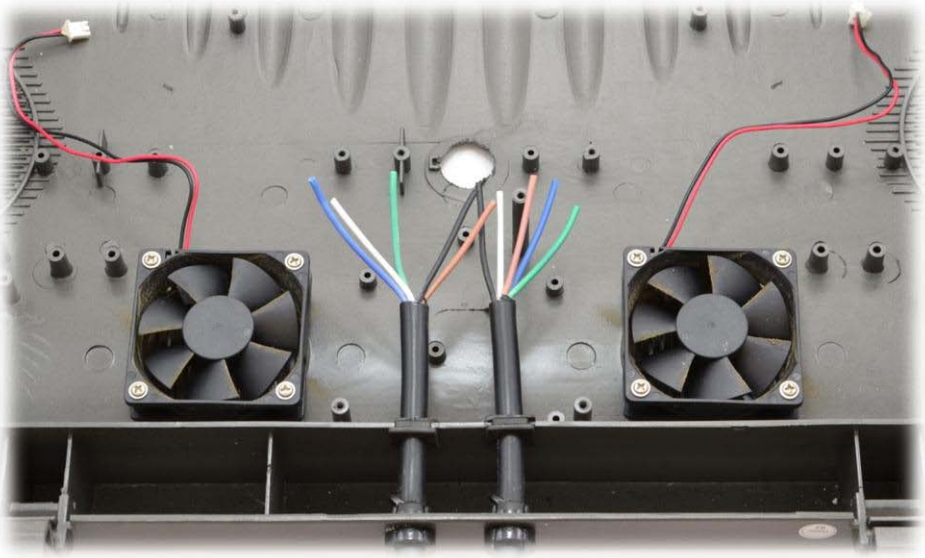
To remove the switch, press in with a flat blade screwdriver at the edges as indicated by the arrows and gently wiggle it out of the socket. You will have to remove the red wiring to get it out of the hood.

Finish:



Hood Power Wiring Preparation

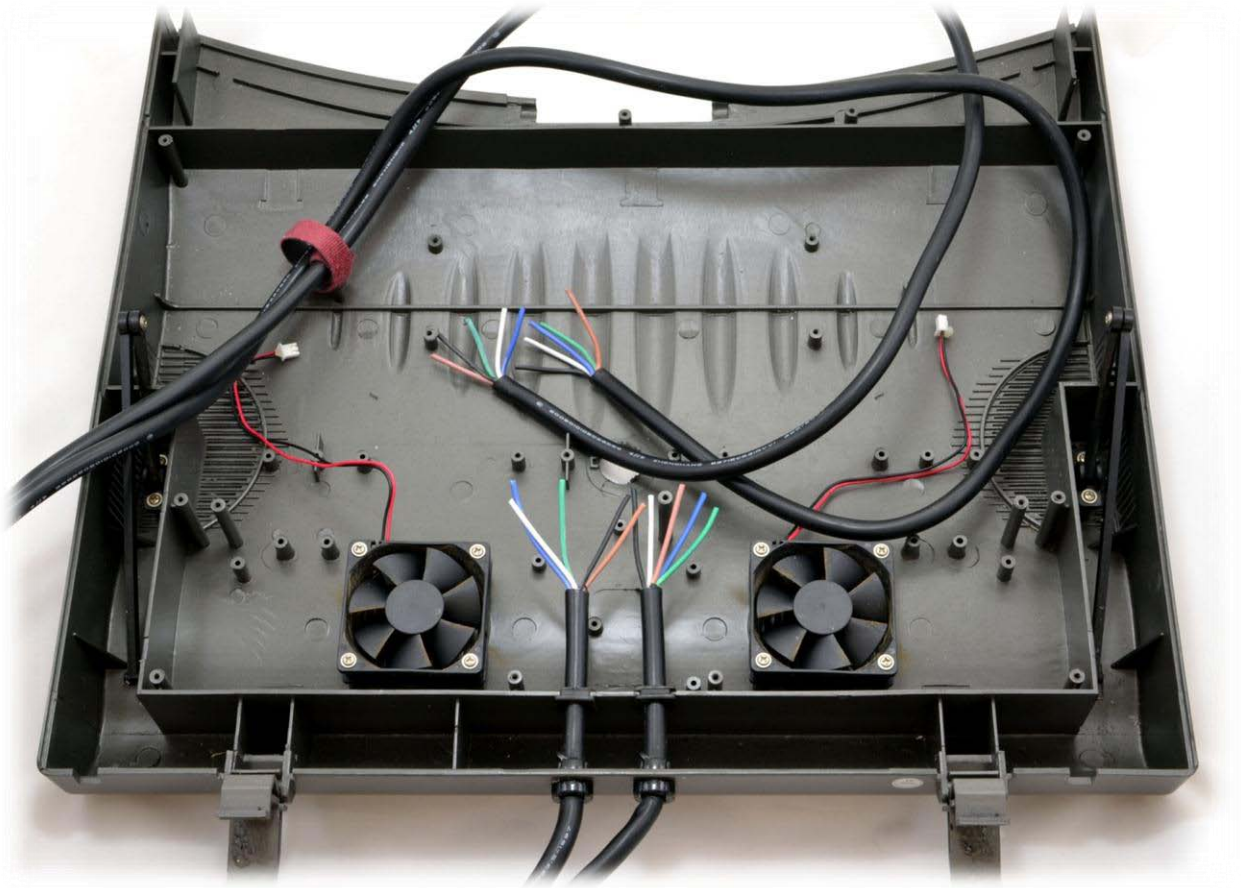
We will be utilizing the original (two rear) power wires in the hood. First step is to strip off about 1.5”-2” inches of the outermost jacket material from the end of the wire – do not strip the ends off of any of the individual wires yet. Be sure you do not damage or cut the protective jacket of the inner wires when stripping off the black power wire jacket that encompasses the 5 inner wires.



Next, we do the same for the opposite end of the power wires:

First, cut the end off of both power wires:

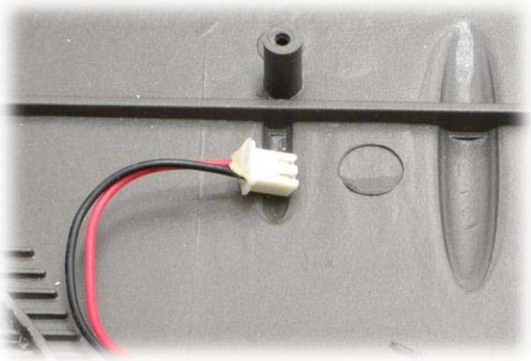
Next, strip off the outermost jacket that encompasses the 5 inner wires, being careful to not damage or cut any of the inner 5 wires:

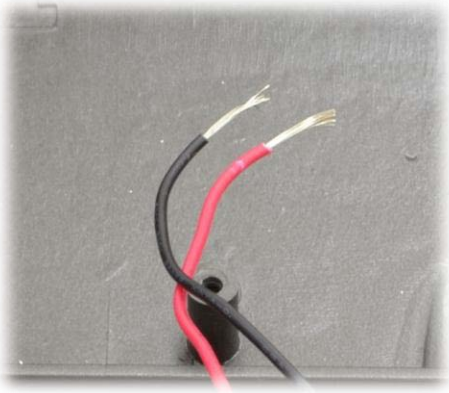


Fan and AC Adapter Wiring

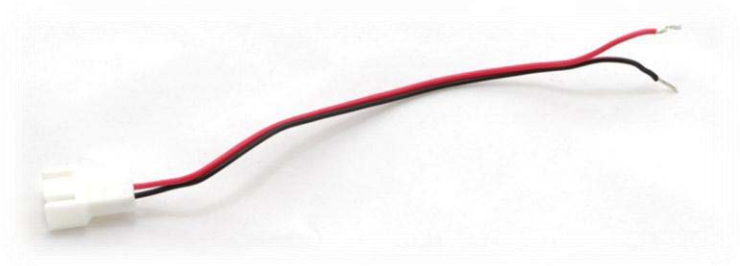
In this step we will install the fans. We will use the original fans and add one additional fan for cross-flow ventilation. For wiring, we will wire the included AC adapter to one of the original power wires and then wire the fans to the same wire. The final result has a AC adapter attached to one end and 3 fans attached to the other.

Step 1: Cut off the original fan connectors and strip each fan wire. Do this for both original fans.



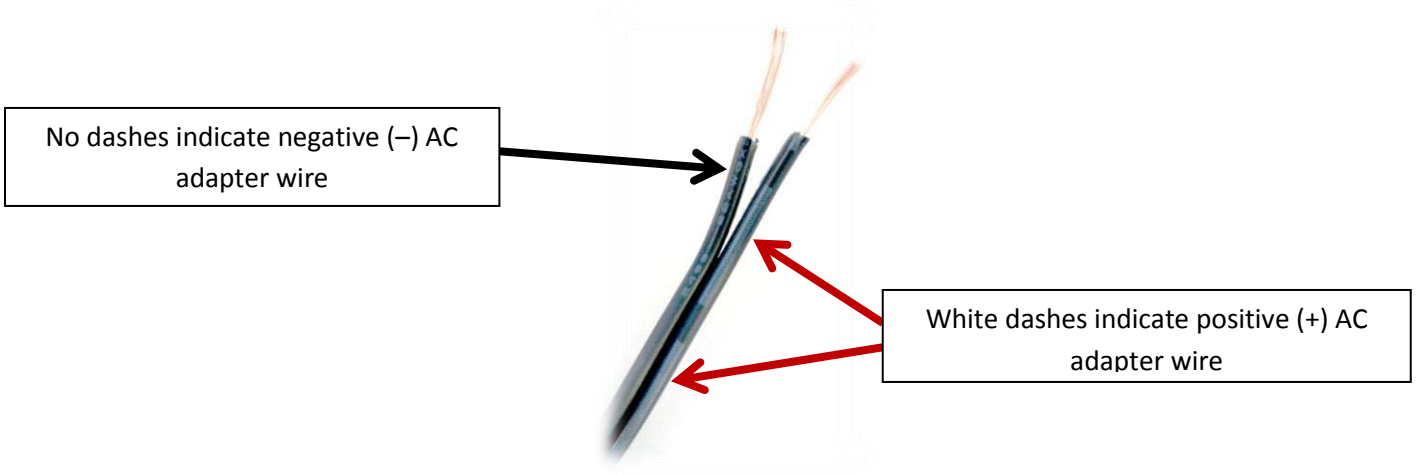


Step 2: The Vantec fan includes an adapter. Cut the end off of it and strip a little bit of wire off of each end. The red wire is positive (+), the black wire is negative (-).

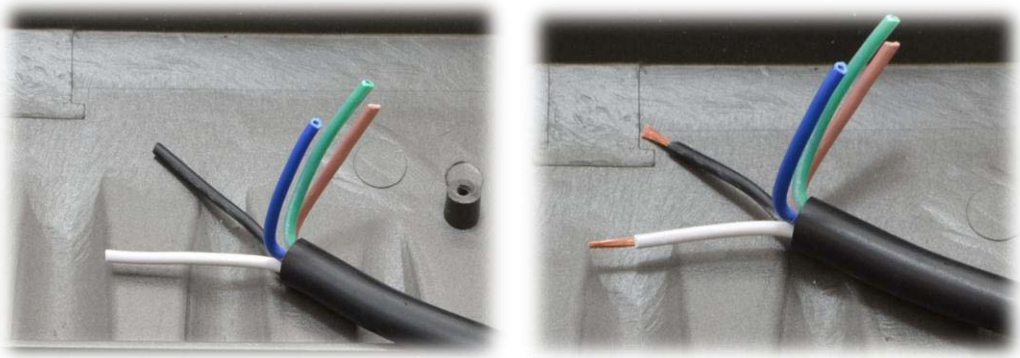


Step 3: Cut the end off of the AC adapter.

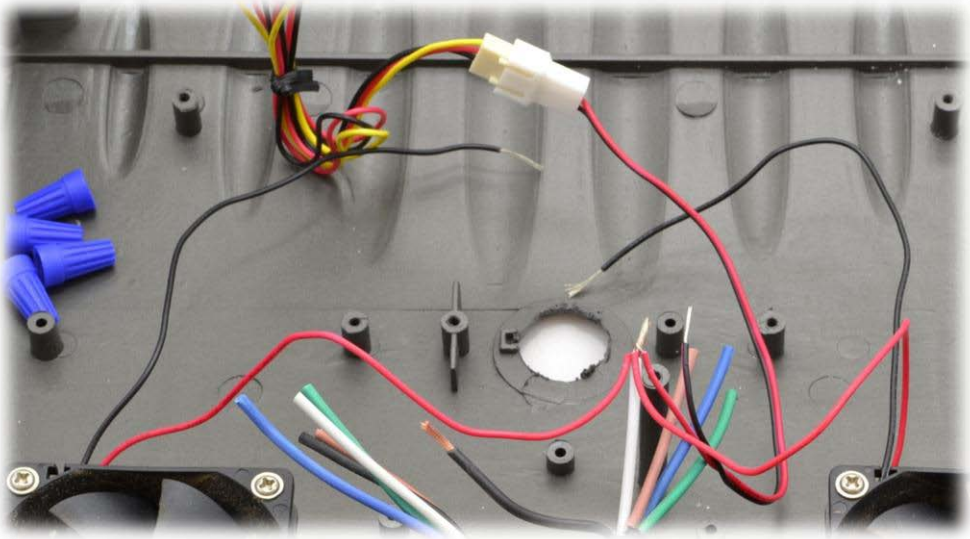
Step 4: Strip a little bit of wire off of the end of the AC adapter wire. Note which wire is positive on the AC adapter and which wire is negative.

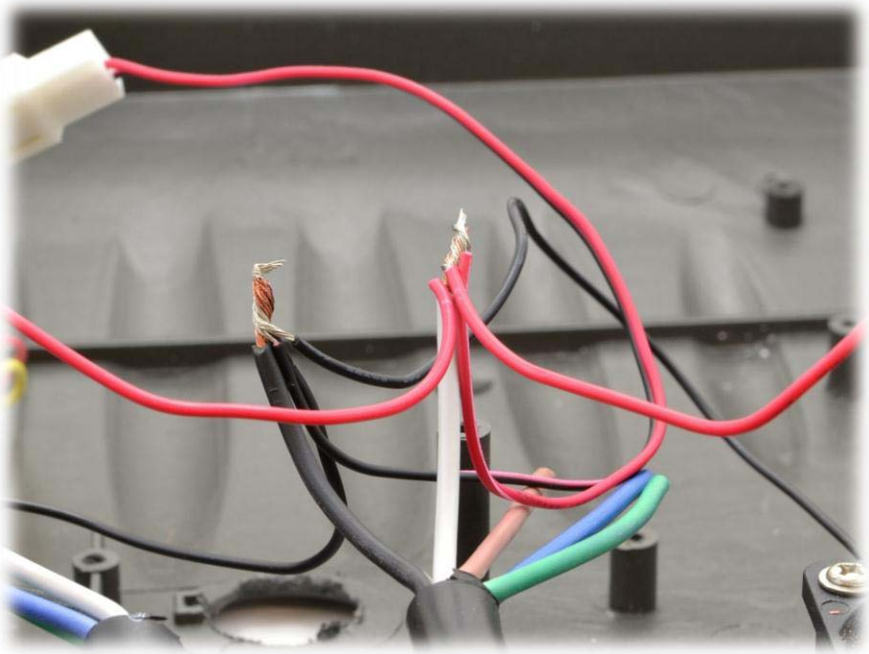


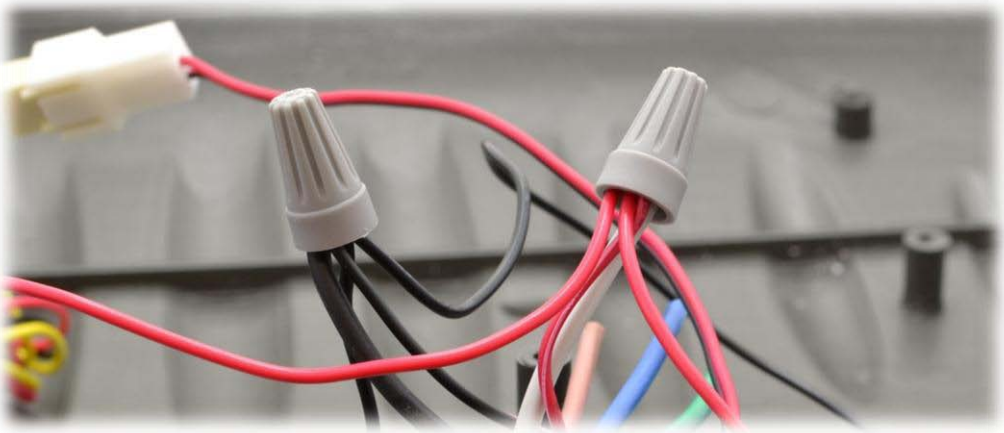
Step 5: In this step, choose one of the original power cable bundles to use to wire the fans. In this case we chose the right cable bundle (with the back of the hood facing our body). Within the right cable, we used the white wire as + and the black wire as -. Once you decide which wires you will use, strip off both ends of each wire.

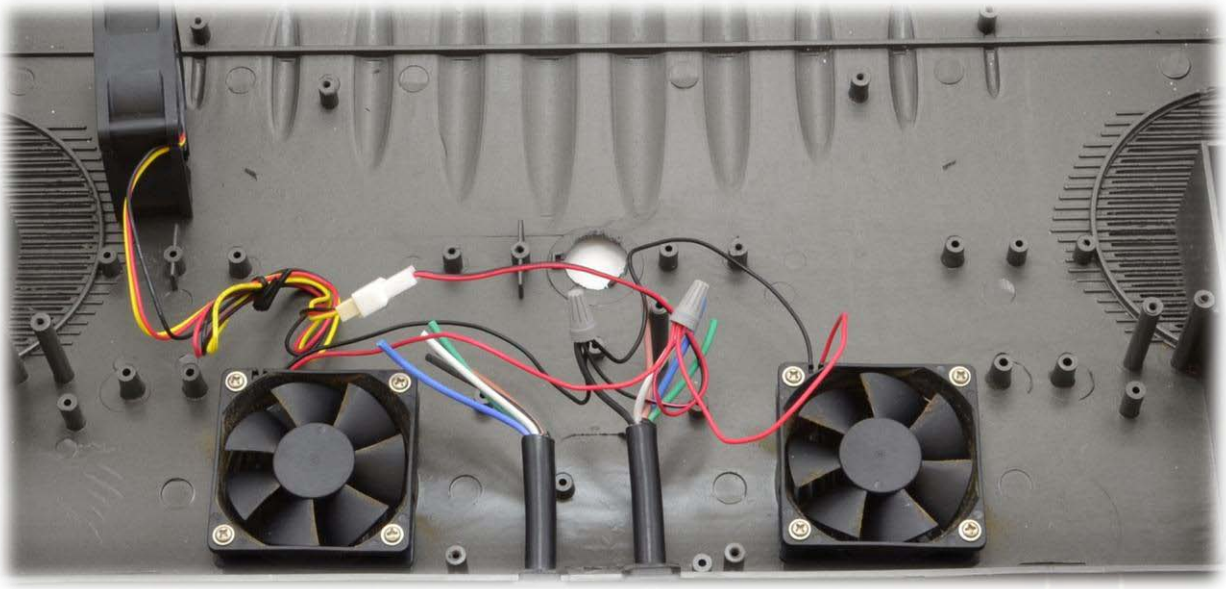


Step 6: Now we wire the fan cables together. Take one of the included wire nuts and wire the four positive (+) wires together. The wires are: 1) white wire from the power cable, 2) red wire from the 1st original fan, 3) red wire from the 2nd original fan, 4) red wire from the Vantec fan adapter. After we wire the reds, we do the same for all black fan wires, connecting them to the black power wire with a wire nut.







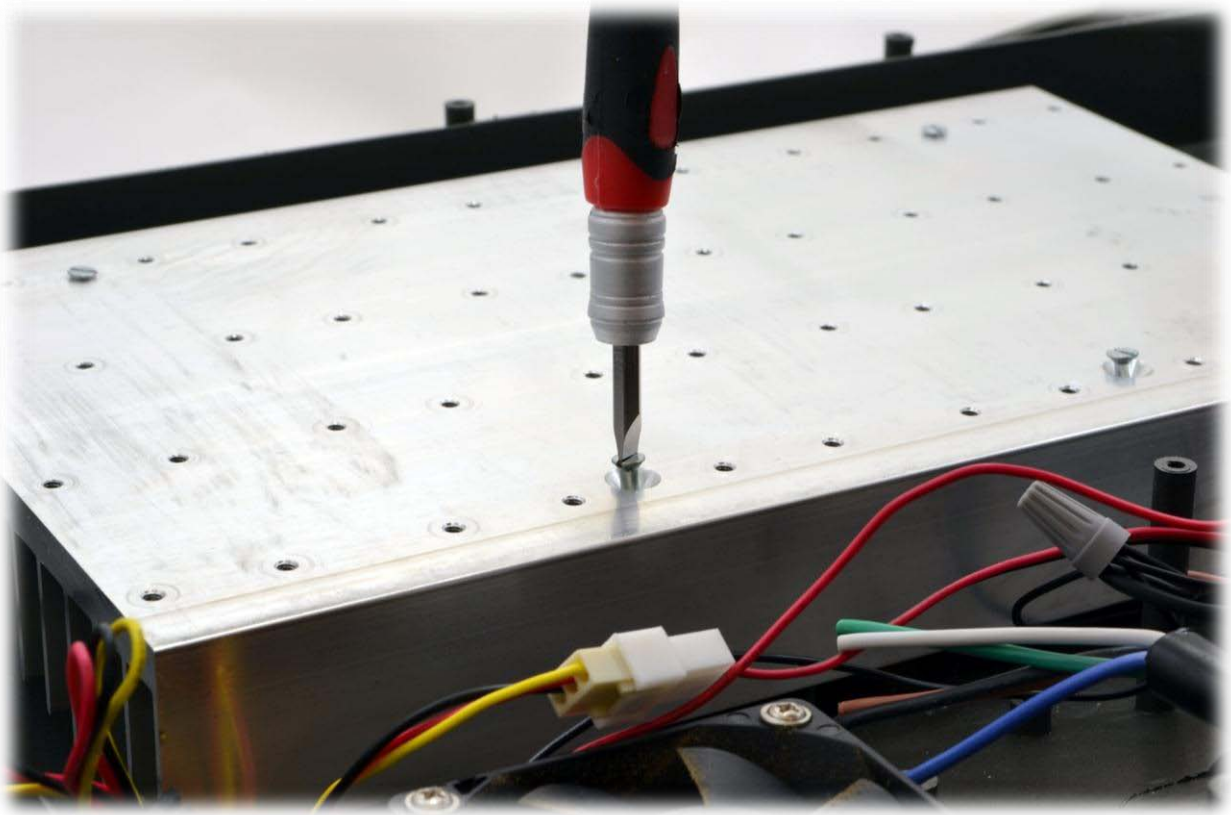


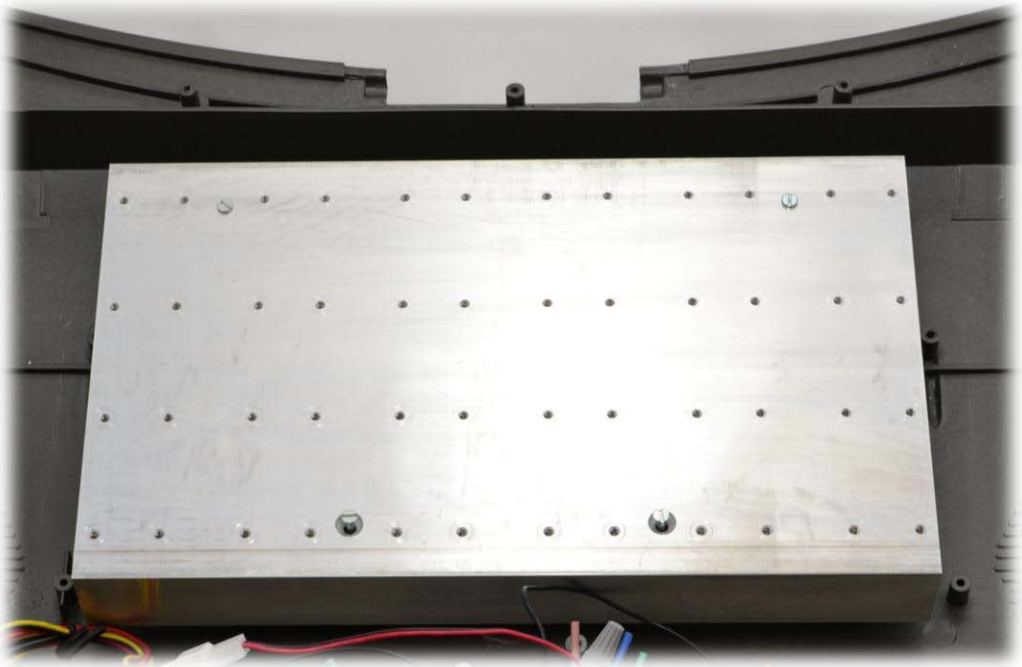
Step 7: Now that the inside wiring is done, we will wire the AC adapter to the outside wires. Simply wire nut the positive and negative wires together. In our example the white power wire and the dashed wire from the AC adapter are positive (+) and should be wired together. The negative (-) wires are the black power wire and the AC adapter non-dashed wire.

Your fans are now completely wired. If you want, try them out and make sure they work!

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. Tightening them more than this may strip out the plastic screw bosses in the hood at which point you will have fill the stripped bosses with a hard glue or epoxy and drill them back out 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.





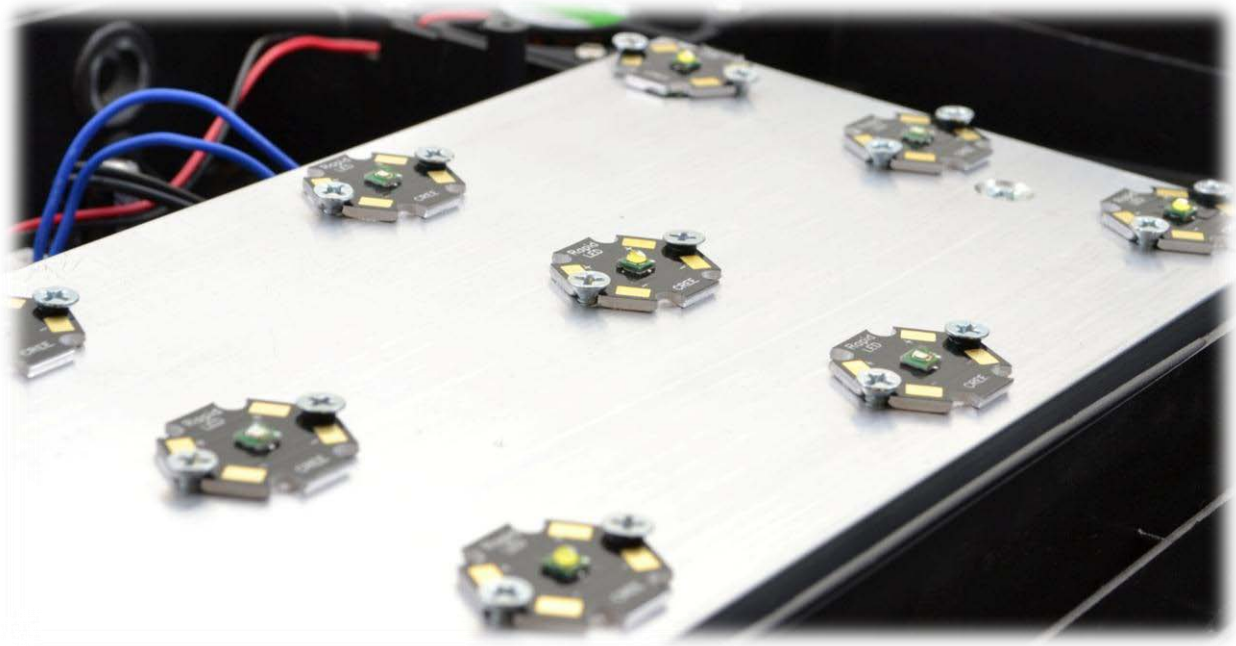
Attaching LEDs to the Heatsink

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.

There is a best way to arrange the LEDs on the heatsink. The LED strings will be wired + to – (or – to + depending on what end of the LED string you begin), which is a series circuit. Lay out all of your LEDs and then rotate them so the wiring from + to – or – to + will be easy and straightforward. For an example, look how the LEDs are rotated in the picture below 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 then attach 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

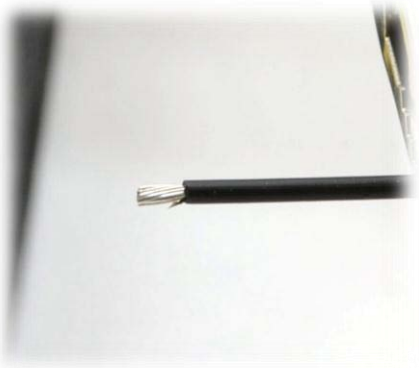
Now that the LEDs are securely attached to the heatsink with thermal grease, any heat applied to the solder pads (the little gold pads) of the LEDs will be quickly conducted away into the heatsink. When soldering, this will be a problem if your soldering iron does not have a clean, tinned tip (new is 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.

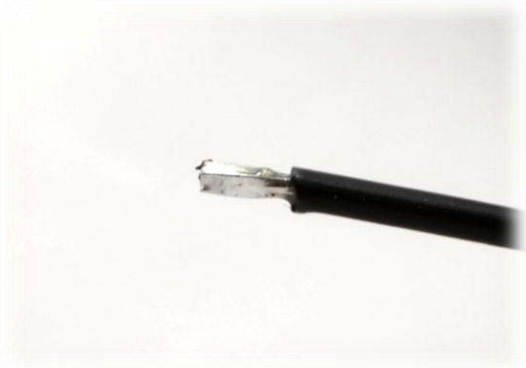
Tinning Wire

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.

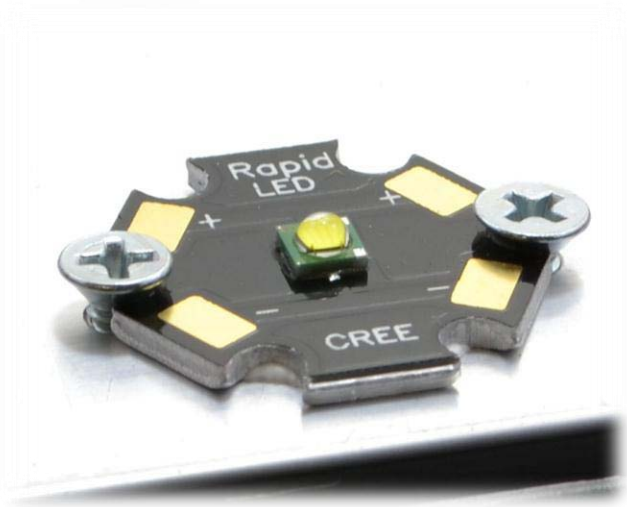
There are two photos below. The left is of untinned wire, the right is of the same wire tinned.





Tinning LEDs

LEDs are tinned similarly to wire. 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 padsor 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.



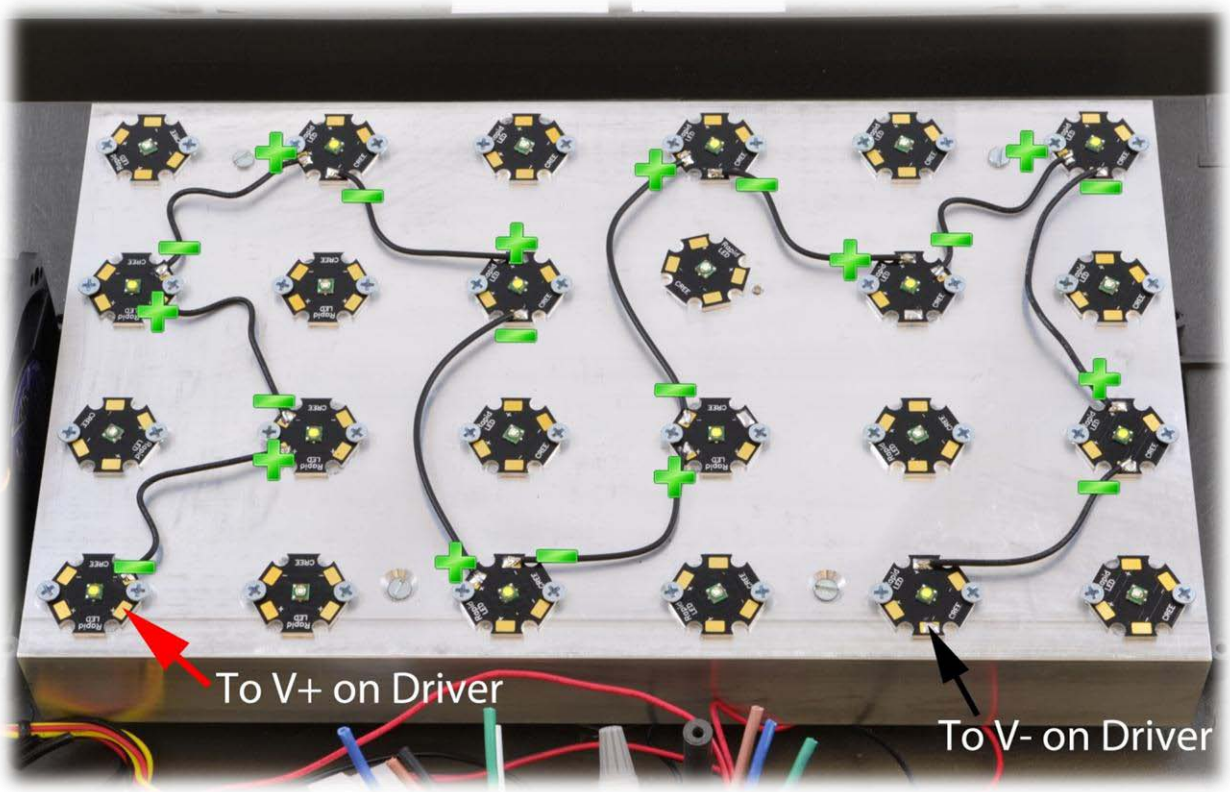
Wiring the LED Strings

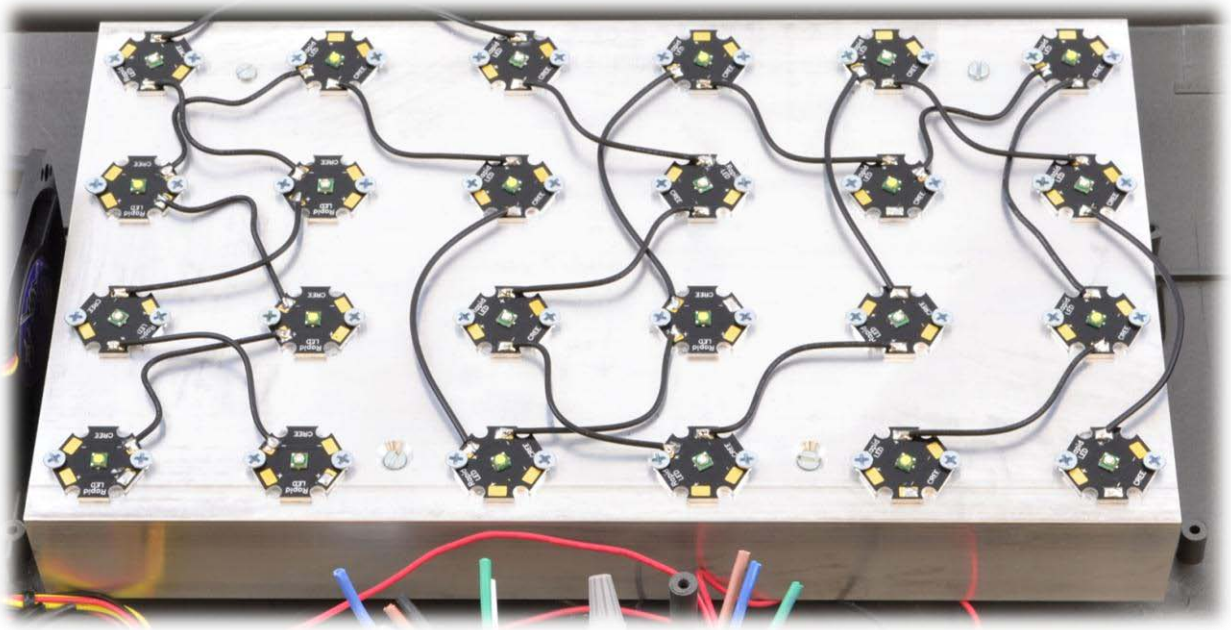
*****NEVER APPLY POWER TO THE LED DRIVER BEFORE ALL WIRING IS COMPLETE *****

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 all 12 white XP-G LEDs wired together, + to – all the way around. Wire your blue LEDs in the same manner. Again, do NOT power the driver until the wiring is complete. You risk burning out your LEDs, a very expensive mistake.

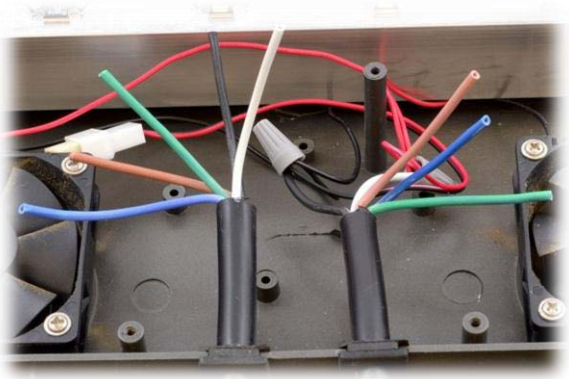


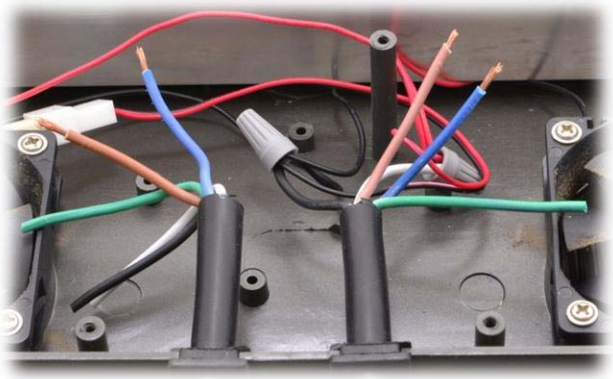


Inside Hood Wiring for LED Strings to V+ and V-

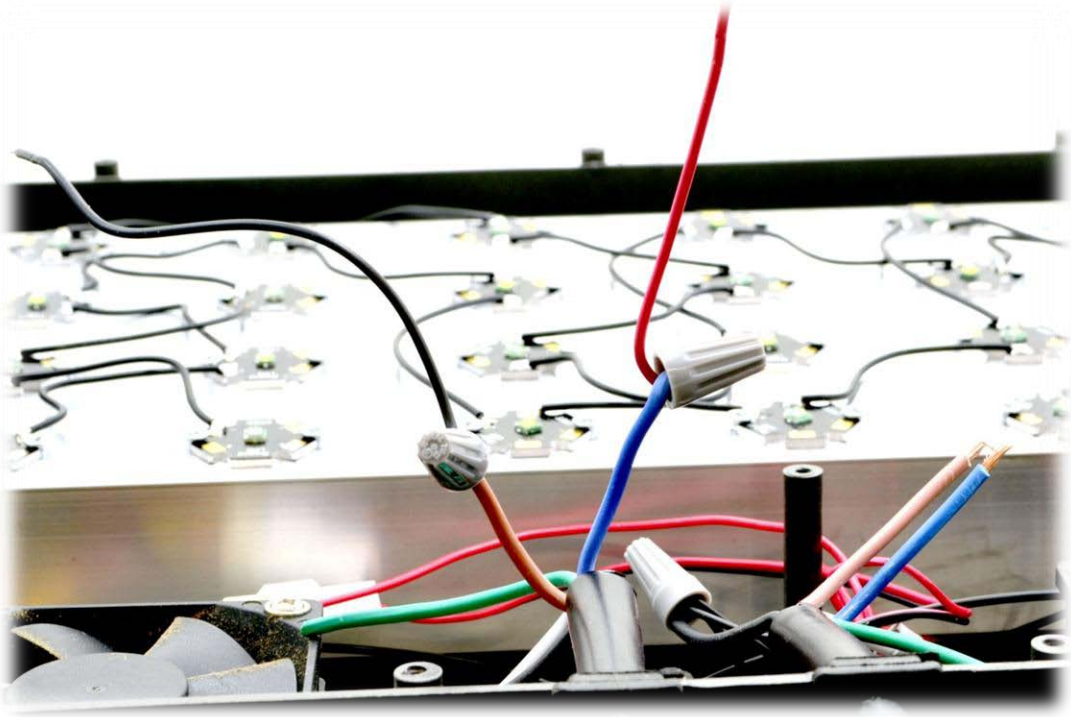
Each driver has a V+ and V- output that powers the LED strings. Since we cannot put the drivers in the hood next to the LEDs, similarly to the AC adapter, we will once again utilize the wires inside of the original 5-wire power cables for wiring. In our example we chose the brown and blue wires from the left and right 5-wire power cables. The left set of brown and blue wires will be connected to one color string of LEDs and the right set the other color. We will use the blue wires as V+ and the brown wires as V-

Step 1: Strip the ends off of the blue and brown wires in from the left and right 5-wire cable.

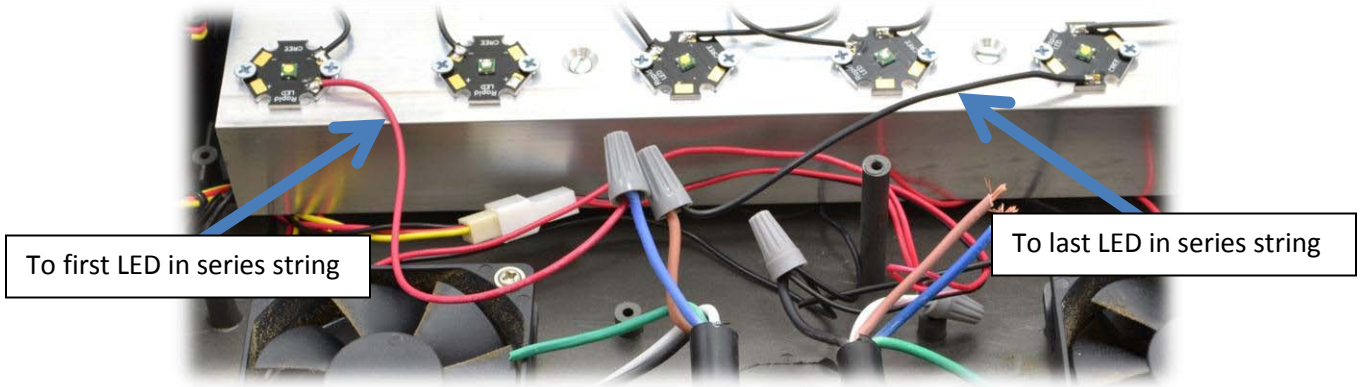




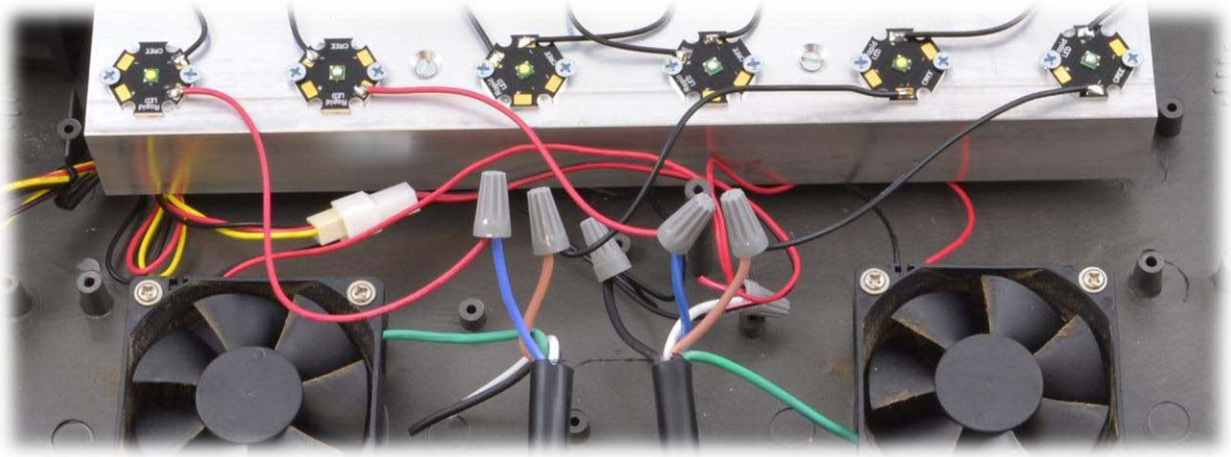
Step 2: Since the brown and blue wires are not long enough to reach the LEDs, we will lengthen them by attaching a piece of jumper wire with a wire nut. Make the jumper wire from the included bulk wire by cutting it to length and stripping a bit off of each end (it would also be a good idea to pre-tin one end at this time. Do not wire nut the tinned end). The jumper wire needs to be long enough to attach to the LEDs as can be seen in the next step (3). Note that the blue wires are being used as V+ and the brown wires are being used as V-.



Step 3: Tin the ends of the jumper wires if you haven't already and solder the red jumper wire (V+) to a + pad on the 1st led in a string. Next, solder the black jumper wire (V-) to the last led in the same string.



Step 4: Repeat steps 2 and 3 for the other brown and blue wire. You should now have two strings of LEDs wired up inside of the hood.

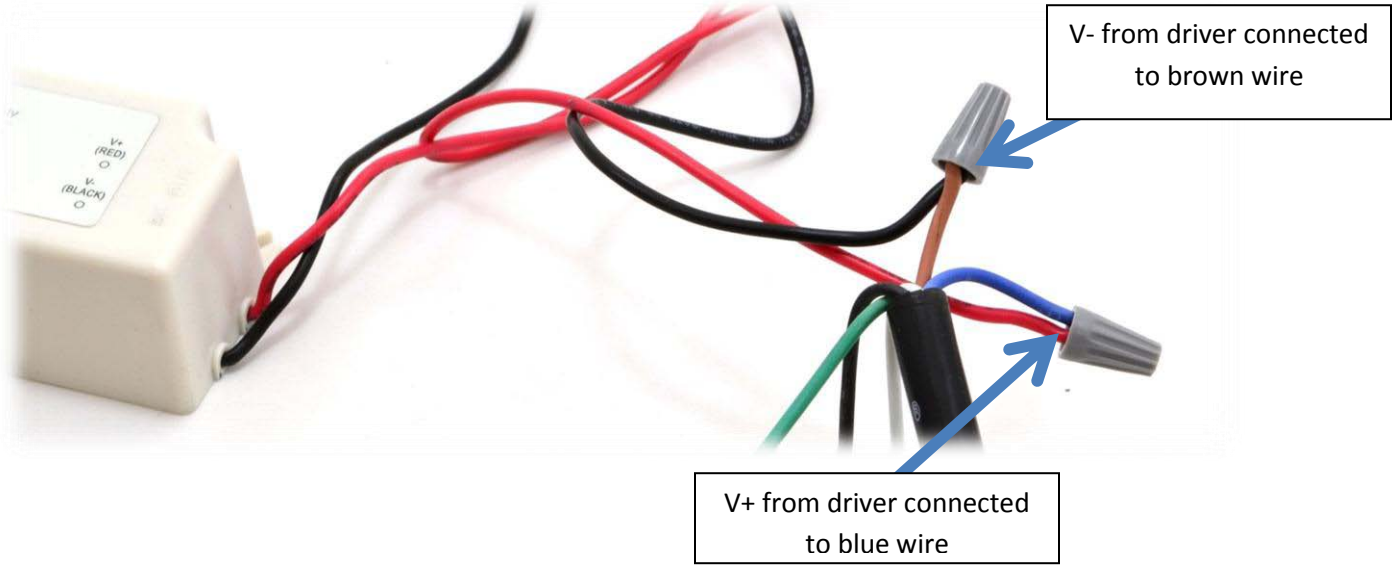


Outside Hood Wiring for LED Strings to V+ and V-

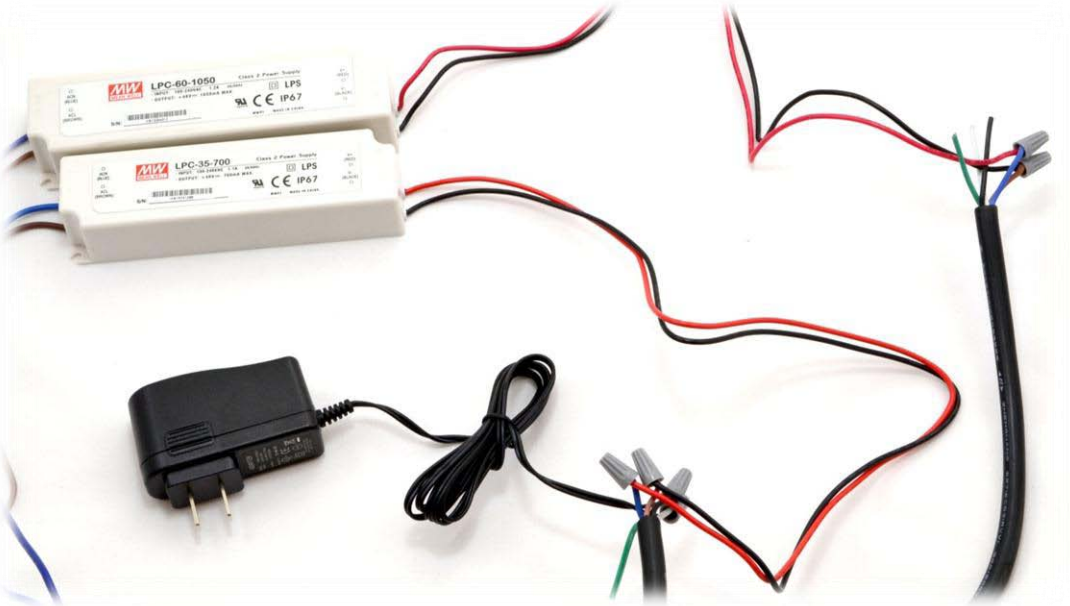
Now that the LEDs are connected to the blue and brown wires inside of the original 5-wire power cables, we have to attach the drivers to those wires to get power to the LEDs. We will attach V+ (red) from the driver to a blue wire and V- (black) from the driver to the brown wire within the same 5-wire bundle. If you have a constant current kit, ensure you connect the LPC-60-1050 to the white LEDs and the LPC-35-700 to the blue LEDs.

If you haven't already, strip the outside jacket off of the original 5-wire power cables and then strip a bit off of the ends of the blue and brown wires.

Step 1: Using a wire nut, connect V+ from the driver to a blue wire from an original 5-wire cable and connect V- from the same driver to a brown wire in the same 5-wire bundle as the blue.

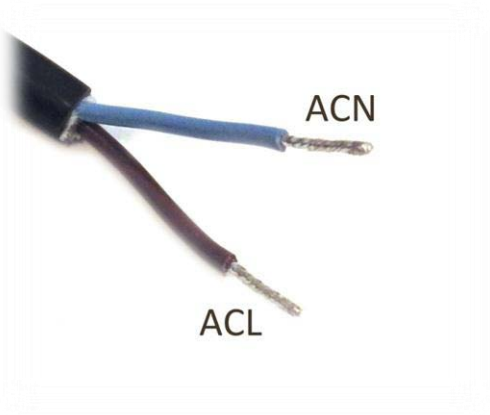


Step 2: Repeat step 1 for the other driver and 5-wire power cable.



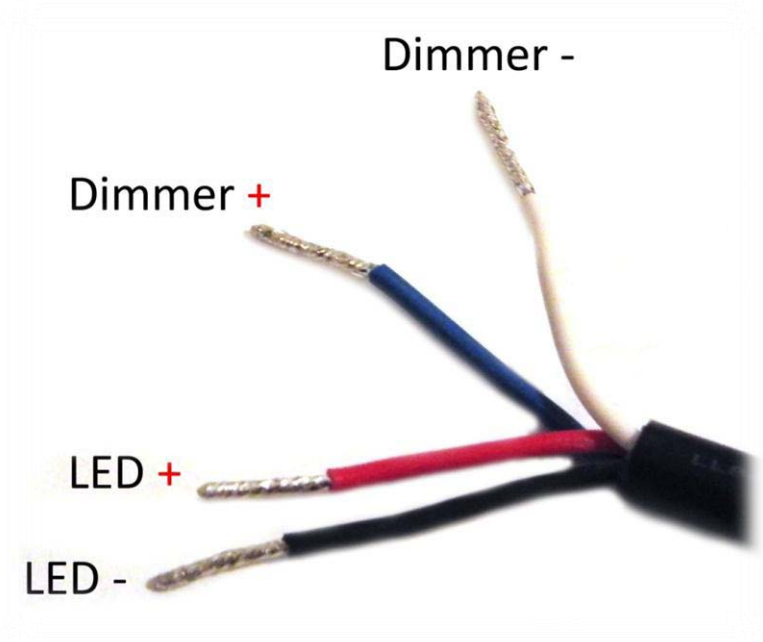
Wiring the Driver to AC Power

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

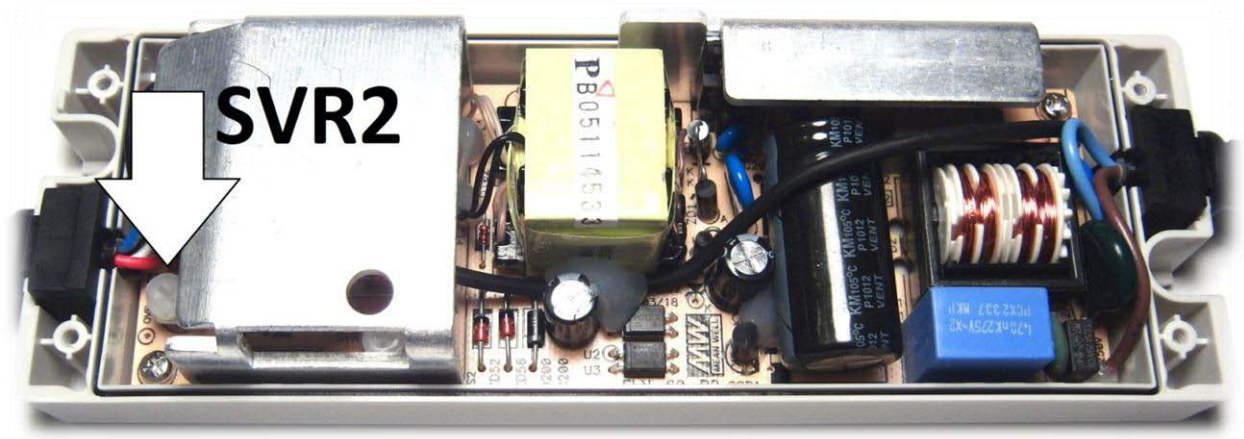


There are 4 output wires on a dimmable driver as in the above photo. The dimming wires, DIM + (blue), and DIM – (white), simply hook up to the respective ports on your controller or dimmer. Dimmable drivers must have the dimmer wires hooked up to a controller or dimmer or the LEDs will not light up. 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.

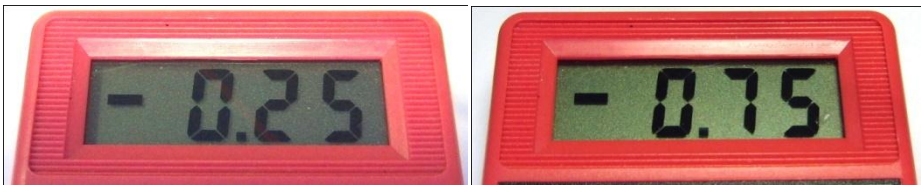
To set your multimeter up for measuring current, move the RED probe plug to the 10A socket and rotate the knob to the 10A position. Multimeters can differ in operation. Please consult your multimeter manual for model specific operating instructions.

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 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!