Introduction

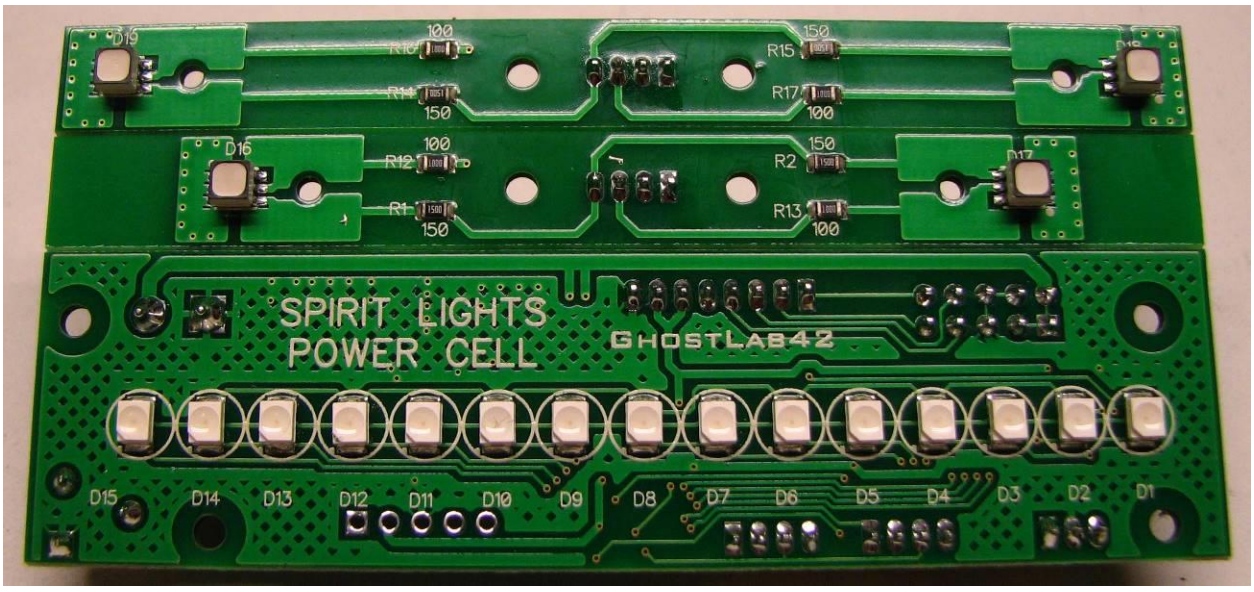
Congratulations on purchasing the Spirit Pack Lights Upgrade Kit that adds some serious lighting effects to your nuclear accelerator!

The Spirit Light Kit is designed to work in the Spirit Halloween Deluxe Proton Pack and can be used with the existing Spirit electronics and battery pack or can be used with additional switch controls, the Matty Blaster board or the GBFans Sound Board. Selection of different operating modes and the speed of the normal lighting sequences can be adjusted by rotating the potentiometer. This Spirit Light Kit also receives commands from the Matty Blaster and the GBFans Sound Board, which adds other cool effects like overheating, venting, and the video game modes. So many features packed into one low priced kit.

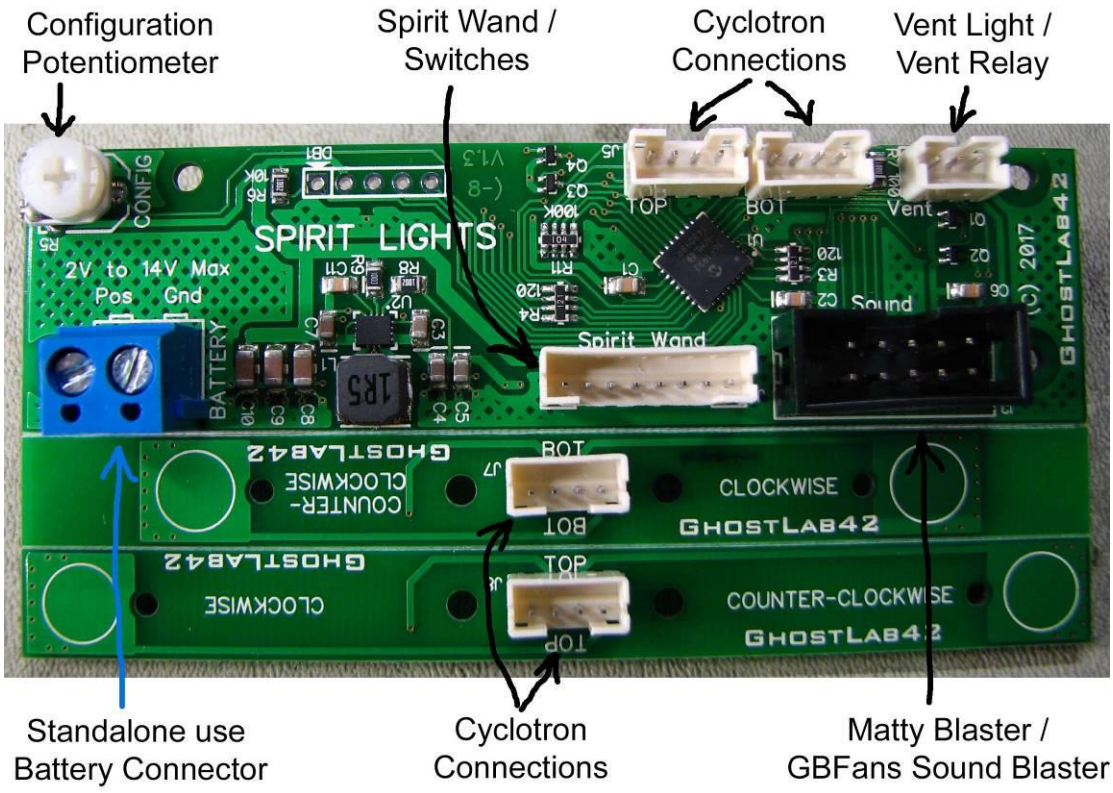
Power Cell and Cyclotron Light Kit features:

- 15 wide-angle diffuse Blue LEDs on the main Power Cell circuit board
- 4 wide-angle Ultra Bright diffuse Red/Green LEDs for the cyclotron Lights
- 1 connection to support a Bright White LED or vent relay for venting affects
- Works with battery voltages from below 3V to 14V
- High efficiency switching power supply for longer battery life
- Easy wiring with a single cable connection for power with the Spirit electronics, or power and control from the Matty Blaster or GBFans Sound Board
- Easy wiring for stand-alone operation with a separate set of battery connection screw terminals (not used when connected to a Matty Blaster or GBFans Sound Board)
- Cables are keyed to only go in one direction
- Capable of providing additional light sequences while powering up and down, firing, overheating, venting and crossing the streams (Matty Blaster only).

Front:



Back:



The Light Kit has a White configuration potentiometer on the back of the board to select between four main modes of operation:

1) Firmware Version Display and Cyclotron Test
   (Configuration potentiometer fully counterclockwise)
   a. The Power Cell LEDs will show the firmware version number
   b. The Cyclotron LEDs will show what is on the 4 digital inputs (all on in stand-alone mode) in Yellow lights (Red and Green both on)
   c. The White Vent LED (not supplied) will be turned on if connected to the vent cable.

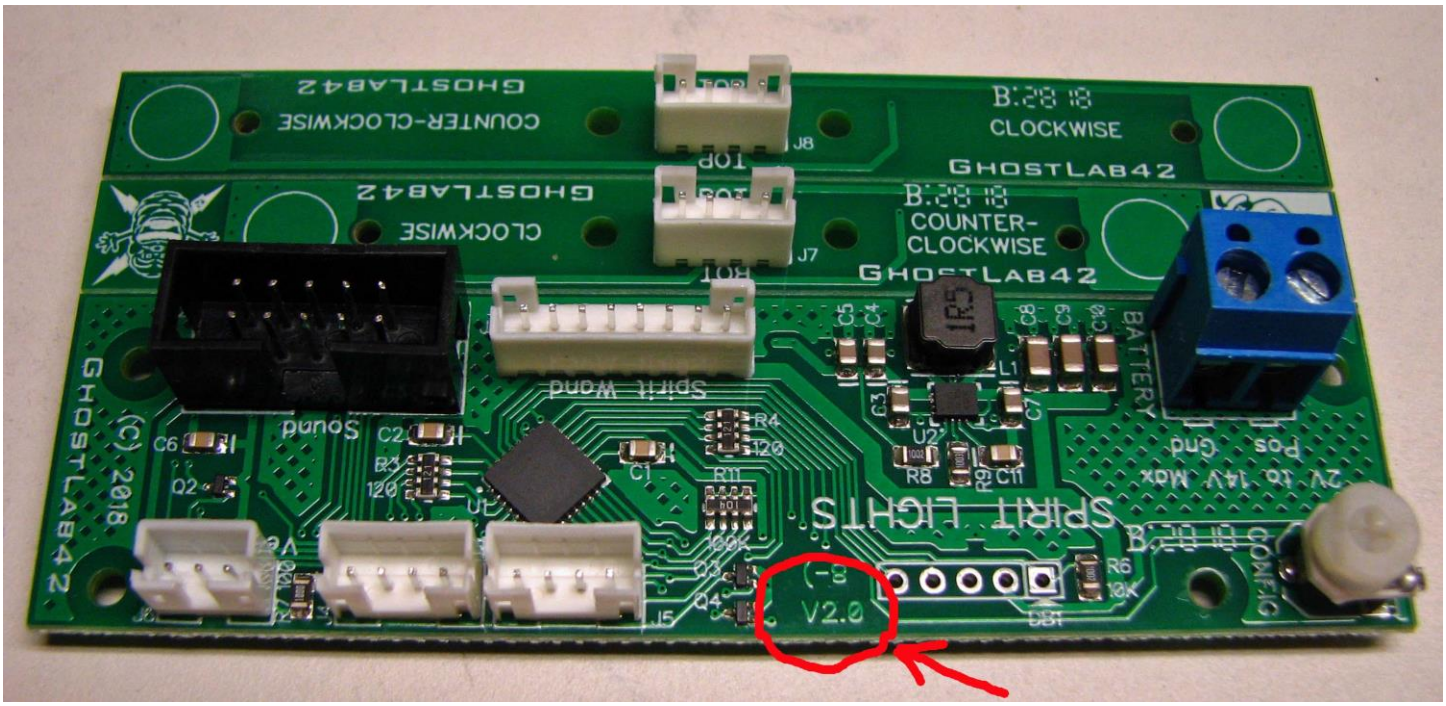
2) Red Cyclotron Only Mode
   (Configuration potentiometer counterclockwise half of the range)
   a. No separate power-up sequence
   b. Each Cyclotron Light will snap on and fade off more quickly
   c. Rotate Counterclockwise for slower or Clockwise for faster sequencing
   d. Vent light or Vent relay supported

3) Red/Green Cyclotron Mode (not to be confused with the Canadian show)
   (Configuration potentiometer clockwise half of the range)
   a. Separate power-up sequence
   b. Cyclotron lights will snap on and fade off slowly like in the Video Game
   c. Rotate Counterclockwise for slower or Clockwise for faster sequencing
   d. No vent light or Vent relay supported in V1.2, supported in Version 2.0 hardware

4) Power Cell Test Mode
   (Configuration potentiometer fully clockwise)
   a. All Power Cell LEDs will be steadily on
   b. All Cyclotron and Vent LEDs are off
      (Well, one cyclotron likes to flash – haven't tracked that down yet…)

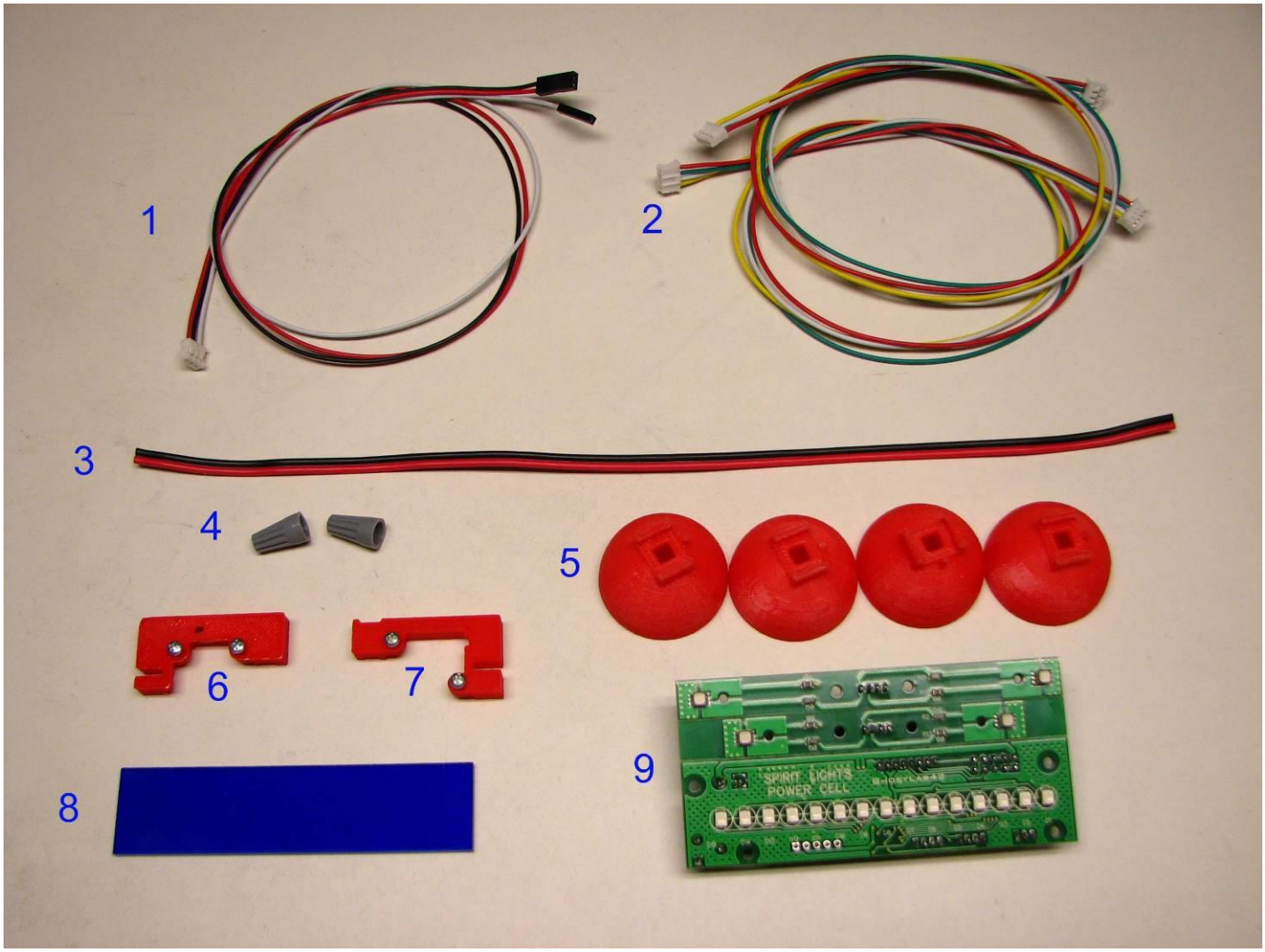
Spirit Pack Lights Board Version indication:

The version number is marked under the green solder mask layer in the circuit board. Shown below is the V2.0 of the circuit board that separates the venting signal from the Green Slime Thrower cyclotron control.



V2.0 now enables selection between the venting and Slime thrower modes without any cable modifications that are described in the “Connecting to …” sections near the end of this document.

Spirit Pack Lights Kit Contents



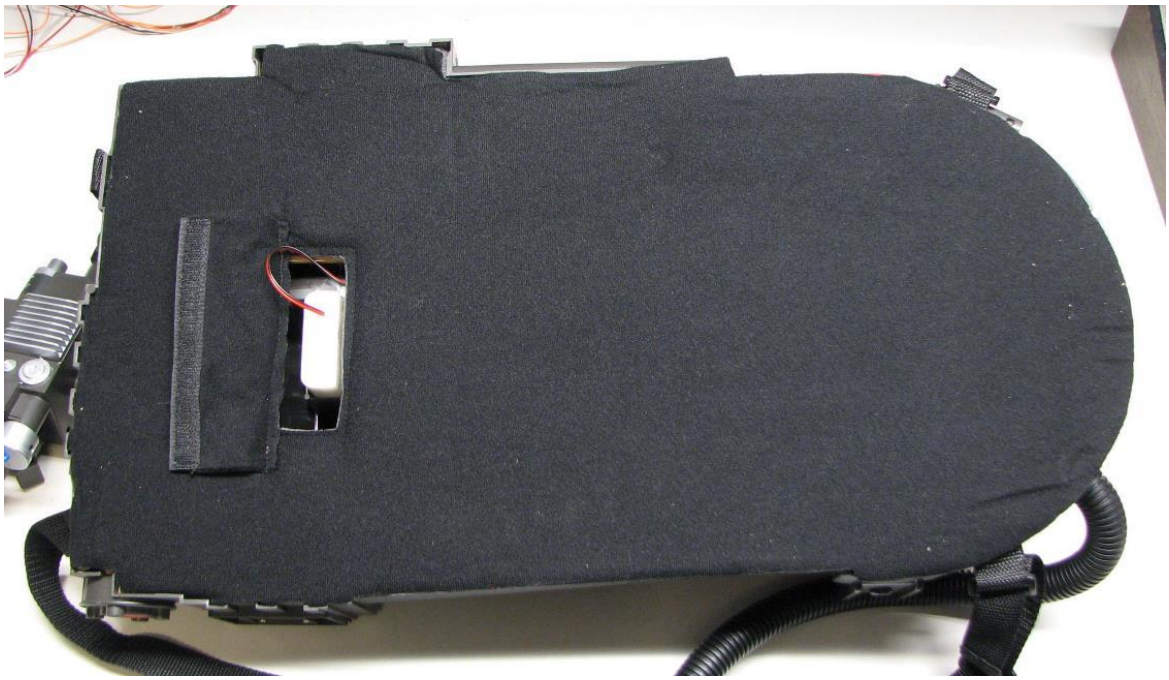
The Spirit Pack Lights Upgrade Kit contains multiple parts to complete the installation into your pack.

1) Vent Light/Vent Relay connection cable with 3 wires
2) 2x Cyclotron connection cables with 4 wires each
3) Power wire to connect the battery to the Spirit board
4) 2x Wire nuts to make electrical connections without soldering
5) 4x Cyclotron Reflectors
6) Bottom powercell mounting bracket
7) Top powercell mounting bracket
8) Powercell Blue acrylic lens
9) Spirit Pack Lights electronics board set
    a. Boards are pre-cut to easily break apart
    b. Top two cyclotron lights (top of board)
    c. Bottom two cyclotron lights (middle board)
    d. Main Powercell board (bottom board, mounts with brackets #6 and #7 above)
10) Diffusion Material (Not Shown), 2 pieces of 1.5”x3”

Installation of main parts in the Spirit Pack

Getting started:
The first step is to remove the back of the Spirit Pack so we can access the inside of the pack shell.

Flip the pack over and we need to locate the screws that hold the fabric covered cardboard “motherboard” to the back of the pack.



You have two main choices here, 1) remove the fabric to expose the cardboard and then glue the fabric back on when done, or 2) make small cuts in the fabric above each screw and leave the fabric attached to the cardboard. I liked option #2 as I expect to open up the pack again (for new wand and sound electronics, hint hint!)

Open the battery cover and then stick your hand between the cardboard and the fabric that is glued to the cardboard around the edges. You can feel around and locate 4 of the 5 screws that are holding the cardboard to the plastic pack.

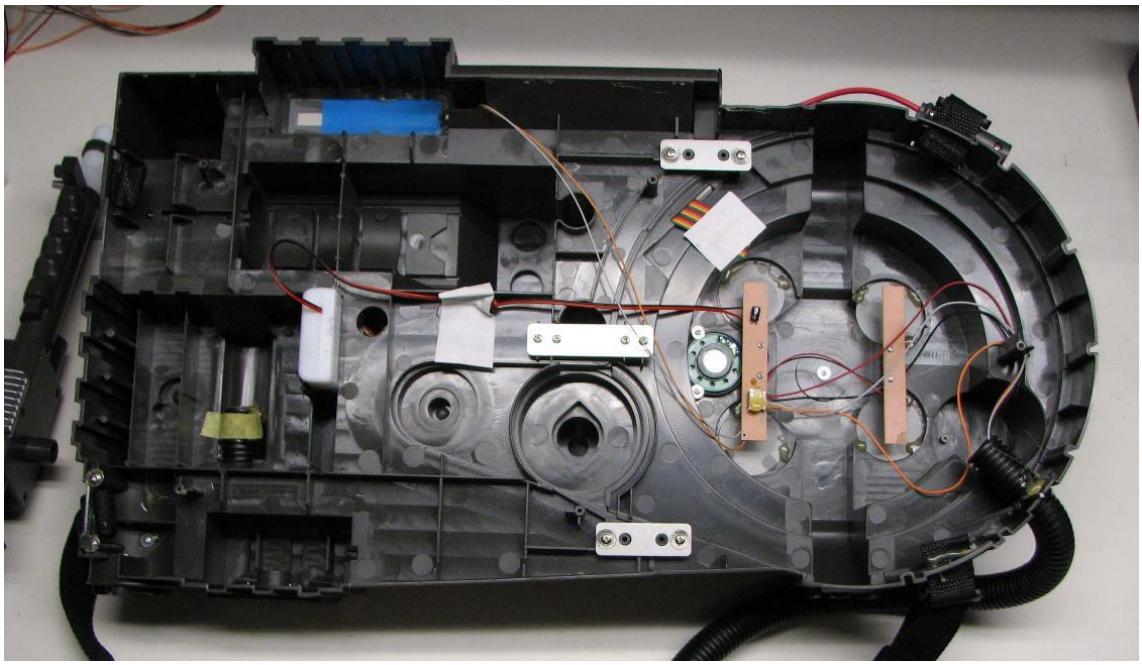
When located, use the X-acto knife or razor blade to make a small cut in the fabric to expose the head of the tiny Philips head screw. I could reach 4 of the screws, but the 5th I could not feel from inside, so pressed around the material from above and located the screw. Knowing where they are would have helped, so here I pulled the material around the screw and washer so you could easily see where you _*should*_ find these screws:



After re-installing the back cover, the screws can still be essentially hidden and only small cuts in the material above them allow easy access for the next time you want access into the pack.

The screws aren't the only thing holding the cardboard onto the pack, and the cardboard is not very stiff, so great care should be taken removing the cardboard backing from the pack. Near the straps, the loom and some random spots along the edge, glue to hold those items of the fabric also oozed out enough to connect the cardboard to something else in the pack. I used a flat screwdriver to carefully separate the cardboard and the pack plastic, frame or loom while slightly lifting the cardboard. I worked my way all around the edge before lifting the cardboard fully from the pack. I did not have any places in the middle of the pack have glue, it was only around the outside edges.

Once you get the back removed, here is the view inside the pack:

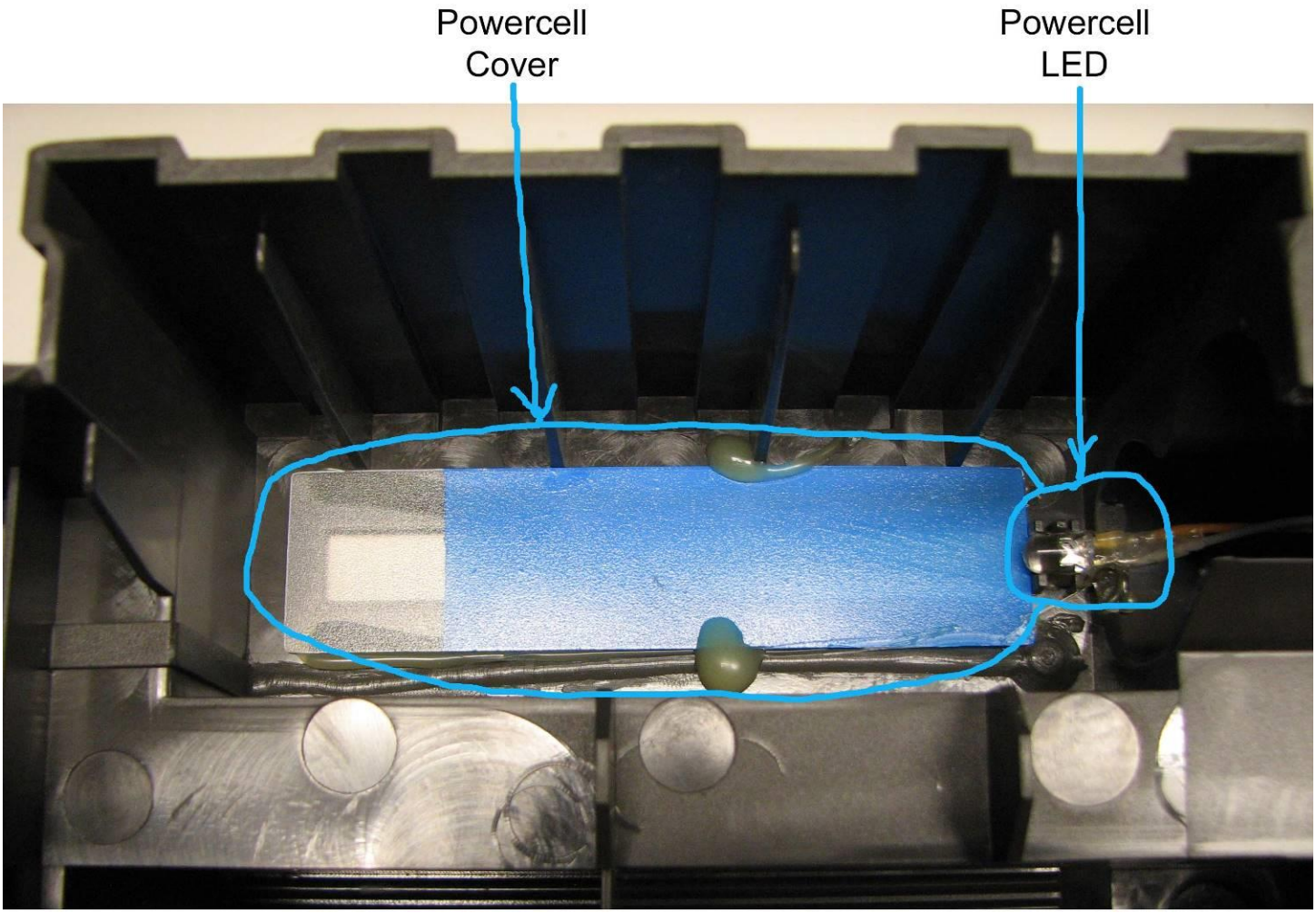


You can leave the screws in the cardboard or remove them and put them in the posts they come from, so they don't get lost.

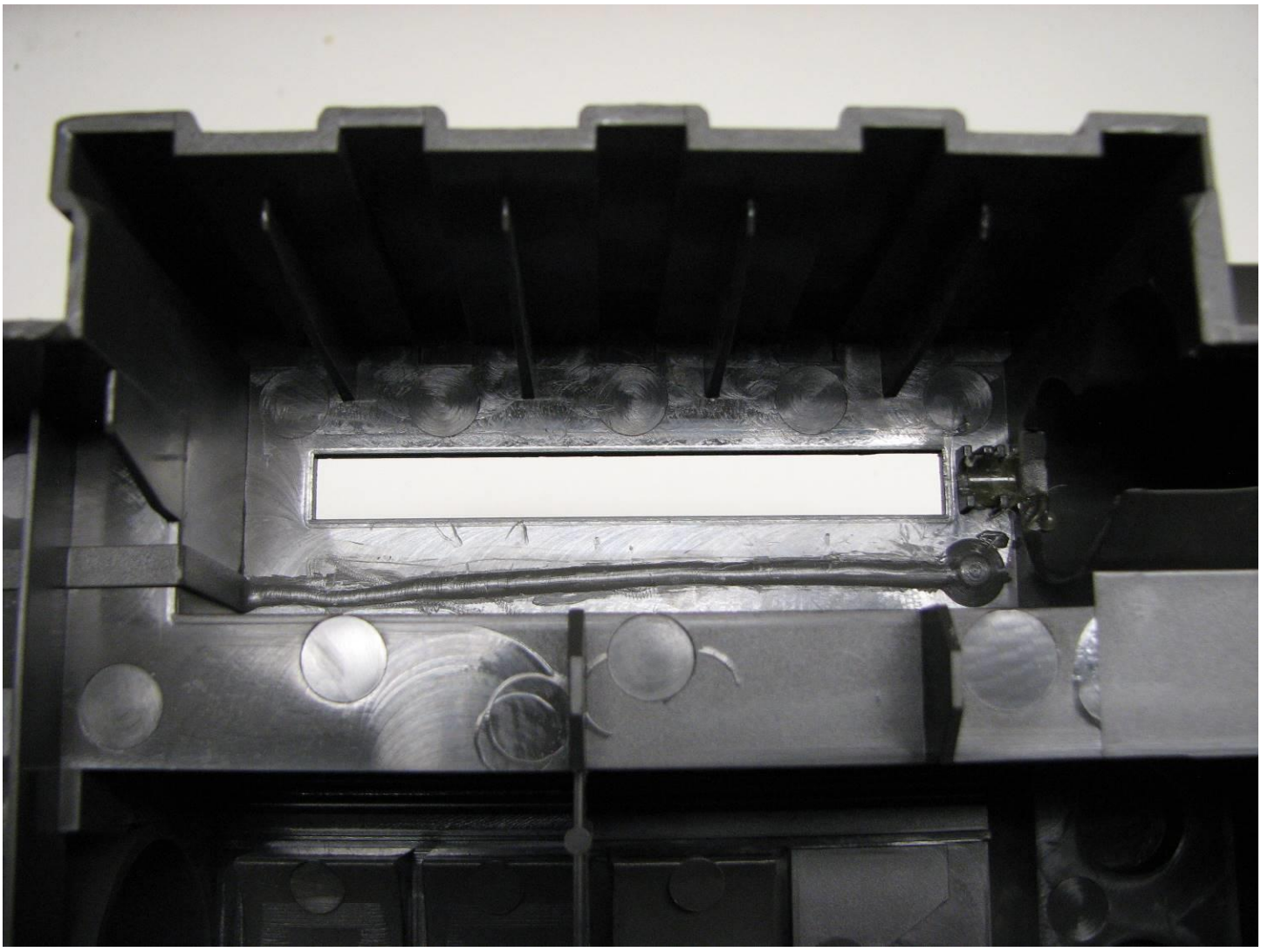
Before we can add in the new electronics, we need to remove and move some of the existing parts and electronics.

Powercell:
The Powercell is in the top region of the pack and has a translucent piece of plastic that is blue on the bottom ¾ of the piece and the top is clear. This two-color "Powercell Cover" needs to be removed and the area underneath needs to have the old glue removed so the new parts can fit flush against the inside of the black shell.

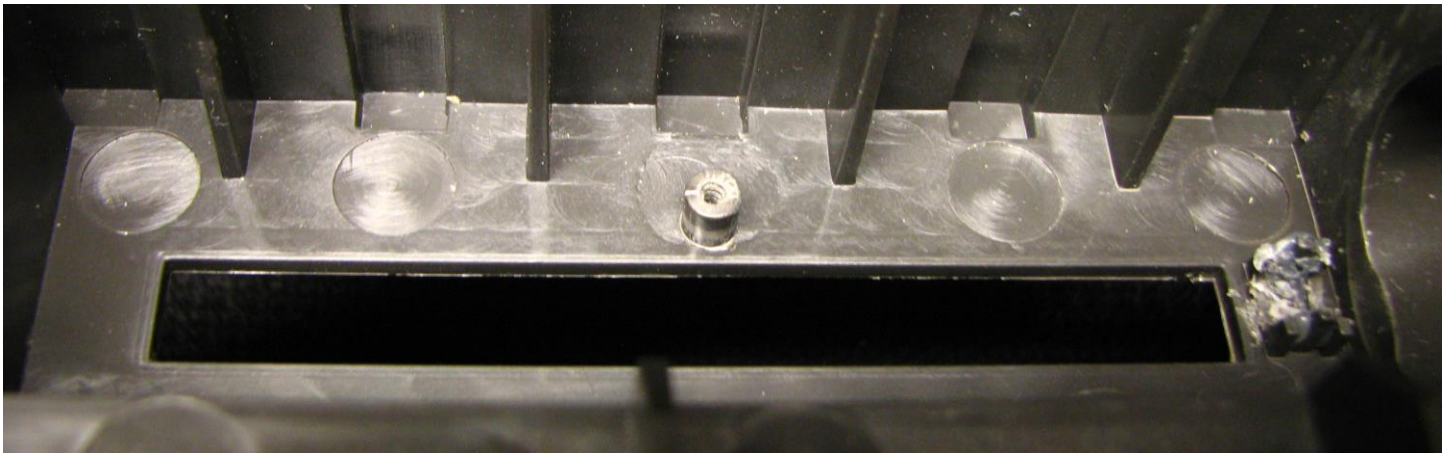
The powercell window is currently illuminated with a single "Powercell LED" that flashes when the spirit wand is being fired. We need to also remove this from the powercell region. There is no more need for it, so you can cut off the two wires (White and Orange) near where they attach to the top cyclotron circuit board, or relocate the LED somewhere else if you still want that flashy light…



After the Cover and LED have been removed and the glue cleaned up (scraped off with small flat screwdriver):



Spirit Halloween is modifying the pack, and some are now using screw posts instead of glue to hold in the blue/white material. This can leave a small plastic post in the middle of where the new blue acrylic part is going to be placed, so the plastic post would need to be ground down so that it looks like the previous pack as shown above.

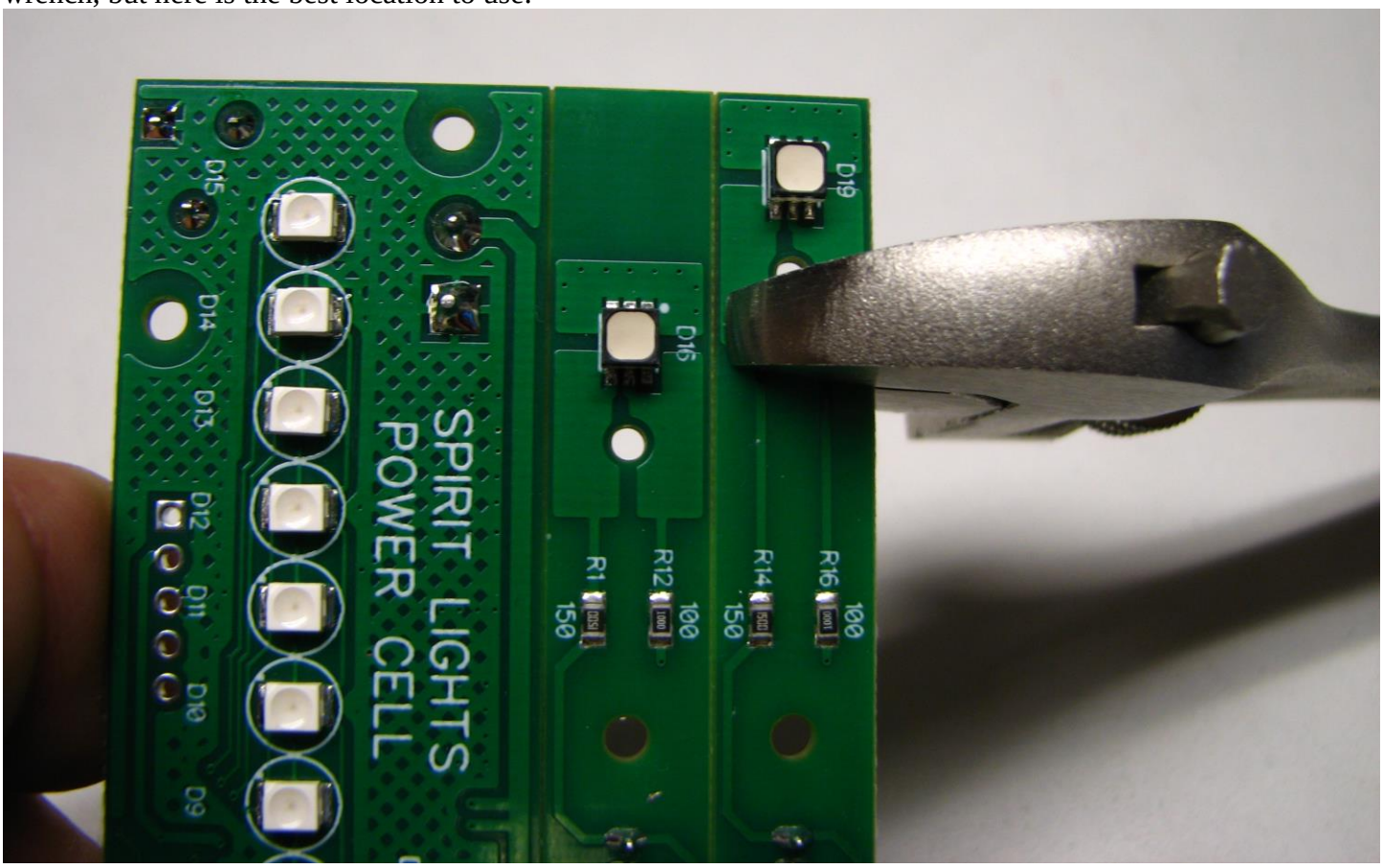


When dealing with the electronics, it is important to be aware of static electricity and the ability to *ZAP* the electronics and possibly damage them. It is best to leave the electronics boards (#9) in the packaging until you are ready to mount them. When it comes time to mount or touch the electronics when attaching any wires to do this in one location and preferably not on carpet. A good habit to get into is to touch something that is grounded before touching any electronic part. Something metal and has a connection to the third prong ("ground") and plugged into the wall outlet is a reasonable way to achieve this. One of the worst things to do is walk around sliding your shoes against the carpet before touching the board and making a huge spark between your finger and the board… It was fun to do to you friend/enemy/sibling when you were a kid, but electronics really don't like that.

We need 4 parts for this step, the powercell board (#9c), the brackets (#6 and #7) and the blue powercell lens (#8)

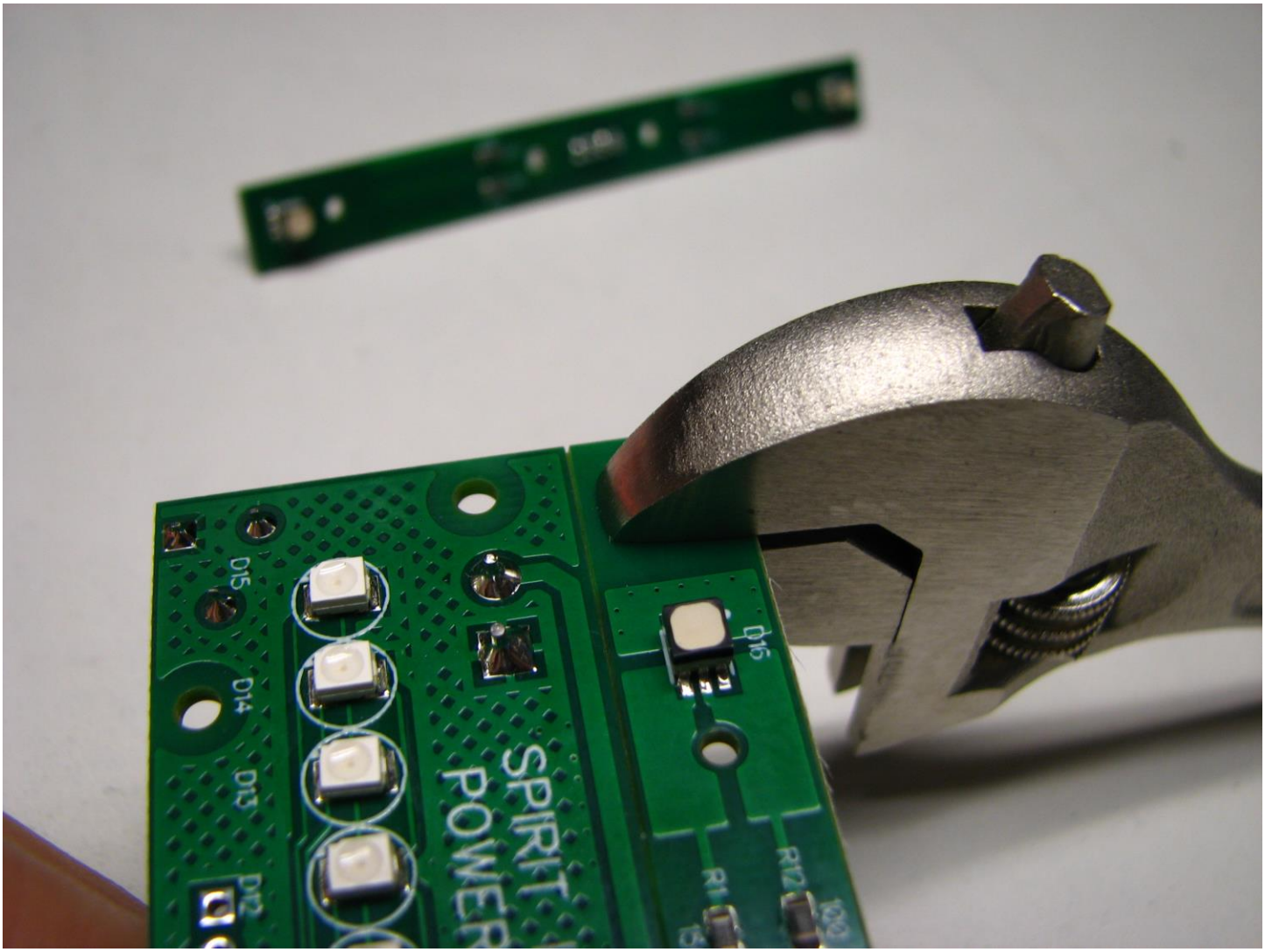
Cut open the protective bag and remove the circuit board (#9) and gently bend the board to break it into 3 long and skinnier boards. Set the two cyclotron boards back inside the bag since we are going to first install just the powercell board.

Some have indicated that it is hard to separate the boards and there must be a better way than just super-human finger strength. You can use a crescent wrench but take great care not to damage any component or traces on the boards. Start with the outside cyclotron board. There is no perfect place to locate the small crescent wrench, but here is the best location to use:



The flat jaws do not cover any parts and are somewhat over a larger section of the traces. Hold the other boards with one hand and gently rotate the crescent wrench to break the outside board free. If needed you can free this side and then place the crescent wrench on the other side of the same board in a similar location and completely free the board.

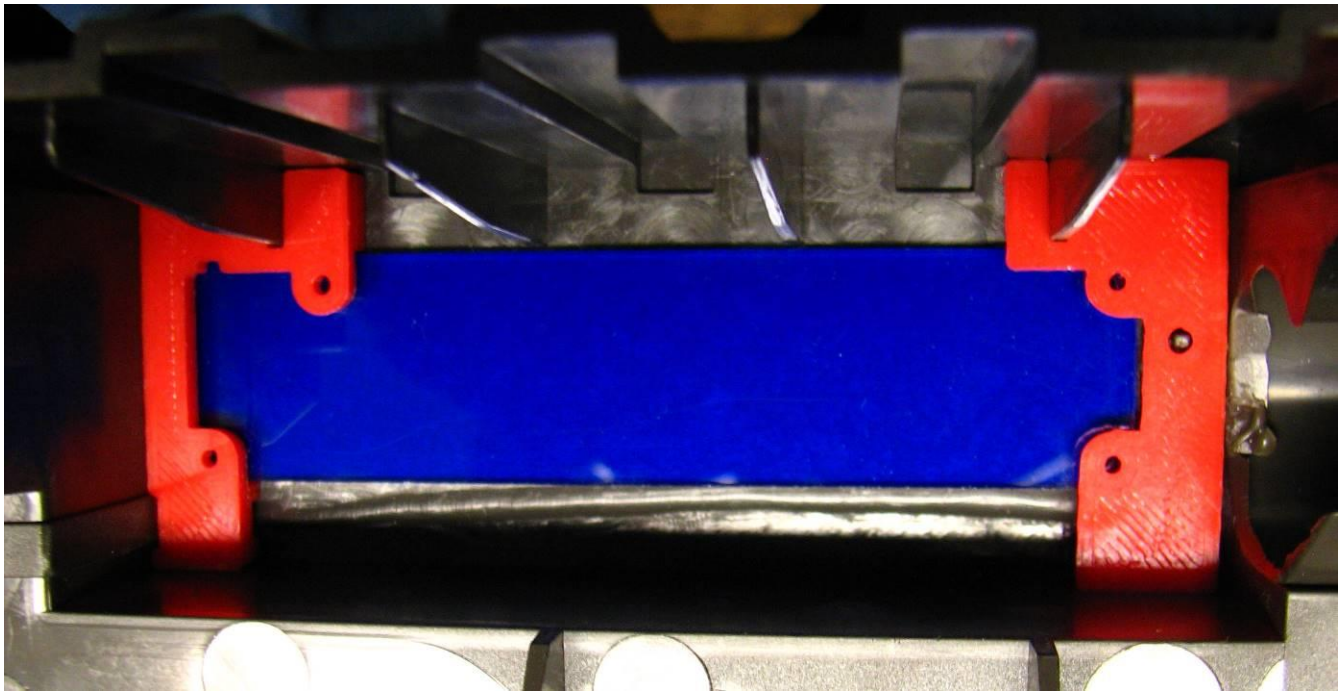
The second board is more ideal. There are no components or traces on the outside ends of the board so there is nothing to worry about damaging:



There is no need to completely separate the board from only this one position. Gently rotate the crescent wrench and part of the board will “crack” free. Then move the crescent wrench to the other end of the small cyclotron board in a similar position and finish the removal.

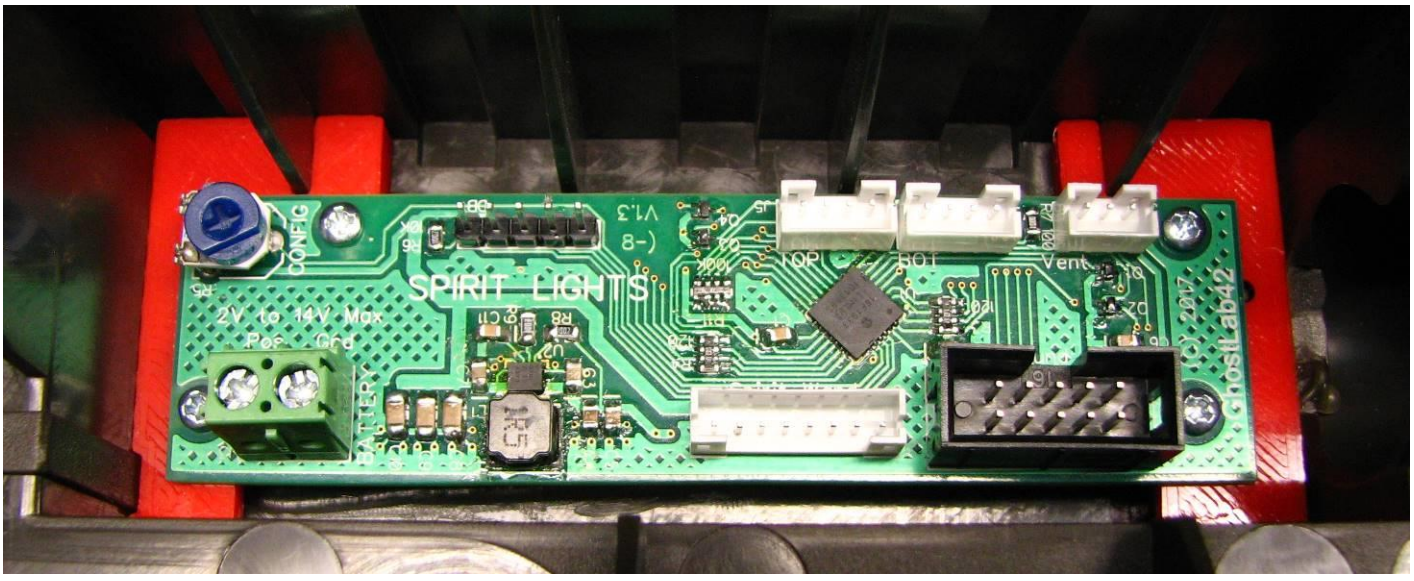
The blue powercell lens (#8) has protective paper layers on both sides to protect it from being scratched. These will soon need to be removed, but you can decide exactly when so you can keep them clean and scratch-free for as long as possible.

Test fit the powercell lens with the two mounting brackets to make sure it can sit flat against the inside of the black shell:

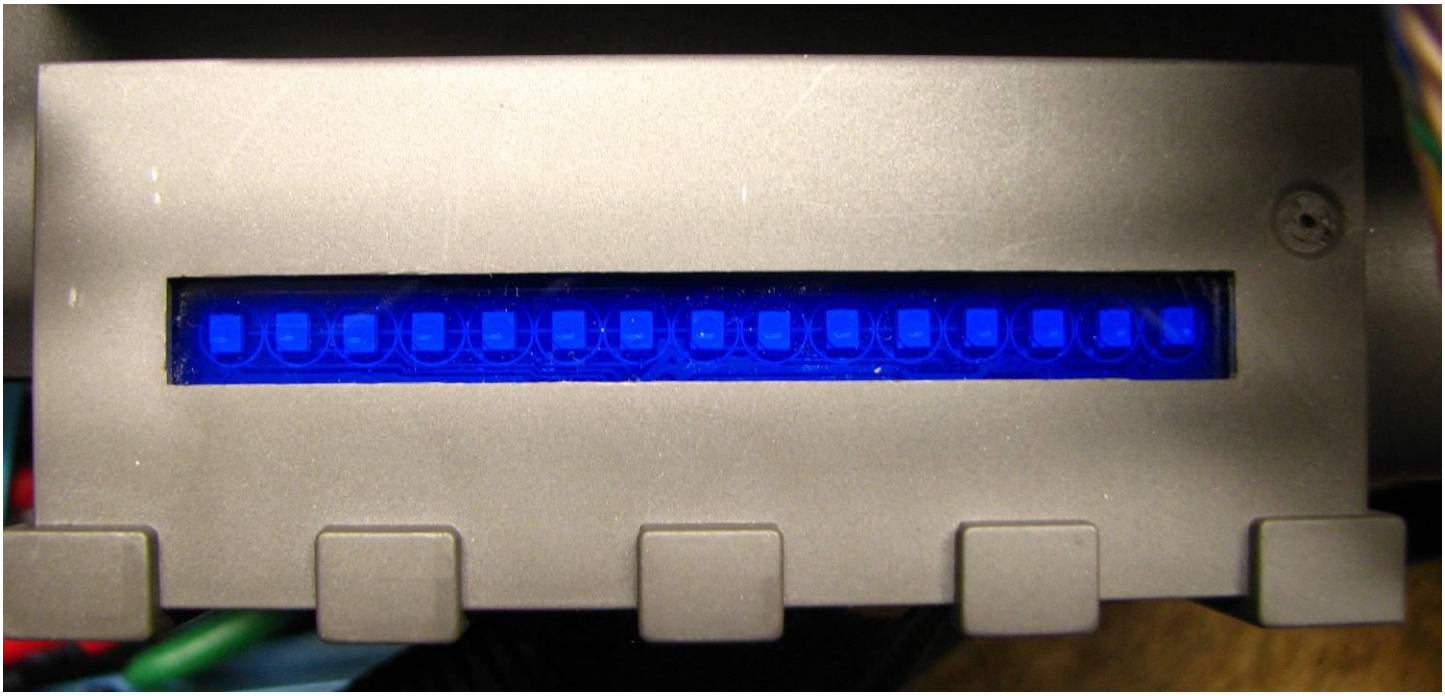


The top bracket (#7) is on the left side in the above picture and the bottom bracket (#6) is on the right-hand side. The brackets have many features in the bottom side (not visible in this picture) to hold the blue lens in place as well as go around various bumps, fins and support structures molded into the black shell. The blue plexiglass should be snug and practically held in place without needing any glue.

Once you have done this, it is probably the time to remove the protective paper on the blue lens (as shown above). I mounted the board to the brackets before I glued them in to make sure the board fits well and the four mounting holes can be aligned. Remove the four tiny screws and then used them to mount the board in the following orientation:



Once the board is sitting flat, you can hold it in place and check the front side of the pack to make sure the blue lens is flat against the case and looks like this:



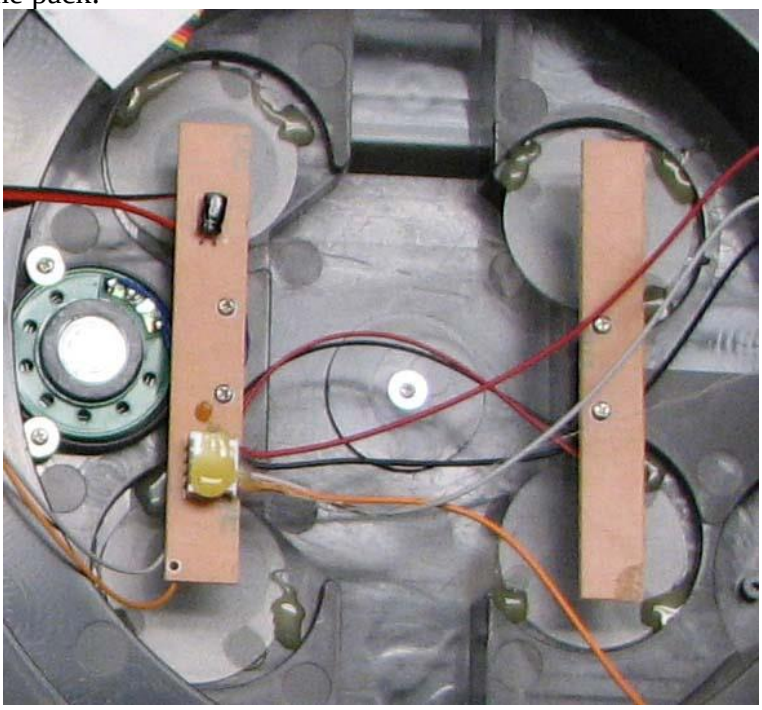
Now you can glue in the two red brackets and the electronics should be held firmly in place. Only glue the red brackets to the black case, try to avoid getting glue on the blue lens and the circuit board.

Even hot glue to the outside four corners should work well if you don't want to mess with epoxies or other solvents. The brackets are made of PLA, in case you need that to determine what adhesive you want to use. You can also remove the circuit board before you glue if the test fit showed that the brackets are in the correct positions and don't move around much.

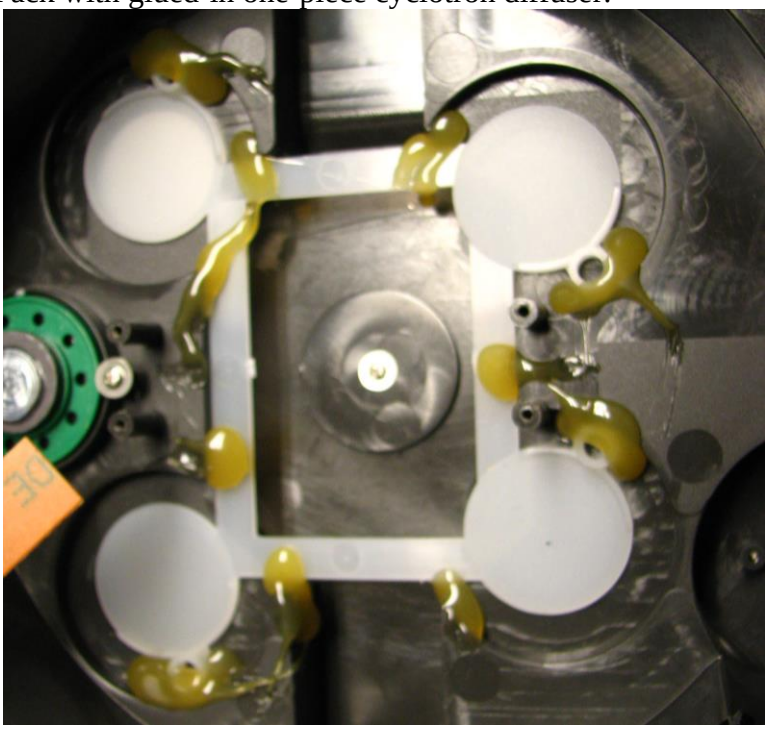
Cyclotron:
The latest round of Spirit Halloween Packs has some updates and they have changed how the Cyclotron Diffusers (clear/white frosted pieces that cover each cyclotron port) are made and attached.

The new version has a diffusor that is twice as thick as the previous one, is made in one piece rather than 4 separate pieces and has features to allow it to be screwed in place. The pack I have stilled glued the single diffuser in place, but others have sent photos that show new molded in features on the pack that allow the diffuser to be held in place with screws instead of gluing.

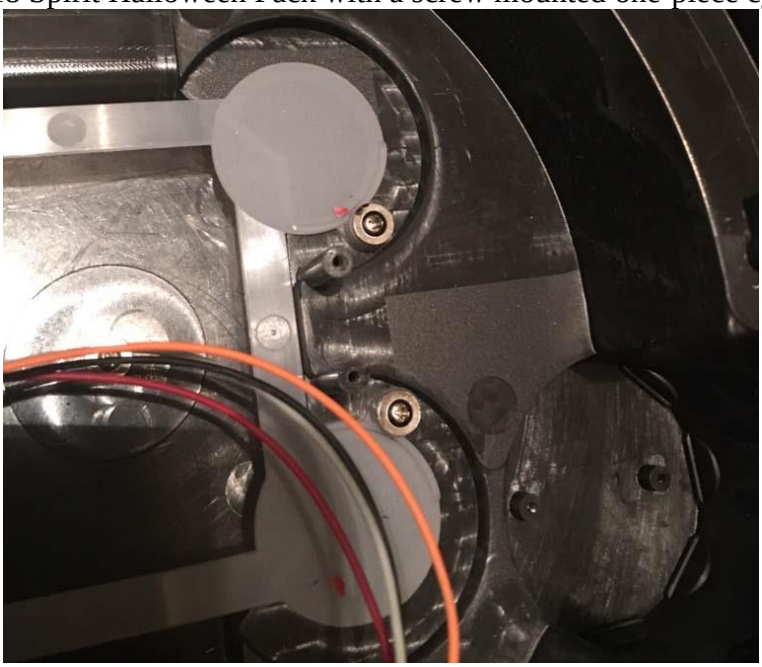
Original 2017 version of the pack:



A 2018 Spirit Halloween Pack with glued-in one-piece cyclotron diffuser:



A (presumably) newer 2018 Spirit Halloween Pack with a screw mounted one-piece cyclotron diffuser:



Newer 2018 pack fitment for the red reflectors

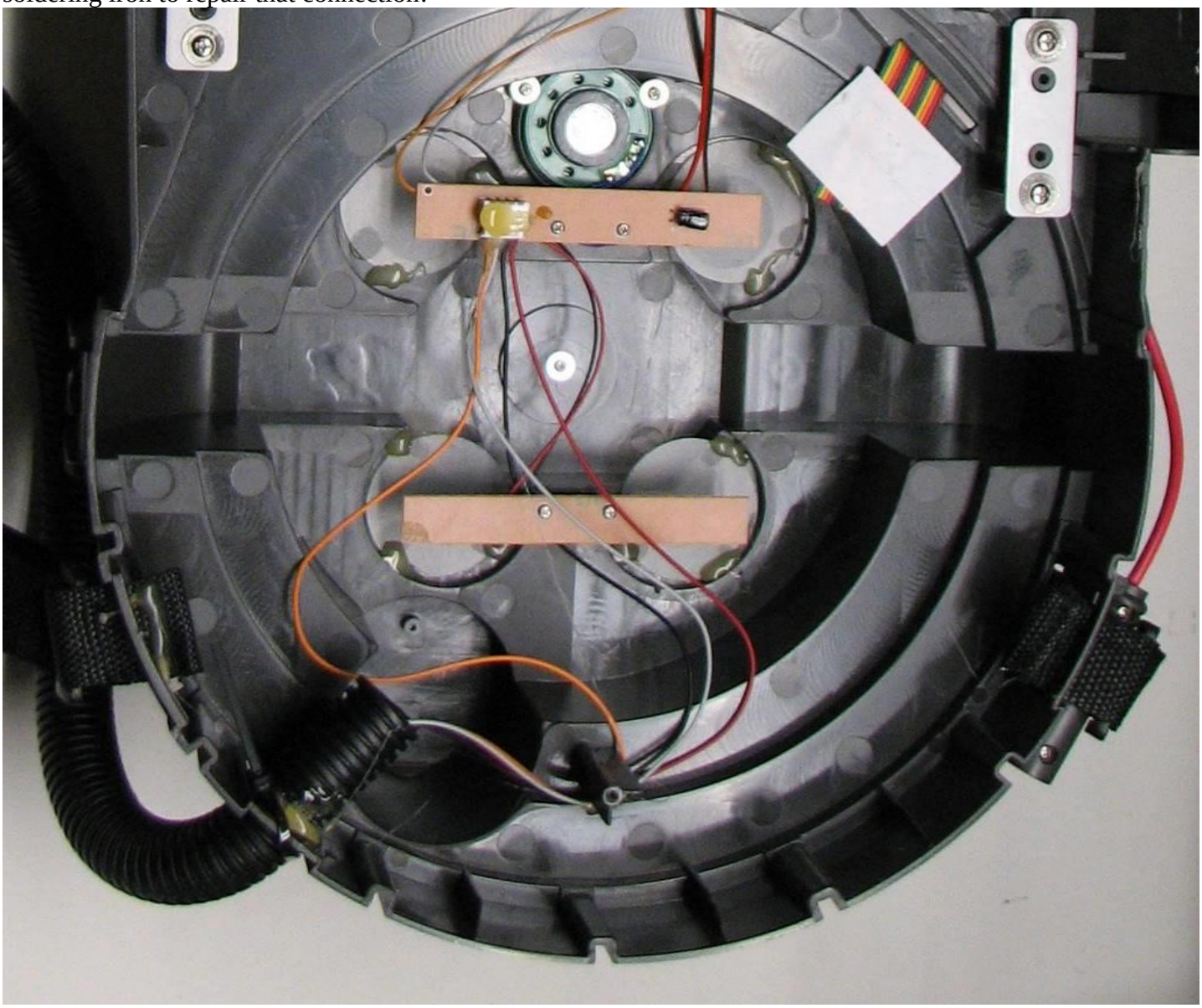
The diffuser material is much thicker and has several features that interfere with the Red reflectors that are included in this kit, so you have a couple of options:

1) Remove the one-piece diffuser and replace with the included diffuser material so that it is like the original 2017 version of the pack. Cut the diffusor material so that it is 4 pieces of about 1.5” x 1.5”. You may need to cut some corners off or make it more like a 1.5” diameter circle to fit over each cyclotron opening. Sand down the black cyclotron diffuser screw posts (not the circuit board posts!) if they interfere with the included RED cyclotron reflectors. You may also need to trim the diffuser a bit if the diffuser interferes with what is left of the black cyclotron diffuser screw posts.

2) Sand down the reflectors where they interfere with the new features.
Be careful when screwing in the two screws into the circuit board if the circuit board is sitting higher above the mounting posts if it is still interfering with some portion of the diffusor. You do not want to screw the board down such that the circuit board would be bowed or bends.

3) Sand down the diffuser and mounting posts so that it is flat and does not interfere with the reflector. The diffuser material is still thicker so take care when attaching the circuit board and do not screw the board down such that the circuit board would be bowed or bends.

There are two brown colored cyclotron boards already installed in the Spirit pack. We are going to replace the bottom one but want to keep the top one since it contains the sound generation electronics. The top brown sound/cyclotron board will be in the way of our new board, so we still need to move that top brown board slightly. The battery wire (red and black pair) is soldered directly to the top powercell board and is quite fragile. Try not to bend or pull on those wires when moving this board around, or you will need to have a soldering iron to repair that connection!

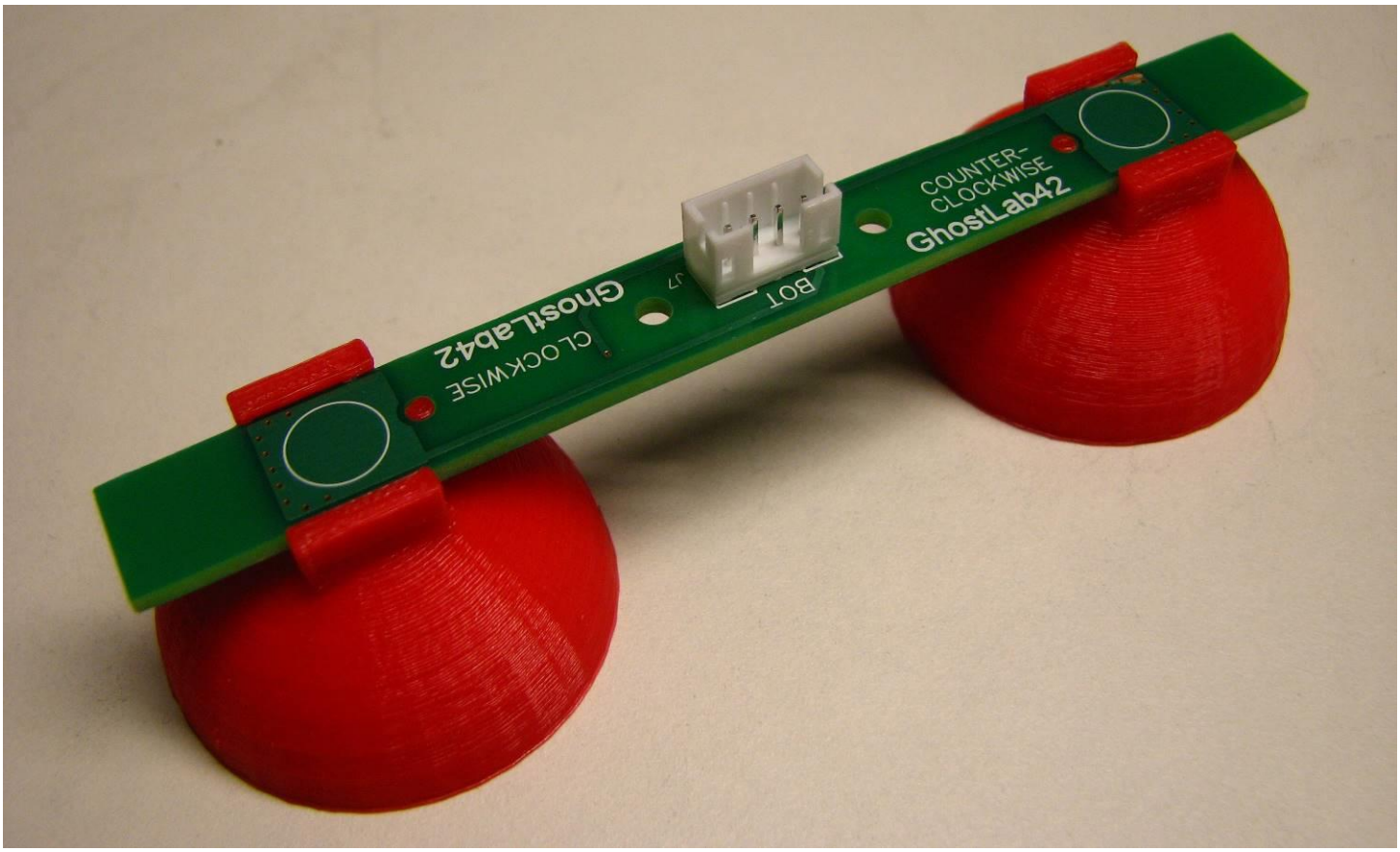


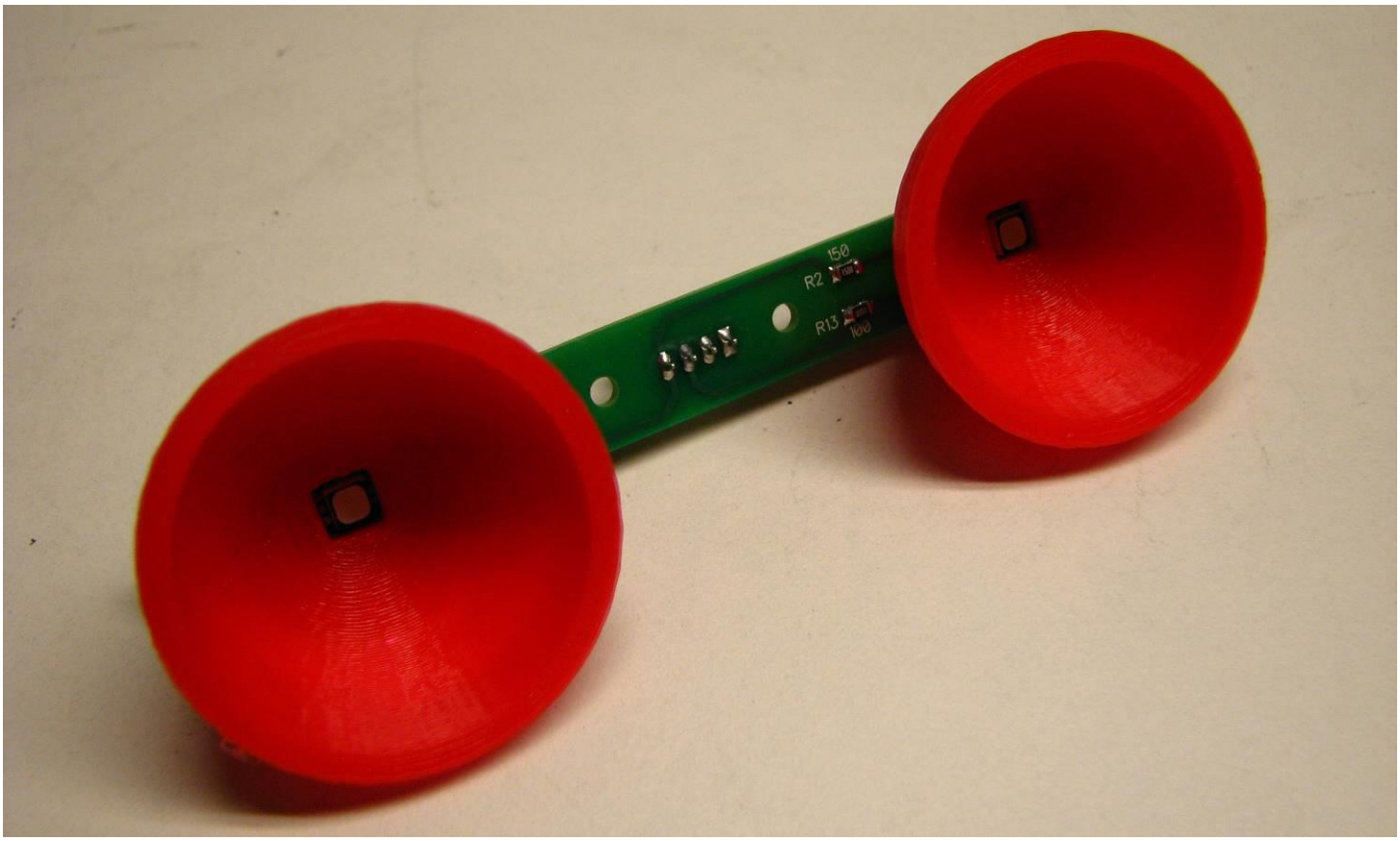
The bottom brown cyclotron board has two smaller separate red and black wires connecting it to the top brown board. We do not want this board, so cut the wires off near the top board. To make sure they do not accidentally short something, either cover the ends coming from the top board with electrical tape or cut them off flush with the top board (easier after the board is unscrewed from the posts holding it in place).

KEEP the two screws! You will use the same two screws to attach the new board to those two posts.

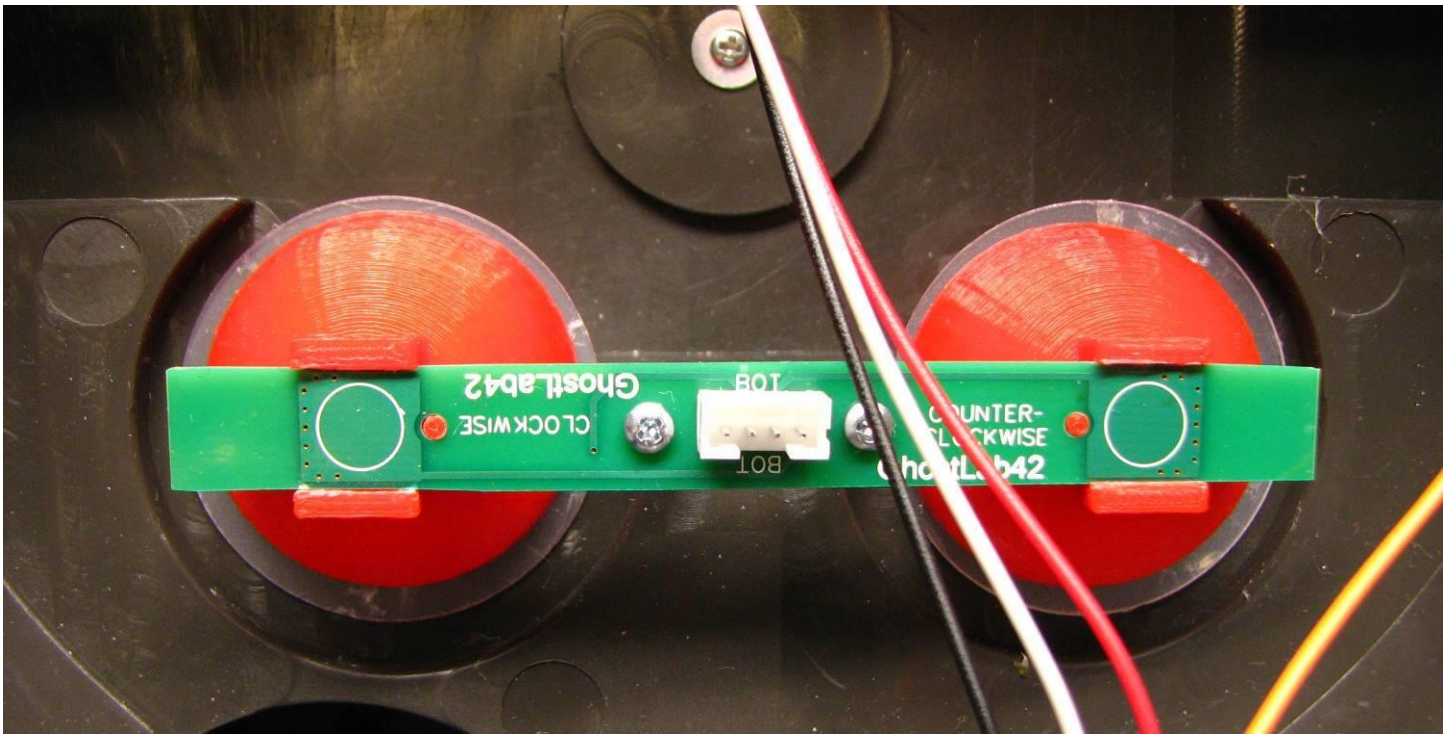
Take the bottom new green cyclotron board (#9b) out from the package. You can identify this as the bottom board because the connector is labeled “Bot” and the two LEDs are not out as far on the ends of the circuit board as they are for the top cyclotron board (#9a).

Carefully attach two of the cyclotron reflectors (#5) to this bottom cyclotron board as shown:





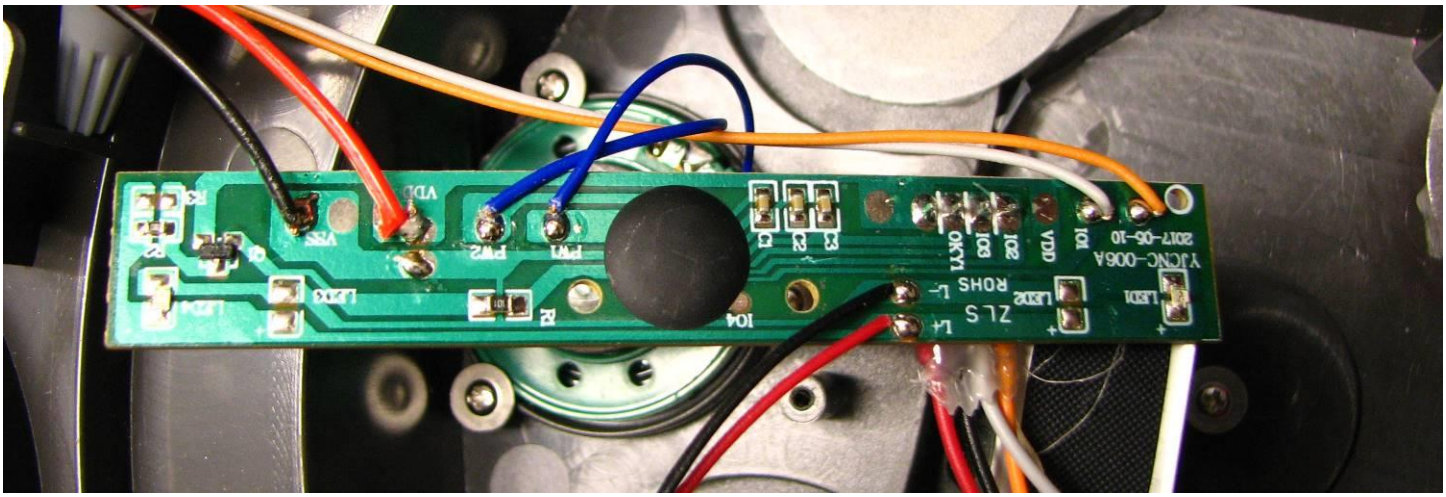
Orient the board with either the words CLOCKWISE or COUNTER-CLOCKWISE right-side up, depending on which way you want the cyclotron firing order to progress when viewed from the outside facing the upright pack. Attach the new board with the reflectors to the two posts with the same two screws that were used to hold in the old brown cyclotron board.



Orient the board with either the words CLOCKWISE or COUNTER-CLOCKWISE right side up, depending on which way you want the cyclotron firing order to progress when viewed from the outside facing the upright pack. Attach the new board with the reflectors to the two posts with the same two screws that were used to hold in the old brown cyclotron board.

The top brown cyclotron board has two thicker red and black paired wires connecting it to the battery pack. It also has wires connecting it to the speaker. Neither of these sets of wires have any strain relief, so take great care not to tug on or repeatedly bend these wires as they may break off from the board. If they break, you will need to re-solder the connections that are broken.

Here is a picture as reference if you need to reattach the wires:

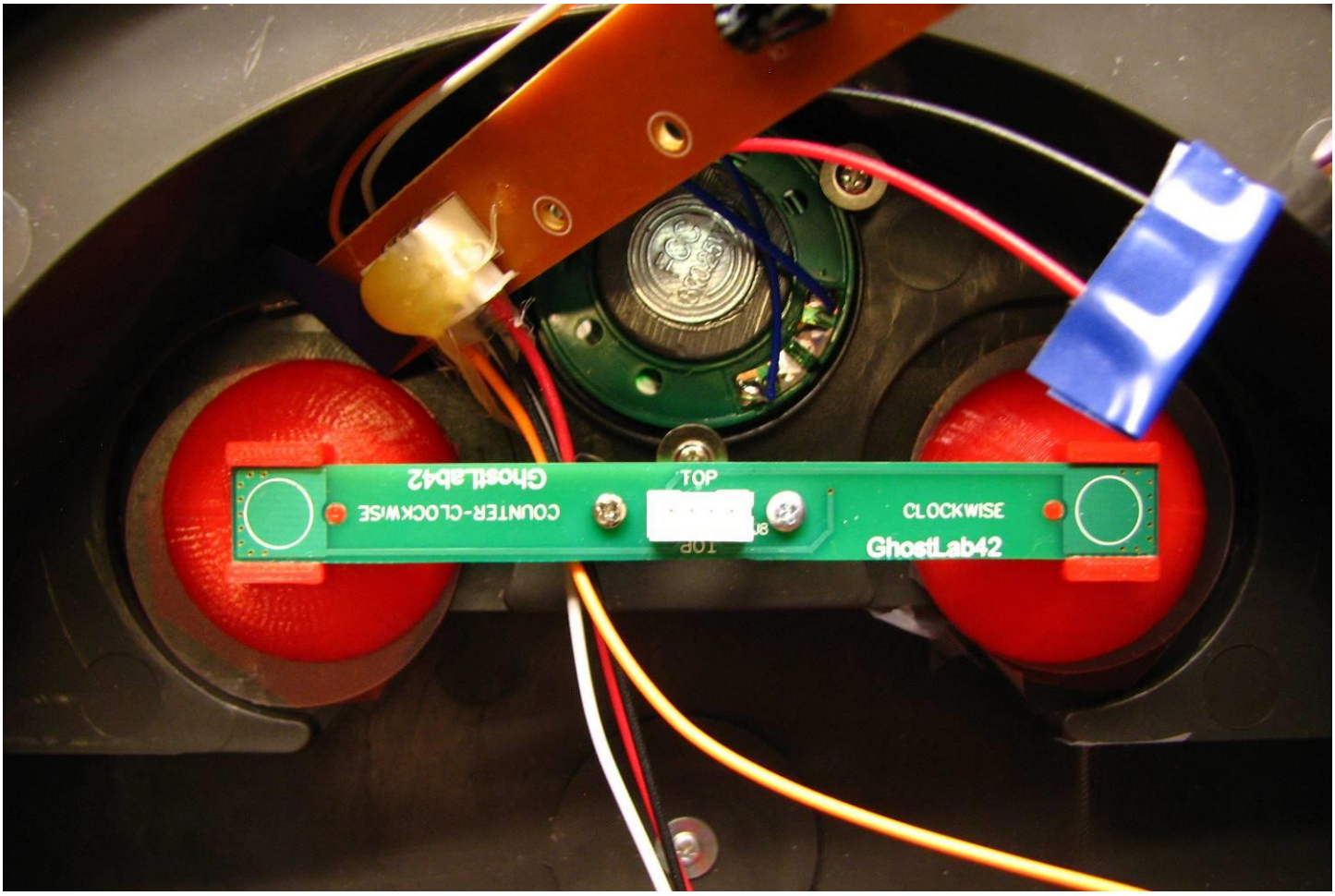


We now need to move the top brown board. We need this board for the sound and wand light, but we are going to mount the new board in its place so it must move up and out of the way. The wires do not allow it to move very far, so it just has to get out of the way!

KEEP the two screws! You will use the same two screws to attach the new board to those two posts.

Take the top new green cyclotron board (#9a) out from the package. You can identify this as the top board because the connector is labeled "TOP" and the two LEDs are out at the far ends of the circuit board. Carefully attach the last two cyclotron reflectors to this top cyclotron board and mount the board on the posts with the previous boards two screws.

Here is how the new board looks when mounted and the old board is sitting just above it:



You can just use some electrical tape (or duct tape?) to hold the old brown board in place. We just don't want it flopping around but can't really move it anywhere useful without a lot of work.

I did end up adding some electrical tape over the two LEDs on the bottom side of this brown board. They were bright enough to illuminate the two closest red cyclotron reflectors when firing and I did not like the look of that. The tape was thick enough to effectively remove the light bleeding in from the old LEDs.

Battery Power:
If you are using the Matty Blaster or the GBFans Sound Blaster boards, you will need a different battery since the 3 AA pack included with the original Spirit Pack cannot deliver enough power to make those boards useful.

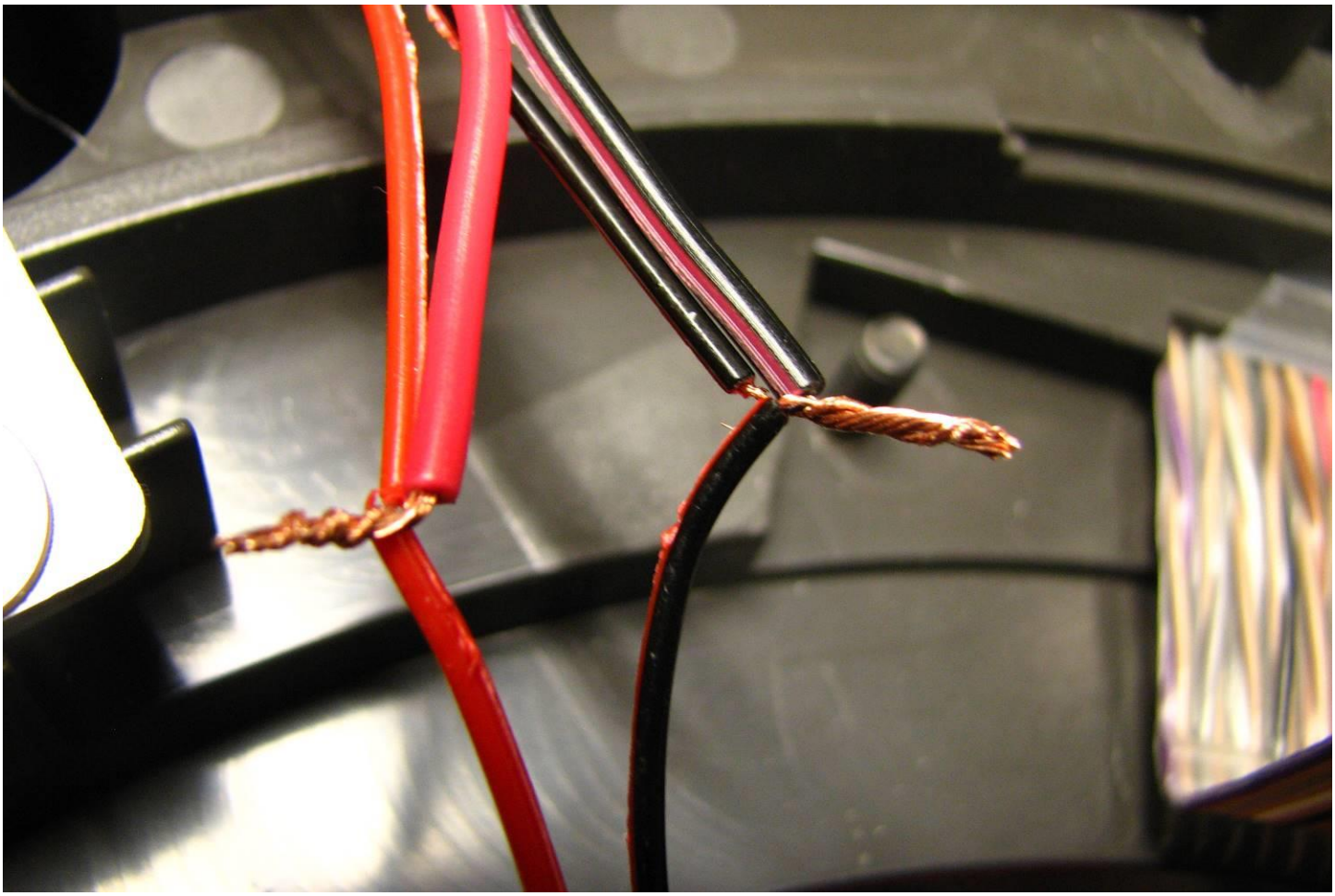
If you are keeping the original sound board, then we need to splice into the existing cable and route the battery to the powercell board and keep a connection to the top brown cyclotron/sound board.

Basically, we need to cut the thicker red/black paired wires going from the battery to the brown board and then reattach those but include the new Red/Black wire pair (#3) and secure those wire connections with the wire nuts (#4).

IMPORTANT NOTE: Where to cut the battery wire? I cut close to the brown board on this pack and it made it *very* difficult to strip the wires and not break the soldered connection to the board. I suggest you cut the wire halfway between the brown board and where the battery wires are glued to the board. Leave enough room to strip the wire without tugging on the brown board connections!

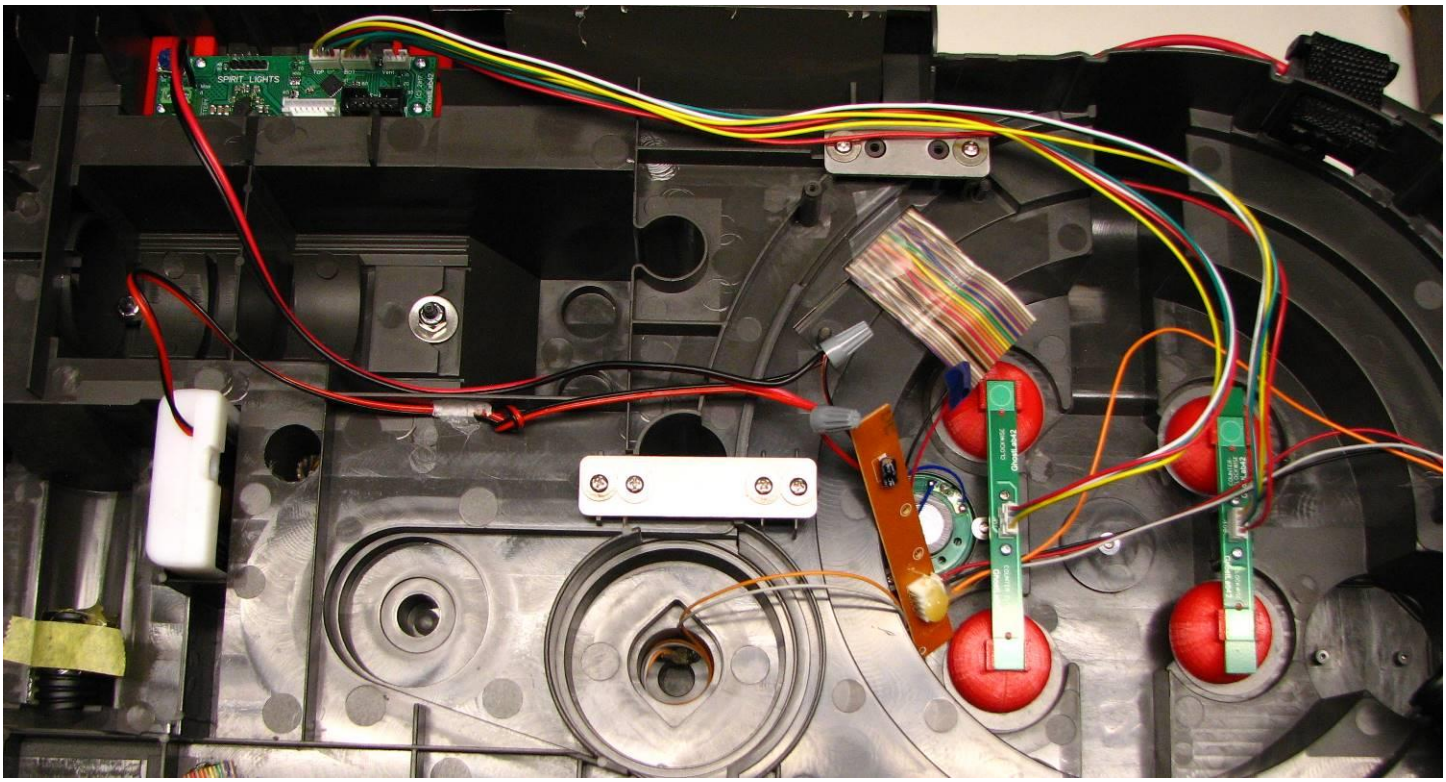
Each nut will connect 3 wire ends that are the same color (two from the cut battery wire and one from the new wire #3). Strip the three ends that go together to expose about 3/8" of copper. The other two ends of the new power wire (#3) should be striped to only 1/4" of exposed copper to go into the BATTERY screw terminals. "Gnd" is BLACK, and "Pos" is RED.

Here are the three wires of each color twisted together before the wire nut is used to hold and cover each connection:

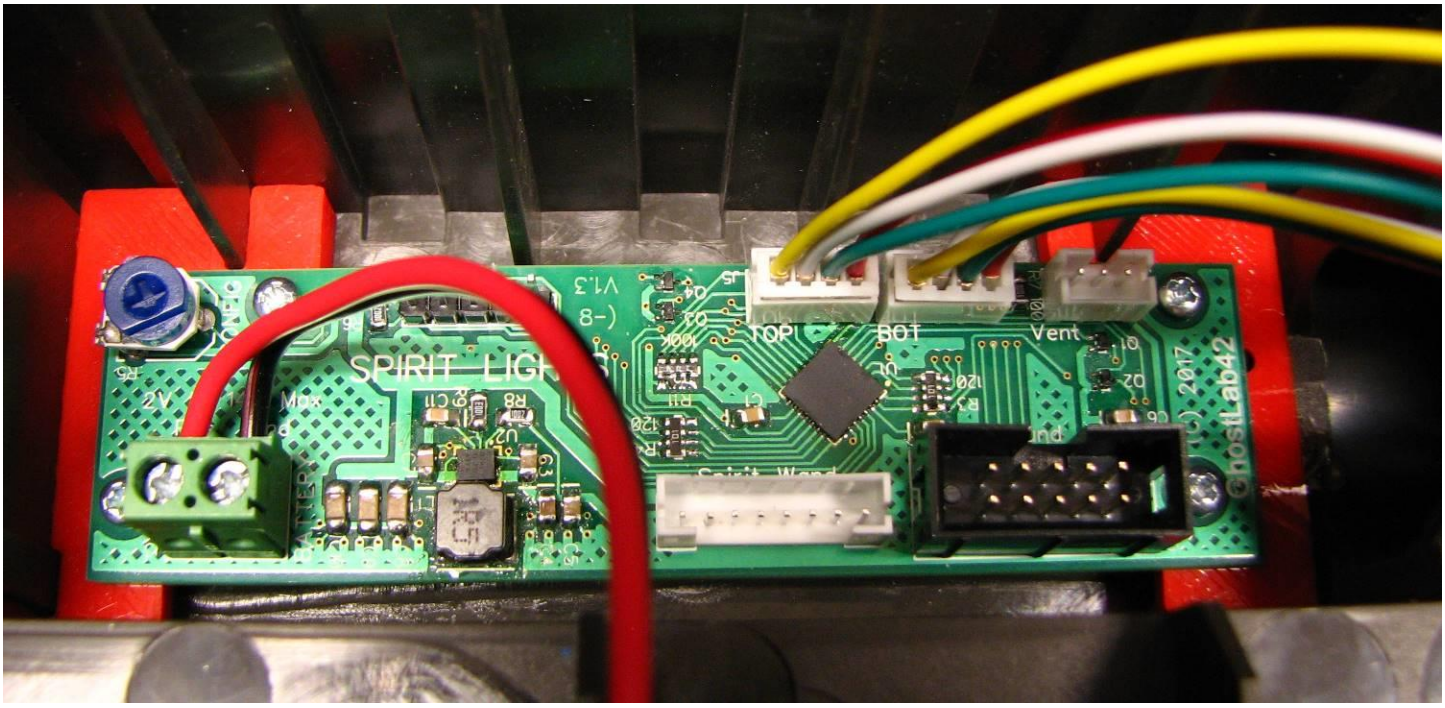


When attaching the new power wires (#3) to the powercell board screw terminals, take care of the color coding and make sure the BLACK wire goes to the screw terminal labeled “Gnd” and the RED wire goes to the screw terminal labeled “Pos”.

Next attach both cyclotron cables (#2), TOP to TOP and BOT to BOT, and your pack should now look like this (hopefully your wire nuts are farther from the brown board!):



And a closeup of the powercell board with the wires and cables attached:



Connecting to the Spirit Pack's original Sound Board

Nothing more to do. Load in some batteries, turn on the power switch on the battery pack and watch your new pack lights come to life. Press the fire button and the wand light and the original sound should still work as before. The Powercell and cyclotron lights do not know about the wand being fired, so they will just keep cycling the proper sequence as long as power is being applied.

No need for the Vent Light/Vent Relay cable (#1) since there is no way to trigger a vent operation.

"CONFIG"uration potentiometer:
Both "Red Cyclotron Only Mode" and "Red/Green Cyclotron Mode" can be used, though there is no way to activate the Green Cyclotron Slime Thrower operation or activate any venting sequences.

Connecting to the GBFans Sound Board

The Spirit original battery pack, top brown cyclotron/sound board and the battery connection wire (#3) are not needed.

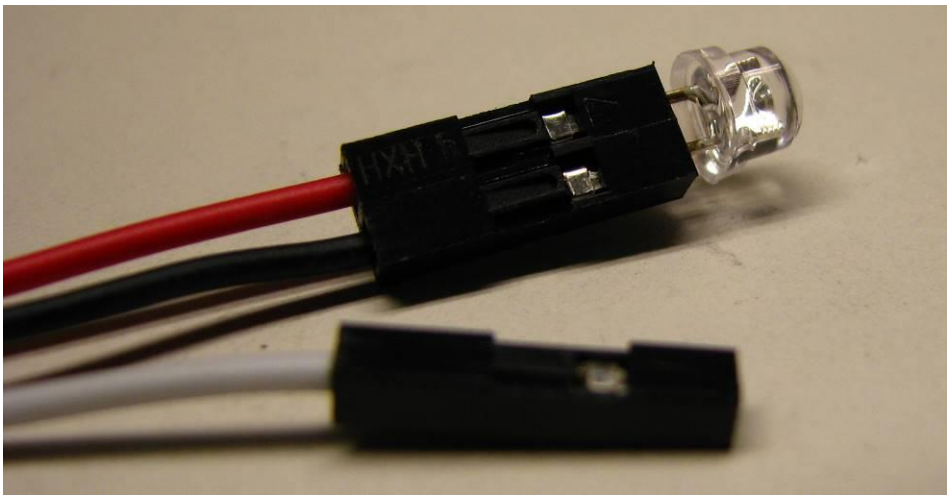
The GBFans 10 conductor "Power Cell / Cyclotron Ribbon Cable" is used to provide power and control to the Spirit Pack Lights board. Connect a 12V battery to the GBFans board for power to it and the Spirit Pack Lights.

*"CONFIG"uration potentiometer in "*Red/Green Cyclotron Mode":
There is no need for the Vent Light/Vent Relay cable (#1) cable since you can only use the Green mode or a vent light/relay but not both. (V1.2 limitation). With Version 2.0 of the circuit board, you can now use both.

In this mode you do get GREEN Cyclotron lights when the sound board is configured to be a Slime thrower.

*"CONFIG"uration potentiometer in "*Red Cyclotron Only Mode":
You can use the Vent Light/Vent Relay cable (#1) to either strobe a White LED (not included) or connect and power a Spirit Vent relay board (not included) in this mode.

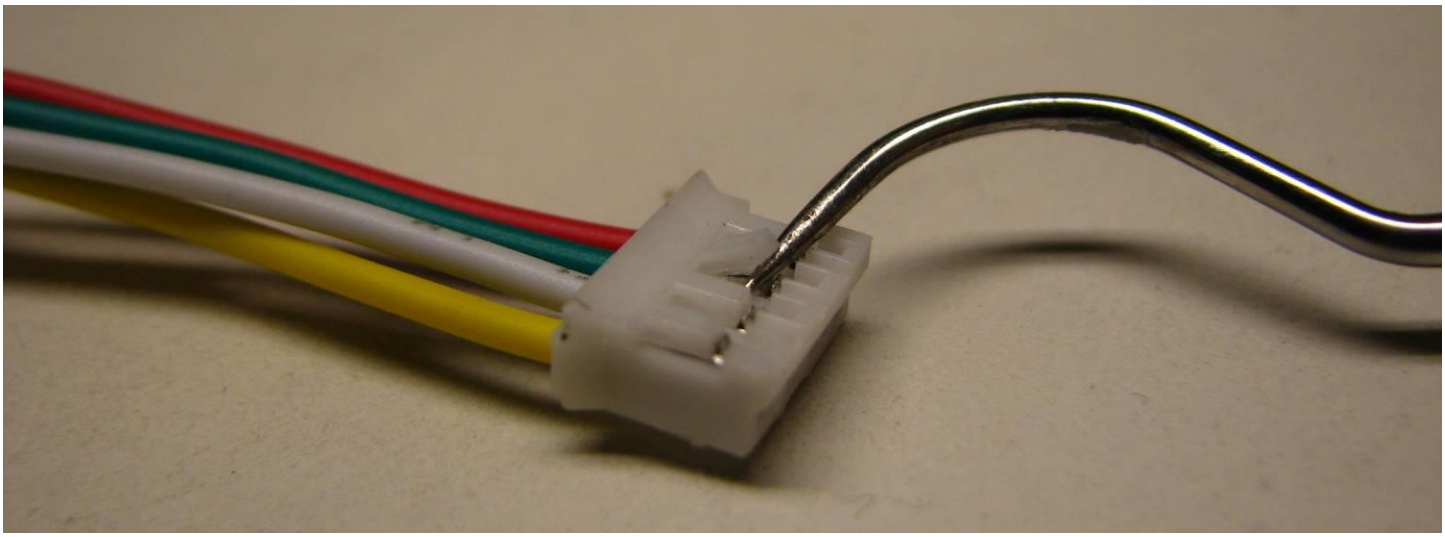
To use a vent light, you need to add the cable (#1) to the powercell board "Vent" connector and place a White LED (not included) into the dual position connector. Long LED lead in the Red wire side and the shorter LED lead into the Black wire side. The White wire is not used. Most any 2 to 4V LED that likes 20mA of current will work fine.

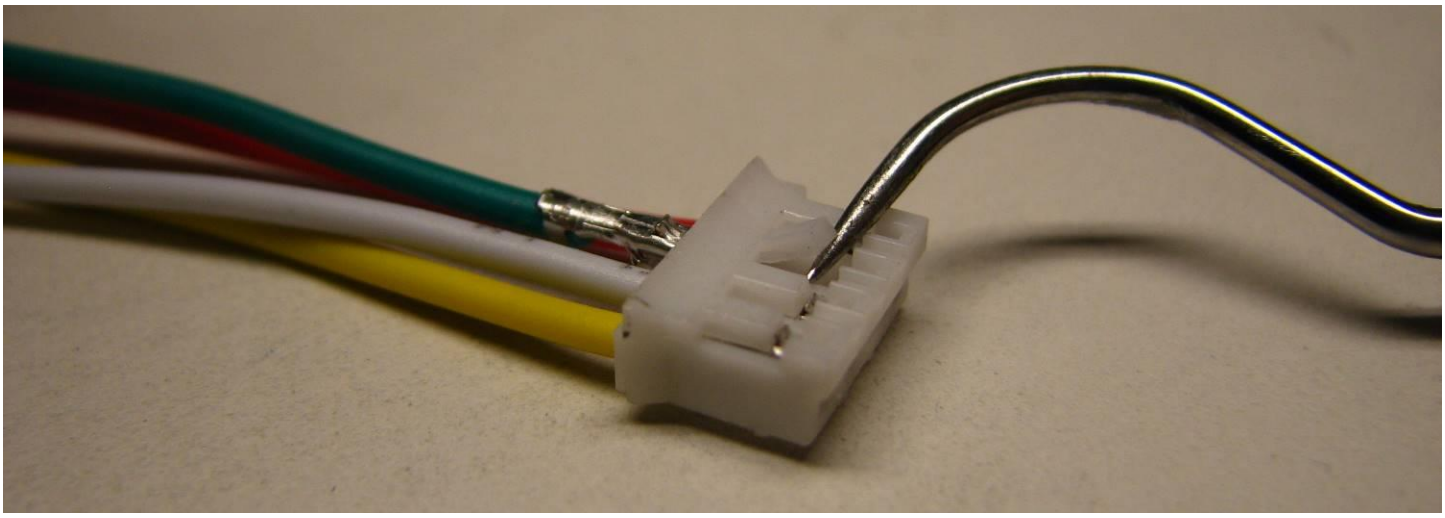


To use the Spirit Vent Relay, you need to plug the cable (#1) connectors onto the 3 connection pins on Spirit Vent Relay board. No pictures of that yet since the Spirit Vent Relay is not yet finished!

**** Cable modification is ONLY needed for V1.2 of Spirit Pack Lights Board ****

When venting, the regular Cyclotron cable wires (#2) will try and illuminate the Green Cyclotron lights when strobing and this is not desirable! To stop this from happening the GREEN wire needs to be removed from each of the cyclotron cables (#2). It is easy to remove a wire from the connectors using a dental pick, needle or tiny flat screwdriver. Gently lift up the plastic tab and the wire and socket will slide out of the connector:





With version 2.0 of the Spirit Pack Lights board, there is no need to remove the green wire – it will work fine with the green wire still installed in the cable.

Connecting to the Matty Blaster Sound Board

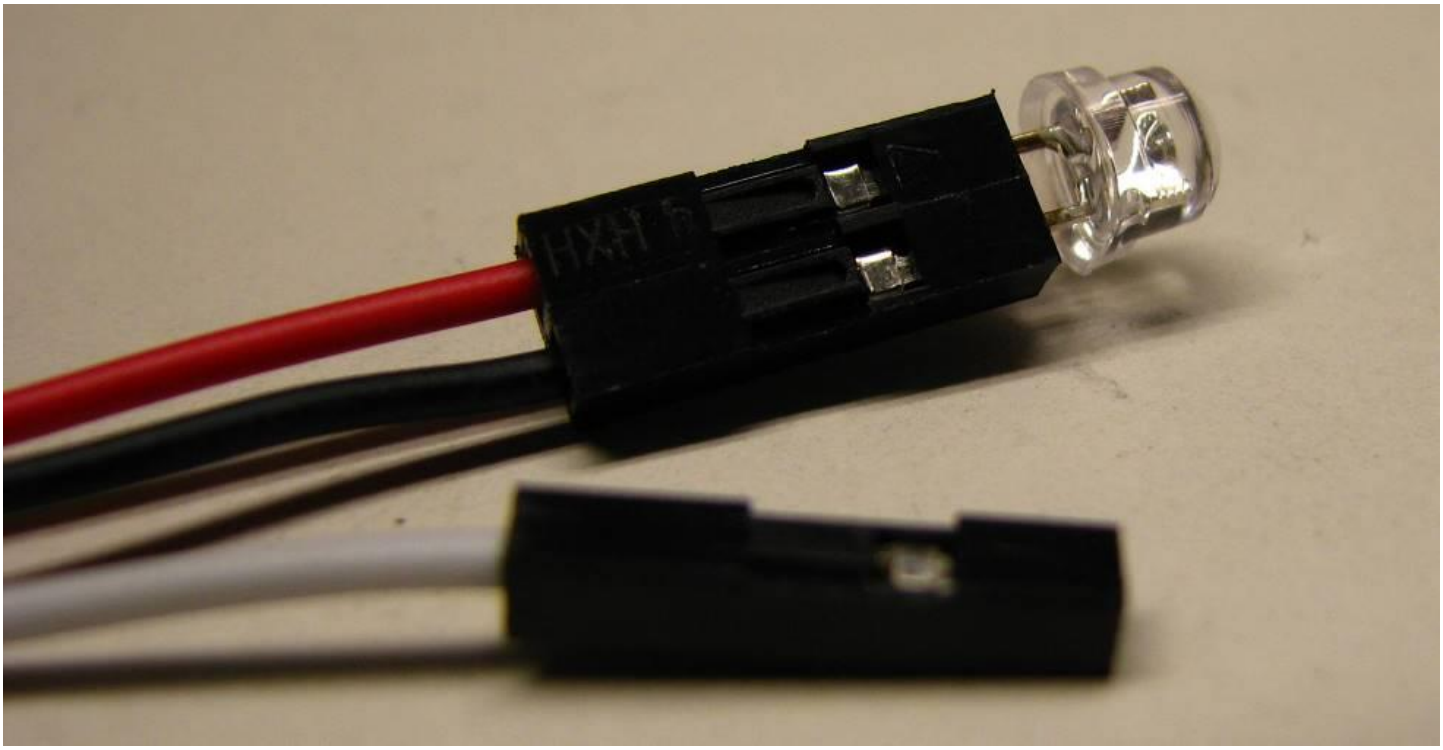
The Spirit original battery pack, top brown cyclotron/sound board and the battery connection wire (#3) are not needed.

The GBFans 10 conductor "Power Cell / Cyclotron Ribbon Cable" is used to provide power and control to the Spirit Pack Lights board. Connect a 12V battery to the Matty Blaster board for power to it and the Spirit Pack Lights.

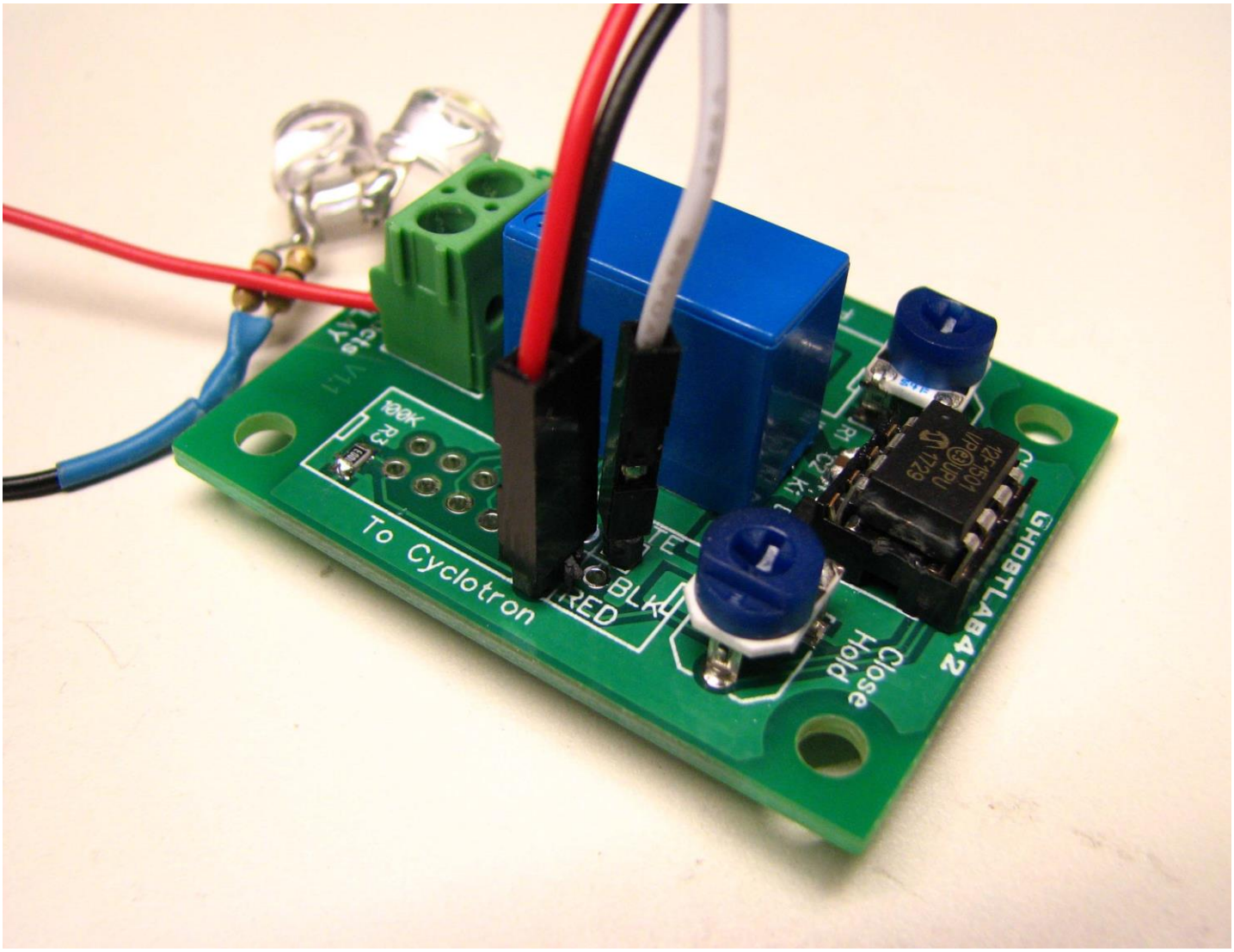
*"CONFIG"uration potentiometer in "*Red/Green Cyclotron Mode":
In this mode you do NOT get GREEN Cyclotron lights since the Matty Blaster does not support the Slime Thrower mode. You can use this configuration, but the Vent Light/Vent Relay will not work if you have V1.2 of the Spirit Pack Lights board. Version 2.0 of the board will work fine.

*"CONFIG"uration potentiometer in "*Red Cyclotron Only Mode":
You can use the Vent Light/Vent Relay cable (#1) to either strobe a White LED (not included) or connect and power a Spirit Vent relay board (not included) in this mode.

To use the vent light, you need to add the cable (#1) to the powercell board "Vent" connector and place a White LED (not included) into the dual position connector. Long LED lead in the Red wire side and the shorter LED lead into the Black wire side. The White wire is not used. Most any 2 to 4V LED that likes 20mA of current will work fine.

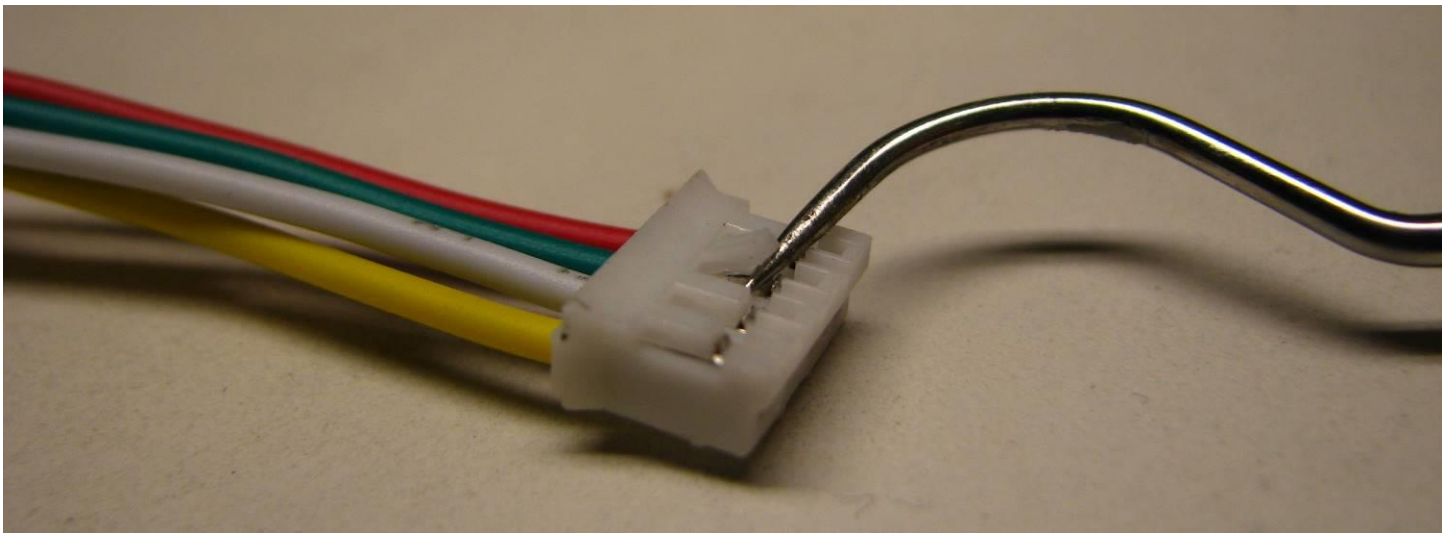


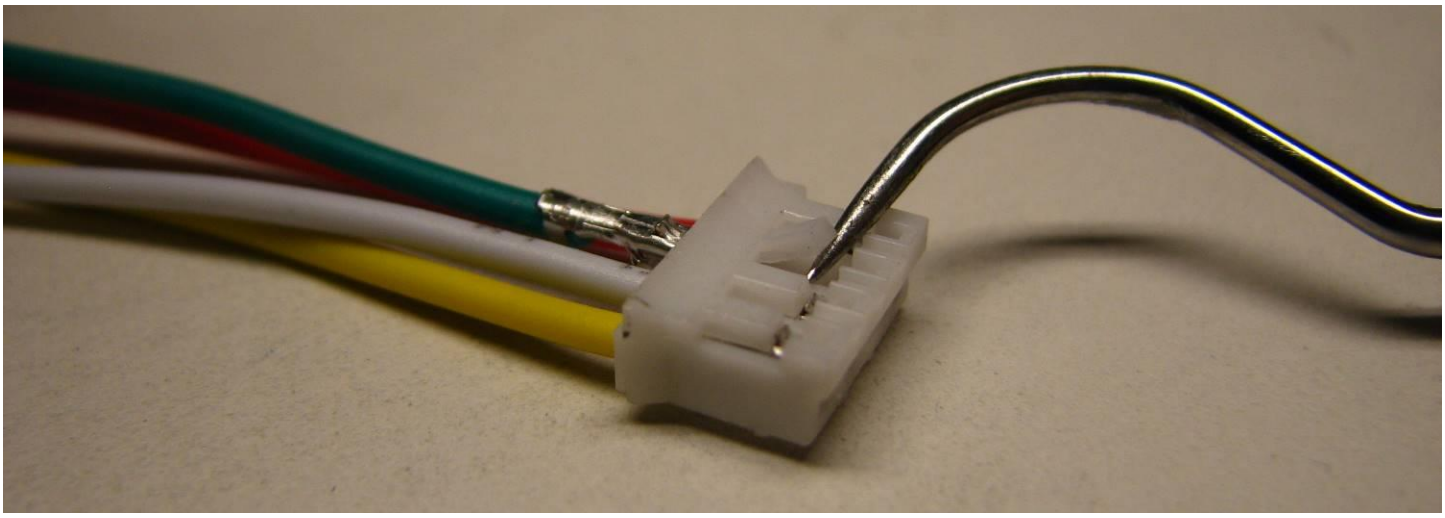
To use the Spirit Vent Relay, you need to plug the cable (#1) connectors onto the 3 connection pins on Spirit Vent Relay board and take care to match up the wire colors as shown on the vent relay circuit board:



**** Cable modification is ONLY needed for V1.2 of Spirit Pack Lights Board ****

When venting, the regular Cyclotron cable wires (#2) will try and illuminate the Green Cyclotron lights when strobing and this is not desirable! To stop this from happening the GREEN wire needs to be removed from each of the cyclotron cables (#2). It is easy to remove a wire from the connectors using a dental pick, needle or tiny flat screwdriver. Gently lift up the plastic tab and the wire and socket will slide out of the connector:





With version 2.0 of the Spirit Pack Lights board, there is no need to remove the green wire – it will work fine with the green wire still installed in the cable.

Advanced Standalone Operation

For those adventurous enough to make their own cable and connect their own switches, the Advanced Standalone mode has additional capabilities compared to the standalone mode when no sound board in control.

The Advanced Standalone mode does support up to four additional switch connections wired directly to a "Spirit Wand" connector cable:

1) PowerUp/Down toggle switch
    a. Enables a power up sequence (if the configuration allows) when the switch is open
    b. Enables a power down sequence when the switch is closed
    c. If power is applied and the switch is closed, the board waits for the switch to be opened
2) Fire momentary switch
    a. Will cause the sequence to speed up when the switch is closed
    b. Will slow back down to the normal sequence speed when the switch is open
3) Vent momentary switch (or toggle)
    a. Vent sequence when the switch is closed (if allowed)
4) Pack Selection toggle switch
    a. The Proton Pack mode is selected when this switch is open
    b. The Slime Thrower mode is selected when this switch is closed

The inputs are all single ended and the switches would need to share a common ground signal (one of the 2 "Gnd" signals in the cable) and just short the selected input to Gnd. If this does not make sense, don't try this advanced operation mode!

"Spirit Wand" 8 pin connector (2mm pitch) Pinout:

Pin "1" is Next to "J1" label

8: GND, connected to "Gnd" Standalone use Battery Connector
7: +VBattery (3VDC to 14VDC), connected to "Pos" Standalone use Battery Connector
6: +VBattery (3VDC to 14VDC), connected to "Pos" Standalone use Battery Connector
5: GND, connected to "Gnd" Standalone use Battery Connector
4: Pack Select (Gnd = SLIME Thrower), has a 100KΩ pullup to +5VDC
3: Vent (Gnd = Vent), has a 100KΩ pullup to +5VDC
2: Fire (Gnd = Fire), has a 00KΩ pullup to +5VDC
1: PowerUp/Down (Gnd = PowerDown), has a 100KΩ pullup to +5VDC