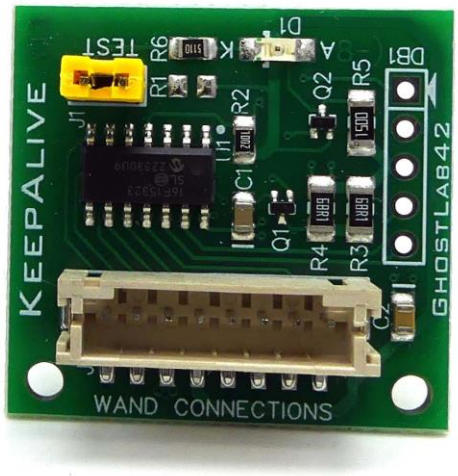
# Introduction

Congratulations on purchasing the Spengler Wand KeepAlive Kit that allows the Hasbro Ghostbusters Plasma Series Spengler's Neutrona Wand to stay powered on until you turn it off!

The Wand KeepAlive Kit is designed to be permanently installed inside the wand and then provide one main function: Keep the wand powered up so that it does not shut down automatically after 30 seconds of inactivity.

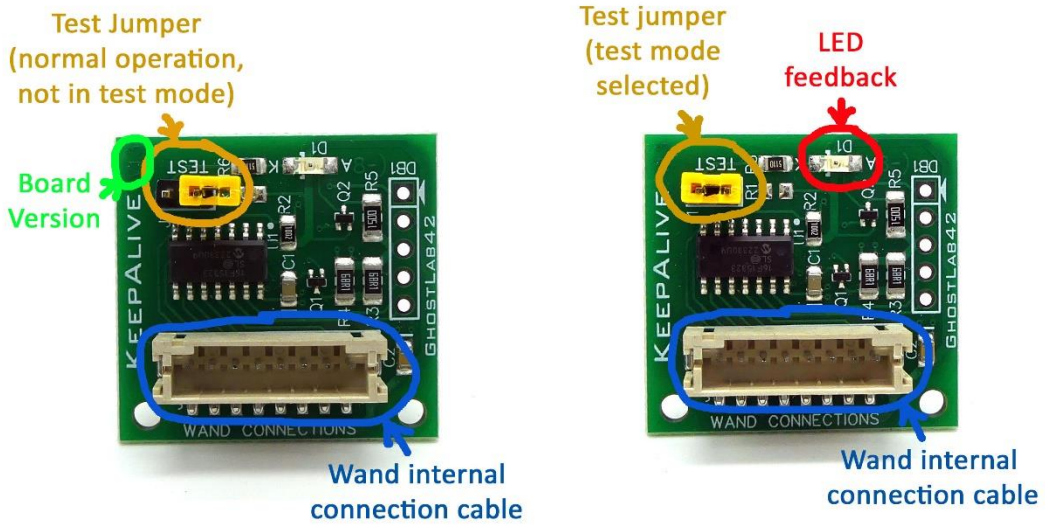
The Spengler wand will still shut down if you fire long enough to trigger the overheat functions. But this enables the pack to shut down for a short amount of time to simulate the pack overheating and needing to recover. Both the pack and the wand will automatically power back up in a few seconds to allow you to continue Bustin' Ghosts!




The Wand KeepAlive board does use some additional battery current even when the wand is shut down so it is recommended that you remove the batteries if the wand will not be used for extended periods of time. If you also have the Pack KeepAlive kit installed in your Hasbro HasLab Ghostbusters Plasma Series Spengler's Proton Pack, then you have a switch available to disconnect the batteries to both the pack and the wand.

***Connections and Settings:***




There is only one cable connection:

1) WAND CONNECTIONS, 8 pin connector (PH style, 2.0mm pitch)
   An 8-wire connector that provides the actual connections to Spengler Wand's electronics.

Test Selection.

There are two jumpers that can be used to select one of several features:

| TEST | Description |
|---|---|
| Off | Normal operation: bypass all timeouts that turn off the wand. |
| ON | Test mode |

The above image shows the "KeepAlive" feature that is the normal operating mode on the left and the test mode operation on the right.

A jumper is considered "ON" when the small shorting part is connected to both pins. A jumper is considered "off" when it is not connected to both pins. Yes, you could just remove the shorting part completely, but I like to keep it on one pin just so you can find it later.

LED Feedback

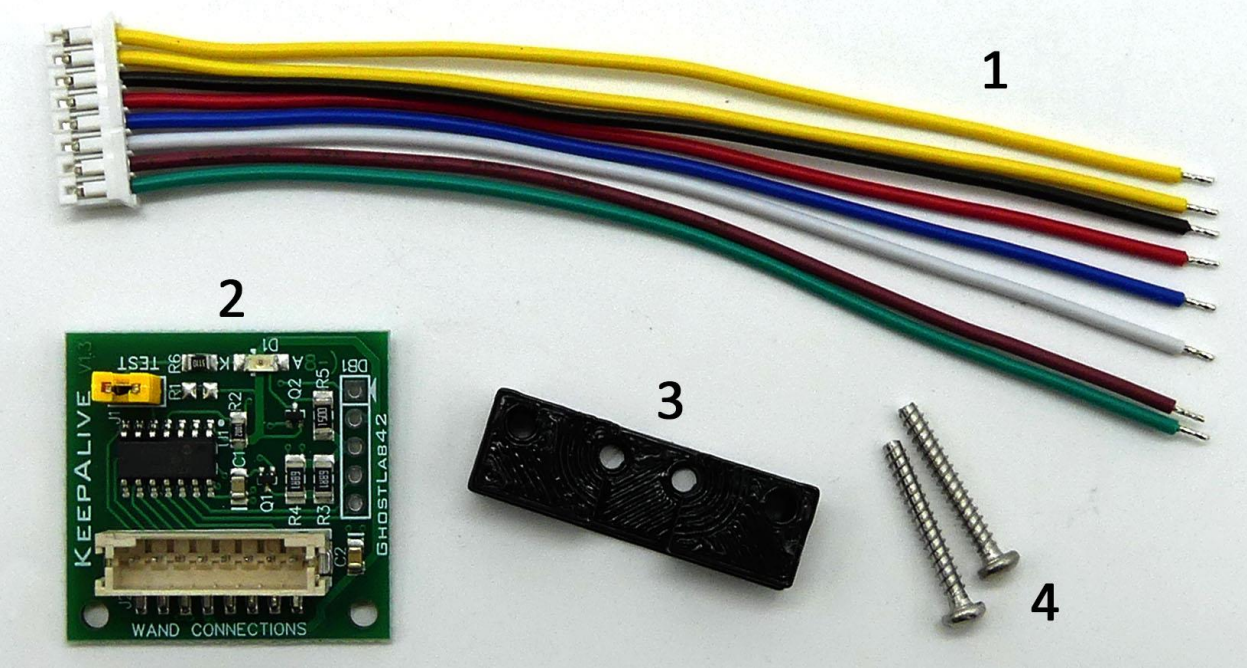
The Test mode will display the firmware version and then have you go through a is a sequence of steps you need to perform to make. During the test mode, the RED LED will provide feedback, so you know that each step has been completed. See the Test Mode section towards the end of this document.

It also turns on during certain operations, so can be ignored during normal operating mode.

Board Version

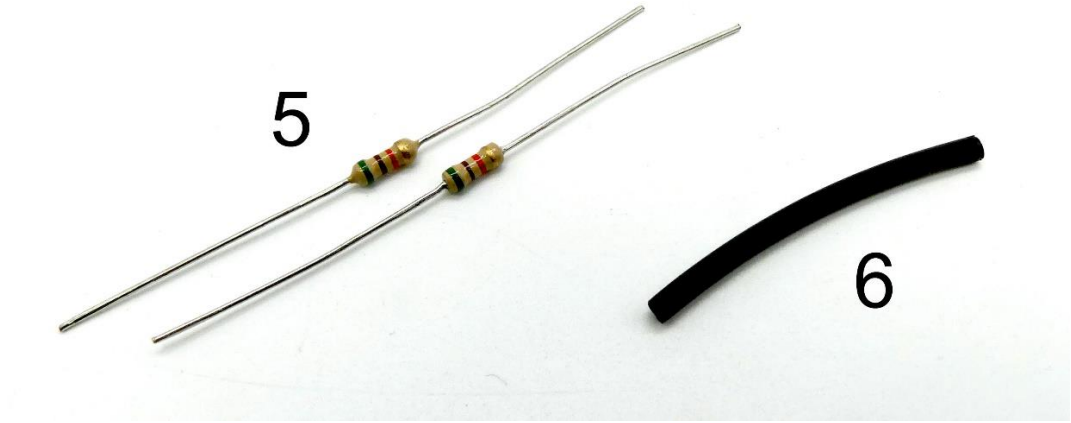
Separate from the firmware version is a board version number that is part of the copper on the top side of the board.

# Spengler Wand KeepAlive Kit Contents:




The Spengler Wand KeepAlive contains several parts to complete the installation into your wand.

1) Wand Connections 8-wire cable (internal connections to the wand circuit board)
   The two YELLOW wires may be PURPLE in some cables
2) Spengler Wand KeepAlive board
3) Mounting Bracket (Secures the Wand KeepAlive to the wand)
4) Mounting screws (holds Wand KeepAlive board on bracket and wand)




5) 2x 51K ohm 1/4W resistors
6) Black heat-shrink tubing

# Installation into the Spengler Wand

***Getting started:***
The first step is to unscrew the end cap from the handle and remove the battery pack so that nothing will be powered while we perform the disassembly and subsequent installation of the new electronics board.

***** ZAP WARNING RANT *****
A note of caution about static electricity. That zap you can give to someone or something when you rub you shuffle across carpet on a dry day and then feel and hear when you come in contact with someone or something like a doorknob is an ESD event (Electro-Static Discharge). This can be annoying or fun or both but can be very damaging to electronics.

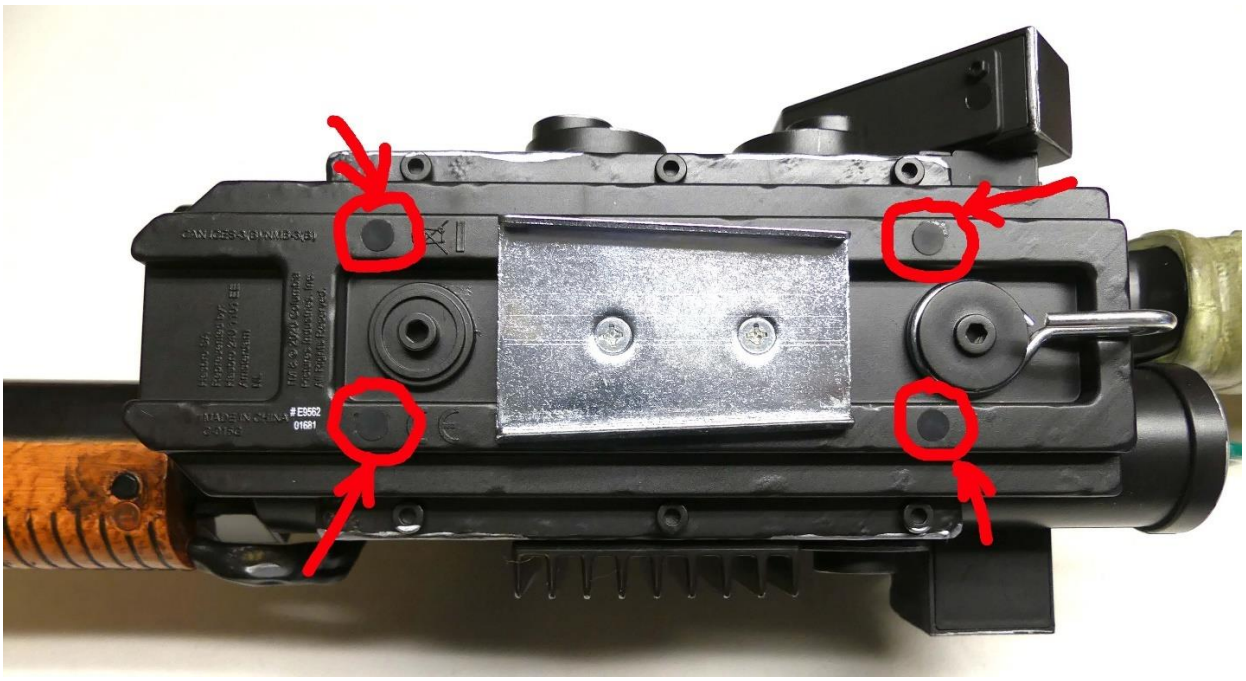
It is best to discharge yourself before touching any of the internal electronics or any of the electronics you are going to put in the wand, like the Spengler Wand KeepAlive board. You can do this by touching something that is metal and is plugged into a 3 prong (grounded) output. If this is not practical, try not to walk around much when working on the electronics and do go touch those doorknobs before you start working on this.

Also be careful of others that may try and zap you while you are working, either intentionally or unintentionally! Just walking up and touching you while you are touching the electronics may cause problems.
***** END OF ZAP WARNING RANT *****

## *Open the wand up:*
Start by removing the rails from the back of the Spengler Wand so we can access the inside of the wand.

Tools Needed:
- 1/8” drill bit and drill
- Small-Medium Philips head screwdriver
- Dental pick or needle – some small pointy thing

There are four screws holding the rails to the back of the wand and they are covered by glued on caps that and are located here:



Use the drill on low speed (screwdriver speed) and start to drill the center of the cap that covers the screw with the 1/8" drill bit. You want to drill in far enough for the bit to "grip" the cap, but not so deep that you will drill the head of the screw. The caps are about ¼" deep, but you only need to drill in about 1/16" to get the bit to grip onto the cap.

Stop drilling with the bit in the cap and pull then pull the drill away. It should pop the cap out. Keep the caps for when you want to cover back up the screw heads.
I tried with smaller bits and they did not provide enough grip and just pulled the bit out and left the cap in place. Tried to pry that out with the dental pick but they were too stubborn.

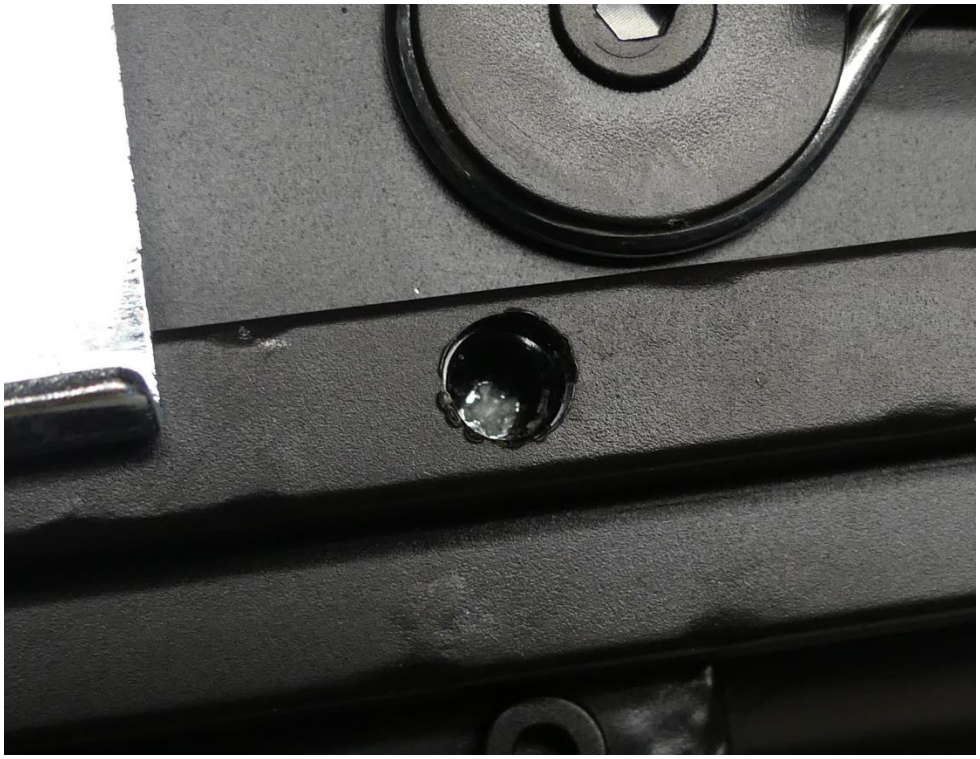


Once the caps are out you may have glue sitting in the hole and filling the head of the Philips screw making it difficult to unscrew.  Use the dental pick (or needle) to scrape out the glue and clean it out of the Philip's head slots so that the screwdriver can have a good connection with the screw head.

Before:



After:

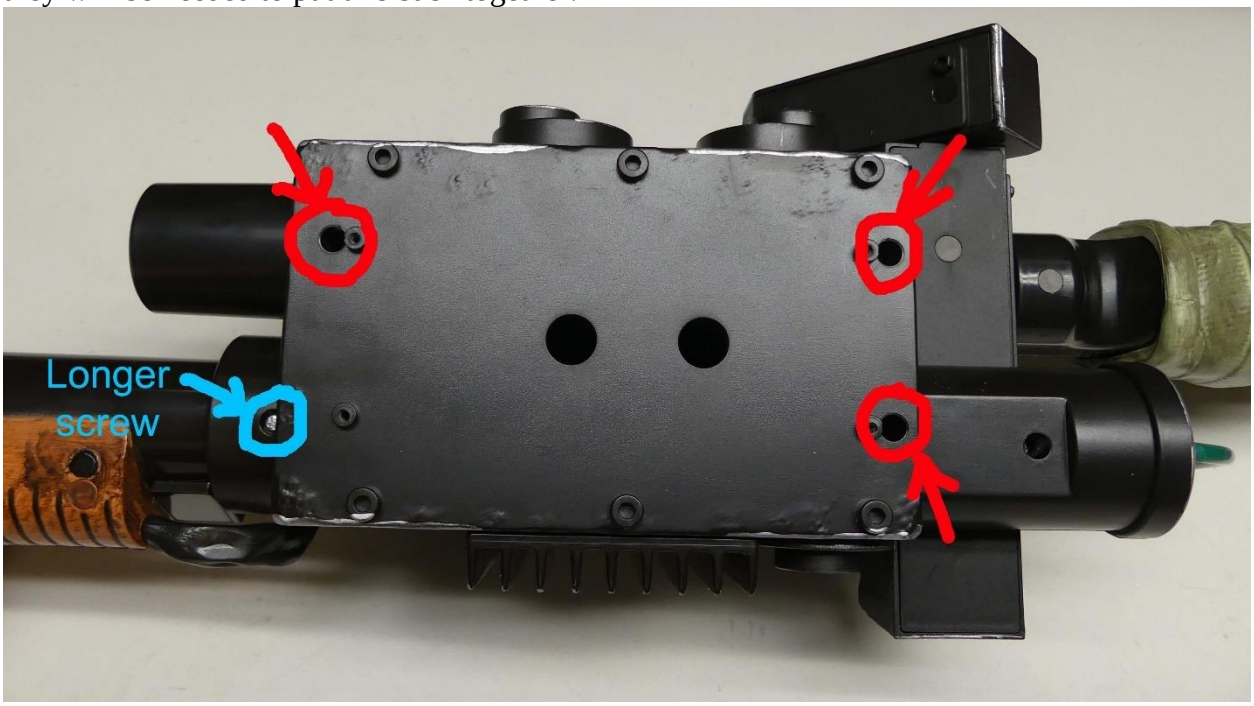


Once the glue residue has been removed, use the screwdriver to remove the four screws. Keep the four screws so you can put them back in when we are done installing the electronics and cables. I use an egg carton to hold, separate and organize the tiny parts that I am removing.

Remove and set aside the rails.

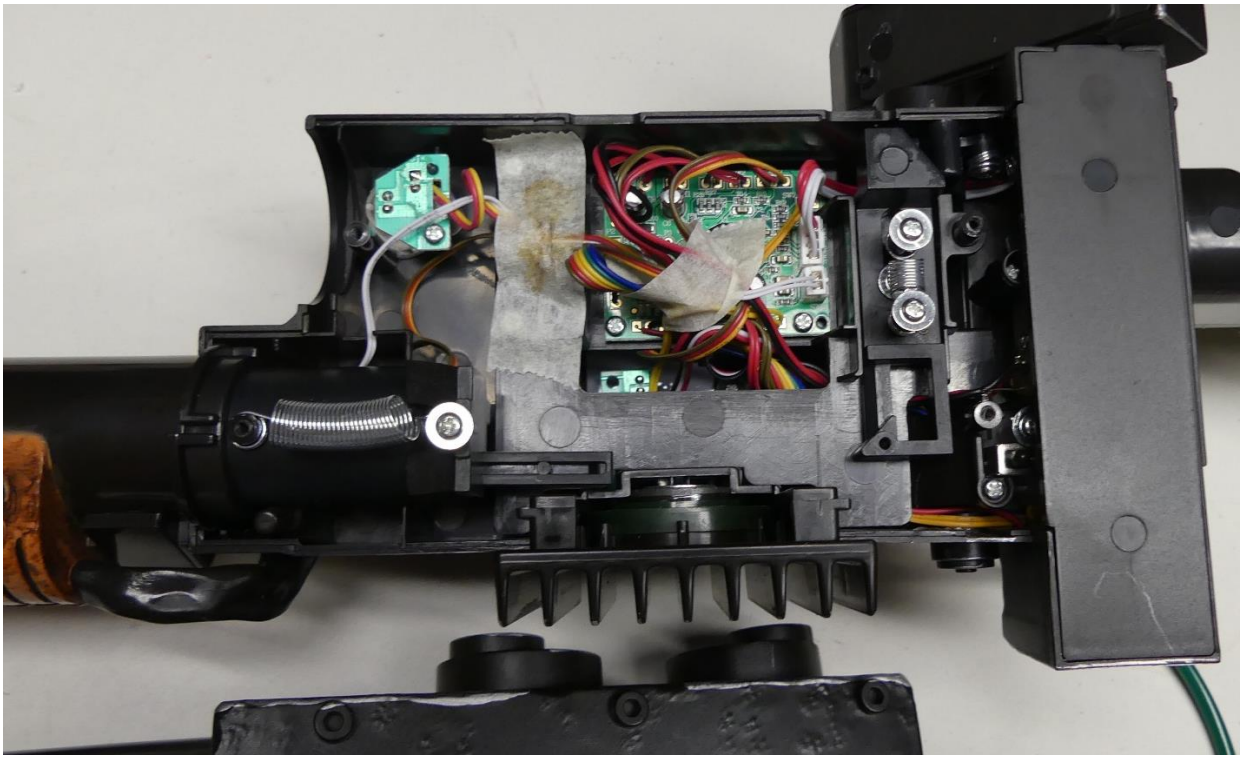
***Remove the wand body bottom:***
We do want the wand tip popped out so there is more room for us to maneuver around, so if the wand top is pushed in, pull on the green level and have the wand pop out before you remove the screws from this bottom piece.

Remove the next set of 4 screws that are holding the bottom piece in place: 3 short screws in the main body of the wand and one longer screw that goes into the wand tube. Keep the screws since they will be needed to put this back together.




Lift the bottom piece off and leave the heat sink and speaker in place attached to the wand. The wires that go to the speaker may become damaged if you remove the heatsink/speaker and just let it dangle and bounce around while doing the rest of the mods. The green tubing will keep this bottom panel close by, but it is a pain to remove so leaving it attached and dangling should not be a problem.

You should now have a nice view of the internal workings of the wand:



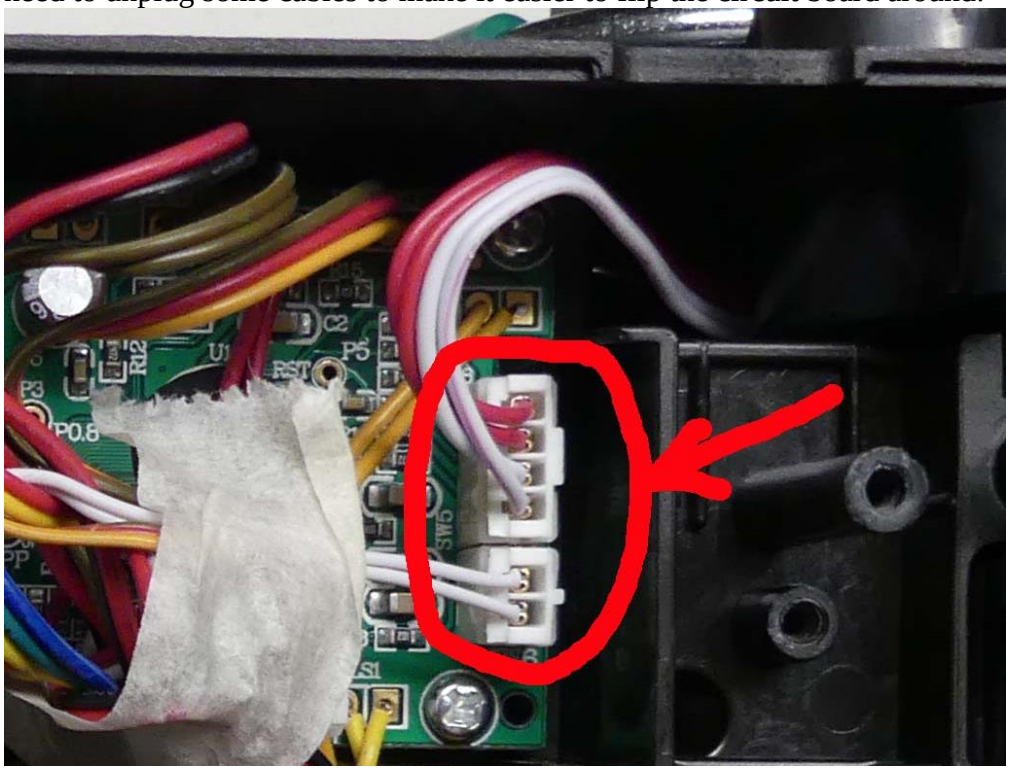
## *Preparing for the new addition:*

In this step we need to clear a place to mount the New Wand KeepAlive board to the wand.

Tools Needed:

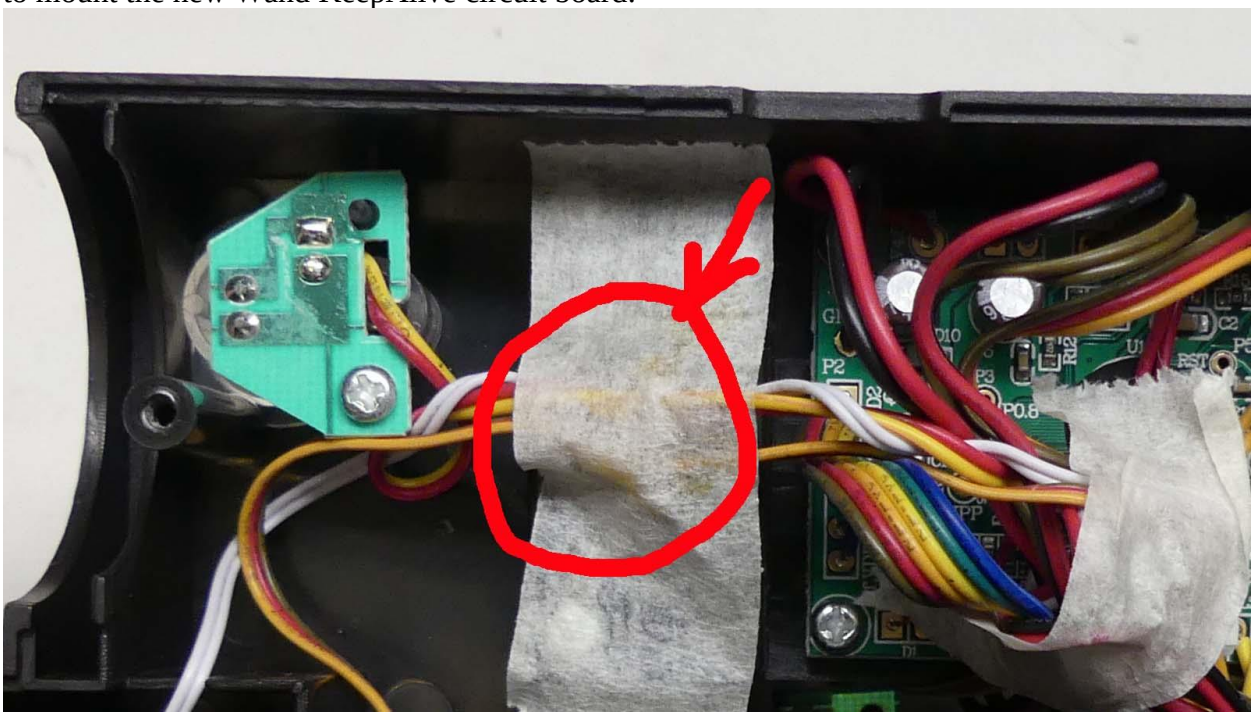
- Dental pick
- Needle nose pliers

Next, we need to unplug some cables to make it easier to flip the circuit board around:



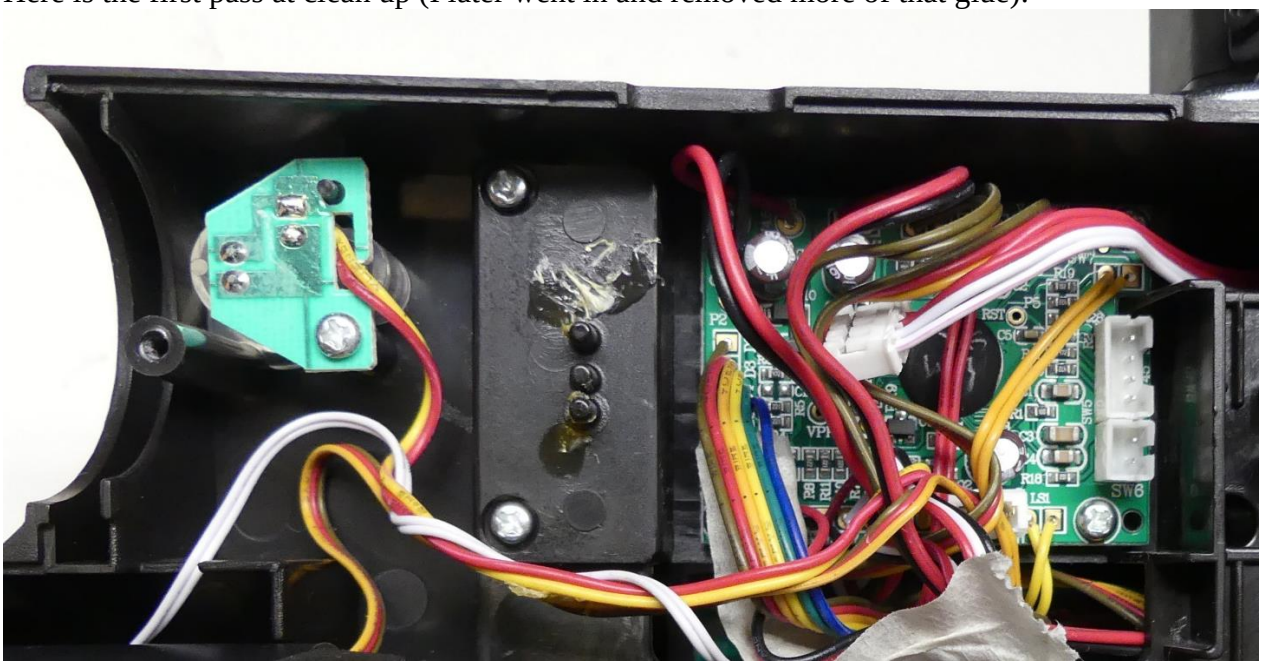

The cables are held in place by a couple of tabs on the right-hand side of the connector that go into indents on the socket. It is just friction but holds them tightly. Not sure the best way to remove these – you can pull from the wires and they will give, but it does stress the wires to do that. I use a curved dental pick and pry them up from the sides of the connectors where there is a lip for the pick to grab on to. I tried pliers and that did not go too well since the connectors are quite easy to squeeze and possibly damage.

Next let's clear a path for the few cables that are currently glued and taped down where we want to mount the new Wand KeepAlive circuit board:

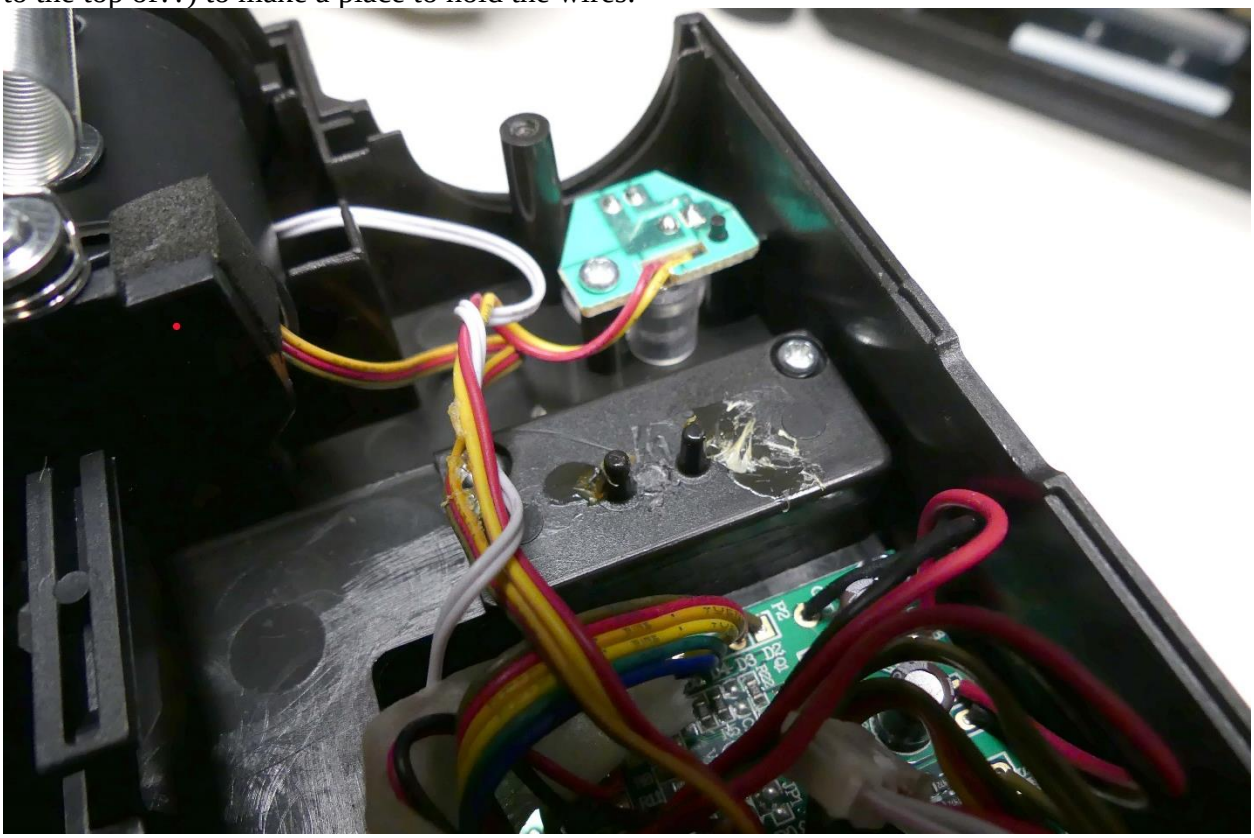


Peel off the white table and the wires should be exposed. They are glued down around (haphazardly!) under the tape, so just take your time and free the wires from the posts. Then remove the glue around the posts. A small flat screwdriver or your favorite dental pick both work well at removing the sticky stuff.

Here is the first pass at clean up (I later went in and removed more of that glue):



I then removed the center of the three posts (why are there three posts that they glued the wires to the top of??) to make a place to hold the wires:



To remove the center post, I just used needle nose pliers and grabbed the center post as close to the base as possible and then rocked it to the side and it came off easily.

## *Soldering the Spengler Cable to the original electronics circuit board*

In this step you will solder the Spengler Wand KeepAlive cable to the original electronics board so the Spengler Wand KeepAlive can see what is happening and either supply or receive power.

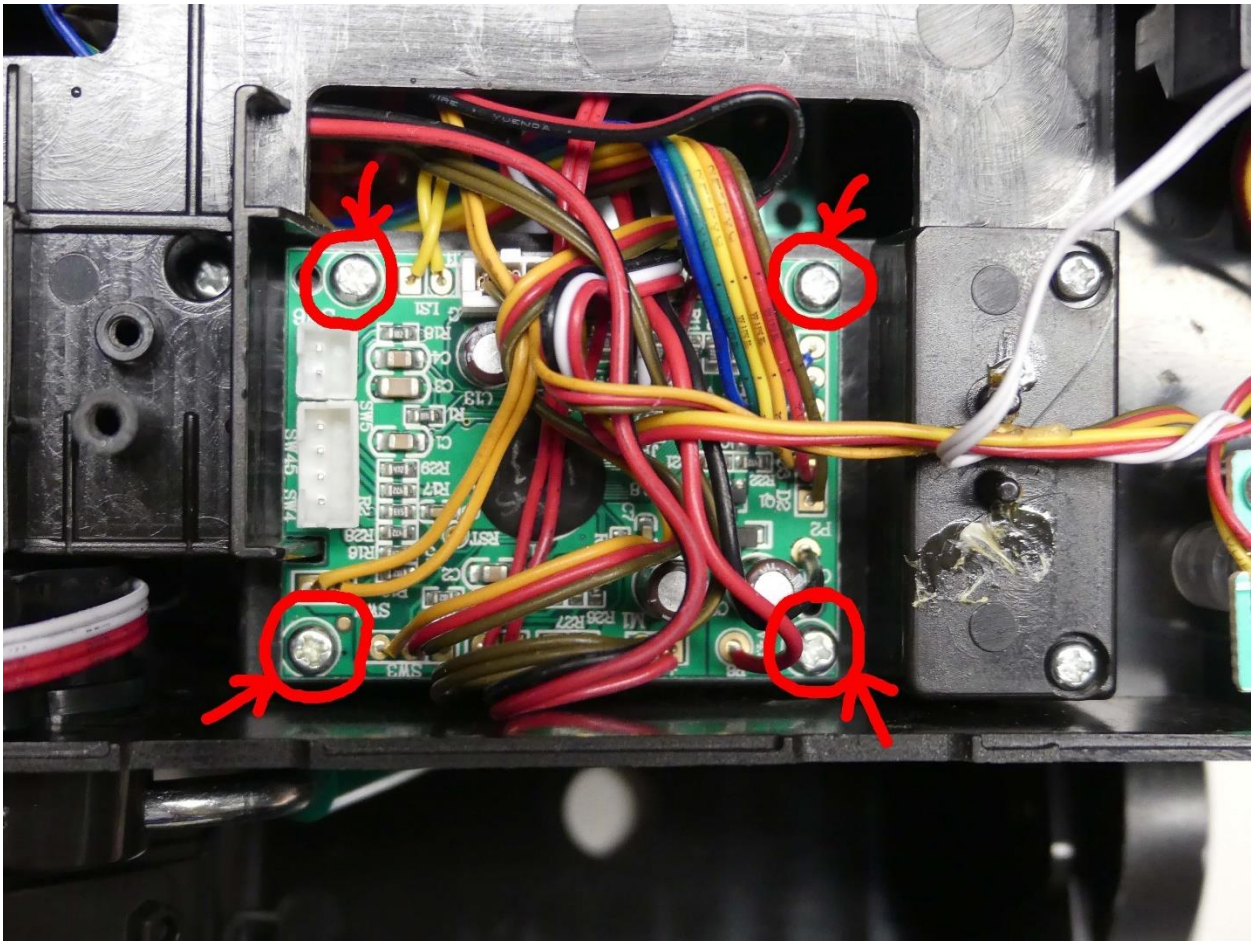
Tools Needed:

- Small-medium Philips head screwdriver
- Soldering iron and solder
- Wire cutters (diagonal or flush)

Parts needed

- 8-wire cable #1

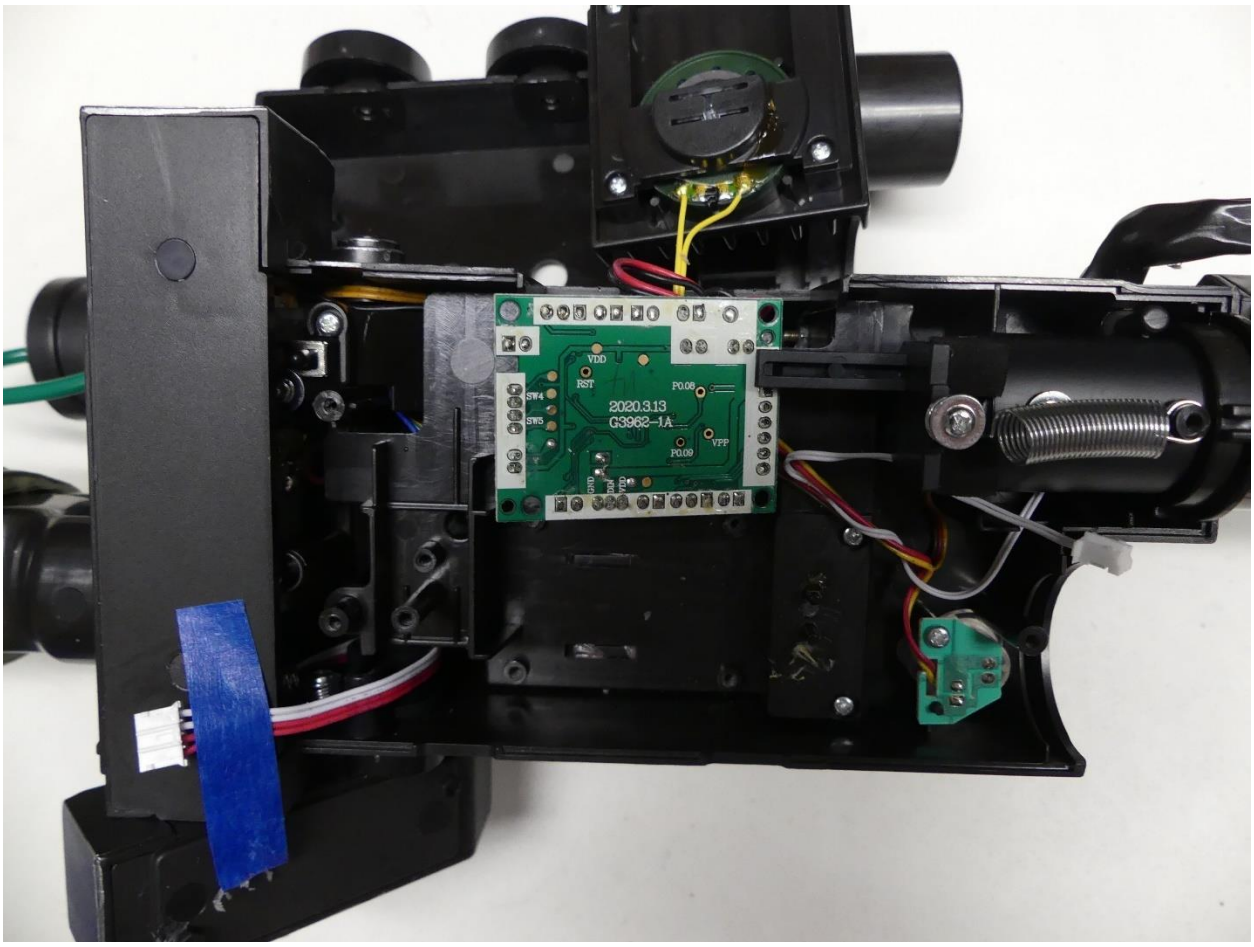
Remove the four screws that are holding the original electronics circuit board in place. The Latch mechanism was removed for these photos, but it should be able to be left in place.



Keep these four screws since you will be needing them to hold this board in place after the soldering has been completed.

I lifted and pulled out the heat sink with the attached speaker to perform the soldering.  Take care not to pull on the speaker wires.

Lift up slightly and flip the board over in a position that will allow soldering to the bottom of this circuit board.  You may want to remove the tape and make sure not to pull too much on any of the whiles while repositioning the board.  The end of the lathing mechanism on the wand tube held the board in place quite nicely:




All 8 wires of the cable #1 will be attached to different locations on this board.

When soldering, tin the wires (even though they are already tinned) and the pads to be soldered prior to making the connection.  Having the same solder on each will make it easier for the soldering process.

Also note:

- Do not overheat the wire as it can melt the insulation
- Keep the tinned end of the wire short enough not to stick out of the solder pad area and onto an adjacent pad or wire end (use a flush or diagonal wire cutter)
- Make sure the solder does not bridge to an adjacent solder pad or wire

*** Optional Improvement with V1.4 of the Wand KeepAlive board ***

The KeepAlive function when the rumble motor running was dependent on the position of the top rotary dial: If the dial was in one of the “detent” positions, the KeepAlive worked fine. If the dial was in between detent positions, the switch would short out the connections and the wand would not be kept alive with the rumble motor going.

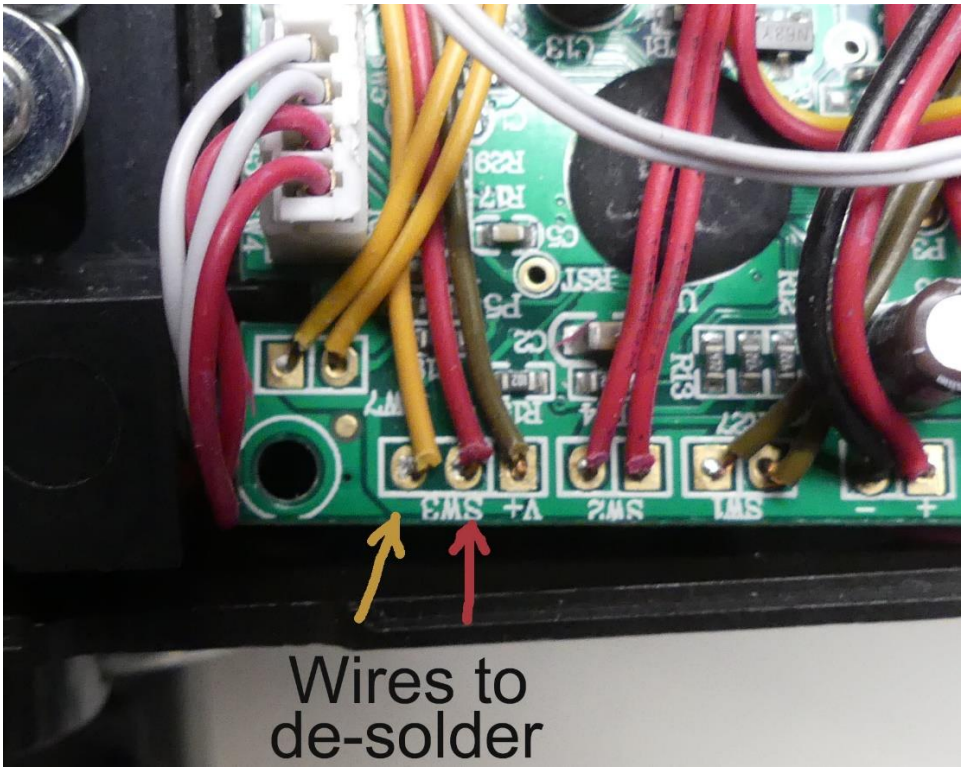
To make this more robust, the V1.4 of the board is designed to drive the output differently and relies on the addition of two external components between the wires and the original circuit board to work effectively. This involves the two 51K ohm resistors (#5) and heat shrink tubing (#6) to cover the connections.

This step is ***_optional_***, so is not required. If not installed, the KeepAlive will be sensitive to the top dial position. If these parts are installed, the KeepAlive should work without regard to the wand’s top dial position.

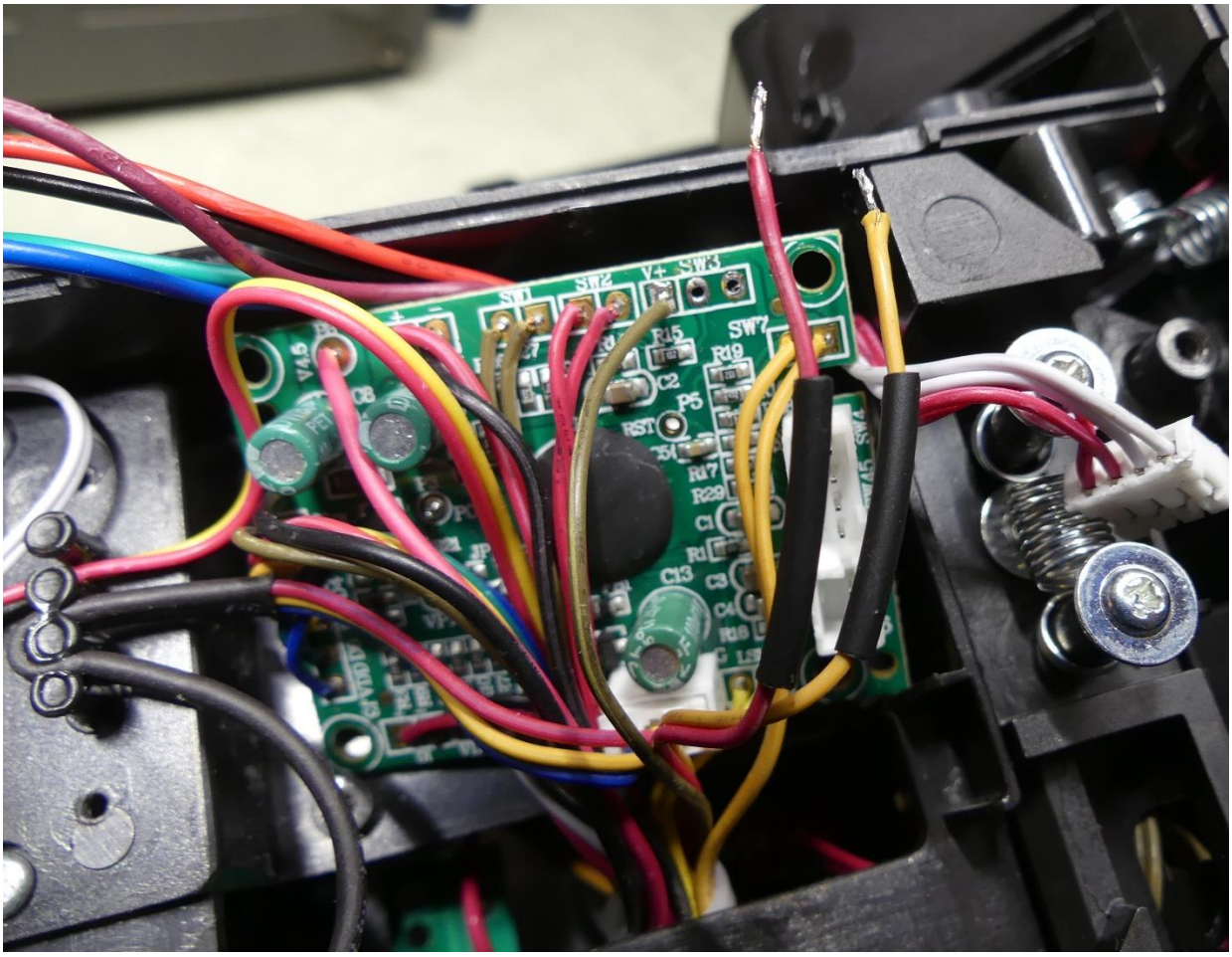
*Installation of the upgraded parts (#5 and #6)*

Two wires that go between the top dial knob sensor and the original circuit board need to be separated from the original circuit board. These are part of 3 wires that are together and connect to “V+ and SW3. Only the two wires labeled “SW3” need to be disconnected. They are the YELLOW and RED wires and order does matter or else the switch will be reversed.

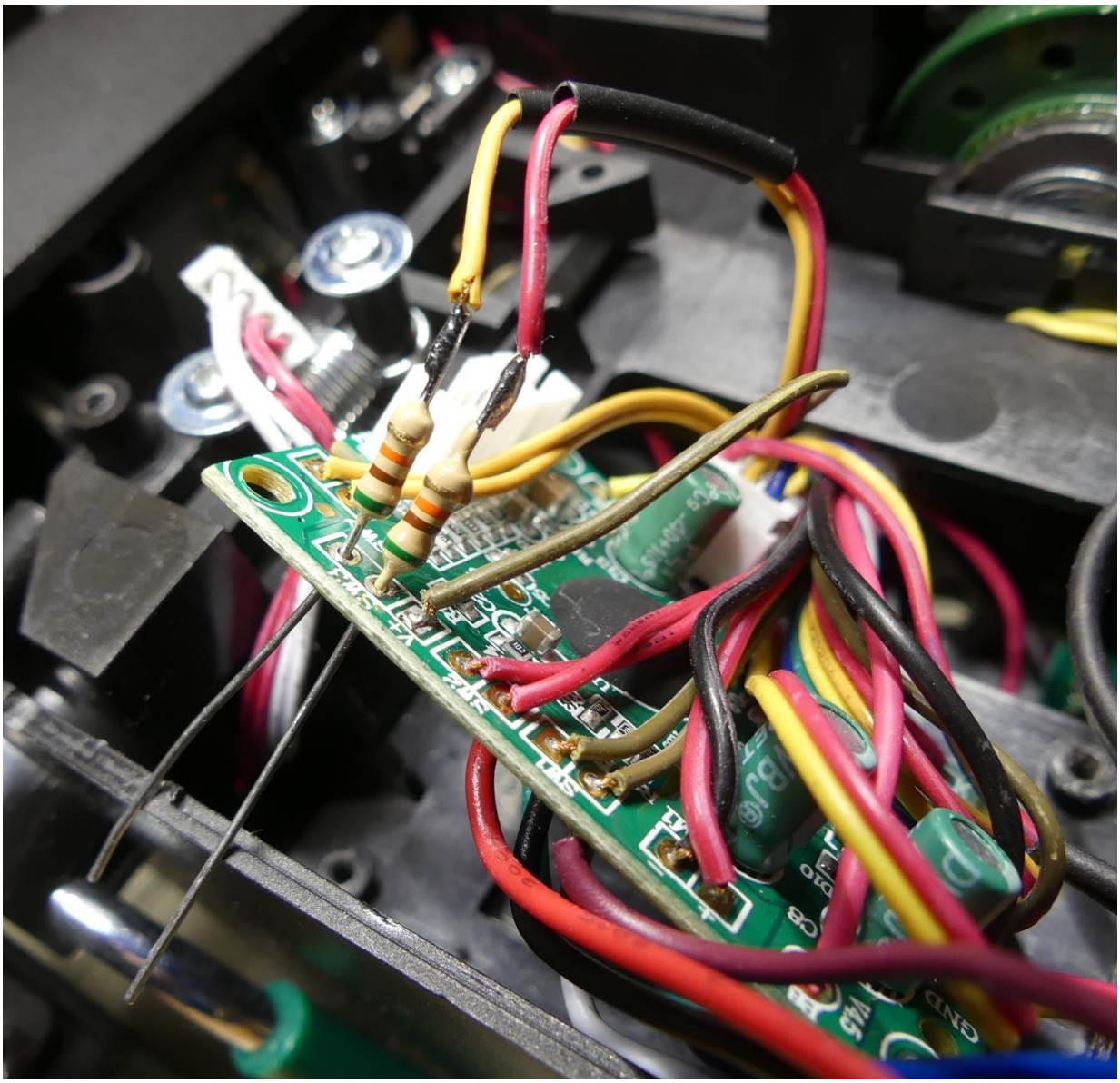
The SW3 YELLOW wire is closest to the corner of the circuit board.
The SW3 RED wire is next to the BROWN wire that is connected to “V+”



Desolder the wires from the original circuit board and clean up the circuit board pads/holes. Then cut the heat shrink tubing in half and slip one piece over each wire:

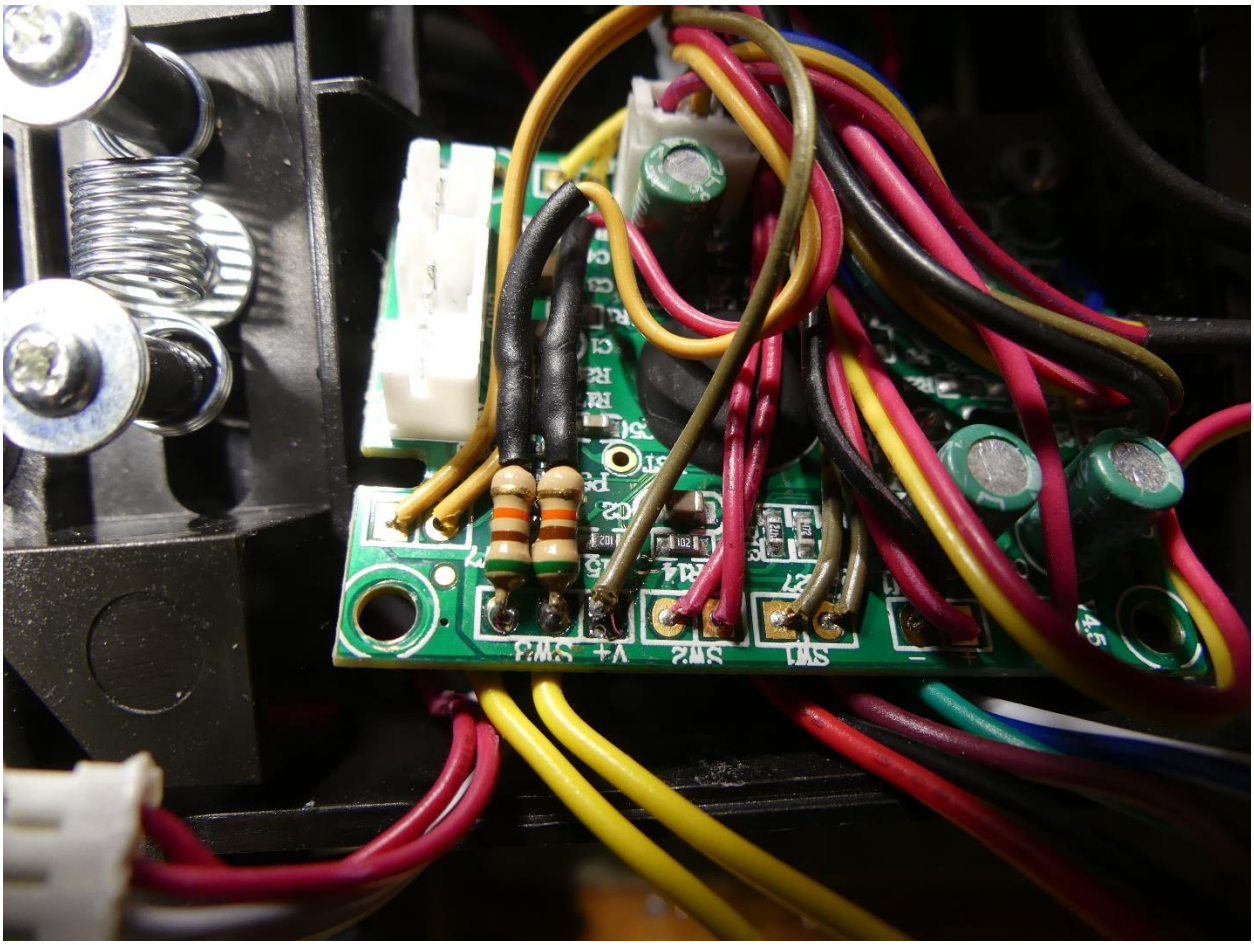


Next cut one side of the resistor leads to about 3/16” long and solder one to each end of the wires’ exposed ends:



The other ends of the resistors are placed in the holes, but not yet soldered in place.

Next slide the heat-shrink over the soldered portion and carefully use a heat source to shrink the tubing. Take care not to melt any of the wand or other nearby wires. You may need to remove the resistors from the holes on the circuit board to get the heat-shrink tubing farther away from wires and other meltable items!




After the heat shrinking is completed, solder the resistor to the circuit board and trim the excess leads that are sticking way out on the other side of the board. The resistor attached to the YELLOW wire goes in the SW3 hole that is closest to the corner of the circuit board. The resistor attached to the RED wire goes to the SW3 hole that is next to the "V+" connection

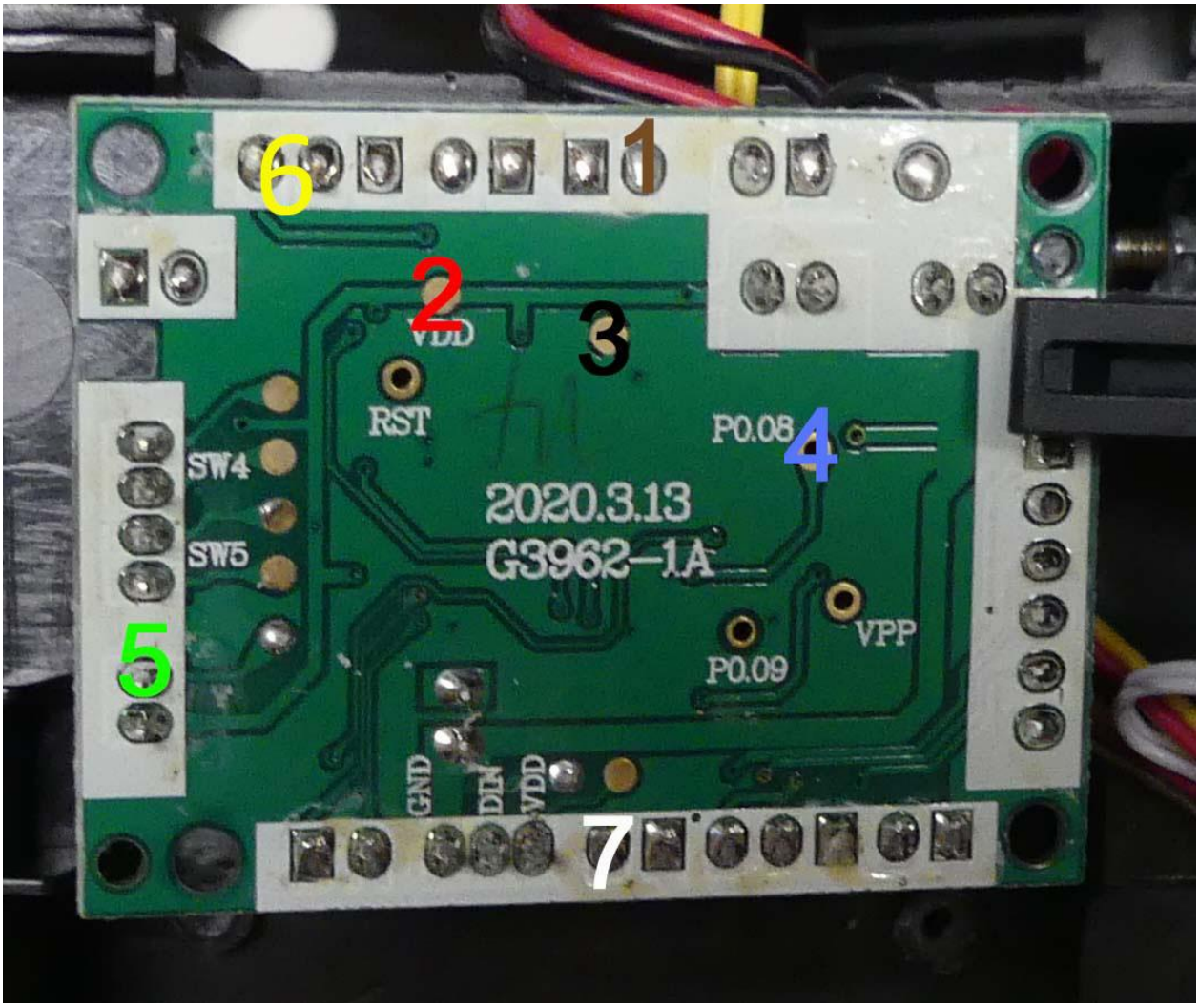
Then bend them over and dress the wires so they will not interfere with any of the following steps.

This photo was taken after I attached the 8 wires to the back side of the board – which we will do in the next step.

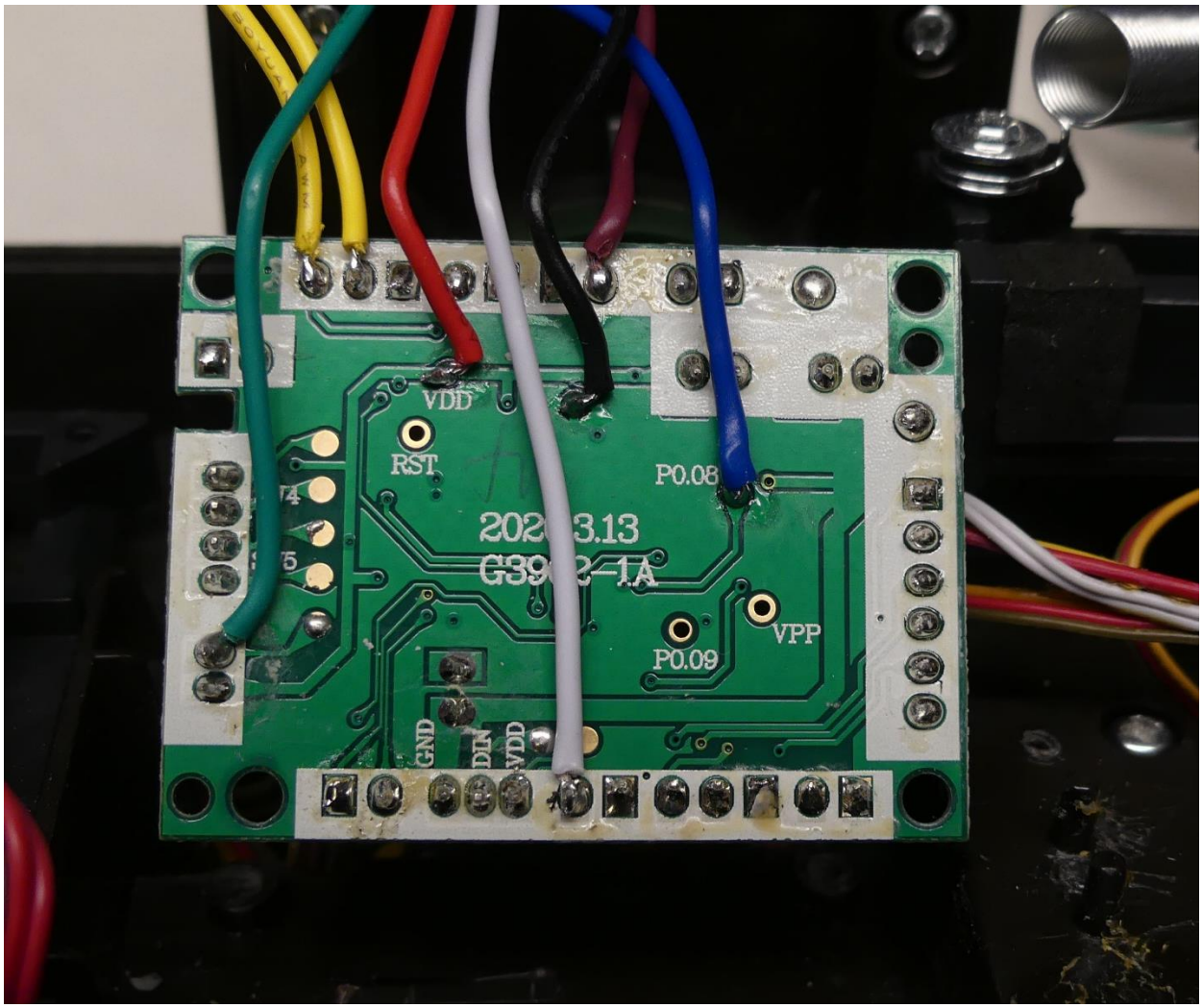
*** End of Optional Improvement for V1.4 of the board ***

Recommended order of wire attachment soldering:

1) BROWN wire, top of the board, 4th pad in from the right
2) RED wire, upper middle left on a gold pad labeled "VDD"
   Pre tin the gold solder pad
3) BLACK wire to a gold pad to the right of where you soldered the red wire
   Pre tin the gold solder pad
4) BLUE wire to the open pad that is to the right of the black wire marked "P0.08". The blue wire may be able to be inserted into the hole and then soldered or just soldered to the surface like the previous wires. If you stick it through the hole, take care that it does not protrude out the other side and touch some other wire. It will get hot enough to melt insulation on some other wire if it is touching. If it sticks out too far on the other side it could also be bent over and make electrical contact with something it shouldn't, so be sure and cut off any excess amount of tinned wire that sticks out.
5) GREEN wire, left side of the board, the second pad from the bottom
6) 2x YELLOW wires, top of the board, leftmost two pads (Wires may be PURPLE)
   Order does not matter, just one yellow wire to each of the two pads. Make sure they are not shorted together or touching/shorted to the pad next to the two we are connecting to.
7) WHITE wire, bottom of board, the 6th pad from the left.



Here is a picture of the board with the wires attached:

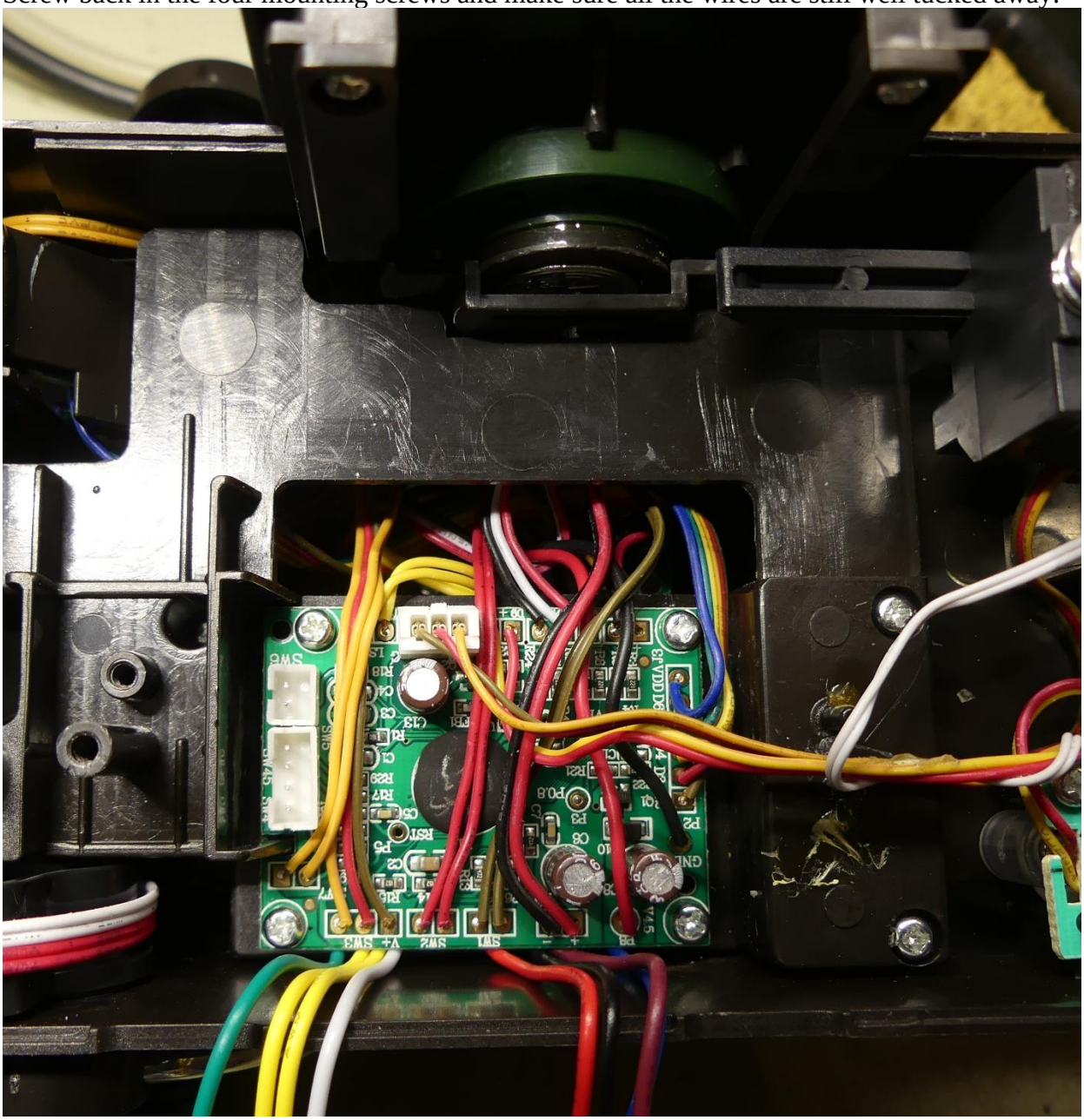



Make sure the wires all reach the upper edge of the board and stay flat against the board. Try to order the wires so there are no overlapping wires that will get squished when we mount the board.

Once the wires look good, carefully flip the board over and place it back where it used to be mounted. Fold the new wires out of the way and see if you can dress the remaining wires so that none will stick up and interfere with anything. Focus on keeping the original wires tucked under where the tube slides in and out so they will not get caught in the moving tube mechanisms.

You may want the heat sink and speaker to be out of the wand while you dress the wires, so you have more access to the wires. Once you have that done put the heat sink and speaker back in place and be careful not to trap any wires between the heat sink and the wand body.

Screw back in the four mounting screws and make sure all the wires are still well tucked away:



***Recommended interim testing:***

Put enough back together to be able to test that the wand still works as before:

1) Plug in the two original cables that were unplugged before (2 wire white and 4 wire red and white) back into the board,
2) put the batteries back in the wand and secure them,
3) you should be able to test the wand and make sure that everything works as before:
    a. Power up the wand (bottom face toggle switch, speaker makes sound and slo-blo LED comes on),
    b. make sure the vent light still works (top face toggle switch),
    c. activate the rumble motor (make sure motor and the bar graph display works),
    d. press the ear button to change to slime blower,
    e. fire to make sure the Wand tip and other LEDs are operating properly.
    f. Power the wand back down (bottom face toggle switch)

When done, remove the battery so we do not accidentally short something will adding the Spengler KeepAlive board.

## *Installing the Spengler Wand KeepAlive Board*

In this step you will install the Spengler Wand KeepAlive board inside the wand.

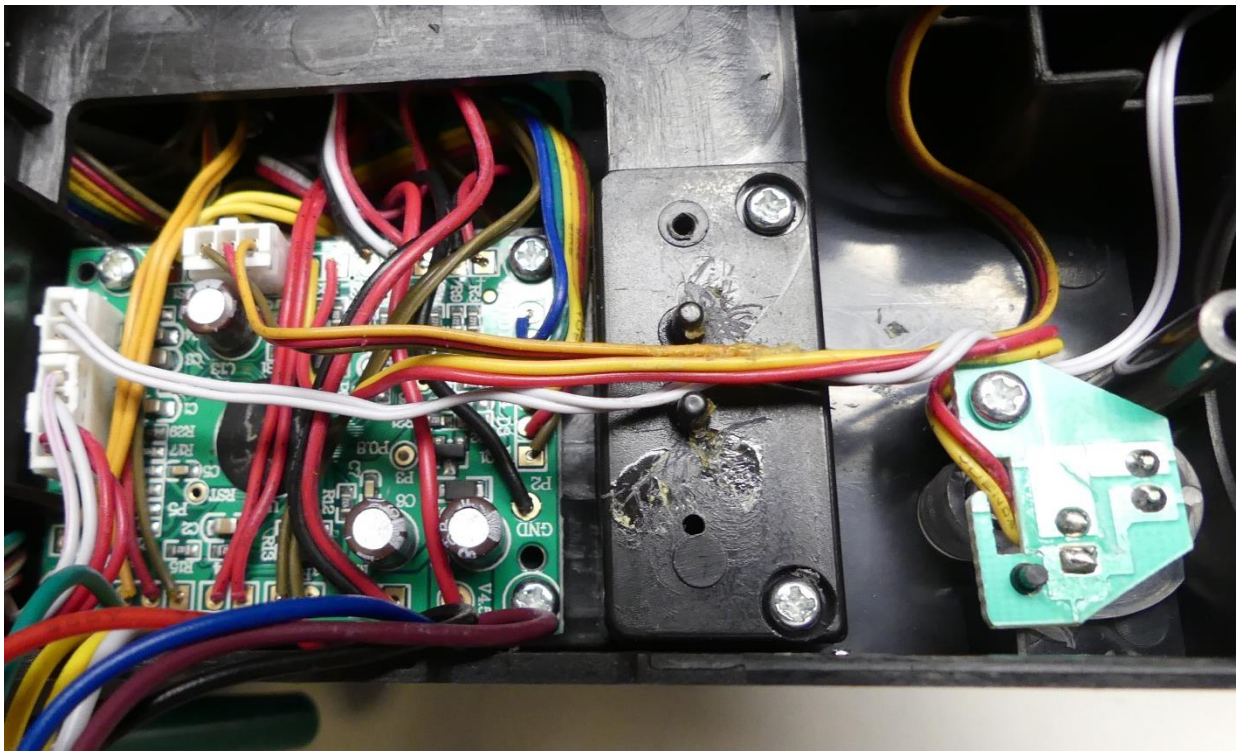
Tools Needed:

- 1/16” drill bit and drill
- Small-medium Philips screwdriver

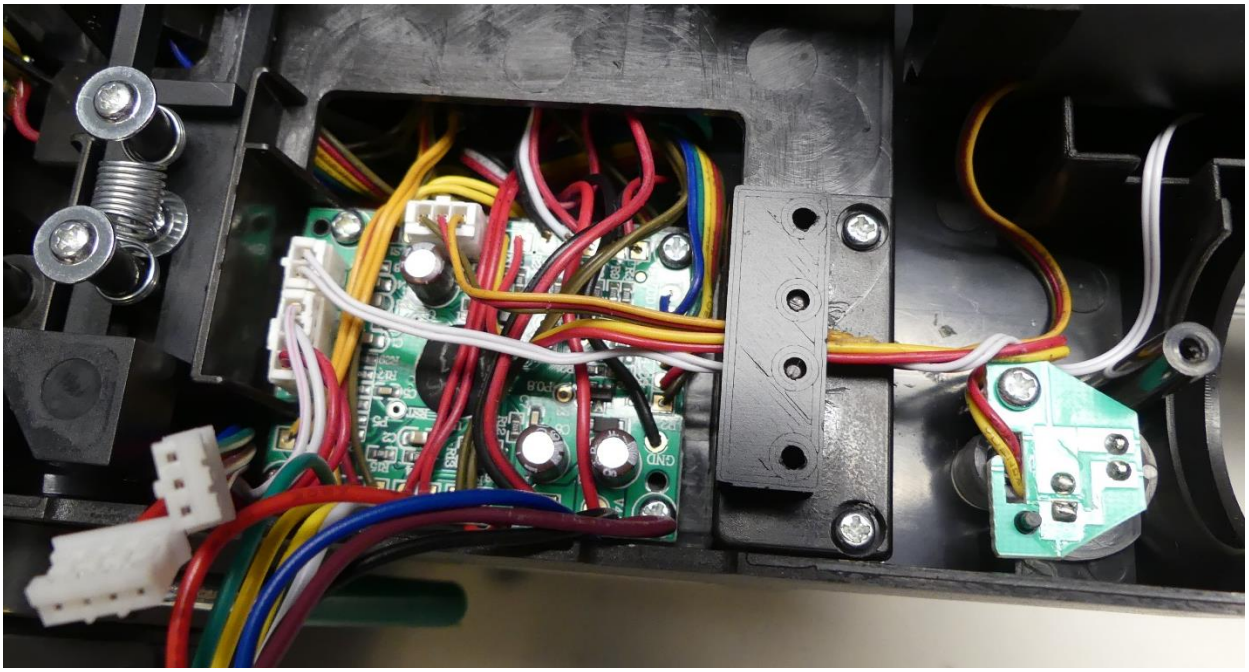
Parts needed

- Mounting bracket #3
- Mounting screws #4 (two screws)
- Spengler Wand KeepAlive board #2

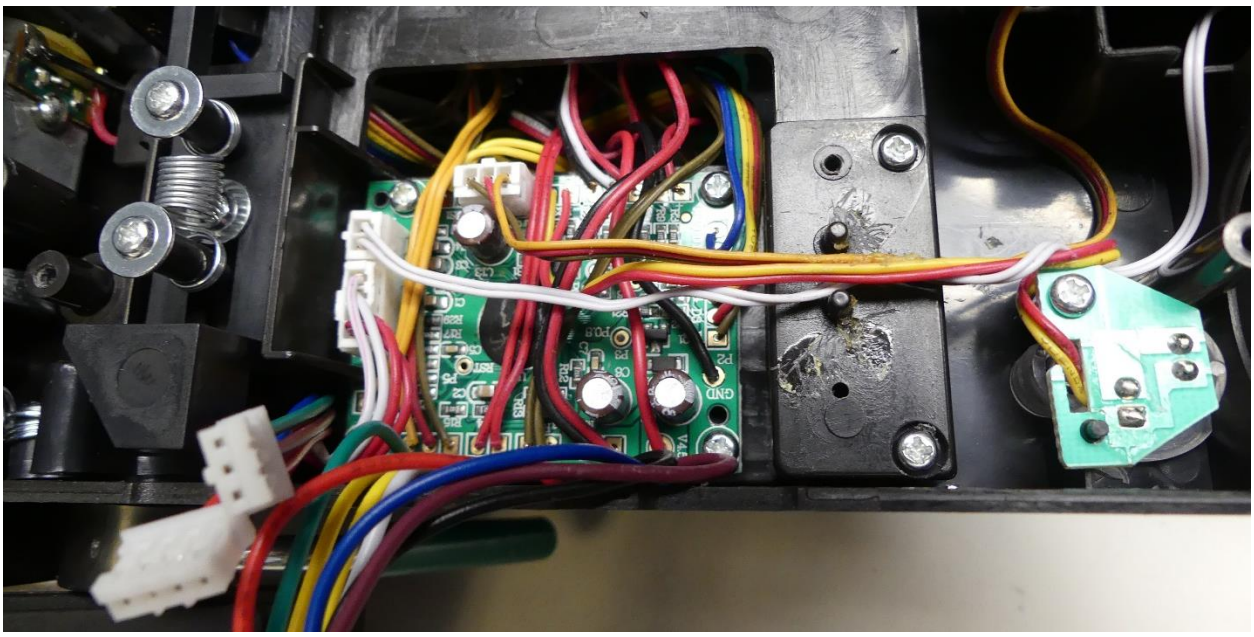
Start by placing some wires in between the two posts:



Place the Wand KeepAlive mounting bracket #3 over those wires and posts for a test fit. I did need to clean up the area a bit more that what is shown in the above image. The mounting bracket should sit flat and not pinch any of the wires it is holding in place. Once you have it able to sit comfortably in place, you need to drill two small holes for the mounting screws to use.



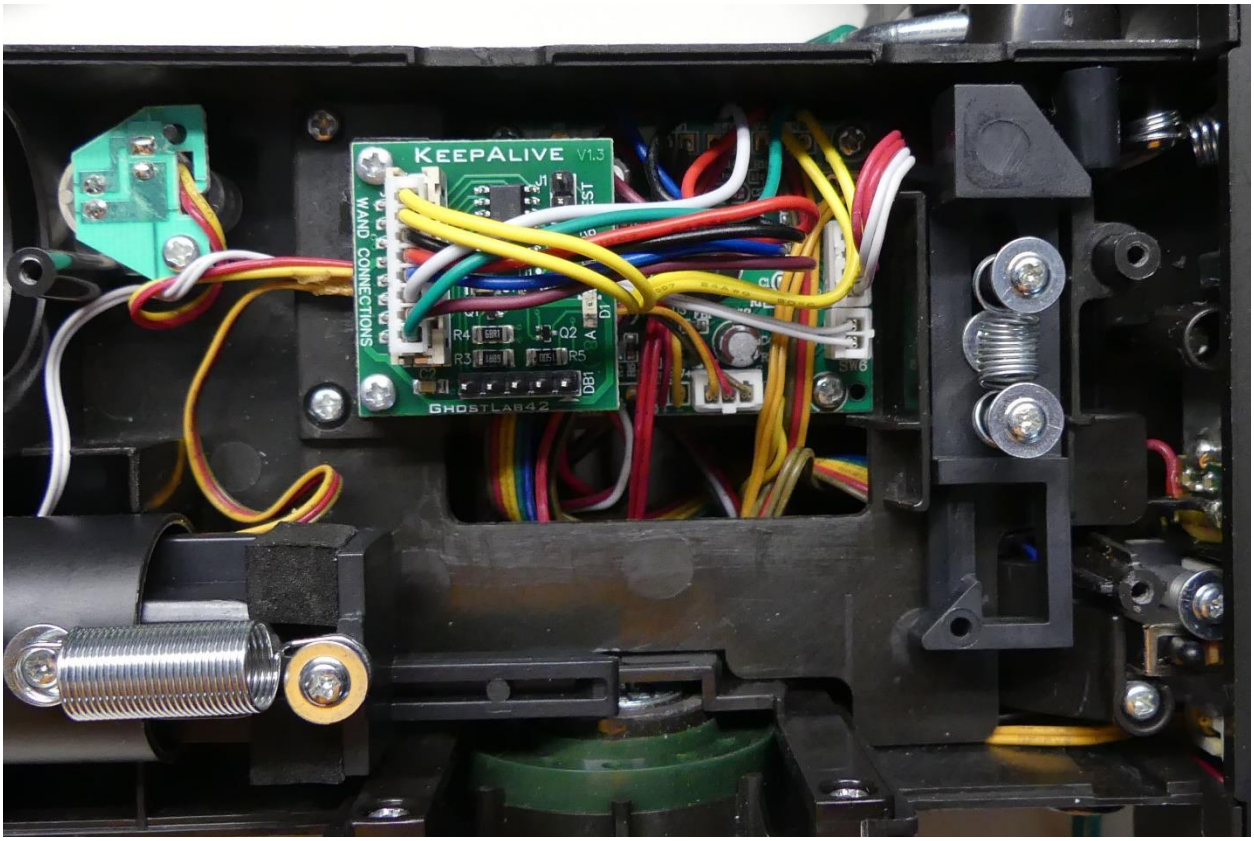
Drill holes with a 1/16” bit centered in each of the two outside mounting holes. I lifted the mounting bracket off for the following image so you could see the two holes that were just drilled. The mounting bracket should be on, and no trapped wires should be between it and the wand when fully seated before proceeding to the next step.



Ignore the two or three cables in the above images – those are from the Spengler Link installation and should not be present with just this Spengler KeepAlive kit.

Once in place use the two mounting screws #4 through the Spengler board mounting holes on both sides of the wand connector, through the mounting bracket #3 and into the wand body.  Do not overtighten and strip the plastic.

Here is the board in position and the cables have been arranged to not interfere with any moving mechanism and allow access to the Test jumper and the feedback LED.




Jumpers shown removed for normal operation (hope I can find it for later use!)

# *Testing the Spengler Wand KeepAlive Board*

In this step you test the Spengler Wand KeepAlive board to make sure the internal wand connections are working.

Parts needed

- Batteries for the wand

*Verify that the wand is getting power*

Put the batteries in the wand handle and screw in the end cap. Turn on the wand and make sure it functions normally. If not, look at the power sources and determine what is not powered or connected. Also make sure the connectors are fully seated in the Spengler Wand KeepAlive Board.

*Perform the Self-Test*

Step 1:

Place all the wand's toggle switches in the down position (wand off, vent light off, activate off)

Step 2:

Place the jumper on the Test pins and immediately watch the feedback LED.
It will flash the LED to indicate the firmware version and then wait for you to perform the next step.
For firmware version "1.4" the LED with flash one time for the main version, a series of short flashes to indicate a decimal point and then four flashes for the minor revision number.

** Troubleshooting **
If you do not get any flashing at this point check that the battery or power supply is connected. Verify that the wand has power by powering it up and down.

If the wand appears to have power, then this is an indication that the RED and BLACK wires of the Wand Connection cable #1 may not be attached in the correct place or may not be soldered properly. If you have a Voltmeter or DMM you can check that there is voltage between these two locations and then check that the board has voltage: You should be able to measure a voltage of 2.5V to 5V between pads 1 and 3 (one is the square pad) on the 5 pads labeled DB1 on the bottom edge of the board.

Also verify the wand connection cable is fully seated in the Spengler Wand KeepAlive board.

Step 3:

The wand board will flash one time followed by a pause to indicate the test jumper is installed. Remove the Test jumper and the flashing should stop.

** Troubleshooting **

If you do not get any flashing at this point check that the wand is turned off, since this step will not be started if the wand is powered on (front face plate lower toggle switch in the up position. If the wand is off and the toggle switch is in the correct position, see step 4 trouble shooting since it is also concerned with the power switch connection.

Step 4:

Turn the wand on (lower face plate toggle switch to the up position). The feedback LED should flash three times to indicate the Spengler Wand KeepAlive noticed the power up.

** Troubleshooting **
If you do not get any flashing at this point check that the power up/down switch on the wand is in the power up position. If it is not, place it in the up position.

If the feedback LED does not flash, then it is an indication that the BROWN wire of the wand connection cable #1 is not making a good connection with the wand's circuit board. Remove the battery and remove the mounting screws for the Spengler Wand KeepAlive and the original circuit board. Move the Spengler Wand KeepAlive off to the side and flip the original circuit board over and verify that the BROWN wire is in the correct position and that it is not shorted to something next to it.
Also verify the wand connection cable is fully seated in the Spengler Wand KeepAlive board.

Step 5:

Press and hold the wand ear button. The feedback LED should flash four times, pause, and repeat as long as the button is held to indicate the Spengler Wand KeepAlive noticed the ear button press. The flashing should stop when the button is released.

** Troubleshooting **
If you do not get any flashing at this point check that the ear button is being pressed firmly.

If the feedback LED does not flash, then it is an indication that the GREEN wire of the wand connection cable #1 is not making a good connection with the wand's circuit board. Remove the battery and remove the mounting screws for the Spengler Wand KeepAlive and the original circuit board. Move the Spengler Wand KeepAlive off to the side and flip the original circuit board over and verify that the GREEN wire is in the correct position and that it is not shorted to something next to it.

Also verify the wand connection cable is fully seated in the Spengler Wand KeepAlive board.

Step 6:

Flip the activate toggle switch to get the wand's rumble motor activated. The feedback LED should flash five times to let you know the Spengler Wand KeepAlive has seen the rumble motor working. It will then pause for a brief moment and then cause a wand

mode change and then flash six times to let you know that it has tried to change the wand mode.

** Troubleshooting **
If you do not get any flashing at this point check that the rumble motor has started up.

If the motor is started and the feedback LED did not flash, then it is an indication that the BLUE wire of the wand connection cable #1 is not making a good connection with the wand's circuit board. Remove the battery and remove the mounting screws for the Spengler Wand KeepAlive and the original circuit board. Move the Spengler Wand KeepAlive off to the side and flip the original circuit board over and verify that the BLUE wire is in the correct position and that it is not shorted to something next to it.

Also verify the wand connection cable is fully seated in the Spengler Wand KeepAlive board.

Step 7:

Flip the vent light toggle switch up (top toggle switch on the face of the wand) and the feedback LED should flash seven times to let you know the Spengler Wand KeepAlive has seen the Vent light turn on.

** Troubleshooting **
If you do not get any flashing at this point check that the orange light by the Clippard valve is turned on. Make sure the correct toggle switch was used and that the vent light is controlled by the toggle switch while the rumble motor is running.

If the switch was in the up position when the activate switch was turned on (and the motor started), this test will run immediately after the Step 8 tests so you may miss the flashing for this step.

If the orange light is on and the feedback LED did not flash, then it is an indication that the WHITE wire of the wand connection cable #1 is not making a good connection with the wand's circuit board. Remove the battery and remove the mounting screws for the Spengler Wand KeepAlive and the original circuit board. Move the Spengler Wand KeepAlive off to the side and flip the original circuit board over and verify that the WHITE wire is in the correct position and that it is not shorted to something next to it.

Also verify the wand connection cable is fully seated in the Spengler Wand KeepAlive board.

Step 8:

After seeing the seven flashes from the previous step, look at the bar graph LEDs and listen (or feel) the rumble motor. The LEDs should grow from only one on to all on and back down in a repeating sequence. The rumble motor should be more intense with more LEDs on, so will also operate in a repeating sequence.

** Troubleshooting **
If you do not see this happening, try adjusting the intensity knob on the top of the wand body. The top knob on may not be sitting in one of the detents. This shorts out the position signal and blocks the KeepAlive board from being able to change that signal. Rotate the knob slightly so it is positioned in the detent and then the wand should immediately start adjusting the LEDs and rumble motor intensity.

If that does not fix the problem, then you need to look carefully at the YELLOW (or PURPLE) wire connections. This is different than the Spengler link, which connected the wires to the Speaker connections. The Wand KeepAlive needs those connected to the position control signals from that intensity control knob. Move the Spengler Wand KeepAlive off to the side and flip the original circuit board over and verify that the YELLOW (or PURPLE) wires are in the correct positions and that they are not shorted to each other or something next to them. The order of the two wires is not important. Either YELLOW (or PURPLE) wire can go to either connection location, just not the same location for both wires.

Step 9:

Flip the power up/down toggle switch (bottom face plate toggle switch) down to power down the wand. You can also flip down the other two toggle switches, so they are in the same position as when the test was started. The feedback LED should flash rapidly to let you know the Spengler Wand KeepAlive has seen the power down and has exited test mode.

## *Put the wand back together*

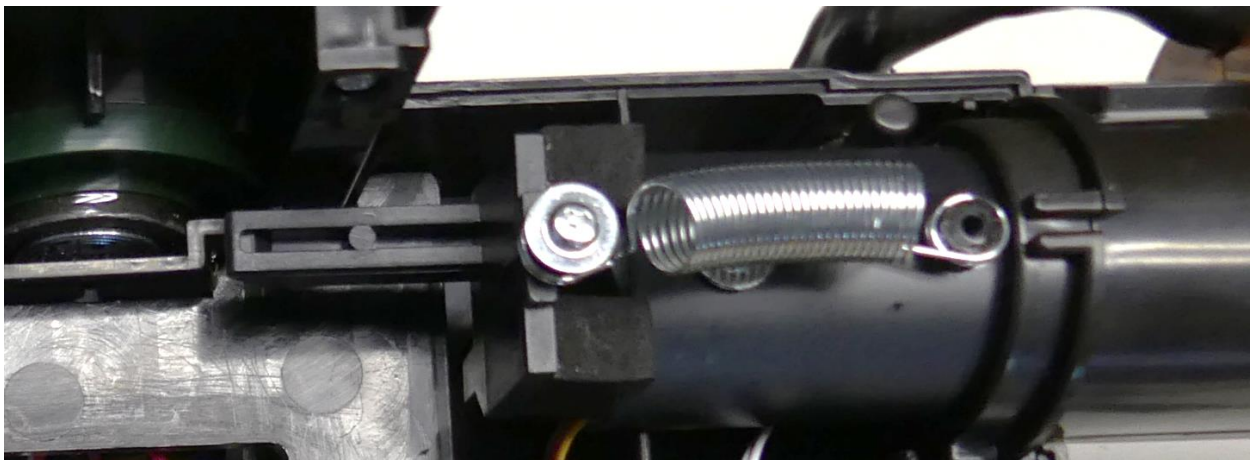
In this step you will be putting the wand back together.  Basically putting the pieces you took apart back together now that you have verified that the wand is working properly.

Parts needed

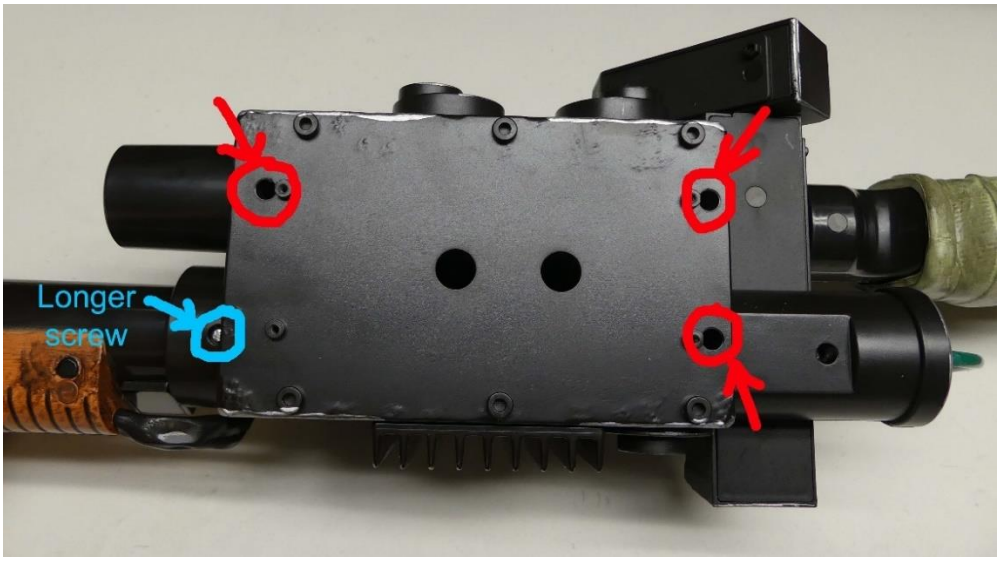
- Small-medium Philips screwdriver

Make sure all the wires are tucked away and routed away from any of the sliding latch or tube mechanisms.

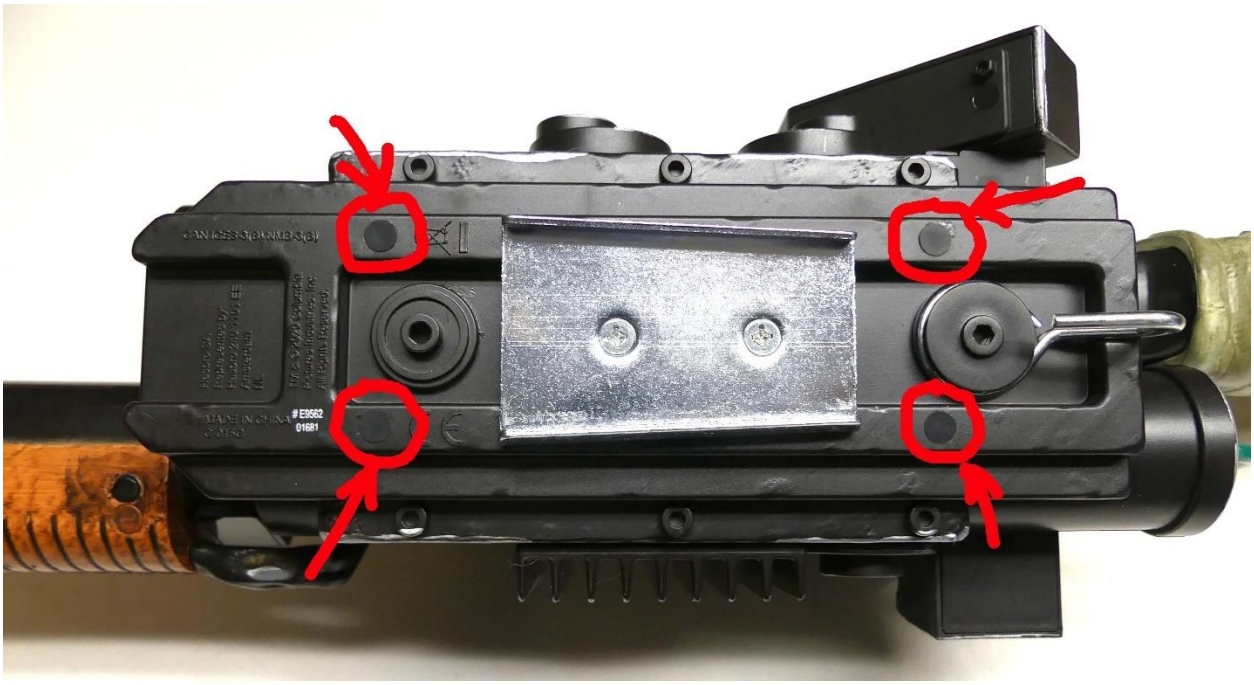
Make sure the wand tube is extended out and attach the free end of the spring from the wand tube mechanism to the post that has a place for a screw:



Place the bottom cover on and hold in place and make sure the pop mechanism is working.  Once verified, secure it with the 4 screws you removed (1 longer screw by the wand tube and 3 shorter screws):



Then reattach the rails with the four screws that were removed earlier:



You can put the caps that covered the screws back in if desired. They do now have holes in them, but you can fill those holes before painting if that is something you want to do. Do not get any filler into the screw heads since you may want access to the inside sometime in the future and you will want to be able to uncover those screws!

## *Usage note:*

To anyone getting all the way to the end of this document, here is one item I ran into a few times: the rumble motor operation still had a 30 second timeout. This was caused by the top knob on the wand body that is used to adjust the intensity was not sitting in one of the detents. This shorts out the position signal and blocks the KeepAlive board from being able to change that signal. Rotate the knob slightly so it is positioned in the detent and then the wand can rumble for a long time without the internal timeout shutting it down.

Have fun and keep Bustin!