

Freeplay CM3 (FPCM3) Build Instructions

This is a living document. It may change at any time.

PLEASE BE AWARE that there was a significant change in Freeplay CM3 PCBs at the start of 2019. If you received your Freeplay CM3 prior to 2019, your circuit board may not have the brightness controller built in. It also will not have all the different options for X/Y buttons (long clicky, soft rubber using a pad, square-based button with rubber nipple, and without X/Y).

Build Video: <https://youtu.be/HcUCw5oCoIE>

Pre-2019 Build Video: <https://www.youtube.com/watch?v=5GydjdLaHzg>

For feedback about the build process or this document, please contact feedback@freeplaytech.com.

Read this entire document before starting your build.

Please see https://www.youtube.com/playlist?list=PLXHmB1p_lYoAiIQpZYJI2AeR3Ixbe71sf for a list of YouTube build videos.

We highly recommend having a mini-HDMI to HDMI adapter on hand. The HDMI can really help with debugging (or playing on a TV).

Hardware & Software Verification

Install the operating system, and test your Raspberry Pi CM3

Before you begin the hardware portion of the install, we recommend that you install the software and boot your Freeplay CM3 as a bench test (without the plastic shell). This is to be sure that you are at a known starting point.

The #1 problem people have building their Freeplay CM3 is using the wrong SD image or not getting it “burned” to the SD card properly (and then they get just a blank white screen when trying to boot).

Use the CM3 SD image file at

https://drive.google.com/drive/folders/0B3u1iTJauWTneXFTTnIPS2M4czg?resourcekey=0-VtDUv32FI_Ftdwp_Rg_wzsQ to prepare your SD card. Burn the image file to your microSD card. We suggest using the Etcher software to burn it. Eject it from your computer, and re-insert it. Make sure that you can see the “boot” partition with files like config.txt.

If you can not see these items, it is a good indication that the image “burn” failed. The image files we provide are compressed. Most SD imaging software will decompress them before/during the burn process. If yours doesn't, you may need to decompress (unzip) the file prior to burning the image to your SD card.

Once you are comfortable that the image is properly burned to your SD card, insert it into the Freeplay CM3. If possible, hook your RPi CM3 up to a TV via HDMI, plug in a battery, and supply power to the micro USB port of the Freeplay CM3. Let it boot up, but keep in mind that you do not need to set anything up yet. You will not be able to control anything at this point, but it is important to know that these pieces are working before plugging them into the FPCM3 and modifying your shell.

Note that the first boot of your SD image will run the SD partition resizing and then shut down the FPCM3. This is normal, but it may seem concerning. Just boot it up again.

Assembly Instructions

Be prepared to cut, build, assemble, repeat several times

Get your tools ready.

The following photo is an example of what tools you may need for the rest of this build process: angle/wire cutters, phillips screwdriver, [triwing screwdriver](#) (often comes with GBA-style shell kit), hobby knife, safety glasses, drill, and drill bits.



For your (X-Acto style) hobby knife, the typical #11 blade (shown on the right) will suffice, but the #17 or #21 flat tip blades (shown on the left) can be very useful for cleaning the plastic down to the plane of the shell.



For the X/Y holes, you may want a 1/8" or 9/64" bit to start and a 15/64" bit to drill holes for the button caps.

Alternatively, you can use a step drill bit as shown here. You may even be able to turn this by hand (or with a pliers) for greater precision.



Example Step Drill Bit Shown
[3/16" to 1/2" Titanium Coating Step Drill Bit Unibit
High Speed 2-flute 6-STEP]

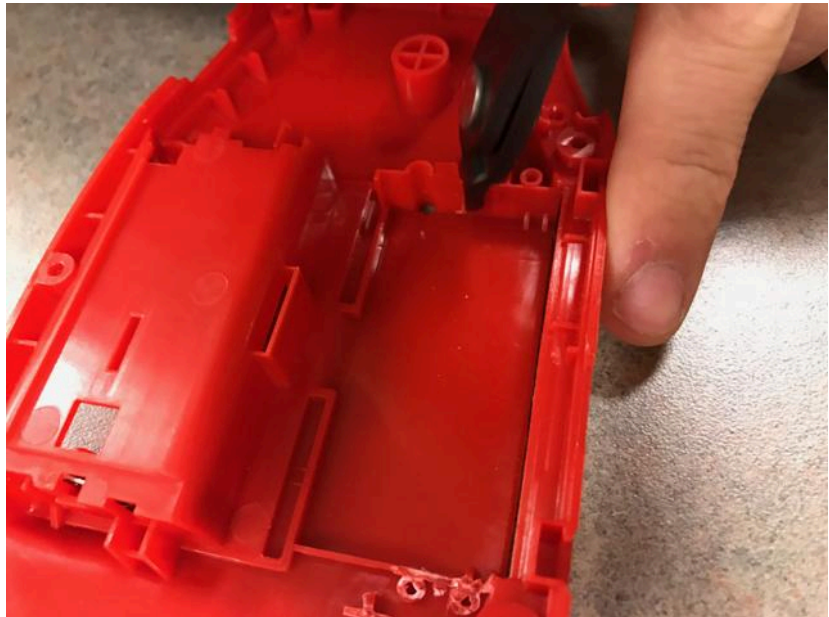
Plastic Shell Modification Overview

You will need to make several modifications to the plastic GBA-style shell. The photo below shows areas that will need to be modified or removed. We recommend that you use a good quality wire cutter or side/angle cutter in combination with an X-Acto style hobby knife. See the section about [knife blades](#) for recommendations.



Remove “walls” around cartridge slot area.

You can do the bulk of this work with a side cutter, and you can clean it up with your hobby knife. It is best to remove these walls clear down so the plane of the shell is as smooth as possible. To access this area, you will first need to remove a metal plate. **Keep the 2 screws for later**, but you will no longer need the metal itself.



With the Freeplay Zero, it is best to remove these walls clear down so the plane of the shell is as smooth as possible. With the Freeplay CM3, you may think it looks best to completely remove them, but it isn't entirely necessary for fitment. If you have a [flat-tip xacto blade](#), that can be good for this sort of shaving.



Remove Plastic Where Battery Connections Lay

This is a fairly simple mod to the plastic near the battery compartment that can be done with an angle cutter. If you want, you can clean it up with the hobby knife after you remove the plastic. It can also be nice to widen these openings to allow easier access to the battery connectors.



Resize the LCD opening.

This step requires plenty of patience and “eyeballing” to get right. Be very careful with the LCD itself. You can use it as a guide, but never put pressure on the LCD or let it flex in any way. **Never force the LCD into place.** If you make the opening too wide, you can use some padding or glue later (to keep it from moving).

Look carefully at these photos to see where the knife blade is pointing and notice which way the LCD ribbon cable is facing (to note direction).

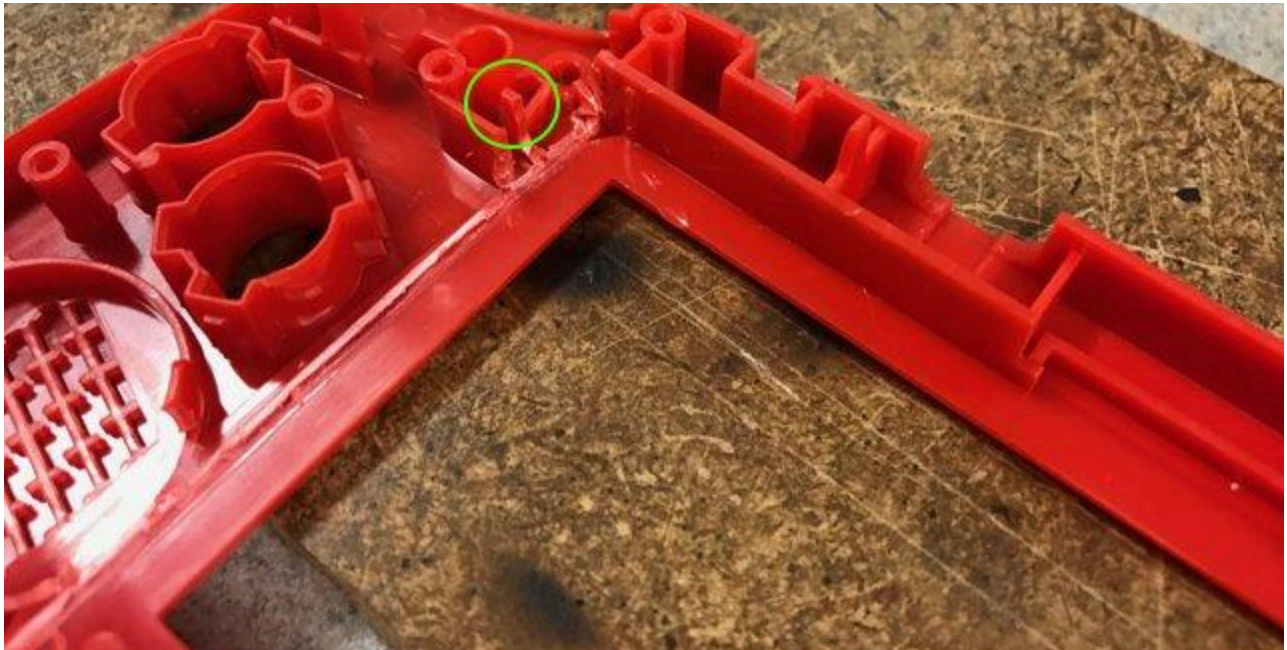
Remove the small wall close to the START/SELECT buttons. To remove these small walls, make a cut vertically (as shown in the following photo) on either end of the wall. Then, you can break the wall off with a pliers or shave it off with the knife.



Do the same thing for the small wall on the opposite side (near the speaker).



The entire wall on the end of the LCD closest to the speaker and A/B buttons must be removed. Make vertical cuts with a knife or side cutters as shown.



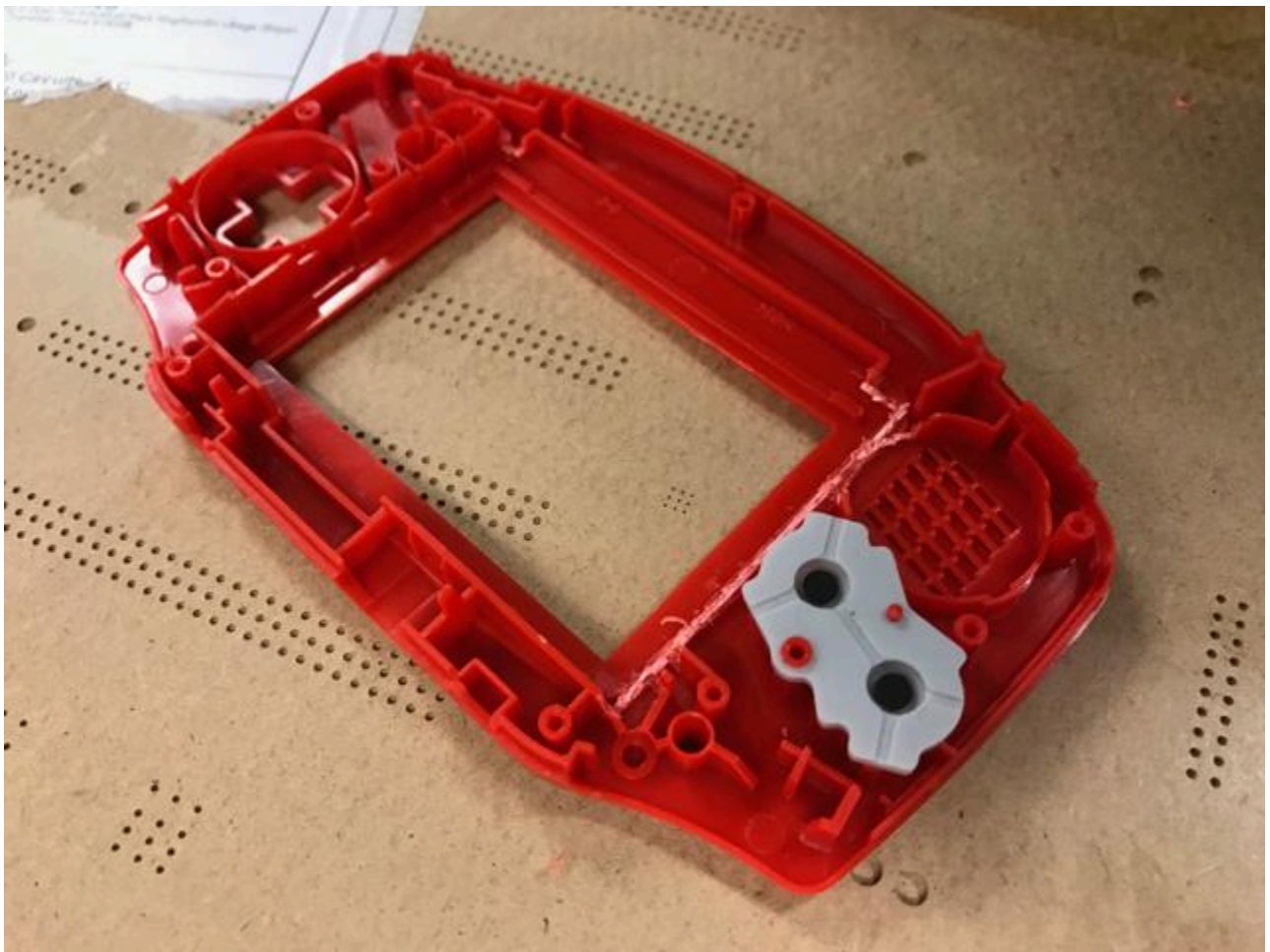
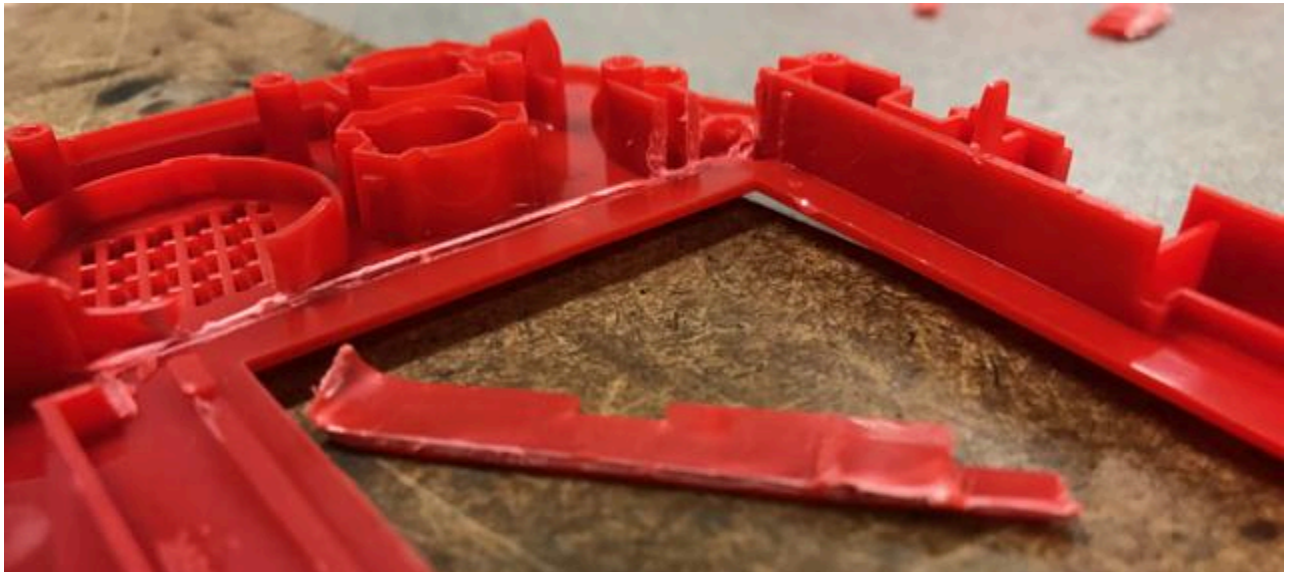
Before you continue this part of the modifications, notice that there is a very small “wall” left as shown in the green circle in the photo above. When completing this LCD area, you will need to cut this back to make room for the LCD, but try to leave some of this standing. If you remove it completely, the R shoulder button leaf spring will push directly on the LCD. Also notice (above) how the speaker’s circle is cut back to make room for the LCD. Cut it back just enough so the LCD has room to fit without having room to move.



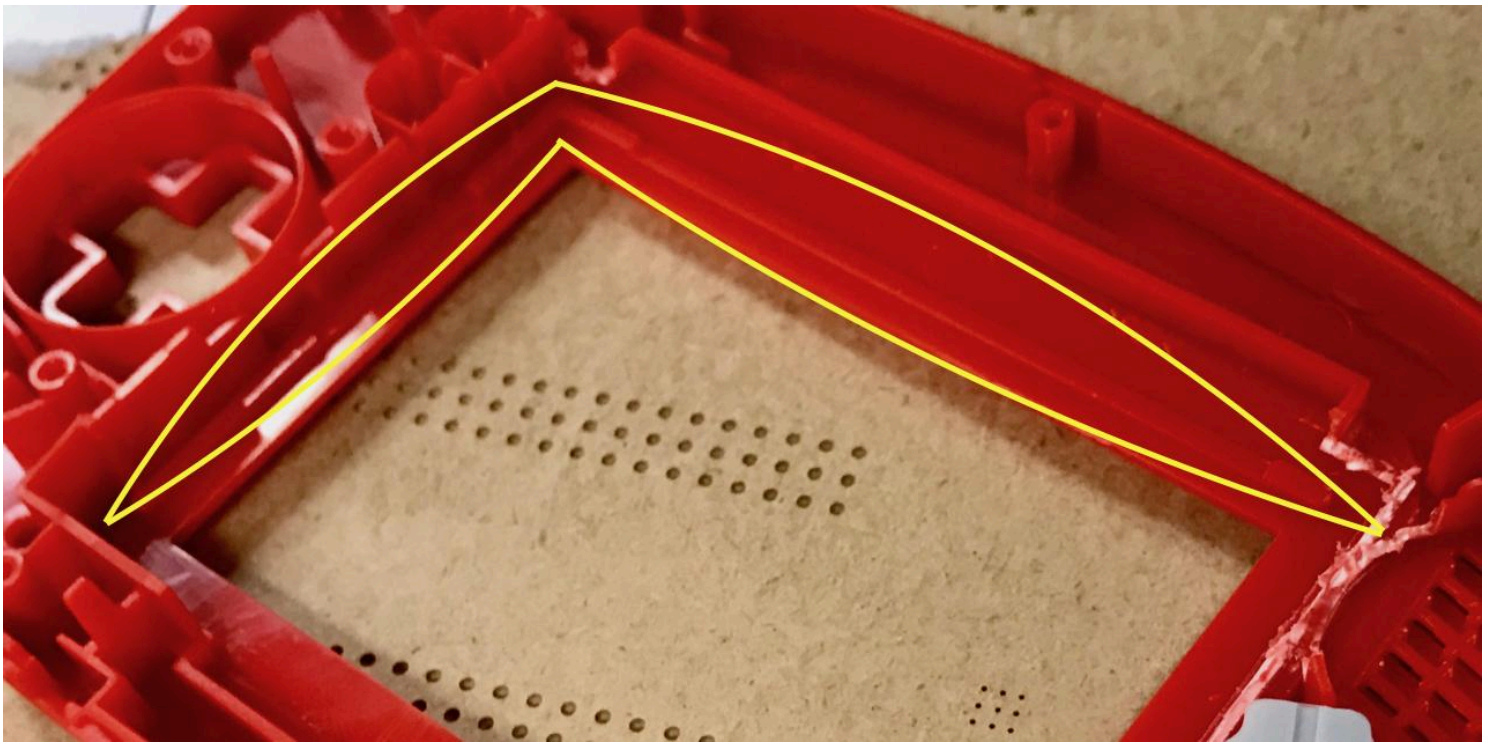
Cut (with knife or side cutters) any reinforcing wall that intersects (T's off of) the wall to be removed. This includes the circular “wall” that surrounds the speaker.



The long wall should now be standing on its own. To complete its removal, you can run your knife lengthwise where the wall meets the plane of the shell several times to weaken it enough that it can snap off or snip it down with the side cutters. The result should look something like this.



After removing the wall, you will need to shave down any remaining parts of the wall. These can be seen above in white.

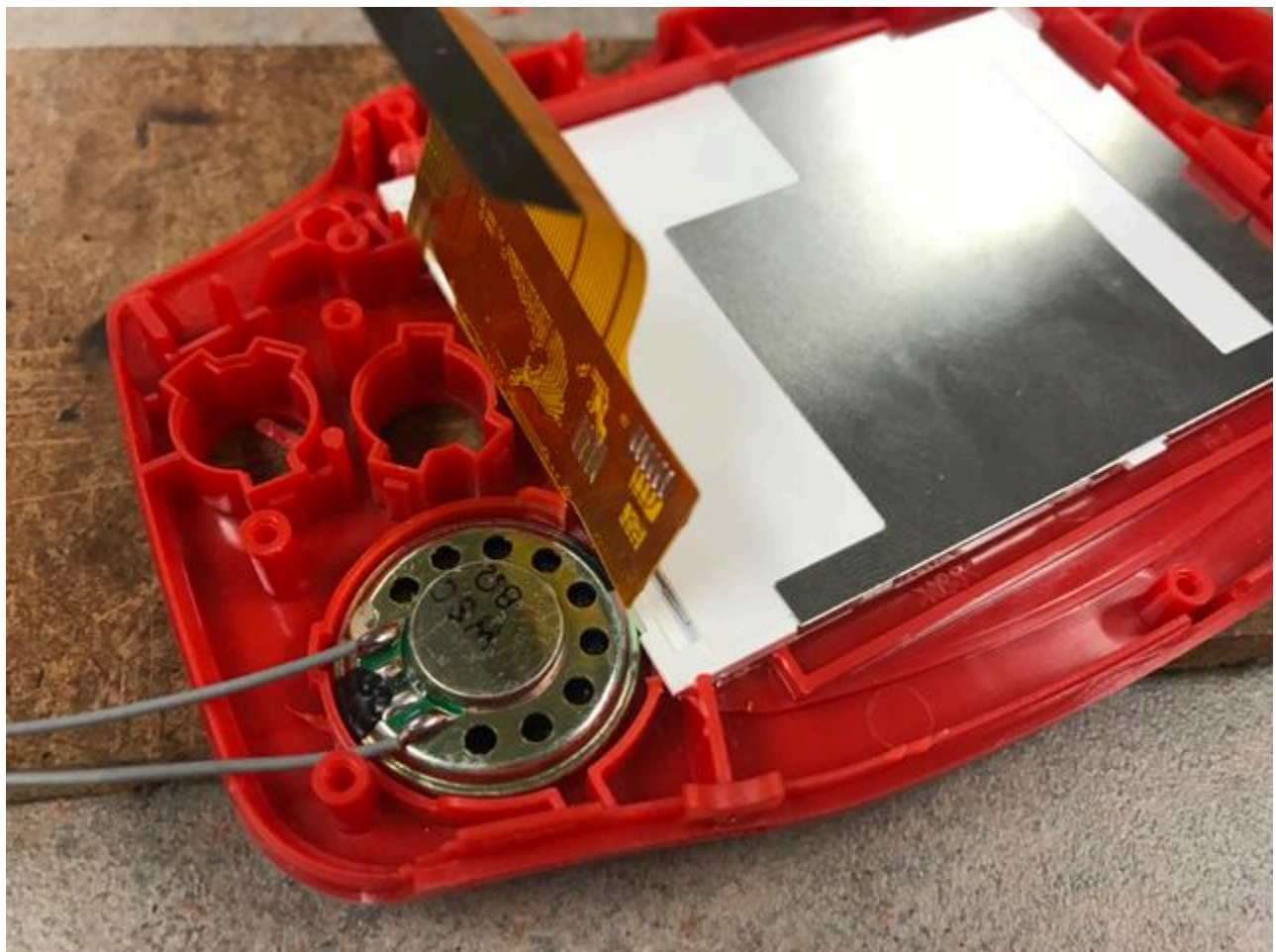


With a sharp blade or a dremel tool, take off anything in this LCD area that may be raised (such as the area shown surrounded by yellow lines in the photo above). The result should be as shown below. Any high points that contact the LCD can put extra (non-uniform) stress on the LCD. The chisel X-Acto blade (as shown to the right) can be help for “shaving” like this.



Use the following photos as a guide showing how the LCD should properly fit once the walls are removed. In the next photo, notice the green and yellow circles. You may want to CAREFULLY remove any protrusions the LCD plastic may have in these (and maybe other) areas that seem to be causing fitment problems. The yellow circle

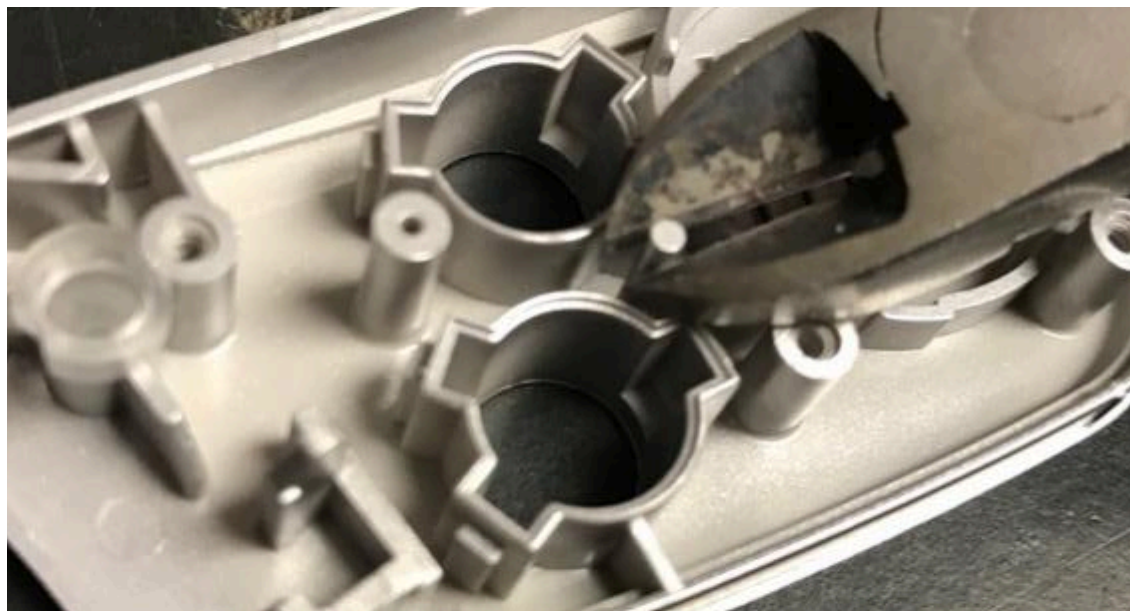
also shows how the plastic walls fit up against the LCD ribbon cable. Snug is good, but make sure it's not so tight that you flex the LCD panel or cause any undue stress to the ribbon or glass.



In the photos above and below, notice how the speaker slightly fits under the LCD. You can also notice the nub in the middle of the bottom of the LCD that was not removed (whereas the one on the top-middle was).



Cut off the pin (shown below) between the A/B buttons (unless you have a circuit board from before 2019).



Create holes for the X/Y buttons and caps.

We believe that the Freeplay CM3 looks very clean and functions quite well without X and Y buttons. Please feel free to build your Freeplay CM3 without these extra buttons. To do that, just use your wire cutter to cut off the button shafts. If you want X and Y buttons, keep reading this section.

Of course, the original GBA-style shell you are working with only has A and B face buttons. For those of you that want to include 2 new X/Y buttons, the Freeplay CM3 now supports 3 options for these additional buttons.

- Long-Clicky Pre-Soldered Tactile Buttons ([jump to that section in this document](#))
- Silicone Rubber Pad ([jump to that section in this document](#))
- Rubber-Nipple Square Solder-Yourself Buttons ([jump to that section in this document](#))

We will break this section up into 3 subsections. If you want to learn more about these options, please see:

- <https://www.freeplaytech.com/product/freeplay-cm3-diy-kit/>
- <https://www.youtube.com/watch?v=HcUCw5oCoIE>

Long-Clicky Pre-Soldered Tactile X/Y Buttons

The X and Y button holes are probably the most difficult part of this build process, because any imperfections can be seen on the face of the game. Most of the other modifications are internal to the shell and therefore aren't as critical.



Use the included guide to locate the holes for the X/Y tactile buttons. Please be careful to line up A and B properly with their associated buttons. Also note that there is a fair bit of wiggle room with the buttons. Try to mark the holes in the middle of the “wiggle” if possible.

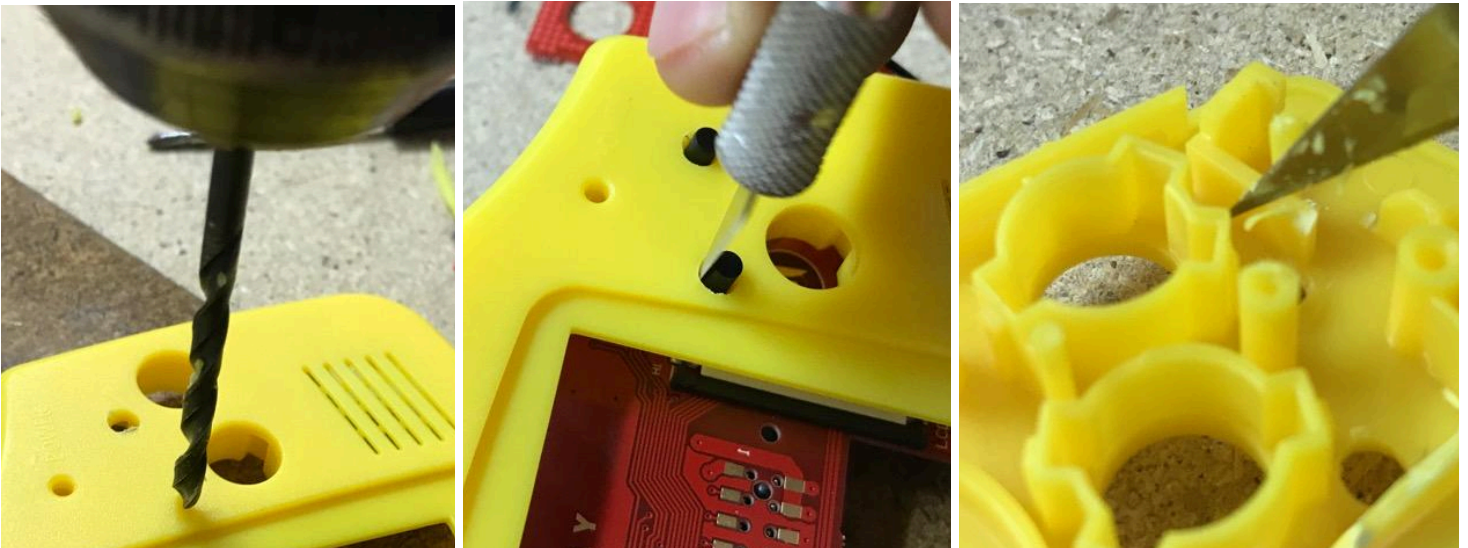
Mark X and Y drill points as shown above. I like to use a phillips style screwdriver for this, but the important part is to “cut” a small divot into the plastic (to rest your drill bit in when starting your hole). You could also use a tiny drill bit to mark the locations.

If you will not use button caps, use a 1/8” drill bit (or the closest size you have to the button shaft itself) to drill the holes. If you will be using caps, you should drill the initial hole slightly larger than the shafts (but not as large as the caps). We recommend 9/64” or a bit larger. If you are planning to use button caps for sure, consider using a 5/32” bit. Unless things go perfectly, the shafts will be off-center compared to your hole. The button caps can help account for this, but you need to know in which direction they are off-center. It's easier to start slightly larger to allow you to judge in which direction they may be off center.

If the holes are too close to the shaft's size, it will cause the shaft to "tip" and it may be difficult to tell which way it is tipped. Furthermore, the buttons will not actuate properly if they are tipped, so open up the holes until you know for sure they're not tipped. The way to tell is to seat the PCB fully and then try to press the button. If you hear/feel the tactile click, they are likely actuating properly.

We have noticed that if you drill increasingly large holes until the hole is the right diameter, the holes will drift each time, because the plastic of the shell is quite soft. **A drill press would be a great option if you have access to one, because it will minimize/eliminate this drift.**

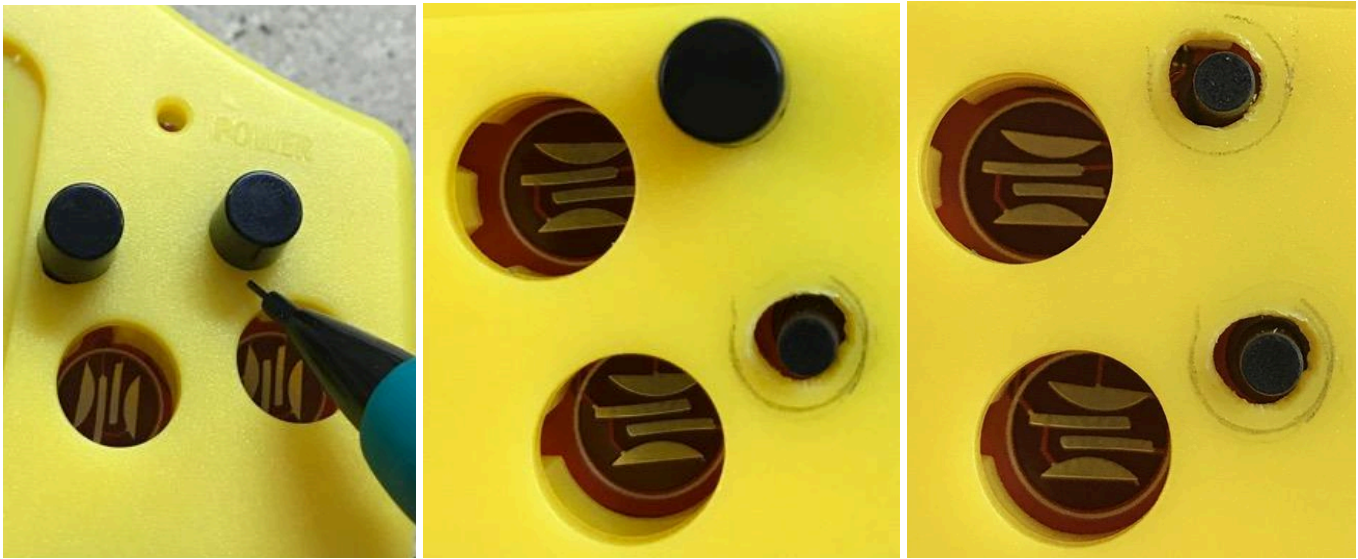
Prior to drilling, you may want to remove some of the plastic wall that surrounds the R shoulder button (seen in the right-most of the next 3 photos). If you leave this portion of the wall, your drill bit may hit this on the way through and cause the drill to drift off center.



Work the hole area with a hobby knife until you can tell that the buttons actuate properly. This may take several attempts to insert the PCB, check the fitment, actuate the buttons, find where things are rubbing, and then cut it out with the hobby knife. Once the buttons seem to work properly, you might end up with holes that look something like the photo to the right.

Set the button caps on top of the buttons, and use a pencil to draw a circle around them. Keep in mind that there is a fair bit of wiggle room here, so place the buttons where you want them and hold them in place while drawing.





Before widening the holes, make sure the “pilot” hole is centered on your pencil mark. If it is not, use your hobby knife to center it (like in the following photos).



Once centered, use a step bit by hand, a hobby knife by hand, a conical dremel bit, or a 15/64” drill bit to create holes for your button caps. Note that the pencil marks will be “larger” than the caps themselves and therefore larger than the actual hole you need to create. They should still be visible once the caps are installed. The pencil marks should easily wipe away once you are satisfied with your holes.

If your X/Y button shafts are not centered, they will sit at an angle which will not allow them to actuate properly. You can always cut the hole to fix this, but it may be at the cost of aesthetics.



After your build is complete and tested/working, you can permanently attach the button caps. For now, just make sure they fit well, and then leave them off to the side.

When you are ready (later), to attach the button caps to the button shafts, use a tiny bit of superglue or other adhesive inside of the button cap. Make sure that you don't get superglue on the outside of the button. Before the glue dries, actuate the buttons to be sure that they are working properly.

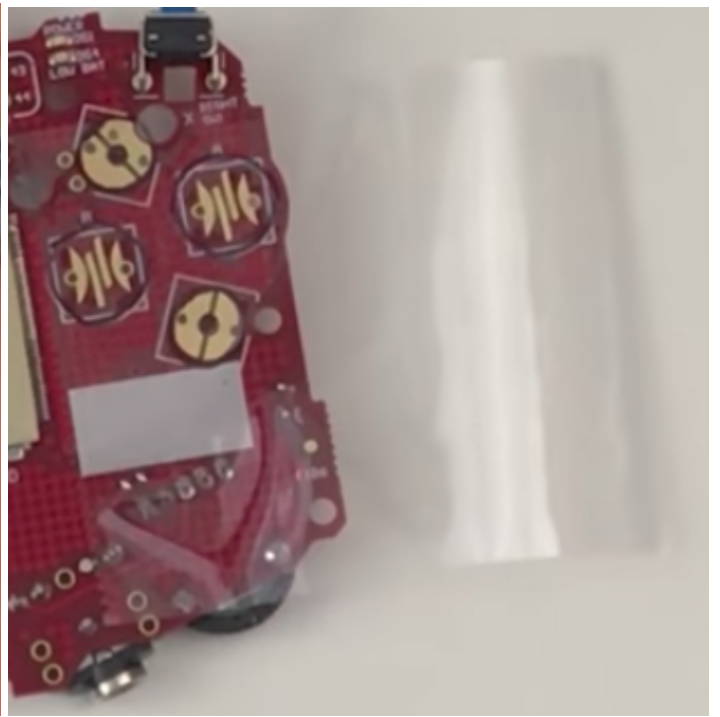
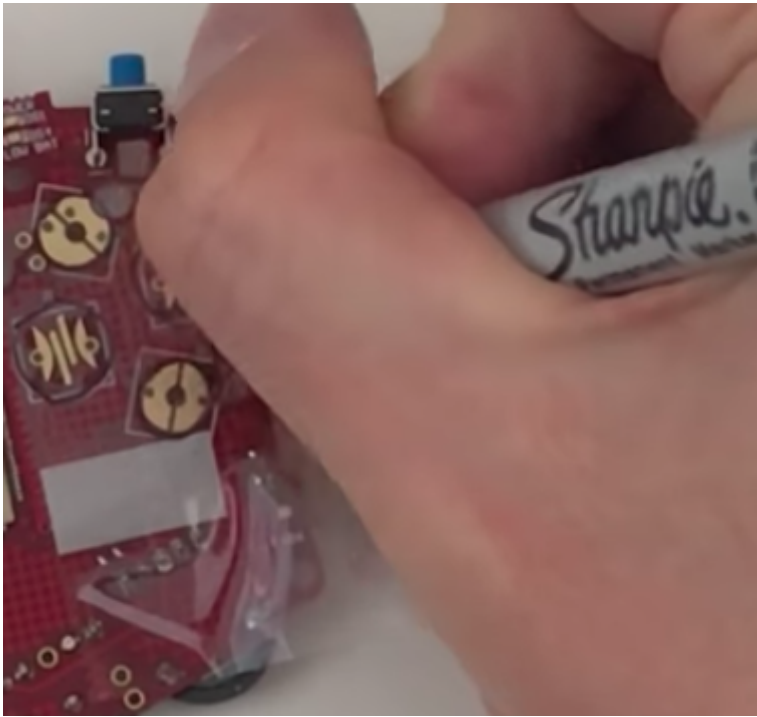
See <https://www.youtube.com/watch?v=5qwiKOBXaqs> for a quick overview of this process.

Silicone Rubber Pad X/Y Buttons

The silicone rubber pad buttons work and feel like the original GBA-style buttons. They use a rubber pad that presses against the circuit board to produce a button-press event.

To add the rubber-pad style buttons, you first need to drill new holes. These holes are the same for the rubber-nipple buttons.

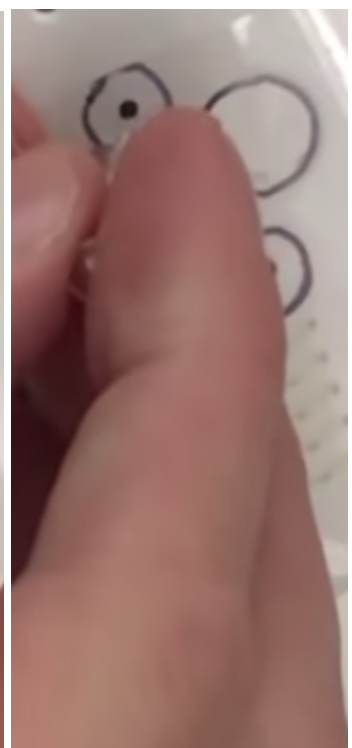
There are 2 recommended ways to mark the holes that need to be drilled. One method uses a piece of clear packing tape to transfer the hole pattern from the circuit board to the shell. This is the method used in the video at <https://youtu.be/HcUCw5oCoIE?t=678>. It is HIGHLY recommended that you watch that video to understand all the parts of this process.



Place a piece of packing tape on the circuit board so that it's covering all 4 of the circular button areas. Then, using a sharpie or something similar, mark the buttons. Include the center and the perimeter of each hole.

Remove the tape, and place the tape on the face of the shell so that the A and B button holes of the shell line up with the A and B circles from the circuit board. With the tape adhered to the shell, use a pin, awl, tiny drill bit, or some other tool to mark a guide divot into the shell. You will use this as the drill guide to keep the drill bit from wandering.

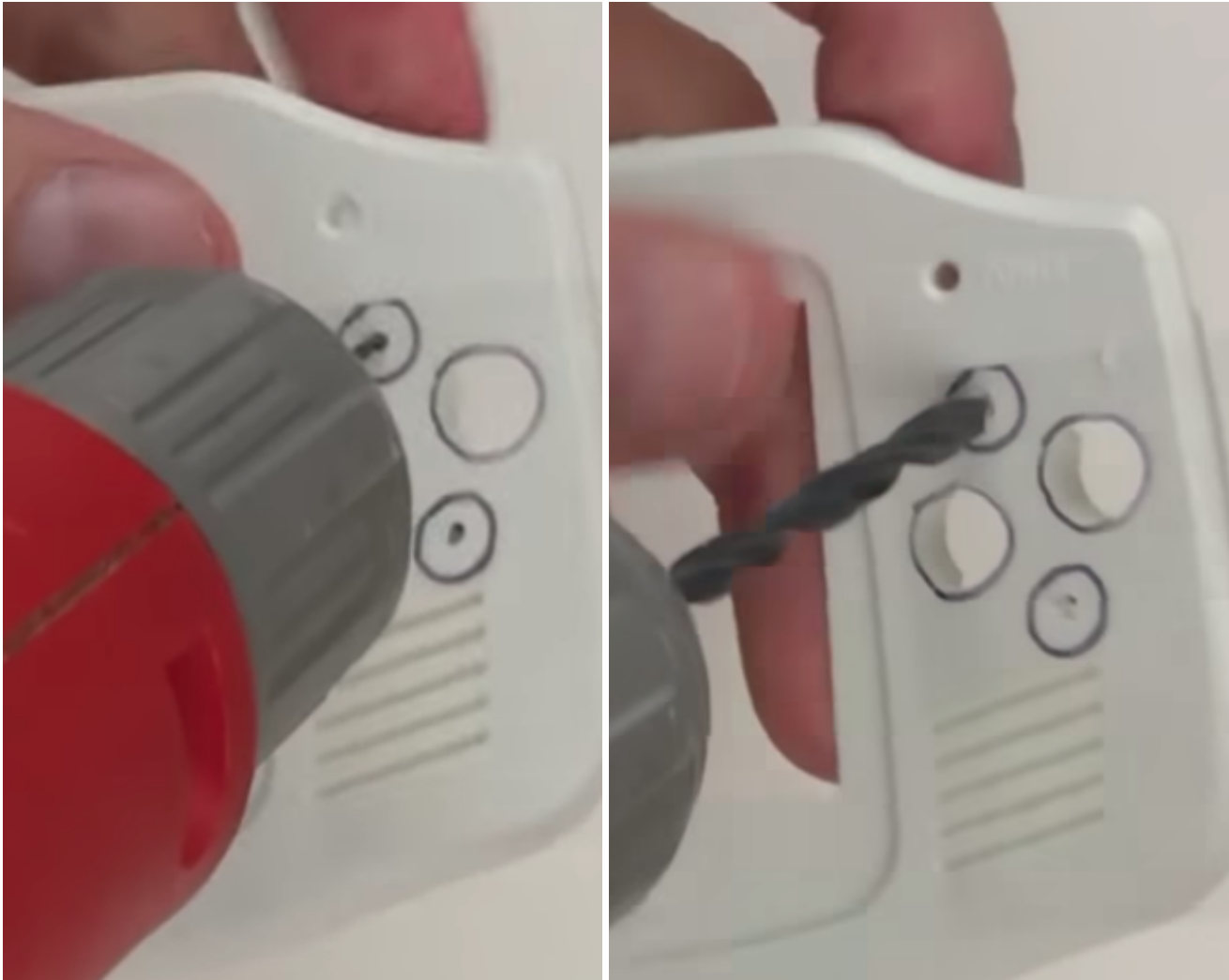
When you're done, be sure to clean off any adhesive left on the circuit board by the tape using isopropyl alcohol!



An alternative marking method involves screwing the circuit board onto the front of the shell. Once in place, you can use a pin or super-small drill bit to extend through the PCB and mark a drill guide into the inside of the front shell piece.

<insert photo>

We recommend that you use this drill guide to drill a small hole. Then line the shell up with the circuit board to determine if the hole is properly centered. If it isn't, you can widen or move the hole a bit with an xacto knife or with a larger drill bit. Use a larger drill bit to widen the hole and check the centering again.



To check centering, you can use something like a toothpick to help determine if the circuitboard's hole lines up perfectly in the center of your newly drilled hole. Once centered, use a larger drill bit or a step bit to widen the hole until the A/B button cap fits perfectly. You can sometimes turn the step bit by hand. If you can, you probably don't need to use a drill, as the drill can drift easier and make your hole off-centered.

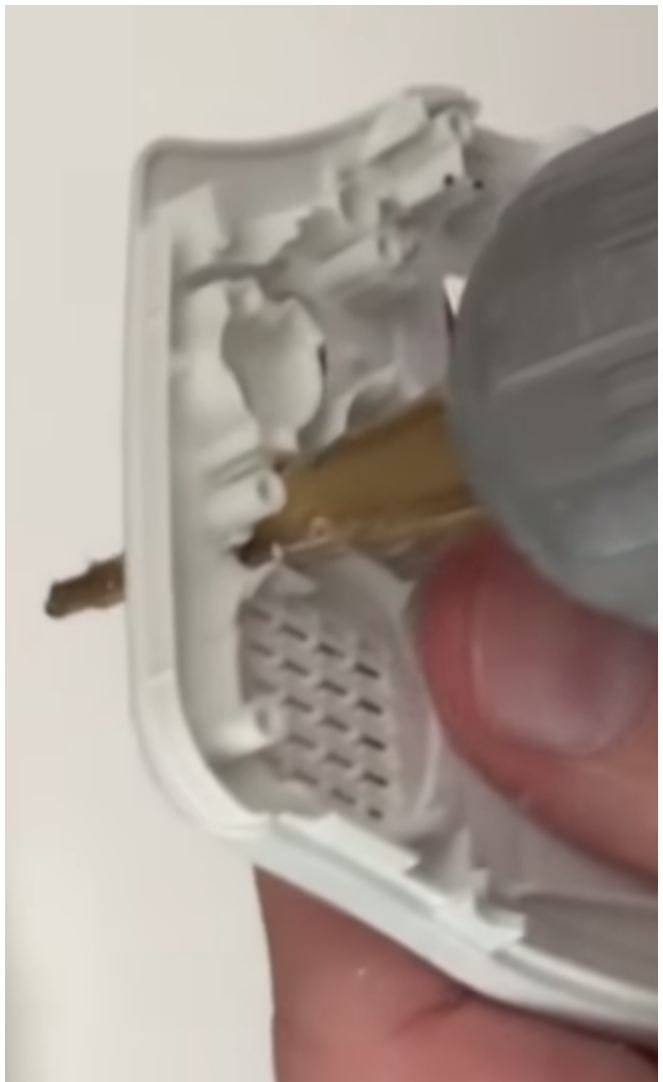
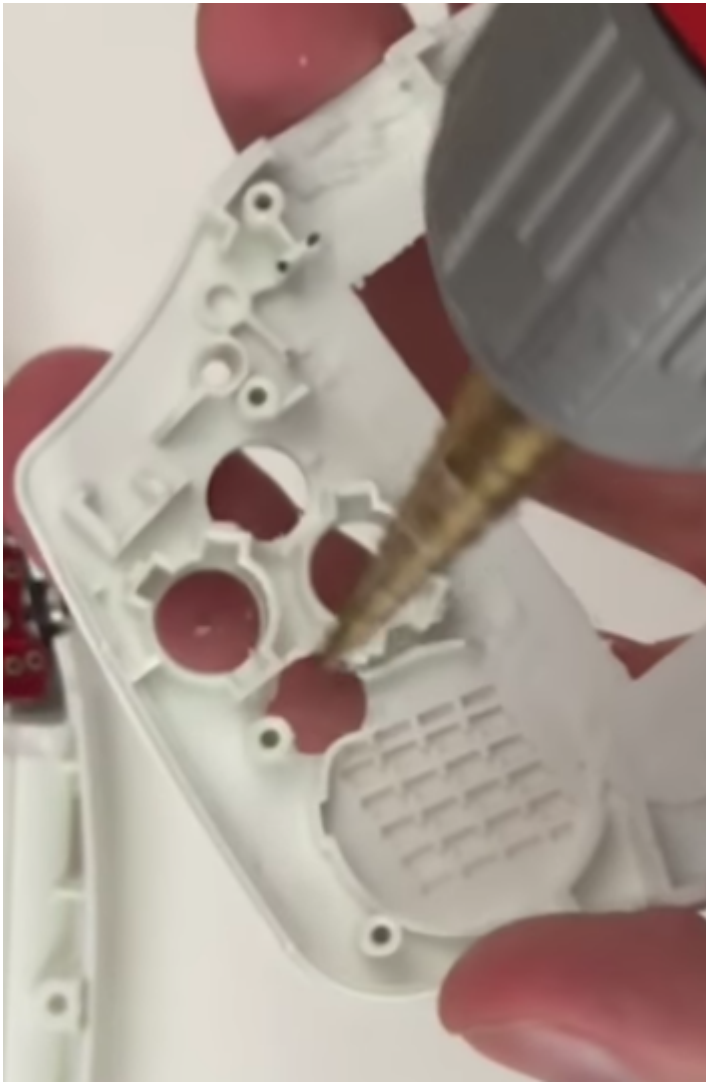
Remember to center, widen, and repeat, but do not over-widen. A hole that is slightly off-center is better than a hole that is too wide.



Once the hole is the proper width, you will want to clean things up. This is especially important on the inside of the shell, where you will be smoothing and removing some “walls” that the button cap may rub against. To do this, you can use a drill bit, a step bit, a hobby knife, etc.

Be very careful not to further widen the hole. You are just doing this to remove excess plastic on the inside of the shell. Remove a little bit of plastic, test fit the button, and repeat until the button fits and actuates smoothly.





You can also use a file at an angle to smooth out walls/burrs on the inside of the shell. Keep cutting/deburring/filing until the button fits well and operates smoothly.

You will, likely, also need to remove a small portion of the nearby screw post. Keep most of it, so that you can still thread a screw into it. The photo on the right shows a modified post, but you probably don't need to remove that much of the screw post.





The stock A/B button caps themselves each have 3 guide tabs that stick out from them. **DO NOT REMOVE THESE TABS.** They help keep the button from spinning AND they help keep the button flat when not depressed. It is recommended to have the 2 tabs that are nearest each other straddle some feature. That will stop the button from spinning during use.

Once the buttons fit well, you will need to remove the entire circular wall around the speaker. You can cut the wall off and then file, xacto, or dremel it flush. Otherwise the speaker will contact the bottom of the four buttons. Make sure the bottom button is rotated such that none of its 3 tabs are facing the speaker. You will likely want 2 of the tabs to “straddle” something like the screw post.

The speaker can be stuck to the shell with adhesive (which may already be on the speaker itself).

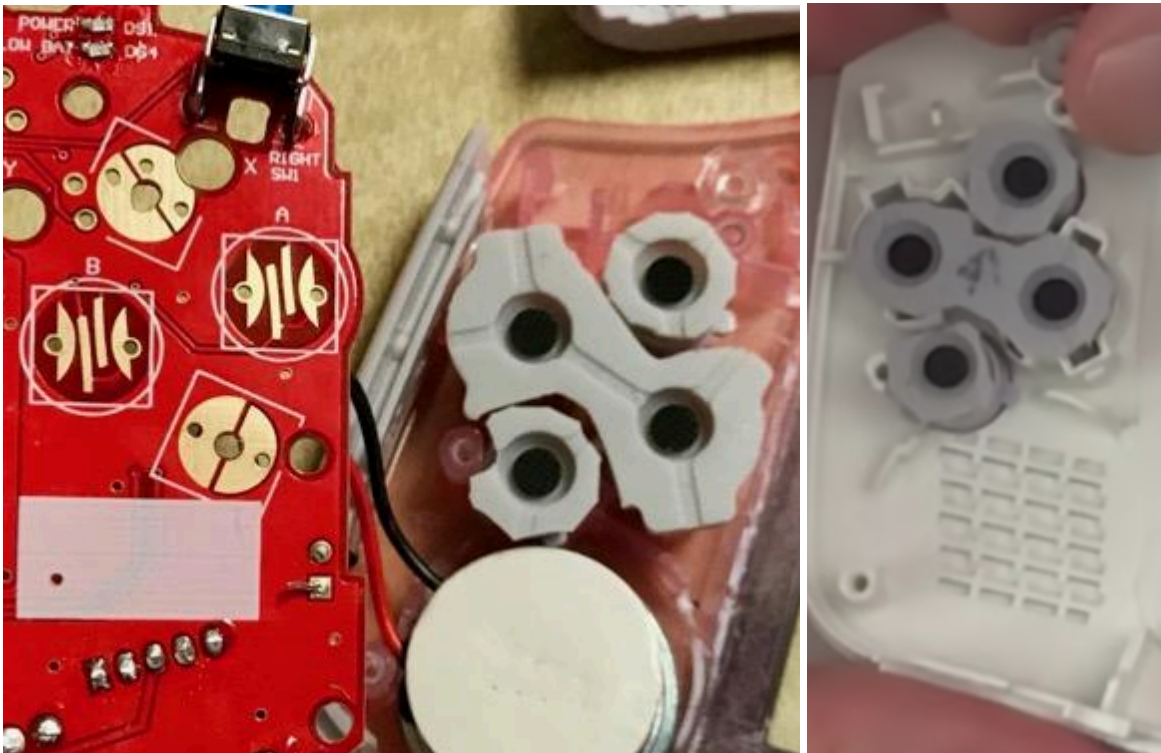




If you are using the [“Rubber-Nipple Square Solder-Yourself X/Y Buttons”](#), then please skip down to that section, now.

Modifying the silicone rubber pads is fairly easy. You can do this with a wire cutter, xacto, scissor, etc. Start with 2 A/B rubber pads. Keep one of them hooked together and cut the other in half (separating the A from the B). Try to keep as much of the connected pad intact. The other separated pads will need to be cut down fairly significantly. Here are a couple examples. Both work, but the example on the left has kept much more rubber intact. That will likely help the integrity of the pad during usage.

You can use a very small dab of superglue (or other adhesive) on the middle of the top and bottom button cap to adhere it to its rubber pad (the ones that are separated). This is not shown in the photos.



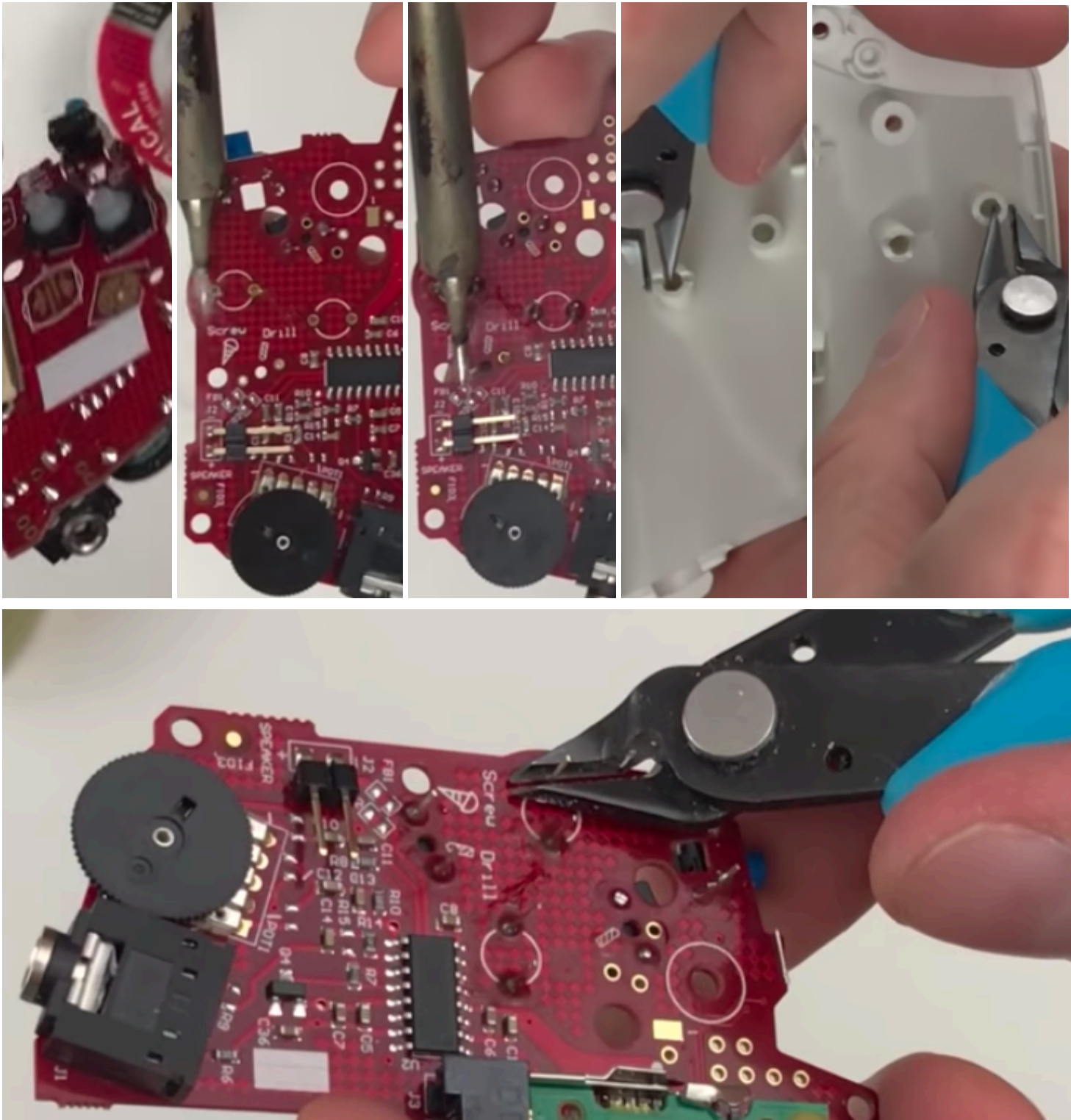
Rubber-Nipple Square Solder-Yourself X/Y Buttons

If you are using the rubber-nipple square solder-on buttons, please follow the [“Silicone Rubber Pad X/Y Buttons”](#) section to create the new button holes. Follow that section until it gets to cutting the rubber pads. Then continue [here](#).

You will need to solder the rubber-nipple square buttons. Be sure to do this AFTER you have created the new holes in the shell, because it is much easier to transfer and mark the hole locations without these buttons soldered in place.

Notice that each of the 4 button locations on the circuitboard has 2 holes that “straddle” the middle of the button footprint. These are where the legs of the button will be soldered on.

Make sure that the button itself is fully flush against the circuitboard before soldering. Once all 4 are soldered into place, cut off the excess leg wires that you just soldered. Cut these as flush to the circuit board as possible. These solder points may contact the plastic of the shell. If so, shave down any shell areas that are making contact.



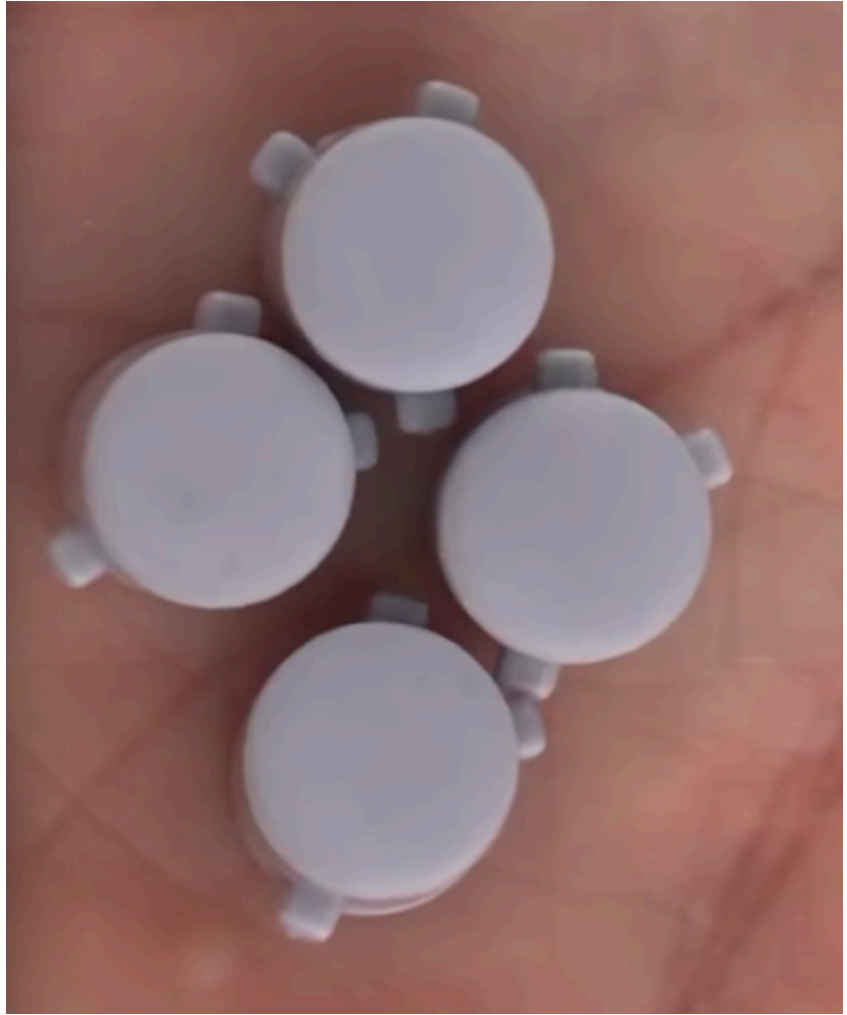
To make room for the base of the buttons, you will need to cut down the walls around the button caps.



You will also need to sand down the walls of the button caps themselves. Sand them until the wall is flush with the protruding tabs.



To finalize your buttons, you may want to remove the A and B labels from the button caps themselves. Do this with increasingly fine sandpaper. It may work well to sand with 120 grit, then with 240, then 600, and then finally 1200.



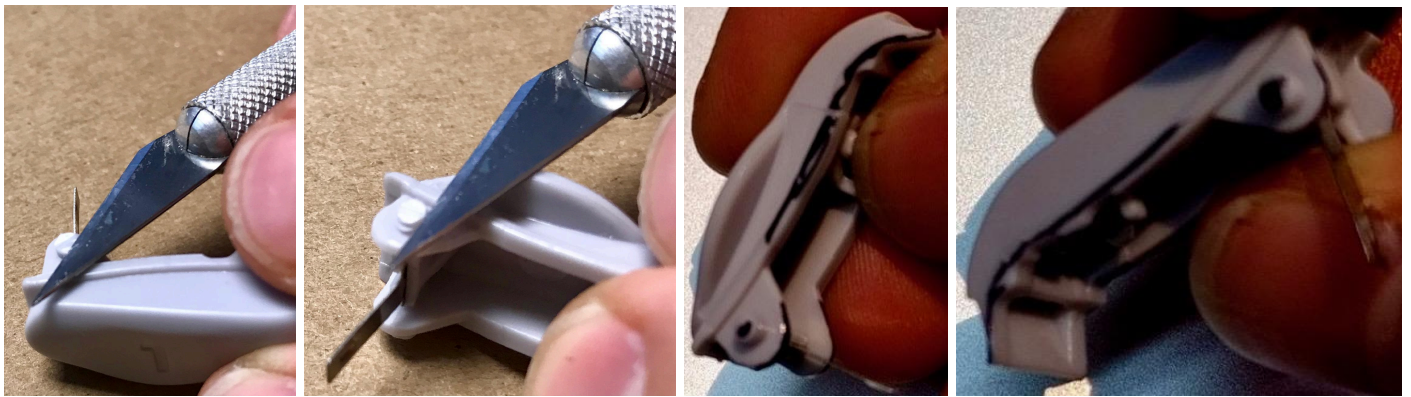
L/R Shoulder Buttons

You will likely need to make some small modifications to allow the L and R shoulder buttons to fit and work properly. You will need to widen the surrounding area where the button (on the PCB) will fit into so that the button itself fits fully down into the shell. There are 3 edges that you need to trim. This can be done very easily with either the hobby knife or the side cutters.





We have also found that the shoulder buttons themselves can vary from shell to shell (or if you get alternative aftermarket colored buttons). Sometimes the shoulders will work well until you screw the case together. Loosening the screws a tiny bit can help. Also, *SLIGHTLY* shortening the shoulder's posts can help. The black marks shown illustrate places that *MAY* need to be modified if you notice binding.



There are also a couple guide "pins" that stick up in places we use. Just snip them off.

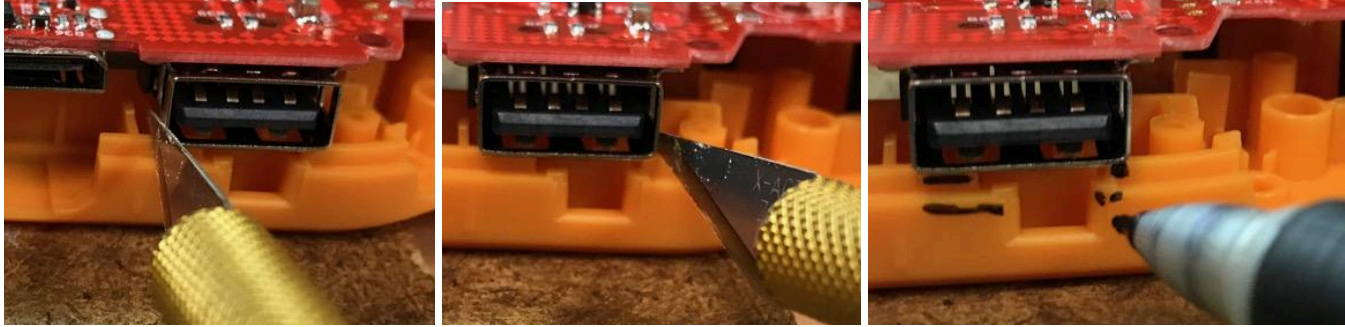


After removing the pins, you can try to fit your board onto the front plate of the shell to view and mark where the peripherals (charge port, micro SD card, HDMI port, and USB port) line up.



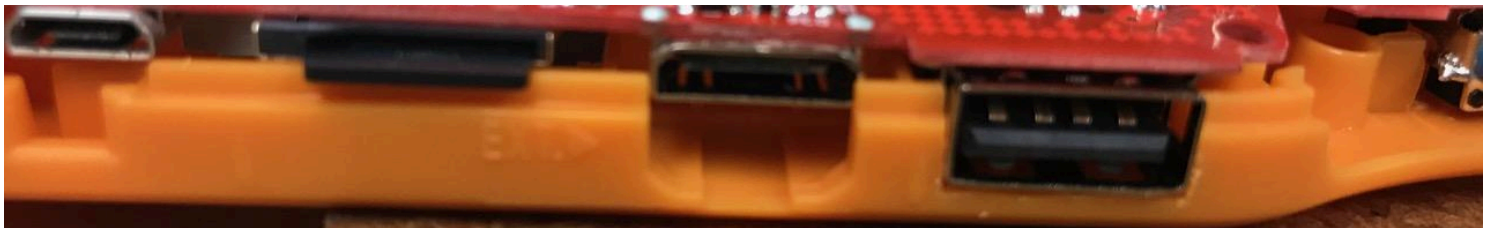
USB Port (Shell Front)

The USB port is where you can plug in things like WiFi, a USB flash drive, or a second player controller. It's the largest item here on the top of the shell, so it's the first that hits. It's really boxy, so it's not too difficult to cut. The main issue here is to measure or carefully cut the proper depth. The width is easy to mark with your knife or pencil.



HDMI Port (Shell Front)

The HDMI port fits perfectly inside of the original shell's "EXT" link port opening. There will be some mods to the "back" of the shell to make this fit, but for now, it is okay to leave it alone.



Micro SD Card Opening (Shell Front)

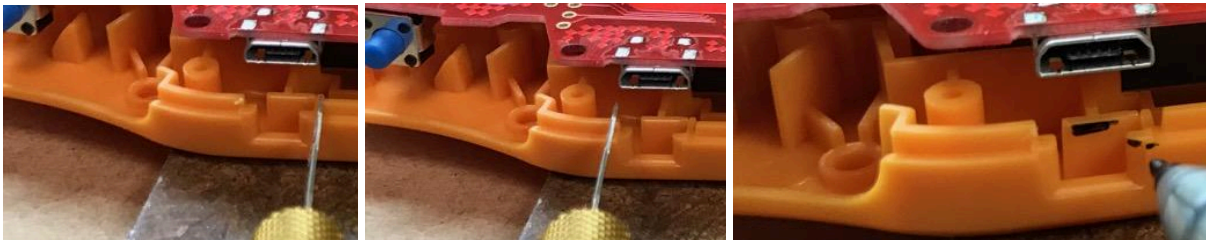
To make an opening for the micro SD card to fit through, you only need to make a slot wide enough for the SD card itself. You do not need to open it up the entire width of the SD receptacle.



Mark the width of the SD card, and then cut the opening down to the top of the “shelf” of the shell.

MicroUSB Charging Port (Shell Front)

You will need to make a modification to the back plate to accommodate charging. You will need to cut the shell down just a little to fit the microUSB port. This modification happens on the “face” of the shell and also on some of the recessed plastic parts (shown with black marker).



USB Port (Shell Back)

The back of the shell needs some small cuts for the USB port. Measurements here can be a bit deceiving, because there is this “shelf” where the back of the shell overlaps the front of the shell to make a nice seam. Go slow and cut carefully. First, you will want to remove these rectangular areas that would hit the USB port (and the charging port).



Next, you can mark and cut the portion of the shell to allow the USB port to fit.



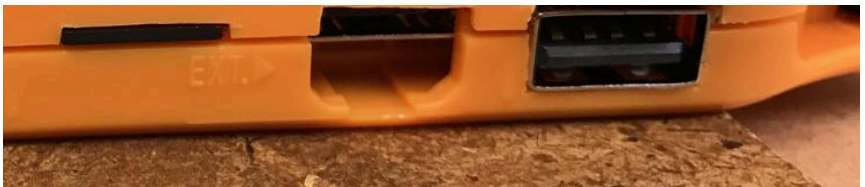
HDMI Port (Shell Back)

Even though the HDMI port width fits perfectly inside of the EXT opening, the back of the shell must be modified to fit the HDMI port's height.



Micro SD Card Opening (Shell Back)

To the opening for the SD card does not need to be very tall, and it only needs to be as wide as the SD card.



MicroUSB Charging Port (Shell Back)

This area can be cut out to make room for the charging port. I didn't have a photo of the finished cut, but this shows the area that needs to be removed around the charging port.



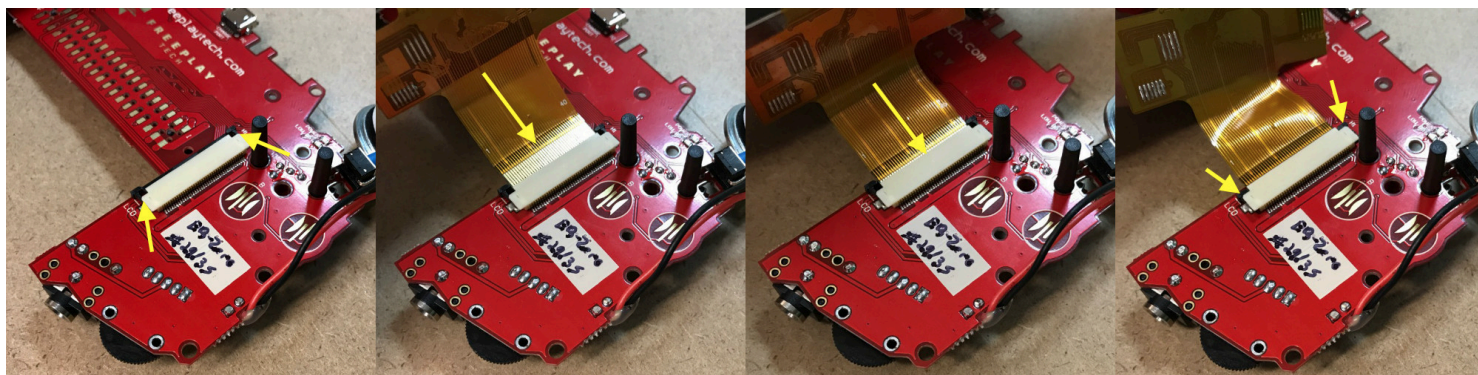
Power Button/Switch Modification



Cut the “nub” from the power switch slider as shown to allow it to spring back into place. The original GBA uses an on/off power switch, but the Freeplay CM3 uses a momentary button more like the NDS.

Front Plate Shell Assembly

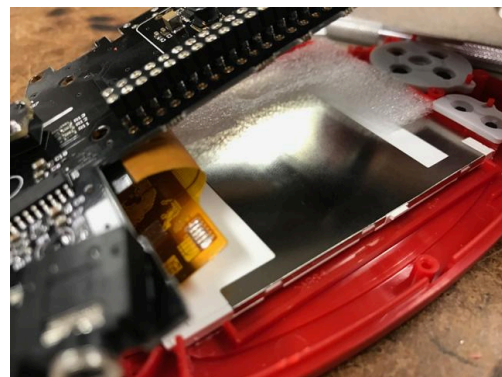
It should now be possible to assemble the front plate with the LCD, buttons, and circuit board. Insert the buttons and the power LED pipe into the front of the shell. Then put the silicone button pads (including the START and SELECT buttons) in place. With the gold contacts of the LCD ribbon facing up, connect the LCD to the FPCM3 board (see <https://youtu.be/sch5ZW1idz4>). With the LCD connected to the main FPCM3 circuit board, fit the LCD into the shell. Put the speaker in place, and fit the circuit board into place.



Open the LCD socket “shoulder” latches by sliding them out like a drawer. Insert the ribbon cable into the socket until you can barely see any of the gold contacts. These gold “finger” contacts should be nearly 90% “inside” of the socket. Once they are seated, close the “shoulder” latches. Please see the yellow arrows in the pictorial above to see the direction of motion.

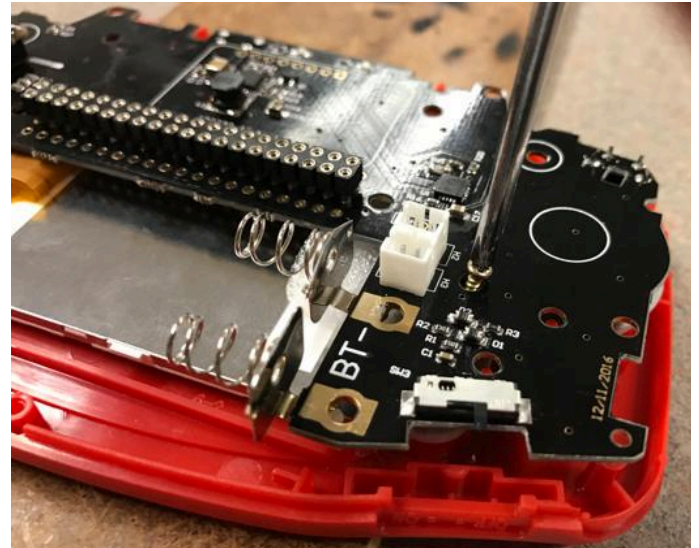
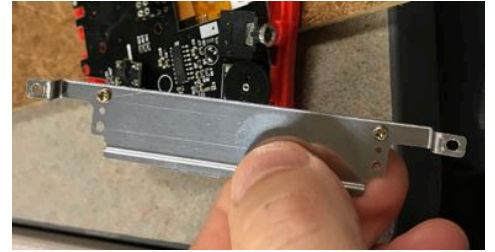
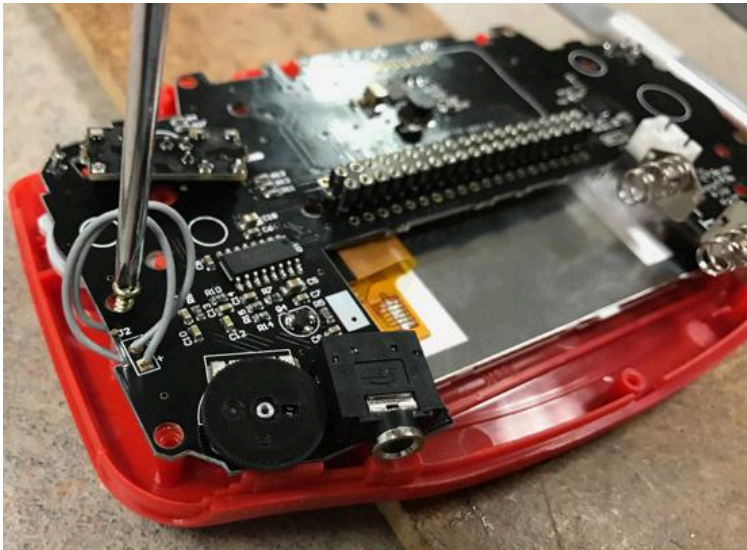


We recommend that you place some thin foam padding between the LCD and circuit board and between the speaker and circuit board. Use just enough to apply very slight pressure between the circuit board and LCD. This will help keep everything in place and provide some electrical insulation. With the thin foam that we use, we fold it on itself to create a 3-layer cushion.



It's quite nice to have a board about the width of the LCD (something like what is shown to the left) that allows the FPZ to sit flat without resting on the d-pad or buttons. If you place this assembly on a flat table, it will push on the buttons and make it difficult to screw together.

The circuit board can be secured to the front shell with 2 or 3 screws. If you kept the screws from the metal plate (shown to the right) that you removed earlier, they are good to use here.

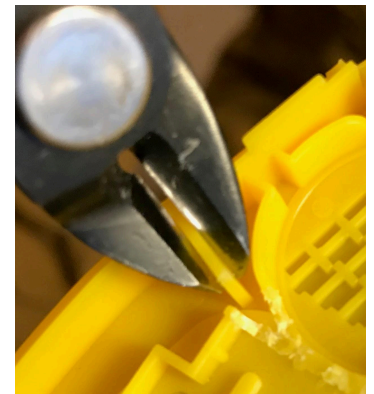


Volume Wheel and Headphone Area

In many builds, the plastic around the volume wheel needs to be modified. This seems to be very much a “fit, test, cut, repeat” process. There are plenty of inconsistencies in both the shell and how the volume wheel lays on the circuit board. Many times the volume wheel will rub on the shell. If this happens, this is typically on the side, and shaving down the plastic will usually alleviate the rubbing. It will sometimes be found on the top/bottom of the volume wheel, and this may not be a problem at all or it may be a problem only when the shell is fully screwed together.

The bottom side of the headphone jack has electrical contacts (wires) that protrude through the circuit board. Often the middle one will contact the plastic shell. You can snip off the wire, snip off the plastic, or do both.

The same thing can be true for the volume wheel. It's best to snip off any excess of the contacts that stick through the circuit board. They can contact the metal of the speaker and cause problems.





Boot Test

This can be a good time to boot up the unit just to be sure that the LCD is properly connected. Do not connect batteries without first reading the “[Battery Connections](#)” section of this document. When booting, you must hold the power switch in the ON position until you see the green LED on the front turn on. When starting up RetroPie, the LCD will go white for about 5-10 seconds and then show the RetroPie logo.

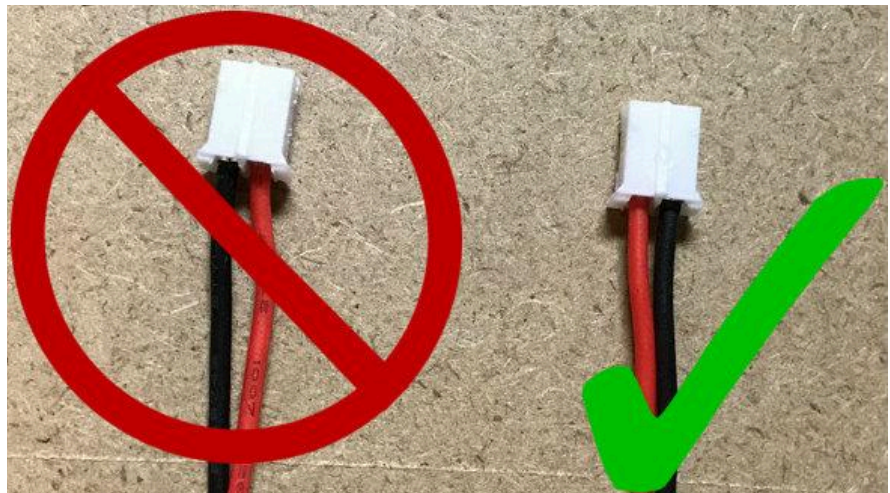
Install Heatsink

Our Freeplay CM3 DIY Kit comes with a heatsink for your built-in Raspberry Pi. You can use this heatsink or try some other cooling solution. To attach the heatsink, peel the backing off of the tape and place the heatsink onto the RPi CPU. We recommend that the fins run vertical to allow the heat to escape via the cartridge opening.

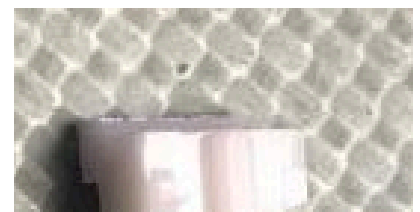
Battery Connections

Do not crush or force the battery in any way!

Please check and **DOUBLECHECK** that the battery you received is wired with the positive (red) and negative (black) as indicated on your Freeplay Zero/CM3 circuit board and as shown in the photos below. We have seen some batteries that have the proper connector but are wired backward. If your battery connections are backward, you can permanently “[swap](#)” the pins inside of the JST connector.



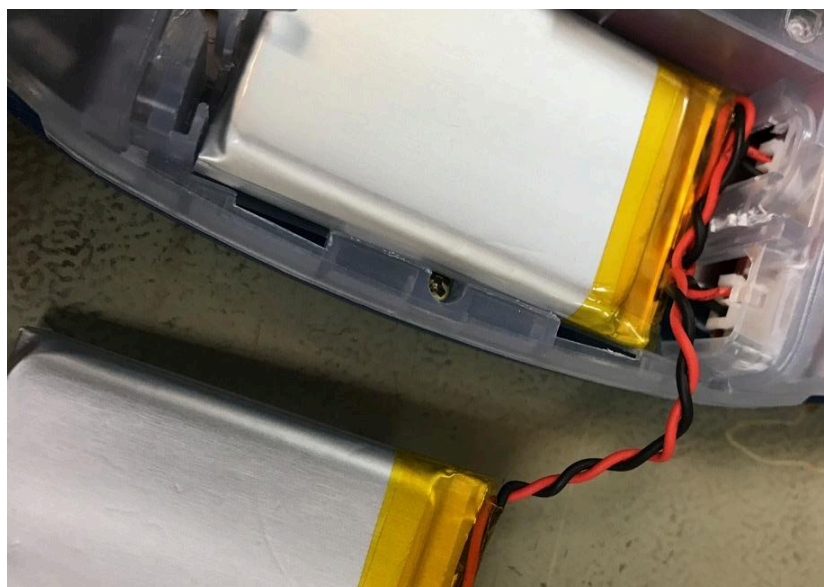
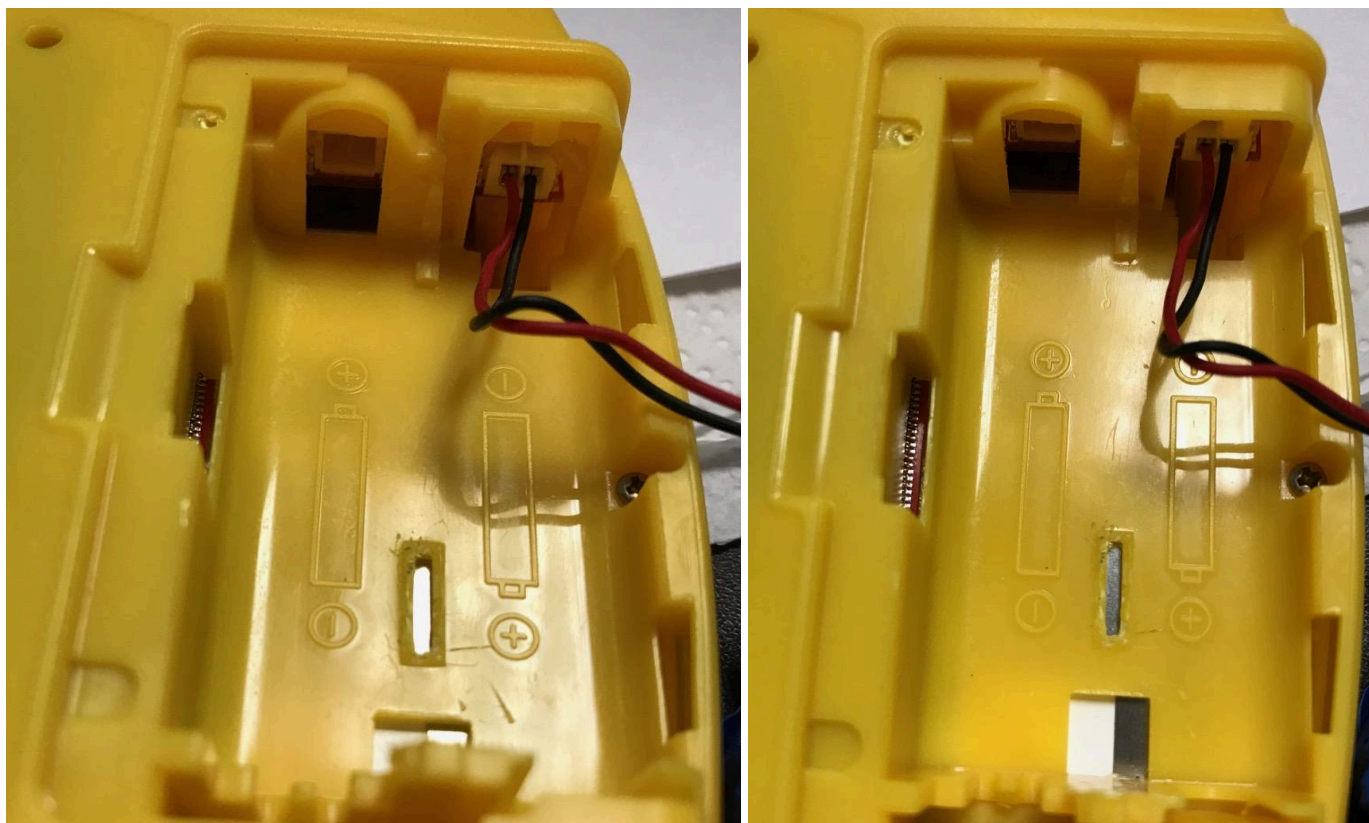
The battery connectors fit snugly, which is good, but they can be difficult to remove. It is unwise to be putting much force on the wires



while pulling on them to disconnect the batteries. To make removal easier, there are 2 “nubs” on the top of the battery’s connector that can be shaved/removed. The connector will still have enough friction to stay seated, especially when the batteries are shut inside of the battery compartment. We recommend this mod, otherwise the batteries can be quite difficult to disconnect.

We have seen that some “clone” or “off-brand” versions of the JST connectors will fit very tightly into the receptacles. Shaving or trimming the “fin” or the sides of the plug can help with this, as a too tight fit can make it more difficult to connect/disconnect the battery.

To install flat lithium cells inside of your battery compartment, you will need to remove the “fins” as shown in the following photo.



Make sure that the battery connectors are fully mated into the Freeplay CM3 sockets. It may seem like the battery is plugged in when it still has some room to press into the socket. This can lead to a poor connection and intermittent supply of power.

After you plug in each battery, you may want to spin the battery several times to twist the red and black wires together. This makes routing the wires easier, and it makes the wires curl themselves up nicely.

If you are using [Freeplaytech "clearance" batteries](#), you will need to make some extra modifications as shown in the following photos.



Completing The Build

You should now be able to close the shell and test the system. Consider just putting a couple screws in, as there is a fair chance you will want to reopen it to tweak something.

Boot it up and make sure that the LCD and all the buttons (especially the L/R shoulders) work properly. To boot the system, hold the power button until you see the green LED light up. That LED indicates that the operating system has taken over. The LCD should turn white during the initial bootup, but it will soon change to a splash screen. You can choose different splash screens (or even videos) in RetroPie's configuration, but we like the default splash screen for its quick boot.

You can use the MENU / CONFIGURE INPUT option of RetroPie's EmulationStation to test the buttons, but we don't recommend saving a new configuration. Just test them, and then hold the power button to shut the system down. You can also put the FPCM3 into a bootup test mode by editing the `/boot/freeplaycfg.txt` accordingly.

Once you are comfortable that everything is in place and working, then screw the shell together. Make sure the LCD is clean, and then install your screen lens that came with your shell. All the aftermarket screen lenses that we have encountered also come with a thin plastic protector. You may want to peel that off when you are satisfied with your build.

In the Freeplay Zero/CM3, the power button acts as a hotkey TOGGLE. Pressing it once (and quickly releasing it) puts the system into hotkey mode. Pressing any other button then does the hotkey function for that button. While in hotkey mode, you can press/release the power button to trigger the hotkey button by itself (and return the system to non-hotkey mode).

In Hotkey mode, here are the button mappings.

- | | |
|------------|--|
| SELECT | - Exit emulator (some emulators require START+SELECT) |
| X | - Emulator menu (gives access to many functions while pausing emulation) |
| B | - Reset (exits some emulators) |
| R shoulder | - Save current state to current slot |
| L shoulder | - Load state from current slot |
| R dpad | - Increment current slot |
| L dpad | - Decrement current slot |

Tips, Tricks, FAQs

Please submit any tips, tricks, or FAQs to feedback@freeplaytech.com

LCD is only White (or only Black)

The white screen would normally be from one of two things.

1. The LCD ribbon cable isn't properly inserted into the socket/housing and locked down.
 - a. Please see [this photo](#).
 - b. This would sometimes result in a black (non-lit) LCD.
2. The SD card/image isn't properly set up.
 - a. You aren't using an [image file set up for the Freeplay](#).
 - b. Something went wrong with burning the image to the SD.
 - c. The LCD drivers/software isn't properly set up on your SD card.

The first thing, if possible, is to just hook the Freeplay CM3 up to a HDMI TV/Monitor. That will narrow it down quite a bit.

If you see video on the monitor, and RetroPie/EmulationStation/Linux boots up, then you know the SD is working. In this case, it could be a bad LCD ribbon connection or you aren't using the Freeplay SD card image we provide.

Button/Speaker/Video Testing

To enter a test sequence on bootup, you can edit /boot/freeplaycfg.txt (even on your PC/Mac) and set FREEPLAYSTARTUP=RUNPY instead of FREEPLAYSTARTUP=EMULATIONSTATION.

Improving a "mushy" GBA D-Pad

<https://gbatemp.net/threads/improving-a-mushy-original-gba-d-pad.468162/>

Audio Problems

The first thing to test when you have audio issues is headphone audio. Using the headphones, test to see if you have audio in BOTH ears. If you have audio in only one ear/channel, then this could point to a hardware problem with the FPZ audio components. If you have audio in both but have no audio from the speaker (when the headphones are disconnected), then the amplifier or the speaker wire itself could be the problem. If you have audio in neither, then it can be a config.txt problem or a problem with the volume wheel.

If you have any extra pressure on the volume wheel, this can lead to failure of one or both of the audio channels. You may easily figure this out by just removing the shell/case screw nearest to the volume wheel. The real fix would be to shave away any plastic adding pressure on the wheel.

No Sound From HDMI TV

Do you want to play on your nice big TV, but all you get is audio through the built-in speaker of the Freeplay CM3? Yeah, that's how it's designed to work, actually. Let's just assure you that there are good reasons for this design choice, and then we can go on to tell you how to switch to HDMI audio whenever you want to.

The simple way to switch is to choose the "RetroPie" menu from the main menu after bootup. Then select the first option, which is "Audio." In there, you can switch to HDMI and then go back to the main menu. This should switch audio to come out the TV from now on. Just remember what you did there, because if you grab the

Freeplay Zero/CM3 and take it with you, next time you go to play you might not have any audio. Then you'd need to switch it back.

If you want to be a bit more technical and want something that may (or may not depending on your HDMI hardware) do a bit better autodetecting, you can edit the /boot/config.txt file and change

```
hdmi_drive=1      #Normal DVI mode (No sound) (2 for HDMI with sound)
```

to

```
hdmi_drive=2      #Normal DVI mode (No sound) (2 for HDMI with sound)
```

But keep in mind that this can cause video problems on some HDMI monitors (ones without audio built in), so that's why we keep it at 1 to work on the most setups (and allow you to tweak for your individual needs).

Have Fun

Game on!