

Tutorial: USB Power Modification for HP97 Calculator

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Introduction

The HP97, introduced in 1976 is one of the most amazing and still useful desktop calculators. At the time, I was a kid too young to buy one, but it was magical seeing them. I will not go into the details here, as they are abundant on the internet, but I will say that this is one of my favorite electronic devices of all time.

I am not a purist nor calculator collector, so this mod may offend folks who want everything “factory.” I don’t believe in that. For example, if you have a 1972 capacitor that failed, and replace it with another, working, 1972 capacitor you can buy, it will probably fail too. So if you are a purist who will be mad at me, please don’t do this mod.

However, the design of the HP97 is such that it is fed 12.8 VAC from an external AC adapter, which, through a simple circuit, charges for sub-C, NiCd batteries to a nominal voltage of 5.0V... So it is natural to think about modifying the calculator to plug into the abundant 5V USB power all around us. That way, one could run the calculator without the expensive and short-lived (and environmentally toxic) NiCd battery pack. Of course, some clever folks have already thought of, and done it, as can be seen on the internet (e.g., <https://www.facebook.com/groups/hpcalc/posts/10159966673384690/>), but my point here was to do it using standard, readily-available parts and write it up as a tutorial.

The bottom line is that even with all display segments lit up and the printer printing away, the calculator draws less than 400mA from a USB port, so this is just fine for plugging into a cheap USB power supply, a spare port on a desktop or laptop computer, or whatever.

The only real risks are upon you, making this mod, to not break, scratch or wire backward any of it. The author (me) accepts no liability whatsoever. However, the mod is really simple and takes only maybe 30 minutes, even proceeding with caution as one should.

My current approach is to first get the card reader (and printer if needed) serviced by the amazing Mark Hoskins (waterhosko@aol.com) – truly a kind and talented person.

Note: the HP97 service manual, with great information about the power supply, including schematics, can be found here:

<https://literature.hpcalc.org/community/hp97-sm-en.pdf>

Note: I accept zero liability for anything relating to this mod. By using this guide, you are accepting full responsibility. No assurances nor warranties are offered nor implied as to this modification. Period. Sorry – had to put this in here.



Figure 1: The final result... an HP97 with a flat USB-A cable coming out of it (I used a 3-foot cable) that does not need (and should not have installed) the original NiCd battery pack and will work well on less than 2W of 5V USB power. This should last until 2125, or so. ☺



Figure 2: It works.



Figure 3: Current draw is around 310mA with all display segments on. Not much different, still less than 400mA, when printing. This does not show peak currents, but my opinion is that it works. Implement at your own risk but if you do, enjoy. ☺

Procedures

Before you start... these calculators can be as much as 50 years old. Capacitors die, plastic gets brittle, dirt collects, wear takes its toll, and many of these were stored in sheds and garages, then picked up by folks at garage sales before being put on EBay. Beware, and don't start this project if you are uncomfortable with mechanical stuff, old equipment and soldering.

Having said that, with a modest amount of skill and patience, this is a very rewarding project, and you can save an HP97 with corroded or absent battery terminals – you do not need them (in fact, I absolutely and totally warn against using this mod with an installed NiCd batter pack – **DO NOT DO IT** – it might overcharge, get hot, or worse. No. These old-tech batteries do not last long and are environmentally awful. No.).

First, I recommend marking the polarity of the battery terminals (even if they are missing) to prevent mis-wiring later. I use a “silver” Sharpie marker.

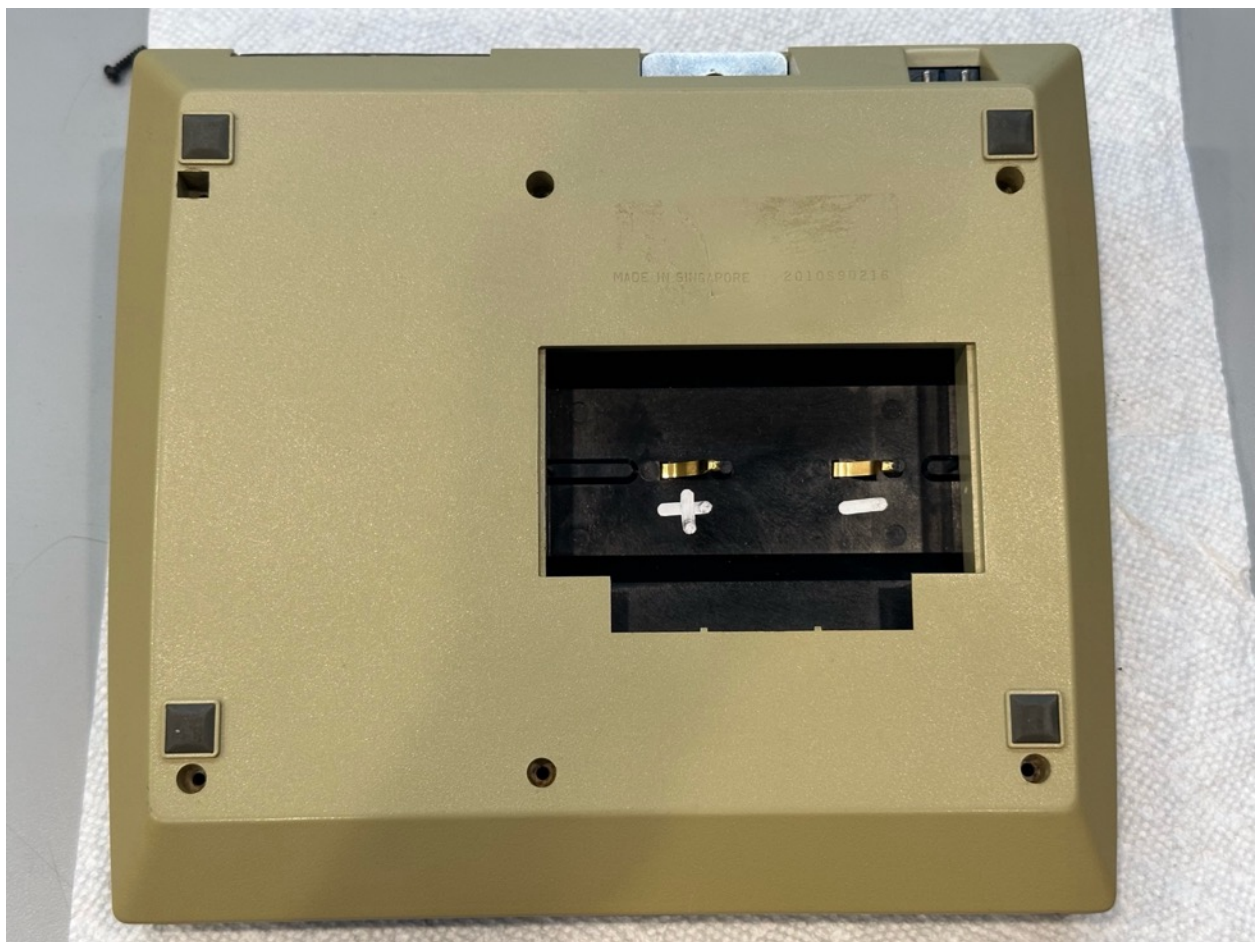


Figure 4: Marking polarity of the battery terminals.

On a soft surface (towel, paper towel, your leg, the back of a sleeping goat, or similar) remove the six screws from the bottom of the case. Then remove the back cover and set aside.

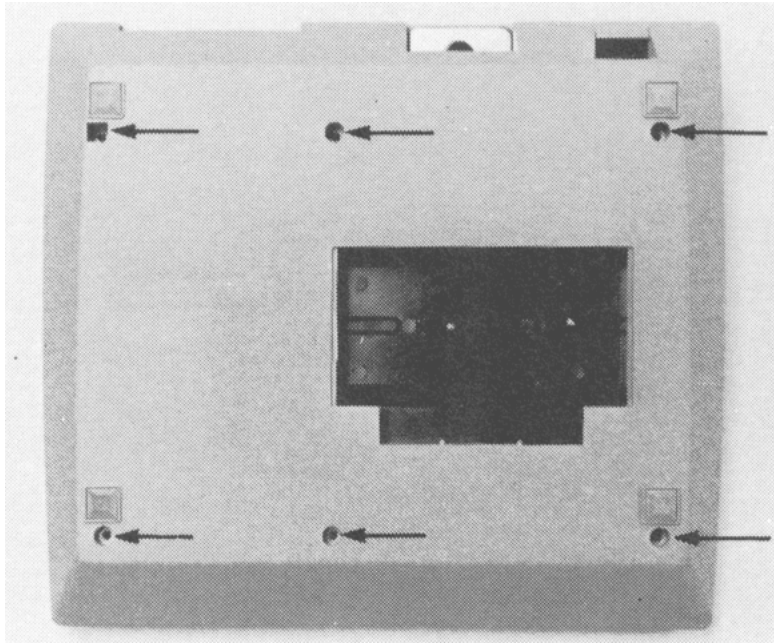


Figure 5: Removal of screws and back cover. (Figure from HP Service Manual.)

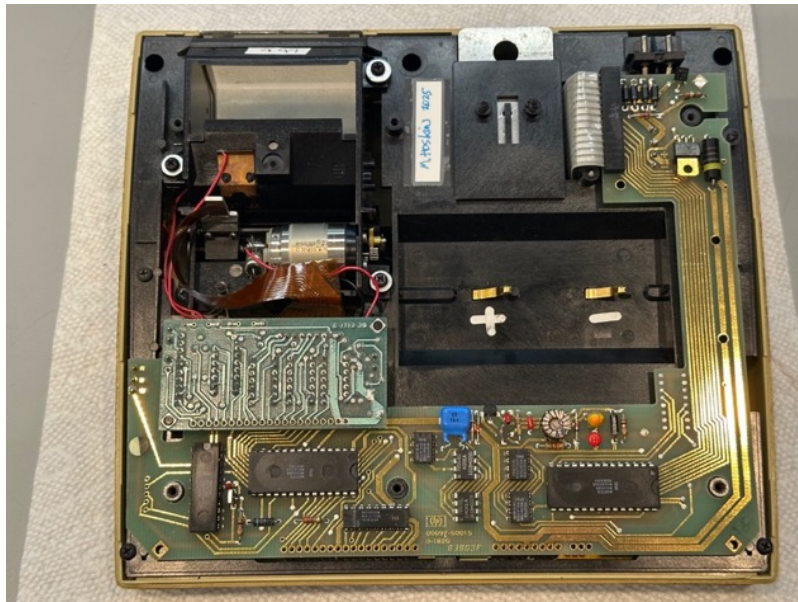


Figure 6: What you see on the inside. Please not the signature of Mark Hoskins, at my request, after he repaired the card reader and printer mechanisms (thanks Mark!). Notably, Apple “Photos” found his signature easily...

Next, remove the seven (sometimes only six are installed) screws that hold the support plate down, and gently remove the support plate and all of the electronics with it. Be very careful with the gold-plated pins and mating holes at the front near the HP faceplate. These should not be bent or otherwise damaged.

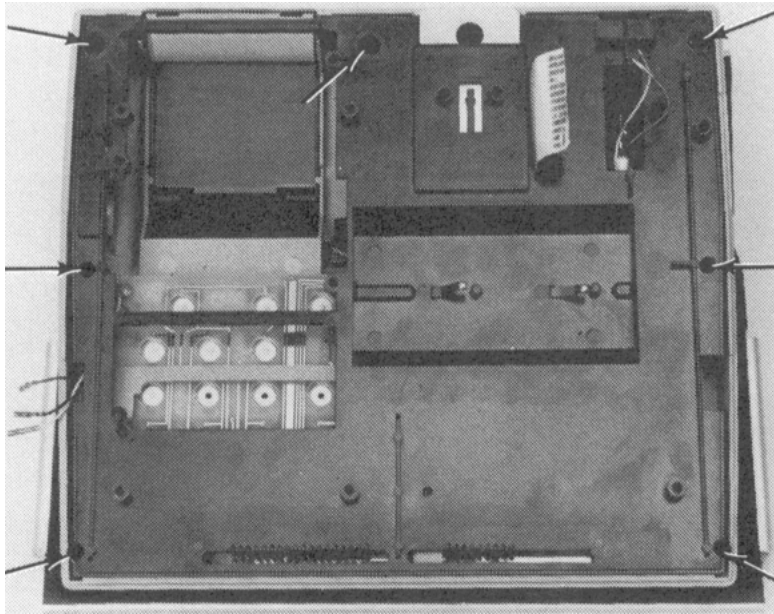


Figure 7: Removing the seven screws holding the support plate.

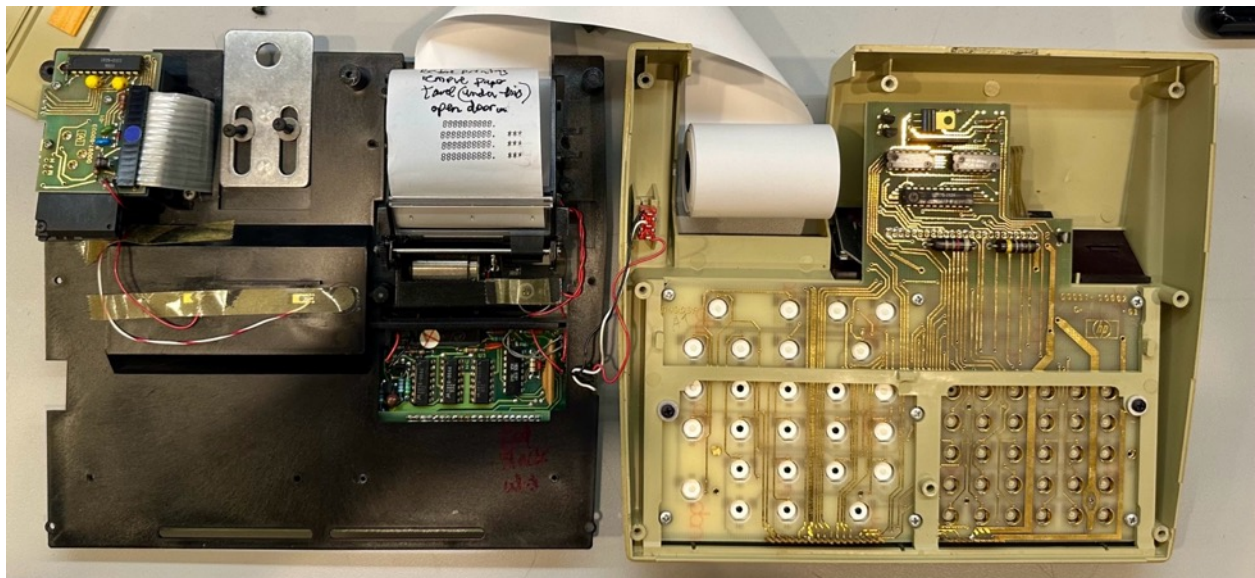


Figure 8: Everything opened up (carefully!).

Next, remove the “security tab” at the back of the support plate – you will not need it but use the mounting points for the USB breakout board.

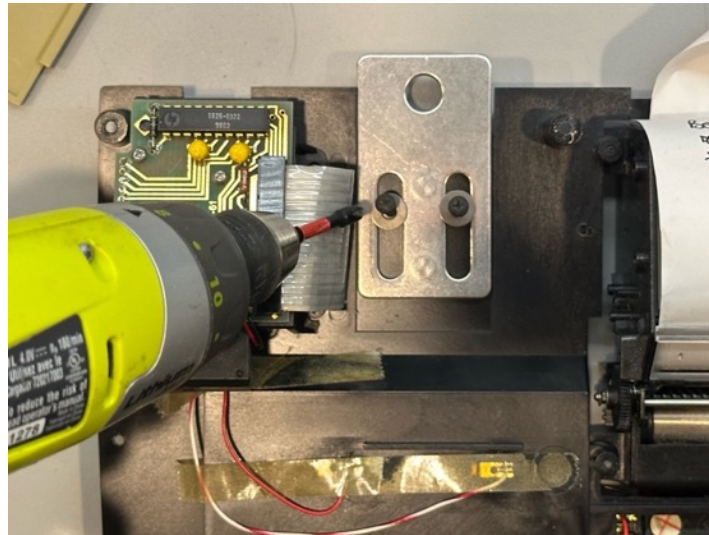


Figure 9: Removing the “security tab.”

Next carefully remove whatever remains of the tape used to cover the top-side of the battery terminals. Note that the white wire with red strip is the positive terminal, not the solid red wire, which is the negative terminal. Here I recommend again marking the polarity.

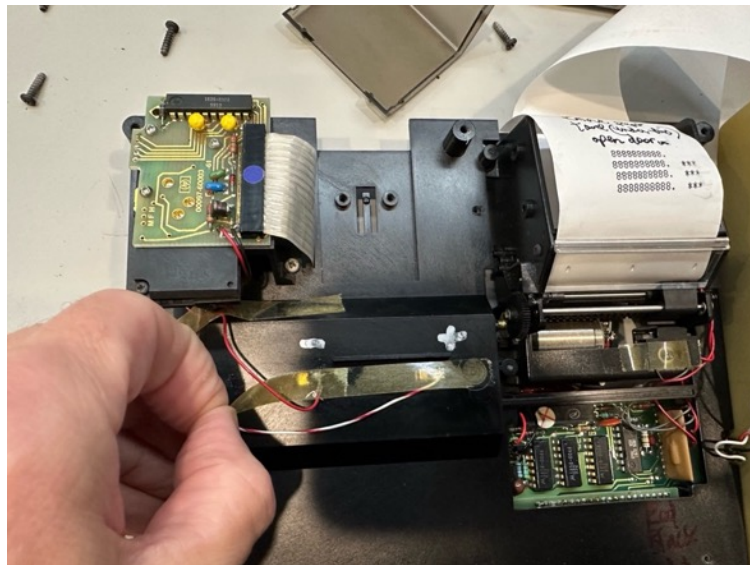


Figure 9: Polarity marked battery terminals. With the security tab removed, my HP97 feels a little bit “insecure” but not for long. Soon it will run from USB power!

Next, you will need to prepare the needed parts: one USB-C breakout; one piece of twisted pair, red/black wire, 28-gauge, stranded, about 5” long; and one flat USB-C to USB-A cable. Specific parts available on Amazon are listed below. I do not like endorsing specific brands. Offshore vendors, in particular, can notice a recommendation, watch upticks in sales, and jack up prices greedily. This stuff called out here is totally trivial and there are multiple vendors and work-arounds. Having said that, for now, here are some links that work (clearly bullshit aimed at tracking... I got them using anonymous connections, I am not including them – just search product names):

USB-C Breakout: Cermant brand, 10pcs for \$9.99 (11/18/25)

Wire: TUOFENG 22awg electrical wire 22 gauge, \$15.99 for 100 ft, so share with others (11/18/25)

Flat USB-C to USB-A cable (a bit expensive): UNIDOPRO, 2pcs, 3FT flat design USB C cable.

Good luck. It’s a scary offshore vendor world out there!

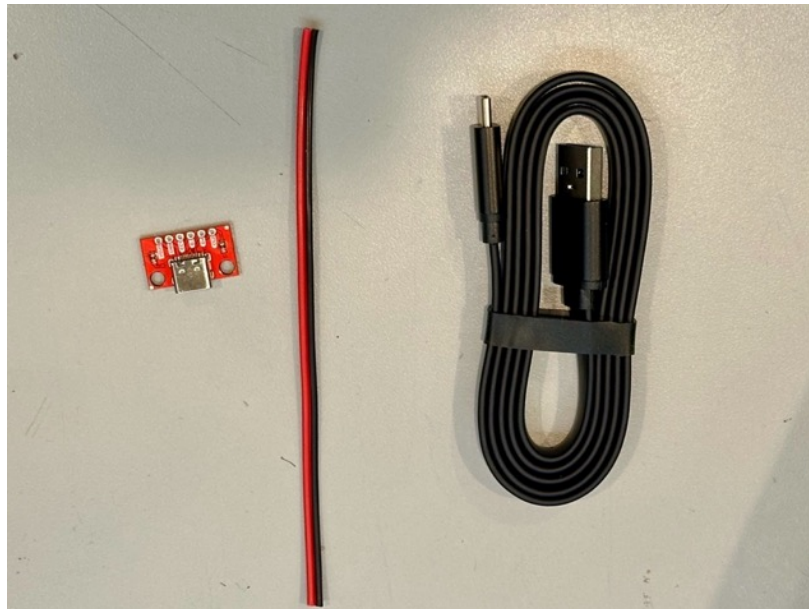


Figure 10: Parts you will need for the HP97 USB power mod. Easy to find at the moment, but beware of the constant supply of crap out there.

Again, I absolutely do not recommend trying to use this modification with an installed NiCd battery. **Do not do it.** Why on Earth would you want to do that anyway? Really.

The Positive Terminal is labeled “VBUS” (red wire) on the breakouts I use, and the negative terminal “GND” (black wire). Solder on the wires, carefully checking the insulation (overheating can melt it, and allow the two wires’ cores to touch and short-circuit the USB power... bad!). Snip off any excess wire on the back-side of the USB-C breakout. Then solder the other ends of the wires to the correct (!) battery terminals (double, no... **triple** check the polarity!).

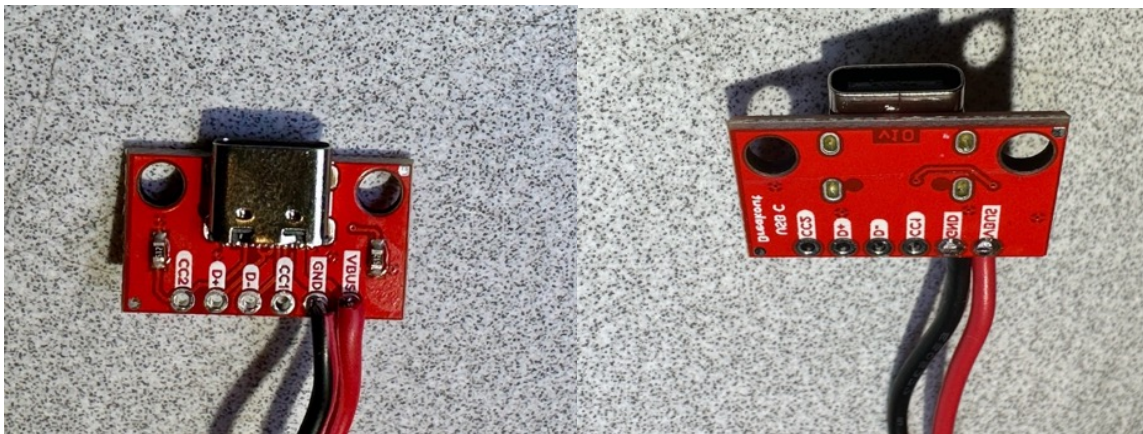


Figure 11: Top (left) and bottom (right) views of USB-C breakout with wires soldered on.

Next, place the USB breakout on the two mounting points where the security tab was, and insert the two screws from the security tab through the USB breaking into the mounting points. You will notice that is is not a perfect fit. The screws, if SLOWLY and CAREFULLY tightened in stages, alternating between screws, will “ream out” the breakout holes to fit (the breakout holes are a bit closer together than the mounting holes of the HP97. If you don’t like this approach, you can enlarge the holes a bit beforehand. When you are done, it should look like what is shown in Figure 12 below.

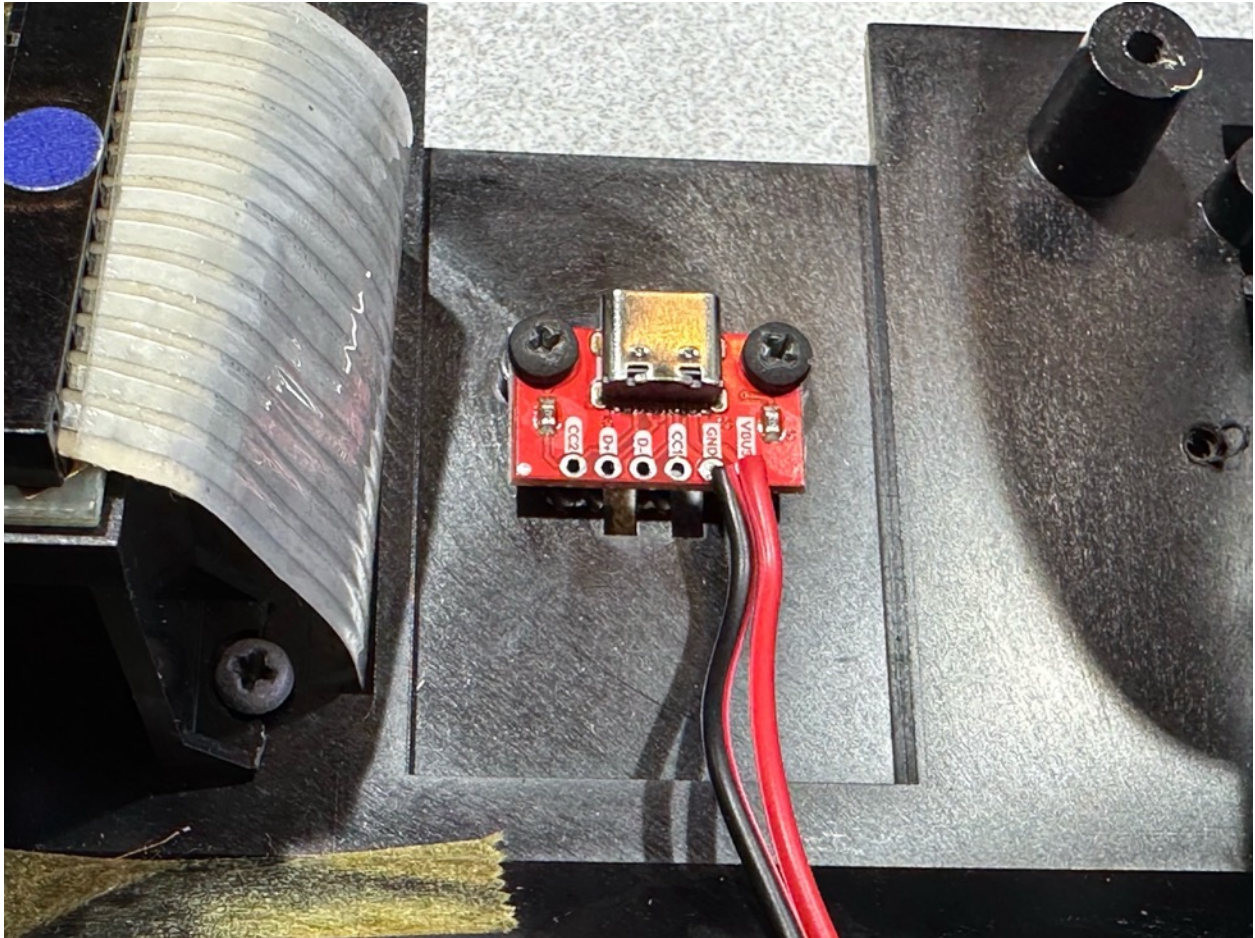


Figure 12: USB-C breakout screwed to the mounting posts that formerly held the metal “security tab.”

Then, apply some kind of insulating tape over the battery terminals. Personally, I like packaging tape (Figure 13) because you can see through it, although it is not clear (ha, ha) how long it will last. Then insert the USB-C end of the cable into the breakout. It is pretty much impossible to insert once the case is closed. It will barely fit within the inner mold-line of the HP97 case. Purists, if you did this anyway, should probably not have done it. Figure 14.

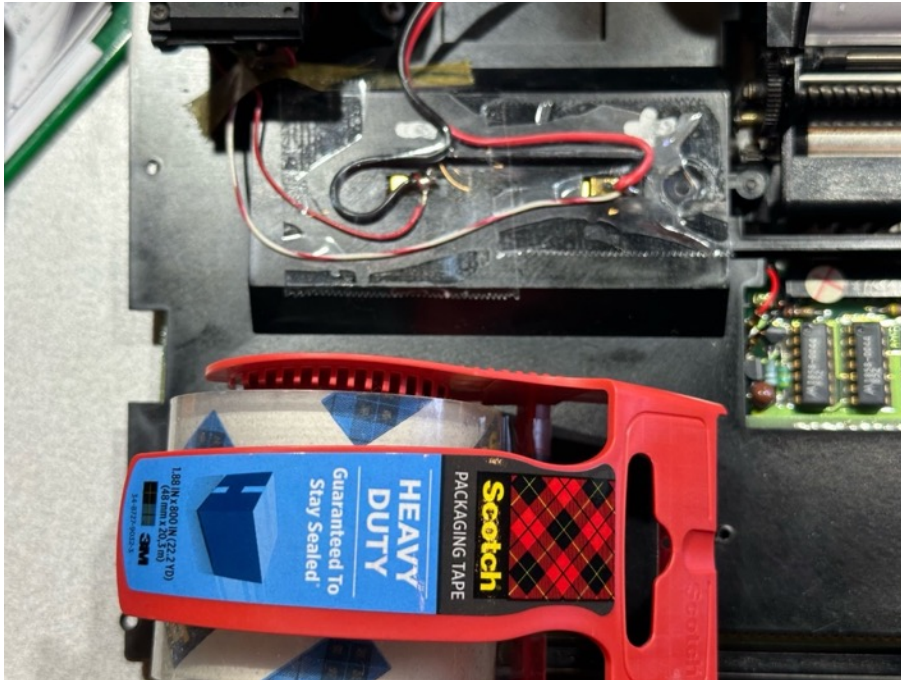


Figure 13: Postal packaging tape seems to work, and you can see through it.

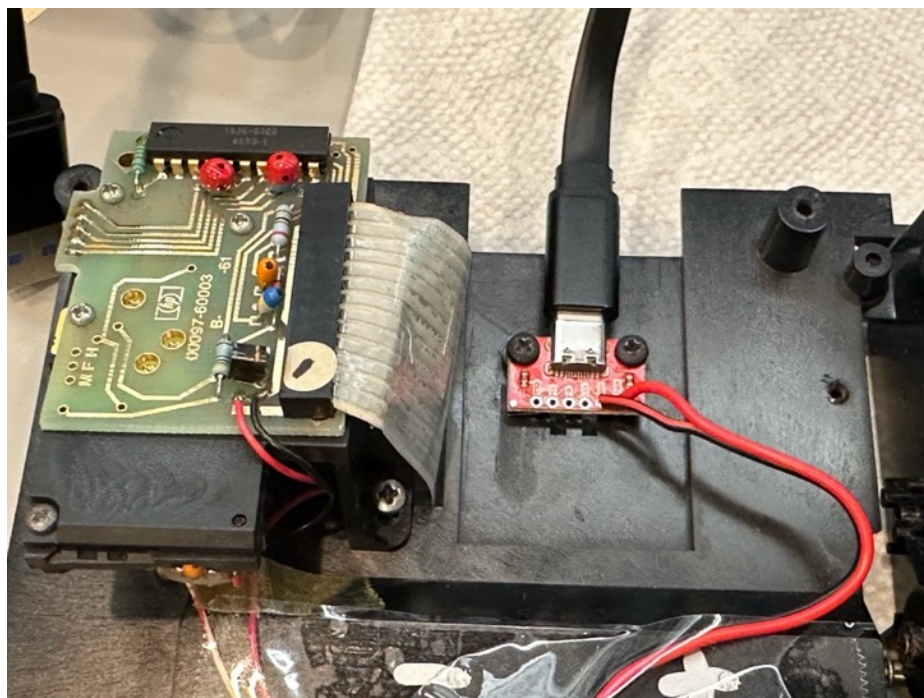


Figure 14: USB-C cable inserted into the mounted breakout board.

Next carefully re-mount the support plate, paying special attention to the gold-plated pins that need to mate with the gold-plated holes at the front of the main circuit board (Figures 15 and 16). Be sure the paper roll cover is in place – there are two tabs that hold it down and allow it to rotate. Replace the six screws that hold the support plate down.

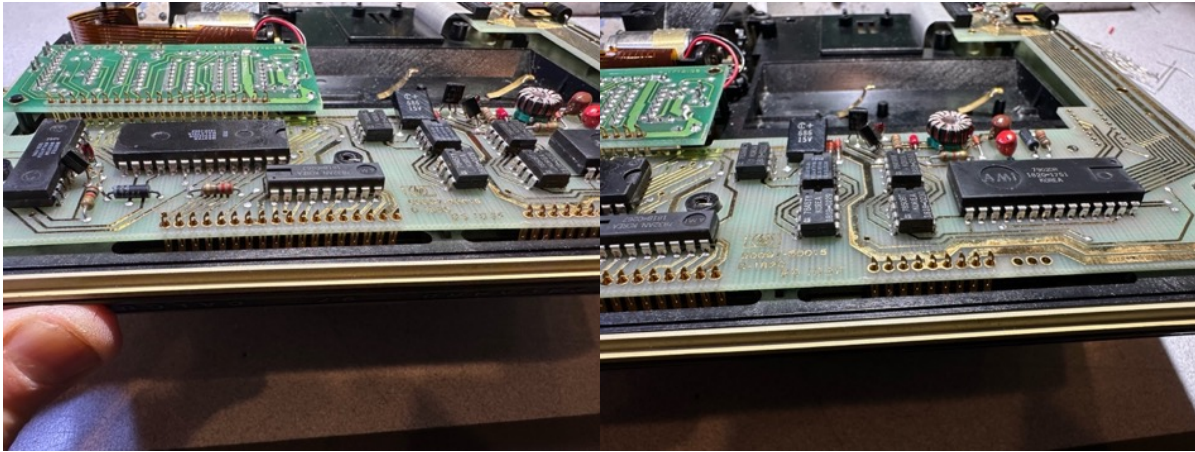


Figure 15: Close-ups of the mating gold-plated pins and holes. Note that the right-most three holes have no corresponding pins.

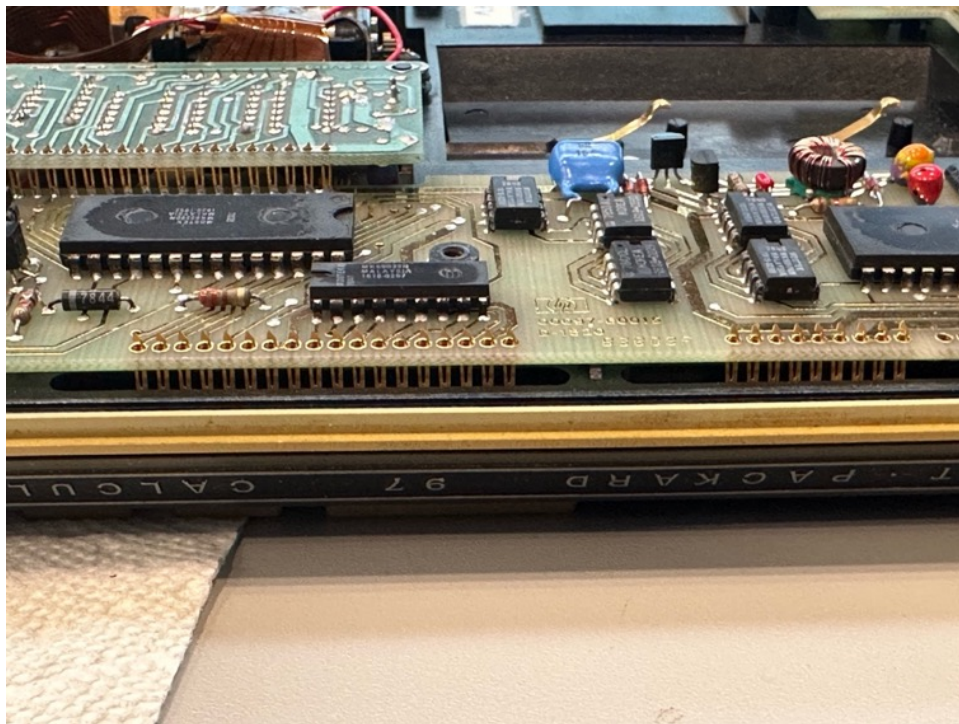


Figure 16: Another look at the whole row, just I case, before you close the case... ☺

At this point it is prudent to test it. Without allowing the bare bottom circuit board to short on anything, plug in USB power and check the calculator. It should work. If not, immediately stop and check your wiring! You can see from Figure 17 that the flat USBC cable barely fits. Nice.

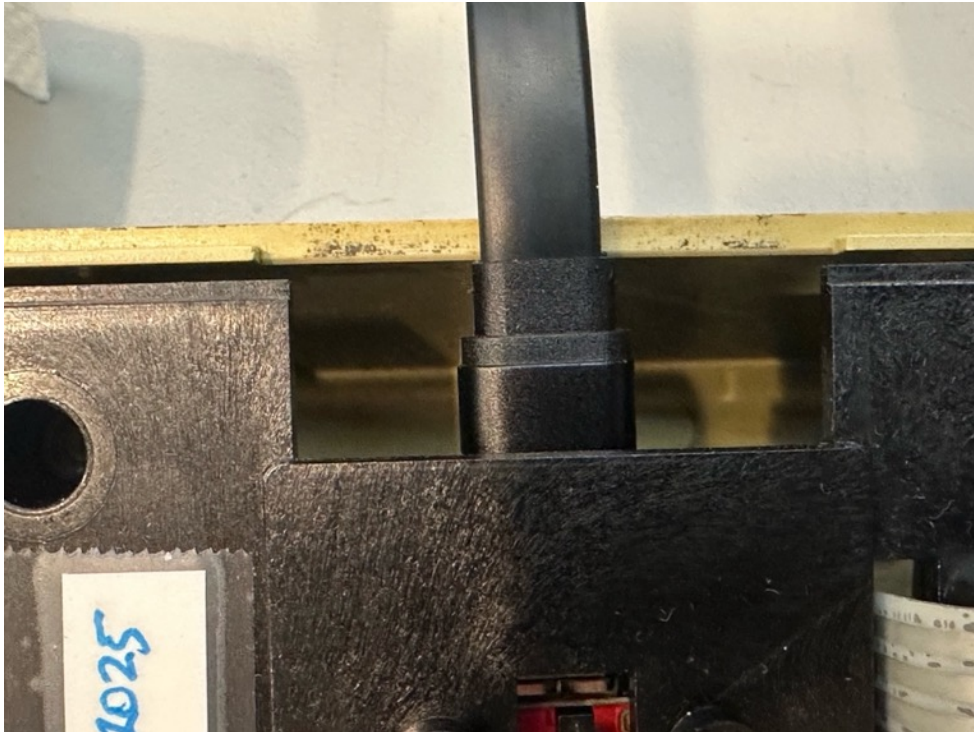


Figure 17: USBC cable barely fitting within inner mold-line of the HP97 case.

Lastly, reassemble the case carefully, with the screws you carefully set aside and enjoy. Also, prepare to explain to your descendants why we used 5V power, what USB is, and importantly, what RPN is.

Thanks,

Greg Kovacs

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