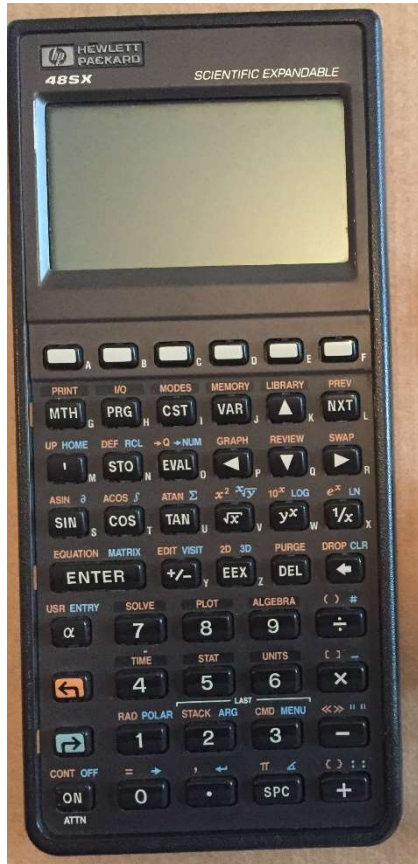


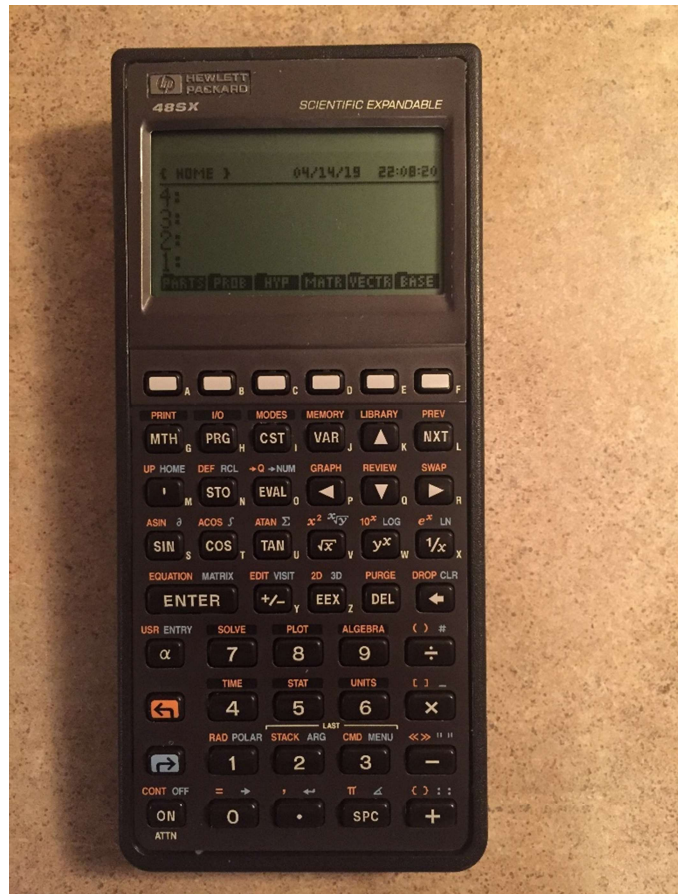
# HP 48SX Keyboard Replacement and LCD Upgrade

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14-April 2019



Broken 48SX Keyboard



Working Keyboard and Upgraded Black LCD

## **Introduction:**

My trusty 48sx was my first HP, and was bought for me in Jan 1991 before I was entering Engineering school. When the calculator was still a teenager (c. 2009 or so), it suffered an issue with the keyboard foam deteriorating, causing keystrokes to miss. At the same time, one of the ENTER key's hinges physically broke.

My very first repair job started at that time, and I entered the calculator using some instructions I found here (the toenail clipper method). The repair was sort of successful, and I had a few dropped LCD lines, but the keys all responded. Sadly, the lack of a quality repair left this unit to sit on the shelf. I purchased several other HP units from then till now, effecting repairs on several Pioneers. I always hoped I could salvage and repair this unit someday.

Fast forward to 2019, armed with some repairs under my belt, I attempted another shot at repairing this unit. To repair and upgrade the 48sx, I purchased a 48S with the foam issue, but otherwise excellent condition to use as a keyboard donor and a working 39G for its black LCD. These two donors would resurrect my own 48sx. Since I wanted the unit to look as original as possible, I elected to use the original 48sx metal overlay/bezel instead of the one that came with the 48s.

## Part 1 – Opening a Donor 48S



Tools:

48S donor

Hair dryer

Plastic electronics opening tool

3M Permanent Mounting Tape (to replace keyboard foam)

XActo knife

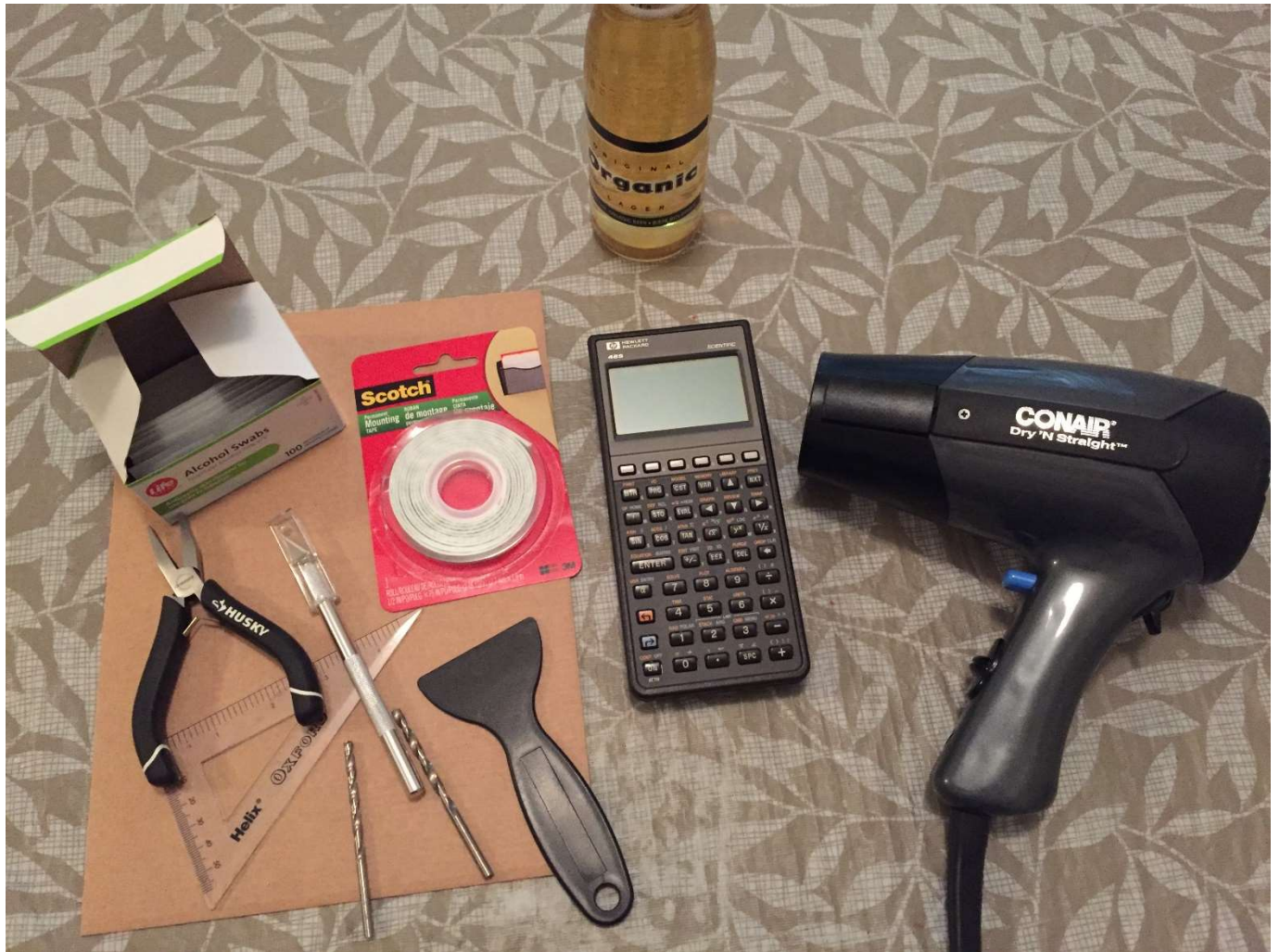
Drill bits

Flat nose hobby pliers (no teeth)

Straight edge to help cut new keyboard foam to size

70% Alcohol Wipes





Additional Tool added: LIQUID COURAGE !! (Mill Street Organic Lager)

I use the opening method detailed by Geoff Quickfall:

Page 6 of 13 here:

[http://h20331.www2.hp.com/hpsub/downloads/Newsletters\\_HP\\_Calculator\\_eNL\\_06\\_June\\_2010.pdf](http://h20331.www2.hp.com/hpsub/downloads/Newsletters_HP_Calculator_eNL_06_June_2010.pdf)





After heating up the bezel at the bottom, carefully pry up the bezel using a wide plastic tool to avoid bends/creases at the edge of the bezel. This particular tool was included in a purchase of a smartphone repair toolkit from Amazon.



Continue heating the bezel to soften the glue, and advance up the keyboard with the tool. I hold the tool and the metal bezel together and pull at about 45 degrees. You want to pull as parallel to the plane of the bezel as much as possible to minimize out of plane creases on the bezel in this process. Otherwise, you get defined creases at each key row that you will have to form back later.





Be very careful as you get the bezel removed at the white key row. There are a few joggles in the metallic bezel at this point that you want to be careful with. Also, the frame around the LCD is delicate, and too much force prying up here will cause creases that are hard to remove later.





I did not show, but you should heat and pry the bezel using the wide tool at the top of the calculator after the last step. This is to prevent the vertical frame around the LCD to bend. There is a significant amount of glue at the top, so take time.



Bezel removed, and its not looking too bad in terms of creases.





Pry up using a plastic tool. Actually, you should use something narrower than this, as you do not want to bend the IR leads which are in the center of the calculator's width here. In the end, the IR leads were not bent, but you really want to be careful, and I suggest using something narrower.





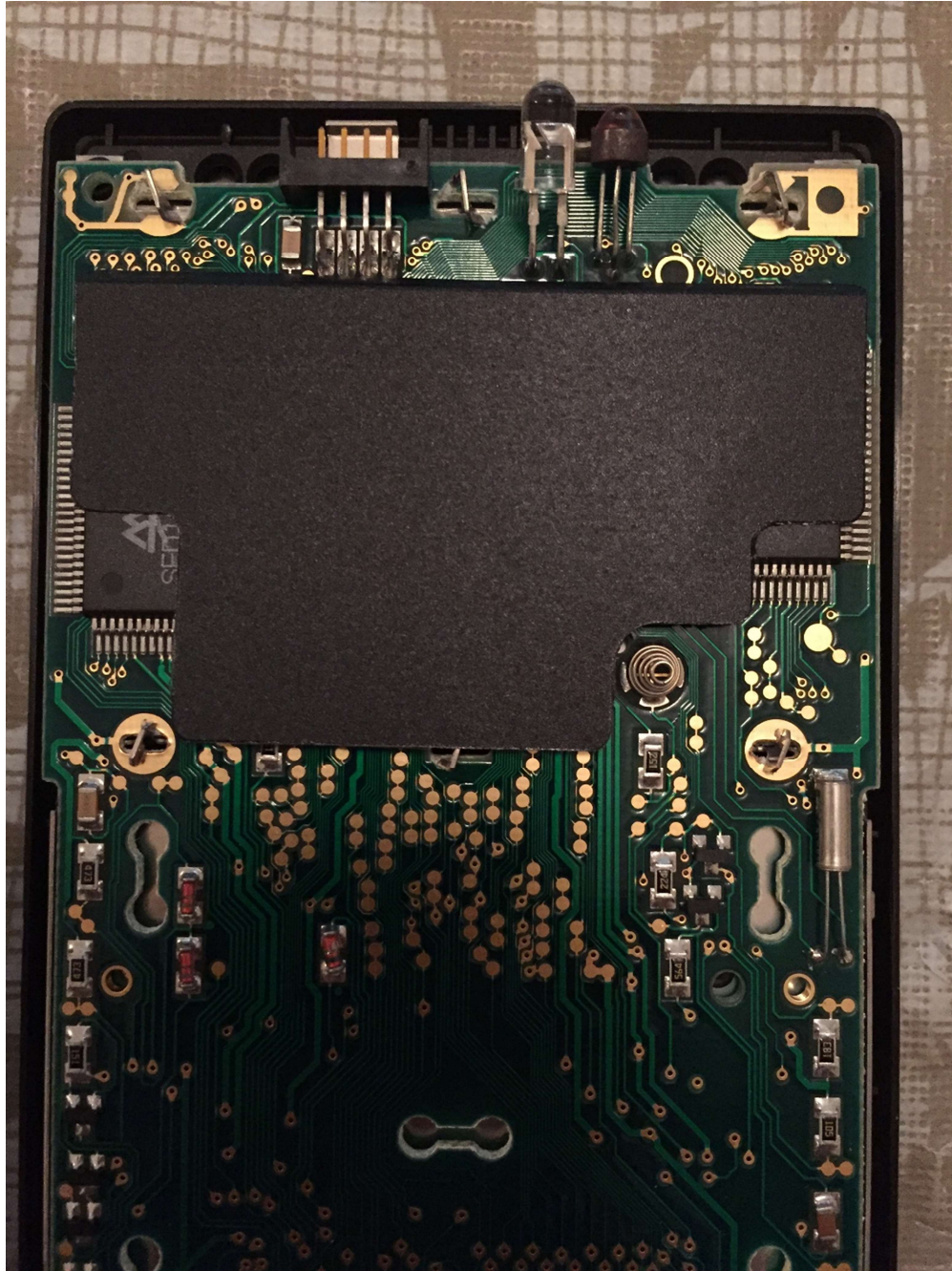
Coming apart nicely. Use the wide plastic tool along the edges to unhook the metal hooks from the plastic case

C



The light of day!!





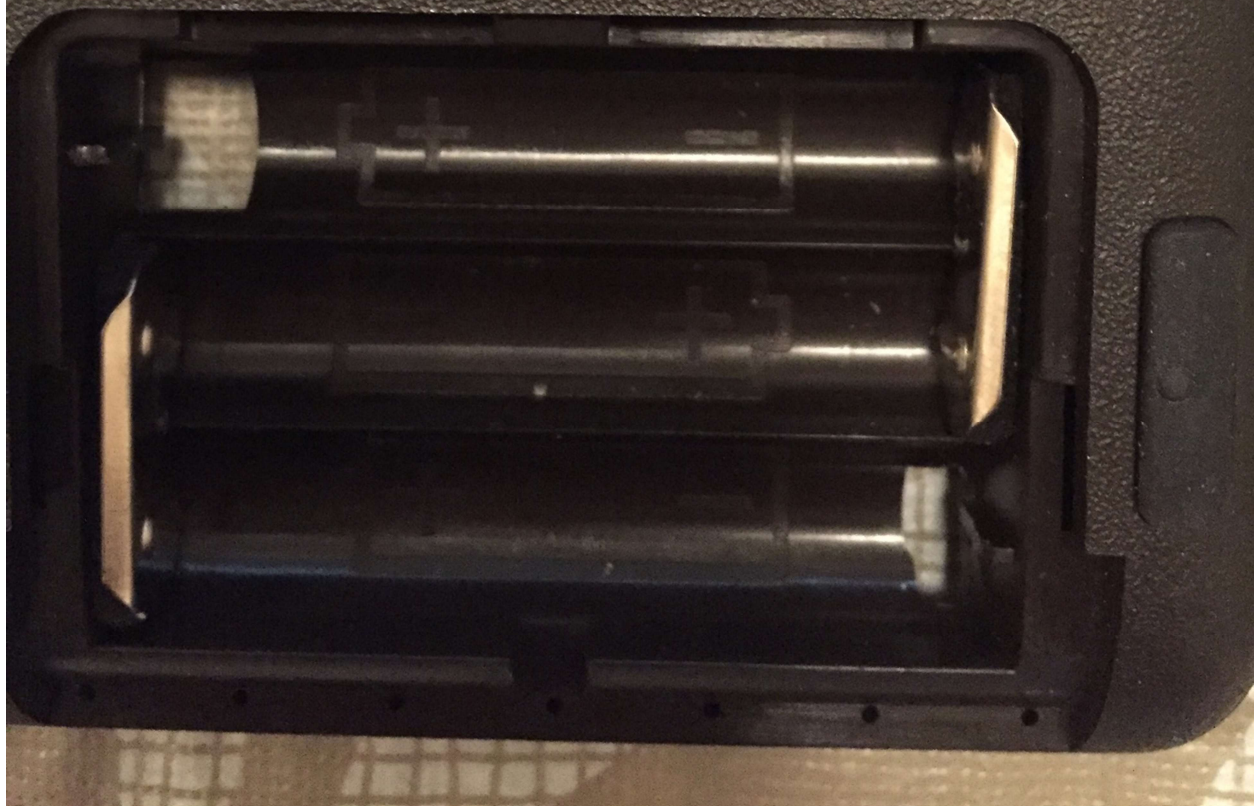
Carefully twist using flat nose pliers. Apply pressure to compress the PCB against the keyboard face at each twisty location while you untwist them. This is to minimize scratching of the PCB from the metal twist tabs. Take note of the direction to untwist each tab as the two rows are typically different from each other.



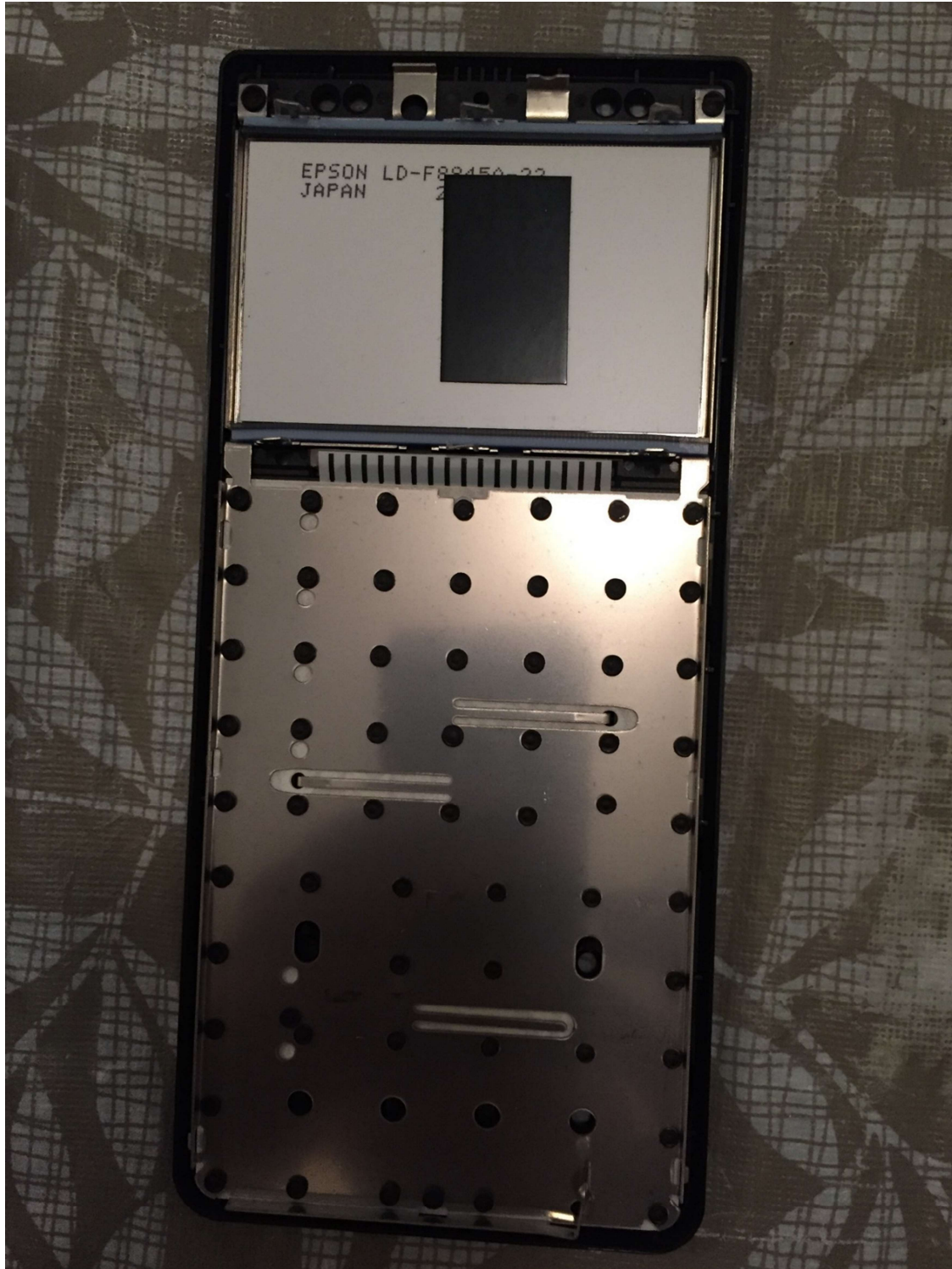


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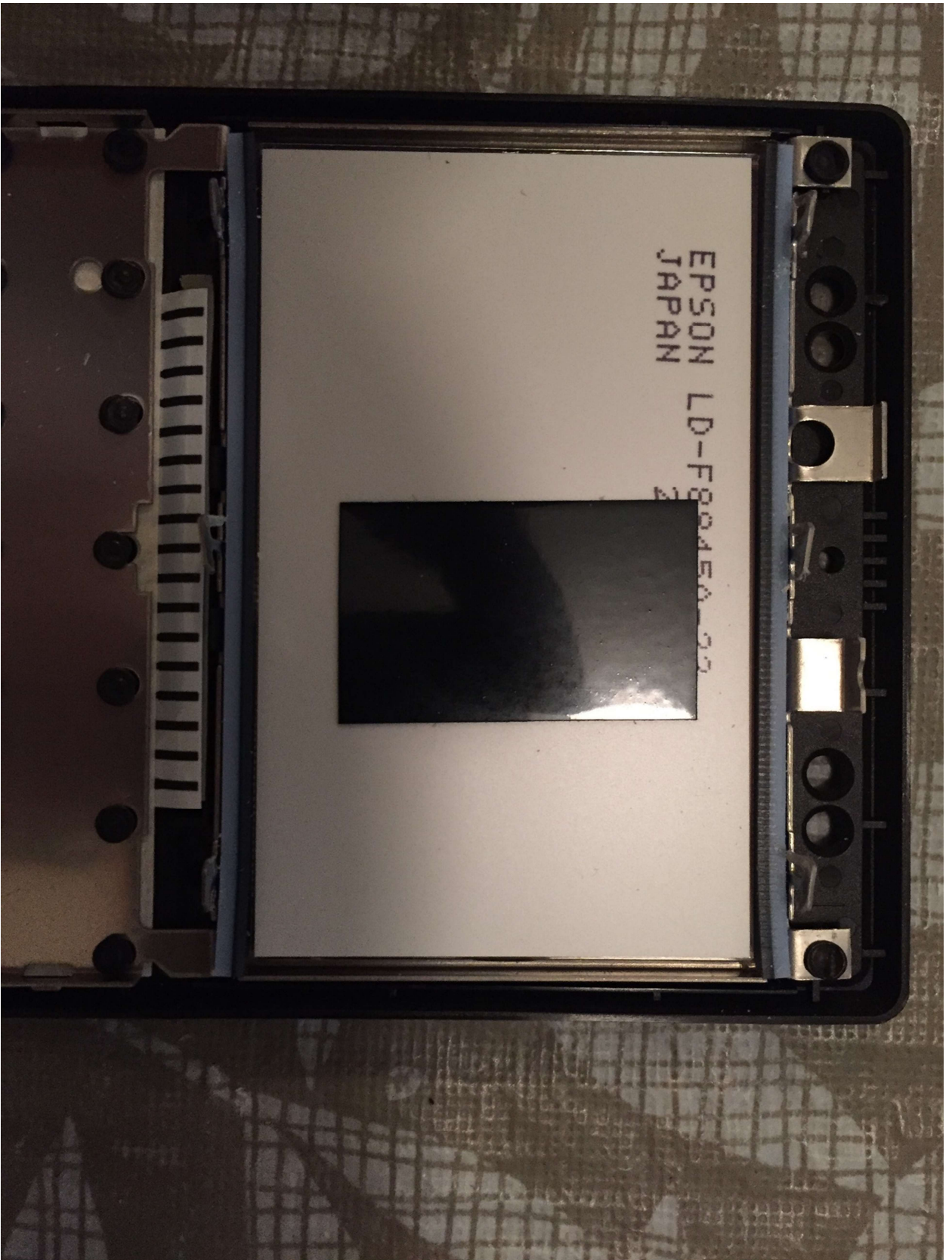
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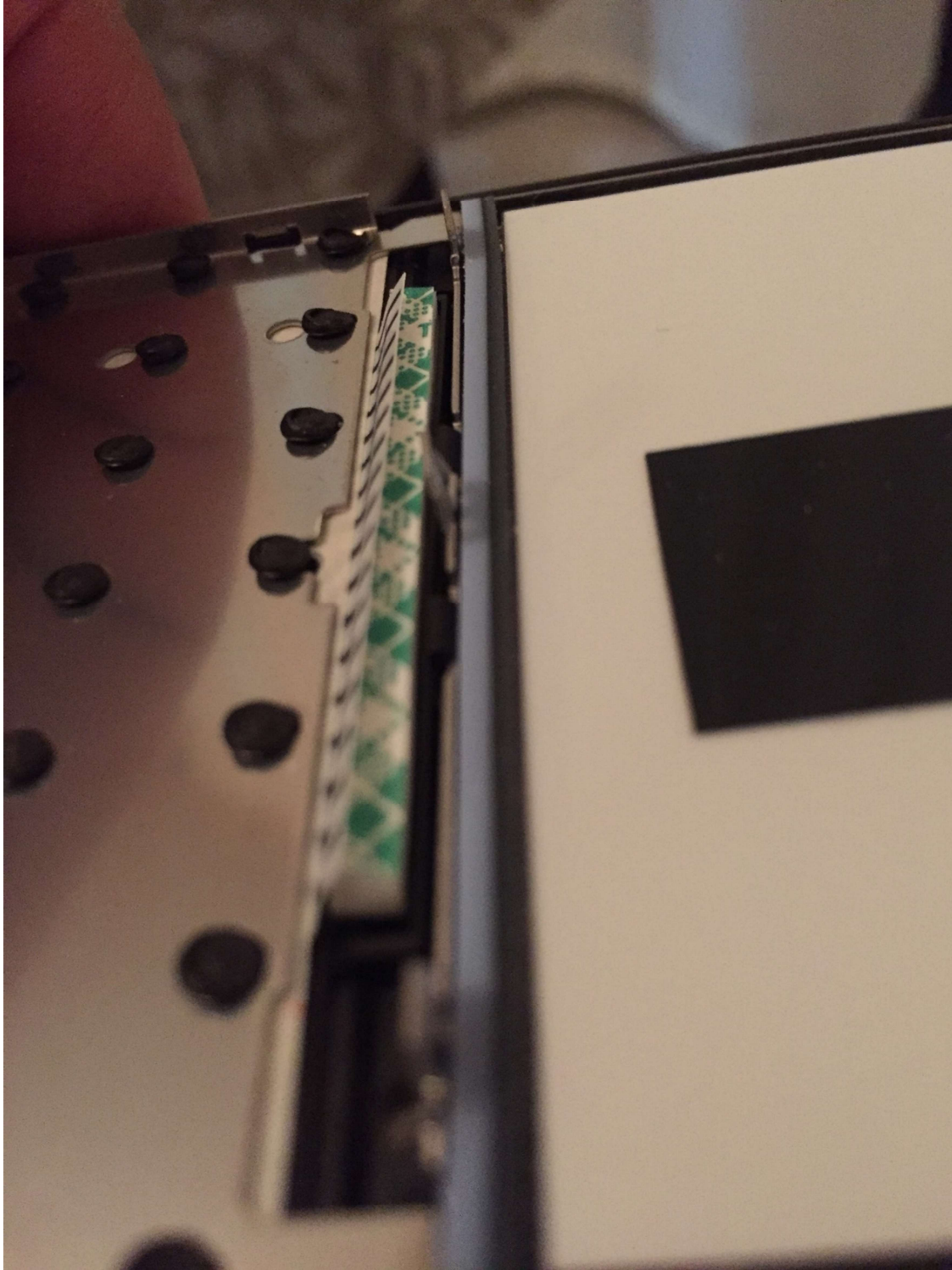
Keyboard Donor requires new keyboard foam. Also that LCD is not going to stay!!







Using a flat tool to slowly pry the old keyboard foam from the channel that it resides in. Go slow, and the objective is to remove the foam in one piece. This will make it easier to put new foam back in as there is nothing to clean up.



New keyboard foam installed. I used Logan West's suggestion of two layers of the 3M mounting tape. It works really well, and is easily available in stores.

Logan West's video tutorial: <https://youtu.be/G8wS95wK4bl>

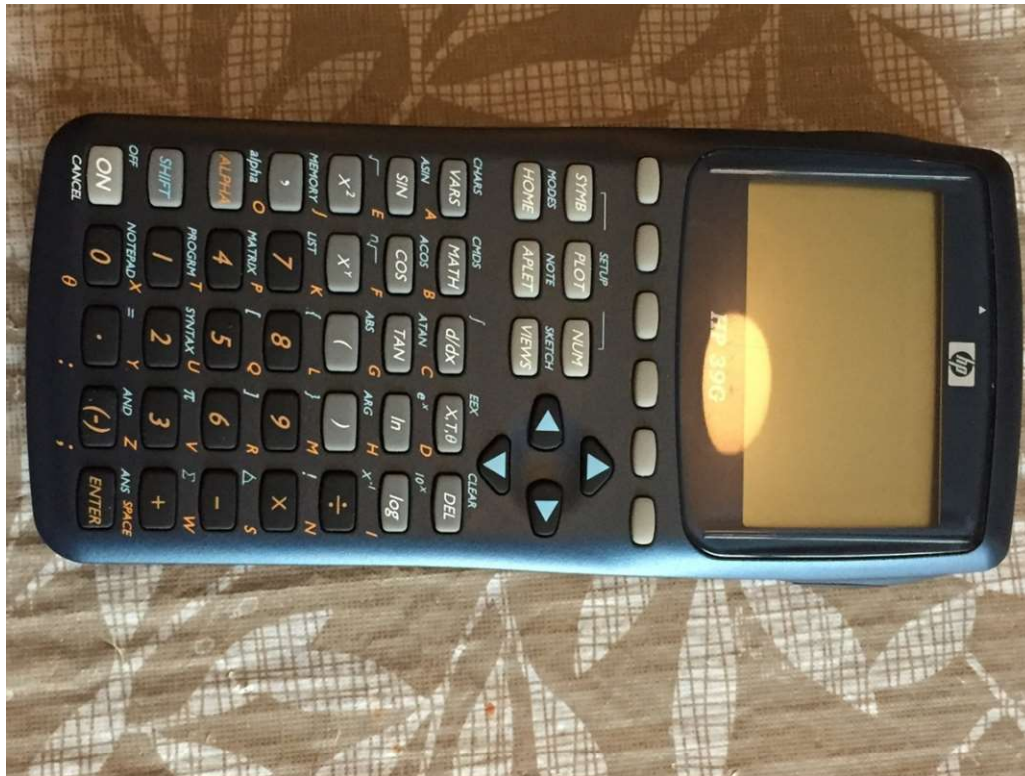




Test the calculator with the 48S PCB before venturing onto the LCD. I use spring clamps from Home Depot. The lower centre clamp is not needed (see later posts). I ran all the self tests to ensure everything was working.

## **Part 2 – LCD Donor (HP 39G)**





Drill out the 6 rivets in the battery compartment. Be careful not to go too deep. I used these instructions for opening the 39G, which is similar to the 49G in construction.

Post #4 here: <https://www.hpmuseum.org/cgi-sys/cgiwrap/hpmuseum/archv013.cgi?read=42503>

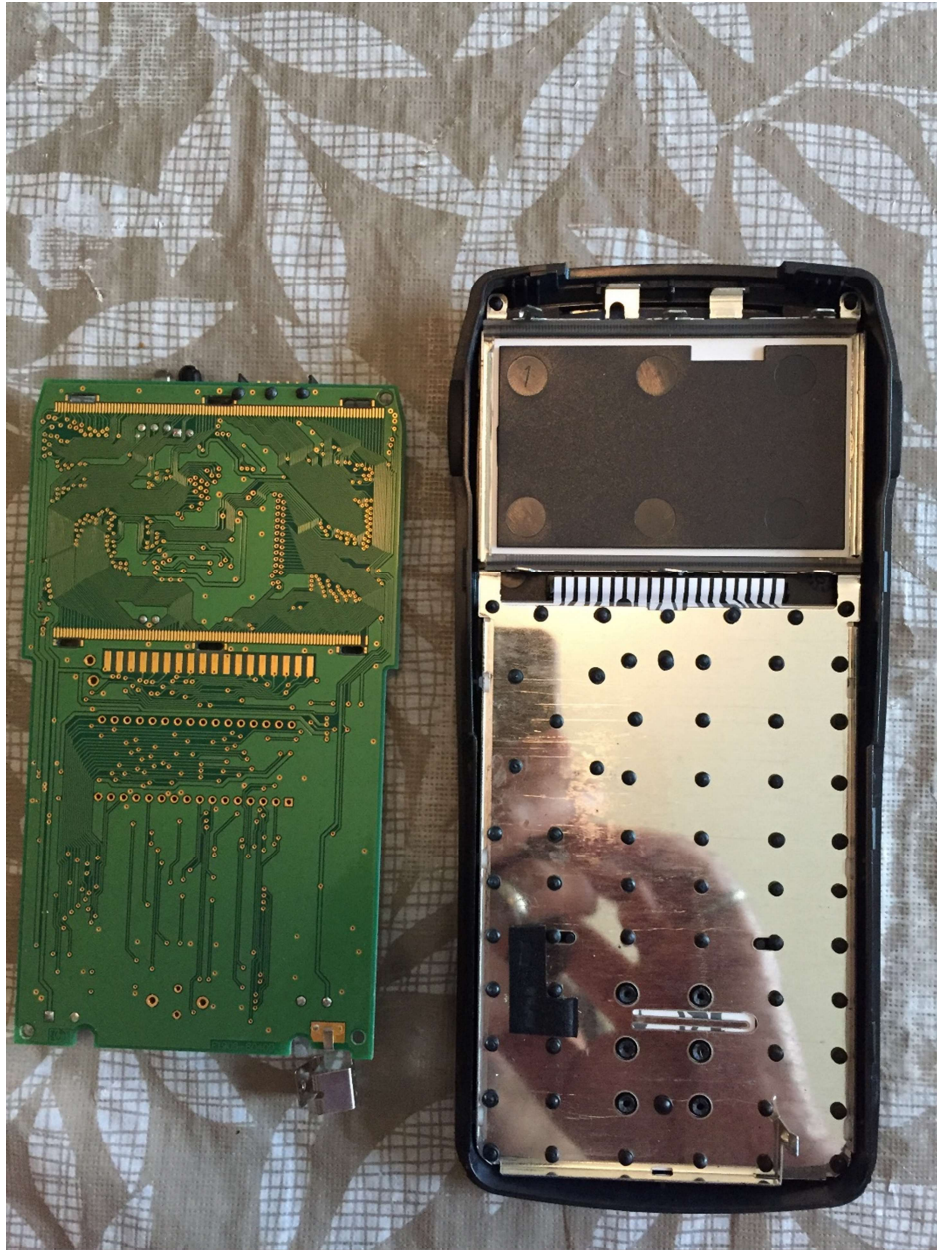


The 39G is very similar to the 48sx under the hood



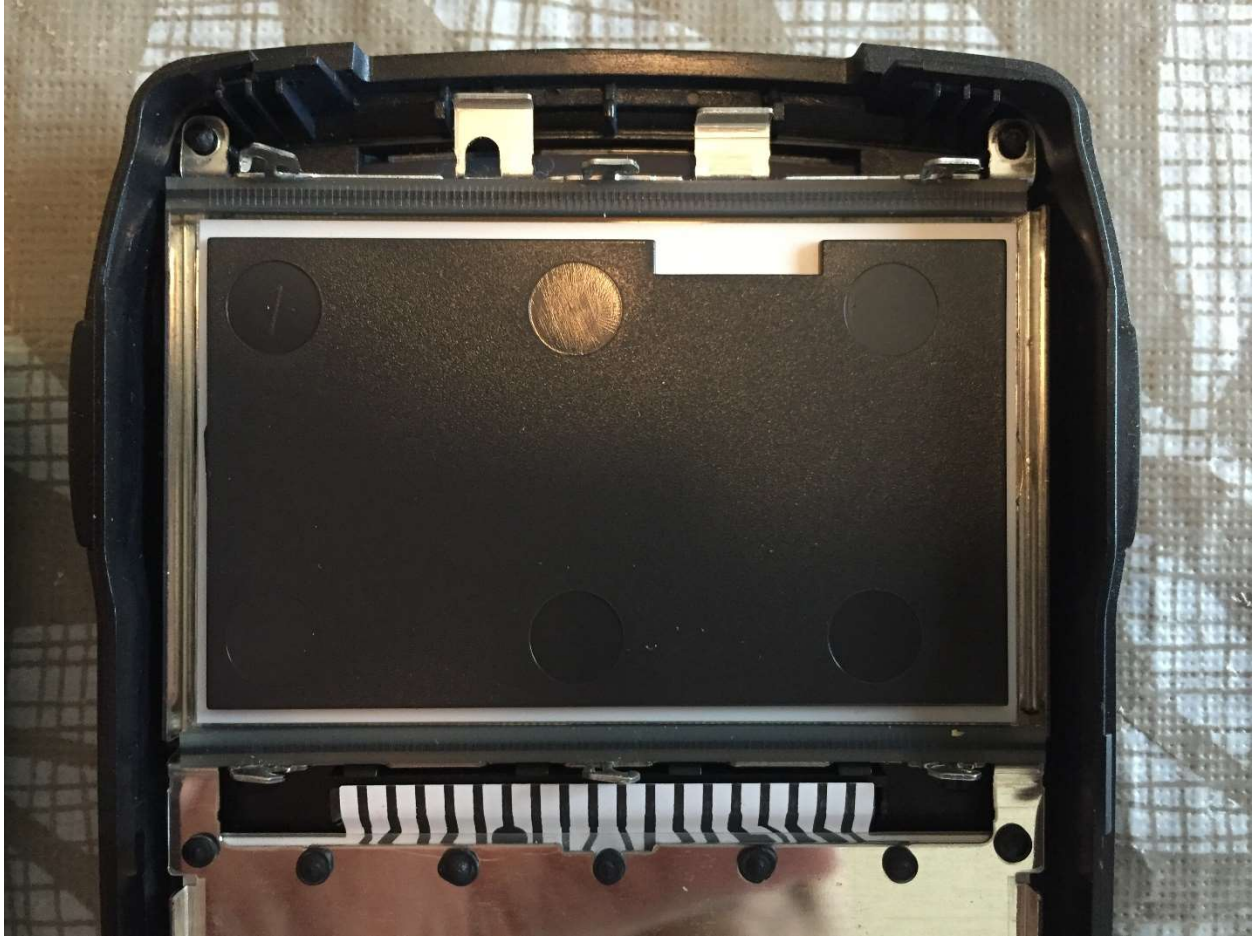


Note the orientation of the twist in the twist tabs.

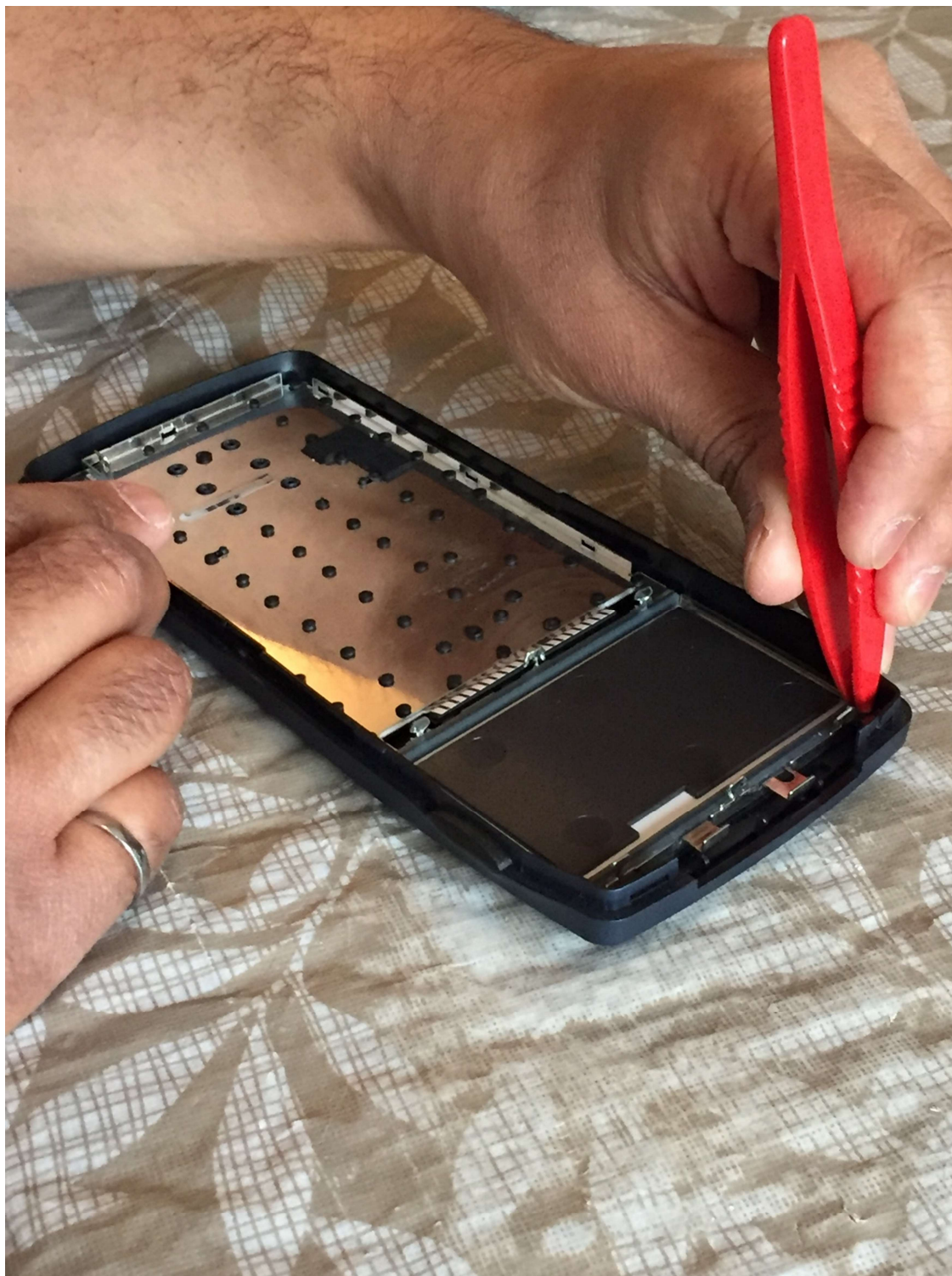


Oh that Black LCD – the sole purpose for opening this calculator up!



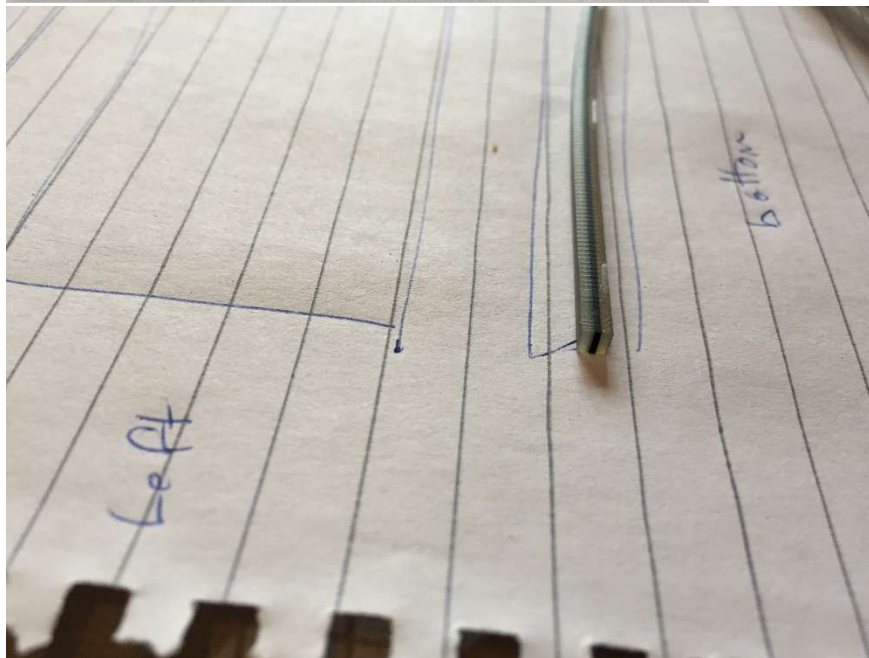
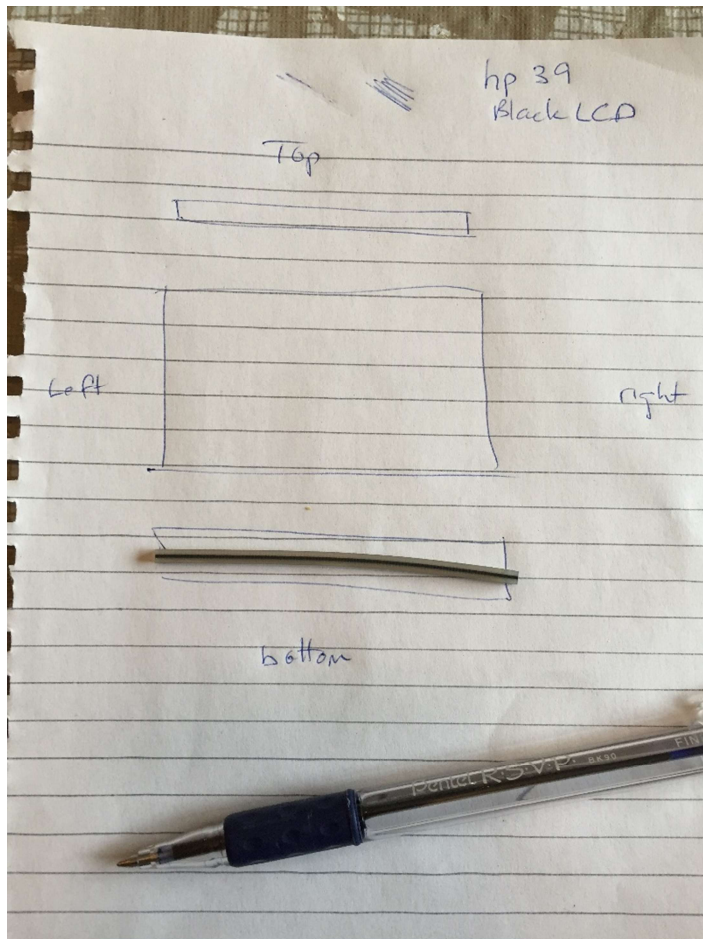


The 39G zebra strips are wider than on the 48SX, and the LCD is backed by a black plate of plastic.



Use a plastic tweezer to gently remove the zebra strips



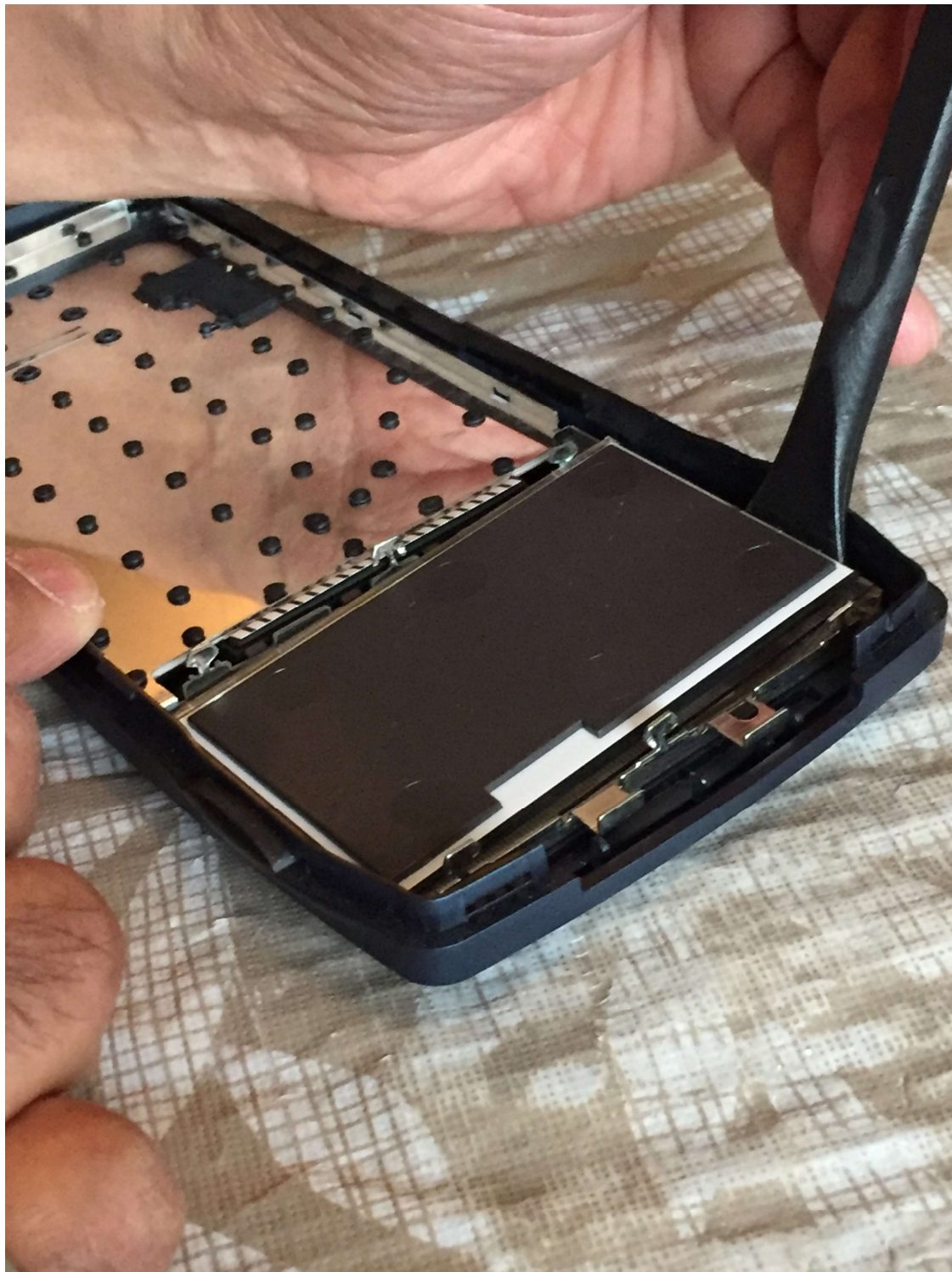


I mark the orientation and location of each zebra strip.



Use a stiff plastic tool for prying the LCD off the keyboard frame





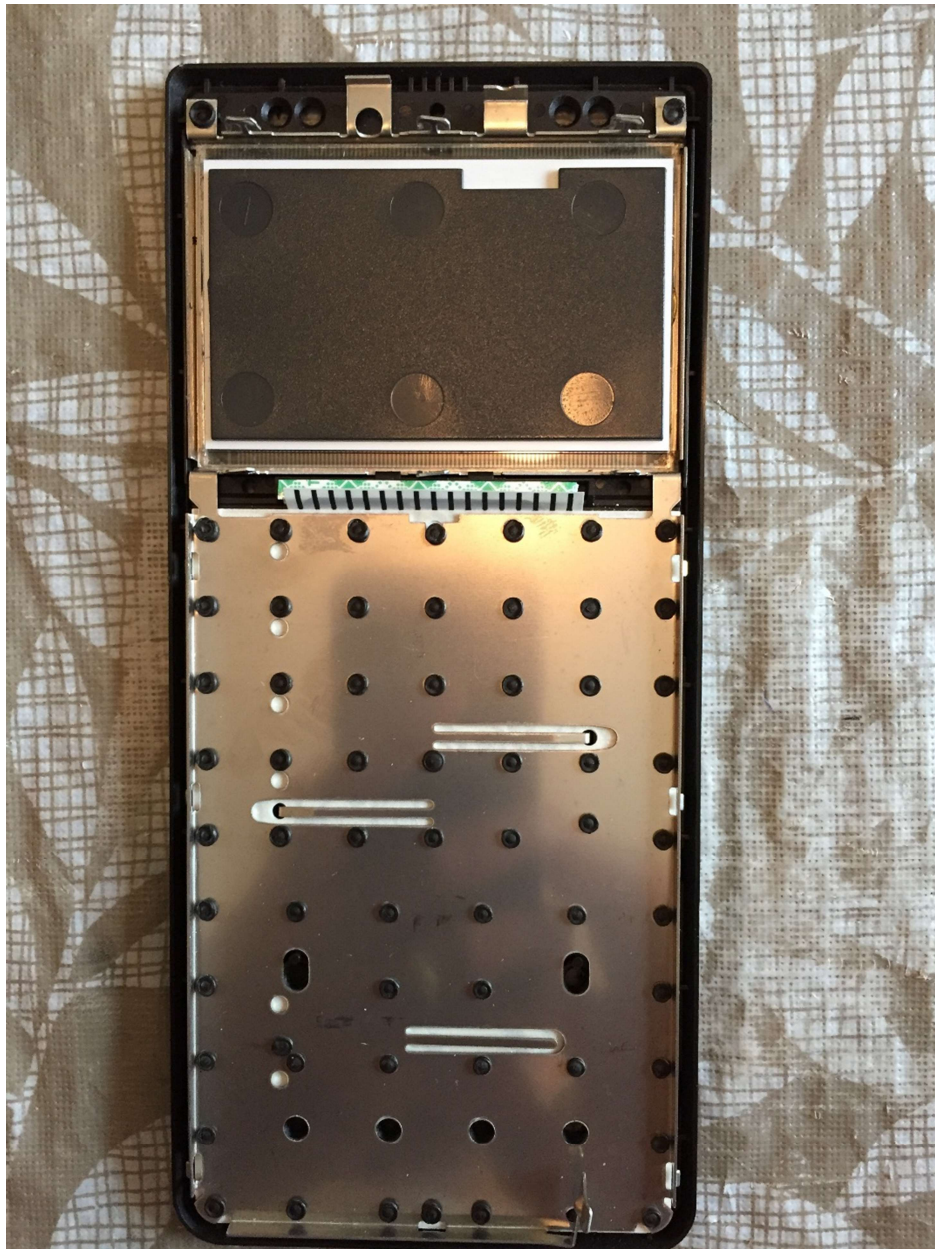
Pry the LCD up from one side. You will start to hear tearing of the adhesive strips as it comes loose.



The Holy Grail – a Black LCD for the 48sx



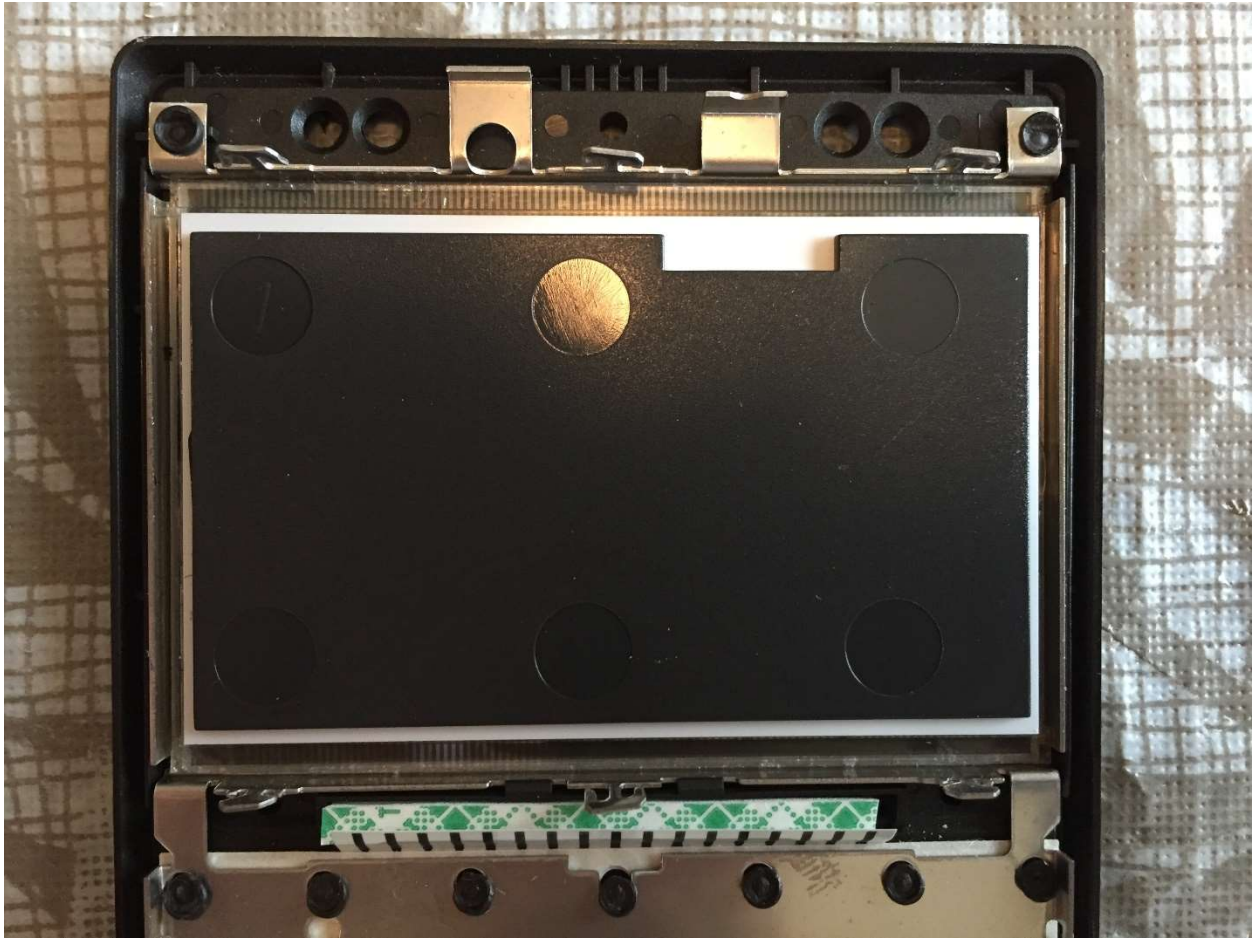
## **Part 3 – Rebuilding the 48SX with New Keyboard and Black LCD**



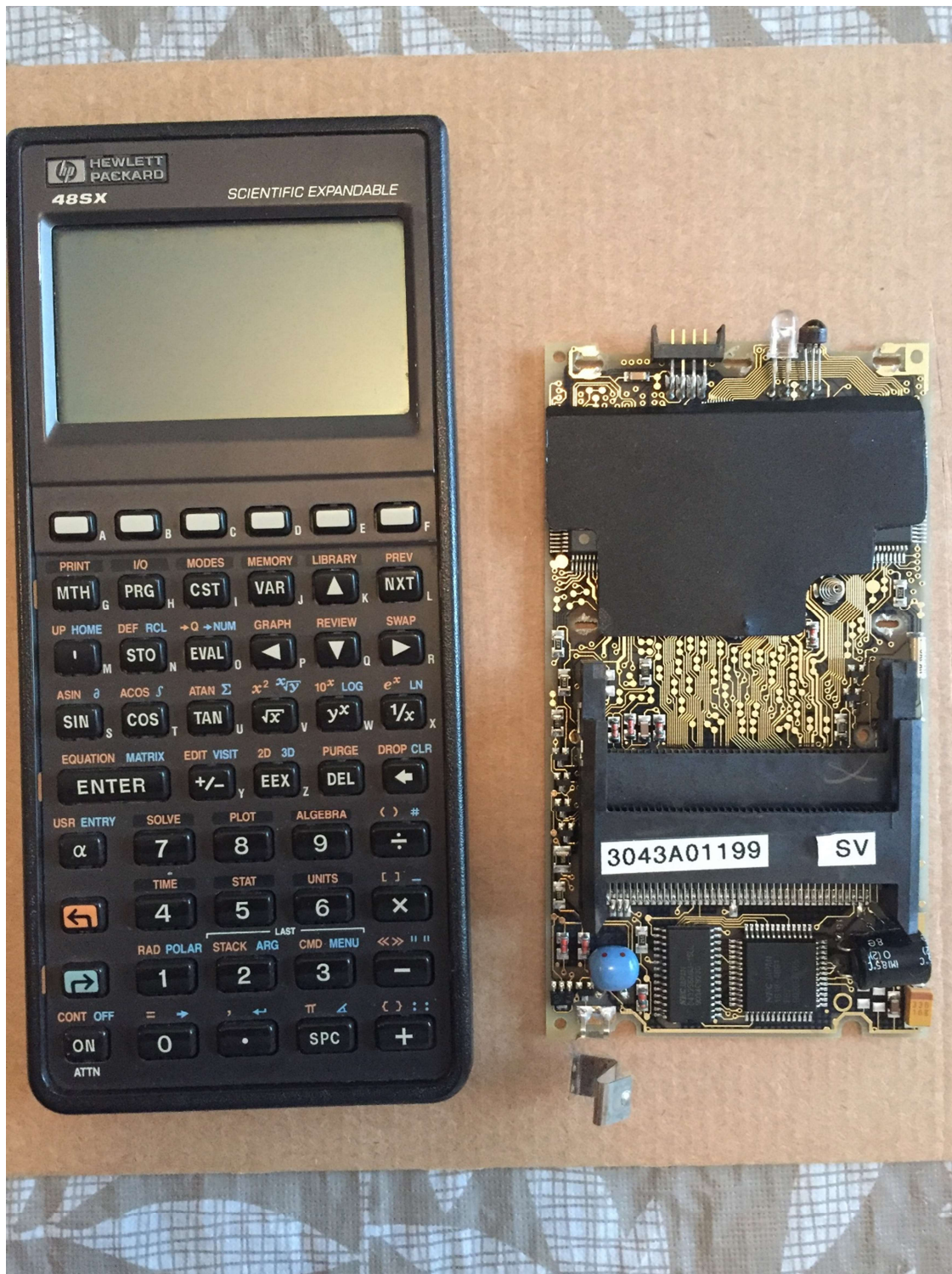
LCD has been transplanted into the 48 donor keyboard!!

Try to position it centred in the LCD frame as much as possible. You can fine tune the position after testing operation (see mention of this later on).





Closeup of the LCD in its new home



The front of my own 48sx and its PCB. The Enter key has a broken hinge, and the ON key does not work electrically anymore. It has been sitting in a case for many years now. I will end up with a Frankenstein unit consisting of my own 48sx overlay, its PCB and back case, a 39G LCD and a 48S keyboard.





I placed my PCB in the calculator and used the clamps to hold it in place. The very first power on gave me some unexpected lines, and lit up annunciators. I was discouraged. But I removed the PCB and gently aligned the LCD from left to right in the LCD frame in the hopes of aligning the contacts correctly. The result on the next power up was a success as you can see above. Use alcohol to ensure clean contacts on the LCD, zebra and PCB contacts.



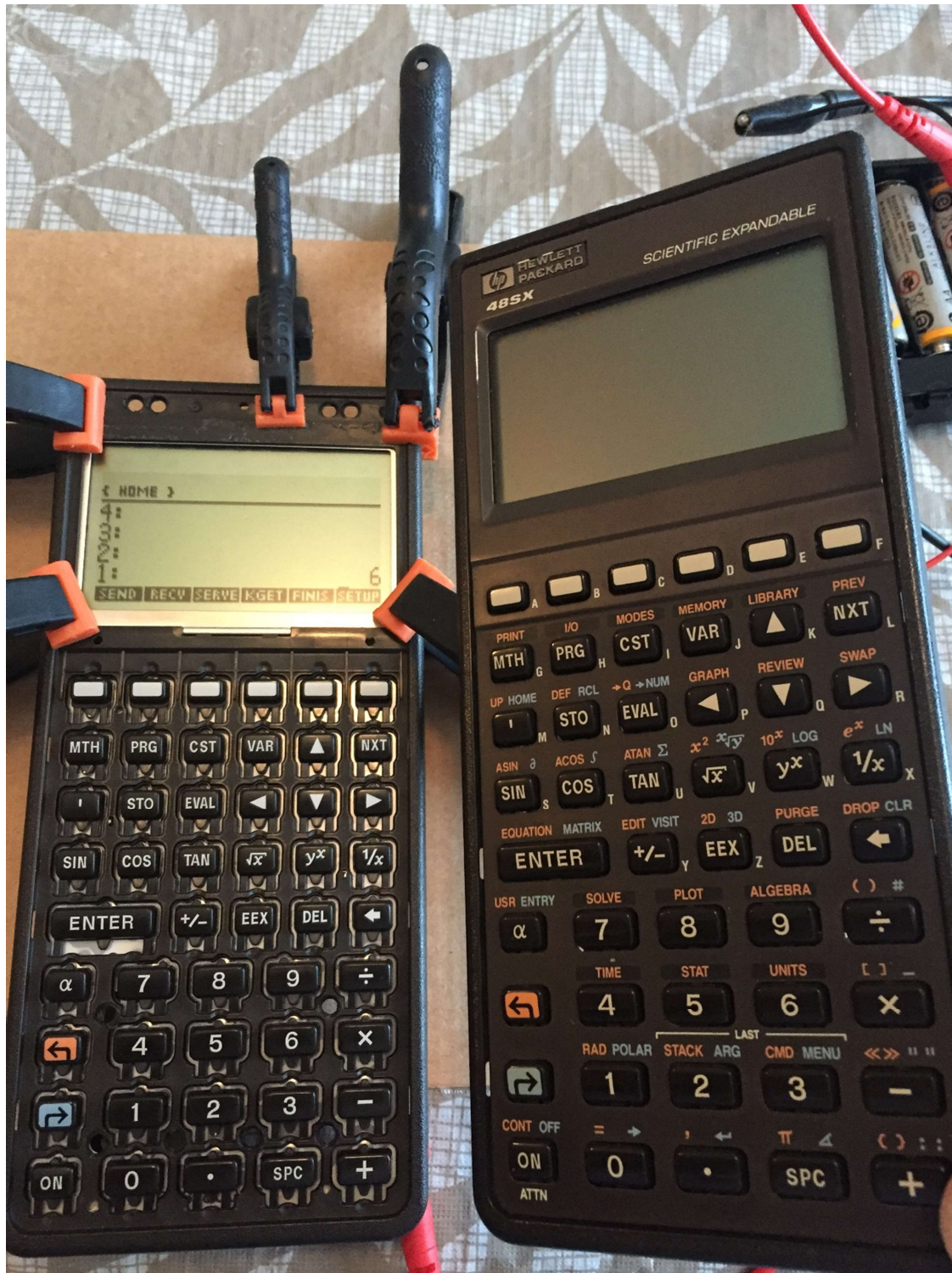
Keyboard self test passes!!

I believe the use of clamps such as these is essential for verification prior to retwisting the twist tabs. Those are pretty delicate, and if you have to realign the LCD, or clean dust on the zebra, etc, you will thank yourself for using clamps to get it all right.



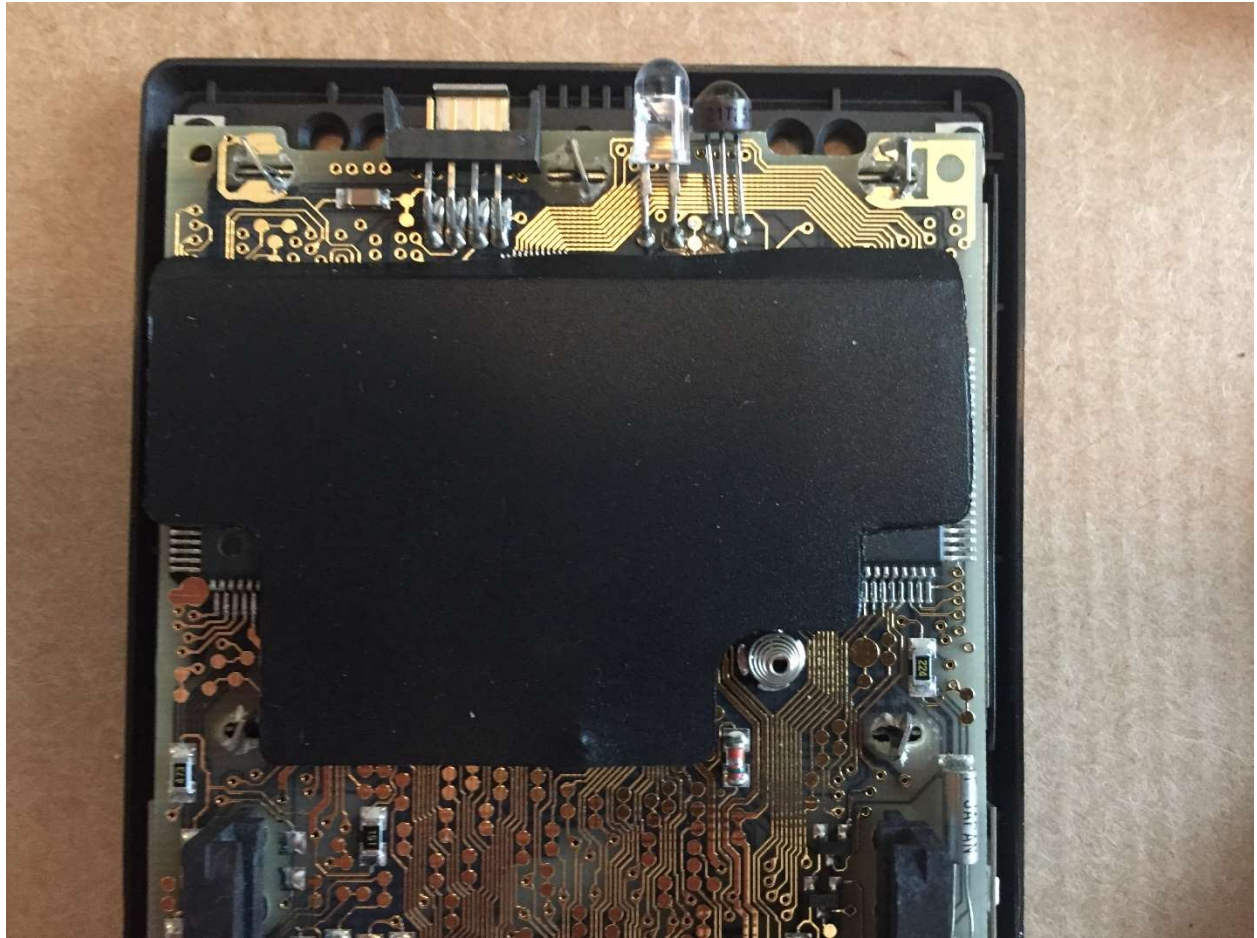


HP 48sx self test passes! I actually verified the IR send/receive, printing, and card slots while the PCB was still attached using the plastic clamps.

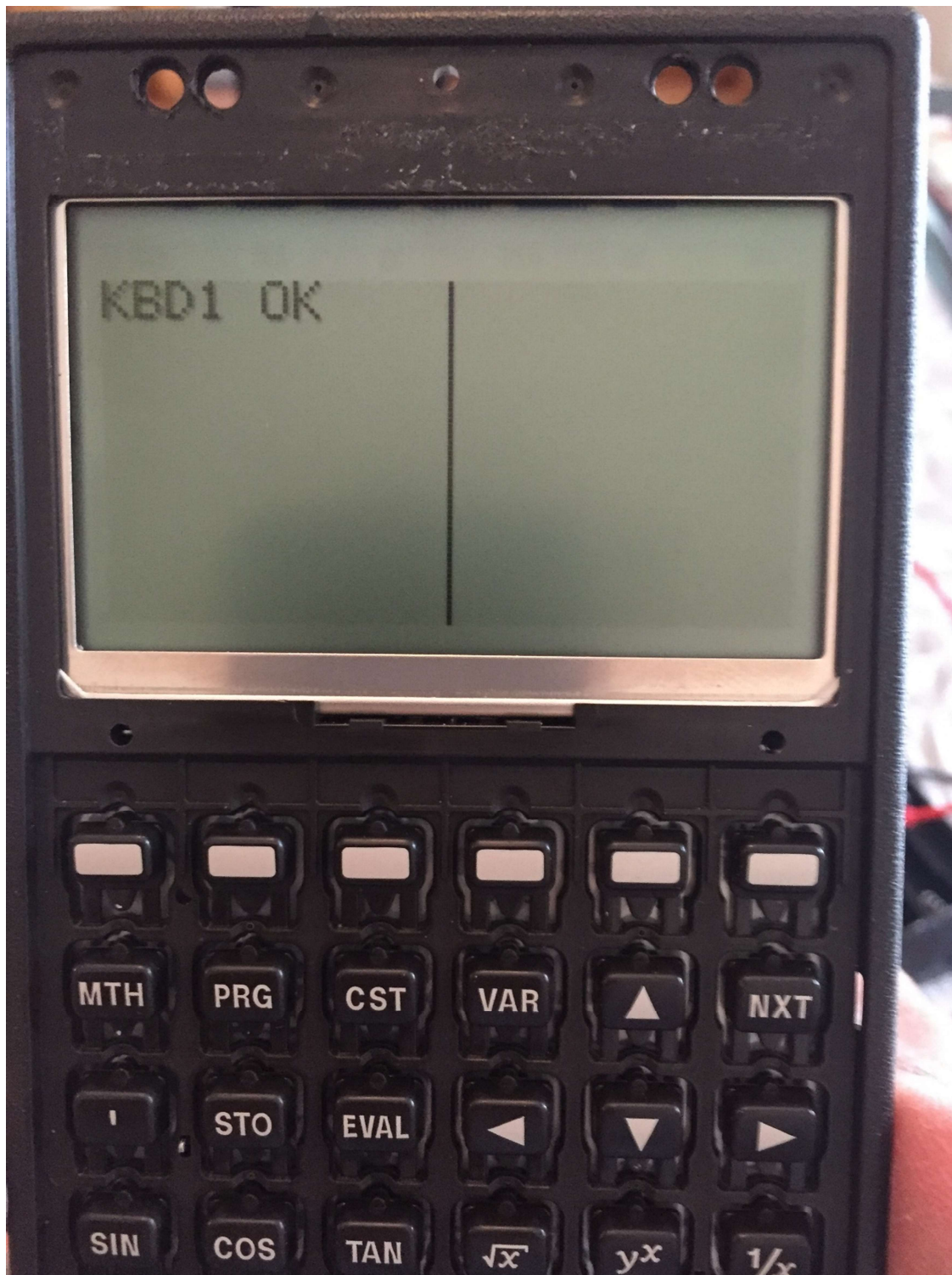


Interesting out of body experience. My old 48sx front with its overlay looking at the donor keyboard and LCD. The metal overlay from the non working keyboard will be carefully removed, straightened and applied to the new donor.



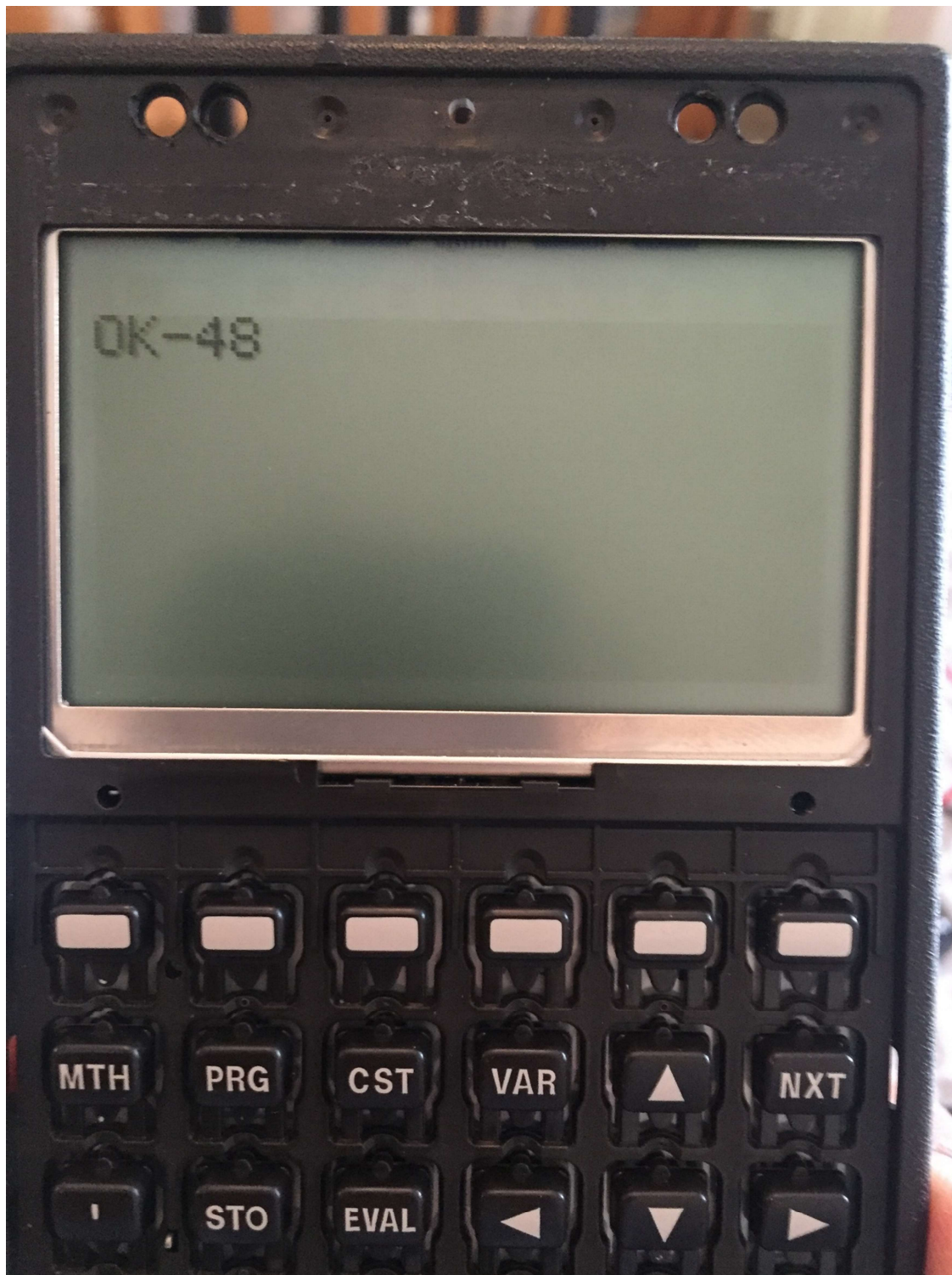


The PCB is installed finally. I push down at each twist tab location while I twist using the flat nose pliers. This minimizes scraping and damage to the PCB and also ensures that the PCB-zebra-LCD and keyboard connections are tight.

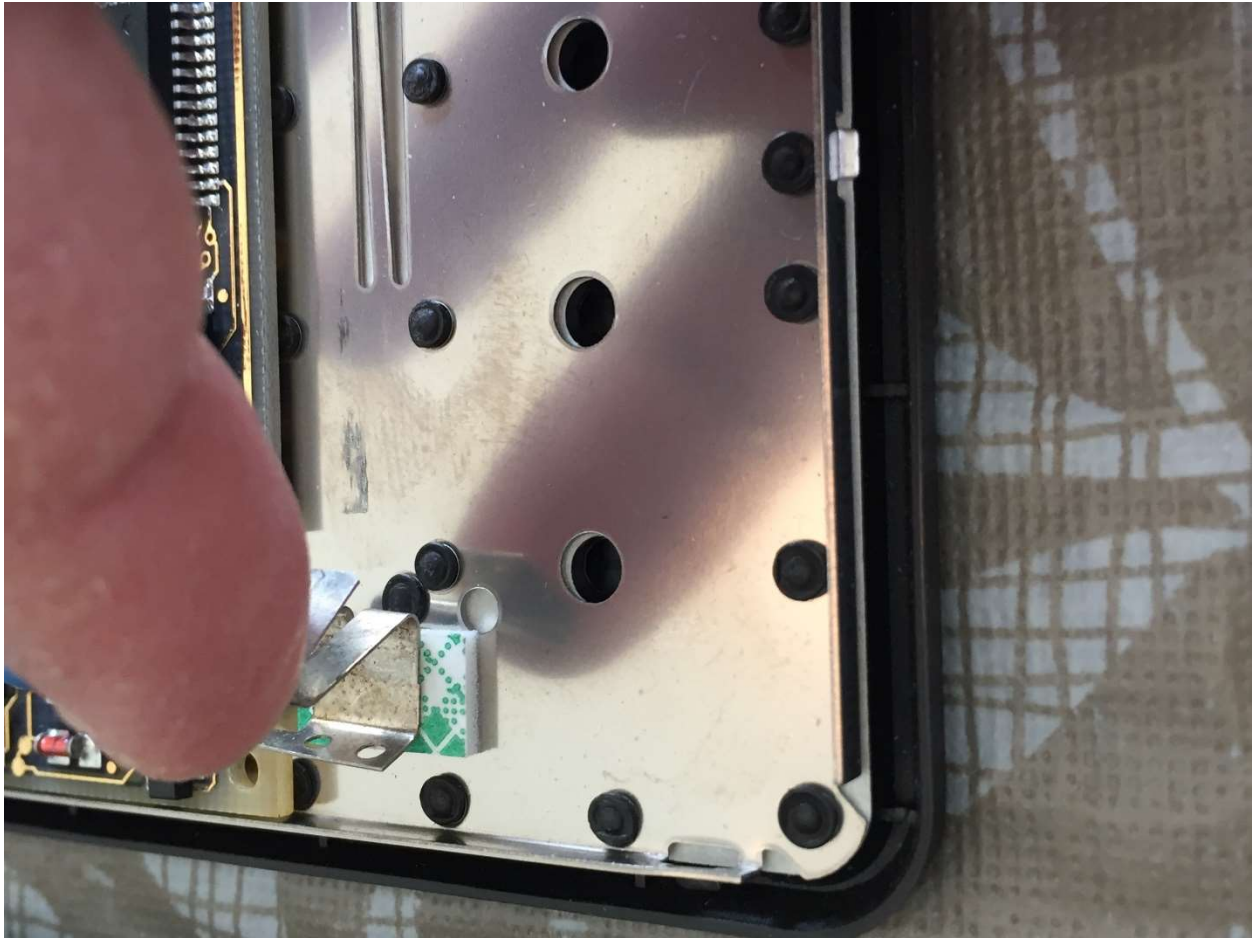


What a relief! My upgraded 48sx now has a working keyboard



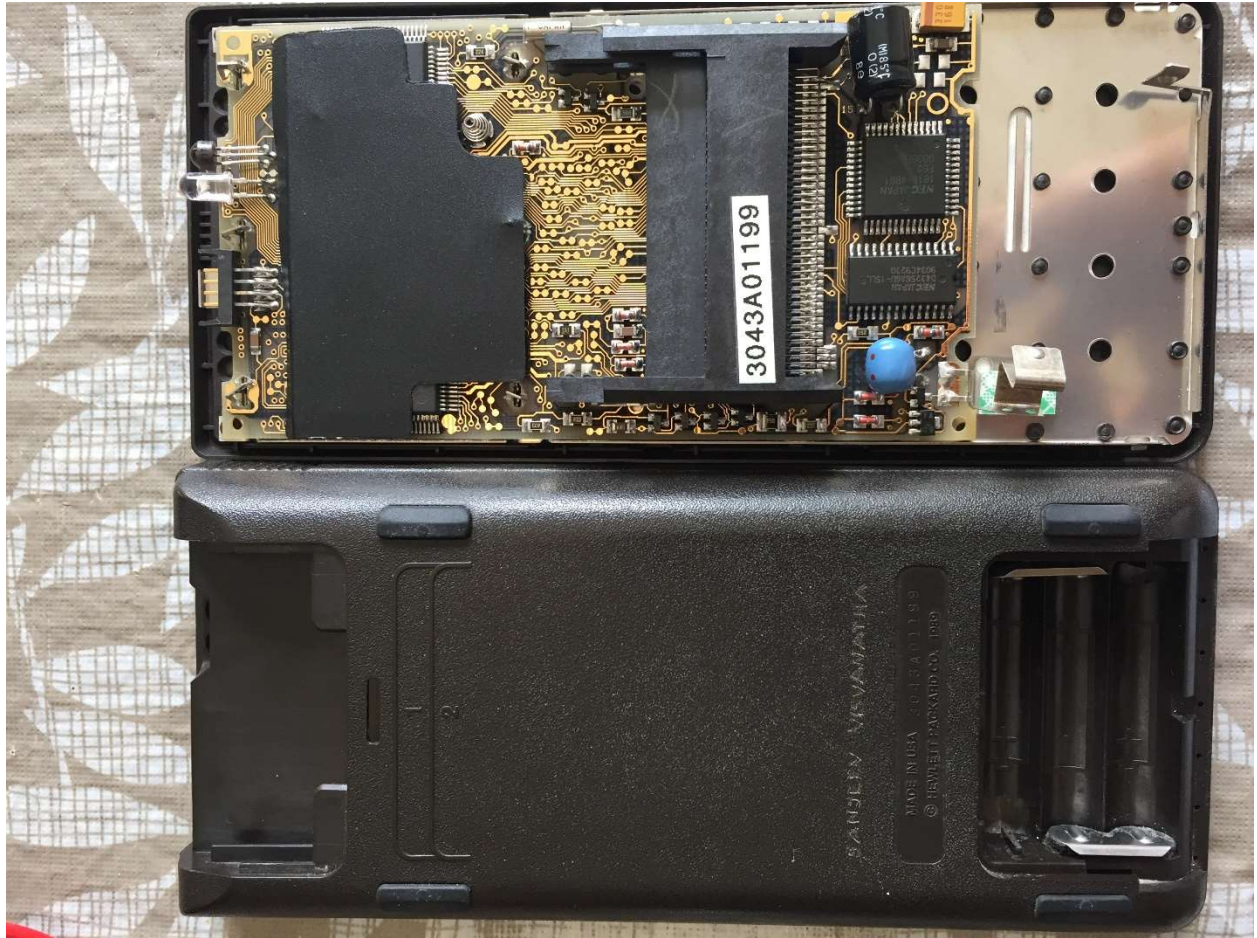


And it passed the self tests!



Place some foam tape beneath the Positive battery terminal to prevent shorts





Front and Back halves about to be joined. I used a label maker to mark the S/N of the PCB. My case had my name engraved 25 years ago.



Putting the halves back together. Note that the rivets are not popped in place yet.





Pushing down on these Lego bits help to push rivets through to the top half.

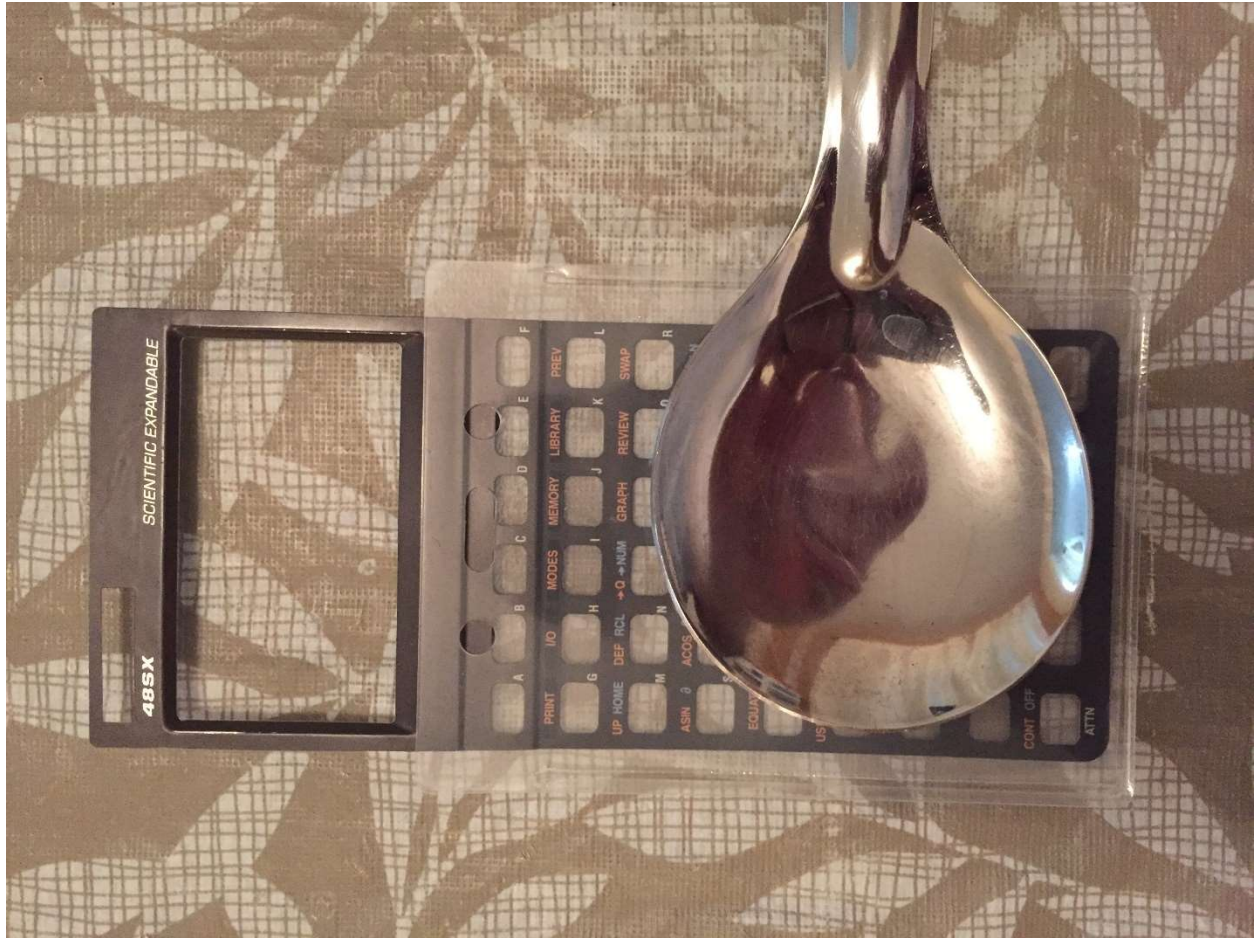


The Metal overlay from the 48sx with the broken keyboard. The top part was very difficult to get loose due to an overzealous glue job from the factory. This will be fun to straighten out again.





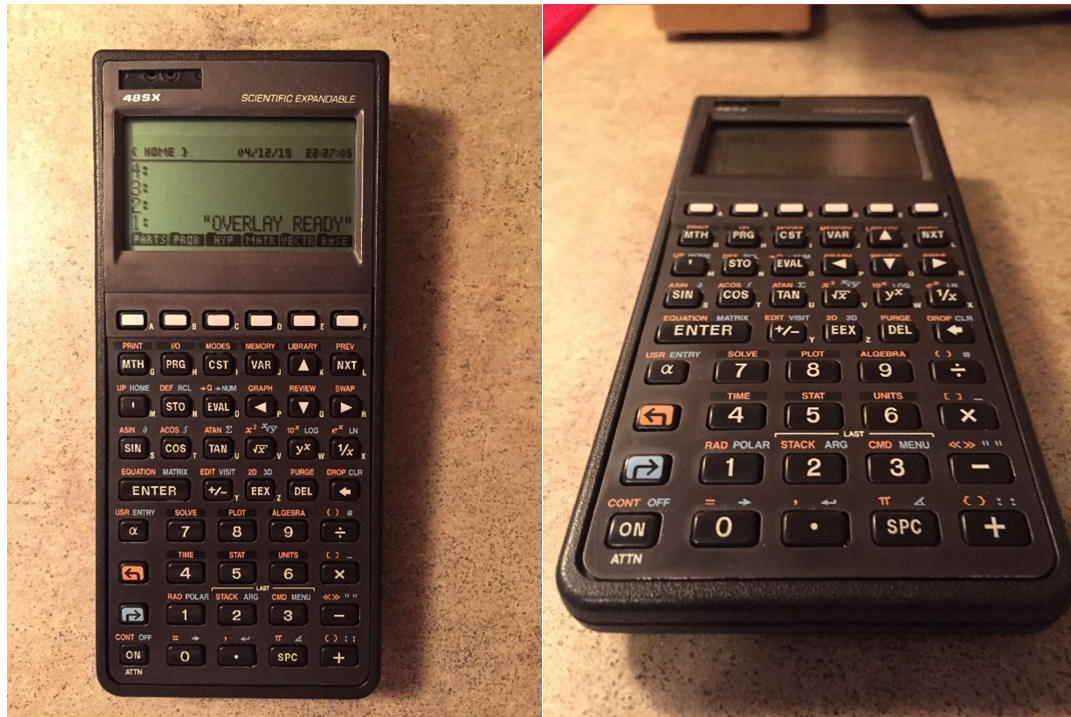
Adhesive remover to get the glue off the overlay



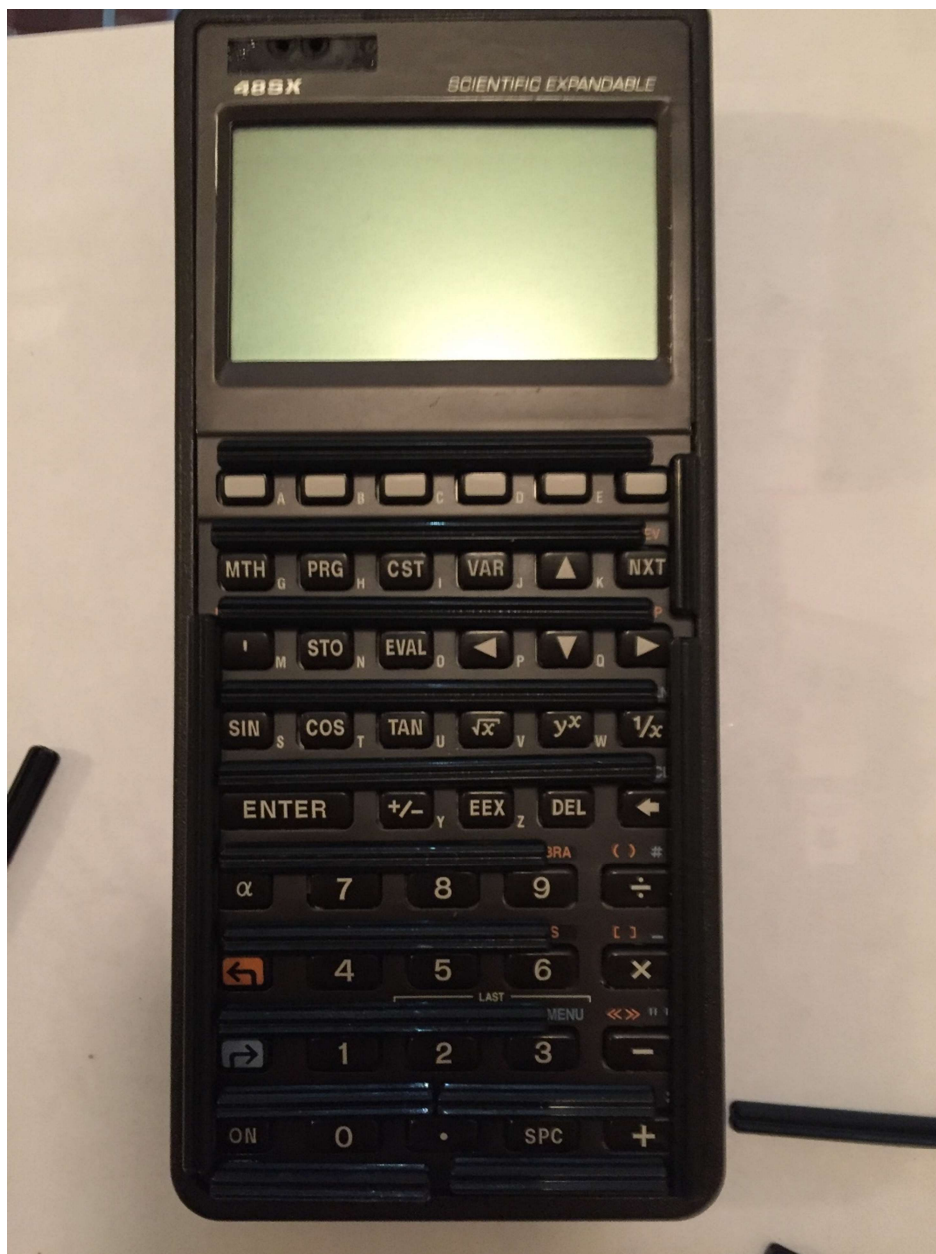
Large metal spoon and an ID badge holder to straighten out the overlay

Also , I placed the top frame between smooth hardwood blocks, and applied gentle hammer to flatten and straighten them again.



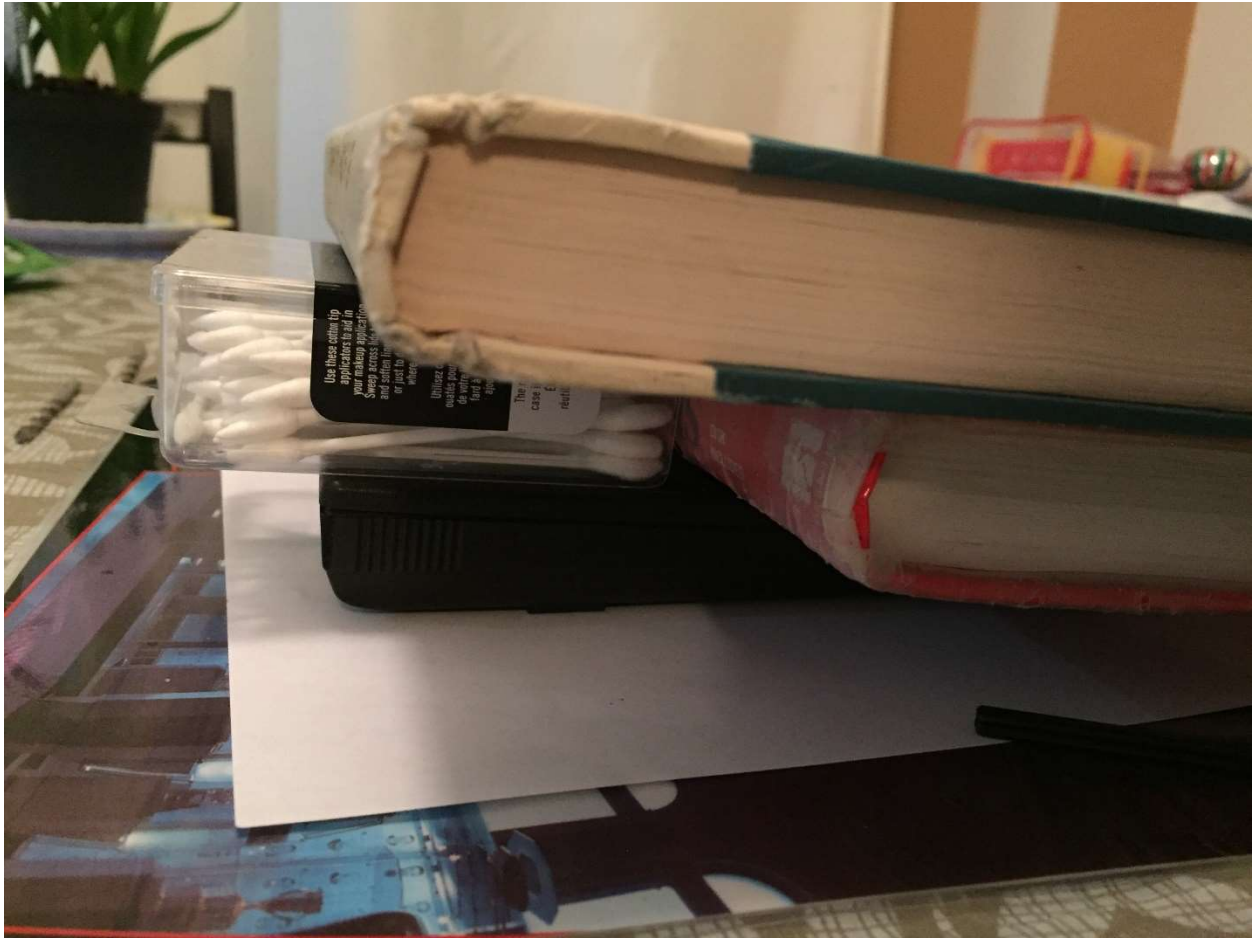


Overlay is ready to be glued. I use good quality contact cement.



Lego Axles make good pieces to apply pressure between rows and columns. Heavy book is placed on top for several hours to ensure good adhesion.





Couple of engineering books placed to apply some pressure to the Lego axles and the top overlay frame.

## Part 4: The Finished Product:

