
Recreating the Classic battery pack



An Odyssey

This is a very simple presentation

- We needed some more presentations to fill out the schedule.
- Feel free to browse, work on the programming contest, or *quietly* chat with people nearby.
- It's possible there may be some attendees who find this information useful and/or interesting. Don't judge.

Tools used on this journey

- Copper tape
- Wire strippers
- Multimeter
- Foam tape– 1/8” and 1/16” thick
- Nickel welding strips
- Battery powered spot welder
- Scissors
- Hot glue gun
- Ruler



The Original

- These battery packs were used in the “Classic” series of HP calculators: the 34, 45, 55, 65, 67, 70, and 80.
- They comprised three NiCad batteries welded together and sealed in a plastic case. The bottom connector in this image is the negative. The battery pack’s offset connectors ensures no contact will be made in the event it’s inserted upside down.



Admit it. We've all done this.

- The original battery packs have long since died. What do do? Well...
- Crack the plastic case open with a knife blade. Chisel off the welded-on metal strips with a knife or razor blade. Crudely solder them to some new batteries. Cram the ungainly assembly back into the original case. Glue the case together or “weld” it with the soldering iron you’ve already abused. Who cares? Soldering iron tips are cheap.

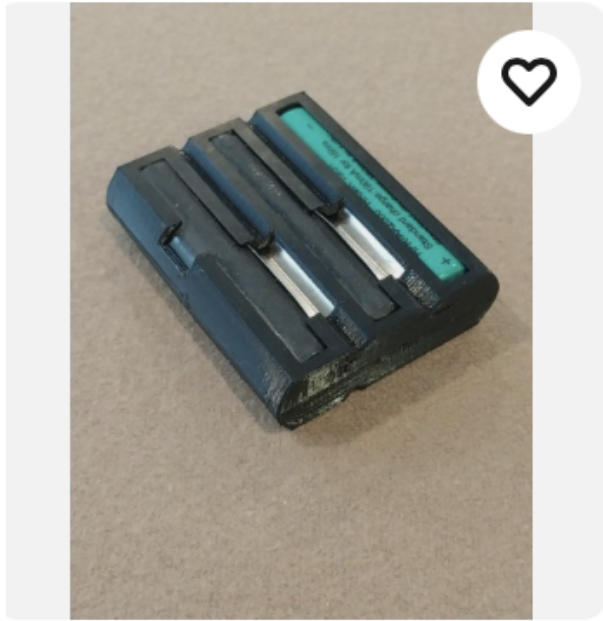


There are downsides...

- It's easy to injure yourself, especially while trying to remove the original contacts
- It's really hard to solder the contacts on to new batteries. The metal in the batteries soaks up the heat, making it difficult to melt the solder. If you do get it to melt you'll get an ungainly blob as shown here.
- Best case is that it works, but looks like crap.



Let's check eBay...I've seen some packs there...umm....



Battery Pack for Hewlett-Packard HP 35/45/55/65/67/70/80
Calculators, Fresh NiMH

Brand New

\$64.95

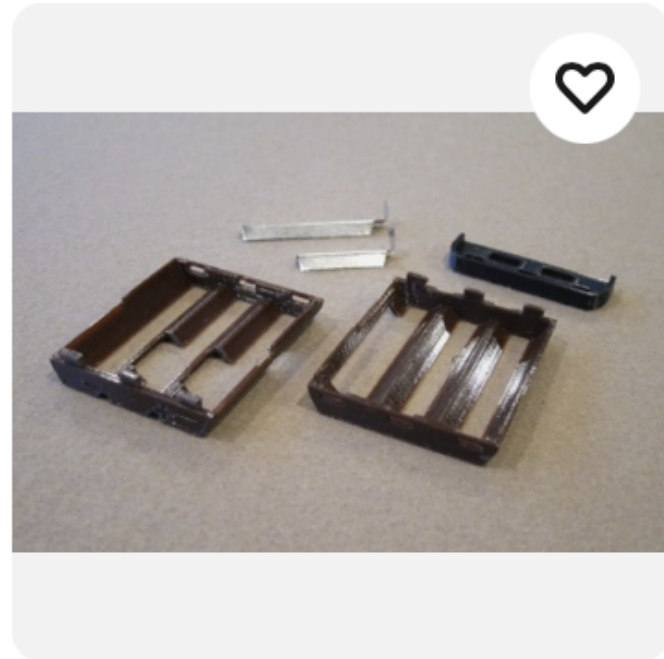
Buy It Now

+\$5.50 delivery

Located in Windsor, CO

husmus 100% positive (540)

Maybe I can buy some parts...



Battery Pack Frame & Terminals for Vintage HP 35/45/55/65/67/70/80 Calculator

Parts Only

\$17.50

Buy It Now

+\$7.50 delivery

Located in Windsor, CO

Save up to 15% when you buy more

husmus 100% positive (540)

Actually, save yourself angst and just buy one of Walter Hosko's packs...still kinda expensive though...especially since it comes with non-rechargeable batteries...



Alkaline Hewlett Packard Calculator Battery CASE HP 35, 45, 55, 65, 67, and 80

\$38.00

Buy It Now

+\$5.00 delivery

Located in Bartlett, IL

Free returns

639 sold

waterhosko 99.6% positive (8.6K)

I'm gonna do it myself

- Yeah, like you've noting better to do.
- But the tools we have today make building your own battery packs much easier than it used to be.
- And if you have a larger collection or use your Classics or just want to have some spare packs around, it's a lot cheaper.

We do have better tools now.

- This is a battery powered spot welder. It does one thing: easily welds thin nickel metal strips to batteries. It's made in China and is about \$65 on Amazon.
- It's super easy to use. Just touch the probes to the surface and after a (configurable) delay of a second or so they'll automatically make the spot weld.
- There's one in the box on the prize table!



But that's not all!

- It also comes with a nice length of the thin nickel metal strips you'll need to weld batteries. This should be enough to make several packs.
- When you need more, order on Amazon. Search for “battery welding strips”. A 32 foot roll was \$9.95 the last time I checked.



You will of course need batteries

- You want “flat top” NiCad or NiMh batteries. These 1100mAh cells provide a lot more power than the 800mAh cells HP used.
- Lilon batteries are not appropriate for this use. In any case flat top Lilon batteries are hard to get. Using the spot welder on standard Lilon cells will ruin them (safety fuse will blow).



I will show you three different ways of building a Classic battery pack

1. The quick and dirty way.
2. The prettier way.
3. The easiest and best way.

ONWARDS!



Things you will need for the quick and dirty method

1. Battery welder
2. Nickel welding strips
3. Hot glue gun
4. Scissors
5. 1/8" adhesive foam tape
6. 3 "AA" flat top NiCad or NiMh batteries



Preparation

Arrange the 3 batteries with their positive and negative terminals alternating.

Cut 4 nickel strips:

- Two 20mm strips
- 1 40mm strip
- 1 55mm strip

Cut a 10mm, half-width section out of the 40 and 55mm strips as shown



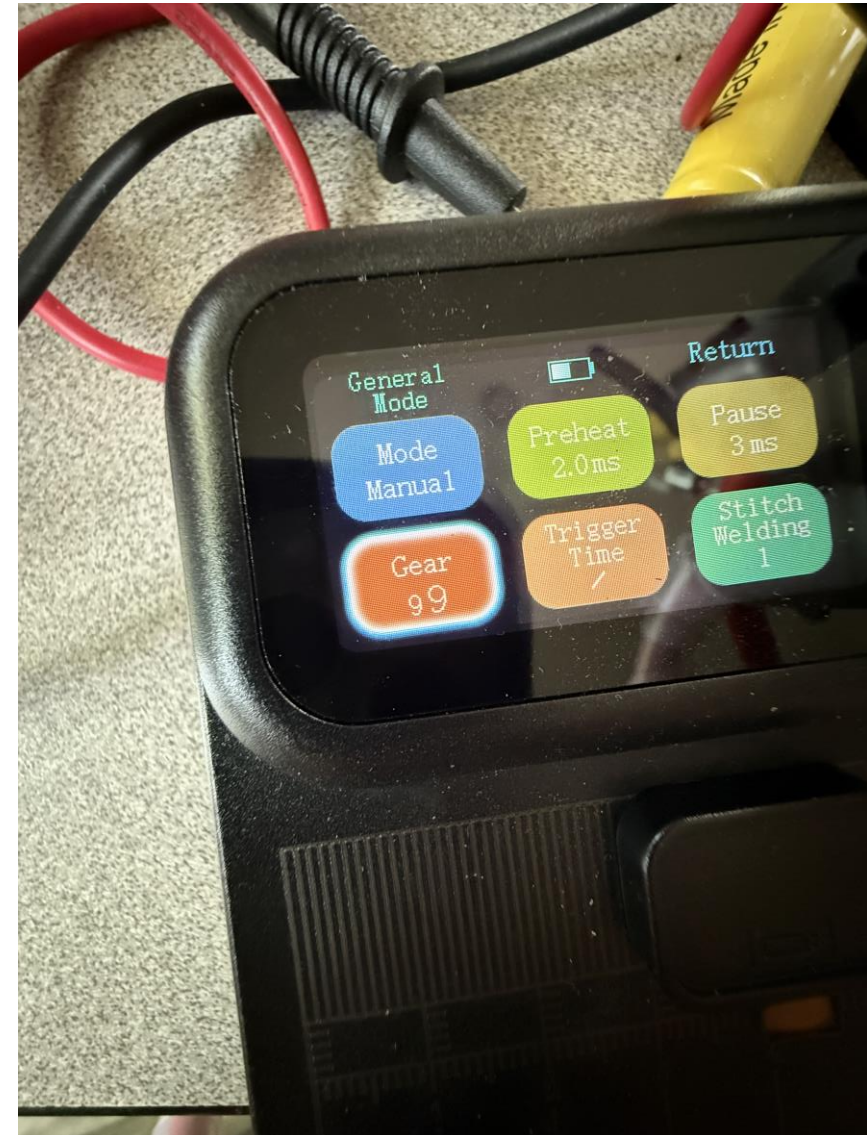
Secure with hot glue

- This battery powered hot glue gun, \$29.99 on Amazon, heats up in seconds once you turn it on.
- Use hot glue to secure batteries in position before welding.
- Remember to position batteries with +/- terminals flipped between each two cells. The positive terminal has the indentation around it.



Before you weld...

- Most of these battery powered spot welders have a number of power settings, oddly referred to as “gears”.
- Crank this setting as high as it will go. Otherwise the welds will be physically weak.
- In my case the max value is “99”.



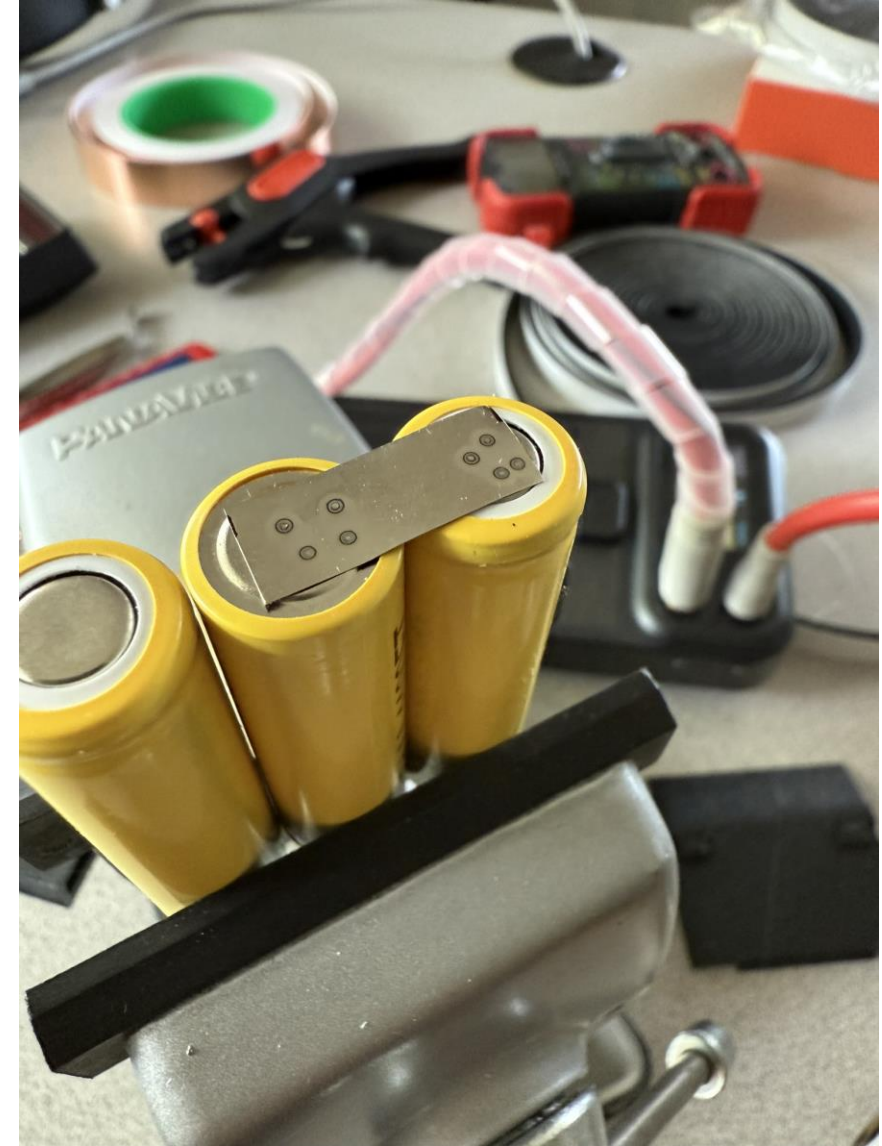
Weld first strip

- A desk vise is useful for this step.
- Position the batteries with the hot glue side facing away from you. The positive terminal of the two end batteries should be up.
- Place one of the 20mm nickel strips between the two right hand batteries.



Weld first strip

- Touch the welder probes to the nickel strip to spot weld it to the battery.
- Each operation produces two welds: one where each tip touches.
- I like to do two weld operations per battery as shown here.



Weld positive terminal

- Take the 55mm strip and place on the positive terminal as shown, with the end that's half-width trimmed at the top.
- Bend down the half width section over the top of the battery. *Make sure you're connecting it to the positive terminal.* Look for the indentation around the top of the battery.
- I bend the remainder of the strip into a "V" by pressing it on top of a butter knife.
- A little tricky as you have to hold the strip in place whilst welding.



Weld negative terminal

- Done! Now flip the battery pack in the vise and weld the 40mm negative strip to the negative terminal on that side.



(Trumpets)

- Your pack should now look like this. The shorter contact at the bottom is the negative contact.
- We're done welding. But the terminal contacts aren't sitting flush with the battery...



Hot glue again

- Squirt some hot glue under the area where the terminal strip goes, then hold it down for 15 seconds or so as the glue sets.
- I'm using an implement here because the hot glue is hot!



We're done.

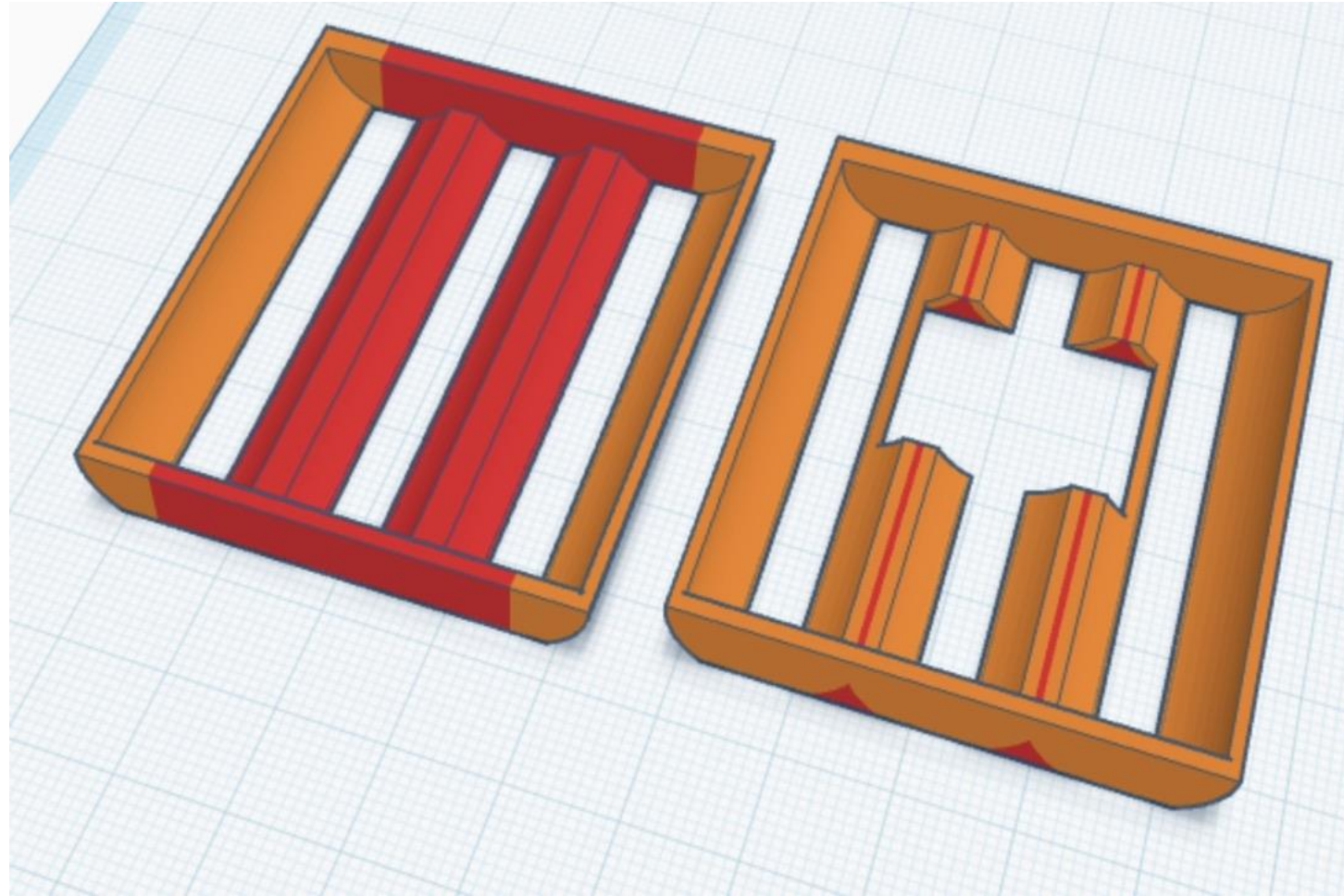
- Cut two 42mm or so pieces of your 1/8" adhesive foam.
- Apply them to the ends of the battery pack. This makes it just large enough to sit snugly in the back of your Classic.
- Optionally trim the corners off the foam
- Sharpie™ labels are optional.



If you have a 3D printer, you can print a case.

I designed this case in TinkerCAD. It's a reasonable approximation of the original HP case.

Let's get started on this iteration...



Things you will need for the battery case method

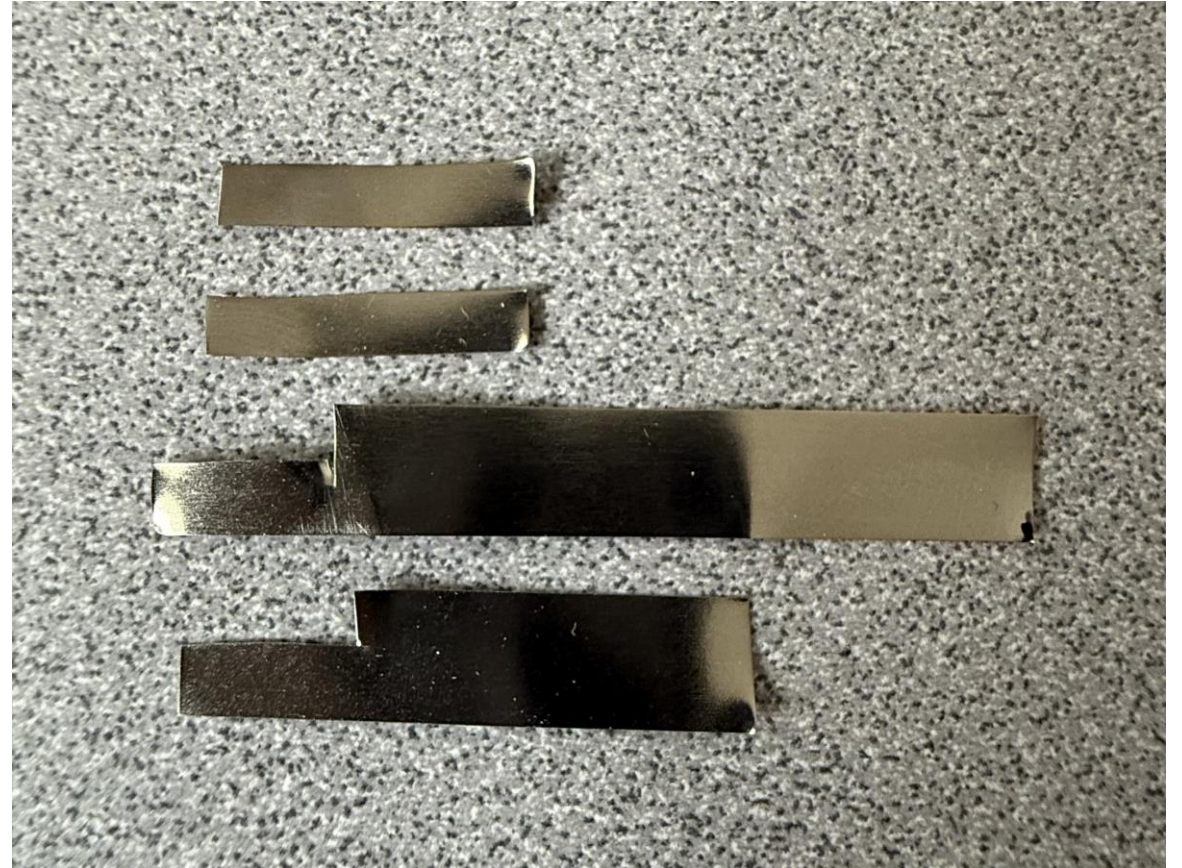
1. Battery welder
2. Nickel welding strips
3. 3D printed battery case
4. Glue or clear packing tape
5. BATTERIES OBVIOUSLY

We will not be using the hot glue gun for this build.



We must use narrower connection strips

1. Cut a single 20mm length of battery strip in half lengthwise. We'll use these instead of two full-width strips
2. Other strips are as before



Make the first weld

1. Position the half width strip between two batteries.
2. Weld!
3. You made sure you were welding positive to negative, right?
4. Complete the rest of the welding as with the quick and easy pack.



Done welding

Since we're not using hot glue– it would interfere with the fit of the battery case– our battery pack is secured only by its welds. Handle carefully!



Insert batteries into case bottom

The longer top strip is positive;
the shorter lower strip is negative.



Place case top

It should fit easily into place and secure the positive and negative terminals as shown.



Optional step

Clamp battery case as glue sets. I used a cyanoacrylate gel that take a while to really secure the case. You could also use other glues or even clear packing tape.



OK, you've seen the “Quick and dirty” way and the “Prettier way”...

I have been using various versions of this method for several years. The most significant change now is the availability of affordable battery welders.

Surprisingly, the process is easier than I anticipated. I can put together one of these “quick and dirty” battery packs quite fast; in fact, I spend more time on preparation and cleanup than on the actual assembly—but it's not flawless.

The main drawback is that if the batteries fail, you need to repeat the entire procedure: gathering tools, cutting metal strips, and so forth.

Although I have described the process thoroughly, I probably won't continue doing it myself, as someone has developed a much better alternative.

Walter Hosko has been selling his custom packs for years on eBay.

His latest iteration uses a commodity 3-”AAA” cell battery holder with some foam tape to pad it out to size.



It's the best way.

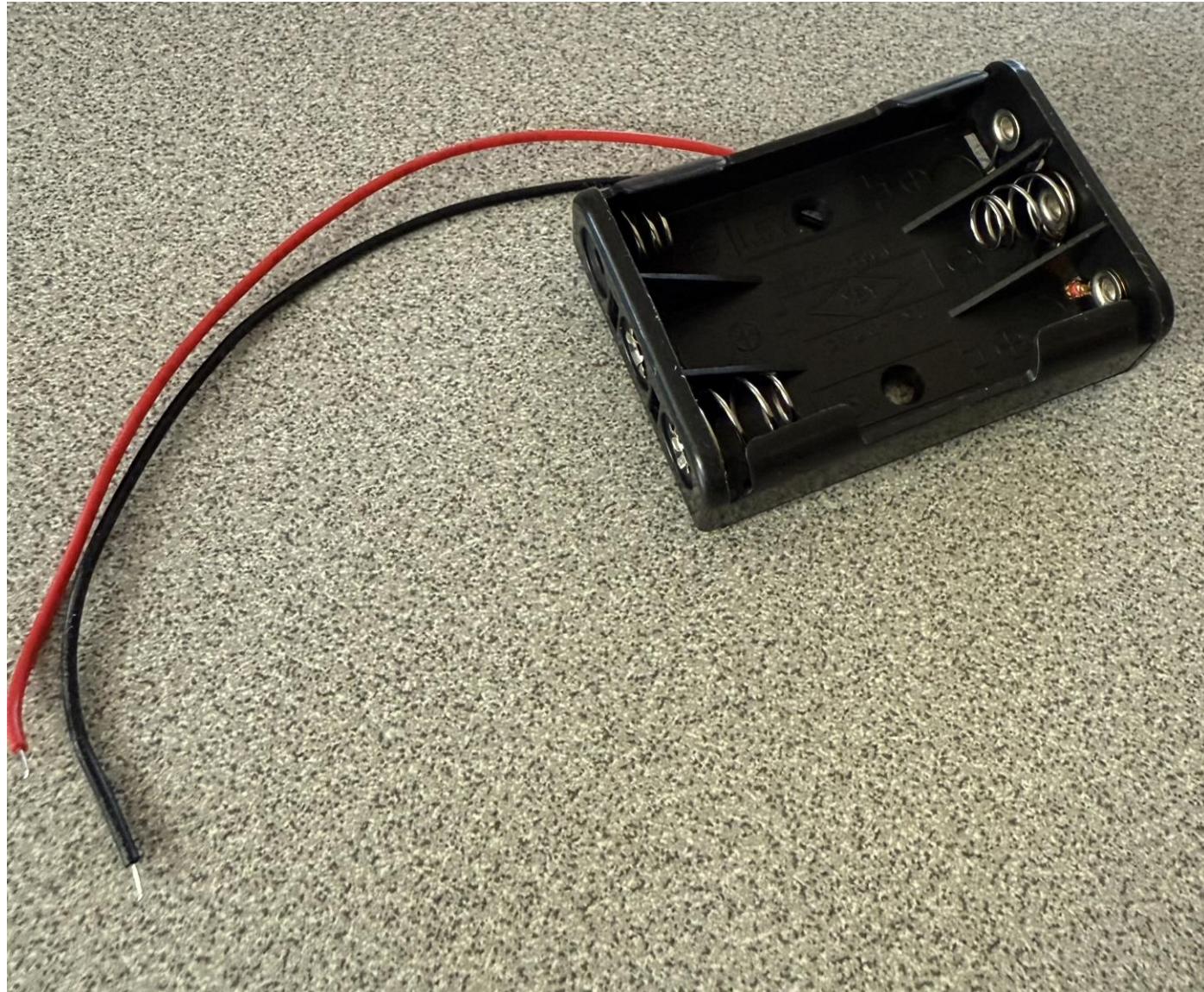
On the other side are two offset copper contacts.

- No more soldering, welding, or gluing.
- You can use NiCads (300-500mAh) or alkaline (800-1200 mAh) batteries
- Replacing batteries is trivial.



Materials needed for the best way

1. Commodity AAA battery holder
2. Conductive copper tape
3. Wire cutters/strippers or pocket knife
4. 1/8" and 1/16" foam tape (optional)
5. Electrical tape



The secret sauce

I originally tried making contacts out of 1mm copper sheet. That didn't work very well.

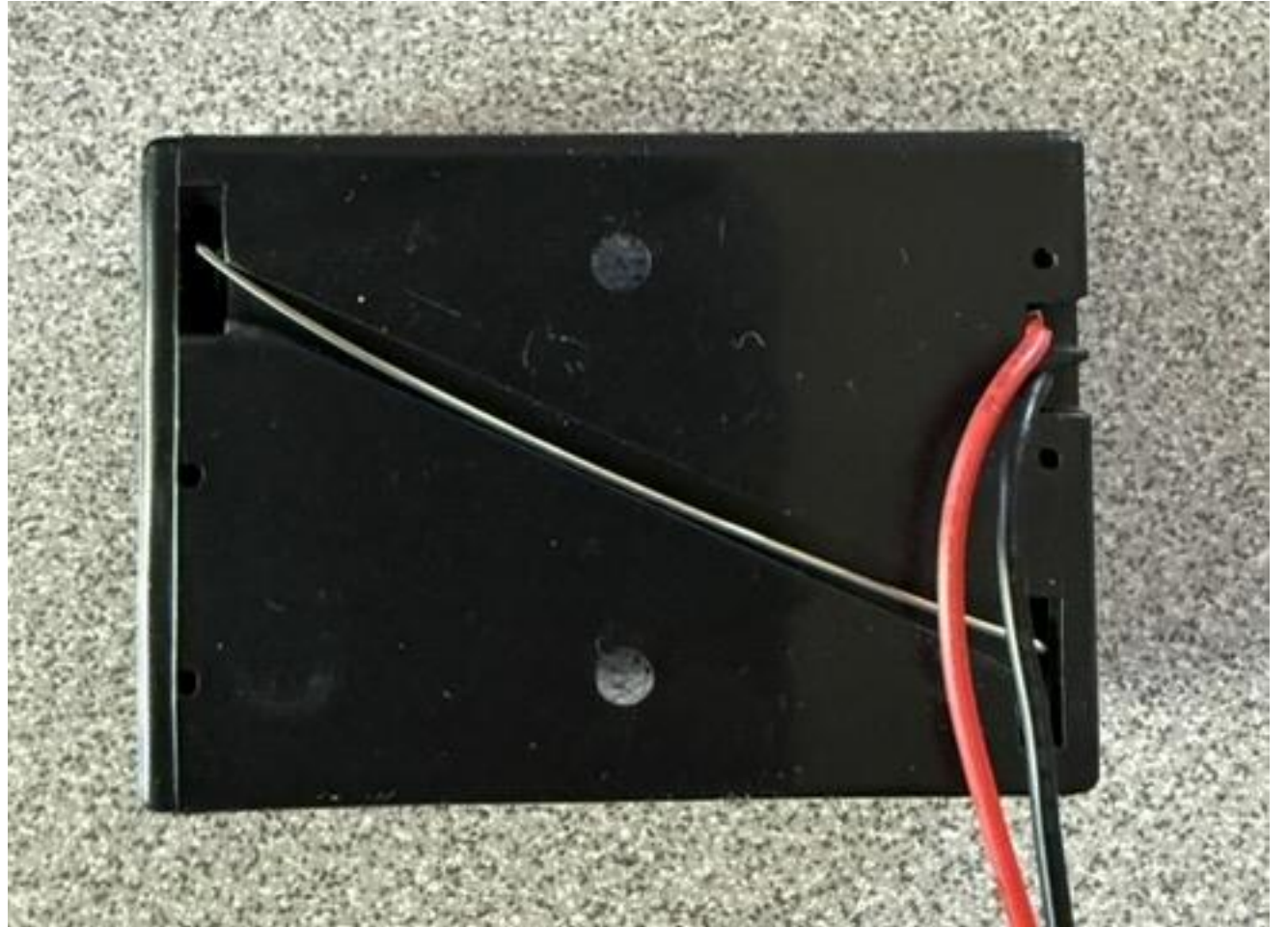
Then I found out that copper foil tape with *conductive adhesive* exists.

So let's go...



Cover that wire

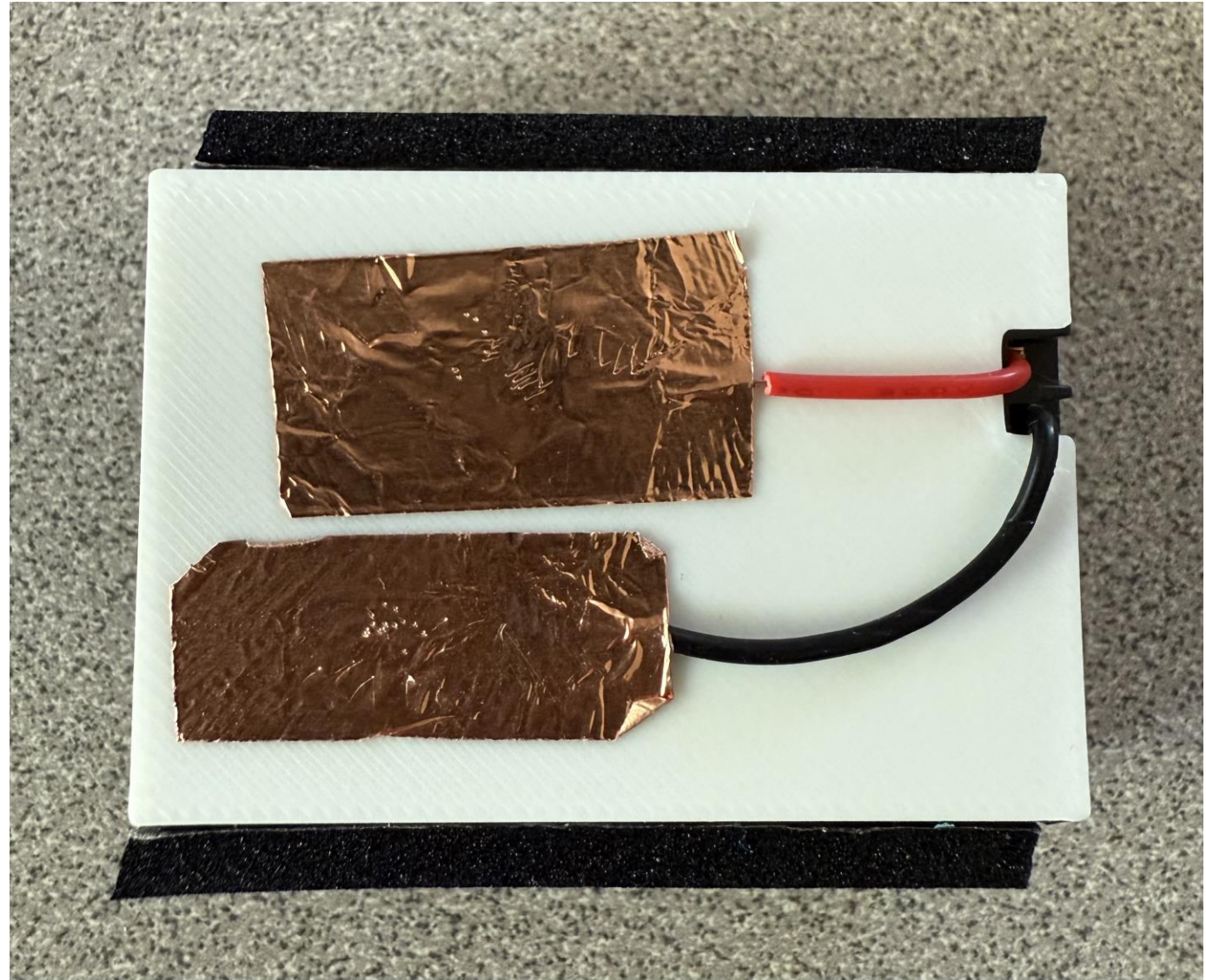
An exposed, albeit recessed, wire on the back of the battery pack connects the positive and negative terminals. We'll want to cover this...



Things that didn't work

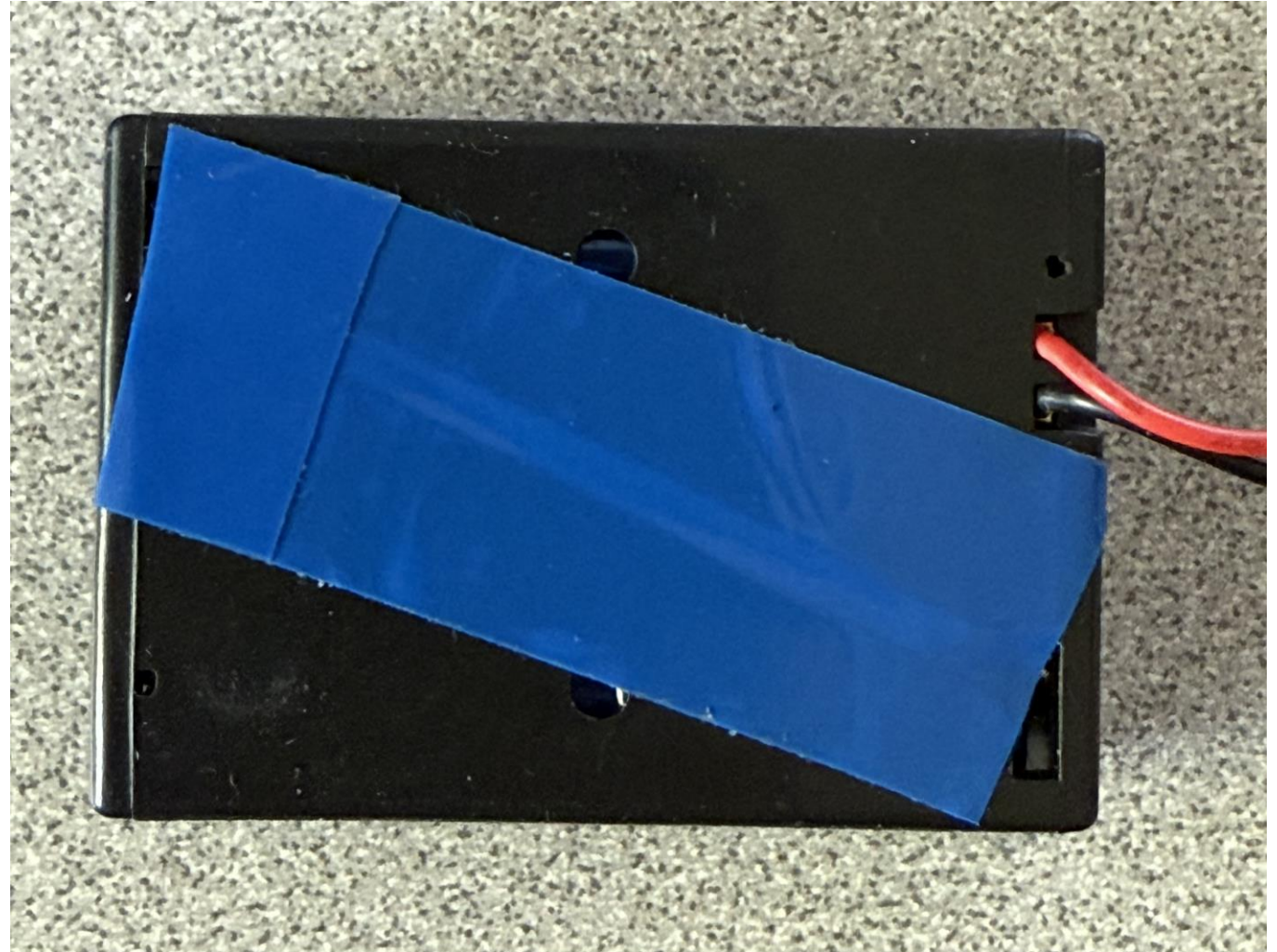
I tried 3D printing a 1mm backplate with a nice cutout for the wires.

Sadly this made the pack so thick it was very difficult to put the rear cover of the calculator on.



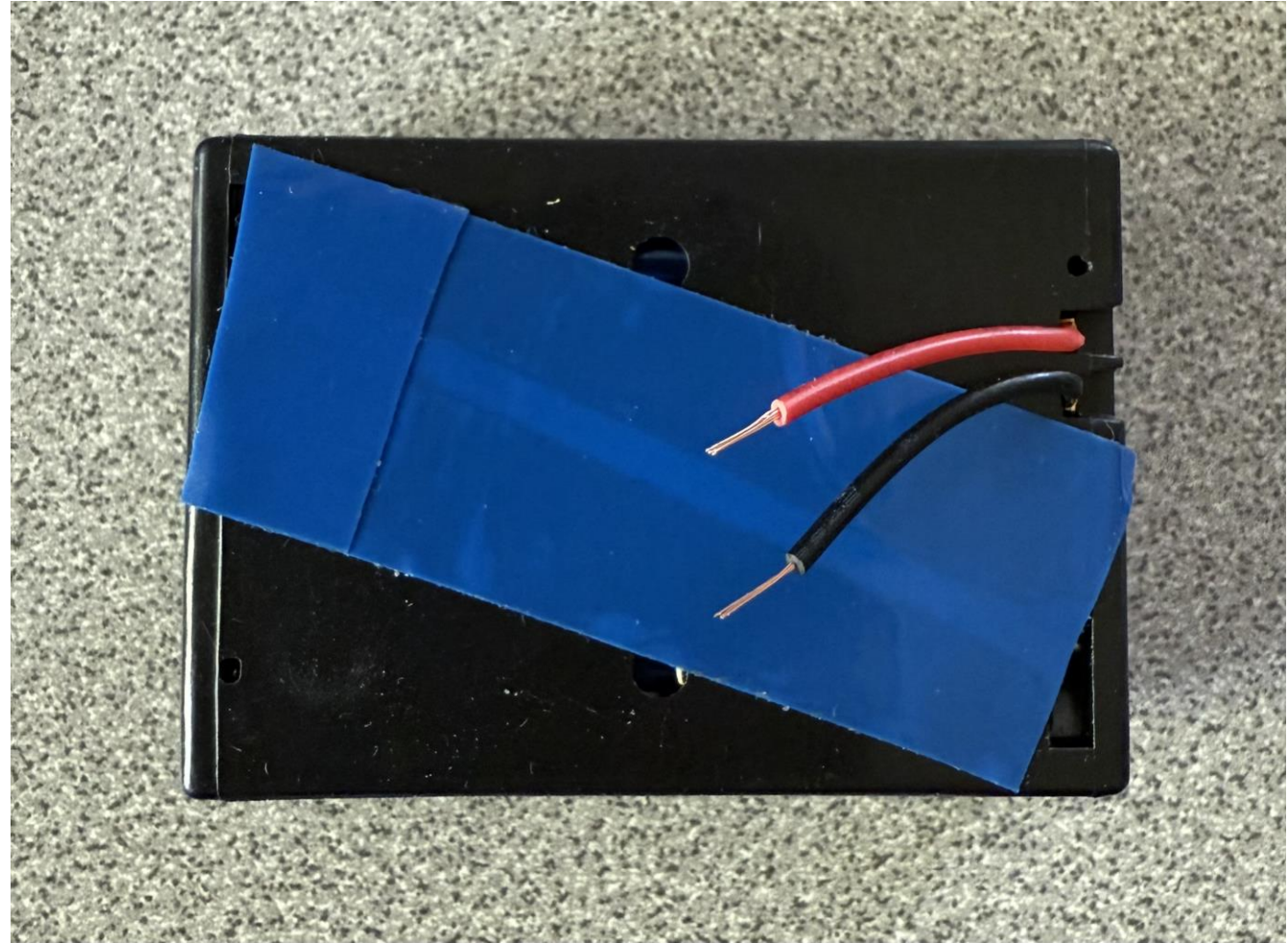
Cover that wire

A strip of electrical tape and we're done.



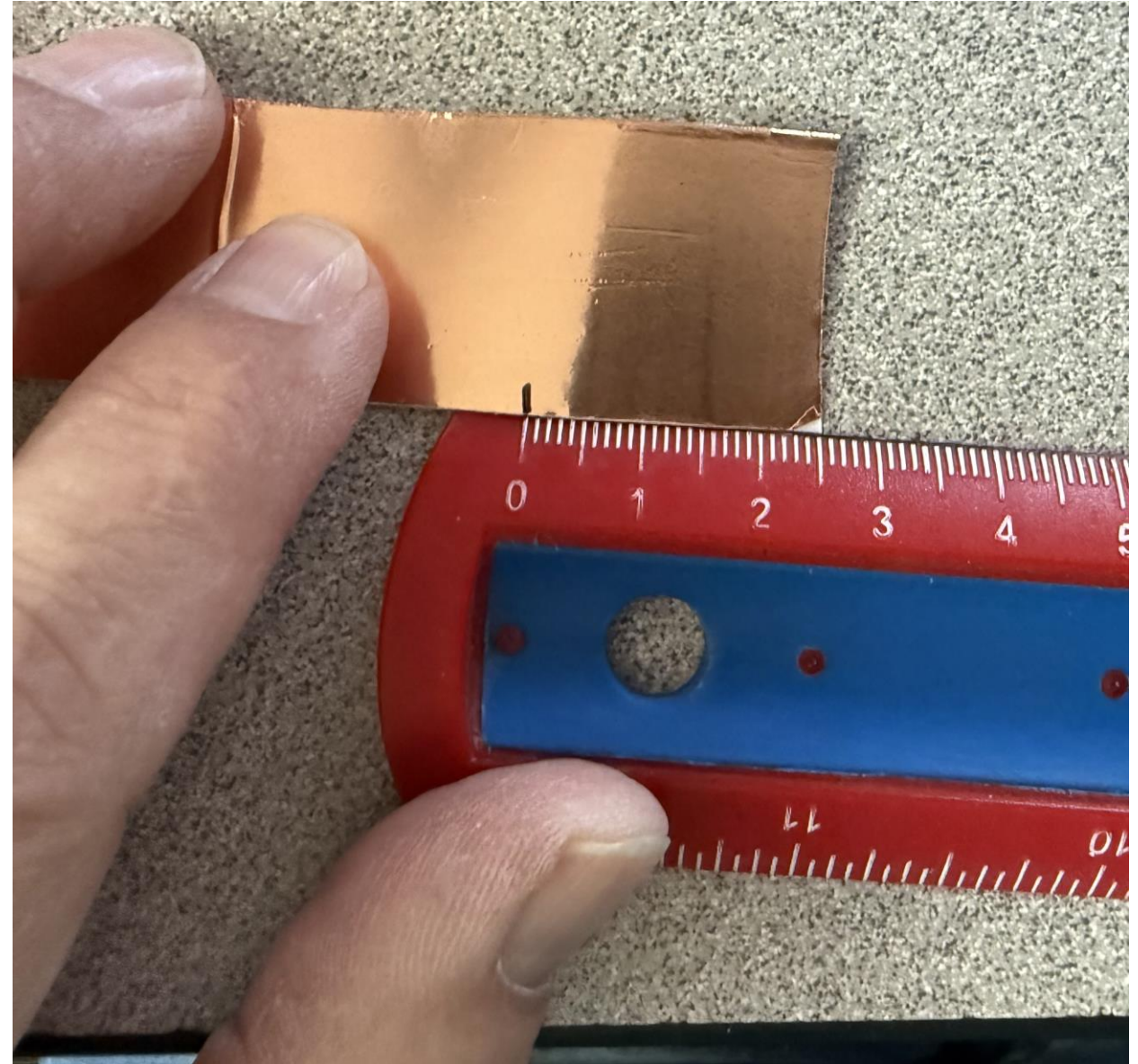
Wires cut and ready

Measurements are not critical at this time. They could be shorter.



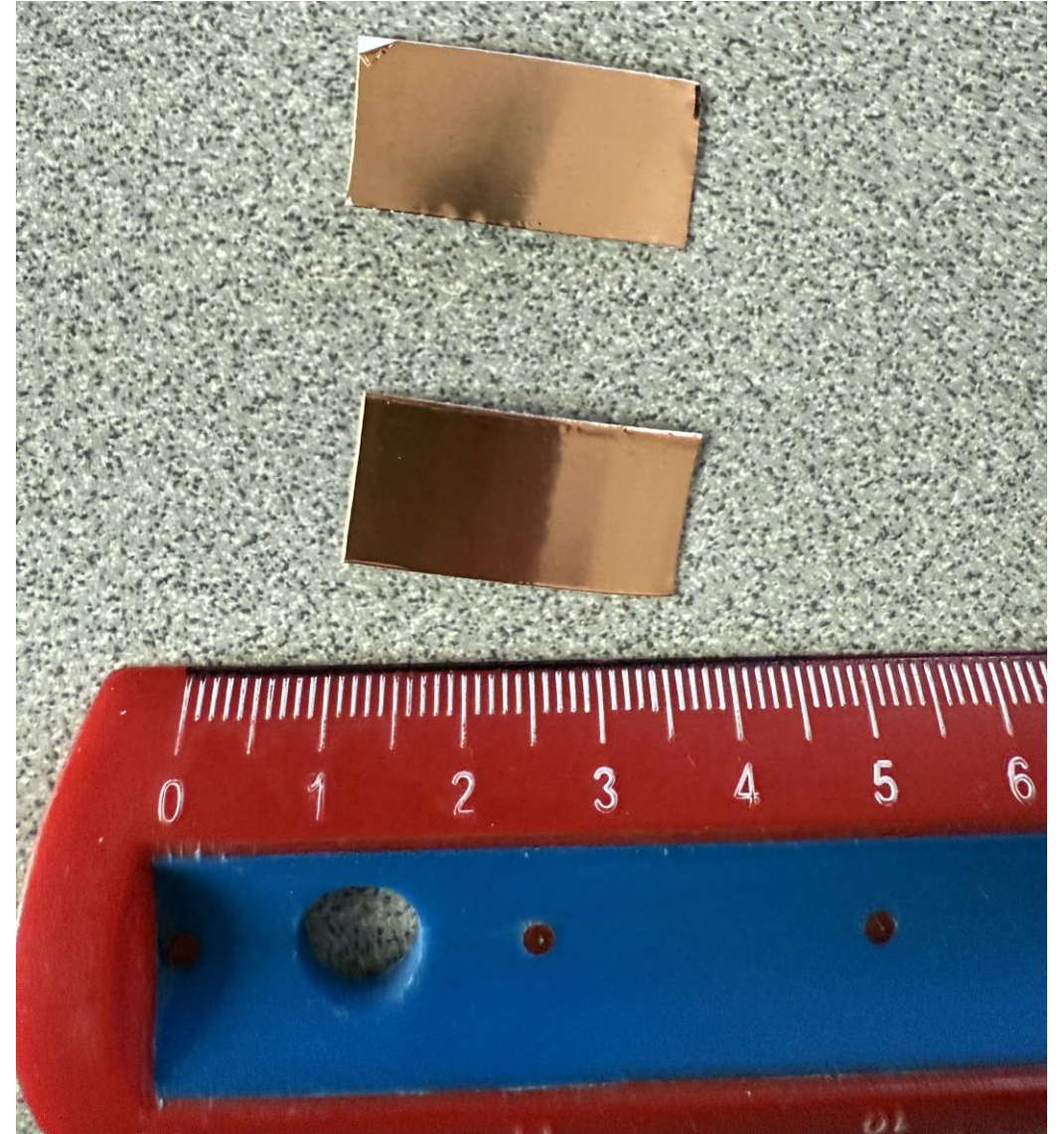
Prepare conductive tape

The copper conductive tape is 1" wide. Cut a single 25mm strip...



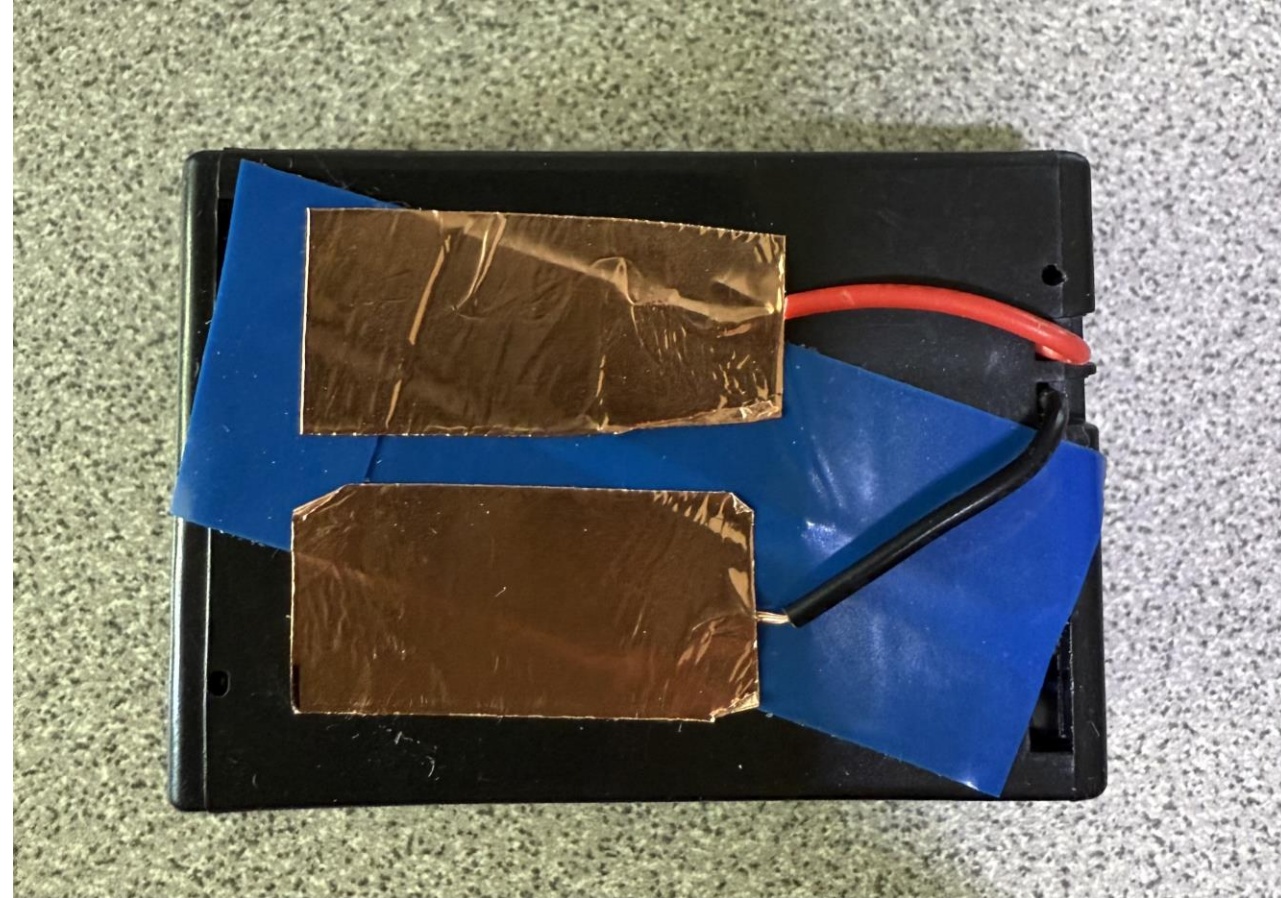
Prepare conductive tape

...then cut that strip lengthwise.



Apply conductive tape

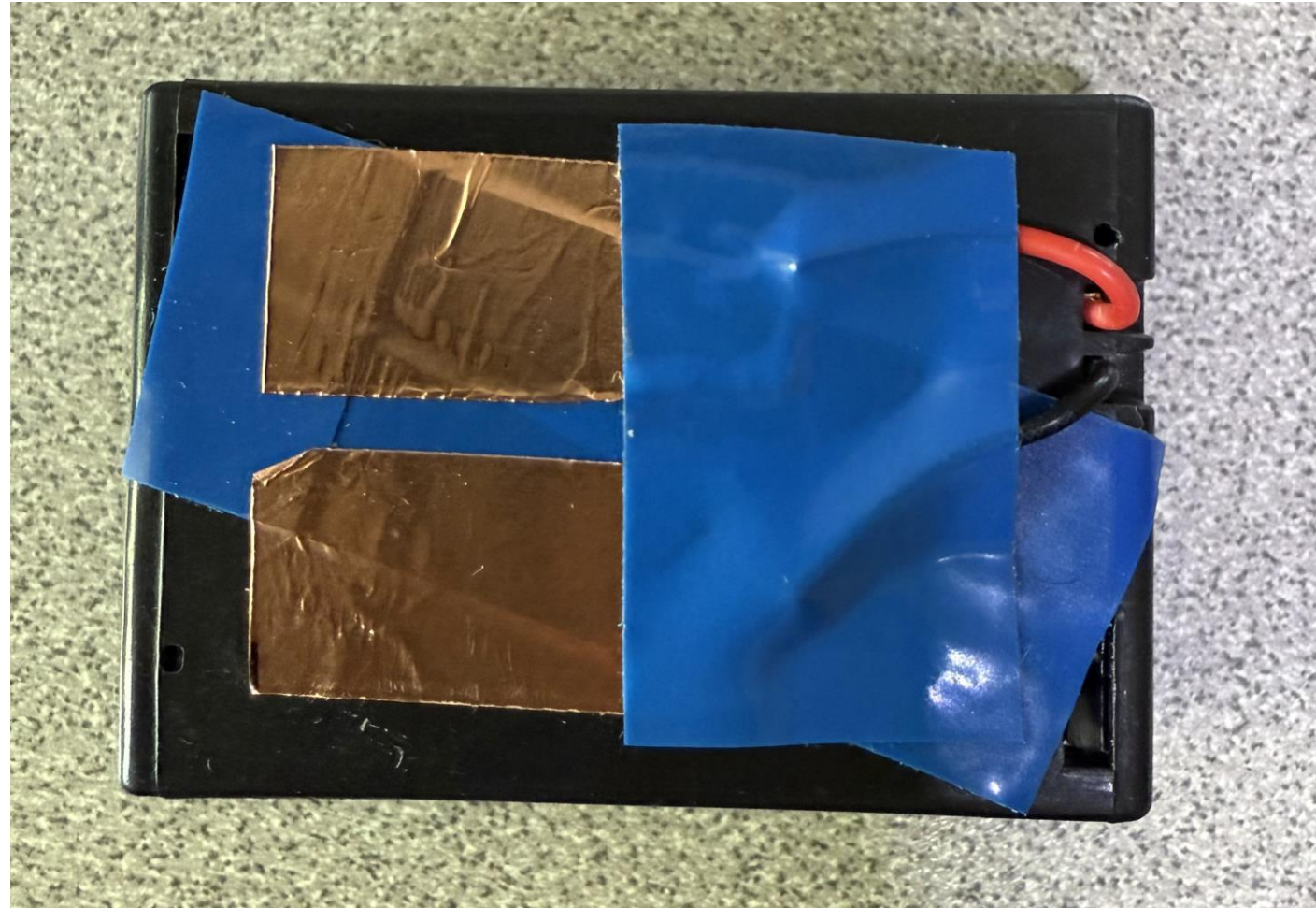
Since the adhesive is conductive, there's no soldering or welding. Just apply the tape on top of the exposed wires.



Safety first

Apply another strip of electrical tape to cover the copper strips at about halfway down the length of the pack.

We don't want the tape to touch the calculator contacts if the battery pack is inserted upside down. As best I can tell there is *no protection* in the calculator against the carnage this would likely cause. Seriously, HP: how much is ONE DIODE?



The last step

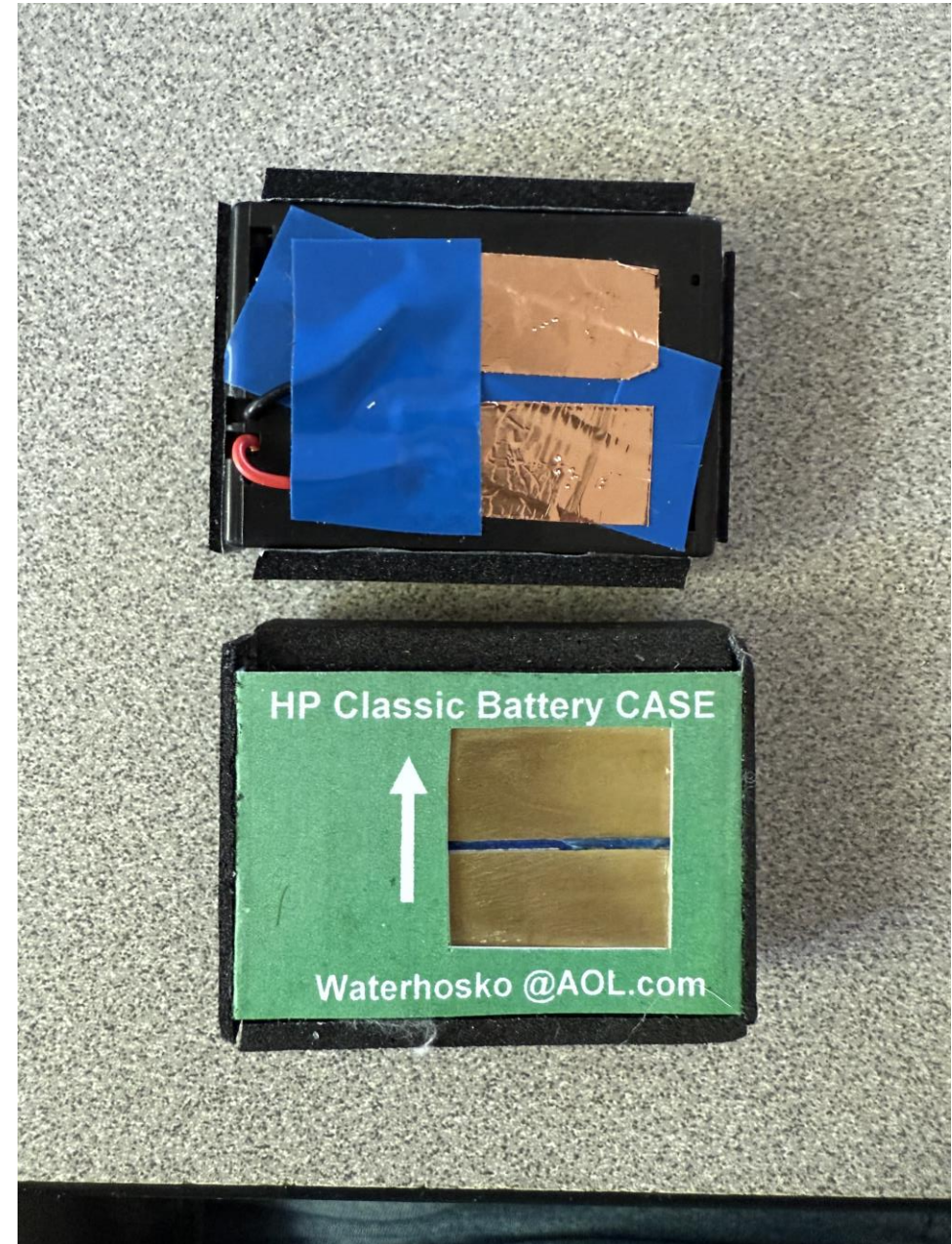
Apply strips of 1/8" weather stripping foam to the long ends of the pack, and strips of 1/16" foam to the short sides.

This keeps the pack from moving about in the calculator's battery compartment.



Details, details

Obviously much less pretty that
Walter Hosko's packs.



Materials Cost Breakdown for standard packs

“AA” NiCads are about \$2.50/each.

The cost of nickel strip and hot glue for the standard packs is in the pennies per pack. This does not consider the cost of the battery welder or glue gun.

The materials cost for a single “quick and easy” pack is well under \$10.00.

Materials Cost Breakdown for replaceable pack

For the “AAA” battery pack, the holders I used are \$10 for a pack of 8.

Copper foil tape, 66 feet: \$18.39

1/8” and 1/16” adhesive weatherstripping tape: about \$20

”AAA” alkaline batteries: 32 Energizers are \$24 on Amazon, so \$0.75 each.

“AAA” NiCads or NiMh batteries: \$1/each.

Materials cost for replaceable pack is about \$4.00 for alkaline pack and \$6.00 for rechargeable pack.

CONCLUSION

- It's way cheaper to build these yourself, and the battery-pack-and-foil-tape method is so easy I can do it.