General Things

All three assemblies snap apart to expose the circuit boards inside. Use care to avoid breaking any of the tabs or slots. Don't rush. Enjoy the ride.

I tried to write this so that pretty much anybody can do it – though there is less and less detail the further you go in (mostly because I'm trying to get this out for people to use). Some folks will be able to just look at the pictures and go do it, and to them I apologize in advance for the long discussion.

Making this modification takes some soldering skill and a half-decent soldering iron. If you aren't comfortable with your skills and equipment, I suggest you hit Radio Shack and buy a "resistor assortment" (like RS 271-308) and some "prototype boards" (like 276-150) to practice with. Don't practice with the 2.2K resistors (red-red-red), you'll use them later.

63/37 tin/lead solder is easiest to work with, because that has the smallest 'pasty' range as it cools; but 60/40 is OK too and available at radio shack. Rosin core, of course. Not too fat, 0.032" is the absolute largest you'll want to use for this. Radio Shack 64-017 would be fine if you don't have usable solder laying around. If you are experienced with soldering, the radio shack 'silver bearing' solder is also fine.

If you don't have a soldering pencil on hand, you will probably need to do that practice step above. Unfortunately, radio shack doesn't have any halfway decent soldering pencils in stock. Search amazon for "Weller wp25" to find what I'd consider about the minimum iron for work like this. A holder with sponge/cleaner is handy to have to keep your tip clean; a dirty tip is going to make life much more difficult (search "Aoyue Soldering Iron Tip Cleaner" on amazon) .

I used 3mm white "inverted cone" LEDs from quickar.com (http://www.quickar.com/discrete.php). Order plenty, you'll be annoyed if you trash a couple and end up short. They will give you resistors to use with them (though they are only useful for the HVAC mod), tell them in the comments that you are using them for automotive use and would like 560-ohm resistors.

LEDs are polarized. They will only light when connected correctly, and they may be destroyed or degraded if hooked up backwards. You'll see that one of the leads is longer than the other; that's the positive lead. There may also be a flat on the base of the LED on the positive side.

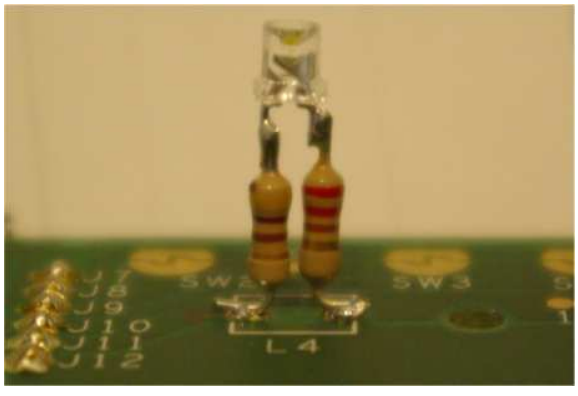


Figure 1 warning: you will only have one resistor!

Look at your LEDs when you get them, maybe take a picture. Note that the two leads look different inside the LED. In the case of the LEDs I used, the 'smaller' part (on the left above) is the positive lead. You'll need to know this if you cut the leads and need to figure out which end is which.

It will be really handy to have a current-limited bench supply for testing. If you don't have one, you can make one up with a 9V battery, a battery clip (RS 270-324) one of the 560-ohm resistors you'll get with the LEDs, and some clip leads (RS 278-1157). Way better to debug this on the bench than blowing fuses in the vehicle.

For the switch banks, you'll need a 3.3K[1] ohm, ¼ watt resistor (RadioShack 271-1328 5pk) for each lighted switch. You may have some from your practice kit above, if you did the trip down practice lane.

Note that you can plug any of the three assemblies back into the body harness and turn on the parking lights to test your work - you don't have to reassemble everything. Do be careful to not let things short out, though.

OK, let's get to work.

Upper Switch Bank, and All the Soldering You'll Need to Know

Carefully separate the two halves of the case; then slip the back half off the connector pins. You'll be left with something that looks like this:

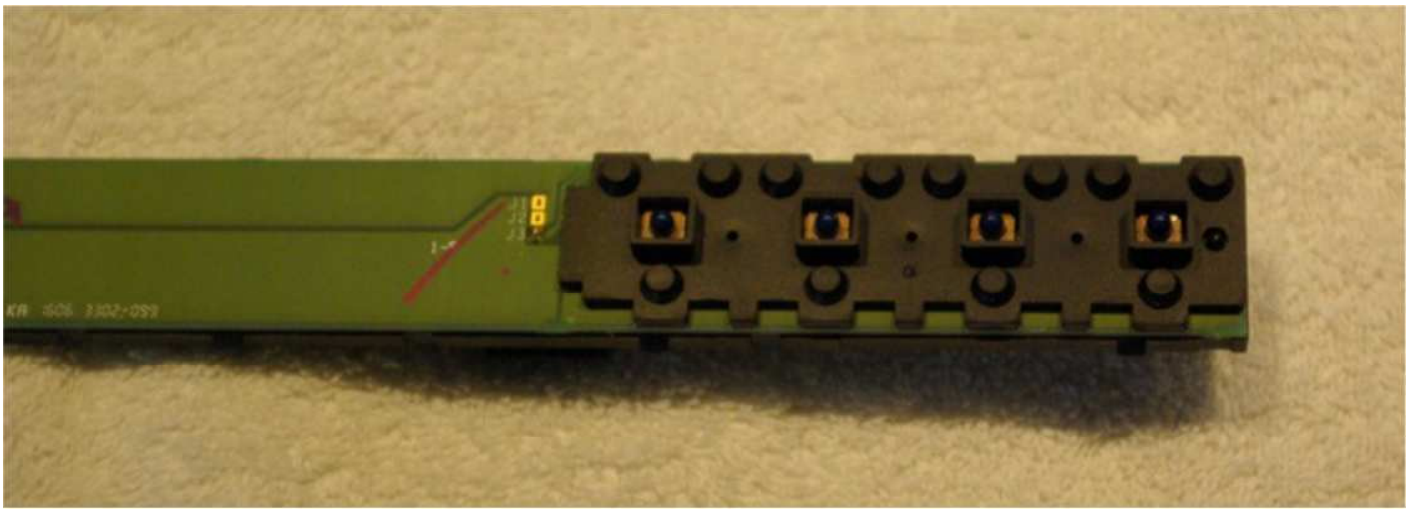


Figure 2 upper switch bank

Gently remove the rubber switch matrix, leaving:

[1] I used 2.2K ohms in the switch banks, and I'm not entirely happy with it. I may redo this yet again with the "ice cube" LEDs to see how that works out. Or change to something like 3.3K. They are still too bright with 2.2K in there, so I'm suggesting 3.3Kfor the next intrepid traveller.

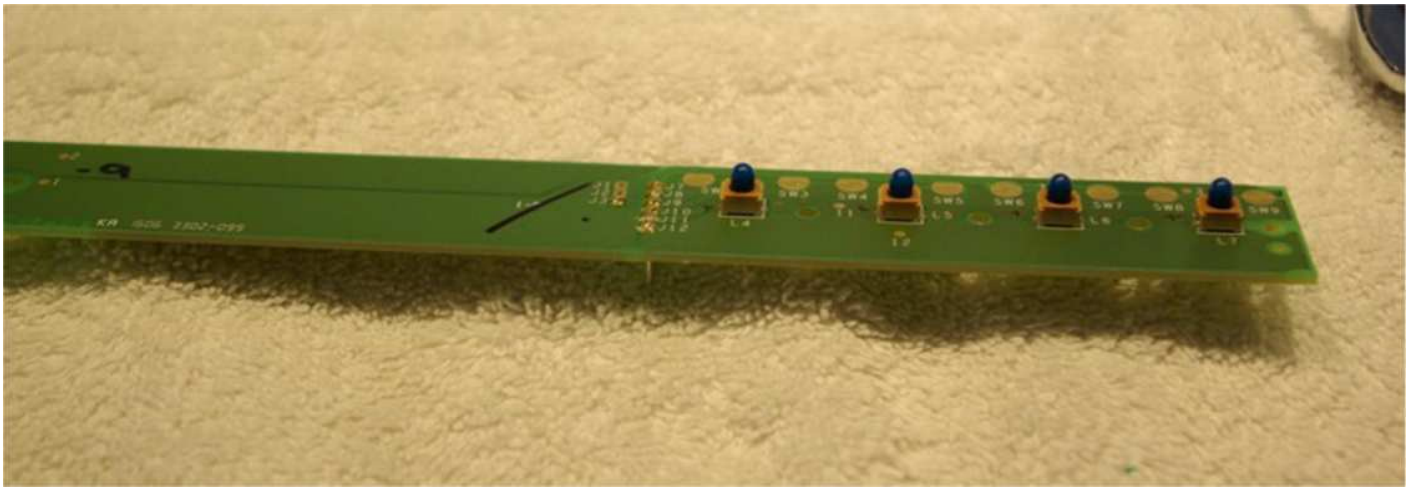


Figure 3 the old bulbs

Now the fun begins. Get your soldering pencil heated up, and the tip all cleaned and tinned. You'll see on the sides of the bulbs a tiny bit of exposed solder; what you're going to do is melt that solder on one side while gently pushing the top of the bulb away from that side, so that it will rotate up just a bit when the solder melts (you'll feel it). I find that if you can see more solder on one side vs. the other, do the side with the LEAST solder showing first. Once you get the first side slightly lifted, do the other side. You will probably be able to get this side to release completely from the board (but don't go crazy pushing the bulb, if you aren't careful you can end up ripping the other pad off the PC board). Then go back and reheat the first side while nudging the bulb away, and the bulb should fall off. It is really easier than it sounds, once you do the first one you'll knock the rest off in no time.

You now have the dirty pads to deal with.

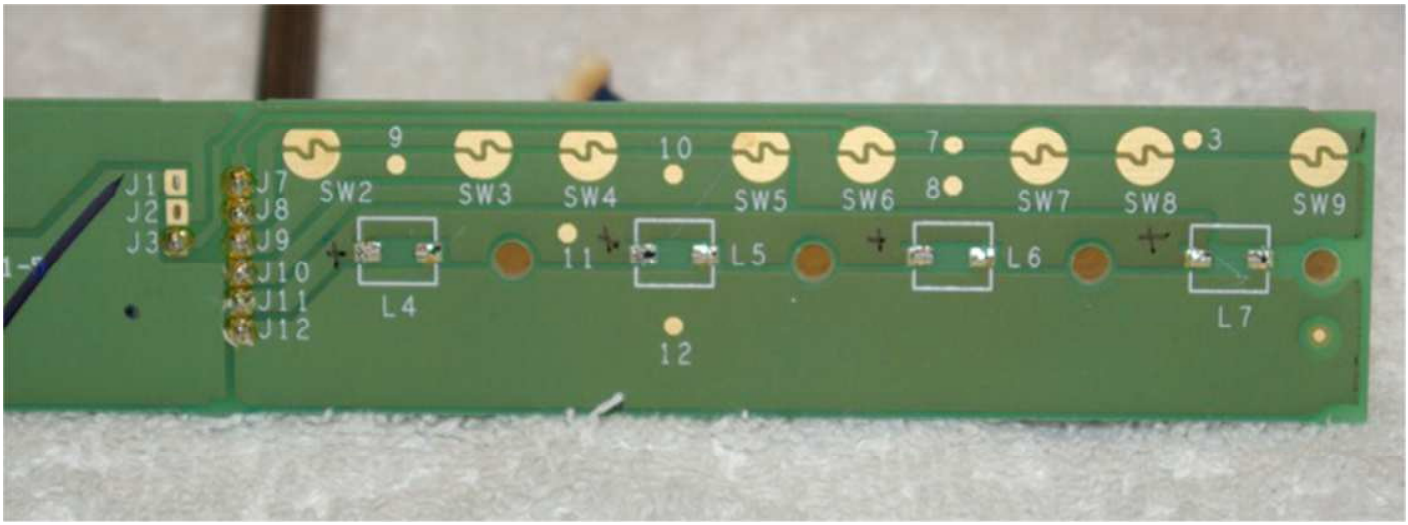


Figure 4 marked polarity

Notice that the + pad of each lamp site has been marked. Using your soldering iron, with its nice tinned and cleaned tip, and put a tiny amount of fresh solder on each pad[2] (touch the iron to the pad, then touch the tip of the solder to the pad; pull the solder away, then pull the iron away).

[2] You'll see this "little bit of fresh solder" technique again. What we're going to be doing is "tack soldering", where we have clean fresh solder on both surfaces - so all we have to do is heat the joint and the solder will "reflow" to make a good connection.

To give you some idea what you are trying for, this is a pic of the “fixed” pads (on the left), and “as-unsoldered” pads (on the right).

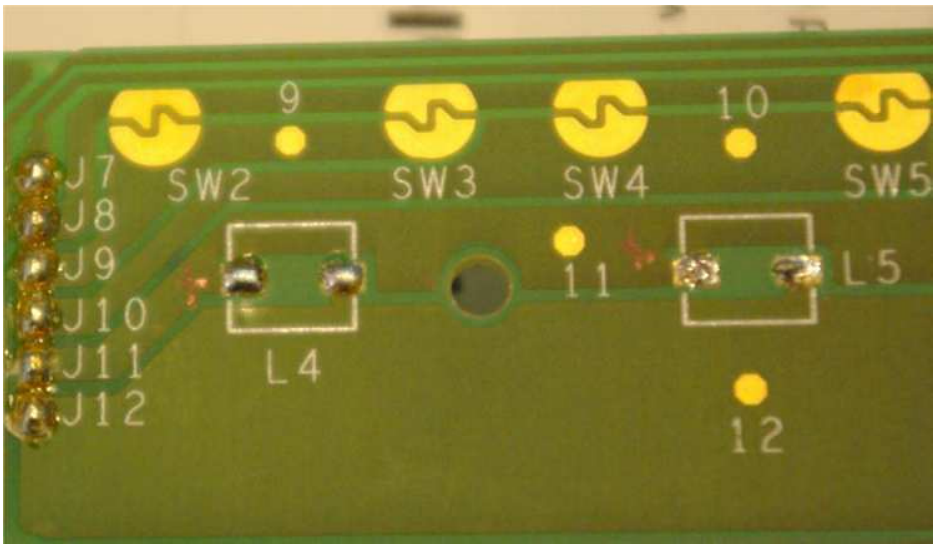


Figure 5 cleaning up the pads

So now we need to prep up some LEDs. What I’m going to show is not what I think you really want to do; it is what I did before I discovered that these LEDs are far too bright in the switch application[3]. What I think you should do is follow this procedure on only one leg of the LED to install a 2.2K (or maybe 2.7K).

Your resistors are probably still in their paper ammo strips, which makes things a bit easier. Using your cleaned and tinned soldering iron, lightly tin both leads of the resistors you’ll be using, from very near the resistor body to about ½” away. “Lightly tin” means a thin, shiny coat of fresh solder. (This is much easier to do when the resistors are held in place on their strips.) Cut one end of each resistor about 1/8” from the resistor body, and cut the other end about ½” (not critical) from the resistor body.

Cut one LED lead about 1/8” long from the beginning of the straight section. Lightly tin this lead (work fast, this is where your practice will come in handy). Now, using your thumb on the long LED lead and the long resistor lead, position the short LED lead and the short resistor lead so that they are parallel and touching (maybe with the tinning solder a bit overlapped). Touch the soldering iron to the two parallel leads, and then remove it without moving the leads. The solder on the leads should flow together and make a good joint.

Now, bend the long resistor lead 90 degrees to the outside, and bend the long LED lead 90 degrees to the other side at the same point (because I used 2 resistors trying to figure out a reasonable value, I don’t have any pix of what this looks like.. but look at figure 6, and imagine that one of the resistors is just an LED lead). Clip the leads about 3/16” from the bend. Check to make sure the cut ends are tinned, and if not, touch up the tinning.

[3] It was clear that I needed to use ¼-watt resistors because of the height restriction under the switches, but a quarter-watt 560-ohm would be running too hot. So I split the resistors, one in each leg, to get them to run cooler. Little did I know that I’d end up running these LEDs with so little current that I could have used a 1/8 watt resistor

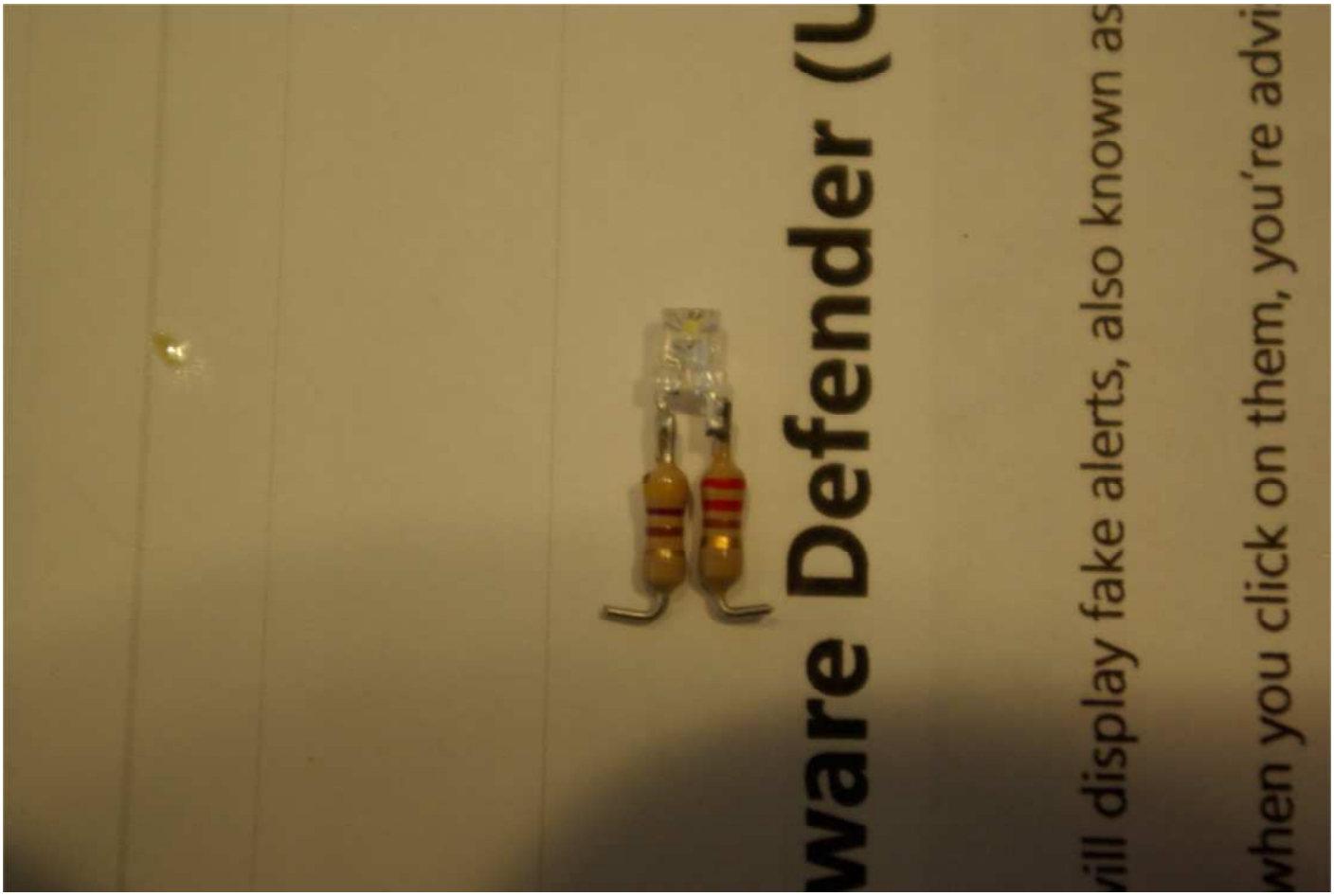


Figure 6 prepped LED assembly

Now, it is time to solder the LED assemblies to the board. Think back and remember which end of the LED assembly is positive – this is important. Use your tack-soldering technique to mount the LED assemblies to the switch board; I think you will find it easiest to tack the long LED lead first, and then the resistor leg. Make sure the positive leg goes on the positive pad that you marked earlier.

When you're done, it will look pretty much like Figure 7, except each LED will only have one resistor.

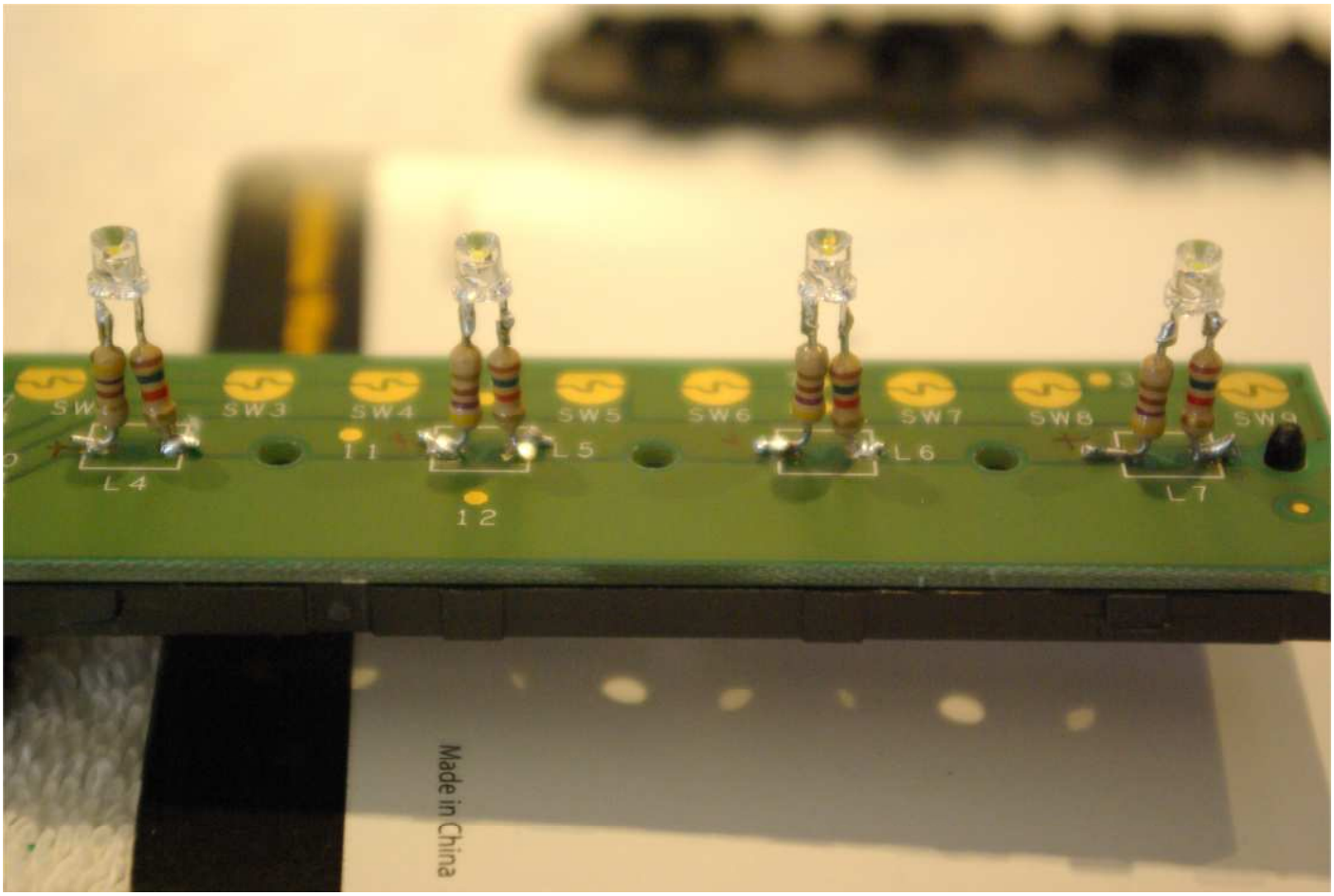
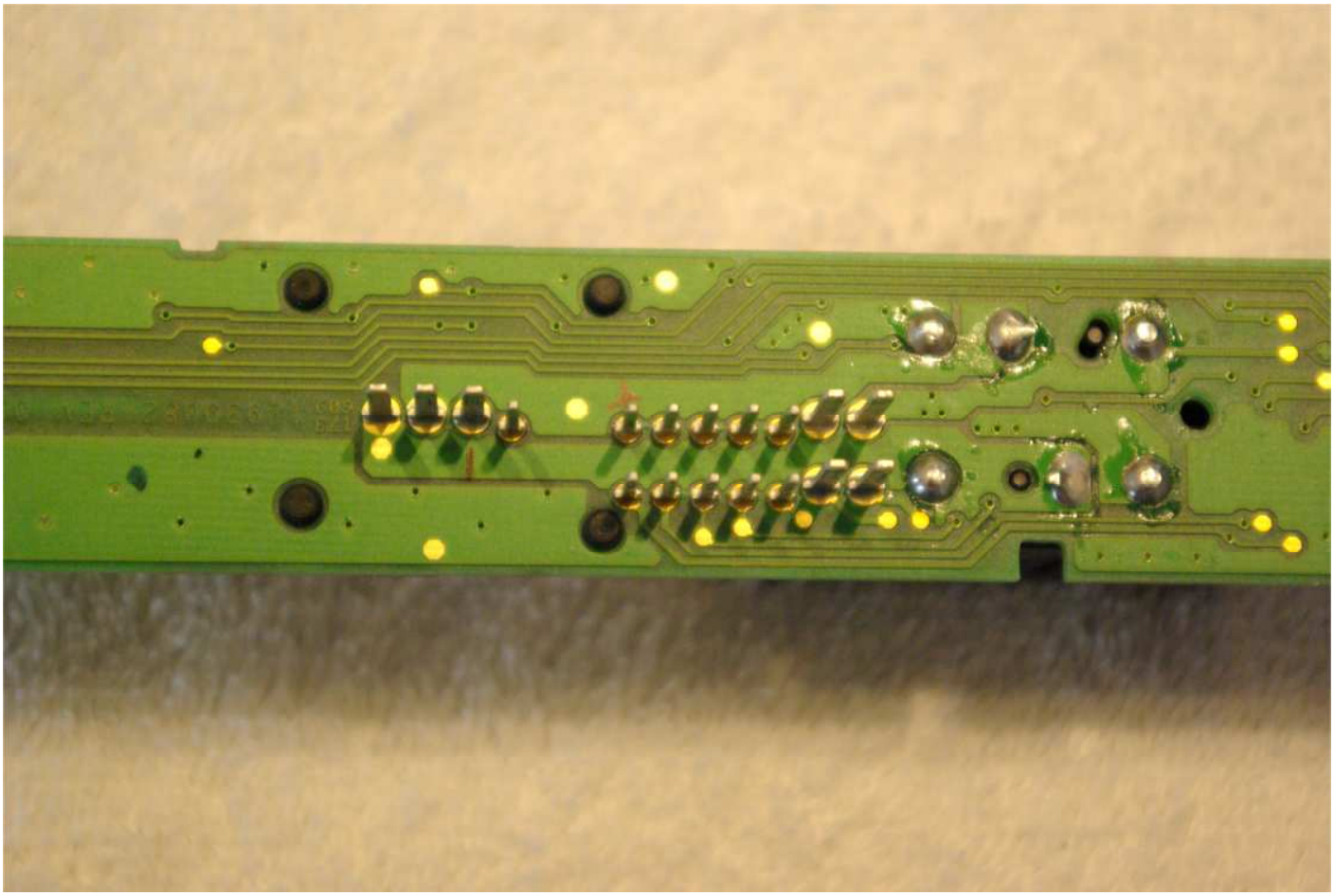


Figure 7 LED assemblies mounted on the upper switch bar

Put all the pieces back together and take the assembly out to your WK for test.

Lower switch bank

If you managed to complete the upper switch bank, the lower switch bank should be no problem. The bad news is that I did not take any photos that show which leg of each lamp site is positive. Figure 8 does show the + and – pins on the board, and you should be able to trade the traces to each site and mark the + side. Maybe when I rip it apart to try the icecube LEDs I'll take more pix.



HVAC controls

Now for the big prize. You are all good at tack-soldering by now, so I'm not going to talk a lot about the LED assembly prep. 560-ohm ½ watt resistors are the correct resistors for this work.

The first important thing about this lighting setup is that you need to have the LEDs positioned so that the bulk of their light output goes into the plastic light-pipe. When you look at the side of the inverted-code LEDs, the bottom of the light output is roughly aligned with the top of the metal parts you can see inside the LED. You want to do your lead-bending so that this is just above the bottom of the light-pipe when assembled.

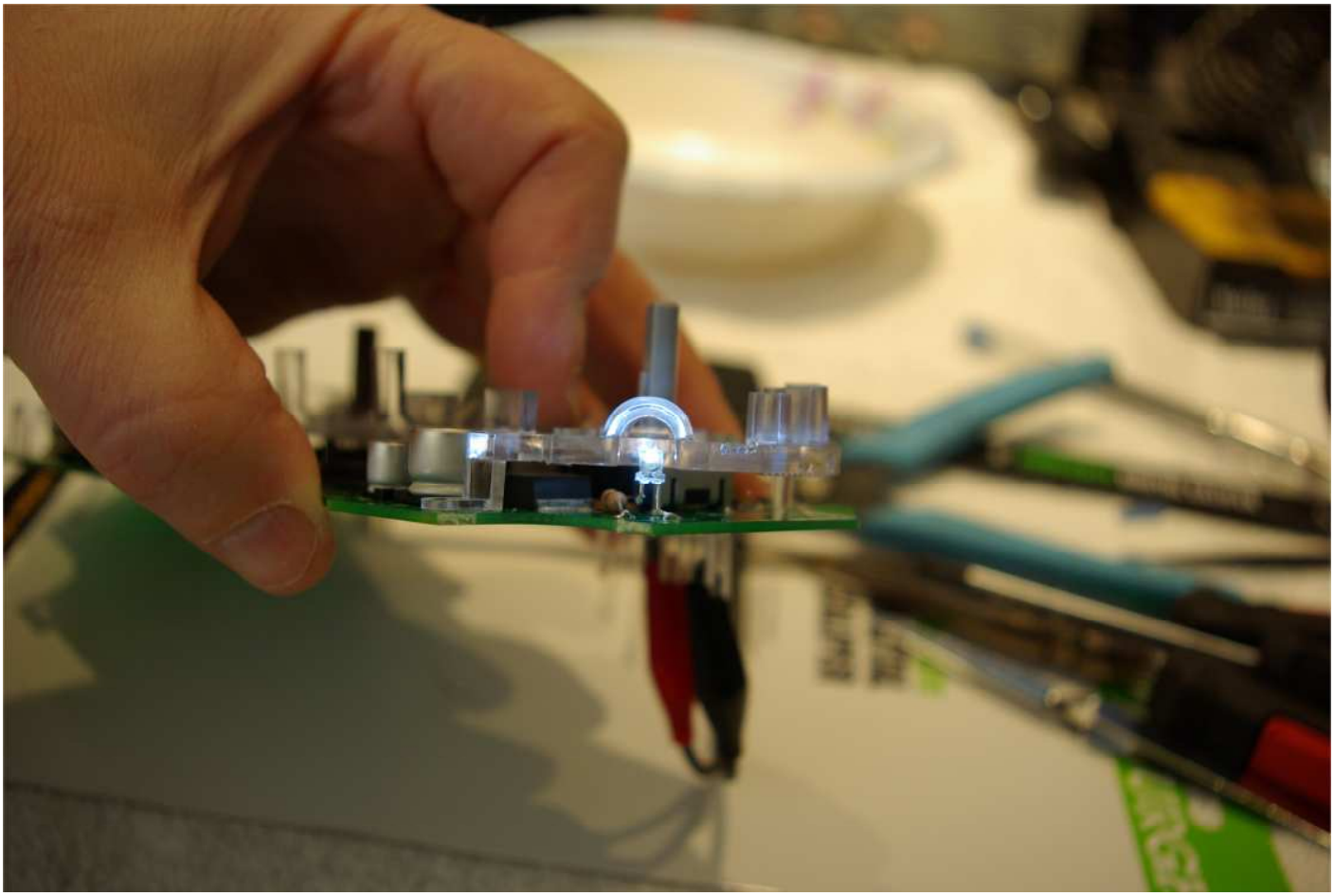


Figure 8 LED alignment

The general idea here is that you will have one leg of the LED that is bent and clipped to set the LED height, and the other leg will be bent about 1/8” closer to the LED body and in the direction you want the resistor to lay. Think about how you want the leads to lay, so that you don’t have any possibility for shorting. Once you have the LEDS set up the way you want (and TESTED), use a small dab of hot-melt glue to make sure things stay in place and can’t short out.

Note that on the end of the resistor away from the LED, you will need to make a double bend so that the lead will land flat on the pad and not be up in the air (see figure 11).

You’ll need to take some sandpaper and rough up the domes on the light-pipe over each lamp, else it will be too bright in that area of the panel

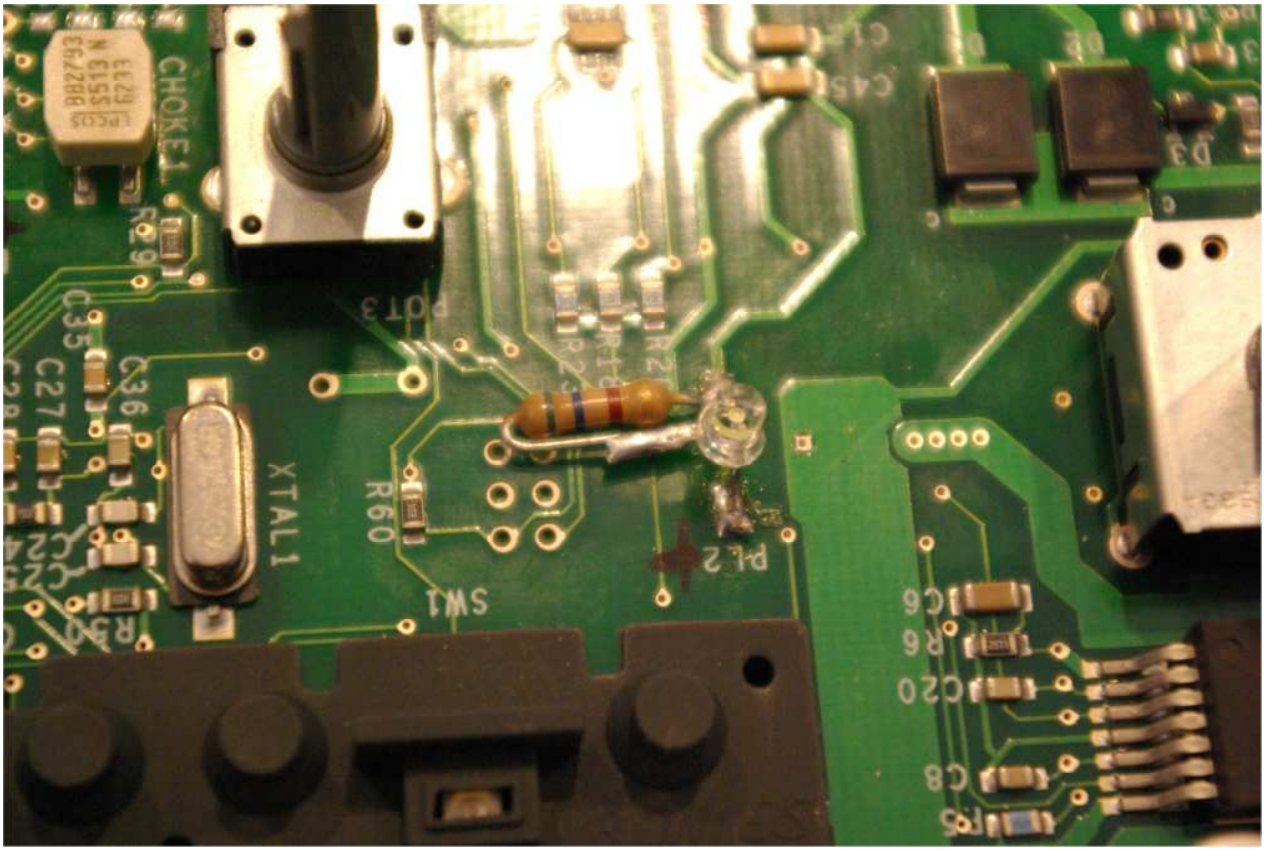


Figure 9 LED

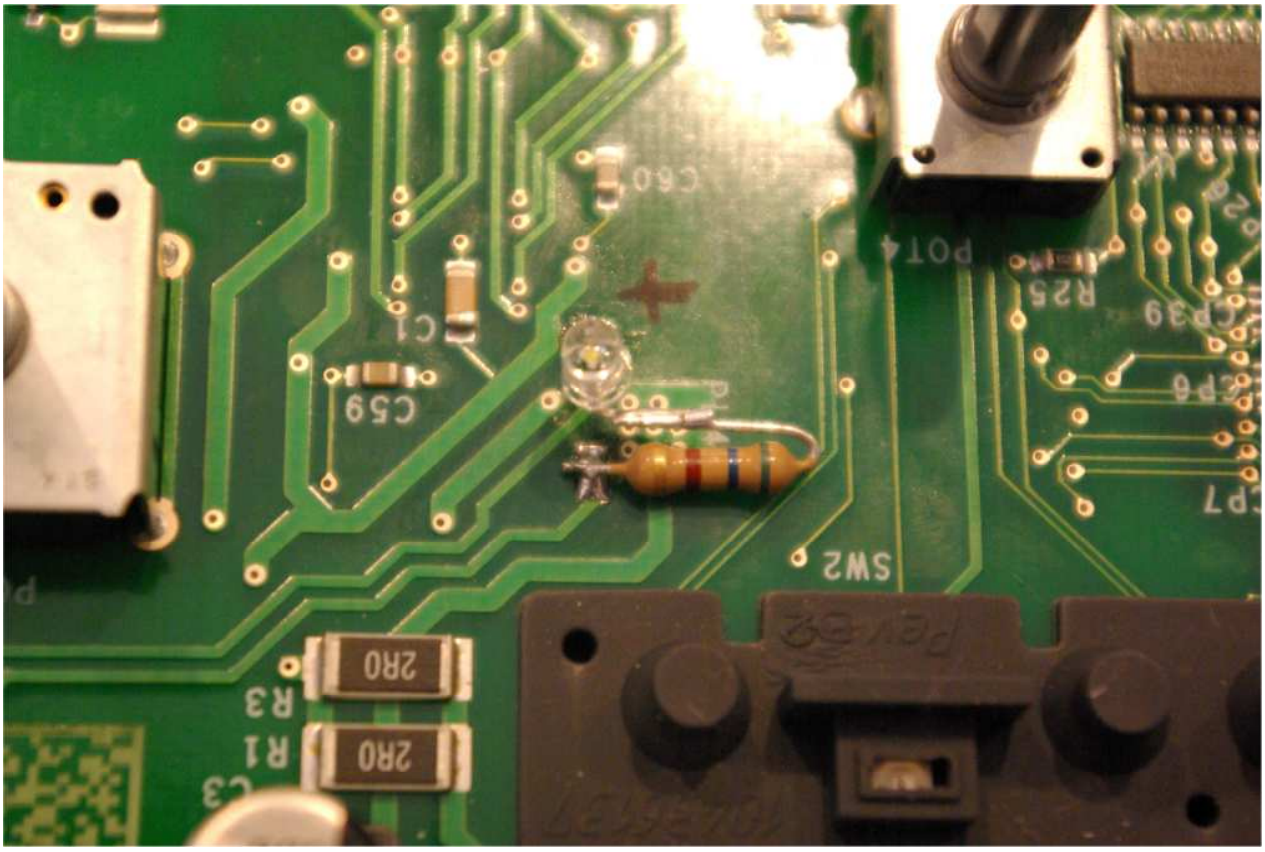


Figure 10 LED

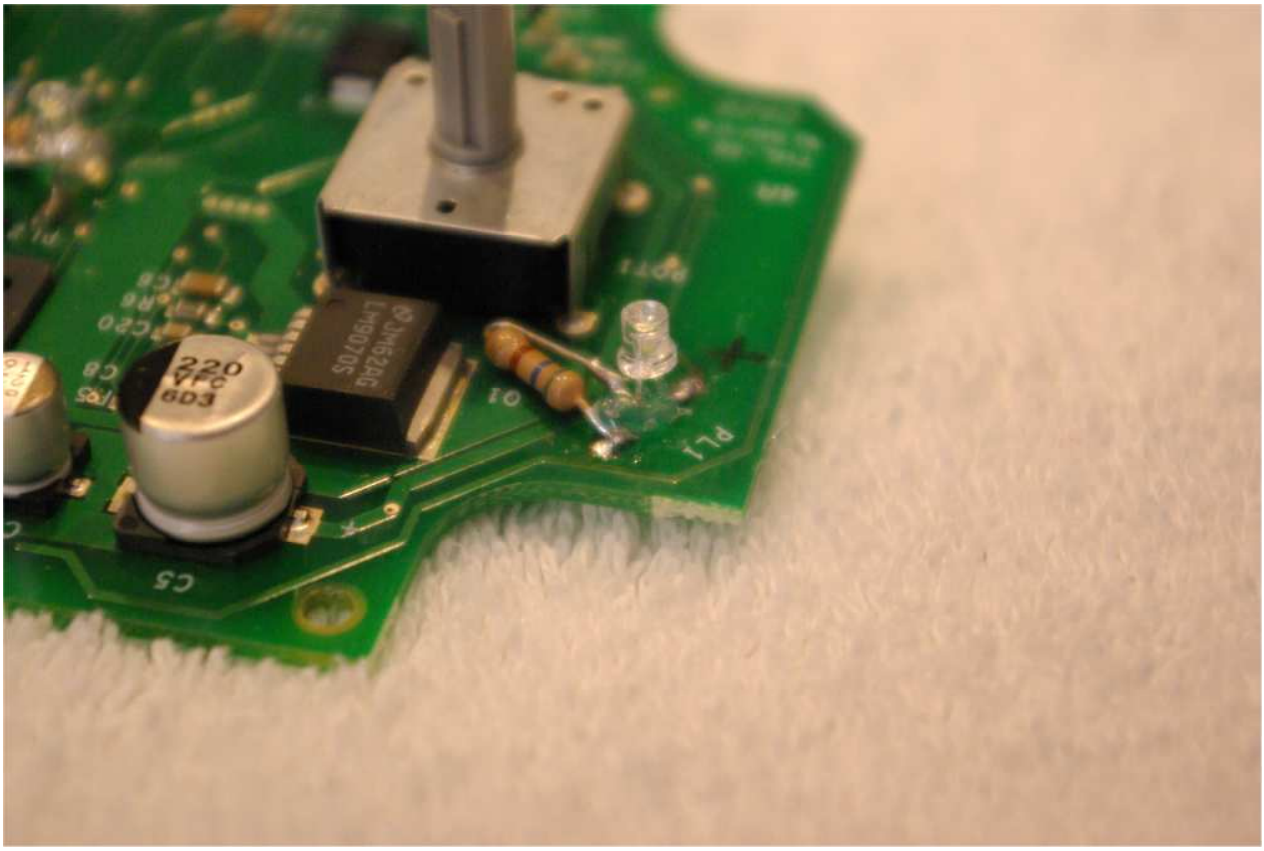


Figure 11 LED, note resistor lead bend and hot-melt glue

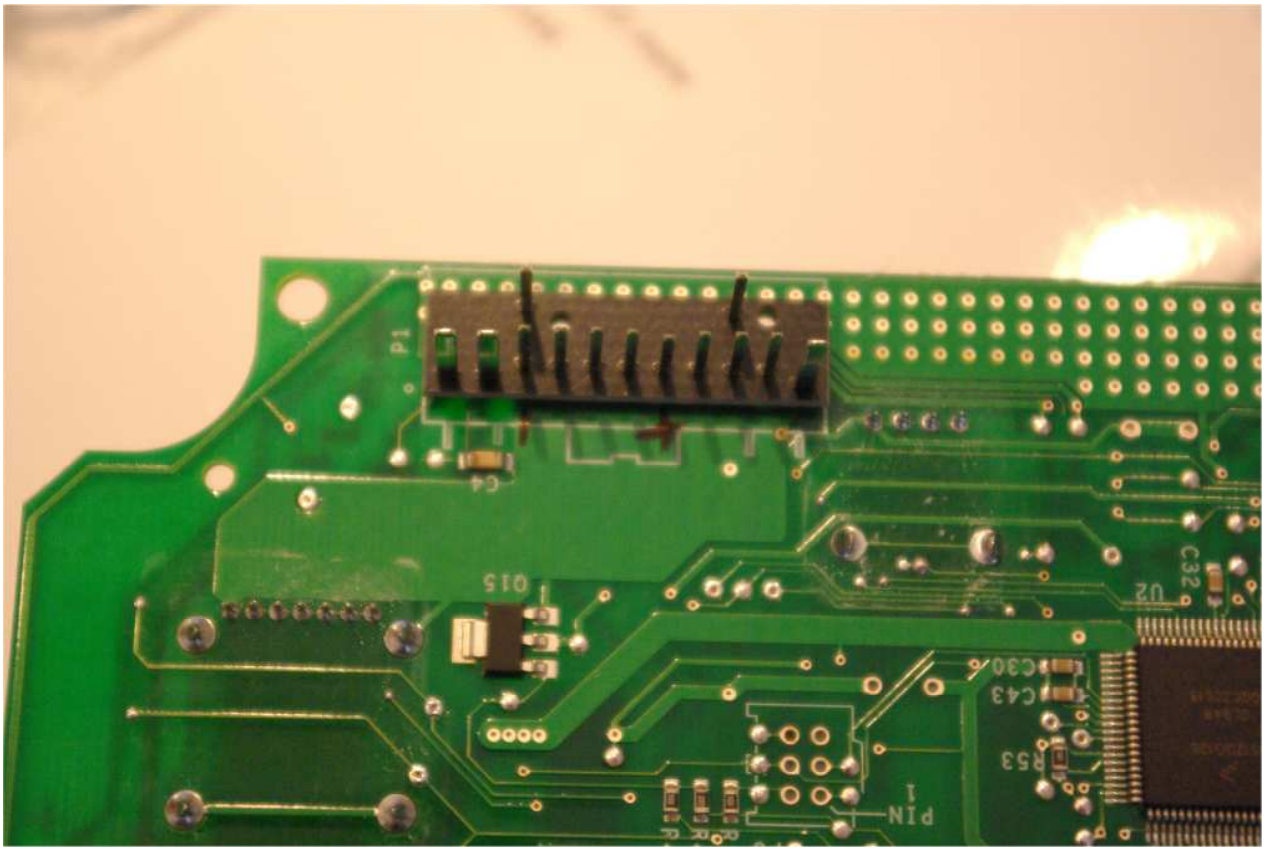


Figure 12 LED power points for testing

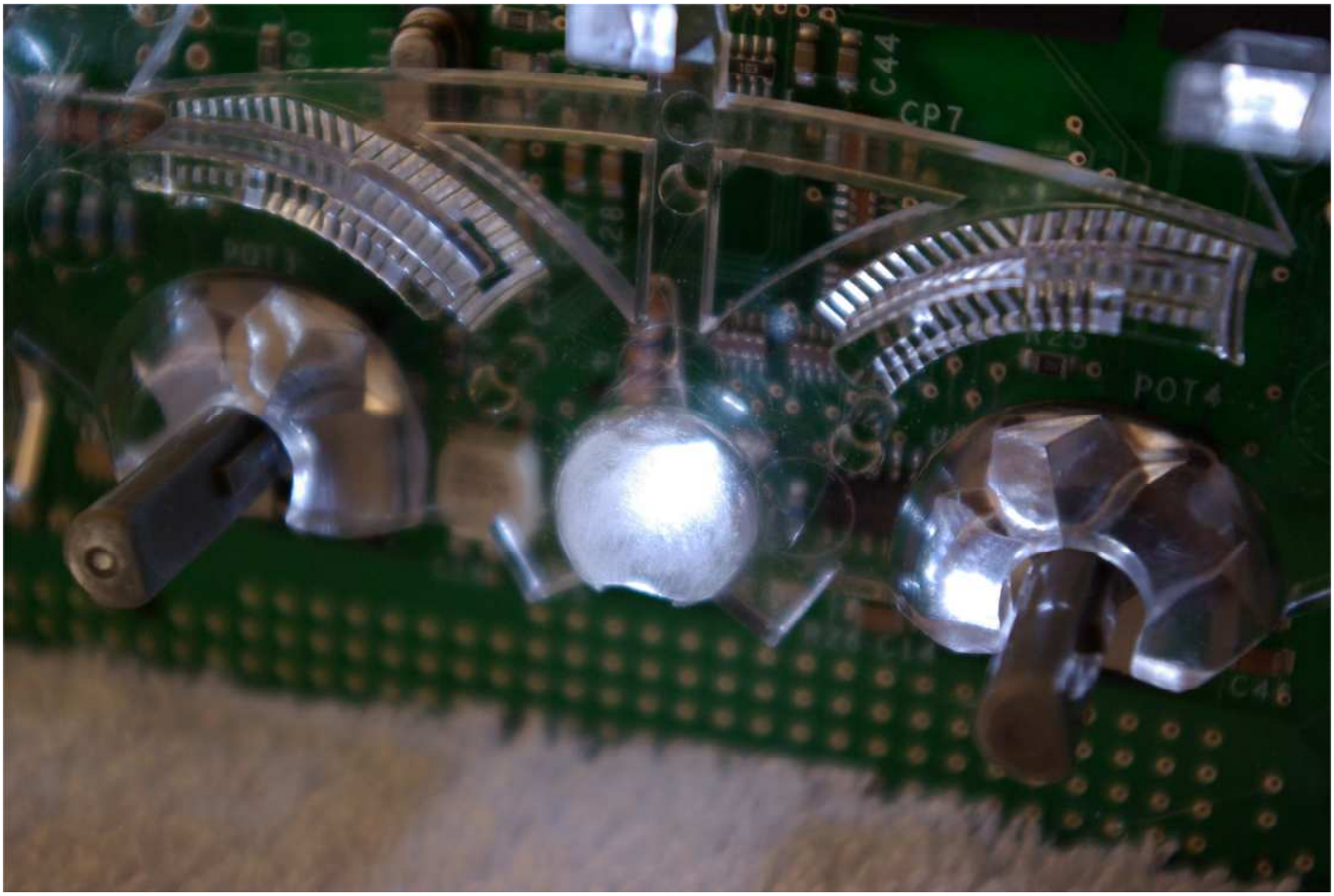


Figure 13 roughed-up light-pipe dome