At the Repair Bench – P-touch® 1400 – May 2023

Fairly recently, I was presented with a somewhat different type of repair. One of my fellow radio club members asked me if I would take a look at a favorite and trusted piece of his shack equipment, namely a Brother P-touch® 1400 hand-held label printer (Figure 1). The printer had stopped responding to the "Y" key, and its owner was hoping that I could repair the machine for him. Enjoying a challenge, I told him that I would take it on, but without any up-front guarantee of success.

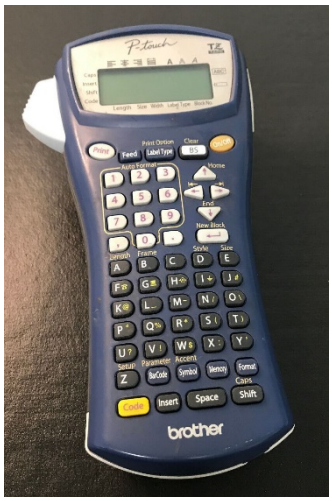

Figure 1 - Brother P-touch 1400

The owner brought the machine to me, and I quickly determined that not only did the "Y" key not work at all, the other keys along the right edge of the keyboard were rather "mushy" and not crisp and quick as they should have been. I opened up the unit to find that the printed circuit board on which the key contacts were etched had delaminated at a mounting pad along its right-hand edge, directly in alignment with the "Y" key, and breaking the circuit traces for that key and one other. This was apparently a product of years of use and pressure on that portion of the board.

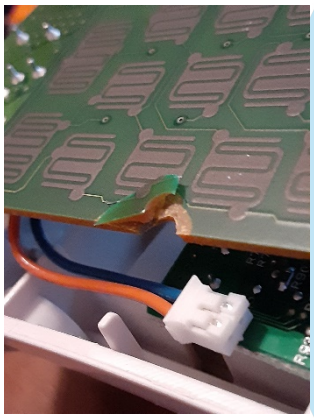

Figure 2 - Delaminated PCB

The keyboard consists of a matrix of conductive pads etched onto the top surface of a phenolic board that also serves as a printed circuit board for some of the related circuitry. Each ley contains a carbon button on its underside that bridges the conductive pads when the key is pressed. Simple enough, right? The problem was that the board had split between its layers (Figure 2), tearing the circuit traces on its upper surface. I was faced with a dual problem – how to first repair the delaminated phenolic board, and then how to repair the circuit traces (Figure 3) so that the machine would operate properly afterwards.

The first problem was solved with some cyanoacrylate glue, applied between the layers, with the layers then being clamped together with the broken section positioned back where it belonged. I clamped it up and set it aside to cure, having placed some waxed paper between the clamp faces and the board surfaces so that the clamp would not end up glued to the board by the excess glue squeeze-out. I then started thinking about the most effective manner in which to repair the circuit traces, assuming that the glue job would hold, of which I was not certain yet.

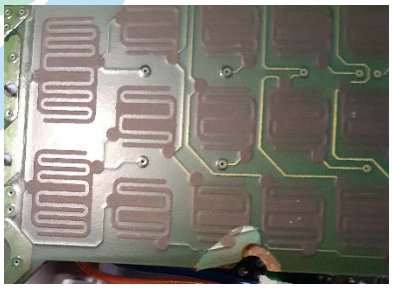

Figure 3 - Torn PCB traces

The most common method of repairing lifted or broken printed circuit traces, by far, is to simply scrape the trace to expose the conductive surface, and then to overlay the trace with some bare wire, and to then solder the wire to the trace. While this might work in some cases, it would clearly *not* be an effective repair in this situation, as one broken trace was directly in the area where the "Y" key's carbon button would have to make contact with the board if that key were to be pressed. Any raised area of the board would be problematic in allowing the carbon button to successfully bridge the pads, which actually contain interlaced "fingers" (Figure 4) rather than being geometrically shaped areas. I needed a better solution.

Figure 4 - PCB contact "fingers"

The next day, still unsure of how to repair the traces, I removed the clamp and waxed paper to find that the board was indeed back into a semblance of its original condition. I used some acetone on a cotton swab to clean the squeezed-out CA glue from the board surface in the area of concern, and the board was ready for trace repairs to begin. Still not having a repair scheme in mind, I put it aside for the day and moved on to something else, having already sent photos of the damage to the machine's owner and having told him that a repair might not be feasible. I went to bed that night thinking about the problem.

At some point during the night, and driven by some unknown and not understood "force", I hit upon an idea that might just work. I had read a while back about pens that write with conductive ink, which contains powdered silver in a volatile carrier. It was well worth a try, so I ordered one of the pens from Amazon and waited another day for it to arrive. Lo and behold, when I tried the pen on some paper, and then measured the resistance of the drawn lines, I found them to be very low impedance traces, and with almost no appreciable height on the paper surface.

I tried some basic experiments to determine the current-carrying capability of the ink, and found that I could easily pass 500mA through a trace that was two pen-points in width. This looked very promising indeed! I decided to try the ink on the phenolic board.

Figure 5 - Ink applied to PCB

To make this idea work, I would have to expose some of the conductive surface of the existing traces for the ink to connect into the original circuit properly. That was a chore best done with the edge of a hobby knife blade, and that is exactly how I achieved the exposure that I needed. I then laid the ink down in place (Figure 5) over the almost invisible cracks in the repaired surface of the board, and checked the results with an ohmmeter. So far, so good. Now for the acid test. Will the key work when coming into contact with the ink and the original traces? A quick test with the keyboard membrane laid over the board proved that it would actually work as intended.

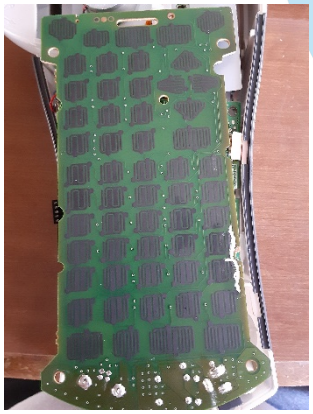

Figure 6 - Repaired PCB

After that, all that was required was to reassemble the machine with the repaired PCB (Figure 6) and to do a final working test of the entire keyboard. That post-assembly test proved successful, and so the repair was complete.

The lessons found in this repair are two-fold. First, think out of the box when faced with an unusual problem, as unusual problems often require unusual repair methods. Second, do not give up too easily. Plan for the worst, but work towards the best, and let your unconscious mind work on the problem for a while. You might just know how to achieve a repair, even if you don't know that you know how to do it!

See you next month.