At the Repair Bench – MFJ-259 SWR Analyzer – February 2023

This month's case history is a slight departure from the norm, in that it involves the repair of a piece of test equipment. Notably, the unit under repair is one that I had already done some repair work to, prior to donating this piece to the club for the test and repair bench.

On a recent Saturday afternoon, **Frank N3PUU** had occasion to use the MFJ-259 SWR Analyzer while setting up the VHF station for an upcoming contest. Unfortunately, the unit did not operate as expected, and Frank left me a note to that effect. Naturally, I picked up the unit and brought it home for repair.

What should have been a quite simple repair job turned into a little bit more than I had bargained for. The reported problem was that the meter was not reading, meaning that there was no indication of the tested SWR value. A quick check verified the condition, showing that the LCD panel was operational as to displaying the test frequency, but the meter movement was inoperative. However, I noticed that the meter came alive when I happened to jar the unit when I went to place it on the bench. That gave me a hint as to where to look for the problem.

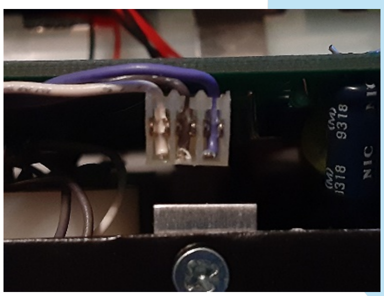

Figure 1 - Meter plug

Diving in "under the hood", so to speak, I quickly found some cracked solder joints on the unit's main printed circuit board. There are two meters on the front panel of this unit. One is the SWR meter, and the other is a resistance meter. These two meters are connected to the main PCB via a three-wire harness with a 90° plug at its end (Figure 1). The plug connects to a three-pin right-angle pin header on the PCB. It was this header that had the cracked solder joints (Figure 2). A simple fix – I simply reflowed the solder on those pins and the meters worked as intended. However, I did not stop there.

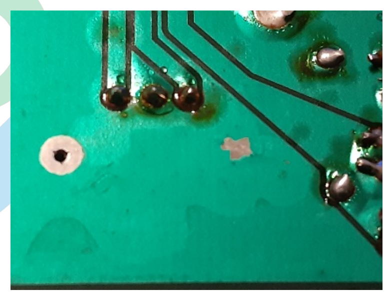

Figure 2 - Cracked solder joints

You see, I had been bothered by this unit ever since I put it on the test and repair bench. I felt that I did not do as thorough a refurb job on this unit as I could have, and this was borne out by the fact that Frank had trouble with the unit when he tried to use it. One of the items that I had intended to replace but did not was the SO-239 jack on the top of the unit. I decided to go ahead and give the whole unit a closer look and to replace the SO-239 jack.

Replacement of the SO-239 connector requires removal of the main PCB, which in turn requires desoldering of the two pushbutton switches and the BNC jack on the unit's upper surface. The SO-239 itself is connected to the main PCB in an unusual fashion. The center pin of the SO-

239, when the main PCB is in place, sits about an eighth of an inch above the PCB. That gap is simply filled with solder at the factory. Each of the two mounting screws used for the SO-239 has a solder lug installed under its nut. The lugs are then bent over to reach the main PCB and are soldered to pads on the PCB. These solder lugs also do not quite reach the board surface, and so their gaps are also solder-filled in production (Figure 3). Large solder bridges of this type are prone to cracking with time, a condition with which I was not happy. I therefore decided to correct this as well.

Figure 3 - Factory treatment

Another poor manufacturing technique, in my view, was the manner in which the BNC jack and the pushbutton switches were connected. The two pushbutton switches are normally-open switches that, when pressed, connect their respective circuits to ground. The way that MFJ chose to implement this was to bend one solder lug of each switch over and solder them to the solder lug under the nut on the BNC jack (also shown in Figure 3). It was a stretch at best, and it put undue stress on the bodies of the pushbutton switches. As it turned out, when I removed these switches, I found that the bodies of both switches were cracked. Solution? Two new switches… which turned out to be an adventure in and of itself.

I installed the new SO-239 to the enclosure. Then, I went over the main and display PCB's carefully, touching up any solder joints that looked the least bit suspicious. I then installed the main PCB to the enclosure, and I added lengths of bus wire between the mainboard solder pads and the SO-239 center pin and also at the solder lugs on its mounting screws (Figure 4). Next, I installed the BNC jack and the two pushbutton switches, wiring them up to the main PCB as they were originally. I added some bus wire to connect the grounded sides of the pushbutton switches to the BNC jack ground lug to make it a more comfortable fit. Now for the moment of truth.

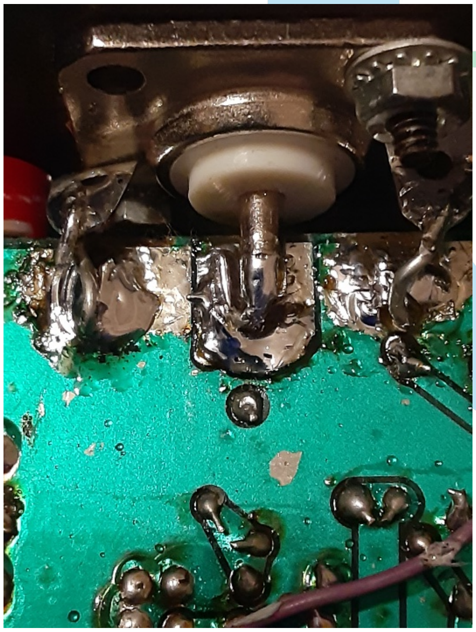

Figure 4 -SO-239 as repaired

I connected the battery banks (there are two of them) and powered up the unit, only to find that the LCD panel was not working. Now what? Did I damage the LCD panel in doing my solder touch-ups? I did not think so, but I went ahead and removed the main PCB again so that I could inspect the display PCB carefully. As luck would have it, I found nothing wrong there.

I sat back and thought about it a little bit, and then I decided to eliminate possibilities by testing the unit operation at each step of assembly. I installed the main PCB and checked the LCD operation, finding that it worked normally. I connected the SO-239 jack and again checked the LCD operation, and it worked just fine, which makes sense, as the jack was open. So, next I wired up the BNC jack, and as expected (as this jack too was open), the LCD operated as it was meant to. I then connected the first of the two pushbutton switches, the one labeled *"GATE".* Once again, the LCD panel worked normally. Finally, a bit confused, I connected the *"INPUT"* pushbutton switch. Of course, now the LCD panel did not work.

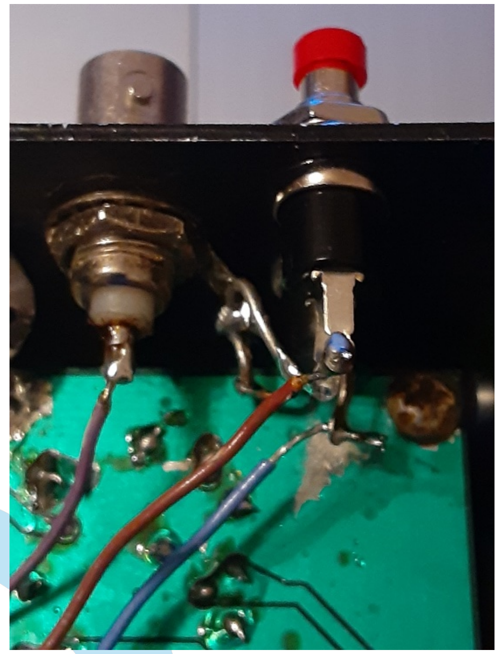

Figure 5 - Pushbutton switches as repaired

As mentioned earlier, the pushbutton switches are normally-open switches, so connecting that last switch should not have made any difference, but it did… which meant that the switch was obviously *not* open! I checked the switch with an ohmmeter, and sure enough, it was a normally-closed switch that had somehow gotten mixed in with my supply of normally-open switches.

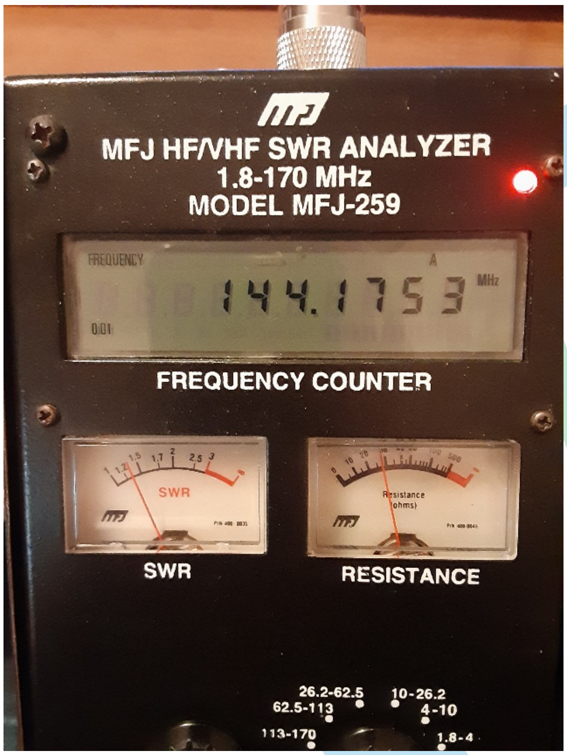

Figure 6 - Working unit

Swapping out that switch for another (verified NO) switch from my stock solved the problem (Figure 6).

The lesson to be learned from this repair is actually a dual lesson. First, I should have done a more complete job on this unit the first time around, before I put it on the club's test and repair bench. Second, and more to the point, remember that each and every "repair" that is made can actually introduce a previously non-existing problem. When things don't work out the way that you expect them to, think it through and carefully go back over what you have done and especially any changes that you have made. A thorough search will usually turn up the culprit.

See you next month!