At the Repair Bench – Conar 231 Tuned Signal Tracer – April 2024

Figure 1 - Conar 231 Tuned Signal Tracer

Back in August of last year (2023), a customer asked me for some help in making his late 1970's-vintage Conar Model 231 Tuned Signal Tracer (Figure 1) operational for him. A little bit of history is called for here. Conar Instruments was the electronic equipment division of National Radio Institute (NRI). *National Radio Institute - McGraw Hill Continuing Education Center* was a private, postsecondary, for-profit correspondence school based in Washington DC, from 1914 to 2002. NRI launched the Conar division in the fall of 1961 and began selling test equipment (and other items) to their students primarily in kit form in early 1962, some of which were assembled as a part of the home study program. Other items were simply made available for purchase, assembly, and use by the students in their new electronics repair trade. The Conar 231 Tuned Signal Tracer was released around 1978, and several hundred were sold.

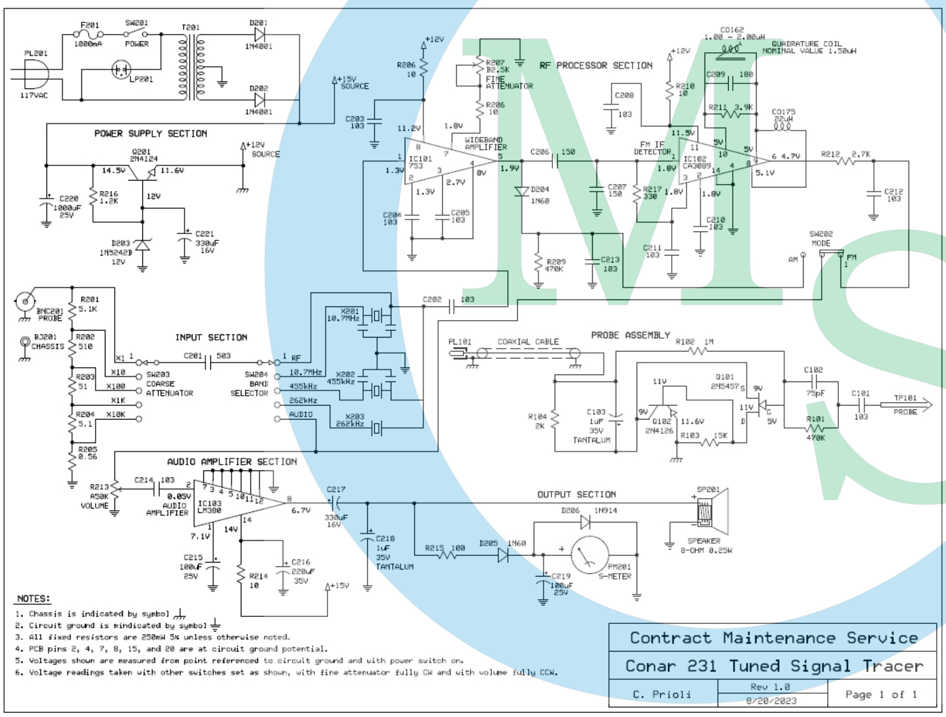

Figure 2 - Conar 231 schematic diagram

The 231 is an easy-to-use, all solid-state tuned signal tracer. It is called a *tuned signal tracer* because it has three selectable ceramic filter controlled tuned inputs covering the standard broadcast IF frequencies of 262kHz, 455kHz, and 10.7MHz. These tuned circuits eliminate the need for manual tuning as was required when using some other signal tracing units. This design simplifies the operating setup, allowing the technician to spend his or her work time where it counts - locating and repairing the defect. The Model 231 also provides two untuned input selections, an RF option and an AUDIO option. The unit schematic is shown in Figure 2. This schematic was derived from the unit itself and was drawn in the *ExpressSchematic* software that I like to use.

The unit came in to my shop as an inoperative piece of equipment that was also missing its test probe and ground connector. Those two items are actually the subject of one of my build articles previously published at this point, as I designed and built a replacement active amplifying probe with the high input impedance necessary to avoid loading of the circuit under test and therefore obtaining undistorted waveform samples. The subject of *this* article is the actual repair of the Conar 231 main unit.

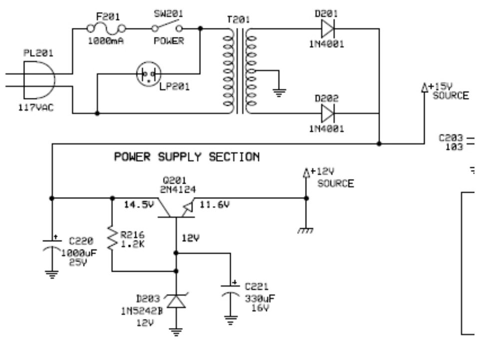

Figure 3 - Power supply section

This model is powered by 117VAC line current into a step-down transformer with a center-tapped secondary, which then produces two operating voltages, a +15VDC source and a +12VDC source (Figure 3). The +15VDC is taken directly off the rectified and filtered output of the power transformer, while the +12VDC output is tapped off the full wave rectifier and regulated down to twelve volts via a 2N2124 transistor and a 1N5242B 12V Zener diode. The +15VDC source is filtered by capacitor C220, a 1000µF/25V axial aluminum electrolytic capacitor, and the +12VDC source is further filtered by capacitor C221, a 330µF/16V radial aluminum electrolytic capacitor.

On power-up, the +15VDC supply was found to be varying from about +6VDC up to about +19VDC, most likely as a result of heavy ripple imposed upon the source. The only possible cause of this ripple was the 1000µF filter capacitor C220. At the same time, the +12VDC supply was found to be dead. As a starting point, I removed and tested capacitor C220 and also C221 (the 330µF filter for the +12VDC source). The 1000µF capacitor turned out to be *extremely* leaky, while the 330µF capacitor was shorted. I replaced these two capacitors and went back to my testing routine. Now the +15VDC source was as it should have been, but the +12VDC supply was still dead. Voltage measurements at the 2N4124 pass transistor Q201 showed that the transistor was shorted, as was the 1N5242B 12V Zener diode. Replacement of both of these components restored the +12VDC source to proper operation.

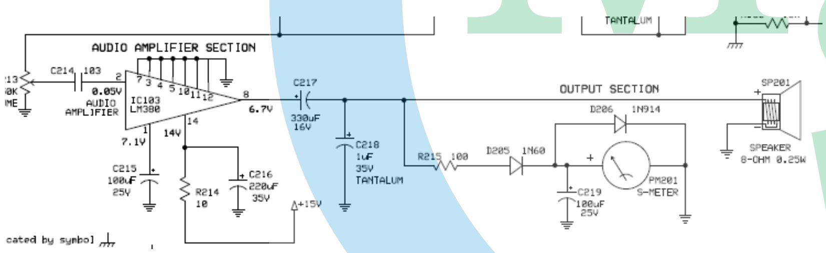

Figure 4 - Audio amplifier and output section

At this point, I thought that I had the problems solved, but it turned out that there was still another problem. In testing the operation of the signal tracer, I found that there was no audio from the speaker at all, and no activity at all on the front panel signal strength meter. It was obviously time for some more tests to be made.

I fired up my signal generator and set it for a 1kHz sine wave output at about a half of a volt amplitude. I then injected that signal at the input of the LM380 audio amplifier, IC103 (Figure 4). There was no signal throughput to the speaker at this point. I checked all of the IC voltage readings and they were all right on the money, where they were supposed to be. That led me to the most likely culprit being C218, a 1µF/35V tantalum capacitor in a shunt position across the speaker. I removed and tested that capacitor and found it to be shorted. Replacement of the tantalum capacitor restored the audio operation to normal.

With three failed polarized capacitors in this unit so far, and considering the age of the unit and therefore its capacitors, I elected to go proactive and replace the remaining polarized capacitors, which included a pair of 100µF/25V axial electrolytics, a second 330µF/16V radial electrolytic, and a single 220µF/35V radial electrolytic. It was good repair practice to replace all of these capacitors based upon the rate of failure already seen and the overall age of the parts involved.

This is a fairly well-designed signal tracer, and in spite of the screwy component numbering scheme used, it is not at all difficult to work on. The single PCB is retained in a modular fashion to the chassis by a set or four nylon retaining stand-offs, setting down onto a pair of ten-position pin connecter strips. The PCB itself has receiver sockets that mate with the pins in the connector strips.

As a footnote, one of the things that I noticed was that the red paint had all come off the needle of the front panel signal strength meter, and was sitting in pieces on the floor of the meter shell. I removed and disassembled the meter, cleaning out the paint particles. I then masked the meter face and re-painted the needle with some red color. After re-assembly, it looked as good as new.

All in all, a fairly easy repair, though there were multiple failures to be tracked down and corrected. The moral of this story is that it's not done until it is *all* done. I packed the unit up together with the new probe and ground lead that I had fabricated, and shipped it back to its owner.

See you next month!