At the Repair Bench – Victoreen Geiger Counter – August 2023

A fellow club member recently brought some of the strangest repairs that I have seen so far… a pair of 1960's vintage Geiger counters, neither of which was operational. The two devices were of different series, both of them Civil Defense standard survey units. One of them was a V-700 series unit while the other was a V-715 type.

Geiger counters, back in those days, were put out to a common specification for the basic outward design and operational standards, but were built by the various firms that got involved in the program each to its own design, electronically. This meant that any V-700 unit would look and function just the same as any other V-700 unit, regardless of the actual manufacturers, but under the skin, each maker had its own proprietary circuit design.

To make matters even more curious, certain manufacturers built multiple different models or design levels of specific devices. For example, from one manufacturer, there was a CD V-700 Model 6, Model 6A, and Model 6B. The circuits in these different design levels were not identical, with each successive sub-model having some sort of design advantage over its previous counterpart.

Figure 1 - PCB before repair

Of the units that were brought to me for repair, this article will discuss the Victoreen CD V-700 Model 6A Radiological Survey Meter. This unit is a two-transistor design that uses a geiger tube as the sensing element, and originally used a corona discharge regulator tube in the high voltage power supply, which operated at about 900 volts. The unit is powered by four standard "D" cells as found in most flashlights at that time. The geiger tube is mounted in a remote probe connected to the main unit via a thirty-six inch long cable. The probe is a nickel-plated brass tube with a window that can be opened to varying degrees to admit beta radiation. This unit will detect both beta and gamma radiation.

The high voltage power supply, operating from about 850 to 920 volts, consists of an oscillator, a flyback transformer, a rectifier and a filter capacitor, as well as the 900V corona discharge regulator tube mentioned earlier. This power supply is operated from only two of the four "D" cells installed in the unit.

There is also a pulse shaping and metering circuit, supplied by the remaining two "D" cells, and using the second transistor for its oscillator. This circuit responds to output pulses from the

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geiger tube, and forms amplified pulses that trigger the meter as well as the headphone circuit, where the characteristic “clicking” sound of the geiger counter can be heard, as well as being seen on the meter.

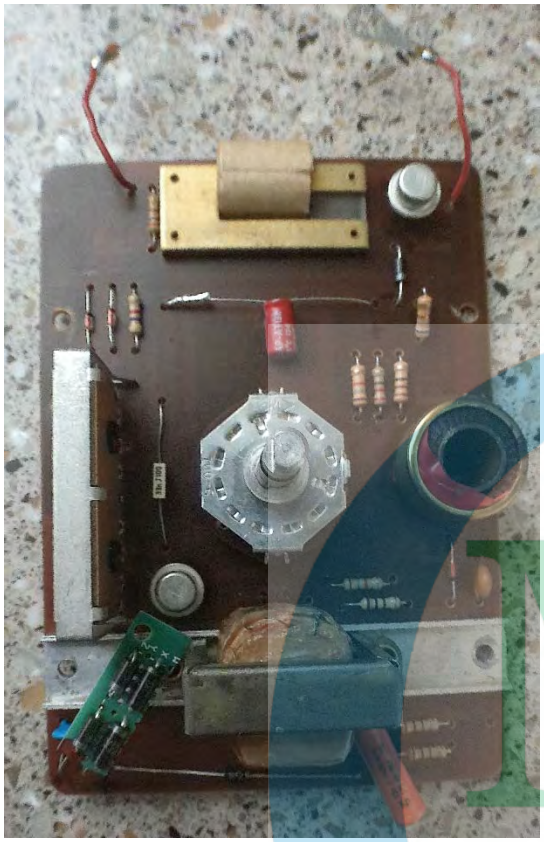

Figure 2 - PCB after repair

The most apparent problem with this unit was the fact that both transistors had failed, as had the corona discharge tube. I was able to source a kit that contained all of the necessary parts including a Zener diode stack on a small PCB that replaced the corona discharge tube and now serves as the 900V regulator.

While the ceramic capacitors in this unit had not failed, I replaced them with their counterparts from the kit, as the replacements were rated for considerably higher voltages, some of which were operating at voltages very near their rated limits. The sole electrolytic capacitor exhibited severe leakage, with an ESR off the high end of the scale on my ESR meter. It too was in the repair kit, and was thus easily replaced.

The range switch was severely oxidized and required extensive cleaning and restoration. This was a job for the DeoxIT® G100L (DeoxIT Gold) cleaner and lubricant. A quarter-hour with some cotton swabs and the DeoxIT® did the trick, and the switch was restored to a fully operational condition. This might be a good point for a word or two about the DeoxIT® products that I use. I regularly use the DeoxIT® D5 cleaner and lubricant, which I purchase in an aerosol can. This is my everyday go-to product for switch and pot cleaning and restoration. I also use the DeoxIT® X10S Precision Instrument Lubricant for lubrication of such things as meter movements, tuning capacitor bearings and bushings, control shaft bushings, and so forth. However, when a really bad switch or pot shows up, I reach for the DeoxIT® G100L. This product is *expensive* (about $50 for a 25ml bottle), and as a result I use it only when I really need to, but when it *is* needed, there is no substitute! Sales talk ended…

A thorough cleaning of the contacts in the battery boxes, and a general cleaning of the exterior of the unit, and it was time for final assembly, testing, and calibration.

Testing consisted of measuring the operating voltages and comparing them to those provided on the unit schematic, which is found in the instruction manual. Next up was a check of the pulse shaping and integrating circuit using an oscilloscope. A three-volt square wave of 150 microseconds duration, followed by a -20V flyback pulse, is what we were looking for and what we found.

Calibration is accomplished simply enough, as a radioactive sample is mounted directly to the outside of the unit lower housing. The instruction manual, readily obtainable online, has calibration instructions that are well-written and easy to follow, so calibration was a breeze.

This unit turned out to be a relatively simple repair, and it was fun working on something that had a place in our national history during the Cold War era. I will write up the second unit, the CD V-715, in another article. That was a little bit different…

See you next month.

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