At the Repair Bench – Astron VS-35M – September 2024

Figure 1 - Astron VS-35M power supply unit

Not too long ago, I was asked to take a look at an Astron VS-32M power supply that was exhibiting current drop-out under high-current demand periods. The PSU would drop out and then simply reset itself, with no blown fuses or other indications of excessive current draw. There is a single SCR used in the PSU, and the owner suspected that the SCR may have been the cause of the problem, but in reality, the SCR is in the crowbar overvoltage protective circuit. If the crowbar circuit were to be activated, the fuse should blow, as the effect is that of dropping a crowbar across the output, creating a dead short across the PSU output.

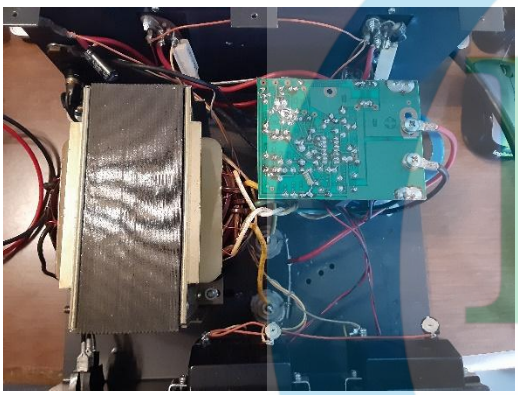

Figure 2 - Interior view of VS-35M

I tested the operation of the unit and found it to be as described. When I tried to draw as little as ten amperes from the supply, it would drop out and reset itself. I quickly eliminated the pass transistors as the cause of the problem, both by thermal evaluation and by static testing of the easily-removed TO-3 devices. I further tested the driver transistor for the pass network, and it too tested OK. At this point, I suspected that the culprit was the LM723 voltage regulator IC. For the sake of being able to answer the owner's anticipated questions, I took a few minutes and tested each of the semiconductor devices used in the PSU, largely by desoldering one end of each diode, and by removing the transistors and SCR for out-of-circuit testing. All semiconductor devices tested out OK *except for the crowbar SCR!* A viable SCR should latch in its conducting mode if the gate and anode are shorted momentarily. In this case, the SCR went into conduction, but failed to latch in that state. Needless to say, I replaced the SCR, though it clearly was not the cause of the specific reported problem.

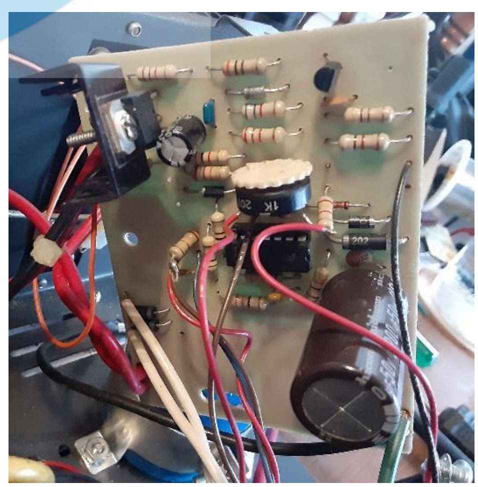

Figure 3 - Component side of PCB

Among the various Astron schematics available online is a pair of VS-35M schematics, both of which provide similar if not exact listings of the "normal" voltages for the LM-723 regulator. Under initial testing, all of the IC voltages checked out OK, but as I ramped up the load on the power supply, the voltages started to go awry. On the LM723, Pin 3 is the "current sense" pin, which is tied to the PSU output, and should range between 13.87VDC (no-load) and 13.7VDC (full load). Pin 2 is the "current limit" pin, and is tied in a roundabout manner to the crowbar circuit, and it should range between 13.1VDC (no load) and 14.0VDC (full load). Pin 10 is the regulator output pin, which drives the TIP-29 pass transistor driver. It should range between 14.8VDC (no-load) and 16.5VDC (full load). While the current sense and current limit voltages were basically where they belonged, as the load went up, the output voltage on Pin 10 would sag way down, eventually dropping to 1.5VDC when a full load was initially applied, and then the PSU dropped out. The cure was a replacement of the LM723 voltage regulator IC.

Along the way, I discovered that the 2200µF 16V electrolytic capacitor across the output was also very leaky. I replaced that capacitor as well as the other small electrolytics that were on the PCB. The 64,000µF main filter capacitor tested OK, and so was left alone.

Figure 4 - Capacitor across output

In post repair testing, the PSU performed flawlessly, so I put this one to bed as a job well done. Using an electronic load test unit, I was able to draw 30 amperes successfully for a thirty-minute period following a 50% duty-cycle pattern. The PSU is rated at 25 amperes at a 100% duty cycle and 35 amperes at a 100% duty cycle. I repeatedly ran the load up to 35 amperes with no drop-out noted.

One final note. The schematic diagram, as drawn by the factory, looks strange at first glance, until the technician realizes that the supply side is nothing more than a pair of nested supplies fed through full-wave rectifier circuits. It just looks odd because we are accustomed to seeing separate secondary windings rather than nested winding pairs. It is nonetheless a straightforward pair of full-wave circuits, one inside the other in the diagram.

See you next month!

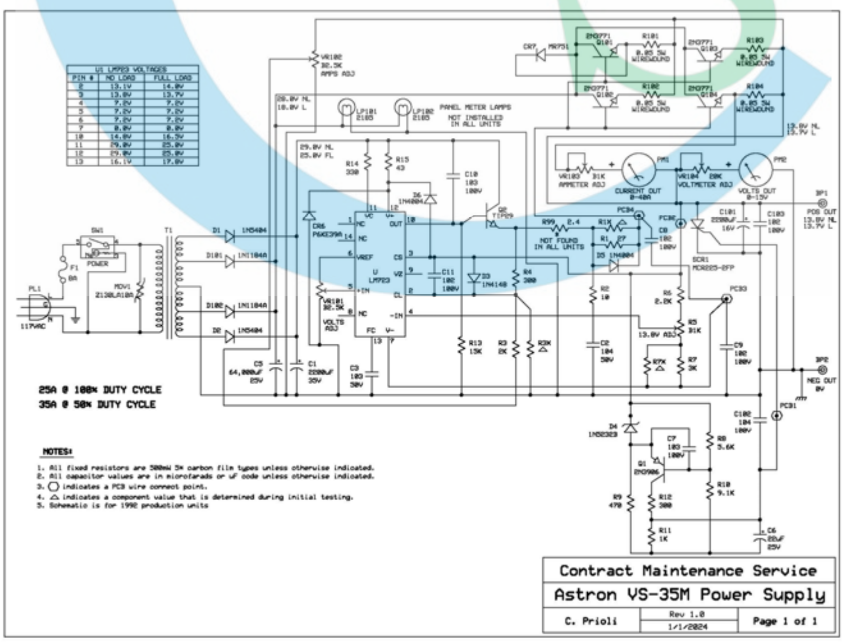

Figure 5 - VS-35M Schematic diagram