VE6HQ
A High-Power 48-Volt DC Supply Using Vertiv R48 Telecom Rectifiers

Modern solid-state amateur radio equipment can require substantial DC power, particularly when high-power RF amplifiers are used. Commercial telecom rectifier modules provide an attractive approach because they combine high efficiency, compact construction, forced-air cooling and sophisticated internal protection in a readily available package. This project uses three surplus Vertiv R48-series rectifier modules operating in parallel to produce a nominal 48-volt class DC supply for amateur radio applications.

The objective was not simply to package three rectifier modules in an enclosure. I also wanted to monitor each module individually, observe how the rectifiers shared load current, and make the operating information available over the station local-area network. A custom Arduino-based controller was therefore developed to communicate with the rectifiers over their CAN bus and provide a web-based display of voltage, current, temperature, AC input voltage and module status.

Figure 1 Completed VE6HQ Vertiv R48 Three-Rectifier Power Supply

Vertiv R48 Rectifier Modules

The Vertiv R48 family was developed for telecommunications DC power systems. Each module is a compact switch-mode rectifier intended for continuous service and parallel operation. The modules include internal cooling fans and communicate with a supervisory controller through a CAN interface. Three approximately 2 kW rectifier modules are installed in this project, providing about 6 kW of installed rectifier capacity. The actual usable station output is, of course, limited by the available AC source, distribution components, wiring and the requirements of the connected load.

An important advantage of the R48 architecture is built-in active current sharing. When multiple modules are connected to a common DC bus, the rectifiers automatically divide the load rather than requiring external current-balancing circuitry. This characteristic was later verified by bench testing of the completed three-module supply.

Mechanical and Electrical Construction

The three rectifier modules were mounted as a removable bank at the front of a ventilated metal enclosure. The completed assembly is shown in Figure 1. The front panel provides a main control switch and a prominent green power indicator, while the rectifier cooling fans and status indicators remain visible and unobstructed.

Figure 2 shows the internal construction. The rectifier outputs are brought to substantial common DC distribution points, while the AC input circuitry, filtering, terminal blocks and protective components are arranged around the rectifier bank. The mechanical layout was chosen to keep the high-current paths short and to preserve the airflow required by the rectifier modules.

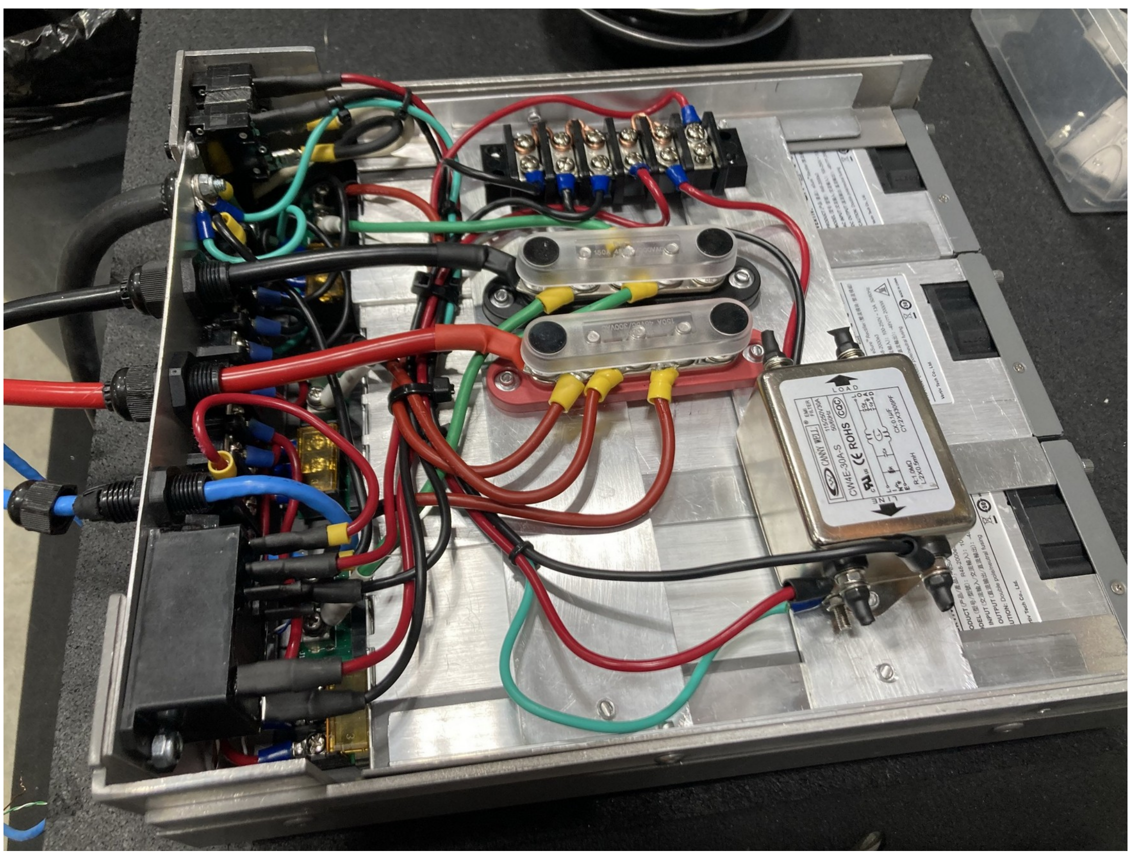

Figure 2 Internal Construction of the Three-Rectifier Power Supply

CAN Bus Monitoring Controller

The R48 modules contain a CAN communications interface normally used by a commercial telecom power-system controller. For this project, a dedicated monitoring controller was developed around an Arduino Uno R4. An Ethernet interface provides connection to the station LAN, while an MCP2515-based CAN interface communicates with the three rectifier modules.

Considerable bench work was required to understand the useful read-only CAN information produced by the rectifiers. The completed software periodically obtains DC output voltage, DC output current, current-limit information, module temperature, AC input voltage and status information from each module. The production controller is intentionally used as a monitoring system; normal operation does not depend upon Internet access or an external computer.

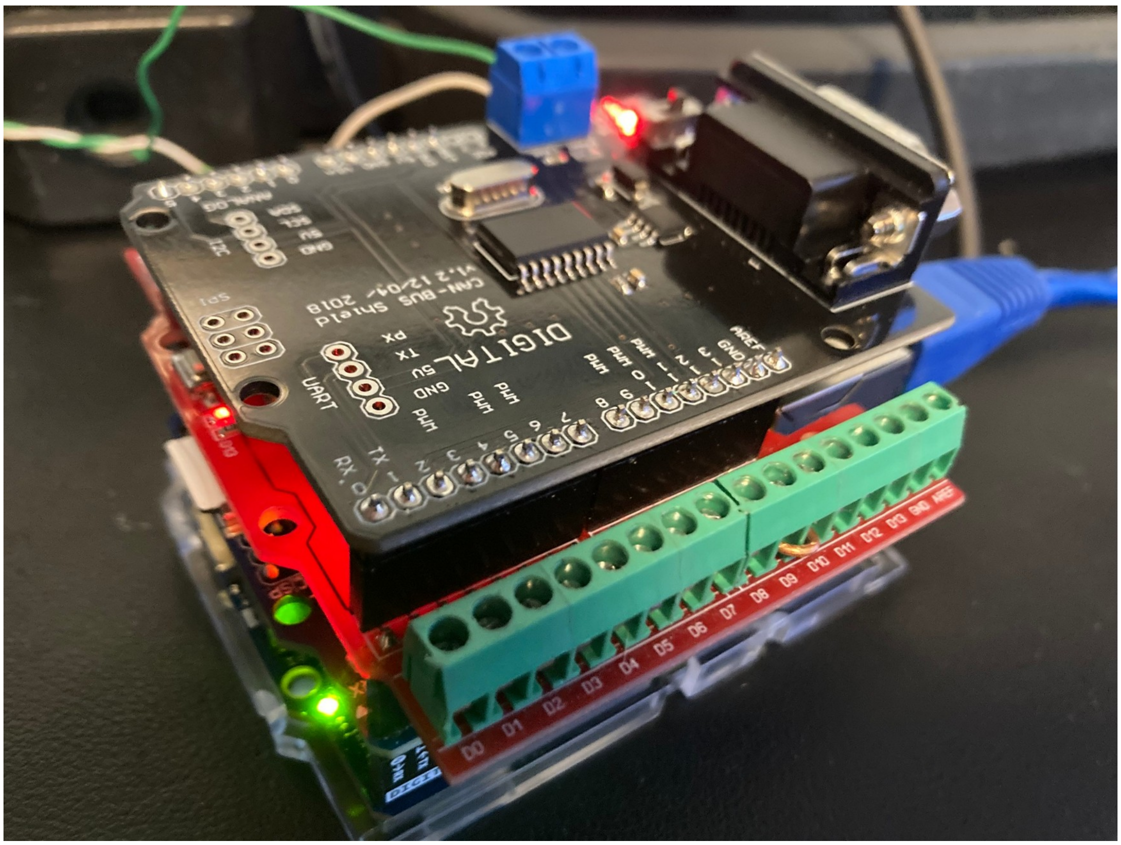

Figure 3 Arduino Uno R4 CAN and Ethernet Controller Hardware

Artificial Intelligence as a Development Tool

An important part of this project was the use of artificial intelligence as a practical engineering tool. The controller firmware and WebGUI were developed with extensive assistance from OpenAI's ChatGPT. For me, a software project of this scope would not have been practical without that assistance. ChatGPT was used to help organize the program structure, develop and revise Arduino code, interpret compiler errors, analyze CAN observations, and progressively add Ethernet, WebGUI, SD-card logging and network-time functions.

The development process remained very much an amateur-radio bench exercise. Code suggested by the AI was compiled, tested against the actual hardware and corrected whenever the measured behaviour did not agree with expectations. This combination of AI assistance and hands-on verification proved extremely effective. It allowed a radio amateur with limited experience in modern embedded software development to undertake a considerably more sophisticated project than might otherwise have been attempted.

I believe this is an important emerging capability for amateur radio. AI programs such as ChatGPT do not replace the need to understand the equipment, make measurements or verify results, but they can provide an accessible software-development partner. They can help bridge the gap between an amateur's knowledge of electronics and radio systems and the programming expertise increasingly required to integrate modern microcontrollers, networks and digital interfaces.

Web-Based Station Interface

The controller includes an embedded web server and is assigned a fixed address on the station LAN. Any computer or tablet on the local network can therefore view the power-supply status without special application software. Figure 4 shows the main WebGUI.

The upper portion of the display provides overall controller status together with the average DC output voltage and total DC output current. Individual panels for R48 #1, #2 and #3 show each module's output voltage and current, current-limit indication, temperature and measured AC input voltage. Module communication status and response age are also displayed. This arrangement has proven particularly useful during load testing because the current contribution of all three rectifiers can be observed simultaneously.

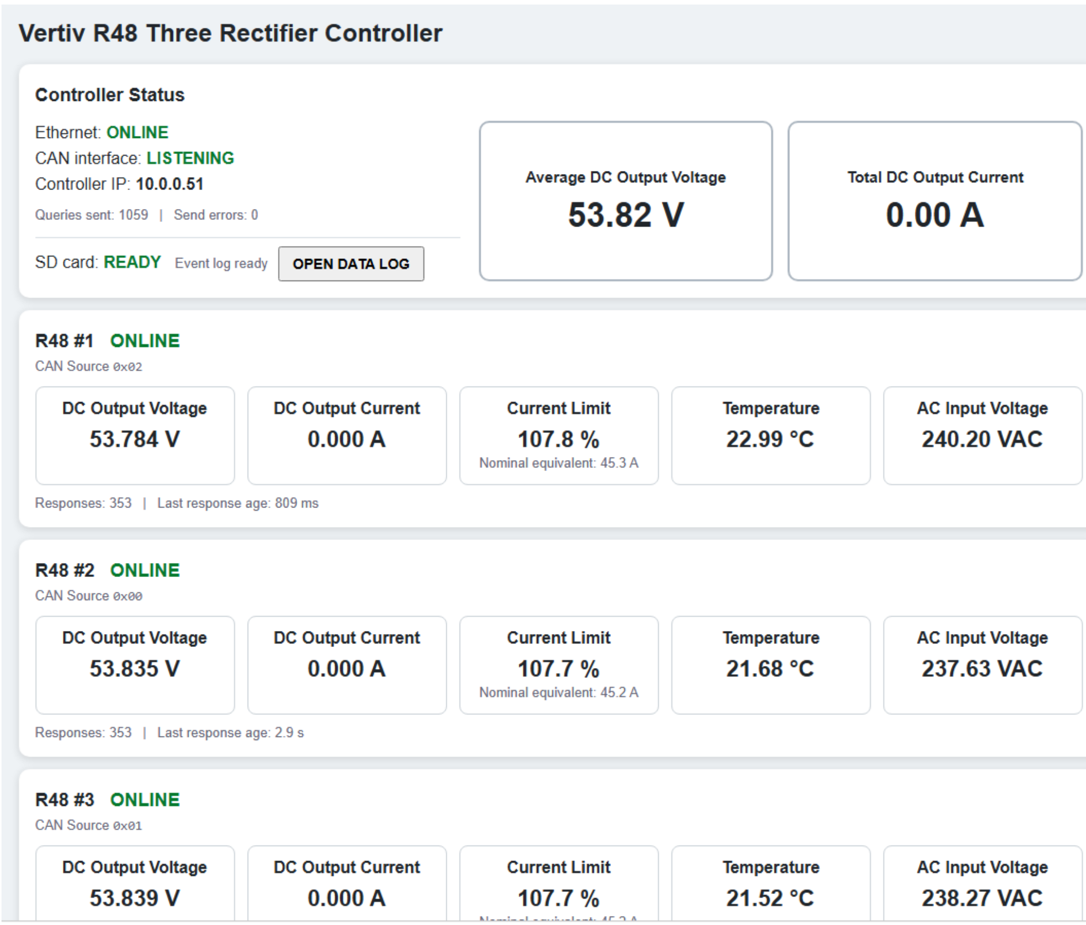

Figure 4 R48 Controller WebGUI Showing Individual Module Telemetry

Parallel Load-Sharing Tests

Bench testing was performed to confirm that all three rectifiers operated correctly both individually and in parallel. During one representative three-module test, the total DC load current was 20.33 amperes. R48 #1 supplied 6.230 A, R48 #2 supplied 7.118 A and R48 #3 supplied 6.984 A. At an average output voltage of approximately 53.7 volts, the test represented about 1.09 kW of DC output power.

Rectifier	Output Current	Approx. Share
R48 #1	6.230 A	30.6 %
R48 #2	7.118 A	35.0 %
R48 #3	6.984 A	34.4 %
Total	20.33 A	100 %

The measured currents demonstrate that the internal active load-sharing system is operating as intended. The modules were not required to carry exactly identical current at every instant; rather, the important result was that all three contributed comparable current and remained stable while operating on the common DC bus.

Voltage regulation was also excellent. The measured average DC output was approximately 53.85 V with no load and approximately 53.74 V at a 20.33 A load. This is a decrease of only about 0.11 V, or approximately 0.20 percent, while delivering roughly 1.09 kW of DC power. For a high-current supply assembled from three independent rectifier modules, this measured regulation is particularly impressive.

SD Card Event Logging and Time Synchronization

A microSD card in the controller provides a compact operating record. Rather than continuously storing every CAN transaction, the software records only significant events such as controller startup, Ethernet and CAN status, module online/offline transitions and meaningful changes in module or total load current. This event-driven approach keeps the log small and makes it much easier to identify important changes.

The controller also obtains time from an NTP server. After the first successful synchronization, the clock is periodically refreshed. If network time is temporarily unavailable, the rectifier monitoring and WebGUI continue to operate normally. Before synchronization, the event log uses controller uptime as a fallback timestamp.

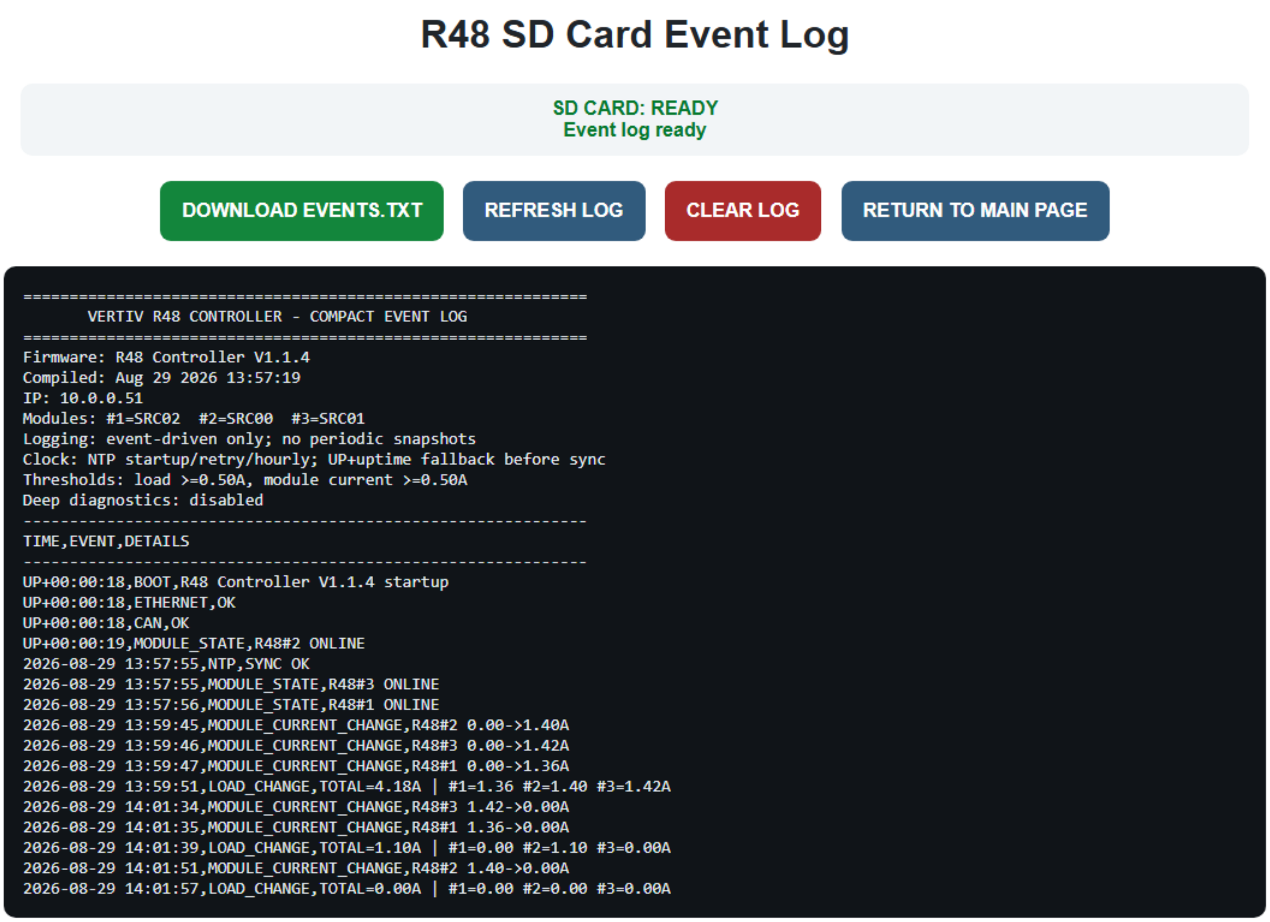

Figure 5 Web-Based SD Card Event Log

Operating Experience

Extended testing of the completed controller has shown stable CAN communications, responsive web operation and reliable event logging. Repeated load cycles are correctly reflected in both the real-time WebGUI and the SD event log. The controller also successfully resynchronizes its network clock during extended operation without interrupting rectifier monitoring.

The project demonstrates that surplus telecom rectifier modules can provide a practical basis for a high-power amateur radio DC supply. The R48 modules provide the power conversion, cooling, protection and current-sharing functions, while the Arduino controller adds a station-oriented monitoring interface that would normally require the original commercial telecom control system.

Conclusion

The completed VE6HQ R48 supply combines three compact commercial rectifier modules with a custom CAN/Ethernet monitoring controller. The result is a network-visible DC power system capable of supporting demanding 48-volt-class amateur radio equipment while providing individual module telemetry and a permanent event history. The project also demonstrates two interesting opportunities for today's radio amateur: adapting high-quality surplus commercial equipment to a new application, and using artificial intelligence as a practical development assistant for the embedded software needed to integrate that equipment.