Power Chassis for the Mass Flow Controllers of the Hall B Gas Controls and Monitoring System

Marc McMullen, Mary Ann Antonioli, Peter Bonneau, Pablo Campero, Brian Eng, Amanda Hoebel, George Jacobs, Mindy Leffel, Tyler Lemon, and Amrit Yegneswaran

Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606

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A Hall B Gas Controls and Monitoring System interface chassis powered several mass flow controllers (MFCs), which provide gas to several detectors. During maintenance of the interface chassis, the AC power to the chassis must be disconnected, which in turn stopped gas flow to all detectors connected to that chassis. To prevent stopping gas flow to detectors that are not being serviced, a new MFC power chassis has been designed and fabricated.

Initially, UPS-supported power for MFCs and instrumentation was provided via the interface chassis, which contained a Sola HD 24 VDC power supply. However, as the gas controls system evolved, frequent maintenance of the interface chassis became necessary, requiring disconnection of AC power, which shut down all connected GE50/250a MFCs, which use a normally closed valve. Hence, gas supply to all detectors associated with the chassis was turned off. To solve this problem, a new MFC power chassis, independent of the interface chassis, was designed and fabricated.

The new power chassis provides power to a maximum of seven MFCs, which are connected to the front panel via 15-pin D-subminiature connectors, Fig. 1.

FIG. 1. Power chassis front panel has seven MFC connections.

The rear panel of the chassis, Fig.2, has an AC connector with a 5 A fuse and a DC OK indicator. Additionally, there are seven 0.5 A fuses and seven additional power indicators for the seven power channels of the chassis. Each power channel has a maximum steady state current capacity of ~180 mA, and can handle an initial in-rush current of ~300 mA.

FIG. 2. Rear panel has seven circuit protection fuses and indicators, and one AC fuse with DC OK indicator.

The power chassis has two Lamda LS-100, 24 VDC, 4.5 A, general purpose power supplies, Fig. 3. Each supply is powered by 120 VAC and has a maximum current capacity of 2.2 A. A single power supply is adequate to power all seven connected MFCs; the additional supply is for redundancy.

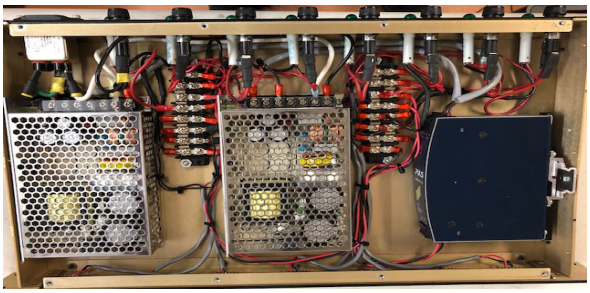

FIG. 3. Internal wiring of the power chassis. Lamda 24 VDC modules are on the left and in the middle of the chassis; the YR2 redundancy module is on the right.

Both supply outputs are connected to a Puls Dimensions YR2 redundancy module, Fig. 4. The redundancy module, a switcher, ensures power is not lost if a supply fails; it switches to the other supply.

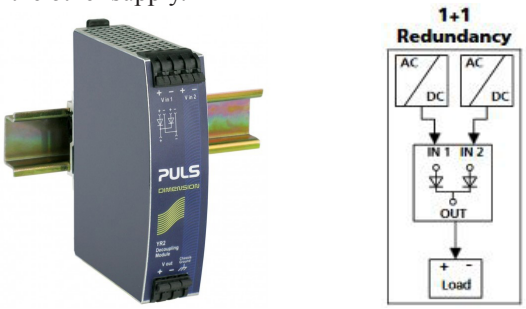

FIG. 4. Puls Dimension YR2 redundancy module. Diagram on the right depicts power flow from the supplies (top), through the YR2 diode module (middle), to the load (bottom).

The YR2 module supplies 24 VDC to two 8-channel barrier blocks. Each block is divided into two sections of bussed connections, containing four channels of 24 VDC and four channels of return. Viewed from the front panel, the left barrier block provides power to the first three MFC channels and to the DC OK LED, the right barrier block supports the remaining four output channels.

To ensure electrical safety, all connection wires are oversized—12 awg is used for AC, 16 awg for DC supply connections and the YR2 to barrier block connections, and 22 awg powers each individual MFC channel.

An MFC power chassis was installed in July of 2018 and has been supplying power, without failure, to the DC MFCs.