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**PPD / EED / Infrastructure Group**

Technical Note: IG\_20110003

**SciBath Electronics Rack**

**Rack Protection and Power Distribution**

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12-Oct-11

**Overview:**

The SciBath electronics rack located in the MINOS tunnel has been outfitted with Smoke Protection / Interlock Interface and Power Distribution systems. In the event that particulate is detected by the rack mounted smoke detector, 120V power to the rack is interrupted.

**Components:**

The smoke detector is a Siemens PE-11 photoelectric model. It’s been mounted to a DB-11 base and connected to an RR-11 relay module to make up the smoke detector assembly. The smoke detector assembly is mounted onto a standard 4 inch utility box which in turn has been fastened to the top of the rack.

The “Cook” Rack Monitor Interface (RMI) has been used by D0 for decades to monitor rack environment and to respond appropriately when conditions deteriorate. In this application, its only function is to interface with the Siemens smoke detector assembly and generate a TTL level interlock signal.

The SciBath 120V Power Distribution Chassis has been fabricated to provide two 120V/20A receptacles that have their power interrupted in the event that the interlock signal voltage drops to ~0V. It further provides two 120V/20A receptacles whose power is not interrupted if the interlock signal is removed. At the very least, the RMI is plugged into one of these outlets, as it needs an un-interrupted source of power to operate properly. Both sets of outlets are protected by a single series 3AG fuse.

**Operation:**

The Siemens smoke detector assembly requires a dc voltage of 16 to 24V to operate. With 20Vdc delivered by the RMI, the normally open relay in the relay module is pulled closed as long as the smoke detector doesn’t detect particulate. The RMI senses this closed relay and generates the TTL level (~5Vdc) interlock signal. When the smoke detector senses sufficient particulate to trip, the relay opens and latches in the open state. The RMI senses the open relay and drops the interlock signal. To reset the smoke detector assembly, the 20Vdc to the smoke detector is interrupted when the user presses the “Reset” button on the front panel of the RMI. If the smoke detector is cleared when the Reset button is released, the smoke detector assembly once again closes the relay; the RMI senses the closed relay and generates the interlock signal.

The SciBath 120V Power Distribution Chassis is connected to a wall-mounted 120V/20A receptacle in the MINOS tunnel by a 30 foot length of 12AWG/3 SOOW cable. It’s terminated with a 5-20P plug. The Chassis is metallically connected to the equipment grounding conductor in the cable, as are the equipment grounding terminals in all four receptacles. The grounded terminals in all four receptacles are connected to the grounded conductor in the cable. The ungrounded conductor in the cable is connected to a front panel mounted fuse holder. The wire gauge within the chassis is compatible with a 20A fuse, but a 15A fuse was installed initially based on the estimate of power needed by equipment in the rack. After the fuse, the ungrounded connection is routed to both a 120V/25A solid state relay and the ungrounded terminals on the two “Unswitched” receptacles. From the solid state relay, a connection is made to the ungrounded terminals on the two “Switched” receptacles. The control inputs to the solid state relay are connected to an isolated BNC connector on the front panel. The solid state relay operates with an applied dc voltage in the range 3 to 32V, so the TTL level from the RMI is sufficient.

See the schematic “SciBath 120V Power Distribution Circuit”, drawing number 173814 for details.

**Testing:**

Prior to the installation in the MINOS tunnel, all components were connected in the appropriate manner on a workbench. We applied power and verified that the RMI provided an appropriate interlock signal to close the solid state relay in the power distribution chassis. We sprayed a small amount of canned smoke in the direction of the smoke detector head. We verified that the indicator LED on the smoke detector assembly indicated a trip. We also verified that the RMI indicated a Smoke Detector Trip and that it dropped the interlock signal. We further verified that the Power Distribution Chassis properly responded to the dropped interlock signal and interrupted power to the “Switched” outlets. Pressing the “Reset Alarms” button on the RMI cleared the trip indication and the Power Distribution Chassis restored power to the “Switched” outlets.