

## Monitoring of the Hall C UPS Units

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PLC software was developed to monitor the three Hall C uninterruptible power supply (UPS) units that provide back-up power to the HMS and SHMS PLC systems.

Backup power for the HMS and SHMS PLC systems is provided by three UPS units: APC UPS model SMT1500RM2U, for all HMS PLC chassis and for the SHMS PLC controller chassis; Eaton FERRUPS model Fe5.3KVA, for instrumentation in the HMS detector hut; and Eaton FERRUPS model Fe5.3KVA, for instrumentation in the SHMS detector hut and for SHMS PLC's I/O chassis.

UPS fault signals are passed to the PLCs via relay interfaces on the UPS units. The UPS units are monitored by digital input channels in the HMS Rotation PLC chassis. The fault status for the APC UPS and SHMS' Eaton UPS is published by the HMS Rotation PLC to a network tag to be read by the SHMS PLC controller.

An APC Dry Contact I/O SmartSlot relay card provides six relays to output the status of the APC UPS. Prior to installation in the UPS, all contacts in the relay card were wired to a 37-pin D-sub connector, Fig. 1, to allow access to all relay channels without having to uninstall the card from the UPS. Appendix Table I provides the pinout of the terminal block and D-sub connector.



FIG. 1. Photo of relay card with terminal block connections wired to 37-pin D-sub connector.

Using a 37-pin-D-sub-to-terminal-block adapter, shown in orange in Fig. 2, the relay card is wired (Fig. 3) to interrupt a 24 V signal if any of six UPS statuses shown in Appendix Table II should occur.

Both Eaton UPS units have a built-in 25-pin D-sub connector on their rear panel. This connector gives a wet-contact relay that drives an external dry-contact relay, providing a 24 V signal for monitoring the UPS unit's Inverter On fault signal. This signal indicates that AC power has been lost and that the UPS is running on battery. Wiring and pinout is shown in Fig. 4.

In summary, fabrication of the cables and external relay interface for each Eaton UPS unit is in progress. All cables

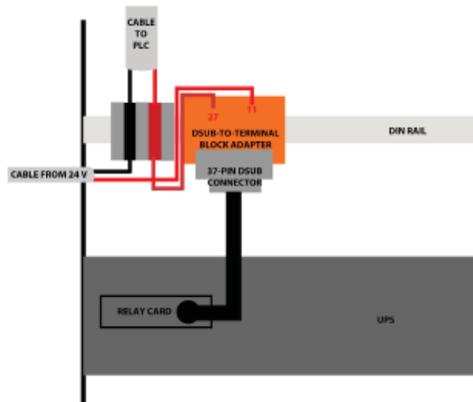


FIG. 2. Wiring diagram for cabling of relay card to 24 V power supply and PLC channel in rack.

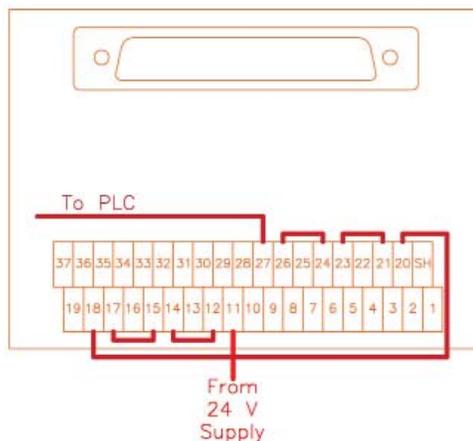


FIG. 3. Wiring diagram for D-sub-to-terminal-block adapter.

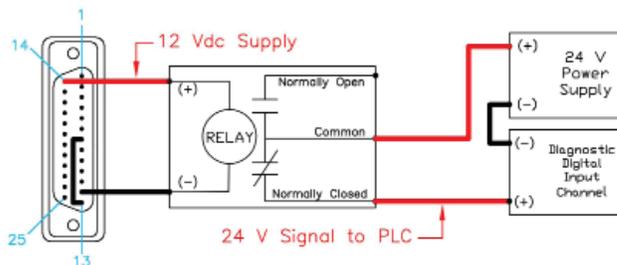


FIG. 4. Pinout and wiring for built-in DB-25 connector on FERRUPS UPS units.

and components will be routed and installed during the next accelerator downtime period. Software to monitor the UPS units is complete.

APPENDIX: TABLES

Pin #	Wire color	Relay card terminal block input
1	yellow violet	IN 1
2	violet gray	ISO GND 1
3	green violet	IN 2
4	yellow gray	ISO GND 2
5	green	IN 3
6	yellow	ISO GND 3
7	green gray	IN 4
8	blue violet	ISO GND 4
9	white	chassis GND
10	gray	NO 1
11	orange white	COM 1
12	brown red	NC 1
13	orange yellow	NO 2
14	orange violet	COM 2
15	yellow green	NC 2
16	green blue	NO 3
17	orange blue	COM 3
18	yellow blue	NC 3
19	red violet	NO 4
20	red gray	COM 4
21	red orange	NC 4
22	red green	NO 5
23	blue white	COM 5
24	red blue	NC 5
25	red	NO 6
26	violet white	COM 6
27	green white	NC 6

TABLE I. Pinout and color-code of wiring for APC UPS' relay card.

Status	Definition
On battery	UPS is running on battery
Low battery	Battery is low, within 10 min. of running out
Off or lost communication	UPS is off or relay card has lost communication with UPS' mainframe
Replace battery	UPS battery is bad and must be replaced
Overload	UPS is overloaded, unable to provide adequate backup power to connected devices
On battery, power fail	UPS is on battery due to a power failure

TABLE II. Conditions monitored in the relay output of the APC UPS relay card.