

Booster/AGS Ring Power Supply Systems Group Procedure EPS-B-007

Pulsed Power Monitoring Relay (PPMR) Procedure for testing the National Instruments PPMR which controls the Booster Main Magnet Power Supply's (BMMPS) Input AC Circuit Breakers

The Main Control Room should be notified prior to testing any critical system. The PPMR should only be tested when the GE PPMR is on-line or the BMMPS is not running. Tripping the PPMR will issue a warning to LIPA Operations. Have the MCR contact LIPA and inform them that the PPMR will be tested.

1.0 General

- 1.1 A test fixture has been constructed to simulate the input signals provided to the PPMR. This test fixture is to be used to implement this procedure.
- 1.2 The output phase voltages of the test fixture are derived from the 208 Volt input line voltages using step-down transformers in a Y-Y configuration.
- 1.3 The simulated phase currents are derived by multiplying the corresponding voltage output with the input power reference, Pref, signal supplied to the test fixture.
- 1.4 The output power simulated with this device can be calculated using the formula “ $P_{out} = Pref * 3 * V_a * 2400 * I_a * 1600$ ”.
- 1.5 The voltage-scaling factor is attributed to 14,400:120 line PT's and 20:1 attenuators, for an equivalent ratio of 2400:1.
- 1.6 The current scaling factor is due to 1200:5 CT's with 0.15 ohm burden resistors, for a ratio of 1600 amps/volt.

2.0 Calibrate the Test Fixture

- ___ 2.1 Connect the test fixture to the 3-phase line.
- ___ 2.2 Measure the voltage from one of the voltage outputs (V_a) using an AC voltmeter.
- ___ 2.3 Supply an accurate 1.00-volt DC reference to the power reference input BNC.
- ___ 2.4 Connect the AC voltmeter to one of the simulated current outputs, and adjust the potentiometer until the value matches that which is calculated using the following formula:

$$I_a = 2,000,000 / (Pref * 3 * V_a * 2400 * 1600)$$

This scales the output to 2 MWatts per volt.

3.0 Testing the PPMR

- ___ 3.1 Remove the connection block providing input signals to the National Instruments Data Acquisition Card and replace it with the BNC test block.
- ___ 3.2 Connect 6 outputs on the PPMR tester to the corresponding inputs on the test block.
- ___ 3.3 Connect a calibrated function generator to the power reference BNC on the test fixture and set it to sine mode.
- ___ 3.4 The top graph displays the three voltages and three currents that are read into the PPMR, insure that these traces are appropriate.
- ___ 3.5 The second graph displays the real power calculated by the PPMR. Insure that this trace has the same profile as the power reference injected into the test fixture.
- ___ 3.6 Set the amplitude to exceed the alarm level for a given band, and adjust the frequency to several locations in and out of the critical bands while observing the display and the action of the alarm indicator. Critical bands and power limits have been defined by L.I.P.A., and should be used as a basis to define the action of the PPMR.
- ___ 3.7 Set amplitude to exceed the trip level for a given band and repeat as above noting the action of the trip indicator. Note: the trip status requires that the PPMR maintain an alarm level for 2 consecutive periods before a trip is initiated.
- ___ 3.8 Set the amplitude to the trip level and repeat observing the action of the alarm and trip relays as the frequency is varied within each protection band. Continue varying the amplitude and frequency until each limit has been tested.
- ___ 3.9 The “In-Service” status can be tested by stopping the program. The watchdog timer will time-out in approximately 20 seconds and issue a warning to the RTU.
- ___ 3.10 When testing is complete, reconnect live signals to PPMR and re-start the program.