A.4: Control system augmentation for beam orbit correction coil power supplies in microtron

Microtron is a 20 MeV pre-injector for Indus-1 and Indus-2 synchrotron radiation sources at RRCAT. Orbit correction coils (OCC) are required for optimizing the beam orbit for increasing the output current from the microtron. There are three OCCs, placed in the microtron. The control system for power supplies (PS) used for energizing these coils is developed and installed. New hardware and software modules have been developed for remotely controlling these OCC PS and integrated with existing control system of microtron.

Hardware: The hardware modules are developed to integrate them with present control system of microtron. Existing control system is described already in one of the earlier issues of RRCAT Newsletter (Vol. 29, Issue 2, 2016). Two equipment control modules (ECMs), which were developed earlier for the microtron control system, have now been upgraded to implement the requirements for control of the three OCC power supplies. The hardware is based on logic modules implemented in Xilinx Spartan3 Field Programmable Gate Arrays (FPGA) (XC3S400-4PQ208). Features like setting the PS to zero value before polarity change, fault status read-back, polarity change status and remote reset have been added and accordingly relay based add-on cards have also been added on expansion facility of the ECMs. Figure A.4.1 shows the integration of new ECMs in the existing control system of microtron.

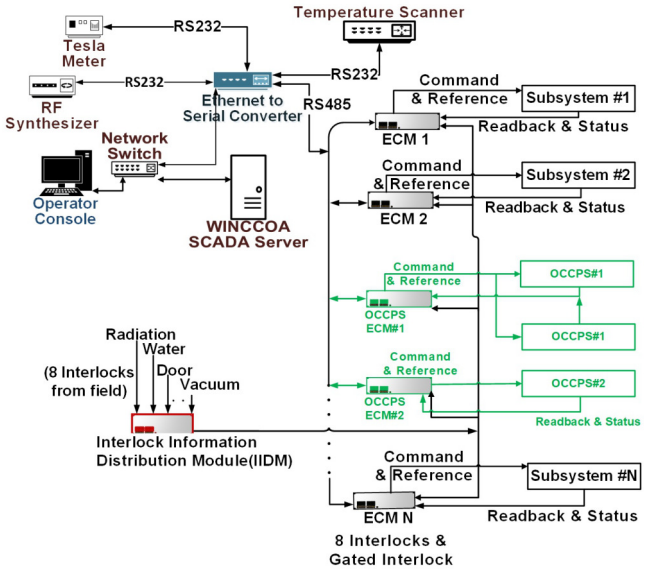

Fig. A.4.1: Integration of new ECMs in the existing control system.

Green colour modules shown in the block diagram are added for realizing the new requirements. The modified FPGA program for the ECMs were developed to provide the above mentioned special interface functions.

These ECMs have been integrated in existing RS-485 bus to communicate with the user layer program of the Microtron control system. The communication with ECMs is done at 115.2 kbps. The communication frames have been suitably updated to incorporate the additional fields of polarity-status and reset & polarity commands.

Software: The user layer software of the existing microtron control system, which is developed in SCADA, has been updated to include these newly designed ECMs. The software consists of an Application Programming Interface (API) manager to communicate with the ECMs over the RS-485 bus, and a Graphical User Interface (GUI) panel with control scripts for monitoring and control by user. The API manager was updated to incorporate the additional fields of polarity and fault status along with additional commands for polarity setting and PS reset. This has been accomplished in a transparent manner, so that the overall communication protocol remained the same, and therefore not affecting the existing ECMs. A new GUI panel is developed (Figure A.4.2) along with required control scripts, which provides user control and monitoring functions. It displays the parameter readings, status of the three OCC PS, and provides buttons for reset, ON/OFF, and settings.

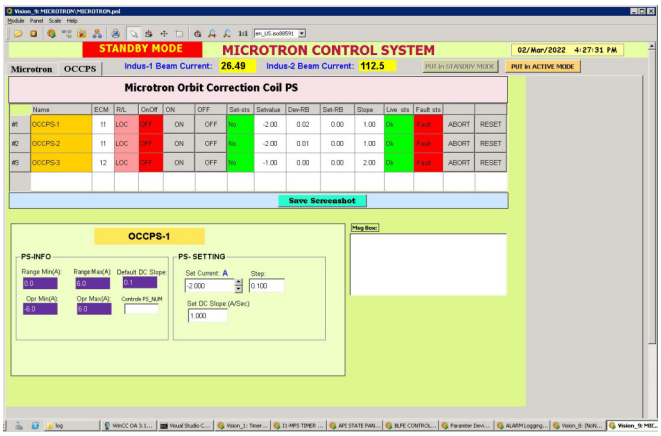

Fig. A.4.2: GUI panel for control of microtron OCC power supplies.

The SCADA database has also been updated to include configuration settings of the three OCCPS and the same is also displayed on GUI panel. Alarms for PS trip events have been configured. This GUI panel is integrated as a tab in the existing control GUI display. The parameter history database has been designed and data logging control module for generating the log data files is updated. The web pages to view and download the microtron data have been updated to include these PSs.

The overall system has been tested in lab condition interfacing with PSs for required functions. The system has been deployed for regular use after integration and testing with the existing control system.

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