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Integrated System Electronics and Instrumentation ; Operation and Diagnostic for Aditya-U Tokamak

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The first phase operations of Aditya-U successfully performed various plasma experiments with repeatable plasma discharges of maximum plasma current of ~160 kA and discharge duration ~250 ms. The electronics and instrumentation requirement for these experiments are mainly of signal conditioning, embedded digital signal processing and automation. The signal conditioning electronics is developed to measure signal through sensors of different plasma diagnostics. To measure accurately and precisely the signal of nano order in highly radiated (electric and magnetic field) environment of Tokamak, special care has been taken in terms of design, component selection, signal transmission and EMC/EMI shielding. The signal conditioning design incorporates attenuation, amplification, isolation, filtration, self-test and offset calibration. At present Electronic system caters around the need of hundreds of channels from different diagnostics of Aditya-U. These channels include electronics for Electromagnetic, Spectroscopy, Bolometer, Soft-x-ray, Microwave and ECE radiometer diagnostic.

FPGA and microcontroller based electronics are designed and developed for plasma operation and control applications. Microcontroller based few real-time feedback control applications were successfully implemented in the last campaigns and these experiments are plasma disruption control using Electrode-Bias and ICR pulse, Radial position control, density feedback control and real-time control of gas-feed pulses to reduce wall loading of fuel gas. FPGA based timing system is developed which generates trigger to operate different subsystems and archive data during plasma discharge of Aditya-U.

The Automation & Instrumentation system is developed for baking of vacuum vessel and pumping lines, TF coil temperature measurement and logging for Aditya-U. The LabVIEW based SCADA application monitors and control the temperature of PLC based baking system

The paper will describe electronics for plasma diagnostics, Instrumentation, embedded control and timing system for plasma operation.

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