

Remote Monitoring and Control of Bias Voltage for Soft X-ray (SXR) Detector Array

Abstract

Remote and Manual Monitoring and Control of Bias Voltage for Soft X-ray (SXR) Detector Array
Soft X-ray (SXR) Plasma diagnostic is routinely operated in ADITYA-U tokamak. It is a multi-chord vertical view diagnostic and provides estimation of chord-averaged electron temperature and radial movement of plasma column during plasma discharges. It consists of a pair of SXR detector arrays which requires a stable reverse bias voltage to enable photo-induced current generation when incident photons interact with the depletion region of the photodiode. The application of an appropriate reverse bias enhances the diode's temporal response, thereby improving its ability to detect high-frequency signals—an essential requirement for time-resolved plasma diagnostics.

This project aims to design and develop a versatile system capable of providing both manual and remote control of the reverse bias voltage applied to the SXR detector arrays. Additionally, the system will offer real-time visual monitoring of the applied bias voltage. Manual adjustment will be facilitated using a precision potentiometer, while remote control and monitoring will be achieved through a Local Area Network (LAN) interface.

The project will be implemented in four key phases:

- Ethernet Communication Integration: Establish reliable Ethernet-based communication using a 32-bit ARM Cortex-M4 microcontroller, enabling remote access and control functionalities.
- Signal Conversion Interface: Interface Analog-to-Digital Converters (ADC) and Digital-to-Analog Converters (DAC) with the microcontroller to enable accurate voltage readout and control.
- Bias Voltage Display Module: Implement a seven-segment display to provide continuous visual feedback of the applied bias voltage for local monitoring.
- User Interface Development: Design an intuitive graphical user interface (GUI) for remote setting and monitoring of the bias voltage.

This project will result in a robust, dual-mode bias control system for SXR arrays.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 3

2) Name of course with branch/discipline: B.E./B.Tech. Electronics and Instrumentation Engineering

3) Academic Project duration:

(a) Total academic project duration: 10 Weeks

(b) Student's presence at IPR for academic project work: 4 Full working Days per week

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