A.11: Programmable control module for scanning magnet power supply of linac

Linac based Agricultural Radiation Processing Facility (ARPF) is being set-up by RRCAT at Devi Ahilyabai Holkar Vegetable Mandi in Indore. A time varying magnetic field, required for scanning of the beam, is produced with the help of scanning magnet and associated power supply to irradiate the product holding box from bottom to top. For this, a bipolar ramp waveform is generated to achieve uniform dose distribution inside the product under irradiation. The ramp profile can be adjusted in amplitude and time scale.

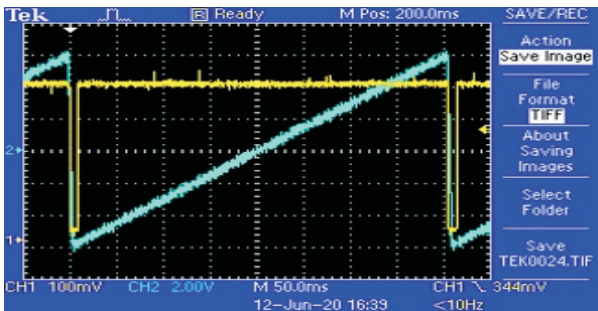*Fig. A.11.1:   Programmable control module for scanning magnet power supply.*

Fig. A.11.2: Reference signal for scanning magnet power supply. Yellow waveform shows the pulse for scan time measurement and the cyan waveform shows ramp reference.

The Programmable Control Module (PCM) (Figure A.11.1) for scanning magnet power supply hardware comprises in house developed FPGA board (Xilinx Spartan 3), analog and digital I/O board, and a controller board. The PCM is provided with LED indicators, RS232/ RS485 selectable communication ports. It has eight control signals, eight status signals, one analog input and one analog output to interface with the subsystem. In Figure A.11.2, cyan trace shows the ramp reference generation and yellow trace shows the scan time measurement pulse. In Figure A.11.3, cyan trace shows the positive and negative peak currents, yellow trace shows the retrace time of power supply. The main features of the system are as follows:

- Analog ramp reference generation for scanning power supply with 0.05% accuracy.

- Reading the positive and negative peak current of power supply read back with 0.05% accuracy.
- Scan time measurement with 0.01% accuracy.
- Eight digital control signals and eight status read back signals for remote operation of power supply.
- Programmable ramp up time from 100 ms to 1000 ms, retrace time from 3 ms to 10 ms.
- Readback of set current and debug mode for calibration check.

A Graphical User Interface (GUI) for remote operation of scanning magnet power supply of linac is developed in LabVIEW. The GUI (Figure A.11.4) interacts with user for required parameters, depending on the type of product. The software communicates with the PCM over a serial link. The command and data is being logged in the database. The system has been developed and tested with scanning magnet power supply successfully.
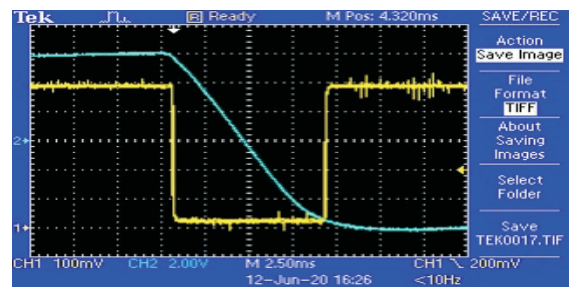

Fig. A.11.3: Positive and negative peak current read back of scanning magnet power supply. The pulse width of yellow waveform shows retrace time and the cyan waveform shows power supply readback for peak current measurement.
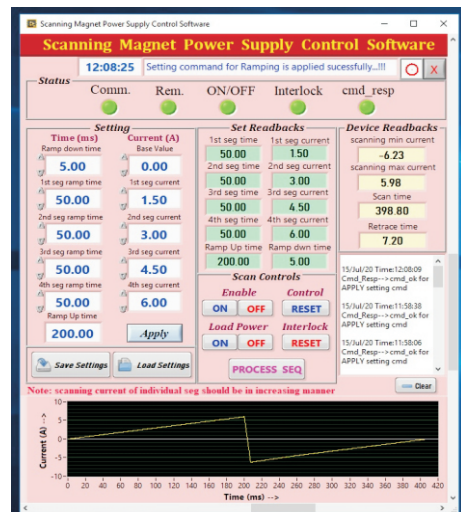

Fig. A.11.4: GUI of PCM for scanning magnet power supply.

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