

Control Scheme for Remote Operation of Magnet Power Supplies of Infrared Free Electron Laser



Lalita Jain, V. P. Bhanage, M.A. Ansari & C. P. Navathe

Laser Electronics Support Division, RRCAT, Indore

Email: lalita@rrcat.gov.in

INTRODUCTION: Infrared Free Electron Laser (IRFEL) is under development at MAASD, RRCAT Indore. The IRFEL machine consists of 90keV thermionic gun as electron source, beam transport line, 25MeV Linear Accelerator (LINAC) and an undulator magnet. There are fifty magnets on beam transport line. These magnets are energized by precision power supplies. These power supplies have local as well as remote control and will be located at equipment hall. The control room and equipment hall are at approximate distance of 300 m. We have designed a control system for centralized operation of Beam Transport line Magnet Power Supplies (BTMPS).

MAGNET POWER SUPPLY PARAMETERS

Magnetic Element	Quantity	Current Rating	Voltage Rating	Required Stability
Corrector Magnets	15	7 A	+/- 15V	100 ppm
Dipole Bending Magnets	5	20 A	30V	100 ppm
Quadrupole Magnets	15	13 A	+/- 15V	100 ppm
Steering Magnets	15	10 A	+/- 10V	100 ppm

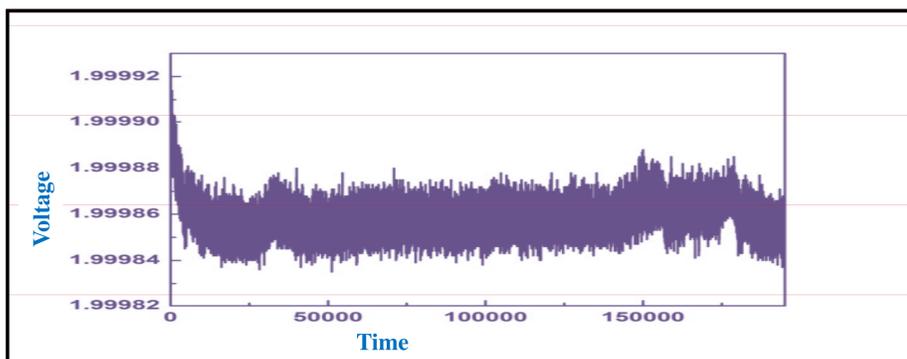
MAGNET POWER SUPPLY CONTROLLER (MPSC)

- 3U, 84T card frame enclosure.
- Back-plane Design , Serial isolated SPI Backplane bus
- RS-485 interface for communication to PC
- 10-pin MS connectors for MPS signal interfacing
- One Master controller & five Slave Controller.
- One MPSC controls five supplies

SLAVE CONTROLLER ARCHITECTURE

- Micro-controller with 64k flash & 1k RAM
- 18-bit DAC with 2 PPM/°C analog output stability
- 16-bit Integrating type ADC.
- Four relay outputs.
- Isolated SPI interface
- DC-DC converter for power supply isolation
- RS-232/RS-485 interface

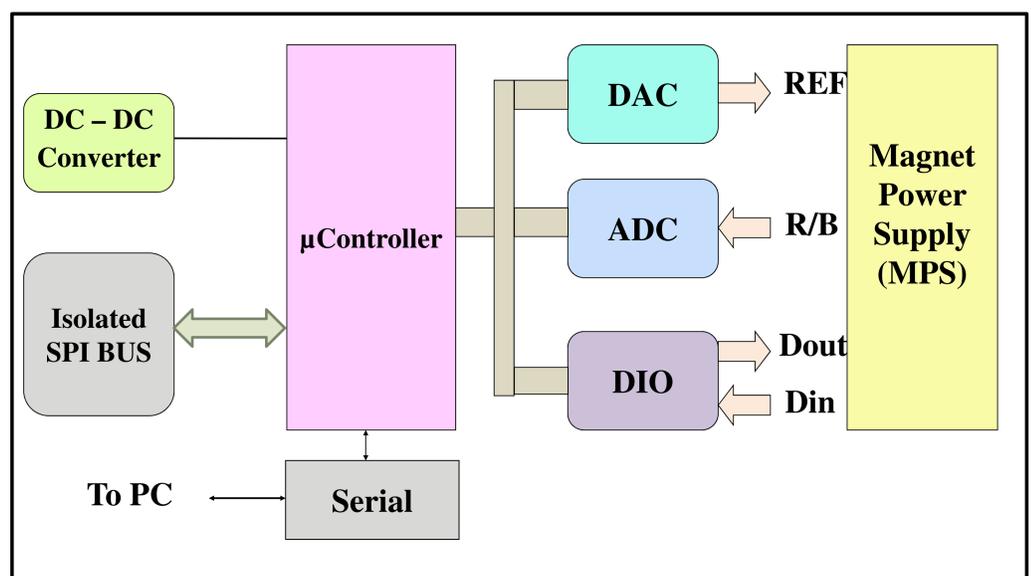
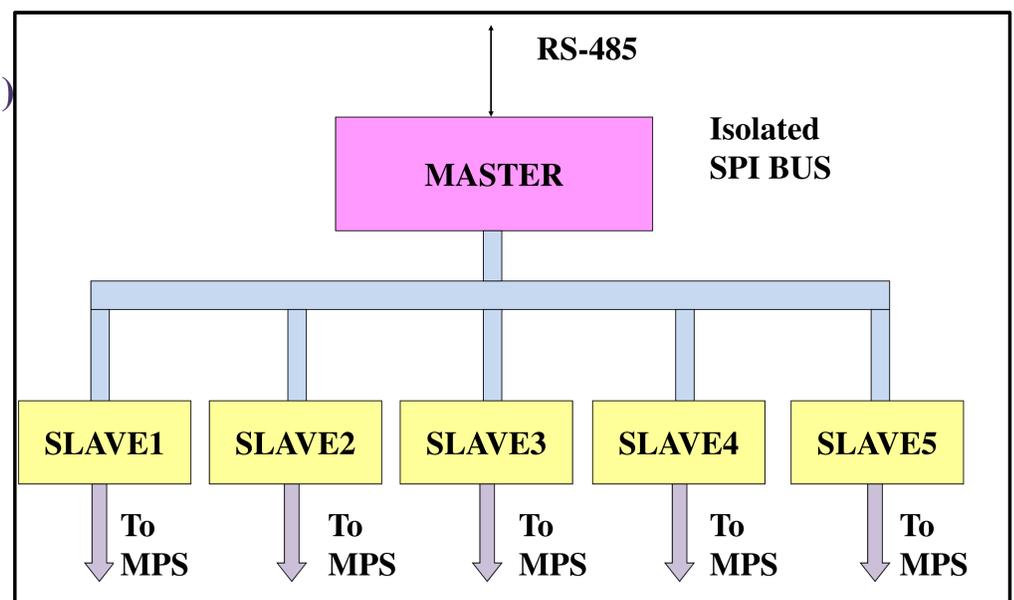
RESULTS: For testing the stability of power supply reference, DAC output was set to 2V and observed for whole day, it is within 50 PPM.



Voltage drift vs. time for enclosed systems

REMOTE INTERFACE SIGNALS OF MAGNET POWER SUPPLIES

- Analog input : 0-10V.
- Analog output: 0-10V.
- Four digital inputs: PS ON, PS OFF, Fault Reset, Current Polarity Reversal.
- Three digital status Signals: ON/OFF indicator, Fault indicator, Local/Remote.
- D-25 connector for Remote Interface.



REFERENCES:

1. [80C51 Family architecture, www.nxp.com](http://www.nxp.com)
2. http://www.analog.com/static/importedfiles/data_sheets/AD1139.pdf
3. <http://datasheets.maxim-ic.com/en/ds/MAX135.pdf>

Ninth International Workshop on Personal Computers and Particle Accelerator Controls (PCaPAC-2012)