A.12: New Control System for Magnet Power Supplies of Transport Line-1 of Indus-1

Indus-1 and Indus-2 share a common injector, which is a 450/550MeV Booster Synchrotron. A 20 MeV microtron is used as pre-injector.The extracted beam from microtron is transported to booster synchrotron through Transport Line-1 (TL-1). TL-1 has dipole, quadrupole and steering magnets for doing its job. Various power supplies for these magnets are controlled and monitored remotely from the control room by the magnet power supply (MPS) control system.

The existing control system for TL-1 (MPS) is based on centralized VME controller with I/O buses connected in daisy chained fashion running out to various Equipment Interface Units (EIUs). This system is operating since 1992-93 and is quite old now. Extensive wiring, large component & connector counts and daisy chaining of I/O buses in this system leads to relatively unreliable and noise prone performance, drifts and system thermal failures.

The new control system for the MPS, TL-1 developed at accelerator control section (ACS) is based on distributed control architecture. In this scheme each power supply will be connected to a Digital Signal Processor (DSP) based controller referred to as Power Supply Control Module (PSCM) sitting in its vicinity. All the controllers pertaining to the power supplies of TL-1 will be communicating to a master server in control room on a common serial link, Rs485, using a custom protocol. Each PSCM is housed in 2U size, 19" rack mountable housing. Fig. A.12.1 shows the external and internal views of a PSCM.

Fig.A.12.1 External and internal view of Power Supply Control Module (PSCM)

Apart from providing basic functionalities like digital status monitoring and controls of eight parameters each and providing stable reference of ±10 V with stability of ±100 ppm to power supply, the PSCM also provides following functionalities:

- Capturing and storing 512K samples of actual set reference with 100 Hz rate at 14 bit accuracy on the RAM.
- Capturing and storing of 512K samples of actual power supply Current (read back) with 100 Hz rate at 14 bit accuracy on the RAM.
- Synchronized data capture by all the PSCMs of TL-1 following an external clock.
- Synchronized data capture following an external event.

Fig. A.12.2 shows the reference signal going to the power supply during cycling process. The cycling parameters are: Start Value (SV) = 0V, Minimum Value(MinV) = 0V, Maximum Value (Max V) =10V, Set Value(SeV) = 5V, Flat Time (FT) = 500mSec, Number of cycles (NOC) =3.

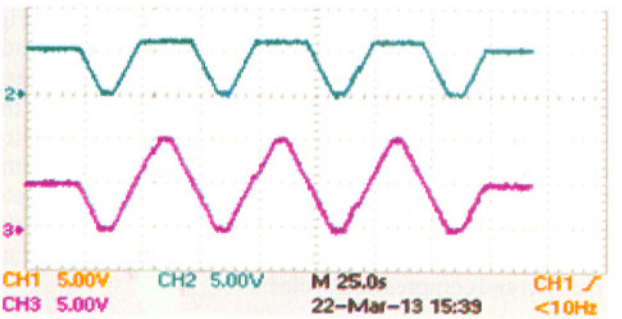

Fig. A.12.2 Reference signal (Purple colour) generated by PSCM during cycling process.

During the evaluation tests, the PSCM is operated continuously for 24 hours at full load. Fig. A.12.3 shows the stability curve of the reference generated by the PSCM for 24 hours of the continuous operation at full load. The long term stability of the reference is better than ±100ppm.

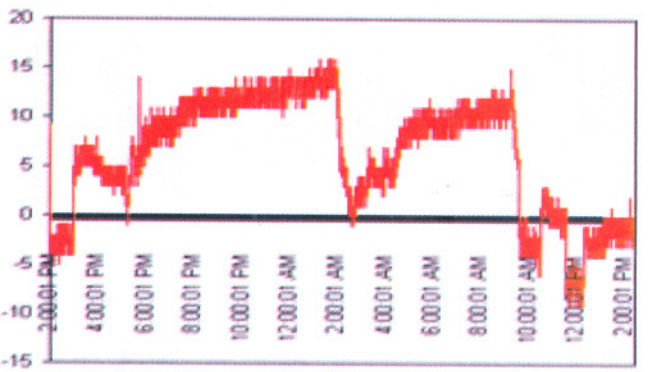

Fig. A.12.3 Stability curve of the reference generated by the PSCM for 24 hours of the continuous operation at full load.

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