A.11: Upgradation of Indus-1 Timing Control System (TCS)

Indus-1 Timing Control System (TCS-I1) controls and monitors 08 Pulsed Power Supplies (PPSs) and generates programmed delays for various timed triggers. The main role of TCS is to facilitate injection of electron beam obtained from Microtron injector into Booster synchrotron, extraction of the same and further injection into Indus-1 ring. Timing signals are given to PPSs which energize the pulsed magnetsto control beam movement. Besides, TCS also controls and monitors all the PPSs using different analog & digital signals.

Existing TCS had lived its life and gone though many incremental changes to meet system requirements in course of time, and also had some short comings. Therefore an up-gradation was mandatory. The new system has been built with the following improved features.

- Complete signal isolation (channel-to-channel)
- Both optical fiber& copper cable interface for trigger and analog signals
- Replacement of independent modules incrementally added as rack mountable cards
- Miniaturization of cables/connectors for increased density
- Debugging facility
- Ethernet based faster communication to PVSS SCADA software
- Interfacing of other system related signals, expandability etc.

Architecture of the upgraded TCS:

TCS hardware is built around VME bus. It has two layers - User interface (L1) and Equipment Control (L2). Equipment Control Station (ECS) in the field houses two L2 stations. These are VME Equipment Controllers (EC). Analog/ digital I/O signals and timing trigger signals are interfaced to separate L2 stations to reduce possibility of noise interference related issues. The two ECs are based on Motorola 68040 CPU on OS-9 real time OS. These are linked upward to PVSS SCADA server over Ethernet. A non VME sub-rack holds the cards for isolated trigger signal interface. The architecture is depicted in Fig A.11.1.

Functionality:

Field I/O signals are interfaced in EC #1. These signals are digital status and control & analog reference set for PPS current amplitudes. Potential-free contacts are used for digital signals while 4-20 mA current loop signals via analog, channel-to-channel isolation are used to set reference current of PPSs.

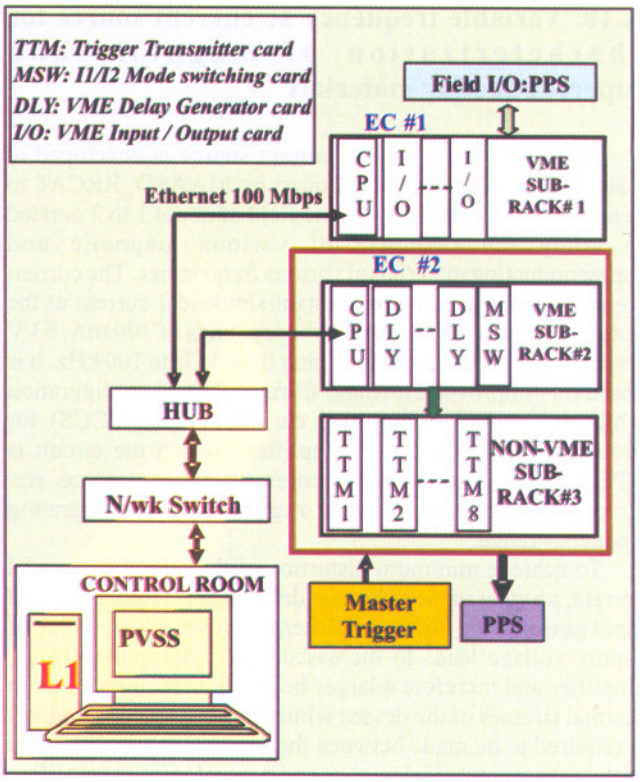

Fig.A.11.1: Architecture of upgraded TCS Indus-1

FPGA based delay generator cards generate the required delayed trigger signals in sub-rack#2. Triggers are generated with respect to the incoming Master Trigger, a 1 Hz trigger, derived from the zero crossing pulse train of 50 Hz signal of Microtron cathode current. Triggers for PPSs for Booster extraction & Indus-1 injection are synchronized with Booster RF frequency (31.613 MHz) to extract the electron buckets of this frequency. Trigger signals are fed to PPSs via Trigger Transmitter (TTM) cards. TTM cards produce channel-to-channel isolated replica of trigger signals. Indications of all signals are given at the front end.

At L1, PVSS SCADA contains both the GUI (Graphical User Interface) as well the API (Applications program Interface). API communicates with L2 controllers. L2 accesses the I/O boards & responds to the API. Parameter data are stored in SQL data base with remote WEB display facility.

Both the hardware and the software of TCS is designed to give more information in GUI to easily debug the system. Upgraded TCS has been installed and commissioned in Indus complex and it works quite satisfactorily.

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