

L.10 : Flash-lamp monitoring system for table top terawatt laser

The Table Top Terawatt laser system operational in LPD, consists of Master oscillator and three laser amplifier stages. The laser amplifiers are pumped by xenon flash-lamps, which in turn are energized by capacitor banks. For proper working of laser chain, it is required that all flash-lamps are fired in synchronism. A data acquisition system is now developed for monitoring current pulses in all flash-lamps in this laser system. The system consists of current sensors, waveform digitizers and personal computer (PC) which displays the current waveform as well as vital parameters like peak value of current and instant of firing.

The current sensor (Fig. L.10.1) developed converts the 0-10 kA flash lamp current pulse to voltage waveform of 0-2.5 V. This sensor is based on ferrite core, which is very compact in size and has passive components only. The sensor was calibrated with commercially available calibrated probe (LEM make RR6030). The results show excellent linearity for the above range without saturation.

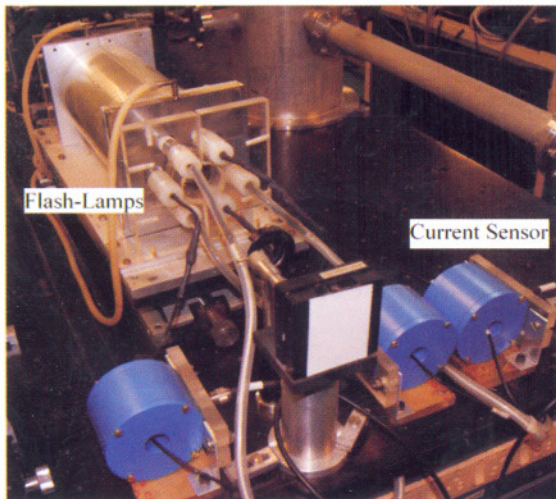


Fig L.10.1: Current Sensors in Table Top Terawatt Laser System

A waveform digitizer module (WDM) is developed which has two independent channels on a single board to digitize and store the current sensor output. Block diagram of one channel is shown in Fig. L.10.2. Each channel consists of a microcontroller (AD C841) which has 12-bit ADC, timer, serial I/O, 62 kbyte EEPROM and 2 k XRAM. This ADC is used to acquire the current signal from one flash-lamp pair at 330 kSPS for ~3 ms duration. The WDM is synchronized with help of pre-trigger signal obtained from laser system. The digitized data consists of information about pre-trigger and main current pulse.

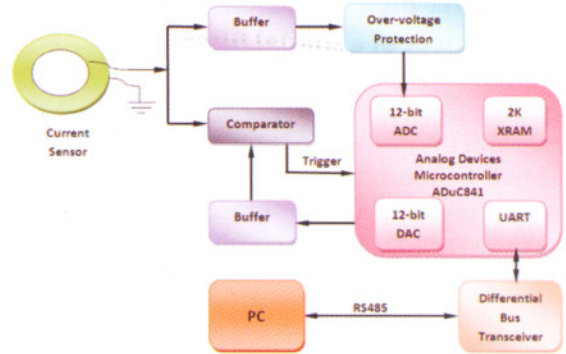


Fig L.10.2: Waveform Digitizer Module

In one unit, WDMs are configured in an RS-485 network with 8 current sensing channels in bus topology, connected to one serial port of PC. Two such units were developed to cater for 15 flash-lamp pairs in the laser system. After each laser shot, digitized current waveforms from all flash lamps in the system are transferred to PC on RS-485 network. The PC displays these waveforms and also calculates peak current and exact location of peak from trigger. (refer Fig. L.10.3) This data is stored in the computer with date and time stamp for future reference.

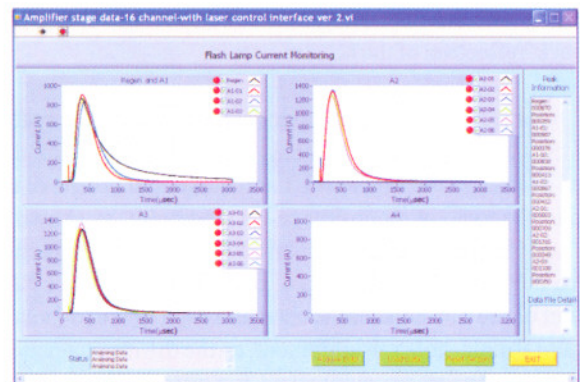


Fig L.10.3: PC display of Flash Lamp Current waveforms

This data acquisition system is connected with the main control system of the laser via ethernet interface. A protocol has been developed for the exchange of data between the two systems. Measured peak current and its calculated value are compared for each shot and communicated to the main control system.

The acquired current waveforms of each flash-lamp of the system will be analyzed periodically to monitor any variation or degradation of performance of flash-lamps, so as to prevent catastrophic failures of the flash-lamp.

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