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Instrumentation of "Solar X-Ray Spectrometer" Low Energy Detector (SLD) - Proposed payload onboard Indian satellite

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Abstract. It is proposed to fly a high spectral and temporal resolution - "Solar X-Ray Spectrometer (SOXS)" onboard Indian satellite. The SOXS will provide the disk integrated flux in the energy range 2 keV-10 MeV. It is composed of two detector modules - SOXS Low Energy Detector (SLD) and SOXS High Energy Detector (SHD). The SLD consists of state-of-the-art Silicon PIN and Cadmium-Zinc-Telluride detectors to study the energy spectra in 2-30 keV with sub-keV energy and 10 ms temporal resolution. Proposed instrumentation for SLD module consists of front-end electronics, Pulse - height analyser, DC to DC modules, house keeping parameters to monitoring logic and interfacing for SOXS Low Energy Processing Electronics (SLE) to SOXS Common Electronics (SCE). The SLE collects the data from the two detectors and process the data in temporal and spectral modes. The SLE is interfaced with Telemetry and SCE. The salient feature of SLD is real time formulation of spectra in four time intervals as commanded by processing electronics.

1. System description

The block diagram of electronic system is given in figure 1. The Si-PIN photodiode is used as an X-Ray detector which is mounted on thermoelectric cooler with FET, special feedback system, charge sensitive preamplifier and temperature sensor. The whole assembly is enclosed in a hermetic TO-8 package with a vacuum tight, light tight Beryllium window. The collimator focuses the full disk of the Sun on 1×1 mm^2 Si PIN detector and similarly on 5×5 mm^2 CZT detector. Low energy 4 keV to 15 keV soft X-ray will be detected by PIN and CZT while 15 keV to 30 keV will be detected by CZT with sub-keV resolution. When an incident radiation interacts with low Energy Detector (LED), charge is collected at the anode of the detector. This charge is then processed in a Low Noise pre-Amplifier (LNA) and converted into equivalent voltage level of the order of few microvolts. A Post-Amplifier with high gain-bandwidth product is used to amplify microvolt pulses into volt pulses which can be analyzed by Master Control Logic (MCL). Gain can be changed for energy calibration in Lab before flight. The output of

Post Amplifier is connected to FET switch as well as energy window logic.

The output of Post Amplifier will be in the form of nanosec pulses. The height of pulse is proportional to energy level of incident radiation. To process the pulse height FET switch will be closed by MCL and Peak Detector (PD) will hold peak level of pulse until ADC converts this information into digital PH data for SLE to further processing. PH data is used to construct an energy spectrum of flares and also to search for possible signal of microflares.

To monitor the health of the module key parameters (House Keeping parameters) are continuously monitored. The parameter to be monitored is selected by SLE and a slow ADC converts this selected analogue parameter into digital HK data. Output of MUX is buffered and given on telemetry bus for standalone monitoring in case of failure of SLE. In this case parameters can be selected directly from telemetry through ground system command.

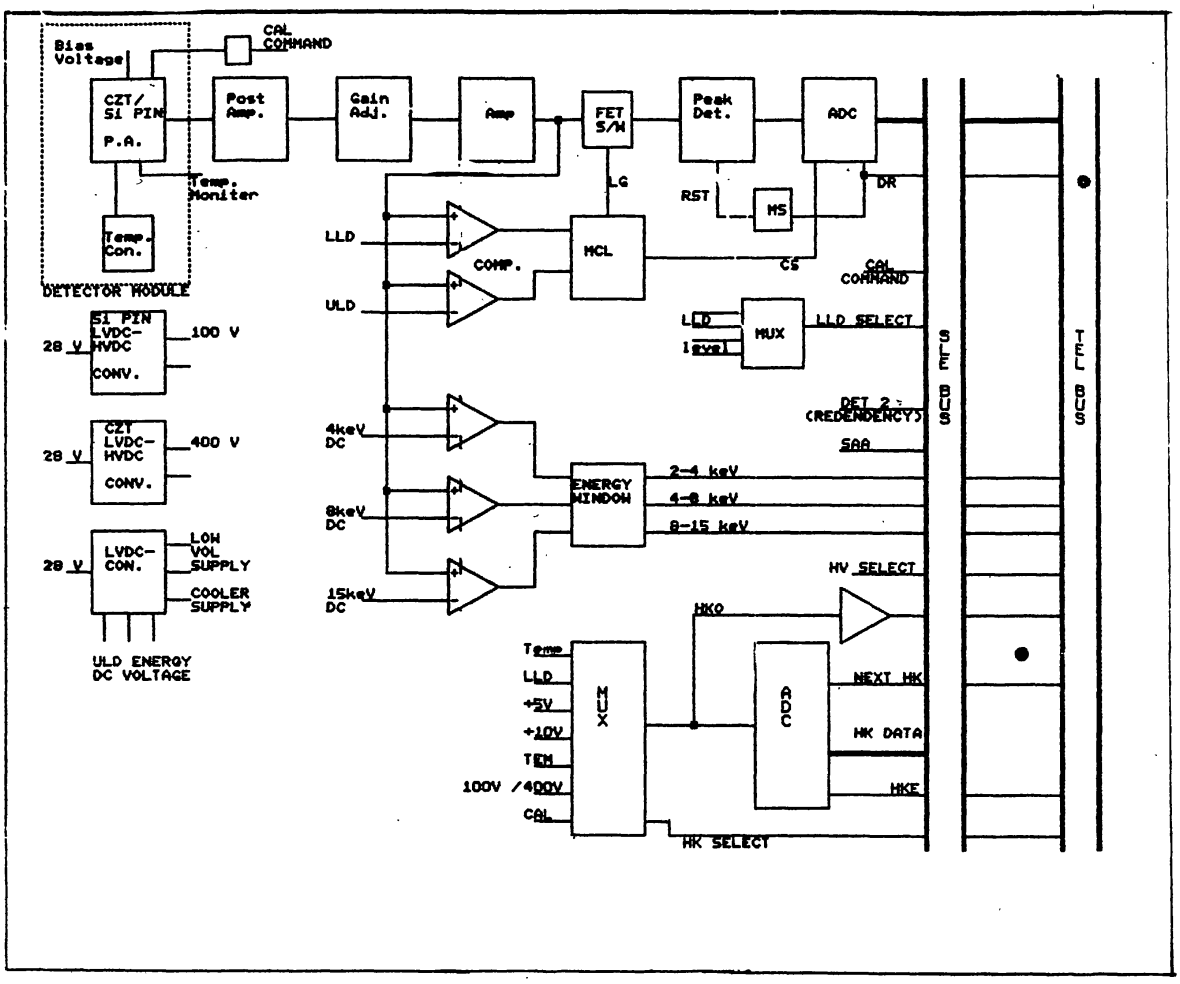

Figure 1.