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A data acquisition system for the TIFR near-infrared camera

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Abstract. A near infrared array camera based on a SBRC 58 × 62 InSb detector (TIRCAM-1) is being developed at TIFR for astronomical imaging applications. The data acquisition system for this camera is described here.

Key words : near infrared array—astronomical imaging

The recent availability of two dimensional near-IR array detectors for astronomical use has revolutionized infrared astronomy (Wynn-Williams & Becklin 1987; Elston 1991). A near-IR camera (TIRCAM-1) based on a SBRC 58 × 62 InSb Focal Plane Array (FPA) is being developed at TIFR for astronomical imaging (Ghosh *et al.* 1991).

The data acquisition system for this camera comprises of two electronic sub-systems, viz., Data Conversion and Storage (DCS), and the computer inferface (PCIC). The complete schematic of TIRCAM-1 is shown in figure 1. The major components are : the cryogenic dewar which houses the array detector, cooled optics etc.; the FPADIE (SBRC) unit which

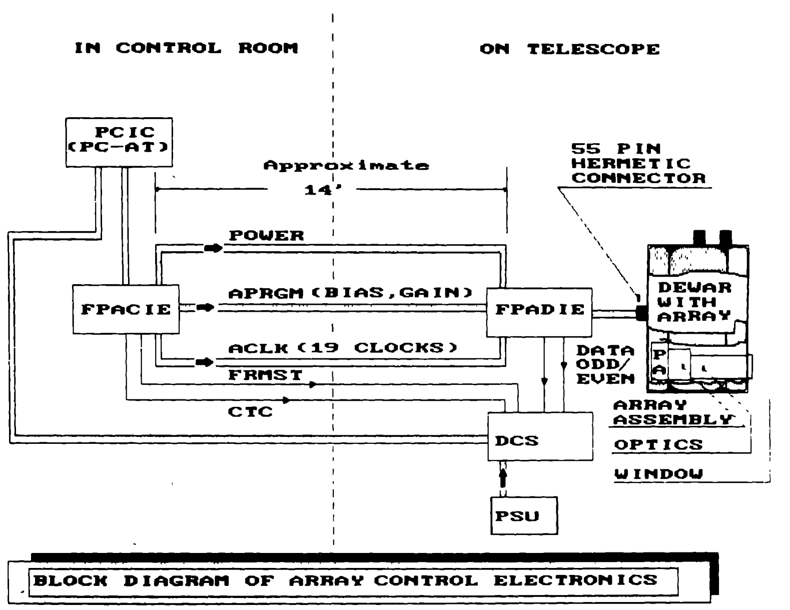

Figure 1. A schematic diagram of the overall TIRCAM-1 system.

provides biases and processes the analogue signals from the FPA; the FPACIE (SBRC) unit which generates the various clocks for the array; the DCS system consisting of the pre-amplifiers, A-to-D conversion and image frame storage; the PCIC system which is an interface card providing communication between a PC-AT and the FPACIE; PSU, the power supplies for DCS; and various interconnecting cables. The dashed line demarks the sub-systems which are mounted at or near the cassegrain focal plane of the telescope from those at the control room.

A detailed block diagram of the DCS system is shown in figure 2. The DCS has two hardware options optimising the frame readout rate and the dynamic range. The fastest

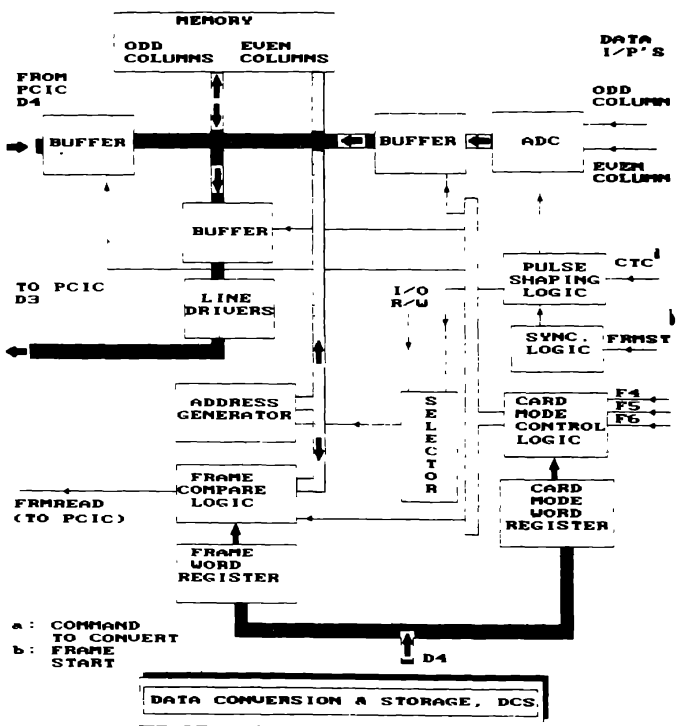

Figure 2. A block diagram of the data conversion and storage (DCS) sub-system.

readout rate is 16 mS/frame and the largest dynamic range is ~ 10,000. The latter option is essential in background limited operation (BLIP) while making astronomical observations. The longest on-source integration time is not restricted by the DCS. The DCS can store (in its local memory), up to 8 images acquired through correlated double sampling (16 images for single sampling).

The PCIC unit interacts with the computer (through the 16 bit AT bus), the DCS and the FPACIE systems as depicted in figure 3. The PCIC is an add-on card for a PC-AT, which controls the DCS operations. The software driver (in BASIC) for PCIC has been designed with the following features : continuous monitoring of the camera and the DCS status; display of previous/current frames; disk storage of image frames etc.

The entire digital electronics is based on LS-TTL/CMOS components. The DCS uses ADCs with 12 (conversion time ct ~1 μS) or 14 (ct ~10 μS) bit resolution. The pre-amplifiers are based on the low noise OP-27 units. Special precautions have been taken to minimize

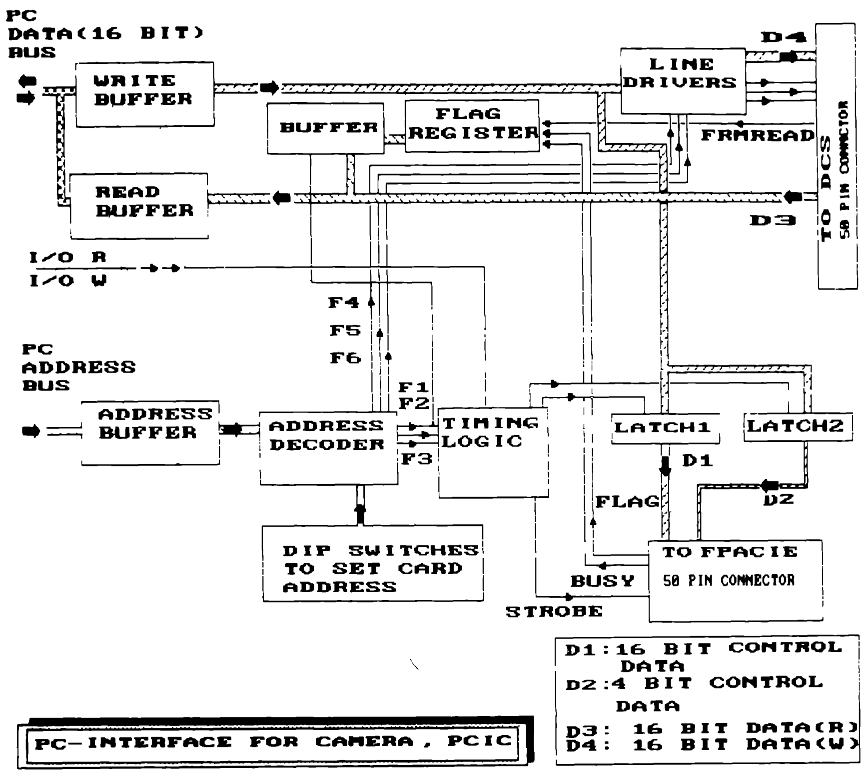

Figure 3. A block diagram of the computer interface card (PCIC).

line pickups and electromagnetic interference to achieve the desired dynamic range in a typical telescope dome environment.

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