

X-ray data acquisition dual energy XDAS 1.6mm pitch multiview

1 description

XDAS 1.6 pitch multiview is a variant of the XDAS-V2 system and provides a modular system of boards for use in multiview X-ray linescan systems. It consists of a set of detector head boards and a signal processing board. Each detector head board has 64 + 64 dual energy detector channels, corresponding to a detector pitch of 1.6mm. The signal processing board has inputs for five views, to each of which up to twelve detector head boards can be connected, giving a system size of sixty boards or 7680 channels. Signal processing boards can be added if a larger system is required. Detectors can be butted end-to-end to provide a continuous array.

Data output is in 16 bit format from the signal processing board. The system can be interfaced to a PC via:

- PCI-7300A data I/O card
- USB2
- standard frame grabber card (single signal processing board only)

X-rays are detected using a photodiode array and scintillator. Scintillators, such as Gadox, CsI(Tl) or CdWO₄, are offered to cover the energy range 30keV to 450keV. X-rays pass through the low energy scintillator, via a filter to a high energy scintillator.

Data from the first detector board in the system is acquired in 52µs and from each subsequent board in 26µs. This information can be used to calculate the minimum data acquisition time for a system. Read-out rate from the signal processing board is programmable to 10 or 20MB/s.

2 applications

- security
- food inspection
- thickness measurement
- process control
- non-destructive testing

3 features

- modular system with five views and up to 7680 channels with a single signal processing card
- 1.6mm detector pitch
- range of scintillator types available
- simultaneous data acquisition and read-out
- wide dynamic range - 3pC to 60pC
- 16 bit output
- 10 or 20MB/s data link to CPU
- low noise

4 XDAS-V2 system

A schematic of a V2 system is shown on the **detector head block diagram, section 10, signal processing block diagram, section 11** and **system block diagram, section 12**.



The detector arrays are connected to the board via a detector socket. Current from the photodiodes is integrated by a custom designed microcircuit containing 128 charge sensitive amplifiers and a multiplexer. A correlated, double sampling system is used to minimise noise and offsets. Data is fed via a 24 input multiplexer to a 14 bit ADC.

Operation is continuous with one set of data being read out whilst the next set is being acquired. Dead time is approximately 1µs.

The maximum charge that can be collected per cycle depends on the choice of the storage capacitors, one per channel, which are internal to the microcircuit. These can be set to 2pF or 10pF. High linearity is maintained with a charge storage of 3pC or 15pC per cycle.

If higher dynamic range is required, a facility for sub-sampling and data summation is incorporated on-board. Using the image data store (**see signal processing block diagram, section 11**), up to 4 sub-samples can be acquired and stored in the image data store, which is a 16 bit device. When data is ready for transmission, it is transmitted via the chosen data interface to the host CPU.

Operation is controlled by a gate array (FPGA), which provides the central intelligence for the board and the timing and control signals for system operation. The gate array is based on fused link technology, providing a high level of radiation hardness.

User settings to control integration times, sub-sampling, and refresh rate, together with information on system configuration, are transmitted via an RS485 interface and stored in non-volatile RAM such that on switch-on, the system is initiated in the last mode used. The RS485 is compatible with the RS232 serial port on standard PCs using the interface converter XDAS-485A-TTL. When the USB2 option is chosen the communications are made via this connection.

Data interface to a PC is via a PCI-7300A data I/O card, USB2 module or frame grabber card. The same configuration of XDAS-V2 system is used for each mode but a different cable set is required to connect to the PC as shown in **section 9, ordering information**.

5 XDAS 1.6 pitch multiview

Up to 12 detector head boards can be connected to each of five inputs on the signal processing board, providing five views in a single detector system.

The signal processing board is capable of acquiring data from up to 7680 channels, transmitting to the host cpu via the selected data link. This link outputs 8 bits at 10 to 20MB/s, allowing for a 1.25ms sample time to be achieved for a full 60 card system. Smaller systems can achieve much faster sample times. Additional signal processing boards can be used if shorter sample times are required.

6 general specification

integration time ¹ (single sample)	100µs to 50ms
sub-samples	4 max
integration time (multiple samples)	200ms max
signal-to-noise (electronics) ²	
no detectors 2pF	25000:1
no detectors 10pF	30000:1
with detectors (Cd <28pF) 2pF	17000:1
with detectors 10pF	25000:1
cross talk	<0.1 % over 10pC
maximum read-out rate	20 MB/s
A/D conversion	5MHz 14 bit
data output	16bit
dimensions:	
detector head board	101mm x 58mm
signal processing board	164mm x 101mm
detector pitch	1.6mm
maximum number of modules	
with 2 signal processing boards	120
maximum number of channels	15360
RS485 Interface	9600 baud, 7 data, odd parity, 1 stop bit

¹integration time depends on system size

²500µs integration time, 4 sub samples

7 environmental specification

operating temperature	+ 5 to + 35°C
storage temperature	-40 to +70°C
humidity (non-condensing)	
operating	30°C 93%
non-operating	40°C 93%

8 evaluation system

An evaluation system is available, consisting of a detector head board, detectors, signal processing board, USB output and evaluation software.

This is mounted in a test box (LINX type, see data sheet) to provide electrical and radiation screening.

The software is available on a CD and can be loaded on to a PC (Pentium 4 or higher) to provide the basic functionality of the system. A serial port is required for PCI7300A or frame grabber interfaces. A high speed USB2.0 port is required for XDAS-USB2 interface. The software enables integration time and number of sub-samples to be set and single lines of data to be acquired.

Data is acquired into a spreadsheet and can be displayed in graphical form. Gain and offset correction can be applied via the software.

9 ordering information

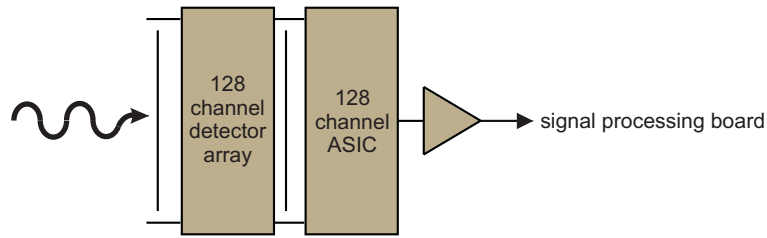
part number	description
XDAS-DH2-80	Detector Head Board without detectors, compatible with 1.6mm pitch dual energy and single energy detectors
XDAS-DH2-81	Detector Head Board with dual energy detectors, 1.6mm pitch with Gadox and CsI scintillator
XDAS-SP2-31	XDAS-V2 Multiview Signal Processing board
XDAS-DATA4	Data output module, connects to Signal Processing Board
XDAS-USB2	RS485 to USB2 converter box, connects to XDAS-DATA4 and processor via SCSI and USB cables
XDAS-485A-TTL	Connects to PCI7300A Card and XDAS-DATA4 via SCSI cable
XDAS-TERMINATOR31	Terminates each detector view
CABLE-50W SCSI-2	50-way cable (specify length)
CABLE-USB2-AB	USB2 cable (specify 3m or 5m)
XDAS-SOFTWARE	Evaluation software and SDK

Notes:

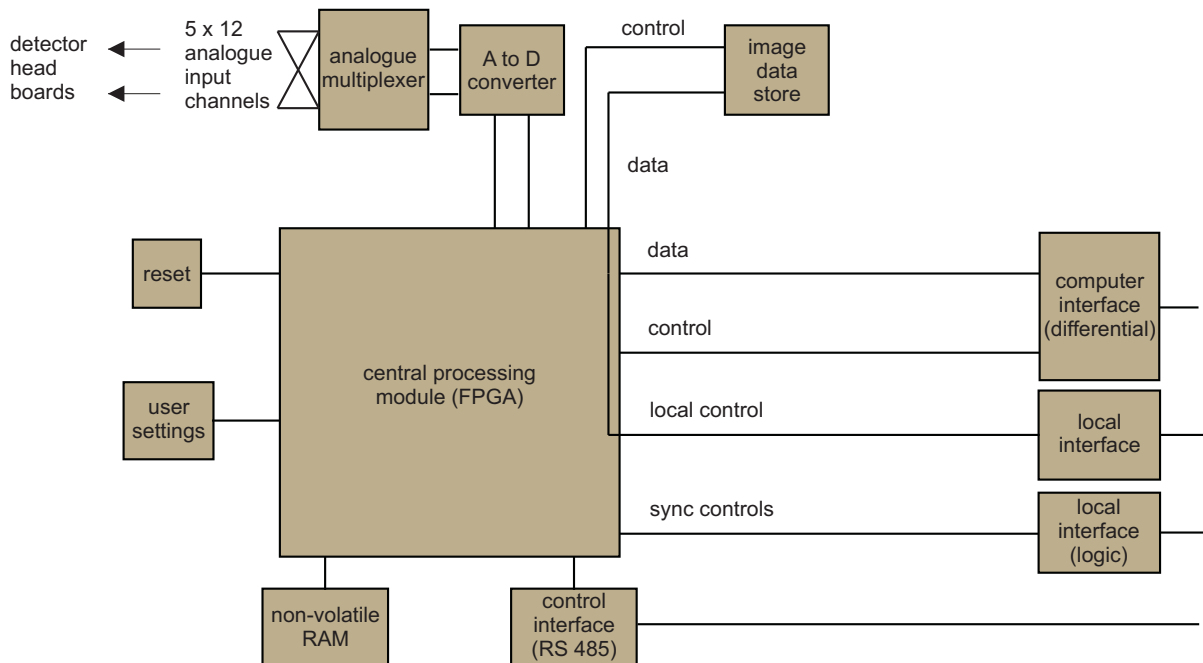
If the processor is within 5m of the signal processing card, a local USB2 converter can be used. This is the XDAS-USB2-2 and connects directly to the signal processing card. An XDAS-DATA4 is not required.

For further details, a manual is available on request

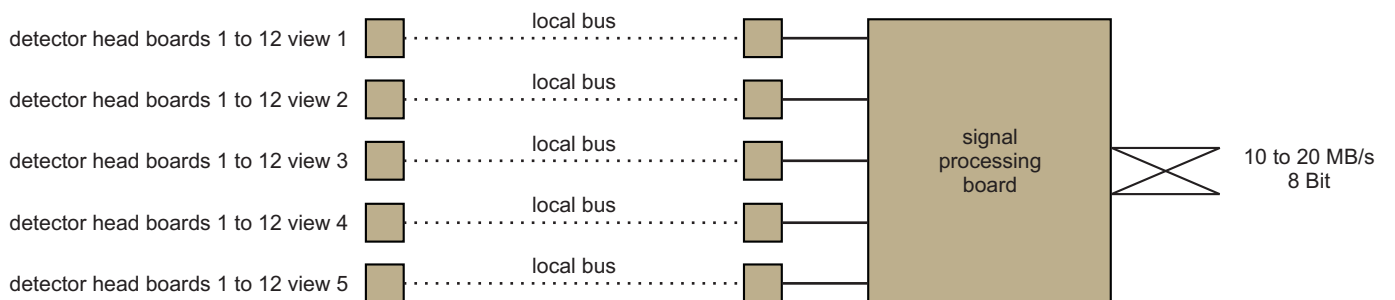
10 detector head block diagram



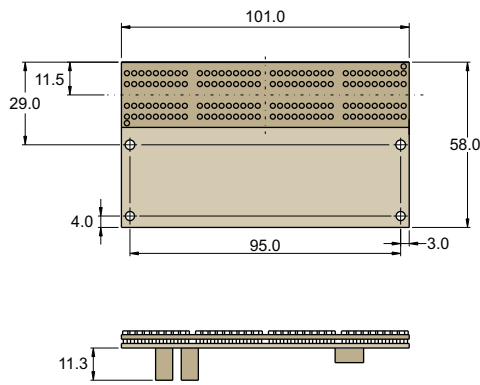
11 signal processing block diagram



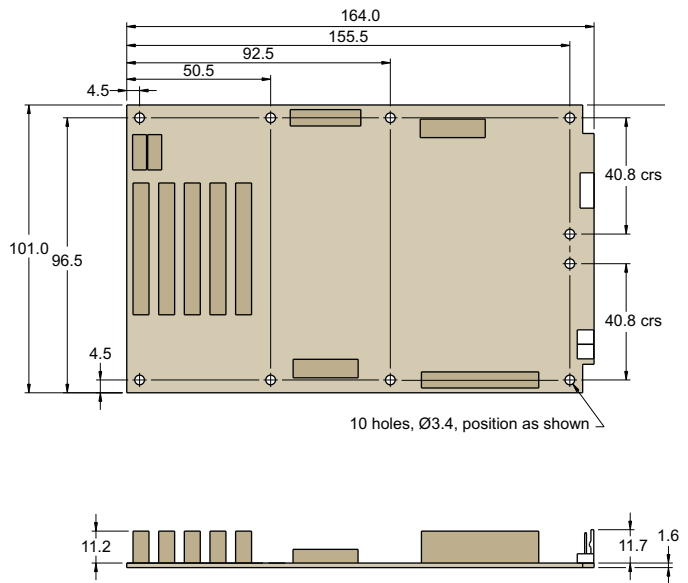
12 system block diagram



XDAS-DH2-80 dual energy board



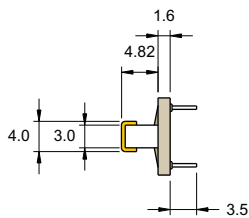
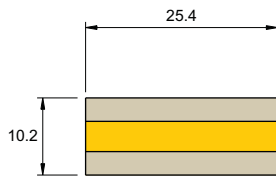
XDAS-SP2-31 signal processing board



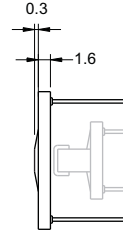
* to obtain height of detector above board, add detector socket height to detector height (excluding pins)

14 detector outline drawings (mm)

1.6 mm pitch CsI



1.6 mm pitch Gadox



1.6 mm pitch CdWO₄

