

XDAS-HE 2.5mm single energy X-ray data acquisition data sheet



1 description

XDAS-HE is a modular system of boards for use in X-ray linescan and CT Systems. It consists of a set of detector head boards and a signal processing board. Each detector head board has 64 detector channels, corresponding to a detector pitch of 2.5mm. Seven signal processing cards can be connected in series with up to 24 detector boards feeding each one, giving a maximum system size of 168 detector head boards or 10752 channels. Detectors can be butted end-to-end to provide a continuous array.

Data output is in 24 bit format from the signal processing board. The system can be interfaced to a PC via:

- PCI-7300A data I/O card
- USB2
- Ethernet

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

The XDAS sensor can acquire a single line of data in a minimum time of 200 μ s. Read-out rate is programmable to 2.5, 5, 10 or 20 MHz data rate.

2 applications

- security
- food inspection
- thickness measurement
- bone densitometry
- non-destructive testing

3 features

- modular system with up to 1536 channels with a single signal processing card
- 2.5mm detector pitch
- range of scintillator types available
- simultaneous data acquisition and read-out
- wide dynamic range - 50pC to 350 pC
- programmable in steps of 50pC
- 24 bit output
- 2.5, 5, 10 or 20 MHz data link to CPU
- 200 μ s minimum signal integration time
- up to 6ppm SNR in 350pC mode

4 XDAS-HE system

A schematic of a HE system is shown on the detector head block diagram, **section 11**, signal processing block diagram, **section 12** and system block diagram, **section 13**.

The 2.5mm pitch detector array is connected to the board via detector sockets on the top side of the board.

Current from the photodiodes is integrated by an integrated microcircuit containing 64 charge sensitive amplifiers and 20 bit ADCs. The microcircuit provides a serial digital output that is fed to the signal processing board using LVDS transceivers.

Operation is continuous with one set of data being read out whilst the next set is being acquired. Dead time is less than 100ns.

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 from 50pC to 350pC in steps of 50pC. High linearity is maintained with a charge storage of 50pC to 350pC per cycle.

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.

User settings to control integration times, sub-sampling, and refresh rate, together with information on system configuration, are transmitted via an LVDS interface and stored in non-volatile RAM such that on switch-on, the system is initiated in the last mode used. The LVDS is compatible with the RS232 serial port on standard PCs using the interface converter supplied as part of the cable set. When the USB2 or Ethernet 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 Ethernet. The same configuration of XDAS-HE system is used for each mode but a different cable set is required to connect to the PC as shown in **section 10, ordering information**.

5 XDAS-HE system

Up to 24 detector head boards, per signal processing board, can be daisy-chained to form a single detector system. Each detector head processes 64 detector channels producing a single serial digital output which is fed to the signal processing board.

The signal processing board is capable of acquiring data from up to 10752 channels, transmitting to the host cpu via the selected data link. This link outputs 8 bits at 2.5 to 20MHz, allowing for a 5ms sample time to be achieved for a full 24 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 (single sample)	200 μ s to 1s
integration time (multiple samples)	200ms max
signal-to-noise*	
no detector 50pC mode	9.3 ppm
no detector 350pC mode	4.8 ppm
with detector 50pC mode	15.5 ppm
with detector 350pC mode	5.3 ppm
cross talk	tbc
integral linearity	1ppm
maximum read-out rate	20 MB/s
A/D conversion	20 bit
data output	24 bit
dimensions:	
detector head board	114 mm x 159 mm
signal processing board	122 mm x 101 mm
detector pitch	2.5 mm
maximum number of modules	168
maximum number of channels	10752
control Interface	9600 baud, 7 data, odd parity, 1 stop bit

*Cd < 47pF, integration time 333 μ s

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 configurations supplied

XDAS-HE can be supplied in several configurations, with the different options listed below. Variants are as follows:

communications interface:

PCI-7300A, USB2, Ethernet

detectors:

64 element - 2.5mm pitch x 2.5mm sensitive width

scintillator types:

phosphor strip, CsI(Tl), CdWO₄

see **Section 15** for detector drawings

9 evaluation system

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

This is supplied in a test box to provide electrical and radiation screening. Components can be selected from the options shown in **section 10**.

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. The following parameters can be set:

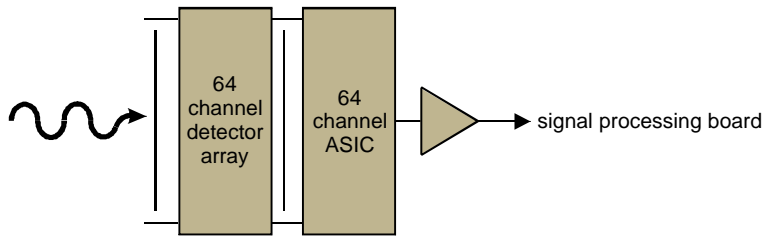
- integration period, from 200 μ s up to 1s
- number of modules in system

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

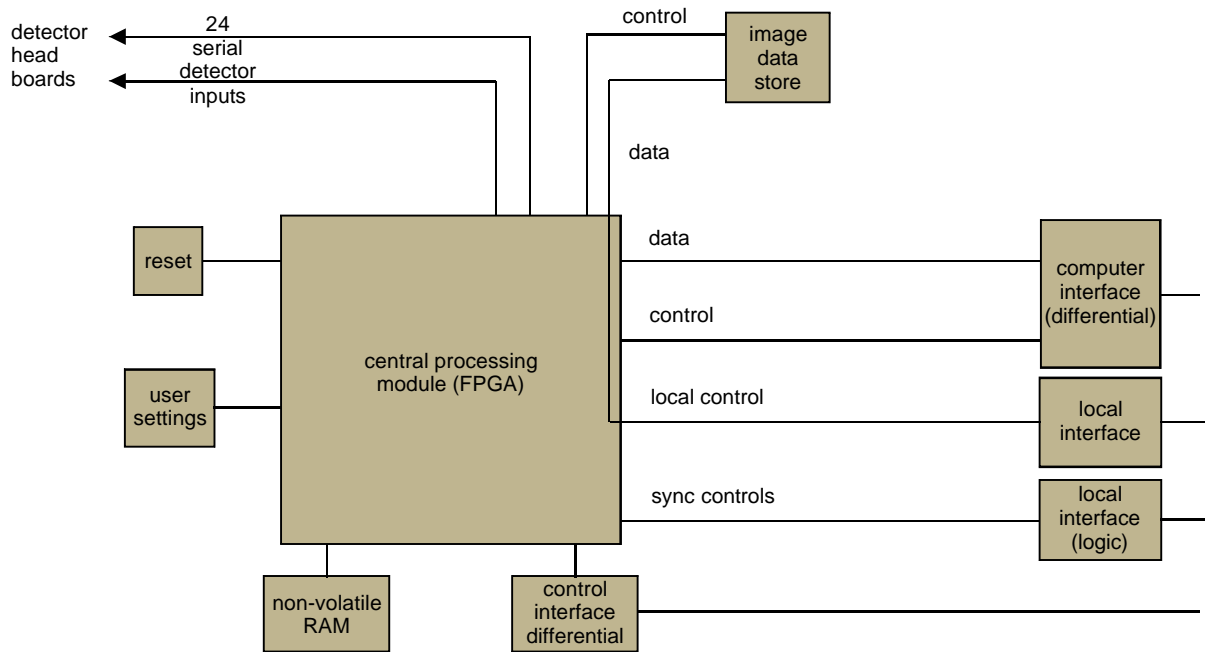
10 ordering information

part number	description
XDAS-HE-40	single energy (64 channels) no detectors, 2.5mm pitch
XDAS-SP3-40 board	XDAS HE signal processing
CABLE-XDASUSB2	cable set for USB2 interface
CABLE-XDAS7300	cable set for PCI-7300A card
XDAS-SOFTWARE	demonstration software
XDAS-SCREENED BOX	test box

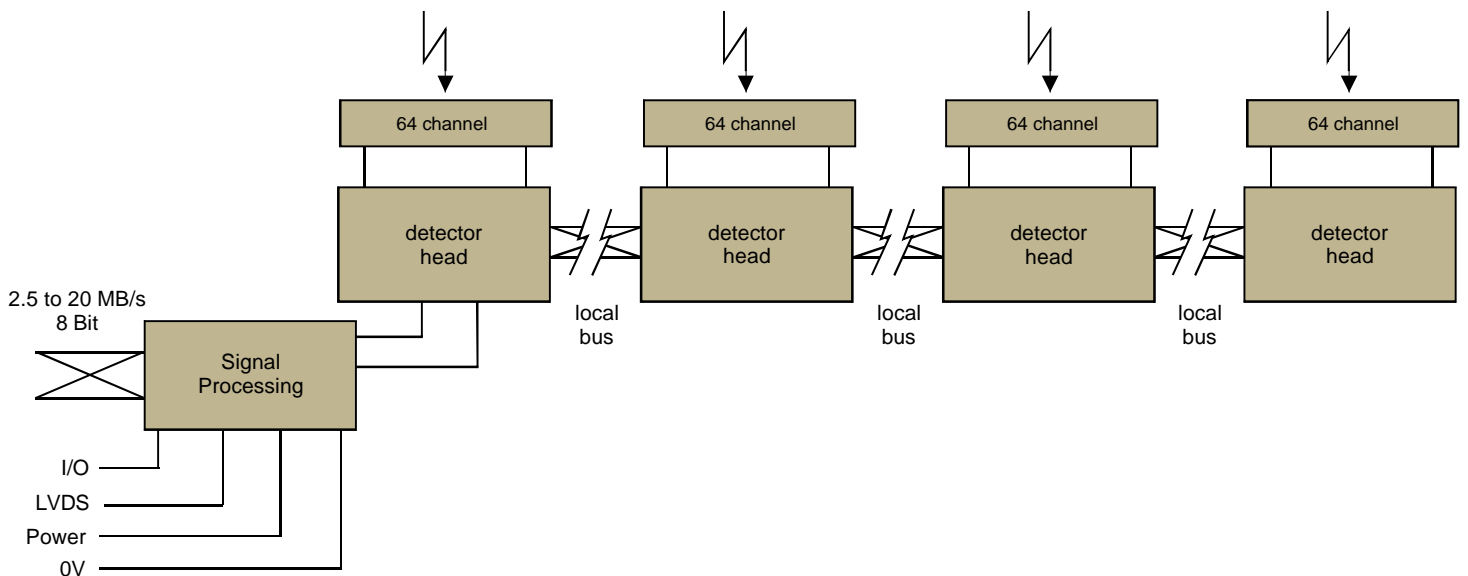
11 detector head block diagram

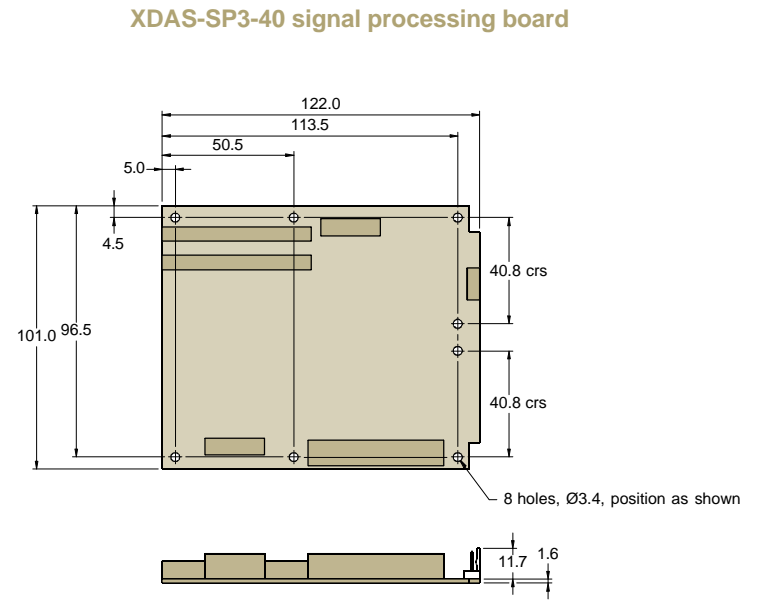
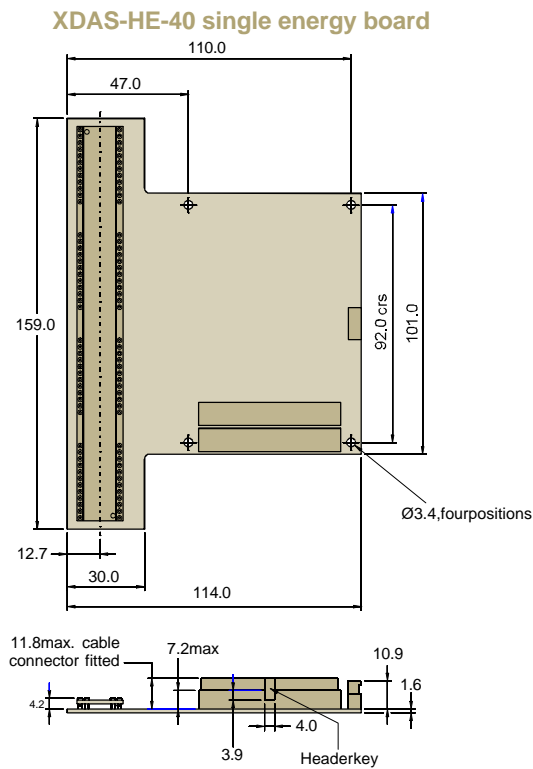


12 signal processing block diagram



13 system block diagram





areas described by chain-dot lines denote component height
 * to obtain height of detector above board, add detector socket height to detector height (excluding pins)

15 detector outline drawings (mm)

2.5 mm pitch silicon

