XCAM Cryo-Cooled Cameras with Controller Unit (XCU-A) Product Specification Notes

Introduction

XCAM have developed liquid-nitrogen cooled cameras which are perfect for very low noise applications. In common with XCAM's philosophy, we have designed these systems with the maximum of flexibility in mind so that almost any e2v Technologies detector can be built into these systems with minimal impact on cost.

Camera systems based on this new electronics features:

- Extremely low noise (depending on sensor used) due to low dark current
- Very low CCD operating temperature
- Based on XCAM's standard controller (XCU-B) which can be used to drive other types of camera head or multiple camera heads in some instances.

Liquid-Nitrogen Cooled Camera Head

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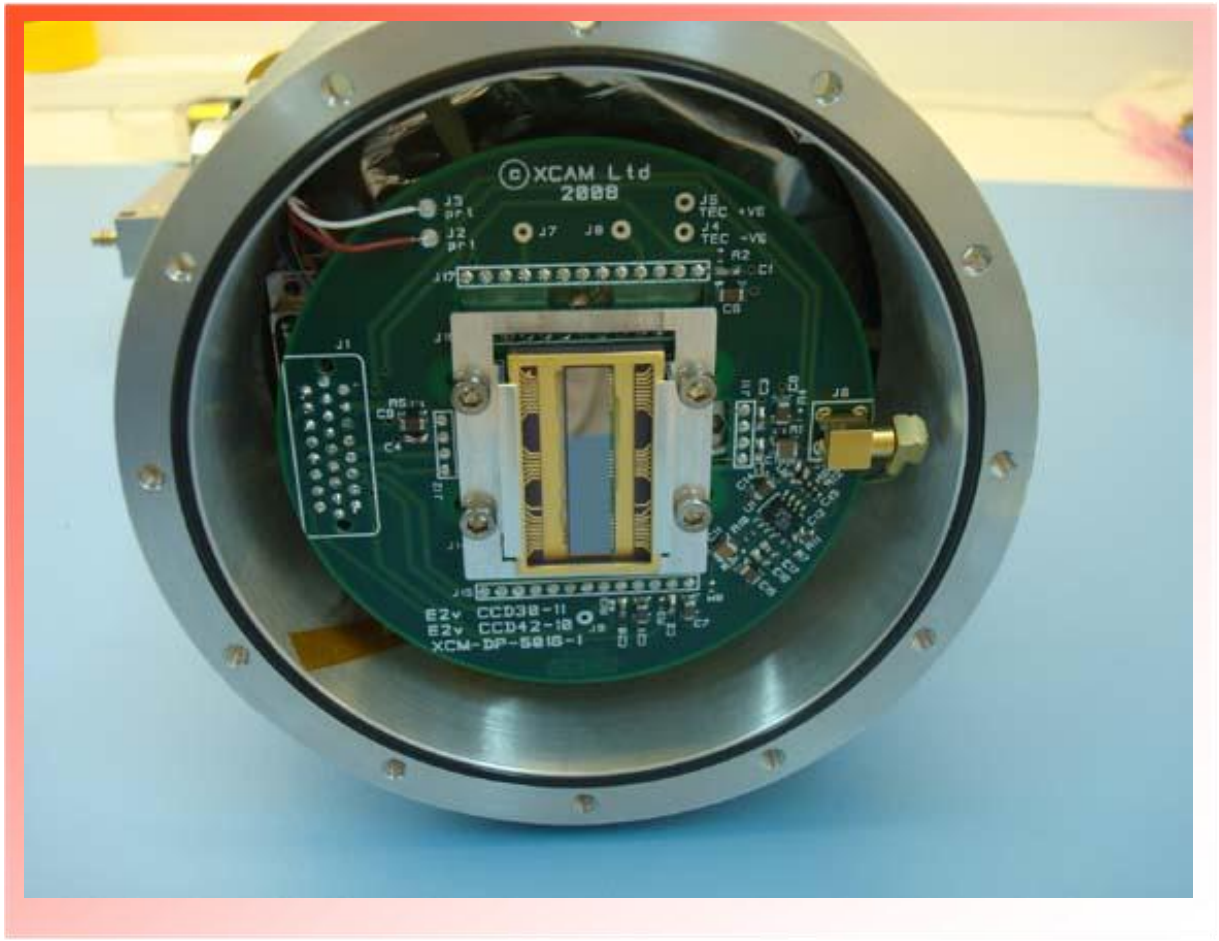
System Elements

The XCAM CyroCooled Camera System is designed for maximum flexibility; the system in constructed using several of the XCAM standard subassemblies including:

1. A headboard suitable for the CCD of choice, enclosed in a cryogenic chamber for liquid-nitrogen cooling – for further information see separate product note *Headboard Types*, for those headboards available off-the-shelf. New headboard types can be provided at small additional cost.
2. A system controller suitable for your application – for further information see separate product note *Drive Unit*
3. Cables to connect the two units above
4. Software to operate the system: XCAM Application Software or users can write their own software using the XCAM Software Developer's Manual – see later notes in this product note.



Headboard shown for CCD30-11 or CCD42-10

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XCAM Controller Software Options

The ***Application User Software Package*** (API) provides users with an easy interface with which to control and communicate with the controller and do simple analysis and data visualisation; please see separate product note which covers the software in more detail.

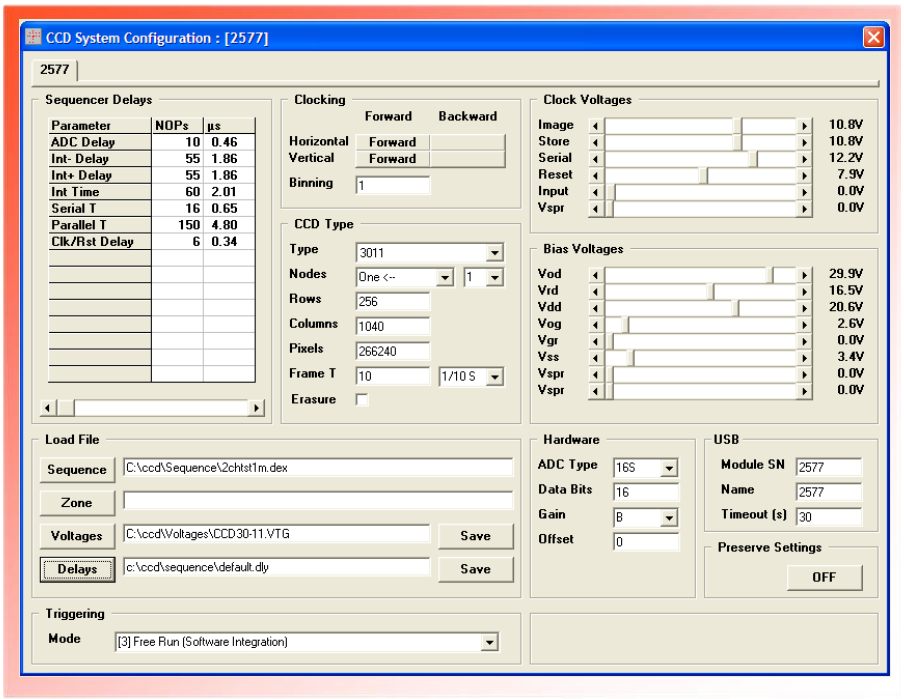
Alternatively, a ***Software Developer's Manual*** is provided for users who would prefer to write or use their own software, calling the XCAM dll files.

Many XCAM Controller users, use programs such as ***Matlab*** to control the drive unit, and a library of code is being developed to assist these users; this code will be made available on request.

The minimum specification for a PC to operate the system is Windows 7, XP Pro or Vista operating system; 2 GHz processor; 2 GB memory minimum; hard drive 100GB minimum; CD drive; 3 USB2 ports.

The controllers can be used to control custom multiple large area CCD camera systems synchronously in master-slave mode operation.

Both hardware and software triggering is possible, of either polarity. Custom triggering schemes are possible allowing seamless integration with experiments can be made produced.



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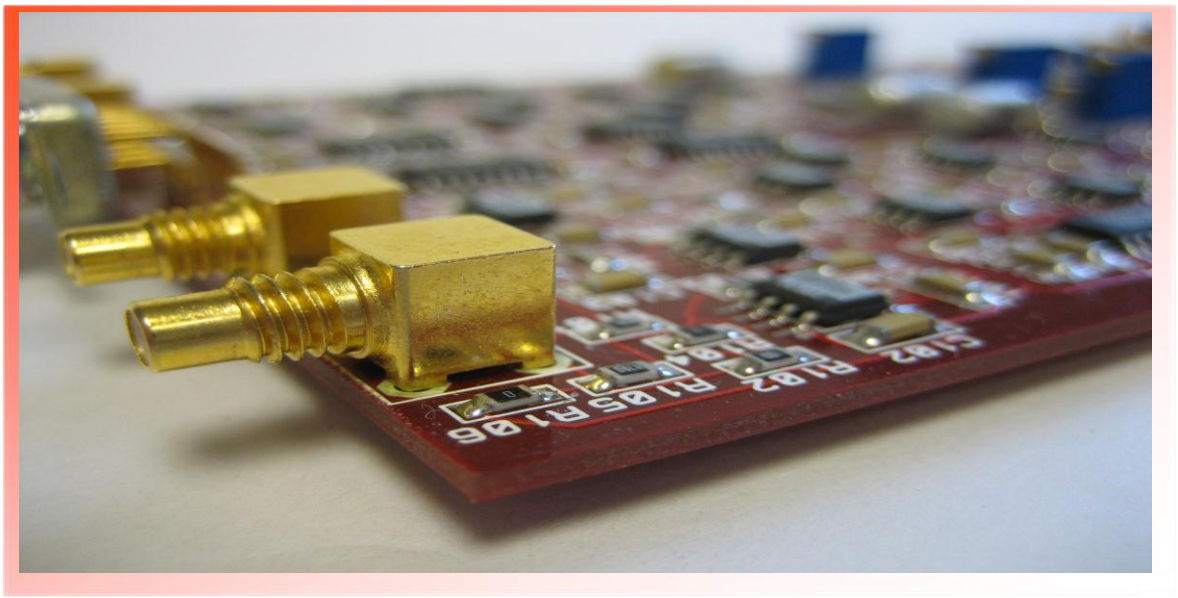
Noise performance and Speed of Operation

The current sequencer card can operate at frequencies of approximately 3MHz, although this may be lower depending on the sequencer program that is operating the CCD and various factors such as number of phases of operation of the CCD. The clock frequency of the CCD is usually 16-20MHz, giving the possibility of programming in 33-20ns steps.

Noise performance is heavily dependent on the speed of operation, the ADC method, and the CCD chip used. Typical values for noise for some common options, together with frequency of operation are given below in the table.

For any custom configuration not shown, please enquire for further information.

ADC Card	Speed	Noise
200KHz, single channel, Dual Slope Integrator	To 200KHz	Sensor noise limited if all voltages and timings optimised ~ 2-3 electrons
1MHz, 2 channel, Correlated Double Sampling	To 2MHz	Approximately 7 electrons (depending on sensor noise) at 1MHz
500KHz, 4 channel, Dual Slope Integrator	To 200KHz	Sensor noise limited if all voltages and timings optimised ~ 2-3 electrons



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Example System Specifications

Whilst choice of ADC card and speed of operation heavily influences the noise performance of the system, the sensor noise also plays a part. Some examples are given below of system performances as a guide.

CCD Type	No pixels and size	ADC Card and readout speed	Noise
CCD 42-40	2048x2048 13.5µm pixels	4 channel CDS @100KHz	<3e- rms
CCD 47-10	1033x1056 13µm pixels	4 channel CDS @100KHz	<3e- rms
CCD 57-10	512x512 15µm pixels	Dual Channel 1 MHz CDS	<10e rms

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