



LuckyXCAM Camera system

Product Specification Notes

Introduction

XCAM offers CCD cameras based on e2v Technologies range of L3 CCDs¹ (also commonly referred to as Electron Multiplying CCDs or EMCCDs) in a range of formats offering the following features and options:

General Features

- High speed means faster frame rates for both full frame and when reading out sub arrays: for example the CCD 97 can readout 552 x 132 pixels at about 160 Hz without any binning.
- By using focal plane masks even faster frame rates are possible; eg 110 x 132 @ 800Hz
- Use with gains of up to 4000 or gain turned off for normal CCD operation
- Optical Photon-Counting
- Systems are individually optimised for each CCD for the very best performance

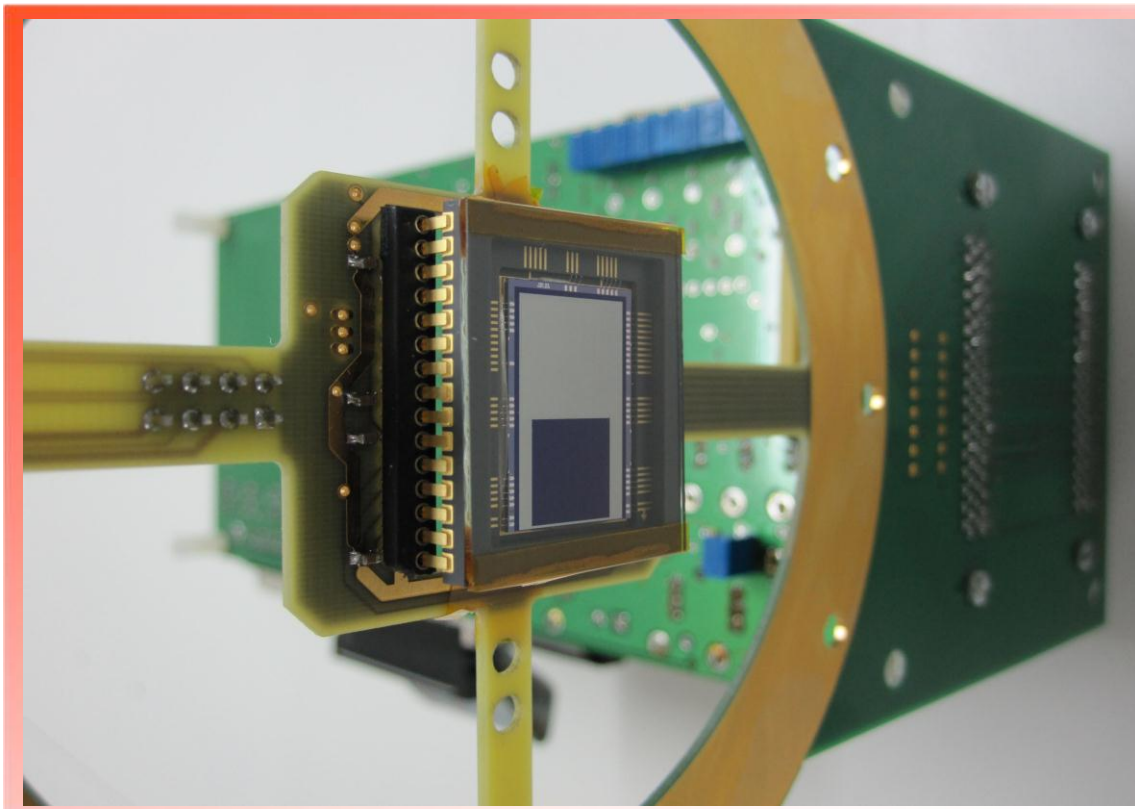


Figure 1: View of Internal Electronics with L3 CCD



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Camera System Features

- EM Gain: 1x up to 4000x under software control
- High Voltage clocks provide 45V swing at 16MHz (for e2v technologies L3 CCDs)
- High voltage clock stability: 10mV@45V
- Peak Signal: 130 ke⁻ for Gain=1, 1300 e⁻ for Gain=100, 130 e⁻ for Gain=1000
- Leakage Current: <4 e⁻/pix/s at -20°C Speed of operation: 15Mpix/s for CCD97, 25Mpix/s for CCD201
- All bias and clock voltages are fully software controllable
- Sequencer: allows flexibility in readout mode, binning, timings, etc.
- Digitisation: 14 bits with full double correlated sampling
- Readout noise: 90 electrons rms. with no EM gain, <1 electrons rms. with 100x EM gain and higher, etc.
- Camera system control communication industry standard USB2, Windows
- Data transfer: Parallel via high-speed LVDS drivers to PCI7300 data acquisition card
- System is modular, and can be expanded to increase the number of detectors being operated in parallel and simultaneously (up to 256)
- The same electronics can be upgraded to operate a different sensor with the modification of the headboard

Extremely Low Clock-induced Charge due to our Unique Analysis System

Our cryogenically-cooled systems have a unique design approach for the clock drivers which results in a very low level of clock induced charge compared to other systems on the market:

- Background equivalent number: 0.0005 electrons per pixel in a 50 ms exposure time of 0.005 electrons per pixel in a 30 ms exposure time quoted by other manufacturers

Cooling – A Range of Laboratory-Friendly Options for Vibration-free Operation

- Liquid Nitrogen cooled devices for -120C sealed vacuum operation – no water, no fan vibration
- UHV compatible systems on conflat flange or custom flange to order, with peltier and water cooling as required; suitable for X-ray and UV applications
- Connections provided for temperature monitoring and control

Custom Systems

- ***XCAM specialises in making custom CCD camera systems that are not available off-the-shelf, and operating CCDs in unusual read-out modes. Please contact us to discuss if you have a specific requirement.***



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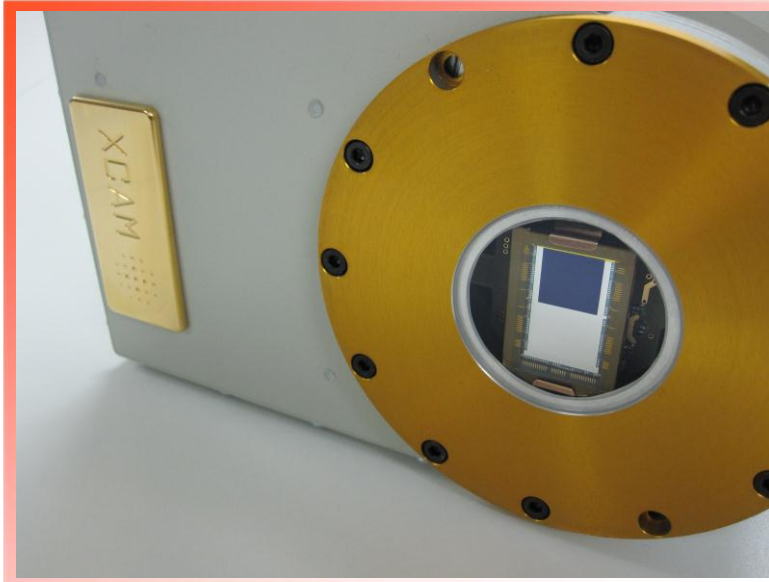


Figure 2 (left): Front of Camera System with CCD

CCD Options

- **CCD options:** all standard L3 frame transfer CCDs eg CCD97 (see Figure 1 below), CCD201 and full-frame L3 CCDs eg CCD207* and CCD207-10* all subject to availability from e2v Technologies
- **Custom and semi-custom sensors** (subject to availability); please enquire with your specific requirements and we can recommend custom specification suitable for your application
- **Image Clocks:** Camera drive electronics will operate devices with up to 4 phases, although 2-phase operation is recommended for fastest transfer times.
- **Coatings:** any e2v Technologies coating offered*, AR coating, mid-band coating is standard, other options may require special order
- **Wavelength range:** 350-1000 nm (see Figure 2 below)
- **Imaging mode:** Frame transfer or Full frame depending on device type, with multiple window selection possible

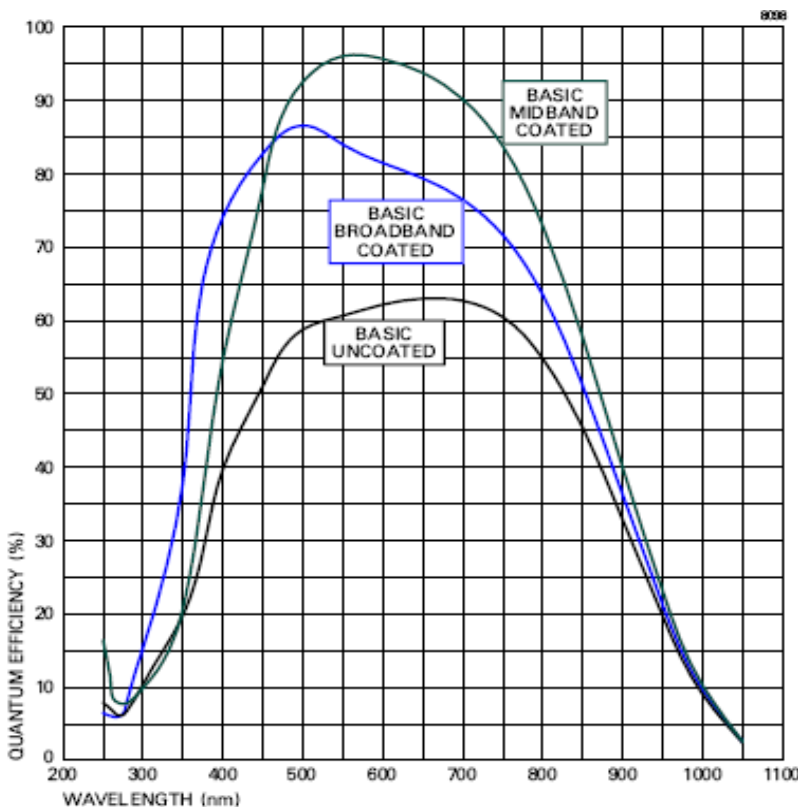


Fig 3: Quantum Efficiency Curve for L3 CCDs showing uncoated, Broadband and Midband coating options



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CCD Options and Characteristics

The following table shows some L3 CCDs available which can be operated by this drive system. E2v Technologies devices offer higher responsivities than Texas Instrument devices.

CCD type	Number Pixels	Pixel Size	Image Area	Frames per second (full image)	Speed of Operation
CCD60	128x128	24µm	3.072x3.072mm		
CCD97 Frame Transfer	512 x 512	16µm	8.192x8.192mm	57 fps	15MHz
CCD201 Frame Transfer	1024 x 1024	13.3µm	13.3x13.3mm	23 fps	25MHz
CCD207-00* Full Frame	1632 x 208	16µm	26.11x3.33mm	44 fps	15MHz
CCD207-10* Full Frame	1632 x 408	16µm	26.11x6.53mm	22 fps	15MHz

Figure 4: Table of CCD Properties and Speed of Operation

*All CCDs and specific coatings are subject to availability from E2v Technologies, and non-stock or non-standard items may be subject to MOQs or additional cost; please enquire if you have a specific requirement

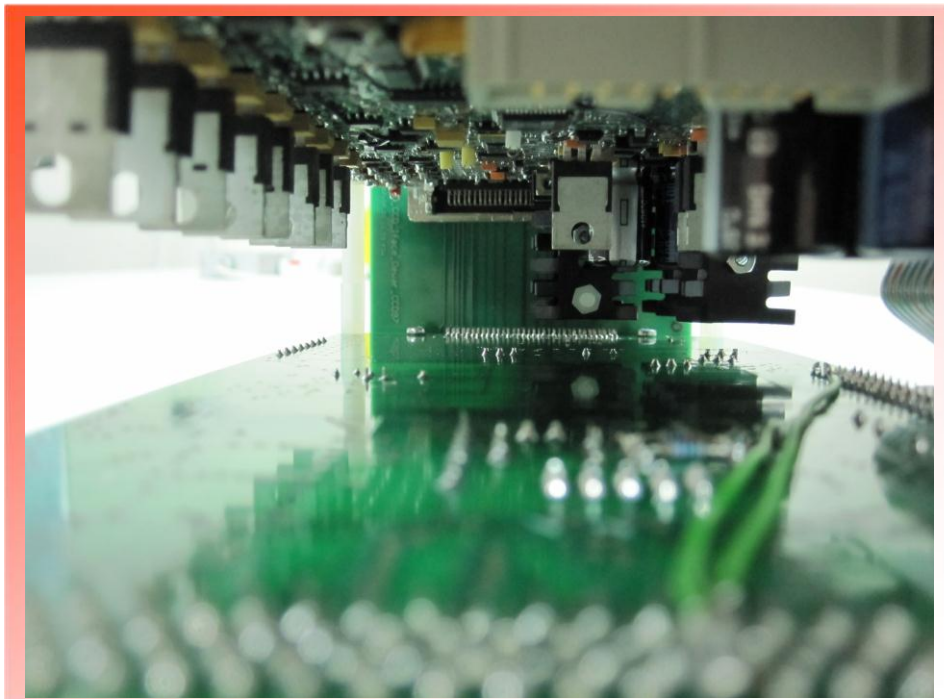


Figure 5: Internal view of High Speed Drive Electronics



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Technical Specifications and Details

Dimensions and Weight

The cryogenically cooled camera system, when empty, has maximum dimensions of approximately 36 x 22 x 14 cm, and weight of approximately 4.2Kg when empty. The centre of gravity of the camera head is about 12-15cm behind the interface



Figure 5: Images of the CCD Camera System showing each side (top left and top right) and the liquid nitrogen entry port (bottom left); front face image shown in figure 1.

For X-ray and UV use, the electronics alone, weighs approximately 450g, and to this must be added the weight of the conflat flange, on which the CCD, peltier, feedthroughs, water connections etc must be added.

Interface and Operation

Control is via USB2, with data transfer using a parallel PCI7300 data acquisition card for high speed data return.

Noise performance and Speed of Operation

<1 electron with 100 x gain or higher; 1 output node, 25MHz operation maximum speed (but can be limited by CCD type), 14 bits