

System Overview

Description	Model		Serial Number	
CCD Head ▽	D Z 4 36 -	BV-9CQ	CCD-	6546
Controller Card	CCI -010		CCD-	6546A
Power Supply Unit	PS 157		CCD-	6546
Multi I/O Box	IO		IO-	
Other	SD -166			
Build Features	(✓)		(✓)	
OPTION-C1-AR1		OPTION-C1-MGF2		
OPTION-C1-BKPLT		OPTION-C2-AR1		
OPTION-C1-LM-C		OPTION-C2-LMS-CEF		
OPTION-C1-LM-NF		OPTION-C2-LMS-NF		
OPTION-C1-LMS-NF		OPTION-C2-MGF2		

▽ Sensor types are defined in Table 1 using the last two letters in box Model Number.

CCD Details

Manufacturer / Model No.		Pixels Array	Size	Serial Number
e2v	CCD30-11	1024x256	26 μm^2	
e2v	CCD40-11	1024x128	26 μm^2	
e2v	CCD42-10	2048x512	13.5 μm^2	
e2v	CCD42-40	2048x2048	13.5 μm^2	04463-21-07
e2v	CCD47-10	1024x1024	13 μm^2	
e2v	CCD47-20	1024x1024 (FT)	13 μm^2	
e2v	CCD55-20	770x1152	22.5 μm^2	
e2v	CCD57-10	512x512, (FT)	13 μm^2	
e2v	CCD77-00	512x512	24 μm^2	
Kodak	KAF-1001E	1024x1024 (FT)	24 μm^2	

Card Details

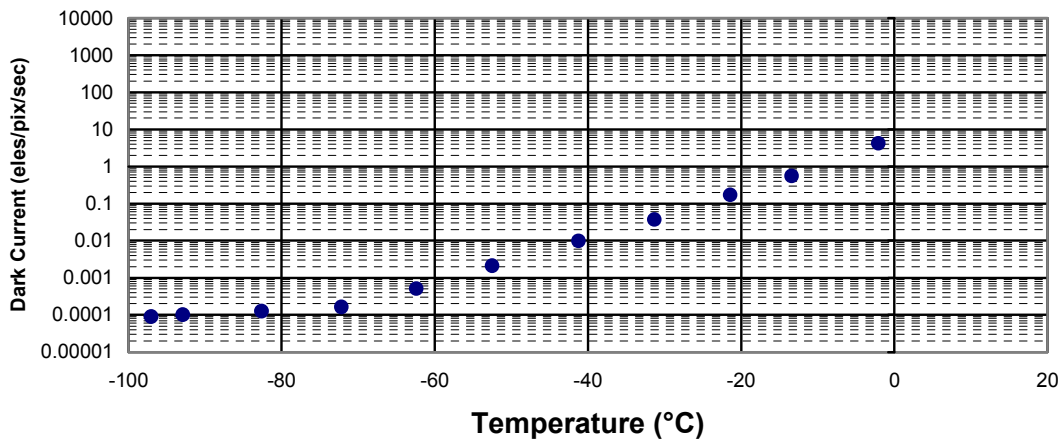
Model		A/D Resolution	Readout Speed
CCI-010	(1 MHz)	16-bit	1, 2, 16, 32 μs per pixel
CCI-001	(62 kHz)	16-bit	16, 32 μs per pixel

Summary of System Test Data

Readout Noise and Base Mean Level

A/D Rate	Digitization Time (μ s)	CCD Sensitivity \blacklozenge 1 eles per A/D count	Single Pixel \blacklozenge 2 Electrons	Full Vert Bin \blacklozenge 2 electrons	Base Level \blacklozenge 3 (Counts)
1 MHz (where applic.)	1	2	7.1	13.4	1580
500 kHz (where applic.)	2	2	6.0	13.9	534
62 kHz	16	1.4	1.9	11.8	155
31 kHz	32	0.7	1.7	11.5	267
Controller Noise	@ 62 kHz		0.6	A/D counts	
Saturation Signal per pixel \blacklozenge4			91749	Electrons/pixel	

CCD Dark Current



Minimum Dark Current Achievable \blacklozenge5	0.000094	electrons/pixel/sec
@ Sensor Temperature of \blacklozenge6	-99°C	achievable using 10°C cooling water with PSU. (see Comments)
Please, refer to system's specification sheet for range of minimum temperature achievable with other cooling setup		
CCD Dark Current Uniformity better than \blacklozenge7	0.319	electrons/pixel/sec

Linearity and Uniformity

Linearity better than \blacklozenge8	0.002	%
Response Uniformity better than \blacklozenge9	0.99	%

Response Defects

White/Black Spots ♦10		(X, Y)			
(287 , 733)	(,)	(,)	(,)	(,)	(,)
(288 , 733)	(,)	(,)	(,)	(,)	(,)
(732 , 1794)	(,)	(,)	(,)	(,)	(,)
(1695 , 1986)	(,)	(,)	(,)	(,)	(,)
(1696 , 1986)	(,)	(,)	(,)	(,)	(,)
(1734 , 1348)	(,)	(,)	(,)	(,)	(,)
(\ , \)	(,)	(,)	(,)	(,)	(,)
(\ , \)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)

White/Black Columns ♦11	\	\
Column numbers indicated.	\	\

Traps ♦12	Position indicated.	(,)	(,)
		(,)	(,)

Dark Current Defects

Hot Spots ♦13		(X, Y)			
(\ , \)	(,)	(,)	(,)	(,)	(,)
(\ , \)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)
(,)	(,)	(,)	(,)	(,)	(,)

Hot Columns ♦14	Column numbers indicated.	\	\
		\	\

Test Conditions

Readout Noise tested at	-50°C	Dark Current Uniformity tested at	-20°C
Base Mean Level tested at	-20°C	Blemishes tested at	-20°C

Additional Comments

Camera fully tested with 15 meter right-angled cable.

Minimum temperature of -90°C is achievable with RC180 with 20°C room temp and 25m tubing.

System Passed for Shipping

Signed

Date

M J F McELLIGOTT

20/09/06

Hardware	HEADBOARD	CC	CABLE	PSU	PLD
Version #	Ikon B	J	TPO4	B	
Shipping	MCD	SDK	COF	RBF	
Software	4.3	2.73	75	35	
Version #					
Testing	MCD	SDK	COF	RBF	
Software	4.3.0.0	\	75	35	
Version #					

▽ Table 1; Key code to define the meanings of the last two letters in the Model Number

Sensor Options			
OE	Open electrode	BV	BI + VIS (550nm) optimised
FI	Front illuminated (FI)	BR	BI + NIR (850) optimised
UV	FI+UV coating	BR-DD	BI+NIR+DD+AR coated [coating optimized 800-1030nm] wedged window std
FO	FI + Fibre optic	BN	BI with no AR coating
FI-DD	FI + deep depletion	FK	Fast Kinetics (masked; 3011 only)
BU2	Back Illuminated (BI) + 250nm UV optimised	KT	Kodak FI coating
BU	BI + Near UV (350nm) optimised		

Performance Notes

- ◆1 Sensitivity is measured in photoelectrons per A/D count from a plot of Variance [noise squared] against Signal. This quantity may not be measured on individual systems.
- ◆2 Readout Noise is measured for both single pixel (SP) and fully vertically binned (FVB) with the CCD in darkness at temperature indicated and minimum exposure time using 1,2,16 & 32 μ s per pixel readout. Note that the nominal gain changes for readout at 32 μ s per pixel.
- ◆3 Average electronic DC offset for CCD in darkness at temperature indicated and minimum exposure time under dark conditions measured by single pixel (SP) for imaging systems and by (FVB) for spectroscopic systems.
- ◆4 Saturation signal per pixel is reported in electrons for conditions of partial illumination of the sensor. Note: a fully illuminated sensor will have a lower saturation level
- ◆5 Dark current falls exponentially with temperature. However, for a given temperature the actual dark current can vary by more than an order of magnitude from device to device. The devices are specified in terms of minimum dark current achievable rather than minimum temperature.
- ◆6 Minimum temperature achieved for thermoelectric (TE) cooler set to maximum value with water cooling
- ◆7 RMS (root mean square) deviation of dark current for fully binned operation for spectroscopic cameras, or full resolution image for imaging cameras, under dark conditions at temperature indicated (pixel/column defects excluded). This variation is mainly cosmetic since it is fully subtractable without significant loss of performance.
- ◆8 Linearity is measured from a plot of counts vs. signal up to the saturation point of the system. Linearity is expressed as a percentage deviation from a straight line fit.
- ◆9 RMS (root mean square) deviation from the average response of the CCD in fully binned operation for spectroscopic cameras, or full resolution image for imaging cameras, illuminated with uniform white light (defects not included).
- ◆10 A black/white spot can be up to 3 pixels in size. White/black spots have signals >25% above/below the average (25% contrast) with uniform illumination across the sensor.
- ◆11 Columns whose signals have >10% contrast in binned operation with uniform illumination across the sensor for spectroscopic cameras, ≥ 10 black spots per column for imaging cameras.
- ◆12 Pixels >10% above/below the average (10% contrast) with uniform illumination across the sensor which absorb charge as it is clocked through the defective pixel. Three images are taken at three fill levels of charge (low, medium and high) with the largest number of contiguous pixels used to characterize the trap pixel. <4 blackspot, ≥ 4 and <30 trap and >29 black column
- ◆13 A hotspot is a pixel size blemish. Hot spots are counted if they exhibit >50 times the maximum specified dark current at the test temperature indicated.
- ◆14 A column is considered defective if >10 hotspot are affected, or if the column exhibits >2 times the maximum specified dark current at the test temperature indicated.