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CCD-18964
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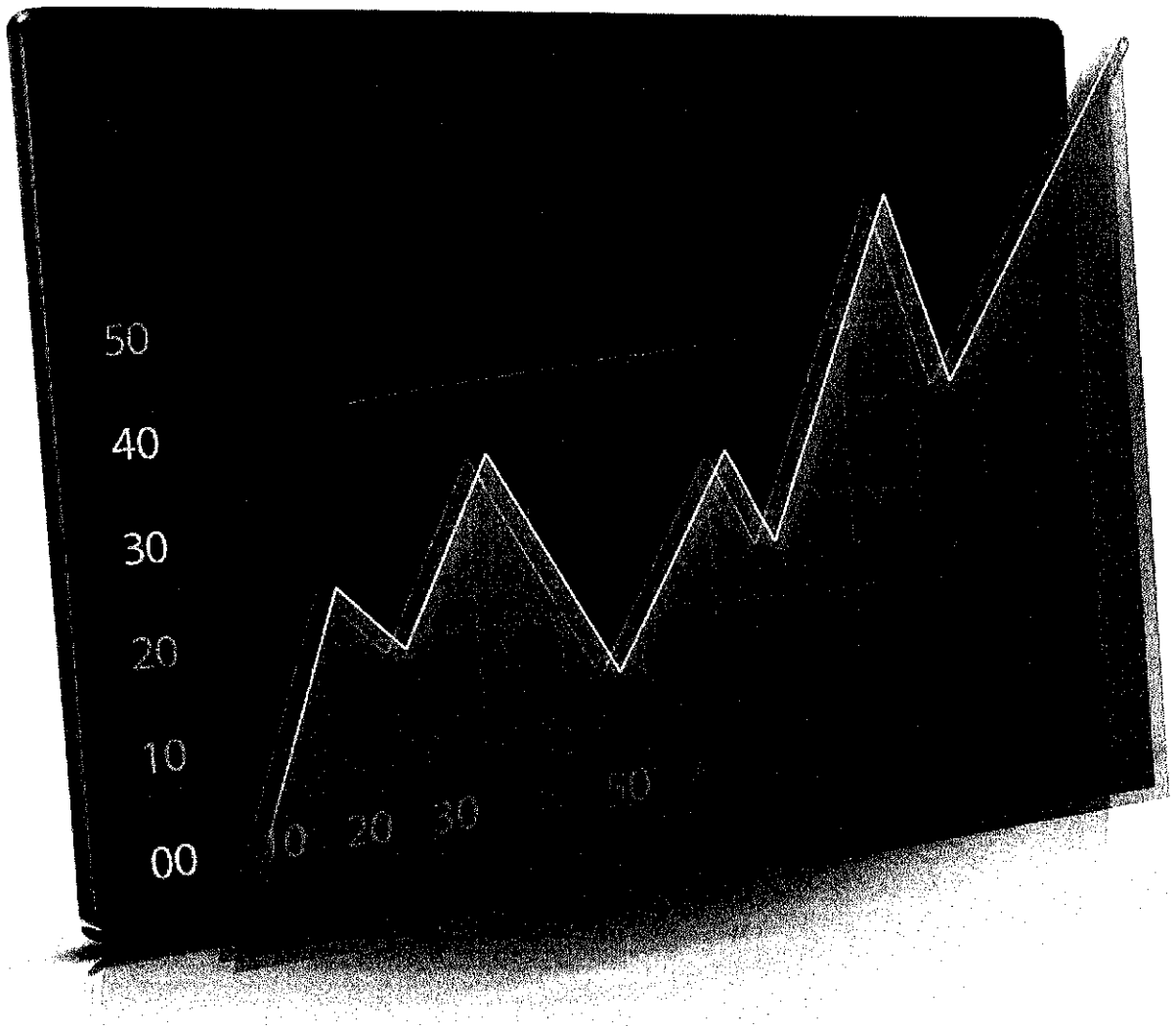
System Performance Booklet

DZ936N-BEX2-DD-9TT_1



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CCD PERFORMANCE

System Overview

Description	Model						Serial Number	
CCD Head ▽	D	Z	9	36N	-	BEX2-DD-9TT	CCD-18964	
TE Cooler performance (✔)						High		Ultra-high ✔
Power Supply Units						PS -29		PS -40
						✔		✔
Accessories						LM-		MFL-
Serial/Batch Number								
Other								

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

CCD Details

Manufacturer / Model No.	Pixels	Serial Number
E2V CCD42-40	2048x2048, 13.5µm x 13.5µm	12321-05-04

Special Features	(✔)		(✔)
NIMO	✔	Nikon F-mount with Shutter	
Fringe Suppression		Custom Cables	
Shielded Anti-Blooming			

Window Variant	(✔)		(✔)
VUV-UV Parallel		NUV-Enhanced Parallel	
Broadband VUV-NIR Wedged		Broadband VUV-NIR Parallel	
Broadband VIS-NIR Wedged		Broadband VIS-NIR Parallel	
VIS-NIR Enhanced Wedged		Bose-Einstein 780nm Wedged	
None		Other	✔

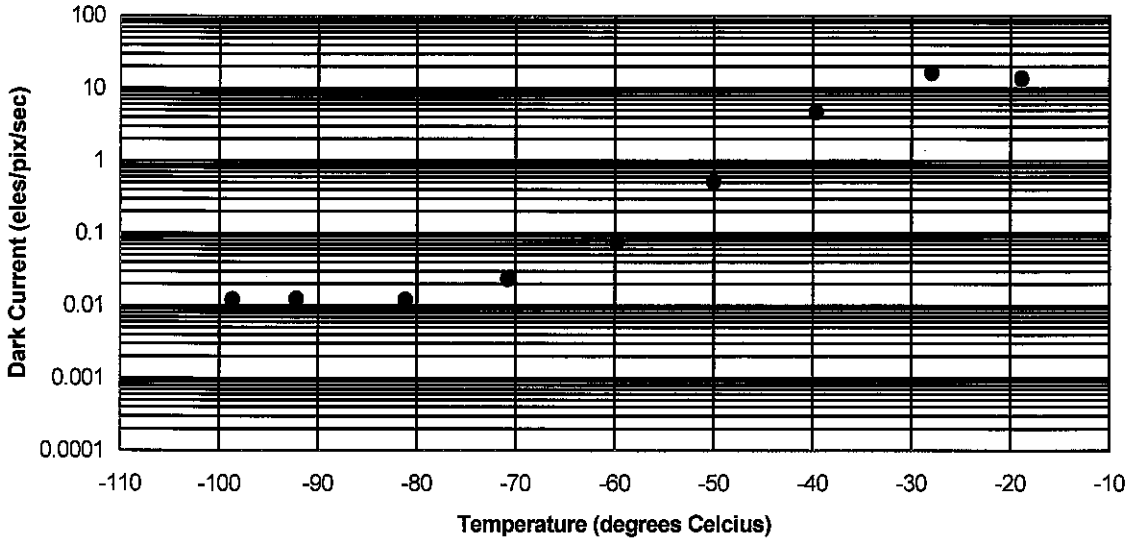
CCD PERFORMANCE

Summary of System Test Data

Readout Noise ♦1 and Base Mean Level ♦2

A/D Rate MHz - all 16 bit	Preamp setting	CCD Sensitivity ♦3 e- per A/D count		Single Pixel Noise electrons rms		Base Mean Level A/D counts	
		High Sensitivity Mode	High Capacity Mode	High Sensitivity Mode	High Capacity Mode	High Sensitivity Mode	High Capacity Mode
5.0	x1	6.9	21.9	40.8	113.3	2071	965
5.0	x2	3.5	12.3	29.7	82.1	3122	986
5.0	x4	1.8	6.3	21.6	60.9	3468	969
3.0	x1	4.4	17.2	21.4	82.6	927	828
3.0	x2	2.3	9.5	13.7	51.2	1618	1401
3.0	x4	1.0	5.2	9.4	41.0	2333	2512
1.0	x1	4.1	18.1	10.4	39.7	830	1059
1.0	x2	2.2	9.8	7.8	29.1	1325	1757
1.0	x4	1.1	5.2	6.2	25.8	2231	3042
0.05	x1	4.1	17.9	5.5	17.6	825	1051
0.05	x2	2.2	9.8	4.8	13.4	1305	1729
0.05	x4	1.1	5.4	3.9	12.5	2193	2982
Saturation Signal per pixel ♦14				146662		electrons	

CCD Dark Current



Minimum Dark Current Achievable ♦4	0.012103	electrons/pixel/sec		
@ Sensor Temperature of ♦5	-98.717	°C	16.0	°C cooling water
CCD Dark Current Uniformity better than ♦6	1.196524	electrons/pixel/sec		

CCD PERFORMANCE

Linearity and Uniformity

Linearity better than ♦7	1	% over 16 bits
Response Uniformity better than ♦8	1.86	%

Response Defects

White/Black Spots ♦9

(X , Y) Number of Pixels

X	Y	Number of Pixels	X	Y	Number of Pixels
116	5	1			
146	78	1			
590	95	1			
856	147	1			
833	194	1			
938	197	1			
582	330	1			
1192	410	1			
X	X	X			

White/Black Columns ♦10		X	X
Column numbers indicated.		X	X
Traps ♦11	Column numbers indicated.	X	X

Dark Current Defects

Hot Spots ♦12

(X , Y)

X	X						

Hot Columns ♦13	Column numbers indicated.	X	X

CCD PERFORMANCE

Test Conditions

Readout Noise tested at	-90	°C with	16	°C water
Base Mean Level measured at	-90	°C with	16	°C water
Dark Current Uniformity tested at	-50	°C with	16	°C water
Blemishes tested at	-50	°C with	16	°C water

Custom Testing

System Passed for Shipping

Signed K.MCDOWELL

Date 23TH MARCH 2016

	HEADBOARD	FPGA
Hardware Version #	AE	20.12
	SOLIS	SDK
Shipping Software Version #	--	--
	SOLIS	SDK
Testing Software Version #	4.28.30026.0	2.100.33026.0

▽ 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 +deepdepletion
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 + UV (350nm) optimised		

Performance Notes

♦1 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. Noise values will change with pre-amplifier gain selection [PAG].

♦2 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.

♦3 Sensitivity is calculated in photoelectrons per A/D count from measurements of the Photon Transfer Curves.

♦4 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.

♦5 Minimum temperature achieved for thermoelectric (TE) cooler set to maximum value with water cooling

♦6 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 not included). This variation is mainly cosmetic since it is fully subtractable without significant loss of performance.

♦7 Linearity is measured from a plot of Counts vs. Signal over the 16 bit dynamic range. Linearity is expressed as a %age deviation from a straight line fit. This quantity is not measured on individual systems.

♦8 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).

♦9 White/black spots have signals >25% above/below the average (i.e >25% contrast) with uniform illumination across the sensor.

♦10 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.

♦11 Pixels which absorb charge as it is clocked through the defective area. When the light source is switched off, the signal from the trap appears to drop off more slowly than the signal from the surrounding pixels.

♦12 A spot can be up to 3 pixels in size. For Grade A devices, hot spots are counted if they exhibit >50 times the maximum specified dark current at the test temperature indicated.

♦13 A column is considered defective if >10 pixels are affected, or if the column exhibits >2 times the maximum specified dark current at the test temperature indicated.

♦14 Saturation Signal per pixel is measured at 1MHz PreAmp x1 High Sensitivity mode