

# System Performance Booklet



## SYSTEM OVERVIEW

### COMPONENTS

Description	Model	Serial Number
Head	DU-888U3-CS0-EXF	X-10639

### SENSOR DETAILS

Manufacturer / Model No.	Pixels	Description
E2V / CCD201-20-1-179	1024x1024, 13µm x 13µm	Back-illum., Fringe Suppression, Dual AR-coated

### WINDOW VARIANT

Window Variant	Broadband VUV-NIR Wedged
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## SUMMARY OF SYSTEM TEST DATA

### SENSITIVITY & READOUT NOISE

System Readout Rate	Preamp setting	CCD Sensitivity ♦1 (electrons per A/D count)	Single Pixel Noise ♦2 (electrons)
30 MHz, 16-bit Single, EM amplifier	1	16.2	186
	2	4.98	113
20 MHz, 16-bit Single, EM amplifier	1	15.8	140
	2	4.25	65.7
10 MHz, 16-bit Single, EM amplifier	1	15.6	77.3
	2	3.94	39.8
1 MHz, 16-bit Single, EM amplifier	1	15.8	24.2
	2	3.90	12.0
1 MHz, 16-bit Single, Conventional amplifier	1	3.34	6.41
	2	0.800	4.66
0.1MHz, 16-bit Single, Conventional amplifier	1	3.37	9.71
	2	0.810	3.27

### PIXEL WELL DEPTHS & CLOCK-INDUCED CHARGE

Image Area Saturation Signal Per Pixel (Fastest Horizontal Speed 16-bit EM amplifier)	88100	electrons / pixel
Clock Induced Charge ♦3	0.00155	events / pixel

### LINEARITY AND UNIFORMITY

Measured Amplifier Linearity ♦4	0.0000157	%
Photon Response Non-Uniformity ♦5	0.09	%



CCD DARK CURRENT

Minimum Dark Current Achievable ♦6	8.5E-05	electrons / pixel / sec
@ Sensor Temperature of ♦7	-101.33	°C and 16 °C water cooling
Dark Signal Non-Uniformity	0.008	electrons / sec

DEFECTS

SPOT DEFECTS ♦8 (Centroid(X, Y) . No. of Pixels Affected, defect type)  
No spot defects.

COLUMN DEFECTS ♦9 (Column No.)  
No column defects.

TRAPS ♦10 ( Location(X, Y) )  
No traps.

TEST CONDITIONS

Readout Noise tested at	-70	°C with 16 °C water cooling
Base Mean Level	-70	°C with 16 °C water cooling
Blemishes tested at	-70	°C with 16 °C water cooling

SYSTEM PASSED FOR SHIPPING

Test Technician	Date
Patrick McAlinden	24/02/2017

NOTES

- ◆ 1 Sensitivity is measured in electrons per A/D count from a plot of Variance [Noise squared] against Signal.
- ◆ 2 RMS Readout Noise is measured for single pixel readout with the CCD in darkness at temperature indicated and minimum exposure time. Noise values will change with pre-amplifier gain selection [PAG].
- ◆ 3 CIC is measured in darkness with EM gain set to the operating maximum (1000x) at fastest Horizontal Shift Speed and second fastest Vertical Shift Speed. A threshold in counts above the base mean level equivalent to the number of electrons that would be output at the maximum EM gain is determined using the camera's sensitivity at these settings. The number of pixels with count values above that threshold is counted and this is converted to a number of events per total pixels on the sensor.
- ◆ 4 Linearity is measured from a plot of exposure vs. counts up to the saturation point of the system. Linearity is expressed as a percentage deviation from a straight line fit.
- ◆ 5 RMS (root mean square) deviation from the average response of the CCD in full resolution image operation illuminated with uniform white light (defects not included).
- ◆ 6 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.
- ◆ 7 Minimum temperature achieved for thermoelectric (TE) cooler set to maximum value with water cooling.
- ◆ 8 White/black spots have signals >25% above/below the average (25% contrast) with uniform illumination across the sensor. A hot 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.
- ◆ 9 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. White/black columns have ≥10 white/black spots with uniform illumination across the sensor.
- ◆ 10 Traps are 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.