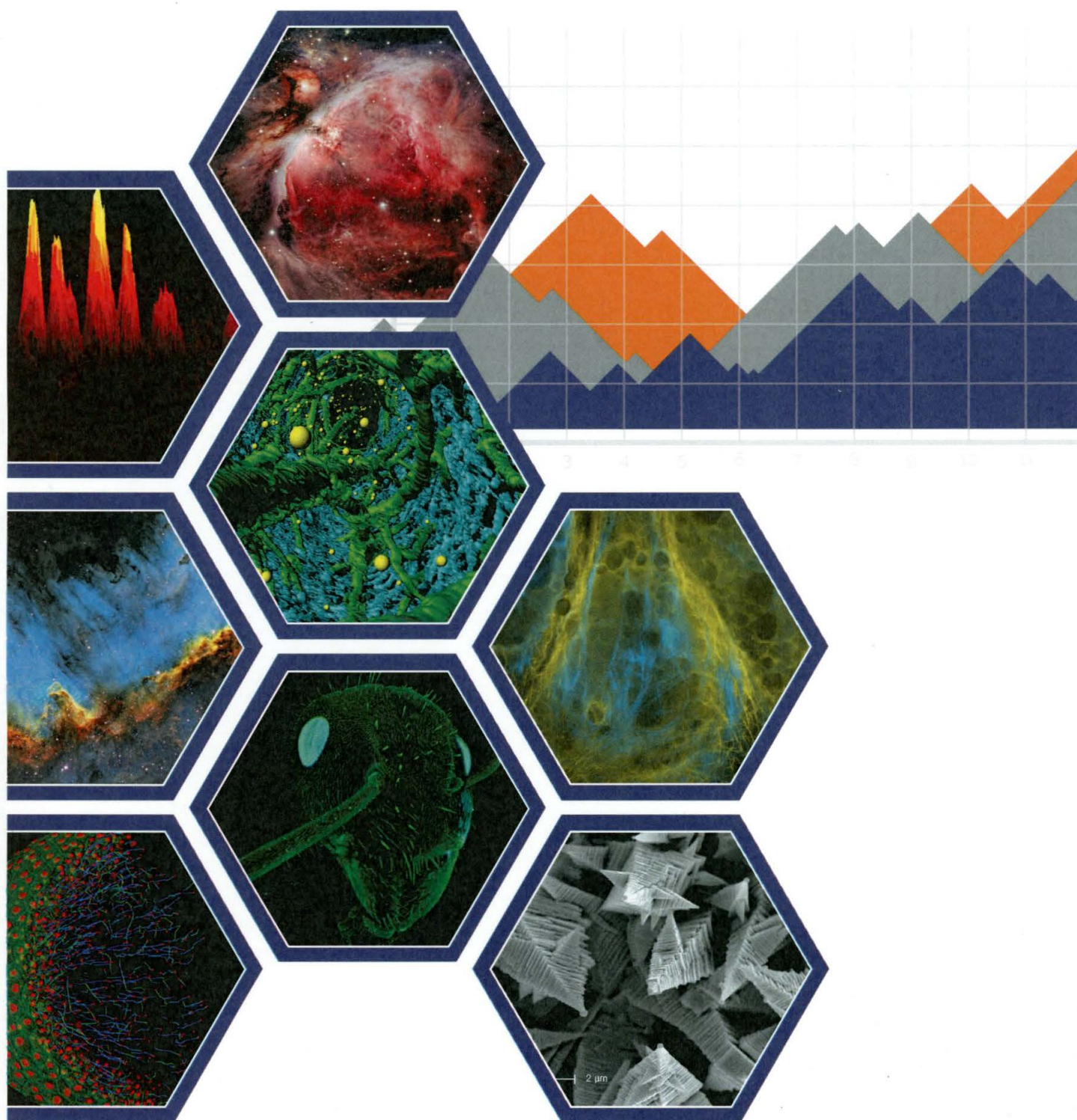


RMA# R62043

CCD-17879  
RS01

**ANDOR**  
an Oxford Instruments company

## System Performance Booklet



SHIPMENT NO: **R62043**  
Andor Order No: R62043  
Division: US / Unknown  
Customer Order No: F018896

Date: 30 October 2018

**Ship To:**

SJSU RESEARCH FOUNDATION  
MLML MARK YARBROUGH  
965 N NIMITZ HWY  
HONOLULU HI 96817  
UNITED STATES

**Customs Information:**

UG-STD

Goods are part of an Optical  
Checking/Measuring Device  
Harmonized No 90275000  
Manufacturer code GBANDTEC7BEL  
Goods are made in the UK  
Values are for Customs Purposes

These goods are uncontrolled  
to destination.  
Goods re-exported may require an  
export licence

ITEM	PART NUMBER	DESCRIPTION	QUANTITY	UNIT PRICE	VALUE
1	NWR (S)	NON WARRANTY REPAIR R62043	1	1,750.00	1,750.00
		DU934P-BR-DD CCD-17879 → R501			
		VALUE FOR CUSTOMS USD 15000			
		CPC 3151000 - IPR IP/0920/500/21			
		HS CODE 9802004040 - 8525804000			
		TERMS NET 30			
		CONFIRM TO HUE NGO			
		EU MARK YARBROUGH			
		ANDOR CONTACT TONY GADOLA			

ups tracking delivered 01-Nov-2018

<b>CARRIER:</b>	<b>AIRWAY BILL:</b> 1Z8W40070460183244	<b>PACKAGES:</b> 1	<b>TOTAL (Exc. Tax)</b> 1,750.00 USD
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## Returns Report

<b>Customer</b>	ANDUSA Yarbrough/MLML	<b>Returns No</b>	R62043
<b>Classification</b>	NON WARRANTY	<b>Customer RMA No</b>	None

<b>Equipment Details</b>	<b>Model</b>	<b>Serial Number</b>
<b>Head</b>	DU934P-BR-DD	CCD-17879
<b>Card</b>		
<b>PSU</b>		
<b>Multi IO</b>		
<b>Other</b>		

### Reported Fault

Returning iKon-M camera for widow changes.

Camera parallel window to be replaced with WN35FS Broadband VUV-NIR Wedged windows, code- (BB-VV-NR)W.

### Diagnosis

Confirmed requested wedged window replacement required.

### Work Carried Out

Wedged window installed.

Full system QC & new performance sheets completed: - Passed.

	<b>Receipt Date</b>	<b>Work Complete</b>	<b>Passed For Shipping</b>	<b>Shipped</b>
<b>Date</b>	22/08/2018	25/10/18	25/10/18	
<b>Initials</b>	PMC	PJ	MB	

\* In the case of Products which are upgraded, the old Model No / Serial No are bracketed first, followed by the new Nos:

\*\* Returns must be passed for shipping by the manufacturing manager and / or Sales Support



## System Overview

Description	Model	Serial Number
CCD Head <input checked="" type="checkbox"/>	D U 9 34P - BR-DD	CCD-17879
TE Cooler performance ( <input checked="" type="checkbox"/> )	High	Ultra-high <input checked="" type="checkbox"/>
Accessories	Power Supply Unit (PS -24)	PS -25
	--	<input checked="" type="checkbox"/>
	SO- 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 CCD47-10	1024x1024, 13 $\mu$ m x 13 $\mu$ m	12262-06-02
E2V CCD57-10	512x512, (FT), 13 $\mu$ m x 13 $\mu$ m	
E2V CCD77-00	512x512, 24 $\mu$ m x 24 $\mu$ m	

Special Feature	( <input checked="" type="checkbox"/> )	( <input checked="" type="checkbox"/> )
NIMO		Custom Mounting Flange
Fringe Suppression		Custom Cables
Shielded Anti-Blooming		

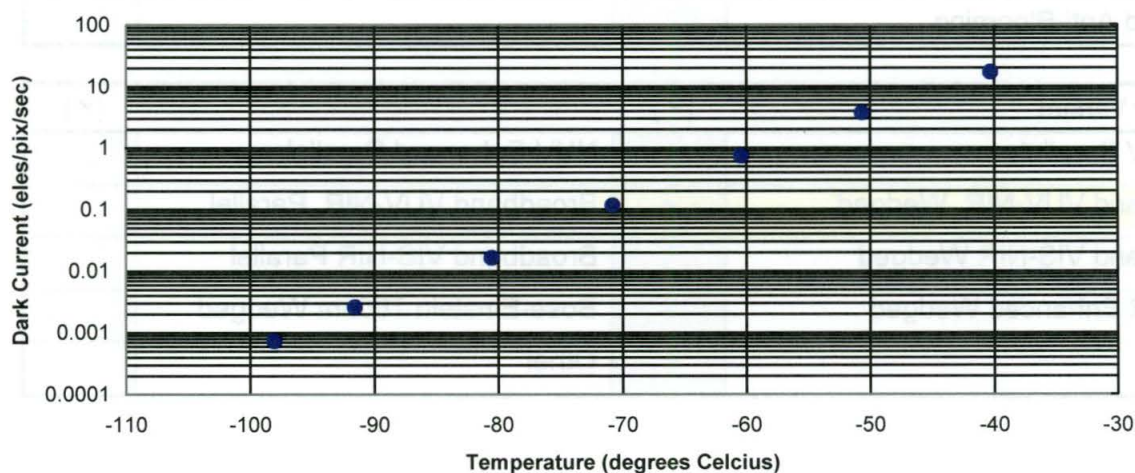
Window Variant	( <input checked="" type="checkbox"/> )	( <input checked="" type="checkbox"/> )
VUV-UV Parallel		NUV-Enhanced Parallel
Broadband VUV-NIR Wedged	<input checked="" type="checkbox"/>	Broadband VUV-NIR Parallel
Broadband VIS-NIR Wedged		Broadband VIS-NIR Parallel
VIS-NIR Enhanced Wedged		Bose-Einstein 780nm Wedged
None		Other

## Summary of System Test Data

### Readout Noise ♦1 and Base Mean Level

A/D Rate (MHz All 16 bit)	Preamp setting	CCD Sensitivity ♦3 eles per A/D count	Single Pixel Noise electrons	Full Vert Bin Noise electrons	Base Level ♦2 (Counts)
5	x1	7.0	36.2	35.6	937
5	x2	3.7	21.5	24.4	1547
5	x4	1.7	15.1	15.0	3032
3	x1	6.1	20.7	19.3	1057
3	x2	3.0	12.9	13.0	1978
3	x4	1.4	10.6	10.5	3696
1	x1	5.7	11.5	11.2	928
1	x2	2.8	8.0	7.7	1875
1	x4	1.3	6.6	6.6	3814
0.05	x1	5.6	5.2	5.2	540
0.05	x2	2.9	4.0	4.0	1461
0.05	x4	1.3	3.5	3.4	3348
Saturation Signal per pixel			134543	Electrons/pixel	

### CCD Dark Current



Minimum Dark Current Achievable ♦4	0.000732	electrons/pixel/sec		
@ Sensor Temperature of ♦5	-98.068	°C	16	°C cooling Water
		With PS-25		
CCD Dark Current Uniformity better than ♦6	0.29705	electrons/pixel/sec		



## Linearity and Uniformity

Linearity better than ♦7	1	% over 16 bits
Response Uniformity better than ♦8	1.85	%

## Response Defects

White/Black Spots ♦9 <span style="float: right;">(X, Y)</span>			
Centroid	Number of Pixels	Centroid	Number of Pixels
( 52 , 792 )	1	( , )	
( X , X )	X	( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	

White/Black Columns ♦10	Column numbers indicated	<input type="checkbox"/> X	<input type="checkbox"/> X
		<input type="checkbox"/> X	<input type="checkbox"/> X

Trap ♦11	(X, Y)	( <input type="checkbox"/> X , <input type="checkbox"/> X )
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## Dark Current Defects

Hot Spots ♦12 <span style="float: right;">(X, Y)</span>			
Centroid	Number of Pixels	Centroid	Number of Pixels
( X , X )	X	( , )	
( X , X )	X	( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	

Hot Columns ♦13	Column numbers indicated	<input type="checkbox"/> X	<input type="checkbox"/> X
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## Test Conditions

Readout Noise tested at	-80	°C with	16	°C water
Base Mean Level measured at	-80	°C with	16	°C water
Dark Current Uniformity tested at	-65	°C with	16	°C water
Blemishes tested at	-65	°C with	16	°C water

## Custom Testing

WN35FS Broadband VUV-NIR Wedged window fitted as per customer request

## System Passed for Shipping

Signed

Date

**PATRICK MCCANN**

**8<sup>TH</sup> OCTOBER 2018**

Hardware	HEADBOARD	FPGA
Version #	AB	20.24
Shipping Software	SOLIS	SDK
Version #	--	--
Testing Software	SOLIS	SDK
Version #	4.32.30014.0	2.103.33014.0

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

Sensor Options			
OE	Open electrode	BU2	Back Illuminated (BI) + 250nm UV optimised
FI	Front illuminated (FI)	BU	BI + UV (350nm) optimised
UV	FI+UV coating	BV	BI + VIS (550nm) optimised
FO	FI + Fibre optic	BR-DD	BI + NIR +deepdepletion
FI-DD	FI + deep depletion	BN	BI with no AR coating

**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 Curve.
- ◆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 full resolution image for imaging cameras, illuminated with uniform white light (defects not included).
- ◆9 White/black pixels have signals >25% above/below the average (25% contrast) with uniform illumination across the sensor.
- ◆10 A black column is defined as having  $\geq 10$  black pixels 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 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.