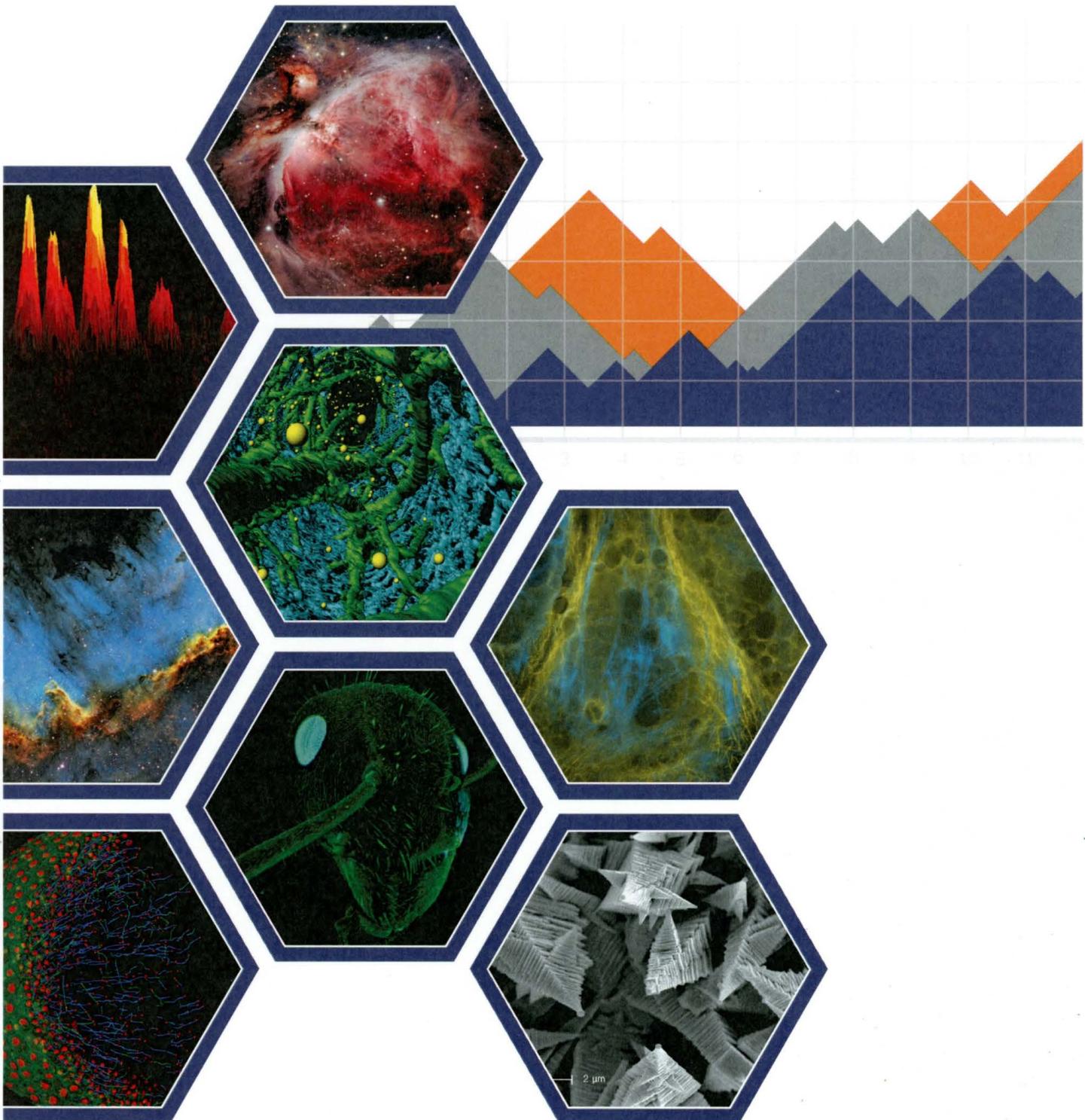


R62040

CCD-16343  
RS05

**ANDOR**  
an Oxford Instruments company

# System Performance Booklet



SHIPMENT NO: **R62040**  
 Andor Order No: R62040  
 Division: US / Unknown  
 Customer Order No: F018893

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 R62040	1	1,750.00	1,750.00
	<i>RS05</i>	DU934P-BR-DD <b>CCD-16343</b> ✓			
		VALUE FOR CUSTOMS USD 15000			
		CPC 3151000 - IPR IP/0920/500/21			
		HS CODE 9802004040 - 8525804000			
		TERMS NET 30			
		CONFIRM TO HUE NGO			
		END USER MARK YARBROUGH			
		ANDOR CONTACT TONY GADOLA			
<b>CARRIER:</b>			<b>AIRWAY BILL:</b> 1Z8W40070459571863	<b>PACKAGES:</b> 1	<b>TOTAL (Exc. Tax) 1,750.00 USD</b>

*13 Nov 2018, MF*

*UPS tracking delivered 01-Nov-2018*

## Returns Report

<b>Customer</b>	ANDUSA Yarbrough/MLML	<b>Returns No</b>	R62040
<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-16343
<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 ▽	D U 9 34P - BR-DD	CCD-16343
TE Cooler performance (✓)	High	Ultra-high ✓
Accessories	Power Supply Unit (PS -24)	PS -25
	--	✓
	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, 13µm x 13µm	10141-09-13
E2V CCD57-10	512x512, (FT), 13µm x 13µm	
E2V CCD77-00	512x512, 24µm x 24µm	

Special Feature	(✓)	(✓)
NIMO	✓	Custom Mounting Flange
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

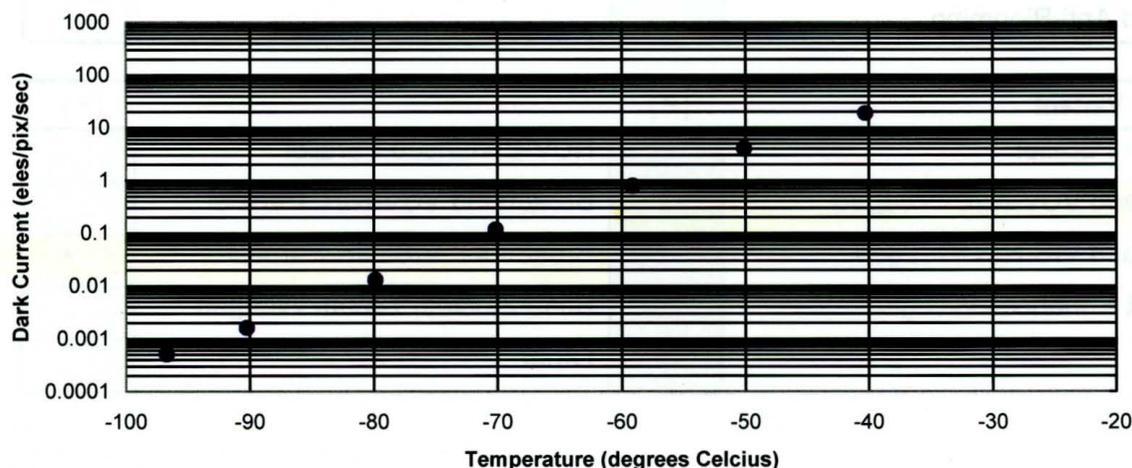
NOT!

**Summary of System Test Data**

**Readout Noise  $\blacklozenge$ 1 and Base Mean Level**

A/D Rate (MHz All 16 bit)	Preamp setting	CCD	Single Pixel	Full Vert Bin	Base Level $\blacklozenge$ 2
		Sensitivity $\blacklozenge$ 3 eles per A/D count	Noise electrons	Noise electrons	(Counts)
5	x1	6.9	36.5	35.7	1059
5	x2	3.4	20.1	21.4	1814
5	x4	1.6	15.2	14.0	2576
3	x1	5.7	19.3	18.9	1037
3	x2	3.0	12.7	13.2	1934
3	x4	1.3	10.2	10.3	3305
1	x1	5.1	10.7	10.7	902
1	x2	2.7	8.1	8.1	1816
1	x4	1.2	6.3	6.2	3696
0.05	x1	5.2	5.1	5.1	537
0.05	x2	2.7	4.2	4.3	1437
0.05	x4	1.2	3.5	3.6	3286
<b>Saturation Signal per pixel</b>			127747	Electrons/pixel	

**CCD Dark Current**



<b>Minimum Dark Current Achievable <math>\blacklozenge</math>4</b>	0.000508	electrons/pixel/sec		
<b>@ Sensor Temperature of <math>\blacklozenge</math>5</b>	-96.77	°C	16	°C cooling Water
		With PS-25		
<b>CCD Dark Current Uniformity better than <math>\blacklozenge</math>6</b>	0.2816	electrons/pixel/sec		

**Linearity and Uniformity**

Linearity better than $\diamond 7$	1	% over 16 bits
Response Uniformity better than $\diamond 8$	2.2	%

**Response Defects**

<b>White/Black Spots <math>\diamond 9</math></b> (X, Y)			
<b>Centroid</b>	<b>Number of Pixels</b>	<b>Centroid</b>	<b>Number of Pixels</b>
( 439 , 742 )	1	( , )	
( X , X )	X	( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
<b>White/Black Columns <math>\diamond 10</math></b>		Column numbers indicated	<input type="checkbox"/> X <input type="checkbox"/> X <input type="checkbox"/> X <input type="checkbox"/> X
<b>Trap <math>\diamond 11</math></b>		(X, Y)	( <input type="checkbox"/> X , <input type="checkbox"/> X )

**Dark Current Defects**

<b>Hot Spots <math>\diamond 12</math></b> (X, Y)			
<b>Centroid</b>	<b>Number of Pixels</b>	<b>Centroid</b>	<b>Number of Pixels</b>
( X , X )	X	( , )	
( X , X )	X	( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
( , )		( , )	
<b>Hot Columns <math>\diamond 13</math></b>		Column numbers indicated	<input type="checkbox"/> X <input type="checkbox"/> X

**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**

**System Passed for Shipping**

Signed

Date

**D.McINTYRE**

**20<sup>TH</sup> SEPT 2018**

Hardware	HEADBOARD	FPGA	<i>rcvd 22 Aug 2018</i>
Version #	AG	20.24	
Shipping Software	SOLIS	SDK	
Version #	--	--	
Testing Software	SOLIS	SDK	
Version #	4.30.30045.0	2.102.33045.0	

▽ **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.