RMA# R62044 CCD-17880 RS02

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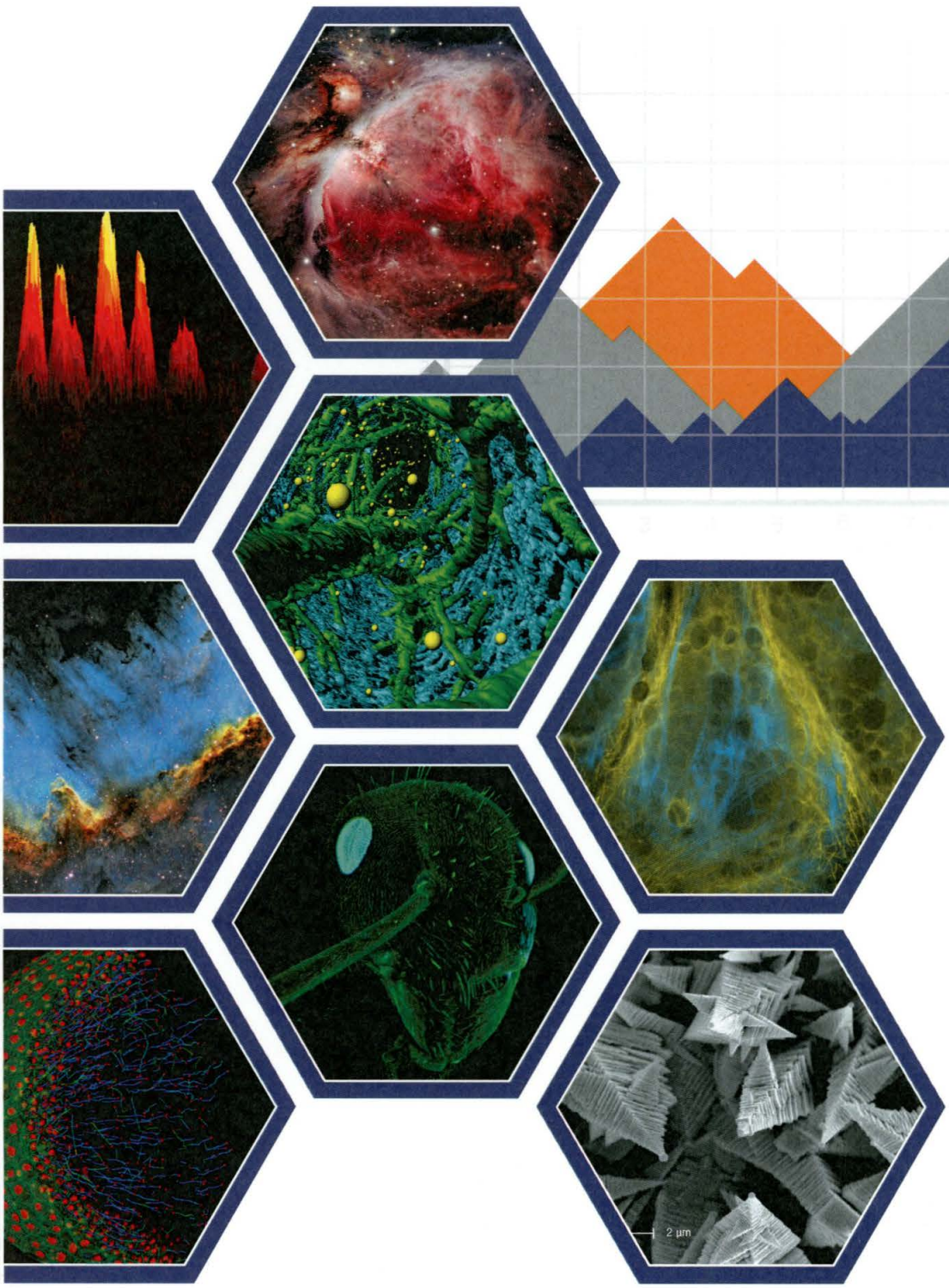
System Performance Booklet



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SHIPPING INVOICE

SHIPMENT NO: **R62044**

Date: 30 October 2018

Andor Order No: R62044

Division : US / Unknown

Customer Order No: F018897

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 R62044	1	1,750.00	1,750.00
		DU934P-BR-DD CCD-17880 → RS02			
		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 GAODLA			

UPS tracking delivered 01-Nov-2018

CARRIER: **AIRWAY BILL:** 1Z8W40070459079173 **PACKAGES:** 1 **TOTAL (Exc. Tax)** **1,750.00 USD**

9 MILLENNIUM WAY, SPRINGVALE BUSINESS PARK,
BELFAST BT12 7AL, NORTHERN IRELAND
TEL +44 (0)28 9023 7126 FAX +44 (0)28 9031 0792
WEBSITE www.andor.com
COMPANY REG NO. NI22466 VAT REG NO. GB 517 1829 44

Importer on Record:
Andor Technology US
425 Sullivan Avenue - Suite 3
South Windsor
CT 06074

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Returns Report

Customer	ANDUSA Yarbrough/MLML	**Returns No**	R62044
Classification	NON WARRANTY	**Customer RMA No**	None

Equipment Details	**Model**	**Serial Number**
Head	DU934P-BR-DD	CCD-17880
Card		
PSU		
Multi IO		
Other		

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.

	Receipt Date	**Work Complete**	**Passed For Shipping**	**Shipped**
Date	22/08/2018	25/10/18	25/10/18	
Initials	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

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CCD PERFORMANCE

System Overview

Description	Model						Serial Number
CCD Head ▽	D	U	9	34P	-	BR-DD	CCD-17880
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	12262-06-08
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	✔ NOT !
VIS-NIR Enhanced Wedged		Bose-Einstein 780nm Wedged	
None		Other	

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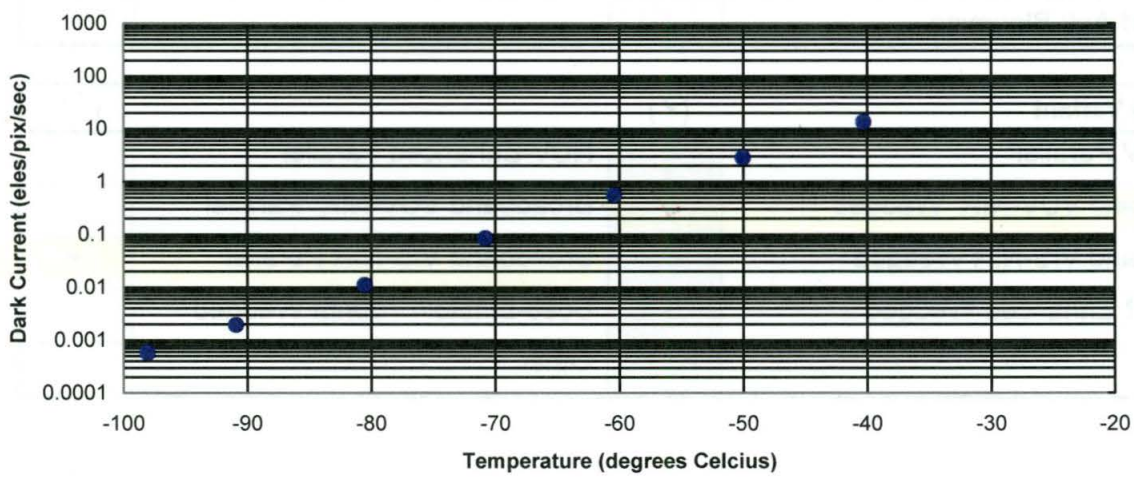
CCD PERFORMANCE

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	7.2	37.6	36.2	925
5	x2	3.2	18.6	18.4	1577
5	x4	1.6	14.0	15.5	2893
3	x1	6.0	20.2	19.9	1006
3	x2	3.2	13.8	14.2	1880
3	x4	1.4	11.2	11.2	3373
1	x1	5.4	11.3	11.2	836
1	x2	2.8	8.6	8.4	1703
1	x4	1.3	7.0	6.8	3499
0.05	x1	5.4	5.4	5.4	512
0.05	x2	2.7	4.1	4.2	1351
0.05	x4	1.3	3.9	3.8	3092
Saturation Signal per pixel			147857	Electrons/pixel	

CCD Dark Current



Minimum Dark Current Achievable ♦4	0.000578	electrons/pixel/sec		
@ Sensor Temperature of ♦5	-98.068	°C	16	°C cooling Water
		With PS-25		
CCD Dark Current Uniformity better than ♦6	0.2383	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)

Centroid	Number of Pixels	Centroid	Number of Pixels
(X , X)	X	(,)	
(,)		(,)	
(,)		(,)	
(,)		(,)	
(,)		(,)	
(,)		(,)	

White/Black Columns ♦10	Column numbers indicated	X X X X
Trap ♦11	(X, Y)	(X , X)

Dark Current Defects

Hot Spots ♦*12* (X, Y)

Centroid	Number of Pixels	Centroid	Number of Pixels
(X , X)	X	(,)	
(X , X)	X	(,)	
(,)		(,)	
(,)		(,)	
(,)		(,)	
(,)		(,)	

Hot Columns ♦*13*	Column numbers indicated	X X

CCD PERFORMANCE

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	20TH SEPT 2018

Hardware Version #	HEADBOARD	FPGA
	AG	20.24
Shipping Software Version #	SOLIS	SDK
	--	--
Testing Software Version #	SOLIS	SDK
	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 ≥ 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.