

## Features and Benefits

- **Peak QE up to 95%**  
Visible-optimized 'BV/BVF', infrared-optimized 'BR-DD' and broadband UV-NIR 'BEX2-DD' model
- **Fringe suppression technology as standard**  
Fringing greatly reduced (Deep-Depletion) or minimized (Back-Thinned 'BVF')
- **Extended range dual-AR option**  
Superior UV-NIR broadband QE
- **TE cooling down to -100°C**  
Critical for elimination of dark current detection limit - no inconvenience associated with LN<sub>2</sub>
- **Ultravac™**  
Critical for sustained vacuum integrity and to maintain unequalled cooling and QE performance, year after year
- **Multi-Megahertz Readout**  
High repetition rates achievable with low noise electronics
- **Crop Mode Operation**  
Up to 1,600 spectra per second rates
- **Single UV-grade fused silica window**  
Best UV-NIR throughput performance, specific AR coating and wedge options available
- **Down to 13.5 x 13.5 µm pixels**  
Optimized format for high resolution spectroscopy
- **Software-selectable pre-amplifier gain**  
Choice of best SNR performance or dynamic range at the touch of a button
- **USB 2.0 connection**  
Ideal for laptop operation  
Seamless operation alongside USB-based Shamrock spectrograph family
- **Solis software for Spectroscopy**  
Comprehensive, user-friendly interface for simultaneous detector & spectrograph control
- **Software Development Kit (SDK)**  
Ease of control integration into complex setups: Matlab, Labview, Visual Basic or C/C++

## Spectroscopy at Pace

The high-end USB 2.0 Newton CCD series brings together Andor's ultra fast, low-noise electronics platform and market-leading deep thermo-electric cooling to -100°C, complemented by Andor's Ultravac™ technology with its un-matched reliability track record in the scientific and industrial communities. Broadband detection rates of up to 1,600 spectra per second are enabled with intelligent Crop Mode operation. The Newton CCD is an ideal tool for ultrafast UV, VIS or NIR spectroscopy (or all the above with the Dual AR-coating BEX2-DD technology), such as 2D chemical mapping, online process monitoring or non-invasive medical diagnosis.

The Newton 940 series offers 13.5 x 13.5 µm pixels for the highest UV to VIS resolution spectroscopy, while the 920 series and its 26 x 26 µm offers the highest dynamic range for UV to NIR applications. Both > 6.6 mm high sensors are ideally suited for multi-track spectroscopy or hyper-spectral imaging.

## Specifications Summary \*1

Active pixels	1024 x 255 (1024 x 256 for Bx-DD model) or 2048 x 512
Pixel size (W x H)	26 x 26 or 13.5 x 13.5 µm
Image area	Up to 27.6 x 6.9 mm
Register well depth:	
Standard mode	1,000,000 e <sup>-</sup>
High Capacity mode	600,000 e <sup>-</sup>
High Sensitivity mode	150,000 e <sup>-</sup>
Maximum cooling	-100°C
Maximum spectra per sec	1,612
Read noise	As low as 2.5 e <sup>-</sup>
Dark current	As low as 0.0001 e <sup>-</sup> /pixel/sec

## Key Specifications \*1

Model number	DU920P	DU920P Bx-DD	DU940P
<b>Sensor options</b>	<ul style="list-style-type: none"> <li>• BU: Back Illuminated CCD, UV-Enhanced, 350 nm optimized</li> <li>• BU2: Back Illuminated CCD, UV-Enhanced, 250 nm optimized</li> <li>• BVF: Back Illuminated CCD, Vis-optimized and anti-fringing</li> <li>• OE: Open Electrode CCD</li> </ul>	<ul style="list-style-type: none"> <li>• BR-DD: Back Illuminated, Deep Depletion CCD with anti-fringing</li> <li>• BEX2-DD: Back Illuminated, Deep Depletion CCD with anti-fringing, extended range dual AR coating</li> </ul>	<ul style="list-style-type: none"> <li>• BU: Back Illuminated CCD, UV-Enhanced, 350 nm optimized</li> <li>• BU2: Back Illuminated CCD, UV-Enhanced, 250 nm optimized</li> <li>• BV: Back Illuminated CCD, Vis-optimized</li> <li>• FI: Front Illuminated CCD</li> <li>• UV: Front Illuminated CCD with UV coating</li> </ul>
<b>Active pixels</b> *2	1024 x 255	1024 x 256	2048 x 512
<b>Pixel size</b>	26 x 26 µm	26 x 26 µm	13.5 x 13.5 µm
<b>Image area</b>	26.7 x 6.7 mm with 100% fill factor	26.7 x 6.7 mm with 100% fill factor	27.6 x 6.9 mm with 100% fill factor
<b>Minimum temperatures</b> *3			
Air cooled		-80°C	
Coolant recirculator		-95°C	
Coolant chiller, coolant @ 10°C, 0.75 l/min		-100°C	
<b>Max spectra per second</b> *4	144 (OE - Full Vertical Bin) 273 (Full Vertical Bin) 1,149 (OE - Crop Mode - 20 rows) 1,612 (Crop Mode - 20 rows)	272 (Full Vertical Bin), 1,587 (Crop Mode - 20 rows)	122 (Full Vertical Bin), 943 (Crop Mode - 20 rows)
<b>System window type</b>	BV, BVF, FI, UV, UVB, OE sensors: UV-grade fused silica, 'Broadband VUV-NIR', unwedged BR-DD sensor: UV-grade fused silica, 'VIS-NIR enhanced', wedged BEX2-DD sensor: UV-grade fused silica, 'Broadband VUV-NIR', wedged (Various AR coatings & MgF <sub>2</sub> options available)		
<b>Blemish specifications</b>	Grade 1 as per sensor manufacturer definition		

## Advanced Specifications \*1

<b>Dark current, e<sup>-</sup>/pixel/sec @ max cooling</b>									
FI, OE, UV	0.0003			-			0.0001		
BU, BU2, BV, UVB	0.0003			-			0.0002		
BVF	0.0002			-			-		
Bx-DD	-			0.003			-		
<b>Register well depth</b>									
Standard mode	1,000,000 e <sup>-</sup>			1,000,000 e <sup>-</sup>			-		
High Sensitivity mode	-			-			150,000 e <sup>-</sup>		
High Capacity mode	-			-			600,000 e <sup>-</sup>		
<b>Active area pixel well depth</b> *5	BU, BU2, BVF: 400,000 e <sup>-</sup> OE: 300,000 e <sup>-</sup>			650,000 e <sup>-</sup>			BU, BU2, BV: 100,000 e <sup>-</sup> FI, UV: 140,000 e <sup>-</sup>		
<b>Read noise (e<sup>-</sup>)</b> *6	50 kHz	1 MHz	3 MHz	50 kHz	1 MHz	3 MHz	50 kHz	1 MHz	3 MHz
Standard mode: Typ (Max)	4 (8)	12 (18)	20 (30)	4 (8)	12 (15)	15 (30)	-	-	-
High Sensitivity mode: Typ (Max)	-	-	-	-	-	-	2.5 (4)	7 (12)	11 (15)
High Capacity mode: Typ (Max)	-	-	-	-	-	-	9 (12)	27 (32)	40 (56)
<b>Sensitivity (e<sup>-</sup>/count)</b>									
Standard mode	Adjustable from 2.5 - 10			Adjustable from 2.5 - 10			-		
High Sensitivity mode	-			-			Adjustable from 1 - 4		
High Capacity mode	-			-			Adjustable from 4 - 16		
<b>Linearity</b> *7	Better than 99%								
<b>Digitization</b>	16 bit								
<b>Vertical clock speed</b> *8	Software selectable between 2 - 179 µs								

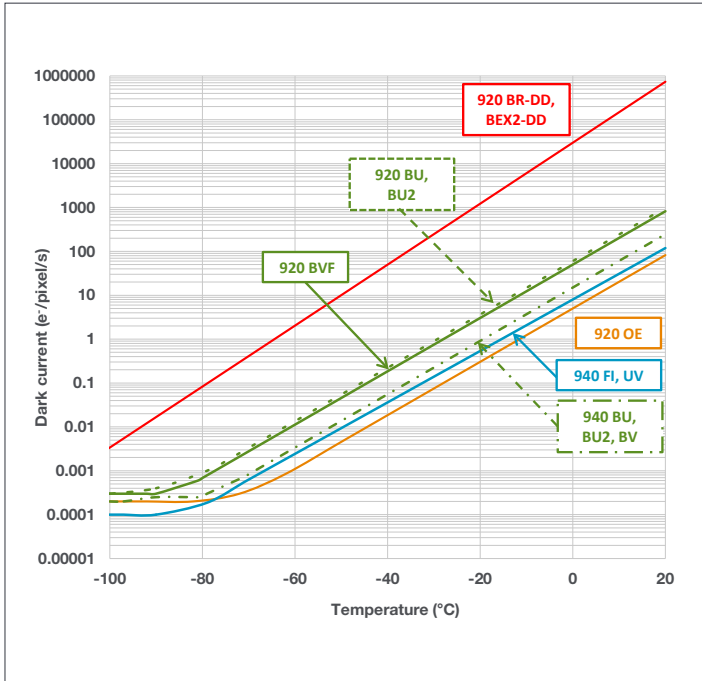
Have you found what you are looking for?

**Need to work further into the NIR?** The iDus InGaAs series, with up to 1024 pixel linear array with transmission to 2.2 µm.

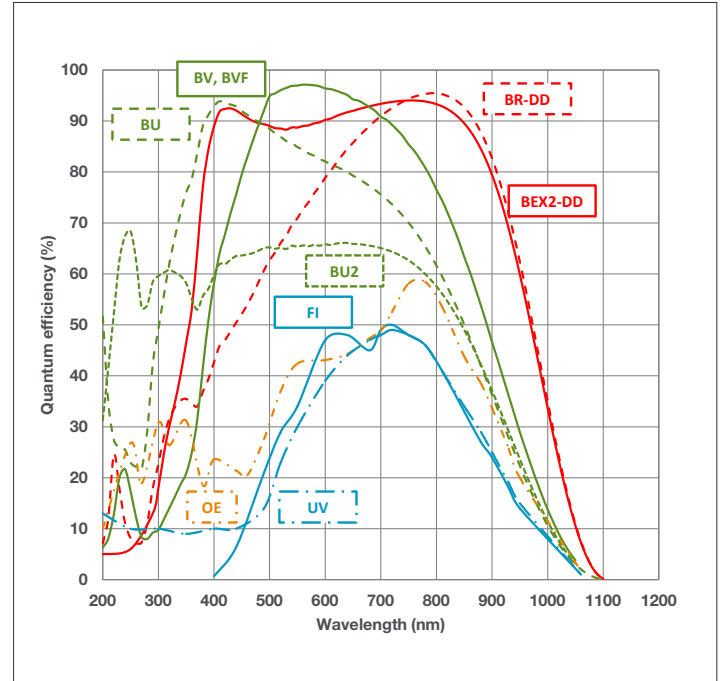
**Need a customized version?** Please contact us to discuss our Customer Special Request options.

The Newton series combines seamlessly with Andor's research grade Shamrock Czerny-Turner spectrographs.

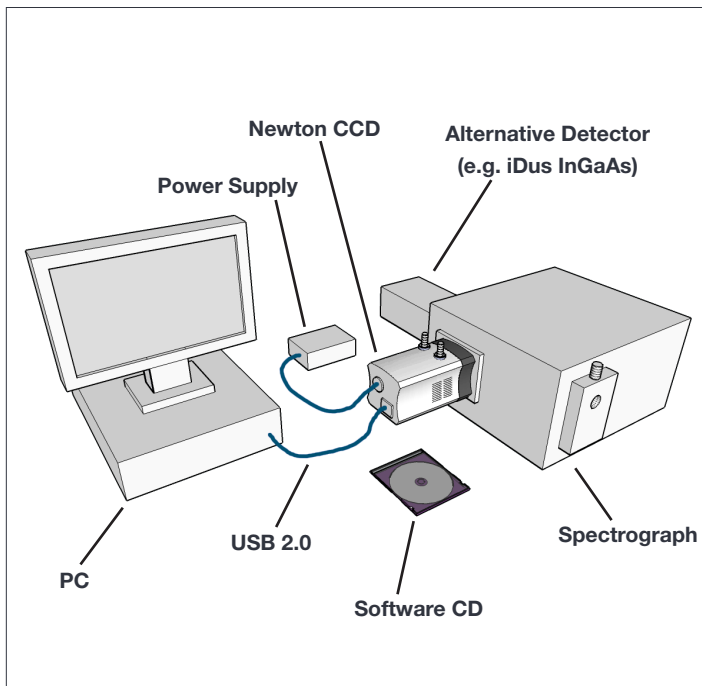
## Dark Current <sup>\*9</sup>



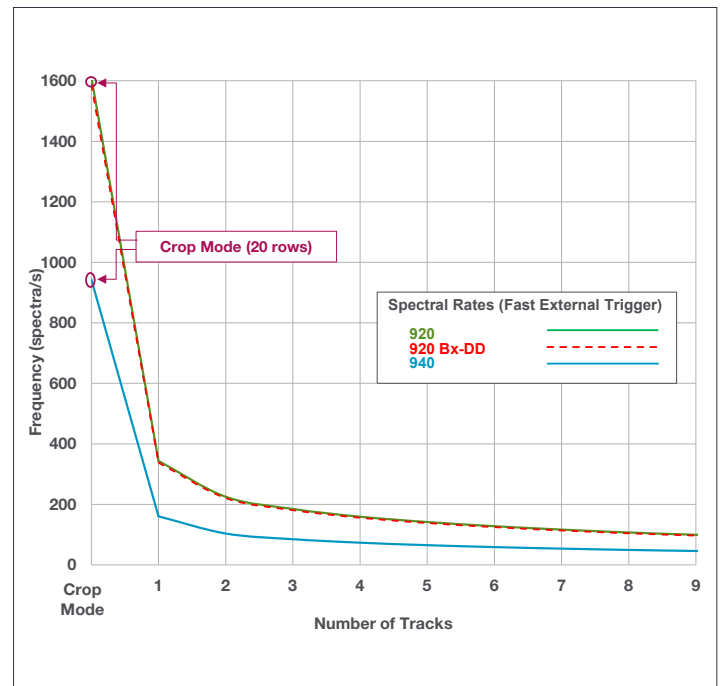
## Quantum Efficiency Curves <sup>\*10</sup> 25°C



## Typical Setup



## Readout Rate & Speed <sup>\*11</sup>



## Creating The Optimum Product for You

How to customize the Newton CCD series:

### Step 1.

Simply select from the 2 sensor array types that best suit your needs from the selection opposite.

### Step 2.

The Newton CCD comes with 9 options for sensor types. Please select the sensor which best suits your needs.

### Step 3.

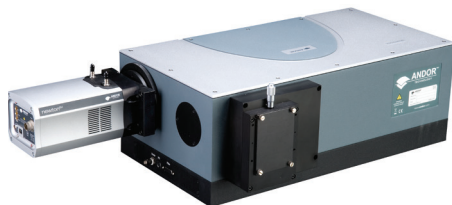
Please indicate if you wish to select an alternative window.

### Step 4.

Please indicate which software you require.

### Step 5.

For compatibility, please indicate which accessories are required.



Newton CCD mounted on a Shamrock 500 mm triple grating imaging spectrograph, ideal for high resolution spectroscopy.

DU 940 P- BV  
example shown

### Step 1.

#### Choose sensor array

**920P:** 1024 x 255 pixel array  
1024 x 256 pixel array (BxDD)  
**940P:** 2048 x 512 pixel array

### Step 2.

#### Choose sensor type

**BEX2-DD:** Back Illuminated, Deep Depletion CCD with fringe suppression and extended range dual AR coating  
**BR-DD:** Back Illuminated, Deep Depletion CCD with fringe suppression  
**BU:** Back Illuminated CCD, Blue optimized AR coating  
**BU2:** Back Illuminated CCD, AR coated for optimized performance in the 250 nm region  
**BV:** Back Illuminated CCD, Vis-optimized  
**BVF:** Back Illuminated CCD, Vis-optimized and anti-fringing  
**FI:** Front Illuminated CCD  
**OE:** Open Electrode CCD  
**UV:** Front Illuminated CCD with UV coating

### Step 2.

#### Select alternative camera window (optional)

The standard window has been selected to satisfy most applications. However, other options are available. The alternative camera window code must be specified at time of ordering.

To view and select other window options please refer to the '**Camera Windows Supplementary Specification Sheet**' which gives the transmission characteristics, product codes and procedure for entering the order. Further detailed information on the windows can be found in the Technical note – '**Camera Windows: Optimizing for Different Spectral Regions**'.

### Step 4.

The Newton CCD also requires at least one of the following software options:

**Solis for Spectroscopy** A 32-bit and fully 64-bit enabled application for Windows (XP, Vista, 7 and 8) offering rich functionality for data acquisition and processing. AndorBasic provides macro language control of data acquisition, processing, display and export. Control of Andor Shamrock spectrographs and a very wide range of 3<sup>rd</sup> party spectrographs is also available, see list below.

**Andor SDK** A software development kit that allows you to control the Andor range of cameras from your own application. Available as 32 and 64-bit libraries for Windows (XP, Vista, 7 and 8) and Linux. Compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab.

### Step 5.

The following accessories are available:

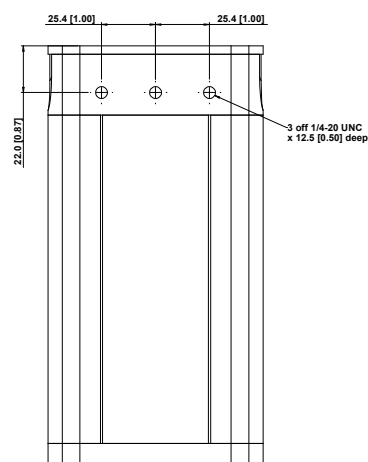
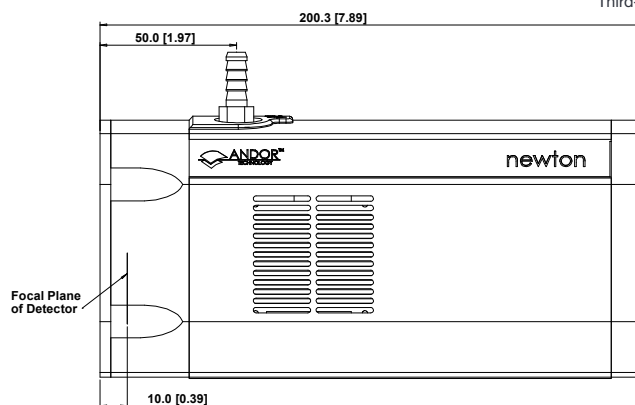
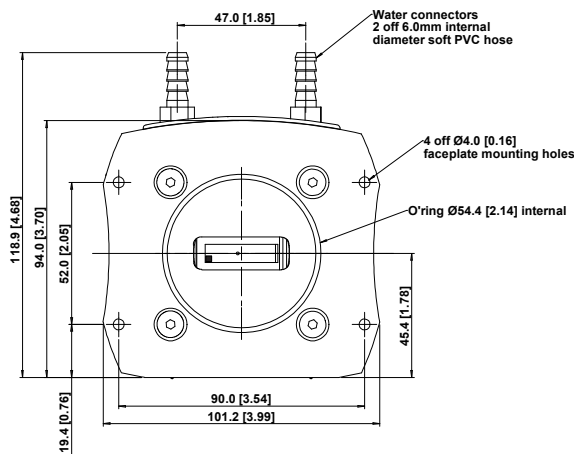
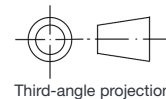
**XW-RECR** Coolant re-circulator for enhanced cooling performance  
**ACC-XW-CHIL-160** Oasis 160 Ultra Compact Chiller Unit (tubing to be ordered separately)  
**ACC-6MM-TUBING-2xxxxM** 6 mm tubing option for ACC-XW-CHIL-160  
**LM-C** C-mount lens adaptor  
**LM-NIKON-F** F-mount lens adaptor  
**LMS-NIKON-F-NS25B** Nikon F-mount lens adaptor with shutter  
**ACC-SD-VDM1000** Shutter Driver for NS25B Bistable Shutter (not needed for Shamrock spectrographs)  
**ACC-SHT-NS25B** Bistable Shutter, Standalone (not needed for Shamrock spectrographs)

#### Spectrograph Compatibility

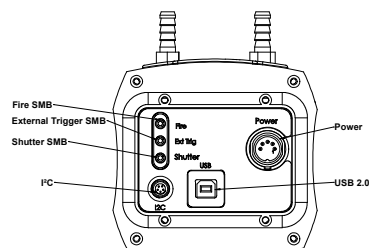
The Newton series is fully compatible with Andor's Shamrock spectrograph (163 - 750 nm focal lengths) family. Spectrograph mounting flanges and software control are available for a wide variety of 3<sup>rd</sup> party spectrographs including, McPherson (including 1 m and greater focal length option), JY/Horiba (excluding USB models), PI/Acton, Chromex/Bruker, Oriol/Newport, Photon Design, Dongwoo, Bentham, Solar TII and others.

## Product Drawings

Dimensions in mm [inches]



Mounting hole locations



Rear connector panel

■ = position of pixel 1,1

Weight: 2.7 kg [5 lb 15 oz]

## Connecting to the Newton

### Camera Control

Connector type: USB 2.0

### TTL / Logic

Connector type: SMB, provided with SMB - BNC cable

1 = Fire (Output), 2 = External Trigger (Input), 3 = Shutter (Output)

### I<sup>2</sup>C connector

Compatible with Fischer SC102A054-130

1 = Shutter (TTL), 2 = I<sup>2</sup>C Clock, 3 = I<sup>2</sup>C Data, 4 = +5 Vdc, 5 = Ground

### Minimum cable clearance required at rear of camera

90 mm

## Applications Guide

	BU/ BU2 models	BV models	BVF models	BR-DD models	BEX2-DD models	FI models	OE models	UV models
Absorption/Transmittance/Reflection	✓	✓	✓	✓	✓	✓	✓	✓
Atomic Emission Spectroscopy	✓	✓	✓	✓	✓	✓	✓	✓
Fluorescence & Luminescence	✓	✓	✓	✓	✓	✓	✓	✓
NIR Spectroscopy				✓	✓	✓	✓	
Raman Spectroscopy (244 – 488 nm)	✓	✓	✓				✓	✓
Raman Spectroscopy (514, 531, 633 nm)	✓	✓	✓	✓	✓	✓	✓	✓
Raman Spectroscopy (785, 830 nm)				✓	✓	✓	✓	
UV-VIS-NIR broadband spectroscopy					✓		✓	✓

✓ = Suitable    ✓ = Optimum



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### Items shipped with your camera:

- 1x 2m BNC - SMB connection cable
- 1x 3m USB 2.0 cable Type A to Type B
- 1x Set of Allen keys (7/64", 3/32" & 3 mm)
- 1x Power supply with mains cable
- 1x Quick launch guide
- 1x CD containing Andor user guides
- 1x Individual system performance booklet
- 1x CD containing either Solis software or SDK (if ordered)

### Footnotes: Specifications are subject to change without notice

1. Figures are typical unless otherwise stated.
2. Edge pixels may exhibit a partial response.
3. Cooling is provided by the use of an external mains driven power supply. Minimum temperatures listed are typical values with ambient temperature of 20°C. Systems are specified in terms of minimum dark current achievable rather than absolute temperature.
4. Based on horizontal pixel readout rate of 3 MHz and a vertical shift speed of 12.9  $\mu$ s (920 models), 14.5  $\mu$ s (940 models) and 25.7  $\mu$ s (OE model). Achievable spectral rates will vary with selected trigger mode. Due to the nature of the Open Electrode sensor, the minimum Vertical Shift Speed (VSS) available is 25.7  $\mu$ s, which will produce a lower maximum spectral rate compared to other models in the series.
5. Shown for High Capacity mode. For high sensitivity mode the measurable well depth value will be lower, as a result of the combination of higher sensitivity values and A/D 16 bits digitization.
6. Readout noise is for the entire system. It is a combination of CCD readout noise and A/D noise. Measurement is for Single Pixel readout with the CCD at a temperature of -80°C and minimum exposure time under dark conditions. Noise values will change with readout mode.
7. Linearity is measured from a plot of counts vs exposure time under constant photon flux up to the saturation point of the system.
8. Vertical speeds are software selectable. All sensors are designed to give optimum Charge Transfer Efficiency (CTE) at 12.9  $\mu$ s (920 models), 14.5  $\mu$ s (940 models) and 25.7  $\mu$ s (OE model) vertical pixel shift, some decrease in CTE may be observed at faster shift speeds.
9. The graph shows typical dark current level as a function of temperature. The dark current measurement is averaged over the CCD area excluding any regions of blemishes.
10. Quantum efficiency of the sensor as supplied by the sensor manufacturer
11. The chart shows the maximum possible readout rates available when using Multi-track mode, each track being defined as 20 rows. Crop mode is a specific single-track readout method optimized for rapid kinetic-type acquisition.

### Minimum Computer Requirements:

- 3.0 GHz single core or 2.4 GHz multi core processor
- 2 GB RAM
- 100 MB free hard disc to install software (at least 1 GB recommended for data spooling)
- USB 2.0 High Speed Host Controller capable of sustained rate of 40 MB/s
- Windows (XP, Vista 7 and 8) or Linux

### Operating & Storage Conditions

- Operating Temperature: 0°C to 30°C ambient
- Relative Humidity: < 70% (non-condensing)
- Storage Temperature: -25°C to 50°C

### Power Requirements

- 110 - 240 VAC, 50 - 60 Hz



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