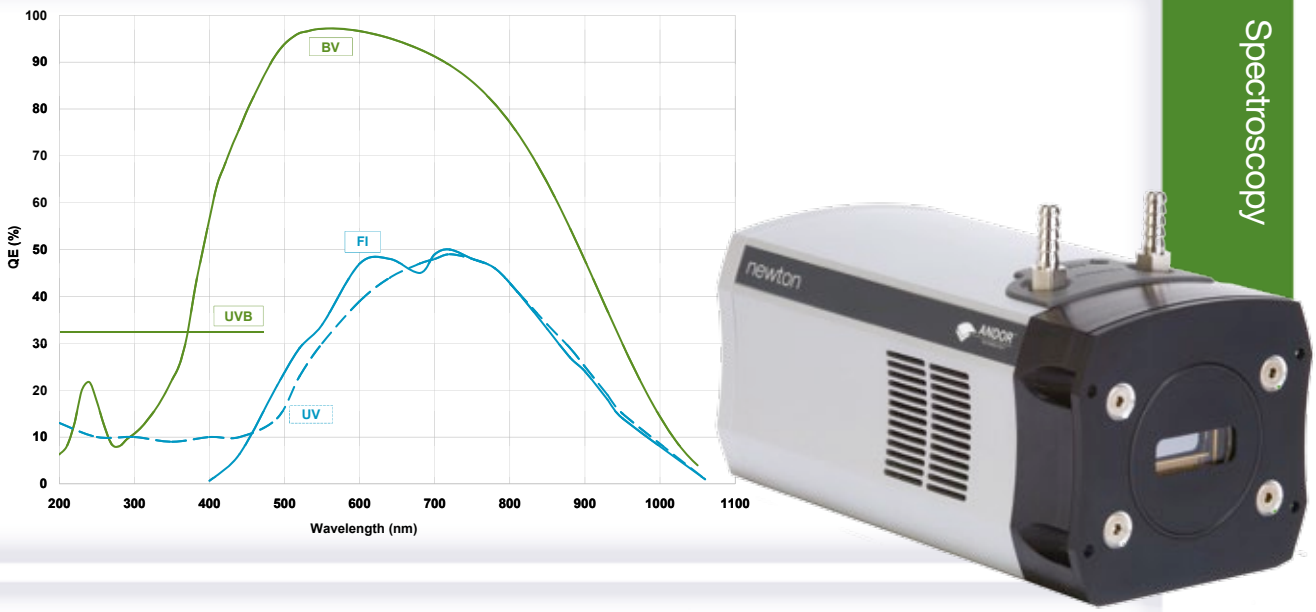
Newton EMCCD

25.6 mm wide / 1600 pixel, 3 MHz Spectroscopy EMCCD



Features and Benefits

- **EM sensor**
  1600 wide array with EM technology
- **Multi-Megahertz Readout**
  High repetition rates achievable with low noise electronics
- **TE cooling to -100°C**
  Negligible dark current without the inconvenience of LN_2
- **UltraVac™ - guaranteed hermetic vacuum seal technology**
  Permanent vacuum integrity, critical for deep cooling
- **16 x 16 µm pixel size**
  Optimised pixel size for achievement of high resolution
- **Dual output amplifiers**
  Software select between either a conventional High Sensitivity output (for low light applications) or an Electron Multiplying output (for single photon sensitivity
- **Crop Mode Operation**
  Achieve the highest possible spectral rates of over 1,500 spectra per second
- **Simple USB Connection**
  USB connection direct from back of camera – no controller box required!

Unique Electron Multiplying (EM) technology provides unparalled sensitivity. Multi-MHz readout rates, -100°C cooling & up to 95% Quantum Efficiency make Newton the ultimate spectroscopy detector.

EM technology enables charge from each pixel to be multiplied on the sensor before readout, providing single photon sensitivity with up to 3 Megahertz readout and USB connectivity.
The camera utilizes a 1600 x 200 (or 1600 x 400) array of 16 µm pixels with thermoelectric cooling down to -100°C resulting in negligible dark current and provides unrivalled performance for spectroscopic applications. The dual output amplifiers allow software selection between either a conventional High Sensitivity or Electron Multiplying outputs.

Specifications Summary

Active pixels	**1600 x 200 or 1600 x 400**
Pixel size (W x H)	**16 x 16 µm**
Image area	**25.6 x 3.2 or 6.4 mm**
Output node well depth (typical)	
High Sensitivity mode **Electron Multiplying mode**	**300,000 e^-** **1,300,000 e^-**
Maximum cooling	**-100ºC**
Maximum spectra per sec	**1,515**
Read noise	**As low as 2.8 e^- (< 1 e^- in EM mode)**
Dark current	**As low as 0.0002 e^-/pixel/sec**

Key Specifications •1

Model number	DU970P	DU971P
Sensor options	• **BV**: Back Illuminated CCD, Vis optimized • **FI**: Front Illuminated CCD • **UV**: Front Illuminated CCD with UV coating • **UVB**: Back Illuminated CCD with UV coating	• **BV**: Back Illuminated CCD, Vis optimized • **FI**: Front Illuminated CCD • **UV**: Front Illuminated CCD with UV coating • **UVB**: Back Illuminated CCD with UV coating
Active pixels •2	1600 x 200	1600 x 400
Pixel size	16 x 16 µm	
Image area	25.6 x 3.2 mm with 100% fill factor	25.6 x 6.4 mm with 100% fill factor
Cooler type	DU	
Minimum temperatures •3 Air cooled Coolant recirculator Coolant chiller, coolant @ 10ºC, 0.75l/min	 -80ºC -95ºC -100ºC	
Max spectra per second •4	649 (Full Vertical Bin), 1,515 (Crop Mode - 20 rows)	396 (Full Vertical Bin), 1,515 (Crop Mode - 20 rows)
System window type	Single quartz window, uncoated. Various AR coatings & MgF_2 options available	
Blemish specifications	Grade 1 as per sensor manufacturer definition	

Advanced Specifications •1

Dark current, e^-/pixel/sec @ max cooling FI, UV BV, UVB	0.0002 0.0006					
Output node well depth (typical) High Sensitivity mode Electron Multiplying mode	 300,000 e^- 1,300,000 e^-					
Register well depth High Sensitivity mode Electron Multiplying mode	 400,000 e^- 800,000 e^-					
Read noise (e^-) •5	50 kHz	1 MHz	3 MHz	50 kHz	1 MHz	3 MHz
High Sensitivity mode: Typ (Max) - EM off Electron Multiplying mode: Typ (Max) - EM off Electron Multiplying mode: Typ (Max) - EM on	2.8 (5) 8 (15) < 1	6.7 (9) 25 (35) < 1	8.5 (12) 38 (50) < 1	2.8 (5) 8 (15) < 1	6.7 (9) 25 (35) < 1	8.5 (12) 38 (50) < 1
Sensitivity (e^-/count) High Sensitivity mode Electron Multiplying mode	 Adjustable from 0.8 - 3 Adjustable from 5 - 20					
Electron Multiplier gain	1 - 1,000 times (software controlled)					
Linearity •6	Better than 99%					
Digitization	16 bit					
Vertical clock speed •7	4.9, 9.8, 19, 38, 57 (software selectable)					

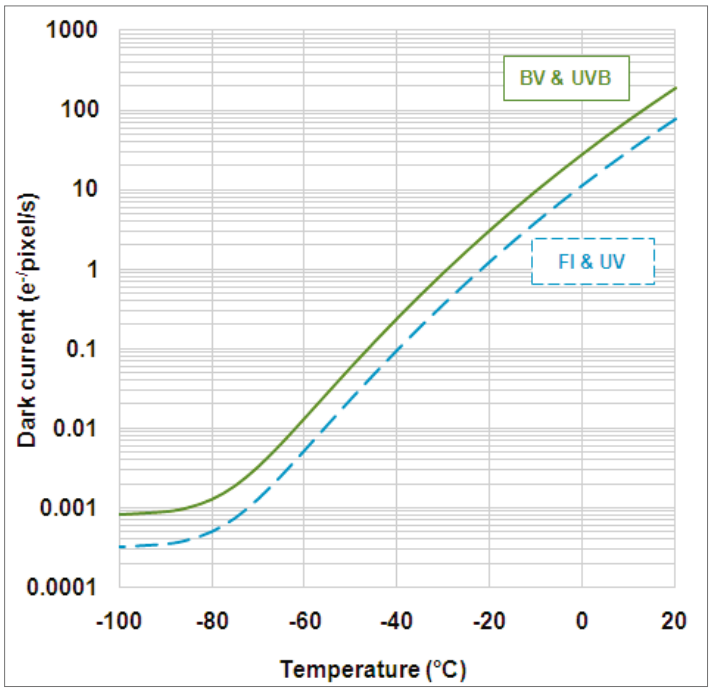
Have you found what you are looking for?

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.

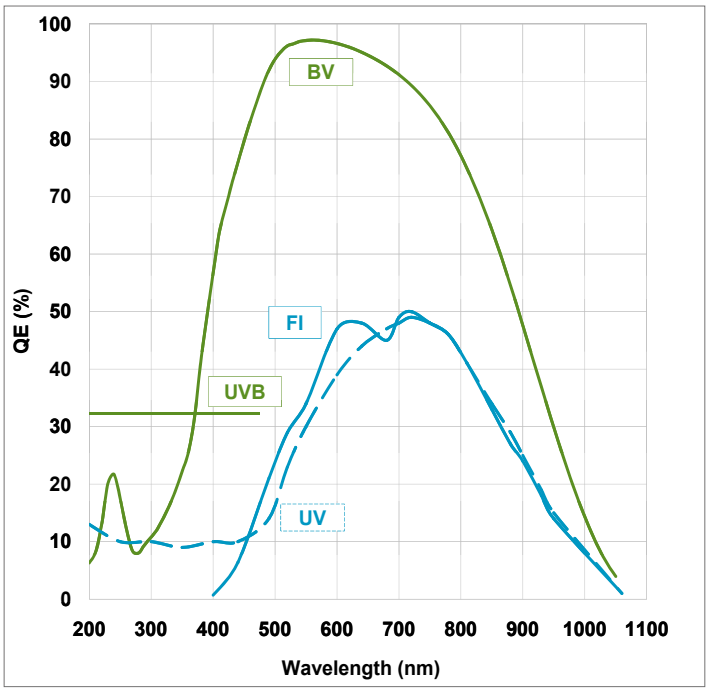
The Newton series combines seamlessly with Andor's research grade Shamrock Czerny-Turner spectrographs.

Dark Current [8]

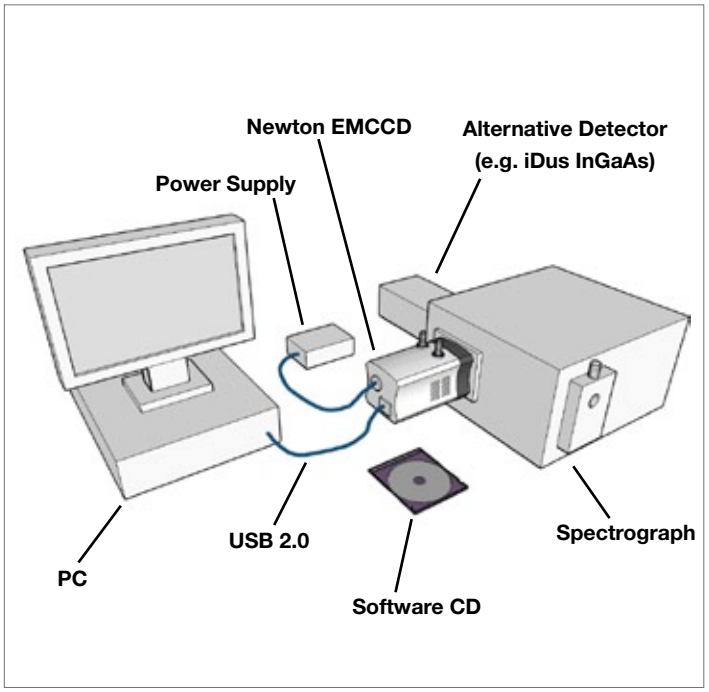


Quantum Efficiency Curves [9]

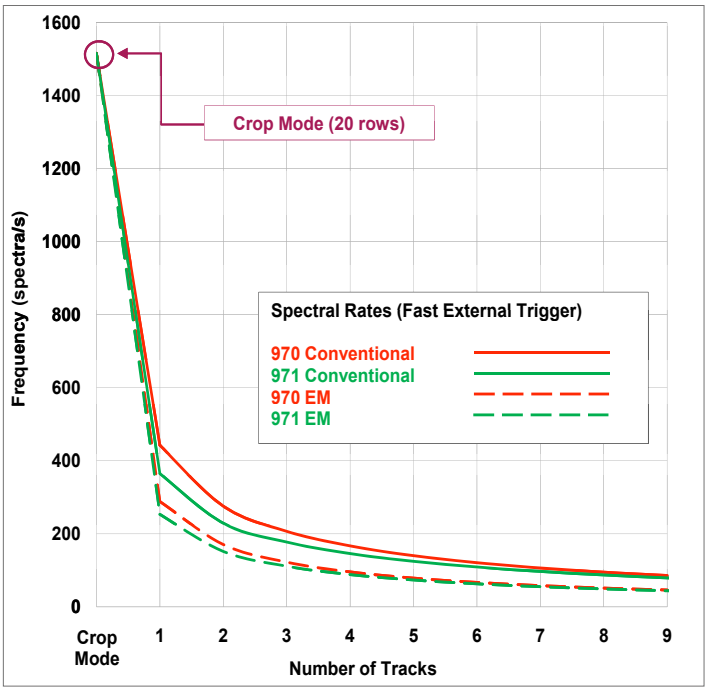
20°C



Typical Setup



Readout Rate & Speed [10]



Creating The Optimum Product for You

How to customize the Newton EMCCD series :

Step 1.

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

Step 2.

The Newton EMCCD comes with 4 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 and which software you require.

Step 4.

For compatibility, please indicate which accessories are required.

Newton EMCCD mounted on a Shamrock 750 mm triple grating imaging spectrograph, ideal for high resolution spectroscopy.

DU 970 P- BV
example shown

Step 1.
Choose sensor array

970P: 1600 x 200 pixel array
971P: 1600 x 400 pixel array

Step 2.
Choose sensor type

BV: Back Illuminated CCD, Vis optimised
FI: Front Illuminated CCD
UV: Front Illuminated CCD with UV coating
UVB: Back Illuminated CCD with UV coating

Step 3.

The Newton EMCCD series models are supplied with an uncoated Quartz window as standard. The following alternative window choices are available and must be ordered at time of build (if selected):
OPTION-C1-AR1 AR coated quartz window (optimised broadband visible 400-900nm). 50% transmission at 180 nm
OPTION-C1-MGF2 Magnesium Fluoride window for transmission in the VUV. 50% transmission at 120 nm

The Newton EMCCD also requires at least one of the following software options:
Solis for Spectroscopy A 32-bit application compatible with 32 and 64-bit Windows (XP, Vista and 7) 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 3rd 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 and 7) and Linux. Compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab.

Step 4.

The following accessories are available:

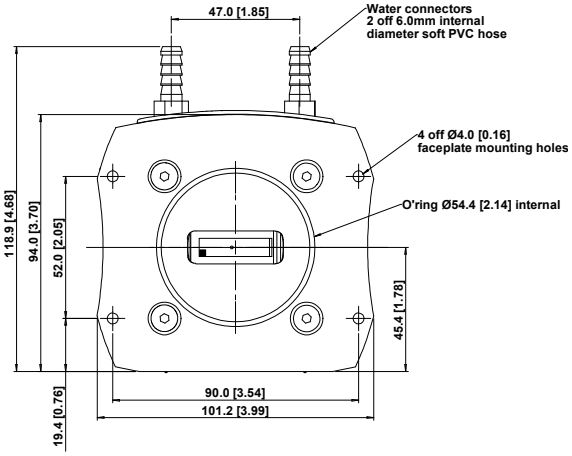
XW-RECR Coolant re-circulator for enhanced cooling performance
ACC-XW-CHIL-160 Oasis 160 Ultra Compact Chiller Unit (tubing to be ordered separately)
ACC-6MM-TUBING-2xxxxM 6 mm tubing option for ACC-XW-CHIL-160
LM-C C-mount lens adaptor
LM-NIKON-F C-mount lens adaptor
LMS-NIKON-F-NS25B Nikon F-mount 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)

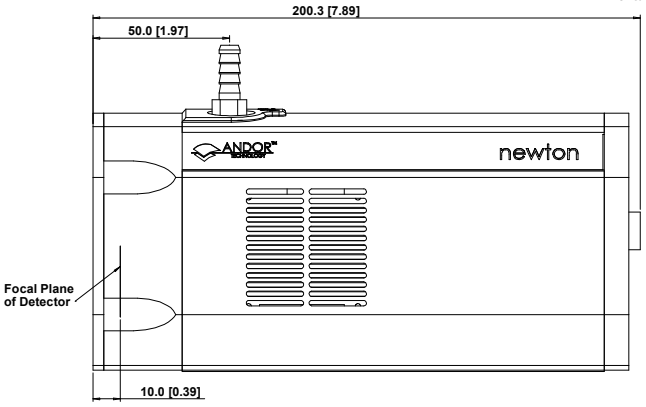
Spectrograph Compatibility
The Newton series is fully compatible with Andor's Shamrock spectrograph (163 - 750 nm focal lengths) family. Spectrograph mounting flanges and software control are available for a wide variety of 3rd party spectrographs including, McPherson, JY/Horiba, PI/Acton, Chromex/Bruker,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

Product Drawings

Dimensions in mm [inches]

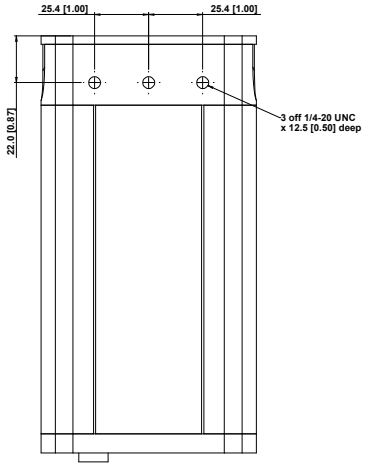
Third-angle projection





■ = position of pixel 1,1

Weight: 2.7 kg [5 lb15 oz]



Mounting hole locations

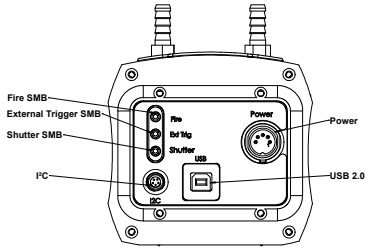
Connecting to the Newton

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)

I²C connector
Compatible with Fischer SC102A054-130
1 = Shutter (TTL), 2 = I²C Clock, 3 = I²C Data, 4 = +5 Vdc, 5 = Ground

Minimum cable clearance required at rear of camera
90 mm



Rear connector panel

Applications & Techniques Guide

	BV models	FI models	UV models	UVB models
Absorption/Transmittance/Reflection	✓		✓	✓
Atomic Emission Spectroscopy	✓	✓	✓	
Fluorescence & Luminescence	✓	✓	✓	✓
Raman Spectroscopy (244 – 488 nm)			✓	✓
Raman Spectroscopy (514, 532, 633 nm)	✓		✓	
Photon Counting	✓	✓		✓
Single Molecule Spectroscopy	✓		✓	✓

✓ = Suitable
✓ = Optimum

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Items shipped with your camera:

1x 2m BNC - SMB conection cable
1x 3m USB 2.0 cable Type A → 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 (in conventional mode) of 4.9 µs. Achievable spectral rates will vary with selected trigger mode.
5. 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.
6. Linearity is measured from a plot of counts vs exposure time under constant photon flux up to the saturation point of the system.
7. Vertical speeds are software selectable. All sensors are designed to give optimum Charge Transfer Efficiency (CTE) at 9.7 µs vertical pixel shift, some decrease in CTE may be observed at faster shift speeds.
8. 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.
9. Quantum efficiency of the sensor at 20°C as measured by the sensor manufacturer.
10. 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 and 7) 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

SNewtonEMSS 1111 R2