SPECTROSCOPY

" Ground-breaking Technology for Spectroscopy "

ANDOR's NEWTON camera, delivering up to 95% QE and single photon sensitivity, is the most sensitive spectroscopic detector ever. This ANDOR exclusive sensor is the only spectroscopic device available with Electron Multiplying CCD (EMCCD) technology. It enables charge from each pixel to be multiplied on the sensor before readout, providing single photon sensitivity with both multi-Megahertz readout and USB connectivity.

The camera utilizes a 1600 x 400 array of 16μm square 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 Responsivity output or an Electron Multiplying output.

- Exclusive EM sensor …. 1600 × 400 array with EM technology - exclusive to ANDOR Technology
- Multi-Megahertz Readout …. High repetition rates achievable with low noise electronics
- Simple USB Connection …. USB connection direct from back of camera – no controller box required!
- Min operating temp of –100ºC with TE cooling …. Negligible dark current without the aggravation or safety concerns associated with LN_2
- Single window design incorporating *UltraVac*™ - guaranteed hermetic vacuum seal technology …. Ultimate reliability and sustained lifetime performance characteristics with maximum photon throughput
- Dual output amplifiers …. Software select between either a conventional High Responsivity output (for low light applications) or an Electron Multiplying output (for single photon sensitivity)

- **Camera Overview**

Active Pixels •1	1600 x 400
Pixel Size (W x H; μm)	16x16
Image Area (mm)	25.6 x 6.4
Active Area Pixel Well Depth (e-; typical)	150 000
Output Saturation (e-; typical) •2 **High Responsivity Mode** **High Signal Mode**	 300 000 1300 000
Max spectra per sec (FVB) •3 **High Responsivity Mode** **High Signal Mode**	 400 328
Read Noise @ 3MHz (e-, typical) **High Responsivity Mode** **High Signal Mode (EM on)**	 18 < 1

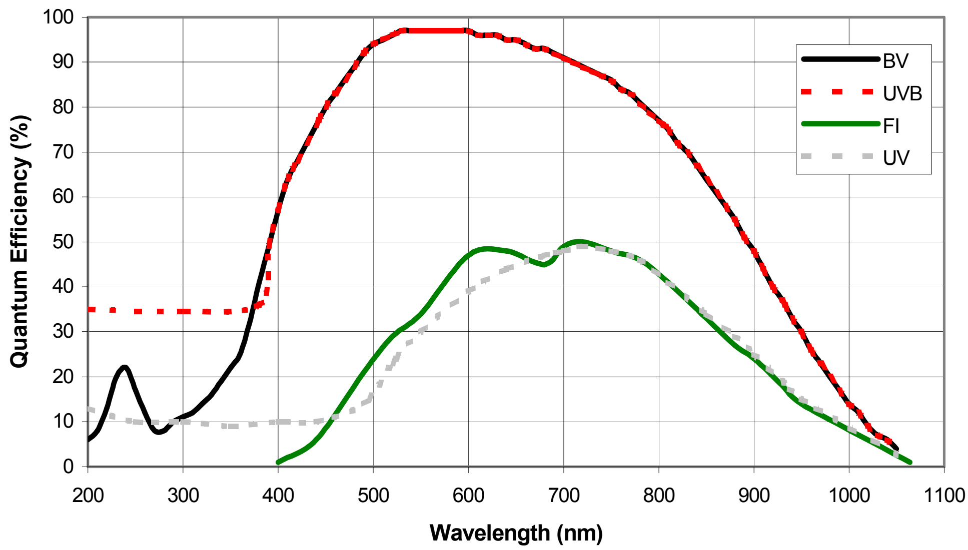
System Characteristics	**Pixel Readout Rate (MHz)**	3, 1, 0.05
	Linearity (%, maximum)[4]	1
	Vertical Clock Speed (μs)	4.9 to 50 (software selectable)
	Electron Multiplier Gain (software controlled)	1 – 1000 times
	Digitization (at all readout speeds)	16 bit
	Camera window type	Single quartz window, AR coating available

Dark Current & Background Events	**Dark Current**[5]	@-70ºC (e-/pix/sec) for back illuminated device [front illuminated device]	0.003 [0.002]
		@ -100ºC (e-/pix/sec) for back illuminated device [front illuminated device]	0.0001 [0.00008]
	EMCCD-Amplified Background Events[6]	(events/pix) @ ×1000 EM Gain, minimum exposure, -70ºC	0.005

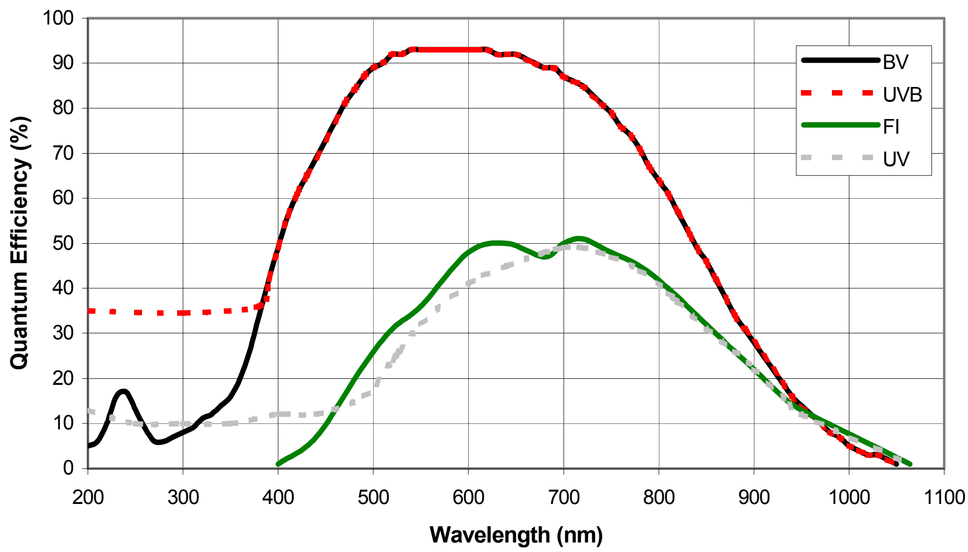
System Readout Noise

Pixel Readout Rate (MHz)	***System Readout Noise (e-; typical)***[7] **High Responsivity Output**	**Electron Multiplying Output**[8] **(EM off)**	**(EM on)**
0.05	2.5	10	< 1
1	7	22	< 1
3	18	35	< 1

Quantum Efficiency at +25°C[9]



Quantum Efficiency at -100°C



Minimum Temperature (°C) using PS-25

	Minimum Sensor Temperature (ºC, typical) *10
Air-cooled *(ambient air @ 20 °C)*	-75
Re-circulator (RC-180) *(ambient air @ 20 °C)*	-95
Water-cooled *(@ 10 °C, 0.75 l / min)*	-100
Each system is configured to allow both air & liquid cooling	

Computer Requirements

To handle data transfer rates of 3MHz readout over extended kinetic series, a powerful computer is recommended, e.g:

- 2.4 GHz Pentium (or better)
- 1GB RAM
- USB 2.0
- 32 Mbytes free hard disc
- Windows 2000 or better

Operating & Storage Conditions

Operating Temperature	0°C to 30°C ambient
Relative Humidity	< 70% (non-condensing)
Storage Temperature	-25°C to 55°C

Ordering Information

The DU971N is supplied with the following:

PS-25 Switchable power brick for optimum air or water cooling

The DU971N also requires one of the following software options:

Andor MCD a ready-to-run Windows 95, 98, 2000, ME, NT or XP -based package with rich functionality for data acquisition and processing

Andor-SDK-CCD a DLL driver and software development kit that let you create your own applications for the Andor Newton

The DU971N is available with the following input window options (which must be ordered at time of build):

OPTION-C1-AR1 AR coated quartz window (broadband visible 400-900nm)

OPTION-C1-MGF2 Magnesium Fluoride window (≥50% transmission at 120nm)

The DU971N may be used with the following accessories:

RC180 200W Re-circulator for enhanced cooling performance

LM-C C-mount lens adaptor

LM-NIKON-F Nikon F-mount lens adaptor

LMS-NIKON-F Nikon F-mount lens adaptor with shutter

To order this camera quote model number **DU971N-**

FI Standard front illuminated device

UV Front illuminated device with UV coating

BV Standard back illuminated device

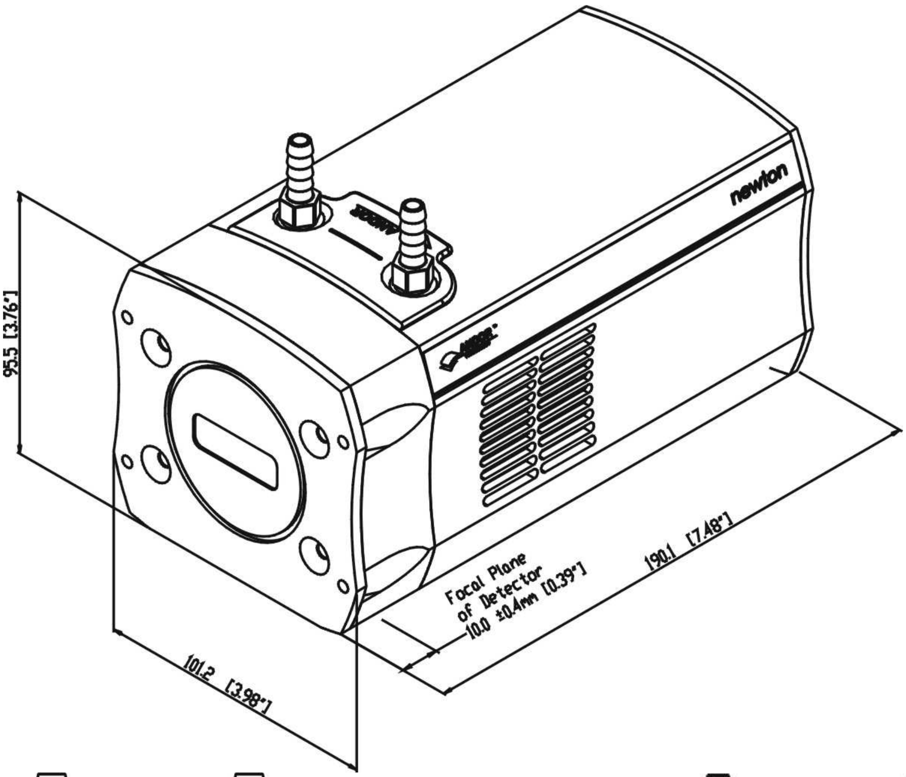
UVB Back illuminated device with UV coating

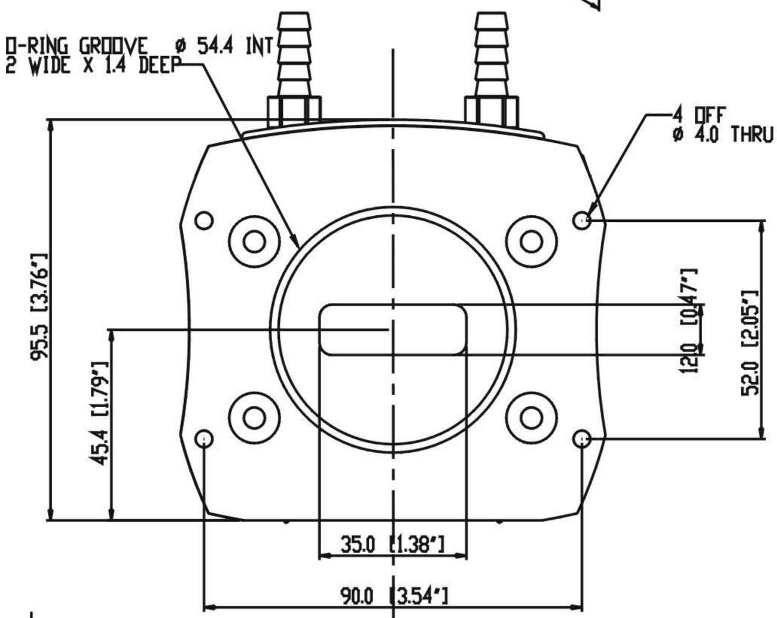
The Andor Newton camera can be easily interfaced to most standard spectrographs.
Contact Andor for further information & details of spectrographs and adapters that can be used with the DU971N.

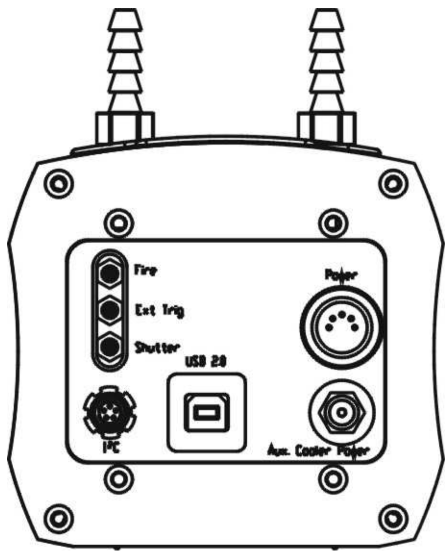
US Office
Phone (860) 290-9211
Fax (860) 290-9566

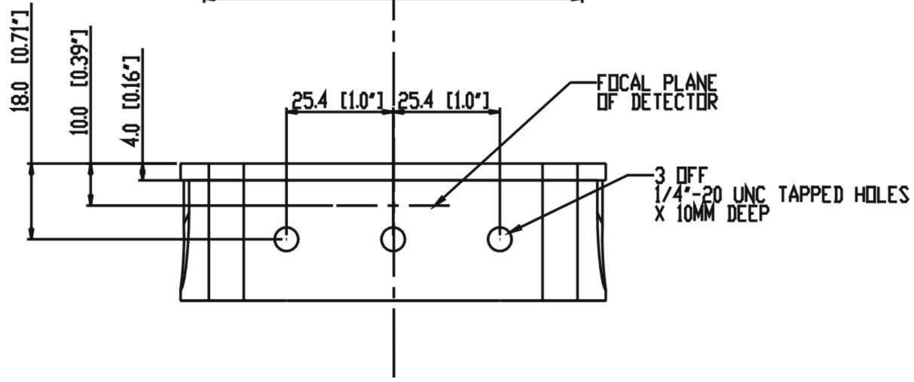
International Office
Phone +44 28 9023 7126
Fax +44 28 9031 0792

Japanese Office
Phone +81 3 3511 0659
Fax +81 3 3511 0662









Weight: 2.2 Kg [4 lb 12 oz]

Dimensions in mm unless otherwise indicated.

NOTE - Specifications are subject to change without notice.

♦*1* Edge pixels may exhibit a partial response.

♦*2* The output saturation that is actually accessible by the CCD system is dependant upon the sensitivity setting selected.

♦*3* Based on a horizontal pixel readout rate of 3MHz and a vertical shift speed of 4.9μs.

♦*4* Linearity is measured from a plot of counts vs. signal up to the saturation point of the system. Linearity is expressed as a percentage deviation from a straight line fit.

♦*5* This value is obtained using the traditional method of measuring dark current, as for any CCD camera, i.e. taking a long integration time (with no EM gain applied) to get a darksignal that is well above the read noise. The dark current measurement is averaged over the CCD area excluding any regions of blemishes.

♦*6* Using Electron Multiplication (EM) the Newton is capable of detecting single photons, therefore the true camera detection limit is set by the number of 'dark' background events. These background events consist of both residual thermally generated electrons and Clock Induced Charge (CIC) electrons (also referred to as Spurious Charge), each appearing as random single spikes that are well above the read noise floor.
A thresholding scheme is employed to count these single electron events and is quoted as a probability of an event per pixel. It is important to realise that to get to this single photon detection regime there must be sufficient cooling, such that there is significantly less than 1 event per pixel.

♦*7* System 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 -50°C and minimum exposure time under dark conditions. Under Electron Multiplying conditions, the effective system readout noise is reduced to sub $1e^-$ levels. Noise values will change with pre-amplifier gain (PAG) selection. Values quoted are measured with highest available PAG setting.

♦*8* The Electron Multiplying output provides single photon sensitivity with the Electron Multiplier gain switched on. It can also be used for high signal-to-noise measurements with the EM gain off.

♦*9* Quantum efficiency of the CCD sensor as measured by the CCD Manufacturer.

♦*10* Cooling is provided by the use of an external mains driven power brick. Minimum temperatures listed are typical values. Systems are specified in terms of minimum dark current achievable rather than absolute temperature.