OXFORD INSTRUMENTS

Andor iXon Ultra Blue

A Quantum Leap Forward in Blue/UV EMCCD Ultra-Sensitivity

Key Specifications

- ✓ Single photon sensitive
- ✓ Blue/UV-optimized QE
- ✓ 13 or 16 µm pixel size
- ✓ Active pixels: 1018 x 1018 or 506 x 506
- ✓ TE cooling down to -95 or -100°C
- ✓ 26 or 56 fps full frame
- ✓ 2 in 1 flexibility: EMCCD & CCD modes

Key Applications

- ✓ Ion trap quantum computing
- ✓ Semiconductor metrology
- ✓ Astronomy
- ✓ Forensic analysis
- ✓ Fast UV spectroscopy
- ✓ Environmental science

iXon Ultra Blue

The iXon Ultra Blue back-illuminated EMCCD camera is the world's most ultra-sensitive detector of Blue and UV photons.

Combining single photon sensitivity with a significantly boosted QE across the 200 to 450nm range, iXon Ultra Blue is ideal for the most demanding of light starved and rapid imaging applications, such as trapped ion quantum imaging.

iXon Ultra is available in two formats:

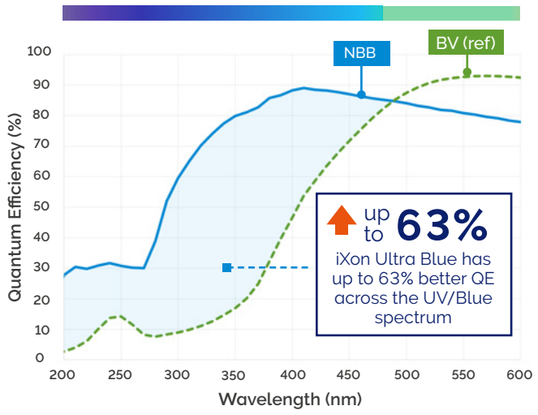
iXon Ultra Blue 888

Featuring a 1018 x 1018 sensor with 13 µm pixel, this megapixel format offers single photon sensitivity of Blue/UV photons across a large field of view. An 'overclocked' 30MHz pixel readout mode can be combined with Crop Mode to accelerate Region of Interest frame rates, for example, achieving 697 fps from a 128 x 128 ROI.

iXon Ultra Blue 897

The iXon Ultra 897 platform takes the popular back-illuminated 506 x 506 sensor with 16 µm pixel, and overclocks readout to push speed performance to an outstanding 56 fps (full frame), whilst maintaining single photon sensitivity and quantitative stability throughout. This format is ideal for applications that do not require megapixel resolution, focusing on speed and ultra-sensitivity.

Blue Spectrum Emissions



Key iXon Ultra 888 Specifications

Active pixels (H x V)	1018 x 1018
Pixel size (W x H; µm)	13 x 13
Image area (mm)	13.3 x 13.3
Active Area Pixel Well Depth (e-)	65,000
Max Readout Rate (MHz)	30
Frame rates (fps)	26 (full frame) - 9690
Read noise (e-)	<1 with EM gain
QE Max	>95%

Key iXon Ultra 897 Specifications

Active pixels (H x V)	506 x 506
Pixel size (W x H; µm)	16 x 16
Image area (mm)	8.2 x 8.2
Active Area Pixel Well Depth (e-)	145,000
Max Readout Rate (MHz)	17
Frame rates (fps)	56 (full frame) - 11,074
Read noise (e-)	<1 with EM gain
QE Max	>95%

The iXon Ultra Platform

The iXon Ultra platform maintains all the advanced performance attributes that have defined the industry-leading iXon EMCCD brand, such as deep vacuum cooling, extremely low spurious noise and rapid frame rate modes. The iXon Ultra platform is designed to be the most flexible yet easy to use EMCCD on the market, optimizable for a wide variety of application requirements in a single click via the OptAcquire™ feature. Count Convert functionality means signal can be quantitatively calibrated in units of electrons or photons, either in real time or postprocessing. Patented, pioneering technology offers automated recalibration of EM gain, alongside anti-ageing protection. Additional features of the iXon Ultra include plug and play USB connectivity, a lower noise conventional CCD mode and an additional Camera Link output, offering the unique ability to directly access data for 'on the fly' processing with minimal data-latency, ideally suited to rapid closed loop experimental systems.

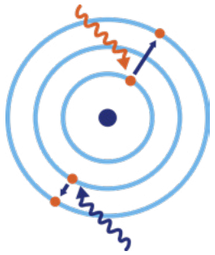
Crucially, the iXon brand carries an outstanding reputation within the industry for quality and reliability, brandishing an unparalleled track record of minimal field failures.

Features & Benefits

Single Photon Sensitive	Image extremely weak signal, including individual trapped ions.
Overclocked readout speeds	Follow dynamic changing processes.
Crop Mode	Continuous imaging with fastest possible frame rate from centrally positioned ROIs. Highly enabling for quantum imaging and much more (e.g. 251 fps with 256 x 256 ROI).
TE cooling to -100°C	Elimination of dark current detection limit.
RealGain™	Absolute EMCCD gain selectable directly from a linear and quantitative scale.
'2-in-1' Flexibility	EMCCD mode for ultra-sensitivity at speed, CCD mode for longer exposures.
Minimal Data Latency	Camera Link output port to facilitate direct access to data for 'on the fly' processing and fast feedback loops.
OptAcquire	Optimize the highly flexible iXon for different application requirements at the click of a button.
Count Convert	Quantitatively capture and view data in electrons or incident photons. Count Convert does this important conversion for you.
EMCAL™	Patented user-initiated self-recalibration of EM gain.
Qualified down to -20°C ambient temperature	Excellent for use at observatories.
Minimal Clock-Induced Charge	Confident discrimination of single photon events in Quantum Imaging.
UltraVac™	Critical for sustained vacuum integrity and to maintain unequalled cooling and QE performance, year after year. Seven year vacuum warranty.
Spurious Noise Filter	Intelligent algorithms to filter clock induced charge events from the background.
Enhanced photon counting modes	Intuitive single photon counting modes ideal for Quantum Imaging. Real time or post-processing.
FPGA Timestamp	Hardware generated timestamp with 10 ns accuracy.

Key Features

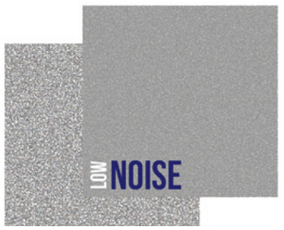
Blue/UV Enhanced QE



- High QE across 200-450nm range
- Back-illuminated, 90% peak @ 400nm
- QE extends across UV-VIS-NIR: flexible solution for multiple ion/atom emissions

iXon Ultra Blue employs back-illuminated sensors that also use 'enhanced silicon' combined with a UV-optimised AR coatings to yield a significantly enhanced UV-Blue response, up to 63% higher QE than a standard 'mid-band' (BV) EMCCD sensor. The QE remains respectably high across the visible and NIR range, rendering the camera a very flexible solution, applicable for example to imaging emission from multiple types of trapped ions or atoms.

Single Photon Sensitive



- Single Photon Sensitive
- Photon Counting
- Detect and quantify trapped Ions/Atoms

iXon Ultra uses Electron Multiplying CCD (EMCCD) technology to amplify signal from even single photon events to well above the read noise floor of the camera, thus rendering single photon sensitivity, even under high speed readout. iXon Ultra is therefore ideally suited to fast detection of extremely weak signal, including single photon counting. Photon Counting performance is further enhanced through suppression of spurious background events, both through vacuum cooling suppression of thermal electrons and events and electronic optimization of Clock Induced Charge events.

High Speed

- 56 fps full frame (897 model)
- Crop Mode: Huge ROI speed boost
- 100% duty cycle – no photons wasted

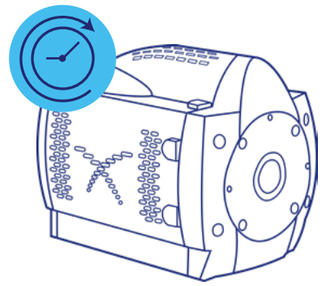
The iXon Ultra platform has been re-engineered to offer stable 'overclocked' readout modes, setting a very high bar in terms of frame rates. The frame transfer architecture of the sensor is ideal for efficiency, meaning that the image readout happens while the subsequent image is being exposed, thus avoiding 'dead time' or photon wastage. Furthermore, the innovative Crop Mode allows significantly accelerated frame rates of Region of Interest, for example achieving 697 fps from the iXon Ultra 888 cropped to a 128 x 128 ROI.

2-in-1 Flexibility

- EMCCD-mode: single photon sensitivity at speed
- CCD-mode: long exposure capture of weak signal

iXon Ultra models offer '2 in 1' performance flexibility, in terms of operating as a single photon EMCCD or a low noise conventional CCD, In photon starved applications, choosing the EMCCD amplifier usually yields better signal to noise ratio when under faster frame rates conditions (> 1 fps), whereas often the CCD amplifier can yield better signal to noise ratio when longer exposures can be applied and when the sensor can be read out slowly (i.e. 'seconds per frame' rather than 'frames per second').

Long Exposure Capability



- Vacuum TEC cooled to -100ºC
- < 0.0002 e-/p/sec dark current
- Luminescence & Astronomy

iXon Ultra uses sensor cooling down to -100ºC (-95ºC for 888 model) for minimization of dark current., allowing access to longer exposures, up to several minutes, especially useful in 'CCD mode'. This broadens the application flexibility of this model, making it ideal for long exposure luminescence measurements and astro-photometry.

Smart Features

- Count Convert - Data in electrons or incident photons
- OptAcquire – Preset application optimization
- FPGA timestamp – 10ns accuracy

iXon Ultra is packed with clever, useful innovation. For example, Count Convert offers the capability to quantitatively capture and present data in units of electrons or photons, this conversion applied either in real time in post-processing. The iXon Ultra platform is designed to be the most flexible yet easy to use EMCCD on the market, optimizable for a wide variety of application requirements in a single click via the OptAcquire™ feature.

Minimal Data Latency

- Additional Camera Link output
- Suitable for 'on-the-fly' rapid processing
- Ideal for closed-loop experimental systems

As well as the USB interface, the iXon Ultra includes an additional Camera Link output port, facilitating more direct access to the image data stream, in order that real-time analysis can be performed. The Camera Link channel intercepts the image data stream in the camera head immediately after the on-head FPGA processing step, but before the USB frame buffer, therefore undergoes the same amount of on-head image processing. The USB data stream is concurrently accessible.

RealGain™ & EMCAL™

- RealGain™ linear calibration of EMCCD gain
- EMCAL™ user-initiated self-calibration of EM gain.

iXon Ultra set new standards in quantitative EMCCD usage and general EMCCD longevity expectations. RealGain™ allows the user to select absolute EM gain direct from a linear and directly quantitative software scale, x1 to x1000. The EM gain you ask for is the EM gain you get.

EMCAL™ is an Innovative, user-initiated, self-recalibration of EM gain, utilizing a patented method of automated EM gain assessment and Andor's unique Linear and Real Quantitative gain implementation.

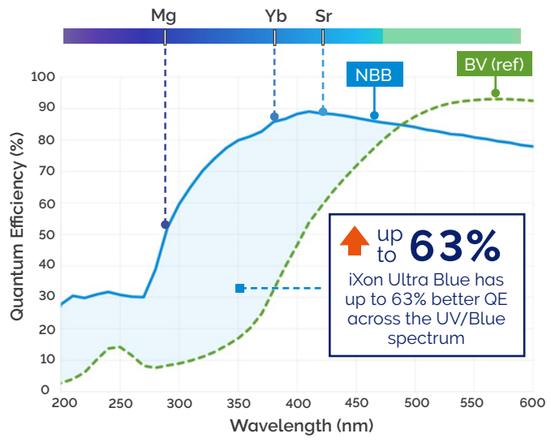
Application Focus

Ion Trap Quantum Computing

The iXon Ultra Blue is superbly suited to the ultra-sensitive detection of emissions from rows or arrays of cold trapped ions or neutral atoms.

Combining single photon sensitivity with a significantly boosted QE across the 200 to 450nm range, iXon Ultra Blue models are ideal for imaging of trapped individual ions or atoms, for example yielding 83% QE at 370nm (Ytterbium). Fast region of interest frame rates and a low data latency capability are also important attributes of the camera in this field of study.

Blue Spectrum Emissions



Key Requirements	Solution: iXon Ultra Blue
Image weak signal from individual trapped ions that emit in UV/Blue	iXon Ultra Blue back-illuminated sensor combines highest UV/Blue QE with single photon sensitivity
Image with Fast Frame Rates	iXon Ultra Blue 897 achieves 56 fps full resolution, much faster again with ROIs as often the full resolution is not required
Transmit data from the camera with minimal latency, in feedback loop configurations with the laser	iXon Ultra Blue Camera Link output offers low latency data transmission, ideal for 'on-the-fly' processing in feedback loop experimental systems
Image ions and neutral atoms	Flexibility: High QE profile across UV/Blue range that also extends well into the VIS-NIR range, rendering iXon Ultra Blue suited to a wide range of species

Other applications of iXon Ultra Blue

Semiconductor Metrology

The UV response of iXon Ultra Blue renders it useful for low light semiconductor metrology applications. Note that the QE response at 193nm is ~20%. A new Time-Delayed Integration (TDI) mode of iXon Ultra Blue can also be applied to semiconductor applications.

Astronomy

iXon Ultra Blue can be used to capture blue and visible emissions from stars, supernova, nebula and comets, including hot stars and stellar formation. Blue photons also take advantage of shorter wavelength diffraction limits for better resolution.

Environmental Science

UV imaging is used to monitor ozone layer depletion, track pollutants, and detect UV-induced fluorescence in aerosols. iXon Ultra Blue can also be used for atmospheric LIDAR.

UV Spectroscopy

The high UV/Blue response and single photon sensitivity of iXon Ultra Blue renders it useful for low light photoluminescence spectroscopy of high bandgap semiconductors (such as GaN). Furthermore, approaches such as UV Raman spectroscopy often cause faster chemical decomposition of photolabile samples, and lower laser powers combined with more sensitive detectors are preferred.

Technical Specifications

System Specifications •2

	iXon Ultra Blue 888		iXon Ultra Blue 897	
Sensor QE options	#NBB: Back-illuminated, UV-Blue Enhanced			
Active pixels	1018 x 1018		506 x 506	
Pixel size	13 x 13 µm		16 x 16 µm	
Image area	13.3 x 13.3 mm with 100% fill factor		8.2 x 8.2 mm with 100% fill factor	
Pixel Readout Rate Minimum temperature, air cooled, ambient 20°C Chiller liquid cooling, coolant @ 10°C, >0.75l/min	10 MHz -80°C -95°C	30 MHz•3 -60°C -75°C	10 MHz -80°C -100°C	17 MHz -80°C -100°C
Thermostatic Precision	± 0.01°C			
Triggering	Internal, External, External Start, External Exposure, Software Trigger			
System window type	UV-grade fused silica, Broadband Vacuum Ultraviolet-Near Infrared, 0.5 degree wedge			
Blemish specification	Grade 1 sensor from supplier. Camera blemishes as defined by Andor Grade A			
Digitization	16-bit (at all speeds)			
PC Interface	USB 3.0•12		USB 2.0	
Lens Mount	C-mount			
Direct Data Access	Camera Link 3-tap output			

Advanced Performance Specifications •2

	iXon Ultra Blue 888						iXon Ultra Blue 897						
Dark current and background events•4,5													
Dark current (e-/pixel/sec) @ -80°C	0.00025						0.00030						
Dark current (e-/pixel/sec) @ max cooling	0.00011						0.00015						
Spurious background (events/pix) @ 1000x gain / -85°C	0.005						0.0018						
Active area pixel well depth	65,000 e^-						145,000 e^-						
Gain register pixel well depth•6,7	730,000 e^-						800,000 e^-						
Pixel readout rates	EM Amplifier: 30, 20, 10 & 1 MHz Conventional Amplifier: 1 & 0.1 MHz						EM Amplifier: 17, 10, 5 & 1 MHz Conventional Amplifier: 3, 1 & 0.08 MHz						
Read noise (e-)•7	EMCCD Amplifier				Conventional Amplifier		EMCCD Amplifier				Conventional Amplifier		
MHz	30	20	10	1	1	0.1	17	10	5	1	3	1	0.08
Without Electron Multiplication	130	80	40	12	6	3.5	89	65	37	15	9.6	5.3	2.7
With Electron Multiplication	< 1	< 1	< 1	< 1	-	-	< 1	< 1	< 1	< 1	-	-	-
Linear absolute Electron Multiplier gain	1 - 1000 times via RealGain™ (calibration stable at all cooling temperatures)												
Linearity•8	Better than 99.9%												
Vertical clock speed	0.6 to 4.33 µs (user selectable)						0.3 to 3.33 µs (user selectable)						
Timestamp accuracy	10 ns												

iXon Ultra 888 Frame Rates

Standard Mode[•3,9]

Binning	1018 x 1018	506 x 506	256 x 256	128 x 128	1018 x 100	1018 x 32	1018 x 1
1 x 1	26	50	95	171	220	498	1163
2 x 2	50	94	170	285	368	699	-
4 x 4	92	167	281	426	552	870	-

Crop Mode - Optically Centred frame rates in brackets[•3,9]

Binning	506 x 506	256 x 256	128 x 128	64 x 64	1018 x 100	1018 x 32	1018 x 1
1 x 1	93 (78)	190 (251)	670 (697)	2053 (1319)	259	778	9690
2 x 2	170 (143)	350 (426)	1150 (1019)	3123 (1646)	492	1416	-
4 x 4	291 (245)	601 (653)	1772 (1504)	4109 (1857)	887	2370	-

iXon Ultra 897 Frame Rates

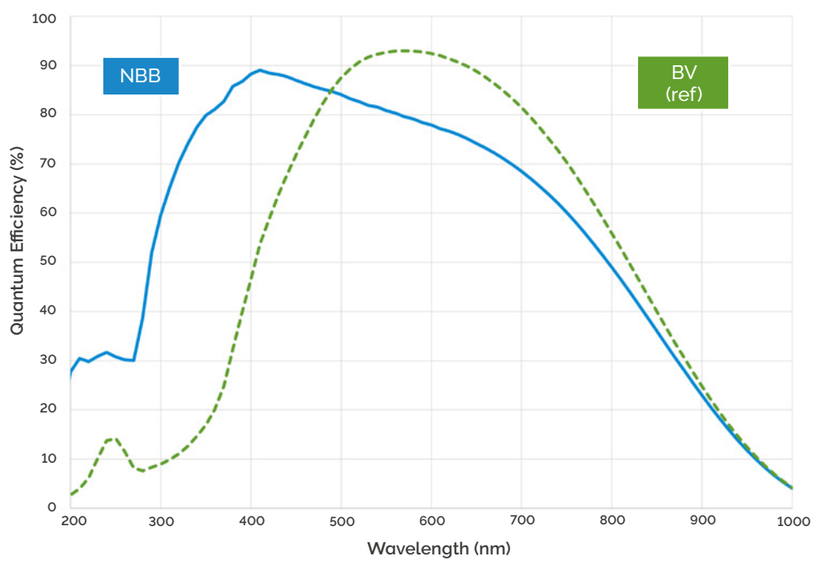
Standard Mode[•10]

Binning	506 x 506	256 x 256	128 x 128	64 x 64	506 x 100	506 x 32	506 x 1
1 x 1	56	110	212	398	267	708	2,881
2 x 2	109	210	394	699	486	1,141	-
4 x 4	206	385	682	1,109	820	1,615	-

Crop Mode - Optically Centred frame rates in brackets[•10]

Binning	256 x 256	128 x 128	64 x 64	32 x 32	506 x 100	506 x 32	506 x 1
1 x 1	111 (174)	595 (569)	1,433 (1,490)	3,533 (3,021)	282	857	11,074
2 x 2	215 (329)	1,094 (1,013)	2,481 (2,325)	5,555 (4,048)	541	1,607	-
4 x 4	405 (593)	1 ,883 (1,661)	3,906 (3,236)	7,751 (4,878)	1,005	2,865	-

Quantum Efficiency (QE) Curves[•11]



Creating The Optimum Product for You

Step 1. Choose the camera type

Camera Type

Description	Code
iXon Ultra 888: 1018 x 1018 EMCCD, max. 30 MHz, with USB 3.0	**DU-888U3-CS0-NBB**
iXon Ultra 897: 506 x 506 EMCCD, max. 17 MHz, with USB 2.0	**DU-897U-CS0-NBB**

Step 2. Select an alternative camera window (optional)

Camera Window

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 is in the Technical note – 'Camera Windows: Optimizing for Different Spectral Regions'.

Step 3. Select the required accessories

Accessories

Description	Order Code
SRRF-Stream Dell Workstation (English), pre-installed with a recommended and tested GPU card, alongside SRRF-Stream enabled MicroManager and Andor SDK2 with SRRF-Stream.	**WKST-SRRF-9ZY**
Monitor (optional) - Dell UltraSharp U3417W - 34.14" Curved LED	**FUS-MNTR-34W**
Dell UltraSharp UP3017 - 30" with PremierColor	**FUS-MNTR-30**
OptoMask accessory, used to mask unwanted sensor area during Crop Mode acquisition (refer to OptoMask Specification Sheet for further information).	**OPTMSK-L/ OPTMSK-OC-L/ OPTMSK-OC-S**

Description	Order Code
Re-circulator for enhanced cooling performance	**XW-RECR**
Oasis 160 Ultra compact chiller unit (tubing to be ordered separately)	**ACC-XW-CHIL-160**
6 mm tubing options for ACC-XW-CHIL-160 (2x2.5 m or 2x5m lengths)	**ACC-6MM-TUBING-2X2.5/ ACC-6MM-TUBING-2X5M**
C-mount to Nikon F-mount adapter	**OA-CNAF**
C-mount to Olympus adapter	**OA-COFM**
C-mount to T-mount adapter	**OA-CTOT**
15 m Active USB 3.0 connector cable (power supply not required) Icron for Ultra 888	**ACC-ASE-06887**
50 m Fibre Optic USB 3.0 extender solution inc. power supply (Adnaco) for Ultra 888	**ACC-ASE-08762**
100 m Fibre Optic USB 3.0 extender solution inc. power supply (Adnaco) for Ultra 888	**ACC-ASE-07860**

Step 4. Select the required software

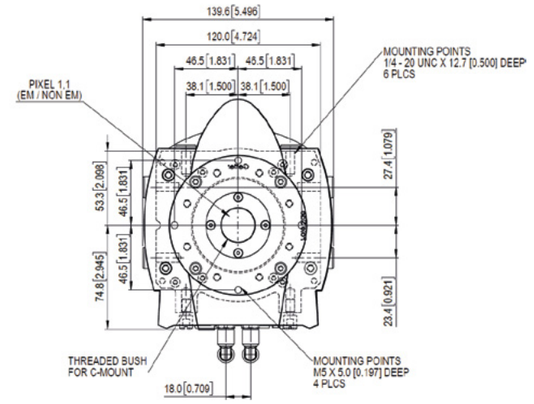
Software

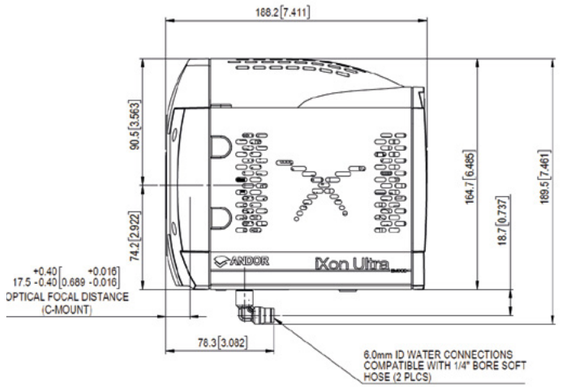
The iXon Ultra series requires one of the following software options:
Solis Imaging: A 32-bit and fully 64-bit enabled application for Windows (8, 8.1, 10 and 11) offering rich functionality for data acquisition and processing. AndorBasic provides macro language control of data acquisition, processing, display and export.
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 (8, 8.1, 10 and 11), compatible with C/C++, C#, Delphi, VB.NET, LabVIEW and Matlab. Linux SDK compatible with C/C++.
Third party software compatibility, drivers are available for a variety of third party imaging packages.

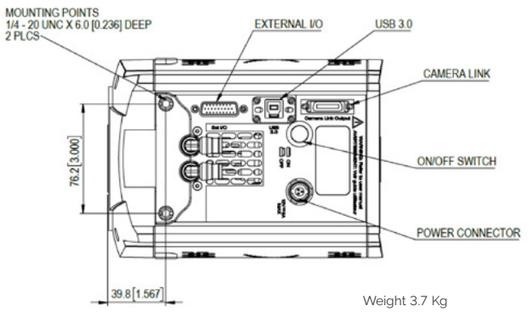
Product Drawings

Dimensions in mm [inches]

iXon Ultra 888

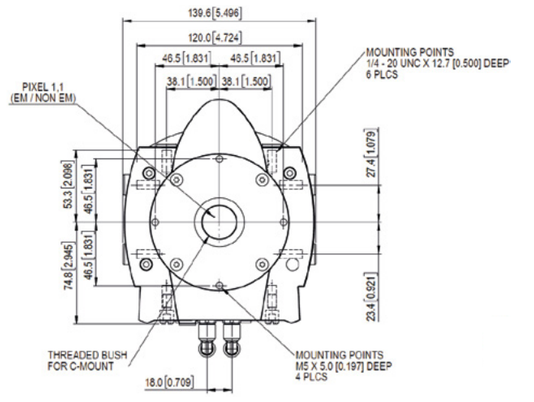


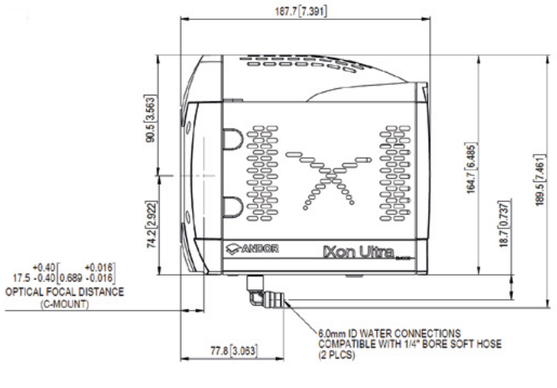


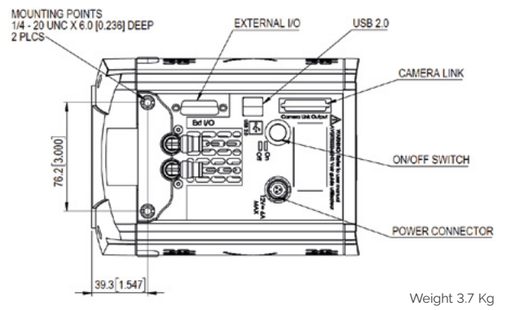


Weight 3.7 Kg

iXon Ultra 897







Weight 3.7 Kg

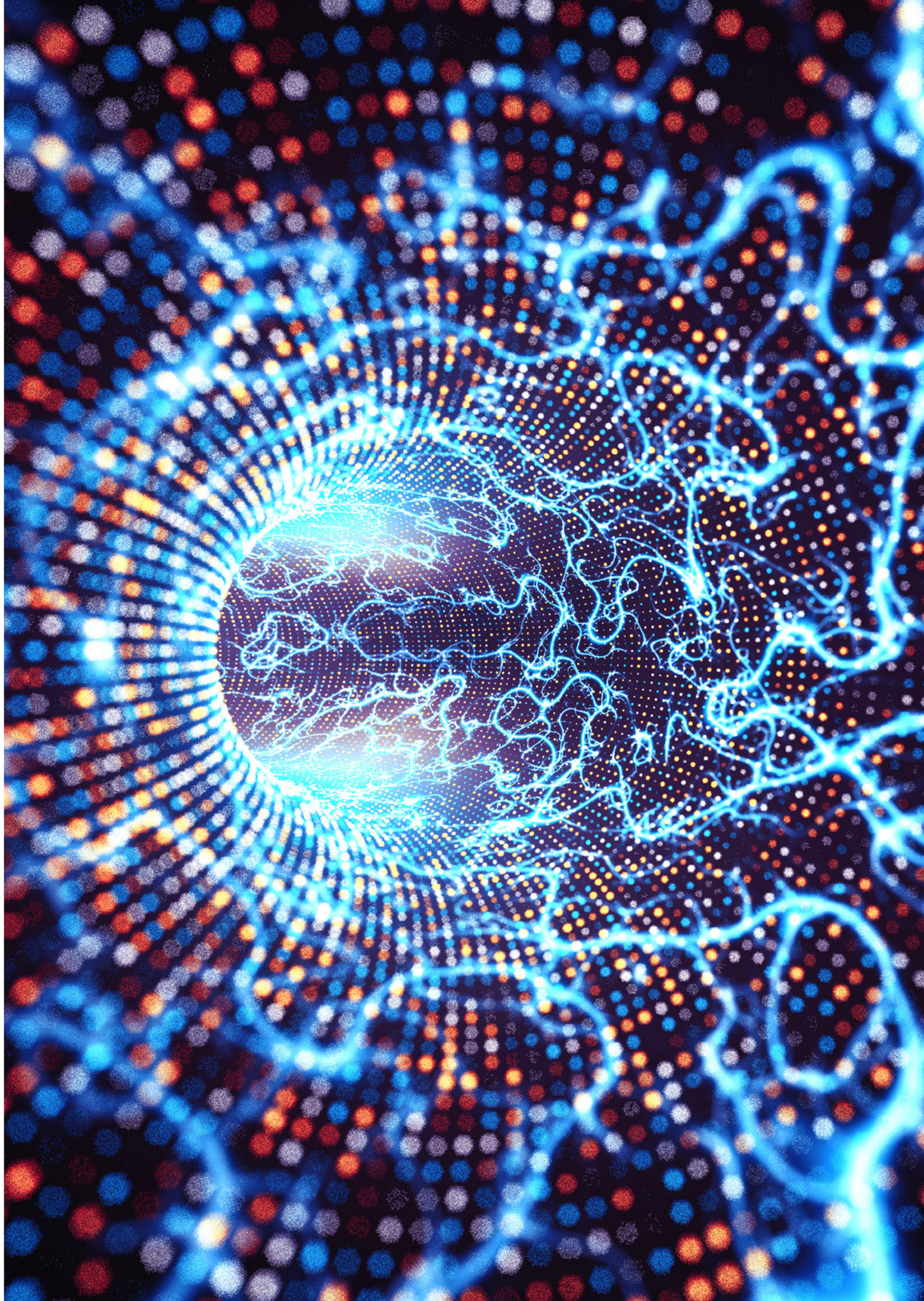
Ultra 888 Power Requirements

- Power Input: +12 VDC ± 5% @ 8 A
- Power Consumption: 96 W max
- Ripple and noise: 120 mV max (peak-peak 0 - 20 MHz)
- External Power Supply: 100 - 240 VAC 50/60 Hz

Ultra 897 Power Requirements

- Power Input: +12 VDC ± 5% @ 6 A
- Power Consumption: 72 W max
- Ripple and noise: 120 mV max (peak-peak 0 - 20 MHz)
- External Power Supply: 100 - 240 VAC 50/60 Hz

Logic: Connector type: 26 way D Type with 8 programmable digital inputs or outputs for control and sensing of up to 8 external devices, Minimum cable clearance required: 90 mm, Weight: 3.7 kg [8 lb 3 oz] approx.



Order Today

Need more information? At Andor we are committed to finding the correct solution for you. With a dedicated team of technical advisors, we are able to offer you one-to-one guidance and technical support on all Andor products. For a full listing of our local sales offices, please see: andor.oxinst.com/contact

Our regional headquarters are:

Europe
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Fax +1 (860) 290 9566

China
Beijing | Shanghai | Guangzhou
Phone +86 (400) 678 0609
Fax +86 (10) 5884 7901

Items shipped with your iXon Ultra 888:
1x Andor ACZ-03463: 2m Multi I/O timing cable, offering Fire, External Trigger, Shutter and Arm
1x 3m USB 3.0 cable Type A to Type B
PCIe USB 3.0 Card Adapter (2-Port)[•12]
1x Power supply unit with mains cable
1x Quick Start guide
1x Electronic copy of user manuals
1x SRRF-Stream Quick Start guide (if applicable)
1x Individual system performance booklet

Items shipped with your iXon Ultra 897:
1x Andor ACZ-03463: 2 m Multi I/O timing cable, offering Fire, External Trigger, Shutter and Arm
1x 3m USB 2.0 cable Type A to Type B
1x Power supply unit with mains cable
1x Quick Start guide
1x Electronic copy of user manuals
1x SRRF-Stream Quick Start guide (if applicable)
1x Individual system performance booklet

Recommended Computer Requirements:
- 3.0 GHz single core or 2.6 GHz multi core processor
- 2 GB RAM
- 100 MB free disc space to install software (at least 1 GB recommended for data spooling)
- USB 3.0 Super Speed Host Controller capable of a sustained rate of 60MB/s for iXon Ultra 888
- USB 2.0 High Speed Host Controller capable of sustained rate of 40MB/s for iXon Ultra 897
- Solid-state drive (SSD) capable of a minimum sustained write speed of 100MB/S for spooling data
- Windows (8.1, 10 and 11) or Linux
- SRRF-Stream+ - If selected, the PC requires a Nvidia GPU card. See page 10 for further details.

Footnotes: Specifications are subject to change without notice

1. Assembled in a state-of-the-art cleanroom facility, Andor's UltraVac™ vacuum process combines a permanent hermetic vacuum seal (no o-rings), with a stringent protocol to minimize outgassing, including use of proprietary materials.
2. Figures are typical unless otherwise stated.
3. At 30 MHz overclocked pixel readout rate, thermal dissipation from the sensor is higher since a greater proportion of time is spent vertical shifting, and it is necessary to set a higher sensor cooling temperature at this rate. Furthermore, stable cooling performance will depend on other variables such as vertical clock speed, Region of Interest size (Standard or Crop Mode) and ambient temp. As such, user testing is advised to determine the stable sensor cooling temperature for selected conditions. Status of temperature stability is apparent through the acquisition software.
4. The dark current measurement is averaged over the sensor area excluding any regions of blemishes.
5. Using Electron Multiplication the iXon is capable of detecting single photons, therefore the true camera detection limit is set by the number of 'dark' background events. These events consist of both residual thermally generated electrons and Clock Induced Charge (CIC) electrons (also referred to as Spurious Noise), each appearing as random single spikes 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. Acquisition conditions are full resolution and max frame rate (30 MHz readout; frame-transfer mode; 1.1 µs vertical clock speed; x 1000 EM gain; 10 ms exposure; -95°C).
6. The EM register on CCD201 sensors has a linear response up to ~400,000 electrons and a full well depth of ~730,000 electrons.
7. Readout noise is for the entire system. It is a combination of sensor readout noise and A/D noise. Measurement is for Single Pixel readout with the sensor at a temperature of -75°C and minimum exposure time under dark conditions. Under Electron Multiplying conditions, the effective system readout noise is reduced to sub 1 e^- levels.
8. Linearity is measured from a plot of counts vs. exposure time under constant photon flux up to the saturation point of the system, at 10 MHz readout speed.
9. All measurements are made at 30 MHz pixel readout speed with 0.6 µs vertical clock speed. It also assumes internal trigger mode of operation. Standard and Crop Mode frame rates shown are for 'Corner Tethered' ROIs, with 'Optically Centred' ROI frame rates shown within brackets.
10. All measurements are made at 17 MHz pixel readout speed with 0.3 µs vertical clock speed. It also assumes internal trigger mode of operation. Standard and Crop Mode frame rates shown are for 'Corner Tethered' ROIs, with 'Optically Centred' ROI frame rates shown within brackets.
11. Quantum efficiency of the sensor at -100°C, as supplied by the sensor manufacturer.
12. iXon Ultra 888 should work with any modern USB 3.0 enabled PC/laptop, as every USB 3.0 port should have its own host controller. iXon Ultra 888 also ships with a USB 3.0 PCI card as a means to add a USB 3.0 port to an older PC, or as a diagnostic aid to interoperability issues.

Operating & Storage Conditions
- Operating Temperature: -20°C to 30°C ambient
- Relative Humidity: < 70% (non-condensing)
- Storage Temperature: -25°C to 50°C

Power Requirements
- Please refer to page 10