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ANDOR
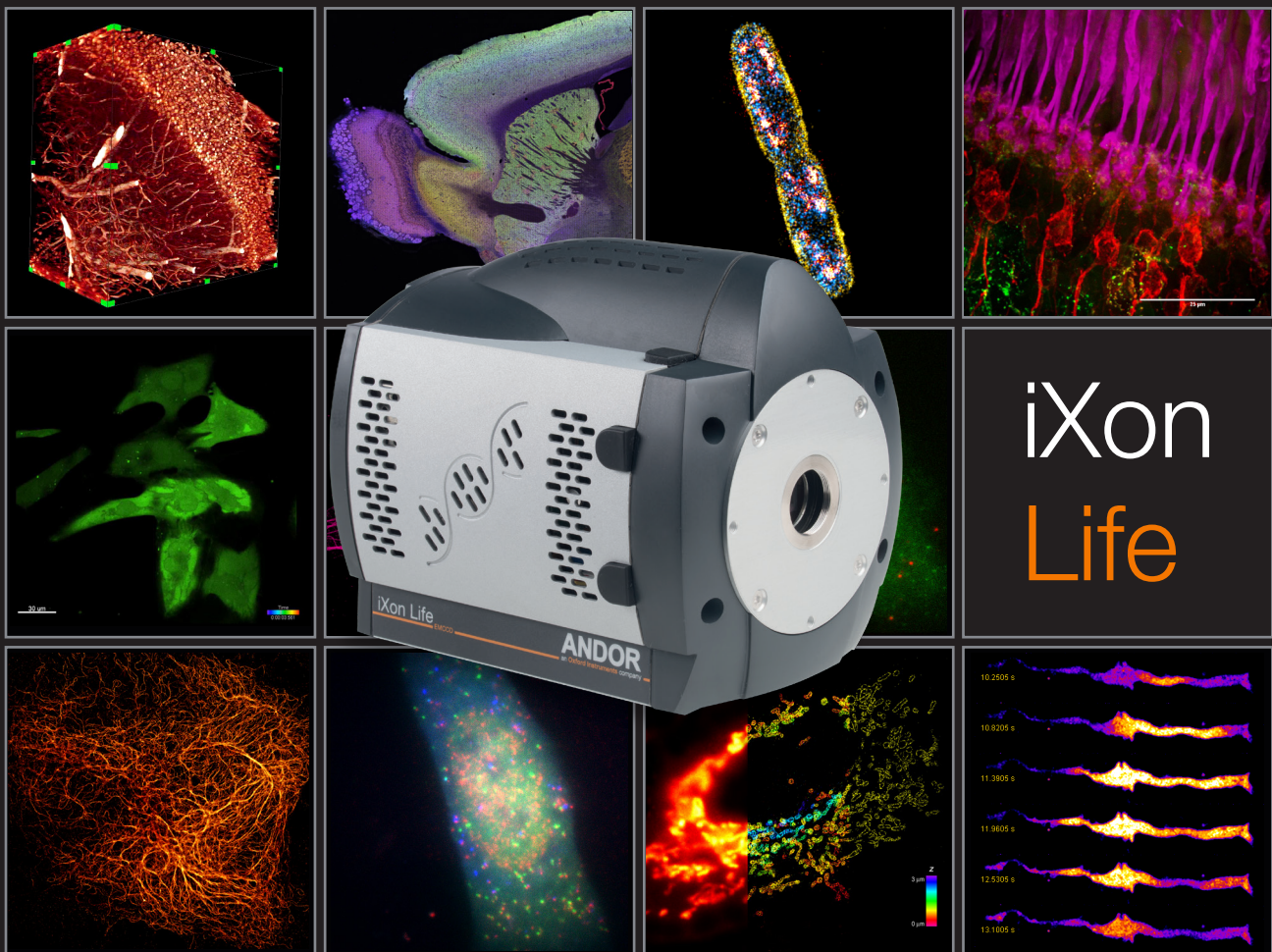an Oxford Instruments company

NEW iXon Life

EMCCD Performance...Superb Value

iXon
Life

- ✓ **THE** detector for **single molecule detection**
- ✓ **NEW SRRF-Stream** - Real time super-resolution from a camera
- ✓ Lowest phototoxicity of living cells - **longer observation time**
- ✓ Lowest fluorophore concentrations - **accurate physiology**
- ✓ Stunning **price/performance**

Exclusively for Fluorescence Microscopy

Introducing iXon Life

EMCCD ultrasensitivity…breakthrough price!

Andor's new **iXon Life EMCCD** (Electron Multiplying CCD) platform is available **exclusively for fluorescence microscopy** applications and is engineered to deliver **single photon sensitivity** with absolutely **unparalleled price/performance**.

Available in 1024 x 1024 and 512 x 512 sensor formats, each **back-illuminated,** to deliver the highest and broadest QE of any microscopy camera, and **deep cooled down to -80ºC** for minimal darkcurrent, iXon Life represents a way to access, quite simply, the ultimate detector technology for single molecule biophysics and low-light live cell microscopy, in a distinctly budget friendly format.
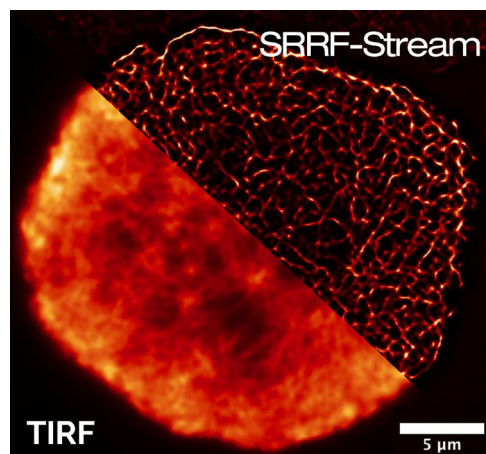
Now available with **NEW SRRF-Stream** technology, converting most modern conventional microscopes into a real time super-resolution microscope, for imaging live and fixed cells with low excitation intensities and without the need for specialised photoswitchable fluorophores (e.g. works with GFP).
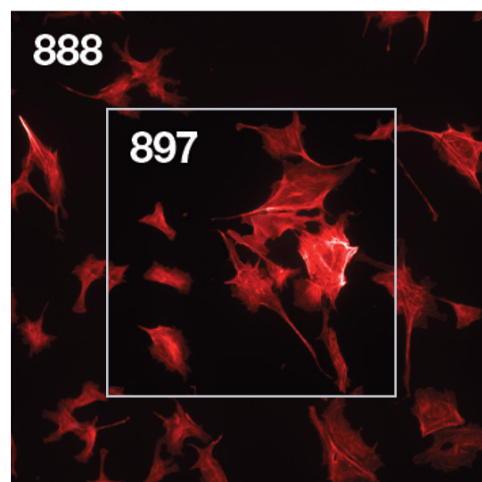
Benefit from the absolute best

Andor, the strong market leaders in EMCCD technology, have been innovating and continually raising the bar in this stimulating technology space for more than 16 years, shipping more than 10,000 EMCCD cameras used in countless publications.

Andor's superb reputation for **performance and quality** has been brought to bear in this latest generation platform in an amazing value format that has been designed exclusively for fluorescence microscopy customers, yet without compromising on the key performance attributes that are critical for this challenging area of research.

Comparative TIRF image compared to TIRF with SRRF-Stream super-resolution. Live-imaging of Jurkat T cells. *Courtesy of Ricardo Henriques, MCR LMB, University College London.*

Relative sensor size of the iXon Life models:

Specification	888	897
Active pixels (H x V)	1024 x 1024	512 x 512
Pixel Size (H x V: μm)	13 x 13	16 x 16
Active Area Pixel Well Depth (e⁻)	80,000	180,000
Max Readout Rate (MHz)	30	17
Frame rates (fps)	26 (full frame) - 9600	56 (full frame) -11,074
Read noise (e⁻)	<1 e⁻ with EM gain	
QE Max	>95%	

Model	Image Area (W x H, mm)	Diagonal (mm)
888	13.3 x 13.3	18.8
897	8.2 x 8.2	11.6

Features & Benefits

Feature	Benefit
Single Photon Sensitive & > 95% QE	Optimal SNR in light starved applications such as single molecule detection and quantum physics.
NEW 'SRRF-Stream' (optional)	Real time, cell super-resolution functionality. Living and fixed cells, works on most modern fluorescence microscopes. Super-resolution down to 50nm.
Overclocked readout speeds	Follow dynamic changing processes.
Crop Mode	Continuous imaging with fastest possible frame rate from centrally positioned ROIs. Highly enabling for live cell super-resolution and much more (e.g. 251 fps with 256 x 256 ROI).
TE cooling to -80°C	Elimination of dark current detection limit.
Superior Baseline Clamp and EM Stability	Essential for quantitative accuracy of dynamic measurements.
RealGain™	Absolute EMCCD gain selectable directly from a linear and quantitative scale.
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. Applied either in real-time or post-processing, Count Convert does this important conversion for you.
EMCAL™	Patented user-initiated self-recalibration of EM gain.
Minimal Clock-Induced Charge	Unique pixel clocking parameters, yielding minimized spurious noise floor.
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. Real-time or post-processing.
iCam	Exposure time fast switching provides market leading acquisition efficiency.
FPGA Timestamp	Hardware generated timestamp with 10 ns accuracy.

What difference can the iXon Life EMCCD make?

The new iXon Life delivers on the key attributes of ultra-sensitivity that thousands of Andor iXon EMCCD customers have been benefiting from for many years:

✓ **Single Molecule Detection** – Single molecule experiments present us with the considerable challenge of harnessing the limited photon budget from dynamic, individual fluorescent molecules, while also avoiding photobleaching. Andor iXon EMCCDs have continued to radically out-perform sCMOS detectors in this most demanding of light starved application areas.

✓ **Reduced phototoxicity** – iXon Life facilitates use of lowest possible excitation power while maintaining superb signal to noise ratio, minimizing phototoxic effects. No other camera is this good at preserving your cell's physiological behaviour over extended periods of measurement.

✓ **Lowest dye concentrations** – There is an ongoing drive in fluorescence microscopy to push to lower and lower fluorophore concentrations in order not to perturb the physiology of the living cells being studied. iXon Life's superior sensitivity facilitates use of unprecedentedly low label concentrations, thus minimizing the 'observer effect'.

Application Focus

Single Molecule Detection

For many years, Andor's iXon EMCCDs have been the gold standard detectors of the biophysics laboratory. To this day they remain the dominant detector type, operating in a low light regime that is less suited to even back-illuminated sCMOS cameras, especially under the critically demanding conditions of minimized fluorophore photobleaching.

The accelerated readout rates of the iXon Life, especially combined with '**Optically Centred Crop Mode**', means that dynamic single molecule processes can be better characterised. The 13 µm pixel of the 888 model provides superb single molecule resolving capability at the diffraction limit, while preserving optical photon collection efficiency.

SRRF-Stream

SRRF-Stream is a **NEW real time super-resolution** 'nanoscopy' functionality that operates on Andor's iXon EMCCD cameras. 'SRRF-Stream unlocks the means to perform real time super resolution microscopy on **conventional modern fluorescence microscopes**. Resolution improvement from **2- to 6-fold (50-150nm final resolution)** can be expected for most datasets.


PALM rpoC-pamCh1	PAINT Nile Red - membrane	dSTORM AF647 - DNA	Overlay rpoC - membrane - DNA
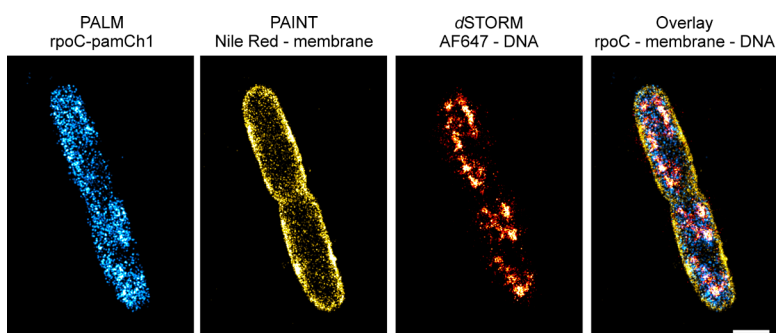
Sequential PALM (RNAp), PAINT(membrane) and dSTORM (DNA) imaging of E.coli cells. Scale bar is 1 µm. *Courtesy of Christoph Spahn, Ulrike Endesfelder & Mike Heilemann, Institute of Physical and Theoretical Chemistry, Goethe-University Frankfurt.*

## Physiology / Ion Imaging & Cell Motility

Unsurpassed EMCCD sensitivity and superb custom ROI speeds make the iXon Life 888 and 897 the best possible detectors for temporally resolving fast calcium sparks and waves under minimal dye concentrations, critical to reducing the 'dye buffering effect' that can distort the very physiology that is under study. Light levels become more challenging still when combined with low light optical sectioning modalities. The same advantages play equally well to imaging of the motile cell.

Spinning Disk Confocal

The iXon Life 888 is the ideal detector to drive superlative performance from confocal spinning disk technology. Whilst affording superb confocality and low rates of phototoxicity, spinning disk experiments are inherently photon starved, by virtue of the photon rejection implicit to optical sectioning. The superior sensitivity of the iXon Life detector brings these low light images to life! Often, confocal systems are equipped with a second Andor sCMOS camera to access the highest possible resolution and field of view, provided the sample is sufficiently bright.
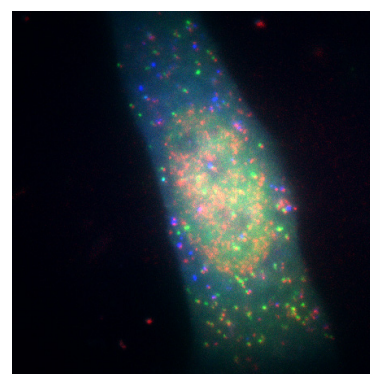
Single molecule imaging mRNA (red), during translation, and proteins, FLAG-KDM5B (green) and HA-KDM5B (blue). *Courtesy of Timothy J. Stasevich, IGAF, Colorado State University.*
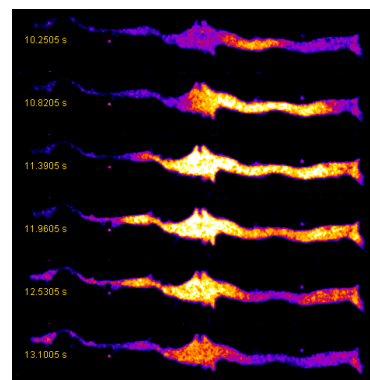
Initiation, propagation and termination of a Ca^{2+} wave visualized with FURA-2 dye. *Courtesy of Mark Hollywoood, Dundalk Institute of Technology.*
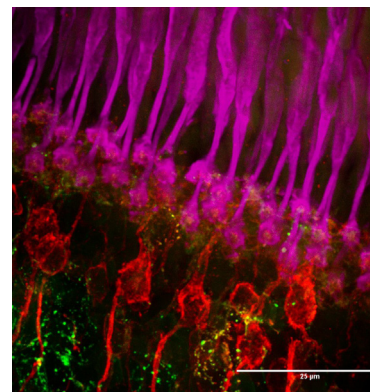
Adult zebrafish retina: cone photoreceptors (pink) and two subpopulations of bipolar cells (red and green). *Courtesy of Tim McGinn, University of Idaho.*

Technical Specifications

System Specifications [2]

	iXon Life 888		iXon Life 897	
Sensor	BV: Back Illuminated, standard AR coated			
Active pixels	1024 x 1024		512 x 512	
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	30 MHz[3]	10 MHz	17 MHz	10 MHz
Minimum temperature, air cooled, ambient 20°C **Chiller liquid cooling, coolant @ 10°C, >0.75l/min**	-55°C -65°C	-70°C -80°C	-70°C -80°C	-70°C -80°C
Thermostatic Precision	± 0.01°C			
Triggering	Internal, External, External Start, External Exposure, Software Trigger			
System window type	UV-grade fused silica, Broadband Visible-Near Infrared, 0.5 degree wedge			
Blemish specification	Grade 1 sensor from supplier. Camera blemishes as defined by Andor Grade A www.andor.com/learning-academy/ccd-blemishes-and-non-uniformities-black-pixels-and-hot-pixels-on-a-ccd-sensor			
Digitization	16-bit (at all speeds)			
PC Interface	USB 3.0[12]		USB 2.0	
Lens Mount	C-mount			

Advanced Performance Specifications [2]

	iXon Life 888	iXon Life 897
Dark current and background events [4,5] **Dark current (e$^-$/pixel/sec) @ -80°C**	0.00025	0.00030
Spurious background (events/pix) @ 1000x gain / -80°C	0.005	0.0018
Active area pixel well depth	80,000 e$^-$	180,000 e$^-$
Gain register pixel well depth [6]	730,000 e$^-$	800, 000 e$^-$
Pixel readout rates	30, 10 MHz	17, 10 MHz
Read noise (e$^-$) [7]	< 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 3.3 µs (user selectable)
Timestamp accuracy	10 ns	
NEW SRRF-Stream mode	Optional	

iXon Life 888 - Frame Rates

Standard Mode [3,9]

Binning	Array size						
	1024 x 1024	512 x 512	256 x 256	128 x 128	1024 x 100	1024 x 32	1024 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	Array size						
	512 x 512	256 x 256	128 x 128	64 x 64	1024 x 100	1024 x 32	1024 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 Life 897 - Frame Rates

(Standard Mode) [10]

Binning	Array size						
	512 x 512	256 x 256	128 x 128	64 x 64	512 x 100	512 x 32	512 x 1
1 x 1	56	110	212	397	277	704	2,857
2 x 2	109	210	394	699	503	1,136	-
4 x 4	206	385	680	1,099	840	1,613	-

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

Binning	Array size						
	256 x 256	128 x 128	64 x 64	32 x 32	512 x 100	512 x 32	512 x 1
1 x 1	111 (174)	595 (569)	1,433 (1,492)	3,532 (3,024)	296	857	11,074
2 x 2	215 (329)	1,085 (1,014)	2,433 (2,329)	5,325 (4,054)	570	1,589	-
4 x 4	402 (594)	1,802 (1,662)	3,577 (3,237)	6,579 (5,252)	1,050	2,682	-

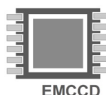## Quantum Efficiency (QE) Curve [11]
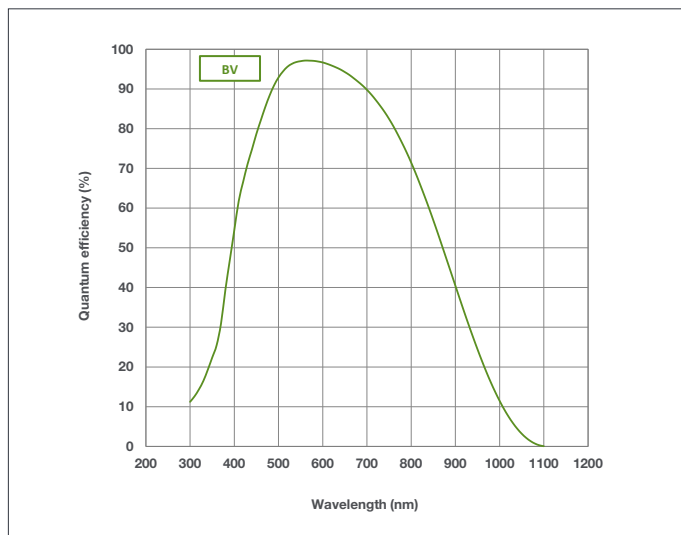
QE vs. Fluorophore Emissions
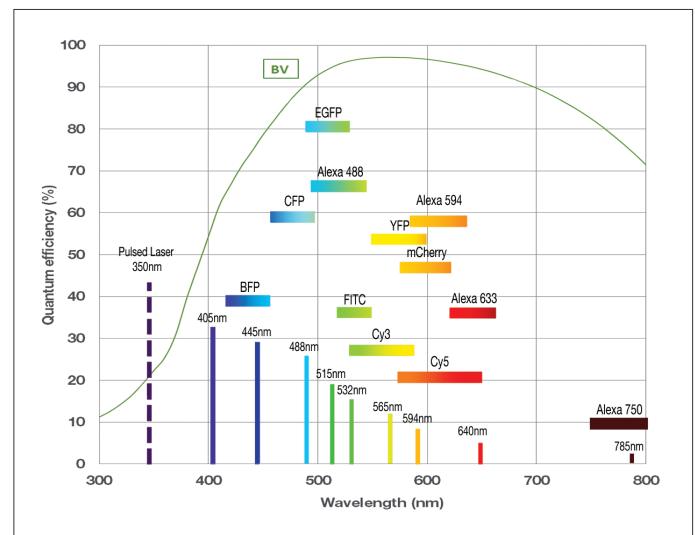
Creating The Optimum Product for You
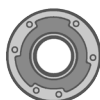
Step 1. Choose the camera type option

EMCCD

Camera Type

Description	Code
iXon Life 888: Back-illuminated 1024 x 1024 EMCCD, BV - standard AR coated, max. 30 MHz, with USB 3.0	**iXon-L-888**
iXon Life 897: Back-illuminated 512 x 512 EMCCD, BV - standard AR coated, max. 17 MHz, with USB 2.0	**iXon-L-897**

NOTE: If **SRRF-Stream** real time super-resolution functionality is required with your iXon Life, please order as an 'accessory' in step 2 below.

Step 2. Select the required accessories

Accessories

Description	Order Code
SRRF-Stream real time super-resolution functionality, compatible with iXon Ultra and iXon Life EMCCD platforms. Camera must be connected to acquisition PC workstation containing an NVidia GPU card (compute capability v3.0, or above, and 4GB or greater on-board GPU RAM).	**SRRF-STREAM-CAM**
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**
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**
15 m Active USB 3.0 connector cable (power supply not required) Icron for iXon Life 888	**ACC-ASE-06887**

Step 3. Select the required software

Software

The iXon Life series requires one of the following software options:

Solis Imaging A 32-bit and fully 64-bit enabled application for Windows (7, 8, 8.1 and 10) 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 (7, 8, 8.1 and 10), compatible with C/C++, C#, Delphi, VB.NET, LabVIEW and Matlab. Linux SDK compatible with C/C++.

Andor iQ A comprehensive multi-dimensional imaging software package. Offers tight synchronization of EMCCD with a comprehensive range of microscopy hardware, along with comprehensive rendering and analysis functionality. Modular architecture for best price/performance package on the market.

Third party software compatibility
Drivers are available so that the iXon range can be operated through a large variety of third party imaging packages.
See Andor web site for detail: andor.com/software

For SRRF-Stream
The iXon must be operated either through MicroManager (Open Imaging) open source microscopy software platform, or through the Andor SDK, if SRRF-Stream functionality is to be accessed.

Have you found what you are looking for?

Need more flexibility? The iXon Ultra series represents the absolute top of the range in terms of EMCCD performance and rich feature set. For example, the Ultra models include both EMCCD and conventional slow scan CCD modes and a greater selection of readout speeds. The Ultra also extends cooling down to -95 ^{0}C!

Need faster frame rates? The Zyla sCMOS platform, configured with CameraLink interface, can deliver 100 fps from a full 4.2 or 5.5 Megapixel array, faster still with sub-array selection.

Need smaller pixels? The Neo and Zyla sCMOS cameras offer sensors with 6.5 µm pixel pitch, ideal for x60 objectives without need for C-mount magnification.

**Need even broader QE?** The iXon Ultra range offers sensor options that extend QE further into the both the blue and NIR ends of the range, accompanied by fringe suppression options for reduced etaloning when imaging in the NIR. Alternatively, if you are not speed challenged then why not consider the 'BEX2-DD' sensor option of the iKon-M or iKon-L CCD platforms – it doesn't come broader than that!

Product Drawings

Dimensions in mm [inches]

iXon Life 888

iXon Life 897

Third-angle projection
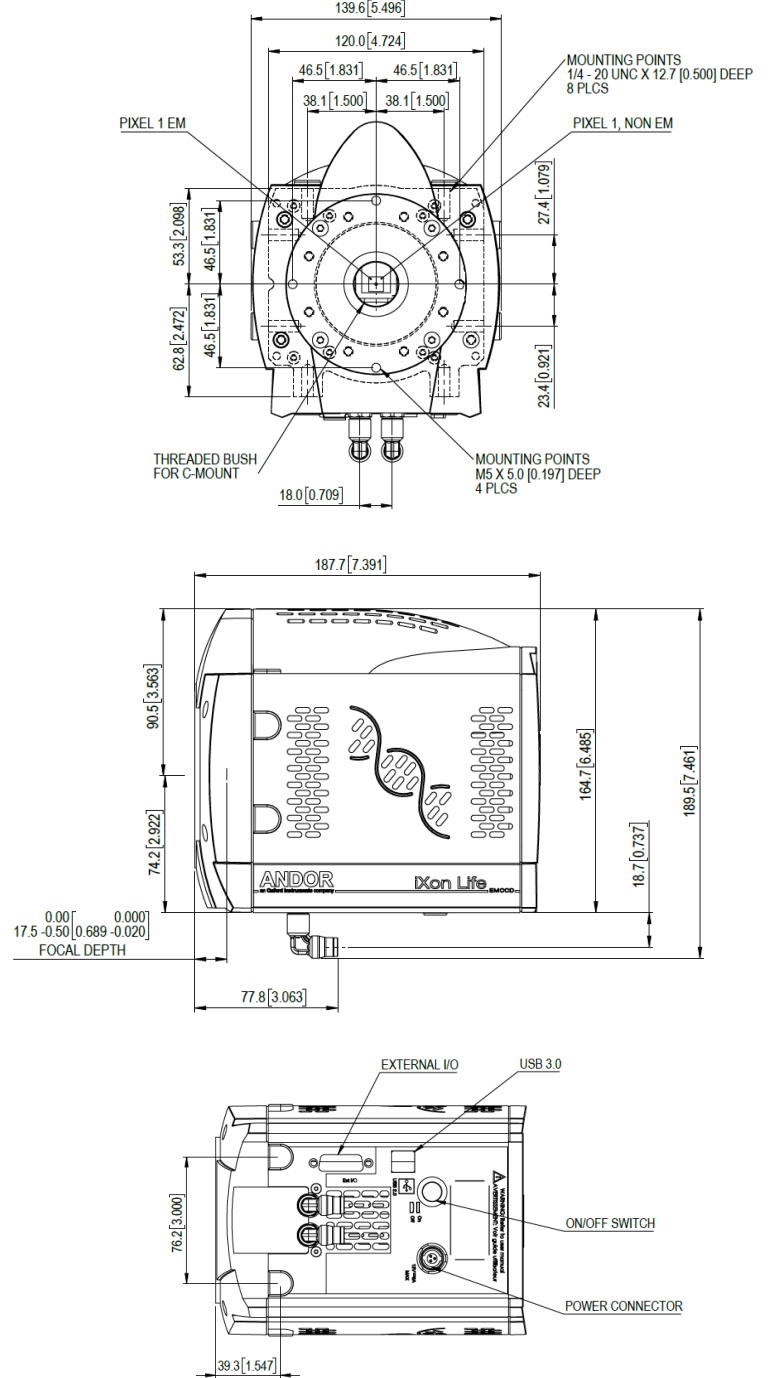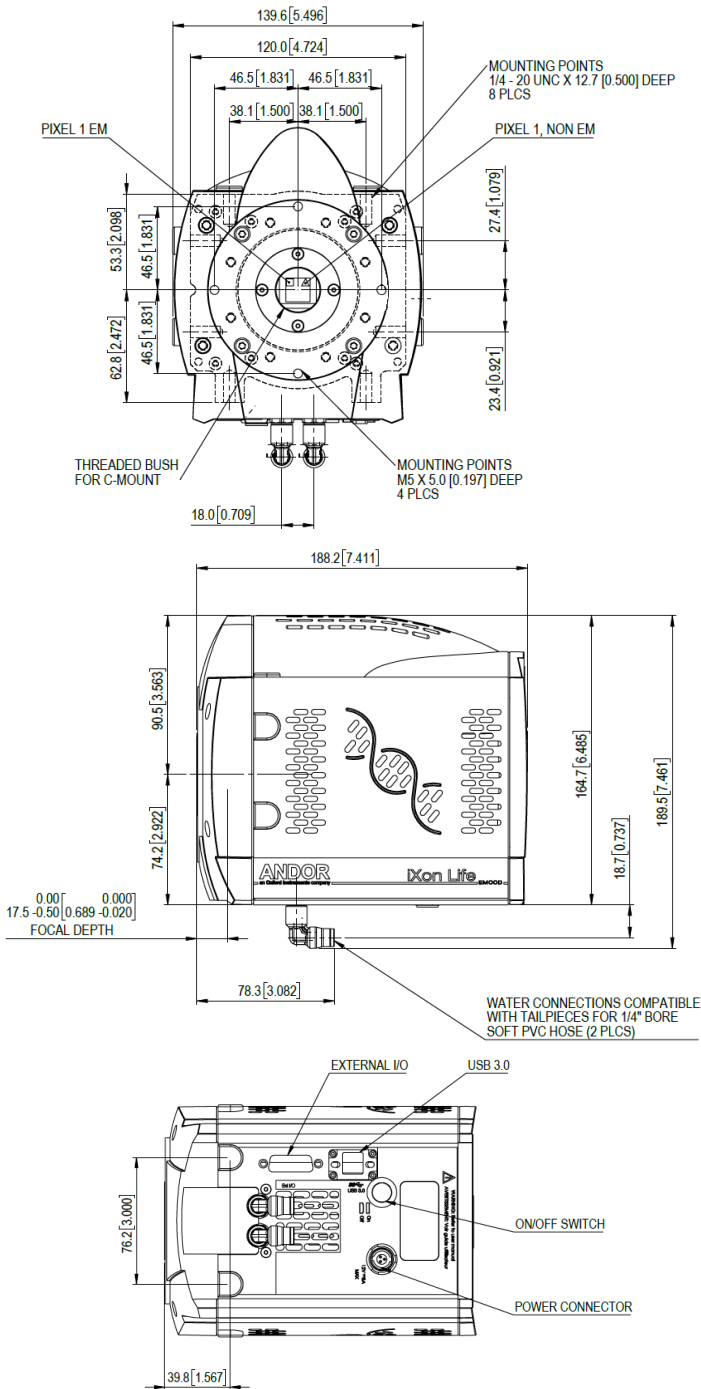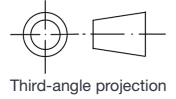
iXon Life 888 Power Requirements

- 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

iXon Life 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.

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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.com/contact**

Our regional headquarters are:

Europe
Belfast, Northern Ireland
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Fax +44 (28) 9031 0792

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Fax +81 (3) 6732 8939

North America
Concord, MA, USA
Phone +1 (860) 290 9211
Fax +1 (860) 290 9566

China
Beijing
Phone +86 (10) 8271 9066
Fax +86 (10) 8271 9055

Items shipped with your iXon Life 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 with mains cable
1x Quick Start guide
1x CD containing Andor user manuals
1x SRRF-Stream Quick Start guide (if applicable)

Items shipped with your iXon Life 897:

1x Andor ACZ-03463: 2m 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 with mains cable
1x Quick Start guide
1x CD containing Andor user manuals
1x SRRF-Stream Quick Start guide (if applicable)

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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; -80°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.
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. 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 0.5 µs vertical clock speed. It also assumes internal trigger mode of operation. 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 25°C, as supplied by the sensor manufacturer.
12. iXon Life 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 Life 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.

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 Life 888
• USB 2.0 High Speed Host Controller capable of sustained rate of 40MB/s for iXon Life 897
• Soild-state drive (SSD) capable of a minimum sustained write speed of 100MB/S for spooling data
• Windows (7, 8, 8.1 and 10) or Linux
• SRRF-Stream - If selected, the PC requires an NVidia GPU card. See page 7 for further details.

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
• Please refer to page 8

Leica MICROSYSTEMS · MetaMorph NX · LabVIEW · MATLAB
NIS-Elements · µManager · cellSens
Compatible with Windows 7 · Windows 8 Compatible · Windows 10 Compatible · Linux · CE
bsi. ISO 9001 Quality Management FM40523 · bsi. ISO 14001 Environmental Management EMS91062 · bsi. OHSAS 18001 Occupational Health and Safety Management OHS502497

LiXonLifeSS 0818 R2