iKon-L Series

4 Megapixel, -100°C, 5 MHz Imaging CCD

ANDOR
an **Oxford Instruments** company

Ultra Sensitive Imaging

NEW

NOW AVAILABLE WITH

DUAL AR EXTENDED RANGE & FRINGE SUPRESSION TECHNOLOGY

Features and Benefits

- **Broad wavelength coverage**
  Now available with BR-DD (red/NIR), BEX2-DD (UV-NIR Broadband) and BU2 (UV/blue) sensor options

- **TE cooling to -100°C**
  Critical for elimination of dark current detection limit

- **Fringe Suppression Technology™**
  NIR etaloning greatly reduced (BR-DD and BEX2-DD sensor types)

- **4-speed readout up to 5 MHz** [10]
  Slower readout for low noise, faster speeds for dynamic processes and 5 MHz for vizualization mode

- **Ultra low noise readout**
  Intelligent low-noise electronics offer the most 'silent' system noise performance available

- **Large area 2048 x 2048 sensor**
  Large field of view and high resolution

- **UltraVac™** [1]
  Critical for sustained vacuum integrity and to maintain unequalled cooling and QE performance, year after year

- **Dual output**
  High Sensitivity output for low-light applications, or High Capacity output for maximum dynamic range

- **Integrated shutter** [2]
  F-mount (EF optional) with integrated programmable 45 mm shutter

- **Fast Kinetics & Cropped Sensor modes**
  For fast temporal resolution down to sub-millisecond

- **USB 2.0 connection**
  Simple Plug & Play connection

- **Windows, Linux & Labview**
  Andor's user-friendly SDK supports both Windows and Linux OS. Labview VI package available

-100°C Deep-Cooled CCD for Large Area Imaging

Andor's iKon-L 936 is designed with scientific imaging in mind. The 2048 x 2048 array and 13.5 µm pixel pitch combine to deliver a 27.6 x 27.6 mm active image area, TE cooled down to -100°C. The iKon-L offers outstanding resolution, field of view, sensitivity and dynamic range performance. Ultimate sensitivity performance is achieved through combination of > 90% QE (back-illuminated sensor), low noise readout electronics and exceptionally deep TE cooling. The new Dual AR deep depletion 'BEX2-DD' sensor option provides an unmatched QE profile, offering highest possible QE from UV through to NIR.

iKon-L boasts a proprietary large area 5-stage TE cooler (4-stage optional), enabling cooling of this large area sensor down to an unprecedented -100°C without the aggravation of liquid nitrogen or compressed gas cooling, perfect for the longest of exposure times. Such performance renders this camera ideal for low-light applications such as astronomy or luminescence imaging, with ideal OEM adaptability and support. USB 2.0 connectivity and multi-MHz readout options provide for ease of integration and operation.

Specifications Summary [3]

Active pixels	2048 x 2048
Sensor size	27.6 x 27.6 mm
Pixel size (W x H)	13.5 µm x 13.5 µm
Active area pixel well depth	100,000 e$^-$ (150,000 e$^-$ for BEX2-DD and BR-DD models)
Maximum readout rate	5 MHz
Read noise	2.9 e$^-$
Maximum cooling	-100°C
Frame rate	0.95 fps (full frame)

System Specifications[3]

Sensor options	**BV**: Back Illuminated CCD, Vis optimized **BU2**: Back Illuminated CCD, UV-Enhanced, 250 nm optimized **FI**: Front Illuminated CCD **BR-DD**: Back Illuminated CCD, Deep Depletion with fringe suppression. Optimum sensor for Near IR applications. **BEX2-DD**: Back Illuminated CCD, Deep Depletion with fringe suppression, extended range dual AR coating
Active pixels [4]	2048 x 2048
Pixel size	13.5 x 13.5 µm
Image area	27.6 x 27.6 mm with 100% fill factor

Minimum temperatures [5]	4-stage peltier cooler	5-stage peltier cooler
Air cooled	-70°C	-80°C
Coolant recirculator	-75°C	-95°C
Coolant chiller, coolant @ 10°C, 0.75 l/min	-80°C	-100°C

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
System window type	**BV, BR-DD sensors**: UV-grade fused silica, 'Broadband VIS-NIR', unwedged **BU2, FI, BEX2-DD sensors**: UV-grade fused silica, 'Broadband VUV-NIR', unwedged (other options available e.g. Bose-Einstein 780nm for Rb BEC experiments)

Advanced Performance Specifications[3]

Dark current, e⁻/pixel/sec [6]	BV, BU2, FI sensors	BR-DD, BEX2-DD sensors
@ -70°C	0.00040	0.020
@ -80°C	0.00013	0.006
@ -100°C (5-stage peltier cooler model only)	0.000059	0.0003

Pixel readout rates	5, 3, 1, 0.05 MHz	
Active area pixel well depth	100,000 e⁻	150,000 e⁻

Read noise (e⁻) [7]	High Sensitivity output	High Capacity output
0.05 MHz	2.9	8.7
1 MHz	7.0	22.2
3 MHz	11.7	40.2
5 MHz [10]	31.5	70.3

Linearity [8]	Better than 99%
Digitization	16-bit
Vertical clock speed	38 or 76 µs (software selectable)

Frame Rates[9]

50 kHz			
Binning	**Full Frame**	**1024 x 1024**	**512 x 512**
1 x 1	0.011	0.023	0.046
2 x 2	0.04	0.059	0.102
4 x 4	0.155	0.138	0.213
8 x 8	0.482	0.293	0.42
16 x 16	1.166	0.572	0.78

1 MHz			
Binning	**Full Frame**	**1024 x 1024**	**512 x 512**
1 x 1	0.221	0.433	0.835
2 x 2	0.662	0.993	1.67
4 x 4	1.594	1.947	2.951
8 x 8	2.912	3.266	4.571
16 x 16	4.152	4.71	6.204

3 MHz			
Binning	**Full Frame**	**1024 x 1024**	**512 x 512**
1 x 1	0.607	1.157	2.115
2 x 2	1.294	2.175	3.588
4 x 4	2.305	3.545	5.326
8 x 8	3.463	5.017	6.953
16 x 16	4.496	6.27	8.18

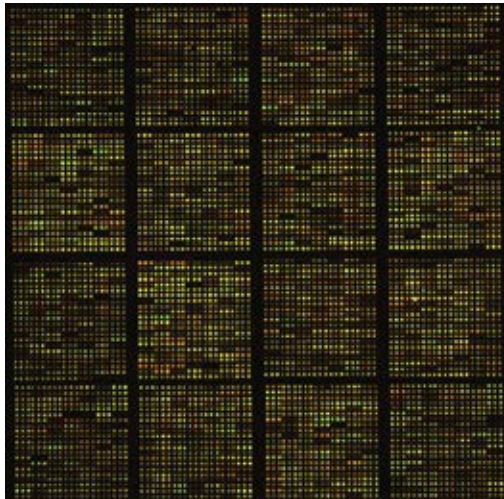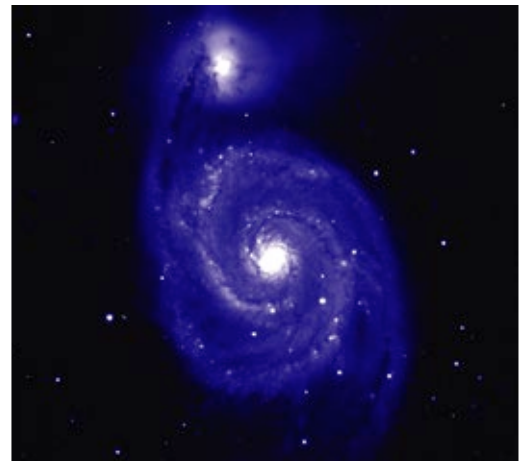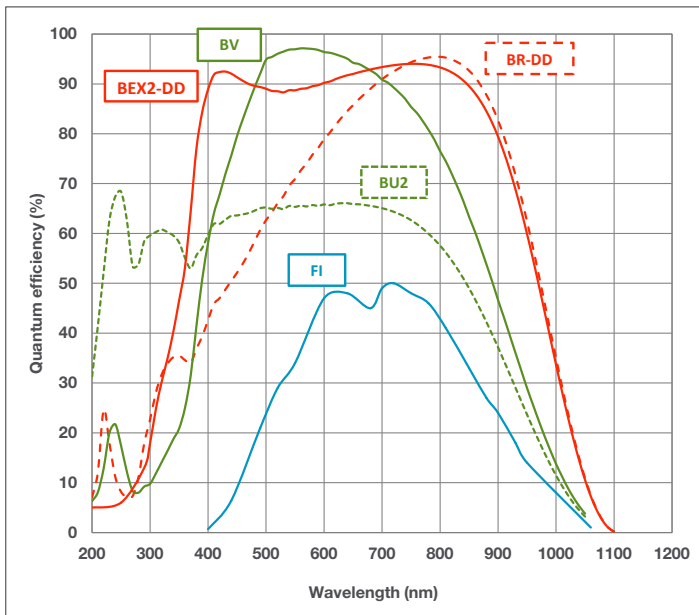| 5 MHz (Vizualization mode)[10]			
Binning	**Full Frame**	**1024 x 1024**	**512 x 512**
1 x 1	0.953	1.771	3.1
2 x 2	1.655	2.922	4.733
4 x 4	2.619	4.329	6.424
8 x 8	3.697	5.7	7.822
16 x 16	4.654	6.776	8.777

Application Images

Image of a high-density gene chip

Two interacting galaxies, M51 (Whirlpool Galaxy) & NGC 5195. Courtesy of Prof. Andrzej Pigulski, Wroclaw University, Poland.

Quantum Efficiency Curves [11]

Have you found what you are looking for?

Need the ultimate in sensitivity? The iXon back-illuminated EMCCD series offers > 90% QE and single photon sensitivity, combined with fast frame rate performance.

Need a large field of view with faster frame rates? The Neo and Zyla sCMOS are available in a large 5.5 megapixel sensor format that offers up to 100 fps (full frame). The iXon Ultra 888 offers ultimate sensitivity at 26 fps.

Need smaller pixels? Check out the Neo and Zyla sCMOS.

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

Creating The Optimum Product for You

D (Z) 936N- (FI)

example shown

Step 1. Choose the cooling option

Cooling

Description	Code
4-stage peltier cooling (Air cooled : -70°C, Coolant recirculator: -75°C, Coolant chiller, coolant @ 10°C, 0.75 l/min: -80°C)	W
5-stage peltier cooling (Air cooled: -80°C, Coolant recirculator: -95°C, Coolant chiller, coolant @ 10°C, 0.75 l/min: : -100°C)	Z

Step 2. Choose the sensor type option

Sensor Type

Description	Code
Back Illuminated CCD	BV
Front Illuminated CCD	FI
Back Illuminated CCD, AR coated for optimized performance in the 250 nm region	BU2
Back Illuminated CCD, Deep Depletion with fringe suppression. Optimum sensor for Near IR applications.	BR-DD
Back Illuminated CCD, Deep Depletion with fringe suppression, extended range dual AR coating	BEX2-DD

Step 3. 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 can be found in the Technical note – **'Camera Windows: Optimizing for Different Spectral Regions'**.

Step 4. Select the required accessories and adapters

Accessories & Adapters

Description	Order Code
Re-circulator for enhanced cooling performance	XW-RECR
Oasis 160 Ultra compact chiller unit	ACC-XW-CHIL-160
C-mount to Canon FD-mount adapter	OA-CCFM
C-mount to Nikon F-mount adapter	OA-CNAF
C-mount to Olympus OM adapter	OA-COFM
C-mount to T-mount adapter	OA-CTOT
Auto extension tubes (set of 3) for Canon EF	OA-ECAF
Auto extension tubes (set of 3) for C-mount	OA-ECMT
Auto extension tubes (set of 3) for Nikon F	OA-ENAF
USB Extender: Icron USB 2.0 Ranger 2201 (100 m) - EU/UK/US	ACC-USBX-EU ACC-USBX-UK ACC-USBX-US

Step 5. Select the required software

Software

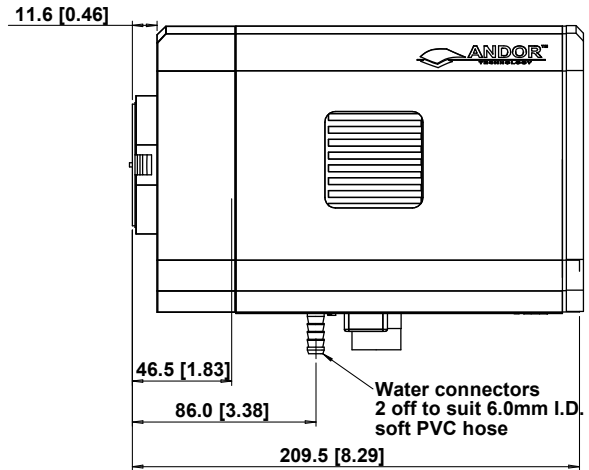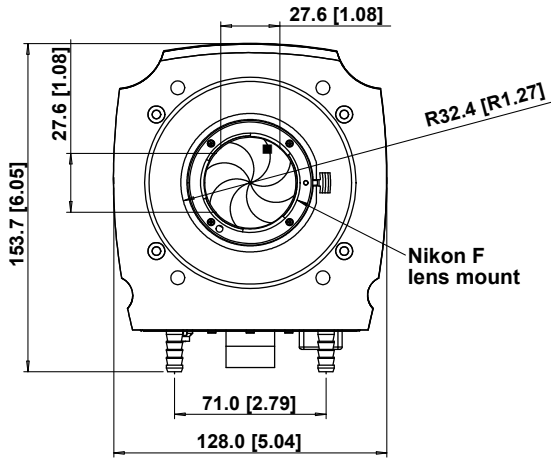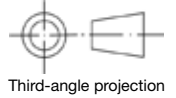**The iKon-L requires at least one of the following software options:**

Solis for Imaging A 32-bit and fully 64-bit enabled application for Windows (XP, Vista, 7 and 8) Linux and Labview, 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 (XP, Vista, 7 and 8), compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab. Linux SDK compatible with C/C++.

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

Product Drawings

Dimensions in mm [inches]

Third-angle projection

27.6 [1.08]

27.6 [1.08]

R32.4 [R1.27]

153.7 [6.05]

Nikon F
lens mount

71.0 [2.79]

128.0 [5.04]

11.6 [0.46]

46.5 [1.83]

86.0 [3.38]

209.5 [8.29]

Water connectors
2 off to suit 6.0mm I.D.
soft PVC hose

■ = position of pixel 1,1

Weight: 4.6 kg [10.2 lb]

Connecting to the iKon-L

Camera Control
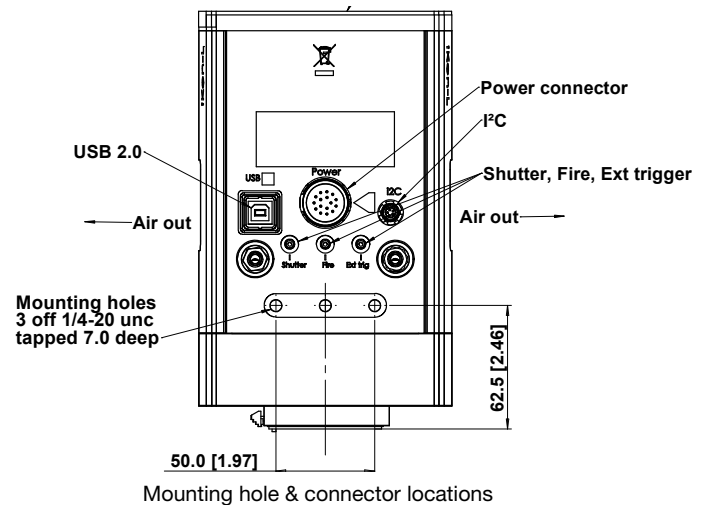Connector type: USB 2.0

TTL / Logic
Connector type: SMB, provided with SMB - BNC cable
Fire (Output), External Trigger (Input), Shutter (Output)

I²C connector
Compatible with Fischer SC102A054-130
Shutter (TTL), I²C Clock, I²C Data, +5 Vdc, Ground

Minimum cable clearance required at bottom of camera
90 mm

Power connector

I²C

USB 2.0

Shutter, Fire, Ext trigger

Air out

Air out

Mounting holes
3 off 1/4-20 unc
tapped 7.0 deep

62.5 [2.46]

50.0 [1.97]

Mounting hole & connector locations

Typical Applications

- ✓ Astronomy
- ✓ Biochip Reading
- ✓ Bioluminescence/Chemiluminescence
- ✓ Bose-Einstein Condensation (BEC)
- ✓ Fluorescence Microscopy
- ✓ High Throughput Screening
- ✓ Hyper-Spectral imaging
- ✓ In-Vivo Luminescence
- ✓ Laser Induced Fluorescence (LIF)
- ✓ Neutron Radiography
- ✓ Semiconductor analysis

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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 camera

1x 2 m BNC - SMB connection cable
1x 3 m USB 2.0 cable Type A to Type B
1x PS-40 power supply
1x PS-40 to camera cable
1x PS-29 power supply with mains cable
1x Quick launch guide
1x CD containing Andor user guides
1x Individual system performance booklet

Background image on front page: NGC 6514 (M20)
The Trifid Nebula courtesy of R. Jay GaBany
(www.cosmotography.com)

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 material.
2. This integrated shutter can be removed on request, and the camera configured to trigger an external shutter via TTL output.
3. Figures are typical unless otherwise stated.
4. Edge pixels may exhibit a partial response.
5. Specified minimum air cooled temperature assumes ambient temperature of 25°C. Specified minimum temperature with coolant assumes coolant temperature of 10°C.
6. Dark current measurement is taken as a median over the sensor area excluding any regions of blemishes.
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 -80°C and minimum exposure time under dark conditions.
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. The frame rates shown are for a range of binning or array size combinations. All measurements are made with 38 µs vertical shift speed. It also assumes internal trigger mode of operation and minimum exposure time.
10. 5 MHz is for focusing/visualization mode only.
11. Quantum efficiency of the sensor at 25°C as supplied by the sensor manufacturer.

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 1GB recommended for data spooling)
- USB 2.0 High Speed Host Controller capable of sustained rate of 40MB/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
- 100 - 240 VAC, 50 - 60 Hz

FM40523   EMS91062   CE

EPICS   Diffraction Limited   LabVIEW   MATLAB

Windows 7   Windows 8   Linux

Windows is a registered trademark of Microsoft Corporation.
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MATLAB is a registered trademark of The MathWorks Inc.

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