iKon-L 936

ANDOR™ TECHNOLOGY

low-light imaging

Features & benefits

Min operating temp of -100°C with TE cooling
Negligible dark current without the aggravation or safety concerns associated with LN_2

Quad-speed readout up to 5 MHz
Extensive choice of readout digitization speeds. Slower readout for low noise, faster speeds for dynamic processes and 5 MHz for focusing mode.

UltraVac™ - guaranteed hermetic vacuum seal technology incorporating single window design
Ultimate reliability and sustained lifetime performance characteristics with maximum photon throughput.

Simple USB 2.0 connection
USB 2.0 connection direct from back of camera - no controller box required! Use with USB 2.0 to fiber-optic converter for long distance control.

Large area 2048 x 2048 sensor
Large field of view and high resolution.

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

High Dynamic Range
High well capacity and 16-bit digitization for simultaneous quantification of dim and bright signal.

Dual output
Software select between either a High Sensitivity output for low-light applications, or a High Capacity output for maximum dynamic range with extensive binning.

Fast Kinetics mode
Special software selectable acquisition and readout mode offering bursts of data with microsecond time resolution.

Cropped sensor mode
Specialised acquisition mode for continuous imaging with fast temporal resolution

Integrated shutter♦1
F-mount (EF optional) with integrated programmable 45mm shutter, shielding sensor during readout and enabling dark reference images.

Solis (i) software
User-friendly interface offering intuitive acquisition optimization and data processing/analysis.

Windows and Linux
Andor's user-friendly SDK supports both Windows and Linux OS.

"-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 13.5µm² pixels combine to deliver a 27.6 x 27.6 mm active image area, TE cooled down to -100°C.

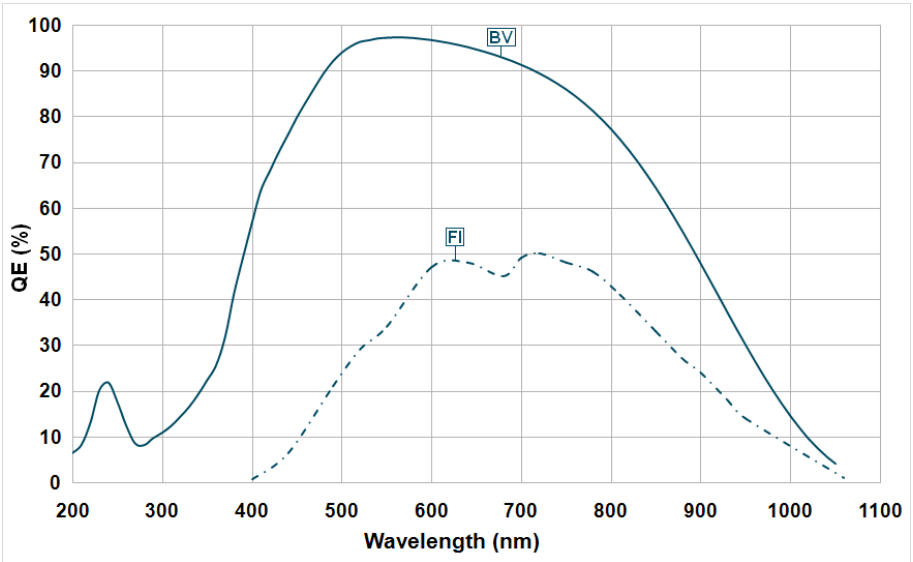
The iKon-L 936 offers outstanding resolution, field of view, sensitivity and dynamic range performance. Ultimate sensitivity performance is achieved through combination of >90% QE (back-illuminated sensor), low noise readout electronics and exceptionally deep TE cooling.

iKon-L 936 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, luminescence imaging and microtitre plate/biochip imaging, with ideal OEM adaptability and support. USB 2.0 connectivity and multi-MHz readout options provide for ease of integration and operation.

Camera overview

Active Pixels♦2	2048 x 2048
Pixel Size (W x H; µm)	13.5 x 13.5
Image Area (mm)	27.6 x 27.6
Active Area pixel well depth (e^-, typical [min])	100,000 [60,000]
Frame Rate (frames per sec)♦3	0.92
Read Noise (e^-, typical [Max])	
@ 50 kHz	2.9 [4]
@ 1 MHz	6.4 [10]
@ 3 MHz	11.8 [14]
@ 5 MHz	27.4 [35]

Quantum efficiency♦4



iKon-L 936

low-light imaging

Technical specifications

System characteristics

Pixel Readout Rate (MHz)	5, 3, 1, 0.05
Linearity (%, maximum)[5]	1
Vertical Clock Speed (µs, maximum)	38 (software selectable)
Software Selectable Sensitivity (e⁻ per A/D count, typical)	
HS output	4.2, 2.3, 1.2
HC output	14.5, 8.0, 4.3
Dummy Pixels	50, 50, 0, 4
Digitization	16 bit (at all readout speeds)
Camera window type	Single quartz window, broadband visible AR coated on each side

System Readout Noise (e⁻, typical [max])[6]

Pixel Readout Rate	High Sensitivity output	High Capacity output
0.05 MHz	2.9 [4]	9 [12]
1 MHz	6.4 [10]	23 [30]
3 MHz	11.8 [14]	42 [56]
5 MHz	27.3 [35]	65 [80]

Minimum sensor temperatures (typical)[7]

	DW option	DZ option
Air cooled (ambient air at 20ºC)	-70ºC	-80ºC
Re-circulator (XW-RECR) (ambient air @ 20ºC)	-75ºC	-95ºC
Water-cooled (@ 10 ºC, 0.75 l / min)	-80ºC	-100ºC

Blemish specifications

As defined by the sensor manufacturer e2V and shown in the table below:

GRADE	1
Column defects; black or white	3
Black spots	150
Traps >200 e⁻	20
White spots	150

For complete description of blemish types and thresholds download the datasheet for the 42-40 (BI, AIMO) sensor from the E2V web site: **http://www.e2v.com/products/ccd-and-cmos-imaging-and-semiconductors/imaging-scientific-sensors/datasheets.cfm**

Dark current (back-illuminated)[8]

@ -100ºC for back illuminated device (typical e⁻/pix/sec [max])	0.00008 [0.0003]
@ -90ºC for back illuminated device (typical e⁻/pix/sec [max])	0.00013 [0.0008]
@ -70ºC for back illuminated device (typical e⁻/pix/sec [max])	0.001 [0.007]

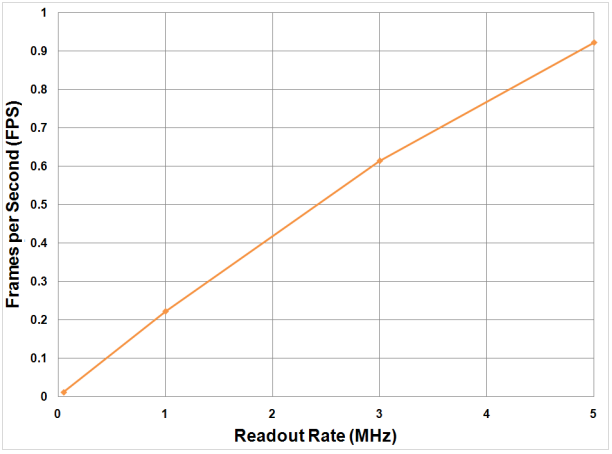
Operating & storage conditions

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

Power requirements

- 24Vdc @ 150 Watts

Full Frame Rate[9]



Maximum Frames per second[10]

3 MHz readout			
Binning	**Full Resolution**	**1024 x 1024**	**512 x 512**
1 x 1	0.614	1.17	2.137
2 x 2	1.333	2.214	3.631
4 x 4	2.386	3.608	5.379
8 x 8	3.564	5.085	7.001
16 x 16	4.585	6.326	8.215

5 MHz readout (Focusing Mode)			
Binning	**Full Resolution**	**1024 x 1024**	**512 x 512**
1 x 1	0.922	1.718	3.019
2 x 2	1.643	2.876	4.654
4 x 4	2.627	4.292	6.359
8 x 8	3.715	5.676	7.774
16 x 16	4.672	6.759	8.745

Computer requirements

To handle data transfer rates of 5 MHz readout, over extended kinetic series, a powerful computer is recommended, e.g.:

- 3 GHz Pentium (or better) + 1Gbyte RAM
- 32 MB free hard disc to install software
- USB 2.0

Need more information? Please contact us at:

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Phone: +44 28 9023 7126	**Phone:** 800.296.1579
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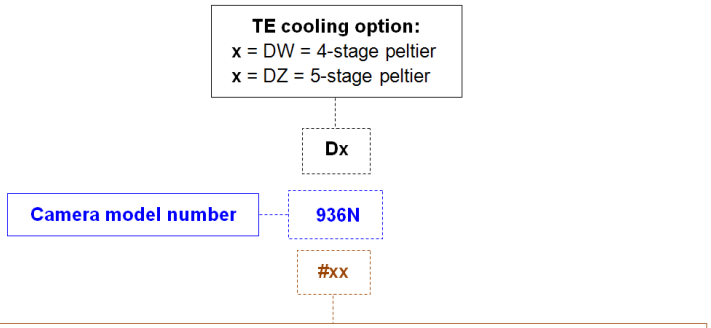
Fax: +81 3 3511 0662	**Fax:** +86-10-6445-5401

Ordering information & notes

To order the camera you require, please use the following ordering system:



E.g. a **DZ936N-#FI** is an **iKon-L 936** camera with **5-stage peltier cooling** and **front illuminated** sensor.

The iKon-L 936 is supplied with the following as standard:

PS-29	150W Power Supply♦11
PS-40	24V DC-driven supply for powering the complete camera

The iKon-L 936 also requires one of the following software options:

Andor Solis (i)	A ready-to-run Windows 2000, XP and Vista-based package with rich functionality for data acquisition and processing. (64 and 32 bit OS supported)
Andor SDK	A DLL driver and software development kit that let you create your own applications for the Andor Camera. Available for Windows 2000, XP, Vista and Linux. (64 and 32 bit OS supported)

The following accessories are available for use with the iKon-L 936:

XW-RECR	Re-circulator for enhanced cooling performance
XW-CHIL-150	Chiller/re-circulator for enhanced cooling performance
XU-RECR/TRANS	USB 2.0 Extender kit comprising Transmitter, Receiver & Power Supplies
OPTION-C2-LMS-CEF♦12	Canon EF lens mount with integral shutter
OPTION-C2-MGF2♦13	Magnesium fluoride window

Specifications are subject to change without notice

♦1	This integrated shutter can be removed on request, and the camera configured to trigger an external shutter via TTL output.
♦2	Edge pixels may exhibit a partial response.
♦3	Based on a horizontal pixel readout rate of 5 MHz (focusing mode) and a vertical shift speed of 38µs.
♦4	Quantum efficiency of the CCD sensor as measured by the CCD Manufacturer (shown at room temperature)
♦5	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.
♦6	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 -90ºC and minimum exposure time under dark conditions. Noise values will change with pre-amplifier gain (PAG) selection. Values quoted are measured with highest available PAG setting.
♦7	Cooling is provided by the use of an external, mains driven, power supply. Minimum temperatures listed are typical values. Systems are specified in terms of minimum dark current achievable rather than absolute temperature.
♦8	This value is obtained using the traditional method of measuring dark current, i.e. taking a long integration time 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. The values given here are for the back-illuminated sensor type. Front-illuminated sensor darkcurrent values are typically a factor of 2 lower still.
♦9	The graph shows the full frame rates possible when reading out the sensor at 5, 3, 1 and 0.05 MHz pixel readout rates, using 38µs vertical clock speed.
♦10	Shown are the frame rates at 5 MHz and 3 MHz digitization rates for a range of binning or array size combinations. All measurements are made with 38µs vertical clock speed. It also assumes internal trigger mode of operation and 'zero' exposure time.
♦11	The PS-29 power supply may be omitted from the order if the customer can provide their own nominal 24V DC power supply to feed the PS-40 Power Supply. Please contact Andor directly if you require further clarification on this.
♦12	Please confirm that this option is required before ordering, otherwise the camera will be supplied with standard F-mount with integrated shutter.
♦13	Please confirm that this option is required before ordering, otherwise the standard AR coated quartz window will be supplied.

Applications

- Astronomy
- Biochip reading
- Bioluminescence/Chemiluminescence
- **B**ose-**E**instein **C**ondensation (**BEC**)
- Fluorescence microscopy
- High throughput screening
- Hyper-spectral imaging
- **L**aser **I**nduced **F**luorescence (**LIF**)
- Neutron Radiography
- Semiconductor analysis

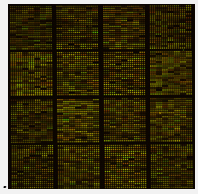
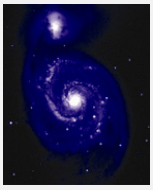


Image of high-density gene chip.

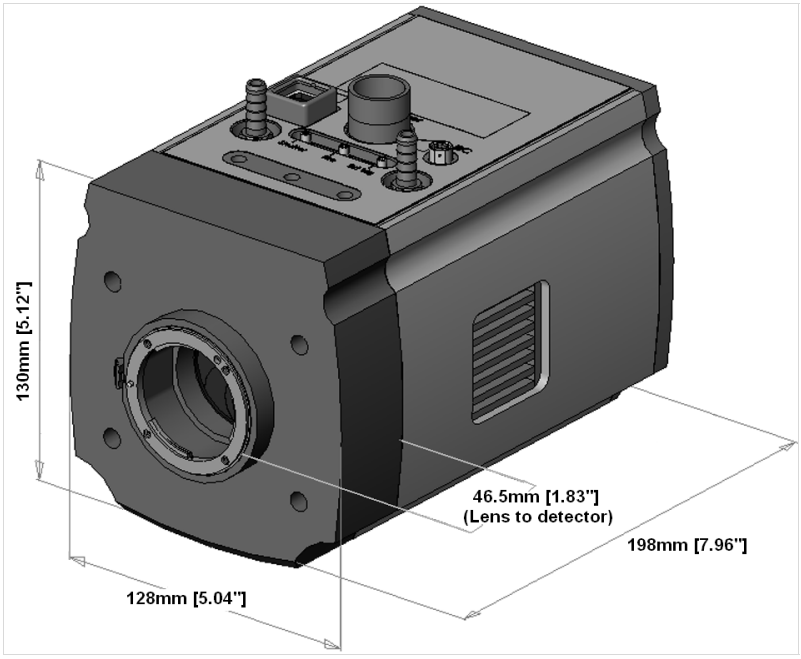


Two interacting galaxies,M51 (Whirlpool Galaxy) & NGC 5195

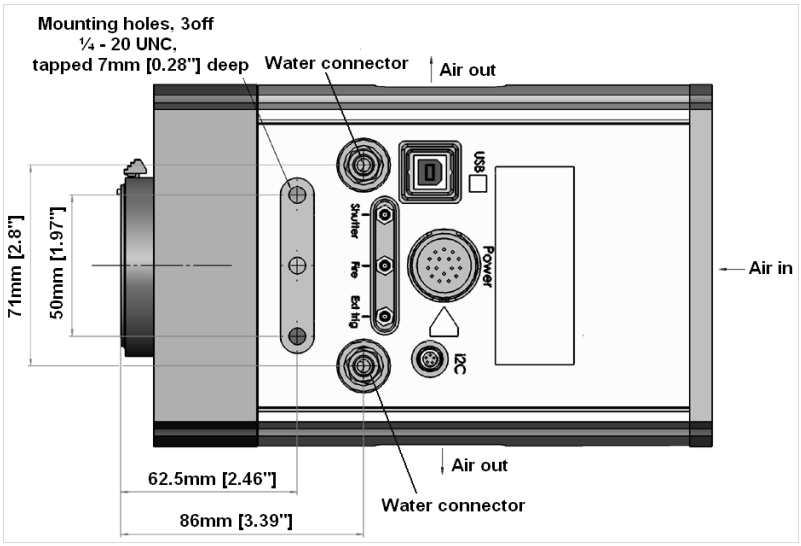
Dimensions

Weight: 4.6 kg [10.2 lb]

Side / front view



Mounting holes & connections



Front face