Ultra Sensitive Imaging

Features and Benefits

- **Extended range Dual-AR option**
  Superior UV-NIR broadband back-illuminated QE

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

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

- **Up to 5 MHz pixel readout** [8]
  High frame rates achievable

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

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

- **13 x 13 µm pixel size**
  Optimal balance of dynamic range and resolution

- **Integrated shutter**
  C-mount shutter as standard. Closed during readout to avoid vertical smear

- **Cropped Sensor Mode**
  Specialised acquisition mode for continuous imaging with fastest possible temporal resolution

- **Enhanced Baseline Clamp**
  Quantitative accuracy of dynamic measurements

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

- **Integrated in EPICS**
  Platform is fully integrated into the EPICS control software

Industry-Leading Ultra-Sensitive Imaging Technology

Andor's iKon-M 934 series cameras are designed to offer the ultimate in high-sensitivity, low noise performance, ideal for demanding imaging applications. These high resolution 1024 x 1024 CCD cameras boast up to 95% QE_{max}, high dynamic range, 13 µm pixels and exceptionally low readout noise. The iKon-M benefits from negligible dark current with industry-leading thermoelectric cooling down to -100°C.

The 'Deep Depletion' sensor option offers ultimate performance for NIR applications, the new Dual AR coating extends the QE performance significantly across the UV/visible region of the spectrum for the broadest possible spectral coverage from one sensor. Fringe Suppression Technology™ radically minimizes etaloning effects in the NIR. Rapid vertical shifts combined with fast kinetics acquisition mode, comprehensive trigger modes and custom coated wedge window options, render the deep Depletion models ideal for NIR optimized Bose Einstein Condensation applications.

Specifications Summary

Active pixels	1024 x 1024
Sensor size	13.3 x 13.3 mm
Pixel size (W x H)	13 µm x 13 µm
Active area pixel well depth	100,000 e⁻ (130,000 e⁻ for BR-DD and BEX2-DD models)
Pixel readout rates (MHz)	5, 3, 1, 0.05
Read noise	2.9 e⁻
Maximum cooling	-100°C
Frame rate	4.4 fps (full frame)

ANDOR
an **Oxford Instruments** company

System Specifications[*2]

Model number	DU934P	DU934P (Deep Depletion)
Sensor options	**BU2**: Back Illuminated CCD, UV-Enhanced, 250 nm optimized **BV**: Back Illuminated CCD, Vis 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	1024 x 1024	
Pixel size	13 x 13 µm	
Image area	13.3 x 13.3 mm with 100% fill factor	
Minimum temperatures [*3] Air cooled Coolant recirculator Coolant chiller, coolant @ 10°C, 0.75 l/min	-80°C -95°C -100°C	
Digitization	16-bit	
Blemish specifications	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	**BU2 sensor**: UV-grade fused silica, 'Broadband VUV-NIR', unwedged **BV sensor**: UV-grade fused silica, 'Broadband VIS-NIR', wedged **BR-DD, BEX2-DD, FI sensors**: UV-grade fused silica, 'Broadband VUV-NIR', wedged (other options available e.g. Bose-Einstein 780nm for Rb BEC experiments)	
Interface	USB 2.0	
Lens mount	C-mount	

Advanced Performance Specifications[*2]

|	DU934P	DU934P (Deep Depletion)
Dark current, e⁻/pixel/sec [*4] @ -80°C @ -100°C	0.00030 0.00012	0.01700 0.00047
Pixel readout rates	5, 3, 1, 0.05 MHz	
Active area pixel well depth	100,000 e⁻	130,000 e⁻
Read noise (e⁻) [*5] 0.05 MHz 1 MHz 3 MHz 5 MHz [*8]	 2.9 6.6 11.6 18.0	 3.3 6.2 9.2 13.6
Linearity [*6]	Better than 99%	
Vertical clock speed	11.3 to 67.3 µs (software selectable)	4.25 to 64.25 µs (software selectable)

Frame Rates[*7]

50 kHz				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	0.04	0.1	0.2	0.4
2 x 2	0.2	0.2	0.4	0.8
4 x 4	0.6	0.6	0.9	1.5
8 x 8	2	1.2	1.7	2.8
16 x 16	5.1	2.3	3.2	5

1 MHz				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	0.9	1.8	3.5	6.9
2 x 2	2.9	4.3	7.5	13.5
4 x 4	7.9	9.4	14.8	24.6
8 x 8	18	18.2	26.6	40.7
16 x 16	33.4	31.6	43	59.8

3 MHz				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	2.6	5.2	10	18.6
2 x 2	6.3	10.9	19.3	33.2
4 x 4	13.4	20.9	34.2	53.5
8 x 8	25.1	36.3	54.4	76.5
16 x 16	41.5	56.1	76.5	97.1

5 MHz Visualization mode[*8]				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	4.4	8.5	16	28.8
2 x 2	8.4	15.9	28.5	47.6
4 x 4	15.6	28.1	47	70.8
8 x 8	27.3	45.8	69.4	93.5
16 x 16	43.6	66.9	91.2	111.5

Quantum Efficiency Curves [9]
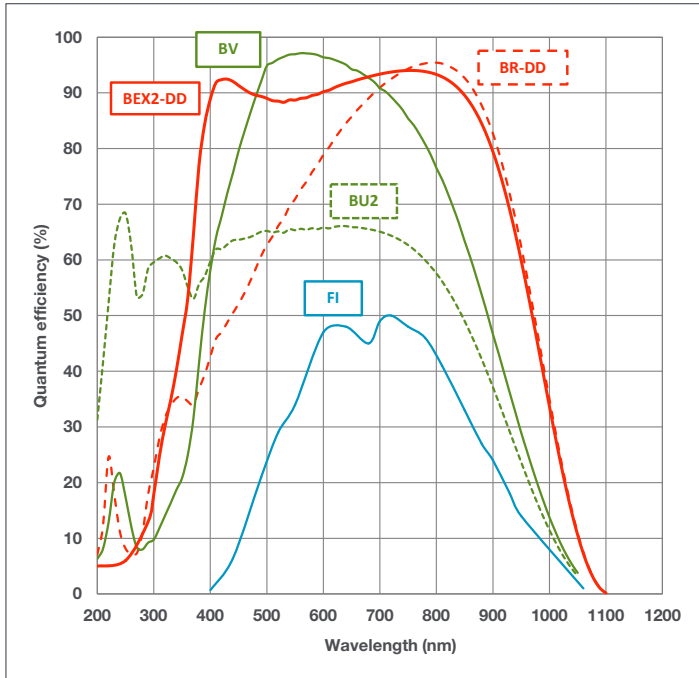
Application Image
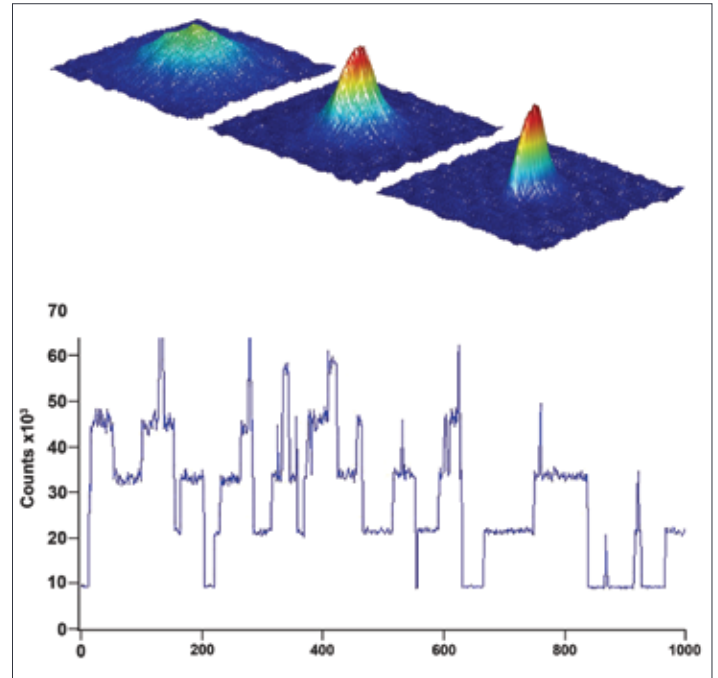
The top image shows surface plots of the transition from a thermal gas (left) to a Bose-Einstein condensate. The sharp, bimodal peak in the right figure is a signature of BEC. The graph below it shows fluorescence from a few-atom MOT against time, showing the discrete steps characteristic of single atoms entering and leaving the trap.
Courtesy of Prof. Michael Chapman, Georgia Institute of Technology, USA.

Have you found what you are looking for?

Need a larger sensor? The iKon-L 936 houses a 4 megapixel, back-illuminated CCD sensor (27.6 mm x 27.6 mm), cooling to -100°C, low noise performance and up to 5 MHz readout.

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 faster frame rates? The Neo and Zyla sCMOS deliver up to 100 frames/sec (full frame).

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

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

Check out Andor's New Neo and Zyla sCMOS. *Simultaneously* offering, ultra-sensitivity, high speed, high-resolution, large field of view & high dynamic range!

Creating The Optimum Product for You
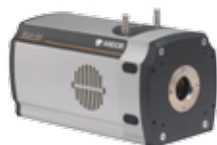
DU934P-[BV]
example shown

Step 1.   Choose the sensor type option

Sensor Type

Description	Code
Back Illuminated CCD, Vis optimized	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 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 can be found in the Technical note – **'Camera Windows: Optimizing for Different Spectral Regions'**.

Step 3.   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 4.   Select the required software

Software

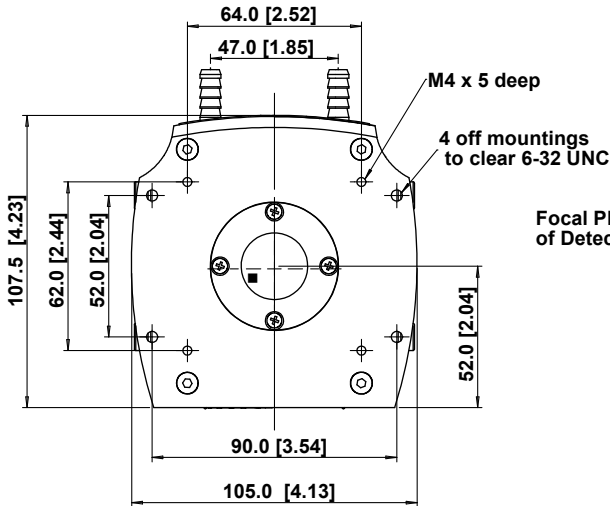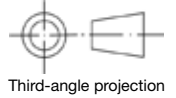**The iKon-M requires at least one of the following software options:**

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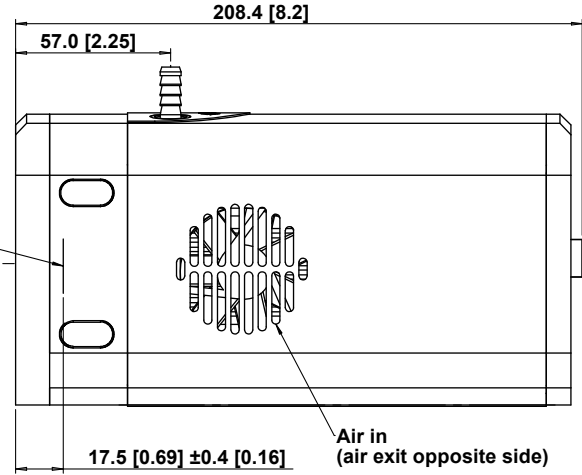
Third party software compatibility Drivers are available so that the iKon-M range can be operated through a large variety of third party imaging packages. See Andor web site for detail: **http://www.andor.com/software/**

Product Drawings

Dimensions in mm [inches]

Third-angle projection

64.0 [2.52]
47.0 [1.85]
M4 x 5 deep
4 off mountings to clear 6-32 UNC
107.5 [4.23]
62.0 [2.44]
52.0 [2.04]
52.0 [2.04]
90.0 [3.54]
105.0 [4.13]

208.4 [8.2]
57.0 [2.25]
Focal Plane of Detector
17.5 [0.69] ±0.4 [0.16]
Air in (air exit opposite side)

■ = position of pixel 1,1
Weight: 2.2 kg [4 lb 13 oz]

25.4 [1.0]
13.0 [0.51]
25.4 [1.0]
13.0 [0.51]
2 off M6 x 10 deep
25.4 [1.0]
3 off 1/4-20 UNC x 1/2" deep

Mounting hole locations

Connecting to the iKon-M

Camera Control
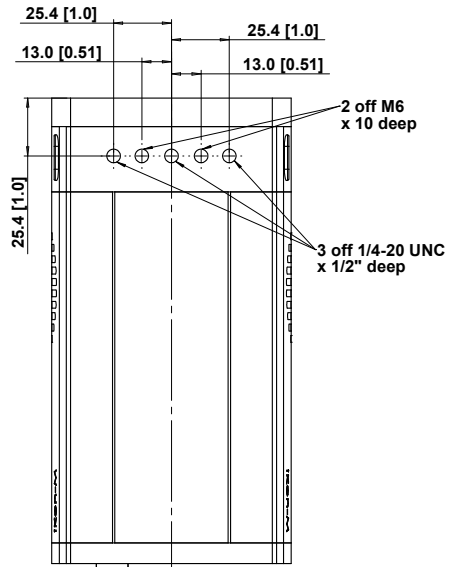Connector type: USB 2.0 with optional lockable connector

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 rear of camera
90 mm

Typical Applications

- ✓ Astronomy
- ✓ Biochip Reading
- ✓ Bioluminescence/Chemiluminescence
- ✓ Bose-Einstein Condensation (BEC)
- ✓ In-Vivo Luminescence
- ✓ Photovoltaic Inspection (see the iKon-M PV Inspector Specification Sheet)
- ✓ Semiconductor analysis

Fire SMB
External trigger SMB
Shutter SMB
Power
I²C
Lockable USB 2.0 Connector
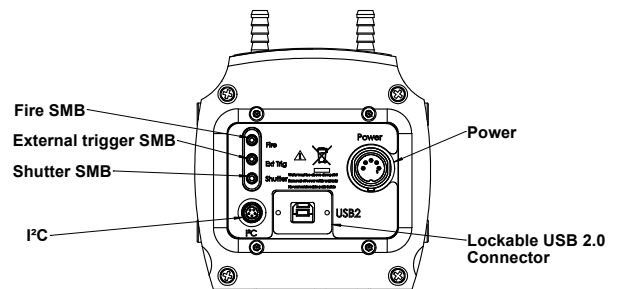
Rear connector panel

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 regional sales offices, please see: **www.andor.com/contact**

Our regional headquarters are:

Europe
Belfast, Northern Ireland
Phone +44 (28) 9023 7126
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Japan
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Fax +81 (3) 6732 8939

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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 camera

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

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. Figures are typical unless otherwise stated.
3. Specified minimum air cooled temperature assumes ambient temperature of 25°C. Specified minimum temperature with coolant assumes coolant temperature of 10°C.
4. The dark current measurement is averaged over the sensor area excluding any regions of blemishes.
5. 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.
6. Linearity is measured from a plot of counts vs exposure time under constant photon flux up to the saturation point of the system.
7. The frame rates shown are for the BR-DD model, for a range of binning or array size combinations. All measurements are made with 4.25 μs vertical shift speed. It also assumes internal trigger mode of operation and minimum exposure time.
8. 5 MHz is for focusing/visualization mode only.
9. Quantum efficiency of the sensor at 25°C as supplied by the sensor manufacturer.

OXFORD INSTRUMENTS
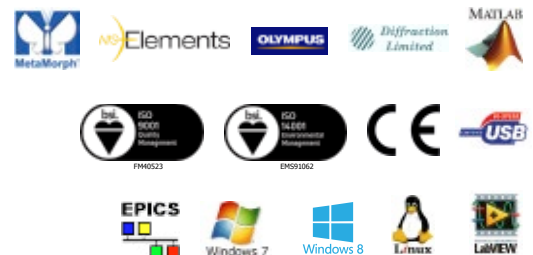*The Business of Science®*

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

LiKonM934SS 0716 R1