ANDOR
an Oxford Instruments company

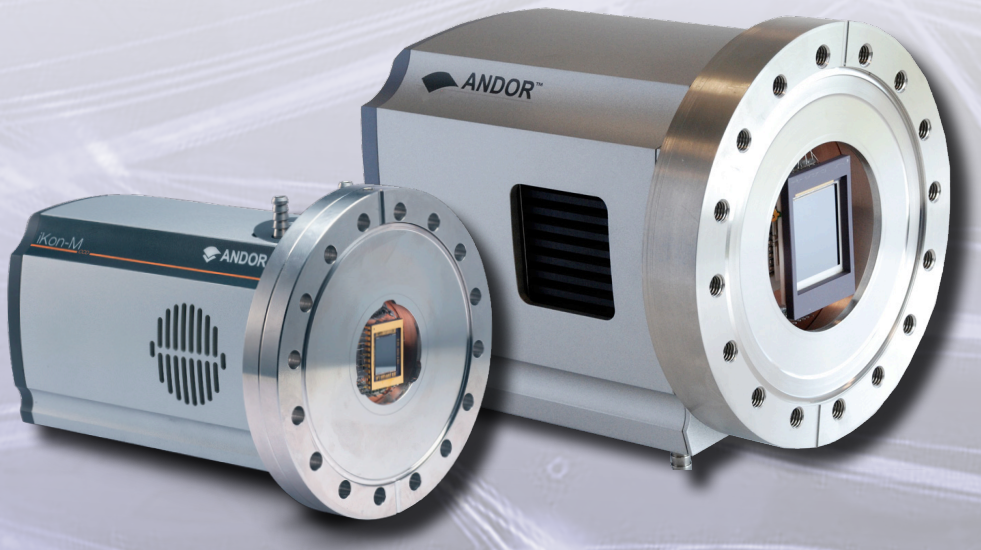
iKon-M/L SO Series

OPEN-FRONT CCDs

DIRECT DETECTION IMAGING

Key Specifications

- 1 MP or large area 4.2 MP sensors
- Peak QE up to 95% (soft x-ray region
- High resolution 13x13 or 13.5x13.5 µm pixels
- TE-cooling down to -100°C
- Readout noise as low as 2.9 e^-
- Labview and EPICS compatibility



Key Applications

- ✓ VUV/EUV/XUV Imaging
- ✓ X-Ray Imaging
- ✓ X-Ray Microscopy
- ✓ X-Ray Diffraction (XRD)
- ✓ X-Ray Plasma Imaging
- ✓ X-Ray source characterization
- ✓ X-Ray Phase Contrast Imaging
- ✓ X-Ray Tomography
- ✓ High Harmonic Generation (HHG)
- ✓ Crystallography

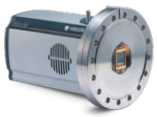
INTRODUCING IKON-M & -L SO

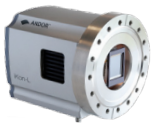
High Resolution, High Sensitivity and High Dynamic Range ‘Direct’ Detection

Andor’s iKon series offers outstanding sensitivity performance through a combination of > 95% QE back-illuminated sensors, low noise readout electronics and industry-leading, maintenance-free deep TE-cooling down to -100°C. It features high resolution 1 and 4.2 Megapixel large area sensor options (with 13 and 13.5 µm pixels respectively) for simultaneous high dynamic range and high spatial resolution imaging in the VUV and soft x-ray range.

A convenient 16-point, knife-edge sealed 6” rotatable CF-152 flange provides a robust and highly-effective seal to any compatible vacuum chamber interface. The iKon-M and -L also offer a USB2 interface and Labview or EPICS compatibility for seamless integration into complex setups.

Meet the Family





NEW

	iKon-M SO	iKon-L SO	iKon-XL SO*
Sensor	• **1 MP** (13 µm pixels)	• **4.2 MP** (13.5 µm pixels)	• **16.8 MP** (15 µm pixels)
Cooling	• **-100°C** TE cooling	• **-100°C** TE cooling	• **-75°C** TE cooling
Peak QE	• **>95%**	• **>95%**	• **>95%**
Read Noise	• Down to **2.9 e**$^-$	• Down to **2.9 e**$^-$	• Down to **2.1 e**$^-$
Pixel Well Depth	• Up to **100 000 e**$^-$	• Up to **150 000 e**$^-$	• Up to **350 000 e**$^-$
Frame Rate	• 4.4 fps	• 0.953 fps	• Up to 0.5 fps (full frame)
Mounting	• DN100CF / 6” CF / CF-152 rotatable flange and knife-edge	• DN100CF / 6” CF / CF-152 flange and knife-edge	• DN160CF / 8” CF / CF-203 rotatable flange and knife-edge

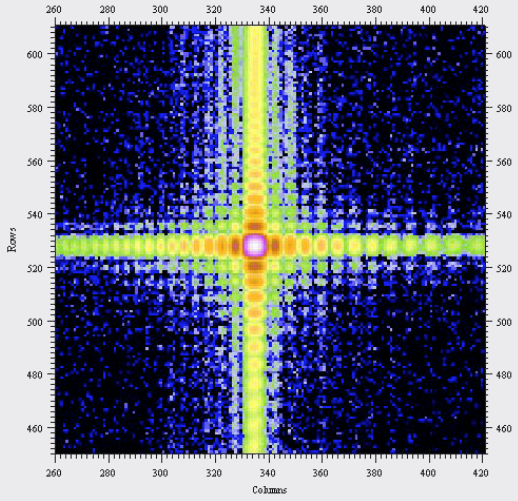
Above: Comparison of the sensor size of the iKon family (actual size).

* For more information about the iKon XL platform, please go to www.andor.com/scientific-cameras/high-energy-detection

FEATURES & BENEFITS

Feature	Benefit
Open-front end	DN100CF / 6" CF / CF-152 flange and knife-edge sealing provided as standard for direct interfacing to vacuum chambers (rotatable design for iKon-M models).
1 MP and 4.2 MP sensor options	Choice of acquisition speed or large field-of-view to best match experimental needs.
13 x 13 and 13.5 x 13.5 µm pixel size options	Ideal balance of dynamic range and resolution, on-head binning to extend dynamic range.
Peak QE up to 95%	High photon collection efficiency for maximising signal-to-noise ratios. 'Enhanced' process back-illuminated sensor options for increased QE in the soft x-ray range.
Thermo-electric cooling down to -100°C	Efficiently minimizes dark current noise for acquisitions requiring longer sensor exposure time, obtain better signal-to-noise ratios faster.
Low noise readout down to 2.9 e^-	Intelligent low-noise electronics offer the most 'silent' system noise.
Up to 5 MHz pixel readout speed	Slow readout for low noise and best SNR performance, faster speed for studying dynamic processes and 5 MHz focusing mode.
USB 2.0 interface	Built-in robust plug and play interface as standard.
Cropped sensor mode	Tracking stability to ensure all readout circuits experience same temperature and operating conditions.
Enhanced baseline clamp	Slower readout for lowest noise, faster speeds for more rapid readout and focusing.
Windows, Linux & Labview	Andor's user-friendly SDK supports both Windows and Linux OS. LabView VI package available.
Integrated in EPICS	Seamless integration and operation at EPICS-based particle accelerators.
Filter and filter holders options	Accommodate beryllium (or aluminium) windows with thickness down to 200 µm for removal of unwanted lower energy radiations (< 2 keV). Ø45.5 mm supported for iKon-M and Ø60 mm for iKon-L.
Open-front to standalone converter options	Provides maximum flexibility – camera can attach directly to a vacuum chamber, or be used as standalone with a beryllium filter.

iKon-M & -L SO Application Images



X-Ray diffraction pattern of the Synchrotron Soleil, France obtained with a iKon-M SO. *Courtesy of Vincent Jacques.*

XRD Powder diffraction image obtained with an iKon-L SO. *Courtesy of NASA AMES, USA*

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TECHNICAL DATA

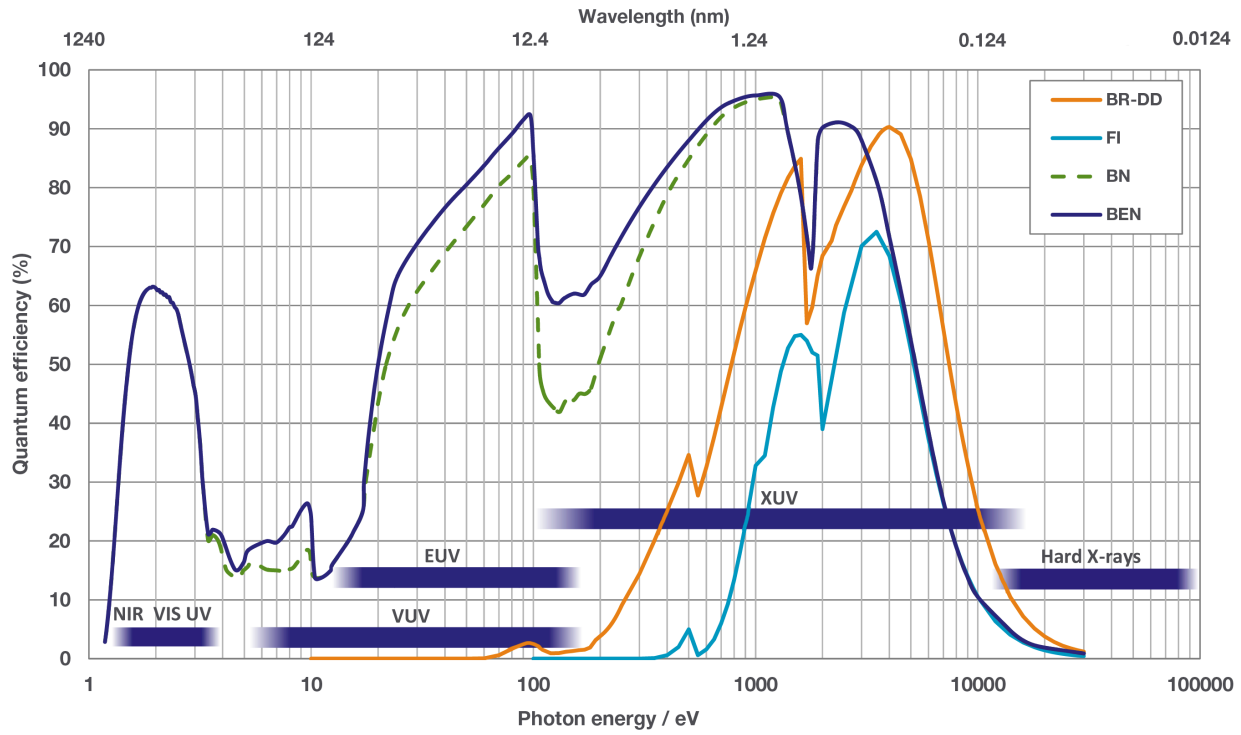
System Specifications •2

	iKon-M SO	iKon-L SO	
Sensor Options	**BN**: Back-illuminated CCD, uncoated **NEW BEN**: Back-illuminated CCD, enhanced process, uncoated **FI:** Front-illuminated CCD **BR-DD**: Back-illuminated CCD, deep-depletion		
Pixels•3	1024 x 1024	2048 x 2048	
Pixel size	13 x 13 µm	13.5 x 13.5 µm	
Image area	13.3 x 13.3 mm with 100% fill factor	27.6 x 27.6 mm with 100% fill factor	
Minimum temperatures•4		**4-stage cooler**	**5-stage cooler**
Air cooled	-80°C	-70°C	-80°C
Coolant recirculator	-95°C	-75°C	-95°C
Coolant chiller coolant @10°C 0.75l/min	-100°C	-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		

Advanced Performance Specifications •2

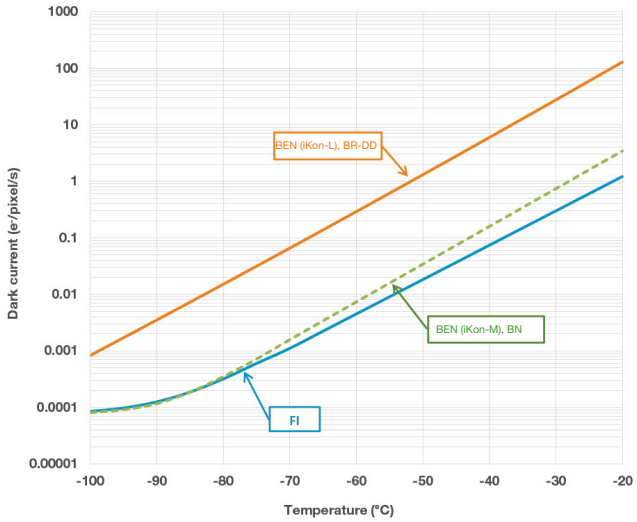
	iKon-M SO		iKon-L SO			
Peak QE •5	>95% (BN/BEN), >90% (BR-DD)					
Active area pixel well depth (typical)	**BN/BEN/BR-DD/FI** 150,000 e^-		**BN/BEN/FI** 100,000 e^-		**BR-DD** 150,000e^-	
Output node capacity	250,000 e^-		1,000,000 e^-			
Pixel readout rates	0.05, 1, 3 and 5 MHz					
Read Noise (e^-)	**BN/BEN**	**BR-DD**	**BN**		**BR-DD/BEN**	
			High Sensitivity	**High Capacity**	**High Sensitivity**	**High Capacity**
0.05 MHz	2.9	3.3	2.9	8.7	4.3	9.5
1 MHz	6.6	6.2	7.0	22.2	6.8	21.8
3 MHz	11.6	9.2	11.7	40.2	11.7	36.3
5 MHz	18.0	13.6	31.5	70.3	34.1	69.4
Dark Current, e^-/pixel/sec •6						
@ -70°C	0.0016	0.066	0.0016		0.066	
@ -80°C	0.0004	0.0151	0.0004		0.0151	
@ -100°C	0.0001	0.0008	0.0001		0.0008	
Frame rate (full frame)	4.4 fps		0.953 fps			
Linearity •7	Better than 99%					
Digitization	16-bit (all speeds)					
Mounting flange	DN100CF / 6” CF / CF-152					
Maximum bake-out temperature	+55°C					
Vacuum compatibility	>10^{-8} millibar					

Quantum Efficiency Curves[•5]

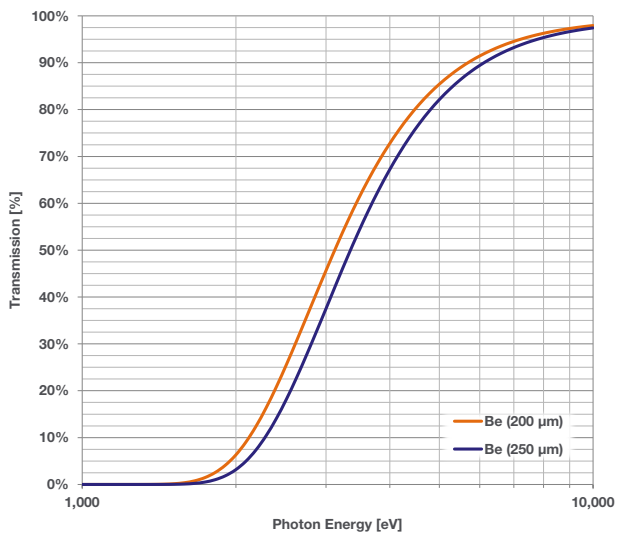


Key:
VUV: Vacuum Ultraviolet, **EUV**: Extreme Ultraviolet, **XUV**: Extreme Ultraviolet (X-Ray)
For more information about Andor solutions for 'indirect' detection please go to www.andor.com/scientific-cameras/high-energy-detection

Dark Current



Beryllium Window Transmission



Frame Rates[8]

iKon-M SO

50 kHz Precision photometry mode				
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	2.0	1.2	1.7	2.8
16 x 16	5.1	2.3	3.2	5.0

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	18.0	18.2	26.6	40.7
16 x 16	33.4	31.6	43.0	59.8

3 MHz				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	2.6	5.2	10.0	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[9]				
Binning	Full Frame	512 x 512	256 x 256	128 x 128
1 x 1	4.4	8.5	16.0	28.8
2 x 2	8.4	15.9	28.5	47.6
4 x 4	15.6	28.1	47.0	70.8
8 x 8	27.3	45.8	69.4	93.5
16 x 16	43.6	66.9	91.2	111.5

iKon-L SO

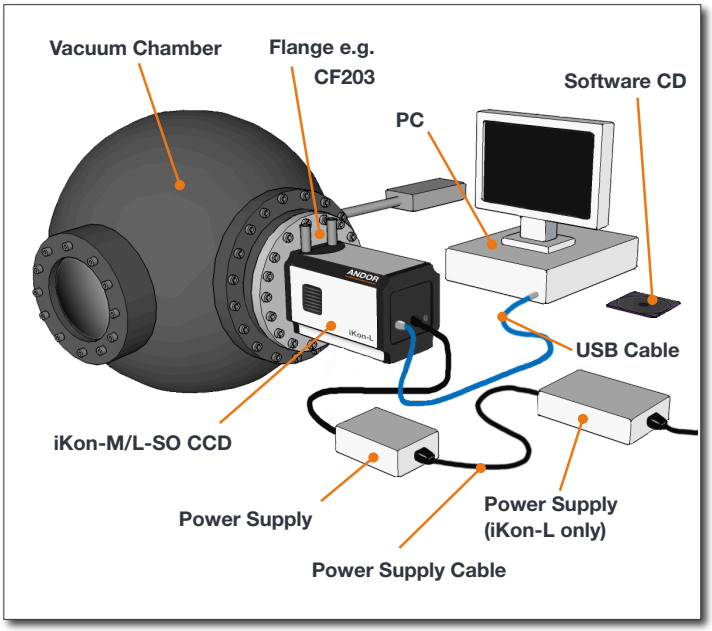
50 kHz Precision photometry mode			
Binning	Full Frame	1024 x 1024	512 x 512
1 x 1	0.011	0.023	0.046
2 x 2	0.04	0.059	0.102
4 x 4	0.155	0.138	0.213
8 x 8	0.482	0.293	0.42
16 x 16	1.166	0.572	0.78

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

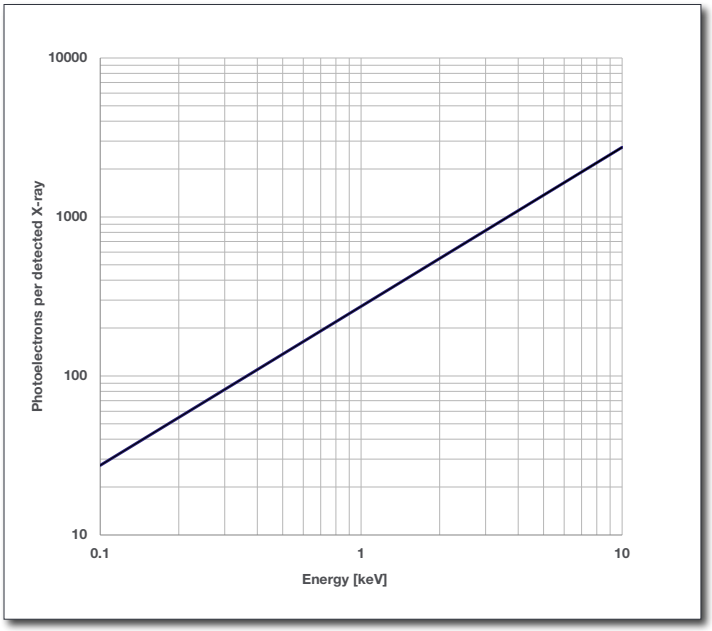
3 MHz			
Binning	Full Frame	1024 x 1024	512 x 512
1 x 1	0.607	1.157	2.115
2 x 2	1.294	2.175	3.588
4 x 4	2.305	3.545	5.326
8 x 8	3.463	5.017	6.953
16 x 16	4.496	6.27	8.18

5 MHz Visualization mode[9]			
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

Typical Set-up



Photoelectrons vs Incident X-rays [10]



Best Practice Guidelines

Condensation

- It is strongly advised that the camera should not be used in a condensing atmosphere.
- If used in a condensing atmosphere the sensor MUST be protected and the use of a cold finger is strongly recommended.

Contamination & Damage

- When not in use, the sensor chamber should be covered and sealed.
- Due to the exposed nature of the sensor, extreme care should be taken with the camera, as damage can easily occur through mishandling or by contamination
- If the sensor becomes contaminated, due to accident or misuse, please contact Andor immediately for advice on cleaning.

Vacuum Operations

- Ensure that the vacuum environment to which the camera is fitted is free of water vapour and other contaminants.
- Care should also be taken to control pressure change, as sudden pressure changes can potentially cause damage to the sensor assembly.

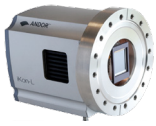
Vacuum Units Equivalences

Vacuum Regime	Pressure Range			
	mBar	bar	pascal (Pa)	Torr
Atmospheric pressure	$1.013x10^{+3}$	1.013	$1.013x10^{+5}$	$7.6x10^{+2}$
High vacuum	$1x10^{-3}$ to $1x10^{-9}$	$1x10^{-6}$ to $1x10^{-12}$	$1x10^{-1}$ to $1x10^{-7}$	$7.5x10^{-4}$ to $7.5x10^{-10}$
Ultra high vacuum	$1x10^{-9}$ to $1x10^{-12}$	$1x10^{-12}$ to $1x10^{-15}$	$1x10^{-7}$ to $1x10^{-10}$	$7.5x10^{-10}$ to $7.5x10^{-13}$
Extremely high vacuum	$<1x10^{-12}$	$<1x10^{-15}$	$<1x10^{-10}$	$<1x10^{-13}$

Please refer to the Andor Technical Note:
Open-front camera flanges for further details.

CREATING THE OPTIMUM PRODUCT FOR YOU

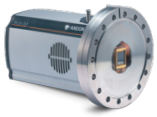
iKon-L SO



example shown

DO936N- M 0 Z - BEN

iKon-M SO



example shown

DO934P- BR-DD

Step 1. Choose the flange hole type (iKon-L)

Flange Hole Type

Description	Code
Imperial thread (5/16 UNC)	I
No thread (ø 8 mm through hole)*	0
Metric thread (M8)	M

*** Please contact your Andor representative for further details about this option. M8 or 5/16 UNC nut required behind flange to secure bolt from vacuum chamber.**

Refer also to Mechanical Drawings on page 9.

Step 2. Choose the cooling option (iKon-L)

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 3. Choose the sensor type option

Sensor Type

Description	Code
Back Illuminated CCD, with no AR coating	#BN
Back Illuminated CCD, no AR coating, enhanced soft X-Ray WE	BEN
Back Illuminated deep-depletion CCD	BR-DD
Front Illuminated CCD	#FI

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
USB Extender: Icron USB 2.0 Ranger 2201 (100 m) - EU/UK/US	ACC-USBX-EU ACC-USBX-UK ACC-USBX-US
Optional filter holder for iKon-L only (supplied as standard for iKon-M)	SO-FILTER-MNT-IKONL
Copper gasket for DN100CF / 6 " CF open-front camera knife-edge vacuum seal	ACC-FLG-SO-GSKT-CU
Beryllium filter for iKon-M, Ø45.5 mm, 250 µm thick	ACC-OPT-02839
Beryllium filter for iKon-L, Ø60.0 mm, 250 µm thick	ACC-OPT-03838
SO-SY adapter for iKon-M, Ø45.5 mm filter	FLG-SO-SY-CONVERT-45
SO-SY adapter for iKon-L, Ø60 mm filter	FLG-SO-SY-CONVERT-60

Step 5. Select the required software

Software

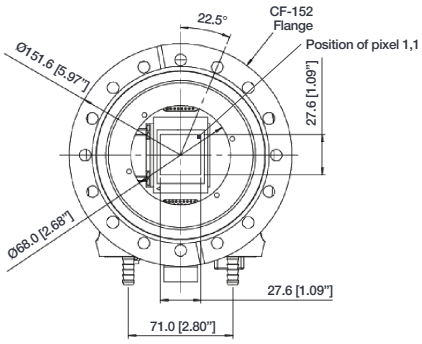
The iKon-M and L SO require at least one of the following software options:

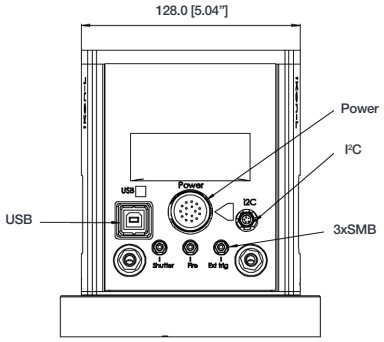
Solis Imaging A 32-bit and fully 64-bit enabled application for Windows (7, 8 and 10) offering rich functionality for data acquisition and processing. AndorBasic provides macro language control of data acquisition, processing, display and export.

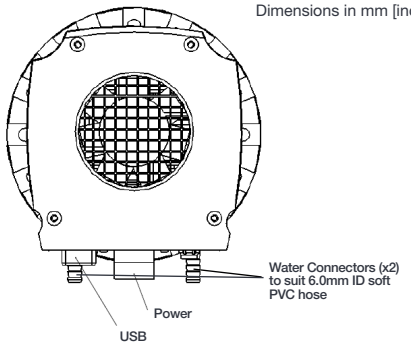
Andor SDK A software development kit that allows you to control the Andor range of cameras from your own application. Available as 32 and 64-bit libraries for Windows (7, 8 and 10), compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab. Linux SDK compatible with C/C++.

MECHANICAL DRAWINGS

iKon-L SO







Third-angle projection

Dimensions in mm [inches]

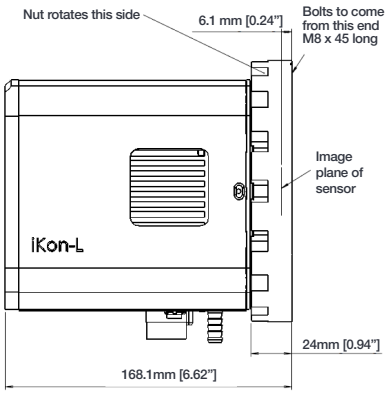
Attachment options:

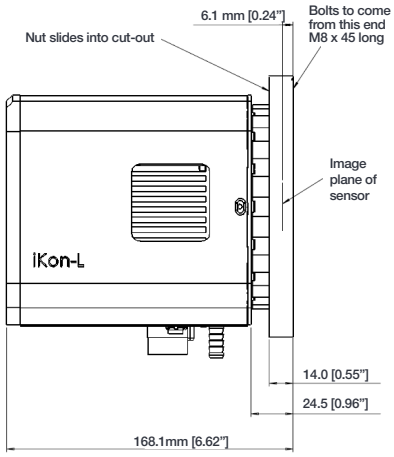
0 **No thread, captive nuts**
e.g. D0936N-**0**0Z-BEN

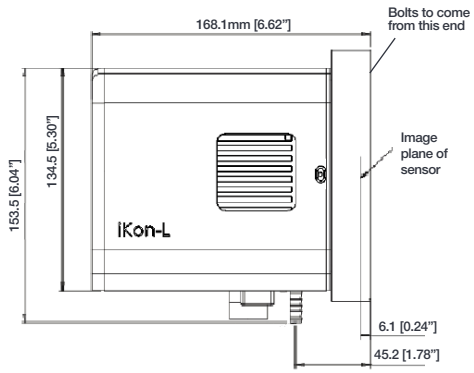
-9OJ **Variation: no thread, non-captive nuts**
Please contact your Andor representative for further details about this option
e.g. D0936N-00Z-#BN-**9OJ**

M **Metric attachment**
e.g. D0936N-**M**0Z-BR-DD

I **Imperial attachment**
e.g. D0936N-**I**0W-#FI

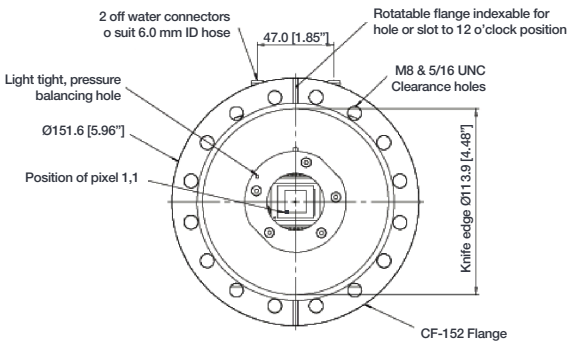


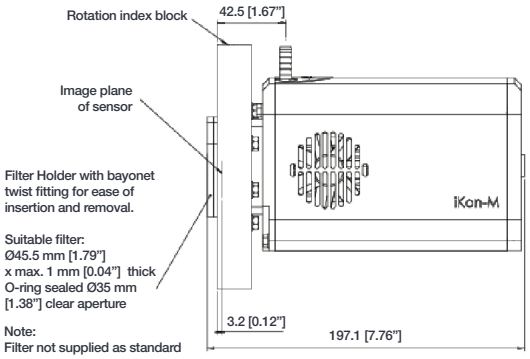


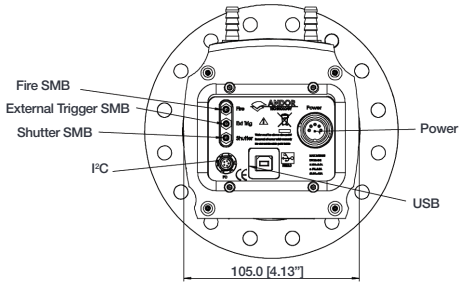


Note: Please contact us for further information on attachment options

iKon-M SO







Connecting to the iKon-M & -L SO

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

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: andor.com/contact

Our regional headquarters are:

Europe
Belfast, Northern Ireland
Phone +44 (28) 9023 7126
Fax +44 (28) 9031 0792

Japan
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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 camera:

1 x 2 m BNC - SMB connection cable
1 x 3 m USB 2.0 cable Type A - Type B
1 x Power supply with mains cable (iKon-M)
2 x Power supplies with associated cables (iKon-L)
1 x CD containing Andor user guides
1 x Individual system performance booklet
1 x Protective cover plate
4 x Fixing screws for cover plate •11

Footnotes: Specifications are subject to change without notice

1. IMPORTANT - Due to the sensor being exposed to environments outside of Andor's control there is no warranty on the sensor. For full details of Andor's Warranty Policy please refer to our webpage at www.andor.com/contact_us/support_request/. For key information on handling precautions for SO/HO open front end systems, please refer to the best practice guidelines on page 7. Note permanent damage can easily occur due to misuse.
2. Figures are typical unless otherwise stated.
3. Edge pixels may exhibit a partial response.
4. Stabilized cooling temperatures are given for slowest readout speed. Use of faster readout speeds (in order to achieve faster frame rates) may require a higher cooling temperature to be selected. Specified minimum air cooled temperature assumes ambient temperature of 25°C. Specified minimum temperature with coolant assumes coolant temperature of 10°C. All cooling performance can be compromised by the environment to which the sensor is exposed.
5. Quantum efficiency as supplied by the sensor manufacturer.
6. Dark current measurement is averaged over the CCD area excluding any regions of blemishes.
7. Linearity is measured from a plot of counts vs exposure time under constant photon flux up to the saturation point of the system.
8. Typical binning or array size combinations. All measurements are made with 4.25 µs (iKon-M), and 38.55 µs (iKon-L) vertical shift speed. It also assumes internal trigger mode of operation and minimum exposure time.
9. 5 MHz is for focusing/visualization mode only.
10. The graph shows photoelectrons generated as a function of photon energy of incident X-ray.
11. Fixing screws for mounting the flange to a vacuum chamber are not included.

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 40 MB/s
- Windows (7, 8 and 10) or Linux

Weight (approx)
- iKon-M SO: 4.9 kg [10 lb 13 oz]
- iKon-L SO: 5.5 kg [12 lb 2 oz]

Operating & Storage Conditions
- Operating Temperature: 0°C to 30°C ambient
- Relative Humidity: < 70% (non-condensing)
- Storage Temperature: -25°C to 50°C
- Maximum Bakeout: Temperature +55°C

Power Requirements
- 100 - 240 VAC, 50 - 60 Hz
- Power Consumption:
  iKon-M 48W max
  iKon-L with 4 stage cooler (W) 60W max
  iKon-L with 5 stage cooler (Z) 120W max