

# iKon-XL 231

CCD

## VERY LARGE AREA ASTRONOMY CCD

### NEW

- ✓ Absolute BEST noise and well depth
- ✓ -100 °C TE Cooling (ColdSpace™)
- ✓ NO liquid nitrogen or cryo-cooler
- ✓ 16-bit and 18-bit Digitization

### Key Specifications

- 16.8 Megapixel sensor (CCD231-84)
- -100 °C TE cooled
- 2.1 e<sup>-</sup> read noise
- 350,000 e<sup>-</sup> well depth
- Standard silicon or deep depletion

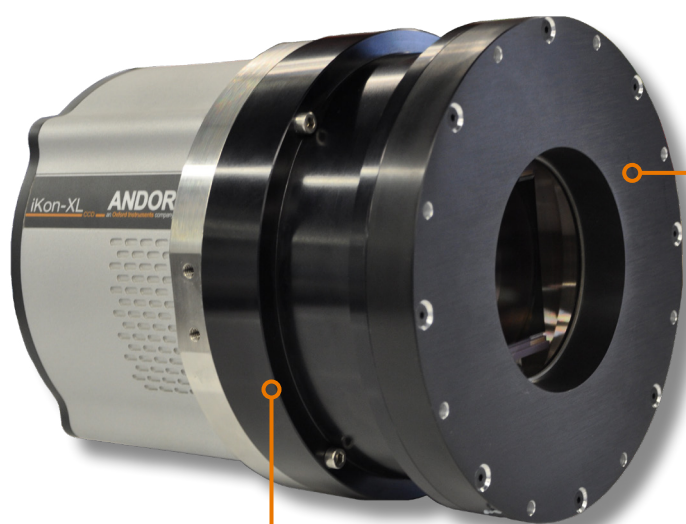


# INTRODUCING IKON-XL 231

## Extreme performance, no hassle...

Andor's iKon-XL is a TE-cooled, very large area CCD camera platform, accommodating large field of view sensors that are ideally suited to long exposure astronomy applications. Patent-pending **ColdSpace™ technology** thermoelectrically cools a **back-illuminated 16.8 Megapixel** sensor (Teledyne e2v) down to **-100 °C**, avoiding the requirement for liquid nitrogen or unreliable cryo coolers. **Extended Dynamic Range technology** is complemented by up to **18-bit digitization**. Flexible connectivity is standard through either **USB 3.0** or a long distance **direct fibre optic** interface. iKon-XL is a **high quality, robust** and '**hassle-free**' detector solution, designed to operate with **low maintenance** and exceptional longevity, perfect for remote observing sites.

The iKon-XL 231 model uses the Teledyne e2v **CCD231-84** 'astro' back-illuminated sensor, offering a very large **61.4 x 61.7 mm** imaging area from a 4096 x 4108 array format and 15 µm pixel size. Available with a range of sensor QE coatings, in both **standard and deep depletion formats** (the latter for extended NIR coverage), the model delivers offers the absolute best CCD performance available, offering exceptionally low **read noise of 2.1 e<sup>-</sup>** and a very large **well depth of 350,000 e<sup>-</sup>**. The iKon-XL 231 can be considered the ultimate camera for challenging Astronomy observations, including exoplanet discovery, large sky surveys, photometry, astro-spectroscopy (Echelle) and debris tracking.



### Low Maintenance Advantage

- ✓ **NO liquid nitrogen (LN<sub>2</sub>)** – LN<sub>2</sub> cooled cameras require ready access to LN<sub>2</sub> supply and routine top up of LN<sub>2</sub> levels in order to hold temperature, as well as carrying an additional safety concern. Many observatories are in remote locations and in some cases unmanned, making LN<sub>2</sub> at best impractical, at worst impossible.
- ✓ **NO cryo cooler** – as many are already painfully aware, cryo coolers are cumbersome and notoriously unreliable. iKon-XL can reach typical cryo-cooled temperatures using only TE cooling and water supply.
- ✓ **No vacuum re-pumping** – the iKon-XL sensor enclosure design is based on Andor's proven, proprietary UltraVac™ process, which carries a Mean Time Between Failure (MTBF) value of > 100 years! Where other very large area CCD cameras require routine re-pumping, expect the iKon-XL to hold firm!
- ✓ **Field replaceable shutter** - No shutter is designed or specified for infinite usage! When it finally fails in a remote observing location, the shutter mounting of the iKon-XL has been purposefully designed such that the shutter can be easily replaced by the user on site.

### Extended Dynamic Range Technology

CCD cameras always require software selection of amplifier gain to optimize either for low noise (weak signal) OR high well depth (bright signal). **Not both...**

**...until now!** iKon-XL utilizes proprietary Andor CCD expertise to offer **low read noise AND high well depth in one image**, with only one gain setting.

# FEATURES & BENEFITS

Feature	Benefit
Thermoelectric Cooling to -100°C (Liquid/Water)	Patent-pending ColdSpace™ very large area TE cooling technology avoids need for liquid nitrogen or unreliable cryo coolers. Minimization of dark current to below the zodiacal background.
61.4 x 61.7 mm sensor	Very large field of view from 16.8 Megapixel, 15 µm pixel pitch sensor
Extended Dynamic Range (18-bit)	Unique method to achieve lowest noise and large well depth within one scan. Supplemented by up to 18-bit digitization.
Peak QE over 95% (deep depletion NIR-enhanced options available)*1	High photon collection efficiency for maximizing SNR. Deep depletion sensor options for extended NIR sensitivity, including Fringe Suppression technology.
Lowest noise readout	Intelligent low-noise electronics, combined with the 'astro' CCD231-84 sensor, deliver the lowest CCD noise available.
350,000 e <sup>-</sup> well depth	Extremely high well depth for linear quantification of relatively bright signals.
Ultravac™*2	Critical for sustained vacuum integrity and to maintain unequalled cooling and QE performance, year after year (5 year vacuum warranty).
'Deep Cooled' and 'Flexi' versions	'Deep Cooled' for -100°C water/liquid (no air cooling). 'Flexi' for combined -80°C water/liquid or -60°C air cooled.
Fibre-optic or USB 3.0 interface flexibility	Built-in robust plug and play interface options as standard. Fibre optic for long distance solution.
Balanced Quad-port readout	Tracking stability to ensure all readout circuits experience same temperature and operating conditions.
Multiple readout speeds, up to 3 MHz	Slower readout for lowest noise, faster speeds for more rapid readout and focusing.
Field replaceable shutter	No shutter is designed or specified for infinite usage! When it finally fails in a remote observing location, it can be easily replaced on site.
IRIG-B GPS timestamp	Image GPS timestamp with 10ms resolution for network integration.
Fully Enclosed Casing (Deep Cooled model)	Reduced thermal bloom; minimal effect on nearby optics
Easy reference column access	Easy and flexible software access to dark (shielded) reference columns
Windows, Linux & Labview	Andor's user-friendly SDK supports both Windows and Linux OS. LabView VI package available.
ASTRO.control compatibility	Redlogix ASTRO.control is a dedicated platform for control of astronomical telescopes and instrumentation <a href="http://www.andor.com/astrocontrol.aspx">http://www.andor.com/astrocontrol.aspx</a>

## Sensor Cosmetic Specifications

Sensor Grade 1	Guaranteed Specifications	Typical Values
Column defect (black or white)	10	<3
White spots	800	<400
Total (black & white) spots	1500	<750
Traps > 200e <sup>-</sup>	15	<10

### Definitions

<b>White spots</b>	A defect is counted as a white spot if the dark generation rate is $\geq 5$ e <sup>-</sup> /pixel/s at 173 K (also equivalent to $\geq 100$ e <sup>-</sup> /hour at 153 K). The temperature dependence is the same for the mean dark signal	<b>Traps</b>	A trap causes charge to be temporarily held in a pixel and these are counted as defects if the quantity of trapped charge is greater than 200 e <sup>-</sup>	<b>Column defects</b>	A column is counted as a defect if it contains at least 100 white or dark single pixel defects
<b>Black spots</b>	A black spot defect is a pixel with a photo-response less than 50% of the local mean	<b>Defect exclusion zone</b>	Defect measurements are excluded from the outer two rows and columns of the sensor		

\*Sensor specifications provided by Teledyne-e2v

# TECHNICAL DATA

## System Specifications \*3

<b>Sensor Options</b>	<b>BV:</b> Back Illuminated CCD231-84 sensor, mid-band AR coating <b>BB:</b> Back Illuminated CCD231-84 sensor, broadband AR coating (blue optimized) <b>BEX2:</b> Back Illuminated CCD (231-84) sensor and dual AR coating <b>BR-DD:</b> Back Illuminated CCD (231-84) sensor, deep depletion with fringe suppression <b>BEX2-DD:</b> Back Illuminated CCD (231-84) sensor, deep depletion with fringe suppression and dual AR coating		
<b>Pixels</b>	4096 (H) x 4108 (V)		
<b>Pixel size</b>	15 x 15 $\mu\text{m}$		
<b>Image area</b>	61.4 x 61.7 mm with 100% fill factor		
<b>Minimum temperatures *4</b>	<b>Deep Cooled Model</b>	<b>Flexi Model</b>	
@ coolant temperature of 10°C	-100°C	-80°C	
@ coolant temperature of 16°C	-95°C	-75°C	
air cooled	N/A	-60°C	
<b>Blemish specification</b>	Grade 1 sensor from supplier.		
<b>System window type</b>	Single AR coated UV grade fused silica window (>98% transmission)		

## Advanced Performance Specifications \*3

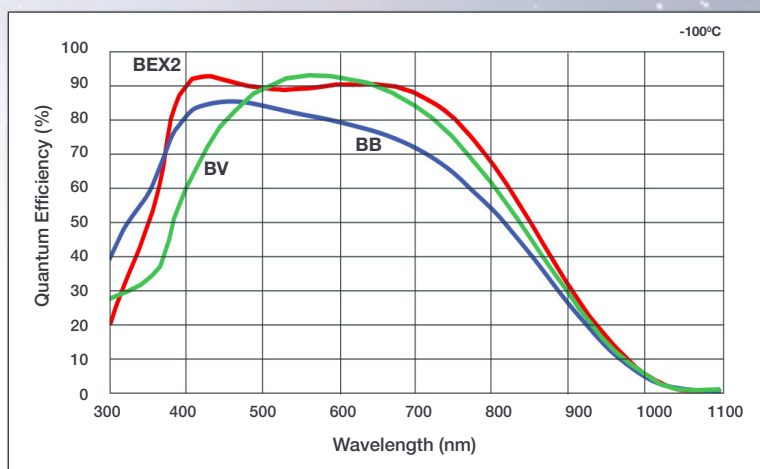
<b>Dark Current, e<sup>-</sup>/pixel/sec *5</b>				
@ -60°C	0.6			
@ -80°C	0.006			
@ -100°C (Deep Cooled Model only)	0.00013			
<b>Active area pixel well depth (typical)</b>	350,000 e <sup>-</sup>			
<b>Pixel readout rates</b>	0.1, 0.5, 1, 3 MHz			
<b>Read Noise (e<sup>-</sup>)</b>	<b>100 kHz</b>	<b>500 kHz</b>	<b>1 MHz</b>	<b>3 MHz</b>
	2.1	3.4	4.6	9.8
<b>Peak QE *1</b>	>95% for BV models, >90% for BEX2, BR-DD and BEX2-DD models, >87% for BB models			
<b>Binning</b>	User definable			
<b>Region of Interest (windowing mode)</b>	User definable (centred in 4-output mode)			
<b>Linearity</b>	Better than 99%			
<b>Digitization</b>	16-bit (all speeds), 18-bit (100 kHz, 500 kHz and 1 MHz)			
<b>Output Amplifier Responsivity</b>	High sensitivity (HS) and High Capacity (HC)			
<b>Outputs</b>	Quad or Single			
<b>Timestamp</b>	IRIG-B GPS with 10 ms resolution			

## Frame Rates \*6

Readout Rate (MHz)	Region of Interest			
	4096 x 4096	2048 x 2048	1024 x 1024	512 x 512
3	0.50	0.81	1.17	1.51
1	0.21	0.37	0.63	0.98
0.5	0.11	0.20	0.38	0.64
0.1	0.022	0.045	0.087	0.17

Readout Rate (MHz)	Binning Mode (ROI=4096 x 4096)		
	1 x 1	2 x 2	4 x 4
3	0.50	0.81	1.18
1	0.21	0.37	0.63
0.5	0.108	0.26	0.53
0.1	0.022	0.08	0.23

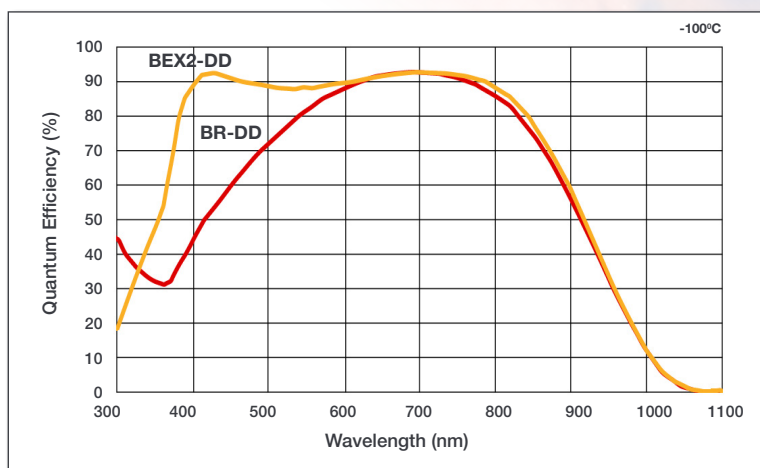
## Quantum Efficiency Curves <sup>•1</sup>



A range of sensor options are available for the iKon-XL 231 that provide high photon collection efficiency for maximizing the SNR. Deep depletion (-DD) sensor options provide extended NIR sensitivity.

### Standard Silicon Sensor Options

- **BV:** Mid-band AR coating
- **BB:** Broadband AR coating (blue optimized)
- **BEX2:** dual AR coating (sensitivity extends to both the blue and NIR wavelength regions)



### Deep Depletion Sensor Options

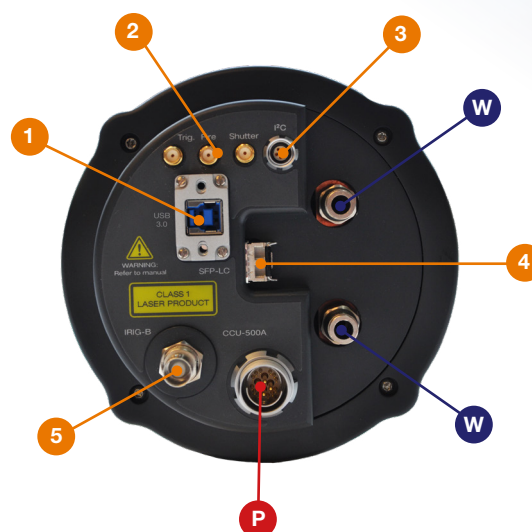
- **BR-DD:** deep depletion with fringe suppression (extended response in the NIR region)
- **BEX2-DD:** deep depletion with fringe suppression and dual AR coating (sensitivity extends to both the blue and NIR wavelength regions)

## Flexible Connectivity

- 1 USB 3.0**  
USB 3.0 offers a robust high speed plug and play data interface
- 2 TTL / Logic**  
Connector type: SMB, provided with SMB - BNC cable  
Fire (Output), External Trigger (Input), Shutter (Output)
- 3 I<sup>2</sup>C**  
Compatible with Fischer SC102A054-130  
Shutter (TTL), I<sup>2</sup>C Clock, I<sup>2</sup>C Data, +5 Vdc, Ground
- 4 Fibre Optic**  
Long distance connection via LC Fibre-optic I/O connection
- 5 IRIG-B**  
Compatible with IRIG-B standard (GPS with 10 ms resolution)
- W Water Cooling**  
Connection to recirculator or other water/liquid cooling system
- P Power**  
Connection to Camera Control Unit (supplied) refer to power requirements on page 8

### Notes:

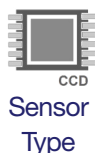
Minimum cable clearance required at rear of camera 150 mm



# CREATING THE OPTIMUM PRODUCT FOR YOU



## Step 1. Choose the sensor type option



Description	Code
16.8 Megapixel CCD231-84 Back Illuminated Sensor. BV: Mid-band AR coating	EA03
16.8 Megapixel CCD231-84 Back Illuminated Sensor. BB: Broadband AR coating	EA04
16.8 Megapixel CCD231-84 Back Illuminated Sensor. EX2 dual AR coating	EA05
16.8 Megapixel CCD231-84 Back Illuminated Sensor. BR-DD deep depletion with fringe suppression.	EA06
16.8 Megapixel CCD231-84 Back Illuminated Sensor. BEX2-DD deep depletion with fringe suppression and dual AR coating	EA07

## Step 2. Choose the cooling option



Description	Code
Flexi Cooling model (max. cooling -80°C @ coolant temp of 10°C; -60°C max. and air cooling)	C
Deep Cooled model (max. cooling -100°C @ coolant temp of 10°C)	D

## Step 3. Select with or without shutter



Description	Code
With Standard Shutter (0°C to +30°C)	S
With Extended Range Shutter (For use between -30°C and +30°C)	S-EXT
Without Shutter	0

## Step 4. Select the required accessories



Description	Code
Replacement 'standard' shutter unit for the iKon-XL. For use between 0°C and +30°C ambient temperatures.	XL-SH-STD
Replacement 'extended temperature range' shutter unit for the iKon-XL. For use between -30°C and +30°C ambient temperatures.	XL-SH-EXT
15 m camera cable with straight attachment for the CCU-500A (iKon-XL Flexi model) If this is ordered it will be provided <i>instead</i> of the standard 5 m cable.	XL-F-CAB-ST-15M
15 m camera cable with straight attachment for the CCU-500B (iKon-XL Deep Cooled model) If this is ordered it will be provided <i>instead</i> of the standard 5 m cable.	XL-DC-CAB-ST-15M
25 m fibre optic cable, LC-LC patch lead OM2 (Standard supplied fibre is 15 m).	FIBR-25M
100 m fibre optic cable, LC-LC patch lead OM3 (Standard supplied fibre is 15 m).	FIBR-100M
Hard shell protective transport case for the iKon-XL Flexi model. Tailored to dimensions of the iKon-XL Flexi model for secure transport to and from observing sites.	XL-F-TRANS-CASE
Hard shell protective transport case for the iKon-XL Deep Cooled model. Tailored to dimensions of the iKon-XL Deep Cooled model for secure transport to and from observing sites.	XL-DC-TRANS-CASE

Please contact your local sales representative regarding other options such as different mounting types, camera window options or other customizations you may require for system integration or your specific application.

## Step 5. Select the required software



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

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

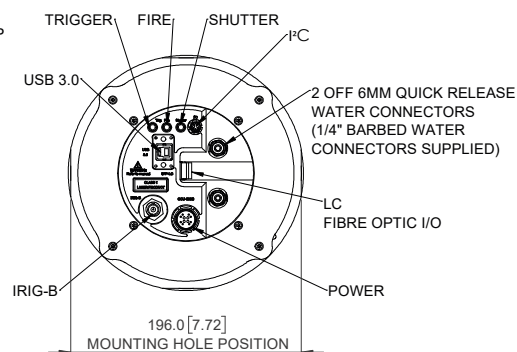
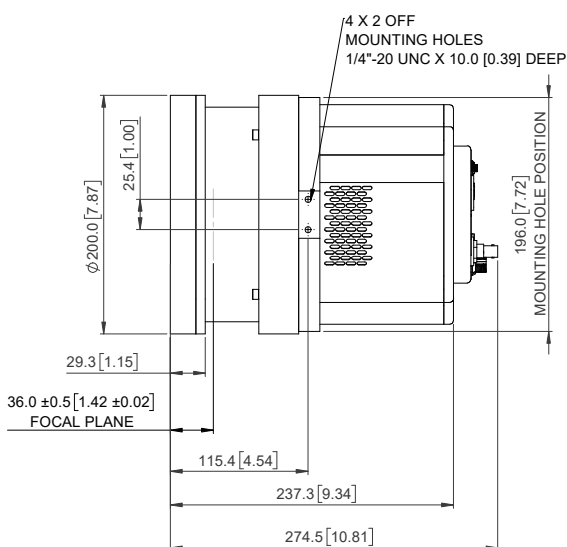
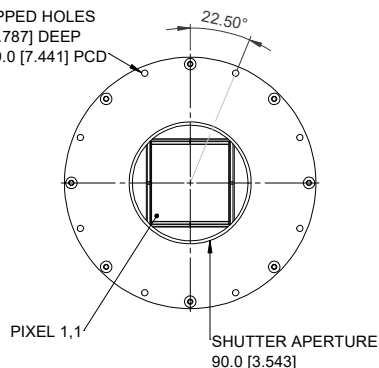
**Third party software compatibility** Drivers are available so that the iKon-XL can be operated through a large variety of third party imaging packages. See Andor web site for detail: <http://www.andor.com/software/>

# MECHANICAL DRAWINGS

Dimensions in mm

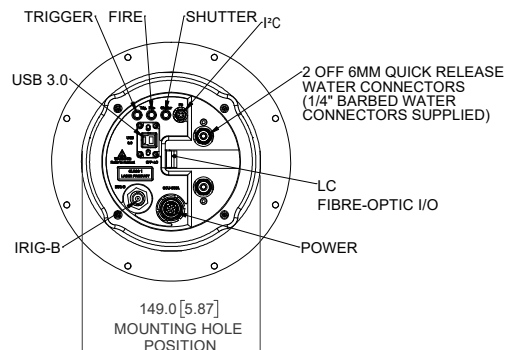
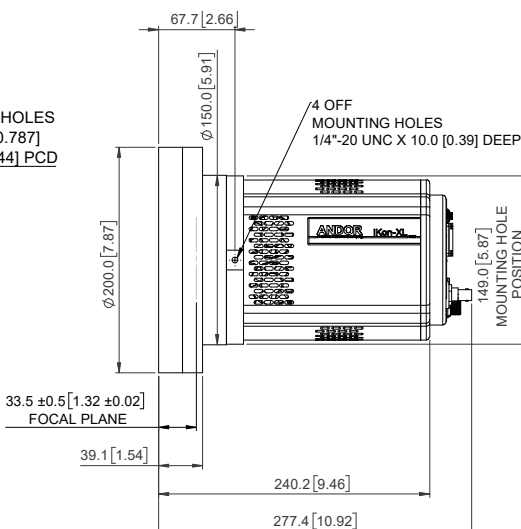
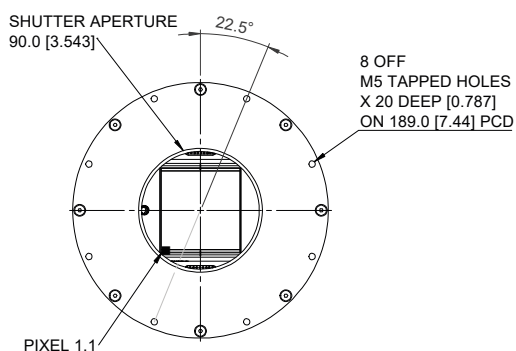
## Deep Cooled Model

8 OFF  
M5 TAPPED HOLES  
X 20 [0.787] DEEP  
ON 189.0 [7.441] PCD



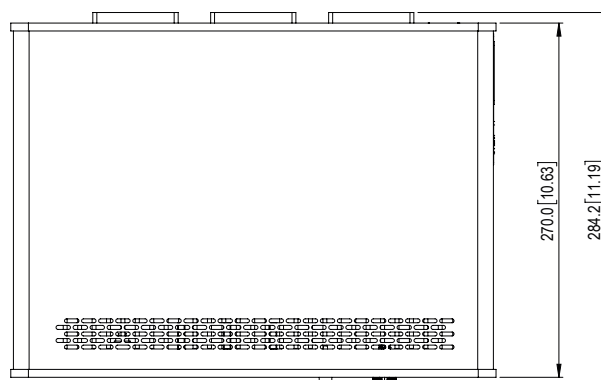
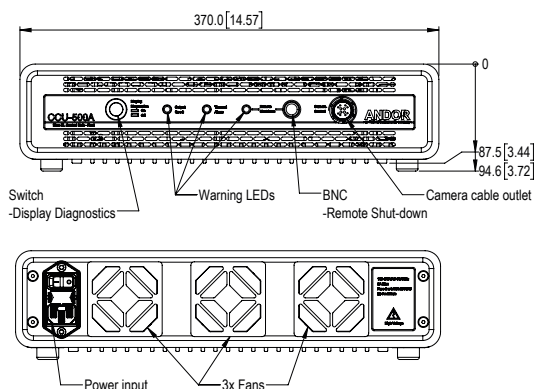
Weight (approx): 12 Kg [26 lbs 7]

## Flexi Model



Weight (approx): 8.25 Kg [18lbs 3]

## Camera Control Unit CCU-500 \*7



Weight (approx): 6.6 Kg [14 lbs 5]

Note: Product drawings of models without shutter can be found at <http://andor.oxinst.com/xl-product-drawings>



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Fax +86 (10) 5884 7901

## Items shipped with your camera

- 1x Fibre Optic PCIe card
  - 1x USB 3 PCIe card
  - 1x iKon-XL camera control unit \*
  - 1x Camera power lead (5m)
  - 3x BNC-SMA cable (2m)
  - 1x USB 3.0 cable (3m)
  - 1x Fibre Optic lead (15m)
  - 1x QuickStart Guide
  - 1x Individual system performance booklet
- (Note: PC requires 1x slot for installation of a PCIe card)

## Footnotes

1. Quantum efficiency as supplied by the sensor manufacturer.
2. Assembled in a state-of-the-art facility, Andor's UltraVac™ vacuum process combines a permanent hermetic vacuum seal (no o-rings), with a stringent protocol and proprietary materials to minimize outgassing. Outgassing is the release of trapped gases that would otherwise degrade cooling performance and potentially cause sensor failure.
3. Figures are typical, unless otherwise stated.
4. Specified minimum temperature with coolant assumes coolant temperature of 10°C or 16°C, measured at camera head. Note that cooling performance may be affected by distance between camera head and cooler.
5. Dark current measurement is averaged over the CCD area, excluding any regions with blemishes.
6. The frame rates shown are for a range of binning or array size combinations. All measurements are made with 102.5 μs vertical shift speed and using the quad output. It also assumes internal trigger mode of operation and minimum exposure time
7. Camera Control Unit (CCU-500) supplied with brackets for 19 inch rack mounting and mounting lugs for securing to optical tables.



## Minimum Computer Requirements:

- 3.0 GHz single core or 2.4 GHz dual or quad core processor
- 2 GB RAM
- 100 MB free hard disc to install software (at least 1 GB recommended for data spooling)
- USB 3.0 High Speed host Controller capable of sustained rate of 60 MB/s
- Windows (8, 8.1 and 10) or Linux

## Operating & Storage Conditions:

- Operating Temperature: 0°C to +30°C ambient (-30°C to +30°C using extended range shutter)
- Operating Altitude: up to 6000m
- Relative Humidity: <70% (non-condensing)
- Storage Temperature: -30°C to 50°C

## Power Requirements:

- 100 - 240 VAC, 50/60 Hz
- Power consumption:  
Flexi models: Camera Head (inc.External Power Supply) 240V/100V (Typ.): 165/180 W  
Deep Cooled models: Camera Head (inc. External Power Supply) 240V/100V (Typ.): 465/480 W



Windows is a registered trademark of Microsoft Corporation. Labview is a registered trademark of National Instruments. Matlab is a registered trademark of The MathWorks Inc.