ANDOR™ TECHNOLOGY
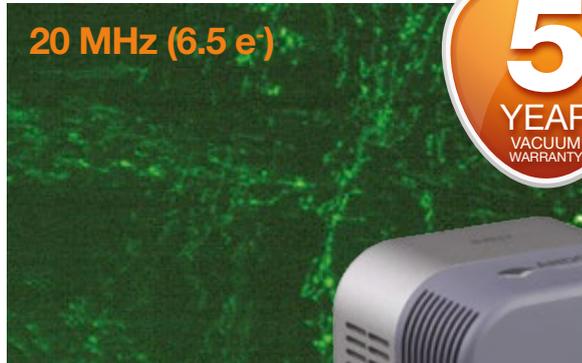
Ultra Sensitive Imaging

1 MHz (2.4 e⁻)

20 MHz (6.5 e⁻)

5 YEAR VACUUM WARRANTY

Comparative weakly fluorescent cell microscopy images showing sensitivity benefit of Clara ultra-low noise 1 MHz mode.

Features and Benefits

- **Ultra-low noise floor**
  Proprietary noise-reduction technique delivers an unprecedented 2.4 e⁻ read noise @ 1 MHz

- **Deep TE cooling to -55°C**
  Elimination of dark current from noise floor

- **-40°C 'vibration free' mode**
  Excellent thermal management offering passive (fan–off) cooling to a stable -40°C for vibration free operation

- **UltraVac™ - guaranteed hermetic vacuum seal technology** [1]
  Permanent vacuum integrity, critical for deep cooling, with 5-year warranty

- **Rapid Frame Rate**
  11 frames/sec @ 20 MHz readout speed

- **High Resolution**
  1.45 megapixel sensor with 6.45 µm pixels

- **High Dynamic Range**
  > 6,500:1 @ 1 MHz; 12,500 with binning

- **16-bit & 14-bit digitization**
  16-bit facilitating low noise / high dynamic range performance at slower speeds

- **iCam**
  Market-leading acquisition efficiency through live cell microscopy software

- **Accurate timestamp**
  FPGA generated for 12.5 ns accuracy

- **USB 2.0**
  Universal 'plug and play' connectivity

"Pushing Interline Further"

Andor's expertise in scientific camera performance optimization has been harnessed once again. Clara has been designed to deliver the highest sensitivity performance achievable from a high-resolution interline CCD camera. Clara 'E' extends the series to offer high sensitivity interline operation in a unique price/performance package. Andor's proven UltraVac™ process, alongside close attention to thermal management, has resulted in deep air cooling to -55°C for elimination of darkcurrent, complementing a uniquely low read noise of 2.4 e⁻ @ 1 MHz.

More dynamic events can be followed with outstanding quantitative stability via low noise 10 or 20 MHz readout modes, the data channelled through a trouble-free USB 2.0 interface. Andor's iCam technology and comprehensive input and output functionality enables market-leading acquisition efficiency through live cell microscopy softwares. The compact, robust design and accessible SDK, renders Clara ideally suited to OEM integration.

Specifications Summary

Active pixels (W x H)	**1392 x 1040**
Pixel size (W x H)	**6.45 x 6.45 µm**
Image area (W x H)	**8.98 x 6.71 mm**
Read noise	**2.4 e⁻**
Maximum dynamic range	**> 6,500:1; 12,500 with binning**
Thermoelectric cooling	**-55°C**
Dark current	**0.0003 e⁻/pixel/sec**
Maximum frame rate	**11 fps**

Specifications[2]

Model	Clara			Clara E		
Active pixels [W x H]	1392 x 1040					
Pixel size	6.45 x 6.45 µm					
Image area [W x H]	8.98 x 6.71 mm					
Pixel readout rate (MHz)	20, 10, 1					
Read noise (e⁻) [3]	1 MHz	10 MHz	20 MHz	1 MHz	10 MHz	20 MHz
Typical	2.4	5	6.5	3.0	5	6.5
Minimum temperature air cooled (fan on) @ 25°C ambient	-55°C			-20°C		
Minimum temperature 'vibration free mode' (fan off) @ 25°C ambient	-40°C			Mode not available		
Dark current, e⁻/pixel/sec @ minimum temperature [4]	0.0003			0.0015		
Maximum frame rate	11 frames per second @ 20 MHz					
Pixel well depth (typical)	18,000 e⁻					
Well depth with binning (typical)	30,000 e⁻					
Maximum dynamic range	> 6,500:1 @ 1MHz; 12,500 with binning					
Linearity [5]	Better than 99%					
Dual digitization	16 bit @ 1 MHz; 14-bit @ 10 MHz & 20 MHz					
Baseline (bias) offset clamp	Yes					
Timestamp accuracy	12.5 ns					
Interface [6]	USB 2.0					
Lens mount	C-mount					

Frame Rates

Full Frame Rate [7]
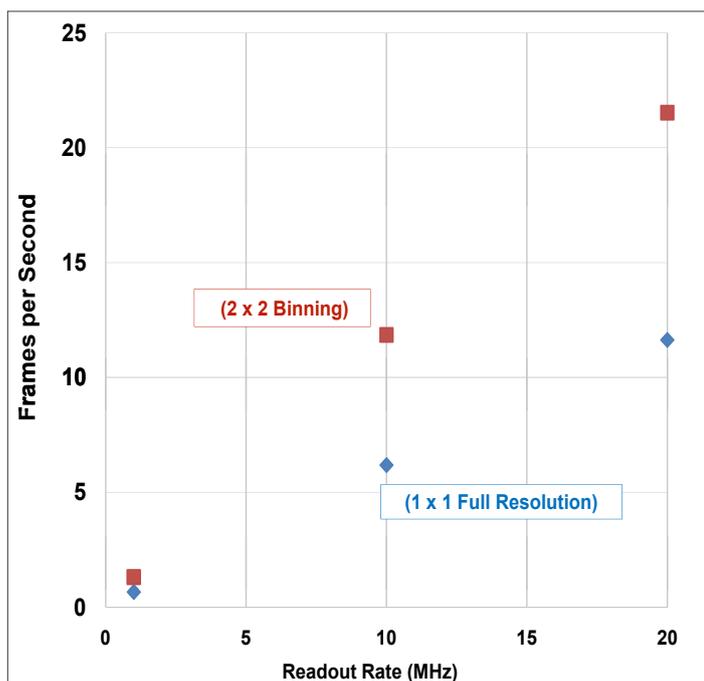
Maximum Frames per Second [8]

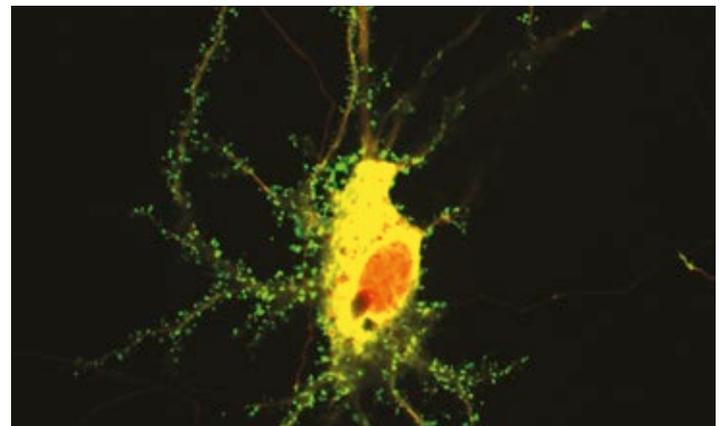| Binning	Array Size			
	1392 x 1040 (Full Frame)	512 x 512	256 x 256	128 x 128
1	11	20.3	34.3	52.5
2	20	34.3	52.5	71.5
4	34	52.5	71.5	87.2
8	52.1	71.5	87.2	97.9

Quantum Efficiency Curves
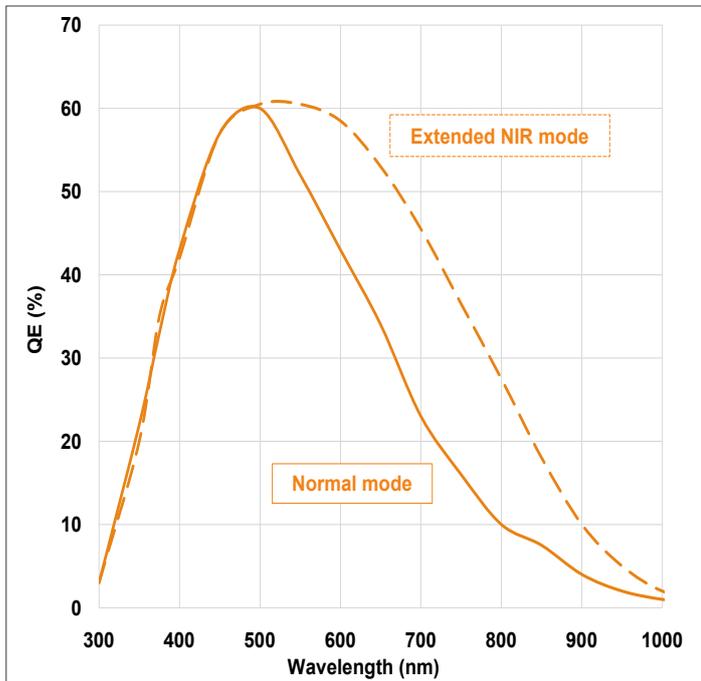
QE v Fluorophores Curves
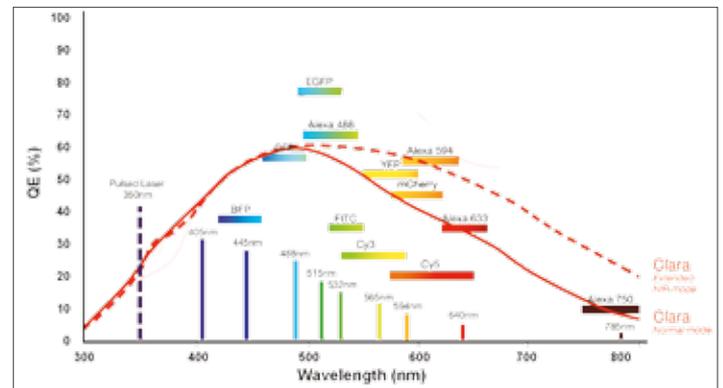
Application Image

Rat hippocampal neuron, grown in culture for 2.5 weeks, co-transfected with tdTomato (red) and an actin-binding protein (green). Images acquired at 60x 1.45 oil, 1.2x C-mount (Z stack at 0.4 μm steps). The red cell fill shows the morphology of individual dendritic spines protruding from the main trunk of the dendrite. The intense green label within the spines reveals the high concentration of actin-regulatory proteins that control synaptic strength by regulating the shape of spines and the trafficking of receptor proteins at the synapse.

Courtesy Dr Thomas Blanpied, Physiology, UMD, Baltimore

Have you found what you are looking for?

Need a price/performance microscopy camera with single photon sensitivity? The Luca R is a compact 1 Megapixel EMCCD USB 2.0 camera, offering high resolution and ultra-sensitivity at 12.4 frames/sec, ideally suited to demanding live cell microscopy applications.

Need better sensitivity in red/NIR? The Luca R and iXon3 885 EMCCD cameras offer excellent QE across the red/NIR wavelength region, ideally suited to red-enhanced fluorophores.

Need faster frame rates? The iXon3 885 EMCCD delivers 31 frames/sec (60 frames/s with 2 x 2 binning) with single photon sensitivity.

Need the ultimate in sensitivity? The iXon3 back-illuminated EMCCD series offers > 90% QE and single photon sensitivity, combined with rapid frame rate performance.

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

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

Creating The Optimum Product for You

How to customise the Clara:

Step 1.

Simply select from the 2 models options that best suit your needs from the selection opposite.

Step 2.

Please indicate which software you require.

Step 3.

For compatibility, please indicate which accessories are required.

DR 328G- C02 -SIL
example shown

Step 1.

Choose Clara model

C01: Clara with fan cooling to -55 °C (-40°C in 'vibration-free mode') and 2.4 e⁻ read noise
C02: Clara E with fan cooling to -20 °C and 3 e⁻ read noise

Step 2.

The Clara also requires at least one of the following software options:
Solis Imaging A 32-bit application compatible with 32 and 64-bit Windows (XP, Vista and 7) 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 and 7) and Linux. Compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab.

Andor iQ A comprehensive multi-dimensional imaging software package. Offers tight synchronization of camera with a comprehensive range of microscopy hardware, along with comprehensive rendering and analysis functionality.
Modular architecture for best price/performance package on the market.

Third Party Software Compatibility Drivers are available so that the Clara can be operated through a large variety of third party imaging packages, including MicroManager, MetaMorph, Image Pro Plus, Nikon NIS Elements and Leica Application Suite

Step 3.

The following accessories are available:
ACZ-03453 Multi I/O cable offering all available Fire, External Triger, Shutter, Arm & I²C
ACZ-03454 Advanced multi I/O cable offering all available timing and I/Os (except I²C)
OA-CCFM C-mount to Canon F-mount adapter
OA-CNAF C-mount to Nikon F-mount adapter
OA-COFM C-mount to Olympus adapter
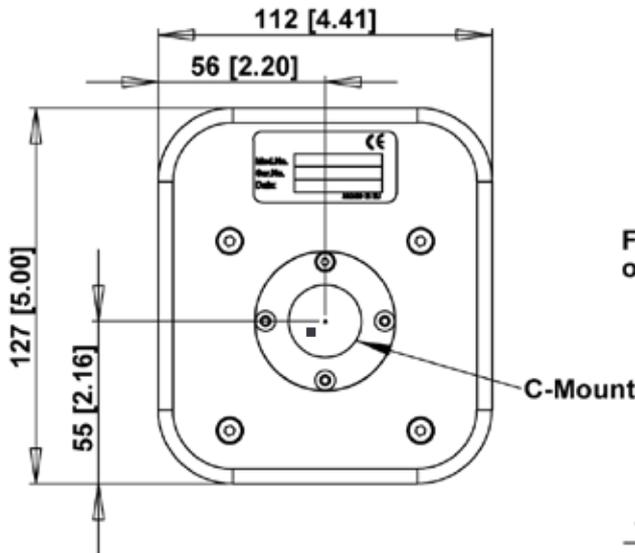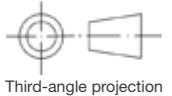**OA-CTOT** C-mount to T-mount adapter
OA-ECAF Auto extension tubes (set of 3) for Canon AF
OA-ECMT Auto extension tubes (set of 3) for C-mount
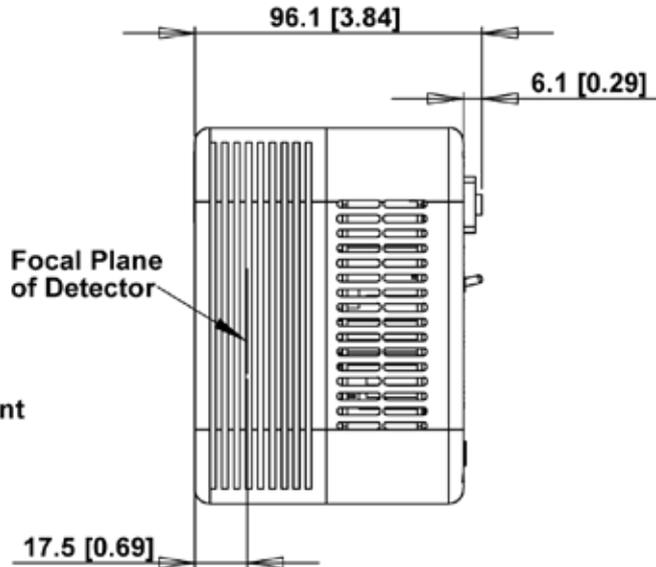**OA-ENAF** OA-ENAF Auto extension tubes (set of 3) for Nikon AF

Product Drawings

Dimensions in mm [inches]

Third-angle projection

Focal Plane of Detector

C-Mount

■ = position of pixel 1,1

Weight: 2.2 kg [4 lb 13 oz]

Connecting to the Clara

Camera Control
Connector type: USB 2.0

Logic
Connector type: 26 way D Type with 8 programmable digital inputs or outputs for control and sensing of up to 8 external devices

Digital to Analog Converter (DAC) Outputs
Connector type: 26 way D Type with 2 precision 16-bit DAC outputs for control of external analog devices, e.g. Z-stages. Software selectable between 0-5V & 0-10V ranges

Minimum cable clearance required at rear of camera
135 mm
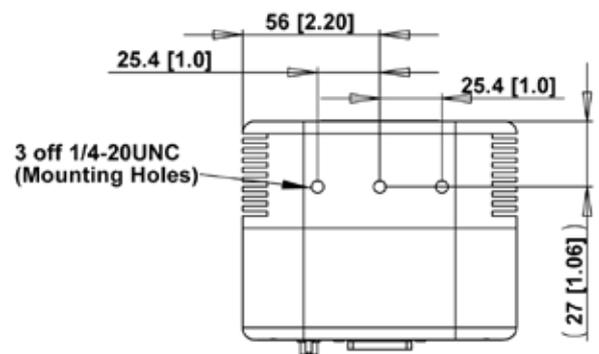
Mounting hole locations

3 off 1/4-20UNC (Mounting Holes)

Typical Applications

Live Cell Multidimensional Microscopy
Luminescence
Cell Motility / Ion Signalling
In-Vivo Imaging / Gel Documentation
FRET / FRAP
Comet Assay
Fluorescence In-Situ Hybridization (FISH)
High Content Screening

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

5 YEAR VACUUM WARRANTY

Our regional headquarters are:

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Fax +1 (860) 290 9566

China
Beijing
Phone +86 (10) 5129 4977
Fax +86 (10) 6445 5401

Items shipped with your camera:

1x Andor ACZ-03452: 2m Multi I/O timing cable, offering Fire, External Trigger, Shutter and Arm
1x 3m USB 2.0 cable Type A → Type B
1x Power supply with mains cable
1x Quick launch guide
1x CD containing Andor user guides
1x Individual system performance booklet
1x CD containing software of choice

Regulatory Compliance
Compliant with the requirements of the EU EMC and LV Directives through testing to EN 61326-1 and EN 61010-1
Compliant with the North American Safety Standards: UL 61010-1 and CAN/ CSA-C22.2 No. 61010-1-04

Footnotes: Specifications are subject to change without notice

1. 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. Our faith in the vacuum process means that we are proud to offer an exclusive 5 year warranty on the vacuum enclosure.
2. Figures are typical unless otherwise stated.
3. 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 -45°C and minimum exposure time under dark conditions.
4. The dark current value is obtained using the traditional method of measuring dark current, as for any CCD camera, i.e. taking a long integration time to get a dark signal that is well above the read noise. The dark current measurement is averaged over the CCD area excluding any regions of blemishes.
5. Linearity is measured from a plot of Counts vs. Signal up to the saturation point of the system.
6. USB 2.0 is truly universal to all PCs, in contrast to a Firewire interface which often requires an internal interface card for PC compatibility.
7. The graph shows the frame rates possible when reading out the complete sensor at 20, 10 and 1 MHz pixel readout rates and using either 1 x 1 'full resolution' or 2 x 2 pixel binning.
8. The table indicates the maximum speed at which the device can acquire images in a standard system. The frame rates at 20 MHz pixel readout rates are shown for a range of binning or array size combinations. It also assumes internal trigger mode of operation.
9. If in doubt, please contact your computer manufacturer.

Minimum Computer Requirements *9 :
- 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 and 7) 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
110 - 240 VAC, 50/60 Hz
or 12V @ 4.75 A (DC)