OXFORD INSTRUMENTS

C-RED 2

Very High Speed, Ultra Low Noise, SWIR Camera

Key Specifications

- ✓ 640 x 512 InGaAs sensor
- ✓ SWIR 0.9 - 1.7 µm
- ✓ 15 µm pixel pitch
- ✓ 80% peak QE
- ✓ Up to 600 fps full frame
- ✓ 23 e- read noise
- ✓ 93 dB & true 16 bits High Dynamic Range

Key Applications

- ✓ Astronomy & Adaptive Optics
- ✓ Fluorescence Microscopy
- ✓ Wavefront sensing
- ✓ Low visibility imaging
- ✓ Hyperspectral imaging
- ✓ Semiconductor inspection
- ✓ Quality / Production control

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Introducing C-RED 2

C-RED 2 is a revolutionary ultra high speed low noise Short Wave Infrared camera designed for demanding applications. C-RED 2 integrates a 640 x512 InGaAs Photodiode detector with 15 µm pixel pitch for high resolution, which embeds an electronic shutter with integration pulses shorter than 5 µs.

Thanks to its state-of-the-art electronics, software, and innovative mechanics, C-RED 2 is able to run at 600 fps in full frame mode with a low readout noise and a low dark current, enabling the detection of very weak signal.

C-RED 2 versatility enables high quality sensing at both long exposure times (up to 60 seconds) and short integration times, enabling up to 600 fps with full resolution. Multiple smart parameter tuning possibilities and hardware optimizations are available to adjust to your specific use cases.

C-RED 2 is also capable of windowing and multiple non-destructive readouts, allowing faster image rates while maintaining very low noise. The camera is reliable for demanding research applications. C-RED 2 also offers a high dynamic range mode with 93dB and 16-bit data range, while maintaining excellent linearity throughput.

C-RED 2 offers air and water cooling, enabling precise temperature stabilization of the sensor down to -40°C. The camera also has a C-Mount for lens attachment and can be easily integrated into any system thanks to multiple mounting points.

Designed primarily for high-end low light SWIR applications, C-RED 2 can be adapted to a range of complex scenarios or challenging environments, and offers new opportunities for science, research and industry.

Astronomy

Visible cameras have been used for a very long time in astronomy, and now, Short Wave Infrared (SWIR) cameras are opening the path to new observations and discoveries. Unlike light at visible wavelengths, infrared light is not blocked by interstellar dust.

Astronomers use SWIR cameras to study the J-band (1.1 – 1.4 µm), H-band (1.5 – 1.8 µm) and K-band (2.0 – 2.4 µm). One of the major applications of First Light Imaging's cameras in astronomy is adaptive optics: the active correction loop used to reduce the atmospheric disturbances that cause spatial and temporal distortions.

Astronomy imaging in the SWIR range. Image of Saturn at 50ms exposure with C-RED 2 / Courtesy of JL Gach, First Light Imaging.

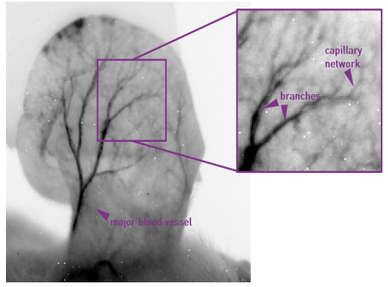
Night vision in the SWIR range. Imaging of a boat in a swimming pool, by a moonless night. Camera used: C-RED 2 with SWIR lens 16 mm, cooled down to -15°C, High gain.

Surveillance and Safety

One of the principle advantages of using SWIR technology for Safety or Surveillance applications, is the ability of SWIR cameras to "see through" smoke, haze, mist, fog and other challenging atmospheric conditions. A significant improvement of contrast compared to visible range images can be observed. Furthermore, our SWIR cameras offer high sensitivity in low light environment, allowing night vision, for example.

Life Science Research

Short Wave Infrared (SWIR) imaging is often referred to as NIR-II imaging in the life science community. Thanks to low scattering and low tissue autofluorescence in this range, NIR-II imaging allows deep, non-invasive, high-resolution detection of *in vivo* or *ex vivo* tissues. With the recent and growing development of contrast agent and dyes that emit at higher wavelength, more and more applications can be targeted.



Fluorescence in vivo imaging of external ear vasculature in the NIR-II range with C-RED 2. Inverted contrast.

Technical Specifications

Specifications•1

Sensor Specifications		C-RED-2
Sensor size		640 x 512 pixels
Pixel pitch		15 µm
Maximum speed Full Frame		600 fps
Noise at high gain, Tint at 50 µs, 600 fps Full Frame		@ -40°C 23 e- (typical •2) 28 e- (max.)
Dark Current (Tuning Long Exposure, Dark Optim 100) @ - 40°C		365 e-/p/s (typical •2) 600 e-/p/s (max.)
Cooling		-15°C (air) -40°C (liquid)
Quantization		14 bit
Quantum Efficiency		80% (peak) > 70% (between 1.0 to 1.65 µm)
Operability due to signal response (pixels with signal ± 0.3*median at 20°C)		> 99.8%
Image Full well capacity	low gain	1400 ke-
	med gain	128 ke-
	high gain	33 ke-
Maximum speed in 32 x 4 (min)		32066 fps •3
Maximum speed in 320 x 256		1779 fps

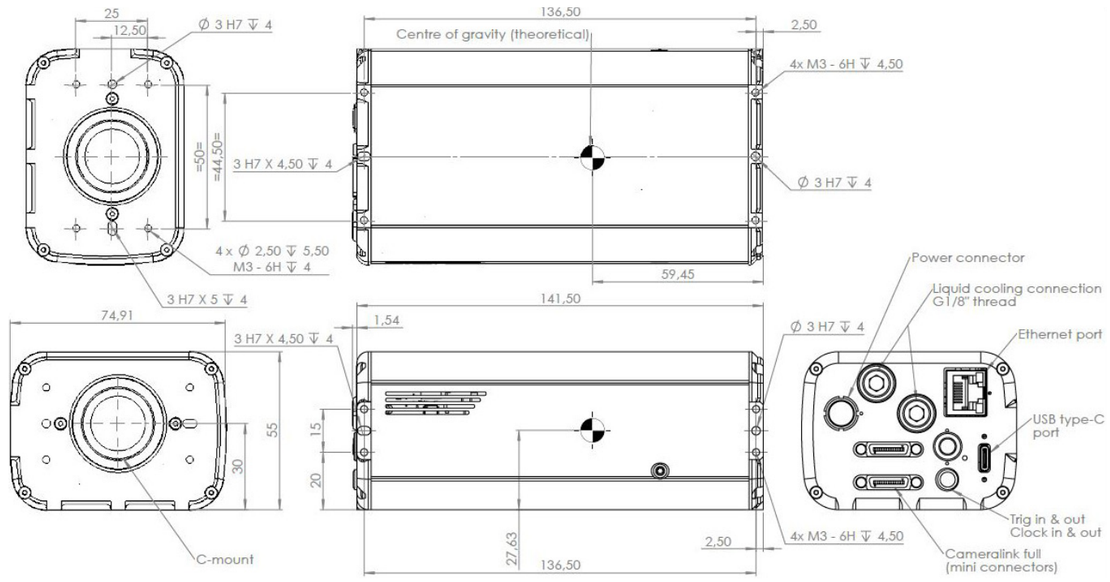
Features	C-RED-2
Output	USB 3.1 Gen 1 and CameraLink® full
Optical interface	C-Mount
Operating temperature	-5° to 35° C
HDR mode	93 dB and 16 bits
On camera image optimisations	Embedded image corrections
Triggering	LVTTL/LVDS synchronization
Software	Graphical User Interface: First Light Vision Software Development Kit: (C, C++, C#, Python, MatLab) / LabVIEW / µManager

Lines	Frame rate at maximum readout speed CameraLink® Output Columns					
	32	64	128	256	512	640
4	32066	31512	30458	28548	25367	24029
8	28108	27348	25945	23532	19840	18397
16	22542	21631	20015	17413	13819	12526
32	16147	15254	13736	11455	8599	7646
64	10302	9596	8440	6801	4898	4297
128	5975	5509	4765	3752	2632	2291
256	3247	2975	2547	1978	1367	1184
512	1697	1549	1319	1016	697	602

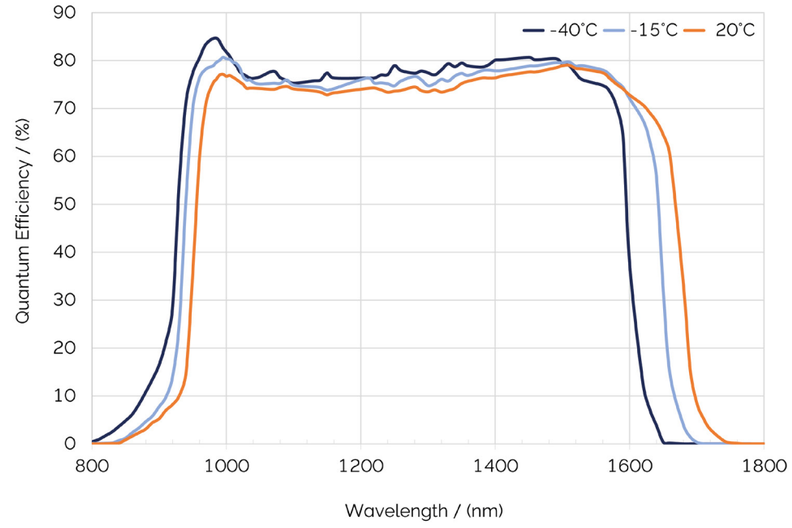
For USB 3 Output: Max 9999 FPS

Product Drawings

Dimensions in mm [inches]
Weight: 900 g



Quantum Efficiency (QE) Curve



Creating The Optimum Product for You

Step 1. Select the camera type

Camera Type

Description	Code
C-RED 2: 640 x 512 InGaAs camera, 600 fps, <30 e-	PAC-CR2-SSC

Step 2. Select the required accessories

Accessories

Description	Order Code
Cooling pack	PAC-COO-200-000
Mounting plate (C-RED 2 and C-RED 2 ER only)	ACC-MOU-CR2-000
Quick coupling set	ACC-QCS-CAM-001
Synchro cables 1 m	ACC-CAB-SYN-000
Synchro cables 3 m	ACC-CAB-SYN-001
Camera Link® cables 5 m	ACC-CAB-CLF-000
Camera Link® cables 10 m	ACC-CAB-CLF-001
Matrox Grabber CL RAD EV 1G CLSF	ACC-GRA-CLF-000

Step 3. Software

Software

Your product is provided with the following software options:

Graphical User Interface: First Light Vision

Software Development Kit: (C, C++, C#, Python, MatLab) / LabVIEW / µManager

Meet the Extended SWIR Camera Family

C-RED 2 Lite

C-RED 2 Lite is the stabilized version of C-RED 2, able to run at 600 fps with 30 e- readout noise.

- ✓ Free space optics
- ✓ Laser communications
- ✓ Quantitative spectral imaging
- ✓ Hyper/multispectral imaging
- ✓ Thermography
- ✓ Non destructive inspection
- ✓ Laser beam profiling

Read More

C-RED 2 ER

C-RED 2 ER 1.9 µm and 2.2 µm are high speed extended InGaAs cameras for eSWIR imaging.

- ✓ Astronomy
- ✓ Adaptive Optics
- ✓ Life Sciences / Research
- ✓ Surveillance and Safety
- ✓ Long range imaging
- ✓ Hyper/Multispectral imaging
- ✓ Quality/Production control

Read More

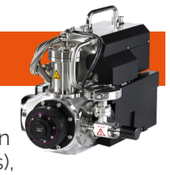
C-RED 3

Specially designed for short exposure times applications, C-RED 3 is a very compact high speed VGA uncooled camera for short wave infrared (SWIR) imaging.

- ✓ Free space optical communications
- ✓ Semiconductor inspection
- ✓ Quality/production control
- ✓ Adaptive optics
- ✓ Laser beam profiling
- ✓ Hyperspectral imaging
- ✓ Thermography

Read More

C-RED One



C-RED One is an unique photon counting SWIR camera based on an e-APD MCT sensor (320x256 pixels), running at 3500 frames per second, for high-end scientific applications:

- ✓ Astronomy
- ✓ Adaptive Optics
- ✓ Space debris tracking
- ✓ Secure laser communications
- ✓ Long range surveillance and tracking
- ✓ Spectroscopy
- ✓ Hyperspectral imaging

Read More

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.oxinst.com/contact

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Items shipped with your camera:
1x Camera (model as ordered)
1x Power supply
1x Power supply cable
1x USB cable
1x Quick start guide

Footnotes: Specifications are subject to change without notice
1. Figures are typical unless otherwise stated.
2. Typical refers to the medican value from a large set of cameras.
3. Tested with cameralink and Zebra frame grabber.

Minimum Computer Requirements:
RAM: 8 GB minimum
Processor: Intel® Core™ i5 or higher
Screen resolution: at least 1920 x 1080
See system requirements for more information.

Operating and Storage Conditions
- Operating Temperature: -5°C to 35°C
- Relative Humidity: < 80% (non-condensing)
- Storage Temperature: -40°C to 70°C

Power Requirements
- 100 - 240 VAC 50 - 60 Hz
- Max. power consumption: 90 W

CE

C-RED2SS 0126 R1