

# C-RED 2 ER

## 1.9 $\mu\text{m}$ & 2.2 $\mu\text{m}$ Extended Range SWIR Camera

### Key Specifications

- ✓ 640 x 512 InGaAs sensor
- ✓ SWIR 1.1 - 1.9  $\mu\text{m}$  or 1.3 - 2.2  $\mu\text{m}$
- ✓ 15  $\mu\text{m}$  pixel pitch
- ✓ 85% peak QE
- ✓ Up to 600 fps full frame
- ✓ 32 e- or 36 e- read noise

### Key Applications

- ✓ Astronomy & Adaptive Optics
- ✓ LiDAR
- ✓ Long Range Imaging
- ✓ Hyper/Multispectral Imaging
- ✓ Quality/Production Control
- ✓ Laser beam characterization
- ✓ Spectroscopy



## Introducing C-RED Extended Range (ER)



C-RED 2 ER is a highly sensitive, Extended Range InGaAs camera series for SWIR imaging to either 1.9  $\mu\text{m}$  or 2.5  $\mu\text{m}$ , opening new imaging and sensing opportunities for bioimaging, laboratory research, laser measurements and industrial applications. C-RED 2 ER contain VGA (640 x 512 pixels) detectors with 15  $\mu\text{m}$  pixel pitch and with peak quantum efficiency > 80%. All models are able to run at 600 fps (full frame) and up to 32,066 fps in cropped mode. All models offer low read noise (< 40 e-) and have an integrated

thermoelectric cooler, enabling stabilized cooling capability down to -40 or -55°C (model dependent) for darkcurrent minimization.

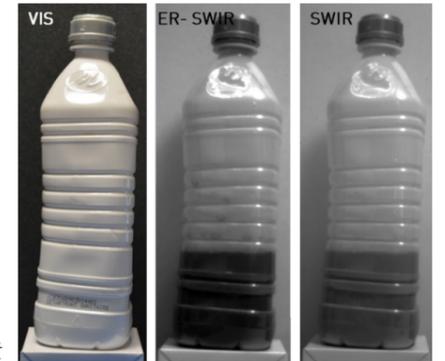
C-RED 2 ER is available with two InGaAs detectors:

- ✓ C-RED 2 ER 1.9  $\mu\text{m}$  is sensitive across the range of 1.1 to 1.9  $\mu\text{m}$
- ✓ C-RED 2 ER 2.2  $\mu\text{m}$  is sensitive across the range of 1.2 to 2.2  $\mu\text{m}$

The development of extended range detectors based on InGaAs technology is a recent breakthrough in imaging. With a double thermoelectric cooling system, the camera is a straightforward solution for imaging in the far end of the SWIR spectrum without the cryogenic cooling required for HgCdTe.

## High Quality Imaging in Extended Range SWIR

Standard InGaAs has a long cut-off wavelength of 1700 nm. Introducing more Indium into GaAs enables the detection of longer wavelengths, this is called "extended wavelength InGaAs". Variation in the substrate composition results in lattice-mismatch artefacts, which degrade image quality. First Light Imaging has developed a specific correction to compensate for the artefacts in real time.



Visible versus SWIR and ER-SWIR images of a plastic bottle filled with water. The bottle is opaque in the visible range, while ER-SWIR increases the contrast compared to SWIR. Courtesy of First Light Imaging.



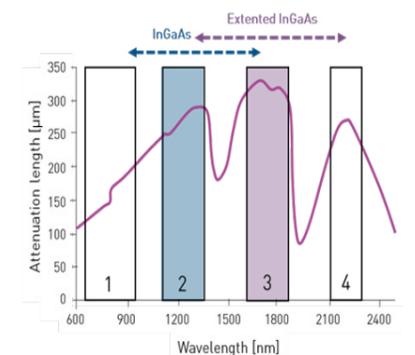
Visible versus ER-SWIR images of bay leaves. Courtesy of First Light Imaging.

## Agriculture and food inspection

Water has four absorption bands within the infrared region, at wavelengths 1200 nm, 1450 nm, 1940 nm and 2950 nm. Measuring the absorption of thin food slices or foliage at these wavelengths enables quantitative measurement of their water content. On thicker objects, such as fruits and vegetables, the absorption properties allow the detection of moisture or defects that are imperceptible in the visible range (by the naked eye). This is particularly useful for food sorting applications and observation of crop fields.

## Life Science Research

Imaging in the range 650 – 950 nm has been widely used for clinical and preclinical fluorescence imaging. More recently, cameras sensitive to the NIR-II range have allowed imaging between 1100 – 1350 nm; used for in vivo small animal imaging and more recently for clinical applications. A further extended spectral range 1600 – 1870 nm optimises the scattering and absorption of tissues, hence the penetration depth of light in tissues and is ideal for deep brain imaging. Other applications such as Optical Coherence Tomography (OCT) will also benefit from the longer penetration depth of light.



Transmittance in brain tissue of 200  $\mu\text{m}$  thicknesses. Four spectral regions are identified. The third wavelength region can be exclusively detected by extended range cameras.



# Creating The Optimum Product for You

## Step 1. Select the camera type

Camera Type	Description	Code
	C-RED 2 ER 2.2: 640 x 512 Extended InGaAs camera, 600 fps, <40 e-, wavelength 1.3-2.2 μm	PAC-CR2-SERB2
	C-RED 2 ER 1.9: 640 x 512 Extended InGaAs camera, 600 fps, <50 e-, wavelength 1.1-1.9 μm	PAC-CR2-SERB1

## Step 2. Select the required accessories

	Description	Order Code
 Accessories	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
	Matrix Grabber CL RAD EV 1G CLSF	ACC-GRA-CLF-000

## Step 3. 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 Cameras 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



Ultra high speed, low noise, short wave infrared camera, able to run at 600 fps with a readout noise under 30 electrons and a very low dark current <600 e-/p/s.

- ✓ Astronomy
- ✓ Adaptive Optics
- ✓ Fluorescence microscopy research
- ✓ Hyperspectral imaging
- ✓ Low visibility imaging
- ✓ Semicon inspection
- ✓ Quality / production control

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## 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](#)

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## China

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Fax +86 (10) 5884 7901



### Items shipped with your camera:

- 1x Camera (model as ordered)
- 1x Power supply
- 1x Power supply cable
- 1x USB cable
- 1x Quick start guide

### 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 50°C

### Power Requirements

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

### Footnotes: Specifications are subject to change without notice

1. Figures are typical unless otherwise stated.