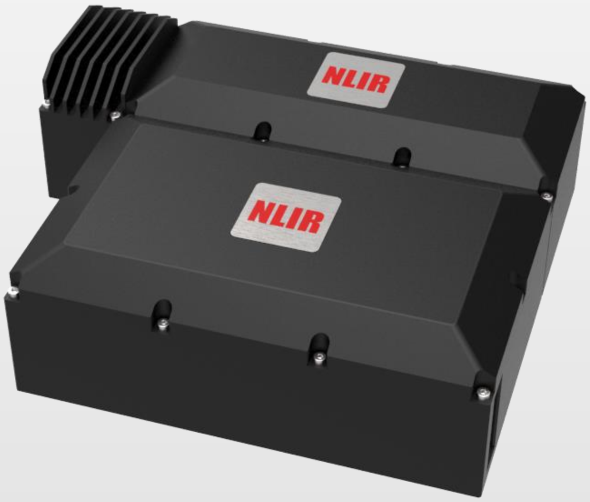
NLIR
Nonlinear Infrared Sensors

Mid-Infrared Light Detector

Fast – Sensitive – Rugged



- Single-wavelength detection from 2.2 – 5.0 µm
- DC – 10 GHz bandwidth
- NEP down to 2 $fW/\sqrt{Hz}$
- Based on novel upconversion technology

NLIR Mid-Infrared Single-Wavelength Detector

– a new paradigm in mid-infrared light detection

Measuring mid-infrared (MIR) light is inherently difficult due to the small photon energies and finite temperatures of detectors, which results in low detection efficiencies and high levels of noise. The NLIR MIR light detector is based on a novel measurement scheme that upconverts the MIR light to the near-visible regime. Near-visible light detectors (based on for example Si) are far superior to MIR light detectors in terms of efficiency, speed and noise. The NLIR upconversion technology therefore brings these attractive features and the advantages that follow to the MIR regime.

New regimes of the MIR region can be explored using the NLIR technology: with up to 10 GHz sampling rate, nanosecond pulses are possible to characterise directly in the time domain or, alternatively, light at specific wavelengths from chemical reactions can be measured at unprecedented much faster than possible otherwise. New regimes of sensitivity also come within reach: the noise-equivalent power of the NLIR single-wavelength detector is as low as 2 $fW/\sqrt{Hz}$, which is orders of magnitude lower than standard cooled HgCdTe (MCT) MIR detectors.

Key applications:

- Nanosecond pulse characterisation
- Low-power MIR light detection
- Detection of gas lines
- Free-space communication
- DIAL (differential absorption LIDAR)
- Chemical kinetics

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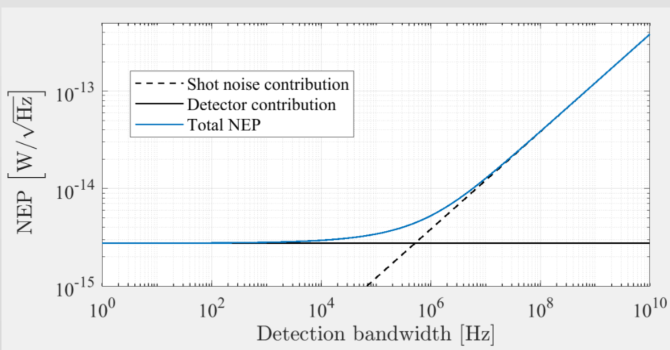
The NLIR MIR light detector is composed of an upconversion unit that changes the wavelength of the MIR light to the near-visible regime and a near-visible light detector. Near-visible light detectors exist with many different combinations of specifications and what detector to choose depends on the desired application. Below, two examples give an overview of possible operation specifications:

Example 1: Fast	
Optical bandwidth	< 10 nm
Centre wavelength	3314 nm
Noise-equivalent power (NEP)	See plot (> 2.75 fw/$\sqrt{\text{Hz}}$)
Saturation limit	1 W
Electrical bandwidth	Up to 10 GHz
Responsivity	1 V/W @ 50 Ω
Optical input	Free space, polarisation sensitive (incl. guide beam)
Connector type	Male SMA
Physical dimensions (h × l × w)	70 mm × 230 mm × 260 mm

Centre wavelength available from 2200 – 5000 nm. Optical bandwidth changes slightly with centre wavelength. Example is without electrical pre-amplifier.



Example 2: Sensitive	
Optical bandwidth	< 10 nm
Centre wavelength	3314 nm
Noise-equivalent power (NEP)	3 fw/$\sqrt{\text{Hz}}$
Saturation limit	20 nW
Electrical bandwidth	DC – 10 MHz
Responsivity	20 000 kV/W @ 50 Ω
Optical input	Free space, polarisation sensitive (incl. guide beam)
Connector type	Male SMC
Physical dimensions (h × l × w)	70 mm × 230 mm × 260 mm

Centre wavelengths are available from 2.5 – 4.5 µm. Optical bandwidth changes slightly with centre wavelength. Higher sampling frequencies are possible at the cost of higher NEP and different values of the saturation limit and responsivity. Electrical pre-amplifier is included in this example.

Preliminary: these specifications may be changed without notice.

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