



### IGA-3000 Array Detectors

#### Spectrum One InGaAs Array Detectors:

As the semiconductor and telecommunications industries continue to become more sophisticated, there is an increasing interest in the NIR region of the spectrum for characterization of optical fibers, light sources, semiconductors and other related materials. In order to cover such applications, Jobin Yvon has developed the IGA-3000 linear array family utilizing very low noise detectors optimized for the Spectroscopic measurements.

#### The Array for IR Spectroscopy

The **new** IGA-3000 series detectors feature spectroscopic-grade InGaAs (Indium-Galium-Arsenide) linear arrays with 25 x 500 micron or 50 x 500 micron pixel elements.

IGA-3000 array detectors offer extremely high sensitivity, dynamic range, signal-to-noise performance and stability for NIR applications. They provide a tremendous multiplexing advantage over single channel NIR detectors, **without the need for an optical chopper**.

The small pixels and a maximum of 85% quantum efficiency make them ideal for spectroscopic analysis: the signal produced from the spectrograph is detected without loss of the spectral information.

IGA-3000 detectors are ideal for many demanding, low light level, multi-channel spectroscopic applications including:

- NIR Raman spectroscopy
- Photoluminescence measurements
- Plasma diagnostics
- Emission spectroscopy
- Characterization of NIR laser diodes, optical filters and light sources
- Fiber Optics Transmission measurements in the telecommunications industry

These versatile array detectors are available in liquid nitrogen (LN<sub>2</sub>) and compact thermoelectrically cooled (TE) packages and are completely controlled by our compact IEEE488 based controller.



IGA-3000 array detectors

#### Features

- Large choice of formats
- 50 or 25 micron pixel widths
- High sensitivity and Ultra Low noise
- Two acquisition modes: **HIS** (High Sensitivity) and **HiD** (High Dynamic Range)
- TE or LN<sub>2</sub> cooling option
- Accommodation to most Spectrographs
- IEEE communication
- Software: SpectraMax for Windows or LabVIEW VI

#### Benefits

- An array for your requirement
- Choice for the best spectroscopic results
- Provides the best Signal/Noise results
- Low noise or High speed operation
- Optimized to match applications
- Versatile
- PC and Laptop compatibility
- Fully automated with SpectraMax or easily customized with LabVIEW



# Specialists in Spectroscopy

## Optical Spectroscopy Division



**NEW  
SPECS**

### IGA-3000 Array Detectors

#### IGA-3000 Detectors: Highest NIR Sensitivity with Ultra Low Noise

##### Jobin Yvon Noise expertise:

The InGaAs arrays used in spectroscopy are constructed from individual photodiodes arranged in a linear array with a silicon CMOS readout multiplexer circuit. In high precision low-light level spectroscopic applications it is important to understand the various noise sources which contribute to a measurement with an InGaAs array and thus affect the signal-to-noise ratio.

Each individual InGaAs photodiode pixel in an array is connected to its own capacitive transimpedance preamplifier circuit. As a result, the bias voltages are often slightly different from pixel to pixel. These minute differences in the output of each element lead to a predictable and repeatable noise signal known as **fixed pattern response**. This source is a strong function of both the integration time and the array operating temperature, and can be reduced by thermoelectric or liquid nitrogen cooling. Fortunately, the fixed pattern response is highly repeatable and can be almost eliminated by subtracting a dark acquisition of the same integration time as the illuminated spectrum of interest. In order to accomplish the dark acquisition it is mandatory to block the signal to the detector using a mechanical shutter. Some InGaAs arrays have an electronic sink circuit that dumps the photocurrent and essentially flushes the detectors in an analogous manner to a CCD detector. This so-called "electronic shutter" does not permit a dark acquisition to be made but it does allow the user to set a fast integration time. Other sources of noise in an InGaAs array which contribute to the measurement include **read noise**, which is electronic noise

Wavelength Range (***)		800 – 1700 nm	
Pixel formats		256x1 or 512x1	512x1
Pixel size		50x500 µm	25x500 µm
Optical Fill Factor:		100%	
Cooling options:		2-stage TE or LN <sub>2</sub> (*)	
Full well capacity (**)		130,000,000 e <sup>-</sup> (Typ) (HiD mode) 5,000,000 e <sup>-</sup> (Typ) (HiS mode)	
Gain (Typ):		75 e <sup>-</sup> /count (HiS mode) 2000 e <sup>-</sup> /count (HiD mode)	
Fixed Pattern Noise		250 e <sup>-</sup> /sec (Typ) LN <sub>2</sub> - 500 e <sup>-</sup> /sec (max) 900 e <sup>-</sup> /sec (Typ) HiS TE - 1000 e <sup>-</sup> /sec (max) 7500 e <sup>-</sup> /sec (Typ) HiD TE - 10,000 e <sup>-</sup> /sec (max)	
Read noise	HiS mode	650 e <sup>-</sup> rms (Typ) LN <sub>2</sub> 1000 e <sup>-</sup> rms (Typ) TE	800 e <sup>-</sup> rms (Typ) LN <sub>2</sub>
	HiD mode	6000 e <sup>-</sup> rms (Typ) LN <sub>2</sub> 10,000 e <sup>-</sup> rms (Typ) TE	10,000 e <sup>-</sup> rms (Typ) LN <sub>2</sub>
Controller		16 bits	
Response non-linearity		+/- 1 % (Typ)	
Response non-uniformity		+/- 5 % of mean (Typ), +/- 10 % of mean (max)	
Pixel defects		Maximum of 2 black or hot spots for 256 pixel array Maximum of 5 black or hot spots for 512 pixel array	

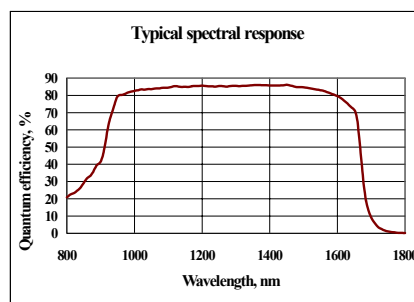
##### InGaAs linear array Specifications

Typical specifications based on manufacturer information.  
Subject to change without notice.

(\*) Adjustable temperature control

(\*\*) Dynamic Range = Full well capacity/Read noise

that occurs when the elements are read out, and **dark signal**, which is the un-illuminated response of the detector. The total noise contribution to the measurement contains contributions from all sources of dark, readout, fixed-pattern and shot noise. The **shot noise** is the intrinsic noise distribution in the photon signal and is equal to the square root of the total signal. A clear understanding of the noise process, the technical specifications of the detector and how these measurements are defined play a critical important role when comparing array detector performance.



Typical spectral response of Spectrum One InGaAs detectors at 25°C.

(\*\*\*) Long wavelength cut-off is dependant on cooling temperature ( $\lambda_{max} = \lambda_{RT} - 1nm$  per degree).

##### In the USA:

Jobin Yvon Inc  
3880 Park Ave,  
Edison, New Jersey,  
08820 USA  
Tel: (732)-494-8660  
Fax: (732)-549-9309  
Email: OSD@jyhoriba.com

##### In France:

Jobin Yvon SA  
16-18 rue du Canal  
91165 Longjumeau cedex  
France  
Tel: (33) (0) 1 64.54.13.00  
Fax: (33) (0) 1 69.09.93.19

##### 1-877-JYHoriba

China: 86-10-68313388  
Germany: 89/46.23.17-0  
Italy: 2/57.60.30.50  
Japan: (81)3-5823-0140  
U.K.: 020-8204-8142



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