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**Operating Instructions
for
ID-443
InSb Detector**

ID-443: IR Detection Assembly (InSb) Instruction Manual

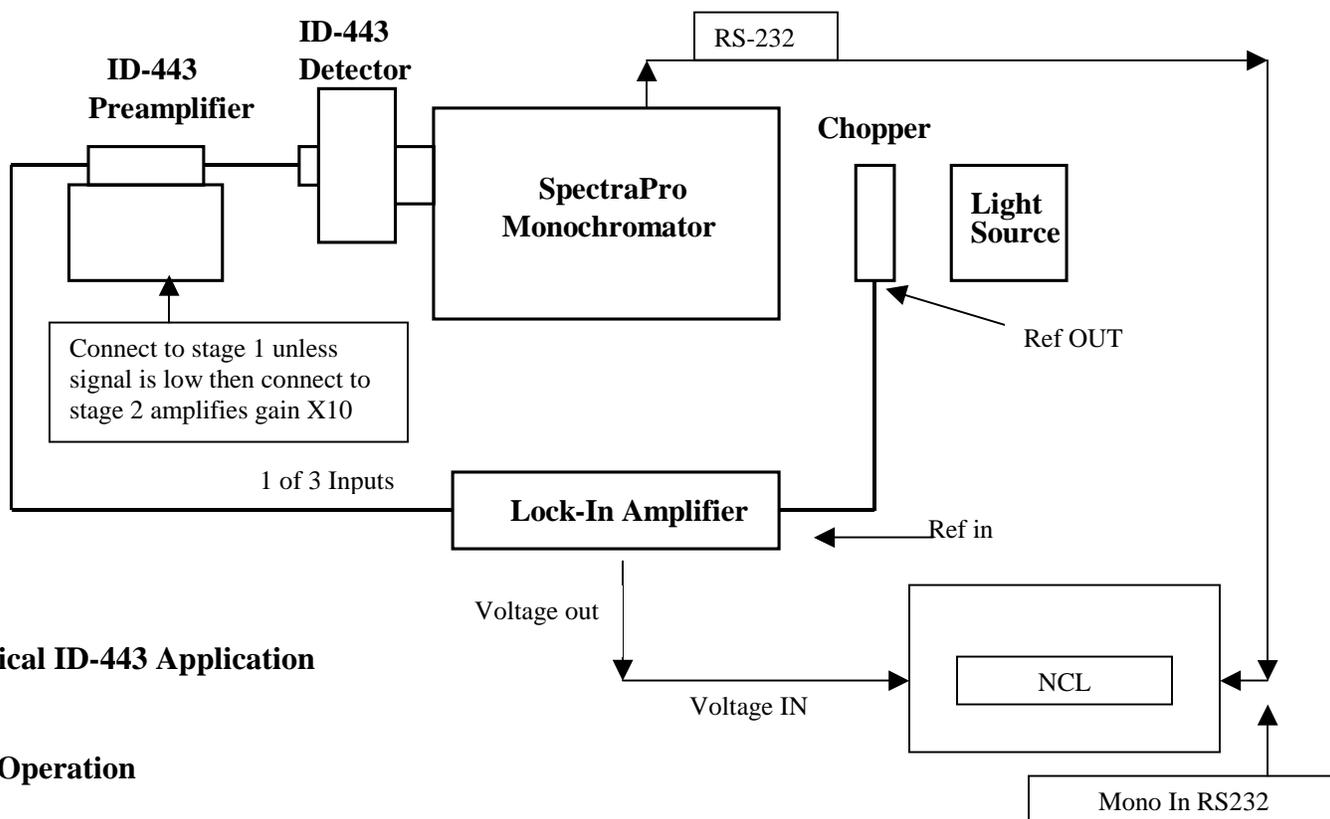
I. Description

The ID-443 IR Detection Assembly is an Indium Antimonide photovoltaic detector operated at 77 degrees K by liquid nitrogen cooling. It operates over the wavelength range of 1.5 to 5 microns. The ID-443 consists of a J10D detector and PA-9 preamplifier from Judson with a power supply and mounting flange for operation with Acton Research Corporation SpectraPro monochromators.

II. Installation

Shown below is the set-up for a typical application using the ID-443 with the SpectraPro monochromator. The detector is attached to the exit slit assembly of the SpectraPro monochromator with the four 8-32 hex screws provided. With the power to the preamplifier module switched off, connect the output of the detector to the input of the preamplifier using the 12 inch cable provided.

Set Software for NCL as Input Bipolar Voltage.



Typical ID-443 Application

III. Operation

Refer to the instructions provided by Manufacturer on the detector and preamplifier before switching on the power to the preamplifier. The detector must be cooled with liquid nitrogen before operation.

Typical Specifications J10D Series InSb @ 77°K

Model Number	Active Size (Dia) (mm)	Peak Responsivity (A/W)	D* @ λ_p and 1kHz (cm Hz ^{1/2} W ⁻¹)	NEP @ λ_p and 1kHz (pW/Hz ^{1/2})	Short Circuit Current I _{sc} (μA)	Open Circuit Voltage V _{oc} (mV)	Shunt Resistance R _D @ V _R =0V (Ω)	Capacitance C _D (nf)	Cutoff Frequency @ R _L =50Ω (Hz)	Dewar Packages	
										Standard	Optional
J10D-M204-R250U	.25	>2	1x10 ¹¹	.2	.4	90 to 120	>10M	.03	4M	M204 Metal Sideview (Page 19)	Shown on Pages 18,19 & 20
J10D-M204-R500U	.5			.4	2		>1M	.1	3M		
J10D-M204-R01M	1			.8	7		>250k	.4	2M		
J10D-M204-R02M	2			1.6	30		>80k	1.6	1M		
J10D-M204-R04M	4			3	110		>20k	6	400k		
J10D-M204-R07M	7			6	350		>5k	20	150k		
J10D-M204-1x4M	1x4			2	28		~80k	2	2M		

Figure 11-1
Detectivity vs Wavelength for J10D Series InSb

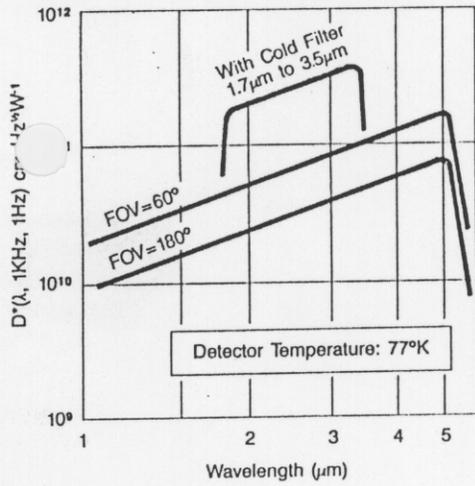


Figure 11-2
Equivalent Circuit for J10D Series InSb

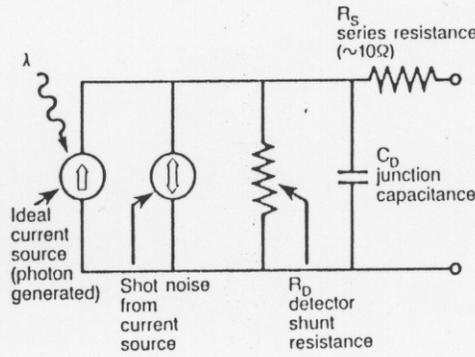


Figure 11-3
Circuit for J10D Series InSb

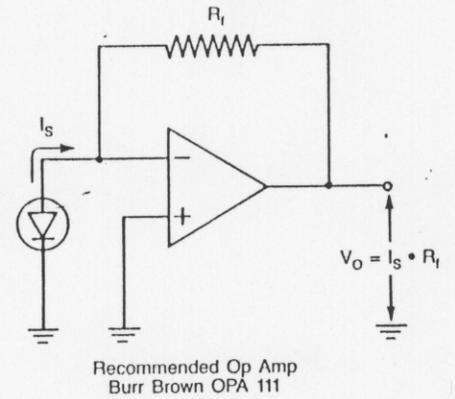


Figure 11-4
Detectivity vs Temperature for J10D Series InSb

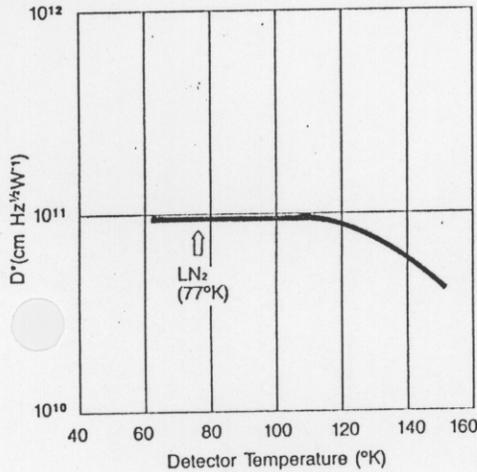


Figure 11-5
Short Circuit Current vs Active Size (60° FOV)

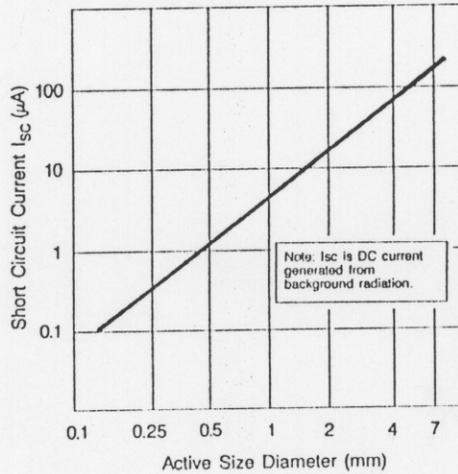
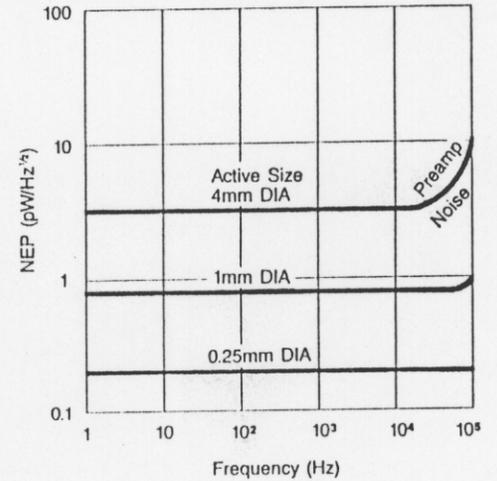


Figure 11-6
Noise Equivalent Power (NEP) vs Frequency



J10D

Series Indium Antimonide Detectors

1.0 to 5.5 μm

Description

The J10D Series detectors are high quality Indium Antimonide (InSb) photodiodes. These devices provide excellent performance in the 1.0 to 5.5 μm wavelength region. Single crystal p-n junction technology yields a high speed, low noise detector with excellent uniformity, linearity and stability.

Operation

InSb detectors are photovoltaic and generate current when exposed to infrared radiation. Peak responsivity is greater than 2 A/W at 5.0 μm . Figure 11-2 shows the equivalent circuit for the detectors, including the shunt resistance (R_D), junction capacitance (C_D) and shot noise. The shot noise results from the DC current (I_{SC}) produced by the background infrared radiation. The background I_{SC} is proportional to the detector active area (see Fig. 11-5) and thus smaller active areas have less shot noise and lower values of NEP.

Optimum performance is achieved when the InSb detector is coupled into a Judson transimpedance gain preamplifier (page 24). The PA-9 or PA-7 preamp converts detector output current to voltage while maintaining the detector at the optimum zero volt bias. The PA-9 preamplifier is specifically matched to each detector to provide maximum sensitivity, gain and bandwidth. The lower-cost adjustable gain PA-7 preamplifier is suitable for low frequency applications. (DC-10kHz).

Dewar Packages

All J10D Series InSb detectors require 77°K operating temperatures. The detector comes mounted in the standard M204 or M205 metal dewar (page 19) with a sapphire window and a cold stop. Other available metal and glass dewars are described on page 18.

Field of View (FOV)

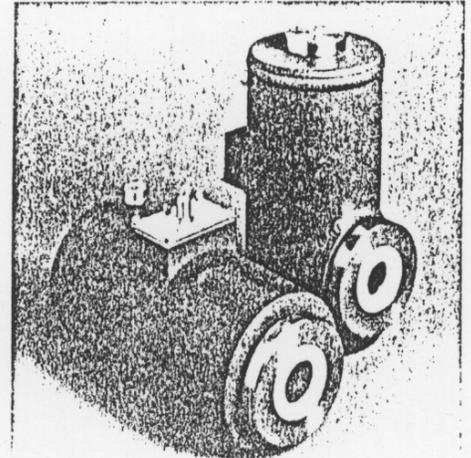
A cold field of view (FOV) stop is provided at no extra charge. Detectivity can be improved by a reduced FOV. The FOV cold stop (page 18) should restrict unwanted background radiation while still accepting all desired radiation from the optical system. A 60° FOV, corresponding to F/1 optics, is provided if the FOV is not specified.

Cold Filter

An optional cold filter can improve detectivity by eliminating background radiation in unwanted wavelength regions. The D^* performance with a 1.7 to 3.5 μm cold filter is shown in Figure 11-1. Other bandpass filters are available on a custom basis.

Custom Detectors

InSb detectors in any size up to 7mm diameter and in any configuration can be provided on a custom basis. Specifications for linear arrays, linear position sensors, quad cells, and two-color detectors are given on pages 26, 27 and 28. All InSb detectors can be provided in the JTC Joule-Thomson Cryostat Cooling System (page 20) for operation without bulk liquid nitrogen.



Applications

- Thermal Imaging
- Heat-seeking Guidance
- Radiometers
- Spectrometry