

EOT 1.5-5 μ m PbSe POWER DETECTOR USER'S GUIDE

Thank you for purchasing your 1.5-5 μ m PbSe Power Detector from EOT. This user's guide will help answer any questions you may have regarding the safe use and optimal operation of your Power Detector.

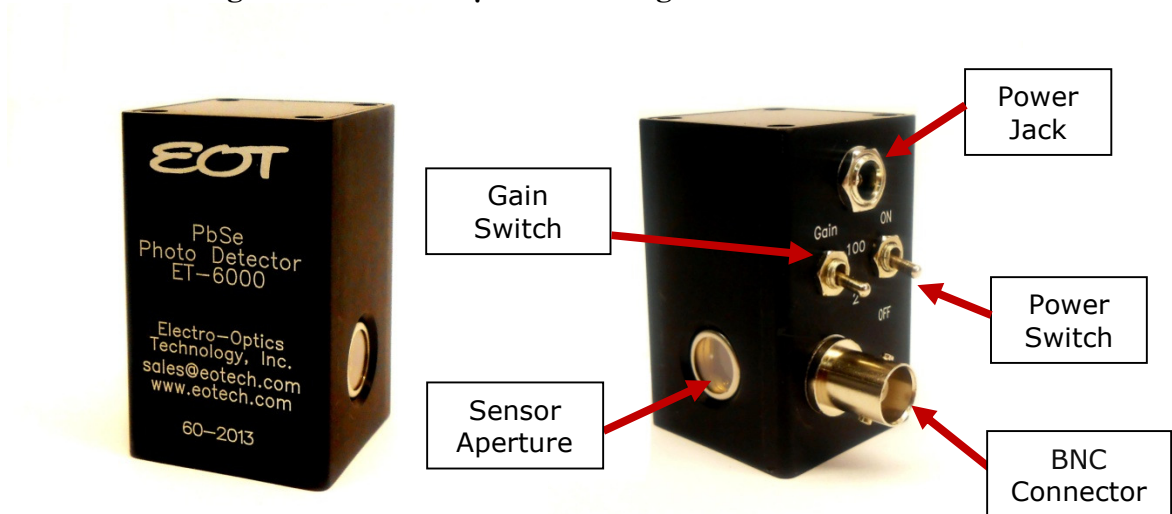
TABLE OF CONTENTS

I.	1.5-5 μ m PbSe Power Detector Overview	1
II.	Operation of Your 1.5-5 μ m PbSe Power Detector.....	1
III.	Troubleshooting.....	2
IV.	Drawings: 1.5-5 μ m PbSe Power Detectors	3
V.	Specifications: 1.5-5 μ m PbSe Power Detectors	4
VI.	Schematics: 1.5-5 μ m PbSe Power Detectors	4
VII.	Warranty Statement and Repair	4
VIII.	Glossary of Terms.....	5

I. 1.5-5 μ m PbSe Power Detector Overview

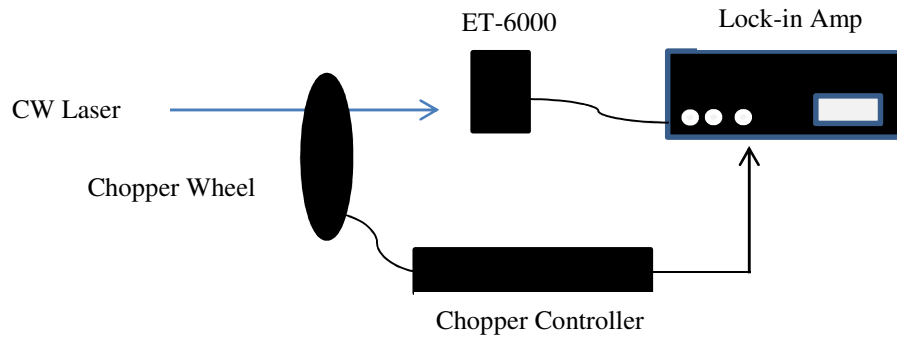
EOT's 1.5-5 μ m PbSe Large Area Power Detectors can be used to measure power from 1.5 μ m to 5.0 μ m, has a selectable gain of either 2X or 100X, and an active area of 5mm x 5mm making alignment easy. Based on a photoconductor, it responds more quickly and reaches a stable state more quickly than a thermopile detector. Figure 1 below identifies the main elements of your Power Detector.

Figure 1: EOT 1.5-5 μ m PbSe Large Area Power Detector



II. Operation of Your 1.5-5 μ m PbSe Power Detector

A. Caution: Eye safety precautions must be followed when utilizing any equipment used in the vicinity of laser beams. Laser beams may reflect from the surface of the detector or the optical mount and caution must be exercised.

B. Typical setup:

- C. An optical chopper and lock-in amplifier (LIA) is required for proper operation due to the high noise components associated with mid-IR devices. A chopping frequency of 1kHz or higher is recommended.
- D. Plug the wall plug-in power supply into the power jack. If a different power supply is to be used, the voltage range is 24V-26V, center pin positive, 2.5mm receptacle.
- E. Turn on the power switch. The device takes about 30 seconds to reach the correct internal bias voltage.
- F. The optical wheel should allow the full beam to be transmitted in the gaps and blocked by the blades.
- G. The gain setting will depend on the incoming optical signal. Use the gain that maximizes output signal but does not saturate the LIA.
- H. The device can be terminated to a 50Ω load or high impedance load; typically, the LIA has a high impedance input.
- I. Keep the coaxial cable to a length of 1m or less if possible.
- J. The device has a maximum linear density of 600mW/mm². The beam diameter should be as large as possible but less than 4mm in diameter for best results.
- K. The output of the device will be an amplified reproduction of the input optical power plus thermal and electrical noise components. The LIA will filter out the noise and convert the electrical signal at the chopping frequency into a DC value proportional to the optical input power.

III. Troubleshooting**A. Do not open the detector.**

1. There are no user serviceable parts in this device. Opening the detector could result in a **SHOCK HAZARD** due to a high voltage bias circuit.

B. There is noise on the output.

1. There is power supply switching noise, thermal noise, and flicker noise at the output of this device; some components are upwards of a couple hundred millivolts on the 100X gain setting and a 1MΩ oscilloscope termination. This is normal and an LIA will filter out these components. Typical noise spectra at 1kHz is 25nVrms²/Hz for a gain of 100 and 10pVrms²/Hz for a gain of 2.

C. There is no output.

1. Verify the connections to the LIA and that it is set up properly.
2. Connect the device to an oscilloscope and look for a signal (scope setting: 10-20mV/div., 50μs/div.). Try both gain settings.
 - a. If not signal is present on the scope but there is noise, verify alignment and power level of the optical beam.
 - b. If no beam is present, verify proper alignment of the beam to the chopper wheel as well as chopper blade size.

D. There is a nonlinear output.

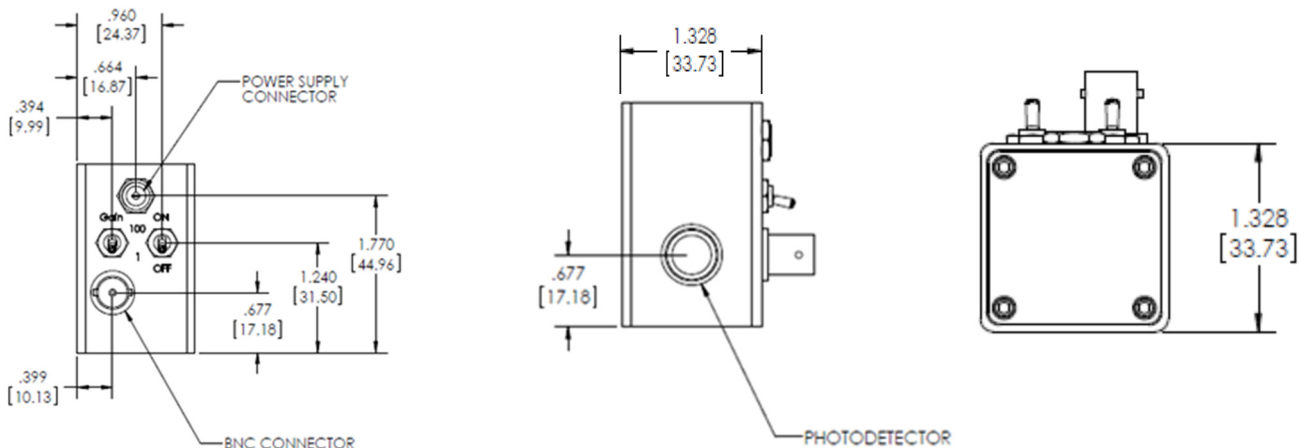
1. Verify power to the device is 600mW/mm² or less. It might be necessary to expand the beam diameter to reduce power density or use crossed polarizers (or other attenuator) to reduce beam power.

E. There are loose parts, internal or external.

1. Call EOT's customer service and request an RMA number to return the device to EOT. DO NOT try to open the detector.

IV. Drawings: 1.5-5μm PbSe Power Detectors

A. ET-6000 Dimensions:



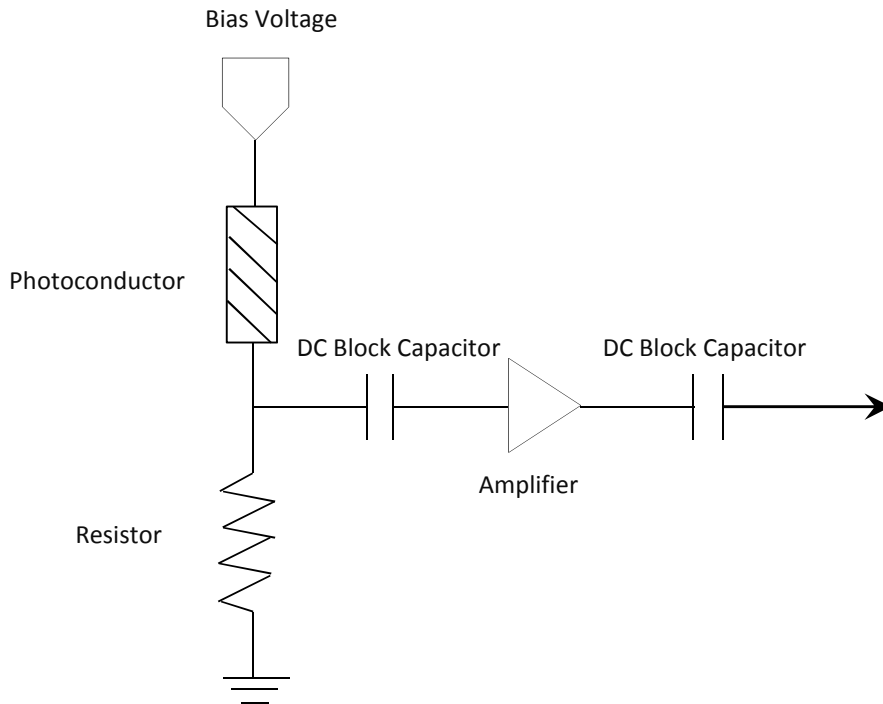
V. Specifications: 1.5-5 μ m PbSe Power Detectors

Part No. (Model)	120-10127-0001 ^{a, b} (ET-6000)	
Detector Type	Photoconductor	
Gain	2x	100x
Rise Time/Fall Time (μ s)	32	25
Responsivity (High Impedance)	$>3.2 \times 10^5 \text{V/W}$ at 3.5 μ m	$>3.2 \times 10^5 \text{V/W}$ at 3.5 μ m
Responsivity (50 Ω Impedance)	$>1.6 \times 10^5 \text{V/W}$ at 3.5 μ m	$>1.6 \times 10^5 \text{V/W}$ at 3.5 μ m
Power Supply (VDC)	24	24
Bandwidth	0.02kHz-15kHz	0.02kHz-10kHz
Active Area (mm x mm)	5 x 5	5 x 5
Detectivity (λ_p , 1000, 1)	$>1.5 \times 10^9 \text{cm} \cdot \sqrt{\text{Hz/W}}$	$>1.5 \times 10^9 \text{cm} \cdot \sqrt{\text{Hz/W}}$
Maximum Output (V)	± 11	± 11
Maximum Input Power	0.6mW/mm ²	0.6mW/mm ²
Operating Temperature ($^{\circ}\text{C}$)	10-40	10-40
Acceptance Angle (1/2 angle)	20 $^{\circ}$	20 $^{\circ}$
Noise Equivalent Power (pW/ $\sqrt{\text{Hz}}$)	400 at 2000nm	450 at 2000nm
Mounting (Tapped Holes)	8-32 or M4	8-32 or M4
Output Connector	BNC	BNC

^a All specifications apply for a 1,000Hz chopping frequency.

^b An optical chopper and lock-in amplifier are recommended for proper operation.

VI. Schematics: 1.5-5 μ m PbSe Power Detectors



VII. Warranty Statement and Repair



EOT warrants its products to be free from defects in material and workmanship and complies with all specifications. EOT will at its option, repair or replace any product or component found to be defective during the warranty period. This warranty applies only to the original purchaser and is not transferrable

for a period of one year after date of original shipment. The foregoing warranties shall not apply, and EOT reserves the right to refuse warranty service, should malfunction or failure result from:

- a. Damage caused by improper installation, handling or use.
- b. Unauthorized product modification or repair.
- c. Operation outside the environmental or damage specifications of the product.
- d. Contamination not reported to EOT within 30 days of the original ship date.

This warranty is exclusive in lieu of all other warranties whether written, oral, or implied. EOT specifically disclaims the implied warranties of merchantability and fitness for a particular purpose. In no event shall EOT be liable for an indirect, incidental, or consequential damages in connection with its products.

If the customer believes there is a problem with the photodetector, they should immediately contact EOT's Sales/Customer department at 231-935-4044 or customerservice@eotech.com. EOT's Customer Service department will either issue an RMA for the device, or provide the customer with a procedure and authorize the customer to modify the device. All returns should reference the RMA number on the outside of the shipping container and should be sent to:

Electro-Optics Technology, Inc.
Attn: Sales/Customer Service
5835 Shugart Lane
Traverse City, MI 49684 USA

EOT reserves the right to inspect photodetectors returned under warranty to assess if the problem was caused by a manufacturer defect. If EOT determines the problem is not due to a manufacturer defect, repairs will be done at the customer's expense. EOT will always provide a written quote for repair prior to performing repairs at the customer's expense.

VIII. Glossary of Terms

Bandwidth: The range of frequencies from 0Hz (DC) to the frequency at which the amplitude decreases by 3dB.

BNC Connector: Used to connect the customer's coaxial cable.

DC Block Capacitor: Prevents the DC voltage from exiting the detector which would cause a large DC offset voltage.

Detectivity: Used to compare the sensitivity of photoconductors for a given wavelength range and temperature in order to select the appropriate device for an application; the higher the detectivity the more sensitive the device.

Noise Equivalent Power (NEP): The minimum optical power needed for an output signal to noise ratio of 1.



Photoconductor: Changes conductance with incident photons.

Responsivity: In volts per watt (V/W), responsivity is the voltage output of the photodiode for a given input power. Responsivity varies with wavelength.

Rise Time/Fall Time: Rise Time is the time taken by a signal to change from a specified low value to a specified high value. Fall Time is the time taken for the amplitude of a pulse to decrease from a specified value to another specified value. A larger junction capacitance will slow the detector's response time.