

# Operating Manual PDA500 - Switchable Gain, Amplified GaAsP Detector

## Description:

The PDA500 is an amplified, switchable-gain, GaAsP detector designed for detection of light signals from DC to 200 kHz. A five-position rotary switch allows the user to vary the gain in 10 dB steps. A buffered output drives a 50Ω load impedance up to 5 volt. The PDA500 housing includes a removable threaded coupler that is compatible with any number of Thorlabs 1" threaded accessories. This allows convenient mounting of external optics, light filters apertures, as well as providing an easy mounting mechanism using the Thorlabs cage assembly accessories.

The PDA500 has an 8-32 tapped mounting hole with a 0.25" mounting depth and includes a 120VAC power AC/DC supply. The PDA500-EC has a M4 tapped mounting hole and includes A 230VAC AC/DC power supply.

## Specifications:

Detector	
Detector	<b>GaAsP</b>
Active Area	<b>1.3 x 1.3 mm</b>
Response	<b>300 to 680 nm</b>
Peak Response	<b>0.3 A/W @ 640 nm</b>
Bandwidth	<b>DC to 150kHz</b>
NEP (640nm, 0dB)	<b>60 x 10<sup>-12</sup> W/√Hz</b>
NEP (640nm, 10dB)	<b>20 x 10<sup>-12</sup> W/√Hz</b>
NEP (640nm, 20dB)	<b>9 x 10<sup>-12</sup> W/√Hz</b>
NEP (640nm, 30dB)	<b>6 x 10<sup>-12</sup> W/√Hz</b>
NEP (640nm, 40dB)	<b>4 x 10<sup>-12</sup> W/√Hz</b>
Output Voltage(50Ω) <sup>1</sup>	<b>0 to 5V</b>
Output voltage <sup>1</sup>	<b>0 to 10V</b>
Output Impedance <sup>1</sup>	<b>50 ohms</b>
Load Impedance <sup>1</sup>	<b>Hi -Z to 50 ohms</b>
Gain Steps	<b>0, 10, 20, 30, 40 dB</b>
Gain Switch	<b>5-Pos Rotary</b>
On / Off Switch	<b>Toggle</b>
Output	<b>BNC</b>
Damage Threshold	<b>100mW CW 0.5J/cm<sup>2</sup> 10ns PW</b>
Optical Head Size	<b>φ1.5" x 0.79"</b>
Weight	<b>60 grams</b>
Accessories	<b>SM1T1 Coupler</b>
Storage Temp	<b>-20 to 80°C</b>
Operating Temp	<b>-10 to 60°C</b>
AC Power Supply	<b>AC - DC Converter</b>
Input Power	<b>100-120VAC, (220-240VAC-EC version) 50-60Hz, 5W</b>

Performance	min	typical	max
0 dB Setting			
Transimpedance Gain <sup>1</sup>		<b>1.5 x 10<sup>4</sup> V/A</b>	
Trans. Gain (50Ω) <sup>1</sup>		<b>0.75 x 10<sup>4</sup> V/A</b>	
Bandwidth		<b>150 kHz</b>	
Noise (RMS)		<b>≤ 100 μV</b>	
Offset	<b>-5 mV</b>	<b>4.5 mV</b>	<b>15 mV</b>
10 dB Setting			
Transimpedance Gain <sup>1</sup>		<b>4.7 x 10<sup>4</sup> V/A</b>	
Trans. Gain (50Ω) <sup>1</sup>		<b>2.35 x 10<sup>4</sup> V/A</b>	
Bandwidth		<b>150 kHz</b>	
Noise (RMS)		<b>130 μV</b>	
Offset	<b>-5 mV</b>	<b>5 mV</b>	<b>15 mV</b>
20 dB Setting			
Transimpedance Gain <sup>1</sup>		<b>1.5 x 10<sup>5</sup> V/A</b>	
Trans. Gain(50Ω) <sup>1</sup>		<b>0.75 x 10<sup>5</sup> V/A</b>	
Bandwidth		<b>150 kHz</b>	
Noise (RMS)		<b>170 μV</b>	
Offset	<b>-10 mV</b>	<b>6.5 mV</b>	<b>20 mV</b>
30 dB Setting			
Transimpedance Gain <sup>1</sup>		<b>4.7 x 10<sup>5</sup> V/A</b>	
Trans. Gain (50Ω) <sup>1</sup>		<b>2.35 x 10<sup>5</sup> V/A</b>	
Bandwidth		<b>100kHz</b>	
Noise (RMS)		<b>250 μV</b>	
Offset	<b>-20 mV</b>	<b>11 mV</b>	<b>50 mV</b>
40 dB Setting			
Transimpedance Gain <sup>1</sup>		<b>1.5 x 10<sup>6</sup> V/A</b>	
Trans. Gain(50Ω) <sup>1</sup>		<b>0.75 x 10<sup>6</sup> V/A</b>	
Bandwidth		<b>45kHz</b>	
Noise (RMS)		<b>400 μV</b>	
Offset	<b>-100 mV</b>	<b>25 mV</b>	<b>100 mV</b>

Note 1: The PDA500 has a 50Ω series terminator resistor (i.e. in series with amplifier output). This forms a voltage divider with any load impedance (e.g. 50Ω load divides signal in half).

## Setup

- Unpack the optical head, install a Thorlabs TR-series 1/2" diameter post into the 8-32 (M4 on -EC version) tapped hole on the bottom of the head, and mount into a PH-series post holder. **Note: Do not install a mounting post more than 1/4" into the housing. This will damage the unit.**
- Plug the 5-pin DIN plug on the power supply provided with the PDA500 into the mating jack on the PDA500.
- Plug the power supply into an 50-60Hz, 100-120VAC outlet (220-240VAC for -EC version).

- Attach a 50Ω coax cable (i.e. RG-58U) to the output of the PDA. When running cable lengths longer than 12" we recommend terminating the opposite end of the coax with a 50Ω resistor (Thorlabs p/n T4119) for maximum performance.

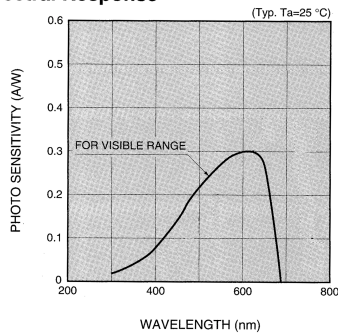
## Operation

- The gain of the PDA500 is adjusted using a small slotted screwdriver to turn the internal, gain-setting rotary switch. An access hole labeled **GAIN** is provided on the rear panel for this purpose. When the slot is aligned vertical with the housing, the gain is at 0dB. Also, the switch has a physical stop at the 0dB setting. If in doubt, turn the switch counter-clockwise until it stops. At that point the gain is at 0dB. Each click of the switch clockwise increases the gain by 10 dB. *Do not use excessive force when adjusting the gain switch.*
- The PDA500 is switched on by the POWER toggle switch on the rear of the head.
- The light to voltage conversion can be estimated by factoring the wavelength-dependent responsivity of the silicon detector with the transimpedance gain

(E.g. output in volts / watt = transimpedance gain (V/A) x responsivity (A/W) )

- The maximum output of the PDA500 is 10 volts (for high impedance loads). Adjust the gain so that the measured signal level out of the PDA500 is below 10 volts (5 volts with a 50Ω load) to avoid saturation. If necessary, use external neutral density filters to reduce the input light level.
- For maximum linearity performance when measuring focused beams, fiber outputs, or small diameter beams, do not exceed a maximum intensity of 10mW/cm<sup>2</sup>.
- Because of the finite gain-bandwidth performance common to all amplifier circuits, the bandwidth of the PDA500 goes down with increased gain settings.

### ● Spectral Response



Gain Switch position	Gain (dB)	Transimpedance Gain (V/A)
1	0	$1.5 \times 10^4$
2	10	$4.7 \times 10^4$
3	20	$1.5 \times 10^5$
4	30	$4.7 \times 10^5$
5	40	$1.5 \times 10^6$

Figure 1. Detector Responsivity

## Fiber Adapters and Other Accessories

Thorlabs sells a number of accessories that are compatible with the 1" thread on the PDA housing including FC, SMA, and ST fiber adapters, stackable lens tubes for mounting optics, and cage assemblies that allow the PDA to be incorporated into elaborate 3-D optical assemblies.

Caution: The PDA500 was designed to allow maximum accessibility to the photodetector by having the front surface of the diode to extend outside of the PDA housing. When using fiber adapters be sure that the fiber ferrule does not crash into the detector to avoid damage to the diode and/or the fiber. An easy way to accomplish this is to install a SM1RR retaining ring (included with the PDA500) inside the 1" threaded coupler *before* installing the fiber adapter.

Also available are Germanium, InGaAs, and Silicon models of the PDA series.

## **Maintaining the PDA500**

There are no serviceable parts in the PDA500 optical head or power supply. The housing can be cleaned by wiping with a soft damp cloth. The window of the detector should only be cleaned using optical grade wipes. If you suspect a problem with your PDA500 please call Thorlabs and an engineer will be happy to assist you.