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PDA400 Operating Manual - Switchable Gain, Amplified InGaAs Detector

Description:

The PDA400 is an amplified, switchable-gain, InGaAs detector designed for detection of light signals from DC to 10 MHz. 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 PDA400 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 PDA400 has an 8-32 tapped mounting hole with a 0.25" mounting depth and includes a 120VAC power AC/DC supply. The PDA400-EC has an M4 tapped mounting hole and includes a 230VAC AC/DC power supply.

Specifications:

Detector	
Detector	**InGaAs**
Active Diameter	**1 mm**
Response	**800 to 1750 nm**
Peak Response	**0.95 A/W @ 1550 nm**
Bandwidth	**DC to 10MHz**
NEP (1310nm, 0dB)	**8.2 x 10^{-12} W/√Hz**
NEP (1310nm, 10dB)	**6 x 10^{-12} W/√Hz**
NEP (1310nm, 20dB)	**3.8 x 10^{-12} W/√Hz**
NEP (1310nm, 30dB)	**3.4 x 10^{-12} W/√Hz**
NEP (1310nm, 40dB)	**2.9 x 10^{-12} W/√Hz**
Output Voltage (50Ω)	**0 to 5V**
Output Voltage[1]	**0 to 10V**
Output Impedance[1]	**50Ω**
Load Impedance[1]	**Hi -Z to 50Ω**
Gain Steps	**0, 10, 20, 30, 40 dB**
Gain Switch	**5-Pos Rotary Switch**
On / Off Switch	**Toggle**
Output	**BNC**
Damage Threshold	**100mW CW 0.5J/cm^2 10ns PW**
Optical Head Size[2]	**ϕ1.425" x 1.45"**
Weight	**60 grams**
Accessories	**SM1T1 Coupler**
Storage Temp	**-40 to 125°C**
Operating Temp	**-40 to 85°C**
AC Power Supply	**AC - DC Converter**
Input Power	**100-120VAC, (220_240VAC -EC version) 50-60Hz, 5W**

Performance	min	typical	max
0 dB Setting			
Transimpedance Gain[1]		**1.5 x 10^4 V/A**	
Trans. Gain (50Ω)[1]		**0.75 x 10^4V/A**	
Bandwidth		**10 MHz**	
Noise (RMS)	**0.28 mV**	**0.33 mV**	**0.44 mV**
Offset	**-5 mV**	**6 mV**	**15 mV**
10 dB Setting			
Transimpedance Gain[1]		**4.7 x 10^4 V/A**	
Trans. Gain (50Ω)[1]		**2.35 x 10^4V/A**	
Bandwidth		**2.2MHz**	
Noise (RMS)	**0.30 mV**	**0.35 mV**	**0.45 mV**
Offset	**-5 mV**	**8 mV**	**15 mV**
20 dB Setting			
Transimpedance Gain[1]		**1.5 x 10^5 V/A**	
Trans. Gain (50Ω)[1]		**0.75 x 10^5V/A**	
Bandwidth		**700kHz**	
Noise (RMS)	**0.36 mV**	**0.40 mV**	**0.46 mV**
Offset	**-10 mV**	**10 mV**	**20 mV**
30 dB Setting			
Transimpedance Gain[1]		**4.7 x 10^5 V/A**	
Trans. Gain (50Ω)[1]		**2.35 x 10^5V/A**	
Bandwidth		**160kHz**	
Noise (RMS)	**0.48 mV**	**0.53 mV**	**0.60 mV**
Offset	**-20 mV**	**20 mV**	**50 mV**
40 dB Setting			
Transimpedance Gain[1]		**1.5 x 10^6 V/A**	
Trans. Gain (50Ω)[1]		**0.75 x 10^6V/A**	
Bandwidth		**50kHz**	
Noise (RMS)	**0.74 mV**	**0.81 mV**	**1.0 mV**
Offset	**-100 mV**	**20 mV**	**100 mV**

Note 1: The PDA400 has a 50Ω series termination resistance (i.e. in series with amplifier output). This forms a voltage divider with any load impedance (e.g. 50Ω load divides signal in half).

2: Newer PDA's have a smaller package diameter to easily fit into Thorlabs cage plate assemblies. Also note that the length includes the SM1T1 mounting adapter and the BNC / power switch.

Setup

- Unpack the optical head, install a Thorlabs TR-series ½" 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.
- Connect the power supply 5-pin DIN plug into the mating receptacle on the PDA400.
- Plug the power supply into a 50-60Hz, 100-120VAC outlet (220-240VAC for -EC version).

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- 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 PDA400 gain 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. The gain is set to 0dB, when the slot is aligned counterclockwise as far as it will go. Each clockwise click of the switch increases the gain by 10 dB. *Do not use excessive force when adjusting the gain switch.*
- The PDA400 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 InGaAs detector with the transimpedance gain

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

- The maximum output of the PDA400 is 10 volts for high impedance loads (5V for 50Ω loads). Adjust the gain so that the measured signal level out of the PDA400 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^2.
- Because of the finite gain-bandwidth performance common to all amplifier circuits, the bandwidth of the PDA400 goes down with increased gain settings.

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

Table 1. Gain Settings

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 PDA400 was designed to allow maximum accessibility to the photodetector by having the front surface of the diode extend outside of the PDA housing. When using fiber adapters, make sure that the fiber ferrule does not crash into the detector. Failure to do so may cause damage to the diode and / or the fiber. An easy way to accomplish this is to install a SM1RR retaining ring (included with the PDA55) inside the 1" threaded coupler *before* installing the fiber adapter.

Also available in the PDA series are and higher bandwidth silicon and InGaAs models.

Maintaining the PDA400

There are no serviceable parts in the PDA400 optical head or power supply. The housing may 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 PDA400 please call Thorlabs and an engineer will be happy to assist you.

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WEEE

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out “wheelie bin” logo (see fig. 1)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

As the WEEE directive applies to self contained operational electrical and electronic products, this “end of life” take back service does not refer to other Thorlabs products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste treatment on your own responsibility
If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

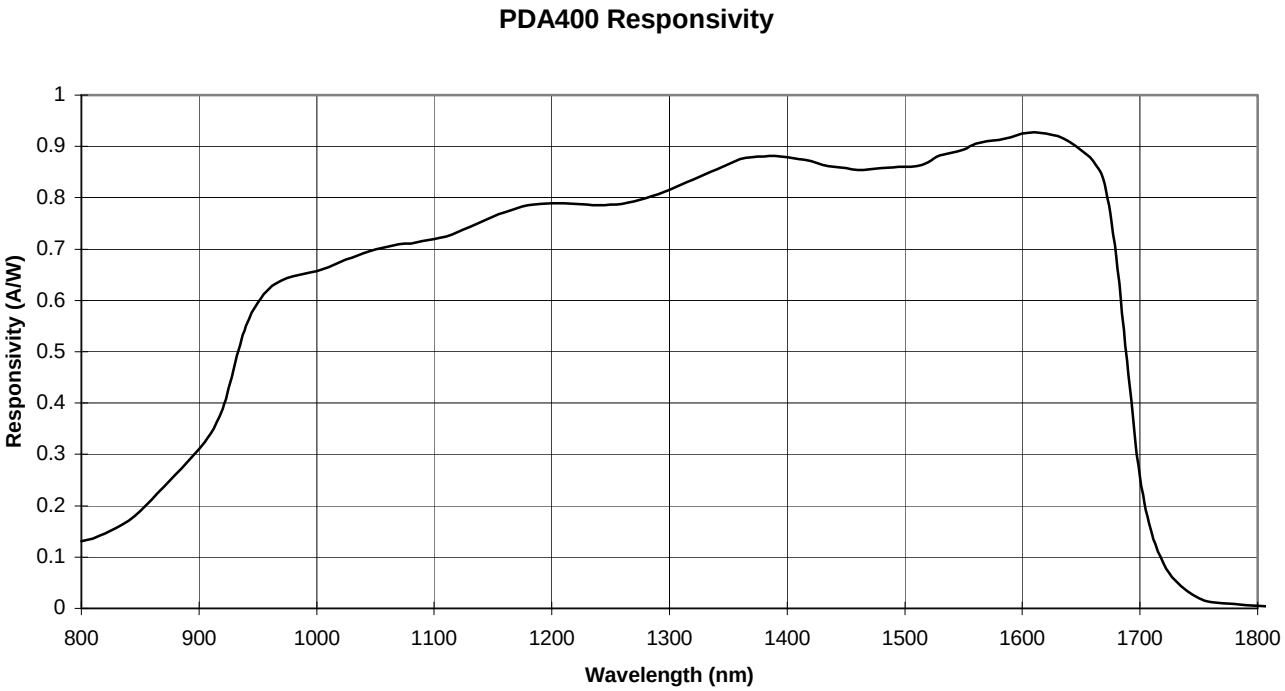
Ecological background
It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.
The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.



Crossed out “wheelie bin” symbol

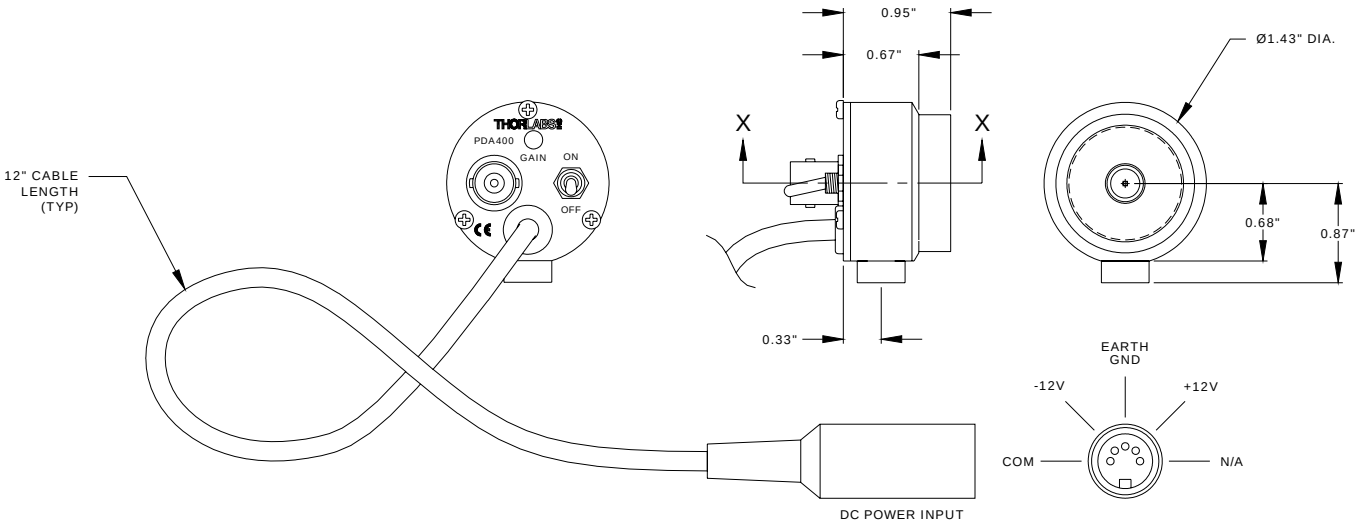
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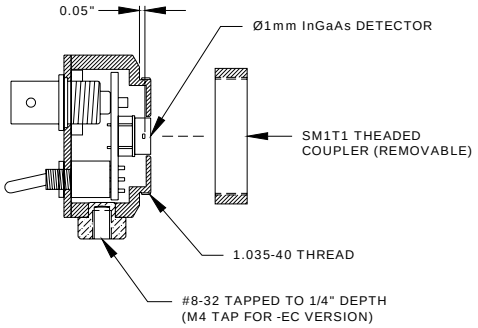
Detector Response Curve



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CROSS SECTION VIEW X-X

INFORMATION ONLY, NOT FOR MANUFACTURING

THORLABS INC				PO BOX 366 NEWTON NJ	
TITLE: SWITCHABLE GAIN AMPLIFIED InGaAs SENSOR					
TOL: X.XXX=+/-0.005 X.XX=+/-0.010 ANGULAR +/-30'					
SURF. FINISH: 32 MICROINCHES UNLESS OTHERWISE NOTED					
DRAWN: EC	ENGINEER: EC	APPROVED: EC			
MATERIAL: PDA400 OR PDA400-EC					
DATE: 10/7/2002	REV: B	SIZE: B	SHEET: 1 OF 1	DRAWING SCALE: 1" = 1"	
DWG NO.: 2151-E01			PART NO.: PDA400		

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