

PDA520 Operating Manual

High Precision Amplified Silicon Detector

Description:

The PDA520 is a high precision, high accuracy, low noise, and switchable-gain silicon detector designed for detection of light in the wavelength range of 400 to 1100nm. A three-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 PDA520 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 PDA520 has an 8-32 tapped mounting hole with a 0.25" mounting depth and includes a 120VAC 50-60Hz power supply. The PDA520-EC has an M4 tapped mounting hole and includes a 230VAC 50-60Hz power supply.

Specifications:

| Detector | |
|--------------------------------------|---|
| Detector | Silicon |
| Active Area | 10 x 10 mm |
| Aperture Diameter | φ0.348" (φ8.8mm) |
| Response Range | 400 to 1100 nm |
| Peak Response | 0.65 A/W @ 980 nm |
| Damage Threshold | 1W/cm² CW |
| Output Voltage (50Ω) ¹ | 0 to 4.5V(min) 0 to 5V (typ) |
| Output voltage (Hi-Z) ^{1,5} | 0 to 9V(min) 0 to 10V (typ) |
| Output Impedance ¹ | 50Ω |
| Load Impedance ^{1,5} | 50Ω / Hi -Z |
| Max Output Current | 100mA |
| Gain Steps | 0, 10, 20dB |
| Gain Switch | 3-Pos Rotary |
| On / Off Switch | Toggle |
| Output | BNC |
| Optical Head Size ² | φ1.425" x 1.45" |
| Weight | 60 grams |
| Accessories | SM1T1 Coupler |
| Operating Temp | 10 to 40°C |
| Storage Temp | -20 to 70°C |
| Power Supply | Linear AC - DC |
| Input Power | 100-120VAC, 50-60Hz, 5W (220-240VAC -EC) |

| Performance | min | typical | max |
|----------------------------------|---------------|---------------------------------------|------------------|
| 0 dB Setting | | | |
| Transimpedance Gain ¹ | | 1.0 x 10⁴ V/A | |
| Trans. Gain (50Ω) ^{1,6} | | 5.0 x 10³ V/A | |
| Gain Error ⁵ | | +/- 0.1% | +/- 0.12% |
| NEP (980nm, 0dB) ³ | | <3 x 10⁻¹¹ W/√Hz | |
| Noise (RMS) ³ | | <0.1 mV | |
| Offset ³ | -1 mV | +/- 0.1mV | 1 mV |
| Bandwidth ^{3,4} | | 250kHz | |
| 10 dB Setting | | | |
| Transimpedance Gain ¹ | | 1.0 x 10⁵ V/A | |
| Trans. Gain (50Ω) ^{1,6} | | 5 x 10⁴ V/A | |
| Gain Error ⁵ | | +/- 0.12% | +/- 0.15% |
| NEP (980nm, 10dB) ³ | | 5.4 x 10⁻¹² W/√Hz | |
| Noise (RMS) ³ | | 0.175 mV | 0.2 mV |
| Offset ³ | -5 mV | +/- 1mV | 5 mV |
| Bandwidth ^{3,4} | | 250kHz | |
| 20 dB Setting | | | |
| Transimpedance Gain ¹ | | 1.0 x 10⁶ V/A | |
| Trans. Gain (50Ω) ^{1,6} | | 5 x 10⁵ V/A | |
| Gain Error ⁵ | | +/- 0.14% | +/- 0.3% |
| NEP (980nm, 20dB) ³ | | 4.6 x 10⁻¹² W/√Hz | |
| Noise (RMS) ³ | | 1.2 mV | 1.5 mV |
| Offset ³ | -20 mV | | 20 mV |
| Bandwidth ^{3,4} | | 160kHz | |

- Note 1: The PDA520 has a 50Ω terminating resistor 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.
- 3: Test performed with a 50Ω terminator and 6' coax cable.
- 4: See 'PDA520 Bandwidth' curve for frequency response.
- 5: Definition of Hi-Z: High Impedance. Refers to an oscilloscope or measurement device input. Actual Impedance values should be 1MΩ or higher. Lower values will create a voltage divider with the output 50Ω impedance and will cause larger gain errors than what is specified.
- 6: The gain error does not apply to the 50Ω load since the user installed output terminating resistor will probably have a resistance tolerance greater than the gain errors above. Also note that the 50Ω output series resistance is 49.9Ω +/- 1%. This will also factor into gain error when using a 50Ω load.

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

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 PDA520.
- Plug the power supply into a 100-120VAC, 50-60Hz 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 PDA520 gain is adjusted using a small slotted screwdriver to turn the internal, gain-setting rotary switch. An access hole is provided on the rear panel for this purpose. The gain is set to 0dB, when the rotary switch is set fully counterclockwise. Each clockwise click of the switch increases the gain by 10 dB. **Note: Do not use excessive force when adjusting the gain switch.**
- The PDA520 is switched on by the POWER toggle switch located on the rear of the optical sensor.
- The light to voltage conversion can be estimated by factoring the wavelength-dependent responsivity of the silicon detector with the transimpedance gain as shown below:

$$\text{E.g. Output (V/W)} = \text{Transimpedance gain (V/A)} \times \text{Responsivity (A/W)}$$

- The maximum output of the PDA520 is 10 volts for high impedance loads (5V for 50Ω loads). Adjust the gain so that the measured signal level out of the PDA520 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/cm².
- Because of the finite gain-bandwidth performance common to all amplifier circuits, the bandwidth of the PDA520 decreases at the highest gain settings.

Output Protection Circuitry

To enhance the product survivability the PDA520 offers output protection against short circuits, connection to output voltages, and current limiting. A 140mA resettable fuse was placed in line with the output drive supply to protect the drive circuitry from shorting or low load resistance values. Under these conditions, the fuse will 'blow' before damaging the unit. In order to reset the fuse the output load will need to be removed until the fuse cools down and resets. A high-speed diode protects the output from accidental application of negative voltages and limits the output from going more than -0.6V.

Maintaining the PDA520

There are no serviceable parts in the PDA520 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 PDA520 please call Thorlabs and technical support will be happy to assist you.

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 PDA520 was designed to allow maximum accessibility to the photodetector by having the front surface of the diode exposed. Make sure that the nothing crashes into the detector. Failure to do so may cause damage to the diode.

Also available in the PDA and DET series are:

| | |
|--------|---|
| PDA55 | Switchable Gain Amplified Silicon Photo Detector |
| PDA155 | Wideband (50MHz) Amplified Silicon Photo Detector |
| PDA255 | Wideband (50MHz) Amplified InGaAs Photo Detector |
| PDA400 | Switchable Gain Amplified InGaAs Photo Detector |
| DET110 | High Speed Large Area Silicon Photo Detector |
| DET210 | High Speed Silicon Photo Detector |
| DET410 | High Speed InGaAs Photo Detector |

Graphical Data:

