



**Silicon Amplified Detector**

# **PDA8A2 Operation Manual**



**2022**

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We aim to develop and produce the best solutions for your applications in the field of optical measurement techniques. To help us to live up to your expectations and constantly improve our products, we need your ideas and suggestions. We and our international partners are looking forward to hearing from you.

*Thorlabs GmbH*

## **Warning**

Sections marked by this symbol explain dangers that might result in personal injury or death. Always read the associated information carefully before performing the indicated procedure.

## **Attention**

Paragraphs preceded by this symbol explain hazards that could damage the instrument and the connected equipment or may cause loss of data.

## **Note**

This manual also contains "NOTES" and "HINTS" written in this form.

Please read this advice carefully!



# 1 General Information

The PDA8A2 is a wideband, fixed-gain-amplified silicon detector designed for the detection of light signals from DC to 50 MHz. A buffered output drives up to 1.8 V into 50  $\Omega$  input loads. The PDA8A2 is sensitive to light within the wavelength range of 320 nm to 1000 nm. The ultra-low noise design includes an active low-pass filter to prevent aliasing effects and to suppress out of band noise effectively.

The PDA8A2 detector housing can be integrated in optical setups using convenient 8-32 and M4 combi-thread mounting holes that are compatible with both imperial and metric threading. Please see the chapter [Mounting](#)<sup>3</sup> for details.

The housing accommodates Thorlabs' SM05 (0.535"-40) and SM1 (1.025"-40) threaded adapters and accessories. This allows convenient mounting of external optics, light filters, and apertures. The product includes a SM1T1 SM1 Coupler Body which adapts the external thread to an internal thread and holds the SM1RR Retaining Ring and a reusable protective plastic cover cap. For accessories, please visit our [website](#) or contact [Thorlabs](#)<sup>13</sup>.

A  $\pm 12$  VDC power supply is included with each amplified photodetector. The appropriate input voltage (100 VAC, 120 VAC, 230 VAC) can be selected with a switch on the [power supply](#)<sup>2</sup>.

## Attention

Please find all safety information and warnings concerning this product in the chapter [Safety](#)<sup>10</sup> in the Appendix.

## 1.1 Ordering Codes and Accessories

**PDA8A2:** Silicon Amplified Photodetector, 320 - 1000 nm, Bandwidth Range DC-50 MHz, Active Area  $\varnothing 0.8$  mm (0.5 mm<sup>2</sup>), Combi-Thread Mounting Holes Compatible with 8-32 and M4 Threads

### Included Accessories

- [LDS12B](#) Power Supply ( $\pm 12$ V, 0.2A), 100 VAC, 120 VAC or 230 VAC Line Voltage
- [Plastic Cover Cap](#) (Item # SM1EC2B) on an included [SM1T1-SM1 Coupler](#) with a [SM1RR-SM1 Retaining Ring](#).

### Optional Accessories

- PDA-C-72 DC power supply cable to PDA8A2: This cable has a connector on one end and open wires at the other. The pin-out of the PDA8A2 DC power jack is shown in the [appendix](#)<sup>9</sup>.

Please visit our homepage <http://www.thorlabs.com> for various accessories like fiber adapters, posts and post holders, data sheets and further information.

## 2 Getting Started

### 2.1 Parts List

Please inspect the shipping container for damage. Please do not cut through the cardboard. You might need the box for storage or for returns.

If the shipping container seems to be damaged, keep it until you have inspected the contents and you have inspected the PDA8A2 mechanically and electrically.

Verify that you have received the following items within the package:

1. PDA8A2 Amplified Photodetector
2. [Plastic Cover Cap](#) (Item # SM1EC2B) on [SM1T1-SM1 Coupler](#) with an [SM1RR-SM1 Retaining Ring](#)
3. [LDS12B](#) Power Supply ( $\pm 12V$ , 0.2A), 100 VAC, 120 VAC or 230 VAC Line Voltage
4. Quick Reference

### 2.2 Preparation

Carefully unpack the unit and accessories. If any damage is noticed, do not use the unit. Contact [Thorlabs](#) <sup>13</sup> and have us replace the defective unit.

#### Note

Prior to operation, please check if the indicated line voltage range on the power supply matches with your local mains voltage! Adjust the power supply accordingly to 100 VAC, 120 VAC or 230 VAC.



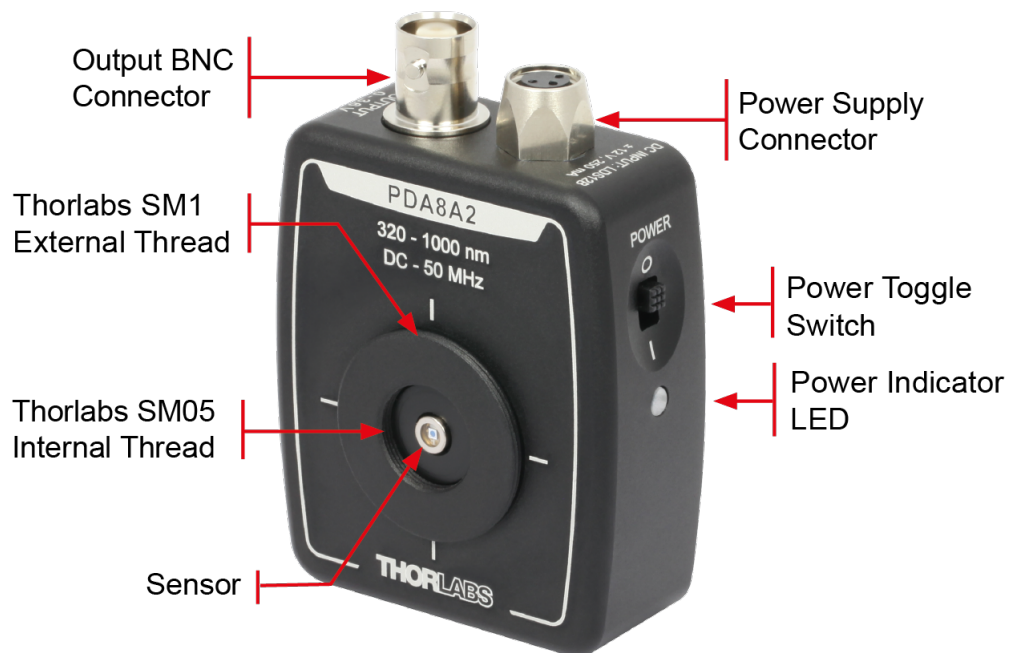
Voltage Selector Switch

#### Note

If you prefer to use your own power supply, please ask [Thorlabs](#) <sup>13</sup> for an appropriate power connector cable.

## 3 Operating Instruction

### 3.1 Operating Elements



The PDA8A2 comes with a SM1T1 SM1 coupler which holds a SM1RR retaining ring and a protective plastic cover cap.

### 3.2 Mounting

Prior to mounting the PDA8A2, please follow the instructions given in the chapter [preparation](#) <sup>2</sup>.

#### Housing

The PDA8A2 is housed in a rugged, shielded, 70.9 mm x 49.9 mm x 22.5 mm aluminum enclosure. The electrical connectors and the ON/OFF slider are located on the side walls of the housing for easy access and to minimize the thickness of the PDA8A2 so it can fit into tight spaces.

#### Mounting PDA8A2 on an optical table

Mount the PDA8A2 on an optical post by using either of the two tapped mounting holes on the side and bottom. The combi-thread tapped holes accept both 8-32 and M4 threads, such that using either imperial or metric TR posts is possible.


#### Mounting external optics

The PDA8A2 housing allows to mount external optics, filters, apertures or fiber adapters. The PDA8A2 comes with an SM1T1 SM1 coupler that adapts the external thread to an SM1 internal thread. A retaining ring in the coupler holds the protective cover cap. Please unscrew the coupler if needed.


The PDA8A2 housing accommodates Thorlabs' SM05-threaded (0.535"-40) series and SM1-threaded (1.035"-40) series adapters that are compatible with any number of Thorlabs 1" and ½" threaded accessories. This also allows convenient mounting of lens tubes or cage systems. For accessories, please visit our website or contact [Thorlabs](#) <sup>13</sup>.

### 3.3 Operation



#### Attention

Ensure that the correct mains voltage is selected on the [power supply](#)  prior to connecting the power supply to the mains power. Wrong settings for the mains voltage may damage the power supply. The  $\pm 12$  V, 250 mA power supply is included, no high voltage power supply is required for operation.

#### Electrical Setup

- [Mount](#)  the detector using the combi-thread mounting holes on the side and bottom of the device.
- Connect the power supply 3-pin plug into the mating receptacle on the PDA8A2.
- Plug the power supply into an outlet.
- Switch on the power supply
- Attach a 50  $\Omega$  coaxial cable (i.e. RG-58U) to the output of the PDA8A2. When running cable lengths longer than 12", we recommend terminating the opposite end of the coax with a 50  $\Omega$  resistor (Thorlabs p/n T4119) for maximum performance.
- Connect the remaining end to a measurement device.
- Move the power slider to I. The green LED on the PDA8A2 indicates the correct power supply.

#### Optical Setup

- Remove the plastic cover cap that protects the optical input.
- [Mount](#)  external optics if needed.
- Align the light source with the optical input. The max  $V_{out}$  is 3.6 V for high impedance loads (1.8 V for 50  $\Omega$  loads). To avoid electrical saturation, keep the output voltage below the maximum listed in the [Technical Data](#) . External neutral density filters or attenuators are recommended to reduce the input light level in critical cases.
- For maximum linearity performance when measuring focused beams, fiber outputs, or small diameter beams, do not exceed a maximum intensity of 10 mW/cm<sup>2</sup>.

#### Turning off the PDA8A2

Move the power slider to O after finishing the measurements.

### 3.4 Operating Principle

In principle, the photodiode generates a current in response to the optical input. The TIA then converts the current to a voltage and amplifies the signal, reaching a frequency response from true DC to the cutoff frequency. The fixed gain amplifies the signal to 1.8 V at 50  $\Omega$ .

The output is passed through a 50  $\Omega$  series resistor before reaching the output connector. The user can apply either a 50  $\Omega$  or high-impedance external load depending on the situation.

The PDA8A2 is powered by an external power supply ( $\pm 12$  V, 200 mA) with switchable 100 V, 120 V or 230 V line voltage. The power supply is connected to the PDA8A2 via a 250 mA, LUMBERG RSMV3 connector.

### 3.4.1 Optical Input

For maximum linearity performance when measuring focused beams, fiber outputs, or small diameter beams, do not exceed a maximum intensity of 10 mW/cm<sup>2</sup>.

#### Note

For optical alignment, use an optical input power below the saturation power while observing the output voltage on a low-frequency measurement device such as a digital voltmeter.

Use external neutral density filters to reduce the input light level in order to stay below the maximum output voltage.

The PDA8A2 housing features internal SM05 and external SM1 threads for convenient mounting of lens tubes or cage systems.

### 3.4.2 Electrical Output

Thorlabs PDA8A2 photodetectors deliver an OUTPUT voltage that is a function of incident light power  $P_{\text{opt}}$ , the detector's responsivity  $\mathfrak{R}(\lambda)$  at a given wavelength, and the transimpedance gain  $G$ :

$$V_{\text{out}} = P_{\text{opt}} \times \mathfrak{R}(\lambda) \times G$$

The detector's responsivity  $\mathfrak{R}(\lambda)$  for a given wavelength can be read from the spectral responsivity curve (see [Appendix 8](#)).

The maximum output of the PDA8A2 is 3.6 V for high-impedance loads and 1.8 V for 50  $\Omega$  loads. The output signal should be below the maximum output voltage to avoid saturation.

## 4 Maintenance and Service

Protect the PDA8A2 from adverse weather conditions. The PDA8A2 is not water resistant. The unit does not require regular maintenance by the user. There are no serviceable parts in the PDA8A2 optical head or power supply. The housing may be cleaned by wiping with a soft, damp cloth. Do not remove covers!

If you suspect a problem with your PDA8A2, please read the section [Safety](#)<sup>10</sup> and contact [Thorlabs](#)<sup>13</sup> tech support and an engineer will be happy to assist you.

### **Attention**

The window of the detector should only be cleaned using optical grade wipes.

To avoid damage to the instrument, do not expose it to spray, liquids, or solvents!

## 5 Appendix

### 5.1 Technical Data

Electrical Specification		
Detector		Silicon
Active Area		Ø0.8 mm (0.5 mm <sup>2</sup> )
Wavelength Range		320 - 1000 nm
Peak Responsivity		0.56 A/W @ 820 nm
Bandwidth <sup>1)</sup>		DC to 50 MHz
NEP		7.8 pW/√Hz
Noise (RMS)		1.8 mV
Dark Offset (Max)		±10 mV
Rise/Fall Time (10% - 90%)		7 ns
Output Voltage	Hi-Z 50 Ω	0 to 3.6 V 0 to 1.8 V
Transimpedance Gain	Hi-Z 50 Ω	100 kV/A 50 kV/A
General		
On / Off Switch		Slide
Output		BNC
Size (detector w/o power supply)		70.9 mm x 49.9 mm x 22.5 mm (2.79" x 1.96" x 0.89")
Weight (detector w/o power supply)		0.06 kg
Operating Temperature Range		10°C to 50°C
Storage Temperature Range		-25°C to 70°C <sup>2)</sup>
Power Supply	Input Output	100 VAC, 120 VAC, 230 VAC, switchable 50-60 Hz, 5 VA, + 12 / -12 VDC

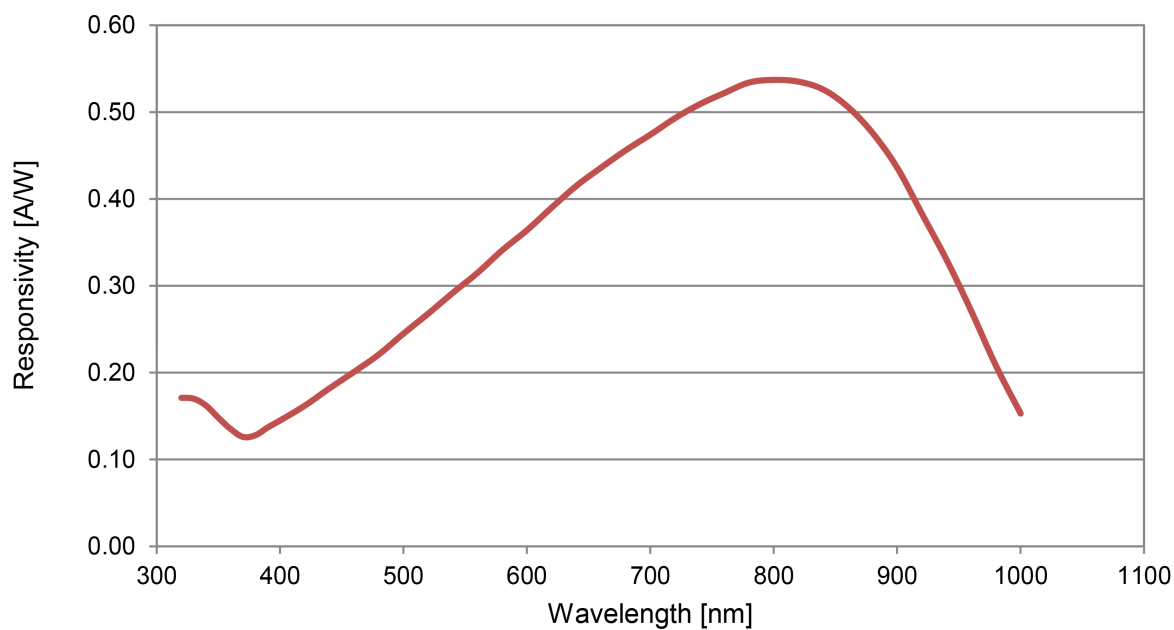
<sup>1)</sup> Measured with output amplitude of 200 mV and a DC offset of 200 mV, driving a 50 Ω load termination.

<sup>2)</sup> Non-Condensing

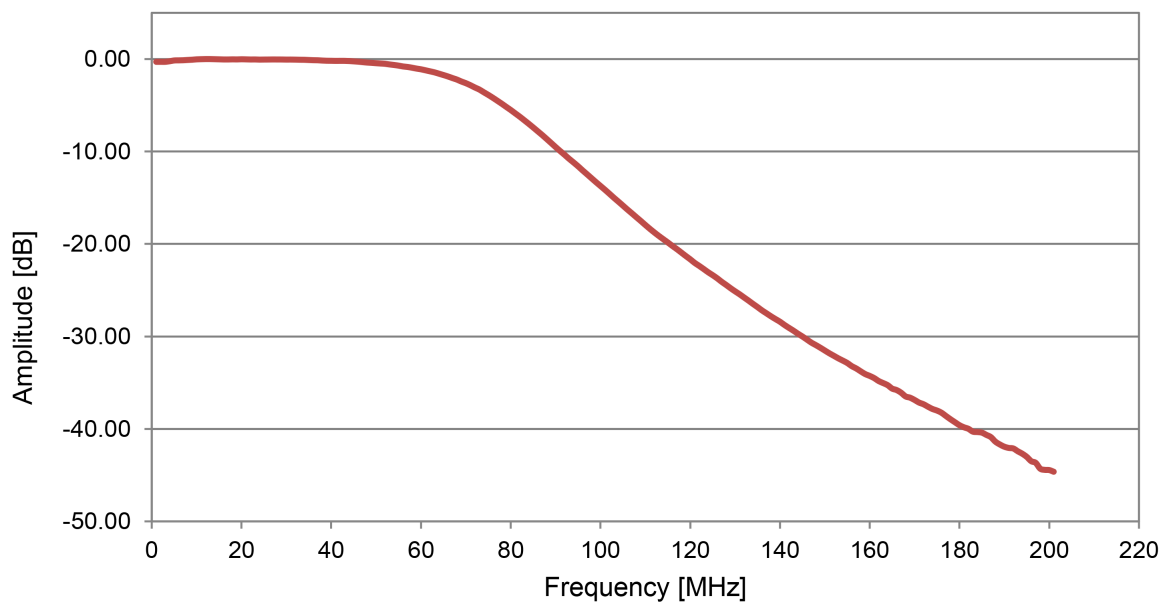
All technical data are valid at 23 ± 5°C and 45 ± 15% rel. humidity (Non-Condensing).

All measurements performed with 50 Ω load unless stated otherwise.

## 5.2 Typical Responsivity and Frequency Response



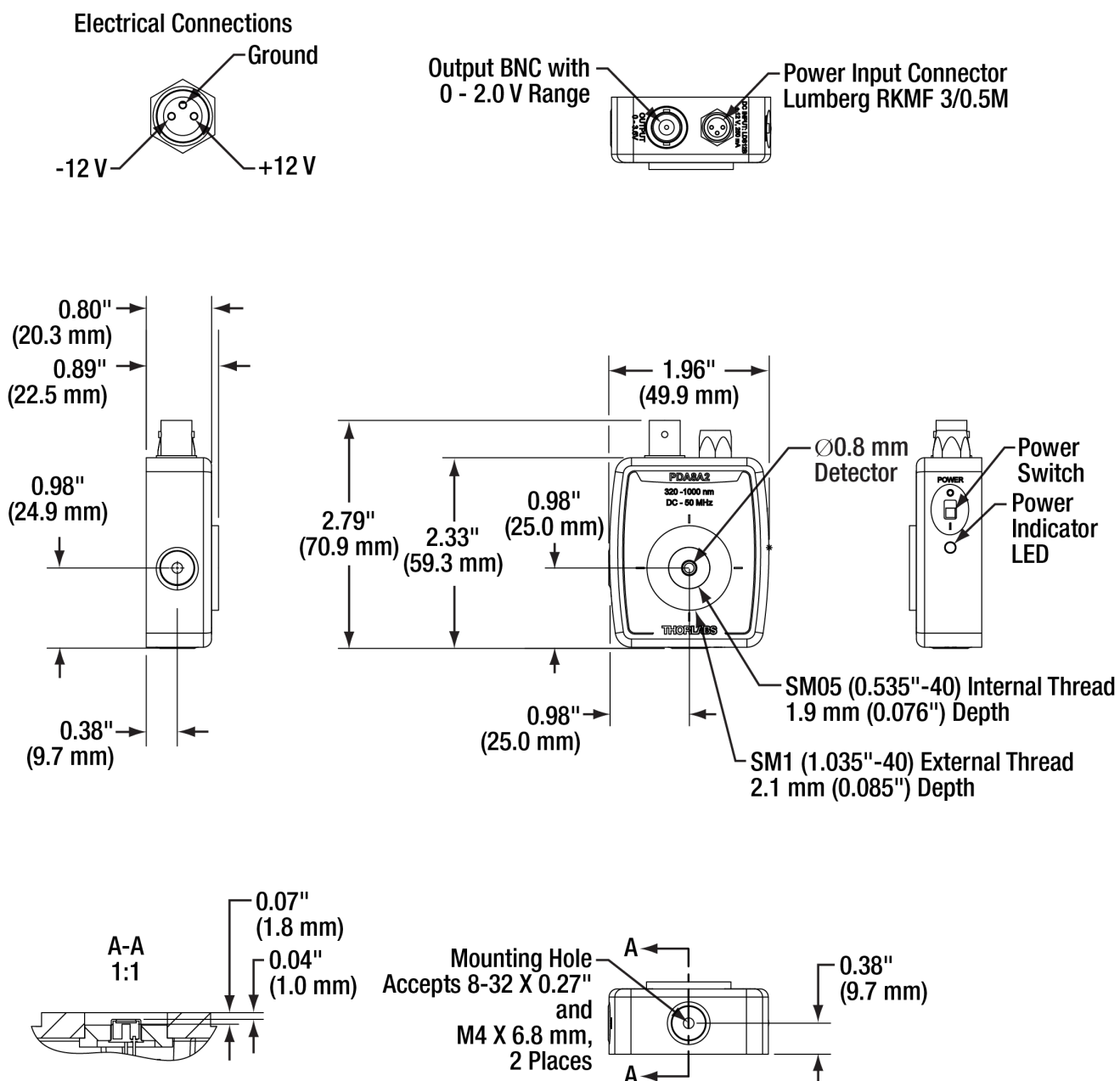
*Responsivity of PDA8A2*



*Frequency Response of PDA8A2*



## 5.3 Drawings



Technical Drawings for PDA8A2

## 5.4 Safety

### Attention

The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

All statements regarding safety of operation and technical data in this instruction manual will only apply when the unit is operated correctly as it was designed for.

The PDA8A2 must not be operated in explosion endangered environments.

Do not remove covers. There are no user-serviceable parts inside.

This precision device is only serviceable if returned and properly packed into the complete original packaging including the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

Changes to this device cannot be made nor may components not supplied by Thorlabs GmbH be used without written consent from Thorlabs GmbH.

### Attention

Prior to applying power to the PDA8A2, make sure that the protective conductor of the 3 conductor mains power cord is correctly connected to the protective earth ground contact of the socket outlet! Improper grounding can cause electric shock resulting in damage to your health or even death!

Ensure that the line voltage setting of the power supply agrees with your local supply and that the corresponding fuses are inserted. If not, please change the line voltage setting (see section Preparation).

To avoid risk of fire, only the appropriate fuses for the corresponding line voltage must be used. All modules must only be operated with duly shielded connection cables.

Users that change or modify the product described in this manual in a way not expressly approved by Thorlabs GmbH (party responsible for compliance) could void the user's authority to operate the equipment.

Thorlabs GmbH is not responsible for any radio television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by Thorlabs GmbH. The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC and ICES rules.

### Attention

Mobile telephones, cellular phones or other radio transmitters are not to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

## 5.5 Certifications and Compliances

### *EU Declaration of Conformity*

*in accordance with EN ISO 17050-1:2010*

**We:** Thorlabs GmbH

**Of:** Münchner Weg 1, 85232 Bergkirchen, Deutschland

*in accordance with the following Directive(s):*

2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

*hereby declare that:*

**Model:** *PDAVJ5/8/10, PDA20C2, PDA8A2, PDF10A2, PDF10C2*

**Equipment:** *Variable-/ Fixed Gain Amplified Detector*

*is/are in conformity with the applicable requirements of the following documents:*

EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010 + A1:2019 + AC:2019.
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

*and which, issued under the sole responsibility of Thorlabs, is/are in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:*

*does not contain substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive*

*I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.*

**Signed:**



**On:** 20 November 2019

**Name:** Bruno Gross

**Position:** General Manager

EDC - PDAVJ5/8/10, PDA20C2, PDA...



## 5.6 Manufacturer Address

### Manufacturer Address Europe

Thorlabs GmbH  
Münchner Weg 1  
D-85232 Bergkirchen  
Germany  
Tel: +49-8131-5956-0  
Fax: +49-8131-5956-99  
[www.thorlabs.de](http://www.thorlabs.de)  
Email: [europe@thorlabs.com](mailto:europe@thorlabs.com)

### EU-Importer Address

Thorlabs GmbH  
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Fax: +49-8131-5956-99  
[www.thorlabs.de](http://www.thorlabs.de)  
Email: [europe@thorlabs.com](mailto:europe@thorlabs.com)

## 5.7 Return of Devices

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

## 5.8 Warranty

Thorlabs warrants material and production of the PDA8A2 for a period of 24 months starting with the date of shipment in accordance with and subject to the terms and conditions set forth in Thorlabs' General Terms and Conditions of Sale which can be found at:

General Terms and Conditions:

[https://www.thorlabs.com/Images/PDF/LG-PO-001\\_Thorlabs\\_terms\\_and\\_%20agreements.pdf](https://www.thorlabs.com/Images/PDF/LG-PO-001_Thorlabs_terms_and_%20agreements.pdf)


and

[https://www.thorlabs.com/images/PDF/Terms%20and%20Conditions%20of%20Sales\\_Thorlabs-GmbH\\_English.pdf](https://www.thorlabs.com/images/PDF/Terms%20and%20Conditions%20of%20Sales_Thorlabs-GmbH_English.pdf)

## 5.9 Copyright and Exclusion of Reliability

Thorlabs has taken every possible care in preparing this document. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this document is regularly updated and adapted to reflect the current status of the product.

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Please refer to the general terms and conditions linked under [Warranty](#)  12.

## 5.10 Thorlabs Worldwide Contacts and WEEE policy

For technical support or sales inquiries, please visit us at <https://www.thorlabs.com/locations.cfm> for our most up-to-date contact information.



### USA, Canada, and South America

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sales@thorlabs.com  
techsupport@thorlabs.com

### UK and Ireland

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techsupport.uk@thorlabs.com

### Europe

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europe@thorlabs.com

### Scandinavia

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### France

Thorlabs SAS  
sales.fr@thorlabs.com

### Brazil

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brasil@thorlabs.com

### Japan

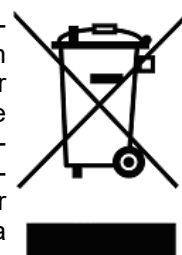
Thorlabs Japan, Inc.  
sales@thorlabs.jp

### China

Thorlabs China  
chinasales@thorlabs.com

### Thorlabs 'End of Life' Policy (WEEE)

Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return "end of life" Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out "wheelie bin" logo (see right), were sold to and are currently owned by a company or institute within the EC, and are not disassembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. "End of life" units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the users responsibility to delete all private data stored on the device prior to disposal.





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