



**Adjustable Gain
Avalanche Photodetectors**

APD440A and APD440A2 Operation Manual



2020

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We aim to develop and produce the best solution for your application in the field of optical measurement technique. To help us to live up to your expectations and constantly improve our products we need your ideas and suggestions. Therefore, please let us know about possible criticism or ideas. 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

Avalanche Photodetectors (APDs) have an exceptionally low noise-equivalent power (NEP), making them ideal for fast low-level light detection applications, such as spectroscopy, fluorescence measurements, laser radar and optical rangefinders. Due to their very high sensitivity, Avalanche Photodetectors can replace Photomultiplier Tubes (PMT) in many applications.

The Thorlabs APD440x temperature-compensated Avalanche Photodetectors combine a high-sensitivity Avalanche Photodiode with a specially designed ultra-low-noise transimpedance amplifier for detection of optical signals from DC to 100 kHz .

The continuously adjustable gain is based on the adjustment of the APDs multiplication factor (M-factor). Each detector also features a special electronic circuit to compensate for the temperature dependency of the M-factor.

The detectors are sensitive to light within the wavelength range of 400 nm - 1000 nm (APD440A) and 200 nm - 1000 nm (APD440A2).

The 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.

The housing accommodates Thorlabs' SM05 (0.535"-40) and SM1 (1.035"-40) threaded adapters and accessories. This allows convenient mounting of external optics, light filters, and apertures. The product includes a SM1T1 SM1 Coupler 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](#)^[20].

The APD440x Avalanche Photodetectors are powered by the included external power supply LDS12B (± 12 VDC, 250 mA) via a PICO M8 power connector. The appropriate input voltage (100 VAC, 120 VAC, 230 VAC) can be selected with a switch on the [power supply](#)^[2].

Attention

Please find all safety information and warnings concerning this product in the chapter [Safety](#)^[16] in the Appendix.

WARNING

Do not remove covers! Dangerous deadly high voltage!

1.1 Ordering Codes and Accessories

- | | |
|-----------------|---|
| APD440A | Avalanche Photodetector, Silicon APD, 400 - 1000 nm, Bandwidth Range DC - 100 kHz, Active Area Diameter 1.0 mm, Combi-Thread Mounting Holes Compatible with 8-32 and M4 Threads |
| APD440A2 | Avalanche Photodetector, UV-enhanced Silicon APD, 200 - 1000 nm, Bandwidth Range DC - 100 kHz, Active Area Diameter 1.0 mm, Combi-Thread Mounting Holes Compatible with 8-32 and M4 Threads |

2 Getting Started

2.1 Parts List

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 APD440x mechanically and electrically.

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

1. APD440x Temperature-Compensated Variable Gain Avalanche Photodetector
2. Plastic Cover Cap ([SM1EC2B](#)) on a Coupler ([SM1T1 SM1 Coupler](#)) with a Retaining Ring ([SM1RR SM1 Retaining Ring](#))
3. [LDS12B](#) Power Supply ($\pm 12V$, 250 mA), 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](#) ^[20] and have us replace the defective unit.

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

Attention

Wrong settings for the mains voltage may damage the power supply.

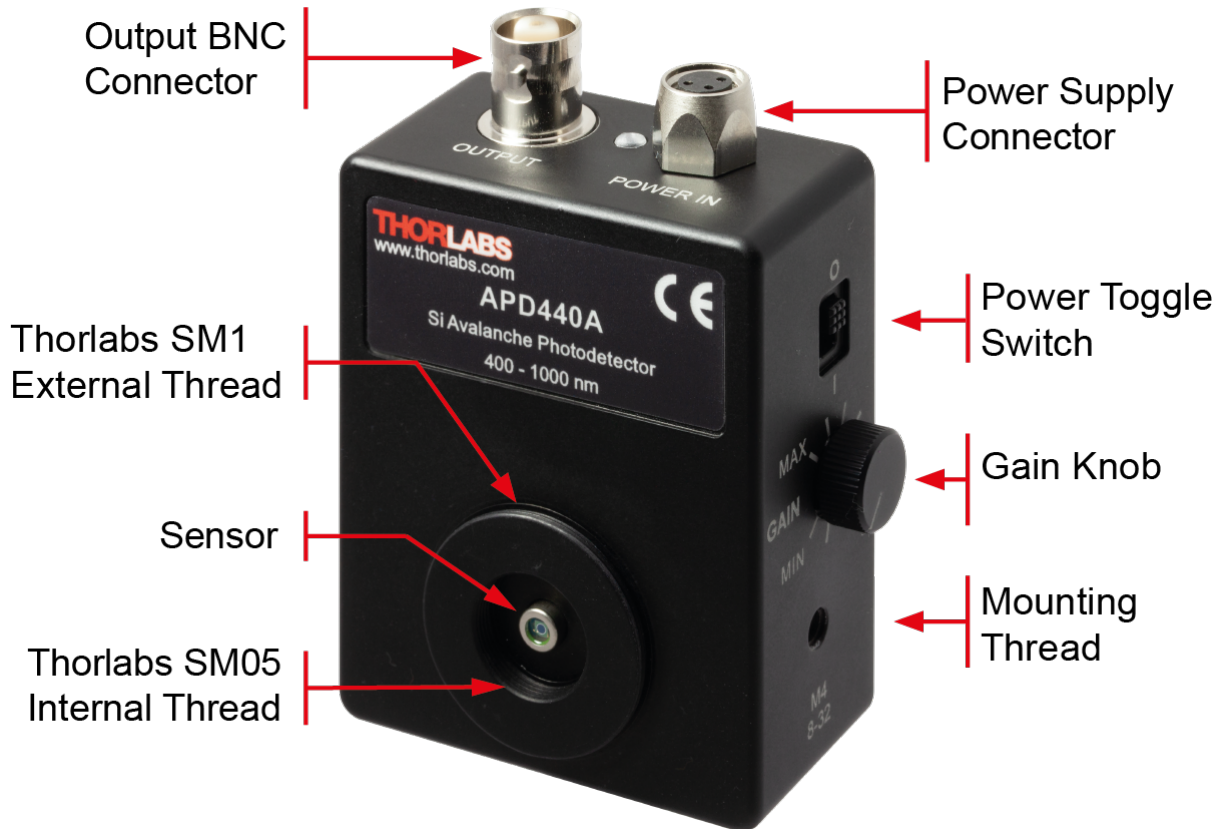
Note

If you prefer to use your own power supply, please ask [Thorlabs](#) ^[20] for an appropriate power connector cable.

3 Operating Instruction

3.1 Operating Elements

APD440A and APD440A2 have identical operating elements. Here shown is the APD440A, representing both APD440A and APD440A2.



3.2 Mounting

Housing

The APD440x is housed in a rugged, shielded, 74.5 mm x 56.1 mm x 27.4 mm aluminum enclosure.

Mounting APD440x on an Optical Table

Mount the APD440x on an optical post by using either of the three tapped mounting holes on the sides 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.

Note

Please see the chapter [Drawings](#) ¹⁴ for precise dimensions.

Mounting External Optics

The APD440x housing allows to mount external optics, filters, apertures or fiber adapters. For this, it features Thorlabs' SM05 (0.535"-40) threads and SM1 (1.035"-40) threads 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](#)^[20].

The APD440x is delivered with an SM1 coupler (SM1T1) which adapts the external thread to an internal SM1 thread and holds the SM1RR retaining ring and a reusable protective plastic cover cap. Please unscrew the coupler if needed.

3.3 Operation

Attention

Prior to connecting the power supply to the mains power, ensure that the correct mains voltage is selected on the [power supply](#)^[2]. Wrong settings for the mains voltage may damage the power supply. The ±12 V, 250 mA power supply is included, no high voltage power supply is required for operation.

Attention

Exceeding the optical damage threshold input power will permanently destroy the detector! Please see the [Technical Data](#)^[9] for the maximum input power.

Electrical Setup

- [Mount](#)^[3] the detector using the combi-thread mounting holes on either side or on the bottom of the device.
- Plug the power connector cable into the POWER IN.
- Plug the power supply into an outlet.
- Connect the OUTPUT connector jack (BNC) to your data acquisition device with a [coaxial cable](#). Please note that a 50 Ω impedance device should be used for best RF performance.
- Switch on the power supply.
- Move the power slider to I to turn on the APD440x. The green LED on the APD440x indicates the correct power supply.

Gain Adjustment

The Gain can be adjusted to achieve an optimal signal to noise ratio (SNR).

The photo-current generated by signal light is amplified by the gain. Because APDs generate noise due to the multiplication process, the noise also increases as the gain is increased. This means that the best SNR for a specific optical input signal exists at a specific gain that can be adjusted.

How to adjust the gain:

- Turn the GAIN knob to minimum before applying the optical signal to the APD440x. This is the condition when the APD440x is least sensitive, can tolerate its highest optical input level and has the lowest noise level.
- Align the light source with the optical input. To avoid electrical saturation, keep the output voltage below this maximum listed in the [Technical Data](#)^[9]. External neutral density filters or attenuators are recommended to reduce the input light level in critical cases.
- Increase the gain to achieve the optimal signal.

Turning off the APD440x

- Move the power slider to O after finishing the measurements.

Note

Avoid saturating the amplifier! Therefore, make sure that the optical input power does not exceed the CW saturation power level listed in [Technical Data](#)^[9].

3.4 Recommendations

• Ambient or stray light

- Avalanche Photodetectors are extremely sensitive devices. To achieve precise results, shield the Avalanche Photodetectors from light sources during measurements to reduce the background. Use opaque light barriers like light boxes, cloth or lens tubes.
- It is highly recommended to use appropriate band pass filters in front of the detector to minimize the influence of stray light.
- It is not necessary to switch off the Avalanche Photodetector when it is exposed to ambient light. The amplifier might saturate but, unlike Photomultiplier Tubes, it will not be damaged or saturated for a long period of time.

• High Optical Input Power

Upon excessive optical input power or at excessive power density (i.e. very focused light and very small beam diameter), a non-linearity caused by intrinsic effects of the APD may appear. Please keep the input power below the maximum input power stated in the [Technical Data](#)^[9].

• Electrostatic Coupling

Electrostatic coupling of electrical noise associated with ground loops can be critical. In most cases an electrically isolated post (see Thorlabs parts TRE or TRE/M) will suppress electrical noise coupling. Electrical noise sources should always be identified and the distance to the Avalanche Photodetector should be increased. If possible, rotate the Avalanche Photodetector input away from the noise source.

• Impact of Temperature

- The amplifier offset voltage is factory set to zero at 23°C ambient temperature. Due to the very high transimpedance gain, even small temperature changes may affect offset voltage. Therefore it is recommended for precise DC light level measurements to use the Avalanche Photodetector in an environment with constant temperature after a short warm up period (~5 min).
- The M-factor is factory set at 23°C ambient temperature. The APD440x is operated at an internal reverse bias voltage that is temperature-compensated. Therefore, the actual M factor will remain nearly constant within the specified ambient temperature range of (23±5)°C. Please see the Appendix for the [Typical M factor Temperatur Dependency](#)^[13].

3.5 Operating Principle

In general, Avalanche Photodiodes use an internal gain mechanism to increase the sensitivity. Incident photons generate electron-hole pairs, as in normal photo diodes. By applying a high reverse voltage, a strong electric field is generated that accelerates these electrons and produces secondary electrons by impact ionization. This leads to an electron avalanche producing

gain factors of up to several hundreds. The amplification depends on the reverse bias voltage and is described by the M-factor.

The reverse bias voltage can be adjusted with the rotary gain knob on the side of the APD440x, resulting in a variation of the M-factor that is equivalent to a gain variation.

3.5.1 Optical Input

The APD440A uses a Silicon Avalanche Photodiode with a detector active area diameter of 1.0 mm, operating from 400 to 1000 nm and the APD440A2 uses an UV-enhanced Silicon Avalanche Photodiode with a detector active area diameter of 1.0 mm, operating from 200 to 1000 nm. The typical responsivity curves can be found in the [appendix](#)^[10].

An open beam should be carefully aligned with the detector. External optics, filters or apertures can be easily attached to the Avalanche Photodetectors because the housing is compatible with any number of Thorlabs 1" and ½" threaded accessories.

For detectors with smaller active areas, as it is the case for APD440x with 1 mm active area diameter, it is recommended to focus the optical signal out of the fiber onto the detector.

For this and other fiber coupled applications, fiber adapters like Thorlabs S120-xx series can be mounted on the optical input. The fiber adapter will accommodate a multi-mode as well as single-mode fiber. For detailed information on fiber coupling, please see the [appendix](#)^[15].

Note

Coupling loss may occur due to small detector size, which will result in a reduced output signal. If angled connectors are used, the fiber adapter can be rotated from its original position to check for an improved alignment. For this process use an optical input power below the saturation power while observing OUTPUT voltage on a digital voltmeter or other low-frequency measurement device.

The maximum OUTPUT voltage swing is 4.1 V at High-Z termination. Saturation of the OUTPUT will occur at optical input power greater than CW Saturation Power listed in [specifications](#)^[9]. If necessary, use external neutral density filters or attenuators to reduce the input light level. Please note that Avalanche Photodetectors are extremely sensitive to unwanted stray light. Careful shielding of the Avalanche Photodetectors from any unwanted light sources is essential. Common techniques to minimize the influence of stray light include baffling or other opaque barriers like black cloths, beam tubes or using appropriate band pass filters in front of the detector.

Attention

The optical damage threshold is 1 mW. Exceeding this value will permanently destroy the Avalanche Photodetector!

3.5.2 Electrical Output

Thorlabs APD440x Avalanche Photodetectors deliver an output voltage. The output voltage V_{out} is a function of the incident light power P_{opt} , the detector's responsivity $\mathfrak{R}_M(\lambda)$ at a given wavelength and M-factor, and the transimpedance gain G :

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

- $\mathfrak{R}_M(\lambda)$ for a given wavelength can be read from the typical spectral responsivity curves (see [Appendix](#)^[10]).
- The M-factor (gain) adjustment range is 5 - 50 (APD440A2) and 10 - 100 (APD440A) at 23°C ambient temperature.
- The amplifier's transimpedance gain G is 50 MV/A (High-Z termination) and 25 MV/A (50 Ω).

The maximum output voltage of the APD440x is 2.0 V into 50 Ω and 4.1 V for high impedance loads. Depending on the wavelength, the responsivity $\mathfrak{R}(\lambda)$ of the detector and the M factor, the amplifier will reach saturation at optical input power greater than CW Saturation Power listed in specifications. To avoid saturation, keep the output signal below the specified maximum output voltage.

The ultra-low noise design includes an active low-pass filter to effectively suppress out-of-band noise.

The amplifier offset voltage is factory set to zero at 23°C ambient temperature. Due to the very high transimpedance gain, small temperature changes may affect the offset voltage. Therefore it is recommended to use the Avalanche Photodetectors in a constant temperature environment after a short warm up period (~5 min) for exact DC light level measurements.

Please find typical curves for [Responsivity](#)^[10], [Output Frequency Response](#)^[11] and [Spectral Noise Distribution](#)^[12] and [M Factor Temperature Dependency](#)^[13] in the chapter Appendix.

3.5.3 Temperature Compensation

Due to internal processes, the M-factor is temperature dependent. At a fixed reverse bias voltage the M-factor will change with temperature: with lower temperatures the M-factor will increase, with higher temperatures, it will decrease.

To compensate for this effect, the Thorlabs APD440x Avalanche Photodetectors carry a thermistor that senses the temperature inside the APD440x enclosure. A special electronic circuit controls the reverse voltage applied to the APD in accordance with the temperature change. Since the M-factor depends on the applied reverse voltage, this reduces the temperature dependency of the M factor. Please see the technical data for the M-factor [Temperature Stability](#)^[9] specifications and the section [M Factor Temperature Dependency](#)^[13] for typical curves.

4 Maintenance and Service

Protect the APD440x from adverse weather conditions. The APD440x is not water resistant.

Attention

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

The unit does not need regular maintenance by the user. It does not contain any modules and/or components that could be repaired by the user himself. If a malfunction occurs, please contact [Thorlabs](#) ²⁰¹ for return instructions.

WARNING

Do not remove covers! Dangerous deadly high voltage!

5 Appendix

5.1 Technical Data

	APD440A	APD440A2
Parameter		
Detector Material/Type	Silicon APD	UV Enhanced Silicon APD
Wavelength Range	400 to 1000 nm	200 to 1000 nm
Typical Maximum APD Responsivity	53 A/W @ 800 nm (M = 100)	25 A/W @ 600 nm (M = 50)
Detector Active Area Diameter	1.0 mm	
M Factor Adjustment Range	10 - 100 (Continuous)	5 - 50 (Continuous)
M Factor Temperature Stability ¹	± 2% (Typical); ± 3% (Max)	
Transimpedance Gain	25 MV/A (50 Ω Termination) 50 MV/A (High-Z Termination)	
Maximum Conversion Gain ²	2.65 x 10 ⁹ V/W	1.25 x 10 ⁹ V/W
Output Bandwidth (3 dB) ³	DC to 100kHz	
CW Saturation Power	1.54 nW @ 800 nm, M=100 15.4 nW @ 800 nm, M=10	3.28 nW @ 600 nm, M=50 32.8 nW @ 600 nm, M=5
Maximum Input Power (Photodiode Damage Threshold)	1 mW	
Minimum NEP ⁴	3.5 fW/√Hz (DC - 100 kHz)	2.5 fW/√Hz (DC - 100kHz)
Integrated Noise (RMS) ³	1.1 pW (DC - 100 kHz)	0.8 pW (DC - 100 kHz)
Electrical Output, Impedance	BNC, 50 Ω	
Maximum Output Voltage	4.1 V (High-Z load) 2.0 V (50 Ω)	
DC-Offset Electrical Output	< ±3 mV	
Power Supply	±12 V, 250 mA (100 V, 120 V, 230 V switchable)	
General		
Operating Temperature Range ⁵	0 to 40 °C	
Storage Temperature Range	-40 to 70 °C	
Dimensions (W x H x D)	2.21" x 2.93" x 1.08" (56.1 mm x 74.5 mm x 27.4 mm)	
Weight	0.12 kg	

¹) Ambient temperature within (23 ± 5)°C.

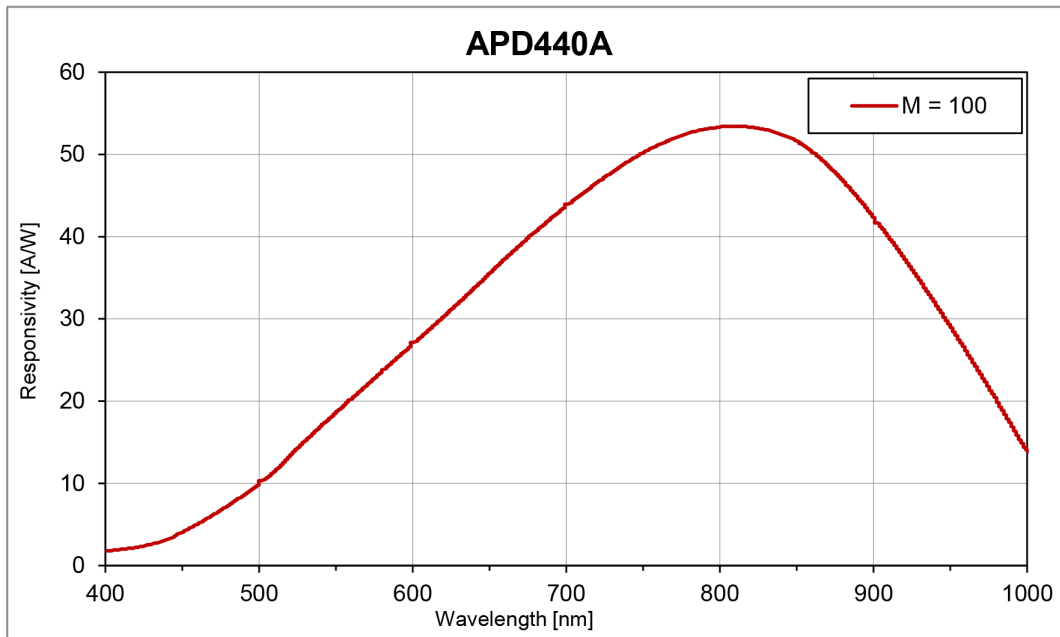
²) Conversion Gain at the Peak Responsivity Wavelength. The Conversion Gain is a product of the Transimpedance Gain and the Responsivity for a given M factor and wavelength.

³) At Maximum Gain Setting.

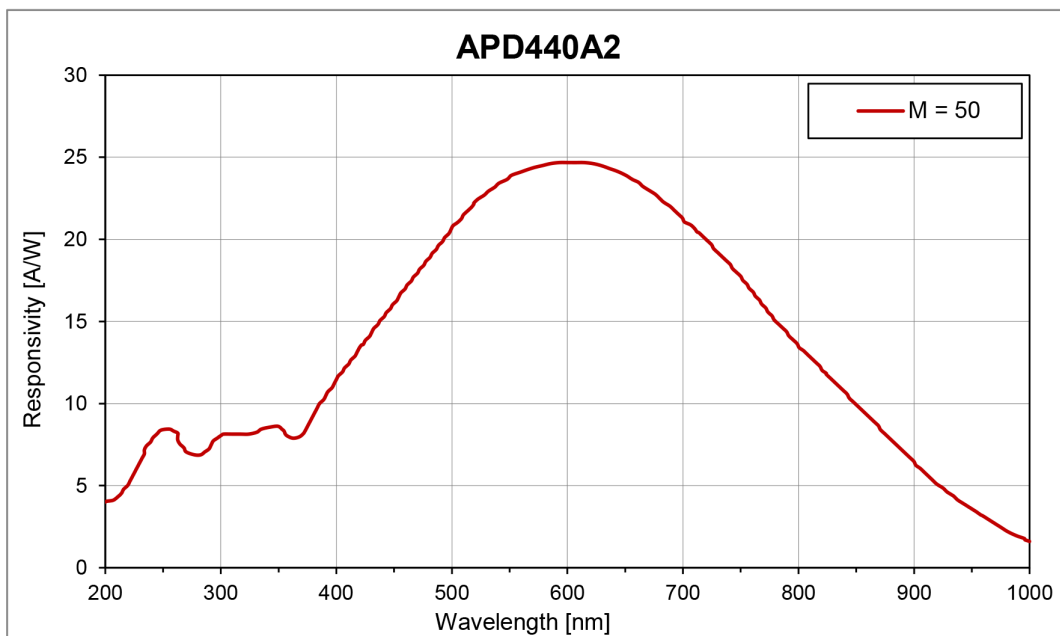
⁴) For more information on how NEP is calculated, please see Thorlabs' [Noise Equivalent Power White Paper](#).

⁵) Non-condensing

5.2 Typical Responsivity Curves



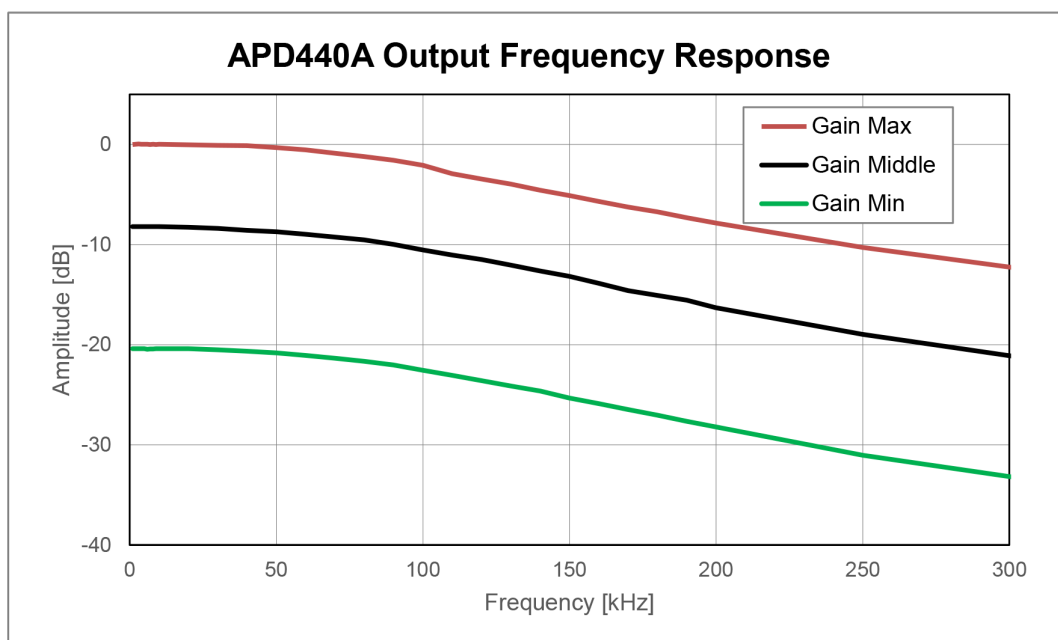
Typical Detector Responsivity APD440A; M = 100



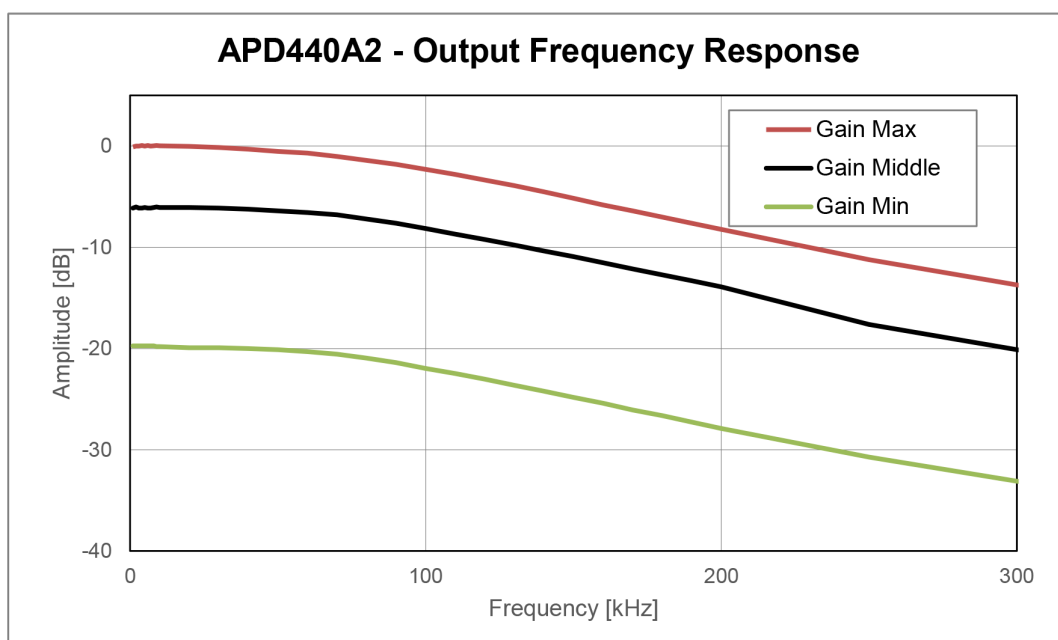
Typical Detector Responsivity APD440A2; M = 50

5.3 Typical Output Frequency Response

Effect of the gain settings on the respective Typical Output Frequency Response. For this measurement a test signal, generated by an optical transmitter, was fiber-coupled to the Avalanche Photodiode. The Output Frequency Response was measured using an optical network analyzer.



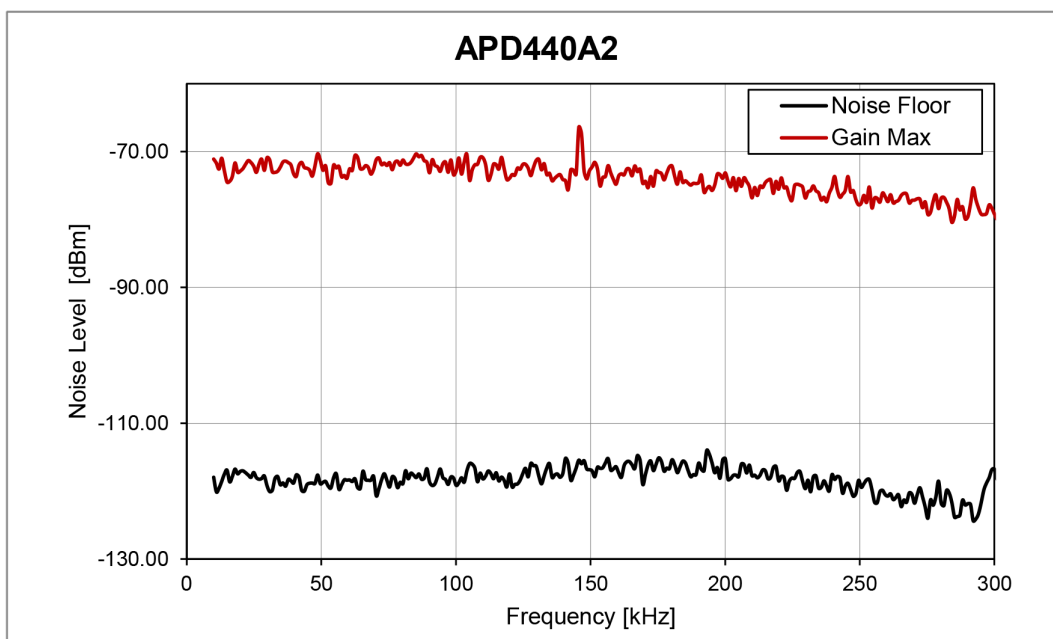
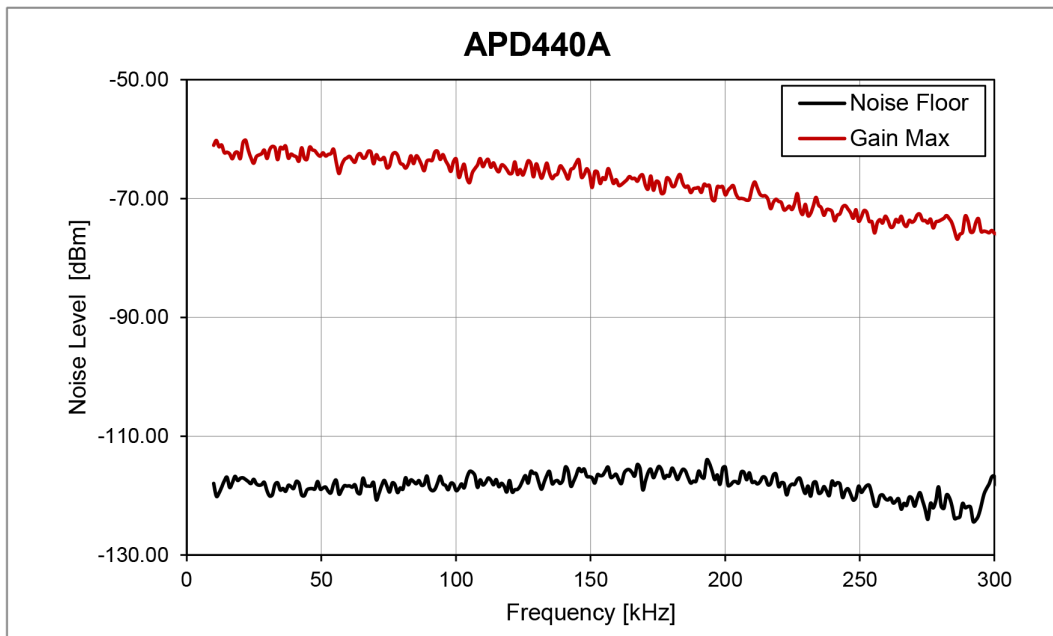
Typical Output Frequency Response APD440A



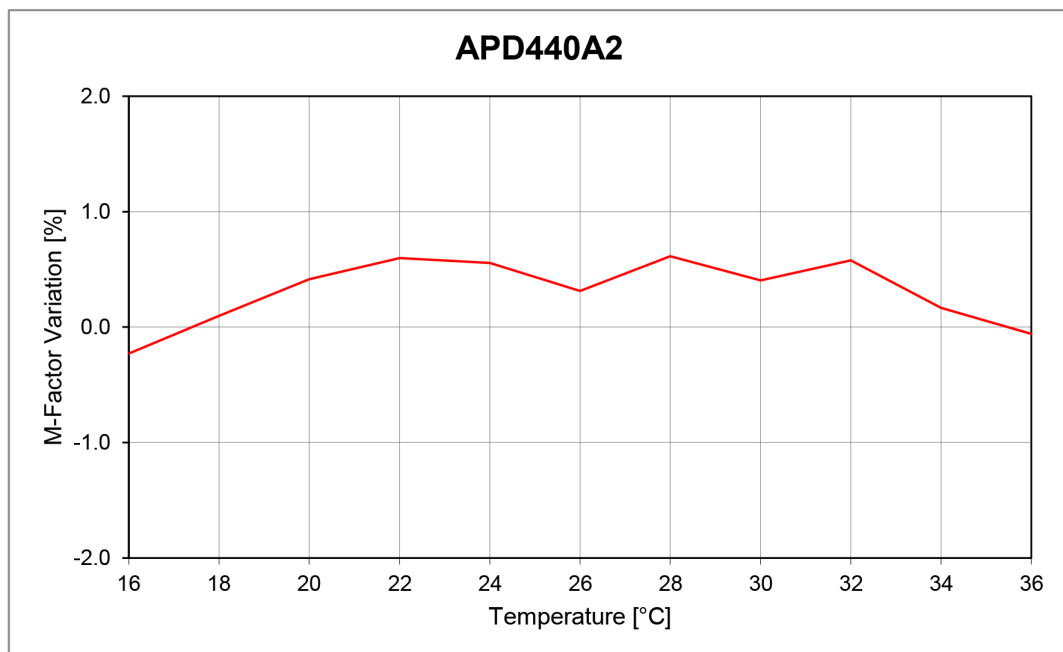
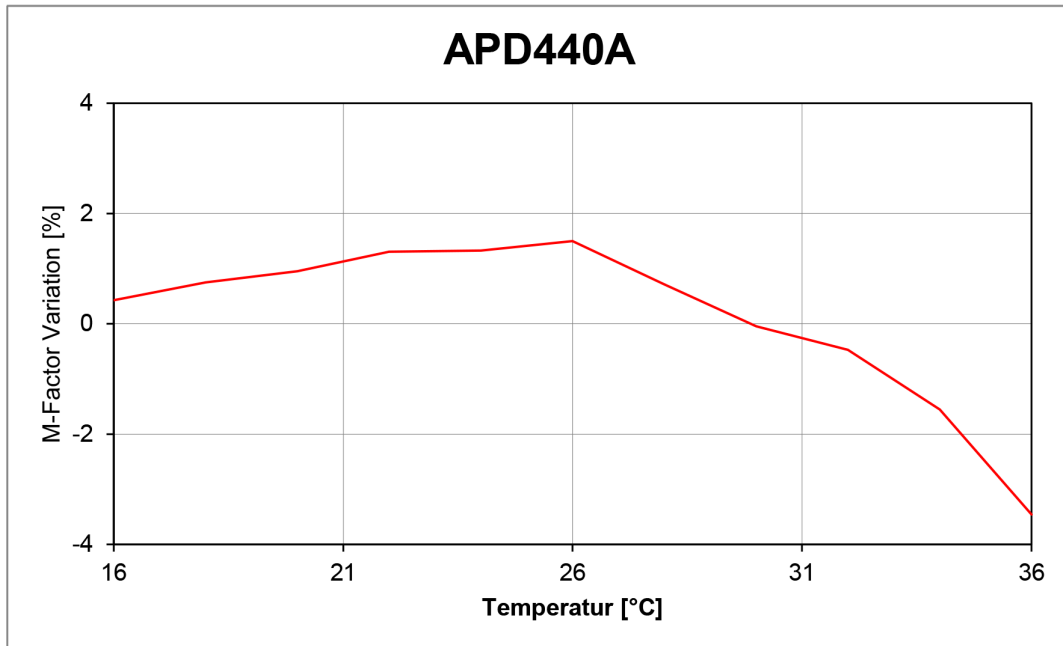
Typical Output Frequency Response APD440A2

5.4 Typical Spectral Noise

The typical noise spectrum was measured using an electrical spectrum analyzer (resolution bandwidth 1 kHz, video bandwidth 1 kHz). The optical input of the detector was blocked. The black curve ("Reference") was measured with the same setup and the detector switched off, i.e., it represents the measurement system's noise floor.

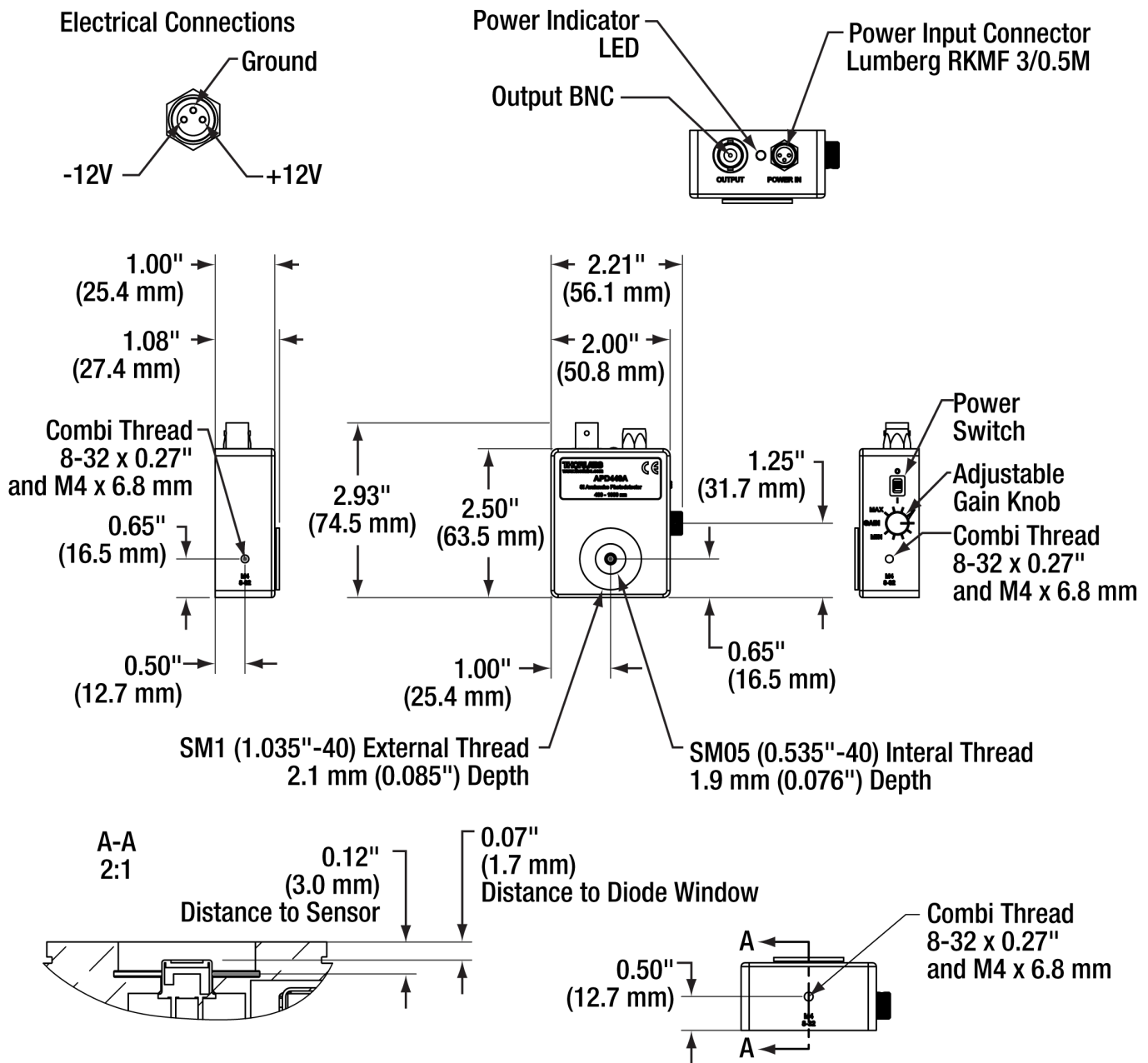


5.5 Typical M Factor Temperature Dependency



5.6 Drawings

The below drawings show the APD440x without the SM1 coupler. Please refer to the APD440A dimensions for APD440A2. The dimensions of these products are identical.

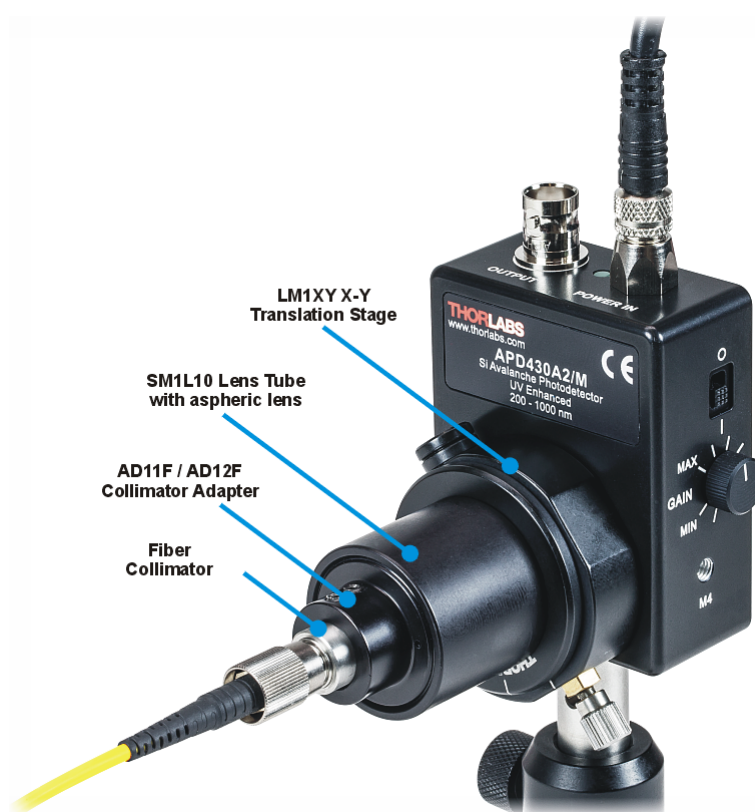


5.7 Fiber Coupling onto Small Detector Area

When coupling an optical fiber into the APD440x, please consider the beam divergence out of the fiber tip and the active detector area.

For detectors with an active area diameter of 1.0 mm^2 , a Thorlabs S120-xx fiber adapter is recommended.

For APD440x we recommend to compensate for possible beam divergence out of the fiber by using a collimator and a focusing lens. Below is a possible arrangement, shown on the example of the APD430A2/M. The arrangement is identical for all Thorlabs Avalanche Photodiodes.



The assembly in front of the detector comprises of a fiber collimator (dependent on fiber), a lens tube collimator adapter (AD11F or AD12F, dependent on collimator), a SM1L1 lens tube with aspheric lens inside (not visible above) and a LM1XY X-Y translation mount.

The beam out of the fiber is collimated (transferred into a nearly parallel beam) and afterwards focused by the aspheric lens onto the detector. The X-Y translation mount allows the focused beam to be aligned with the center of the sensor.

5.8 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 APD440x must not be operated in explosion endangered environments!

Do not obstruct the air ventilation slots in the housing!

Do not remove covers!

Do not open the cabinet. There are no parts serviceable by the operator inside!

This precision device is only serviceable if properly packed into the complete original packaging including the plastic foam sleeves. If necessary, ask for replacement packaging.

Refer servicing to qualified personnel!

Only with written consent from Thorlabs may changes to single components be made or components not supplied by Thorlabs be used.

All modules must only be operated with duly shielded connection cables.

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.

This product has been tested and found to comply with the limits according to IEC 61326-1 for using connection cables shorter than 3 meters (9.8 feet).

5.9 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
Email: europe@thorlabs.com



EU-Importer Address

Thorlabs GmbH
Münchner Weg 1
D-85232 Bergkirchen
Germany
Tel: +49-8131-5956-0
Fax: +49-8131-5956-99
www.thorlabs.de
Email: europe@thorlabs.com

5.10 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.

5.11 Certifications and Compliances

<i>EU Declaration of Conformity</i>		
<i>in accordance with EN ISO 17050-1:2010</i>		
We:	Thorlabs GmbH	
Of:	Münchner Weg 1, 85232 Bergkirchen, Deutschland	
<i>in accordance with the following Directive(s):</i>		
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)	
<i>hereby declare that:</i>		
Model:	APD440x	
Equipment:	Avalanche Photodetector	
<i>is in conformity with the applicable requirements of the following documents:</i>		
EN 61010-1	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.	2010
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
<i>and which, issued under the sole responsibility of Thorlabs, is 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:</i>		
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>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.</i>		
Signed:		On: 15 November 2019
Name:	Bruno Gross	
Position:	General Manager	EDC - APDxxxx - 2019-11-15
		

5.12 Warranty

Thorlabs warrants material and production of the APD440x for a period of 24 months starting with the date of shipment. During this warranty period Thorlabs will see to defaults by repair or by exchange if these are entitled to warranty.

For warranty repairs or service the unit must be sent back to Thorlabs. The customer will carry the shipping costs to Thorlabs, in case of warranty repairs Thorlabs will carry the shipping costs back to the customer.

If no warranty repair is applicable the customer also has to carry the costs for back shipment.

In case of shipment from outside EU duties, taxes etc. which should arise have to be carried by the customer.

Thorlabs warrants the hard- and/or software determined by Thorlabs for this unit to operate fault-free provided that they are handled according to our requirements. However, Thorlabs does not warrant a fault free and uninterrupted operation of the unit, of the software or firmware for special applications nor this instruction manual to be error free. Thorlabs is not liable for consequential damages.

Restriction of Warranty

The warranty mentioned before does not cover errors and defects being the result of improper treatment, software or interface not supplied by us, modification, misuse or operation outside the defined ambient stated by us or unauthorized maintenance.

Further claims will not be consented to and will not be acknowledged. Thorlabs does explicitly not warrant the usability or the economical use for certain cases of application.

Thorlabs reserves the right to change this instruction manual or the technical data of the described unit at any time.

5.13 Copyright and Exclusion of Liability

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5.14 List of Acronyms

Acronyms

AC	<u>A</u> lternating <u>C</u> urrent
APD	<u>A</u> valanche <u>P</u> hoto <u>D</u> iode
CW	<u>C</u> ontinuous <u>W</u> ave
DC	<u>D</u> irect <u>C</u> urrent
LED	<u>L</u> ight <u>E</u> mitting <u>D</u> iode
NEP	<u>N</u> oise <u>E</u> quivalent <u>P</u> ower
RF	<u>R</u> adio <u>F</u> requencies
Si	<u>S</u> ilicon
SNR	Signal-to-Noise Ratio
UV	<u>U</u> ltraviolet

5.15 Thorlabs Worldwide Contacts and WEEE policy

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



USA, Canada, and South America

Thorlabs, Inc.
sales@thorlabs.com
techsupport@thorlabs.com

UK and Ireland

Thorlabs Ltd.
sales.uk@thorlabs.com
techsupport.uk@thorlabs.com

Europe

Thorlabs GmbH
europe@thorlabs.com

Scandinavia

Thorlabs Sweden AB
scandinavia@thorlabs.com

France

Thorlabs SAS
sales.fr@thorlabs.com

Brazil

Thorlabs Vendas de Fotônicos Ltda.
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.





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