TIA60
Transimpedance Amplifier

User Guide

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Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

All statements regarding safety of operation and technical data in this user guide will only apply when the unit is operated correctly. Please read the following warnings and cautions carefully before operating the device.

WARNING

DO NOT use the device for anything other than its intended use. If the device is used in a manner not specified by Thorlabs, the protection provided by the equipment may be impaired.

CAUTION

DO NOT operate in a wet, damp, or explosive environment.

Chapter 3 Description

Thorlabs' TIA60 Transimpedance Amplifier is designed to amplify the output signal from a photomultiplier tube (PMT), PIN photodiode, or other devices that require an amplified current to voltage signal. A trim pot, accessible through a hole on the top of the amplifier (see ***Chapter 5 Operation on Page 5*** for more details), provides a DC offset adjustment to improve the dynamic range of the data collection system.

The TIA60 can be powered with a 15 V, 2.4 A, 3.5mm Jack Connector Power Supply (sold separately). Internal electronics of the TIA60 regulate the power to the amplification circuitry, isolating the performance of this amplifier from electrical noise that may be inherent to the power source.

The compact amplifier housing is designed to mount it close to the detector in order to reduce the noise coupled into the unamplified signal between the detector and the amplifier. It comes with an SMA to BNC adapter, a 4-pin to power jack adapter, and a trim pot adjuster. M3 screws are also included for mounting the amplifier to the Hamamatsu H7422 series PMT.

This amplifier is fully compatible with Hamamatsu's H7422, H10720, and H10721 series PMTs, but the mounting hole pattern only accommodates the H7422 series. The TIA60 amplifier is also compatible with Thorlabs' biased photodetectors and passive electrical filters**.**

3.1. Features

- Transimpedance Gain: 30200 V/A
- Large Operation Bandwidth: DC to 60 MHz
- Low Input Current Noise: 4.8 pA/√Hz @ 1 MHz
- Designed for Multiphoton and Other Laser Scanning Microscopies
- Ideal for Hamamatsu H7422, H10720, and H10721 Series PMTs

3.2. Overview

Figure 1 TIA60 Front View

Chapter 4 Getting Started

This section is provided for those interested in getting the TIA60 up and running quickly.

4.1. Unpacking and Inspection

Open the package, and carefully remove the TIA60 and its accessories. The table lists the standard accessories shipped with the device.

Name	Quantity
Transimpedance Amplifier	1
Trim Pot Adjuster	1
BNC to SMA Input Cable	1
Power Cord Adapter	1
M3x10 mm Mounting Screws	2

Inspect the device and its accessories for any missing parts or damage. If there is any problem, please contact our nearest office (see ***Chapter 14 Thorlabs Worldwide Contacts on Page 14*** for details).

4.2. Setting up TIA60

4.2.1. Preparation

1. Connect the **Input** port of TIA60 to the output port of the device that requires an amplified current to voltage signal.
2. Connect one end of the Power Cord Adapter to the **Power** port of TIA60 and the other end to a power supply unit (sold separately).
3. Connect the **Output** port of TIA60 to a data acquisition system.

Chapter 5 Operation

Some applications, like the PMTs, require you to adjust the amplifier's DC output bias. The output offset adjustment allows you to achieve the maximum dynamic range of the amplifier (and ADC).

5.1. Output Offset Adjustment

The output offset adjustment is helpful for unipolar signals (example: signals from PMTs). Adjust the output offset only after the device connected to the TIA60 is turned on.

To adjust the output DC bias:

1. Connect the Output port of the TIA60 to an oscilloscope.

   Note: Terminate the output with 50 Ω for accurate adjustment.
2. Turn on the device connected to the TIA60.
3. Use the Trim Pot Adjuster to turn the POT screw in the small access hole.

   Note: Adjust the output offset only after the device connected to the TIA60 is turned on.

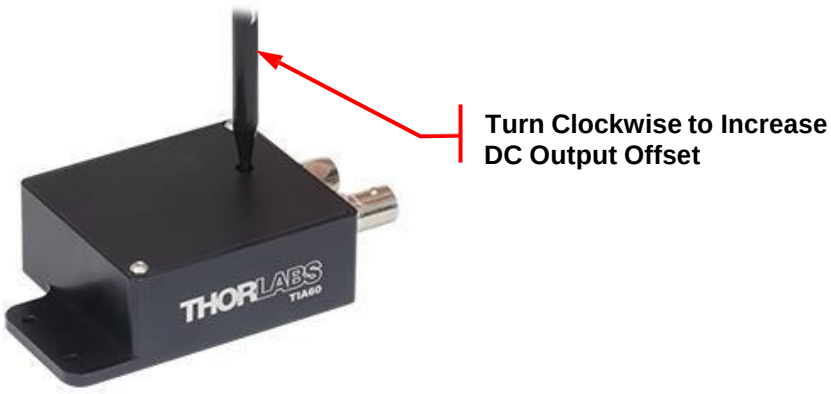


Figure 2 Trim Pot Adjuster

4. Observe the output on the oscilloscope.

If you use a DMM (or other high-impedance meter), set the offset to double the desired offset bias.

Chapter 6 Maintaining the TIA60

There are no serviceable parts in the TIA60. If you suspect a problem with the TIA60, please contact our nearest office for assistance from an applications engineer (see ***Chapter 14 Thorlabs Worldwide Contacts on Page 14*** for details).

Use a soft, damp cloth to clean the housing.

Chapter 7 Electrical Schematic

Below is an electrical schematic of an amplified PMT system. The inside of the dashed box represents the TIA60 schematic.

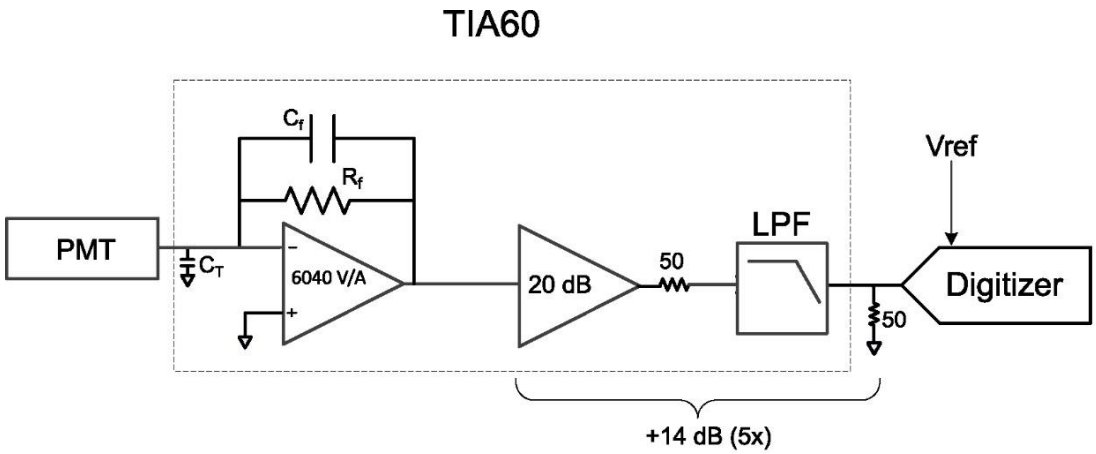


Figure 3 Electrical Schematic of TIA60

Chapter 8 Performance Plots

The graphs below represent measured data using a previous-generation KPS101 as the power source. $T_{ambient}$ = 25 °C, V_{Source} = +15 VDC, Total Cin = 4pF + the capacitance from a 4" RG-174 coaxial cable, Output Coaxial Cable: 12" - RG223, 50Ω Load.

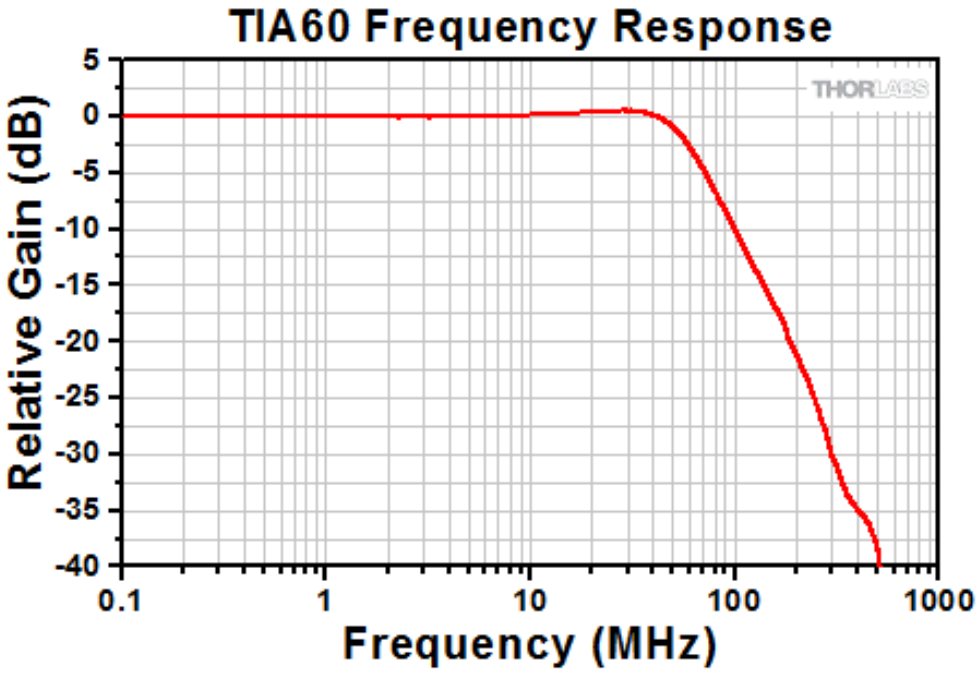


Figure 4 Frequency Response

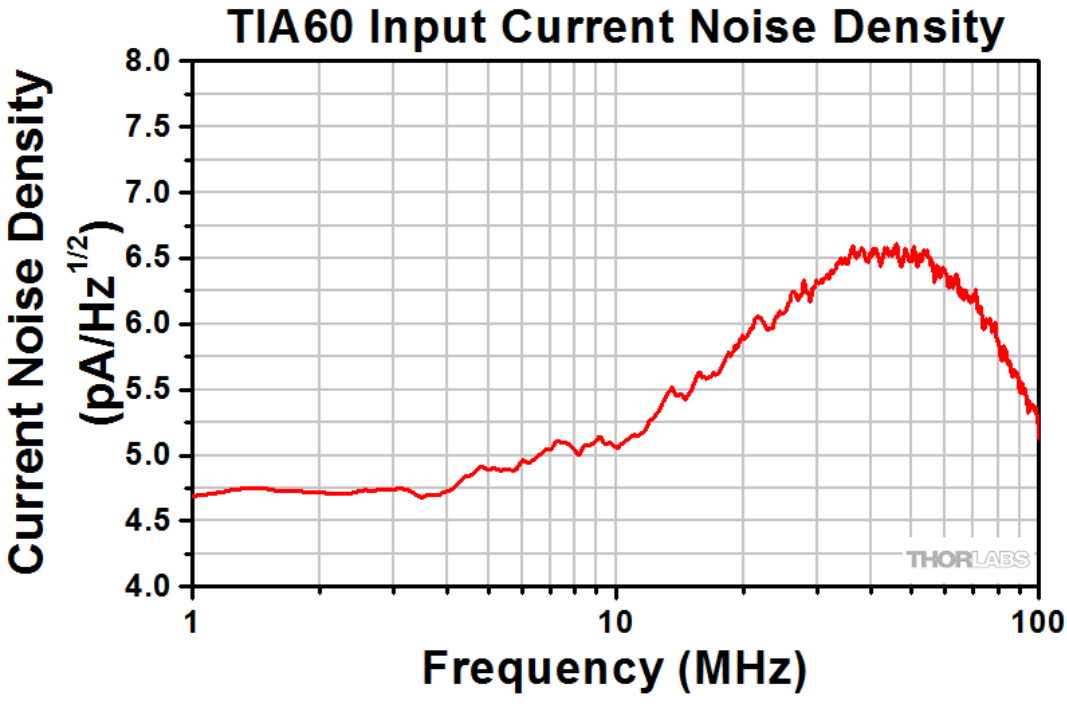


Figure 5 Input Current Noise Density

Chapter 9 Specifications

9.1. General Specifications

Specification	Value
Dimensions	3.78" x 1.06" x 2.20" (95.9 mm x 26.8 mm x 55.9 mm)
Operating Temperature	5 to 55 °C
Storage Temperature	-40 to +55 °C
Weight	100 g

9.2. Electrical Specifications

Specifications	Minimum	Typical	Maximum
AC Performance			
Bandwidth (3 dB, C_{in} = 4 pF)[a]	-	60 MHz	-
Rise/Fall Time (10% to 90%)	-	5.5 ns	-
Settling Time (3%, 0.5 V Output)	-	16 ns	-
Transfer Characteristics			
Total Transimpedance (Combined Stages, DC)[b]	29000 V/A	30200 V/A	32000 V/A
Transresistance (Input Stage Z-Amp, DC)	-	6.04 kΩ	-
Input			
Linear Input Range, 0 V Bias	-	-	±50 µA
Maximum Input[c]	-	-	±500 µA
DC Input Impedance	-	33 Ω	-
Input Reference	-	0 V	-
Noise			
Input Current Noise (1 MHz, C_{in} = 4 pF)[a]	-	4.8 pA/√Hz	-
Total Input RMS Noise (DC to 60 MHz)[a]	-	50 nA	-
Output			
DC Bias (50 Ω Load)	-0.15 VDC	0 VDC	1.5 VDC
Output Range (50 Ω Load)	-1.5 V	-	1.5 V
Impedance (DC to 60 MHz)	-	50 Ω	-
Return Loss (DC to 60 MHz)	15 dB	-	-
Slew Rate	-	625 V/µs	-
DC Performance			
Offset Voltage Drift (at Output)	-	±103 µV/°C	-
Power Supply			
Input Voltage	9 V	12 V	15 V
Input Current	-	65 mA	100 mA

a) Bandwidth and equivalent input current noise are typical values, which depend on the source capacitance. Keep the source capacitance as low as possible by using short cables at the input to achieve best possible bandwidth and noise performance.

b) Positive Gain; current is considered positive flowing into the amplifier input, and produces a resulting positive output voltage.

c) A significant chance of damaging the amplifier exists if operating above this specification.

Chapter 10 Mechanical Drawing

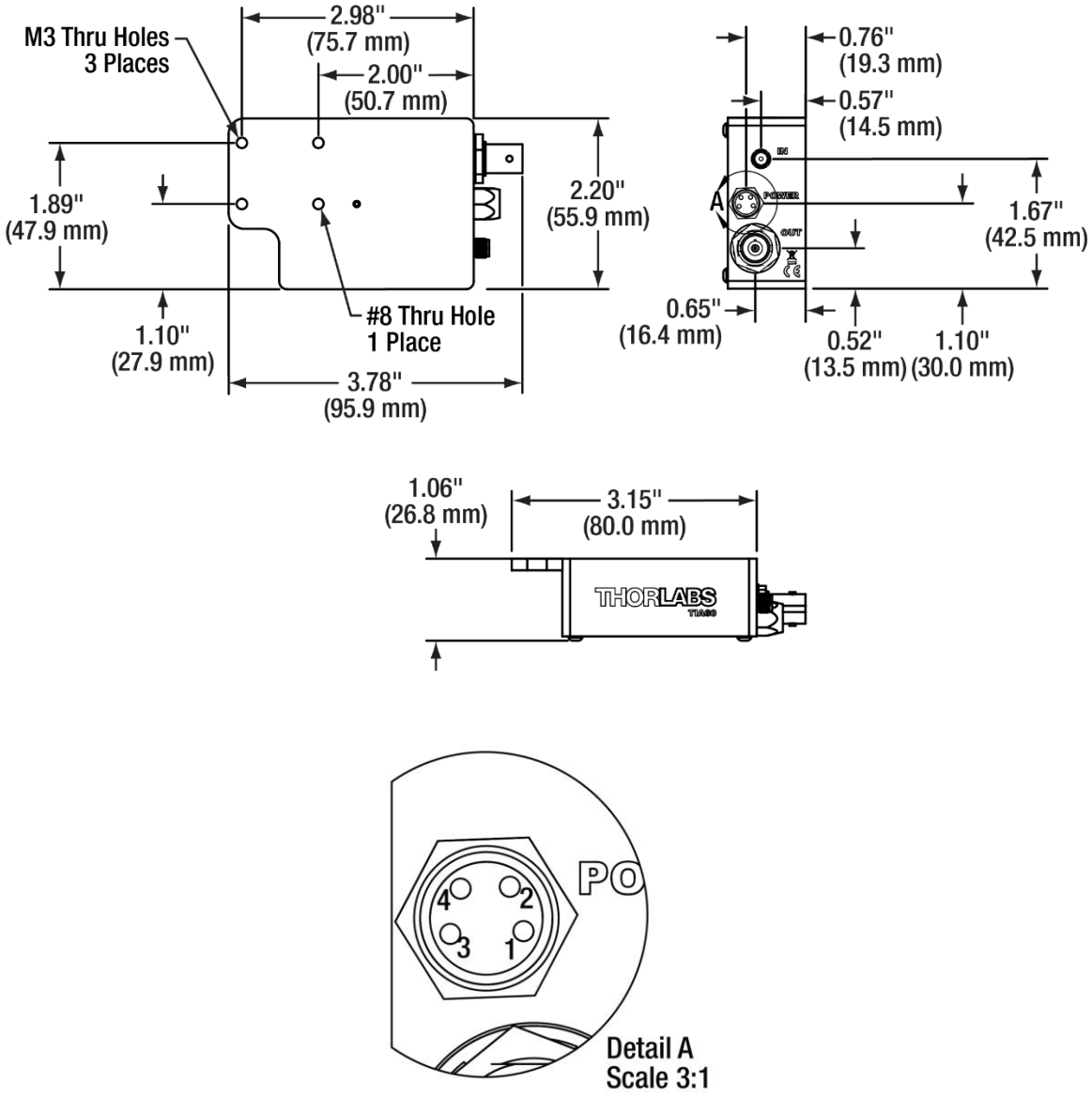
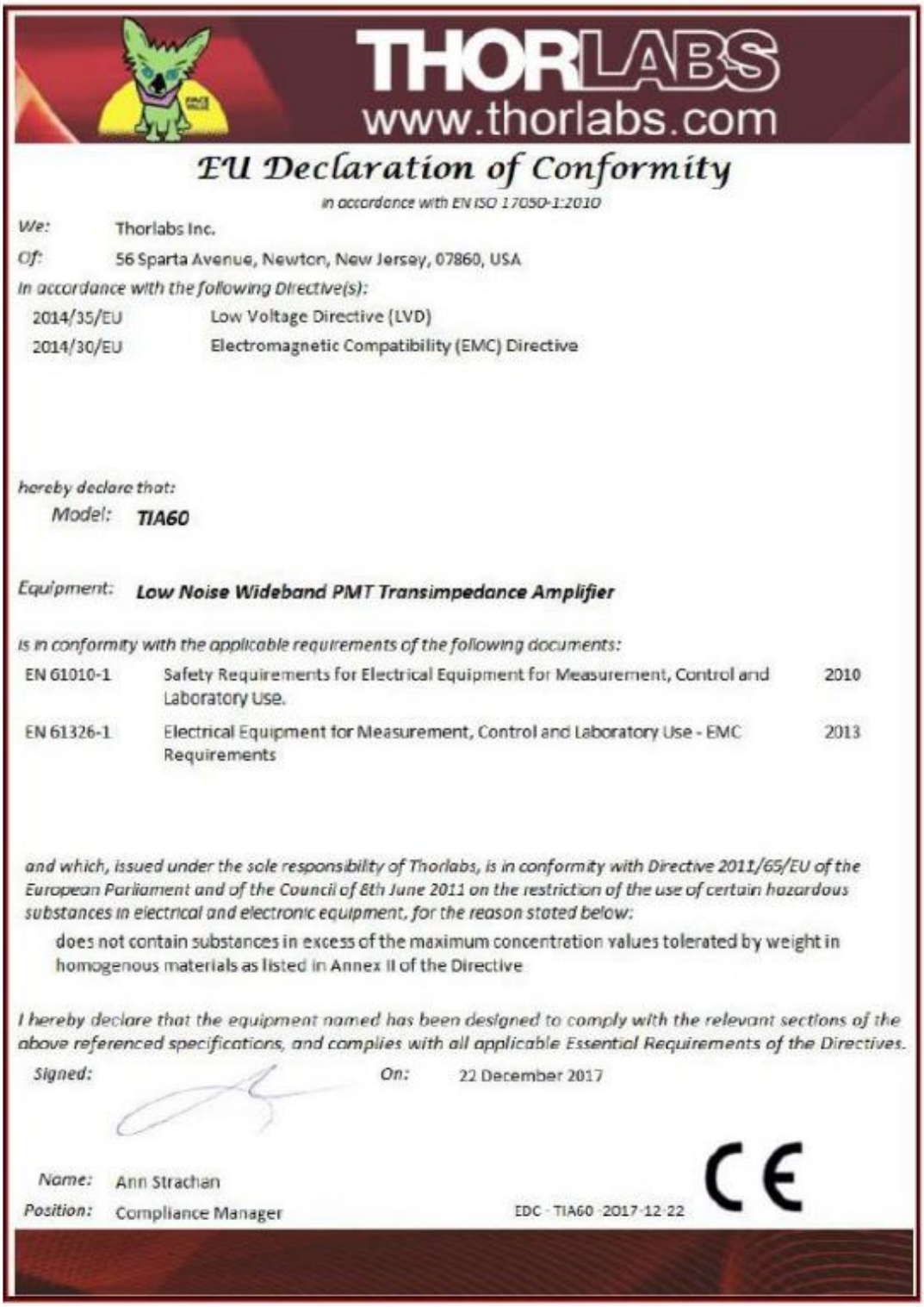


Figure 6 Mechanical Drawing of the TIA60 Housing

Pin	Description
1	V+ Power Supply Unit
2	No Connect
3	No Connect
4	Ground Power Supply Return

Chapter 11 Certifications and Compliance



THORLABS
www.thorlabs.com

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Inc.

Of: 56 Sparta Avenue, Newton, New Jersey, 07860, USA

In accordance with the following Directive(s):

2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive

hereby declare that:

Model: ***TIA60***

Equipment: ***Low Noise Wideband PMT Transimpedance Amplifier***

is 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
EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013

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:

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:* 22 December 2017

Name: Ann Strachan

Position: Compliance Manager

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Chapter 12 Warranty

Thorlabs warrants that all products sold by Thorlabs will conform to the published specifications and shall be free from defects in material and workmanship under normal use, handling, and service.

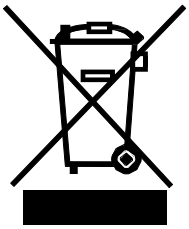
Thorlabs provides warranty for a period of one year.

Chapter 13 Regulatory

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 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- 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



Wheelie Bin Logo

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 is 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 life products will thereby avoid negative impacts on the environment.

Chapter 14 Thorlabs Worldwide Contacts

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

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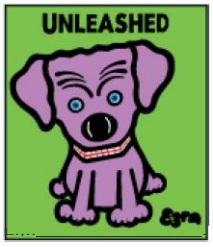
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