THORLABS

T-Cube LED Driver

LEDD1B
Operation Manual

2023

Version: 2.6
Date: 23-Mar-2023

Contents

Foreword 2

1 General Information 3

1.1 Safety 4
1.2 Ordering Codes and Accessories 5

2 Getting Started 6

2.1 Parts List 6
2.2 Mounting Options 6
2.3 Setup 6
2.4 Switch Off 7
2.5 Removing the Base Plate 7

3 Operating Instruction 9

3.1 Top Panel Controls 9
3.2 Current Limit Control 10
3.3 CW Mode 10
3.4 Trigger Mode 10
3.5 Modulation Mode 11

4 Maintenance and Service 12

4.1 Troubleshooting 12

5 Appendix 14

5.1 Technical Data 14
5.2 LED Connector 15
5.3 Application Note 16
5.3.1 LED Driver 16
5.3.2 Pulse Width Modulation 17
5.4 Certifications and Compliances 18
5.5 Manufacturere Address 19
5.6 Warranty and RMA Information 19
5.7 Return of Devices 19
5.8 Copyright and Exclusion of Liability 19
5.9 List of Acronyms 20
5.10 Thorlabs Worldwide Contacts and WEEE Policy 21

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

The T-Cube Series LED Driver is a compact, single channel controller for easy control of the LED intensity. The LEDD1B delivers a max output current of 1200 mA. It is designed for use with Thorlabs collimated and mounted LED packages. The connected LED is controlled by one of three selectable modes: continuous, modulated, or trigger mode.

The continuous mode is ideal for imaging with CCD cameras or photodiodes. In this mode the LED current is controlled by means of a single rotary control knob.

When operating in modulation mode, an external control signal modulates the LED current and the brightness of the LED.

The trigger mode can be used to strobe the LED, or to control average power by using pulse width modulation (up to 1 kHz rep rate).

For convenience, the LEDD1B driver features a small footprint (60 mm x 60 mm (2.4" x 2.4")). The included adapter plate allows to mount the LEDD1B directly to an optical table or bread-board. The controls for LED current and operating mode are located on top.

The LED current limit control is situated on the front side of the driver and can be adjusted in the range between 200 mA and 1200 mA, using the included screwdriver.

LEDD1B T-Cube LED Driver with MxxxLy-C1 type LED with Collimator Assembly

The LEDD1B is powered by an external power supply (not included). For this, please use either of the following power supplies:

- KPS201 or the predecessor KPS101 power supply powers a single T-Cube LEDD1B, plugs into a standard wall outlet and provides +15 VDC.
- KCH301 or KCH601 T-Cube Hub and Power Supply. The KCH301 or KCH601 hub and power supplies consist of two parts: the hub, which can support up to three (KCH301) or six (KCH601) standard-footprint T-cubes, and a power supply that plugs into a standard wall outlet and powers the hub. The hub, in turn, powers all the connected T-cube LEDD1B LED drivers.

1.1 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 LEDD1B must not be operated in explosion endangered environments!

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 proper shielded connection cables. Improper grounding can cause electric shock with damages to your health or even death!

Attention

The following statement applies to the products covered in this manual, unless otherwise specified herein. The statement for other products will appear in the respective accompanying documentation.

Note This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules and meets all requirements of the Canadian Interference-Causing Equipment Standard ICES-003 for digital apparatus. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Users that change or modify the product described in this manual in a way not expressly approved by Thorlabs (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.

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).

Warning

Inappropriate use of any Thorlabs High Power LED product could result in permanent eye damage.

To prevent injury, these products must be used in accordance with the International Standard "Photobiological Safety of Lamps & Lamp Systems" CEI IEC 62471.

Warnings

The LEDD1B driver was designed for operation of high brightness LEDs, which can handle forward currents of several hundreds of mA. Use of LEDs with a lower forward current could result in damage to the LED.

When Thorlabs LED's are used in microscope applications as a replacement for Mercury Vapor lamps, the same precautions should be taken as those applying to Mercury Vapor lamps.

When Thorlabs LEDs are used in other applications, they should be used in accordance with CEI IEC 62471.

During normal operation, the housing temperature of Thorlabs High Power LED products may rise by up to 25°C (45°F) above ambient temperature.

1.2 Ordering Codes and Accessories

Ordering code	Short description
LEDD1B	T-Cube LED Driver

Required Accessories

One of the following power supplies is required.

KCH301 or KCH601	USB Controller Hub and Power Supply for Three (KCH301) or Six (KCH601) K-Cube series devices or T-Cube series devices
KPS201	Single Way Power Supply

Optional Accessories

KAP101 or KAP102	Adapter Plate for KCH Series Power Supply Hubs and 60 mm Wide T-Cubes
CAB-LEDD1	LED Cable (One End without Connector)

Supported LED Types

MxxxLx	Mounted LED @ xxx nm
MxxxF1	Fiber Coupled Mounted LED @ xxx nm
MxxxL2-C1	Collimator Assembly for Olympus BX & IX Microscopes
MxxxL2-C2	Collimator Assembly for Leica DMI Microscopes
MxxxL2-C3	Collimator Assembly for Nikon Eclipse Microscopes
MxxxL2-C4	Collimator Assembly for Zeiss Axioskop Microscopes

Please visit our homepage http://www.thorlabs.com for further information.

2 Getting Started

2.1 Parts List

Inspect the shipping container for damage.

If the shipping container seems to be damaged, keep it until you have inspected the contents and you have inspected the LEDD1B mechanically and electrically.

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

1. 1x LEDD1B Mounted on Base Plate
2. 1x CAB-LEDD1 (LED Cable, one End without Connector)
3. 4x Rubber Foot
4. 1x QuickReference
5. 1x Screwdriver to Adjust the Current Limit

2.2 Mounting Options

The T-Cube LEDD1B LED Driver is shipped with a base plate attached, ready to be mounted to a breadboard, optical table or similar surface.

The base plate can be removed and the unit can be put on rubber feet - see Section Removing the Base Plate 7.

2.3 Setup

1. Perform the mechanical installation as detailed in the section Mounting Options 6.
2. Connect the LED head cable to the socket via the M8 4-pin connector labeled "LED" at the back of the LEDD1B, see figure below. The M8 connector is compatible with all Thorlabs light generating LED assemblies. Please see section LED Connector 15 for pin out details.
3. **Attention** **Switch the rotary control knob to the position | prior to connecting the power supply. In position |, the LEDD1B is turned off and prevents immediate powering of the LED when the power supply is connected to the network outlet.**

   Warning

   Immediate powering up the LED with the LEDD1B rotary knob not in the | position may cause bodily harm if strong LED light hits an eye or may destroy the LED due to excess current.

4. Make sure that the line voltage set below the DC connector corresponds to the input voltage range of the power supply.
5. Connect the LEDD1B to one of the recommenced power supplies 5, using the DC connector on the bottom left in the rear panel of the housing (see image below). The power supply can be connected via the connector on the bottom using the T-Cube Controller USB Hub and Power Supply (KCH301 or KCH601). To access the connector on the bottom, please remove the base plate 7.

Rear Panel Connections

6. Set the Current Limit 10 to a level appropriate for the attached LED.
7. **Warning** Please follow the Warning and Safety instructions for the attached LED.
8. Switch on the LEDD1B LED Driver by turning the rotary control knob on top of the LEDD1B in the clockwise direction until the LED reaches the desired intensity.
9. See chapter Top Panel Controls 9 of this manual, for operation instruction.

Signal Modulation

To modulate the signal, the standard BNC connector allows to apply an externally generated signal (0 to 5V) to the unit (center pin: V+, housing: Ground). This provides an external control of the LED device. For example, a pulse modulation signal to strobe the LED could be connected. Please see the chapter Trigger Mode 10 and Modulation Mode 11 for more information.

2.4 Switch Off

To switch off the LEDD1B, turn the rotary control knob to position |.

Switching Off the LEDD1B while Maintaining the Current Setting

It is often desired to switch off an LED without changes to the current directed towards the LED.

In this case, the user may utilize the MODE switch on top of the device as long as no signal is applied to the BNC connector. Switching the Mode to TRIG will turn off the LED. Return to CW turns the LED on again without change to the current.

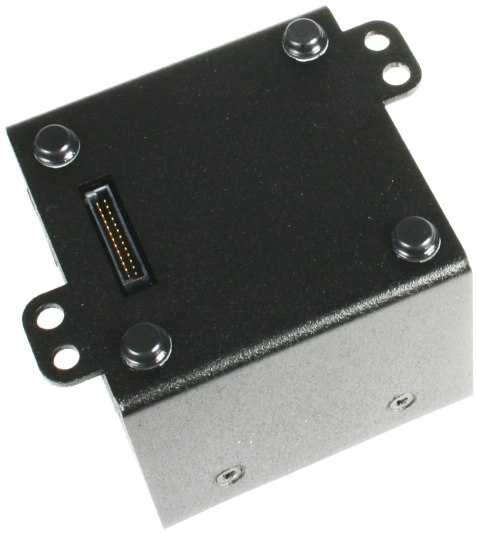
Warning

When using the Mode switch to turn the LED off or on, make sure the LED points away from any person and meets the Warning and Safety requirements as stated in the respective documentation.

2.5 Removing the Base Plate

In order to fit the rubber feet (supplied) or in case the unit is to be connected to the USB controller hub, the base plate must be removed. Remove the bolts securing the unit to the base plate using a hexagon key. Retain the bolts for future use if the base plate is refitted.

1. Turn the unit upside down.



Fitting rubber feet

2. Remove the backing paper from the rubber feet taking care not to touch the exposed adhesive surface.
3. Position the feet as desired, then press and hold for a few seconds until the adhesive has bonded.
4. The unit may now be used freestanding, sitting on its rubber feet.

3 Operating Instruction

3.1 Top Panel Controls

Operating Elements on the Top Panel

MODE Switch

This switch is used to select between CW, Trigger, and Modulation modes.

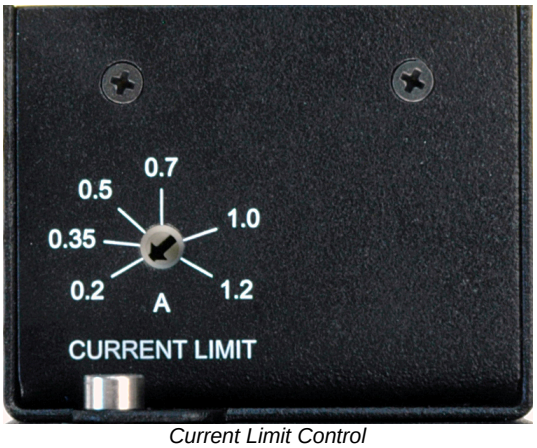
CW Mode:
The CW (continuous wave) mode provides a constant unmodulated LED current. The LED brightness can be adjusted using the rotary control knob. This mode is ideal for imaging with CCD cameras or photodiodes.

Trigger Mode "TRIG":
In Trigger Mode the brightness of the LED can be adjusted using the control knob. An externally applied TTL signal has to be used to switch the LED current on and off. A high level will enable the LED current and a low level will switch the LED current off.
This mode can be used to capture images with a CCD camera on a microscope automatically. First the brightness can be set manually. Then switch to the Trigger mode and a computer controlled TTL signal switches the LED on for a predefined period of time, while the camera is triggered to take pictures.
Furthermore this Trigger mode can be used to drive the LED in Pulse Width Modulation (PWM).

Modulation Mode "MOD":
In Modulation Mode the LED is controlled completely by an external voltage. 0V corresponds to off and 5V represents maximum LED current. All values in between correspond to the according LED current.
The LED current can be arbitrary modulated, i.e. sine wave modulation.

Rotary Control Knob
The rotary control know is used to switch on the unit (from | to 0), and to adjust the intensity of the associated LED when operating in CW mode.

3.2 Current Limit Control



Current Limit Control

The LEDD1B features an LED current limit control. A potentiometer accessible on the front is used to adjust the current limit. The limit can be set in the range from 200mA up to 1200mA. In CW and Trigger mode the adjustment range of the rotary control knob on the top side is automatically adapted. The maximum value always corresponds to the adjusted limit. Therefore, the complete tuning range of the rotary control knob can be used for any limit set value. In Modulation mode, the current limit equals the LED current for maximum input voltage of 5V. This way the entire tuning range from 0 to 5 V can be used.

3.3 CW Mode

1. Move the Mode switch to select the CW mode.
2. Turn the rotary control knob clockwise to increase the LED brightness.
3. Turn the rotary control knob counterclockwise to decrease the LED brightness.
4. Turn the rotary control knob fully counterclockwise beyond 0 to | to turn the unit OFF.

3.4 Trigger Mode

1. Select the CW Mode with the Mode Switch.
2. Turn the control knob clockwise to 0 turn ON the unit.
3. Adjust the brightness of the LED by turning the rotary control knob.
4. Connect an external voltage source to the MOD IN connector (center pin: +V, housing: Ground).
5. Set the output voltage to 0V and switch on the voltage source.
6. Move the Mode switch to select the TRIG Mode.
7. The LED is now off.
8. Set the output voltage to a TTL High signal.
9. The LED is set to the manually adjusted brightness. If the control knob is moved the brightness will change.
10. If a pulsed signal is applied, the LED is switched on and off like a strobe effect.
11. Turn off the external voltage source.
12. Turn the control knob fully counterclockwise to turn off the unit OFF.

3.5 Modulation Mode

1. Move the Mode switch to select the MOD Mode.
2. Turn the rotary control knob clockwise to switch ON the unit.
3. With no external voltage source connected, the LED is off.
4. Connect an external voltage source to the MOD IN connector (center pin: +V, casing: Ground).
5. Set the output voltage to 0V and switch on the voltage source.
6. The LED is switched off.
7. Increase the voltage from 0 to 5V and notice how the LED brightness increases accordingly.
8. If a modulated signal is applied, the LED is modulated accordingly.
9. Turn off the external voltage source.
10. Turn the control knob fully counterclockwise to turn the unit OFF.

4 Maintenance and Service

Protect the LEDD1B from adverse weather conditions. The LEDD1B 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 a 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 first refer to Troubleshooting 12. If you cannot resolve the issue by yourself, please contact Thorlabs 21 for return instructions.

4.1 Troubleshooting

Warning

Do not apply a negative voltage or a voltage greater than 5V to the MOD IN connector!

Attention

Set the limit current appropriate for the supplied LED specifications. The LEDD1B driver was designed for operation of LEDs which can handle forward currents of up to 1200mA. Use of LEDs with a forward current lower than 200mA could result in damage to the LED. Use of LEDs with a current rating in between 200mA and 1200mA could result in damage to the LED if the limit current of the LEDD1B is not set properly.

If you split the output current among several LEDs, damage can result if individual LEDs can not handle the set limit current of the LEDD1B. In such an application use of proper current balancing is necessary.

Take care not to reverse connect LEDs. LEDs with a reverse voltage rating than 15V may be destroyed.

LED does not illuminate

- Turning the control knob does not drive a current through the LED.
  → Move the Mode switch to 'CW' mode.
- In Trigger or Modulation mode an applied external voltage does not drive a current through the LED.
  → Move the control knob from Off position to an On position.
- General
  → Check if a power supply is connected to the LEDD1B.

LED brightness does not increase while turning the control knob clockwise or while increasing analog input voltage

- The LEDD1B has a compliance voltage of 11V min / 12V (typ) if loaded. If this voltage is reached the internal circuit will limit both the LED voltage and LED current to prevent damage. Unloaded the LEDD1B may output voltages up to 14V.
  → A LED with a forward voltage higher than 11V cannot be operated with the LEDD1B. If using a LED string, take care that the overall forward voltage does not exceed 11V. You may also connect LEDs or LED strings in parallel. In this case proper current balancing of the LED´s / LED-Strings is recommended

The brightness of the LED is too small.

- The LEDD1B features a current limit. If for example the limit is set to 350mA no more than this limit can be driven through the LED.

  → Check the current limit and adjust it if necessary.

- The maximum current of the LEDD1B is 1200mA.

  → The LEDD1B cannot drive a higher current than 1200mA through a LED. If using several LEDs parallel, connect them in series.

5 Appendix

5.1 Technical Data

Specification	
LED Current Range	0 ... 1200 mA
LED Current Limit Range	200 ... 1200 mA
LED Forward Voltage	min. 11 V; typ. 12 V
Current Ripple	8 mA
Current Ripple Frequency	570 kHz
Modulation Input Impedance	10 kΩ
Modulation Mode [2) 3)]	
Modulation Frequency Range	typ. 0 ... 5 kHz (Sine Wave)
Modulation Form	Arbitrary
Input Voltage Range	0 ... 5 V
Zero Set Point Offset	10 ... 40 mV; typ. 24 mV
Slew Rate	13.6 mA/µs
Decay Rate	13.1 mA/µs
Trigger Mode [2)]	
Modulation Frequency Range	0 ... 1 kHz
Duty Cycle Range	20 ... 80 % @ 1 kHz 2 ... 98 % @ 100 Hz 0.2 ... 99.8 % @ 10 Hz
Modulation Form	Square Wave / PWM
Logic Input levels	TTL (Min H-Level: 2 V; Max L-Level: 0.55 V)
Slew Rate	18 mA/µs
Rise Time (10% -> 90%)	51 µs
Turn-on Dead Time	57 µs
Decay Rate	12 mA/µs
Fall Time (90% -> 10%)	79 µs
Turn-off Dead Time	14 µs
Power Supply	
Line Voltage (Ext. Power Supply)	100 ... 240 VAC (-10 %, +10 %)
Line Frequency (Ext. Power Supply)	50 ... 60 Hz
Supply mains over Voltage	Category II (Cat II)
Input Voltage (LEDD1B chassis)	15 V DC
Power Consumption (max)	15 VA

General	
Operating Temperature Range 1)	0 - 40 °C
Storage Temperature Range	-40 to 70 °C
Relative Humidity	Max. 80% up to 31 °C decreasing to 50% at 40 °C
Pollution Degree (indoor use only)	2
Operation Altitude	< 3000 m
Dimensions (W x H x D) - without operating elements - with operating elements and baseplate	 60 x 47 x 60 mm³ 60 x 73 x 104 mm³
Weight	240 g

[1]) non-condensing

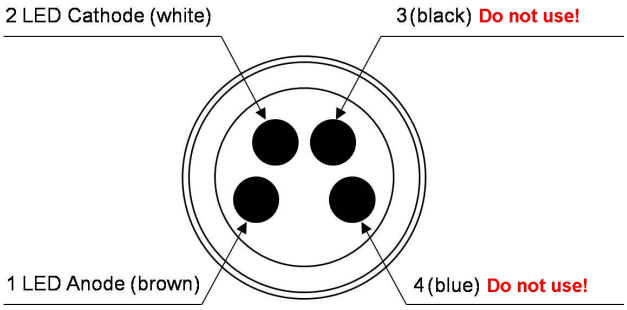
[2]) Specifications for the modulation and trigger modes depend on the forward voltage and capacitance of the connected LED.

[3]) Specifications are valid for a current limit of 1.2 A.

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

5.2 LED Connector

A custom LED connection cable (one end open) is supplied with each T-Cube LED driver. The figure below shows the pin-out of the male connector of this CAB-LEDD1. It is a standard M8x1 sensor connector. Pin 1 and 2 are the connections to the LED. Pin 3 and 4 must not be connected.



Male Connector of the CAB-LEDD1

5.3 Application Note

This chapter contains background knowledge about the LED driver and pulse width modulation.

5.3.1 LED Driver

An LED driver is a circuit that can produce a current which is sufficient for light emission through a LED.

There are many ways to design such a circuit. In principle, voltage provided by a source is, following a series resistor, provided to the LED. This leads of course to a waste of energy and does not meet most requirements, particularly for high power LEDs. Thus, the designs are rather as described in the following:

There are three main categories of LED drivers;

1. Linear LED drivers
2. Switching LED drivers
3. Combination of linear and switching LED drivers

Linear LED Driver

A linear voltage driver can be used to generate a constant current. A shunt is in series with the load (LED). The voltage drop across the shunt is proportional to the current and used as a feedback signal to adjust the output voltage and therefore the current.

The main advantages are the low output current ripple and its EMC compatibility. There are no switching elements in the circuit. For this reason it is advantageous for fluorescence microscopy illumination. Thorlabs DC4100 LED drivers use this principle of operation.

The disadvantage is the low efficiency of the linear current control: linear regulators waste energy as they operate by dissipating excess power as heat. This loss depends on LED type and current.

Switching LED Drivers

A switching LED driver with a constant current output is an efficient way to drive especially high power LEDs.

The operating principle is based on an inductor in series with an LED load or a capacitor parallel to an LED load. These reactants accumulate energy during the switch-on state, which is used to supply a current through the LED.

Further, two types of switching converters exist: The Buck driver is a step-down DC-to-DC converter, which converts a relatively high supply voltage into the lower LED forward voltage, while the Boost driver is a step-up power converter with an DC output voltage greater than its input DC voltage. It is also possible to combine both methods to a Buck-Boost solution.

The main advantage of switching power supplies is their high efficiency of up to 95%: the dissipated heat power loss is much smaller. The disadvantage results from the switching mode operation - a switching driver shows a ripple on the output current of up to 20%. This ripple amplitude in conjunction with the switching operation requires careful considerations under point of electromagnetic emissions and interferences (EMC).

Particularly the ripple on the output current might be a disadvantage for a number of microscopy LED illumination applications.

The Thorlabs LEDD1B is a switching driver.

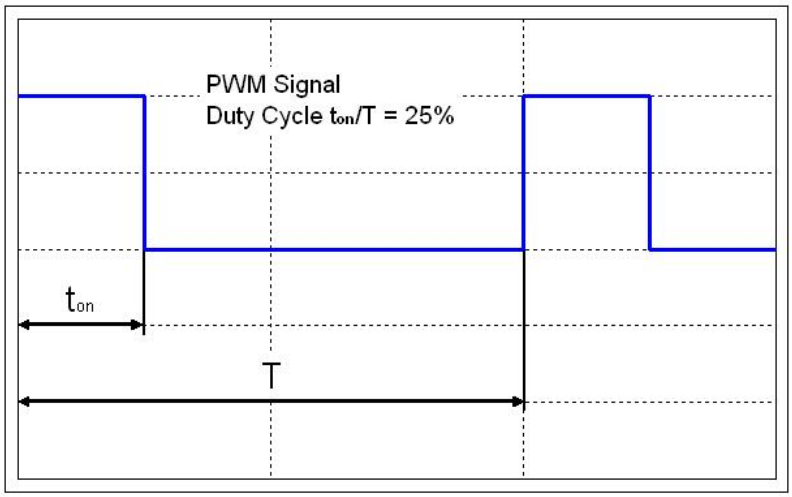
Combination of Linear and Switching LED Drivers

This method combines the advantages of both principles. A switching driver is used to adjust the supply voltage to a value close to the LED forward bias. It is followed by a linear driver, generating constant current with low ripple. In such a design the heat dissipation is reduced to a minimum. Thorlabs DC2200 LED Driver is based on this approach.

The disadvantage of this method is the use of more, often expensive components and the requirement for more space than conventional constant current linear or switching drivers.

5.3.2 Pulse Width Modulation

The change of the duty cycle of a pulse train, having a constant amplitude and pulse frequency, is called Pulse Width Modulation. The magnitude of the parameter (e.g. electrical current) is switched between two values. The duty cycle is varied (modulated) while maintaining a constant frequency. The demodulation is usually done by a low pass filter.



Pulse Width Modulation

When an LED is pulse-width modulated, the amplitude I_{max} of the current is constant, while the ratio of "On"-time (t_{on}) to "Cycle"-time (period T of the pulse train) is varying. The ratio t_{on}/T is known as "duty cycle". By varying the duty cycle, the brightness of the LED can be changed. It corresponds to the arithmetic mean current value.

5.4 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):

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

hereby declare that:

Model: ***LEDD1B***

Equipment: ***T-Cube LED Driver***

is in conformity with the applicable requirements of the following documents:

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:* 19 November 2019

Name: Bruno Gross

Position: General Manager

EDC - LEDD1B -2019-11-19

CE

5.5 Manufacturere 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

UK-Importer Address
Thorlabs, LTD.
204 Lancaster Way Business Park
Ely, CB6 3NX
UK
Tel: +44-1353-654440
Fax: +44 (0)1353-654444
www.thorlabs.com
Email:
techsupport.uk@thorlabs.com

5.6 Warranty and RMA Information

Thorlabs warrants material and production of the LEDD1B 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

and

https://www.thorlabs.com/images/PDF/Terms%20and%20Conditions%20of%20Sales_Thorlabs-GmbH_English.pdf

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 Copyright and Exclusion of Liability

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.

Please refer to the general terms and conditions linked under Warranty 19.

5.9 List of Acronyms

The following acronyms and abbreviations are used in this manual:

AC	Alternating Current
AGND	Analog Ground
CCD	Charge Coupled Device
CW	Continuous Wave
DC	Direct Current
DGND	Digital Ground
EMC	Electromagnetic Compatibility
FCC	Federal Communications Commission
HBLED	High Brightness LED
IEC	International Electrotechnical Commission
LED	Light Emitting Diode
PCB	Printed Circuit Board
PSU	Power Supply Unit
USB	Universal Serial Bus
WEEE	Waste Electrical and Electronic Equipment Directive

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
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 dissembled 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.

THORLABS

www.thorlabs.com