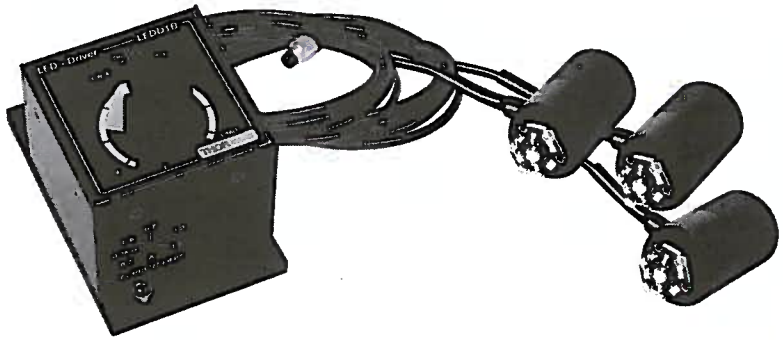
THORLABS

T-Cube LED Driver

LEDD1B
Operation Manual



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Contents

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 improve our products permanently 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 preceeded 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 these advices carefully!

1 General Information

The T-Cube Series LED Driver is a very compact, single channel controller for easy control of the LED intensity. The LEDD1B delivers a max output current of 1200mA. It is designed for use with the Thorlabs collimated and mounted high power LED packages. The connected LED is controlled by one of 3 selectable modes: continuous, modulation or trigger mode.

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

When operating in modulation mode, an external control signals modulates the LED current and subsequently the brightness

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 footprint of the unit has been kept small (60 mm x 60 mm or 2.4" x 2.4"), the included adapter plate allows to mount the LEDD1B to mount it directly to an optical table or breadboard. The controls for LED current and operating mode are located on top.

The LED current limit control is placed on the front side of the driver. A screwdriver (included in the package) is necessary to adjust the LED current limit in the range between 200mA and 1200mA.

LEDD1B T-Cube LED Driver with M455L2-C1 Collimator Assembly

The LEDD1B can be powered using either a TPS001 power supply or the TCH002 T-Cube Hub and Power Supply. The TPS001, which powers a single T-Cube, plugs into a standard wall outlet and provides +15 VDC. The TCH002 Hub and Power Supply consists of two parts: the hub, which can support up to six standard-footprint T-cubes, and a power supply that plugs into a standard wall outlet and powers the hub, which in turn powers all the T-cubes connected to the hub.

Also, the compact 8-way TPS008 power supply unit is available from Thorlabs to power up to 8 LEDD1B or other T-Cube Drivers from a single mains outlet. This power supply unit is also designed to take up minimal space and can be mounted on the optical table in close proximity to the driver units, connected via short power leads.

1.1 Safety

Attention

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.

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!

The LEDD1B must not be operated in explosion endangered environments!

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

Do not remove covers!

Refer servicing to qualified personal!

This precision device is only dispatchable if duly packed into the complete original packaging including the plastic form parts. If necessary, ask for a replacement package.

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).

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

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.

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

When Thorlabs high power 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 High Power LED's are used in other applications, they should be used in accordance with CEI IEC 62471.

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 accompanying documentation.

Note: This equipment has been tested and found to comply with the limits for a Class B 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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- **Reorient or relocate the receiving antenna.**
- **Increase the separation between the equipment and receiver.**
- **Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.**
- **Consult the dealer or an experienced radio/T.V. technician for help.**

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.

1.2 Ordering Codes and Accessories

Ordering code	Short description
LEDD1B	T-Cube LED Driver
TCH002	T-Cube Controller USB Hub and Power Supply
TPS001	Single Way Power Supply
TPS008	8-way Power Supply
MxxxL2	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
CAB-LEDD1	LED cable (one end without connector)

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

1.3 T-Cube Controller Hub

The TCH002 T-Cube controller hub product has been designed specifically for operation of multiple T-Cubes in order to simplify cable management, power supply routing, multiple USB device communications and different optical table mounting capabilities.

The T-Cube Controller Hub comprises a slim base-plate type carrier (375mm x 86mm x 21.5mm, 14.75" x 3.4" x 0.85") with electrical connections located on the upper surface to accept up to six T-Cubes.

Note

The LEDD1B LED Driver is a manually operated unit with no USB functionality. However if it is used on the TCH002, USB communications can be employed for any other T-Cube in the hub.

Internally the Controller Hub contains a fully compliant USB 2.0 hub circuit to provide communications for all six T-Cubes. A single USB connection to the Controller Hub is all that is required for PC control. The Controller Hub also provides power distribution for up to six T-Cubes, requiring only a single power connection (from a separate supply unit TPS006 supplied by Thorlabs).

Warning

Do not plug an already powered up T-Cube into the TCH002 USB controller hub. Always ensure that all power supplies are disconnected from the LED Driver T-Cube AND the hub before the T-Cube is plugged into the hub. Failure to observe this precaution will seriously damage the T-Cube unit and could result in personal injury.

2 Installation

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:

- LEDD1B mounted on base plate - 1 pcs.
- CAB-LEDD1 (LED cable, one end without connector) - 1 pcs.
- Operation manual - 1 pcs.
- Screwdriver for adjusting the current limit - 1pcs.

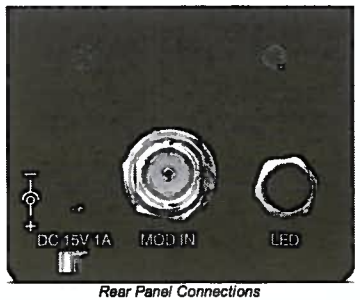
2.2 Getting Started

1. Connect LED head cable to the socket labeled "LED" at the back of the LEDD1B, see figure below.
2. Perform the mechanical installation as detailed in section Mounting Options 8.

Attention

Prior to connect the power supply unit, make sure it's ***not connected*** to mains power and that the line voltage corresponds to the input voltage range of the power supply! Always power up the T-Cube unit by connecting its power supply to the mains. DO NOT connect the T-Cube unit to an already powered external power supply. Doing so (i.e. "hot plugging") carries the risk of PERMANENT damage to the unit. Similarly, to power down the unit, disconnect the power supply from the mains before disconnecting the T-Cube unit.

3. Connect the LEDD1B to the power supply. All electrical connections can be accessed via the rear panel. Furthermore, the power supply can be connected via the connector on the bottom using the T-Cube Controller USB Hub and Power Supply (TCH002) or 8-way Power Supply (TPS008).



Rear Panel Connections

The LED device is connected via the M8 4-pin connector, which is compatible with all Thorlabs light generating LED assemblies - see Section LED Connector 19 for pin out details.
A 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.

A single way power supply (TPS001) can be used to power the LEDD1B. .

4. Connect the PSU to the main supply, switch it 'ON' (not TPS001).
5. Your T-Cube LED driver is now ready for use. Turn the unit on by turning the control knob clockwise.
   See chapter Top Panel Controls 9 of this manual, for a brief tutorial on operation of the unit.

2.3 Mounting Options

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

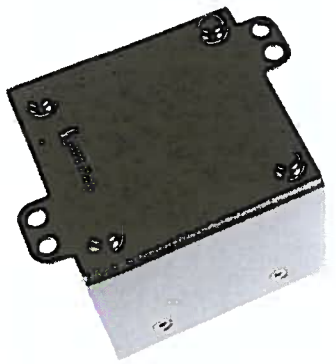
If desired, the base plate can be removed and the unit can be stood on rubber feet - see Section Removing the Base plate 8.

For multiple cube systems, a USB controller hub (TCH002) is available - see Section T-Cube Controller Hub 6 for further details. Full instructions on the fitting and use of the controller hub are contained in the manual *ha0146 T-Cube Controller Hub*, shipped with the TCH002.

2.4 Removing the Baseplate

In order to fit the rubber feet (supplied) or the unit shall 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.

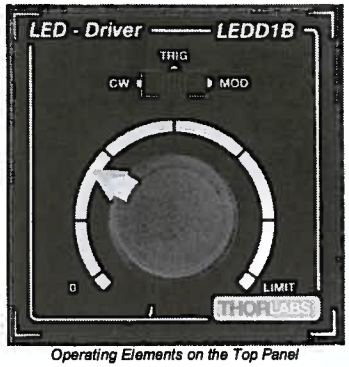


Fitting rubber feet

2. Remove the backing paper from the rubber feet (supplied) 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 - Used to switch between CW, Trigger and Modulation modes.

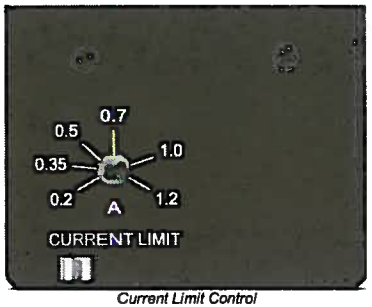
CW Mode:
The CW (continuous wave) mode provides a constant non-modulated LED current. The LED brightness can be adjusted using the control knob. This mode is ideal for imaging with CCD cameras or photodiodes.

Trigger Mode "TRIG":
In Trigger Mode the brightness of the LED can be adjusted using the control knob, and 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.

Control Knob
Used to switch on the unit, 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 a LED current limit control. A potentiometer accessible on the front surface 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 control knob on the top side is automatically adapted. The maximum value corresponds always to the adjusted limit. Therefore, the complete tuning range of the 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 5V can be used.

3.3 CW Mode

1. Move the Mode switch to select the CW mode.
2. Turn the control knob clockwise, the LED brightness increases.
3. Turn the control knob counterclockwise, the LED brightness decreases.
4. Turn the control knob fully counterclockwise to turn the unit OFF.

3.4 Trigger Mode

1. Move the Mode switch to select the CW Mode.
2. Turn the control knob clockwise to switch ON the unit.
3. Adjust the brightness of the LED by turning the 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 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 20 for return instructions.

Do not remove covers!

4.1 Troubleshooting

Warning

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

The LEDD1B driver was designed for operation of high brightness 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 otherwise.

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)]	
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.

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

5.2 Certifications and Compliances

Category	Standards or description	
EC Declaration of Conformity - EMC	Meets intent of Directive 2004/108/EC [1] for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 61326-1:2006	Electrical equipment for measurement, control and laboratory use – EMC requirements: Immunity: complies with basic immunity test requirements [2,3]. Emission: complies with EN 55011 Class B Limits [2,3,4], IEC 610003-2 and IEC 61000-3-3.
	IEC 61000-4-2	Electrostatic Discharge Immunity (Performance Criterion B)
	IEC 61000-4-3	Radiated RF Electromagnetic Field Immunity (Performance Criterion A) [5]
	IEC 61000-4-4	Electrical Fast Transient / Burst Immunity (Performance Criterion B)
	IEC 61000-4-6	Conducted RF Immunity (Performance Criterion A)
FCC EMC Compliance	Emissions comply with the Class B Limits of FCC Code of Federal Regulations 47, Part 15, Subpart B [2,3,4].	
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 2006/95/EC [7]	
	EN 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1: General Requirements
U.S. Nationally Recognized Testing Laboratory Listing	UL 61010-1 2nd ed.	
	ISA-82:02.01 2nd ed.	
Canadian Certification	CAN/CSA C22.2 No. 61010-1 2nd ed.	
Additional Compliance	IEC 61010-1:2001	
Equipment Type	Test and Measuring	
Safety Class	Class I equipment (as defined in IEC 60950-1:2001)	

[1] Replaces 89/336/EEC.

[2] Compliance demonstrated using high-quality shielded interface cables shorter than or equal to 3 meters.

[3] Compliance demonstrated with MxxxLx series installed at the LED port.

[4] Emissions, which exceed the levels required by these standards, may occur when this equipment is connected to a test object.

[5] Ext Trig port capped at IEC 61000-4-3 test.

[6] Performance Criterion C was reached at voltage interruptions test level 0% for 250 / 300 cycles and is permitted at this test level.

[7] Replaces 73/23/EEC, amended by 93/68/EEC

5.3 Application Note

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

5.3.1 LED Driver

A simple definition of a LED driver:

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

There are many ways to make such a circuit. A simple solution would be a voltage source, a series resistor and the LED. This leads of course to a waste of energy and won't meet most requirements, particularly for high power LEDs.

LED drivers which can be divided in three categories:

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

Linear 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 DC3100 and 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 Drivers

A switching 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 a LED load or a capacitor parallel to a LED load. These reactances 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 it's 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%; so the dissipated as heat power loss is much less. The disadvantage is resulting 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 LEDD1B is a switching driver.

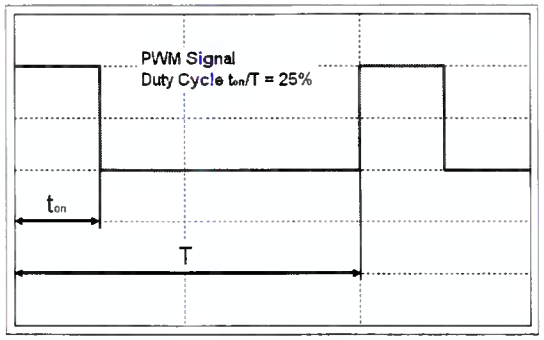
Combination of Linear and Switching Drivers

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 DC2100 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 done usually by a low pass filter.

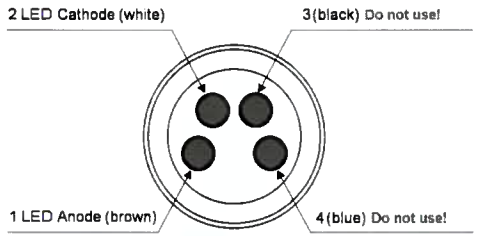


Pulse Width Modulation

When a 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 know as "duty cycle". By varying the duty cycle, the brightness of the LED can be changed, it corresponds to the arithmetic mean current value.

5.3.3 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

5.4 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

5.5 Thorlabs Worldwide Contacts

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Thorlabs 'End of Life' Policy (WEEE)

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see figure below)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated.

As the WEEE directive applies to self contained operational electrical and electronic products, this "end of life" take back service does not refer to other Thorlabs products, such as:

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

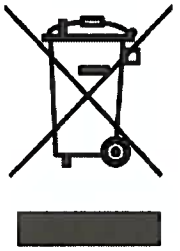
Waste treatment on your own responsibility

If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

WEEE Number (Germany) : DE97581288

Ecological background

It is well known that waste treatment 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.



Crossed out "Wheelie Bin" symbol

Warranty

Thorlabs warrants material and production of the LEDD1B 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 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.

Restiction 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.

Copyright

Thorlabs GmbH has taken every possible care in preparing this Operation Manual. We however assume no liability for the content, completeness or quality of the information contained therein. The content of this manual is regularly updated and adapted to reflect the current status of the software. We furthermore do not guarantee that this product will function without errors, even if the stated specifications are adhered to.
Under no circumstances can we guarantee that a particular objective can be achieved with the purchase of this product.
Insofar as permitted under statutory regulations, we assume no liability for direct damage, indirect damage or damages suffered by third parties resulting from the purchase of this product. In no event shall any liability exceed the purchase price of the product.
Please note that the content of this User Manual is neither part of any previous or existing agreement, promise, representation or legal relationship, nor an alteration or amendment thereof. All obligations of Thorlabs GmbH result from the respective contract of sale, which also includes the complete and exclusively applicable warranty regulations. These contractual warranty regulations are neither extended nor limited by the information contained in this User Manual. Should you require further information on this product, or encounter specific problems that are not discussed in sufficient detail in the User Manual, please contact your local Thorlabs dealer or system installer.

Status: 2012