



4 Channel LED Driver

DC4104 Operation Manual



2022

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Contents

Foreword

1	General Information	1
1.1	Ordering Codes and Accessories	1
1.2	Supported Thorlabs LEDs	2
1.3	Requirements	2
1.3.1	Hardware Requirements	2
1.3.2	Software Requirements	2
2	Getting Started	3
2.1	Parts List	3
2.2	Preparation	3
3	Operating Instructions	4
3.1	Operating Elements	5
3.2	Operation Modes	5
3.2.1	Constant Current Mode	5
3.2.2	Brightness Mode	6
3.2.3	External Control Mode	8
3.3	Settings and Configuration	9
3.3.1	User Limit	9
3.3.2	Settings	10
3.3.3	About	11
4	Computer Interface	12
4.1	Software Installation	12
4.2	Firmware Update	13
4.3	Driver Installation	14
4.4	Operating the DC4100 Series remotely	14
4.4.1	Connecting a Device	14
4.4.2	Constant Current Mode	15
4.4.3	Brightness Mode	16
4.4.4	External Control Mode	17
4.4.5	User Limit Current	17
4.4.6	Device Information	18
4.4.7	Help Menu	19
5	Maintenance and Service	20
5.1	Version Information	20
5.2	Troubleshooting	20
6	Appendix	22
6.1	Technical Data	22
6.2	Trigger Input Cable	23

6.3 Dimensions	24
6.4 Command Reference	25
6.4.1 Set User Current Limit	26
6.4.2 Get User Current Limit	26
6.4.3 Set Maximum Current Limit	26
6.4.4 Get Maximum Current Limit	26
6.4.5 Set Operation Mode	26
6.4.6 Get Operation Mode	26
6.4.7 Set Selection Mode	27
6.4.8 Get Selection Mode	27
6.4.9 Set LED OnOff	27
6.4.10 Get LED OnOff	27
6.4.11 Set Constant Current	27
6.4.12 Get Constant Current	27
6.4.13 Set Percental Brightness	28
6.4.14 Get Percental Brightness	28
6.4.15 Set Display Brightness	28
6.4.16 Get Display Brightness	28
6.4.17 Get Status Register	28
6.4.18 Error Message	28
6.4.19 Identification Query	29
6.4.20 Revision Query	29
6.4.21 LED Head Identification Query	29
6.4.22 Get Wavelength	29
6.4.23 Get Forward Bias	29
6.4.24 Status Reporting	30
6.5 Safety	31
6.6 Return of Devices	32
6.7 Manufacturer Address	32
6.8 Warranty	32
6.9 Copyright and Exclusion of Liability	32
6.10 Certifications and Compliances	33
6.11 List of Acronyms	34
6.12 Thorlabs Worldwide Contacts	35

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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

Thorlabs' DC4104 four-channel LED controller is designed for microscopy and other applications that require multiple color channels. It is the ideal driver for the [LED4D](#) series of four-wavelength LED sources. Via the optional [DC4100-HUB](#), it can concurrently drive 4 LEDs like the Thorlabs [collimated or uncollimated mounted LEDs](#)^[2]. Using the DC4100-HUB connector hub and 4 CAB-LEDD1 connection cables, the driver can also be used with 4 Thorlabs LEDs on metal-core PCB or with 4 user-supplied LEDs. The LED current of each channel can be adjusted independently from 0 to 1000 mA or modulated via an external voltage.

The DC4104 can be operated in constant current mode (setting the LED current in mA), brightness mode (setting the LED as a percentage of its maximum current) or external control mode, applying modulation through an external signal generator.

Additionally, the LED driver can be operated remotely via the USB 2.0 interface by the DC410x software package. The LED drivers are also compatible with [uManager](#), a versatile, open source, GUI software platform for automated microscopy. A plugin allows the user to control the LED drivers right out of the box.

The DC4104 controls each LED by a separate modulation signal, all of which are also provided through a single, included modulation cable for external modulation. The controller accepts voltages ranging from 0 to 10 V, with 1 V corresponding to an LED current of 100 mA.

1.1 Ordering Codes and Accessories

DC4104 4 Channel LED Driver for Thorlabs [LED4D Series four-wavelength LED Sources](#) with 12V Power Supply and USB 2.0 Cable. Individual Modulation of up to 4 Activated LEDs with the Included Modulation Cable. Driver for Individual [Supported LEDs](#)^[2] Using the DC4100-HUB.

Optional Accessories:

LED4Dxxx	4-Wavelength High-Power LED Source.
DC4100-HUB	Hub to Connect to DC4104 in Order to Control up to 4 Thorlabs Supported LEDs ^[2] with M8 x 1 Circular Connector.
PCB Mounted LEDs (MxxxDy)	These LEDs Require Attachment via an CAB-LEDD1 Cable to the DC4001-HUB, Connected to the DC4104.
Mounted LEDs (MxxxLy, MxxxLPy)	These LEDs Require Attachment to the DC4104 via the DC4001-HUB.
Fiber Coupled LEDs (MxxxFy, MxxxFPy)	These LEDs Require Attachment to the DC4104 via the DC4001-HUB.
Collimated LEDs (MxxxLy-Cz, MxxxLPy-Cz)	These LEDs Require Attachment to the DC4104 via the DC4001-HUB.

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

1.2 Supported Thorlabs LEDs

The following types of Thorlabs LEDs are compatible with the [DC4100-HUB](#), which can be attached to the DC4104:

- [PCB Mounted LEDs](#)

- MxxxDy

These LEDs require attachment via the CAB-LEDD1 cable.

- [Mounted LEDs](#)

- MxxxLy
- MxxxLPy

- [Fiber Coupled LEDs](#)

- MxxxFy
- MxxxFPy

- [Collimated LEDs](#)

- MxxxLy-Cz
- MxxxLPy-Cz

1.3 Requirements

1.3.1 Hardware Requirements

- Processor (CPU): 1 GHz or higher
- Memory (RAM): 256 MB
- Graphic Card with at least 32 MB memory
- Hard Drive: Min. 100 MB of available disk space
- Interface: Free USB 2.0 port

1.3.2 Software Requirements

The DC4104 software is compatible with the following operating systems:

- Windows® XP (32-bit) SP3
- Windows® Vista (32-bit, 64-bit)
- Windows® 7 (32-bit, 64-bit)
- Windows® 10 (32-bit, 64-bit)

For operation of the DC4104, also an NI-VISA™ (version 5.1.1 or higher) is required. This NI-VISA™ engine comes with the installation package in the download, but can also be downloaded also from National Instruments' website www.ni.com.

2 Getting Started

2.1 Parts List

Please inspect the shipping container for damage. Please do not cut through the cardboard, as the box might be needed for storage or returns.

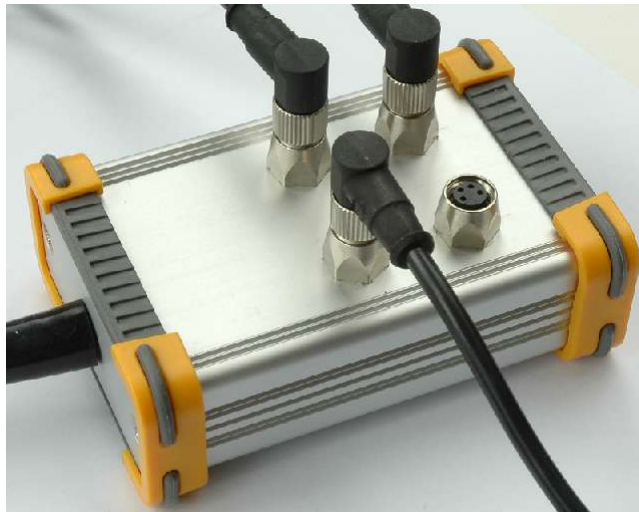
If the shipping container appears to be damaged, keep it until you have inspected the contents for completeness and tested the DC4104 mechanically and electrically.

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

1. DC4104 LED Driver
2. Power Supply (12V / 5.5A)
3. Power Cord, Connector According to Ordering Country
4. USB 2.0 Cable
5. Trigger Cable with 8pin Push-Pull Female Connector and Open Wiring on the Other End
6. Quick Reference

2.2 Preparation

1. Connect the cable from the [LED4Dxxx](#) four-color light source to the socket labeled 'LED' at the back of the main control unit.
2. Alternatively, a [DC4100-HUB](#) can be connected to this socket. This allows to drive up to 4 of the [supported LEDs](#) via the standard Thorlabs LED connector. Please see the figure below. For PCB mounted LEDs, please use the [CAB-LEDD1](#) adapter cable.



3. Connect the power supply cable to the main control unit. Please use only the power supply which is included in the shipment of the DC4104 unit.
4. Plug in power supply.
5. Turn the unit on by pressing the power switch on the rear side of the unit.
6. After the device is powered up, the graphics display will show a 'Welcome' screen for a few seconds.
7. The rated accuracy of the DC4104 is reached after a warm-up period of approximately 10 minutes.

3 Operating Instructions

The DC4104 can be controlled directly on the device or remotely via the DC41xx software.

In the device, the DC4104 is controlled by three buttons and the multi-control knob on the front panel. Please see the chapter [Operating Elements](#). The two buttons below the graphics display have an Escape and Enter (OK) functionality. The 'LED' Button is used to switch LED(s) on or off. The multi-control is used to select the desired menu or to change the settings.

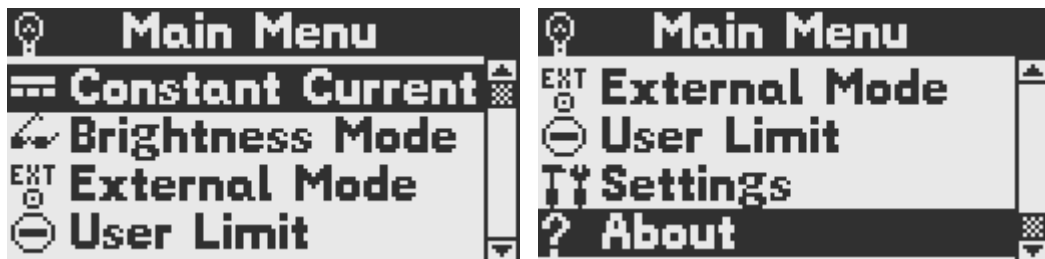
After switching on the DC4104 a 'Welcome' screen appears for a few seconds.



In case no LED head is connected you will be prompted to switch off the main unit, connect the LED head and switch on the device.

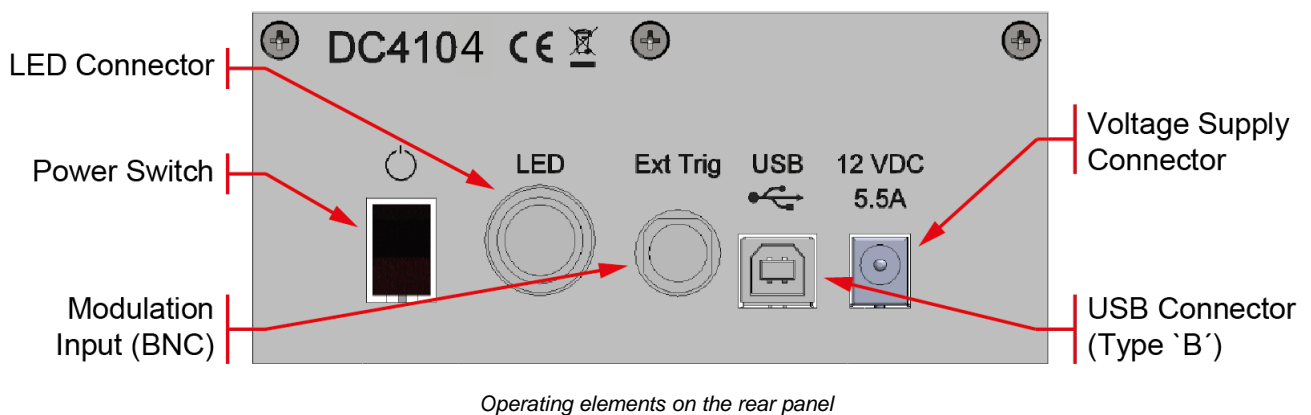
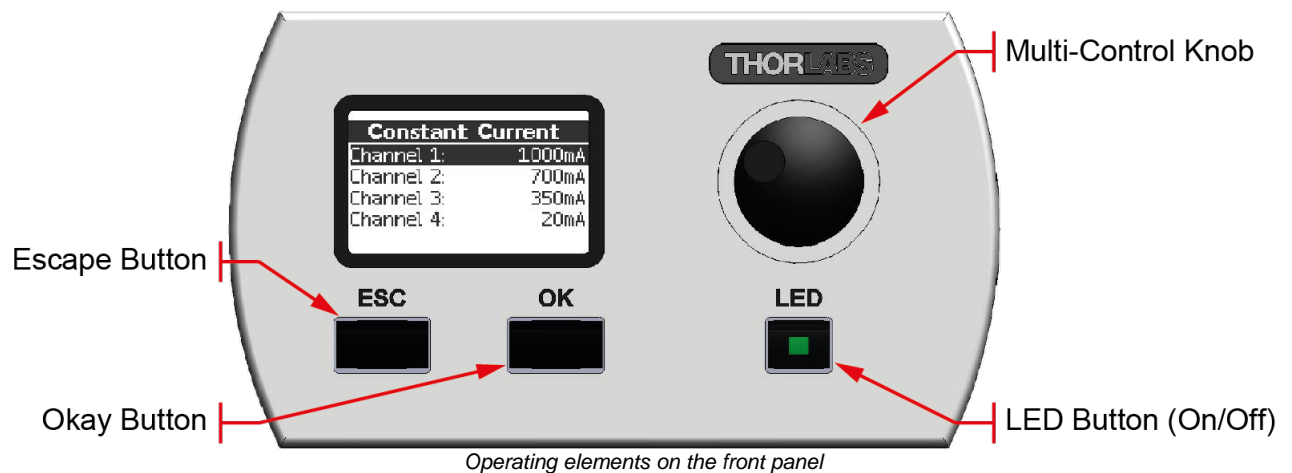


The display will show the screen of one of the three LED operation modes (Constant Current, Brightness or External Control Mode). The 'Main Menu' can be accessed via the 'ESC' button.



To select an operation mode or a configuration display the multi-control knob is used. Press the 'Ok' button to enter the selected item.

3.1 Operating Elements



3.2 Operation Modes

For safety reasons the LED can be switched on only if one of the three operation modes (Constant Current, Brightness or External Control) is selected.

It is possible to leave the active mode when the LED is switched on and enter the main menu. However, the LED needs to be switched off before you can enter another operation mode. This can be done while the main menu is selected by pressing the LED button.

The last selected operation mode will be saved. After switching on the DC4104 again this operation mode will be automatically restored. All settings are saved and validated after a shut off.

3.2.1 Constant Current Mode

The 'Constant Current Mode' provides a constant non-modulated LED current.

The actual current for each channel is displayed. If you connected a [supported Thorlabs LED](#) (features and EEPROM) or the 4 Color LED LED4Dx, the corresponding wavelength will be displayed instead of the channel number. There are two different output modes, 'Single Selection' and 'Multi Selection'. The output mode can be selected in the 'Setting' menu (see [Settings](#)).

The 'Multi Selection Mode' is illustrated by square indicators. More than one LED at a time can be switched on. This is indicated by the check mark in the square box.

The 'Single Selection Mode' features circles as output indicators, which are filled with a dot when the LED is on. Only one LED at a time can be switched on within this mode. This eases

quickly switching between two LEDs. It is not necessary to switch off a LED prior to switching on another LED.

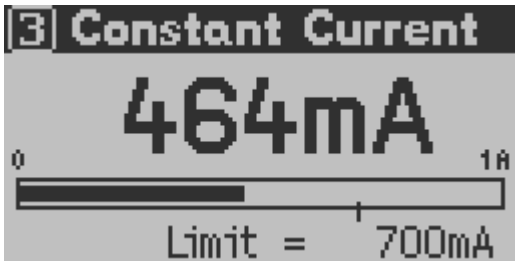
Select a channel with the multi-control knob and press the 'LED' button to switch the LED on or off, respectively. If you press and hold the 'LED' button for more than 3 seconds you will switch on all LEDs at once. To turn all LEDs off if they LEDs are switched on, press and hold the 'LED' button for more than 3 seconds.

If no LED is connected to a channel it will be marked with 'n/a'.

Constant Current			Constant Current		
627.0 nm:	<input checked="" type="checkbox"/>	20mA	Channel 1:	<input type="radio"/>	842mA
455.0 nm:	<input type="checkbox"/>	350mA	Channel 2:		n/a
590.0 nm:	<input checked="" type="checkbox"/>	700mA	365.0 nm:	<input checked="" type="radio"/>	409mA
530.0 nm:	<input type="checkbox"/>	1000mA	Channel 4:	<input type="radio"/>	344mA

In order to change the current applied to a connected LED channel, which changes the brightness, this channel needs to be selected using the multi-control knob and confirmed with the 'OK' button. A new screen appears and the current for the selected channel can be set directly using the multi-control knob. The change takes affect immediately. To confirm the adjusted current, press the 'OK' button. To cancel the set current, press the 'ESC' button. Both actions will return the user to the channel selection menu. The LED current can be changed when the LED is off as well as when it is in operation. This allows to increase or reduce the brightness of the LED. The current limit is displayed at the bottom of the screen. In the upper left corner the selected channel is displayed.

Return to the main menu with the 'ESC' button.



The faster the multi-control knob is turned, the greater is the adjustment ratio of the current. Move the knob slowly to set the current with a 1mA resolution. Move it faster and the resolution increases up to a 200mA resolution.

3.2.2 Brightness Mode

This mode can be used to apply a constant current in terms of percentage. This can be useful if two or more LEDs are superimposed. A maximum current can be defined, which corresponds to 100%. Each channel can be set individually or all channels can be set simultaneously.

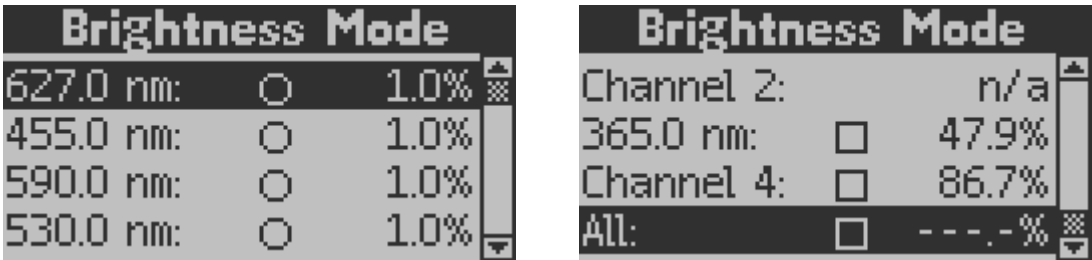
The actual brightness in percent for each channel is displayed. If a [supported Thorlabs LED](#)² with an internal EEPROM is connected via the DC4100-HUB, or if the 4 Color LED LED4Dx is connected, the corresponding wavelength will be displayed instead of the channel number. There are two different output modes: 'Single Selection' and 'Multi Selection'. The output mode can be selected in the 'Settings' menu (see [Settings](#))¹⁰.

The 'Multi Selection Mode' is illustrated by square indicators. More than one LED at a time can be switched on and is indicated by a check mark in the square box.

The 'Single Selection Mode' features circles as output indicators which are filled when the LED is on. Only one LED at a time can be switched on within this mode. This is convenient to quickly switch between two LEDs. It is not necessary to switch a LED off prior to switch on another LED.

Select a channel with the multi-control knob and press the 'LED' button to switch the LED on or off, respectively. Press and hold the 'LED' button for more than 3 seconds to switch on all LEDs at once. If all LEDs are already on you can switch them off using the same procedure.

If no LED is connected to a channel it will be marked with 'n/a'.

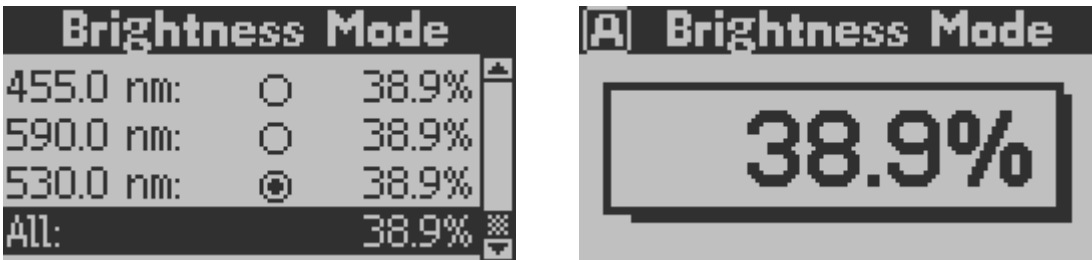


In order to change the brightness of a LED on a certain channel, this channel needs to be selected using the multi-control knob and confirmed with the 'OK' button. A new screen appears and the brightness of the selected channel can be set directly using the multi-control knob. The change takes affect immediately. To confirm the adjusted brightness, press the 'OK' button. To reject the set brightness, press the 'ESC' button. Both actions yield back to the channel selection menu. The LED brightness can be changed when the LED is off as well as when it is in operation. This allows to increase or reduce the brightness of the LED. The resulting current is displayed at the bottom of the screen. In the upper left corner the selected channel is displayed.

Return to the main menu by pressing the 'ESC' button.



Use the brightness mode to set the brightness of all channels simultaneously. Select 'All Channels' in the channel selection menu and confirm by 'OK' button. Now the brightness in percent can be set and will take affect immediately. The value in percent is the same for all channels. The adjusted brightness can be confirmed with 'OK' or rejected with 'ESC'. The display will return to the channel selection menu.




The current corresponding to 100% brightness is defined in the panel 'User Limit' or by the max current read from the EEPROM of a [supported Thorlabs LED](#)². Select 'User Limit' from the main menu to change this value.

The faster the multi-control knob is turned, the greater is the adjustment ratio of the brightness. Move the knob slowly to set the current with a 0.1% resolution. Move it faster and the resolution will increase up to a 20% resolution.

3.2.3 External Control Mode


Use the 'External Control Mode' to modulate/control the DC4104 by an signal from an external signal generator. To modulate LEDs via this mode, please connect a DC4104 with a signal generator via a the included Trigger Cable on the connector labeled 'Ext. Trig' on the DC4104. The appropriate LED channel must be enabled in the External Control Mode menu.

The 'External Control Mode' has no parameter settings. The LEDs can only be controlled via the Push-Pull connector at the rear panel of the DC4104. The applied voltage corresponds to the LED current where 1V is equivalent to an LED current of 100mA. A maximum voltage of 10V can be applied, which results in a current of 1000mA.

Note The maximum current is defined by the user in the ['User Limit'](#)  menu.

Ext. Control Mode		
627.0 nm:	<input checked="" type="checkbox"/>	1000mA
455.0 nm:	<input type="checkbox"/>	1000mA
590.0 nm:	<input checked="" type="checkbox"/>	700mA
530.0 nm:	<input type="checkbox"/>	1000mA

Ext. Control Mode		
Channel 1:	<input type="radio"/>	1000mA
Channel 2:		n/a
365.0 nm:	<input type="radio"/>	700mA
Channel 4:	<input type="radio"/>	1000mA

The modulation frequency range is 0 kHz to 100 kHz and valid for sine wave modulation. There are 4 separate inputs which will affect the corresponding channels. To enable or disable one or more LEDs select the corresponding LED by turning the multi-control knob and press the 'LED' button. Depending on the selected output mode only one LED or all 4 LEDs can be enabled. The output mode can be changed within the ['Settings'](#)  menu.

The 'Single Selection Mode' allows to enable only one LED at a time. It is indicated by a circle. If an LED is enabled there is a dot within this circle.

The 'Multi Selection Mode' offers the possibility to enable up to four LEDs. It is represented by square boxes and a check mark indicates an enabled LED.

Note

If more than one LED at a time has to be illuminated switch to the 'Multi Selection Mode' and enable this LED. If the LED is not enabled it will not illuminate even if a modulation signal is applied to the modulation input.

A cable for the modulation signals is provided. The following table shows the correlation of the single wires:

Connector #	Description	Color
1	LED Channel 1	Pink
2	GND	Green
3	LED Channel 2	Blue
4	GND	Red
5	LED Channel 4	Brown
6	GND	Yellow

Connector #	Description	Color
7	LED Channel 3	Grey
8	GND	White

3.3 Settings and Configuration

Settings and system configurations can be accessed via the main menu. To enter the main menu from one of the operation modes press the 'ESC' button.



Select an item with the multi-control knob and press the 'Ok' button to access the desired setting or configuration panel.

3.3.1 User Limit

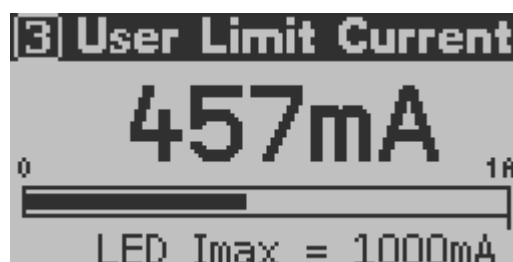
The current limit can be changed by selecting 'User Limit'. The following screen appears. Select a channel and confirm with the 'OK' button.

User Limit Current	
627.0 nm:	1000mA
455.0 nm:	1000mA
590.0 nm:	700mA
530.0 nm:	1000mA

Now the LED current limit can be set using the multi-control knob. The new value has to be confirmed with the 'Ok' button or canceled with the 'ESC' button. The LED current limit can be set up to the maximum LED current limit (LED I_{max}). It is displayed on the bottom of the screen. Certain LED sources have an EEPROM, which contain data about the LED like maximum current. LEDs without an EEPROM will show 1000mA as maximum LED current limit.

Note

The User Limit current corresponds to 100% brightness in the 'Brightness Mode'.



Attention

A 'User Limit' which exceeds the maximum current of the LED can cause damage to the LED. Prior to changing the LED maximum current limit of the LED head check if the LED can handle this current!

LED Configuration

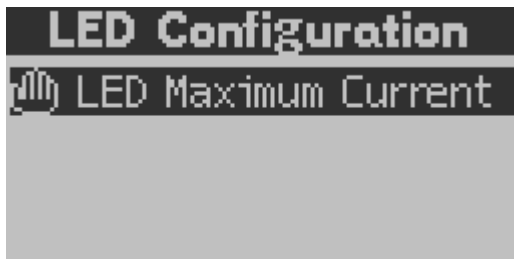
For LEDs with an EEPROM, the LEDs maximum current can be temporarily reconfigured. This value remains valid until the DC4104 is switched off. After switching on, the individual LED's limit current is read out from the EEPROM and becomes valid.

Warning

Exceeding a given limit may lead to destruction of the LED. Please be aware of the fact, that no warranty applies for the LED in such case!

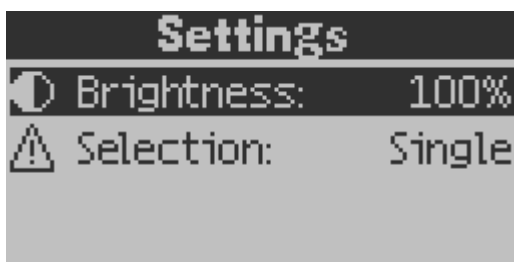
The modification of LED's max. current is a hidden entry in the 'User Limit Current' menu: Go to the 'User Limit' screen described above and select the channel. Then press and hold the 'LED' button for about three seconds.

A sub menu appears and the LED's maximum current can be set. Press the 'Ok' button to select the 'Maximum Current Limit' menu. The multi-control knob is used to change the value and has to be confirmed with the 'Ok' button or canceled with the 'ESC' button.



3.3.2 Settings

Within the system configuration the LCD backlight brightness can be set. Select 'Settings' from the main menu via the multi-control knob and press 'Ok'. A sub menu appears and the 'Brightness' setting can be accessed by pressing the 'Ok' button. The multi-control knob is used to change the brightness of the LCD backlight between 0 and 100%. Confirm your setting with 'Ok' or cancel it with 'ESC'.



The additional menu item 'Selection' in the 'Settings' section describes the output mode. The 'Single Selection Mode' allows to switch on only one LED at a time, while within the 'Multi Selection Mode' any configuration and up to all four LEDs can be switched on together.

3.3.3 About

The item 'About' gives information about the firmware version, serial number of the DC4104 and the connected LED head if available.



4 Computer Interface

The DC4104 comes with a USB 2.0 interface to connect the DC4104 to a PC. This provides a remote control capability via the Thorlabs USB remote control software. For flexible user applications, Thorlabs provides the device drivers for users who want to create an own remote control application, e.g. using C or LabVIEW®.

4.1 Software Installation

Note

Please make sure to have administrator privileges on the PC to be used, in order to install the software.

Download the software from the Thorlabs [DC41xx website](#).

Install the software by double clicking the .exe file.



Note

For remote operation of a DC4104, a 'NI-VISA™ Engine' of version 5.1.1 or higher must be installed on your system. The DC4100 Series software installer package contains this VISA Runtime Engine and checks your system. If it is not installed, or an earlier version is recognized, the installer will automatically install it to your computer. After Installation you might be prompted to reboot your PC - please see detailed description as below.

Select 'DC4100 Series - Application Software' from the installation menu and follow the instructions. Below the installation to a Windows 7 © operating system is described.

If the NI VISA Runtime V 5.1.1 is not installed yet the Wizard starts its installation and you might need to restart the computer following the installation. Otherwise the wizard skips NI-VISA installation and proceeds with the installation of the [DC4100 Series application](#) software.

Please accept the license agreement.

4.2 Firmware Update


The firmware of the DC4104 can be updated by the user via the USB interface with firmware update files from the [DC410x website](#).

The firmware .zip file includes the files required for the firmware update:

1. Windows batch file Upload_DC4104_Firmware.bat
2. hex file DC4104.hex
3. sig.hex file, a CHOICE.EXE
4. AVROSP.exe
5. ATmega1281.xml

Additionally, the change log file is saved. All these files need to be in the same directory for a successful firmware update.

Please follow these steps:

1. Turn off the DC4104.
2. Download the firmware .zip file to the PC to be connected to the DC4104.
3. Connect the DC4104 to the PC.
4. Start the DC4104 in the bootloader status: press the '[LED button](#)'  and keep it pressed while switching on the device with the power switch. The display of the DC4104 shows 'DC4104 BOOTLOADER'.
5. Determine the COM port used by the DC4104 via the device manager on your PC.
6. Open the ZIP file on your PC.
7. Open the .bat file. the terminal window will open and asks to select the COM port to be used.
8. Press 1, 2, 3, 4, 5, 6, 7, 8, or 9 in the terminal window to assign the respective COM port. The firmware update will start automatically.
9. The DC4104 display will indicate the download of the new firmware.
10. Do not switch off the DC4104 or disconnect the USB cable during the firmware download.
11. Please wait until the update process is completed as indicated on the display and in the terminal.

4.3 Driver Installation

On the software download website, please also find an Instrument Driver package for DC4104 for programming in C, .Net. These drivers are being installed automatically together with the Remote Control Application software and can be found at:

C:\Program Files\IVI Foundation\VISA\WINNT\Thorlabs DC4100 Series

In this directory you will find the drivers, a Programmer's Reference Manual and a sample for C.

If the installer recognized a LabVIEW® installation on your PC, a LabVIEW® container file will be installed to the recognized LabVIEW® installation folder. For example, in case of a standard installation of a 32 bit LabVIEW 2011 to a Win7 64 bit system the path is:

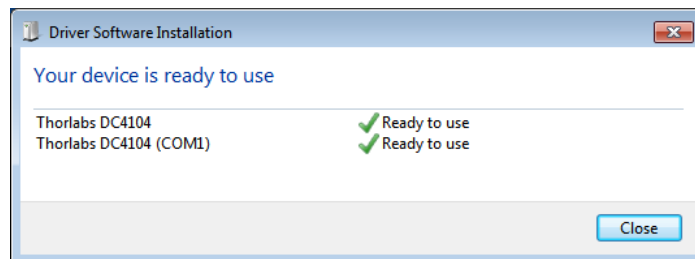
C:\Program Files (x86)\National Instruments\LabVIEW 2011\instr.lib\DC4100 Series\TLDC4100.llb

The TLDC4100.llb contains a number of driver VIs and a sample VI. They can also be accessed via the LabVIEW functions Palette (-> Instrument I/O -> Instr Drivers -> TLDC4100).

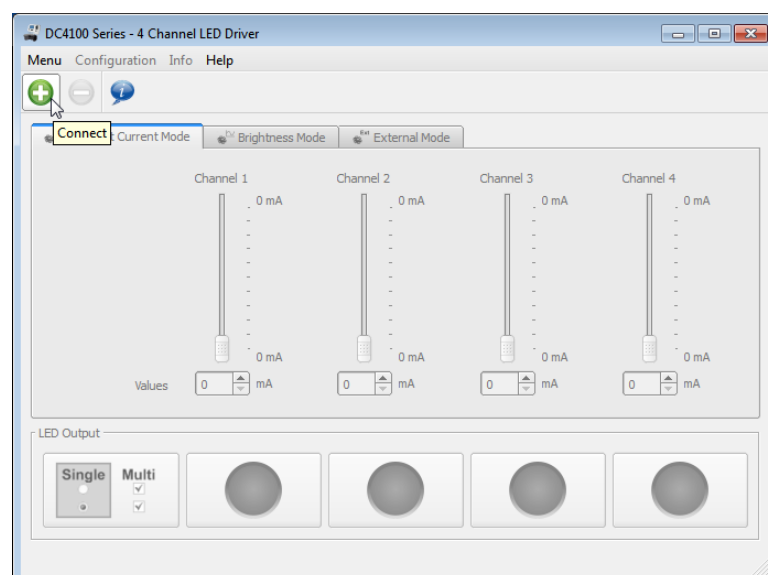
4.4 Operating the DC4100 Series remotely

4.4.1 Connecting a Device

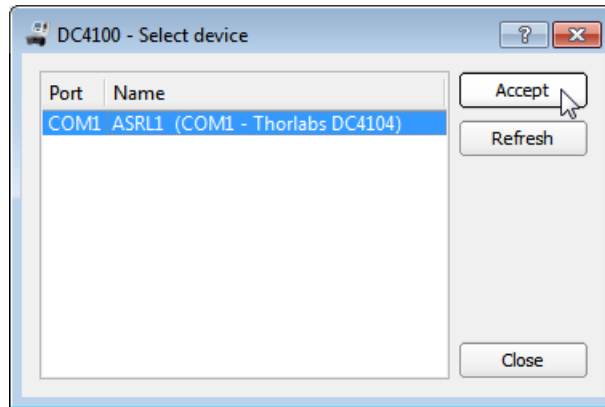
Please connect the DC4104 to your PC with the shipped USB cable. The USB socket is labeled 'USB' at the back of the main control. Windows recognizes the connected instrument and automatically loads the necessary drivers:



To start the remote application, double click to the "DC4100 Series" software icon on your desktop.

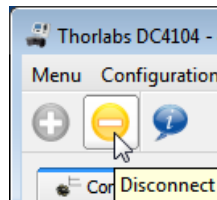


Use the green button or the menu option 'Connect...' to open the device selection dialog.



Select your DC4104 - 4 Channel LED Driver and click 'Accept'. The device will be connected and the last active mode will be entered. The upload of the actual values on the system may take some seconds.

You can disconnect the DC4104 by clicking on the 'Disconnect' button or by selecting 'Menu -> Disconnect':



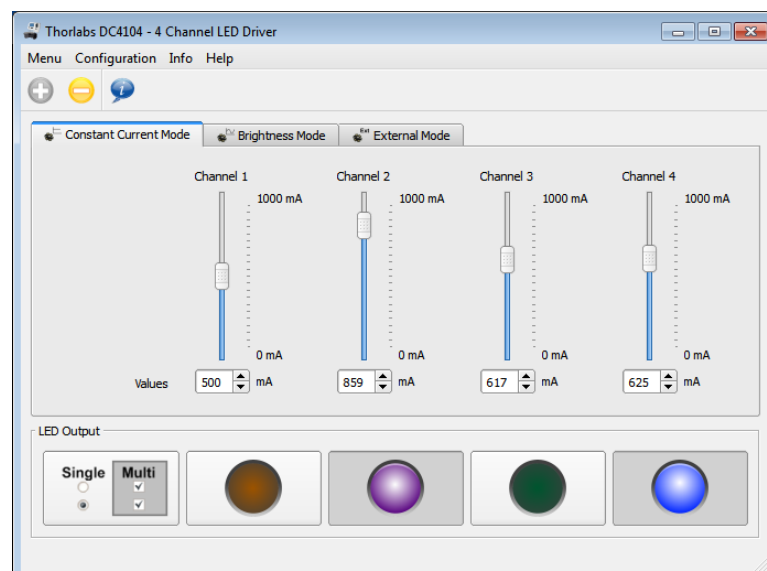
4.4.2 Constant Current Mode

The constant current can be selected by pressing the 'Constant Current Mode' tab. All connected LEDs must be switched off.

The value can be changed directly by typing into the numeric control, using the small arrows, or changing the slider. If you enter a numerical value, please press 'Enter' to confirm it. The maximum value depends on the user current limit, which is set in the configuration menu.

The individual LEDs can be switched on or off by clicking on the LED figure below the corresponding slider. In the picture below, channel 2 and channel 4 are switched on.

The button in the left lower corner is used to change between the output modes 'Single Selection' and 'Multi Selection'. Within the 'Single Selection Mode' only one LED can be switched on while within the 'Multi Selection Mode' up to four LEDs can be used.



If no LED is connected the controls for the corresponding channel are disabled. The supported Thorlabs LEDs feature an EEPROM and the information is imported and used for the maximum current limit and the display of the wavelength. The wavelength is displayed as color. In the above picture a Thorlabs LED4Dxx is connected. If no wavelength information is available the LED is displayed grey.

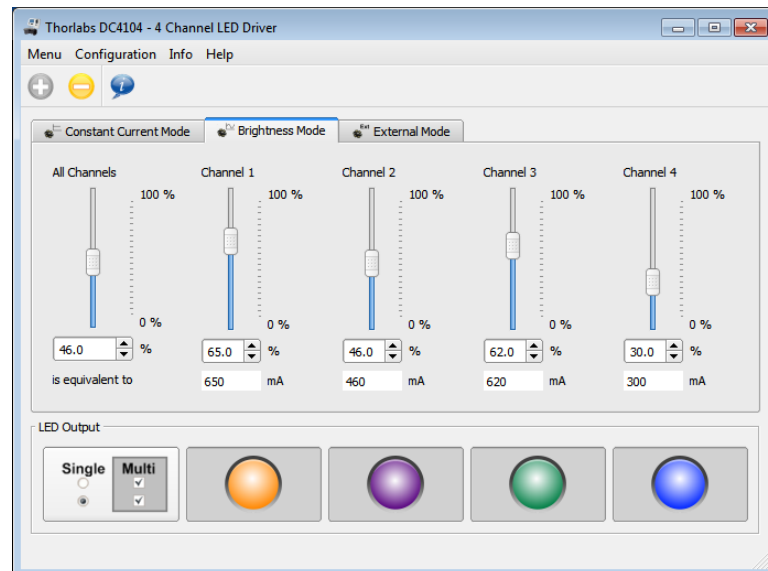
4.4.3 Brightness Mode

In this mode, the brightness of the individual LED is controlled relative to the max. LED current. The maximum LED current equals 100% and is the value set in the configuration menu (User Limit), or the value imported from the LED EEPROM. The resulting current for each LED channel is displayed below the numeric control (boxes "is equivalent to").

The value can be changed directly by typing into the numeric control, by using the small arrows, or by changing the slider. If you enter a numerical value, please press 'Enter' to confirm it.

Each channel can be set individually by the corresponding control element. Using the control elements 'All Channels' will set the same brightness value to all channels.

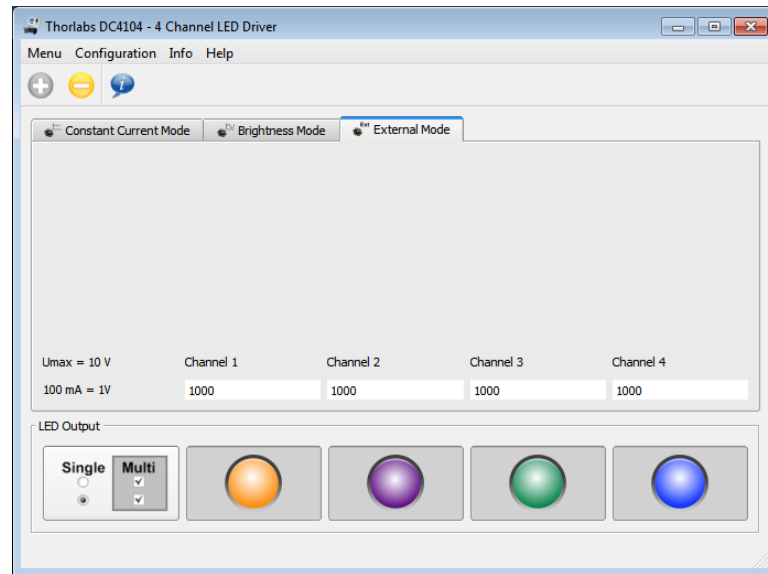
The individual LEDs can be switched on or off by clicking on the LED figure below the corresponding slider. In the screenshot below, all LED are switched on.



The button in the left lower corner is used to change between the output modes 'Single Selection' and 'Multi Selection'. Within the 'Single Selection Mode' only one LED can be switched on while within the 'Multi Selection Mode' up to four LEDs can be controlled.

4.4.4 External Control Mode

Use the 'External Control Mode' to modulate/control the DC4104 by an signal from an external signal generator. Click on the tab 'External Mode' to open the appropriate interface.



To modualte LEDs via this mode, please connect a DC4104 with a signal generator via a the included Trigger Cable on the connector labeled 'Ext. Trig' on the DC4104.

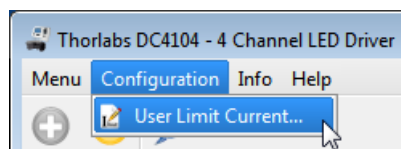
The LEDs can then be controlled only via the 4 channel Push-Pull connector at the rear panel of the DC4104. The applied voltage corresponds to the LED current in that 1 V is equivalent to a LED current of 100 mA. A maximum voltage of 10 V can be applied, which will result in a current of 1 A. All LED channels will be addressed by their individual control voltage, provided they are enabled by clicking on the LED figure below the corresponding channel indicator, similar to the hardware [External Control Mode](#).

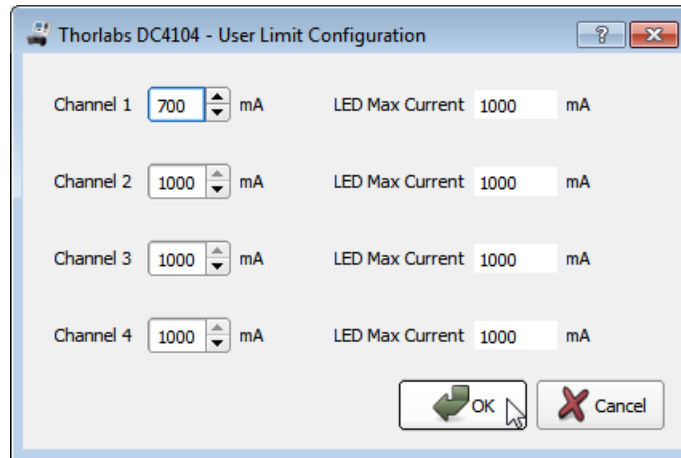
The button in the left lower corner is used to change between the output modes 'Single Selection' and 'Multi Selection'. Within the 'Single Selection Mode' only one LED can be enabled while within the 'Multi Selection Mode' up to four LEDs can be used.

4.4.5 User Limit Current

For each LED, and individual current limit can be set. The supported Thorlabs LEDs feature an EEPROM with the LED maximum current limit stored. This maximum current is imported by the DC4100 and its software. The user current limit can be manually set below or equal to this maximum current limit.

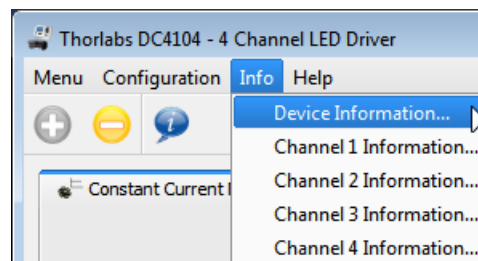
Select 'Configuration -> User Limit Current...' from the menu.



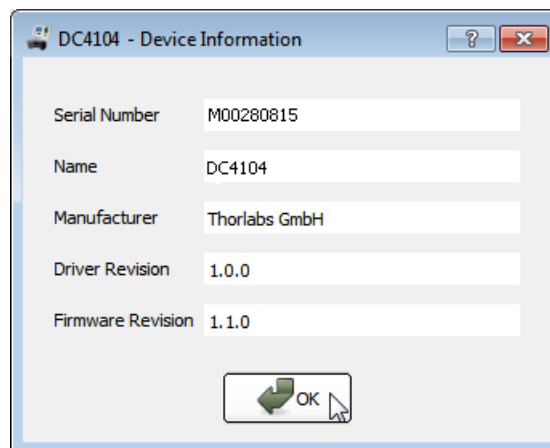


4.4.6 Device Information

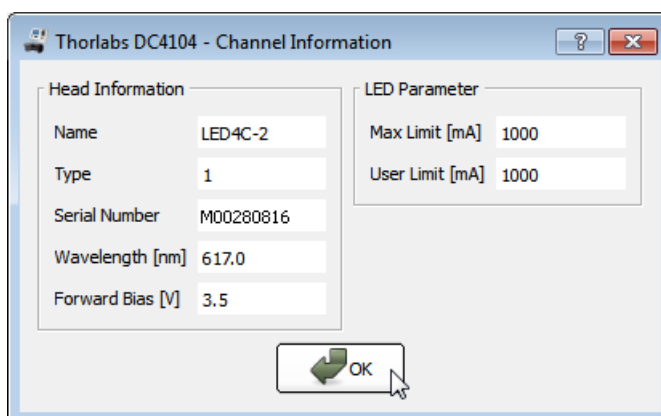
Select 'Info -> Device Information...' from the menu to obtain data about the DC4104 and the connected LED.



The following screen appears containing the serial number, device name, manufacturer, driver version and firmware revision.

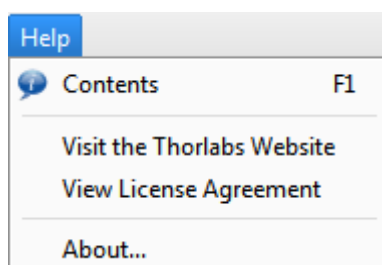


If a channel information was selected the appropriate panel appears giving information about the connected LED. The LED data are available only if the LED comes with an EEPROM.



4.4.7 Help Menu

Within the topic 'Help' of the menu you can access the help file of the DC4104, visit the Thorlabs website, view the license agreement and get information about applications.



5 Maintenance and Service

Protect the DC4104 from adverse weather conditions. The DC4104 is not water resistant.

Attention

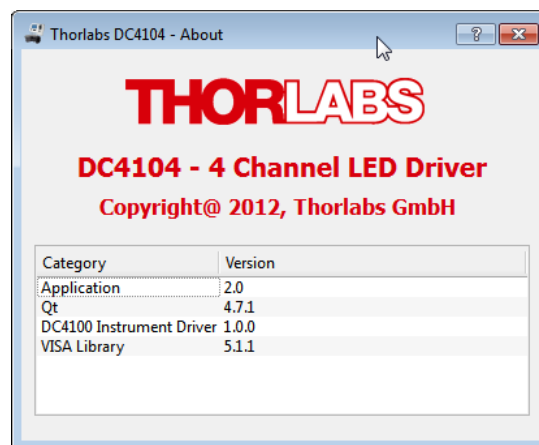
To avoid damage to the instrument, do not expose it to spray, liquids or solvents!

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 contact [Thorlabs](https://www.thorlabs.com) for return instructions.

Do not remove covers!

5.1 Version Information

The DC4100 Series Software menu entry 'Help -> About Thorlabs' displays application relevant data.

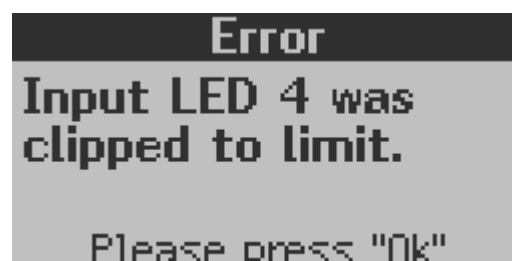


In case of a support request, please submit the software version of the application. This will help to locate the error.

Visit Thorlabs website www.thorlabs.com for available updates to download.

5.2 Troubleshooting

The DC4104 features protection circuits to prevent damage of the unit. The user will be informed about the occurrence of errors. Example:



The following table summarizes possible errors:

Message Text	Explanation and Impact	Elimination
Clipped to	The current of the specified channel was reduced to the set current	Decrease the input voltage.

Message Text	Explanation and Impact	Elimination
Limit Error	limit. This can happen in the 'External Control Mode', when a voltage was applied to the external trigger input representing a current, which is higher than the limit.	
LED Open Error	The LED is switched off, because the maximum forward voltage was reached. If a LED with more than 5V forward voltage was connected this error can occur.	Only LEDs with a forward voltage below or equal to 5V can be driven with the DC4104. The forward voltage depends on the actual current. Reduce the current to a forward voltage level of 5V or less.
Over Temperature Error	The temperature within the DC4104 case reached the maximum limit and all channels are switched off.	Make sure that the ventilation slots are not covered. It is necessary to ensure an air ventilation through the DC4104 unit.
Software Installation failed	The software cannot be installed on the computer.	Be sure to have administrative rights on your computer, which enables you to install software at all. Ask your system administrator to give you such rights or to do the installation himself.
LED cannot be switched on	After pressing the LED button the LED does not emit light.	Check if the LED current is set to a value larger than 0mA. A LED can only be switched on if one of the 3 operation modes is selected.
LED EEPROM is not read	The DC4104 might be outdated.	Download the latest DC4104 firmware and install the firmware ¹³ on the device.

6 Appendix

6.1 Technical Data

Item#	DC4104
LED Control	
LED Current Range (for each Channel)	0 ... 1000mA
LED Current Resolution	1mA
LED Current Accuracy	±10mA
Compliance Voltage (for each Channel)	5V
Modulation	
Modulation Frequency Range (External Control Mode only)	0 ... 100kHz (Sine Wave)
Modulation (External Control Mode only)	arbitrary
Trigger Input (External Control Mode only)	max. 10V 1V corresponds to 100mA
Power Supply	
Line Voltage (Ext. Power Supply)	100 ... 240VAC (-10%, +10%)
Line Frequency (Ext. Power Supply)	50 ... 60Hz
Power Consumption (max)	45VA
Supply mains over Voltage	Category II (Cat II)
Input Voltage (DC4104 chassis)	12VDC
General	
Operating Temperature Range ¹⁾	0 to +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
Warm-up Time for Rated Accuracy	10 min
Dimensions (W x H x D) without operating elements	152 x 74 x 147 mm ³
Dimensions (W x H x D) with operating elements	152 x 74 x 164 mm ³
Weight	< 1 kg

¹⁾ non-condensing

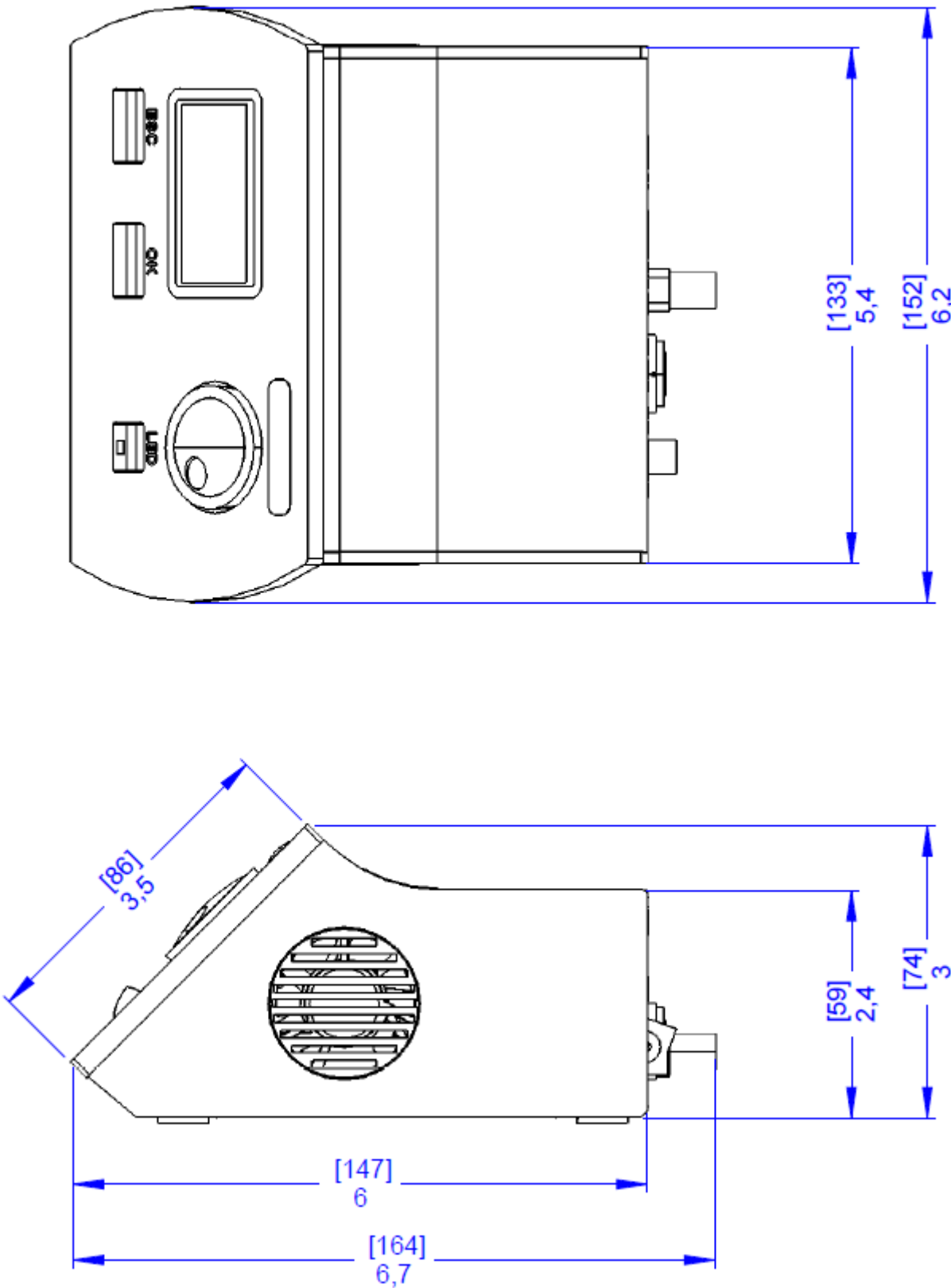
All technical data are valid at 23 ± 5°C and 45 ± 15% rel. humidity (non condensing)

6.2 Trigger Input Cable

A cable for the modulation signals is provided. The following table shows the correlation of the single wires:

Connector #	Description	Color
1	LED Channel 1	Pink
2	GND	Green
3	LED Channel 2	Blue
4	GND	Red
5	LED Channel 4	Brown
6	GND	Yellow
7	LED Channel 3	Grey
8	GND	White

6.3 Dimensions



Dimensions in inches / [mm]

6.4 Command Reference

Command	Description
DC4100_setLimitCurrent	Set User Current Limit
DC4100_getLimitCurrent	Get User Current Limit
DC4100_setMaxLimit	Set Maximum Current Limit
DC4100_getMaxLimit	Get Maximum Current Limit
DC4100_setOperationMode	Set Operation Mode
DC4100_getOperationMode	Get Operation Mode
DC4100_setSelection Mode	Set Selection Mode
DC4100_getSelection Mode	Get Selection Mode
DC4100_setLedOnOff	Set LED On or Off
DC4100_getLedOnOff	Gets the LED Output State
DC4100_setConstCurrent	Set Constant Current
DC4100_getConstCurrent	Get Constant Current
DC4100_setPercentalBrightness	Set Percentile Brightness
DC4100_getPercentalBrightness	Get Percentile Brightness
DC4100_setDispBright	Set Display Brightness
DC4100_getDispBright	Get Display Brightness
DC4100_getStatusRegister	Get Status Register
DC4100_errorMessage	Error Message
DC4100_identificationQuery	Identification Query
DC4100_revisionQuery	Revision Query
DC4100_getHeadInfo	LED Head Identification Query
DC4100_getWavelength	Get LED Wavelength
DC4100_getForwardBias	Get LED Forward Bias

6.4.1 Set User Current Limit

Command: DC4100_setLimitCurrent
Parameter: LED channel Current limit in ampere
Response: None
Description: Sets the current limit for a specified channel. This limit may not exceed the LEDs limit specified in the LED head.

6.4.2 Get User Current Limit

Command: DC4100_getLimitCurrent
Parameter: LED channel
Response: Current limit in ampere
Description: Returns the current limit for specified LED channel.

6.4.3 Set Maximum Current Limit

Command: DC4100_setMaxLimit
Parameter: LED channel Maximum current limit in ampere
Response: None
Description: Sets the LEDs maximum current limit in ampere. This limit takes affect until the next restart of the system.

6.4.4 Get Maximum Current Limit

Command: DC4100_getMaxLimit
Parameter: LED channel
Response: Maximum current limit in ampere
Description: Gets the LEDs maximum current limit in ampere. This value is specific for each LED channel.

6.4.5 Set Operation Mode

Command: DC4100_setOperationMode
Parameter: Operation mode
Response: None
Description: Sets the operation mode.

6.4.6 Get Operation Mode

Command: DC4100_getOperationMode
Parameter: None
Response: Operation mode
Description: Gets the actual operation mode.

6.4.7 Set Selection Mode

Command: DC4100_setSelectionMode
Parameter: Selection mode
Response: None
Description: Sets the selection mode.

6.4.8 Get Selection Mode

Command: DC4100_getSelectionMode
Parameter: None
Response: Selection Mode
Description: Gets the selection mode.

6.4.9 Set LED OnOff

Command: DC4100_setLedOnOff
Parameter: LED channel LED output
Response: None
Description: Sets the LED on or off.

6.4.10 Get LED OnOff

Command: DC4100_getLedOnOff
Parameter: LED channel
Response: LED output state
Description: Gets the LED output state.

6.4.11 Set Constant Current

Command: DC4100_setConstCurrent
Parameter: LED channel Constant current in ampere
Response: None
Description: Sets the current for one channel used in the constant current mode.

6.4.12 Get Constant Current

Command: DC4100_getConstCurrent
Parameter: LED channel
Response: Constant current in ampere
Description: Gets the current of a specified channel used for the constant current mode.

6.4.13 Set Percental Brightness

Command: DC4100_setPercentalBrightness
Parameter: LED channel Percental brightness
Response: None
Description: Sets the percental brightness for one LED channel.

6.4.14 Get Percental Brightness

Command: DC4100_getPercentalBrightness
Parameter: LED channel
Response: Brightness in percent
Description: Gets the percental brightness of one LED channel in %.


6.4.15 Set Display Brightness

Command: DC4100_setDispBright
Parameter: Display brightness in %
Response: None
Description: Sets the display brightness.

6.4.16 Get Display Brightness

Command: DC4100_getDispBright
Parameter: None
Response: Display brightness in %
Description: Returns the current limit for specified LED channel.

6.4.17 Get Status Register

Command: DC4100_getStatusRegister
Parameter: None
Response: Status register value
Description: Reads the content of the instruments status register. Refer to chapter [Status Reporting](#) .

6.4.18 Error Message

Command: DC4100_errorMessage
Parameter: Error Code
Response: User readable message string
Description: This function takes the error code returned by the instrument driver functions, interprets it and returns it as an user readable string.

6.4.19 Identification Query

Command: DC4100_identificationQuery

Parameter: None

Response: Manufacturer name Device name Serial number Firmware version

Description: This function returns the device identification information.

6.4.20 Revision Query

Command: DC4100_revisionQuery

Parameter: None

Response: Instrument driver revision Firmware revision

Description: This function returns the instrument driver revision and the device firmware revision.

6.4.21 LED Head Identification Query

Command: DC4100_revisionQuery

Parameter: LED channel

Response: LED type Serial number

Description: This function returns the LED head identification information for the specified channel.

6.4.22 Get Wavelength

Command: DC4100_getWavelength

Parameter: LED channel

Response: LED wavelength

Description: This function returns the wavelength information for specified channel.

6.4.23 Get Forward Bias

Command: DC4100_getForwardBias

Parameter: LED channel

Response: LED forward bias

Description: This function returns the forward bias for specified channel.

6.4.24 Status Reporting

The DC4104 stores the status in a register.

It can be accessed via the 'DC4100_getStatusRegister' command. The following table lists all status numbers and the according descriptive messages. Each bit represents an error.

Status Bit	Name	Description
Bit 0	VCC Fail Changed	The bit 'VCC Fail' has changed.
Bit 1	VCC Fail	The power supply is out of range.
Bit 2	OTP Change	The bit 'OTP' (Over Temperature) has changed.
Bit 3	OTP	Over temperature in the chassis detected. All LEDs switched off.
Bit 4	No LED1 Changed	The bit 'No LED1' has changed.
Bit 5	No LED1	The LED at channel1 is not connected.
Bit 6	No LED2 Changed	The bit 'No LED2' has changed.
Bit 7	No LED2	The LED at channel2 is not connected.
Bit 8	No LED3 Changed	The bit 'No LED3' has changed.
Bit 9	No LED3	The LED at channel3 is not connected.
Bit 10	No LED4 Changed	The bit 'No LED4' has changed.
Bit 11	No LED4	The LED at channel4 is not connected.
Bit 12	LED Open1 Changed	The bit 'LED Open 1' has changed.
Bit 13	LED Open1	LED channel 1: No LED is connected.
Bit 14	LED Open2 Changed	The bit 'LED Open 2' has changed.
Bit 15	LED Open2	LED channel 2: No LED is connected.
Bit 16	LED Open3 Changed	The bit 'LED Open 3' has changed.
Bit 17	LED Open3	LED channel 3: No LED is connected.
Bit 18	LED Open4 Changed	The bit 'LED Open 4' has changed.
Bit 19	LED Open4	LED channel 4: No LED is connected.
Bit 20	Limit1 Changed	The bit 'Limit 1' has changed.
Bit 21	Limit1	LED channel 1: Adjusted current exceeds the current limit and was set to limit.
Bit 22	Limit2 Changed	The bit 'Limit 2' has changed.
Bit 23	Limit2	LED channel 2: Adjusted current exceeds the current limit and was set to limit.
Bit 24	Limit3 Changed	The bit 'Limit 3' has changed.
Bit 25	Limit3	LED channel 3: Adjusted current exceeds the current limit and was set to limit.
Bit 26	Limit4 Changed	The bit 'Limit 4' has changed.
Bit 27	Limit4	LED channel 4: Adjusted current exceeds the current limit and was set to limit.
Bit 28	Interface Refresh	The user has changed settings.

6.5 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.

Before applying power to your DC4104, make sure that the protective conductor of the 3 conductor mains power cord is correctly connected to the protective earth contact of the socket outlet!

Improper grounding can cause electric shock with damages to your health or even death!

The DC4104 must not be operated in explosion endangered environments!

The LED head, control inputs and outputs must only be connected with duly shielded connection cables.

Do not obstruct the air ventilation slots in housing!

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).

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

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

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.

6.6 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.

6.7 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

6.8 Warranty

Thorlabs warrants material and production of the DC4104 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



6.9 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.

All rights reserved. This document may not be reproduced, transmitted or translated to another language, either as a whole or in parts, without the prior written permission of Thorlabs. Copyright © Thorlabs 2022. All rights reserved.

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

6.10 Certifications and Compliances

<h3 style="text-align: center;">EU Declaration of Conformity</h3> <p style="text-align: center;"><i>in accordance with EN ISO 17050-1:2010</i></p>		
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:	DC410x, DC4100-HUB	
Equipment:	Four-Channel LED Driver Family	
<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: 30 April 2020
Name:	Dr. Bruno Gross	
Position:	General Manager	EDC - DC410x, DC4100-HUB -2020-04-30
		

6.11 List of Acronyms

The following acronyms and abbreviations are used in this manual:

AC	Alternating Current
AGND	<u>A</u> nalog <u>G</u> round
DC	<u>D</u> irect <u>C</u> urrent
DGND	<u>D</u> igital <u>G</u> round
DLL	<u>D</u> ynamic <u>L</u> ink <u>L</u> ibrary
EEPROM	<u>E</u> lectrically <u>E</u> rasable <u>P</u> rogrammable <u>R</u> ead- <u>O</u> nly <u>M</u> emory
FCC	<u>F</u> ederal <u>C</u> ommunications <u>C</u> ommission
FLIM	<u>F</u> luorescence <u>L</u> ifetime <u>I</u> maging
GUI	<u>G</u> raphical <u>U</u> ser <u>I</u> nterface
IEC	<u>I</u> nternational <u>E</u> lectrotechnical <u>C</u> ommission
LCD	<u>L</u> iquid <u>C</u> rystal <u>D</u> isplay
LED	<u>L</u> ight <u>E</u> mitting <u>D</u> iode
PC	<u>P</u> ersonal <u>C</u> omputer
PCB	<u>P</u> rinted <u>C</u> ircuit <u>B</u> oard
PWM	<u>P</u> ulse <u>W</u> idth <u>M</u> odulation
USB	<u>U</u> niversal <u>S</u> erial <u>B</u> us
WEEE	<u>W</u> aste <u>E</u> lectrical and <u>E</u> lectronic <u>E</u> quipment Directive

6.12 Thorlabs Worldwide Contacts

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

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europe@thorlabs.com

Scandinavia

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France

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Brazil

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brasil@thorlabs.com

Japan

Thorlabs Japan, Inc.
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Thorlabs 'End of Life' Policy (WEEE)

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



Index

A

About 11

C

Command Reference 25
Configuration 9
Connect 14
Current Limit 9, 17

D

Device Information (Remote) 18
Disconnect 14
Display Brightness 10

E

Error Handling 20

G

Graphical User Interface 14

H

Hardware 2
Help Menu 19

I

Installation
Getting Started 3
Parts List 3

O

Operation 4
Operating elements 5
Parts List 3
Preparation 3
Operation Mode 5
Brightness Mode 6, 16
Constant Current Mode 5, 15
External Control Mode 8, 17

R

Remote Application 14
Remote Operation 14

Brightness Mode 16
Connecting a Device 14
Constant Current Mode 15
External Control Mode 17
User Current Limit 17

S

Safety Mode 10
Settings 9, 10
Software Installation 12
Specifications 22
Status Bit 30
System 2

T

Trigger Input Cable 23

U

User Limit 9, 17



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