THORLABS

OGK2 and OGK2
Optogenetics Starter Kits

User Guide

Table of Contents

Chapter 1 Warning Symbol Definitions

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

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

Chapter 2 Safety

SHOCK WARNING

Before applying power to your DC2100 system, make sure that the protective conductor of the 3-conductor main 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!

WARNING

Optical Power Density out of the output connector or fiber tip may be hazardous to the human eye – do not look into the connector or fiber aperture.

See the individual operating manuals for the M470F1 LED and DC2100 LED Driver for complete warnings and safety information.

Chapter 3 Quick-Start Guide

3.1. Setup

3.1.1. LED and Driver

The OGK2 and OGK4 Optogenetics Starter Kits include an M470F1 Fiber-Coupled LED, and a DC2100 LED Driver. The LED can be operated by connecting it to the "LED" jack in the back of the DC2100. The power supply for the DC2100 should be plugged into the unit as well. The DC2100 can then be powered on using the rocker switch on the back of the unit.

After the device is powered up, the display will show a "Welcome" screen for a few seconds. The DC2100 is immediately ready for use after turning on. However, the rated accuracy is reached after a warm-up period of 10 minutes.

3.1.2. Patch Cable and Cannula

Insert the M51L01 (for OGK2) or M54L01 (for OGK4) patch cable's SMA connector into the LED unit by threading the rotating barrel on the connector onto the LED unit's housing. Then, place the ADAF1 mating sleeve onto the ferrule end of the patch cable, leaving approximately one third of the mating sleeve length exposed for the cannula connection. Then, connect the mating sleeve to the cannula. Note: To disconnect the cannula, grip the patch cable by the ferrule and mating sleeve (not the heat shrink tubing) and use a twisting motion.

Figure 1 Insert the Mating Sleeve 1/2 to 2/3 of the way onto the Ferrule End of the Patch Cable

It is very important that the ends of the patch cable's ferrule and the cannula's ferrule are in physical contact. If they are not, the output power at the cannula tip will decrease significantly.

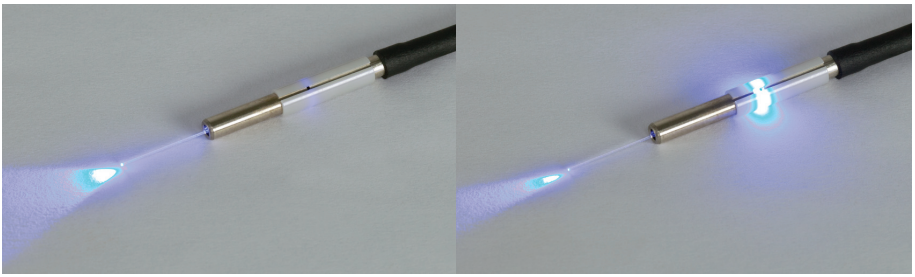

Figure 2 The cannula and patch cable must be in physical contact inside the mating sleeve (left) to avoid light losses at this connection (right).

3.2. Operation

The LED can be operated using the front panel controls of the DC2100, or remotely via PC. Use the scroll wheel and "OK" and "ESC" buttons to navigate through the DC2100's menus. The DC2100 can operate in three different modes, 'Constant Current Mode', 'PWM Mode' (Pulse-Width Modulation), or 'External Control'. The DC2100 can also be operated remotely via USB. Note: The LED must be switched off when switching between modes. Use the "ESC" button to display the main menu, and then use the scroll wheel and "OK" button to select an operating mode.

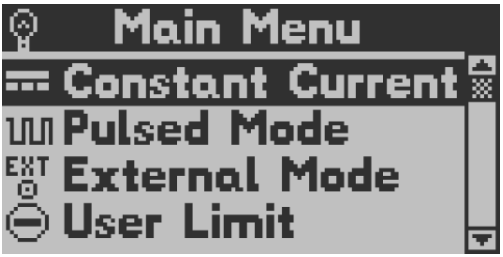

Figure 3 Main Menu

3.2.1. Constant Current Mode

While operating in constant current mode, the scroll wheel controls the LED's power (limited to 1 A by the LED unit), and the "LED" button toggles the LED on/off.

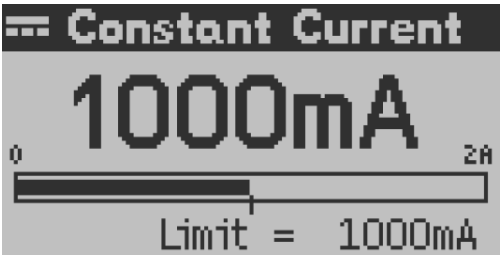

Figure 4 Constant Current Mode

3.2.2. Pulse Width Modulation (PWM) Mode

In Pulse Width Modulation mode, the frequency, amplitude, duty cycle (pulse width), and number of pulses can all be defined. The main Pulsed Mode screen (see figure below) displays each parameter. To edit the parameters, highlight that line with the scroll when, press "OK", edit using the scroll wheel, and press "OK" again to save that parameter. Again, the "LED" button toggles the LED on/off. With the LED switched off, press "ESC" to return to the main menu.

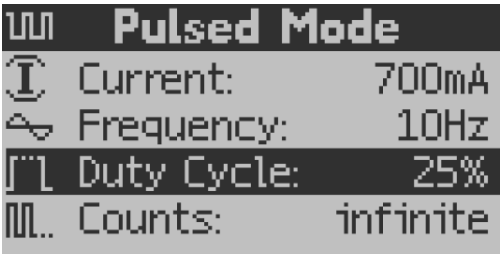

Figure 5 Pulse Width Modulation Mode

3.2.3. External Control Mode

This mode allows controlling the DC2100 by an external signal. The 'External Control Mode' has no parameter settings. The LED can only be controlled via the BNC connector at the rear panel of the DC2100. The applied voltage corresponds to the LED current. 1 V is equivalent to a LED current of 200 mA. A maximum voltage of 10V can be applied, which results in a current of 2000 mA.

3.2.4. Remote Operation via PC

The DC2100 can be controlled remotely by a Windows-based PC. Refer to the DC2100 user's manual for software installation instructions.

The DC2100 is controlled with the DC2100 software. All controls available on the front panel of the DC2100 are also available using this application. The front panel controls of the DC2100 can also be used when the device is connected to a PC, and the DC2100 display automatically updates.

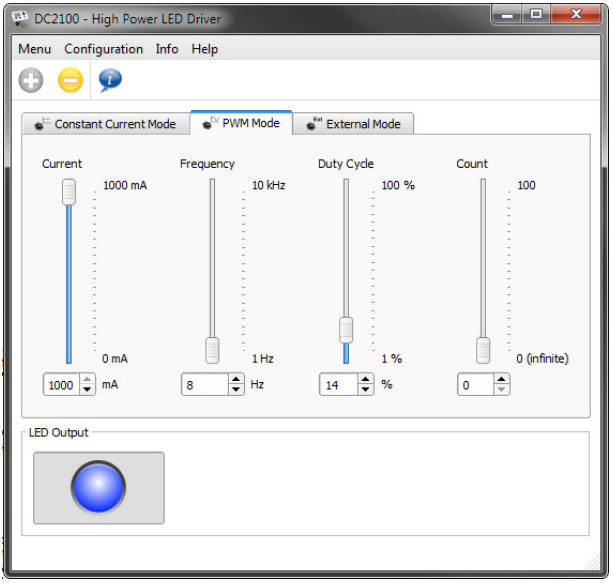

Figure 6 DC2100 PC Remote Control Software

Chapter 4 Specifications

Kit Components and Specifications

Item #	OGK2	OGK4
LED Driver	DC2100	
LED	M470F1	
Fiber Patch Cable	M51L01	M51L01
Cannula Mating Sleeve	5 x ADAF1	
Cannulae	5 x CFM12L02 5 x CFM12L05 5 x CFM12L10 5 x CFM12L20	5 x CFM12L02 5 x CFM12L05 5 x CFM12L10 5 x CFM12L20
Approximate Cannula Output Power*	2.6 mW	2.6 mW

*Tested with the LED driven at maximum current (1 A).

Fiber Specifications

Item #	Fiber Type	NA	Core Diameter	Wavelength Range
OGK2	FT200EMT Multimode	0.39 ± 0.02	∅200 µm	400 – 2200 nm
OGK4	FT400EMT Multimode		∅400 µm	

LED Specifications

Item #	M470F1
Center Wavelength	470 nm
Typical FWHM	15 nm
Max CW Drive Current	1 A
LED Forward Voltage	3.6 V
Typical Lifetime	>50,000 hours

Refer to the Fiber-Coupled LEDs manual or web presentation for full specifications.

LED Driver Specifications

Item #	DC2100
LED Current Range	0 – 2 A
LED Current Resolution	1 mA
LED Current Accuracy	±20 mA
LED Forward Voltage	24 V
Modulation Frequency Range	0 – 100 kHz, Sine Wave
Duty Cycle Range	1 – 100%

Refer to the DC2100 manual or web presentation for full specifications.

Chapter 5 Further Reading

1. Aravanis A, Wang LP, Zhang F, Meltzer L, Mogri M, Schneider MB, Deisseroth K. **An optical neural interface: *in vivo* control of rodent motor cortex with integrated fiberoptic and optogenetic technology.** J. Neural Eng. 2007 Sept; 4:S143-S156.
2. Gradinaru V, Thompson KR, Zhang F, Mogri M, Kay K, Schneider MB, Deisseroth K. **Targeting and readout strategies for fast optical neural control *in vitro* and *in vivo*.** J Neurosci. 2007 Dec 26;27(52):14231-8.
3. Zhang F, Gradinaru V, Adamantidis AR, Durand R, Airan RD, de Lecea L, Deisseroth K. **Optogenetic interrogation of neural circuits: technology for probing mammalian brain structures.** Nat Protoc. 2010;5(3):439-56. Epub 2010 Feb 18.
4. Yizhar O, Fenno LE, Davidson TJ, Mogri M, Deisseroth K. **Optogenetics in Neural Systems.** Neuron. 2011 July;72:9-34.
5. http://www.stanford.edu/group/dlab/optogenetics/
6. http://www.openoptogenetics.org/index.php?title=Main_Page

Chapter 6 Regulatory

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

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated

Wheelie Bin Logo

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

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

6.1. Waste Treatment is Your Own Responsibility

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

6.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

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