

Prizmatix

USER MANUAL

Dual-Optogenetics-LED

Fiber Coupled LED for
in-vivo

Optogenetics Experiments with Freely Moving Mammals



Version: 7

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1 Introduction

The Prizmatix Dual-Optogenetics-LED module is specially designed to provide high power Light to activate opsins in Optogenetics experiments with freely moving mammals. This LED light-source provides powerful light pulses triggered by external TTL input.

1.1 Features

- High Power
- Reciprocal SMA fiber connection
- Precisely adjustable power by 10 turns potentiometer
- TTL external modulation input (up to 50KHz)
- Analog input (0-5V) for power control
- TTL and Analog Inputs are Optically Isolated


1.2 Intended Use


The Dual-Optogenetics-LED is an in-vivo illuminator designed to be used with free-moving small animals inside maze systems. The unit is self-contained. The LED light exits through an SMA ferrule directly to an attached 1000um POF, which is connected to a rotary joint. On the other side of the rotary joint is a 500um POF which shall be connected to the implanted cannula in the animal.

2 Safety

Please make yourself familiar with the contents of these operating instructions before using the Dual-Optogenetics-LED system. Please make yourself familiar with the contents of these operating instructions before using the Optogenetics-LED system. Use the illuminator only as specified in this manual. Otherwise, the protection provided by the illuminator may be impaired.

The following symbols are used for the warnings:

 **CAUTION!** Failure to comply with the safety instructions can be hazardous to the user.

 **CAUTION!** Failure to comply with the safety instructions can result in damage to the instrument.

Do not use the illuminator if it is damaged. Before you use the illuminator, inspect the case. Look for cracks or missing parts.

Do not use the device around explosive gas.

Never operate the illuminator with the cover removed or the case open.

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Any maintenance should ONLY be performed by a Prizmatix authorized technician.

Prizmatix products are NOT authorized for use as components in life support devices or systems.

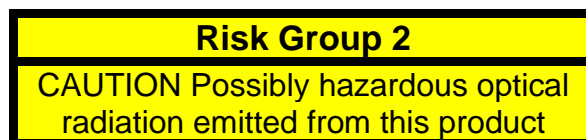
2.1 Eye Safety

The Dual-Optogenetics-LED illuminator is assigned to following risk groups according to IEC 62471: 2006. The assignment done on each channel separately based on the standard system configuration as explained in section 3.3.2. The assignment results are summarized in Table 1.

Table 1: Illuminator assignment to risk groups according to IEC 62471: 2006.

Product Type	Assignment to Risk Group		
	Exempt RG0	Low Risk RG1	Mod Risk RG2
Dual-Optogenetics-LED Violet Channel			√
Optogenetics-LED Blue Channel			√
Optogenetics-LED Green Channel	√		
Optogenetics-LED Red Channel	√		

The products Dual-Optogenetics-LED with Violet or Blue channels are marked on the product with following label:



2.1.1 Special Safety Notes

Table 2 summarize the safety notes specific to various product types (IEC 62471-2/TR (1st edition, 2009), Table 2 page 17).

Table 2: Safety notes specific to various product types

Product	Safety Note
Optogenetics-LED Violet Channel	⚠ CAUTION! Do not stare at operating lamp. May be harmful to the eyes
Optogenetics-LED Blue Channel	⚠ CAUTION! Do not stare at operating lamp. May be harmful to the eyes

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2.1.2 Hazard Distances (HD)

Following Table 3 provides the distance from distal end of the fiber at which the threshold illuminance EL returns the product to RG 1.



Table 3: Distances from distal end of the fiber at which the photochemical hazard reduces to Risk group 1, for relevant products.

Product	Distance at which Blue-Light hazard reduced to Risk Group 1 [m]
Optogenetics-LED Violet Channel	0.35
Optogenetics-LED Blue Channel	0.4

3 Set-up of the Device

Remove the device from the packaging and inspect the device for loose components or any signs of damage. Notify Prizmatix if the device appears damaged in any way: do not install or operate a damaged device.

3.1 Package Contents List

Optogenetics-LED	Power Adaptor / Mains Power Cord
	

	Item	Description	Quantity
1	Dual-Optogenetics-LED	High Power LED light source	1
2	Power Adaptor / Mains Power Cord	Universal power adaptor and Cord to connect the power adaptor to mains power	1


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3.2 Specifications

3.2.1 Electrical Specifications

Digital modulation inputs		Optically isolated TTL
Connector for TTL and Analog input		BNC
Digital modulation frequency	Hz	DC-30000
Rise / Fall time (10% - 90%)	µs	<3 / <10
Analog input voltage range	V	0-5
Input Voltage	V	12
Max Input current	A	5
Power Adaptor Input		85-264 VAC, 47-63Hz, 1.5A

3.2.2 General Specifications

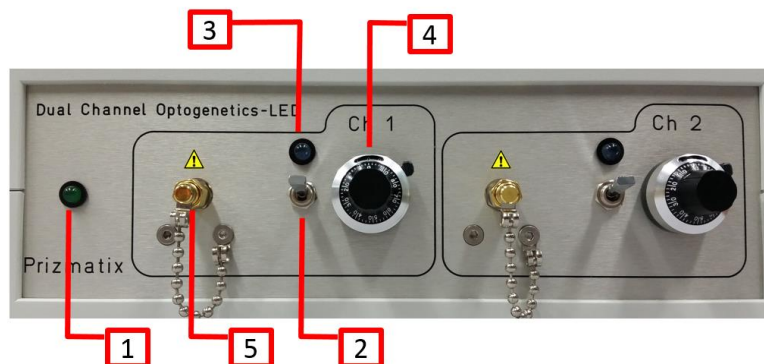
Operation temperature range	°C	10 - 35
Storage temperature range	°C	-10 - 55
Operating relative humidity (Non-condensing)	%	<90
Dimensions (L x W x H)	mm	197 x 241 x 80
Weight	g	1200
Power adaptor dimensions (L x W x H)	mm	167 x 67 x 35
Power adaptor weight	g	620
Power Adaptor Safety		
Fan noise	dBA	28.4

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3.3 System Overview

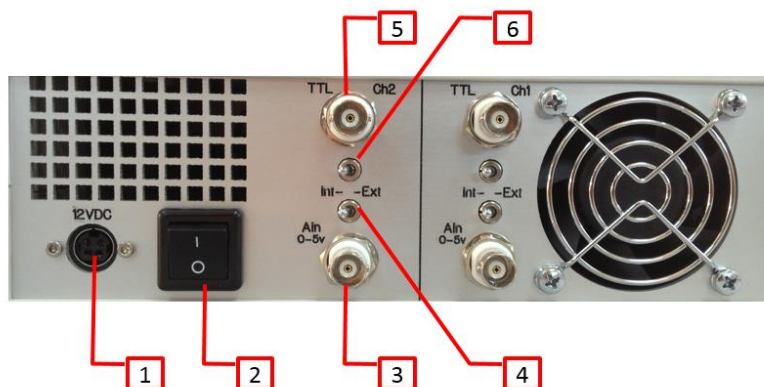
3.3.1 Optogenetics-LED Controls

The front panel of Optogenetics-LED unit features (only one channel described for simplicity): (1) Power indicator, (2) LED Enable (ON/OFF) switch (3) LED enable indicator (4) 10 turn dial of precision potentiometer for manual setup of output power, (5) SMA connector for optical fiber.



Dual-Optogenetics-LED front panel

The back panel of Dual-Optogenetics-LED unit features (only one channel described for simplicity): (1) Power adaptor input socket, (2) Main power switch, (3) Connector for Analog input (0-5V) for control of LED power from computer, (4) Toggle switch Analog Input Int/Ext to enable control of LED power by external analog input, (5) Connector for TTL input, (6) Toggle switch TTL Input Int/Ext to enable control of LED ON/OFF by external TTL signal.



Dual-Optogenetics-LED back panel

⚠ CAUTION!: Do not use the illuminator without the Optical Fiber connected to SMA port!

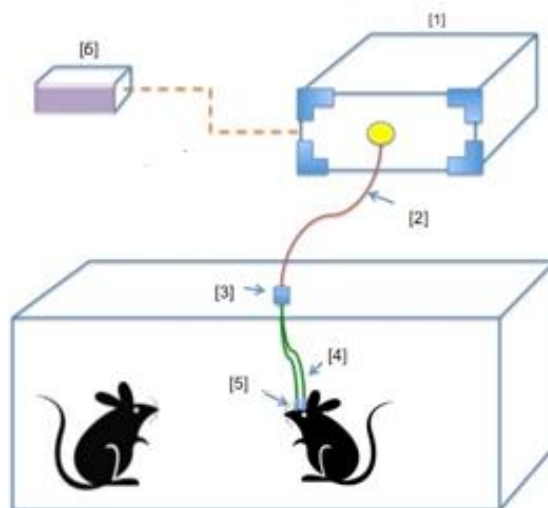
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3.3.2 Typical System Setup

Typical Optogenetics setup will include following components

Remark: For simplicity only one channel is shown

- (1) Optogenetics-LED - Fiber coupled LED light source
- (2) Optogenetics-Fiber-1000 - Polymer optical fiber 1000um core, NA 0.63, length 1m, optical connectors SMA-FC
- (3) Rotary Joint - Enables free movement of the mammals
- (4) Optogenetics-Fiber-500 / Optogenetics-Fiber-Dual-500 - Single or Dual branch (Y-shape) polymer optical fiber 500um core, NA 0.63, optical connectors FC-ferrule
- (5) Cannulae - One or two fiber optic implant shall be connected to 500um fiber by a sleeve
- (6) Pulser - Pulse generator to provide fast TTL pulses to the LED



3.4 Initial Set-up of Dual-Optogenetics-LED


1. Set Power Switch on back panel of the unit to OFF position and connect power adaptor to the back of the unit and into wall mains socket.
2. Set both the TTL and Ain (Analog Input) switches on back panel to 'Int' position.
3. Connect the Optogenetics-Fiber-1000 fiber to the front panel SMA connector.
4. Connect the other end of the Optogenetics-Fiber-1000 fiber to the Rotary-Joint.


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5. Connect the FC connector on the 500um fiber to the Rotary-joint.
6. Push the back-panel power switch to the "ON" position, and then Press the green button on front panel to turn the LED on (the internal green light of the button is turned on too). Turn the dial of the potentiometer clockwise. The LED light should be seen at the ferrule on the 500um fiber.

 **CAUTION!**: Do not stare at operating lamp. May be harmful to the eyes


7. LED power can be adjusted using the 10-turn potentiometer on front panel.
8. Press the green button once again, the LED is turned off (as indicated by the button light). Make sure to turn the unit off by switching the Power Switch on back panel before disconnecting from power supply.
9. For TTL input connect BNC cable to **TTL** input connector on back of unit. To enable TTL control change the position of the **TTL Int/Ext** switch to **Ext** position.
10. For Analog Input connect BNC cable to **Ain** input connector on back of unit. To enable Analog Input control change the position of the **Ain Int/Ext** switch to **Ext** position

 **CAUTION!**: Do not use the illuminator without the Optical Fiber connected to SMA port!


 **CAUTION!**: Do not cover back panel of unit - ensure that air can circulate freely.

3.5 Cleaning

Keep the connector port clear from dirt and do not leave it open. Make sure to close the SMA port with the chained cap when the fiber is not connected.

 **CAUTION!**: Do not try to clean inside the port – you may damage the illuminator!

The box can be wiped with mild wet-wipes.

 **CAUTION!**: Do not attempt to use chemicals, e.g. Alcohol or Acetone – you may damage plastic components