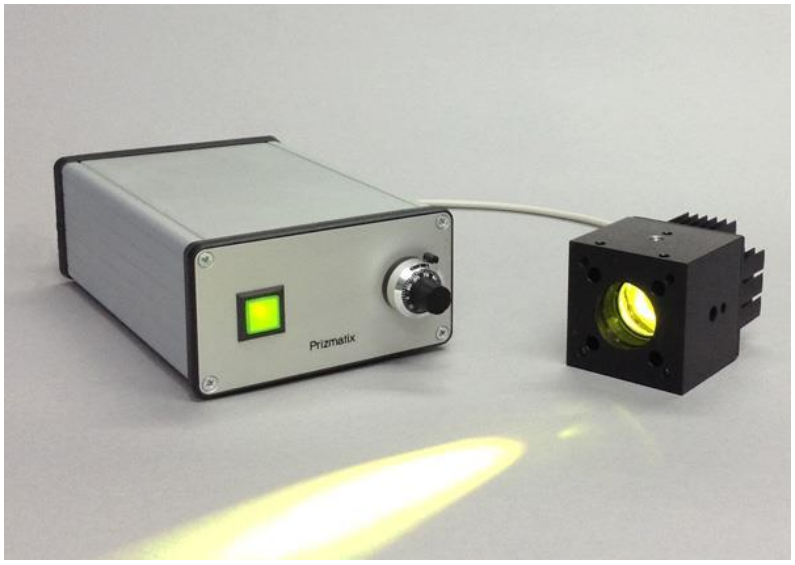
Prizmatix

Mic-LED
with
BLCC-04

User Manual



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Prizmatix

Contents

1 Introduction

The Prizmatix Mic-LED is a High-Power LED light source for various laboratory applications including fluorescence microscopy, high power illumination and other applications. It is an effective replacement for spectral lamps and lasers. The Mic-LED heads are part of Prizmatix OptiBlock system that enable easy assembly of various complex multi-wavelength illuminations setups. For details please see the OptiBlock section in this manual. The BLCC-04 LED current controller provides a stable, low noise current source for LED operation. The controller supports continuous or pulsed illumination. The light level adjusted manually by a precision 10-turn potentiometer with a locking dial or from a computer via an analog input (Ain) connector. A pulse operation mode also available through a TTL connector in order to synchronize the exposure with image acquisition.

1.1 Features

- Compatible with Prizmatix modular UHP-Mic-LED and UHP-T-LED Light-Source products family – for creation of multi-wavelength setups, fiberoptic applications and more.
- Single chip High Brightness LED
- Easy connection to Olympus, Nikon, Zeiss or Leica microscopes by direct adaptor connection, Liquid Light Guide or Optical fiber
- Optically isolated TTL input for external triggering (no shutter needed)
- Optically isolated Analog input (0-5V) for LED power control by external device
- Easy illumination field adjustment by XY and Focus (collimation)
- Stable precisely adjustable power
- Passive cooling without fan

1.2 Intended use

The Mic-LED is a high-power LED light source designed to be used in various scientific applications in laboratory. Few examples of use are fluorescence microscopy, whole body imaging of small animals (*in-vivo*), bio-analysis, photo-activation and numerous others.

1.3 Mic-LED versions

The Mic-LEDs are manufactured in several versions according to the preinstalled LED type and wavelength. The Mic-LED head will be equipped with an enhanced heat-sink depending to heat dissipation requirements of a specific LED chip.

2 Safety

2.1 General safety

Please make yourself familiar with the contents of these operating instructions before using the Mic-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.

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.

2.2 Eye safety

Some of Mic-LED illuminator systems are in ***excess of the Exempt Group***. The viewer-related risk is highly dependent upon the use and installation of the product. For example if the product is attached to epifluorescence port of microscope the beam is restricted and in most case such system will be assigned to a Low Risk or Exempt Group, on the contrary if the illuminator is used for table top illumination of a Petri dish – such assembly may be of potentially High Risk Group. Each specific setup shall be evaluated and assigned to an appropriate risk group by the user and appropriate safety means should be taken. Herein below a free space unrestricted setup is analyzed and various models of Mic-LED illuminators are assigned to appropriate Risk Groups. This assignment is a worst case analysis.

2.2.1 Mic-LED assignment according to IEC 62471

The Mic-LED illuminator is assigned to following risk groups according to IEC 62471: 2006. The assignment done based on the standard system configuration for table top illumination. The assignment results are summarized in Table 1.

Table 1: Mic-LED illuminator assignment to risk groups according to IEC 62471: 2006.

Product Type	Assignment to Risk Group			
	Exempt RG0	Low Risk RG1	Mod Risk RG2	High Risk RG3
Mic-LED-365B				√
Mic-LED-390B				√
Mic-LED-405B				√
Mic-LED-445CA				√
Mic-LED-465CA			√	
Mic-LED-515CA		√		
Mic-LED-550A		√		
Mic-LED-590A		√		
Mic-LED-630CA	√			

The UHP-T illuminators are marked on the product with following labels:

Product	Safety Label
Mic-LED-365B Mic-LED-390B	**RISK GROUP 3** WARNING UV emitted from this product. WARNING Possibly hazardous optical radiation emitted from this product.
Mic-LED-405B	**RISK GROUP 3** WARNING Possibly hazardous optical radiation emitted from this product. CAUTION UV emitted from this product.
Mic-LED-445CA	**RISK GROUP 3** WARNING Possibly hazardous optical radiation emitted from this product.
Mic-LED-465CA	**RISK GROUP 2** CAUTION Possibly hazardous optical radiation emitted from this product.
Mic-LED-515CA	Not required

Mic-LED-550A	Not required
Mic-LED-590A	Not required
Mic-LED-630CA	Not required

2.2.2 Special safety notes

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

Table 2: Safety notes specific to various product types

Product	Risk group assignment	Safety label
Mic-LED-365B Mic-LED-390B	Risk Group 3	**RISK GROUP 3** WARNING. UV emitted from this product. Avoid eye and skin exposure to unshielded products.
Mic-LED-405B	Risk Group 3	**RISK GROUP 3** WARNING. UV emitted from this product. Avoid eye and skin exposure to unshielded product CAUTION. UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding. CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes. .

Mic-LED-445CA	Risk Group 3	**RISK GROUP 3** WARNING. Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result. CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.
Mic-LED-465CA	Risk Group 2	**RISK GROUP 2** CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.
Mic-LED-515CA	Low Risk (Risk Group 1)	Not required
Mic-LED-550A	Low Risk (Risk Group 1)	Not required
Mic-LED-590A	Low Risk (Risk Group 1)	Not required
Mic-LED-630CA	Exempt (Risk Group 0)	Not required

2.2.3 Hazard Distances (HD)

Following Table 3 provides the distance at which the threshold illuminance EL for Blue Light photochemical hazard returns the product to RG 1. Only Mic-LED-405B, Mic-LED-445CA and Mic-LED-465CA shall be considered since other products are already at RG 1 or lower.

Table 3: Distances at which the Blue Light photochemical hazard reduces to Risk group 1, for relevant products.

Product	Distance at which Blue-Light hazard reduced to Risk Group 1
Mic-LED-405B	3.9 m
Mic-LED-445CA	5.6 m
Mic-LED-465CA	4.4 m

2.2.4 Permissible exposure duration (tmax)

The Permissible exposure durations for Mic-LED product are calculated and reported in Table 4 below

Table 4: Permissible exposure durations for Mic-LED products.

Product	Radiance	t_{max}
	[$W \cdot m^{-2} \cdot sr^{-1}$]	[sec]
Mic-LED-365B	9.154E+02	1092
Mic-LED-390B	6.568E+03	152
Mic-LED-405B	3.627E+04	28
Mic-LED-445CA	7.686E+04	13
Mic-LED-465CA	4.666E+04	21
Mic-LED-515CA	1.323E+03	756
Mic-LED-550A	2.086E+03	479
Mic-LED-590A	4.935E+02	2026
Mic-LED-630CA	7.435E+01	13450

3 Setup 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

(1) Mic-LED Head	(2) BLCC-04 LED Current Controller
	
(3) LED Control Cable	(4) Mains Power Adaptor
	
(5) Mains Power Cord	
	

#	Item	Description	QTY
1	Mic-LED	Mic-LED head	1
2	BLCC-04	Benchtop High-Power LED Current Controller	1
3	LED Control Cable	A cord to connect the Mic-LED to the BLCC-04	1
4	Power Adaptor	Power Adaptor 12VDC	1
5	Mains Power Cord	A Cord to connect the power adaptor to mains power	1

Remark: If the system is ordered with Microscope Adaptor, in most cases it will be assembled on the Mic-LED head.

3.2 System overview

Following two sections provide brief overview of the product.

3.2.1 BLCC-04 LED current controller

Fig. 1: BLCC-04 Current Controller Front Panel

- 1 - ON\OFF switch
- 2 - LED power adjust

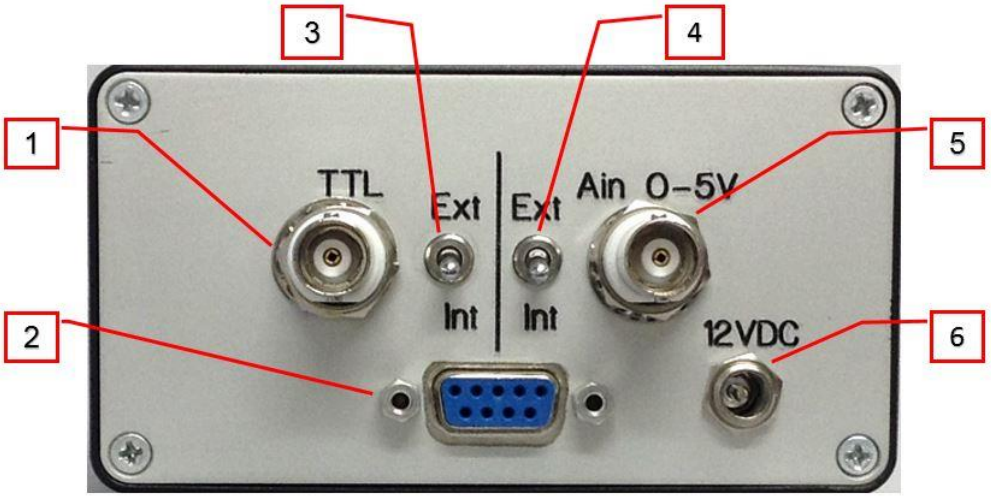


Fig 2: BLCC-04 Current Controller Back Panel

- 1 - TTL input from external source
- 2 - 9-pin D-type connector for LED current cord
- 3 - TTL input enable switch
- 4 - Analog input enable switch
- 5 - Analog input from external source
- 6 - 12VDC power input from power adaptor (included)

3.2.2 Mic-LED head

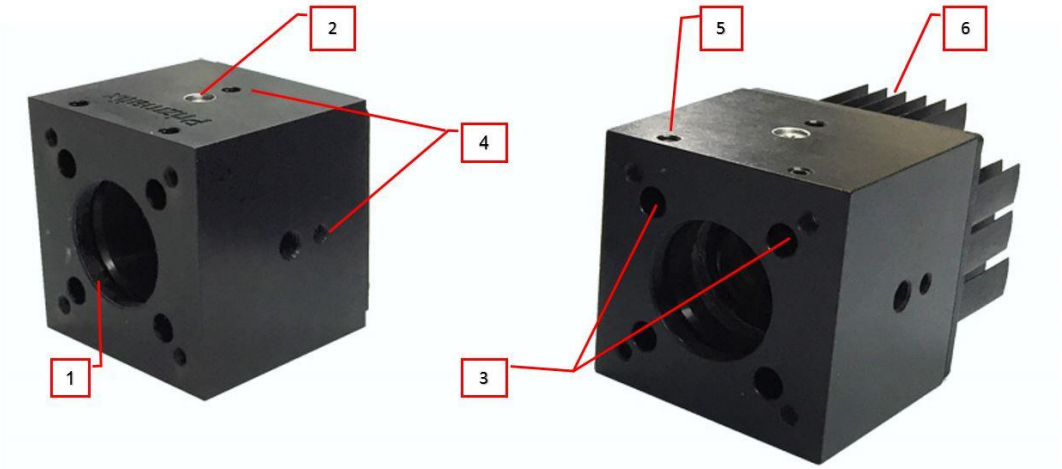


Fig 3: Mic-LED head. Some of the Mic-LEDs are manufactured with an enhanced heatsink according to the specific LED chip.

- 1 - SM1 compatible thread
- 2 - Lens Z-adjustment screw
- 3 – Four (4) holes for interconnecting pins
- 4 - X-Y LED adjustment screws
- 5 - Threaded holes for locking screws (M4)
- 6 – Heat Sink

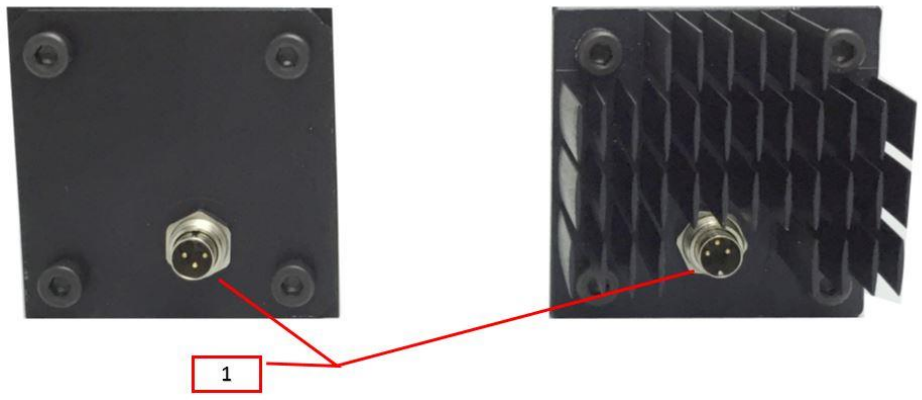


Fig 4: Back panel of Mic-LED head.

- 1 - Cable connector

3.3 Mic-LED system setup

1. Turn OFF the ON/OFF switch on the front panel and turn the LED power dial counter-clockwise to minimum.
2. Connect the DC Current cord to the Mic–LED (circular 3-pin connector) and to the BLCC-04 LED connector on the back panel (9-Pin D-Type Connector) (See Fig. 5 below).
3. Install the Mic-LED head into your setup. If the LED head will be used on a microscope, please see the section “Mic-LED System Connection to Microscope” in this manual.
4. Connect the Power Adaptor output cord to the 12VDC socket on the back panel of the BLCC-04
5. Connect the Power Adaptor to the wall outlet.
6. Switch the two Int / Ext toggle switches on the back panel of BLCC-04 to the "Int" position.
7. Press the green ON key on the front panel and adjust the LED power dial clockwise to the desired power level.

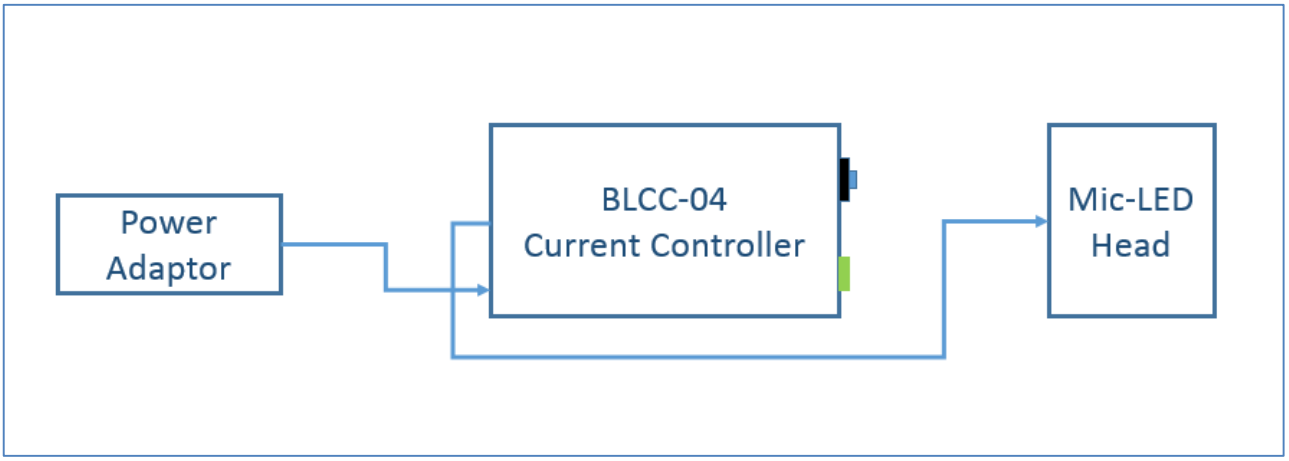


Fig 5: Mic-LED with BLCC-04 system connection diagram.

3.3.1 External TTL switching

The external TTL input on the back panel of BLCC-04 enables external control of LED ON/OFF state. The TTL Low state will switch the LED OFF and the TTL High state will switch the LED ON. The LED power is still controlled by the dial on the front panel of the BLCC-04. In order to enable this operation mode switch the Int/Ext toggle switch to "Ext" position and connect a TTL source.

3.3.2 LED Power control by external analog input

The external Analog Input (Ain) on the back panel of BLCC-04 enables control of LED output power by an external voltage source (0-5Vdc). The 0V at Ain will switch the LED

OFF and the 5V at Ain will provide maximum LED power. In order to enable this operation mode switch Int/Ext toggle switch to "Ext" position

3.4 Use of Mic-LED on a microscope

3.4.1 Setting of the Mic-LED on the microscope

1. The Mic-LED is designed to fit into the fluorescence lamp port of a microscope by using appropriate microscope adaptors.
2. Dismantle any existing fluorescence lamp (Hg, Xenon, etc.) from the microscope: most microscope manufacturers (Zeiss, Olympus, Leica) use set screws to tighten the lamp onto the port. Release the screws and carefully pull out the lamp. In the case of Nikon microscopes with an F-mount, turn the grooved collar counterclockwise and release the lamp.
3. Carefully insert the Mic-LED into the lamp port. Ensure the Z-adjustment screw is accessible and tighten the set screws (or collar in Nikon microscopes).
4. Observe the illumination. If needed adjust the Mic-LED axial focus by a Hex Key (2mm or 5/64")

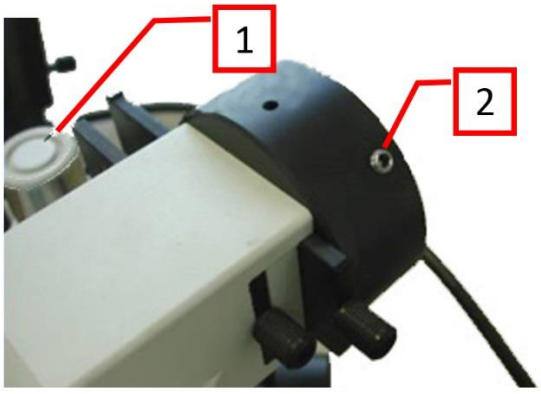


Fig 6: Olympus microscope epi-fluorescence lamp port: (1) Olympus hex screw driver, (2) Light source fixation set screws.

3.4.2 Mic-LED to microscope alignment

XY adjustment is sometimes needed due to a slight misalignment of the optical path of the Mic-LED relative to the optical path of the microscope.

Z -alignment of the collector lens is required to optimize the excitation power and the illumination provided by the Mic-LED.

3.4.3 XY adjustment

Align the LED with small movements (few mm in each direction) of the internal LED assembly relative to the Mic-LED output lens.

The procedure should be performed when the Mic-LED head is connected to the microscope body.

Adjust the X and Y placement of the LED assembly by slightly turning the respective XY adjustment screws (M4 Allen screws see Fig. 2) as follows:

(a) Turn ON the Mic-LED at **less than maximum power**.
(b) Slightly release all 4 screws by about ¼ turn. Use a 3 mm Allen screw driver.
(c) Use the two 3 mm Allen screwdrivers on opposite sides of the Mic-LED head block. The screwdrivers should be turned in opposite directions (one side tightens the setscrew and the other side loosens it) in order to move the internal LED assembly relative to the lens.
(d) Observe the spot of light on a piece paper held in front of the light while turning the setscrews until an optimal position is obtained.
(e) After reaching optimal position in both X and Y directions tighten all screws.

Important: Do not use excessive force on the screws.

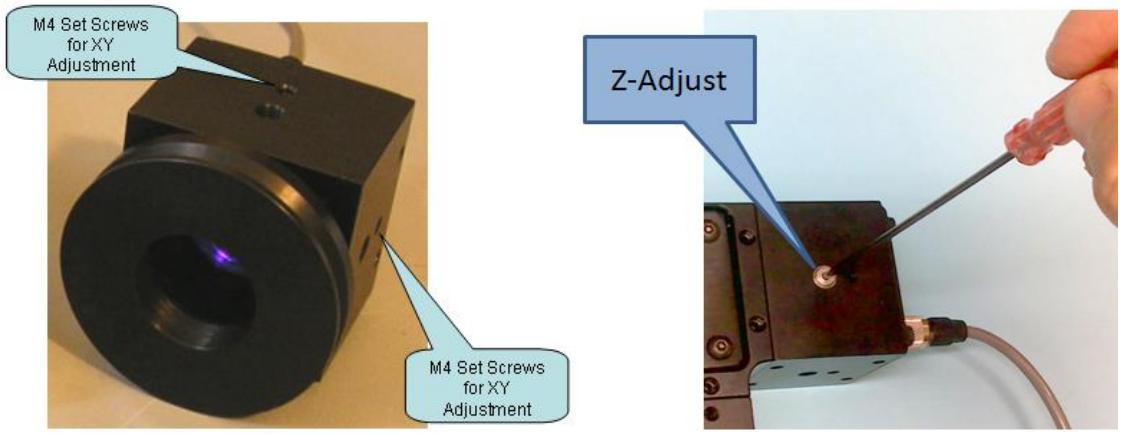


Fig. 7: Mic-LED XY adjustment set screws and Z adjustment fine screw.

3.4.4 Z - adjustment

Adjust the Z placement of the collimating lens relative to the LED chip by slightly turning the Z-Adjust screw on one of the faces of the Mic-LED head.

3.5 LED control by TTL and /or analog input

The TTL input (TTL) and Analog Input (Ain) BNC connectors are placed at rear panel of the BLCC-04 controller, featuring the TTL and Ain connector and toggle switches as shown above.

To control the LED by TTL input:

- Connect the BNC cable to the TTL input and to TTL trigger source.
- Switch the "TTL Enable" toggle to **Ext** position to enable the triggering

To control the LED power via Analog Input voltage:

- Connect the BNC cable to the Ain input and to voltage source.
- Switch the "Ain Enable" toggle to **Ext** position to enable power control by analog voltage

! CAUTION!:

- The absolute maximum voltage to be applied to Ain is +5V.
- The internal pin of BNC connector is Positive (+).
- The external part of the connector is Negative (-).
- The Ain input is not opto-isolated.
- The Ain is intended for LED power control via Digital to Analog (D/A) modules. It is not suited for analog modulation of LED power at rates higher than few 10Hz

! CAUTION!:
Using more than the maximum voltage or inverse polarity may cause permanent damage to LED and Current Controller!

4 Cleaning

Keep the Mic-LED head clear from dirt and do not leave it open. Make sure to close the output aperture of the illuminator with a cap when it is not in use.

The BLCC-04 current controller 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!

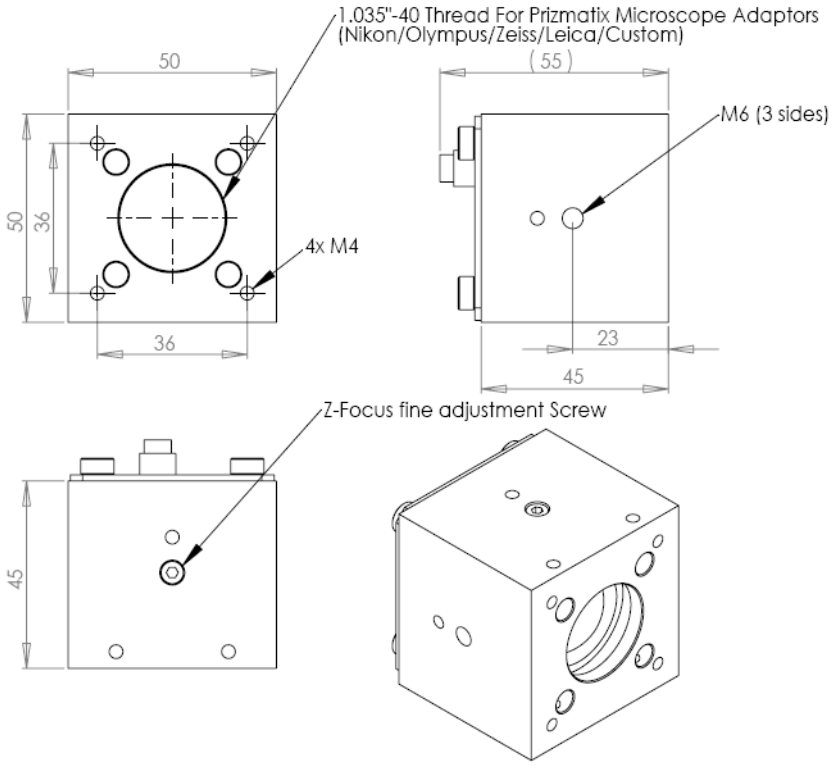
5 Specifications

5.1 Electrical specifications

TTL and Analog Input		Optically isolated BNC connectors
Rise / Fall time (10% - 90%)	µs	<5 / <2.5
Analog power control	%	0-100
Analog input voltage range	V	0 - 5
ON/OFF		Power switch or by TTL signal
Current controller input supply voltage	V	12
Power Adaptor Input		85-264 VAC, 47-63 Hz, 1.5 A

5.2 General specifications

Operation temperature range	°C	10 - 35
Storage temperature range	°C	-10 - 55
Operating relative humidity (Non condensing)	%	<90
Head dimensions		See drawing below
Head weight	g	350
Controller dimensions (L x W x H)	mm	197 x 174 x 80
Controller weight	g	400
Power adaptor dimensions (L x W x H)	mm	90 x 53 x 35
Power adaptor weight	g	190
Power Adaptor Safety		



6 Prizmatix OptiBlock system

All Prizmatix's LED light sources can be easily configured for use in a wide variety of applications (microscopy, imaging and spectroscopy are just few) by simply using additional components. These use a standard 1.035” 40TPI thread (SM1 compatible) or Prizmatix's 4-pin connection system. Fig. 8 shows the various OptiBlock units available for the Mic-LED system.

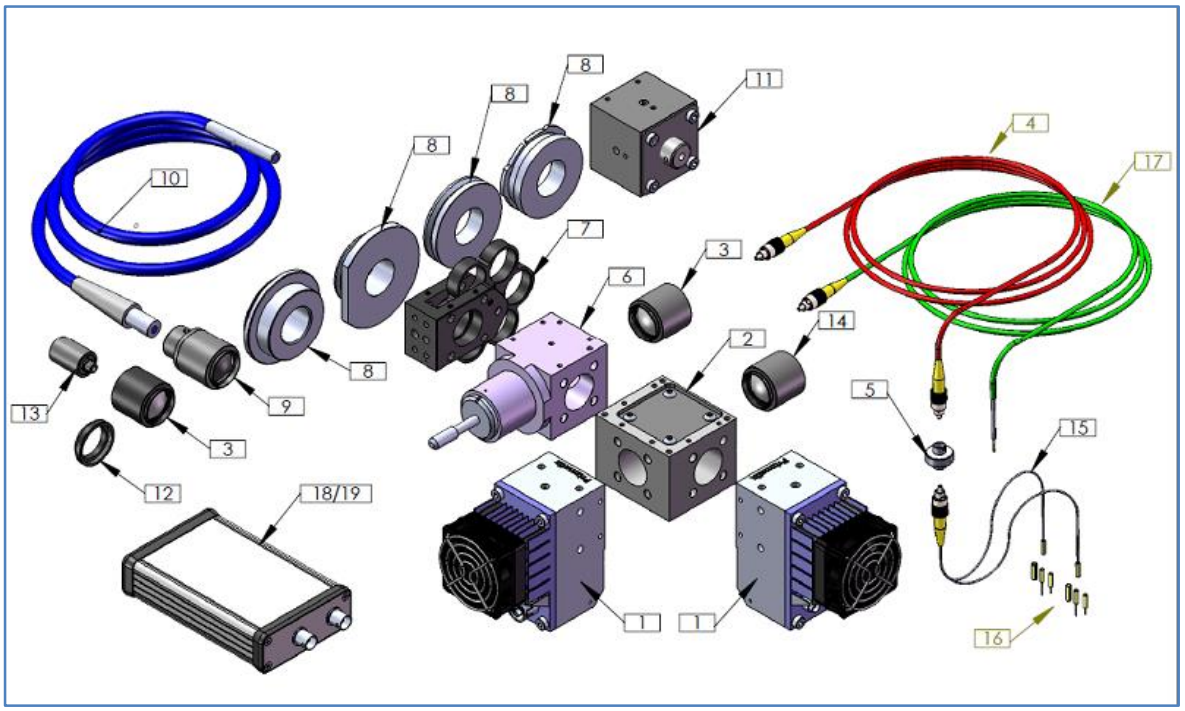


Fig. 8: OptiBlock units

The following table summarizes the most popular accessories according to application, further information on individual parts can be found in thenext page.

The connection of Beam-Combiner OptiBlock is performed by Prizmatix's 4-pin connection system as shown in the following figures

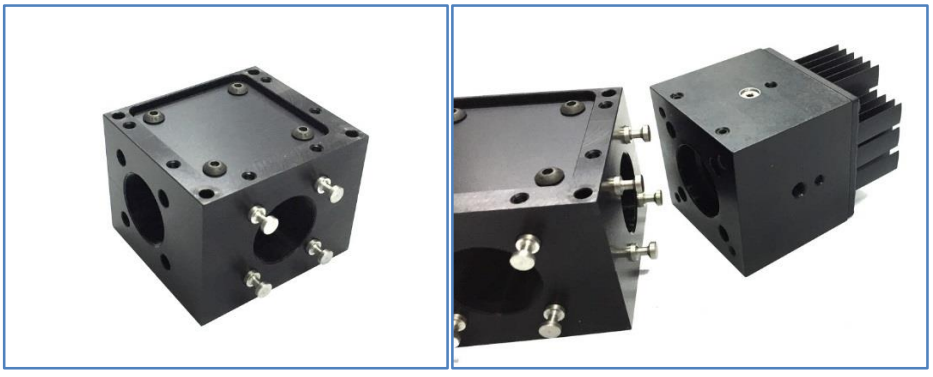


Fig 9: (a) Beam-Combiner OptiBlock, (b) Beam-Combiner OptiBlock with Mic-LED head

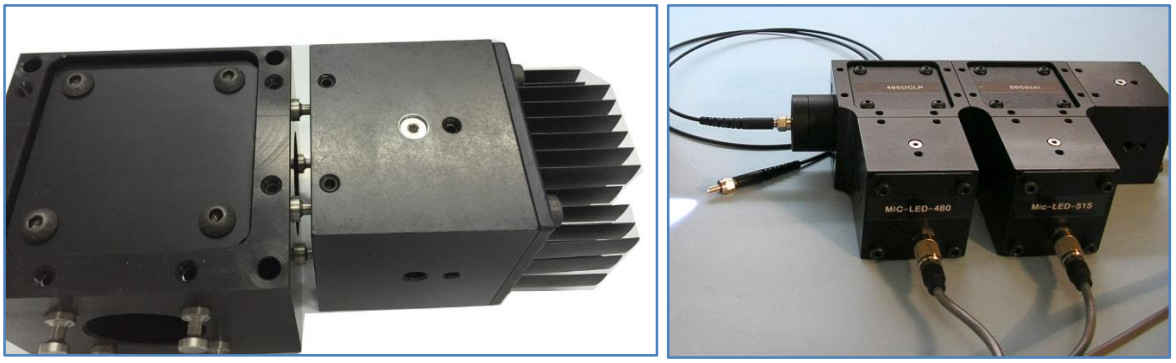


Fig 10: (a) Beam-Combiner OptiBlock attached to Mic-LED, (b) Multi-wavelength system built from 3 X Mic-LED heads, 2 X Beam-Combiners and 1 X FCA fiber coupler adaptor.

All accessories are available for purchase on the Prizmatix website.

#	***Accessories***		
	Fiber delivery, Spectroscopy Microscopy and Imaging	↓	↓
1	Prizmatix Mic-LED, UHP-Mic-LED and UHP-T LED Light Source	♦	♦
2	Beam Combiner – Combines several LEDs into one beam using a dichroic mirror	♦	♦
3	FCA – Fiber Coupler Adaptor - couples an optical fiber to LED: SMA or FC connectors		♦
4	Fiber Patch Cord – Polymer / silica optical fiber (single or multiple branches)		♦
6	Beam Switcher – Changes direction of beam output (e.g. microscope to fiber)	♦	♦
7	Filter wheel – Takes up to six 1” filters	♦	
8	Microscope Adaptors - Adaptors for epi-fluorescence ports of Nikon / Olympus / Zeiss / Leica microscopes	♦	
9	LLG-A - Couples Liquid Light Guide to LED system	♦	
10	LLG-3 / LLG-5 - Liquid Light Guide: 3mm or 5mm core	♦	
11	LLG-C - Collimates Liquid Light Guide beam for fluorescent microscope	♦	
12	C-Mount Adaptor - Used to mount LED on camera port of microscope	♦	
13	Fiber Collimator – Specially designed to collimate high NA optical fibers		♦
14	Reference Photodiode - Monitors LED system power output	♦	♦
19	USB-TTL Interface - To control Prizmatix LEDs from Imaging software (e.g. microManager) via USB connection	♦	♦