BioLED Light Source Solutions

(Related Products: BLS-SA0x-US, BLS-PL0x-US and BLS-series LED sources)

FEATURES

- Turn-key, complete light source solutions
- Enhanced output optical power in "IntelliPulsing" mode for Optogenetics
- Over 100 LED modules, from fiber-coupled, collimated, lightguide-coupled to micro-scope illuminator
- Wide range of wavelengths UV, VIS to NIR and white
- TTL triggers
- Fast time response (μs)
- Operates with or without a PC
- Powerful and user-friendly GUI

APPLICATIONS

- Optogenetics
- Fluorescence excitation
- Biophotonics applications

BioLED Control Module

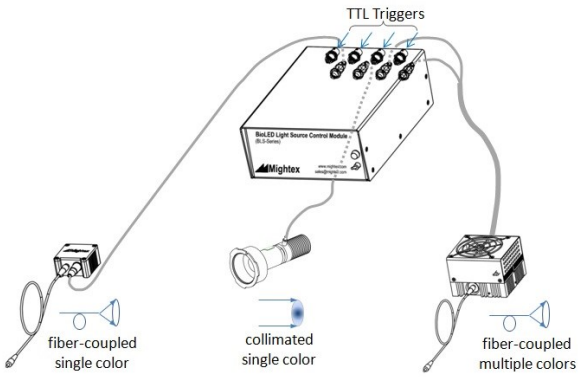
(a) Front view.

(b) Rear view.

PRODUCT DESCRIPTION

Goptica BLS-series BioLED light sources are modularized fully-customizable turn-key solutions for optogenetics, fluorescence excitation, and other biophotonics applications. Precisely-timed and high-intensity light pulses are required in optogenetics experiments to activate channelrhodopsins (ChR2, ChR1 etc.) and halorhodopsins (NpHR) in order to excite and inhibit neurons. To meet these requirements, Goptica has developed a proprietary "IntelliPulsing" technology to allow BLS-series sources to output significantly higher power in pulse mode than what the LEDs are rated for in CW mode.

Figure-1: A typical example of Goptica BioLED light source turn-key solution. This example shows a solution that includes a Control Module and three (3) Optical Heads: one single-color fiber-coupled LED (i.e. FCS-series), one single-color collimated LED (i.e. LCS-series) with a Nikon microscope adapter, andone multi-wavelength fiber coupled LED (i.e. WFC-series, with two colors).



As shown in Figure-1, a typical Goptica BioLED light source consists of a Control Module and up to four (4) Optical Heads (i.e. LED modules), which can be chosen from over 100 models of LED sources and from over 30 (and a growing number of) wavelengths/colors ranging from 240nm to 940nm (see Figure-2). A product selection guide is illustrated in Figure-3. After a customer has chosen the desired optical head(s), they are programmed together with the Control Module in factory to provide a turn-key solution ready to use upon delivery. Some of these optical heads are capable of outputting more than 1W of optical power. A wide selection of illumination formats (e.g. fiber-coupled, collimated and lightguide coupled etc.) will suit the illumination needs for a broad range of applications. Below are some examples -

For *in vivo* stimulations:

- Fiber-coupled, single-fiber, single color;
- Multi-wavelength fiber coupled, single fiber, multiple colors;
- Precision spotlights.

For *in vitro* stimulations (e.g. cultured neurons and brain slices under microscopes):

- Collimator source and microscope sources, single or multiple colors;
- Lightguide-coupled;
- Wavelength-switchable source (collimated beam or lightguide coupled).

All standard Goptica LED light sources can be integrated into the BLS-series light source system. Furthermore, customers may choose optical heads with different wavelengths and formats to be integrated with the same control module. Multiple control modules can be 'stacked' in software to support more than 4 optical heads.

The control module features a linear LED driver design that eliminates light intensity ripples and oscillations often observed when low-cost buckpuck nonlinear drivers are used. Clean and highly repeatable pulses are critical to quantitative experiments. Both CW mode and pulse modes are supported. Time resolution of the control module is 20μs and light intensity can be adjusted with 0.1% increments. Each driving channel on the control module has its own TTL trigger input. Rising edge, falling edge, and follower mode are supported in the trigger mode.

The control module can be operated without being connected to a computer. Once pulse sequences are programmed and stored into the control module (by user through software), the light source can operate alone without a computer. All it needs is a TTL trigger signal to output the user-programmed pulse sequences.

Goptica BioLED light sources come with a Windows-based operation software featuring an intuitive yet powerful graphic user interface. A software development kit (SDK) is also provided for user integration into environment such as Labview and Matlab.

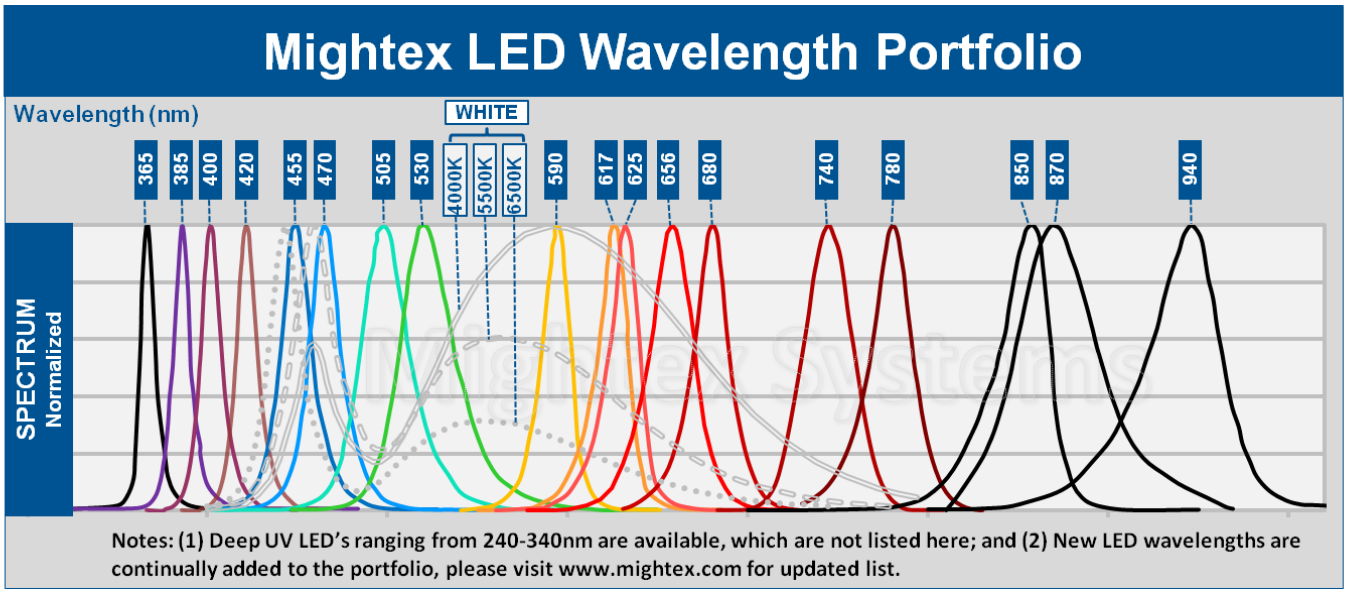


Figure-2: Typical spectra of Mightex's LED sources. Please contact Mightex for UV LED spectra between 240-365nm.

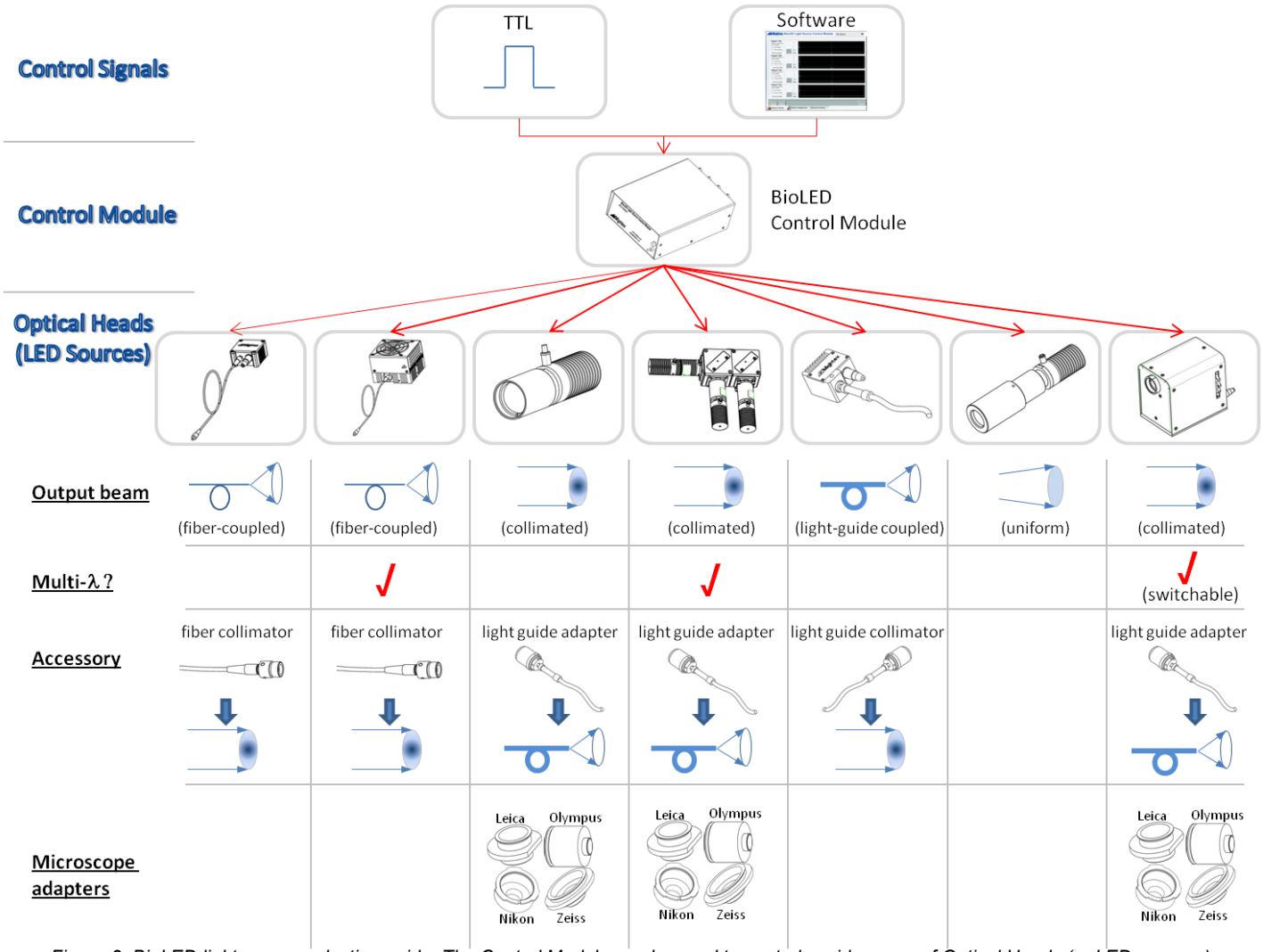
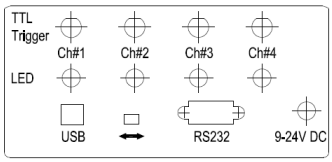


Figure-3: BioLED light source selection guide. The Control Module can be used to control a wide range of Optical Heads (or LED sources).

PERFORMANCE SPECIFICATIONS

(1) Electrical Specifications for Control Modules.

Parameter	BLS-SA02-US	BLS-SA04-US	BLS-PL02-US	BLS-PL04-US	Unit
Synchronization with Polygon400	NO		YES		
Number of channels	2	4	2	4	
Power supply, V_{dc}	9 ~ 24				V
Output intensity resolution	0.1%				-
Time resolution	20				µs
Maximum number of pulses in one period	21				-
Maximum repeat count of pulse sequence	10^8				-
External trigger level	TTL*				-
Trigger connector type	BNC				-
Max. Trigger delay	25				µs
Optical Head connector type	2-pin Aero connector				-
Host interface	USB or RS232, selectable				-
Non-volatile memory	Yes**				-
Dimensions	213 (L) x 156 (W) x 73 (H)				mm
Weight	800				g



Rear Panel

*. An opto-coupler is used for each trigger input, which can accept voltage from 3.6~12 V as “H”. Please note that the trigger source should be capable of providing at least 5mA current when it’s “H”.
**. Built-in non-volatile memory allows all the operation parameters to be stored on the BioLED Control Module, thus the device can work without a host connected.

(2) Optical Specifications for BLS-series Optical Heads (i.e. LED Modules)

2.1. Fiber-Coupled LED Modules

Part Numbers and Ordering Information

BLS - FCS - xxxx - 000

xxxx: Wavelength Code; 000: Configuration Code

Fiber Patch Cord Ordered Separately

Wavelength Code (xxxx)	Description	Peak Wavelength (nm)	Radiant Flux[1] (mW)	
			CW Mode	IntelliPulsing Mode
0000	Cool White	5,500K	3.2	6.5
0001	Warm White	3,400K	3.2	6.5
0240	Deep UV	240	10µW	20µW
0255	Deep UV	255	45µW	90µW
0260	Deep UV	260	45µW	90µW
0275	Deep UV	275	90µW	180µW
0280	Deep UV	280	90µW	180µW
0285	Deep UV	285	90µW	180µW
0295	Deep UV	295	75µW	150µW
0310	Deep UV	310	90µW	180µW
0325	Deep UV	325	60µW	120µW
0340	Deep UV	340	60µW	120µW
0365	UV365nm	365	5.8	12
0385	UV385nm	385	5.8	12
0400	UV400nm	400	0.8	1.6
0400	UV400nm, 4W	400	3.5	13
0420	420nm	420	2.6	5.2
0455	Royal Blue	455	7.0	15
0470	Blue	470	8.0	16
0505	Cyan	505	3.5	7.0
0530	Green	530	2.0	4.0
0590	Amber	590	1.2	2.5
0617	Red-Orange	617	6.5	13
0625	Red	625	6.5	13
0656	Deep red	656	6.5	13
0657	Deep red	657	1.0	2.0
0680	Deep red	680	1.4	2.8
0740	NIR 3W	740	3.6	7.2
0780	NIR	780	2.2	4.5
0850	NIR	850	4.0	8.0
0870	NIR	870	1.4	2.8
0940	NIR	940	4.0	8.0

Note: * - measured with a 400µm core 0.22 numerical aperture (NA) fiber. Output optical power scales approximately linearly with fiber core area and NA^2. With a 400micron-core 0.39NA fiber, the output power will be 3.14x as what has been stated in the table above. For example, for the 470nm wavelength, the output power will become 25mW in CW mode and 50mW in "IntelliPulsing" mode, instead of 8mW and 16mW (respectively) as shown in the table above.

2.2. Multi-Wavelength Fiber-Coupled LED Modules

Part Numbers and Ordering Information

BLS - WFC - Hx - xxxx - xxxx - ..... - xxxx

- Hx: # of Wavelengths
- xxxx: Wavelength Code #1
- xxxx: Wavelength Code #2
- .....: (repeat if applicable)
- xxxx: Wavelength Code #N

Wavelength Code (xxxx)	Wavelength (nm)	Output Power[1](mW)							
		2-wavelength		3-wavelength		4-wavelength		(5~8)-wavelength	
		CW	IntelliPulsing	CW	IntelliPulsing	CW	IntelliPulsing	CW	IntelliPulsing
0365	365	4.8	10.0	4.6	9.2	4.3	8.5	3.9	8.0
0385	385	4.8	10.0	4.6	9.2	4.3	8.5	3.9	8.0
0400	400	4.4	9.0	4.2	8.5	4.0	8.0	3.6	7.2
0420	420	1.6	3.5	1.5	3.0	1.4	2.8	1.3	2.6
0455	455	5.6	11.5	5.3	11.0	5.1	10.5	4.5	9.0
0470	470	6.0	12.0	5.7	11.5	5.4	11.0	4.9	10.0
0505	505	2.8	5.6	2.6	5.2	2.5	5.0	2.3	4.6
0530	530	2.4	4.8	2.3	4.6	2.2	4.4	1.9	4.0
0590	590	1.3	2.6	1.2	2.4	1.2	2.4	1.1	2.2
0617	617	5.2	10	4.9	10	4.7	9.4	4.2	8.4
0625	625	6.1	12.2	5.9	11.8	5.5	11.0	5.0	10.0
0656	656	5.2	10	4.9	10	4.7	9.4	4.2	8.4
0740	740	2.4	4.8	2.3	4.6	2.2	4.4	1.9	3,8
0850	850	3.2	6.4	3.0	6	2.9	5.0	2.6	5.2
0870	870	2.4	4.8	2.3	4.6	2.2	4.4	1.9	4.0
0940	940	3.2	6.4	3.0	6.0	2.9	6.0	2.6	5.2

Note: * - measured with a 400µm core 0.22 numerical aperture (NA) fiber. Output optical power scales approximately linearly with fiber core area and NA^2. With a 400micron-core 0.39NA fiber, the output power will be 3.14x as what has been stated in the table above.

2.3. Precision LED Spotlights

Part Numbers and Ordering Information

BLS - PLS - xxxx - xxx - xx

- xxxx: Wavelength Code
- xxx: Beam Diameter (mm)
- xx: Electrical Power (W)

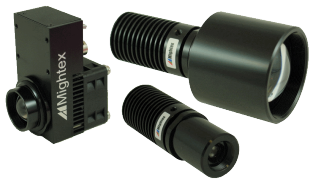
Part Number	Type	Wavelength Code (xxxx)	Wavelength (nm)	Output Power (mW)	
				CW	IntelliPulsing
BLS-PLS-0365-030-02	A	0365	365	50	100
BLS-PLS-0365-030-07	B	0365 (7W)	365	250	500
BLS-PLS-0385-030-02	A	0385	385	50	100
BLS-PLS-0385-030-07	B	0385(7W)	385	300	600
BLS-PLS-0400-030-01	A	0400	400	50	100
BLS-PLS-0400-030-05	A	0400	400	120	240
BLS-PLS-0400-030-17	B	0400	400	400	800
BLS-PLS-0420-030-01	A	0420	420	35	70
BLS-PLS-0455-030-04	A	0455	455	150	300
BLS-PLS-0470-030-04	A	0470 (4W)	470	110	230
BLS-PLS-0470-030-15	B	0470 (15W)	470	450	900
BLS-PLS-0505-030-04	A	0505	505	65	140
BLS-PLS-0530-030-04	A	0530 (4W)	530	50	100
BLS-PLS-0530-030-15	B	0530 (15W)	530	200	400
BLS-PLS-0590-030-04	A	0590	590	35	70
BLS-PLS-0590-030-10	B	0590	590	140	280
BLS-PLS-0617-030-04	A	0617	617	150	300
BLS-PLS-0617-030-10	B	0617 (10W)	617	450	900
BLS-PLS-0625-030-04	A	0625	625	150	300
BLS-PLS-0656-030-04	A	0656	656	180	360
BLS-PLS-0657-030-01	A	0657	657	50	100
BLS-PLS-0740-030-03	A	0740	740	100	200
BLS-PLS-0740-030-10	B	0740	740	300	600
BLS-PLS-0850-030-02	A	0850	850	85	180
BLS-PLS-0940-030-01	A	0940	940	50	100
BLS-PLS-6500-030-04	A	6500	glacier white 6,500K	100	200
BLS-PLS-6500-030-15	B	6500 (15W)	glacier white 6,500K	400	800
BLS-PLS-5500-030-04	A	5500	cool white 5,500K	85	180
BLS-PLS-4000-030-04	A	4000	warm white 4,000K	85	180

2.4. High-Power Collimated LED Modules

Part Numbers and Ordering Information

BLS - LCS - xxxx - xx - xx

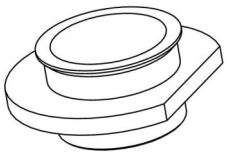
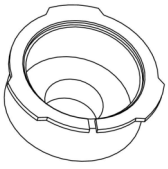
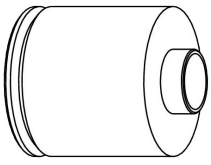
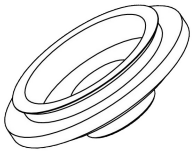
- xxxx: Wavelength Code
- xx: Electrical Power (W)
- xx: Beam Diameter (mm)



Part Number	Type	Wavelength Code (xxxx)	Wavelength (nm)	Half Diverging Angle (deg.)				Output Power (mW)	
				φ11mm[1]	φ22mm[1]	φ38mm[1]	φ48mm[1]	CW	IntelliPulsing
BLS-LCS-0365-02-xx	A	0365	365	3.4	1.7	1.0	0.75	80	160
BLS-LCS-0365-07-xx	B	0365	365	6.8	3.4	2.0	1.5	400	800
BLS-LCS-0365-11-xx	B	0365	365	6.8	3.4	2.0	1.5	500	1,000
BLS-LCS-0385-02-xx	A	0385	385	3.4	1.7	1.0	0.75	100	200
BLS-LCS-0385-07-xx	B	0385	385	6.8	3.4	2.0	1.5	500	1,000
BLS-LCS-0385-11-xx	B	0385	385	6.8	3.4	2.0	1.5	620	1,250
BLS-LCS-0400-01-xx	A	0400	400	5.0	2.5	1.5	1.1	100	200
BLS-LCS-0400-05-xx	A	0400	400	7.5	6.3	2.3	1.7	240	480
BLS-LCS-0400-17-xx	B	0400	400	15	12.6	4.6	3.4	810	1,620
BLS-LCS-0455-03-xx	A	0455	455	3.4	1.7	1.0	0.75	280	600
BLS-LCS-0455-05-xx	A	0455	455	10	5.0	3.0	2.2	350	700
BLS-LCS-0470-03-xx	A	0470	470	3.4	1.7	1.0	0.75	200	400
BLS-LCS-0470-15-xx	B	0470	470	6.8	3.4	2.0	1.5	600	1,200
BLS-LCS-0505-03-xx	A	0505	505	3.4	1.7	1.0	0.75	135	280
BLS-LCS-0530-03-xx	A	0530	530	3.4	1.7	1.0	0.75	100	200
BLS-LCS-0530-15-xx	B	0530	530	10	5.0	3.0	2.2	300	600
BLS-LCS-0590-03-xx	A	0590	590	3.4	1.7	1.0	0.75	65	130
BLS-LCS-0590-10-xx	B	0590	590	10	5	3	2.2	200	400
BLS-LCS-0617-03-xx	A	0617	617	3.4	1.7	1.0	0.75	280	560
BLS-LCS-0617-10-xx	B	0617	617	6.8	3.4	2.0	1.5	600	1,200
BLS-LCS-0625-03-xx	A	0625	625	3.4	1.7	1.0	0.75	280	550
BLS-LCS-0656-03-xx	A	0656	656	3.4	1.7	1.0	0.75	280	550
BLS-LCS-0657-01-xx	A	0657	657	5	2.5	1.5	1.1	100	200
BLS-LCS-0740-03-xx	A	0740	740	7.5	6.3	2.3	1.7	200	400
BLS-LCS-0740-10-xx	B	0740	740	15	12.6	4.6	3.4	600	1,200
BLS-LCS-0780-02-xx	A	0780	780	3.4	1.7	1.0	0.75	110	220
BLS-LCS-0850-02-xx	A	0850	850	3.4	1.7	1.0	0.75	240	480
BLS-LCS-0850-03-xx	A	0850	850	3.4	1.7	1.0	0.75	430	880
BLS-LCS-0940-02-xx	A	0940	940	3.4	1.7	1.0	0.75	200	400
BLS-LCS-6500-03-xx	A	6500	glacier white 6,500K	3.4	1.7	1.0	0.75	180	360
BLS-LCS-6500-15-xx	B	6500	glacier white 6,500K	6.8	3.4	2.0	1.5	540	1,100
BLS-LCS-5500-03-xx	A	5500	cool white 5,500K	3.4	1.7	1.0	0.75	170	350
BLS-LCS-4000-03-xx	A	4000	warm white 4,000K	3.4	1.7	1.0	0.75	180	360

1. Clear aperture diameter. Use these two-digit numbers to replace xx in the part number.

Microscope Adapters for Collimated LED Modules

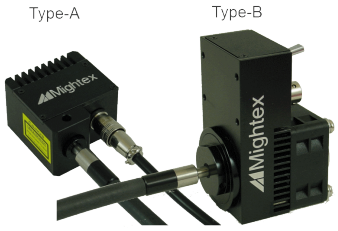
Part Number	ACC-BC25-LC1	ACC-BC25-NK1	ACC-BC25-OL1	ACC-BC25-ZS1
Description	For Leica DMI microscope	For Nikon Eclipse microscope	For Olympus IX & BX micro-scope	For Zeiss Axioskop microscope
Drawing				

2.5. Light-Guide Coupled LED Modules

Part Numbers and Ordering Information

BLS - GCS - xxxx - xx - xxxxx

- xxxx: Wavelength Code
- xx: Electrical Power (W)
- xxxxx: Light Guide Adapter Code



Note: Light guide not included

Part Number[1]	Wavelength Code	Type	Description	Peak Wavelength (nm)	Radiant Flux[2] (mW)	
					CW	IntelliPulsing
BLS-GCS-0365-02-xxxxx	0365 (2W)	A	UV 365nm, 2W	365	90	180
BLS-GCS-0365-07-xxxxx	0365 (7W)	B	UV 365nm, 7W	365	300	600
BLS-GCS-0365-11-xxxxx	0365 (11W)	B	UV 365nm, 11W	365	375	750
BLS-GCS-0385-02-xxxxx	0385 (2W)	A	UV 385nm, 2W	385	100	200
BLS-GCS-0385-07-xxxxx	0385 (7W)	B	UV 385nm, 7W	385	330	700
BLS-GCS-0385-11-xxxxx	0385 (11W)	B	UV 385nm, 11W	385	410	820
BLS-GCS-0455-04-xxxxx	0455	A	Royal Blue, 4W	455	165	350
BLS-GCS-0470-04-xxxxx	0470 (4W)	A	Blue, 4W	470	130	270
BLS-GCS-0470-15-xxxxx	0470 (15W)	B	Blue, 15W	470	400	800
BLS-GCS-0505-04-xxxxx	0505	A	Cyan, 4W	505	30	60
BLS-GCS-0530-04-xxxxx	0530 (4W)	A	Green, 4W	530	60	120
BLS-GCS-0530-15-xxxxx	0530 (15W)	B	Green, 15W	530	180	360
BLS-GCS-0590-03-xxxxx	0590	A	Amber, 3W	590	35	70
BLS-GCS-0617-03-xxxxx	0617 (3W)	A	Red-Orange, 3W	617	200	400
BLS-GCS-0617-10-xxxxx	0617 (10W)	B	Red-Orange, 10W	617	600	1,200
BLS-GCS-0625-03-xxxxx	0625	A	Red, 3W	625	200	400
BLS-GCS-0850-02-xxxxx	0850	A	NIR, 2W	850	125	250
BLS-GCS-0940-02-xxxxx	0940	A	NIR, 2W	940	125	250
BLS-GCS-4000-04-xxxxx	4000	A	Warm White, 4W	4,000K	95	200
BLS-GCS-5500-04-xxxxx	5500	A	Cool White, 4W	5,500K	95	200
BLS-GCS-6500-04-xxxxx	6500 (4W)	A	Glacier White, 4W	6,500K	95	200
BLS-GCS-6500-15-xxxxx	6500 (15W)	B	Glacier White, 15W	6,500K	300	600

Note: 1. “xxxxx” is the Light Guide Adapter code, see Table-2 below; 2. Measured at exiting end of a 3mm-core 0.59 numerical aperture (NA) liquid light guide; and 3. LED modules with electrical power of 7W or higher have a built-in cooling fan (i.e. Type-B), and lower-power modules are Type-A.

Light Guide Adapters

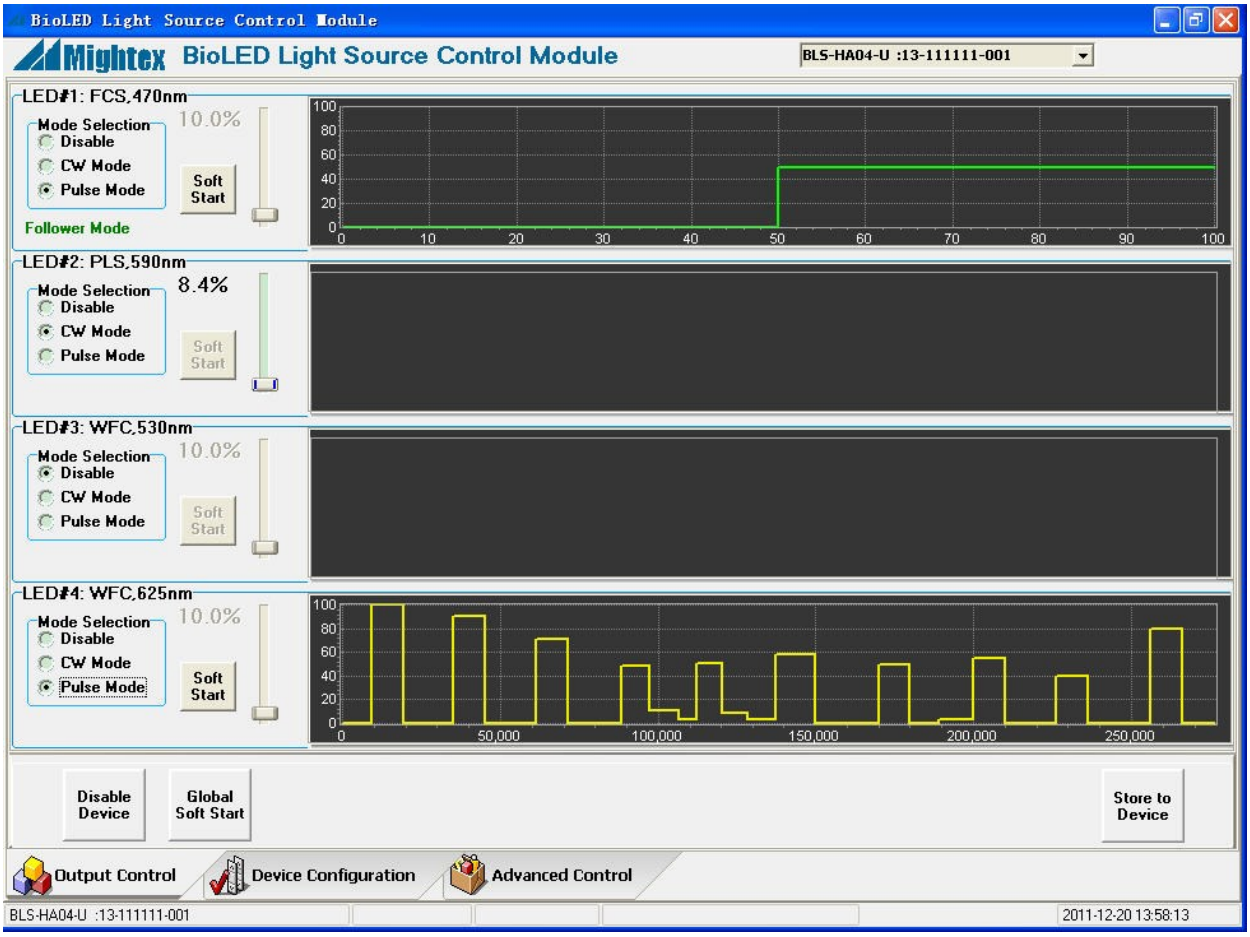
Adapter Code	For Ferrule Diameter (mm)	For Ferrule Length (mm)
A0510	5	≥10
A0610	6	≥10
A0710	7	≥10
A0810	8	≥10
A0815	8	≥15

SOFTWARE FEATURES

Each BioLED Control Module (e.g. BLS-SA04-US) is capable of driving up to four (4) LED modules (or “Optical Heads”) , which a customer can choose from >100 different models/wavelengths according to Figure-3 when ordering the turn-key solution. If more than four (4) Optical Heads are needed, one can simply use multiple Control Modules, and the BioLED software is capable of controlling all Control Modules via the same GUI, as illustrated in the screenshot below.

An Optical Head can be operated in CW or pulse mode, and the software GUI allows one to easily program the pulse shape and sequence to meet individual customer’s needs. In addition, all control parameters can be stored into the non-volatile memory in the Control Module, such that the Control Module can be used as a stand-alone device and the pre-programmed pulse sequence can be activated using an external trigger, without the need to have the Control Module connected to a host PC all the time. Furthermore, BioLED Light Source Solutions also support a ‘follower’ mode, in which the output optical pulse is synchronized with the duration of the input TTL trigger pulse.

Another unique and powerful feature of Goptica’s BioLED Light Source Solutions is ‘IntelliPulsing’, which enables one to obtain significantly higher LED output power than in CW mode. This feature is very useful for those customers who require much higher optical power in pulse mode.



How to order a BioLED light source solution?

Here is a step-by-step guide:

Step-1: Add BioLED Control Module (P/N: BLS-SA04-US) to shopping cart;
Step-2: Add desired BLS-series Optical Heads (e.g. BLS-FCS-0470 etc.) to shopping cart; and
Step-3: In the notes section, mark the channel positions on the BioLED Control Module for each Optical Head. For example: Channel#1: BLS-FCS-0470, Channel#2: BLS-PLS-0590-030, Channel#3: 530nm LED in BLS-WFC-H2-0530-0625, and Channel#4: 625nm LED in BLS-WFC-H2-0530-0625. Order completed.

With a world-class OEM design team, Goptica offers a broad range of customized solutions in order to meet individual customer’s unique requirements. Please call 1-416-840 4991 or email sales@mightex.com for details.