

The **DRAGON** series High Power LED Light Sources

Features

- Plug-and-play frame for LEDs
- Interchangeable LED heads provided
- 455nm, 475nm, 505nm, 530nm, 590nm, 617nm, 630nm, white 5500 K, white 3300 K, UV and IR options
- Selection of collimating optics/ attachments
- Selection of base units
- Fast analog control (some models)
- Low-noise CW control (some models)
- Fast pulsed (digital) control (some models)
- Narrow bandwidth or broadband
- Wide field or focused output
- Continuous, waveforms, or pulses to <150ns
- Up to 400mW CW, x5 intensity short pulse
- Accepts LEDs with 0.2", 0.4", 0.6", 0.8", 1", 1.2" pin spacing

Applications

- Fluorescence excitation
- High-speed imaging
- UV Curing
- Synchronous detection
- Machine vision
- Biomedical optics

Description

The HPLS-45 series of high power LED light sources are designed as flexible system of interchangeable components for applications where it is hard to standardize the requirements for mass-production.

Building a system comes down to (1) selection of appropriate base with specific functionality and type of control; (2) selection of LED head[s] and (3) focusing optics specific for the application.

Functionality of base units include fast analog control (to generate any optical function, sine, saw, square, CW...); low-noise CW control (for applications where ATC-like or PWM algorithms may cause problem); and fast pulsed (digital) control (faster and more powerful than analog).

Selection of the way the optical power is set include external digital/analog signal supplied thru connector (BNC/Twin BNC), or, for CW application, Built-In Potentiometer).

LED heads are currently available in LEDH-xxx series with 0.8" pin spacing for higher performance and wider selection of focusing optics. Many other models of LEDs can be adapted.

The function of focusing optics is to direct the light to the certain spot size on certain distance as required and often custom designed for specific application. Most of new optics is backward-compatible (fits the units previously shipped)



HPLS-45 LED Controller shown with Optional RS1 LED socket and OH36-24X11 Collimator



Front – Local Control

3 digit Potentiometer

Settings by part number

HPLS-45APXXXX-3DEXT

45AP1000: 0-1000mA

45AP0100: 0-100mA

45AP0010: 0-10mA



Back – External Control

0-5V input: 0 to full scale

TTL Disable:

0V: On

5V: Off

Green Connector:

To LED

The output is scaled to the 3 digit potentiometer settings and voltage control.

For example HPLS-45AP1000-3DEXT:

Digital Potentiometer setting 200: Current output 200mA,

0-5V External Voltage control 1V: 200mA, 5V: 1000mA

Disable is active for both local and external control. Default is 0V=ON (No signal)



HPLS-45APL Shown with optional RS1 LED Socket and LED

Description

HPLS Base Unit with built-in 2-channel driver. Analog channel has linear control and continuously variable output, with 1% input offset to ensure shutdown when signal is not applied. Digital channel has 2-level ON-OFF control (active HI). Output current is the sum of outputs of both channels. Switch on the control panel selects which channel is addressed by input BNC connector, thus selecting Digital or Analog mode.

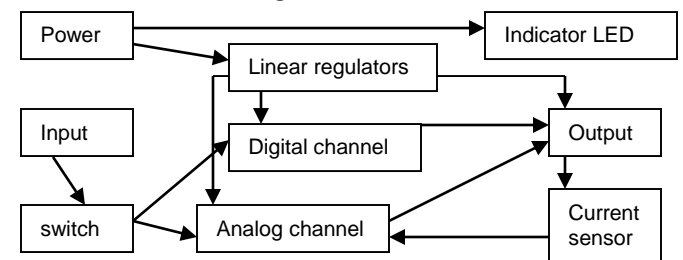
There is an important difference between the output stages of Analog and Digital channels. Analog channel operates in current regulation mode using a feedback from the current sensor in the output stage. Digital channel, on the other hand, provides fast switching while the current is limited by the resistor (without active feedback). This is because the channels are optimized for different purposes: Analog channel is designed to convert the input voltage into output current as precisely as possible and as fast as reasonable but not to hurt the precision; while Digital is optimized for switching the current to MAX level and back to 0 as fast as possible. As a side effect, the current in Digital mode varies slightly for different LED head; while the Analog channel current is regulated to be the same.

Base unit accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR). Accepts focusing optics and attachments mounted on LED head directly and models that have index "36" in a part number.

Common Specifications

- Two operating modes: Analog/Digital
- Dimensions: Ø1.45x4.5" (36.8x115mm)
- Weight: 0.66 lb (0.3 kg)
- Power Requirement: 12V, 0.5A
- Power Connector: 5.5/2.1 mm Power Jack, center positive, barrel common ground
- Control Signal Connector: BNC
- Thermal resistance, convection: 5 C/Watt

HPLS-36AD3500 block diagram



Absolute Maximum Ratings

- Power Input: -1 to 14V; -2A to 2A; fuse protected (2A)
- Signal Input, Digital Mode: -2.5V to 7V; 50mA max, 50 Ohm input impedance
- Input, Analog Mode: -10V to 20V

HPLS-45AD3500 control panel:

Front

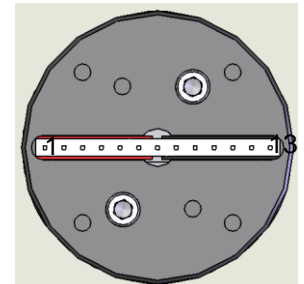
- Local / External selection
- On / Off
- 3 Digit Potentiometer for analog Control

Back:

- External Analog Control 0-5V
- Digital Input TTL Digital output LED Overdrive (1 output setting)



HPLS-45AD3500 exterior view



RS1 Socket LED head connector:

- 13 pins x 0.1" pitch
- Pins 1-6, marked red or yellow: positive
- Pin 7: NC
- Pins 8-13: negative
- Accepts 0.025" (0.64mm) square pins, 0.230" long

Waveforms and specifications

Digital mode specifications:

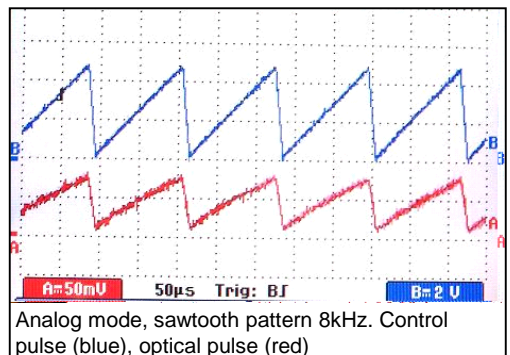
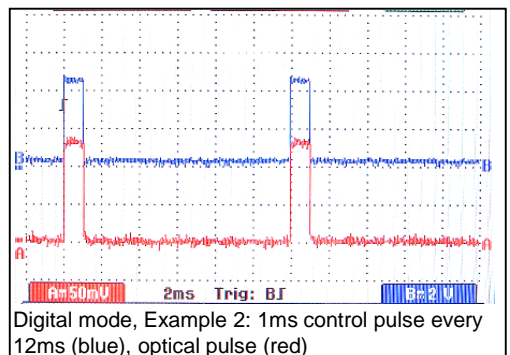
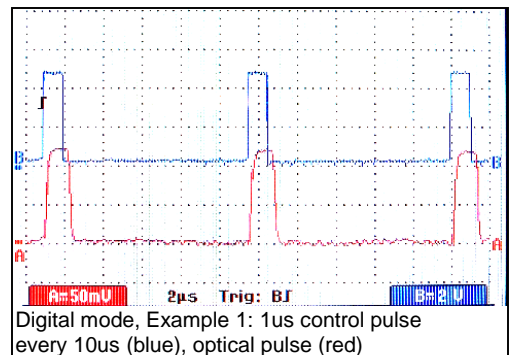
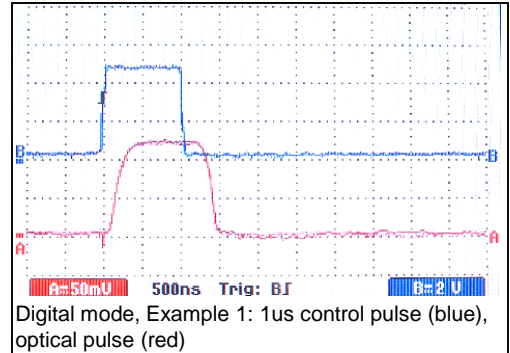
- Output current: 3.5A +/- 0.3A (LED head dependent)
- Rise Time: 80ns (to 1/2 level); 200ns (to 90%)
- Rise front propagation delay: 100ns typ
- Fall Time: 140ns (to 1/2 level); 200ns (to 90%)
- Fall front propagation delay: 200ns
- Pulse front/fall jitter: < 10ns, <5ns typ
- Nominal Signal Level: 3.3-5V; TTL/CMOS
- Logical "0" (light OFF): <0.8V
- Logical "1" (light ON): >2.4V
- Smart Time Limiting Circuitry for LED Protection Limits the Cumulative Energy Delivered to LED
- Single Control Pulse length range: 50ns-1ms
- Maximum Duty Cycle of Continuous Waveform: 10%
- Average Ratio, Active Time/Relaxation Time: 1:10
- Any Repetition Rate
- Trimmer on the Board to Down Regulate the Pulsed Current and Optical Power

Digital mode, protocol examples:

- Example 1: 1us pulse permitted every 10us
- Example 2: 1 ms max duration pulse every 10ms
- Example 3: 50% duty cycle waveform 2ms total duration, permitted every 10ms
- Example 4: 20% duty cycle waveform 5ms total duration, permitted every 10ms
- Example 5: 200ns starting pulse: optical pulse has Gaussian profile, 420ns(1/2), peak is 100% of steady level
- Example 6: 100ns starting pulse: optical pulse has Gaussian profile, 270ns(1/2), peak is 80% of steady level
- Example 7: 50ns starting pulse: optical pulse has Gaussian profile, 200ns(1/2), peak is 60% of steady level

Analog mode specifications:

- Input/Output relationship: Linear, 1% offset
- Output current, continuously variable: 0-500mA
- Output current drift: < 800ppm/hour
- Output current accuracy: +/-3% of set value
- Output current RMS noise: <0.5%
- Input Signal Format: User Programmable (4-Dip switch on the driver board)
- Input Signal Format (Default): 0-5V
- Input Signal Formats: 0-10V; 0-20mA, 4-20mA
- Rise Time/Delay for 0-250mA transit: 400ns(50%), 1.2us(90%) / 1.8us Delay
- Fall Time/Delay for 250-0mA transition: 750ns(50%), 500ns(90%) / 20ns Delay
- Rise Time/Delay for 50-300mA transition: 350ns(50%), 800ns(90%); 20ns Delay



Typical system configuration

Base unit with specific functionality



Front – Local Control



Back – External Control

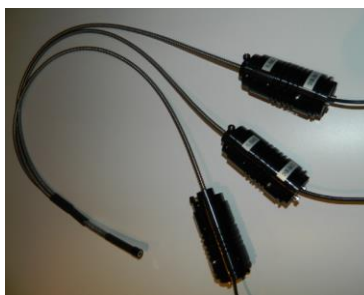
Two Wavelength Direct Fluorescence Configuration



LED RS1 Socket



Three Wavelength Fluorescence Configuration With Fiber Bundles



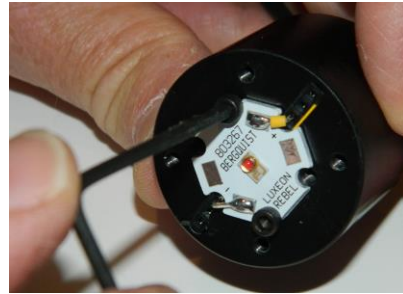
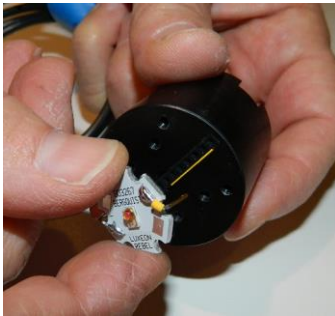
Optics



RS1 LED Socket and
OH36-24X11
Collimator / Focusing
Optic

Well Plate Illuminator Configuration





Installing LED (yellow pin to yellow stripe)



Installing Collimator –Thumb Screw and focus
OX36-24X11 accepts 1 inch filters



Installing FL-25 fiber launcher and FA-XX Adapter

Specifications p.1

LEDH and LEDHR are user-replaceable, LED-based light sources, attached to the HPLS-36 series base units, which provide electrical connection to the driver, means of mechanical mounting and the heat dissipation from the LED. Available in two form factors – LEDHR, bigger, with build-in reflector to collimate the light emitted from the LED, and LEDH, smaller, higher performance, un-collimated light source. Reference to the table below for typical optical power achievable by 14 different models of LED heads when plugged into various HPLS-36 models. For spectral information, form factors, and temperature coefficient of optical power, see the next page.

HPLS-36[] model suffix ⁽⁵⁾	AD500 DD500 AD3500		AP750 AR750 AT750		AP1000 AR1000 AT1000		AD3500 AD3500- DI		AD3500 AD3500-DI		AD3500 AD3500-DI						DD7500	
	Optical power range, min-max, mWt ^{(3), (4)}																	
	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
Current, A	0.5		0.75		1		3.5		3.5		3.5		7.5		7.5			
duty cycle, % ⁽⁶⁾	100		100		100		10		5		2		5		2			
LEDHR-455 ⁽¹⁾	148	270	192	351	222	405	666	1215	681	1242	814	1485	1036	1890	1066	1944		
LEDHR-470 ⁽¹⁾	131	255	170	332	197	383	590	1148	603	1173	721	1403	917	1785	943	1836		
LEDHR-505 ⁽¹⁾	90	160	113	200	135	240	297	528	306	544	315	560	432	768	468	832		
LEDHR-530 ⁽¹⁾	80	145	100	181	120	218	264	479	272	493	280	508	384	696	416	754		
LEDHR-595 ⁽¹⁾	36	85	45	106	54	128	119	281	122	289	126	298	0	0	252	595		
LEDHR-617 ⁽¹⁾	246	340	308	425	369	510	935	1292	1230	1700	1427	1972	0	0	1722	2380		
LEDHR-630 ⁽¹⁾	177	280	230	364	266	420	673	1064	885	1400	1027	1624	0	0	1239	1960		
LEDHR-3500 ⁽¹⁾	70	120	88	150	105	180	315	540	322	552	385	660	490	840	504	864		
LEDHR-5500 ⁽¹⁾	115	190	144	238	173	285	518	855	529	874	633	1045	805	1330	828	1368		
LEDH-455 ⁽²⁾	211	272	274	354	317	408	950	1224	971	1251	1161	1496	1477	1904	1857	2394		
LEDH-470 ⁽²⁾	201	320	261	416	302	480	905	1440	925	1472	1106	1760	1407	2240	1769	2816		
LEDH-505 ⁽²⁾	167	210	209	263	251	315	551	693	568	714	585	735	802	1008	868	1092		
LEDH-530 ⁽²⁾	92	170	115	213	138	255	304	561	313	578	322	595	442	816	478	884		
LEDH-595 ⁽²⁾	99	150	124	188	149	225	327	495	337	510	347	525	0	0	693	1050		
LEDH-617 ⁽²⁾	235	350	294	438	353	525	893	1330	1175	1750	1363	2030	0	0	1645	2450		
LEDH-630 ⁽²⁾	262	380	341	494	393	570	996	1444	1310	1900	1520	2204	0	0	1834	2660		
LEDH-3500 ⁽²⁾	108	180	135	225	162	270	486	810	497	828	594	990	756	1260	950	1584		
LEDH-5500 ⁽²⁾	158	240	198	300	237	360	711	1080	727	1104	869	1320	1106	1680	1390	2112		

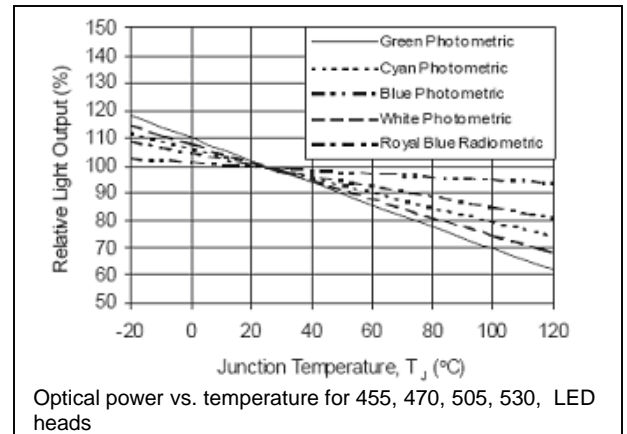
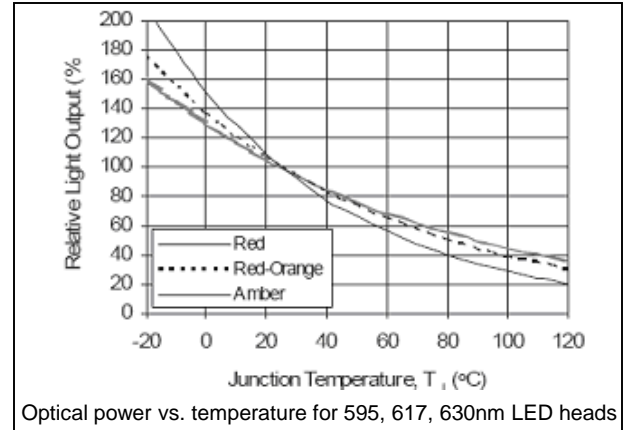
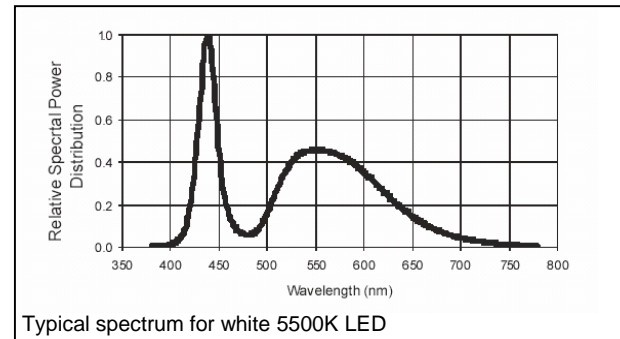
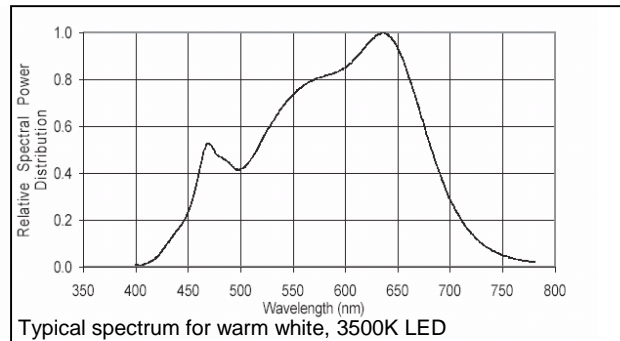
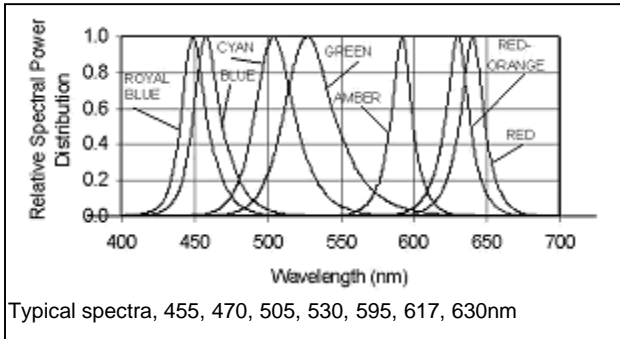
Table 1. Optical power range of various models of LED heads vs. HPLS-36 model, current, and duty cycle.

- (1) Note: Optical power for LEDHR is measured after reflector, using 2" (5cm) diameter optical power meter placed on optical axes 4" (10 cm) from the LED
- (2) Note: For LEDH, the optical power is total of the chip before any optics, and measured by 2" (5cm) diameter optical power meter placed on optical axes touching the LED lens.
- (3) Due to the nature of the semiconductor structures involved, important parameter of LEDs such as optical power, maximum current that LED can tolerate, spectrum and voltage drop, vary greatly for different batches and affect the performance of the HPLS-36 series light sources. It is not uncommon that the power of LEDs from different batches differs 2 times and more. The information presented here should be used for reference only. Please ask if your application demands more stringent requirements.
- (4) Optical power is measured with LED head attached to the HPLS-36 unit, at the room temperature 25C.
- (5) Optical power indicated is power range while ON, for Digital models, and maximum power for continuously variable models. Please note the 2-channel models such as AD3500 and AD3500-DI, presented in 2 columns, for digital and analog channels, respectively.
- (6) Duty cycle affects the performance of LEDs. Typically, for a given current, optical power is higher for lower duty cycle due to lower heating effect of the LED chip. For the pulsed units, exceeding duty cycles indicated for the given current can cause permanent damage to the LED. Some HPLS-36 models have built-in protection against exceeding duty cycle, however, due to wide spread of duty cycle requirements and flexible nature of HPLS-36 series, it is impossible to satisfy to all the requirements in one unit.

LED Heads

LEDH, LEDHR series

Specifications p.2



Other Wavelengths
available UV/VIS/NIR

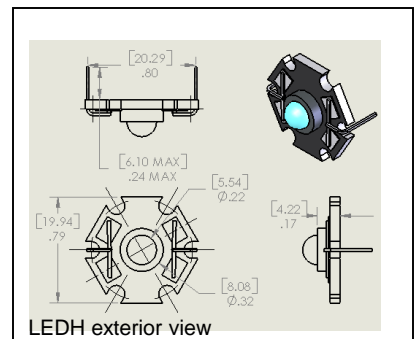
Ordering information:

LEDH[R] - XXXX (color, temperature) – XXXX (performance model, for LEDH only)

-455 (royal blue)	-omitted: 1.0x1.0 mm die, basic performance
-470 (blue)	-3: 1.0x1.0mm die, high brightness, high power
-505 (cyan)	-5: 3x3mm die, moderate brightness, high power
-530 (green)	-K2: 1.0x1.0mm die, best brightness, best power
-590 (amber)	
-617 (red orange)	
-630 (red)	
-3500 (warm white)	
-5500 (bright white)	

examples:

LEDHR-470: blue, 1.2" pitch, with reflector, basic performance LED head
LEDH-530: green, 0.8" pitch, basic performance LED head.
LEDH-455-K2: royal blue, 0.8" pitch, best brightness/power LED head.

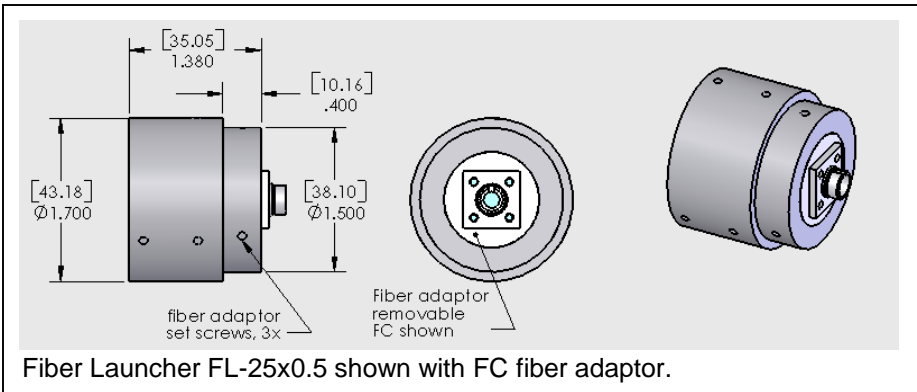


Fiber Launcher 25 mm x 0.5NA

FL-25x0.5

General description.

Fiber Launcher FL-25x0.5 is designed to function primarily as an optical attachments for HPLS-36 series light sources, to inject the light generated into the optical fiber or light guide. Fiber launcher accepts pre-collimated beam therefore must be used with the collimator (primarily with 24mm aperture OH36-24x11). The first component (HPLS-36 base unit with LEDH) generates light, the second component (OH-36 series collimator) converts it into quasi-parallel beam, the third component (fiber launcher body) focuses light onto optical fiber, fourth component (adapter) holds optical fiber or light guide in place and allows axial adjustment for optimal focusing. Such modular product structure represents cost-effective solution when application flexibility is required since many components can be used independently or in combinations with other components.



FL-25x0.5 features and specifications:

- Accepts collimated beam
- Focuses light on the entrance of the fiber (light guide)
- Input: Linear aperture 25mm
- Output: convergent beam 0.5NA
- Efficiency (before fiber) : approximately 90%
- Efficiency (after fiber): subject to fiber diameter
- Weight (with adaptor, without collimator): 50g
- Spot size: 3mm, when used with OH36-24x11 collimator and LEDH heads.

Fiber Adaptor options:

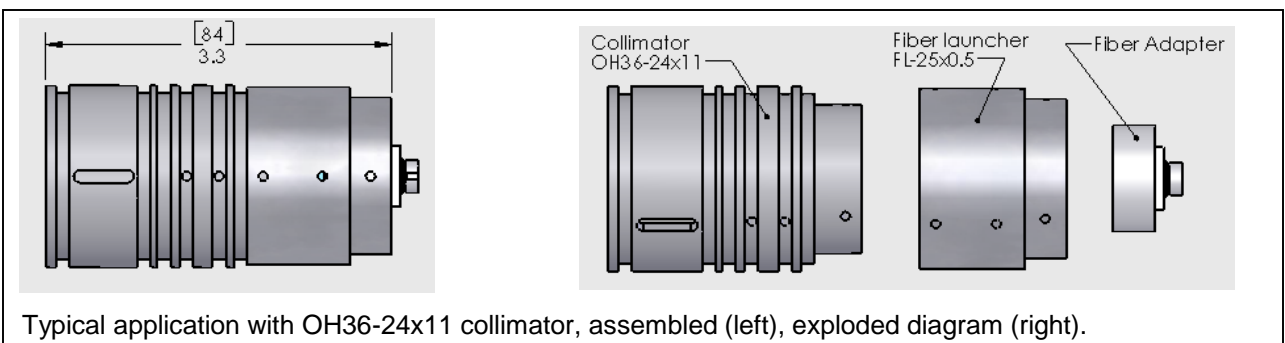
- One fiber adaptor included with fiber launcher.
- FA-25xFC: FC fiber adaptor
- FA-25xSMA: SMA-905 fiber adaptor
- FA-25xST: ST fiber optic adaptor
- Liquid and glass light guide adaptors available, please inquire.

Optical power in the fiber:

- Please note that LEDs have limited ability to focus light into small and single-mode fibers.
- Power in the optical fiber <3mm:

$$P_{opt} = P_{led} \cdot (D/3mm)^2 \cdot (NA/0.5)^2$$
 Power in the liquid light guide >3mm: $P_{opt} = P_{led} \cdot 0.9$
- Power in the glass bundle >3mm:

$$P_{opt} = P_{led} \cdot 0.9 \cdot K$$
 where K is glass bundle fill factor
- Definitions: P_{opt} = power in the fiber, P_{led} = power on the input of the fiber, D-diameter of fiber in mm, NA – numerical aperture of fiber.
- Example1: 200mW with 600um x 0.45NA fiber will produce $P_{opt} = 200 \cdot (0.6/3)^2 \cdot (0.45/0.5)^2 = 6.5mW$
- Example2: 200mW with 100um x 0.22NA fiber will produce $P_{opt} = 200 \cdot (0.1/3)^2 \cdot (0.22/0.5)^2 = 0.043mW$
- Example3: 200mW with 60um x 0.22NA fiber will produce $P_{opt} = 200 \cdot (0.06/3)^2 \cdot (0.22/0.5)^2 = 0.015mW$



Prices and Quotations

All quotations are valid for 30 days unless stated otherwise. Published prices are subject to change without notice. Custom and specialty products are individually priced per requirements specified and subject to change if changes are made from original request.

Purchase Orders and Payment Methods

Orders are accepted by email, mail, and fax. Verbal orders are not advised but accepted on individual basis. Payments by Net 30 account upon approval of credit or by credit card. Late fee 2% per month invoiced if past due. International customers: 100% pre-payment, credit card, or wire transfer Net 30 with approved credit.

Delivery and shipping.

Shipments are made domestically by USPS priority or FedEx prepaid and added to invoices unless shipping method and shipping account number provided with order. International shipments do not include importation or duty fees and international shipping charges are specified with product quotes.

Safety warnings and operating conditions.

Lightspeed Technologies is not liable for equipment damage or personal injury resulting from the use of these products. Do not look into the beam directly, or stare at the specular reflection from reflective surfaces such as mirrors. Do not operate unless LED head is secured by 2 screws. Do not disassemble drivers unless to access user-level controls inside per user manual. Do not operate outdoors, in high humidity or condensing environment. HPLS series of light sources and drivers are designed for operation in indoor environment, non-condensing conditions, with ambient temperature from 4.5°C to 29.5°C (40°F to 85°F).

Warranty Terms and Conditions

Lightspeed Technology's products, HPLS base units, drivers, optics, accessories (except LED heads) are warranted to be free from manufacturing defects in materials, parts and labor for a period of 1 year from the date of delivery to a customer, customer's shipping department, and/or designated agent. Components that are subject for failure per conditions specific to customer's testing environment, including but not limited to, incompatible line outlet voltage, out-of-the-specifications line outlet voltage, incompatible signal voltages and/or timing requirements; specifically including, but not limited to, LED heads, are warranted for a period of 90 days.

Returns and cancellation conditions.

No returns on special order items, or if a demo unit was requested, furnished and subsequently tested by a customer prior to placing an order. All products should be returned with original packaging material. All returns are subject to inspection and restocking fees upon arrival if without original packaging, damaged, or otherwise tampered with. Contact Lightspeed Technologies for a return materials authorization (RMA) number and shipping address if product is to be returned. No returns after 30 days from the day of product delivery to a customer, shipping department, or designated agent. Lightspeed Technologies will make the determination of cause of damage and if warranty replacement is applied.

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