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
- 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
- Mounting to standard and metric posts (8-32 and M4x0.75 threads in base unit)
- Base unit diameter 1.450” (36.8mm)

Applications

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

Description

The HPLS-36 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.

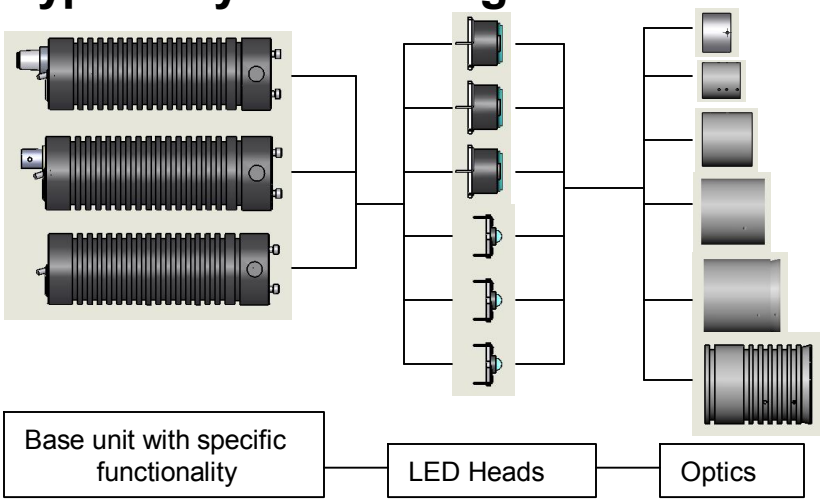
Functionality of base units include fast analog control (to generate any optical function, sine, saw, square, CW…); low-noise CW control (for applications where ATC-like or PWM algorithms may cause problem); and fast pulsed (digital) control (faster and more powerful then analog).

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/ Remote Potentiometer/ 2-level Switch).

LED heads are currently available in two form-factors: LEDHR-xxx series, pre-collimated with build-in reflector and 1.2” pin spacing for close-range illumination, and 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)

Typical system configuration



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Campbell, CA 95011
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(408)378-3629 fax
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Base Units
Ordering information

LIGHTSPEED TECHNOLOGIES

Model	Brief description	Functionality and controls	Detailed description
HPLS-36-DD500	500mA digital driver	Power connector: 12V500mA Signal connector: Digital input Switch: Aim 1-OFF-ON	Base unit with built-in 500mA "digital" (triggered) driver for PWM/triggering, any duty cycle up to CW. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR) Driver: build-in, light is triggered by external signal, TTL/CMOS input 3V-5V, BNC connector. 150 ns rise time, 200ns fall time. From 300ns pulses to CW, any repetition rate. Power requirements: 12V, 0.5A.
HPLS-36-AD500	500mA analog/digital driver	Power connector: 12V/0.5A Signal connector: A/D input Switch: mode D-OFF-A	Base unit built-in 500mA driver. Analog or digital mode, selectable by switch on control panel. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR) Digital mode: light is triggered by external signal, TTL/CMOS input 3V-5V, BNC connector; 150 ns rise time, 200ns fall time; from 300ns pulses to CW, any repetition rate. Analog mode: optical output is proportional to the analog signal applied, <2us stab time, selectable format 0-5V, 0-10V, 4-20mA, 0-20mA. Power requirements: 12V, 0.5A.
HPLS-36-AD3500	500mA analog 3500mA digital driver	Power connector: 12V/1.0A Signal connector: A/D input Switch: mode D-OFF-A	Base unit with built-in driver, for high current at low duty cycle/ pulse busts app. Analog mode (500mA) or digital mode (3.5A), selectable by switch on control panel. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR) Digital mode: light is triggered by external signal, TTL/CMOS input 3V-5V, BNC connector; 150 ns rise time, 200ns fall time; Smart Time Limiting circuitry limits cumulative energy delivered to LED for protection. Single pulse length range: 0.5us - 1 ms, maximum duty cycle of pulse train is 10%, average active time/relaxation time ratio is 1:10. Any repetition rate. Analog mode: optical output is proportional to the analog signal applied, <2us stab time, selectable format 0-5V, 0-10V, 4-20mA, 0-20mA. Power requirements: 12V, 0.5A (included)
HPLS-36-AD3500-DI	dual input variant	Power connector: 12V/1.0A Signal connector: A&D input Switch: Aim 0-OFF-1	Same as HPLS-36-AD3500 but Dual Inputs for simultaneous Analog and Digital Control. Twin BNC connector. Test mode for aiming. Twin BNC cable, power supply included
HPLS-36-DD7500	faster rise time, higher intensity	Power connector: 24V/0.5A Signal connector: Digital input Switch: Aim 0-OFF-1	Base unit with built-in 7.5A driver for applications where faster fall/rise time, short pulses at low duty cycle are required. Light is triggered by external signal, TTL/CMOS 3-5V, BNC connector, 117ns rise time, 45ns fall time. Optical pulse half-width matching the half-width of starting pulse. Smart Time Limiting circuitry limits cumulative energy delivered to LED. Single pulse length range 50ns-40us, maximum duty cycle of pulse train 3.3%, average active/relaxation time ratio is 50:1. Any repetition rate.
HPLS-36-AP(750, 1000)	CW, with build-in potentiometer	Power connector: 4.5-5V/1A Potentiometer: current adjust Switch: power Adj-OFF-Max	Base unit with built-in low-noise linear driver and manual analog control. Current 0-750mA/0-1A - specify. Two operating modes, selectable by the switch on control panel: fixed maximum power or adjustable by potentiometer knob. Switch momentarily between 2 levels. Easy to change LED heads, 7 different colors and 2 shades of white. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR). Power requirements: 4.5-5V, 1A (included)
HPLS-36-AR(750, 1000)	CW, with remote potentiometer	Power connector: 4.5-5V/1A Signal Connector: ext pot/signal Switch: power Adj-OFF-Max	Base unit with built-in low-noise linear driver and manual analog control. Current 0-750mA/0-1A - specify. Two operating modes, selectable by the switch on control panel: fixed maximum power or adjustable by potentiometer knob. Switch momentarily between 2 levels. Easy to change LED heads, 7 different colors and 2 shades of white. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR). Power requirements: 4.5-5V, 1A.
HPLS-36-AT(750, 1000)	CW, two-level control	Power connector: 4.5-5V/1A Blank plug Switch: power 1-OFF-2	Base unit with built-in low-noise linear driver and 2-level power control by the ON-OFF-ON switch on the control panel. Suffix 750/1000 - specify. Current levels: 500, 750 mA for model with suffix "750". Currents of 500mA, 1000mA for model with suffix "1000". Switch momentarily between 2 levels. Easy to change LED heads, 7 different colors and 2 shades of white. Accepts LED heads with 0.2-1.2 inch pin spacing. (LEDH, LEDHR). Power requirements: 4.5-5V, 1A (included)

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P.O. Box 110161
Campbell, CA 95011
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(408)378-3629 fax
www.light-speed-tech.com
sales@light-speed-tech.com

Base Unit
HPLS-36AD3500

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 in 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.

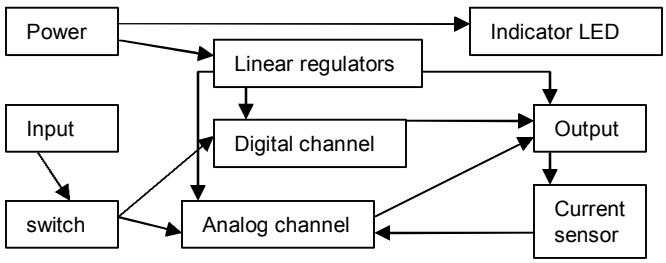
There is an important difference between the output stages of Analog and Digital channels. Analog channel operates in current regulation mode using a feedback from the current sensor in the output stage. Digital channel, on the other hand, provides fast switching while the current is limited by the resistor (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



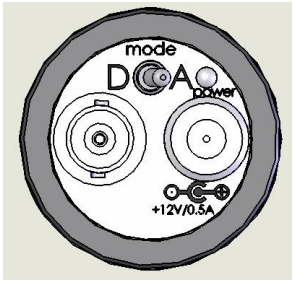
Absolute Maximum Ratings

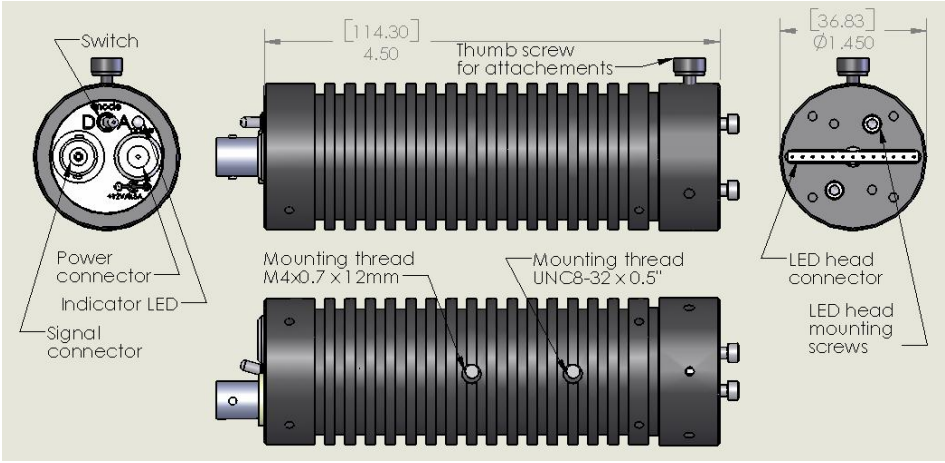
- Power Input: -1 to 14V; -2A to 2A; fuse protected (2A)
- Signal Input, Digital Mode: -2.5V to 7V; 50mA max, 50 Ohm input impedance
- Input, Analog Mode: -10V to 20V

HPLS-36AD3500 control panel:
Switch function: mode selection
- Left: Digital mode
- Center: OFF
- Right: Analog mode

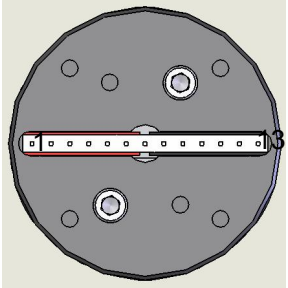
BNC connector:
- Central pin: input signal
- Barrel: common ground

LED: input power indicator





HPLS-36AD3500 exterior view, dimensions and mounting interface.



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" (0.64m) square pins, 0.230" long

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(408)378-3629 fax
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Waveforms and specifications

Digital mode specifications:

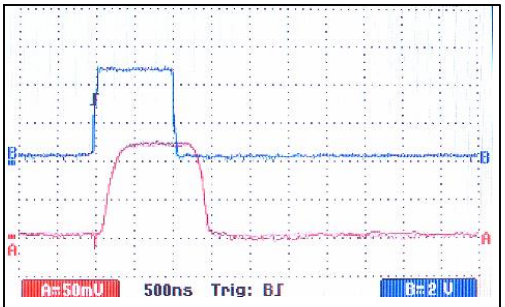
- Output current: 3.5A +/- 0.3A (LED head dependent)
- Rise Time: 80ns (to 1/2 level); 200ns (to 90%)
- Rise front propagation delay: 100ns typ
- Fall Time: 140ns (to ½ level); 200ns (to 90%)
- Fall front propagation delay: 200ns
- Pulse front/fall jitter: < 10ns, <5ns typ
- Nominal Signal Level: 3.3-5V; 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:

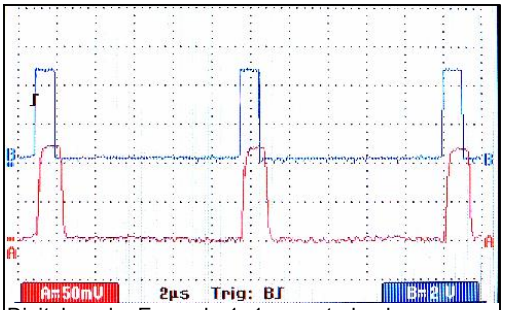
- Example 1: 1us pulse permitted every 10us
- Example 2: 1 ms max duration pulse every 10ms
- Example 3: 50% duty cycle waveform 2ms total duration, permitted every 10ms
- Example 4: 20% duty cycle waveform 5ms total duration, permitted every 10ms
- Example 5: 200ns starting pulse: optical pulse has 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:

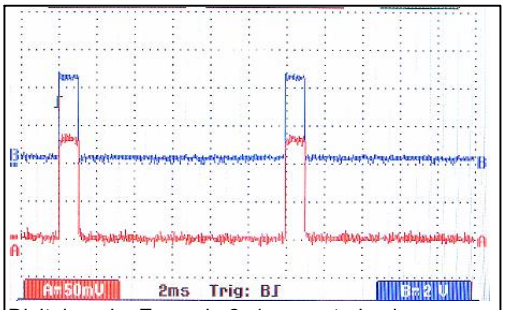
- Input/Output relationship: Linear, 1% offset
- Output current, continuously variable: 0-500mA
- Output current drift: < 800ppm/hour
- Output current accuracy: +/-3% of set value
- Output current RMS noise: <0.5%
- Input Signal Format: User Programmable (4-Dip switch on the driver board)
- Input Signal 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



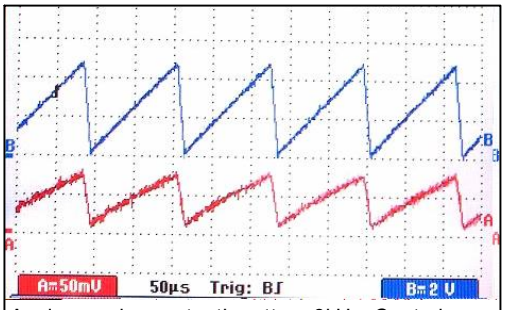
Digital mode, Example 1: 1us control pulse (blue), optical pulse (red)



Digital mode, Example 1: 1us control pulse every 10us (blue), optical pulse (red)



Digital mode, Example 2: 1ms control pulse every 12ms (blue), optical pulse (red)



Analog mode, sawtooth pattern 8kHz. Control pulse (blue), optical pulse (red)

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Base Unit
HPLS-36AD3500-DI

Description

HPLS Base Unit with built-in 2-channel driver. HPLS-36AD3500-DI is Dual Input variant of HPLS-36AD3500. 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 in the sum of outputs of both channels. Twin BNC connector on a control panel allows simultaneous access to both channels. Aiming mode for Analog channel (by the switch on control panel) provides easy aiming and testing.

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.

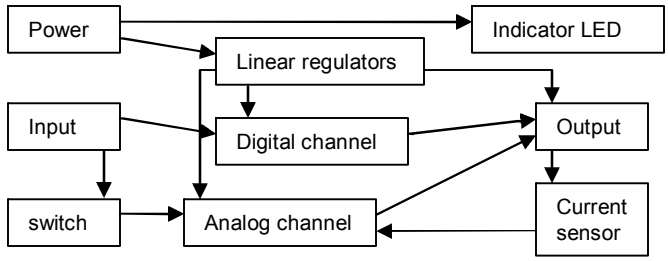
Common Specifications

- Two channels: Analog and 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: Twin BNC
- Thermal resistance, convection: 5 C/Wt

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

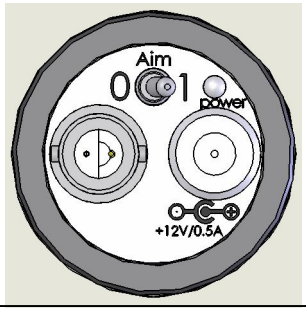
HPLS-36AD3500-DI block diagram

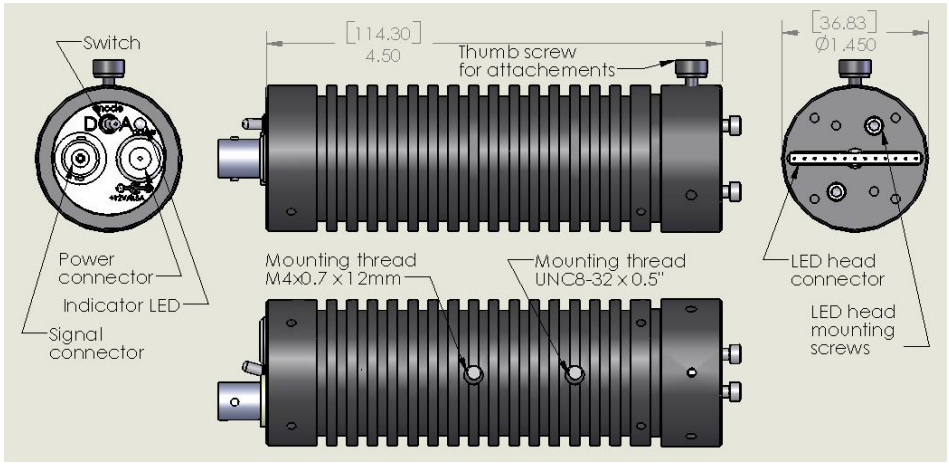


HPLS-36AD3500-DI control panel:
Switch function: analog channel mode
- Left: normal (external control)
- Center: Analog OFF
- Right: Aiming ON (500mA)

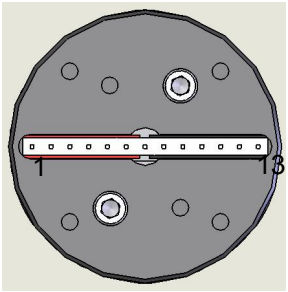
Twin BNC connector:
- Male pin: digital channel
- Female pin: analog channel
- Barrel: common ground

LED: input power indicator





HPLS-36AD3500[DI] exterior view, dimensions and mounting interface. HPLS-36AD3500 shown. DI has different signal connector (twin BNC) and switch notations.



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” (0.64m) square pins, 0.230” long

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Waveforms and specifications

Digital mode specifications:

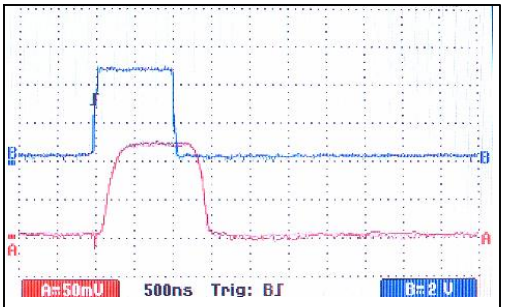
- Output current: 3.5A +/- 0.3A (LED head dependent)
- Rise Time: 80ns (to 1/2 level); 200ns (to 90%)
- Rise front propagation delay: 100ns typ
- Fall Time: 140ns (to ½ level); 200ns (to 90%)
- Fall front propagation delay: 200ns
- Pulse front/fall jitter: < 10ns, <5ns typ
- Nominal Signal Level: 3.3-5V; 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:

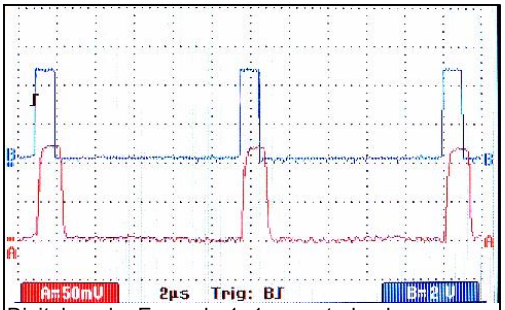
- Example 1: 1us pulse permitted every 10us
- Example 2: 1 ms max duration pulse every 10ms
- Example 3: 50% duty cycle waveform 2ms total duration, permitted every 10ms
- Example 4: 20% duty cycle waveform 5ms total duration, permitted every 10ms
- Example 5: 200ns starting pulse: optical pulse has 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:

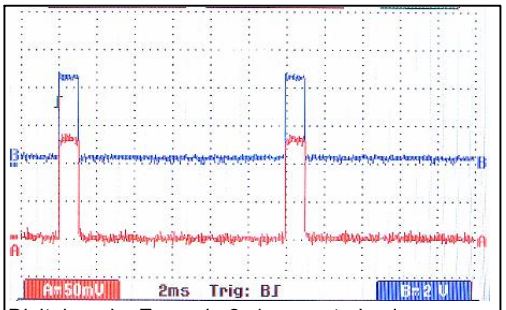
- Input/Output relationship: Linear, 1% offset
- Output current, continuously variable: 0-500mA
- Output current drift: < 800ppm/hour
- Output current accuracy: +/-3% of set value
- Output current RMS noise: <0.5%
- Input Signal Format: User Programmable (4-Dip switch on the driver board)
- Input Signal 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



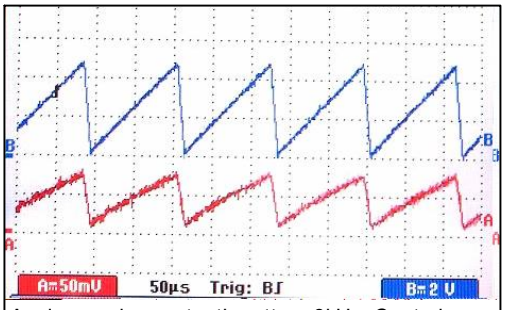
Digital mode, Example 1: 1us control pulse (blue), optical pulse (red)



Digital mode, Example 1: 1us control pulse every 10us (blue), optical pulse (red)



Digital mode, Example 2: 1ms control pulse every 12ms (blue), optical pulse (red)



Analog mode, sawtooth pattern 8kHz. Control pulse (blue), optical pulse (red)

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Base Unit
HPLS-36DD7500

Description

HPLS Base Unit with built-in "digital" driver. Operating principles are similar to the Digital channel of HPLS-36AD3500, but further optimized for faster response and higher output current. Has 2-level ON-OFF control (active HI). Half-width of the optical pulse is optimized to match the half-width of starting pulse to +/-15ns accuracy with wide range of pulse length changes. Aiming mode (by the switch on control panel) provides easy aiming and testing by running 150mA CW current thru LED.

Digital driver of HPLS-36DD7500 is optimized for switching the current to MAX level and back to 0 as fast as possible, without active feedback, thus providing ultimate high-speed LED light source. As a side effect, the current may vary slightly for different LED heads with different voltage requirements. Refer to the specifications for typical variations.

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.

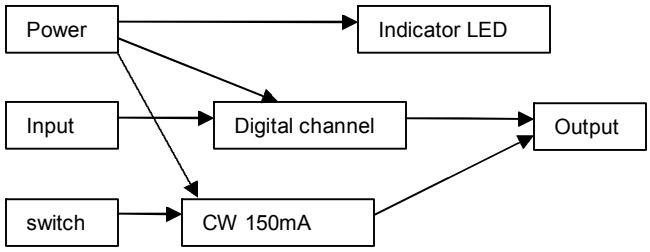
Common Specifications

- Two modes: Digital / Aiming
- Dimensions: Ø1.45x4.5" (36.8x115mm)
- Weight: 0.66 lb (0.3 kg)
- Power Requirement: 24V, 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/Wt
- Cooling: convection

Absolute Maximum Ratings

- Power Input: -1 to 30V; -2A to 2A; fuse protected (2A)
- Signal Input, Digital Mode: -2.5V to 7V; 50mA max, 50 Ohm input impedance

HPLS-36DD7500 block diagram:



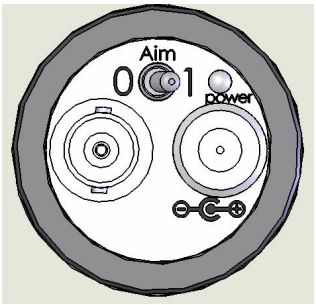
HPLS-36DD7500 control panel:
Switch function: Aim

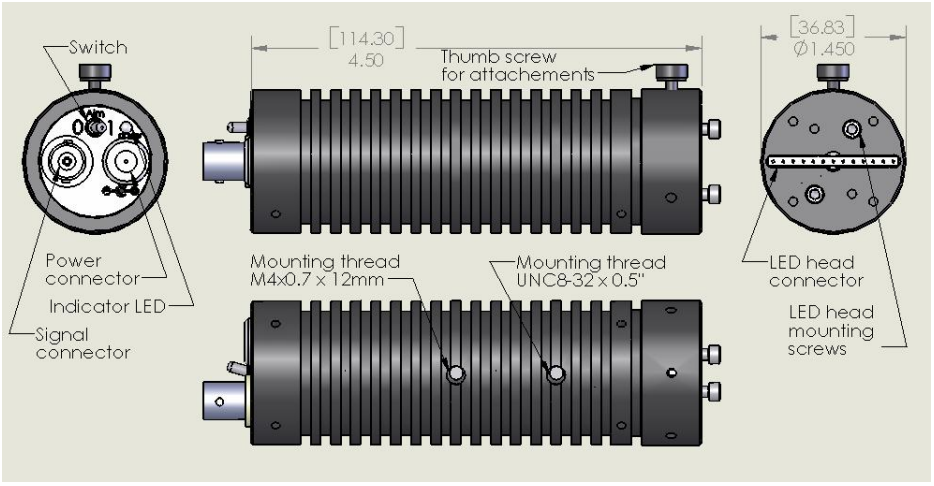
- Left: aim OFF
- Center: aim OFF
- Right: Aiming ON (150mA)

BNC connector:

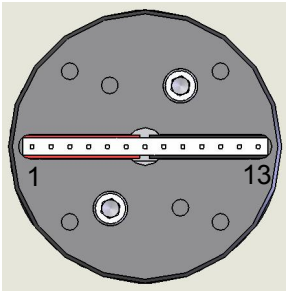
- Center: TTL/CMOS input
- Barrel: common ground

LED: input power indicator





HPLS-36DD7500 exterior view, dimensions and mounting interface.



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" (0.64m) square pins, 0.230" long

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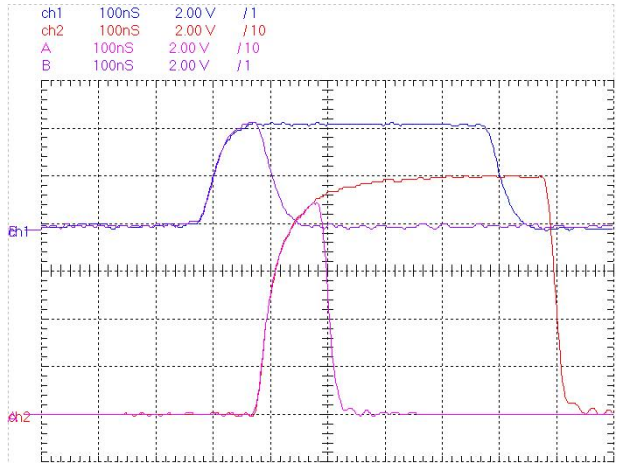
Waveforms and specifications

Digital mode specifications:

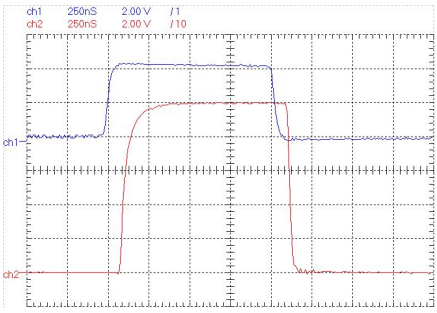
- Output current: 7.5A +/- 1A (LED head dependent)
- Rise Time: 45ns (to 1/2 level); 117ns (to 90%)
- Rise front propagation delay: 100ns +/-5
- Fall Time: 30ns (to ½ level); 45ns (to 90%)
- Fall front propagation delay: 100ns +/-5
- Pulse front/fall jitter: 10ns MAX, <5ns typ
- Nominal Signal Level: 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-40us
- Matching optical pulse half-width (50ns-40us)
- Maximum Duty Cycle of Continuous Waveform: 3.3%
- Average Ratio, Active Time/Relaxation Time: 1:50
- Any Repetition Rate

Digital mode, protocol examples:

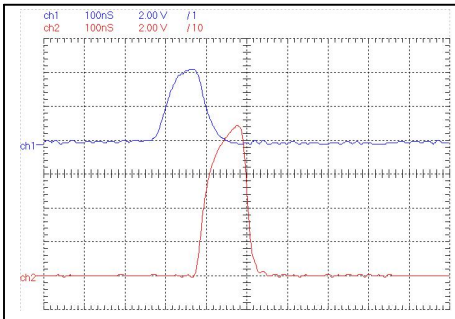
- Example 1: 1us pulse produces optical pulse with matching within +/-15ns accuracy. 1 us pulse is permitted every 30us
- Example 2: 100 ns starting pulse produces optical pulse with matching to +/-15ns accuracy
- Example 3: 10us starting pulse produces virtually “rectangular” optical pulse
- Example 4: Too long starting pulse will be cut by Time Limiting Circuitry to 40 us.
- Example 5: 100ns starting pulse will produce 100 ns optical pulse with peak which is 88% of steady level observed with 1us pulse. Further shortening the pulse will lower the peak more.



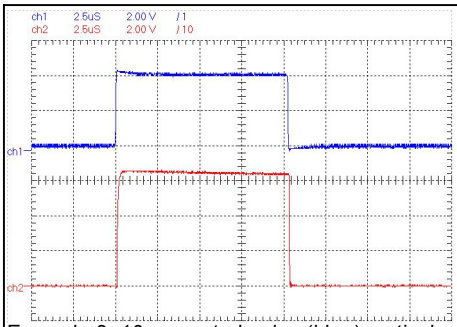
Example 5: Illustration how the position of fall front of starting pulse (blue, violet) affects the shape of optical pulse (red, purple)



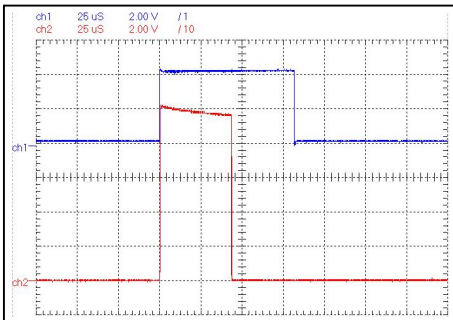
Example 1: 1.025us control pulse (blue), matching 1.017ns optical pulse (red)



Example 2: 100ns control pulse (blue); 108ns optical pulse (red)



Example 3: 10 us control pulse (blue), optical pulse (red)



Example 4: 80us starting pulse (blue) cut to 40us optical pulse (red) by Time Limiting Circuitry

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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
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.

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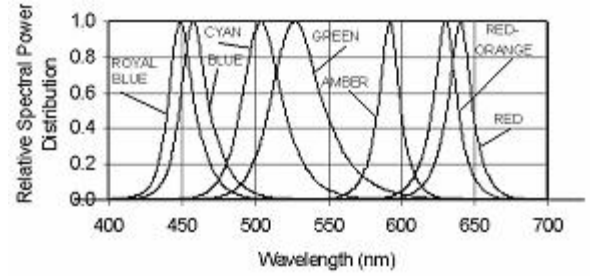
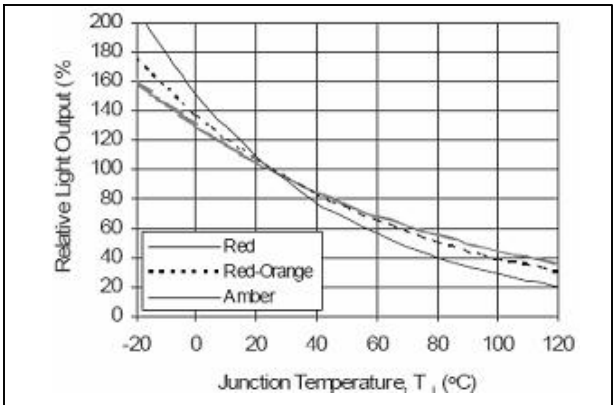
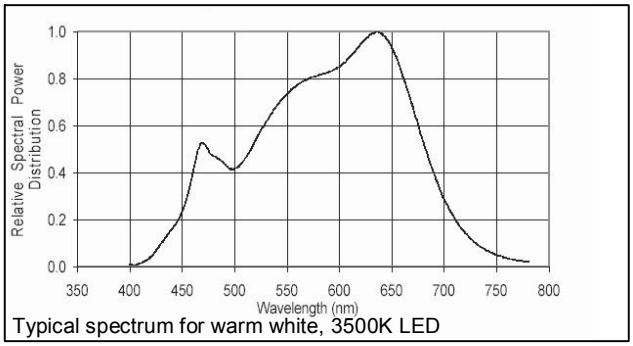
Specifications p.2



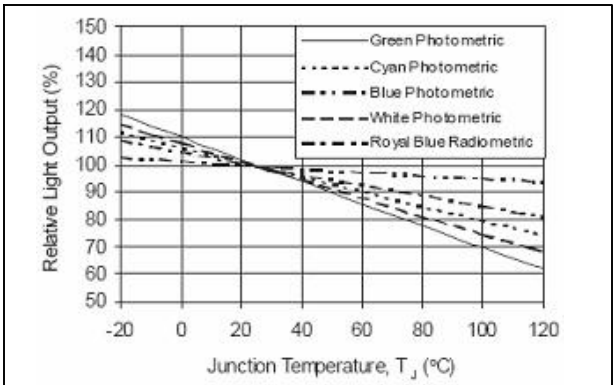
Typical spectra, 455, 470, 505, 530, 595, 617, 630nm



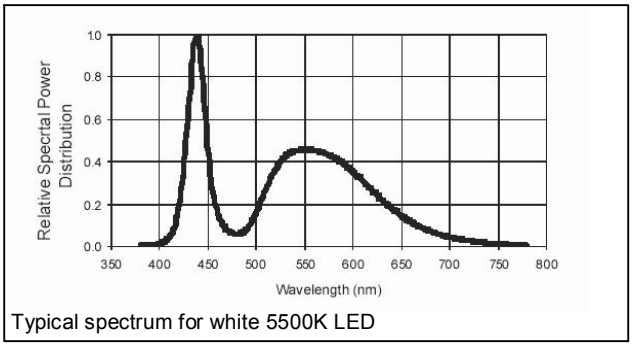
Optical power vs. temperature for 595, 617, 630nm LED heads



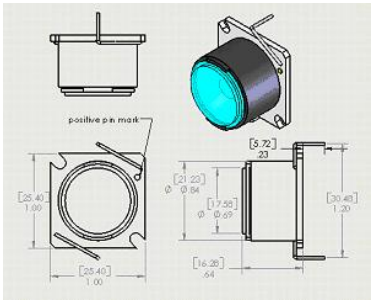
Typical spectrum for warm white, 3500K LED



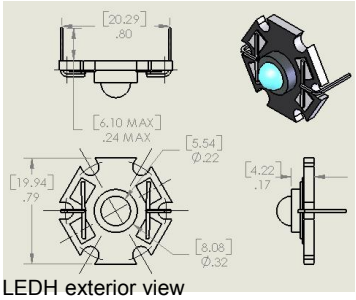
Optical power vs. temperature for 455, 470, 505, 530, LED heads



Typical spectrum for white 5500K LED



LEDHR exterior view



LEDH exterior view

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.

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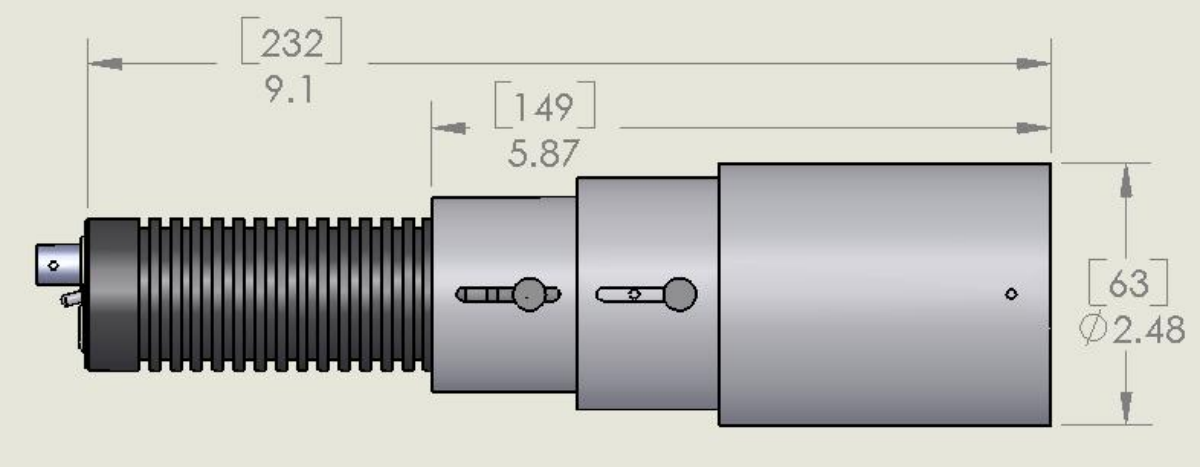
General description.

Collimators OH36-60x140-210 (variable focal length) and OH36-60x135 (fixed focal length) are designed as optical attachments for HPLS-36 light sources. They represent illumination quality optics optimized for throughput efficiency rather then imaging therefore some aberrations in the LED chip image (such as low-intensity halo around main spot at some focusing settings) are inherent and therefore acceptable.



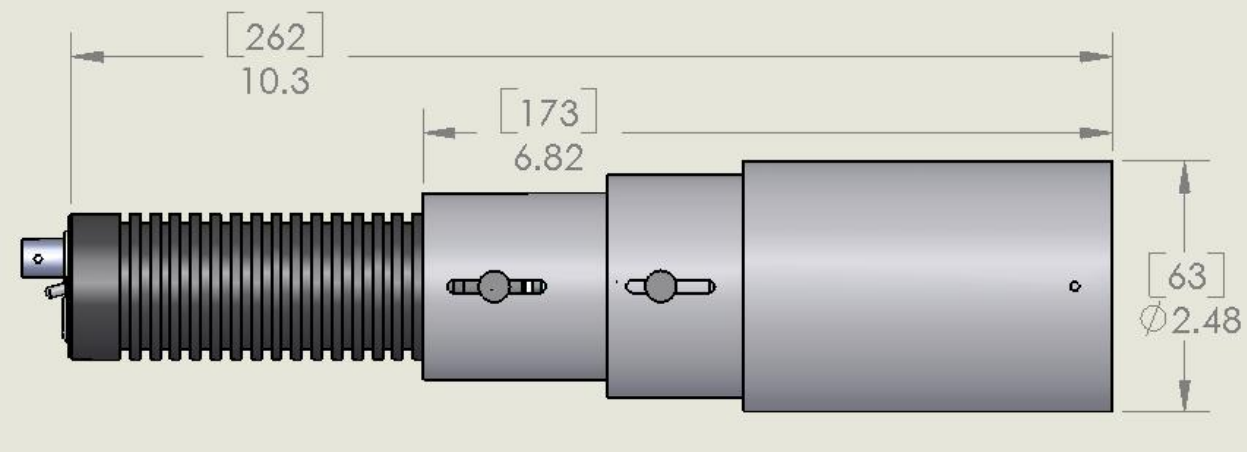
Collimator OH-36-60x130-200, with HPLS-36 attached, shown as set to 150mm focal length

OH36-60x140-210 specifications:

- Effective focal length: 140-210mm
- Main lens diameter: 60mm
- Clear optical aperture: 57mm
- F#: 2.45-3.68
- Light collection efficiency (geometrical factor): 4.8-2% min
- Overall efficiency (with reflection losses): 4.2-1.75% min
- Spot size, LEDH head (1.4x1.4mm emitter), at 84" (213cm) distance: adjustable, 23x23m – 15x15mm MIN
- Operating range at f=140mm: 70cm (7x7mm spot) – infinity
- Operating range at f=210mm: 55cm (4x4mm spot) - infinity
- Weight, collimator only: 315g

OH36-60x135 specifications:

- Effective focal length: 135mm
- Main lens diameter: 60mm
- Clear optical aperture: 57mm
- F#: 2.37
- NA: 0.21
- Light collection efficiency (geometrical factor): 4.4% min
- Overall efficiency (including reflection losses): 4.0-4.2%
- Spot size, LEDH head (1.4x1.4mm emitter), at 84" (213cm) distance: 22x22mm MIN
- Weight, collimator only: 350g



Collimator OH-36-60x135, with HPLS-36 attached, typical dimensions as set to image at infinity.

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Terms and Conditions

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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