

Light Sources



## Laser Safety Guide

**H003**

### Laser



Laser Diode (Visible)  
LDU33

**H006**



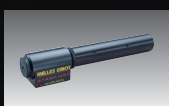
He-Ne Lasers  
05-LHP

**H006**



Power Supplies for He-Ne Lasers  
05-LPL

**H007**



Stabilized He-Ne Lasers  
05-STP

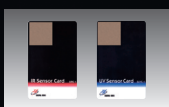
**H007**

### Detectors



Laser Checker  
LCP

**H008**



IR/UV Sensor Card  
SIRC/SUVC

**H008**



Photodiode Amplifier  
Temperature controlled Photodiode  
PAD-1/PAD-PD-1

**H009**



Multiple Scanning  
Knife-Edge beam profiler  
OS-BA-SAT

**H010**



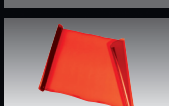
CCD Type Beam Profiler  
OS-BeamOnHR

**H011**

### Laser Safety Equipments

#### Laser Shield Curtain Guide

**H012**



Laser Shield Curtain  
YLC-1/YLC-2

**H013**



Laser Safety PVC Films  
YL-600

**H014**



Laser Safety Windows  
(made of acrylic resin)  
YL-500

**H015**



Laser Safety Panels  
OFUP2

**H017**

## Laser Protective Eyewear Guide

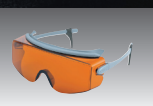
**H018**

### Laser Safety Equipments



YL-760 Model (Three-way type)  
YL-760

**H020**



YL-717 Model  
(Over prescription glasses type)  
YL-717

**H021**



YL-335 Model  
(Over prescription glasses type)  
YL-335

**H022**



YL-290 Model (Eyeglass shaped)  
YL-290

**H022**



YL-250G Model  
(Over prescription glasses type, reinforced glass type)  
YL-250G

**H023**



YL-130 Model (Goggle shaped)  
YL-130

**H023**



YL-120H Model  
(Goggle shaped, reinforced glass type)  
YL-120H

**H023**



Laser Classification Labels  
Laser Warning Labels  
Laser Controlled Area Signs  
817/838

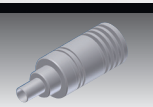
**H025**

### Illumination Systems



LED light source  
for use with light-guide  
LLS-W

**H026**



LED Spot Illumination  
SLSI

**H027**



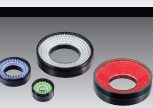
Power Supply  
for LED Spot Illumination  
SPS-SLSI

**H027**



RGB Color Mixing Unit  
SLSI-RGBM

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Ring Illumination  
SLRI

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Low Angle Ring Illumination  
SLRI-LA

**H029**

Illumination Systems		Flat Illumination SLFI	<b>H030</b>	Illumination Systems		Tungsten Halogen Fiber Illumination Systems Replacement Lamps for Tungsten Halogen Fiber Illumination Systems LS-LHA/HL	<b>H033</b>
		Coaxial Illumination SLCI	<b>H030</b>			Metal Halide Fiber Illumination Systems Lamps for Metal Halide Fiber Illumination Systems IMH-250/MHL	<b>H034</b>
		Line Sensor Illumination (Bright Field) SLLI	<b>H031</b>			Light Guides MSL/MTI/MRL/MM80	<b>H035</b>
		Line Sensor Illumination (Dark Field) SLLIH	<b>H031</b>			Focusing Lenses for Fiber Illumination Systems Glass Rod Homogenizers for Light Guide MGF/RHO-13S-E2	<b>H037</b>
		LED Light Source Device Light Guide Adapter Compatibility SLA-100/SLA-ADP	<b>H032</b>			Light Guide for LED Spot Illumination S1/S2	<b>H038</b>

## Laser Safety Guide

### Hazards of Laser Light

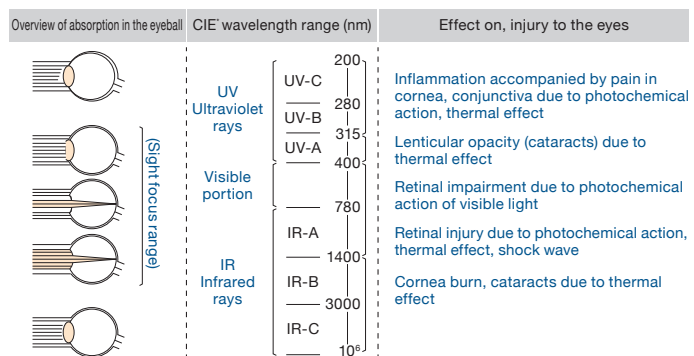
A laser is a special man-made light, with completely different characteristics from natural light. With directional characteristics, and monochromatic action, power is concentrated and reaches high density from the focusing effect of lenses. Under certain conditions a laser can be so strong that it will melt metal in an instant. No matter how well laser workers know these characteristics, if preventive measures are not taken, it is highly likely that disasters can occur with serious bodily harm and lasting effects.

### Effects of Laser Light on the Human Body

JIS C6802, the safety standards for laser products, covers the wavelengths ranging from 180nm and 1m with the objective of protecting the human body.

As shown in Fig. 1, the position of harm to the eyes is different depending on the wavelength range of light.

**Fig 1 Effect on the Human Body when Exposed to Excessive Laser Light**



\* CIE: Abbreviation for Commission Internationale de Eniuminure (International Commission on Illumination)

# Laser Safety Guide

## Injury to the Eyes

### Ultraviolet Range (Below 400nm)

Most ultraviolet light is absorbed by the surface of the cornea, and a partially transmitted portion is absorbed by the crystalline lens of the eye.

If exposed to a high output UV laser, tissue is injured due to photochemical action, inflammation (burns) of the cornea will occur in the short term, while long term exposure might lead to cataracts due to light action.

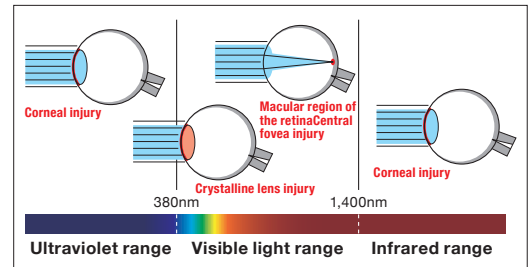
### Visible Light Range (400 – 700nm)

Glare is felt immediately, and blinking is a protective response. However there is a temporal limit, it takes about 0.25 seconds for the protective response once the hazard is sensed, during which time the laser enters the eye. Here, the output that is regarded as virtually safe even though the laser enters the eye within this time is basically 1mW or less. At output above that, the retina (Fig. 2) will receive local injury due to thermal effects and focusing effect, even permanent impairment might result.

### Near Infrared Range (700 – 1400nm)

The laser reaches the retina in the same way as the visible light range. A point of particular caution is that in the non-visible light range, injury is received without noticing it, so it is a very hazardous wavelength range for the eyes.

Fig 2 Effect on the Retina due to Thermal Effect and Focusing Effect



\* The site of injury will vary according to the wavelength of the laser exposed to.

## World Safety Standards

### [International Organization]

IEC60825-1 [Safety of laser products]

[Japan] JIS C6802 [Safety standards of laser products]

## What Is IEC60825-1 “?”

The IEC is the

### [International Electrotechnical Commission]

As an organization for international standardization in the electrical and electronic fields, it has the following objectives to facilitate and promote international commerce.

\* The promotion of the formulation and promulgation of international standards for the electrical and electronic engineering technical fields.

## What Are Laser Safety Standards

IEC60825-1 was created as an international standard for laser equipments, and it is a common safety standard for IEC member nations.

## On JIS C6802

The Japanese Industrial Standard based on IEC60825-1 As determined by IEC60825-1 a standard to utilize and manufacture laser products properly world-wide, Japan has also enacted JIS C6802, safety standards for laser products on that basis.

JIS C6802, a translation of IEC60825-1 which is the international standard, is deemed “World Common Safety Standards”.

The provisions of this standard range from the details of safety measures required according to the wavelengths and strength of lasers to the hazard display labels, and it is considered that as long as based on this standard “laser light can be utilized safely”.

## Classification of Lasers by Class (IEC60825-1)

Each category by class is defined based on AEL (Accessible Emission Limit: the limit of the laser emission level allowed for that laser class).

### Classification of Lasers by Class

Class 1	<b>Low-power level:</b> Regarded as a safe laser under normal operating conditions (reasonably foreseeable operating conditions).
Class 1M	<b>Low-power level (wavelengths of 302.5nm – 4,000nm),</b> parallel large diameter beam or divergent beam Safe with the naked eye, viewing of the laser with optical instruments is hazardous.
Class 2	<b>Low-power visible light (wavelengths of 400nm – 700nm):</b> The same as a conventional visible light laser, safe with blinking and avoidance. Long-term viewing might cause eye injury, particularly hazardous for long-term viewing of blue light. ● <b>Power conditions: CW visible light 1mW or less</b>
Class 2M	<b>Low-power visible light (wavelengths of 400nm – 700nm),</b> parallel large diameter beam or divergent beam Applied in visible lasers, safe with the naked eye if blinking or avoidance responses are possible. Direct viewing of laser light with optical instruments is regarded as potentially hazardous.
Class 3R	Laser light in the wavelengths of 302.5nm – 10 <sup>6</sup> nm, and direct viewing of beams is regarded as potentially hazardous. ● <b>Power conditions: CW visible light 5mW or less, otherwise within 5 times of Class 1</b>
Class 3B	Direct intrabeam viewing is hazardous. However, viewing of pulse laser emissions by diffuse reflection not connected to a focal point, is safe under certain conditions. ● <b>Power conditions: Light 315nm or greater, CW laser 0.5W or less</b>
Class 4	<b>Lasers that produce high-output (exceeding the AEL of Class 3B) hazardous diffuse reflection</b> Not merely direct beam contact with the skin or eyes even momentarily is regarded as hazardous, even diffuse reflection is regarded as injurious to skin and eyes. It is also believed to cause fires.

\* It is important to confirm the class of lasers to be used, and carry out measures to prevent injury.

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## Measures to Prevent Injury by Laser Classes

Directives from the Ministry of Health, Labor and Welfare [On Measures to Prevent Injury from Laser Radiation] formulate specific details for safety and preventive measures in work with lasers, with laser equipments other than Class 1 and Class 2 as the subject.

List of Standard Measures for Laser Equipments by Class

Details of Measures (item only)			Class of Laser Equipment			
			4	3B	3R	2M and 1M
Assignment of Laser Equipment Managers			○	○	○ <sup>*1</sup>	
Controlled Area (Sign, Keep Out)			○	○		
Laser Equipments	Laser light path	Position of optical path	○	○	○	○
		Appropriate design and shielding of optical path	○	○	○ <sup>*1</sup>	
		Appropriate termination	○	○	○ <sup>*1</sup>	○ <sup>*2</sup>
	Key control		○	○		
	Emergency stop switches, etc.	Emergency stop switches	○	○		
		Alarm device	○	○	○ <sup>*1</sup>	
		Shutter	○	○		
	Interlock system, etc.		○	○		
	Emission window display		○	○	○	
Work Management, Health Management, etc.	Operation position		○			
	Measures for optical system adjustment		○	○	○	○
	Protective equipment	Protective eyewear	○	○	○ <sup>*1</sup>	
		Work clothes to reduce exposure of the skin	○	○		
		Use of flame-retardant materials	○	○		
	Inspection and maintenance		○	○	○	○
	Safety and hygiene education		○	○	○	○
	Health management	Examination of anterior eye segments (cornea, crystalline lens of the eye)	○	○	○ <sup>*1</sup>	
Examination of the fundus of the eye		○				
Other	Notices	Laser equipment managers	○	○	○ <sup>*1</sup>	
		Precautions for hazards, toxicity and handling	○	○	○	○
		Display of installation of laser equipments	○	○		
	Display of high voltage components of laser equipments		○	○	○	○
	No hazardous materials allowed		○	○		
	Measures for toxic gas, particulates etc.		○	○		
	Medical examination and treatment for those believed injured by laser radiation		○	○	○	○

○ Indicates that measures are required. Details of the measures summarized by our company are the details determined in [Summary of Measures to Prevent Injury from Laser Radiation]. Always refer to the original document.

\*1 Measures are required for laser equipments emitting laser radiation other than the 400 – 700nm wavelengths.

\*2 Regarding laser equipments written in JIS Standard 10.6, measures are required for ends of laser light path.

## Preventive Measures

There is need to enhance safety measures protecting against laser light to avoid grave injuries and after-effects. Injuries do not occur merely from exposing the body to laser light, secondary injuries are also possible from inhaling toxic gases produced by laser light irradiating objects such as workpieces and peripheral equipment (gases and fine particles). Therefore, there is a need for laser workers and managers to take a variety of measures to avoid laser accidents.

### ■ Protection with Laser Shield Windows and Curtains [Reference](#) H013 to H017

Windows and curtains made of the similar special materials as laser protective eyewear protect the eyes of not only nearby workers, but also the eyes and skin of people nearby. It is necessary to make a selection based on the type of laser oscillator (wave length) and output power.

### ■ Protection with Laser Protective Eyewear [Reference](#) H020 to H023

Protection of the eyes with eyewear made of special materials is necessary so that laser light does not accidentally strike the eyes.

It is necessary to make a selection based on the type of laser oscillator (wave length) and output power.

### ■ Safety Display to Inform of Laser Use with Panels and Plates [Reference](#) H025

There are panels and plates to post at the entrances of rooms to inform that lasers are being used in the vicinity. These panels and plates need to be posted by users of the laser equipment (device) themselves.

### ■ Safety Displays with Stick-on Seals and Labels for Laser Oscillators and Devices [Reference](#) H025

Hazard displays with seals and labels draw attention to the hazard of lasers and processors.

In compliance with JIS C6802 the manufacturer of the laser equipments must display the seals and labels.

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# Laser Diode (Visible) He-Ne Lasers

**LDU33**  
**05-LHP**

## LDU33

**RoHS** **Catalog Code** W5001

**Low noise laser diode module and power supply. The compact head with integrated aspheric collimating lens makes this laser head smaller than optical systems utilizing He-Ne lasers. The small size and simple operation make this popular for embedding in OEM equipment.**



- Collimation can be changed by means of the helicoid focus ring, making it easy to adjust beam size.
- Quick startup and stable output due to high quality APC power supply.
- With an emphasis on ease of use the laser head is connected to the power supply with a high reliability snap-on connector. The laser head is enclosed in a precision machined aluminum housing, making it easy to mount in an adjustable holder.

Common Specifications	
Beam Divergence	<1mrad
Output Stability	<3%
Temperature Control	None
Laser Classes	3R
Input Voltage	100VAC
Head Weight [kg]	about 0.15
Weight of Power Supply [kg]	about 0.3

### Guide

- ▶ For custom wavelengths, outputs and modulation, contact our International Sales Division for more information.
- ▶ Can be mounted with the laser mount (MHG-20LDU) for the kinematic mirror holder. [Reference](#) C016

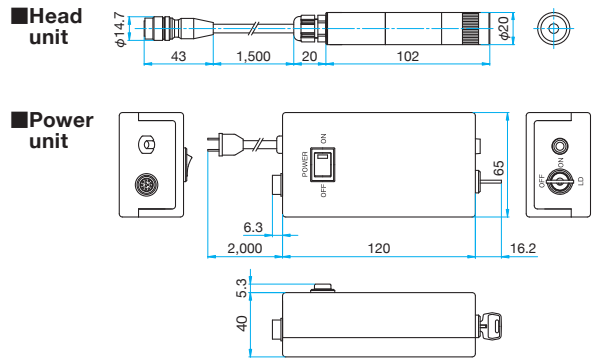
### Attention

- ▶ Power supply voltage for the 405nm model is 9V.

Part Number	Wavelength [nm]	CW Output [mW]	Beam Diameter [mm]	Drive Voltage [V]
LDU33-405-3.5	405	3.5	about 2x1	9
LDU33-635-4.5	635	4.5	about 5x2	5
LDU33-670-4.5	670	4.5	about 5x2	5
LDU33-785-4.5	785	4.5	about 5x2	5

### Outline Drawing

(Units: mm)



## 05-LHP

**Catalog Code** W5002



**The standard He-Ne laser has a laser head with oscillation wavelength of 632.8nm, an aluminum cylinder that houses the laser tube, ballast resistor and electrical wiring.**

- Integrated 1.8m power cable with a special connector at the end.
- This laser is in compliance with the provisions of CDRH (U.S. safety standard).

### Guide

- ▶ Mountable on rod form laser mounts (LAH), and fine adjustment laser holders (LAHU-A). [Reference](#) C048
- ▶ He-Ne lasers generally have a service life of 1 year or 10,000 hours of actual use, depending on usage conditions.
- ▶ Contact our International Sales Division regarding randomly polarized light He-Ne lasers.

### Attention

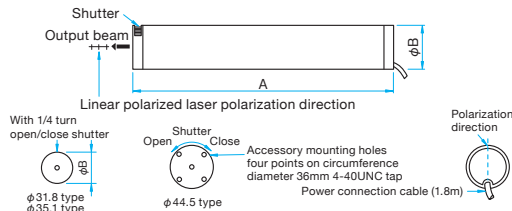
- ▶ The power supply (05-LPL series: detachable model) is not included. It can be purchased separately. [Reference](#) H007
- ▶ Please note that since this product is imported, prices and delivery dates are subject to change.

### Common Specifications

Beam Quality	M <sup>2</sup> : <1.05	
Wavelength	632.8nm	
Transverse Mode	TEM <sub>00</sub>	
Centrality of Beam	Angular error	<1mrad
	Position	±0.25mm
Long Term Drift	±2.5% (at 8 hours)	
Noise (RMS)	<0.5%	
Noise Frequency	30Hz - 10MHz	
Power Voltage	100VAC, 115VAC, or 230VAC±10%	
Input Frequency	50 - 60Hz	
Shock	25G/11msec	
Operation Temperature Range	-20°C - +40°C	
Storage Temperature Range	-40°C - +80°C	
Operation Humidity	0% - 90% (without condensation)	
Storage Humidity	0% - 100%	

### Outline Drawing

(Units: mm)



Linear Polarized Beam Part Number	A [mm]	φB [mm]
05-LHP-213	177.8	φ31.8
05-LHP-211	177.8	φ31.8
05-LHP-111	271.8	φ44.5
05-LHP-121	271.8	φ44.5
05-LHP-151	396.2	φ44.5
05-LHP-171	455.9	φ44.5
05-LHP-991	483.9	φ44.5
05-LHP-925	637.3	φ44.5

### Linear Polarized Beam (Extinction Ratio>500:1)

Part Number	CW Output Power TEM <sub>00</sub> [mW]	Beam Diameter 1/e <sup>2</sup> [mm]	Beam Divergence [mrad]	Vertical Mode Spacing C/2L [MHz]	Operation Current [mA]	Operation Voltage [V±100]	IEC Class	Power Supply	Weight [kg]
05-LHP-213	0.5	0.46	1.77	1063	4	1,320	2	05-LPL-900-040	0.2
05-LHP-211	0.84	0.46	1.77	1063	4	1,320	3R	05-LPL-900-040	0.2
05-LHP-111	1	0.59	1.35	687	6.5	1,790	3R	05-LPL-911-065	0.4
05-LHP-121	2	0.59	1.35	687	6.5	1,790	3R	05-LPL-911-065	0.4
05-LHP-151	5	0.8	1	438	6.5	2,290	3B	05-LPL-902-065	0.6
05-LHP-171	7	1.02	0.79	373	7	2,650	3B	05-LPL-951-070	0.68
05-LHP-991	10	0.65	1.24	341	6.5	2,640	3B	05-LPL-951-065	0.66
05-LHP-925	17	0.96	0.84	257	7	3,900	3B	05-LPL-951-070	0.8

## 05-LPL

Catalog Code W5003

Power supply for standard He-Ne laser head (CDRH compliant).



- Compact laser power supply.
- Constant current, feedback stabilized, low ripple output.
- Equipped with a protection circuit that automatically shuts down the laser in the event of frequent arc discharges, open output terminal, output-terminal short or extremely low input voltage.

### Common Specifications

Input Voltage	100VAC±10%
Input Frequency	50 – 60Hz
Current Ripple (RMS)	<0.71%
Conversion Efficiency	>75%
Delay time of CDRH	3 – 7 secs
Temperature Range	Operation –20°C – +40°C
	Storage –40°C – +80°C
Ambient Humidity	Operation 0% – 90%
	Storage 0% – 100%
Altitude	Operation 0 – 3,000m
	Storage 0 – 5,800m
Shock	25G/11msec

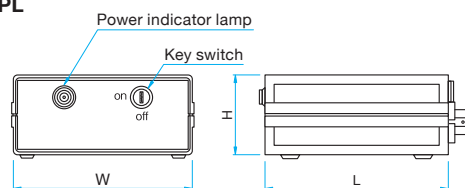
### Attention

- ▶ Voltage is 100VAC intended for use in Japan, if used abroad, please contact our International Sales Division for more information.
- ▶ Please note that since this product is imported, prices and delivery dates are subject to change.

### Outline Drawing

(Units: mm)

05-LPL



Part Number	Width W [mm]	Length L [mm]	Height H [mm]	Output Current [mA]	Output Voltage [VDC]	Drive Voltage [kVDC]	Weight [kg]
05-LPL-900-040	129	133	61	4	1,100 – 1,500	>8	1
05-LPL-901-040	129	133	61	4	1,450 – 2,050	>8	1
05-LPL-911-065	129	133	61	6.5	1,700 – 2,100	>10	1
05-LPL-902-065	129	133	61	6.5	1,850 – 2,450	>10	1
05-LPL-951-065	161	241	54	6.5	3,700 – 4,100	>11	1.8
05-LPL-951-070	161	241	54	7	2,500 – 4,100	>11	1.8

## 05-STP

Catalog Code W5004

Stabilized He-Ne laser head with oscillation wavelength of 632.8nm, Cylindrical aluminum housing encloses the laser tube, ballast resistor and electric wiring.



- Stabilized wavelength with frequency fluctuation in 1 month is 10MHz or.
- Integrated 1.8m power cable with a special connector at the end.
- A label of guarantee indicating that the product complies with CDRH requirements (U.S. safety standard) is attached to the exterior.

### Common Specifications

Wavelength	632.8nm
Transverse Mode	TEM <sub>00</sub>
Polarization	Linear
Extinction Ratio	>5000:1
Noise (RMS)	0.1% (30Hz – 10MHz)
Frequency Stability	±1.0MHz(1min)/±2.0MHz(1h)/±3.0MHz(8h)
Power Stability	±0.2% (1min/1h/8h)
Temperature Dependence	0.5MHz/°C
Time to Stabilization	<10 minutes
Possible Stabilization Temperature Range	15°C – 30°C
Input Voltage	100VAC±10%
Input Frequency	50 – 60Hz

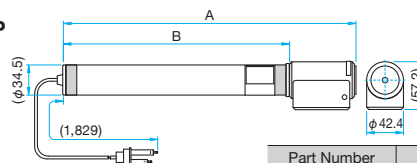
### Attention

- ▶ The power supply (05-LPL series: detachable model) is not included. Please purchase separately.
- ▶ Note that since this product is imported, prices and delivery dates are subject to change.

### Outline Drawing

(Units: mm)

05-STP



Part Number	A	B
05-STP-910	259.1	176.8
05-STP-912	302	219.7

Part Number	CW Output Power TEM <sub>00</sub> [mW]	Beam Diameter 1/e <sup>2</sup> [mm]	Beam Divergence [mrad]	Operation Current [mA]	Operation Voltage [V±100]	IEC Class	Power Supply
05-STP-910	0.5 – 0.95	0.48	1.7	4	1,220	2	05-LPL-900-040
05-STP-912	1	0.54	1.5	4	1,600	3R	05-LPL-901-040

# Laser Checker IR/UV Sensor Cards

## LCP SIRC/SUVC

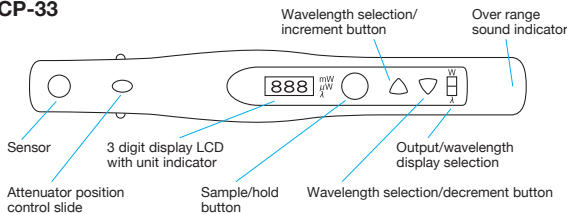
### LCP

**Catalog Code** W5005

Compact and lightweight power meter for checking laser output that is small enough to fit into a pocket or tool kit.



- Press the sample/hold button to power up. Allow the laser beam to strike the sensor for two seconds or more while holding down the button. Then release the button, and the measured output will appear clearly on the LCD screen.
- Automatically powers down 10 seconds after measurement is completed.
- The maximum output density is  $30\text{W}/\text{cm}^2$  when the built-in ND attenuator is used, and  $0.5\text{W}/\text{cm}^2$  when the attenuator is not used.
- The sensor disk is made of silicon and has an 8mm aperture.
- Battery life is 180,000 measurements at 12 sec/sample. The built-in lithium cell is not replaceable.
- “---” will be displayed on the LCD screen and beeping will sound as an overload warning.
- Microprocessor controlled, this power meter comes equipped with wavelength dependent sensitivity-calibration, auto-range (shown in  $\mu\text{W}$  or  $\text{mW}$ ), attenuator, output-overload-warning, and auto-stop functions.

**LCP-33**


#### Attention

- ▶ Laser-shielding protective gear must be worn during use.

#### Specifications

Part Number	Wavelength [nm]	Power Range [W]	Outer Dimensions [mm]	Weight [kg]
LCP-33	400 – 1064	$0.5\mu - 1$	168×24×20	0.05

### SIRC/SUVC

**Catalog Code** W5006

Card-type sensor designed for optical-axis adjustment and verification.


**SIRC-1**
**SUVC-1**

- The active area is coated with ET (Electron Trapping) material in powder form.
- Reaches excitation within one minute in natural light or indoor light (especially 450 – 500nm). Emits light for about one minute.
- Laser damage threshold:  $200\text{mW}/\text{cm}^2$  (reference value)
- The SIRC-1 emits visible light upon the reception of infrared light to allow visual observation of the form of infrared light, which is not visible with the naked eyes, and the intensity of the incident beam, making it effective for observation of the optical axis of LD and YAG lasers.
- The SUVC-1 emits visible light upon the reception of ultraviolet light to allow visual observation of the form of ultraviolet light, which is not visible with the naked eyes, and the intensity of the incident beam, making it extremely effective for observation of the optical axis.

#### Attention

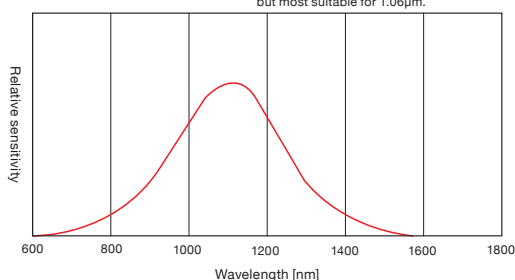
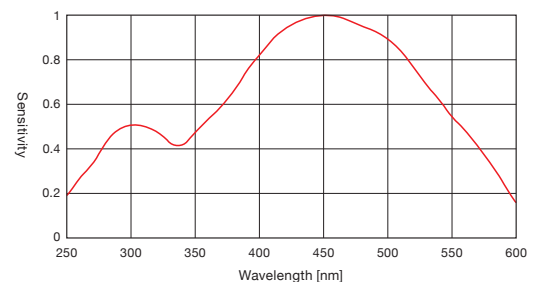
- ▶ Laser-shielding protective gear must be worn during use.
- ▶ If used continuously in a darkroom, it might stop emitting, in which case, place it in natural light about one minute to cause excitation.
- ▶ Since ET material is sensitive to humidity, always store in a plastic bag with a desiccant after use.

#### Specifications

Part Number	Active area Surface Dimensions [mm]	External Dimensions [mm]	Luminescence Color
SIRC-1	□25	54×85 thickness 0.5	Orange
SUVC-1			Red

#### Wavelength Characteristic

**SIRC-1**

 Usable in wavelength range of 0.7~1.6 $\mu\text{m}$ , but most suitable for 1.06 $\mu\text{m}$ .

**SUVC-1**




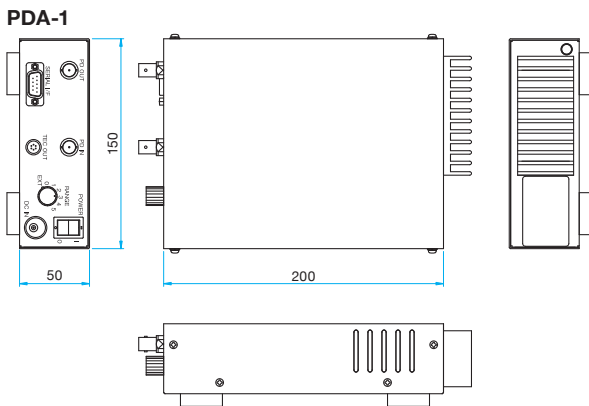
A transimpedance amplifier that converts weak photodiode output current to voltage. Highly sensitive and supports external operation with PC.



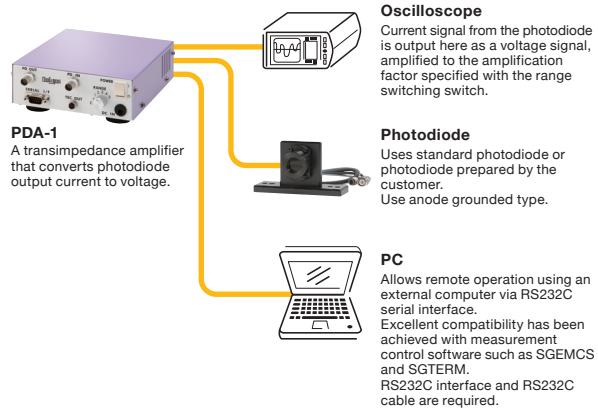
- Includes six conversion ranges  $10^5 - 10^{10}$  (V/A) and extremely large conversion ratio, enabling detection of weak light.
- Allows operation from the front panel as well as remotely using a computer via the RS232C interface. Switching of ranges and acquisition of current values are possible from the PC. Excellent compatibility has been achieved with measurement control software such as SGEMCS and SGTERM.
- Includes temperature control of the photodiode when used with PDA-PD-1, achieving stable detection of weak light.

### Outline Drawing

(Units: mm)



### System Configuration



### Characteristics Table (Ambient Temperature 25°C)

Operation Temperature	0°C – 40°C (Except sensor)	
Amplifier Gain	Range 0	$10^5$ V/A
	Range 1	$10^6$ V/A
	Range 2	$10^7$ V/A
	Range 3	$10^8$ V/A
	Range 4	$10^9$ V/A
	Range 5	$10^{10}$ V/A
MAX analog output voltage Load 2kΩ	4V	
Measurement Gain Error	(@Range 0 – 3)	2% vs. max light received in range
	(@Range 4)	3% vs. max light received in range
	(@Range 5)	4% vs. max light received in range
Cutoff Frequency	(@Range 1)	3kHz
	(@Range 3)	30Hz
	(@Range 5)	0.3Hz
A/D Converter Conversion Frequency	16Hz	
A/D Converter Resolution	24bits (but effective resolution is 16bits)	
Temperature Control Temperature	–10°C (Special photodiode)	
Temperature Control Fluctuation Temperature	0.1°C (Special photodiode)	
Peltier Output Current	1A (Special Photodiode)	

Note) Use of Peltier is limited to the special photodiode.

### Specifications

Part Number	PDA-1
Operation Ambient Temperature	0°C – 40°C
Storage Ambient Temperature	–20°C – 60°C
Ambient Humidity	20 – 90%RH (without condensation)
External Dimensions [mm]	(W)150×(H)50×(D)200 (Except for protrusions)
Interface	RS232C Photodiode signal input connector (Attention: PD and photodiode are anode grounded) SIGMA's photodiode special temperature control connector Signal output connector etc.
Accessories	Special AC adapter (AC100V)

### Option Temperature controlled Photodiode PDA-PD-1



- The PDA-PD-1 has built-in Peltier cooler, amp, temperature control circuit, and photo detector.
- The photodiode maintains low temperature by means of the Peltier cooling module.
- ND filters can be mounted to adjust the volume of received light. Absorption type fixed ND filters can be used. [Reference](#) B211
- Length of the cable to the amp is about 500mm.
- Structured to not be affected by peripheral noise.

### Guide

▶ C mount type is available separately. Contact our International Sales Division for more information.

### Specifications

Part Number	PDA-PD-1	
Light Receiving Surface Size [mm]	5.8×5.8	
Electrical and Optical Characteristics (Ambient Temperature 25°C)	Sensitivity wavelength range	$\lambda=190 - 1100$ nm
	MAX sensitivity wavelength	$\lambda p=960$ nm

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A compact stand-alone type beam measuring device with an integrated touch screen.



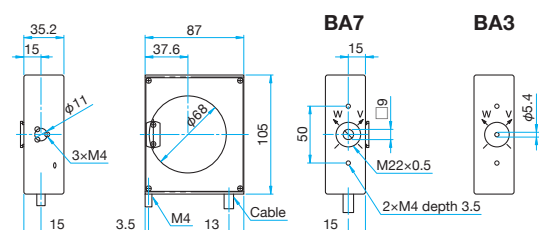
- Supports a wide wavelength measurement range (190nm to 2700nm), and capable of measuring beam profile, beam size, beam shape, position and beam intensity. It measures beam size between 3µm and 9mm with 0.1µm resolution.

#### [Features]

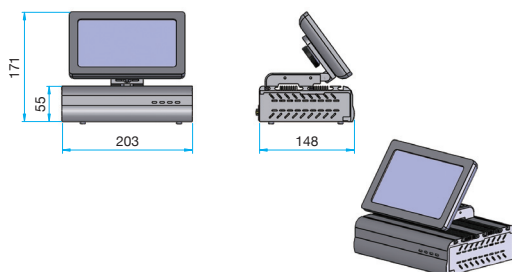
- 12-bit A/D converter enables high resolution sampling.
- Real-time beam profiling displays beam size, beam intensity and Gaussian fits.
- Capable of calculating the beam gravity center and ellipticity of loaded data. In addition, it can save external control and logging data in Excel or text (.txt) format using RS232C and TCP/IP communication.
- USB control type is available as option.

#### Outline Drawing

(Units: mm)



#### Stand Alone Unit Drawing



USB control type is available as option.

#### Specifications for Sensorheads

Sensor type	Silicon (Si) 350 – 1100nm UV-Silicon (UV-Si) 190 – 1100nm InGaAs (IR) 800 – 1800nm IR Enhanced (IR) 1200 – 2700nm
Spectral range	3 for BA3 heads 7 for BA7 heads
Beam size range	3µm – 5mm BA3-Si, BA3-UV 15µm – 10mm BA7-Si, BA7-UV(Oval) 15µm – 9mm BA7-Si, BA7-UV(Round) 3µm – 3mm BA3-IR3, BA3-IR3-E 15µm – 3mm BA7-IR3, BA7-IR3-E 3µm – 5mm BA3-IR5 15µm – 5mm BA7-IR5
Beamwidth resolution	1µm for beams >100µm in size, 0.1µm for beams <100µm in size
Beamwidth accuracy	±2%
Power accuracy	±5% for Si and UV-Si heads, ±10% for InGaAs heads
Power range	10µW to 1W with filters for Si and UV-Si heads 10µW to 5mW (no Filters provided) for the InGaAs heads
Power resolution	0.1W/cm <sup>2</sup> (no Filters provided)
Power resolution	0.1µW
Position accuracy	±15µm
Position resolution	1µm
Operating Temperature	10°C – 50°C
Weight	Sensor head 755 gr with cable, Stand alone unite 1.95Kg with built-in touch screen
Measurement rate	5Hz

#### Specifications for touch screen

LCD	LCD 7" wide Resolution 800×400 Contrast ratio 350:1 Processor Intel Atom D525 1/8Ghz, one 16GB CF (32 optional) Windows <sup>®</sup> 7 pro 4×RS-232 2LAN PORT.
-----	--

Part Number	Specifications
OS-BA3-Si-SAT	3-blades, Si detector 5mm circular
OS-BA7-Si-SAT	7-blades, Si detector 9mm square
OS-BA3-UV-SAT	3-blades, UV-Si detector 5mm circular
OS-BA7-UV-SAT	7-blades, UV-Si detector 9mm square
OS-BA3-IR3-SAT	3-blades, InGaAs detector 3mm circular
OS-BA3-IR3E-SAT	3-blades, InGaAs Enhanced 3mm circular
OS-BA7-IR3-SAT	7-blades, InGaAs detector 3mm circular
OS-BA7-IR3E-SAT	7-blades, InGaAs Enhanced 3mm circular
OS-BA3-IR5-SAT	3-blades, InGaAs detector 5mm circular
OS-BA7-IR5-SAT	7-blades, InGaAs detector 5mm circular

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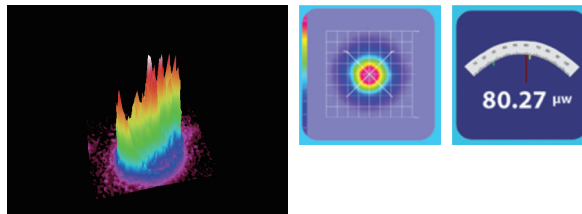
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A CCD type beam profiler for both CW and pulsed lasers, providing improved analytical capability.

- High resolution CCD sensor supports both CW and pulsed lasers.
- Supports a wide range of output with a filter (option) set in the accessory filter wheel.
- Measures beam profiles, position and beam intensity with 350nm to 1310nm sensitivity.



### [Features]

- Capable of measuring both CW and pulsed lasers.
- Our original technology enables measurement in a wide dynamic range.
- Capable of output the logging data using RS232C and TCP/IP.

### Specifications

Products Name	<b>OS-BeamOnHR</b>
Details	CCD camera with 350nm to 1310nm sensitivity
Components	USB2.0 cable, post, filter wheel, software, carrying case

### CCD Specifications

Camera Type	1.4 mega-pixel, 1/2-inch progressive scan
Pixel Size	4.65μm×4.65μm
Sensor Effective Area	6.47mm×4.83mm
Weight	0.165kg
Trigger Terminal	RCA female, TTL4.5V rectangular wave.
Power Consumption	4W 6V

### System Performance

Wavelength Sensitivity	350nm – 1310nm
Frame Rate	15fps (1392×1040)
Imaging Resolution	1392×1040
Shutter Speed	0.6s – 1μs
Gain Control	1× – 23×
Dynamic Range	60DB (without filter)
Damage Threshold	50W/cm <sup>2</sup> (with filter)
Sensitivity	633nm: 5nW/cm <sup>2</sup> , 1310nm: 60μW/mm <sup>2</sup>
Saturation Point	2mW/cm <sup>2</sup>
Used with Pulsed Laser	Measurement of laser output between 1Hz to 100Hz, also single shot measurement is possible.
Trigger	Operate the slide bar on the software display and decide the detection threshold.

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These products are intended for protection or shielding from accidental exposure to scattered laser light.

Absorb indirect scattering light of laser light to protect the eye. The type, wavelength and optical density (OD) of laser light to be absorbed are inscribed on these products.

- Apply to windows, inset windows or partitions in laser controlled areas in laboratories and factories.
- Effective as safety measures for expected and unexpected visitors, since laser injuries can occur instantaneously.

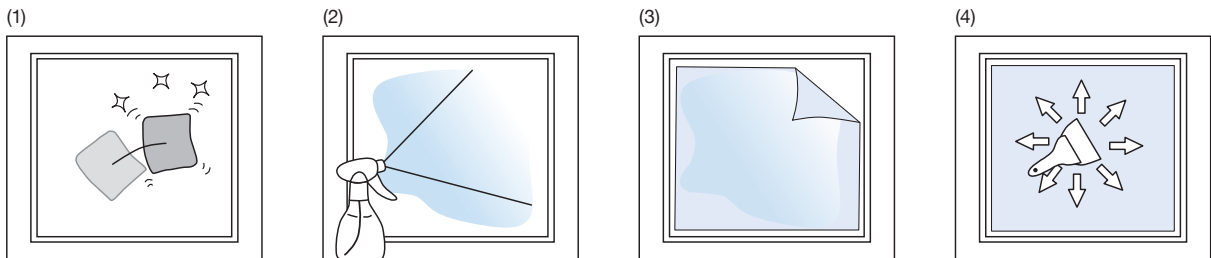
## How to Attach and Install

Replace curtains periodically because the optical density may deteriorate depending on the usage or storage environment (direct sunlight, high temperature and high humidity) or due to scratches.

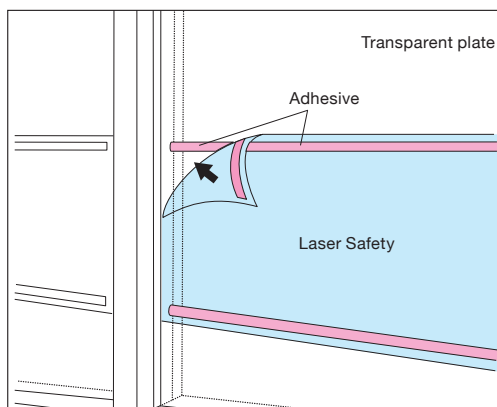
These products are made of flexible PVC, which may be vulnerable to degradation by organic solvents, acids, and alkalis, depending on the solvent type. If stained, wash with water containing a neutral detergent or wipe with alcohol. Also wipe with alcohol when curtains become cloudy over time with oily exudations (plasticizer).

### Installation method of YLC-1 laser shield curtain

- (1) Wipe the glass clean.
- (2) Spray water onto the glass surface.
- (3) Apply the product to the wet glass.
- (4) Push out water and air from underneath the product by moving a rubber spatula on top of the product from the center to its edges.



### Attaching method of YL-600 laser curtain

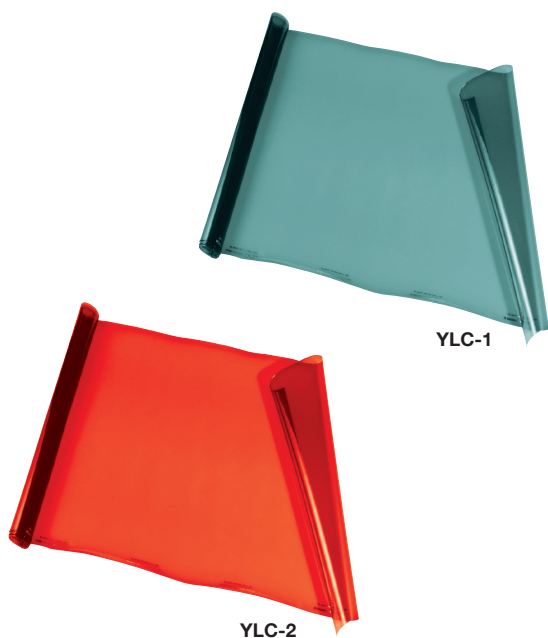


### Attention

- ▶ Do not use with incompatible lasers or wavelengths. (Even if laser names are the same, their wavelengths might be different.)
- ▶ Do not use products that are damaged or after they have received large laser energy.
- ▶ Never subject laser (shield) curtains to direct laser beam exposure. Direct exposure may damage the curtains.
- ▶ These are not protective equipments that completely absorb laser light. (Refer to the absorption characteristic graph.)
- ▶ Do not directly look into the laser beam through laser (shield) curtains.

Protect larger areas (1,000mm) compared to conventional YL-600 (effective width: 330mm), and offer excellent antistatic and fire retardant properties.

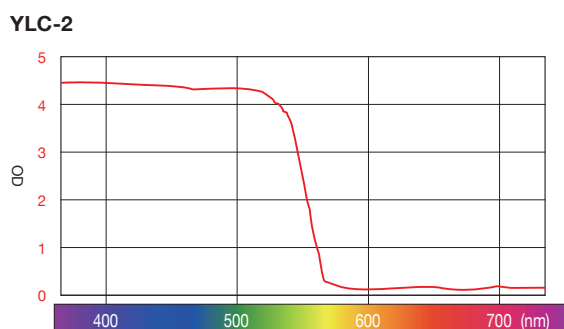
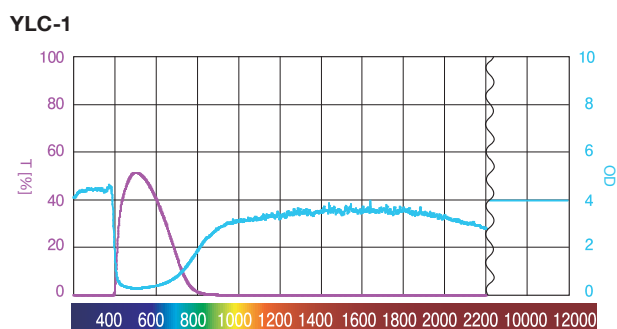
- Ensure high visibility with improvements in surface accuracy and visible light transmittance.
- Flexibly used in various shapes repeatedly since it adhere with water instead of band.



Common Specifications	
Material	Flexible PVC
Thickness [mm]	0.5
Compatible Wavelength [nm]	YLC-1: 266, 355, 1064, 2100, 10600 YLC-2: 190 - 380, 441 - 532
Color	YLC-1: Clear gray YLC-2: Clear orange
Optical Density [OD]	3<
Visible Light Transmittance [%]	YLC-1: Standard 40 YLC-2: Standard 30
Antistatic Property (Surface resistance value)	YLC-1: $1.1 \times 10^{10}$ (JIS K6911) YLC-2: $1.1 \times 10^{13}$ (JIS K6911)
Fire Retardant	Class 2 fire retardant (JIS A1322)

Part Number	Part Number	Length [mm]
YLC-1(0.5M)	YLC-2(0.5M)	500
YLC-1(1M)	YLC-2(1M)	1,000
YLC-1(2M)	YLC-2(2M)	2,000
YLC-1(3M)	YLC-2(3M)	3,000
YLC-1(4M)	YLC-2(4M)	4,000
YLC-1(5M)	YLC-2(5M)	5,000
YLC-1(6M)	YLC-2(6M)	6,000
YLC-1(7M)	YLC-2(7M)	7,000
YLC-1(8M)	YLC-2(8M)	8,000
YLC-1(9M)	YLC-2(9M)	9,000
YLC-1(10M)	YLC-2(10M)	10,000

Absorption characteristic graph T: Transmittance



\* Note that the graphs of optical density show measured values, not guaranteed values.

# Laser Safety PVC Films | YL-600

RoHS Catalog Code W5009

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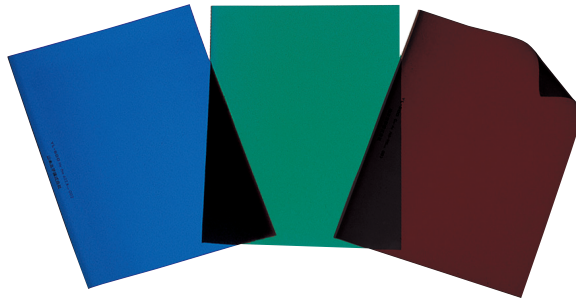
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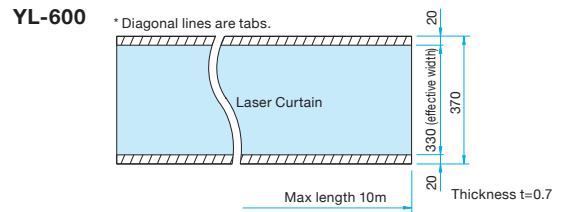
Light Sources

These products are intended for protection or shielding from accidental exposure to scattered laser light.

- Made of flexible PVC, this material is easily cut with scissors. Apply to a wide range including windows, doors or glass in laser controlled areas in laboratories and factories.



### Outline Drawing (Units: mm)



### Common Specifications

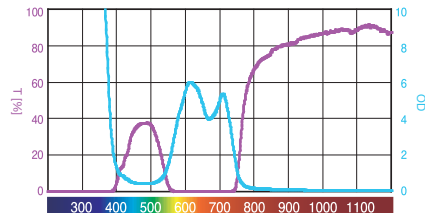
Material	Flexible PVC
Thickness [mm]	0.7
External Dimensions [mm]	Effective width: 330

Part Number	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Visible Light Transmittance [%]	Color	Length [mm]	Weight [kg]
YL-600-HN(0.5M)	He-Ne	632.8 570 – 694.3	2<	12	Blue	500	0.18
YL-600-HN(1M)						1,000	0.35
YL-600-HN(2M)						2,000	0.7
YL-600-HN(5M)						5,000	1.75
YL-600-HN(10M)						10,000	3.5
YL-600-LD(0.5M)	LD	740 – 910 700 – 1000	3< (However, Ti-Sapphire 1 – 3<)	12	Green	500	0.18
YL-600-LD(1M)						1,000	0.35
YL-600-LD(2M)						2,000	0.7
YL-600-LD(5M)						5,000	1.75
YL-600-LD(10M)						10,000	3.5
YL-600C-Y2(0.5M)	YAG	266 355 532 1064	3<	7	Amber	500	0.18
YL-600C-Y2(1M)						1,000	0.35
YL-600C-Y2(2M)						2,000	0.7
YL-600C-Y2(5M)						5,000	1.75
YL-600C-Y2(10M)						10,000	3.5

### Absorption characteristic graph \* Note that the graphs of optical density show measured values, not guaranteed values. T: Transmittance

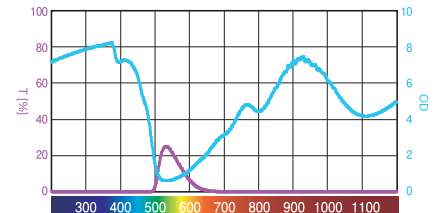
#### YL-600-HN

Compatible Laser	He-Ne
Color	Blue
Visible Light Transmittance	12%
Optical Density [OD]	
He-Ne	632.8nm
DYE	570 – 630nm
GOLD-VAPOR	627.8nm
Kr	647.1nm
	676.4nm
Ruby	694.3nm



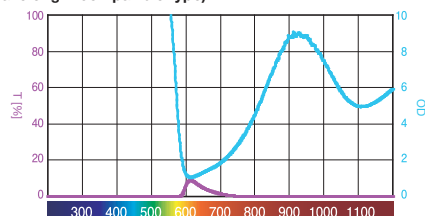
#### YL-600-LD

Compatible Laser	LD
Color	Green
Visible Light Transmittance	12%
Optical Density [OD]	
LD	740 – 910nm
ALEXANDRITE	740 – 820nm
Ti-Sapphire	700 – 1000nm

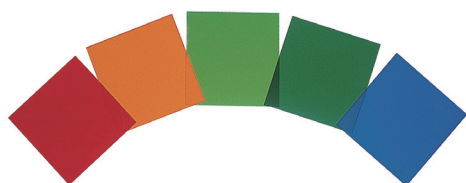


#### YL-600C-Y2 (Multi-wavelength compatible type)

Compatible Laser	YAG
Color	Amber
Visible Light Transmittance	7%
Optical Density [OD]	
YAG	226nm
	355nm
	532nm
	1064nm



These products are intended for protection or shielding from accidental exposure to scattered laser light. Appropriate for inspection windows of laser processing devices and partitions in laser controlled areas.



- Designed for safety, which is appropriate for extended adjustment tasks and normal operations.
- High optical density blocks visual observation of laser light.
- Apply to partial windows, inset windows or partitions in laser controlled areas in laboratories and factories.
- Effective as safety measures for expected and unexpected visitors, since laser injuries can occur instantaneously.

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- ▶ Contact us for shapes not listed in the catalog or according to the intended use.
- ▶ Replace laser windows periodically as the optical density may deteriorate depending on the usage or storage environment (direct sunlight, high temperature and high humidity) or due to scratches.

### Attention

- ▶ Do not use with incompatible lasers or wavelengths. (Even if laser names are the same, their wavelengths might be different.)
- ▶ Do not use products that are damaged or once they have received large laser energy.
- ▶ Do not irradiate the laser beam directly at laser safety windows because it may damage them.
- ▶ These are not protective equipments that completely absorb laser light. [Reference](#) Absorption characteristic graph H016
- ▶ Do not directly look into the laser beam through laser safety windows.

Part Number	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Color	Visible Light Transmittance [%]	External Dimensions [mm]	Thickness t [mm]	Weight [kg]
YL-500P-AR(1)	Ar	190 – 380	4<	Orange	60	100× 100	3	0.04
YL-500P-AR(2)						100× 150	3	0.07
YL-500P-AR(3)						200× 200	3	0.16
YL-500P-AR(4)						250× 300	3	0.3
YL-500P-AR(5)						300× 300	3	0.36
YL-500P-AR(6)						400× 400	3	0.64
YL-500P-AR(7)						400× 400	3	0.64
YL-500P-Y2(1)	YAG2ω	480 – 540	6<	Red	15	100× 100	3	0.04
YL-500P-Y2(2)						100× 150	3	0.07
YL-500P-Y2(3)						200× 200	3	0.16
YL-500P-Y2(4)						250× 300	3	0.3
YL-500P-Y2(5)						300× 300	3	0.36
YL-500P-Y2(6)						400× 400	3	0.64
YL-500P-Y2(7)						400× 400	3	0.64
YL-500P-LD(1)	LD	632.8	5<	Blue	7	100× 100	3	0.04
YL-500P-LD(2)						100× 150	3	0.07
YL-500P-LD(3)						200× 200	3	0.16
YL-500P-LD(4)						250× 300	3	0.3
YL-500P-LD(5)						300× 300	3	0.36
YL-500P-LD(6)						400× 400	3	0.64
YL-500P-LD(7)						400× 400	3	0.64
YL-500P-Y1(11)	YAG	1064	5<	Green	25	100× 100	3.5	0.04
YL-500P-Y1(12)						100× 150	3.5	0.07
YL-500P-Y1(13)						200× 200	3.5	0.16
YL-500P-Y1(14)						250× 300	3.5	0.3
YL-500P-Y1(15)						300× 300	3.5	0.36
YL-500P-Y1(16)						400× 400	3.5	0.65
YL-500P-Y1(17)						500× 600	3.5	1.2
YL-500P-Y1(18)						1,000×1,200	3.5	4.8
YL-500P-CO2(1)	CO <sub>2</sub>	10600	10<	Green	60	100× 100	4	0.05
YL-500P-CO2(2)						100× 150	4	0.08
YL-500P-CO2(3)						200× 200	4	0.2
YL-500P-CO2(4)						250× 300	4	0.37
YL-500P-CO2(5)						300× 300	4	0.45
YL-500P-CO2(6)						400× 400	4	0.8
YL-500P-CO2(7)						400× 400	4	0.8

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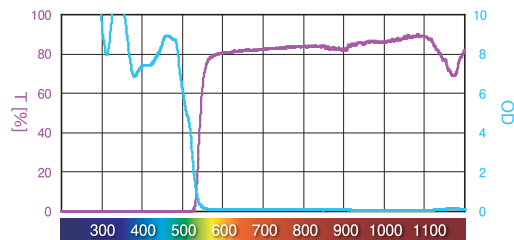
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Absorption characteristic graph \* Note that the graphs of optical density show measured values, not guaranteed values.

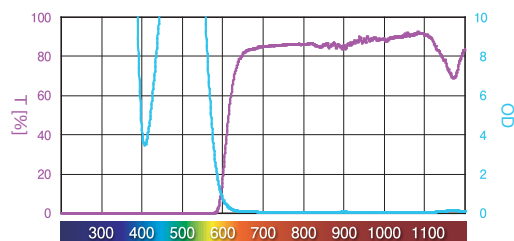
T: Transmittance

## Complete absorption type

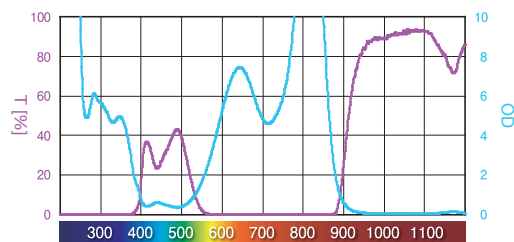
Part Number	YL-500P-AR	
Window Type	Ar	
Color	Orange	
Visible Light Transmittance	60%	
Optical Density [OD]		
EXCIMER		
Ar	200 – 514.5nm	4<
He-Cd		



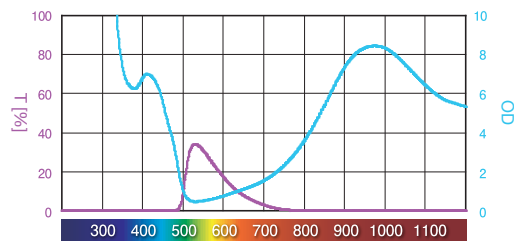
Part Number	YL-500P-Y2	
Window Type	YAG2 $\omega$	
Color	Red	
Visible Light Transmittance	15%	
Optical Density [OD]		
Ar	480 – 540nm	6<
YAG2 $\omega$	532nm	



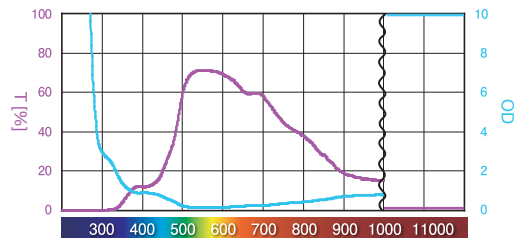
Part Number	YL-500P-LD	
Window Type	LD	
Color	Blue	
Visible Light Transmittance	7%	
Optical Density [OD]		
LD	760 – 850nm	5<
He-Ne	632.8nm	



Part Number	YL-500P-Y1	
Window Type	YAG	
Color	Green	
Visible Light Transmittance	25%	
Optical Density [OD]		
YAG	1064nm	5<
Nd-YVO <sub>4</sub>		



Part Number	YL-500P-CO2	
Window Type	CO <sub>2</sub>	
Color	Green	
Visible Light Transmittance	60%	
Optical Density [OD]		
CO <sub>2</sub>	10600nm	10<



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Panels for protecting eyes to ensure safety against accidental exposure to scattered laser light. Enable observation of internal situation by blocking laser lights using laser shield curtains or laser windows compatible with various wavelengths.

- Fitted with casters, making it easy to move.



### Guide

- ▶ Refer to H013 and H015 pages for the specifications of laser shield curtains and laser safety windows.
- ▶ Connection of panels is possible as an option.

### Attention

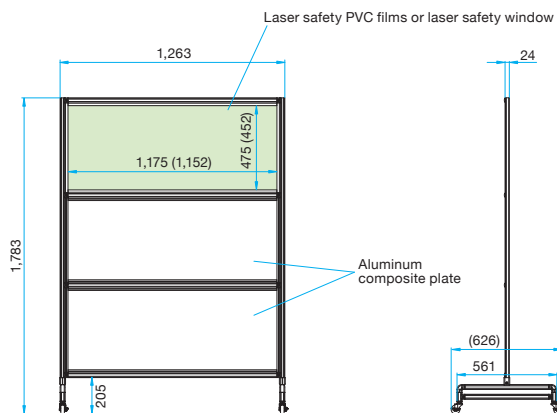
- ▶ Delivery cost will be quoted separately.

### Connection Examples



### Outline Drawing

(Units: mm)



Dimensions inside ( ) are service area when using laser safety PVC films

### Laser Shield Curtain Type (YLC-1 type)

Part Number	Wavelength [nm]	Optical Density [OD]	Used Laser Shield Curtain	Color	Visible Light Transmittance [%]	Width [mm]
<b>OFUP2-121750YLC1</b>	266 355 1064 2100 10600	3<	YLC-1	Clear gray ●	40	1,200
<b>OFUP2-121750YLC2</b>	190 – 380 441 – 532	3<	YLC-2	Clear orange ●	30	1,200

### Laser Safety Windows Type (YL-500 type)

Part Number	Wavelength [nm]	Optical Density [OD]	Used Laser Shield Curtain	Color	Visible Light Transmittance [%]	Width [mm]
<b>OFUP2-121750PAR</b>	200 – 514.5	4<	YL-500P-AR	Orange ●	60	1,200
<b>OFUP2-121750PY2</b>	480 – 540	6<	YL-500P-Y2	Red ●	15	1,200
<b>OFUP2-121750OPLD</b>	632.8, 760 – 850	5<	YL-500P-LD	Blue ●	7	1,200
<b>OFUP2-121750PY1</b>	900 – 1200	5<	YL-500P-Y1	Green ●	25	1,200
<b>OFUP2-121750PCO2</b>	10600	10<	YL-500P-CO2	Green ●	60	1,200

# Laser Protective Eyewear Guide

## Use of Laser Protective Eyewear

According to the directives from the Ministry of Health, Labor and Welfare [On Measures to Prevent Injury from Laser Radiation], laser protective eyewear appropriate for the laser type is required in laser controlled areas of the Class 3R laser equipments that emit lasers at wavelengths other than 400 to 700nm, as well as Class 3B and Class 4 laser equipments as safety and preventive measures.

## Selection of Laser Protective Eyewear

- (1) Confirm laser output wavelengths.
- (2) Confirm laser output.  
For CW output: Output power  
For pulse: Energy per pulse, pulse duration, pulse recurrence frequency, etc.
- (3) Calculate MPE (maximum permissible exposure).
- (4) Determine the maximum exposure duration.
- (5) Calculate the maximum radiation exposure value.
- (6) Calculate the required optical density.
- (7) (Confirm whether it is required to see beams in case of visible lasers.)
- (8) (Select the shape of protective eyewear (whether users will wear prescription glasses).)

## What Is MPE (Maximum Permissible Exposure)

The MPE is the value that indicates a safety level for the human body, and defined as 1/10 of the strength of laser output at which probability of causing hazard is 50%.

Although the MPE is determined by two axes, wavelength and exposure time, attention is required since the MPE value is given as power density ( $W/m^2$ ) or energy density ( $J/m^2$ ) per unit surface area.

This area is based on the limiting aperture size, and the value varies according to the wavelength, eye or skin, exposure time and other conditions, considering hazard types.

## What Is OD Value (Optical Density)

Optical transmission is generally indicated by transmittance (%).

It is commonly expressed in percentage, and indicated by logarithm. That is the OD value (optical density).


Optical density (OD) is the attenuation rate of incident light that passes through the optical filter, in this case laser protective eyewear, and calculated with the following formula.

$$OD(\lambda) = \text{Log}_{10}(PI(\lambda)/PT(\lambda)) = -\text{log}_{10}T(\lambda)$$

(PI: Incidence PT: Transmission T: Transmittance of characteristic wavelength)

\* The larger the OD value, the larger the attenuation rate of incident light, thus providing higher protective function.

\* If the OD value increases, then the transmittance decreases.

Optical Density (OD value)	Transmittance	Attenuation Rate	Protective Function
0	100%	0	 Weak High
1	10%	1/10	
2	1%	1/100	
3	0.1%	1/1000	
4	0.01%	1/10000	
5	0.001%	1/100000	
6	0.0001%	1/1000000	
7	0.00001%	1/10000000	
8	0.000001%	1/100000000	
9	0.0000001%	1/1000000000	
10	0.00000001%	1/10000000000	

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## Differences in Usage of Complete Absorption Type, Multi-wavelength Compatible Type and Partially Transmitting Type

### Complete absorption type

Normally, you cannot see visible laser light because the optical density (OD) is set to high.

### Multi-wavelength compatible type

Appropriate for work involving multiple wavelengths.

### Partially transmitting type for maintenance

Appropriate for maintenance involving 100mW or less (OD 1 – 2), and 10W or less (OD 4). Use this type for checking optical paths or adjusting optical axes.

### Reinforced glass (complete absorption) type

Optical density (OD) and damage threshold are high enough to prevent damage from direct beam exposure.

#### YL-760 model (three-way type)

This model offers improved fitting functions including angle adjustment for the gap with the face and flexible temples. Inner frames (optional) customized according to lens prescriptions are available for people who wear prescription glasses.



Reference > H020

#### YL-717 model (over prescription glasses type)

Can be used over prescription glasses.

This model is fitted with top canopy and sides, and the angle of the front frame and the length of temples are adjustable.



Reference > H021

#### YL-335 model (over prescription glasses type)

Can be used over prescription glasses. This model is well cushioned and comfortable to wear. (Some large glasses may not fit.)



Reference > H022

#### YL-290 model (eyeglass shaped)

Light and compact two-lens type is easy to wear and remove.

This model features a highly protective cover frame and wide temples.



Reference > H022

#### YL-250G model (over prescription glasses, reinforced glass type)

This model uses reinforced glass for lenses, provides high visible light transmittance, and offers improved visibility and permeability of light. Lenses also offer excellent chemical resistance.



Reference > H023

#### YL-130 model (goggle shaped)

This model fits the face snugly, and can be worn over prescription glasses. Appropriate for use when the angle of beam or scattering light cannot be identified.



Reference > H023

#### YL-120H model (goggle shaped)

With its laminated glass structure, this model provides high visible light transmittance and ensures safety with high damage threshold against laser.



Reference > H023

#### Attention

- ▶ Do not directly look into the laser beam through laser protective eyewear.
- ▶ Do not irradiate the laser beam directly at laser protective eyewear because it may damage the eyewear.
- ▶ Do not use with incompatible lasers or wavelengths. (Even if laser names are the same, their wavelengths might be different.)
- ▶ Do not take off laser protective eyewear during work.
- ▶ Do not use as protective eyewear for welding.
- ▶ Complete absorption type eyewear is not protective equipments that completely absorb laser light. (Refer to the absorption characteristic graph.)
- ▶ Do not use products with visible light transmittance of 20% or less in a darkroom.
- ▶ Cease use of eyewear that is damaged or once it has received high laser energy.

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Adjustable fit including angle adjustment for the gap with the face and flexible temples.

- Used for the naked eye, over prescription glasses, and with prescription inner frame (optional).



#### Guide

- ▶ Wearing laser protective eyewear over prescription glasses causes a lot of stress. To release the stress, prescription inner frames (optional) are available. Contact our International Sales Division for more information.
- ▶ All prescriptions can be supported since these are custom-made.

#### Common Specifications

Frame	Nylon elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, adjustable angle, soft rubber temple (flexibly adjustable)
External Dimensions [mm]	(W)160×(H)58×(D)170
Weight [kg]	0.14

#### Function Description

##### ■ Rubber Nose Pad



Normal size



Large size

The rubber nose pad keeps eyewear from sliding to provide comfort for extended work. Together with the normal size, the large size is included as standard so that eyewear is easy to fit for women as well as people who use inner frames.

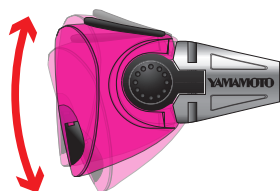
##### Option Inner Frame



With its simple attachment structure, the inner frame can be easily attached or taken off at the time of maintenance. It eliminates the stress of wearing protective eyewear over prescription glasses, providing comfortable work conditions.

(\* Ophthalmic prescription data is required for production.)

##### ■ Angle Adjustment Function



With the angle adjustment function, it is possible to align the eyewear with the line of sight, fit it on the nose and adjust the gap with the face.

##### ■ Adjustable Earpiece



Rubber coated earpieces can be shaped into ear hook type, straight type and other shapes as desired by freely bending them.

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-760-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-760-LDY1	Complete absorption	LD-YAG	800 – 810 940, 1064	7<	Green	35
YL-760-Y1	Complete absorption	YAG	1064	6<	Green	50
YL-760C-Y2	Multi-wavelength compatible type	YAG	266, 355 532 1064	10< 4< 6<	Amber	35
YL-760M-Y2	Partially transmitting for maintenance	YAG2ω	532	2<	Red	30
YL-760M-VLD	Partially transmitting for maintenance	LD	660 – 680 647.1, 676.4	2<	Blue	55

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Can be used with prescription glasses. The adjustable locking rubber ear-piece improves fit.

- This model is fitted with top canopy and sides, and the angle of the front frame and the length of temples are adjustable.

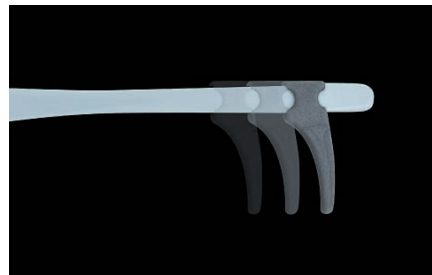


Common Specifications	
Frame	Nylon elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, elastomer cushion, adjustable temple angle
External Dimensions [mm]	(W)163×(H)65×(D)167
Weight [kg]	0.04

Function Description



Uses a newly designed straight temple. Angle of frame edge is adjustable to fit the face (three adjustment stages).



Newly designed locking rubber ear-piece for improved fit.

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
CE YL-717-EX	Complete absorption	EXCIMER	190 – 380	10<	Clear	85
YL-717-AR(45)	Complete absorption	Ar	488, 514.5	10<	Orange	45
CE YL-717-Y2	Complete absorption	YAG2 $\omega$	532	10<	Red	16
YL-717-DYE	Complete absorption	DYE	590 – 598	6<	Blue	20
CE YL-717-HN	Complete absorption	He-Ne	632.8	5<	Blue	25
CE YL-717-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-717-LD2	Complete absorption	LD	790 – 910	3 – 6<	Green	27
CE YL-717-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-717-CO2	Complete absorption	CO <sub>2</sub>	10600	5<	Green	60
CE YL-717C-LD	Complete absorption/multi-wavelength	LD	660 – 680 680 – 1100	2 – 3< 3 – 5<	Green	7
YL-717C-Y1	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 2< 6<	Amber	40
CE YL-717C-Y2	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 4< 6<	Amber	35
YL-717C-Y3	Complete absorption/multi-wavelength	YAG	266, 355 532 1064	10< 7< 6<	Amber	30
YL-717M-AR	Partially transmitting, OD2	Ar	488, 514.5	3< 2<	Orange	57
CE YL-717M-Y2	Partially transmitting, OD2	YAG2 $\omega$	532	2<	Red	30
YL-717M-HN	Partially transmitting, OD2	He-Ne	627.8, 632.8, 635	2<	Blue	47
CE YL-717M-VLD	Partially transmitting, OD2	LD	660 – 680 647.1, 676.4	2<	Blue	55
YL-717M-LD	Partially transmitting, OD2	LD	780	1<	Green	48
YL-717A-AR	Partially transmitting, OD4	Ar	488, 514.5	4<	Orange	50
CE YL-717A-Y2	Partially transmitting, OD4	YAG2 $\omega$	532	4<	Red	25

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# YL-335 Model (Over prescription glasses type)

## YL-290 Model (Eyeglass shaped)

YL-335  
YL-290

### YL-335

RoHS

CE

Catalog Code

W5015

Can be used over prescription glasses.



- This model is well cushioned and has small gaps to ensure wide view, providing comfort and excellent functionality. (Some large glasses may not fit.)

#### Common Specifications

Frame	Polycarbonate elastomer
Lens	Polycarbonate (hard coated)
Specifications	Compatible with prescription glasses, wide temple, soft nose pad, flexible temple
External Dimensions [mm]	(W)158×(H)65×(D)168
Weight [kg]	0.05

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-335-EX	Complete absorption	EXCIMER	190 – 380	10<	Clear	85
CE YL-335-EX/He-Cd	Complete absorption	EXCIMER	193 – 442	10<	Yellow	75
YL-335-AR(45)	Complete absorption	Ar	488, 514.5	10<	Orange	45
YL-335-Y2	Complete absorption	YAG2 $\omega$	532	10<	Red	16
YL-335-HN	Complete absorption	He-Ne	632.8	5<	Blue	25
CE YL-335-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
YL-335-LDY1	Complete absorption	LD-YAG	800 – 810 940, 1064	7<	Green	35
YL-335-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
YL-335-CO2	Complete absorption	CO <sub>2</sub>	10600	6<	Green	60
YL-335-CO2-CLA	Complete absorption	CO <sub>2</sub>	10600	6<	Clear	85
YL-335M-BLD	Partially transmitting, OD2	LD	405	3<	Clear	85
YL-335M-AR	Partially transmitting, OD2	Ar	514.5	2<	Orange	57
YL-335M-Y2	Partially transmitting, OD2	YAG2 $\omega$	532	2<	Red	30
YL-335M-HN	Partially transmitting, OD2	He-Ne	627.8, 632.8, 635	2<	Blue	47
YL-335M-VLD	Partially transmitting, OD2	LD	660 – 680	2<	Blue	55
YL-335M-LD	Partially transmitting, OD2	LD	780	1<	Green	48
YL-335M-LD2	Partially transmitting, OD2	LD	635 – 780	0.5 – 1<	Blue	58
YL-335M-RGB	Partially transmitting, OD2	RGB-LED	457, 532, 633	2<	Purple	8
YL-335A-AR	Partially transmitting, OD4	Ar	488, 514.5	4<	Orange	50
YL-335A-Y2	Partially transmitting, OD4	YAG2 $\omega$	532	4<	Red	25
YL-335C-LD	Complete absorption multi-wavelength	LD	660 – 680 680 – 1100	2 – 3< 3 – 5<	Green	7
YL-335C-Y1	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10< 2< 6<	Amber	40
CE YL-335C-Y2	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10< 4< 6<	Amber	35
YL-335C-Y3	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10< 7< 6<	Amber	30

### YL-290

RoHS

CE

Catalog Code

W5016

Lightweight and compact two-lens type.



- This model features a highly protective cover frame and wide temples.

#### Common Specifications

Frame	Nylon
Lens	Polycarbonate (hard coated)
Specifications	Round frame, wide temple
External Dimensions [mm]	(W)138×(H)39×(D)155
Weight [kg]	0.03

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
CE YL-290-EX/He-Cd	Complete absorption	EXCIMER, He-Cd	193 – 442	10<	Yellow	75
CE YL-290-Y2	Complete absorption	YAG2 $\omega$	532	10<	Red	16
CE YL-290-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
CE YL-290-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
CE YL-290M-Y2	Partially transmitting, OD2	YAG2 $\omega$	532	2<	Red	30
CE YL-290M-VLD	Partially transmitting, OD2	LD	660 – 680 647.1, 676.4	2<	Blue	55
CE YL-290C-Y2	Complete absorption multi-wavelength	YAG	266, 355 532 1064	10< 4< 6<	Amber	35

**YL-250G Model** (Over prescription glasses, reinforced glass type)  
**YL-130 Model** (Goggle shaped)/**YL-120H Model** (Goggle shaped, reinforced glass type)

**YL-250G**  
**YL-130 / YL-120H**

**YL-250G**

RoHS CE Catalog Code W5017  
\*With exceptions

Reinforced glass lenses provide high visible light transmittance, and offer improved visibility and permeability of light.



- Lenses also offer excellent scratch and chemical resistance.

Common Specifications	
Frame	Nylon
Lens	Reinforced glass
Specifications	Compatible with prescription glasses
External Dimensions [mm]	(W)155×(H)57×(D)141
Weight [kg]	0.07

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-250G-3Y	Reinforced glass type	Nd-YAG:OD3(3Y)	780	0,8<	Green	80
			980	3<		
			1064	3<		
			1310, 1550	2<		
			2100, 2940	2<		
CE YL-250G-5Y	Reinforced glass type	Nd-YAG:OD5(5Y)	1064	5<	Green	74
YL-250G-7Y	Reinforced glass type	Nd-YAG:OD7(7Y)	1064	7<	Green	69
			2100, 2940	5<		

**YL-130**

RoHS CE Catalog Code W5018  
\*With exceptions

Provides a snug, sealed fit, can be worn over prescription glasses.



- Appropriate for use when the angle of beam or scattering light cannot be identified.
- Optional parts for supporting use in clean room (fasteners for adjustment, with hard cases) are available. [▶ WEB Reference](#)

Common Specifications	
Frame	PP elastomer
Lens	Polycarbonate (anti-fog hard coated)
Specifications	Compatible with prescription glasses (some glasses do not fit)
External Dimensions [mm]	(W)192×(H)83×(D)92
Weight [kg]	0.09

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
YL-130-EX	Complete absorption	EXCIMER	190 – 380	10<	Clear	85
CE YL-130-Y2	Complete absorption	YAG2 $\omega$	532	10<	Red	16
CE YL-130-ALX	Complete absorption	ALEXANDRITE	750 – 800 – 850	4–10–4<	Pink	30
CE YL-130-Y1(50)	Complete absorption	YAG	1064	6<	Green	50
CE YL-130C-Y2	Complete absorption multi-wavelength	YAG	266, 355	10<	Amber	35
			532	4<		
CE YL-130M-Y2	Partially transmitting, OD2	YAG2 $\omega$	1064	6<	Red	30
			532	2<		
CE YL-130M-VLD	Partially transmitting, OD2	LD	660 – 680	2<	Blue	55
			647.1, 676.4			

**YL-120H**

RoHS CE Catalog Code W5019

Laminated glass offers high visible light transmittance.  
 Damage threshold against high-power laser is high to ensure stability.



Common Specifications	
Frame	Special laminating resin
Lens	Special laminating glass
Specifications	Compatible with prescription glasses
External Dimensions [mm]	(W)160×(H)80×(D)73
Weight [kg]	0.16

Part Number	Type	Compatible Laser	Wavelength [nm]	Optical Density [OD]	Lens Color	Visible Light Transmittance [%]
CE YL-120H-Y1	Reinforced glass type	YAG	1064, 1319,5	7<	Green	67
			1060			
			1319,5			
CE YL-120H-CO2	Reinforced glass type	CO <sub>2</sub>	10600	10<	Clear	86
			193, 248, 308			

\*1 Damage threshold: Value indicating the degree of power at which damage occurs if laser light is irradiated.

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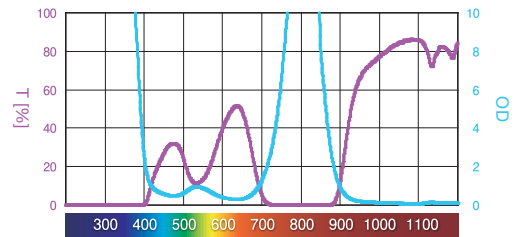
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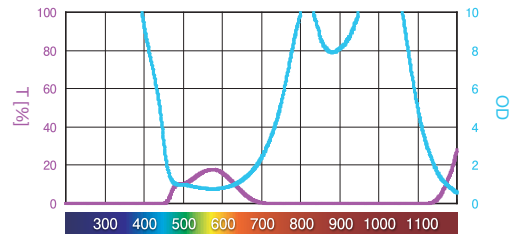
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**Complete absorption type** Normally, you cannot see visible laser light because the optical density is set to high. T: Transmittance

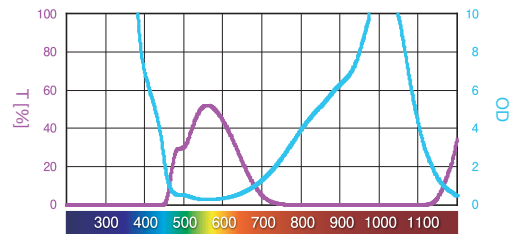
Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290		
Lens Type	ALEXANDRITE		
Color	Pink		
Visible Light Transmittance	30%		
Optical Density [OD]			
ALEXANDRITE	755nm	6<	
LD	750 – 850nm	4 – 10<	
	800nm	10<	
	750 – 850nm	4<	



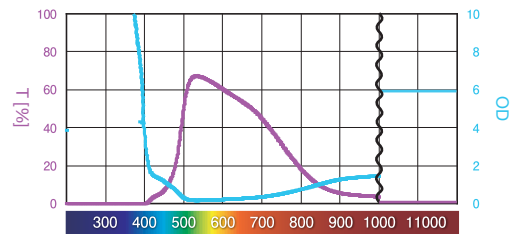
Frame Type	YL-335 YL-760		
Lens Type	LD-YAG		
Color	Green		
Visible Light Transmittance	35%		
Optical Density [OD]			
FIBER LASER	800 – 1080nm	6<	
YAG	1064nm	7<	
LD	800 – 810nm	7<	
	940nm	7<	



Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290		
Lens Type	YAG		
Color	Green		
Visible Light Transmittance	50%		
Optical Density [OD]			
Nd-YLF	1047nm 1053nm	6<	
YAG	1064nm	6<	

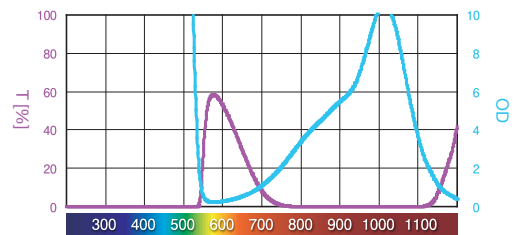


Frame Type	YL-717		
Lens Type	CO <sub>2</sub>		
Color	Green		
Visible Light Transmittance	60%		
Optical Density [OD]			
CO <sub>2</sub>	10600nm	6<	



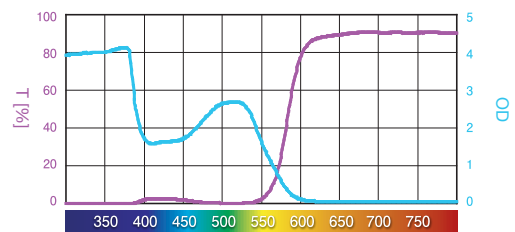
**Multi-wavelength compatible type** One filter handles multiple wavelengths of laser.

Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290		
Lens Type	YAG		
Color	Amber		
Visible Light Transmittance	40%		
Optical Density [OD]			
YAG	226nm	10<	
	355nm	10<	
	532nm	4<	
	1064nm	6<	

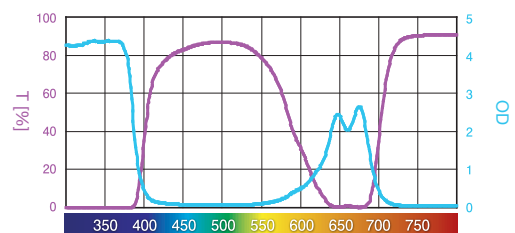


**1/100 attenuation partially transmitting type for maintenance** For maintenance for 100mW or less (optical density 1 – 2). Use this type for checking optical paths or adjusting optical axes.

Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290		
Lens Type	YAG2ω		
Color	Red		
Visible Light Transmittance	30%		
Optical Density [OD]			
YAG2ω	532nm	2<	



Frame Type	YL-130 YL-760 YL-717 YL-335 YL-290		
Lens Type	LD		
Color	Blue		
Visible Light Transmittance	55%		
Optical Density [OD]			
LD	660 – 680nm	2<	
Kr	647.1nm	2<	
	676.4nm	2<	



\* Note that the graphs of optical density show measured values, not guaranteed values.



## Laser Classification Labels

\* The content of this products is only available in Japanese.

Catalog Code **W5020**



- Classification labels for laser processing devices and measuring equipments.
- Used for production sites of laser processing, laboratories where laser light is used, or the like.
- Various sizes are available for Class 1 to Class 4.
- Compliant with JIS C6802.

### Specifications

External Dimensions [mm]	L size	(W)250×(H)100
	S size	(W)148×(H)84
Quantity [pieces]	25	

	Part Number	Class	Size		Part Number	Class	Size
	817-821A	1	L		817-861A	3R (A type)	L
	817-822A		S		817-862A		S
	817-831A	1M	L		817-871A	3R (B type)	L
	817-832A		S		817-872A		S
	817-841A	2	L		817-881A	3B	L
	817-842A		S		817-882A		S
	817-851A	2M	L		817-891A	4	L
	817-852A		S		817-892A		S

## Laser Warning Labels

\* The content of this products is only available in Japanese.

Catalog Code **W5021**



Part Name	Laser Radiation Label (L)	Laser Radiation Label (M)	Laser Radiation Label (S)
Part Number	<b>817-25</b>	<b>817-26</b>	<b>838-20</b>
External Dimensions [mm]	150 (length of each side)	100 (length of each side)	50×50
Quantity [pieces]	50	50	60

## Laser Controlled Area Signs

\* The content of this products is only available in Japanese.

Catalog Code **W5022**



Part Name	Laser Controlled Area Sign (1)	Laser Controlled Area Sign (2)	Laser Controlled Area Sign (3)
Part Number	<b>817-01</b>	<b>817-02</b>	<b>817-03</b>
External Dimensions [mm]	(W)450×(H)300×(D)1.2	(W)450×(H)300×(D)1.2	(W)450×(H)300×(D)1.2
Mounting hole	φ2.5mm holes on four corners	φ2.5mm holes on four corners	φ2.5mm holes on four corners
Quantity [pieces]	5	5	5

Reduces running costs because of its long life time and low power consumption and realizes brightness equivalent to a metal halide light source.

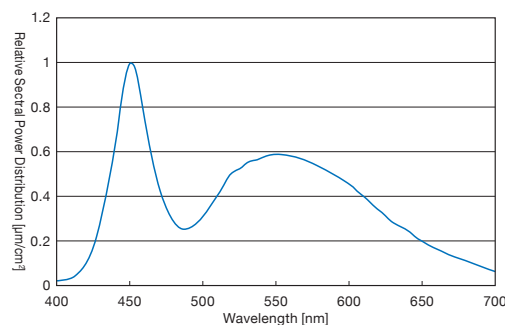


- Over 30,000 hours operation life \*1
- 160VA low power consumption
- White-light emission with brightness over 3000 lumens \*2
- Output aperture for  $\phi 10\text{mm}$  /  $\phi 14\text{mm}$  light-guide
- 8bit external dimming control equipped as standard
- Error messages displayed at front panel and error code acquirable through RS232C interface.

### Specifications

Part Number	LLS-W
LED	White light (correlated color temperature = 6,500K) *as reference
Brightness	3,500lm <sup>*2</sup>
LED lifetime	30,000H <sup>*1</sup>
Rated input power	AC100V – 240V $\pm 10\%$ (50/60Hz)
Power consumption	160VA
Dimming control	Manual control with front panel control knob External control by 8bit I/O or RS232C interface
Cooling	Forced-air-cooling
Error indication (output)	LED element temperature error, Cooling fan error, etc.
Interface	RS232C, I/O
Operating environment	Ambient temperature: 5 – 40°C Ambient humidity: 20% – 80%RH (without dew condensation)
Dimensions	(W)190 × (H)200 × (D)322mm (excluding extrusions)
Weight	7.5kg (excluding cables)

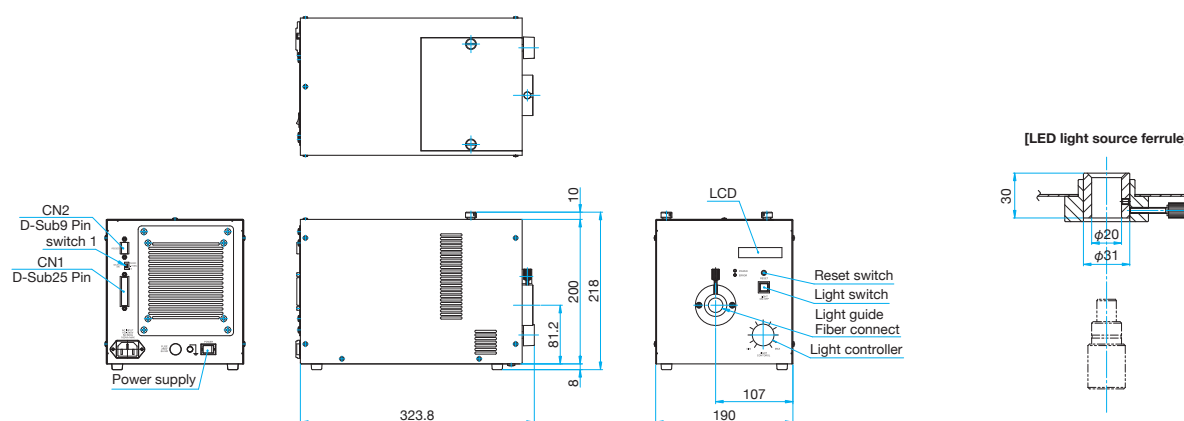
### Spectral Distribution



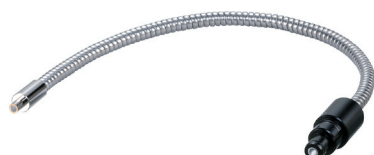
- \*1 Operation life is prescribed by 70% intensity dropping point. Operation life may vary from the condition of use and not a guaranteed specification.  
\*2 Brightness is measured at the spreading illumination of 0.5m×0.5m area (0.25m<sup>2</sup>), which generated by a rod homogenizer with 12mm on a side.

### Outline Drawing

(Units: mm)



### Applicable Light Guide



### Guide

- Various light guides are available. [Reference](#) ► H035, H036

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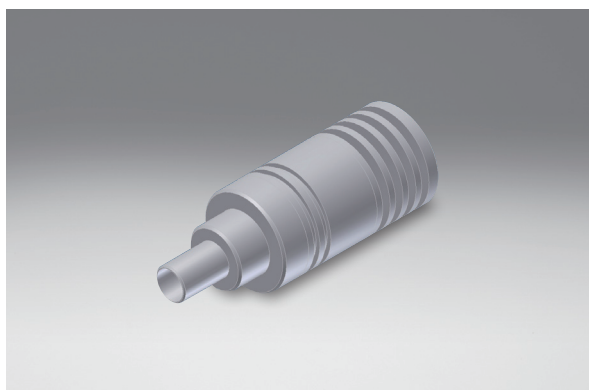
Laser Safety Equipments

Light Sources

## SLSI

Catalog Code **W5036**

LED illumination for coaxial epi-illumination and spot illumination.



- It can be used as coaxial epi-illumination for our zoom microscope, ultra long working distance zoom microscope, observation unit with coaxial illumination, and various telecentric lenses.
- It can be used as spot illumination.
- It can be used in ring or line illumination when connected to various light guides using light guide adapters.

### Guide

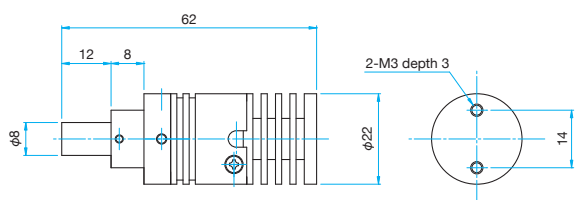
- ▶ Cable extension is available as an option.
- ▶ Various light guides and light guide adapters are available as options.

### Attention

- ▶ Use with the dedicated power supply (SPS-SLSI).

### Outline Drawing

(Units: mm)



### Specifications

Part Number	Luminescence Color	Maximum Rated Current
SLSI-22W	White ○	0.7A
SLSI-22R	Red ●	0.7A
SLSI-22G	Green ●	0.7A
SLSI-22B	Blue ●	0.7A

## SPS-SLSI

Catalog Code **W5037**

Power supply for LED spot illumination.  
It comes in a palm-size slim body capable of being mounted on a DIN rail.  
In addition, it allows dimming by volume or USB control.



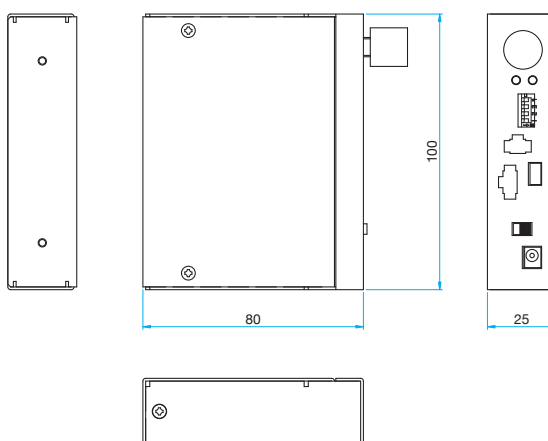
- The volume control on the front panel enables easy dimming. The switch connectors are all located on the front panel to facilitate work efficiency. (Comes with a DIN rail connection adapter)
- LED ON/OFF and dimming are possible from a PC with USB connection.
- Flash operation is available with external trigger input.

### Guide

- ▶ The DIN rail connection adapter needs to be installed by the customer.

### Outline Drawing

(Units: mm)



### Specifications

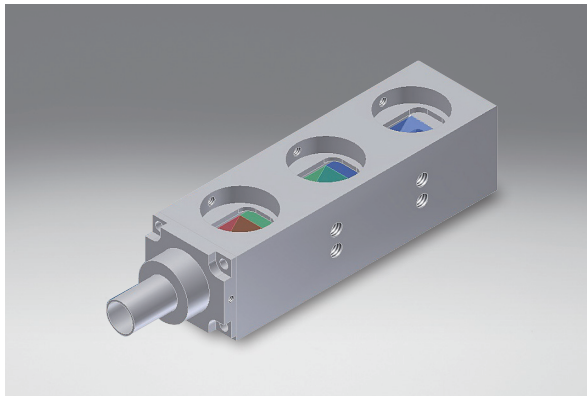
Part Number	SPS-SLSI
Controllable Number of LEDs	1ch
Power Voltage	AC100 – 240V±10%
Apparent Power	30VA
Operating Temperature	5 – 40°C
Storage Temperature	-20 – 60°C
Functions	Dimming by volume control, USB control, flash operation, external gate operation
External Output	Output for LED
Interface	USB (Mini-B type) USB1.1 compliant Trigger (Gate) Input Connector

# RGB Color Mixing Unit | SLSI-RGBM

Catalog Code W5038

A unit used in combination with LED spot illumination to irradiate any color by mixing red, green and blue lights.

- Its tip has the shape same as that of the LED spot illumination, allowing direct mounting on various lenses.
- When connected with various light guides using light guide adapters. It enables irradiation of any color in ring and line illumination.

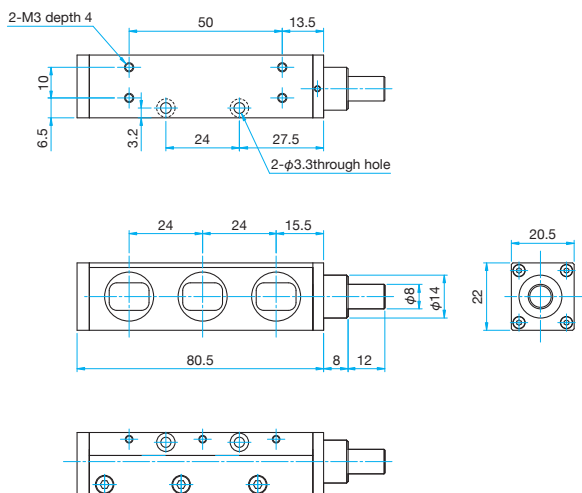


## Guide

- ▶ Use with LED spot illumination (SLSI).
- ▶ When mounting the LED spot illumination on this unit, remove the tip portion and check the color position before mounting it.
- ▶ Various light guides and light guide adapters are available as options.

## Outline Drawing

(Units: mm)



## Specifications

Part Number	SLSI-RGBM
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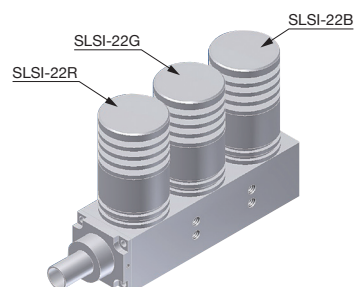
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## Example of Combination with LED Spot Illumination (SLSI series)



# Ring Illumination

## Low Angle Ring Illumination

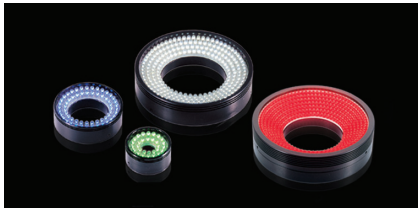
SLRI  
SLRI-LA

RoHS

CE

### SLRI

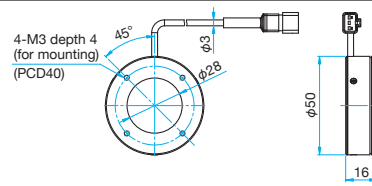
Catalog Code W5039



These Light Units are equipped with high-density LED arrays in a ring shape. Direct light can be irradiated with focus on the center of the workpiece from any angle.

#### Outline Drawing

(Units: mm)



#### Guide

- ▶ SLRI-42 series (outer diameter  $\phi 42$ , inner diameter  $\phi 18$ ) and SLRI-70 series (outer diameter  $\phi 70$ , inner diameter  $\phi 35$ ) are also available.
- ▶ Diffusers and polarization plates are available as options. Available luminance colors are red, white, blue and green.
- ▶ Diffusers, polarization plates and adapters for SLRI-42, 50 and 70 series are available. Contact our International Sales Division for more information.

#### Attention

- ▶ Polarization plates for SLRI-42 and 50 require mounting adapters.
- ▶ Use SPS-3024, SPS-3024-3-PI and SPSB-3024VB as power supply.

#### Ring Illumination

Part Number	Luminescence Color	Size	Power Consumption
SLRI-50RD2	Red ●	Outer $\phi 50$ Inner $\phi 28$	24V/3.1W
SLRI-50SW2	White ○		
SLRI-50BL2	Blue ●		
SLRI-50GR2	Green ●		

#### Common Specifications

Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Housing Material	Aluminum alloy
Cooling Method	Natural air cooling
Operating Temperature and Humidity	Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)
Storage Temperature and Humidity	Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)
Accessories	Instruction Guide

#### Diffuser, Polarization Plate, Mounting Adapter

Part Number	Compatible Products
DF-SLRI-50	Diffuser for SLRI-50
PL-SLRI-50	Polarization plate for SLRI-50
AD-SLRI-50	Adapter for SLRI-50

### SLRI-LA

Catalog Code W5040

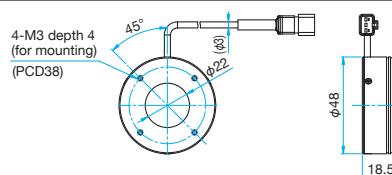
These Light Units are equipped with LED arrays in a ring shape, radiating direct light from a low angle towards the center of the workpiece to achieve shadow-free uniform illumination.



- Radiate from a low angle towards the center of the workpiece.
- Diffusers and polarization plates are available as options.

#### Outline Drawing

(Units: mm)



#### Guide

- ▶ SLRI-74 series (outer diameter  $\phi 74$ , inner diameter  $\phi 48$ ) are available. Diffusers and polarization plates are available as options. Available luminance colors are red, white, blue and green.
- ▶ Diffusers for SLRI-48 or 74 series and sheet polarizers for lens mounting are available. Contact our International Sales Division for more information.

#### Attention

- ▶ Use SPS-3024, SPS-3024-3-PI and SPSB-3024VB as power supply.

#### Low Angle Ring Illumination

Part Number	Luminescence Color	Size	Power Consumption
SLRI-48RD2-LA	Red ●	Outer $\phi 48$ Inner $\phi 22$	24V/2.1W
SLRI-48SW2-LA	White ○		
SLRI-48BL2-LA	Blue ●		
SLRI-48GR2-LA	Green ●		

#### Common Specifications

Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Housing Material	Aluminum alloy
Cooling Method	Natural air cooling
Operating Temperature and Humidity	Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)
Storage Temperature and Humidity	Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)
Accessories	Instruction Guide

#### Diffuser

Part Number	Compatible Products
DF-SLRI-48LA	Diffuser for SLRI-48LA

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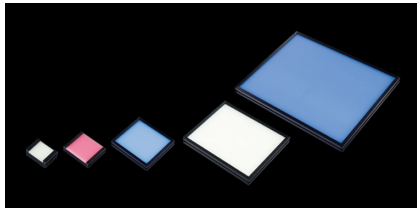
# Flat Illumination Coaxial Illumination

SLFI  
SLCI

RoHS CE

## SLFI

Catalog Code W5041



These Light Units radiate high-power diffused light from a flat light-emitting surface.

- Matted diffuser surface prevents reflected glare.
- The frame structure and tapped holes for mounting allow highly flexible mounting.
- Light control films and fixing brackets are available as options.

### Guide

- ▶ SLFI-27 series (light emitting surface 27×27) and SLFI-51 series (light emitting surface 51×51) are available. Available luminance colors are red, white and blue.
- ▶ Light control films and fixing brackets for SLFI-27, 43 and 51 are available. Contact our International Sales Division for more information.

### Common Specifications

Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Housing Material	Diffusion plate: Acrylic resin, Base/Side panels: Aluminum alloy
Cooling Method	Natural air cooling
Operating Temperature and Humidity	Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)
Storage Temperature and Humidity	Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)
Accessories	Instruction Guide

### Flat Illumination

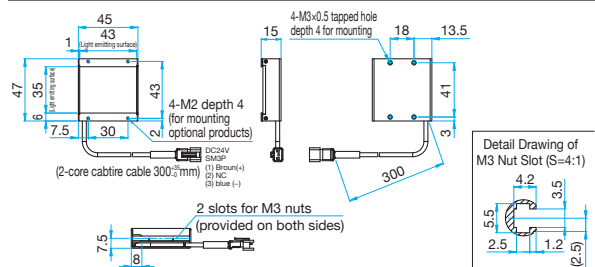
Part Number	Luminescence Color	Light Emitting Surface Size [mm]	Power Consumption
SLFI-43X35RD	Red ●	43×35	24V/3.8W
SLFI-43X35SW	White ○	43×35	24V/3.0W
SLFI-43X35BL	Blue ●	43×35	24V/3.0W

### Attention

- ▶ Use SPS-3024, SPS-3024-3-PI and SPSB-3024VB as power supply. (Reference) Digital power source H031

### Outline Drawing

(Units: mm)



### Light Control Films

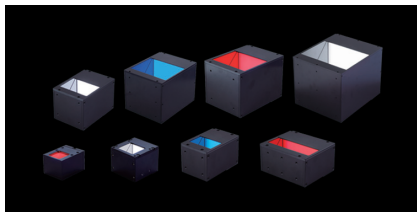
Part Number	Compatible Products
LC-SLFI-43X35-HO	For SLFI-43×35, Horizontal louver
LC-SLFI-43X35-VE	For SLFI-43×35, Vertical louver

### Fixing Brackets

Part Number	Note
BK-SLFI-LE12	4 L-shaped fixing brackets

## SLCI

Catalog Code W5042



These Light Units radiate diffused light in the same axis as the camera axis, allowing uniform irradiation on a mirror-finished workpiece.

- Optical glass with surface accuracy of 0.3μm is used for a half mirror and camera window, enabling photography of high-quality images.
- A large camera window ensures a large field of view.
- Polarization plates and light control films are available as options.

### Guide

- ▶ SLCI-CP-13 series (light emitting surface 15×15), SLCI-CP-18 series (light emitting surface 20×20) and SLCI-50 series (light emitting surface 52×52) are available.
- ▶ SLCI-50 series (light emitting surface 52×52) is available. Luminance colors of red, white and blue are available in each series.
- ▶ Light control films and polarization plates for SLCI-13, 18 and 50 series products are available. Contact our International Sales Division for more information.

### Attention

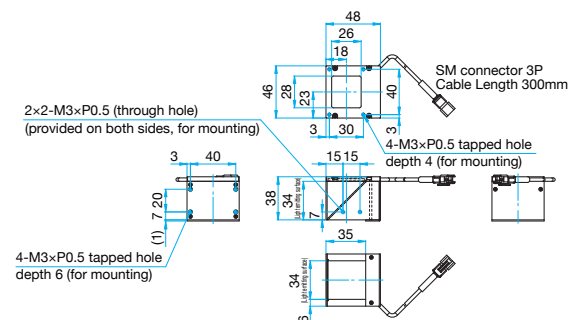
- ▶ Use SPS-3024, SPS-3024-3-PI and SPSB-3024VB as power supply. (Reference) Digital power source H031

### Common Specifications

Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Cooling Method	Natural air cooling
Operating Temperature and Humidity	Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)
Storage Temperature and Humidity	Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)
Accessories	Instruction Guide

### Outline Drawing

(Units: mm)

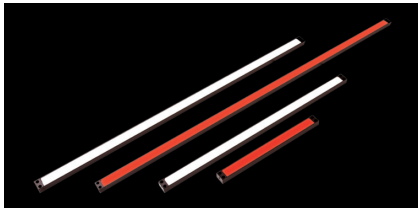


### Coaxial Illumination

Part Number	Luminescence Color	Light Emitting Surface Size [mm]	Power Consumption
SLCI-34RD	Red ●	34×34	24V/3.7W
SLCI-34SW	White ○	34×34	24V/3.2W
SLCI-34BL	Blue ●	34×34	24V/3.2W

SLLI (Bright Field)

Catalog Code W5043



These Line Illumination Units emit light of the same brightness as fluorescent light.

- Lifetime (50,000 hours) is longer than fluorescent light.

Specifications

LED Luminescence Color	White light
Peak Wavelength	5500K typ.
Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Housing Material	Aluminum alloy, Polyacetal
Cooling Method	Natural air cooling
Operating Temperature and Humidity	Temperature: 0 to 40°C, Humidity: 20 to 85%RH (No condensation)
Storage Temperature and Humidity	Temperature: -20 to 60°C, Humidity: 20 to 85%RH (No condensation)
External Dimensions	(W)332mm × (D)27.2mm × (H)18mm
Accessories	Instruction Guide

Part Number	Luminescence Color	Note	Power Consumption
SLLI-100SW	White ○	Light emitting surface 100mm SM connector	24V/23W

Guide

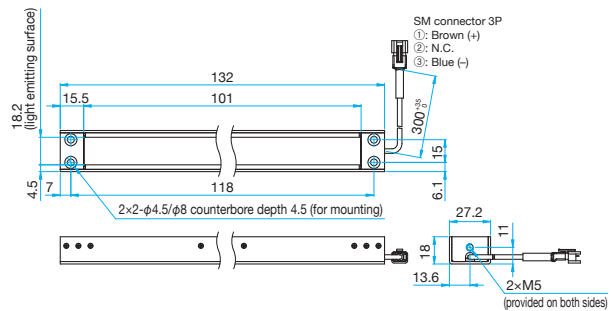
- ▶ SLLI-200SW (light emitting surface 200) and SLLI-300SW (light emitting surface 300) are available.
- ▶ Various cable lengths are available up to 15m. Contact our International Sales Division for more information.

Attention

- ▶ Use an SM connector type cable extension.
- ▶ To connect these Line Illumination Units with compatible power supply SPSB3-30024, a dedicated cable is required.

Outline Drawing

(Units: mm)



SLLIH (Dark Field)

Catalog Code W5044

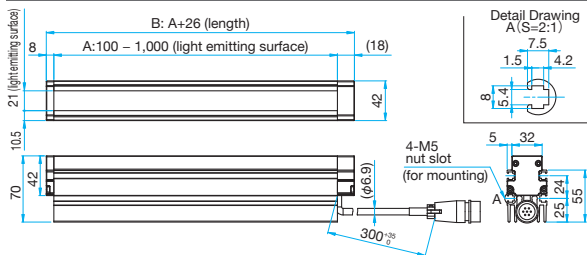


These Line Illumination Units emit high power light while reducing defused light.

- Provide high-power illuminance of 4000lx.
- Capable of narrowing the angle between the illumination and camera, allowing short distance irradiation.

Outline Drawing

(Units: mm)



Specifications

Input Voltage	DC24V
Cable Length	0.3m
Input Connector	SMR-03V-B × 1Piece
Polarity & Signal	1: Anode (+) Brown / 2: No Connection / 3: Cathode (-) Blue
Housing Material	Aluminum alloy
Cooling Method	Natural air cooling
Accessories	Instruction Guide

Part Number	Luminescence Color	Note	Power Consumption
SLLIH-100SW	White ○	Light emitting surface 100mm, Metal connector	24V/21W

Common to Line Sensor Illumination for Bright Field and Dark Field

Catalog Code W5045

Analog Power Supply, Cable Extension, Dedicated Cable

Part Number	Product Description
SPSB3-30024	Analog Power Supply Units
FCB-1-EL2	Cable extension (Straight Cables 1m)
FCB-W-1-EL2	Cable extension (Two-way Cables 1m)
FCB-0.3-EL2-SM3-OC	Dedicated cable for SLLI (bright field)
FCB-0.3-ME7-EL2-OC	Dedicated cable for SLLIH (dark field)

Common to Ring Illumination, Flat Illumination and Coaxial Illumination

Catalog Code W5047

Digital Power Supply Units, Cables

Part Number	Note
SPS-3024	Digital Power Supply Units (1CH, manual and parallel 8-bit external control)
SPS-3024-3-PI	Digital Power Supply Units (3CH, manual and parallel 8-bit external control)
FCB-1	Extension Cable (Straight Cables 1m)
FCB-W-1	Cable extension (Two-way Cables 1m)
FRCB-1	Cable extension (Straight 1m flexible cable)
NFCB-3	External ON/OFF cable
EXCB2-B3	D-sub 15pin, external control cable for SPS-3024
EXCB2-M10-3	External ON/OFF cable for SPS-3024-3-PI
EXCB2-M20-3	External dimmer cable for SPS-3024-3-PI
BK-PD3	Power supply fixing bracket for SPS-3024-3-PI

## LED Light Source Device | SLA-100A

RoHS

Catalog Code W5023

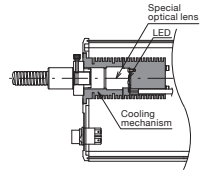
## LED light source with illumination intensity approximating 100W halogen using high-intensity white LED.

- Its passive cooling design (fanless) is quiet and friendly to environments sensitive to dust or vibration.
- Enhanced reliability and lifetime due to elimination of mechanical fan.
- External analog intensity control included as a standard feature.
- Lifetime approximately 15 to 30 times longer than halogen light source. Can significantly reduce down-time for maintenance.

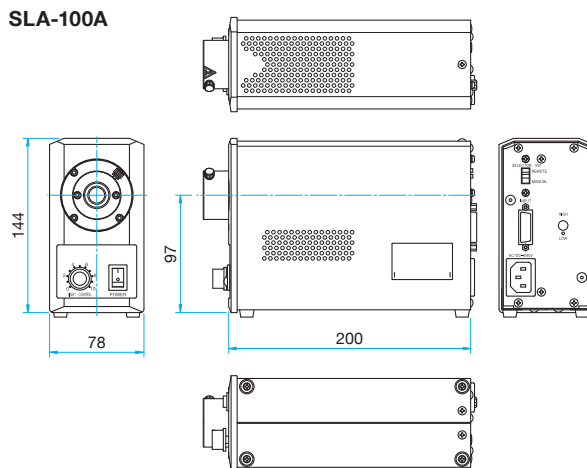


## Guide

- ▶ Optional adapters are available so that light guides of other companies can be used. (Note that some light guides are incompatible.)
- ▶ Light guides sold separately.  
Reference ▶ H035
- ▶ Unique optical and cooling design provides passive cooling design (fanless).
- ▶ Low power consumption of 20W.
- ▶ Power consumption reduced by 67 – 89% compared to halogen light source.
- ▶ Low heat generation minimized risk of burn injury or influence on environment.
- ▶ Optional color filters can be mounted in the light guide inlet to produce a range of colors. Contact our International Sales Division for more information.



## Outline Drawing (Units: mm)



## Specifications

Part Number	SLA-100A		
Luminescence Color	White light		
Color Temperature (typ.)	5600K <sup>*1</sup>		
Rated Input Voltage	AC100V – 240V±10%		
Power Consumption	20W		
Input Frequency	50/60Hz		
Function and Dimming	(1) LED light ON/OFF function (2) Continuous dimming by manual full dimming volume (3) Remote: Analog input voltage DC0V – +5V * 8bit digital dimming is optional (contact us separately)		
Cooling Method	Natural cooling		
Environment Conditions	Ambient temperature: 0°C – +40°C Ambient humidity: 20% – 80%RH (without condensation) Indoor use altitude: Up to 2,000m		
Average Luminance <sup>*2</sup>	φ5mm	φ8mm	
	(W.D.=100mm)	17,900lx	40,000lx
	(W.D.=50mm)	68,000lx	130,000lx
	(W.D.=15mm)	510,000lx	700,000lx
LED Life	30,000H <sup>*3</sup>		
External Dimensions [mm]	(W)78×(H)144×(D)200 (excluding protrusions)		
Weight [kg]	2.0 (excluding the power cord)		

\*1 Color temperature: Reference value

\*2 Illuminance: Reference values measured at each working distance (W.D.) from the edge of light guide (straight type, length=500mm)

\*3 Life: Varies depending on the usage environment temperature. Not a guaranteed value.

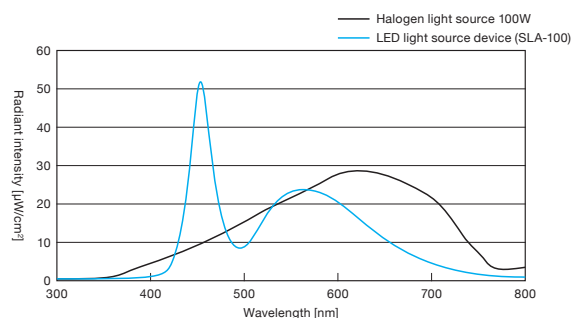
## Option ■ Light Guide Adapter Compatibility SLA-ADP

Part Number	Compatible Light Guide	Specifications
SLA-ADP-SU*		φ13mm L=15mm
SLA-ADP-MO		φ15mm L=37mm
SLA-ADP-HO		φ15mm L=31mm
SLA-ADP-HA		φ15mm L=20mm

\* SLA-100A comes with SLA-ADP-SU as standard.

Note) Some light guides are incompatible with compatibility adapters.

## Spectral intensity comparison



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# Tungsten Halogen Fiber Illumination Systems

## Replacement Lamps for Tungsten Halogen Fiber Illumination Systems

LS-LHA  
HL

### LS-LHA

RoHS CE Catalog Code W5024

Proportional Intensity control Light source with Universal Power Supply designed for worldwide use.

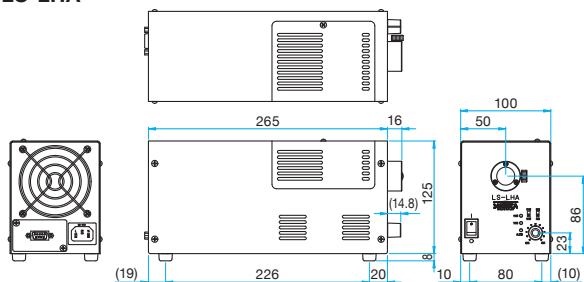
- 12V100W and 15V150W halogen lamps can be selected with a switch. This product is sold with 150W lamp as standard.
- Linear control of light intensity provides finer, more useful control.
- Analog external remote control is available as standard.



#### Outline Drawing

(Units: mm)

#### LS-LHA



#### Guide

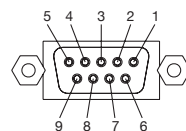
- ▶ Contact our International Sales Division for addition of the shutter function.
- ▶ Light guide (LS-LHA) is also available. [Reference](#) H035

#### Specifications

Part Number	LS-LHA	
Lamp Used	100W: JCR12V100WB	150W: JCR15V150WBN
Average lamp life *1	Nominal 1,000 hours (DC12V)	Nominal 500 hours (DC15V)
Color Temperature *2	about 3,100K	
Average Luminance *2	230,000lx (Reference value)	406,000lx (Reference value)
Input Voltage	Rated AC100 – 240V (AC85 – 264V) 50/60Hz (47Hz – 63Hz)	
Power Consumption	123W/100V 115W/240V	182W/100V 175W/240V
Installation Method	Horizontal installation	
Usage Environment	0°C – 40°C / 20 – 85%RH (without condensation)	
External Dimensions [mm]	(W)100×(H)133×(D)265 (excluding protrusions)	
Weight [kg]	2.7	

- \*1 Time when the ratio of the maximum intensity to the maximum intensity of the new bulb decreases to 50%
- \*2 Illumination at 15mm away from the tip of light guide when a light guide of bundle diameter  $\phi 5 \times L1,000$  is used with maximum light intensity

#### Pin assignment of remote terminals

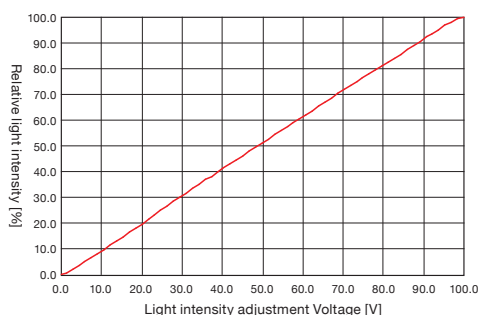


Pin number	Signal name
1	: Light intensity adjustment
2	: 5V standard voltage
3	: Shutter open/close
4	: Lamp out detection
5	: Temperature error detection
6	: Analog signal GND
7	: Lamp ON/OFF
8	: Power for photocoupler
9	: GND for Photocoupler

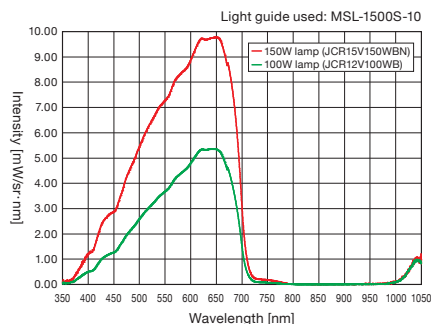
#### External cable connector

Recommended product  
(Japan Aviation Electronics Industry, Ltd.)  
Connector Part Number: DEU-9PF-F0  
\*Select pin contact to match the power cable used.

#### Light intensity adjustment power - Illuminance characteristics



#### Spectral characteristics



### HL

Catalog Code W5025



- Replacement lamps for tungsten halogen fiber illumination systems (LS-LHA).
- HL-100-2 and HL-150-2 are compatible with the conventional illumination system PHL-100 and LS-LHA, respectively.

#### Guide

- ▶ Contact our International Sales Division for information on replacement lamps (HL-50) for the conventional model PHL-50.

Part Number	Product Description
HL-100-2 (JCR12V100WB)	For 100W (conventional model PHL-100)
HL-150-2 (JCR15V150WBN)	For 150W (conventional model PHL-150)

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# Metal Halide Fiber Illumination Systems Lamps for Metal Halide Fiber Illumination Systems

**IMH-250**  
**MHL**
**IMH-250**
**Catalog Code** W5026

**High intensity and high precision illumination systems with metal halide lamp and twin mirror system.**

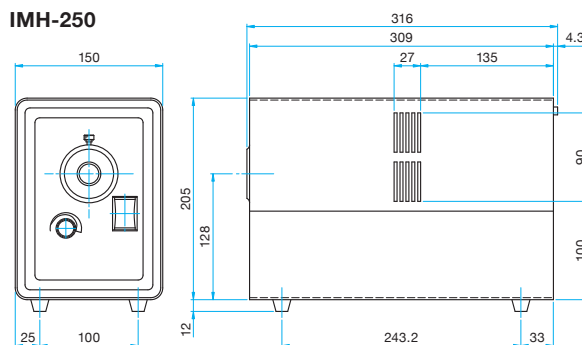
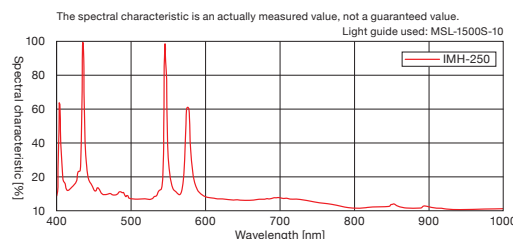
- Bright, efficient illumination using short arc metal halide lamps. Spectral output more closely matched to human spectral response than other types of high intensity lamps.
- Newly designed optical system has combined an elliptical mirror and a spherical mirror to focus light into a light guide very efficiently.
- Uses a combination of cold mirror and heat absorbing filter to efficiently manage heat output.
- Lamp replacement is a simple one-touch operation without need for adjustment, as the lamp and the elliptical cold mirror are integrated.
- A new mechanical aperture allows control of output intensity without changing spectral characteristics.
- High stability, low ripple output. The DC metal halide lamp employed has significantly lower ripple than AC metal halide lamps, which makes this product suitable for high-speed image processing.


**Guide**

▶ Light guides sold separately. [Reference](#) ▶ H035

**Outline Drawing**

(Units: mm)


**Reference spectral data**

**Common Specifications**

Lamp Type	Mirror integrated metal halide lamp DC250W
Lamp Life	Average 2,000 hours (to decrease in light intensity by 30% from initial value)
Power Supply	AC90 – 132V 50/60Hz
Input Voltage	AC100V±10% 50/60Hz
Power Consumption	about 330W
Illumination Intensity	80,000lx or more (initial value) at a position 100mm from the edge of the light guide of L=500mm and $\phi$ 5
Fluctuations in Illumination Intensity	about 1.5%
Color Temperature	7,500°K
Cooling Method	Forced-air cooling method
Usage Environment	Temperature: 5°C – 35°C, Humidity: 70% or less
External Dimensions [mm]	(W)150×(H)205×(D)309 (excluding rubber feet and protrusions)
Weight [kg]	about 6.0

Part Number	Product Description	Light Intensity Adjustment Method	Shutter Open/Close	Power Supply ON/OFF	External control Connector	Interface
<b>IMH-250</b>	Low-light intensity ripple (high stability) type	Manual	None	Manual	None	None
<b>IMH-250A</b>	Low-light intensity ripple (high stability) type with continuous automatic aperture function	Manual and remote selection with switch	None	Manual	D-sub25pin	TTL level
<b>IMH-250SL</b>	Low-light intensity ripple (high stability) type with shutter and lamp control function	Manual	External control	External control	BNC	TTL level

**MHL**
**Catalog Code** W5027

**Replacement lamps for metal halide fiber illumination system IMH-250.**


- Since this product comes as a unit of the lamp placed and fixed at the focus position of the elliptical mirror, it is easily fixed in the relative position of the elliptical mirror, spherical mirror and metal halide lamp just by removing the cover from a metal halide fiber illumination system and fix the unit with the spring included in this product.

**Specifications**

Part Number	<b>MHL-250</b>
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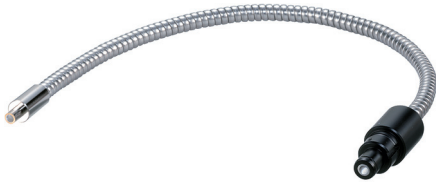
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Light guides used for LED light source device, tungsten halogen fiber illumination systems and metal halide fiber illumination systems. Light guides are made of bundled glass fibers and assembled in various output shapes. When combined with a light source light guides provide noiseless and heatless high intensity illumination.

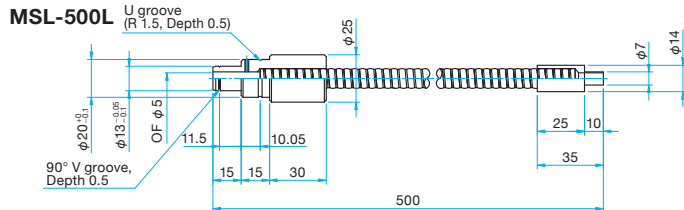
- Semi-rigid flexible outer tube (gooseneck) can be bent freely and fixed at that position.

**Straight light guides (Semi-rigid flexible) | MSL**

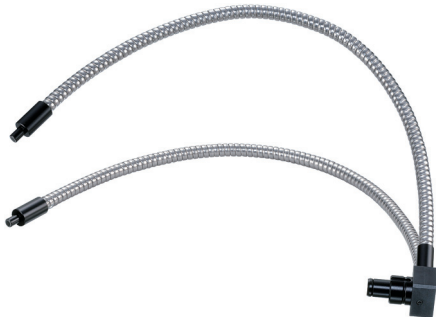


Outline Drawing

(Units: mm)

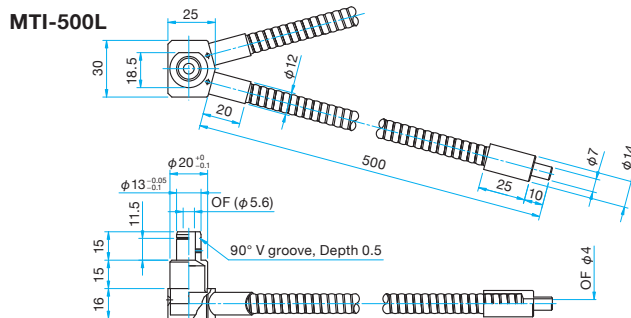


**Twin light guides (Semi-rigid flexible) | MTI**



Outline Drawing

(Units: mm)



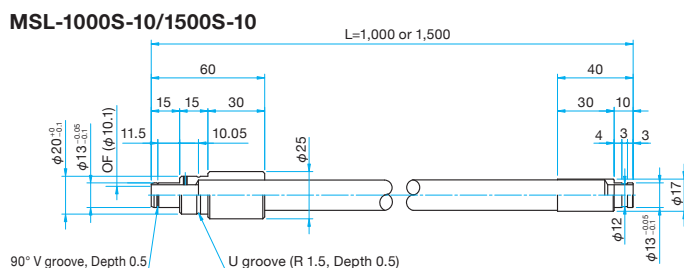
**Straight light guides (SUS flexible) | MSL-S**

- MSL-1000S-10 and MSL-1500S are intended for use with metal halide fiber illumination systems only. These light guides have a bundle diameter of φ10mm, which enables more efficient transmission with lower loss compared to other guides.



Outline Drawing

(Units: mm)



**Guide**

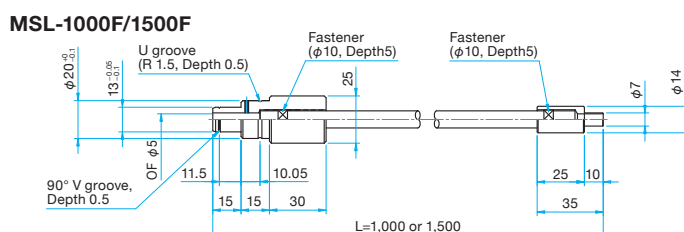
- ▶ Select the type with bundle diameter of φ10mm to increase the intensity of light transmitting from tungsten halogen fiber illumination systems.

**Straight light guides (Flexible) | MSL-F**



Outline Drawing

(Units: mm)



Ring light guides (SUS flexible) | MRL

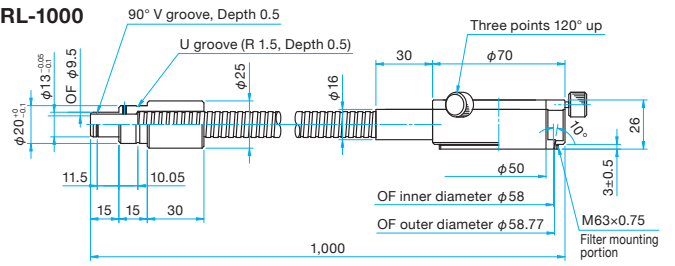
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(Units: mm)

MRL-1000



Surface emitting light guides (SUS flexible) | MM80

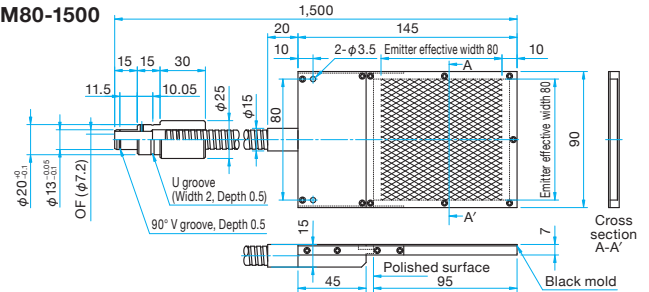
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(Units: mm)

MM80-1500

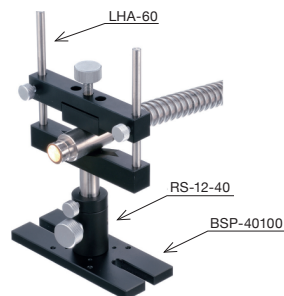


Specifications

Part Number	Type	External Coating	Fiber Diameter [μm]	Length [mm]	Bundle Diameter (φ) [mm]	Numerical Aperture [NA]
MSL-500L	Straight	Semi-rigid flexible	50	500	5	0.57 (70°)
MTI-500L	Twin	Semi-rigid flexible	50	500×2	5.6	0.57 (70°)
MSL-1000S-10	Straight flexible	SUS flexible	50	1,000	10	0.57 (70°)
MSL-1500S-10		SUS flexible	50	1,500	10	0.57 (70°)
MSL-1000F		Tube	50	1,000	5	0.57 (70°)
MSL-1500F		Tube	50	1,500	5	0.57 (70°)
MRL-1000	Ring	SUS flexible	30	980	9.5	0.57 (70°)
MM80-1500	Surface emitting	SUS flexible	50	1,500	7.2	Surface emitting light

Guide

► If holders are necessary, contact our International Sales Division. Improvised holders can be made using standard catalog products.



## MGF

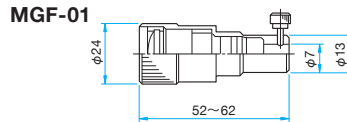
Catalog Code W5029

Condenser lens units provide a uniform beam spot when mounted at the tip of light guides.

- Focuses the output of the light guide and easily create focusing and diverging lights.
- Mounts on the end of  $\phi 7$ mm light guides.



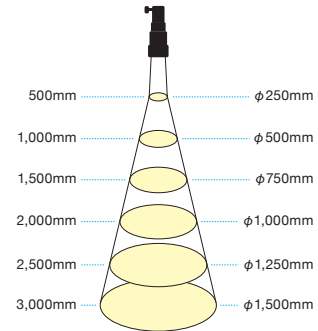
### Outline Drawing (Units: mm)



### Specifications

Part Number	<b>MGF-01</b>
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### Lighting characteristic



## RHO-13S-E2

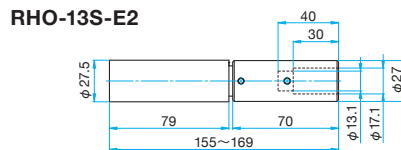
Catalog Code W5030

Glass rod homogenizers for MSL-1000S-10 and MSL-1500S-10 light guides.

- Mounts on the end of  $\phi 13$ mm light guides.



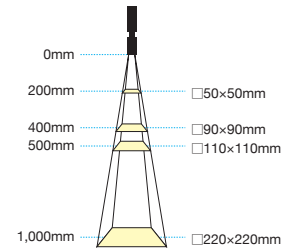
### Outline Drawing (Units: mm)



### Specifications

Part Number	<b>RHO-13S-E2</b>
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### Lighting characteristic



### Example of RHO-13S-E2 usage



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# Light Guide for LED Spot Illumination | S1/S2

Light guides for LED spot illumination and RGB mixed color units.



## Specifications

External Coating	SUS flexible
Fiber Diameter [ $\mu\text{m}$ ]	50
Bundle Diameter [mm]	6
Numerical Aperture [NA]	0.56
SUS flexible tube diameter ( $\phi$ ) [mm]	10 $\pm$ 0.2

## Guide

- ▶ Contact our International Sales Division for SUS flexible + PVC wrapped external coating and SUS interlock.
- ▶ To connect with LED spot illumination, use a light guide adapter.

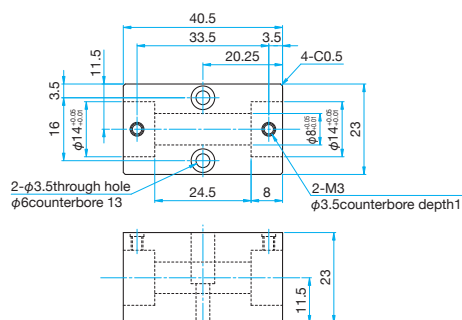
## Specifications

Part Number	Type	Exit End Shape [mm]	L=Length [mm]
S1S8-500F	Straight	$\phi 8$	500
S1S8-1000F			1,000
S1S8-1500F			1,500
S2S8-500I-V	Twin	$\phi 8$	500
S1L30-500F-R	Line	30 $\times$ 0.95	500
S1L30-1000F-R			1,000
S1L30-1500F-R			1,500
S1L50-500F-R			500
S1L50-1000F-R			1,000
S1L50-1500F-R			1,500
S1L100-1000F-R		100 $\times$ 0.29	1,000
S1L100-1500F-R			1,500
S1R18-500F-R	Ring	R18	500
S1R18-1000F-R			1,000
S1R18-1500F-R			1,500
S1R25-500F-R		R25	500
S1R25-1000F-R			1,000
S1R25-1500F-R			1,500
S1R32-500F-R		R32	500
S1R32-1000F-R			1,000
S1R32-1500F-R			1,500
S1P30-1000F-R	Surface emitting	$\phi 30$	1,000
S1P30-1500F-R			1,500
S1P60-1000F-R			1,000
S1P60-1500F-R			1,500

## Light Guide Adapter | AD-0808

### Outline Drawing

(Units: mm)



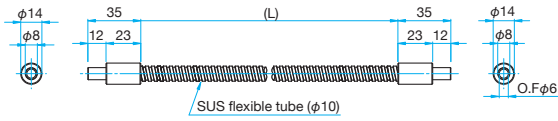
### Specifications

Part Number	External Dimensions [mm]	Material
AD-0808	(W)40.5 $\times$ (H)23 $\times$ (D)23	Aluminum alloy

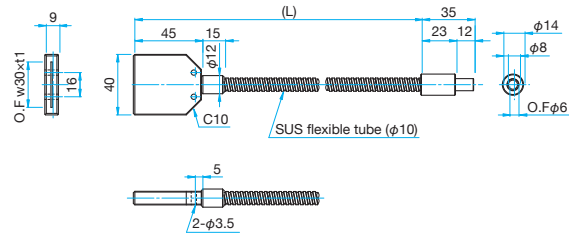
**Outline Drawing**

(Units: mm)

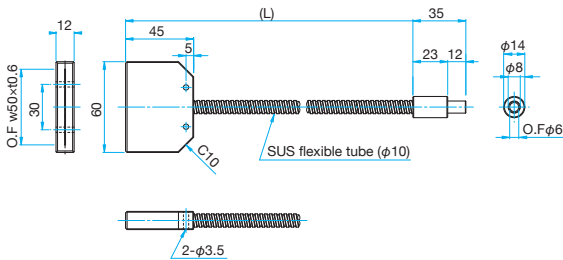
**S1S8-500F/S1S8-1000F/S1S8-1500F**



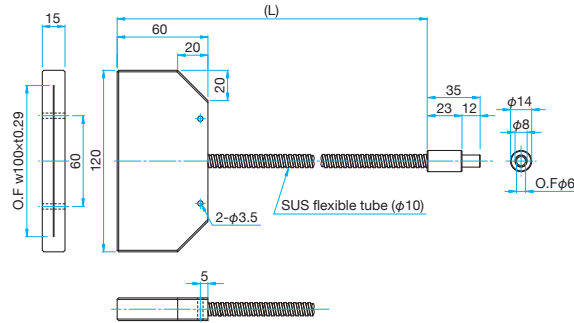
**S1L30-500F-R/S1L30-1000F-R/S1L30-1500F-R**



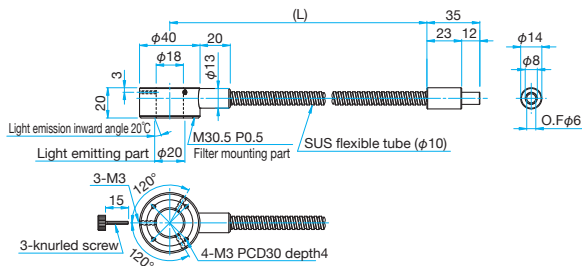
**S1L50-500F/S1L50-1000F/S1L50-1500F**



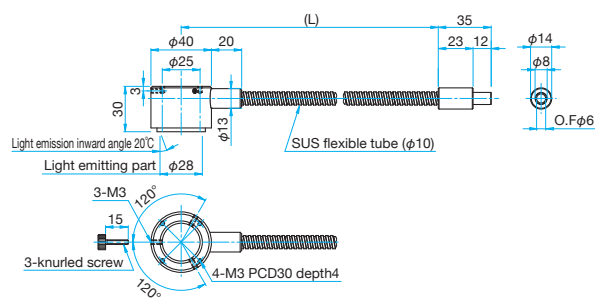
**S1L100-1000F-R/S1L100-1500F-R**



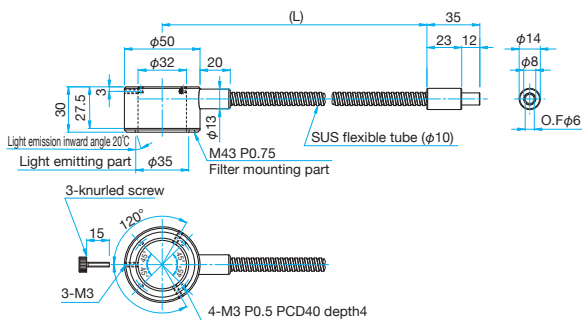
**S1R18-500F/S1R18-1000F/S1R18-1500F**



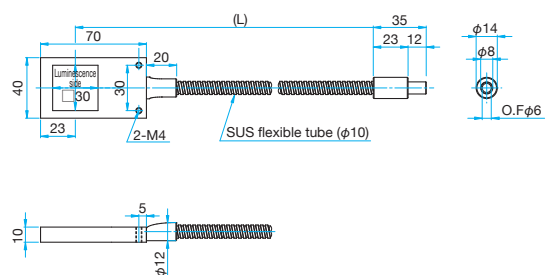
**S1R25-500F-R/S1R25-1000F-R/S1R25-1500F-R**



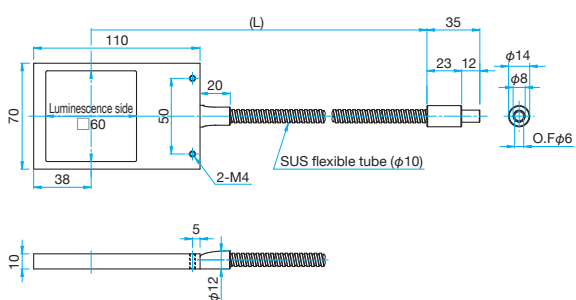
**S1R32-500F/S1R32-1000F/S1R32-1500F**



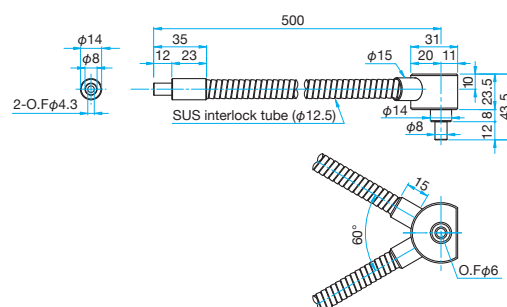
**S1P30-1000F-R/S1P30-1500F-R**



**S1P60-1000F/S1P60-1500F**



**S2S8-500I-V**



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