Schlieren & Shadowgraph LED Module

**Operating Instructions** 

LMS-XXX





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- 1. Read these instructions
- 2. Keep these instructions
- 3. Heed all warnings.
- 4. Follow all instructions.
- 5. Do not use this device near water.
- 6. Clean only with a dry cloth.
- D o not block any ventilation openings. Install in accordance with the manufacturer's instructions.

#### A WARNING

Equipment and surface temperature may be high during use. Check for hot surface before handling.



- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
- 9. Use only the supplied power cord. Consult manufacturer for replacement if lost or damaged.
- 10. Protect the power cond from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- 11. Only use attachments/accessories specified by the manufacturer.
- 12. Refer all servicing to manufacturer. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- 13. This apparatus shall not be exposed to dripping or splashing, and no object filled with liquids, such as vases or beer glasses, shall be placed on the apparatus.
- Do not overload wall outlets and extension cords as this can result in a risk of fire or electric shock.
- 15. Wear appropriate safety glasses at all times. ISSI recommends UVEX SCT Orange lenses. Safety glasses utilizing these lenses block near 100% of the damaging retinal blue light. The LM3X series of LED Illuminators have a high optical output power. The light they produce is in the blue to UV wavelength which in substantial amounts can be very damaging to the eye. It is though that severe exposure may lead to age related macular degration (AMD), and possible bindness. Wear appropriate safety glasses at all times during use. ISSI recommends UVEX SCT Orange lenses. Safety glasses utilizing these lense block near 100% of the damaging retinal blue light.

A WARNING Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.



16. This apparatus has been designed with Class-I construction and must be connected to a mains socket outlet with a protective earthing connection (the third grounding prong).

#### A WARNING Electrical shock hazard. Do

not open. No user servicable parts inside. Refer to manufacturer.



- 17. This apparatus has been equipped with an all-pole, rocker-style AC mains power switch. This switch is located on the front panel and should remain readily accessible to the user.
- 18. NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference to valinot occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the iser is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Changes or modifications to this device not expressly approved by innovalive Scientific Solutions,

- Inc. could void the user's authority to operate the equipment under FCC rules.
- 19. This apparatus (ors not exceed the Class A/Class B (whichever is applicable) limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.
- ATTENTION Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant las limites applicables aux appareils numériques de class A/de class B (selon le cas) prescrites dans le réglement aux le brouillage radioélectrique édicté par les ministere des communications du Canada.
- 20. Exposure to extremely high noise levels may cause permanent hearing loss. Individuals vary considerably in susceptibility to noise-induced hearing loss, but nearly everyone will lose some hearing if exposed to sufficiently intense noise for a period of time. The U.S. Government's Occupational Safety and Heath Administration (OSHA) has specified the permissible noise level exposures shown in the following chart.

A conting to OSHA, any exposure in excess of these permissible limits could result in some hearing loss. To ensure against potentially dangerous exposure to high sound pressure levels, it is recommended that all persure exposed to equipment capable of producing high sound pressure levels use hearing protectors while the equipment is in operation. Ear plugs or protectors in the ear canals or over the ears must be worn when operating the equipment in order to prevent permanent hearing loss iff exposure is in excess of the limits.



### **Background**

Schlieren photography is a technique utilized to image fluid density gradients. The density gradient of the fluid gives rise to refractive index changes which distort the collimated beam of light between two mirrors and thus the point of focus. Using a knife edge, variable density slide or color slides at the focus to exploit this effect allows high-contrast imaging of otherwise nearly invisible density gradients. At the focus, the light intensity is cut in half by the knife edge. Refractive index changes in one direction are brighter and in the other direction are darker. This type of imaging is widely used in wind tunnel, heating, ventilation and air conditioning (HVAC) research.





### **Specifications**

The Series LMS-XXX module is a compact, high-output device for schlieren and shadowgraph photography. It is capable of operating in a constant-light-output mode (DC) or gated on and off by an external signal.

AC Power Input (Using Supplied Wall Adapter)	100-240 V, 50-60Hz
DC Input	24VDC, 6.6A
Output Power	~1.5 W (DC) (Optical)
Stability	~0.1 % per hour after warmup
Wavelength (Standard)	*400-nm, 460-nm
Operating Temperature	-10-60 °C
Rise Time	< 900-ns
Fall Time	< 900-ns
Duty Cycle	100% (DC)
FWHM	+/- 18-nm
ECCN	EAR99

\*Note: Custom wavelengths are available. XXX denotes wavelength in nanometers.

#### **Description**

The LMS-XXX consists of a lamp body and associated power supply (24 VDC). With the toggle switch in the neutral position, connect the power supply using the screw-an-lock connection until it is secure. When the power supply is connected to the lamp body and energized, the fans in the lamp body should begin to operate. There should be no output from the LED at this time.





There is a single toggle switch and a BNC connector on the control input side of the lamp body. The small toggle switch adjacent to the BNC input connector is used to switch from DC continuous to pulsed output. The switch operates perpendicular to the body length.

In the neutral position, there will be no output from the LED. In the PULSE position, the output will mimic the TTL input to the BNC (same repetition rate and pulse width). In CONT, the LED will remain on continuously with or without any connection to the INPUT.

For the PULSE mode, a BNC cable must be



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connected to the INPUT BNC connection. This input should be a 5 VDC TTL level input. The lamp has a built-in safety circuit to automatically shut down the drive circuits if the LED temperature gets too high. There is no limit to the duty factor of this mode of operation.





### **Mounting**

An optional mounting clamp is available for purchase. This clamp includes a base with mounting slot for M6 or ¼"-20 bolts (standard optical table connections) with standard spacing. The clamp grips the LED module body for secure mounting. The LED can be easily articulated and placed precisely using this mounting clamp. The LED module also features a ¼"-20 mounting hole for directly mounting to a post. When using the clamp, do not block vent holes or the module could overheat causing the LED safety circuit to shut off the output. There are two cooling fans in the module. One is located inside the module behind the heat sink. This fan draws external air through the vent holes. The second is located in the rear of the unit in the driver section. Do not block this rear fan or overheating could result.



Caution: Do NOT block vent holes or cooling fan.



# Slit Adjustment

A variable width adjustable slit is used to adjust the output light down to a narrow slit.



Variable width slit adjusted to nearly closed and fully open.



Output power varies for different wavelength LEDs. It also varies depending on the driver mode (DC or high-power) the LED is being operated in.



# **Dimensions**







### **Export Disclaimer**

Any and all underlying information and technology contained in this document may be subject to U.S. export controls, including the Export Administration Act (50 U.S.C. Appx. §§ 2401 et seq.) and the Export Administration Regulations ("EAR", 50 C.F.R. Parts 730-774), and may be subject to export or import regulations in other countries. You are responsible for complying with all trade regulations and laws both foreign and domestic. Except as authorized by law or distributor agreement with ISSI, you agree and warrant not to export or re-export the information to any country, or to any person, entity, or end-user subject to U.S. export controls, including without limitation persons or entities listed on the U.S. Department of Commerce Bureau of Export Administration's Denied Parties List and the U.S. Department of Treasury's Specially Designated Nationals. You further represent and warrant that no U.S. federal agency has suspended, revoked, or denied your export privileges.