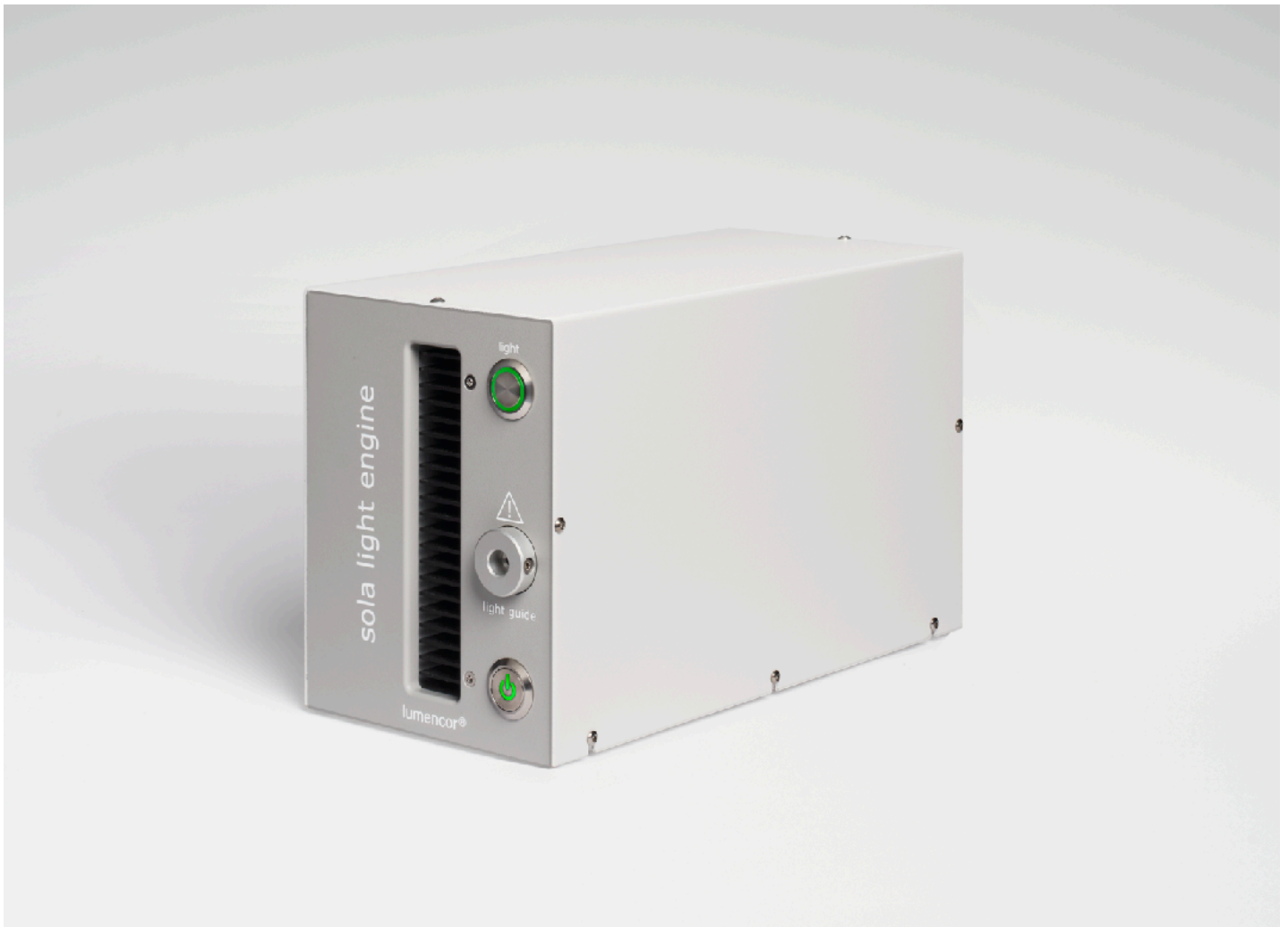


Lumencor Light Engine Manual

SOLA and SOLA FISH Light Engine



Regulatory Models

Lumencor utilizes regulatory model names for all certified and CE marked products. The regulatory model names are traceable to all regulatory documentation, third party reports and certifications.

“**Regulatory Model: Sola**” is used as a representative model for all certified and CE marked Sola Products.

“**Regulatory Models: Sola FISH**” is used as a representative model for all certified and CE marked Sola FISH Products.

Emissions

This equipment has been tested and found to comply with the limits of EMC directive 2014/30/EU and FCC part 15 (CISPR 11:+A1:2016). These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Safety Certifications

TÜV SÜD America, CB Certification (IEC 61010-1:2010)

TÜV SÜD America, NRTLus Certification (UL 61010-1:2012/R:2016-04)

TÜV SÜD America, cNRTL Certification (CAN/CSA-C22.2 No. 61010-1:2012/U2:2016-04)

TÜV SÜD America, EN Certification (EN 61010-1:2010)

CE Marking

Low Voltage Directive (2014/35/EU)

EMC Directive (2014/30/EU)

RoHS Directive (2011/65/EU+2015/863/EU)

REACH Regulation (EC) No. (1907/2006/EC)

EU Declarations of Conformity can be found at <https://lumencor.com/company/compliance>



For EU customers discarding end-of-life Lumencor electrical and electronic equipment: Please submit an RMA request with “Recycle product under WEEE” in the Description of Issues field.

For disposal in countries outside of the European Union: This symbol is only valid in the European Union (EU). If you wish to discard this product, please contact your local authorities or dealer and ask for the correct method of disposal.

Lumencor Light Engines as supplied, and as represented in this manual, meet safety and regulatory requirements For Research Use Only. If the light engine is incorporated into an instrument or system for a specific end-use application, it is the responsibility of the system integrator to verify that the light engine, and the system into which it is incorporated, meet all safety and regulatory requirements of that end-use application.

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1. Introduction

Lumencor’s SOLA and SOLA FISH light engines are designed for laboratory use by bioanalytical researchers and/or developers of life science instrumentation. SOLA and SOLA FISH light engines generate white light output by combining the outputs of 4, 5 or 6 solid state light sources. The resulting output spectral distributions are shown in Section 4 of this manual. The light engine output is directed into a liquid light guide connected to the light output port on the front panel. The distal end of the liquid light guide is typically connected to a collimating adapter attached to an optical instrument such as a fluorescence microscope. The on/off status and intensity of the white light output is electronically controlled via serial commands from a USB-connected computer workstation or a control pod accessory (part number 83-10007). On/off status can also be controlled manually via a button located on the front panel or a foot switch accessory (part number 29-10045) that plugs into the 3.5 mm connector on the rear panel. This manual covers SOLA, SOLA FISH, SOLA V-nIR, and SOLA U-nIR light engine models, which are defined in the table below.

SOLA Light Engine PRODUCT MATRIX	SOLA	SOLA FISH	SOLA V-nIR	SOLA U-nIR
Manual Control	✓	✓	✓	✓
Electronic Control	✓	✓	✓	✓
Number of Sources	4	5	6	6
365 nm Ultraviolet Source	✓	✓		✓
395 nm Violet Source			✓	
735 nm near-IR source			✓	✓

2. Precautions and Warnings {Précautions et mises en garde}

A few simple practices will ensure trouble-free operation for the life of the light engine.

Les quelques règles simples suivantes permettront d'assurer un fonctionnement fiable pendant toute la durée de service de la source lumineuse.

Safety Instructions:

Please read and follow all safety instructions provided BEFORE using your new SOLA or SOLA FISH light engine. Failure to comply with the safety instructions may result in fire, electrical shock, or personal injury and may damage or impair protection provided by equipment. Please save all safety instructions.

Instructions de sécurité:

Veiller à lire et à respecter toutes les instructions de sécurité fournies AVANT d'utiliser le nouveau SOLA ou SOLA FISH. Afin d'écartier les risques d'incendie, de décharge électrique, de blessure corporelle et de possibles dommages ou défaillance de la protection offerte par l'appareil. Conserver toutes les instructions de sécurité.

Safety Definitions {Définitions relatives à la sécurité}:



Warning: Statements identify conditions or practices that could result in personal injury.

Avertissement: déclarations qui identifient des situations ou des pratiques susceptibles d'entraîner des blessures corporelles.

Caution: Statements identify conditions or practices that could result in damage to your equipment.

Attention: déclarations qui identifient des situations ou des pratiques susceptibles d'endommager le matériel.

Safety Items {Mesures de sécurité}:

Warning: DO NOT use an unapproved power supply. The Lumencor-supplied external power supply is recommended for use with the SOLA and SOLA FISH light engine. Alternative 24 V DC power supplies may be used provided that the current is limited to 5.0 A max. Also, it is imperative that the alternative power supply has output over-current protection, as the power input of the SOLA and SOLA FISH is not fused. The equipment is required to be supplied by a properly approved/certified DC power source meeting the minimum electrical ratings of the product. Connect the AC power cord to a receptacle with a protective safety (earth) ground terminal.

Avertissement: NE PAS utiliser une alimentation électrique non homologuée. Il est conseillé d'utiliser l'alimentation électrique externe fournie par Lumencor avec la source lumineuse SOLA and SOLA FISH. Il est possible d'utiliser une autre alimentation électrique continue 24 V à condition que l'intensité soit limitée à 5,0 A maximum. En outre, il est impératif qu'elle présente une protection de sortie

contre les surintensités, car l'entrée d'alimentation du SOLA and SOLA FISH ne comporte pas de fusible. L'équipement doit être fourni par un / certifié DC réunion de source d'alimentation correctement approuvé les ratings électriques minimales du produit. Brancher le cordon électrique sur une prise de courant protégée par une borne de terre.

Warning: DO NOT look into the output of the light engine. The brightness of this light source is higher than most commercial lighting fixtures and must be coupled directly into a microscope or other bioanalytical instrument.

Avertissement: NE PAS regarde directement la sortie de la source lumineuse. L'intensité lumineuse de cette source est supérieure à celle de la majorité des appareils d'éclairage disponibles dans le commerce et doit être couplé directement à un microscope ou à un autre instrument bioanalytique.

Warning: DO NOT turn on the light unless the output end of the light guide is safely directed into an enclosed optical path. DO NOT point the light output directly onto any flammable or burn-susceptible material. This includes all animal or vegetable tissues, plastics, fabrics, paper and liquids.

Avertissement: NE PAS allumer la lumière sans l'extrémité de sortie du guide de lumière dirigée en toute sécurité dans un chemin optique fermé. NE PAS pointer la sortie de lumière directement sur un matériau susceptible d'être inflammable ou susceptible de brûler. Cela comprend tous les tissus, les plastiques, les tissus, le papier et les liquides animaux ou végétaux.

RISK GROUP 3



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

Warning: Infrared (IR) emitted from this product. Do not look at operating lamp. Avoid eye exposure. Use appropriate shielding or eye protection.

Warning: UV emitted from this product. Avoid eye and skin exposure to unshielded product.

GROUPE DE RISQUE 3

Avertissement: Rayonnement optique peut-être dangereux émis par ce produit. Ne regardez pas la lampe d'exploitation. Une blessure oculaire peut entraîner.

Avertissement: Infrarouge (IR) émise par ce produit. Ne regardez pas la lampe d'exploitation.

Avertissement: UV émis par ce produit. Évitez les yeux et la peau exposition au produit non blindé.

Caution: DO NOT open the unit. There are no serviceable parts inside and opening the light engine enclosure will void the manufacturer's warranty.

Attention: NE PAS ouvrir l'appareil. Il ne contient aucune pièce réparable et l'ouverture de son boîtier a pour effet d'annuler la garantie.

Caution: DO NOT set liquids on the light engine. Spilled liquids may damage your light engine.

Attention: NE PAS placer de liquide sur la source lumineuse. Les liquides renversés peuvent endommager la source lumineuse.

Caution: DO NOT drop the light engine. It contains glass optical components that could be damaged or misaligned by the shock produced by a drop onto a hard surface.

Attention: NE PAS laisser tomber la source lumineuse. Elle contient des composants optiques en verre susceptibles d'être endommagés ou désalignés par le choc résultant d'une chute sur une surface dure.

DISCLAIMER: Lumencor shall not be liable for injury to the user or damage to the product resulting from the SOLA or SOLA FISH light engine being used in a way for which it was not intended and in complete disregard for any posted safety precautions and warnings.

AVIS DE NON-RESPONSABILITÉ: Lumencor décline toute responsabilité pour les blessures corporelles ou les dommages au produit résultant d'une utilisation du SOLA ou SOLA FISH autre que celle prévue et du mépris total de les mesures de sécurité et mises en garde affichées.

3. Operating Instructions

3.1 Contents

SOLA and SOLA FISH light engines ship with the following list of standard items:

1. SOLA or SOLA FISH light engine configured with an output adapter for coupling to a 3 mm diameter liquid light guide.
2. A 24 V /5 A DC power supply (Lumencor part number 27-10001).
3. A region-specific 6 ft AC power cord for the power supply (see adjacent table).
4. A 6 ft USB A (M) to USB (B) M cable (29-10058) for serial connection to a light engine control pod or host computer.
5. 3 mm liquid Light guide (Lumencor part number 10-10084).

AC Power Cords

Region	Part Number
North America	29-10002
Europe	29-10005
United Kingdom	29-10004
Israel	29-10008
Australia/New Zealand	29-10024

The model name and unique 4- or 5- digit serial number of the light engine are marked on a label affixed to the back panel (Figure 1). SOLA U-nIR light engines are identified by a UV marking on the rear panel (Figure 1). Performance specifications for individual light engines are listed on the certificate of conformance included with the shipping documents e-mailed to the customer. It is important to retain the certificate of conformance for reference. In the event that the light engine is sold or transferred, the certificate of conformance should be conveyed to the new owner.

3.2 Installation

NOTE: Any end-product/system incorporating or coupled to a Lumencor Light Engine shall be fully evaluated to verify all applicable safety and regulatory compliance requirements prior to use.

When setting up the SOLA or SOLA FISH light engine for use, be sure to place the unit on a hard surface and avoid blocking or restricting airflow at the air intake (front panel) and exhaust port (rear panel, Figure 1). The light engine must be operated in a non-condensing environment (dew point <10°C with controlled ambient temperature <30° C). Restricting the airflow



Figure 1. Model and serial number identification label on the SOLA U-nIR light engine rear panel.

will cause the unit to operate at elevated temperatures and may result in decreased product life and/or premature failure.

Position the unit in an orientation that allows unrestricted access to the DC power connector at the back of the light engine. In an emergency, you may need to disconnect power to the unit quickly. The master power push button switch is located in the bottom right corner of the front panel; it turns electrical power to the unit on and off. This button has a green inlay which is illuminated when power to the light engine is ON. On the top right corner of the front panel, there is also a light source enable push button, labeled “Light.” The Light button is NOT a power switch; it only disables the light output while the system remains on.



Figure 2. 3 mm diameter liquid light guide inserted in front panel light output port.

Refer to Figure 1 for the rear panel locations of the input DC power connection, the foot pedal connection and the electronic shutter control input. Note that the foot pedal is an on/off toggle switch. Its on/off status cannot be determined from its position. Before connecting the foot pedal, make sure the master power switch is in the OFF position (i.e., unlit) to avoid unintentional initiation of light output. After connecting the foot pedal, and with the light guide output safely directed into an enclosed optical path (e.g. microscope input collimator or a beam dump), turn the master power switch ON to begin operation.

WARNING: Prior to turning the light output on, be sure the output end of the liquid light guide or optical fiber is safely directed into an enclosed optical path (e.g. a beam dump).

AVERTISSEMENT : avant d'activer la sortie de lumière, assurez-vous que l'extrémité de sortie du guide de lumière liquide ou de la fibre optique est dirigée en toute sécurité dans un chemin optique fermé (par exemple, une décharge de faisceau).

The SOLA and SOLA FISH light engines have a safety interlock for the light guide that prevents light output unless a liquid light guide is fully inserted into the light guide port. Before operating the unit, make sure the 3 mm diameter liquid light guide is properly installed in the light guide port (Figure 2). The set screw should be loosened using a 2 mm hex wrench so the light guide slides all the way into the receptacle without obstruction. Once the light guide is fully inserted, lightly tighten the set screw to hold it in place and prevent inadvertent disconnection. Prior to turning light output on, be sure the distal end of the light guide is safely directed into an enclosed optical path (e.g. microscope input collimator or a beam dump). Do not bend the light guide beyond its specified minimum bending radius (40 mm or 1.6 inches). Extreme bending of the light guide may cause permanent

deformation, resulting in decreased light transmission. In the event that the light guide is retracted from the output port during operation, light output will cease immediately. To restart light output: 1) turn the master power switch OFF, 2) fully insert and secure the light guide in the output port (Figure 2), 3) turn the master power switch back ON, and then 4) activate light output using the front panel light source enable button, foot pedal or serial control device (control pod or computer workstation). Take necessary precautions to protect yourself and others from the high intensity light when turning on the unit.

3.3 Operation Using Light Engine Control Pod

1. Connect the USB A port of the light engine control pod accessory (Figure 3) to the USB B port on the SOLA or SOLA FISH (Figure 1) using the USB A-to-USB B cable (29-10058) [1]. For pass-through control from a computer workstation, connect the USB B port of the control pod to a USB A port on the host computer.
2. The manual light output control button in the top right corner of the front panel (above the light output port) should be in the OFF position. This is necessary to avoid manual override of serial on/off commands from the pod.
3. Press and hold the **right** button on the pod until a menu of light engines appears. Turn the rotary dial to select “SOLA” from the menu. Press the **right** button again to return to the main (0–100 analog intensity) display screen.
- 4.
5. Before turning the light output on, be sure the output end of the light guide is safely directed into an enclosed optical path (e.g. microscope input collimator or a beam dump).
6. Press the **right** button to turn the light output on. Illumination of the circular inlay in the manual light output control button on the SOLA or SOLA FISH front panel (top right) indicates active light output. Adjust the output intensity using the rotary dial [3,4]. Press the **right** button again to turn the light output off [2].
7. Press and hold the left button to view a digital rendition of the intensity setting [5]. Press the **right** button to return to the main display screen.
8. Serial commands sent from a host computer to the USB B port of the control pod will automatically switch the pod from local to pass-through mode, indicated by the message “PC pass through mode active” shown on the pod display screen. Local command mode is disabled as long as pass-through mode remains active.

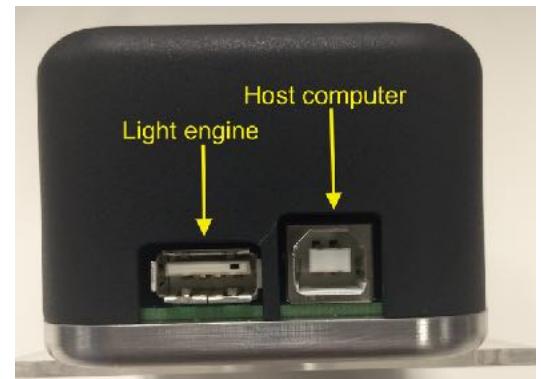


Figure 3. USB connectors on the rear of the light engine control pod.

9. To exit pass-through mode and return to local command mode, press the right button on the pod twice.
10. Further details of control pod operation are available at Lumencor's [Operating Instructions site](#)

Notes

- [1] This connection supplies electrical power to the pod from the SOLA or SOLA FISH. The pod will turn on when the connection is made.
- [2] There is no warm-up time; the light engine output stabilizes less than 1 second after the light output is switched on. Light output can be switched off during intervals when it is not required for active viewing or data collection. After light output is switched off, the cooling fan will continue to run for 5 minutes, after which it will automatically stop until light output is turned back on.
- [3] Output intensity can be set from 0–100% in 1% increments. The recommended range for normal operation is 5–100 %.
- [4] Dialing intensity to zero automatically issues an OFF command to the light engine. Press the right button to turn the light output on again.
- [5] The current intensity settings are internally stored. When the pod is powered down, the settings are retained and will be restored at the next restart.

3.4 Operation Using Computer Workstation

1. Although the following instructions specify Lumencor's SOLA GUI, operations using third-party image acquisition control software providing co-ordinated operation of the light engine with cameras and other peripherals are generally similar.
2. Operation and installation of the SOLA GUI requires a computer running the Windows operating system with a free USB port.
3. Download the zip file for the SOLA GUI INSTALLER from <https://lumencor.com/customer-center/downloads?category=control-software>.
4. Unzip the file and run setup.exe to install the SOLA GUI.
5. Connect the USB A-to-USB B cable between the computer and the USB B port on the SOLA (Figure 1).
6. Successful installation is indicated by the appearance of "USB Serial Port (COM #)" under the "Ports (COM & LPT)" tab in the Windows Device Manager. If the virtual COM port (VCP) is not registered by the operating system, download and install the VCP driver from <https://lumencor.com/customer-center/downloads?category=control-software>.
7. Connect the DC power supply to the SOLA.
8. Check that the liquid light guide is fully inserted and locked in the front panel receptacle (Figure 2) and that the output end is safely directed into an enclosed optical path (e.g. microscope input collimator or a beam dump).
9. Press the master power button on the front panel (lower right). The power button will illuminate green when on.
10. The light source enable button in the top right corner of the front panel (above the light output port) should be in the OFF position (i.e. unlit). This is necessary to avoid manual override of serial on/off commands from the computer.
11. Run the GUI by going to the Program Menu and selecting LLE SOLA SE-2 Controller.
12. In the COM pulldown menu (GUI window, upper left), select COM # assigned to USB-Serial port.
13. Press the "INIT" button in the GUI
14. The computer should now have control of the SOLA or SOLA FISH. In the GUI window, the ON-OFF button below the intensity slider turns light output on or off. Illumination of the circular inlay

in the light source enable button on the SOLA or SOLA FISH front panel (top right) indicates active light output. The graduated slider in the GUI window controls the source output intensity [1,2].

15. There is no warm-up time; the light engine output stabilizes less than 1 second after the light output is switched on. Light output can be switched off during intervals when it is not required for active viewing or data collection. After light output is switched off, the cooling fan will continue to run for 5 minutes, after which it will automatically stop until light output is turned back on.

Notes

[1] Output intensity can be set from 0–100%. The recommended range for normal operation is 5–100 %.

[2] Setting the intensity slider to zero is not functionally equivalent to turning light output off using the ON-OFF button. In this condition, the fan will continue to run as the light sources are still energized, even though their output may not be detectable.

3.5 Using the Electronic Shutter Function

The SOLA and SOLA FISH light engine output can be selectively enabled and disabled using TTL levels applied to the BNC connector marked “shutter in” on the rear panel (Figure 1). A > 3.3 V “high” signal applied to the BNC connector will enable white light output, while a < 1.5 V signal will disable it. The SOLA and SOLA FISH light engines can support an on/off switching rate up to approximately 1 kHz. Note that DC control levels applied to the shutter in connector are not TTL source triggers. Light output must first be turned on using the front panel light output switch, foot pedal or a serial control device (control pod or computer workstation; Sections 3.3, 3.4). The output intensity remains under the control of the serial device.

3.6 Manual/Foot Pedal Operation

SOLA or SOLA FISH light engine output can be turned on or off using the light source enable button on the top right front panel or using the foot pedal toggle switch accessory (part number 29-10045). Do not intermix the operation of these switches or light output on/off commands from serial control devices (control pod or computer workstation).

4. Spectral Output

Typical output spectral distributions of SOLA, SOLA FISH, SOLA V-nIR, and SOLA U-nIR light engines are shown below (Figure 4).

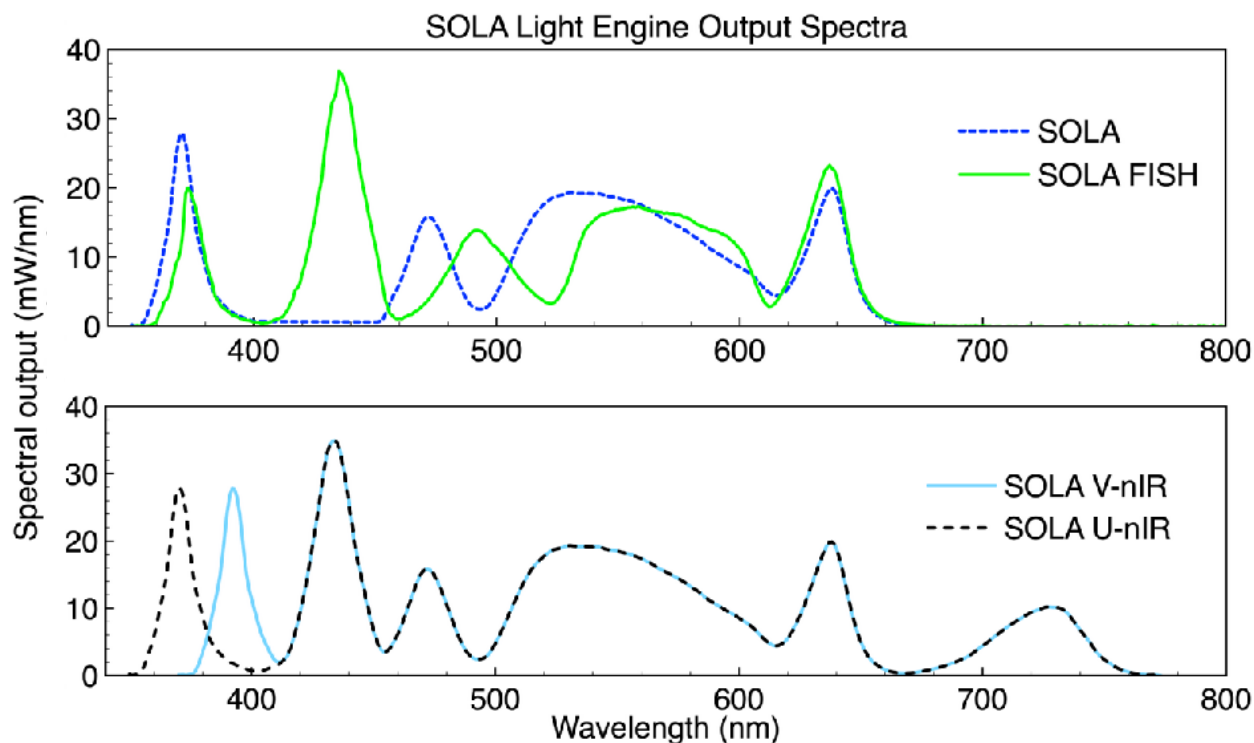


Figure 4. SOLA, SOLA FISH, SOLA V-nIR, and SOLA U-nIR light engine spectral output distributions.

5. Product Specifications

SOLA and SOLA FISH light engines must be operated and stored within the environmental conditions specified in the table below. Performance specifications for individual light engines are listed on the certificate of conformance included with the shipping documents e-mailed to the customer. It is important to retain the certificate of conformance for reference. In the event that the light engine is sold or transferred, the certificate of conformance should be conveyed to the new owner. Certificates of conformance are also recorded in Lumencor’s manufacturing database and copies can be requested by e-mail to techsupport@lumencor.com. The request message must include the 4- or 5-digit serial number of the light engine as displayed on the rear panel (Figure 1).

Specification	Detail
Temperature	
Operating	32 to 95° F (0 to 35° C)
Non-operating	-4 to 158° F (-20 to 70° C)
Humidity	
Operating and non-operating	0 to 80% relative humidity, non-condensing
Altitude	
Operating	0 to 10,000 feet (3,048 meters)

Specification	Detail
Non-operating	0 to 45,000 feet (13,176 meters)
Dimensions (WxLxH)	12.5 cm x 26.3 cm x 16.3 cm (4.90 in x 10.4 in x 6.40 in)
Weight	8.0 lb / 3.6 kg
Input Power Requirements	24 V DC / 5.0 A, 120 W maximum, power supply included
Power consumption	90 W (light output on at 100%); 3 W (light output off, fan on)
Warm-up Period	1 s
Electronic Shutter	On/Off rate up to 1 kHz
Protection	IP Rating of X0
Sound Level	Sound Level at 1 m < 10 db(A)
Connections	3.5 mm foot switch (optional accessory), USB B for serial connection to controller pod or host computer, BNC connector for TTL electronic shutter control.
Warranty	24 months parts and labor

6. Routine Maintenance and Troubleshooting

No routine maintenance is required. There are no user-replaceable components or sub-assemblies in SOLA or SOLA FISH light engines. Opening the light engine enclosure will void the manufacturer's warranty. In the event that the light engine fails to perform in accordance with the specifications listed on the certificate of conformance, review the troubleshooting procedures below. If the problem remains unresolved, please contact Lumencor Technical Support for assistance, as directed in Section 7.

SOLA and SOLA FISH Light Engine Troubleshooting	
Problem	Check the following
Green inlay does not light up when the master power button (front panel, lower right) is in the ON position	Check that the liquid light guide is fully inserted in the front panel receptacle and is secured by the set screw.
Light engine does not respond to light on/off commands from the control pod or PC	Check that the manual light output control button in the top right corner of the front panel (above the light output port) is in the OFF position.
Unusually weak fluorescence signals across all detection channels	Weak fluorescence in all detection channels (DAPI, FITC, TRITC, Cy5 etc) is likely to be due to poor light transmission by the liquid light guide, the collimating adaptor or another distal component of the microscope optical path and not to abnormally low light output from the SOLA or SOLA FISH light engine.
Unusually weak fluorescence signals in a single detection channel (e.g. DAPI)	Check that the filter cube in the microscope is compatible with the output spectrum of the SOLA or SOLA FISH model that you are using. If no filter compatibility problem is found, then contact Lumencor Technical Support as directed in Section 7.

7. Customer Support

For technical support of SOLA and SOLA FISH light engines, please contact Lumencor by phone at 503.213.4269 or via e-mail at techsupport@lumencor.com. Please be prepared to provide the 4- or 5-digit serial number of the light engine (see Figure 1), a description of the problems encountered and information on the usage context (e.g. what microscope and what control software is being used). This information will help to determine whether the problems can be resolved in situ by adjustments to the system configuration, or whether a fault has developed in the light engine that requires its return to Lumencor's facility in Beaverton, Oregon for evaluation and, if necessary, repair. Any light engine return to Lumencor for service or repair must have a material authorization (RMA) number. To request an RMA number, fill out and submit the [online request form](#). It is the customer's responsibility to properly package and safely ship products to Lumencor. Instructions for shipping will be provided in the e-mail giving notification of the RMA number.

8. Warranty

SOLA and SOLA FISH light engines come with a 24 month warranty, starting on the original date of shipment from Lumencor. Light Engines qualifying for warranty service must be verifiably delivering performance that is substantially at variance with the levels documented in the certificate of conformance. The light engine must also have been used and maintained under operating conditions consistent with the specifications given in Section 5, and observing all the Precautions and Warnings notified in Section 2. This warranty does not extend to light engines that have been subject to misuse, accident, tampering or improper installation. Accessories including (but not limited to) liquid light guides, optical fibers, collimators, cables and control consoles are not covered by the warranties attached to light engines. Please fill out and submit the [online warranty registration form](#). This will facilitate provision of warranty service should it be required.