

Lumencor Operation Manual

AURA (N) 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: Aura III**” is used as a representative model for all certified and CE marked Gen III AURA 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 the vendor from which the product was purchased and ask for the correct method of disposal.

For Research Use Only 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

The AURA (N) Light Engine consists of 3 to 5 individually addressable solid-state light sources with integrated electronic control systems. The constituent light sources may be LEDs or luminescent light pipes. The outputs of the constituent light sources are refined by bandpass filters and merged into a common optical train directed to the light output port on the front panel. Before exiting, light output is sampled by a calibrated photodiode array providing a real-time display of the power output in the onboard control GUI. The light output port has a built-in adapter for connection to an SMA-terminated optical fiber or a liquid light guide (LLG). The light sources within the AURA Light Engine are controlled by an onboard microprocessor operating Lumencor firmware accessed via one of two serial interfaces, USB/RS-232 or TCP. The user can enable or disable each source independently by serial commands as well as change the intensity of each source independently. The AURA Light Engine can either be controlled by external data acquisition software or by a GUI resident on the onboard microprocessor. Alternatively, the light sources may be turned on and off by TTL inputs from a trigger device such as a camera or a real-time controller. The only manual control is the master power switch on the front panel. Optimal internal operating temperature is maintained by negative pressure air cooling with the air intake at the front of the light engine and the exhaust fan at the rear.

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 the AURA 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 AURA Light Engine 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: ONLY use the power supply provided by Lumencor. The Lumencor-supplied 24 V DC, 9.2 A external power supply is required for use with the AURA Light Engine. The Light Engine is required to be supplied by an approved/certified DC power source meeting the minimum electrical ratings of the product. The DC power supply must have the AC power cord connected to a receptacle with a protective safety (earth) ground terminal.

Avertissement: utiliser uniquement l'alimentation fournie par Lumencor. Le Lumencor fourni 24 V CC/9.2 A alimentation externe est recommandé pour une utilisation avec le moteur de lumière AURA. Le moteur léger doit être alimenté par une source d'alimentation CC approuvée/certifiée répondant aux caractéristiques électriques minimales du produit. L'alimentation CC doit avoir le cordon d'alimentation CA connecté à une prise avec une borne de terre de sécurité (terre).

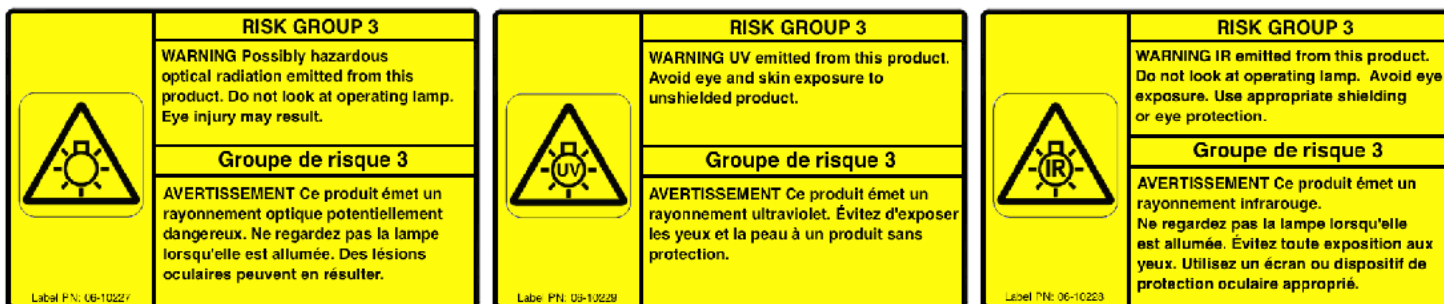
Warning: DO NOT look into the output of the light engine. The brightness of this light source is higher than most commercial lighting fixtures and is intended to couple directly into a microscope or other bioanalytical instrument.

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 est conçue pour un raccordement direct à un microscope ou autre appareil de bioanalyse.

Warning: DO NOT apply/remove power or turn on the light without the output end of the light guide 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 appliquer/couper l'alimentation ou 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.

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

GRUPE DE RISQUE 3

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

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

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 AURA 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 AURA Light Engine autre que celle prévue et du mépris total de les mesures de sécurité et mises en garde affichées.

3. Installation

3.1 Contents

The AURA Light Engine ships with the following list of standard components:

1. The AURA Light Engine, configured with 3 to 5 output channels (colors) and an output adapter for connection to an SMA-terminated optical fiber **or** a liquid light guide (LLG) as documented on the certificate of conformance (Figure 1).
2. A 24 V/9.2 A DC power supply (Lumencor part number 27-10019).
3. A region-specific AC power cord for the power supply (see Table 1).
4. RJ45 ethernet and USB A-to-USB B control cables.
5. Control key, external gate jumper, and remote interlock jumper (Figure 2).
6. Quickstart Guide instruction document (57-10040).

Table 1. 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, unique 5-digit serial number and certification markings of the light engine are carried on a label affixed to the rear panel (Figure 3). Performance specifications for individual light engines are listed on the certificate of conformance included with the shipping documents e-mailed to the customer (Figure 1). It is important to retain the certificate

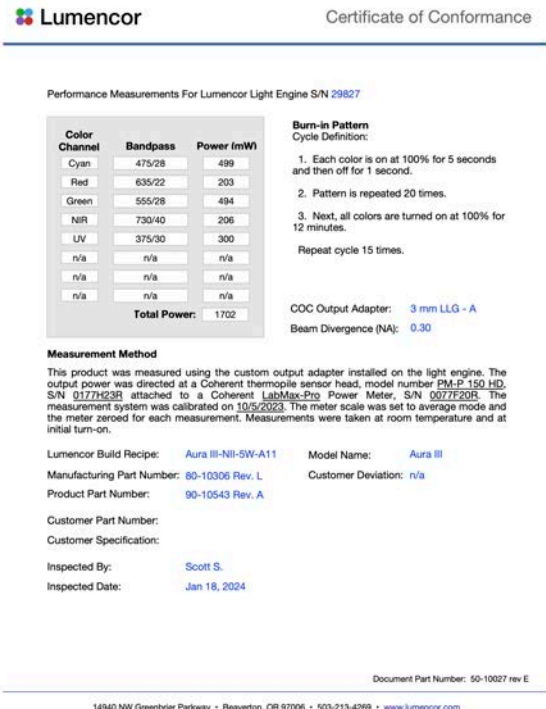


Figure 1. Specimen certificate of conformance (C of C) for AURA Light Engine. The C of C identifies the color channels installed in the light engine and the internal bandpass filters associated with each channel. Full (100%) power outputs measured at the terminus of the liquid light guide (LLG) are recorded in the third column.

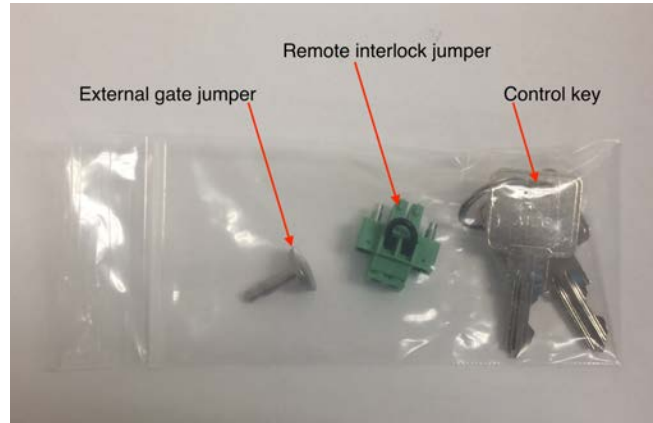


Figure 2. Control key, remote interlock jumper and external gate jumper. These items are packed in a plastic bag inside the shipping box. Their functions are described in Section 3.3



Figure 3. Identification label for AURA light engine serial number 30095

of conformance for reference, as it provides documentation of light engine performance benchmarks. **If the light engine is resold, the Certificate of Conformance must be transferred 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 the AURA Light Engine up for use, place the unit on a hard surface, within 6 feet (2 meters) of a grounded AC power outlet (100–240 V AC, 50–60 Hz). Avoid blocking or restricting airflow at the air inlet (front panel; Figure 4, #9) or exhaust ports (rear panel) on the enclosure. Restricting the airflow will cause the unit to operate at elevated temperatures and may result in decreased product life and/or premature failure. The AURA Light Engine must be operated in a non-condensing environment (dew point <15°C with controlled ambient temperature between 20 and 30° C). Thermal overload protection is provided by the microprocessor controller in conjunction with an onboard temperature sensor. If the internal temperature registered by the sensor exceeds 50°C

or the fan rotor is stopped, all light output channels automatically turn OFF and are locked in this state until the internal temperature is below 50°C and/or the fan restarts. The current reading of the on-board temperature sensor is displayed on the front panel status display (Figure 4, #2) and in the control GUI (Figure 6, #8).

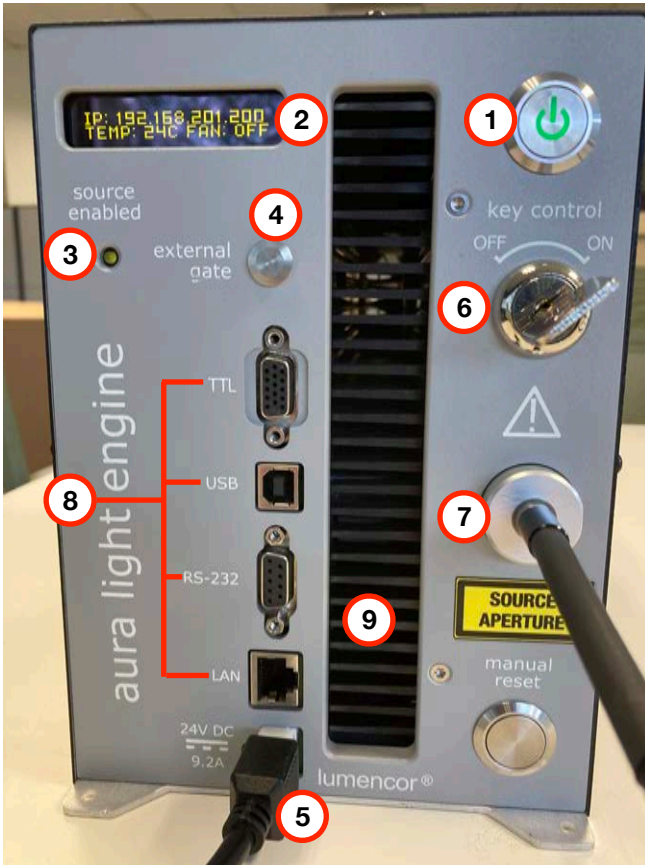


Figure 4. AURA Light Engine front panel. 1. Master power button. 2. Status indicator display. 3. Source enabled indicator. 4. External gate port with jumper inserted. 5. DC power input. 6. Key Control. 7. Light output port with liquid light guide inserted. 8. Control ports. Top-to-bottom: TTL, USB B, RS232, LAN (ethernet). 9. Air intake.



Figure 5. Remote interlock jumper inserted in the labeled receptacle on the lower left side of the rear panel of the light engine.

The AURA Light Engine may be configured for light delivery via a liquid light guide (Figure 4, #7), an SMA-terminated optical fiber or a custom fiber bundle. The output couplers are built into the light engine front panel and are not field-exchangeable. After fully inserting the liquid light guide, lock it in position using the set screw on the right-hand side of the receptacle to prevent inadvertent disconnection of the light guide during use. Connect the DC power supply to the 6-pin receptacle on the front of the light engine (Figure 4, #5). Connect the control cables to the light engine (Figure 4, #8).

3.3 Control and Interlock Set Up

The **Master Power Switch** button on the front panel (Figure 4, #1) toggles the electrical power to the unit on or off. A green inlay power embedded in the button is illuminated when the power supply

is connected to the light engine and the power button is in the on position. Initialization of the onboard computer takes about 30 seconds after the master power switch is turned on. When initialization is complete, the status indicator display (Figure 4, #2) will automatically activate.

The **Key Control** (Figure 4, #6) must be in the **on** position before light output can be turned on. The key must be removed and stored in a secure location when the product is not in use. **ONLY** trained individuals should use and have access to the key.

The **Master Power Switch** button, **Key Control** and **Remote Interlock** (Figure 5) can be used to shut off light output. If the **key control**, **remote interlock** or **light output port interlock** are opened **after** light output has been enabled, the **manual reset** button (Figure 4, lower left) will need to be pushed to resume light output. Interlocks that are opened when there is no active light output will close automatically as soon as the cause of the open condition is rectified. Open interlock conditions are indicated by a red (●) ILK indicator in the control GUI (Figure 6, #9).

The **Source Enabled** indicator LED (Figure 4, #3) provides a warning indication that one or more light sources are active and emitting invisible and/or visible radiation.

The **External Gate** port allows light output to be selectively disabled by control signals from an external device such as a microscope. When no external gate control is in use, light output will be disabled unless the external gate jumper (Figure 2) is inserted in the port (Figure 4, #4).

The **Remote Interlock Connector** (rear panel) allows light output to be disabled upon opening of an enclosure in which the light engine is housed. When no external enclosure is in use, the interlock is closed by the remote interlock jumper (Figure 5).

WARNING: The Remote Interlock relies on a passive continuity circuit for proper operation. It does not provide a voltage source for external circuitry, nor can external voltage sources be applied to it. **UNDER NO CIRCUMSTANCES** should a voltage or voltage source be applied to the Remote Interlock circuit. **APPLYING A VOLTAGE OF EITHER POLARITY MAY RESULT IN ANOMALOUS OPERATION AND/OR DAMAGE THE PRODUCT, AND COULD IMPACT SAFETY.**

Customers planning to connect multiple Light Engine remote interlocks together will need to contact Lumencor prior to integration. **INTERCONNECTING LIGHT ENGINES OR USING THE REMOTE INTERLOCK INCORRECTLY CAN RESULT IN ANOMALOUS BEHAVIOR AND/OR DAMAGE TO THE PRODUCTS.**

AVERTISSEMENT : Le verrouillage à distance repose sur un circuit de continuité passif pour un fonctionnement correct. Il ne fournit pas de source de tension pour les circuits externes, et aucune source de tension externe ne peut lui être appliquée. **EN AUCUN CAS**, une tension ou une source de tension ne doit être appliquée au circuit de verrouillage à distance. **L'APPLICATION D'UNE TENSION DE POLARITÉ OU DE POLARITÉ PEUT ENTRAÎNER UN FONCTIONNEMENT ANOMAL ET/OU ENDOMMAGER LE PRODUIT, ET POURRAIT AVOIR UN IMPACT SUR LA SÉCURITÉ.**

Les clients prévoyant de connecter plusieurs verrouillages à distance Light Engine ensemble devront contacter Lumencor avant l'intégration. **L'INTERCONNEXION DE MOTEURS LÉGERS OU L'UTILISATION INCORRECTE DU VERROUILLAGE À DISTANCE PEUT ENTRAÎNER UN COMPORTEMENT ANOMAL ET/OU ENDOMMAGER LES PRODUITS.**

The **Light Output Port Interlock** disables light output **unless** a liquid light guide, optical fiber or custom fiber bundle is connected to the output port as shown in Figure 4 (#7).

WARNING: Prior to turning electrical power on or off, or 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'appliquer/de couper l'alimentation ou 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).

Note: In the event of ANY normal or abnormal interlock fault condition (including high ESD/EMP/EFT conditions ~2kV) you **MUST** clear the latch fault condition, either by depressing the manual reset button or by cycling the power switch.

4. Operation

4.1 Start Up

1. Insert the light guide and secure it with the set screw on the right-hand side of the light output port (Figure 4, #7) [1].
2. Insert the external gate jumper (Figure 2) in the labeled socket on the front panel (Figure 4, #4). Insert the remote interlock jumper in the labeled socket in the lower left corner of the rear panel (Figure 5).
3. Insert the control key, turn it to the **ON** position.
4. Connect the AC power cord supplied with the light engine to the DC power supply.
5. As soon the DC power supply is energized, the light engine automatically starts up; there is no need to push the master power button [2]. Illumination of the embedded green indicator in the master power button indicates electrical power supply to the light engine is active.
6. Wait 30–45 seconds for the initiation sequence (onboard microprocessor boot-up) to complete. Do not press any buttons or insert any plugs during this time.
7. When the initiation sequence completes, “LUMENCOR” will flash on front display panel and then be replaced by a display showing the current light engine IP address, the internal temperature and the fan status. At the same time, the fan will come on at HI for about 2 seconds and then shut off automatically. The light engine is now ready for use. Prior to turning the light output on, verify the output end of the liquid light guide or optical fiber is safely directed into an enclosed optical path (e.g. microscope epilluminateur or a beam dump).

Notes:

[1] The light output port incorporates an interlock circuit that disables light output unless a liquid light guide, optical fiber or custom fiber bundle is connected to the output port. Open interlock conditions are indicated by a red (●) ILK indicator in the control GUI (Figure 6, #9)

[2] If the DC power supply remained energized after the the previous shut down, press the master power button to start.

4.2 Shut Down

When the light engine is no longer required for immediate use, make sure that the **Source Enabled Indicator** (Figure 4,#3) is off. Then press the master power button (Figure 4, #1) to shut down the light engine. Alternatively, shut down can be accomplished using the **Shut Down** button on the Light Engine Control GUI control page (Figure 6).

4.3 Light Engine Control GUI

The built-in Light Engine Control GUI provides a quick and easy way to control the light engine, providing the ability to turn each source on/off and to adjust the intensity of each source independently from 0 to 100% output power (Figure 6, #3) [1]. The GUI also tracks the total on time (Figure 6, #13) and the onboard power sensor readings (Figure 6, #4). To access the Light Engine Control GUI on a Windows PC [2,3] follow the follow protocol below [4]:

1. Connect the PC ethernet port to the LAN port (Figure 4, #8) using the RJ45 ethernet cable shipped with the AURA light engine [5].
2. Go to Start menu > Control Panel > Network & Internet and/ or Network & Sharing Center
3. Click Change Adapter Settings
4. Right-click on Local Area Connection
5. Click on Properties (in pop-up)
6. Select Internet Protocol Version 4 (TCP/IPv4).
7. Click Properties button
8. Use the following IP addresses:
 - Manual/Static IP Address: 192.168.201.201 [6]
 - Subnet Mask: 255.255.255.0
 - Default gate way and DNS Server are OK to leave blank
9. Connect the RJ45 cable (supplied with the light engine) between the LAN port on the light engine and an Ethernet port on the computer.
10. Type the Light Engine IP address (Figure 4, #2) into any web browser address bar to access the onboard control GUI (Figure 6). The factory default IP address is 192.168.201.200.

Output power regulation allows users to eliminate variations in light output due to temperature fluctuations and other environmental factors in photometric and quantitative imaging applications where reproducibility and accuracy are essential [7]. To use power regulation, a desired power reference value in milliwatts is entered in the onboard control GUI. To activate power regulation, simply click the padlock icon next to the reference power value. Gray shading of the padlock icon and the reference power value shows that power regulation is active for the selected output channel. When power regulation is active, the intensity setting for the channel is controlled by the onboard microprocessor, based on feedback from the light engine's reference photodiode array. The

microprocessor continuously adjusts the intensity setting so that the output power matches the power reference value set by the user.

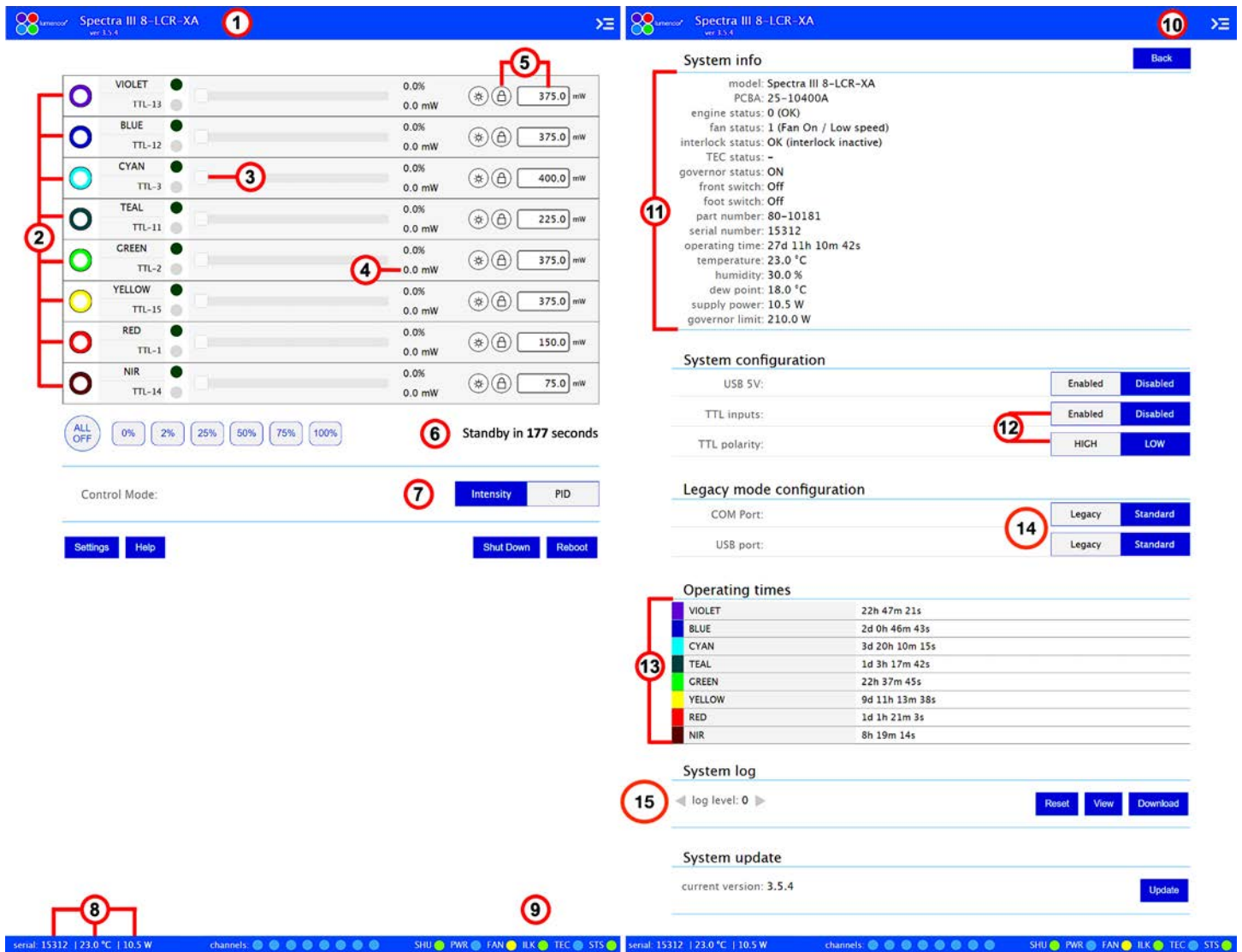


Figure 6. Light Engine Control GUI. Control Page (Left) and Settings Page (Right). 1) Lumencor light engine model number and software version. 2) ON/OFF toggle control of source channel (filled circle = ON, ring = OFF). 3) Intensity control slider. 4) Live power read out in mW. 5) power regulation controls: locked in when padlock and input box are grey. 6) Standby mode countdown timer. 7) Intensity control mode setting. **Intensity** is the default setting and is recommended for most applications. 8) serial number of light engine, live temperature read out, and live power draw read out. 9) System status indicators. 10) Command line access. 11) System information. 12) TTL port configuration controls. 13) Cumulative light source operating time read out. 14) Command set selection for USB and RS232 (COM) ports. 15) Microprocessor log file portal. Log level should be set to 0 (zero) for normal operations. **Note** that although the figure shows a SPECTRA light engine control GUI, the AURA control GUI has the same format, features and functionality.

Notes:

- [1] The output power response to intensity control settings (Figure 6, #3) is linear. Settings in the range 5–100% intensity, avoiding the 0–5% range, are recommended for normal operations. An intensity setting of 0% is NOT functionally equivalent to OFF (Figure 6, #2).
- [2] Any type of computer may be used, including Windows, MacOS and Android systems.

[3] The control GUI and external control software connected via the USB or RS232 ports can be run simultaneously.

[4] These instructions are also included in the *Quickstart Guide* document enclosed in the light engine shipping box.

[5] If the computer does not have an available ethernet port, a USB-to-ethernet adapter may be used instead.

[6] Do not use DHCP.

[7] Power regulation should only be used for stabilization of continuous light output of 15 minutes duration or more. Do not use when discontinuous (pulsed) light output is required.

4.4 External Software Control via Serial Ports

AURA Light Engines have two serial ports, labeled USB and RS-232 (Figure 4, #8), which can be set to receive either LEGACY or STANDARD mode commands. Connection to the computer requires a USB-A-to-USB B cable (29-10058) or USB-to-RS-232 cable (29-10011). Select the command mode setting (Figure 6, #14) for the serial port that is compatible with the command syntax and serial communication protocol implemented in the control software driver. Any changes are applied instantaneously and are retained between power cycles. A driver sending LEGACY mode commands to a port set to receive STANDARD mode commands (or vice versa) will result in a persistent communication error. The COM port address assigned by the computer to the light engine USB serial port must be correctly registered in control software.

LEGACY commands are limited to controlling on/off switching and intensity adjustment of individual color channels. Only one of the two ports (USB **or** RS-232) can be set to LEGACY mode at one time. The STANDARD mode command set gives access to an extensive panel of operating status reports and configuration settings in addition to the the basic control functions of the LEGACY command set. A complete listing of STANDARD mode commands is provided in *Lumencor Light Engine Command Reference* (Document number 57-10018). Note that LEGACY and STANDARD mode communications use different serial protocols (9600,8,N,1 and 115200,8,N,1 respectively).

4.5 Control via Light Engine Control Pod

1. Connect the AURA Light Engine USB B port (Figure 4, #8) to the pod USB A port using a USB A-to-USB B cable (29-10058).
2. Open the control GUI as described in Section 4.3.
3. On the GUI SETTINGS page, check that the USB port configuration is set to LEGACY mode (Figure 6, #14) and USB 5V is set to ENABLED (Figure 6, #12).
4. The pod must be set in the AURA Light Engine control mode. The light engine control mode setting is shown in green letters at the bottom of the pod display screen. If the pod is not in the AURA Light Engine control mode, change the setting by holding down the MODE button on the pod until the light engine selection menu appears. Move the cursor to “AURA” in the selection menu by turning the pod control knob. Press the MODE button again to select the AURA Light Engine control mode and return to the main control screen.
5. Follow instructions on Lumencor’s Light Engine Control Pod Operation sheet ([54-10036](#)). In brief, press the COLOR button to select output light output channel, press the MODE button to toggle light output on and off, turn the control knob to adjust intensity for the current light output channel selection.

4.6 TTL Control

The TTL interface provides users with a faster method of switching color channel outputs on and off. When using TTL triggering, the source channel ON/OFF toggles in the control GUI (Figure 6, #2), and corresponding ON/OFF toggles in external control software, must be in the OFF position. Intensity settings are independent of TTL inputs and remain under the control of the GUI (Figure 6, #3) or external software. Trigger inputs to the light engine TTL port (Figure 4, #8; Table 2) are relayed by an accessory breakout cable (Figure 7). As a safeguard against unintended light output when the inputs are initially connected, new AURA light engines may be shipped with the TTL port disabled. To enable TTL input, click the **Enabled** button next to “TTL inputs” on the the control GUI settings page (Figure 6, #12). The response polarity of the TTL input can be set to positive or negative in the GUI settings tab (Figure 6, #12). Changes are applied instantaneously and are retained between power cycles. The breakout cable also provides a global shutter input (labeled “shutter”). TTL signals input to the global shutter will synchronously toggle all currently enabled source channels on and off.

5. Light Output Characteristics

AURA Light Engines may incorporate different numbers and types of solid state light sources. Constituent light sources may include LEDs and luminescent light pipes. The number of light sources installed and the bandpass filters associated with each are shown on the Certificate of Conformance (Figure 1) included with the shipping documents e-mailed by Lumencor to the customer. The certificate of conformance also shows full (100%) power outputs for each source measured at the terminus of the liquid light guide (LLG) or optical fiber. Not all sources may be turned on simultaneously. To prevent exceeding the capacity of the DC power supply, power consumption is tracked by the onboard microprocessor. If a set limit (**governor limit**, Figure 6, #11) is exceeded, either by increasing intensity settings for sources that are already on, or by turning on additional sources, commands will be rejected. To clear the error condition, reduce intensities of sources that are on or turn off additional sources.

Light source outputs are refined by internal bandpass filters. See Figure 8 for a representative spectral output plot for an AURA Light Engine. The specifications of these bandpass filters are recorded on the certificate of conformance (Figure 1) as CWL/FWHM where CWL = center

Table 2. TTL Connector Pin Definitions

OUTPUT COLOR	Pin#	OUTPUT COLOR	Pin#
RED	1	BLUE	12
GREEN	2	VIOLET	13
CYAN	3	nIR	14
TEAL	11	YELLOW	15
Gnd	6,7,8,10	Global Shutter	9

$V_{\text{high}} (\text{min}) = 2.0\text{V}$, $V_{\text{high}} (\text{max}) = 5.5\text{V}$
 $V_{\text{low}} (\text{min}) = 0.0\text{V}$, $V_{\text{low}} (\text{max}) = 0.8\text{V}$
 • TTL pin references are also indicated next to the ON/OFF toggle buttons in the control GU (Figure 6, #2)



Figure 7. 9X BNC-terminated breakout cable to enable TTL triggering (Lumencor p/n 29-10156). An equivalent SMB-terminated cable (Lumencor p/n 29-10216) is also available.

wavelength and FWHM = full width at half-maximum transmission, both measured in nanometers (nm). In fluorescence microscopy applications, excitation filters installed in the microscope cube are generally redundant [1]. Internal bandpass filters are not user-exchangeable and changes require return of the light engine to Lumencor’s factory for service (see Section 8). Since changing bandpass filters will result in source output power changes, a new certificate of conformance will be provided as part of this service.

Note

[1] Exceptions are (a) if the transmission spectra of the internal bandpass filter and the emission filter in the microscope cube overlap to a significant extent or (b) if the AURA light engine is supplied without internal bandpass filters by customer specification.

AURA Light Engine

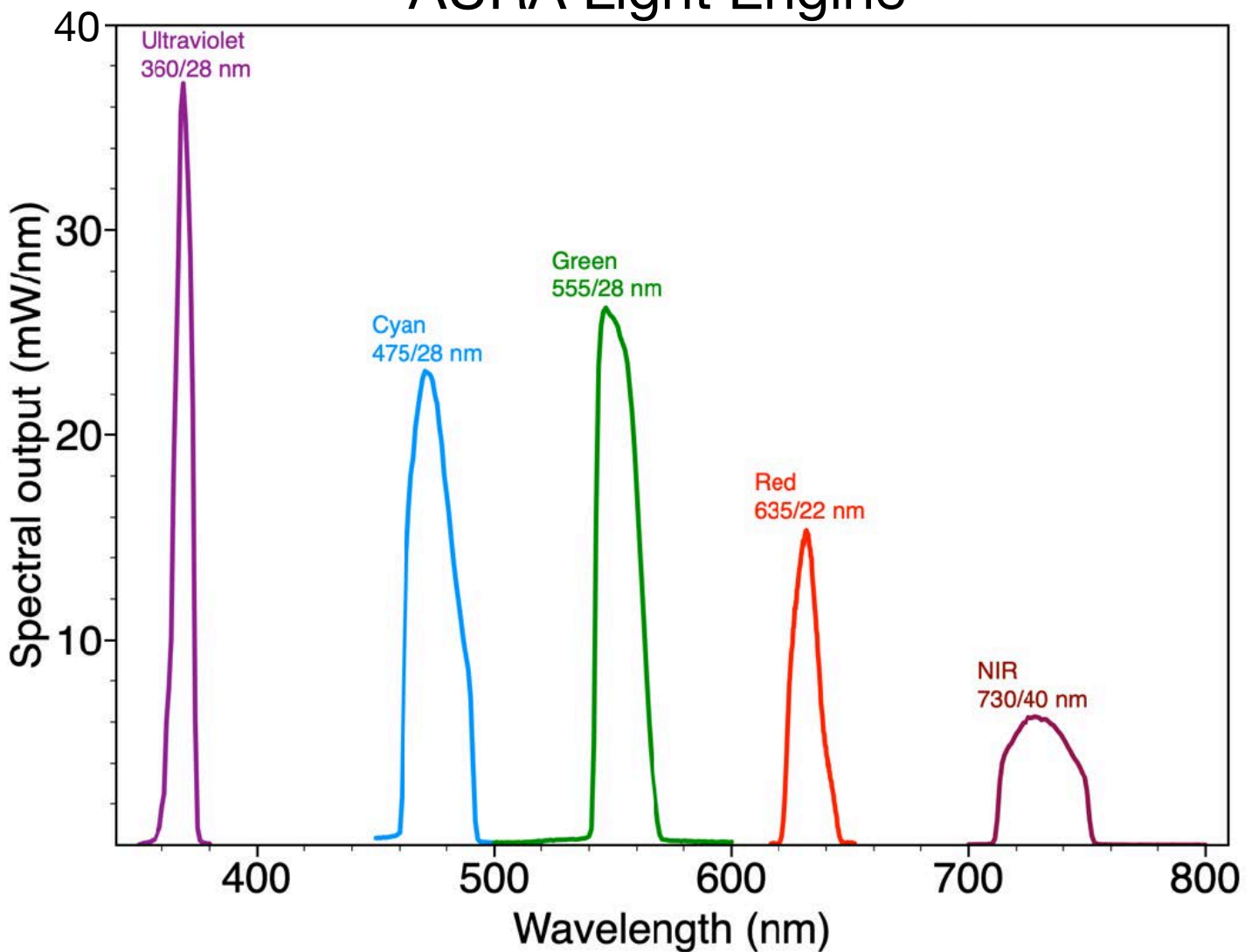


Figure 8. Spectral output plot for a representative AURA Light engine, showing 5 color channels: DAPI (violet), FITC (cyan), TRITC (green), Cy5 (red), and Cy7(nIR).

6. Operational Specifications

The AURA Light Engine must be operated and stored within the environmental conditions specified in Table 3. Performance specifications for individual light engines are listed on the certificate of conformance included with the shipping documents e-mailed to the customer (see example shown in Figure 1). It is important to retain the certificate of conformance for reference. In the event that the light engine is sold, the certificate of conformance should be transferred to the new owner. Certificates of conformance are also recorded in Lumencor’s 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.

Table 3. AURA Light Engine Operational Specifications

Specification	Detail
Temperature	
Operating	68 to 86° F (20 to 30° C) but it can vary depending on the specific model
Non-operating	-4 to 158° F (-20 to 70° C)
Humidity	
Operating and non-operating	Dependent on ambient temperature [1]
Altitude	
Operating	0 to 10,000 feet (3,048 meters)
Non-operating	0 to 45,000 feet (13,176 meters)
Dew Point	
Operating and non-operating	32 to 59° F (0 to 15° C)
Dimensions	
Size (W x L x H)	145 mm x 263 mm x 203 mm (5.7 in x 10.4 in x 8.0 in)
Weight	6.5 kg /14.3 lbs
Lifetime	Time for light engine output to decrease to 70% of the values recorded on the original certificate of conformance [2].
AC Power Requirements	100–240 V, 50–60 Hz
DC Power supply	220 W (24 V DC / 9.2A)
Warm-up Period	1 s
Protection	Thermal overload (Section 3.2). Power overdraw (Section 5)
Sound Level	Sound level at 1 meter < 65db(A)
Control Interfaces	USB, RS-232, TCP, TTL
Warranty	24 months parts and labor
<p>[1] Humidity level must be consistent with the requirement for a non-condensing environment (dew point <15°C) under ambient temperature conditions. [2] The corresponding number of days/months/years may vary considerably depending on the duty cycle implemented by the user and the prevailing environmental conditions during operation.</p>	

7. Routine Maintenance and Troubleshooting

No routine maintenance is required. There are no user-serviceable components or sub-assemblies inside the AURA Light Engine. 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, follow the troubleshooting procedures detailed in Table 4. If the problem remains unresolved, please contact Lumencor Technical Support for assistance, as directed in Section 8.

Table 4. Troubleshooting Procedures

Problem	Check the following
No response to serial (USB or RS-232) commands	Check that the LEGACY or STANDARD command mode selection (Figure 6, #14) is compatible with the software driver.
No response to TTL trigger commands	Check that TTL inputs are ENABLED (Figure 6, #12) and that the TTL polarity setting is consistent with the trigger inputs. Also check that all serial ON/OFF controls are in the OFF state.
No light output in response to source ON command (serial or TTL).	Check all of the following: <ol style="list-style-type: none"> Control key must be inserted in front panel and turned to "on" position (Figure 4, #6) [1] Liquid light guide must be inserted in light output receptacle (Figure 4, #7) [1]. Remote interlock jumper must be inserted in rear panel (Figure 5) [1]. External gate jumper must be inserted in front panel (Figure 4, #4).
No light output in response to source ON command (serial or TTL) after passing checks 1–4 above.	A live output power reading of 0.0 mW (Figure 6, #4) when the source enabled indicator (Figure 4, #3) is lit and intensity is set to 5% or above is directly indicative of a source failure requiring factory service. In this case, submit an online RMA request as described in Section 8.
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 light engine.
Unusually weak fluorescence signals in a single detection channel (e.g. DAPI)	<ol style="list-style-type: none"> Check that the light engine power output reading in the control GUI (Figure 6, #4) is normal. Check that the dichroic beamsplitter and emission bandpass filter in the microscope are compatible with light engine excitation filter specifications shown on the certificate of conformance (Figure 1) [2].
High, spatially uniform fluorescence background	Check that transmission spectra of the internal bandpass filter and the emission filter in the microscope cube do not overlap to a significant extent.
<p>[1] If a safety interlock is open, the condition will be indicated by a red status indicator in the lower right corner of the GUI control screen (Figure 6, #9).</p> <p>[2] Excitation filters are installed in the light engine. In this case, excitation filters installed in the microscope cube are redundant and it is generally recommended that they are removed.</p>	

8. Customer Support

For technical support of the AURA Light Engine, please contact Lumencor by phone at 503-213-4269 or through e-mail at techsupport@lumencor.com. Please be prepared to provide the 4- or 5-digit serial number of the light engine. Any light engine returned to Lumencor for repairs or upgrades requires a pre-issued return 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.

9. Warranty

The AURA Light Engine is backed by a 24 month warranty to end users. Warranty coverage starts 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 6, 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, improper installation or shipping damage. 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. AURA light engine owners are encouraged to fill out and submit the [online warranty registration form](#). This will facilitate provision of warranty service should it be required.