

SPECTRA TUNE LAB



Light Engine for Scientists

Q2 - 2020

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DESCRIPTION

The SPECTRA TUNE LAB device is the most versatile LED light engine from LEDMOTIVE. The system can deliver either white light or any light spectrum obtained from the modulation of each of its different wavelength channels. Brightness can be dimmed down to 10% for each channel of the whole specific spectral power distribution.

The SPECTRA TUNE LAB is equipped with 10 different types of colored LEDs.

LEDMOTIVE patented technology (Patent PCT/EP2011/050002) warrants spectral precision and accuracy as well as stability over time, through a CMOS-based onboard spectroradiometer.

The system can emit a different spectrum every 10 milliseconds on average¹.



Figure 1. SPECTRA TUNE LAB front and rear view

SPECTRA TUNE LAB - Features

- High power multi-spectral LED light engine
 - Adjustable brightness
- Spectral output control
- Fast spectral transition in asynchronous operation mode
- Mounting accessories compatible w/ standard optical tables & ¼ thread for tripod mounting
- Free operational software control (µWAVE) with basic features
- Optional: RESTful API
- Optional: C-mount adaptor that allow to connect standard compatible light guide connectors
- Communications based on EIA-485 protocol
- Multiple SPECTRA TUNE LAB can be connected in serial

¹ asynchronous operation mode

LED ENGINE CONFIGURATION

The SPECTRA TUNE LAB contains ten LED channels for multispectral reproduction. The characterization of each LED is shown in Table 1 and Figure 2*

Channel	Color	Peak Emission (nm)	Radiometric value (W)	Photometric value(lm)	FWHM (nm)
CH 1	UV	430	0.74	13	16
CH 2	Royal Blue	445	0.95	36	19
CH 3	Dark Blue	465	0.94	74	23
CH 4	Blue	475	0.89	97	30
CH 5	Cyan	505	0.98	319	30
CH 6	Green	525	0.77	389	34
CH 7	Lime	545	2.75	1256	110
CH 8	PC Amber	595	2.76	990	82
CH 9	Red	640	0.62	102	19
CH 10	Deep Red	660	1.25	81	18

Table 1. Generic features of the SPECTRA TUNE LAB light engine

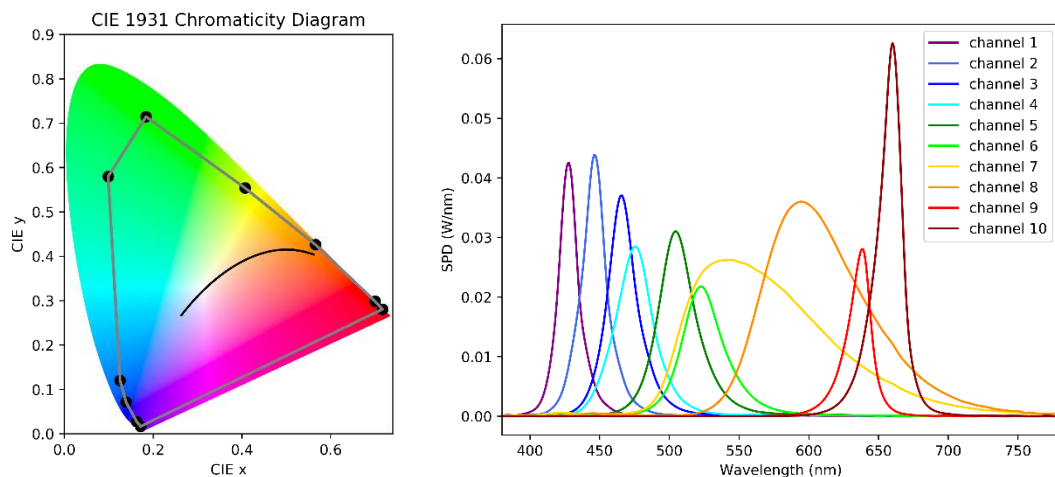


Figure 2. (left) CIE 1931 xy coordinates of the 10 channels that define the color gamut and (right) Spectral Power Distributions (SPDs) of the LED channel

* Measured at 25°C. Dominant wavelength and amplitude of some channel may vary slightly depending on bin availability at the moment of the manufacturing; however, the individual calibration of each SPECTRA TUNE LAB would be taken in account internally to correct any eventual deviation and produce the desired spectrum.

Since the light output of the SPECTRA TUNE LAB is generated by mixing 10 wavelength (color) channels, every spectrum is determined by 10 independent pulse width modulation (PWM) signals. Consequently, the luminous flux is not constant across the 1931 CIE diagram. All active channels are mixed, providing with a smooth (uniform in color) light with a quasi-Lambertian pattern profile

SPECTRAL MODULATION

Figure 3 shows the product performance based on two different spectral modulations that reproduce a blackbody radiation curve at two different temperatures such as 2700 K and 6500 K.

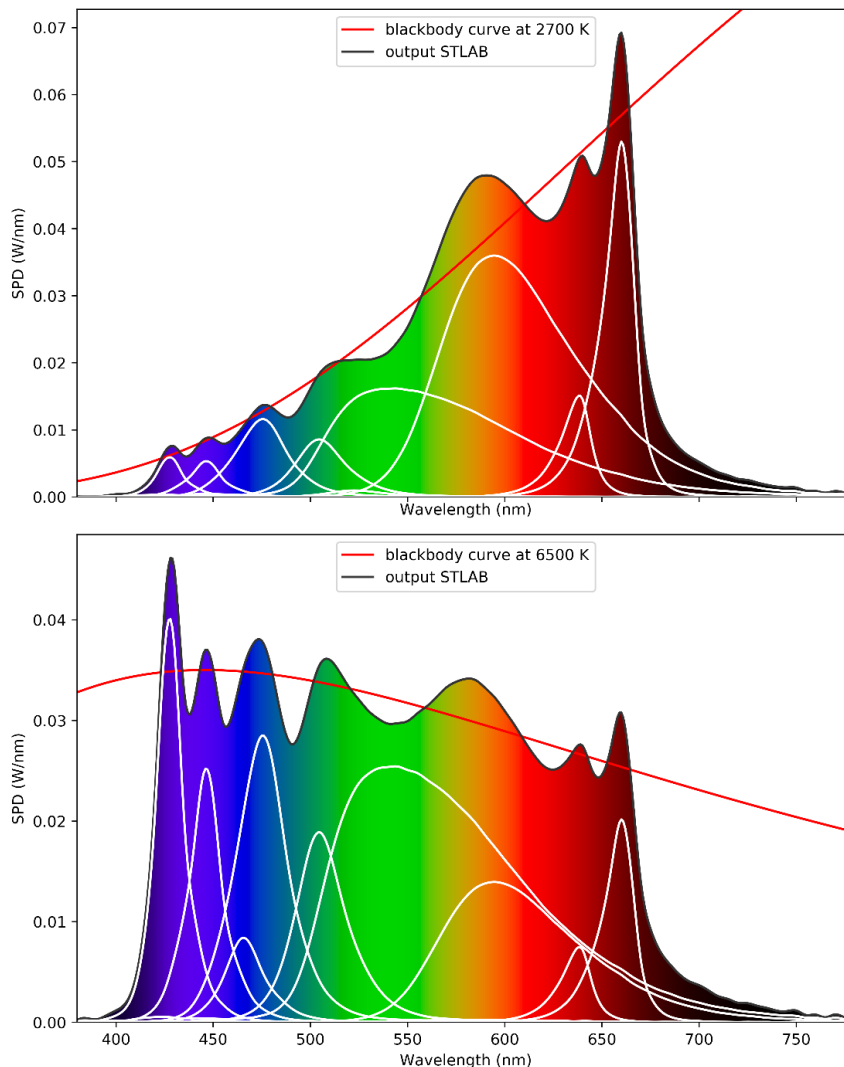


Figure 3. Example of two different spectral fittings using a blackbody radiation at 2700 K and 6500 K

SPECTRAL PRECISION AND ACCURACY

LED MOTIVE patented technology allows the SPECTRA TUNE LAB to emit light spectra with precision and accuracy thanks to the on-board CMOS spectrometer and the associated feedback loop control algorithms.

When testing the system at different CCT when the brightness level is at 80% and the feedback control loop is activated, color deviations of Duv' within a 2-step circles can be achieved according to the ANSI C78.377-2015.

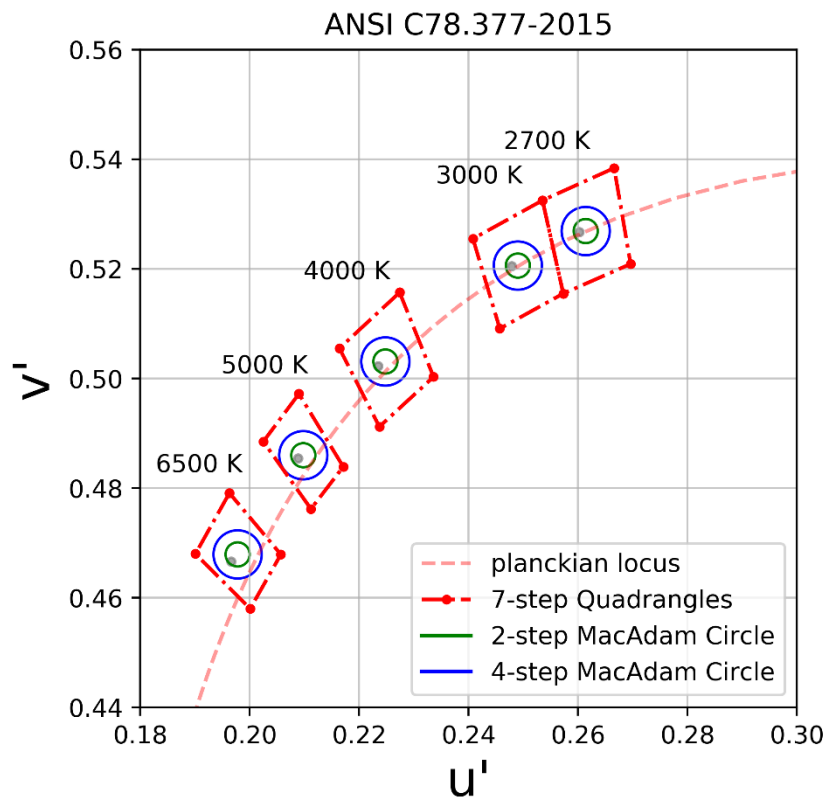


Figure 4. Results at different CCT when the feedback loop is activated

SPECTRAL SWITCHING TIME

The SPECTRA TUNE LAB works in synchronous mode by default. It means that it acknowledges the receipt of each command sent by the LIGHT HUB² before accepting a new instruction, so that “collisions” between messages can be detected and duly corrected. Typical response times of this operation mode is within few hundreds of milliseconds.

² For more information check the LIGHT HUB Data Sheet

Whenever an application requires fast switching times, the SPECTRA TUNE LAB can be set to work in asynchronous mode³.

In that case, the light engine does not send any acknowledge signal to the LIGHT HUB, making it possible to send spectral sequences to the SPECTRA TUNE LAB faster. Typical average time between consecutive light spectra operating under the asynchronous mode is around 10 milliseconds (100 different spectra every second).

THERMAL PROTECTION

The SPECTRA TUNE LAB incorporates a temperature protection control that is enabled by default. In the unlikely event of PCB overheating (fan or dissipation failure, harsh environments, etc.), the LED module will automatically reduce its luminous flux and consequently the consumed electrical power to keep the temperature within a safety range. In this way, the optimal working conditions that warrant the lifespan of the LED engine and its components are always preserved.

ELECTRICAL SPECIFICATIONS

Nominal Input Voltage	24 V DC (Constant Voltage) $\pm 5\%$
Max. Power Input	80 W
Max. Current Input	3.3 A*
Data connector	RJ9
Data communication control	LEDMOTIVE proprietary protocol**

* fuse protection at 3.5 A

** based on a communication bus EIA-485 (also known as RS-485)

A power adaptor is provided to convert from a 100-240 V AC, 50/60 Hz, 1.3 A to a 24 V DC, 3.75 A (90 W max) used in the light engine and another power adaptor to convert from a 100-240 V AC, 50/60 Hz, 1.3A to a 5 V DC, 2.4 A (12 W max) used in the LIGHT HUB is also included.

³ The RESTful API with the spectral sequence's functionality is necessary to make use of asynchronous mode

CONTROL SOFTWARE

With every SPECTRA TUNE LAB, a PC/Laptop version of the μ WAVE software is provided to control the device properly. For research applications that need advanced programmatic functionalities the RESTful API is the recommended option.

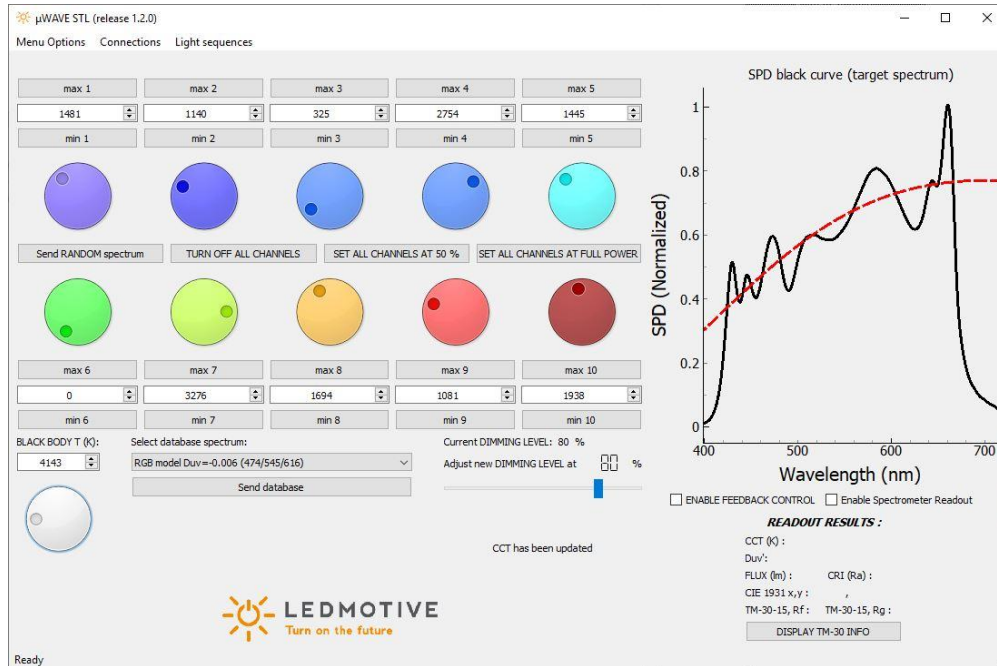


Figure 5. Screenshot of the μ WAVE software

Computer requirements:

- 64-bit Operating System
- Windows version; preferred WIN 8 and above

Features:

- Change the amplitude of each channel to create a specific spectrum
- Brightness adjustment
- Save and import light spectra
- Playback spectra from the spectral database
- Create, save, and reproduce light sequences (dynamic streaming of light spectra) by adding different light spectra to the sequence pool

OPTIONAL: RESTful API

To provide the user with full programming flexibility in the operation of the SPECTRA TUNE LAB, a RESTful API is available for the LIGHT HUB. The LIGHT HUB can be accessed using the HTTP protocol under any programming language (C, C++, C#, Python, MATLAB, Java, JavaScript, etc.).

Some details are provided in Appendix 2. Please contact us at info@ledmotive.com for further information.

PRODUCT PARTS

The SPECTRA TUNE LAB includes the following items:

- Spectrally tunable LED light engine (weight = 1.5 Kg)
- Light engine power supply (from 110 – 240 V A/V to 24 V D/C)
- LIGHT HUB control
- Control power supply (from 110 – 240 V A/C to 5 V D/C)
- Standard optical tables compatible mounting hole adaptors
- Communications cable (RJ9)
- UBS to mini USB connector cable
- Pen Drive
 - μ WAVE installation software
 - Software guide
 - LED calibration report and LED calibration files
 - User-guide
- IP67 rugged carrying suitcase

OPTIONAL:

- C-mount adaptor
- License & RESTful API documentation

Figure 6. Items delivered with the SPECTRA TUNE LAB system.

Total weight = 5.7 Kg



DIMENSIONS

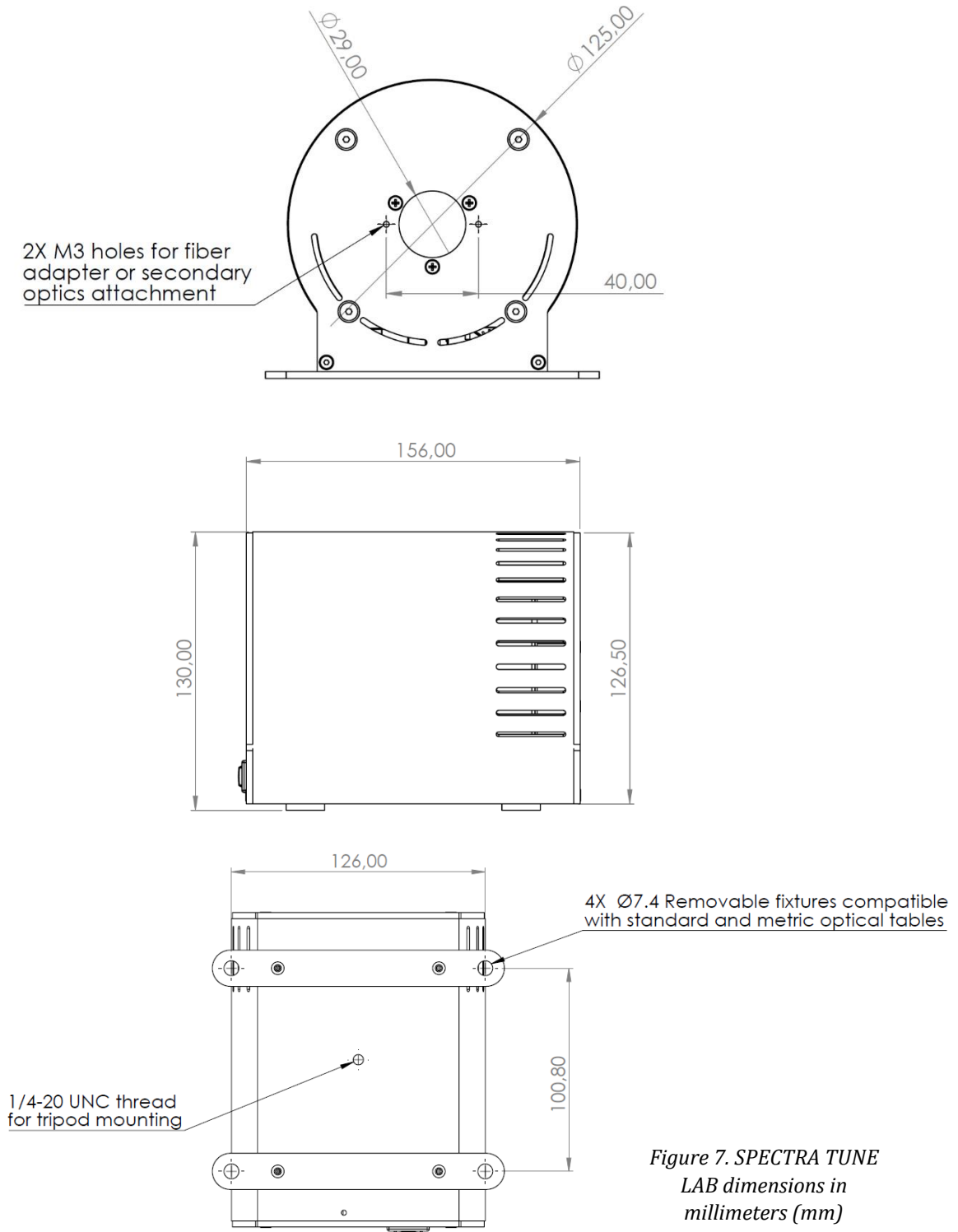


Figure 7. SPECTRA TUNE LAB dimensions in millimeters (mm)

OPTIONAL: C-MOUNT ADAPTOR

LEDMOTIVE can provide with a C-mount adaptor at the output area of the diffuser.

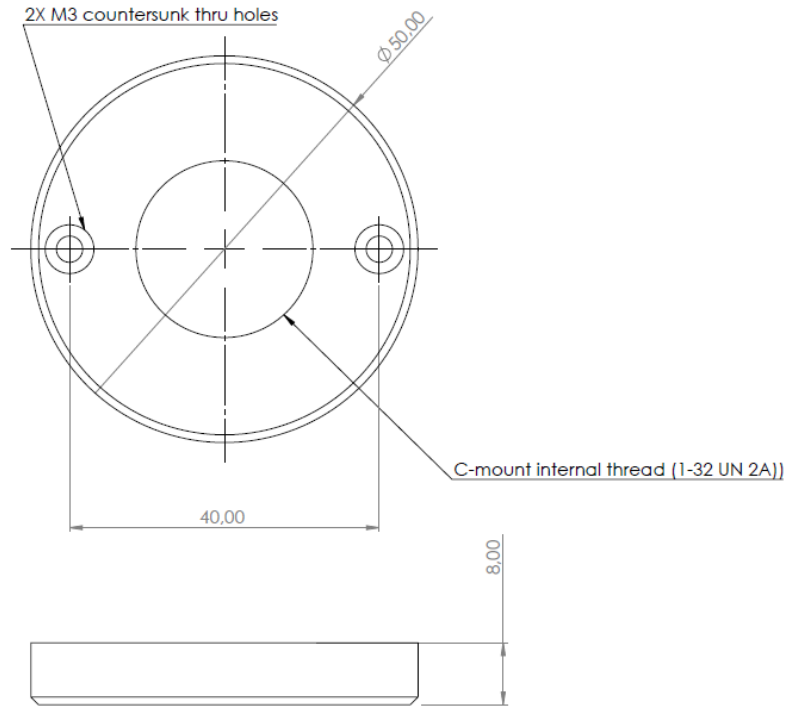


Figure 8. C-mount dimensions

C-mount is a market standard in optics. This C-mount adaptor is designed to allow the connection of compatible standard light guide connectors (Liquid Light Guide and/or Optic Fiber) to the SPECTRA TUNE LAB. email us at info@ledmotive.com for further information.

QUICK START – OPERATING INSTRUCTIONS

1. Connect all parts together as shown in Figure 9

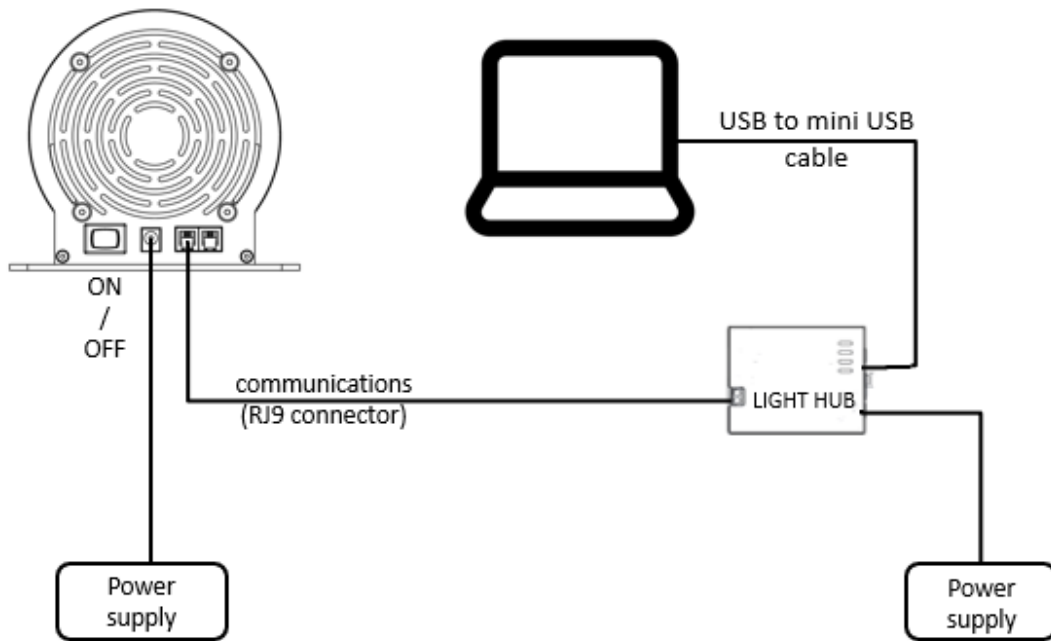


Figure 9. Schematics of the SPECTRA TUNE LAB connections. Instead of a USB to mini USB cable which is responsible for the local network, an ethernet connector cable can be used to connect the LIGHT HUB to a ROUTER or LAN.

2. Wait for the “Green” light to appear in the LIGHT HUB
3. Turn ON the Light Engine
4. Execute the μ WAVE software control
5. Follow the software guide from the pen-drive provided

There may be cases when multiple SPECTRA TUNE LAB’s are being used together with the same LIGHT HUB. In this case it is possible to connect different devices in serial as show in Figure 10 using the data in (DI) and Data out (DO) connections cable.

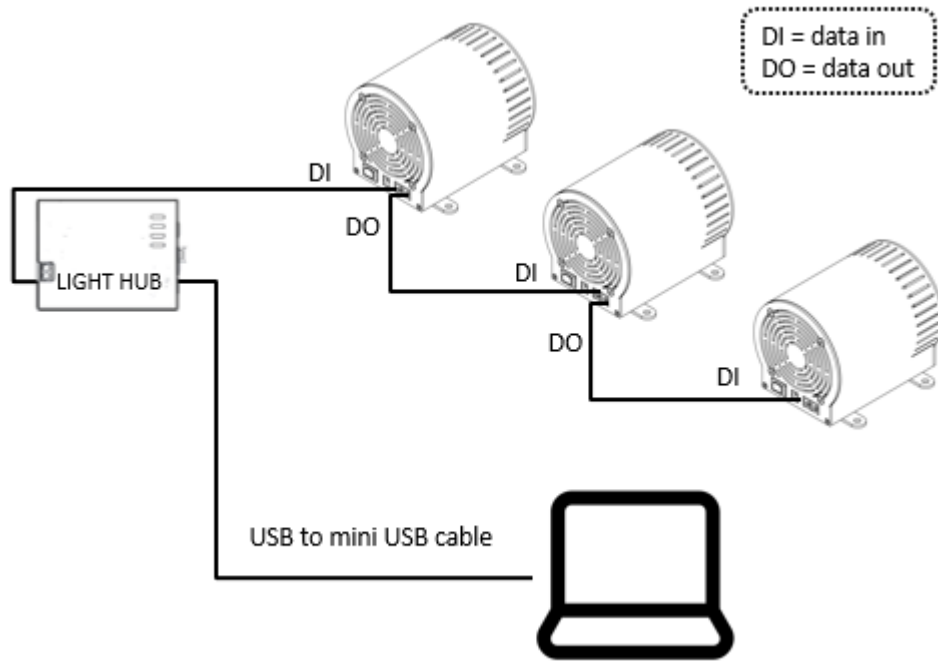


Figure 10. Schematics of several SPECTRA TUNE LAB's connected and controlled by a single LIGHT HUB

FEATURES - SUMMARY

Source type	Multiple high-power LED
Max Luminous Flux	3800 lm ⁴
Spectral range	400-700 nm
Light output pattern	Quasi-Lambertian
Operating temperature range	0 °C to +35 °C
Synchronous operation mode speed	< 250 milliseconds
Feedback control loop	Not enabled by default
Thermal control available	Yes
Power protection available	Yes
Nominal Input voltage	24 V DC (Constant voltage) ± 5%
Max Input current	3.3 A
Max Input electrical power	80 W
Communications protocol	bus EIA-485
Control software	μWAVE
Dimensions (mm)	156 x 126 x 130
IP	20
Insolation Class	Class II
OPTIONAL	
Adapters	C-Mount adaptor
Advanced control software	RESTful API
Asynchronous operation mode speed	10 milliseconds (API required)

Table 3. Summary of features

⁴ Values may change slightly depending on the currently available LED binning



MAINTENANCE & SERVICE

- If a fingerprint mark or dirt is observed at the diffuser, you may clean it. Before cleaning, disconnect from the main supply and allow the system to cool down. Wipe the surface of the diffuser gently with a tissue containing ethanol.
- Do not open, disassemble, or manipulate the SPECTRA TUNE LAB system

WARNING & SAFETY

- All statements regarding safety of operation, warranty and technical data only apply when the unit is operated correctly according to its specifications. The safety of any system incorporating the equipment is the responsibility of the assembler of the system.
- All necessary measures must be taken to avoid electric shock when handling electrical and/or electronic equipment. In case of doubt disconnect the main power supply when handling this electrical equipment.
- The SPECTRA TUNE LAB is intended for use in dry interiors only. It is not water resistant and must be protected from adverse weather conditions (hot and humid).
- To avoid damage, do not expose it to spray, liquids, dust, or chemical products.
- To prevent injury, use this product in accordance with the International Standard "Photobiological Safety of Lamps & Lamp Systems" IEC 62471.
- This light engine falls under Risk Group RG1 – Low Risk Group in accordance with the standard IEC 62471:2008. Regardless of the risk factor classification, LEDMOTIVE does not recommend staring directly into any LED lamp or luminaire.
- During normal operation, the light engine can reach high temperature, be careful when handling and avoid touching it when it hot.
- The SPECTRA TUNE LAB device uses an active cooling system to dissipate the heat produced by the LEDs. Do not manipulate the light engine when it is connected to the mains and ensure there are always free space around the device to allow air flow.

DISPOSAL

- In accordance with EU Directive WEEE (Waste Electrical and Electronic Equipment), this scientific equipment must not be disposed of with another household waste.
- At the end of their life, it must be taken to the appropriate local facility available for the disposal or recycling of electronic products.

WARRANTY

This product has passed the EU regulations and directives. See Appendix 1 for further details. LEDMOTIVE offers a one-year limited warranty.

DISCLAIMER

This document is intended for all audiences. The material herein is provided "AS-IS" and LEDMOTIVE makes no warranty of any kind regarding this material.

LEDMOTIVE shall not be liable for errors and omissions contained herein.

All product specifications and data included in this document are subject to change without notice to improve operation, reliability, design or otherwise.

APPENDIX 1: DIRECTIVE & NORMS

This product complies with the following directives and norms:

DIRECTIVE:

- 2014/35/EU: Low Voltage Directive (LV)
- 2014/30/EU: Electromagnetic Compatibility (EMC) Directive
- 2011/65/EU: RoHS Directive

NORMS:

- EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use.
- EN 62471:2008 Photobiological safety of lamps and lamp systems
- EN 50581:2012 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

APPENDIX 2: RESTful API

To be able to control the light output, a RESTful API is available to send the proper commands to the SPECTRA TUNE LAB.

Once the LIGHT HUB is powered on and connected to a computer, HTTP commands (GET/SET/POST) can be programmed.

With the API the user can:

- Read the temperature from the PCB Board
- Switch on the system with a default spectrum
- Send a specific spectrum
- Read a spectrum
- Read the current luminous flux of the system
- Switch off the lights
- Define a default spectrum
- Define parameters settings
- Work the luminaire in asynchronous mode (spectral sequences)
- And much more...

Ledmotive Technologies, SL
C/ de Joan Comorera 8-12, Local 15, Escalera H - 08030 - BARCELONA – SPAIN
EMAIL : info@ledmotive.com
TEL +34 934 884 890