SPECTRA TUNE HCL

Human Centric Lighting for Researchers

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DESCRIPTION

The SPECTRA TUNE HCL device is a unique LED downlight luminaire for Human Centric Lighting researchers developed by LEDMOTIVE. The system can deliver either white light or any light spectrum obtained from the modulation of each of its different wavelength channels. No warm up time is required, and light can be dimmed from 0% to 100% for each channel with a resolution depth of 12 bits (4096 steps).

The standard SPECTRA TUNE HCL is equipped with 10 different types of colored LEDs. Optionally, the customer can tailor its own wavelength configurations (up to 12 different LED channels) by filling a Customer Special Request form.

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 playback programmed spectra sequences over time, dynamically modifying the spectral components and atmosphere present in the working environment.

SPECTRA TUNE HCL – Features

- High power multi-spectral LED light engine
- Independent wavelength channel dimming
- Precise, accurate and stable light emission
- No warm up period required
- Compact and lightweight downlight
- Integrated thermal protection
- Standard mounting drill hole (121 mm)
- Compatible with LIGHT CREATOR® digital light IoT and spectral sharing platform
- μWAVE Software© with the SPECTRA TUNE HCL basic operation controls
- Optional: RESTful API for scientific custom applications
- Optional: IP65 front glass
- Multiple SPECTRA TUNE HCL devices operation (up to 1024 per LIGHT HUB)
LED-ENGINE: STANDARD CONFIGURATION

Below is a summary of the standard configuration. Values may change slightly depending on the current availability of the different wavelength (color) or flux bins.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Nº of LEDs</th>
<th>Color</th>
<th>Peak Emission (nm)</th>
<th>radiometric value (W)</th>
<th>Photometric Value (lm)</th>
<th>FWHM (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 1</td>
<td>2</td>
<td>UV</td>
<td>429</td>
<td>0.74</td>
<td>13.4</td>
<td>16</td>
</tr>
<tr>
<td>CH 2</td>
<td>2</td>
<td>Royal Blue</td>
<td>446</td>
<td>0.95</td>
<td>35.8</td>
<td>22</td>
</tr>
<tr>
<td>CH 3</td>
<td>3</td>
<td>Dark Blue</td>
<td>465</td>
<td>0.94</td>
<td>73.9</td>
<td>27</td>
</tr>
<tr>
<td>CH 4</td>
<td>3</td>
<td>Blue</td>
<td>475</td>
<td>0.89</td>
<td>97.5</td>
<td>27</td>
</tr>
<tr>
<td>CH 5</td>
<td>5</td>
<td>Cyan</td>
<td>505</td>
<td>0.98</td>
<td>319.3</td>
<td>34</td>
</tr>
<tr>
<td>CH 6</td>
<td>5</td>
<td>Green</td>
<td>525</td>
<td>0.77</td>
<td>389.2</td>
<td>37</td>
</tr>
<tr>
<td>CH 7</td>
<td>10</td>
<td>Lime</td>
<td>550</td>
<td>2.75</td>
<td>1256.4</td>
<td>115</td>
</tr>
<tr>
<td>CH 8</td>
<td>12</td>
<td>PC Amber</td>
<td>595</td>
<td>2.76</td>
<td>990.9</td>
<td>81</td>
</tr>
<tr>
<td>CH 9</td>
<td>2</td>
<td>Red</td>
<td>638</td>
<td>0.62</td>
<td>101.9</td>
<td>21</td>
</tr>
<tr>
<td>CH 10</td>
<td>4</td>
<td>Deep Red</td>
<td>660</td>
<td>1.25</td>
<td>81.4</td>
<td>23</td>
</tr>
</tbody>
</table>

Figure 2. Generic features of the standard SPECTRA TUNE HCL downlight

Figure 3. (left) CIE 1931 xy coordinates of the 10 channels that define the color gamut and (right) Spectral Power Distributions (SPDs) of the LED channels

All active channels are mixed at the exit plane of the LED module, which provides the SPECTRA TUNE HCL with a smooth (highly uniform in color) light.
SPECTRAL MODULATION

Example of two different spectral modulations that best reproduce a blackbody radiation curve at two different temperatures (2700 K and 6500 K):

Figure 4. Example of two different spectral fittings (2700 K and 6500 K blackbody radiators)
LED-ENGINE: CUSTOMER SPECIAL REQUEST

Even though the standard version comes with 10 wavelength channels, the SPECTRA TUNE HCL has indeed 12 physical drivers which can be grouped in different channels. Each of these drivers can control a specific number of LEDs as shown in the table below.

<table>
<thead>
<tr>
<th>Physical Driver</th>
<th>Nº of LEDs</th>
<th>LED type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr 1</td>
<td>2</td>
<td>See Table A</td>
</tr>
<tr>
<td>Dr 2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dr 3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dr 4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Dr 5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dr 6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dr 7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dr 8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Dr 9</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Dr 10</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Dr 11</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dr 12</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

Table A | peak wavelength range
---|----------------------
UV-VIS | from 380 nm to 425 nm
VIS | from 440 nm to 670 nm
NIR | 850 nm, 940 nm

Table B | peak wavelength range
---|----------------------
VIS | from 440 nm to 750 nm

Figure 5. Different types of LEDs and number of LEDs in each driver for a Customer Special Request option

Based on a Customer Specific Request (CSR), different wavelength channel arrangements can be ordered to build a customized light engine, with wavelength channels spanning from the long ultraviolet to the near infrared (please contact sales for a quotation). Further developments may require a full new design of the LED PCB and need to be discussed in detail with our technical team.

Please contact our Sales team at sales@ledmotive.com to find out more about how to define your special requests and get the perfect multi-channel solution that suits best your needs.
SPECTRAL PRECISION, ACCURACY and STABILITY

LEDMOTIVE patented technology allows the SPECTRA TUNE HCL to emit light spectra with unprecedented accuracy and precision. It also offers perfect stability over time thanks to the on-board CMOS spectrophotometer and the associated feedback loop control algorithms.

The proper indicator for the goodness of a spectral fit is the Mean Absolute Percentage Deviation (MAPD). The MAPD gives an idea of the percentage error measurement between a target spectrum (after applying a non-negative least square method to the channel's PWM signal) and the measured spectrum. The MAPD expression is given by

\[
MAPD = \frac{100}{n^0 \text{ of points}} \sum_{i=0}^{n^0 \text{ of points}} \left| \frac{SPD_{\text{actual}}^i - SPD_{\text{target}}^i}{SPD_{\text{target}}^i} \right|
\]

The table below shows MAPD values obtained from different light spectra and output powers. When the feedback loop is enabled, a significant improvement can be seen and a very low MAPD is obtained.

Spectral errors are kept below 3% with the optical feedback ON. In cases, this translates into color deviations Duv' lower than 10⁻³ or well below a 4-step Mac Adam (ANSI C78.377-2015 specifications).

<table>
<thead>
<tr>
<th>MAPD</th>
<th>W/O feedback loop</th>
<th>W/ feedback loop</th>
<th>Duv' (color matching feedback)</th>
<th>% improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST spectrum 1- low power</td>
<td>4</td>
<td>3</td>
<td>8.00E-04</td>
<td>25%</td>
</tr>
<tr>
<td>TEST spectrum 1- medium power</td>
<td>2</td>
<td>2</td>
<td>9.00E-04</td>
<td>0%</td>
</tr>
<tr>
<td>TEST spectrum 1- high power</td>
<td>3</td>
<td>2</td>
<td>2.30E-03</td>
<td>33%</td>
</tr>
<tr>
<td>TEST spectrum 2- low power</td>
<td>6</td>
<td>4</td>
<td>3.50E-03</td>
<td>33%</td>
</tr>
<tr>
<td>TEST spectrum 2- medium power</td>
<td>3</td>
<td>2</td>
<td>4.00E-04</td>
<td>33%</td>
</tr>
<tr>
<td>TEST spectrum 2- high power</td>
<td>2</td>
<td>2</td>
<td>8.00E-04</td>
<td>0%</td>
</tr>
<tr>
<td>TEST spectrum 3- low power</td>
<td>8</td>
<td>4</td>
<td>4.70E-03</td>
<td>50%</td>
</tr>
<tr>
<td>TEST spectrum 3- medium power</td>
<td>3</td>
<td>2</td>
<td>5.00E-04</td>
<td>33%</td>
</tr>
<tr>
<td>TEST spectrum 3- high power</td>
<td>2</td>
<td>2</td>
<td>2.00E-03</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Figure 6. MAPD values for different spectra with and without the feedback loop control respectively and its % of improvement*
SPECTRA TUNE HCL
Human Centric Lighting for Researchers

SPECTRAL SWITCHING TIME

The SPECTRA TUNE HCL works in synchronous mode by default.

In this mode, the SPECTRA TUNE HCL acknowledges receipt of all the commands sent by the LIGHT HUB before it accepts a new instruction, so that “collisions” between messages can be detected and duly corrected. Typical response times of this operation mode is 250 milliseconds approximately. Most of the commands in the SPECTRA TUNE HCL are programmed to work in synchronous mode.

Whenever the application requires fast switching times, the SPECTRA TUNE HCL can be set to work in asynchronous mode1. In that case, the SPECTRA TUNE HCL does not send an acknowledge receipt signal to the LIGHT HUB, making it possible a sort of spectral streaming in real time. Typical average time between consecutive light spectra operating under the asynchronous mode is less than 10 milliseconds (1 spectrum every 10 milliseconds).

THERMAL PROTECTION

The SPECTRA TUNE HCL 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

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Input Voltage</td>
<td>100-270 V AC 50/60 Hz</td>
</tr>
<tr>
<td>Max. Input Power</td>
<td>55 W (limited by firmware)</td>
</tr>
<tr>
<td>Max. Input Current</td>
<td>2.5 A* (limited by firmware)</td>
</tr>
<tr>
<td>Data connector</td>
<td>Electric terminal</td>
</tr>
<tr>
<td>Data communication control</td>
<td>LEDMOTIVE proprietary protocol**</td>
</tr>
</tbody>
</table>

* fuse protection at 3.5 A
** based on a communication bus EIA-485 (also known as RS-485)

OPTIONAL IP65 GLASS PROTECTOR

LEDMOTIVE can provide, optionally, a transparent glass protector and a rubber O-ring that warrants a frontal IP65.

---

1 The optional RESTful API is necessary to make use of the asynchronous mode. Go to page #11 for more details
LIGHTING LEVELS – INSTALLATION PROPER DIMENSIONING

As in every lighting installation, light intensity levels on the specific room where the SPECTRA TUNE HCL is going to be installed will depend on several parameters such as dimensions, wall painted colors, furniture, presence of natural light, materials, etc.

The following table may be used as a quick guide to calculate the number of SPECTRA TUNE HCL luminaires that would be needed for a particular application, depending on the room dimensions and the desired maximum illuminance levels required for the research undergone²:

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>300 lx</th>
<th>500 lx</th>
<th>1000 lx</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 m²</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>12 m²</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>16 m²</td>
<td>6</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

Figure 7. Lighting simulation of a residential bedroom

Figure 8. Quick calculation of number of luminaires required as a function of illuminance and room dimensions

² This table should be considered as a rough approximation, not contractual data. Calculations have been done for a rectangular room with a simple furniture equipment, 2.5 m ceiling height, with no natural or additional light sources and with a regular maintenance and cleaning policy.
CONTROL SOFTWARE

With every SPECTRA TUNE HCL, a PC/Laptop a µWAVE Software© license is provided to control the installation properly. For research applications that need advanced programmatic functionalities please check the optional RESTful API described in Appendix 2).

![Screenshot of the µWAVE Software](image)

**Figure 9. Screenshot of the µWAVE Software**

Computer requirements:
- 64-bit Operating System
- Windows version: preferred WIN 8 and above

Features:
- Change the amplitude of each channel to design a specific spectrum
- Dim the light output
- 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

Please contact our sales team at sales@ledmotive.com if an executable version with special requests (MAC version or 32-bit OS) is needed.
OPTIONAL RESTful API

To provide the user with full programming flexibility in the operation of the SPECTRA TUNE HCL, 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, but an Application Note explaining in full the RESTful API commands is available on request. Please contact the sales team at sales@ledmotive.com to request a quotation on this optional item.

PRODUCT PARTS

The SPECTRA TUNE HCL includes the following hardware and software items:

- **Spectrally tunable** LED downlight luminaire
- **µWAVE Software©**

OPTIONAL:

- IP65 glass protector
- RESTful API

Other needed material (not included)³:

- LEDMOTIVE LIGHT HUB
- End-of-line (EOL) resistor
- Ethernet cable (to connect the LIGHT HUB to the LAN router)
- Communications cable (single cable to connect all the luminaires to the LIGHT HUB device)

³ See Appendix 3 for more information about the LEDMOTIVE LIGHT HUB and communication wires
DIMENSIONS (in mm)

Figure 10. SPECTRA TUNE HCL dimensions and drill hole

PHOTOMETRY

Figure 11. SPECTRA TUNE HCL photometry
ELECTRICAL CONNECTIONS

Each SPECTRA TUNE HCL luminaire and the LIGHT HUB should be connected to the mains electrical power (please check that the provided power supply comply with the country mains electrical network voltage and frequency specifications before connecting) as shown in Figure 12.

Each downlight comes with its own power supply unit as well as the LIGHT HUB.

![Diagram of electrical and signal connection scheme](image)

*Not provided by LEDMOTIVE

*Figure 12. Electrical and signal connection scheme*

The installer must wire the installation with a single twisted pair bus cable to enable communication between the LIGHT HUB and the network of SPECTRA TUNE HCL downlights.

**NOTE:** Installation of the luminaires and the equipment MUST be done only by qualified staff, taking the security measures collected by the regulation in force at the installation site.

COMMUNICATIONS BUS

To build the communication bus, a shielded twisted pair wire should be used. It is recommended to use any range of wires between AWG-24 to AWG-18 with a characteristic impedance of 120 Ω. Ideally, the wires should be of different colors to avoid confusion when connecting all luminaires to the bus. Each luminaire should be connected to the twisted pair bus as show in Figure 13.
Even though in some circumstances may not be necessary, it is highly recommended to always use an end-of-line (EOL) 120 Ohm (Ω) resistor.

![Diagram of communication bus layout](image)

*Figure 13. Details of the communication bus RS485. Pair of twisted wires must be connected to the LIGHT HUB connector labeled A, B.*

An example of the communication bus layout is shown in *Figure 14* for a typical configuration:

![Diagram of example bus layout](image)

*Figure 14. Example of the bus layout*

As can be seen, the twisted pair of wires are connected to the LIGHT HUB and each luminaire is connected to the twisted pair bus. An EOL resistor is used at the end of the bus (recommended).

The LIGHT HUB is then connected to the intranet LAN using an ethernet connector or directly to a PC/laptop using a mini-USB to USB connector cable. The Software provided must be installed in a computer that is in the same LAN network as the LIGHT HUB (not necessary if a network via a mini-USB to USB cable is used instead).

Each SPECTRA TUNE HCL downlight has its own power supply. The power supply not only provides the required power to the downlight but also includes a connector to clamp the communication bus (twisted pair). In this connector, shown in *Figure 15*, there are 4 conductors. The first two conductors are reserved for bus-B (input and output) and the other two for bus-A (input and output).
Figure 15. A and B connector as visible in the driver

Figure 16 shows a schematic on how the wires should be connected for each power supply to build the communication bus. The electrical installation team will be responsible to set up the communication bus according to the location of the different luminaires in the room under consideration.

Figure 16. Communication bus connections for multiple luminaires
LUMINAIRE INSTALLATION

1. TEMPERATURA DE OPERACIÓN
   AMBIENT TEMPERATURE RANGE
   +10 / +40°C

2. CONEXIÓN ELÉCTRICA Y BUS CONTROL
   MAIN POWER & CONTROL BUS CONNECTION
   - AC 230V/50Hz
   - L= Línea / Line  ---  
   - N= Neutro / Neutral ---
   - E= Tierra / Earth ---  
   - PRI

   NOTA: Debe colocarse la tapa clara del transformador
         para garantizar el aislamiento y bloqueo de las
         conexiones eléctricas
   NOTE: It is necessary to close the transformer cover in
         order to clamp and isolate the electrical connections.

3. MONTAJE A TECHO
   CEILING ASSEMBLY

   ¡ATENCIÓN! ¡WARNING!
   La instalación de este material puede resultar peligrosa y debe ser
   realizada por personal cualificado.
   Installation of this material can be dangerous and must be done by qualified personnel.

   EN60598-2-2:2012
   EN60598-1:2015

   IP 20
   ~230V/50-60Hz

   www.ledmotive.com
NOTES:

- Installation of the luminaires and the equipment MUST be done only by qualified staff, taking the security measures collected by the regulation in force at the installation site.
- Do not manipulate the luminaire when it is connected to the mains.
- The luminaire is designed to be installed in a plaster or Armstrong type ceiling, please contact us at sales@ledmotive.com if other ceiling (like aluminum plate) is used in the installation.
- Minimum recessed height = luminaire height (h) + 40 mm.
- Prevent any contact with the cooling fan.

QUICK START

1. Connect all the items together as explained in the previous sections
2. Make sure the EOL resistor is connected to the data connector of the last luminaire in the bus
3. Connect all luminaires to the mains electrical net
4. TURN ON the luminaires (through their correspondent wall switches)
5. Run the provided Control Software
6. Discover what you can do with the SPECTRA TUNE HCL

As part of a Customer Special Request, a Wi-Fi LIGHT HUB can be used to reduce the number of cables. Please contact our sales team at sales@ledmotive.com for further information.
### FEATURES - SUMMARY

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source type</td>
<td>Multiple high-power LED</td>
</tr>
<tr>
<td>Output</td>
<td>10 different spectral bands</td>
</tr>
<tr>
<td>Max Radiometric Power</td>
<td>7.4 W (for all channels at full power)⁴</td>
</tr>
<tr>
<td>Max Luminous Flux</td>
<td>1950 lumens</td>
</tr>
<tr>
<td>Spectral range</td>
<td>400-700 nm</td>
</tr>
<tr>
<td>Beam angle</td>
<td>60°</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>0 °C to +35 °C</td>
</tr>
<tr>
<td>Synchronous operation mode speed</td>
<td>250 milliseconds</td>
</tr>
<tr>
<td>Feedback control loop</td>
<td>Enabled by default</td>
</tr>
<tr>
<td>Nominal Input voltage</td>
<td>100-270 V AC 50/60 Hz</td>
</tr>
<tr>
<td>Max Input current</td>
<td>2.5 A (limited by firmware)</td>
</tr>
<tr>
<td>Max Input Power</td>
<td>55 W (limited by firmware)</td>
</tr>
<tr>
<td>Communications protocol</td>
<td>bus EIA-485</td>
</tr>
<tr>
<td>Control software</td>
<td>μWAVE Software©</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>Ø133 x 175 mm</td>
</tr>
<tr>
<td>IP</td>
<td>20</td>
</tr>
<tr>
<td>Insolation Class</td>
<td>Class II</td>
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</tbody>
</table>

### OPTIONAL

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal IP65</td>
<td>Transparent Glass</td>
</tr>
<tr>
<td>Advanced control software</td>
<td>RESTful API</td>
</tr>
<tr>
<td>Asynchronous operation mode speed</td>
<td>10 milliseconds (API required)</td>
</tr>
</tbody>
</table>

⁴ Radiometric power may slightly change depending on the currently available LED binning
MAINTENANCE AND SERVICE

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

WARNING AND SAFETY

- Installation of the luminaires and the equipment MUST be done only by qualified staff, taking the security measures collected by the regulation in force at the installation site.
- 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 lighting equipment.
- The SPECTRA TUNE HCL 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.
- This LED-based module must not be operated in explosive environments.
- 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 to the standard IEC 62471:2006. Regardless of the risk factor classification, LEDMOTIVE does not recommend staring directly into any LED lamp or luminaire.
- During normal operation, the fixture can achieve high temperature, be careful when handling it to avoid burning.
- The SPECTRA TUNE HCL luminaire uses an active cooling system to dissipate the heat produced by the LEDs when they are on. Do not manipulate the luminaire when it is connected to the mains and prevent any contact with the moving parts (cooling fan).
- 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.

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.
APPENDIX 1: Compliance with directives and norms

This product complies with the following directives and norms:

DIRECTIVE:
- 2014/35/UE: Low Voltage (LV)
- 2014/30/UE: Electromagnetic Compatibility (EMC)

NORMS:
- UNE-EN 60598-1:2015 General requirements and tests
- UNE-EN 60598-2-2:2012 Fixed luminaires for general lighting
- UNE-EN 60598-2.2: Recessed luminaires
- UNE-EN 61000-3-2:2014 Limits for harmonic current emissions (input current ≤16A)
- UNE-EN 61000-3-3:2013 Flicker and voltage fluctuations (input current ≤16A)
- UNE-EN 55015:2013 Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
- UNE-EN 55022:2011+/AC:2012 Information technology equipment, Radio disturbance characteristics
- UNE-EN 61547:2011 Luminaires, EMC immunity requirements
- UNE-EN 62471-2009: Photobiological safety of lights and devices that uses light
APPENDIX 2: Light programmatic control with the RESTful API

To be able to control the lights, a RESTful API is available to send the proper commands to the SPECTRA TUNE HCL.

Once the LIGHT HUB is powered on and connected to a computer, it will start the REST API automatically and will begin to listen to a specific port.

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
- And much more…
APPENDIX 3: Communications components

LIGHT HUB

The LIGHT HUB is the device responsible to manage and control the communications from and towards a single downlight or a grouped of downlights. The communication bus is a EIA-485 (also known as RS-485) allowing for high speed signals over long distances in serial connections.

The LIGHT HUB is designed for indoor applications only (IP20).

The LIGHT HUB can be accessed remotely connecting the device to the local network (LAN) using an ethernet cable or it can also be accessed locally using a mini-USB to USB cable directly connected to a PC or laptop (first a network over the USB must be created between the PC and the LIGHT HUB).

To provide the user with full programing flexibility, an optional RESTful API is available. Please contact the sales team at sales@ledmotive.com to ask for the documentation if you have purchased this item.

Please refer to the LIGHT HUB datasheet to find more information about this device.

COMMUNICATION WIRES

To build the communication bus, a shielded twisted pair of wires should be used. It is recommended to use any range of wires between AWG-24 to AWG-18 with a characteristic impedance of 120 Ω. Ideally the wires should be of different colors to avoid confusion when connecting all luminaires to the bus. We strongly recommend suiting the following regulations in the wire selection:

- UNE-EN 50267-2-1 / IEC 60754-1
- UNE-EN 50265-2-1 / IEC 60332-1
- UNE-EN 50266 / IEC 60332-3
- UNE-EN 50268 / IEC 61034
- UNE-EN 50267-2-2 / IEC 60754-2