araya® Logic Module
Tunable Color Linear LED Arrays (LTM2)
24V DC Input (Constant Voltage)
1000 Typical Peak Lumens / Foot

Data Sheet
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**Description**

Araya Logic Modules (ALM) connect to tunable color mid-power linear LED arrays that mix five colors of LEDs to deliver tunable and dimmable white light at 90+ CRI with color consistency of <2 step MacAdam ellipse (SDCM) across a tuning range of 1650 - 8000K. The ALM is connected to one or more LED arrays via low-cost ribbon cables, and features on-board driver electronics and the araya logic for precise control of LED light output while tuning and dimming. On board closed loop thermal feedback compensates each color channel for thermally induced variations in light output due to dimming or changes in ambient temperatures. On-board closed loop optical feedback measures the lumen depreciation of each channel and re-balances the color model to ensure color consistency over the 50,000 hour life of the LED array. A patented in-line manufacturing process captures and stores the spectral characteristics of each LED on the array, rapidly generating a unique color model for each array. Delivered light can be dimmed from 100 - 0.1% at constant CCT. Gradients of saturated colors from 1 - 100% can be added to color points within the tuning range. The Zhaga-compliant LED arrays are compatible with traditional 0 - 10V wired controls, and feature on-board Bluetooth Low Energy (BLE) for commissioning. The arrays can access DMX512-A-RDM, Legrand Watsitopper’s Digital Light Management (DLM) control interface, DALI Type 8 or Lutron EcoSystem inputs via an optional accessory board that connects to an electrically isolated expansion port within the ALM. For simple deployment, scene set allows up to five scenes to be pre-programmed into the LED array during production and recalled at the venue using a 0 - 10V recommended dimmer or via Bluetooth. Commissioning of the LED array and the re-programming of scenes is done via the wireless araya Tunable Color 2.0 iOS app that connects to the embedded Bluetooth radio.

**Key Features**

- Tunable range: 1650 - 8000K
- 90+ CRI
- Dimmable from 100 - 0.1% at constant CCT
- Color gamut control: gradients of saturated colors from 1 - 100% can be added to color points
- Integrated driver electronics and araya logic
- On board thermal and optical feedback for color consistency of <2 step MacAdam ellipse over 50,000 hour life
- In-line spectral capture and storage creates an unique color model for each Zhaga-compliant LED array, resulting in consistent CRI and CCT across all arrays
- On-board thermal turndown
- Compatible with 0 - 10V wired controls
- On-board Bluetooth Low Energy (BLE) for commissioning
- DMX512-A-RDM, Watsitopper DLM, DALI Type 8 or Lutron EcoSystem control accessibility via optional accessory board that connects to an electrically isolated compartment within the ALM
- Scene set enables up to five scenes to be preprogrammed and recalled using a 0 - 10V recommended dimmer or via Bluetooth
- DMX slots set by RDM or via wireless araya Tunable Color 2.0 iOS app
# Photometrics and Ordering Codes (Linear LED Array Kits)

<table>
<thead>
<tr>
<th>Tunable Range</th>
<th>Typical Peak Lumens</th>
<th>Nominal Length</th>
<th>Nominal Wattage (±10%)</th>
<th>Connectors Location</th>
<th>Ordering Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1650 - 8000K</td>
<td>8000</td>
<td>88 inches (4 x 22 in.)</td>
<td>80W</td>
<td>Bottom</td>
<td>80.001.097.03**</td>
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<tr>
<td></td>
<td>77 inches (1 x 11 in. + 3 x 22 in.)</td>
<td>70W</td>
<td>Top</td>
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</tr>
<tr>
<td></td>
<td>66 inches (3 x 22 in.)</td>
<td>60W</td>
<td>Bottom</td>
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<tr>
<td></td>
<td>55 inches (1 x 11 in. + 2 x 22 in.)</td>
<td>50W</td>
<td>Bottom</td>
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<tr>
<td></td>
<td>48 inches (2 x 24 in.)</td>
<td>40W</td>
<td>Top</td>
<td>80.001.103.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>44 inches (2 x 22 in.)</td>
<td>40W</td>
<td>Bottom</td>
<td>80.001.095.03**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>33 inches (1 x 11 in. + 1 x 22 in.)</td>
<td>30W</td>
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</tr>
<tr>
<td></td>
<td>24 inches (1 x 24 in.)</td>
<td>20W</td>
<td>Bottom</td>
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<tr>
<td></td>
<td>22 inches (1 x 22 in.)</td>
<td>20W</td>
<td>Bottom</td>
<td>80.001.094.03**</td>
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<tr>
<td></td>
<td>11 inches (1 x 11 in.)</td>
<td>10W</td>
<td>Bottom</td>
<td>80.001.093.03**</td>
<td></td>
</tr>
</tbody>
</table>

**CRI (Ra) Across Tuning Range:** >90**

**Dimming:** 100% to 0.1%**

**Nominal Color Consistency:** <2 step MacAdam ellipse (±0.002 Duv from ANSI C78.377-2008 curve)

**Color Consistency Over Life:** Calibration maintains original color points over life

**Lumen Maintenance:** L70 (70% of initial lumens) at 50,000 hours

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1. Kit includes linear LED array and araya™ Logic Module with on-board 0-10V and BT LE, as a factory pre-matched set which MUST be kept that way during installation for proper operation and control and CANNOT be separated. It does not include ribbon cables, cable assemblies, reflector end caps or accessory boards (see below for accessory ordering specifications).

2. Specifications are within ±10% of the nominal value. Peak efficacy is not necessarily at typical peak lumens.

*From 2000 - 6000K. **100 - 0.1% eFlicker Free dimming is available for the indicated arrays when connected to digital controls. 100 - 1% dimming is available with analog 0 - 10V control, and for all other modules regardless of control type.

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### Accessories (Ordered Separately)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
<th>Ordering Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8” long flat ribbon cable; 16-pin Tyco connectors at each end (for connecting 1 ft. linear boards to each other)</td>
<td>28.031.001.04</td>
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<tr>
<td>1</td>
<td>24” long flat ribbon cable; 16-pin Tyco connectors at each end (for connecting ALM to one linear boards)</td>
<td>28.030.002.02</td>
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<tr>
<td>1</td>
<td>32” long flat ribbon cable; 16-pin Tyco connectors at 0”, 24” and 32” (for connecting ALM to two linear boards)</td>
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<tr>
<td>1</td>
<td>44” long flat ribbon cable; 16-pin Tyco connectors at -20”; -12”; 0”; and 24” (for connecting ALM to three linear boards)</td>
<td>28.031.001.02</td>
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<tr>
<td>1</td>
<td>68” long flat ribbon cable; 16-pin Tyco connectors at -34”; -26”; 0”; and 34” (for connecting ALM to four linear boards)</td>
<td>28.031.001.03</td>
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<tr>
<td>1</td>
<td>24” long 2-wire ALM power cable assembly</td>
<td>28.030.001.01</td>
</tr>
<tr>
<td>1</td>
<td>24” long 7-wire ALM control cable assembly</td>
<td>28.002.002.01</td>
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<td>1</td>
<td>DMX512-A-RDM Accessory Board***</td>
<td>80.003.001.01</td>
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<td>1</td>
<td>Lutron Accessory Board***</td>
<td>80.003.002.02</td>
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<td>1</td>
<td>DALI Accessory Board***</td>
<td>80.003.004.01</td>
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<td>1</td>
<td>Legrand Wattstopper DLM - LMLM Module***</td>
<td>80.003.003.03</td>
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<tr>
<td>Set of 2</td>
<td>Reflector end caps</td>
<td>45.001.011.01</td>
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</table>

***Accessory boards are shipped pre-attached to the ALM, & cannot be shipped individually. Accessory boards for different controls should NOT be interchanged in the field. This will void the Lumenetix warranty.
3 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications (araya® LOGIC MODULE)

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>24V DC (Constant Voltage)</th>
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<tr>
<td>Nominal Power Input*</td>
<td>30W, 40W, 60W, and 80W</td>
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<tr>
<td>Nominal Current Input</td>
<td>1.25A (30W); 1.7A (40W); 2.5A (60W); 3.3A (80W)</td>
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<tr>
<td>Power Supply Classification</td>
<td>Class 2 (UP TO 100W RATED POWER)</td>
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<tr>
<td>Power and Control Connector</td>
<td>Power Connector: Molex 5023520200; Control Connector: Molex 874380743</td>
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<tr>
<td>Ribbon Cable Connector (supplied by third parties)</td>
<td>TE Micro-Match 215460-4 (requires TE mating connector 2-215083-0)</td>
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<td>Control Options**</td>
<td>0–10V, DMX512-A-RDM, Wattstopper DLM, Lutron® EcoSystem, DALI Type 8</td>
</tr>
<tr>
<td>CCT and Dimming Control Connections</td>
<td>Plug-in connector for 24 gauge leads</td>
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</table>

*araya® Logic Module (ALM) power dissipation is up to 10% of total power dissipation. Therefore ALM must be provided with adequate heat sink capability when applicable.

**DMX512-A-RDM, Lutron EcoSystem, DALI Type 8 or Wattstopper Digital Light Management control compatibility requires optional accessory board.

IMPORTANT

The araya® Logic Module (ALM) has on-board drive electronics, including dimming. A dimming driver should NOT be used.

3.2 Recommended Power Supplies (Constant Voltage)

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Part Number</th>
<th>Rated Power</th>
<th>1' array (10W)</th>
<th>2' array (20W)</th>
<th>3' array (30W)</th>
<th>4' array (40W)</th>
<th>5' array (50W)</th>
<th>6' array (60W)</th>
<th>7' array (70W)</th>
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<td>Amperor</td>
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<td>DELTA Electronics</td>
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<td>Philips Advance</td>
<td>LEDINTA0024V41F0</td>
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<td>✓</td>
</tr>
</tbody>
</table>

CAUTION:
• Using a constant current power supply, or using a triac or dimming driver, will damage the module and will void the Lumenetix warranty.
• The power supply MUST be evaluated with the module(s) that it will be operated with.
• If unqualified power supplies are used in a fixture, it will void the Lumenetix warranty.
• It is the responsibility of the fixture manufacturer to ensure that the power supply performance does not change over time. The Lumenetix warranty is void if problems occur as a result of such changes.

*U.L. CLASS 1 — NON-NORTH AMERICA ONLY.

NOTES:
• Recommendations are subject to change. Consult your Lumenetix representative for the most updated list.
• IMPORTANT: Please contact the power supply manufacturer to verify that the current version of the listed power supply still meets the latest Lumenetix testing approvals / qualifications.
• Power supply qualification process: if a power supply that is not part of the above list is submitted for testing to Lumenetix (during the design-in phase), it will be qualified or disqualified within two weeks of submission.
4.1.1 Linear LED Arrays

Array Dimensions (W x L)

- Nominal 88 inches array (4 x 22 in. boards)  
  W = 24 mm; L = 2240 mm
- Nominal 77 inches array (1 x 11 in. + 3 x 22 in. boards)  
  W = 24 mm; L = 1960 mm
- Nominal 66 inches array (3 x 22 in. boards)  
  W = 24 mm; L = 1680 mm
- Nominal 55 inches array (1 x 11 in. + 2 x 22 in. boards)  
  W = 24 mm; L = 1400 mm
- Nominal 48 inches array (2 x 24 in. boards)  
  W = 24 mm; L = 1214 mm
- Nominal 44 inches array (2 x 22 in. boards)  
  W = 24 mm; L = 1120 mm
- Nominal 33 inches array (1 x 11 in. + 1 x 22 in. boards)  
  W = 24 mm; L = 840 mm
- Nominal 24 inches array (1 x 24 in. boards)  
  W = 24 mm; L = 607 mm
- Nominal 22 inches array (1 x 22 in. boards)  
  W = 24 mm; L = 560 mm
- Nominal 11 inches array (1 x 11 in. boards)  
  W = 24 mm; L = 280 mm

Standard linear arrays are made up of a combination of 11 in. and 22 in. boards as per above. Other requested board lengths may be available.

araya® Linear LED Board (2000 lumens; 24 inches Nominal Length)

All dimensions are in millimeters. Linear board is shown with downward-facing connector on the bottom.

araya® Linear LED Board (2000 lumens; 22 inches Nominal Length)

All dimensions are in millimeters. Linear board is shown with downward-facing connector on the bottom.
4 MECHANICAL SPECIFICATIONS

4.1.1 Linear LED Arrays (continued)

araya® Linear LED Board (1000 lumens; 11 inches Nominal Length)
All dimensions are in millimeters. Linear board is shown with downward-facing connector on the bottom.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22.700.025.01</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>lumileds 3535L</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>462.038 16 PIN CONNECTOR 8-188275-6</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>67.700.002.01 B LTM2 INSULATOR PAD 1FT LX</td>
<td>1</td>
</tr>
</tbody>
</table>
4 MECHANICAL SPECIFICATIONS

4.1.2 Heat Sinking / Electrical Insulation of LTM2 Boards

To ensure proper electrical insulation between the linear arrays and heat sink, the linear arrays are provided with a pre-applied double sided adhesive insulating tape. This thermal pad insulates electrically while also allowing the heat to flow from the LED board to the luminaire's heat sink.

Be sure to remove the plastic liner before attaching the linear array to the heat sink.

araya® Thermal Pad for Linear LED Board (2 ft. Nominal Length)
All dimensions are in millimeters.

araya® Thermal Pad for Linear LED Board (1 ft. Nominal Length)
All dimensions are in millimeters.
4 MECHANICAL SPECIFICATIONS

4.1.3 Connector Cutouts / Hole Patterns for 2 Ft. Linear Array Fixture Designs

Leave adequate clearance around the ribbon cable connector so that it does not come in contact with the fixture’s metal edge.

Connector Cutouts / Hole Patterns for Linear LED Board (2 ft. Nominal Length)
All dimensions outside parentheses are in millimeters. All dimensions within parentheses are in inches.
4 MECHANICAL SPECIFICATIONS

4.1.4 Connector Cutouts / Hole Patterns for 1 Ft. Linear Array Fixture Designs

Leave adequate clearance around the ribbon cable connector so that it does not come in contact with the fixture’s metal edge.

Connector Cutouts / Hole Patterns for Linear LED Board (1 ft. Nominal Length)

All dimensions outside parentheses are in millimeters. All dimensions within parentheses are in inches.
4 MECHANICAL SPECIFICATIONS

4.2 araya® Logic Module

| ALM Dimensions (H x W x L) | H = 15.11 mm (0.60 in.); W = 30 mm (1.18 in.); L = 133 mm (5.24 in) |

Dimensions provided are for the ALM without optional accessory boards.

araya® Logic Module

All dimensions are in millimeters. The mounting holes are 5 mm in diameter.
5.1 araya® Logic Module with DMX512-A-RDM Accessory Board

| ALM Dimensions (H x W x L) | H = 18.13 mm (0.71 in.); W = 30 mm (1.18 in.); L = 133 mm (5.24 in.) |

araya® Logic Module with DMX Accessory Board and Cover
Dimensions outside parentheses are in millimeters. Dimensions within parentheses are in inches.
The mounting holes are 5 mm in diameter.

5.2 Mechanical Specifications (DMX512-A-RDM Accessory Board)

Lumenetix part #:
80.003.001.01

Wire Specifications:
22-24 AWG, stranded tinned copper (TC) only

Connector:
Phoenix Contact 1771033

DMX Accessory Board
All dimensions are in millimeters.
5 DMX512-A ACCESSORY BOARD

5.3 Mounting Specifications (DMX Accessory Board)

The Accessory Board is mounted on the 10-pin header and located on the two bosses, and then captured in place to the ALM with two (2) self-tapping screws.

**Screw Specifications:** Phillips Rounded Head Thread-Forming Screws for Plastic, 18-8 Stainless Steel, Number 4 Size, 1/8” Long; McMasterCarr # 99461A105.

**Torque Specifications:** 2.0 to 2.5 in-lb

**CAUTION:** The screws are very small and are self-threaded into small plastic bosses. Overtorquing will strip the plastic and damage the ALM housing.
6.1 araya® Logic Module with Lutron® EcoSystem Accessory Board

| ALM Dimensions (H x W x L) | H = 20.53 mm (0.81 in.); W = 30 mm (1.18 in.); L = 133 mm (5.24 in.) |

araya® Logic Module with Lutron Accessory Board and Cover
Dimensions outside parentheses are in millimeters. Dimensions within parentheses are in inches.
The mounting holes are 5 mm in diameter.

6.2 Mechanical Specifications (Lutron EcoSystem Accessory Board)

Lumenetix part #:
80.003.002.02

Wire Specifications:
18-22 AWG, solid wire or tin-dipped stranded

Connector:
TE 2834006-2
6 LUTRON ACCESSORY BOARD

6.3 Mounting Specifications (Lutron® EcoSystem Accessory Board)

The Accessory Board is mounted on the 10-pin header and located on the two bosses, and then captured in place to the ALM with two (2) self-tapping screws.

**Screw Specifications:** Phillips Rounded Head Thread-Forming Screws for Plastic, 18-8 Stainless Steel, Number 4 Size, 1/8" Long; McMasterCarr # 99461A105.

**Torque Specifications:** 2.0 to 2.5 in-lb

**CAUTION:** The screws are very small and are self-threaded into small plastic bosses. Overtorquing will strip the plastic and damage the ALM housing.
7 WATTSTOPPER DLM — LMLM MODULE

7.1 araya® Logic Module with Legrand Wattstopper’s DLM LMLM Module

| ALM Dimensions (H x W x L) | H = 20.27 mm (0.80 in.); W = 30 mm (1.18 in.); L = 133 mm (5.24 in.) |

araya® Logic Module with LMLM Module and Cover
Dimensions outside parentheses are in millimeters. Dimensions within parentheses are in inches.
The mounting holes are 5 mm in diameter.

7.2 Mechanical Specifications (LMLM Module)

Lumenetix part #:
80.003.003.03

Wire Specifications:
Solid 20/3 AWG, red/blue/black

Connector:
TE 2834006-3

Legrand Wattstopper DLM LMLM Module
Dimensions outside parentheses are in millimeters. Dimensions within parentheses are in inches.
The LMLM Module is mounted on the 10-pin header and located on the two bosses, and then captured in place to the ALM with two (2) self-tapping screws.

**Screw Specifications:** Phillips Rounded Head Thread-Forming Screws for Plastic, 18-8 Stainless Steel, Number 4 Size, 1/8" Long; McMasterCarr # 99461A105.

**Torque Specifications:** 2.0 to 2.5 in-lb

**CAUTION:** The screws are very small and are self-threaded into small plastic bosses. Overtorquing will strip the plastic and damage the ALM housing.

Please refer to the Legrand Wattstopper website for detailed specifications, wiring diagrams and installation instructions: https://www.legrand.us/categories/lightingcontrolsbuildingsystems/human-centric-lighting/led-light-engines.aspx
8 DALI TYPE 8 ACCESSORY BOARD

8.1 araya® Logic Module with DALI Type 8 Accessory Board

| ALM Dimensions (H x W x L) | H = 20.53 mm (0.81 in.); W = 30 mm (1.18 in.); L = 133 mm (5.24 in.) |

araya® Logic Module with DALI Accessory Board and Cover
Dimensions outside parentheses are in millimeters. Dimensions within parentheses are in inches.
The mounting holes are 5 mm in diameter.

8.2 Mechanical Specifications (DALI Type 8 Accessory Board)

Lumenetix part #:
80.003.004.01

Wire Specifications:
18-22 AWG, solid wire or tin-dipped stranded

Connector:
TE 2834006-2

DALI Accessory Board
All dimensions are in millimeters.
8 DALI TYPE 8 ACCESSORY BOARD

8.3 Mounting Specifications (DALI Type 8 Accessory Board)

The Accessory Board is mounted on the 10-pin header and located on the two bosses, and then captured in place to the ALM with two (2) self-tapping screws.

**Screw Specifications:** Phillips Rounded Head Thread-Forming Screws for Plastic, 18-8 Stainless Steel, Number 4 Size, 1/8” Long; McMasterCarr # 99461A105.

**Torque Specifications:** 2.0 to 2.5 in-lb

**CAUTION:** The screws are very small and are self-threaded into small plastic bosses. Overtorquing will strip the plastic and damage the ALM housing.
Lumenetix part #:
45.001.011.01

Reflector End Caps (Set of 2) with Diffuser

**NOTE:** The reflector end caps are fastened to the fixture using 6mm - 8mm (M2.5 - M4) screws, which are inserted through the end caps and the hole in the LED PCB. The opposite side -- where it is not fastened -- must be used with double-sided tape.
10 CASE TEMPERATURE MEASUREMENT POINTS

10.1 araya® Logic Module (ALM) Case Temperature (Tc) Measurement Points

MAXIMUM CASE TEMPERATURE (Tc) FOR ALM: 70°C

10.2 Linear LED Array Case Temperature (Tc) Measurement Point

1’ Linear Array

MAXIMUM Tc FOR LINEAR LED ARRAY: 60°C
11 IDENTIFYING “MATCHED SETS”

IDENTIFYING MATCHED SETS OF ALM AND LED BOARDS

ALM

L220341000100232024
L2177BAG3830E59

Match ALM with this LED board

ALM Number

LED Board Number

Match LED board with this ALM
12 RIBBON CABLE ASSEMBLIES

12.1 Flat 16-Pin Ribbon Cable (Nominal 8” Length)

Lumenetix part #:
28.031.001.04

16-pin Tyco connectors at each end; for connecting 1 ft. linear boards to each other.

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16 PIN RIBBON CABLE 3M 3365-16</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>LABEL, LUMENETIX, PART#, DESCRIPTION, REVISION</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16 PIN CONNECTOR 1-215083-6</td>
<td>2</td>
</tr>
</tbody>
</table>
12 RIBBON CABLE ASSEMBLIES

12.2 Flat 16-Pin Ribbon Cable (Nominal 24” Length)

Lumenetix part #: 28.030.002.02

16-pin Tyco connectors at each end; for connecting ALM to 1 linear board.

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16 PIN RIBBON CABLE</td>
<td>3M 3365/16 PIN PVC RIBBON CABLE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>LABEL</td>
<td>LUMENETIX, P/N, DESCRIPTION, REVISION</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16 PIN CONNECTOR c-1-215083-6-1-3d</td>
<td>CONNECTOR 16 PIN 1-215083-6</td>
<td>2</td>
</tr>
</tbody>
</table>
12.3 Flat 16-Pin Ribbon Cable (Nominal 32” Length)

Lumenetix part #: 28.031.001.01

16-pin Tyco connectors at at 0”, 24” and 32”; for connecting ALM to 2 linear boards.

Note: All dimensions are in millimeters.
12.4 Flat 16-Pin Ribbon Cable (Nominal 44” Length)

Lumenetix part #: 28.031.001.02

16-pin Tyco connectors at -20”, -12”, 0”, and 24”, for connecting ALM to 3 linear boards.

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LABEL, LUMENETIX, PART#; DESCRIPTION, REVISION</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>16 PIN CONNECTOR 1-215083-6</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>16 PIN RIBBON CABLE 3M 3365-16</td>
<td>1</td>
</tr>
</tbody>
</table>
12 RIBBON CABLE ASSEMBLIES

12.5 Flat 16-Pin Ribbon Cable (Nominal 68” Length)

Lumenetix part #: 28.031.001.03

16-pin Tyco connectors at -34", -26", 0", 26" and 34"; for connecting ALM to 4 linear boards.

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>16 PIN RIBBON CABLE</td>
<td>3M 3365/16 PIN PVC RIBBON CABLE</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>LABEL</td>
<td>LUMENETIX, P/N, DESCRIPTION, REVISION</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>16 PIN CONNECTOR c-1-215083-6-1-3d</td>
<td>CONNECTOR 16 PIN 1-215083-6</td>
<td>5</td>
</tr>
</tbody>
</table>
13 POWER / CONTROL CABLE ASSEMBLIES

13.1.1 Power Cable Assembly (Nominal 24” Length)

Provides power to each module.

Lumenetix part #: 28.030.001.01

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RED WIRE 24AWG</td>
<td>HOOK -UP WIRE STRANDED 7/32 24AWG RED</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>BLACK WIRE 24AWG</td>
<td>HOOK -UP WIRE STRANDED 7/32 24AWG BLACK</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>CONNECTOR MOLEX 5023510200</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>CRIMP MOLEX 0503728000</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

13.1.2 Pin Allocation Chart for Power Cable Assembly

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Lead Color</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>Red</td>
<td>Power 24V DC (+)</td>
</tr>
<tr>
<td>Pin 2</td>
<td>Black</td>
<td>Power Common (-)</td>
</tr>
</tbody>
</table>
13 POWER / CONTROL CABLE ASSEMBLIES

13.2.1 Control Cable Assembly (Nominal 24” Length)

Provides 0-10V control and RS-485 signals to each module.

Lumenetix part #: 28.002.002.01

Note: All dimensions are in millimeters.

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>PART NUMBER</th>
<th>DESCRIPTION</th>
<th>QTY.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>87430700</td>
<td>MOLEX CONNECTOR</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>87421000</td>
<td>CRIMP</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>VIOLET WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG VIOLET</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>BLUE WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG BLUE</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>ORANGE WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG ORANGE</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>WHITE WITH ORANGE STRIPE</td>
<td>WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG WHITE WITH ORANGE STRIPE</td>
</tr>
<tr>
<td>7</td>
<td>BROWN WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG BROWN</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>GREY WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG GREY</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>WHITE WIRE 24AWG</td>
<td>HOOK-UP WIRE STRANDED 7/32 24AWG WHITE</td>
<td>1</td>
</tr>
</tbody>
</table>

13.2.2 Pin Allocation Chart for Control Cable Assembly

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Lead Color</th>
<th>Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>Violet</td>
<td>0-10V Dimming (+)</td>
</tr>
<tr>
<td>Pin 2</td>
<td>Blue</td>
<td>0-10V Color (+)</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Orange</td>
<td>Digital Data - (NOT USED)</td>
</tr>
<tr>
<td>Pin 4</td>
<td>White with orange stripe</td>
<td>Digital Data + (NOT USED)</td>
</tr>
<tr>
<td>Pin 5</td>
<td>Brown</td>
<td>Digital Common (NOT USED)</td>
</tr>
<tr>
<td>Pin 6</td>
<td>Gray</td>
<td>0-10V Dimming (-)</td>
</tr>
<tr>
<td>Pin 7</td>
<td>White</td>
<td>0-10V Color (-)</td>
</tr>
</tbody>
</table>
14 WIRING DIAGRAMS

14.1 0-10V Best Wiring Practice

Any manufacturer that makes a dimmer that sinks will work with Lumenetix modules since we source the voltage.

0-10V is a topology defined by the International Electrotechnical Commission (IEC) 60929 Annex E standard and uses a varying DC voltage between 1 and 10V to determine the lighting level. The fixture outputs a minimum light level below 1V which is defined as low-end. Between 1 and 10V, the signal corresponds to levels between the minimum and maximum output level. A signal above 10V corresponds to the maximum light level. Sometimes it is referred to as 1-10V, as that is the actual range in which the light levels will vary. Each dimmer will have their own distinct dimming profile.

Best practice is to limit the distance run for the analog control wiring from the controller to the last driver to 300’. This is based on 18 AWG wire. It is possible to extend the run to 400’ by using 16 AWG wire, but that should be considered carefully as an exception to best design practice.

Whenever any part of the control circuit (the driver, dimer, or wire used) is designed for use in a Class 2 installation, it is critical that the entire control circuit be kept separate from Class 1 line voltage wiring per the requirement of National Electric Code, section 725.136. The electrical drawings must be very clear that class 1 and class 2 wiring cannot be combined. There must be separation because: a) it is possible for higher voltage wiring to induce an AC voltage into the low voltage signal wiring; and, b) undesirable visual artifacts in the dimmed lighting can be caused when the line and low voltage wiring is run together (especially for long distances). We do not recommend installing the low voltage signal wiring in the same conduit or raceway as line voltage wiring even when all elements of the control circuit are listed for Class 1 wiring methods.

NOTE: Lumenetix modules operate between 1-10V. All dimmers that have minimum and maximum trim pots should be set at a minimum of 1 volt and a maximum of 10 volts, measuring the voltage at the end of the line.

0-10V Dimmers (recommended list)*

- Crestron
- ETC
- Fresco
- Legrand
- Leviton
- Lutron
- Nexlight
- N-Light
- Pass & Seymour
- Vantage
- Wattstopper

*Recommendations are subject to change. Consult your Lumenetix representative for the most updated list.
INDEX TAB ON RED END OF CABLE CONNECTOR SHOULD LINE UP WITH INDEX SLOT ON ALM.

MAKE SURE TO ALIGN INDEX TAB TO INDEX SLOT.

The Constant Hot/Live must not be wired to a switching device.
14 WIRING DIAGRAMS

14.2 Bluetooth Operation using the araya® Tunable Color 2.0 iOS App

**NOTE:** BLUETOOTH OPERATION IS FOR COMMISSIONING THE MODULES ONLY, NOT FOR CONTROLLING THEM.
14.3 DMX512-A Protocol

DMX512-A is an acronym for Digital Multiplex, a communication protocol used to remotely control lighting dimmers and intelligent fixtures. It is designed to provide a common communications standard between these lighting devices regardless of the manufacturer. The 512-A after the DMX refers to the number of control channels used on one network segment (often called a ‘universe’) of devices. In a simple dimming system, one channel controls the intensity of the fixture. A single intelligent fixture such as the araya® requires several channels to control its various parameters (one channel each for DIM, CCT, SAT, HUE).

DMX512A Specifications:
- DMX 512-A (Controller).
- A universe is 512 Channels.
- DMX value is between 0 and 255, where 0 is off and 255 is full on.
- The maximum number of devices in a daisy-chain wire run is 32, which include the controller and opto-splitter.
- The maximum network wire run is a distance of up to 1600 feet for non-RDM systems and up to 1000 feet for RDM systems.
- One device functions as the master (DMX controller) on a network, while the rest function as slaves (mergers, splitters, intelligent fixtures, etc.).
- Only the controller (master) transmits over the network, and all fixtures receive the same data.
- The final device in the daisy-chain must be terminated with a 120 ohm resistor between DMX+ and DMX- pins.
- It is recommended that the terminator for the final device be located in the control panel, if it falls within the recommended wiring distance.
- All wiring must be in a continuous run and daisy-chained.
- Star wiring is only allowed in conjunction with an opto-splitter.
- Do not run DMX control cable in close proximity to AC power lines. EM spikes from switching of high-current devices such as HVAC equipment or generators will induce noise into the DMX cable.
- The shield must be carried through between modules and properly grounded at one point only.
- Connections to DMX512-A-RDM accessory board: wire size to be 24AWG, and solid or stranded cables may be used. Stranded wire used must be tinned or installed with ferule connector.

RDM

DMX512-A control protocol that enables Remote Device Management for two-way communications for configuration, monitoring and system setup. Allows two way communication between lighting controller and the fixtures. Allows for remote setting of DMX start addressing. RDM signals are sent back the other way, but not constantly. Controller can ask one or more devices for query feedback. RDM packets are inserted in-between the existing DMX data packets being used to control the lighting. The DMX Control Console will broadcast up to 512 channels over one DMX cable (max. run of 1000 feet for RDM). Some of these channels may not be used, but will still be transmitted, as required by the protocol. It must be set to a desired channel (001, 002, 003, 004, etc.) to control the connected light fixture. This is usually accomplished using RDM. This desired ‘channel’ is commonly known as the DMX address. When addressing fixtures, it is not recommended to skip addresses.

When RDM is not available with the control system, it is permissible to use the Lumenetix commissioning tool (the araya® Tunable Color 2.0 iOS App) to set the address of the slots. The instructions to configure the DMX channels can be found in the separate araya® Tunable Color Instruction Manual.

The DMX512-A interface follows the ANSI E1.11-2008 (R21013) standard. Four address slots are allocated to each interface board and control the Dim level, CCT, Saturation and Hue of the araya® modules connected to the board.

**Default DMX512-A Slot Allocation:**

<table>
<thead>
<tr>
<th>Slot</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dim Level</td>
</tr>
<tr>
<td>2</td>
<td>CCT</td>
</tr>
<tr>
<td>3</td>
<td>Saturation Level</td>
</tr>
<tr>
<td>4</td>
<td>Hue</td>
</tr>
</tbody>
</table>
14 WIRING DIAGRAMS

14.3.1 DMX512-A Electrical Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESD Protection</td>
<td>±15KV (air), ±8KV (conducted)</td>
<td>Per IEC 61000-4-2</td>
</tr>
<tr>
<td>Termination</td>
<td>Recommended</td>
<td>The DMX512 bus termination rules apply</td>
</tr>
<tr>
<td>Directionality</td>
<td>Receive only</td>
<td></td>
</tr>
<tr>
<td>Frequency stability</td>
<td>±20ppm</td>
<td></td>
</tr>
<tr>
<td>Load per port</td>
<td>1/256</td>
<td>1/8 of Nominal RS-485</td>
</tr>
<tr>
<td>Isolation</td>
<td>3KVrms</td>
<td></td>
</tr>
</tbody>
</table>

DMX512-A Control Systems (recommended list)

Choreo
Cognito
Creston Greenlight System
Entec
ETC Mosaic
ETC Paradigm
Fresco
Interactive Technologies
Lutron HomeWorks QS
Lutron Quantum
Nicolaudie
Pathway Connectivity
Pharos
Traxon Ecue
Vantage Controls

*Recommendations are subject to change. Consult your Lumenetix representative for the most updated list.
14 WIRING DIAGRAMS

14.3.2 DMX512-A Recommended Field Wiring

Liberty 24-2P-48S (Non-Plenum), 24 AWG, 2 pair dual 120 ohm, 11.2 pf/ft low capacitance (Wago, XLR and PHX connectors)
Liberty 24-2P-P48S (Plenum), 24 AWG, 2 pair dual 120 ohm, 11.2 pf/ft low capacitance (XLR and PHX connectors)
Belden #9842 (Non-Plenum), 24 AWG, 2 pair dual shielded 120 ohm, 12.8 pf/ft low capacitance (XLR and PHX connectors)
Belden #89842 (Plenum), 24 AWG, 2 pair dual shielded 120 ohm, 12.8 pf/ft low capacitance (XLR and PHX connectors)

Please refer to wire manufacturer’s lighting catalog for and/or equals as required by code.

Category Wire or Equal

The Entertainment Services and Technology Association (ESTA) does not define a maximum run length for DMX over Cat5 since many factors will affect the maximum run length, such as number of devices, number of splices in the cable, the strength of the DMX transmitter(s), if Remote Device Management (RDM) is being used, and sources of interference. ESTA does state (again, in ANSI E1.21-2):

“A properly selected and installed DMX512 cable should provide acceptable signal strength for runs of 300m (1000ft). Please note that the technical requirements, such as run-length and topology for other networking technologies, such as Ethernet, should be considered if using the installed cable for another networking technology in the future is anticipated.”

Cat5 or equivalent is not preferred as a portable cable since it is not as rugged as other DMX cables. Male RJ45 connectors are especially prone to breakage over repeated re-connections.

LUMENETIX RECOMMENDATION:

CAT 5E - 150 FEET
CRESTRON
DM-CBL-8G-NP
DM-CBL-8G-P

CAT 7- 330 FEET
CRESTRON
DM-CBL-ULTRA-NP
DM-CBL-ULTRA-P

DMX512-A Recommended Field Connectors (or Equal)

WAGO 221
PHOENIX CONTACT
XLR NEUTRIK
CRESTRON
RJ45 - DM-8G-CONN
RJ45 IDC DM-CONN

DMX512-A Wiring Connections

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
<th>Pin Colors (4-Pair Cable)</th>
<th>Pin Colors (2-Pair Cable)</th>
<th>3-pin XLR connector</th>
<th>5-Pin XLR connector</th>
<th>5-Pin PHX connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Common</td>
<td></td>
<td>White/Brown and Brown</td>
<td>White/Blue and Blue</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Data (-)</td>
<td>Primary Data Link</td>
<td>Orange</td>
<td>Orange</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Data (+)</td>
<td>Primary Data Link</td>
<td>White/Orange</td>
<td>White/Orange</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Data2 (-), or not used</td>
<td>Optional Secondary Data Link</td>
<td></td>
<td></td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Data2 (+), or not used</td>
<td>Optional Secondary Data Link</td>
<td></td>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

XLR Connectors (5-Pin)

<table>
<thead>
<tr>
<th>PIN</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COMMON</td>
</tr>
<tr>
<td>2</td>
<td>DATA</td>
</tr>
<tr>
<td>3</td>
<td>DATA+</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
<tr>
<td>5</td>
<td>N/C</td>
</tr>
</tbody>
</table>

RJ-45 Connector Pin-Out (T568B)

<table>
<thead>
<tr>
<th>RJ-45 Pin</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WHIT/GRY</td>
</tr>
<tr>
<td>2</td>
<td>WHIT/GRN</td>
</tr>
<tr>
<td>3</td>
<td>BLU</td>
</tr>
<tr>
<td>4</td>
<td>N/C</td>
</tr>
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<td>5</td>
<td>N/C</td>
</tr>
<tr>
<td>6</td>
<td>N/C</td>
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<tr>
<td>7</td>
<td>WHIT/GRN</td>
</tr>
<tr>
<td>8</td>
<td>WHIT/GRY</td>
</tr>
</tbody>
</table>
14.3.3 DMX512-A Controller Example

DMX512-A Drain Wire Connections

Drain wire connections are required as follows.

**Shielding**

To add another level of protection from electromagnetic noise, a grounded shield is added over the twisted pair wires. When this is enclosed in a protective jacket, to avoid ground loops and electromagnetic contamination of the ground system, all control ground wiring, including cable shields and drain wires, should be treated like sensitive current-carrying conductors. All control ground wires should be insulated (not bare) and the same wiring practices should be observed with ground wires as with other sensitive signals. Care must also be taken when designing control wiring to ensure that each shield is connected to only a single ground point. You should establish this point at a central location, like a control panel or cabinet, and avoid all connection to grounds in the field. A control ground is sometimes referred to as an isolated ground (an oxymoron) for this reason, but the term single-point ground is more accurate.

**Method-1**

A typical two-pair shielded cable can be prepared for termination to the terminals with the drain wire cut off. This is usually done at the field end of the cable where no shield grounding is desired. You will then use insulating tape or heat-shrink tubing to protect the cable from contamination and to prevent accidental grounding of the shield or drain wire. An accidental ground at this point would almost certainly create an undesirable ground loop.

**Method-2**

A typical two-pair shielded cable can be prepared for termination to the terminals with the drain wire cut off. The drain wire, which is an uninsulated conductor, is sleeved with an insulating tubing to prevent accidental grounding. The crimp-on lug is valuable in this instance to retain the tubing. Insulating tape or heat-shrink tubing is again used to protect the cable from contamination and to prevent accidental grounding, since any accidental connection between the drain wire and a chassis, frame, or enclosure would almost certainly create a ground loop.
14.3.4 DMX512-A-RDM Accessory Card Wiring Diagram

Notes:
1. 24V power (red/black) is Class-2 rated.
2. Adapter is configured at factory for DMX inputs.
3. If more than one line of DMX is needed, then a DMX Splitter must be used to create multiple independent branches of a DMX signal and/or to extend the usable distance of each branch. Each of the splitter’s 4, 6, 8, or 16 output ports generates an independently protected DMX signal.

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DMX SLOTS SET BY RDM OR BY TUNABLE COLOR 2.0 IOS APP
(MAX. OF 8 MODULES CAN BE COMMISSIONED AT A TIME)

NOTE: BLUETOOTH OPERATION IS FOR COMMISSIONING THE MODULES ONLY, NOT FOR CONTROLLING THEM.
14.4 Lutron® EcoSystem Protocol

EcoSystem technology is a control method for LEDs that provides addressing of individual fixtures and status feedback. This makes it easy to digitally assign one or many fixtures without complicated wiring. This opens up an entire suite of energy-saving, system-monitoring and system-control schemes where the design, setup and rezoning are all done within software, making the electrical and control design simple.

The araya® modules attached to different interface boards can be controlled independently or assigned to a single group by the EcoSystem controller.

The EcoSystem control is responsible for saving any configuration settings. Once an interface board is assigned a pair of addresses, assigned addresses are saved in NVRAM. During the EcoSystem discovery process, the user pairs the desired dimming control in the controller to the Dim channel address in the interface board. The same applies for the CCT channel.

- 1 pair 16AWG Eco Loop, 900 feet (field wiring).
- Maximum of 64 addresses on each loop.

EcoSystem Control Systems (recommended list)*

Quantum System
HomeWorks QS
Grafik Eye QS Control Unit with EcoSystem
EnergiSavr Node with EcoSystem
Power Module with EcoSystem

*Recommendations are subject to change. Consult your Lumenetix representative for the most updated list.

Lutron EcoSystem Controller Example

*Fixture refers to a luminaire with one Lumenetix module, and with one address (DDM) or two addresses (CTM).
14.4.1 Lutron® EcoSystem Field Wiring

- EcoSystem Digital Loop can be wired as Mains voltage or IEC PELV/NECR Class 2 for maximum wiring flexibility.
- The Loop is polarity insensitive and can be wired in any topology.
- Consult all national and local electrical codes for separation requirements.

<table>
<thead>
<tr>
<th>Wire Gauge</th>
<th>Maximum EcoSystem-Compliant Loop Wire Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 mm² (12 AWG)</td>
<td>671 m (2200 ft)</td>
</tr>
<tr>
<td>2.5 mm² (14 AWG)</td>
<td>427 m (1400 ft)</td>
</tr>
<tr>
<td>1.5 mm² (16 AWG)</td>
<td>275 m (900 ft)</td>
</tr>
<tr>
<td>1.0 mm² (18 AWG)</td>
<td>175 m (570 ft)</td>
</tr>
</tbody>
</table>

Drain Wire Connections

Drain wire connections are required as follows.

Shielding

To add another level of protection from electromagnetic noise, a grounded shield is added over the twisted pair wires. When this is enclosed in a protective jacket, to avoid ground loops and electromagnetic contamination of the ground system, all control ground wiring, including cable shields and drain wires, should be treated like sensitive current-carrying conductors. All control ground wires should be insulated (not bare) and the same wiring practices should be observed with ground wires as with other sensitive signals. Care must also be taken when designing control wiring to ensure that each shield is connected to only a single ground point. You should establish this point at a central location, like a control panel or cabinet, and avoid all connection to grounds in the field. A control ground is sometimes referred to as an isolated ground (an oxymoron) for this reason, but the term single-point ground is more accurate.

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14.4.2 Lutron® EcoSystem Accessory Card Wiring Diagram

Notes:

1. 24V power (red/black) is Class-2 rated.
2. EcoSystem Channel 1 is always Intensity control. EcoSystem Channel 2 is always CCT control.
3. In the EcoSystem programming mode, EcoSystem Channel 1 controls the intensity from 100%-1%. EcoSystem Channel 2 controls the CCT range from 1650 - 8000K.
4. The araya® Tunable Color 2.0 iOS App should be turned on, and the DMX channels should be set to 2, 4, 6, 8.

Fixture manufacturer to provide minimum 18 AWG of Lutron EcoSystem wire tail (labeled E1 and E2) to junction box. Consult Lutron for field wiring.

The Constant Hot/Live must not be wired to a switching device. This may be put on a relay for maintenance.
14.5 DALI Type 8 Protocol Specifications

Digital Addressable Lighting Interface (DALI) is a communication language. DALI facilitates the communication and therefore control of multiple devices such as drivers, transformers and other lighting equipment. Devices which speak the same language can exchange information, in much the same way people can exchange information when they communicate using the same language.

DALI Devices:

Designed on a distributed intelligent framework, each DALI device has on-board memory that stores all relevant information about the device, including diagnostics, which reduces the technical requirements on the control system and the amount of data to be transmitted over the line.

DALI Standards:

- DALI is a lighting control standard defined under the European Standard IEC 62386.
- IEC stands for International Electrotechnical Commission and is a non-profit organization.
- DALI was designed to replace traditional 1-10 V analog systems and proprietary digital systems such as DSI (Digital Serial Interface).
- At a maximum there can be 64 DALI devices on a single DALI line and it has a data baud rate of 1200 baud.

DALI Technical Specifications:

- Numbers of units: max. 64
- Numbers of addresses: 64
- Signal level: +/- 16V
- Cable length: max. 300m, and less than 2V voltage drop
- Cable type: any 2 wire unshielded cable
- Cable topology: any (line, star, tree, ring)
- Refresh rate: max 40 messages / second +/- 1200 baud
- Safety: DALI is not SELV; cable must be treated like mains wiring

Maximum DALI-compliant Bus Wire Length:

- 1.5 mm² (300 m)
- 0.75 mm² (150 m)
- 0.50 mm² (100 m)

A DALI system contains one current source, a controller and input(s). In idle state the current signal is “high” so there is current. A driver input current is 2mA in idle state. Nominal current for 64 inputs is 128mA. Information is transferred by short circuiting the current, (controller / input). Communication is always started by the controller. An input can only “answer” (=back channel info). Random addressing is possible. DALI units have no address from factory. Any address can be changed via the DALI connection. An input can detect if the DALI current is present.
14 WIRING DIAGRAMS

14.5.1 DALI Type 8 Wiring Specifications

DALI Wiring can be run up to 300m using 1.5mm cable. (15 awg) The DALI specification allows for maximum 2V drop in the communication signal. The DALI line does not require termination of the line and supports all wiring topologies except rings and closed loops (trees, branches and chains are all acceptable).

The following are National Electric Code (NEC 70) requirements.

**DALI Class 1 and Class 2 Wiring Overview:**

DALI dimming ballasts and drivers are connected together by a 2-wire low voltage bus that is suitable for Class 1 or Class 2 wiring installations. This application note explains how both Class 1 and 2 wiring are made and how they both meet National Electric Code (NEC) regulations.

**DALI Dimming Ballast and Driver Wired Class 2:**

For more information on Class 2 wiring and additional Class 2 wiring requirements see National Electric Code Article 725. With regards to factory installed wiring, as per UL1598 section 6.17.1: Factory-installed power limited wiring and branch circuit wiring that come in random contact within the luminaire shall have insulation rated for the maximum voltage that exists in any of the circuits.

If wiring with the properly rated insulation is used, then no spacing or separation is required regardless of the circuit conductor voltage although shielding may be required.

Class 2 wiring of the DALI dimming ballast and driver follows the NEC Requirement 725.136(D) (references to Class 3 are eliminated).

Class 2 circuit conductors in compartments, enclosures, device boxes, outlet boxes, or similar fittings shall be permitted to be installed with electric light, power, Class 1 circuits where they are introduced solely to connect the equipment connected to Class 2 circuits and where (1) or (2) applies:

1. The electric light, power, Class 1 circuit conductors are routed to maintain a minimum of 6 mm (.25 in) separation from the conductors and cables of Class 2.

2. The circuit conductors operate at 150 volts or less to ground and also comply with one of the following:
   A. The Class 2 circuits are installed using Type CL3, CL3R, or CL3P or permitted substitute cables provided these Class 3 cable conductors extending beyond the jacket are separated by a minimum of 6 mm (0.25 in) or by a nonconductive sleeve or nonconductive barrier from all other conductors.
   B. The Class 2 circuit conductors are installed as a Class 1 circuit.

The DALI dimming ballast and driver have a minimum spacing of 0.25 inches between line voltage and the bus terminals (purple and grey wires) for Class 2 installations.

**DALI Bus Wired Class 1:**

Class 1 wiring methods follow the NEC Requirement 725.48.

Class 1 circuits shall be permitted to be installed with other circuits as specified in 725.48 (A) and (B):

A. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating or direct current, provided all conductors are insulated for the maximum voltage of any conductors in the cable, cable tray, enclosure or raceway.

B. Class 1 circuits shall be permitted to be installed with power supply conductors as specified:
   1. Class 1 and power supply circuits shall be permitted to occupy the same cable, enclosure, or raceway only when functionally associated.

Since the DALI dimming ballast and driver meets Class 2 installation requirements, it can also be installed in a Class 1 configuration when Class 2 markings are not present. The NEC allows the reclassification of Class 2 circuits per Article 725.130 Exception No.2:

Class 2 and circuits shall be permitted to be reclassified and installed as Class 1 circuits if the Class 2 markings are eliminated and the entire circuit is installed using the wiring methods and materials in accordance with Part II, Class 1 circuits.

Note: For more information regarding Class 2 wiring and additional requirements see the National Electrical Code Article 725.

**Reference Information:**

Code quotation, guidance, and wiring guides above are listed for reference only. Always follow local and national wiring requirements. NEC 2008 was used as a reference in this Application Note. More recent releases of the National Electrical Code should always be consulted. The National Electrical Code (NEC) is a registered trademark of the National Fire Protection Association, Quincy, MA.

Revised 5.3.19 Specifications subject to change without notice
14 WIRING DIAGRAMS

14.5.2 DALI Type 8 Accessory Card Wiring Diagram

Notes:
1. 24V power (red/black) is Class-2 rated.
2. One DALI address per linear array / ALM kit.

Fixture manufacturer to provide minimum 18 AWG of DALI wire tail to junction box. Consult DALI specifications for field wiring.

The Constant Hot/Live must not be wired to a switching device. This may be put on a relay for maintenance.
15 PRE-INSTALLATION NOTES

TUNABLE COLOR LINEAR LED ARRAYS (PRINTED CIRCUIT BOARDS)

- To ensure proper electrical insulation between the linear arrays and heat sink, the linear arrays (PCBs) are provided with a pre-applied double sided adhesive insulating tape. Be sure to remove the plastic liner before attaching the linear array to the heat sink.

- Ensure that the PCBs are properly aligned with reference arrows facing each other (see image below). This is critical for proper mixing.

- **Exercise caution** when connecting the ribbon cables to the LED PCBs. Do not press the LEDs against a hard surface (like a table or workbench) as they can be damaged. Do not break off the indexing tabs.

- **IMPORTANT:** Please allow a space of 2 mm - 5 mm between the LED PCBs. Do NOT butt the LED PCBs to each other. If a 2 mm - 5 mm spacing is not provided, the LED PCBs may bow. Gaps larger than 5 mm may not have proper color mixing.

- Mount the LED PCB to the fixture using 6 mm - 8 mm (M2.5 - M4) screws. **PLEASE NOTE:** Use plastic washers to protect the PCB. Do NOT over-tighten the screws, since that can damage the LED PCB.

- PCBs need to be isothermal (intra-board and inter-board). ALMs can be mounted on a different thermal platform.

REFLECTOR END CAPS

- Test-fit the reflector end caps on the LED PCBs. Note that the opening (with diffuser) should face in the OPPOSITE direction of the alignment arrows. The mounting hole should match the hole on the reflector end caps.

- The reflector end caps are fastened to the fixture using 6 mm - 8 mm (M2.5 - M4) screws inserted through the end caps and the holes in the LED PCB. The opposite side where it is not fastened must be used with double-sided tape. **NOTE:** The end caps will cover the last few LEDs.

RIBBON CABLE CONNECTORS

- The surface of the fixture to which the PCB is mounted must have relief areas for the connectors.

- Leave adequate clearance around the ribbon cable connector so that it does not come in contact with the fixture’s metal edge.

- Cut-outs in the heat sink around the connectors should be made as large as possible to avoid potential shorting. Adding insulation around the cutout using polyimide tape is recommended.

araya® LOGIC MODULE

- Mount the araya® Logic Module to the fixture with 6 mm - 8 mm (M2.5 - M4) screws in desired location.

Test-fit all components prior to installation. Mark edges for correct alignment.
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.1 1-Foot Linear Array Configuration Example

11 inches Linear LED Array Kit: 80.001.090.01
Ordering code includes: one 11 in. linear LED board and 10W araya® Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:
2-wire power cable assembly: 28.030.001.01
24” flat ribbon cable; 16-pin Tyco connectors at each end: 28.030.002.02
Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control of the above, the following items must also be added to the order:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.2 2-Foot Linear Array Configuration Example

To implement the above configuration, the following items must be added to the order:

- 2-wire power cable assembly: 28.030.001.01
- 24” flat ribbon cable: 28.030.002.02
- Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:

- 7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:

- DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:

- Lutron Accessory Board: 80.003.002.02

22 inches Linear LED Array Kit: 80.001.091.01, OR
24 inches Linear LED Array Kit: 80.001.201.01
Ordering code includes: one 22 in. or one 24 in. linear LED board and 20W araya Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.3 3-Foot Linear Array Configuration Example

33 inches Linear LED Array Kit: 80.001.092.01
Ordering code includes: one 22 in. linear LED board, one 11 in. linear LED board and 30W araya Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:
2-wire power cable assembly: 28.030.001.01
32” flat ribbon cable; 16-pin Tyco connectors at 0”, 24” and 32”: 28.031.001.01
Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.4 4-Foot Linear Array Configuration Example

Reflectors end caps; set of 2
(45.001.011.01)

22 in. or 24 in. linear board

2-wire power cable assembly
(28.030.001.01)

40W ALM

32” flat ribbon cable
(28.031.001.01)

22 in. or 24 in. linear board

44 inches Linear LED Array Kit: 80.001.093.01, OR
48 inches Linear LED Array Kit: 80.001.200.01
Ordering code includes: two 22 in. or two 24 in. linear LED boards and 40W araya® Logic Module.

0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:

- 2-wire power cable assembly: 28.030.001.01
- 32” flat ribbon cable; 16-pin Tyco connectors at 0”, 24” and 32”: 28.031.001.01
- Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:

- 7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16  LINEAR ARRAY CONFIGURATION EXAMPLES

16.5  5-Foot Linear Array Configuration Example

Reflectors end caps; set of 2
(45.001.011.01)

11 in. linear board
22 in. linear board
22 in. linear board

8” flat ribbon cable
(28.031.001.04)

32” flat ribbon cable
(28.031.001.01)

2-wire power cable assembly
(28.030.001.01)

50W ALM

55 inches Linear LED Array Kit: 80.001.094.01
Ordering code includes: two 22 in. linear LED boards, one 11 in. linear LED board and 50W araya® Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:
2-wire power cable assembly: 28.030.001.01
32” flat ribbon cable; 16-pin Tyco connectors at 0”, 24” and 32”: 28.031.001.01
8” flat ribbon cable; 16-pin Tyco connectors at each end: 28.030.001.04
Reflectors end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.6 6-Foot Linear Array Configuration Example

Reflector end caps; set of 2
(45.001.011.01)

22 in. or 24 in. linear board
22 in. or 24 in. linear board
22 in. or 24 in. linear board

2-wire power cable assembly
(28.030.001.01)

60W ALM

44” flat ribbon cable
(28.031.001.02)

66 inches Linear LED Array Kit: 80.001.095.01, OR
72 inches Linear LED Array Kit: 80.001.202.01
Ordering code includes: three 22 in. or three 24 in. linear LED boards and 60W araya\textsuperscript{5} Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:
2-wire power cable assembly: 28.030.001.01
44” flat ribbon cable; 16-pin Tyco connectors at -20”, -12”, 0”, and 24”: 28.031.001.02
Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.7 7-Foot Linear Array Configuration Example

Reflector end caps; set of 2
(45.001.011.01)

11 in. linear board 22 in. or 24 in. linear board 22 in. or 24 in. linear board 22 in. or 24 in. linear board

68” flat ribbon cable
(28.031.001.03)

2-wire power cable assembly
(28.030.001.01)

70W ALM

77 inches Linear LED Array Kit: 80.001.096.01, OR
83 inches Linear LED Array Kit: 80.001.204.01
Ordering code includes: three 22 in. or three 24 in. linear LED boards, one 11 in. linear board and 70W araya® Logic Module.

To implement the above configuration, the following items must be added to the order:

2-wire power cable assembly: 28.030.001.01
68” flat ribbon cable; 16-pin Tyco connectors at -34”, -26”, 0”, 26” and 34”: 28.031.001.03
Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:

7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.8 8-Foot Linear Array Configuration Example

Reflector end caps; set of 2
(45.001.011.01)

22 in. or 24 in. linear board

68” flat ribbon cable
(28.031.001.03)

2-wire power cable assembly
(28.030.001.01)

80W ALM

88 inches Linear LED Array Kit: 80.001.097.01, OR
96 inches Linear LED Array Kit: 80.001.203.01
Ordering code includes: Four 22 in. or four 24 in. linear LED boards and 80W araya® Logic Module.
0-10V; Bluetooth-enabled for iOS commissioning.

To implement the above configuration, the following items must be added to the order:
2-wire power cable assembly: 28.030.001.01
68” flat ribbon cable; 16-pin Tyco connectors at -34”, -26”, 0”, 26” and 34”: 28.031.001.03
Reflector end caps (set of 2): 45.001.011.01

To implement 0-10V Control of the above, the following items must also be added to the order:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control of the above, the following items must also be added to the order:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.9 8-Foot Square-Shaped Linear Array Configuration Example

88 inches Linear LED Array Kit: 80.001.097.01, OR
96 inches Linear LED Array Kit: 80.001.203.01
Ordering code includes: Four 22 in. or four 24 in. linear LED boards and 80W araya® Logic Module.

0-10V; Bluetooth-enabled for iOS commissioning.

Required accessories (ordered separately):
2-wire power cable assembly: 28.030.001.01
68” flat ribbon cable; 16-pin Tyco connectors at -34”, -26”, 0”, 26” and 34”: 28.031.001.03
Reflector end caps (set of 2): 45.001.011.01 (four orders)

To implement 0-10V Control:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control:
Lutron Accessory Board: 80.003.002.02
16 LINEAR ARRAY CONFIGURATION EXAMPLES

16.10 6-Foot U-Shaped Linear Array Configuration Example

66 inches Linear LED Array Kit: 80.001.095.01, OR
72 inches Linear LED Array Kit: 80.001.202.01
Ordering code includes: three 22 in. or three 24 in. linear LED boards and 60W araya® Logic Module.

0-10V; Bluetooth-enabled for iOS commissioning.

Required accessories (ordered separately):
2-wire power cable assembly: 28.030.001.01
44” flat ribbon cable; 16-pin Tyco connectors at -20”, -12”, 0”, and 24”: 28.031.001.02
Reflector end caps (set of 2): 45.001.011.01 (three orders)

To implement 0-10V Control:
7-wire control cable assembly: 28.002.002.01

To implement DMX512-A control:
DMX512-A-RDM Accessory Board: 80.003.001.01

To implement Lutron EcoSystem control:
Lutron Accessory Board: 80.003.002.02

1000 Lumens / Foot
araya® Logic Module (24V DC)
Tunable Color Linear LED Arrays
LTM2
Revised 5.3.19 | Specifications subject to change without notice