EcoSystem™ technical guide
Lutron’s first principle is to take care of our customer.

Commitment to innovation
Lutron has been dedicated to producing innovative light control solutions for commercial buildings of every type and style since 1961. A dedication matched only by our commitment to quality, performance, value and service for our customers.

World-class quality
Lutron quality is fueled by a relentless pursuit of the highest standards. Constant improvement activities include an integrated quality system, strict engineering guidelines, and world-class quality and manufacturing processes.

Comprehensive light control solutions for daylight and electric light
Lutron is your comprehensive resource for light control solutions for any commercial or institutional application.

• Architectural dimming systems
• Daylight harvesting
• Low-voltage switching systems
• Floor plan based control software
• Light management systems
• Integrated light automation systems
• Factory service plans

Please contact us for information on Lutron’s residential light control products.
The EcoSystem solution is designed to fulfill the needs of light control in the 21st century. Specifically, EcoSystem revolutionizes energy savings, flexibility, and maintenance in a way that changes the workplace.

Designed for open office spaces and K-12/university classrooms, EcoSystem easily integrates environment sensors, such as daylight and occupancy sensors, with personal controls, such as wallstations and infrared remotes. With up to 50% of energy use in offices (60% of energy use in schools) going to lighting, the combined effect of multiple environment sensors and personal controls operating together brings unparalleled energy savings to spaces that previously had none.

Beyond the energy savings, EcoSystem creates a more flexible workspace. Composed of digital ballasts that have individual addresses and communicate via control wires, EcoSystem ballasts can be programmed, instead of wired, to work individually or as a group. This eliminates the need for an area to be rewired when changes take place, creating flexibility in a space that adjusts to the shifting needs of a company.

Finally, EcoSystem reduces lighting system maintenance. All of the environment sensors and personal controls connect directly to any ballast, removing interfaces, power packs, and control devices that on other systems require more parts, programming and maintenance.

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Here are the **4 steps** to designing an EcoSystem:

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**Step 1** Ballast Selection

A. Determine number of fixtures that will be connected to EcoSystem.
   \- Note: Do not consider control zones, since they will be programmed rather than wired.

B. Classify the type of ballast in each fixture.
   \- Note: Use a Ballast Module Fixture-mounted (BMF) in conjunction with a ballast for dimming down to 1% or for lamp types where EcoSystem is not yet available. A BMF connected to any Eco-10™ or Hi-lume® ballast gives full EcoSystem functionality to that ballast.

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**Step 2** Sensor/Receiver Selection

Determine what sensors should be connected to EcoSystem.
   \- Note: EcoSystem ballasts are compatible only with EcoSystem daylight sensors.

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Step 3 Control Selection

Determine what controls should be connected to EcoSystem.

- **EcoSystem™ IR Receiver**
  - IR Receiver and Remote for Personal Control
  - pg. 12

- **EcoSystem 1-Button Wallstation**
  - Wallstation with Raise/Lower and IR Receiver
  - pg. 14

- **EcoSystem 4-Button Wallstation**
  - Wallstation with Raise/Lower and IR Receiver
  - pg. 14

Step 4 Support Components

A. Include 1 EcoSystem programmer for EcoSystem programming

B. Include 1 bus supply for each room or area, up to a maximum of 64 ballasts

- **EcoSystem Programmer**
  - pg. 15

- **EcoSystem Bus Supply**
  - pg. 16
### EcoSystem T8 Digital Ballast

**EC 5 T832 J (120, 277) (1, 2)**
T8 Linear & U-Bent 32W, 120 or 277V, 4' Lamp

**EC 5 T832 G 277 (2, 3)**
T8 Linear & U-Bent 32W, 277V, 4' Lamp

### EcoSystem T5 Digital Ballast

**EC 5 T514 J (120, 277) (1, 2)**
T5HE Linear 14W, 120 or 277V

**EC 5 T521 J (120, 277) (1, 2)**
T5HE Linear 21W, 120 or 277V

**EC 5 T528 J (120, 277) (1, 2)**
T5HE Linear 28W, 120 or 277V

### EcoSystem T8 and T5 Digital Ballast

- Smooth and continuous dimming from 100% to 10%
- Provides power for and responds to one occupancy sensor, one daylight sensor, and one personal control input (infrared receiver or wallstation)
- Communicates status and sensor inputs over the EcoSystem bus
- Lamp current crest factor: Less than 1.7
- Light output variation: Constant +/- 2% light output for line voltage variations of +/- 10%
- Lamp life: Average lamp life meets or exceeds lamp manufacturer ratings
- Total Harmonic Distortion (THD): model numbers with “J” have less than 10% THD; model numbers with “G” have less than 20% THD
- Maximum inrush current: 3 Amps per ballast at 277V
- Ambient temperature operating range: 50 – 140°F (10 – 60°C)
- Terminal blocks on the ballast accept the following wire gauges:
  - EcoSystem bus: #16 – #18 AWG (1.29 – 1.02mm) solid
  - Power wiring: #16 – #18 AWG (1.29 – 1.02mm) solid
  - Class 2 sensor wires: #22 AWG (0.635mm) solid
- Class P thermally protected
- Meets ANSI C82.11 high frequency ballast standard
- Meets FCC Part 18 non-consumer requirements for EMI/RFI emissions
- Meets ANSI C62.41 category A surge protection standards up to and including 4kV
- Mounts using two screws inside a fluorescent fixture

### Step 1 Ballast Selection

**G Ballast Dimensions**
- L: 9.50" (241mm)
- W: 2.38" (60mm)
- H: 1.00" (25mm)
- Mounting center: 8.9" (226mm)

**J Ballast Dimensions**
- L: 18.00" (457mm)
- W: 1.18" (30mm)
- H: 1.00" (25mm)
- Mounting center: 17.70" (450mm)
**Step 1 Ballast Selection**

**EcoSystem Ballast Module Fixture-mounted (BMF)**

- **C5-BMF-2A**
  - Allows integration of any Lutron Eco-10™ or Hi-lume® phase-control ballast into the EcoSystem bus
  - Provides power for and responds to one occupancy sensor, one daylight sensor, and one personal control input (infrared receiver or wallstation)
  - Universal voltage input: 120/240/277 V ~ 50/60 Hz
  - Dimming range: 100% to minimum ballast level (10% for Eco-10, 1% for Hi-lume) relative light output
  - Ambient temperature operating range: 50 – 140°F (10 – 60ºC)
  - Terminal blocks on the BMF accept the following wire gauges:
    - EcoSystem bus: #16 – #18 AWG (1.29 – 1.02mm) solid
    - Power wiring: #16 – #18 AWG (1.29 – 1.02mm) solid
    - Class 2 sensor wires: #22 AWG (0.635mm) solid
  - Mounts using two screws either inside a fluorescent fixture or in a rated electrical enclosure
  - If mounting outside a fluorescent fixture, can be up to 50’ from ballast
  - Can be used with a Lutron dimming ballast to dim one control zone of up to 2 Amps
  - BMF does not contain a 3-wire input
  - Capable of mechanical off through internal air-gap switch

**Implementing an EcoSystem BMF**
The BMF has input terminals that accept EcoSystem low-voltage sensors, controls and the bus communication wires. It controls any Lutron Eco-10 or Hi-lume dimming ballast.

**One-Line Diagram**

- **120V or 277V**
- **EcoSystem Bus Communication Wires**
  - BMF (C5-BMF-2A)
  - 3 #16 Power Wires (Hot, Dimmed Hot, Neutral)
  - Any Eco-10 or Hi-lume Ballast
- **To other Ballasts or BMFs**

**Dimensions**
- L: 9.30" (236mm)
- W: 1.18" (30mm)
- H: 1.00" (25mm)
- Mounting center: 8.90" (226mm)

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Step 2 Sensor Selection

Daylighting
Design Statement: Use 1 daylight sensor for each zone of fenestration.*
If the zone extends more than 30’ (9.14m), include a daylight sensor for every 30’ (9.14m) segment. **Wiring a daylight sensor to one ballast allows control of multiple ballasts on a bus.**

* Fenestration: Any opening in a building’s envelope including windows, doors and skylights.

EcoSystem Daylight Sensor with IR Receiver

C-SR-M1-WH

- Automatically dim the lights when the available daylight is high and brighten the lights when the available daylight is low in order to maintain a specific light level in the space
- Integrated IR receiver for EcoSystem programming
- 1 daylight sensor can control multiple fixtures or groups of fixtures differently
- Up to 8 daylight sensors can exist on a single EcoSystem bus
- Total wire length to ballast (or BMF) must not exceed 100’ (30m)
- Designed for Class 2 operation only
- Operating voltage: Low-voltage Class 2, 20VDC
- Analog signal: 0 – 20VDC
- Daylight (photo) sensors from other manufacturers are not compatible with EcoSystem

Dimensions
H: 0.69" (17mm)
D: 1.18" (30mm)
Stem Length: 1.25" (32mm)
Step 2 Sensor Selection

Wiring the Daylight Sensor
- Wire color designations of the daylight sensor:
  - Red = 20VDC
  - Black = Common
  - White = IR Signal
  - Yellow = Daylight Sensor Signal
- Make sure that the supply breaker to the digital ballast is OFF when wiring
- Connect the four conductors to the four digital ballast terminals as shown

Note: The digital ballast accepts only one IR input. Use of the IR input for the daylight sensor precludes the use of an infrared receiver with the same digital ballast.

Mounting the Daylight Sensor
Determine the proper location of the daylight sensor using the adjacent diagrams.
- The arrow on the daylight sensor points toward the area viewed by the sensor
- Place the daylight sensor so its viewing area is centered upon the nearest window at a distance of between 1-2 H from the window
- The effective window height, H, starts 3’ (0.91m) up from the floor or at the window sill, whichever is higher, and ends at the top of the window
- Ensure that the view of the daylight sensor is not obstructed
- Do not position the daylight sensor in the well of a skylight or above indirect lighting fixtures

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### Step 2: Sensor/Receiver Selection

#### Occupancy Sensing

Design Statement: Use an ultrasonic sensor for small movement detection when fans or other automated systems are not present. Use an infrared sensor for occupant detection when “line of sight” is available from the sensor. Use a dual-tech sensor for a combination of both technologies. For more information visit www.lutron.com/occsensors.

<table>
<thead>
<tr>
<th>Occupancy Sensor – Ceiling Mounted*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LOS-CUS-(500, 1000, 2000)-WH</strong> Ultrasonic</td>
</tr>
<tr>
<td><strong>LOS-CDT-(500, 1000, 2000)-WH</strong> Dual technology</td>
</tr>
<tr>
<td><strong>LOS-CDT-(500R, 1000R, 2000R)-WH</strong> Dual technology with second contact closure output</td>
</tr>
<tr>
<td><strong>LOS-CIR-(450, 1500)-WH</strong> Infrared</td>
</tr>
<tr>
<td>† Denotes square feet of sensor coverage</td>
</tr>
</tbody>
</table>

#### Occupancy Sensor – Wall Mounted* |

| **LOS-WDT-WH** Dual technology |
| **LOS-WDT-R-WH** Dual technology with second contact closure output |
| **LOS-WIR-WH** Infrared |

- No power pack is necessary, occupancy sensor receives power from BMF

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**Dimensions**

**W: 6.12” (156mm)**

**H: 1.62” (41mm)**

**D: 2.31” (59mm)**

Ceiling Mounted: 3/4” (19mm) diameter hole for mounting post (Lutron-supplied)

**Dimensions**

**W: 3.75” (95mm)**

**H: 5.50” (140mm)**

**D: 4.00” (102mm)**

* Please visit www.lutron.com/ecosystem for a complete list of occupancy sensors compatible with EcoSystem.
Step 2 Sensor/Receiver Selection

Wiring to an Occupancy Sensor
- Wire color designations of the sensor:
  Red = 20VDC
  Black = Common
  Blue = Occupancy Sensor Signal
- Make sure that the supply breaker to the digital ballast is OFF when wiring
- Connect the three conductors to the three digital ballast terminals as shown

Occupancy Sensor Compatibility
All LOS- models are compatible. Occupancy sensors from other manufacturers must meet the following criteria:
- Input Voltage and range includes 20V
- Maximum Current Draw is 40mA

Contact Closure Output
The “R” model numbers represent a contact closure output that can be used for BMS or HVAC response to occupant detection.

*Note: Occupancy sensors by other manufacturers may use different color wires but also need to connect to the blue input on the ballast or BMF.
Step 3 Control Selection

Personal Control
Design Statement: Add EcoSystem IR receivers with remotes to provide personal control to any fixture on the EcoSystem bus.

EcoSystem IR Receiver for Personal Control

C-R-M1-WH
- Can control individual or grouped EcoSystem ballasts or BMFs
- Flashing LED response to indicate signal reception
- Receives IR signals from up to 8’ (2.44m) away when mounted on a 10’ (3.05m) ceiling
- Designed for Class 2 operation only
- Operating voltage: Low-voltage Class 2, 20VDC
- Analog signal: 0 – 20VDC
- Total wire length to ballast (or BMF) must not exceed 100’ (30m)
- IR receivers from other manufacturers are not compatible with EcoSystem

EcoSystem IR Remote with Favorite Scene

C-FLRC-WH
- Allows personal control of individual fixture or group of fixtures
- The round orange button allows programming of a favorite light level for quick settings

Dimensions
- C-R-M1-WH
  - H: 0.69” (17mm)
  - D: 1.18” (30mm)
  - Stem Length: 1.25” (32mm)
- C-FLRC-WH
  - W: 1.51” (38mm)
  - H: 4.63” (118mm)
  - D: 0.55” (14mm)
Step 3 Control Selection

Wiring the Infrared Receiver/Wallstation
- Wire color designations of the IR sensor:
  Red = 20VDC
  Black = Common
  White = IR Signal
- Make sure that the supply breaker to the digital ballast is OFF when wiring
- Connect the three conductors to the three digital ballast terminals as shown

Note: The digital BMF accepts only one IR input. Use of the infrared receiver precludes the use of the IR output in the daylight sensor for programming.

Mounting the Infrared Receiver
Determine the proper location of the infrared receiver using the adjacent diagrams.
- The infrared receiver receives IR signals from up to 8’ (2.44m) away when mounted on a 10’ (3.05m) ceiling
- The cone of reception is centered upon the infrared receiver per the diagram to the right
- The cone of reception will be diminished when receiver is mounted less than 10’ (3.05m) from the floor
- Ensure that the receiver is placed with a clear line of sight between the receiver and the desired control locations
### EcoSystem 1-Button Wallstations with Raise/Lower

**CC-1BRL-WH**

- Low-voltage wires connect directly to the ballast or BMF, receives power from a ballast or BMF
- On/Off and dimmer rocker to adjust light between 100-10%
- Integrated IR receiver for programming or push-button programming
- Fits in standard single gang wall box
- Engraving is available
- Wallplate not included

### EcoSystem 4-Button Wallstations with Raise/Lower

**CC-4BRL-WH**

- Low-voltage wires connect directly to the ballast or BMF, receives power from ballast or BMF
- Allows 4 scenes to be created for instant recall from memory
- Integrated IR receiver for programming or push-button programming
- Fits in standard single gang wall box
- Engraving is available
- Wallplate not included

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**Dimensions**

- **CC-1BRL-WH**
  - W: 2.75" (70mm)
  - H: 4.56" (116mm)
  - D: 1.25" (32mm)

- **CC-4BRL-WH**
  - W: 2.75" (70mm)
  - H: 4.56" (116mm)
  - D: 1.25" (32mm)
Step 4 Support Components

Programming EcoSystem
Any EcoSystem can be programmed using the EcoSystem programmer. This device is designed with a graphic display to make programming quick and simple.

EcoSystem Programmer

C-PDA-CLR
- Handles programming changes for all sensors and ballast
- Transmits to any IR receiver, daylight sensor, or EcoSystem wallstation
- Simple user interface allows programming without training or guidebook
- User name/Password requirement ensures security of system
- Programmer will not operate or store non-EcoSystem programs or information

Functionality

- Lighting Control
  - Personal control of the light level of individual fixtures or groups of fixtures

- Grouping
  - Assign individual or groups of fixtures to wallstations, daylight sensors and occupancy sensors so that one sensor can control multiple fixtures/ballasts

- Device Setup
  - Daylight sensor: Set the electric light level that responds to the presence of daylight
  - Occupancy sensor: Set the time-out length, light level when room is occupied, and light level when room is not occupied
  - 4-Button Wallstations: Set light levels for each individual or group of fixtures to create scenes for each button of the wallstation.

- Ballasts
  - Addressing: This begins the automatic addressing of individual or multiple ballasts
  - Configuration: Set maximum level, fade time, or emergency level for each ballast or all ballasts on the system
  - Replacement: Simply enter the serial number of the old ballast and all programming is transferred to the new ballast

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**Step 4 Support Components**

**EcoSystem Bus Supply**
Design Statement: The EcoSystem bus supply is required for two or more ballasts (or BMFs) to work together. The bus supply powers the communication bus and is capable of supporting up to 64 ballasts or BMFs. For integration of multiple bus supplies or other lighting control systems, please contact a Lutron Representative.

**EcoSystem Digital Bus Supply**

- **CS-1L-CM** (shown)
  - Contractor mountable, no enclosure,
    2 contact closures, 1 panic contact closure
- **CS-1L-WM**
  - 2 contact closures, 1 panic contact closure, 1 wallstation/IR connection, wall-mountable inside enclosure

- Accepts one panic normally open or normally closed dry contact closure to override light level to full output
- EcoSystem bus may be wired Class 1 or Class 2; bus wires are polarity insensitive
- Topology-free wiring; Bus supply may be wired to the communication bus at any point
- Output voltage: 16VDC 250 mA Max (Class 1 or Class 2)
- Powered by 120 or 277 V, ~50 or 60 Hz
- Bus supply terminals:
  - EcoSystem bus: #12 – #18 AWG (2.05 – 1.02mm) Solid
  - Power wiring: #12 – #18 AWG (2.05 – 1.02mm) Solid
  - Class 2 contact closures
- Non-volatile (EEPROM) memory stores system programming for 10 years from power down to power restored
- Lutron recommends 1 bus supply for each room being controlled by EcoSystem
- Power draw is < 0.12 A; can be fed with same circuit as fixtures

**Dimensions**

- W: 1.77” (45mm)
- H: 3.56” (85mm)
- D: 3.62” (92mm)

**Limits**
Each EcoSystem bus can accommodate the following:
- 64 Ballasts/BMFs
- 32 Occupancy Sensors
- 64 Wallstations or Infrared Sensors
- 8 Daylight Sensors
Wiring to an EcoSystem Bus Supply

- The bus supply does not have to be located at the end of the EcoSystem bus.
- E1 and E2 wires are polarity insensitive.
- Bus length is limited by the wire gauge used for E1 and E2 as follows:

<table>
<thead>
<tr>
<th>Wire Gauge</th>
<th>Max Loop Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>#12 AWG (2.05mm)</td>
<td>2,200' (670m)</td>
</tr>
<tr>
<td>#14 AWG (1.63mm)</td>
<td>1,400' (426m)</td>
</tr>
<tr>
<td>#16 AWG (1.29mm)</td>
<td>900' (274m)</td>
</tr>
<tr>
<td>#18 AWG (1.02mm)</td>
<td>550' (167m)</td>
</tr>
</tbody>
</table>

Attention Electricians and Contractors

Regardless of bus wire gauge, ballast and BMF terminals will hold only one #16 to #18 AWG solid wire. In most cases a wire connection to the EcoSystem bus is required.

Note: Two different color wires are recommended for the EcoSystem bus. This prevents accidentally creating a loop circuit with one wire.

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Note: Any sensor connected to 1 ballast can control any or all ballasts or BMFs on the EcoSystem bus.
EcoSystem™ Ballast pg. 06

EcoSystem bus is Class 1 or Class 2, topology free; Lutron recommends 2 different colors

IR Receiver pg. 12

EcoSystem Bus Supply, pg. 16 Can connect up to 64 ballasts or BMFs with one power supply.

Distribution 120/277V

Distribution

BMF pg. 07

Eco-10™ or Hi-lume® Ballast

To Distribution

Occupancy Sensor pg. 10

Type B

Type A

Type D

Wire Gauge Key

Type A
EcoSystem Bus
#16 – #18 AWG Solid

Type B
Line Voltage
#16 – #18 AWG Solid

Type C
Class 2 LV
#22 AWG Solid 105°C Only

Type D
Line Voltage
#12 – #18 AWG Solid

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Two areas where EcoSystem was designed to save energy and improve flexibility are open office spaces and schools. The following two examples demonstrate common designs and benefits of incorporating EcoSystem into offices and schools.

Office Space

Typical Layout:

Legend
■ Bus Supply
○ Downlight with Hi-lume® and BMF
◆ IR Receiver
● Daylight Sensor
▲ Occupancy Sensor
□ Wallstation

Bill of Materials

Step 1:
12 EcoSystem Ballasts
(EC 5 T832 G 277 3)
4 EcoSystem BMFs
(C5-BMF-2A)
4 Hi-lume® ballasts
(HL3-T426-277-1)

Step 2:
2 Daylight Sensors
(C-SR-M1-WH)
2 Occupancy Sensors
(LOS-CUS-1000-WH)

Step 3:
2 Low-voltage Wallstations
(CC-1BRL-WH)
3 IR Receivers
(C-R-M1-WH)

Step 4:
1 EcoSystem Bus Supply
(CS-1L-CM)
1 EcoSystem Programmer
(C-PDA-CLR) (not shown)

Note: Power wiring not shown. EcoSystem bus connects all ballasts and bus supply.
Can eliminate 40% – 60% of lighting energy cost by combining:
- dimming
- daylighting
- occupancy sensing

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### Common Office Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Daylighting at different light levels for all fixtures | • Reduced energy use  
- Appropriate lighting for different employee needs |
| Occupancy sensing in closed off rooms         | • No wasted energy when rooms are unoccupied                              |
| Dimming controls in closed off rooms          | • Exact light levels for varying needs  
- Saved scenes                                  |
| Personal control above cubicles               | • Exact light levels for varying needs  
- Improved employee productivity                |

### Results:

- Increase flexibility for changing purposes of work space
- Save energy through combined sensor and control technologies
- Reduce maintenance from fewer parts and low-voltage sensor/control wires
- Increase productivity through personal control and proper lighting

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In this design example of a school, pendant fixtures are used with EcoSystem to illustrate the flexibility to work with either recessed or pendant fixtures. Shown below, occupancy sensor connects directly to the bus supply.

**K-12 Schools**

**Typical Layout:**

**Bill of Materials**

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>9 EcoSystem Ballasts (EC 5 T832 G 277 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2:</td>
<td>1 Daylight Sensor (C-SR-M1-WH)</td>
</tr>
<tr>
<td></td>
<td>1 Occupancy Sensor (LOS-CUS-1000)</td>
</tr>
<tr>
<td>Step 3:</td>
<td>1 Low-voltage Wallstation (CC-1BRL-WH)</td>
</tr>
<tr>
<td>Step 4:</td>
<td>1 EcoSystem Bus Supply (CS-1L-CM)</td>
</tr>
<tr>
<td></td>
<td>1 EcoSystem Programmer (C-PDA-CLR)</td>
</tr>
</tbody>
</table>

Note: Power wiring not shown. EcoSystem bus connects all ballasts and bus supply.
Common Classroom Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Daylighting levels set on a class-by-class basis | • Reduced energy use  
• Even light level throughout classroom  
• Non-distracting light level changes  
• Increased productivity |
| Occupancy sensing                | • No wasted energy when classrooms are empty         |
| Dimming                          | • Saved scenes for various presentation and computer/classwork needs |

Results:

Save Energy through combined sensor and control technologies in every classroom  
Reduce maintenance from fewer parts and low-voltage sensor/control wires  
Increase student productivity through use of daylight and exact light levels for task needs

Alternate Wiring Method

CS-IL-CM

• Use an 'R' model of occupancy sensor with a power pack to wire directly to the EcoSystem bus supply.

Legend

- Bus Supply  
- Occupancy Sensor  
- Wallstation  
- Power Pack

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Class 2 Terminal Operation and Bus Supply Programming

Contact Closure Inputs

- Contact closures on the Bus Supply may be used for integrating a BMS system or occupancy sensors with relay outputs to an EcoSystem Lighting Network.
- CCI-1 and CCI-2 are programmable to control two different groups of ballasts (one group per CCI).
- CCIs force the assigned groups to an “Occupied mode” or “Unoccupied mode”.
- Occupied mode enables the system to operate normally: wallstations, daylight sensors, occupancy sensors, and infrared transmitters control ballasts as programmed.
- Unoccupied mode turns EcoSystem ballasts and BMFs off. The off setting is overridden by an occupancy sensor, or the contact closure input. Unoccupied mode is locally overridden if an occupancy sensor in the space detects motion. Once the local sensor times out, the space becomes unoccupied.
- Each input may be normally open (NO) or normally closed (NC) (see below for required OPT switch settings).

OPT SWITCH FUNCTION

<table>
<thead>
<tr>
<th>OPT</th>
<th>Description</th>
<th>Mode</th>
</tr>
</thead>
</table>
| 1   | CCI-1       | OFF = Normally closed  
|     |             | ON = Normally open      |
| 2   | CCI-2       | OFF = Normally closed   
|     |             | ON = Normally open      |
| 3   | Reserved    |      |
| 4   | Reserved    |      |
| 5   | Emergency   | OFF = Ignore input      
|     | Operation   | ON = Input Valid (open = emerg) |
| 6   | Programmer  | OFF = Programmer enable   
|     | Lockout     | ON = Programmer disable |

OPT SWITCHES 7 AND 8

<table>
<thead>
<tr>
<th>OPT 7</th>
<th>OPT 8</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>Normal Operation (default)</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
<td>Override: High End</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>Override: Low End</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>Override: Off</td>
</tr>
</tbody>
</table>
There are two different ways that EcoSystem can integrate with Emergency systems.

<table>
<thead>
<tr>
<th>Emergency Situation:</th>
<th>No power is lost</th>
<th>Normal power is lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Result</td>
<td></td>
<td></td>
</tr>
<tr>
<td>An emergency signal can be sent from a building management system or emergency system to the contact closure on the EcoSystem bus supply. All ballasts on the bus will respond by going to 100%, unless programmed to do otherwise.</td>
<td>All ballasts will turn off except ballasts that are fed by the emergency power source (i.e. generator, battery) as shown in the wiring diagram. The ballasts receiving emergency power will go to 100% unless programmed to do otherwise.</td>
<td></td>
</tr>
</tbody>
</table>
In order to ensure that environment sensors and personal controls do not override each other in a way that disturbs users, a hierarchy was established for the sensor and control inputs.

**Input Priority to EcoSystem Ballast or BMF (highest to lowest)**

**Priority 1:** Emergency Command (typically lights to full on)

**Priority 2:** Configuration Commands, Status Responses, Addressing Commands, and Load Shedding (ballast responds to in-progress programming)

**Priority 3:** Occupancy Sensor Input

**Priority 4:** Daylight Sensor Input

**Priority 5:** Personal Control (IR, wallstation), IR Input, Phase Control

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The occupancy sensor turns the lights on to the programmed “occupied” level.

If enough daylight is entering the space, the daylight sensor will reduce the light level to maintain the designed proper luminance level for the room.

In the middle of the day, the light level is reduced to the load shed level to reduce energy during peak usage hours.

If the person uses a wallstation or IR remote they can adjust the light level below the level set by the daylight sensor. The person always has the flexibility to set the lights to any level below the maximum light level programmed for the room.

After a programmed time-out setting, the occupancy sensor will set all the lights to the programmed “unoccupied” level.
Wiring to 1 Lamp

Wiring to 2 Lamps

Wiring to 3 Lamps

Attention Electricians and Contractors

Ballast/Socket Leads
Lead lengths from ballast to socket must not exceed 7’ (2m) for T8 lamps.

Lamp Sockets
Lamp sockets as per IEC 60400 are required to ensure positive lamp-pin to socket contact.

Attention Facility Managers

Lamp Seasoning
Refer to your lamp company for lamp seasoning requirements prior to dimming.

Lamp Mounting for T8
Keep lamp 1/2” ± 1/4” away from the grounded metal surface. Having a lamp too close to the grounded metal will not reduce lamp life but may cause a visible difference in brightness along the length of the lamp.

Technical Support: 1.800.523.9466 ... 24 hours/7 days (US/CAN)
To Order: 1.888.LUTRON1 ... 8 am – 8 pm/M-F ET (US/CAN)
0-10V Dimming:
Dimming system using 2 power wires and 2 low-voltage communication wires to send dimming levels to the ballasts.

Ballast:
An electrical device for starting and regulating fluorescent lamps. Required for all fluorescent lights.

BMS (Building Management System):
Automated/manual control systems that allow integration of multiple systems in a building for control from a single location.

Class 1 or Class 2:
Class 1 wiring is manufactured with insulation to provide safe use up to 600V. Class 2 wiring is not insulated for line-voltage loads and is typically used in low-voltage scenarios such as telephone or internet wire.

Commissioning:
Initial programming to set up groups and sensor responses of EcoSystem components.

DALI (Digital Addressable Lighting Interface):
A lighting protocol developed in Europe as a type of communication for digital ballasts.

Daylighting:
Harvesting natural light entering a space to reduce the amount of electrical light that is used.

EcoSystem by Lutron:
The most efficient, most adaptable fluorescent lighting control system in the world.

EcoSystem Bus:
Communication wires that carry information between up to 64 ballasts (or BMFs) and EcoSystem digital bus supply.

Environment Sensors:
Sensors that receive input from a space and respond by automatically adjusting lighting.

Lighting EcoSystem:
A combination of sensors and controls operating to save energy and increase productivity in a building. For more information visit www.lightingecosystem.com.

Polarity-Free:
Polarity is the polar indication of whether an electrical terminal is positive or negative. EcoSystem bus wires can be reversed without electrical problems. Polarity-free indicates that the terminals are reversible and are not permanently positive or negative.

Repurposing:
Changing the use of a space, such as a group of cubicles being removed to create a larger conference area.

Start-up:
Lutron on-site system set-up and configuration by a Lutron engineer to ensure proper functionality by all components. Start-up is only required on GRAFIK 7000™ systems with EcoSystem integration, but is available for all EcoSystem projects. Service pricing is proportional to the size and complexity of the EcoSystem project.

Topology-Free:
Topology is the configuration of a communication network. The most common topologies used for wiring are daisy chain, star method, or T-tap. Topology-free indicates that any wiring configuration will work for the EcoSystem bus.
A comparison of systems

<table>
<thead>
<tr>
<th>What can a lighting system do for you?</th>
<th>0-10V</th>
<th>DALI</th>
<th>EcoSystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works without power packs or interfaces to sensors</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Scalable to any project size</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ballast replacement without reprogramming</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Easily integrates with daylighting</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Zones are programmed, not wired</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Easy reconfiguration or adjustments without going above a ceiling or a computer</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Class 1 or Class 2 communication bus wiring</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Always Class 2 sensor and wallstation wiring</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Always out-of-box functionality of daylighting, occupancy sensing, or manual controls</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Each fixture is addressable</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be modified or &quot;re-zoned&quot; without rewiring</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Worldwide sales and service

Lighting Control application experts are available 24 hours/7 days a week to assist you. Service is available in over 140 languages.

**Technical Support:**
24 Hours/7 Days
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**Customer Service:**
8am-8pm ET
1.888.LUTRON1

**Internet Support:**
www.lutron.com/ecosystem

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Innovation and quality from the world leader in light control solutions.
In 1961, Lutron introduced the world’s first electronic (solid-state) dimmer. From that point forward, Lutron innovations transformed the world of light control. Today, with more than 75 utility and 180 design patents, and more than 10,000 products shipped to 80 countries worldwide, Lutron continues to lead the way with innovation and quality.