EcoSystem®
Design and Application Guide

LUTRON®
Lutron solutions do more than just control the light in a space. With the right design strategies, they can save substantial amounts of energy, reduce operating costs, and improve productivity.

Energy-saving strategies

- High-end trim/Tuning \(^1\) (20% lighting)
- Occupancy or vacancy sensing \(^2\) (15% lighting)
- Daylight harvesting \(^3\) (15% lighting)
- Personal dimming control \(^4\) (10% lighting)

Potential lighting energy savings

60%

Sources can be found on pg.04.
The new EcoSystem H-Series ballast is a cost-effective digital ballast option designed to meet the growing need for intelligent energy savings. The H-Series ballast offers superior capability, easy setup, and increased flexibility, see pg. 16.

EcoSystem is designed for office spaces, K-12/university classrooms, and patient rooms, where lighting typically accounts for 39% of electricity usage. These applications benefit from EcoSystem’s unparalleled energy savings achieved through the use of personal controls including wallstations and infrared remote control transmitters, and environmental sensors such as daylight and occupancy/vacancy sensors.

In addition to providing energy savings, EcoSystem creates a more flexible workspace in which lighting fixtures with EcoSystem fluorescent ballasts and LED drivers are individually addressed. These ballasts and drivers are programmed, instead of wired, to work individually or as a group, creating flexibility in a space that adjusts to the shifting needs of any building.

Finally, EcoSystem features fewer parts and user-friendly programming reducing lighting system maintenance. Environmental sensors and personal controls integrate wirelessly or connect directly to any ballast, Energi Savr Node™ module, or QS sensor module, eliminating interfaces, power packs, and control devices.

Energy-saving light control strategies

Intelligent lighting control offers a significant energy-saving opportunity

Despite the fact that most lighting is energy-efficient fluorescent, the number-one source of energy consumption in any building is still lighting.

High-end trim/Tuning
Set the maximum light level in a space based on customer or design requirements.
Best applied in daylit spaces such as open office areas, classrooms, and corridors or when retrofitting an existing installation.

Typical lighting energy savings: 20%¹

Occupancy/Vacancy sensing
Slowly dim lights to a low level or turn lights off when the space is unoccupied; turn lights on when someone enters.
Best applied in enclosed areas such as meeting rooms, offices, classrooms, and corridors.

Typical lighting energy savings: 15%²

Daylight harvesting
Take advantage of available daylight.
Adjust electric lighting smoothly, unobtrusively and continuously.
Best applied in areas with large windows or skylights, such as perimeter offices, classrooms, malls, and atriums.

Typical lighting energy savings: 15%³

Personal dimming control
Provide personal choice and control of light levels to accommodate for different tasks and activities. Permit dimming from multiple locations.
Allow the ability to turn lights on and off.
Best applied in areas such as meeting rooms, offices, classrooms, and patient rooms.

Typical lighting energy savings: 10%⁴

Potential lighting energy savings when combining all light control strategies: 60%+

² IESNA 2000 Proceedings, Paper #43: An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems. “Occupancy sensor savings range from 17% to 60% depending upon space type and time delay settings.”
⁴ IESNA 2000 Proceedings, Paper #34: Occupant Use of Manual Lighting Controls in Private Offices. “Giving the occupant manual switching and dimming provided a total of 15% added savings above the 43% achieved by motion sensors.”
## Codes and standards

### ASHRAE Energy Code 90.1–2010

ASHRAE Energy Code 90.1–2010 is the newest energy standard and is the basis for most state-specific codes as well as the IECC code. The following chart outlines sections of the ASHRAE code most applicable to lighting energy, and identifies the Lutron® lighting control solutions that can help you meet and exceed these codes.

For more specific information on energy codes in your state, visit [www.bcap-energy.org](http://www.bcap-energy.org).

<table>
<thead>
<tr>
<th>ASHRAE Section</th>
<th>Lighting Control Solution</th>
</tr>
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<tbody>
<tr>
<td><strong>Automatic Lighting Shut-off (9.4.1.1)</strong></td>
<td><strong>Interior lighting</strong> shall be controlled with an automatic control device to shut off building lighting in all spaces (no 5,000 sq. ft. minimum building size)</td>
</tr>
<tr>
<td><strong>Space Control (9.4.1.2)</strong></td>
<td><strong>Multi-level lighting</strong>—The controlled lighting in a space shall have at least one control step between 30% and 70% (inclusive) of full-lighting power in addition to all off.</td>
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<tr>
<td>Each space enclosed by ceiling height partitions shall have at least one control device to independently control the general lighting within the space.</td>
<td><strong>Energi Savr Node</strong> modules with seeTouch® QS wallstations. <strong>EcoSystem</strong> wallstations and/or <strong>Pico</strong> wireless controls</td>
</tr>
<tr>
<td>An occupant sensor or timer switch shall be installed that automatically turns lighting off within 30 minutes of all occupants leaving a space (specific room type are defined within the code).</td>
<td><strong>EcoSystem</strong> with occupancy/vacancy sensors, integration with a timeclock, or after hours mode</td>
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<tr>
<td><strong>Automatic Daylighting Controls for Primary Sidelighted Areas (9.4.1.3) and for Toplighting (9.4.1.4)</strong></td>
<td>Sidelighted areas larger than 250 sq. ft. (and/or daylighted areas under skylights larger than 900 sq. ft.) must have a multi-level photocontrol that reduces electric lighting in response to available daylight with at least one control step that is between 50% and 70% of design lighting power and another control step that is no greater than 35% (including off) of design power.</td>
</tr>
<tr>
<td><strong>Additional Lighting Control (9.4.1.6)</strong></td>
<td><strong>Stairwell lighting</strong>—Lighting in enclosed stairwells shall have one or more control devices to automatically reduce lighting power in any one controlled zone by at least 50% within 30 minutes of all occupants leaving that controlled zone.</td>
</tr>
<tr>
<td><strong>Additional Lighting Power (9.6.2)</strong></td>
<td>Additional lighting power allowances toward Lighting Power Density (LPD) requirements when you use controls that are not already mandated. Controls that give you credits are: Multi-level occupancy/vacancy sensors, dimming, workstation occupancy/vacancy sensors, daylight switching and daylight dimming.</td>
</tr>
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</table>
Foundation for a system

EcoSystem® lighting control starts with one simple, but essential building block—the EcoSystem ballast—which replaces the non-dim ballast in a fixture. Depending on the type of room or facility, any combination of environmental sensors or wallstations can be used to control the fixture.

Digital ballast options for 1% dimming

EcoSystem H-Series 1% fluorescent dimming ballasts, pg. 16
Please visit www.lutron.com/hseries for model availability.
Available for:
• 4 ft. T8 1, 2 and 3-lamp fixtures (1.0 and 1.17 ballast factor)
• 4 ft. T5 and T5HO 1- and 2-lamp fixtures

Hi-lume 3D 1% fluorescent dimming ballasts, pg. 17
Please visit www.lutron.com/hilume3D for model availability.

10%
Other digital ballast options

EcoSystem digital ballasts with integral sensor connections, pg. 18
Please visit www.lutron.com/ecosystem for model availability.

1%
Additional digital ballast options for 1% dimming

5%
Other digital ballast options

EcoSystem CFL digital ballasts, pg. 19
Please visit www.lutron.com/ecosystem for model availability.
How to design a system

Before designing a system consider the following to help clarify the scope of the project:

Define your space

The appropriate lighting control solution is defined by the needs of the space. The following steps help to answer key questions and drive you to the ideal lighting control solution.

Step 1 ballast and driver selection

A Determine number of fixtures that will be connected to EcoSystem
B Determine the fixture type and how the fixtures are driven
   – Fluorescent and/or LED
   – Digital control only and/or digital and 3-wire control

See pgs. 16–20 for all ballast and driver options

Step 2 Energi Savr Node™ selection

A Select main control module
B Determine if additional lighting fixtures will be controlled as a switched or 0–10 V zone

See pgs. 21–23 for all module options

Step 3 sensor selection

A Determine what sensors will be connected to EcoSystem
B Choose wireless or wired sensors or a combination of both technologies

See pgs. 24–27 for all sensor options

Step 4 control selection

Determine the type of wall control required and/or if there are additional points of control needed in the space

See pgs. 28–31 for all control options

Step 5 accessory devices

Determine integration strategy needed (if any) and timeclock requirements

See pg. 32 for accessory options

Step 6 programming

Determine device for system programming

See pg. 33 for all programming options
**Integral Sensor**

- **Type A**
- **Type B**
- **Type C**

**TRIM OFF**

- **Wi-Fi**
  - **Router**
  - **(Required for wireless integration)**

**Wireless sensor and control limits:** (30 total devices)
- **4 wired sensor connections in total can be used**
- **Requires 3 – 11 PDUs depending**
- **Counts as 1 QS device**

**NEW QS Sensor Module**

- **NEW Radio Powr Savr wireless occupancy/vacancy Sensor,**
- **NEW Pico wireless controls (maximum)**
- **Wireless sensor and control limits: (30 total devices)**
- **will be on the same link,**
- **or is programmed to communicate with a fluorescent ballast**
- **EcoSystem-compatible fluorescent ballasts and LED drivers per EcoSystem digital link**

**Sensor and control communication limits:**
- **Up to 100 devices, including Energi Savr Node™**
- **Maximum of 100 zones**
- **Maximum of 100 devices, including EcoSystem® Ballasts,**
- **EcoSystem-compatible fluorescent ballasts and LED drivers per EcoSystem digital link**

**Wire gauge key**

- **Class 1 Standard:** C-CBL-216-WH-C1
- **Class of Power Ribs:** C-PCBL-216-CL-1
- **Class 2 Standard:** C-CBL-216-WH-1
- **Class 2 Plenum Rated:** C-CBL-216-SWH-1
- **Class 2 Plenum Rated:** C-CBL-216-5WH-1
- **Class 1 Standard:** C-CBL-216-WH-C1
- **Class 2 Standard:** C-CBL-216-WH-CL-1
- **Class 2 Standard:** C-CBL-216-5WH-1
- **Class 2 Plenum Rated:** C-CBL-216-5WH-1
- **Class 2 Plenum Rated:** C-CBL-216-SWH-1

**System rules and maximums**

**EcoSystem Digital Link Rate (Type A Wire)**
- Up to 100 compatible components, fluorescent ballasts and/or LED drivers per EcoSystem digital link
- **Sensor and control communication limits:**
  - **4 wired sensor connections in total can be used**
-

**Wireless sensor and control limits:** (30 total devices)
- **Counts as 1 QS device**
**Step 1 ballast and driver selection**

### EcoSystem H-Series digital ballasts

**Design statement:** Specify EcoSystem H-Series digital ballasts for high-performance 1% dimming. Lighting will be controlled entirely by EcoSystem; sensors communicate to ballasts via an Energi Savr Node™ module.

**NEW T8, T5, and TSHO digital ballast dimensions (C case)**
- L: 18.00” (457 mm)
- W: 1.18” (30 mm)
- H: 1.00” (25 mm)
- Mounting center: 17.70” (450 mm)

**NEW T8, T5, and TSHO digital ballast dimensions (M case)**
- L: 14.13” (359 mm)
- W: 1.18” (30 mm)
- H: 1.00” (25 mm)
- Mounting center: 13.68” (347 mm)

**NEW T8, 3-lamp digital ballast dimensions (G case)**
- L: 9.50” (241 mm)
- W: 2.38” (60 mm)
- H: 1.00” (25 mm)
- Mounting center: 8.90” (226 mm)

**Performance**
- Universal voltage input allows the ballast to be operated at 120V, 220/240V, or 277V at 50/60Hz
- 347 V input available for 1- and 2-lamp fixtures
- High-performance dimming down to <1% for T8, 1% for T5 and TSHO
- Strikes to any light level

**Benefits**
- With models available for T8, T5, and TSHO, use EcoSystem H-Series throughout any space
- Digitally configured zones can be changed without re-wiring
- The EcoSystem digital link offers improved flexibility and can be wired as Class 1 or Class 2
- The low-voltage, 2-conductor EcoSystem digital link installs as easy as 0–10V and provides for individual fixture control
- Responds to daylight sensors, occupancy/vacancy sensors, and controls connected to the EcoSystem ballast, Energi Savr Node module, or QS sensor module

**Energy**
- Saves energy as it dims
- Helps meet energy codes such as ANSI/ASHRAE/IESNA standard 90.1-2010, Title 24, and IECC
- Custom factory-tuned ballast factors available to help meet lighting power density requirements

**Models**
For the latest information and model numbers, visit www.lutron.com/hseries

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

**Note:** For 2 ft. and 3 ft., 1% dimming ballast use Hi-lume 3D, see www.lutron.com/hilume3d for more information.

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### Hi-lume, 3D digital ballasts

**Design statement:** Specify Hi-lume 3D digital ballasts to be installed in areas of an EcoSystem lighting control solution that require architectural level dimming. Ballasts also have 3-wire inputs.

**T8 and T5 Twin-tube digital ballast dimensions**
- L: 9.50” (241 mm)
- W: 2.38” (60 mm)
- H: 1.00” (25 mm)
- Mounting center: 8.90” (226 mm)

**T8, T5 and TSHO digital ballast dimensions**
- L: 18.00” (457 mm)
- W: 1.18” (30 mm)
- H: 1.00” (25 mm)
- Mounting center: 17.70” (450 mm)

**Performance**
- Universal voltage; operates at 120V, 220/240V, and 277V, at 50/60Hz
- Smoothly dims from 100% to 0.7% for T8 lamps; 100% to 1% for T5 and TSHO lamps; and 100% to 5% for T5 Twin-tube lamps
- Strikes to any light level

**Benefits**
- Models available for T8, TSHO and T5 Twin-tube; use in conference rooms, classrooms, and/or patient rooms
- Hi-lume 3D ballasts are digitally addressed and configured to work in zones after installation, which can reduce zone definition and additional design steps
- Responds to daylight sensors, occupancy/vacancy sensors, and controls connected to EcoSystem ballasts, Energi Savr Node modules, or QS sensor modules

**Energy**
- Saves energy as it dims
- Helps meet energy codes such as ANSI/ASHRAE/IESNA standard 90.1-2010, Title 24, and IECC
- Custom factory-tuned ballast factors available to help meet lighting power density requirements

**Models**
For the latest information and model numbers, visit www.lutron.com/hilume3d

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41
Step 1 ballast and driver selection

EcoSystem digital ballasts with integral sensor connections

**Design statement:** Specify EcoSystem ballasts with integral sensor connection for dimming performance to 10%. Lighting controls can be a combination of EcoSystem digital and/or 3-wire controls; sensors communicate directly via integral ballast sensor connections or through the Energi Savr Node™ module.

**Performance**
- Universal voltage; operates at 120V, 220/240V, and 277V, at 50/60Hz; select models are available in 347V
- Smoothly dims from 100% to 10% for T8, T5, TSHO and T5 twin-tube
- Strikes to any light level

**Benefits**
- Models available for T8, T5, TSHO, and T5 twin-tube; use throughout an office, school, and/or healthcare building
- EcoSystem ballasts are digitally addressed and configured to work in zones after installation, which can reduce zone definition and additional design steps
- Powers and/or responds to one daylight sensor, occupancy/vacancy sensor, and wallstation or infrared receiver

**Energy**
- Saves energy as it dims
- Helps meet energy codes such as ANSI/ASHRAE/IESNA standard 90.1-2010, Title 24, and IECC
- Custom factory-tuned ballast factors available to help meet lighting power density requirements

**Models**
For the latest information and model numbers, visit www.lutron.com/ecosystem

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

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T8, T5, TSHO, and T5 twin-tube digital ballast dimensions
- L: 18.00" (457 mm)
- W: 1.18" (30 mm)
- H: 1.00" (25 mm)
- Mounting center: 17.70" (450 mm)

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T8 digital ballast
- L: 9.50" (241 mm)
- W: 2.38" (60 mm)
- H: 1.00" (25 mm)
- Mounting center: 8.90" (226 mm)

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Step 1 ballast and driver selection

EcoSystem CFL digital ballasts

**Design statement:** Specify EcoSystem CFL digital ballasts for dimming performance to 5%. Lighting controls can be a combination of EcoSystem digital and/or 3-wire controls; sensors communicate to ballasts via the Energi Savr Node module.

**Performance**
- Universal voltage; operates at 120V, 220/240V, and 277V, at 50/60Hz
- Smoothly dims from 100% to 5% for T4 triple-tube and T4 quad-tube
- Strikes to any light level

**Benefits**
- Models available for T4 triple-tube and T4 quad-tube; use throughout an office, school, and/or healthcare building
- EcoSystem ballasts are digitally addressed and configured to work in zones after installation, which can reduce zone definition and additional design steps
- Powers and/or responds to one daylight sensor, occupancy/vacancy sensors, and controls connected to the EcoSystem ballast, Energi Savr Node module, or QS sensor module

**Energy**
- Saves energy as it dims
- Helps meet energy codes such as ANSI/ASHRAE/IESNA standard 90.1-2010, Title 24, and IECC
- Custom factory-tuned ballast factors available to help meet lighting power density requirements

**Models**
For the latest information and model numbers, visit www.lutron.com/ecosystem

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

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T4 triple-tube and T4 quad-tube digital ballast dimensions
- L: 4.90" (124 mm)
- W: 3.00" (76 mm)
- H: 1.00" (25 mm)
- Mounting center: 4.60" (117 mm)
Step 1 ballast and driver selection

Hi-lume® A-Series LED drivers

Design statement: Specify Hi-lume® A-Series LED drivers for smooth and continuous 1% dimming for virtually any LED light engine, whether it requires constant current or constant voltage.

Performance
- Constant voltage options from 10 V to 40 V, available in 0.5 V steps up to 40 watts
- Constant current options from 200 mA to 2.1 Amps, available in 10 mA steps up to 40 watts
- Universal voltage; operates at 120 V, 220/240 V and 277 V, at 50/60 Hz
- Immediate light output
- Strikes to any light level

Benefits
- Service-free lifetime of 50,000 hours
- Responds to daylight sensors, occupancy/vacancy sensors, and controls connected to EcoSystem ballasts, Energi Savr Node® modules, or QS sensor modules

Energy
- Saves energy as it dims
- Helps meet energy codes
- Contact the LED Control Center of Excellence for details: 1.877.DIM.LED8

Models
For the latest information and model numbers, visit www.lutron.com/HilumeLED
For a list of compatible fixtures, visit www.lutron.com/LEDTool
For wiring overview, see pgs. 12-15
For concept drawings, see pgs. 36-41

Step 2 Energi Savr Node selection

Energi Savr Node with EcoSystem module

Design statement: EcoSystem communication starts with an Energi Savr Node module. The Energi Savr Node module digitally links ballasts and powers communications throughout the lighting control system. Specify an Energi Savr Node module for controlling up to 64 or 128 fluorescent ballasts or LED drivers.

Features
- Provides individual control of 64 or 128 EcoSystem-compatible fluorescent ballasts and/or LED drivers
- Combines high-end trim, daylight harvesting, occupancy/vacancy sensing, personal control, and contact closure integration
- Connects directly to other Energi Savr Node modules, GRAFIK Eye® QS units, or Quantum® to expand functionality and control
- Sensor information can be shared across multiple EcoSystem digital links and across multiple Energi Savr Node modules (iPod touch programming application required)
- Programmable contact-closure input can activate scenes, enable/disable after hours mode, or enable/disable loadshed for demand response
- Model also available for integration with shades, see pg. 35

Mounting
- Surface mounted
- Can be installed in accordance with National Electrical Code® (NEC®) Article 300.22(c) “Other spaces used for environmental air”

Models
- QSN-1ECO-S—1 EcoSystem digital link controlling up to 64 EcoSystem-compatible fluorescent ballasts and/or LED drivers
- QSN-2ECO-S—2 EcoSystem digital links controlling up to 128 EcoSystem-compatible fluorescent ballasts and/or LED drivers
- QSN-2ECO-PS120—2 EcoSystem digital links controlling up to 128 EcoSystem-compatible fluorescent ballasts and/or LED drivers and up to 10 Sivoia® QS shade drives

For wiring overview, see pgs. 12-15
For concept drawings, see pgs. 36-41
Step 2 Energi Savr Node™ selection

QS sensor module

Design statement: Add a QS sensor module to integrate Lutron wireless and wired sensors and controls through the Energi Savr Node module to EcoSystem®-compatible ballasts and Hi-lume® A-Series LED drivers.

 Performance
 - Uses Clear Connect™ RF Technology for communication with up to 10 Radio Powr Savr occupancy/vacancy sensors, up to 10 Radio Powr Savr daylight sensors, and up to 10 Pico wireless controls
 - QS sensor module connects to up to four Lutron wired sensors or controls—occupancy sensors, daylight sensors, EcoSystem infrared (IR) receivers, EcoSystem wallstations, or Pico Wired control (each input is universal)
 - QS sensor module integrates Radio Powr Savr wireless sensors and Pico wireless controls
 - Also compatible with Energi Savr Node with Softswitch® and Energi Savr Node for 0–10 V modules
 - RF Range: 60 ft. (18 m) line of sight, or 30 ft. (9 m) through walls

 Benefits
 - Powered by QS communication link—no line voltage connections are required

 Mounting
 - Installs on the ceiling, visible from inside the space, to guarantee wireless range
 - Option for J-box mount

 Models
 QSM2-4W-C—434 MHz North America (wired and wireless capability)
 QSMX-4W-C—wired sensor inputs only
 QSM2-XW-C—434 MHz North America (wireless capability only)
 QSM2-4W-J—434 MHz North America (wired and wireless capability, J-box mount)
 QSM2-XW-J—434 MHz North America (wireless capability only, J-box mount)

 For wiring overview, see pgs. 12–15
 For concept drawings, see pgs. 36–41

Step 2 Energi Savr Node™ selection

Other Energi Savr Node modules

Design statement: Specify additional Energi Savr Node modules based on the control type and functionality you need to add to the lighting control system; for example, adding additional switched zones and/or additional 0–10 V dimming zones.

 Features
 - Provide switched and dimming control of other lighting loads
 - Combines high-end trim, daylight harvesting, occupancy/vacancy sensing, personal control, and contact closure integration
 - Easily expand a system by connecting Energi Savr Node modules directly to other Energi Savr Node modules, GRAFIK® Eye® QS units, or Quantum® to expand functionality and control
 - Sensor information can be shared across multiple EcoSystem® digital links and across multiple Energi Savr Node modules (iPod touch programming application and Energi Savr Node programming interface required)
 - Programmable contact-closure input can activate scenes, enable/disable after hours mode, or enable/disable loadshed for demand response

 Mounting
 - Surface mounted
 - Can be installed in accordance with National Electrical Code® (NEC®) Article 300.22(c) "Other spaces used for environmental air"

 Models
 QSN-4S16-S—Energi Savr Node with Softswitch® for switching of four 16 A circuits of lighting loads
 QSN-4T16-S—Energi Savr Node for 0–10 V for switching and dimming of four 16 A circuits of 0–10 V loads

 For wiring overview, see pgs. 12–15
 For concept drawings, see pgs. 36–41
Step 3 sensor selection

Radio Powr Savr wireless daylight sensors

Design statement: Specify a wireless daylight sensor to dim or switch zones of light in response to daylight. Wireless integration is ideal in most situations and perfect for retrofit applications.

Performance
- 10-year battery life
- Up to 10 wireless daylight sensors per QS sensor module
- Up to 16 total daylight sensors per EcoSystem digital link
- Features Lutron’s reliable proportional daylight open loop control
- Has a light range (0–10,000 fc) and a photopic response that matches human eye
- Designed to give a linear response to changes in viewed light level
- One sensor is capable of switching, stepped dimming, and continuous dimming of multiple zones
- RoHS compliant

Benefits
- Sensors require no wiring and simple calibration
- Multiple ceiling-mount methods available for different ceiling materials
- Pendant-mount bracket available to mount sensor to a light fixture
- Front accessible test buttons make setup easy
- Sensor information can be shared across multiple EcoSystem digital links and across multiple Energi Savr Node modules (iPod touch programming application required, see pg. 33)

How it works
- Daylight sensors detect sunlight and communicate the sunlight level to the digital ballasts or LED drivers
- The daylight sensor is suitable for internal ambient light levels between 0 and 500 fc

Models
LRF2-DCRB-WH—434 MHz daylight sensor

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

Step 3 sensor selection

EcoSystem wired daylight sensors

Design statement: Specify a wired daylight sensor to dim or switch multiple zones of light in response to daylight. Select a wired solution for installations where wireless communication is not recommended or approved (i.e. certain government or medical buildings).

Performance
- Up to 16 total daylight sensors per EcoSystem digital link
- Features Lutron’s reliable proportional daylight open loop control
- Has a light range and a photopic response that matches human eye
- Designed to give a linear response to changes in viewed light level
- One sensor is capable of switching, stepped dimming, and continuous dimming of multiple zones
- RoHS compliant

Benefits
- Low profile for mounting on ceiling tiles or fixtures
- Class 2 low voltage enables simplified wiring and mounting
- Wires directly to the nearest EcoSystem ballast with integral sensor connections, Energi Savr Node module, or QS sensor module
- Sensor information can be shared across multiple EcoSystem digital links and across multiple Energi Savr Node modules (iPod touch programming application required, see pg. 33)

How it works
- EcoSystem daylight sensors detect incoming daylight and communicate the daylight level to the digital ballasts or LED drivers
- The daylight sensor is suitable for internal ambient light levels between 0 and 500 fc

Models
EC-DIR-WH—Daylight sensor with infrared receiver

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41
Step 3 sensor selection

**Radio Powr Savr® wireless occupancy/vacancy sensors**

**Design statement:** Specify a wireless occupancy/vacancy or vacancy only sensor to provide an automatic off for energy savings. Wireless integration is ideal in most situations and perfect for retrofit applications.

**Performance**
- 10-year battery life design
- Up to 10 wireless occupancy/vacancy sensors per QS sensor module
- Up to 32 occupancy/vacancy sensors per EcoSystem digital link
- Passive infrared motion detection with exclusive Lutron XCT™ Technology for fine motion detection
- Vacancy model available to meet CA Title 24 requirements
- Wall-mount and ceiling-mount options available
- Combine with PowPak CCO module for easy integration with BMS and A/V systems

**Benefits**
- Sensors require no wiring
- Sensors have simple test modes to verify ideal locations during installation using front-accessible buttons
- Multiple ceiling-mount methods available for different ceiling materials
- Sensor information can be shared across multiple EcoSystem digital links and across multiple Energi Savr Node™ modules (Pod touch programming application required, see pg. 33)

**Models**

- **Ceiling Mount**
  - LRF2-OCR2B-P-WH — 434 MHz occupancy/vacancy sensor
  - LRF2-VCR2B-P-WH — 434 MHz vacancy sensor

- **Wall Mount**
  - LRF2-OWLB-P-WH — 434 MHz occupancy/vacancy sensor
  - LRF2-VWLB-P-WH — 434 MHz vacancy sensor

- **Corner Mount**
  - LRF2-OCLB-P-WH — 434 MHz occupancy/vacancy sensor
  - LRF2-VKLB-P-WH — 434 MHz vacancy sensor

- **Hall Mount**
  - LRF2-OHLB-P-WH — 434 MHz occupancy/vacancy sensor
  - LRF2-VHLB-P-WH — 434 MHz vacancy sensor

See [www.lutron.com/RPS](http://www.lutron.com/RPS) for more information

**NEW! QS sensor module pg. 22**

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**EcoSystem® wired occupancy/vacancy sensors**

**Design statement:** Specify a wired occupancy/vacancy sensor to provide an automatic off for energy savings. Select a wired solution for installations where wireless communication is not recommended or approved (i.e. certain government or medical buildings).

**Performance**
- Up to 32 occupancy/vacancy sensors per EcoSystem digital link
- Broad range of models for offices to open spaces—500 sq. ft., 1000 sq. ft., 1600 sq. ft., or 2000 sq. ft. spaces
- Wall-mounted and ceiling-mounted modules available
- Ultrasonic, infrared, and dual technology models available
- “-R” models provide auxiliary dry contact closure for easy integration with BMS (building management systems) and A/V systems

**Benefits**
- No power pack required since power for the sensor comes directly from the EcoSystem ballast with integral sensor connection, an Energi Savr Node module, or the QS sensor module
- Sensor information can be shared across multiple EcoSystem digital links and across multiple Energi Savr Node™ modules (Pod touch programming application required, see pg. 33)

**Models**

- **Ceiling Mount**
  - LOS-CDT-(500,1000)-WH — Dual technology, 180°
  - LOS-CDT-2000-WH — Dual technology, 360°

- **Wall Mount**
  - LOS-WDT-WH — Dual technology, 110°

- **Corner Mount**
  - LOS-WDT-R-WH — Dual technology with relay, 110°

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

See [www.lutron.com/occsensors](http://www.lutron.com/occsensors) for more information
**Step 4 control selection**

**Pico wireless control**

**Design statement:** Use Pico wireless lighting controls to control lights or shades wirelessly within a space with the touch of a button.

**Performance**
- Communicates with the QS sensor module via radio frequency (RF) using Clear Connect™ RF Technology
- Up to 10 Pico wireless controls per QS sensor module
- Unique serial number prevents interference between systems
- Battery powered (5-year battery life)—requires no new wiring

**Benefits**
- Flexible device that allows the user to control lights or shades by wirelessly communicating with the QS sensor module
- Can function as a tabletop control on a pedestal, a lightweight handheld remote, or it can be wall-mounted with or without a Lutron Claro® wallplate
- Available in 2- and 3-button configurations with options for preset and raise/lower buttons

**Models**
- **Pico wireless controls**
  - MRF2-3BRL-L-XX—3 buttons with raise/lower
  - MRF2-3B-L-XX—3 buttons with preset button
  - MRF2-3B-L-XX-E01—3 buttons with Welcome button
  - MRF2-2BRL-L-XX—2 buttons with raise/lower
  - MRF2-2B-L-XX—2 buttons
- **Pedestals**
  - L-PED1-XX—Single pedestal
  - L-PED2-XX—Double pedestal
  - L-PED3-XX—3-gang pedestal
  - L-PED4-XX—4-gang pedestal
- **Wallplates**
  - CW-1-XX—1-gang wallplate (gloss/stainless steel)
  - CW-2-XX—2-gang wallplate (gloss/stainless steel)
  - CW-3-XX—3-gang wallplate (gloss/stainless steel)
  - PICO-FP-ADAPT—Pico wireless control faceplate adapter
- XX in the model number represents color/finish code.
  Please see www.lutron.com for color choices.

**Other control mounting styles**

**Wireless integration requires:**

**Infrared receiver module pg. 22**

**Infrared remote control transmitter module pg. 22**

**Step 4 control selection**

**EcoSystem wired infrared receiver and remote control transmitter**

**Design statement:** Add an EcoSystem infrared receiver with an infrared remote control transmitter to provide personal light control to any fixture on the EcoSystem digital link.

**Performance**
- Allows personalized light level selection from maximum to minimum light levels
- Can control multiple zones or areas
- Integral LED indicates signal reception
- Up to 64 infrared receivers (one per ballast) may be used per EcoSystem digital link

**Benefits**
- Low profile for mounting on ceiling tiles or fixtures
- Class 2 low voltage enables simplified wiring and mounting
- Wires directly to the nearest EcoSystem ballast with integral sensor connections, Energi Savr Node™, module, or QS sensor module

**Models**
- **EC-IR-WH**—Infrared receiver
- **C-FLRC-WH**—Infrared remote control transmitter
- **RCTH-GR**—Remote control holster/tether

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

**Infrared receiver dimensions**
- H: 0.69" (17 mm)
- D: 1.18" (30 mm)
- Stem length: 1.25" (32 mm)
- Max wire length: 100 ft. (30 m)

**Infrared remote control transmitter dimensions**
- W: 1.51" (38 mm)
- H: 4.63" (118 mm)
- D: 0.55" (14 mm)
### Step 4 control selection

**seeTouch® QS wallstations**

*Design statement:* Specify seeTouch QS wallstations where needed for full-range dimming control with engraved buttons.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (W)</td>
<td>2.75” (70 mm)</td>
</tr>
<tr>
<td>Height (H)</td>
<td>4.56” (116 mm)</td>
</tr>
<tr>
<td>Depth (D)</td>
<td>1.25” (32 mm)</td>
</tr>
</tbody>
</table>

**Performance**
- Buttons are backlit and can be engraved to provide intuitive control of the space.
- Recall scenes to adjust lighting for different activities.
- Control individual zones of light to set the perfect light for any task.
- Control up to 100 zones of lighting from up to 99 wallstations.

**Benefits**
- Class 2 low voltage QS communication link simplifies wiring and mounting.
- Wallstations are powered directly from the QS communication link.

**Models**
- **QSWS2-1B**—1-button wallstation
- **QSWS2-3B**—3-button wallstation
- **QSWS2-5B**—5-button wallstation
- **QSWS2-7B**—7-button wallstation
- **QSWS2-2BRL**—2-button wallstation with raise/lower
- **QSWS2-3BRL**—3-button wallstation with raise/lower
- **QSWS2-5BRL**—5-button wallstation with raise/lower
- **QSWS2-2BRLIR**—2-button wallstation with raise/lower and IR receiver
- **QSWS2-3BRLIR**—3-button wallstation with raise/lower and IR receiver
- **QSWS2-5BRLIR**—5-button wallstation with raise/lower and IR receiver
- **QSWS2-1RLD**—dual wallstation with 3-button and 2-button with raise/lower
- **QSWS2-2RLD**—dual 2-button wallstation with raise/lower
- **QSWS2-3BD**—dual 3-button wallstation

* Consult seeTouch QS specification submittal sheet for information on specifying insert style, engraving, and color.

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

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**Pico® wired control**

*Design statement:* Add a Pico wired control wherever needed for intuitive lighting control.

**Performance**
- Provides control for Lutron® products incorporating wired IR input including Energi Savr Node units, QS Sensor Modules, and EcoSystem® ballasts or ballast modules, allowing users to:
  - Turn an individual fixture or group of fixtures on and off.
  - Raise and lower light levels (PX-2BRL-GZZ and PX-3BRL-GZZ).
  - Recall favorite light levels (PX-3B-GZZ and PX-3BRL-GZZ).

**Benefits**
- IEC PELV/NEC® Class 2
- Mounts easily in any single-gang wallbox 2.5 in (64 mm) deep minimum (not included).
- Fits any designer Claro® opening faceplates.
- Low-cost wall control for many applications.

**Models**
- **PX-3BRL-GZZ-I01**—3 buttons with raise/lower
- **PX-3B-GZZ-I01**—3 buttons with preset button
- **PX-2BRL-GZZ-I01**—2 buttons with raise/lower
- **PX-2B-GZZ-I01**—2 buttons

* ZZ in the model number represents color code.

For wiring overview, see pgs. 10–11
For concept drawings, see pgs. 26–31
Step 5 accessory devices

QS interfaces and QS timeclock

Design statement: Specify QS interfaces to integrate third-party devices through RS-232/Ethernet and/or contact closures. Specify QS timeclock device to provide automatic control of lights and shades.

Performance
- Each QS interface and QS timeclock counts as 1 QS device; QS communication link system limit is 100 QS devices
- RS-232/Ethernet interface uses standard 9-pin female serial connector or RJ45 connector
- Contact closure interface provides five inputs and five dry contact closure outputs
- QS timeclock provides an astronomical timeclock with up to 25 events per day for 7 days and a holiday

Benefits
- Integrate with third-party devices and controls via RS-232/Ethernet or contact-closure inputs
- Sweep lights to low levels or off through RS-232/Ethernet, contact closure commands from third-party controls, or timeclock events
- Add third-party touchscreen control using RS-232/Ethernet commands
- Deliver code compliant automatic light shut-off to meet ASHRAE 90.1-2010

Models
- QSE-CI-NWK-E—RS-232/Ethernet control interface
- QSE-IO—Contact closure input/output interface
- QS GR-TC-35-WH-CPS023—QS timeclock for lights and shades

For wiring overview, see pgs. 12–15
For concept drawings, see pgs. 36–41

For more information on mounting options and installation, please visit www.lutron.com/TechnicalDocumentLibrary

Step 6 programming

Programming application for Apple iPhone or iPod touch digital devices

Design statement: Use the Energi Savr Node® programming application to set up, fine-tune, and maintain the lighting control system.

The Energi Savr Node programming application for Apple iPod or iPhone touch mobile digital devices is the key to an intelligent light and shade control system.
- Adjust ballasts to the needs of any space
- Define light level
- Adjust sensor and control preferences

NEW! System Backup
The Pod application can be used to save all configuration settings in the system. In the event that an Energi Savr Node module is replaced, all system settings and configuration can be automatically restored.

Energi Savr Node Programming Interface
The QSE-CI-AP-D is a programming interface for Energi Savr Node modules that provides the capability to program the lighting control system with an intuitive application for Apple iPhone or iPod touch devices. This required component allows for Ethernet inputs for programming with an Apple iPhone or iPod touch.

Features
- Program all Energi Savr Node modules connected to the same QS communication link
- Programming interface installs via surface mount or DIN-rail

Energi Savr Node Wireless Setup Kit (optional—US only)
The kit allows users to quickly connect to the system, set up the desired configuration, and make changes as needed.

Features
- Plug & Play - fully preconfigured and preloaded with Lutron software
- Programs all Energi Savr Node modules
- Kit includes an Apple iPod touch and wireless router
Note: Use of the Energi Savr Node Wireless Setup Kit is optional. Any Apple iPod touch and wireless router may be used to setup an Energi Savr Node system

Apple and iPod are registered trademarks and iPhone is a trademark of Apple, Inc., registered in the U.S. and other countries.
Expanding the system

Lutron EcoSystem® control solutions can be installed to control any size space, and expand easily to accommodate changing lighting control needs, enhanced performance requirements, or building renovation and expansion.

Lutron systems ensure interoperability and wireless capability that provide many options for growth including multi-scene control, timeclock interface, shade control, and even total light management for the entire building.

Consider using GRAFIK Eye QS wireless, Energi Savr Node™ with EcoSystem for shades, or Quantum® Total Light Management™ to meet system expansion needs.

GRAFIK Eye QS Wireless with EcoSystem

- Preset light and shade control that allows you to adjust the total light level for any task or activity, while saving energy
- Create lighting effects by assigning fluorescent lights to 6, 8, or 16 zones
- Combines EcoSystem light control, Sivoia® QS wired and wireless shades, and timeclock
- Integrates EcoSystem to touchscreens and other systems via RS-232/Ethernet interfaces and input/output devices

For more information, visit www.lutron.com/grafikeyeqs

Energi Savr Node with EcoSystem for Shades

- Control electric lights and daylight with one control panel
- Integrates up to 10 Sivoia® QS shade drives and up to 128 EcoSystem-compatible fluorescent ballasts and/or LED drivers
- System provides a power source for seeTouch® QS keypads, QS interfaces, QS sensor modules, or up to 10 Sivoia QS shade drives
- System can expand via the QS communication link—add panels as a system grows or upgrade to Quantum

Standard Model Number QSN-2ECO-PS120

Quantum Total Light Management

- Create an energy-efficient environment by enabling a centralized management, monitoring, and light and shade control system
- Reduce cooling loads by dimming lights and controlling shades to block solar heat gain
- Increase operating efficiency—system automatically reports lamp failures and monitors lamp hours to manage and reduce maintenance
- Reconfigure lighting and shading zones without costly rewiring

For more information, visit www.lutron.com/quantum

Q-Admin™ software

Lutron EcoSystem® control solutions can be installed to control any size space, and expand easily to accommodate changing lighting control needs, enhanced performance requirements, or building renovation and expansion.
Use Energi Savr Node with EcoSystem to control all the fluorescent lights in a private or open office—**wireless option**

**Design statement:** EcoSystem ballasts and wireless controls (can be wall-mounted or personal control) enable individual fixture control, daylight harvesting, and/or occupancy/vacancy sensing throughout the office space. Easily reprogram lighting zones if the space is reconfigured or if the employee needs change.

Use Energi Savr Node with EcoSystem to control all the fluorescent lights in a private or open office—**wired option**

**Design statement:** EcoSystem ballasts and wallstation controls enable individual fixture control, daylight harvesting, and/or occupancy/vacancy sensing throughout the office space. Easily reprogram lighting zones if the space is reconfigured or if the employee needs change.
Use Energi Savr Node with EcoSystem to control lighting in traditional classroom spaces

**Design statement:** In classrooms, EcoSystem ballasts provide individual fixture control, daylight harvesting, and occupancy/vacancy sensing to save energy, save money, and create a more productive teaching and learning environment.

Use Energi Savr Node with EcoSystem to control lights in university lecture halls

**Design statement:** Control both fluorescent and LED fixtures within the space, and take advantage of the ability to integrate A/V and shade control (wired or wireless). Automatic controls like occupancy and daylight sensors ensure energy savings.
Use Energi Savr Node, with EcoSystem, and Energi Savr Node with Softswitch, modules to control lights on an entire office floor

**Design statement:** Interoperability and seamless communication between EcoSystem and Softswitch Energi Savr Node modules enables control of all the lights in the space. Connected by the EcoSystem digital link—sensors, ballasts, and controls work together to provide an integrated lighting control solution.

**NEW** Energi Savr Node with EcoSystem module

Controlling all EcoSystem H-Series digital ballasts along the perimeter of the space allowing for full range dimming as well as daylight harvesting, occupancy/vacancy sensing, and personal control.

**NEW** Energi Savr Node with Softswitch module

Controlling all interior lighting of the space allowing for switching as well as occupancy/vacancy sensing, and personal control.

Ballasts connected by EcoSystem digital link

**NEW** EcoSystem H-Series digital ballast

Radio Powr Savr™ wireless daylight sensor

**NEW** Radio Powr Savr™ wireless occupancy/vacancy sensor

**NEW** Pico® wireless control (wall-mounted)

QS sensor module

**NEW** Ecosavr Node with EcoSystem module

Controlling all EcoSystem H-Series digital ballasts along the perimeter of the space allowing for full range dimming as well as daylight harvesting, occupancy/vacancy sensing, and personal control.
System functionality

Emergency system integration

**Design statement:** Energi Savr Node™ modules offer several options for easily integrating emergency lighting control into applications. Choose battery backup within the EcoSystem® fixture, or power EcoSystem ballasts via emergency power.

**Use emergency battery backup ballasts within an EcoSystem-controlled fixture.**
- In this case the fixture operates under EcoSystem control when normal power is present
- With loss of normal power the emergency battery backup ballast drives the lamp(s)

**Power EcoSystem ballasts via emergency/essential power and power the Energi Savr Node module from normal power.**
- Loss of normal power causes the EcoSystem digital link to turn off
- This signals emergency-powered EcoSystem or EcoSystem-compatible ballasts and drivers to operate at their emergency levels (100% by default)

**Note:**
- The loss of any phase of normal power results in the emergency mode being activated
- Ballasts will operate at their emergency light level until the fault is cleared

**Multi-phase lighting system or UL924 compliance**
The following design consideration should be met to achieve this performance:
1. Power emergency fixtures with EcoSystem ballasts or LED drivers via emergency/essential power.
2. Power the Energi Savr Node module and 24 V DC power pack via emergency/essential power.
3. Install and connect LUT-ELI-3PH to the EcoSystem Energi Savr Node module via installation instructions.

For more information please see Lutron Application Note 140 at www.lutron.com.

System hierarchy: description of how system decisions are made

EcoSystem achieves coordinated integration of controls and sensors. The flow chart below shows the hierarchy of the system.

**Typical usage**

**Emergency usage**
Energy-saving, Buy American-compliant light control solutions

Buy American Act
Lutron makes it easy for you to comply with the Buy American Act and the Buy American provisions in the American Recovery and Reinvestment Act (ARRA). We offer hundreds of light control products that are manufactured in the United States. Contact your authorized Lutron distributor for details.

www.Lutron.com/BAA

Targeted to both new and retrofit markets, Lutron ballasts and controls install easily into new construction or existing spaces. Lutron has offered solutions manufactured in the United States since our first product introduction in 1961. With the expansion of our ballast lines, we offer a complete lighting control system for virtually any project requiring products manufactured in the United States.

Digital fluorescent dimming ballasts manufactured in the United States for your energy-saving needs.

NEW Ballast selection tool with custom ballast factor

For more information or to order ballasts with custom ballast factors contact your local Lutron sales representative or visit www.lutron.com/BallastTool

Generate part numbers, confirm ballast performance specs (input power, system lumens, ballast factor) and select the proper ballast by utilizing the Custom Ballast Factor (CBF) option on the Lutron Ballast Selection Tool. CBF is the percentage of light output for a given lamp-ballast combination, and Lutron enables our customers to order reduced ballast factors and achieve greater energy savings, meet lumen/ft² specifications, and/or qualify for the highest levels of LEED.

Custom Ballast Factor
• Lutron’s custom ballast factor program offers ballasts with factors ranging from Lutron’s standard offering down to a 0.50 ballast factor
• Each ballast with a custom ballast factor is UL listed and marked with lower input power
• Ballasts with a custom ballast factor have a unique model number for easy reorder and replacement
• Longer shipping lead times apply

LEED is a registered trademark of the United States Green Building Council.